MITSUBISHI SEMICONDUCTOR <GaAs FET>

MGF1202

FOR MICROWAVE LOW-NOISE AMPLIFIERS N-CHANNEL SCHOTTKY BARRIER GATE TYPE

DESCRIPTION

The MGF1202 low-noise GaAs FET with an N-channel Schottky gate designed for use in L- to C-band amplifiers. The ceramic package has a configuration suitable for microstrip circuits.

FEATURES

- Low noise figure NF = 1.4 dB (TYP.) @ f = 4 GHz
- High associated gain G_s = 11 dB (TYP.) @ f = 4 GHz

APPLICATION

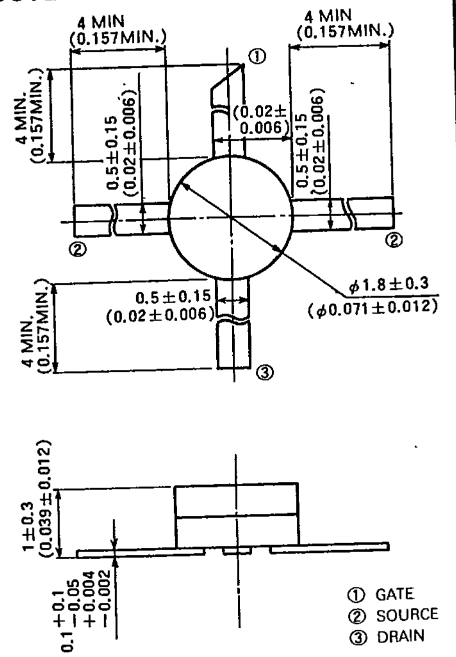
L- to C-band low-noise amplifiers.

QUALITY GRADE

- GG

OUTLINE DRAWING

Unit: millimeters (inches)



ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Symbol	Parameter	Rating	Unit
V_{GDO}	Gate to drain voltage	−6	V
V_{GSO}	Gate to source voltage	−6	V
I_D	Drain current	100	mA
P_T	Total power dissipation	300	mW
Tch	Channel temperature	150	°C
Tstg	Storage temperature	−55~+150	°C
Rth(ch-a)	Thermal resistance	416	°C/W

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Symbol	Parameter	Conditions		Limits Min	Limits Typ	Limits Max	Unit
$V_{(BR)GDO}$	Gate to drain breakdown voltage	I_G=−100μA		−6			V
$V_{(BR)GSO}$	Gate to source breakdown voltage	I_G=−100μA		−6			V
I_{GSS}	Gate to source leakage current	V_{GS}=−3V, V_{DS}=0V				10	μA
I_{DSS}	Saturated drain current	V_{GS}=0V, V_{DS}=3V		30	60	100	mA
$V_{GS(off)}$	Gate to source cut-off voltage	V_{DS}=3V, I_D=100μA		−0.3		−3.5	V
gm	Transconductance	V_{DS}=3V, I_D=10mA		25	45		mS
Gs	Associated gain	V_{DS}=3V, I_D=10mA	f=2GHz		15		dB
			f=4GHz	9	11		
NFmin	Minimum noise figure	V_{DS}=3V, I_D=10mA	f=2GHz		0.9		dB
			f=4GHz		1.4	1.8	

MITSUBISHI ELECTRIC

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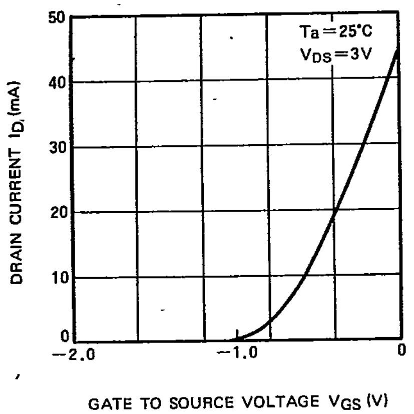
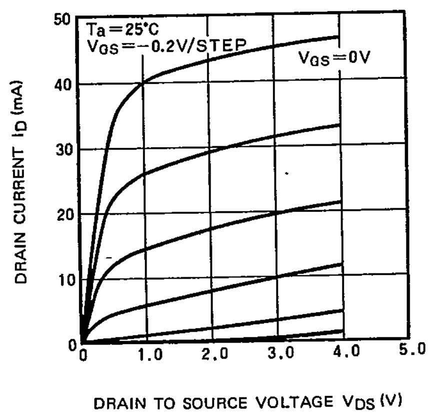
TYPICAL CHARACTERISTICS

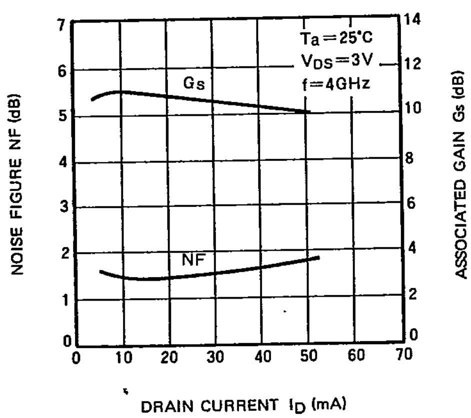
I_D vs. V_{GS}



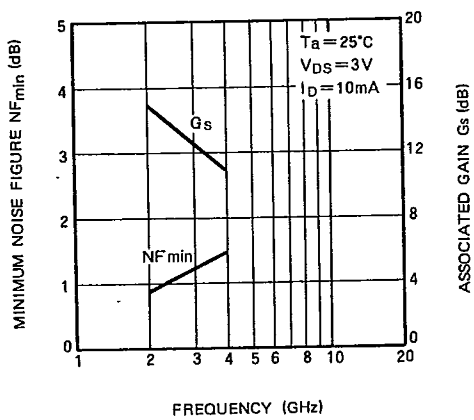
I_D vs. V_{DS}



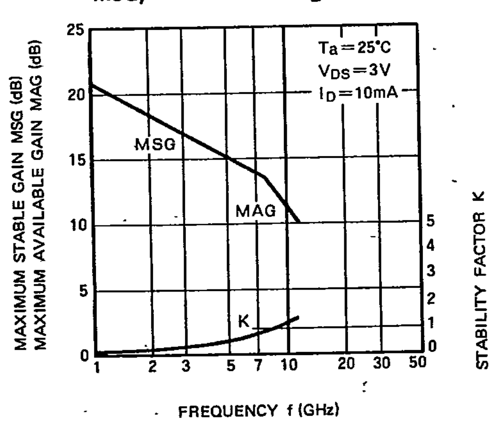
NF & Gs vs. I_D



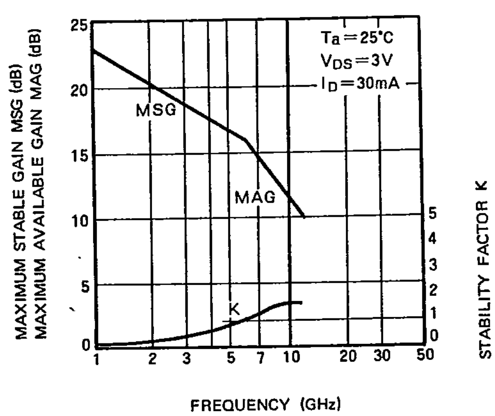
MSG, MAG & K vs. f



MSG, MAG & K vs. f (I_D = 10mA)



MSG, MAG & K vs. f (I_D = 30mA)



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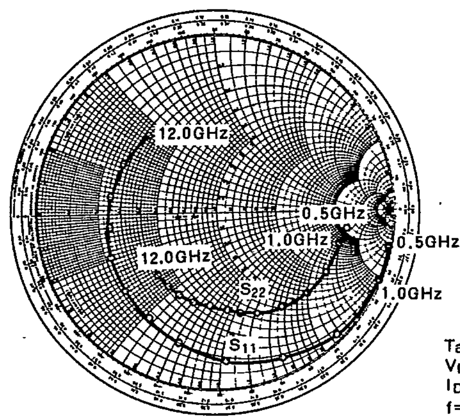
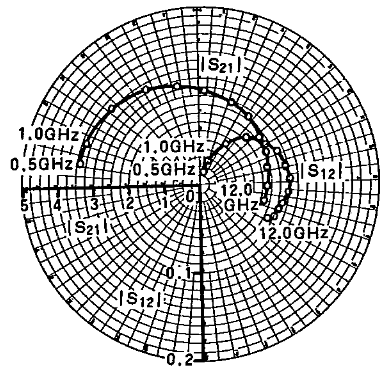
S_{11}, S_{22} vs. f.



S_{12}, S_{21} vs. f.



Ta=25°C
V_{DS}=3V
I_D=10mA
f=1GHz/STEP

S PARAMETERS (T_a=25°C, V_{DS}=3V, I_D=10mA)

f (GHz)	S_{11}		S_{12}		S_{21}		S_{22}	
	Magn.	Angle (deg.)	Magn.	Angle (deg.)	Magn.	Angle (deg.)	Magn.	Angle (deg.)
0.5	0.994	−12.1	0.014	83.3	3.447	169.4	0.732	−7.7
1.0	0.992	−23.6	0.028	74.2	3.392	159.0	0.726	−15.2
1.5	0.972	−35.7	0.041	66.0	3.319	147.9	0.715	−22.5
2.0	0.958	−46.7	0.052	58.7	3.243	138.5	0.706	−29.5
2.5	0.920	−56.9	0.063	50.0	3.148	128.0	0.696	−35.1
3.0	0.893	−67.3	0.071	45.1	3.062	119.5	0.680	−42.7
3.5	0.862	−76.9	0.079	36.8	2.958	110.0	0.671	−48.5
4.0	0.831	−87.8	0.084	32.2	2.854	102.5	0.652	−56.3
4.5	0.799	−97.2	0.089	24.6	2.757	92.4	0.627	−62.9
5.0	0.766	−106.5	0.092	21.8	2.661	85.8	0.605	−68.7
5.5	0.746	−115.1	0.095	15.6	2.570	76.9	0.588	−73.6
6.0	0.714	−123.6	0.097	10.5	2.492	69.5	0.568	−77.8
6.5	0.702	−131.2	0.098	6.1	2.413	61.9	0.558	−81.9
7.0	0.685	−139.9	0.099	2.1	2.331	54.1	0.550	−85.5
7.5	0.670	−148.3	0.099	−2.5	2.254	47.2	0.540	−90.9
8.0	0.652	−157.1	0.098	−6.3	2.183	39.3	0.535	−95.0
8.5	0.640	−165.3	0.097	−9.4	2.121	33.0	0.527	−100.5
9.0	0.624	−172.6	0.095	−13.6	2.058	25.4	0.524	−104.9
9.5	0.617	178.7	0.094	−15.7	2.007	20.0	0.518	−110.0
10.0	0.609	170.9	0.092	−19.2	1.957	13.1	0.511	−114.6
10.5	0.602	160.7	0.090	−21.8	1.910	6.7	0.506	−119.5
11.0	0.596	151.8	0.088	−24.0	1.871	−1.0	0.500	−124.0
11.5	0.583	140.6	0.086	−26.5	1.830	−7.6	0.491	−129.4
12.0	0.580	131.1	0.085	−28.4	1.795	−15.8	0.489	−134.3

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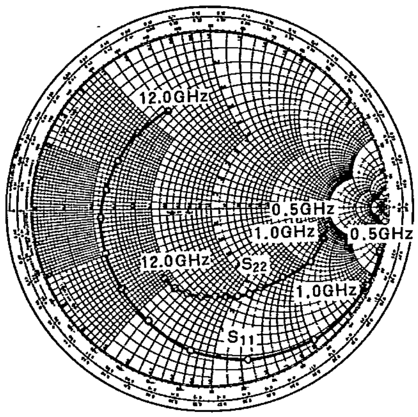
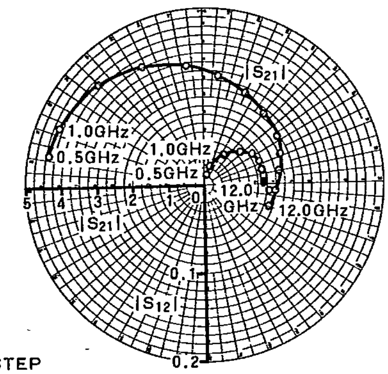
S_{11}, S_{22} vs. f.



S_{12}, S_{21} vs. f.



Ta=25°C
V_{DS}=3V
I_D=30mA
f=1GHz/STEP

S PARAMETERS (Ta=25°C, V_{DS}=3V, I_D=30mA)

f (GHz)	S11		S12		S21		S22	
	Magn.	Angle (deg.)	Magn.	Angle (deg.)	Magn.	Angle (deg.)	Magn.	Angle (deg.)
0.5	0.991	− 14.0	0.012	83.1	4.441	168.5	0.668	− 7.7
1.0	0.985	− 27.0	0.023	73.3	4.365	157.3	0.659	− 15.1
1.5	0.961	− 40.9	0.033	65.5	4.266	145.4	0.649	− 22.2
2.0	0.939	− 53.1	0.042	58.4	4.126	135.3	0.637	− 29.0
2.5	0.897	− 64.9	0.050	49.3	3.936	124.6	0.624	− 34.7
3.0	0.864	− 76.6	0.056	43.6	3.780	115.9	0.610	− 41.9
3.5	0.826	− 86.9	0.061	37.4	3.597	105.4	0.596	− 45.7
4.0	0.795	− 98.7	0.064	33.7	3.432	98.2	0.585	− 54.2
4.5	0.761	−109.1	0.066	26.7	3.262	88.4	0.566	− 60.1
5.0	0.727	−119.2	0.067	24.5	3.115	82.3	0.546	− 65.3
5.5	0.706	−128.6	0.068	19.5	2.978	77.6	0.535	− 69.7
6.0	0.680	−138.1	0.068	16.3	2.858	66.3	0.518	− 73.3
6.5	0.664	−146.7	0.068	13.2	2.738	57.3	0.512	− 76.9
7.0	0.649	−156.5	0.068	10.4	2.639	49.8	0.507	− 79.8
7.5	0.649	−165.3	0.068	8.0	2.553	42.9	0.501	− 84.5
8.0	0.631	−174.6	0.068	6.4	2.466	34.2	0.503	− 88.2
8.5	0.616	177.2	0.068	5.3	2.371	30.7	0.498	− 93.4
9.0	0.610	169.3	0.068	3.3	2.291	21.8	0.501	− 97.2
9.5	0.610	160.5	0.068	2.6	2.213	17.5	0.499	−101.7
10.0	0.597	152.4	0.068	2.0	2.138	9.7	0.498	−105.8
10.5	0.596	142.2	0.068	1.0	2.065	3.3	0.495	−110.2
11.0	0.596	133.6	0.069	0	2.007	− 3.8	0.493	−114.3
11.5	0.591	122.5	0.070	− 0.4	1.952	−10.3	0.483	−118.9
12.0	0.596	113.4	0.072	− 2.9	1.908	−18.0	0.486	−123.6

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HANDLING PRECAUTIONS

1. Check of Electrical Characteristics

(1) Measurement of DC Characteristics by Curve Tracer
Many curve tracers, if not properly grounded, exhibit a high leakage current from the high-voltage transformer, which can be a prime cause of failure or degradation of the FET. Measurement of the DC characteristics using a curve tracer is therefore not recommended. However, when tests using a curve tracer are required, first of all, check that the curve tracer is grounded to earth.

(2) Measurement of RF Characteristics
Before measurement, check that the measuring instruments are grounded to earth. Many instruments to measure RF characteristics such as RF power meters, network analyzers and so on, if not properly grounded to earth, sometimes allow a high AC leakage of up to 20 or more volts, which can be a cause of failure or degradation of the FET.

2. Installation of GaAs FETs

The ceramic cap of the FET package is fixed with resin. Therefore, when the FET is to be soldered on a microstrip circuit, please:

(1) Avoid stress to the FET package.
(2) Properly ground the soldering iron.
Leakage current from the soldering iron could cause failure or degradation of the FET.
(3) Solder the FET as promptly as possible at a low temperature. Soldering each FET in less than 5 seconds at a temperature of less than 250°C is recommended.

3. Bias Procedure and Conditions

When a GaAs FET is biased, the following procedure is recommended.

(1) Slowly adjust the gate to source voltage, V_{GS}, to about −1 V.
(2) Gradually increase the drain to source voltage, V_{DS}, from zero to the desired value.
(3) Adjust the drain current, I_D, to the desired value by controlling the gate to source voltage, V_{GS}.

When bias is released, the reverse procedure is recommended.

Typical bias conditions for MGF 1202 are as follows,
for low-noise operation: V_{DS} = 3 V
I_D = 10 mA
for high-gain operation: V_{DS} = 3 V
I_D = 30 mA

Be careful that the FET is not operated under conditions exceeding the absolute maximum ratings.

4. Guaranteed Characteristics

All the graphic characteristics illustrated in this catalog are typical examples. The characteristics of individual devices as specified in the tables of absolute maximum ratings and electrical characteristics are guaranteed under the specified conditions.