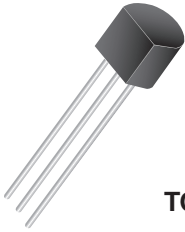
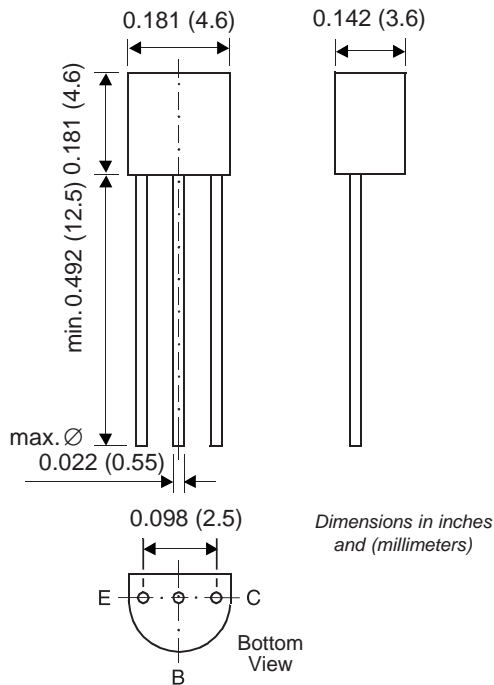


Small Signal Transistor (NPN)


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, 20K/box

E7/4K per Ammo mag., 20K/box

Maximum Ratings & Thermal Characteristics Ratings at 25°C ambient temperature unless otherwise specified.

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CE0}	40	V
Collector-Base Voltage	V_{CB0}	60	V
Emitter-Base Voltage	V_{EB0}	6.0	V
Collector Current	I_C	200	mA
Power Dissipation	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

Note:

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

Electrical Characteristics ($T_J = 25^\circ\text{C}$ unless otherwise noted)

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

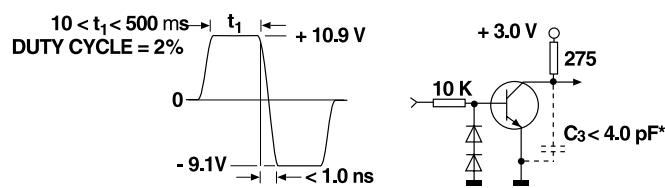


Fig. 1: Test circuit for delay and rise time
* total shunt capacitance of test jig and connectors

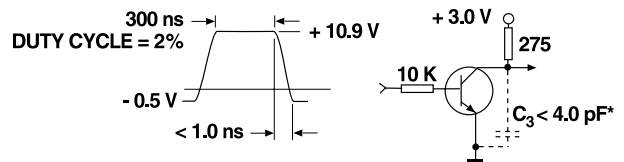


Fig. 2: Test circuit for storage and fall time
* total shunt capacitance of test jig and connectors