

# DATA SHEET

# NEC

## NPN SILICON RF TRANSISTOR 2SC4703

### NPN EPITAXIAL SILICON RF TRANSISTOR FOR HIGH-FREQUENCY LOW DISTORTION AMPLIFIER 3-PIN POWER MINIMOLD

#### DESCRIPTION

The 2SC4703 is designed for low distortion, low noise RF amplifier operating with low supply voltage ( $V_{CE} = 5\text{ V}$ ). This low distortion characteristic makes it suitable for CATV, tele-communication and other use. It employs surface mount type plastic package, power minimold (SOT-89).

#### FEATURES

- Low distortion, low voltage:  $IM_2 = 55\text{ dBc TYP.}$ ,  $IM_3 = 76\text{ dBc TYP.}$  @  $V_{CE} = 5\text{ V}$ ,  $I_C = 50\text{ mA}$ ,  $V_O = 105\text{ dB}\mu\text{V}/75\Omega$
- Large  $P_{tot}$  :  $P_{tot} = 1.8\text{ W}$  (Mounted on double-sided copper-clad  $16\text{ cm}^2 \times 0.7\text{ mm}$  (t) ceramic substrate)
- Small package : 3-pin power minimold package

#### ★ ORDERING INFORMATION

Part Number	Quantity	Supplying Form
2SC4703	25 pcs (Non reel)	• 12 mm wide embossed taping
2SC4703-T1	1 kpcs/reel	• Collector face the perforation side of the tape

**Remark** To order evaluation samples, contact your nearby sales office.

The unit sample quantity is 25 pcs.

#### ABSOLUTE MAXIMUM RATINGS ( $T_A = +25^\circ\text{C}$ )

Parameter	Symbol	Ratings	Unit
Collector to Base Voltage	$V_{CBO}$	25	V
Collector to Emitter Voltage	$V_{CEO}$	12	V
Emitter to Base Voltage	$V_{EBO}$	2.5	V
Collector Current	$I_C$	150	mA
Total Power Dissipation	$P_{tot}^{\text{Note}}$	1.8	W
Junction Temperature	$T_j$	150	$^\circ\text{C}$
★ Storage Temperature	$T_{stg}$	-65 to +150	$^\circ\text{C}$

**Note** Mounted on double-sided copper-clad  $16\text{ cm}^2 \times 0.7\text{ mm}$  (t) ceramic substrate

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

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.  
Not all devices/types available in every country. Please check with local NEC Compound Semiconductor Devices representative for availability and additional information.

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = +25°C)**

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit	
DC Characteristics							
Collector Cut-off Current	I <sub>CBO</sub>	V <sub>CB</sub> = 20 V, I <sub>E</sub> = 0 mA	–	–	1.5	μA	
Emitter Cut-off Current	I <sub>EBO</sub>	V <sub>EB</sub> = 2 V, I <sub>C</sub> = 0 mA	–	–	1.5	μA	
★ DC Current Gain	h <sub>FE</sub> <sup>Note 1</sup>	V <sub>CE</sub> = 5 V, I <sub>C</sub> = 50 mA	50	–	250	–	
RF Characteristics							
★ Gain Bandwidth Product	f <sub>T</sub>	V <sub>CE</sub> = 5 V, I <sub>C</sub> = 50 mA	–	6.0	–	GHz	
Insertion Power Gain (1)	S <sub>21e</sub>   <sup>2</sup>	V <sub>CE</sub> = 5 V, I <sub>C</sub> = 50 mA, f = 1 GHz	6.5	8.3	–	dB	
Insertion Power Gain (2)	S <sub>21e</sub>   <sup>2</sup>	V <sub>CE</sub> = 10 V, I <sub>C</sub> = 20 mA, f = 1 GHz	–	8.5	–	dB	
Noise Figure	NF	V <sub>CE</sub> = 5 V, I <sub>C</sub> = 50 mA, f = 1 GHz	–	2.3	3.5	dB	
Collector Capacitance	C <sub>ob</sub> <sup>Note 2</sup>	V <sub>CB</sub> = 5 V, I <sub>E</sub> = 0 mA, f = 1 MHz	–	1.5	2.5	pF	
★ 2nd Order Intermodulation Distortion	IM <sub>2</sub>	I <sub>C</sub> = 50 mA, V <sub>O</sub> = 105 dBμV/75 Ω, f = 190 – 90 MHz	V <sub>CE</sub> = 5 V	–	55	–	dBc
			V <sub>CE</sub> = 10 V	–	63	–	
★ 3rd Order Intermodulation Distortion	IM <sub>3</sub>	I <sub>C</sub> = 50 mA, V <sub>O</sub> = 105 dBμV/75 Ω, f = 2 × 190 – 200 MHz	V <sub>CE</sub> = 5 V	–	76	–	dBc
			V <sub>CE</sub> = 10 V	–	81	–	

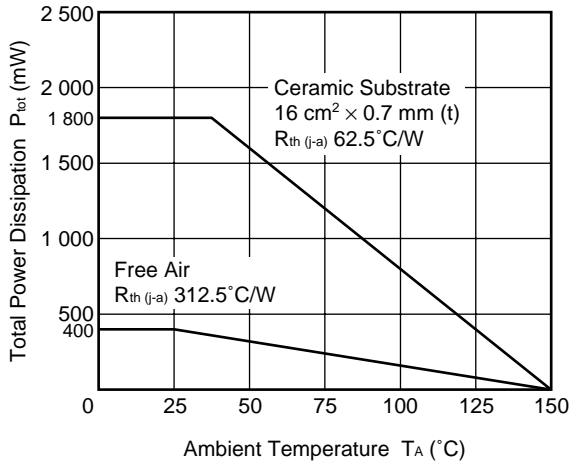
- Notes 1.** Pulse measurement: PW ≤ 350 μs, Duty Cycle ≤ 2%  
**2.** Collector to base capacitance when the emitter grounded

**h<sub>FE</sub> CLASSIFICATION**

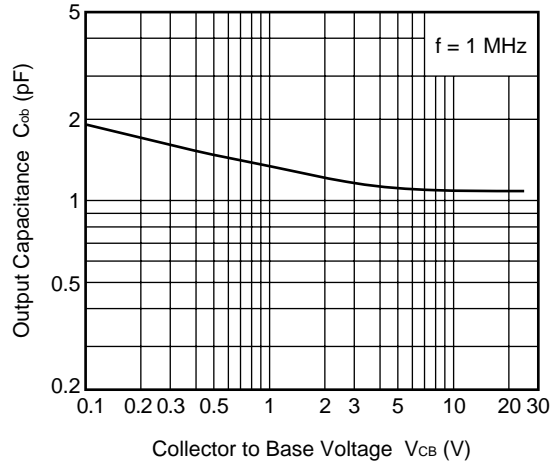
Rank	SH	SF	SE
Marking	SH	SF	SE
h <sub>FE</sub> Value	50 to 100	80 to 160	125 to 250

★ TYPICAL CHARACTERISTICS (T<sub>A</sub> = +25°C)

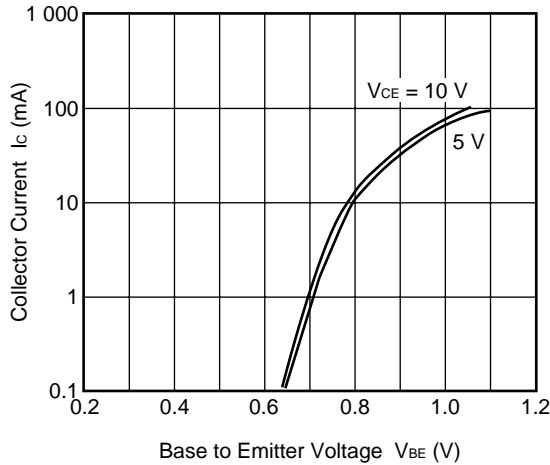
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



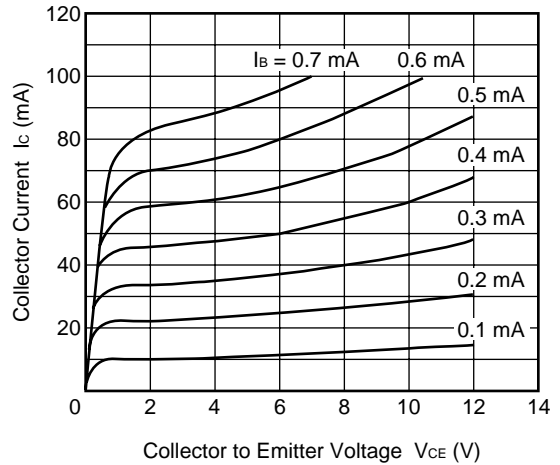
OUTPUT CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



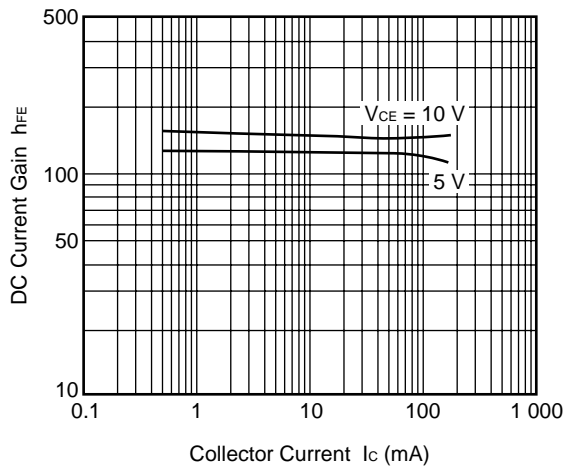
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



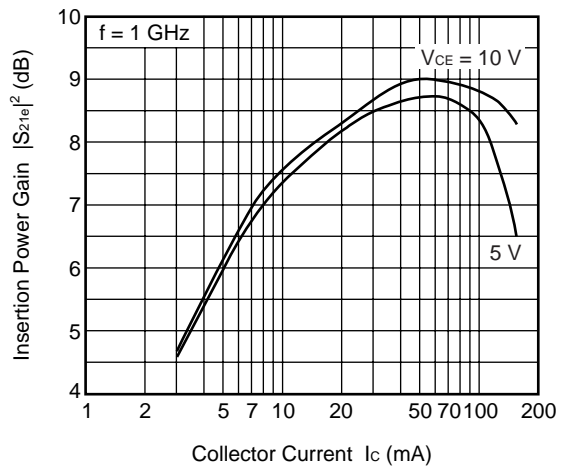
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



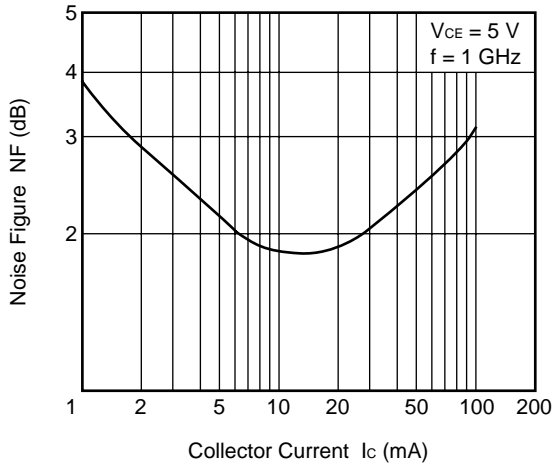
DC CURRENT GAIN vs. COLLECTOR CURRENT



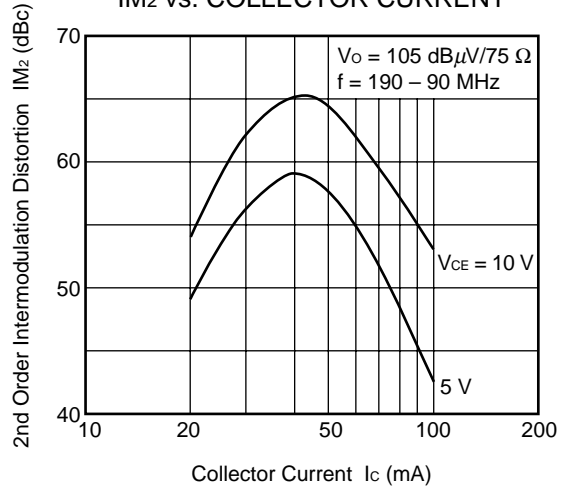
INSERTION POWER GAIN vs. COLLECTOR CURRENT



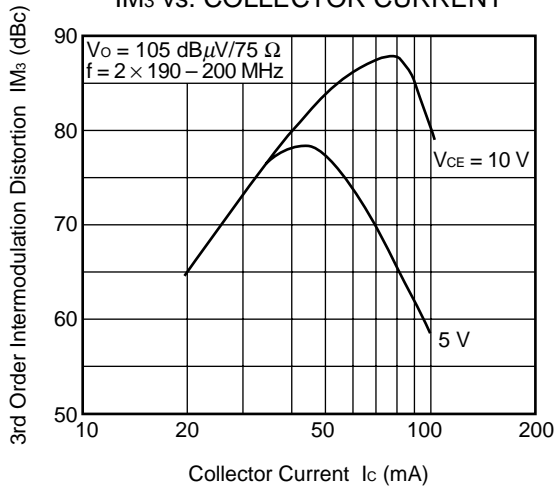
NOISE FIGURE vs. COLLECTOR CURRENT



IM<sub>2</sub> vs. COLLECTOR CURRENT



IM<sub>3</sub> vs. COLLECTOR CURRENT



**Remark** The graphs indicate nominal characteristics.

**S-PARAMETERS**

S-parameters/Noise parameters are provided on the NEC Compound Semiconductor Devices Web site in a form (S2P) that enables direct import to a microwave circuit simulator without keyboard input.

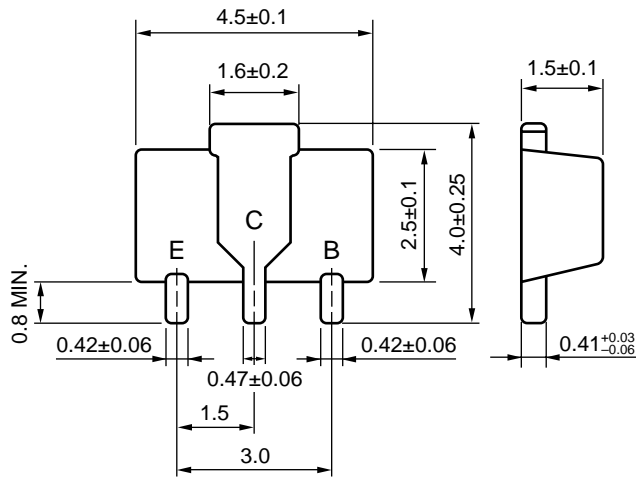
Click here to download S-parameters.

[RF and Microwave] → [Device Parameters]

URL <http://www.csd-nec.com/>

★ PACKAGE DIMENSIONS

3-PIN POWER MINIMOLD (UNIT: mm)



**PIN CONNECTIONS**

- E : Emitter
- C : Collector (Fin)
- B : Base

(IEC : SOT-89)

- **The information in this document is current as of May, 2003. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC's data sheets or data books, etc., for the most up-to-date specifications of NEC semiconductor products. Not all products and/or types are available in every country. Please check with an NEC sales representative for availability and additional information.**
  - No part of this document may be copied or reproduced in any form or by any means without prior written consent of NEC. NEC assumes no responsibility for any errors that may appear in this document.
  - NEC does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from the use of NEC semiconductor products listed in this document or any other liability arising from the use of such products. No license, express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC or others.
  - Descriptions of circuits, software and other related information in this document are provided for illustrative purposes in semiconductor product operation and application examples. The incorporation of these circuits, software and information in the design of customer's equipment shall be done under the full responsibility of customer. NEC assumes no responsibility for any losses incurred by customers or third parties arising from the use of these circuits, software and information.
  - While NEC endeavours to enhance the quality, reliability and safety of NEC semiconductor products, customers agree and acknowledge that the possibility of defects thereof cannot be eliminated entirely. To minimize risks of damage to property or injury (including death) to persons arising from defects in NEC semiconductor products, customers must incorporate sufficient safety measures in their design, such as redundancy, fire-containment, and anti-failure features.
  - NEC semiconductor products are classified into the following three quality grades:  
 "Standard", "Special" and "Specific". The "Specific" quality grade applies only to semiconductor products developed based on a customer-designated "quality assurance program" for a specific application. The recommended applications of a semiconductor product depend on its quality grade, as indicated below. Customers must check the quality grade of each semiconductor product before using it in a particular application.  
 "Standard": Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots  
 "Special": Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)  
 "Specific": Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems and medical equipment for life support, etc.
- The quality grade of NEC semiconductor products is "Standard" unless otherwise expressly specified in NEC's data sheets or data books, etc. If customers wish to use NEC semiconductor products in applications not intended by NEC, they must contact an NEC sales representative in advance to determine NEC's willingness to support a given application.
- (Note)
- (1) "NEC" as used in this statement means NEC Corporation, NEC Compound Semiconductor Devices, Ltd. and also includes its majority-owned subsidiaries.
  - (2) "NEC semiconductor products" means any semiconductor product developed or manufactured by or for NEC (as defined above).

M8E 00.4-0110

---

► For further information, please contact

**NEC Compound Semiconductor Devices, Ltd.**

5th Sales Group, Sales Division TEL: +81-44-435-1588 FAX: +81-44-435-1579 E-mail: salesinfo@csd-nec.com

**NEC Compound Semiconductor Devices Hong Kong Limited**

Hong Kong Head Office TEL: +852-3107-7303 FAX: +852-3107-7309 E-mail: ncsd-hk@elhk.nec.com.hk

Taipei Branch Office TEL: +886-2-8712-0478 FAX: +886-2-2545-3859

Korea Branch Office TEL: +82-2-558-2120 FAX: +82-2-558-5209

**NEC Electronics (Europe) GmbH** <http://www.ee.nec.de/>

TEL: +49-211-6503-01 FAX: +49-211-6503-487

**California Eastern Laboratories, Inc.** <http://www.cel.com/>

TEL: +1-408-988-3500 FAX: +1-408-988-0279