

MMBT3904-HAF

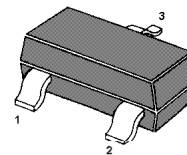
NPN Silicon General Purpose Transistor

Features

- Halogen and Antimony Free(HAF), RoHS compliant

Applications

- For Switching and Amplifier



1. Base 2. Emitter 3. Collector
TO-236 Plastic Package

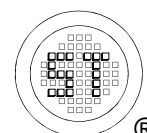
Absolute Maximum Ratings ($T_a = 25^\circ\text{C}$)

Parameter	Symbol	Value	Unit
Collector Base Voltage	V_{CBO}	60	V
Collector Emitter Voltage	V_{CEO}	40	V
Emitter Base Voltage	V_{EBO}	6	V
Collector Current	I_C	200	mA
Power Dissipation	P_{tot}	350	mW
Operating Junction and Storage Temperature Range	T_j, T_{stg}	- 55 to + 150	$^\circ\text{C}$

Thermal Characteristics

Parameter	Symbol	Max.	Unit
Thermal Resistance from Junction to Ambient ¹⁾	$R_{\theta JA}$	357	$^\circ\text{C/W}$

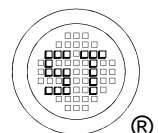
¹⁾ Device mounted on FR-4 PCB with minimum recommended pad layout.



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Characteristics at $T_a = 25\text{ }^{\circ}\text{C}$

Parameter	Symbol	Min.	Max.	Unit
DC Current Gain at $V_{CE} = 1\text{ V}$, $I_C = 0.1\text{ mA}$ at $V_{CE} = 1\text{ V}$, $I_C = 1\text{ mA}$ at $V_{CE} = 1\text{ V}$, $I_C = 10\text{ mA}$ at $V_{CE} = 1\text{ V}$, $I_C = 50\text{ mA}$ at $V_{CE} = 1\text{ V}$, $I_C = 100\text{ mA}$	h_{FE} h_{FE} h_{FE} h_{FE} h_{FE}	40 70 100 60 30	- - 300 - -	- - - - -
Collector Base Cutoff Current at $V_{CB} = 30\text{ V}$	I_{CBO}	-	50	nA
Emitter Base Cutoff Current at $V_{EB} = 6\text{ V}$	I_{EBO}	-	50	nA
Collector Base Breakdown Voltage at $I_C = 10\text{ }\mu\text{A}$	$V_{(BR)CBO}$	60	-	V
Collector Emitter Breakdown Voltage at $I_C = 1\text{ mA}$	$V_{(BR)CEO}$	40	-	V
Emitter Base Breakdown Voltage at $I_E = 10\text{ }\mu\text{A}$	$V_{(BR)EBO}$	6	-	V
Collector Emitter Saturation Voltage at $I_C = 10\text{ mA}$, $I_B = 1\text{ mA}$ at $I_C = 50\text{ mA}$, $I_B = 5\text{ mA}$	$V_{CE(sat)}$ $V_{CE(sat)}$	- -	0.2 0.3	V V
Base Emitter Saturation Voltage at $I_C = 10\text{ mA}$, $I_B = 1\text{ mA}$ at $I_C = 50\text{ mA}$, $I_B = 5\text{ mA}$	$V_{BE(sat)}$ $V_{BE(sat)}$	0.65 -	0.85 0.95	V V
Current Gain Bandwidth Product at $V_{CE} = 20\text{ V}$, $I_C = 10\text{ mA}$, $f = 100\text{ MHz}$	f_T	300	-	MHz
Collector Output Capacitance at $V_{CB} = 5\text{ V}$, $f = 1\text{ MHz}$	C_{ob}	-	4	pF
Delay Time at $V_{CC} = 3\text{ V}$, $V_{BE} = 0.5\text{ V}$, $I_C = 10\text{ mA}$, $I_{B1} = 1\text{ mA}$	t_d	-	35	ns
Rise Time at $V_{CC} = 3\text{ V}$, $V_{BE} = 0.5\text{ V}$, $I_C = 10\text{ mA}$, $I_{B1} = 1\text{ mA}$	t_r	-	35	ns
Storage Time at $V_{CC} = 3\text{ V}$, $I_C = 10\text{ mA}$, $I_{B1} = -I_{B2} = 1\text{ mA}$	t_s	-	200	ns
Fall Time at $V_{CC} = 3\text{ V}$, $I_C = 10\text{ mA}$, $I_{B1} = -I_{B2} = 1\text{ mA}$	t_f	-	50	ns



Electrical Characteristics Curves

Fig. 1 Output Characteristics Curve

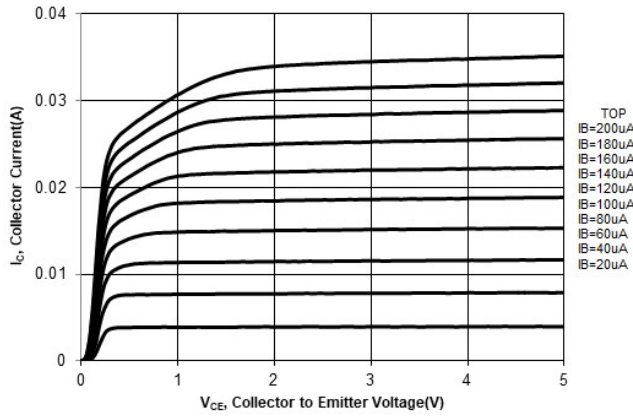


Fig. 2 Base to Emitter Voltage vs. Collector Current

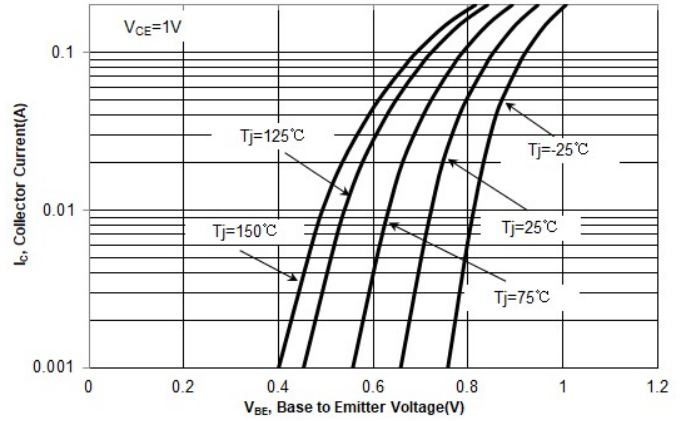


Fig. 3 DC Current Gain vs. Collector Current

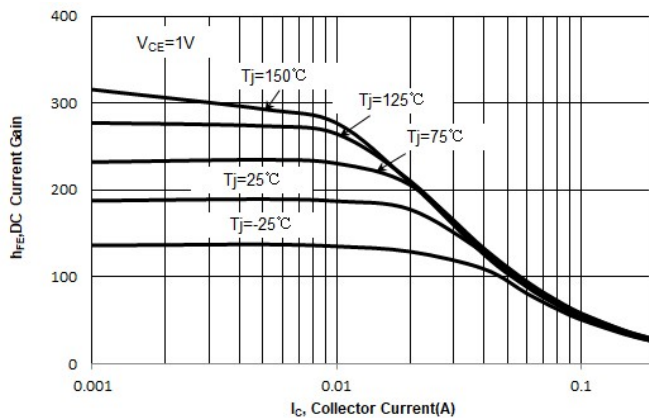
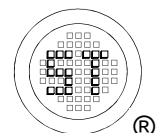
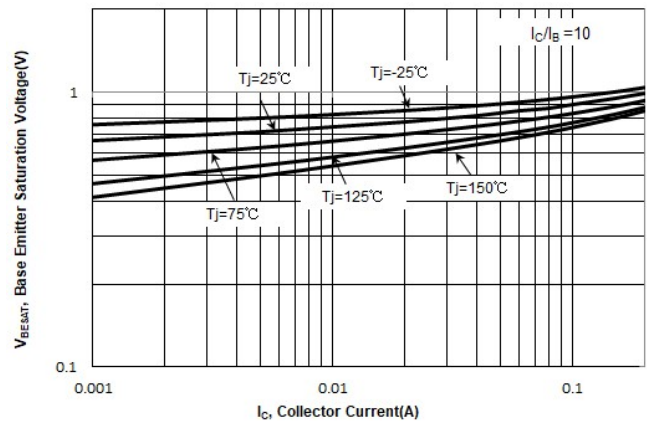


Fig. 4 $V_{BE(sat)}$ vs. Collector Current



Electrical Characteristics Curves

Fig. 5 $V_{CE(sat)}$ vs. Collector Current

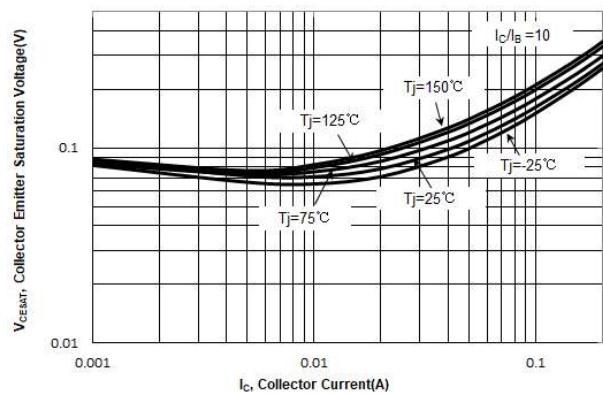


Fig. 6 Output Capacitance

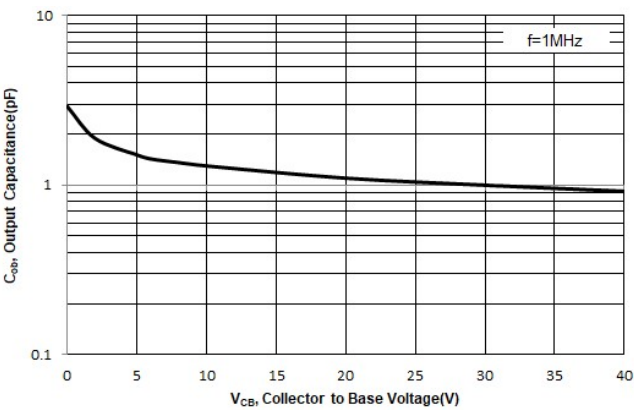
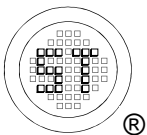
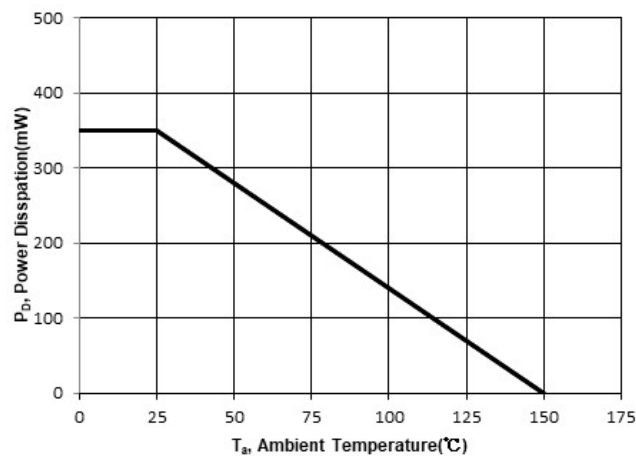


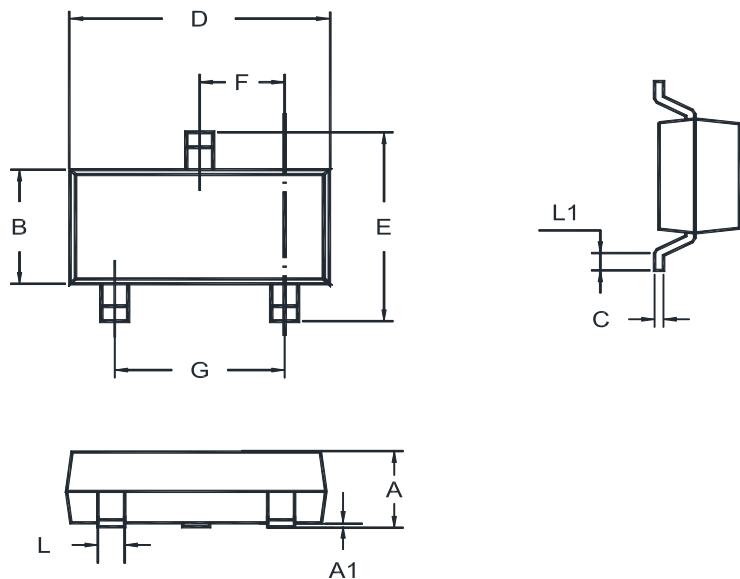
Fig. 7 Power Derating Curve



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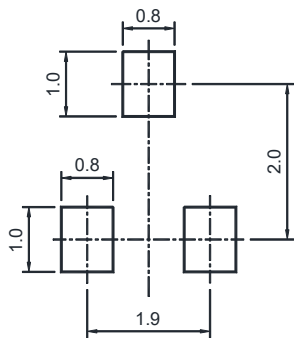
Package Outline (Dimensions in mm)

TO-236



Unit	A	A1	B	C	D	E	F	G	L	L1
mm	1.20 0.89	0.100 0.013	1.40 1.20	0.19 0.08	3.04 2.80	2.6 2.2	1.02 0.89	2.04 1.78	0.51 0.37	0.2 MIN

Recommended Soldering Footprint



Packing information

Package	Tape Width (mm)	Pitch		Reel Size		Per Reel Packing Quantity
		mm	inch	mm	inch	
TO-236	8	4 ± 0.1	0.157 ± 0.004	178	7	3,000

Marking information

" 1E " = Part No.

" • " = HAF (Halogen and Antimony Free)

"YM" = Date Code Marking

"Y" = Year

"M" = Month

Font type: Arial

