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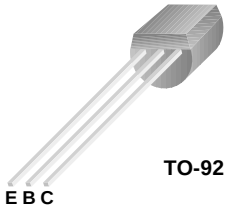
SEMICONDUCTOR®

PN2222A MMBT2222A PZT2222A



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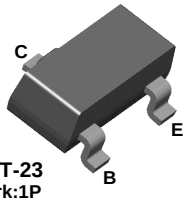

SOT-23
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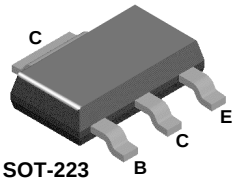


SOT-223

NPN General Purpose Amplifier

- This device is for use as a medium power amplifier and switch requiring collector currents up to 500mA.
- Sourced from process 19.

Absolute Maximum Ratings * T_a=25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	40	V
V_{CBO}	Collector-Base Voltage	75	V
V_{EBO}	Emitter-Base Voltage	6.0	V
I_C	Collector Current	1.0	A
T_{STG}	Operating and Storage Junction Temperature Range	- 55 ~ 150	°C

* These ratings are limiting values above which the serviceability of any semiconductor device may be impaired

NOTES:
1) These ratings are based on a maximum junction temperature of 150 degrees C.
2) These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations

Electrical Characteristics T_a=25°C unless otherwise noted

Symbol	Parameter	Test Condition	Min.	Max.	Units
Off Characteristics					
$BV_{(BR)CEO}$	Collector-Emitter Breakdown Voltage *	I_C = 10mA, I_B = 0	40		V
$BV_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 10μA, I_E = 0	75		V
$BV_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 10μA, I_C = 0	6.0		V
I_{CEX}	Collector Cutoff Current	V_{CE} = 60V, $V_{EB(off)}$ = 3.0V		10	nA
I_{CBO}	Collector Cutoff Current	V_{CB} = 60V, I_E = 0 V_{CB} = 60V, I_E = 0, T_a = 125°C		0.01 10	μA μA
I_{EBO}	Emitter Cutoff Current	V_{EB} = 3.0V, I_C = 0		10	μA
I_{BL}	Base Cutoff Current	V_{CE} = 60V, $V_{EB(off)}$ = 3.0V		20	μA
On Characteristics					
h_{FE}	DC Current Gain	I_C = 0.1mA, V_{CE} = 10V I_C = 1.0mA, V_{CE} = 10V I_C = 10mA, V_{CE} = 10V I_C = 10mA, V_{CE} = 10V, T_a = -55°C I_C = 150mA, V_{CE} = 10V * I_C = 150mA, V_{CE} = 10V * I_C = 500mA, V_{CE} = 10V *	35 50 75 35 100 50 40	 300 	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage *	I_C = 150mA, V_{CE} = 10V I_C = 500mA, V_{CE} = 10V		0.3 1.0	V V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage *	I_C = 150mA, V_{CE} = 10V I_C = 500mA, V_{CE} = 10V	0.6	1.2 2.0	V V

* Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2.0%

Electrical Characteristics Ta=25°C unless otherwise noted (Continued)

Symbol	Parameter	Test Condition	Min.	Max.	Units
Small Signal Characteristics					
f_T	Current Gain Bandwidth Product	I_C = 20mA, V_{CE} = 20V, f = 100MHz	300		MHz
C_{obo}	Output Capacitance	V_{CB} = 10V, I_E = 0, f = 1MHz		8.0	pF
C_{ibo}	Input Capacitance	V_{EB} = 0.5V, I_C = 0, f = 1MHz		25	pF
$rb'C_c$	Collector Base Time Constant	I_C = 20mA, V_{CB} = 20V, f = 31.8MHz		150	pS
NF	Noise Figure	I_C = 100µA, V_{CE} = 10V, R_S = 1.0KΩ, f = 1.0KHz		4.0	dB
$Re(h_{ie})$	Real Part of Common-Emitter High Frequency Input Impedance	I_C = 20mA, V_{CE} = 20V, f = 300MHz		60	Ω
Switching Characteristics					
t_d	Delay Time	V_{CC} = 30V, $V_{EB(off)}$ = 0.5V, I_C = 150mA, I_{B1} = 15mA		10	ns
t_r	Rise Time			25	ns
t_s	Storage Time	V_{CC} = 30V, I_C = 150mA, I_{B1} = I_{B2} = 15mA		225	ns
t_f	Fall Time			60	ns

Thermal Characteristics T_a=25°C unless otherwise noted

Symbol	Parameter	Max.			Units
		PN2222A	*MMBT2222A	**PZT2222A	
P_D	Total Device Dissipation Derate above 25°C	625 5.0	350 2.8	1,000 8.0	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3			°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	357	125	°C/W

* Device mounted on FR-4 PCB 1.6" × 1.6" × 0.06".
** Device mounted on FR-4 PCB 36mm × 18mm × 1.5mm; mounting pad for the collector lead min. 6cm^2.

Spice Model

NPN (Is = 14.34f Xti = 3 Eg = 1.11 Vaf = 74.03 Bf = 255.9 Ne = 1.307 Ise = 14.34 Ikf = .2847 Xtb = 1.5 Br = 6.092 Isc = 0 Ikr = 0 Rc = 1 Cjc = 7.306p Mjc = .3416 Vjc = .75 Fc = .5 Cje = 22.01p Mje = .377 Vje = .75 Tr = 46.91n Tf = 411.1p Itf = .6 Vtf = 1.7 Xtf = 3 Rb = 10)

Typical Characteristics

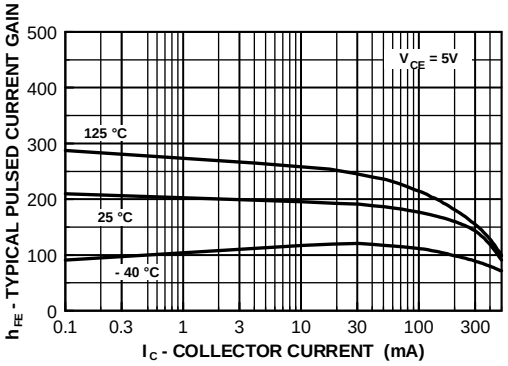


Figure 1. Typical Pulsed Current Gain vs Collector Current

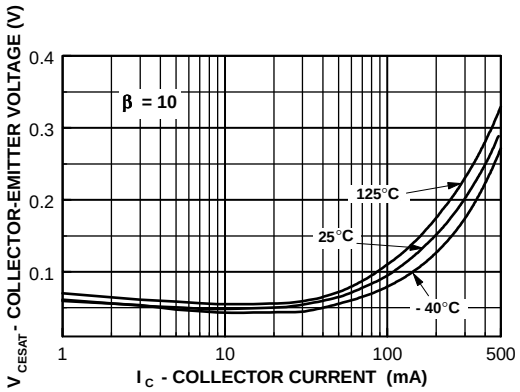


Figure 2. Collector-Emitter Saturation Voltage vs Collector Current

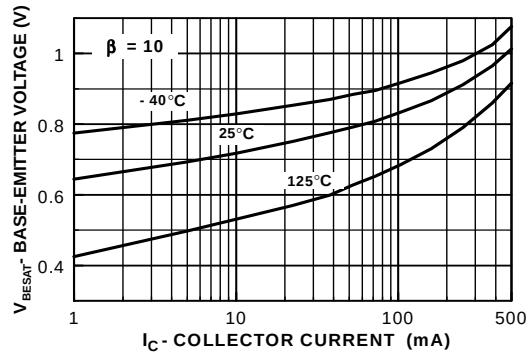


Figure 3. Base-Emitter Saturation Voltage vs Collector Current

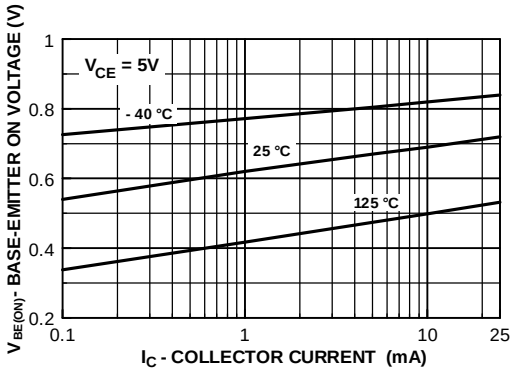


Figure 4. Base-Emitter On Voltage vs Collector Current

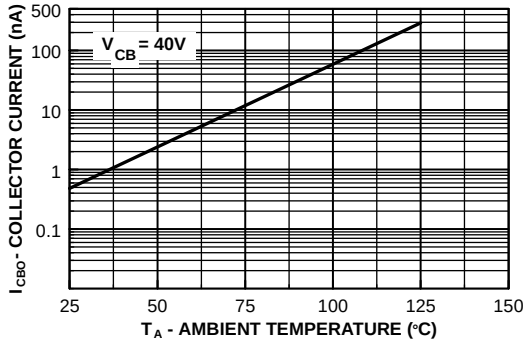


Figure 5. Collector Cutoff Current vs Ambient Temperature

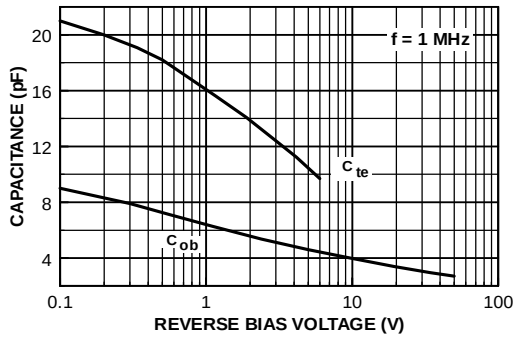


Figure 6. Emitter Transition and Output Capacitance vs Reverse Bias Voltage

Typical Characteristics

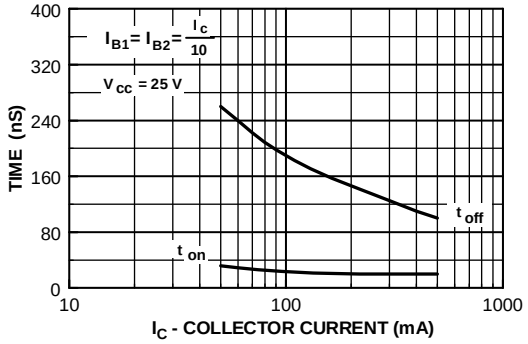


Figure 7. Turn On and Turn Off Times vs Collector Current

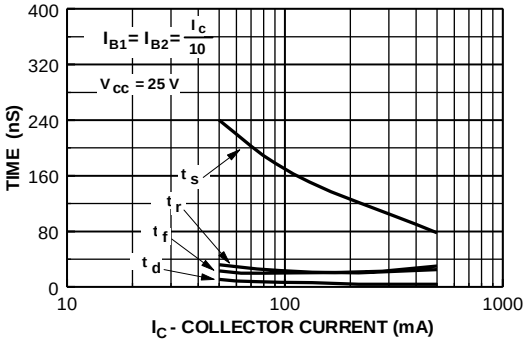


Figure 8. Switching Times vs Collector Current

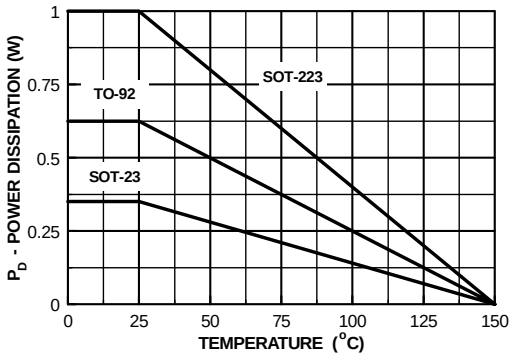


Figure 9. Power Dissipation vs Ambient Temperature

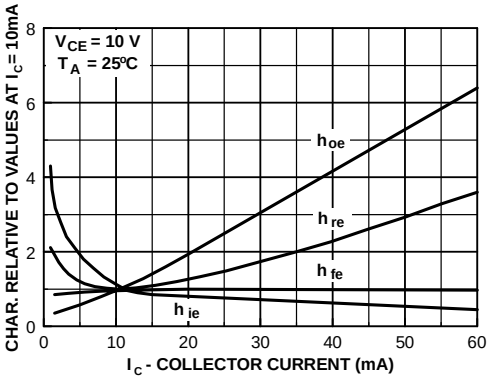


Figure 10. Common Emitter Characteristics

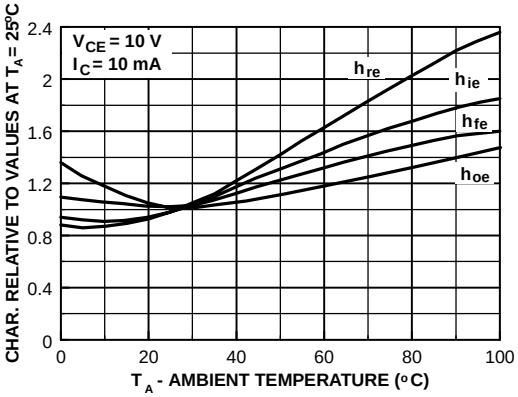


Figure 11. Common Emitter Characteristics

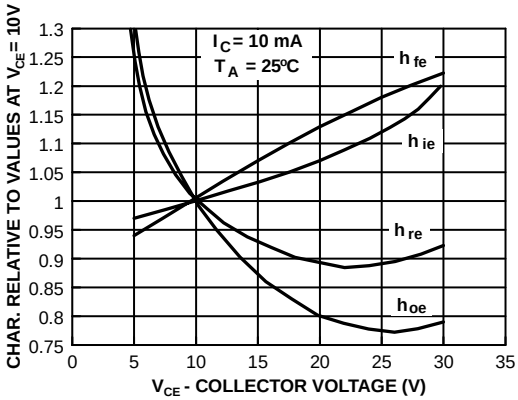
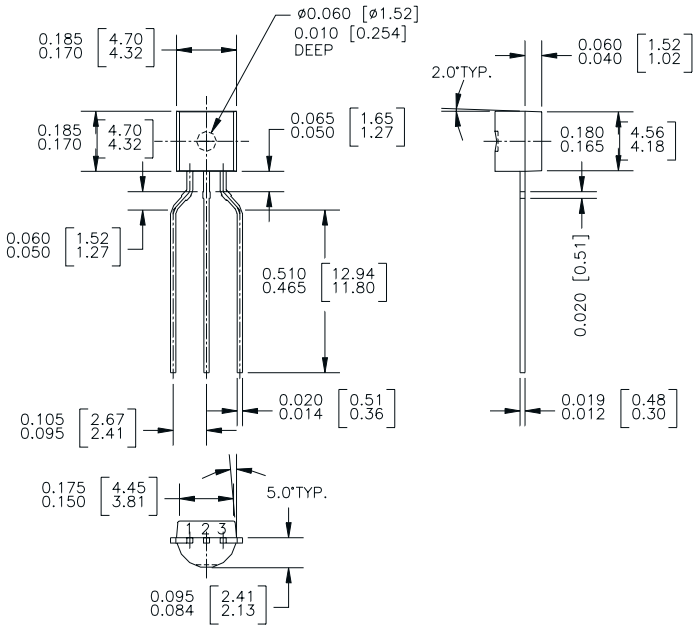


Figure 12. Common Emitter Characteristics

Package Dimensions

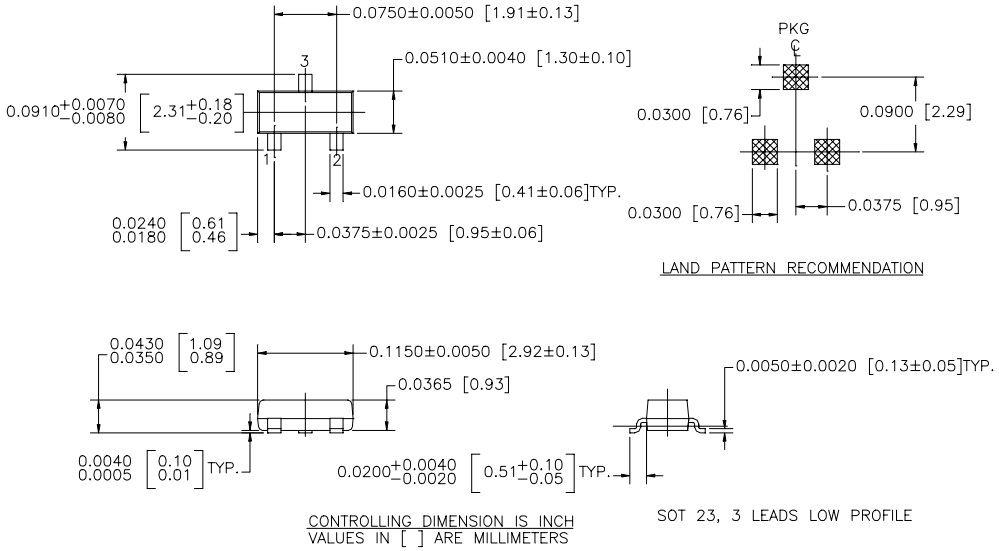
TO-92



Dimensions in Millimeters

Package Dimensions (Continued)

SOT-23



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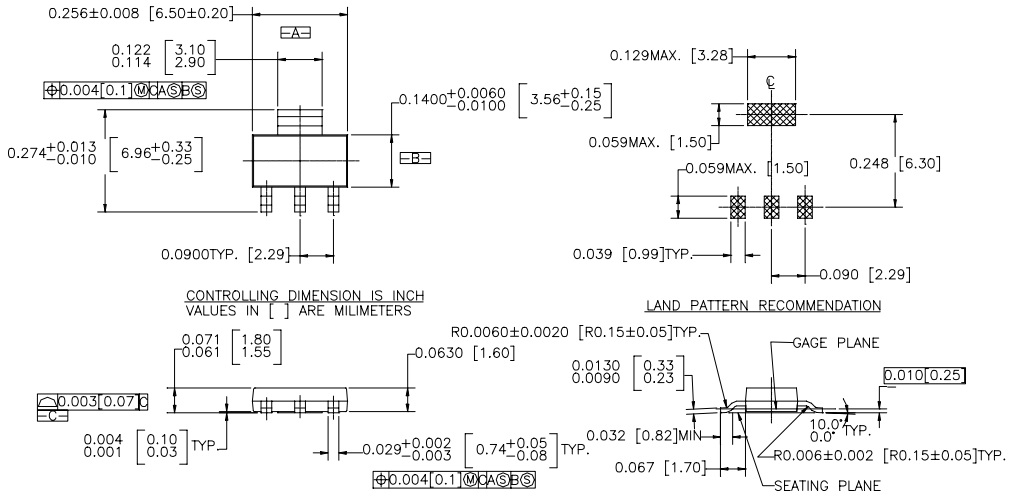
2. REFERENCE JEDEC REGISTRATION TO−236, VARIATION AB, ISSUE G, DATED JUL 1993

Dimensions in Millimeters

Package Dimensions (Continued)

SOT-223



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2. REFERENCE JEDEC REGISTRATION TO−261, VARIATION AA, ISSUE A, DATED JAN 1990

SOT223, 4 LEADS

Dimensions in Millimeters

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