2N3904

Silicon NPN Epitaxial
General Purpose Amplifier

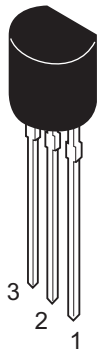
REA03G0001-0200Z
Rev.2.00
Jul.22.2004

Features

- Low saturation voltage
- General purpose amplifier and switching
- The useful dynamic range extends to 100mA as a switch and to 100MHz as an amplifier

Outline

TO-92 (1)



1. Emitter
2. Base
3. Collector

Absolute Maximum Ratings

(Ta = 25°C)

Item	Symbol	Ratings	Unit
Collector to base voltage	V_{CBO}	60	V
Collector to emitter voltage	V_{CEO}	40	V
Emitter to base voltage	V_{EBO}	6	V
Collector current	I_C	200	mA
Total power dissipation	P_C	625	mW
Junction temperature	Tj	150	°C
Storage temperature	Tstg	–55 to +150	°C

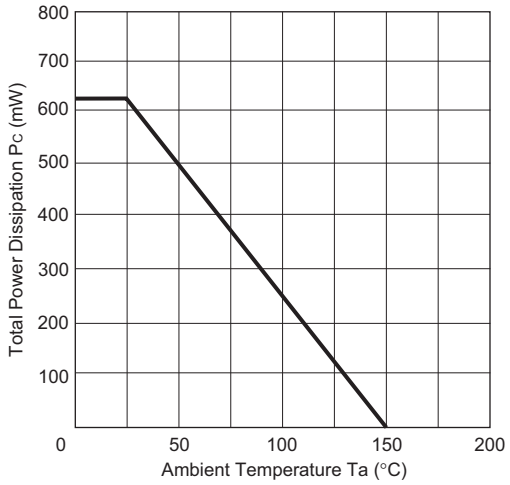
Electrical Characteristics

(Ta = 25°C)

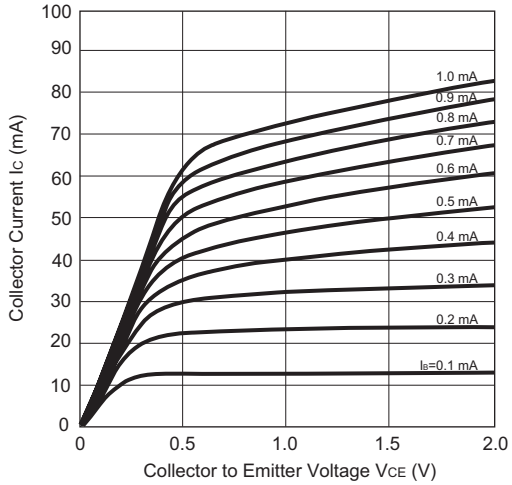
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Collector to base breakdown voltage	$V_{(BR)CBO}$	60	—	—	V	I_C = 10 µA, I_E = 0
Collector to emitter breakdown voltage	$V_{(BR)CEO}$	40	—	—	V	I_C = 1 mA, R_{BE} = ∞
Emitter to base breakdown voltage	$V_{(BR)EBO}$	6	—	—	V	I_E = 10 µA, I_C = 0
Base cutoff current	I_{BL}	—	—	50	nA	V_{CE} = 30 V, V_{EB} = 3 V
Collector cutoff current	I_{CEX}	—	—	50	nA	V_{CE} = 30 V, V_{EB} = 3 V
DC current transfer ratio	h_{FE}	40	—	—	—	V_{CE} = 1 V, I_C = 100 µA
		70	—	—	—	V_{CE} = 1 V, I_C = 1 mA
		100	—	300	—	V_{CE} = 1 V, I_C = 10 mA
		60	—	—	—	V_{CE} = 1 V, I_B = 50 mA
		30	—	—	—	V_{CE} = 1 V, I_B = 100 mA
Collector to emitter saturation voltage	$V_{CE(sat)}$	—	—	0.2	V	I_C = 10 mA, I_B = 1 mA
		—	—	0.3	V	I_C = 50 mA, I_B = 5 mA
Base to emitter saturation voltage	$V_{BE(sat)}$	0.65	—	0.85	V	I_C = 10 mA, I_B = 1 mA
		—	—	0.95	V	I_C = 50 mA, I_B = 5 mA
Gain bandwidth product	f_T	—	540	—	MHz	V_{CE} = 20 V, I_C = 10 mA
Collector output capacitance	C_{ob}	—	1.9	—	pF	V_{CE} = 5 V, I_E = 0, f = 1 MHz
Collector input capacitance	C_{ib}	—	5.9	—	pF	V_{CE} = 0.5 V, I_E = 0, f = 1 MHz
Noise figure	NF	—	1.0	—	dB	V_{CE} = 5 V, I_C = 0.1 mA, f = 1 MHz, R_g = 1 kΩ

Main Characteristics

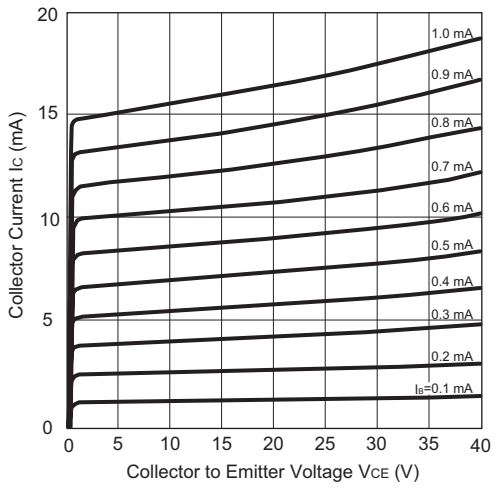
Total Power Dissipation Curve



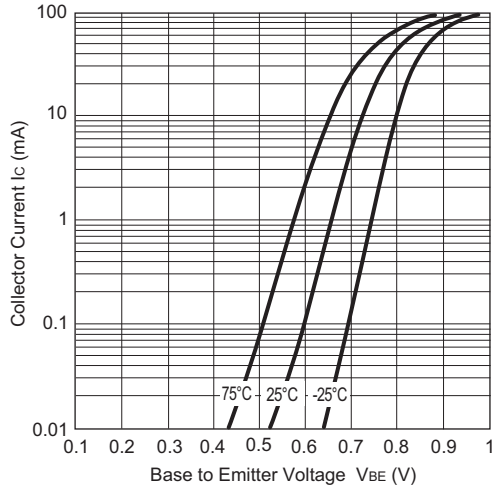
Typical Output Characteristics (1)



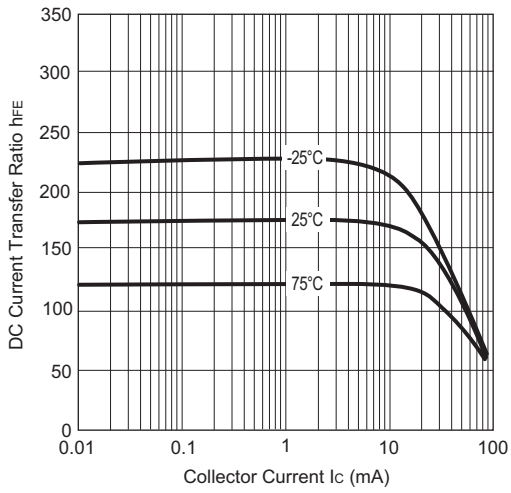
Typical Output Characteristics (2)



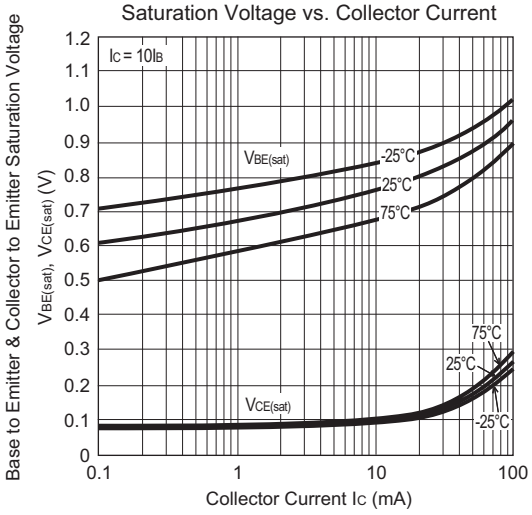
Typical Transfer Characteristics

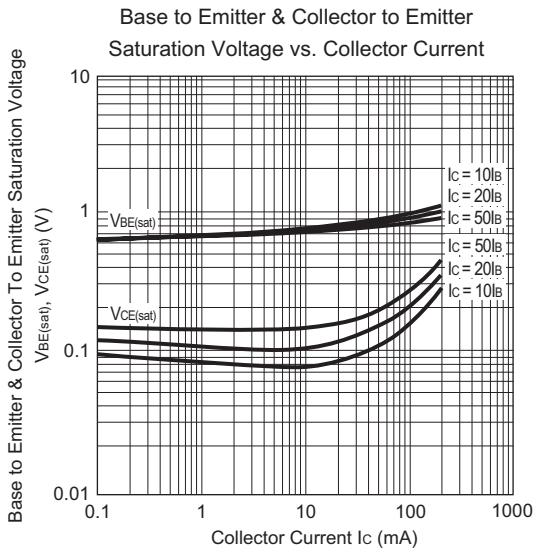


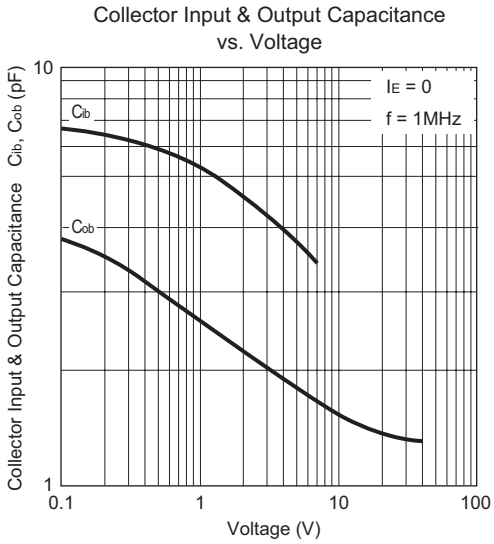
DC Current Transfer Ratio vs. Collector Current

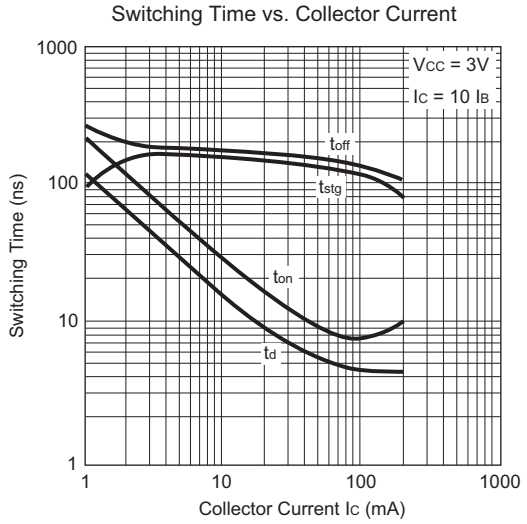


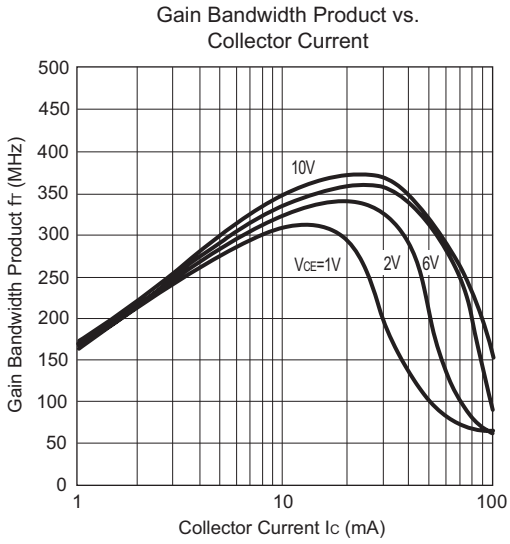
Base to Emitter & Collector to Emitter Saturation Voltage vs. Collector Current











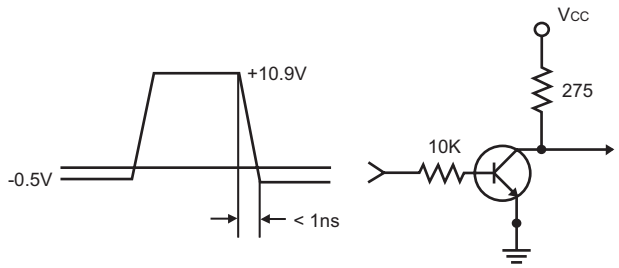


Figure 1 Delay and rise time equivalent test circuit

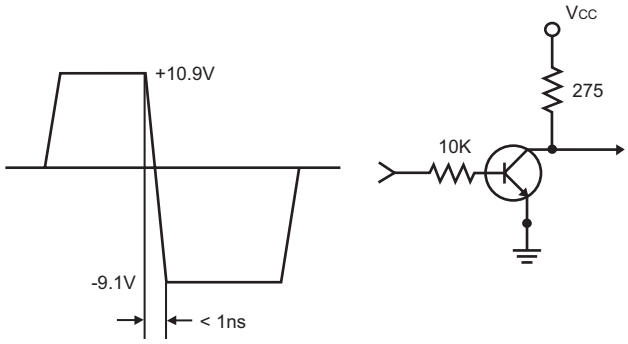
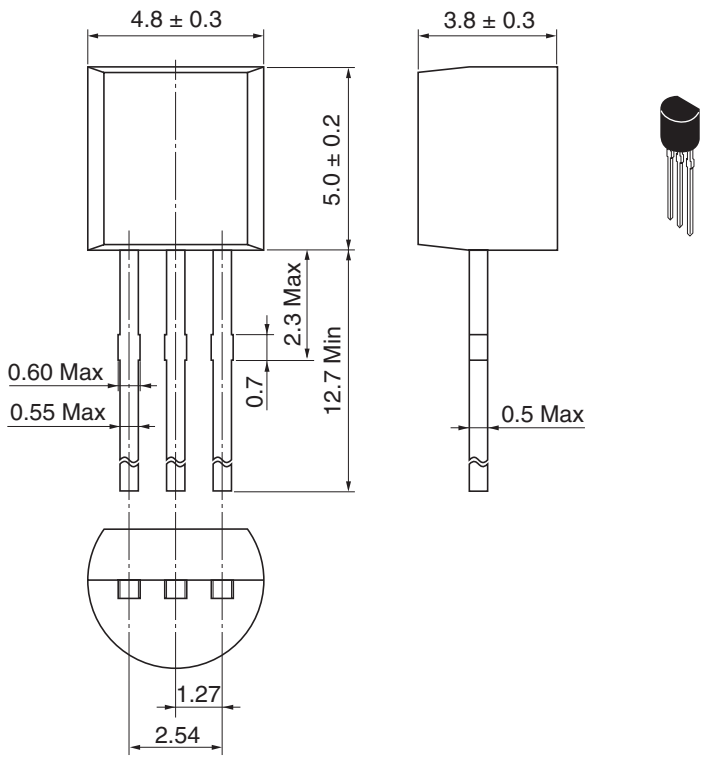


Figure 2 Storage and fall time equivalent test circuit

Package Dimensions

As of January, 2003

Unit: mm



Package Code	TO-92 (1)
JEDEC	Conforms
JEITA	Conforms
Mass (reference value)	0.25 g

Ordering Information

Part Name	Quantity	Shipping Container
2N3904	2500pcs	Radial Taping (Hold Box)

Note: For some grades, production may be terminated. Please contact the Renesas sales office to check the state of production before ordering the product.

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