

DATA SHEET



NPN SILICON RF TRANSISTOR

NE664M04 / 2SC5754 JEITA Part No.

NPN SILICON RF TRANSISTOR FOR MEDIUM OUTPUT POWER AMPLIFICATION (0.4 W) FLAT-LEAD 4-PIN THIN-TYPE SUPER MINIMOLD (M04)

FEATURES

- Ideal for 460 MHz to 2.4 GHz medium output power amplification
- $P_{O(1\text{ dB})} = 26.0\text{ dBm TYP. @ } V_{CE} = 3.6\text{ V, } f = 1.8\text{ GHz, } P_{in} = 15\text{ dBm}$
- High collector efficiency: $\eta_C = 60\%$
- UHS0-HV technology ($f_T = 25\text{ GHz}$) adopted
- High reliability through use of gold electrodes
- Flat-lead 4-pin thin-type super minimold (M04) package

ORDERING INFORMATION

Part Number	Quantity	Supplying Form
NE664M04-A 2SC5754-A	50 pcs (Non reel)	• 8 mm wide embossed taping • Pin 1 (Emitter), Pin 2 (Collector) face the perforation side of the tape
NE664M04-T2-A 2SC5754-T2-A	3 kpcs/reel	

Remark To order evaluation samples, contact your nearby sales office.
The unit sample quantity is 50 pcs.

Caution Observe precautions when handling because these devices are sensitive to electrostatic discharge.

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ABSOLUTE MAXIMUM RATINGS (T_A = +25°C)

Parameter	Symbol	Ratings	Unit
Collector to Base Voltage	V _{CBO}	13	V
Collector to Emitter Voltage	V _{CEO}	5.0	V
Emitter to Base Voltage	V _{EBO}	1.5	V
Collector Current	I _c	500	mA
Total Power Dissipation	P _{tot} ^{Note}	735	mW
Junction Temperature	T _j	150	°C
Storage Temperature	T _{stg}	-65 to +150	°C

Note Mounted on 38 × 38 mm, t = 0.4 mm polyimide PCB

THERMAL RESISTANCE

Parameter	Symbol	Test Conditions	Ratings	Unit
★ Junction to Ambient Resistance	R _{th j-a1}	Mounted on 38 × 38 mm, t = 0.4 mm polyimide PCB	170	°C/W
	R _{th j-a2}	Stand alone device in free air	570	°C/W

ELECTRICAL CHARACTERISTICS (T_A = +25°C)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
DC Characteristics						
Collector Cut-off Current	I _{CBO}	V _{CB} = 5 V, I _E = 0 mA	-	-	1 000	nA
Emitter Cut-off Current	I _{EBO}	V _{BE} = 1 V, I _C = 0 mA	-	-	1 000	nA
DC Current Gain	h _{FE} ^{Note 1}	V _{CE} = 3 V, I _C = 100 mA	40	60	100	-
RF Characteristics						
Gain Bandwidth Product	f _T	V _{CE} = 3 V, I _C = 100 mA, f = 0.5 GHz	16	20	-	GHz
Insertion Power Gain	S _{21e} ²	V _{CE} = 3 V, I _C = 100 mA, f = 2 GHz	5.0	6.5	-	dB
Reverse Transfer Capacitance	C _{re} ^{Note 2}	V _{CB} = 3 V, I _E = 0 mA, f = 1 MHz	-	1.0	1.5	pF
Maximum Available Power Gain	MAG ^{Note 3}	V _{CE} = 3 V, I _C = 100 mA, f = 2 GHz	-	12.0	-	dB
Linear Gain	G _L	V _{CE} = 3.6 V, I _{Cq} = 20 mA, f = 1.8 GHz, P _{in} = 0 dBm, 1/2 Duty	-	12.0	-	dB
Gain 1 dB Compression Output Power	P _{O (1 dB)}	V _{CE} = 3.6 V, I _{Cq} = 4 mA, f = 1.8 GHz, P _{in} = 15 dBm, 1/2 Duty	-	26.0	-	dBm
Collector Efficiency	η _C	V _{CE} = 3.6 V, I _{Cq} = 4 mA, f = 1.8 GHz, P _{in} = 15 dBm, 1/2 Duty	-	60	-	%

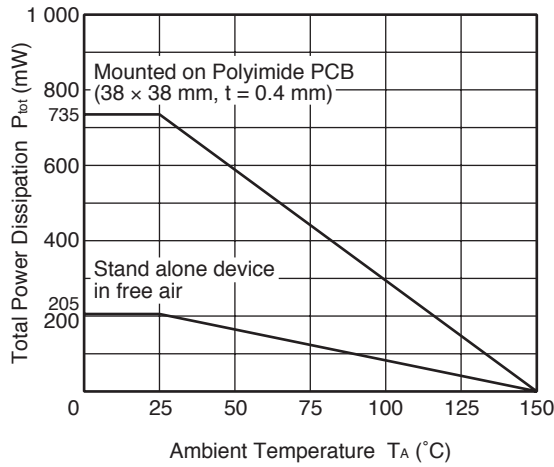
- Notes**
1. Pulse measurement: PW ≤ 350 μs, Duty Cycle ≤ 2%
 2. Collector to base capacitance when the emitter grounded
 3. $MAG = \left| \frac{S_{21}}{S_{12}} \right| (K - \sqrt{K^2 - 1})$

h_{FE} CLASSIFICATION

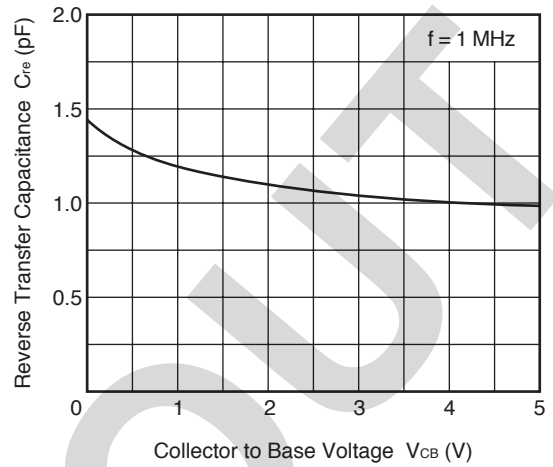
Rank	FB
Marking	R57
h _{FE} Value	40 to 100

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

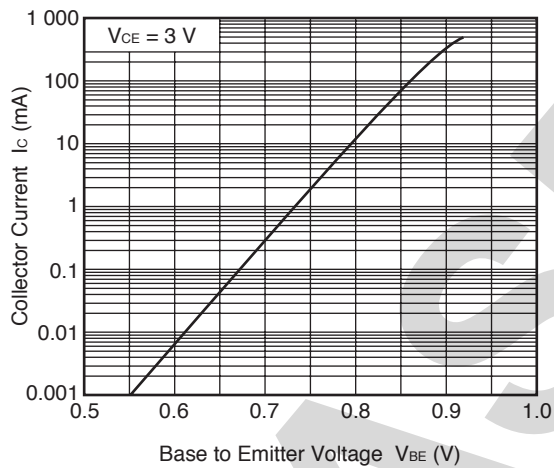
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



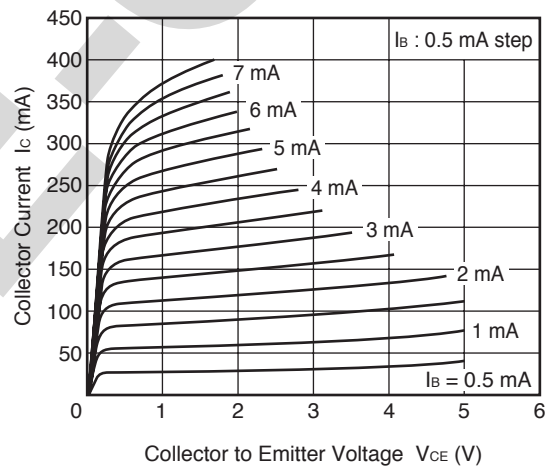
REVERSE TRANSFER CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



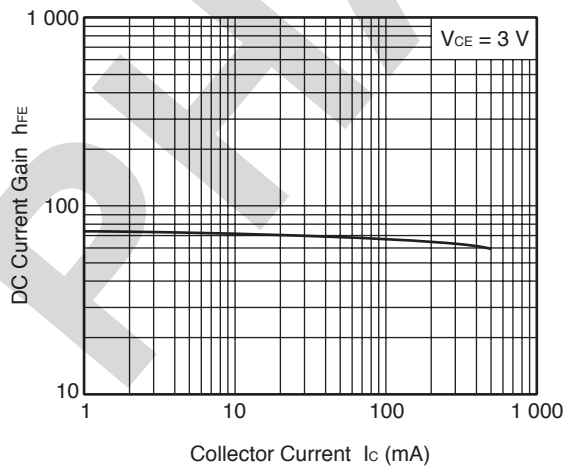
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



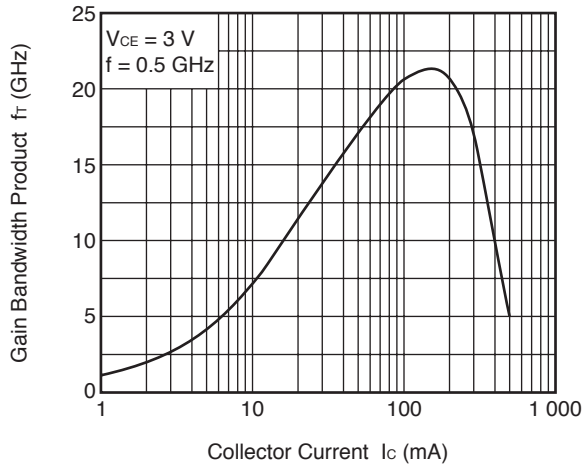
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



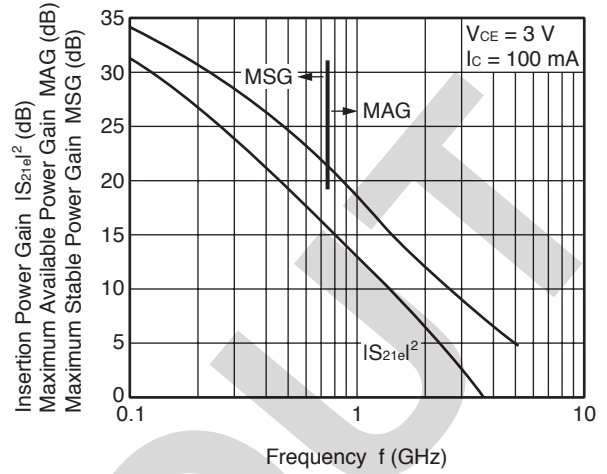
DC CURRENT GAIN vs. COLLECTOR CURRENT



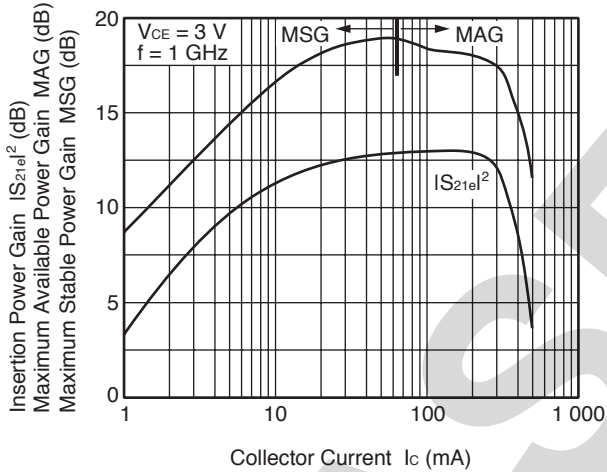
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



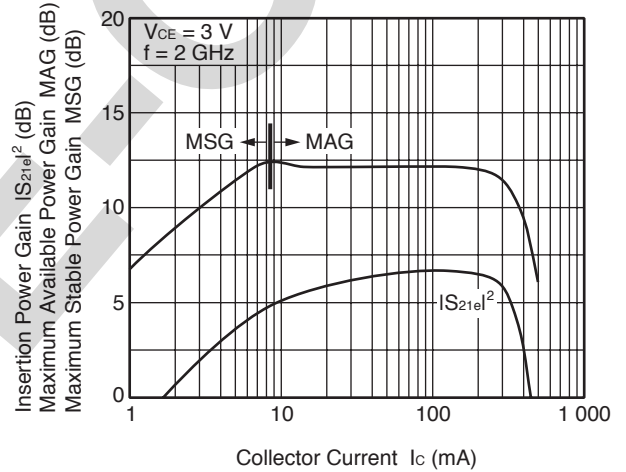
INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



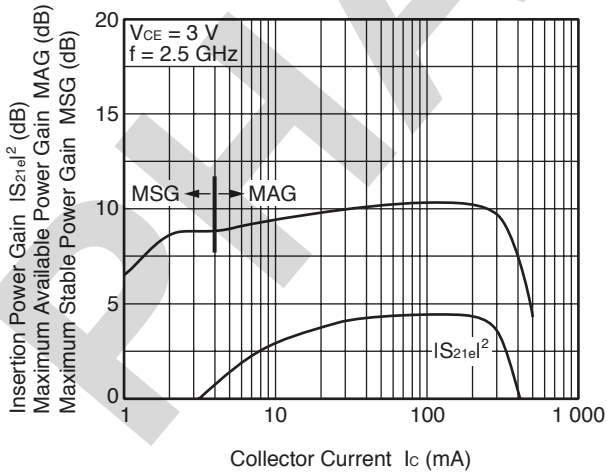
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



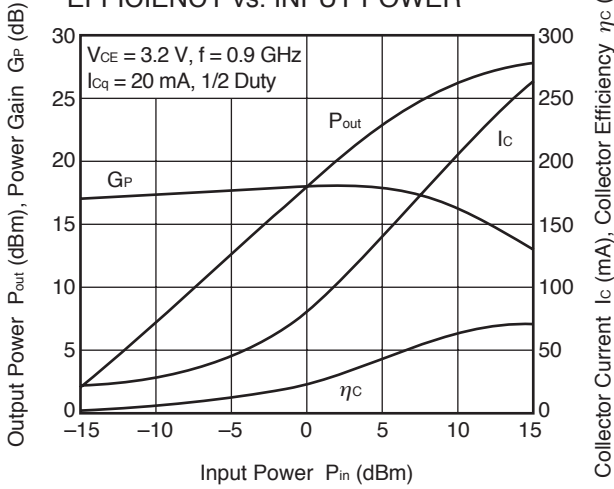
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



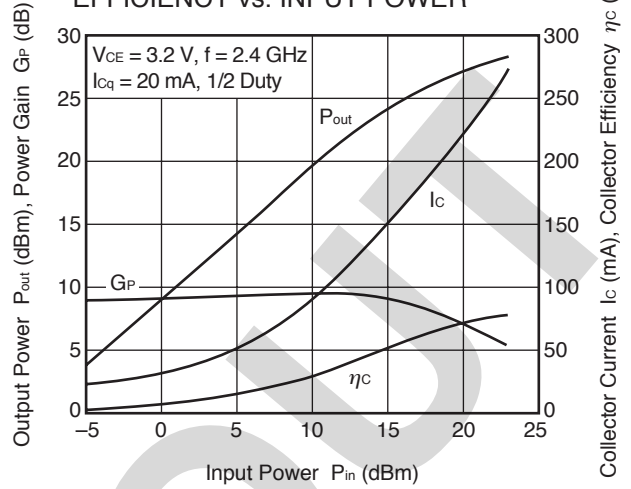
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



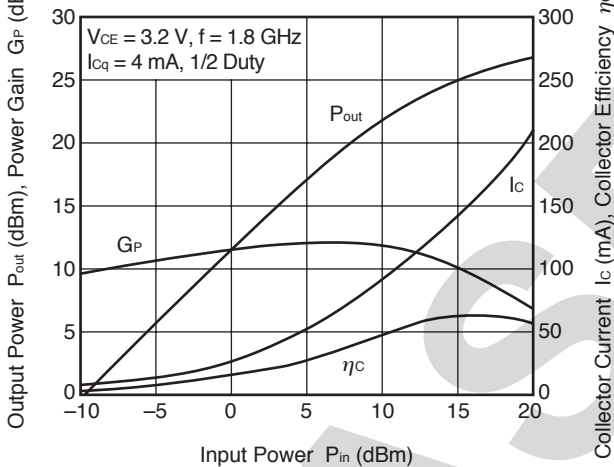
OUTPUT POWER, POWER GAIN, COLLECTOR CURRENT, COLLECTOR EFFICIENCY vs. INPUT POWER



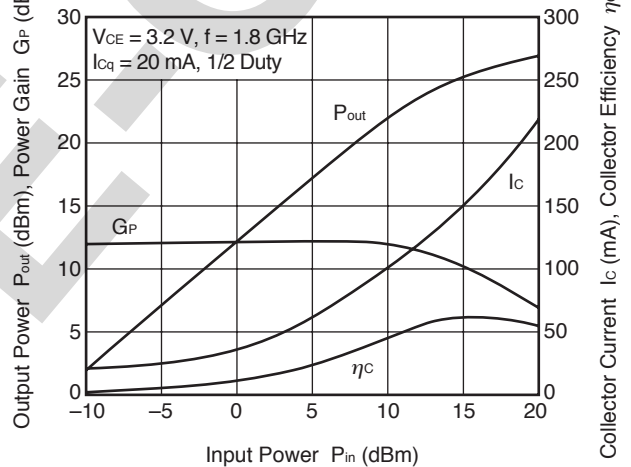
OUTPUT POWER, POWER GAIN, COLLECTOR CURRENT, COLLECTOR EFFICIENCY vs. INPUT POWER



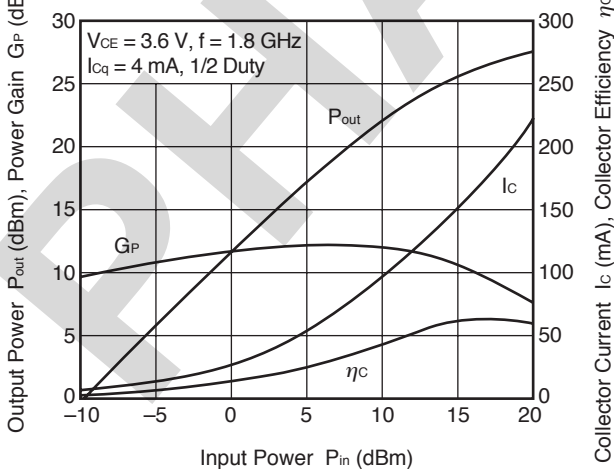
OUTPUT POWER, POWER GAIN, COLLECTOR CURRENT, COLLECTOR EFFICIENCY vs. INPUT POWER



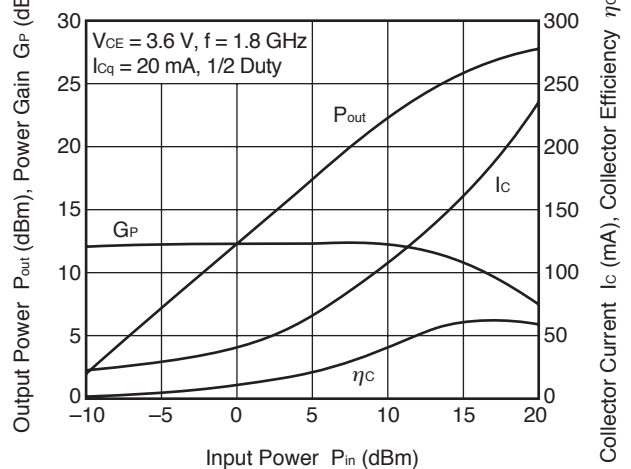
OUTPUT POWER, POWER GAIN, COLLECTOR CURRENT, COLLECTOR EFFICIENCY vs. INPUT POWER



OUTPUT POWER, POWER GAIN, COLLECTOR CURRENT, COLLECTOR EFFICIENCY vs. INPUT POWER



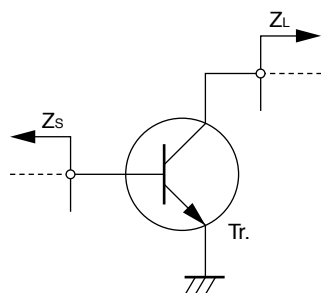
OUTPUT POWER, POWER GAIN, COLLECTOR CURRENT, COLLECTOR EFFICIENCY vs. INPUT POWER



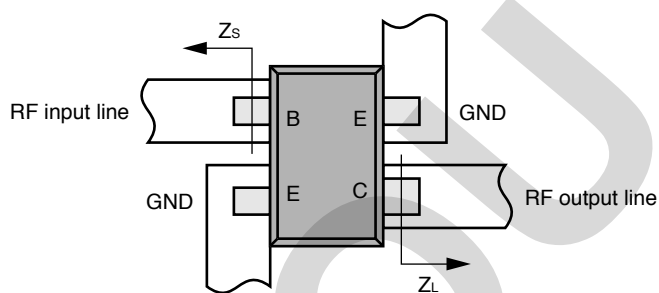
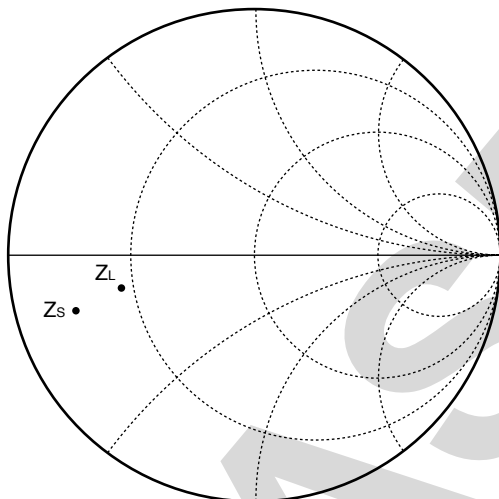
Remark The graphs indicate nominal characteristics.

POWER SUPPLY IMPEDANCE, LOAD IMPEDANCE (Recommended value)

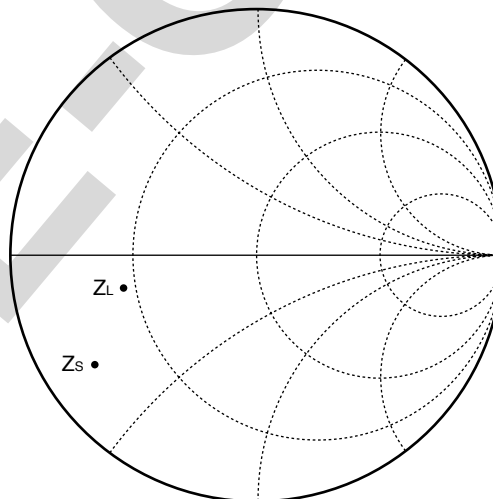
Frequency f (GHz)	Collector to Emitter Voltage V _{CE} (V)	Supply Impedance Z _s (Ω)	Load Impedance Z _L (Ω)
0.9	2.8 to 3.6	8.4 - 5.2 j	15.1 - 4.3 j
1.8	2.8 to 3.6	6.3 - 16.4 j	15.8 - 6.9 j
2.4	2.8 to 3.6	5.9 - 22.1 j	15.2 - 17.9 j



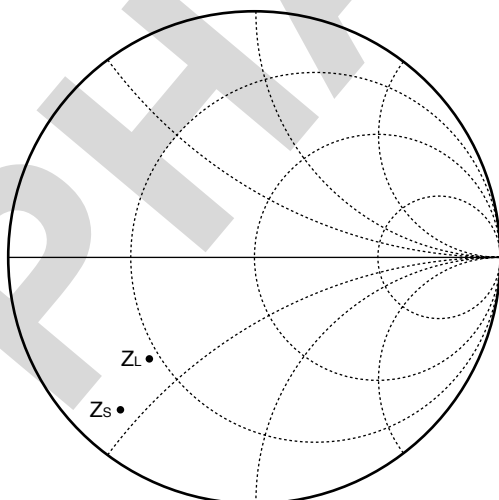
f = 0.9 GHz



f = 1.8 GHz

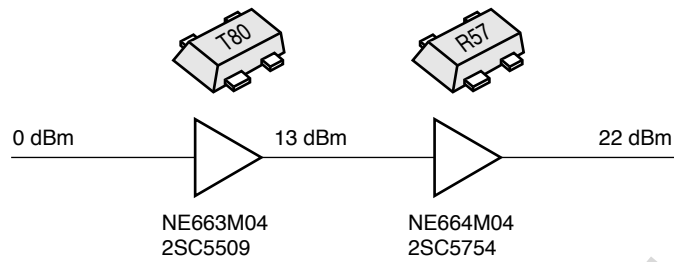


f = 2.4 GHz

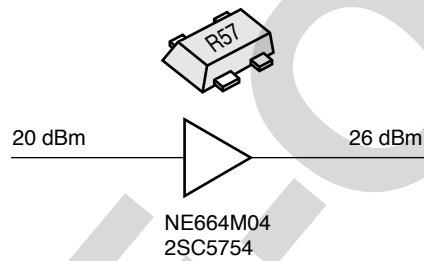


APPLICATION EXAMPLE (Low-cost PA solution)

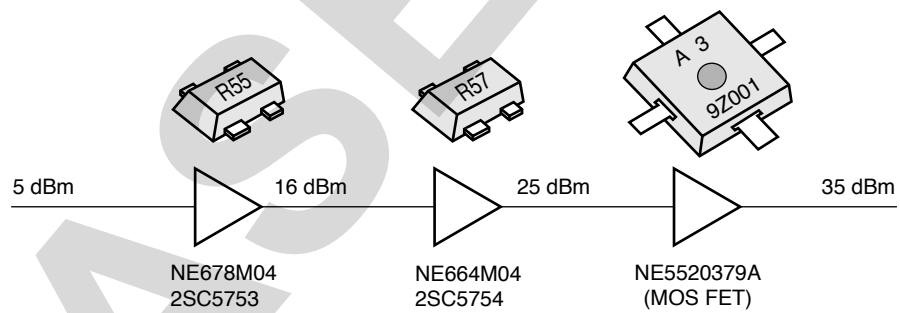
Bluetooth Power Class 1
 $f = 2.4 \text{ GHz}$



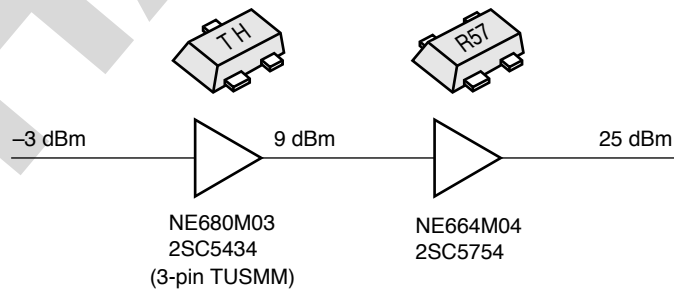
SS Cordless Phone
 $f = 2.4 \text{ GHz}$



DCS1800 (GSM1800) Cellular Phone
 $f = 1.8 \text{ GHz}$

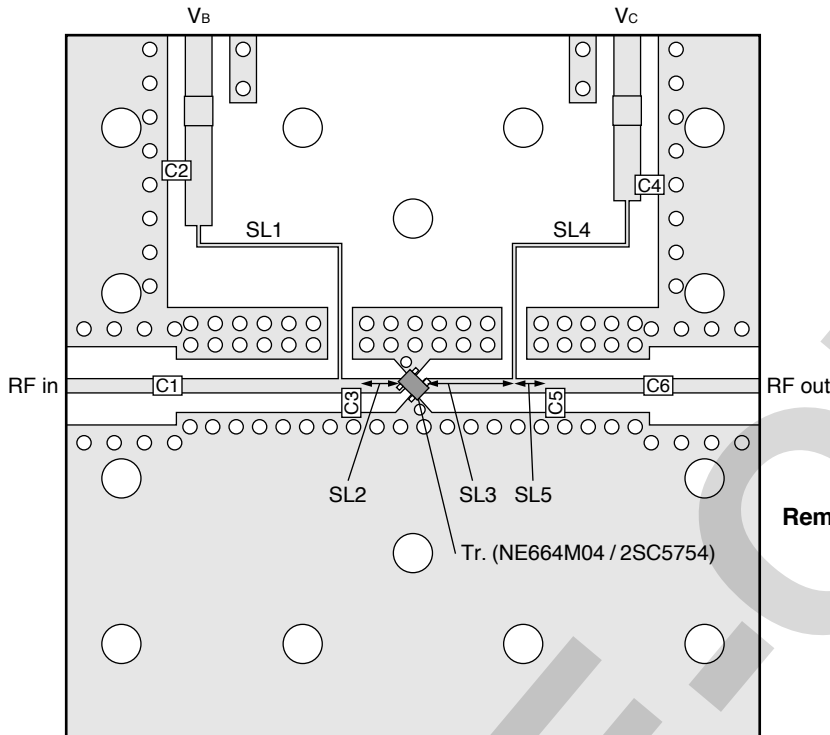


Cordless Phone
 $f = 0.9 \text{ GHz}$



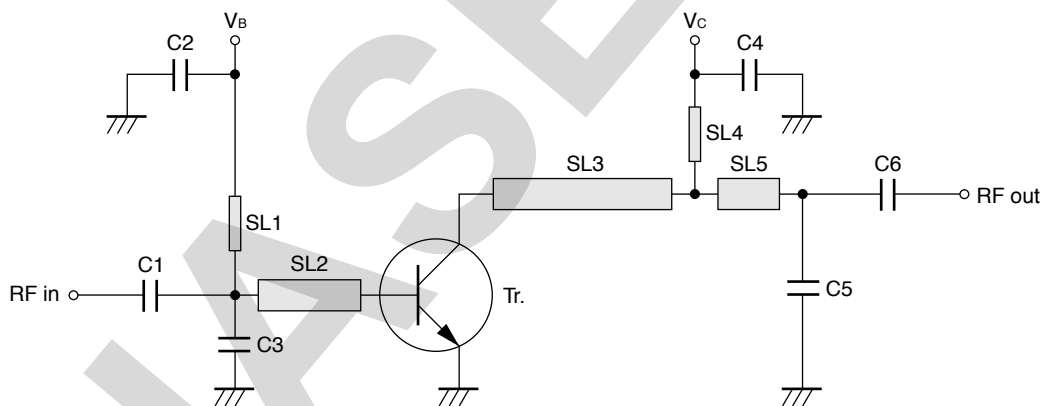
EVALUATION CIRCUIT EXAMPLE : 1.8 GHz PA EVALUATION BOARD

PCB Pattern and Element Layout



- Remarks**
1. 38 × 38 mm, t = 0.4 mm, $\epsilon_r = 4.55$ double-sided copper-clad polyimide board
 2. Back side : GND pattern
 3. Solder plating on pattern
 4. \circ \circ : Through holes

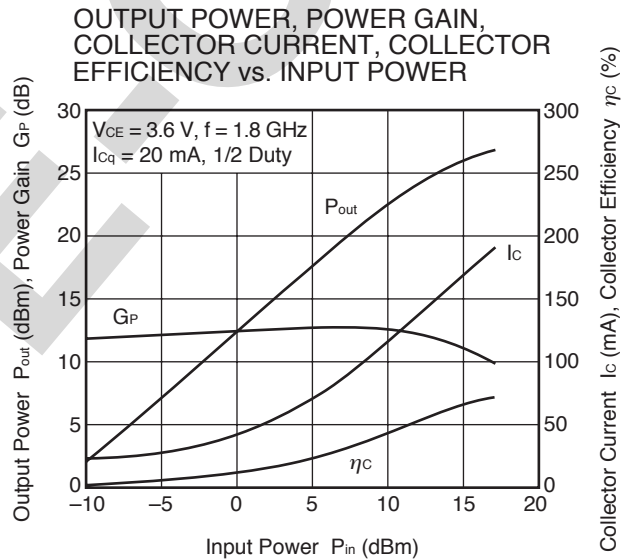
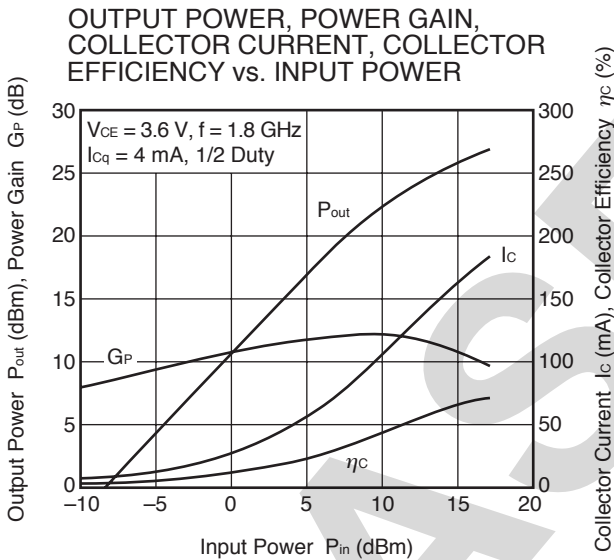
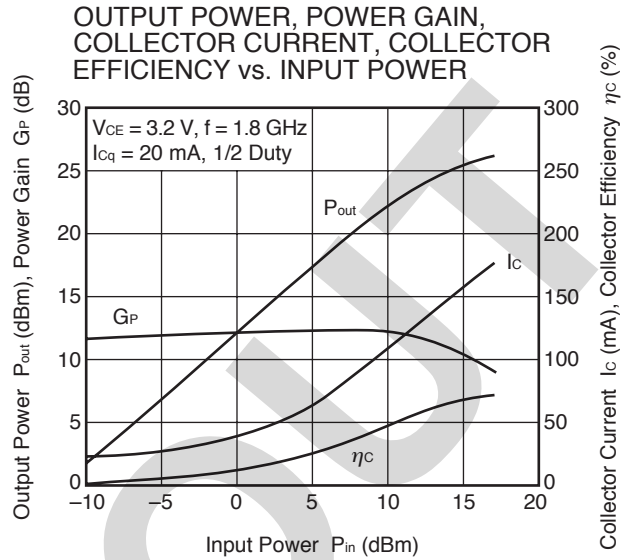
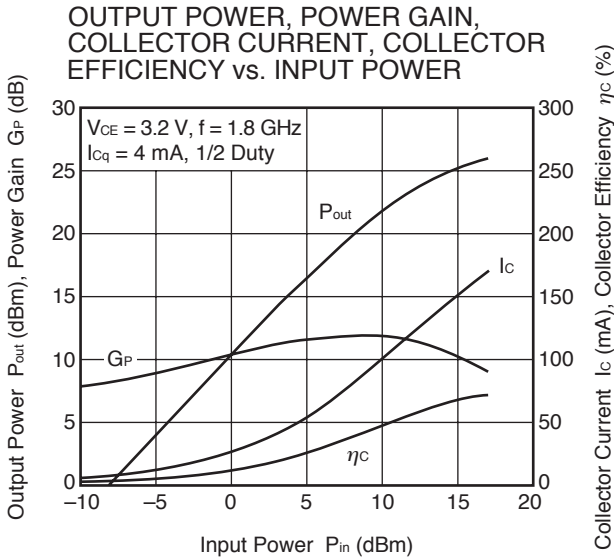
Equivalent Circuit



Parts List

Parts	Value	Size	Classification
C1, C6	18 pF		Multilayer ceramic chip capacitor
C2	3 300 pF		Multilayer ceramic chip capacitor
C3	3 pF		Multilayer ceramic chip capacitor
C4	15 pF		Multilayer ceramic chip capacitor
C5	1.5 pF		Multilayer ceramic chip capacitor
SL1, SL4		w = 0.20 mm	Strip line
SL2		w = 0.76 mm, l = 2.5 mm	Strip line
SL3		w = 0.76 mm, l = 5 mm	Strip line
SL5		w = 0.76 mm, l = 1.5 mm	Strip line

EXAMPLE OF CHARACTERISTICS FOR 1.8 GHz PA EVALUATION BOARD



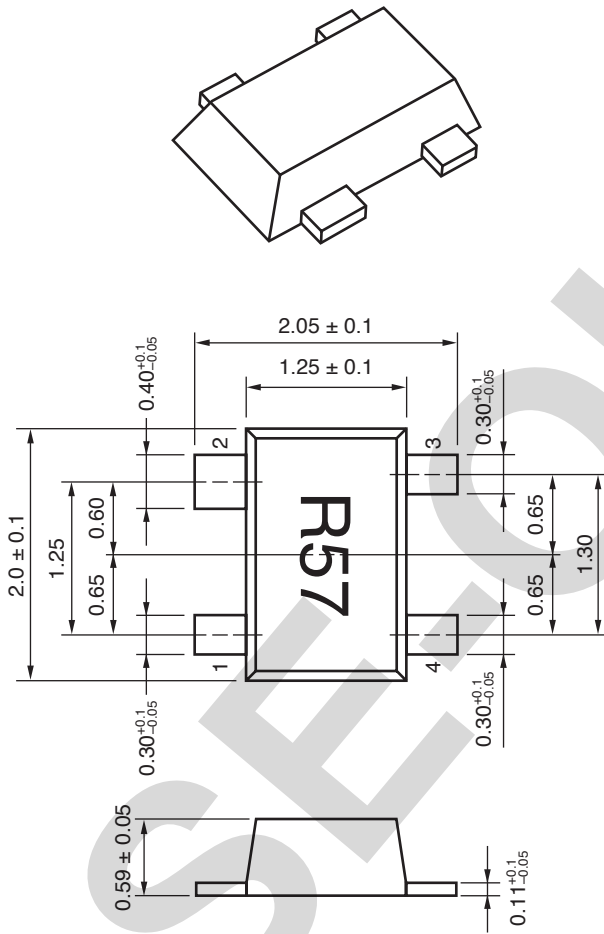
Remark The graphs indicate nominal characteristics.

S-PARAMETERS

- S-parameters and noise parameters are provided on our Web site in a format (S2P) that enables the direct import of the parameters to microwave circuit simulators without the need for keyboard inputs.
- Click here to download S-parameters.
- [RF and Microwave] ® [Device Parameters]
- URL <http://www.necel.com/microwave/en/>

PACKAGE DIMENSIONS

FLAT-LEAD 4-PIN THIN-TYPE SUPER MINIMOLD (M04) (UNIT: mm)



PIN CONNECTIONS

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

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