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
- $P_{O\ (1\ dB)}$ = 26.0 dBm TYP. @ V_{CE} = 3.6 V, f = 1.8 GHz, P_{in} = 15 dBm
- High collector efficiency: η_C = 60%
- UHS0-HV technology (f_T = 25 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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Date Published March 2003 CP(K)

The mark ★ shows major revised points.

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	$R_{th\ j\text{-}a}1$	Mounted on 38 × 38 mm, t = 0.4 mm polyimide PCB	170	°C/W
	$R_{th\ j\text{-}a}2$	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	$\lvert S_{21e}\rvert^2$	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

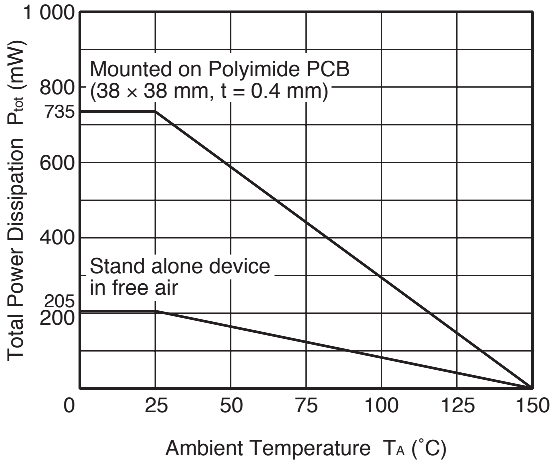
3. $\text{MAG} = \left|\frac{S_{21}}{S_{12}}\right| (K - \sqrt{(K^2 - 1)})$

h_{FE} CLASSIFICATION

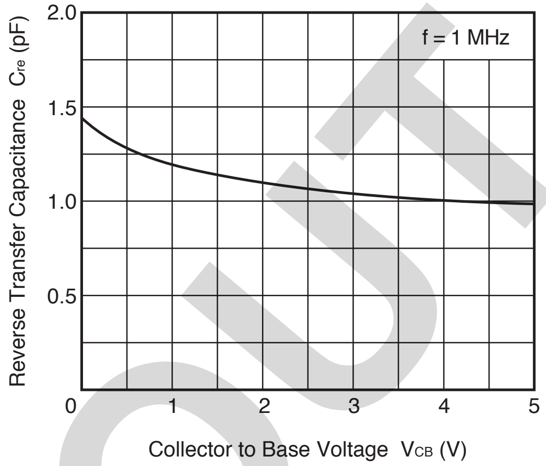
Rank	FB
Marking	R57
h_{FE} Value	40 to 100

TYPICAL CHARACTERISTICS (Unless otherwise specified, T_A = +25°C)

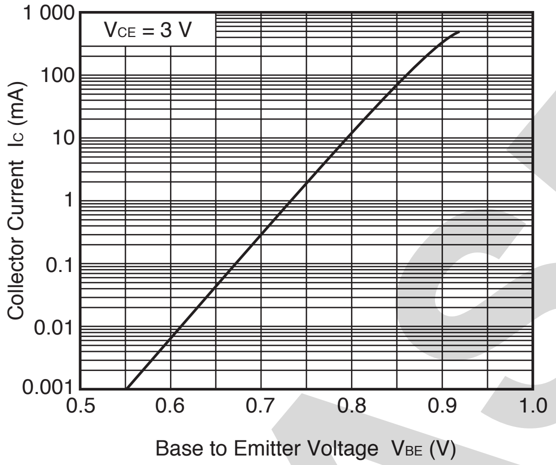
TOTAL POWER DISSIPATION
vs. AMBIENT TEMPERATURE



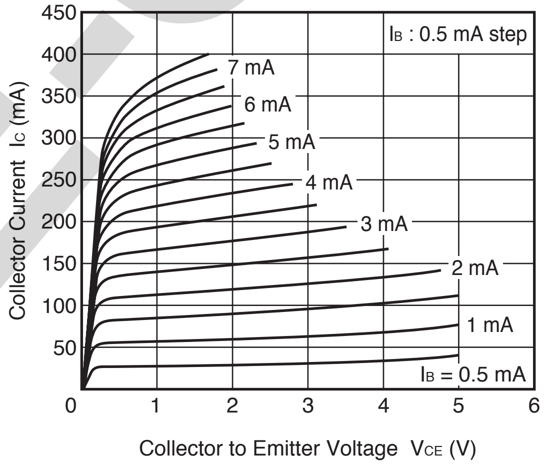
REVERSE TRANSFER CAPACITANCE
vs. COLLECTOR TO BASE VOLTAGE



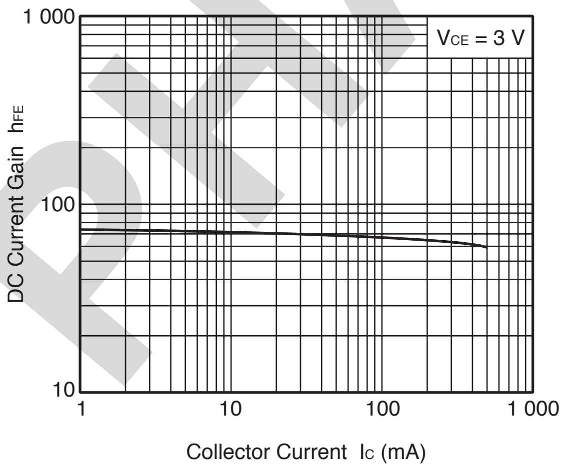
COLLECTOR CURRENT vs.
BASE TO EMITTER VOLTAGE



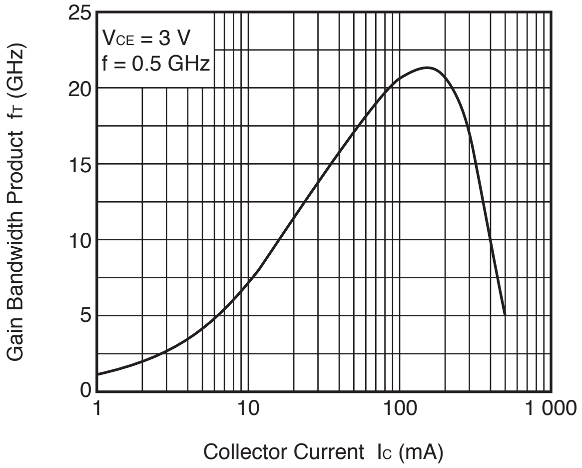
COLLECTOR CURRENT vs.
COLLECTOR TO EMITTER VOLTAGE



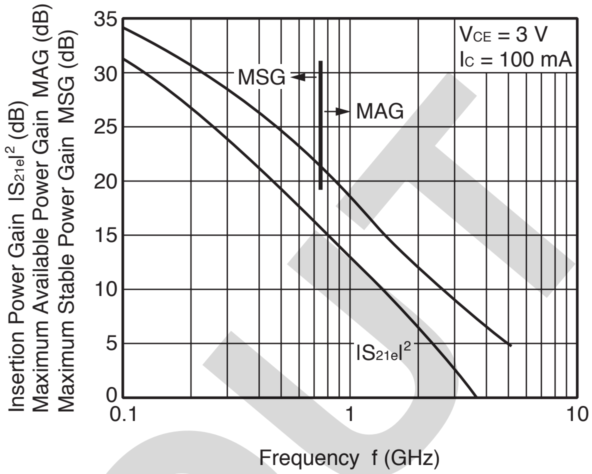
DC CURRENT GAIN vs.
COLLECTOR CURRENT



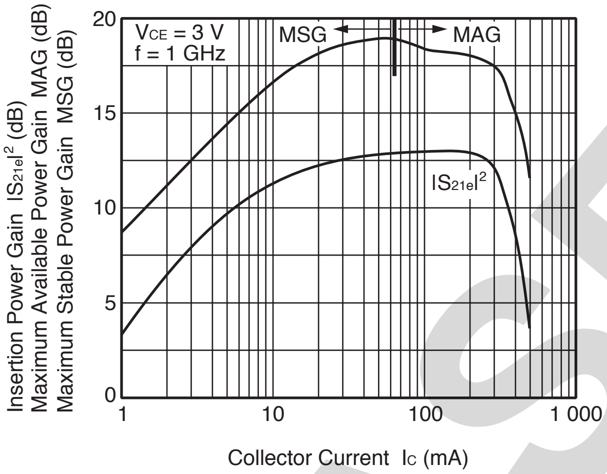
GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT



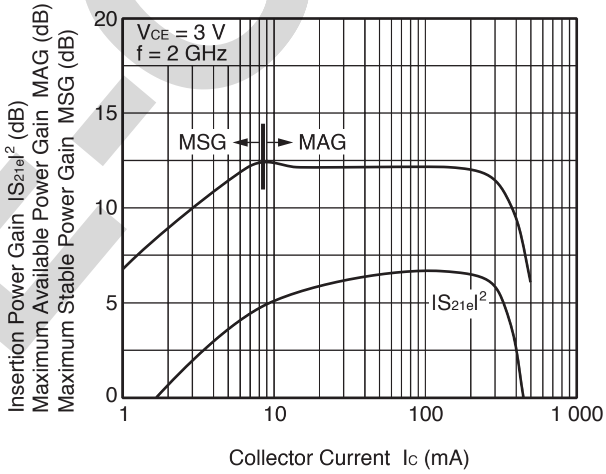
INSERTION POWER GAIN,
MAG, MSG vs. FREQUENCY



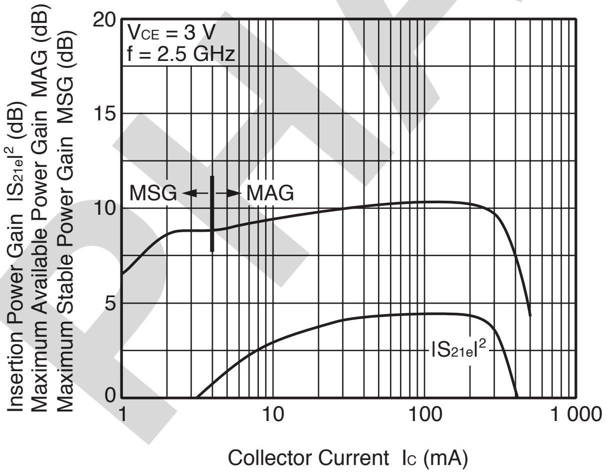
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



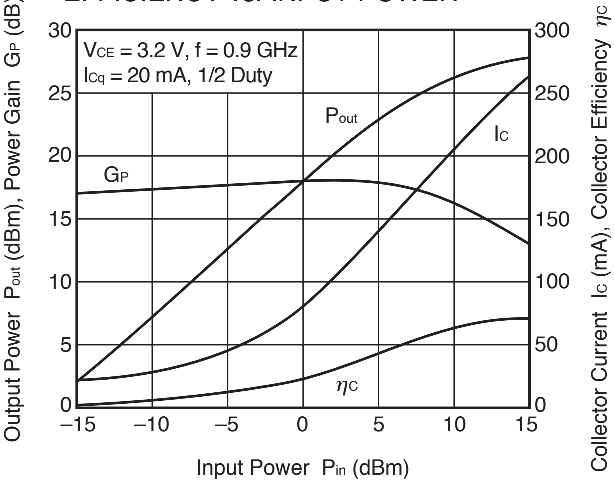
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



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



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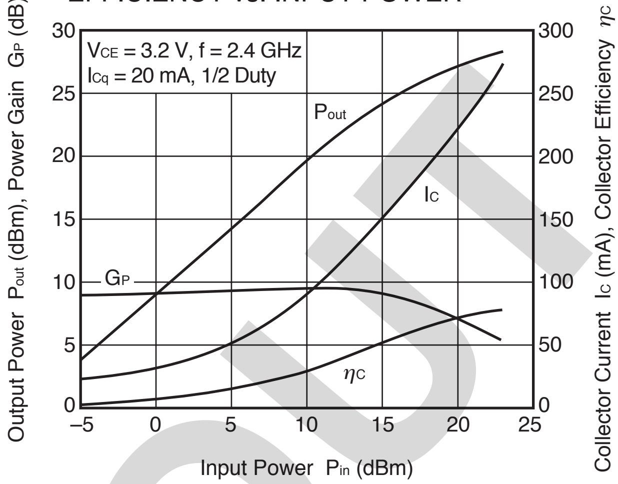

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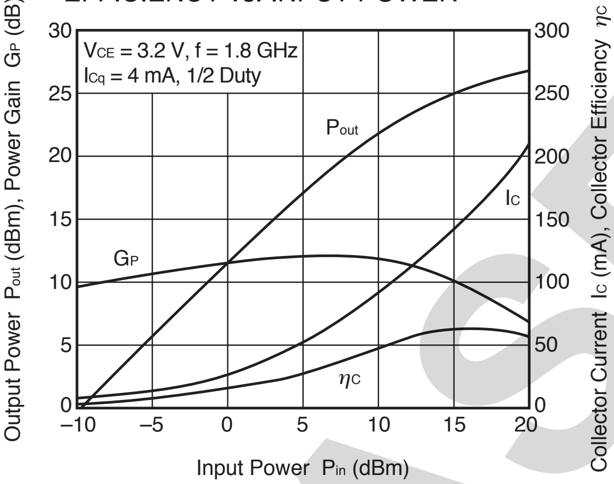
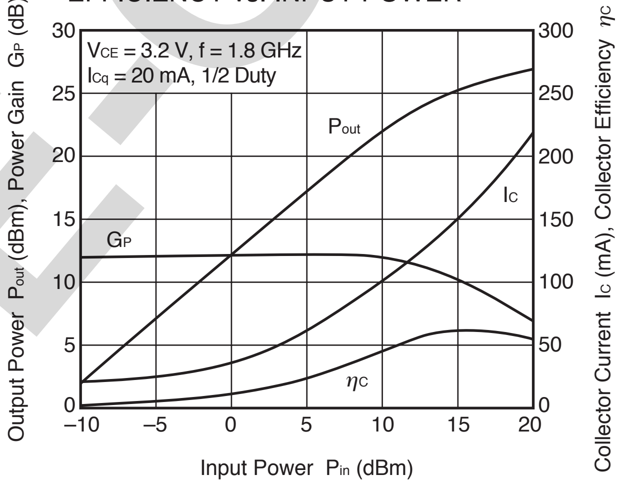
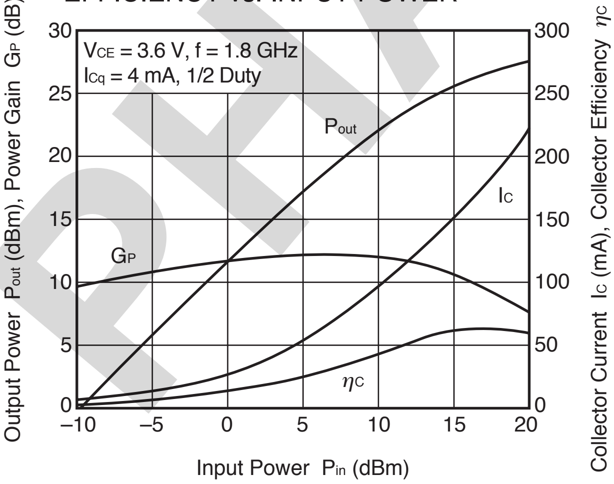


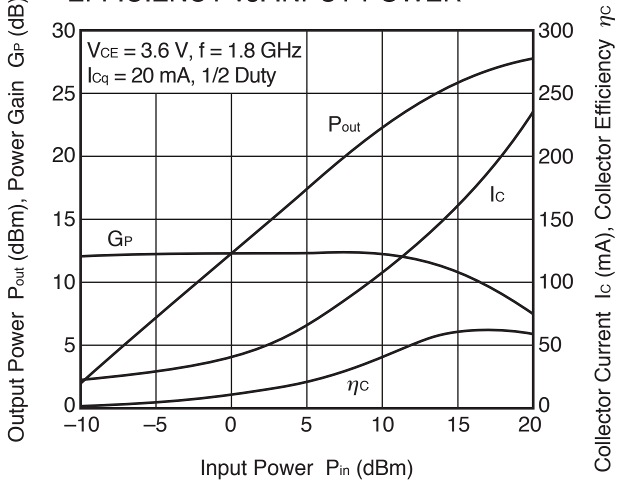
OUTPUT POWER, POWER GAIN, COLLECTOR CURRENT, COLLECTOR EFFICIENCY vs. INPUT POWER



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



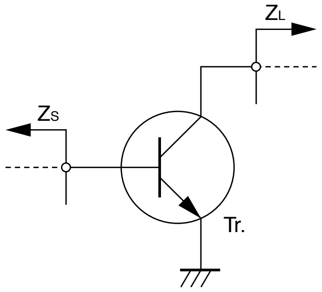
OUTPUT POWER, POWER GAIN, COLLECTOR CURRENT, COLLECTOR EFFICIENCY vs. INPUT POWER

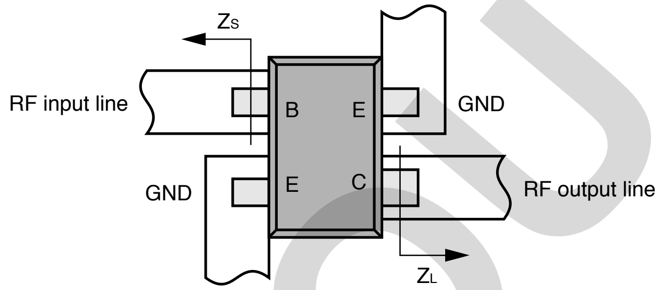


Remark The graphs indicate nominal characteristics.

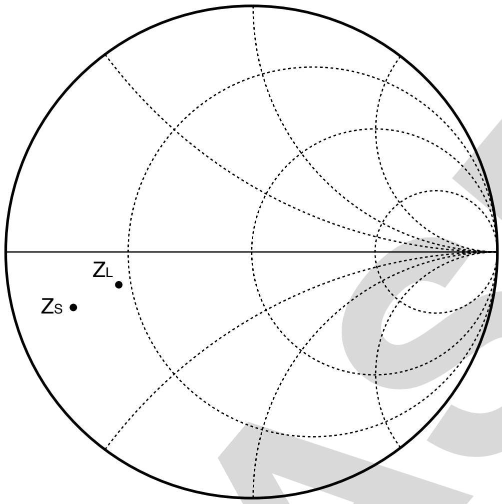
POWER SUPPLY IMPEDANCE, LOAD IMPEDANCE (Recommended value)

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

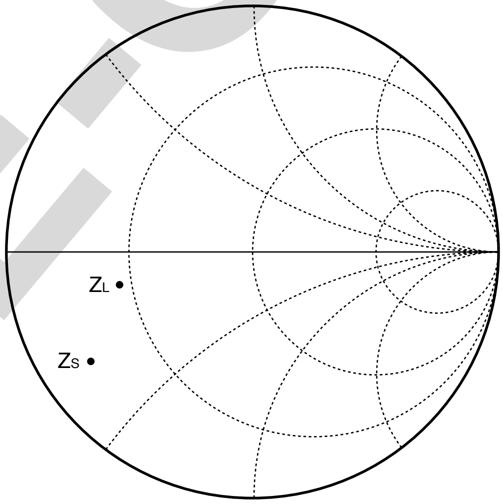




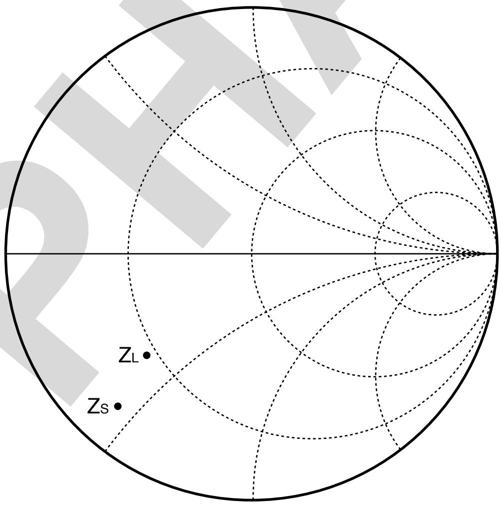
f = 0.9 GHz



f = 1.8 GHz

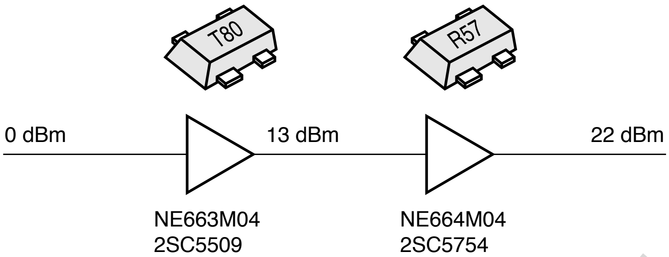


f = 2.4 GHz

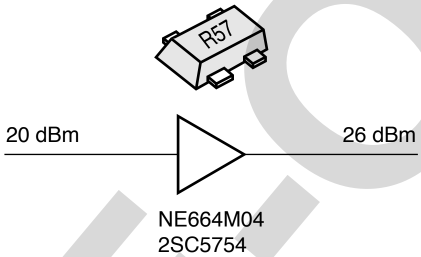


APPLICATION EXAMPLE (Low-cost PA solution)

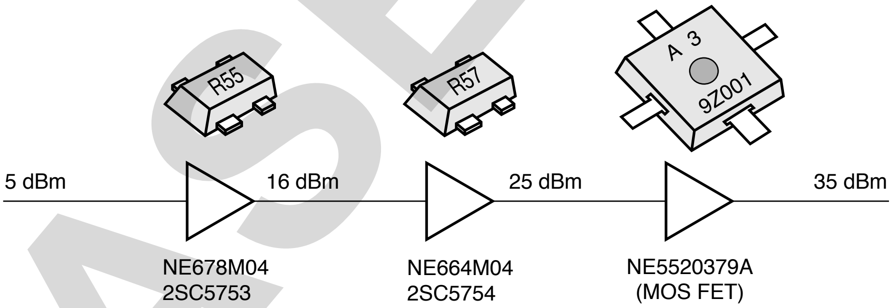
Bluetooth Power Class 1
f = 2.4 GHz



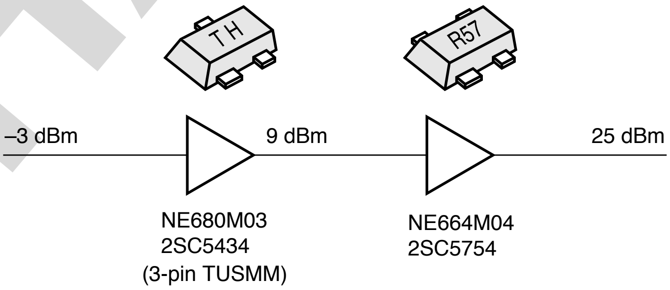
SS Cordless Phone
f = 2.4 GHz



DCS1800 (GSM1800) Cellular Phone
f = 1.8 GHz

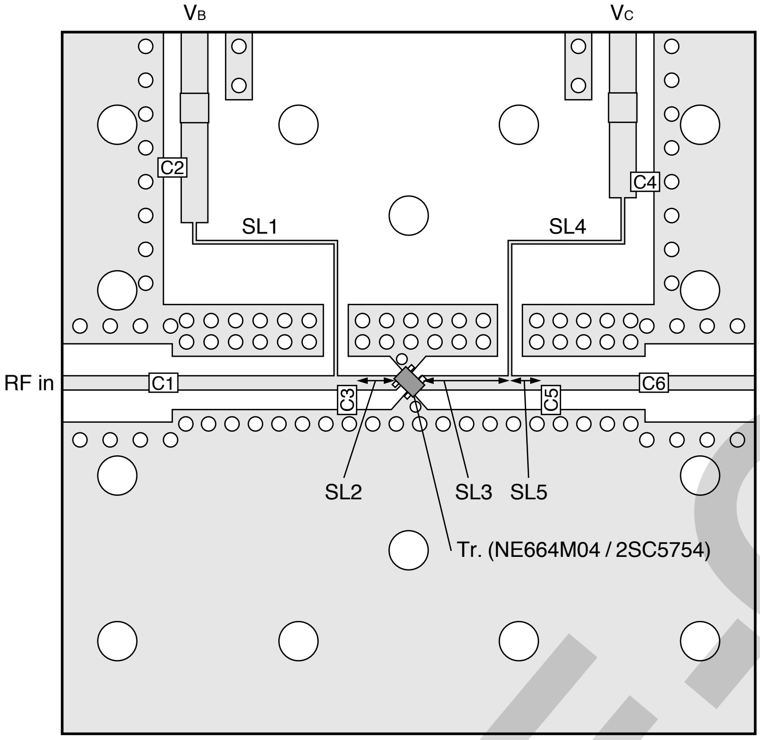


Cordless Phone
f = 0.9 GHz



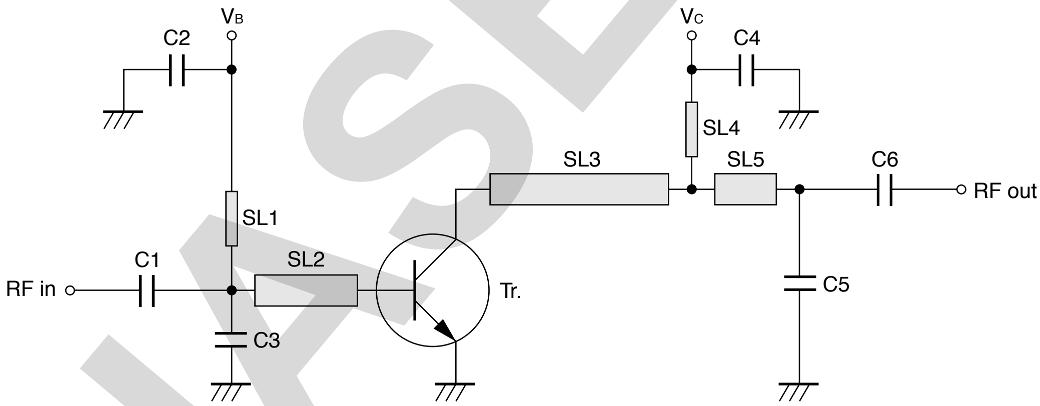
EVALUATION CIRCUIT EXAMPLE : 1.8 GHz PA EVALUATION BOARD

PCB Pattern and Element Layout



Remarks 1. 38 × 38 mm, t = 0.4 mm, ε_r = 4.55 double-sided copper-clad polyimide board
2. Back side : GND pattern
3. Solder plating on pattern
4. ○ ◯ : Through holes

Equivalent Circuit

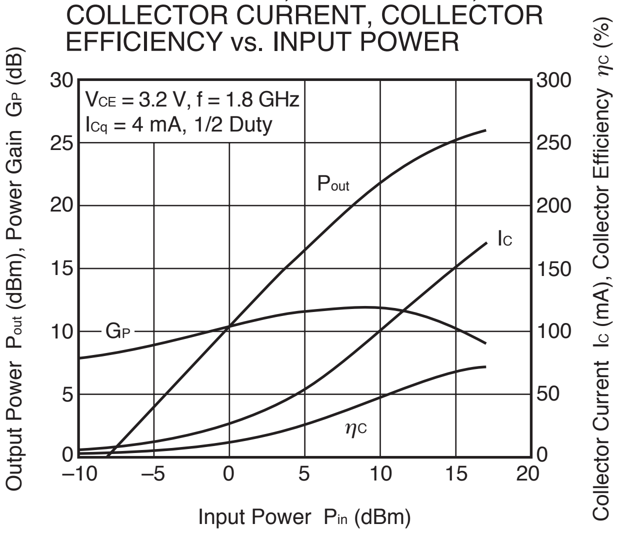


Parts List

Parts	Value	Size	Classification
C1, C6	18 pF		Multiplayer ceramic chip capacitor
C2	3 300 pF		Multiplayer ceramic chip capacitor
C3	3 pF		Multiplayer ceramic chip capacitor
C4	15 pF		Multiplayer ceramic chip capacitor
C5	1.5 pF		Multiplayer 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

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



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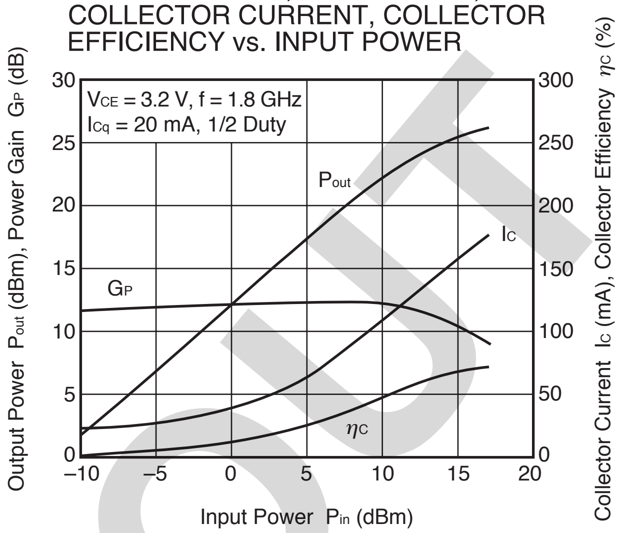

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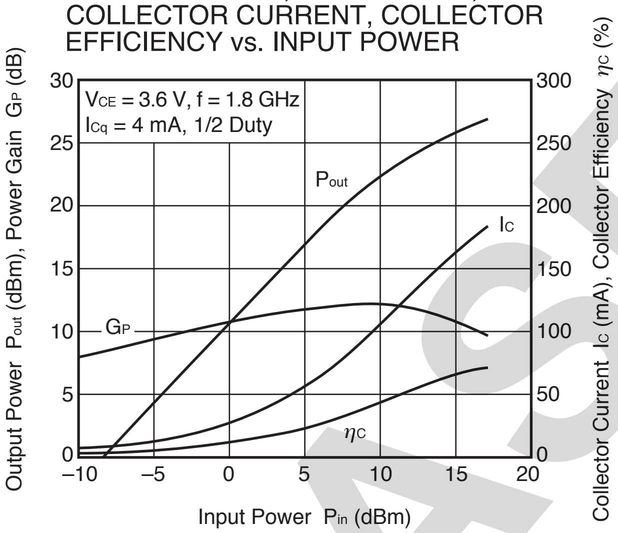

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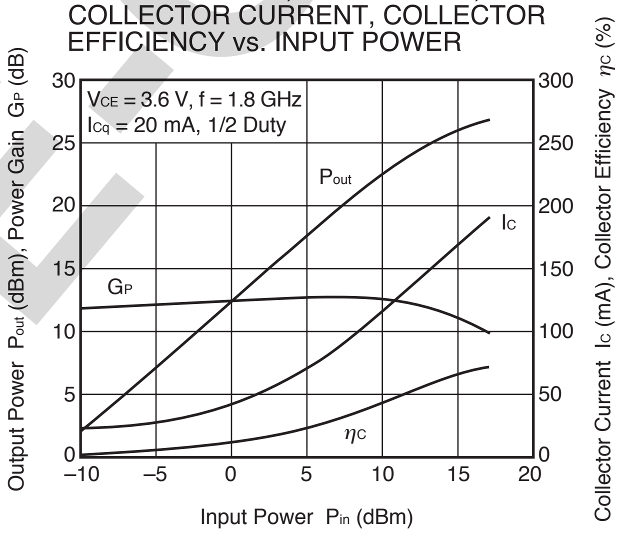


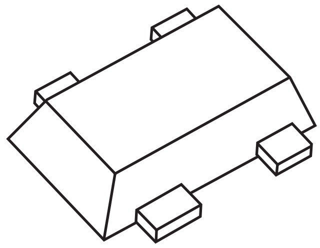
Remark The graphs indicate nominal characteristics.

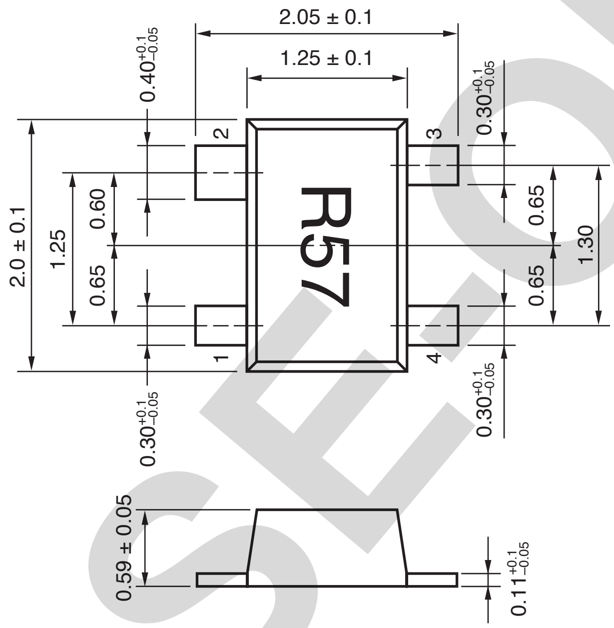
S-PARAMETERS

- 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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