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MMBT3904 Silicon NPN Transistor General Purpose Amp, Surface Mount

Description:

The MMBT3904 is a silicon NPN transistor in a SOT-23 type surface mount package designed for use as a general purpose amplifier and switch. The useful dynamic range extends to 100mA as a switch and to 100MHz as an amplifier.

Absolute Maximum Ratings: ($T_A = +25^\circ\text{C}$, Note 1, Note 2 unless otherwise specified)

Collector-Emitter Voltage, V_{CEO}	40V
Collector-Base Voltage, V_{CBO}	60V
Emitter-Base Voltage, V_{EBO}	6V
Continuous Collector Current, I_C	200mA
Total Device Dissipation (Note 3), P_D	350mW
Derate above $+25^\circ\text{C}$	2.8mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient (Note 3), R_{thJA}	357 $^\circ\text{C}/\text{W}$
Operating Junction Temperature Range, T_J	-55° to $+150^\circ\text{C}$
Storage Temperature Range, T_{stg}	-55° to $+150^\circ\text{C}$

Note 1. Stresses exceeding the Absolute Maximum Ratings may damage the device. The device may not function or be operated above the Recommended Operating Conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the Recommended Operation Conditions may affect device reliability. The Absolute maximum ratings are stress ratings only.

Note 2. These are steady-state limits and are based on a maximum junction temperature of $+150^\circ\text{C}$.

Note 3. Device is mounted on FR-4 PCB 1.6 inch x 1.6 inch x 0.06 inch.

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
OFF Characteristics						
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 1\text{mA}, I_B = 0$	40	-	-	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 10\mu\text{A}, I_E = 0$	60	-	-	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\mu\text{A}, I_C = 0$	6	-	-	V
Base Cut-Off Current	I_{BL}	$V_{CE} = 30\text{V}, V_{BE} = 3\text{V}$	-	-	50	nA
Collector Cutoff Current	I_{CEX}	$V_{CE} = 30\text{V}, V_{BE} = 3\text{V}$	-	-	50	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 4)						
DC Current Gain	h_{FE}	$V_{CE} = 1\text{V}, I_C = 0.1\text{mA}$	40	-	-	
		$V_{CE} = 1\text{V}, I_C = 1\text{mA}$	70	-	-	
		$V_{CE} = 1\text{V}, I_C = 10\text{mA}$	100	-	300	
		$V_{CE} = 1\text{V}, I_C = 50\text{mA}$	60	-	-	
		$V_{CE} = 1\text{V}, I_C = 100\text{mA}$	30	-	-	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\text{mA}, I_B = 1\text{mA}$	-	-	0.2	V
		$I_C = 50\text{mA}, I_B = 5\text{mA}$	-	-	0.3	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 10\text{mA}, I_B = 1\text{mA}$	0.65	-	0.85	V
		$I_C = 50\text{mA}, I_B = 5\text{mA}$	-	-	0.95	V
Small-Signal Characteristics						
Current Gain-Bandwidth Product	f_T	$I_C = 10\text{mA}, V_{CE} = 20\text{V}, f = 100\text{MHz}$	300	-	-	MHz
Output Capacitance	C_{obo}	$V_{CB} = 5\text{V}, I_E = 0, f = 100\text{kHz}$	-	-	4	pF
Input Capacitance	C_{ibo}	$V_{EB} = 0.5\text{V}, I_C = 0, f = 100\text{kHz}$	-	-	8	pF
Noise Figure	NF	$V_{CE} = 5\text{V}, I_C = 100\mu\text{A}, R_S = 1\text{k}\Omega, f = 10\text{Hz to } 15.7\text{kHz}$	-	-	5	dB
Switching Characteristics						
Delay Time	t_d	$V_{CC} = 3\text{V}, V_{BE} = 0.5\text{V}, I_C = 10\text{mA}, I_{B1} = 1\text{mA}$	-	-	35	ns
Rise Time	t_r		-	-	35	ns
Storage Time	t_s	$V_{CC} = 3\text{V}, I_C = 10\text{mA}, I_{B1} = I_{B2} = 1\text{mA}$	-	-	200	ns
Fall Time	t_f		-	-	50	ns

Note 4. Pulse Test: Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$.

