



DATA SHEET

SEMICONDUCTOR

MMBT3906

General Purpose Transistors



PNP Silicon

- Pb-Free Package May be Available. The G-Suffix Denotes a Pb-Free Lead Finish
- ESD Rating: Human Body Model, class 3A

ORDERING INFORMATION

Device	Package	Shipping
MMBT3906	SOT-23	3000/Tape & Reel

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	- 40	Vdc
Collector-Base Voltage	V_{CBO}	- 40	Vdc
Emitter-Base Voltage	V_{EBO}	- 5.0	Vdc
Collector Current — Continuous	I_C	- 200	mAdc

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation FR-5 Board(1) $T_A = 25^\circ\text{C}$	P_D	225	mW
Derate above 25°C		1.8	mW/ $^\circ\text{C}$
Thermal Resistance Junction to Ambient	$R_{\theta JA}$	556	$^\circ\text{C/W}$
Total Device Dissipation Alumina Substrate, (2) $T_A = 25^\circ\text{C}$	P_D	300	mW
Derate above 25°C		2.4	mW/ $^\circ\text{C}$
Thermal Resistance Junction to Ambient	$R_{\theta JA}$	417	$^\circ\text{C/W}$
Junction and Storage Temperature	T_J, T_{stg}	-55 to +150	$^\circ\text{C}$

DEVICE MARKING

MMBT3906= 2A

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
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OFF CHARACTERISTICS

Collector-Emitter Breakdown Voltage (3) ($I_C = -1.0\text{ mA}$, $I_E = 0$)	$V_{(BR)CEO}$	- 40	—	Vdc
Collector-Base Breakdown Voltage ($I_C = -10\text{ }\mu\text{A}$, $I_E = 0$)	$V_{(BR)CBO}$	- 40	—	Vdc
Emitter-Base Breakdown Voltage ($I_E = -10\text{ }\mu\text{A}$, $I_C = 0$)	$V_{(BR)EBO}$	- 5.0	—	Vdc
Base Cutoff Current ($V_{CE} = -30\text{ Vdc}$, $V_{EB} = -3.0\text{ Vdc}$)	I_{BL}	—	- 50	nAdc
Collector Cutoff Current ($V_{CE} = -30\text{ Vdc}$, $V_{EB} = -3.0\text{ Vdc}$)	I_{CEX}	—	- 50	nAdc

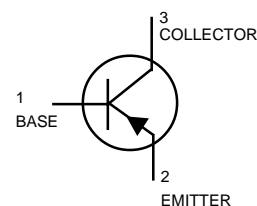
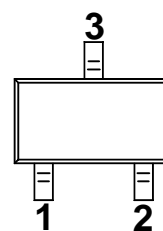
1. FR-5 = 1.0 x 0.75 x 0.062 in.

2. Alumina = 0.4 x 0.3 x 0.024 in. 99.5% alumina.

3. Pulse Width $\leq 300\text{ }\mu\text{s}$; Duty Cycle $\leq 2.0\%$.

4. ESD Ratings: Human Body Model, 3A

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ELECTRICAL CHARACTERISTICS

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ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) (Continued)

Characteristic	Symbol	Min	Max	Unit
ON CHARACTERISTICS (2)				
DC Current Gain (I _C = -0.1 mA _{dc} , V _{CE} = -1.0 V _{dc}) (I _C = -1.0 mA _{dc} , V _{CE} = -1.0 V _{dc}) (I _C = -10 mA _{dc} , V _{CE} = -1.0 V _{dc}) (I _C = -50 mA _{dc} , V _{CE} = -1.0 V _{dc}) (I _C = -100 mA _{dc} , V _{CE} = -1.0 V _{dc})	h _{FE}	60 80 100 60 30	— — 300 — —	—
Collector-Emitter Saturation Voltage (I _C = -10 mA _{dc} , I _B = -1.0 mA _{dc}) (I _C = -50 mA _{dc} , I _B = -5.0 mA _{dc})	V _{CE(sat)}	— —	- 0.25 - 0.4	V _{dc}
Base-Emitter Saturation Voltage (I _C = -10 mA _{dc} , I _B = -1.0 mA _{dc}) (I _C = -50 mA _{dc} , I _B = -5.0 mA _{dc})	V _{BE(sat)}	- 0.65 —	- 0.85 - 0.95	V _{dc}

SMALL-SIGNAL CHARACTERISTICS

Current-Gain — Bandwidth Product (I _C = -10 mA _{dc} , V _{CE} = -20 V _{dc} , f = 100 MHz)	f _T	250	—	MHz
Output Capacitance (V _{CB} = -5.0 V _{dc} , I _E = 0, f = 1.0 MHz)	C _{obo}	—	4.5	pF
Input Capacitance (V _{EB} = -0.5 V _{dc} , I _C = 0, f = 1.0 MHz)	C _{ibo}	—	10	pF
Input Impedance (V _{CE} = -10 V _{dc} , I _C = -1.0 mA _{dc} , f = 1.0 kHz)	h _{ie}	2.0	12	kΩ
Voltage Feedback Ratio (V _{CE} = -10 V _{dc} , I _C = -1.0 mA _{dc} , f = 1.0 kHz)	h _{re}	0.1	10	X 10 ⁻⁴
Small-Signal Current Gain (V _{CE} = -10 V _{dc} , I _C = -1.0 mA _{dc} , f = 1.0 kHz)	h _{fe}	100	400	—
Output Admittance (V _{CE} = -10 V _{dc} , I _C = -1.0 mA _{dc} , f = 1.0 kHz)	* h _{oe}	3.0	60	μmhos
Noise Figure (V _{CE} = -5.0V _{dc} , I _C = -100 μA _{dc} , R _S = 1.0 kΩ, f = 1.0kHz)	NF	—	4.0	dB

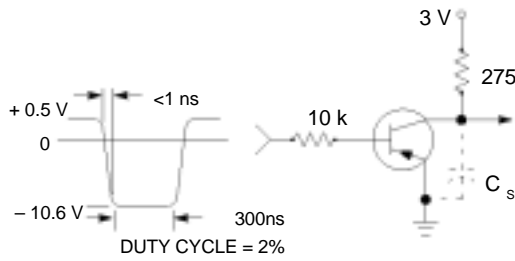
SWITCHING CHARACTERISTICS

Delay Time	(V _{CC} = - 3.0 V _{dc} , V _{BE} = 0.5 V _{dc} ,	t _d	—	35	ns
Rise Time	I _C = -10 mA _{dc} , I _{B1} = -1.0 mA _{dc})	t _d	—	35	
Storage Time	(V _{CC} = -3.0 V _{dc} , I _C = -10 mA _{dc} ,	t _s	—	225	ns
Fall Time	I _{B1} = I _{B2} = -1.0 mA _{dc})	t _f	—	75	

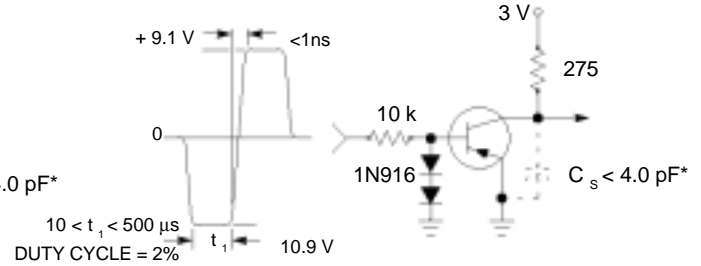
3. Pulse Test: Pulse Width ≤300 μs; Duty Cycle ≤2.0%.

DEVICE CHARACTERISTICS

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**Figure 1. Delay and Rise Time
Equivalent Test Circuit**



**Figure 2. Storage and Fall Time
Equivalent Test Circuit**

*Total shunt capacitance of test jig and connectors

TYPICAL TRANSIENT CHARACTERISTICS

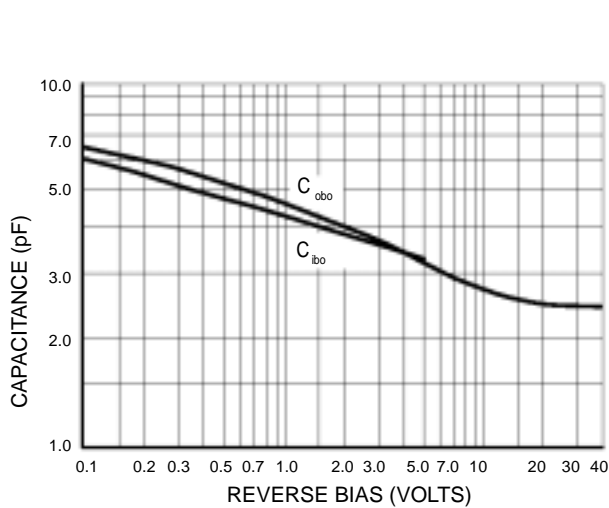


Figure 3. Capacitance

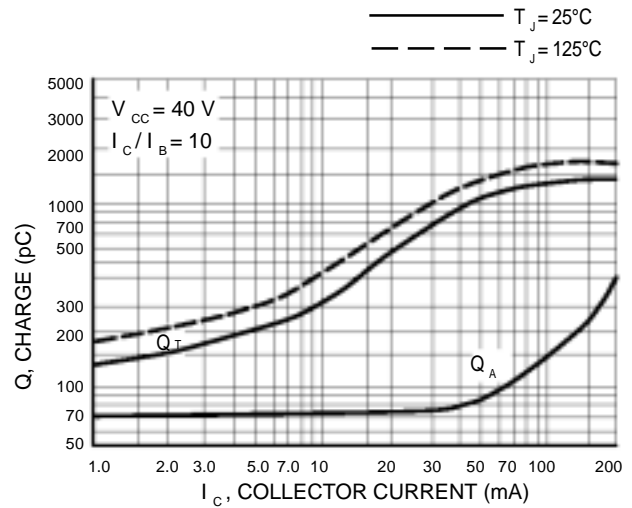


Figure 4. Charge Data

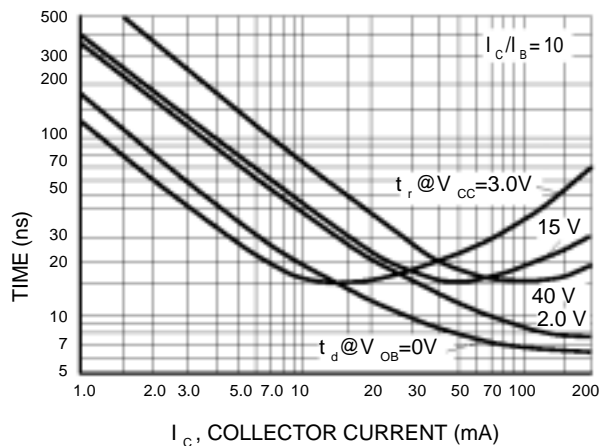


Figure 5. Turn-On Time

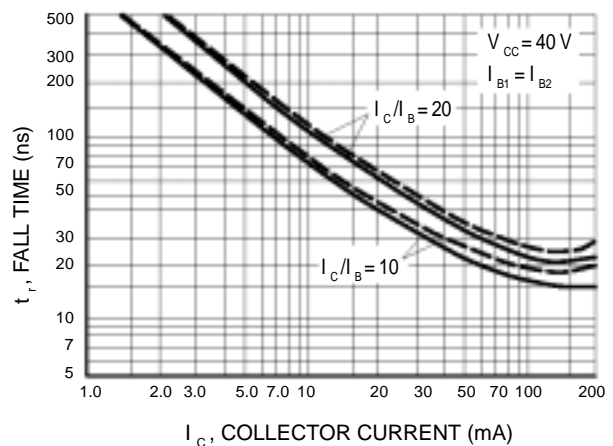


Figure 6. Fall Time

DEVICE CHARACTERISTICS

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TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS

NOISE FIGURE VARIATIONS

($V_{CE} = -5.0$ Vdc, $T_A = 25^\circ\text{C}$, Bandwidth = 1.0 Hz)

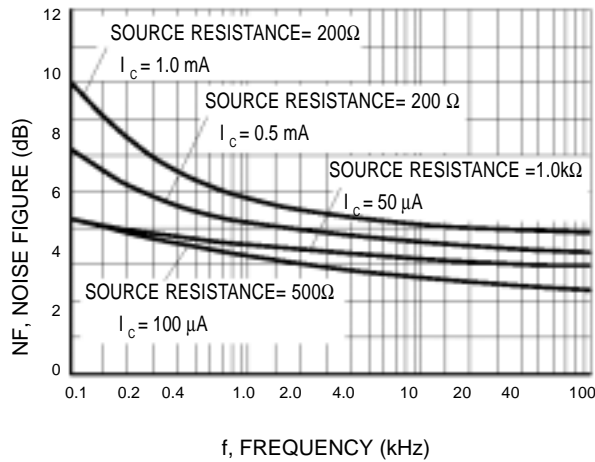


Figure 7. Noise Figure

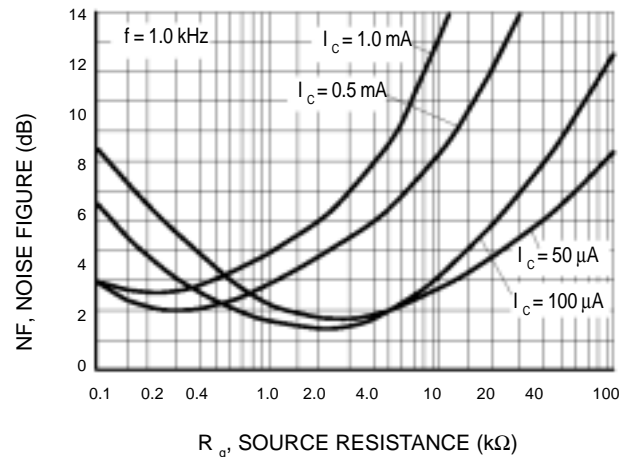


Figure 8. Noise Figure

h PARAMETERS

($V_{CE} = 10$ Vdc, $f = 1.0$ kHz, $T_A = 25^\circ\text{C}$)

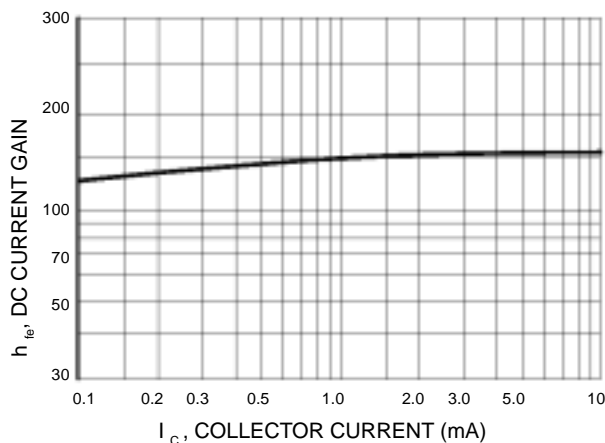


Figure 9. Current Gain

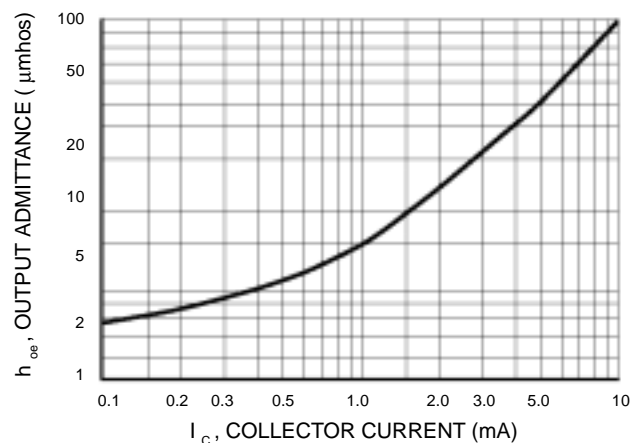


Figure 10. Output Admittance

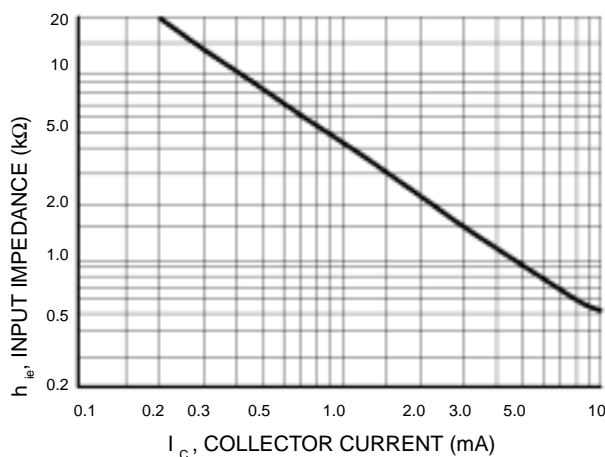


Figure 11. Input Impedance

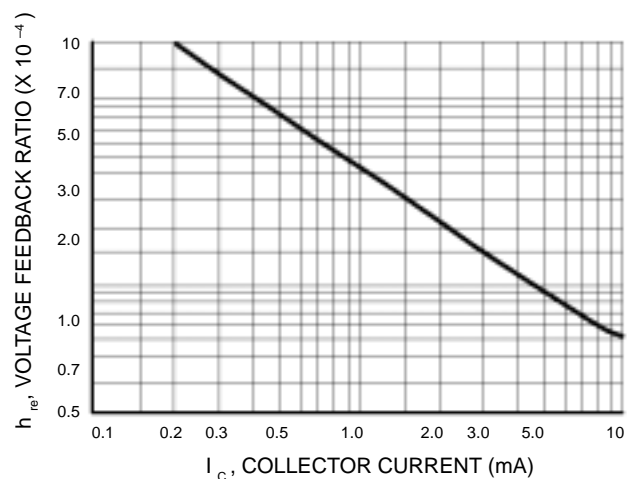


Figure 12. Voltage Feedback Ratio

DEVICE CHARACTERISTICS

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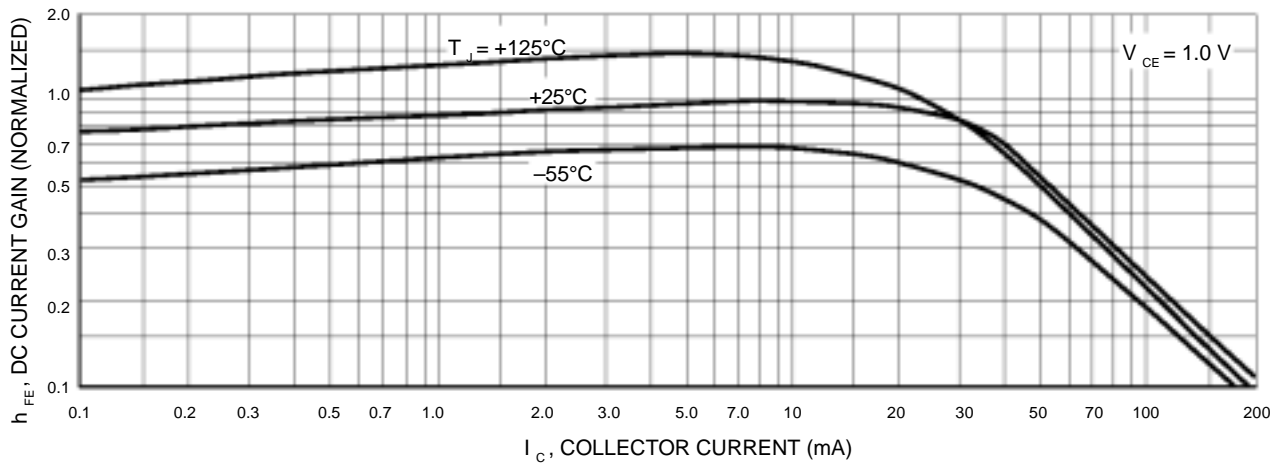


Figure 13. DC Current Gain

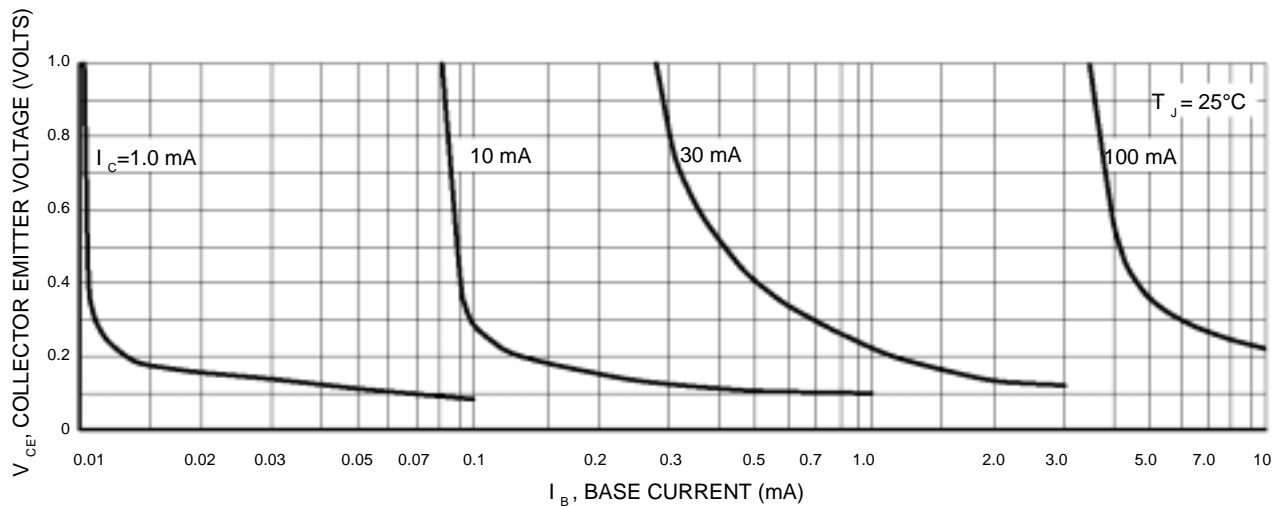


Figure 14. Collector Saturation Region

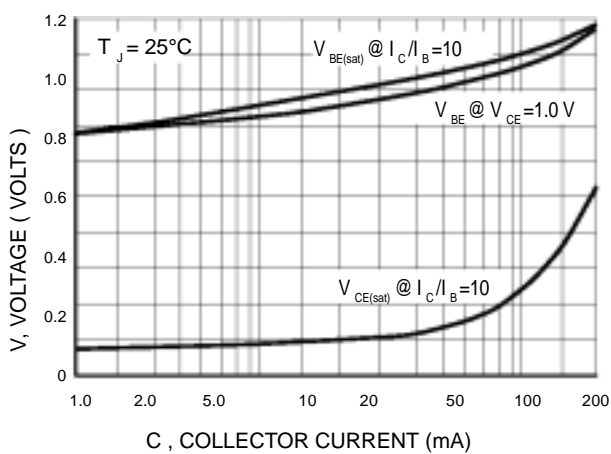


Figure 15. "ON" Voltages

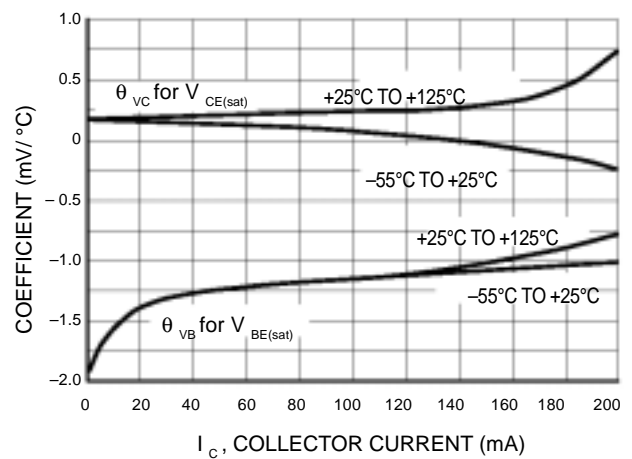
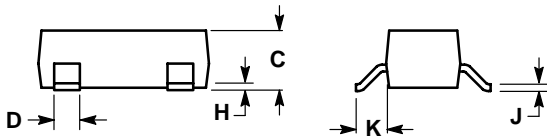
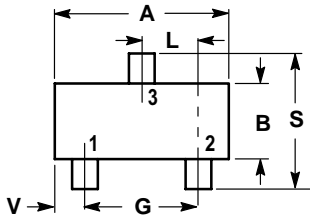


Figure 16. Temperature Coefficients

PACKAGE OUTLINE & DIMENSIONS

MMBT3906

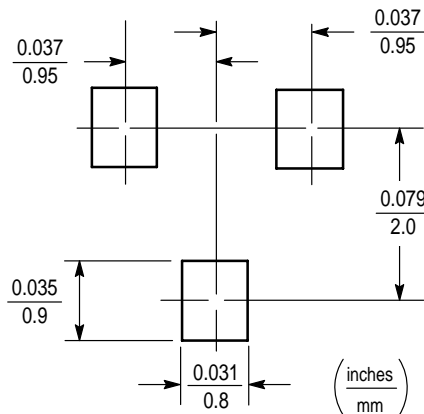
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NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.1102	0.1197	2.80	3.04
B	0.0472	0.0551	1.20	1.40
C	0.0350	0.0440	0.89	1.11
D	0.0150	0.0200	0.37	0.50
E	0.0701	0.0807	1.78	2.04
F	0.0005	0.0040	0.013	0.100
G	0.0034	0.0070	0.085	0.177
H	0.0140	0.0285	0.35	0.69
I	0.0350	0.0401	0.89	1.02
J	0.0830	0.1039	2.10	2.64
K	0.0177	0.0236	0.45	0.60



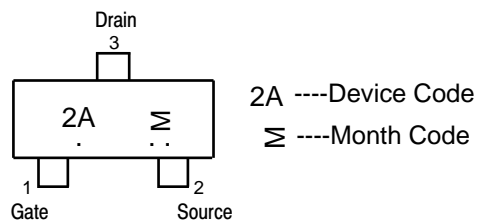


SEMICONDUCTOR

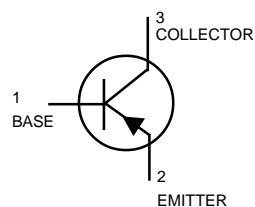
Approve Sheet: Part Number: MMBT3906

MARKING

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CIRCUIT FIGURE



MARKING DIAGRAM & PIN ASSIGNMENT

ORDERING INFORMATION

Device	Marking	Minimum Q'ty
MMBT3906	2A	3000/TR



SEMICONDUCTOR

Approve Sheet: Part Number: SOD/SOT

MARKING

MONTH CODE

ODD YEARS (2001/1/3)

Jan	1
Feb	2
Mar	3
Apr	4
May	5
Jun	6
Jul	7
Aug	8
Sep	9
Oct	T
Nov	V
Dec	C

MONTH CODE

EVEN YEARS (2002/1/3)

Jan	E
Feb	F
Mar	H
Apr	J
May	K
Jun	L
Jul	N
Aug	P
Sep	U
Oct	X
Nov	Y
Dec	Z

Location coding features

(DEV=Device code, M=Date code)



DEV----Device Code

M----Month Code



Pb Free

Wafer Source Code