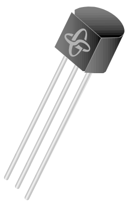
GENERAL SEMICONDUCTOR®

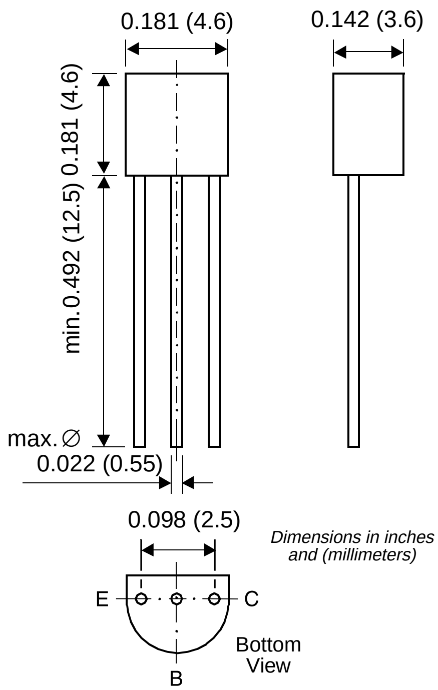
2N3904

Small Signal Transistor (NPN)



New Product

TO-226AA (TO-92)



Features

- NPN Silicon Epitaxial Planar Transistor for switching and amplifier applications.
- As complementary type, the PNP transistor 2N3906 is recommended.
- On special request, this transistor is also manufactured in the pin configuration TO-18.
- This transistor is also available in the SOT-23 case with the type designation MMBT3904.

Mechanical Data

Case: TO-92 Plastic Package

Weight: approx. 0.18g

Packaging Codes/Options:

E6/Bulk - 5K per container

E7/4K per Ammo tape

Maximum Ratings & Thermal Characteristics

Ratings at 25°C ambient temperature unless otherwise specified.

Parameters		Symbols	Value	Units
Collector-Emitter Voltage		V_{CEO}	40	V
Collector-Base Voltage		V_{CBO}	60	V
Emitter-Base Voltage		V_{EBO}	6.0	V
Collector Current		I_C	200	mA
Power Dissipation	T_A = 25°C T_C = 25°C	P_{tot}	625 1.5	mW W
Thermal Resistance Junction to Ambient Air		$R_{\Theta JA}$	250(1)	°C/W
Junction Temperature		T_j	150	°C
Storage Temperature Range		T_S	– 65 to +150	°C

Notes:
(1) Valid provided that leads are kept at ambient temperature.

GENERAL SEMICONDUCTOR®

2N3904

Small Signal Transistor (NPN)

Electrical Characteristics (T_J = 25°C unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	I_C = 10 µA, I_E = 0	60	—	—	V
Collector-Emitter Breakdown Voltage[(1)]	$V_{(BR)CEO}$	I_C = 1 mA, I_B = 0	40	—	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	I_E = 10 µA, I_C = 0	6	—	—	V
Collector Saturation Voltage	V_{CEsat}	I_C = 10 mA, I_B = 1 mA I_C = 50 mA, I_B = 5 mA	— —	— —	0.2 0.3	V
Base Saturation Voltage	V_{BEsat}	I_C = 10 mA, I_B = 1 mA I_C = 50 mA, I_B = 5 mA	— —	— —	0.85 0.95	V
Collector-Emitter Cutoff Current	I_{CEV}	V_{EB} = 3 V, V_{CE} = 30 V	—	—	50	nA
Emitter-Base Cutoff Current	I_{EBV}	V_{EB} = 3 V, V_{CE} = 30 V	—	—	50	nA
DC Current Gain	h_{FE}	V_{CE} = 1 V, I_C = 0.1 mA V_{CE} = 1 V, I_C = 1 mA V_{CE} = 1 V, I_C = 10 mA V_{CE} = 1 V, I_C = 50 mA V_{CE} = 1 V, I_C = 100 mA	40 70 100 60 30	— — 300 — —	— — — — —	—
Input Impedance	h_{ie}	V_{CE} = 10 V, I_C = 1 mA f = 1 kHz	1	—	10	kΩ
Voltage Feedback Ratio	h_{re}	V_{CE} = 10 V, I_C = 1 mA f = 1 kHz	$0.5 \bullet 10^{-4}$	—	$8 \bullet 10^{-4}$	—
Gain-Bandwidth Product	f_T	V_{CE} = 20 V, I_C = 10 mA f = 100 MHz	300	—	—	MHz
Collector-Base Capacitance	C_{CBO}	V_{CB} = 5 V, f = 100 kHz	—	—	4	pF
Emitter-Base Capacitance	C_{EBO}	V_{CB} = 0.5 V, f = 100 kHz	—	—	8	pF
Small Signal Current Gain	h_{fe}	V_{CE} = 10 V, I_C = 1 mA, f = 1 kHz	100	—	400	—
Output Admittance	h_{oe}	V_{CE} = 1 V, I_C = 1 mA, f = 1 kHz	1	—	40	µS
Noise Figure	NF	V_{CE} = 5 V, I_C = 100 µA, R_G = 1 kΩ, f = 10...15000 kHz	—	—	5	dB
Delay Time (see fig. 1)	t_d	I_{B1} = 1 mA, I_C = 10 mA	—	—	35	ns
Rise Time (see fig. 1)	t_r	I_{B1} = 1 mA, I_C = 10 mA	—	—	35	ns
Storage Time (see fig. 2)	t_s	$-I_{B1}$ = I_{B2} = 1 mA I_C = 10 mA	—	—	200	ns
Fall Time (see fig. 2)	t_f	$-I_{B1}$ = I_{B2} = 1 mA I_C = 10 mA	—	—	50	ns

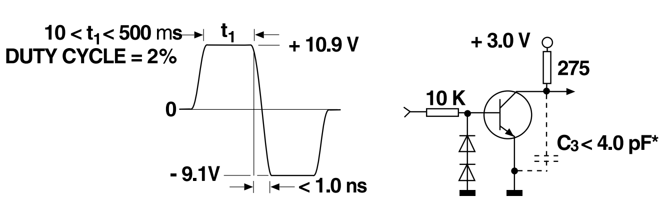


Fig. 1: Test circuit for delay and rise time
* total shunt capacitance of test jig and connectors

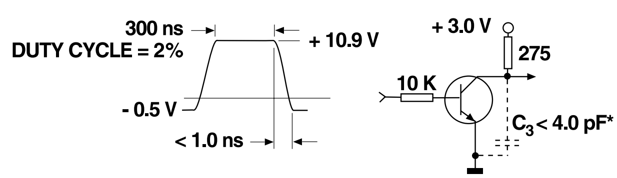


Fig. 2: Test circuit for storage and fall time
* total shunt capacitance of test jig and connectors