

# 2N3904

## Silicon NPN Epitaxial General Purpose Amplifier

REA03G0001-0200Z

Rev.2.00

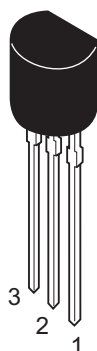
Jul.22.2004

### 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)

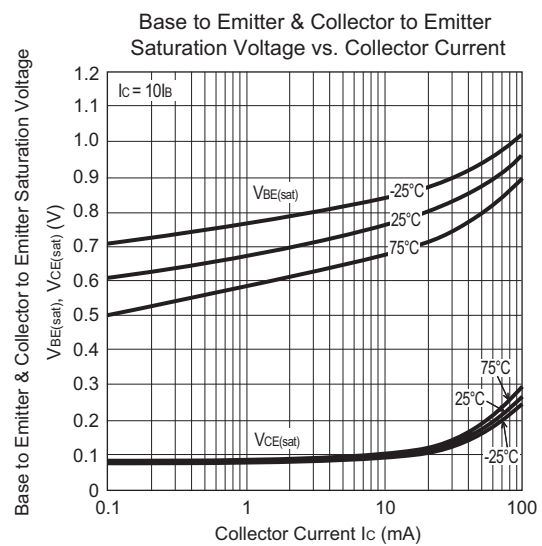
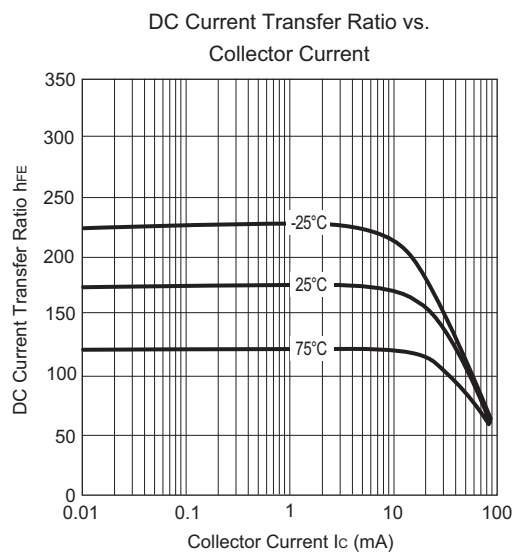
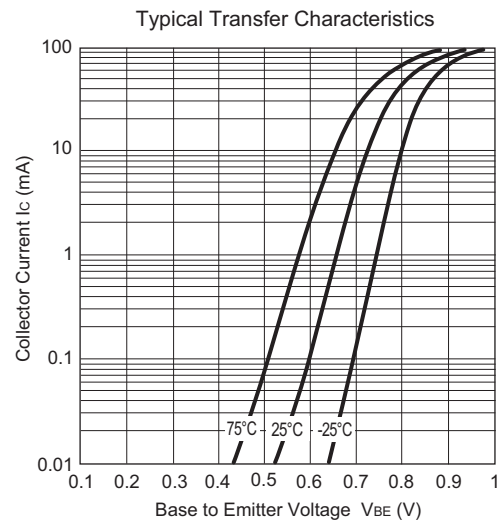
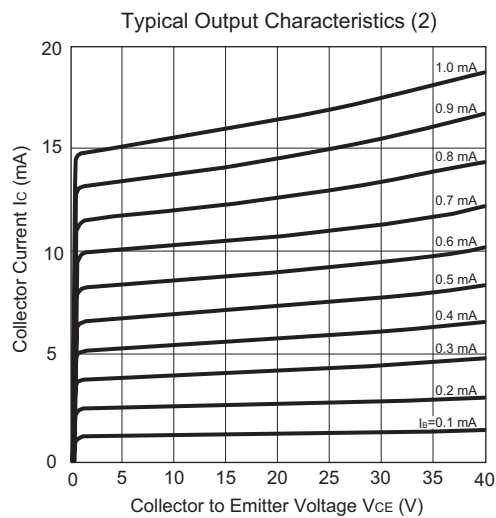
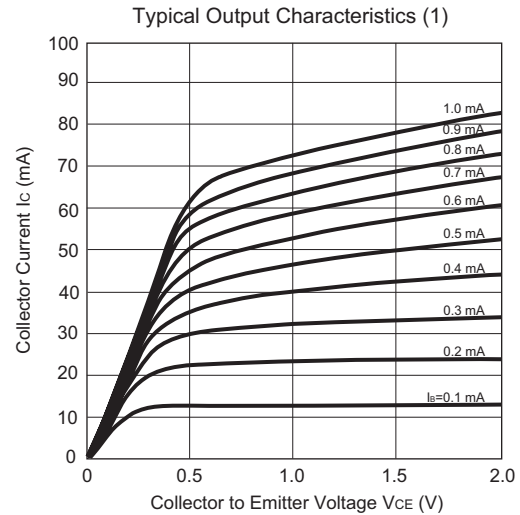
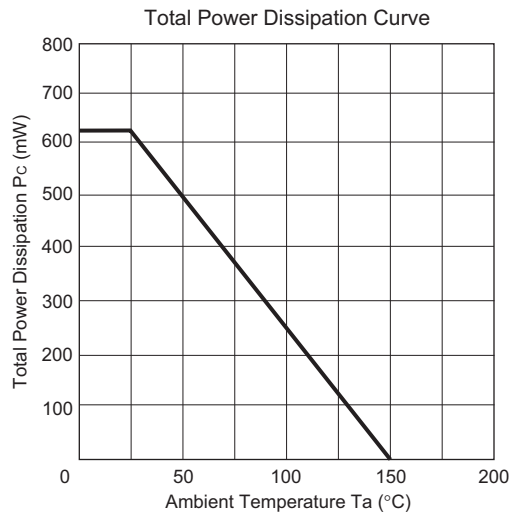
Item	Symbol	Ratings	Unit
Collector to base voltage	$V_{CBO}$	60	V
Collector to emitter voltage	$V_{CEO}$	40	V
Emitter to base voltage	$V_{EBO}$	6	V
Collector current	$I_C$	200	mA
Total power dissipation	$P_C$	625	mW
Junction temperature	$T_j$	150	°C
Storage temperature	$T_{stg}$	-55 to +150	°C

## Electrical Characteristics

(Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Collector to base breakdown voltage	$V_{(BR)CBO}$	60	—	—	V	$I_C = 10\ \mu A$ , $I_E = 0$
Collector to emitter breakdown voltage	$V_{(BR)CEO}$	40	—	—	V	$I_C = 1\ mA$ , $R_{BE} = \infty$
Emitter to base breakdown voltage	$V_{(BR)EBO}$	6	—	—	V	$I_E = 10\ \mu A$ , $I_C = 0$
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	—	—	—	$V_{CE} = 1\ V$ , $I_C = 100\ \mu A$
		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	$V_{CE} = 5\ V$ , $I_C = 0.1\ mA$ , $f = 1\ MHz$ , $R_g = 1\ k\Omega$

## Main Characteristics



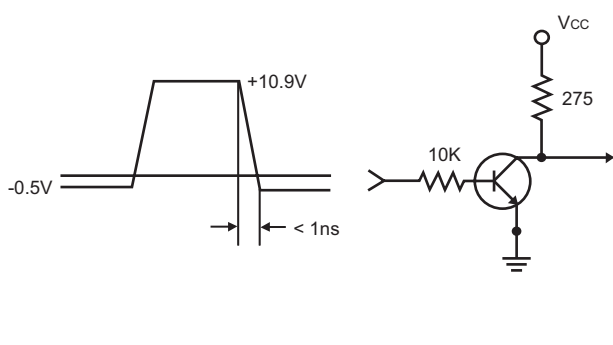
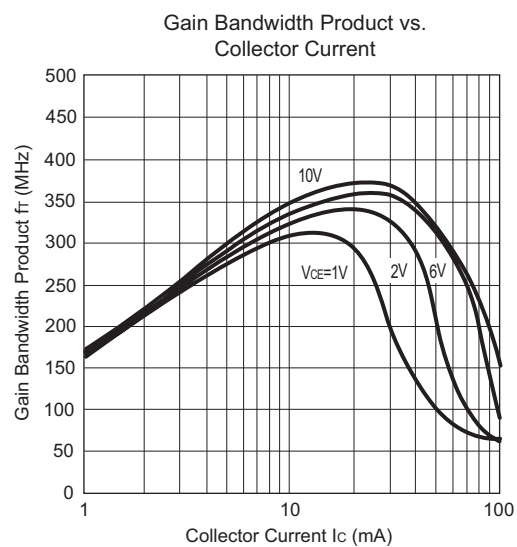
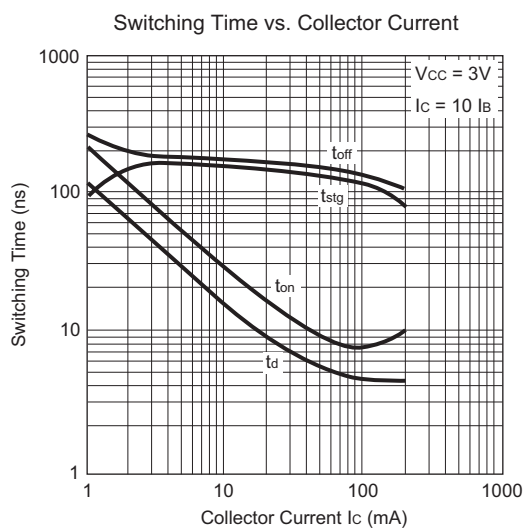
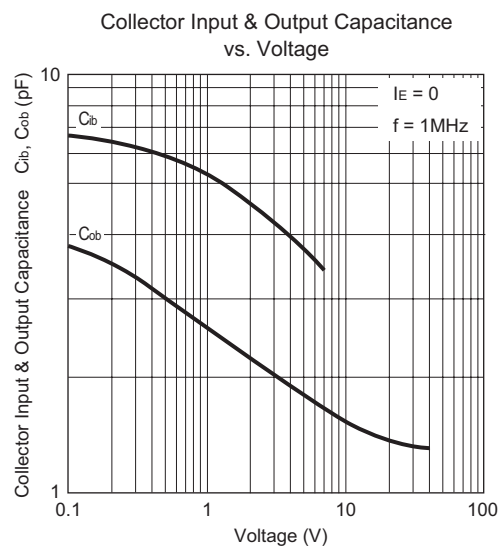
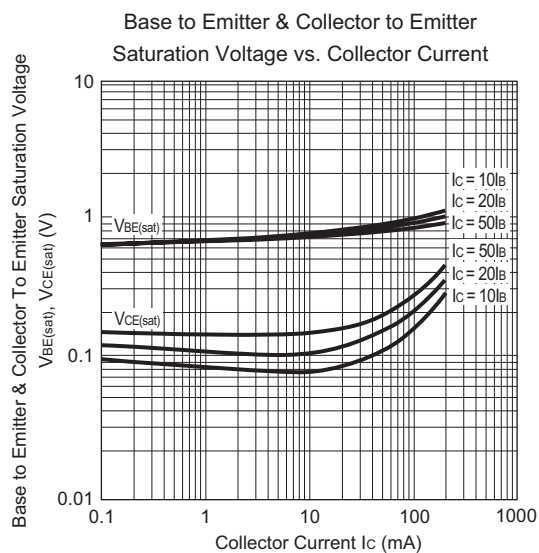


Figure 1 Delay and rise time equivalent test circuit

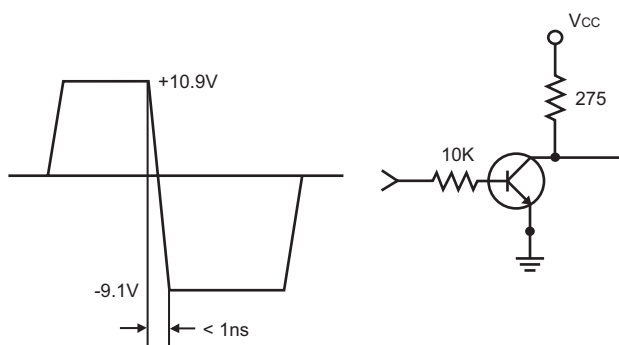
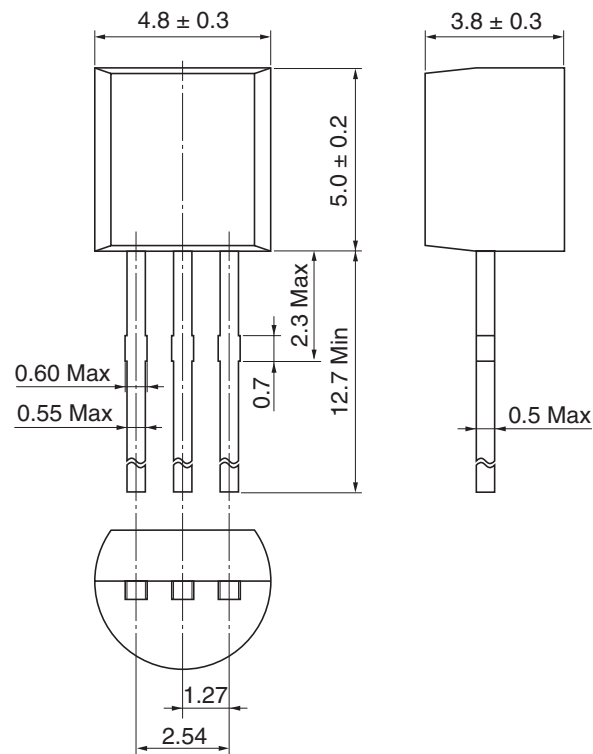


Figure 2 Storage and fall time equivalent test circuit

## 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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