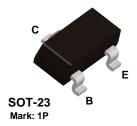


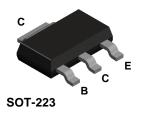
PN2222A

MMBT2222A

PZT2222A

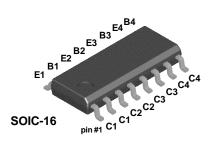


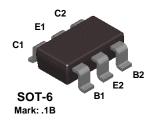




MMPQ2222

NMT2222





NPN General Purpose Amplifier

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

Absolute Maximum Ratings*

TA = 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 - Continuous		A	
T _J , T _{stg}	Operating and Storage Junction Temperature Range	-55 to +150	°C	

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

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.

(continued)

25

225

60

ns

ns

Symbol	Parameter	Test Conditions	Min	Max	Units
OFF CHA	ARACTERISTICS				
V _{(BR)CEO}	Collector-Emitter Breakdown Voltage*	$I_{C} = 10 \text{ mA}, I_{B} = 0$	40		V
V _{(BR)CBO}	Collector-Base Breakdown Voltage	$I_{C} = 10 \mu\text{A}, I_{E} = 0$	75		V
V _{(BR)EBO}	Emitter-Base Breakdown Voltage	$I_E = 10 \mu\text{A}, I_C = 0$	6.0		V
I _{CEX}	Collector Cutoff Current	$V_{CE} = 60 \text{ V}, V_{EB(OFF)} = 3.0 \text{ V}$		10	nA
I _{CBO}	Collector Cutoff Current	V _{CB} = 60 V, I _E = 0		0.01	μА
		$V_{CB} = 60 \text{ V}, I_{E} = 0, T_{A} = 150^{\circ}\text{C}$		10	μA
I _{EBO}	Emitter Cutoff Current	$V_{EB} = 3.0 \text{ V}, I_{C} = 0$		10	nA
I _{BL}	Base Cutoff Current	$V_{CE} = 60 \text{ V}, V_{EB(OFF)} = 3.0 \text{ V}$		20	nA
ON CHAF	RACTERISTICS DC Current Gain	I _C = 0.1 mA, V _{CE} = 10 V	35		1
		$ \begin{split} &I_C = 1.0 \text{ mA, V}_{CE} = 10 \text{ V} \\ &I_C = 10 \text{ mA, V}_{CE} = 10 \text{ V} \\ &I_C = 10 \text{ mA, V}_{CE} = 10 \text{ V, T}_{A} = \text{-}55^{\circ}\text{C} \\ &I_C = 150 \text{ mA, V}_{CE} = 10 \text{ V*} \\ &I_C = 150 \text{ mA, V}_{CE} = 1.0 \text{ V*} \\ &I_C = 500 \text{ mA, V}_{CE} = 10 \text{ V*} \end{split} $	50 75 35 100 50 40	300	
$V_{\text{CE(sat)}}$	Collector-Emitter Saturation Voltage*	$I_C = 150 \text{ mA}, I_B = 15 \text{ mA}$ $I_C = 500 \text{ mA}, I_B = 50 \text{ mA}$		0.3 1.0	V V
V _{BE(sat)}	Base-Emitter Saturation Voltage*	$I_C = 150 \text{ mA}, I_B = 15 \text{ mA}$ $I_C = 500 \text{ mA}, I_B = 50 \text{ mA}$	0.6	1.2 2.0	V
SMALL S	IGNAL CHARACTERISTICS (except MMPQ2222 and NMT2222)			
f _T	Current Gain - Bandwidth Product	$I_C = 20 \text{ mA}, V_{CE} = 20 \text{ V}, f = 100 \text{ MHz}$	300		MHz
C _{obo}	Output Capacitance	$V_{CB} = 10 \text{ V}, I_{E} = 0, f = 100 \text{ kHz}$		8.0	pF
C _{ibo}	Input Capacitance	$V_{EB} = 0.5 \text{ V}, I_{C} = 0, f = 100 \text{ kHz}$		25	pF
rb'C _C	Collector Base Time Constant	$I_C = 20 \text{ mA}, V_{CB} = 20 \text{ V}, f = 31.8 \text{ MHz}$		150	pS
NF	Noise Figure	$I_C = 100 \mu A$, $V_{CE} = 10 V$, $R_S = 1.0 k\Omega$, $f = 1.0 kHz$		4.0	dB
Re(h _{ie})	Real Part of Common-Emitter High Frequency Input Impedance	$I_C = 20 \text{ mA}, V_{CE} = 20 \text{ V}, f = 300 \text{ MHz}$		60	Ω
SWITCHI	NG CHARACTERISTICS (exce	ept MMPQ2222 and NMT2222)			
t _d	Delay Time	$V_{CC} = 30 \text{ V}, V_{BE(OFF)} = 0.5 \text{ V},$		10	ns
=	<u> </u>				

*Pulse Test: F	Pulse Width	≤ 300 μs,	Duty (Cycle ≤ 2.0%
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Rise Time

Fall Time

Storage Time

Spice Model

ts

 $t_{\text{f}} \\$

 $NPN \ (Is=14.34f \ Xti=3 \ Eg=1.11 \ Vaf=74.03 \ Bf=255.9 \ Ne=1.307 \ Is=14.34f \ Ikf=.2847 \ Xtb=1.5 \ Br=6.092 \ Nc=2 \ Isc=0 \ Ikr=0 \ Rc=1 \ Cjc=7.306p \ Mjc=.3416 \ Vjc=.75 \ Fc=.5 \ Cje=22.01p \ Mje=.377 \ Vje=.75 \ Tr=46.91n \ Tf=411.1p \ Itf=.6 \ Vtf=1.7 \ Xtf=3 \ Rb=10)$

 I_C = 150 mA, I_{B1} = 15 mA

 $V_{CC} = 30 \text{ V}, I_{C} = 150 \text{ mA},$

 $I_{B1} = I_{B2} = 15 \text{ mA}$

(continued)

Thermal Characteristics

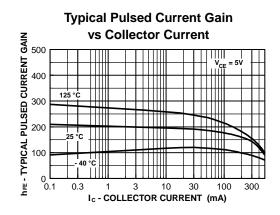
TA = 25°C unless otherwise noted

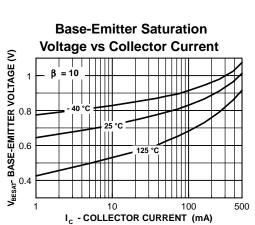
Symbol	Characteristic	Max		Units
		PN2222A	*PZT2222A	
P_D	Total Device Dissipation Derate above 25°C	625 5.0	1,000 8.0	mW mW/∘C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3		°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	125	°C/W

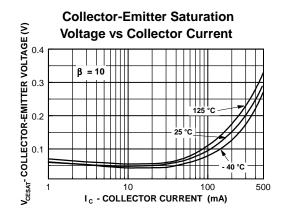
Symbol	Characteristic	Max		Units
		**MMBT2222A	MMPQ2222	
P_D	Total Device Dissipation Derate above 25°C	350 2.8	1,000 8.0	mW mW/°C
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient Effective 4 Die Each Die	357	125 240	°C/W °C/W

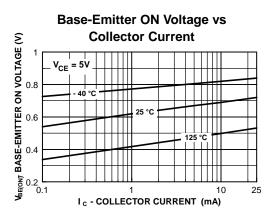
^{*}Device mounted on FR-4 PCB 36 mm X 18 mm X 1.5 mm; mounting pad for the collector lead min. 6 cm².

Typical Characteristics







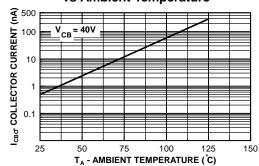


^{**}Device mounted on FR-4 PCB 1.6" X 1.6" X 0.06."

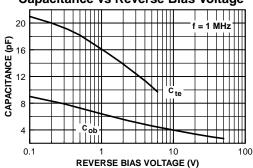
(continued)

Typical Characteristics (continued)

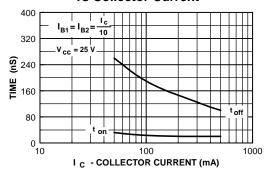
Collector-Cutoff Current vs Ambient Temperature



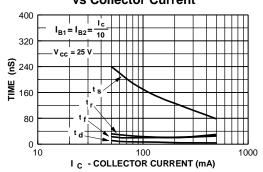
Emitter Transition and Output Capacitance vs Reverse Bias Voltage



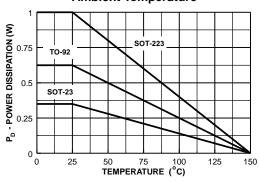
Turn On and Turn Off Times vs Collector Current



Switching Times vs Collector Current



Power Dissipation vs Ambient Temperature



(continued)

Test Circuits

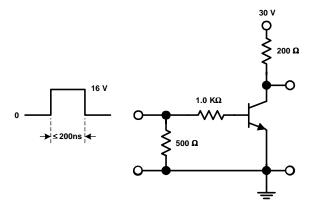


FIGURE 1: Saturated Turn-On Switching Time

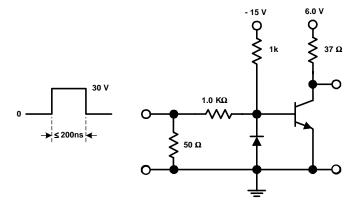


FIGURE 2: Saturated Turn-Off Switching Time

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