



# MMBT2222A

## SMALL SIGNAL NPN TRANSISTOR

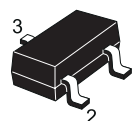
PRELIMINARY DATA

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

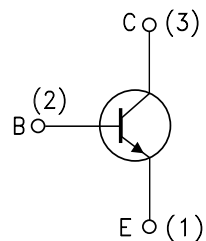
### APPLICATIONS

- 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

## MMBT2222A

### THERMAL DATA

$R_{thj-amb}$ •	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 ( $T_{case} = 25\text{ °C}$ unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{CEX}$	Collector Cut-off Current ( $V_{BE} = -3\text{ V}$ )	$V_{CE} = 60\text{ V}$			10	nA
$I_{BEX}$	Base Cut-off Current ( $V_{BE} = -3\text{ V}$ )	$V_{CE} = 60\text{ V}$			20	nA
$I_{CBO}$	Collector Cut-off Current ( $I_E = 0$ )	$V_{CB} = 75\text{ V}$ $V_{CB} = 75\text{ V}$ $T_j = 150\text{ °C}$			10 10	nA μA
$I_{EBO}$	Emitter Cut-off Current ( $I_C = 0$ )	$V_{EB} = 3\text{ V}$			15	nA
$V_{(BR)CEO}^*$	Collector-Emitter Breakdown Voltage ( $I_B = 0$ )	$I_C = 10\text{ mA}$	40			V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage ( $I_E = 0$ )	$I_C = 10\text{ μA}$	75			V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage ( $I_C = 0$ )	$I_E = 10\text{ μA}$	6			V
$V_{CE(sat)}^*$	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	V V
$V_{BE(sat)}^*$	Collector-Base 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	V V
$h_{FE}^*$	DC Current Gain	$I_C = 0.1\text{ mA}$ $V_{CE} = 10\text{ V}$ $I_C = 1\text{ mA}$ $V_{CE} = 10\text{ V}$ $I_C = 10\text{ mA}$ $V_{CE} = 10\text{ V}$ $I_C = 150\text{ mA}$ $V_{CE} = 10\text{ V}$ $I_C = 150\text{ mA}$ $V_{CE} = 1\text{ V}$ $I_C = 500\text{ mA}$ $V_{CE} = 10\text{ V}$	35 50 75 100 50 40		300	
$f_T$	Transition Frequency	$I_C = 20\text{ mA}$ $V_{CE} = 20\text{ V}$ $f = 100\text{ MHz}$		270		MHz
$C_{CBO}$	Collector-Base Capacitance	$I_E = 0$ $V_{CB} = 10\text{ V}$ $f = 1\text{ MHz}$		4	8	pF
$C_{EBO}$	Emitter-Base Capacitance	$I_C = 0$ $V_{EB} = 0.5\text{ V}$ $f = 1\text{ MHz}$		20	25	pF
NF	Noise Figure	$I_C = 0.1\text{ mA}$ $V_{CE} = 10\text{ V}$ $f = 1\text{ KHz}$ $\Delta f = 200\text{ Hz}$ $R_G = 1\text{ K}\Omega$		4		dB
$h_{ie}^*$	Input Impedance	$V_{CE} = 10\text{ V}$ $I_C = 1\text{ mA}$ $f = 1\text{ KHz}$ $V_{CE} = 10\text{ V}$ $I_C = 10\text{ mA}$ $f = 1\text{ KHz}$	2 0.25		8 1.25	K $\Omega$ K $\Omega$
$h_{re}^*$	Reverse Voltage Ratio	$V_{CE} = 10\text{ V}$ $I_C = 1\text{ mA}$ $f = 1\text{ KHz}$ $V_{CE} = 10\text{ V}$ $I_C = 10\text{ mA}$ $f = 1\text{ KHz}$			8 4	$10^{-4}$ $10^{-4}$
$h_{fe}^*$	Small Signal Current Gain	$V_{CE} = 10\text{ V}$ $I_C = 1\text{ mA}$ $f = 1\text{ KHz}$ $V_{CE} = 10\text{ V}$ $I_C = 10\text{ mA}$ $f = 1\text{ KHz}$	50 75		300 375	
$h_{oe}^*$	Output Admittance	$V_{CE} = 10\text{ V}$ $I_C = 1\text{ mA}$ $f = 1\text{ KHz}$ $V_{CE} = 10\text{ V}$ $I_C = 10\text{ mA}$ $f = 1\text{ KHz}$	5 25		35 200	μS μS

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

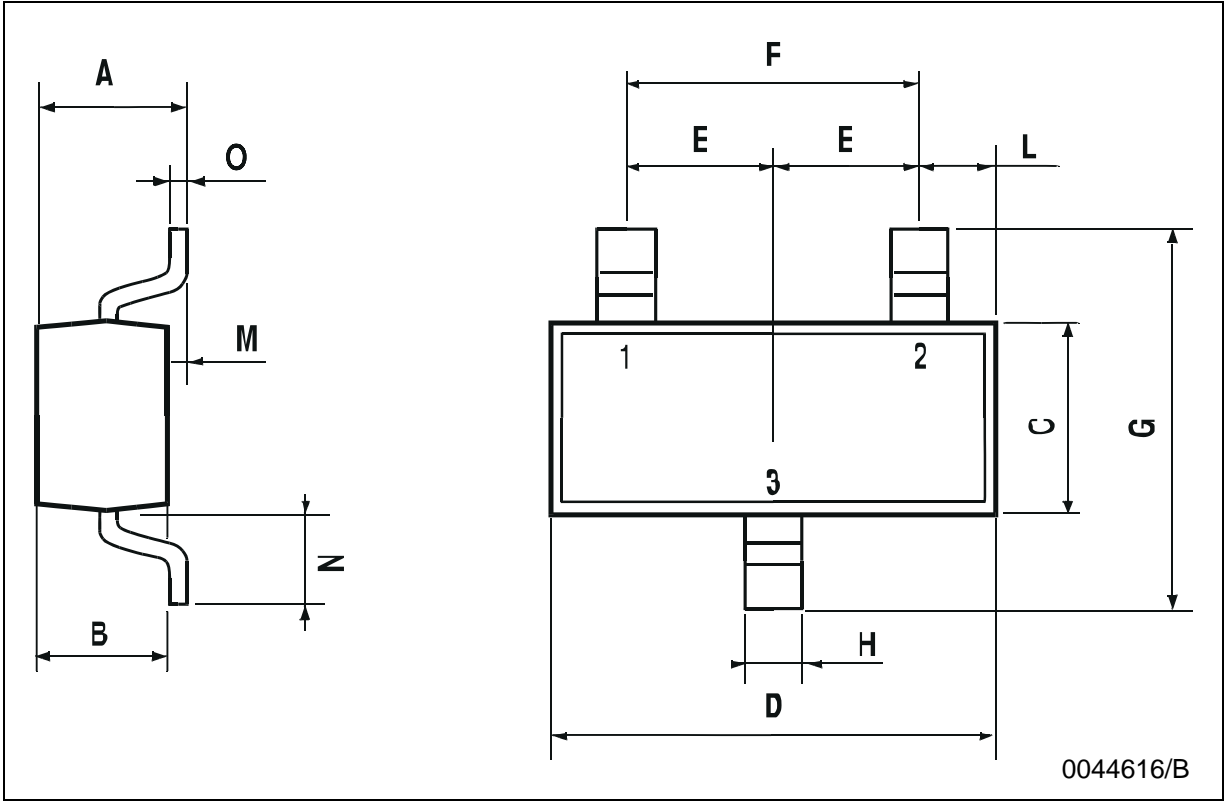
**ELECTRICAL CHARACTERISTICS** (Continued)

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