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MMBT2222A Silicon NPN Transistor General Purpose Amp SOT-23 Type Surface Mount Package

Absolute Maximum Ratings: ($T_A = +25^\circ\text{C}$ unless otherwise specified)

Collector-Base Voltage, V_{CBO}	75V
Collector-Emitter Voltage, V_{CEO}	40V
Emitter-Base Voltage, V_{EBO}	6V
Continuous Collector Current, I_C	600mA
Total Device Dissipation (FR-5 Board, Note 1), P_D	225mW
Derate above $+25^\circ\text{C}$	1.8mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient (FR-5 Board, Note 1), R_{thJA}	556 $^\circ\text{C}/\text{W}$
Total Device Dissipation (Alumina Substrate, Note 2), P_D	300mW
Derate above $+25^\circ\text{C}$	2.4mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient (Alumina Substrate, Note 2), R_{thJA}	417 $^\circ\text{C}/\text{W}$
Operating Junction Temperature Range, T_J	-55 $^\circ$ to +150 $^\circ\text{C}$
Storage Temperature Range, T_{stg}	-55 $^\circ$ to +150 $^\circ\text{C}$

Note 1. FR-5 = 1.000 (25.4mm) x .750 (19.05mm) x .062 (1.57mm).

Note 2. Alumina = .400 (10.2mm) x .300 (7.62mm) x .024 (.609mm), 99.5% alumina.

Electrical Characteristics: ($T_A = +25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
OFF Characteristics						
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 10\mu\text{A}, I_E = 0$	75	-	-	V
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\text{mA}, I_B = 0$	40	-	-	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\mu\text{A}, I_C = 0$	6	-	-	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 60\text{V}, I_E = 0$	-	-	0.01	μA
		$V_{CB} = 60\text{V}, I_E = 0, T_A = +125^\circ\text{C}$	-	-	10	μA
	I_{CEX}	$V_{CE} = 60\text{V}, V_{EB(off)} = 3\text{V}$	-	-	10	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 3\text{V}, I_C = 0$	-	-	10	nA
Base Cutoff Current	I_{BL}	$V_{CE} = 60\text{V}, V_{EB(off)} = 3\text{V}$	-	-	20	nA

Electrical Characteristics (Cont'd): ($T_A = +25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
ON Characteristics (Note 3)						
DC Current Gain	h_{FE}	$V_{CE} = 10\text{V}, I_C = 0.1\text{mA}$	35	–	–	
		$V_{CE} = 10\text{V}, I_C = 1\text{mA}$	50	–	–	
		$V_{CE} = 10\text{V}, I_C = 10\text{mA}$	75	–	–	
		$V_{CE} = 10\text{V}, I_C = 10\text{mA}, T_A = -55^\circ\text{C}$	35	–	–	
		$V_{CE} = 1\text{V}, I_C = 150\text{mA}$	50	–	–	
		$V_{CE} = 10\text{V}, I_C = 150\text{mA}$	100	–	300	
		$V_{CE} = 10\text{V}, I_C = 500\text{mA}$	40	–	–	
Collector–Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 150\text{mA}, I_B = 15\text{mA}$	–	–	0.3	V
		$I_C = 500\text{mA}, I_B = 50\text{mA}$	–	–	1.0	V
Base–Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 150\text{mA}, I_B = 15\text{mA}$	0.6	–	1.2	V
		$I_C = 500\text{mA}, I_B = 50\text{mA}$	–	–	2.0	V
Small–Signal Characteristics						
Current Gain–Bandwidth Product	f_T	$I_C = 20\text{mA}, V_{CB} = 20\text{V}, f = 100\text{MHz}$	300	–	–	MHz
Output Capacitance	C_{obo}	$V_{CB} = 10\text{V}, I_E = 0, f = 1\text{MHz}$	–	–	8	pF
Input Capacitance	C_{ibo}	$V_{EB} = 0.5\text{V}, I_C = 0, f = 1\text{MHz}$	–	–	25	pF
Input Impedance	h_{ie}	$V_{CE} = 10\text{V}, I_C = 1\text{mA}, f = 1\text{kHz}$	2	–	8	$k\Omega$
		$V_{CE} = 10\text{V}, I_C = 10\text{mA}, f = 1\text{kHz}$	0.25	–	1.25	$k\Omega$
Voltage Feedback Ratio	h_{re}	$V_{CE} = 10\text{V}, I_C = 1\text{mA}, f = 1\text{kHz}$	–	–	8	$\times 10^4$
		$V_{CE} = 10\text{V}, I_C = 10\text{mA}, f = 1\text{kHz}$	–	–	4	$\times 10^4$
Small–Signal Current Gain	h_{fe}	$V_{CE} = 10\text{V}, I_C = 1\text{mA}, f = 1\text{kHz}$	50	–	300	
		$V_{CE} = 10\text{V}, I_C = 10\text{mA}, f = 1\text{kHz}$	75	–	375	
Output Admittance	h_{oe}	$V_{CE} = 10\text{V}, I_C = 1\text{mA}, f = 1\text{kHz}$	5	–	35	μmhos
		$V_{CE} = 10\text{V}, I_C = 10\text{mA}, f = 1\text{kHz}$	25	–	200	μmhos
Collector–Base Time Constant	$r_b'C_c$	$V_{CB} = 20\text{V}, I_E = 20\text{mA}, f = 31.8\text{MHz}$	–	–	150	ps
Noise Figure	NF	$I_C = 100\mu\text{A}, V_{CE} = 10\text{V}, R_S = 1k\Omega, f = 1\text{kHz}$	–	–	4	dB
Switching Characteristics						
Delay Time	t_d	$V_{CC} = 30\text{V}, I_C = 150\text{mA}, V_{BE(off)} = 0.5\text{V}, I_{B1} = 15\text{mA}$	–	–	10	ns
Rise Time	t_r		–	–	25	ns
Storage Time	t_s	$V_{CC} = 30\text{V}, I_C = 150\text{mA}, I_{B1} = I_{B2} = 15\text{mA}$	–	–	225	ns
Fall Time	t_f		–	–	60	ns

Note 3. Pulse Test: Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$.

