



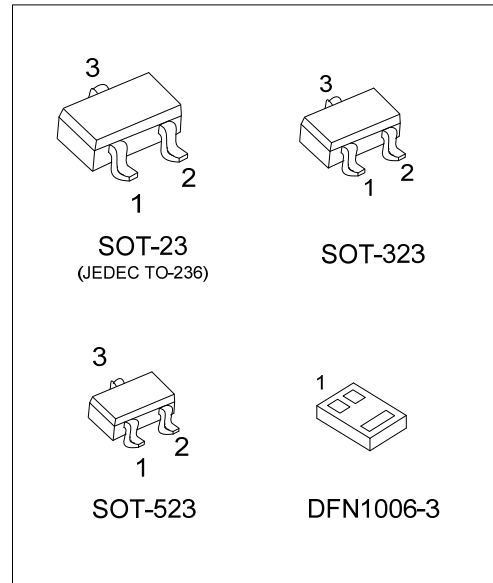
# MMBT2222A

## NPN SILICON TRANSISTOR

### NPN GENERAL PURPOSE AMPLIFIER

■ FEATURES

\* This device is for use as a medium power amplifier and switch requiring collector currents up to 600mA.



■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
MMBT2222AL-AE3-R	MMBT2222AG-AE3-R	SOT-23	B	E	C	Tape Reel
MMBT2222AL-AL3-R	MMBT2222AG-AL3-R	SOT-323	B	E	C	Tape Reel
MMBT2222AL-AN3-R	MMBT2222AG-AN3-R	SOT-523	B	E	C	Tape Reel
MMBT2222AL-K03-1006-R	MMBT2222AG-K03-1006-R	DFN1006-3	B	E	C	Tape Reel

Note: Pin Assignment: B: Base E: Emitter C: Collector

<p>MMBT2222AG-AE3-R</p> <p>(1) Packing Type (2) Package Type (3) Green Package</p>	<p>(1) R: Tape Reel (2) AE3: SOT-23, AL3: SOT-323, AN3: SOT-523 K03-1006: DFN1006-3 (3) G: Halogen Free and Lead Free, L: Lead Free</p>
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■ MARKING

SOT-23 / SOT-323 / SOT-523	DFN1006-3

# MMBT2222A

## NPN SILICON TRANSISTOR

### ■ ABSOLUTE MAXIMUM RATINGS ( $T_A=25^{\circ}\text{C}$ , unless otherwise specified.)

PARAMETER		SYMBOL	RATINGS	UNIT
Collector-Base Voltage		$V_{CBO}$	75	V
Collector-Emitter Voltage		$V_{CEO}$	40	V
Emitter-Base Voltage		$V_{EBO}$	6	V
Collector Current		$I_C$	600	mA
Collector Dissipation	SOT-23	$P_C$	350	mW
	SOT-323		200	
	SOT-523		150	
	DFN1006-3		300 (Note 1)	
Junction Temperature		$T_J$	+150	$^{\circ}\text{C}$
Storage Temperature		$T_{STG}$	-55 ~ +150	$^{\circ}\text{C}$

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

### ■ THERMAL CHARACTERISTICS

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	SOT-23	$\theta_{JA}$	357	$^{\circ}\text{C}/\text{W}$
	SOT-323		625	
	SOT-523		833	
	DFN1006-3		416 (Note)	

Note: Transistor mounted on an FR4 printed circuit board.

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## NPN SILICON TRANSISTOR

■ ELECTRICAL CHARACTERISTICS (Ta=25°C, unless otherwise specified.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
Collector-Base Breakdown Voltage	$BV_{CBO}$	$I_C=10\mu A, I_E=0$	75			V
Collector-Emitter Breakdown Voltage	$BV_{CEO}$	$I_C=10mA, I_B=0$	40			V
Emitter-Base Breakdown Voltage	$BV_{EBO}$	$I_E=10\mu A, I_C=0$	6			V
Collector Cutoff Current	$I_{CBO}$	$V_{CB}=60V, I_E=0$			0.01	$\mu A$
		$V_{CB}=60V, I_E=0, T_a=150^\circ C$			10	$\mu A$
Emitter Cutoff Current	$I_{EBO}$	$V_{EB}=3.0V, I_C=0$			10	nA
Base Cutoff Current	$I_{BL}$	$V_{CE}=60V, V_{EB(OFF)}=3.0V$			20	nA
Collector Cutoff Current	$I_{CEX}$	$V_{CE}=60V, V_{EB(OFF)}=3.0V$			10	nA
<b>ON CHARACTERISTICS</b>						
DC Current Gain	$h_{FE}$	$I_C=0.1mA, V_{CE}=10V$	35			
		$I_C=1.0mA, V_{CE}=10V$	50			
		$I_C=10mA, V_{CE}=10V$	75			
		$I_C=10mA, V_{CE}=10V, T_a=-55^\circ C$	35			
		$I_C=150mA, V_{CE}=10V$ (Note)	100		300	
		$I_C=150mA, V_{CE}=1.0V$ (Note)	50			
Collector-Emitter Saturation Voltage(Note)	$V_{CE(SAT)}$	$I_C=150mA, I_B=15mA$			0.3	V
		$I_C=500mA, I_B=50mA$			1.0	V
Base-Emitter Saturation Voltage(Note)	$V_{BE(SAT)}$	$I_C=150mA, I_B=15mA$	0.6		1.2	V
		$I_C=500mA, I_B=50mA$			2.0	V
<b>SMALL SIGNAL CHARACTERISTICS</b>						
Real Part of Common-Emitter High Frequency Input Impedance	$Re(h_{je})$	$I_C=20mA, V_{CB}=20V, f=300MHz$			60	$\Omega$
Transition Frequency	$f_T$	$I_C=20mA, V_{CE}=20V, f=100MHz$	300			MHz
Output Capacitance	$C_{obo}$	$V_{CB}=10V, I_E=0, f=100kHz$			8.0	pF
Input Capacitance	$C_{ibo}$	$V_{EB}=0.5V, I_C=0, f=100kHz$			25	pF
Collector Base Time Constant	$rb'C_c$	$I_C=20mA, V_{CB}=20V, f=31.8MHz$			150	pS
Noise Figure	NF	$I_C=100\mu A, V_{CE}=10V, R_s=1.0k\Omega, f=1.0kHz$			4.0	dB
<b>SWITCHING CHARACTERISTICS</b>						
Delay Time	$t_D$	$V_{CC}=30V, V_{BE(OFF)}=0.5V,$			10	ns
Rise Time	$t_R$	$I_C=150mA, I_{B1}=15mA$			25	ns
Storage Time	$t_S$	$V_{CC}=30V, I_C=150mA$			225	ns
Fall Time	$t_F$	$I_{B1}=I_{B2}=15mA$			60	ns

Note: Pulse test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2.0\%$

## ■ TEST CIRCUITS

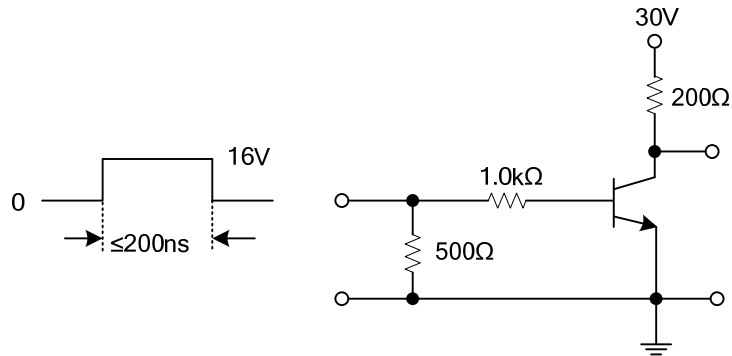


Fig 1. Saturated Turn-On Switching Time

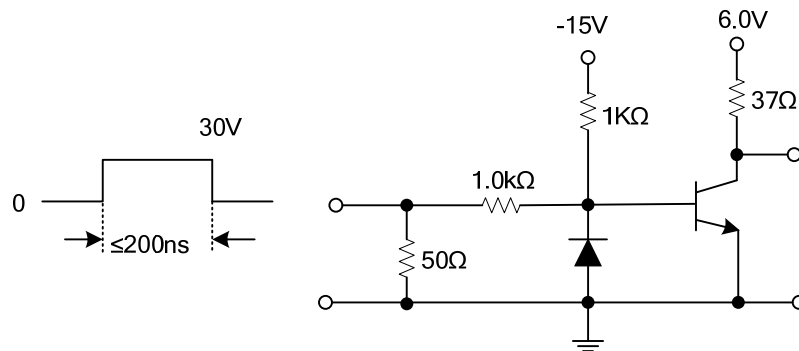
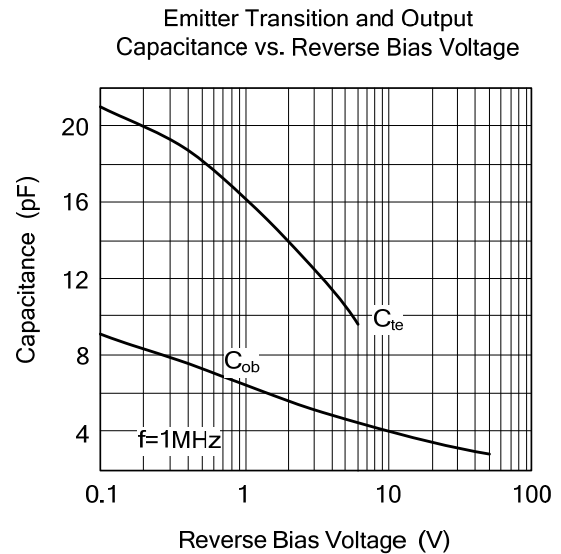
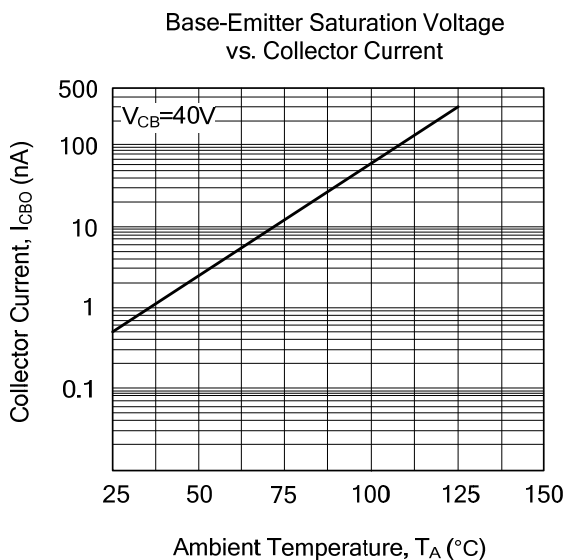
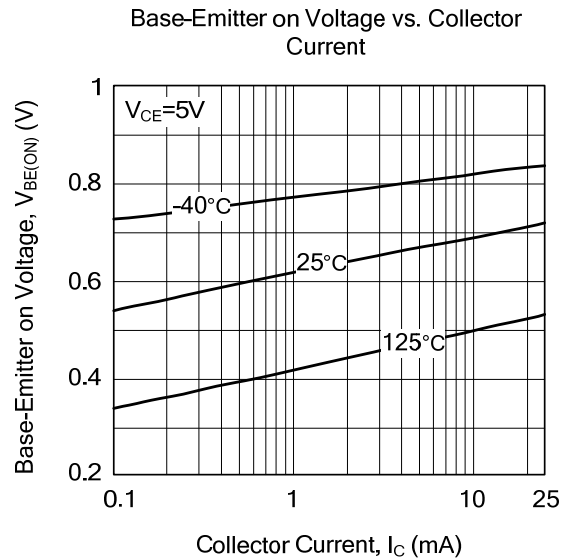
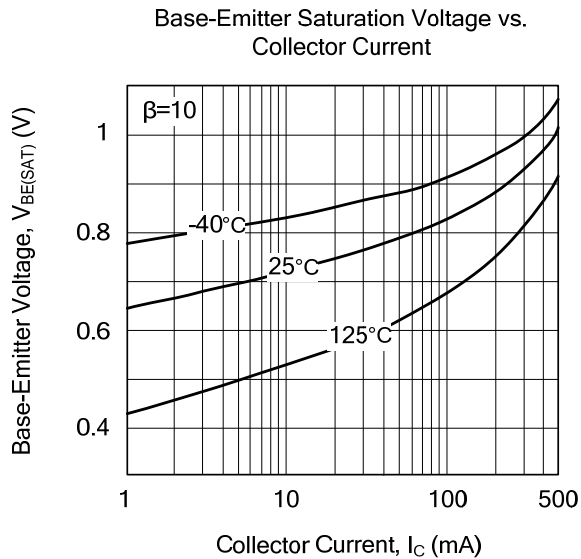
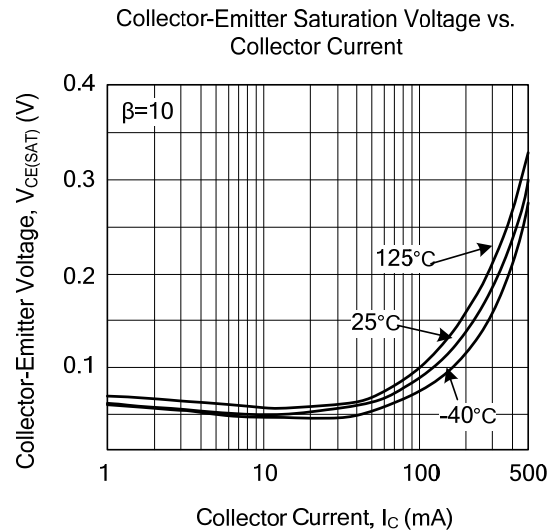
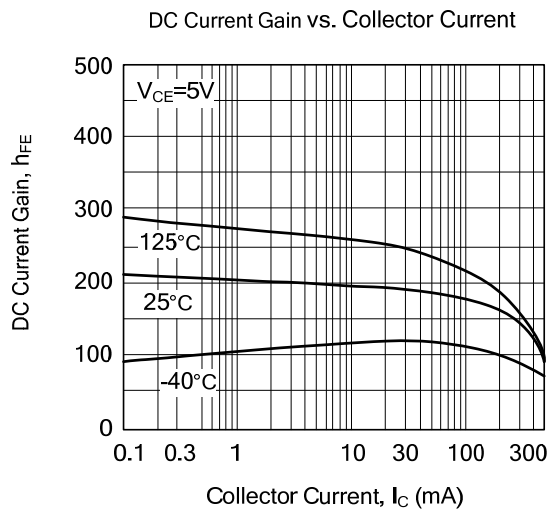
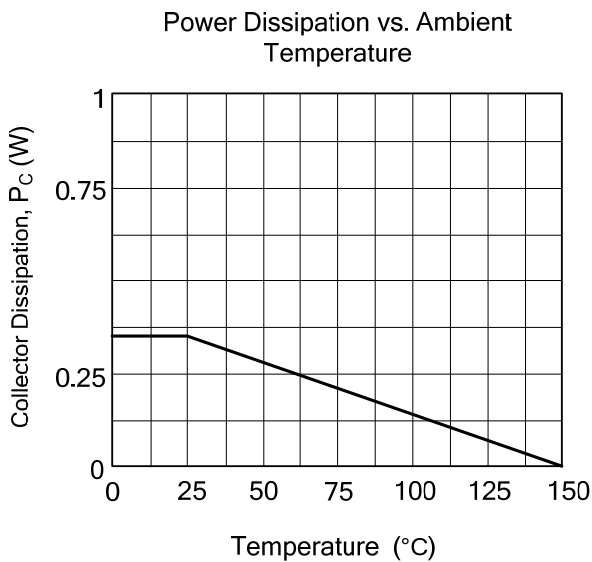
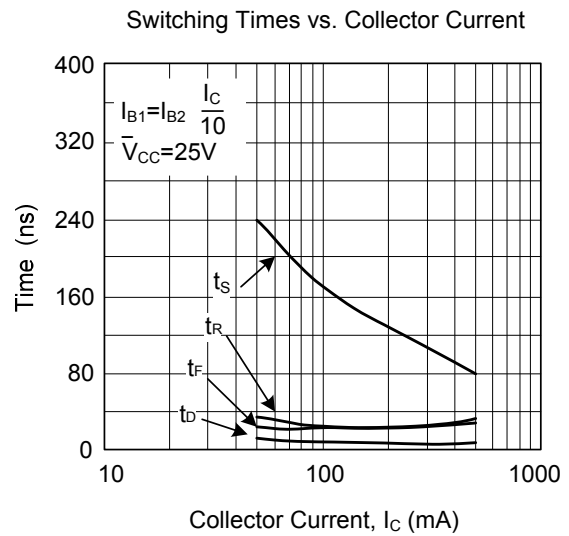
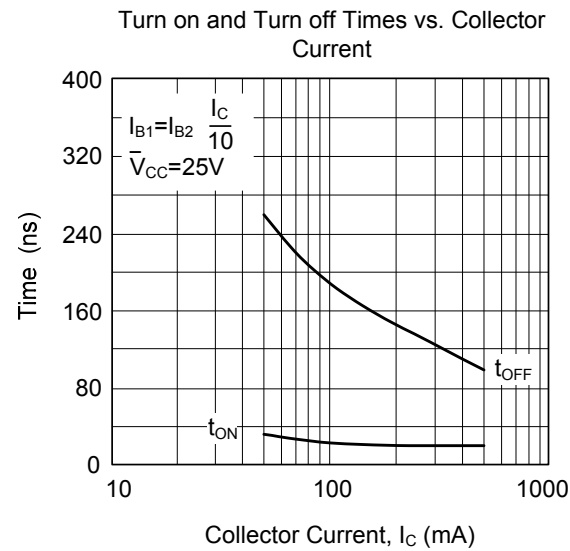


Fig 2. Saturated Turn-Off Switching Time

### TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS(Cont.)



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