

ELECTRICAL CHARACTERISTICS (T_A = +25 °C)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
DC Characteristics						
Collector Cut-off Current	I _{CBO}	V _{CB} = 5 V, I _E = 0	–	–	600	nA
Emitter Cut-off Current	I _{EBO}	V _{EB} = 1 V, I _C = 0	–	–	600	nA
DC Current Gain	h _{FE} ^{Note 1}	V _{CE} = 2 V, I _C = 10 mA	50	70	100	–
RF Characteristics						
Gain Bandwidth Product	f _T	V _{CE} = 3 V, I _C = 90 mA, f = 2 GHz	13	15	–	GHz
Insertion Power Gain	S _{21e} ²	V _{CE} = 2 V, I _C = 50 mA, f = 2 GHz	8	11	–	dB
Noise Figure	NF	V _{CE} = 2 V, I _C = 10 mA, f = 2 GHz, Z _S = Z _{opt}	–	1.2	1.7	dB
Reverse Transfer Capacitance	C _{re} ^{Note 2}	V _{CB} = 2 V, I _E = 0, f = 1 MHz	–	0.5	0.75	pF
Maximum Available Power Gain	MAG ^{Note 3}	V _{CE} = 2 V, I _C = 50 mA, f = 2 GHz	–	14	–	dB
Maximum Stable Power Gain	MSG ^{Note 4}	V _{CE} = 2 V, I _C = 50 mA, f = 2 GHz	–	15	–	dB
Gain 1 dB Compression Output Power	P _{O (1 dB)}	V _{CE} = 2 V, I _C = 70 mA ^{Note 5} , f = 2 GHz	–	17	–	dBm
3rd Order Intermodulation Distortion Output Intercept Point	OIP ₃	V _{CE} = 2 V, I _C = 70 mA ^{Note 5} , f = 2 GHz	–	27	–	dBm

Notes 1. Pulse measurement: PW ≤ 350 μs, Duty Cycle ≤ 2%

2. Collector to base capacitance when the emitter grounded

$$3. \text{ MAG} = \left| \frac{S_{21}}{S_{12}} \right| (K - \sqrt{K^2 - 1})$$

$$4. \text{ MSG} = \left| \frac{S_{21}}{S_{12}} \right|$$

5. Collector current when P_{O (1 dB)} is output

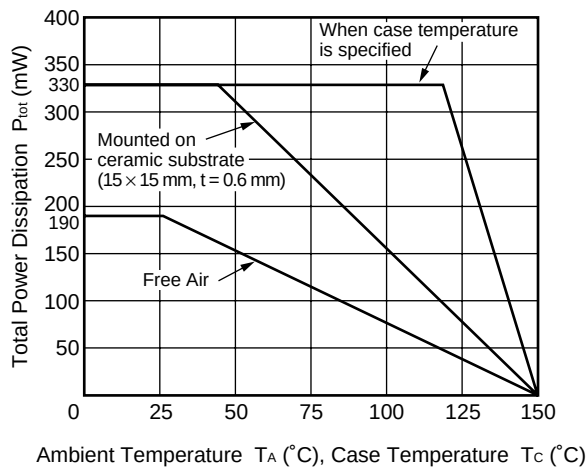
h_{FE} CLASSIFICATION

Rank	FB/YFB
Marking	T80
h _{FE} Value	50 to 100

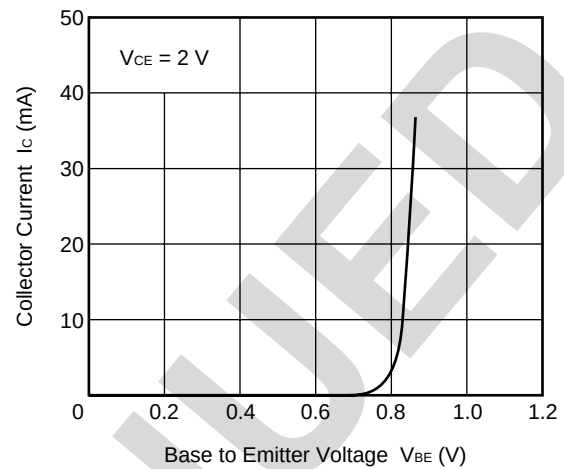
TYPICAL CHARACTERISTICS ($T_A = +25^\circ\text{C}$, unless otherwise specified)

Thermal/DC Characteristics

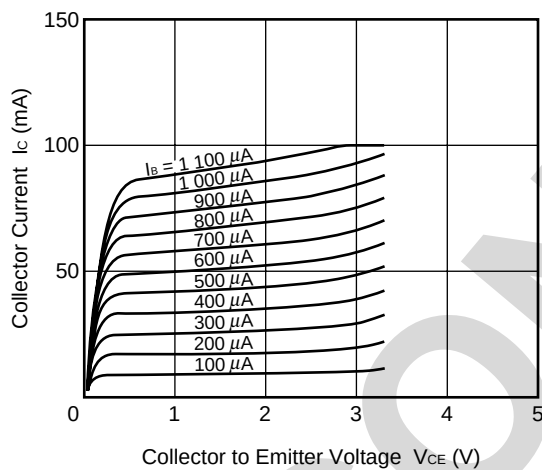
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE, CASE TEMPERATURE



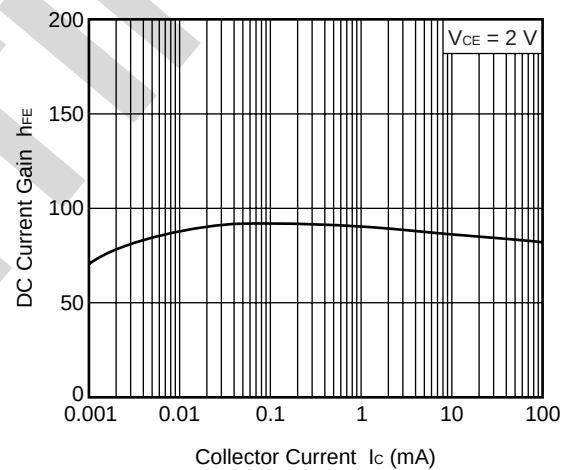
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE

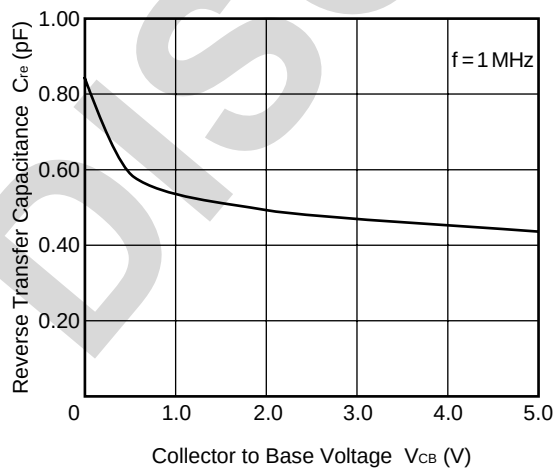


DC CURRENT GAIN vs. COLLECTOR CURRENT

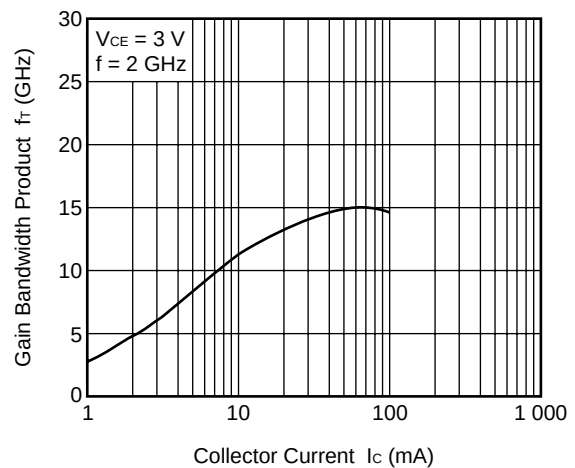


Capacitance/ f_T Characteristics

REVERSE TRANSFER CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



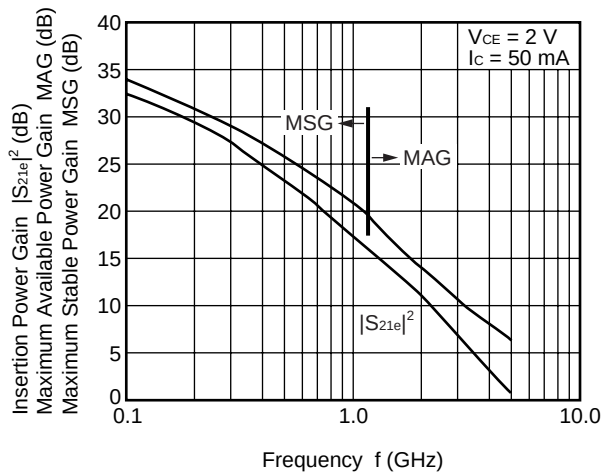
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



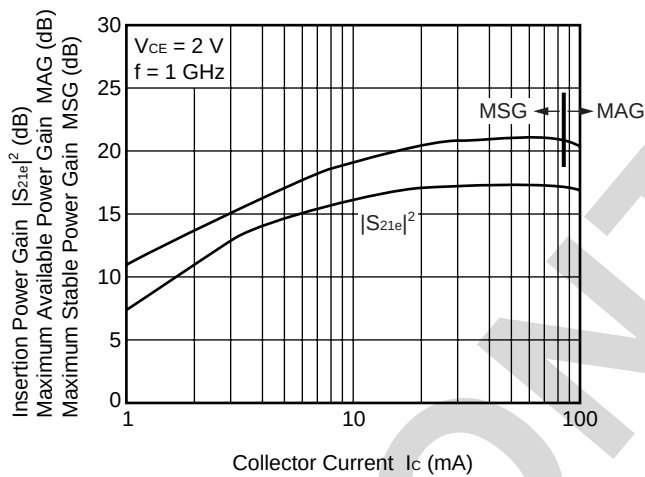
Remark The graphs indicate nominal characteristics.

Gain Characteristics

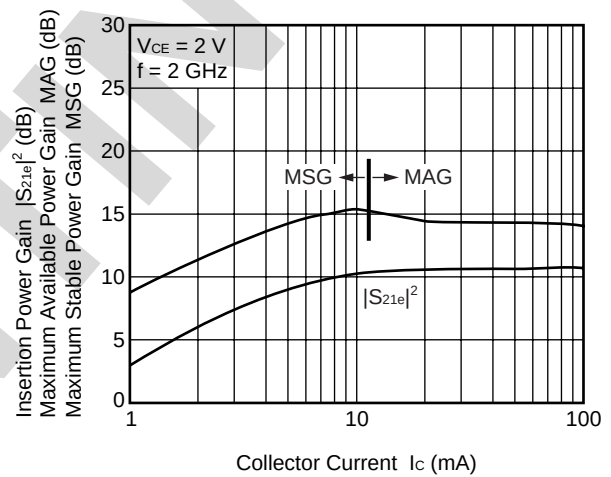
INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT

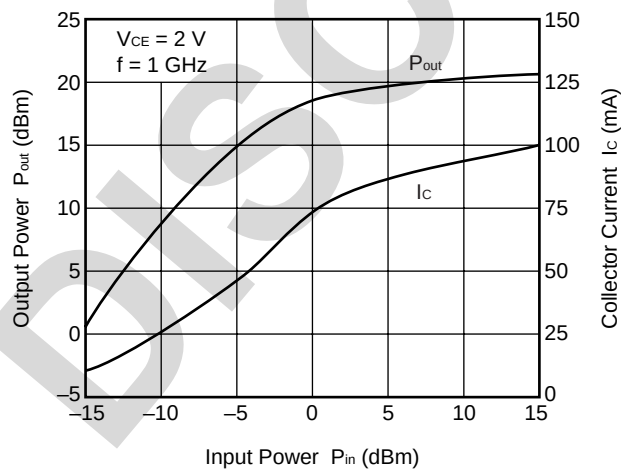


INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT

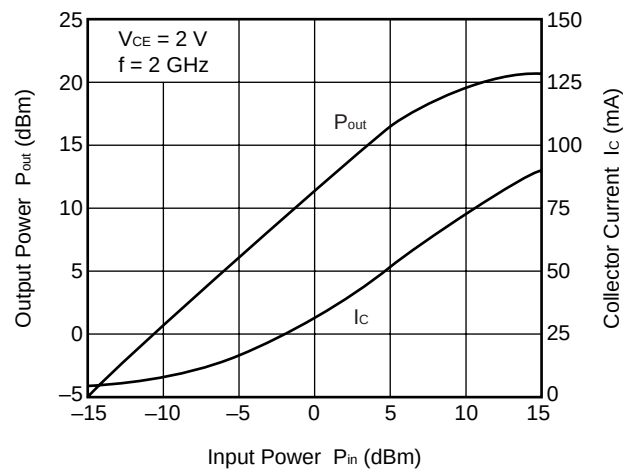


Output Characteristics

OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



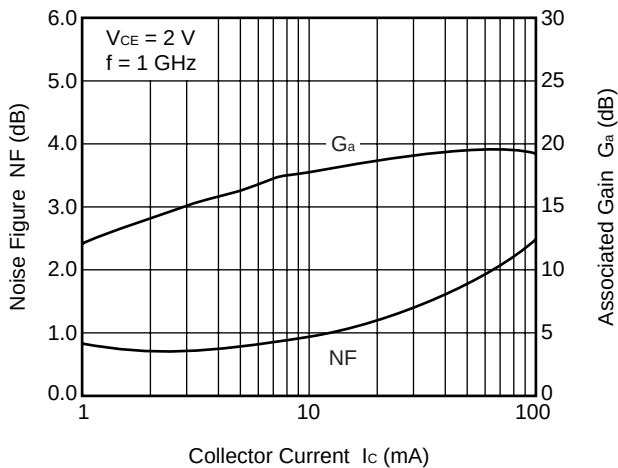
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



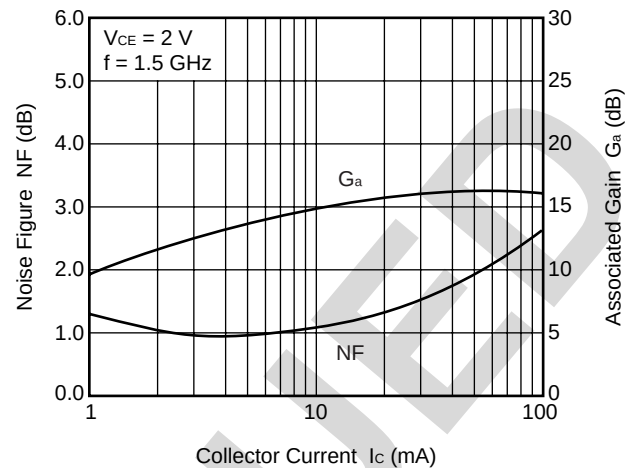
Remark The graphs indicate nominal characteristics.

Noise Characteristics

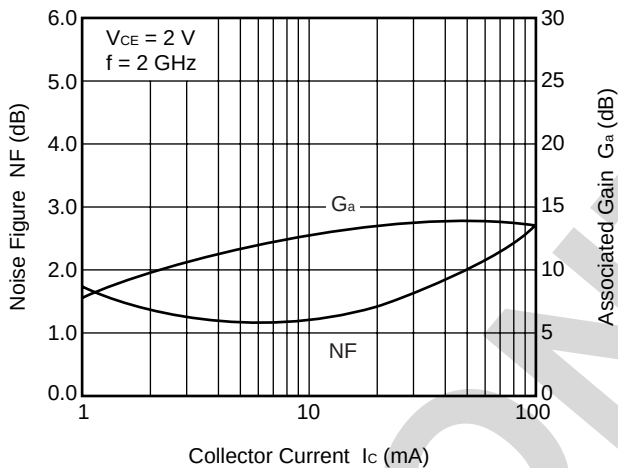
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



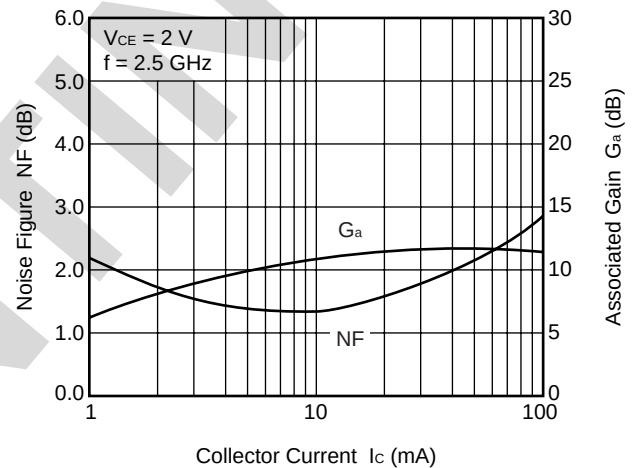
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



Remark The graphs indicate nominal characteristics.

<R> S-PARAMETERS

S-parameters and noise parameters are provided on our web site in a form (S2P) that enables direct import of the parameters to microwave circuit simulators without the need for keyboard inputs.

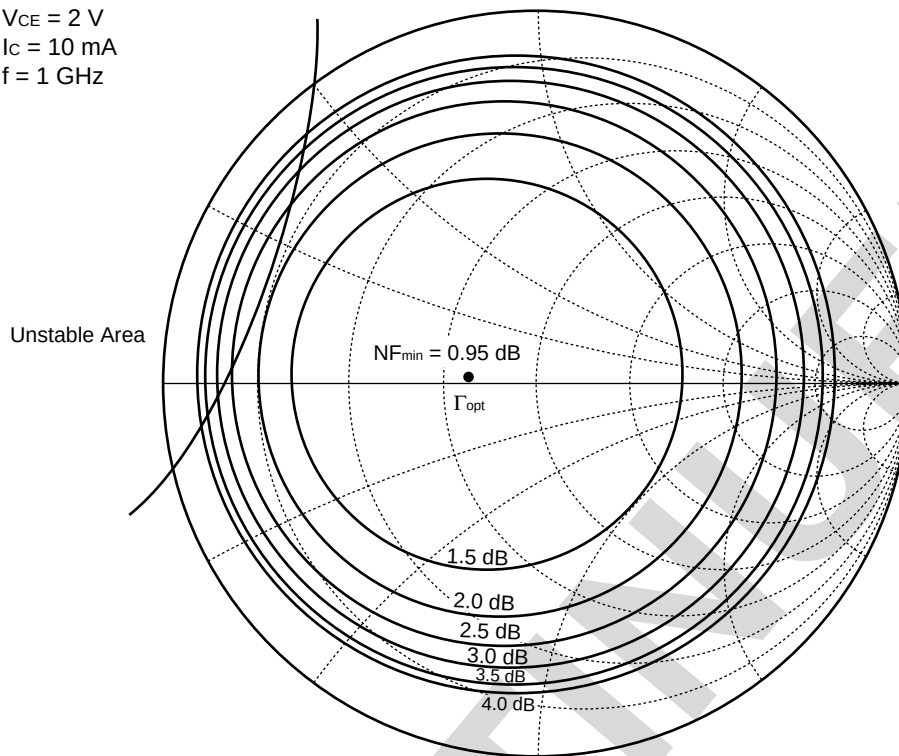
Click here to download S-parameters.

[Products] → [RF Devices] → [Device Parameters]

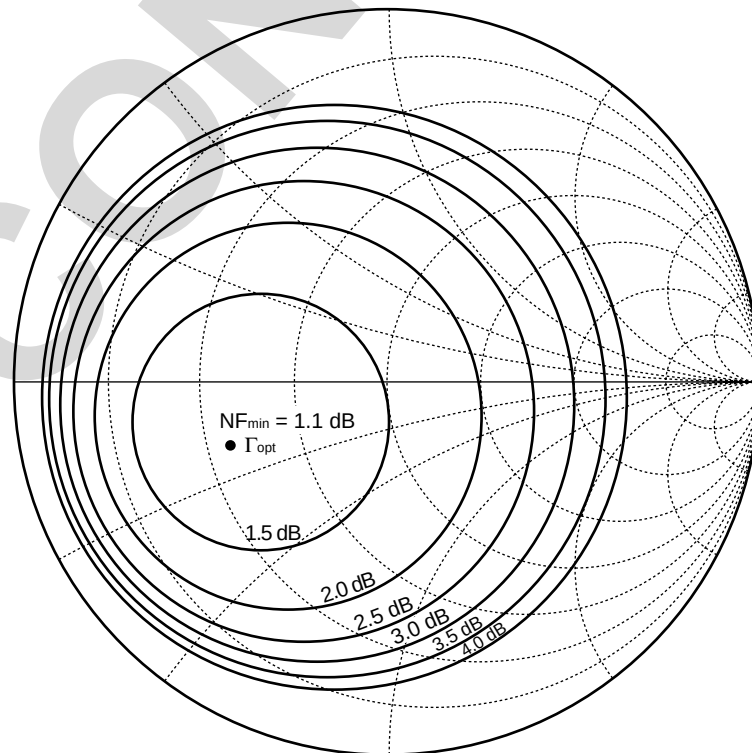
URL <http://www.renesas.com/products/microwave/>

EQUAL NF CIRCLE

$V_{CE} = 2\text{ V}$
 $I_C = 10\text{ mA}$
 $f = 1\text{ GHz}$



$V_{CE} = 2\text{ V}$
 $I_C = 10\text{ mA}$
 $f = 2\text{ GHz}$



NOISE PARAMETERS

 $V_{CE} = 2\text{ V}$, $I_C = 5\text{ mA}$

f (GHz)	NF _{min} (dB)	G _a (dB)	Γ _{opt}		Rn/50
			MAG.	ANG.	
0.8	0.70	18.0	0.17	93.0	0.11
0.9	0.74	17.0	0.18	103.0	0.11
1.0	0.78	16.2	0.20	112.7	0.11
1.5	0.98	13.6	0.32	155.4	0.09
1.8	1.10	12.5	0.40	176.2	0.07
1.9	1.14	12.2	0.43	-177.8	0.06
2.0	1.18	11.8	0.46	-172.2	0.06
2.5	1.39	9.9	0.56	-151.8	0.08

 $V_{CE} = 2\text{ V}$, $I_C = 20\text{ mA}$

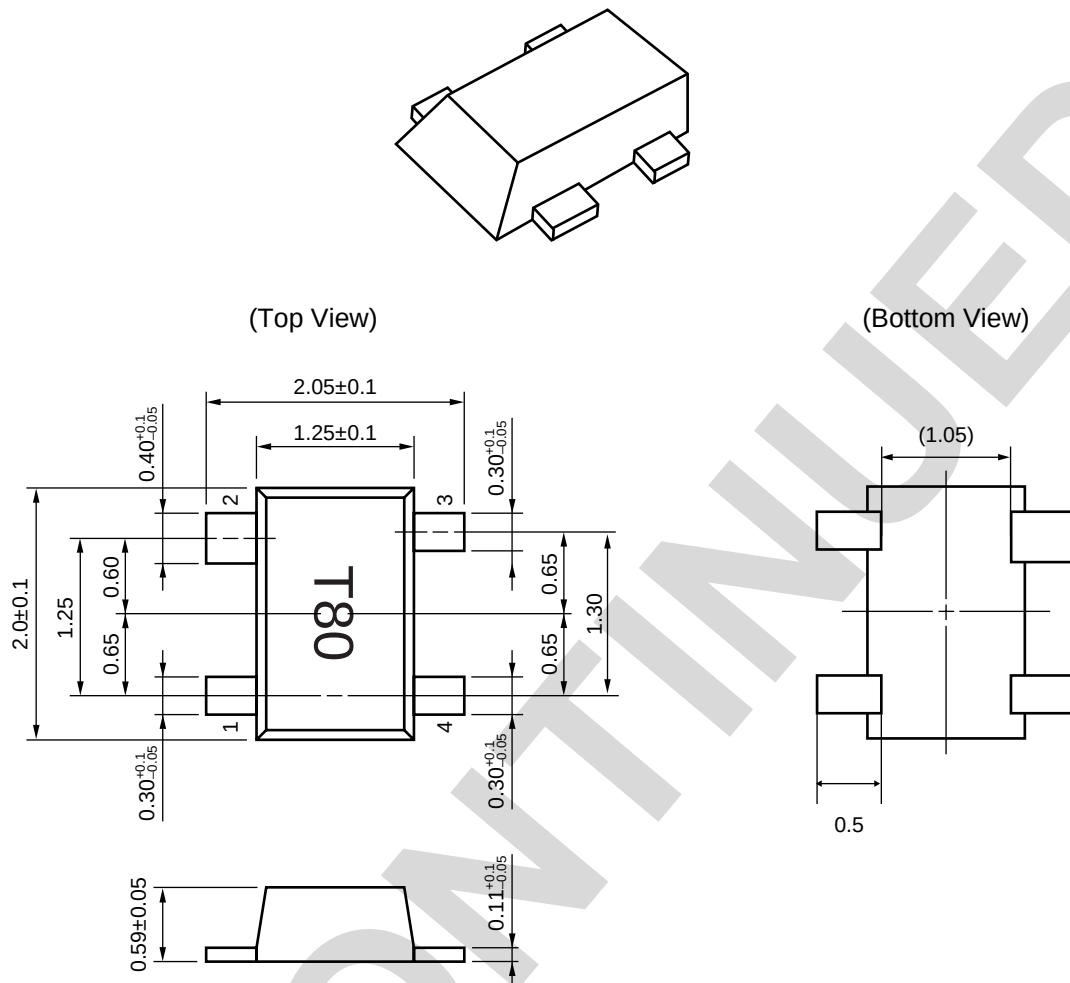
f (GHz)	NF _{min} (dB)	G _a (dB)	Γ _{opt}		Rn/50
			MAG.	ANG.	
0.8	1.12	20.7	0.30	-164.8	0.08
0.9	1.15	19.7	0.31	-162.7	0.09
1.0	1.18	18.8	0.32	-160.7	0.09
1.5	1.31	15.7	0.39	-151.5	0.10
1.8	1.38	14.4	0.45	-146.3	0.10
1.9	1.41	14.0	0.47	-144.6	0.10
2.0	1.43	13.6	0.49	-142.9	0.11
2.5	1.56	11.5	0.56	-133.5	0.14

 $V_{CE} = 2\text{ V}$, $I_C = 10\text{ mA}$

f (GHz)	NF _{min} (dB)	G _a (dB)	Γ _{opt}		Rn/50
			MAG.	ANG.	
0.8	0.87	19.6	0.13	170.3	0.09
0.9	0.90	18.6	0.15	171.5	0.09
1.0	0.93	17.8	0.17	173.0	0.09
1.5	1.07	14.8	0.30	-174.1	0.08
1.8	1.15	13.6	0.39	-164.1	0.07
1.9	1.18	13.2	0.41	-160.6	0.07
2.0	1.20	12.8	0.44	-157.2	0.07
2.5	1.35	10.9	0.53	-142.3	0.10

 $V_{CE} = 2\text{ V}$, $I_C = 50\text{ mA}$

f (GHz)	NF _{min} (dB)	G _a (dB)	Γ _{opt}		Rn/50
			MAG.	ANG.	
0.8	1.75	21.3	0.49	-159.4	0.10
0.9	1.78	20.3	0.49	-157.2	0.10
1.0	1.80	19.4	0.50	-154.9	0.11
1.5	1.92	16.2	0.55	-144.7	0.14
1.8	2.00	14.8	0.59	-139.1	0.17
1.9	2.02	14.4	0.60	-137.3	0.19
2.0	2.04	13.9	0.61	-135.5	0.20
2.5	2.17	11.8	0.65	-126.4	0.28

<R> **PACKAGE DIMENSIONS****FLAT-LEAD 4-PIN THIN-TYPE SUPER MINIMOLD (M04) PACKAGE (UNIT: mm)****PIN CONNECTIONS**

1. Emitter
2. Collector
3. Emitter
4. Base

Revision History	NE663M04 / 2SC5509 Data Sheet
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Rev.	Date	Description	
		Page	Summary
1.00	Sep 9, 2004	–	First edition issued
3.00	Mar 5, 2013	Throughout	Renesas format is applied to this data sheet.
		p.1	ORDERING INFORMATION is modified.
		p.5	Up to date S-PARAMETERS.
		p.8	Added a drawing backside to PACKAGE DIMENSIONS.

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