

MMBT3904



NPN UNIVERSAL SMALL SIGNAL TRANSISTOR

V_{CBO} : 60 Volts

I_C : 200 Ampers

Package: SOT-23

FEATURES

- NPN General-Purpose Small Signal Transistor.
- Small Temperature Drift And Low Cost.
- Extremely Low Saturation Voltage Drop
- The Summary Capacitor Is Suitable For High-Frequency Applications.
- Complementary to MMBT3906

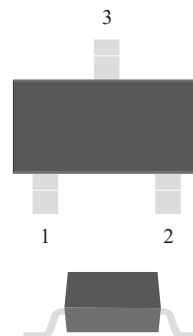
MECHANICAL DATA

- **Package:** Molding Compound Meets UL 94V-0 Flammability Rating.
The Material Of Product Compliance With RoHS Requirements.
- **Mounting Position:** Any.
- **Pin and polarity:** As Shown In The Figure On The Right.

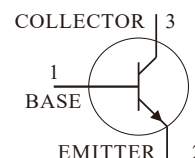
Device DATA

Device	MMBT3904
Marking	1AM

Diagram:



Polarity:



Maximum Ratings ($T_a=25^{\circ}\text{C}$ Unless otherwise specified)

Parameter	Test Conditions	Symbol	Ratings	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

Thermal Characteristics ($T_a=25^{\circ}\text{C}$ Unless otherwise specified)

Parameter	Test Conditions	Symbol	Ratings	Unit
Total Device Power Dissipation		P_D	200	mW
Derating Factor	above 25°C	D_F	1.6	mW/ $^{\circ}\text{C}$
Operating Junction Temperature Range		T_J	-55 to 150	$^{\circ}\text{C}$
Storage Temperature Range		T_{STD}	-55 to 150	
Thermal Resistance From Junction To Ambient With Steady-State	Device Mounted On 1 in2 FR-4 Board With 2oz.Copper	$R_{\theta JA}$	625	$^{\circ}\text{C/W}$

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ELECTRICAL CHARACTERISTICS (Ta= 25°C)

Characteristic	Test Condition	Symbol	Min.	Typ.	Max.	Unit
OFF CHARACTERISTICS						
Collector-Base Breakdown Voltage	I _C = 10 uAdc,I _E = 0	V _{(BR)CBO}	60	-	-	V
Collector-Emitter Breakdown Voltage	I _C = 1 mAdc,I _B = 0	V _{(BR)CEO}	40	-	-	V
Emitter-Base Breakdown Voltage	I _E = 10 uAdc,I _C = 0	V _{(BR)EBO}	6	-	-	V
Emitter Cut-off Current	V _{CB} = 30 Vdc,I _E = 0	I _{CBO}	-	-	100	nA
Base Cut-off Current	V _{CE} = 30 Vdc,I _B = 0	I _{CEO}	-	-	100	nA
Collector Cut-off Current	V _{EB} = 3.6 Vdc,I _C = 0	I _{EBO}	-	-	100	nA
ON CHARACTERISTICS						
DC Current Gain	V _{CE} = 1 V,I _C = 0.1 mA	H _{FE(1)}	40	-	-	-
	V _{CE} = 1 V,I _C = 1 mA	H _{FE(2)}	70	-	-	
	V _{CE} = 1 V,I _C = 10 mA	H _{FE(3)}	100	-	300	
	V _{CE} = 1 V,I _C = 50 mA	H _{FE(4)}	60	-	-	
	V _{CE} = 1 V,I _C = 100 mA	H _{FE(5)}	30	-	-	
Collector-Emitter Saturation Voltage	I _C = 10 mA,I _B = 1 mA	V _{CE(Sat)}	-	-	0.2	V
	I _C = 50 mA,I _B = 5 mA		-	-	0.3	
Base-Emitter Saturation Voltage	I _C = 10 mA,V _{CE} = 1 V	V _{BE(Sat)}	0.65	-	0.85	V
	I _C = 50 mA,V _{CE} = 5 V		-	-	0.95	
Transition Frequency	V _{CE} = 20 V,I _C = 10 mA f= 30 MHz	f _T	300	-	-	MHz
Output Capacitance	V _{CB} = 5 V,f= 1 MHz I _E = 0	C _{obo}	-	-	4	PF
Input Capacitance	V _{BE} = 0.5 V,f= 1 MHz I _C = 0	C _{ibo}	-	-	8	PF
Noise Figure	I _C = 100 uA,V _{CE} = 5 V R _S = 1 KΩ,f= 10 MHz To 15.7 KHz	NF	-	-	5	dB
ON CHARACTERISTICS						
Delay Time	V _{CC} = 3.0 V,I _C = 10 mA	td	-	-	35	ns
Rise Time	V _{BE} = 0.5 V,I _{B1} = 1.0 mA	tr	-	-	35	
Storage Time	V _{CC} = 3.0 V,I _C = 10 mA	ts	-	-	200	ns
Fall Time	I _{B1} = I _{B2} = 1.0 mA	tf	-	-	50	
Classification Of H _{FE(3)}						
Rank	L	H				
Range	100-200	200-300				

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Typical Characteristics Curves

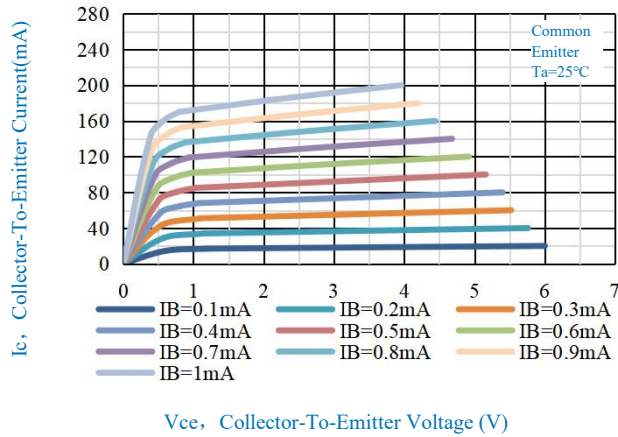


Fig.1-Static Characteristics

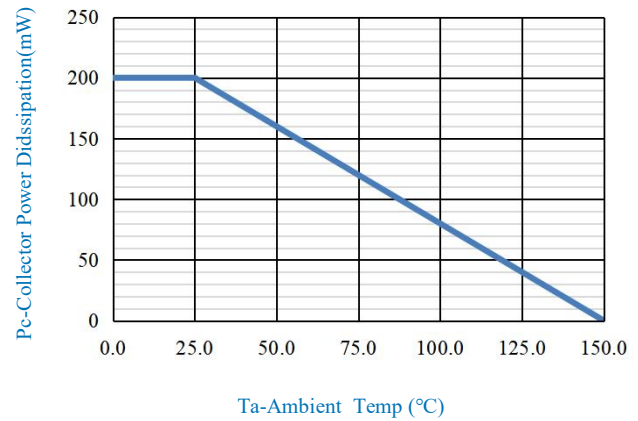


Fig.2-Collector Power Dissipation Vs. Ta

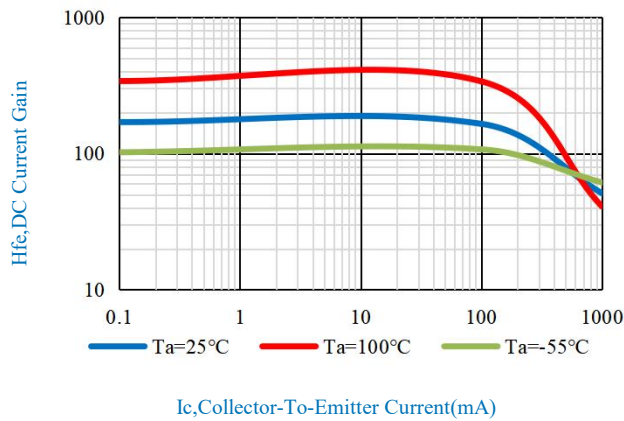


Fig.3-Dc Current Gain Vs. Collector Current

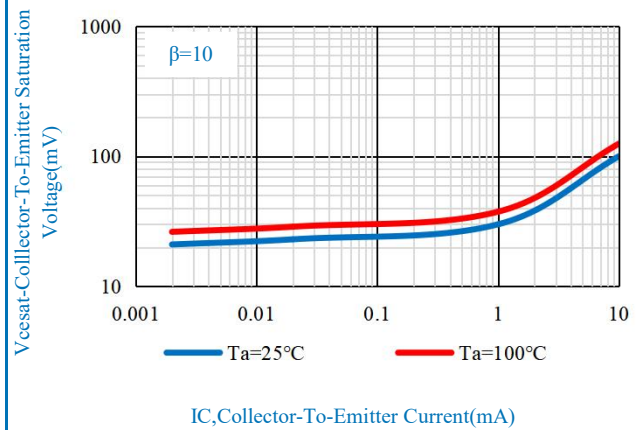


Fig.4-Base-To-Emitter Saturation Voltage Vs. Collector Current

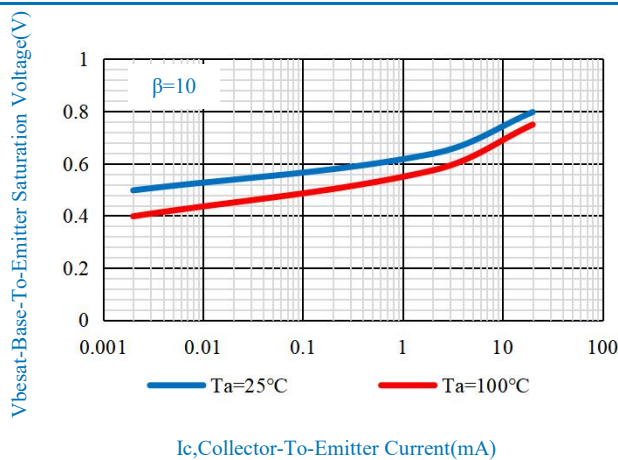


Fig.5-Base-To-Emitter Saturation Voltage Vs. Collector Current

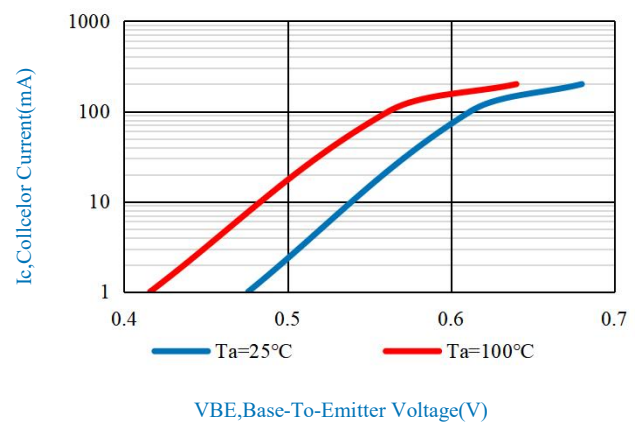


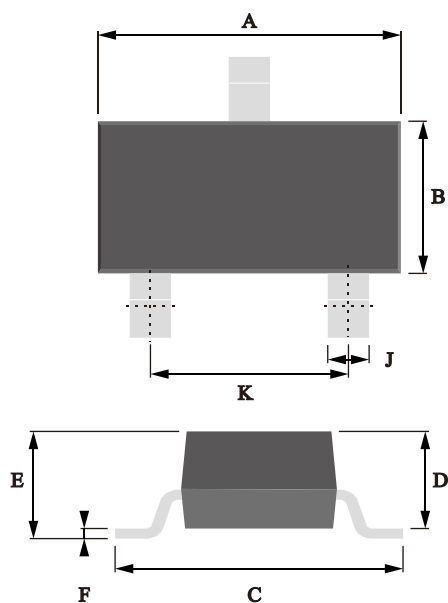
Fig.6-Base-To-Emitter Voltage Characteristics

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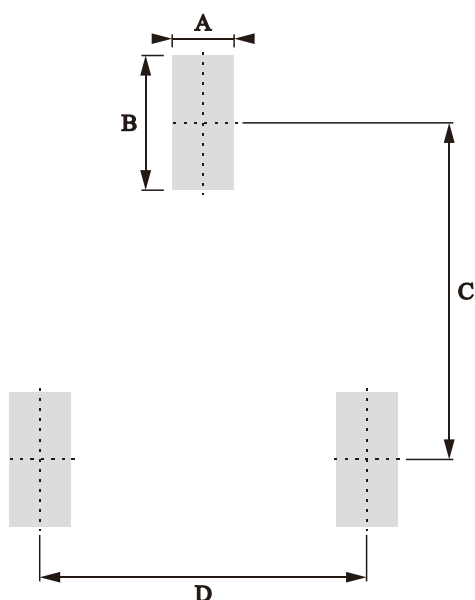
OUTLINE DRAWINGS



SOT-23

OUTLINE DIMENSIONS						
Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.80	-	3.20	0.1102	-	0.1260
B	1.15	-	1.45	0.0453	-	0.0571
C	2.25	-	2.65	0.0886	-	0.1043
D	0.85	-	1.15	0.0335	-	0.0453
E	0.90	-	1.20	0.0354	-	0.0472
F	0.08	-	0.18	0.0031	-	0.0071
J	0.30	-	0.50	0.0118	-	0.0197
K	1.70	-	2.10	0.0669	-	0.0827

RECOMMENDED LAYOUT DRAWINGS



SOT-23

OUTLINE DIMENSIONS						
Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	-	0.60	-	-	0.0000	-
B	-	0.80	-	-	0.0315	-
C	-	2.00	-	-	0.0787	-
D	-	1.90	-	-	0.0748	-

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MARKING INFORMATION

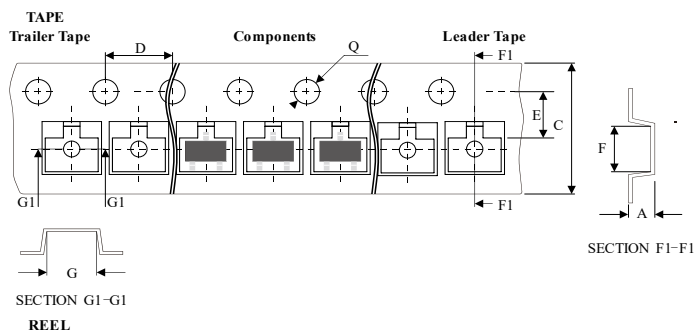
MARKING INSTRUCTIONS



1AM=mark

PACKAGING

SOT-23



OUTLINE DIMENSIONS

Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
TAPE						
A	1.12	-	1.32	0.0441	-	0.0520
C	7.90	-	8.10	0.3110	-	0.3189
D	3.70	-	4.30	0.1457	-	0.1693
E	3.40	-	3.60	0.1339	-	0.1417
F	2.67	-	2.87	0.1051	-	0.1130
G	3.05	-	3.25	0.1201	-	0.1280
Q Φ	1.40	-	1.60	0.0551	-	0.0630
REEL						
L Φ	176.00	-	180.00	6.929	-	7.087
R	12.00	-	14.00	0.4724	-	0.5512
M	11.00	-	13.00	0.4331	-	0.5118

PACKING INFORMATION

Package Type	Package Code	Product Weight Approx(g/Pcs)	Package Method	Quantity (Pcs/Min. Pack.)	Quantity (Pcs/Inner Box)	Quantity (Pcs/Carton)
SOT-23	P1	0.008	7" Reel	3000	45000	180000

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Recommended wave soldering condition

Product	Peak Temperature	Soldering Time
Pb-free devices	260 +0/-5 °C	5 +1/-1 seconds

Recommended temperature profile for IR reflow

	Profile feature	Sn-Pb eutectic Assembly	Pb-free Assembly
	Average ramp-up rate (T _{smax} to T _p)	3°C/second max.	3°C/second max.
	Preheat-Temperature Min (T _S min) -Temperature Max (T _S max) -Time(t _s min to t _s max)	100°C 150°C 60-120 seconds	150°C 200°C 60-180 seconds
	Time maintained above: -Temperature (T _L) - Time (t _L)	183°C 60-150 seconds	217°C 60-150 seconds
	Peak Temperature(T _P)	240 +0/-5 °C	260 +0/-5 °C
	Time within 5°C of actual peak temperature (t _p)	10-30 seconds	20-40 seconds
	Ramp down rate	6°C/second max.	6°C/second max.
	Time 25 °C to peak temperature	6 minutes max.	8 minutes max.

Note : All temperatures refer to topside of the package, measured on the package body surface.

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Specification Revision History

Rev.	Date	Changed Items	Pre-Changed Content	Changed Content
A/1	2014-10-20	First Issue		
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