HITACHI Ultra High Frequency Devices DATA BOOK

HITACHI

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GENERAL INFORMATION

List of Device by Structure

Si Bipolar Transistors

Type No.	Package	Application	Ref. Page
2SC1856	TO-92	VHF Amplifier/VHF TV Tuner RF Amplifier	107
2SC1906	TO-92	VHF Amplifier/Mixer, Local Oscillator	66
2SC1907	TO-92	UHF Amplifier/UHF TV Tuner Local Oscillator	66
2SC2464	FPAK	UHF Amplifier/UHF TV Tuner RF Amplifier	43
2SC2465	FPAK	VHF Amplifier/VHF TV Tuner RF Amplifier	107
2SC2466	FPAK	UHF Amplifier/UHF TV Tuner Mixer	77
2SC2467	FPAK	VHF Amplifier/VHF TV Tuner Mixer	49
2SC2468	FPAK	VHF Amplifier/VHF TV Tuner Mixer, Oscillator	66
2SC2469	FPAK	VHF Amplifier/VHF TV Tuner Mixer, Oscillator	66
2SC2471	TO-92	UHF Amplifier/UHF TV Tuner Local Oscillator	77
2SC2512	TO-92	VHF Amplifier/VHF TV Tuner Mixer	49
2SC2727	FPAK	VHF Amplifier/VHF TV Tuner RF Amplifier	13
2SC2731	FPAK	UHF Amplifier/UHF TV Tuner Frequency Converter, Local Oscillator and Wide Band Amplifier	55
2SC2732	MPAK	UHF Frequency Converter	43
2SC2733	MPAK	VHF Frequency Converter	49
2SC2734	MPAK	UHF Frequency Converter, Local Oscillator, Wide Band Amplifier	55
2SC2735	MPAK	UHF/VHF Local Oscillator/VHF Frequency Converter	66
2SC2736	MPAK	UHF/VHF Frequency Converter, Local Oscillator	77
2SC3126	FPAK	UHF/VHF Wide Band Amplifier	88
2SC3127	MPAK	UHF/VHF Wide Band Amplifier	88
2SC3337	TO-92	UHF/VHF Wide Band Amplifier	99
2SC3338	UPAK	UHF/VHF Wide Band Amplifier	88
2SC3374	MPAK	VHF Amplifier/VHF TV Tuner RF Amplifier	107
2SC3493	MPAK	VHF Amplifier/VHF TV Tuner RF Amplifier	113
2SC3501	FPAK	VHF Amplifier/VHF TV Tuner Mixer, Oscillator	55
2SC3510	TO-92	UHF/VHF Wide Band Amplifier	88
2SC3511	FPAK	UHF/VHF Wide Band Amplifier	124
2SC3512	TO-92	UHF/VHF Wide Band Amplifier	124
2SC3513	MPAK	UHF/VHF Wide Band Amplifier	124
2SC3793	MPAK	UHF Local Oscillator	120
2SC3867	MPAKR	UHF Frequency Converter, Wide Band Amplifier	55
2SC4126	MPAK-4	UHF/VHF Wide Band Amplifier	124
2SC4196	MPAK	UHF Tuner Oscillator	135
2SC4197	MPAK	UHF Frequency Converter, Wide Band Amplifier	144
2SC4229	MPAK	UHF Tuner RF, Low Noise Amplifier	153
2SC4259	CMPAK	UHF Tuner RF Amplifier	153
2SC4260	CMPAK	UHF Frequency Converter, Wide Band Amplifier	144

2SC4261	CMPAK	UHF Local Oscillator	135
2SC4262	CMPAK	UHF/VHF Local Oscillator	120
2SC4263	CMPAK	VHF RF Amplifier	113
2SC4264	CMPAK	UHF/VHF RF Amplifier, Local Oscillator, Mixer	55
2SC4265	CMPAK	VHF RF Amplifier, Local Oscillator, Mixer	66
2SC4308	TO-92	VHF Wide Band Amplifier	165
2SC4415	MPAK-4	UHF Tuner High Frequency Amplifier	153
2SC4416	MPAKR	UHF Frequency Converter, Wide Band Amplifier	144
2SC4422	UPAK	UHF/VHF Wide Band Amplifier	124
2SC4462	CMPAK	UHF Frequency Converter	43
2SC4463	CMPAK	VHF Frequency Converter	49
2SC4464	CMPAK	High f_T in Low Voltage Low Current Operation	171
2SC4537	CMPAK	UHF/VHF Wide Band Amplifier	124
2SC4591	MPAK	UHF/VHF Wide Band Amplifier	181
2SC4592	MPAK-4	UHF/VHF Wide Band Amplifier	181
2SC4593	CMPAK	UHF/VHF Wide Band Amplifier	181
2SC4629	TO-92	UHF/VHF Wide Band Amplifier	181
2SC4643	UPAK	UHF/VHF Wide Band Amplifier	181
2SC4674	CMPAK	High f_T in Low Voltage Low Current Operation	190
2SC4680	MPAK	VHF and UHF RF Switch	199

Si MOS FET

Type No.	Package	Application	Ref. Page
2SK359	TO-92	VHF Amplifier	206
2SK360	MPAK	VHF Amplifier	206
2SK439	SPAK	VHF Amplifier	206
3SK80	FPAK	UHF TV Tuner RF Amplifier	253
3SK81	FPAK	VHF TV Tuner RF Amplifier	212
3SK85	FPAK	VHF TV Tuner RF Amplifier	267
3SK96	FPAK	VHF TV Tuner RF Amplifier	238
3SK103	FPAK	UHF TV Tuner RF Amplifier	229
3SK104	FPAK	UHF TV Tuner RF Amplifier	220
3SK104V	FPAK	VHF TV Tuner RF Amplifier	220
3SK136	MPAK-4	VHF TV Tuner RF Amplifier	212
3SK137	MPAK-4	UHF TV Tuner RF Amplifier	220
3SK137V	MPAK-4	VHF TV Tuner RF Amplifier	220
3SK138	MPAK-4	UHF TV Tuner RF Amplifier	229
3SK154	MPAK-4	VHF TV Tuner RF Amplifier	238
3SK156	FPAK	VHF TV Tuner RF Amplifier	246
3SK162	MPAK-4	VHF TV Tuner RF Amplifier	246
3SK182	MPAK-4	UHF TV Tuner RF Amplifier	253
3SK186	MPAK-4	UHF TV Tuner RF Amplifier	262
3SK188	MPAK-4	VHF TV Tuner RF Amplifier	267

3SK194	MPAK-4	VHF/UHF TV Tuner RF Amplifier	275
3SK196	MPAK-4	VHF/UHF TV Tuner RF Amplifier	283
3SK197	MPAK-4	VHF RF Amplifier/VHF TU Tuner RF Amplifier, Mixer	293
3SK217	CMPAK-4	UHF TV Tuner RF Amplifier	262

GaAs Devices

Type No.	Package	Application	Ref. Page
2SK457	FPAK	UHF/SHF Low Noise Amplifier	301
2SK666	FPAK	RF Wide Band Low Noise Amplifier	307
2SK668	MPAK-4	UHF/SHF Low Noise Amplifier	301
2SK779	Ceramic	SHF Converter RF Amplifier	317
2SK1092	MPAK-4	RF Wide Band Low Noise Amplifier	307
2SK1615	Ceramic	SHF Low Noise Amplifier	326
2SK1616	μFPAK	SHF Low Noise Amplifier	332
2SK1617	μFPAK	SHF Low Noise Amplifier	338
2SK1844	Ceramic	SHF Low Noise Amplifier	344
2SK1845	μMFPAK	SHF Low Noise Amplifier	351
3SK113	FPAK	UHF TV Tuner RF Amplifier	358
3SK191	MPAK-4	UHF RF Amplifier	366
3SK228	MPAK-4	UHF TV Tuner RF Amplifier	373
3SK229	MPA-4	UHF TV Tuner RF Amplifier	373
HA21001MS	MSP-18	VHF/UHF Tuner Use GaAs IC	382
HA21005	MPAK-4	BS Tuner Wide Band Amplifier	399
HA21006MP	MP-18	BS Tuner IC	411
HSE11	ERP	Schottky Barrier Mixer Diode	423
HSE11S	HFP	Balanced Dual Schottky Barrier Diodes	426

High Frequency High Power FET

Type No.	Package	Application	Ref. Page
2SK317	RFPAK-A	HF/VHF Power Amplifier	431
2SK318	RFPAK-A	HF/VHF Power Amplifier	437
2SK408	TO-220AB	HF/VHF Power Amplifier	443
2SK409	TO-220AB	HF/VHF Power Amplifier	443
2SK410	RFPAK-A	HF/VHF Power Amplifier	451
2SK1575	RFPAK-B	VHF Amplifier	459
2SK1640	RFPAK-B	UHF Power Amplifier	466

List of Device by Structure

Saw Filters

Type No.	Package	Application	Ref. Page
HW837M	TO39	Amps Transmit Filter	475
HW882M	TO39	Amps Receive Filter	478
HW903M	TO39	NMT/GSM Transit Filter	474
HW948M	TO39	NMT/GSM Receive Filter	477
HWSA101	S.M.	ETACS Transmit Filter	473
HWSB101	S.M.	ETACS Receive Filter	476
HWSA601	S.M.	Amps Transmit Filter	475
HWSB601	S.M.	Amps Receive Filter	478
HWSA201	S.M.	NMT/GSM Transmit Filter	474
HWSB201	S.M.	NMT/GSM Receive Filter	477

VHF Power Modules

Type No.	Package	Application	Ref. Page
PF0015	PFPAK-C	Amps Handy Phone Amplifier	479
PF0016	PFPAK-C	NMT-900 Handy Phone Amplifier	484
PF0017	PFPAK-C	ETACS Handy Phone Amplifier	489
PF0025	PFPAK-E	Amps Handy Phone Amplifier	494
PF0026	PFPAK-E	NMT-9W Handy Phone Amplifier	494
PF0027	PFPAK-E	ETACS Handy Phone Amplifier	494
PF0030	PFPAK-B2	Amps Mobile Phone Amplifier	501
PF0031	PFPAK-B2	NMT-90 Mobile Phone Amplifier	501
PF0032	PFPAK-B2	ETACS Mobile Phone Amplier	501
PF0040	PFPAK-B3	Amps Mobile Phone Amplifier	513
PF0042	PFPAK-B3	ETACS Mobile Phone Amplifier	513
PF0085	PFPAK-E	Amps Handy Phone Amplifier	524

Transistor Structures

Structure

There are two major types of high-frequency transistor structure: one is the bipolar transistor and the other is the field effect transistor (FET). The basic structures of different kinds of each device type are shown in figure 1.

Bipolar Transistor

A bipolar transistor is a current control device in which the collector current is controlled by changing the base current. It has better 1/f noise and mutual conductance characteristics than a FET, and its main applications are in wide-band amplifier and local oscillator circuits.

Field Effect Transistor (FET)

A FET is a voltage control device in which the drain current is controlled by changing the gate voltage. It has better distortion characteristics than a bipolar transistor, and its main applications are in 1st-stage amplifier and mixer circuits.
There are three types of FET: Si metal oxide semiconductor (MOS) FET, GaAs metal semiconductor (MES) FET, and GaAs high electron mobility transistor (HEMT).
Si MOS FETs are mainly used in dual gate structures for small-signal applications, in order to reduce reverse transfer capacitance. GaAs MES FETs and GaAs HEMTs are used in high-frequency applications ranging from UHF to SHF, because their electron mobilities are much higher than those of Si FETs. The GaAs MES FET structure is also used for monolithic GaAs ICs.

Packages

Hitachi's packages for high-frequency devices are shown in figure 2.

Packages for Small-Signal Transistors

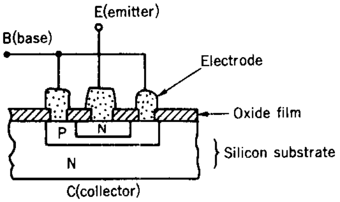
Surface-mount packages are becoming popular for small-signal transistors. Our surface-mount packages are the MPAK, MPAK-4, CMPAK, CMPAK-4, UPAK, FPAK, Ceramic, and μFPAK, but we also provide the TO-92 and SPAK as conventional insertion-type packages. All these packages are available in tape and reel shipping form.

Packages for High-Frequency Power Transistors

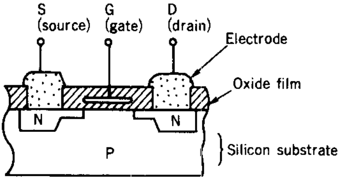
The TO-220 package is used for devices operating in the HF band (2 to 30 MHz) below 30 W. For VHF- and UHF-band applications, the RFPAK-A and RFPAK-B (ceramic packages) are used to reduce both feedback capacitance and dielectric loss. The RFPAK-B is a package containing 2 transistors to provide a high-power push-pull circuit.

IC Package

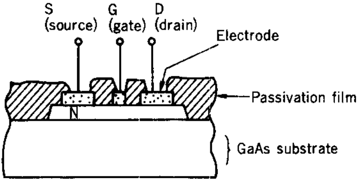
The MSP-18 package is capable of handling frequencies of up to 2 GHz and, because it is a plastic surface-mount package, it is suitable for high-frequency consumer applications.



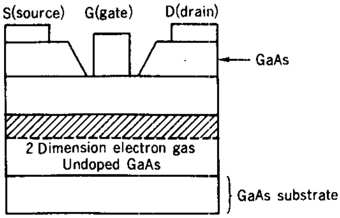
(i) Silicon NPN bipolar transistor



(ii) Silicon N channel MOS FET



(iii) Gallium arsenic N channel MES FET



(iv) HEMT

Figure 1 Structure of High Frequency Transistor

Semiconductor Handling Precautions

High-frequency devices are designed to be used in low-noise applications at high frequencies. To achieve this performance, the gate lengths of these devices are very thin. In order to guarantee device characteristics at frequencies of 1 to 12 GHz, it is very difficult for some parts to integrate protection components such as diodes into the chip itself, which may cause increase of stray components.
For these reasons, Hitachi's high-frequency devices are very sensitive to electrostatic discharges or surge voltages induced by surrounding circuits. When handling or testing such devices, take good care to prevent them being damaged by electrostatic discharge or surge voltages.

Destruction Due to Abnormal Oscillation

High-frequency devices tend to oscillate even in DC-biased conditions because of their high impedance and gain levels at high frequencies. To minimize damage under such conditions, note the following points:

- While testing DC characteristics, insert a series resistor (of several hundred kiloohms to several tens of kiloohms) at the gate, or add a large enough bypass capacitor between gate and source or between drain and source. In addition, keep the wiring as short as possible.
- When inserting devices into circuit boards, place a ceramic or mica capacitor between the power supply and ground to absorb oscillations caused by the power supply. In addition, keep the wiring as short as possible to minimize inductance.

Destruction Due to Overcurrent

With a depletion-type device, if the biasing procedure is not appropriate or a poor connection causes an open-gate condition, the device may be destroyed by overcurrent.

To avoid this danger, note the following points:

- Apply –1 to –2 V across gate and source with a protection resistor.
- Gradually increase the drain to source voltage to the setting voltage level.
- Adjust the gate to source voltage to obtain the desired drain current.

Destruction Due to Overvoltage

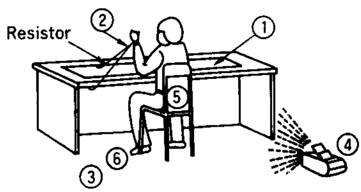
Do not test breakdown voltage (V_{GSS}, V_{DSX}); test leakage current (I_{GSS}, I_{DSX}) instead. When breakdown voltage is measured, any negative resistance will tend to induce oscillation in the device, and a poor connection will generate an excessively large voltage from the current source of the test equipment.
When testing electronic characteristics, connect the ground lines of all test equipment correctly. If the equipment is not arranged correctly, devices may be damaged by leakage voltages from measuring instruments.
Be aware of the danger of radiation pulse noise and induction from measuring equipment. If test equipment must be located close to a transformer or relay, shield the power supply lines and signal lines. Avoid turning the power supply on or off and changing the range of equipment with biasing devices.
Ground soldering irons in order to protect devices from leakage voltages.
To protect devices in actual circuits from surge voltages, note the following points:

- Insert a 1-kΩ to 100-kΩ resistor in series with the gate.
- If this is not possible, insert two 100-Ω resistors in series with both the source and drain.
- If a signal is directly input to the device from outside, insert an inductance between the input pin and ground.
- If possible, insert a Zener diode at the power supply pin as close to the device as possible.

Destruction Due to Electrostatic Discharge

To prevent destruction due to electrostatic discharge, note the following points:

- Recommended precautions to protect devices from electrostatic discharges are shown in figures 1 to 3. All personnel, work stations, test equipment, conveyors, tools, and the floor must be grounded with conductive mats when devices are handled.
- Do not put GaAs devices in plastic cases or bags; put them in antistatic bags, conductive foam, or aluminum foil. In addition, keep devices away from contact or friction with any insulating material likely to induce static electricity.
- When shipping devices in circuit boards, put them in antistatic bags or make sure that all pins are shorted.
- A low relative humidity tends to induce static electricity. To prevent this, make sure that the relative humidity is always at least 50%.
- With taped devices, an increase in peeling speed will lead to an increase in electron charge. To prevent destruction due to electrostatic discharge, make sure that the peeling speed is always less than 10 mm/s.



① Conductive mat (earthed) of high resistance ($10^9 - 10^{11}\Omega$)
② Human body earth (with bracelet)
③ Conductive mat (earthed) of high resistance ($10^9 - 10^{11}\Omega$)
④ Humidifier or ion blower
⑤ Insulative clothes
⑥ Work shoes

Figure 1 Example of Work Station Arrangement

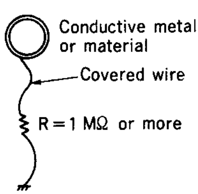


Figure 2 Example of Human Body Ground

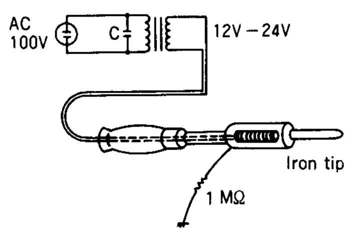
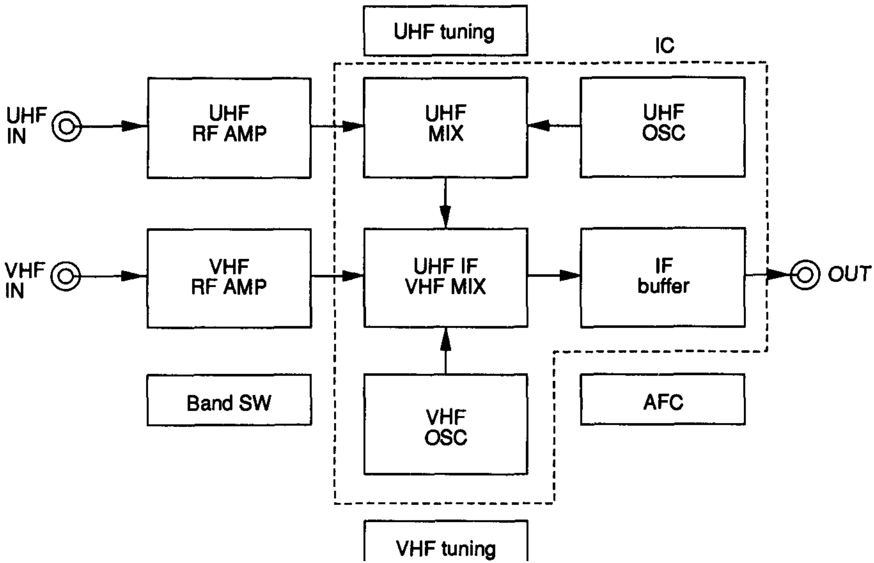


Figure 3 Example of Grounded Soldering Iron

Products at a Glance by Application

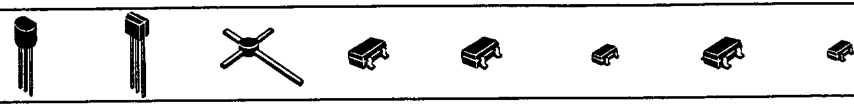
TV Tuner

Block Diagram

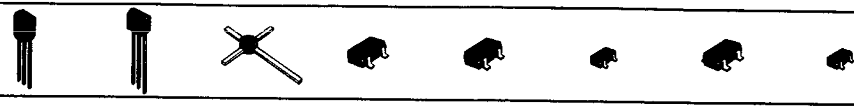


Products at a Glance by Application

Line Up

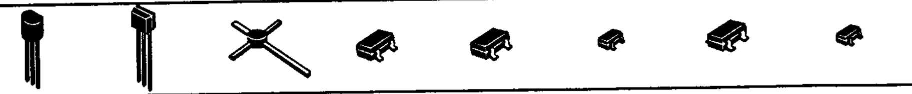


Application			Outline: TO-92	SPAK	FPAK	MPAK	MPAK-R	CMPAK	MPAK-4	CMPAK-4	Note
UHF	RF	GaAs			3SK113						
		MES							3SK191		
									3SK228		
									3SK229		
		MOS			3SK80				3SK182		λ/4 Resonance circuit
					3SK103				3SK138		λ/4 Resonance circuit
									3SK186	3SK217	V_{DD} = 12 V
					3SK104				3SK137		λ/2 Resonance circuit
									3SK194		V_{DD} = 12 V
									3SK196		
		Bipolar			2SC2464	2SC2732		2SC4462			
						2SC4229		2SC4259	2SC4415		V_{CC} = 4 V Operation
	MIX	Bipolar	2SC2471		2SC2466	2SC2736					
					2SC2731	2SC2734	2SC3867	2SC4264			
						2SC3793		2SC4262			
						2SC4197	2SC4416	2SC4260			
	OSC	Bipolar	2SC1907		2SC2468	2SC2735		2SC4265			
					2SC3501	2SC2734		2SC4264			V_{CC} = 6 V Operation



Application			Outline TO-92	SPAK	FPAK	MPAK	MPAK-R	CMPAK	MPAK-4	CMPAK-4	Note
UHF	OSC	Bipolar				2SC3793		2SC4262			
						2SC4196		2SC4261			
VHF	RF	MOS			3SK81				3SK136		
					3SK85				3SK188		
									3SK194		
									3SK196		
					3SK96				3SK154		High $\|y_{fs}\|$
					3SK104V				3SK137V		
					3SK156				3SK162		V_{DD} = 9 V Operation
		Bipolar	2SC1856		2SC2465	2SC3374					
						2SC3493		2SC4263			V_{CC} = 6 V Operation
	MIX	MOS			3SK81				3SK136		
					3SK85				3SK188		
					3SK96				3SK154		High $\|y_{fs}\|$
									3SK197		High $\|y_{fs}\|$ = 27 mS
		Bipolar	2SC2512		2SC2467	2SC2733		2SC4463			
			2SC2471		2SC2466	2SC2736					

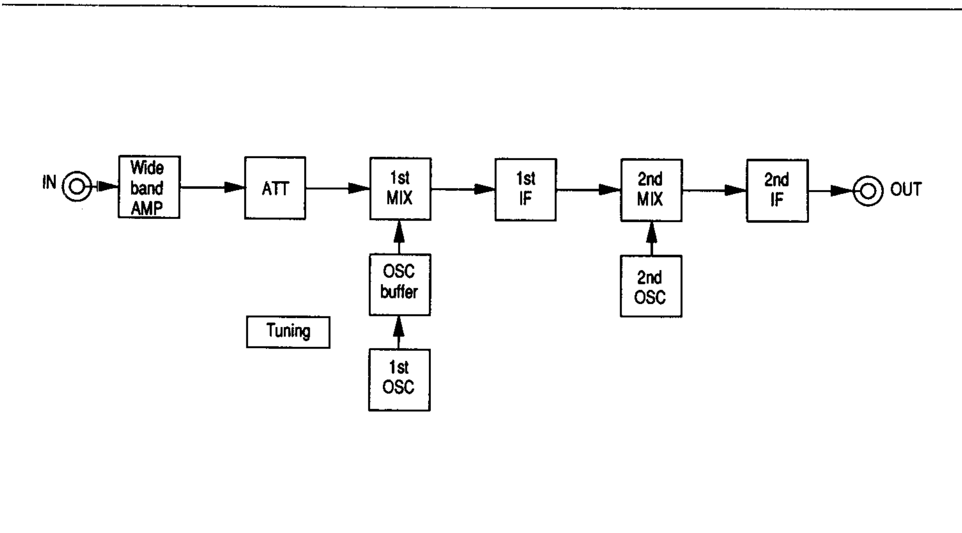
Products at a Glance by Application



Application			Outline: TO-92	SPAK	FPAK	MPAK	MPAK-R	CMPAK	MPAK-4	CMPAK-4	Note
VHF	OSC	Bipolar	2SC1906		2SC2469	2SC2735		2SC4265			
						2SC3793		2SC4262			
RF SW						2SC2735					
						2SC4680					
IF buffer		MOS			3SK156				3SK162		V_{DD} = 9 V Operation
			2SK359	2SK439		2SK360					
		Bipolar	2SC1855		2SC2465	2SC3374					
UHF/VHF MIX OSC IF 1 chip IC			HA21001MS (Outline: MSP-18)								GaAs MMIC for TV tuner

CATV Converter

Block Diagram



Products at a Glance by Application

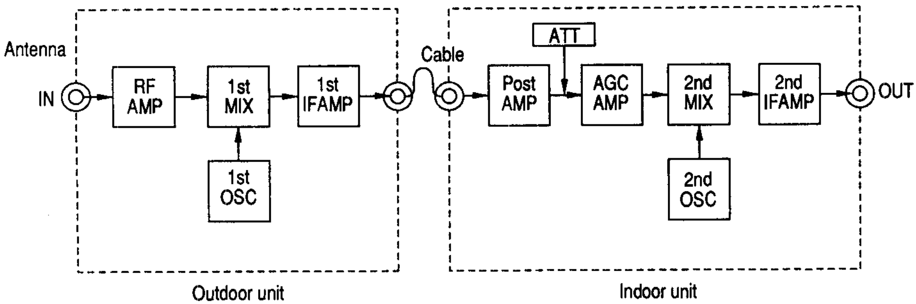
Line Up

Application		Outline TO-92	UPAK	FPAK	MPAK	MPAK-4	CMPAK	Note
								
Wide	Bipolar	2SC3510	2SC3338	2SC3126	2SC3127			f_T = 4.5 GHz
band amp.		2SC3512	2SC4422	2SC3511	2SC3513	2SC4126	2SC4537	f_T = 6 GHz
		2SC4629	2SC4643		2SC4591	2SC4592	2SC4593	f_T = 9 GHz
OSC	Bipolar	2SC3510	2SC3338	2SC3126	2SC3127			f_T = 4.5 GHz
buffer		2SC3337						f_T = 4.5 GHz (50 mA)
1st IF	Bipolar	2SC3510	2SC3338	2SC3126	2SC3127			f_T = 4.5 GHz
		2SC3512	2SC4422	2SC3511	2SC3513	2SC4126	2SC4537	f_T = 6 GHz
	GaAs					3SK191		
	MES					3SK228		
						3SK229		
	MOS			3SK103		3SK138		
						3SK186		

Application		Outline TO-92	UPAK	FPAK	MPAK	MPAK-4	CMPAK	Note
								
1st OSC	Bipolar	2SC1907		2SC2468	2SC2735		2SC4265	
2nd OSC				2SC3501	2SC2734		2SC4264	
		2SC2471		2SC2466	2SC2736			
					2SC3793		2SC4262	
					2SC4196		2SC4261	
					2SC4197		2SC4260	
2nd IF	MOS			3SK81		3SK136		
				3SK156		3SK162		V_{DD} = 9 V Operation

DBS Receiver

Block Diagram

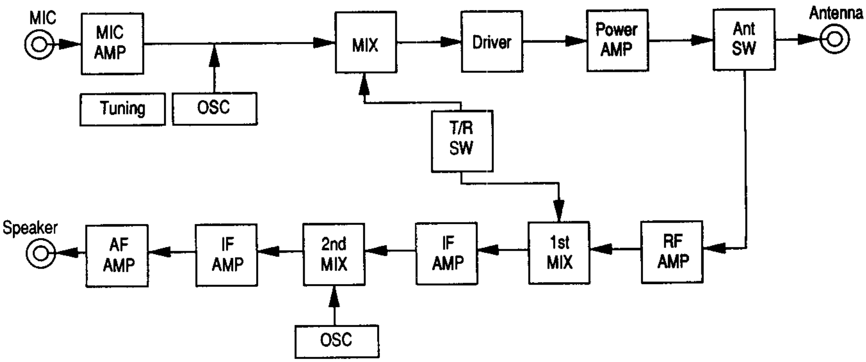


Line Up

Application		FPAK	UPAK	MPAK-4	MPAK	CMPAK	CERAMIC	μFPAK	Note
Outdoor unit	RF AMP						2SK779		GaAs FET, NF = 1.3 dB
							2SK1229		HEMT NF = 1.0 dB
							2SK1615		HEMT NF = 0.8 dB
								2SK1617	HEMT NF = 1.0 dB typ
	RF/MIX/ OSC							2SK1616	HEMT NF = 1.3 dB typ
	1st IF AMP	2SC3511	2SC4422	2SC4126	2SC3513	2SC4537			f_T = 6 GHz
			2SC4643	2SC4592	2SC4591	2SC4593			f_T = 9 GHz
Indoor unit	POST AMP	2SC3511	2SC4422	2SC4126	2SC3513	2SC4537			f_T = 6 GHz
			2SC4643	2SC4592	2SC4591	2SC4593			f_T = 9 GHz
	AGC AMP	3SK113							GaAs FET
				3SK191					GaAs FET
				3SK228					
	2nd OSC	2SC3511	2SC4422	2SC4126	2SC3513	2SC4537			f_T = 6 GHz
			2SC4643	2SC4592	2SC4591	2SC4593			f_T = 9 GHz
	2nd IF AMP	2SC3126	2SC3338		2SC3127				f_T = 4.5 GHz
		2SC3511	2SC4422	2SC4126	2SC3513	2SC4537			f_T = 6 GHz

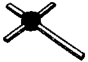
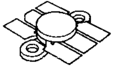
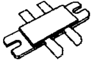
Mobile Communication

Block Diagram



Line Up

Application		TO-92	FPAK	MPAK	MPAK-4	CMPAK	UPAK	TO-220AB	RFPAK-A	RFPAK-B	Note
RF	GaAs MES				3SK191						
					3SK229						
	Bipolar	2SC3512	2SC3511	2SC3513	2SC4126	2SC4537	2SC4422				f_T = 6 GHz
		2SC4629		2SC4591	2SC4592	2SC4593	2SC4643				f_T = 9 GHz
						2SC4464					f_T = 4 GHz (V_{CE} = 1 V, I_C = 1 mA)
						2SC4674					f_T = 6 GHz (V_{CE} = 1 V, I_C = 1 mA)
1st MIX	GaAs MES				3SK191						
					3SK229						
	Bipolar	2SC3512	2SC3511	2SC3513	2SC4126	2SC4537	2SC4422				f_T = 6 GHz
		2SC4629		2SC4591	2SC4592	2SC4593	2SC4643				f_T = 9 GHz
IF	MOS		3SK103		3SK138						
			3SK104		3SK137						
	Bipolar	2SC3510	2SC3126	2SC3127			2SC3338				f_T = 4.5 GHz
		2SC3512	2SC3511	2SC3513	2SC4126	2SC4537	2SC4422				f_T = 6 GHz
OSC	Bipolar	2SC3512	2SC3511	2SC3513	2SC4126	2SC4537	2SC4422				f_T = 6 GHz
		2SC4629		2SC4591	2SC4592	2SC4593	2SC4643				f_T = 9 GHz

Application	Outline TO-92	FPAK	MPAK	MPAK-4	CMPAK	UPAK	TO-220AB	RFPAK-A	RFPAK-B	Note
										
High power transistor							2SK408 2SK409			f = 28 MHz, P_O = 10 W
								2SK317		f = 100 MHz, P_O = 180 W
								2SK318		f = 100 MHz, P_O = 90 W
								2SK410		f = 28 MHz, P_O = 180 W
									2SK1575	f = 200 MHz, P_O = 200 W
									2SK1640	f = 800 MHz, P_O = 100 W

Package Information

Si Bipolar Transistors

Type No.	Package	Marking of SMD	Pin Arrangement Pin 1	Pin 2	Pin 3	Pin 4
2SC1856	TO-92	—	Base	Emitter	Collector	—
2SC1906	TO-92	—	Emitter	Collector	Base	—
2SC1907	TO-92	—	Emitter	Collector	Base	—
2SC2464	FPAK	—	Emitter	Base	Collector	Base
2SC2465	FPAK	—	Base	Emitter	Collector	Emitter
2SC2466	FPAK	—	Emitter	Base	Collector	Base
2SC2467	FPAK	—	Base	Emitter	Collector	Emitter
2SC2468	FPAK	—	Base	NC	Emitter	Collector
2SC2469	FPAK	—	Base	NC	Emitter	Collector
2SC2471	TO-92	—	Base	Emitter	Collector	—
2SC2512	TO-92	—	Base	Emitter	Collector	—
2SC2727	FPAK	—	Base	Emitter	Collector	Emitter
2SC2731	FPAK	—	Emitter	Base	Collector	Base
2SC2732	MPAK	EC	Emitter	Base	Collector	—
2SC2733	MPAK	HC	Emitter	Base	Collector	—
2SC2734	MPAK	GC	Emitter	Base	Collector	—
2SC2735	MPAK	JC	Emitter	Base	Collector	—
2SC2736	MPAK	TC	Emitter	Base	Collector	—
2SC3126	FPAK	—	Base	Emitter	Collector	Emitter
2SC3127	MPAK	ID–	Emitter	Base	Collector	—
2SC3337	TO-92	—	Base	Emitter	Collector	—
2SC3338	UPAK	AR	Base	Collector	Emitter	—
2SC3374	MPAK	IJ–	Emitter	Base	Collector	—
2SC3493	MPAK	IL–	Emitter	Base	Collector	—
2SC3501	FPAK	—	Base	NC	Emitter	Collector
2SC3510	TO-92	—	Base	Emitter	Collector	—
2SC3511	FPAK	—	Base	Emitter	Collector	Emitter
2SC3512	TO-92	—	Base	Emitter	Collector	—
2SC3513	MPAK	IS–	Emitter	Base	Collector	—
2SC3793	MPAK	IP–	Emitter	Base	Collector	—
2SC3867	MPAKR	DI–	Base	Emitter	Collector	—
2SC4126	MPAK-4	MI–	Collector	Emitter	Base	Emitter
2SC4196	MPAK	QI–	Emitter	Base	Collector	—

Package Information

Si Bipolar Transistors (cont)

Type No.	Package	Marking of SMD	Pin Arrangement Pin 1	Pin 2	Pin 3	Pin 4
2SC4197	MPAK	TI–	Emitter	Base	Collector	—
2SC4229	MPAK	UI–	Emitter	Base	Collector	—
2SC4259	CMPAK	UI–	Emitter	Base	Collector	—
2SC4260	CMPAK	TI–	Emitter	Base	Collector	—
2SC4261	CMPAK	QI–	Emitter	Base	Collector	—
2SC4262	CMPAK	IP–	Emitter	Base	Collector	—
2SC4263	CMPAK	IL–	Emitter	Base	Collector	—
2SC4264	CMPAK	GC	Emitter	Base	Collector	—
2SC4265	CMPAK	JC	Emitter	Base	Collector	—
2SC4308	TO-92	—	Base	Emitter	Collector	—
2SC4415	MPAK-4	XC–	Collector	Base	Emitter	Base
2SC4416	MPAKR	XB–	Base	Emitter	Collector	—
2SC4422	UPAK	CR	Base	Collector	Emitter	—
2SC4462	CMPAK	EC	Emitter	Base	Collector	—
2SC4463	CMPAK	HC	Emitter	Base	Collector	—
2SC4464	CMPAK	XF–	Emitter	Base	Collector	—
2SC4537	CMPAK	IS–	Emitter	Base	Collector	—
2SC4591	MPAK	XM–	Emitter	Base	Collector	—
2SC4592	MPAK-4	XN–	Collector	Emitter	Base	Emitter
2SC4593	CMPAK	XM–	Emitter	Base	Collector	—
2SC4629	TO-92	—	Base	Emitter	Collector	—
2SC4643	UPAK	DR	Base	Collector	Emitter	—
2SC4674	CMPAK	XT–	Emitter	Base	Collector	—
2SC4680	MPAK	XU–	Emitter	Base	Collector	—

Si MOS FET

Type No.	Package	Marking of SMD	Pin Arrangement Pin 1	Pin 2	Pin 3	Pin 4
2SK359	TO-92	—	Gate	Source	Drain	—
2SK360	MPAK	IG–	Gate	Drain	Source	—
2SK439	SPAK	—	Gate	Source	Drain	—
3SK80	FPAK	—	Gate1	Gate2	Drain	Source
3SK81	FPAK	—	Gate1	Gate2	Drain	Source
3SK85	FPAK	—	Gate1	Gate2	Drain	Source
3SK96	FPAK	—	Gate1	Gate2	Drain	Source
3SK103	FPAK	—	Gate1	Gate2	Drain	Source
3SK104	FPAK	—	Gate1	Gate2	Drain	Source
3SK104V	FPAK	—	Gate1	Gate2	Drain	Source
3SK136	MPAK-4	IV–	Source	Drain	Gate2	Gate1
3SK137	MPAK-4	IW–	Source	Drain	Gate2	Gate1
3SK137V	MPAK-4	IW–	Source	Drain	Gate2	Gate1
3SK138	MPAK-4	IX–	Source	Drain	Gate2	Gate1
3SK154	MPAK-4	IZ–	Source	Drain	Gate2	Gate1
3SK156	FPAK	—	Gate1	Gate2	Drain	Source
3SK162	MPAK-4	IT–	Source	Drain	Gate2	Gate1
3SK182	MPAK-4	EI–	Source	Drain	Gate2	Gate1
3SK186	MPAK-4	FI–	Source	Drain	Gate2	Gate1
3SK188	MPAK-4	HI–	Source	Drain	Gate2	Gate1
3SK194	MPAK-4	IY–	Source	Drain	Gate2	Gate1
3SK196	MPAK-4	XI–	Source	Drain	Gate2	Gate1
3SK197	MPAK-4	WI–	Source	Drain	Gate2	Gate1
3SK217	CMPAK-4	FI–	Source	Drain	Gate2	Gate1

Package Information

GaAs Devices

Type No.	Package	Marking of SMD	Pin Arrangement Pin 1	Pin 2	Pin 3	Pin 4
2SK457	FPAK	—	Gate	Source	Drain	Source
2SK666	FPAK	—	Gate	Source	Drain	Source
2SK668	MPAK-4	IU–	Source	Drain	Source	Gate
2SK779	Ceramic	A	Gate	Source	Drain	Source
2SK1092	MPAK-4	XE–	Source	Drain	NC	Gate
2SK1615	Ceramic	T	Gate	Source	Drain	Source
2SK1616	μFPAK	B	Gate	Source	Drain	Source
2SK1617	μFPAK	A	Gate	Source	Drain	Source
2SK1844	Ceramic	L	Gate	Source	Drain	Source
2SK1845	μFPAK	C	Gate	Source	Drain	Source
3SK113	FPAK	—	Gate1	Gate2	Drain	Source
3SK191	MPAK-4	NI–	Source	Draw	Gate2	Gate1
3SK228	MPAK-4	XR–	Source	Draw	Gate2	Gate1
3SK229	MPAK-4	XS–	Source	Draw	Gate2	Gate1
HA21001MS	MSP-18	—	—	—	—	—
HA21005	MPAK-4	—	Ground	Input	VCC	Output
HA21006MP	MSP-18	—	—	—	—	—
HSE11	ERP	—	Cathode	Anode	—	—
HSE11S	HFP	—	Cathode1	Anode1	Cath1/m²	—

High Frequency High Power FET

Type No.	Package	Marking of SMD	Pin Arrangement Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6
2SK317	RFPAK-A	—	Source	Source	Source	Source	Drain	Gate
2SK318	RFPAK-A	—	Source	Source	Source	Source	Drain	Gate
2SK408	TO-220AB	—	Gate	Source	Drain	—	—	—
2SK409	TO-220AB	—	Drain	Source	Gate	—	—	—
2SK410	RFPAK-A	—	Source	Source	Source	Source	Drain	Gate
2SK1575	RFPAK-B	—	Gate1	Drain1	Source	Gate2	Drain2	—
2SK1640	RFPAK-B	—	Gate1	Drain1	Source	Gate2	Drain2	—

UHF Power Modules

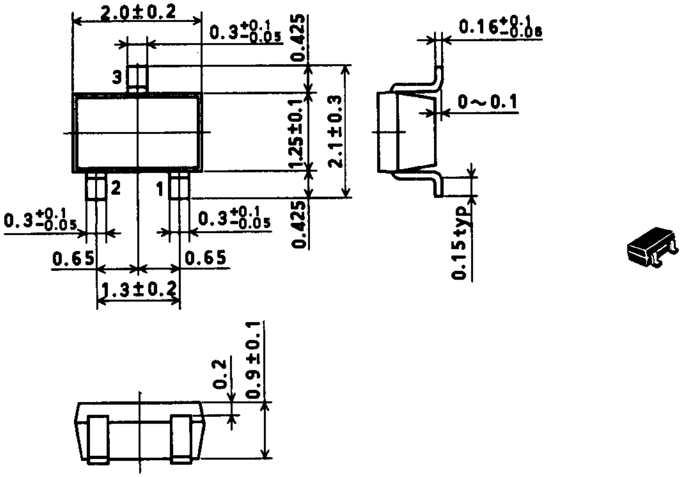
Type No.	Package	Pin Arrangement					
		Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Flange/G
PF0015	PFPAK-C	Pin/Vapc	Vdd1	Vdd2	Vdd3	Pout	Ground
PF0016	PFPAK-C	Pin/Vapc	Vdd1	Vdd2	Vdd3	Pout	Ground
PF0017	PFPAK-C	Pin/Vapc	Vdd1	Vdd2	Vdd3	Pout	Ground
PF0025	PFPAK-E	Pin	Vapc	Vdd	Pout	—	Ground
PF0026	PFPAK-E	Pin	Vapc	Vdd	Pout	—	Ground
PF0027	PFPAK-E	Pin	Vapc	Vdd	Pout	—	Ground
PF2030	PFPAK-B2	Pin	Vapc	Vdd	Pout	—	Ground
PF2031	PFPAK-B2	Pin	Vapc	Vdd	Pout	—	Ground
PF0032	PFPAK-B2	Pin	Vapc	Vdd	Pout	—	Ground
PF0040	PFPAK-B3	Pin	Vapc	Vdd	Pout	—	Ground
PF0042	PFPAK-B3	Pin	Vapc	Vdd	Pout	—	Ground
PF0085	PFPAK-E	Pin	Vapc	Vdd	Pout	—	Ground

Saw Filters

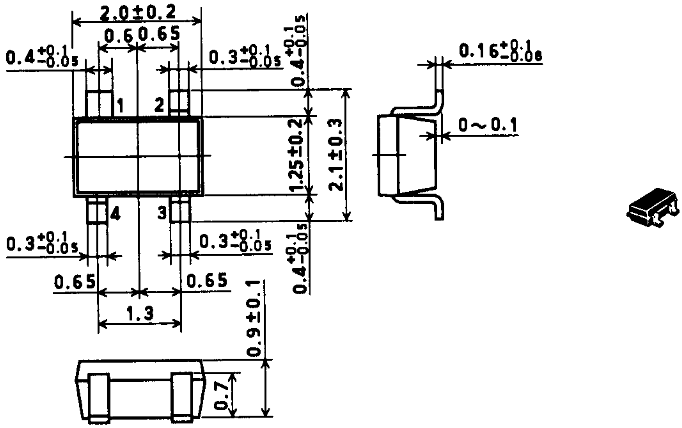
Type No.	Package	Pin Arrangement			
		Pin 1	Pin 2	Pin 3	Pin 4
HW837M	T039	Ground	Input	Output	Ground
HW883M	T039	Ground	Input	Output	Ground
HW902M	T039	Ground	Input	Output	Ground
HW948M	T039	Ground	Input	Output	Ground
HWSA101	SAW-SM1	Input	Output	Ground	Ground
HWSA201	SAW-SM1	Input	Output	Ground	Ground
HWSA601	SAW-SM1	Input	Output	Ground	Ground
HWSB101	SAW-SM1	Input	Output	Ground	Ground
HWSB201	SAW-SM1	Input	Output	Ground	Ground
HWSB601	SAW-SM1	Input	Output	Ground	Ground

Package Information

Unit: mm

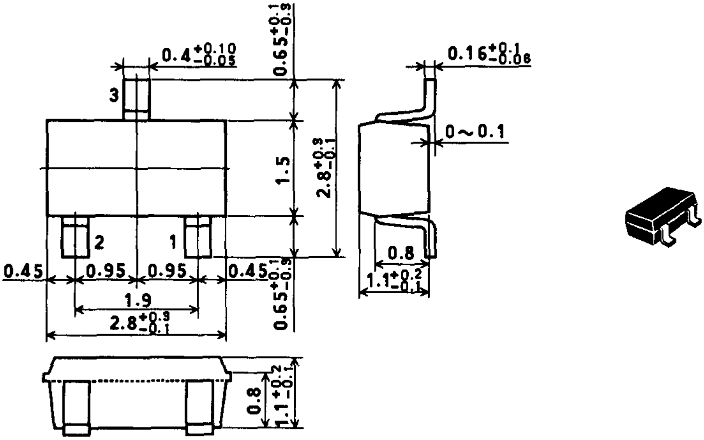


Hitachi Code	CMPAK
EIAJ	—
JEDEC	—

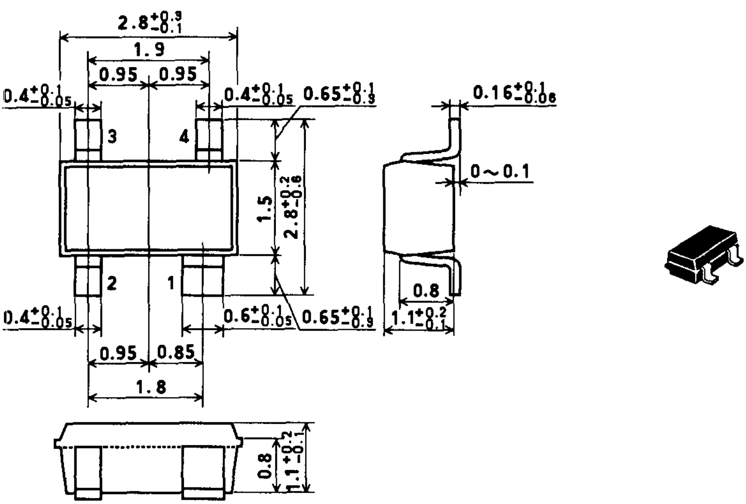


Hitachi Code	CMPAK-4
EIAJ	—
JEDEC	—

Unit: mm



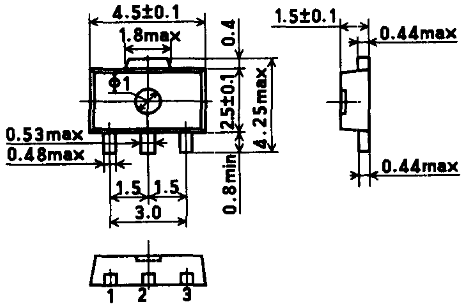
Hitachi Code	MPAK
EIAJ	—
JEDEC	—

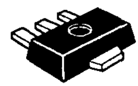


Hitachi Code	MPAK-4
EIAJ	—
JEDEC	—

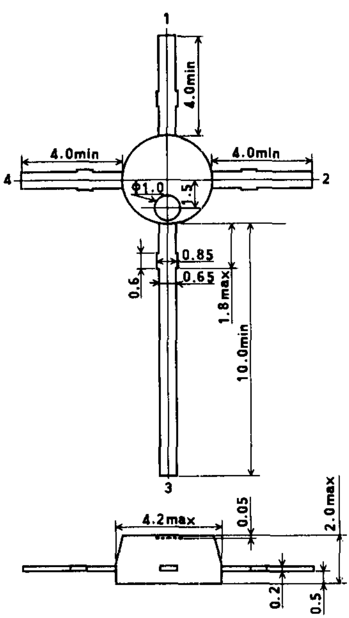
Package Information

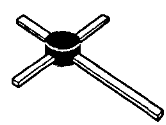
Unit: mm





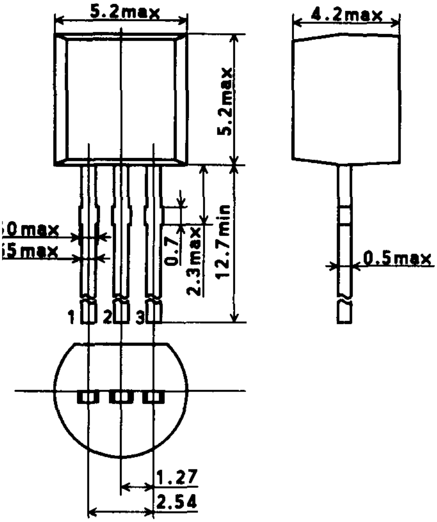
Hitachi Code	UPAK
EIAJ	—
JEDEC	—



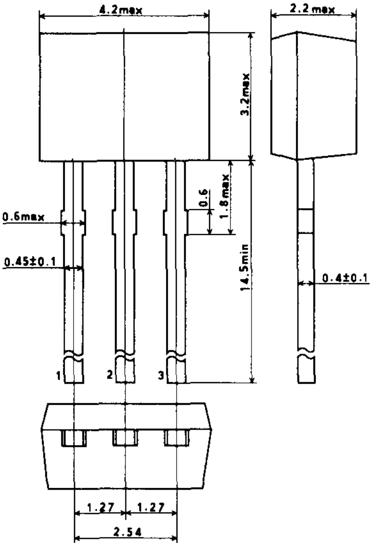


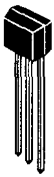
Hitachi Code	FPAK
EIAJ	—
JEDEC	—

Unit: mm



Hitachi Code	TO-92
EIAJ	—
JEDEC	—

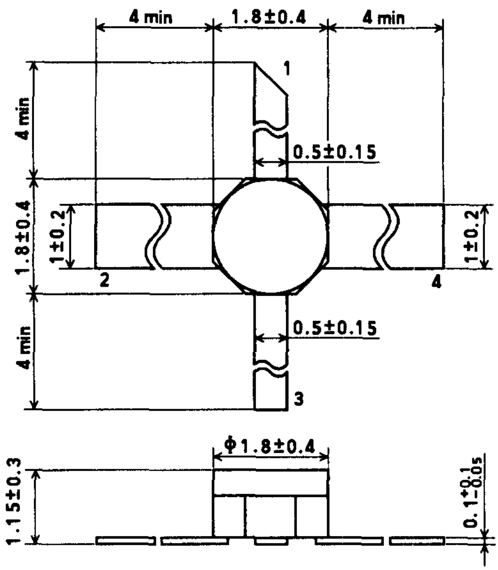


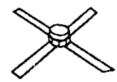


Hitachi Code	SPAK
EIAJ	—
JEDEC	—

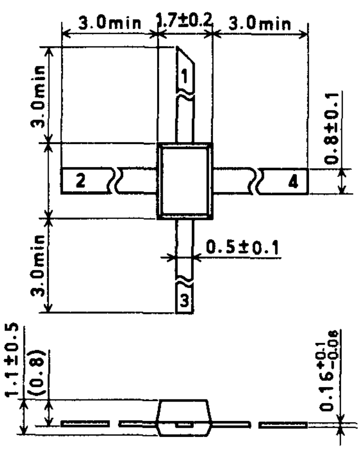
Package Information

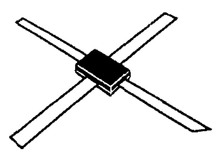
Unit: mm





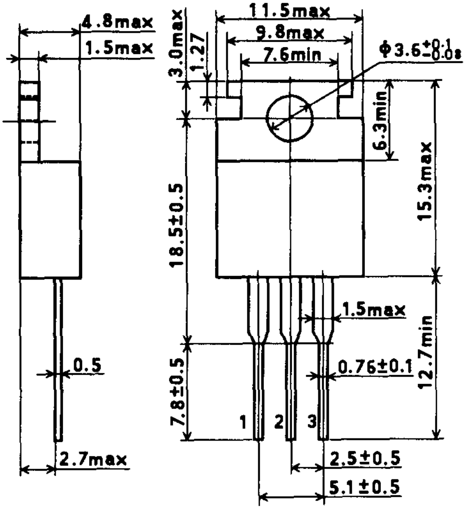
Hitachi Code	CERAMICS
EIAJ	—
JEDEC	—

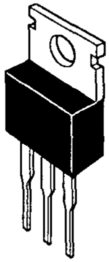




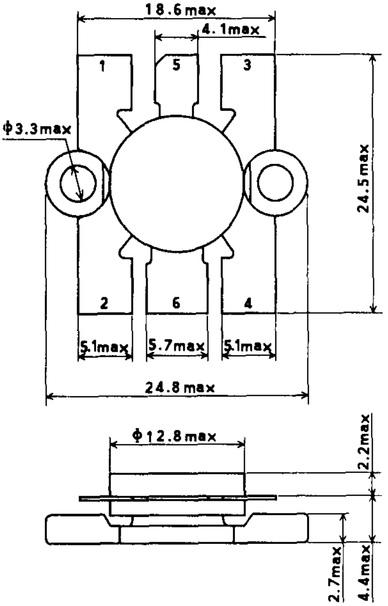
Hitachi Code	μFPAK
EIAJ	—
JEDEC	—

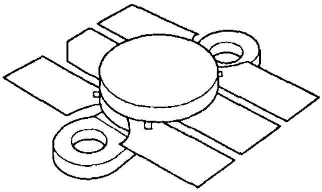
Unit: mm





Hitachi Code	TO-220AB
EIAJ	—
JEDEC	—

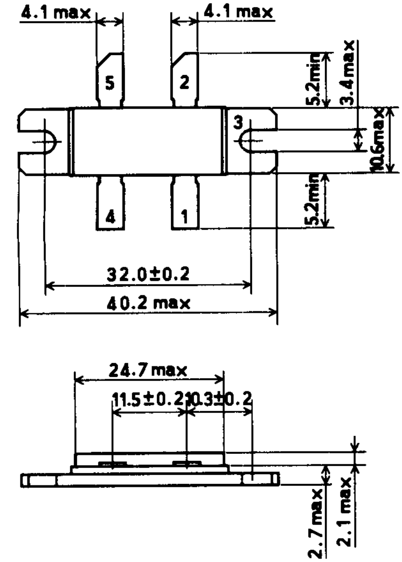


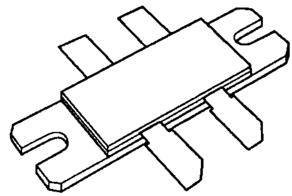


Hitachi Code	RFPAK-A
EIAJ	—
JEDEC	—

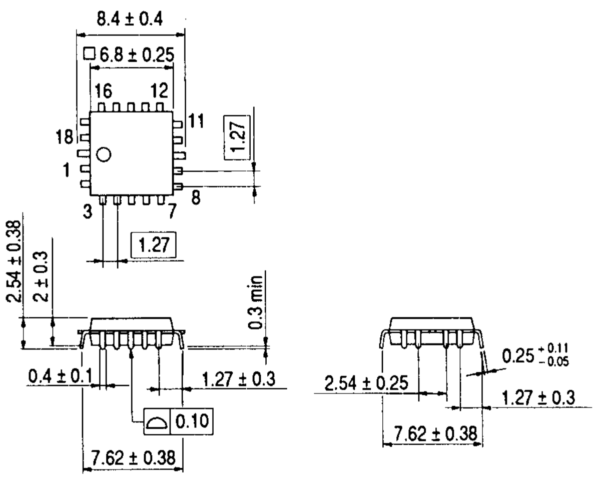
Package Information

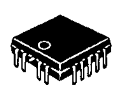
Unit: mm





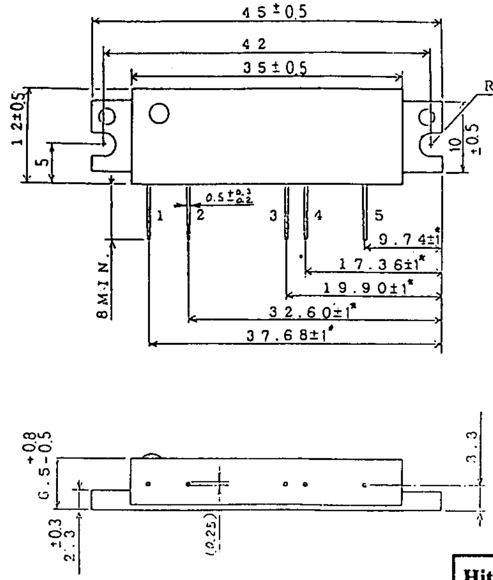
Hitachi Code	RFPAK-B
EIAJ	—
JEDEC	—



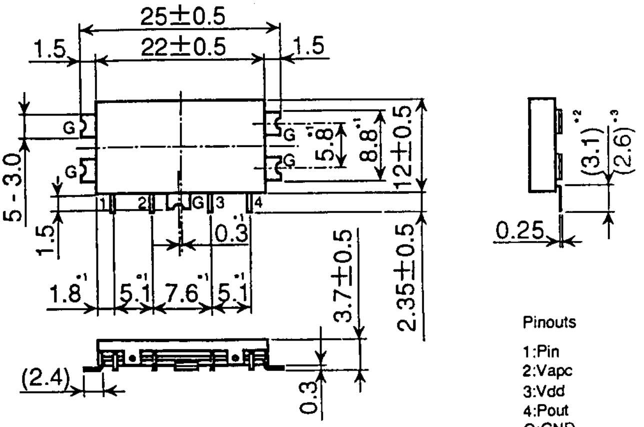


Hitachi Code	MSP-18
EIAJ	—
JEDEC	—

Unit: mm



Hitachi Code	PFPAK-C



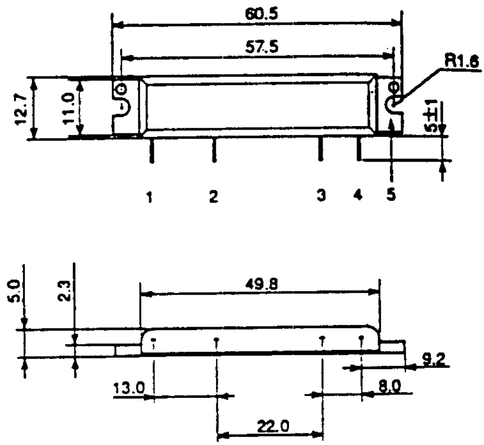
Pinouts

1:Pin
2:Vapc
3:Vdd
4:Pout
G:GND

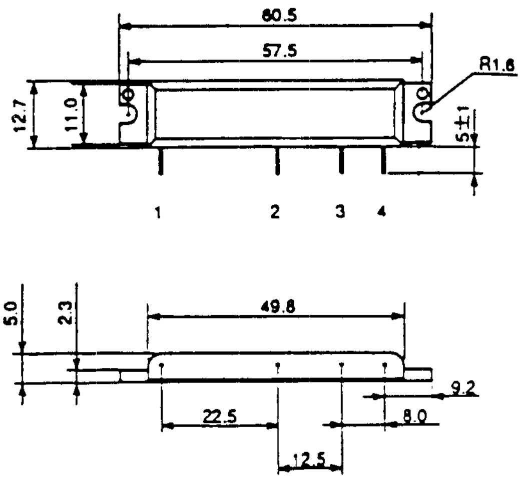
* 1. Demension at the root point of the lead frame and ground fin.
* 2. Applied to lead pins 1~4.
* 3. Applied to ground fin between pin 2 and 3.

Hitachi Code	PFPAK-E

Unit: mm

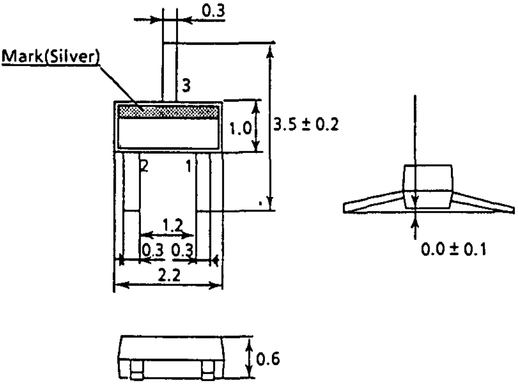


Hitachi Code	PFPAK-B2

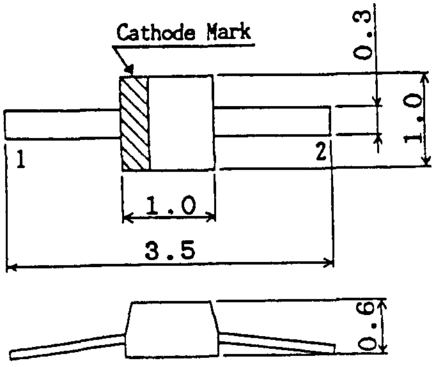


Hitachi Code	PFPAK-B3

Unit: mm



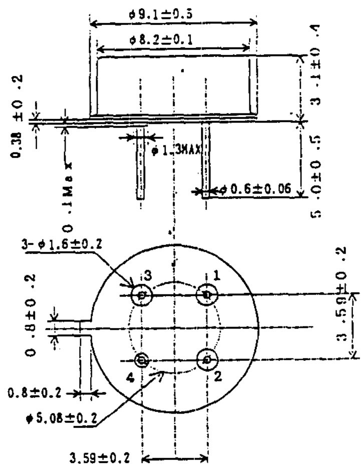
Hitachi Code	HFP



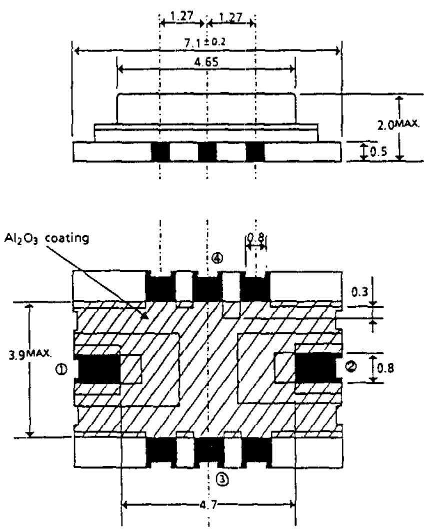
Hitachi Code	ERP

Package Information

Unit: mm



Hitachi Code	TO-39



Hitachi Code	SAW-SM1

DATA SHEETS

2SC2732 Series

Silicon NPN Epitaxial

Application

UHF frequency converter

Features

- Surface mount packages (MPAK, CMPAK, FPAK)

Table 1 Ordering Information

Type No.	Package
2SC2464	FPAK
2SC2732	MPAK
2SC4462	CMPAK

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Ratings	Unit
Collector to base voltage		V_{CBO}	30	V
Collector to emitter voltage		V_{CEO}	25	V
Emitter to base voltage		V_{EBO}	4	V
Collector current		I_C	20	mA
Collector power dissipation	2SC2464	P_C	200	mW
	2SC2732		150	
	2SC4462		100	
Junction temperature		Tj	150	°C
Storage temperature		Tstg	–55 to +150	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Collector to base breakdown voltage	$V_{(BR)CBO}$	30	—	—	V	I_C = 10 µA, I_E = 0
Collector to emitter breakdown voltage	$V_{(BR)CEO}$	25	—	—	V	I_C = 1 mA, R_{BE} = ∞
Emitter to base breakdown voltage	$V_{(BR)EBO}$	4	—	—	V	I_E = 10 µA, I_C = 0
Collector cutoff current	I_{CBO}	—	—	0.5	µA	V_{CB} = 10 V, I_E = 0
Collector to emitter saturation voltage	$V_{CE(sat)}$	—	—	5	V	I_C = 10 mA, I_B = 1 mA

Electrical Characteristics (Ta = 25°C) (cont)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
DC current transfer ratio	h_{FE}	30	—	—		V_{CE} = 10 V, I_C = 3 mA
Gain bandwidth product	f_T	700	1000	—	MHz	V_{CE} = 10 V, I_C = 5 mA
Collector output capacitance	Cob	—	—	0.8	pF	V_{CB} = 10 V, I_E = 0 , f = 1 MHz
Conversion gain	CG	—	7.0	—	dB	V_{CC} = 12 V, I_C = 1 mA, f = 900 MHz fosc = 930 MHz (0 dBm), fout = 30 MHz
Noise figure	NF	—	10.0	—	dB	

2SC2732 representing the characteristics curves hereafter.

For the detail of characteristics of other parts, please consult our sales office near you.

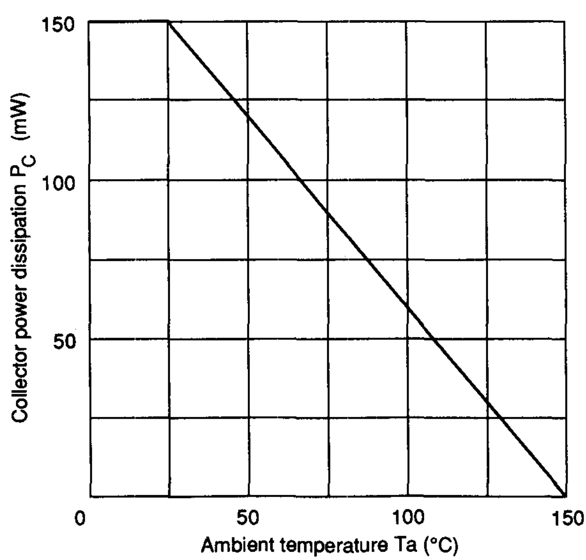


Figure 1 Maximum Collector Power Dissipation Curve

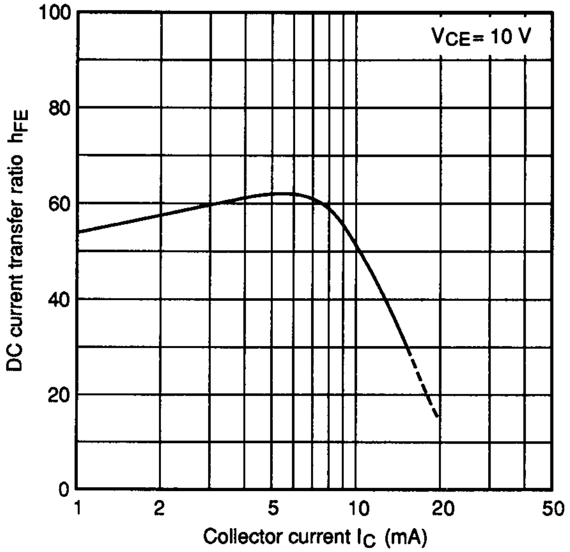


Figure 2 DC Current Transfer Ratio vs. Collector Current

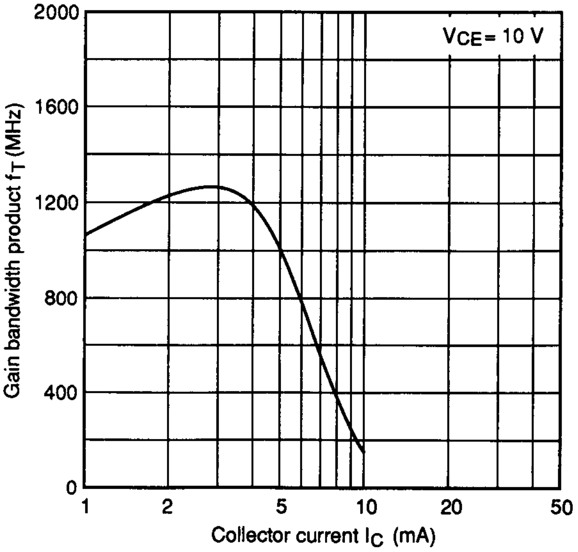


Figure 3 Gain Bandwidth Product vs. Collector Current

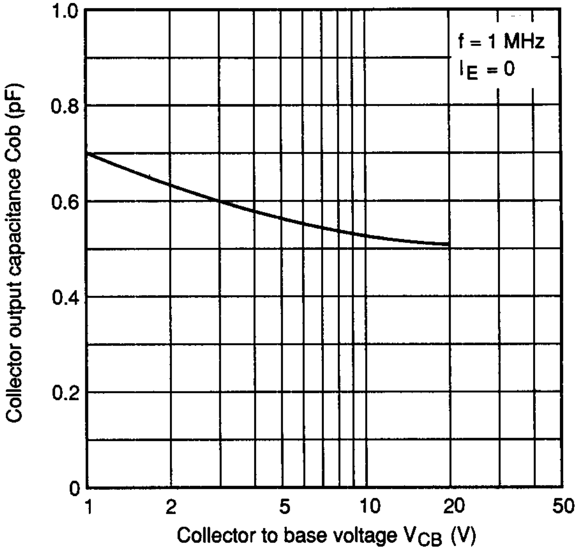


Figure 4 Collector Output Capacitance vs. Collector to Base Voltage

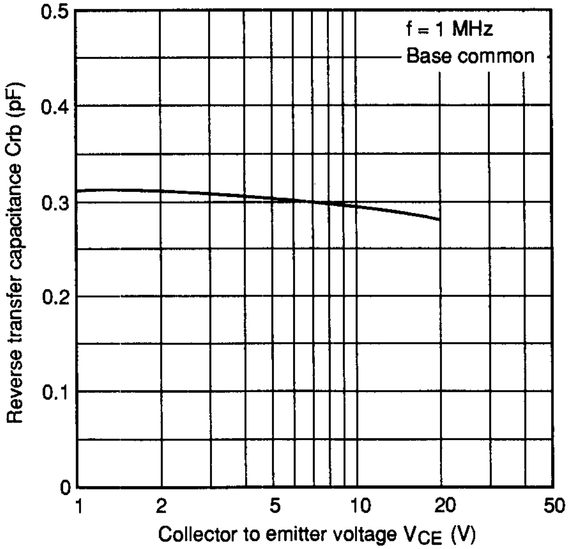


Figure 5 Reverse Transfer Capacitance vs. Collector to Emitter Voltage

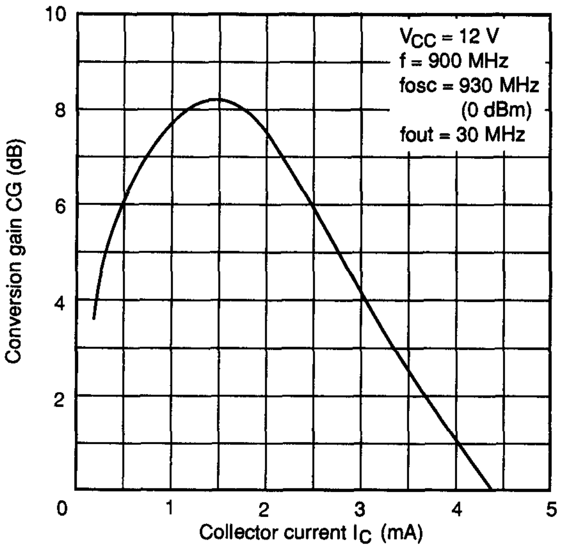


Figure 6 Conversion Gain vs. Collector Current

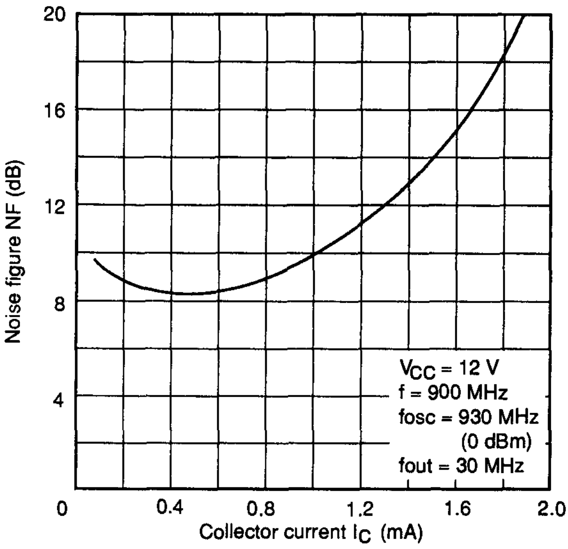
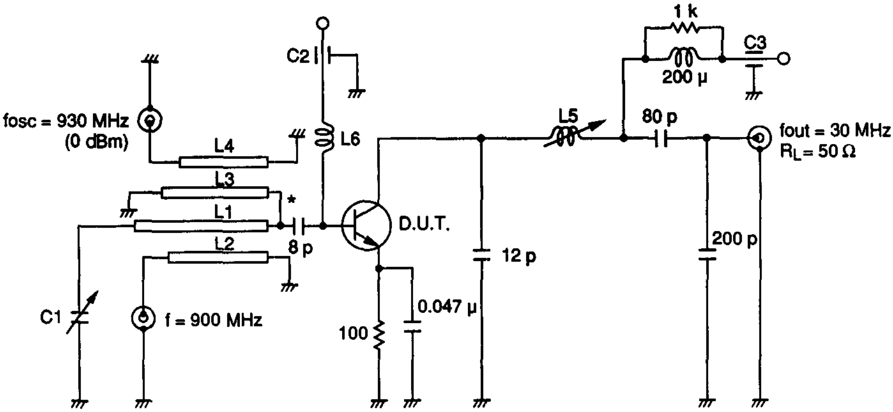


Figure 7 Noise Figure vs. Collector Current



* ······ Disk capacitor

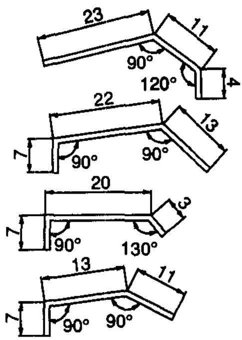
Unit R: Ω
C: F
L: H

L1: ϕ1 mm enameled copper wire

L2: ϕ1 mm enameled copper wire

L3: ϕ1 mm enameled copper wire

L4: ϕ1 mm enameled copper wire



L5: Bobbin ϕ 5 mm inside dia
ϕ 0.2 mm enameled copper wire 20 turns

L6: ϕ0.5 mm enameled copper wire 1 turn inside dia ϕ6 mm

C1: 20 pF max air trimmer capacitor

C2, C3: 1000 pF air core capacitor

Figure 8 Conversion Gain, Noise Figure Test Circuit

2SC2733 Series

Silicon NPN Epitaxial

Application

VHF frequency converter

Table 1 Ordering Information

Type No.	Package
2SC2467	FPAK
2SC2512	TO-92
2SC2733	MPAK
2SC4463	CMPAK

Table 2 Absolute Maximum Ratings (Ta= 25°C)

Item		Symbol	Ratings	Unit
Collector to base voltage		V_{CBO}	30	V
Collector to emitter voltage		V_{CEO}	20	V
Emitter to base voltage		V_{EBO}	3	V
Collector current		I_C	50	mA
Collector power dissipation	2SC2467	P_C	200	mW
	2SC2512		300	
	2SC2733		150	
	2SC4463		100	
Junction temperature		Tj	150	°C
Storage temperature		Tstg	–55 to +150	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Collector to base breakdown voltage	$V_{(BR)CBO}$	30	—	—	V	I_C = 10 µA, I_E = 0
Collector to emitter breakdown voltage	$V_{(BR)CEO}$	20	—	—	V	I_C = 1 mA, R_{BE} = ∞
Emitter to base breakdown voltage	$V_{(BR)EBO}$	3	–	—	V	I_E = 10 µA, I_C = 0
Collector cutoff current	I_{CBO}	—	—	0.5	µA	V_{CB} = 10 V, I_E = 0

Electrical Characteristics (Ta = 25°C) (cont)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Collector to emitter saturation voltage	$V_{CE(sat)}$	—	—	1.0	V	I_C = 20 mA, I_B = 4 mA
DC current transfer ratio	h_{FE}	60	120	—	—	V_{CE} = 10 V, I_C = 10 mA
Gain bandwidth product	f_T	600	1000	—	MHz	V_{CE} = 10 V, I_C = 10 mA
Reverse transfer capacitance	Cre	—	0.35	0.65	pF	V_{CB} = 10 V, emitter common, f = 1 MHz
Conversion gain	CG	—	21	—	dB	V_{CC} = 12 V, I_C = 2 mA, f = 200 MHz, fosc = 230 MHz (0 dBm), fout = 30 MHz
Noise figure	NF	—	4.0	—	dB	

2SC2733 representing the characteristics curves hereafter.

For the detail of characteristics of other parts, please consult our sales office near you.

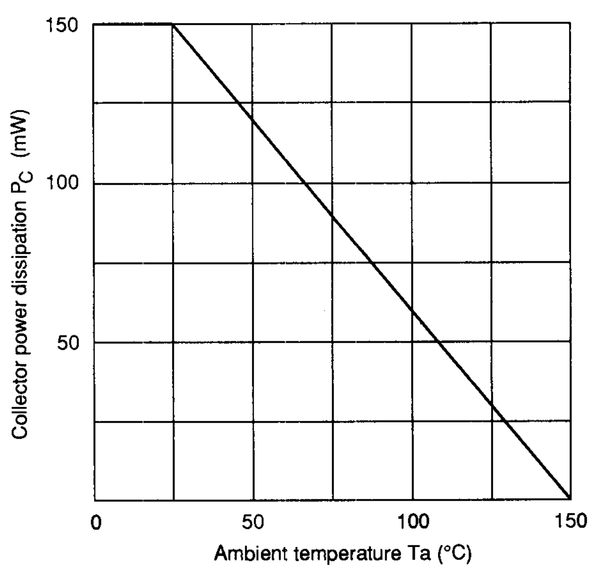


Figure 1 Maximum Collector Power Dissipation Curve

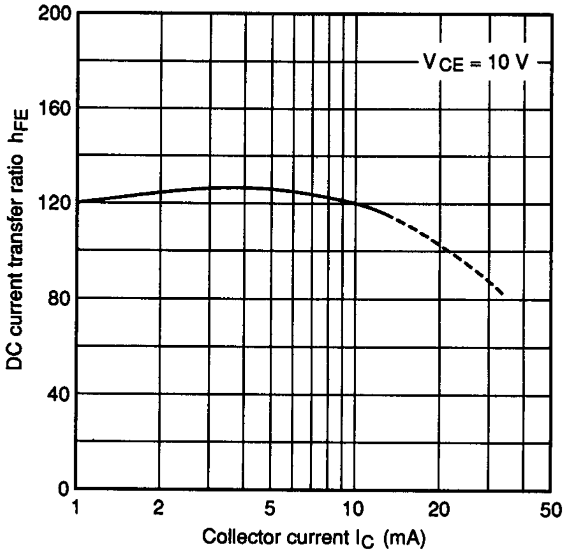


Figure 2 DC Current Transfer Ratio vs. Collector Current

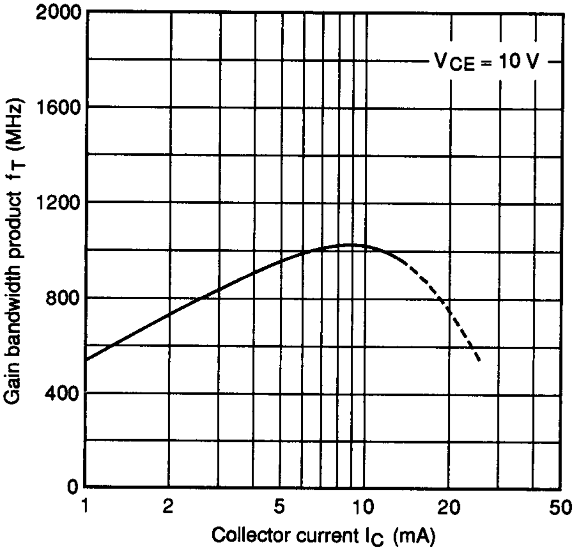


Figure 3 Gain Bandwidth Product vs. Collector Current

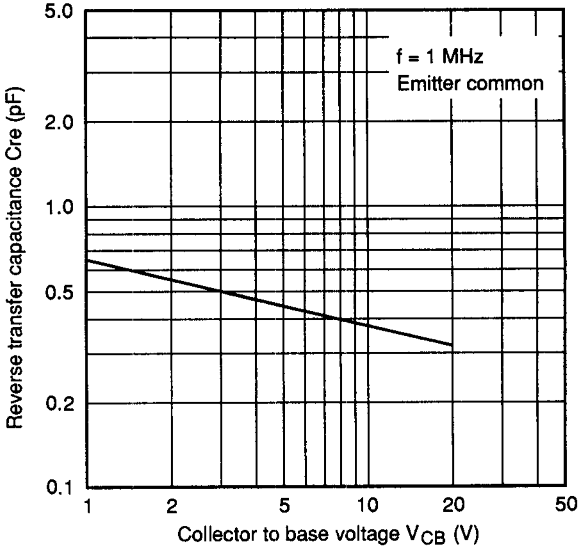


Figure 4 Reverse Transfer Capacitance vs. Collector to Base Voltage

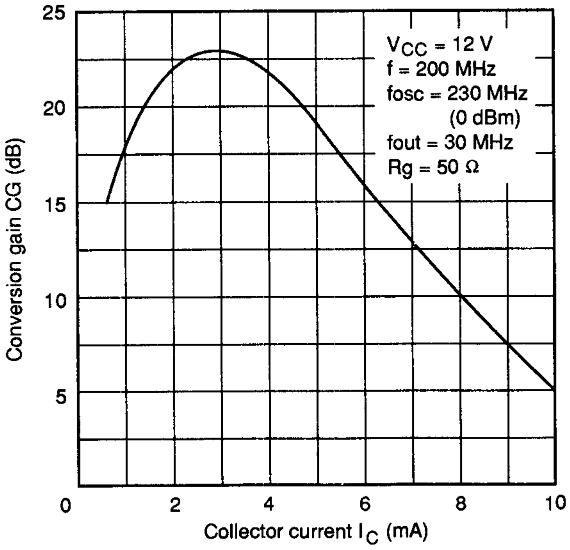


Figure 5 Conversion Gain vs. Collector Current

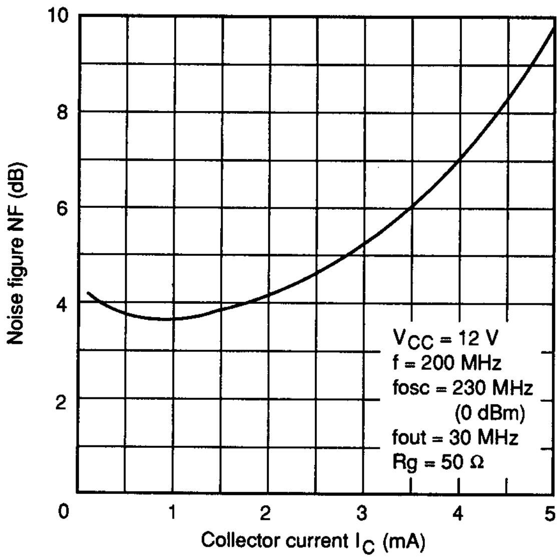


Figure 6 Noise Figure vs. Collector Current

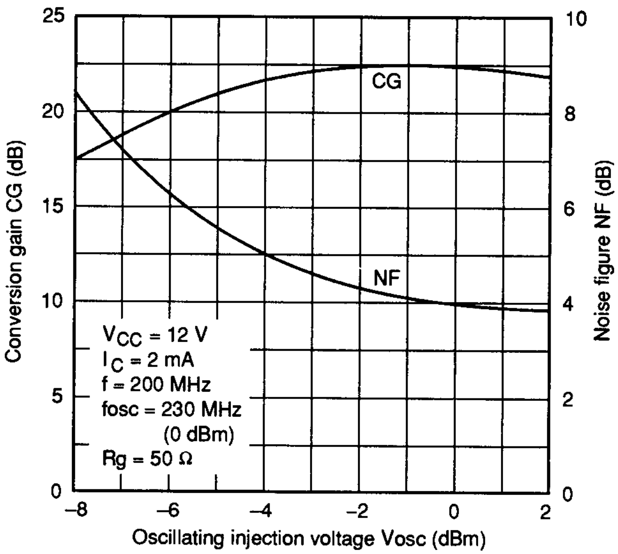
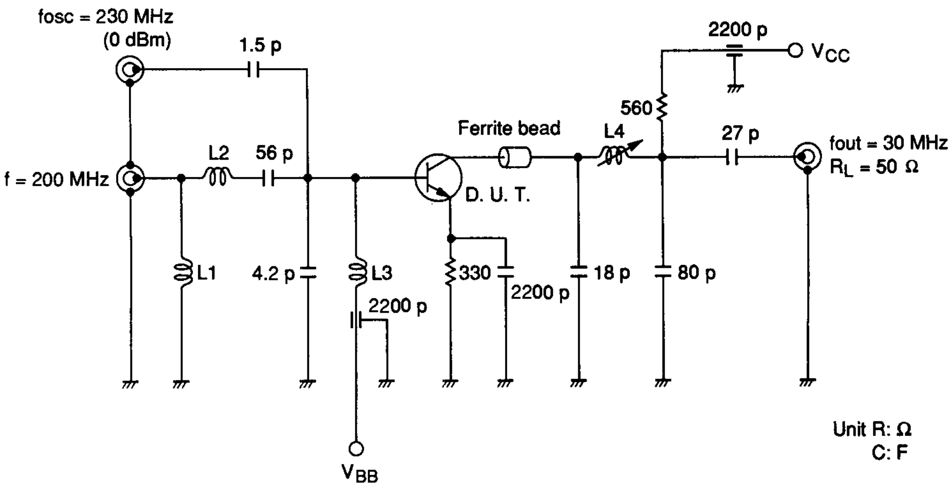


Figure 7 Conversion Gain, Noise Figure vs. Oscillating Injection Voltage



L1: ϕ0.5 mm enameled copper wire 4 tums inside dia ϕ5 mm
L2: ϕ0.5 mm enameled copper wire 4 turns inside dia ϕ4 mm
L3: ϕ0.2 mm enameled copper wire 6 turns inside dia ϕ3 mm
L4: Outside dia ϕ0.5 mm bobbin, ϕ0.2 mm enameled copper wire 16 turns, using ferrite bead

Figure 8 Conversion Gain, Noise Figure Test Circuit

2SC2734 Series

Silicon NPN Epitaxial

Application

UHF frequency converter, local oscillator, wide band amplifier

Table 1 Ordering Information

Type No.	Package
2SC2731	FPAK
2SC2734	MPAK
2SC3501	FPAK
2SC3867	MPAK-R
2SC4264	CMPAK

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Ratings	Unit
Collector to base voltage		V_{CBO}	20	V
Collector to emitter voltage		V_{CEO}	11	V
Emitter to base voltage		V_{EBO}	3	V
Collector current		I_C	50	mA
Collector power dissipation	2SC2731	P_C	200	mW
	2SC2734		150	
	2SC3501		200	
	2SC3867		150	
	2SC4264		100	
Junction temperature		Tj	150	°C
Storage temperature		Tstg	–55 to +150	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Collector to base breakdown voltage	$V_{(BR)CBO}$	20	—	—	V	I_C = 10 μA, I_E = 0
Collector to emitter breakdown voltage	$V_{(BR)CEO}$	11	—	—	V	I_C = 1 mA, $R_{BE} = \infty$

Electrical Characteristics (Ta = 25°C) (cont)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Emitter to base breakdown voltage	$V_{(BR)EBO}$	3	—	—	V	I_E = 10 μA, I_C = 0
Collector cutoff current	I_{CBO}	—	—	0.5	μA	V_{CB} = 10 V, I_E = 0
Collector to emitter saturation voltage	$V_{CE(sat)}$	—	—	0.7	V	I_C = 10 mA, I_B = 5 mA
DC current transfer ratio	h_{FE}	20	90	200		V_{CE} = 10 V, I_C = 5 mA
Gain bandwidth product	f_T	1.4	3.5	—	GHz	V_{CE} = 10 V, I_C = 10 mA
Collector output capacitance	Cob	—	0.9	1.5	pF	V_{CB} = 10 V, I_E = 0, f = 1 MHz
Conversion gain	CG	—	15	—	dB	V_{CC} = 6 V, I_C = 2 mA, f = 900 MHz, fosc = 930 MHz (0 dBm), fout = 30 MHz
Noise figure	NF	—	9	—	dB	
Oscillating output voltage	Vosc	—	140	—	mV	V_{CC} = 6 V, I_C = 5 mA, f = 930 MHz

Note: Marking of 2SC2734 and 2SC4264 is "GC"
Marking of 2SC3867 is "DI-"

2SC2734 representing the characteristics curves hereafter.

For the detail of characteristics of other parts, please consult our sales offices near you.

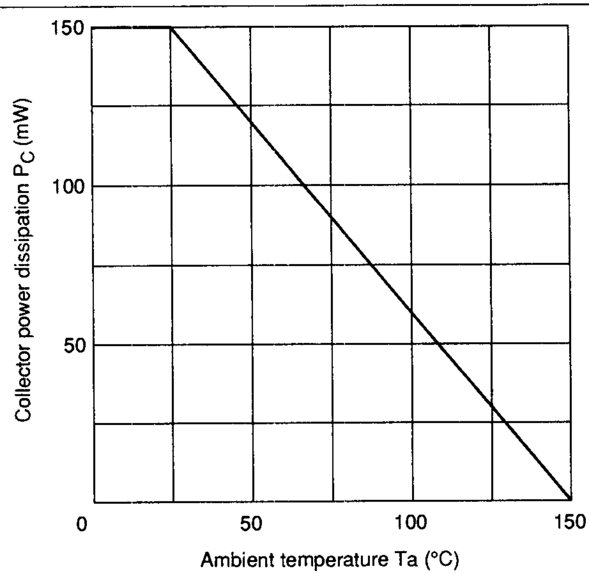


Figure 1 Maximum Collector Power Dissipation Curve

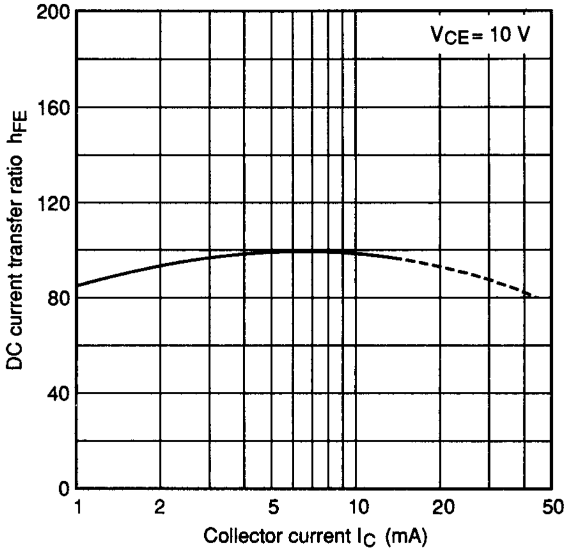


Figure 2 DC Current Transfer Ratio vs. Collector Current

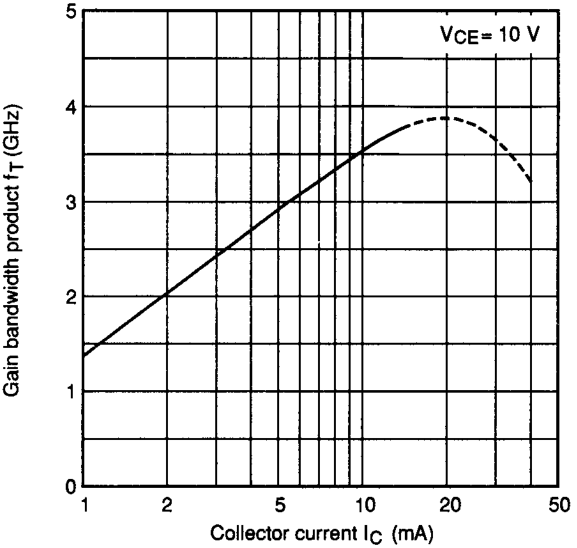


Figure 3 Gain Bandwidth Product vs. Collector Current

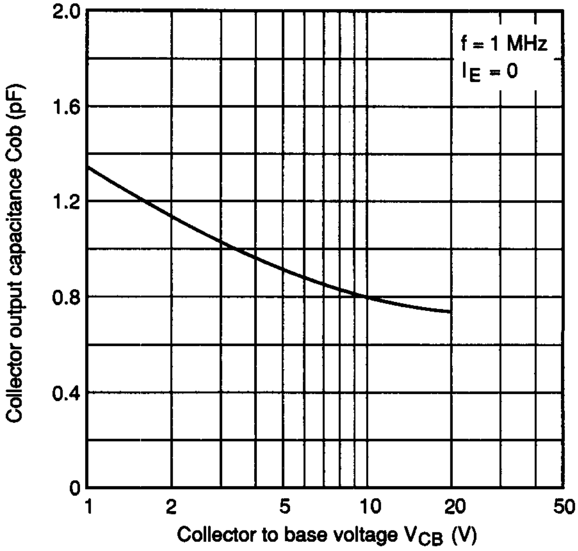


Figure 4 Collector Output Capacitance vs. Collector to Base Voltage

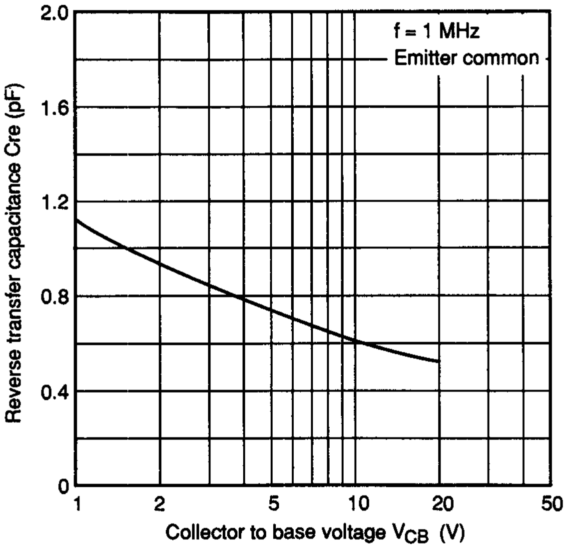


Figure 5 Reverse Transfer Capacitance vs. Collector to Base Voltage

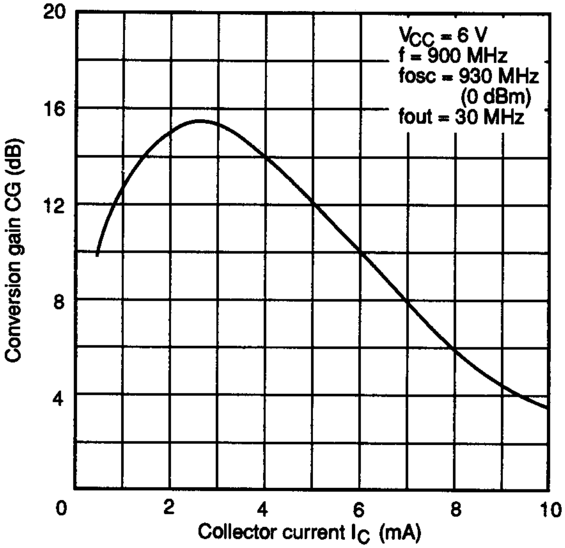


Figure 6 Conversion Gain vs. Collector Current

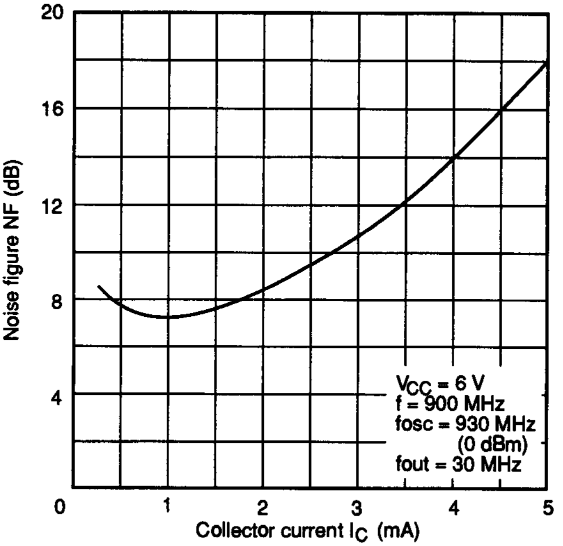


Figure 7 Noise Figure vs. Collector Current

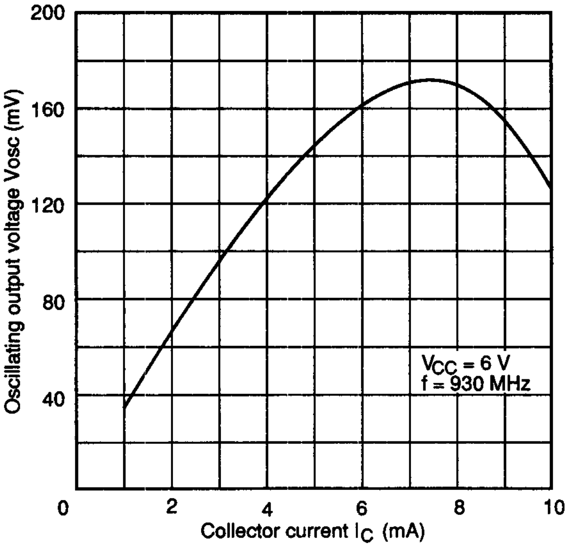


Figure 8 Oscillating Output Voltage vs. Collector Current

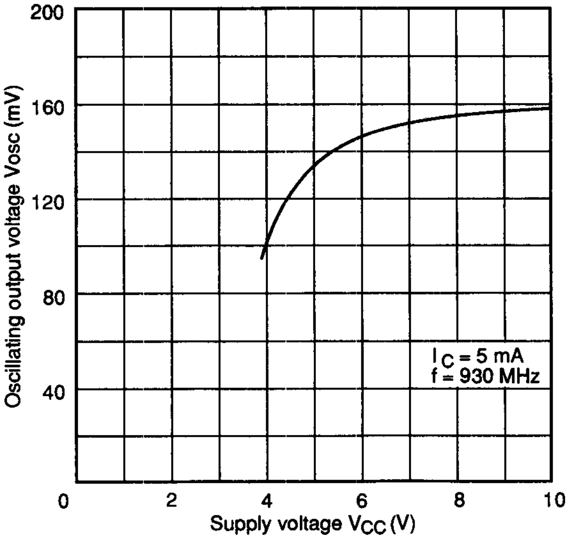


Figure 9 Oscillating Output Voltage vs. Supply Voltage

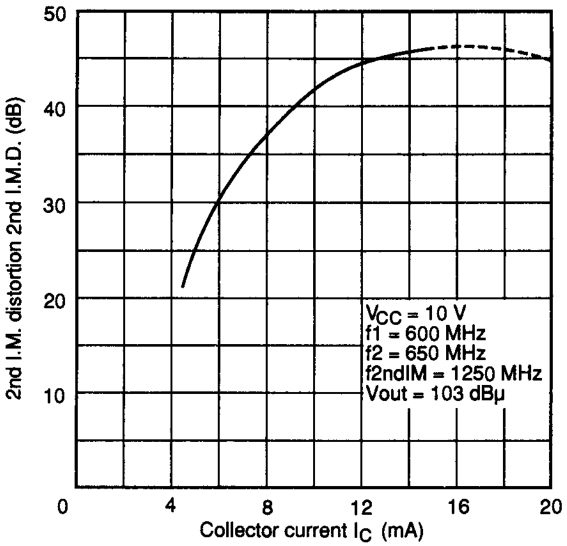


Figure 10 2nd I.M. Distortion vs. Collector Current

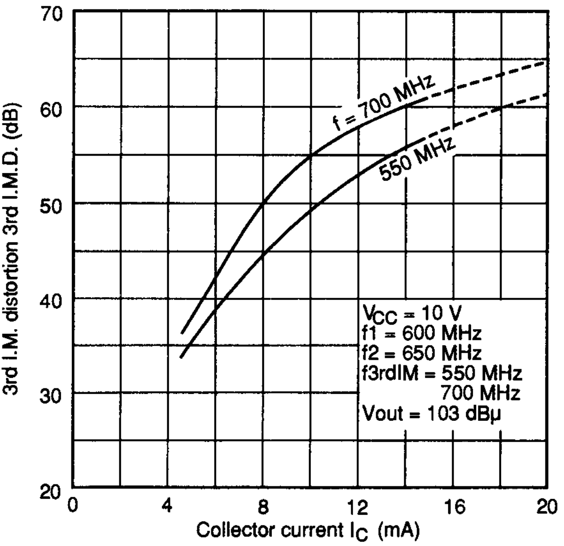


Figure 11 3rd I.M. Distortion vs. Collector Current

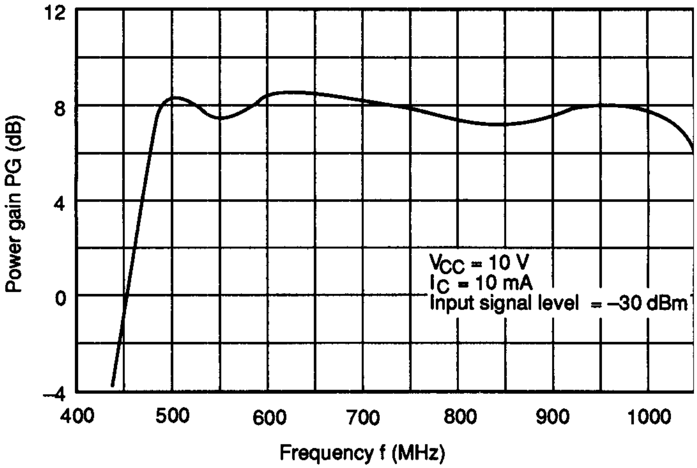
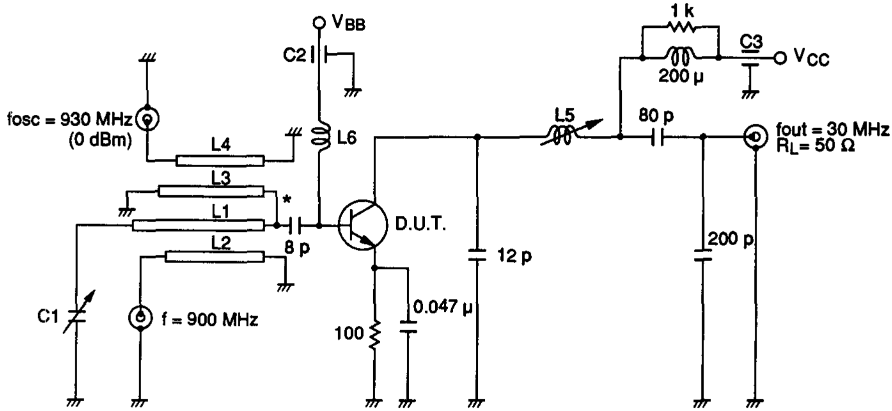


Figure 12 Power Gain vs. Frequency



* ······ Disk capacitor

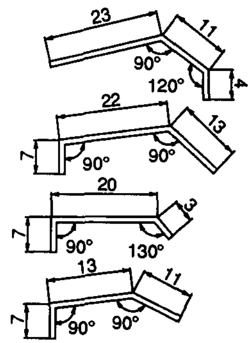
Unit R: Ω
C: F
L: H

L1: ϕ 1 mm enameled copper wire

L2: ϕ 1 mm enameled copper wire

L3: ϕ 1 mm enameled copper wire

L4: ϕ 1 mm enameled copper wire



Unit: mm

L5: Bobbin ϕ 5 mm inside diameter
ϕ 0.2 mm enameled copper wire 20 turns

L6: ϕ 0.5 mm enameled copper wire 1 turn inside diameter ϕ 6 mm

C1: 20 pF max air trimmer capacitor

C2, C3: 1000 pF air core capacitor

Figure 13 Conversion Gain, Noise Figure Test Circuit

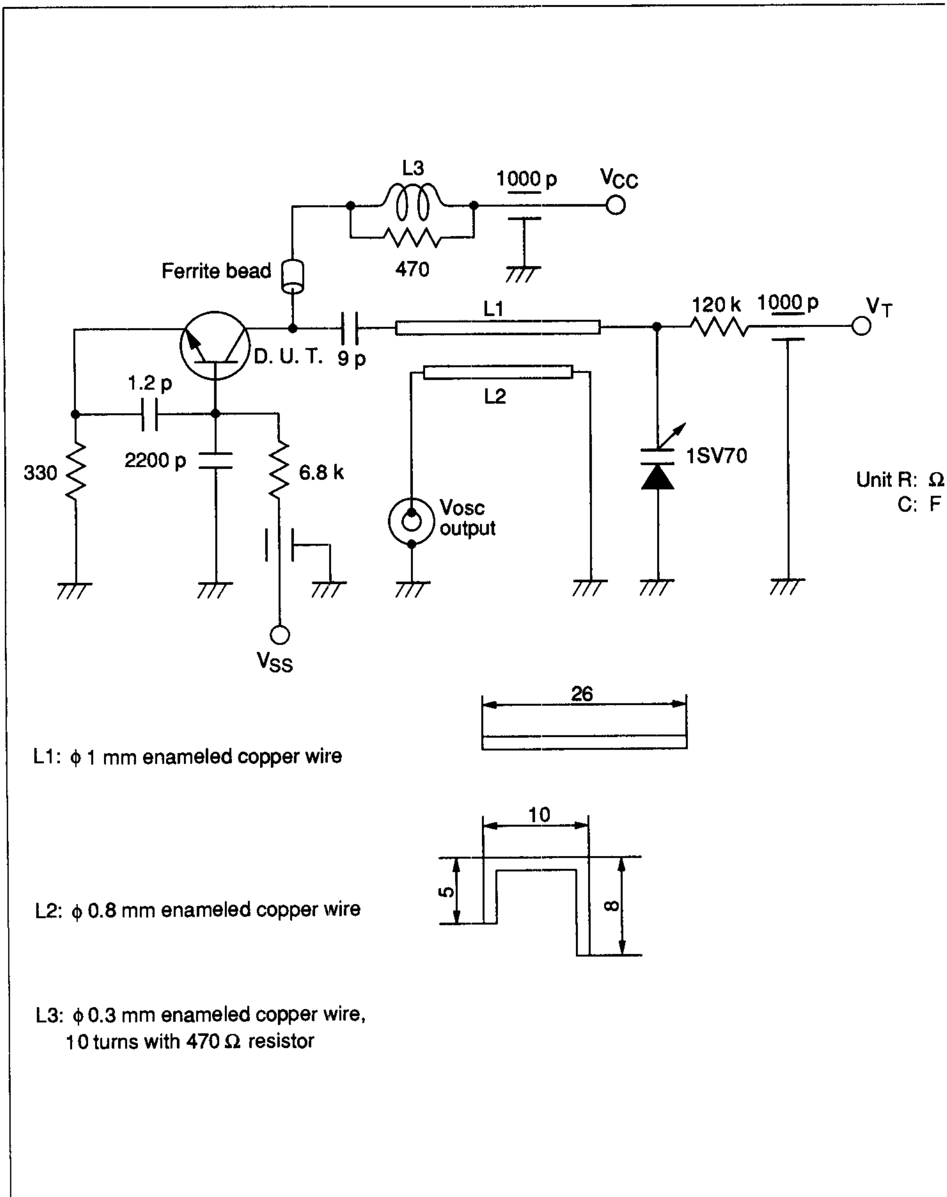
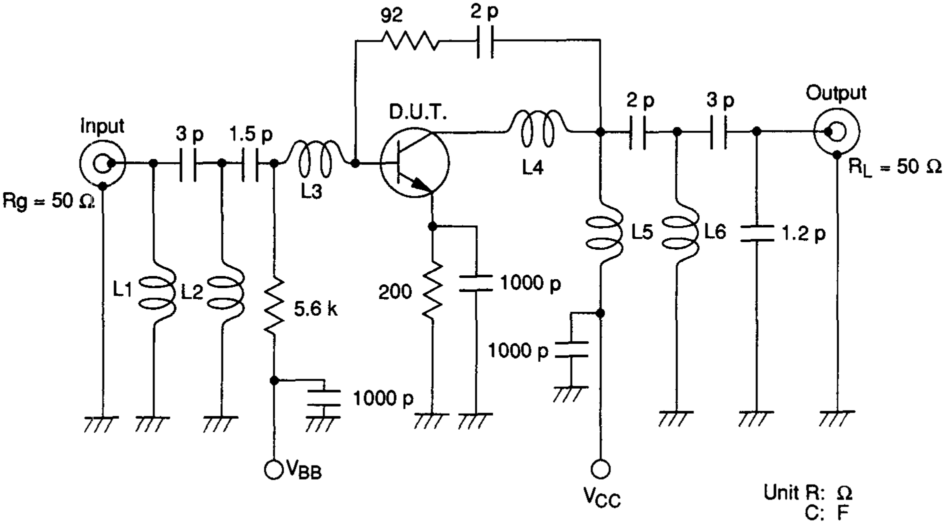


Figure 14 Vosc Test Circuit



L1: ϕ 0.5 mm copper wire 5 turns inside diameter ϕ 3 mm

L2: ϕ 0.5 mm copper wire 2 turns inside diameter ϕ 2 mm

L3: ϕ 0.5 mm copper wire 2 turns inside diameter ϕ 2 mm

L4: ϕ 0.5 mm copper wire 1.5 turns inside diameter ϕ 2 mm

L5: ϕ 0.5 mm copper wire 4 turns inside diameter ϕ 2 mm

L6: ϕ 0.5 mm copper wire 3 turns inside diameter ϕ 2 mm

Figure 15 Circuit Example-UHF Wide Bandwidth Amplifier (f = 500 MHz to 950 MHz)

2SC2735 Series

Silicon NPN Epitaxial

Application

- UHF/VHF local oscillator
- VHF frequency converter

Table 1 Ordering Information

Type No.	Package
2SC1906	TO-92
2SC1907	TO-92
2SC2468	FPAK
2SC2469	FPAK
2SC2735	MPAK
2SC4265	CMPAK

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Ratings	Unit
Collector to base voltage		V_{CBO}	30	V
Collector to emitter voltage		V_{CEO}	20	V
Emitter to base voltage		V_{EBO}	3	V
Collector current		I_C	50	mA
Collector power dissipation	2SC1906	P_C	300	mW
	2SC1907		300	
	2SC2468		200	
	2SC2469		200	
	2SC2735		150	
	2SC4265		100	
Junction temperature		Tj	150	°C
Storage temperature		Tstg	–55 to +150	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Collector to base breakdown voltage	$V_{(BR)CBO}$	30	—	—	V	I_C = 10 μA, I_E = 0
Collector to emitter breakdown voltage	$V_{(BR)CEO}$	20	—	—	V	I_C = 1 mA, R_{BE} = ∞
Emitter to base breakdown voltage	$V_{(BR)EBO}$	3	—	—	V	I_E = 10 μA, I_C = 0
Collector cutoff current	I_{CBO}	—	—	0.5	μA	V_{CB} = 10 V, I_E = 0
Collector to emitter saturation voltage	$V_{CE(sat)}$	—	—	1.0	V	I_C = 20 mA, I_B = 4 mA
DC current transfer ratio	h_{FE}	40	—	—		V_{CE} = 10 V, I_C = 10 mA
Collector output capacitance	Cob	—	0.85	1.5	pF	V_{CB} = 10 V, I_E = 0, f = 1 MHz
Gain bandwidth product	f_T	600	1200	—	MHz	V_{CE} = 10 V, I_C = 10 mA
Oscillating output voltage	Vosc1	—	210	—	mV	V_{CC} = 12 V, I_C = 7 mA, fosc = 300 MHz
	Vosc2	—	130	—	mV	V_{CC} = 12 V, I_C = 7 mA, fosc = 930 MHz
Conversion gain	CG	—	21	—	dB	V_{CC} = 12 V, I_C = 2 mA, f = 200 MHz, fosc = 230 MHz (0 dBm)
Noise figure	NF	—	6.5	—	dB	V_{CC} = 12 V, I_C = 2 mA, f = 200 MHz, fosc = 230 MHz (0 dBm)

Note: Marking of 2SC2735 and 2SC4265 is "JC".

2SC2735 representing the characteristics curves hereafter.

For the detail of characteristics of other parts, please consult our sales office near you.

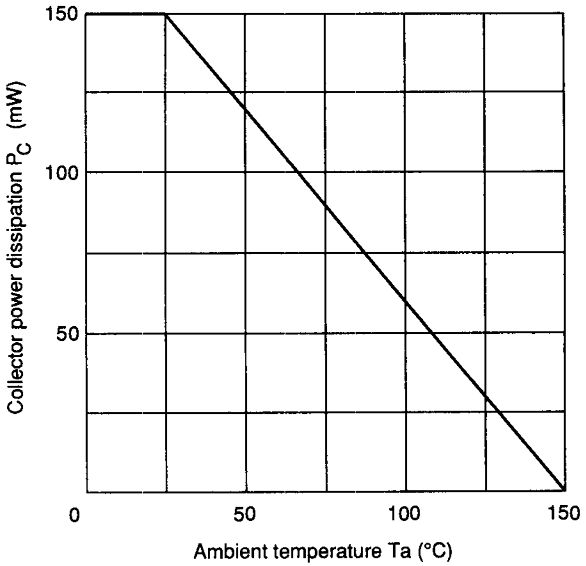


Figure 1 Maximum Collector Power Dissipation Curve

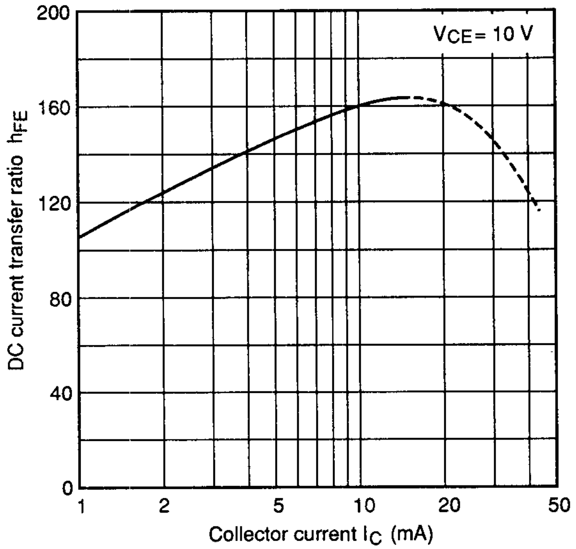


Figure 2 DC Current Transfer Ratio vs. Collector Current

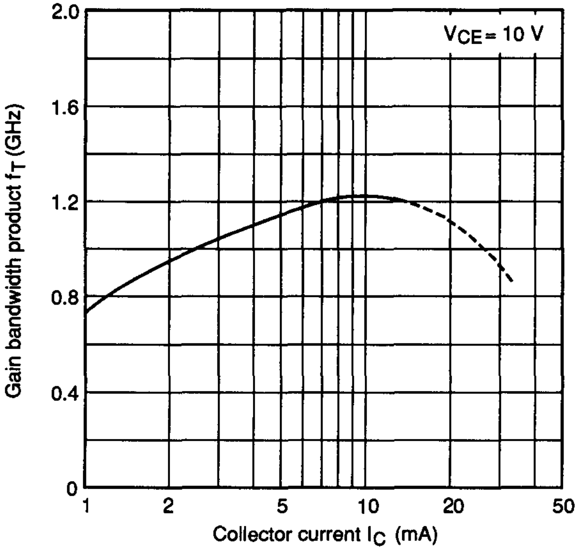


Figure 3 Gain Bandwidth Product vs. Collector Current

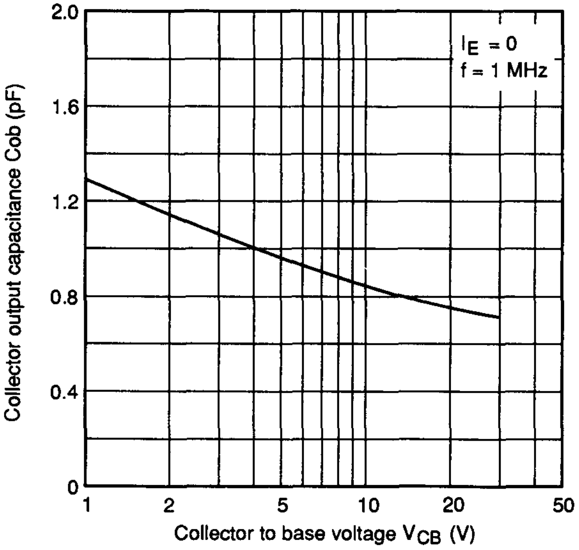


Figure 4 Collector Output Capacitance vs. Collector to Base Voltage

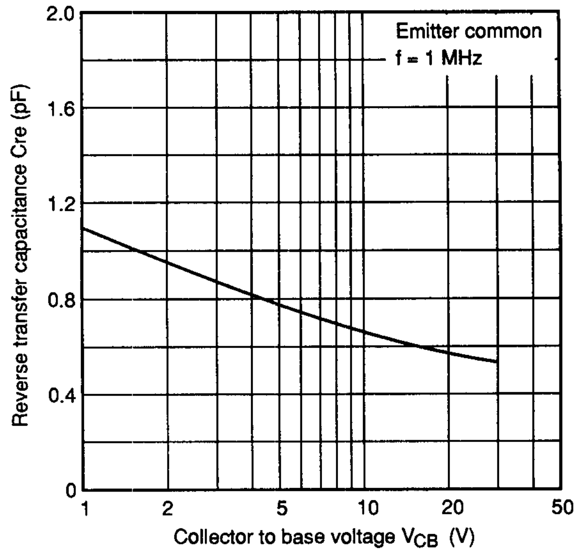


Figure 5 Reverse Transfer Capacitance vs. Collector to Base Voltage

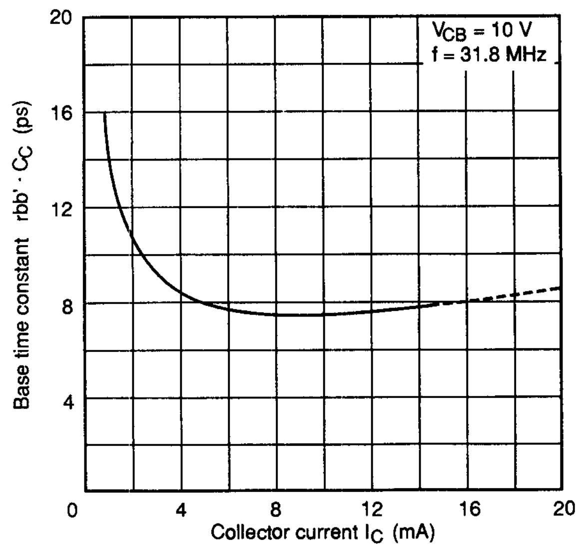


Figure 6 Base Time Constant vs. Collector Current

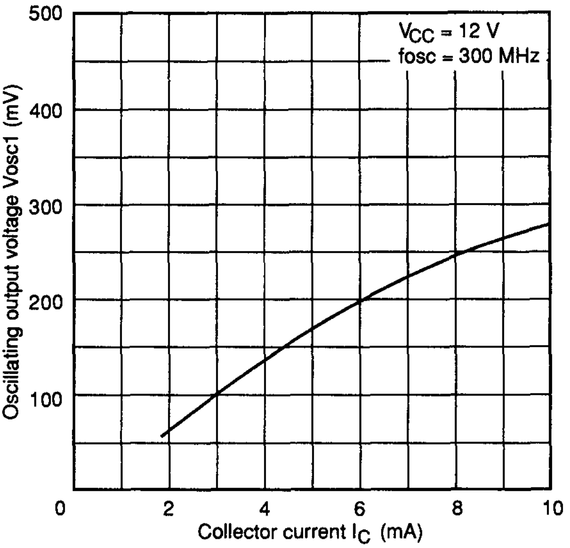


Figure 7 Oscillating Output Voltage vs. Collector Current

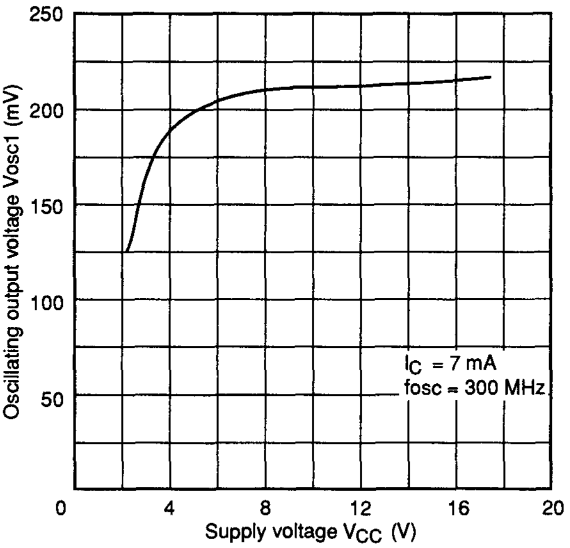


Figure 8 Oscillating Output Voltage vs. Supply Voltage

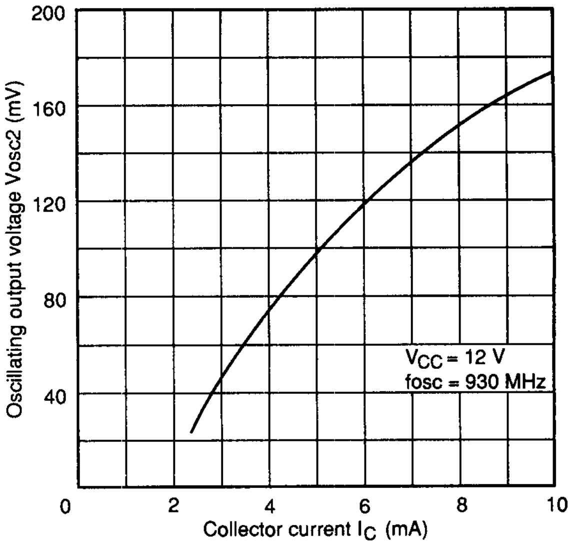


Figure 9 Oscillating Output Voltage vs. Collector Current

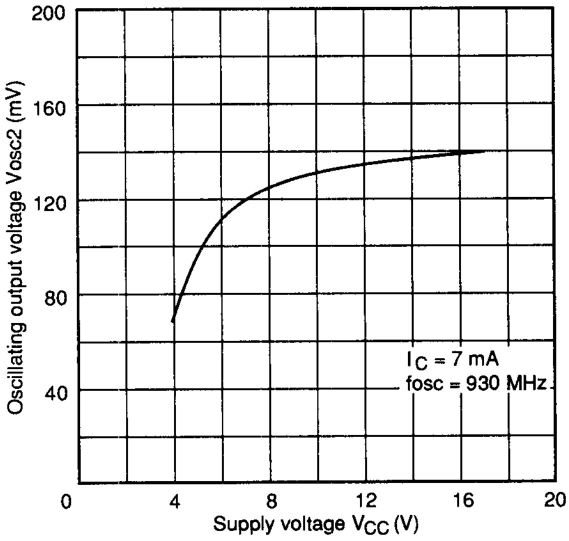


Figure 10 Oscillating Output Voltage vs. Supply Voltage

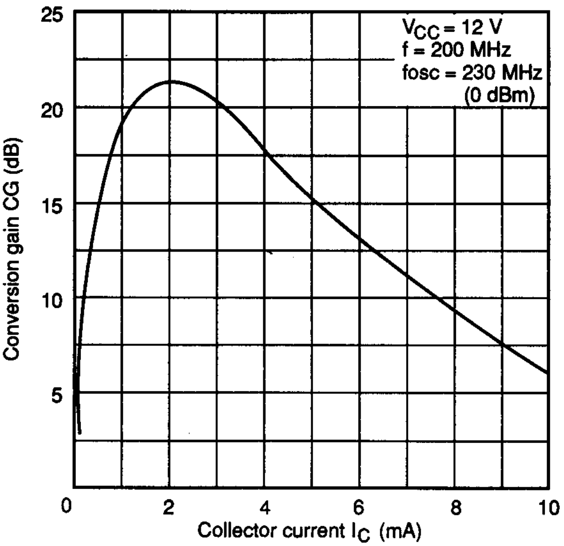


Figure 11 Conversion Gain vs. Collector Current

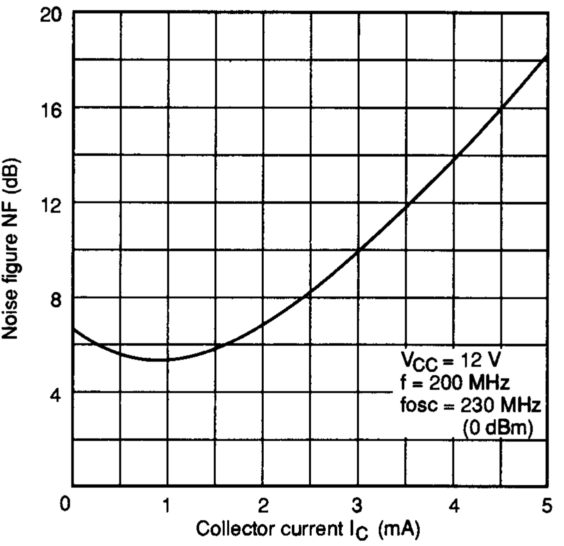
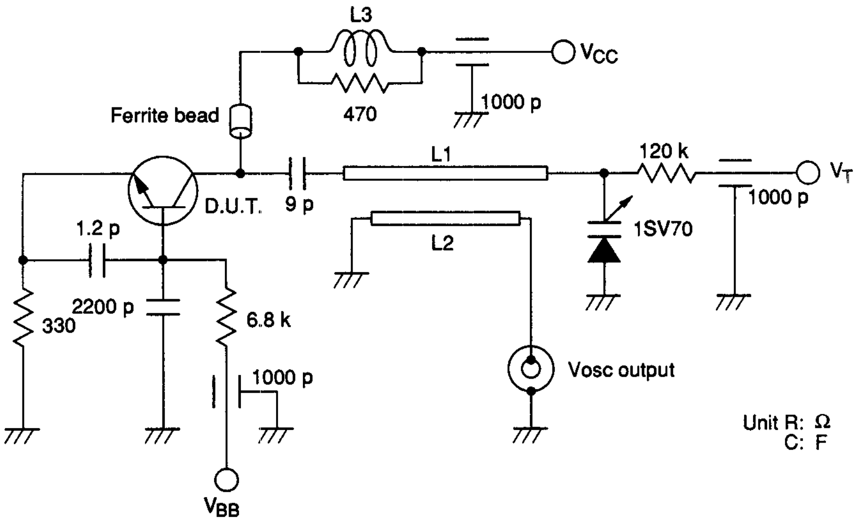
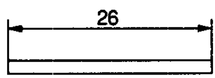


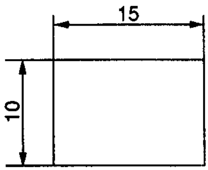
Figure 12 Noise Figure vs. Collector Current



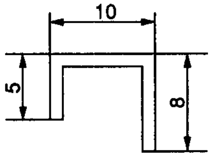
Cavity

L1: Polyurethane coated copper wire





L2: Polyurethane coated copper wire



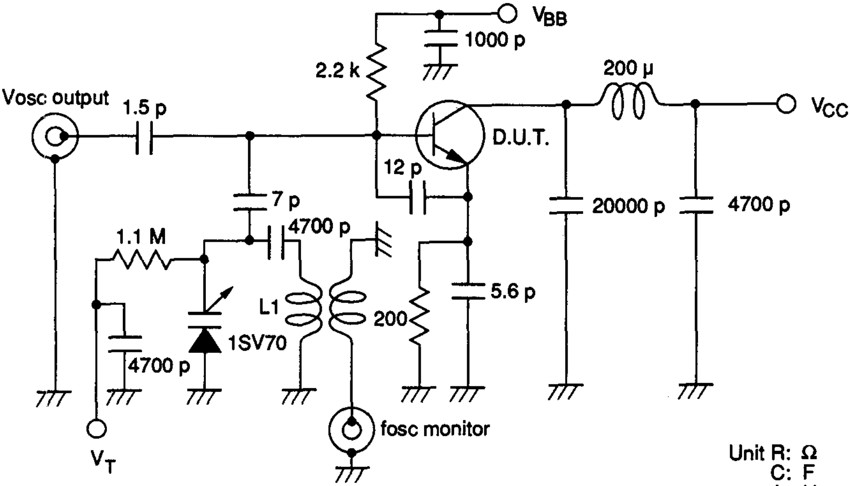
Unit: mm

L3: ϕ0.3 mm enameled copper wire
10 turns with 470 Ω (1/4 W) resistor

Test frequency: fosc = 930 MHz

Test equipment: YHP 4271A vector voltmeter

Figure 13 Vosc2 UHF Oscillating Output Voltage Test Circuit

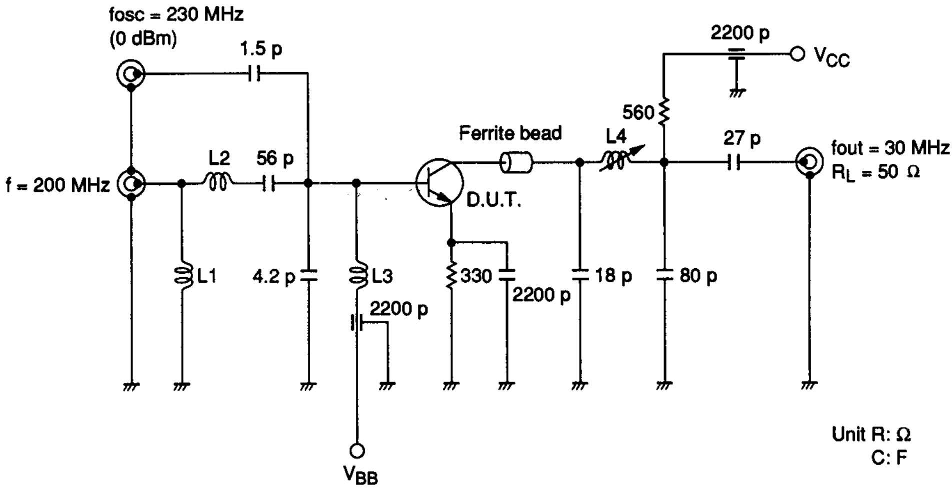


L1: Inside dia ϕ3 mm, ϕ0.3 mm enameled copper wire 12 turns

Test frequency: fosc = 300 MHz

Test equipment: YHP 4271A vector voltmeter

Figure 14 Vosc1 VHF Oscillating Output Voltage Test Circuit



L1: ϕ 0.5 mm enameled copper wire 4 turns inside dia ϕ5 mm
L2: ϕ 0.5 mm enameled copper wire 4 turns inside dia ϕ4 mm
L3: ϕ 0.2 mm enameled copper wire 6 turns inside dia ϕ3 mm
L4: Outside dia ϕ0.5 mm bobbin, ϕ0.2 mm enameled copper wire 16 turns, using ferrite bead

Figure 15 VHF Conversion Gain, Noise Figure Test Circuit

2SC2736 Series

Silicon NPN Epitaxial

Application

UHF/VHF frequency converter, local oscillator

Table 1 Ordering Information

Type No.	Package
2SC2466	FPAK
2SC2471	TO-92
2SC2736	MPAK

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Ratings	Unit
Collector to base voltage		V_{CBO}	30	V
Collector to emitter voltage		V_{CEO}	20	V
Emitter to base voltage		V_{EBO}	3	V
Collector current		I_C	50	mA
Collector power dissipation	2SC2466	P_C	200	mW
	2SC2471		310	
	2SC2736		150	
Junction temperature		Tj	150	°C
Storage temperature		Tstg	–55 to +150	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Collector to base breakdown voltage	$V_{(BR)CBO}$	30	—	—	V	I_C = 10 µA, I_E = 0
Collector to emitter breakdown voltage	$V_{(BR)CEO}$	20	—	—	V	I_C = 1 mA, R_{BE} = ∞
Emitter to base breakdown voltage	$V_{(BR)EBO}$	3	—	—	V	I_E = 10 µA, I_C = 0
Collector cutoff current	I_{CBO}	—	—	500	nA	V_{CB} = 15 V, I_C = 0
Collector to emitter saturation voltage	$V_{CE(sat)}$	—	—	1	V	I_C = 10 mA, I_B = 5 mA
DC current transfer ratio	h_{FE}	30	—	200		V_{CE} = 10 V, I_C = 5 mA

Electrical Characteristics (Ta = 25°C) (cont)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Collector output capacitance	Cob	—	—	1.0	pF	V_{CB} = 10 V, I_E = 0, f = 1 MHz
Gain bandwidth product	fT	1400	2200	—	MHz	V_{CE} = 10 V, I_C = 5 mA
Conversion gain	CG1	—	22.5	—	dB	V_{CC} = 12 V, I_C = 2 mA, f = 200 MHz, fosc = 230 MHz (0 dBm)
	CG2	—	10	—	dB	V_{CC} = 12 V, I_C = 2 mA, f = 900 MHz, fosc = 930 MHz (0 dBm), fout = 30 MHz
Noise figure	NF	—	4.0	—	dB	V_{CC} = 12 V, I_C = 2 mA, f = 200 MHz, fosc = 230 MHz (0 dBm)
Oscillating output voltage	Vosc1	—	300	—	mV	V_{CC} = 12 V, I_C = 7 mA, fosc = 300 MHz
	Vosc2	—	200	—	mV	V_{CC} = 12 V, I_C = 7 mA, fosc = 930 MHz

Note: Marking of 2SC2734 is "TC".

2SC2736 representing the characteristics curves hereafter. For the detail of characteristics of other parts, please consult our sales office near you.

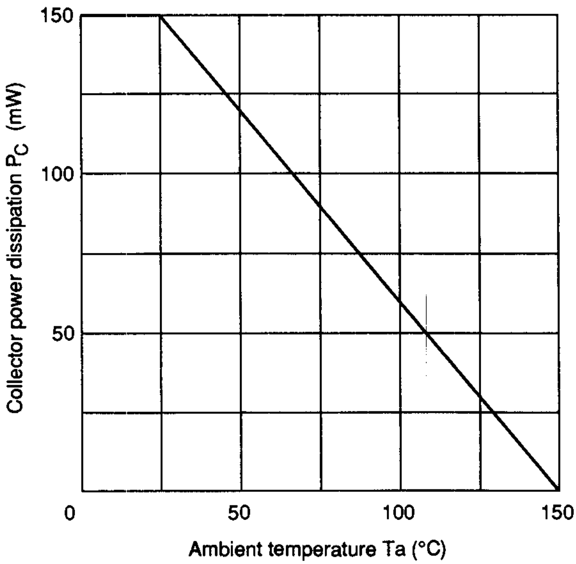


Figure 1 Maximum Collector Power Dissipation Curve

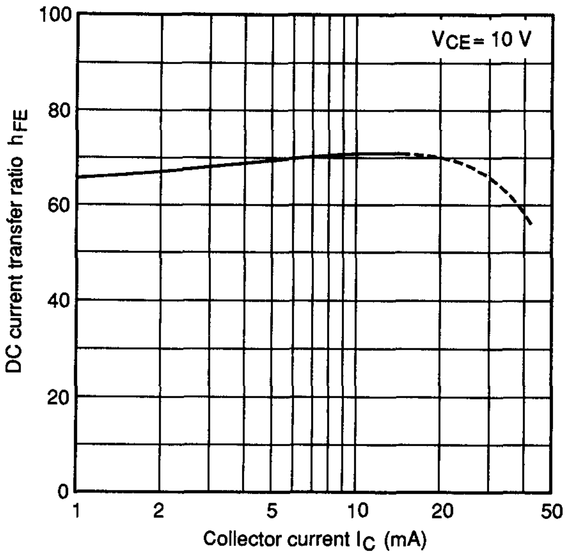


Figure 2 DC Current Transfer Ratio vs. Collector Current

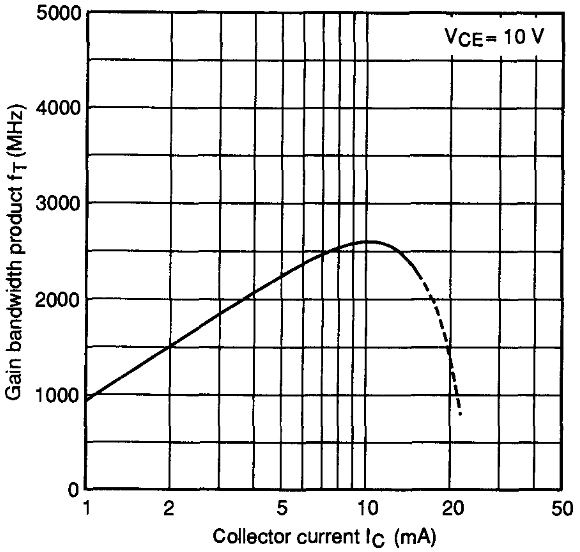


Figure 3 Gain Bandwidth Product vs. Collector Current

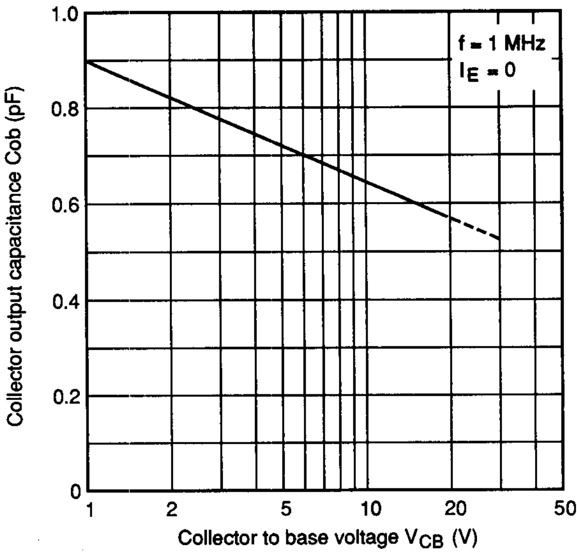


Figure 4 Collector Output Capacitance vs. Collector to Base Voltage

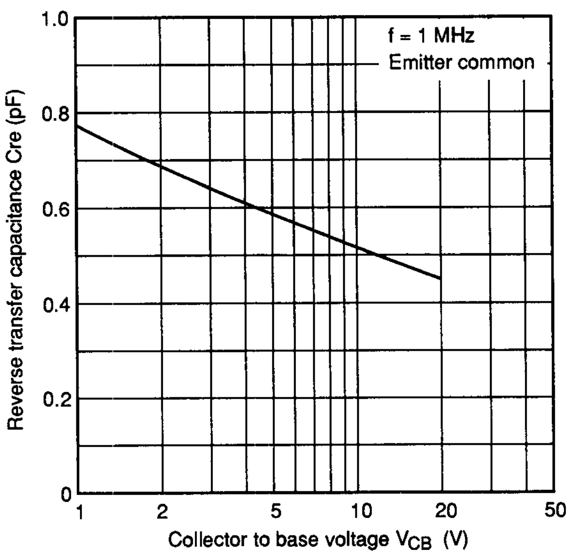


Figure 5 Reverse Transfer Capacitance vs. Collector to Base Voltage

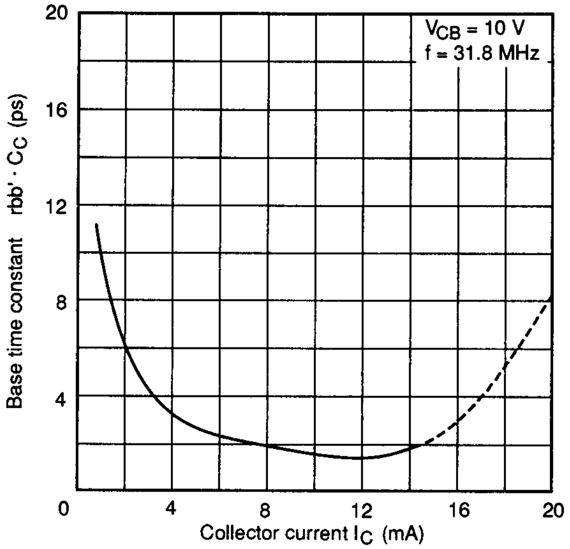


Figure 6 Base Time Constant vs. Collector Current

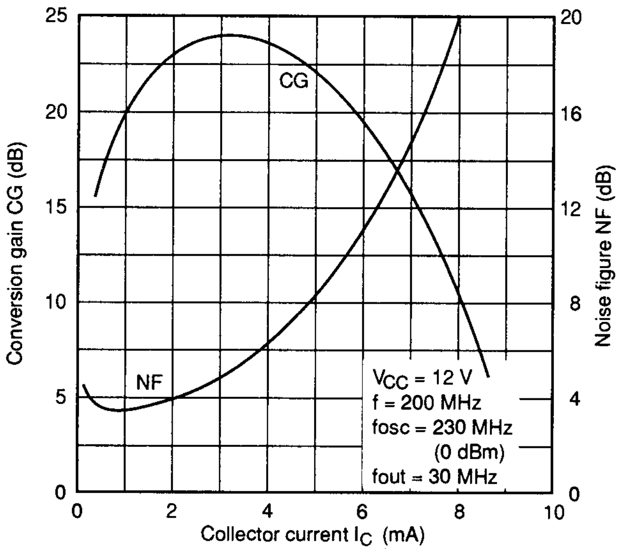


Figure 7 Conversion Gain, Noise Figure vs. Collector Current

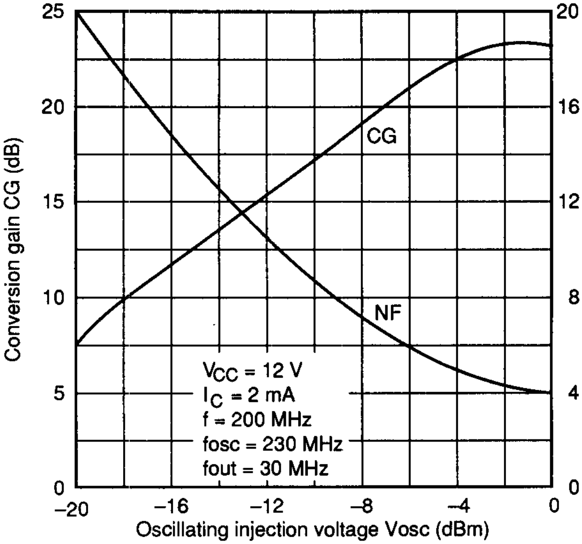


Figure 8 Conversion Gain, Noise Figure vs. Oscillating Injection Voltage

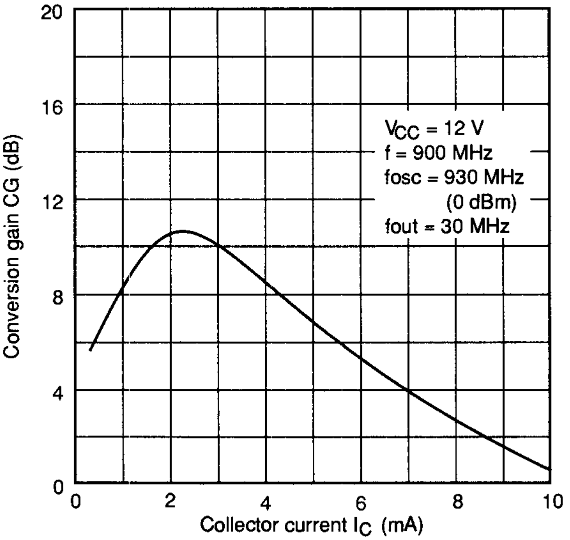


Figure 9 Conversion Gain vs. Collector Current

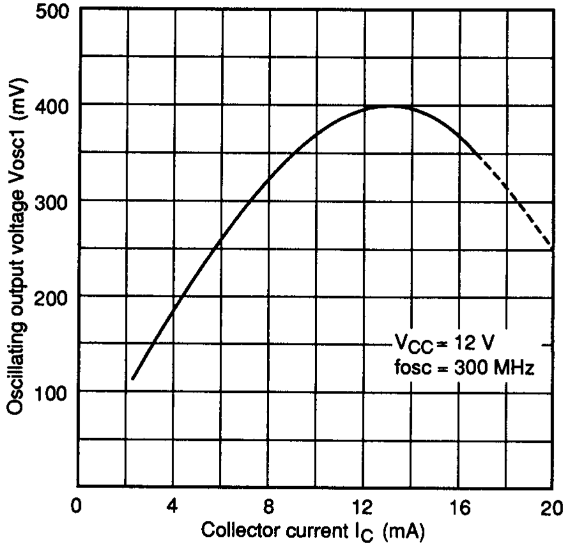


Figure 10 Oscillating Output Voltage vs. Collector Current

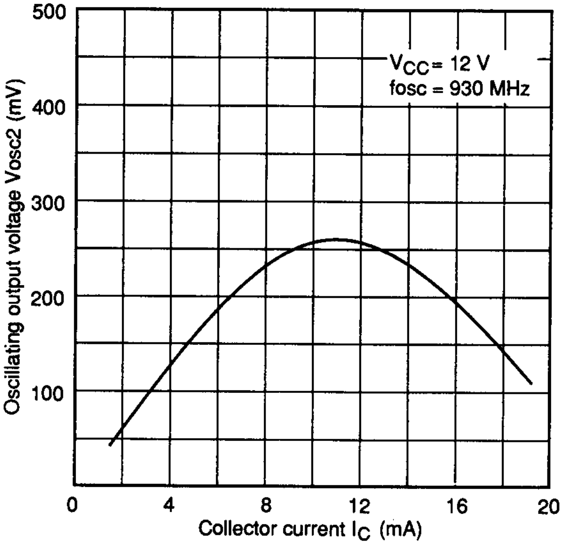


Figure 11 Oscillating Output Voltage vs. Collector Current

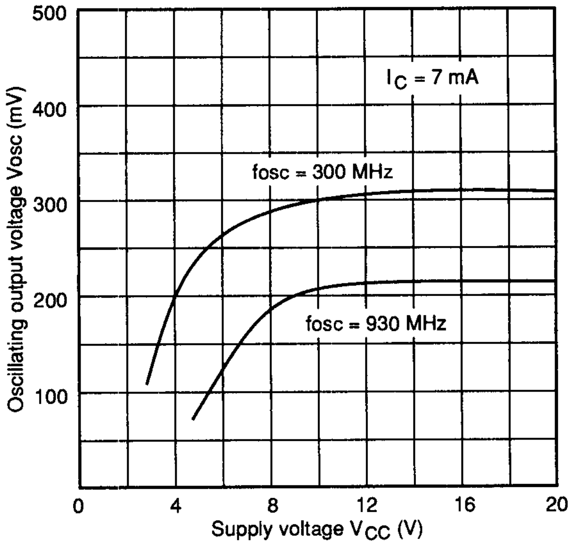
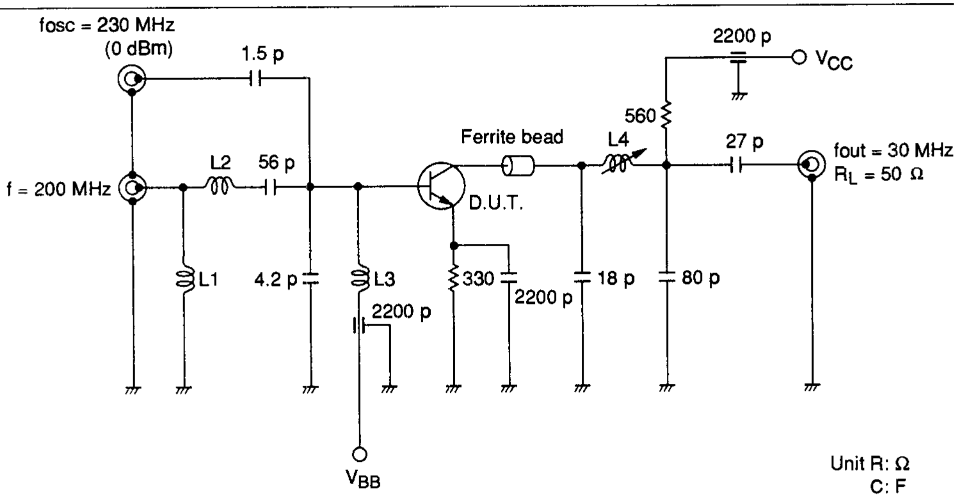
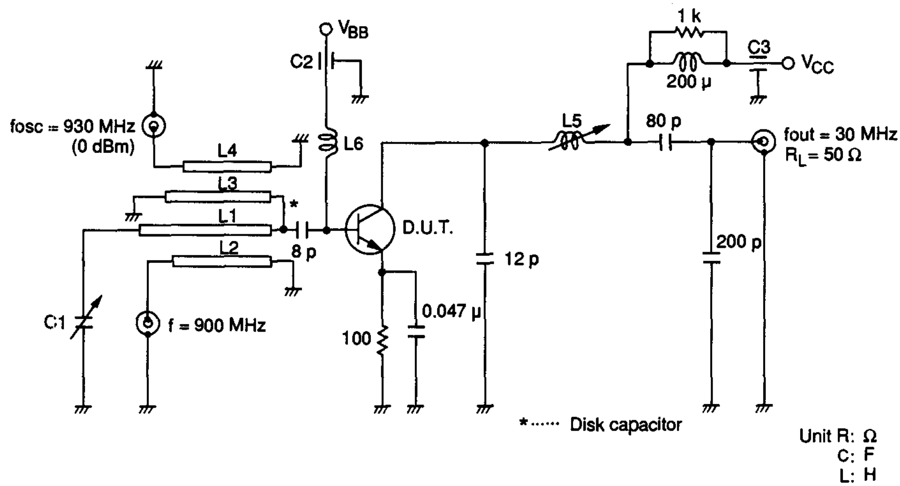


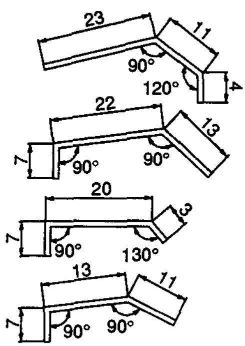
Figure 12 Oscillating Output Voltage vs. Supply Voltage



L1: ϕ0.5 mm enameled copper wire 4 turns inside dia ϕ5 mm
L2: ϕ0.5 mm enameled copper wire 4 turns inside dia ϕ4 mm
L3: ϕ0.2 mm enameled copper wire 6 turns inside dia ϕ3 mm
L4: Outside dia ϕ0.5 mm bobbin, ϕ0.2 mm enameled copper wire 16 turns, using ferrite bead

Figure 13 VHF Conversion Gain (CG1), Noise Figure Test Circuit





L1: ϕ1 mm enameled copper wire

L2: ϕ1 mm enameled copper wire

L3: ϕ1 mm enameled copper wire

L4: ϕ1 mm enameled copper wire

Unit: mm

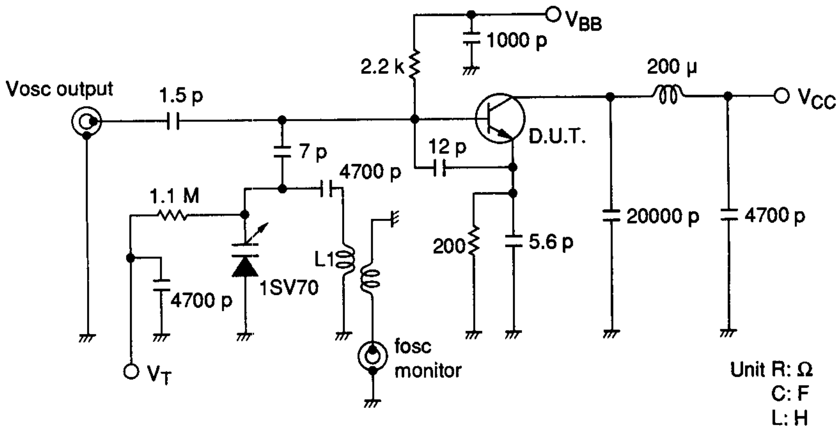
L5: Bobbin ϕ5 mm inside dia
ϕ0.2 mm enameled copper wire 20 turns

L6: ϕ0.5 mm enameled copper wire 1 turn inside dia ϕ6 mm

C1: 20 pF max air trimmer capacitor

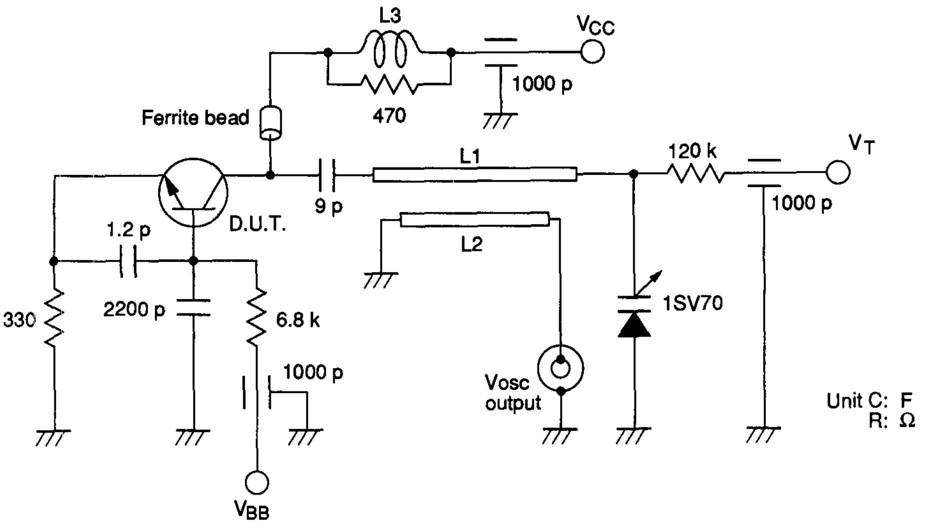
C2, C3: 1000 pF air core capacitor

Figure 14 UHF Conversion Gain (CG2) Test Circuit

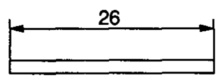


L1: ϕ 0.3 mm enameled copper wire 3 turns inside dia ϕ3 mm
Test frequency: fosc = 300 MHz
Test equipment: YHP 4271A vector voltmeter

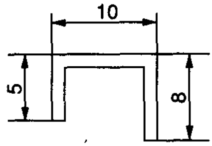
Figure 15 VHF Oscillating Output Voltage (Vosc1) Test Circuit



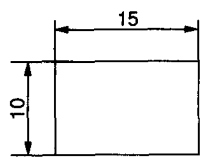
L1: Polyurethane coated copper wire



L2: Polyurethane coated copper wire



Cavity



Unit: mm

L3: ϕ0.3 mm enameled copper wire,
10 turns with 470 Ω (1/4 W) resistor

Test frequency: fosc = 930 MHz
Test equipment: YHP 4271A vector voltmeter

Figure 16 UHF Oscillating Output Voltage (Vosc2) Test Circuit

2SC3126 Series

Silicon NPN Epitaxial

Application

VHF & UHF wide band amplifier

Features

- High gain bandwidth product
  f_T = 4.5 GHz typ
- High gain, low noise figure
  PG = 10.5 dB typ, NF = 2.2 dB typ at
  f = 900 MHz

Table 1 Ordering Information

Type No.	Package
2SC3126	FPAK
2SC3127	MPAK4
2SC3338	UPAK
2SC3510	TO-92

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Ratings	Unit
Collector to base voltage		V_{CBO}	20	V
Collector to emitter voltage		V_{CEO}	12	V
Emitter to base voltage		V_{EBO}	3	V
Collector current		I_C	50	mA
Collector power dissipation	2SC3126	P_C	200	mW
	2SC3127		150	
	2SC3338		400	
	2SC3510		600	
Junction temperature		Tj	150	°C
Storage temperature		Tstg	–55 to +150	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item		Symbol	Min	Typ	Max	Unit	Test conditions
Collector to base breakdown voltage		$V_{(BR)CBO}$	20	—	—	V	I_C = 10 µA, I_E = 0
Collector to emitter breakdown voltage		$V_{(BR)CEO}$	12	—	—	V	I_C = 1 mA, R_{BE} = ∞
Emitter cutoff current		I_{EBO}	—	—	10	µA	V_{EB} = 3 V, I_C = 0
Collector cutoff current		I_{CBO}	—	—	0.5	µA	V_{CB} = 12 V, I_E = 0
Output capacitance	2SC3126	Cob	—	0.9	1.5	pF	V_{CB} = 5 V, I_E = 0, f = 1 MHz
	2SC3127						
	2SC3338			1.0			
	2SC3510						
Gain bandwidth product		f_T	3.5	4.5	—	GHz	V_{CE} = 5 V, I_C = 20 mA
Power gain	2SC3126	PG	—	10.5	—	dB	V_{CE} = 5 V, I_C = 20 mA, f = 900 MHz
	2SC3127			9.5			
	2SC3338			8.3			
	2SC3510						
Noise figure	2SC3126	NF	—	2.5	—	dB	V_{CE} = 5 V, I_C = 5 mA, f = 900 MHz
	2SC3127						
	2SC3338						
	2SC3510						

2SC3126 representing the characteristics curves hereafter.

For the detail of characteristics of other parts, please consult our sales office near you.

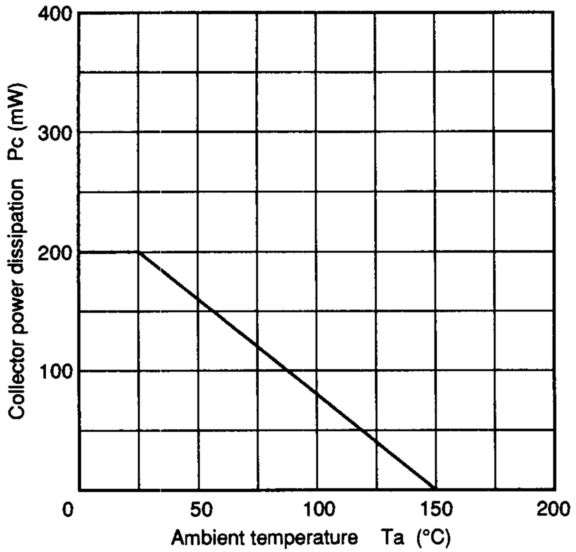


Figure 1 Maximum Collector Power Dissipation Curve

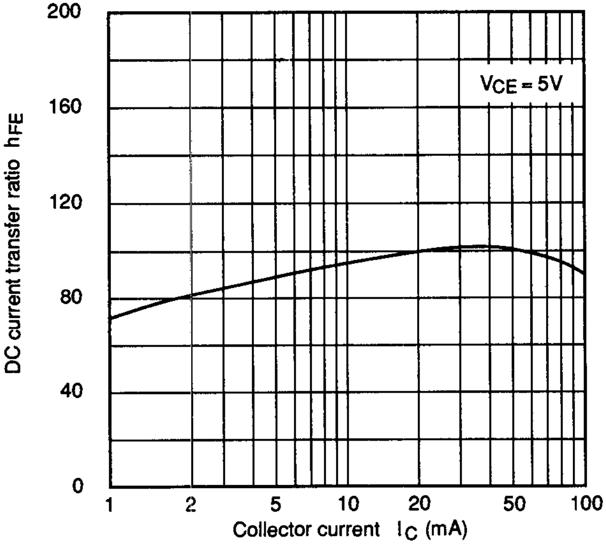


Figure 2 DC Current Transfer Ratio vs. Collector Current

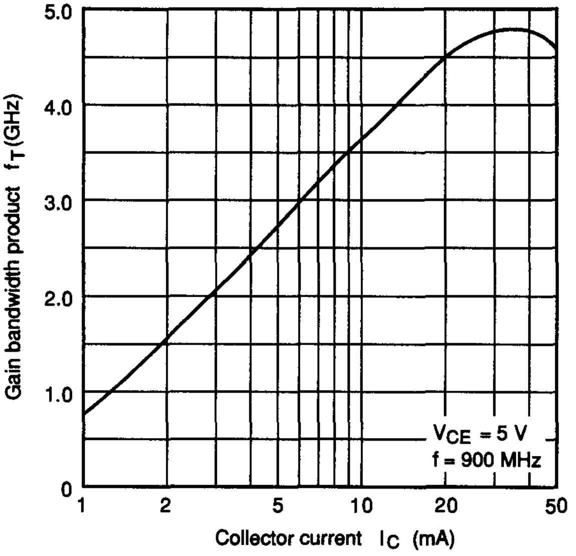


Figure 3 Gain Bandwidth Product vs. Collector Current

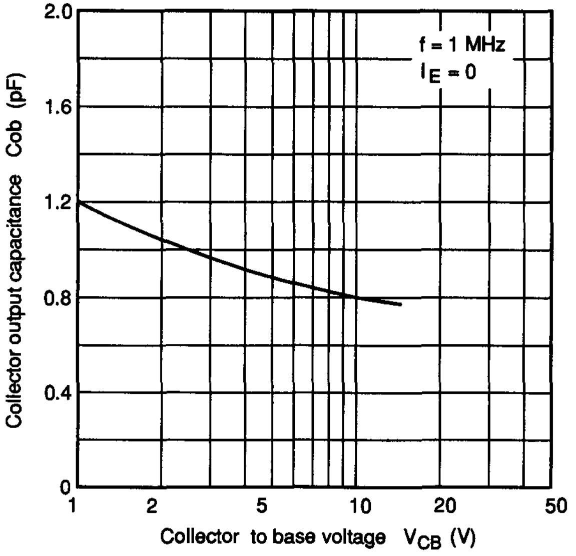


Figure 4 Collector Output Capacitance vs. Collector to Base Voltage

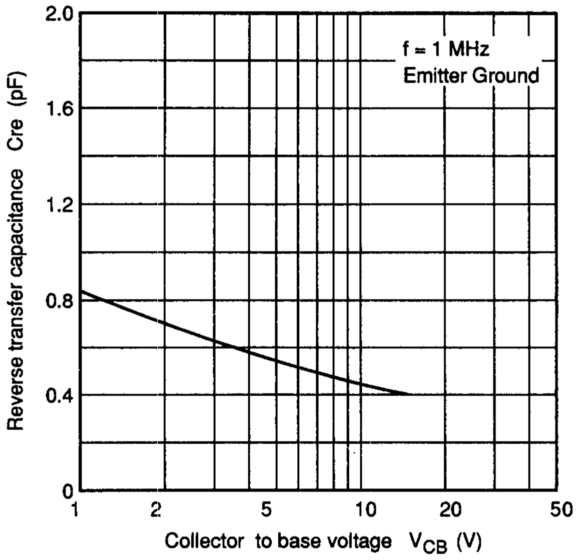


Figure 5 Reverse Transfer Capacitance vs. Collector to Base Voltage

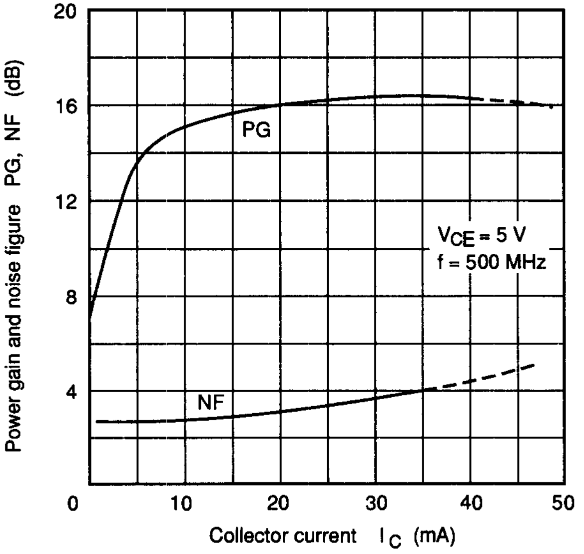


Figure 6 Power Gain and Noise Figure vs. Collector Current

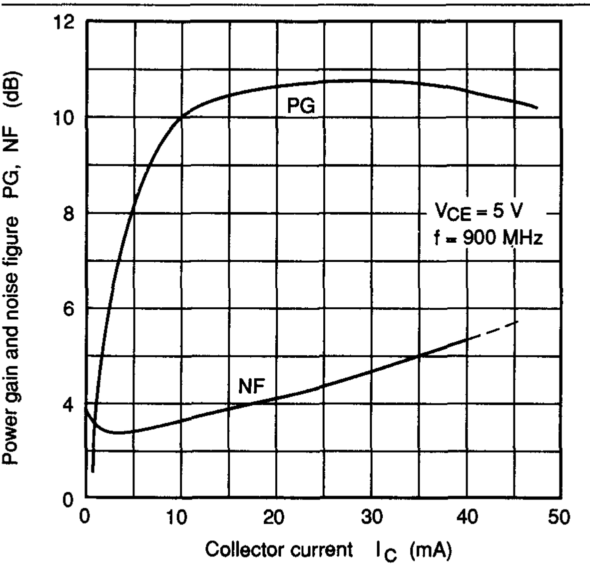


Figure 7 Power Gain and Noise Figure vs. Collector Current

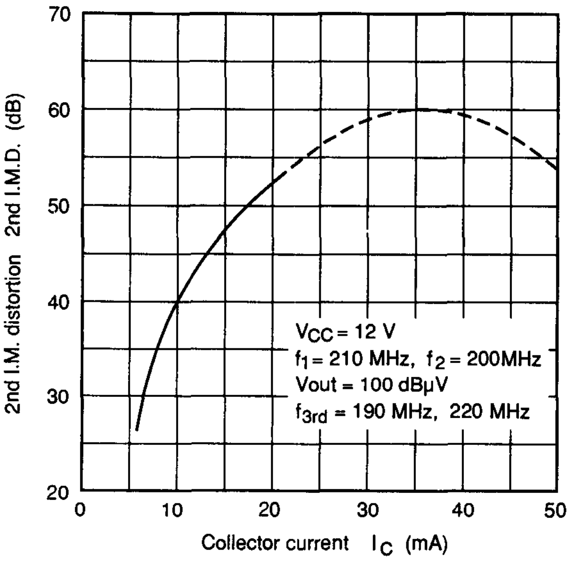


Figure 8 2nd I.M Distortion vs. Collector Current

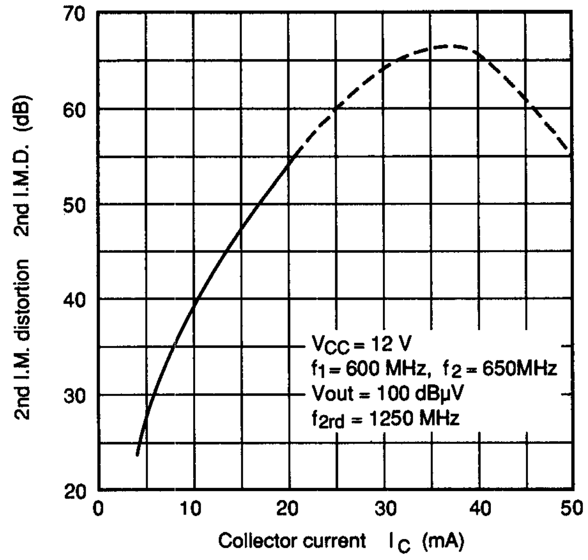


Figure 9 2nd I.M Distortion vs. Collector Current

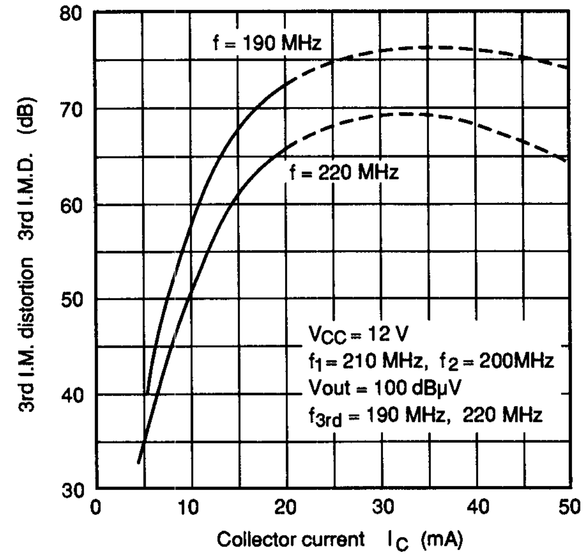


Figure 10 3rd I.M Distortion vs. Collector Current

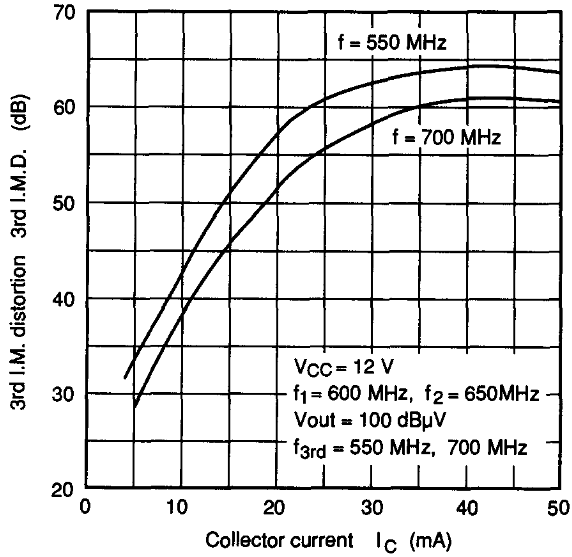


Figure 11 3rd I.M Distortion vs. Collector Current

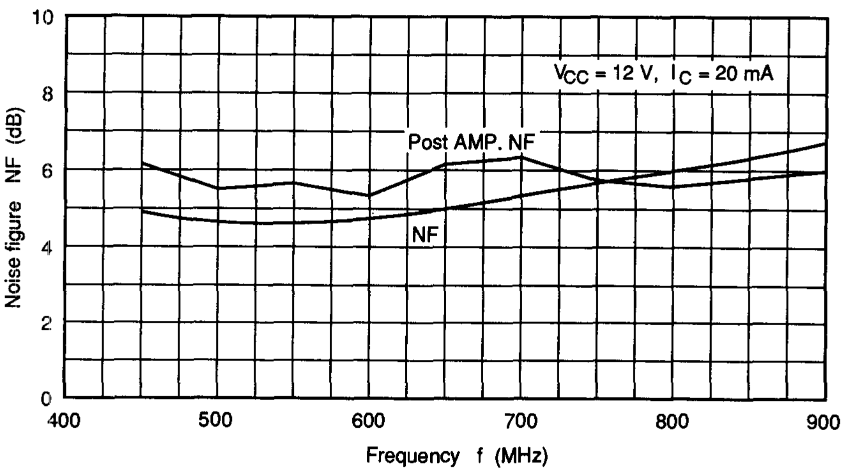


Figure 12 Noise Figure vs. Frequency

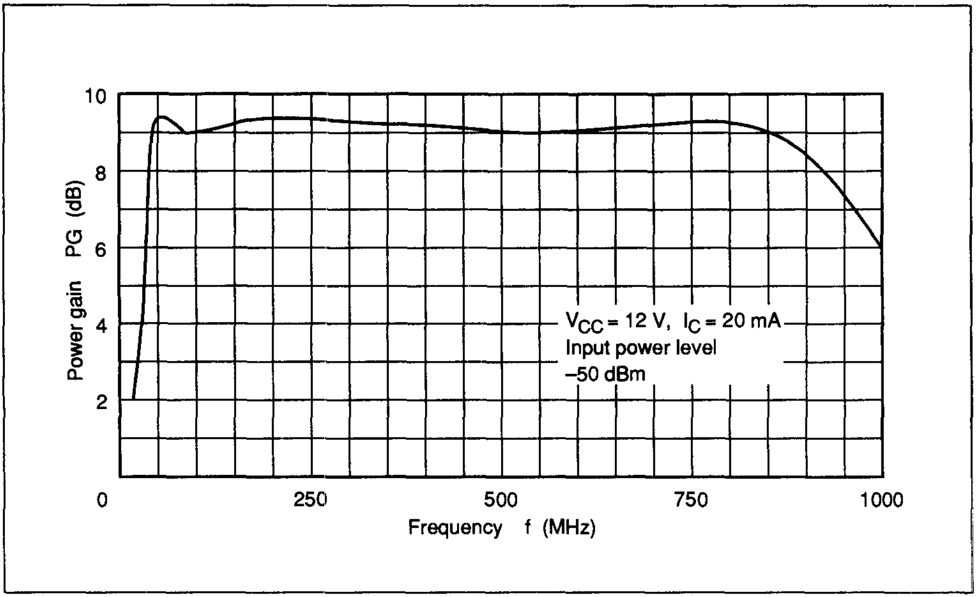


Figure 13 Power Gain vs. Frequency

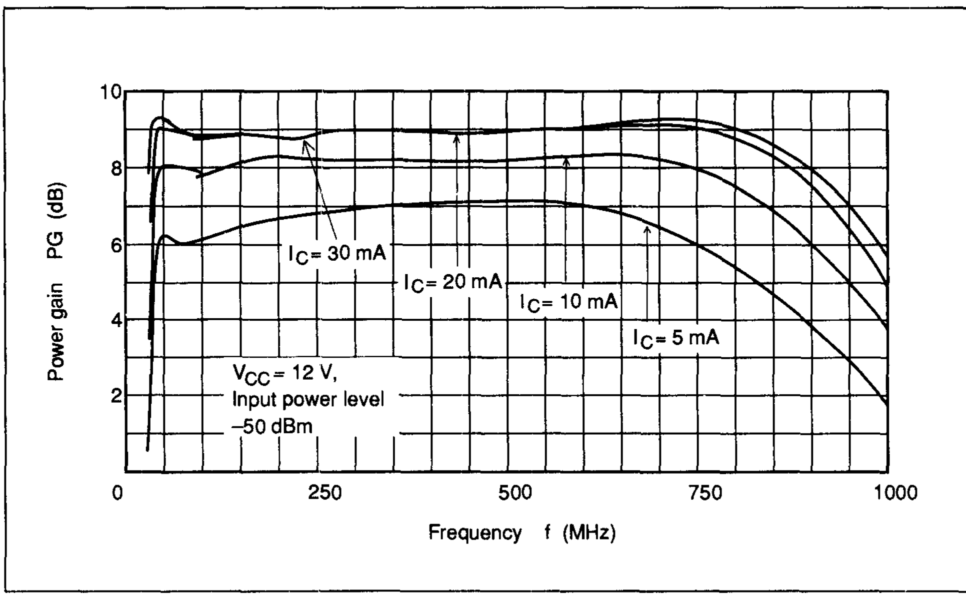


Figure 14 Power Gain vs. Frequency

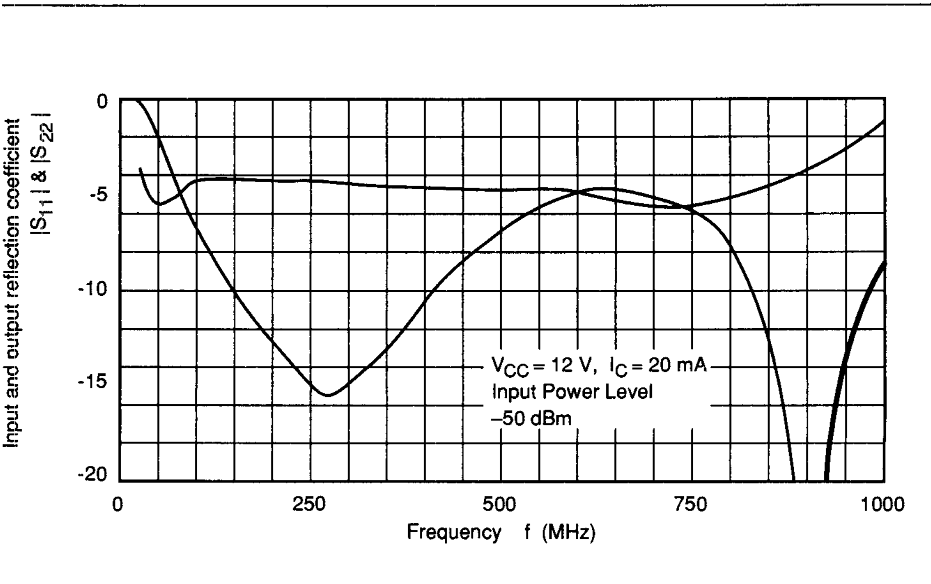


Figure 15 Input and Output Reflection Coefficient vs. Frequency

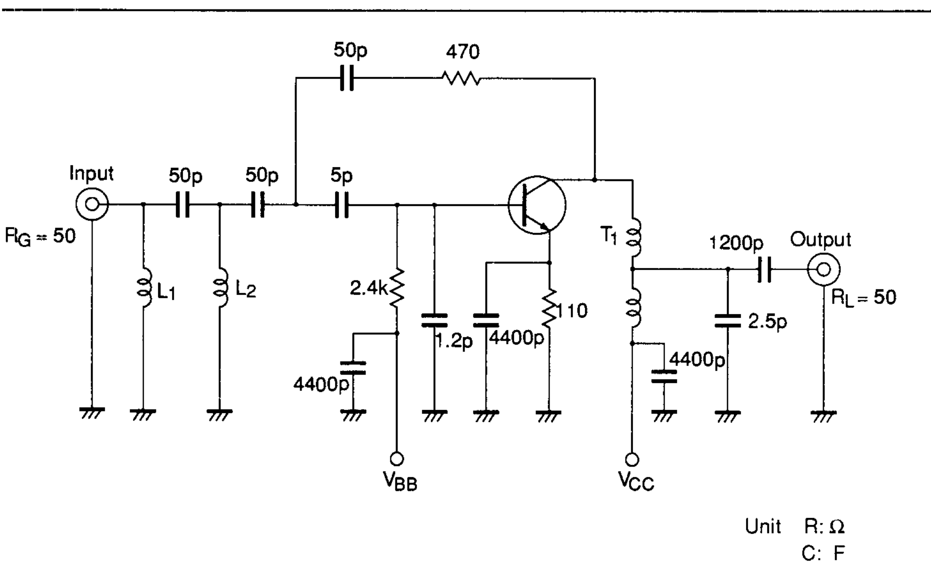


Figure 16 VHF and UHF Band Amp Circuit

Parts Specification

L1: Inside dia Ø 3.0 mm, Ø 0.4 mm polyurethane coated copper wire 12 tums.
L2: Inside dia Ø 3.5 mm, Ø0.5 mm polyurethane coated copper wire 9 turns.
T1: Balance wind used ferrite core
Outside dia Ø 4.0 mm, inside dia Ø 2.0 mm
Ø 0.1 mm polyurethane coated copper wire 3 turns
Ratio input to output is 2 : 1.

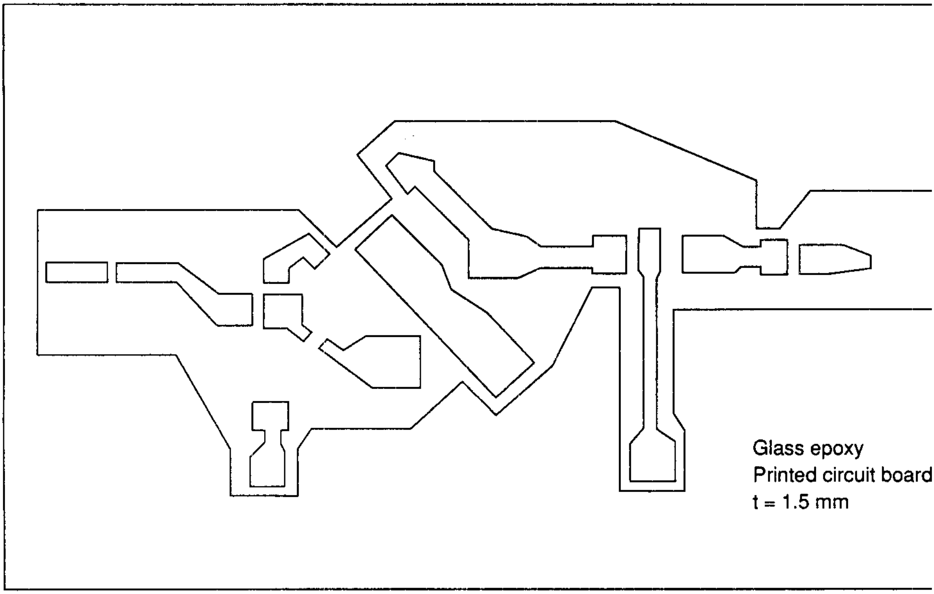


Figure 17 Circuit Pattern

2SC3337

Silicon NPN Epitaxial

Application

UHF & VHF wide band amplifier

Features

- High gain bandwidth product
  f_T = 4.4 GHz typ
- High gain, low noise figure
  PG = 8.6 dB typ, NF = 2.9 dB typ at
  f = 900 MHz

Table 1 Ordering Information

Type No.	Package
2SC3337	TO-92

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Collector to base voltage	V_{CBO}	20	V
Collector to emitter voltage	V_{CEO}	15	V
Emitter to base voltage	V_{EBO}	3	V
Collector current	I_C	100	mA
Collector power dissipation	P_C	600	mW
Junction temperature	Tj	150	°C
Storage temperature	Tstg	–55 to +150	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Collector to base breakdown voltage	$V_{(BR)CBO}$	20	—	—	V	I_C = 10 µA, I_E = 0
Collector to emitter breakdown voltage	$V_{(BR)CEO}$	15	—	—	V	I_C = 1 mA, R_{BE} = ∞
Emitter cutoff current	I_{EBO}	—	—	10	µA	V_{EB} = 3 V, I_C = 0
Collector cutoff current	I_{CBO}	—	—	0.5	µA	V_{CB} = 15 V, I_E = 0
DC current transfer ratio	h_{FE}	30	100	200	—	V_{CE} = 5 V, I_C = 50 mA
Output capacitance	Cob	—	1.5	2.3	pF	V_{CB} = 5 V, I_E = 0, f = 1 MHz
Gain bandwidth product	f_T	3.0	4.4	—	GHz	V_{CE} = 5 V, I_C = 50 mA
Power gain	PG	—	8.6	—	dB	V_{CE} = 5 V, I_C = 50 mA, f = 900 MHz
Noise figure	NF	—	2.9	—	dB	V_{CE} = 5 V, I_C = 10 mA, f = 900 MHz

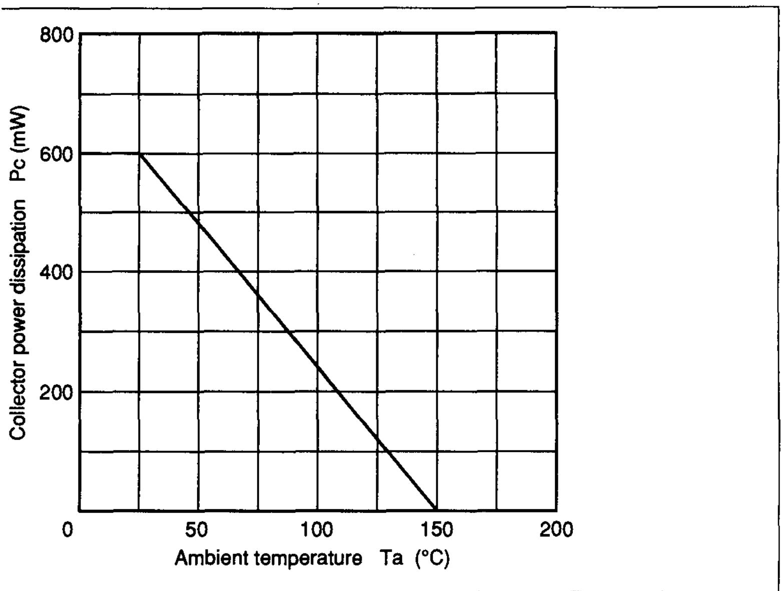


Figure 1 Maximum Collector Power Dissipation Curve

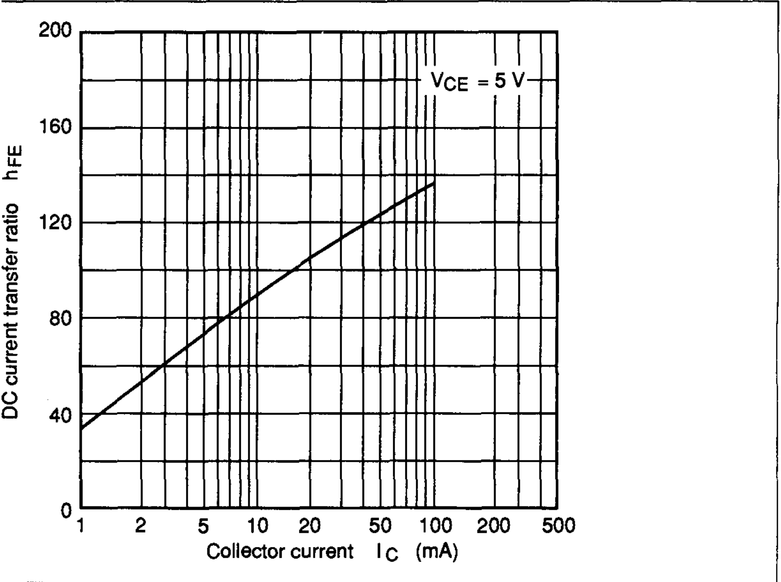


Figure 2 DC Current Transfer Ratio vs. Collector Current

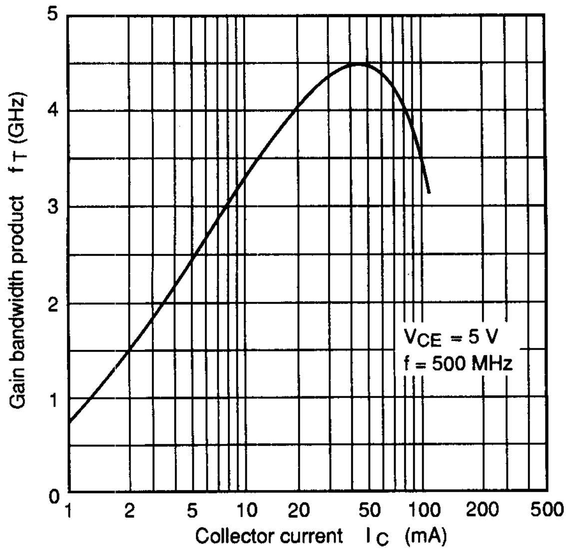


Figure 3 Gain Bandwidth Product vs. Collector Current

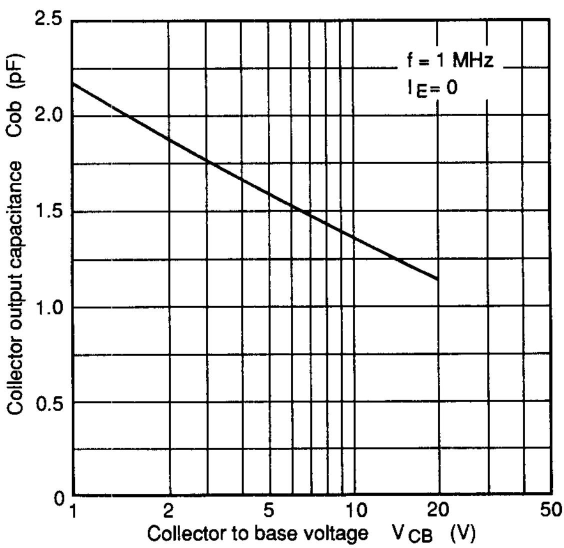


Figure 4 Collector Output Capacitance vs. Collector to Base Voltage

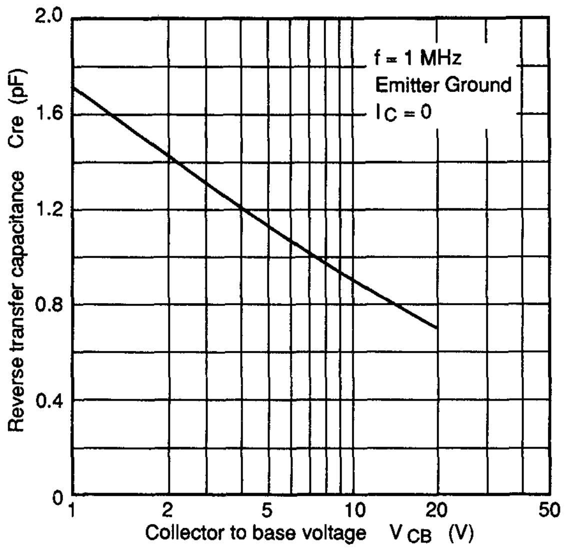


Figure 5 Reverse Transfer Capacitance vs. Collector to Base Voltage

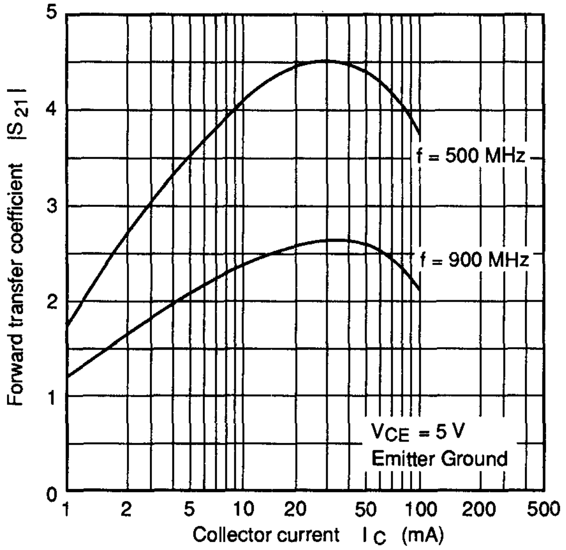


Figure 6 Forward Transfer Coefficient vs. Collector Current

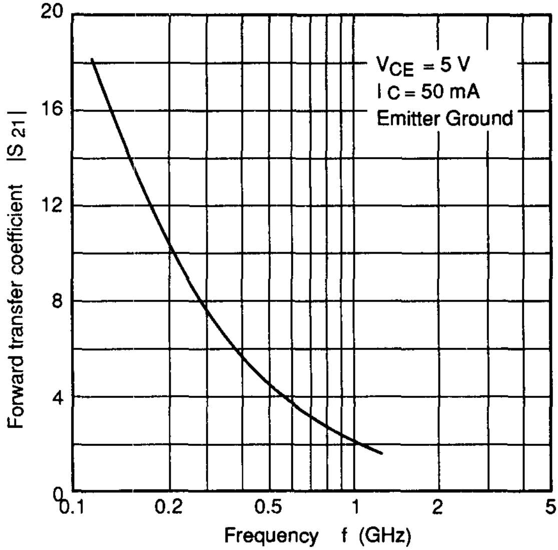


Figure 7 Forward Transfer Coefficient vs. Frequency

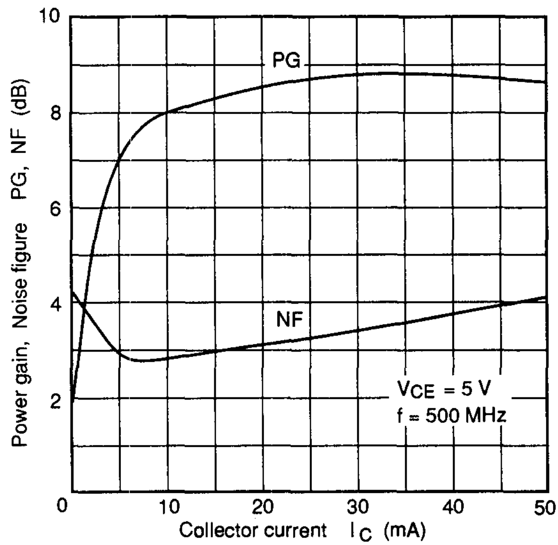


Figure 8 Power Gain and Noise Figure vs. Collector Current

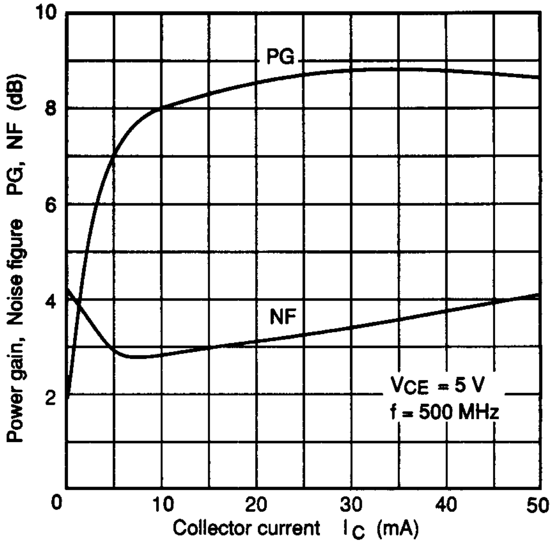
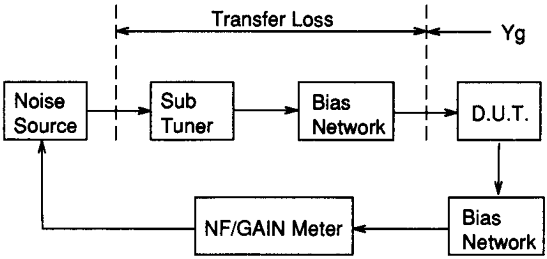


Figure 9 Power Gain and Noise Figure vs. Collector Current



Item	f = 500 MHz	f = 900 MHz
Transfer Loss (dB)	0.4	0.65
Yg (mS)	9.785 + 67.25j	46.32 + 129.77j

Figure 10 Noise Figure and Power Gain Measurement Block Diagram

Table 4 S Parameter (V_{CE} = 5 V, I_C = 50 mA, Z_O = 50 Ω)

	S11		S21		S12		S22	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.3115	–144.2	21.195	104.6	0.018	60.8	0.2946	–54.7
200	0.3024	–169.7	11.089	91.9	0.038	64.0	0.1731	–51.7
300	0.3039	173.6	7.484	85.2	0.058	66.4	0.1267	–48.4
400	0.3189	163.4	5.728	79.4	0.080	67.8	0.0994	–48.9
500	0.3255	152.5	4.639	74.3	0.100	65.6	0.0844	–36.9
600	0.3608	143.2	3.894	69.4	0.117	63.3	0.0424	–10.8
700	0.3841	138.3	3.376	64.6	0.140	60.7	0.0248	–17.9
800	0.3960	133.7	2.956	59.8	0.159	59.0	0.0165	–115.7
900	0.4079	125.7	2.680	55.1	0.177	55.6	0.0099	68.5
1000	0.4342	120.5	2.419	50.9	0.198	54.0	0.0188	86.4

2SC3374 Series

Silicon NPN

Application

- VHF amplifier
- VHF TV tuner RF amplifier

Table 1 Ordering Information

Type No.	Package
2SC1856	TO-92
2SC2465	FPAK
2SC3374	MPAK

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Ratings	Unit
Collector to base voltage		V_{CBO}	20	V
Collector to emitter voltage		V_{CEO}	20	V
Emitter to base voltage		V_{EBO}	3	V
Collector current		I_C	20	mA
Emitter current		I_E	–20	mA
Collector power dissipation	2SC1856	P_C	250	mW
	2SC2465		200	
	2SC3374		150	
Junction temperature		Tj	150	°C
Storage temperature		Tstg	–55 to +150	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Collector to base breakdown voltage	$V_{(BR)CBO}$	20	—	—	V	I_C = 100 µA, I_E = 0
Collector to emitter breakdown voltage	$V_{(BR)CEO}$	20	—	—	V	I_C = 3 mA, R_{BE} = ∞
Emitter cutoff current	I_{EBO}	—	—	10	µA	V_{EB} = 3 V, I_C = 0
Collector cutoff current	I_{CBO}	—	—	100	nA	V_{CB} = 20 V, I_E = 0
DC current transfer ratio	h_{FE}	20	—	200		V_{CE} = 10 V, I_C = 2 mA
Gain bandwidth product	f_T	400	550	—	MHz	V_{CE} = 10 V, I_C = 2 mA

Electrical Characteristics (Ta = 25°C) (cont)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Reverse transfer capacitance	Cre *	—	—	0.5	pF	V_{CB} = 12 V, f = 1 MHz, emitter common
Power gain	PG	15.5	—	—	dB	V_{CC} = 12 V, V_{AGC} = 1.7 V, f = 200 MHz, (I_C ≈ 2mA)
Noise figure	NF	—	—	3.2	dB	V_{CE} = 10 V, I_C = 2 mA, f = 200 MHz
AGC voltage	V_{AGC}	4.3	—	5.8	V	V_{CC} = 12 V, GR = 30 dB, f = 200 MHz

* Measured by the balanced type capacitance bridge. (Emitter lead is connected to earth terminal of the tester.)

** Marking is "IJ–".

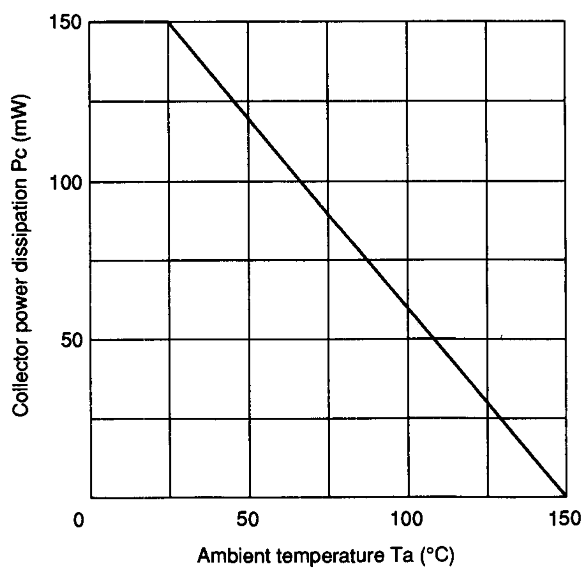


Figure 1 Maximum Collector Power Dissipation Curve

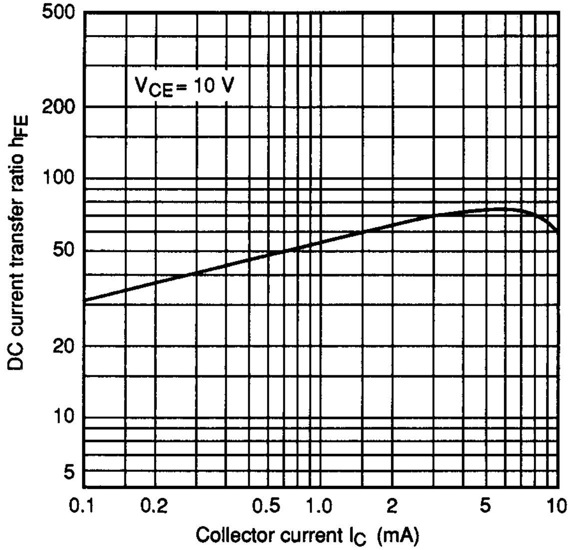


Figure 2 DC Current Transfer Ratio vs. Collector Current

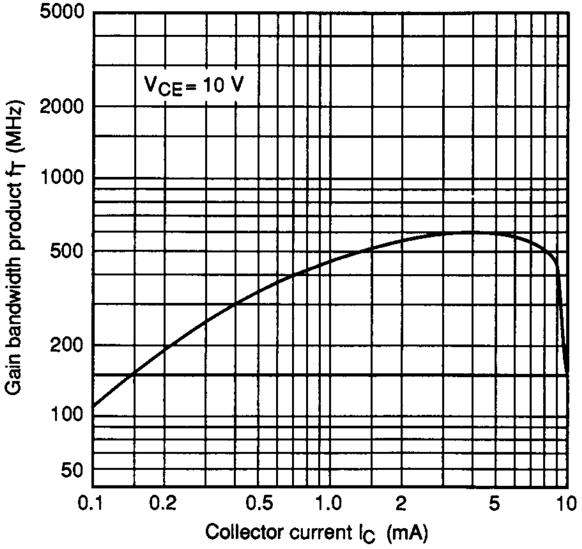


Figure 3 Gain Bandwidth Product vs. Collector Current

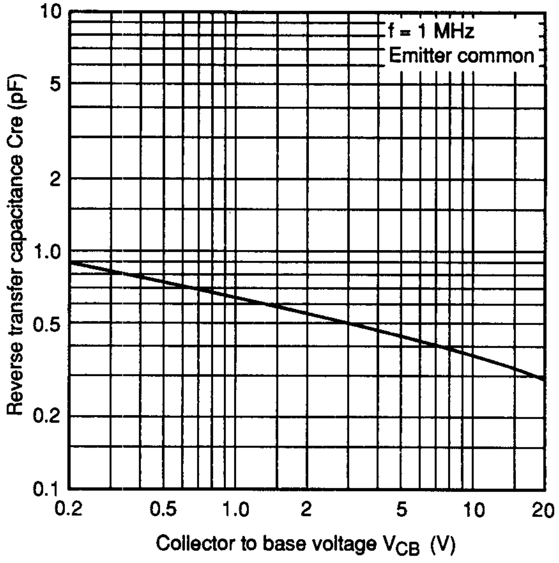


Figure 4 Reverse Transfer Capacitance vs. Collector to Base Voltage

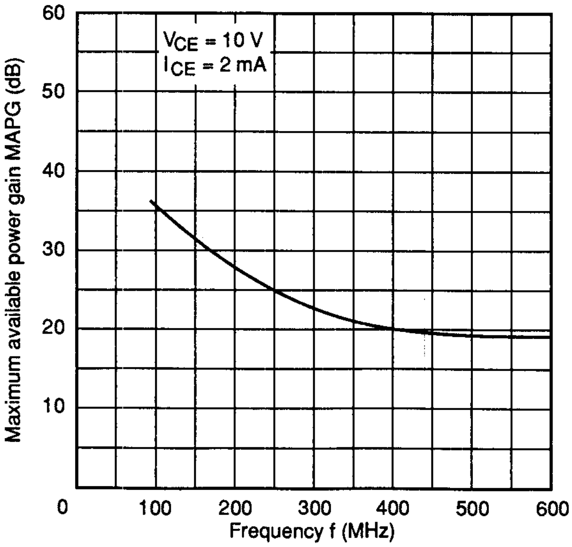


Figure 5 Maximum Available Power Gain vs. Frequency

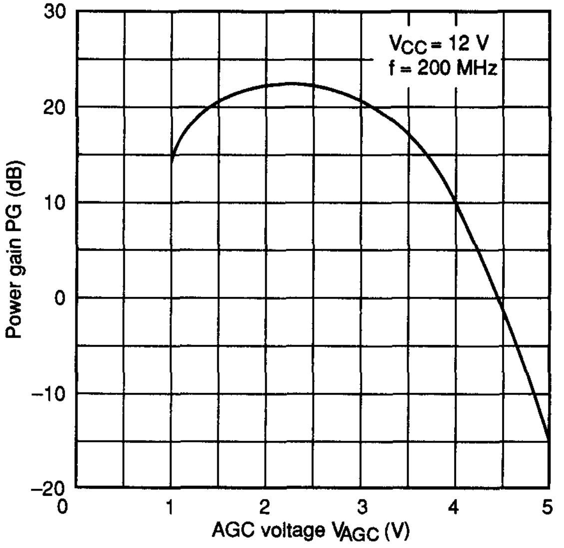


Figure 6 Power Gain vs. AGC Voltage

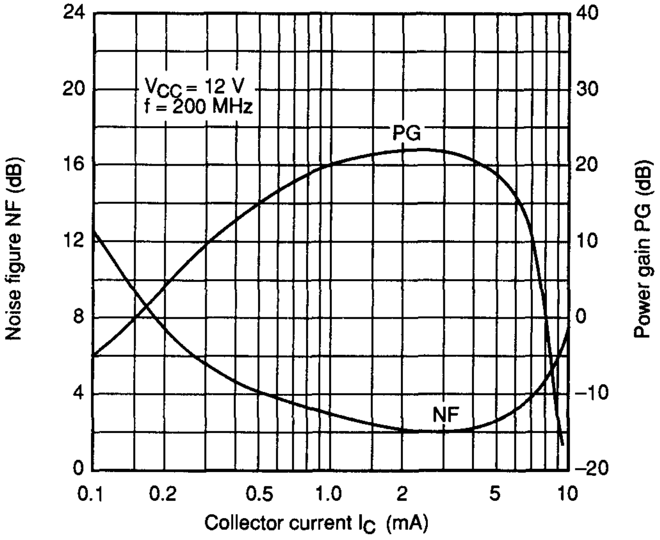
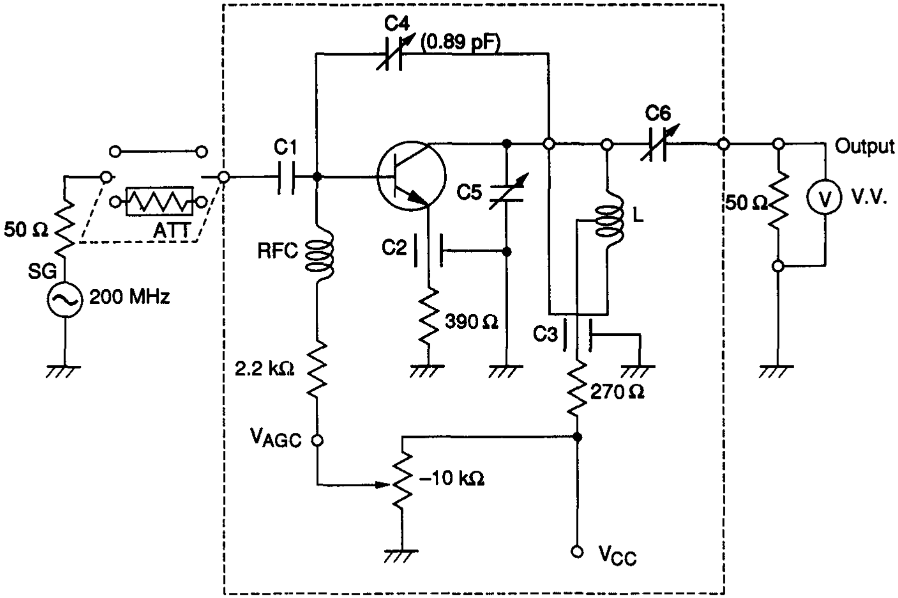


Figure 7 Power Gain, Noise Figure vs. Collector Current



C1: 0.005 μF
C2: 0.005 μF
C3: 0.005 μF
C4: 10 pF max
C5: 10 pF max
C6: 10 pF max
L: ϕ1.0 mm Cu wire plated with Sn 4 turns inside dia, ϕ 9.5 mm ground with 2 turns from collector, pitch 2.0 mm
ATT: 30 dB

V_{AGC} Test Procedure

1. Set up at V_{CC} = 12 V and V_{AGC} = 1.7 V
2. Adjust C5 for max, output with ATT (30 dB) connected.
3. Adjust output of SG for Vout = 1 mV.
4. Then, remove ATT and adjust V_{AGC} for Vout= 1 mV.
   (at this time, output of SG and C5 should not be changed.)
5. The V_{AGC} value adjusted is defined as the AGC voltage at 30 dB attenuation.

Figure 8 PG, NF and V_{AGC} Test Circuit

2SC3493 Series

Silicon NPN Epitaxial

Application

- VHF amplifier
- VHF TV tuner RF amplifier

Table 1 Ordering Information

Type No.	Package
2SC2727	FPAK
2SC3493	MPAK
2SC4263	CMPAK

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Ratings	Unit
Collector to base voltage		V_{CBO}	15	V
Collector to emitter voltage		V_{CEO}	12	V
Emitter to base voltage		V_{EBO}	3	V
Collector current		I_C	20	mA
Collector power dissipation	2SC2727	P_C	200	mW
	2SC3493		150	
	2SC4263		100	
Junction temperature		Tj	150	°C
Storage temperature		Tstg	–55 to +150	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Collector to base breakdown voltage	$V_{(BR)CBO}$	15	—	—	V	I_C = 10 µA, I_E = 0
Collector to emitter breakdown voltage	$V_{(BR)CEO}$	12	—	—	V	I_C = 1 mA, R_{BE} = ∞
Emitter cutoff current	I_{EBO}	—	—	10	µA	V_{EB} = 3 V, I_C = 0
Collector cutoff current	I_{CBO}	—	—	500	nA	V_{CB} = 12 V, I_E = 0
DC current transfer ratio	h_{FE}	30	—	200		V_{CE} = 4 V, I_C = 2 mA
Reverse transfer capacitance	Cre	—	—	0.5	pF	V_{CB} = 4 V, f = 1 MHz, emitter common
Gain bandwidth product	f_T	700	—	—	MHz	V_{CE} = 4 V, I_C = 2 mA
Power gain	PG	16	21	—	dB	V_{CC} = 6 V, I_C = 2 mA,
Noise figure	NF	—	2.3	3.2	dB	f = 200 MHz
AGC voltage	V_{AGC}	2.4	—	3.6	V	V_{CC} = 6 V, GR = 30 dB, f = 200 MHz

Note: Marking of 2SC3493 and 2SC4263 is "IL–".

2SC3493 representing the characteristics curves hereafter.

For the detail of characteristics of other parts, please consult our sales office near you.

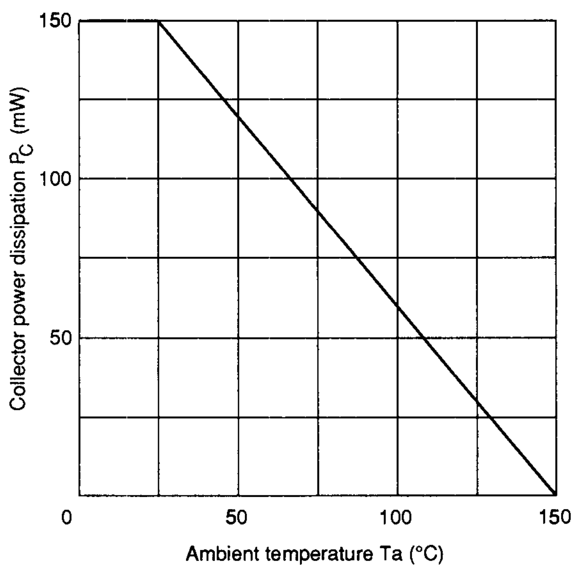


Figure 1 Maximum Collector Power Dissipation Curve

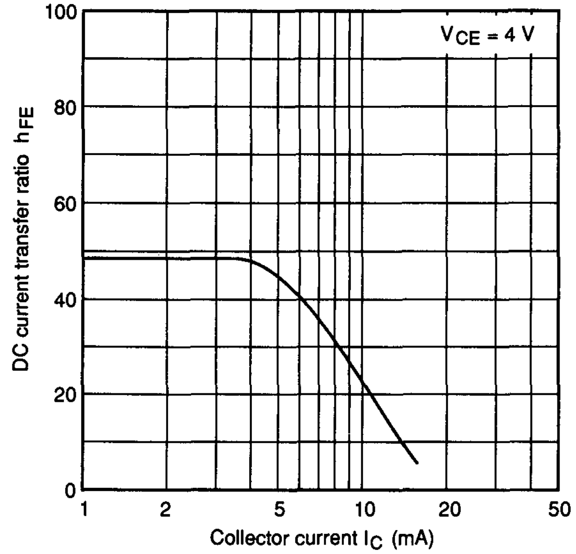


Figure 2 DC Current Transfer Ratio vs. Collector Current

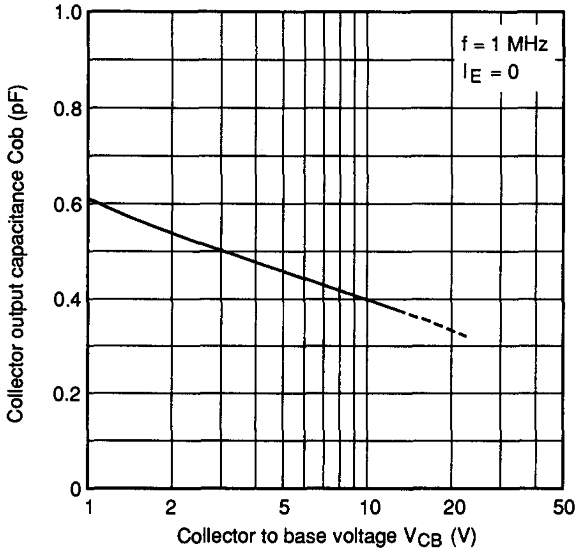


Figure 3 Collector Output Capacitance vs. Collector to Base Voltage

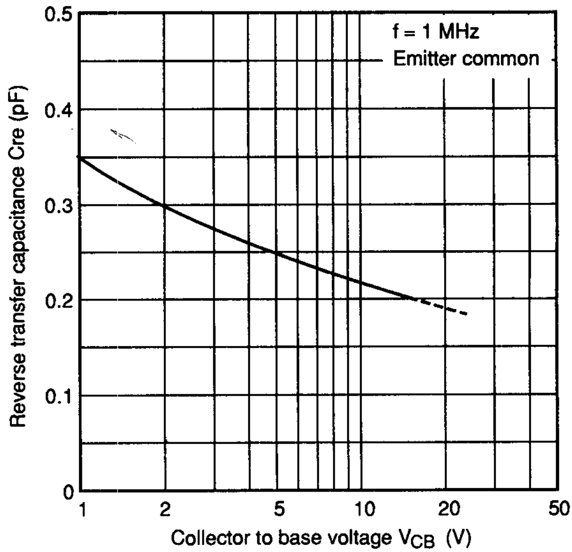


Figure 4 Reverse Transfer Capacitance vs. Collector to Base Voltage

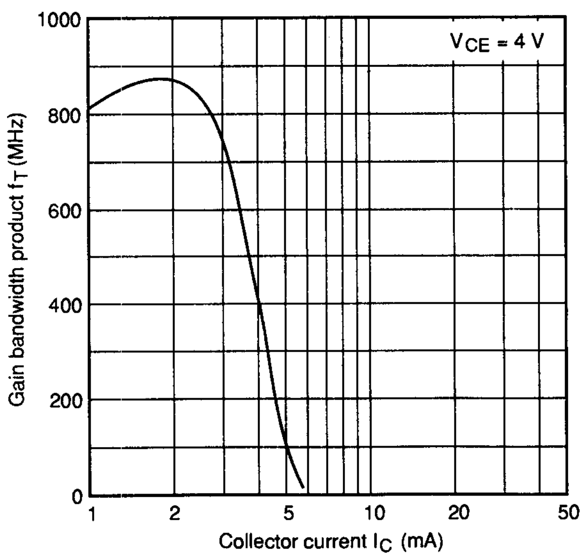


Figure 5 Gain Bandwidth Product vs. Collector Current

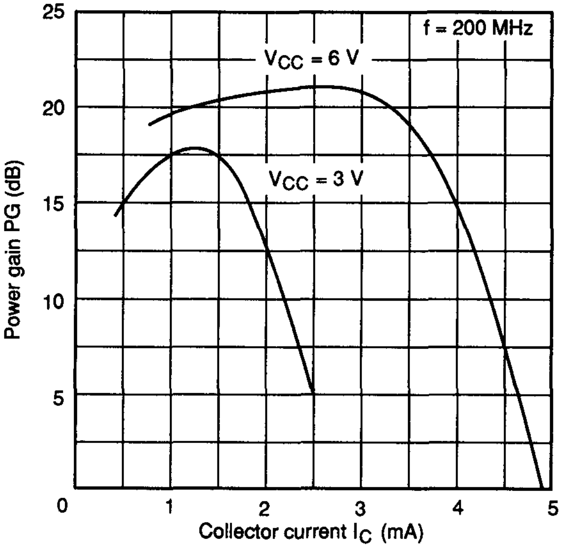


Figure 6 Power Gain vs. Collector Current

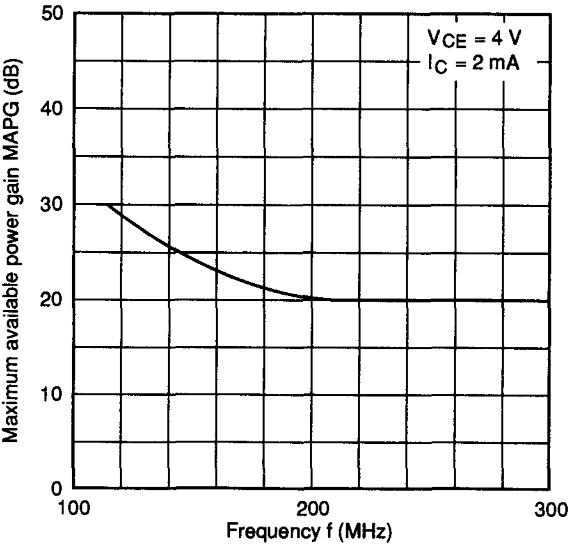


Figure 7 Maximum Available Power Gain vs. Frequency

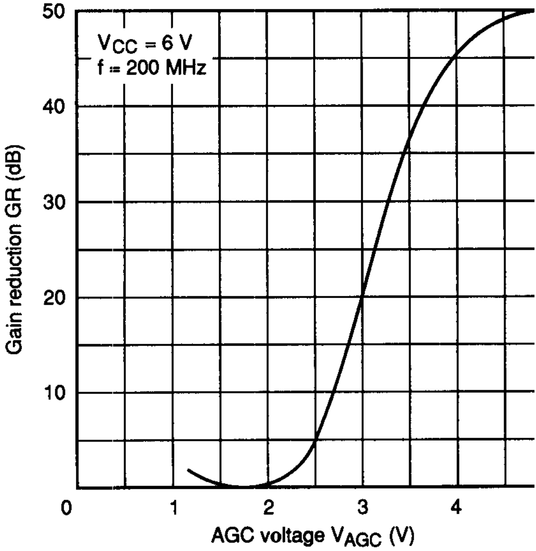


Figure 8 Gain Reduction vs. AGC Voltage

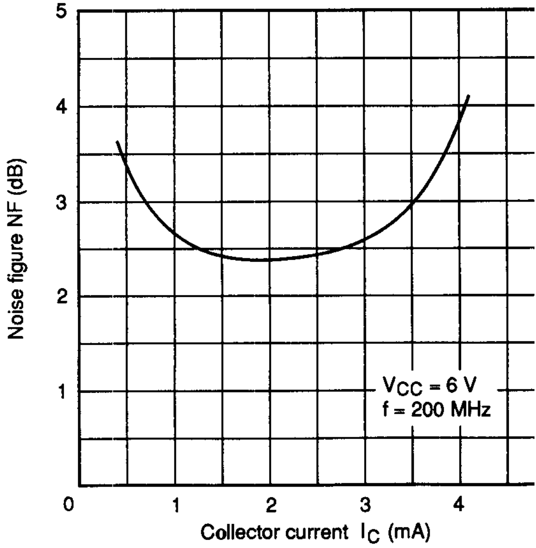


Figure 9 Noise Figure vs. Collector Current

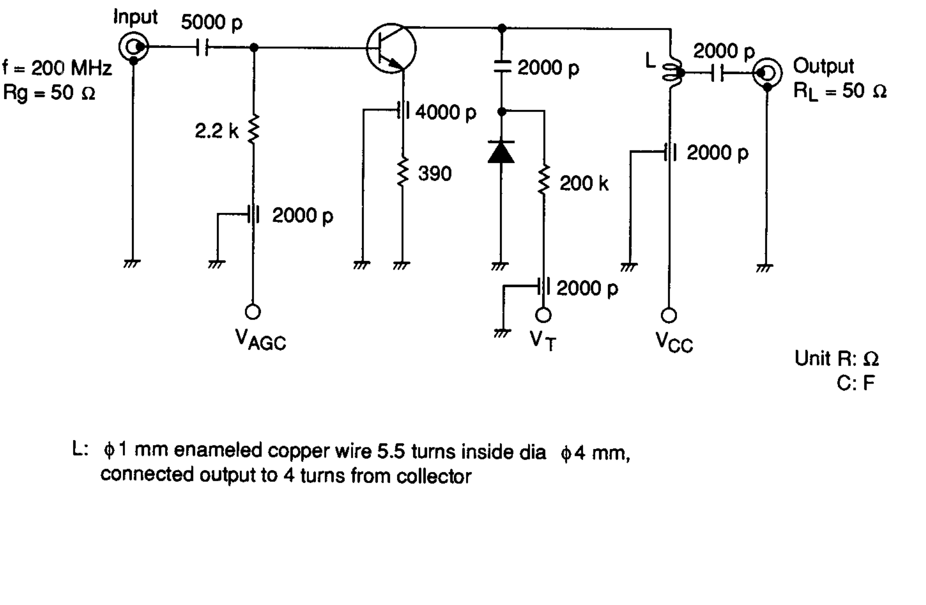


Figure 10 PG, NF and V_{AGC} Test Circuit

2SC3793 Series

Silicon NPN Epitaxial

Application

UHF local oscillator

Table 1 Ordering Information

Type No.	Package
2SC3793	MPAK
2SC4262	CMPAK

Table 2 Absolute Maximum Ratings (Ta= 25°C)

Item		Symbol	Ratings	Unit
Collector to base voltage		V_{CBO}	20	V
Collector to emitter voltage		V_{CEO}	15	V
Emitter to base voltage		V_{EBO}	3	V
Collector current		I_C	50	mA
Collector power dissipation	2SC3793	P_C	150	mW
	2SC4262		100	
Junction temperature		Tj	150	°C
Storage temperature		Tstg	–55 to +150	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Collector to base breakdown voltage	$V_{(BR)CBO}$	20	—	—	V	I_C = 10 μA, I_E = 0
Collector to emitter breakdown voltage	$V_{(BR)CEO}$	15	—	—	V	I_C = 1 mA, R_{BE} = ∞
Collector cutoff current	I_{CBO}	—	—	1	μA	V_{CB} = 15 V, I_E = 0
Emitter cutoff current	I_{EBO}	—	—	1	μA	V_{EB} = 3 V, I_C = 0
DC current transfer ratio	h_{FE}	50	—	200		V_{CE} = 10 V, I_C = 5 mA
Collector to emitter saturation voltage	$V_{CE(sat)}$	—	—	0.5	V	I_C = 20 mA, I_B = 4 mA
Collector output capacitance	Cob	—	0.75	1	pF	V_{CB} = 10 V, I_E = 0, f = 1 MHz
Gain bandwidth product	f_T	1.4	—	—	GHz	V_{CE} = 10 V, I_C = 5 mA

Note: Marking of 2SC3793 and 2SC4262 is "IP–".

2SC3793 representing the characteristics curves hereafter.

For the detail of characteristics of other parts, please consult our sales office near you.

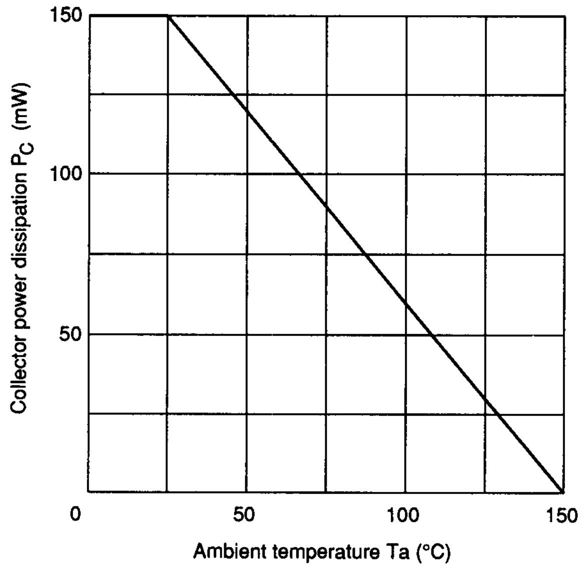


Figure 1 Maximum Collector Power Dissipation Curve

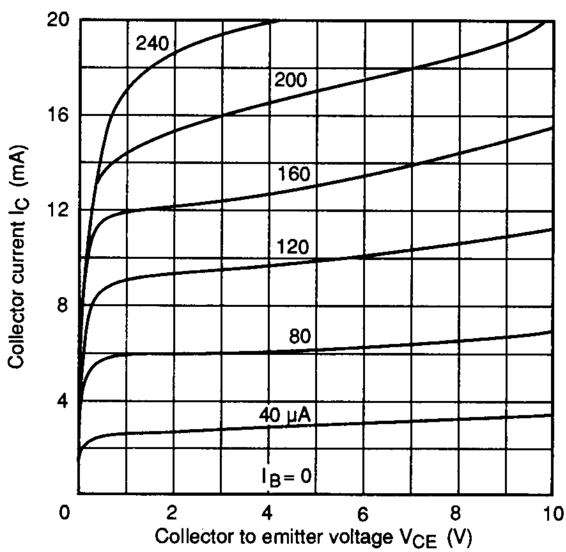


Figure 2 Typical Output Characteristics

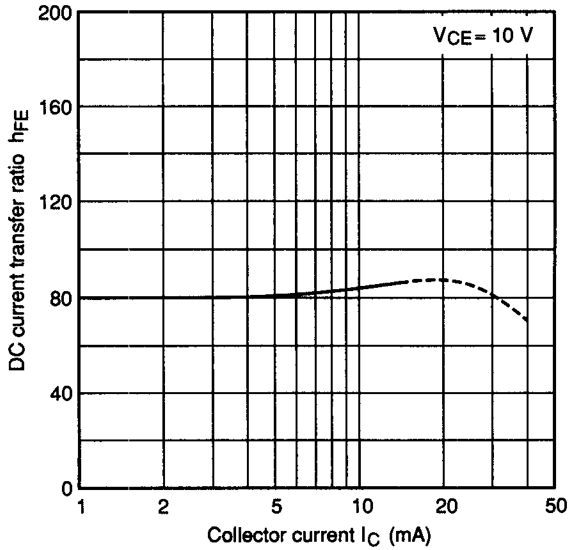


Figure 3 DC Current Transfer Ratio vs. Collector Current

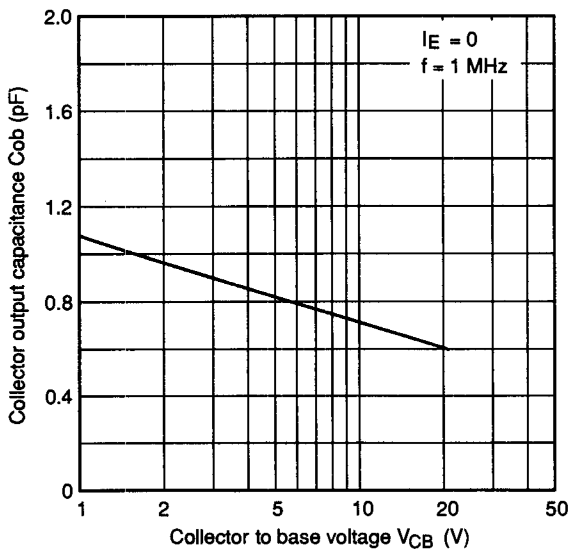


Figure 4 Collector Output Capacitance vs. Collector to Base Voltage

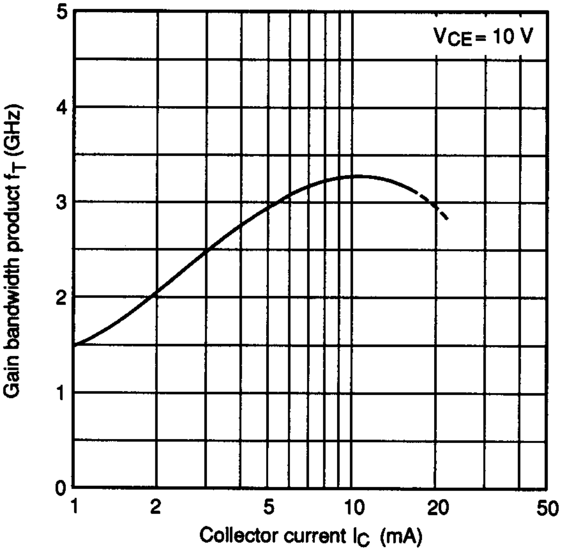


Figure 5 Gain Bandwidth Product vs. Collector Current

2SC4126 Series

Silicon NPN Epitaxial

Application

UHF & VHF wide band amplifier

Features

- High gain bandwidth product
  f_T = 6.0 GHz typ
- High gain, low noise figure
  PG = 11 dB typ, NF = 1.5 dB typ at
  f = 900MHz

Table 1 Ordering Information

Type No.	Package
2SC3511	FPAK
2SC3512	TO-92
2SC3513	MPAK
2SC4126	MPAK-4
2SC4422	UPAK
2SC4537	CMPAK

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Ratings	Unit
Collector to base voltage		V_{CBO}	15	V
Collector to emitter voltage		V_{CEO}	11	V
Emitter to base voltage		V_{EBO}	2	V
Collector current		I_C	50	mA
Collector power dissipation	2SC3511	P_C	200	mW
	2SC3512		600	
	2SC3513		150	
	2SC4126		150	
	2SC4422		400	
	2SC4537		100	
Junction temperature		Tj	150	°C
Storage temperature		Tstg	–55 to +150	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item		Symbol	Min	Typ	Max	Unit	Test conditions
Collector to base breakdown voltage		$V_{(BR)CBO}$	15	—	—	V	I_C = 10 μA, I_E = 0
Collector cutoff current		I_{CEO}	—	—	1	μA	V_{CE} = 10 V, R_{BE} = ∞
Emitter cutoff current		I_{EBO}	—	—	1	μA	V_{EB} = 1 V, I_C = 0
Collector cutoff current		I_{CBO}	—	—	1	μA	V_{CE} = 12 V, I_E = 0
DC current transfer ratio		h_{FE}	50	120	250	—	V_{CE} = 5 V, I_C = 20 mA
Output capacitance	2SC3511	Cob	—	1.0	1.5	pF	V_{CB} = 5 V, I_E = 0, f = 1 MHz
	2SC3512			1.2	1.6		
	2SC3513			1.0	1.5		
	2SC4126						
	2SC4422			1.2	1.6		
	2SC4537			1.0	1.5		
Gain bandwidth product		f_T	4.5	6.0	—	GHz	V_{CE} = 5 V, I_C = 20 mA
Power gain	2SC3511	PG	—	11	—	dB	V_{CE} = 5 V, I_C = 20 mA, f = 900 MHz
	2SC3512			10.5			
	2SC3513			10			
	2SC4126		9.0	11.0			
	2SC4422		7.0	9.0			
	2SC4537						

Table 3 Electrical Characteristics (Ta = 25°C) Cont

Item		Symbol	Min	Typ	Max	Unit	Test conditions
Noise figure	2SC3511	NF	—	1.5	3.0	dB	V_{CE} = 5 V, I_C = 5 mA, f = 900 MHz
	2SC3512			1.6			
	2SC3513						
	2SC4126			1.5			
	2SC4422			1.6			
	2SC4537						

2SC4126 representing the characteristics curves hereafter.

For the detail of characteristics of other parts, please consult our sales office near you.

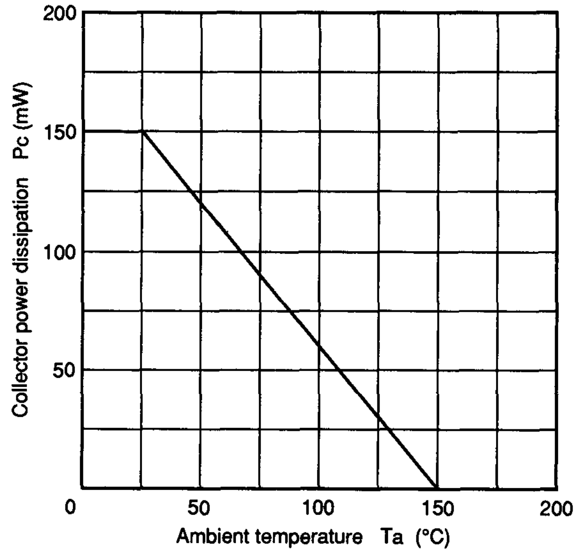


Figure 1 Maximum Collector Power Dissipation Curve

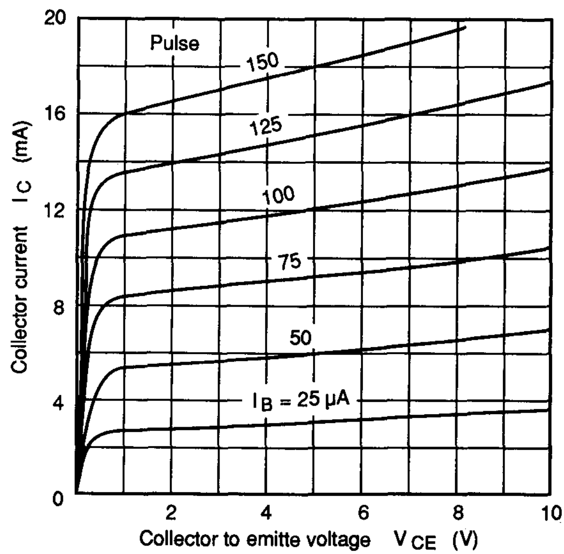


Figure 2 Typical Output Characteristics

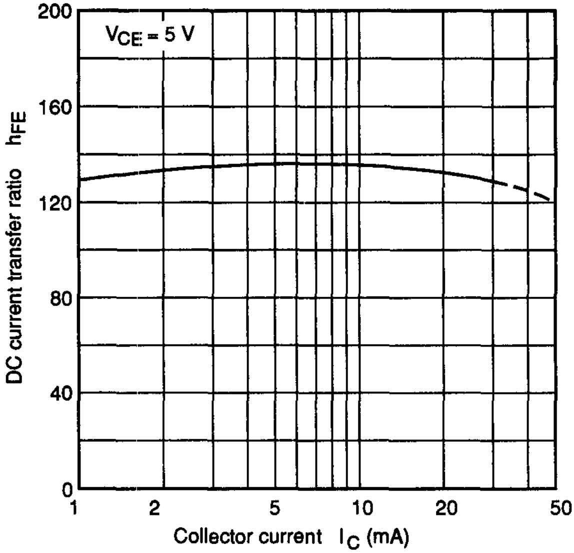


Figure 3 DC Current Transfer Ratio vs. Collector Current

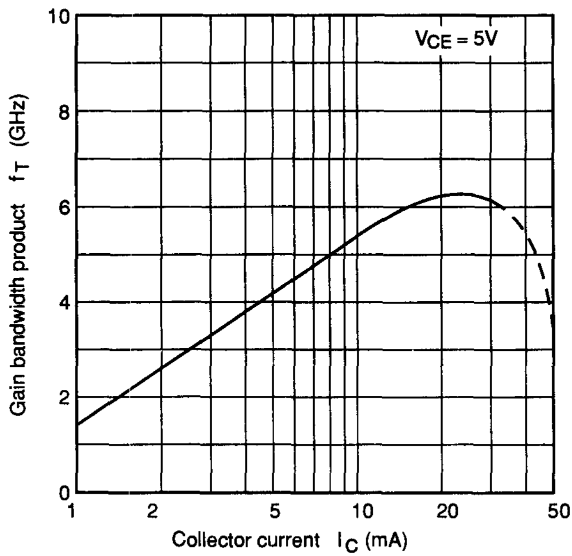


Figure 4 Gain Bandwidth Product vs. Collector Current

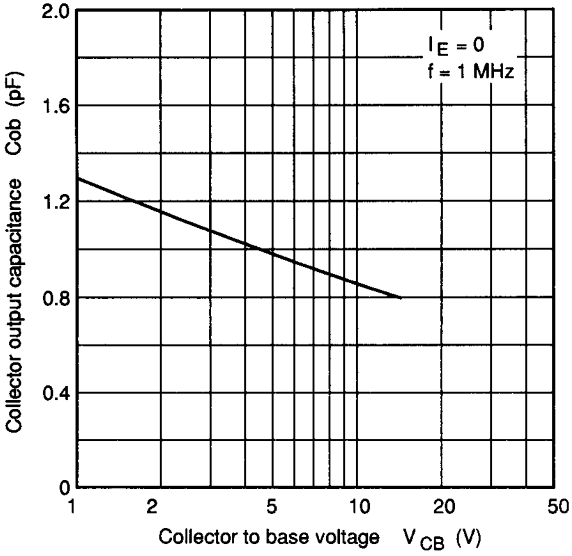


Figure 5 Collector Output Capacitance vs. Collector to Base Voltage

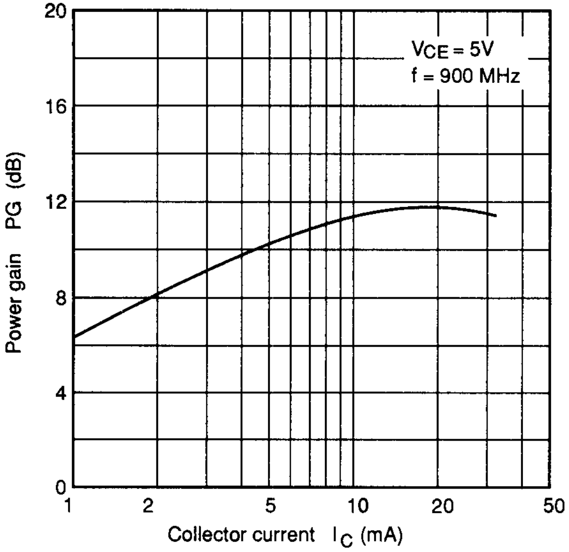


Figure 6 Power Gain vs. Collector Current

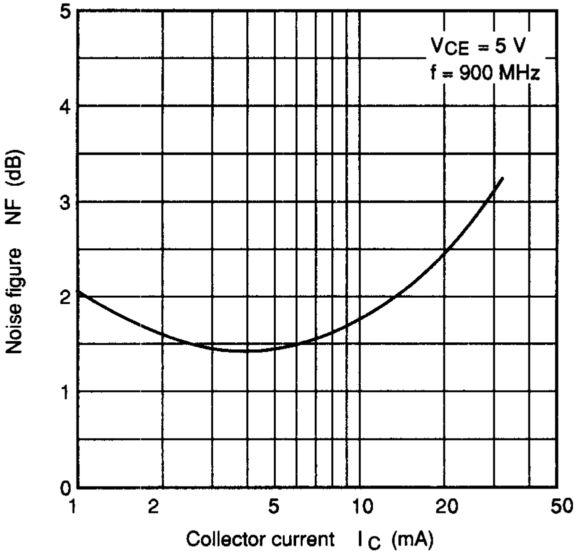


Figure 7 Noise Figure vs. Collector Current

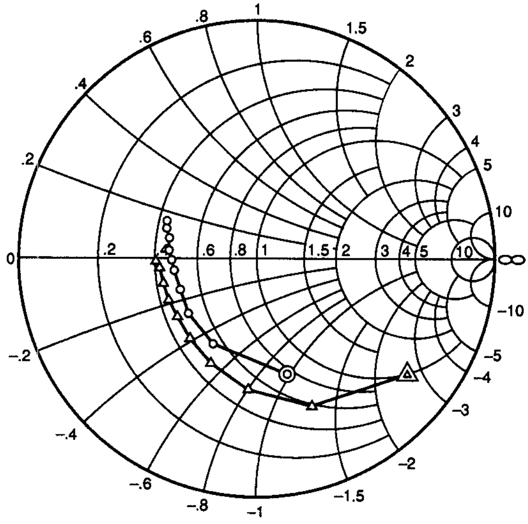


Figure 8 S_{11} Parameter vs. Frequency (Emitter Common)

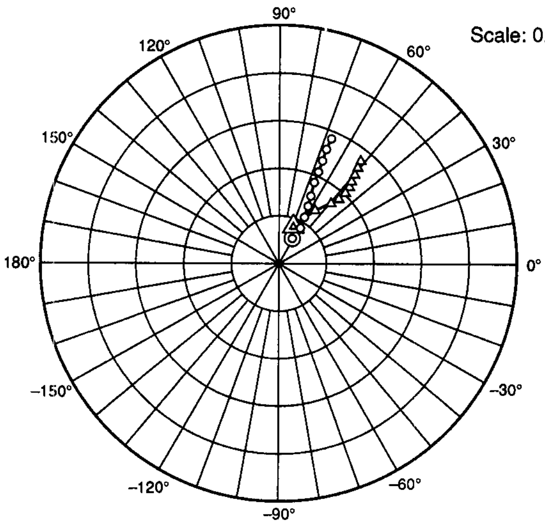


Figure 9 S_{12} Parameter vs. Frequency (Emitter Common)

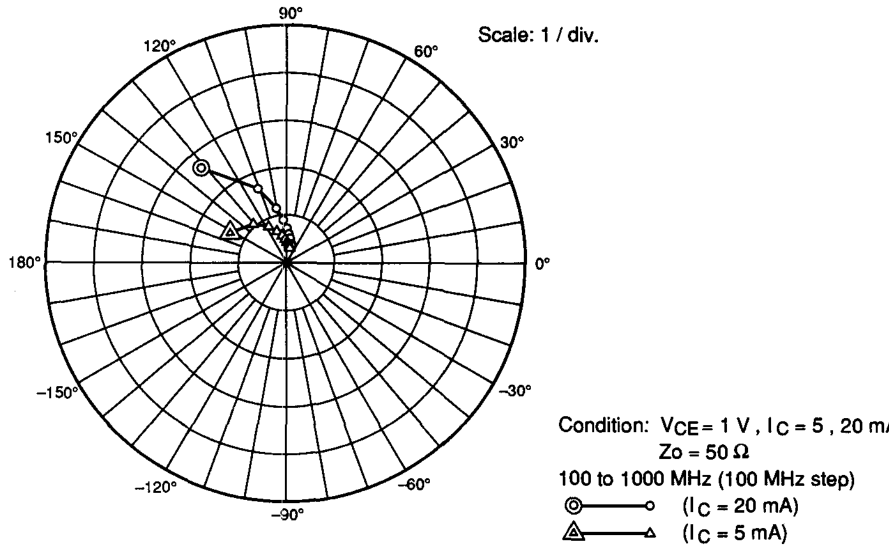


Figure 10 S_{21} Parameter vs. Frequency (Emitter Common) (2SC4126)

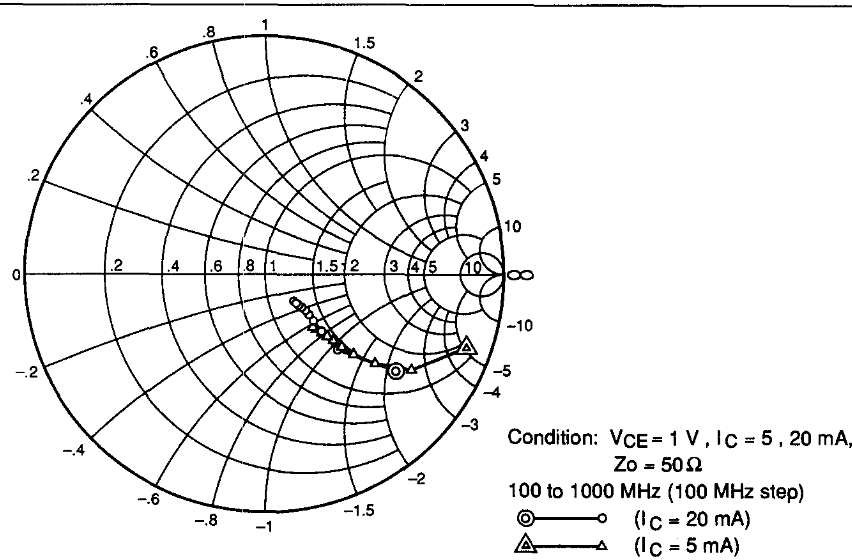


Figure 11 S_{22} Parameter vs. Frequency (Emitter Common) (2SC4126)

Table 4 S Parameter (Emitter Common) (V_{CE} = 5 V, I_C = 5 mA, Z_O = 50 Ω)

	S11		S21		S12		S22		Gmax *
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
100	0.798	–37.3	13.345	152.3	0.033	69.6	0.898	–20.1	34.03
200	0.659	–69.4	10.696	131.4	0.054	56.0	0.730	–33.1	26.37
300	0.550	–93.7	8.434	117.0	0.067	49.2	0.592	–39.3	21.96
400	0.480	–113.6	6.815	107.3	0.074	47.3	0.502	–42.3	19.07
500	0.438	–129.8	5.684	100.0	0.081	47.0	0.442	–43.7	16.96
600	0.414	–143.6	4.847	94.2	0.087	47.3	0.399	–44.4	15.28
700	0.410	–154.4	4.229	89.4	0.092	48.6	0.366	–45.3	13.95
800	0.406	–164.7	3.750	85.0	0.098	49.5	0.340	–46.3	12.80
900	0.412	–174.9	3.352	81.0	0.104	50.6	0.317	–47.4	11.78
1000	0.424	–178.1	3.071	77.4	0.110	51.6	0.299	–48.3	11.01

* $Gmax = \frac{1}{|1 - |S_{11}|^2|} \cdot |S_{21}|^2 \cdot \frac{1}{|1 - |S_{22}|^2|}$

Table 5 S Parameter (Emitter Common) (V_{CE} = 5 V, I_C = 20 mA, Z_O = 50 Ω)

	S11		S21		S12		S22		Gmax *
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
100	0.501	–75.1	26.789	131.8	0.0.24	62.2	0.683	–36.5	32.54
200	0.402	–117.1	16.600	111.1	0.035	58.5	0.446	–45.4	26.13
300	0.368	–141.0	11.543	100.7	0.044	61.3	0.337	–45.6	22.40
400	0.347	–157.6	8.823	94.7	0.054	63.3	0.282	–44.2	19.83
500	0.354	–169.0	7.131	89.5	0.063	65.0	0.250	–42.8	17.92
600	0.358	–178.7	5.979	85.8	0.074	66.6	0.228	–42.1	16.36
700	0.370	174.9	5.158	82.3	0.084	66.9	0.208	–42.1	15.08
800	0.380	167.1	4.536	79.2	0.094	67.3	0.192	–42.7	13.98
900	0.400	161.5	4.042	76.5	0.104	67.6	0.178	–43.2	13.03
1000	0.411	157.0	3.677	73.5	0.114	67.4	0.165	–43.3	12.24

$$* \ \text{Gmax} = \frac{1}{|1 - |S_{11}|^2|} \cdot |S_{21}|^2 \cdot \frac{1}{|1 - |S_{22}|^2|}$$

2SC4196 Series

Silicon NPN Epitaxial

Application

UHF tuner oscillator

Features

- High gain bandwidth product
  f_T = 2.4 MHz typ
- Capable of low voltage operation
- Capable of high density mount

Table 1 Ordering Information

Type No.	Package
2SC4196	MPAK
2SC4261	CMPAK

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Ratings	Unit
Collector to base voltage		V_{CBO}	25	V
Collector to emitter voltage		V_{CEO}	15	V
Emitter to base voltage		V_{EBO}	3	V
Collector current		I_C	50	mA
Collector power dissipation	2SC4196	P_C	150	mW
	2SC4261		100	
Junction temperature		Tj	150	°C
Storage temperature		Tstg	–55 to +150	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Collector to base breakdown voltage	$V_{(BR)CBO}$	25	—	—	V	I_C = 10 μA, I_E = 0
Collector cutoff current	I_{CBO}	—	—	0.3	μA	V_{CB} = 15 V, I_E = 0
	I_{CEO}	—	—	10	μA	V_{CE} = 15 V, R_{BE} = ∞
Emitter cutoff current	I_{EBO}	—	—	1.0	μA	V_{EB} = 3 V, I_C = 0
Collector to emitter saturation voltage	$V_{CE(sat)}$	—	—	0.3	V	I_C = 20 mA, I_B = 4 mA
DC current transfer ratio	h_{FE}	50	—	180	—	V_{CE} = 5 V, I_C = 5 mA
Output capacitance	Cob	—	0.7	1.0	pF	V_{CB} = 10 V, I_E = 0, f = 1 MHz
Gain bandwidth product	f_T	1.8	2.4	—	GHz	V_{CE} = 5 V, I_C = 20 mA
Oscillating output voltage	Vosc	—	200	—	mV	V_{CC} = 5 V, I_C = 5 mA, fosc = 930 MHz

Note: Marking of 2SC4196 and 2SC4261 is "QI–"

2SC4196 representing the characteristics curves hereafter.

For the detail of characteristics of other parts, please consult our sales office near you.

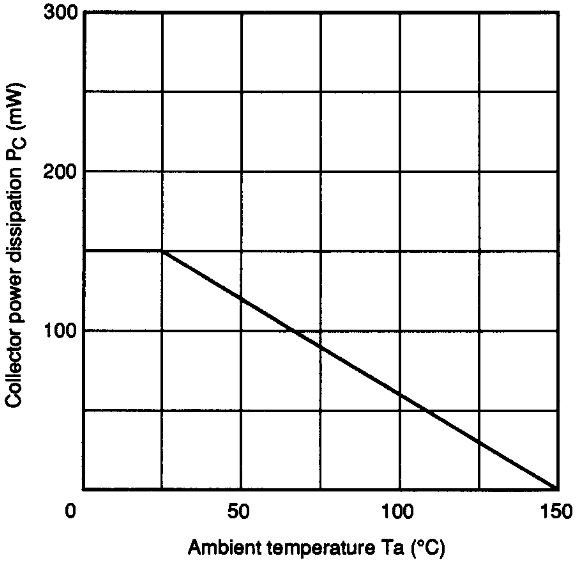
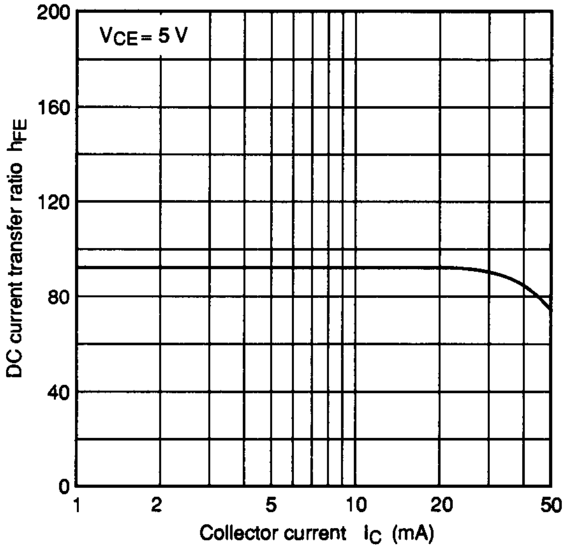


Figure 1 Maximum Collector Power Dissipation Curve



Figuare 2 DC Current Transfer Ratio vs. Collector Current

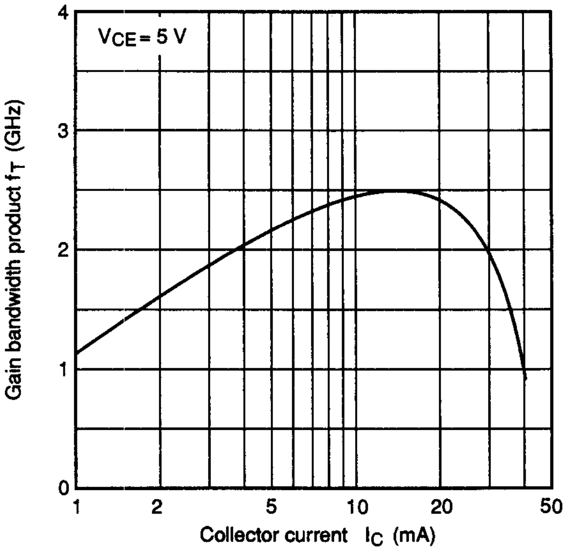


Figure 3 Gain Bandwidth Product vs. Collector Current

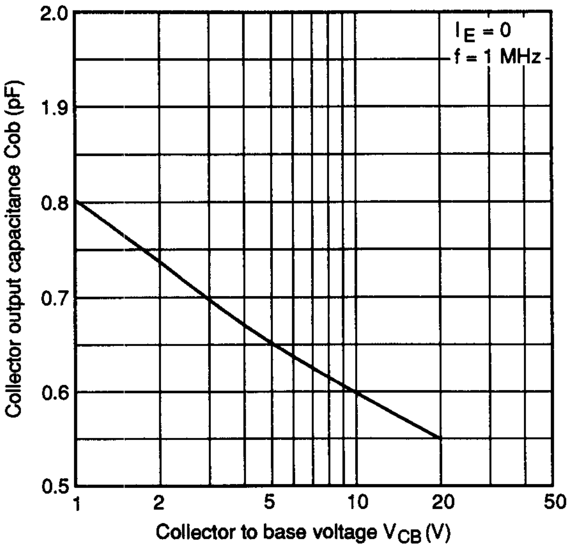


Figure 4 Collector Output Capacitance vs. Collector to Base Voltage

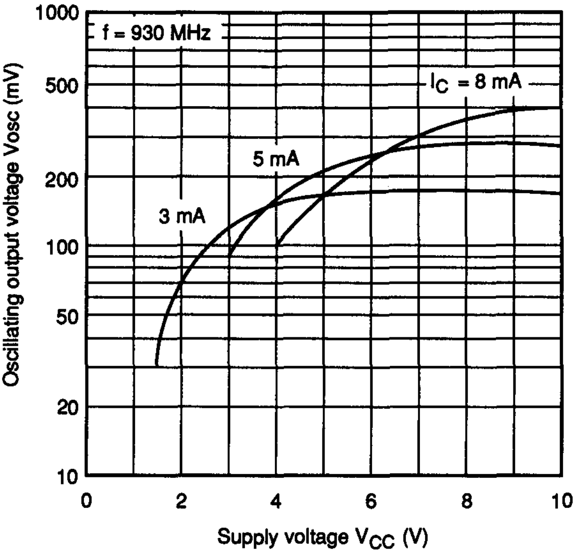


Figure 5 Oscillating Output Voltage vs. Supply Voltage

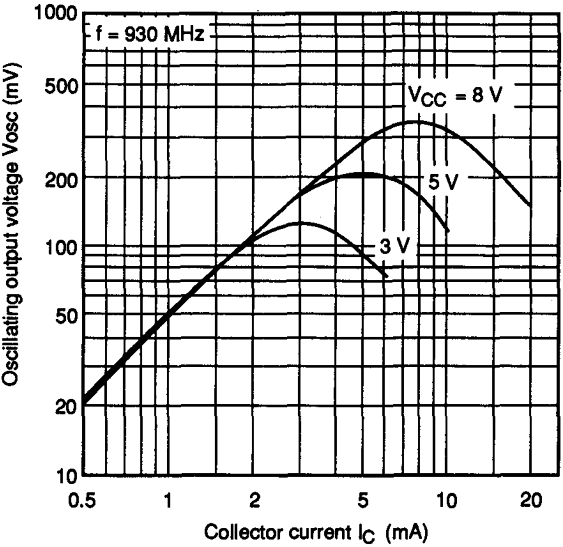


Figure 6 Oscillating Output Voltage vs. Collector Current

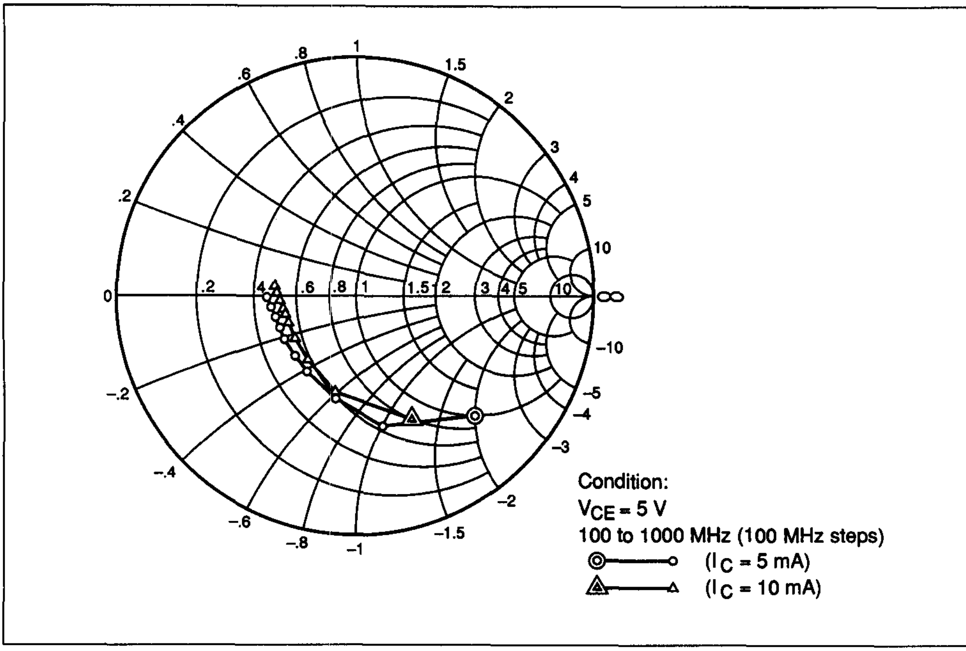


Figure 7 S_{11} Parameer vs. Frequency (Emitter Common)

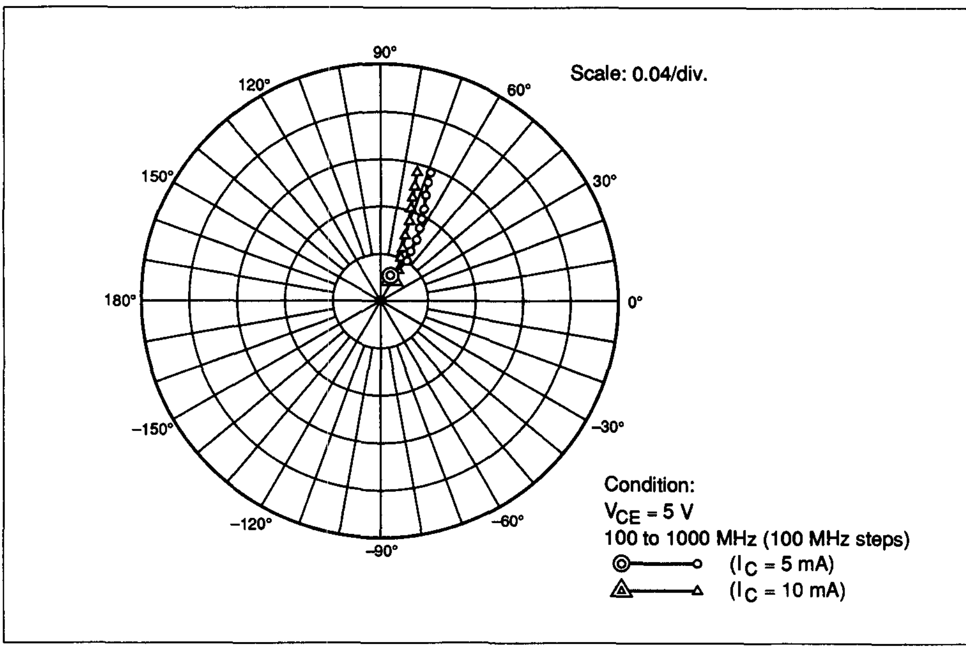


Figure 8 S_{12} Parameter vs. Frequency (Emitter Common)

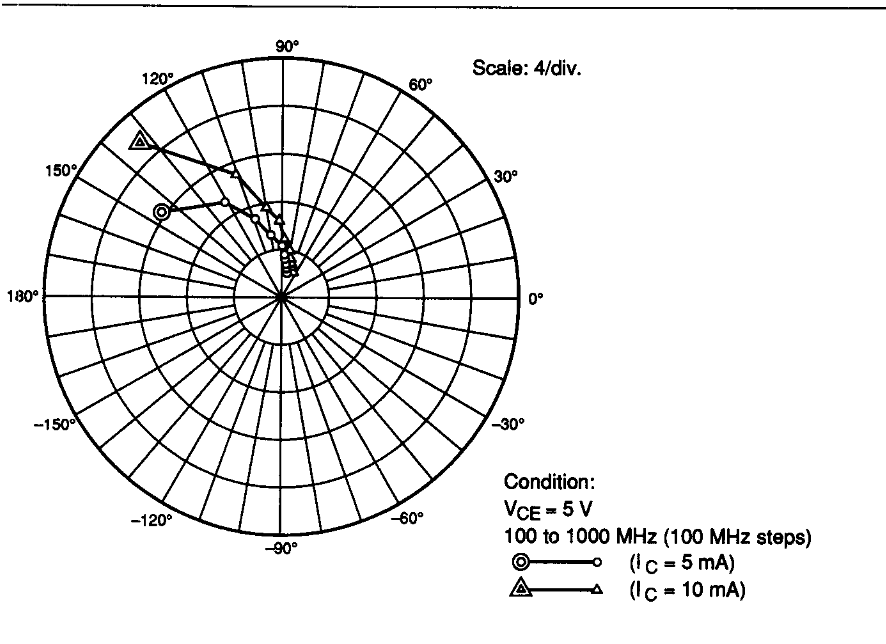


Figure 9 S_{21} Parameter vs. Frequency (Emitter Common)

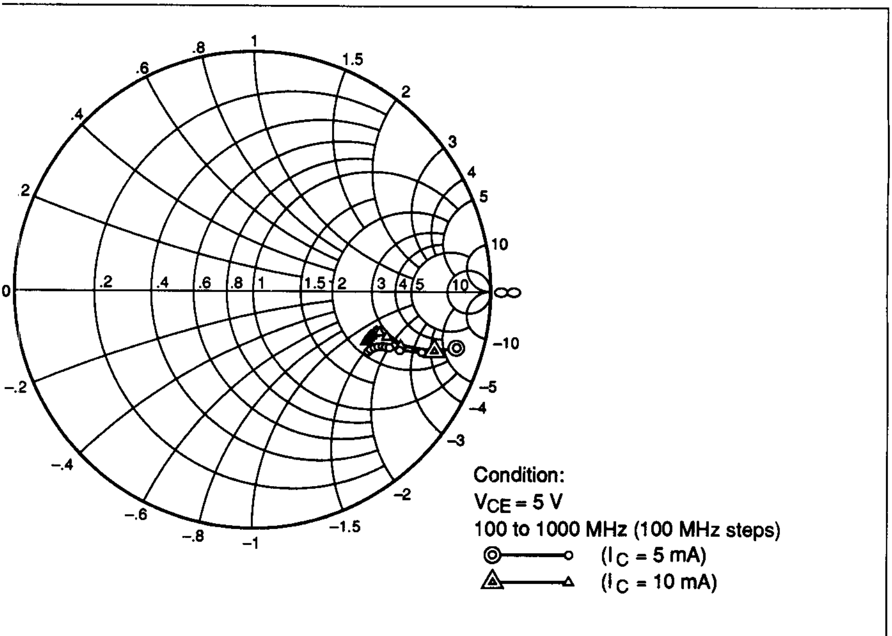


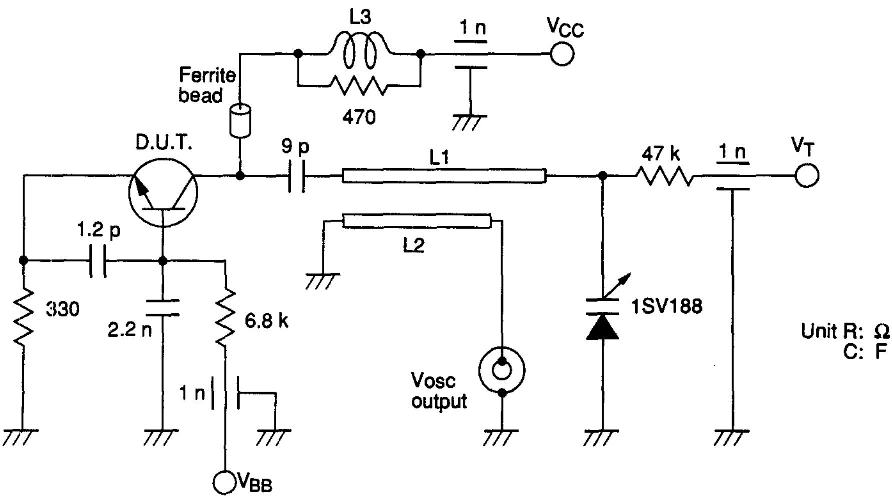
Figure 10 S_{22} Parameter vs. Frequency (Emitter Common)

Table 4 S Parameter (2SC4196) (Emitter Common) (V_{CE} = 5 V, I_C = 5 mA, Z_O = 50 Ω)

	S_{11}		S_{21}		S_{12}		S_{22}	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.718	–44.8	12.498	144.9	0.026	68.8	0.895	–14.6
200	0.549	–78.8	9.123	122.0	0.042	59.3	0.756	–20.3
300	0.439	–102.0	6.788	108.4	0.051	57.6	0.671	–21.3
400	0.381	–120.8	5.348	99.3	0.060	58.5	0.626	–21.5
500	0.351	–135.5	4.396	92.4	0.068	60.6	0.600	–21.8
600	0.340	–148.2	3.732	86.7	0.076	62.5	0.582	–22.5
700	0.337	–157.8	3.240	81.7	0.085	64.3	0.569	–23.3
800	0.337	–165.2	2.875	77.3	0.094	66.0	0.558	–24.4
900	0.343	–173.1	2.575	73.4	0.103	67.3	0.547	–25.8
1000	0.359	–177.9	2.355	70.0	0.112	68.4	0.538	–27.2

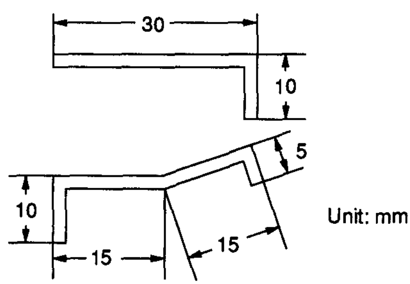
Table 5 S Parameter (2SC4196) (Emitter Common) (V_{CE} = 5 V, I_C = 10 mA, Z_O = 50 Ω)

	S_{11}		S_{21}		S_{12}		S_{22}	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.553	–65.2	17.540	133.2	0.022	64.8	0.809	–18.0
200	0.401	–103.4	11.066	111.3	0.033	61.3	0.659	–20.0
300	0.337	–127.4	7.723	99.9	0.043	63.9	0.598	–18.6
400	0.314	–143.9	5.939	92.5	0.052	66.3	0.570	–18.1
500	0.313	–155.7	4.816	86.7	0.063	68.6	0.555	–18.2
600	0.314	–165.5	4.052	81.8	0.073	70.1	0.545	–18.9
700	0.327	–172.2	3.496	77.6	0.083	71.4	0.536	–19.9
800	0.335	–177.7	3.090	73.8	0.093	72.4	0.530	–21.0
900	0.349	176.8	2.753	70.1	0.103	73.0	0.523	–22.4
1000	0.354	172.8	2.515	67.0	0.113	74.0	0.516	–24.0



L1: ϕ 0.8 mm enameled copper wire

L2: ϕ 0.8 mm enameled copper wire



L3: Inside dia 3 mm, ϕ 0.3 mm enameled copper wire 10 turns

Figure 11 2SC4196 Vosc Test Circuit

2SC4197 Series

Silicon NPN Epitaxial

Application

UHF frequency conversion, wide band amplifier

Features

- High gain bandwidth product
  f_T = 3.8 GHz typ
- Capable of low voltage operation
- Capable of high density mount

Table 1 Ordering Information

Type No.	Package
2SC4197	MPAK
2SC4260	CMPAK
2SC4416	MPAKR

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Ratings	Unit
Collector to base voltage		V_{CBO}	25	V
Collector to emitter voltage		V_{CEO}	13	V
Emitter to base voltage		V_{EBO}	3	V
Collector current		I_C	50	mA
Collector power dissipation	2SC4197	P_C	150	mW
	2SC4260		100	
	2SC4416		150	
Junction temperature		Tj	150	°C
Storage temperature		Tstg	–55 to +150	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Collector to base breakdown voltage	$V_{(BR)CBO}$	25	—	—	V	I_C = 10 µA, I_E = 0
Collector cutoff current	I_{CBO}	—	—	0.1	µA	V_{CB} = 15 V, I_E = 0
	I_{CEO}	—	—	10	µA	V_{CE} = 13 V, R_{BE} = ∞
Emitter cutoff current	I_{EBO}	—	—	0.3	µA	V_{BE} = 3 V, I_C = 0
Collector to emitter saturation voltage	$V_{CE(sat)}$	—	—	0.3	V	I_C = 20 mA, I_B = 4 mA
DC current transfer ratio	h_{FE}	50	—	180	—	V_{CE} = 5 V, I_C = 5 mA
Output capacitance	Cob	—	0.85	1.3	pF	V_{CB} = 10 V, I_E = 0, f = 1 MHz
Gain bandwidth product	f_T	3.0	3.8	—	GHz	V_{CE} = 5 V, I_C = 20 mA
Conversion gain	CG	15	19	—	dB	V_{CC} = 5 V, I_C = 0.8 mA, fin = 900 MHz, fosc = 930 MHz (–5 dBm), fout = 30 MHz
Noise figure	NF	—	8	12	dB	

Note: Marking of 2SC4197 and 2SC4260 is "TI–".
Marking of 2SC4416 is "XB–".

2SC4197 representing the characteristics curves hereafter. For the detail of characteristics of other parts, please consult our sales office near you.

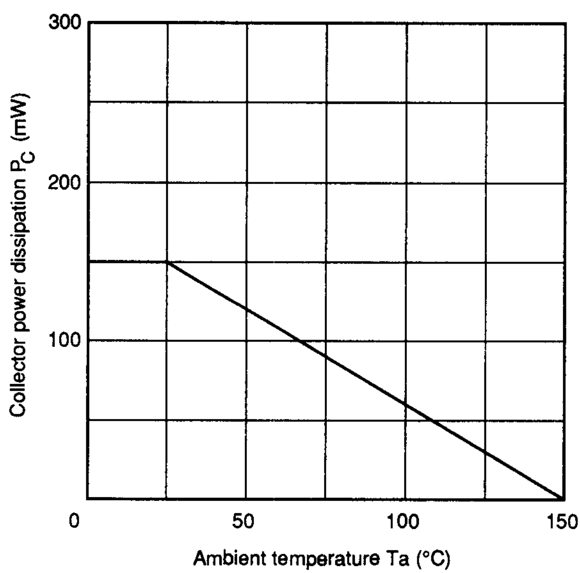


Figure 1 Maximum Collector Power Dissipation Curve

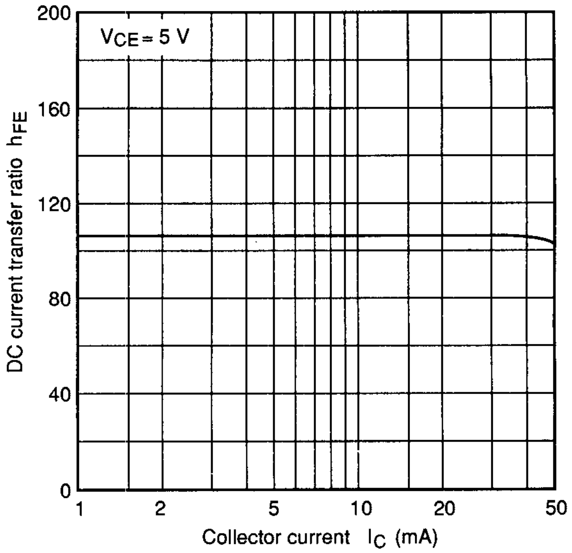


Figure 2 DC Current Transfer Ratio vs. Collector Current

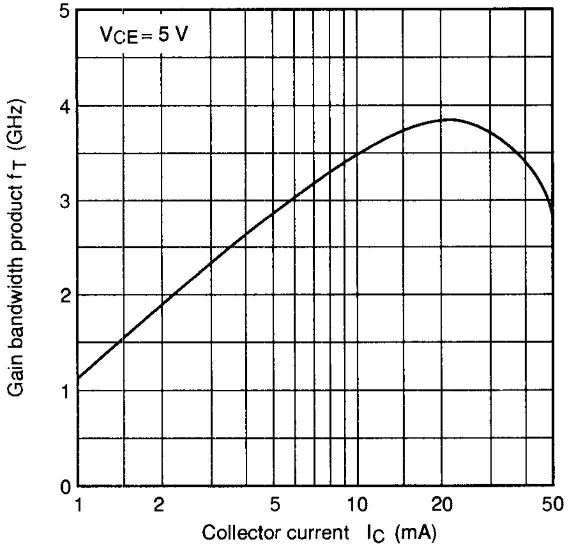


Figure 3 Gain Bandwidth Product vs. Collector Current

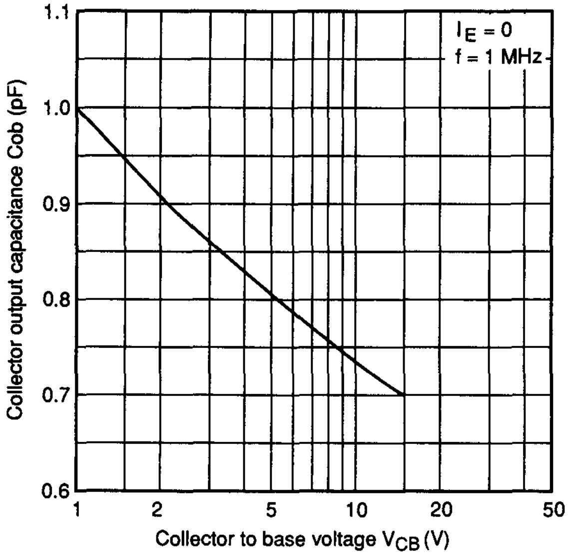


Figure 4 Collector Output Capacitance vs. Collector to Base Voltage

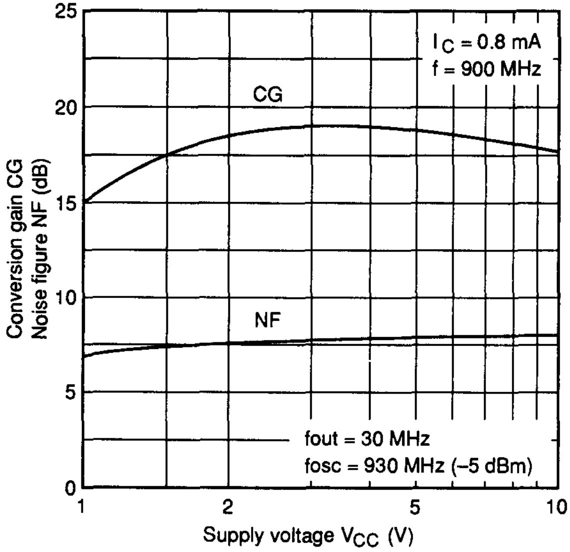


Figure 5 Conversion Gain and Noise Figure vs. Supply Voltage

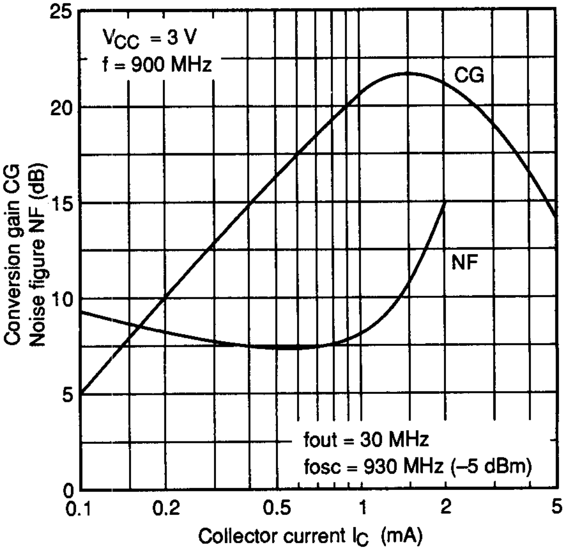


Figure 6 Conversion Gain and Noise Figure vs. Collector Current

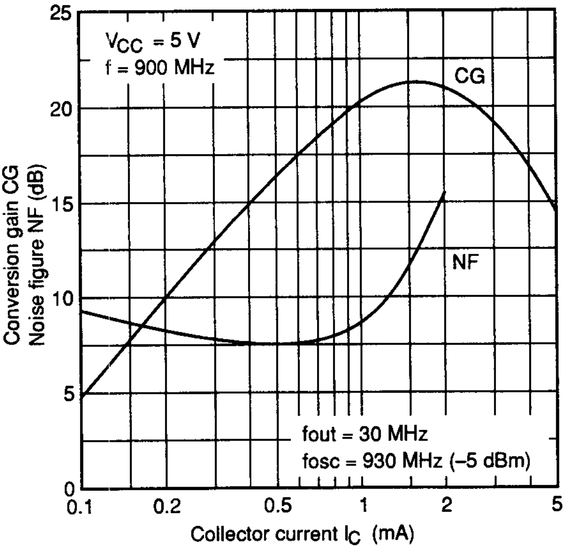


Figure 7 Conversion Gain and Noise Figure vs. Collector Current

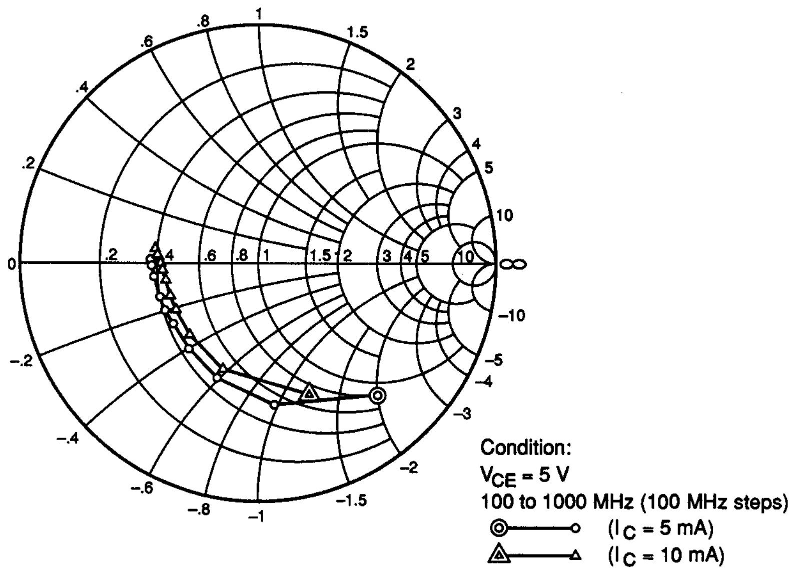


Figure 8 S_{11} Parameter vs. Frequency (Emitter Common)

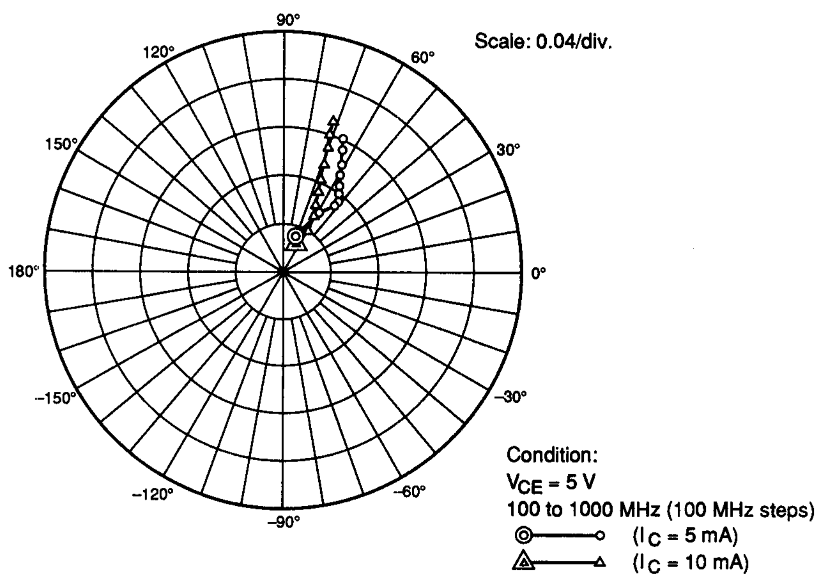


Figure 9 S_{12} Parameter vs. Frequency (Emitter Common)

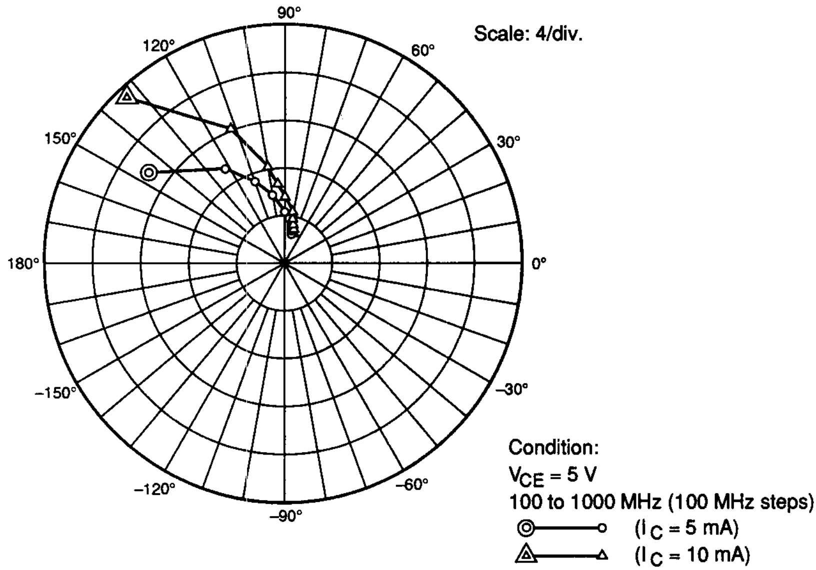


Figure 10 S_{21} Parameter vs. Frequency (Emitter Common)

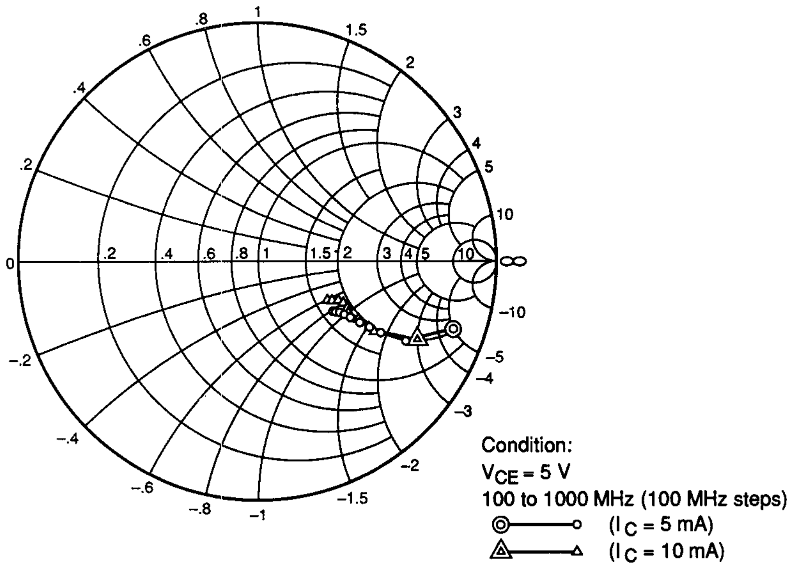


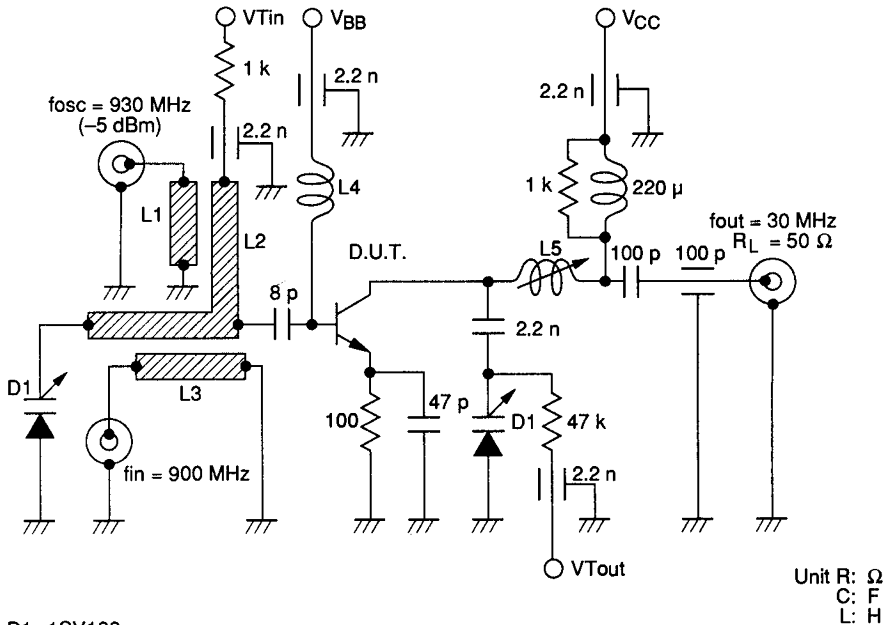
Figure 11 S_{22} Parameter vs. Frequency (Emitter Common)

Table 4 S Parameter (2SC4197) (Emitter Common) (V_{CE} = 5 V, I_C = 5 mA, Z_O = 50 Ω)

	S11		S21		S12		S22	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.744	–48.4	13.142	145.9	0.034	67.5	0.876	–19.1
200	0.599	–85.5	9.669	123.5	0.053	55.9	0.702	–28.2
300	0.506	–110.7	7.201	109.5	0.064	52.6	0.586	–30.9
400	0.457	–128.9	5.696	100.6	0.072	52.7	0.520	–31.2
500	0.440	–143.5	4.687	93.9	0.079	54.3	0.480	–31.2
600	0.430	–155.1	3.977	88.1	0.087	57.1	0.452	–31.5
700	0.437	–163.2	3.453	83.5	0.095	59.4	0.432	–31.7
800	0.441	–170.9	3.070	79.1	0.104	61.3	0.417	–32.4
900	0.452	–177.1	2.746	75.4	0.113	63.6	0.402	–33.4
1000	0.462	177.5	2.508	71.9	0.122	65.6	0.390	–34.5

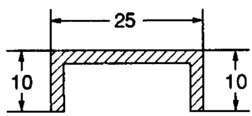
Table 5 S Parameter (2SC4197) (Emitter Common) (V_{CE} = 5 V, I_C = 10 mA, Z_O = 50 Ω)

	S11		S21		S12		S22	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.585	–69.3	19.233	134.4	0.028	63.8	0.768	–25.6
200	0.460	–110.1	12.238	112.6	0.041	58.1	0.564	–31.4
300	0.408	–133.9	8.571	101.3	0.052	60.0	0.468	–30.5
400	0.390	–149.7	6.608	94.5	0.062	62.9	0.420	–29.1
500	0.390	–160.7	5.348	88.7	0.073	65.3	0.394	–28.1
600	0.391	–169.8	4.503	84.4	0.084	67.7	0.375	–27.8
700	0.404	–176.7	3.884	80.3	0.095	69.1	0.361	–27.7
800	0.411	178.0	3.446	76.8	0.107	70.3	0.350	–28.2
900	0.426	173.1	3.069	73.4	0.119	71.5	0.339	–29.0
1000	0.436	169.8	2.803	70.7	0.131	72.2	0.330	–29.7

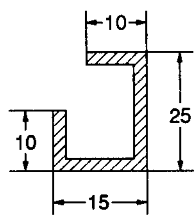


D1: 1SV188

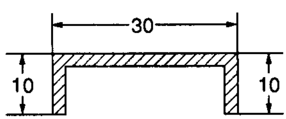
L1: ϕ1 mm enameled copper wire



L2: ϕ1 mm enameled copper wire



L3: ϕ1 mm enameled copper wire



Unit: mm

L4: ϕ0.5 mm enameled copper wire
1 turn inside dia ϕ3 mm

L5: Outside dia ϕ5 mm bobbin,
ϕ 0.2 mm enameled copper wire
20 turns, using ferrite core

Figure 12 2SC4197 Conversion Gain-Noise Figure Test Circuit

2SC4229 Series

Silicon NPN Epitaxial

Application

UHF tuner RF, low noise amplifier

Features

- Low noise operation
  NF = 3.0 dB typ (f = 900 MHz)
- Capable of low voltage operation
- Capable of high density mount

Table 1 Ordering Information

Type No.	Package
2SC4229	MPAK
2SC4259	CMPAK
2SC4415	MPAK-4

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Ratings	Unit
Collector to base voltage		V_{CBO}	30	V
Collector to emitter voltage		V_{CEO}	25	V
Emitter to base voltage		V_{EBO}	3	V
Collector current		I_C	20	mA
Collector power dissipation	2SC4229	P_C	150	mW
	2SC4259		100	
	2SC4415		150	
Junction temperature		Tj	150	°C
Storage temperature		Tstg	–55 to +150	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Collector to base breakdown voltage	$V_{(BR)CBO}$	30	—	—	V	I_C = 10 µA, I_E = 0
Collector cutoff current	I_{CBO}	—	—	0.3	µA	V_{CB} = 15 V, I_E = 0
	I_{CEO}	—	—	10	µA	V_{CE} = 25 V, $R_{BE} = \infty$
Emitter cutoff current	I_{EBO}	—	—	1.0	µA	V_{EB} = 3 V, I_C = 0
Collector to emitter saturation voltage	$V_{CE(sat)}$	—	—	5.0	V	I_C = 10 mA, I_B = 1 mA

Electrical Characteristics (Ta = 25°C) (cont)

Item		Symbol	Min	Typ	Max	Unit	Test conditions
DC current transfer ratio		h_{FE}	50	—	180	—	V_{CE} = 5 V, I_C = 2 mA
Output capacitance	2SC4229	Cob	—	0.6	0.9	pF	V_{CB} = 10 V, I_E = 0,
	2SC4259						f = 1 MHz
	2SC4415			0.65			
Gain bandwidth product		f_T	0.7	1.0	—	GHz	V_{CE} = 5 V, I_C = 2 mA
Power gain		PG	10	15	—	dB	V_{CC} = 4 V, I_C = 2 mA, f = 900 MHz
Noise figure		NF	—	3.0	4.5	dB	V_{CC} = 4 V, I_C = 2 mA, f = 900 MHz
AGC voltage		V_{AGC}	1.8	—	2.7	V	V_{CC} = 4 V, I_C = 2 mA, f = 900 MHz, Pin = –50 dBm, GR = 30 dB

Note: Marking of 2SC4229 and 2SC4259 is "UI–".
Marking of 2SC4415 is "XC–".

2SC4229 representing the characteristics curves hereafter. For the detail of characteristics of other parts, please consult our sales office near you.

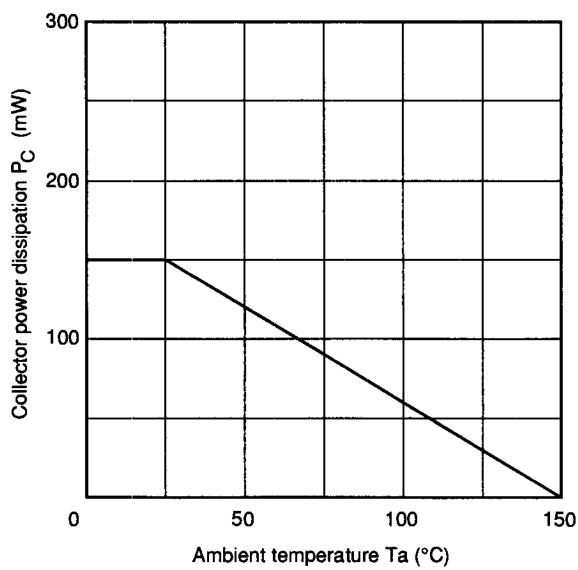


Figure 1 Maximum Collector Power Dissipation Curve

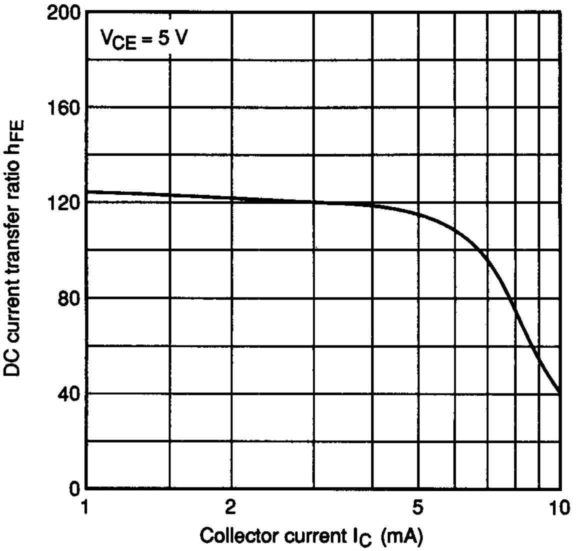


Figure 2 DC Current Transfer Ratio vs. Collector Current

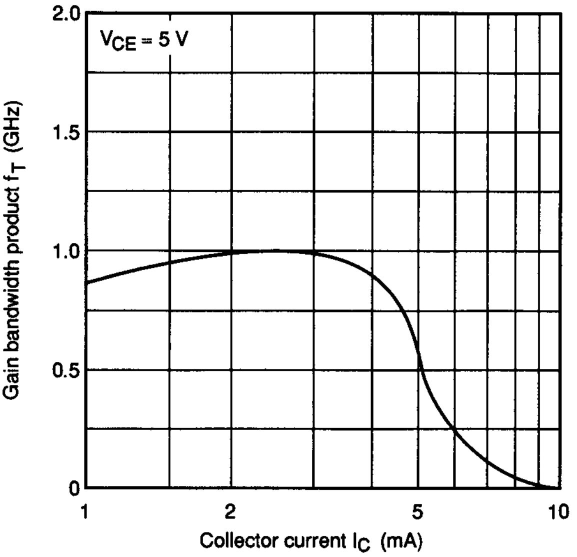


Figure 3 Gain Bandwidth Product vs. Collector Current

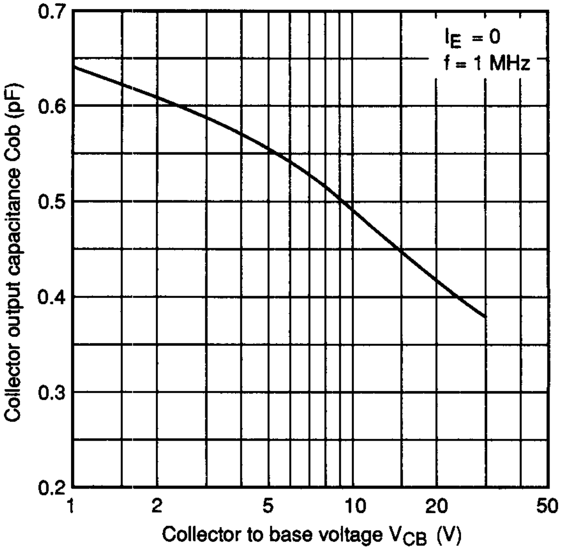


Figure 4 Collector Output Capacitance vs. Collector to Base Voltage

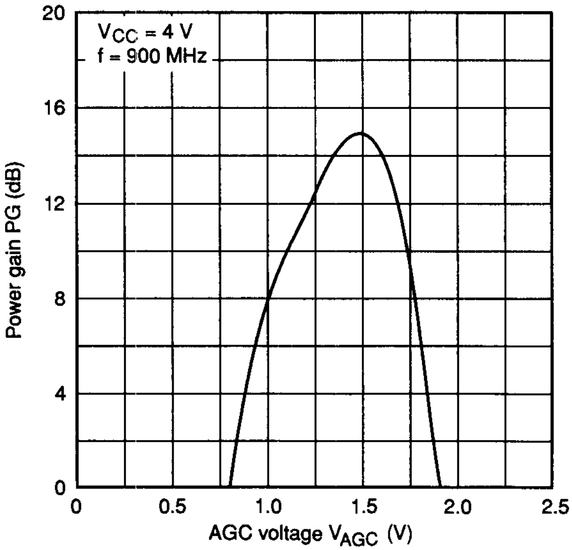


Figure 5 Power Gain vs. AGC Voltage

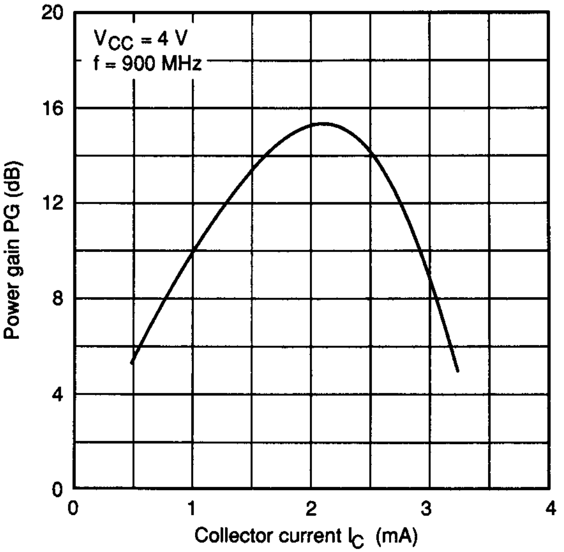


Figure 6 Power Gain vs. Collector Current

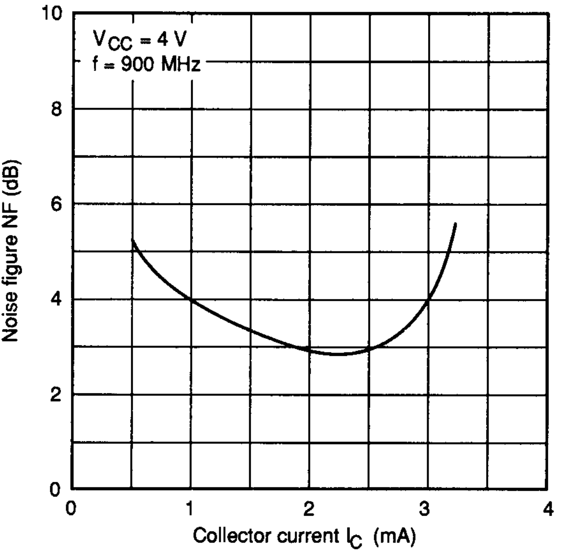


Figure 7 Noise Figure vs. Collector Current

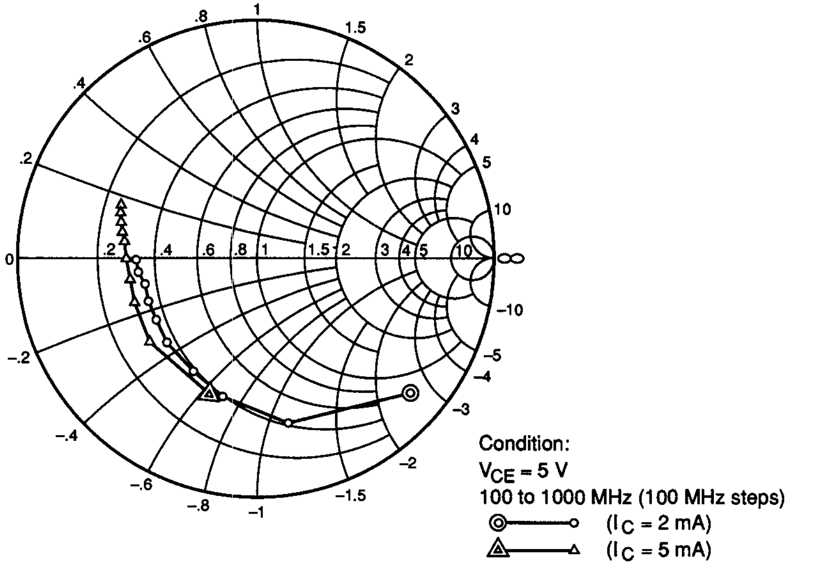


Figure 8 S_{11} Parameter vs. Frequency (Emitter Common)

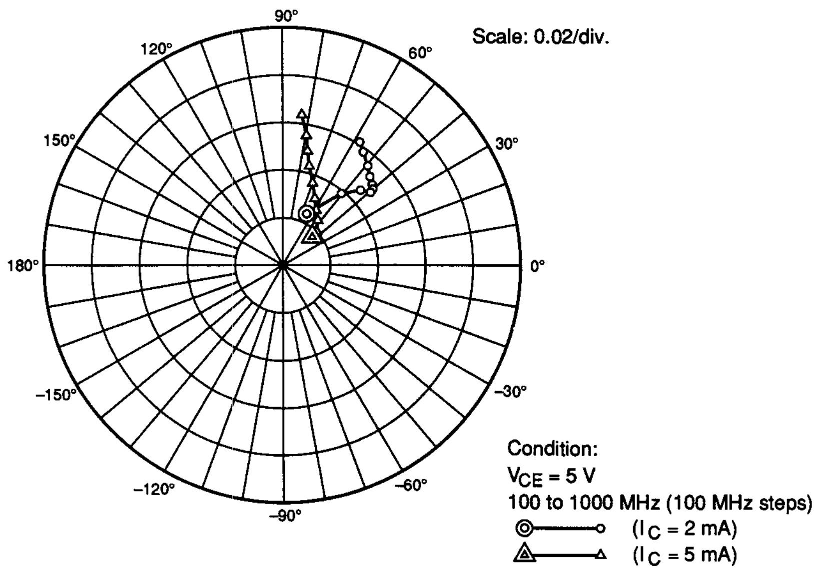


Figure 9 S_{12} Parameter vs. Frequency (Emitter Common)

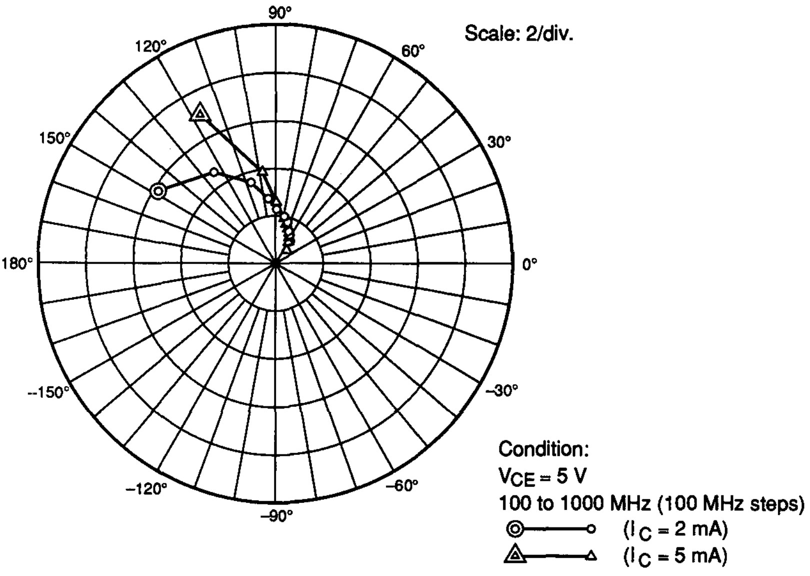


Figure 10 S_{21} **Parameter vs. Frequency (Emitter Common)**

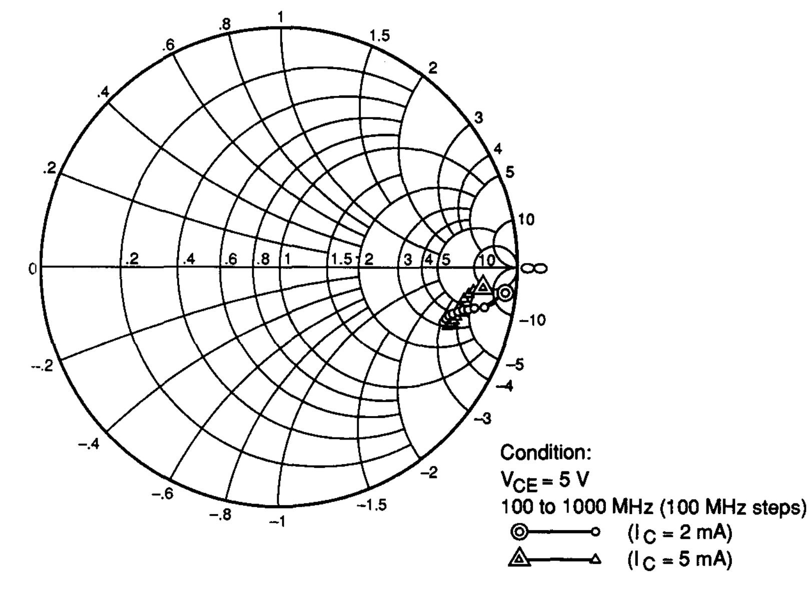


Figure 11 S_{22} **Parameter vs. Freuqency (Emitter Common)**

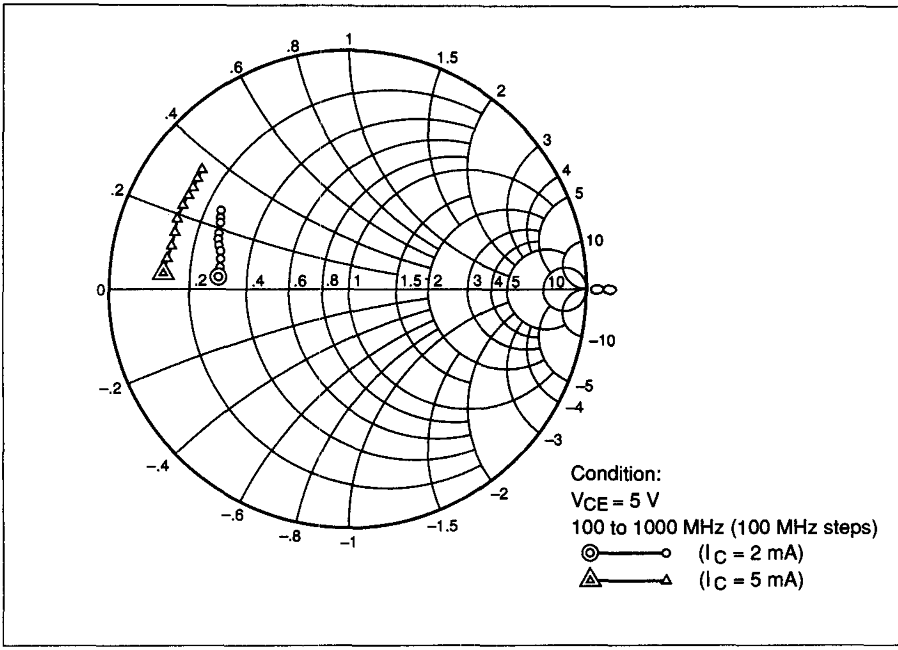


Figure 12 S_{11} Parameter vs. Frequency (Base Common)

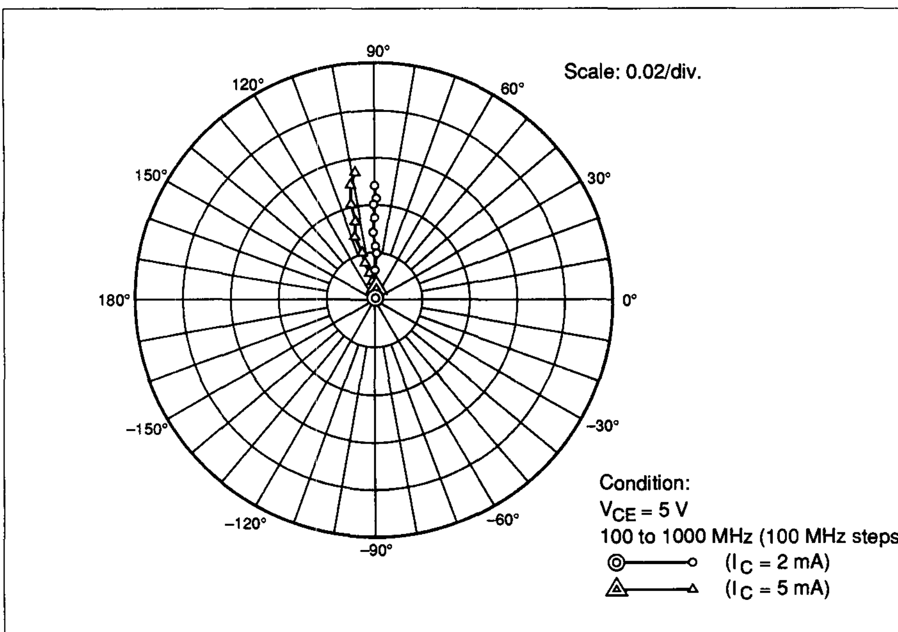


Figure 13 S_{12} Parameter vs. Frequency (Base Common)

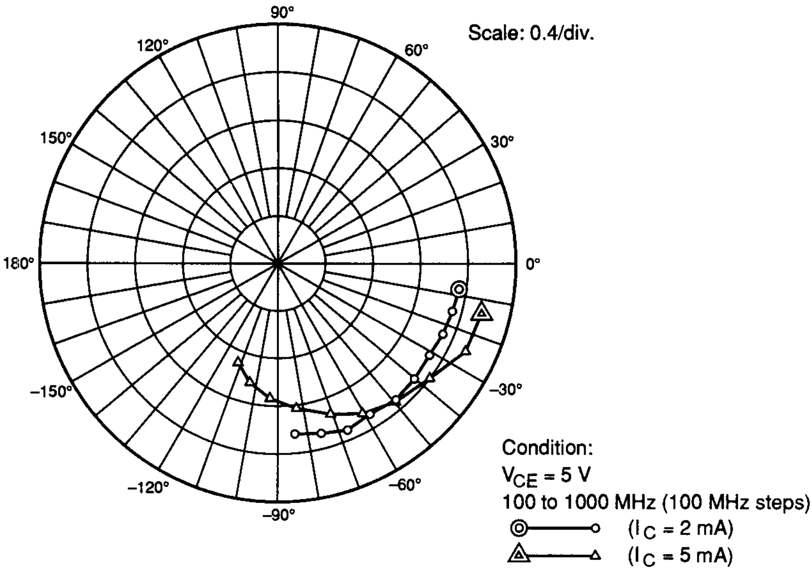


Figure 14 S_{21} Parameter vs. Frequency (Base Common)

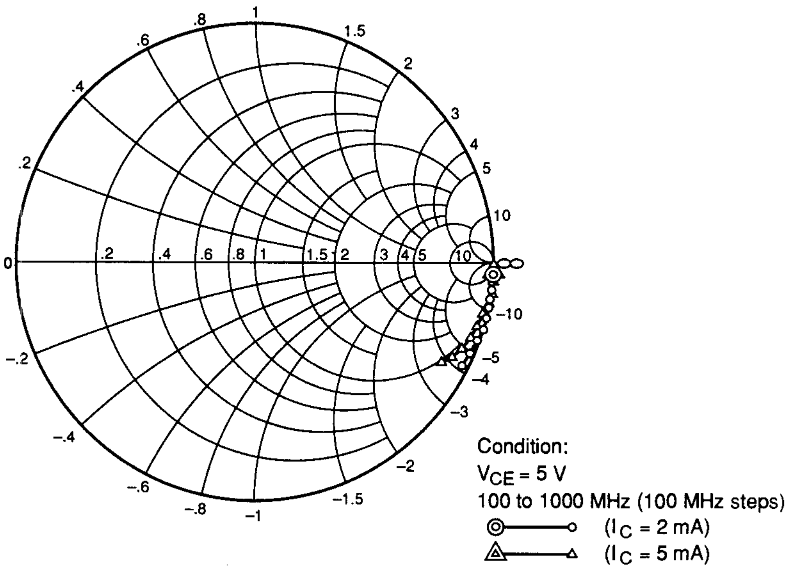


Figure 15 S_{22} Parameter vs. Frequency (Base Common)

Table 4 S Parameter (2SC4229) (Emitter Common) (V_{CE} = 5 V, I_C = 2 mA, Z_O = 50 Ω)

	S_{11}		S_{21}		S_{12}		S_{22}	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.847	–42.5	5.910	148.0	0.025	67.6	0.951	–7.0
200	0.702	–77.7	4.593	124.5	0.039	51.2	0.879	–10.6
300	0.598	–103.7	3.528	108.2	0.046	43.6	0.828	–11.6
400	0.540	–121.4	2.817	97.2	0.049	41.3	0.799	–12.1
500	0.513	–137.6	2.325	88.3	0.051	41.7	0.781	–12.8
600	0.498	–149.7	1.984	81.1	0.052	43.6	0.767	–13.6
700	0.500	–159.1	1.719	74.6	0.054	46.7	0.756	–14.7
800	0.501	–166.9	1.522	68.8	0.056	49.8	0.745	–15.8
900	0.520	–173.8	1.355	63.3	0.058	54.4	0.734	–16.9
1000	0.524	–179.5	1.232	59.1	0.061	58.5	0.725	–18.1

Table 5 S Parameter (2SC4229) (Emitter Common) (V_{CE} = 5 V, I_C = 5 mA, Z_O = 50 Ω)

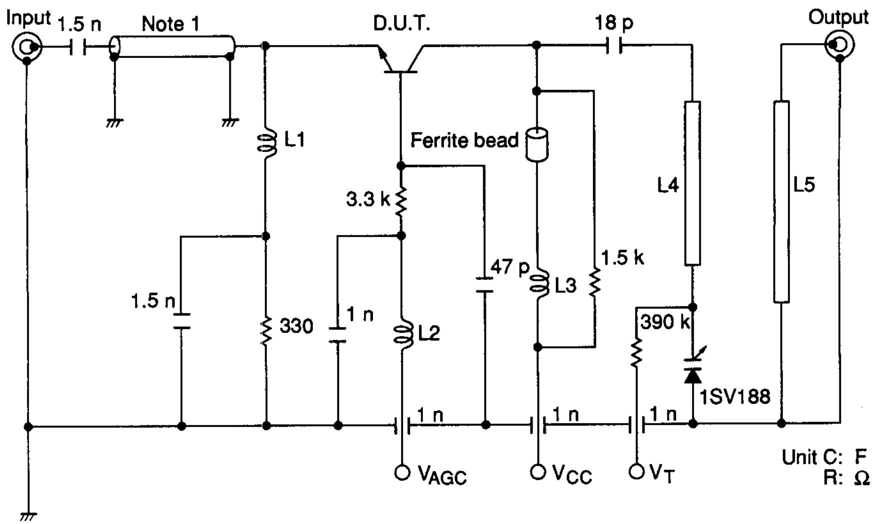
	S_{11}		S_{21}		S_{12}		S_{22}	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.606	–110.9	6.693	116.7	0.017	47.2	0.877	–6.3
200	0.559	–145.3	3.889	98.1	0.021	45.6	0.843	–6.9
300	0.543	–161.9	2.638	88.2	0.024	52.4	0.828	–8.0
400	0.546	–171.3	2.023	80.9	0.028	58.5	0.818	–9.3
500	0.555	–179.2	1.635	74.5	0.033	64.9	0.809	–10.7
600	0.562	174.6	1.378	68.8	0.038	70.3	0.799	–12.4
700	0.577	170.2	1.184	63.4	0.043	75.0	0.788	–14.0
800	0.583	165.7	1.045	58.5	0.049	77.8	0.777	–15.7
900	0.596	161.8	0.933	53.8	0.056	80.6	0.765	–17.3
1000	0.607	158.4	0.838	49.8	0.063	82.7	0.752	–18.8

Table 6 S Parameter (2SC4229) (Base Common) (V_{CE} = 5 V, I_C = 2 mA, Z_O = 50 Ω)

	S_{11}		S_{21}		S_{12}		S_{22}	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.554	176.3	1.538	–7.7	0.004	76.2	0.999	–1.9
200	0.559	173.3	1.535	–15.5	0.010	87.8	1.001	–4.1
300	0.566	169.9	1.531	–23.8	0.015	88.8	1.002	–6.3
400	0.568	166.4	1.516	–32.0	0.020	89.1	1.003	–8.6
500	0.583	163.6	1.500	–40.5	0.024	90.1	1.004	–11.2
600	0.597	160.4	1.478	–48.9	0.029	91.6	1.003	–13.8
700	0.605	157.7	1.447	–57.7	0.035	90.4	0.999	–16.8
800	0.615	154.6	1.412	–66.6	0.041	91.2	0.993	–19.8
900	0.628	152.7	1.365	–76.1	0.044	89.9	0.979	–23.1
1000	0.640	149.7	1.307	–84.4	0.049	90.0	0.962	–26.1

Table 7 S Parameter (2SC4229) (Base Common) (V_{CE} = 5 V, I_C = 5 mA, Z_O = 50 Ω)

	S_{11}		S_{21}		S_{12}		S_{22}	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.762	175.4	1.715	–13.1	0.003	75.5	0.999	–2.4
200	0.764	171.1	1.676	–25.1	0.007	95.9	1.001	–4.8
300	0.761	166.5	–1.599	–37.5	0.012	97.2	1.000	–7.5
400	0.757	162.5	1.517	–49.0	0.017	100.7	0.997	–10.3
500	0.761	158.6	1.427	–60.5	0.022	104.1	0.990	–13.2
600	0.764	154.6	1.334	–71.4	0.028	105.2	0.980	–16.4
700	0.761	151.6	1.233	–82.4	0.033	103.3	0.962	–19.6
800	0.761	147.8	1.137	–92.7	0.041	102.8	0.942	–22.7
900	0.761	144.7	1.042	–102.7	0.048	101.7	0.917	–25.7
1000	0.759	141.9	0.944	–112.1	0.054	98.9	0.885	–28.4

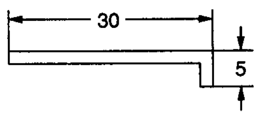


L1: Inside dia ϕ3 mm, ϕ0.5 mm enameled copper wire 7 turns

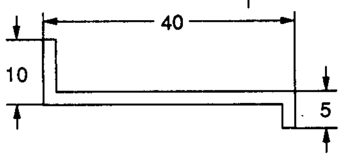
L2: Inside dia ϕ3 mm, ϕ0.3 mm enameled copper wire 13 turns

L3: Inside dia ϕ3 mm, ϕ0.5 mm enameled copper wire 9 turns

L4: ϕ0.8 mm enameled copper wire



L5: ϕ0.8 mm enameled copper wire



Note 1: 50 Ω semirigid cable

Unit: mm

Figure 16 2SC4229 Power Gain and Noise Figure Test Circuit

2SC4308

Silicon NPN Epitaxial Planar

Application

VHF wide band amplifier

Features

- High gain bandwidth product
  f_T = 2.5 GHz typ
- High current capacity
  ic(peak) = 500 mA
- Suitable for wide band video amplifier

Table 1 Ordering Information

Type No.	Package
2SC4308	TO-92

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Collector to base voltage	V_{CBO}	30	V
Collector to emitter voltage	V_{CEO}	20	V
Emitter to base voltage	V_{EBO}	3	V
Collector current	I_C	300	mA
Collector peak current	ic(peak)	500	mA
Collector power dissipation	P_C	600	mW
Junction temperature	Tj	150	°C
Storage temperature	Tstg	–55 to +150	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Collector to base breakdown voltage	$V_{(BR)CBO}$	30	—	—	V	I_C = 100 µA, I_E = 0
Collector to emitter breakdown voltage	$V_{(BR)CEO}$	20	—	—	V	I_C = 1 mA, R_{BE} = ∞
Collector cutoff current	I_{CBO}	—	—	1.0	µA	V_{CB} = 25 V, I_E = 0
Emitter cutoff current	I_{EBO}	—	—	10	µA	V_{EB} = 3 V, I_E = 0
DC current transfer ratio	h_{FE}	50	—	200	—	V_{CE} = 5 V, I_C = 50 mA
Gain bandwidth product	f_T	1.5	2.5	—	GHz	V_{CE} = 5 V, I_C = 50 mA
Output capacitance	Cob	—	4.0	—	pF	V_{CB} = 10 V, I_E = 0, f = 1 MHz

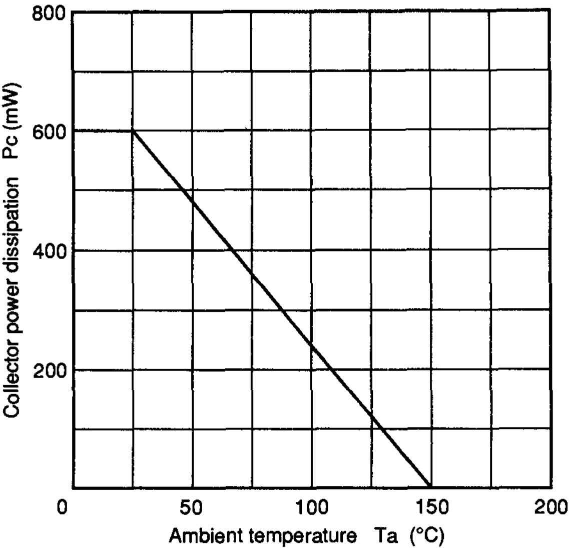


Figure 1 Maximum Collector Power Dissipation Curve

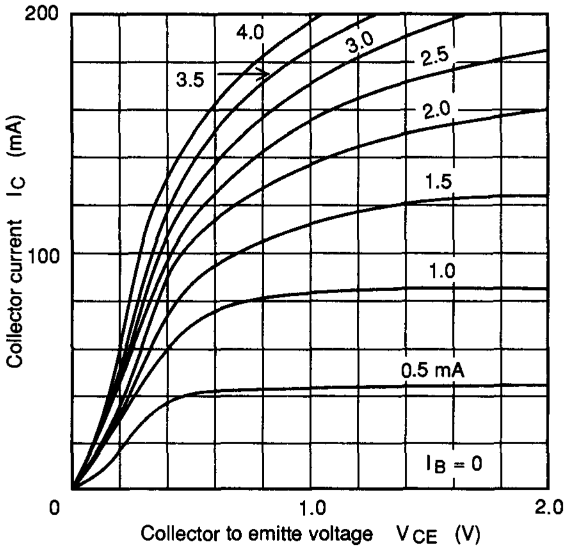


Figure 2 Typical Output Characteristics

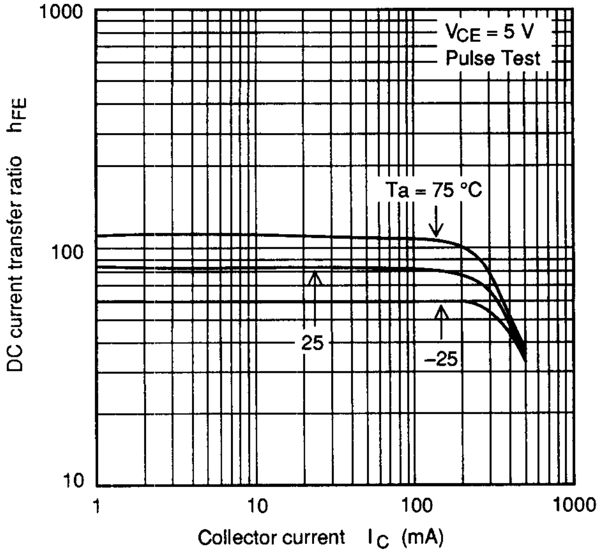


Figure 3 DC Current Transfer Ratio vs. Collector Current

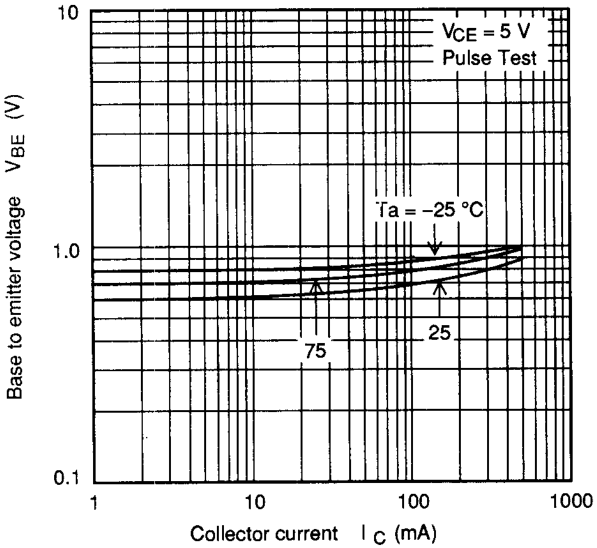


Figure 4 Base to Emitter Voltage vs. Collector Current

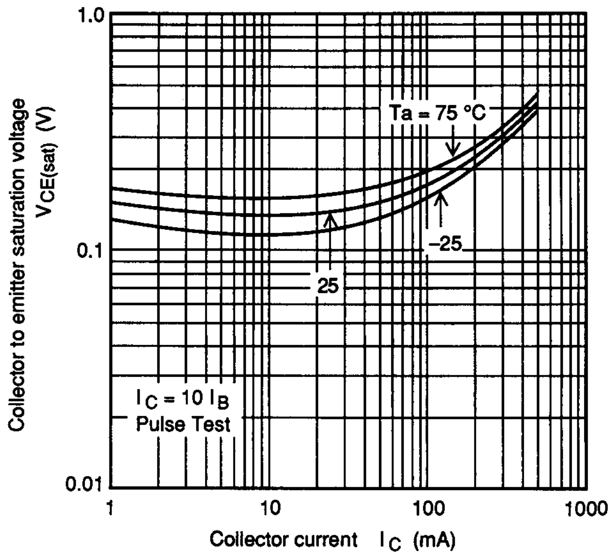


Figure 5 Collector to Emitter Saturation Voltage vs. Collector Current

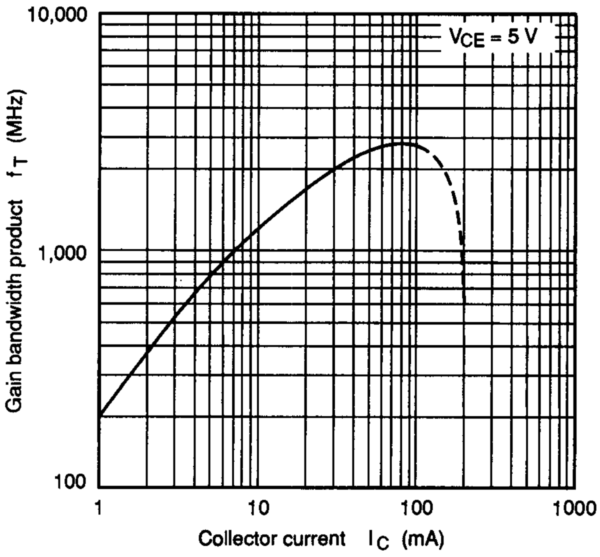


Figure 6 Gain Bandwidth Product vs. Collector Current

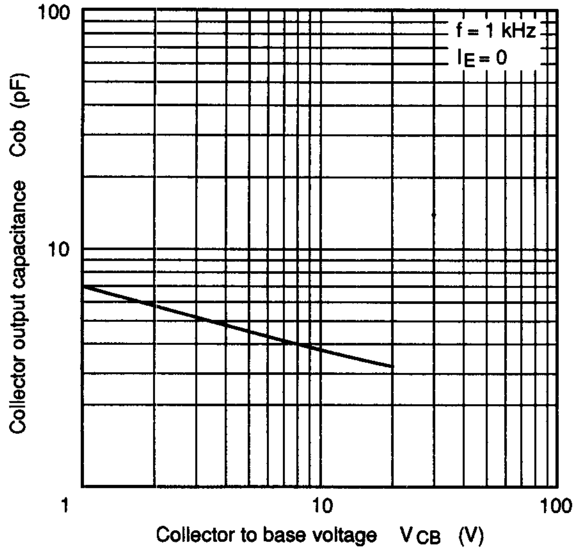


Figure 7 Collector Output Capacitance vs. Collector to Base Voltage

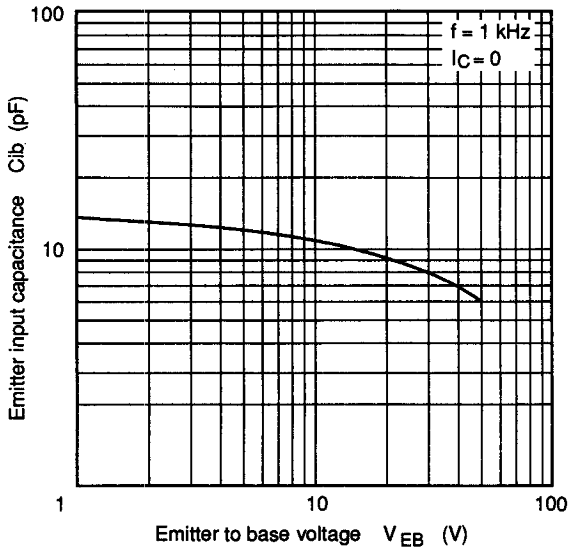


Figure 8 Emitter Input Capacitance vs. Emitter to Base Voltage

2SC4464

Silicon NPN Epitaxial

Application

High f_T in low voltage low current operation

Features

- Capable of low voltage and low current operation
  $f_T = 4$ GHz typ at $V_{CE} = 1$ V, $I_C = 1$ mA
- Capable of high density mount
  Compared with MPAK, mount area 40 % down

Table 1 Ordering Information

Type No.	Package
2SC4464	CMPAK

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Collector to base voltage	V_{CBO}	15	V
Collector to emitter voltage	V_{CEO}	8	V
Emitter to base voltage	V_{EBO}	2	V
Collector current	I_C	5	mA
Collector power dissipation	P_C	50	mW
Junction temperature	Tj	150	°C
Storage temperature	Tstg	–55 to +150	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Collector cutoff current	I_{CBO}	—	—	10	μA	V_{CB} = 15 V, I_E = 0
	I_{CEO}	—	—	1.0	mA	V_{CE} = 8 V, R_{BE} = ∞
Emitter cutoff current	I_{EBO}	—	—	10	μA	V_{EB} = 2 V, I_C = 0
DC current transfer ratio	h_{FE}	40	100	250	—	V_{CE} = 1 V, I_C = 250 μA
Output capacitance	Cre	—	0.35	0.55	pF	V_{CB} = 1 V, V_E = 0, f = 1 MHz
Gain bandwidth product	f_T	2.5	4.0	—	GHz	V_{CE} = 1 V, I_C = 1 mA
Power Gain	PG	6	8	—	dB	V_{CE} = 1 V, I_C = 1 mA, f = 900 MHz
Noise Figure	NF	—	3.0	4.5	dB	V_{CE} = 1 V, I_C = 0.5 mA, f = 900 MHz

Attention: This is electorostatic sensitive device.

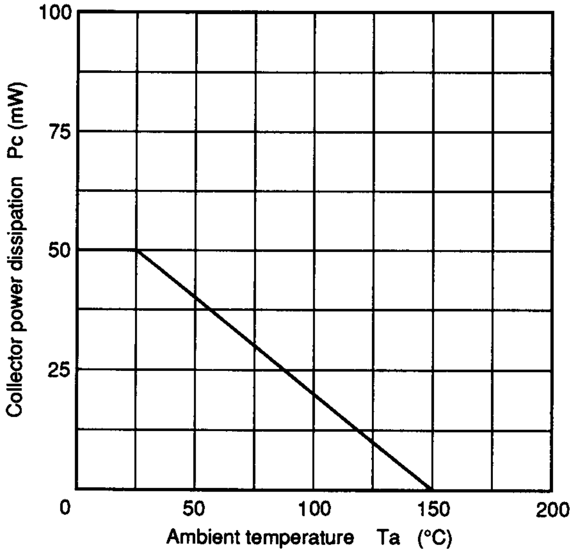


Figure 1 Maximum Collector Power Dissipation Curve

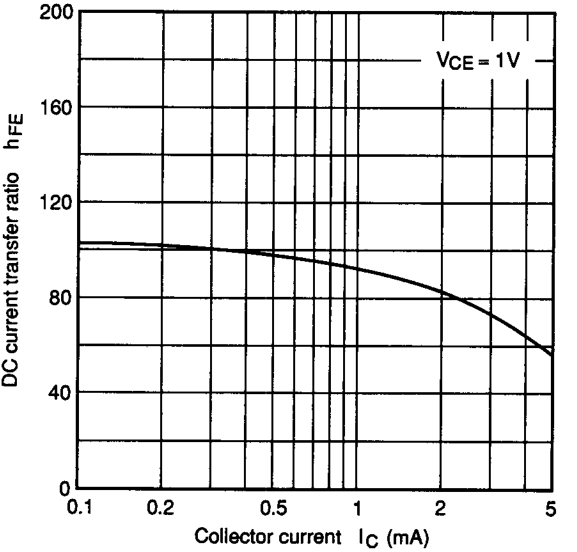


Figure 2 DC Current Transfer Ratio vs. Collector Current

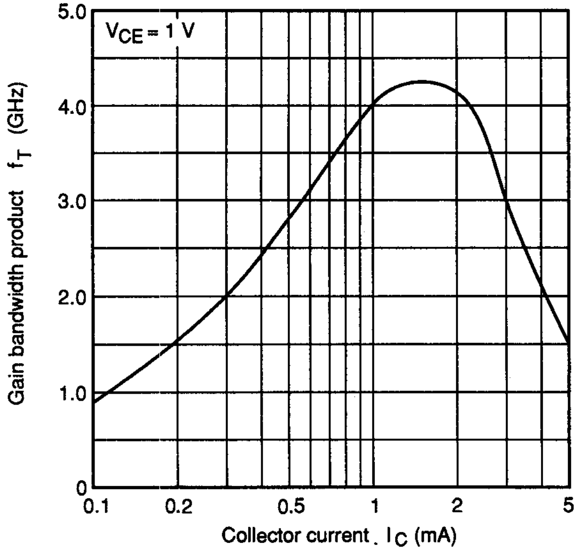


Figure 3 Gain Bandwidth Product vs. Collector Current

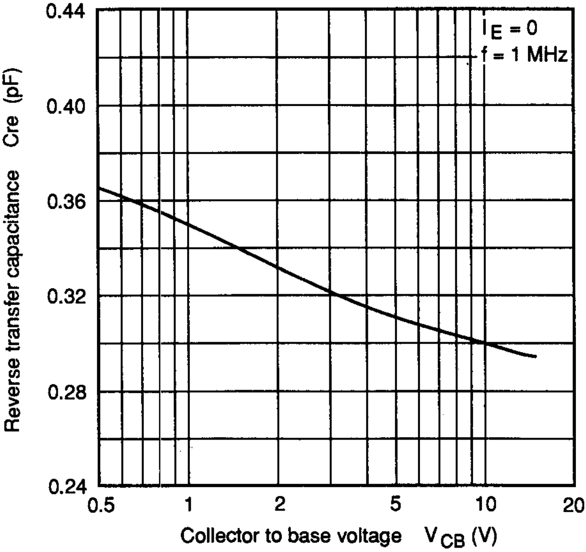


Figure 4 Reverse Transfer Capacitance vs. Collector to Base Voltage

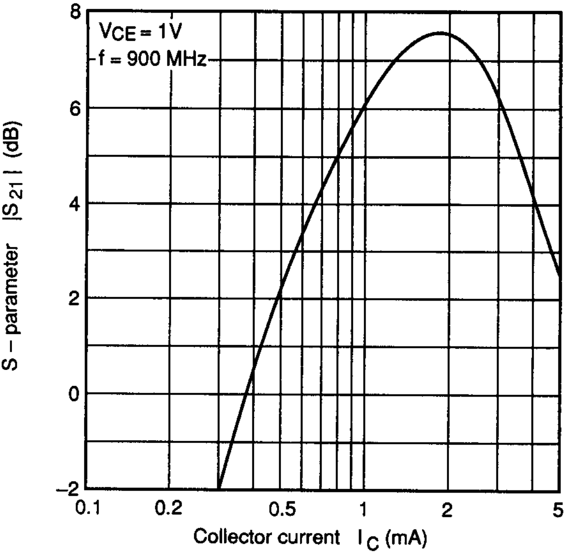


Figure 5 S Parameter vs. Collector Current

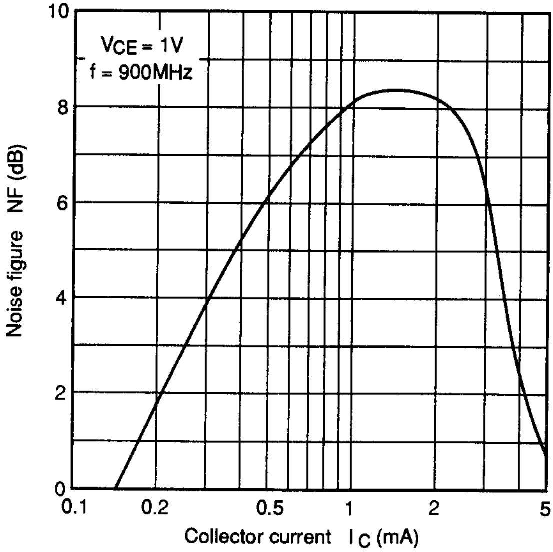


Figure 6 Power Gain vs. Collector Current

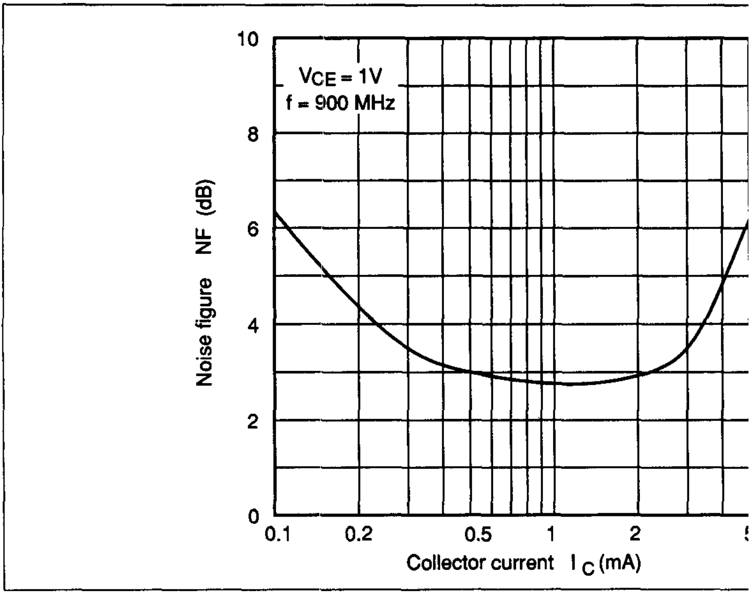


Figure 7 Noise Figure vs. Collector Current

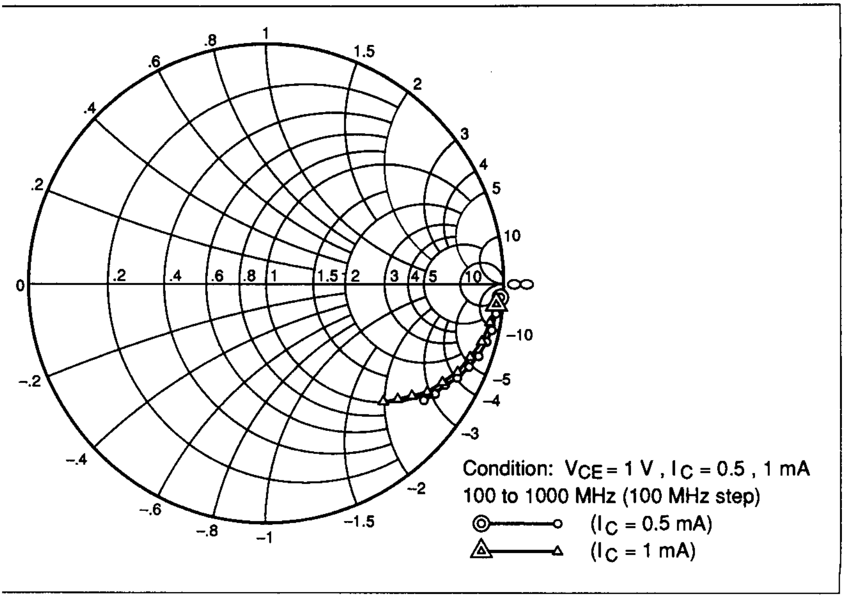


Figure 8 S_{11} Parameter vs. Frequency

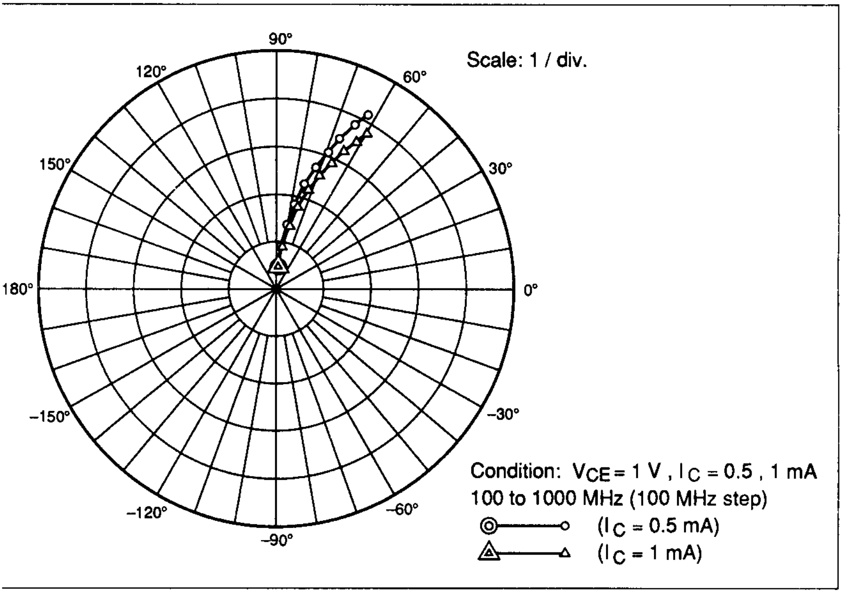


Figure 9 S_{12} Parameter vs. Frequency

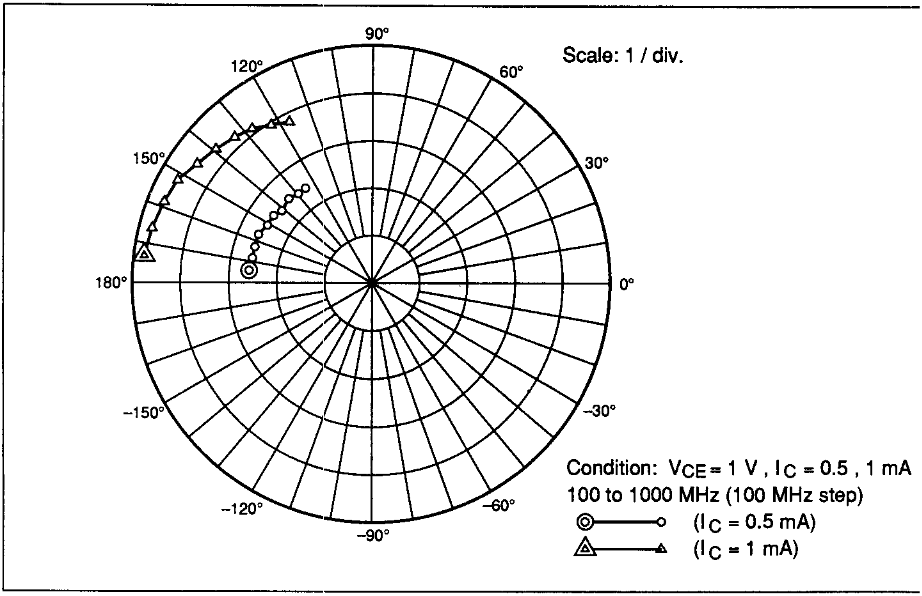


Figure 10 S_{21} Parameter vs. Frequency

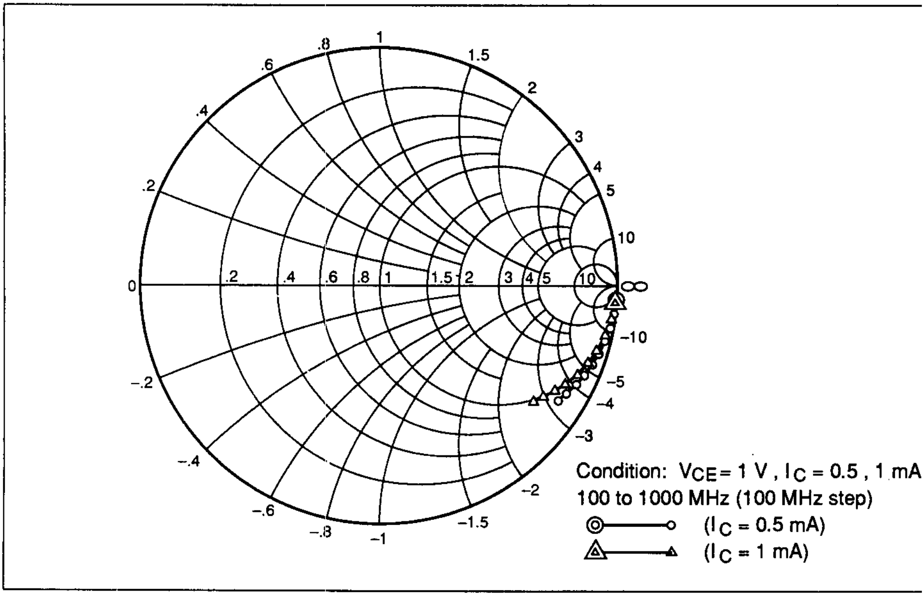


Figure 11 S_{22} Parameter vs. Frequency

Table 4 S Parameter (V_{CE} = 1 V, I_C = 0.5 mA, Z_O = 50 Ω)

	S_{11}		S_{21}		S_{12}		S_{22}	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.985	–3.3	1.335	174.2	0.023	86.1	0.997	–3.3
200	0.976	–7.3	1.319	168.4	0.046	84.0	0.993	–6.8
300	0.969	–11.3	1.327	162.4	0.069	80.5	0.986	–10.4
400	0.959	–14.8	1.337	156.6	0.092	78.0	0.975	–13.8
500	0.945	–18.6	1.293	151.0	0.144	74.9	0.965	–17.1
600	0.924	–22.4	1.291	145.5	0.135	72.0	0.952	–20.3
700	0.905	–26.3	1.277	139.8	0.154	69.4	0.938	–23.6
800	0.867	–29.5	1.284	134.6	0.172	67.2	0.923	–26.6
900	0.851	–33.1	1.256	129.5	0.192	64.4	0.905	–29.9
1000	0.827	–36.4	1.248	124.2	0.208	62.3	0.888	–32.8

Table 5 S Parameter (V_{CE} = 1 V, I_C = 1 mA, Z_O = 50 Ω)

	S_{11}		S_{21}		S_{12}		S_{22}	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.972	–4.8	2.478	173.2	0.023	85.8	0.994	–4.1
200	0.955	–9.8	2.447	165.9	0.045	82.4	0.985	–8.4
300	0.939	–15.0	2.413	158.6	0.068	78.4	0.970	–12.5
400	0.913	–19.7	2.379	152.0	0.090	75.6	0.953	–16.7
500	0.887	–24.6	2.292	145.7	0.110	72.1	0.932	–20.4
600	0.851	–29.2	2.231	139.4	0.128	69.1	0.910	–24.1
700	0.819	–33.6	2.174	133.3	0.145	66.5	0.884	–27.6
800	0.776	–37.6	2.124	128.0	0.161	64.1	0.859	–30.8
900	0.738	–41.2	2.036	122.7	0.176	61.6	0.832	–33.8
1000	0.701	–45.1	1.964	117.3	0.190	60.0	0.809	–36.7

Table 6 Y Parameter (V_{CE} = 1 V, I_C = 0.5 mA,)

	Y_{11}(mS)		Y_{21}(mS)		Y_{12}(mS)		Y_{22}(mS)	
f (MHz)	RAAL	IMAG	REAL	IMAG	REAL	IMRG	REAL	IMAG
100	0.133	0.423	13.451	–0.699	–0.004	–0.229	0.021	0.419
200	0.201	0.966	13.354	–1.273	0.001	–0.466	0.031	0.889
300	0.215	1.512	13.466	–1.941	–0.001	–0.709	0.041	1.357
400	0.247	1.973	13.621	–2.640	0.006	–0.951	0.073	1.800
500	0.307	2.509	13.234	–3.182	0.007	–1.199	0.088	2.258
600	0.424	3.043	13.322	–3.851	0.010	–1.448	0.104	2.697
700	0.520	3.625	13.278	–4.526	0.025	–1.695	0.131	3.158
800	0.809	4.049	13.529	–5.356	0.033	–1.953	0.147	3.588
900	0.857	4.603	13.328	–5.906	0.039	–2.228	0.191	4.080
1000	0.994	5.108	13.296	–6.685	0.060	–2.485	0.206	4.531

Table 7 Y Parameter (V_{CE} = 1 V, I_C = 1 mA,)

	Y_{11}(mS)		Y_{21}(mS)		Y_{12}(mS)		Y_{22}(mS)	
f (MHz)	RAAL	IMAG	REAL	IMAG	REAL	IMRG	REAL	IMAG
100	0.255	0.599	25.155	–1.414	–0.002	–0.230	0.034	0.424
200	0.362	1.127	25.037	–2.964	–0.002	–0.469	0.053	0.891
300	0.415	1.772	24.849	–4.502	–0.006	–0.714	0.069	1.337
400	0.559	2.321	24.779	–5.909	0.003	–0.961	0.092	1.810
500	0.676	2.962	24.162	–7.063	0.002	–1.208	0.127	2.274
600	0.895	3.562	23.870	–8.435	0.007	–1.458	0.147	2.732
700	1.075	4.144	23.559	–9.807	0.017	–1.707	0.197	3.194
800	1.386	4.636	23.402	–11.190	0.019	–1.963	0.229	3.622
900	1.640	5.168	22.677	–12.366	0.012	–2.237	0.274	4.075
1000	1.957	5.726	22.072	–13.643	0.040	–2.505	0.304	4.543

2SC4592 Series

Silicon NPN Epitaxial

Application

UHF & VHF wide band amplifier

Features

- High gain bandwidth product
  $f_T = 9.5$ GHz typ
- High gain, low noise figure
  PG = 14.0 dB typ,
  NF = 1.2 dB typ at f = 900 MHz

Table 1 Ordering Information

Type No.	Package
2SC4591	MPAK
2SC4592	MPAK4
2SC4593	CMPAK
2SC4629	TO-92
2SC4643	UPAK

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Ratings	Unit
Collector to base voltage		V_{CBO}	15	V
Collector to emitter voltage		V_{CEO}	9	V
Emitter to base voltage		V_{EBO}	1.5	V
Collector current		I_C	50	mA
Collector power dissipation	2SC4591	P_C	150	mW
	2SC4592		150	
	2SC4593		100	
	2SC4629		600	
	2SC4643		400	
Junction temperature		Tj	150	°C
Storage temperature		Tstg	–55 to +150	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item		Symbol	Min	Typ	Max	Unit	Test conditions
Collector to base breakdown voltage		$V_{(BR)CBO}$	15	—	—	V	I_C = 10 µA, I_E = 0
Collector cutoff current		I_{CBO}	—	—	1	µA	V_{CB} = 12 V, I_E = 0
		I_{CEO}	—	—	1	mA	V_{CE} = 9 V, R_{BE} = ∞
Emitter cutoff current		I_{EBO}	—	—	10	µA	V_{EB} = 1.5 V, I_C = 0
DC current transfer ratio		h_{FE}	40	120	250	—	V_{CE} = 5 V, I_C = 20 mA
Output capacitance	2SC4591	Cob	—	0.8	1.5	pF	V_{CB} = 5 V, I_E = 0, f = 1 MHz
	2SC4592						
	2SC4593						
	2SC4629			1.15	1.85		
	2SC4643			1.0	1.7		
Gain bandwidth product	2SC4591	f_T	6.5	9.0	—	GHz	V_{CE} = 5 V, I_C = 20 mA
	2SC4592		7.0	9.5			
	2SC4593		6.5	9.0			
	2SC4629		5.5	8.0			
	2SC4643						
Power gain	2SC4591	PG	9.5	12.5	—	dB	V_{CE} = 5 V, I_C = 20 mA, f = 900 MHz
	2SC4592		11.0	14.0			
	2SC4593		9.5	12.5			
	2SC4629		8.5	11.5			
	2SC4643		7.5	10.5			
Noise figure		NF	—	1.2	2.5	dB	V_{CE} = 5 V, I_C = 5 mA, f = 900 MHz

2SC4592 representing the characteristics curves hereafter.

For the detail of characteristics of other parts, please consult our sales office near you.

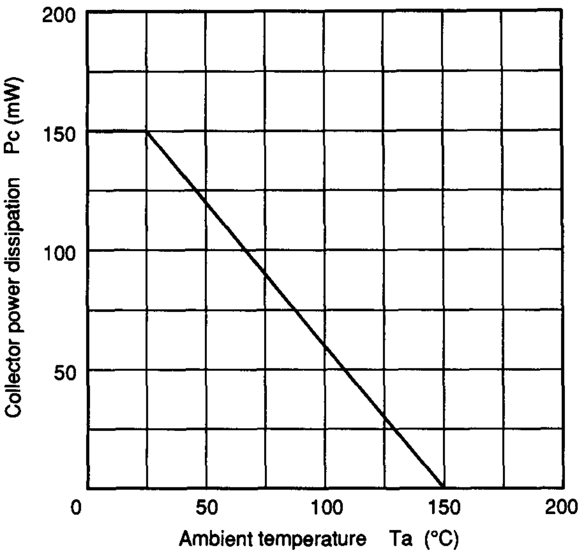


Figure 1 Maximum Collector Power Dissipation Curve

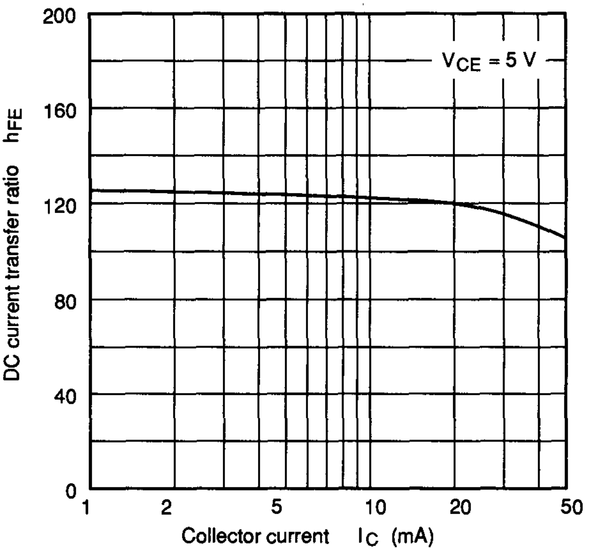


Figure 2 DC Current Transfer Ratio vs. Collector Current

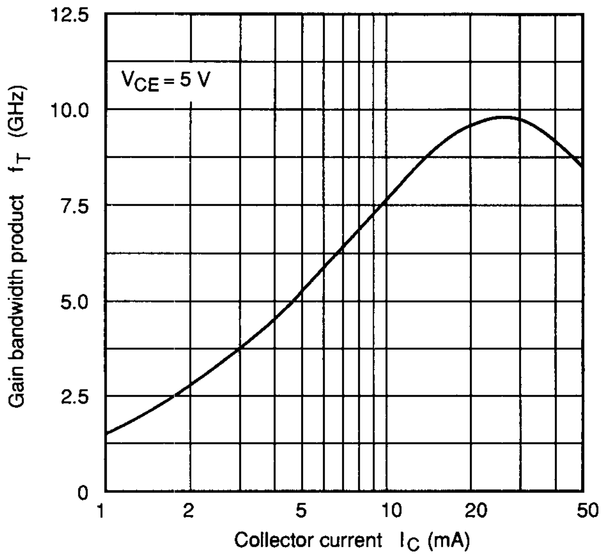


Figure 3 Gain Bandwidth Product vs. Collector Current

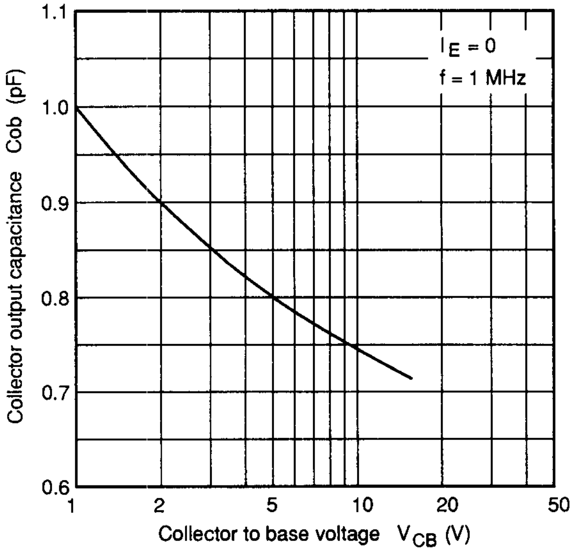


Figure 4 Collector Output Capacitance vs. Collector to Base Voltage

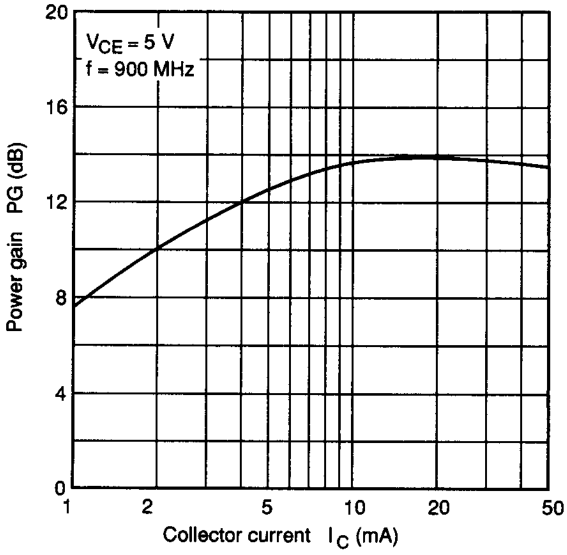


Figure 5 Power Gain vs. Collector Current

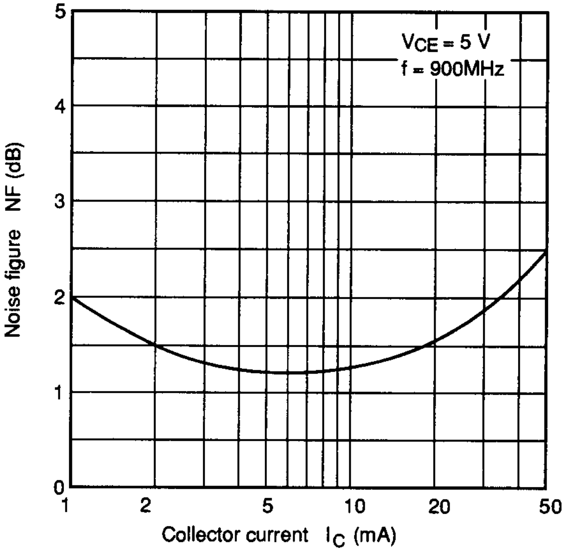


Figure 6 Noise Figure vs. Collector Current

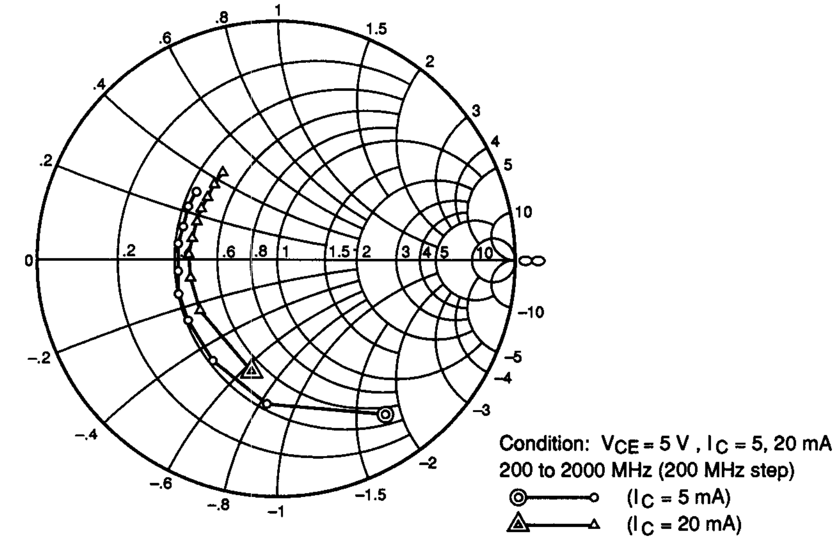


Figure 7 S_{11} Parameter vs. Frequency

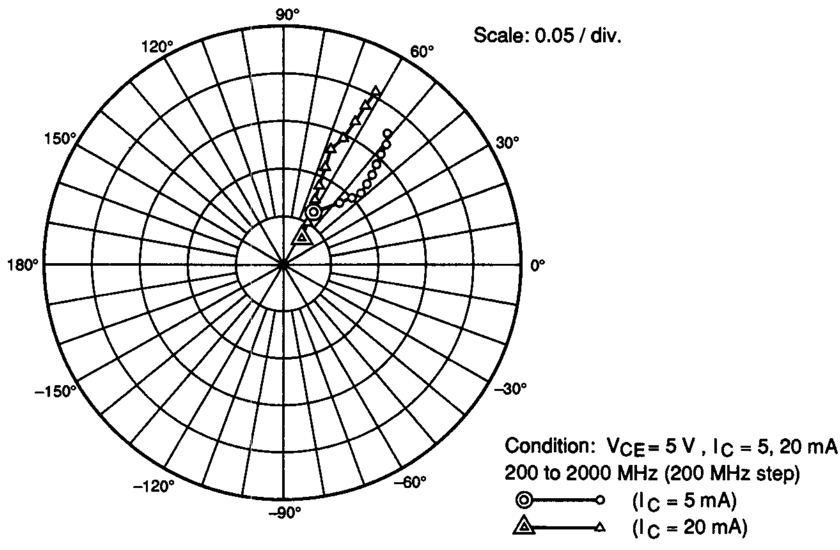


Figure 8 S_{12} Parameter vs. Frequency

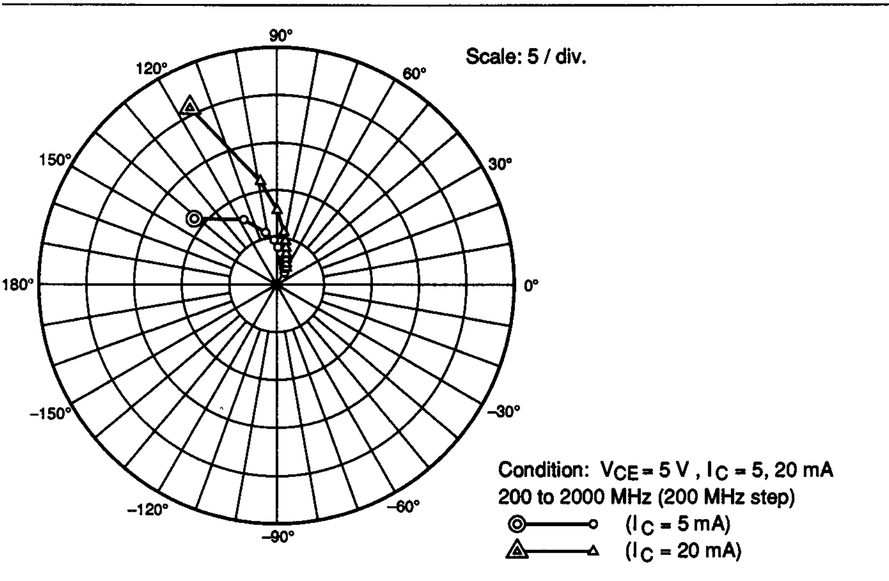


Figure 9 S_{21} Parameter vs. Frequency

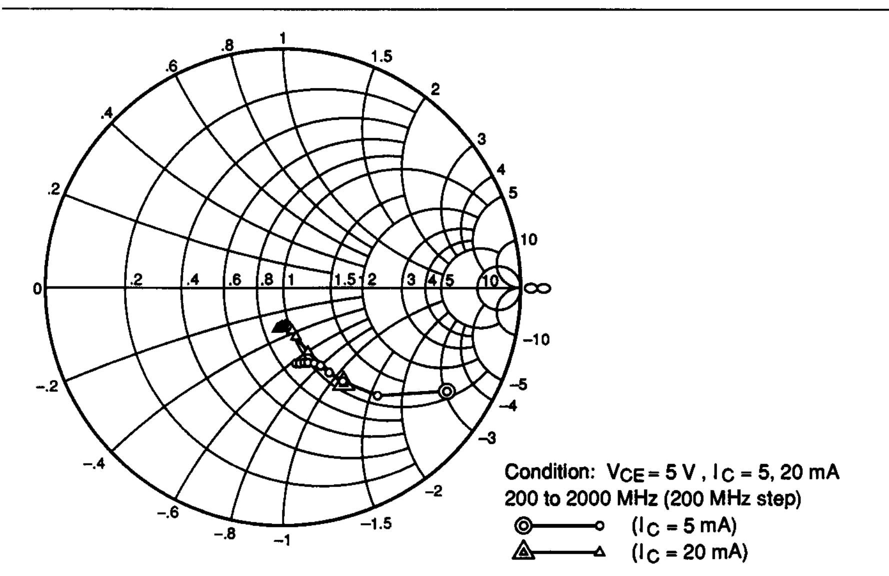


Figure 10 S_{22} Parameter vs. Frequency

Table 7 S Parameter (2SC4592) (V_{CE} = 5 V, I_C = 5 mA, Z_O = 50 Ω)

	S_{11}		S_{21}		S_{12}		S_{22}	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.893	–28.8	12.428	159.3	0.034	74.2	0.939	–17.2
200	0.788	–54.8	10.823	141.1	0.058	61.4	0.819	–31.5
300	0.693	–76.3	9.118	127.1	0.076	52.8	0.699	–41.8
400	0.603	–94.1	7.714	116.9	0.087	47.9	0.602	–48.5
500	0.542	–110.1	6.565	108.8	0.094	45.3	0.531	–52.8
600	0.507	–122.6	5.693	102.5	0.100	44.0	0.478	–55.9
700	0.472	–133.8	5.002	96.9	0.105	43.2	0.437	–58.5
800	0.454	–144.1	4.477	92.3	0.110	42.8	0.405	–60.8
900	0.443	–152.1	4.001	88.2	0.115	43.3	0.382	–62.5
1000	0.436	–160.1	3.660	84.2	0.119	44.1	0.363	–64.3
1100	0.423	–167.8	3.372	80.9	0.124	44.6	0.350	–65.9
1200	0.420	–174.8	3.100	77.7	0.129	45.5	0.340	–66.8
1300	0.419	178.6	2.882	74.7	0.134	46.4	0.336	–68.2
1400	0.420	172.4	2.703	71.8	0.139	46.9	0.328	–69.9
1500	0.419	166.2	2.542	69.3	0.144	47.9	0.323	–71.3
1600	0.423	161.8	2.392	66.3	0.150	48.5	0.320	–72.0
1700	0.422	156.4	2.270	63.9	0.155	49.0	0.317	–74.2
1800	0.433	151.3	2.149	61.6	0.161	49.5	0.316	–76.0
1900	0.432	147.3	2.050	59.5	0.167	50.1	0.315	–77.4
2000	0.442	142.5	1.958	56.9	0.174	50.6	0.315	–79.0

Table 8 S Parameter (2SC4592) (V_{CE} = 5 V, I_C = 20 mA, Z_O = 50 Ω)

	S_{11}		S_{21}		S_{12}		S_{22}	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.619	–64.2	31.361	137.5	0.025	63.5	0.729	–39.2
200	0.475	–104.2	20.515	116.0	0.036	56.8	0.483	–57.2
300	0.417	–128.3	14.505	105.1	0.045	57.8	0.356	–65.2
400	0.385	–145.2	11.189	98.3	0.054	60.1	0.287	–69.2
500	0.374	–157.4	9.053	93.4	0.063	61.6	0.245	–71.9
600	0.367	–166.9	7.608	89.6	0.072	62.8	0.220	–73.8
700	0.367	–175.4	6.547	86.1	0.081	64.1	0.201	–75.5
800	0.366	177.2	5.773	83.0	0.090	64.7	0.189	–77.2
900	0.369	172.0	5.121	80.6	0.100	64.9	0.181	–78.4
1000	0.368	166.2	4.632	77.9	0.109	65.1	0.175	–80.1
1100	0.369	160.6	4.238	75.3	0.119	65.3	0.171	–81.2
1200	0.373	155.7	3.897	73.2	0.128	65.1	0.168	–82.7
1300	0.377	151.2	3.616	71.0	0.137	65.1	0.167	–84.2
1400	0.382	146.9	3.369	68.8	0.147	64.5	0.167	–85.7
1500	0.384	142.1	3.154	66.8	0.156	64.1	0.168	–87.1
1600	0.386	138.7	2.960	64.5	0.166	63.5	0.168	–88.3
1700	0.391	133.7	2.803	62.9	0.175	63.0	0.169	–89.9
1800	0.401	130.6	2.662	60.6	0.185	62.4	0.171	–91.5
1900	0.405	127.4	2.533	59.1	0.193	61.7	0.172	–92.6
2000	0.408	12.8	2.416	57.0	0.202	61.1	0.175	–94.1

2SC4674

Silicon NPN Epitaxial

Application

High f_T in low voltage low current operation

Table 1 Ordering Information

Type No.	Package
2SC4674	CMPAK

Features

- Capable of low voltage and low current operation
  f_T = 6 GHz Typ. (V_{CE} = 1 V , I_C = 1 mA)
- Capable of high density mount
  Compared with MPAK , mount area 40 % down

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Collector to base voltage	V_{CBO}	12	V
Collector to emitter voltage	V_{CEO}	7	V
Emitter to base voltage	V_{EBO}	2	V
Collector current	I_C	8	mA
Collector power dissipation	P_C	50	mW
Junction temperature	Tj	150	°C
Storage temperature	Tstg	–55 to +150	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Collector cutoff current	I_{CBO}	—	—	10	μA	V_{CB} = 12 V, I_E = 0
	I_{CEO}	—	—	1	mA	V_{CE} = 7 V, R_{BE} = ∞
Emitter cutoff current	I_{EBO}	—	—	10	μA	V_{EB} = 2 V, I_C = 0
DC current transfer ratio	h_{FE}	50	100	250	—	V_{CE} = 1 V, I_C = 1 mA
Output capacitance	Cre	—	0.35	0.55	pF	V_{CB} = 1 V, V_E = 0
Gain bandwidth product	f_T	4.0	6.0	—	GHz	V_{CE} = 1 V, I_C = 1 mA
Power gain	PG	7.0	9.0	—	dB	V_{CE} = 1 V, I_C = 1 mA, f=900MHz
Noise figure	NF	—	3.0	4.5	dB	V_{CE} = 1 V, I_C = 1 mA f = 900 MHz

* Attention: This is electorostatic sensitive device.

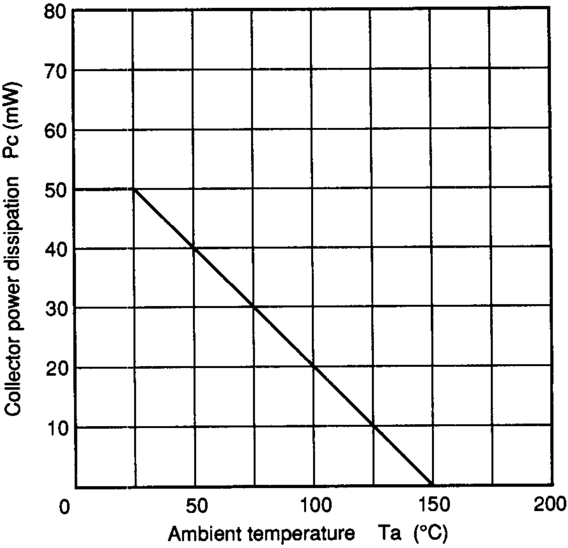


Figure 1 Maximum Collector Power Dissipation Curve

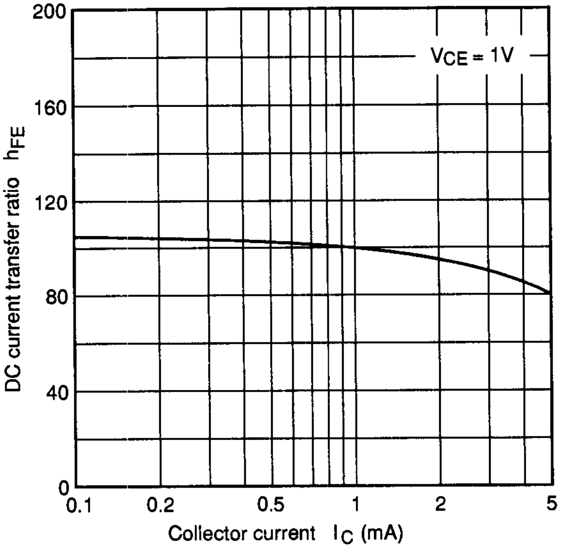


Figure 2 DC Current Transfer Ratio vs. Collector Current

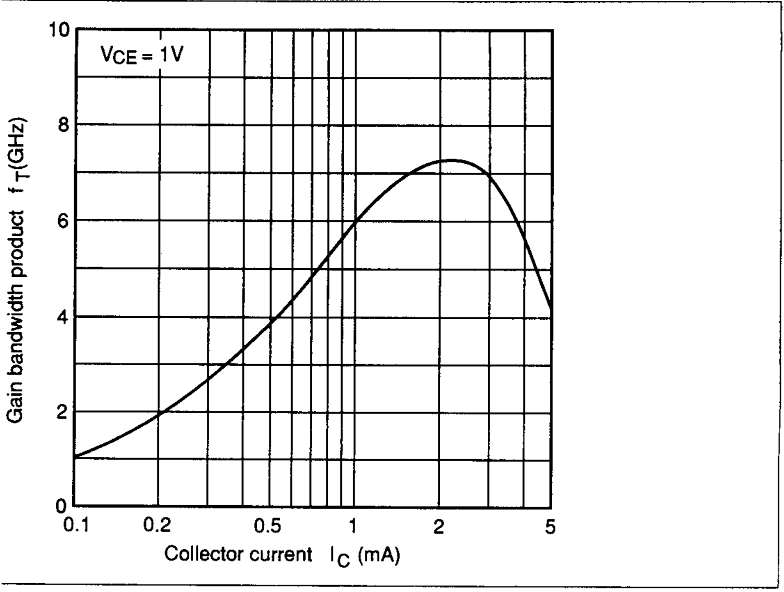


Figure 3 Gain Bandwidth Product vs. Collector Current

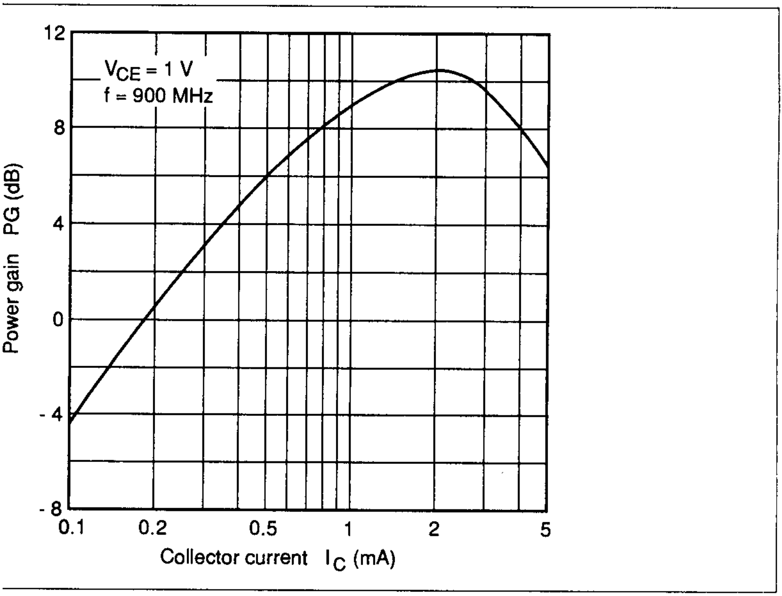


Figure 4 Power Gain vs. Collector Current

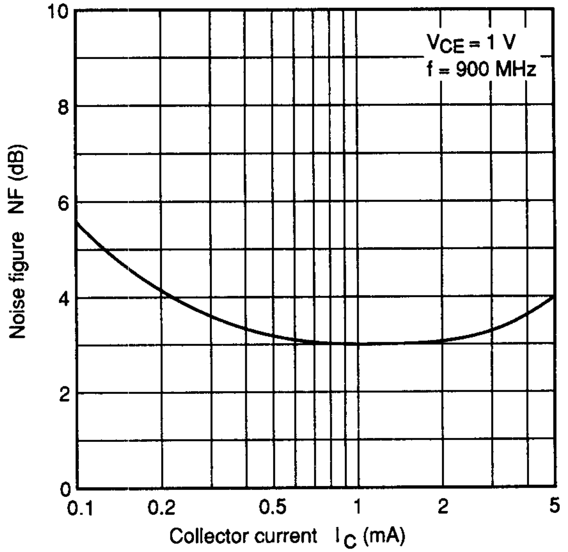


Figure 5 Noise Figure vs. Collector Current

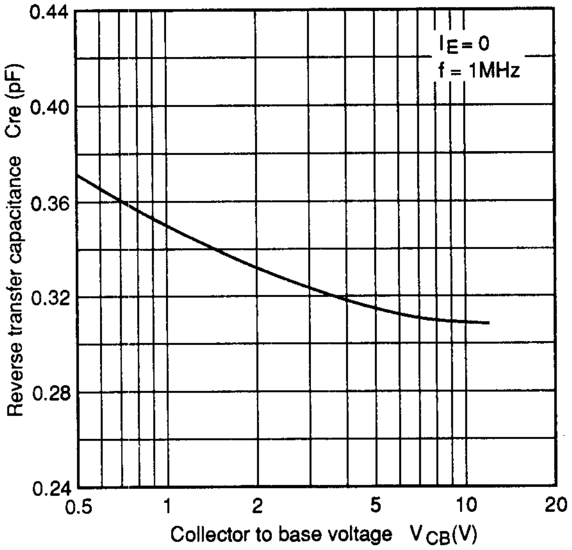


Figure 6 Reverse Transfer Capacitance vs. Collector to Base Voltage

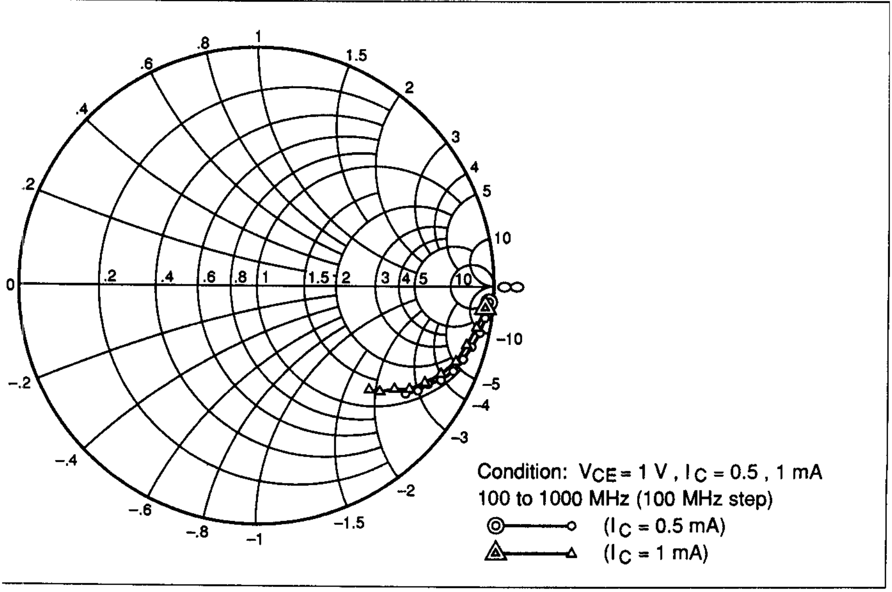


Figure 7 S_{11} Parameter vs. Frequency

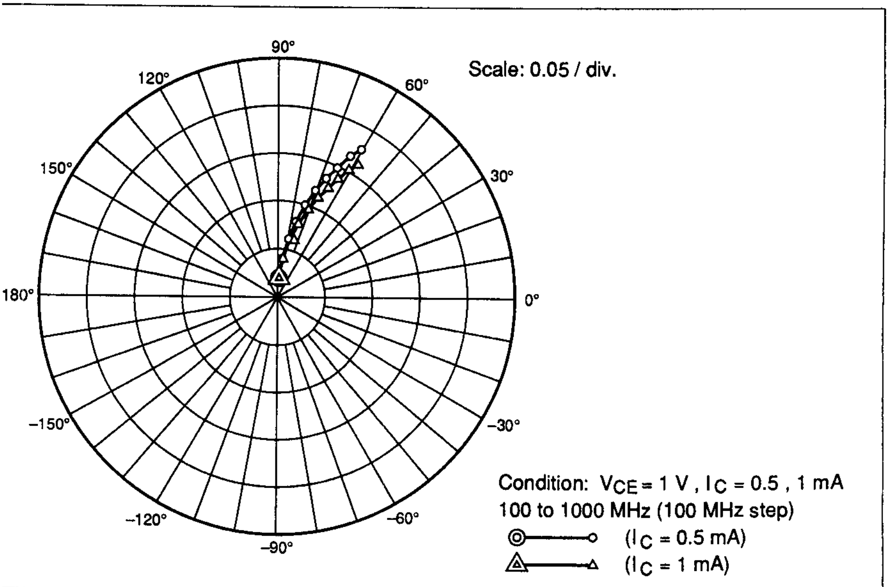


Figure 8 S_{12} Parameter vs. Frequency

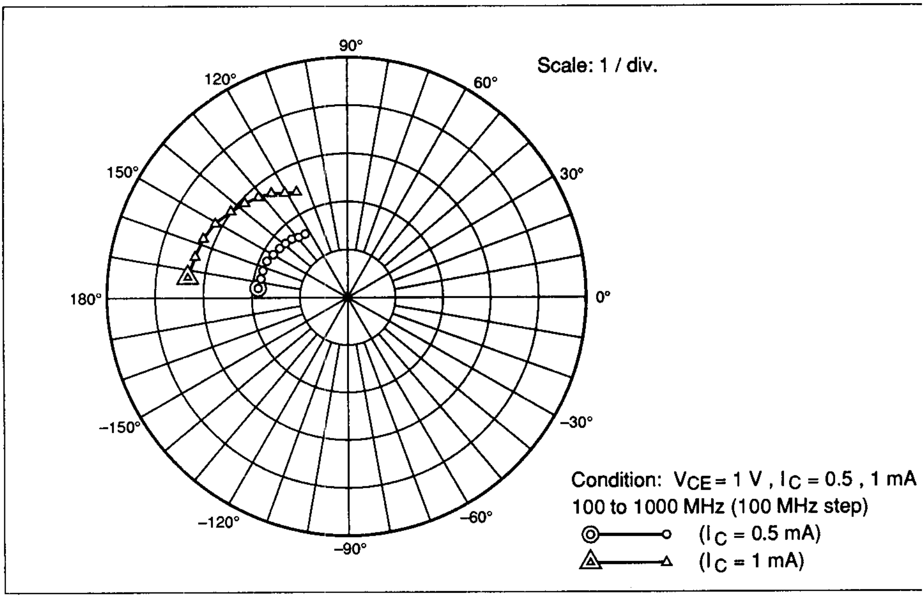


Figure 9 S_{21} Parameter vs. Frequency

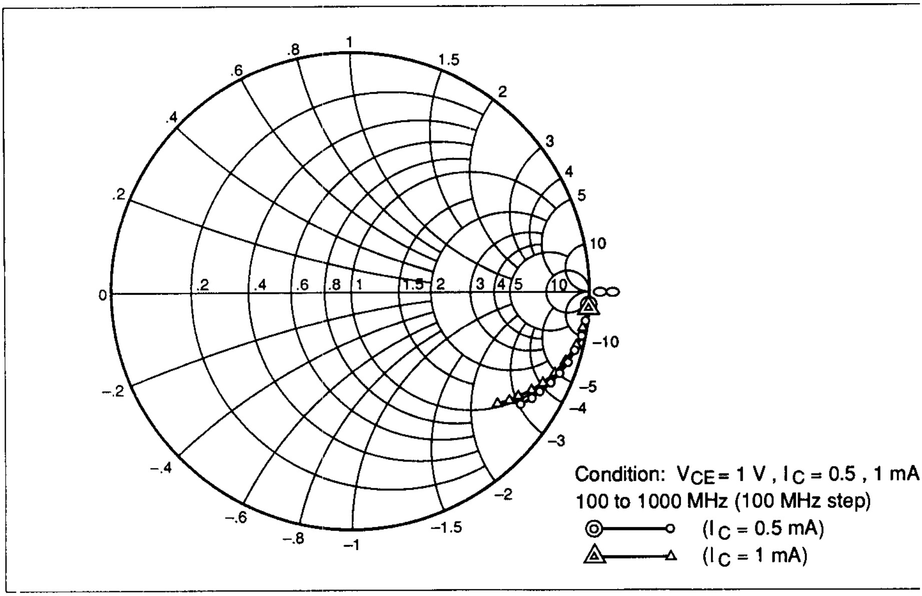


Figure 10 S_{22} Parameter vs. Frequency

Table 3 S Parameter (V_{CE} = 1 V, I_C = 0.5 mA, Z_O = 50 Ω)

	S_{11}		S_{21}		S_{12}		S_{22}	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.982	–3.8	1.872	173.9	0.020	86.5	0.998	–3.2
200	0.972	–7.7	1.853	167.7	0.040	83.1	0.990	–7.3
300	0.961	–11.6	1.855	161.9	0.061	79.5	0.984	–11.1
400	0.942	–15.5	1.848	155.6	0.080	76.4	0.969	–15.0
500	0.923	–19.1	1.790	149.9	0.100	73.4	0.956	–18.3
600	0.902	–22.9	1.752	144.1	0.117	70.5	0.938	–21.7
700	0.871	–26.5	1.718	138.9	0.133	67.7	0.920	–24.8
800	0.830	–29.2	1.687	133.7	0.148	65.2	0.896	–28.2
900	0.809	–32.5	1.621	128.9	0.165	62.5	0.881	–30.8
1000	0.773	–35.3	1.593	123.7	0.177	60.5	0.853	–33.9

Table 4 S Parameter (V_{CE} = 1 V, I_C = 1 mA, Z_O = 50 Ω)

	S_{11}		S_{21}		S_{12}		S_{22}	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.968	–5.3	3.352	172.7	0.020	85.8	0.997	–4.1
200	0.944	–10.5	3.285	164.9	0.040	82.2	0.982	–9.1
300	0.928	–15.2	3.238	157.7	0.060	78.1	0.971	–13.6
400	0.898	–20.3	3.158	150.5	0.079	74.0	0.944	–18.2
500	0.859	–25.1	3.021	143.8	0.096	70.7	0.920	–22.1
600	0.816	–29.4	2.905	137.5	0.111	67.7	0.891	–25.8
700	0.774	–33.5	2.792	131.5	0.125	65.0	0.861	–28.9
800	0.723	–36.2	2.686	126.1	0.138	62.8	0.827	–32.3
900	0.681	–40.0	2.536	120.9	0.152	60.7	0.805	–34.8
1000	0.642	–42.1	2.438	115.8	0.162	58.5	0.772	–37.8

Table 5 Y Parameter (V_{CE} = 1 V, I_C = 0.5 mA)

	Y_{11}(mS)		Y_{21}(mS)		Y_{12}(mS)		Y_{22}(mS)	
f (MHz)	RAAL	IMAG	REAL	IMAG	REAL	IMAG	REAL	IMAG
100	0.168	0.478	18.948	–1.023	–0.002	–0.201	0.007	0.374
200	0.225	0.970	18.790	–1.952	–0.004	–0.409	0.036	0.895
300	0.260	1.444	18.870	–2.829	–0.010	–0.629	0.0.25	1.366
400	0.364	1.940	18.973	–3.883	–0.012	–0.843	0.074	1.864
500	0.450	2.429	18.494	–4.744	–0.017	–1.062	0.092	2.307
600	0.545	2.956	18.254	–5.654	–0.018	–1.280	0.148	2.771
700	0.758	3.464	18.154	–6.504	–0.024	–1.497	0.187	3.206
800	1.053	3.802	18.108	–7.580	–0.037	–1.725	0.278	3.699
900	1.161	4.315	17.476	–8.211	–0.053	–1.964	0.280	4.111
1000	1.423	4.732	17.352	–9.333	–0.058	–2.193	0.402	4.594

Table 6 Y Parameter (V_{CE} = 1 V, I_C = 1 mA)

	Y_{11}(mS)		Y_{21}(mS)		Y_{12}(mS)		Y_{22}(mS)	
f (MHz)	RAAL	IMAG	REAL	IMAG	REAL	IMAG	REAL	IMAG
100	0.297	0.577	34.037	–2.149	–0.002	–0.201	–0.004	0.376
200	0.462	1.147	33.784	–4.398	–0.001	–0.413	0.050	0.912
300	0.471	1.647	33.361	–6.464	–0.006	–0.627	0.0.12	1.393
400	0.599	2.232	33.012	–8.514	–0.014	–0.848	0.082	1.907
500	0.816	2.817	32.039	–10.355	–0.018	–1.069	0.093	2.366
600	1.084	3.342	31.328	–12.269	–0.025	–1.290	0.158	2.826
700	1.342	3.891	30.499	–14.113	–0.035	–1.504	0.205	3.247
800	1.702	4.188	29.759	–16.064	–0.051	–1.738	0.312	3.724
900	2.040	4.728	28.276	–17.340	–0.060	–1.988	0.283	4.133
1000	2.291	5.054	27.164	–19.095	–0.090	–2.198	0.416	4.670

2SC4680

Silicon NPN Epitaxial

Application

VHF and UHF RF Switch

Features

- Low Ron and High Performance for RF Switch
- Capable of High Density Mount
(MPAK Package)

Table 1 Ordering Information

Type No.	Package
2SC4680	MPAK

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Collector to base voltage	V_{CBO}	12	V
Collector to emitter voltage	V_{CEO}	8	V
Emitter to base voltage	V_{EBO}	3	V
Collector current	I_C	50	mA
Collector power dissipation	P_C	150	mW
Junction temperature	Tj	150	°C
Storage temperature	Tstg	–55 to +150	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Collector to Base Breakdown Voltage	$V_{(BR)CBO}$	12	—	—	V	I_C = 10 µA, I_E = 0
Collector cutoff current	I_{CBO}	—	—	10	µA	V_{CB} = 12 V, I_E = 0
	I_{CEO}	—	—	1	mA	V_{CE} = 8 V, R_{BE} = ∞
Emitter cutoff current	I_{EBO}	—	—	10	µA	V_{EB} = 3 V, I_C = 0
Collector to Emitter Satutation Voltage	$V_{CE(sat)}$	—	70	100	mV	I_C = 20 mA, I_B = 4 mA
DC current transfer ratio	h_{FE}	100	250	—	—	V_{CE} = 5 V, I_C = 5 mA
Output capacitance	Cob	—	1.0	1.5	pF	V_{CB} = 5 V, I_E = 0, f = 1 MHz

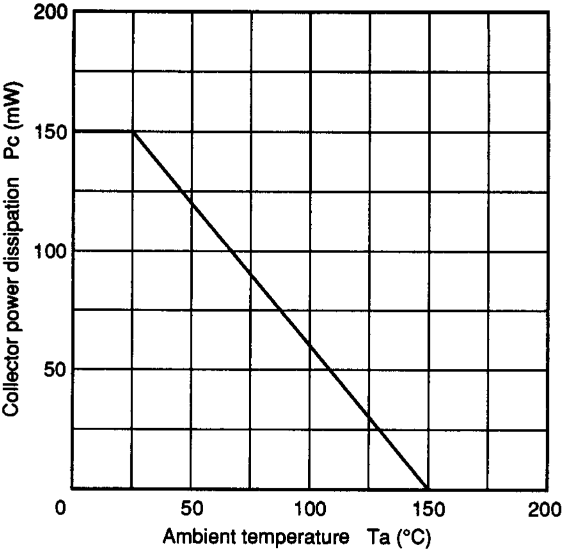


Figure 1 Maximum Collector Power Dissipation Curve

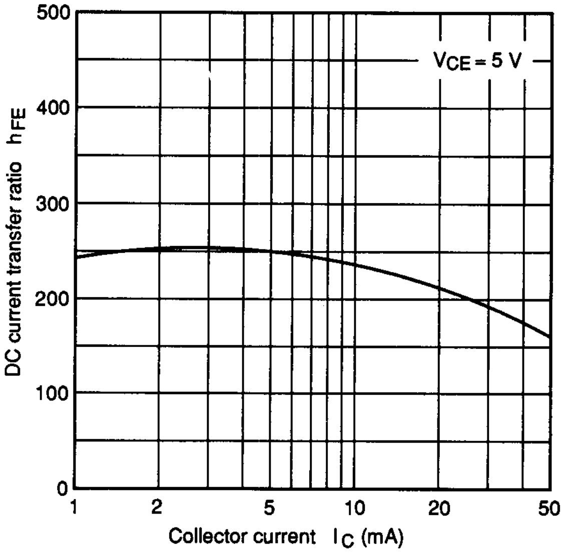


Figure 2 DC Current Transfer Ratio vs. Collector Current

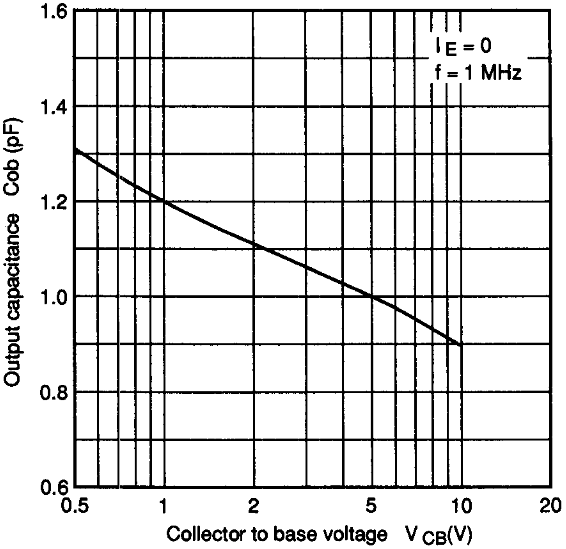


Figure 3 Output Capacitance vs.Collector to Base Voltage

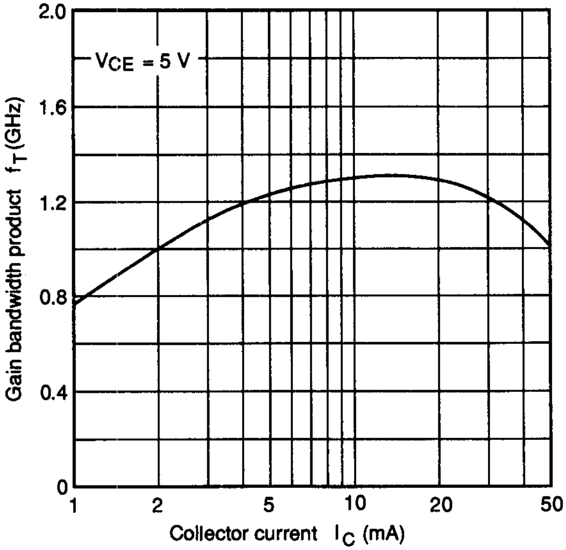


Figure 4 Gain Bandwidth Product vs. Collector Current

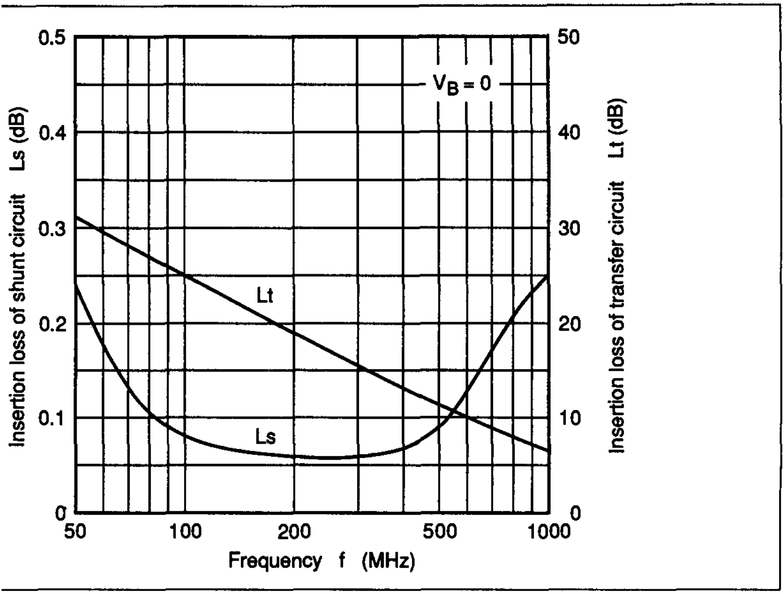


Figure 5 Insertion Loss vs. Frequency (V_B = 0)

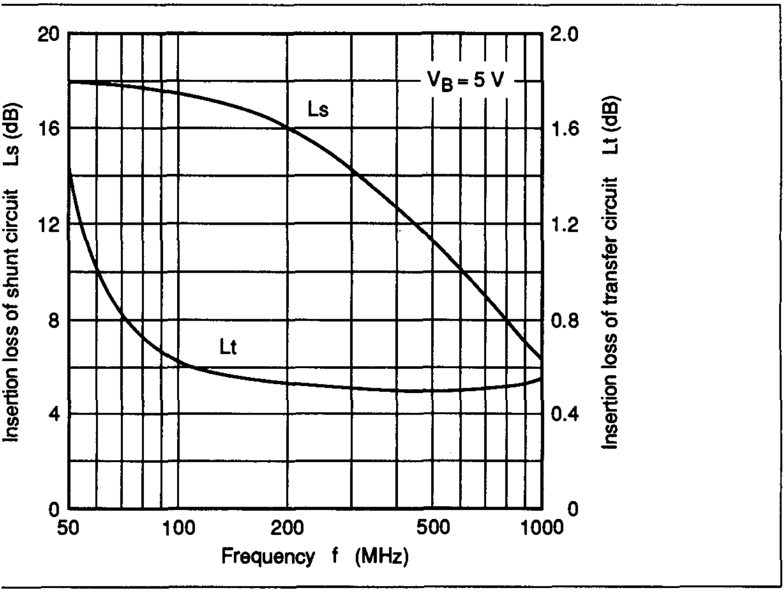


Figure 6 Insertion Loss vs. Frequency (V_B = 5 V)

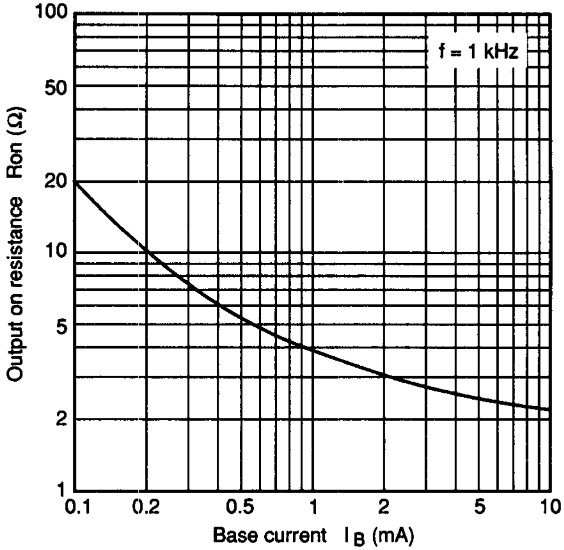


Figure 7 Output on Resistance vs. Base Current

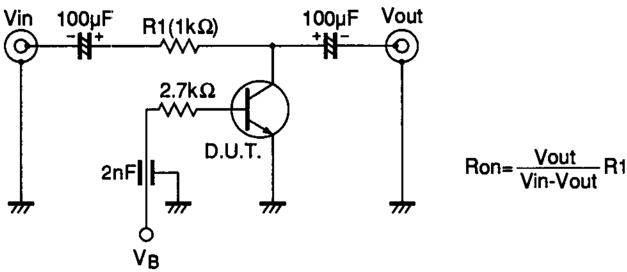
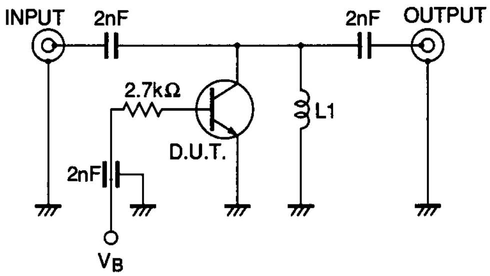
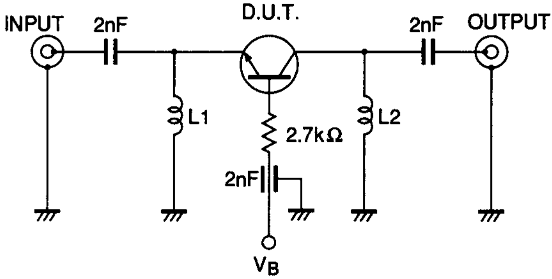


Figure 8 Test Circuit of Output on Resistance



L1 : Inside dia ø 3 mm , ø 0.2 mm Enameled Copper Wire 15 Turns.

Figure 9 Test Circuit of Insertion Loss (Shunt Circuit)



L1,L2 : Inside dia ø 3 mm , ø 0.2 mm Enameled Copper Wire 15 Turns.

Figure 10 Test Circuit of Insertion Loss (Transfer Circuit)

2SK360 Series

Silicon N-Channel MOS FET

Application

VHF amplifier

Features

- Capable of high density mount
- High gain, low noise
- Capable of IF amplifier

Table 1 Ordering Information

Tyoe No.	Package
2SK359	TO-92
2SK360	MPAK
2SK439	SPAK

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Ratings	Unit
Drain to source voltage		V_{DSX}*	20	V
Gate to source voltage		V_{GSS}	±5	V
Drain current		I_D	30	mA
Gate current		I_G	±1	mA
Channel dissipation	2SK359	Pch	400	mW
	2SK360		150	
	2SK439		300	
Channel temperature		Tch	150	°C
Storage temperature		Tstg	–55 to +150	°C

*: V_{GS} = –4 V

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Drain to source breakdown voltage	$V_{(BR)DSX}$	20	—	—	V	I_D = 100 µA, V_{GS} = –4 V
Gate leakage current	I_{GSS}	—	—	±20	nA	V_{GS} = ±5 V, V_{DS} = 0
Drain current	I_{DSS}	4	—	12	mA	V_{DS} = 10 V, V_{GS} = 0
Gate to source cutoff voltage	$V_{GS(off)}$	0	—	–2.0	V	V_{DS} = 10 V, I_D = 10 µA
Forward transfer admittance	$\|y_{fs}\|$	8	14	—	mS	V_{DS} = 10 V, V_{GS} = 0, f = 1 kHz

Electrical Characteristics (Ta = 25°C) (cont)

Item		Symbol	Min	Typ	Max	Unit	Test conditions
Input capacitance		Ciss	—	2.5	—	pF	V_{DS} = 10 V, V_{GS} = 0, f = 1 MHz
Output capacitance	2SK359	Coss	—	1.6	—	pF	V_{DS} = 10 V, V_{GS} = 0,
	2SK360						f = 1 MHz
	2SK439			1.8			V_{DS} = 5 V, V_{GS} = 0, f = 1 MHz
Reverse transfer capacitance		Crss	—	0.03	—	pF	V_{DS} = 10 V, V_{GS} = 0, f = 1 MHz
Power gain		PG	—	30	—	dB	V_{DS} = 10 V, V_{GS} = 0,
Noise figure		NF	—	2.0	—	dB	f = 100 MHz

2SK360 representing the characteristics curves hereafter.

For the detail of characteristics of other parts, please consult our sales office near you.

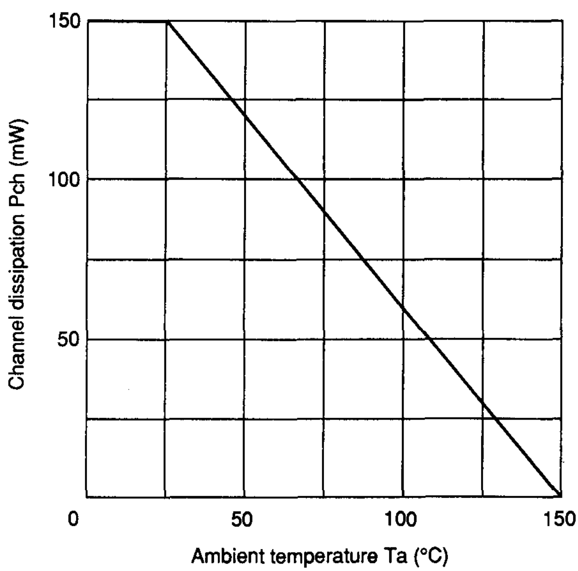


Figure 1 Maximum Channel Dissipation Curve

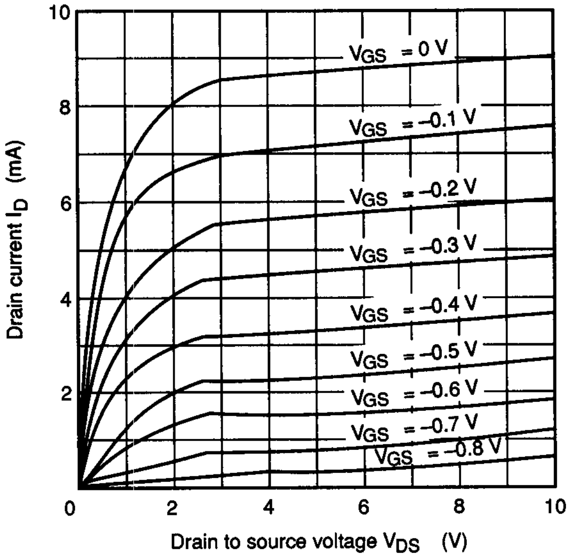


Figure 2 Typical Output Characteristics

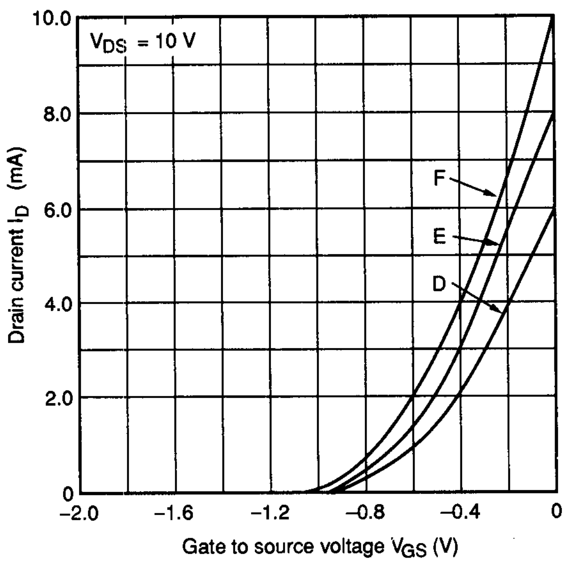


Figure 3 Typical Transfer Characteristics

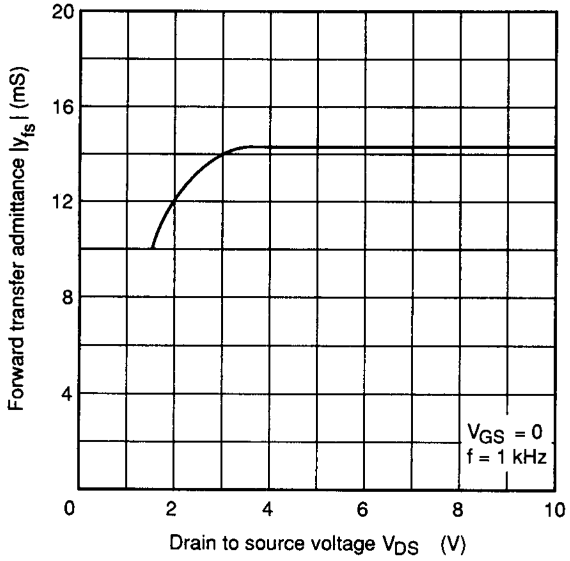


Figure 4 Forward Transfer Admittance vs. Drain to Source Voltage

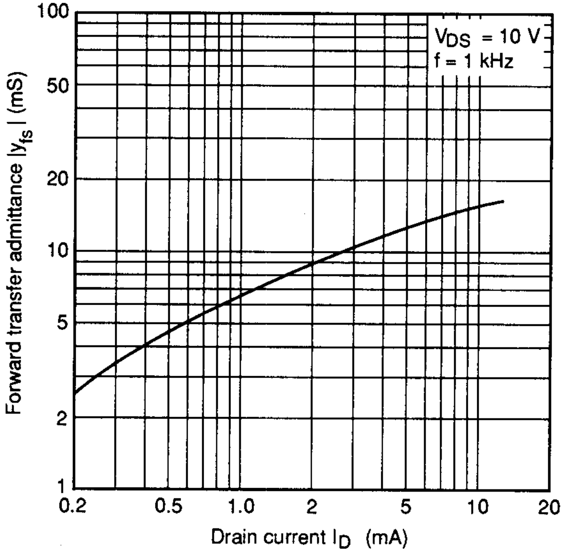


Figure 5 Forward Transfer Admittance vs. Drain Current

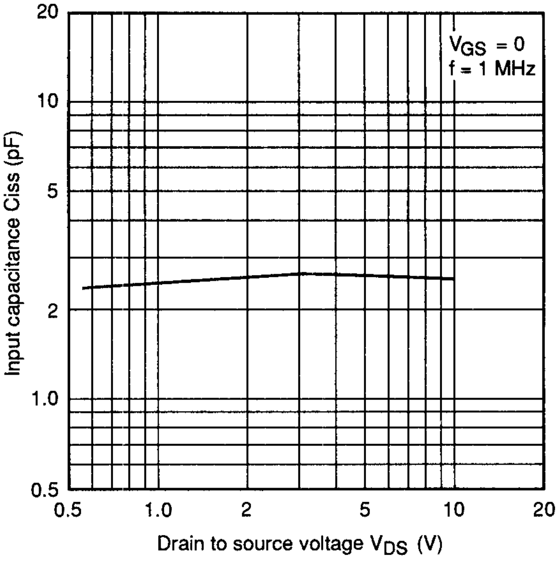


Figure 6 Input Capacitance vs. Drain to Source Voltage

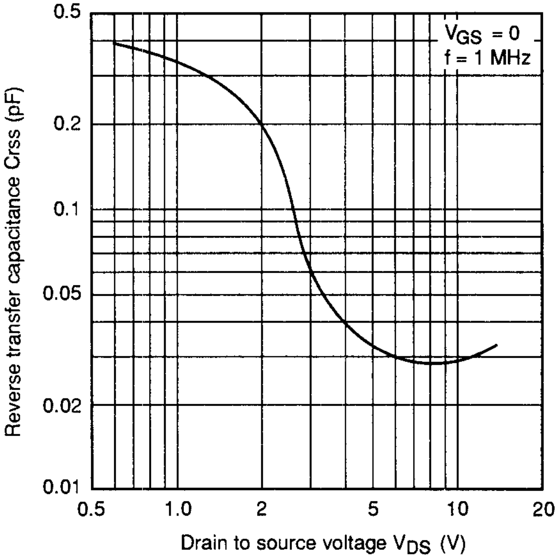


Figure 7 Reverse Transfer Capacitance vs. Drain to Source Voltage

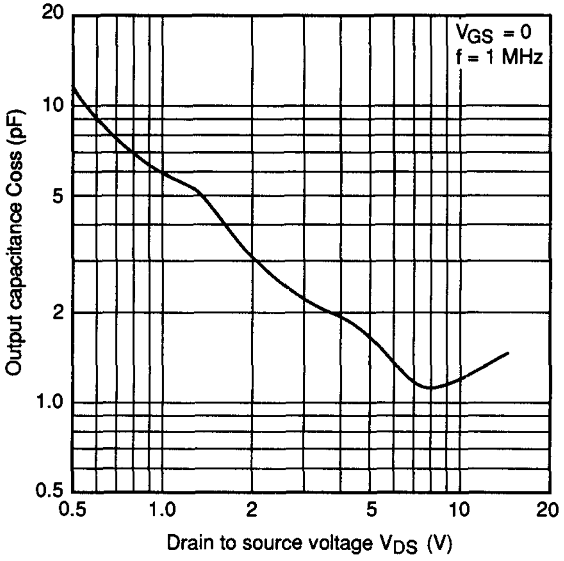


Figure 8 Output Capacitance vs. Drain to Source Voltage

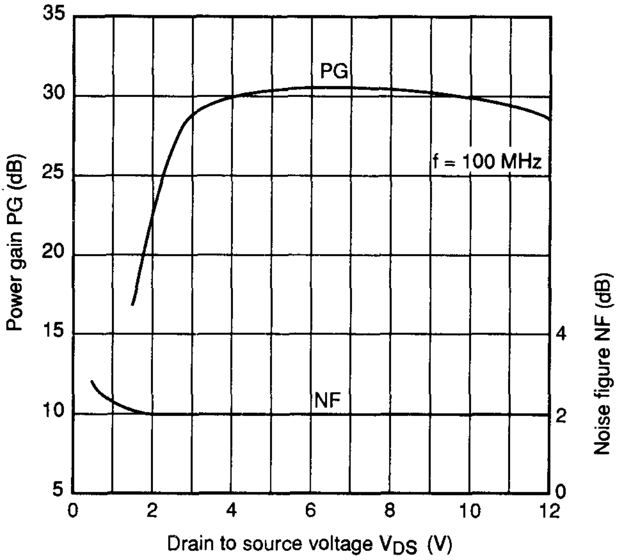


Figure 9 Power Gain, Noise Figure vs. Drain to Source Voltage

3SK136 Series

Silicon N-Channel Dual Gate MOS FET

Application

VHF TV tuner RF amplifier

Features

- High gain, low noise
- Low reverse transfer capacitance
- Surface mount package

Table 1 Ordering Information

Type No.	Package
3SK81	FPAK
3SK136	MPAK-4

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Ratings	Unit
Drain to source voltage		V_{DS}	20	V
Gate1 to source voltage		V_{G1S}	±8	V
Gate2 to source voltage		V_{G2S}	±8	V
Drain current		I_D	35	mA
Channel dissipation	3SK81	Pch	200	mW
	3SK136		150	
Channel temperature		Tch	125	°C
Storage temperature		Tstg	–55 to +125	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Gate1 to source breakdown voltage	$V_{(BR)G1SS}$	±8	—	±20	V	I_{G1S} = ±10 μA, $V_{DS} = V_{G2S} = 0$
Gate 2 to source breakdown voltage	$V_{(BR)G2SS}$	±8	—	±20	V	I_{G2S} = ±10 μA, $V_{DS} = V_{G1S} = 0$
Gate1 leakage current	I_{G1SS}	—	—	±100	nA	V_{G1S} = ±8 V, $V_{DS} = V_{G2S} = 0$
Gate2 leakage current	I_{G2SS}	—	—	±100	nA	V_{G2S} = ±8 V, $V_{DS} = V_{G1S} = 0$
Gate1 to source cutoff voltage	$V_{G1S(off)}$	–0.3	—	–3.0	V	V_{DS} = 15 V, V_{G2S} = 4 V, I_D = 100 μA

Electrical Characteristics (Ta = 25°C) (cont)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Gate2 to source cutoff voltage	$V_{G2S(off)}$	–0.4	—	–2.0	V	V_{DS} = 15 V, V_{G1S} = 0, I_D = 100 μA
Drain current	I_{DSS}	5.0	—	25	mA	V_{DS} = 15 V, V_{G2S} = 4 V, V_{G1S} = 0
Forward transfer admittance	$\|y_{fs}\|$	8.0	—	—	mS	V_{DS} = 15 V, V_{G2S} = 4 V, I_D = 10 mA, f = 1 kHz
Input capacitance	Ciss	—	5.0	—	pF	V_{DS} = 15 V, V_{G2S} = 4 V,
Output capacitance	Coss	—	2.0	—		I_D = 10 mA, f = 1 MHz
Reverse transfer capacitance	Crss	—	0.03	—		
Power gain	PG	17	—	—	dB	V_{DS} = 15 V, V_{G2S} = 4 V,
Noise figure	NF	—	—	3.3		I_D = 10 mA, f = 200 MHz

3SK136 representing the characteristics curves hereafter. For the detail of characteristics of other parts, please consult our sales office near you.

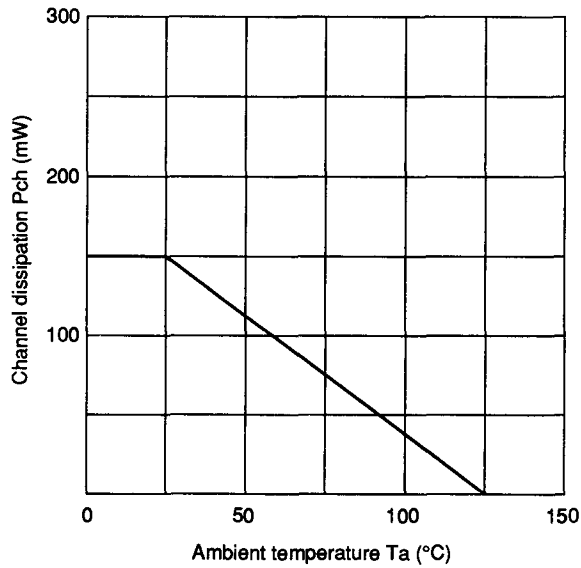


Figure 1 Maximum Channel Dissipation Curve

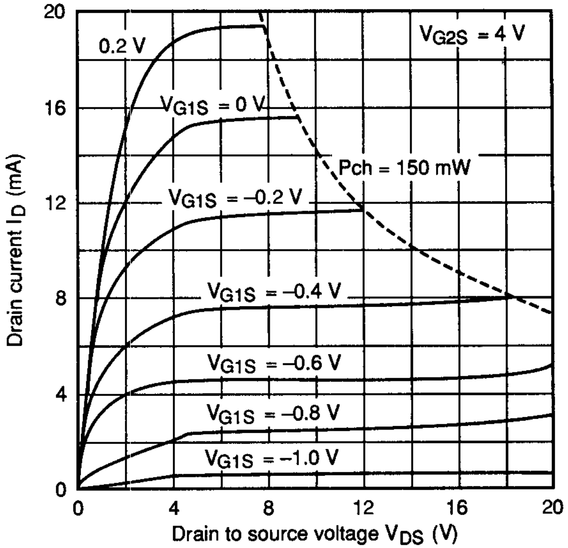


Figure 2 Typical Output Characteristics

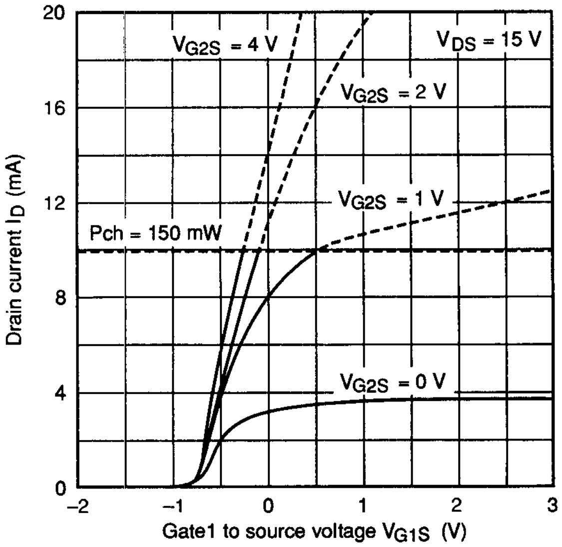


Figure 3 Drain Current vs. Gate1 to Source Voltage

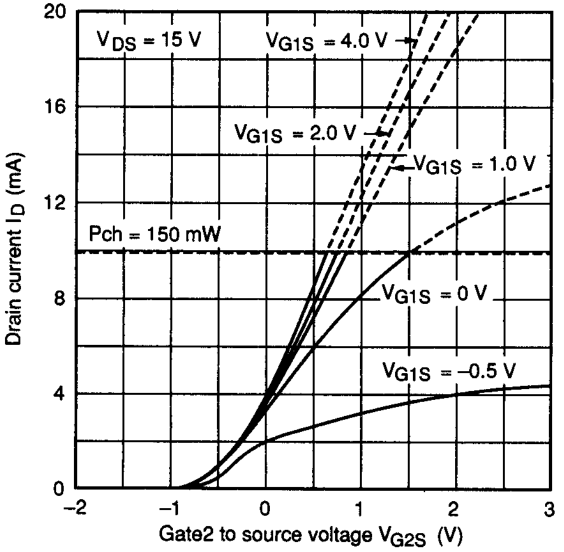


Figure 4 Drain Current vs. Gate2 to Source Voltage

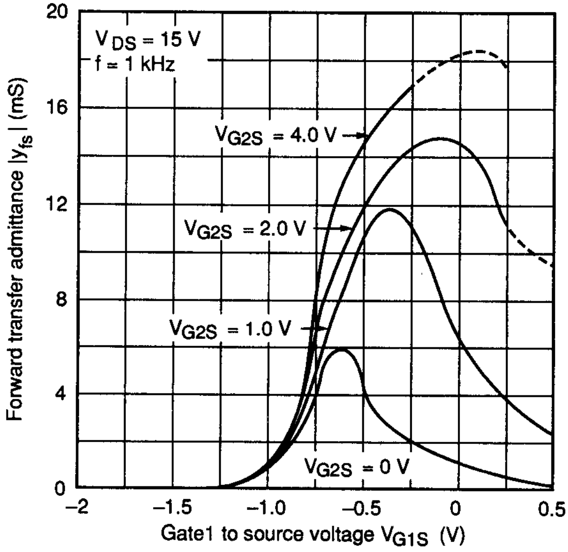


Figure 5 Forward Transfer Admittance vs. Gate1 to Source Voltage

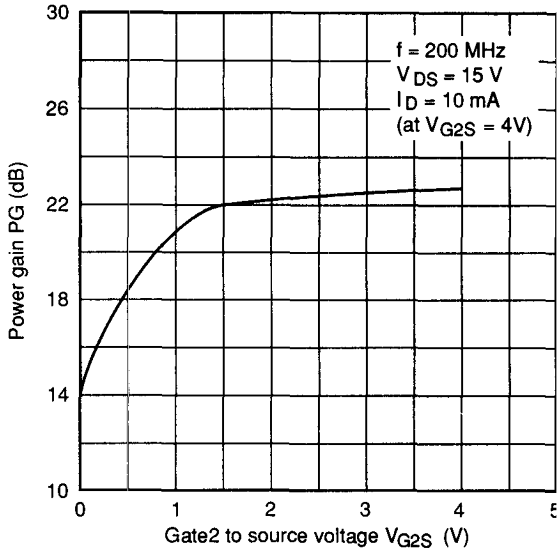


Figure 6 Power Gain vs. Gate2 to Source Voltage

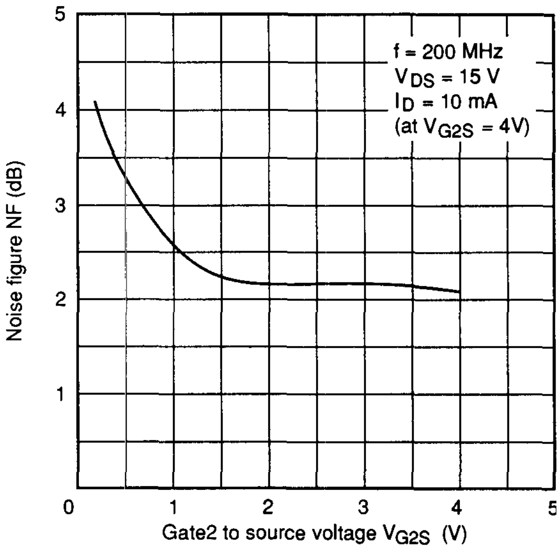


Figure 7 Noise Figure vs. Gate2 to Source Voltage

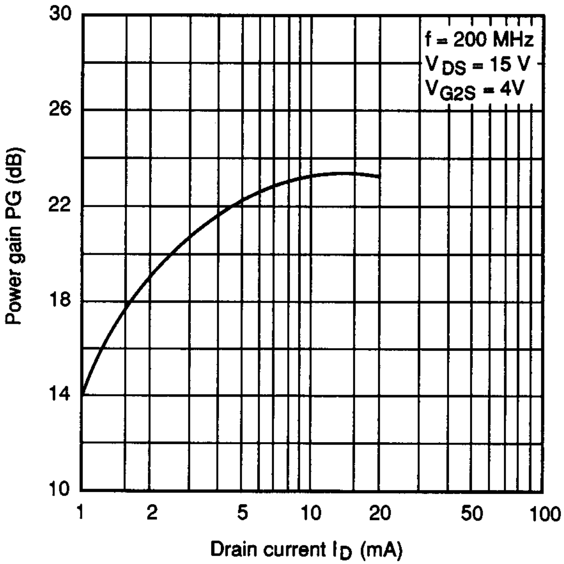


Figure 8 Power Gain vs. Drain Current

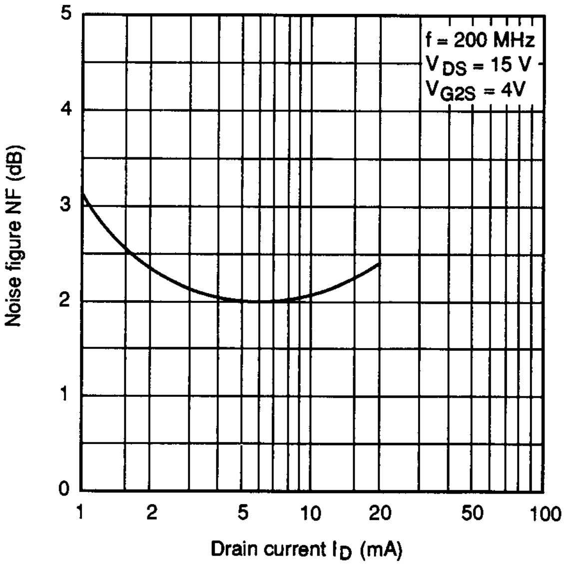


Figure 9 Noise Figure vs. Drain Current

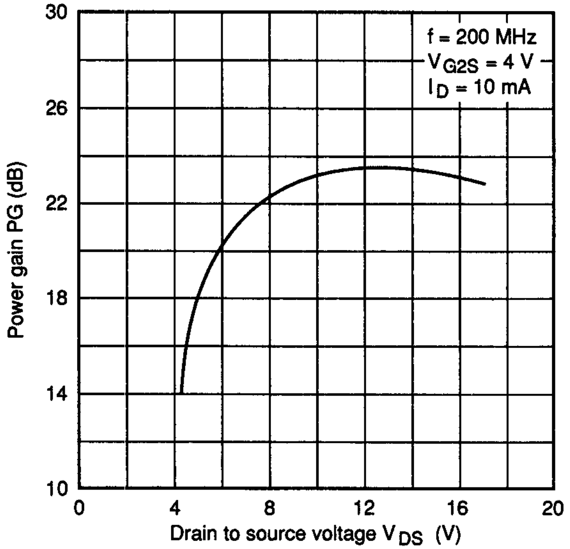


Figure 10 Power Gain vs. Drain to Source Voltage

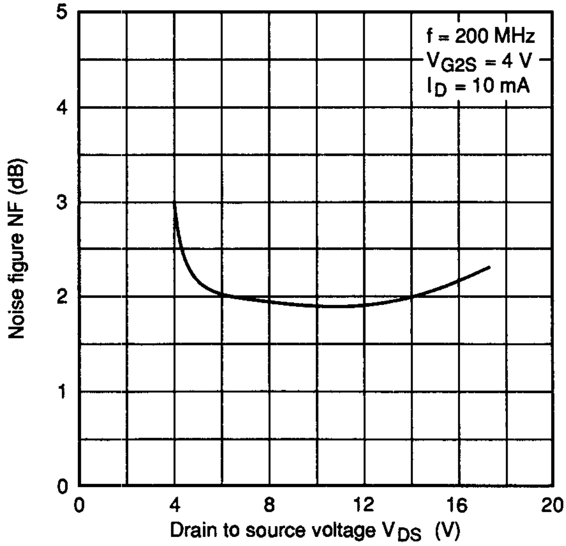
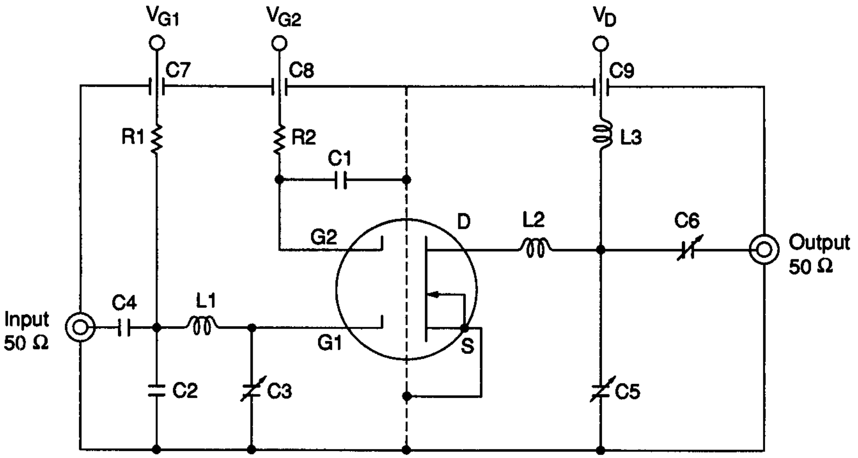


Figure 11 Noise Figure vs. Drain to Source Voltage



R1:	15 kΩ	C4:	1000 pF disk capacitor
R2:	11 kΩ	C7, C8, C9:	1000 pF air core capacitor
C1:	1000 pF	L1, L2:	ϕ 0.8 mm enameled copper wire 2.5 T inside dia ϕ6 mm
C2:	47 pF	L3:	ϕ 0.8 mm enameled copper wire 1.5 T inside dia ϕ6 mm
C3, C5, C6:	10 pF max variable capacitor		

Figure 12 Power Gain and Noise Figure Test Circuit

3SK137 Series

Silicon N-Channel Dual Gate MOS FET

Application

UHF TV tuner RF amplifier

Features

- Capable of high density mount
- Capable of low voltage operation
- High gain, low noise, low impedance
- Suitable for half wave length resonant circuit

Table 1 Ordering Information

Type No.	Package
3SK104	FPAK
3SK104V	FPAK
3SK137	MPAK-4
3SK137V	MPAK-4

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Ratings	Unit
Drain to source voltage		V_{DS}	15	V
Gate1 to source voltage		V_{G1S}	±10	V
Gate2 to source voltage		V_{G2S}	±10	V
Drain current		I_D	35	mA
Channel dissipation	3SK104	Pch	200	mW
	3SK104V			
	3SK137		150	
	3SK137V			
Channel temperature		Tch	125	°C
Storage temperature		Tstg	–55 to +125	°C

Table 3 Electrical Characteristics

Item		Symbol	Min	Typ	Max	Unit	Test conditions
Drain to source breakdown voltage		$V_{(BR)DSX}$	15	—	—	V	$V_{G1S} = V_{G2S} = -5$ V $I_D = 200$ μA
Gate1 to source breakdown voltage		$V_{(BR)G1SS}$	±10	—	—	V	$I_{G1S} = \pm 10$ μA, $V_{G2S} = V_{DS} = 0$
Gate2 to source breakdown voltage		$V_{(BR)G2SS}$	±10	—	—	V	$I_{G2S} = \pm 10$ μA, $V_{G1S} = V_{DS} = 0$
Gate1 leakage current		I_{G1SS}	—	—	±100	nA	$V_{G1S} = \pm 8$ V, $V_{G2S} = V_{DS} = 0$
Gate2 leakage current		I_{G2SS}	—	—	±100	nA	$V_{G2S} = \pm 8$ V, $V_{G1S} = V_{DS} = 0$
Gate1 to source cutoff voltage		$V_{G1S(off)}$	—	—	–2.0	V	$V_{DS} = 10$ V, $V_{G2S} = 3$ V, $I_D = 100$ μA
Gate2 to source cutoff voltage		$V_{G2S(off)}$	—	—	–2.0	V	$V_{DS} = 10$ V, $V_{G1S} = 3$ V, $I_D = 100$ μA
Drain current		I_{DSS}	—	—	20	mA	$V_{DS} = 6$ V, $V_{G2S} = 3$ V, $V_{G1S} = 0$
Forward transfer admittance		|yfs|	14	—	—	mS	$V_{DS} = 6$ V, $V_{G2S} = 3$ V, $I_D = 10$ mA, f = 1 kHz
Input capacitance		Ciss	—	2.6	—	pF	$V_{DS} = 6$ V, $V_{G2S} = 3$ V,
Output capacitance		Coss	—	1.8	—		$I_D = 10$ mA, f = 1 MHz
Reverse transfer capacitance		Crss	—	0.02	—		
Power gain	3SK104	PG	10	—	—	dB	$V_{DS} = 6$ V, $V_{G2S} = 3$ V, $I_D = 10$ mA, f = 900 MHz
	3SK104V		20				$V_{DS} = 6$ V, $V_{G2S} = 3$ V, $I_D = 10$ mA, f = 200 MHz
	3SK137		10				$V_{DS} = 6$ V, $V_{G2S} = 3$ V, $I_D = 10$ mA, f = 900 MHz
	3SK137V		20				$V_{DS} = 6$ V, $V_{G2S} = 3$ V, $I_D = 10$ mA, f = 200 MHz
Noise figure	3SK104	NF	—	—	5.0	dB	$V_{DS} = 6$ V, $V_{G2S} = 3$ V, $I_D = 10$ mA, f = 900 MHz
	3SK104V				3.0		$V_{DS} = 6$ V, $V_{G2S} = 3$ V, $I_D = 10$ mA, f = 200 MHz
	3SK137				5.0		$V_{DS} = 6$ V, $V_{G2S} = 3$ V, $I_D = 10$ mA, f = 900 MHz
	3SK137V				3.0		$V_{DS} = 6$ V, $V_{G2S} = 3$ V, $I_D = 10$ mA, f = 200 MHz

3SK137 representing the characteristics curves hereafter. For the detail of characteristics of other parts, please consult our sales office near you.

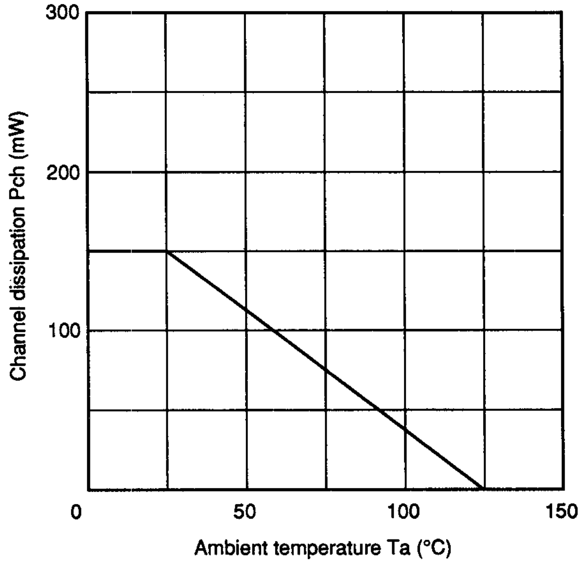


Figure 1 Maximum Channel Dissipation Curve

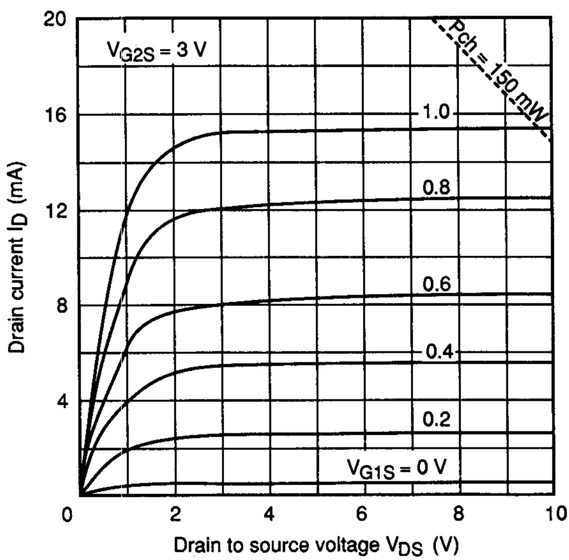


Figure 2 Typical Output Characteristics

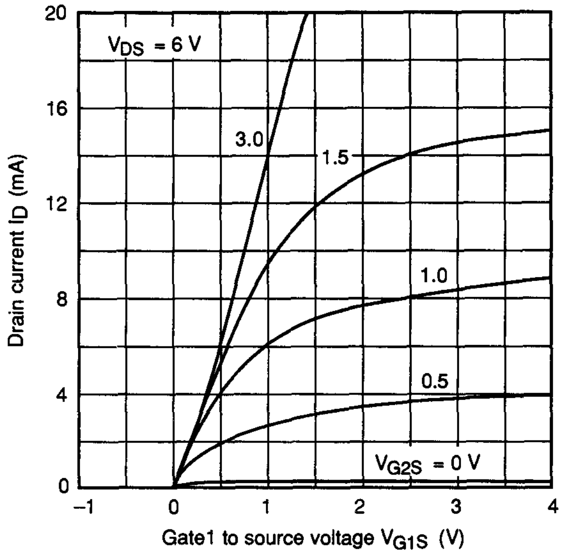


Figure 3 Drain Current vs. Gate1 to Source Voltage

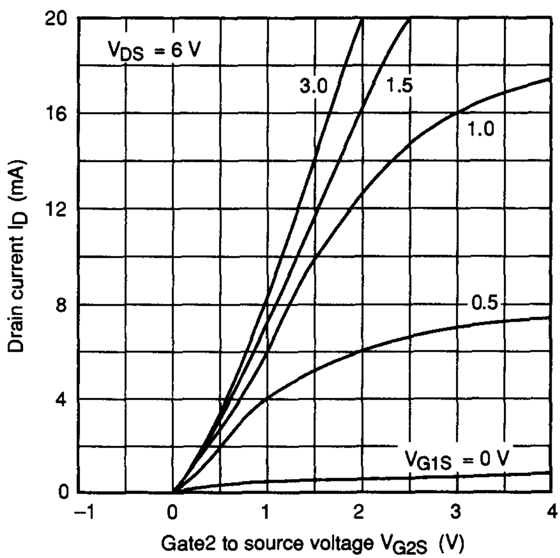


Figure 4 Drain Current vs. Gate2 to Source Voltage

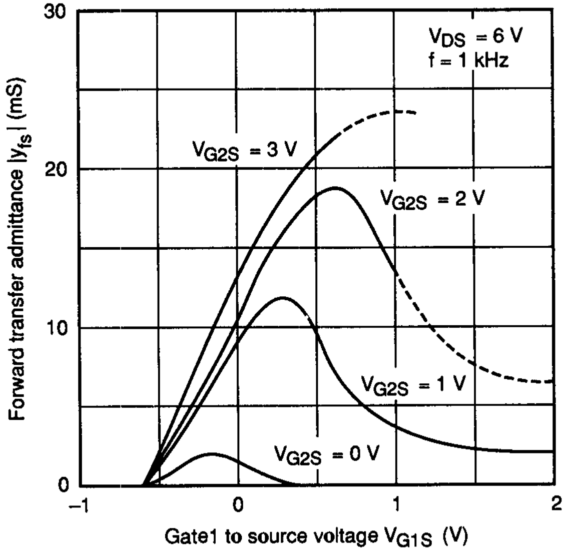


Figure 5 Forward Transfer Admittance vs. Gate1 to Source Voltage

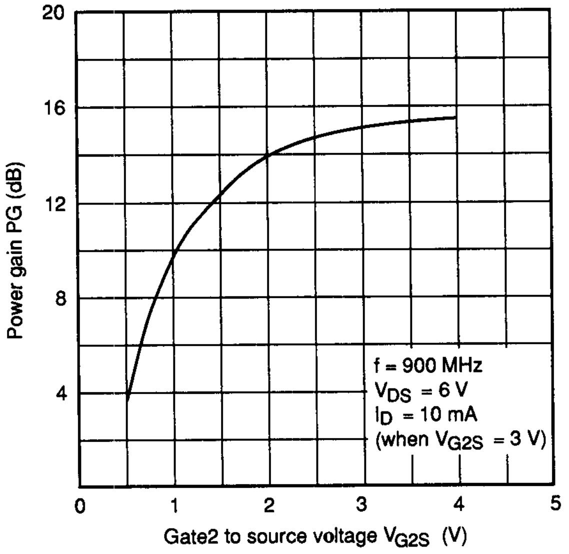


Figure 6 Power Gain vs. Gate2 to Source Voltage

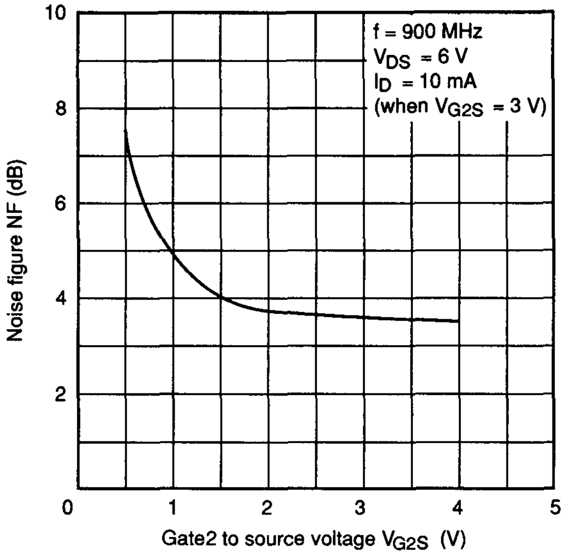


Figure 7 Noise Figure vs. Gate2 to Source Voltage

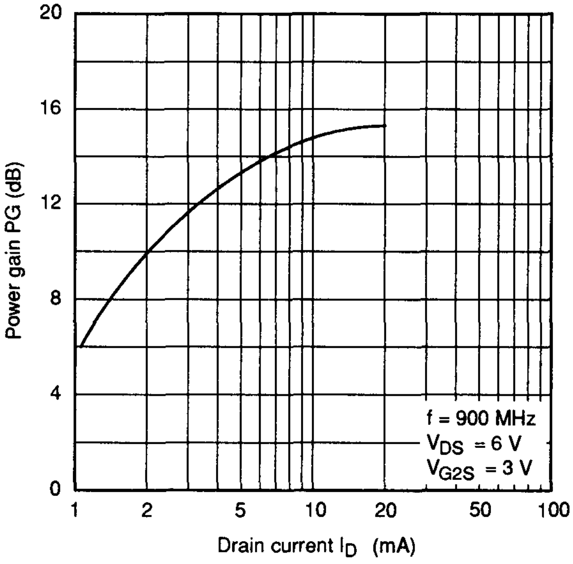


Figure 8 Power Gain vs. Drain Current

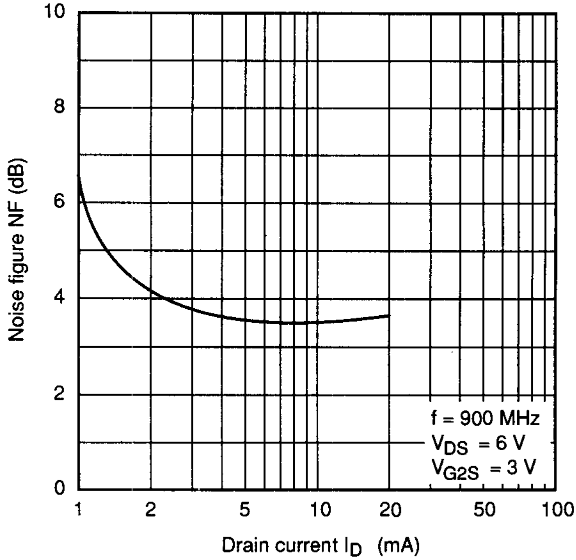


Figure 9 Noise Figure vs. Drain Current

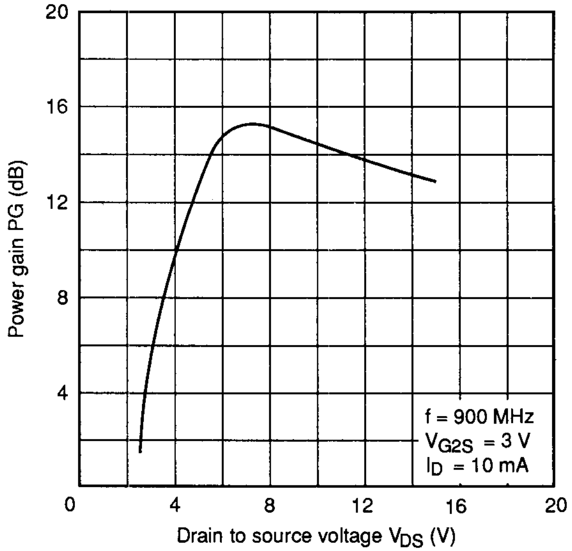


Figure 10 Power Gain vs. Drain to Source Voltage

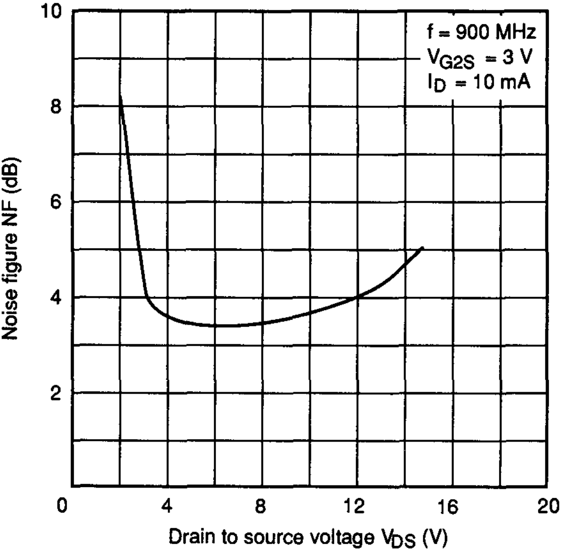
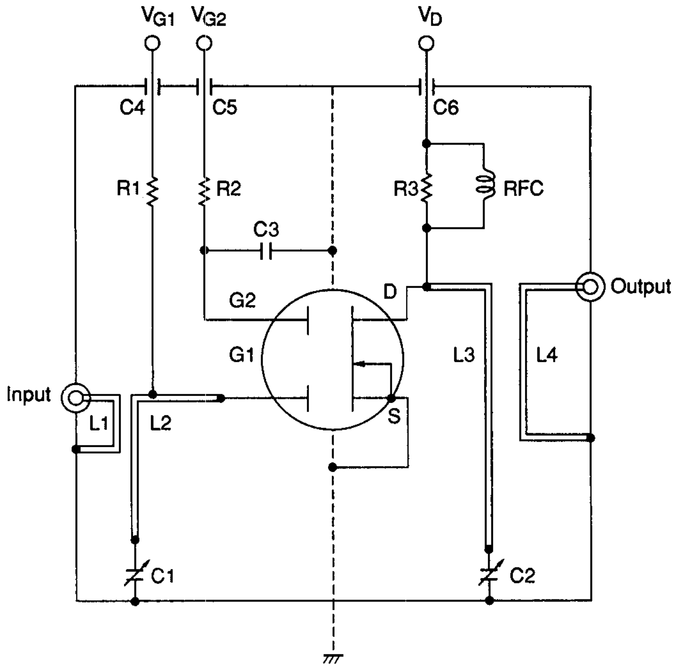
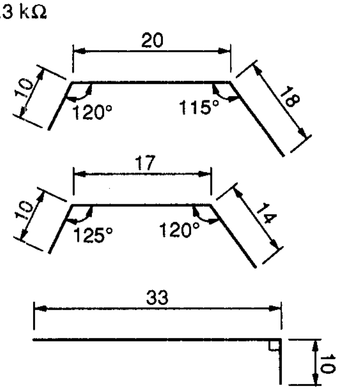


Figure 11 Noise Figure vs. Drain to Source Voltage



C1, C2: 10 pF max variable capacitor
C3: 1000 pF disk capacitor
C4 to C6: 1000 pF air core capacitor
R1: 90 kΩ
R2: 47 kΩ
R3: 3.3 kΩ

L1:
L2:
L3, L4:



(ϕ1.5 mm copper wire)
Unit: mm

RFC: ϕ1.0 mm copper wire with enamel 4 T inside dia ϕ7 mm

Figure 12 Power Gain and Noise Figure Test Circuit

3SK138 Series

Silicon N-Channel Dual Gate MOS FET

Application

UHF TV tuner RF amplifier

Features

- Capable of high density mount
- Capable of low voltage operation
- High gain, low noise
- Suitable for quarter wave length resonant circuit

Table 1 Ordering Information

Type No.	Package
3SK103	FPAK
3SK138	MPAK-4

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Ratings	Unit
Drain to source voltage		V_{DS}	15	V
Gate1 to source voltage		V_{G1S}	±10	V
Gate2 to source voltage		V_{G2S}	±10	V
Drain current		I_D	35	mA
Channel dissipation	3SK103	Pch	200	mW
	3SK138		150	
Channel temperature		Tch	125	°C
Storage temperature		Tstg	–55 to +125	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Drain to source breakdown voltage	$V_{(BR)DSX}$	15	—	—	V	$V_{G1S} = V_{G2S} = -5$ V, $I_D = 200$ μA
Gate1 to source breakdown voltage	$V_{(BR)G1SS}$	±10	—	—	V	$I_{G1S} = \pm10$ μA, $V_{G2S} = V_{DS} = 0$
Gate2 to source breakdown voltage	$V_{(BR)G2SS}$	±10	—	—	V	$I_{G2S} = \pm10$ μA, $V_{G1S} = V_{DS} = 0$
Gate1 leakage current	I_{G1SS}	—	—	±100	nA	$V_{G1S} = \pm8$ V, $V_{G2S} = V_{DS} = 0$

Electrical Characteristics (Ta = 25°C) (cont)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Gate2 leakage current	I_{G2SS}	—	—	±100	nA	V_{G2S} = ±8 V, V_{G1S} = V_{DS} = 0
Gate1 to source cutoff voltage	$V_{G1S(off)}$	+0.7	—	–1.0	V	V_{DS} = 10 V, V_{G2S} = 3 V, I_D = 100 μA
Gate2 to source cutoff voltage	$V_{G2S(off)}$	+0.7	—	–1.0	V	V_{DS} = 10 V, V_{G1S} = 3 V, I_D = 100 μA
Drain current	I_{DSS}	-	—	10	mA	V_{DS} = 6 V, V_{G2S} = 3 V, V_{G1S} = 0
Forward transfer admittance	$\|y_{fs}\|$	10	15	—	mS	V_{DS} = 6 V, V_{G2S} = 3 V, I_D = 10 mA, f = 1 kHz
Input capacitance	Ciss	—	2.0	—	pF	V_{DS} = 6 V, V_{G2S} = 3 V,
Output capacitance	Coss	—	1.0	—		I_D = 10 mA, f = 1 MHz
Reverse transfer capacitance	Crss	—	0.02	—		
Power gain	PG	10	—	—	dB	V_{DS} = 6 V, V_{G2S} = 3 V,
Noise figure	NF	—	—	5.0		I_D = 10 mA, f = 900 MHz

3SK138 representing the characteristics curves hereafter.

For the detail of characteristics of other parts, please consult our sales offices near you.

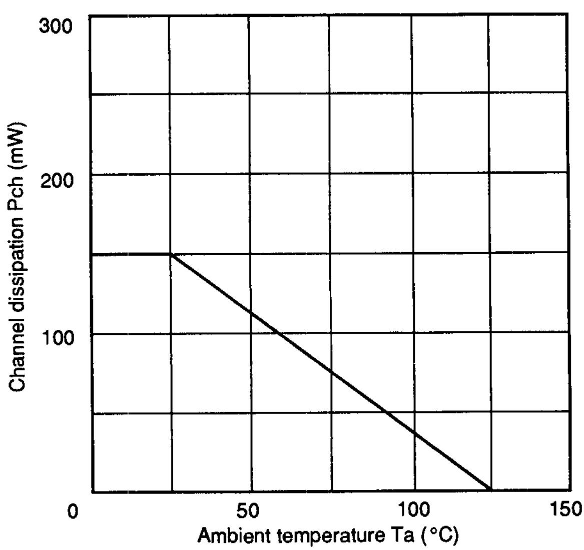


Figure 1 Maximum Channel Dissipation Curve

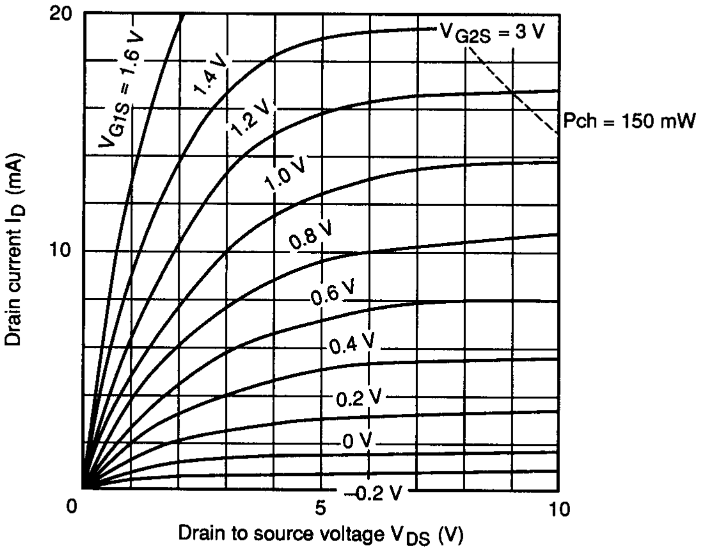


Figure 2 Typical Output Characteristics

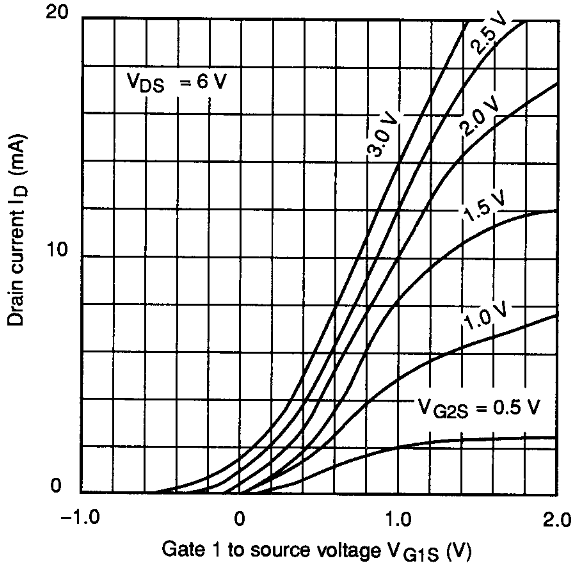


Figure 3 Drain Current vs. Gate1 to Source Voltage

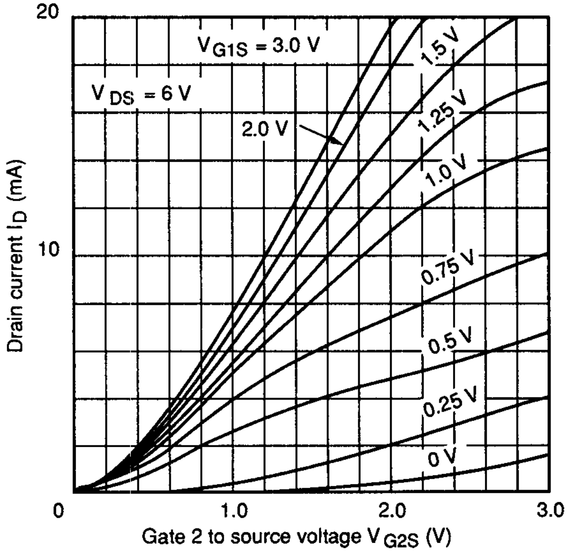


Figure 4 Drain Current vs. Gate2 to Source Voltage

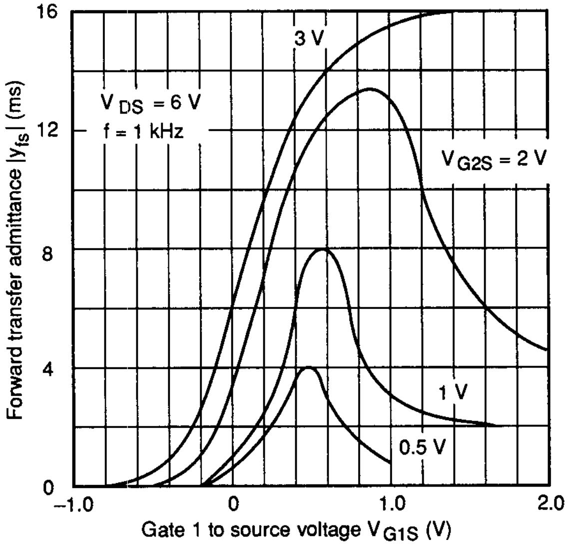


Figure 5 Forward Transfer Admittance vs. Gate1 to Source Voltage

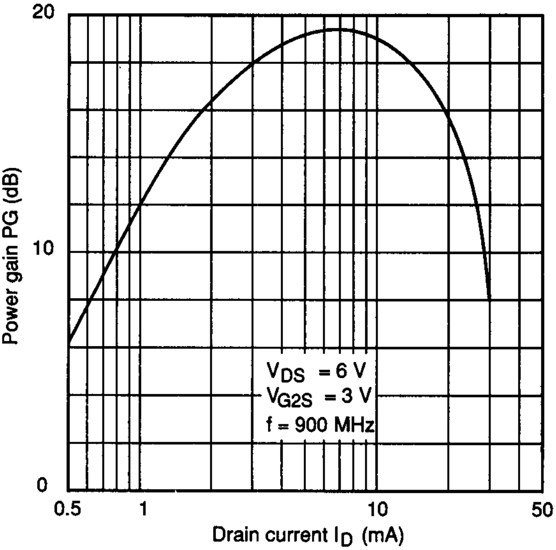


Figure 6 Power Gain vs. Drain Current

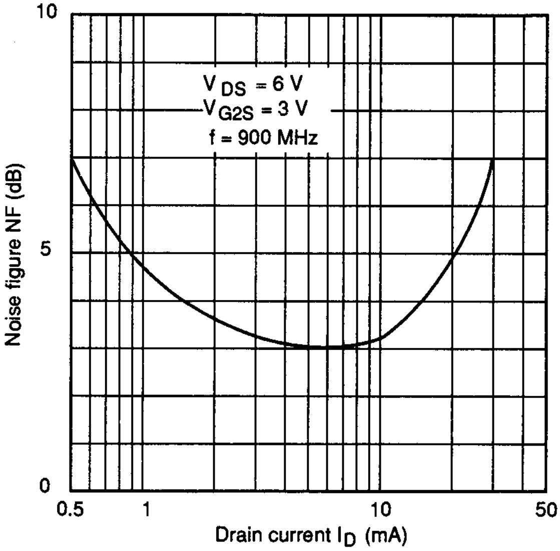


Figure 7 Noise Figure vs. Drain Current

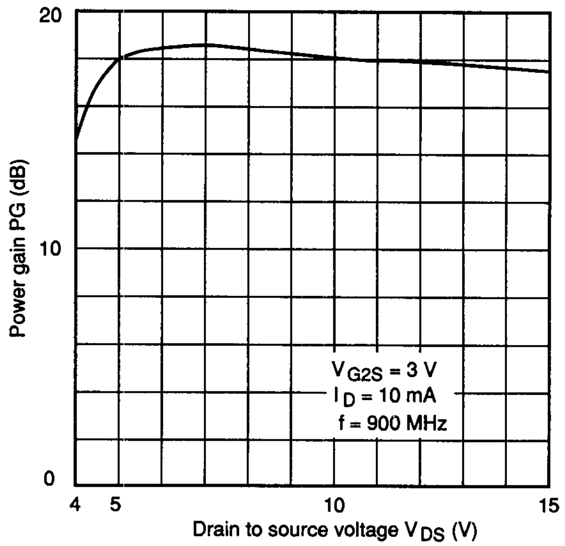


Figure 8 Power Gain vs. Drain to Source Voltage

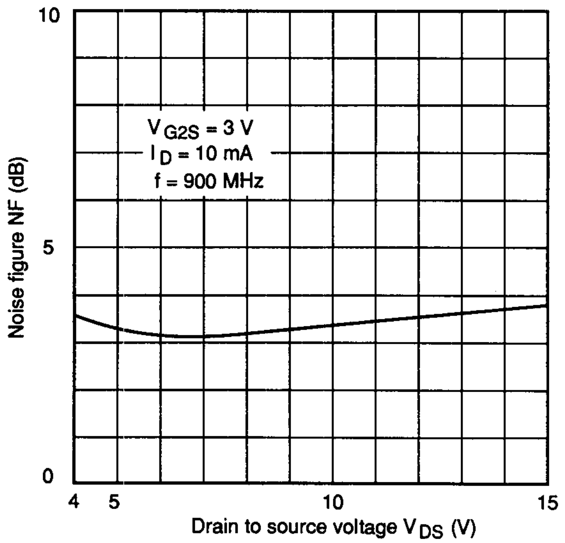


Figure 9 Noise Figure vs. Drain to Source Voltage

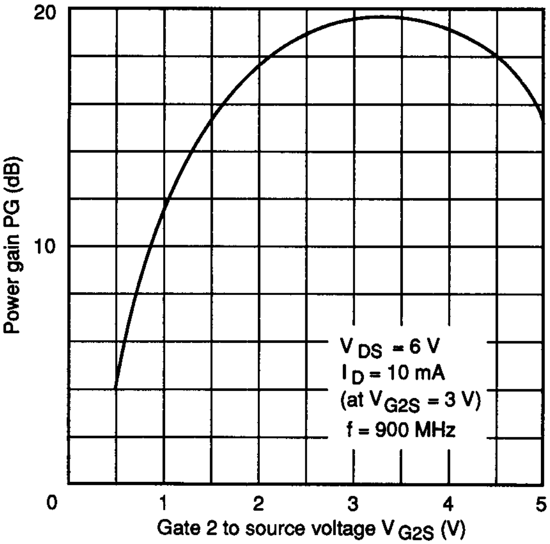


Figure 10 Power Gain vs. Gate2 to Source Voltage

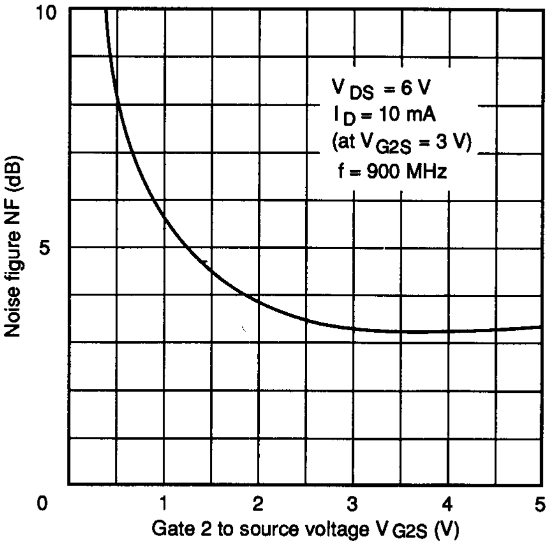


Figure 11 Noise Figure vs. Gate2 to Source Voltage

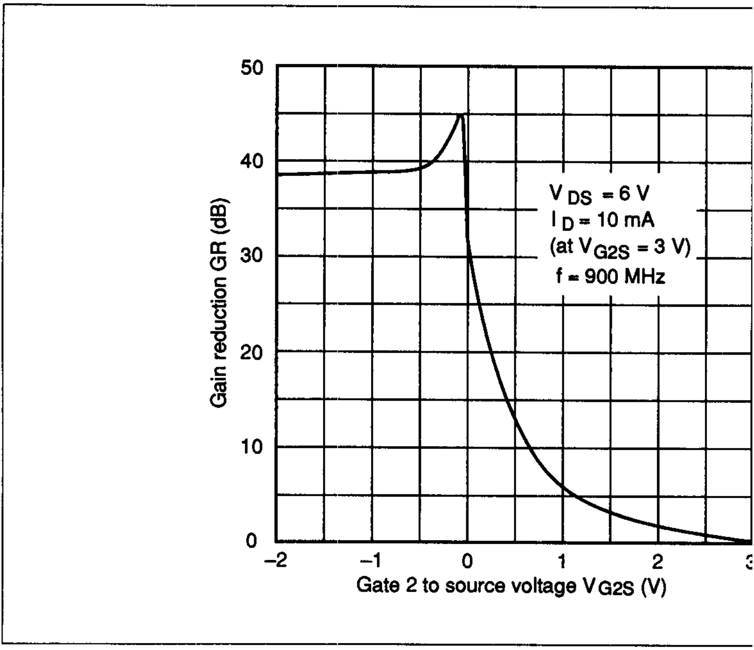
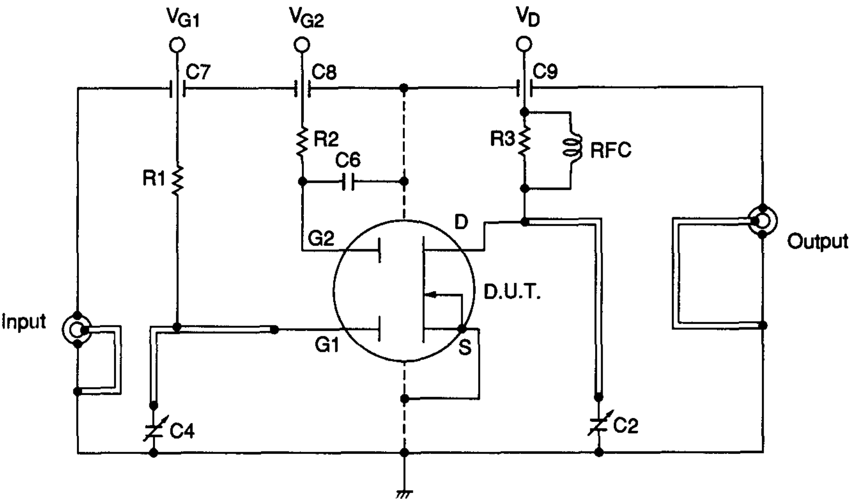


Figure 12 Gain Reduction vs. Gate2 to Source Voltage



C1, C2: 10 pF max variable capacitor
C3: 1000 pF disk capacitor
C4, C5, C6: 1000 pF air core capacitor
R1: 100 kΩ
R2: 47 kΩ
R3: 3.3 kΩ
RFC: ϕ 0.8 mm copper wire with enamel, 4 T inside dia ϕ 5 mm

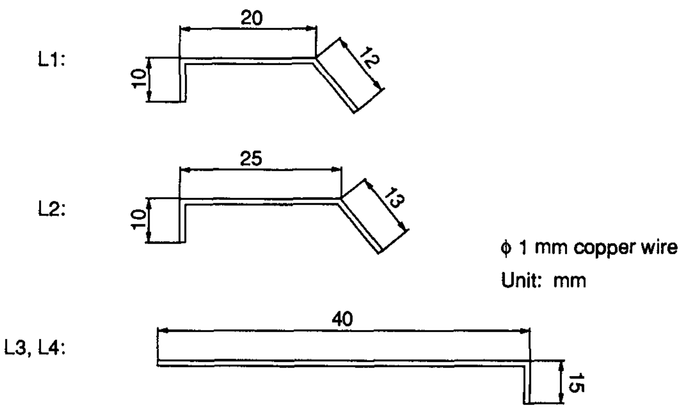


Figure 13 Power Gain and Noise Figure Test Circuit

3SK154 Series

Silicon N-Channel Dual Gate MOS FET

Application

VHF TV tuner RF amplifier

Features

- Capable of high density mount
- Capable of low voltage operation
- High gain, low noise

Table 1 Ordering Information

Type No.	Package
3SK96	FPAK
3SK154	MPAK-4

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Ratings	Unit
Drain to source voltage		V_{DS}	15	V
Gate1 to source voltage		V_{G1S}	±8	V
Gate2 to source voltage		V_{G2S}	±8	V
Drain current		I_D	35	mA
Channel dissipation	3SK96	Pch	200	mW
	3SK154		150	
Channel temperature		Tch	125	°C
Storage temperature		Tstg	–55 to +125	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Drain to source breakdown voltage	$V_{(BR)DSX}$	15	—	—	V	$V_{G1S} = V_{G2S} = -8$ V, $I_D = 200$ μA
Gate1 to source breakdown voltage	$V_{(BR)G1SS}$	±8	—	±20	V	$I_{G1S} = \pm 10$ μA, $V_{G2S} = V_{DS} = 0$
Gate2 to source breakdown voltage	$V_{(BR)G2SS}$	±8	—	±20	V	$I_{G2S} = \pm 10$ μA, $V_{G1S} = V_{DS} = 0$
Gate1 leakage current	I_{G1SS}	—	—	±100	nA	$V_{G1S} = \pm 8$ V, $V_{G2S} = V_{DS} = 0$
Gate2 leakage current	I_{G2SS}	—	—	±100	nA	$V_{G2S} = \pm 8$ V, $V_{G1S} = V_{DS} = 0$

Electrical Characteristics (Ta = 25°C) (cont)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Gate1 to source cutoff voltage	$V_{G1S(off)}$	—	—	–2.0	V	V_{DS} = 10 V, V_{G2S} = 3 V, I_D = 100 µA
Gate2 to source cutoff voltage	$V_{G2S(off)}$	—	—	–2.0	V	V_{DS} = 10 V, V_{G1S} = 3 V, I_D = 100 µA
Drain current	I_{DSS}	—	—	30	mA	V_{DS} = 6 V, V_{G2S} = 3 V, V_{G1S} = 0
Forward transfer admittance	$\|y_{fs}\|$	15	—	—	mS	V_{DS} = 6 V, V_{G2S} = 3 V, I_D = 10 mA, f = 1 kHz
Input capacitance	Ciss	—	4.5	—	pF	V_{DS} = 6 V, V_{G2S} = 3 V,
Output capacitance	Coss	—	3	—		I_D = 10 mA, f = 1 MHz
Reverse transfer capacitance	Crss	—	0.03	—		
Power gain	PG	22	—	—	dB	V_{DS} = 6 V, V_{G2S} = 3 V,
Noise figure	NF	—	—	3		I_D = 10 mA, f = 200 MHz

3SK154 representing the characteristics curves hereafter.

For the detail of characteristics of other parts, please consult our sales offices near you.

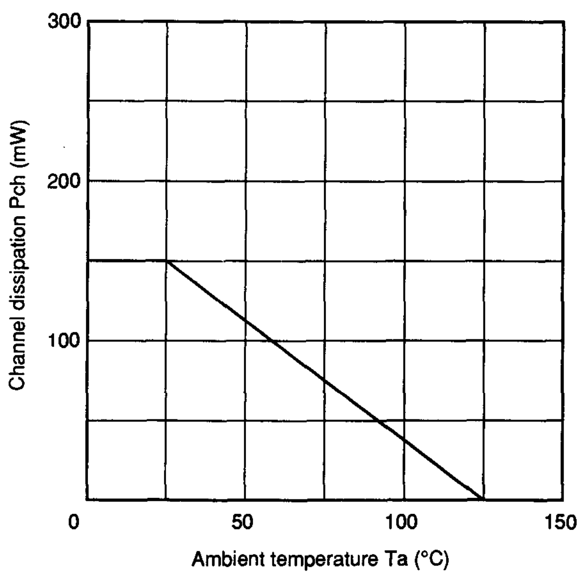


Figure 1 Maximum Channel Dissipation Curve

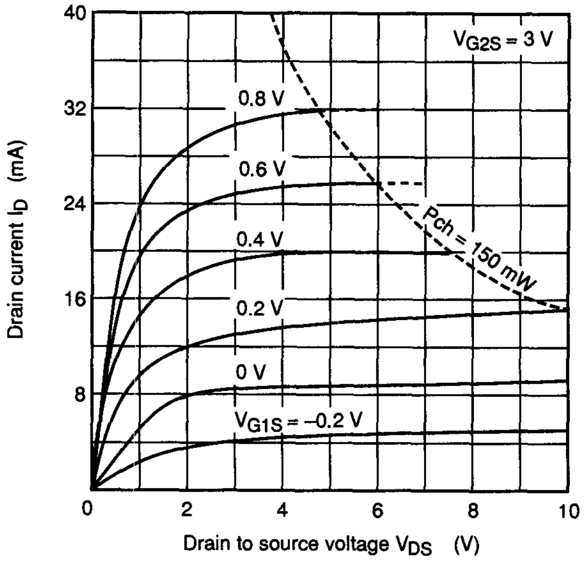


Figure 2 Typical Output Characteristics

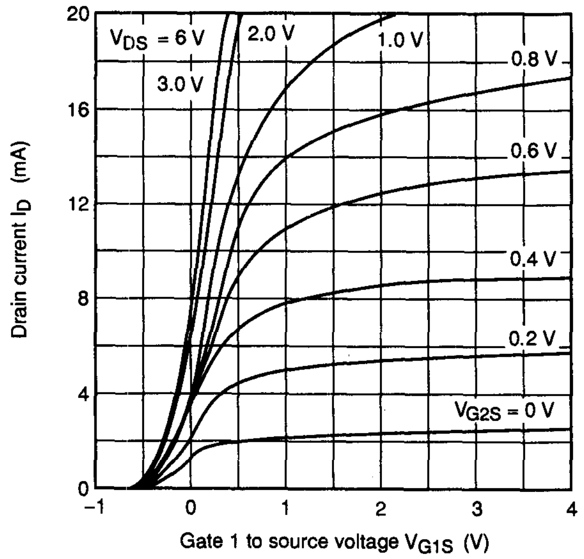


Figure 3 Drain Current vs. Gate1 to Source Voltage

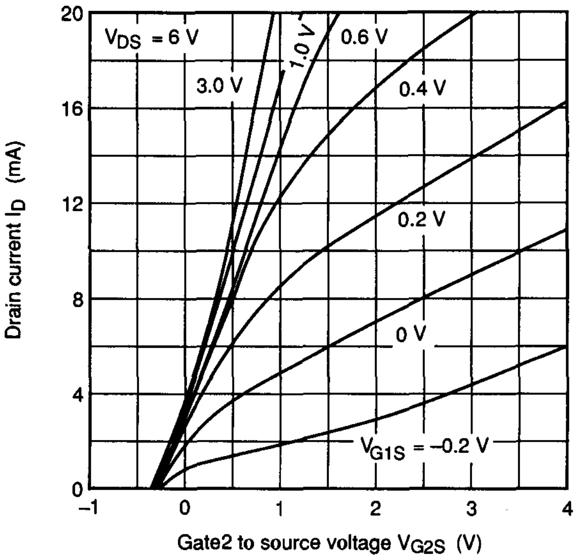


Figure 4 Drain Current vs. Gate2 to Source Voltage

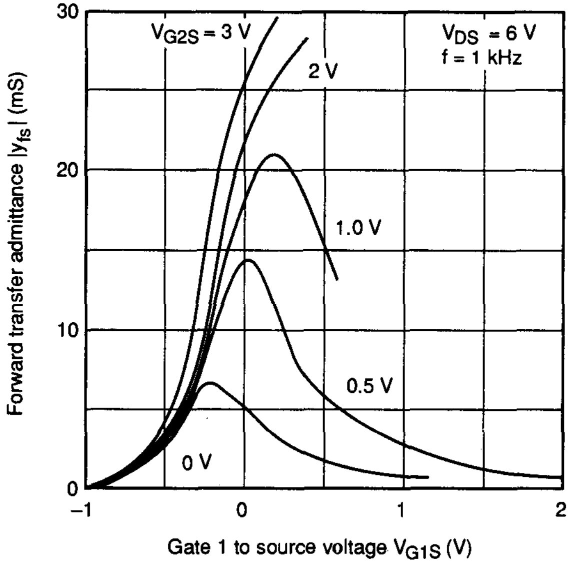


Figure 5 Forward Transfer Admittance vs. Gate1 to Source Voltage

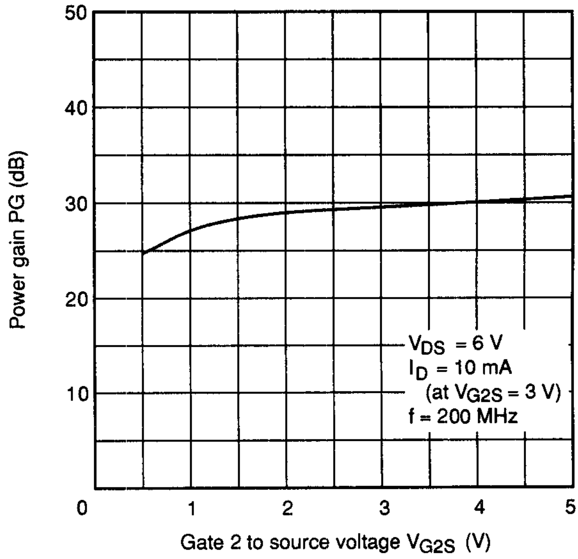


Figure 6 Power Gain vs. Gate2 to Source Voltage

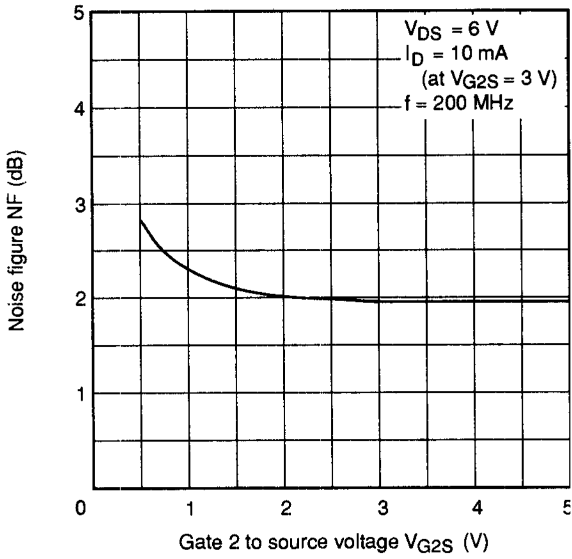


Figure 7 Noise Figure vs. Gate2 to Source Voltage

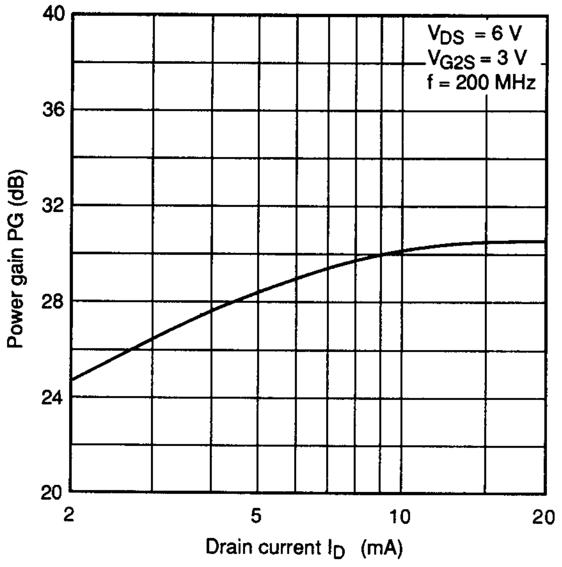


Figure 8 Power Gain vs. Drain Current

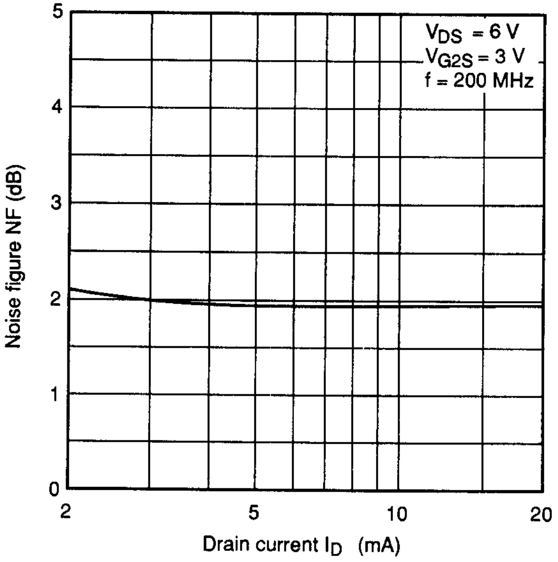


Figure 9 Noise Figure vs. Drain Current

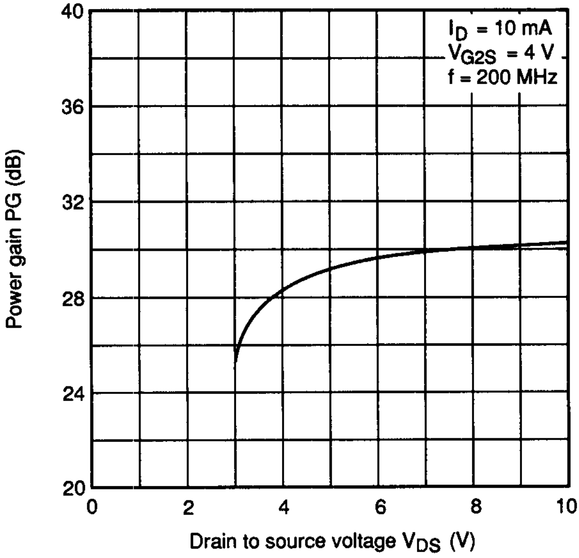


Figure 10 Power Gain vs. Drain to Source Voltage

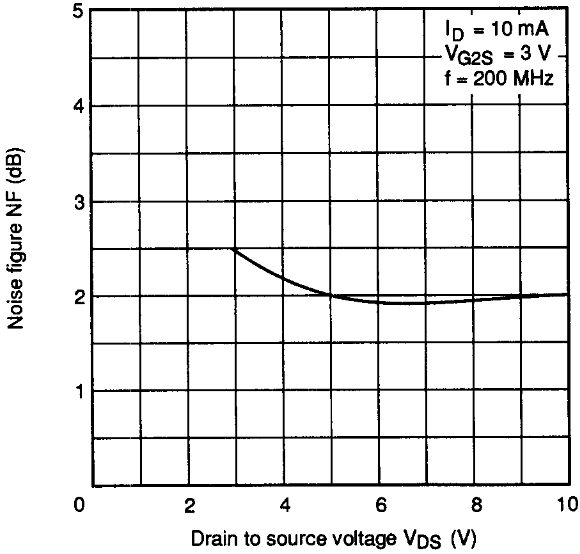
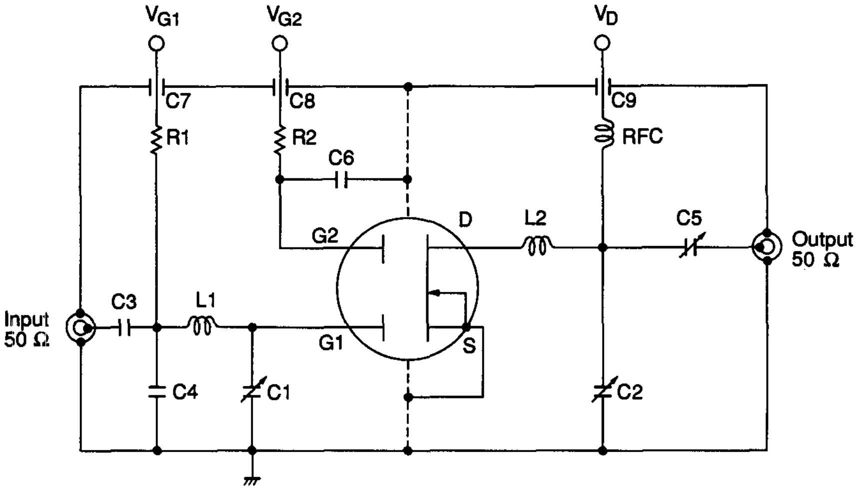


Figure 11 Noise Figure vs. Drain to Source Voltage



R1: 15 kΩ
R2: 11 kΩ
C1, C2, C5: Variable capacitor 10 pF max
C3: 1000 pF
C4: 37 pF
C6: Disk capacitor 1000 pF
C7, C8, C9: Air core capacitor 1000 pF

L1: 3 turns, inside dia ϕ 10 mm
L2: 3 turns, inside dia ϕ 10 mm
ϕ 1 mm enameled copper wire
RFC: 2 turns, inside dia ϕ 5 mm

Figure 12 Power Gain and Noise Figure Test Circuit

3SK162 Series

Silicon N-Channel Dual Gate MOS FET

Application

VHF TV tuner RF amplifier

Features

- Capable of low voltage operation
- Excellent cross modulation characteristics
- Capable of high density mount

Table 1 Ordering Information

Type No.	Package
3SK156	FPAK
3SK162	MPAK-4

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Ratings	Unit
Drain to source voltage		V_{DS}	12	V
Gate1 to source voltage		V_{G1S}	±8	V
Gate2 to source voltage		V_{G2S}	±8	V
Drain current		I_D	35	mA
Channel dissipation	3SK156	Pch	200	mW
	3SK162		150	
Channel temperature		Tch	125	°C
Storage temperature		Tstg	–55 to +125	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Drain to source breakdown voltage	$V_{(BR)DSX}$	12	—	—	V	I_D = 200 μA, $V_{G1S} = V_{G2S}$ = –5 V
Gate1 to source breakdown voltage	$V_{(BR)G1SS}$	±8	—	—	V	I_{G1} = ±10 μA, $V_{DS} = V_{G2S}$ = 0
Gate2 to source breakdown voltage	$V_{(BR)G2SS}$	±8	—	—	V	I_{G2} = ±10 μA, $V_{DS} = V_{G1S}$ = 0
Gate1 leakage current	I_{G1SS}	—	—	±50	nA	V_{G1} = ±5 V, $V_{DS} = V_{G2S}$ = 0
Gate2 leakage current	I_{G2SS}	—	—	±50	nA	V_{G2} = ±5 V, $V_{DS} = V_{G1S}$ = 0

Electrical Characteristics (Ta = 25°C) (cont)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Drain current	I_{DSS}	0	—	12	mA	V_{DS} = 4 V, V_{G1S} = 0, V_{G2S} = 3 V
Gate1 to source cutoff voltage	$V_{G1S(off)}$	—	—	–1.7	V	V_{DS} = 6 V, V_{G2S} = 3 V, I_D = 100 µA
Gate2 to source cutoff voltage	$V_{G2S(off)}$	—	—	–1.4	V	V_{DS} = 6 V, V_{G1S} = 3 V, I_D = 100 µA
Forward transfer admittance	$\|y_{fs}\|$	14	—	—	mS	V_{DS} = 6 V, V_{G2S} = 3 V, I_D = 10 mA, f = 1 kHz
Input capacitance	Ciss	—	4.7	—	pF	V_{DS} = 6 V, V_{G2S} = 3 V,
Output capacitance	Coss	—	2.8	—	pF	I_D = 10 mA, f = 1 MHz
Reverse transfer capacitance	Crss	—	0.03	—	pF	
Power gain	PG	18	23	—	dB	V_{DS} = 4 V, V_{G2S} = 3 V,
Noise figure	NF	—	2.2	3.0	dB	I_D = 10 mA, f = 200 MHz

3SK162 representing the characteristics curves hereafter.

For the detail of characteristics of other parts, please consult our sales office near you.

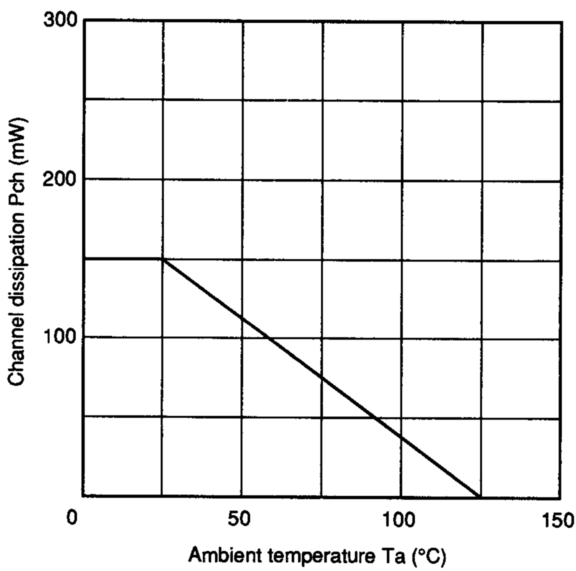


Figure 1 Maximum Channel Dissipation Curve

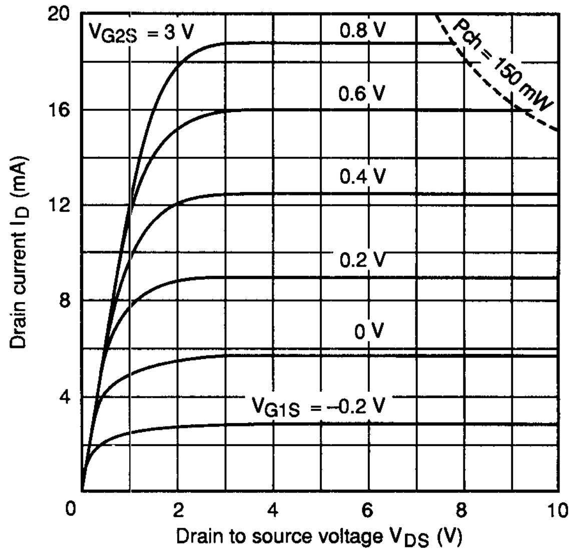


Figure 2 Typical Output Characteristics

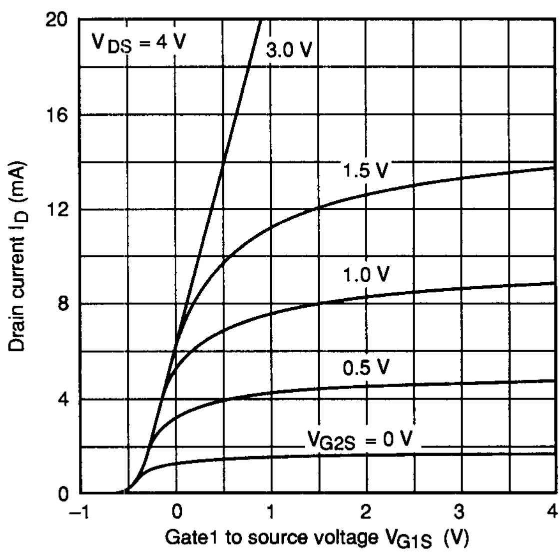


Figure 3 Drain Current vs. Gate1 to Source Voltage

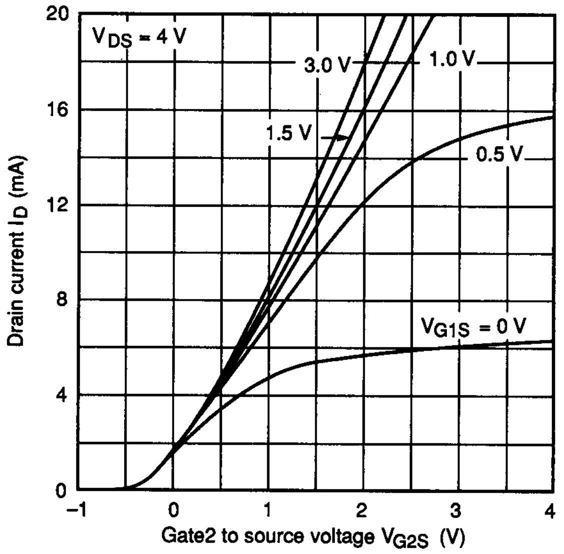


Figure 4 Drain Current vs. Gate2 to Source Voltage

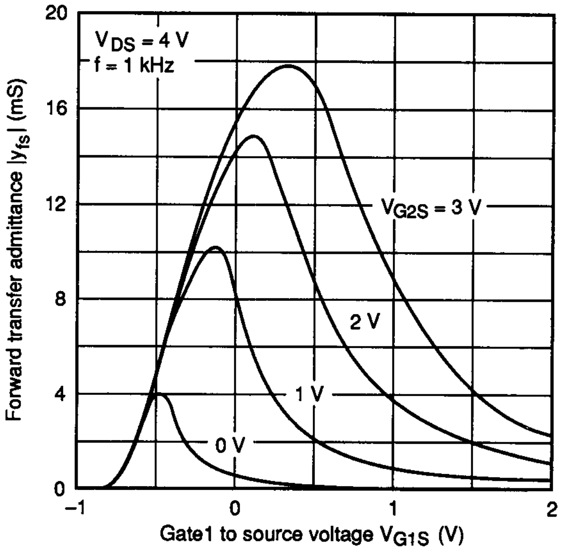


Figure 5 Forward Transfer Admittance vs. Gate1 to Source Voltage

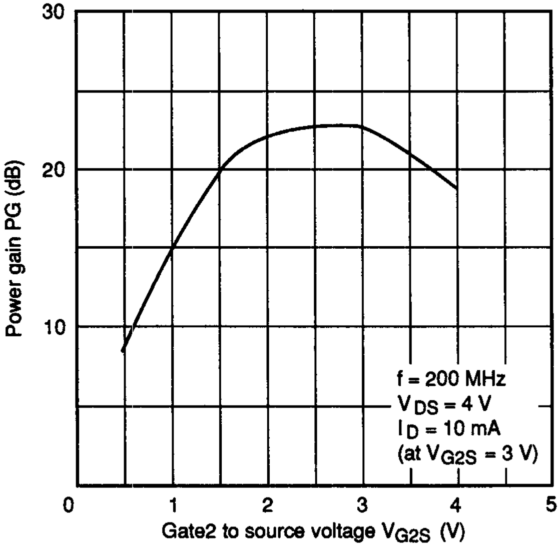


Figure 6 Power Gain vs. Gate2 to Source Voltage

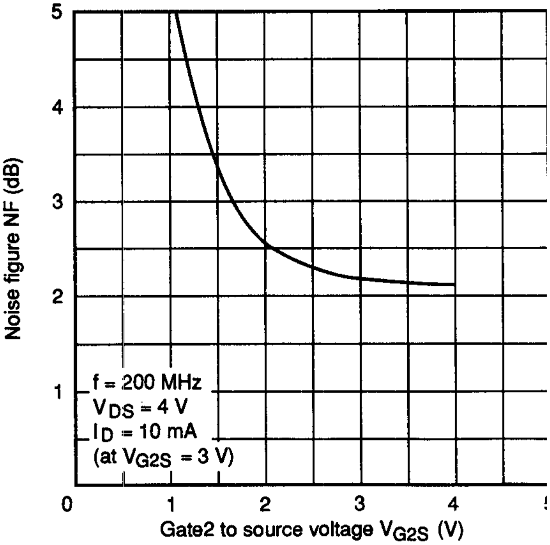


Figure 7 Noise Figure vs. Gate2 to Source Voltage

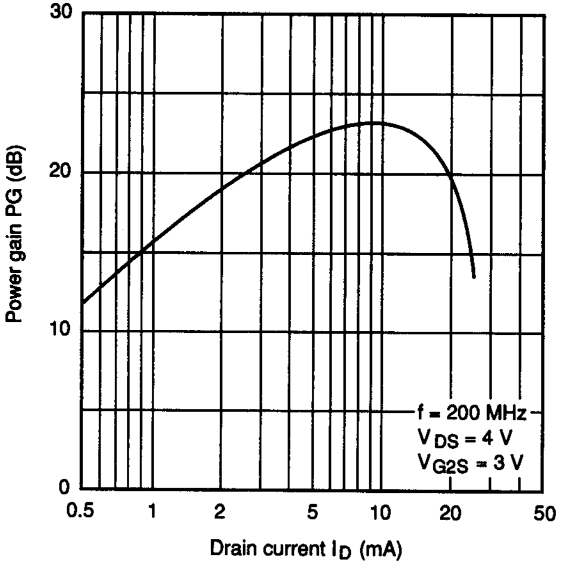


Figure 8 Power Gain vs. Drain Current

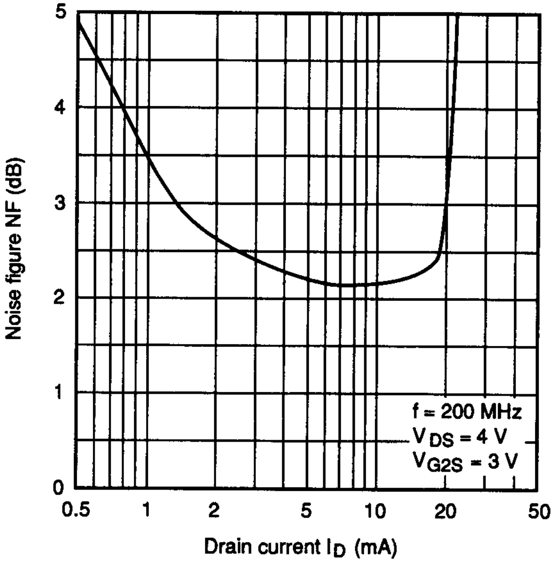


Figure 9 Noise Figure vs. Drain Current

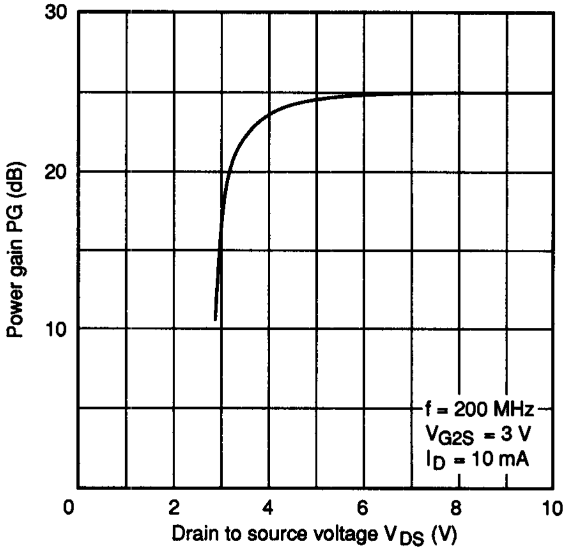


Figure 10 Power Gain vs. Drain to Source Voltage

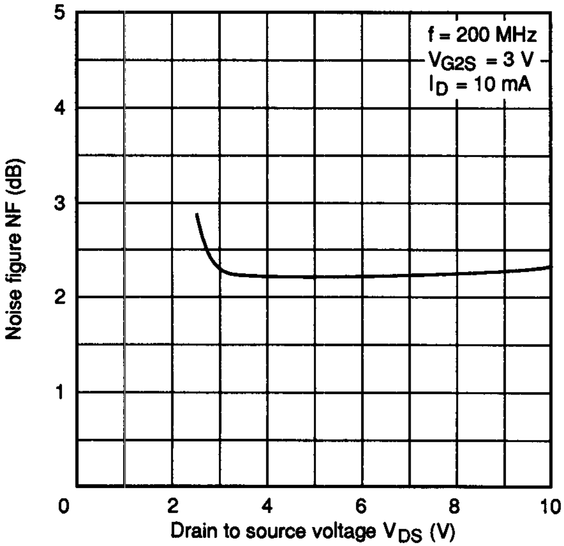


Figure 11 Noise Figure vs. Drain to Source Voltage

3SK182 Series

Silicon N-Channel Dual Gate MOS FET

Application

UHF TV tuner RF amplifier

Features

- Capable of high density mount
- High gain, low noise
- Suitable for quarter wave length resonant circuit

Table 1 Ordering Information

Type No.	Package
3SK80	FPAK
3SK182	MPAK-4

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Ratings	Unit
Drain to source voltage		V_{DS}	20	V
Gate1 to source voltage		V_{G1S}	±8	V
Gate2 to source voltage		V_{G2S}	±8	V
Drain current		I_D	50	mA
Channel dissipation	3SK80	Pch	200	mW
	3SK182		150	
Channel temperature		Tch	125	°C
Storage temperature		Tstg	–55 to +125	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Drain to source breakdown voltage	$V_{(BR)DSX}$	20	—	—	V	$V_{G1S} = V_{G2S} = -5$ V, $I_D = 200$ µA
Gate1 to source breakdown voltage	$V_{(BR)G1SS}$	±8	—	—	V	$I_{G1S} = \pm 10$ µA, $V_{G2S} = V_{DS} = 0$
Gate2 to source breakdown voltage	$V_{(BR)G2SS}$	±8	—	—	V	$I_{G2S} = \pm 10$ µA, $V_{G1S} = V_{DS} = 0$
Gate1 leakage current	I_{G1SS}	—	—	±20	nA	$V_{G1S} = \pm 5$ V, $V_{G2S} = V_{DS} = 0$
Gate2 leakage current	I_{G2SS}	—	—	±20	nA	$V_{G2S} = \pm 5$ V, $V_{G1S} = V_{DS} = 0$
Gate1 to source cutoff voltage	$V_{G1S(off)}$	—	—	–3	V	$V_{DS} = 15$ V, $V_{G2S} = 4$ V, $I_D = 100$ µA
Gate2 to source cutoff voltage	$V_{G2S(off)}$	—	—	–3	V	$V_{DS} = 15$ V, $V_{G1S} = 0$, $I_D = 100$ µA
Drain current	I_{DSS}	1.0	—	20	mA	$V_{DS} = 15$ V, $V_{G2S} = 4$ V, $V_{G1S} = 0$
Forward transfer admittance	$\|y_{fs}\|$	7	—	—	mS	$V_{DS} = 15$ V, $V_{G2S} = 4$ V, $I_D = 7$ mA, f = 1 kHz
Input capacitance	Ciss	—	—	5	pF	$V_{DS} = 15$ V, $V_{G2S} = 4$ V, $I_D = 7$ mA, f = 1 MHz
Output capacitance	Coss	—	—	4	pF	$V_{DS} = 15$ V, $V_{G2S} = 4$ V, $I_D = 7$ mA, f = 1 MHz
Reverse transfer capacitance	Crss	—	0.02	—	pF	$V_{DS} = 15$ V, $V_{G2S} = 4$ V, $I_D = 7$ mA, f = 1 MHz
Power gain	PG	10	—	—	dB	$V_{DS} = 15$ V, $V_{G2S} = 4$ V,
Noise figure	NF	—	—	6		$I_D = 7$ mA, f = 900 MHz

3SK182 representing the characteristics curves hereafter.

For the detail of characteristics of other parts, please consult our sales offices near you.

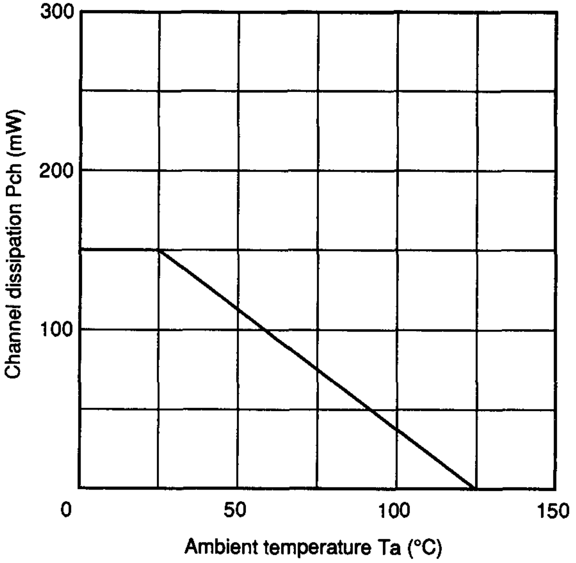


Figure 1 Maximum Channel Dissipation Curve

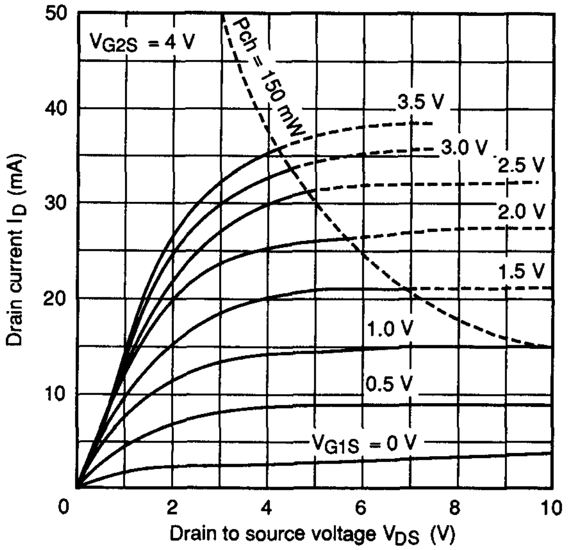


Figure 2 Typical Output Characteristics

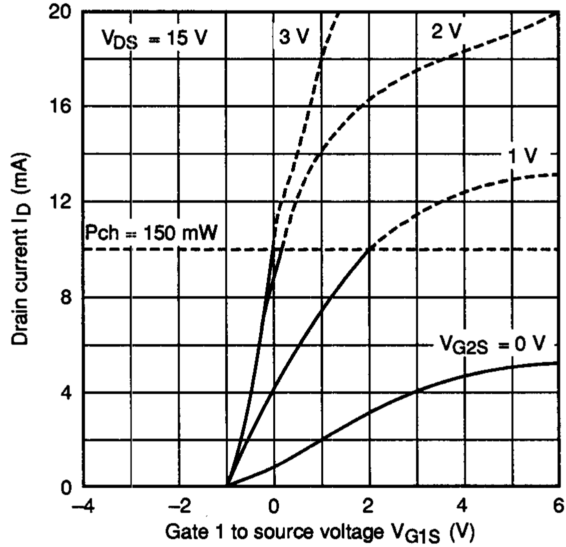


Figure 3 Drain Current vs. Gate1 to Source Voltage

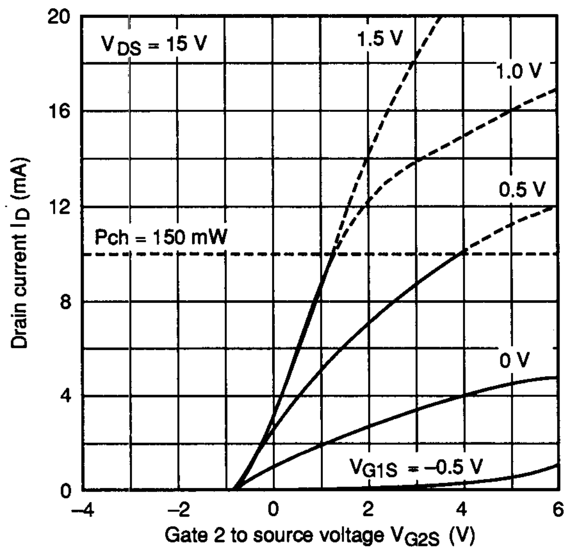


Figure 4 Drain Current vs. Gate2 to Source Voltage

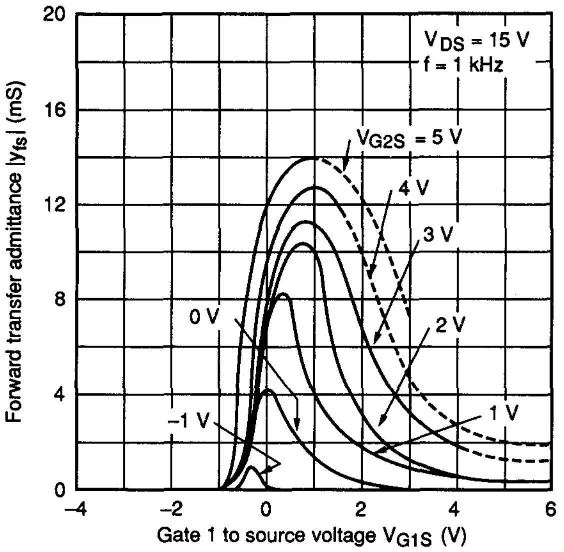


Figure 5 Forward Transfer Admittance vs. Gate1 to Source Voltage

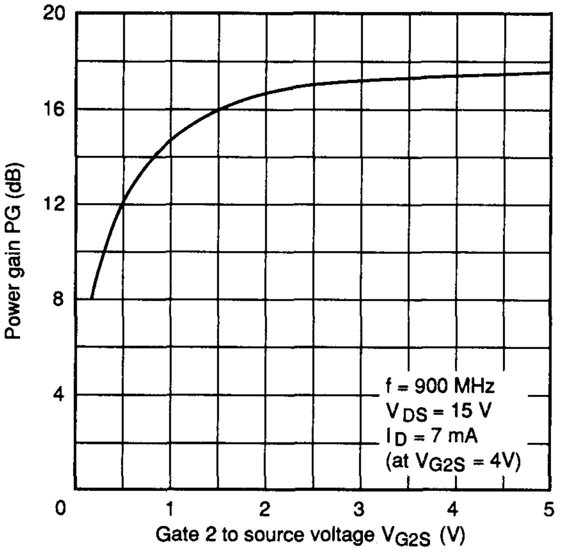


Figure 6 Power Gain vs. Gate2 to Source Voltage

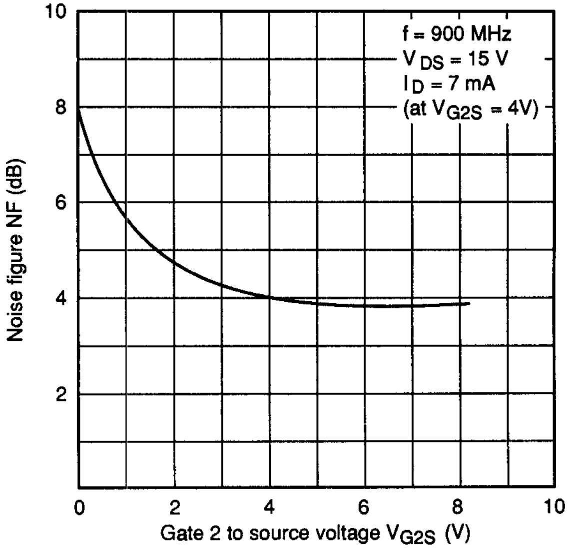


Figure 7 Noise Figure vs. Gate2 to Source Voltage

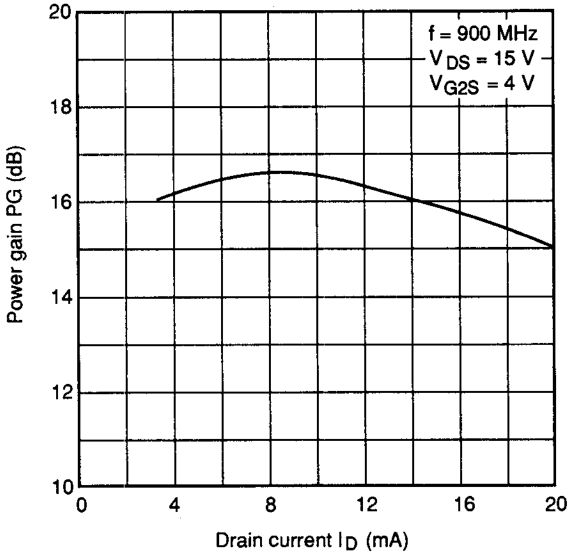


Figure 8 Power Gain vs. Drain Current

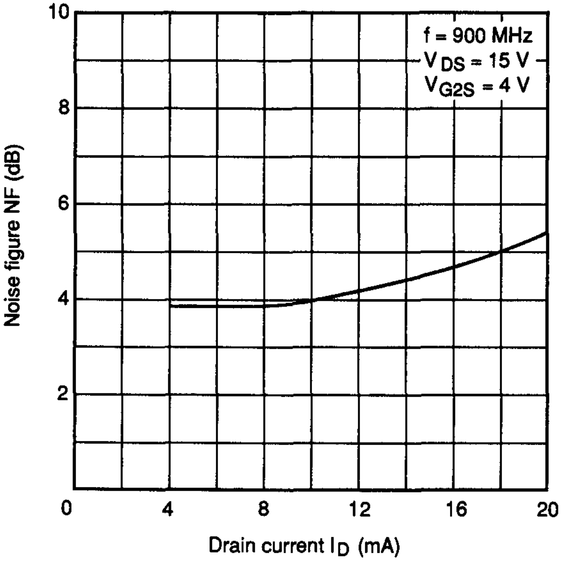


Figure 9 Noise Figure vs. Drain Current

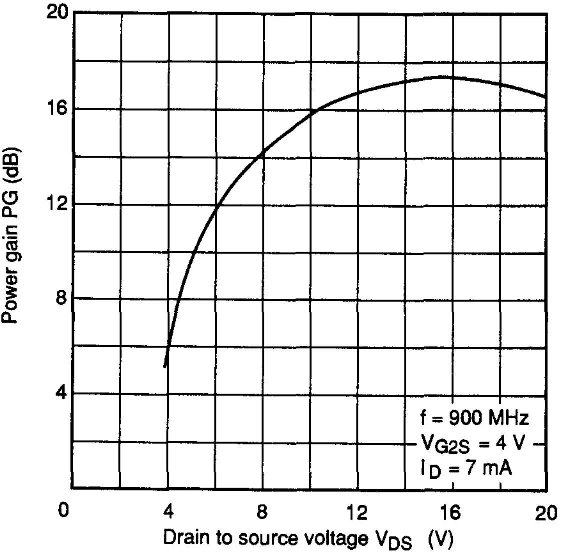


Figure 10 Power Gain vs. Drain to Source Voltage

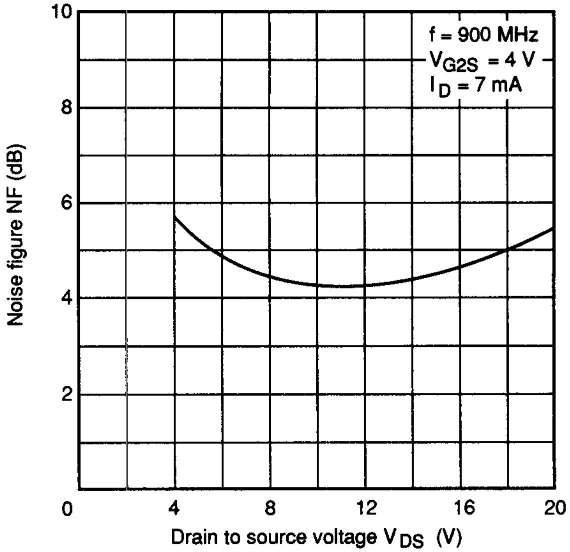
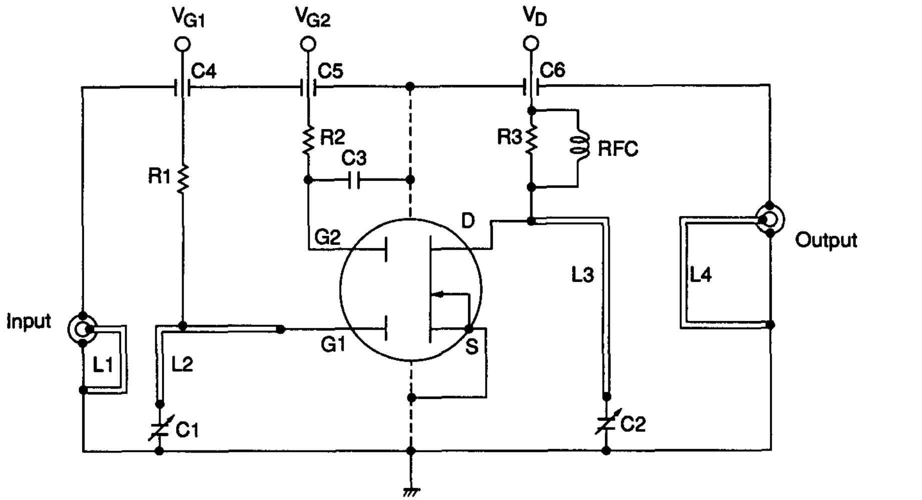


Figure 11 Noise Figure vs. Drain to Source Voltage



C1, C2: 10 pF max variable capacitor
C3: 1000 pF disk capacitor
C4, C5, C6: 1000 pF air core capacitor
R1: 100 kΩ
R2: 47 kΩ
R3: 3.3 kΩ
RFC: φ 0.8 mm enameled copper wire, 4 T inside dia 5 mm

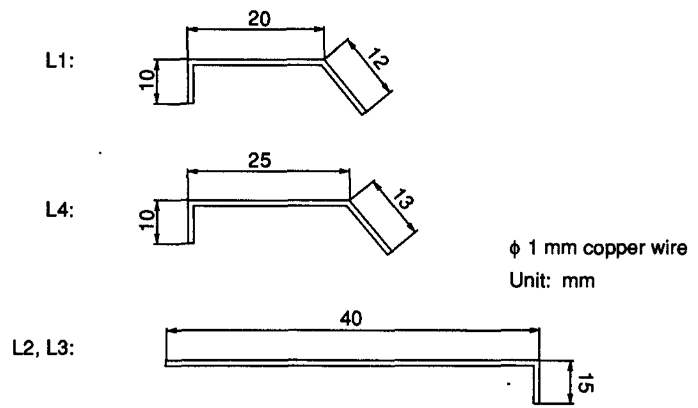


Figure 12 Power Gain and Noise Figure Test Circuit

3SK186 Series

Silicon N-Channel Dual Gate MOS FET

Application

UHF TV Tuner RF Amplifier

Features

- Low voltage operation
- Low noise figure
  NF = 3.0 dB typ

Table 1 Ordering Information

Type No.	Package
3SK186	MPAK-4
3SK217	CMPAK-4

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Ratings	Unit
Drain to source voltage		V_{DS}	12	V
Gate1 to source voltage		V_{G1S}	±10	V
Gate2 to source voltage		V_{G2S}	±10	V
Drain current		I_D	35	mA
Channel dissipation	3SK186	Pch	150	mW
	3SK217		100	
Channel temperature		Tch	125	°C
Storage temperature		Tstg	–55 to +125	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Drain to source breakdown voltage	$V_{(BR)DSX}$	12	—	—	V	I_D = 200 µA, $V_{G1S} = V_{G2S}$ = –5 V
Gate1 to source breakdown voltage	$V_{(BR)G1SS}$	±10	—	—	V	I_{G1S} = ±10 µA, $V_{G2S} = V_{DS}$ = 0
Gate2 to source breakdown voltage	$V_{(BR)G2SS}$	±10	—	—	V	I_{G2S} = ±10 µA, $V_{G1S} = V_{DS}$ = 0
Gate1 leakage current	I_{G1SS}	—	—	±100	nA	V_{G1S} = ±8 V, $V_{G2S} = V_{DS}$ = 0
Gate2 leakage current	I_{G2SS}	—	—	±100	nA	V_{G2S} = ±8 V, $V_{G1S} = V_{DS}$ = 0

Electrical Characteristics (Ta = 25°C) (cont)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Gate1 to source cutoff voltage	$V_{G1S\,(off)}$	+0.5	—	–0.8	V	V_{DS} = 6 V, V_{G2S} = 3 V, I_D = 100 µA
Gate2 to source cutoff voltage	$V_{G2S\,(off)}$	+0.5	—	–0.8	V	V_{DS} = 6 V, V_{G1S} = 3 V, I_D = 100 µA
Drain current	I_{DSS}	0	—	4	mA	V_{DS} = 6 V, V_{G1S} = 0, V_{G2S} = 3 V
Forward transfer admittance	$\|y_{fs}\|$	15	—	—	mS	V_{DS} = 6 V, V_{G2S} = 3 V, I_D = 10 mA, f = 1 kHz
Input capacitance	Ciss	—	1.7	2.2	pF	V_{DS} = 6 V, V_{G2S} = 3 V, I_D = 10 mA, f = 1 MHz
Output capacitance	Coss	—	1.0	1.4	pF	
Reverse transfer capacitance	Crss	—	0.017	0.03	pF	
Power gain	PG	16	19	—	dB	V_{DS} = 4 V, V_{G2S} = 3 V, I_D = 10 mA, f = 900 MHz
Noise figure	NF	—	3.0	4.5	dB	

3SK186 representing the characteristics curves hereafter.

For the detail of characteristics of other parts, please consult our sales offices near you.

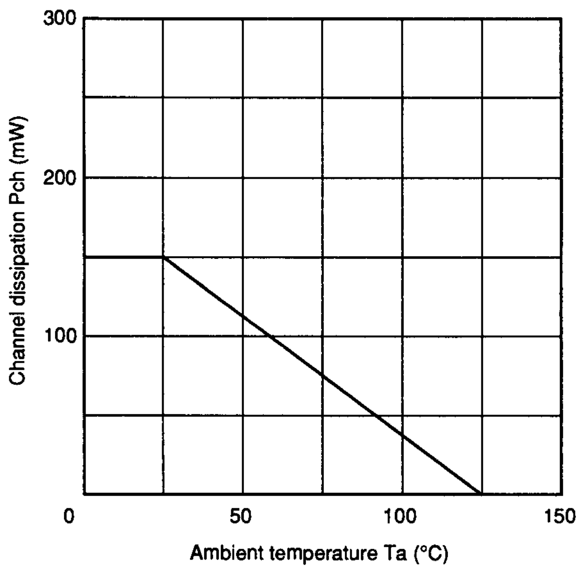


Figure 1 Maximum Channel Dissipation Curve

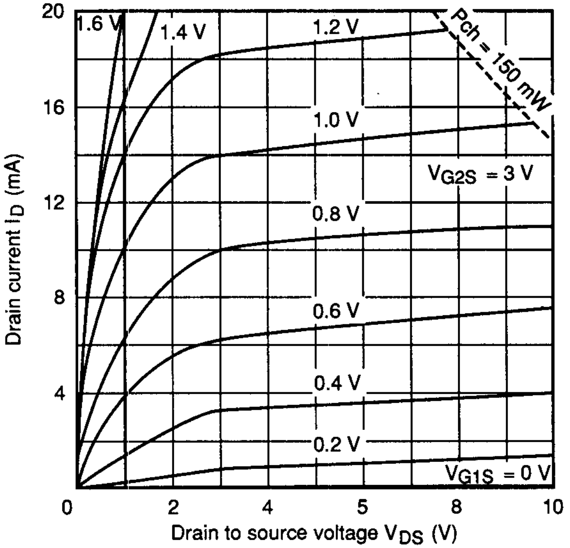


Figure 2 Typical Output Characteristics

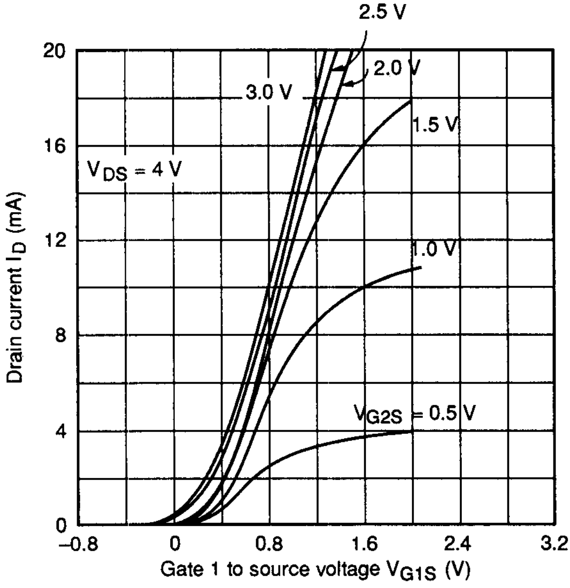


Figure 3 Drain Current vs. Gate1 to Source Voltage

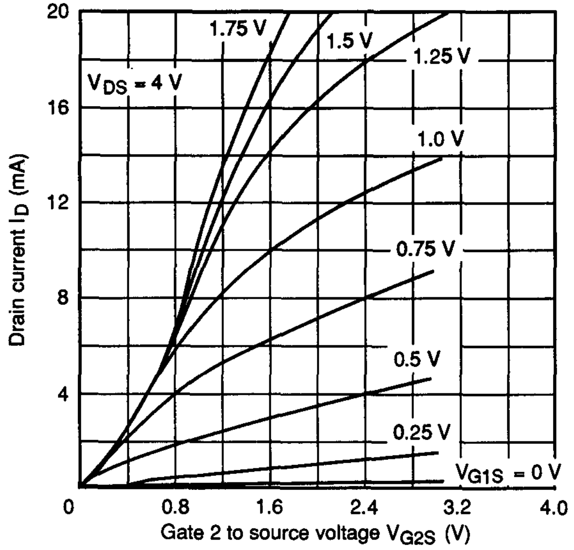


Figure 4 Drain Current vs. Gate2 to Source Voltage

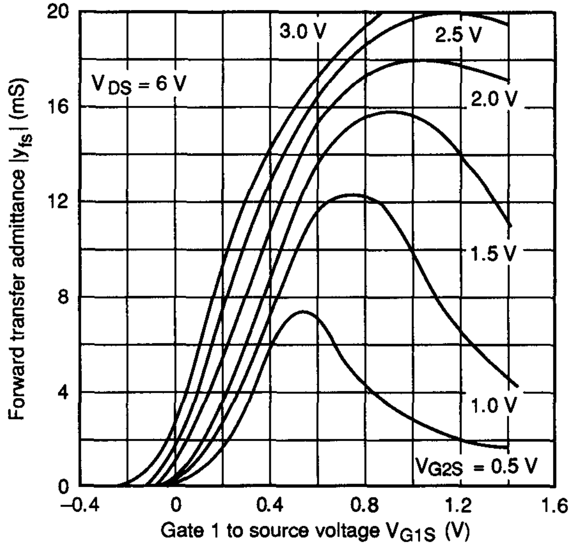


Figure 5 Forward Transfer Admittance vs. Gate1 to Source Voltage

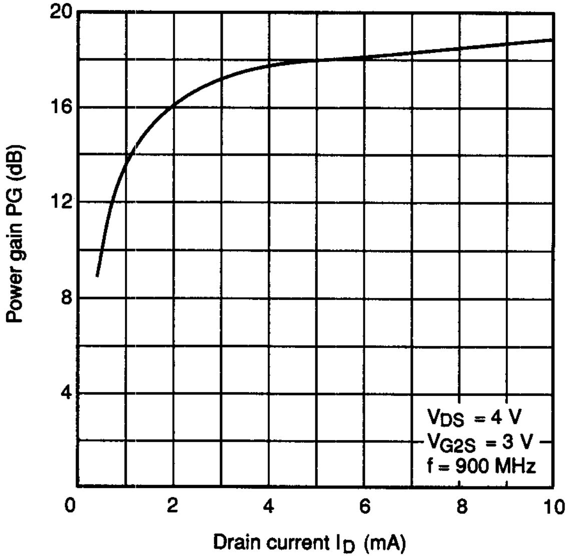


Figure 6 Power Gain vs. Drain Current

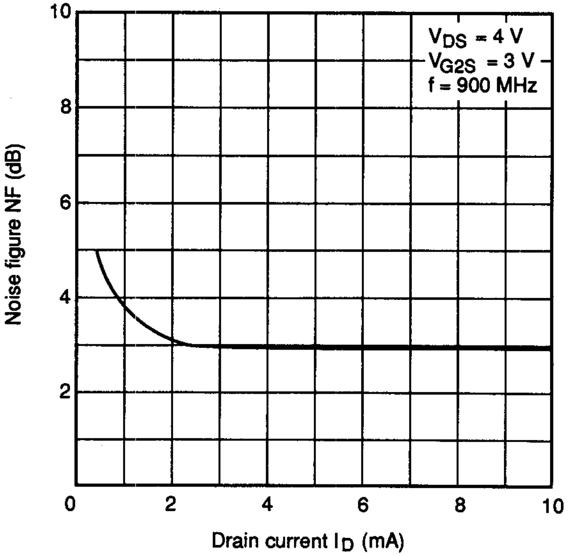


Figure 7 Noise Figure vs. Drain Current

3SK188 Series

Silicon N-Channel Dual Gate MOS FET

Application

VHF TV Tuner RF Amplifier

Features

- Capable of high density mount
- High gain, low noise
- Low reverse transfer capacitance

Table 1 Ordering Information

Type No.	Package
3SK85	FPAK
3SK188	MPAK-4

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Ratings	Unit
Drain to source voltage		V_{DS}	22	V
Gate1 to source voltage		V_{G1S}	±8	V
Gate2 to source voltage		V_{G2S}	±8	V
Drain current		I_D	35	mA
Channel dissipation	3SK85	Pch	200	mW
	3SK188		150	
Channel temperature		Tch	125	°C
Storage temperature		Tstg	–55 to +125	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Gate1 to source breakdown voltage	$V_{(BR)G1SS}$	±8	—	±20	V	I_{G1S} = ±10 µA, V_{DS} = V_{G2S} = 0
Gate2 to source breakdown voltage	$V_{(BR)G2SS}$	±8	—	±20	V	I_{G2S} = ±10 µA, V_{DS} = V_{G1S} = 0
Gate1 leakage current	I_{G1SS}	—	—	±50	nA	V_{G1S} = ±8 V, V_{DS} = V_{G2S} = 0
Gate2 leakage current	I_{G2SS}	—	—	±50	nA	V_{G2S} = ±8 V, V_{DS} = V_{G1S} = 0
Gate1 to source cutoff voltage	$V_{G1S(off)}$	–0.3	—	–3.0	V	V_{DS} = 15 V, V_{G2S} = 4 V, I_D = 100 µA

Electrical Characteristics (Ta = 25°C)(cont)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Gate2 to source cutoff voltage	$V_{G2S(off)}$	—	—	–2.0	V	V_{DS} = 15 V, V_{G1S} = 0, I_D = 100 μA
Drain current	I_{DSS}	4	—	32	mA	V_{DS} = 15 V, V_{G2S} = 4 V, V_{G1S} = 0
Forward transfer admittance	$\|y_{fs}\|$	10	—	—	mS	V_{DS} = 15 V, V_{G2S} = 4 V, I_D = 10 mA, f = 1 kHz
Input capacitance	Ciss	—	3.3	—	pF	V_{DS} = 15 V, V_{G2S} = 4 V, I_D = 10 mA, f = 1 MHz
Output capacitance	Coss	—	1.5	—		
Reverse transfer capacitance	Crss	—	0.03	—		
Power gain	PG	18	—	—	dB	V_{DS} = 15 V, V_{G2S} = 4 V, I_D = 10 mA, f = 200 MHz
Noise figure	NF	—	—	3.2		

3SK188 representing the characteristics curves hereafter.

For the detail of characteristics of other parts, please consult our sales offices near you.

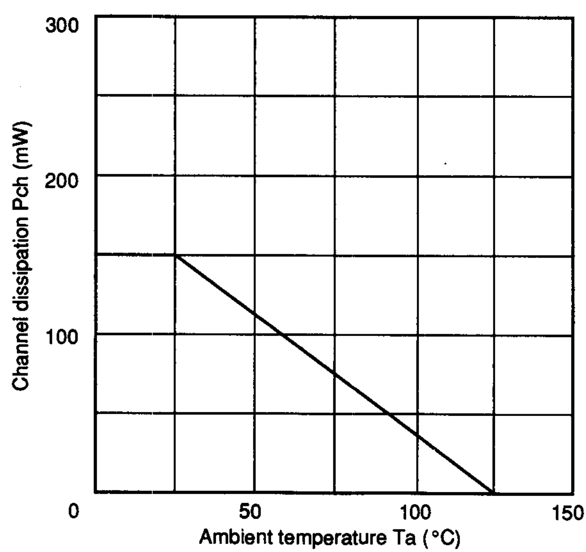


Figure 1 Maximum Channel Dissipation Curve

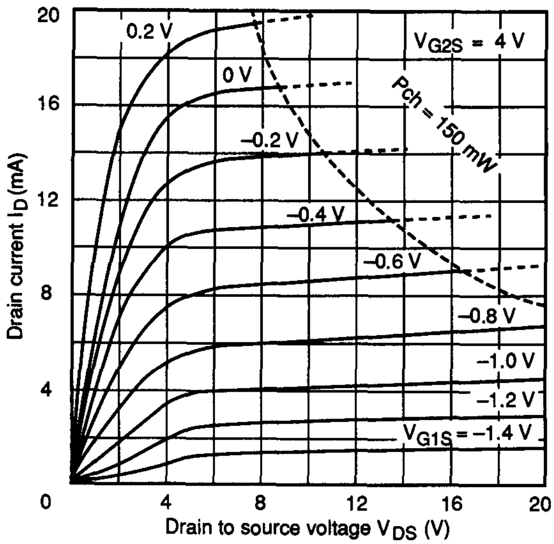


Figure 2 Typical Output Characteristics

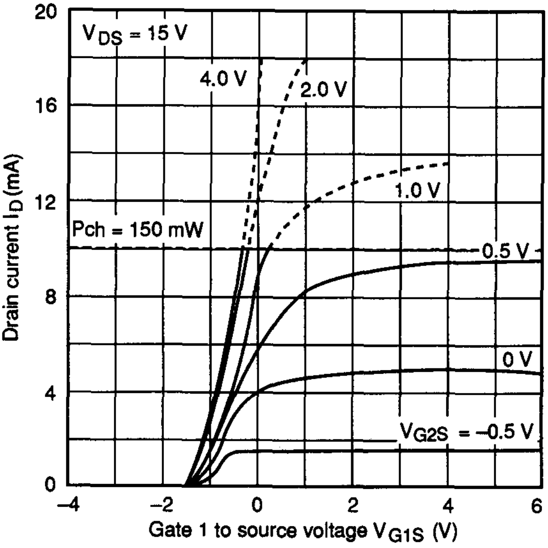


Figure 3 Drain Current vs. Gate 1 to Source Voltage

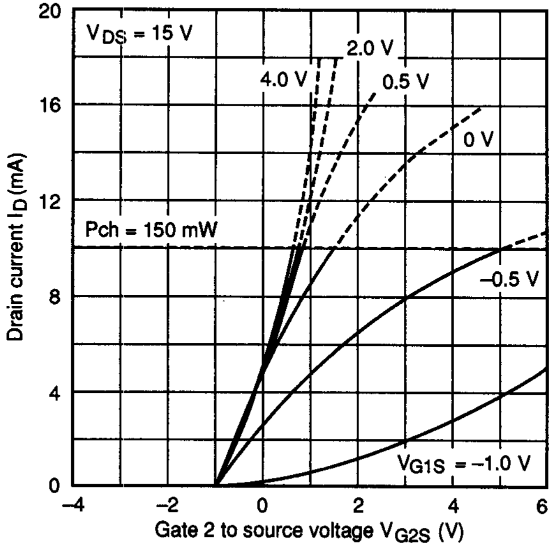


Figure 4 Drain Current vs. Gate2 to Source Voltage

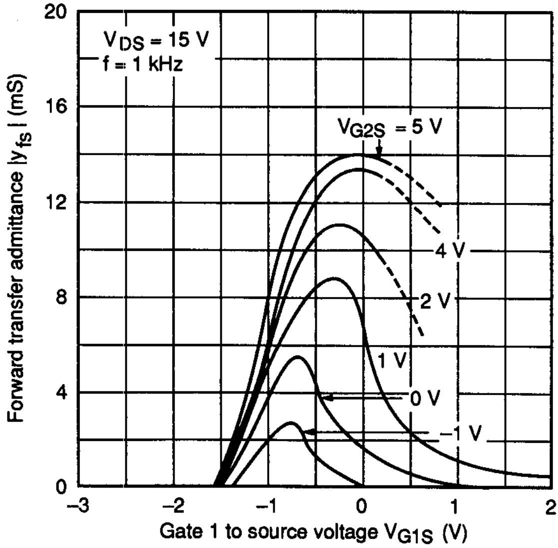


Figure 5 Forward Transfer Admittance vs. Gate1 to Source Voltage

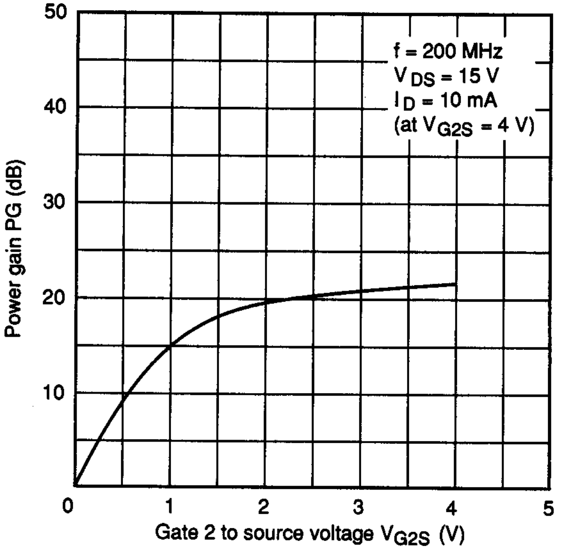


Figure 6 Power Gain vs. Gate2 to Source Voltage

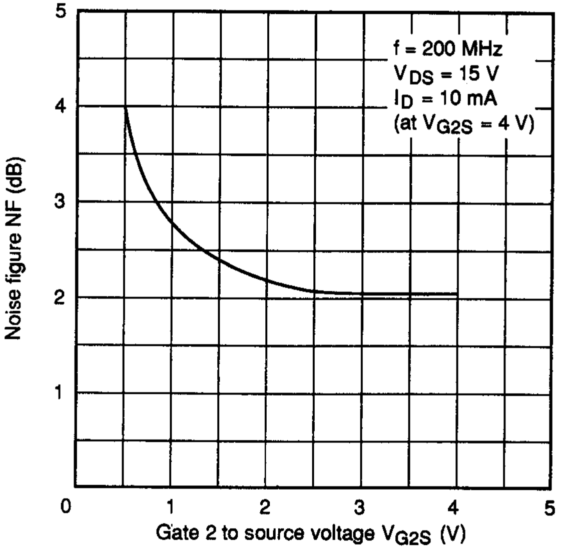


Figure 7 Noise Figure vs. Gate2 to Source Voltage

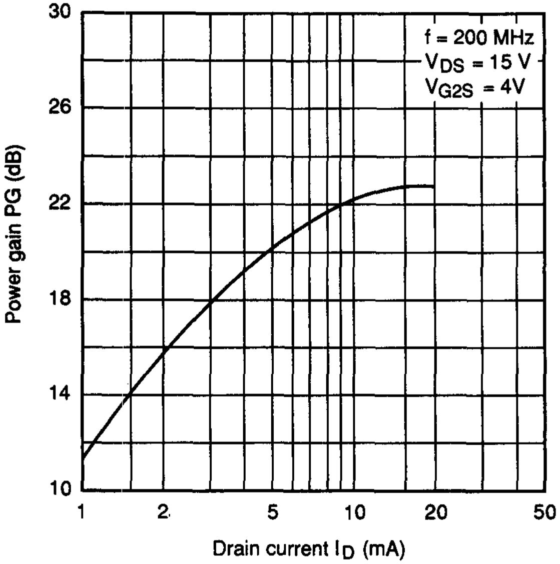


Figure 8 Power Gain vs. Drain Current

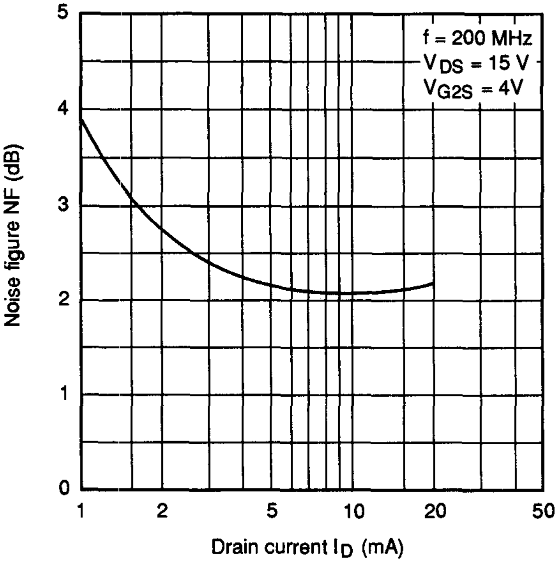


Figure 9 Noise Figure vs. Drain Current

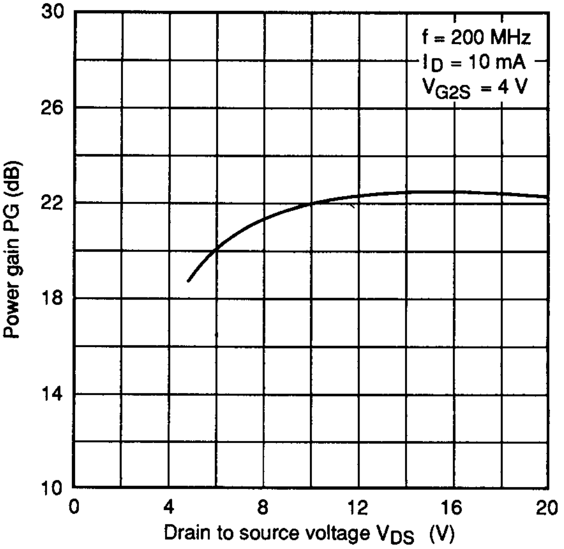


Figure 10 Power Gain vs. Drain to Source Voltage

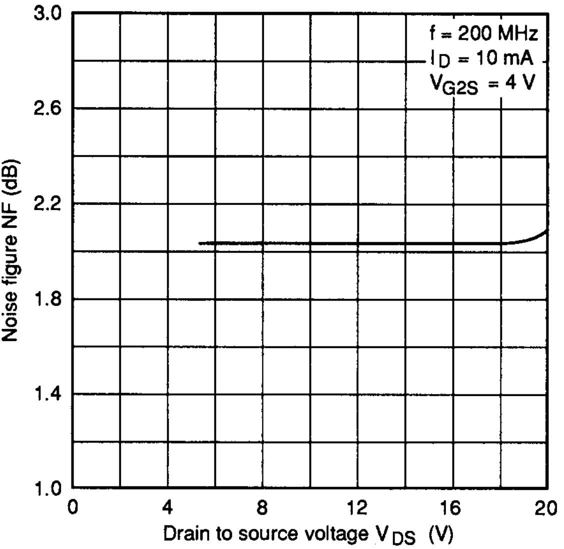
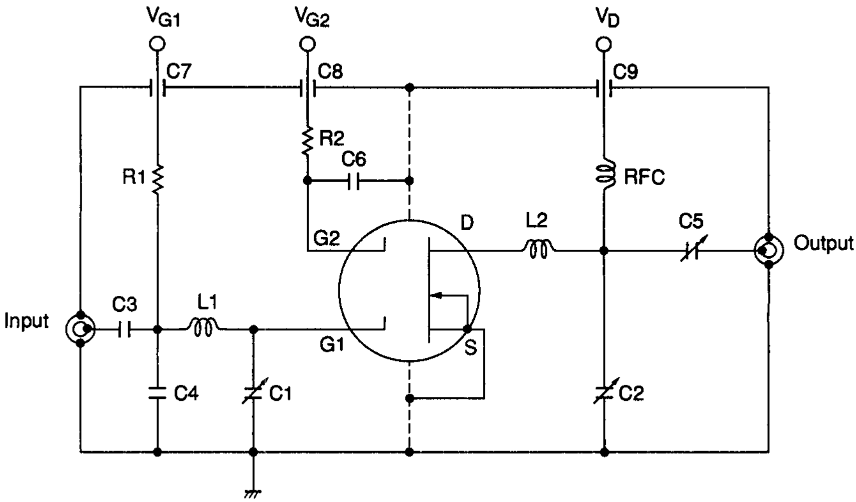


Figure 11 Noise Figure vs. Drain to Source Voltage



R1: 15 kΩ
R2: 11 kΩ
C1, C2, C5: 10 pF max variable capacitor
C3: 1000 pF
C4: 33 pF
C6: 1000 pF disk capacitor
C7, C8, C9: 1000 pF air core capacitor
L1: 3 T, inside dia 10 mm
L2: ϕ 1 mm enameled copper wire 3 T inside dia 10 mm
RFC: 2 T, inside dia 7 mm

Figure 12 Power Gain and Noise Figure Test Circuit

3SK194

Silicon N-Channel Dual Gate MOS FET

Application

VHF/UHF TV tuner RF amplifier

Features

- Super compact package
- Low noise amplifier for VHF – UHF band, capable of RF amplifier for CATV wide band tuner.

Table 1 Ordering Information

Type No.	Package
3SK194	MPAK-4

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DS}	15	V
Gate1 to source voltage	V_{G1S}	±10	V
Gate2 to source voltage	V_{G2S}	±10	V
Drain current	I_D	35	mA
Channel dissipation	Pch	150	mW
Channel temperature	Tch	125	°C
Storage temperature	Tstg	–55 to +125	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Drain to source breakdown voltage	$V_{(BR)DSX}$	15	—	—	V	I_D = 200 μA, $V_{G1S} = V_{G2S}$ = –5 V
Gate1 to source breakdown voltage	$V_{(BR)G1SS}$	±10	—	—	V	I_{G1S} = ±10 μA, $V_{G2S} = V_{DS}$ = 0
Gate2 to source breakdown voltage	$V_{(BR)G2SS}$	±10	—	—	V	I_{G2S} = ±10 μA, $V_{G1S} = V_{DS}$ = 0
Gate1 leakage current	I_{G1SS}	—	—	±100	nA	V_{G1S} = ±8 V, $V_{G2S} = V_{DS}$ = 0
Gate2 leakage current	I_{G2SS}	—	—	±100	nA	V_{G2S} = ±8 V, $V_{G1S} = V_{DS}$ = 0
Gate1 to source cutoff voltage	$V_{G1S(off)}$	—	—	–1.0	V	V_{DS} = 10 V, V_{G2S} = 3 V, I_D = 100 μA

Electrical Characteristics (Ta = 25°C) (cont)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Gate2 to source cutoff voltage	$V_{G2S(off)}$	—	—	–1.5	V	V_{DS} = 10 V, V_{G1S} = 3 V, I_D = 100 μA
Drain current	I_{DSS}	0	—	10	mA	V_{DS} = 6 V, V_{G1S} = 0, V_{G2S} = 3 V
Forward transfer admittance	$\|y_{fs}\|$	17	—	—	mS	V_{DS} = 6 V, V_{G2S} = 3 V, I_D = 10 mA, f = 1 kHz
Input capacitance	Ciss	—	2.8	3.5	pF	V_{DS} = 6 V, V_{G2S} = 3 V, I_D = 10 mA, f = 1 MHz
Output capacitance	Coss	—	1.8	2.5	pF	
Reverse transfer capacitance	Crss	—	0.02	—	pF	
Power gain	PG	12	15	—	dB	V_{DS} = 6 V, V_{G2S} = 3 V, I_D = 10 mA, f = 900 MHz
Noise figure	NF	—	3.0	4.5	dB	
Noise figure	NF	—	3.0	4.0	dB	V_{DD} = 12 V, V_{AGC} = 10.5 V, f = 60 MHz
Power gain	PG	27	30	—	dB	V_{DS} = 6 V, V_{G2S} = 3 V, I_D = 10 mA, f = 200 MHz
Noise figure	NF	—	1.0	2.5	dB	

Note: Mark is "IY–".

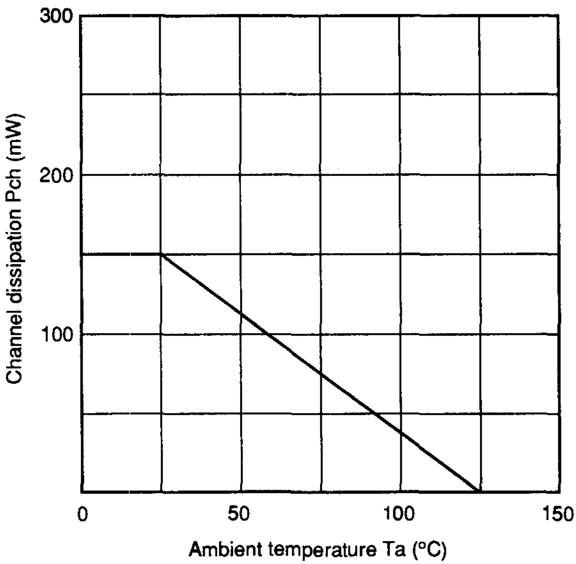


Figure 1 Maximum Channel Dissipation Curve

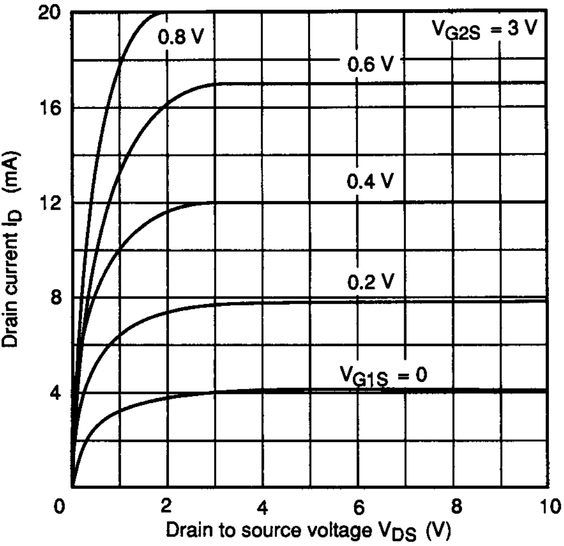


Figure 2 Typical Output Characteristics

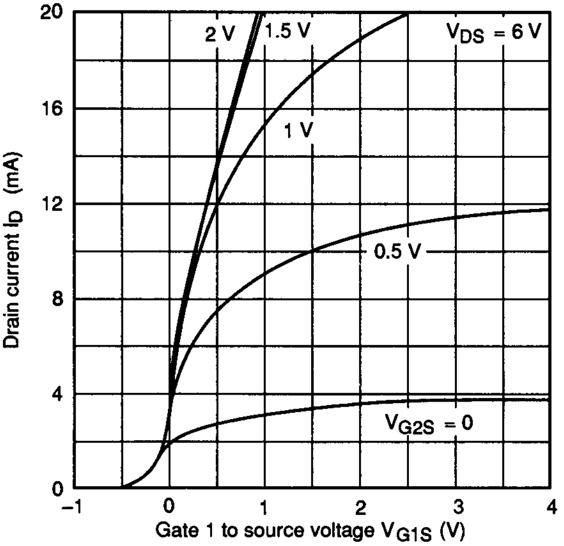


Figure 3 Drain Current vs. Gate1 to Source Voltage

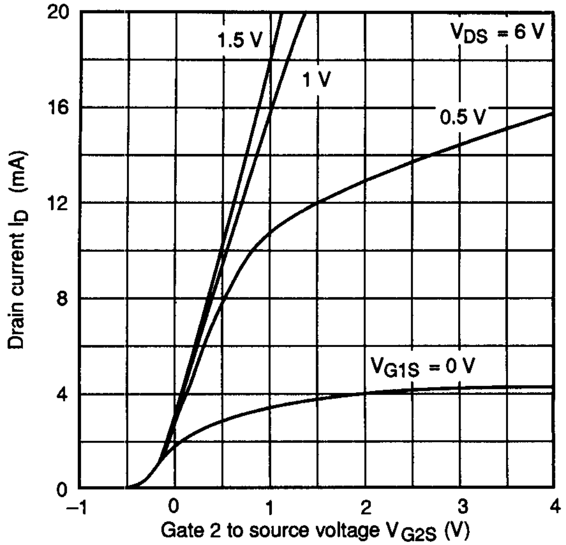


Figure 4 Drain Current vs. Gate2 to Source Voltage

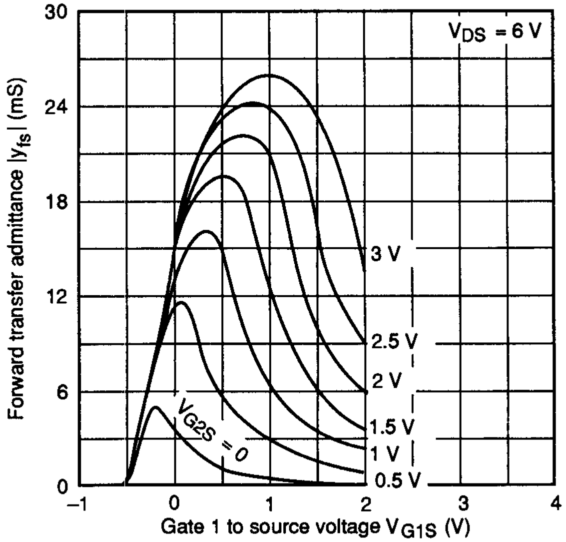


Figure 5 Forward Transfer Admittance vs. Gate1 to Source Voltage

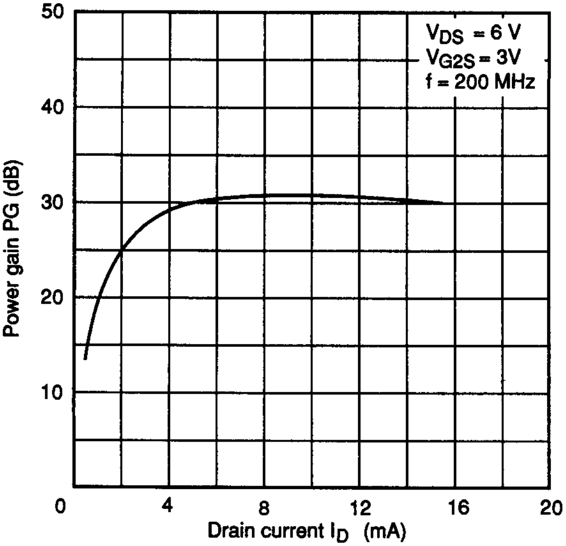


Figure 6 Power Gain vs. Drain Current

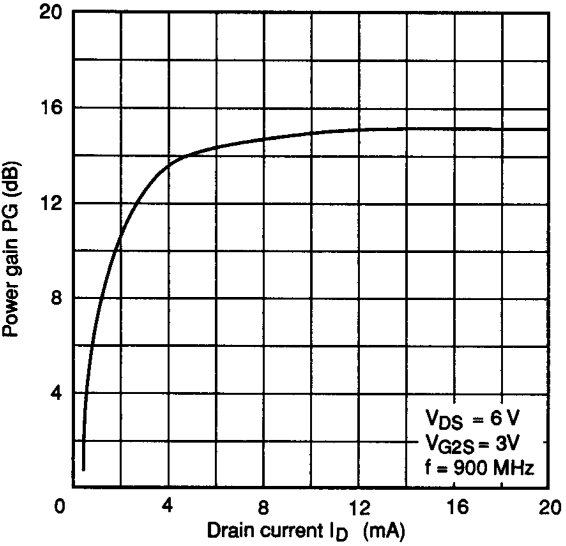


Figure 7 Power Gain vs. Drain Current

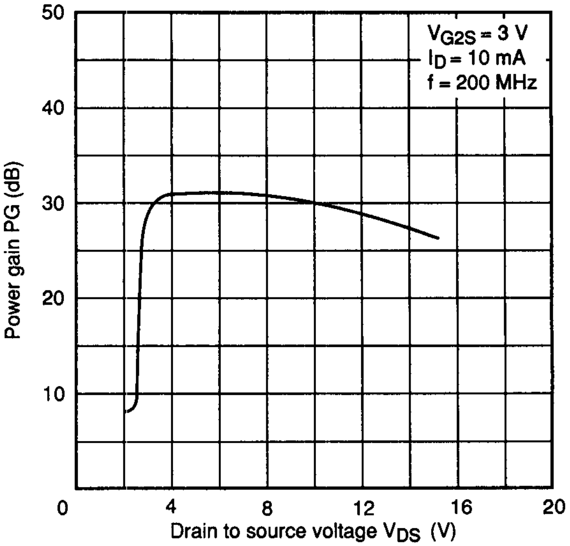


Figure 8 Power Gain vs. Drain to Source Voltage

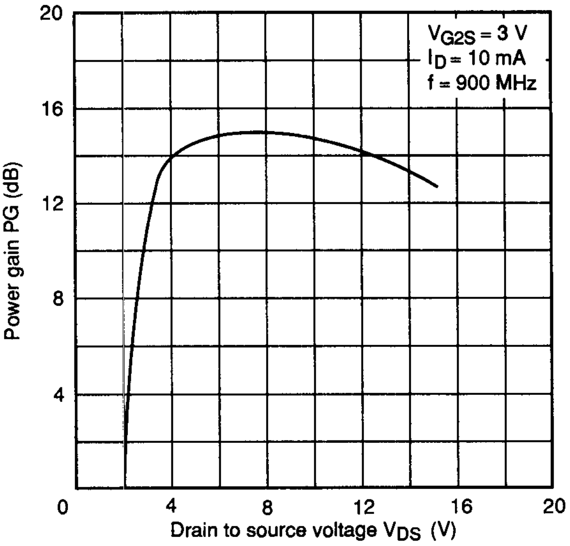


Figure 9 Power Gain vs. Drain to Source Voltage

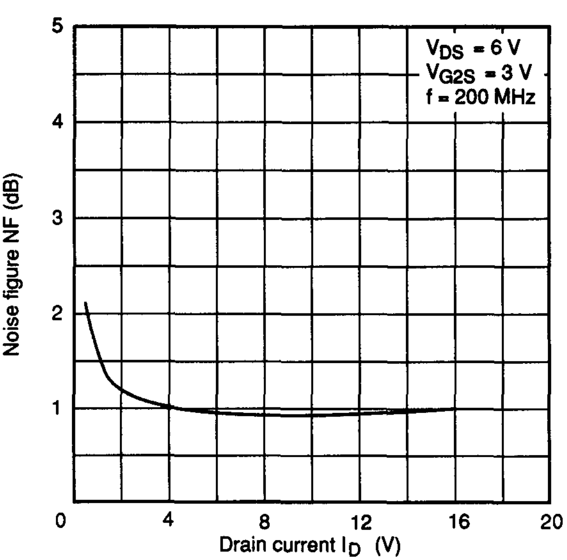


Figure 10 Noise Figure vs. Drain Current

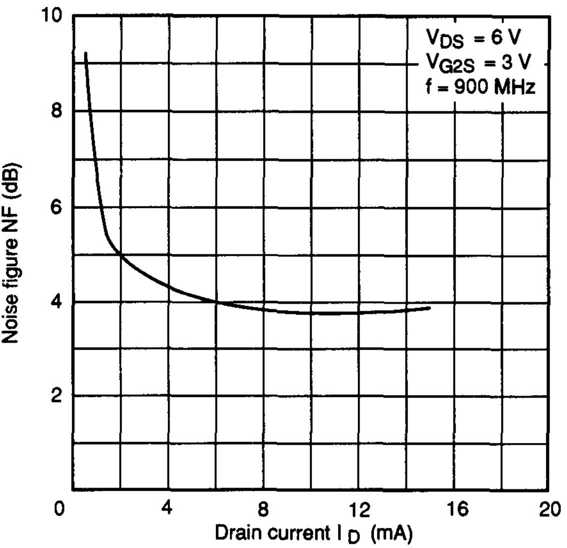


Figure 11 Noise Figure vs. Drain Current

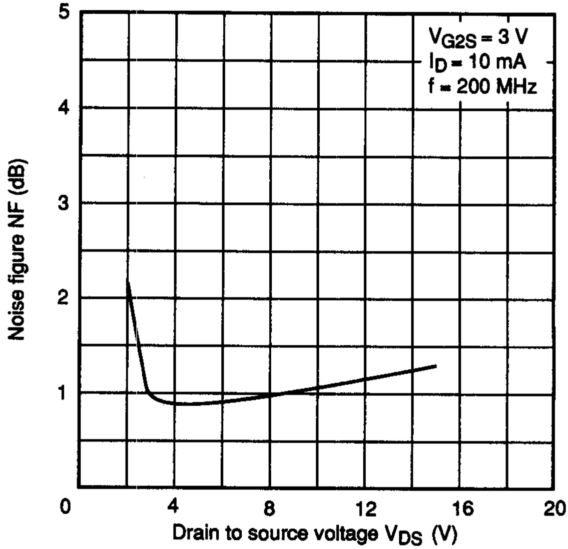


Figure 12 Noise Figure vs. Drain to Source Voltage

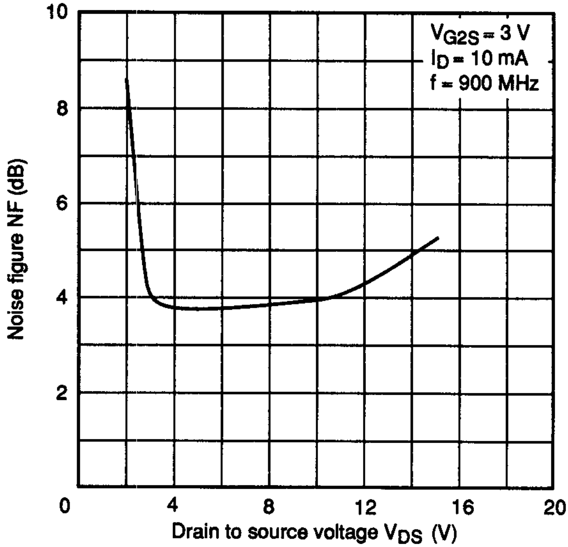


Figure 13 Noise Figure vs. Drain to Source Voltage

3SK196

Silicon N-Channel Dual Gate MOS FET

Application

VHF/UHF TV tuner RF amplifier

Features

- Super compact package
- Low noise amplifier for VHF – UHF band, capable of RF amplifier for CATV wide band tuner.

Table 1 Ordering Information

Type No.	Package
3SK196	MPAK-4

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DS}	12	V
Gate1 to source voltage	V_{G1S}	±10	V
Gate2 to source voltage	V_{G2S}	±10	V
Drain current	I_D	35	mA
Channel dissipation	Pch	150	mW
Channel temperature	Tch	125	°C
Storage temperature	Tstg	–55 to +125	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Drain to source breakdown voltage	$V_{(BR)DSX}$	12	—	—	V	$V_{G1S} = V_{G2S} = -5$ V, $I_D = 200$ µA
Gate1 to source breakdown voltage	$V_{(BR)G1SS}$	±10	—	—	V	$I_{G1S} = \pm 10$ µA, $V_{G2S} = V_{DS} = 0$
Gate2 to source breakdown voltage	$V_{(BR)G2SS}$	±10	—	—	V	$I_{G2S} = \pm 10$ µA, $V_{G1S} = V_{DS} = 0$
Gate1 leakage current	I_{G1SS}	—	—	±100	nA	$V_{G1S} = \pm 8$ V, $V_{G2S} = V_{DS} = 0$
Gate2 leakage current	I_{G2SS}	—	—	±100	nA	$V_{G2S} = \pm 8$ V, $V_{G1S} = V_{DS} = 0$
Gate1 to source cutoff voltage	$V_{G1S(off)}$	–0.5	—	1.5	V	$V_{DS} = 10$ V, $V_{G2S} = 3$ V, $I_D = 100$ µA
Gate2 to source cutoff voltage	$V_{G2S(off)}$	0.2	—	1.5	V	$V_{DS} = 10$ V, $V_{G1S} = 3$ V, $I_D = 100$ µA
Drain current	I_{DSS}	0	0.16	1	mA	$V_{DS} = 6$ V, $V_{G2S} = 3$ V, $V_{G1S} = 0$
Forward transfer admittance	$\|y_{fs}\|$	14	21	—	mS	$V_{DS} = 6$ V, $V_{G2S} = 3$ V, $I_D = 10$ mA, f = 1 kHz
Input capacitance	Ciss	—	2.4	3.5	pF	$V_{DS} = 6$ V, $V_{G2S} = 3$ V, $I_D = 10$ mA, f = 1 MHz
Output capacitance	Coss	—	1.1	2.5	pF	
Reverse transfer capacitance	Crss	—	0.02	—	pF	
Power gain	PG	—	14	—	dB	$V_{DS} = 6$ V, $V_{G2S} = 3$ V, $I_D = 10$ mA, f = 900 MHz
Noise figure	NF	—	3.6	—	dB	
Noise figure	NF	—	3.3	—	dB	$V_{DD} = 12$ V, $V_{AGC} = 10.5$ V, f = 60 MHz
Power gain	PG	—	32	—	dB	$V_{DS} = 6$ V, $V_{G2S} = 3$ V, $I_D = 10$ mA, f = 200 MHz
Noise figure	NF	—	1.0	—	dB	

Note: Mark is XI–.

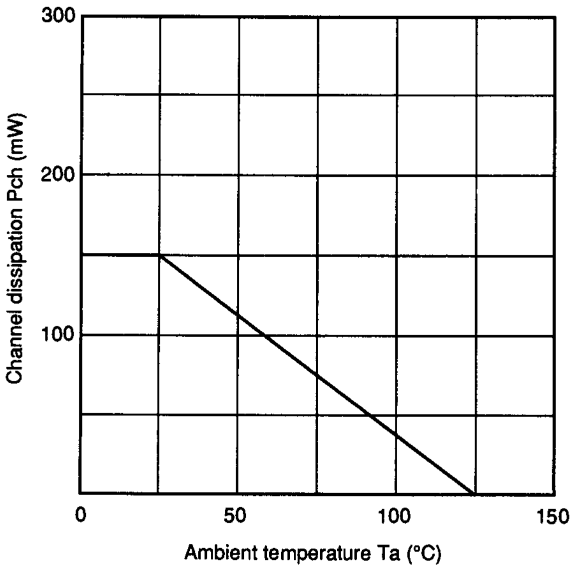


Figure 1 Maximum Channel Dissipation Curve

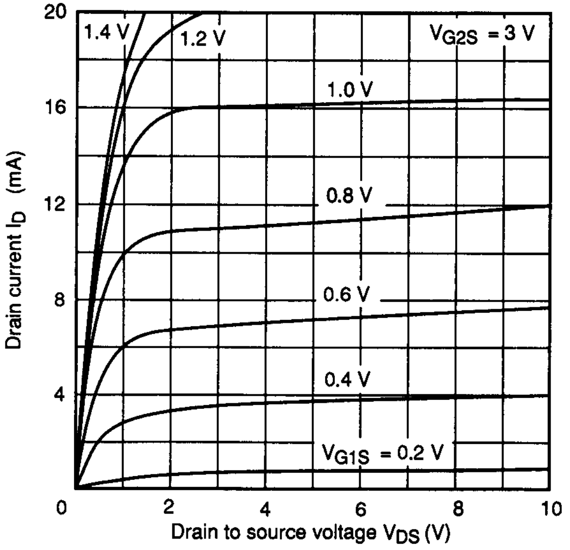


Figure 2 Typical Output Characteristics

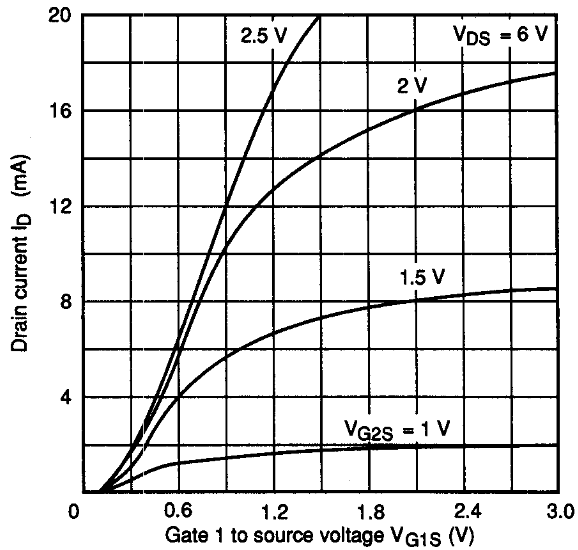


Figure 3 Drain Current vs. Gate1 to Source Voltage

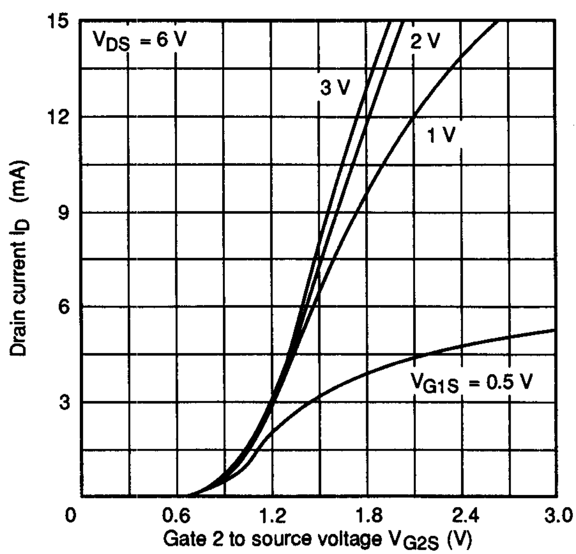


Figure 4 Drain Current vs. Gate2 to Source Voltage

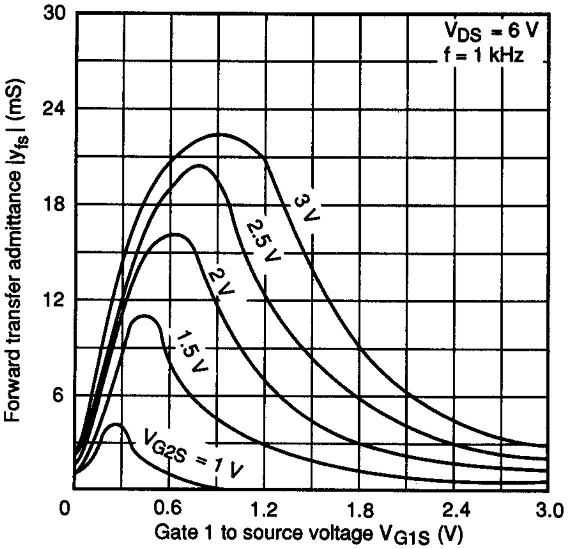


Figure 5 Forward Transfer Admittance vs. Gate1 to Source Voltage

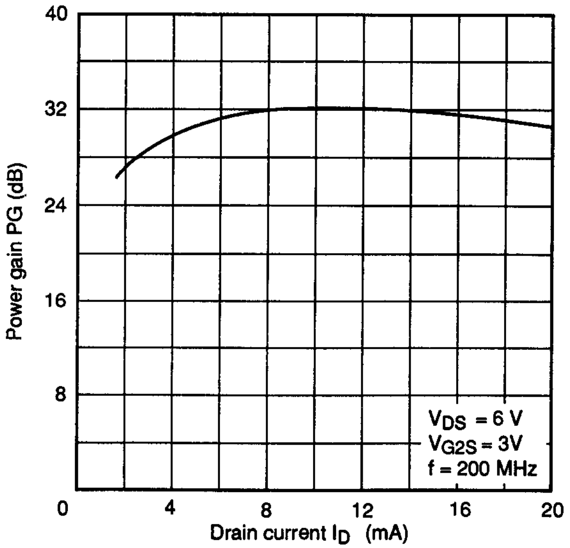


Figure 6 Power Gain vs. Drain Current

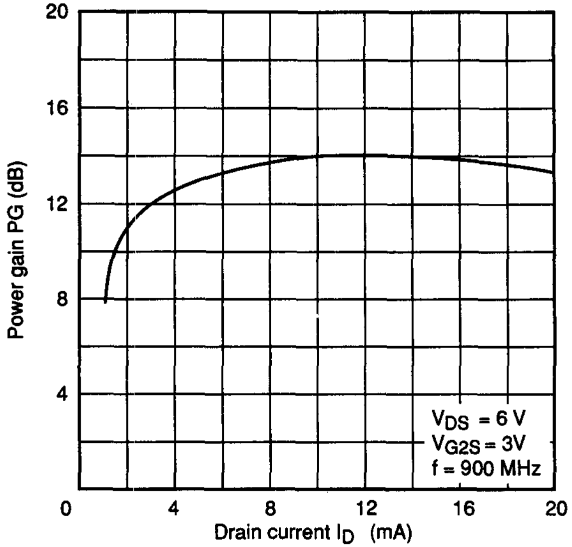


Figure 7 Power Gain vs. Drain Current

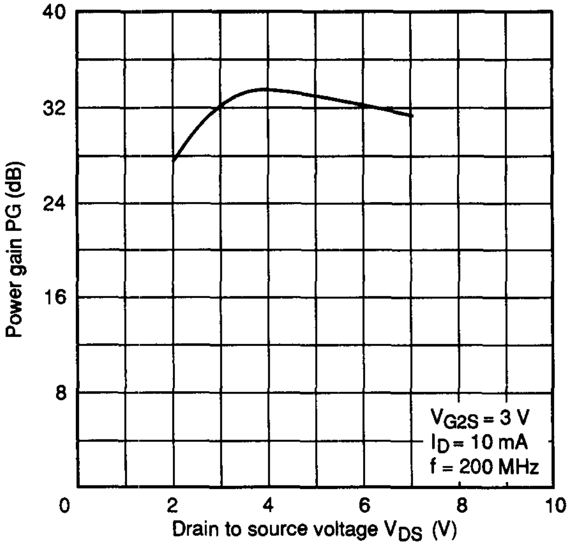


Figure 8 Power Gain vs. Drain to Source Voltage

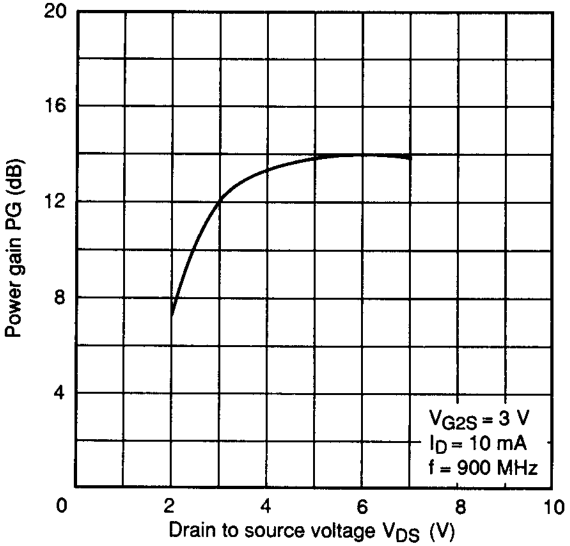


Figure 9 Power Gain vs. Drain to Source Voltage

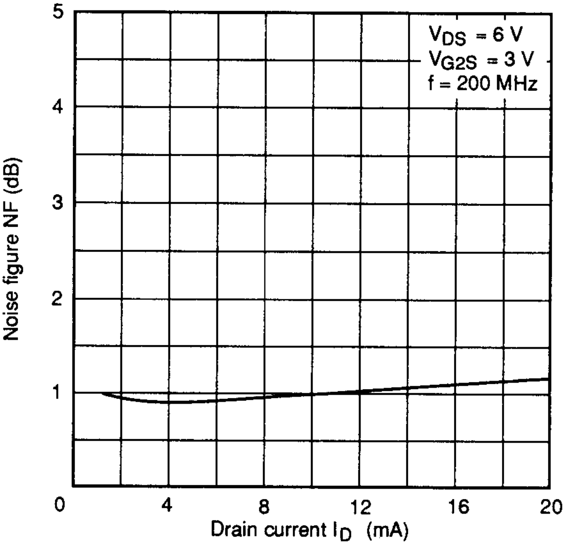


Figure 10 Noise Figure vs. Drain Current

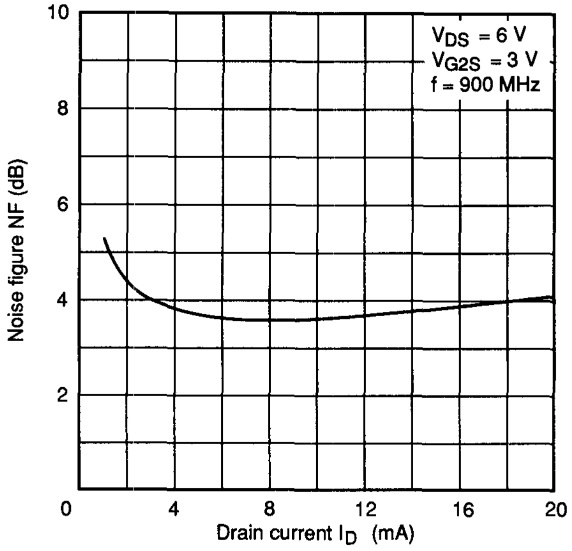


Figure 11 Noise Figure vs. Drain Current

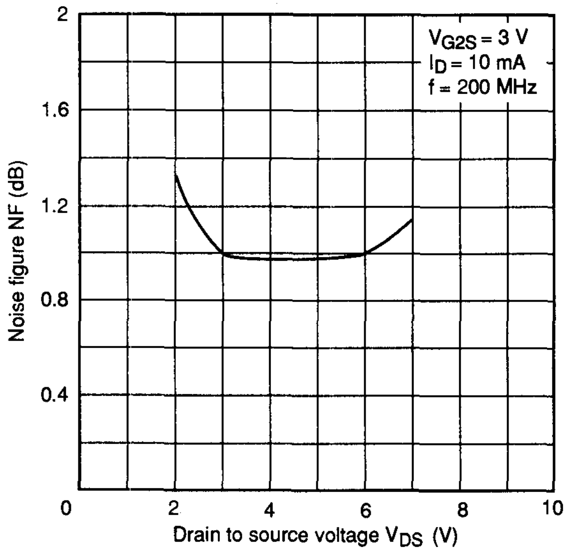


Figure 12 Noise Figure vs. Drain to Source Voltage

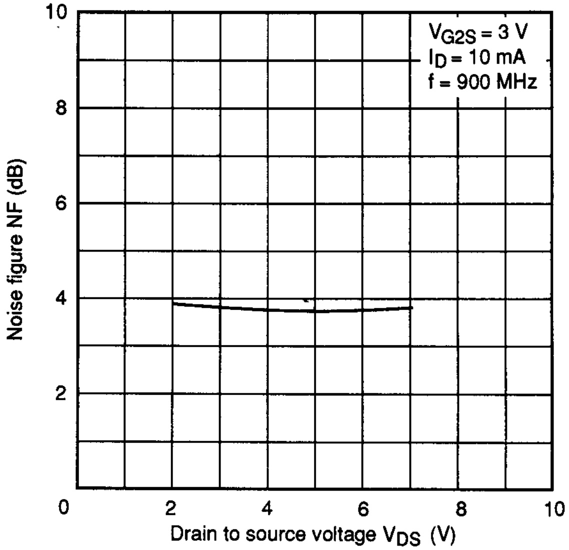


Figure 13 Noise Figure vs. Drain to Source Voltage

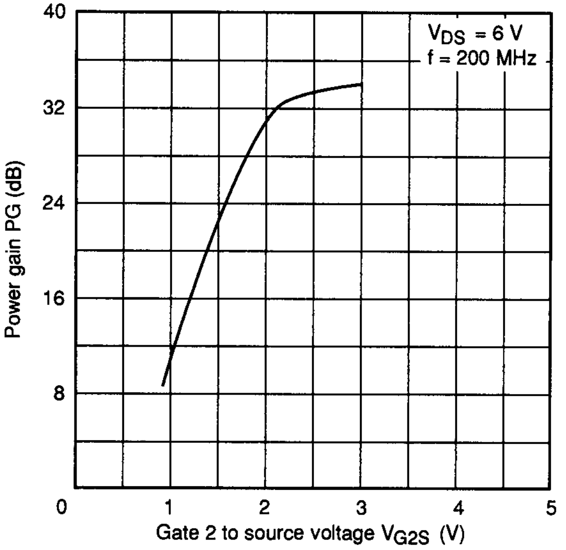


Figure 14 Power Gain vs. Gate2 to Source Voltage

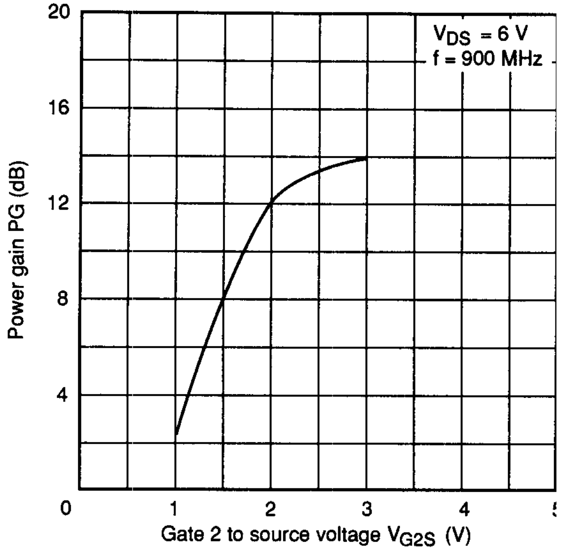


Figure 15 Power Gain vs. Gate2 to Source Voltage

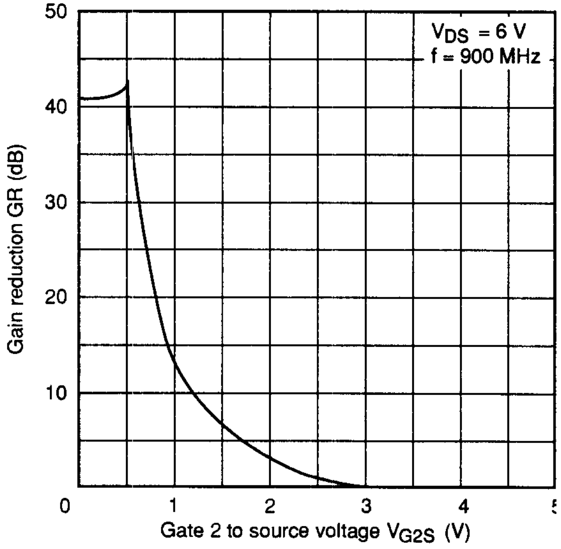


Figure 16 Gain Reduction vs. Gate2 to Source Voltage

3SK197

Silicon N-Channel Dual Gate MOS FET

Application

- VHF RF amplifier
- VHF TV tuner RF amplifier, mixer

Table 1 Ordering Information

Type No.	Package
3SK197	MPAK-4

Features

- Super compact package
- High conversion gain (24 dB typ)

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DS}	12	V
Gate1 to source voltage	V_{G1S}	±10	V
Gate2 to source voltage	V_{G2S}	±10	V
Drain current	I_D	35	mA
Channel dissipation	Pch	150	mW
Channel temperature	Tch	125	°C
Storage temperature	Tstg	–55 to +125	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Drain to source breakdown voltage	$V_{(BR)DSX}$	12	—	—	V	$V_{G1S} = V_{G2S} = -5$ V, $I_D = 200$ μA
Gate1 to source breakdown voltage	$V_{(BR)G1SS}$	±10	—	±20	V	$I_{G1S} = \pm 10$ μA, $V_{G2S} = V_{DS} = 0$
Gate2 to source breakdown voltage	$V_{(BR)G2SS}$	±10	—	±20	V	$I_{G2S} = \pm 10$ μA, $V_{G1S} = V_{DS} = 0$
Gate1 leakage current	I_{G1SS}	—	—	±100	nA	$V_{G1S} = \pm 8$ V, $V_{G2S} = V_{DS} = 0$
Gate2 leakage current	I_{G2SS}	—	—	±100	nA	$V_{G2S} = \pm 8$ V, $V_{G1S} = V_{DS} = 0$
Gate1 to source cutoff voltage	$V_{G1S(off)}$	0	—	−1	V	$V_{DS} = 10$ V, $V_{G2S} = 3$ V, $I_D = 100$ μA
Gate2 to source cutoff voltage	$V_{G2S(off)}$	0	—	−1	V	$V_{DS} = 10$ V, $V_{G1S} = 3$ V, $I_D = 100$ μA
Drain current	I_{DSS}	1	4	10	mA	$V_{DS} = 6$ V, $V_{G2S} = 3$ V, $V_{G1S} = 0$
Forward transfer admittance	$\|y_{fs}\|$	20	27	—	mS	$V_{DS} = 6$ V, $V_{G2S} = 4.5$ V, $I_D = 5$ mA, f = 1 kHz
Input capacitance	Ciss	—	4.3	—	pF	$V_{DS} = 6$ V, $V_{G2S} = 3$ V, $I_D = 10$ mA, f = 1 MHz
Output capacitance	Coss	—	2.2	—	pF	
Reverse transfer capacitance	Crss	—	0.03	—	pF	
Power gain	PG	—	30	—	dB	$V_{DS} = 6$ V, $V_{G2S} = 3$ V, $I_D = 10$ mA, f = 200 MHz
Noise figure	NF	—	1.4	—	dB	
Power gain	PG	—	24.6	—	dB	$V_{DS} = 6$ V, $V_{G2S} = 4.5$ V, $I_D = 2$ mA, f = 200 MHz, fosc = 230 MHz
Noise figure	NF	—	5.5	—	dB	

Note: Mark is "WI–".

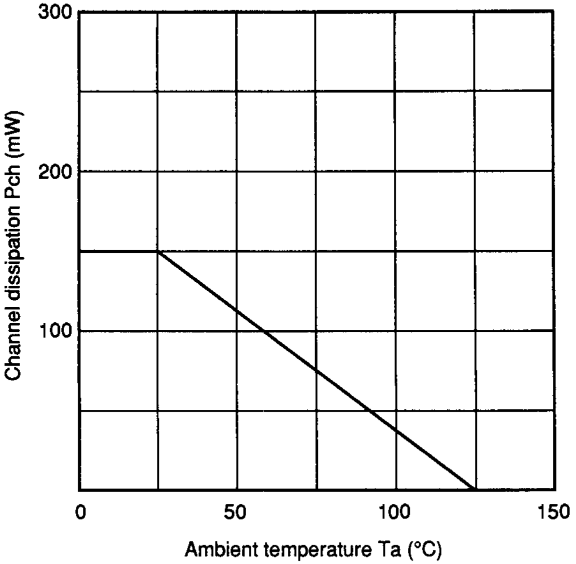


Figure 1 Maximum Channel Dissipation Curve

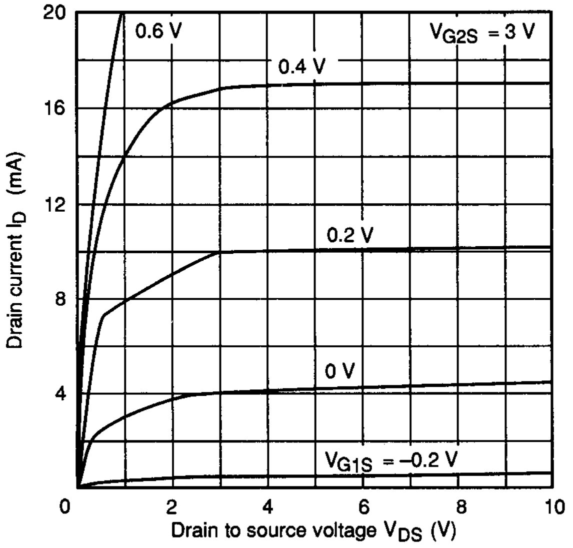


Figure 2 Typical Output Characteristics

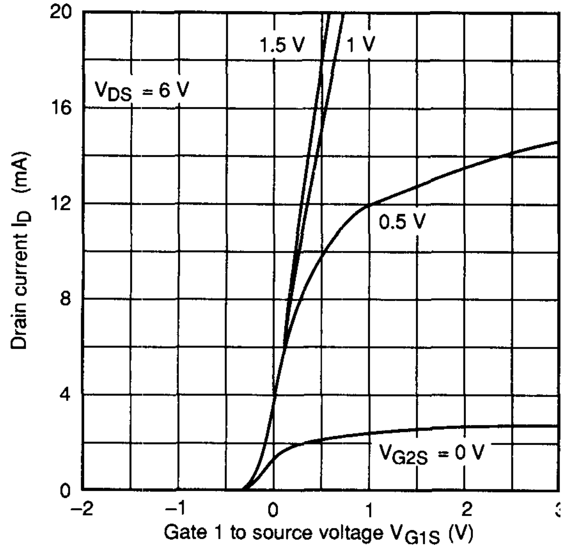


Figure 3 Drain Current vs. Gate1 to Source Voltage

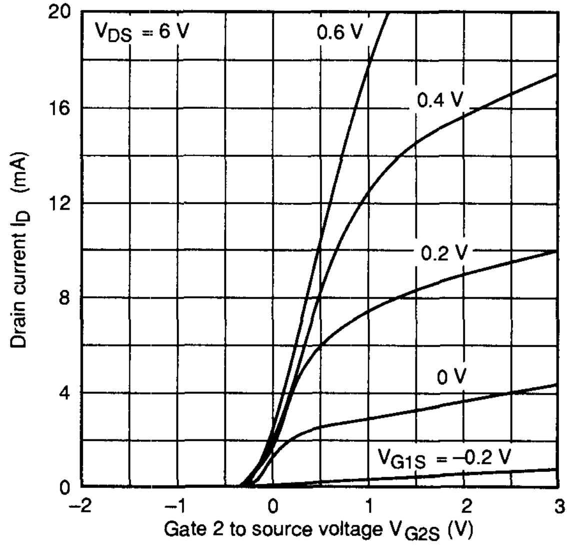


Figure 4 Drain Current vs. Gate2 to Source Voltage

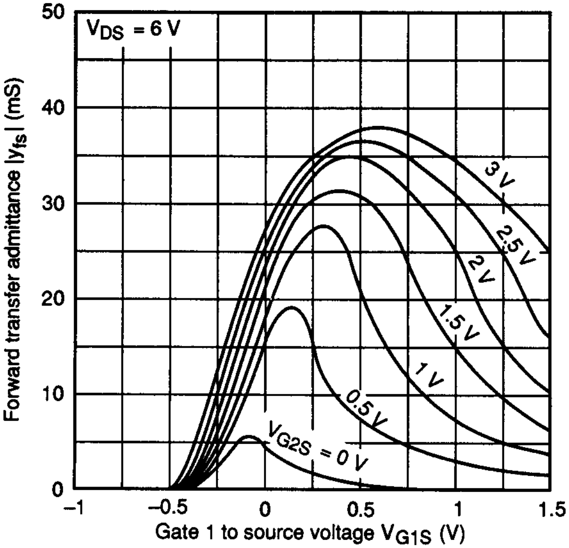


Figure 5 Forward Transfer Admittance vs. Gate1 to Source Voltage

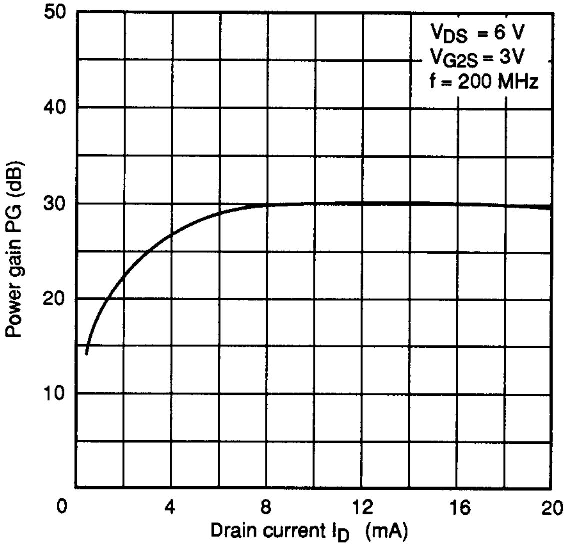


Figure 6 Power Gain vs. Drain Current

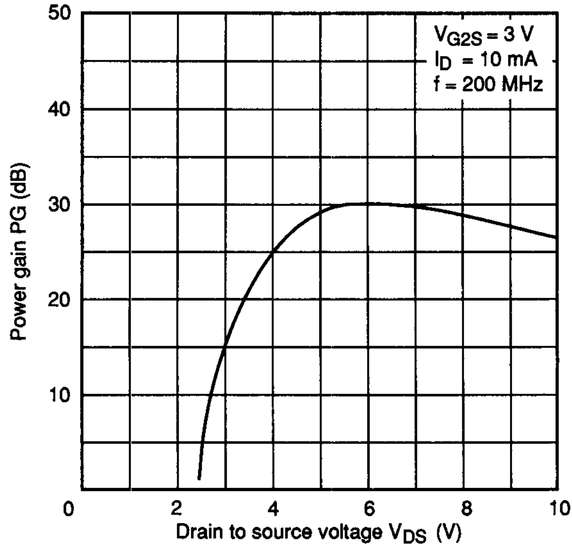


Figure 7 Power Gain vs. Drain to Source Voltage

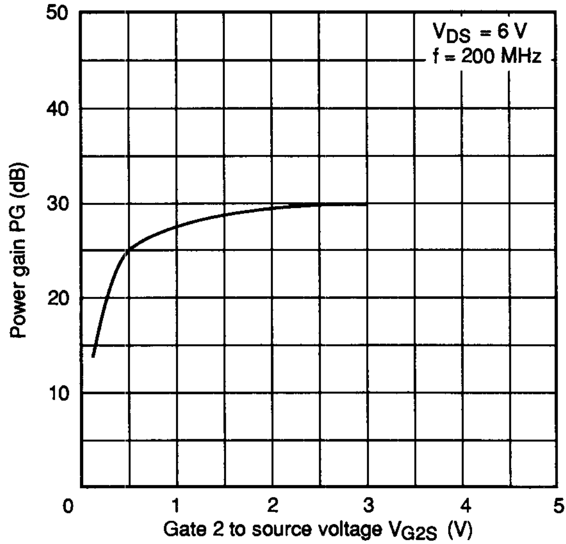


Figure 8 Power Gain vs. Gate2 to Source Voltage

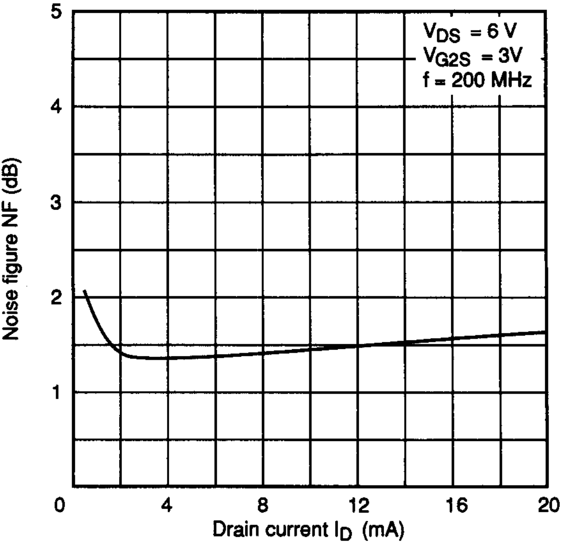


Figure 9 Noise Figure vs. Drain Current

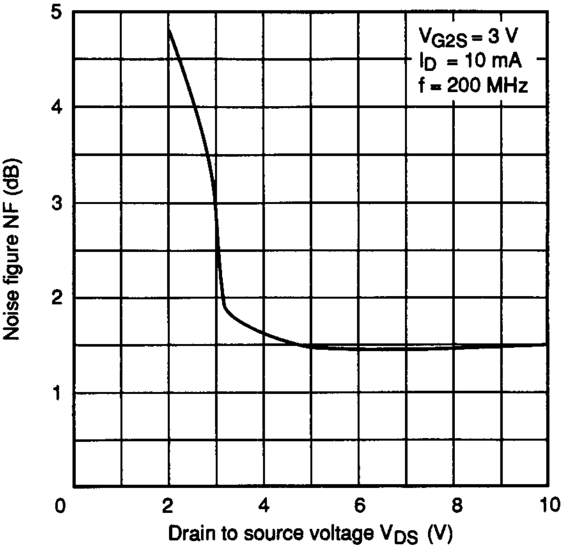


Figure 10 Noise Figure vs. Drain to Source Voltage

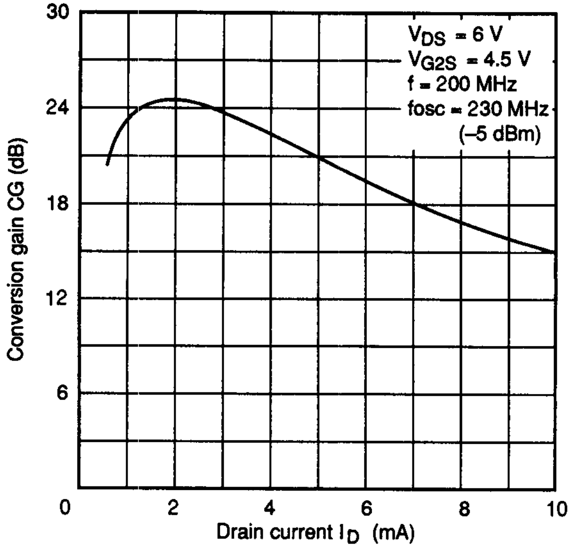


Figure 11 Conversion Gain vs. Drain Current

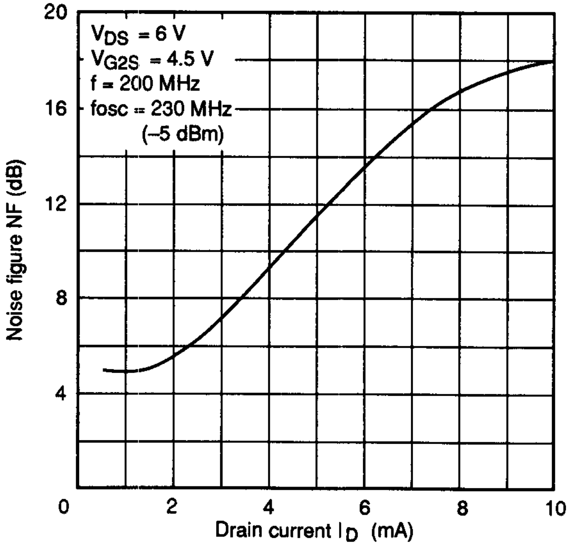


Figure 12 Noise Figure vs. Drain Current

2SK457 Series

N-Channel GaAs Single Gate MES FET

Application

UHF/SHF low noise amplifier

Features

- Low noise, high gain
  NF = 2.1 dB typ, PG = 10 dB typ at 3 GHz

Table 1 Ordering Information

Type No.	Package
2SK457	FPAK
2SK668	MPAK-4

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Ratings	Unit
Drain to source voltage		V_{DS}	6	V
Gate to source voltage		V_{GS}	+0.5, –6.0	V
Drain current		I_D	100	mA
Channel dissipation	2SK457	Pch	200	mW
	2SK668		150	
Channel temperature		Tch	125	°C
Storage temperature		Tstg	–55 to +125	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item		Symbol	Min	Typ	Max	Unit	Test conditions
Drain cutoff current		I_{DSX}	—	—	50	µA	V_{DS} = 6 V, V_{GS} = –4 V
Gate leakage current		I_{GSS}	—	—	10	µA	V_{GS} = –6 V, V_{DS} = 0
Drain current		I_{DSS}	20	—	100	mA	V_{DS} = 5 V, V_{GS} = 0
Gate to source cutoff voltage		$V_{GS(off)}$	—	—	–5	V	V_{DS} = 5 V, I_D = 100 µA
Forward transfer admittance		$\|y_{fs}\|$	15	35	—	mS	V_{DS} = 5 V, I_D = 20 mA, f = 1 kHz
Power gain		PG	—	10	—	dB	V_{DS} = 4 V, I_D = 20 mA, f = 3 GHz
Noise figure	2SK457	NF	—	2.1	—	dB	V_{DS} = 4 V, I_D = 20 mA,
	2SK668			2.5			f = 3 GHz

2SK457 representing the characteristics curves hereafter.

For the detail of characteristics of other parts, please consult our sales office near you.

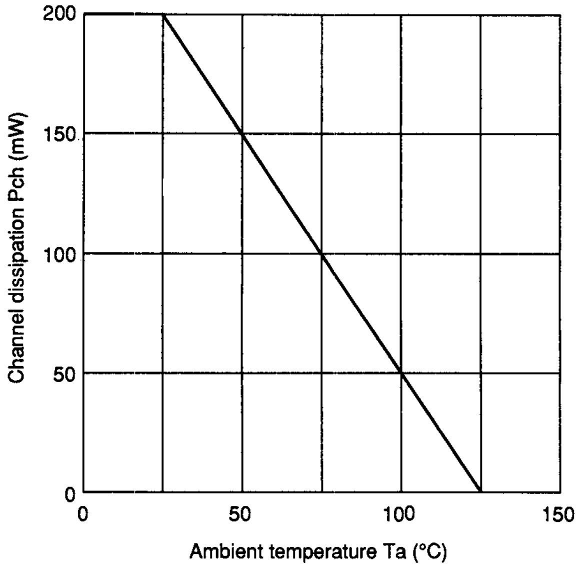


Figure 1 Maximum Channel Dissipation Curve

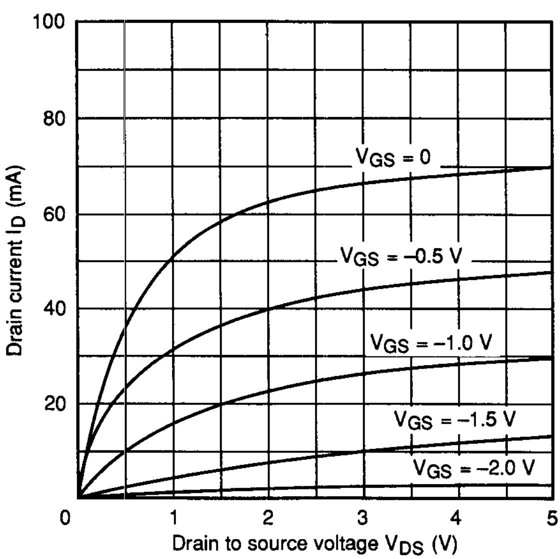


Figure 2 Typical Output Characteristics

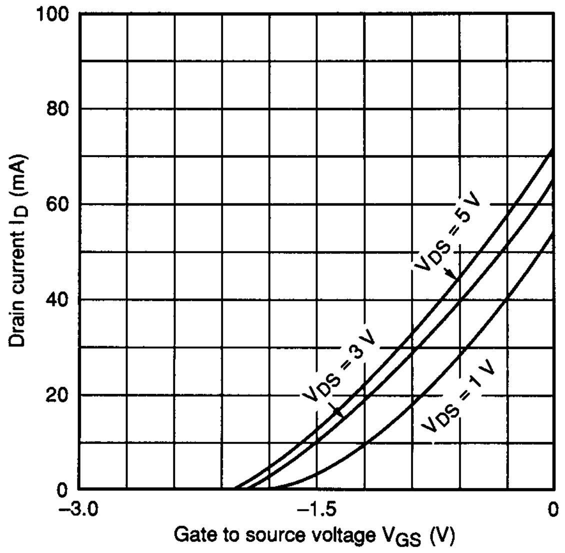


Figure 3 Drain Current vs. Gate to Source Voltage

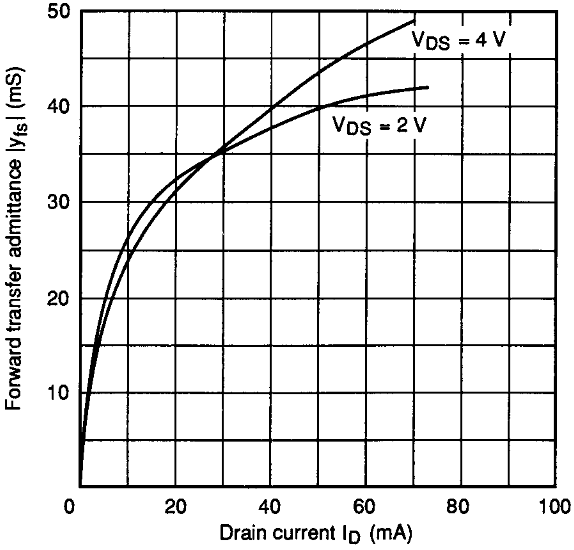


Figure 4 Forward Transfer Admittance vs. Drain Current

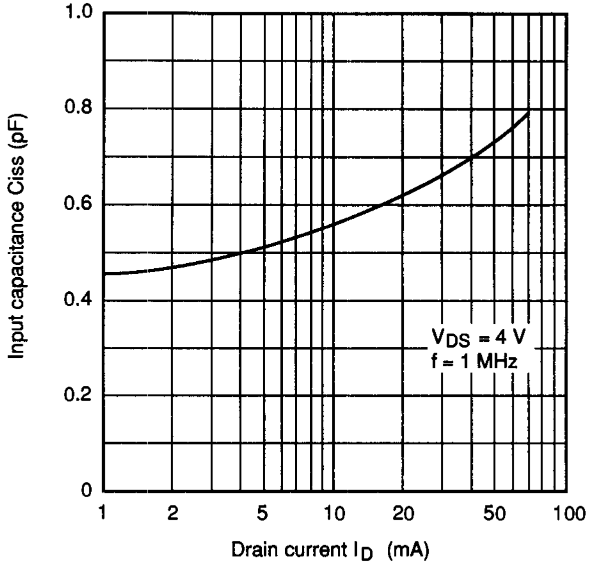


Figure 5 Input Capacitance vs. Drain Current

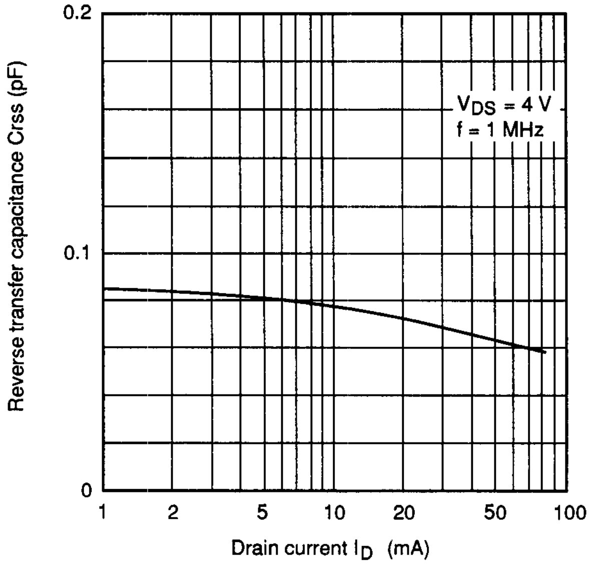


Figure 6 Reverse Transfer Capacitance vs. Drain Current

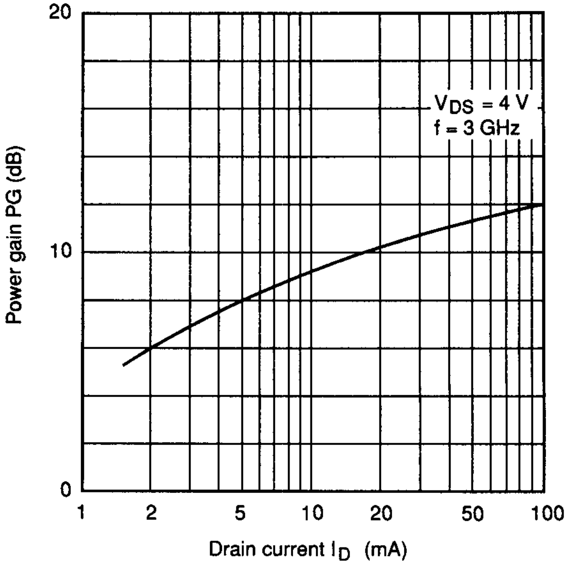


Figure 7 Power Gain vs. Drain Current

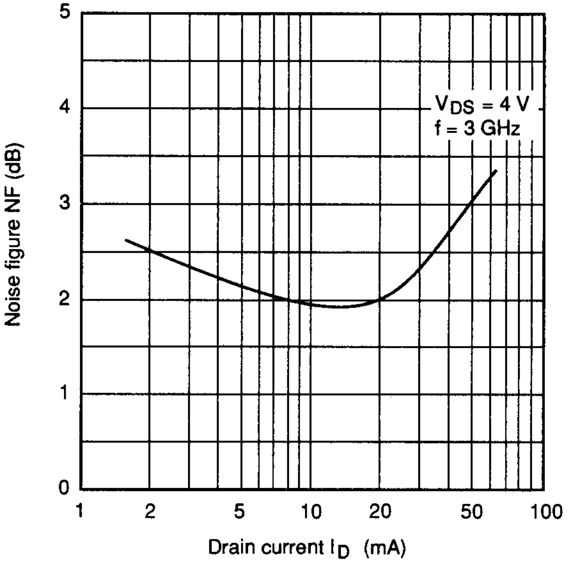


Figure 8 Noise Figure vs. Drain Current

Table 4 S Parameter (2SK457) (V_{DS} = 4 V, I_D = 20 mA)

	S_{11}		S_{21}		S_{12}		S_{22}	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
500	0.9656	–10.9	2.9479	165.8	0.0182	87.2	0.6394	–3.6
1000	0.9097	–21.8	2.8546	151.8	0.0352	85.2	0.6118	–7.7
1500	0.8503	–32.7	2.7889	139.5	0.0501	82.8	0.5879	–12.4
2000	0.7782	–44.8	2.6831	128.0	0.0633	81.1	0.5682	–15.1
2500	0.6904	–53.0	2.5648	115.2	0.0763	81.4	0.5562	–16.2
3000	0.5994	–59.7	2.4482	103.2	0.0897	83.6	0.5441	–18.2
3500	0.4919	–72.8	2.3873	91.8	0.1080	82.6	0.5105	–16.9
4000	0.3836	–94.1	2.3424	82.0	0.1282	82.1	0.4410	–16.1

2SK666 Series — Preliminary

Single Gate GaAs MES FET

Application

RF wide band low noise amplifier

Table 1 Ordering Information

Type No.	Package
2SK666	FPAK
2SK1092	MPAK-4

Features

- Wide band amplifier (f = 50 to 1000 MHz)
- Low noise
  NF = 2.5 dB typ (f = 50 to 1000 MHz)
- Low I. M. D.

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Ratings	Unit
Drain to source voltage		V_{DS}	4	V
Gate to source voltage		V_{GS}	–3	V
Drain current		I_D	150	mA
Channel Dissipation	2SK666	Pch	200	mW
	2SK1092		150	
Channel temperature		Tch	125	°C
Storage temperature		Tstg	–55 to +125	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Drain cutoff current	I_{DSX}	—	—	200	µA	V_{DS} = 4 V, V_{GS} = –2 V
Gate leakage current	I_{GSS}	—	—	–100	µA	V_{GS} = –3 V, V_{DS} = 0
Gate to drain leakage current	I_{GDO}	—	—	–100	µA	V_{GD} = –7 V, V_{GS} = Open
Drain current	I_{DSS}	20	—	80	mA	V_{DS} = 3 V, V_{GS} = 0, Pulse test
Forward transfer admittance	$\|y_{fs}\|$	50	82	—	mS	V_{DS} = 3 V, I_D = 20 mA, f = 1 kHz

Electrical Characteristics (Ta = 25°C) (cont)

Item		Symbol	Min	Typ	Max	Unit	Test conditions
Power gain	2SK666	PG	8	12.5	—	dB	V_{DS} = 3 V, I_D = 20 mA,
	2SK1092		8	10	—		f = 50 MHz
Noise figure	2SK666	NF	—	2.8	3.5	dB	
	2SK1092		—	2.5	3.5		
Power gain		PG	6.5	8.0	—	dB	V_{DS} = 3 V, I_D = 20 mA,
Noise figure	2SK666	NF	—	2.7	3.5	dB	f = 900 MHz
	2SK1092		—	2.5	3.5		

2SK666 representing the characteristics curves hereafter. For the detail of characteristics of other parts, please consult our sales office near you.

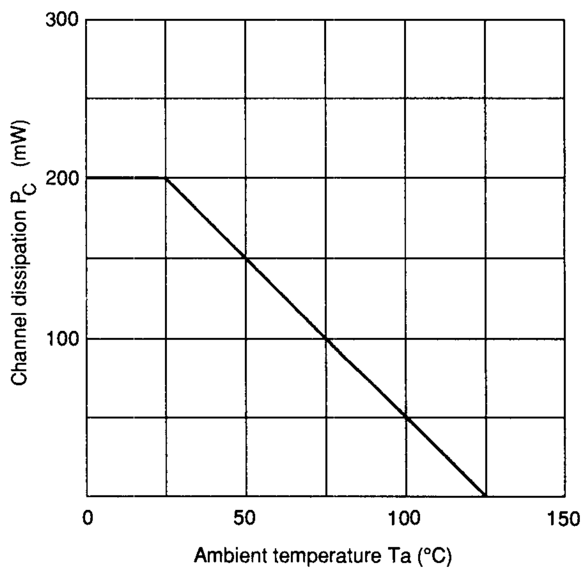


Figure 1 Maximum Channel Dissipation Curve

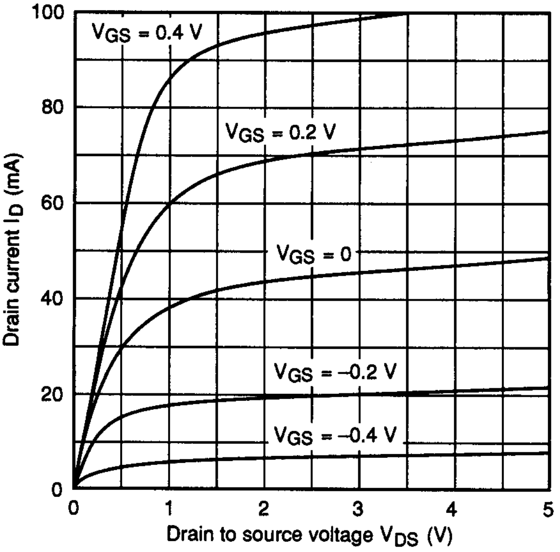


Figure 2 Typical Output Characteristics

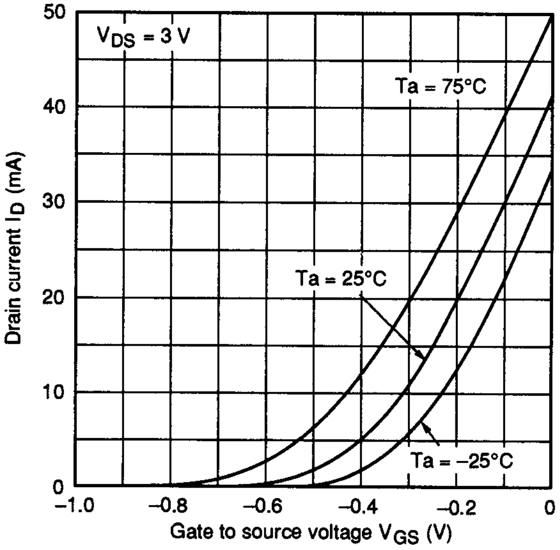


Figure 3 Drain Current vs. Gate to Source Voltage

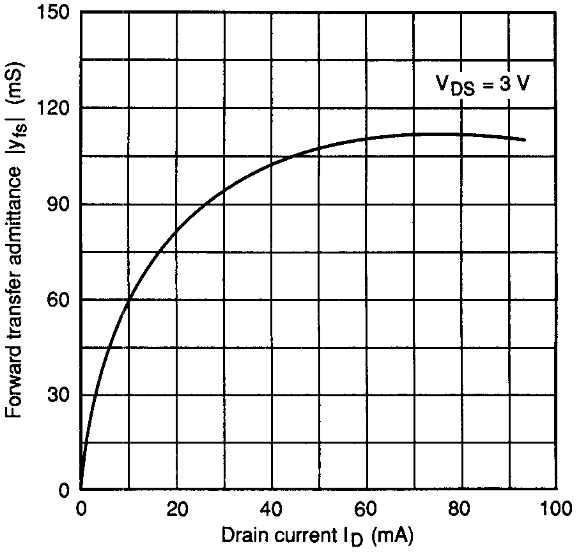


Figure 4 Forward Transfer Admittance vs. Drain Current

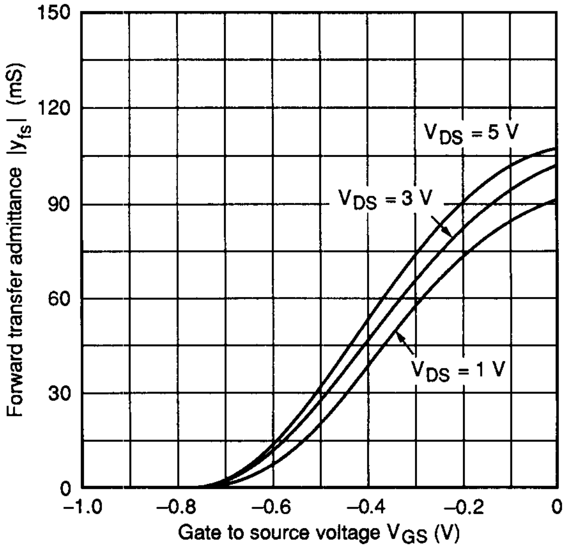


Figure 5 Forward Transfer Admittance vs. Gate to Source Voltage

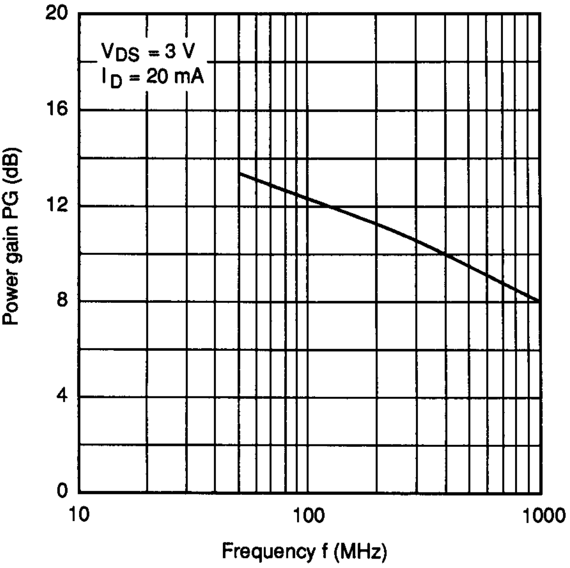


Figure 6 Power Gain vs. Frequency

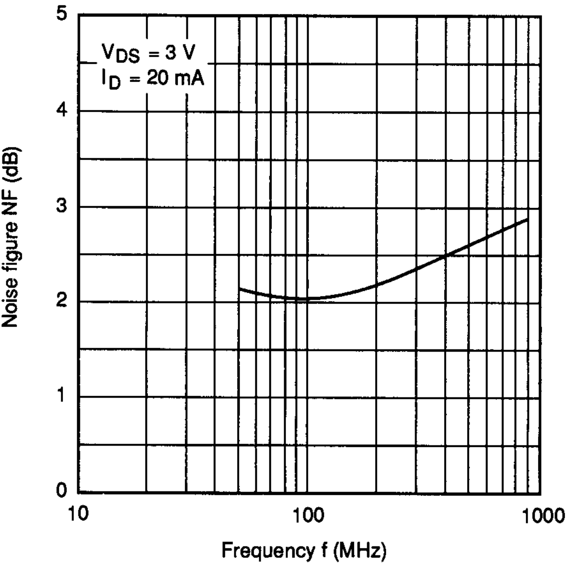


Figure 7 Noise Figure vs. Frequency

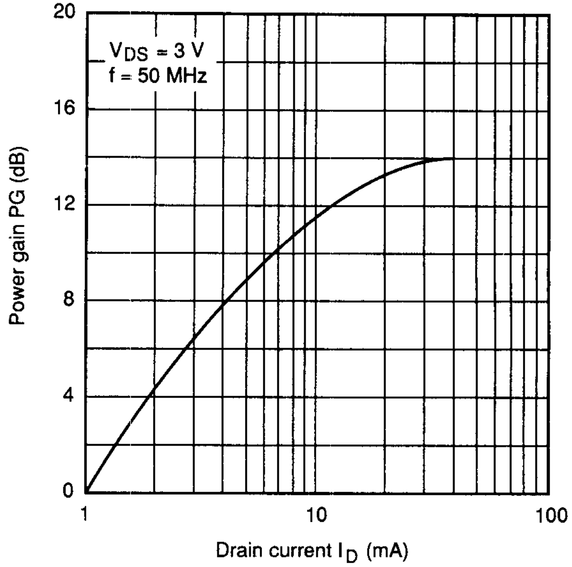


Figure 8 Power Gain vs. Drain Current

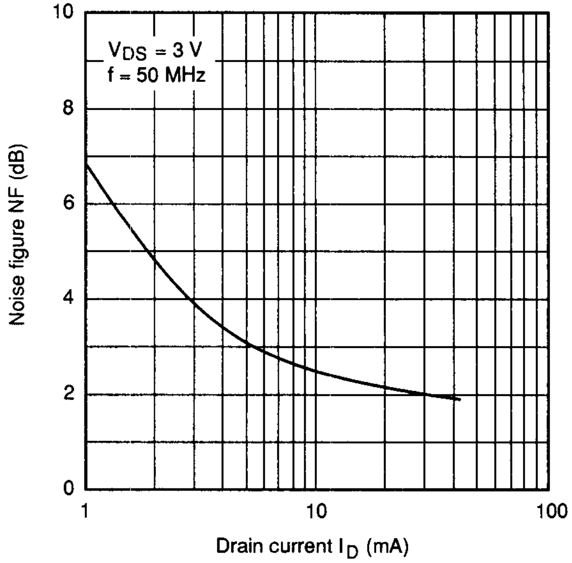


Figure 9 Noise Figure vs. Drain Current

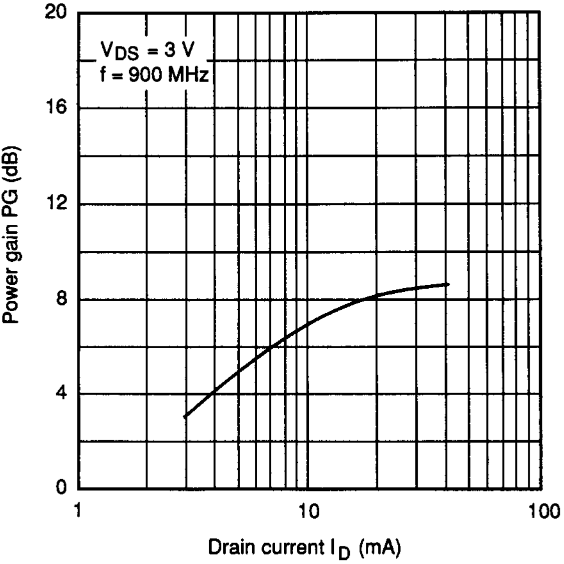


Figure 10 Power Gain vs. Drain Current

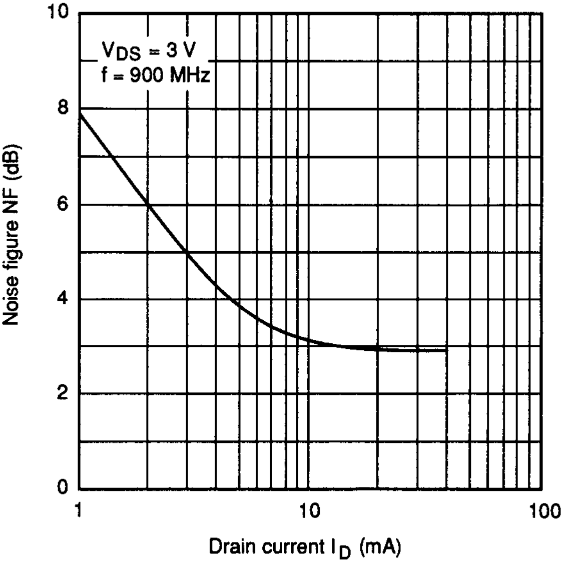


Figure 11 Noise Figure vs. Drain Current

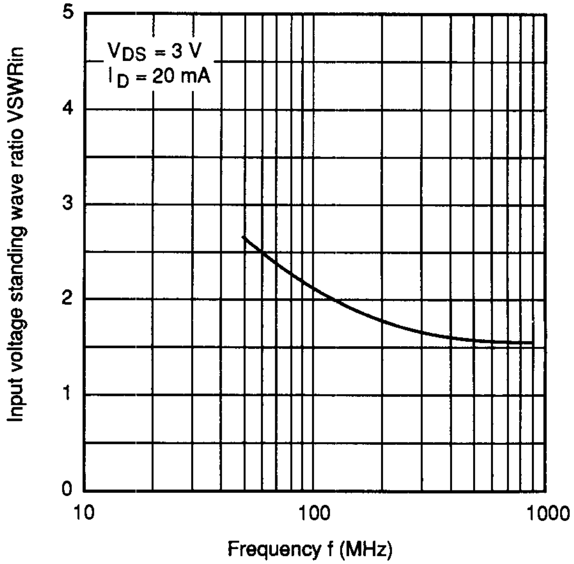


Figure 12 Input Voltage Standing Wave Ratio vs. Frequency

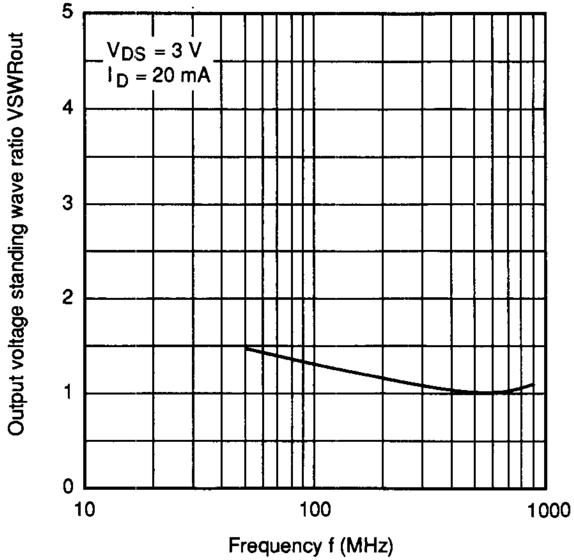


Figure 13 Output Voltage Standing Wave Ratio vs. Frequency

Table 4 S Parameter 2SK666 (V_{DS} = 3 V, I_D = 20 mA, Ta = 25°C)

	S_{11}		S_{21}		S_{12}		S_{22}	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
50	0.454	–30.7	5.07	164.7	0.063	9.6	0.198	–43.4
100	0.352	–42.6	4.26	160.5	0.101	11.9	0.135	–53.7
150	0.323	–49.3	3.95	158.1	0.113	9.4	0.106	–61.9
200	0.294	–57.0	3.72	156.9	0.124	11.5	0.091	–72.7
250	0.282	–63.9	3.62	153.8	0.128	8.8	0.073	–79.1
300	0.267	–73.1	2.49	150.9	0.136	6.9	0.057	–87.4
350	0.264	–78.5	3.33	147.9	0.138	7.0	0.047	–90.2
400	0.246	–83.9	3.26	145.6	0.140	6.4	0.026	–90.0
450	0.248	–88.0	3.15	141.0	0.140	7.0	0.014	–73.4
500	0.240	–93.8	3.04	137.7	0.144	6.1	0.016	–50.4
550	0.236	–97.5	3.01	135.5	0.145	6.2	0.006	–23.6
600	0.241	–100.3	2.94	134.9	0.145	5.8	0.011	–22.3
650	0.237	–106.4	2.87	132.2	0.145	3.8	0.008	20.0
700	0.236	–114.7	2.80	129.7	0.146	4.6	0.023	61.1
750	0.236	–118.9	2.73	127.7	0.145	6.0	0.035	57.2
800	0.230	–123.2	2.71	125.5	0.149	5.3	0.042	55.6
850	0.229	–127.5	2.65	121.1	0.149	5.1	0.048	57.0
900	0.230	–132.5	2.59	118.9	0.146	4.1	0.052	60.3
950	0.227	–135.4	2.55	116.3	0.149	3.3	0.056	62.5
1000	0.239	–139.6	2.50	115.5	0.146	5.4	0.059	55.4
1050	0.236	–144.3	2.46	114.0	0.145	6.0	0.063	49.7
1100	0.236	–148.3	2.42	112.0	0.149	7.7	0.070	51.9
1150	0.242	–152.4	2.37	110.2	0.147	7.1	0.078	43.9
1200	0.240	–154.3	2.33	107.6	0.146	6.7	0.080	43.5
1250	0.247	–158.2	2.29	103.7	0.147	8.4	0.085	37.1
1300	0.251	–160.8	2.26	101.0	0.147	6.7	0.079	36.9

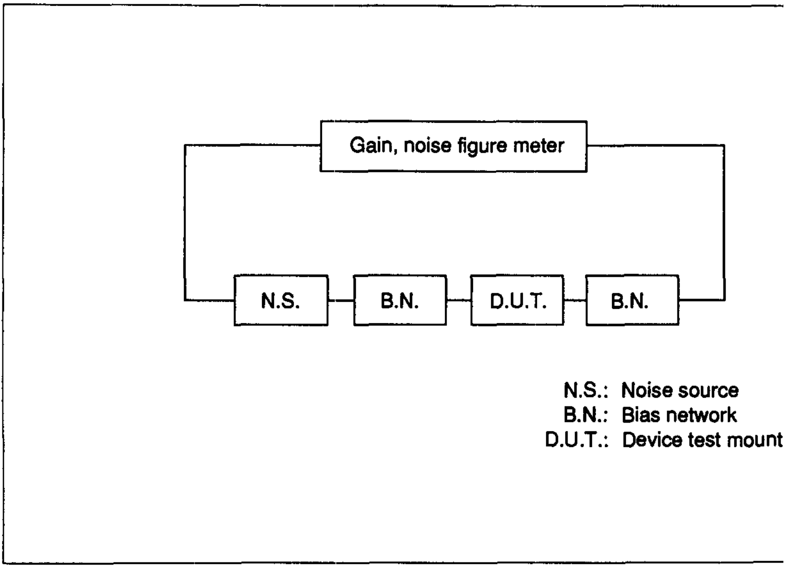


Figure 14 Power Gain, Noise Figure Test Block Diagram

2SK779 — Preliminary

GaAs N-Channel MES FET

Application

SHF converter RF amplifier

Features

- Excellent low noise characteristics
  NF = 1.3 dB typ (f = 12 GHz)
- High associated gain
  Ga = 11 dB typ (f = 12 GHz)

Table 1 Ordering Information

Type No.	Package
2SK779	Ceramic

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DSX}	5	V
Gate to source voltage	V_{GSO}	–6	V
Gate to drain voltage	V_{GDO}	–6	V
Drain current	I_D	100	mA
Channel dissipation	Pch	200	mW
Channel temperature	Tch	125	°C
Storage temperature	Tstg	–55 to +125	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Gate to source leakage current	I_{GSS}	—	—	–10	μA	V_{GS} = –6 V, V_{DS} = 0
Drain current	I_{DSS}	15	—	100	mA	V_{DS} = 3 V, V_{GS} = 0 (pulse test)
Gate to source cutoff voltage	$V_{GS(off)}$	–0.5	—	–3.5	V	V_{DS} = 3 V, I_D = 100 μA
Forward transfer admittance	$\|y_{fs}\|$	30	50	—	mS	V_{DS} = 3 V, I_D = 10 mA, f = 1 kHz
Minimum noise figure	NF	—	1.3	1.6	dB	V_{DS} = 3 V, I_D = 10 mA
Associated gain	Ga	8	11	—	dB	f = 12 GHz (at NF min)
Maximum frequency of oscillation	fmax	—	90	—	GHz	V_{DS} = 3 V, ID = 30 mA

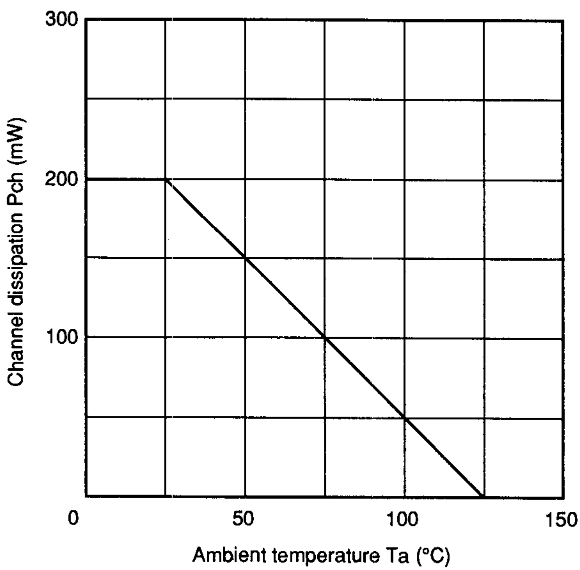


Figure 1 Maximum Channel Dissipation Curve

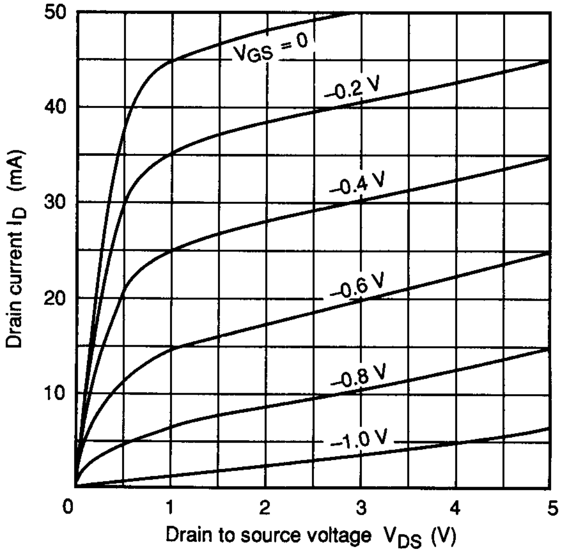


Figure 2 Typical Output Characteristics

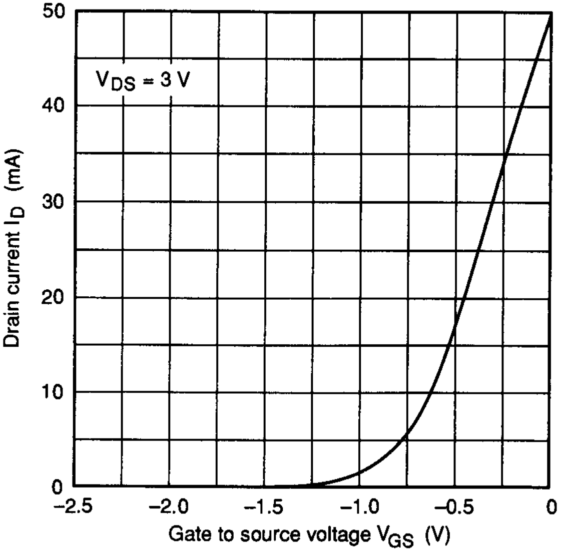


Figure 3 Drain Current vs. Gate to Source Voltage

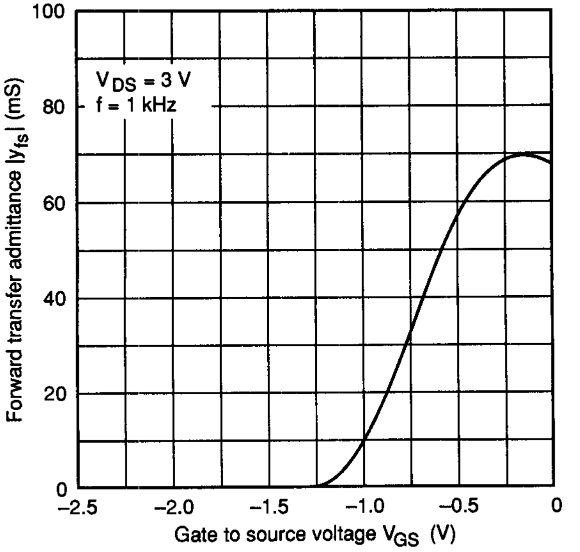


Figure 4 Forward Transfer Admittance vs. Gate to Source Voltage

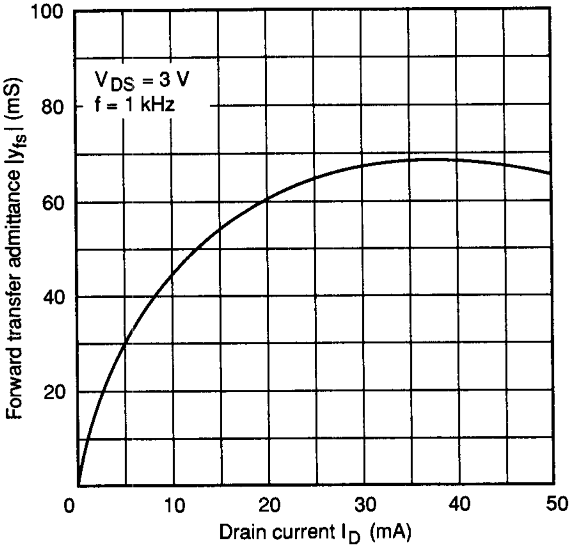


Figure 5 Forward Transfer Admittance vs. Drain Current

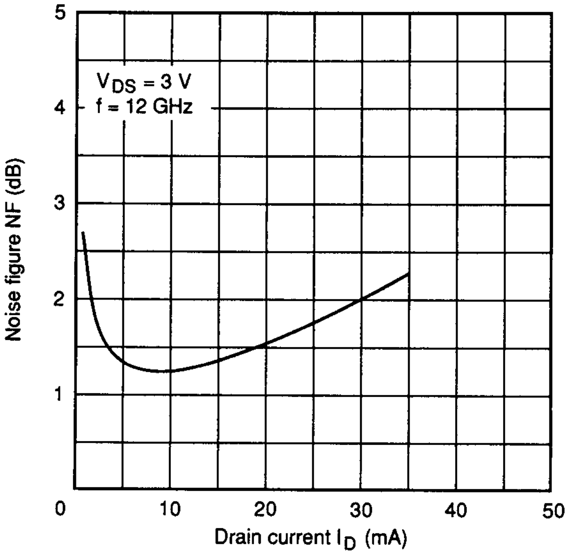


Figure 6 Noise Figure vs. Drain Current

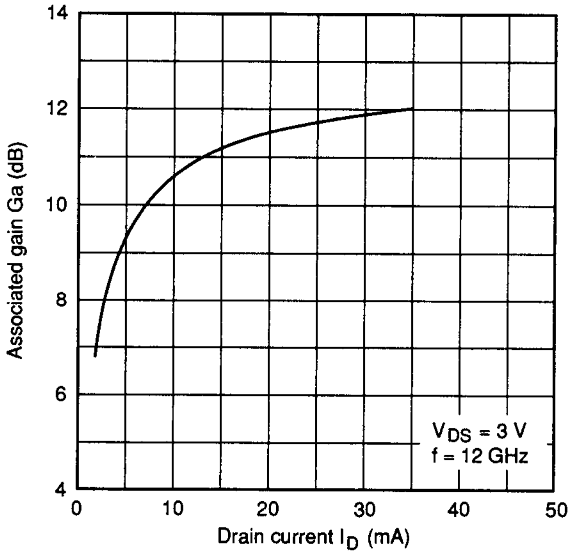


Figure 7 Associated Gain vs. Drain Current

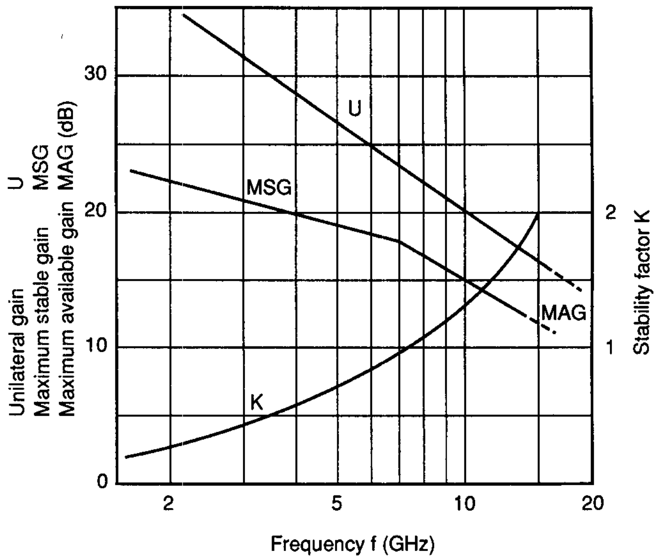


Figure 8 U, MSG, MAG, K vs. Frequency

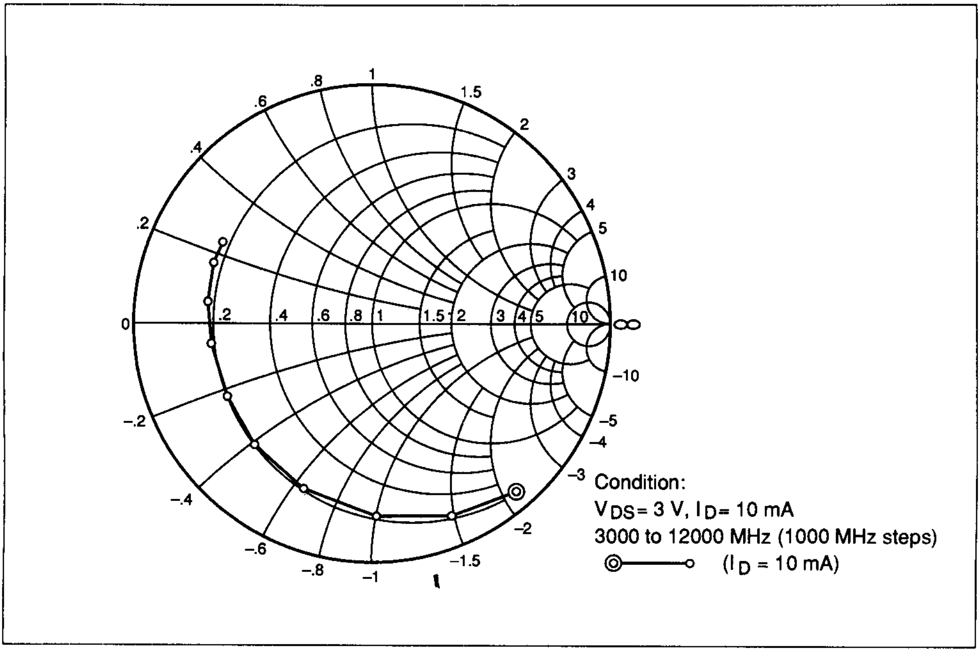


Figure 9 S_{11} Parameter vs. Frequency

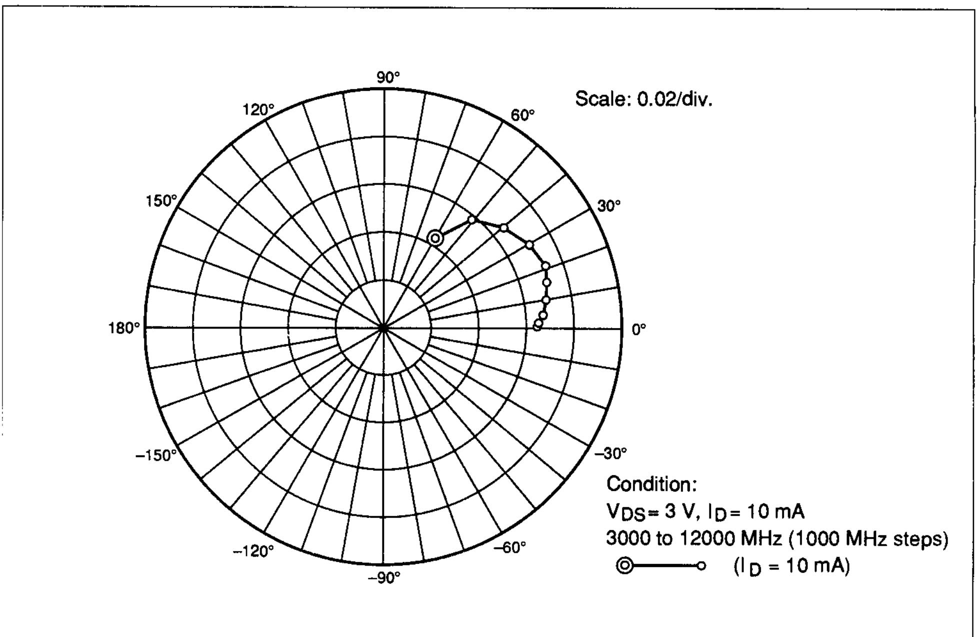


Figure 10 S_{12} Parameter vs. Frequency

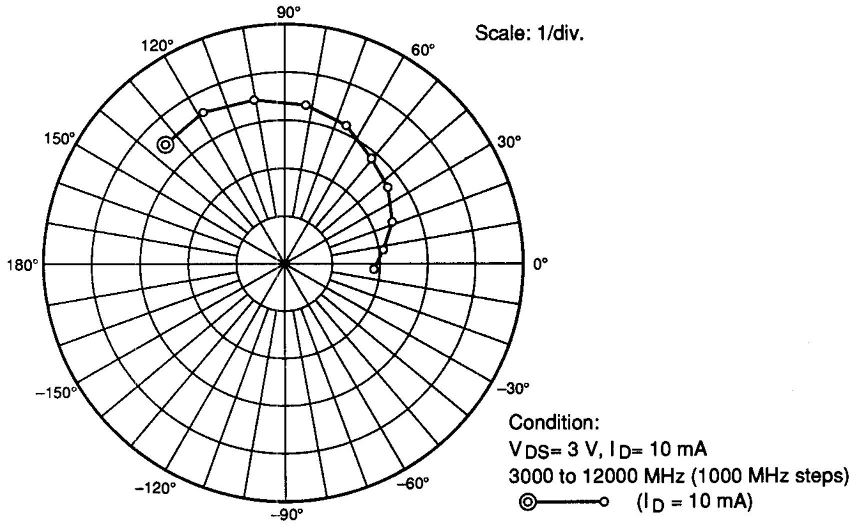


Figure 11 S_{21} Parameter vs. Frequency

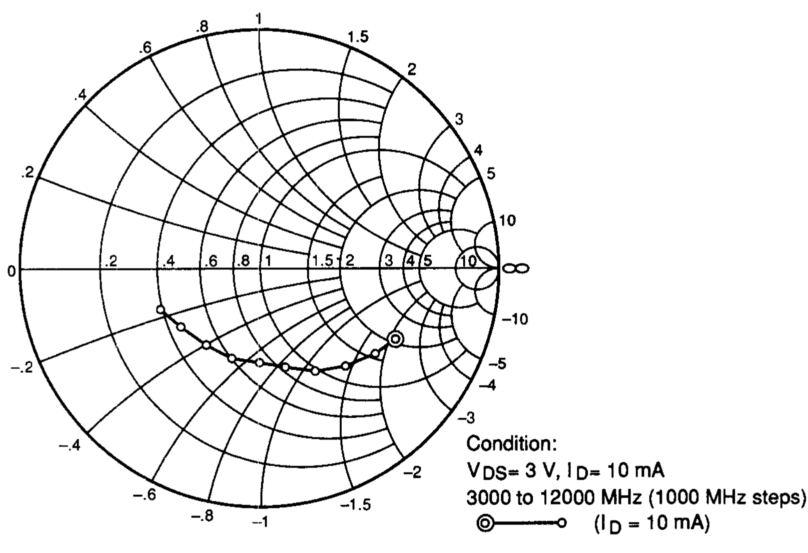


Figure 12 S_{22} Parameter vs. Frequency

Table 4 S-Parameter (Ta = 25°C, V_{DS} = 3 V, I_D = 10 mA)

	S_{11}		S_{21}		S_{12}		S_{22}	
f (GHz)	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
3	0.930	–48.1	3.539	134.7	0.044	61.5	0.637	–26.7
4	0.869	–67.1	3.584	118.1	0.057	51.0	0.593	–37.1
5	0.808	–89.1	3.504	100.7	0.065	40.0	0.541	–49.6
6	0.745	–112.2	3.346	83.0	0.071	29.7	0.490	–62.4
7	0.709	–134.1	3.135	66.6	0.073	21.3	0.437	–76.0
8	0.685	–154.7	2.868	50.9	0.072	15.2	0.402	–92.1
9	0.687	–172.1	2.610	36.4	0.070	9.8	0.394	–109.2
10	0.695	172.8	2.358	21.6	0.068	5.2	0.393	–125.7
11	0.712	160.0	2.105	8.6	0.066	2.4	0.412	–143.5
12	0.715	151.1	1.880	–3.5	0.065	1.0	0.453	–157.4

2SK1615

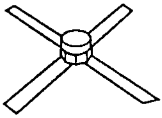
GaAs 2 DEG FET

Application

SHF low noise amplifier

Features

- HEMT structure
- Excellent low noise characteristics
  NF=0.8dB typ (f=12GHz)
- High associated gain
  Ga=11dB typ (f=12GHz)



CERAMICS

SCALE : 2/1

Table 1 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DS}	3.5	V
Gate to source voltage	V_{GSO}	–3	V
Gate to drain voltage	V_{GDO}	–3	V
Drain current	I_D	60	mA
Channel dissipation	Pch	160	mW
Channel temperature	Tch	125	°C
Storage temperature	Tstg	–55 to +125	°C

Table 2 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Gate to source leakage current	I_{GSS}	—	—	-10	μA	V_{DS} = 0V, V_{GS} = -3V
Drain Current	I_{DSS}	12	—	60	mA	V_{DS} = 2V, V_{GS} = 0 (Pulse Test)
Gate to source cutoff voltage	$V_{GS(off)}$	-0.3	—	-2.5	V	V_{DS} = 2 V, I_D = 100μA
Forward transfer admittance	$\|y_{fs}\|$	30	50	—	mS	V_{DS} = 2 V, I_D = 10mA f=1kHz
Minimum noise figure	NF	—	0.8	1.1	dB	V_{DS} = 2 V, I_D = 10mA
Associated gain	Ga	9.5	11	—	dB	f=12GHz

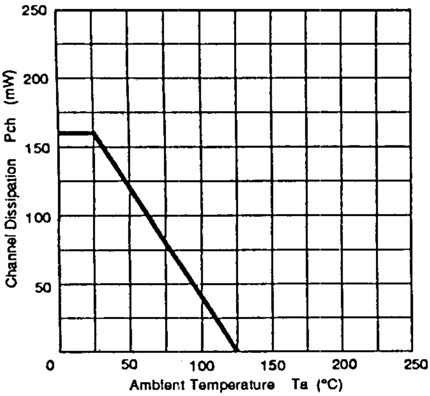


Figure 1 Maximum Channel Dissipation

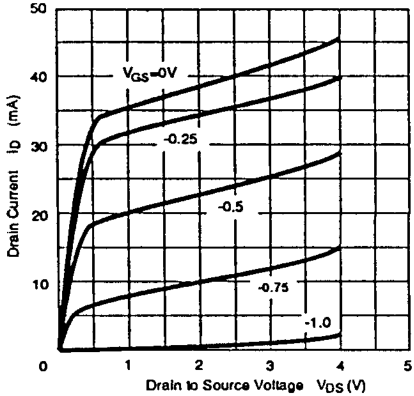


Figure 2 Typical Output Characteristics

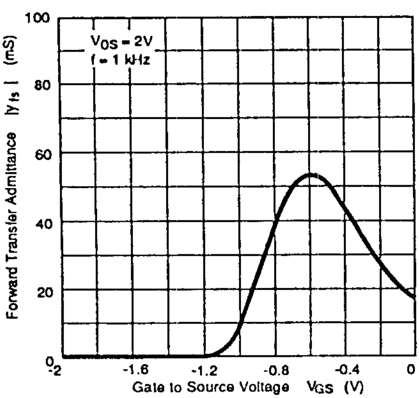


Figure 3 Forward Transfer Admittance vs.Gate to Source Voltage

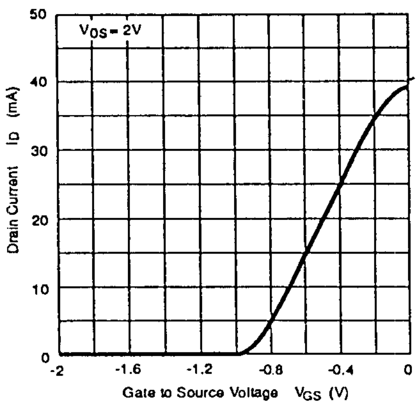


Figure 4 Drain Current vs.Gate to Source Voltage

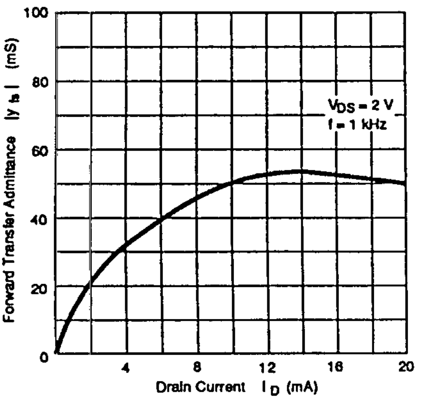


Figure 5 Forward Transfer Admittance vs. Drain Current

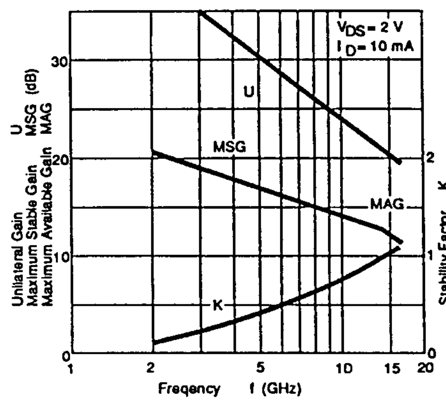


Figure 6 U,MSG,MAG,K vs. f

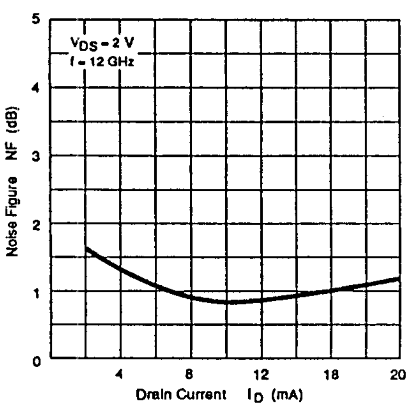


Figure 7 Noise Figure vs. Drain Current

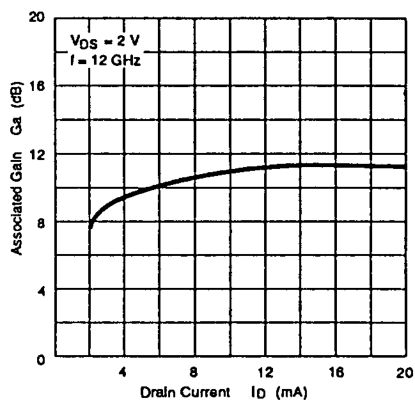


Figure 8 Associated Gain vs.Drain Current

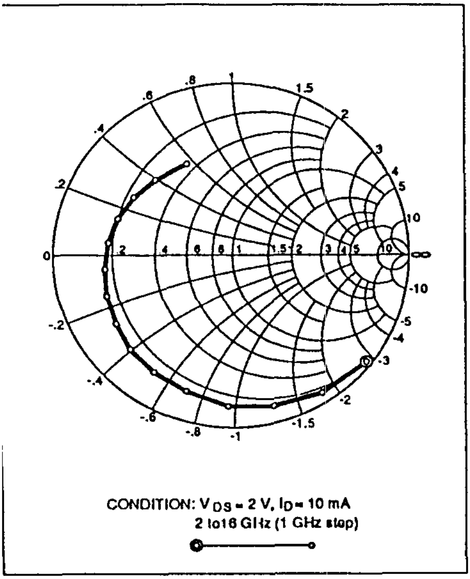


Figure 9 S_{11} Parameter vs.Frequency

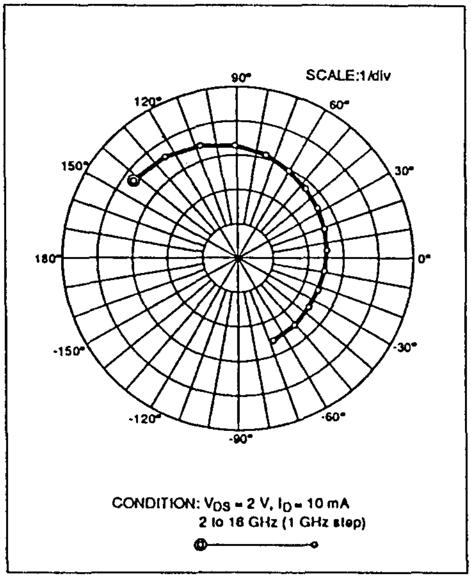


Figure 10 S_{21} Parameter vs. Frequency

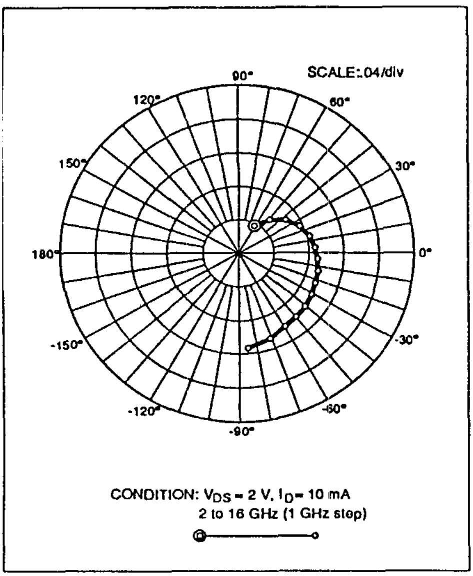


Figure 11 S_{12} Parameter vs. Frequency

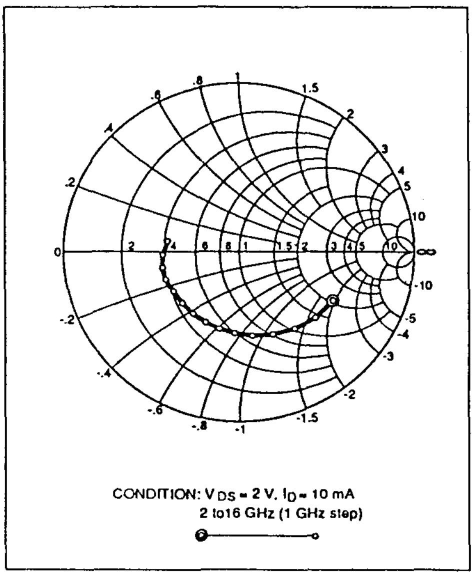


Figure 12 S_{22} Parameter vs. Frequncy

Table 3 S Parameter (Ta = 25°C, V_{DS} = 2 V, I_D = 10 mA)

	S11		S21		S12		S22	
f (GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2	0.972	–39.4	3.719	142.6	0.037	61.7	0.607	–28.4
3	0.942	–57.9	3.597	124.7	0.053	48.8	0.584	–41.8
4	0.902	–75.6	3.439	107.7	0.066	36.6	0.553	–55.0
5	0.876	–92.2	3.290	91.1	0.076	24.9	0.525	–68.5
6	0.831	–108.6	3.122	74.8	0.083	13.9	0.501	–81.5
7	0.806	–123.2	2.947	60.2	0.087	4.2	0.481	–93.3
8	0.787	–136.5	2.791	46.5	0.090	–4.7	0.468	–104.2
9	0.759	–148.5	2.685	32.9	0.093	–13.4	0.458	–115.0
10	0.734	–161.2	2.596	19.0	0.094	–22.4	0.450	–126.1
11	0.711	–173.4	2.532	5.1	0.096	–31.2	0.445	–137.1
12	0.692	174.0	2.478	–8.9	0.098	–40.4	0.443	–148.1
13	0.670	161.5	2.450	–22.6	0.099	–49.6	0.449	–158.5
14	0.643	148.4	2.447	–35.8	0.101	–59.2	0.446	–167.8
15	0.613	134.3	2.503	–50.8	0.107	–71.1	0.435	–177.6
16	0.586	115.4	2.584	–67.6	0.113	–85.1	0.412	171.2

Table 4 Optimum Source Impedance (G_{Fmin}) vs. Frequency

f (GHz)	NF (dB)	$\|G_{Fmin}\|$	G_{Fmin} (deg.)	Rn (ohm)	Ga (dB)
8	0.58	0.74	102.07	8.2	12.7
10	0.68	0.69	127.6	4.8	11.9
12	0.80	0.61	156.0	2.6	11.0
14	0.93	0.53	–172.8	2.1	10.1
16	1.08	0.43	–138.8	4.0	9.2

2SK1616

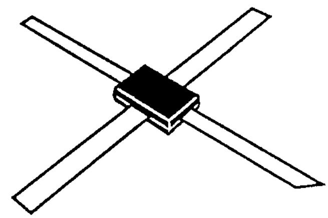
GaAs 2 DEG FET

Application

SHF low noise amplifier

Features

- HEMT structure
- Excellent low noise characteristics
  NF=1.3dB typ (f=12GHz)
- High associated gain
  Ga=10dB typ (f=12GHz)



μFPAK
SCALE : 4/1

Table 1 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DS}	3.5	V
Gate to source voltage	V_{GSO}	-3	V
Gate to drain voltage	V_{GDO}	-3	V
Drain current	I_D	70	mA
Channel dissipation	Pch	180	mW
Channel temperature	Tch	125	°C
Storage temperature	Tstg	–55 to +125	°C

Table 2 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Gate to source leakage current	I_{GSS}	—	—	-10	μA	V_{DS} = 0V, V_{GS} = -3V
Drain Current	I_{DSS}	12	—	70	mA	V_{DS} = 2V, V_{GS} = 0 (Pulse Test)
Gate to source cutoff voltage	$V_{GS(off)}$	-0.3	—	-2.5	V	V_{DS} = 2 V, I_D = 100μA
Forward transfer admittance	$\|y_{fs}\|$	40	60	—	mS	V_{DS} = 2 V, I_D = 20mA f=1kHz
Minimum noise figure	NF	—	1.3	1.7	dB	V_{DS} = 2 V, I_D = 20mA
Associated gain	Ga	8	10	—	dB	f=12GHz

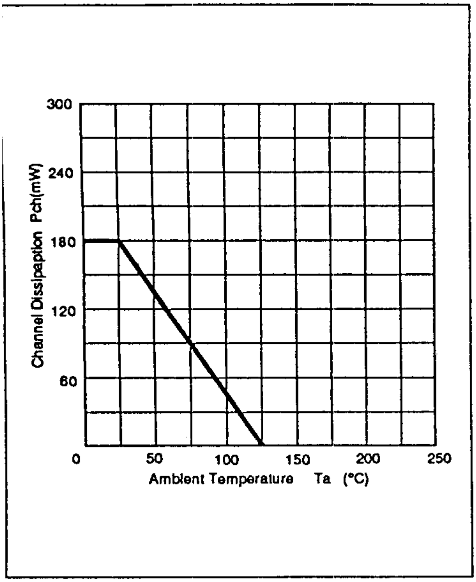


Figure 1 Maximum Channel Dissipation

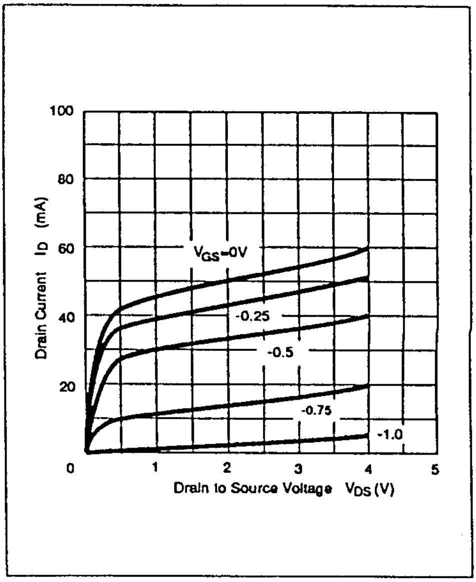


Figure 2 Typical Output Characteristics

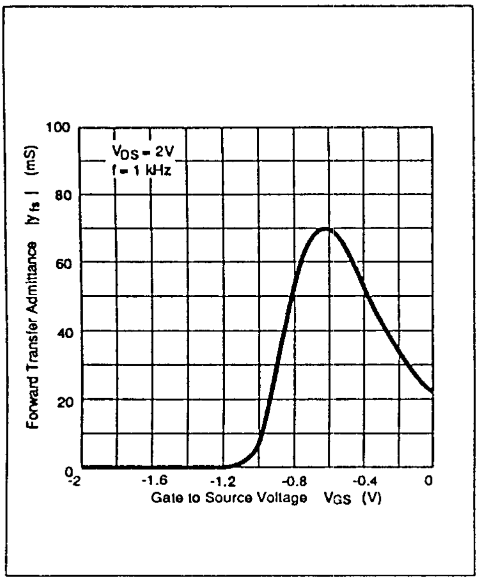


Figure 3 Forward Transfer Admittance vs.Gate to Source Voltage

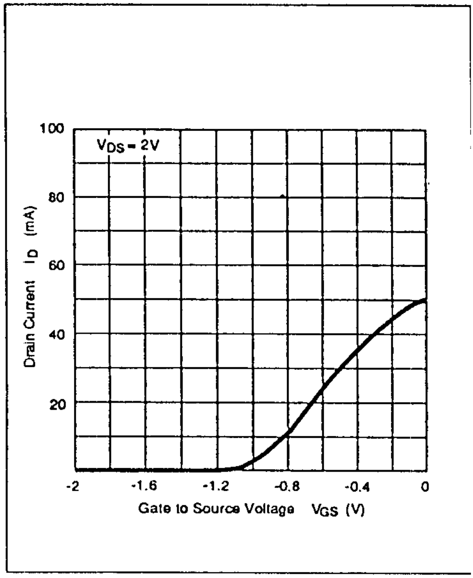


Figure 4 Drain Current vs.Gate to Source Voltage

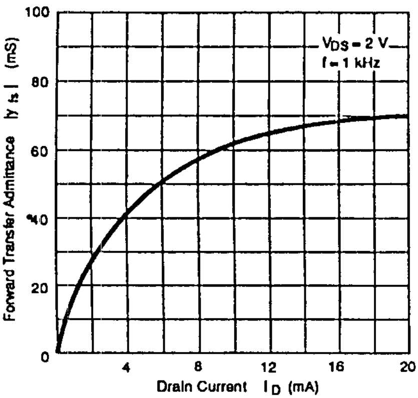


Figure 5 Forward Transfer Admittance vs. Drain Current

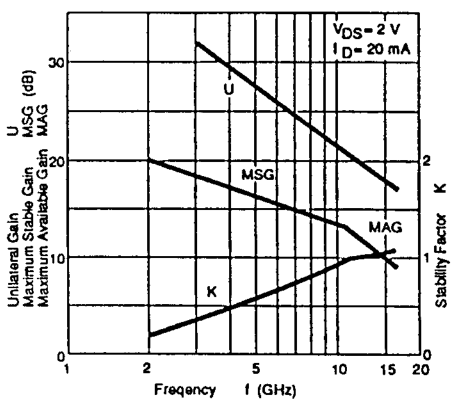


Figure 6 U,MSG,MAG,K vs. f

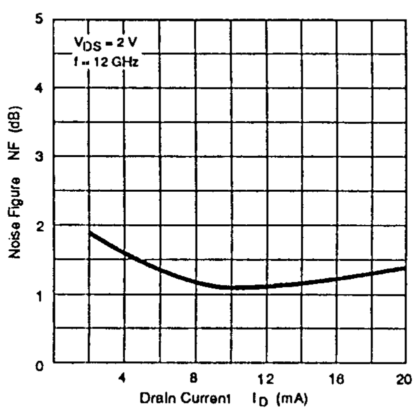


Figure 7 Noise Figure vs. Drain Current

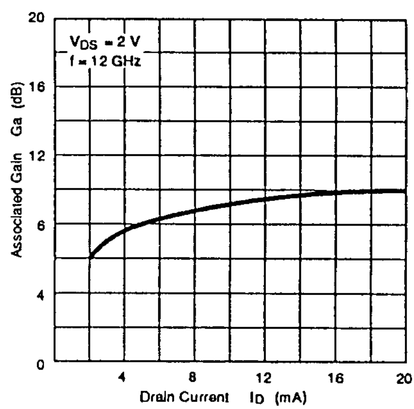


Figure 8 Associated Gain vs.Drain Current

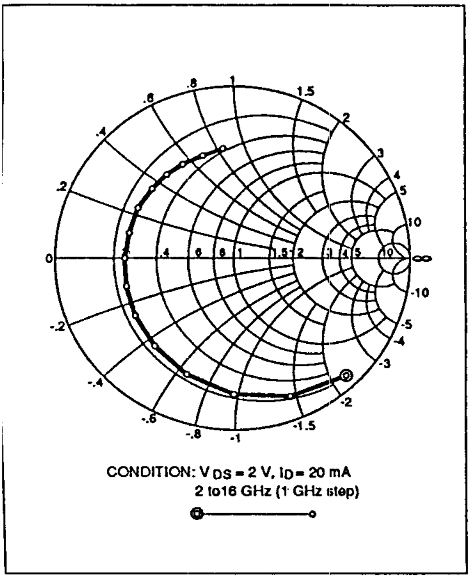


Figure 9 S11 Parameter vs.Frequency

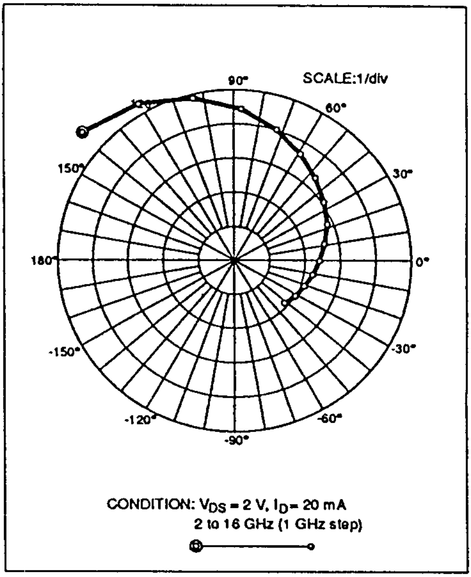


Figure 10 S21 Parameter vs. Frequency

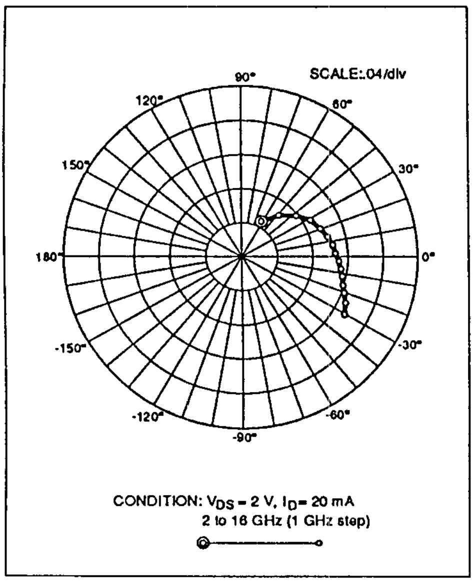


Figure 11 S12 Parameter vs. Frequency

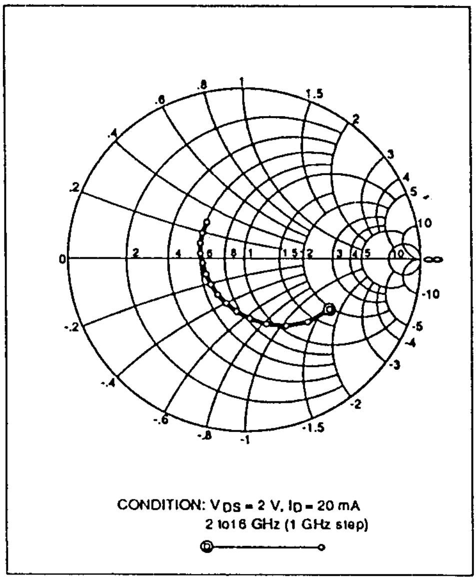


Figure 12 S22 Parameter vs. Frequncy

Table 3 S Parameter (Ta = 25°C, V_{DS} = 2 V, I_D = 20 mA)

	S11		S21		S12		S22	
f (GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2	0.931	–47.2	5.696	138.9	0.047	61.7	0.565	–31.1
3	0.863	–68.9	5.304	120.5	0.064	49.0	0.513	–45.3
4	0.792	–90.1	4.877	103.6	0.078	37.9	0.454	–58.6
5	0.724	–111.1	4.445	87.3	0.089	28.7	0.397	–71.8
6	0.672	–130.3	4.024	72.6	0.095	20.3	0.347	–85.2
7	0.640	–148.3	3.642	59.1	0.100	13.4	0.308	–98.5
8	0.618	–164.7	3.334	46.6	0.104	7.5	0.278	–112.0
9	0.605	179.9	3.056	34.1	0.106	2.0	0.258	–126.2
10	0.599	165.6	2.834	22.1	0.110	–3.1	0.242	–141.7
11	0.606	151.1	2.593	11.0	0.113	–7.6	0.234	–157.4
12	0.606	138.2	2.404	–0.2	0.116	–11.7	0.237	–173.9
13	0.612	127.3	2.246	–10.8	0.119	–16.6	0.250	172.3
14	0.615	117.2	2.112	–20.8	0.123	–20.2	0.265	159.4
15	0.622	105.9	2.006	–31.2	0.129	–25.0	0.280	147.0
16	0.644	95.1	1.881	–41.6	0.134	–30.4	0.300	134.3

Table 4 Optimum Source Impedance (G_{Fmin}) vs. Frequency

f (GHz)	NF (dB)	$\|G_{Fmin}\|$	G_{Fmin} (deg.)	Rn (ohm)	Ga (dB)
8	0.88	0.43	116.9	6.0	12.3
10	1.08	0.39	152.2	3.9	11.2
12	1.30	0.38	–170.1	4.5	10.0
14	1.54	0.41	–130.1	9.3	8.9
16	1.80	0.47	–87.9	19.8	7.6

2SK1617

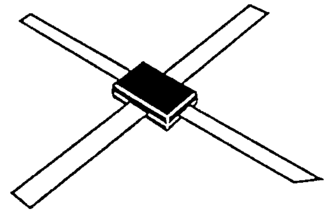
GaAs 2 DEG FET

Application

SHF low noise amplifier

Features

- HEMT structure
- Excellent low noise characteristics
  NF=1.0dB typ (f=12GHz)
- High associated gain
  Ga=9.3dB typ (f=12GHz)



μFPAK
SCALE : 4/1

Table 1 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DS}	3.5	V
Gate to source voltage	V_{GSO}	-3	V
Gate to drain voltage	V_{GDO}	-3	V
Drain current	I_D	60	mA
Channel dissipation	Pch	160	mW
Channel temperature	Tch	125	°C
Storage temperature	Tstg	–55 to +125	°C

Table 2 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Gate to source leakage current	I_{GSS}	—	—	-10	μA	V_{DS} = 0V, V_{GS} = -3V
Drain Current	I_{DSS}	12	—	60	mA	V_{DS} = 2V, V_{GS} = 0 (Pulse Test)
Gate to source cutoff voltage	$V_{GS(off)}$	-0.3	—	-2.5	V	V_{DS} = 2 V, I_D = 100μA
Forward transfer admittance	$\|y_{fs}\|$	30	50	—	mS	V_{DS} = 2 V, I_D = 10mA f=1kHz
Minimum noise figure	NF	—	1.0	1.4	dB	V_{DS} = 2 V, I_D = 10mA
Associated gain	Ga	8	9.3	—	dB	f=12GHz

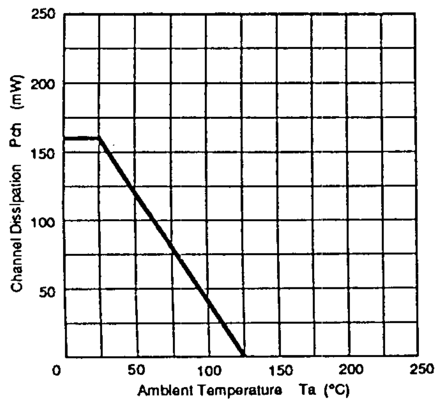


Figure 1 Maximum Channel Dissipation

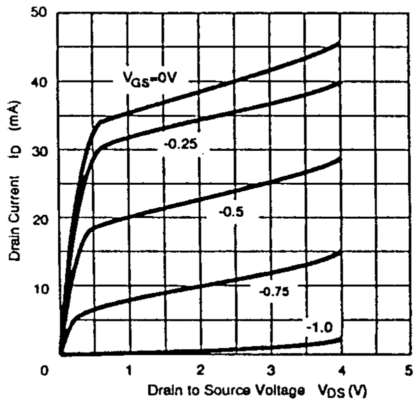


Figure 2 Typical Output Characteristics

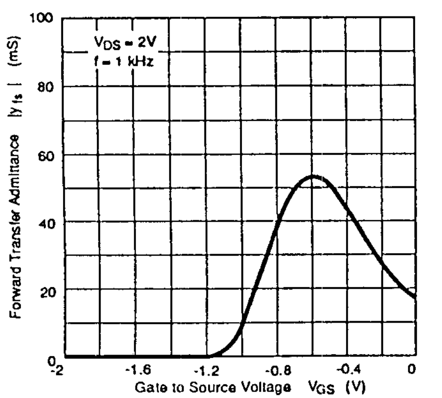


Figure 3 Forward Transfer Admittance vs.Gate to Source Voltage

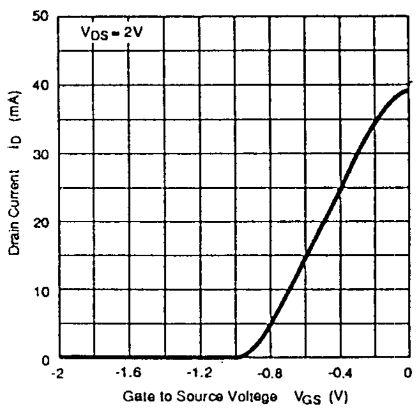


Figure 4 Drain Current vs.Gate to Source Voltage

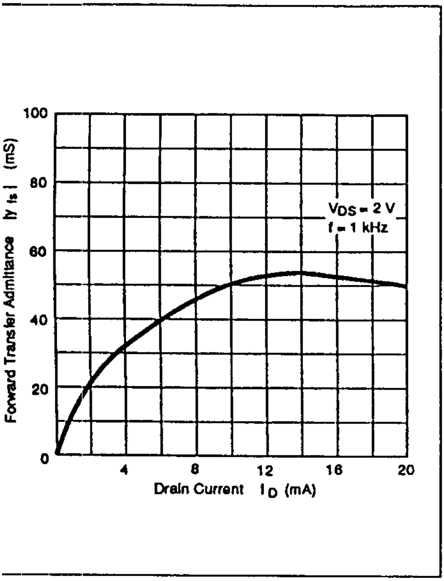


Figure 5 Forward Transfer Admittance vs. Drain Current

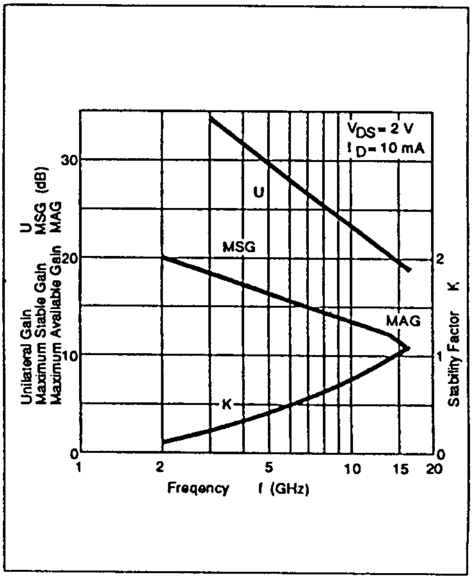


Figure 6 U,MSG,MAG,K vs. f

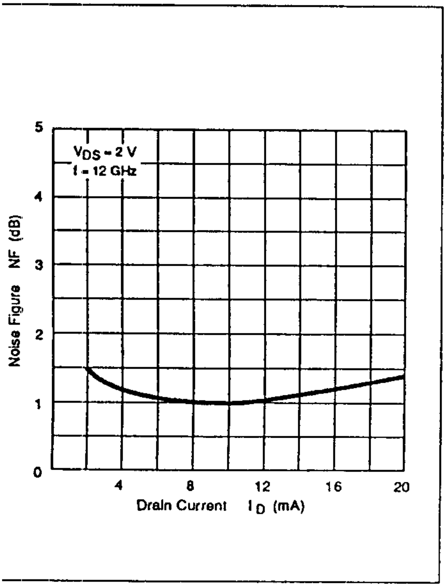


Figure 7 Noise Figure vs. Drain Current

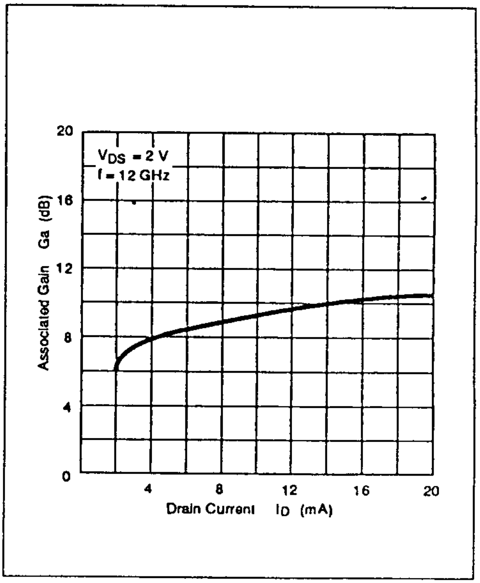


Figure 8 Associated Gain vs.Drain Current

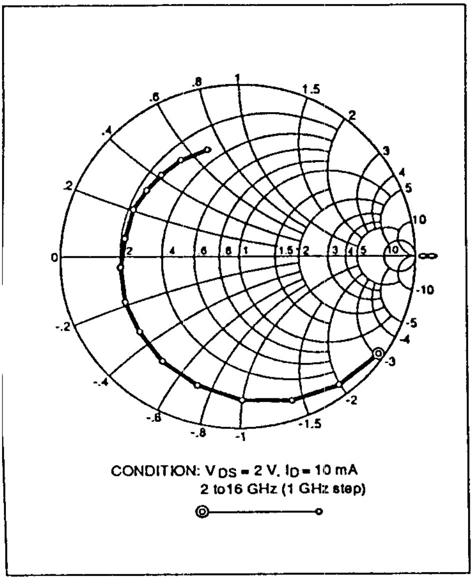


Figure 9 S_{11} Parameter vs.Frequency

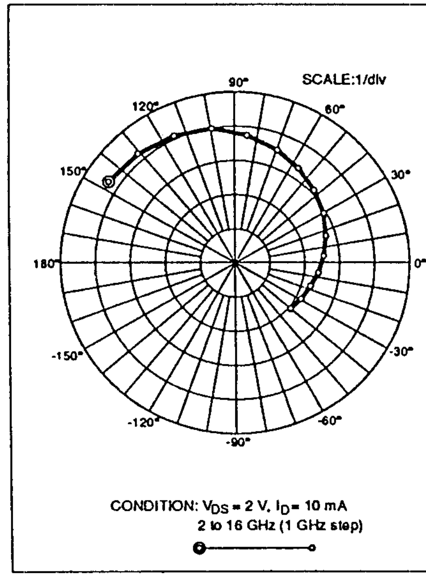


Figure 10 S_{21} Parameter vs. Frequency

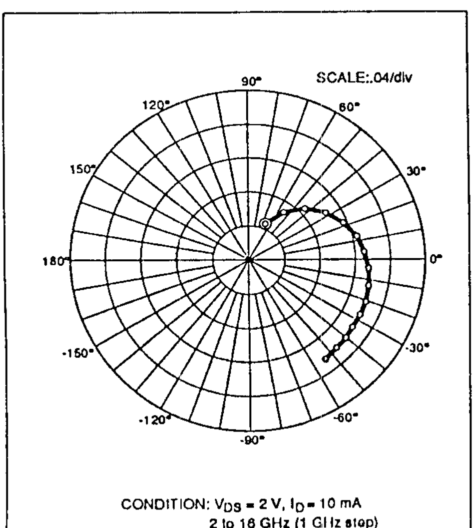


Figure 11 S_{12} Parameter vs. Frequency

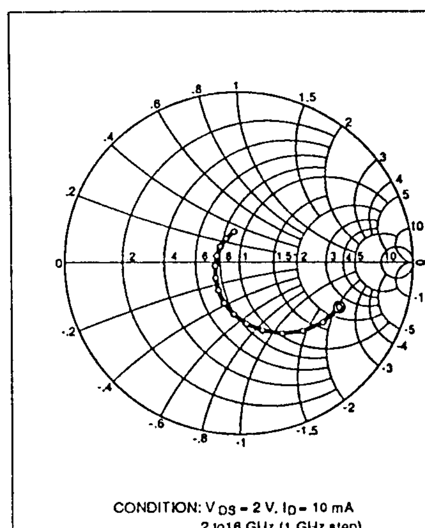


Figure 12 S_{22} Parameter vs. Frequncy

Table 3 S Parameter (Ta = 25°C, V_{DS} = 2 V, I_D = 10 mA)

	S11		S21		S12		S22	
f (GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2	0.968	−35.8	4.311	146.7	0.046	66.1	0.630	−24.0
3	0.932	−53.3	4.230	130.8	0.068	54.9	0.592	−35.6
4	0.886	−70.9	4.107	115.0	0.087	43.5	0.539	−47.3
5	0.835	−89.2	3.938	99.5	0.103	32.4	0.480	−59.2
6	0.783	−107.5	3.743	84.6	0.115	22.1	0.416	−71.5
7	0.739	−125.3	3.522	69.6	0.125	12.6	0.356	−83.7
8	0.699	−142.0	3.319	56.5	0.130	3.9	0.300	−96.4
9	0.683	−157.7	3.108	43.0	0.135	−4.4	0.250	−110.9
10	0.663	−174.9	2.931	29.7	0.138	−12.8	0.201	−127.0
11	0.645	170.4	2.724	17.0	0.140	−20.5	0.163	−146.7
12	0.650	154.9	2.544	4.7	0.140	−27.1	0.140	−172.0
13	0.643	143.1	2.403	−6.8	0.140	−34.3	0.135	163.4
14	0.644	132.2	2.263	−17.1	0.142	−40.2	0.142	139.5
15	0.651	119.9	2.160	−28.8	0.142	−46.4	0.158	118.1
16	0.650	105.7	2.061	−39.9	0.144	−53.8	0.182	98.9

Table 4 Optimum Source Impedance (G_{Fmin}) vs. Frequency

f (GHz)	NF (dB)	$\lvert G_{Fmin}\rvert$	G_{Fmin} (deg.)	Rn (ohm)	Ga (dB)
8	0.70	0.59	96.7	8.0	11.8
10	0.84	0.52	127.8	4.8	10.8
12	1.00	0.47	163.4	3.2	9.8
14	1.18	0.44	−156.7	4.4	8.8
16	1.37	0.45	−112.2	10.0	7.7

2SK1844

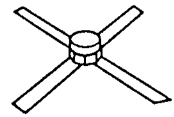
GaAs 2 DEG FET

Application

SHF low noise amplifier

Features

- HEMT structure
- Excellent low noise characteristics
  NF=0.6dB typ (f=12GHz)
- High associated gain
  Ga=11.5dB typ (f=12GHz)



CERAMICS

SCALE : 2/1

Table 1 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DS}	3	V
Gate to source voltage	V_{GSO}	-3	V
Gate to drain voltage	V_{GDO}	-3	V
Drain current	I_D	70	mA
Channel dissipation	Pch	160	mW
Channel temperature	Tch	125	°C
Storage temperature	Tstg	–55 to +125	°C

Table 2 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Gate to source leakage current	I_{GSS}	—	—	-10	μA	V_{DS} = 0V, V_{GS} = -3V
Drain Current	I_{DSS}	12	—	70	mA	V_{DS} = 2V, V_{GS} = 0 (Pulse Test)
Gate to source cutoff voltage	$V_{GS(off)}$	-0.3	—	-2.5	V	V_{DS} = 2 V, I_D = 100μA
Forward transfer admittance	$\|y_{fs}\|$	30	55	—	mS	V_{DS} = 2 V, I_D = 10mA f=1kHz
Minimum noise figure	NF	—	0.6	0.85	dB	V_{DS} = 2 V, I_D = 10mA
Associated gain	Ga	10.5	11.5	—	dB	f=12GHz

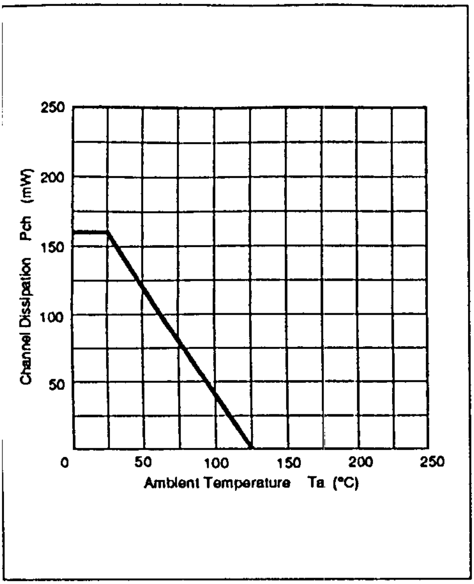


Figure 1 Maximum Channel Dissipation

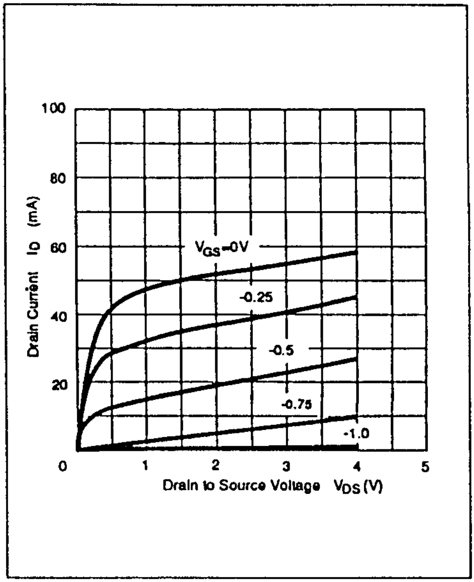


Figure 2 Typical Output Characteristics

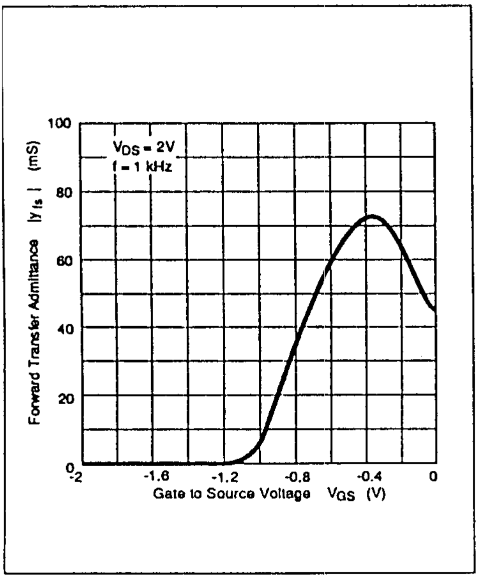


Figure 3 Forward Transfer Admittance vs.Gate to Source Voltage

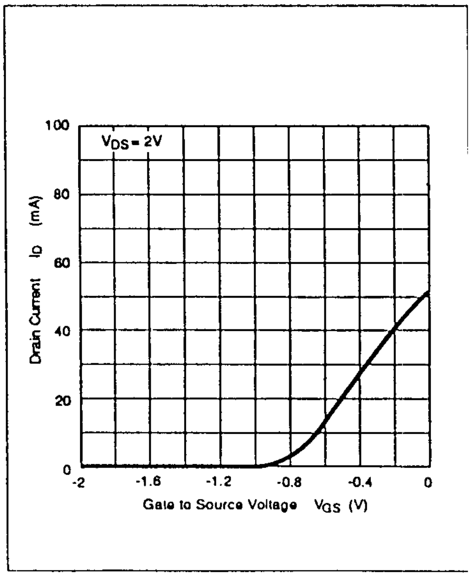


Figure 4 Drain Current vs.Gate to Source Voltage

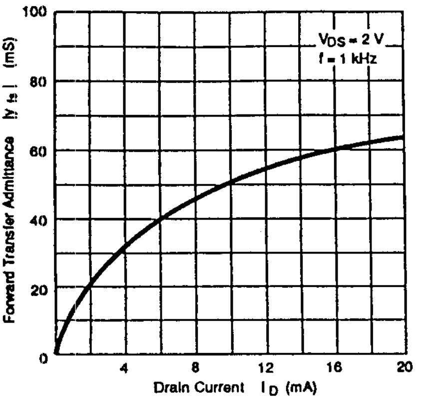


Figure 5 Forward Transfer Admittance vs. Drain Current

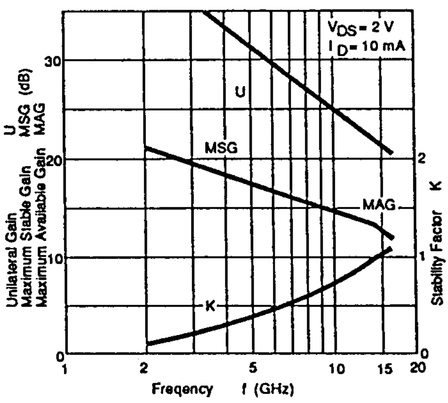


Figure 6 U,MSG,MAG,K vs. f

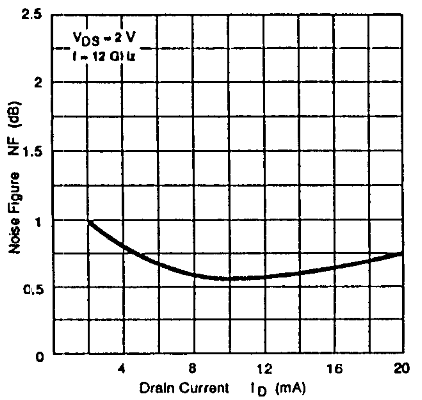


Figure 7 Noise Figure vs. Drain Current

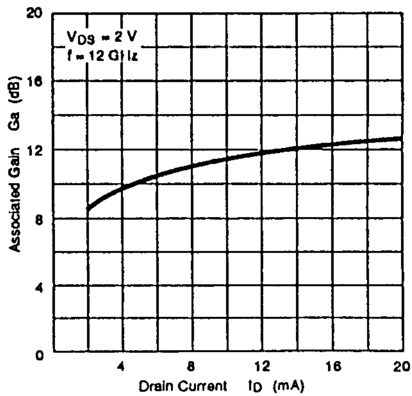


Figure 8 Associated Gain vs.Drain Current

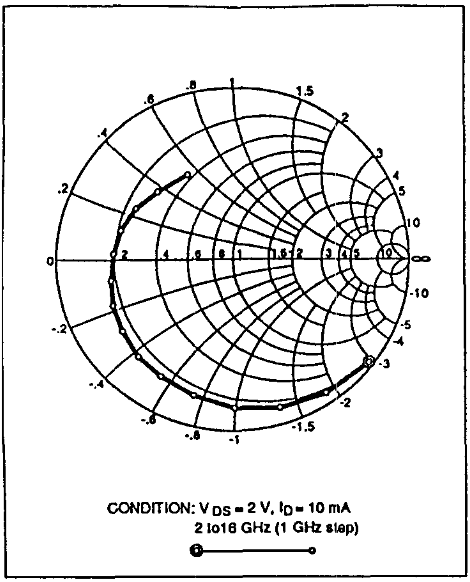


Figure 9 S11 Parameter vs.Frequency

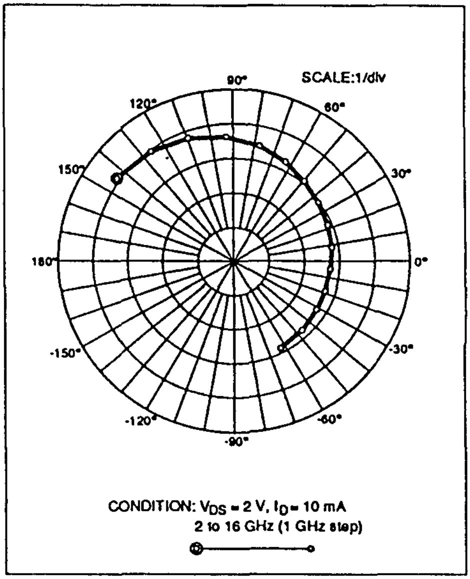


Figure 10 S21 Parameter vs. Frequency

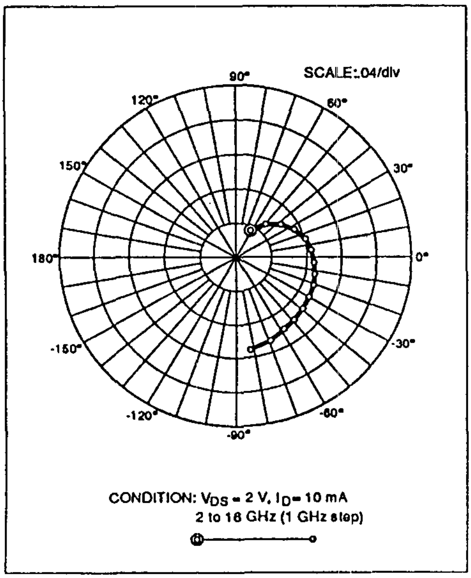


Figure 11 S12 Parameter vs. Frequency

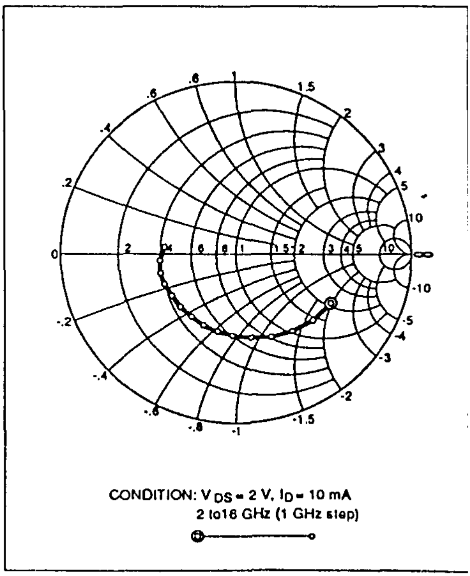


Figure 12 S22 Parameter vs. Frequncy

Table 3 S Parameter (Ta = 25°C, V_{DS} = 2 V, I_D = 10 mA)

	S11		S21		S12		S22	
f (GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2	0.974	–38.1	4.097	143.8	0.035	63.0	0.611	–28.0
3	0.938	–56.3	3.950	126.1	0.051	49.5	0.587	–41.6
4	0.904	–73.4	3.803	109.6	0.063	37.4	0.556	–54.6
5	0.868	–89.8	3.631	93.2	0.073	26.4	0.528	–67.7
6	0.825	–105.8	3.443	77.7	0.081	15.4	0.500	–80.1
7	0.795	–120.8	3.258	63.2	0.085	5.8	0.481	–92.5
8	0.779	–133.2	3.089	49.5	0.088	–4.1	0.467	–103.1
9	0.750	–146.1	2.956	35.9	0.090	–12.8	0.457	–113.8
10	0.726	–158.8	2.869	22.2	0.093	–20.8	0.446	–124.3
11	0.697	–170.3	2.809	8.5	0.094	–29.9	0.442	–135.5
12	0.673	176.7	2.740	–4.7	0.096	–39.1	0.438	–146.2
13	0.653	164.5	2.707	–18.5	0.098	–48.6	0.442	–156.5
14	0.624	150.8	2.713	–31.4	0.100	–57.8	0.441	–165.5
15	0.582	136.3	2.780	–46.5	0.106	–68.8	0.430	–174.9
16	0.562	116.9	2.875	–62.9	0.111	–82.2	0.405	174.1

Table 4 Optimum Source Impedance (Γ_{Fmin}) vs. Frequency

f (GHz)	NF (dB)	$\lvert\Gamma_{Fmin}\rvert$	Γ_{Fmin} (deg.)	Rn (ohm)	Ga (dB)
8	0.41	0.69	90.7	8.0	13.4
10	0.49	0.62	115.5	5.7	12.5
12	0.60	0.55	144.0	3.5	11.5
14	0.73	0.47	176.4	2.2	10.6
16	0.88	0.38	–147.5	2.6	9.7

2SK1844

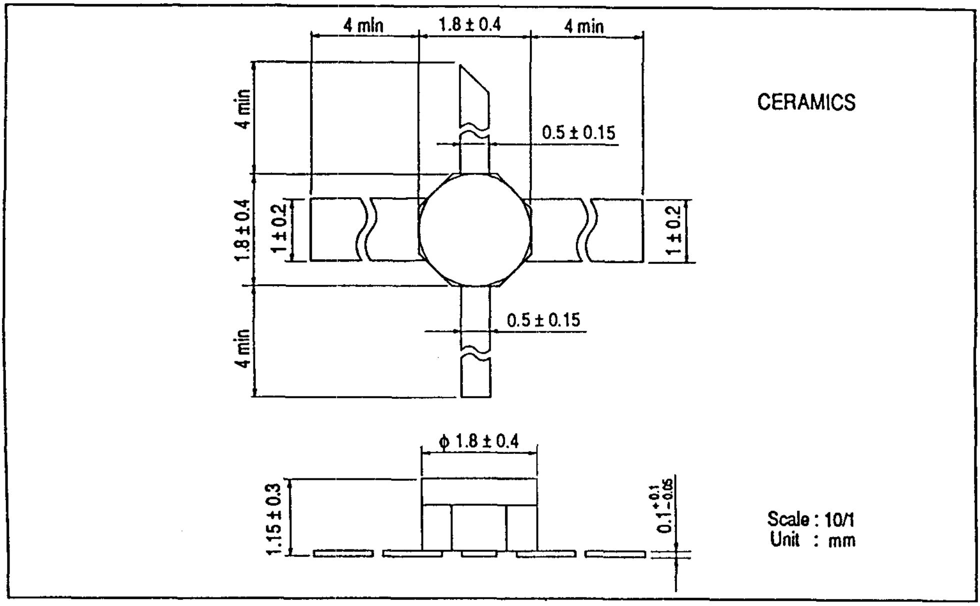


Figure 13 Package Outline

2SK1845

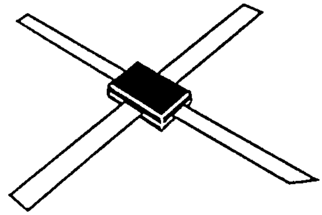
GaAs 2 DEG FET

Application

SHF low noise amplifier

Features

- HEMT structure
- Excellent low noise characteristics
  NF=0.8dB typ (f=12GHz)
- High associated gain
  Ga=10.5dB typ (f=12GHz)



μFPAK
SCALE : 4/1

Table 1 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DS}	3	V
Gate to source voltage	V_{GSO}	-3	V
Gate to drain voltage	V_{GDO}	-3	V
Drain current	I_D	70	mA
Channel dissipation	Pch	160	mW
Channel temperature	Tch	125	°C
Storage temperature	Tstg	–55 to +125	°C

Table 2 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Gate to source leakage current	I_{GSS}	—	—	-10	μA	V_{DS} = 0V, V_{GS} = -3V
Drain Current	I_{DSS}	12	—	70	mA	V_{DS} = 2V, V_{GS} = 0 (Pulse Test)
Gate to source cutoff voltage	$V_{GS(off)}$	-0.3	—	-2.5	V	V_{DS} = 2 V, I_D = 100μA
Forward transfer admittance	$\|y_{fs}\|$	30	55	—	mS	V_{DS} = 2 V, I_D = 10mA f=1kHz
Minimum noise figure	NF	—	0.8	1.0	dB	V_{DS} = 2 V, I_D = 10mA
Associated gain	Ga	9.5	10.5	—	dB	f=12GHz

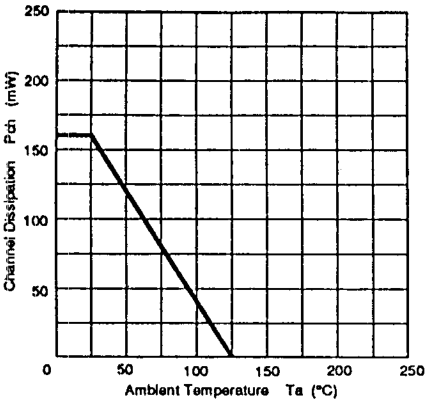


Figure 1 Maximum Channel Dissipation

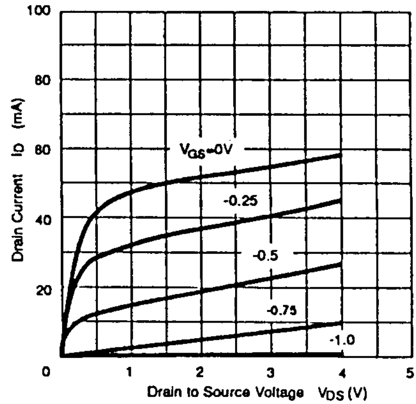


Figure 2 Typical Output Characteristics

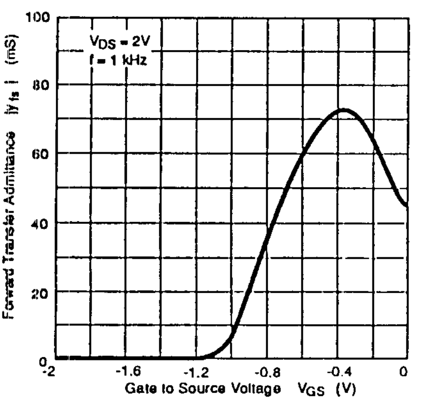


Figure 3 Forward Transfer Admittance vs.Gate to Source Voltage

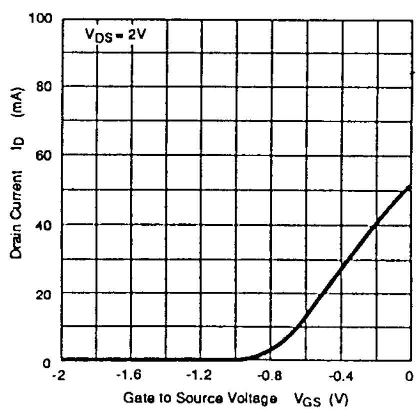


Figure 4 Drain Current vs.Gate to Source Voltage

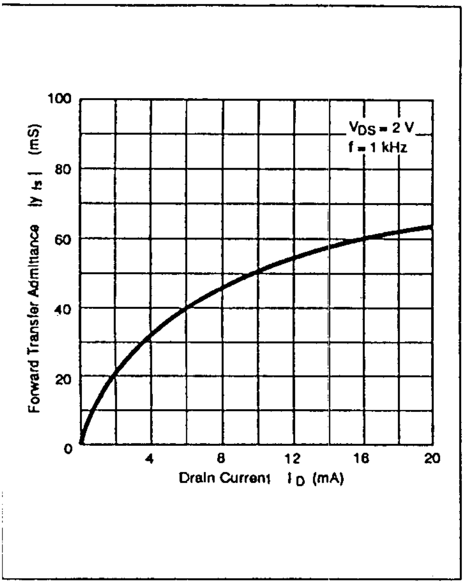


Figure 5 Forward Transfer Admittance vs. Drain Current

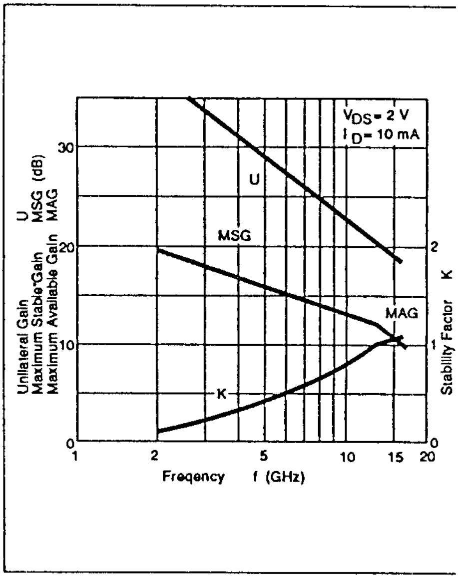


Figure 6 U,MSG,MAG,K vs. f

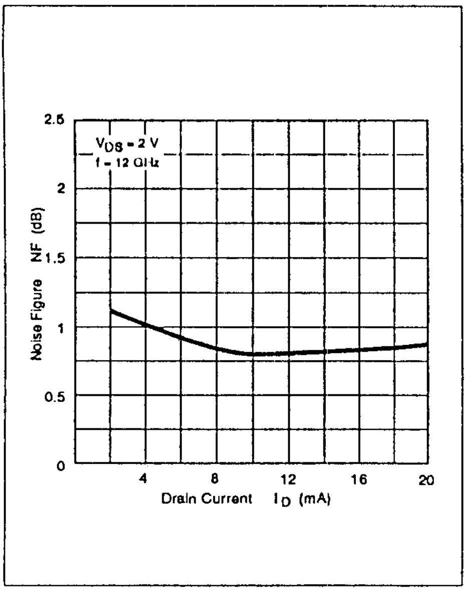


Figure 7 Noise Figure vs. Drain Current

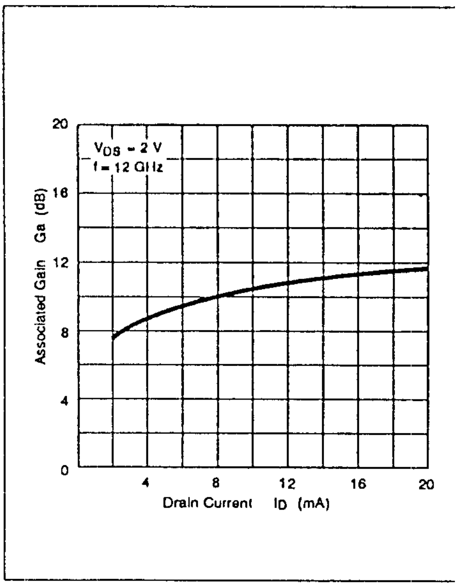


Figure 8 Associated Gain vs.Drain Current

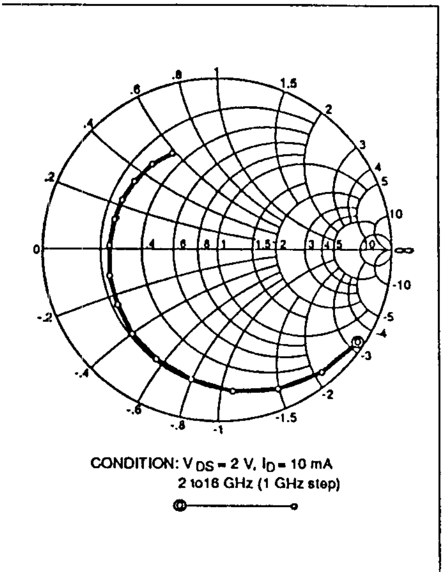


Figure 9 S11 Parameter vs.Frequency

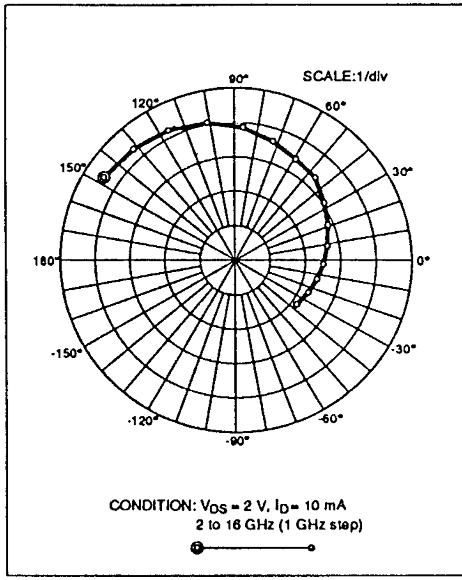


Figure 10 S21 Parameter vs. Frequency

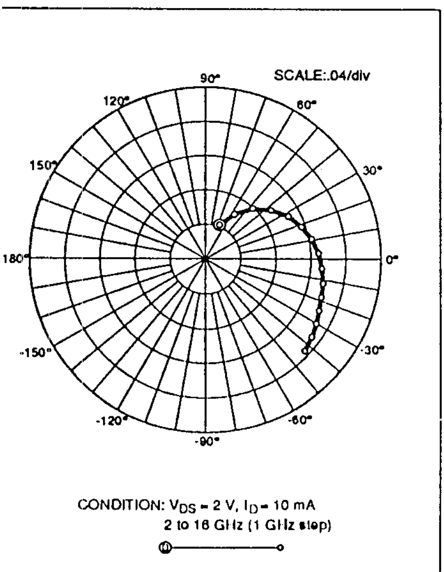


Figure 11 S12 Parameter vs. Frequency

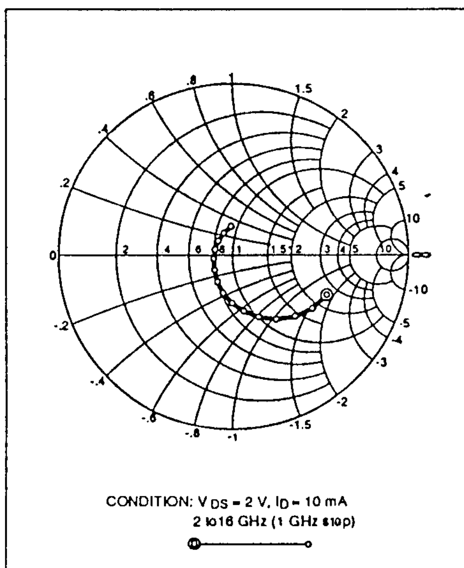


Figure 12 S22 Pnrameter vs. Frequncy

Table 3 S Parameter (Ta = 25°C, V_{DS} = 2 V, I_D = 10 mA)

	S11		S21		S12		S22	
f (GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2	0.970	–33.0	4.324	147.8	0.041	68.0	0.580	–22.1
3	0.927	–48.8	4.233	132.6	0.060	57.7	0.546	–32.7
4	0.888	–65.3	4.136	117.6	0.077	47.9	0.497	–43.3
5	0.843	–82.0	3.990	102.8	0.091	37.8	0.446	–54.3
6	0.785	–99.2	3.797	87.7	0.103	28.2	0.387	–65.7
7	0.748	–115.9	3.608	73.7	0.113	19.2	0.331	–77.2
8	0.702	–131.4	3.421	60.8	0.120	11.6	0.278	–89.0
9	0.676	–146.8	3.222	47.7	0.126	3.7	0.230	–102.6
10	0.651	–162.5	3.055	34.5	0.131	–3.9	0.181	–118.7
11	0.627	–178.5	2.861	22.3	0.135	–11.4	0.141	–138.8
12	0.623	167.0	2.699	10.0	0.138	–17.6	0.115	–166.5
13	0.617	155.7	2.538	-1.6	0.140	–23.8	0.113	166.0
14	0.601	142.8	2.407	-12.2	0.143	–29.3	0.122	138.5
15	0.608	130.3	2.295	–23.5	0.148	–36.1	0.140	116.5
16	0.613	118.2	2.176	–35.4	0.150	–42.9	0.170	97.0

Table 4 Optimum Source Impedance (G_{Fmin}) vs. Frequency

f (GHz)	NF (dB)	$\lvert G_{Fmin}\rvert$	G_{Fmin} (deg.)	Rn (ohm)	Ga (dB)
8	0.60	0.59	85.7	7.2	12.6
10	0.69	0.53	114.2	4.5	11.6
12	0.80	0.48	147.6	2.6	10.5
14	0.92	0.46	–174.1	2.5	9.4
16	1.05	0.44	–130.9	5.0	8.4

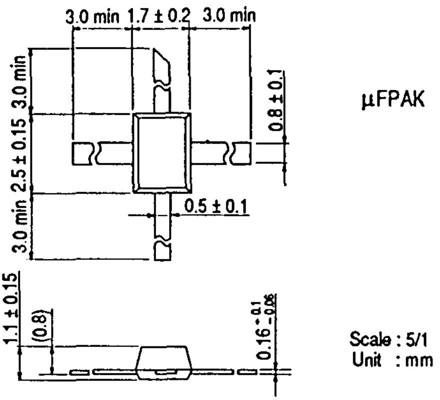


Figure 13 Package Outline

3SK113

GaAs Dual Gate FET

Application

UHF TV tuner RF amplifier

Features

- Excellent low noise characteristics (NF = 1.5 dB at f = 900 MHz)
- Capable of low voltage operation
- Suitable for UHF RF amplifier

Table 1 Ordering Information

Type No.	Package
3SK113	FPAK

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DS}	12	V
Gate1 to source voltage	V_{G1S}	+0.5, –6	V
Gate2 to source voltage	V_{G2S}	+0.5, –6	V
Drain current	I_D	80	mA
Channel dissipation	Pch	200	mW
Channel temperature	Tch	125	°C
Storage temperature	Tstg	–55 to +125	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Drain to source breakdown voltage	$V_{(BR)DSX}$	12	—	—	V	I_D = 50 µA, V_{G1S} = –6 V, V_{G2S} = 0
Gate1 to source breakdown voltage	$V_{(BR)G1SS}$	–6	—	—	V	I_{G1S} = –10 µA, V_{G2S} = V_{DS} = 0
Gate2 to source breakdown voltage	$V_{(BR)G2SS}$	–6	—	—	V	I_{G2S} = –10 µA, V_{G1S} = V_{DS} = 0
Gate1 leakage current	I_{G1SS}	—	—	–20	µA	V_{G1S} = –6 V, V_{G2S} = V_{DS} = 0
Gate2 leakage current	I_{G2SS}	—	—	–20	µA	V_{G2S} = –6 V, V_{G1S} = V_{DS} = 0
Gate1 to source cutoff voltage	$V_{G1S(off)}$	—	—	–6	V	V_{DS} = 5 V, V_{G2S} = 0, I_D = 100 µA
Gate2 to source cutoff voltage	$V_{G2S(off)}$	—	—	–6	V	V_{DS} = 5 V, V_{G1S} = 0 I_D = 100 µA
Drain current	I_{DSS}	10	—	80	mA	V_{DS} = 5 V, V_{G1S} = V_{G2S} = 0
Forward transfer admittance	$\|y_{fs}\|$	10	—	—	mS	V_{DS} = 5 V, V_{G2S} = 0 I_D = 10 mA, f = 1 kHz
Input capacitance	Ciss	—	1.2	—	pF	V_{DS} = 5 V,
Output capacitance	Coss	—	0.4	—	pF	V_{G1S} = V_{G2S} = –6 V,
Reverse transfer capacitance	Crss	—	0.02	—	pF	f = 1 MHz
Power gain	PG	10	15	—	dB	V_{DS} = 5 V, V_{G2S} = 0,
Noise figure	NF	—	1.5	3.0	dB	I_D = 10 mA, f = 900 MHz

The 3SK113 is grouped by I_{DSS} as follows.

F	G	H	J	
10 to 20	16 to 32	25 to 50	40 to 80	mA

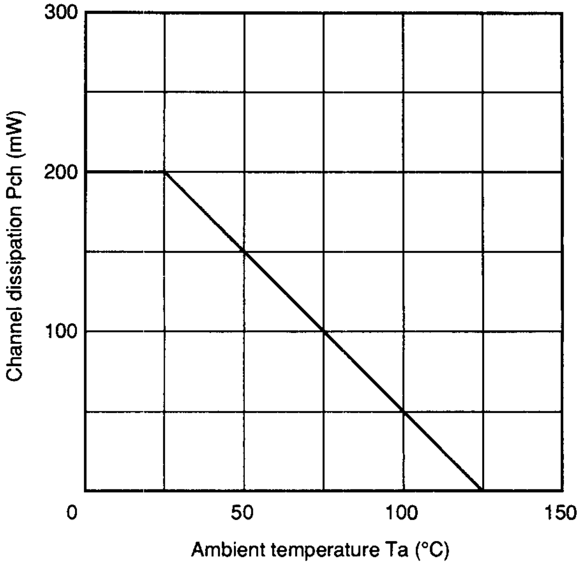


Figure 1 Maximum Channel Dissipation Curve

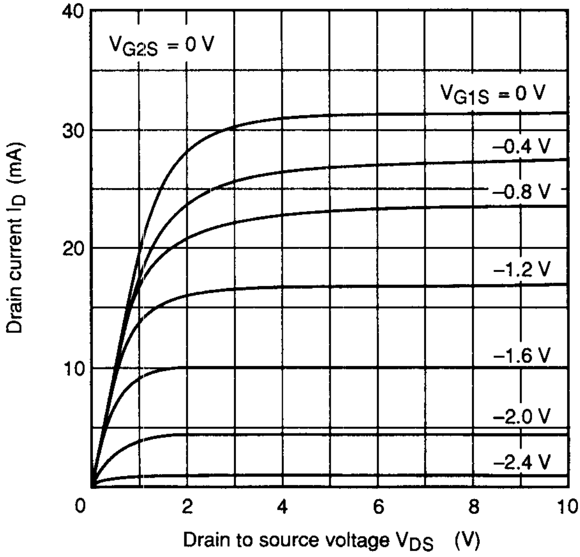


Figure 2 Typical Output Characteristics

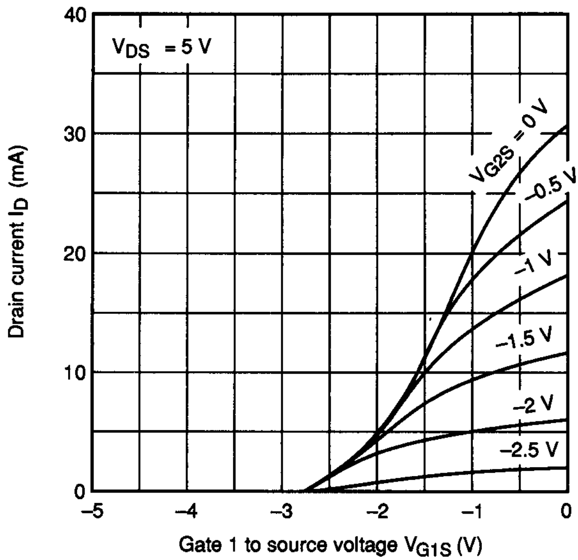


Figure 3 Drain Current vs. Gate1 to Source Voltage

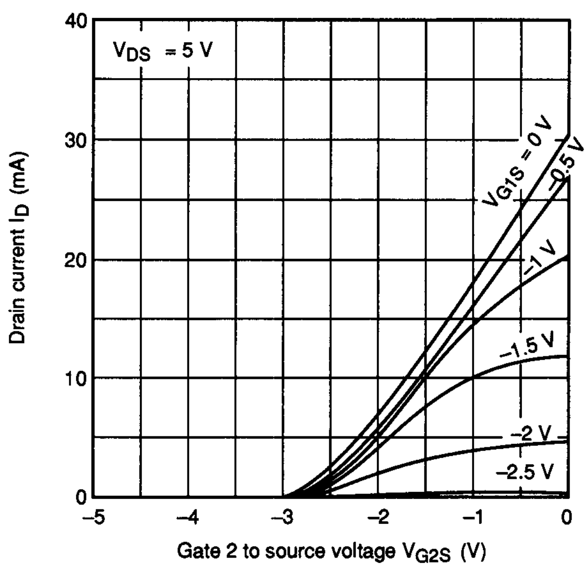


Figure 4 Drain Current vs. Gate2 to Source Voltage

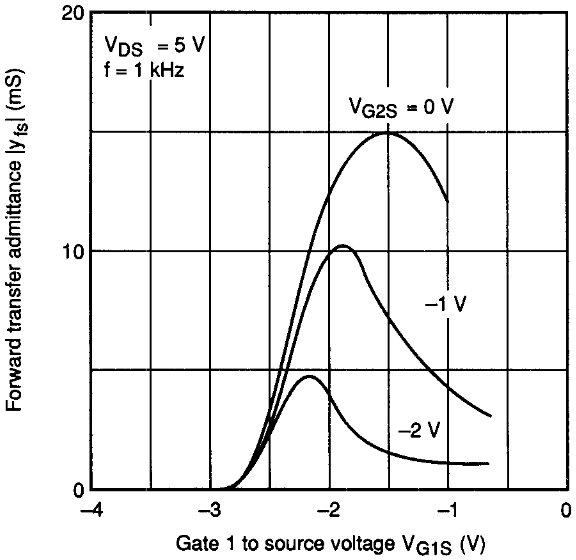


Figure 5 Forward Transfer Admittance vs. Gate1 to Source Voltage

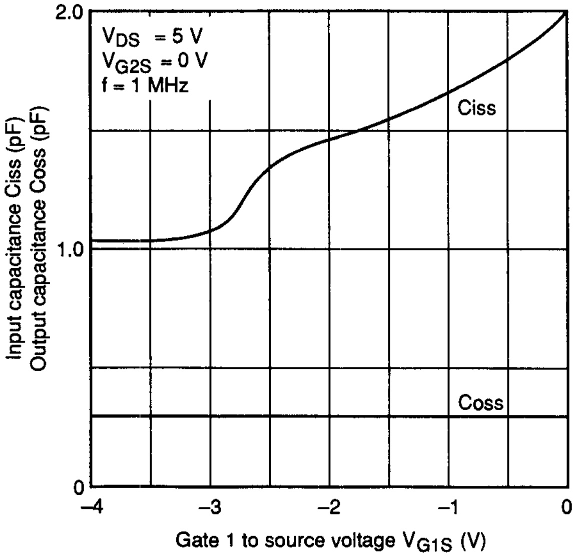


Figure 6 Input Output Capacitance vs. Gate1 to Source Voltage

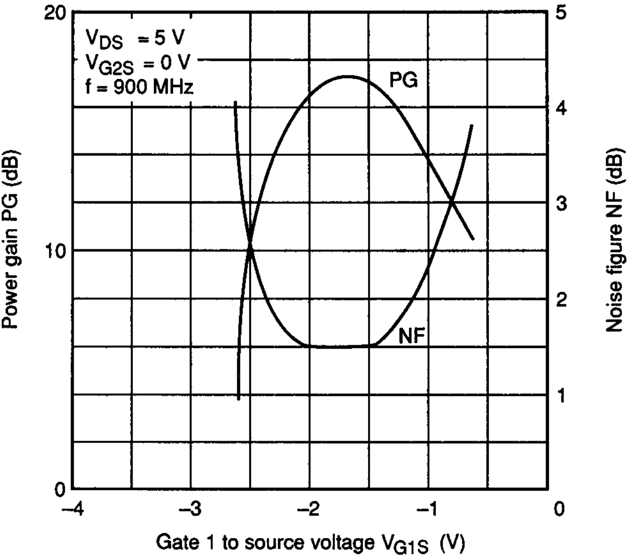


Figure 7 Power Gain, Noise Figure vs. Gate1 to Source Voltage

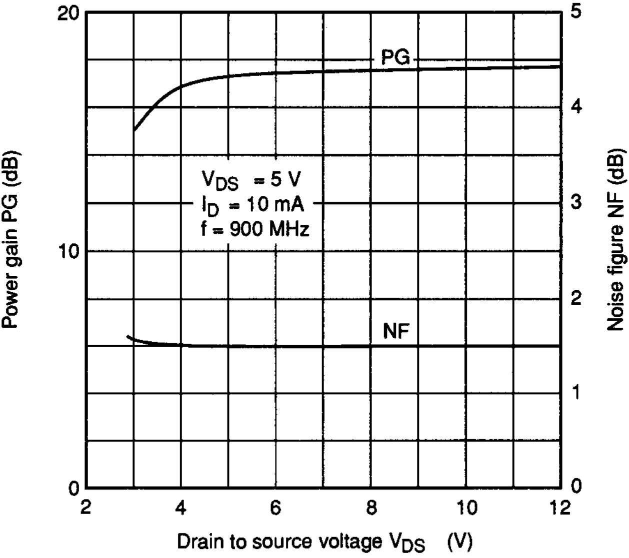


Figure 8 Power Gain, Noise Figure vs. Drain to Source Voltage

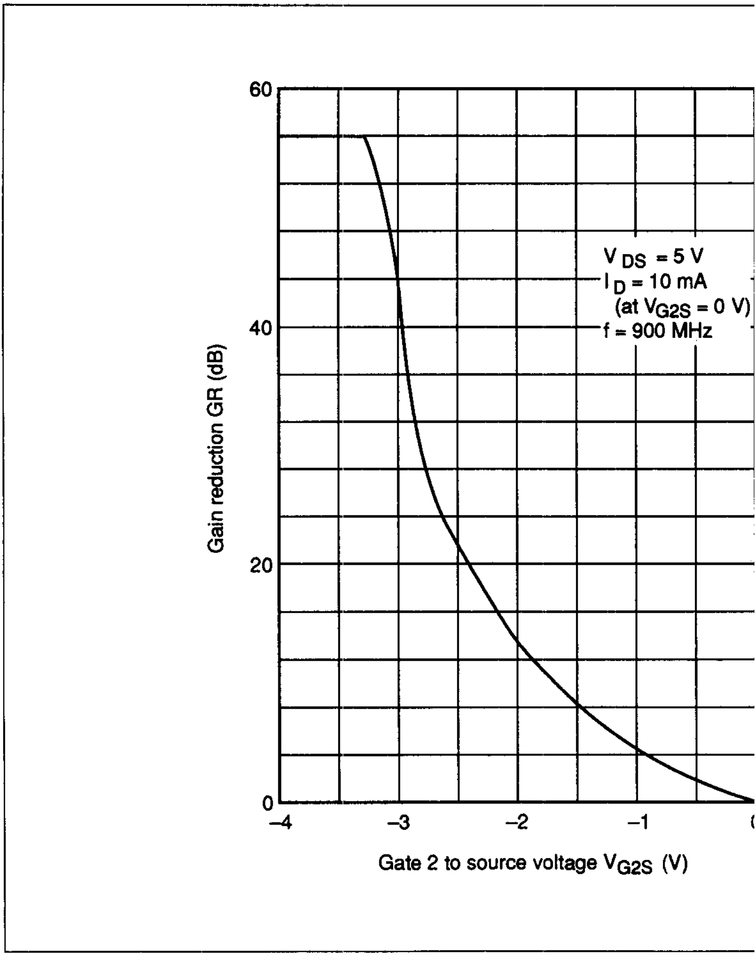
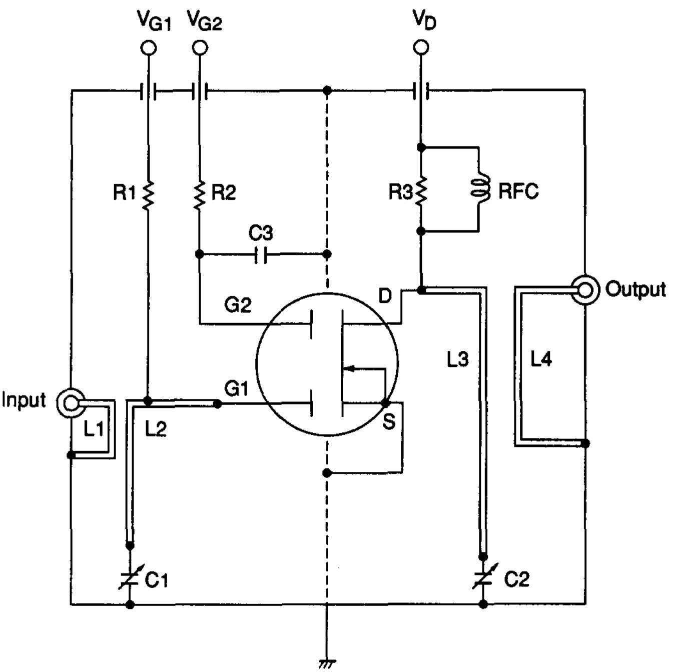


Figure 9 Gain Reduction vs. Gate2 to Source Voltage



R1, R2, R3: 47 kΩ
RFC: 3T inside dia 6 mm (φ 1 mm copper wire with enamel)
C1, C2: 1000 pF air trimmer capacitor
C3: 1000 pF disk capacitor

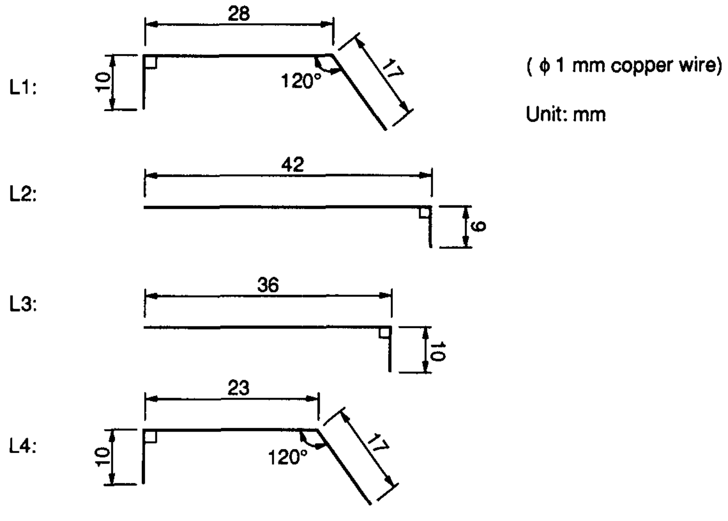


Figure 10 3SK113 PG, NF Test Circuit

3SK191

GaAs MES FET

Application

UHF RF Amplifier

Table 1 Ordering Information

Type No.	Package
3SK191	MPAK-4

Features

- Excellent low noise characteristics (NF=1.5dB Typ. at f=900MHz)
- Capable of low voltage operation

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Rating	Unit
Drain to source voltage	V_{DS}	12	V
Gate1 to source voltage	V_{G1S}	+0.5, –6	V
Gate2 to source voltage	V_{G2S}	+0.5, –6	V
Drain current	I_D	80	mA
Channel dissipation	Pch	150	mW
Channel temperature	Tch	125	°C
Storage temperature	Tstg	–55 to +125	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test condition
Drain to source breakdown voltage	$V_{(BR)DSX}$	12	—	—	V	I_D = 50 μA, V_{G1S} = –6 V, V_{G2S} = 0
Gate1 to source breakdown voltage	$V_{(BR)G1SS}$	–6	—	—	V	I_{G1} = –10 μA, V_{G2S} = V_{DS} = 0
Gate2 to source breakdown voltage	$V_{(BR)G2SS}$	–6	—	—	V	I_{GS} = –10 μA, V_{G1S} = V_{DS} = 0
Gate1 leakage current	I_{G1SS}	—	—	–20	μA	V_{G1S} = –6 V, V_{G2S} = V_{DS} = 0
Gate2 leakage current	I_{G2SS}	—	—	–20	μA	V_{G2S} = –6 V, V_{G1S} = V_{DS} = 0
Drain current	I_{DSS}	10	—	32	mA	V_{DS} = 5 V, V_{G1S} = V_{G2S} = 0
Gate1 to source cutoff voltage	$V_{G1S(off)}$	—	—	–5	V	V_{DS} = 5 V, V_{G2S} = 0, I_D = 100 μA
Gate2 to source cutoff voltage	$V_{G2S(off)}$	—	—	–4	V	V_{DS} = 5 V, V_{G1S} = 0, I_D = 100 μA
Forward transfer admittance	$\|y_{fs}\|$	10	—	—	mS	V_{DS} = 5 V, V_{G2S} = 0, I_D = 10 mA, f = 1 kHz
Input capacitance	Ciss	—	0.55	1.0	pF	V_{DS} = 5 V, V_{G1S} = V_{G2S} = –6 V, f = 1 MHz
Output capacitance	Coss	—	0.3	0.6	pF	
Reverse transfer capacitance	Crss	—	0.02	0.05	pF	
Power gain	PG	12	16.6	—	dB	V_{DS} = 5 V, V_{G2S} = 0, I_D = 10 mA, f = 900 MHz
Noise figure	NF	—	1.5	3.0	dB	

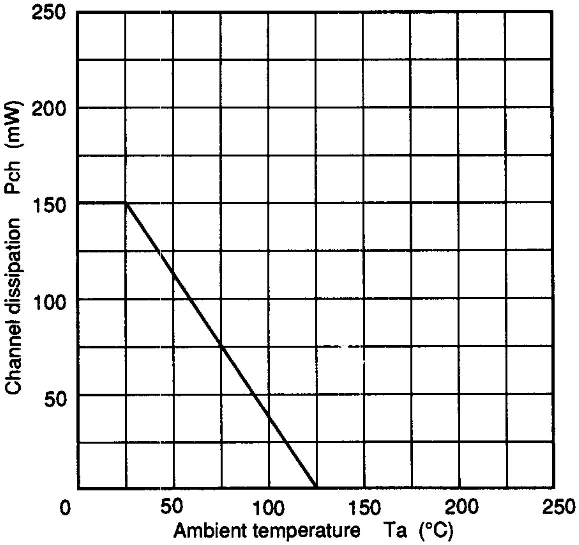


Figure 1 Maximum Channel Dissipation Curve

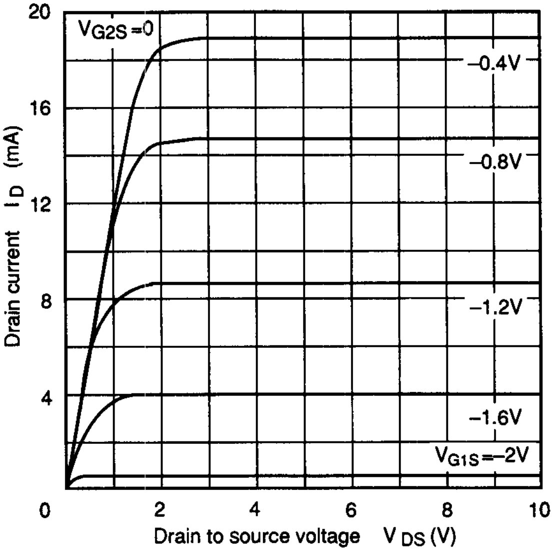


Figure 2 Typical Output Characteristics

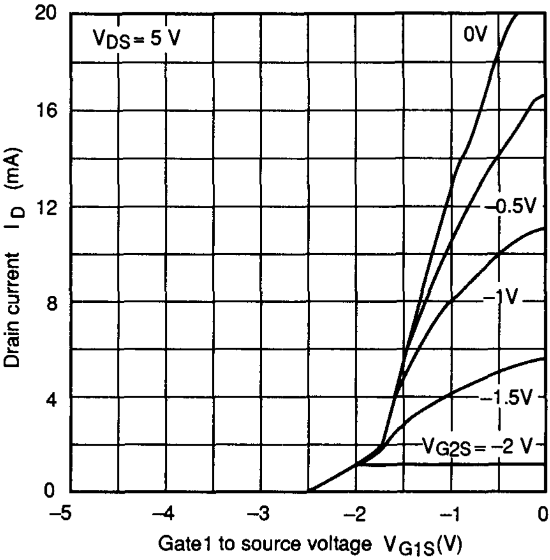


Figure 3 Drain Current vs. Gate1 to Source Voltage

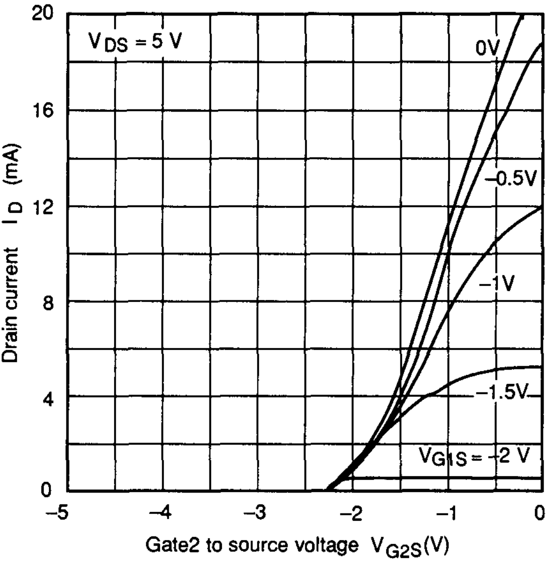


Figure 4 Drain Current vs. Gate2 to Source Voltage

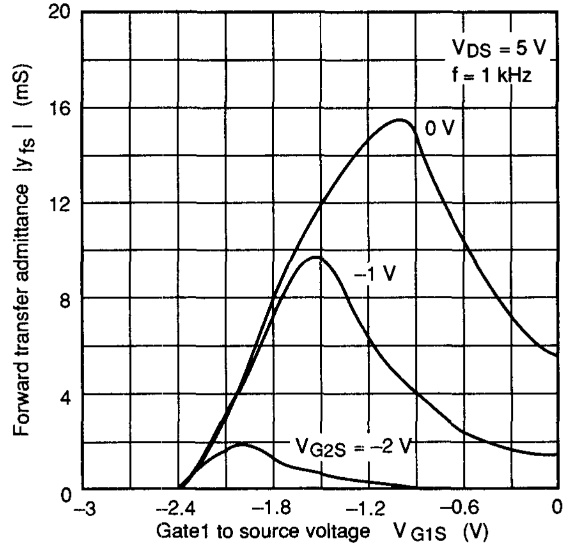


Figure 5 Forward Transfer Admittance vs. Gate1 to Source Voltage

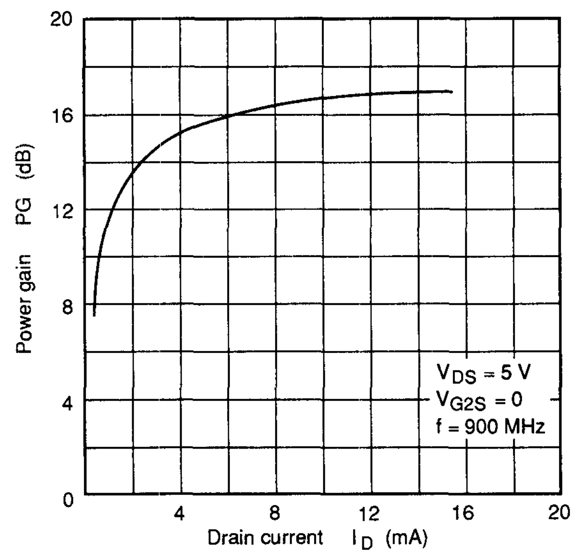


Figure 6 Power Gain vs. Drain Current

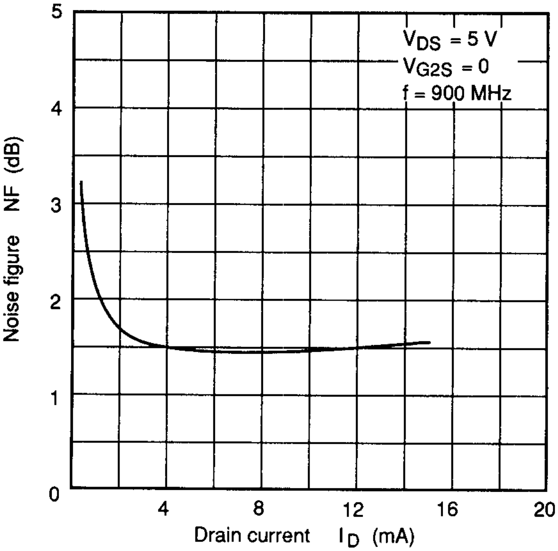


Figure 7 Noise Figure vs. Drain Current

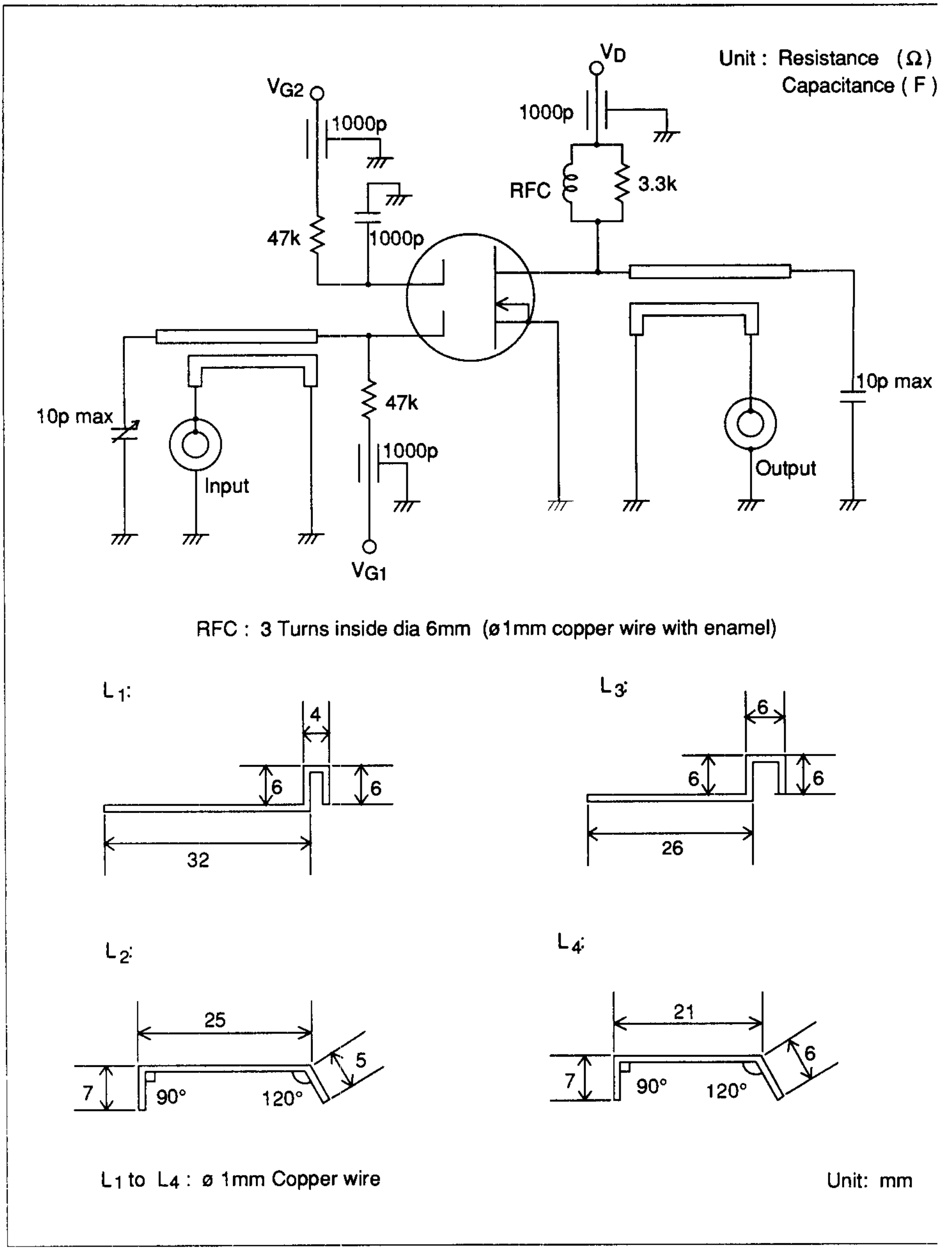


Figure 8 3SK191 PG, NF Test Circuit

3SK228 Series

GaAs Dual Gate MES FET

Application

UHF TV tuner RF amplifier

Features

- Excellent low noise characteristics (NF = 1.3 dB typ at f = 900 MHz)
- Capable of low voltage operation

Table 1 Ordering Information

Type No.	Package
3SK228	MPAK-4
3SK229	

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DS}	12	V
Gate1 to source voltage	V_{G1S}	–6	V
Gate2 to source voltage	V_{G2S}	–6	V
Drain current	I_D	50	mA
Channel dissipation	Pch	150	mW
Channel temperature	Tch	125	°C
Storage temperature	Tstg	–55 to +125	°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item		Symbol	Min	Typ	Max	Unit	Test conditions
Drain to source leakage current		I_{DSX}	—	—	50	μA	V_{DS} = 12 V, V_{G1S} = –3 V, V_{G2S} = 0
Gate1 to source breakdown voltage		$V_{(BR)G1SS}$	–6	—	—	V	I_{G1} = –10 μA, V_{G2S} = V_{DS} = 0
Gate2 to source breakdown voltage		$V_{(BR)G2SS}$	–6	—	—	V	I_{G2} = –10 μA, V_{G1S} = V_{DS} = 0
Gate1 leakage current		I_{G1SS}	—	—	–5	μA	V_{G1S} = –5 V, V_{G2S} = V_{DS} = 0
Gate2 leakage current		I_{G2SS}	—	—	–5	μA	V_{G2S} = –5 V, V_{G1S} = V_{DS} = 0
Drain current	3SK228	I_{DSS}	10	17	32	mA	V_{DS} = 5 V,
	3SK229		15	25	40		V_{G1S} = V_{G2S} = 0
Gate1 to source	3SK228	$V_{G1S(off)}$	—	–1.1	–1.5	V	V_{DS} = 5 V, V_{G2S} = 0,
cutoff voltage	3SK229		—	–1.3	–3.5		I_D = 100 μA
Gate2 to source	3SK228	$V_{G2S(off)}$	—	–1.1	–1.5	V	V_{DS} = 5 V, V_{G1S} = 0,
cutoff voltage	3SK229		—	–1.3	–3.5		I_D = 100 μA
Forward transfer admittance		$\|y_{fs}\|$	20	34	—	mS	V_{DS} = 5 V, V_{G2S} = 1 V, I_D = 10 mA, f = 1 kHz
Input capacitance	3SK228	Ciss	—	0.58	1.0	pF	V_{DS} = 5 V,
	3SK229		—	0.56	1.0		V_{G1S} = V_{G2S} = –3 V,
Output capacitance		Coss	—	0.36	0.6	pF	f = 1 MHz
Reverse transfer	3SK228	Crss	—	0.028	0.05	pF	
capacitance	3SK229		—	0.027	0.05		
Power gain	3SK228	PG	17	19.6	—	dB	V_{DS} = 5 V, V_{G2S} = 1 V,
	3SK229		17	20	—		I_D = 10 mA, f = 900 MHz
Noise figure		NF	—	1.3	2.0	dB	

Note: Mark is "XR–".

3SK228 representing the characteristics curves hereafter.

For the detail of characteristics of other parts, please consult our sales offices near you.

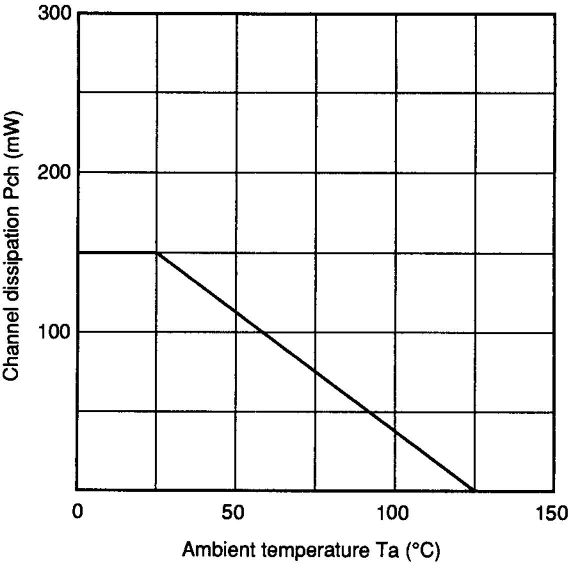


Figure 1 Maximum Channel Dissipation Curve

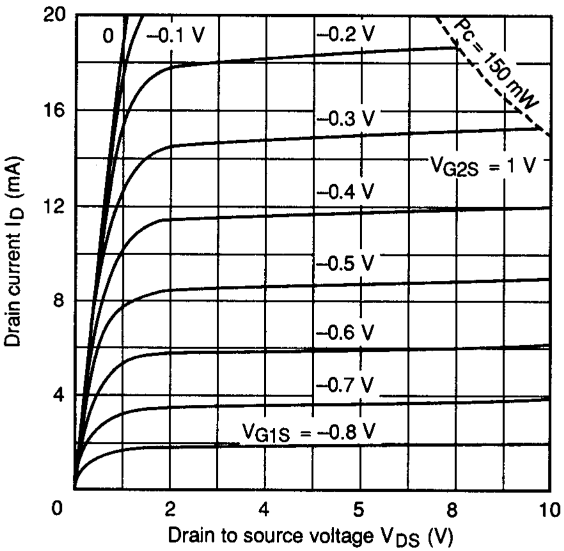


Figure 2 Typical Output Characteristics

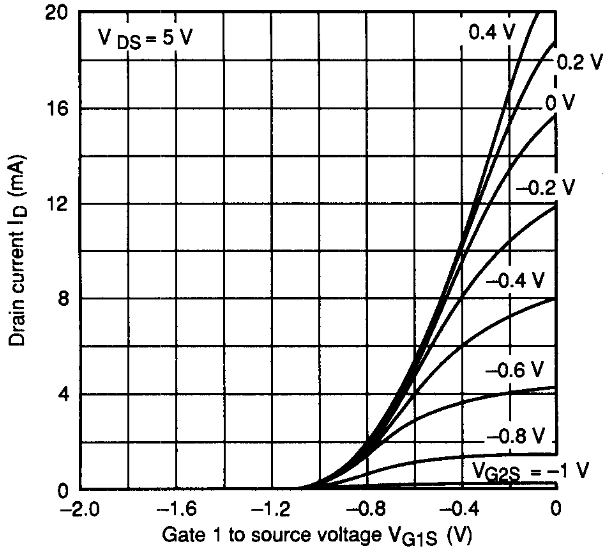


Figure 3 Drain Current vs. Gate1 to Source Voltage

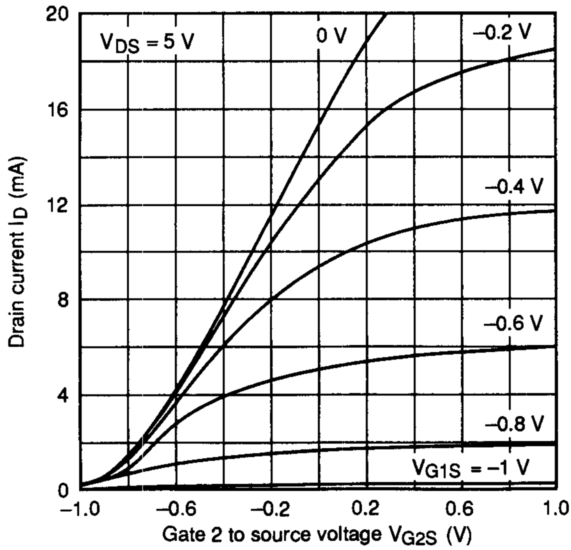


Figure 4 Drain Current vs. Gate2 to Source Voltage

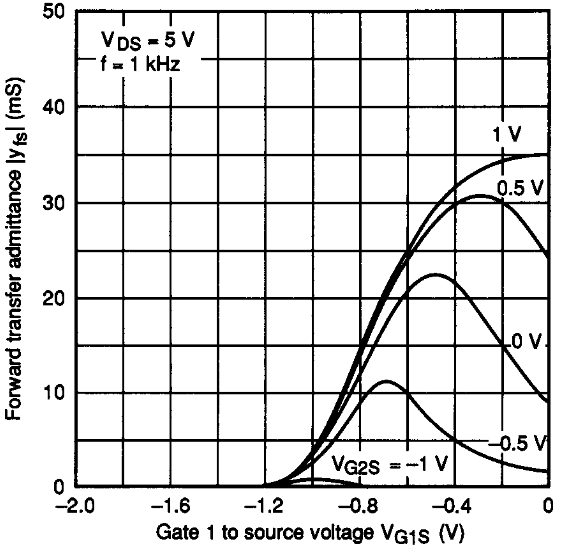


Figure 5 Forward Transfer Admittance vs. Gate1 to Source Voltage

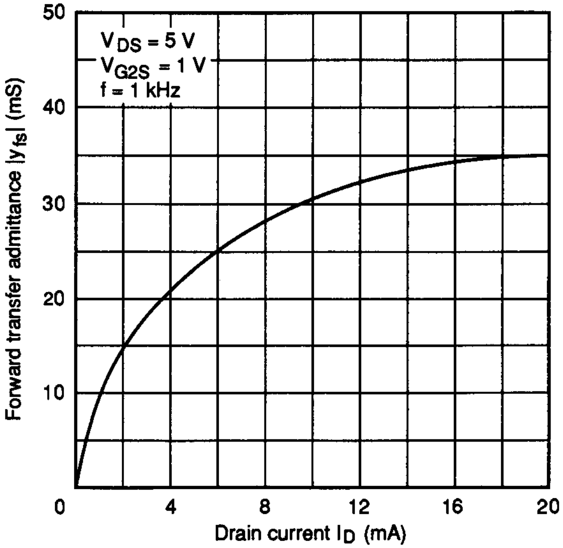


Figure 6 Forward Transfer Admittance vs. Drain Current

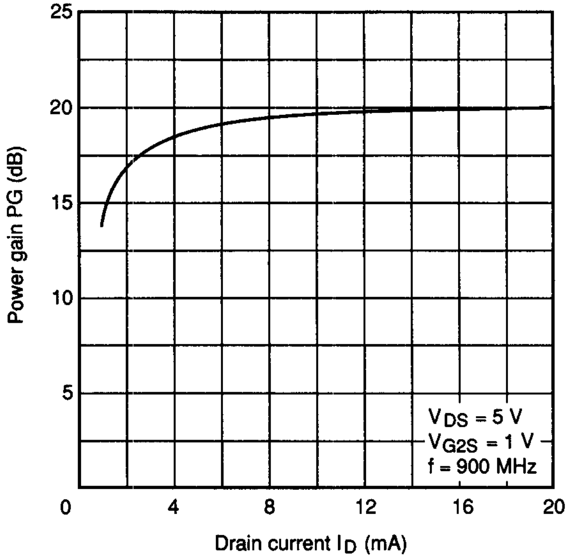


Figure 7 Power Gain vs. Drain Current

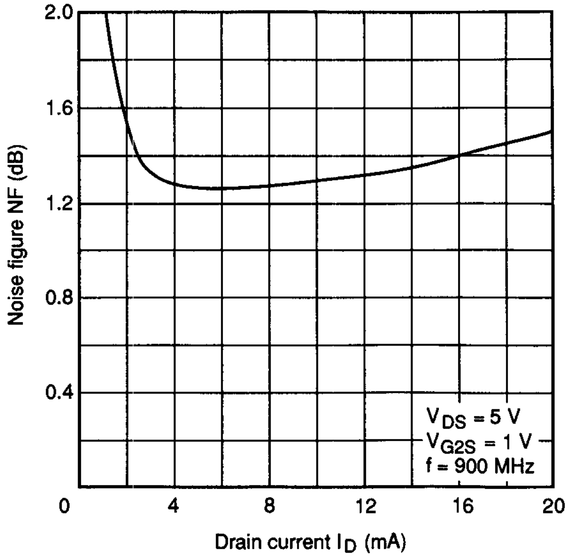


Figure 8 Noise Figure vs. Drain Current

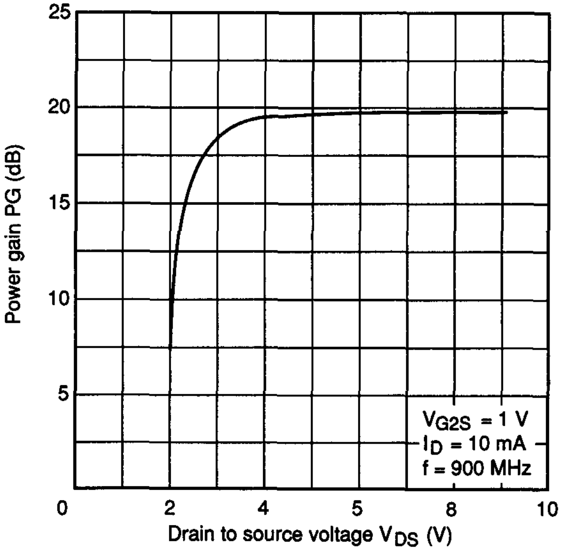


Figure 9 Power Gain vs. Drain to Source Voltage

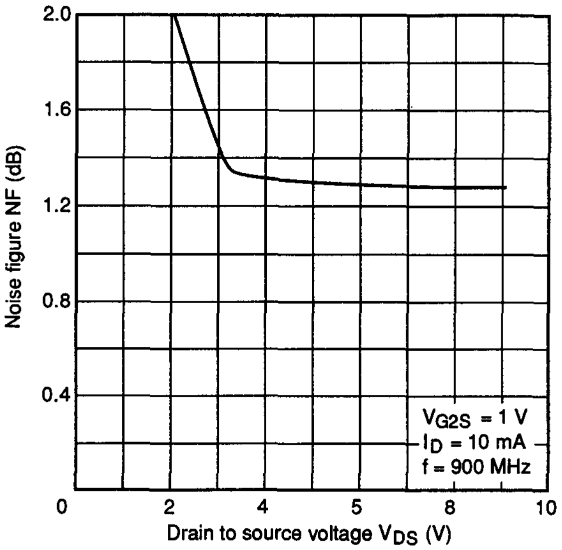


Figure 10 Noise Figure vs. Drain to Source Voltage

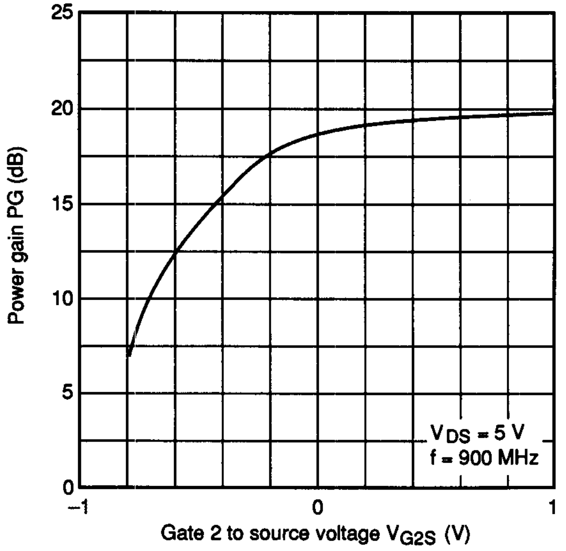


Figure 11 Power Gain vs. Gate2 to Source Voltage

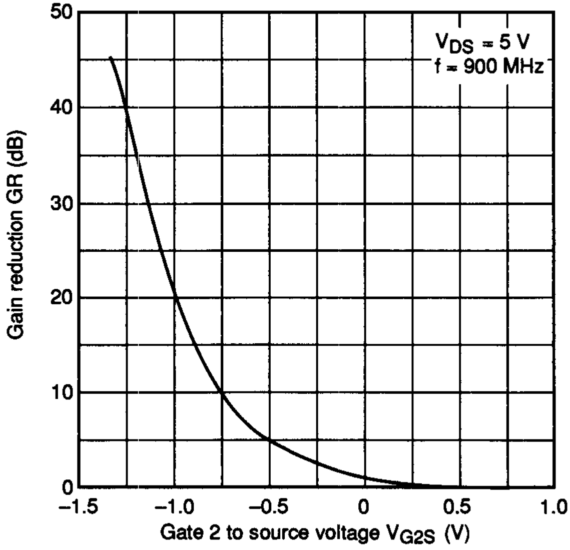
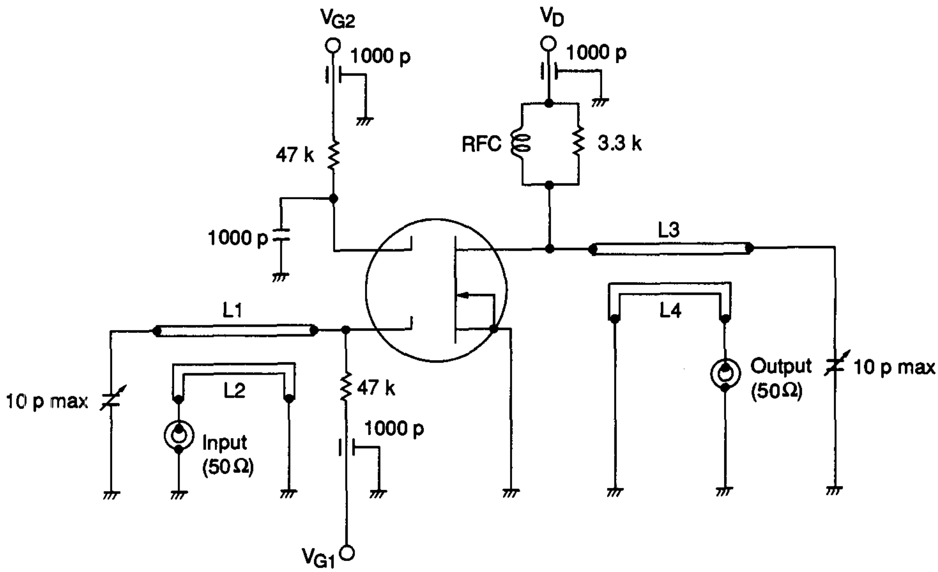
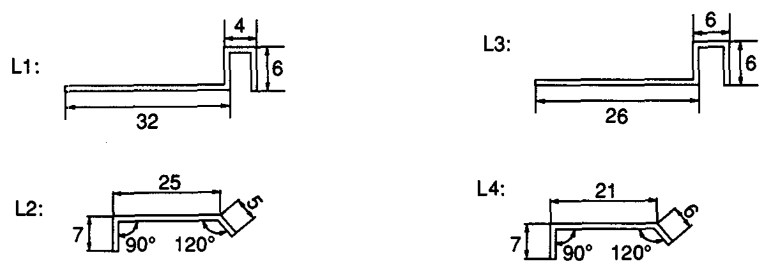


Figure 12 Gain Reduction vs. Gate2 to Source Voltage



L1 to L4: φ 1 mm copper wire



Unit: mm

RFC: 3 turns inside dia 6 mm (φ 1 mm copper wire with enamel)

Figure 13 3SK228 PF, NF Test Circuit

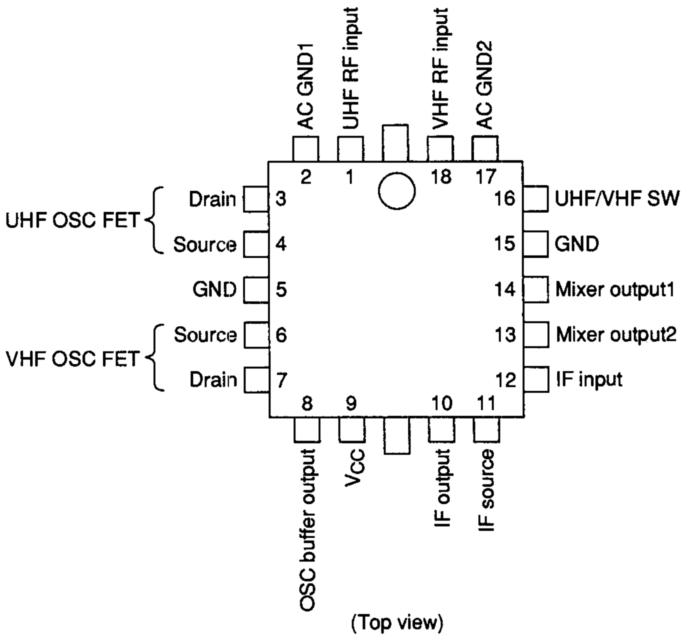
HA21001MS

VHF/UHF Tuner Use GaAs IC

Features

- Covers VHF and UHF frequencies
- Contains local OSC FETs, double balance mixer and IF amp dual gate FET
- Low noise, low distortion
- Surface mount package

Pin Arrangement



Caution

This product uses GaAs. Since dust and fumes from GaAs are highly poisonous to the human body, do not treat the product mechanically or chemically in a manner which might release hazardous substances into the air. It should never be thrown out with general industrial or domestic wastes.

Block Diagram

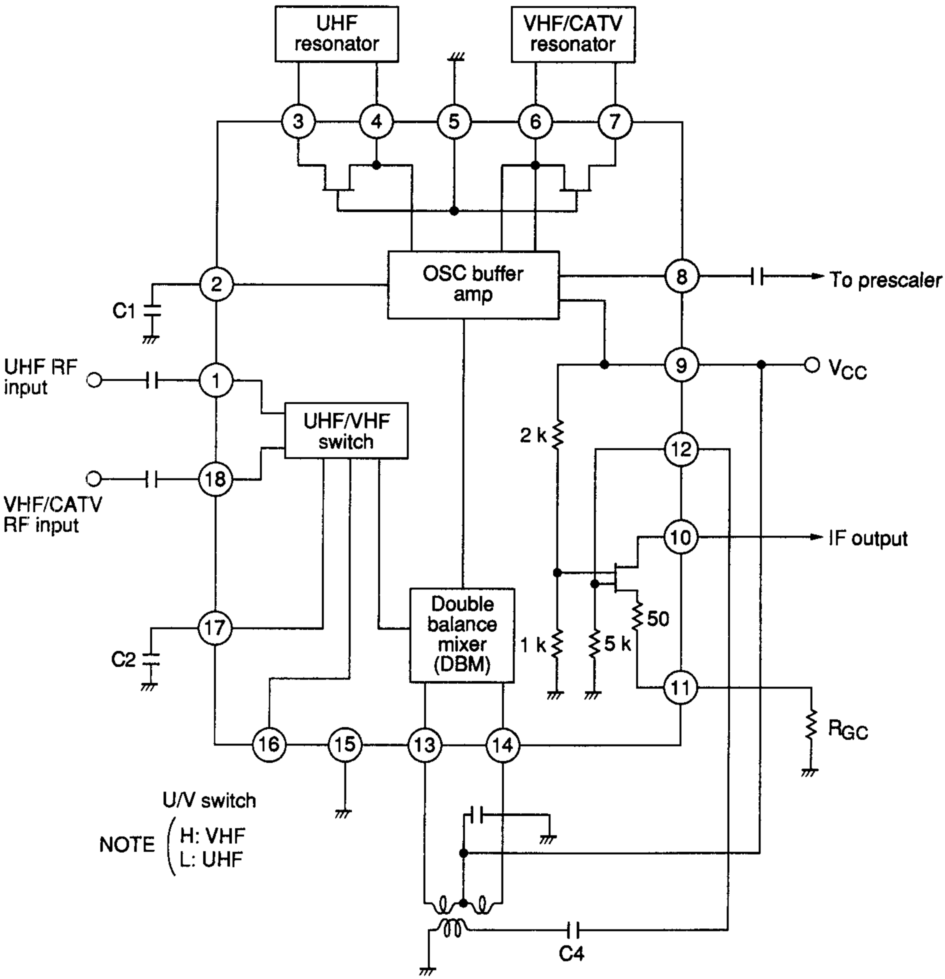


Table 1 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Supply voltage *1	V_{CC}	12	V
Maximum input voltage *2	Vin	±5	V
Maximum current	It	50	mA
Power dissipation *3	P_T	450	mW
Channel temperature	Tch	125	°C
Storage temperature	Tstg	–55 to +125	°C
Operation temperature	Topr	–10 to +75	°C

Notes: 1. Operation voltage is 8 to 10 V.
2. Apply on pins 1, 12, 16, 18.
3. When mounted on glass epoxy PCB (40 mm × 40 mm × 1.5 mm^t) convered with copper more than 30%. (Ta = 75°C)

Table 2 Electrical Characteristics (Ta = 25°C, V_{CC} = 9 V)

Item	Symbol	Min	Typ	Max	Unit	Applicable Pin No.	Test conditions
Quiescent current	I_Q	20	34	42	mA		No signal
VHF SW voltage	V_{SWH}	5.0	—	—	V	16	
UHF SW voltage	V_{SWL}	—	—	0.8	V	16	
Conversion gian	CG1	20	23	—	dB	6, 10, 18	RF = 60 MHz
	CG2	20	23	—	dB	6, 10, 18	RF = 460 MHz (VHF)
	CG3	24	31	—	dB	4, 10, 1	RF = 860 MHz
OSC buffer output	Pps1	–21	–18	—	dBm	10, 18	LOCAL = 105.75 MHz
	Pps2	–22	–17	—	dBm	1, 10	LOCAL = 905.75 MHz
Noise figure	NF1	—	10	—	dB	6, 10, 18	RF = 60 MHz
	NF2	—	10	—	dB	6, 10, 18	RF = 460 MHz (VHF)
	NF3	—	8	—	dB	4, 10, 1	RF = 860 MHz

Table 3 Typical Performance (Ta = 25°C, V_{CC} = 9 V)

Item	Symbol	Typ	Unit	Applicable Pin No.	Test conditions
1% cross modulation	CM	–17	dBm	6, 10, 18	RF = 210 MHz, S/I = 50 dB, Undesire = RF ± 12 MHz, 50 kHz 63% AM
Inter-modulation distortion ratio	IM2	–70	dB	6, 10, 18	RF = 210 MHz, Undesire = 256.75 MHz, –30 dBm
	IM3	–50	dB	6, 10, 18	RF = 210 MHz, Undesire = 211 MHz, –30 dBm
Local to RF leakage	LL1	–27	dBm	1, 4, 6	LOCAL = 905.75 MHz
	LL2	–36	dBm	18, 4, 6	LOCAL = 505.75 MHz

Note: RF and local input test conditions are as follows.
RF = 60 to 460 MHz, –30 dBm
RF = 510 to 860 MHz, –40 dBm
LOCAL = 7 dBm, IF = 45.75 MHz

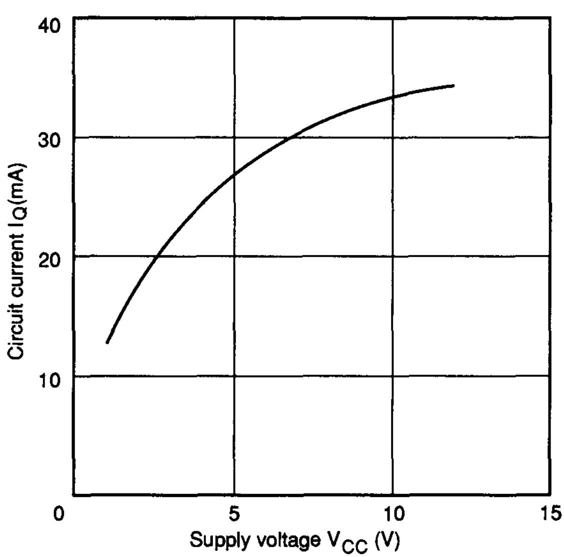


Figure 1 Circuit Current vs. Supply Voltage

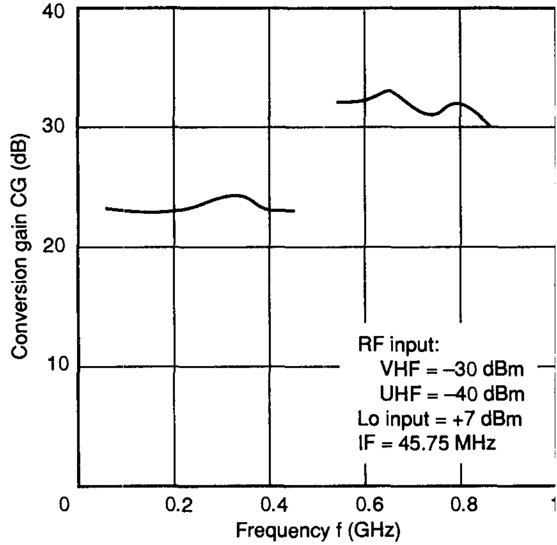


Figure 2 Conversion Gain vs. Frequency

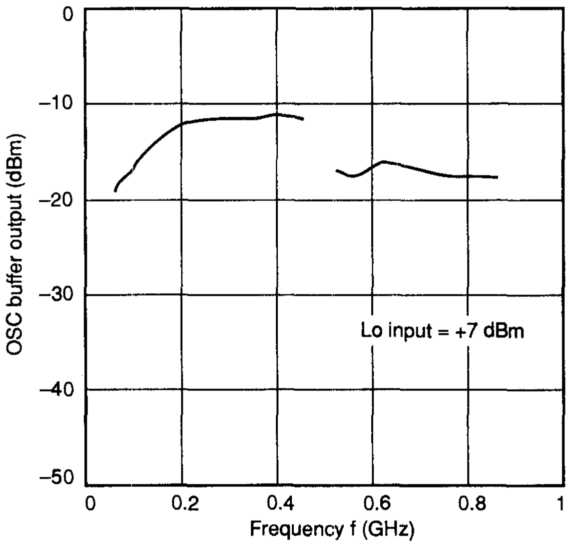


Figure 3 OSC Buffer Out vs. Frequency

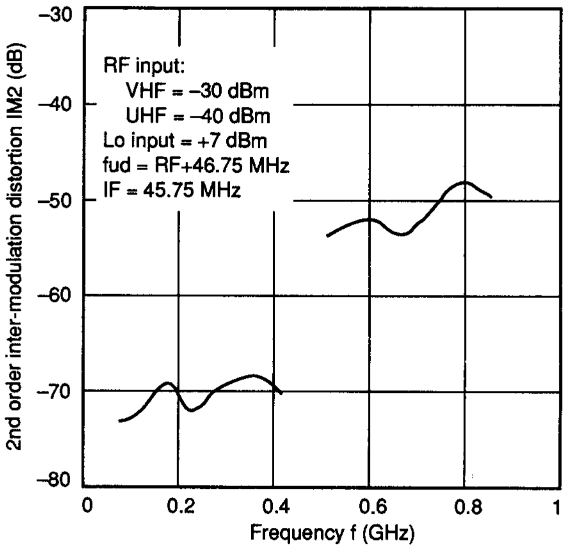


Figure 4 2nd Order IMD vs. Frequency

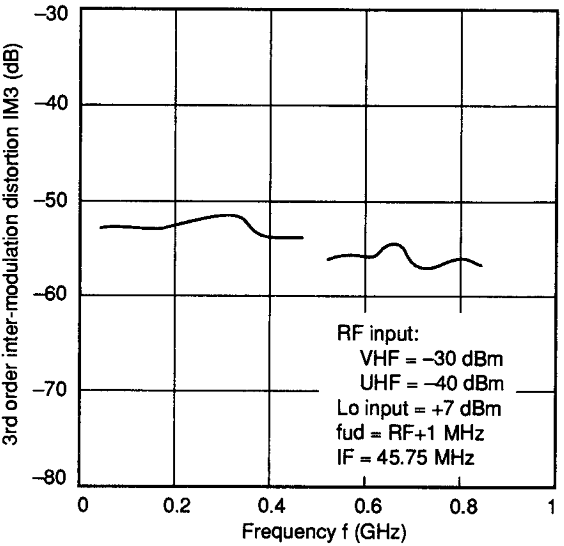


Figure 5 3rd Order IMD vs. Frequency

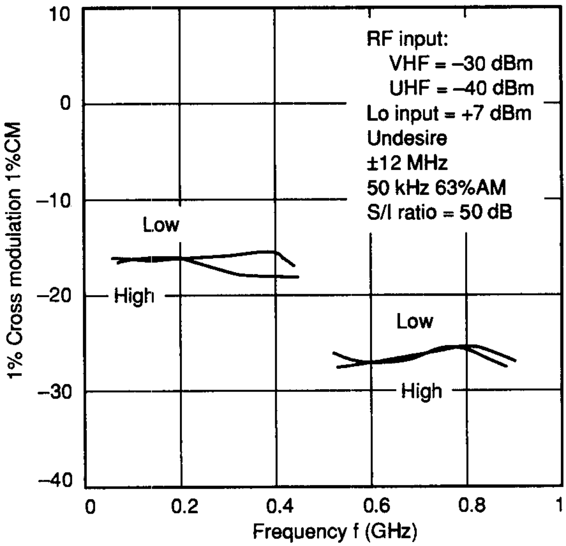


Figure 6 1% Cross Modulation vs. Frequency

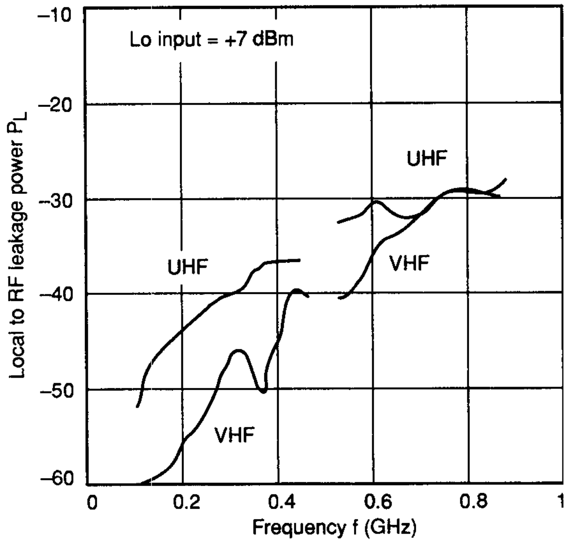
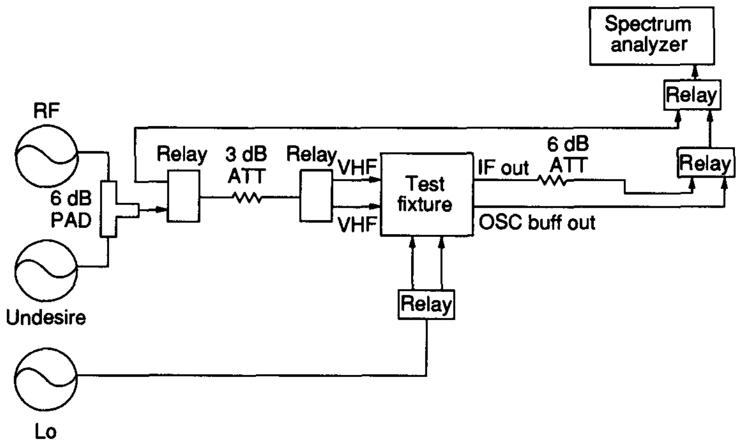


Figure 7 Local to RF Leakage Power vs. Frequency

Test System Diagram



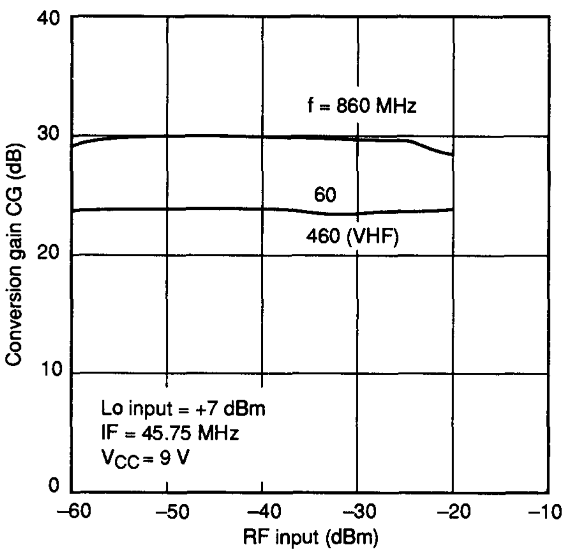


Figure 8 Conversion Gain vs. RF Input

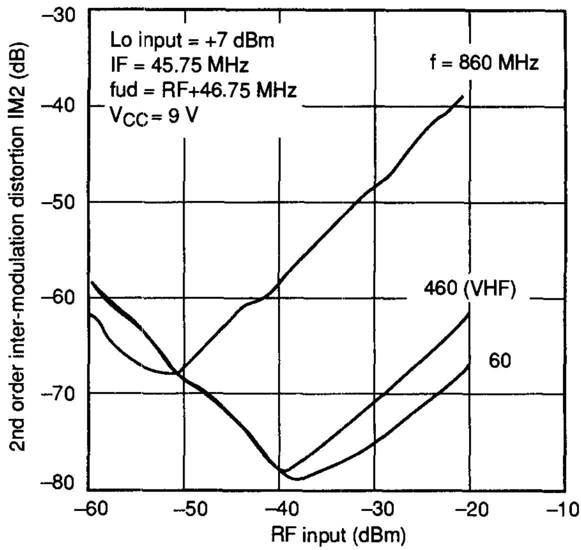


Figure 9 2nd Order IMD vs. RF Input

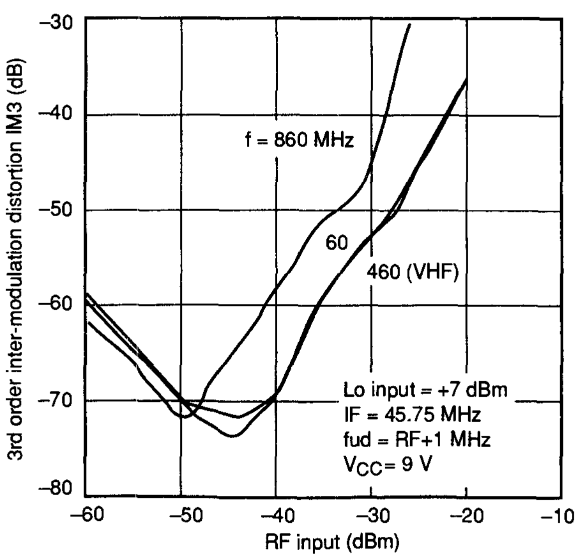


Figure 10 3rd Order IMD vs. RF Input

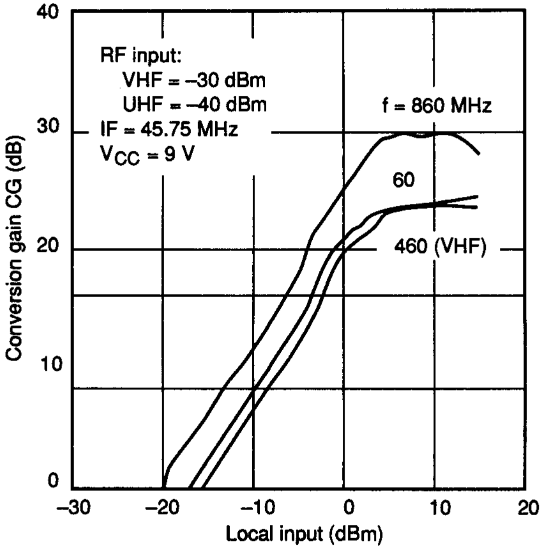


Figure 11 Conversion Gain vs. Local Input

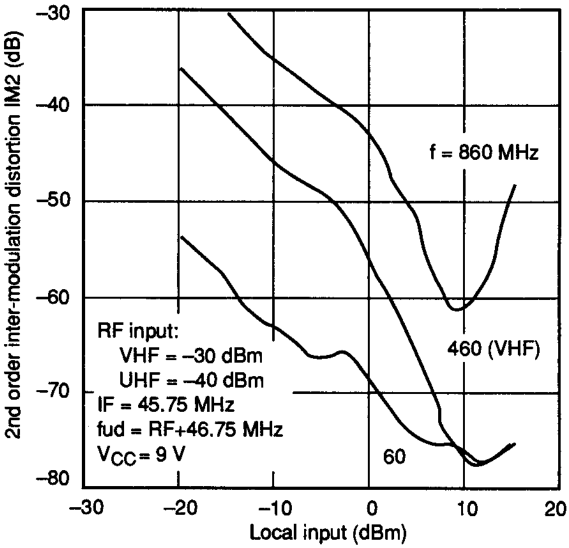


Figure 12 2nd Order IMD vs. Local Input

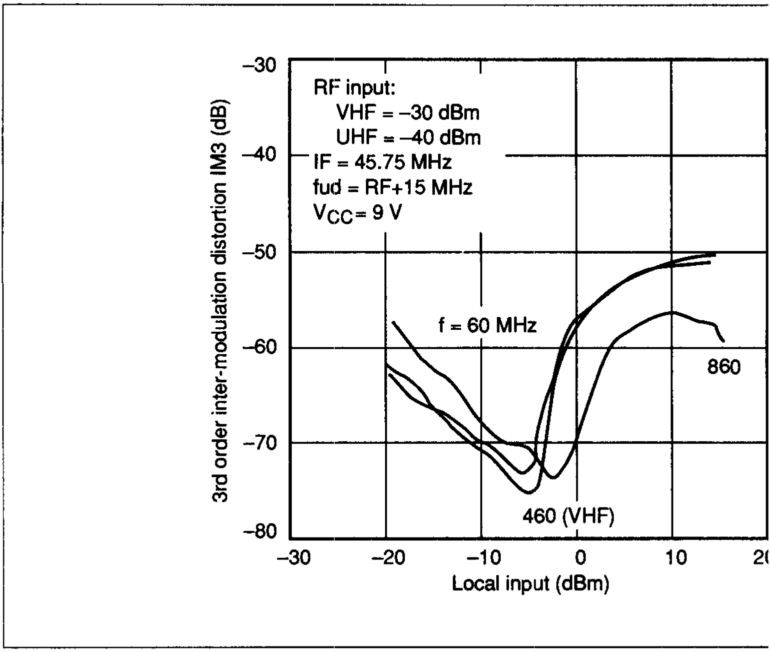


Figure 13 3rd Order IMD vs. Local Input

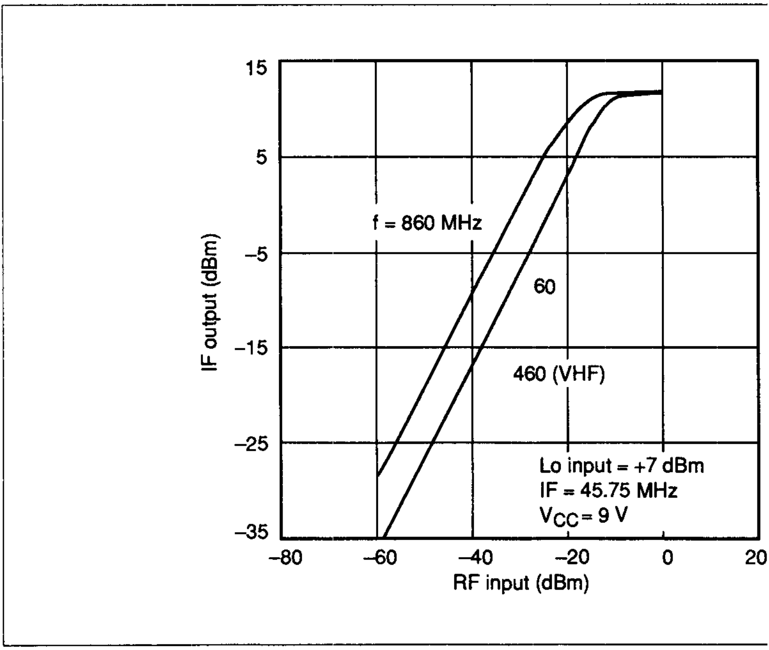
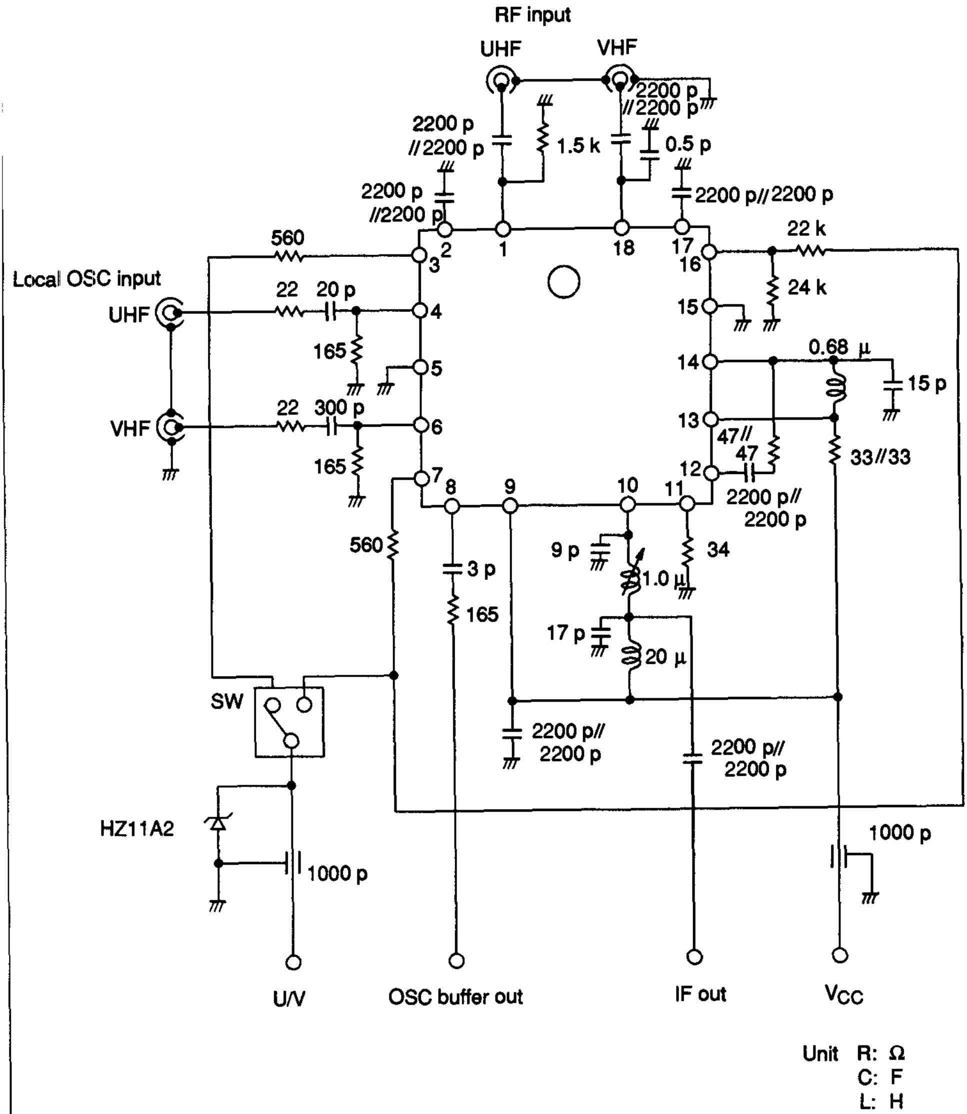
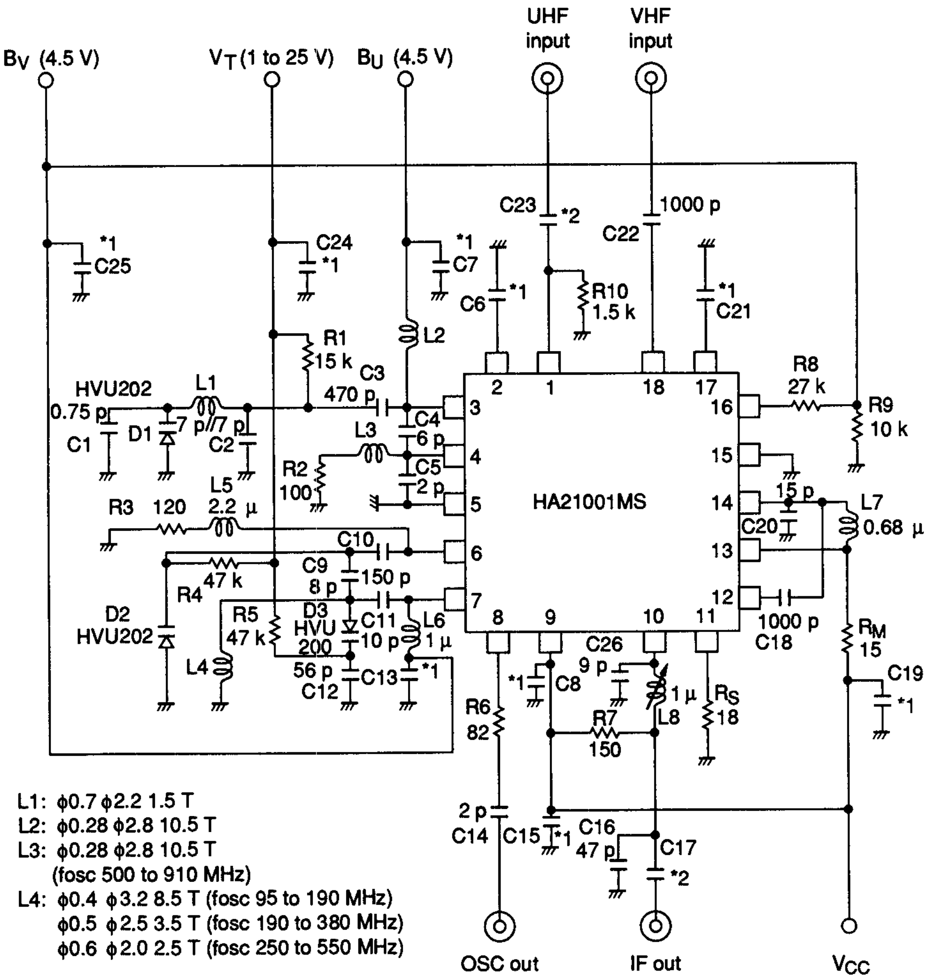


Figure 14 IF Output vs. RF Input

Test Fixture



Evaluation Circuit



L1: ϕ0.7 ϕ2.2 1.5 T
L2: ϕ0.28 ϕ2.8 10.5 T
L3: ϕ0.28 ϕ2.8 10.5 T
(fosc 500 to 910 MHz)
L4: ϕ0.4 ϕ3.2 8.5 T (fosc 95 to 190 MHz)
ϕ0.5 ϕ2.5 3.5 T (fosc 190 to 380 MHz)
ϕ0.6 ϕ2.0 2.5 T (fosc 250 to 550 MHz)

*2 Coupling capacitor (2200 pF)

*1 Bypass capacitor (2200 pF)

Evaluation Circuit Test Data

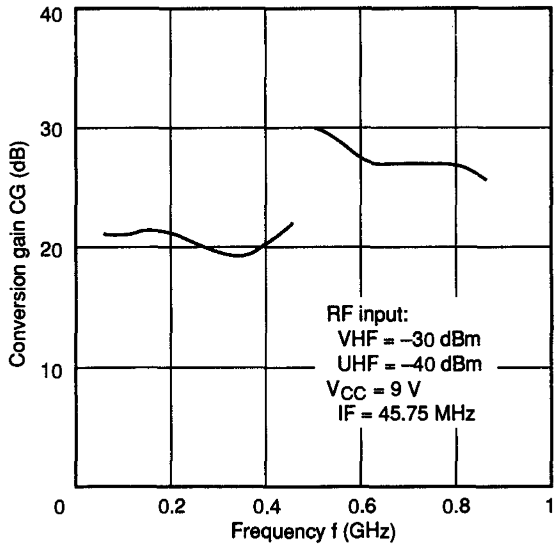


Figure 15 Conversion Gain vs. Frequency

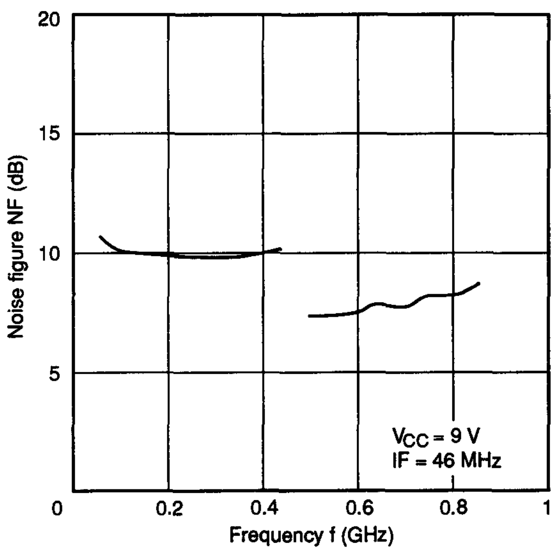


Figure 16 Noise Figure vs. Frequency

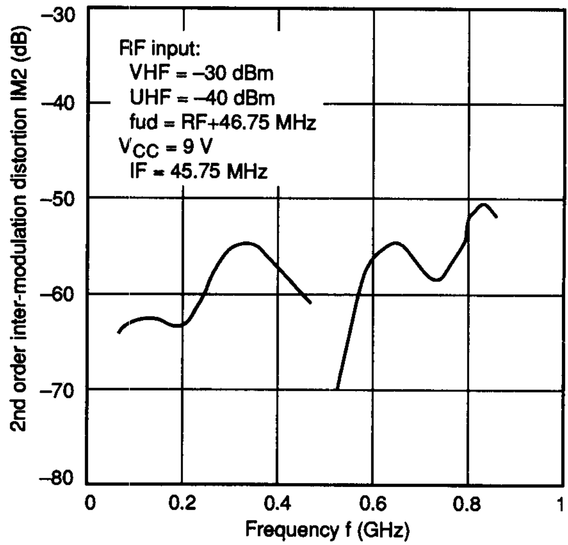


Figure 17 2nd Order IMD vs. Frequency

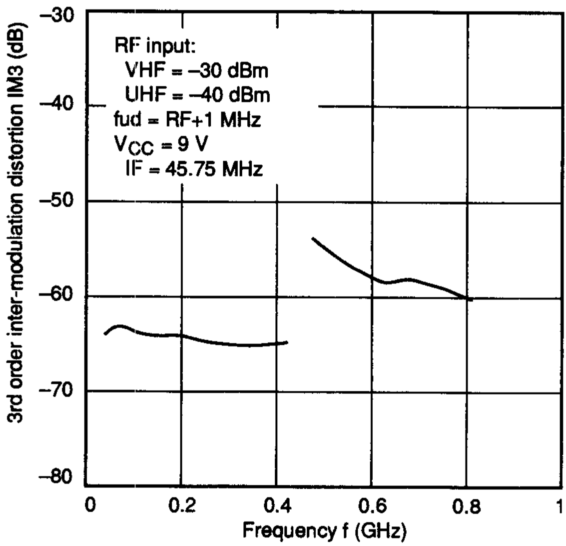


Figure 18 3rd Order IMD vs. Frequency

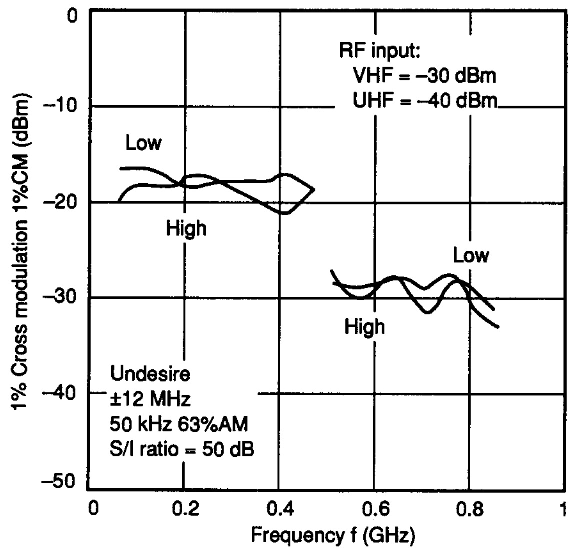


Figure 19 1% Cross Modulation vs. Frequency

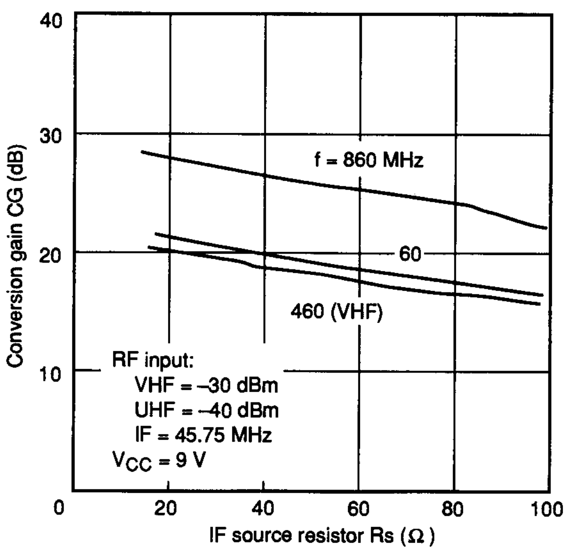


Figure 20 Conversion Gain vs. IF Source Resistor

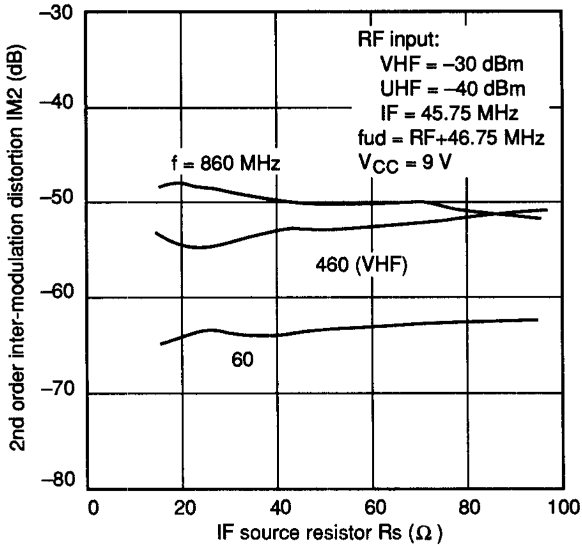


Figure 21 2nd Order IMD vs. IF Source Resistor

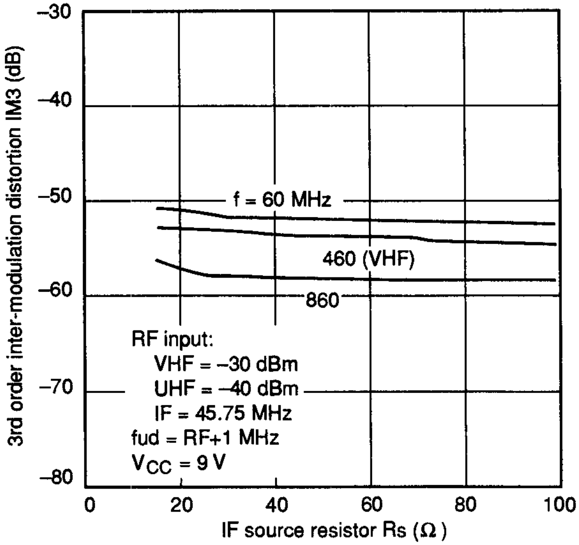


Figure 22 3rd Order IMD vs. IF Source Resistor

HA21005

BS Tuner Use GaAs IC

Application

GaAs monolithic IC
BS tuner wide band amplifier

Features

- Operational in all BS frequency (0.95 to 1.75 GHz)
- Stable input impedance (VSWR = 2 typ)
- Surface mount package

Table 1 Package Information

Type No.	Package
HA21005	MPAK—4

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Supply voltage	V_{CC}*	11	V
Maximum current	I_t	40	mA
Power dissipation	P_d**	290	mW
Channel temperature	Tch	150	°C
Storage temperature	Tstg	–55 to +150	°C
Operation temperature	Topr	–10 to +70	°C

* Operation voltage is 8.5 to 9.5V.
** Tc = 70 °C

Table 3 Electrical Characteristics ($Ta = 25°C$)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Quiescent current	I_Q	18	—	32	mA	No signal
Power gain	PG	—	11	—	dB	f = 950 MHz
Noise figure	NF	—	7	—	dB	f = 950 MHz

Table 4 Typical Performance ($Ta = 25°C$, $V_{CC} = 9$ V)

Item	Symbol	Typ	Unit	Test conditions
Power gain	PG	8	dB	f = 1.75 GHz
Noise figure	NF	7	dB	f = 1.75 GHz
3rd order intermodulation	IM3	–50	dB	–25 dBm, 2 RF input
Voltage standing wave ratio	VSWR	2	—	

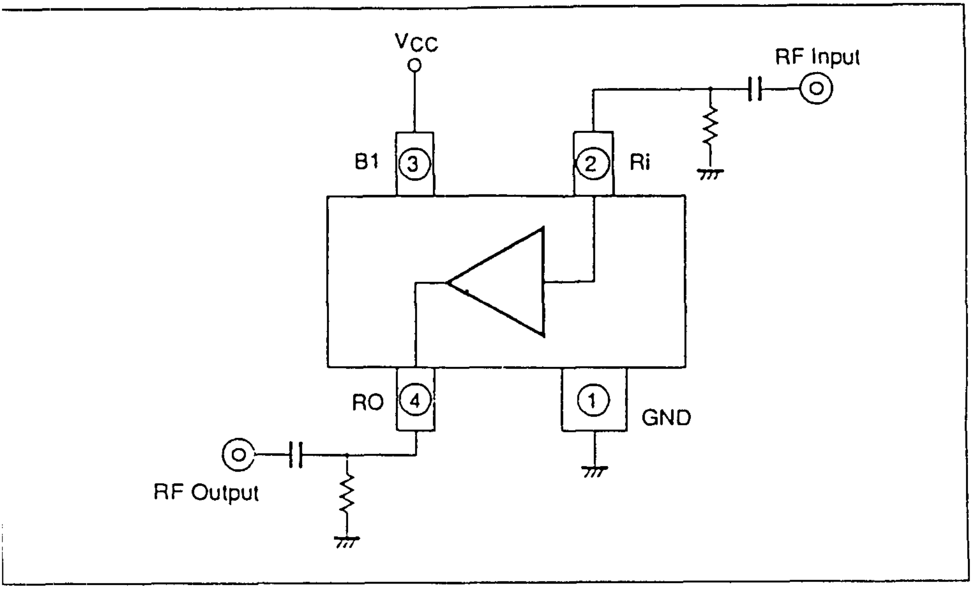


Figure 1 Block Diagram

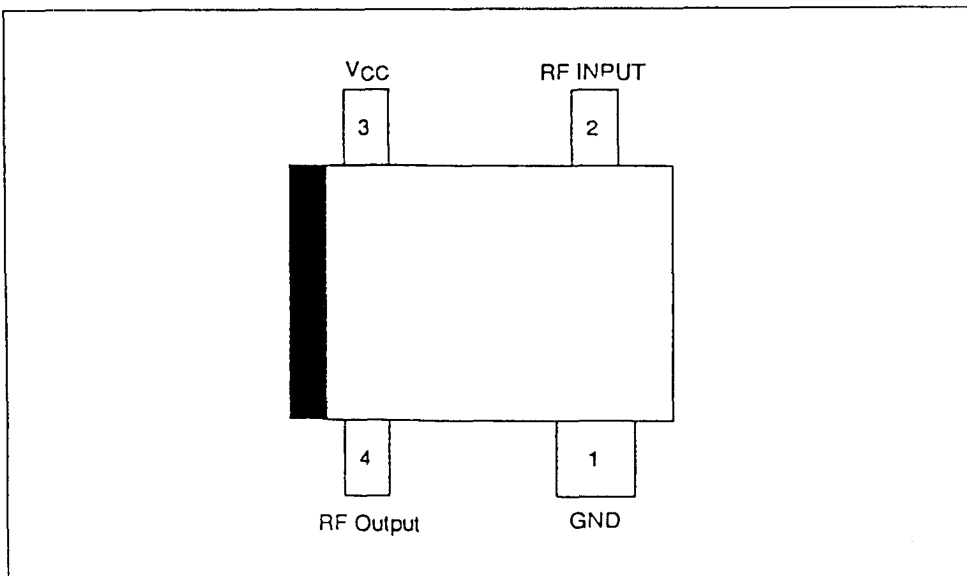


Figure 2 Pin Arrangement

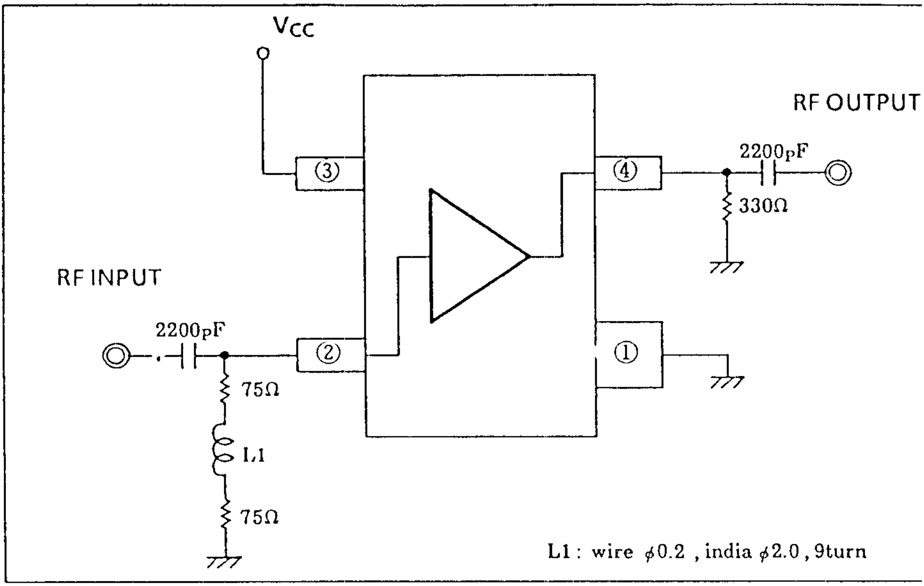


Figure 3 Test Fixture

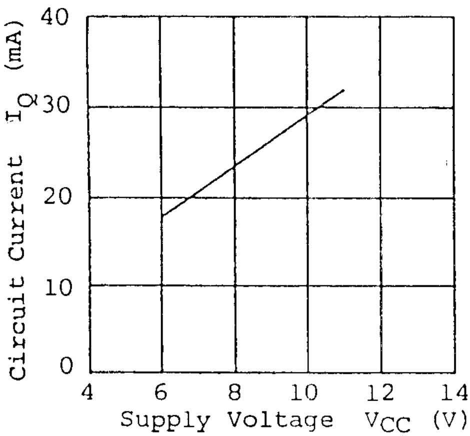


Figure 4 Circuit Current vs. Supply Voltage

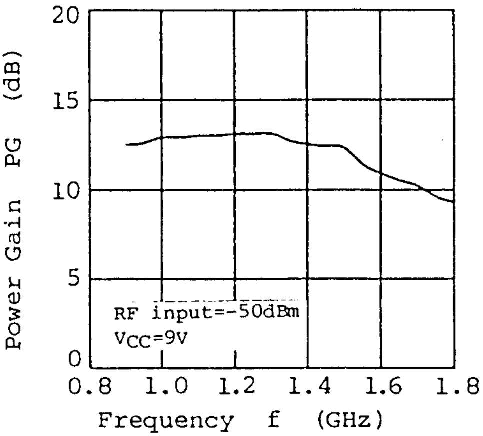


Figure 5 Power gain vs. Frequency

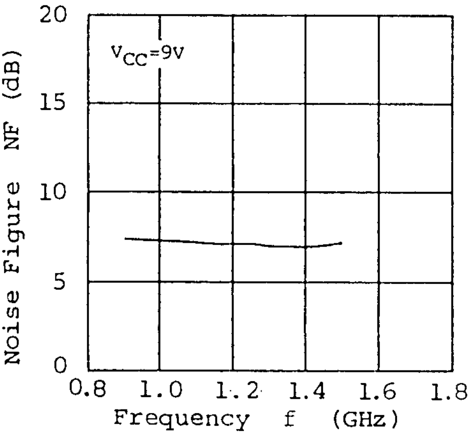


Figure 6 Noise Figure vs. Frequency

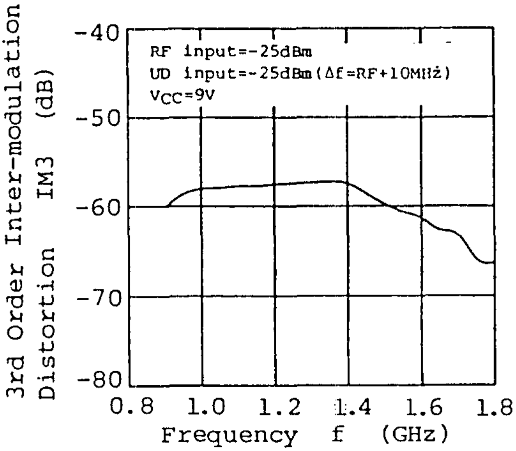


Figure 7 3rd Order Inter Modulation Distortion vs. Frequency

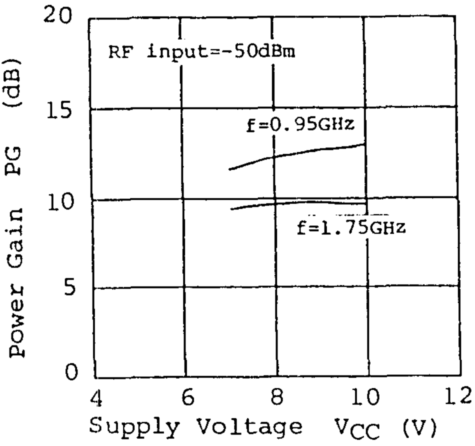


Figure 8 Power gain vs. Supply Voltage

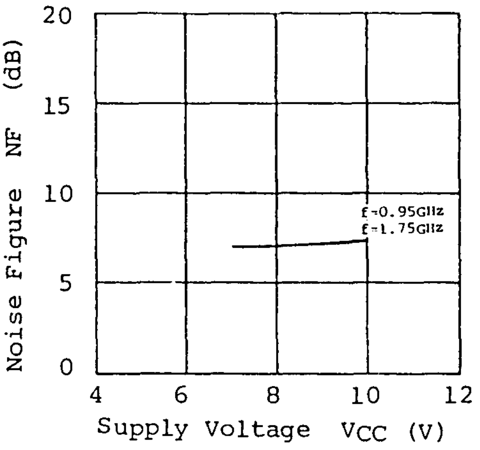


Figure 9 Noise Figure vs. Supply Voltage

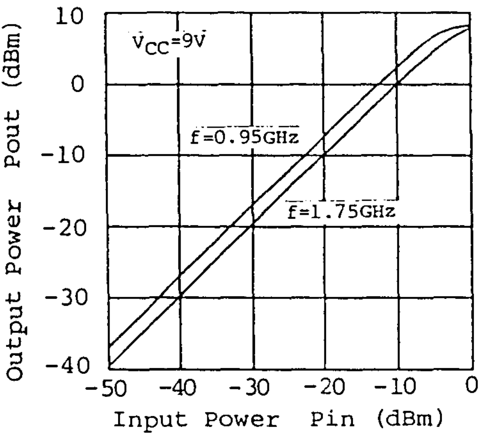


Figure 10 Output Power vs. Input Power

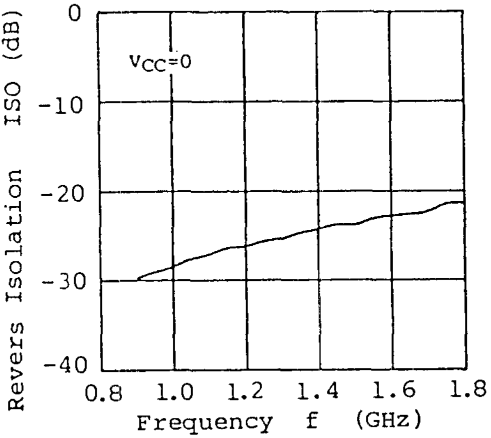


Figure 11 Reverse Isolation vs. Frequency

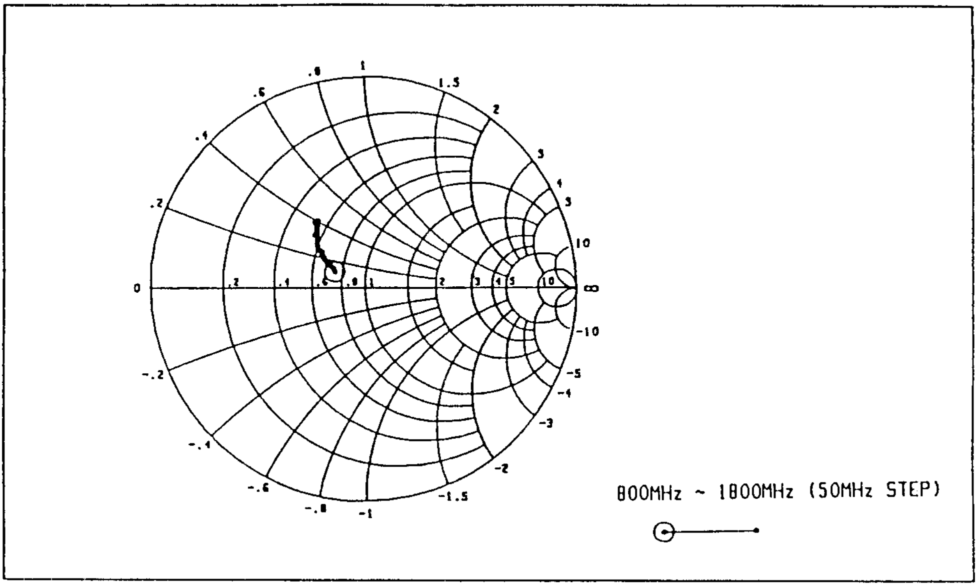


Figure 12 S_{11} Parameter vs. Frequency

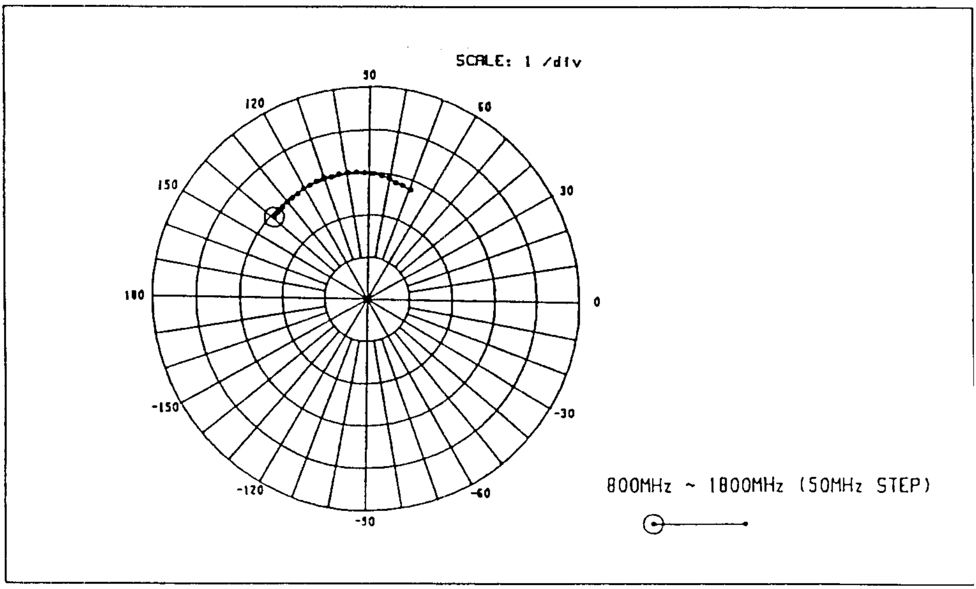


Figure 13 S_{21} Parameter vs. Frequency

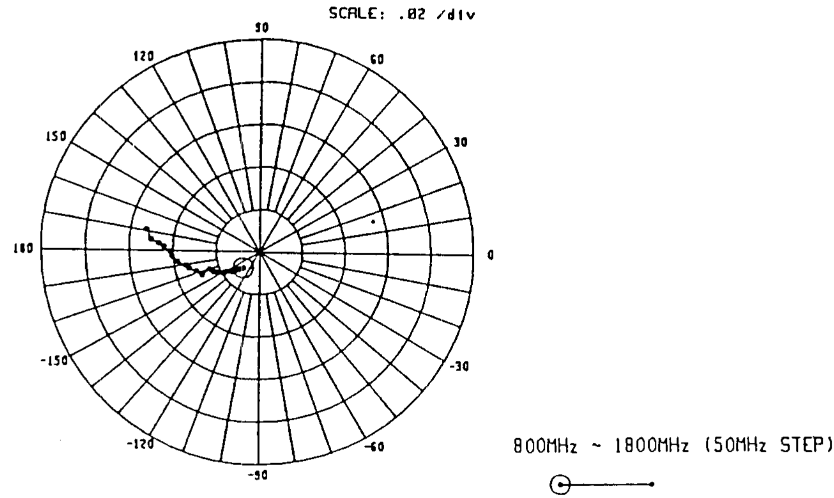


Figure 14 S_{12} Parameter vs. Frequency

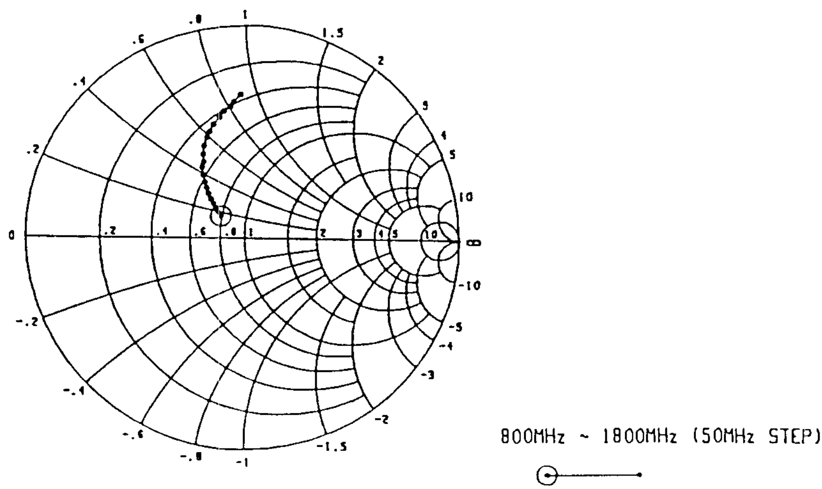


Figure 15 S_{22} Parameter vs. Frequency

Table 5 S Parameter (HA21005) (V_{CC} = 9 V, Z_O = 50 Ω)

	S11		S21		S12		S22	
f (GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.8	0.162	150.9	2.92	139.3	0.0107	–135.5	0.151	135.6
0.85	0.178	147.2	2.93	136.5	0.0124	–139.5	0.174	134.6
0.9	0.189	147.3	2.95	133.3	0.0132	–141.0	0.194	133.0
0.95	0.194	146.9	2.96	130.0	0.0149	–141.3	0.217	131.3
1.0	0.207	146.9	2.97	127.1	0.0162	–144.7	0.241	130.1
1.05	0.219	144.8	2.98	123.9	0.018	–149.1	0.268	128.5
1.1	0.231	144.4	3.01	120.5	0.0193	–148.3	0.293	126.4
1.15	0.243	142.9	3.01	117.3	0.0214	–153.0	0.320	124.7
1.2	0.255	141.8	3.03	113.9	0.0232	–156.1	0.351	122.8
1.25	0.266	139.3	3.06	110.2	0.0245	–160.7	0.386	120.4
1.3	0.283	139.8	3.02	106.9	0.0287	–157.5	0.403	117.9
1.35	0.301	137.6	3.04	103.3	0.0305	–162.5	0.436	116.0
1.4	0.313	135.4	3.03	99.4	0.0334	–166.4	0.470	113.3
1.45	0.320	133.3	3.02	95.6	0.0346	–169.0	0.501	110.1
1.5	0.344	132.9	2.99	92.0	0.0383	–173.0	0.523	108.0
1.55	0.343	130.9	2.98	88.0	0.0404	–176.6	0.552	105.1
1.6	0.351	129.4	2.93	83.9	0.0414	–179.9	0.578	101.6
1.65	0.361	128.3	2.90	80.4	0.0442	177.0	0.602	99.3
1.7	0.369	126.9	2.84	76.9	0.0467	175.3	0.620	96.2
1.75	0.388	126.6	2.81	73.5	0.0502	173.8	0.641	94.8
1.8	0.387	124.4	2.77	69.3	0.0532	168.9	0.673	91.8

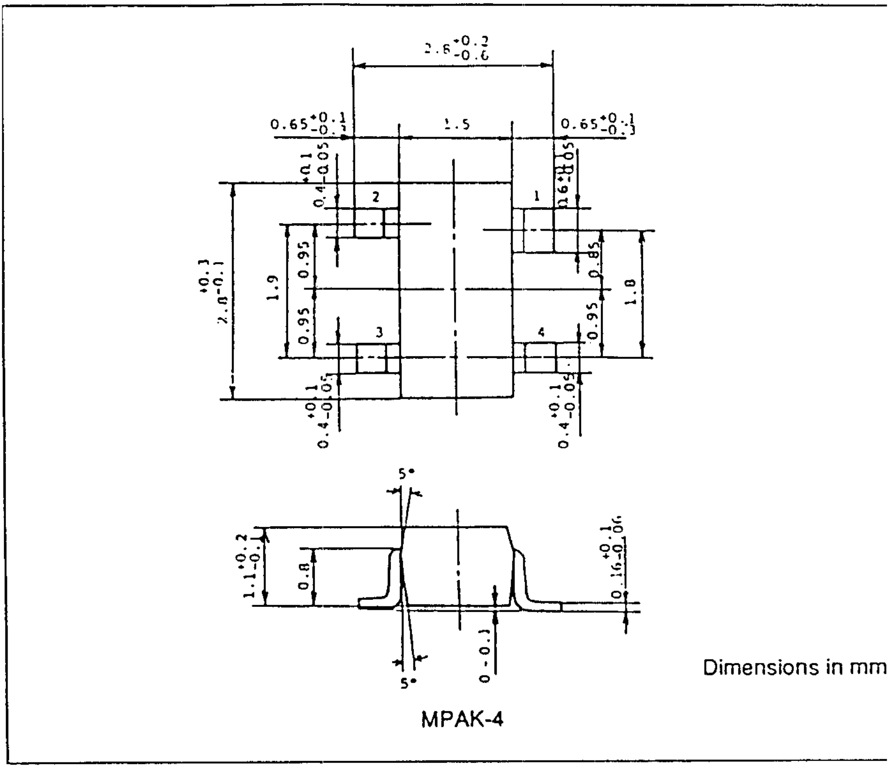


Figure 16 Package Outline

HA21006MP

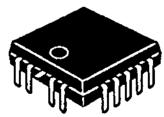
BS Tuner Use GaAs IC

Application

GaAs monolithic IC
BS tuner

Features

- BS tuner IC include mixer, RF AGC, IF AGC
- Operational in all BS frequency (0.95 to 1.75 GHz)
- Surface mount package



MP–18

Table 1 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Supply voltage	V_{CC}*	11	V
Maximum current	I_t	50	mA
Maximum input voltage	V_{in}**	±5	V
Power dissipation	P_d***	500	mW
Channel temperature	Tch	125	°C
Storage temperature	Tstg	–55 to +125	°C
Operation temperature	Topr	–10 to +70	°C

* Operation voltage is 8.5 to 9.5V.
** Applied to 3, 4, 9, 11 and 16 pin.
*** When mounted on glass epoxy PCB (40 mm x 40 mm x 1.5 mm^t) covered with copper more than 30%. (Ta = 70 °C)

Table 2 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Quiescent current	I_Q	25	—	50	mA	No signal
Conversion gain	CG	—	30	—	dB	V_{agc} = 4.5 V
Gain Reduction	GR	38	50	62	dB	V_{agc} = 4.5 V to 1 V

Table 3 Typical Performance (Ta = 25°C, V_{CC} = 9 V)

Item	Symbol	Typ	Unit	Test conditions
Noise figure	NF	8	dB	
2nd order intermodulation distortion	IM2	50	dB	GR = 50 dB, –25 dBm, 2 RF signal input
3rd order intermodulation distortion	IM3	56	dB	GR = 50 dB, –25 dBm, 2 RF signal input
Local leak level	LL_{RF}	–40	dBm	Leak to RF input
Local leak level	LL_{IF}	–24	dBm	Leak to I_F output

Note 1 Test condition is as follows unless otherwise specified.
RF = 990 MHz, IF = 480 MHz, P_{LOCAL} = 4 dBm, P_{RF} = –50 dBm

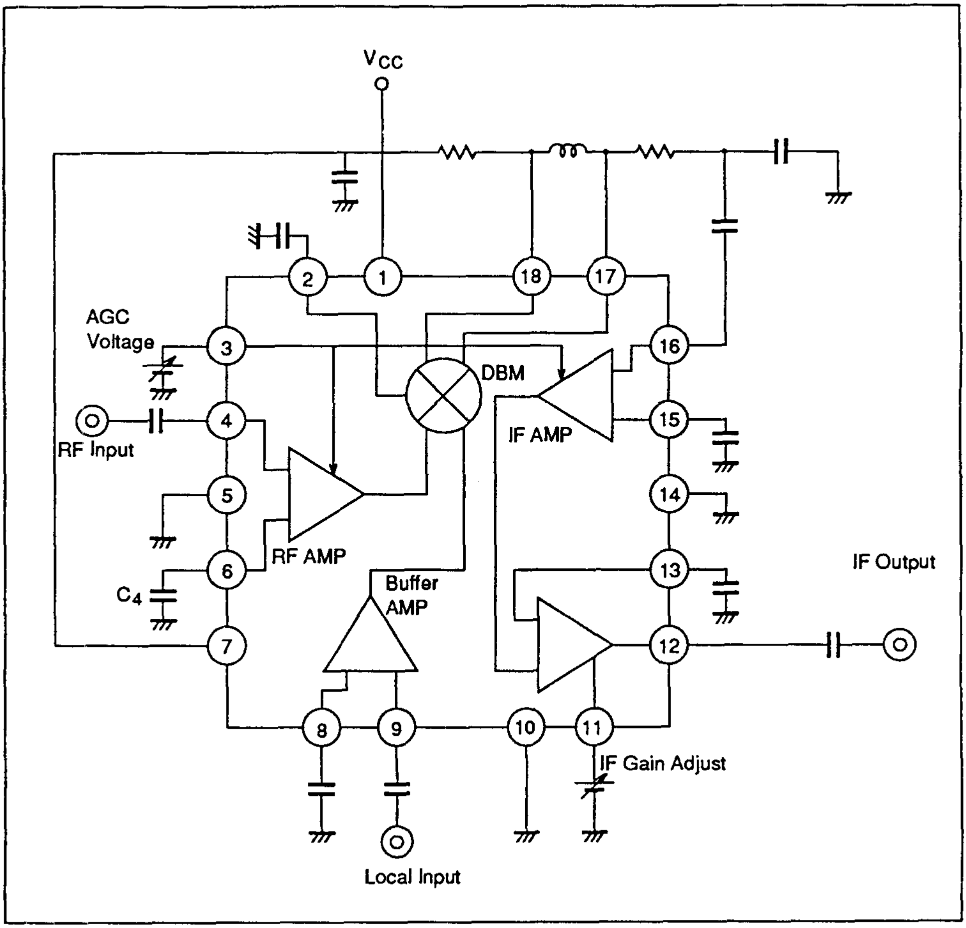


Figure 1 Block Diagram

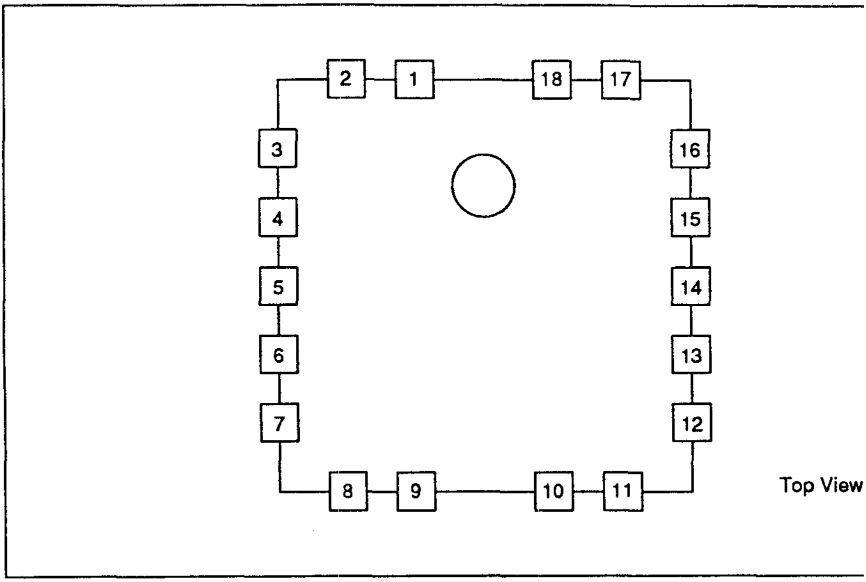
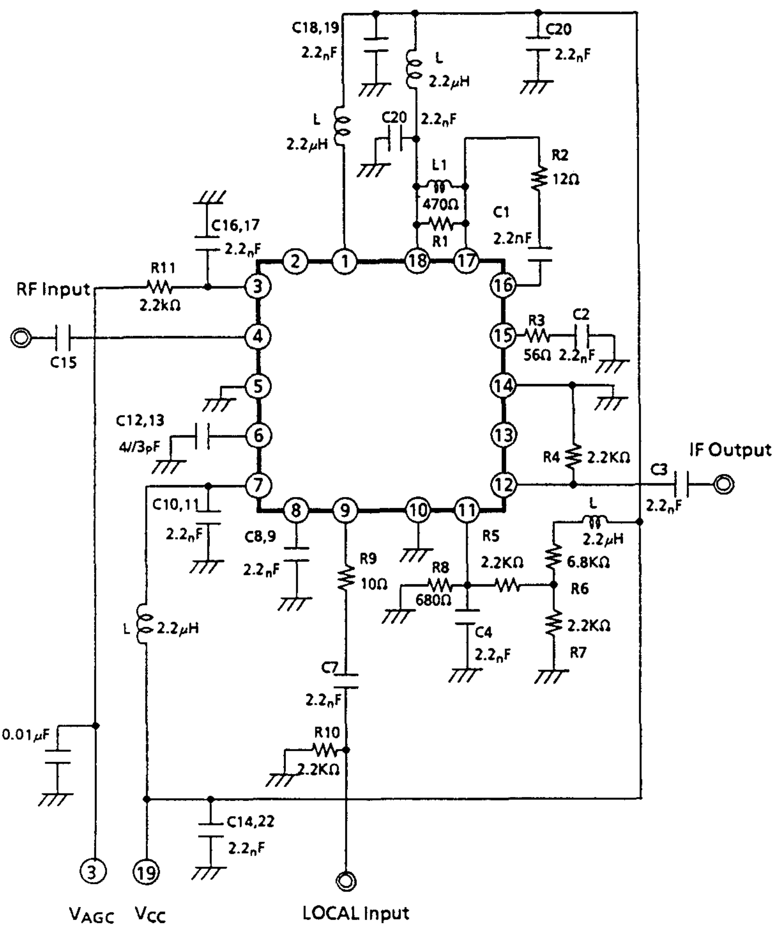


Figure 2 Pin Arrangement

Tabel 4

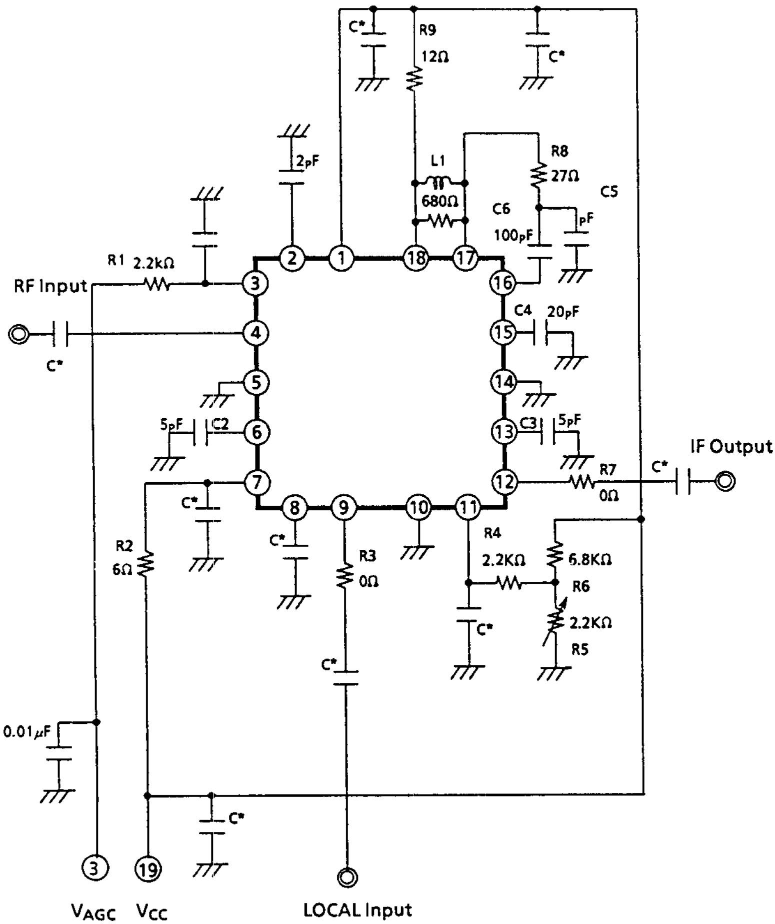
Pin No	Pin Name	Pin No	Pin Name
1	VCC1	10	GND
2	Mixer AC GND	11	IF Gain Adjust
3	AGC	12	IF Out 1
4	RF Input	13	AC GND 3
5	GND	14	GND
6	AC GND 2	15	AC GND 1
7	VCC2	16	IF Input
8	AC GND 4	17	Mixer Out 2
9	Local Input	18	Mixer Out 1



note 1. C* Capacitor : 2200pF

note 2. L1: Inside dia ϕ2.5mm, Cu wire ϕ0.35mm, 4Turn.

Figure 3 Test Fixture



note 1. C* Capacitor : 2200pF

note 2. L1: Inside dia ϕ2.5mm, Cu wire ϕ0.35mm, 4Turn.

Figure 4 Evaluation Circuit

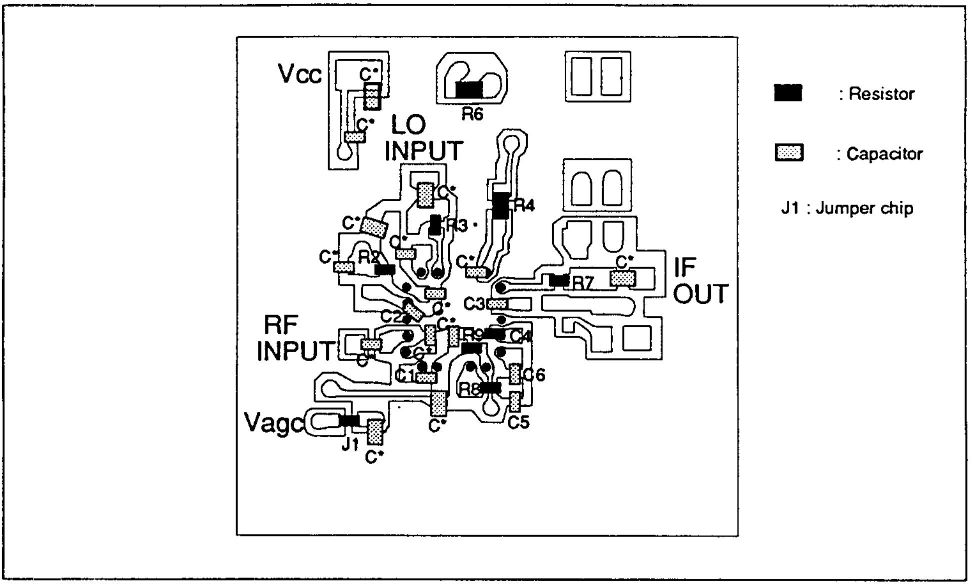


Figure 5 Back Side view of PCB Pattern

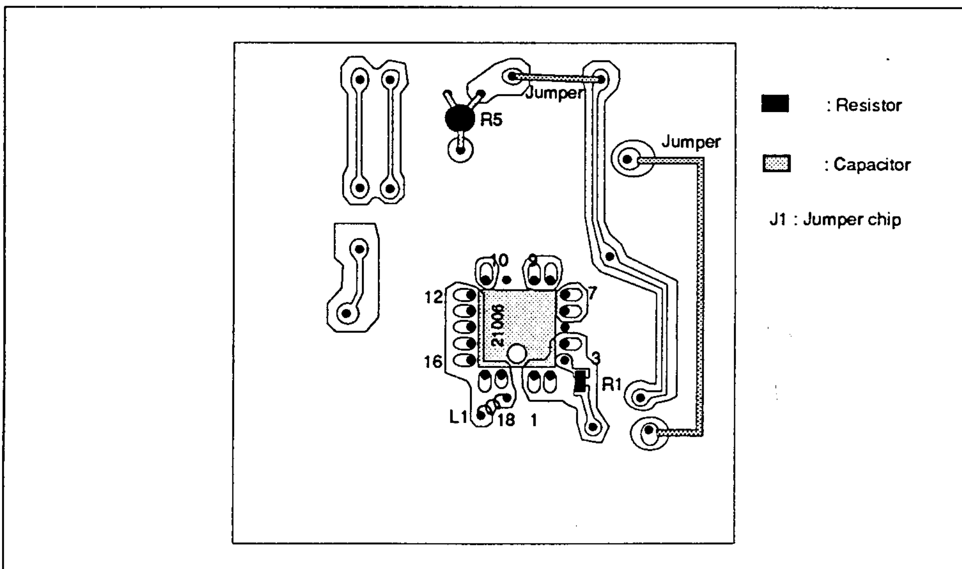


Figure 6 Front Side view of PCB Pattern

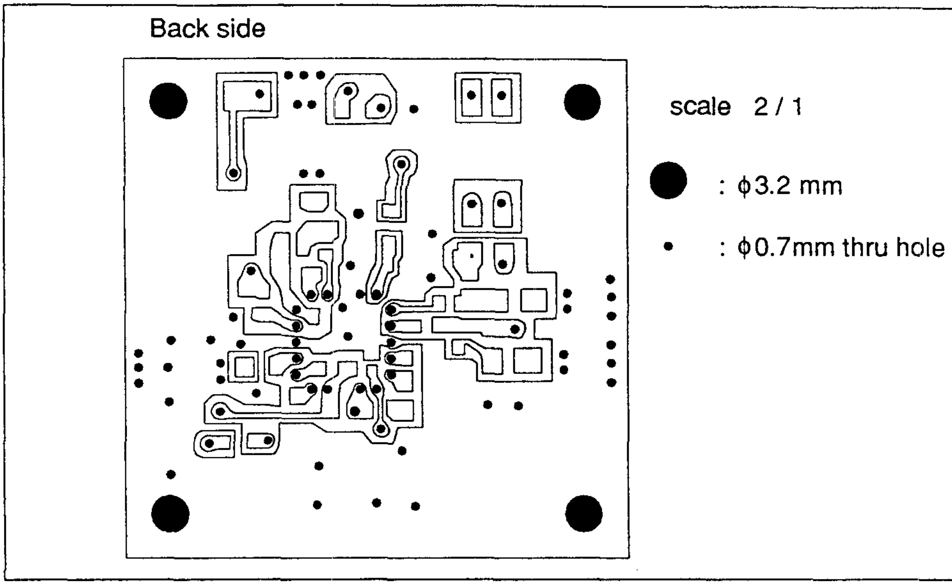


Figure 7 Back Side view of Part Layout

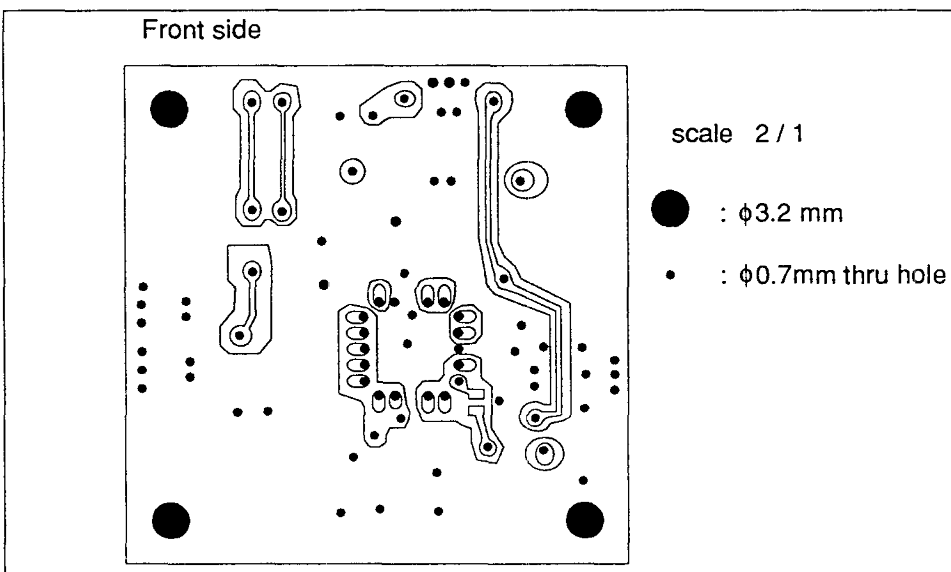


Figure 8 Front Side view pf Part Layout

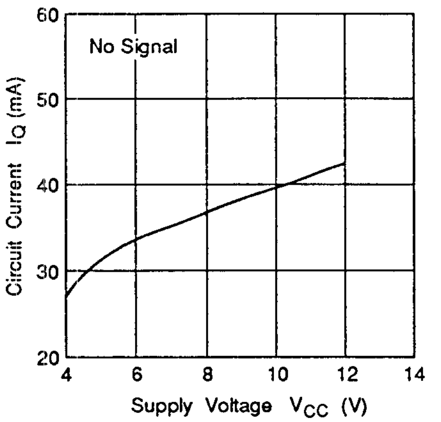


Figure 9 Circuit Current vs. Supply Voltage

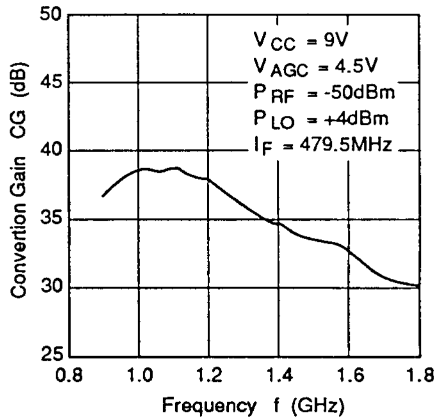


Figure 10 Conversion Gain vs. Frequency

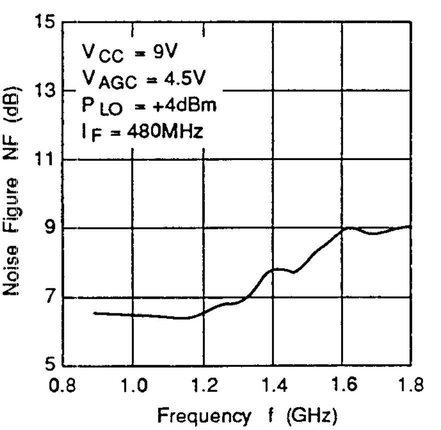


Figure 11 Noise Figure vs. Frequency

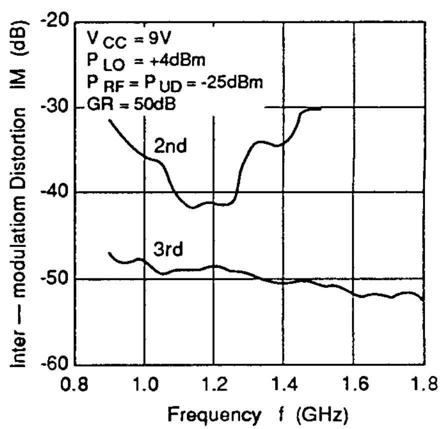


Figure 12 Inter-modulation Distortion vs. Frequency

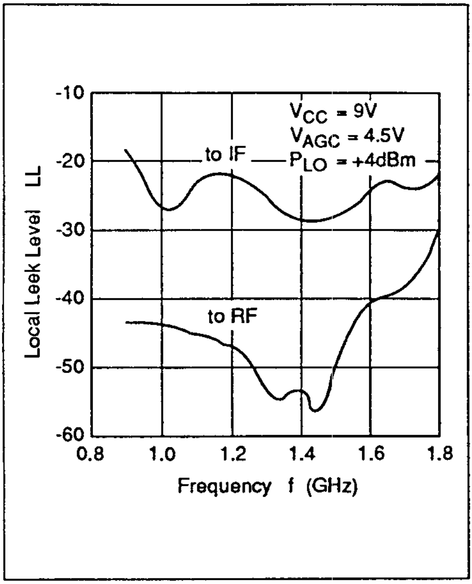


Figure 13 Local Leak Level vs. Frequency

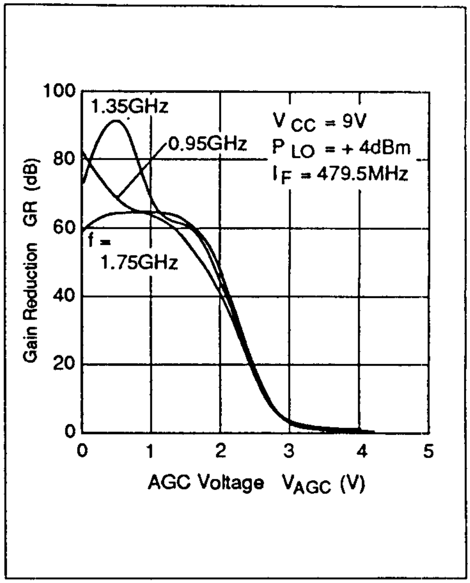


Figure 14 Gain Reduction vs. AGC Voltage

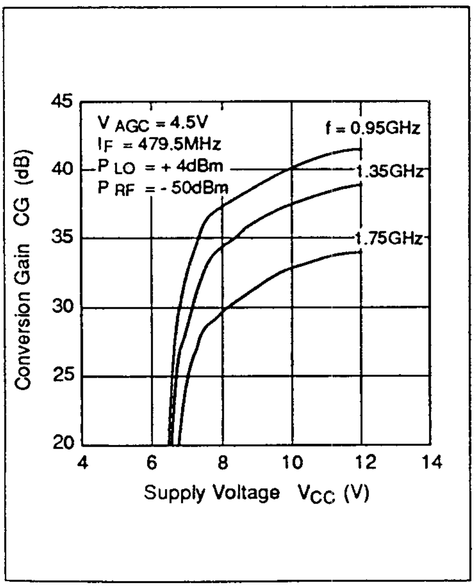


Figure 15 Conversion Gain vs. Supply Voltage

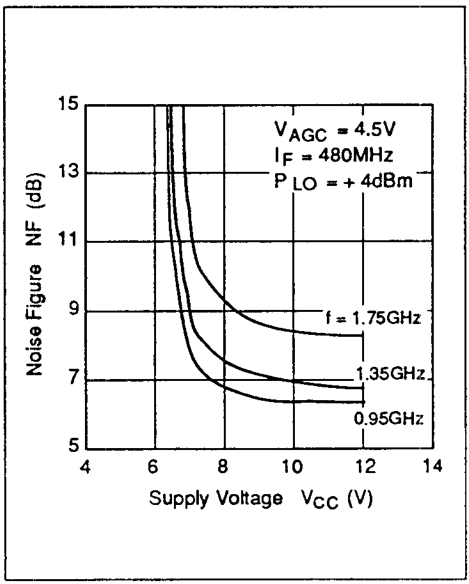


Figure 16 Noise Figure vs. Supply Voltage

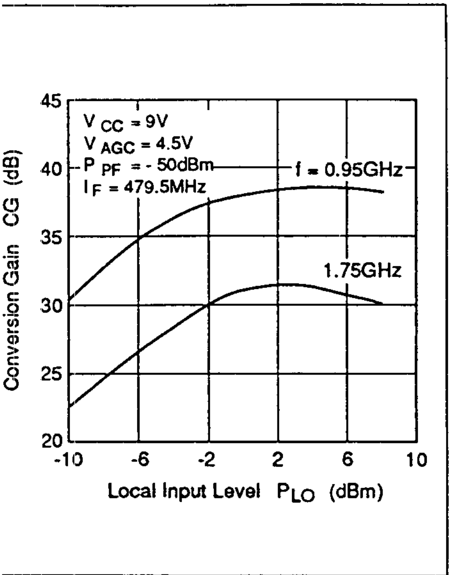


Figure 17 Conversion Gain vs. Local Input Level

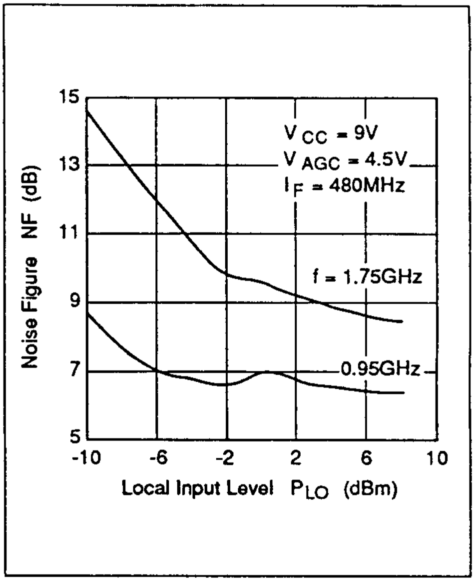
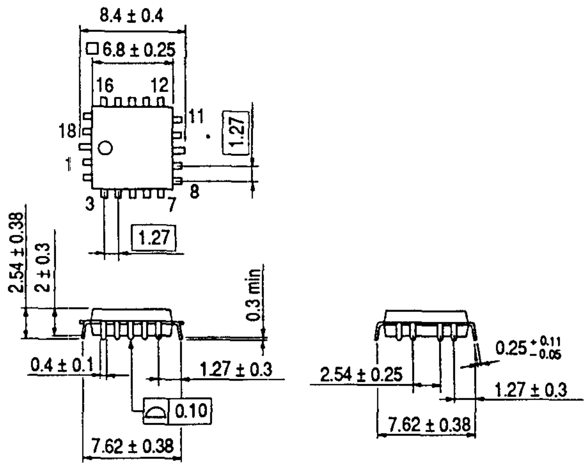


Figure 18 Noise Figure vs. Local Input Level



Scale : 2/1

Figure 19 Package Outline

HSE11

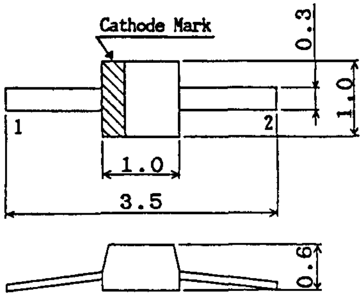
GaAs SCHOTTKY BARRIER MIXER

GaAs SCHOTTKY BARRIER DIODE

SHF MIXER

□ GENERAL DESCRIPTION

HITACHI GaAs SCHOTTKY BARRIER MIXER HSE11 is especially designed for SHF CONVERTER.



□ FEATURES

1. Low Niose GaAs Schottky.
2. Low Capacitancre.(C≦0.4pF)
3. Low Cost. (Extremely Small Plastic Package)

□ ABSOLUTE MAXIMUM RATINGS (Ta=25℃)

Item	Symbol	Rating	Unit
Reverse Voltage	VR	4.0	V
Forward Current	IF	50	mA
Peak Forward Current	IF(peak)	150	mA
Junction Temperature	Tj	125	℃
Storage Temperature	Tstg	−55~+125	℃
Lead Temperature *	Tl	230	℃

*Value at the nearest point from body for 10sec max.(one time)

[ERP]

1:Cathode

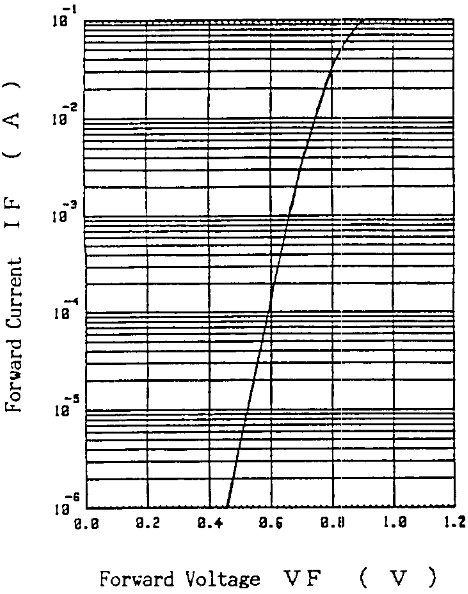
2:Anode

(Dimensions in mm)

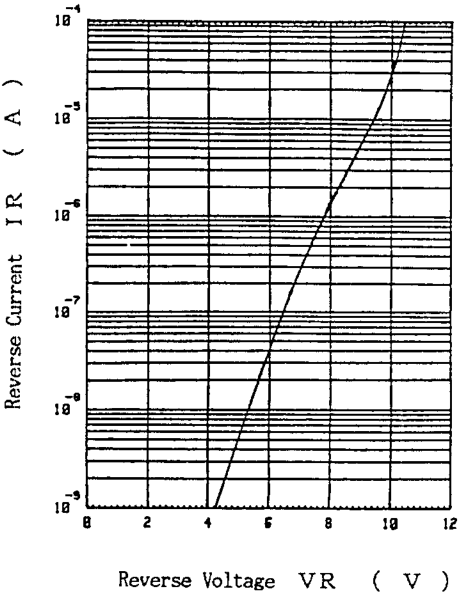
□ ELECTRICAL CHARACTERISTICS (Ta=25℃)

Item	Symbol	Test Condition	min	typ	max	Unit
Reverse Voltage	VR	IR=10μA	4.0	−	−	V
Forward Voltage	VF	IF=50mA	−	−	1.0	V
Capacitance	C	VR=0V, f=1MHz	−	−	0.4	pF
Series Resistance	rs	rs=50VF3−150.75VF2+100.75VF1 VF1:IF=1.0mA VF2:IF=2.7mA VF3:IF=20mA	−	−	1.3	Ω

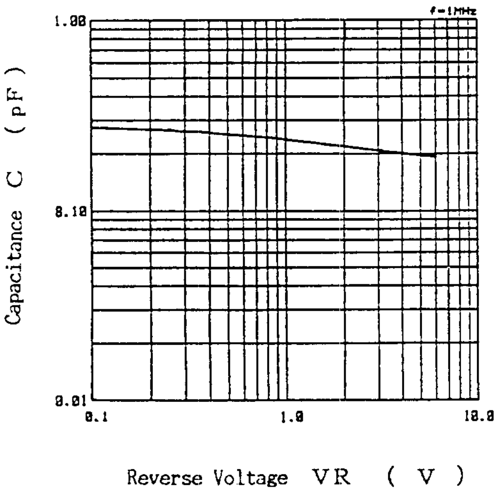
FORWARD CURRENT VS. FORWARD VOLTAGE



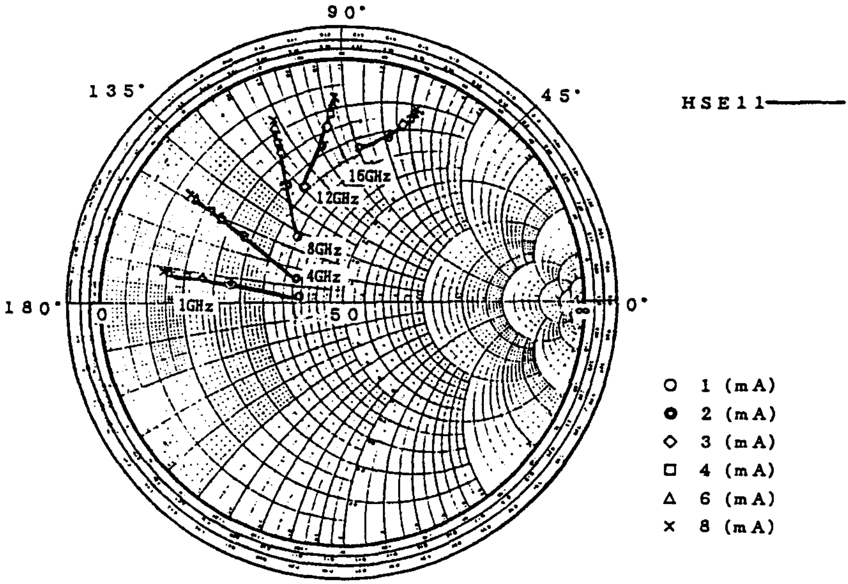
REVERSE CURRENT VS. REVERSE VOLTAGE



CAPACITANCE VS. REVERSE VOLTAGE



□ S Parameter


90°
135°
45°
180°
0°
0
50
∞
16GHz
12GHz
8GHz
4GHz
1GHz
HSE11
○ 1 (mA)
● 2 (mA)
◇ 3 (mA)
□ 4 (mA)
△ 6 (mA)
× 8 (mA)

HSE11S

GaAs Pair single Blanced Schottky Barrier Diode for SHF Converter, Marine Radar

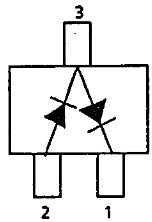
Features

- Wide band operation
- Very low local leakage
- High isolation
- Small fullmold package
- 8mm emboss taping

Ordering Information

TypeNo.	Ink Mark	Package
HSE11S	Silver	HFP

Pin Arrangement



1. Cathode2
2. Anode1
3. Cathode1
   Anode2

Absolute Maximum Ratings (Ta=25°C)

Item	Symbol	Value	Unit
Reverse voltage	V_R	2.0	V
Peak reverse voltage	V_{RM}	2.2	V
Forward current	I_F	50	mA
Peak foward voltage	I_{FM}	150	mA
Junction temperature	T_j	125	°C
Solder temperature	T_1*	230	°C
Storage temperature	T_{stj}	-55 to + 125	°C

* Value at distance 0.8mm from body for 10sec max.

Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Condition
Forward voltage	V_{F1}	–	–	1.0	V	$I_F = 50mA$
	V_{F2}	–	–	0.8		$I_F = 50mA$
Reverse voltage	V_R	2.0	–	–	V	$I_R = 10\mu A$
Terminal capacitance	C_t*	–	–	0.4	pF	$V_R = 0V, f = 1.0MHz$
Delta forward voltage	ΔV_{F2}**	–	–	0.02	V	$I_F = 1.0mA$
Delta Terminal capacitance	ΔC_t**	–	–	0.05	pF	VR = 0V, f = 1.0MHz

* Measurement terminal ①-③ , ②-③
** Deviation of C_t ①-③ , ②-③

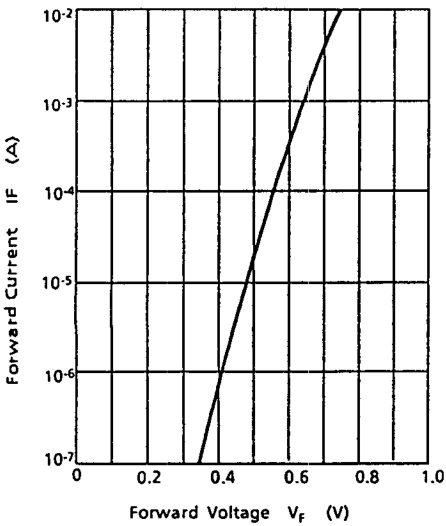


Fig.1 FORWARD CURRENT VS. FORWARD VOLTAGE

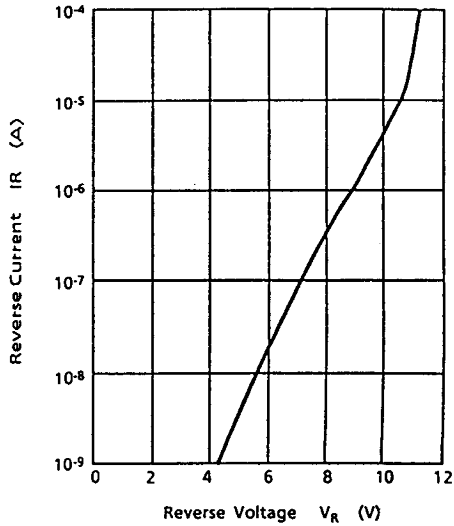


Fig.2 REVERSE CURRENT VS. REVERSE VOLTAGE

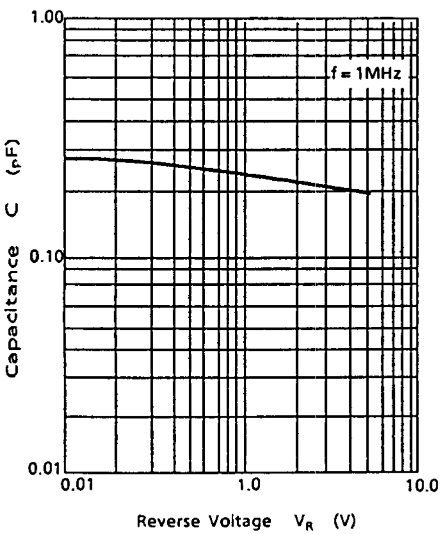


Fig.3 CAPACITANCE VS. REVERSE VOLTAGE

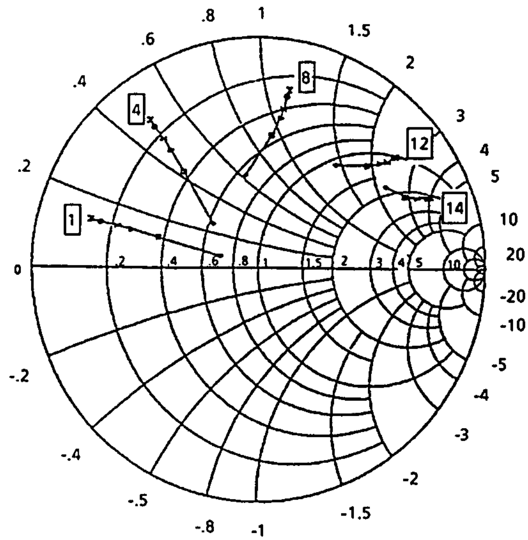


Fig.4 S11 INPEDANCE

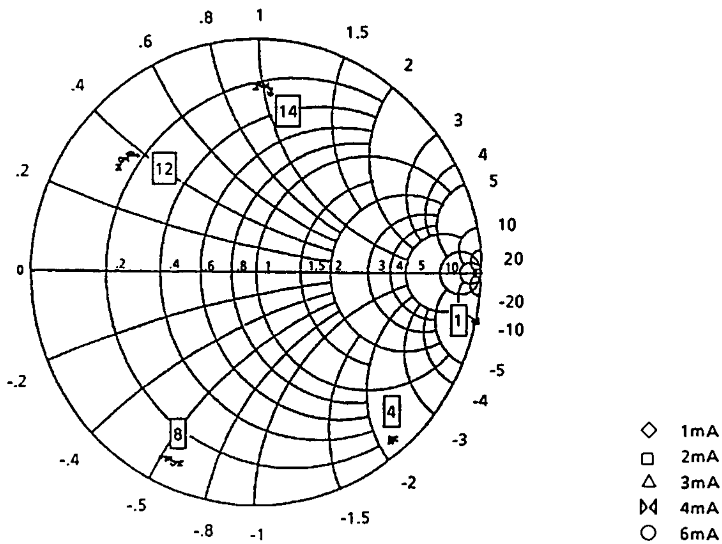
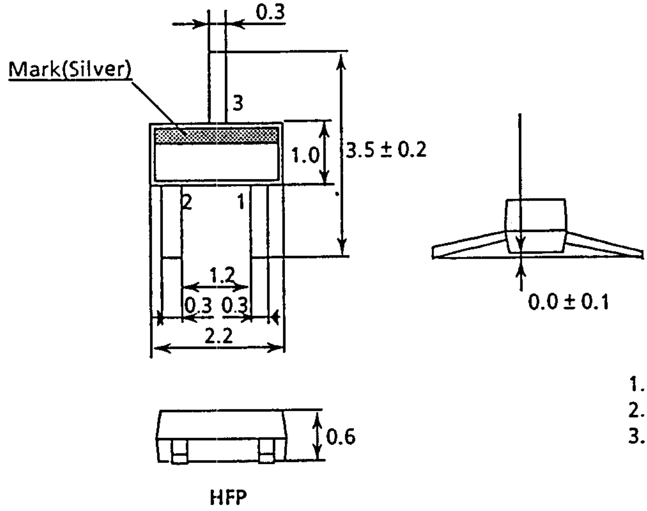


Fig.5 S22 INPEDANCE

Unit : GHz

Package Dimensions

Unit : mm



1. Cathode2
2. Anode1
3. Cathode1
   Anode2

2SK317

Silicon N-Channel MOS FET

Application

HF/VHF power amplifier

Features

- High breakdown voltage
- You can decrease handling current.
- Gate is protected by zenner diodes.
- No secondary-breakdown
- Wide area of safe operation
- Infinite VSWR
- No thermal runaway
- Simple bias circuitry

Table 1 Ordering Information

Type No.	Package
2SK317	RFPAK-A

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DSS}	180	V
Gate to source voltage	V_{GSS}	±20	V
Drain current	I_D	8	A
Channel dissipation	P_{ch}*	120	W
Channel temperature	Tch	150	°C
Storage temperature	Tstg	–55 to +150	°C

* Value at Tc = 25°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Output power	P_O	120	—	—	W	V_{DD} = 80 V, I_{DQ} = 0.1A, Pin = 8 W, f = 100 MHz
Drain efficiency	η	—	80	—	%	
Drain to source breakdown voltage	$V_{(BR)DSS}$	180	—	—	V	I_D = 10 mA, V_{GS} = 0
Gate to source breakdown voltage	$V_{(BR)GSS}$	±20	—	—	V	I_G = ±100 μA, V_{DS} = 0
Drain leakage current	I_{DSS}	—	—	1.0	mA	V_{DS} = 140 V, V_{GS} = 0
Gate to source cutoff voltage	$V_{GS(off)}$	0.5	—	3.0	V	I_D = 1 mA, V_{DS} = 10 V *
Drain to source saturation * voltage	$V_{DS(on)}$	—	3.8	6.0	V	I_D = 4 A, V_{GS} = 10 V *
Forward transfer admittance *	$\|y_{fs}\|$	0.9	1.25	—	S	I_D = 3 A, V_{DS} = 20 V *
Input capacitance	Ciss	—	600	—	pF	V_{GS} = 5 V, V_{DS} = 0, f = 1 MHz
Output capacitance	Coss	—	90	—	pF	V_{GS} = −5 V, V_{DS} = 50, f = 1 MHz
Reverse transfer capacitance	Crss	—	0.5	—	pF	V_{GD} = −50 V, f = 1 MHz

* Pulse test

CAUTION: OPERATING HAZARDS
Beryllium Oxide Ceramics have been employed in these products.
Since dust or fume of the material is highly poison to the human body, please do not treat them mechanically or chemically in the manner which might expose them to the air. And it should never be thrown out with general industrial or domestic waste.

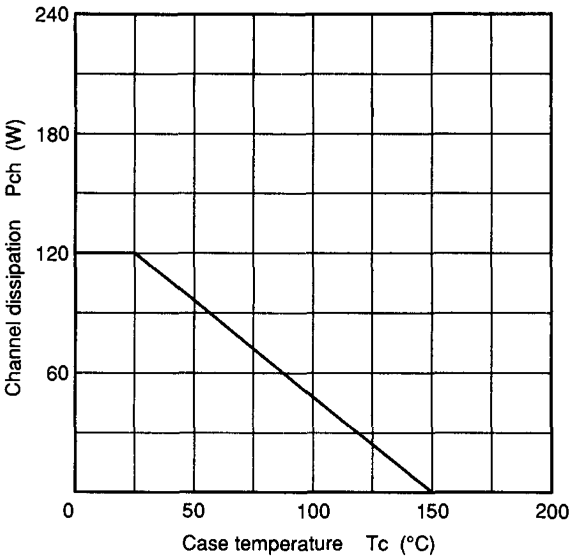


Figure 1 Maximum Channel Dissipation Curve

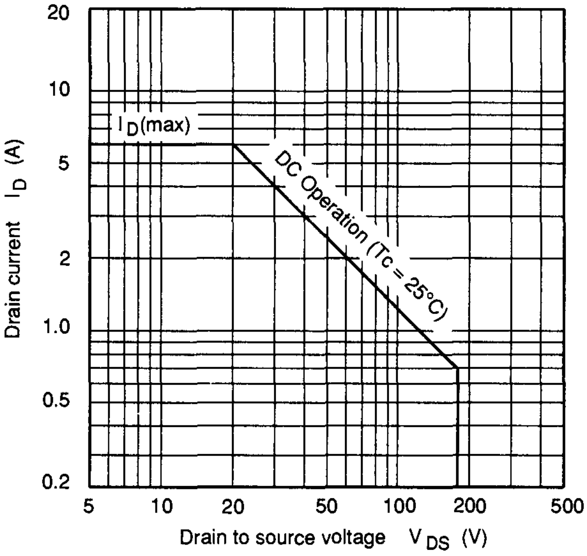


Figure 2 Maximum Safe Operation Area

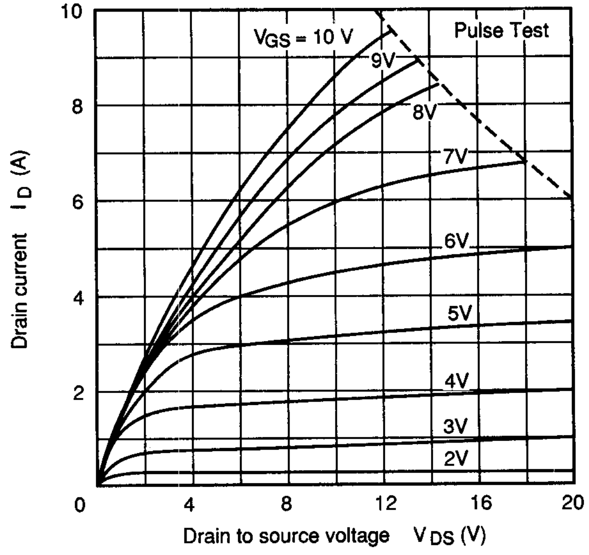


Figure 3 Typical Output Characteristics

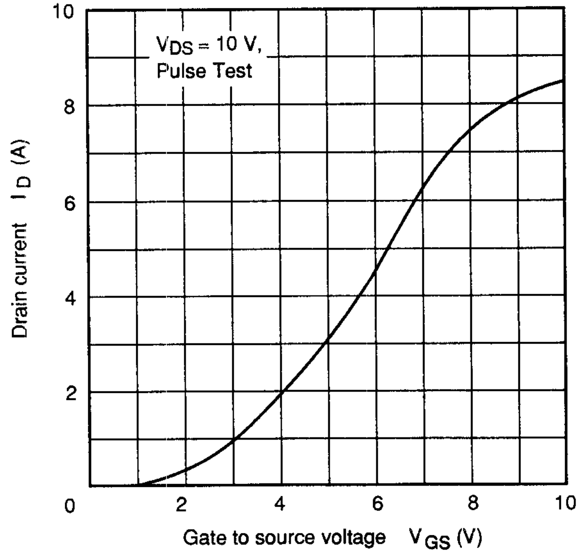


Figure 4 Typical Transfer Characteristics

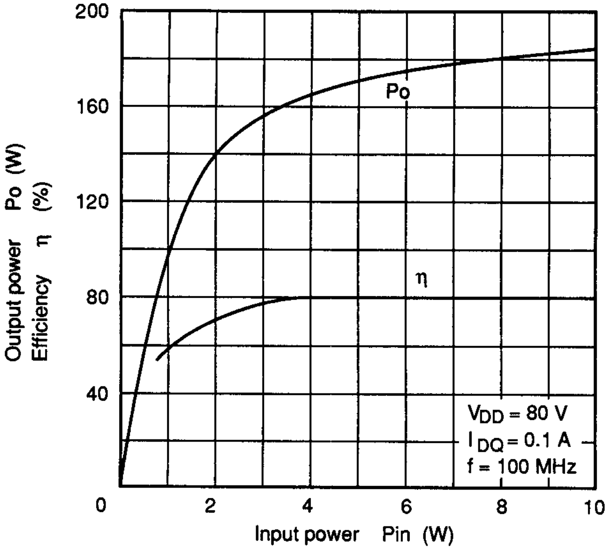


Figure 5 Input Power vs. Output Power (1)

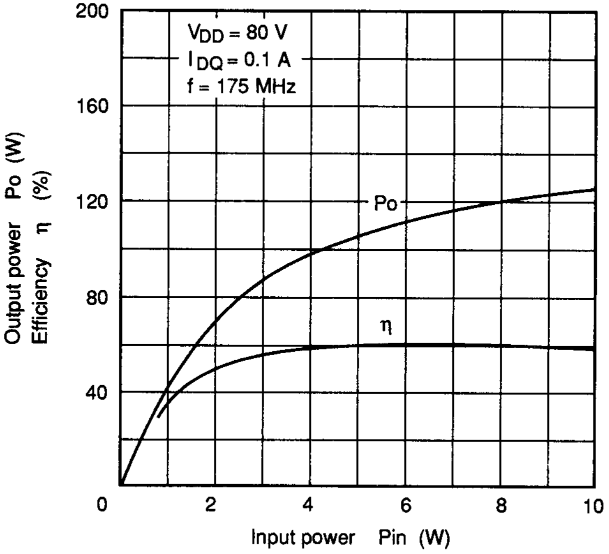


Figure 6 Input Power vs. Output Power (2)

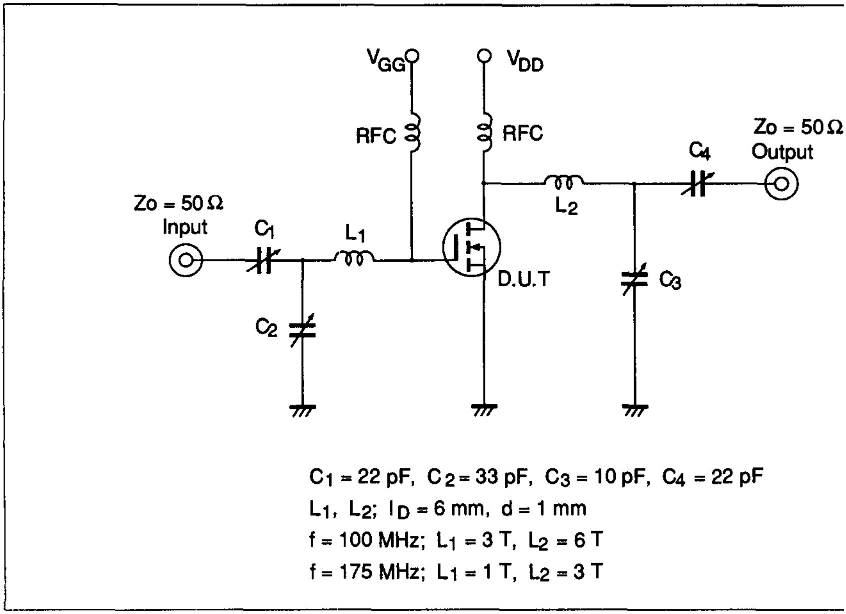


Figure 7 Output Power Test Circuit

2SK318 — Preliminary

Silicon N-Channel MOS FET

Application

HF/VHF power amplifier

Features

- High breakdown voltage
- You can decrease handling current.
- Gate is protected by zenner diodes.
- No secondary-breakdown
- Wide area of safe operation
- Infinite VSWR
- No thermal runaway
- Simple bias circuitry

Table 1 Ordering Information

Type No.	Package
2SK318	RFPAK-A

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DSS}	180	V
Gate to source voltage	V_{GSS}	±20	V
Drain current	I_D	4	A
Channel dissipation	P_{ch}*	70	W
Channel temperature	Tch	150	°C
Storage temperature	Tstg	–55 to +150	°C

* Value at Tc = 25°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Output power	P_O	60	90	—	W	V_{DD} = 80 V, I_{DQ} = 0.1A, Pin = 4 W, f = 100 MHz
Drain efficiency	η	—	80	—	%	
Drain to source breakdown voltage	$V_{(BR)DSS}$	180	—	—	V	I_D = 10 mA, V_{GS} = 0
Gate to source breakdown voltage	$V_{(BR)GSS}$	±20	—	—	V	I_G = ±100 μA, V_{DS} = 0
Drain leakage current	I_{DSS}	—	—	1.0	mA	V_{DS} = 140 V, V_{GS} = 0
Gate to source cutoff voltage	$V_{GS(off)}$	0.5	—	3.0	V	I_D = 1 mA, V_{DS} = 10 V *
Drain to source saturation * voltage	$V_{DS(on)}$	—	3.8	6.0	V	I_D = 2 A, V_{GS} = 10 V *
Forward transfer admittance *	$\|y_{fs}\|$	0.4	0.6	—	S	I_D = 1.5 A, V_{DS} = 20 V *
Input capacitance	Ciss	—	300	—	pF	V_{GS} = 5 V, V_{DS} = 0, f = 1 MHz
Output capacitance	Coss	—	45	—	pF	V_{GS} = –5 V, V_{DS} = 50 V, f = 1 MHz
Reverse transfer capacitance	Crss	—	0.3	—	pF	V_{GD} = –50 V, f = 1 MHz

* Pulse test

CAUTION: OPERATING HAZARDS
Beryllium Oxide Ceramics have been employed in these products.
Since dust or fume of the material is highly poison to the human body, please do not treat them mechanically or chemically in the manner which might expose them to the air. And it should never be thrown out with general industrial or domestic waste.

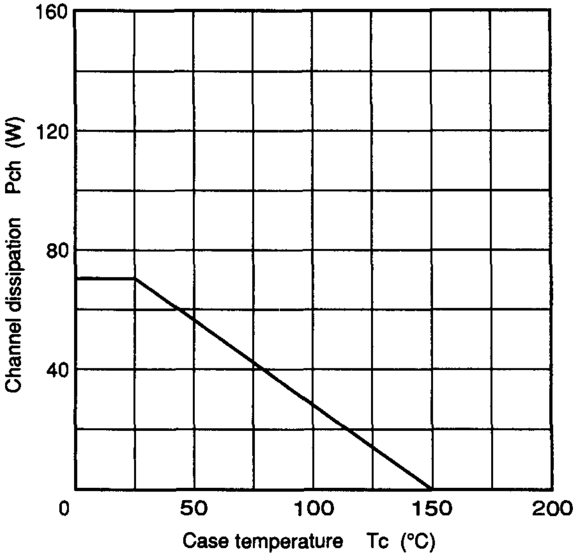


Figure 1 Maximum Channel Dissipation Curve

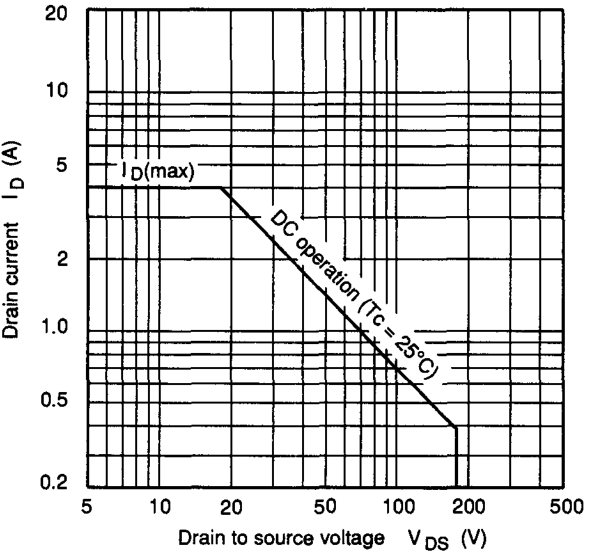


Figure 2 Maximum Safe Operation Area

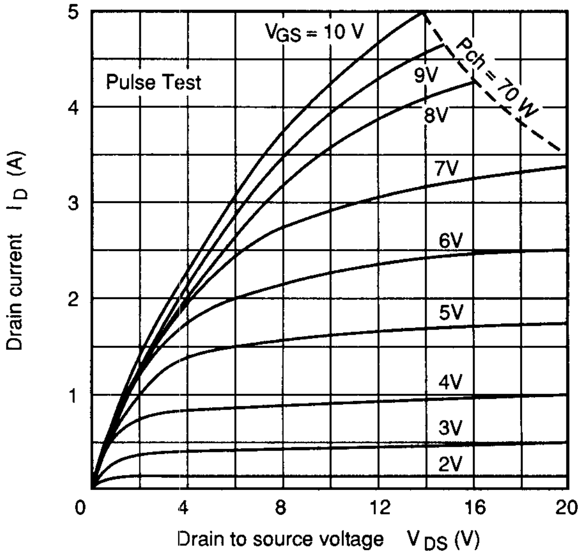


Figure 3 Typical Output Characteristics

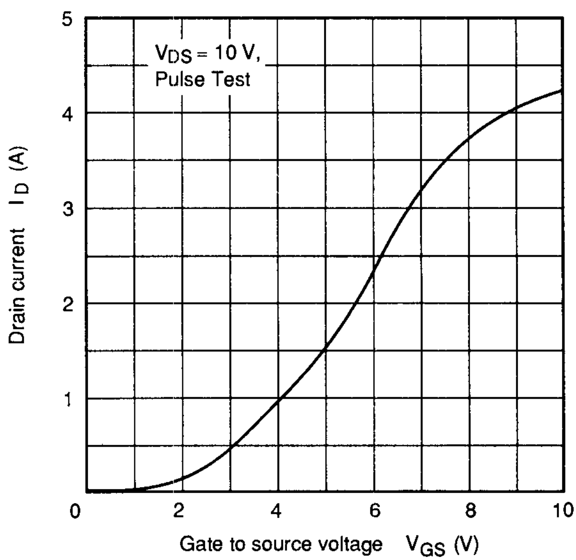


Figure 4 Typical Transfer Characteristics

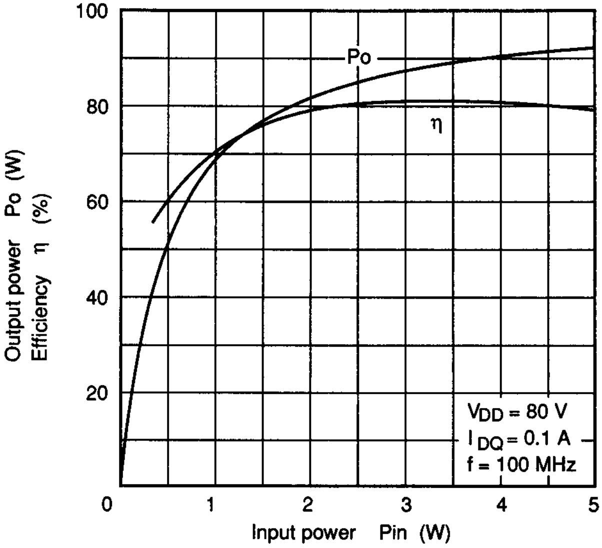


Figure 5 Input Power vs. Output Power (1)

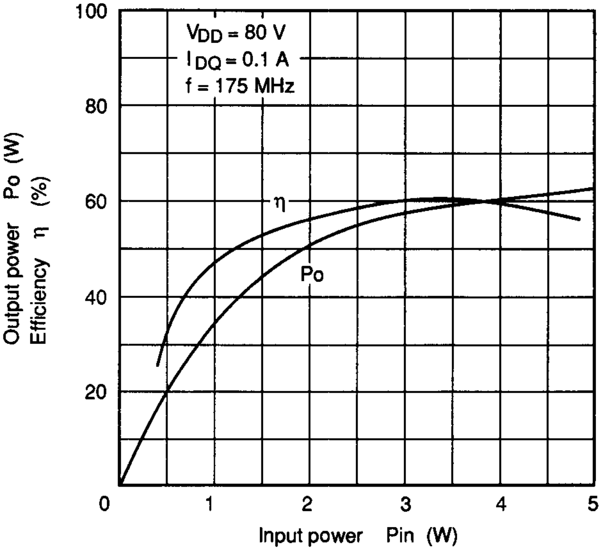
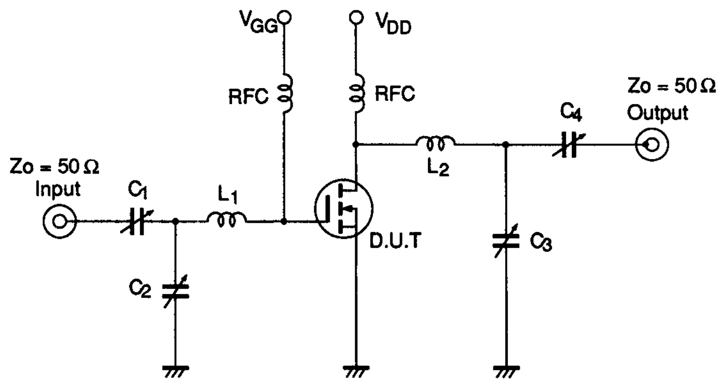


Figure 6 Input Power vs. Output Power (2)



C_1 = 22 pF, C_2 = 33 pF, C_3 = 22 pF, C_4 = 50 pF
L_1, L_2; I_D = 6 mm, d = 1 mm
f = 100 MHz; L_1 = 3 T, L_2 = 5 T
f = 175 MHz; L_1 = 1 T, L_2 = 3 T

Figure 7 Output Power Test Circuit

2SK408 Series — Preliminary

Silicon N-Channel MOS FET

Application

HF/VHF power amplifier

Features

- High breakdown voltage
- You can decrease handling current.
- Included gate protection diode
- No secondary-breakdown
- Wide area of safe operation
- Simple bias circuitry
- No thermal runaway

Table 1 Ordering Information

TO-220AB

Pin No	2SK408	2SK409
1	Gate	Drain
2	Source	Source
3	Drain	Gate

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DSS}	180	V
Gate to source voltage	V_{GSS}	±20	V
Drain current	I_D	2	A
Channel dissipation	P_{ch}*	30	W
Channel temperature	Tch	150	°C
Storage temperature	Tstg	–55 to +150	°C

* Value at Tc = 25°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Output power	P_O	10	16	—	W	V_{DD} = 80 V, f = 28 MHz, I_{DQ} = 50mA, Pin = 150 mW
Drain efficiency	η	—	80	—	%	
Drain to source breakdown voltage	$V_{(BR)DSS}$	180	—	—	V	I_D = 1 mA, V_{GS} = 0
Gate to source cutoff voltage	$V_{GS(off)}$	0.5	—	3.0	V	I_D = 1 mA, V_{DS} = 10 V
Drain leakage current	I_{DSS}	—	—	1.0	mA	V_{DS} = 140 V, V_{GS} = 0
Drain to source saturation * voltage	$V_{DS(on)}$	—	6.5	8.0	V	I_D = 1.0 A, V_{GS} = 10 V *
Forward transfer admittance *	$\lvert y_{fs} \rvert$	0.2	0.3	—	S	I_D = 1.0 A, V_{DS} = 20 V *
Input capacitance	Ciss	—	100	—	pF	V_{GS} = 5 V, V_{DS} = 0, f = 1 MHz
Output capacitance	Coss	—	20	—	pF	V_{GS} = –5 V, V_{DS} = 50 V, f = 1 MHz
Reverse transfer capacitance	Crss	—	0.2	—	pF	V_{GD} = –50 V, f = 1 MHz
Output power	P_O	—	10	—	W_{PEP}	V_{DD} = 80 V, f = 28 MHz, Δf = 20 kHz, IMD ≤ –30 dB
Power gain	P.G	—	20	—	dB	

* Pulse test

2SC408 representing the characteristics curves hereafter.

For the detail of characteristics of other parts, please consult our sales office near you.

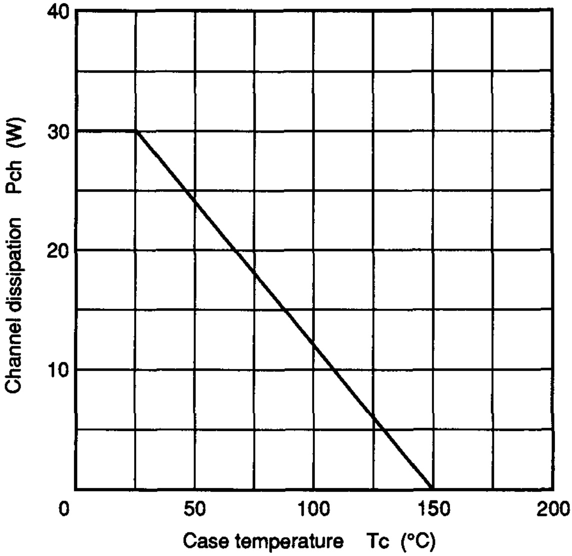


Figure 1 Maximum Channel Dissipation Curve

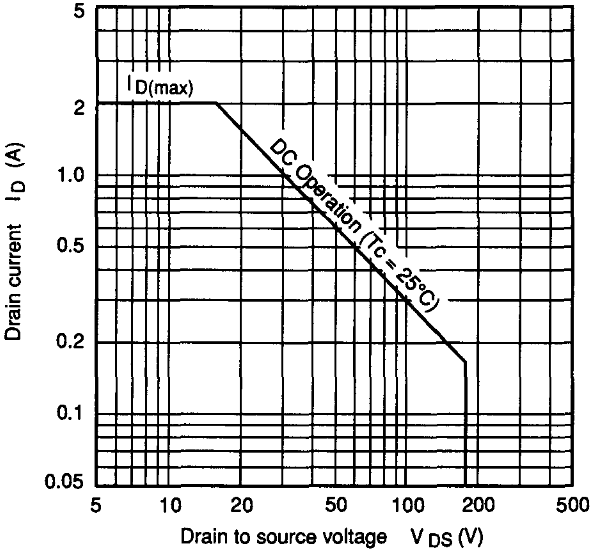


Figure 2 Maximum Safe Operation Area

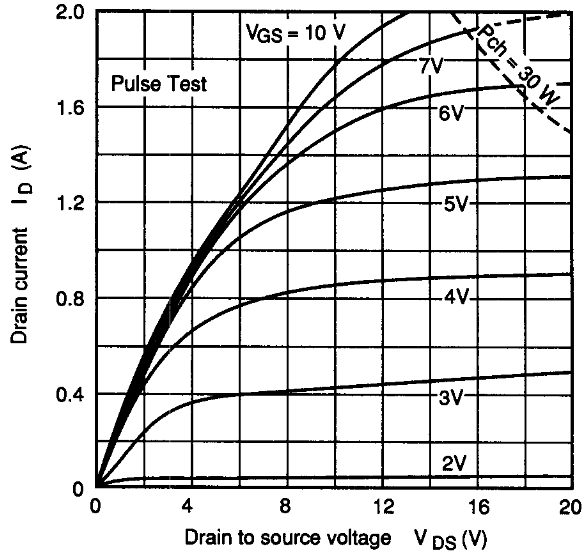


Figure 3 Typical Output Characteristics

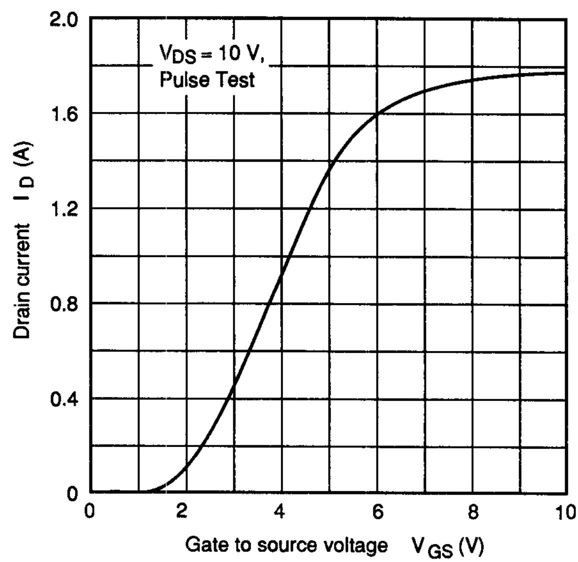


Figure 4 Typical Transfer Characteristics

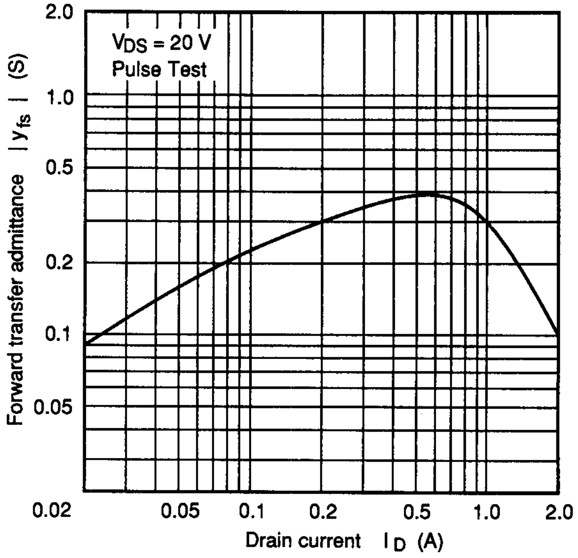


Figure 5 Forward Transfer Admittance vs. Drain Current

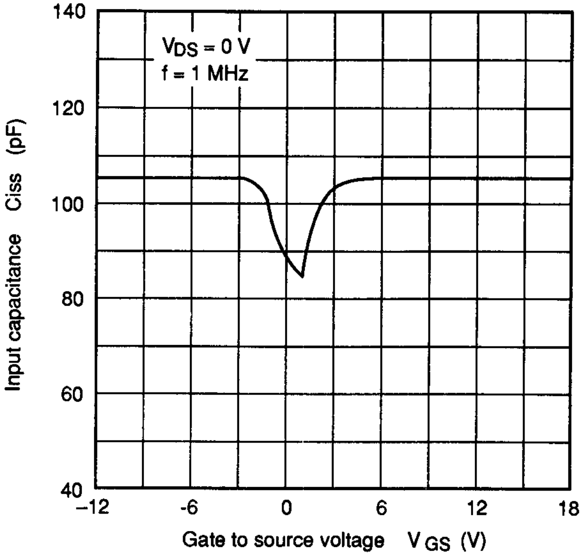


Figure 6 Input Capacitance vs. Gate to Source Voltage

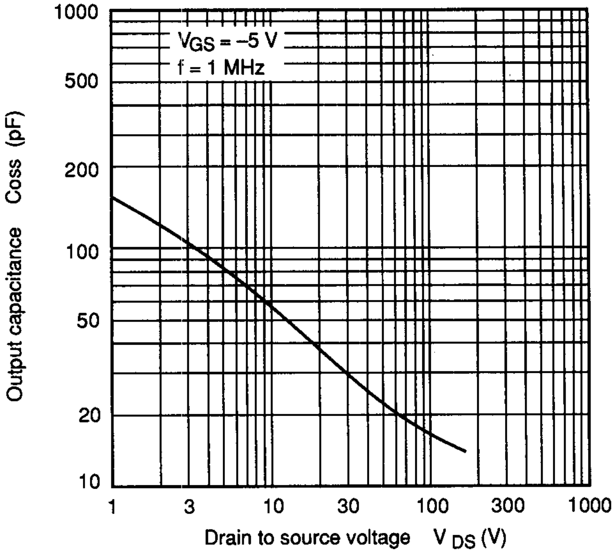


Figure 7 Output Capacitance vs. Drain to Source Voltage

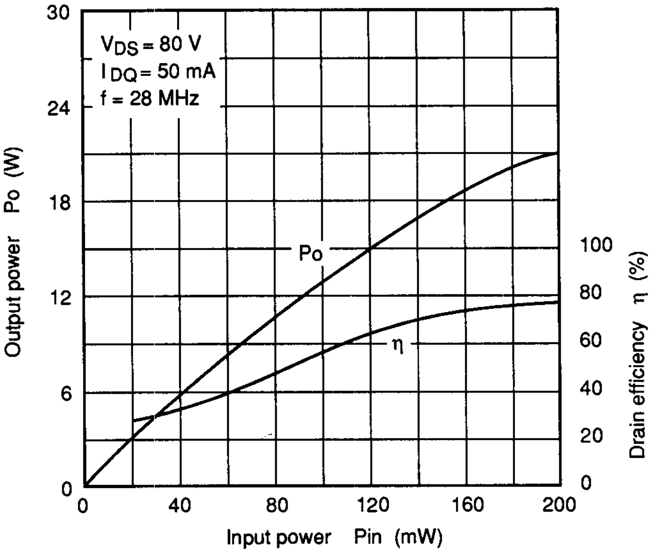


Figure 8 Output Power, Drain Efficiency vs. Input Power

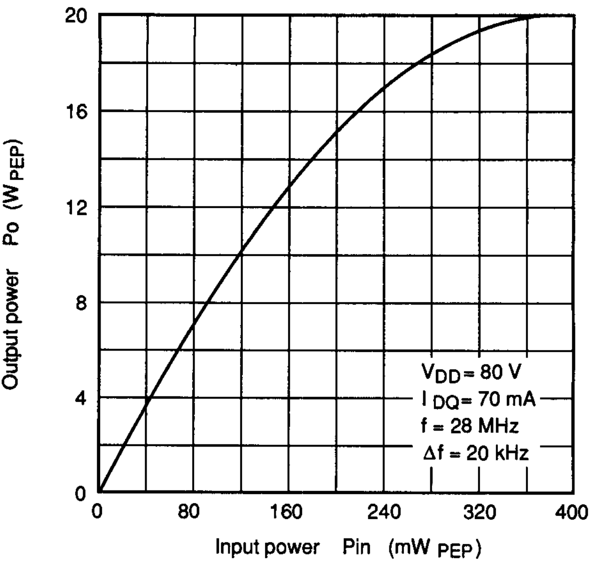


Figure 9 Output Power vs. Input Power (2 Tones)

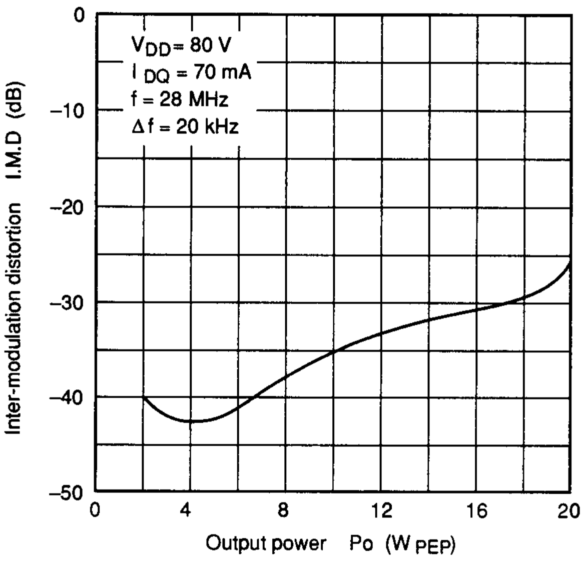
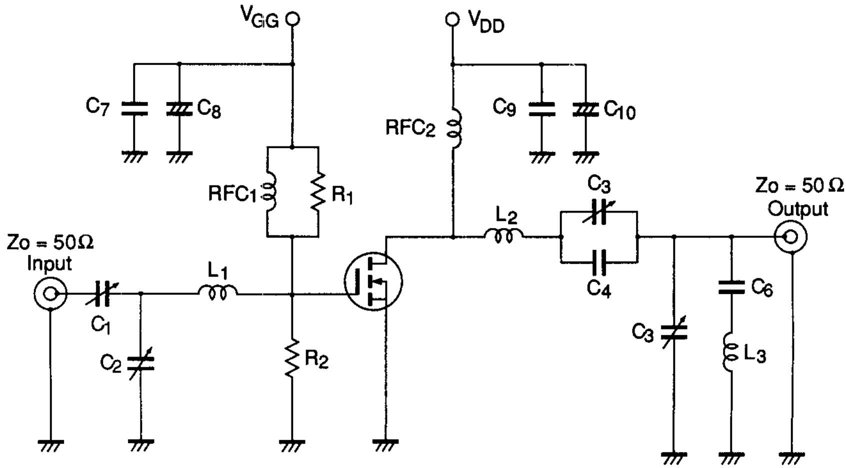


Figure 10 Inter–Modulation Distortion vs. Output Power



C_1 , C_2 , C_3 = to 50 pF
C_4 = 68 pF
C_5 = to 20 pF
C_6 = 1.5 pF
C_7 , C_9 = 0.1 µF
C_8 = 4.7 µF
C_{10} = 22 µF
L_1: ID = 12 mm, d = 1.5 mm, T = 6 T
L_2: ID = 12 mm, d = 1.5 mm, T = 9 T
L_3: ID = 12 mm, d = 1.5 mm, T = 5 T

Figure 11 28 MHz Pout Test Circuit

2SK410

Silicon N-Channel MOS FET

Application

HF/VHF power amplifier

Features

- High breakdown voltage
- You can decrease handling current.
- Included gate protection diode
- No secondary-breakdown
- Wide area of safe operation
- Simple bias circuitry
- No thermal runaway

Table 1 Ordering Information

Type No.	Package
2SK410	RFPAK-A

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DSS}	180	V
Gate to source voltage	V_{GSS}	±20	V
Drain current	I_D	8	A
Channel dissipation	P_{ch}*	120	W
Channel temperature	Tch	150	°C
Storage temperature	Tstg	–55 to +150	°C

* Value at Tc = 25°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Power output	P_O	140	180	—	W	V_{DD} = 80 V, f = 28 MHz, I_{DQ} = 0.1A, Pin = 5 W
Drain efficiency	η	—	80	—	%	
Drain to source breakdown voltage	$V_{(BR)DSS}$	180	—	—	V	I_D = 10 mA, V_{GS} = 0
Gate to source breakdown voltage	$V_{(BR)GSS}$	±20	—	—	V	I_G = ±100 μA, V_{DS} = 0
Gate to source cutoff voltage	$V_{GS(off)}$	0.5	—	3.0	V	I_D = 1 mA, V_{DS} = 10 V *
Drain current	I_{DSS}	—	—	1.0	mA	V_{DS} = 140 V, V_{GS} = 0
Drain to source saturation voltage	$V_{DS(on)}$	—	3.8	6.0	V	I_D = 4 A, V_{GS} = 10 V *
Forward transfer admittance	$\|y_{fs}\|$	0.9	1.25	—	S	I_D = 3 A, V_{DS} = 20 V *
Input capacitance	Ciss	—	440	—	pF	V_{GS} = 5 V, V_{DS} = 0, f = 1 MHz
Output capacitance	Coss	—	75	—	pF	V_{GS} = –5 V, V_{DS} = 50 V, f = 1 MHz
Reverse transfer capacitance	Crss	—	0.5	—	pF	V_{GD} = –50 V, f = 1 MHz
Power output	P_O	—	100	—	W_{PEP}	V_{DD} = 80 V, f = 28 MHz, Δf = 20 kHz, IMD ≤ –30 dB
Power gain	P.G	—	17	—	dB	

* Pulse test

CAUTION: OPERATING HAZARDS
Beryllium Oxide Ceramics have been employed in these products.
Since dust or fume of the material is highly poison to the human body, please do not treat them mechanically or chemically in the manner which might expose them to the air. And it should never be thrown out with general industrial or domestic waste.

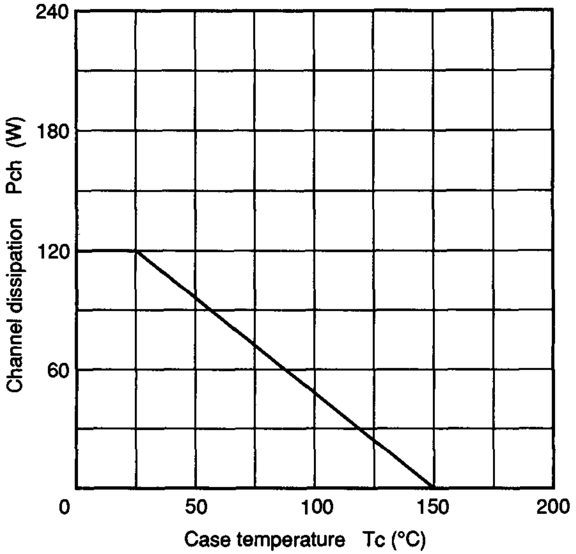


Figure 1 Maximum Channel Dissipation Curve

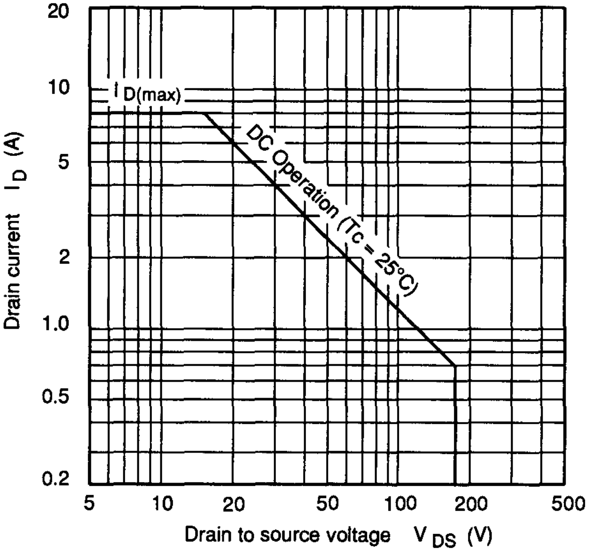


Figure 2 Maximum Safe Operation Area

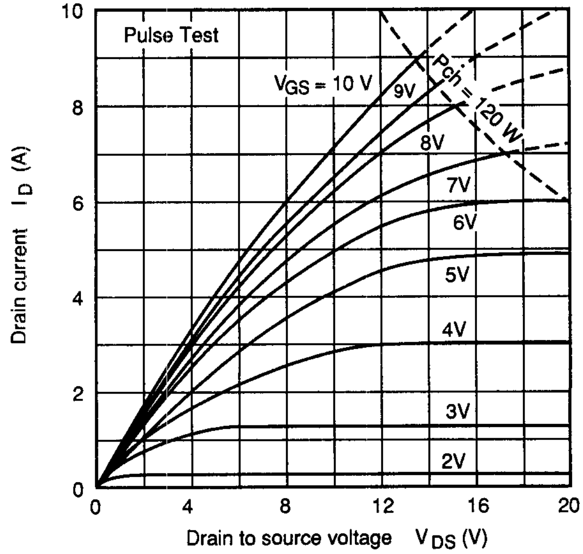


Figure 3 Typical Output Characteristics

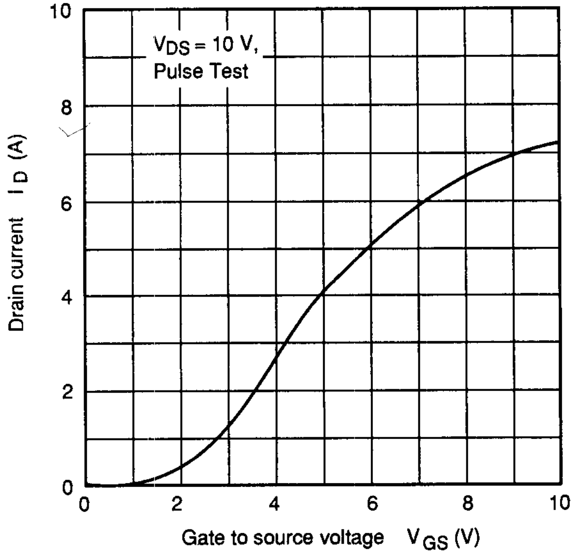


Figure 4 Typical Transfer Characteristics

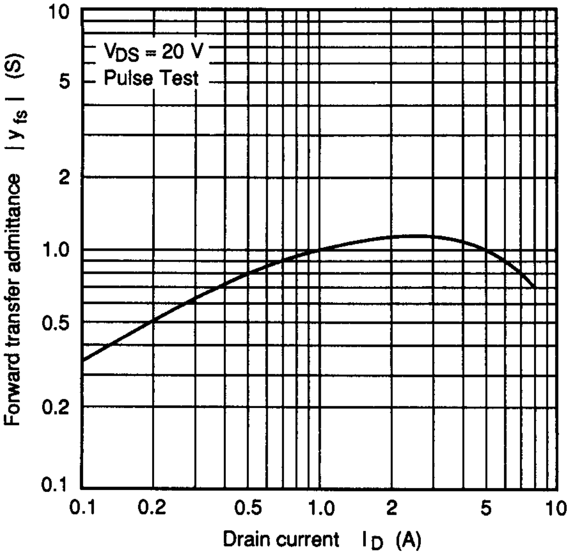


Figure 5 Forward Transfer Admittance vs. Drain Current

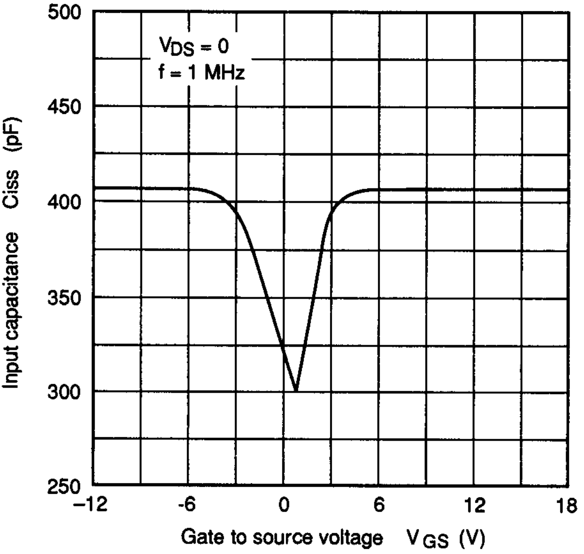


Figure 6 Input Capacitance vs. Gate to Source Voltage

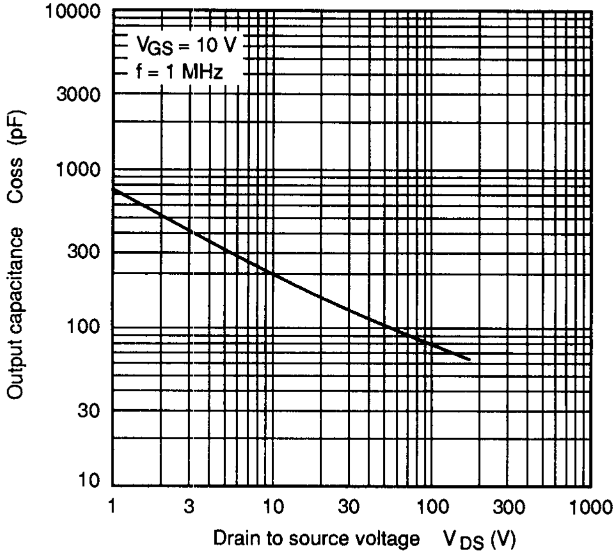


Figure 7 Output Capacitance vs. Drain to Source Voltage

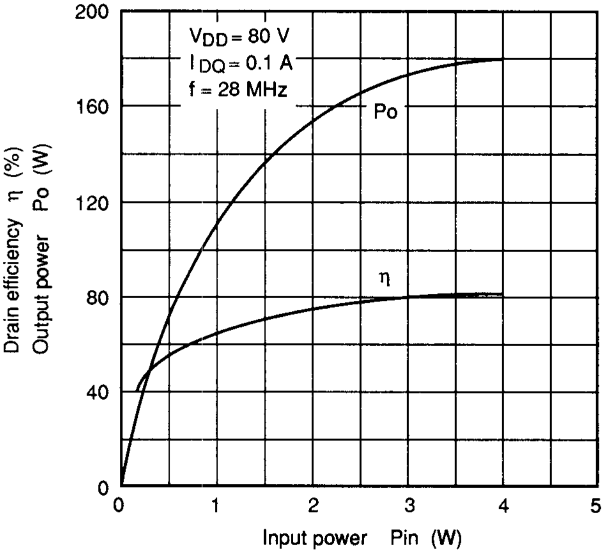


Figure 8 Output Power, Drain Efficiency vs. Input Power

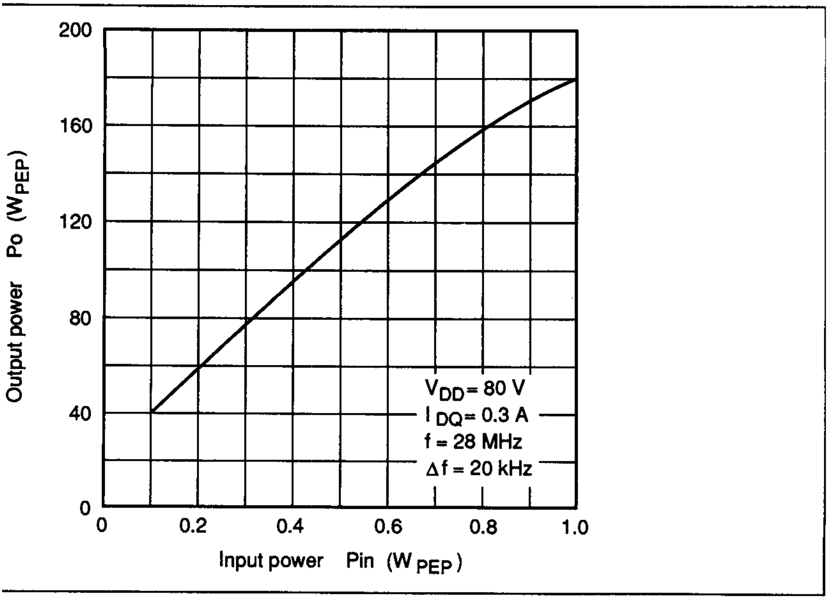


Figure 9 Output Power vs. Input Power (2 Tones)

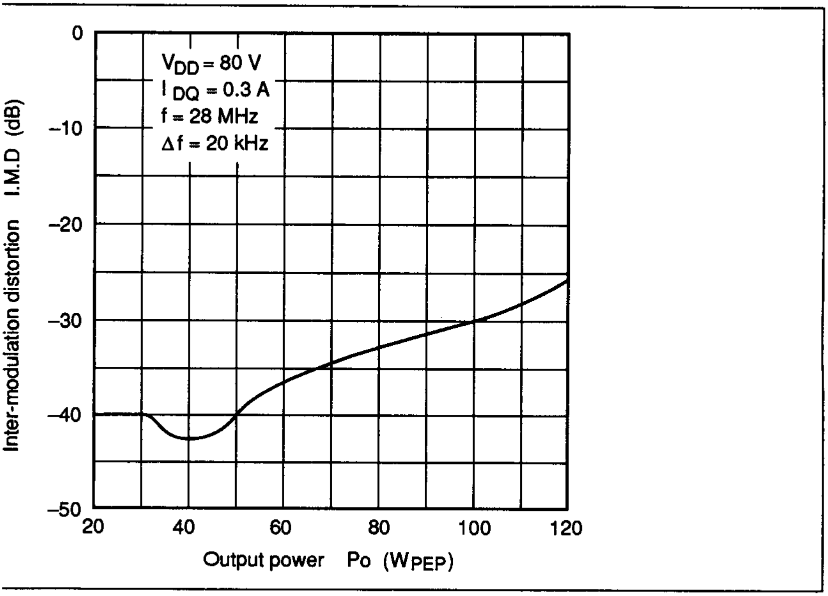
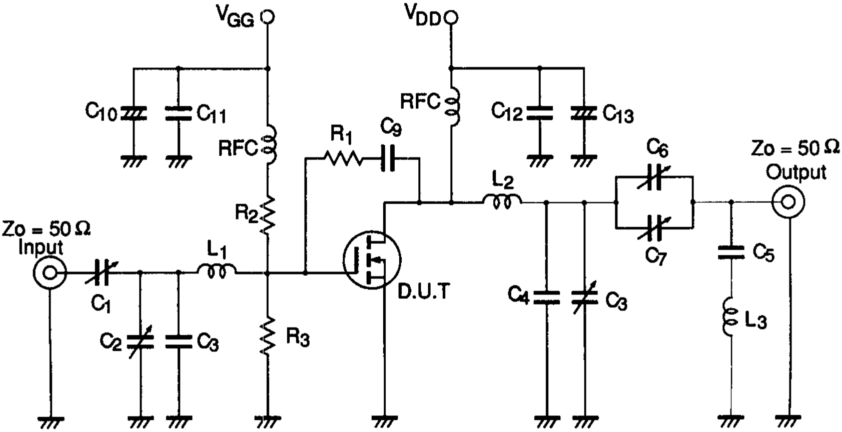


Figure 10 Inter–Modulation Distortion vs. Output Power



C_1, C_4 = to 50 pF
C_2, C_5 = to 20 pF
C_3, C_6 = 10 pF
C_7 = 32 pF
C_8 = 15 pF
C_9, C_{11}, C_{12} = 0.1 μF
C_{10} = 4.7 μF
C_{13} = 22 μF

L_1: ID = 12 mm, d = 1.5 mm, T = 7 T
L_2: ID = 12 mm, d = 1.5 mm, T = 5 T
L_3: ID = 12 mm, d = 1.5 mm, T = 5 T
R_1 = 1 kΩ
R_2, R_3 = 100 Ω
RFC_1 = FC 15 ø, d = 1 mm, T = 3 T
RFC_2 = FC 6 ø, d = 1 mm, T = 4 T

Figure 11 28 MHz Pout Test Circuit

2SK1575

Preliminary

Silicon N-Channel MOS FET

Application

VHF amplifier

Features

- High gain, high efficiency
  PG = 13 dB, $_D$ = 65% typ (f = 190 MHz)
- Compact package
  Suitable for push-pull circuit

Table 1 Ordering Information

Type No.	Package
2SK1575	RFPAK-B

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DSS}	180	V
Gate to source voltage	V_{GSS}	±20	V
Drain current	I_D	16	A
Channel dissipation	Pch*	200	W
Channel temperature	Tch	150	°C
Storage temperature	Tstg	–55 to +150	°C

* Value at Tc = 25°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Drain to source breakdown voltage	$V_{(BR)DSS}$	180	—	—	V	I_D = 10 mA, V_{GS} = 0
Gate to source breakdown voltage	$V_{(BR)GSS}$	±20	—	—	V	I_G = ±100 µA, V_{DS} = 0
Drain leakage current *	I_{DSS}	—	—	1.0	mA	V_{DS} = 140 V, V_{GS} = 0
Gate to source cutoff voltage *	$V_{GS(off)}$	0.5	—	4.0	V	V_{DS} = 10 V, I_D = 1 mA
Drain to source voltage *	$V_{DS(on)}$	—	—	6.0	V	V_{GS} = 10 V, I_D = 4.0 A**
Forward transfer admittance *	$\|y_{fs}\|$	0.9	1.25	—	S	V_{DS} = 20 V, I_D = 3.0 A**
Input capacitance *	Ciss	—	440	—	pF	V_{GS} = 5 V, V_{DS} = 0, f = 1 MHz
Output capacitance *	Coss	—	75	—	pF	V_{GS} = −5 V, V_{DS} = 50 V, f = 1 MHz
Reverse transfer capacitance	Crss	—	0.5	—	pF	V_{GD} = −50 V, f = 1 MHz
Output power	Po	180	220	—	W	V_{DD} = 80 V, I_{DQ} = 0.2 A, f = 190 MHz, Pin = 10 W
Drain efficiency	η_D	—	65	—	%	

*: Shows/unit FET
**: Pulse test

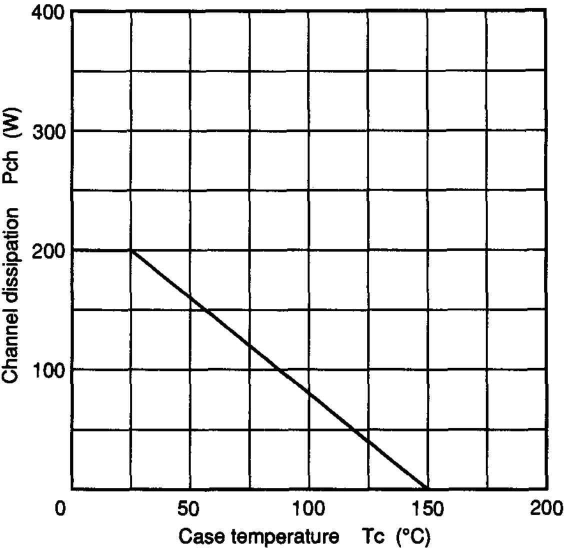


Figure 1 Maximum Channel Dissipation Curve

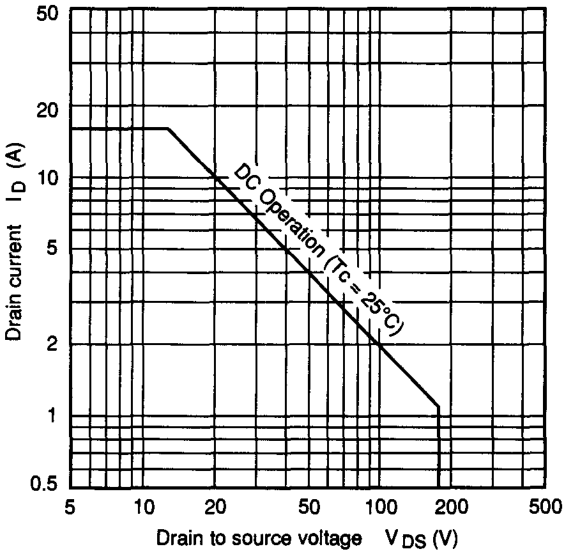


Figure 2 Maximum Safe Operation Area

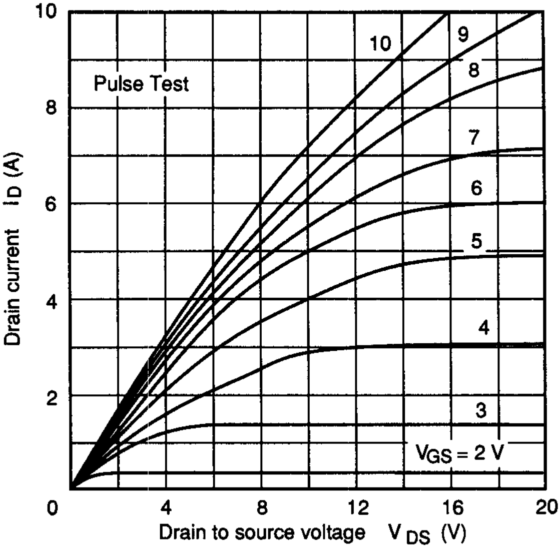


Figure 3 Typical Output Characteristics

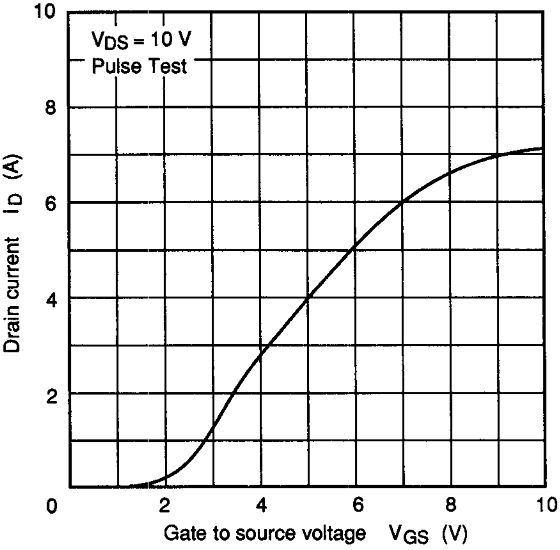


Figure 4 Typical Transfer Characteristics

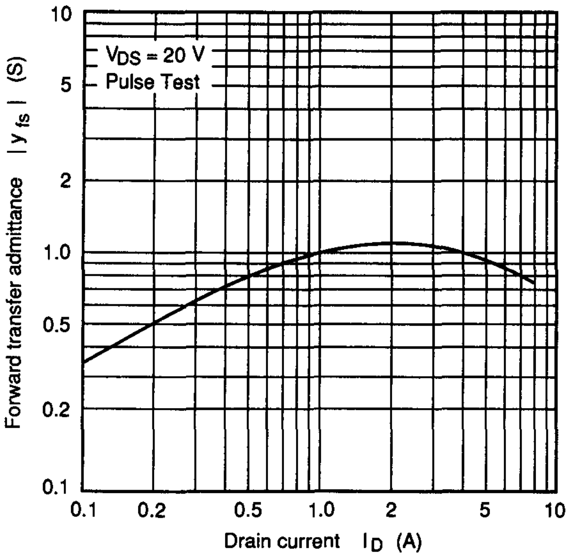


Figure 5 Forward Transfer Admittance vs. Drain Current

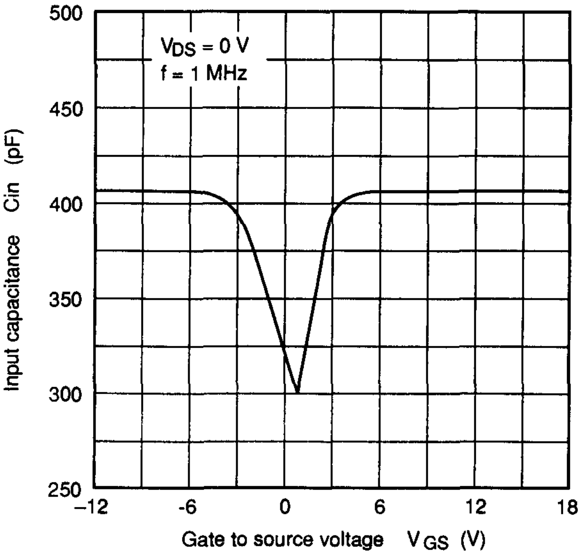


Figure 6 Input Capacitance vs. Gate to Source Voltage

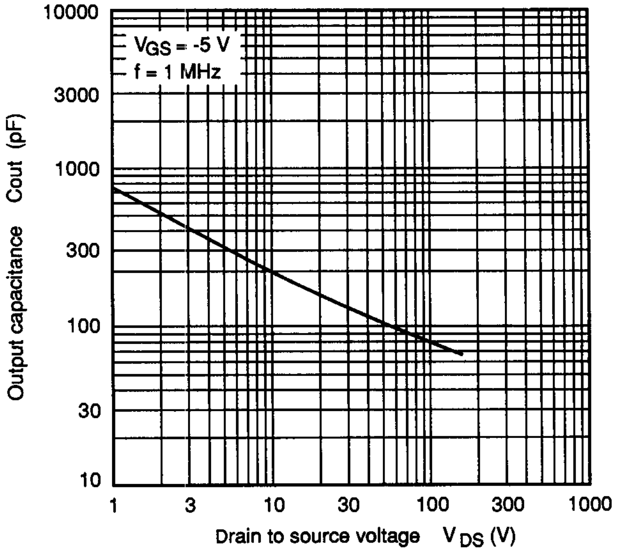


Figure 7 Output Capacitance vs. Drain to Source Voltage

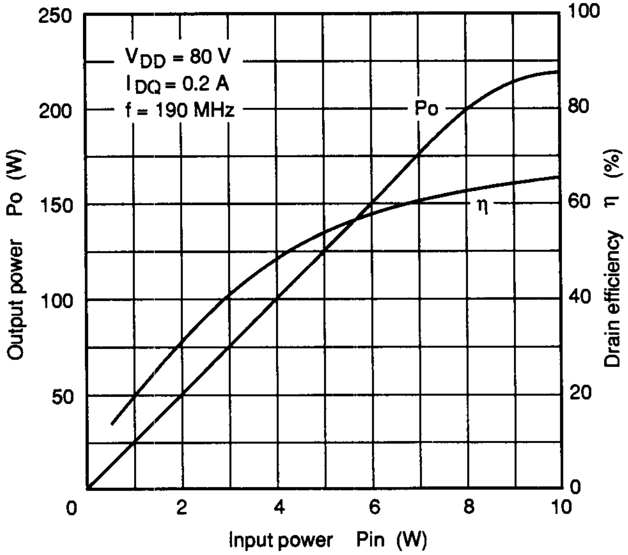
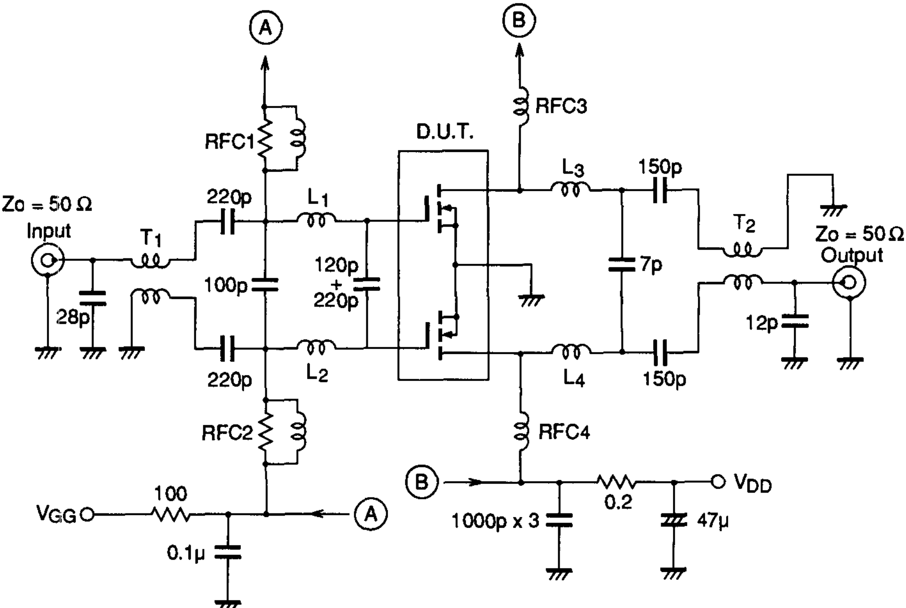


Figure 8 Output Power, Drain Efficiency vs. Input Power



T_1: Zo = 25 Ω, 70 mm

T_2: Zo = 50 Ω, 180 mm

RFC1, RFC2: 33 Ω and ø 0.6, 10 turn

RFC3, RFC4: ø 1.0, 1 turn

L_1, L_2: 15 mm x 12 mm

L_3, L_4: 15 mm x 6 mm

Unit
C: F
R: Ω

Figure 9 190 MHz Output Power Test Circuit

2SK1640 — Preliminary

Silicon N-Channel MOS FET

Application

UHF power amplifier

Table 1 Ordering Information

Type No.	Package
2SK1640	RFPAK-B

Features

- High gain, high efficiency
  PG = 8 dB, η_D = 48% typ (f = 860 MHz)
- Compact Package
  Suitable for push-pull circuit

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DSS}	60	V
Gate to source voltage	V_{GSS}	±10	V
Drain current	I_D	20	A
Channel dissipation	Pch*	125	W
Channel temperature	Tch	150	°C
Storage temperature	Tstg	–55 to +150	°C

* Value at Tc = 25°C

Table 3 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Drain leakage current *	I_{DSS}	—	—	1	mA	V_{DS} = 60 V, V_{GS} = 0
Gate leakage current *	I_{GSS}	—	—	±1	μA	V_{GS} = ±10 V, V_{DS} = 0
Gate to source cutoff voltage *	$V_{GS(off)}$	0.5	—	2.0	V	V_{DS} = 10 V, I_D = 1 mA
Drain to source voltage *	$V_{DS(on)}$	—	3.5	5.0	V	V_{GS} = 10 V, I_D = 7.0 A**
Forward transfer admittance *	$\|y_{fs}\|$	1.4	2.0	—	S	V_{DS} = 10 V, I_D = 4.0 A**
Input capacitance *	Ciss	—	190	—	pF	V_{GS} = 5 V, V_{DS} = 0 V, f = 1 MHz
Output capacitance *	Coss	—	90	—	pF	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz
Output power	Po	80	100	—	W	V_{DD} = 30 V, I_{DQ} = 0.2 A, f = 860 MHz, Pin = 15 W
Drain efficiency	η_D	—	48	—	%	

*: Shows/unit FET
**: Pulse test

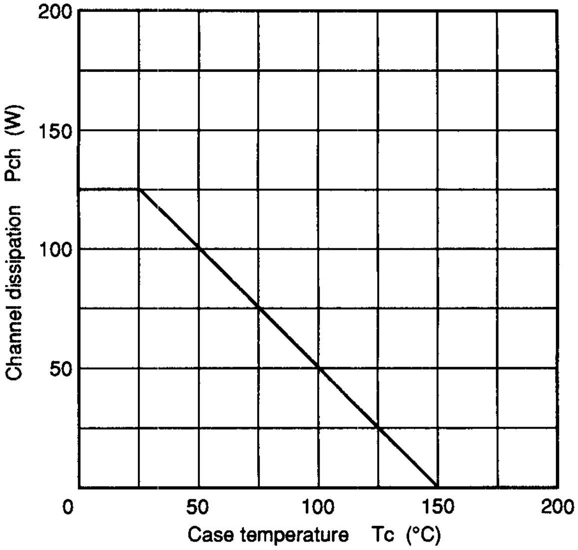


Figure 1 Maximum Channel Dissipation Curve

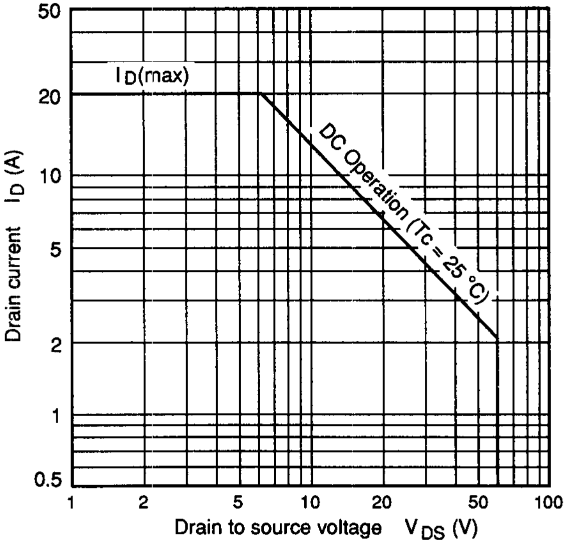


Figure 2 Maximum Safe Operation Area

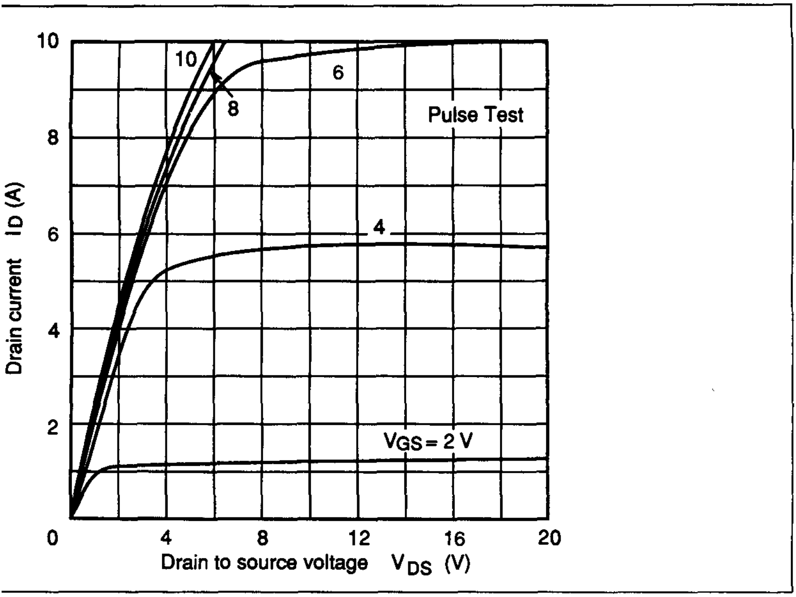


Figure 3 Typical Output Characteristics

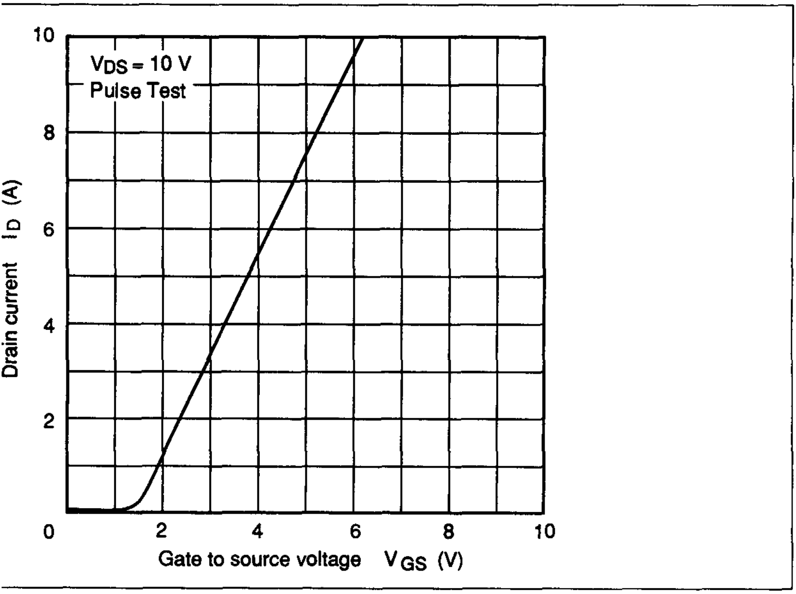


Figure 4 Typical Transfer Characteristics

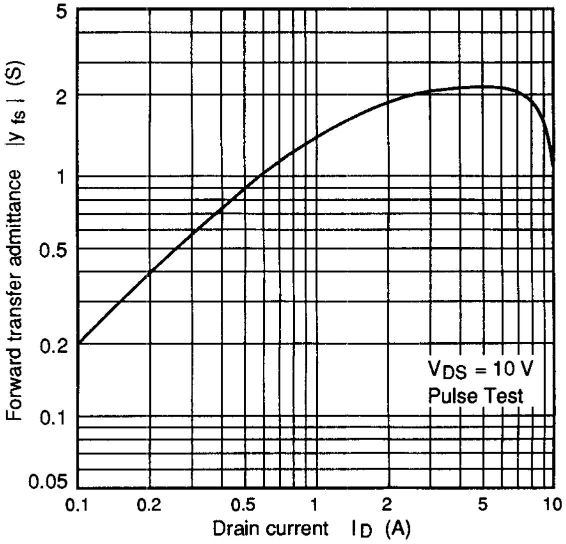


Figure 5 Forward Transfer Admittance vs. Drain Current

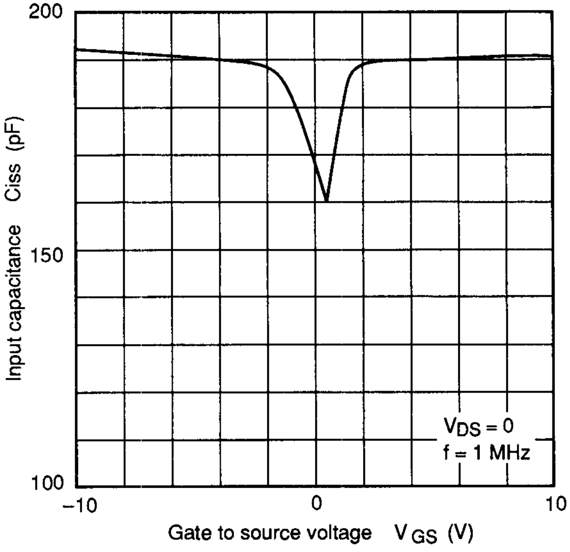


Figure 6 Input Capacitance vs. Gate to Source Voltage

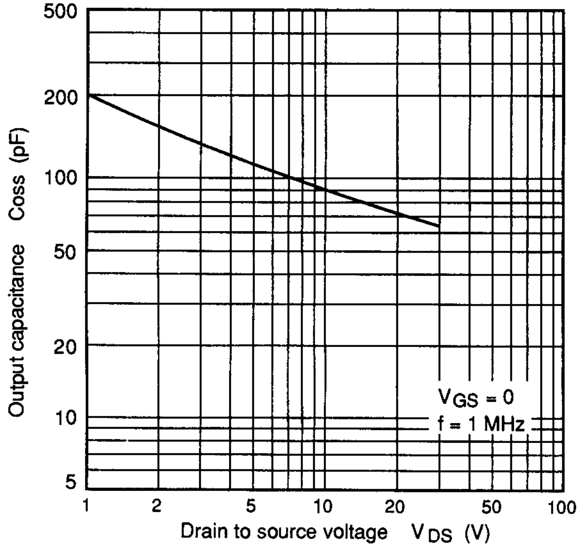


Figure 7 Output Capacitance vs. Drain to Source Voltage

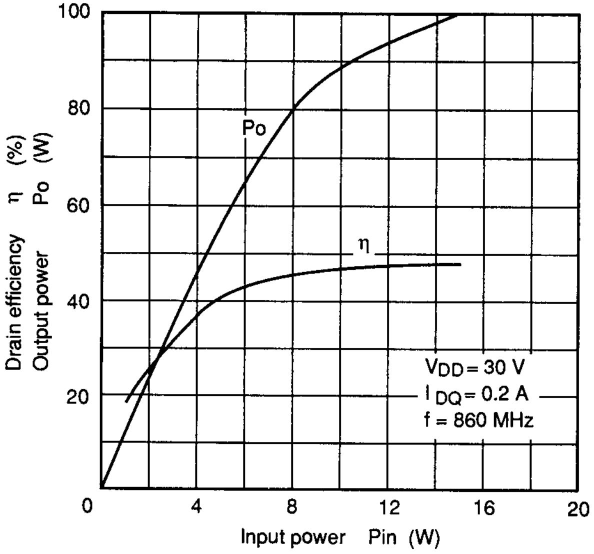


Figure 8 Output Power, Drain Efficiency vs. Input Power

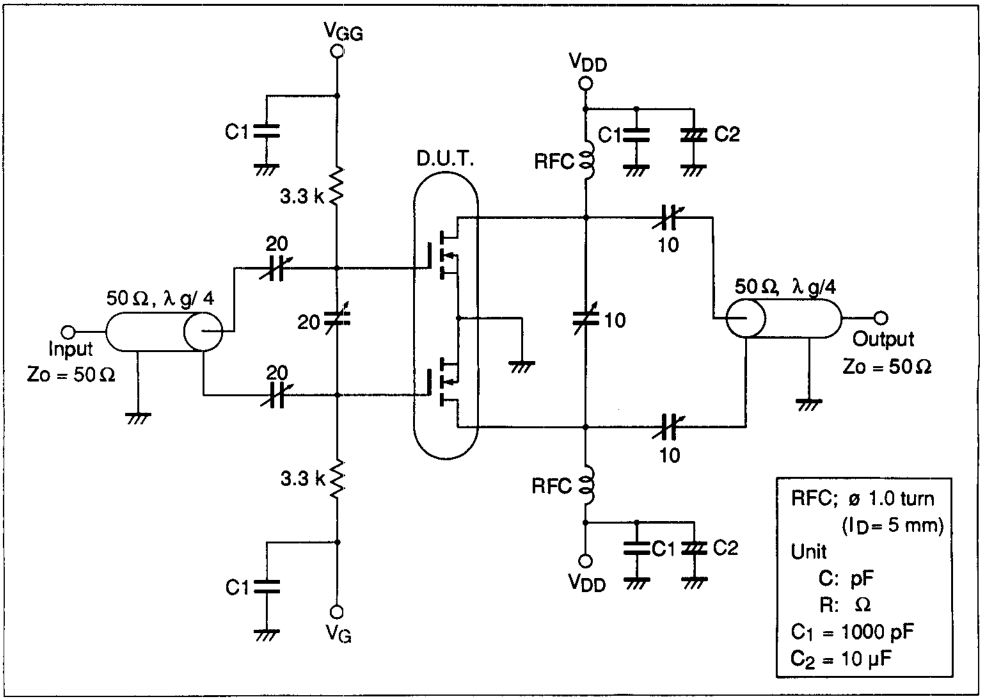


Figure 9 860 MHz Output Power Test Circuit

HWSA101

Surface Acoustic Wave Filter

ETACS Transmit Band 872 - 905 MHz

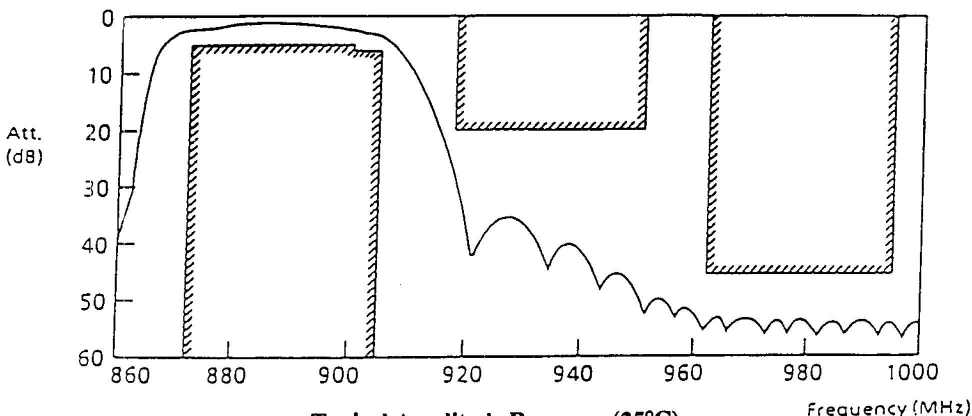
• FEATURES

- Small Package
- Low Insertion Loss
- Excellent Out-Of-Band Characteristics

Electrical Characteristics

ITEM No.	Characteristics	Frequency (MHz)	Value Min.	Value Standard	Value Max.	Units	Ambient Temperature
1	Inband Level	872 - 900		4.3	6.8	dB	-10 to +80
				4.3	5.3		25
		900 -905		5	7.5	dB	-10 to +80
				5	6		25
2	Inband Variation	872 - 905		2	4.5	dB	-10 to +80
				2	3		25
3	Stopband Attenuation	917 - 950	15	25		dB	-10 to +80
			20	25			25
4	Stopband Attenuation	962 - 995	40	45		dB	-10 to +80
			40	45			25
5	Temperature Coefficient of Frequency	888.5		-30		ppm/C	

Test Conditions : Input Drive Impedance 50 Ω // 5nH
Load Impedance 50 Ω // 5nH



Typical Amplitude Response (25°C)

HWSA201

Surface Acoustic Wave Filter

NMT Transmit Band 890 - 915 MHz

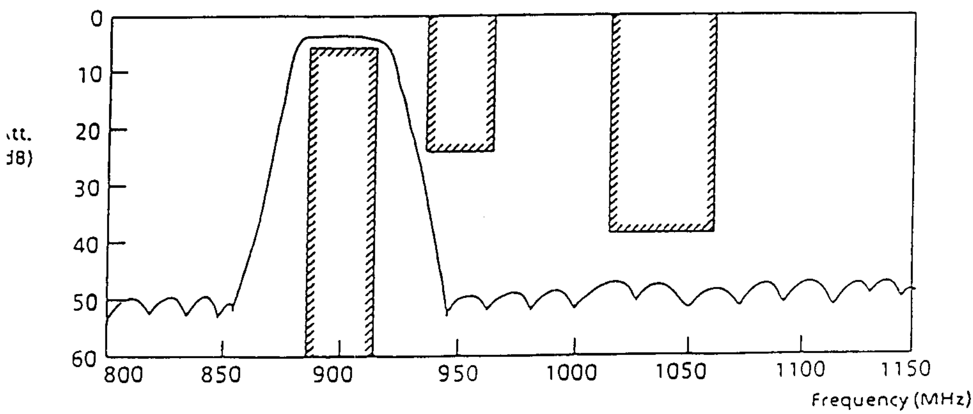
• FEATURES

- Small Packages HW903M - TO-39
  HWSA201 - SM1
- Low Insertion Loss
- Excellent Out-Of-Band Characteristics

Electrical Characteristics

ITEM No.	Characteristics	Frequency (MHz)	Value Min.	Value Standard	Value Max.	Units	Ambient Temperature
1	Inband Level	890 - 915		5	6.5	dB	-30 to +80
				5	6		25
2	Inband Variation	890 - 915		1.2	2.5	dB	-30 to +80
				1.2	2		25
3	Stopband Attenuation	935 - 960	17	30		dB	-30 to +80
			22	30			25
4	Stopband Attenuation	1012 - 1058	40	50		dB	-30 to +80
			40	50			25
5	Temperature Coefficient of Frequency	902.5		-30		ppm/C	

Test Conditions : Input Drive Impedance 50 Ω // 5nH
Load Impedance 50 Ω // 5nH



Typical Amplitude Response (25°C)

HWSA601

Surface Acoustic Wave Filter

AMPS Transmit Band 824 - 849 MHz

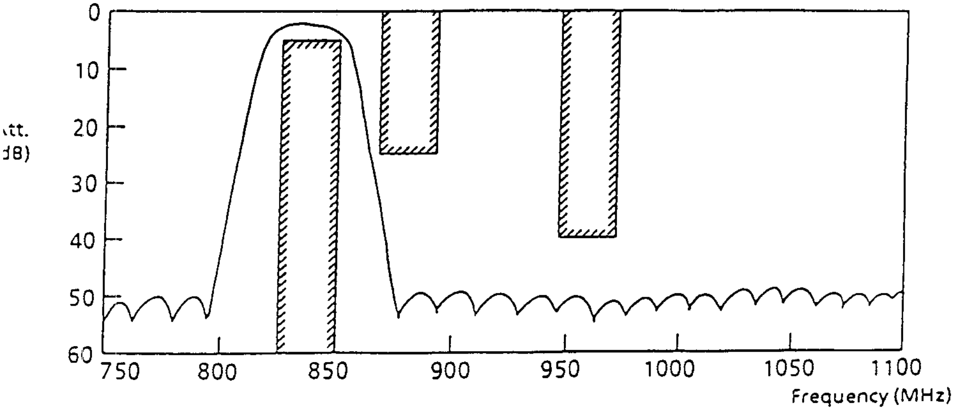
• FEATURES

- Small Packages HW837M - TO-39
  HWSA601 - SM1
- Low Insertion Loss
- Excellent Out-Of-Band Characteristics

Electrical Characteristics

ITEM	Characteristics	Frequency (MHz)		Value		Units	Ambient
No.			Min.	Standard	Max.		Temperature
1	Inband Level	824 - 849		4.5	6	dB	-30 to +80
				4.5	5.5		25
2	Inband Variation	824 - 849		1.5	3	dB	-30 to +80
				1.5	2.5		25
3	Stopband	869 - 894	25	27		dB	-30 to +80
	Attenuation		25	27			25
4	Stopband	947 - 972	40	50		dB	-30 to +80
	Attenuation		40	50			25
5	Temperature Coefficient of Frequency	836.5		-30		ppm/C	

Test Conditions : Input Drive Impedance 50 Ω // 5nH
Load Impedance 50 Ω // 5nH



Typical Amplitude Response (25°C)

HWSB101

Surface Acoustic Wave Filter

ETACS Receive Band 917 - 950 MHz

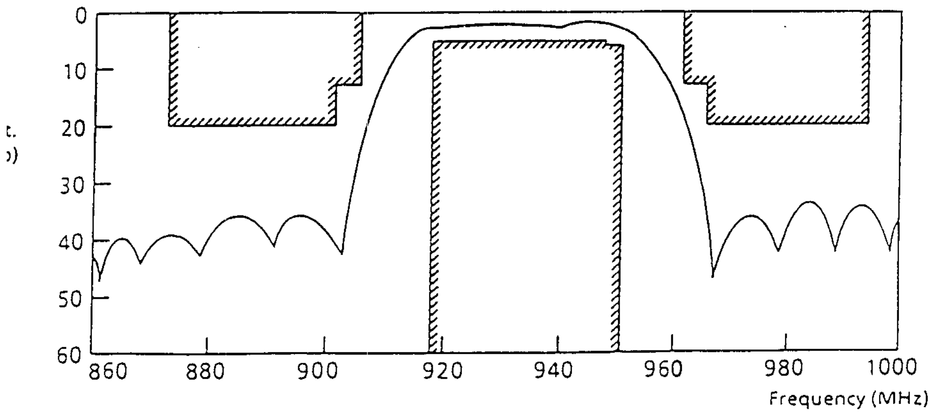
• FEATURES

- Small Package
- Low Insertion Loss
- Excellent Out-Of-Band Characteristics

Electrical Characteristics

ITEM No.	Characteristics	Frequency (MHz)	Value			Units	Ambient Temperature
			Min.	Standard	Max.		
1	Inband Level	917 - 947		5	7.5	dB	-10 to +80
				5	6		25
		947 - 950		5.5	7.8	dB	-10 to +80
				5.5	6.3		25
2	Inband Variation	917 - 950		1.5	4	dB	-10 to +80
				1.5	2.5		25
3	Stopband Attenuation	872 - 902	15	25		dB	-10 to +80
			20	25			25
4	Stopband Attenuation	902 - 905	10	17		dB	-10 to +80
			13	17			25
5	Stopband Attenuation	962 - 965	10	17		dB	-10 to +80
			13	17			25
6	Stopband Attenuation	965 - 995	15	28		dB	-10 to +80
			20	28			25
7	Temperature Coefficient of Frequency	933.5		-30		ppm/C	

Test Conditions : Input Drive Impedance 50 Ω // 5nH
Load Impedance 50 Ω // 5nH



Typical Amplitude Response (25°C)

HWSB201

Surface Acoustic Wave Filter

NMT Receive Band 935- 960 MHz

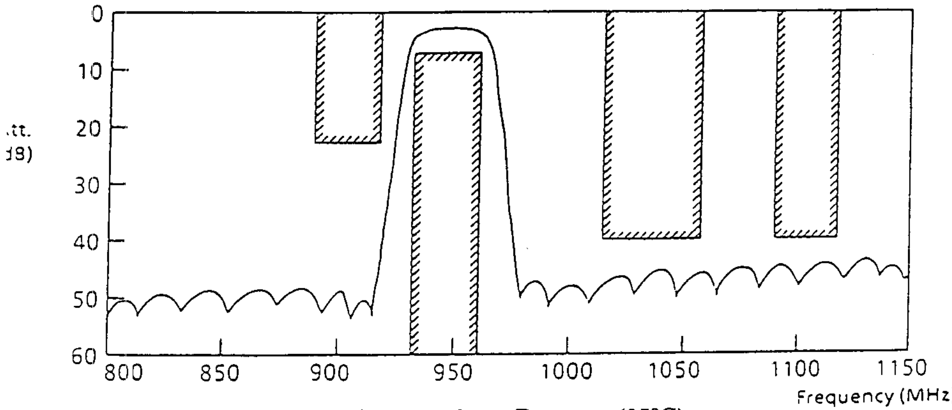
• FEATURES

- Small Packages HW948M - TO-39
  HWSB201 - SM1
- Low Insertion Loss
- Excellent Out-Of-Band Characteristics

Electrical Characteristics

ITEM No.	Characteristics	Frequency (MHz)	Value Min.	Value Standard	Value Max.	Units	Ambient Temperature
1	Inband Level	935 - 960		5	6.5	dB	-30 to +80
				5	6		25
2	Inband Variation	935 - 960		1.3	2.5	dB	-30 to +80
				1.3	2		25
3	Stopband Attenuation	890 - 915	20	35		dB	-30 to +80
			23	35			25
4	Stopband Attenuation	1012 - 1058	40	50		dB	-30 to +80
			40	50			25
5	Stopband Attenuation	1089 - 1115	40	50		dB	-30 to +80
			40	50			25
6	Temperature Coefficient of Frequency	947.5		-30		ppm/C	

Test Conditions : Input Drive Impedance 50 Ω // 5nH
Load Impedance 50 Ω // 5nH



Typical Amplitude Response (25°C)

HWSB601

Surface Acoustic Wave Filter

AMPS Receive Band 869- 894 MHz

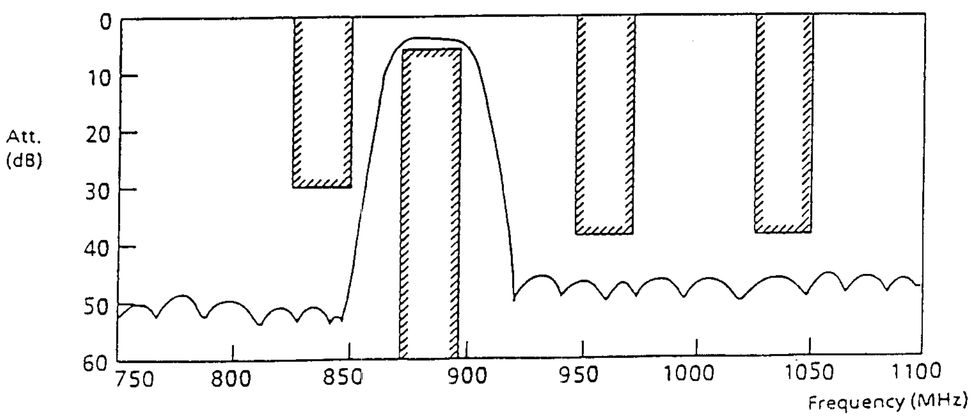
• FEATURES

- Small Packages HW882M - TO-39
  HWSB601 - SM1
- Low Insertion Loss
- Excellent Out-Of-Band Characteristics

Electrical Characteristics

ITEM No.	Characteristics	Frequency (MHz)	Value Min.	Value Standard	Value Max.	Units	Ambient Temperature
1	Inband Level	869 - 894		5	6.5	dB	-30 to +80
				5	6		25
2	Inband Variation	869 - 894		1.3	2.5	dB	-30 to +80
				1.3	2		25
3	Stopband Attenuation	824 - 849	30	33		dB	-30 to +80
			30	33			25
4	Stopband Attenuation	947 - 972	40	49		dB	-30 to +80
			40	49			25
5	Stopband Attenuation	1024 - 1049	40	50		dB	-30 to +80
			40	50			25
6	Temperature Coefficient of Frequency	881.5		-30		ppm/C	

Test Conditions : Input Drive Impedance 50 Ω // 5nH
Load Impedance 50 Ω // 5nH



Typical Amplitude Response (25°C)

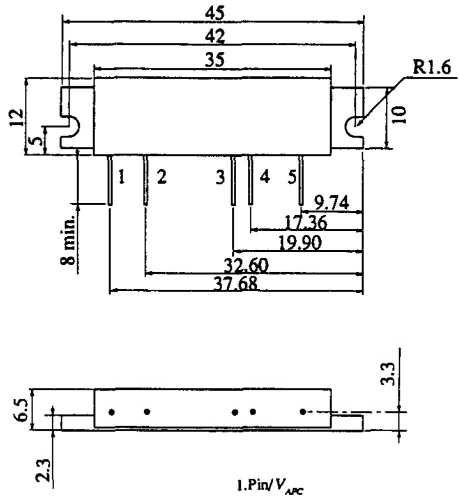
PF0015

MOS FET Power Amplifier

AMPS Band 824-849 MHz

■ FEATURES

- Small Package 12 × 45 × 6.5 mm³
- Low Voltage Operation 6V
- Low Power Control Current 300μA
- Good Stability of Load Change Load VSWR ≥ 20



1.Pin/V_{APC}
2. V_{DD1}
3. V_{DD2}
4. V_{DD3}
5.Pout
(Unit: mm)

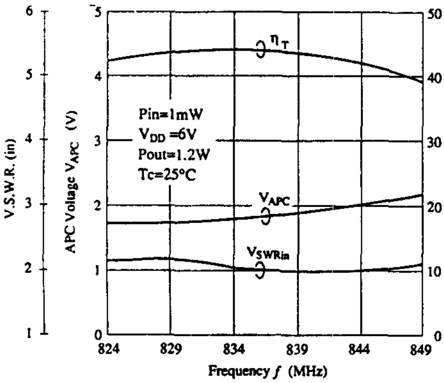
■ABSOLUTE MAXIMUM RATINGS (Ta = 25℃)

Item	Symbol	Rating	Unit
Supply Voltage	V_{DD}	12	V
Supply Current	I_{DD}	2	A
APC Voltage	V_{APC}	±8	V
Input Power	P_{in}	20	mW
Operating Case Temperature	$T_{C(op)}$	−30～+100	℃
Storage Temperature	T_{stg}	−30～+100	℃

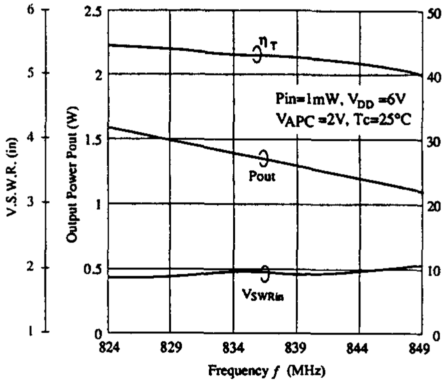
■ELECTRICAL CHARACTERISTICS (Ta = 25℃)

Item	Symbol	Test Condition	min.	typ.	max.	Unit
Drain Cutoff Current	I_{DS}	V_{DD1} = V_{DD2} = V_{DD3} = 12V, V_{APC} = 0V	−	−	100	μA
Total Efficiency	η_T	f = 824, 849MHz,	35	40	−	%
2nd Harmonic Distortion	2nd H. D.	P_{in} = 1mW,	−	−40	−30	dB
3rd Harmonic Distortion	3rd H. D.	V_{DD1} = V_{DD2} = V_{DD3} = 6V,	−	−50	−30	dB
Input VSWR	VSWR (in)	P_{out} = 1.2W (at APC Control),	−	1.8	3	−
Output VSWR	VSWR (out)	Z_{in} = Z_{out} = 50Ω	−	2	−	−
Stability	−	V_{DD1} = V_{DD2} = V_{DD3} = 6V, P_{in} = 1mW, f = 824MHz, R_g = 50Ω, P_{out} = 1.2W (at APC Control) Output VSWR = 20 All Phases, t = 20sec	No Parastic Oscillation			−

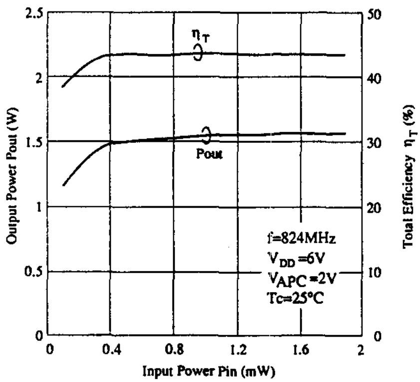
VSWR , V APC , η_T VS. FREQUENCY



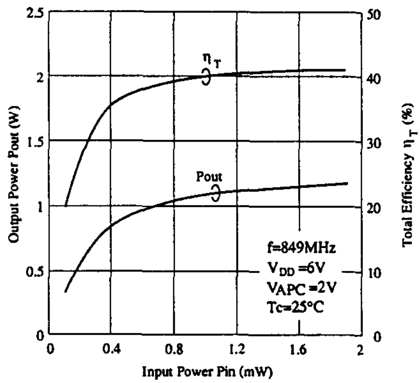
VSWR, Pout η_T VS. FREQUENCY

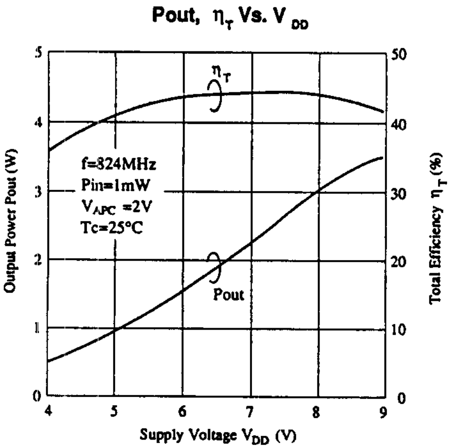


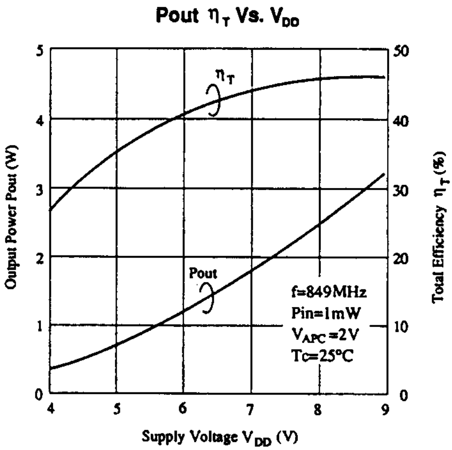
Pout, η_T VS. Pin

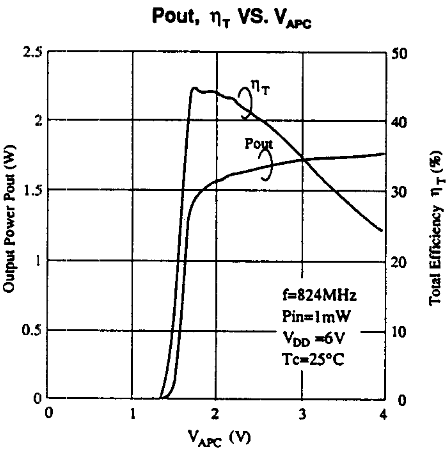


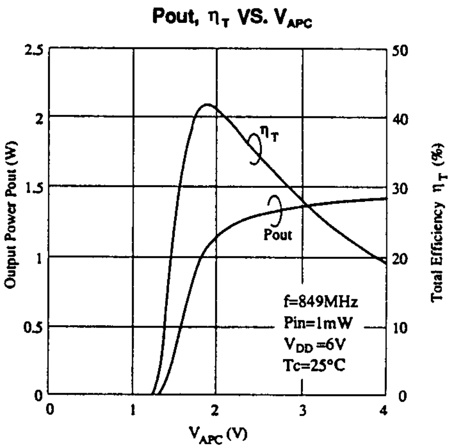
Pout, η_T VS. Pin



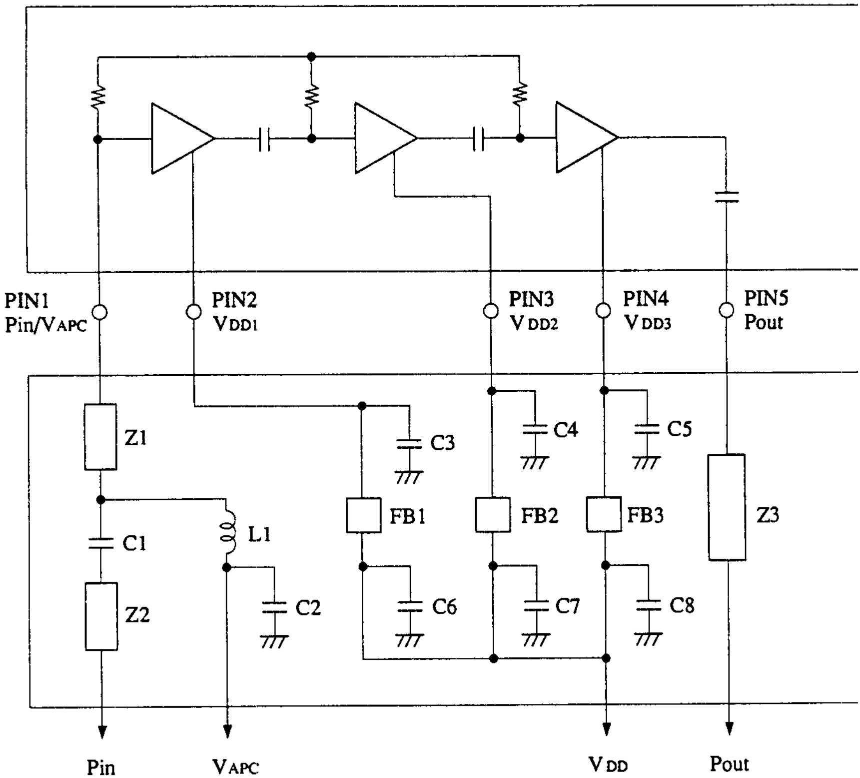

Pout, η_T Vs. V_{DD}
η_T
Pout
f=824MHz
Pin=1mW
V_{APC} =2V
Tc=25°C
Output Power Pout (W)
Total Efficiency η_T (%)
Supply Voltage V_{DD} (V)


Pout η_T Vs. V_{DD}
η_T
Pout
f=849MHz
Pin=1mW
V_{APC}=2V
Tc=25°C
Output Power Pout (W)
Total Efficiency η_T (%)
Supply Voltage V_{DD} (V)


Pout, η_T VS. V_{APC}
η_T
Pout
f=824MHz
Pin=1mW
V_{DD} =6V
Tc=25°C
Output Power Pout (W)
Total Efficiency η_T (%)
V_{APC} (V)


Pout, η_T VS. V_{APC}
η_T
Pout
f=849MHz
Pin=1mW
V_{DD} =6V
Tc=25°C
Output Power Pout (W)
Total Efficiency η_T (%)
V_{APC} (V)

■TEST SYSTEM DIAGRAM



C1=0.02μF CERAMIC CHIP

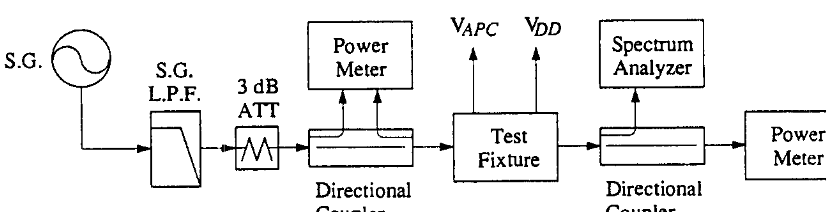
C2,C3,C4,C5=0.01μF CERAMIC CHIP

C6,C7,C8=10μF TANTALUM

L1=RFC 1mmϕ, 15turns

FB=FERRITE BEAD BLO1RN1-A62-001(MURATA) or equivalent

Z1,Z2,Z3=50Ω MICROSTRIP LINE

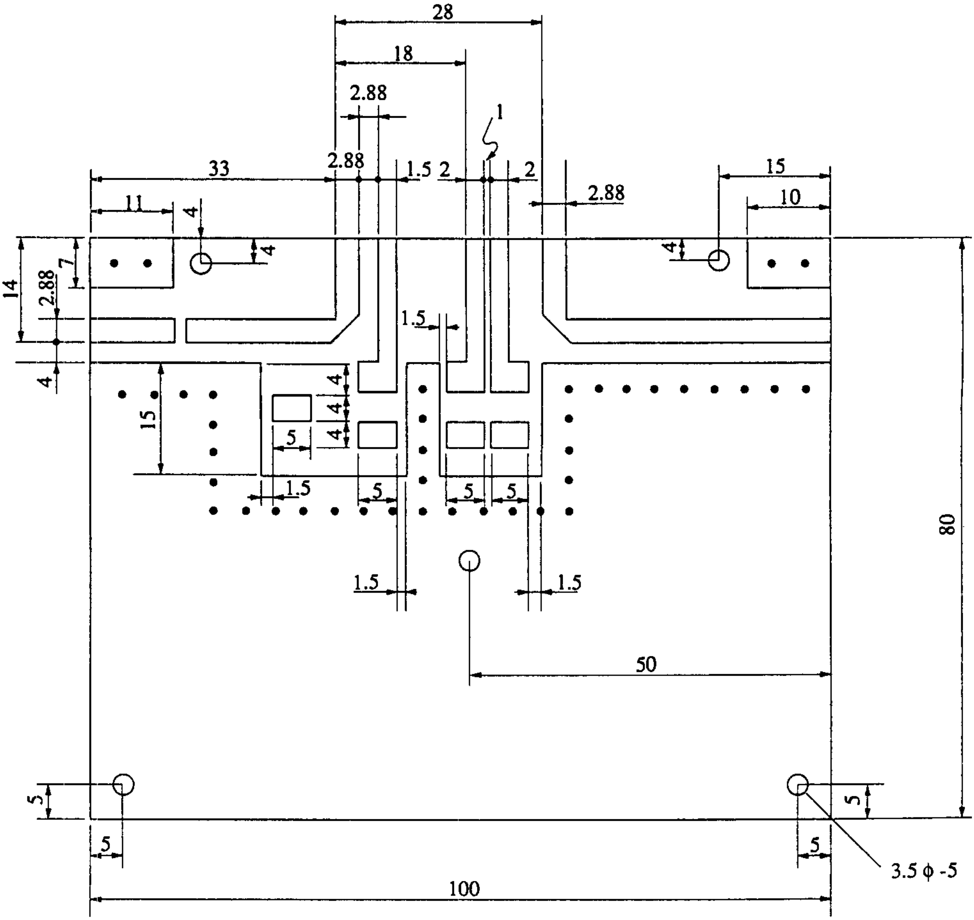


Output power Pout is defined at the root point of the module output pin Pout.

The coefficient of output power loss in the PCB output line Z3 is showed bellow.

$$1/(S_{Z1})^2=1/(0.9805)^2=1.04$$

■TEST FIXTURE PATTERN



Grass Epoxy Double Sided PCB
(t=1.6mm, ε r=4.8)

UNIT : mm

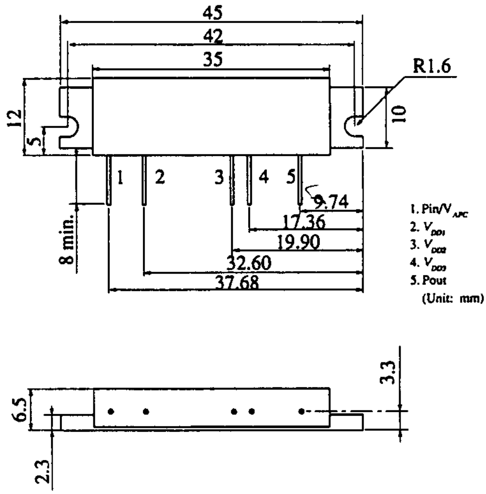
PF0016

MOS FET Power Amplifier

NMT900-Band 890-915 MHz

■ FEATURES

- Small Package 12 × 45 × 6.5 mm³
- Low Power Control Current 300μA
- Good Stability of Load Change Load VSWR ≥ 20



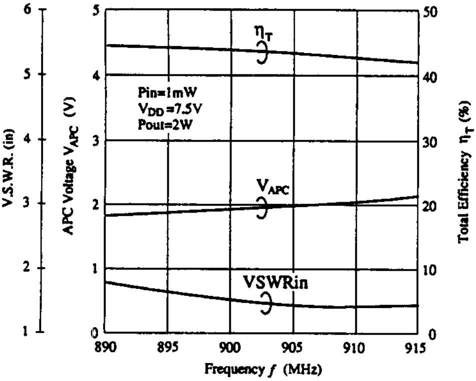
■ABSOLUTE MAXIMUM RATINGS (Ta = 25℃)

Item	Symbol	Rating	Unit
Supply Voltage	V_{DD}	12	V
Supply Current	I_{DD}	2	A
APC Voltage	V_{APC}	±8	V
Input Power	P_{in}	20	mW
Operating Case Temperature	$T_{C(op)}$	−30～+100	℃
Storage Temperature	T_{stg}	−30～+100	℃

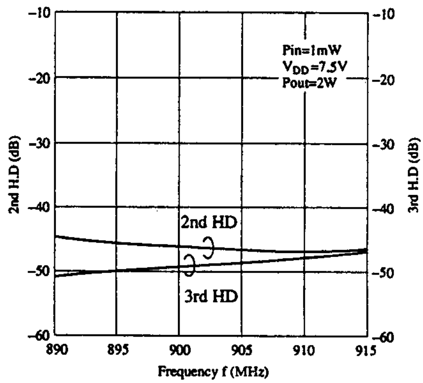
■ELECTRICAL CHARACTERISTICS (Ta = 25℃)

Item	Symbol	Test Condition	min.	typ.	max.	Unit
Drain Cutoff Current	I_{DS}	$V_{DD1} = V_{DD2} = V_{DD3}$ = 12V, V_{APC} = 0V	−	−	100	μA
Total Efficiency	η_T	f = 890, 915MHz, P_{in} = 1mW, $V_{DD1} = V_{DD2} = V_{DD3}$ = 7.5V, P_{out} = 2W (at APC Control), $Z_{in} = Z_{out}$ = 50Ω	35	40	−	%
2nd Harmonic Distortion	2nd H. D.		−	−40	−30	dB
3rd Harmonic Distortion	3rd H. D.		−	−50	−30	dB
Input VSWR	VSWR (in)		−	1.8	3	−
Output VSWR	VSWR (out)		−	2	−	−
Stability	−	$V_{DD1} = V_{DD2} = V_{DD3}$ = 7.5V, P_{in} = 1mW, f = 890MHz, R_g = 50Ω, P_{out} = 2W (at APC Control) Output VSWR = 20 All Phases, t = 20sec	No Parastic Oscillation			−

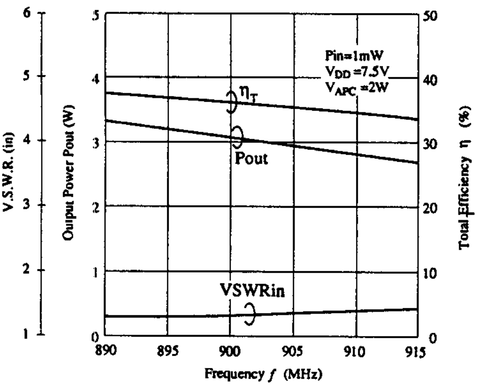
VSWR, η_T VS. FREQUENCY



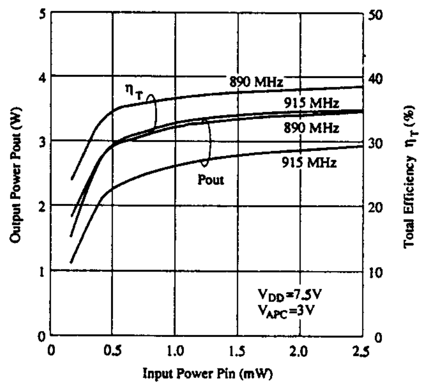
2nd HD, 3rd HD VS, FREWUENCY



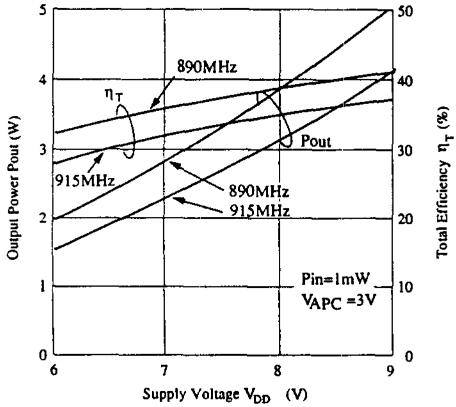
VSWR, Pout, η_T VS. FREQUENCY



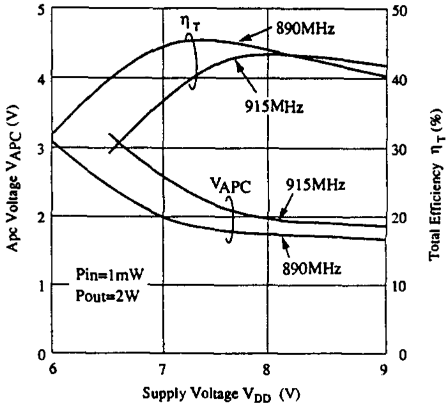
Pout, η_T VS. Pin



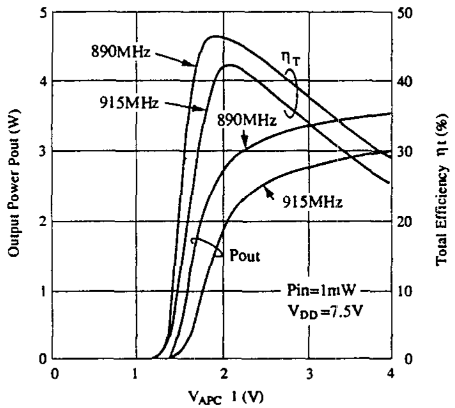
Pout, η_T VS. V_{DD}



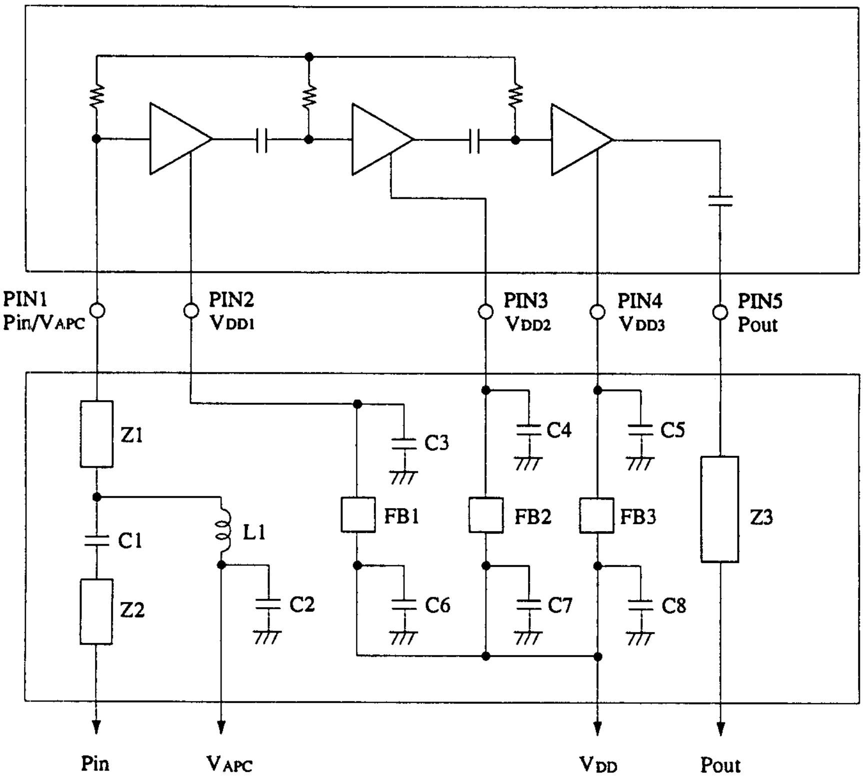
V_{APC}, η_T , VS. V_{DD}



Pout, η_T VS. V_{APC}1



■ TEST SYSTEM DIAGRAM



C1=0.02μF CERAMIC CHIP

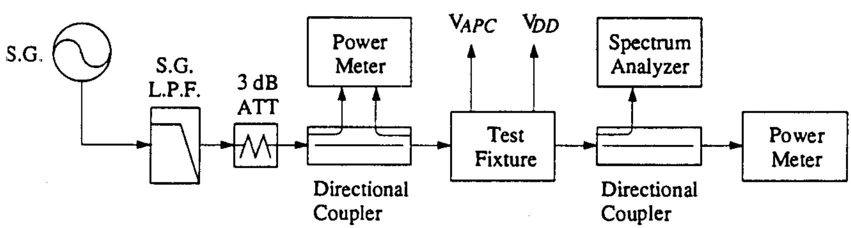
C2, C3, C4, C5=0.01μF CERAMIC CHIP

C6, C7, C8=10μF TANTALUM

L1=RFC 1mmϕ, 15turns

FB=FERRITE BEAD BLO1RN1-A62-001(MURATA) or equivalent

Z1, Z2, Z3=50Ω MICROSTRIP LINE

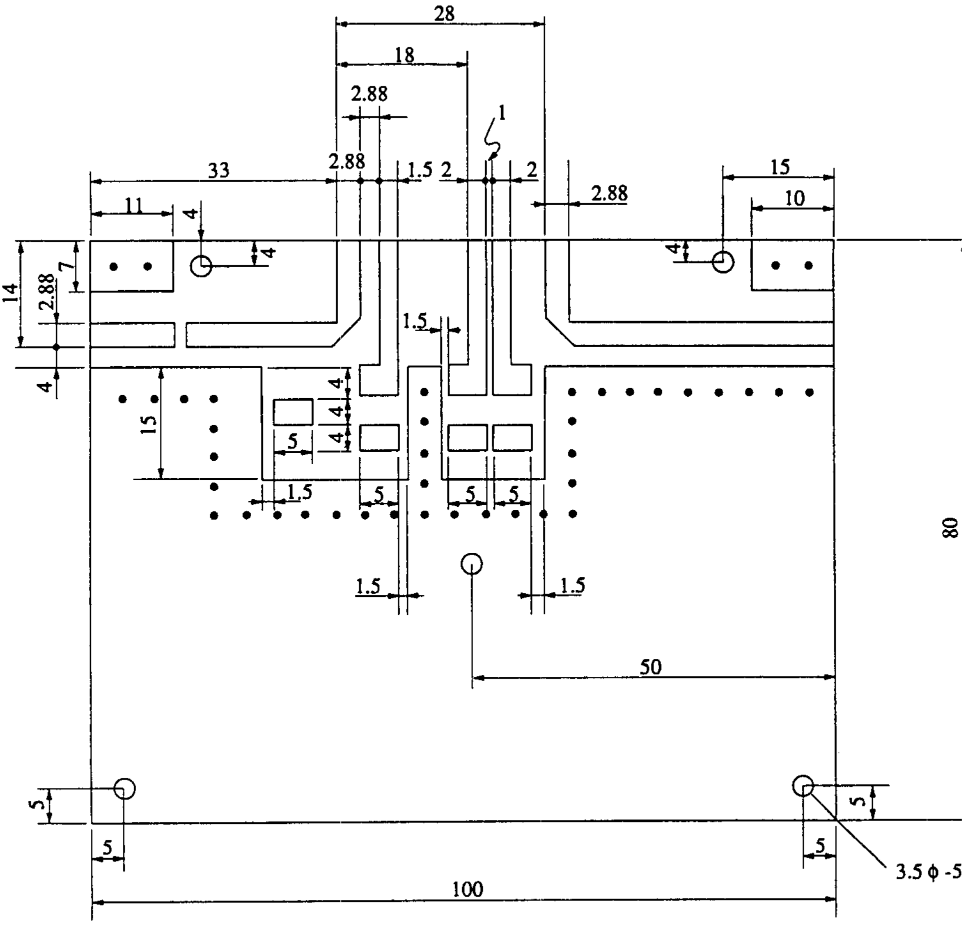


Output power Pout is defined at the root point of the module output pin Pout.

The coefficient of output power loss in the PCB output line Z3 is showed bellow.

$$1/(S_{21})^2=1/(0.9805)^2=1.04$$

■ TEST FIXTURE PATTERN



Grass Epoxy Double Sided PCB
(t=1.6mm, εr=4.8)

UNIT : mm

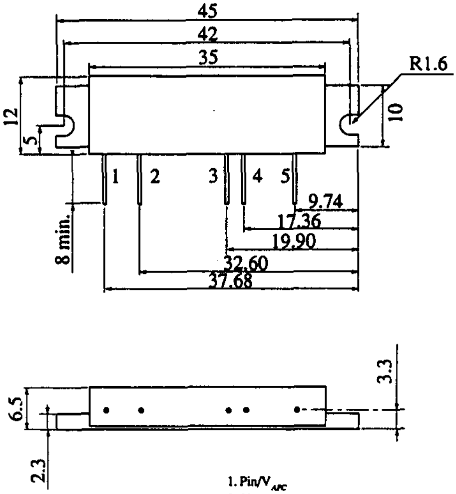
PF0017

MOS FET Power Amplifier

E-TACS Band 872-905 MHz

■ FEATURES

- Small Package 12 × 45 × 6.5 mm³
- Low Voltage Operation 6V
- Low Power Control Current 300µA
- Good Stability of Load Change Load VSWR ≥ 20



1. Pin/V_{APC}
2. V_{DD1}
3. V_{DD3}
4. V_{DD2}
5. Pout

(Unit: mm)

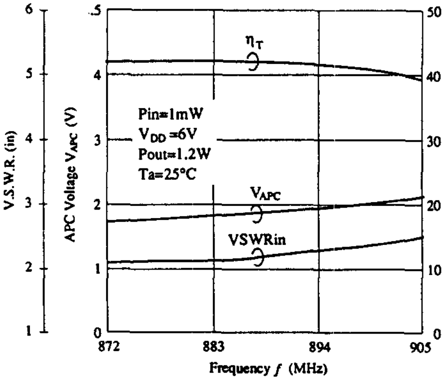
■ABSOLUTE MAXIMUM RATINGS (Ta = 25℃)

Item	Symbol	Rating	Unit
Supply Voltage	V_{DD}	12	V
Supply Current	I_{DD}	2	A
APC Voltage	V_{APC}	±8	V
Input Power	P_{in}	20	mW
Operating Case Temperature	$T_{C(op)}$	−30〜+100	℃
Storage Temperature	T_{stg}	−30〜+100	℃

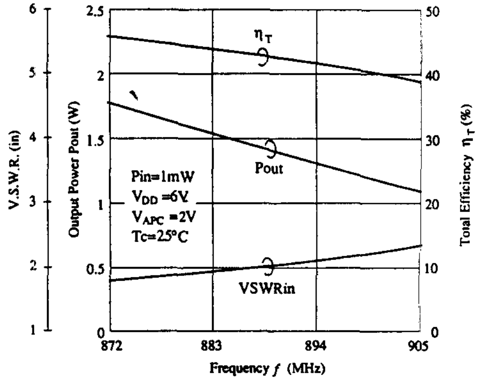
■ELECTRICAL CHARACTERISTICS (Ta = 25℃)

Item	Symbol	Test Condition	min.	typ.	max.	Unit
Drain Cutoff Current	I_{DS}	V_{DD1} = V_{DD2} = V_{DD3} = 12V, V_{APC} = 0V	−	−	100	µA
Total Efficiency	η_T	f = 872, 905MHz,	35	40	−	%
2nd Harmonic Distortion	2nd H. D.	P_{in} = 1mW,	−	−40	−30	dB
3rd Harmonic Distortion	3rd H. D.	V_{DD1} = V_{DD3} = V_{DD3} = 6V,	−	−50	−30	dB
Input VSWR	VSWR (in)	P_{out} = 1.2W (at APC Control),	−	1.8	3	−
Output VSWR	VSWR (out)	Z_{in} = Z_{out} = 50Ω	−	2	−	−
Stability	−	V_{DD1} = V_{DD3} = V_{DD3} = 6V, P_{in} = 1mW, f = 872MHz, R_g = 50Ω, P_{out} = 1.2W (at APC Control) Output VSWR = 20 All Phases, t = 20sec	No Parastic Oscillation			−

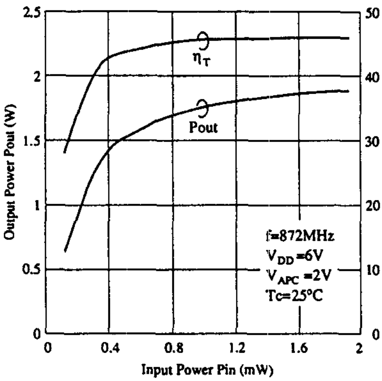
VSWR, V_{APC}, η_T VS. FREQUENCY



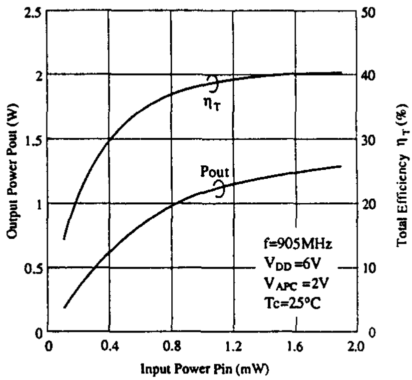
VSWR, Pout, η_T VS. FREQUENCY

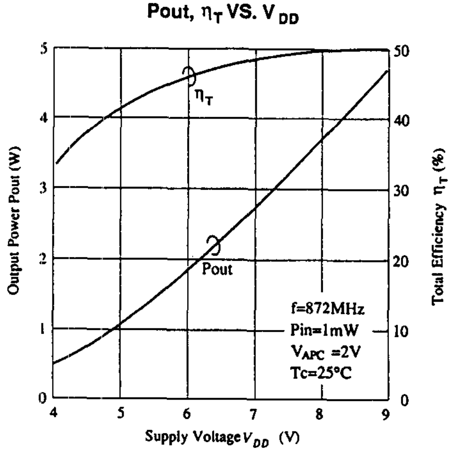


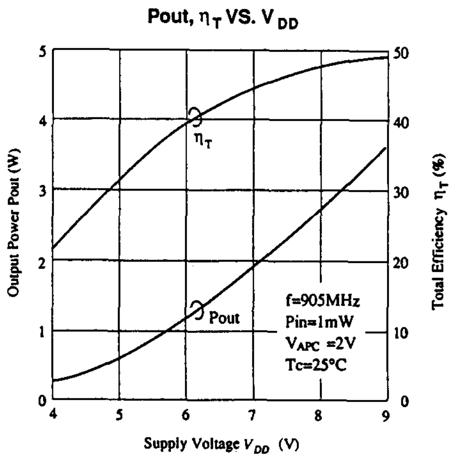
Pout, η_T VS. Pin

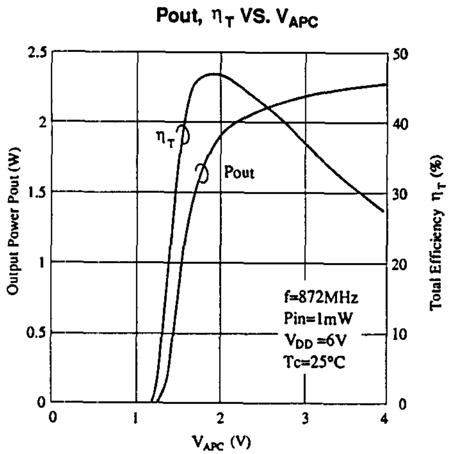


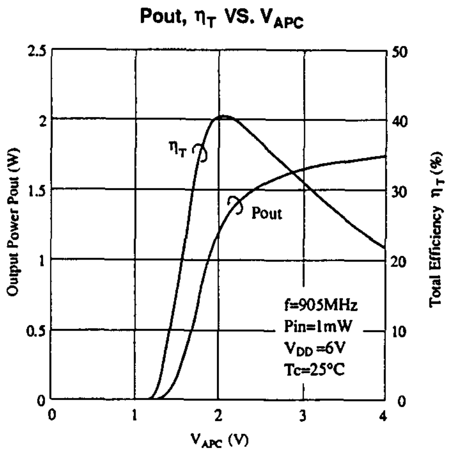
Pout, η_T VS. Pin



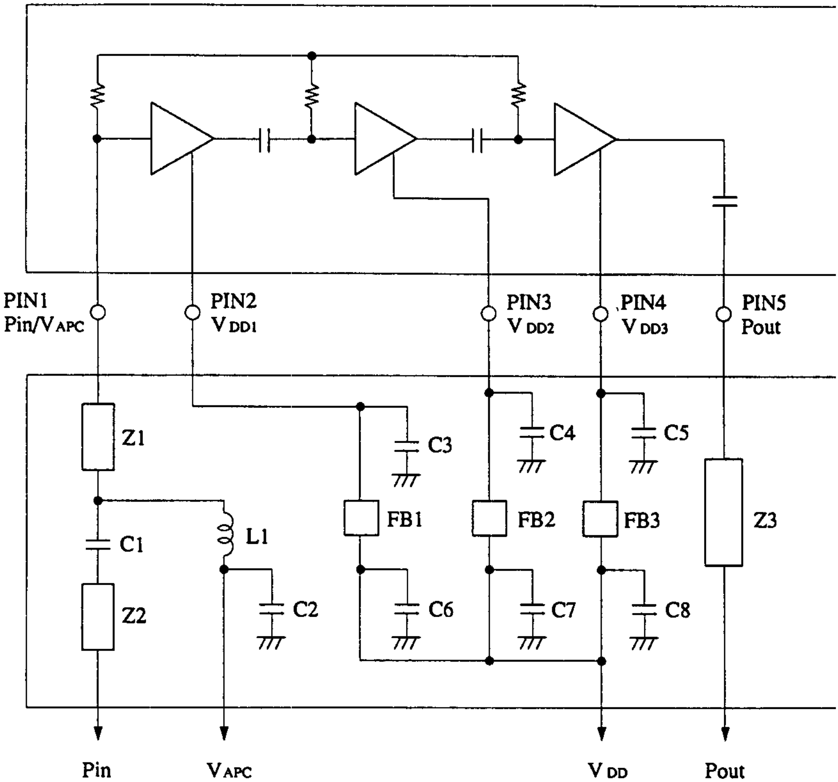

Pout, ηT VS. VDD
Output Power Pout (W)
Total Efficiency ηT (%)
ηT
Pout
f=872MHz
Pin=1mW
VAPC =2V
Tc=25°C
Supply Voltage VDD (V)
0
1
2
3
4
5
10
20
30
40
50
6
7
8
9


Pout, ηT VS. VDD
Output Power Pout (W)
Total Efficiency ηT (%)
ηT
Pout
f=905MHz
Pin=1mW
VAPC =2V
Tc=25°C
Supply Voltage VDD (V)


Pout, ηT VS. VAPC
Output Power Pout (W)
Total Efficiency ηT (%)
ηT
Pout
f=872MHz
Pin=1mW
VDD =6V
Tc=25°C
VAPC (V)


Pout, ηT VS. VAPC
Output Power Pout (W)
Total Efficiency ηT (%)
ηT
Pout
f=905MHz
Pin=1mW
VDD =6V
Tc=25°C
VAPC (V)

■TEST SYSTEM DIAGRAM



C1=0.02μF CERAMIC CHIP

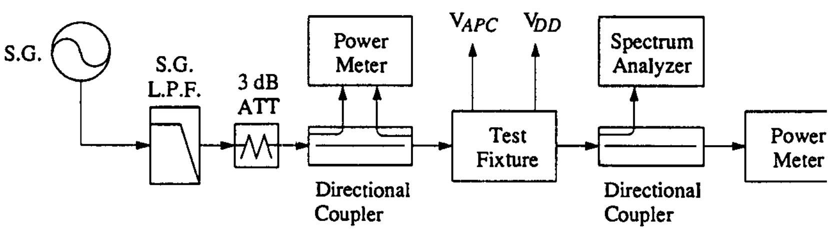
C2, C3, C4, C5=0.01μF CERAMIC CHIP

C6, C7, C8=10μF TANTALUM

L1=RFC 1mm ϕ ,15turns

FB=FERRITE BEAD BLO1RN1-A62-001(MURATA) or equivalent

Z1, Z2, Z3=50Ω MICROSTRIP LINE

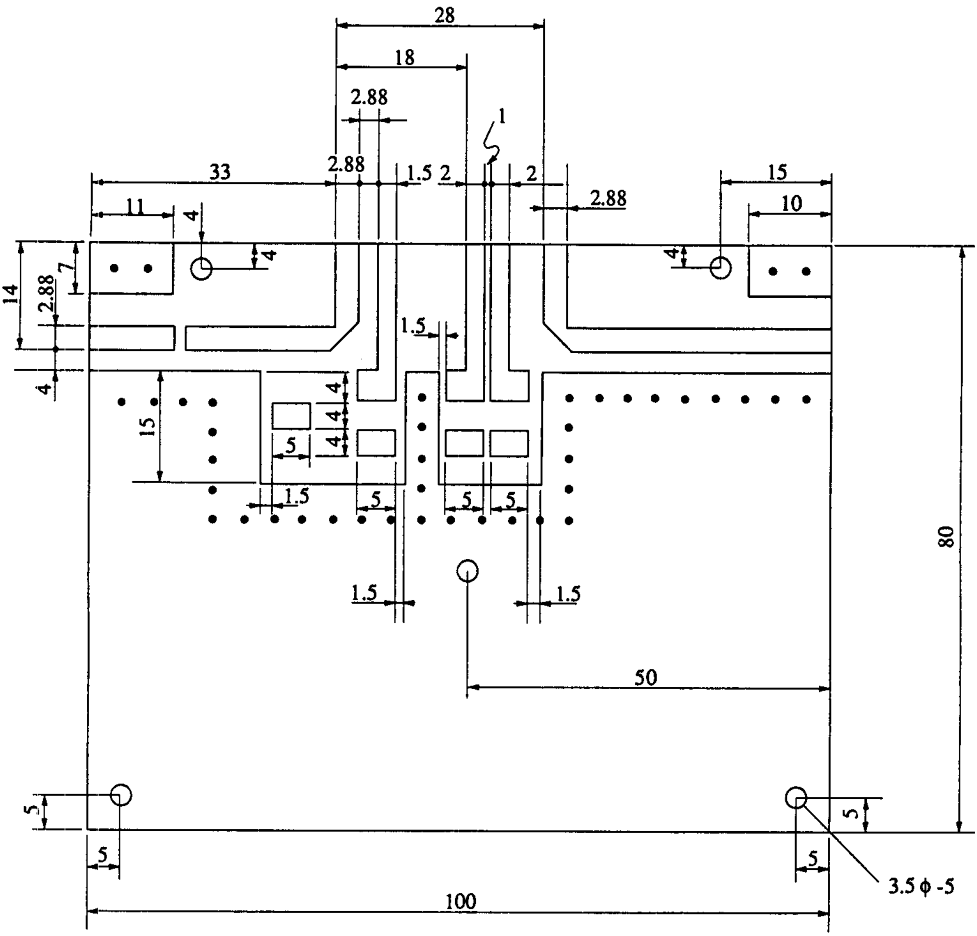


Output power Pout is defined at the root point of the module output pin Pout.

The coefficient of output power loss in the PCBoutput line Z3 in showed bellow.

$$1/(S_{21})^2=1/(0.9805)^2=1.04$$

■TEST FIXTURE PATTERN



Grass Epoxy Double Sided PCB
(t=1.6mm, ε r=4.8)

UNIT : mm

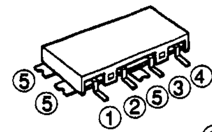
PF0025 Series

MOS FET Power Amplifier

Features

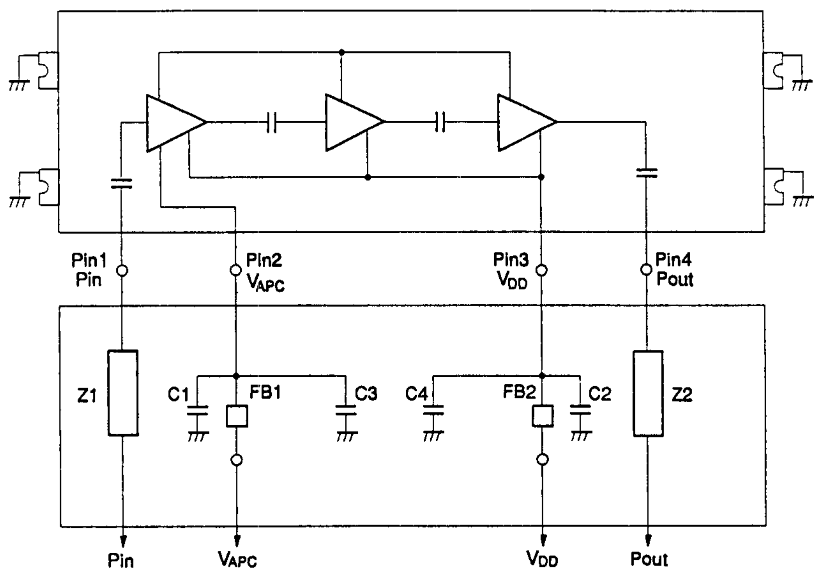
- Surface mounted small package 1 cc, 3 g with shielded cover
- High efficiency 47% TYP. at actual output condition 1.2 W (AMPS / ETACS)
- Low voltage operation 6 V
- Low power control current 300 μA

Type No	Operating Frequency	Application	Power
PF0025	824 to 849 MHz	AMPS	1.2W
PF0026	890 to 915 MHz	NMT900	1.6W
PF0027	872 to 905 MHz	ETACS	1.2W



① Pin
② V_{APC}
③ V_{DD}
④ Pout
⑤ GND

Block Diagram and External Circuit



C1 = C2 = 0.01 μF (Ceramic chip capacitor)
C3 = C4 = 4.7 μF (Tantalum)
FB = Ferrite bead BL01RN1-A62-001 (Manufacturer: MURATA) or equivalent
Z1 = Z2 = 50 Ω (Microstrip line)

Table 1 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Rating	Unit
Supply voltage	V_{DD}	12	V
Supply current	I_{DD}	2	A
APC voltage	V_{APC}	±8	V
Input power	Pin	20	mW
Operating case temperature	Tc (op)	–30 to +100	°C
Storage temperature	Tstg	–30 to +100	°C

Table 2 PF0025 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Max	Unit	Test Condition
Drain cutoff current	I_{DS}	—	100	µA	V_{DD} = 12 V, V_{APC} = 0 V, Rg = R_L = 50 Ω
Total efficiency	η_T	43	—	%	f = 824 to 849 MHz, Pin = 1 mW, V_{DD} = 6 V, Rg = R_L = 50 Ω, Pout = 1.2 W (at APC controlled),
2nd harmonic distortion	2nd H.D.	—	–30	dB	
3rd harmonic distortion	3rd H.D.	—	–30	dB	
Input VSWR	VSWR (in)	—	3	—	
Output VSWR	Pout (1)	1.6	—	W	V_{DD} = 6 V, f = 824 to 849 MHz, Pin = 1 mW, V_{APC} = 4 V, Rg = R_L = 50 Ω
Isolation	Pout(2)	—	–40	dBm	V_{DD} = 6 V, f = 824 to 849 MHz, Pin = 1 mW, V_{APC} = 0.5 V, Rg = R_L = 50 Ω
Load VSWR tolerance	—	No degradation		—	V_{DD} ≤ 8 V, f = 824 to 849 MHz, Pin = 1 mW, Rg = 50 Ω, V_{APC} ≤ 4 V, t = 20 sec, Load VSWR ≤ 20 All Phase angles
Stability	—	No parastic oscillation		—	f = 824 to 849 MHz, Pin = 1 mW, V_{DD} = 5.2 to 7.5 V, Pout ≤ 1.6 W, Zg = 50 Ω Load VSWR = 3 All Phase angles

The following curves show typical values for the PF0025.

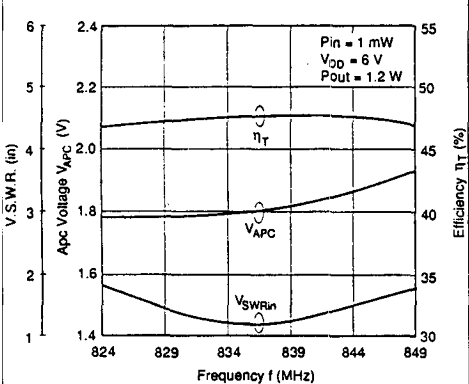


Figure 1 V_{APC}, η_T, VSWR (in) vs. Frequency

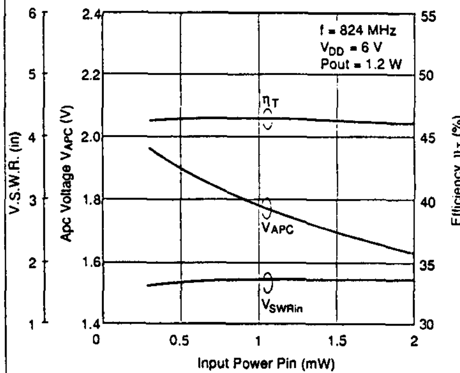


Figure 2 V_{APC}, η_T, VSWR (in) vs. Frequency

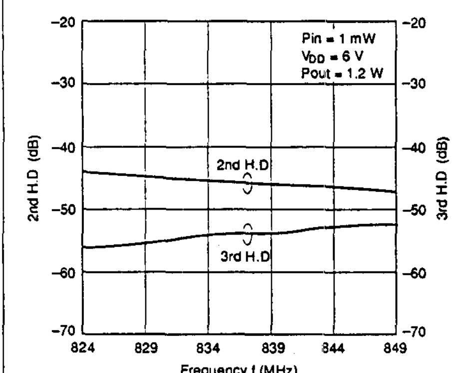


Figure 3 2nd H.D, 3rd H.D vs. Frequency

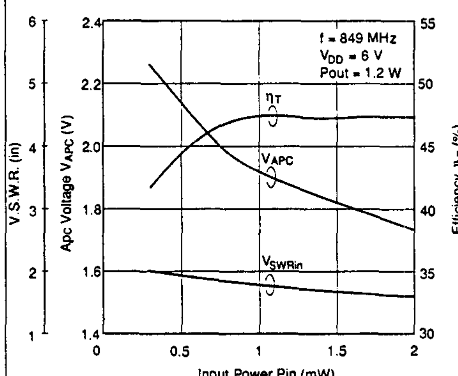


Figure 4 V_{APC}, η_T, VSWR (in) vs. Pin

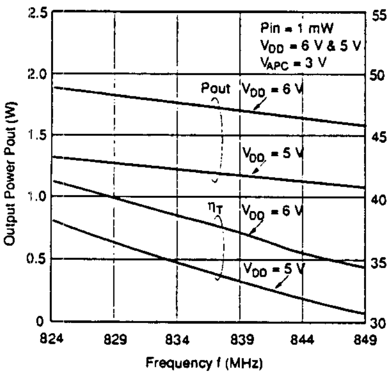


Figure 5 Pout, η_T vs. Frequency

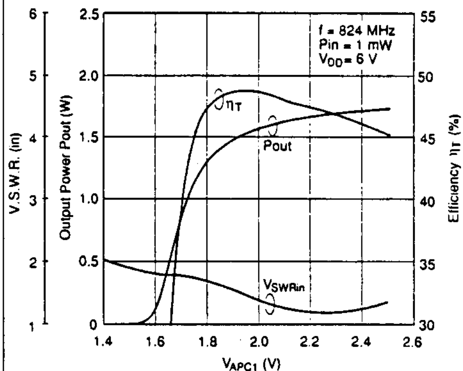


Figure 6 Pout, η_T, VSWR (in) vs. V_{APC1}

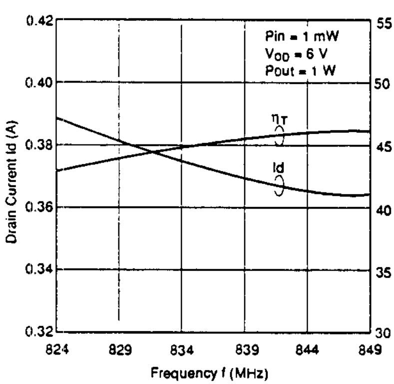


Figure 7 I_D, η_T vs. Frequency

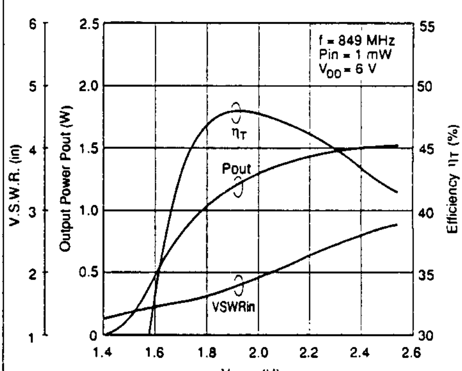


Figure 8 Pout, η_T, VSWR (in) vs. V_{APC1}

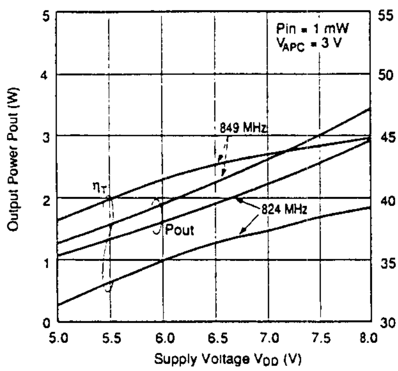


Figure 9 Pout, η_T vs. V_{DD}

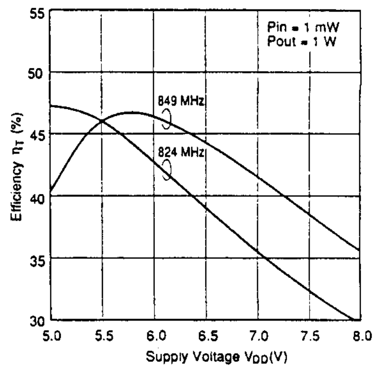


Figure 10 η_T vs. V_{DD}

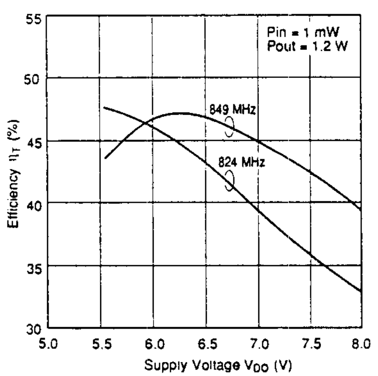
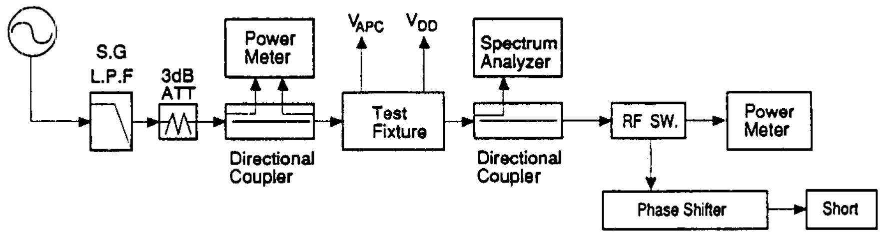


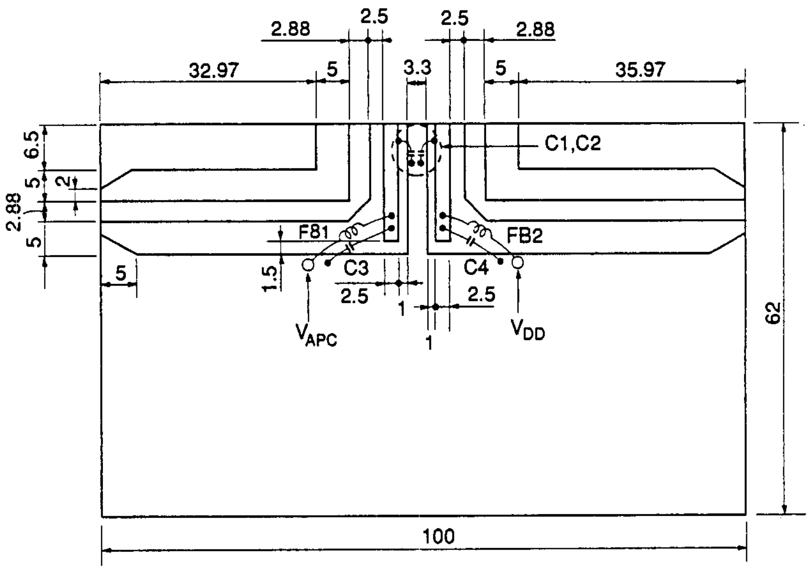
Figure 11 η_T vs. V_{DD}

Test System Diagram



Test Fixture Pattern

(Unit: mm)



Grass Epoxy Double sided PCB
(t = 1.6 mm, εr = 4.8)

Note for Use

- Unevennness and distortion at the surface to attached PF0025 should be as small as possible.
- It should not be existed any dust between PF0025 and the surface to attached it.
- Don't apply the reflow soldering process to the whole of package.
- Don't apply the dipping solder process to the lead pins.
- To avoid the stress against the lead pins, lead pins should be soldered after the soldering of ground flange.
- Soldering temperature and time should be less than 230°C, 10 sec.
- To protect devices from electro-static damage, soldering iron, measuring equipment and human body etc. should be guounded.
- To avoid the degradation of efficiency and output power, lead pins should not be float from PCB, and connected just on the RF signal line. (Refer to Figure12)
- Recommendation to decrease the thermal resistance is showed below.
  1: Arrangement of through holes under as many as possible under PF0025.
  2: Addition of external heat sink on the metal case of PF0025.

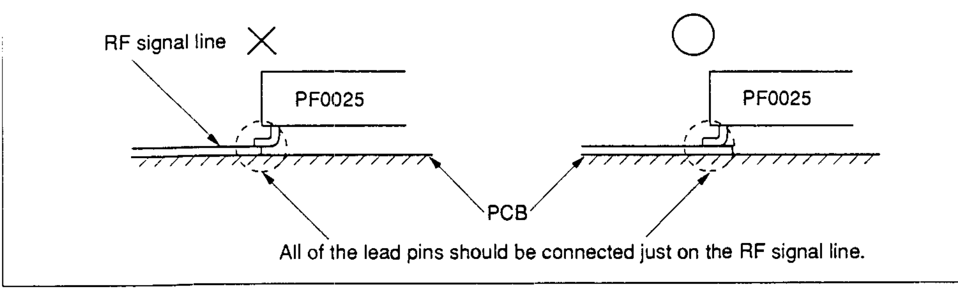
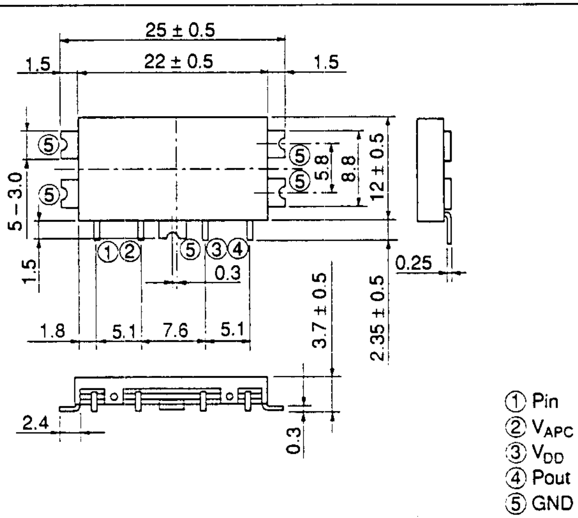


Figure 12

Package Dimensions

(Unit: mm)



PF0030 Series

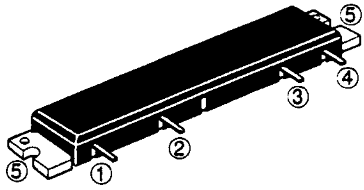
MOS FET Power Amplifier

Features

- High stability: Load VSWR ≈ ∞
- Low power control current: 400 μA
- Thin package: 5 mmt

Ordering Information

Type No	Operating Frequency	Application
PF0030	824 to 849 MHz	AMPS
PF0031	890 to 915 MHz	NMT900
PF0032	872 to 905 MHz	ETACS



① Pin, ② V_{APC}, ③ V_{DD}, ④ Pout, ⑤ GND

Block Diagram

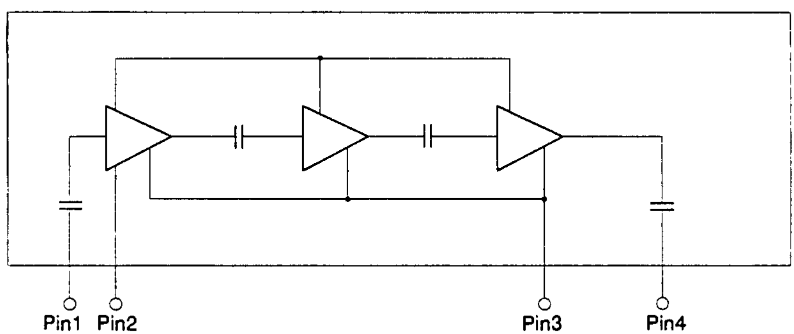


Table 1 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Rating	Unit
Supply voltage	V_{DD}	17	V
Supply Current	I_{DD}	3	A
APC voltage	V_{APC}	±8	V
Input power	Pin	20	mW
Operating case temperature	Tc (op)	–30 to +110	°C
Storage temperature	Tstg	–40 to +110	°C

Table 2 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Condition
Drain cutoff current	I_{DS}	—	—	500	µA	V_{DD} = 17 V, V_{APC} = 0 V
Total efficiency	η_T	35	40	—	%	Pin = 2 mW, V_{DD} = 12.5 V, Pout = 6 W (at APC controlled), Zin = Zout = 50 Ω
2nd harmonic distortion	2nd H.D.	—	–50	–30	dB	
3rd harmonic distortion	3rd H.D.	—	–50	–30	dB	
Input VSWR	VSWR (in)	—	1.5	3	—	
Output VSWR	VSWR (out)	—	1.5	—	—	
Stability	—	No parastic oscillation			—	Pin = 2 mW, V_{DD} = 12.5 V, Pout = 6 W (at APC controlled), Zin = 50 Ω, Output VSWR ≈ ∞ All phases, t = 20 sec

PF0030 Standard data

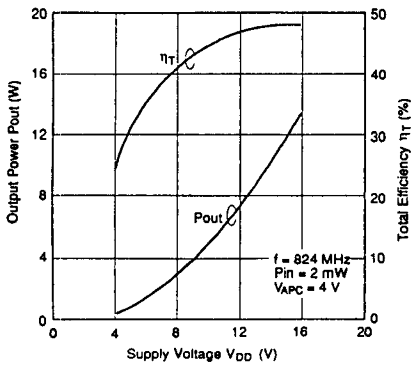


Figure 1 Pout, η_T vs. V_{DD}

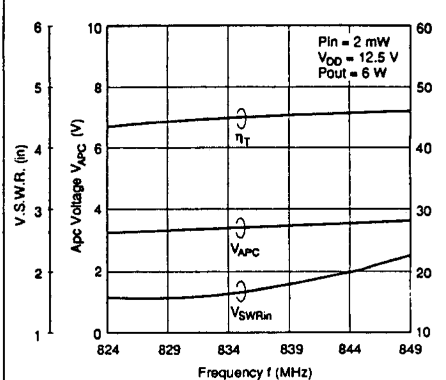


Figure 2 V_{APC}, η_T, VSWR (in) vs. Frequency

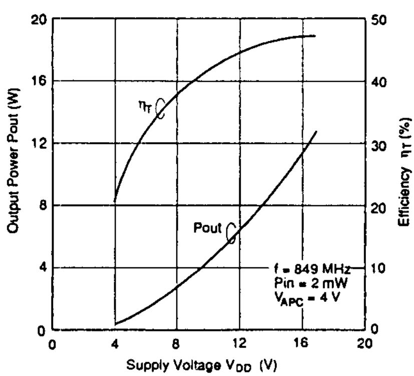


Figure 3 Pout, η_T vs. V_{DD}

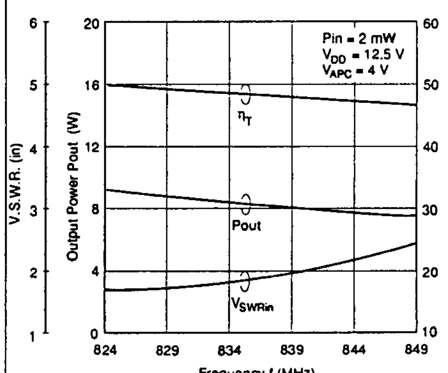


Figure 4 Pout, η_T, VSWR (in) vs. Frequency

PF0030 Standard data (cont)

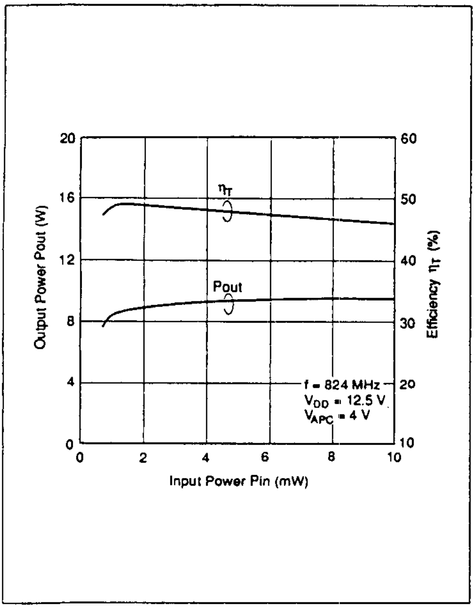


Figure 5 Pout, η_T vs. Pin

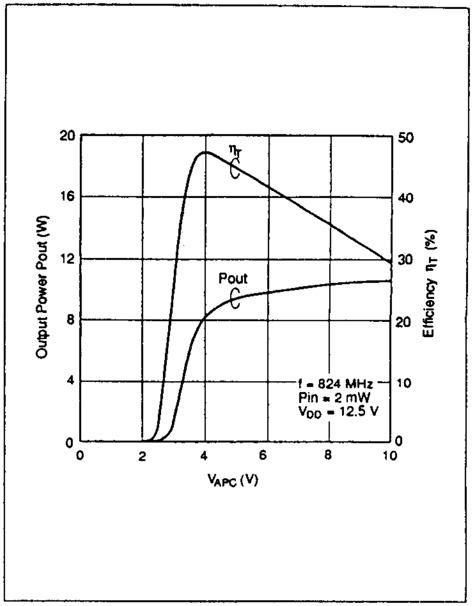


Figure 6 Pout, η_T vs. V_{APC}

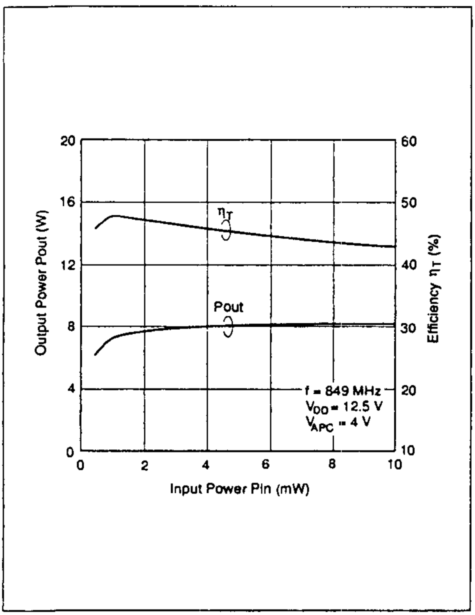


Figure 7 Pout, η_T vs. Pin

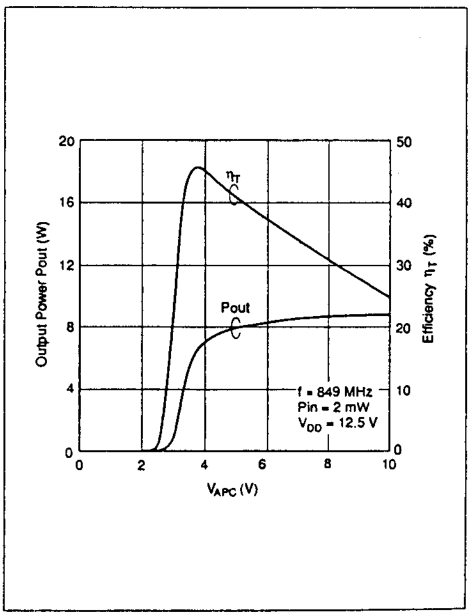


Figure 8 Pout, η_T vs. V_{APC}

PF0030 Standard data (cont)

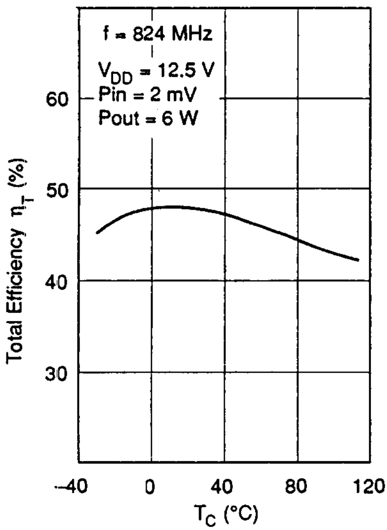


Figure 9 η_T **vs.** T_C

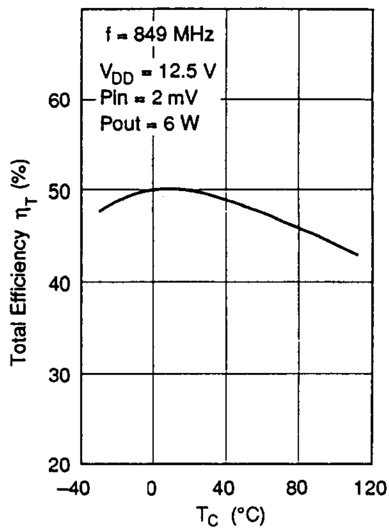


Figure 10 η_T **vs.** T_C

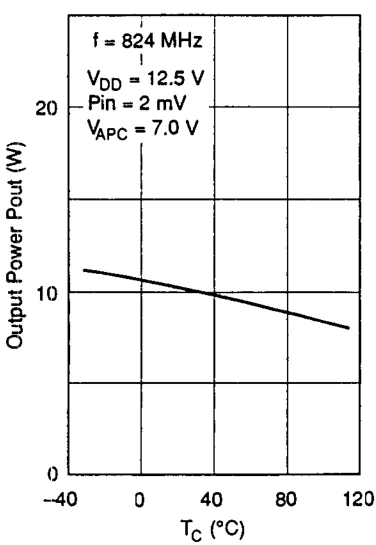


Figure 11 Pout vs. T_C

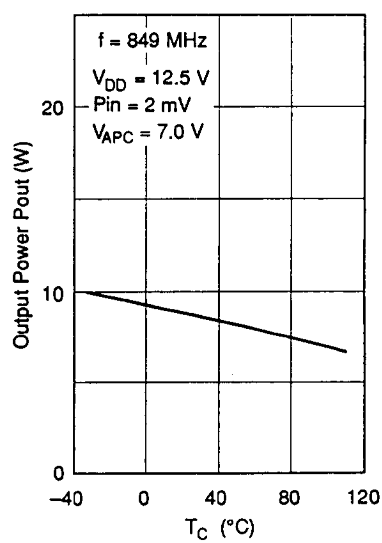


Figure 12 Pout vs. T_C

PF0031 Standard data

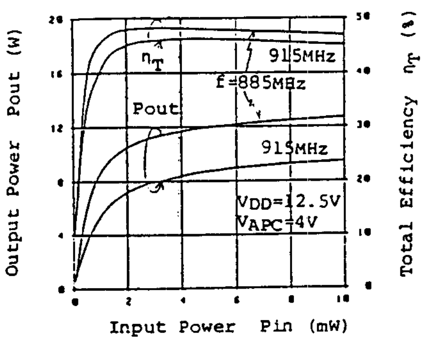


Figure 13 Pout, η_T vs. Pin

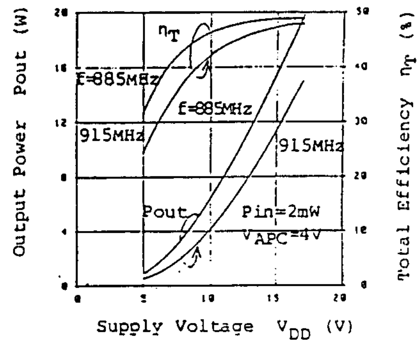


Figure 14 Pout, η_T vs. V_{DD}

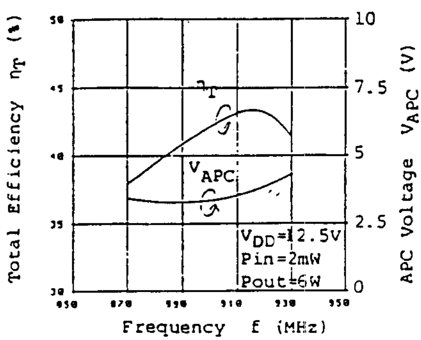


Figure 15 V_{APC}, η_T, vs. Frequency

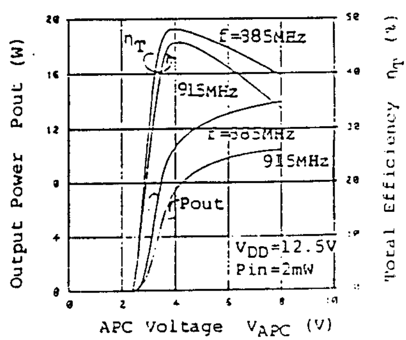


Figure16 Pout, η_T, vs. V_{APC}

PF0031 Standard data

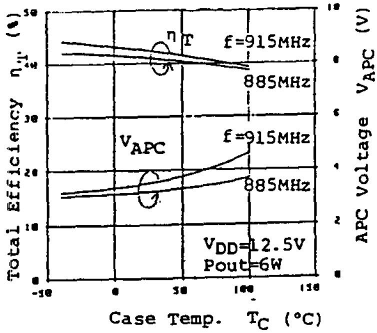


Figure17 V_{APC}, η_T vs. T_C

PF0032 Standard data

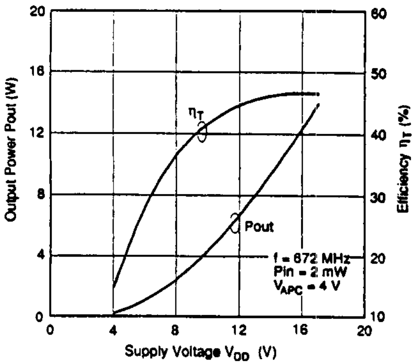


Figure 18 Pout, η_T vs. V_{DD}

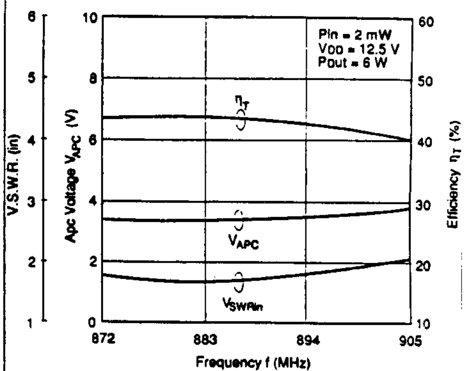


Figure 19 V_{APC}, η_T, VSWR (in) vs. Frequency

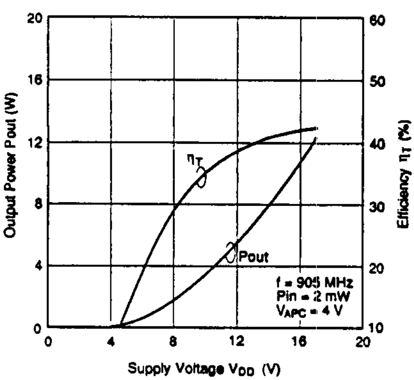


Figure 20 Pout, η_T vs. V_{DD}

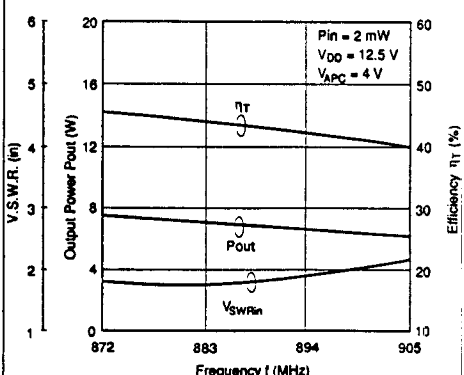


Figure 21 Pout, η_T, VSWR (in) vs. Frequency

PF0032 Standard data (cont)

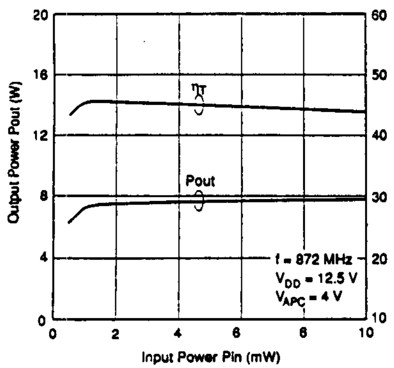


Figure 22 Pout, η_T vs. Pin

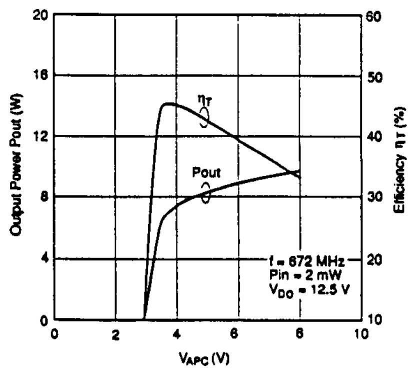


Figure 23 Pout, η_T vs. V_{APC}

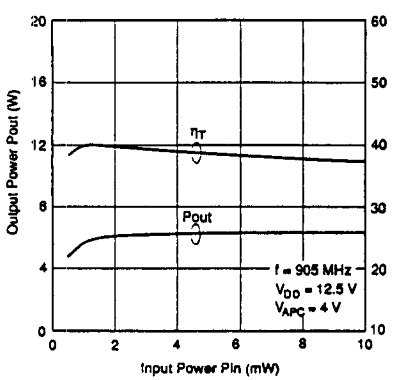


Figure 24 Pout, η_T vs. Pin

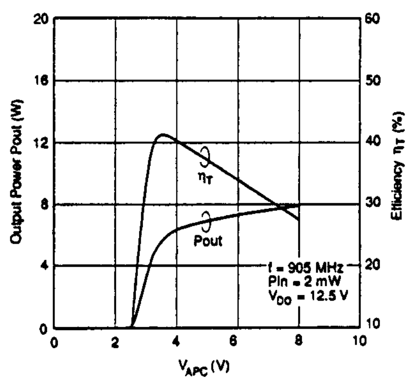


Figure 25 Pout, η_T vs. V_{APC}

PF0032 Standard data (cont)

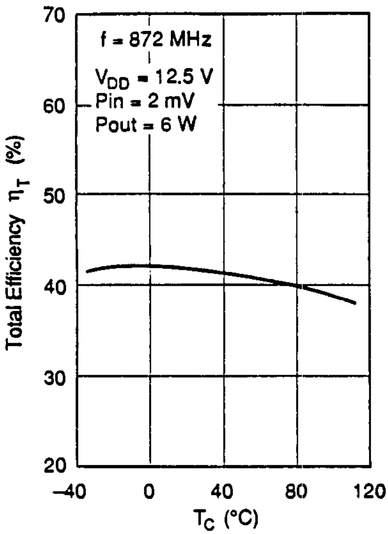


Figure 26 η_T vs. T_C

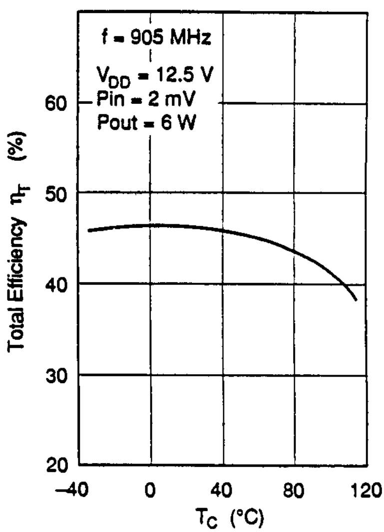


Figure 27 η_T vs. T_C

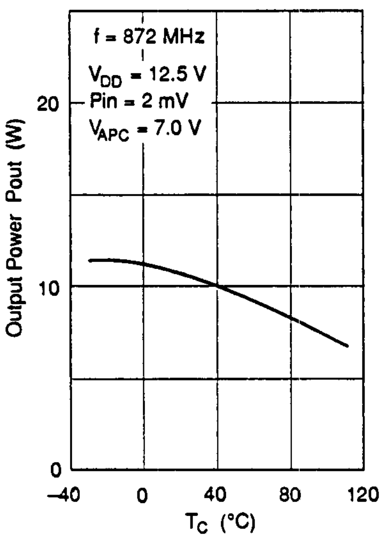


Figure 28 Pout vs. T_C

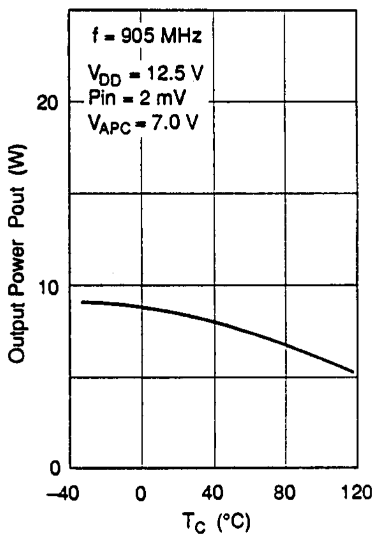
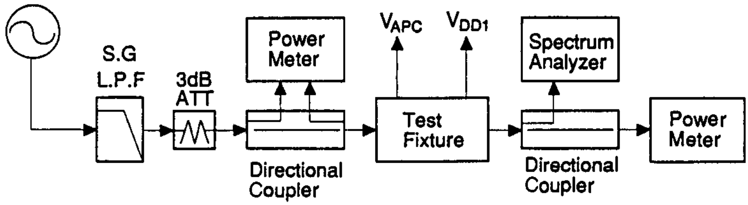
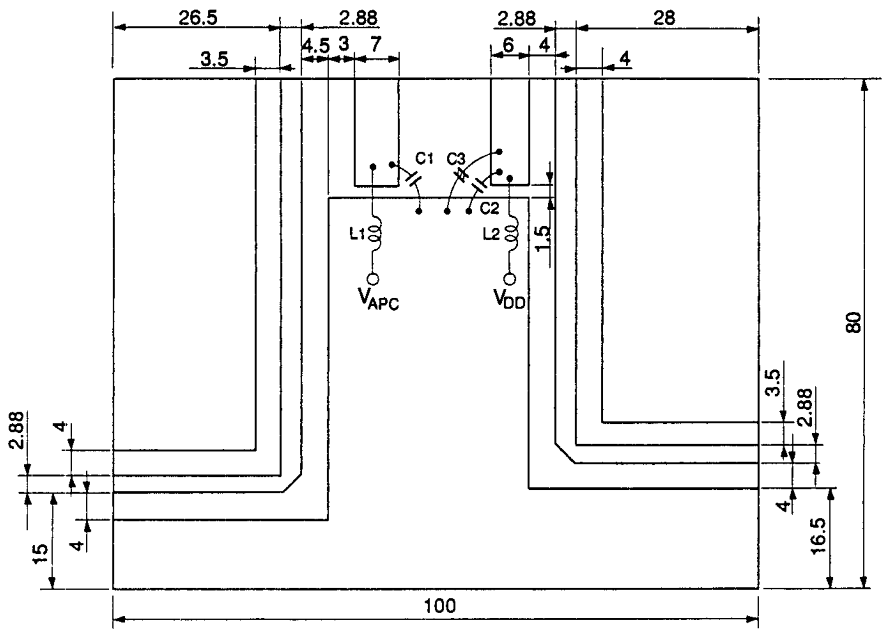


Figure 29 Pout vs. T_C

Test System Diagram



Test Fixture Pattern

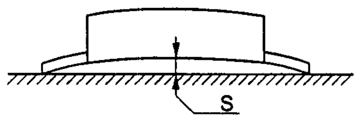


Grass epoxy double sided P.C.B
(t = 1.6 mm, εr = 4.8)

Unit: mm

C1 = C2 = 0.01 μF (Ceramic chip capacitor)
C3 = 10 μF (Aluminium electrolyte capacitor)
L1 = L2: BL02RN1-R62 (Manufacturer: MURATA)
or equivalent (Ferrite bead inductor)

Mechanical Characteristics

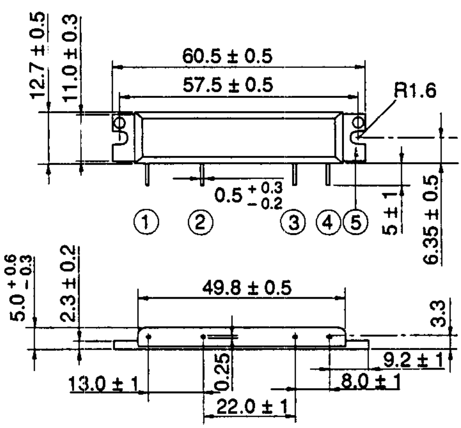
Item	Conditions	Spec.
Torque for screw up the heatsink flange	M3 Screw-Bolts	4 to 6 kg/cm
Warp size of the heatsink flange: S		S = 0 +0.3/–0 mm

Note for Use

- Unevenness and distortion at the surface of the heatsink attached module should be less than 0.05 mm.
- It should not be existed any dust between module and heatsink.
- Module should be separated from PCB less than 1.5 mm.
- Soldering temperature and soldering time should be less than 230°C, 10 sec. (Soldering position spaced from the root point of the lead frame: 2 mm)
- Recommendation of thermal joint compounds is TYPE G746 (Manufacturer: Shin-Etu Chemical, Co., Ltd.) or equivalent.
- To protect devices from electro-static damage, soldering iron, measuring-equipment and human body etc. should be grounded.

Package Dimensions

(Unit: mm)



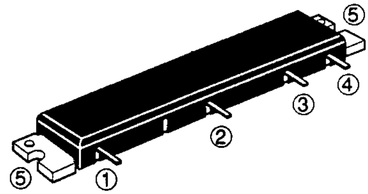
① Pin, ② V_{APC}, ③ V_{DD}, ④ Pout, ⑤ GND

PF0040 Series

MOS FET Power Amplifier

Features

- High stability: Load VSWR ≈ ∞
- Low power control current: 400 μA
- Thin package: 5 mmt



① Pin,② V_{APC} ,③ V_{DD},④ Pout,⑤ GND

Ordering Information

Type No	Operating Frequency	Application
PF0040	824 to 849 MHz	AMPS
PF0042	872 to 905 MHz	E-TACS

Block Diagram

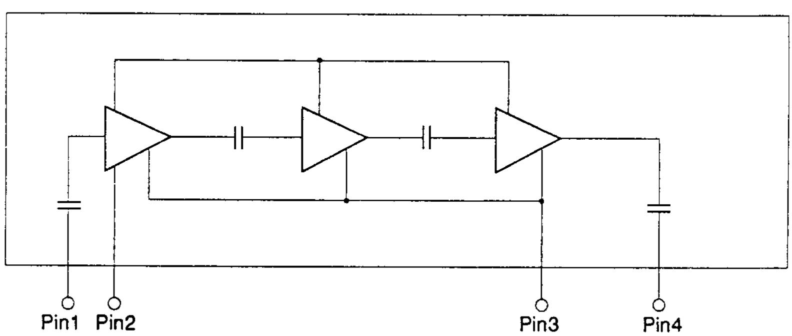


Table 1 Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Rating	Unit
Supply voltage	V_{DD}	17	V
Supply Current	I_{DD}	3	A
APC voltage	V_{APC}	±8	V
Input power	Pin	20	mW
Operating case temperature	Tc (op)	–30 to +110	°C
Storage temperature	Tstg	–40 to +110	°C

Table 2 Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Condition
Drain cutoff current	I_{DS}	—	—	500	μA	V_{DD} = 17 V, V_{APC} = 0 V
Total efficiency	η_T	35	40	—	%	Pin = 2 mW, V_{DD} = 12.5 V, Pout = 6 W (at APC controlled), Zin = Zout = 50 Ω
2nd harmonic distortion	2nd H.D.	—	–50	–30	dB	
3rd harmonic distortion	3rd H.D.	—	–50	–30	dB	
Input VSWR	VSWR (in)	—	1.5	3	—	
Output VSWR	VSWR (out)	—	1.5	—	—	
Stability	—	No parastic oscillation			—	Pin = 2 mW, V_{DD} = 12.5 V, Pout = 6 W (at APC controlled), Zin = 50 Ω, Output VSWR = ∞ All phases, t = 20 sec

PF0040 Standard data

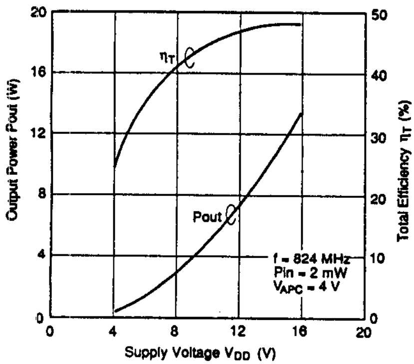


Figure 1 Pout, η_T vs. V_{DD}

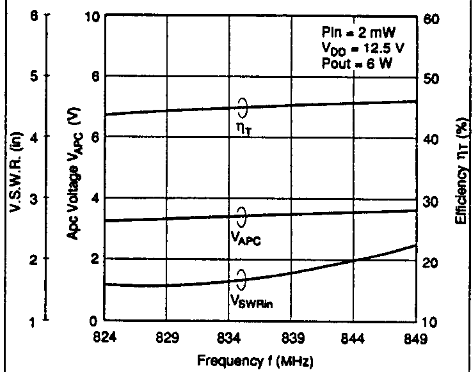


Figure 2 V_{APC}, η_T, VSWR (in) vs. Frequency

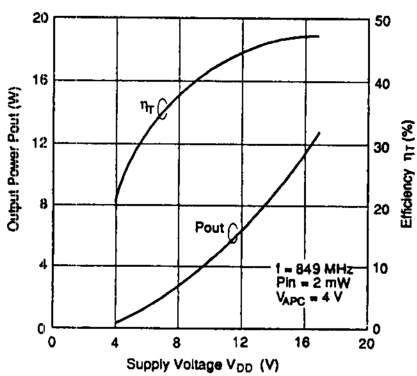


Figure 3 Pout, η_T vs. V_{DD}

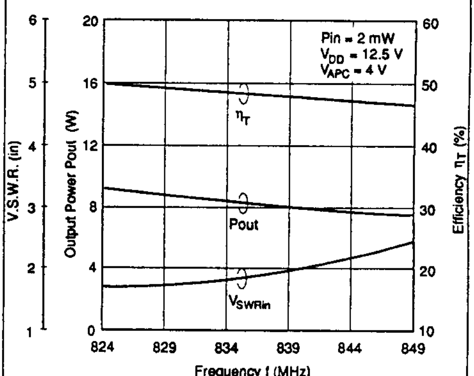


Figure 4 Pout, η_T, VSWR (in) vs. Frequency

PF0040 Standard data (cont)

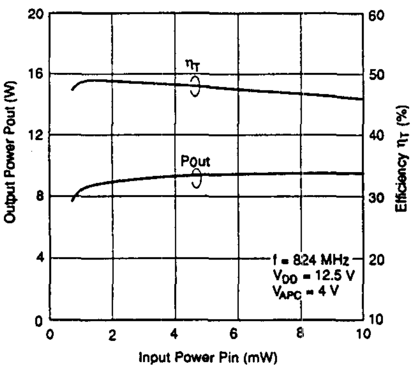


Figure 5 Pout, η_T vs. Pin

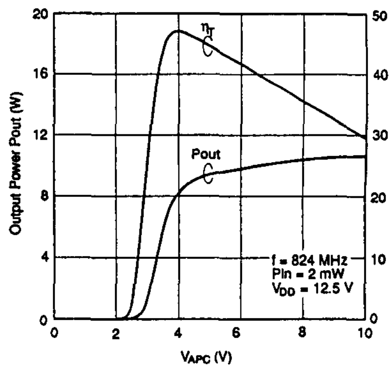


Figure 6 Pout, η_T vs. V_{APC}

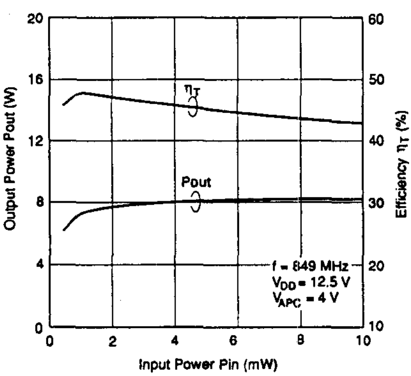


Figure 7 Pout, η_T vs. Pin

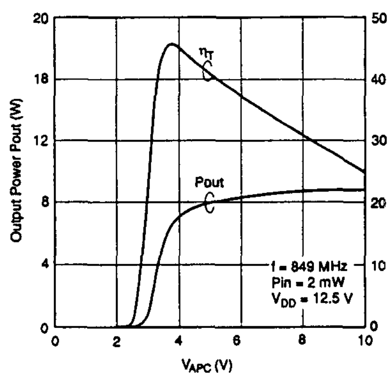


Figure 8 Pout, η_T vs. V_{APC}

PF0040 Standard data (cont)

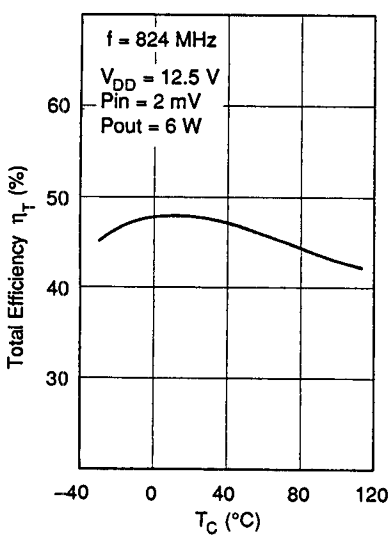


Figure 9 η_T **vs.** T_C

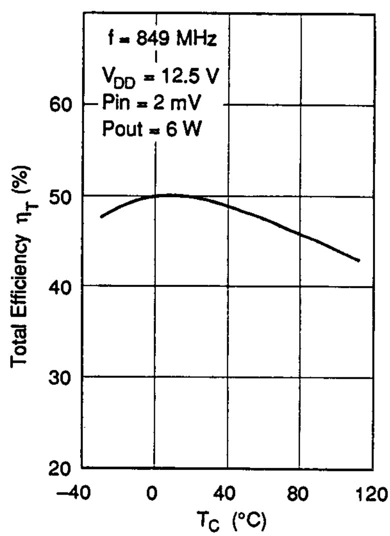


Figure 10 η_T **vs.** T_C

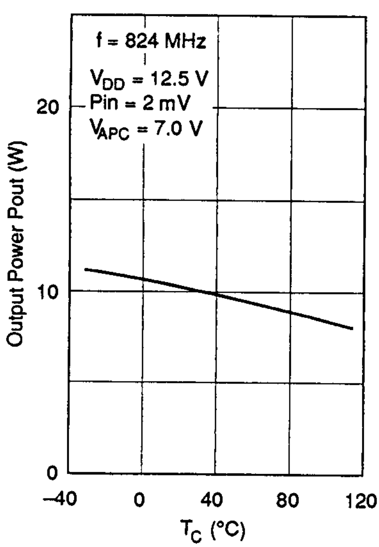


Figure 11 Pout vs. T_C

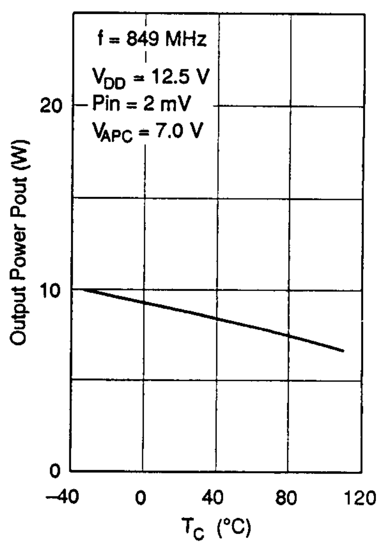


Figure 12 Pout vs. T_C

PF0042 Standard data

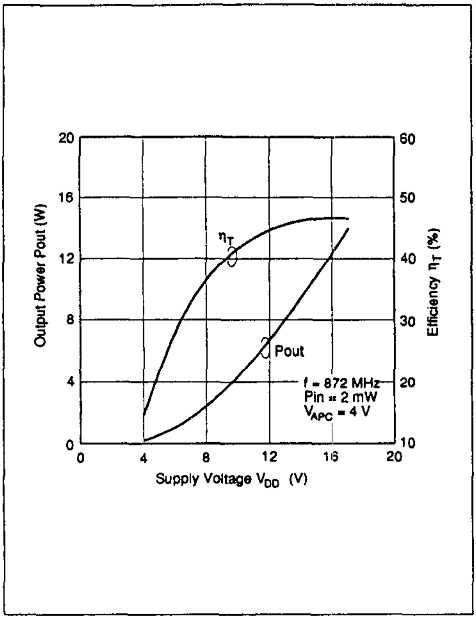


Figure 13 Pout, η_T vs. V_{DD}

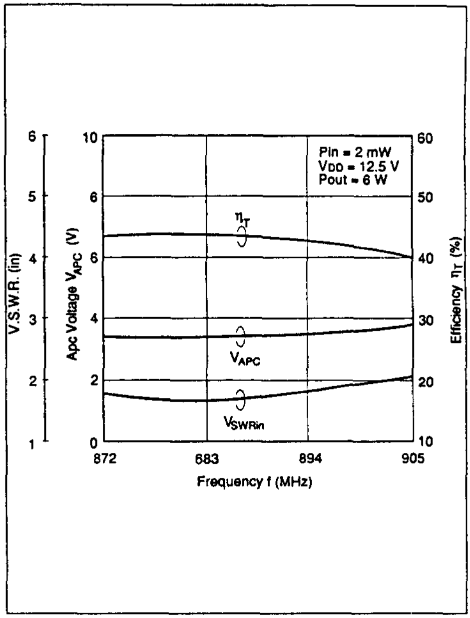


Figure 14 V_{APC}, η_T, VSWR (in) vs. Frequency

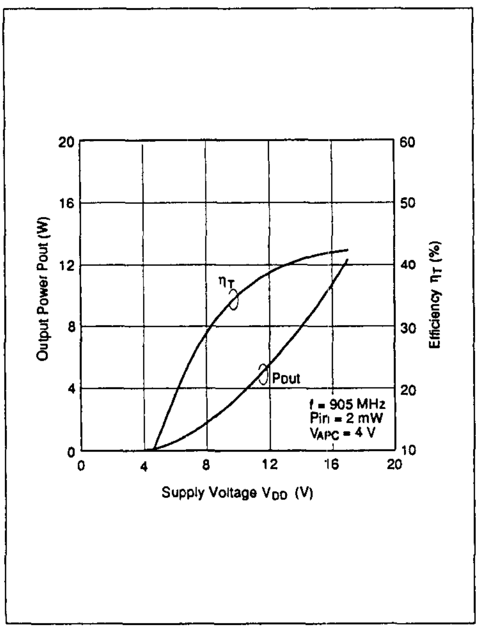


Figure 15 Pout, η_T vs. V_{DD}

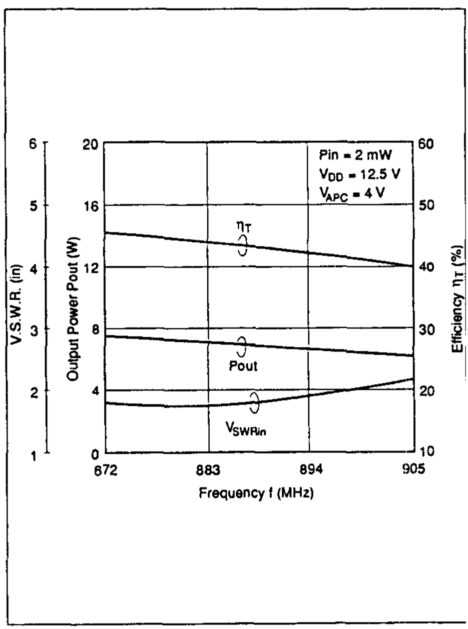


Figure 16 Pout, η_T, VSWR (in) vs. Frequency

PF0042 Standard data (cont)

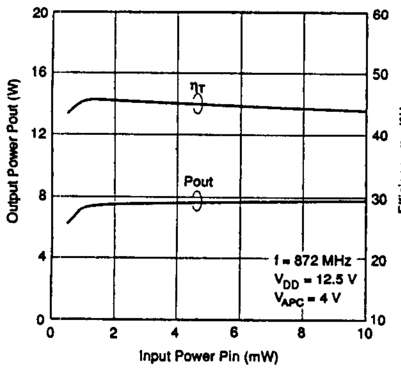


Figure 17 Pout, η_T vs. Pin

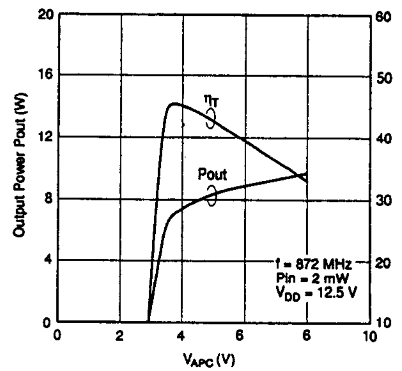


Figure 18 Pout, η_T vs. V_{APC}

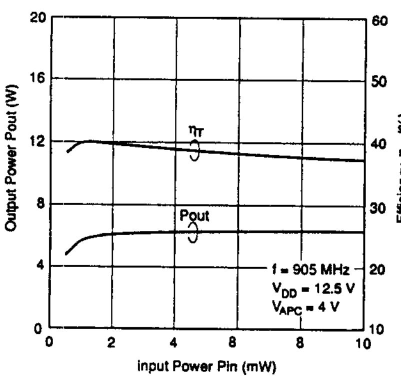


Figure 19 Pout, η_T vs. Pin

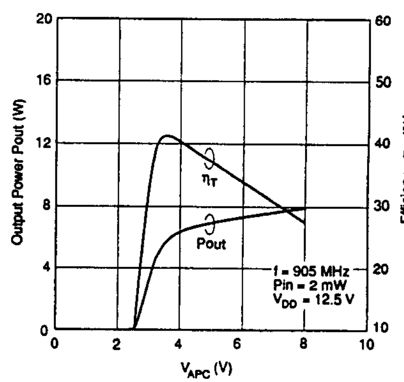


Figure 20 Pout, η_T vs. V_{APC}

PF0042 Standard data (cont)

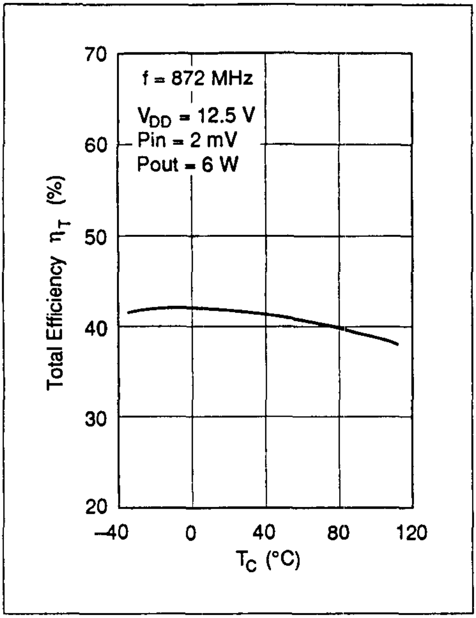


Figure 21 η_T vs. T_C

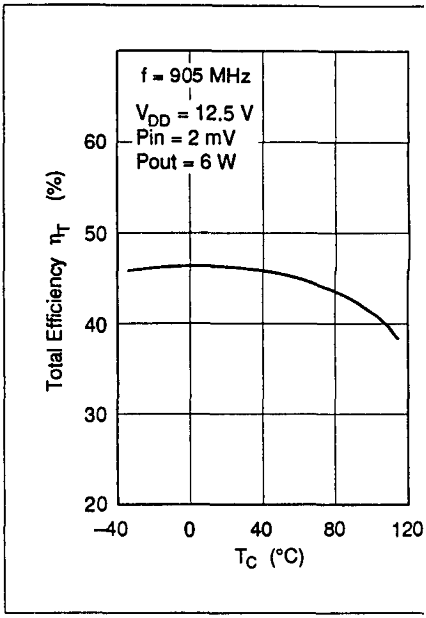


Figure 22 η_T vs. T_C

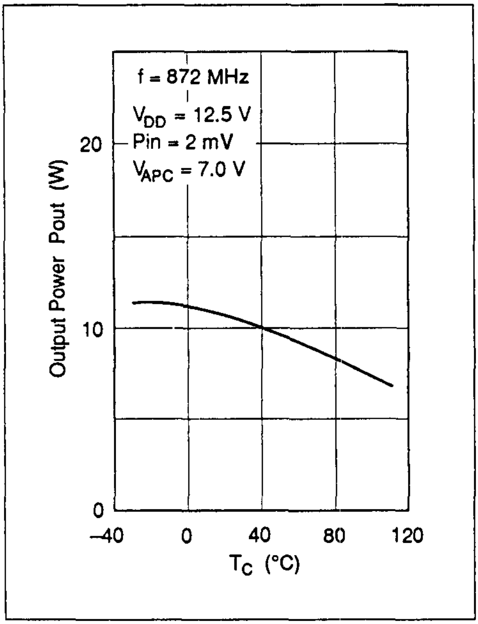


Figure 23 Pout vs. T_C

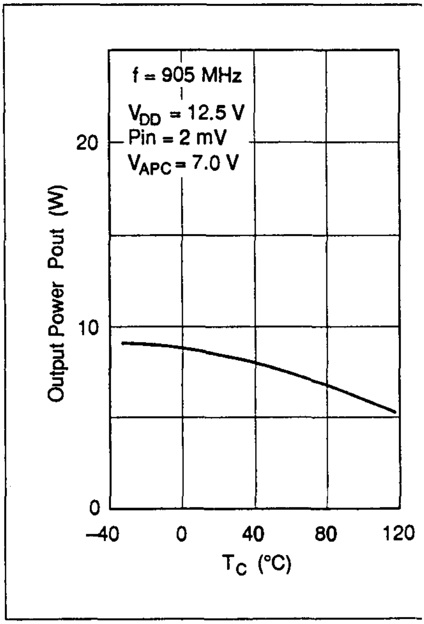
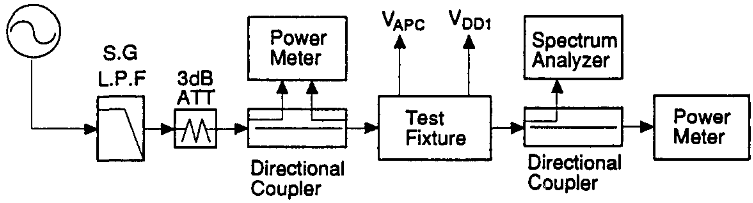
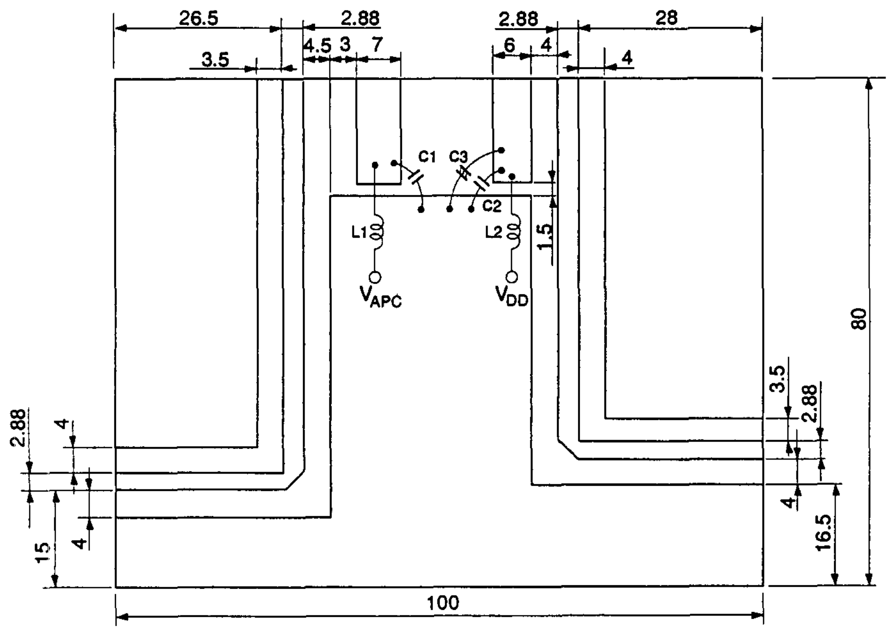


Figure 24 Pout vs. T_C

Test System Diagram



Test Fixture Pattern

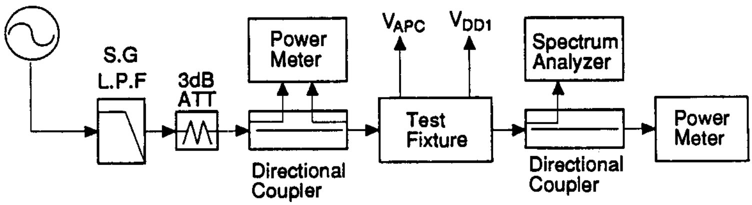


Grass epoxy double sided P.C.B
(t = 1.6 mm, εr = 4.8)

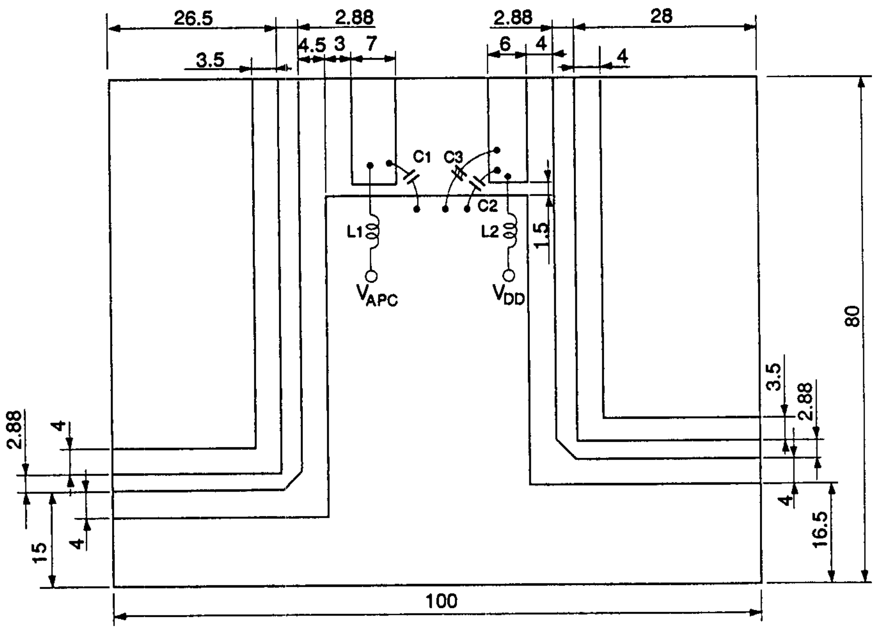
Unit: mm

C1 = C2 = 0.01 μF (Ceramic chip capacitor)
C3 = 10 μF (Aluminium electrolyte capacitor)
L1 = L2: BL02RN1-R62 (Manufacturer: MURATA)
or equivalent (Ferrite bead inductor)

Test System Diagram



Test Fixture Pattern



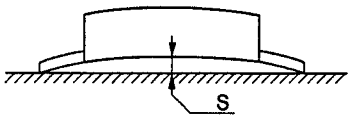
Grass epoxy double sided P.C.B
(t = 1.6 mm, εr = 4.8)

Unit: mm

C1 = C2 = 0.01 μF (Ceramic chip capacitor)
C3 = 10 μF (Aluminium electrolyte capacitor)
L1 = L2: BL02RN1-R62 (Manufacturer: MURATA)
or equivalent (Ferrite bead inductor)

Mechanical Characteristics

Item	Conditions	Spec.
Torque for screw up the heatsink flange	M3 Screw-Bolts	4 to 6 kg/cm
Warp size of the heatsink flange: S		S = 0 +0.3/–0 mm

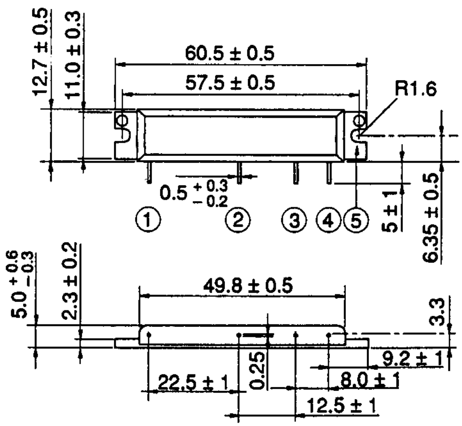


Note for Use

- Unevenness and distortion at the surface of the heatsink attached module should be less than 0.05 mm.
- It should not be existed any dust between module and heatsink.
- Module should be separated from PCB less than 1.5 mm.
- Soldering temperature and soldering time should be less than 230°C, 10 sec. (Soldering position spaced from the root point of the lead frame: 2 mm)
- Recommendation of thermal joint compounds is TYPE G746 (Manufacturer: Shin-Etu Chemical, Co., Ltd.) or equivalent.
- To protect devices from electro-static damage, soldering iron, measuring-equipment and human body etc. should be grounded.

Package Dimensions

(Unit: mm)



① Pin, ② V_{APC}, ③ V_{DD}, ④ Pout, ⑤ GND

PF0085 Series

UNDER DEVELOPMENT

MOS FET Power Amplifier

Features

- Surface mounted small package 1 cc, 3 g with shielded cover
- High efficiency 47% TYP. at actual output condition 1.0 W
- Low voltage operation 4.8 V
- Low power control current 300 μA

Type No	Operating Frequency	Application
PF0085	824 to 849 MHz	AMPS
PF0087	872 to 905 MHz	ETACS

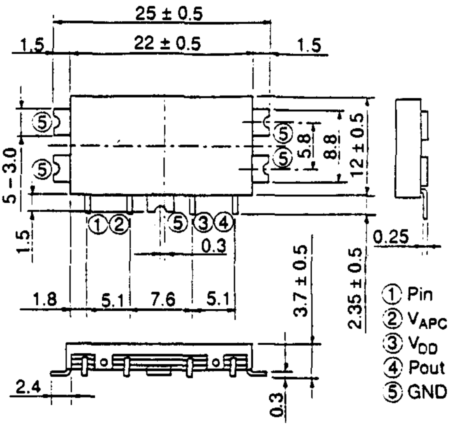


Table 1 **Absolute Maximum Ratings** (Ta = 25°C)

Item	Symbol	Rating	Unit
Supply voltage	V_{DD}	12	V
Supply current	I_{DD}	2	A
APC voltage	V_{APC}	±8	V
Input power	Pin	20	mW
Operating case temperature	Tc (op)	–30 to +100	°C
Storage temperature	Tstg	–30 to +100	°C

Table 2 PF0085 **Electrical Characteristics** (Ta = 25°C)

Item	Symbol	Min	Max	Unit	Test Condition
Drain cutoff current	I_{DS}	—	100	μA	V_{DD} = 12 V, V_{APC} = 0 V, Rg = R_L = 50 Ω
Total efficiency	η_T	43	—	%	f = 824 to 849 MHz, Pin = 2mW V_{DD} =4.8V, Rg = R_L = 50 Ω, Pout = 1.0 W (at APC controlled),
2nd harmonic distortion	2nd H.D.	—	–30	dB	
3rd harmonic distortion	3rd H.D.	—	–30	dB	
Input VSWR	VSWR (in)	—	3	—	
Output VSWR	Pout (1)	1.2	—	W	V_{DD} 4.8V, f = 824 to 849 MHz, Pin = 2mW V_{APC} = 4 V, Rg = R_L = 50 Ω
Isolation	Pout(2)	—	-35	dBm	V_{DD} 4.8V, f = 824 to 849 MHz, Pin = 2mW V_{APC} = 0.5 V, Rg = R_L = 50 Ω
Load VSWR tolerance	—	No degradation		—	V_{DD} ≤ 8 V, f = 824 to 849 MHz, Pin = 2mW Rg = 50 Ω, V_{APC} ≤ 4 V, t = 20 sec, Load VSWR ≤ 20 All Phase angles
Stability	—	No parastic oscillation		—	f = 824 to 849 MHz, Pin = 2mW V_{DD} =4.2 to 6.0 V, Pout ≤ 1.2 W, Zg = 50 Ω Load VSWR = 3 All Phase angles

UNDER DEVELOPMENT, SPECIFICATION MAY BE SUBJECT TO CHANGE

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