



# DATA SHEET

## MMBT2222A

### NPN GENERAL PURPOSE SWITCHING TRANSISTOR

**VOLTAGE** 40 Volts    **POWER** 225 mWatts    **SOT-23**    Unit: inch (mm)

#### FEATURES

- NPN epitaxial silicon, planar design
- Collector-emitter voltage  $V_{CE} = 40V$
- Collector current  $I_C = 600mA$
- Pb free product are available : 99% Sn above can meet Rohs environment substance directive request

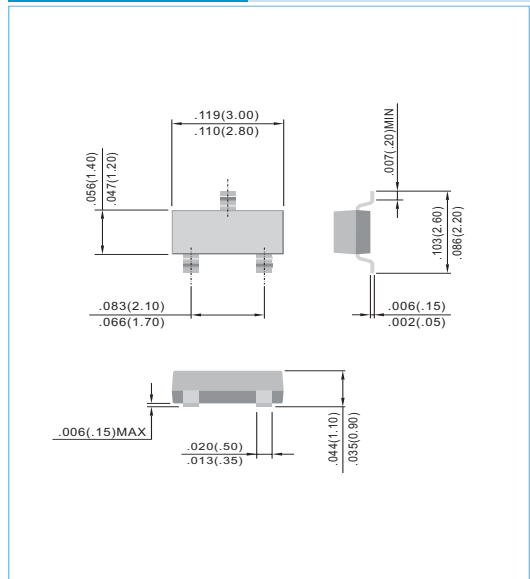
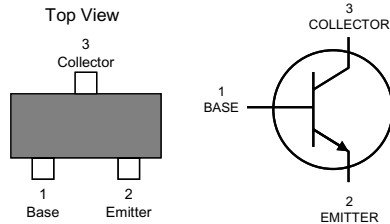
#### MECHANICAL DATA

Case: SOT-23, Plastic

Terminals: Solderable per MIL-STD-202 , Method 208

Approx. Weight: 0.008 gram

Marking: M2A



#### ABSOLUTE RATINGS

PARAMETER	Symbol	Value	Units
Collector - Emitter Voltage	$V_{CE0}$	40	V
Collector - Base Voltage	$V_{CB0}$	75	V
Emitter - Base Voltage	$V_{EB0}$	6.0	V
Collector Current - Continuous	$I_C$	600	mA

#### THERMAL CHARACTERISTICS

PARAMETER	Symbol	Value	Units
Max Power Dissipation (Note 1)	$P_{TOT}$	225	mW
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	556	$^{\circ}C/W$
Junction Temperature	$T_J$	-55 to 150	$^{\circ}C$
Storage Temperature	$T_{STG}$	-55 to 150	$^{\circ}C$

Note 1: Transistor mounted on FR-5 board 1.0 x 0.75 x 0.062 in.

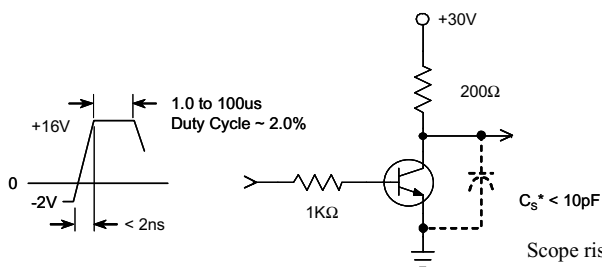


## ELECTRICAL CHARACTERISTICS

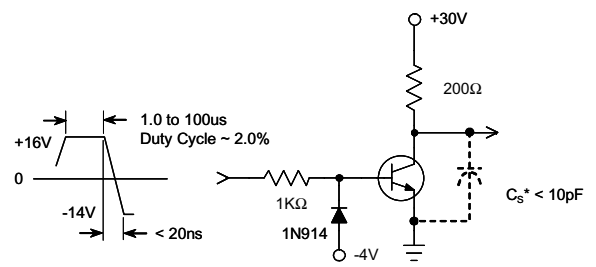
PARAMETER	Symbol	Test Condition	MIN.	TYP.	MAX.	Units
Collector - Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C=1.0mA, I_B=0$	40	-	-	V
Collector - Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C=10\mu A, I_E=0$	75	-	-	V
Emitter - Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E=10\mu A, I_C=0$	6.0	-	-	V
Base Cutoff Current	$I_{BL}$	$V_{CE}=60V, V_{EB}=3.0V$	-	-	20	nA
Collector Cutoff Current	$I_{cEX}$	$V_{CE}=60V, V_{EB}=3.0V$	-	-	10	nA
	$I_{cBO}$	$V_{CE}=60V, I_E=0, T_J=125^\circ C$ $V_{CE}=60V, I_E=0, T_J=125^\circ C$	-	-	10 10	nA uA
Emitter Cutoff Current	$I_{EBO}$	$V_{EB}=3.0V, I_C=0,$	-	-	100	nA
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	-	-	-
		$I_C=10mA, V_{CE}=10V, T_J=125^\circ C$	35	-	-	-
		$I_C=150mA, V_{CE}=10V$ (Note 2)	100	-	300	-
		$I_C=150mA, V_{CE}=1V$ (Note 2)	50	-	-	-
		$I_C=500mA, V_{CE}=10V$ (Note 2)	40	-	-	-
Collector - Emitter Saturation Voltage (Note 2)	$V_{CE(SAT)}$	$I_C=150mA, I_B=15mA$ $I_C=500mA, I_B=50mA$	-	-	0.3 1.0	V
Base - Emitter Saturation Voltage (Note 2)	$V_{BE(SAT)}$	$I_C=150mA, I_B=15mA$ $I_C=500mA, I_B=50mA$	0.6 -	- -	1.2 2.0	V
Collector - Base Capacitance	$C_{CBO}$	$V_{CB}=10V, I_E=0, f=1MHz$	-	-	8.0	pF
Emitter - Base Capacitance	$C_{EBO}$	$V_{CB}=0.5V, I_C=0, f=1MHz$	-	-	25	pF
Delay Time	$t_d$	$V_{CC}=3V, V_{BE}=-5V, I_C=150mA, I_B=15mA$	-	-	10	ns
Rise Time	$t_r$	$V_{CC}=3V, V_{BE}=-5V, I_C=150mA, I_B=15mA$	-	-	25	ns
Storage Time	$t_s$	$V_{CC}=30V, I_C=150mA, I_{B1}=I_{B2}=15mA$	-	-	225	ns
Fall Time	$t_f$	$V_{CC}=30V, I_C=150mA, I_{B1}=I_{B2}=15mA$	-	-	60	ns

Note 2: Pulse Test: Pulse Width < 300 us, Duty Cycle < 2.0%.

## SWITCHING TIME EQUIVALENT TEST CIRCUITS



**Fig. 1. Turn-On Time**

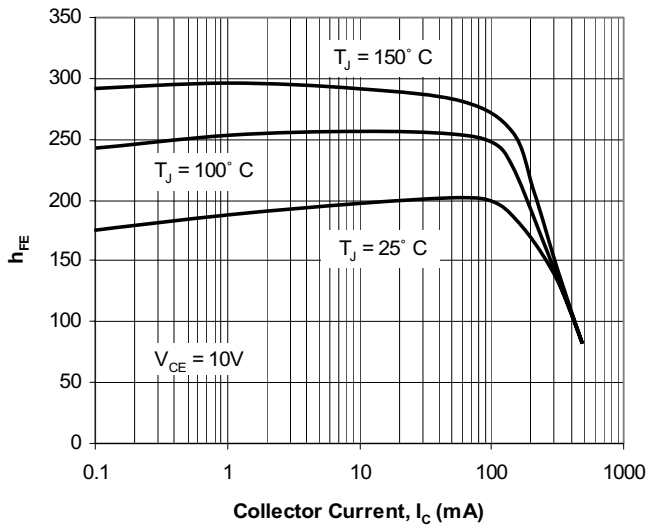


**Fig. 2. Turn-Off Time**

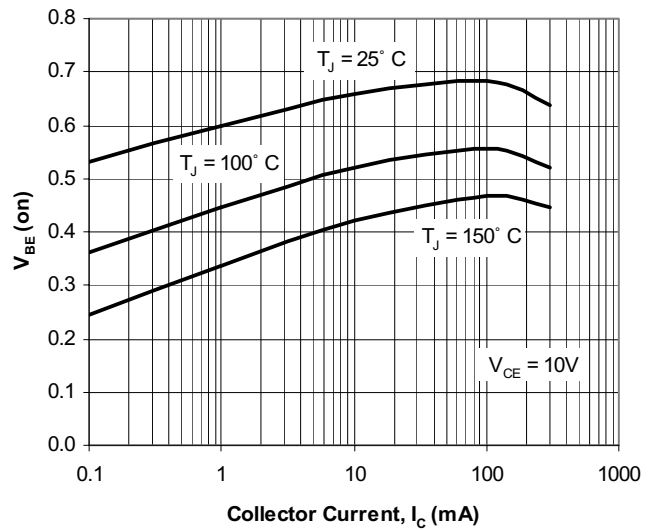
\* Total shunt capacitance of test jig, connectors, and oscilloscope



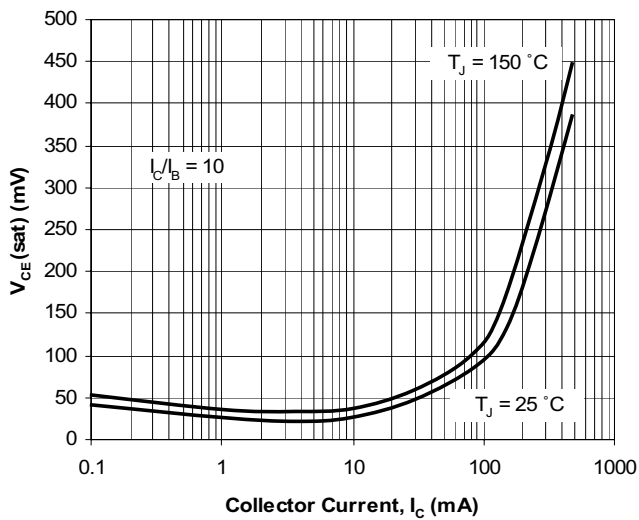
**ELECTRICAL CHARACTERISTICS CURVE**



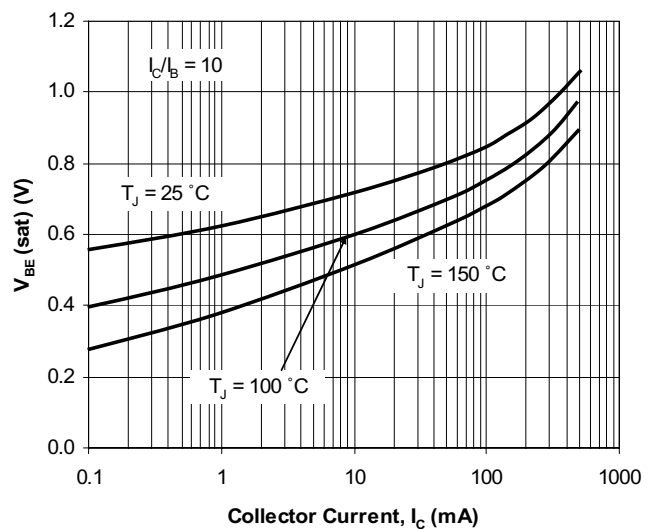
**Fig. 3. Typical  $h_{FE}$  vs Collector Current**



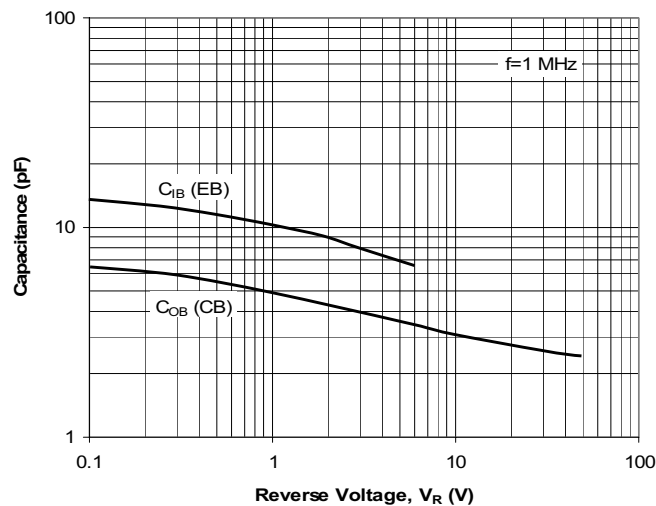
**Fig. 4. Typical  $V_{BE}$  vs Collector Current**



**Fig. 5. Typical  $V_{CE(sat)}$  vs Collector Current**



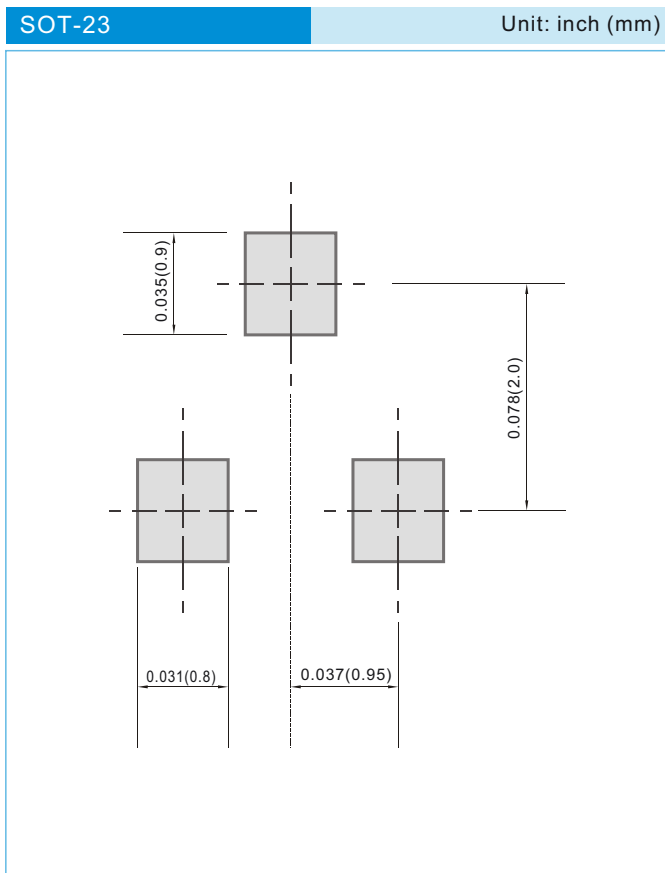
**Fig. 6. Typical  $V_{BE(sat)}$  vs Collector Current**



**Fig. 7. Typical Capacitances vs Reverse Voltage**



## MOUNTING PAD LAYOUT



## ORDER INFORMATION

- Packing information

T/R - 12K per 13" plastic Reel

T/R - 3.0K per 7" plastic Reel

## LEGAL STATEMENT

### IMPORTANT NOTICE

This information is intended to unambiguously characterize the product in order to facilitate the customer's evaluation of the device in the application. The information will help the customer's technical experts determine that the device is compatible and interchangeable with similar devices made by other vendors. The information in this data sheet is believed to be reliable and accurate. The specifications and information herein are subject to change without notice. New products and improvements in products and product characterization are constantly in process. Therefore, the factory should be consulted for the most recent information and for any special characteristics not described or specified.

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