

# MMBT3904T

## MMBT3904T SOT-523 Silicon General Purpose Transistor (NPN)

### General description

SOT-523 Silicon General Purpose Transistor (NPN)

### FEATURES

- Simplifies Circuit Design
- RoHS Compliant
- Green EMC
- Matte Tin(Sn) Lead Finish
- Weight: approx. 0.002g

**Absolute Maximum Ratings** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

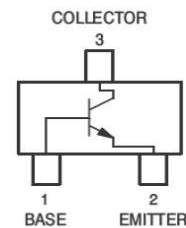
Symbol	Parameter	Value	Units
$V_{CB0}$	Collector-Base Voltage	60	V
$V_{CE0}$	Collector-Emitter Voltage	40	V
$V_{EB0}$	Emitter-Base Voltage	6	V
$I_C$	Collector Current	200	mA
$P_D$	Power Dissipation (FR-4 Board – minimum pad)	200	mW
$R_{\theta JA}$	Thermal Resistance from Junction to Ambient	600	$^\circ\text{C}/\text{W}$
$T_J$ $T_{STG}$	Junction & Storage Temperature Range	-55 to +150	$^\circ\text{C}$

**Green Product**

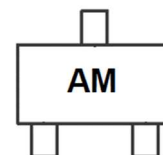


SOT-523 (SC-75A)

**Electrical Symbol:**



**Device Marking :**



### Off Characteristics

Symbol	Parameter	Test Condition	Limits		Unit
			Min	Max	
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage (Note 1)	$I_C = 1\text{mA}$ , $I_B = 0\text{A}$	40	-	Volts
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	$I_C = 10\mu\text{A}$ , $I_E = 0\text{A}$	60	-	Volts
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	$I_E = 10\mu\text{A}$ , $I_B = 0\text{A}$	6	-	Volts
$I_{BL}$	Base Cutoff Current	$V_{CE} = 30\text{V}$ , $V_{EB} = 3\text{V}$	-	50	nA
$I_{CEX}$	Collector Cutoff Current	$V_{CE} = 30\text{V}$ , $V_{EB} = 3\text{V}$	-	50	nA

Note 1: Pulse Test. Pulse width <300us, Duty cycle < 2.0%

# MMBT3904T

## On Characteristics

Symbol	Parameter	Test Condition	Limits		Unit
			Min	Max	
$H_{FE}$	DC Current Gain	$I_C = 0.1\text{mA}, V_{CE} = 1\text{V}$	40	-	-
		$I_C = 1.0\text{mA}, V_{CE} = 1\text{V}$	70	-	
		$I_C = 10\text{mA}, V_{CE} = 1\text{V}$	100	300	
		$I_C = 50\text{mA}, V_{CE} = 1\text{V}$	60	-	
		$I_C = 100\text{mA}, V_{CE} = 1\text{V}$	30	-	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C = 10\text{mA}, I_B = 1\text{mA}$	-	0.2	Volts
		$I_C = 50\text{mA}, I_B = 5\text{mA}$	-	0.3	
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	$I_C = 10\text{mA}, I_B = 1\text{mA}$	0.65	0.85	Volts
		$I_C = 50\text{mA}, I_B = 5\text{mA}$	-	0.95	

## Small-signal Characteristics

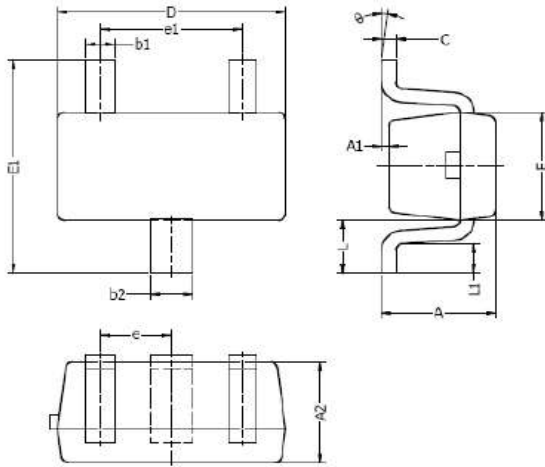
Symbol	Parameter	Test Condition	Limits		Unit
			Min	Max	
$f_T$	Current-Gain-Bandwidth Product	$I_C = 10\text{mA}, V_{CE} = 20\text{V}, f = 100\text{MHz}$	200	-	MHz
$C_{obo}$	Output Capacitance	$V_{CB} = 5\text{V}, I_E = 0\text{A}, f = 1.0\text{MHz}$	-	4	pF
$C_{ibo}$	Input Capacitance	$V_{BE} = 0.5\text{V}, I_C = 0\text{A}, f = 1.0\text{MHz}$	-	8	pF
$h_{ie}$	Input Impedance	$V_{CE} = 10\text{V}, I_C = 1\text{mA}, f = 1.0\text{kHz}$	1	10	pF
$h_{re}$	Voltage Feedback Ratio	$V_{CE} = 10\text{V}, I_C = 1\text{mA}, f = 1.0\text{kHz}$	0.5	8	$\times 10^{-4}$
$h_{fe}$	Small-signal Current Gain	$V_{CE} = 10\text{V}, I_C = 1\text{mA}, f = 1.0\text{kHz}$	100	400	-
$h_{oe}$	Output Admittance	$V_{CE} = 10\text{V}, I_C = 1\text{mA}, f = 1.0\text{kHz}$	1	40	$\theta$ mhos
NF	Noise Figure	$V_{CE} = 5\text{V}, I_C = 100\mu\text{A}$ $R_s = 1.0\text{k}\Omega, f = 1.0\text{kHz}$		5	dB

## Switching Characteristics

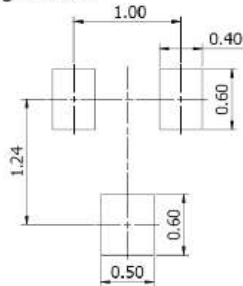
Symbol	Parameter	Test Condition	Limits		Unit
			Min	Max	
$t_d$	Delay Time	$V_{CC} = 3\text{V}, V_{BE} = 0.5\text{V},$	-	35	nS
$t_r$	Rise Time	$I_C = 10\text{mA}, I_{B1} = 1\text{mA}$	-	35	
$t_s$	Storage Time	$V_{CC} = 3\text{V}, I_C = 10\text{mA},$	-	200	nS
$t_f$	Fall Time	$I_{B1} = I_{B2} = 1\text{mA}$	-	50	

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## SOT-523 PACKAGE OUTLINE



Typical Soldering Pattern:



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.70	0.90	0.028	0.035
A1	0.00	0.10	0.000	0.004
A2	0.70	0.80	0.028	0.031
b1	0.15	0.25	0.006	0.010
b2	0.25	0.35	0.010	0.014
c	0.10	0.20	0.004	0.008
D	1.50	1.70	0.059	0.067
E	0.70	0.90	0.028	0.035
E1	1.45	1.75	0.057	0.069
e	0.50 TYP.		0.020 TYP.	
e1	0.90	1.10	0.035	0.043
L	0.40 REF.		0.016 REF.	
L1	0.10	0.30	0.004	0.012
θ	0°	8°	0°	8°

NOTES:

1. Above package outline conforms to JEITA EAIJ ED-7500A SC-75A.
2. Dimensions are exclusive of Burrs, Mold Flash & Tie Bar extrusions.

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