

MMBT4401WT1

Preferred Device

Switching Transistor

NPN Silicon

Features

- Moisture Sensitivity Level: 1
- ESD Rating: Human Body Model; 4 kV, Machine Model; 400 V
- Pb-Free Package is Available

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	40	Vdc
Collector-Base Voltage	V_{CBO}	60	Vdc
Emitter-Base Voltage	V_{EBO}	6.0	Vdc
Collector Current - Continuous	I_C	600	mAdc

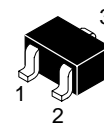
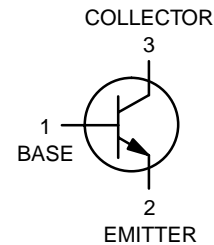
THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation FR-5 Board $T_A = 25^\circ\text{C}$	P_D	150	mW
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	833	$^\circ\text{C/W}$
Junction and Storage Temperature	T_J, T_{stg}	-55 to +150	$^\circ\text{C}$



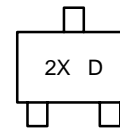
ON Semiconductor®

<http://onsemi.com>



SC-70 (SOT-323)
CASE 419
STYLE 3

MARKING DIAGRAM



2X = Specific Device Code
D = Date Code

ORDERING INFORMATION

Device	Package	Shipping†
MMBT4401WT1	SC-70	3000/Tape & Reel
MMBT4401WT1G	SC-70 (Pb-Free)	3000/Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

Preferred devices are recommended choices for future use and best overall value.

MMBT4401WT1

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector–Emitter Breakdown Voltage (Note 1) (I _C = 1.0 mA _{dc} , I _B = 0)	V _{(BR)CEO}	40	–	V _{dc}
Collector–Base Breakdown Voltage (I _C = 0.1 mA _{dc} , I _E = 0)	V _{(BR)CBO}	60	–	V _{dc}
Emitter–Base Breakdown Voltage (I _E = 0.1 mA _{dc} , I _C = 0)	V _{(BR)EBO}	6.0	–	V _{dc}
Base Cutoff Current (V _{CE} = 35 V _{dc} , V _{EB} = 0.4 V _{dc})	I _{BEV}	–	0.1	μA _{dc}

ON CHARACTERISTICS (Note 1)

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 = 150 mA _{dc} , V _{CE} = 1.0 V _{dc}) (I _C = 500 mA _{dc} , V _{CE} = 2.0 V _{dc})	h _{FE}	20 40 80 100 40	– – – 300 –	–
Collector–Emitter Saturation Voltage (I _C = 150 mA _{dc} , I _B = 15 mA _{dc}) (I _C = 500 mA _{dc} , I _B = 50 mA _{dc})	V _{CE(sat)}	– –	0.4 0.75	V _{dc}
Base–Emitter Saturation Voltage (I _C = 150 mA _{dc} , I _B = 15 mA _{dc}) (I _C = 500 mA _{dc} , I _B = 50 mA _{dc})	V _{BE(sat)}	0.75 –	0.95 1.2	V _{dc}
Collector Cutoff Current (V _{CE} = 35 V _{dc} , V _{EB} = 0.4 V _{dc})	I _{CEX}	–	0.1	μA _{dc}

SMALL-SIGNAL CHARACTERISTICS

Current–Gain – Bandwidth Product (I _C = 20 mA _{dc} , V _{CE} = 10 V _{dc} , f = 100 MHz)	f _T	250	–	MHz
Collector–Base Capacitance (V _{CB} = 5.0 V _{dc} , I _E = 0, f = 1.0 MHz)	C _{cb}	–	6.5	pF
Emitter–Base Capacitance (V _{EB} = 0.5 V _{dc} , I _C = 0, f = 1.0 MHz)	C _{eb}	–	30	pF
Input Impedance (I _C = 1.0 mA _{dc} , V _{CE} = 10 V _{dc} , f = 1.0 kHz)	h _{ie}	1.0	15	kΩ
Voltage Feedback Ratio (I _C = 1.0 mA _{dc} , V _{CE} = 10 V _{dc} , f = 1.0 kHz)	h _{re}	0.1	8.0	X 10 ⁻⁴
Small–Signal Current Gain (I _C = 1.0 mA _{dc} , V _{CE} = 10 V _{dc} , f = 1.0 kHz)	h _{fe}	40	500	–
Output Admittance (I _C = 1.0 mA _{dc} , V _{CE} = 10 V _{dc} , f = 1.0 kHz)	h _{oe}	1.0	30	μmhos

SWITCHING CHARACTERISTICS

Delay Time	(V _{CC} = 30 V _{dc} , V _{EB} = 2.0 V _{dc} , I _C = 150 mA _{dc} , I _{B1} = 15 mA _{dc})	t _d	–	15	ns
Rise Time		t _r	–	20	
Storage Time	(V _{CC} = 30 V _{dc} , I _C = 150 mA _{dc} , I _{B1} = I _{B2} = 15 mA _{dc})	t _s	–	225	ns
Fall Time		t _f	–	30	

1. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

SWITCHING TIME EQUIVALENT TEST CIRCUITS

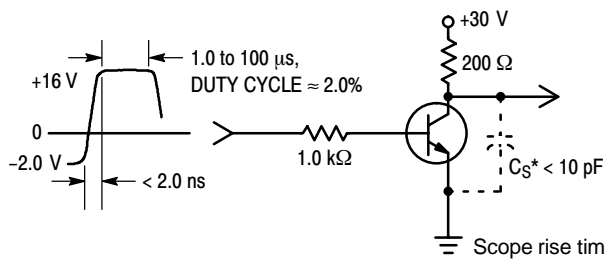


Figure 1. Turn–On Time

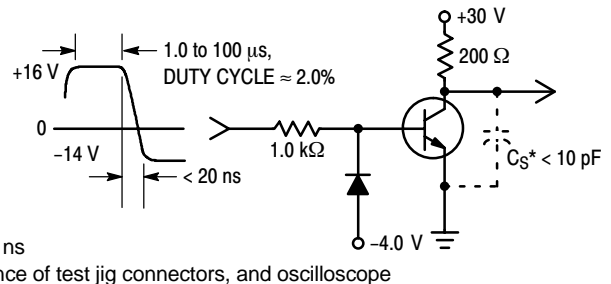


Figure 2. Turn–Off Time

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TRANSIENT CHARACTERISTICS

— 25°C - - - 100°C

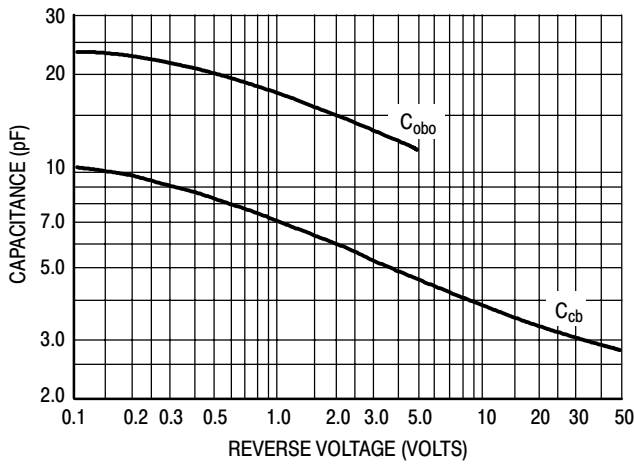


Figure 3. Capacitances

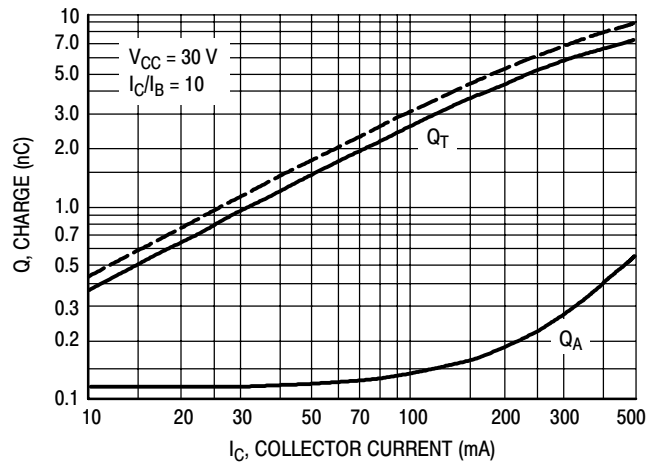


Figure 4. Charge Data

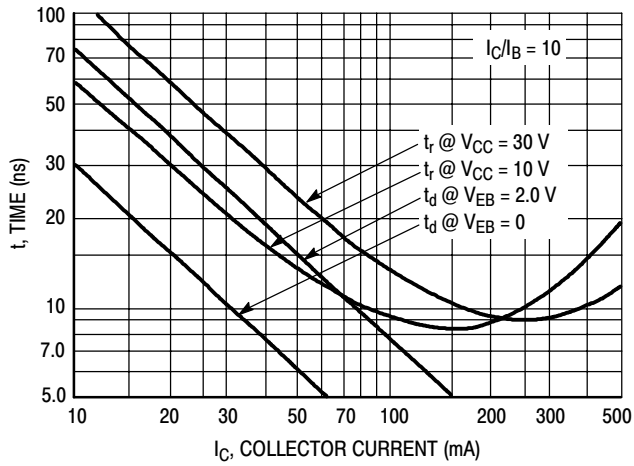


Figure 5. Turn-On Time

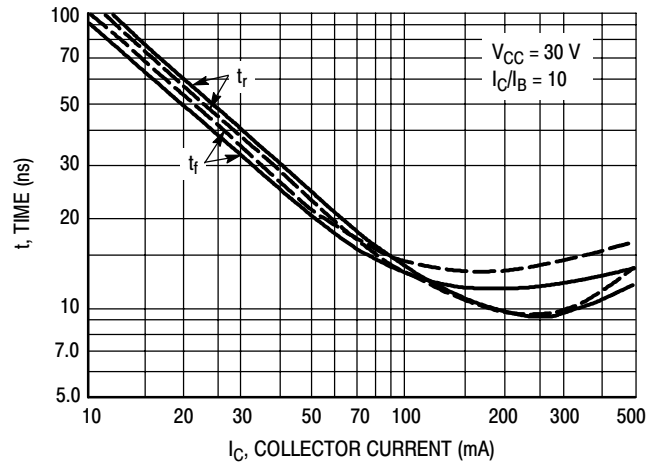


Figure 6. Rise and Fall Times

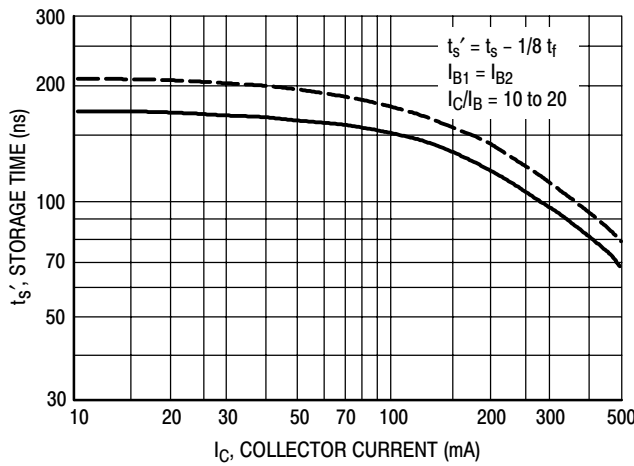


Figure 7. Storage Time

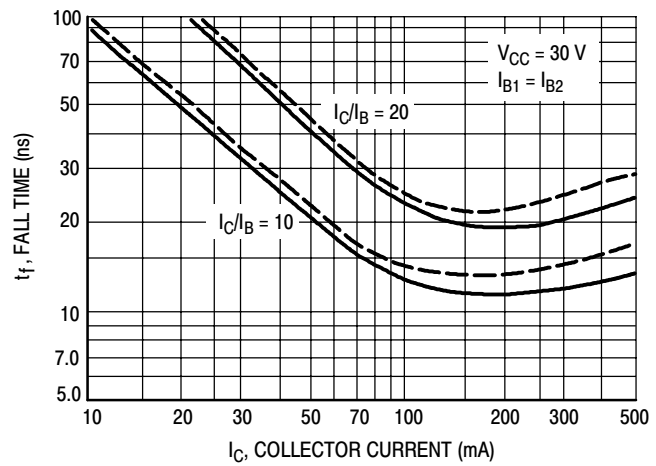


Figure 8. Fall Time

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SMALL-SIGNAL CHARACTERISTICS NOISE FIGURE

$V_{CE} = 10 \text{ Vdc}$, $T_A = 25^\circ\text{C}$; Bandwidth = 1.0 Hz

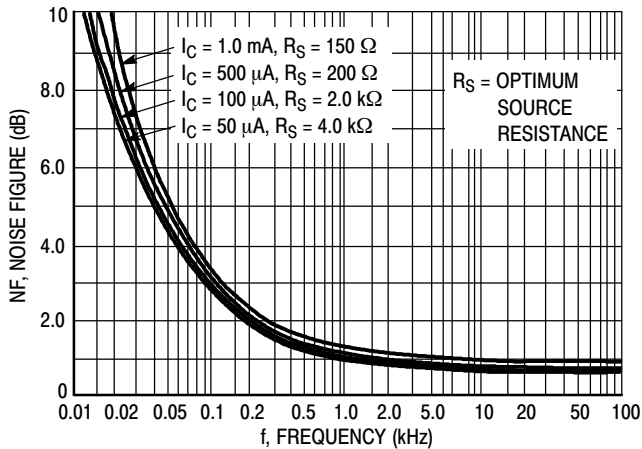


Figure 9. Frequency Effects

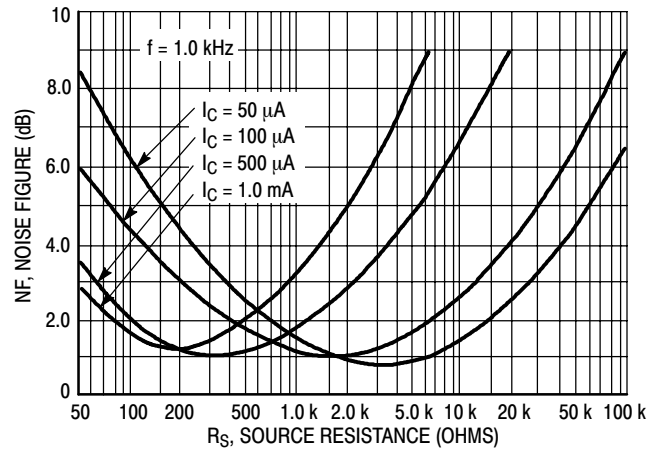


Figure 10. Source Resistance Effects

h PARAMETERS

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

This group of graphs illustrates the relationship between h_{fe} and other “h” parameters for this series of transistors. To obtain these curves, a high-gain and a low-gain unit were selected from the MMBT4401WT1 lines, and the same units were used to develop the correspondingly numbered curves on each graph.

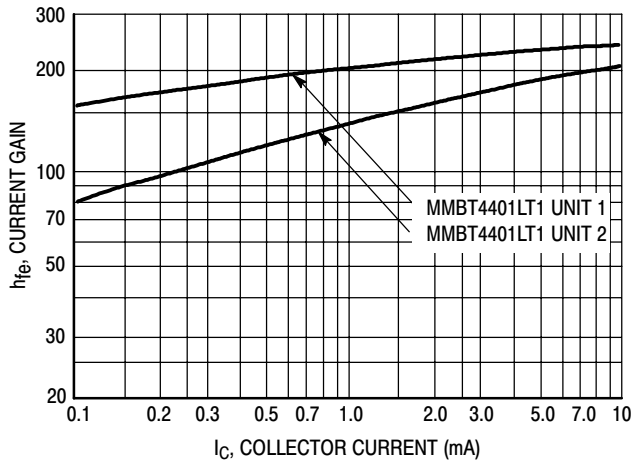


Figure 11. Current Gain

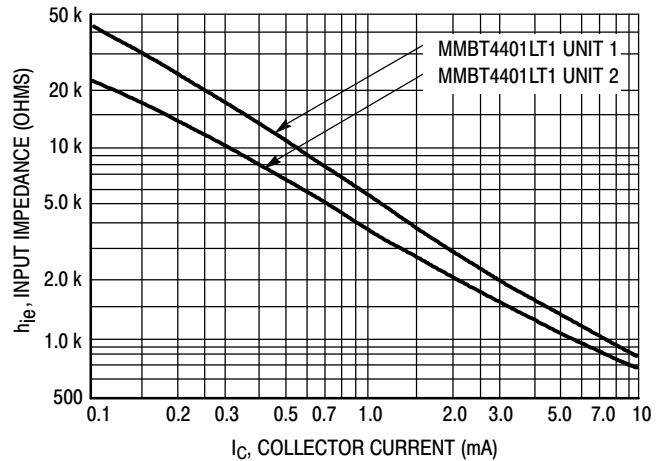


Figure 12. Input Impedance

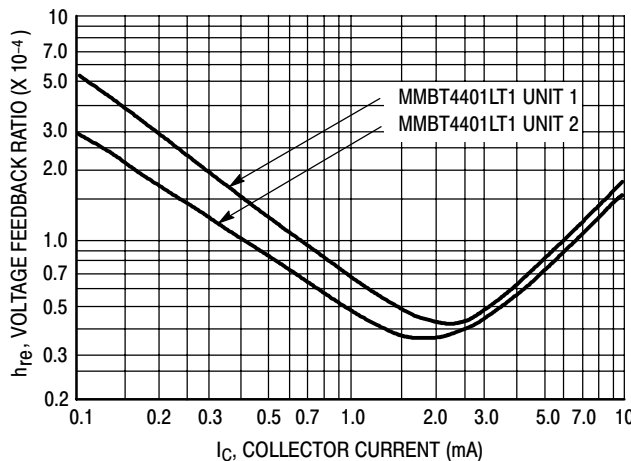


Figure 13. Voltage Feedback Ratio

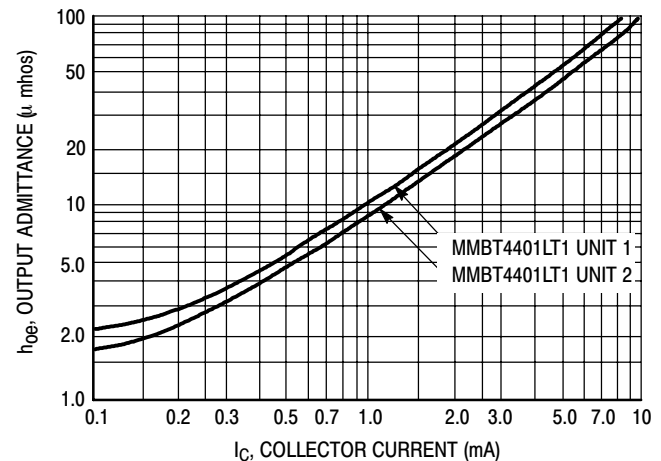


Figure 14. Output Admittance

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STATIC CHARACTERISTICS

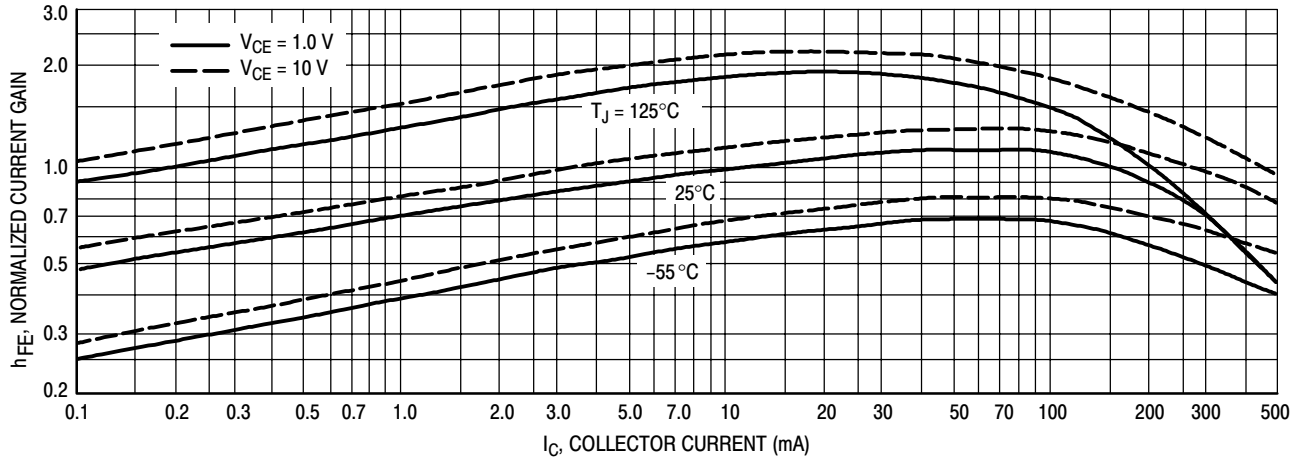


Figure 15. DC Current Gain

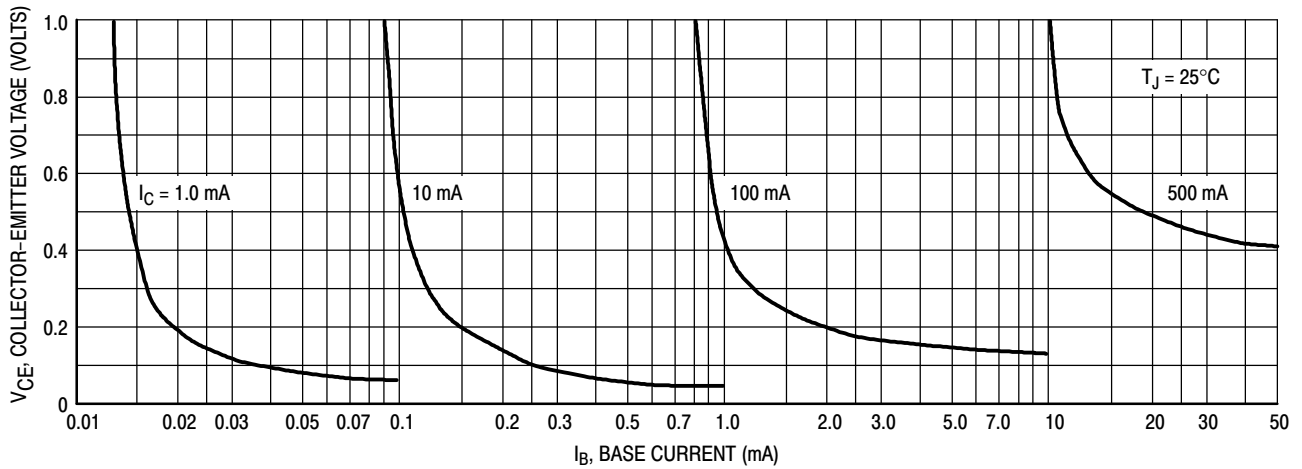


Figure 16. Collector Saturation Region

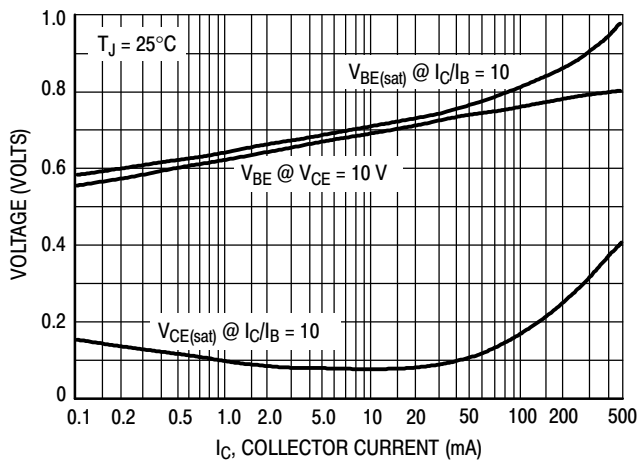


Figure 17. "On" Voltages

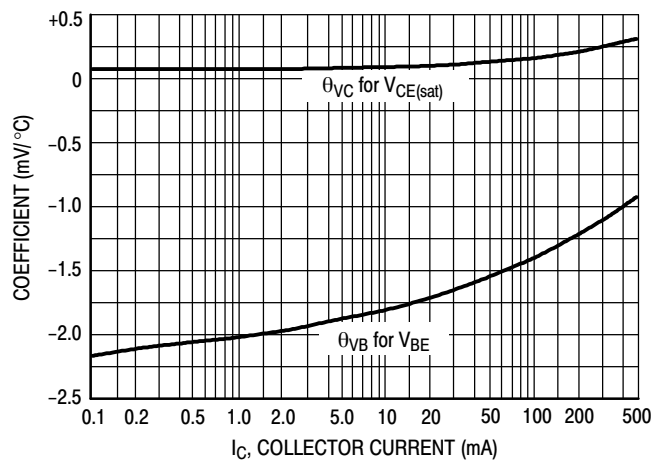
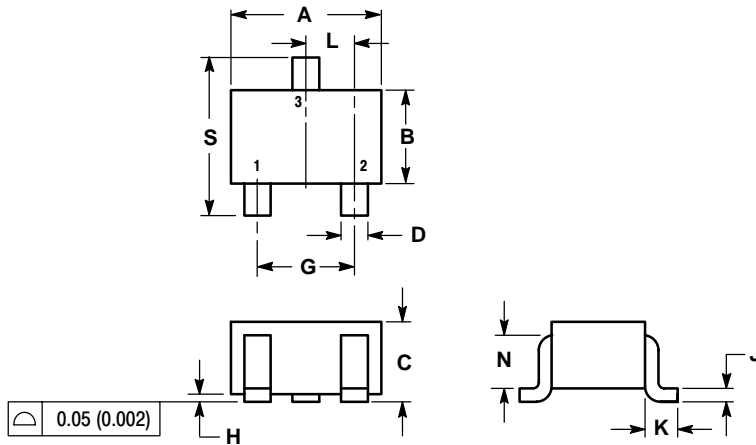


Figure 18. Temperature Coefficients

MMBT4401WT1

PACKAGE DIMENSIONS

SC-70/SOT-323
CASE 419-04
ISSUE L



NOTES:

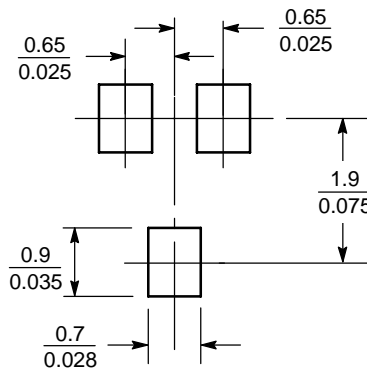
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.071	0.087	1.80	2.20
B	0.045	0.053	1.15	1.35
C	0.032	0.040	0.80	1.00
D	0.012	0.016	0.30	0.40
G	0.047	0.055	1.20	1.40
H	0.000	0.004	0.00	0.10
J	0.004	0.010	0.10	0.25
K	0.017 REF		0.425 REF	
L	0.026 BSC		0.650 BSC	
N	0.028 REF		0.700 REF	
S	0.079	0.095	2.00	2.40

STYLE 3:

- PIN 1. BASE
- EMITTER
- COLLECTOR

SOLDERING FOOTPRINT*



SCALE 10:1 ($\frac{\text{mm}}{\text{inches}}$)

SC-70/SOT-323

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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