



# MMBT2222A

## SMALL SIGNAL NPN TRANSISTOR

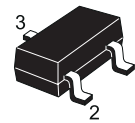
PRELIMINARY DATA

Type	Marking
MMBT2222A	M22

- SILICON EPITAXIAL PLANAR NPN TRANSISTOR
- MINIATURE SOT-23 PLASTIC PACKAGE FOR SURFACE MOUNTING CIRCUITS
- TAPE & REEL PACKING
- THE PNP COMPLEMENTARY TYPE IS MMBT2907A

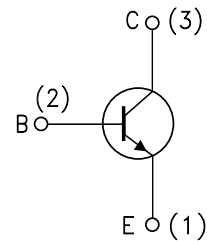
### APPLICATIONS

- WELL SUITABLE FOR PORTABLE EQUIPMENT
- SMALL LOAD SWITCH TRANSISTOR WITH HIGH GAIN AND LOW SATURATION VOLTAGE



SOT-23

### INTERNAL SCHEMATIC DIAGRAM



### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{CBO}$	Collector-Emitter Voltage ( $I_E = 0$ )	75	V
$V_{CEO}$	Collector-Emitter Voltage ( $I_B = 0$ )	40	V
$V_{EBO}$	Emitter-Base Voltage ( $I_C = 0$ )	6	V
$I_C$	Collector Current	0.6	A
$I_{CM}$	Collector Peak Current ( $t_p < 5$ ms)	0.8	A
$P_{tot}$	Total Dissipation at $T_{amb} = 25$ °C	350	mW
$T_{stg}$	Storage Temperature	-65 to 150	°C
$T_j$	Max. Operating Junction Temperature	150	°C

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## THERMAL DATA

R <sub>thj-amb</sub> •	Thermal Resistance Junction-Ambient	Max	357.1	°C/W
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• Device mounted on a PCB area of 1 cm<sup>2</sup>.

## ELECTRICAL CHARACTERISTICS (T<sub>case</sub> = 25 °C unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit	
I <sub>CEX</sub>	Collector Cut-off Current (V <sub>BE</sub> = -3 V)	V <sub>CE</sub> = 60 V			10	nA	
I <sub>BEX</sub>	Base Cut-off Current (V <sub>BE</sub> = -3 V)	V <sub>CE</sub> = 60 V			20	nA	
I <sub>CBO</sub>	Collector Cut-off Current (I <sub>E</sub> = 0)	V <sub>CB</sub> = 75 V V <sub>CB</sub> = 75 V			10 10	nA μA	
I <sub>EBO</sub>	Emitter Cut-off Current (I <sub>C</sub> = 0)	V <sub>EB</sub> = 3 V			15	nA	
V <sub>(BR)CEO</sub> *	Collector-Emitter Breakdown Voltage (I <sub>B</sub> = 0)	I <sub>C</sub> = 10 mA	40			V	
V <sub>(BR)CBO</sub>	Collector-Base Breakdown Voltage (I <sub>E</sub> = 0)	I <sub>C</sub> = 10 μA	75			V	
V <sub>(BR)EBO</sub>	Emitter-Base Breakdown Voltage (I <sub>C</sub> = 0)	I <sub>E</sub> = 10 μA	6			V	
V <sub>CE(sat)</sub> *	Collector-Emitter Saturation Voltage	I <sub>C</sub> = 150 mA I <sub>C</sub> = 500 mA			0.3 1	V V	
V <sub>BE(sat)</sub> *	Collector-Base Saturation Voltage	I <sub>C</sub> = 150 mA I <sub>C</sub> = 500 mA	0.6		1.2 2	V V	
h <sub>FE</sub> *	DC Current Gain	I <sub>C</sub> = 0.1 mA I <sub>C</sub> = 1 mA I <sub>C</sub> = 10 mA I <sub>C</sub> = 150 mA I <sub>C</sub> = 150 mA I <sub>C</sub> = 500 mA	V <sub>CE</sub> = 10 V V <sub>CE</sub> = 10 V V <sub>CE</sub> = 10 V V <sub>CE</sub> = 10 V V <sub>CE</sub> = 1 V V <sub>CE</sub> = 10 V	35 50 75 100 50 40		300	
f <sub>T</sub>	Transition Frequency	I <sub>C</sub> = 20 mA V <sub>CE</sub> = 20V f = 100MHz		270		MHz	
C <sub>CBO</sub>	Collector-Base Capacitance	I <sub>E</sub> = 0 V <sub>CB</sub> = 10 V f = 1 MHz		4	8	pF	
C <sub>EBO</sub>	Emitter-Base Capacitance	I <sub>C</sub> = 0 V <sub>EB</sub> = 0.5 V f = 1MHz		20	25	pF	
NF	Noise Figure	I <sub>C</sub> = 0.1 mA V <sub>CE</sub> = 10 V f = 1 KHz Δf = 200 Hz R <sub>G</sub> = 1 KΩ		4		dB	
h <sub>ie</sub> *	Input Impedance	V <sub>CE</sub> = 10 V I <sub>C</sub> = 1 mA f = 1 KHz V <sub>CE</sub> = 10 V I <sub>C</sub> = 10 mA f = 1 KHz	2 0.25		8 1.25	KΩ KΩ	
h <sub>re</sub> *	Reverse Voltage Ratio	V <sub>CE</sub> = 10 V I <sub>C</sub> = 1 mA f = 1 KHz V <sub>CE</sub> = 10 V I <sub>C</sub> = 10 mA f = 1 KHz			8 4	10 <sup>-4</sup> 10 <sup>-4</sup>	
h <sub>fe</sub> *	Small Signal Current Gain	V <sub>CE</sub> = 10 V I <sub>C</sub> = 1 mA f = 1 KHz V <sub>CE</sub> = 10 V I <sub>C</sub> = 10 mA f = 1 KHz	50 75		300 375		
h <sub>oe</sub> *	Output Admittance	V <sub>CE</sub> = 10 V I <sub>C</sub> = 1 mA f = 1 KHz V <sub>CE</sub> = 10 V I <sub>C</sub> = 10 mA f = 1 KHz	5 25		35 200	μS μS	

\* Pulsed: Pulse duration = 300 μs, duty cycle ≤ 2 %

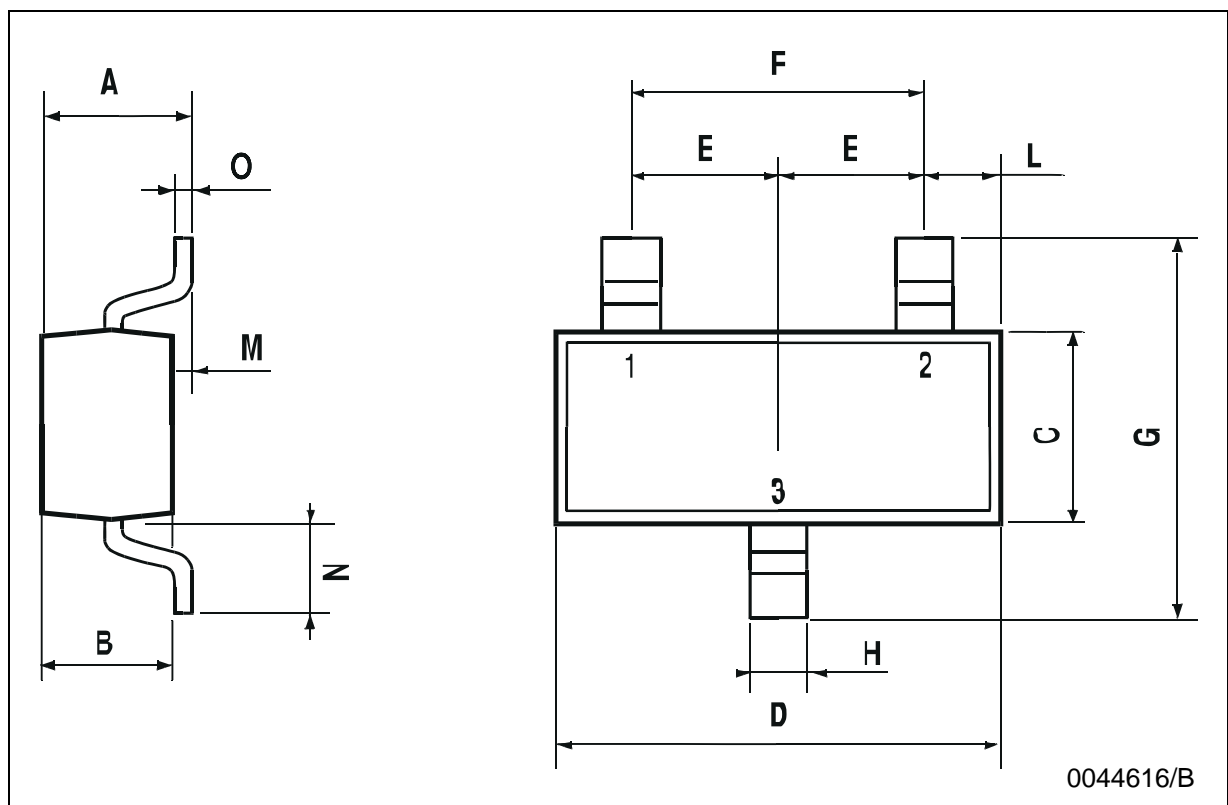
## ELECTRICAL CHARACTERISTICS (Continued)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_d$	Delay Time	$I_C = 150 \text{ mA}$ $I_B = 15 \text{ mA}$		5	10	ns
$t_r$	Rise Time	$V_{CC} = 30 \text{ V}$		12	25	ns
$t_s$	Storage Time	$I_C = 150 \text{ mA}$ $I_{B1} = - I_{B2} = 15 \text{ mA}$		185	225	ns
$t_f$	Fall Time	$V_{CC} = 30 \text{ V}$		24	60	ns

\* Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle  $\leq 2\%$

**SOT-23 MECHANICAL DATA**

DIM.	mm			mils		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	0.85		1.1	33.4		43.3
B	0.65		0.95	25.6		37.4
C	1.20		1.4	47.2		55.1
D	2.80		3	110.2		118
E	0.95		1.05	37.4		41.3
F	1.9		2.05	74.8		80.7
G	2.1		2.5	82.6		98.4
H	0.38		0.48	14.9		18.8
L	0.3		0.6	11.8		23.6
M	0		0.1	0		3.9
N	0.3		0.65	11.8		25.6
O	0.09		0.17	3.5		6.7



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