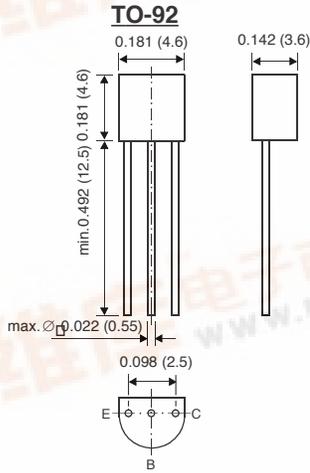


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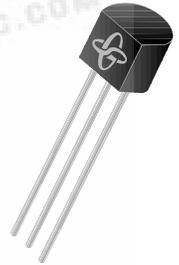
SMALL SIGNAL TRANSISTORS (NPN)



Dimensions in inches and (millimeters)

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

MAXIMUM RATINGS AND THERMAL CHARACTERISTICS

Ratings at 25°C ambient temperature unless otherwise specified

	SYMBOL	VALUE	UNIT
Collector-Base Voltage	V _{CBO}	75	Volts
Collector-Emitter Voltage	V _{CEO}	40	Volts
Emitter-Base Voltage	V _{EBO}	6.0	Volts
Collector Current-Continuous	I _C	600	mA
Power Dissipation at T _A =25°C Derate above 25°C	P _{tot}	625 5.0	mW mW/°C
Power Dissipation at T _C =25°C Derate above 25°C	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

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ELECTRICAL CHARACTERISTICS

Ratings at 25°C ambient temperature unless otherwise specified

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

NOTES

(1) Pulse test: Pulse width $\leq 300\mu\text{s}$ - Duty cycle $\leq 2\%$

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ELECTRICAL CHARACTERISTICS

Ratings at 25°C ambient temperature unless otherwise specified

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

SWITCHING TIME EQUIVALENT TEST CIRCUIT

FIGURE 1 - TURN-ON TIME

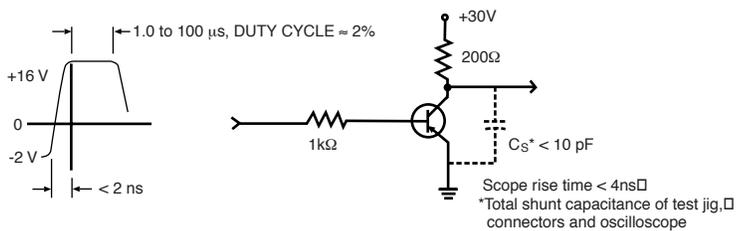


FIGURE 2 - TURN-OFF TIME

