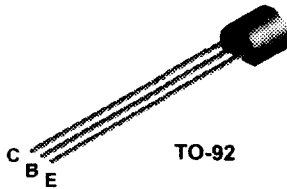
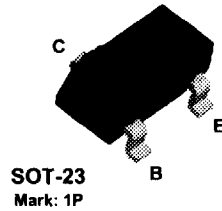


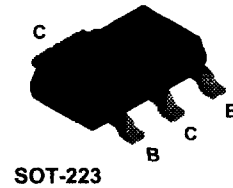
PN2222A



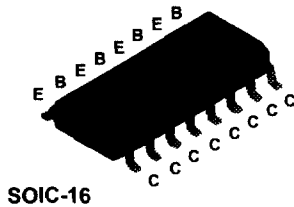
MMBT2222A



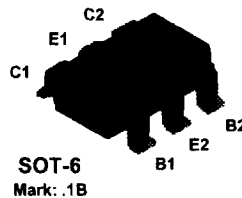
PZT2222A



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	1.0	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.

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.

NPN General Purpose Amplifier

(continued)

Electrical Characteristics

TA = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Max	Units
OFF CHARACTERISTICS					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage*	$I_C = 10 \text{ mA}, I_B = 0$	40		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	$I_C = 10 \text{ }\mu\text{A}, I_E = 0$	75		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	$I_E = 10 \text{ }\mu\text{A}, I_C = 0$	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	$V_{CB} = 60 \text{ V}, I_E = 0$ $V_{CB} = 60 \text{ V}, I_E = 0, T_A = 150^\circ\text{C}$		0.01 10	μA 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 CHARACTERISTICS

h_{FE}	DC Current Gain	$I_C = 0.1 \text{ mA}, V_{CE} = 10 \text{ V}$ $I_C = 1.0 \text{ mA}, V_{CE} = 10 \text{ V}$ $I_C = 10 \text{ mA}, V_{CE} = 10 \text{ V}$ $I_C = 10 \text{ mA}, V_{CE} = 10 \text{ V}, T_A = -55^\circ\text{C}$ $I_C = 150 \text{ mA}, V_{CE} = 10 \text{ V}^*$ $I_C = 150 \text{ mA}, V_{CE} = 1.0 \text{ V}^*$ $I_C = 500 \text{ mA}, V_{CE} = 10 \text{ V}^*$	35 50 75 35 100 50 40	300	
$V_{CE(sat)}$	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*	$I_C = 150 \text{ mA}, I_B = 1.0 \text{ mA}$ $I_C = 500 \text{ mA}, I_B = 5.0 \text{ mA}$	0.6	1.2 2.0	V V

SMALL SIGNAL 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
$r_b' C_c$	Collector Base Time Constant	$I_C = 20 \text{ mA}, V_{CB} = 20 \text{ V}, f = 31.8 \text{ MHz}$		150	pS
NF	Noise Figure	$I_C = 100 \text{ }\mu\text{A}, V_{CE} = 10 \text{ V},$ $R_S = 1.0 \text{ k}\Omega, f = 1.0 \text{ kHz}$		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

SWITCHING CHARACTERISTICS (except MMPQ2222 and NMT2222)

t_d	Delay Time	$V_{CC} = 30 \text{ V}, V_{BE(OFF)} = 0.5 \text{ V},$		10	ns
t_r	Rise Time	$I_C = 150 \text{ mA}, I_{B1} = 15 \text{ mA}$		25	ns
t_s	Storage Time	$V_{CC} = 30 \text{ V}, I_C = 150 \text{ mA},$		225	ns
t_f	Fall Time	$I_{B1} = I_{B2} = 15 \text{ mA}$		60	ns

*Pulse Test: Pulse Width $\leq 300 \text{ }\mu\text{s}$. Duty Cycle $\leq 2.0\%$

Spice Model

NPN (Is=14.34f Xti=3 Eg=1.11 Vaf=74.03 Bf=255.9 Ne=1.307 Ise=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)

PN2222A / MMBT2222A / MMPQ2222 / NMT2222 / PZT2222A

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NPN General Purpose Amplifier

(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	1,000	mW
		5.0	8.0	mW/°C
R _{NJC}	Thermal Resistance, Junction to Case	83.3		°C/W
R _{NJA}	Thermal Resistance, Junction to Ambient	200	125	°C/W

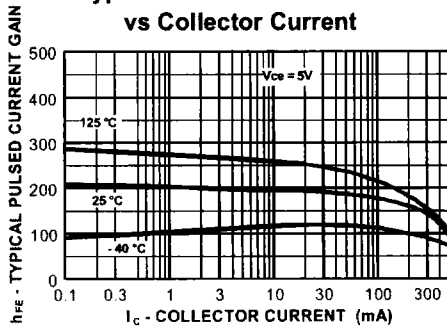
Symbol	Characteristic	Max		Units
		**MMBT2222A	MMPQ2222	
P _D	Total Device Dissipation Derate above 25°C	350	1,000	mW
		2.8	8.0	mW/°C
R _{NJA}	Thermal Resistance, Junction to Ambient Effective 4 Die Each Die	357		°C/W
			125	°C/W
			240	°C/W

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

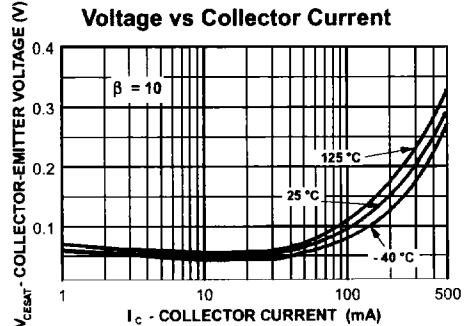
** Device mounted on FR-4 PCB 1.6" X 1.6" X 0.06."

DC Typical Characteristics

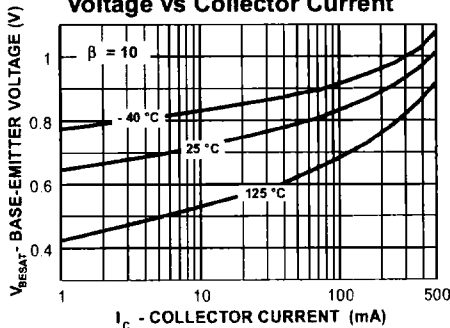
Typical Pulsed Current Gain vs Collector Current



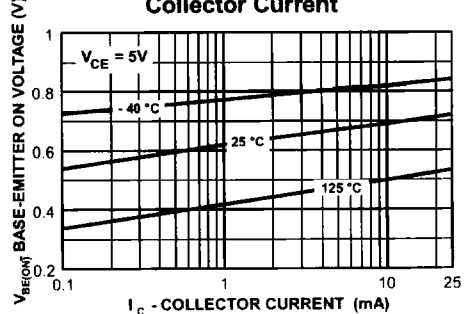
Collector-Emitter Saturation Voltage vs Collector Current



Base-Emitter Saturation Voltage vs Collector Current



Base-Emitter ON Voltage vs Collector Current

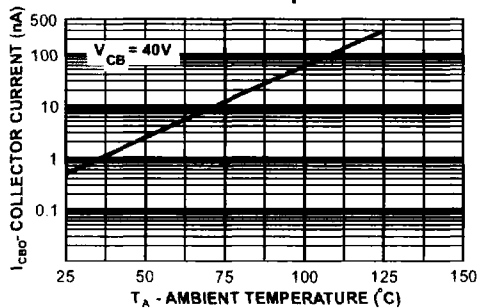


NPN General Purpose Amplifier

(continued)

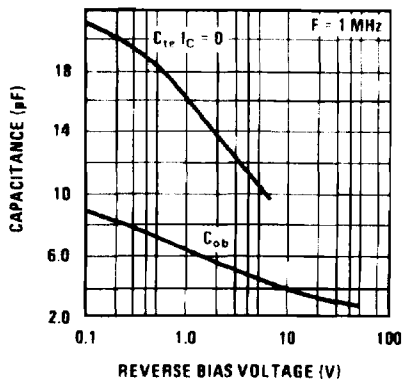
DC Typical Characteristics (continued)

Collector-Cutoff Current vs Ambient Temperature

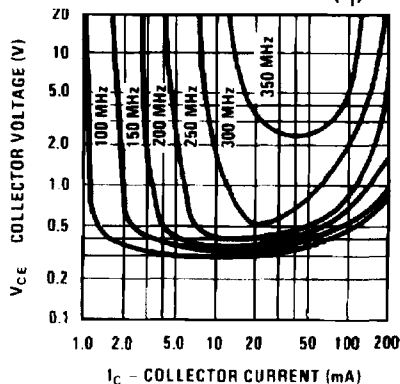


AC Typical Characteristics

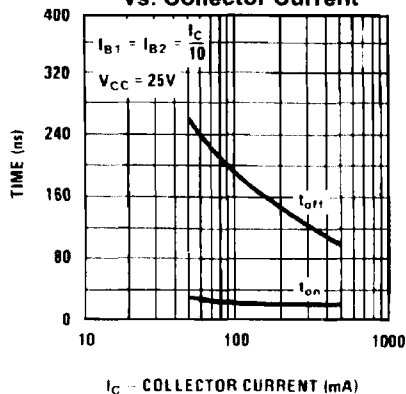
Emitter Transition and Output Capacitance vs. Reverse Bias Voltage



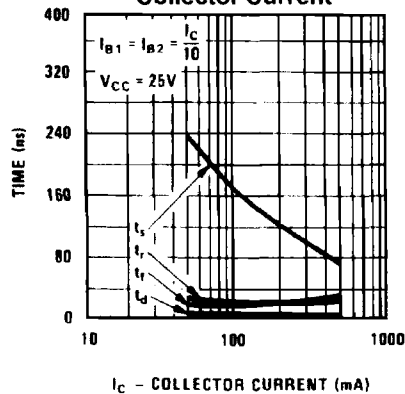
Contours of Constant Gain Bandwidth Product (f_T)



Turn On / Turn Off Times vs. Collector Current



Switching Times vs. Collector Current



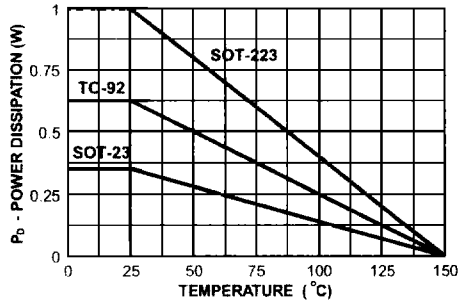
PN2222A / MMBT2222A / MMPQ2222 / NMT2222 / PT2222A

NPN General Purpose Amplifier

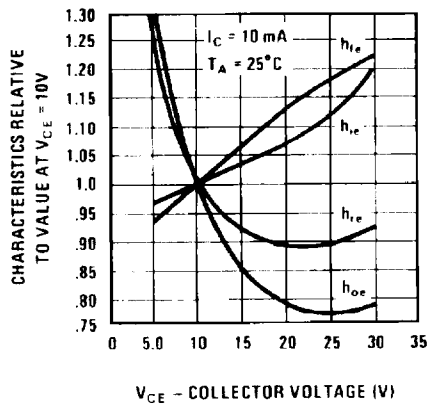
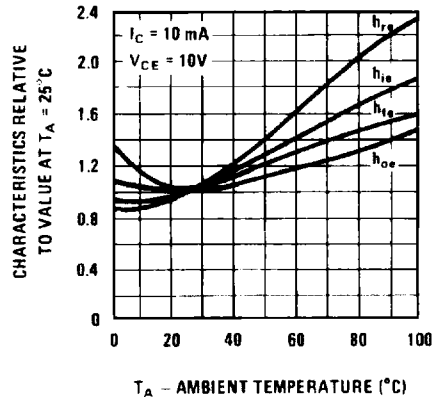
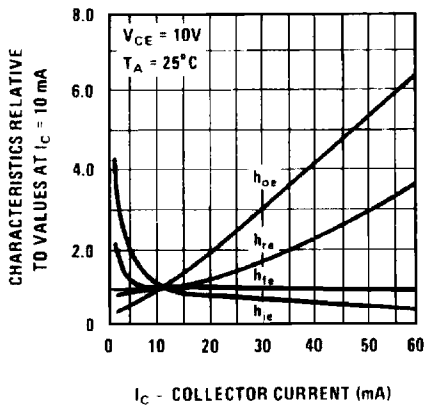
(continued)

AC Typical Characteristics (continued)

POWER DISSIPATION vs AMBIENT TEMPERATURE



Typical Common Emitter Characteristics (f = 1.0 kHz)



Test Circuits

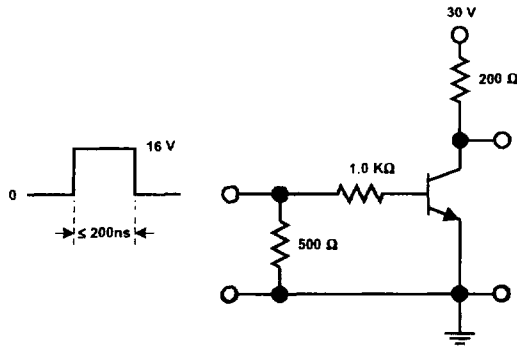


FIGURE 1: Saturated Turn-On Switching Time

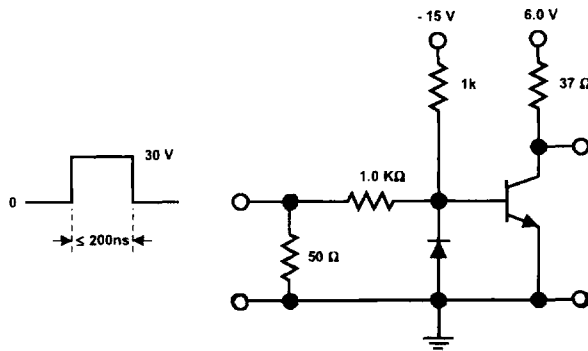


FIGURE 2: Saturated Turn-Off Switching Time