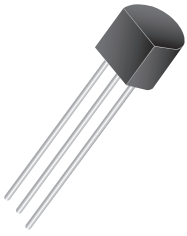
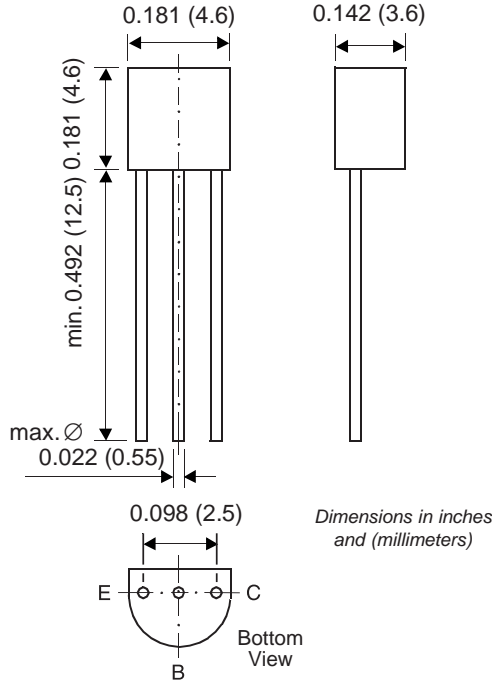




Small Signal Transistor (NPN)



TO-226AA (TO-92)



Features

- NPN Silicon Epitaxial Planar Transistor for switching and amplifier applications.
- 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 MMBT2222A.

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-Base Voltage	V _{CB0}	75	V
Collector-Emitter Voltage	V _{CEO}	40	V
Emitter-Base Voltage	V _{EB0}	6.0	V
Collector Current	I _C	600	mA
Power Dissipation <small>T_A = 25°C Derate above 25°C</small>	P _{tot}	625 5.0	mW mW/°C
Power Dissipation <small>T_C = 25°C Derate above 25°C</small>	P _{tot}	1.5 12	W mW/°C
Thermal Resistance Junction to Ambient Air	R _{θJA}	200	°C/W
Thermal Resistance Junction to Case	R _{θJC}	83.3	°C/W
Junction Temperature	T _j	150	°C
Storage Temperature Range	T _s	-55 to +150	°C

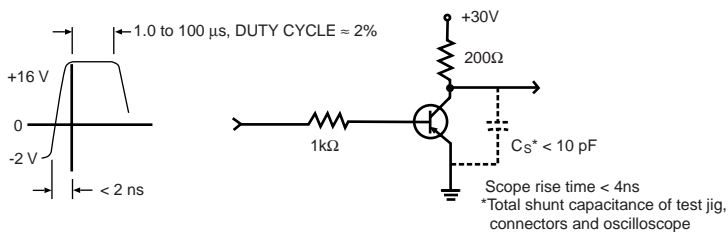
Electrical Characteristics ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
DC Current Gain	h_{FE}	$V_{CE} = 10\text{ V}, I_C = 0.1\text{ mA}$	35	—	—	—
		$V_{CE} = 10\text{ V}, I_C = 1\text{ mA}$	50	—	—	
		$V_{CE} = 10\text{ V}, I_C = 10\text{ mA}$	75	—	—	
		$V_{CE} = 10\text{ V}, I_C = 10\text{ mA}$ $T_A = -55^\circ\text{C}$	35	—	—	
		$V_{CE} = 10\text{ V}, I_C = 150\text{ mA}^{(1)}$	100	—	300	
		$V_{CE} = 1.0\text{ V}, I_C = 150\text{ mA}^{(1)}$	50	—	—	
		$V_{CE} = 10\text{ V}, I_C = 500\text{ mA}^{(1)}$	40	—	—	
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 10\text{ }\mu\text{A}, I_E = 0$	75	—	—	V
Collector-Emitter Breakdown Voltage ⁽¹⁾	$V_{(BR)CEO}$	$I_C = 10\text{ mA}, I_B = 0$	40	—	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\text{ }\mu\text{A}, I_C = 0$	6.0	—	—	V
Collector-Emitter Saturation Voltage ⁽¹⁾	V_{CEsat}	$I_C = 150\text{ mA}, I_B = 15\text{ mA}$	—	—	0.3	V
		$I_C = 500\text{ mA}, I_B = 50\text{ mA}$	—	—	1.0	
Base-Emitter Saturation Voltage ⁽¹⁾	V_{BEsat}	$I_C = 150\text{ mA}, I_B = 15\text{ mA}$	0.6	—	1.2	V
		$I_C = 500\text{ mA}, I_B = 50\text{ mA}$	—	—	2.0	
Collector Cut-off Current	I_{CEV}	$V_{EB} = 3\text{ V}, V_{CE} = 60\text{ V}$	—	—	10	nA
Collector Cut-off Current	I_{CBO}	$V_{CB} = 60\text{ V}, I_E = 0$	—	—	0.01	μA
		$V_{CB} = 50\text{ V}, I_E = 0, T_A = 125^\circ\text{C}$	—	—	10	
Emitter Cut-off Current	I_{EBO}	$V_{EB} = 3\text{ V}, I_C = 0$	—	—	100	nA
Base Cut-off Current	I_{BL}	$V_{CE} = 60\text{ V}, V_{EB} = 3.0\text{ V}$	—	—	20	nA
Input Impedance	h_{ie}	$V_{CE} = 10\text{ V}, I_C = 1\text{ mA},$ $f = 1\text{ kHz}$	2.0	—	8.0	k Ω
		$V_{CE} = 10\text{ V}, I_C = 10\text{ mA},$ $f = 1\text{ kHz}$	0.25	—	1.25	
Voltage Feedback Ratio	h_{re}	$V_{CE} = 10\text{ V}, I_C = 1\text{ mA},$ $f = 1\text{ kHz}$	—	—	$8 \cdot 10^{-4}$	—
		$V_{CE} = 10\text{ V}, I_C = 10\text{ mA},$ $f = 1\text{ kHz}$	—	—	$4 \cdot 10^{-4}$	
Current Gain-Bandwidth Product	f_T	$V_{CE} = 20\text{ V}, I_C = 20\text{ mA}$ $f = 100\text{ MHz}$	300	—	—	MHz
Output Capacitance	C_{OBO}	$V_{CB} = 10\text{ V}, f = 1\text{ MHz}, I_E = 0$	—	—	8.0	pF
Input Capacitance	C_{IBO}	$V_{EB} = 0.5\text{ V}, f = 1\text{ MHz}, I_C = 0$	—	—	25	pF

Note: (1) Pulse test: pulse width $\leq 300\text{ }\mu\text{s}$, cycle $\leq 2\%$

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Output Admittance	h_{oe}	$V_{CE} = 10\text{ V}, I_C = 1\text{ mA}, f = 1\text{ kHz}$	5.0	—	35	μS
		$V_{CE} = 10\text{ V}, I_C = 10\text{ mA}, f = 1\text{ kHz}$	25	—	200	
Small Signal Current Gain	h_{fe}	$V_{CE} = 10\text{ V}, I_C = 1\text{ mA}, f = 1\text{ kHz}$	50	—	300	—
		$V_{CE} = 10\text{ V}, I_C = 10\text{ mA}, f = 1\text{ kHz}$	75	—	375	
Collector Base Time Constant	$r_b' C_C$	$I_E = 20\text{ mA}, V_{CB} = 20\text{ V}, f = 31.8\text{ MHz}$	—	—	150	ps
Noise Figure	NF	$V_{CE} = 10\text{ V}, I_C = 100\text{ }\mu\text{A}, R_S = 1\text{ k}\Omega, f = 1\text{ kHz}$	—	—	4.0	dB
Delay Time (see Fig. 1)	t_d	$I_{B1} = 15\text{ mA}, I_C = 150\text{ mA}, V_{CC} = 30\text{ V}, V_{BE} = -0.5\text{ V}$	—	—	10	ns
Rise Time (see Fig. 1)	t_r	$I_{B1} = 15\text{ mA}, I_C = 150\text{ mA}, V_{CC} = 30\text{ V}, V_{BE} = -0.5\text{ V}$	—	—	25	ns
Storage Time (see Fig. 2)	t_s	$I_{B1} = I_{B2} = 15\text{ mA}, I_C = 150\text{ mA}, V_{CC} = 30\text{ V}$	—	—	225	ns
Fall Time (see Fig. 2)	t_f	$I_{B1} = I_{B2} = 1\text{ mA}, I_C = 10\text{ mA}, V_{CC} = 30\text{ V}$	—	—	60	ns

Switching Time Equivalent Test Circuit
Figure 1 - Turn-On Time

Figure 2 - Turn-Off Time
