

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

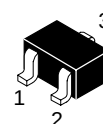
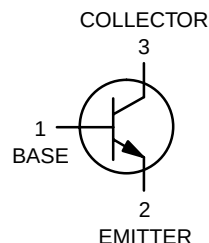
THERMAL CHARACTERISTICS

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	$^\circ\text{C}$



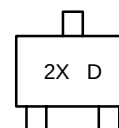
ON Semiconductor®

<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 mAdc, I _B = 0)	V _{(BR)CEO}	40	–	Vdc
Collector–Base Breakdown Voltage (I _C = 0.1 mAdc, I _E = 0)	V _{(BR)CBO}	60	–	Vdc
Emitter–Base Breakdown Voltage (I _E = 0.1 mAdc, I _C = 0)	V _{(BR)EBO}	6.0	–	Vdc
Base Cutoff Current (V _{CE} = 35 Vdc, V _{EB} = 0.4 Vdc)	I _{BEV}	–	0.1	μAdc

ON CHARACTERISTICS (Note 1)

DC Current Gain (I _C = 0.1 mAdc, V _{CE} = 1.0 Vdc) (I _C = 1.0 mAdc, V _{CE} = 1.0 Vdc) (I _C = 10 mAdc, V _{CE} = 1.0 Vdc) (I _C = 150 mAdc, V _{CE} = 1.0 Vdc) (I _C = 500 mAdc, V _{CE} = 2.0 Vdc)	h _{FE}	20 40 80 100 40	– – – 300 –	–
Collector–Emitter Saturation Voltage (I _C = 150 mAdc, I _B = 15 mAdc) (I _C = 500 mAdc, I _B = 50 mAdc)	V _{CE(sat)}	– –	0.4 0.75	Vdc
Base–Emitter Saturation Voltage (I _C = 150 mAdc, I _B = 15 mAdc) (I _C = 500 mAdc, I _B = 50 mAdc)	V _{BE(sat)}	0.75 –	0.95 1.2	Vdc
Collector Cutoff Current (V _{CE} = 35 Vdc, V _{EB} = 0.4 Vdc)	I _{CEX}	–	0.1	μAdc

SMALL–SIGNAL CHARACTERISTICS

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

SWITCHING CHARACTERISTICS

Delay Time	(V _{CC} = 30 Vdc, V _{EB} = 2.0 Vdc, I _C = 150 mAdc, I _{B1} = 15 mAdc)	t _d	–	15	ns
Rise Time		t _r	–	20	
Storage Time	(V _{CC} = 30 Vdc, I _C = 150 mAdc, I _{B1} = I _{B2} = 15 mAdc)	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

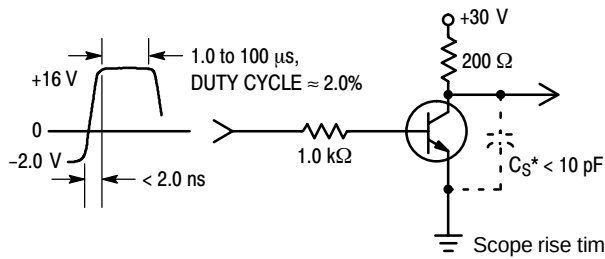


Figure 1. Turn–On Time

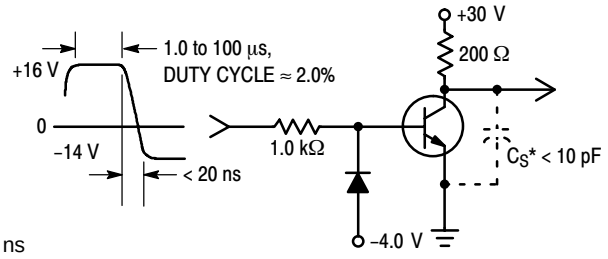


Figure 2. Turn–Off Time

MMBT4401WT1

TRANSIENT CHARACTERISTICS

— 25°C — 100°C

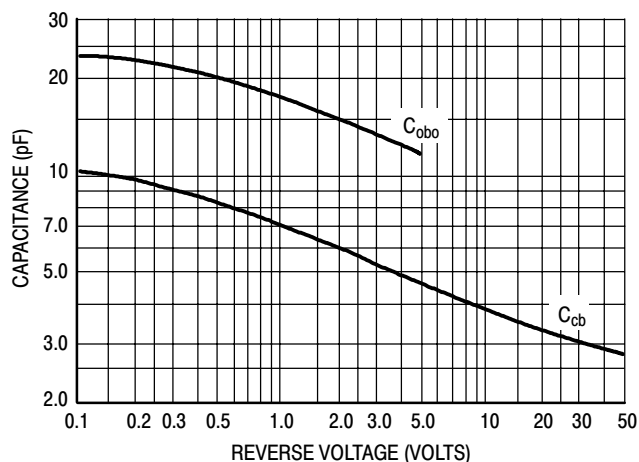


Figure 3. Capacitances

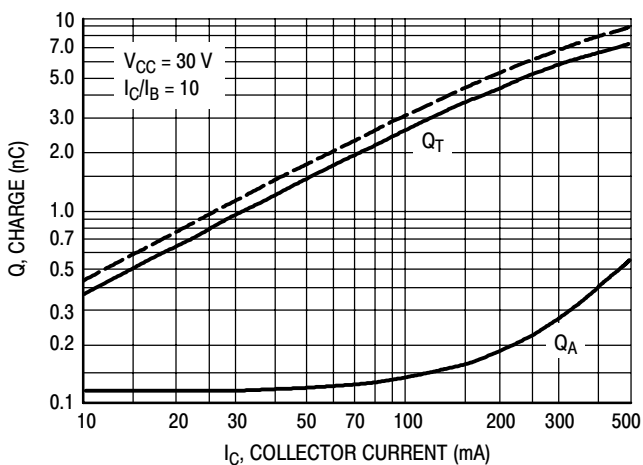


Figure 4. Charge Data

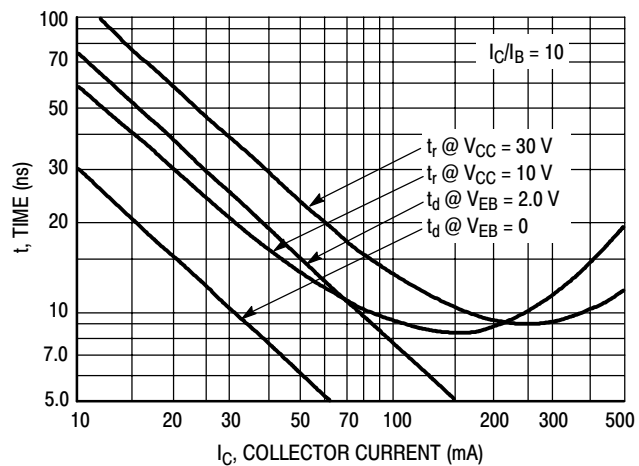


Figure 5. Turn-On Time

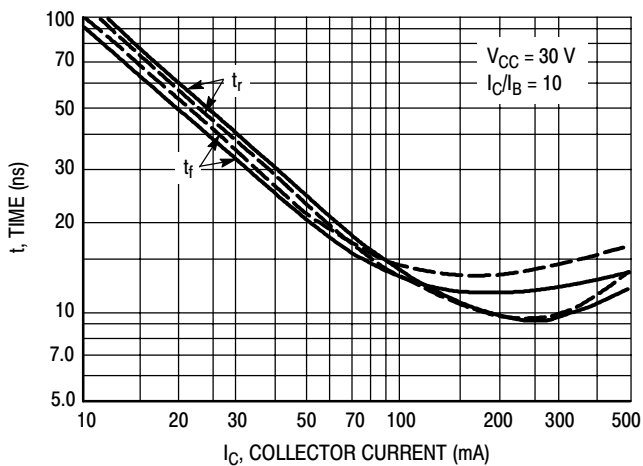


Figure 6. Rise and Fall Times

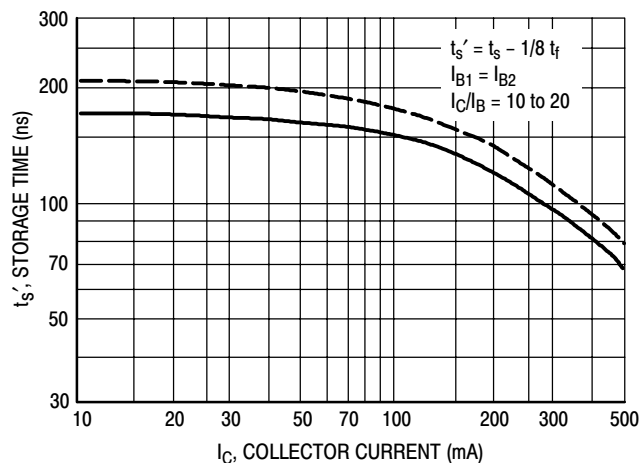


Figure 7. Storage Time

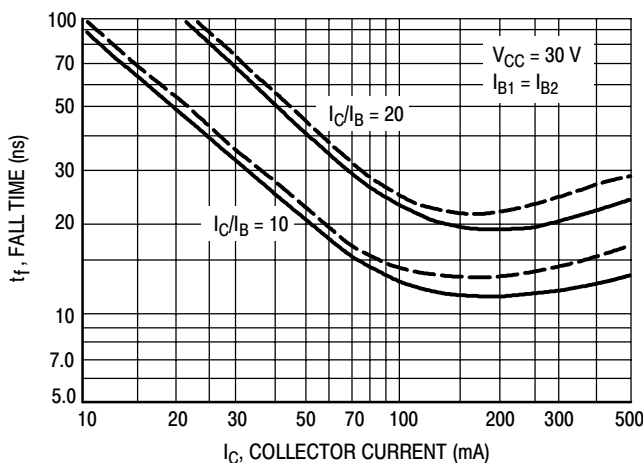


Figure 8. Fall Time

MMBT4401WT1

SMALL-SIGNAL CHARACTERISTICS NOISE FIGURE

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

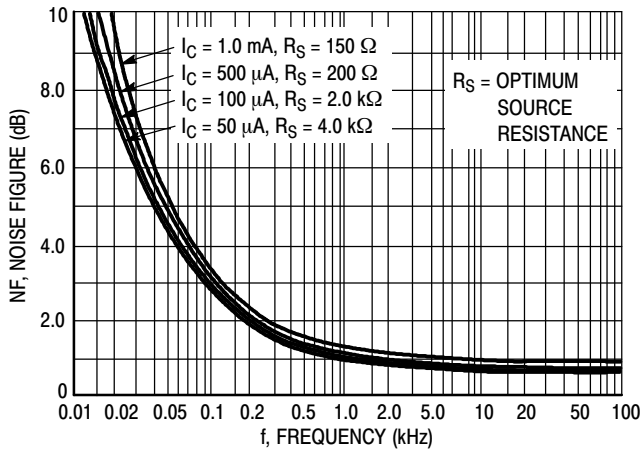


Figure 9. Frequency Effects

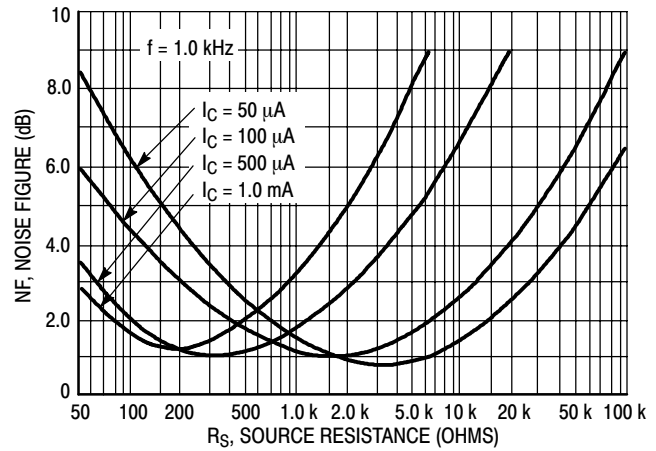


Figure 10. Source Resistance Effects

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.

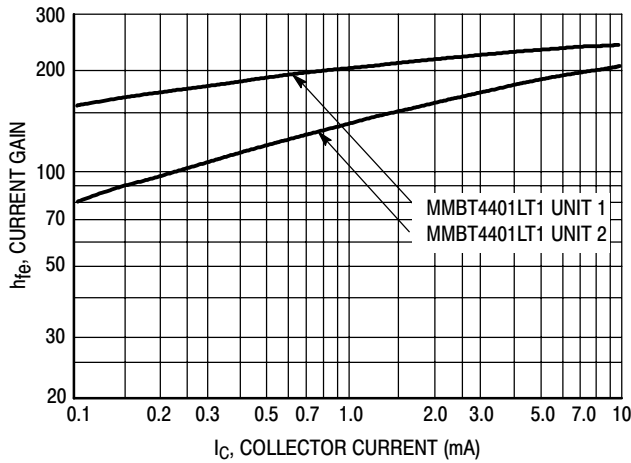


Figure 11. Current Gain

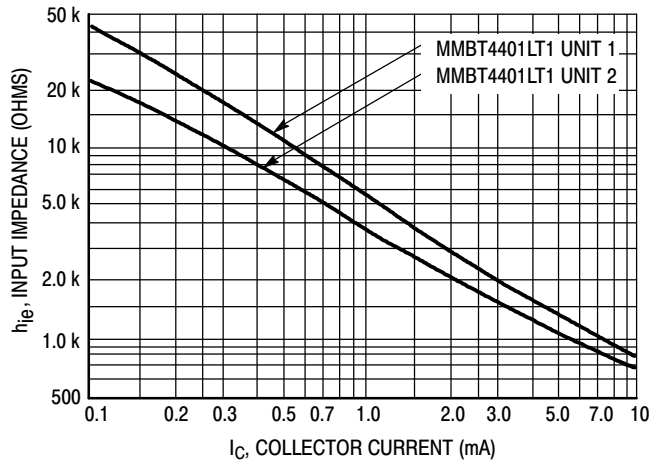


Figure 12. Input Impedance

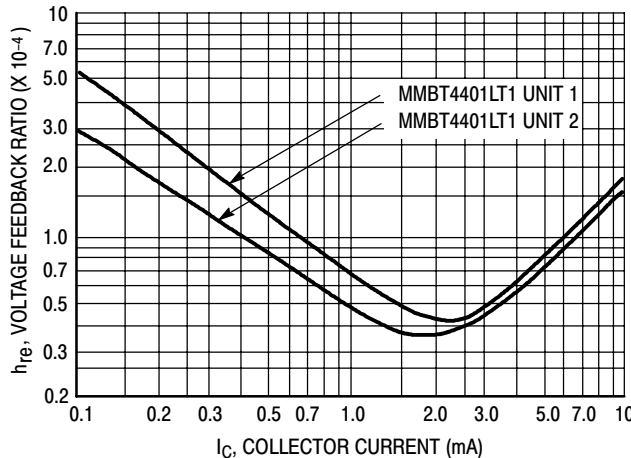


Figure 13. Voltage Feedback Ratio

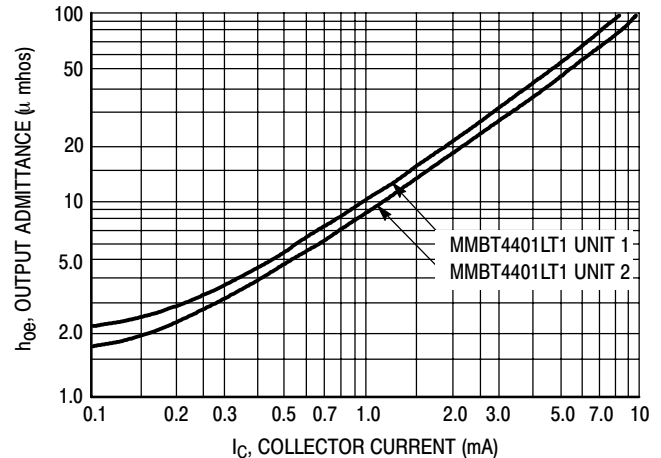


Figure 14. Output Admittance

MMBT4401WT1

STATIC CHARACTERISTICS

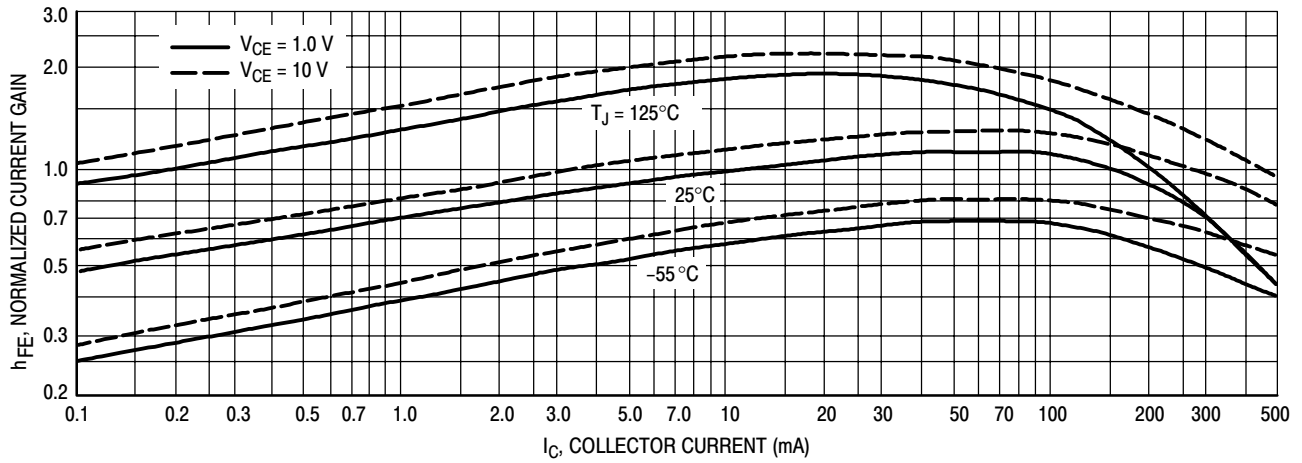


Figure 15. DC Current Gain

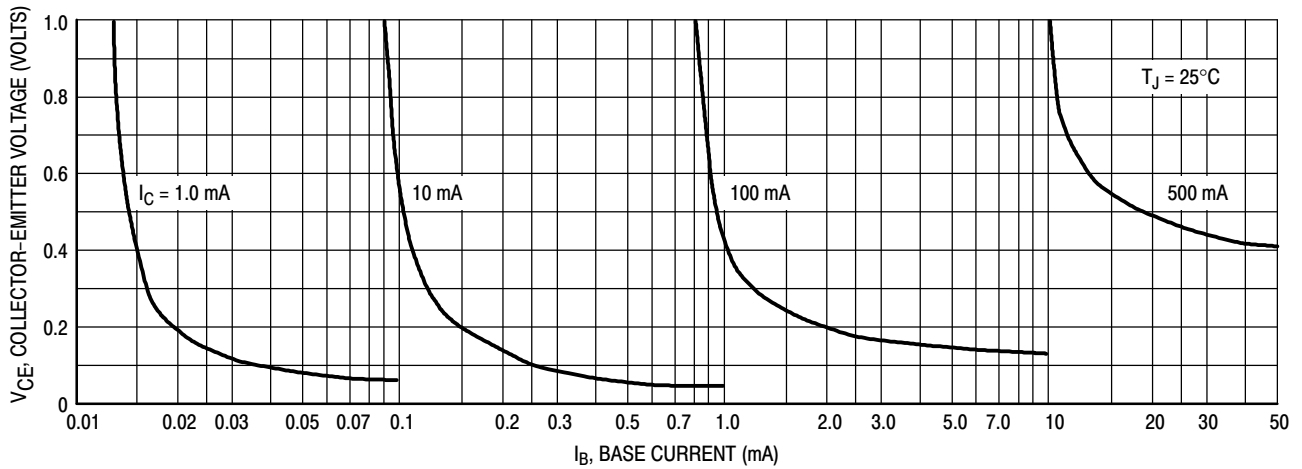


Figure 16. Collector Saturation Region

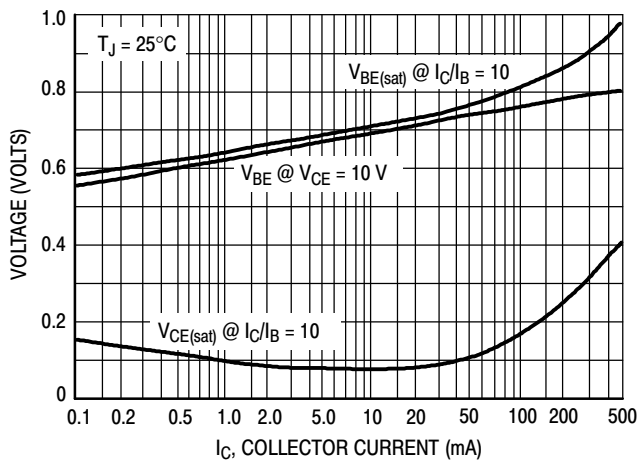


Figure 17. "On" Voltages

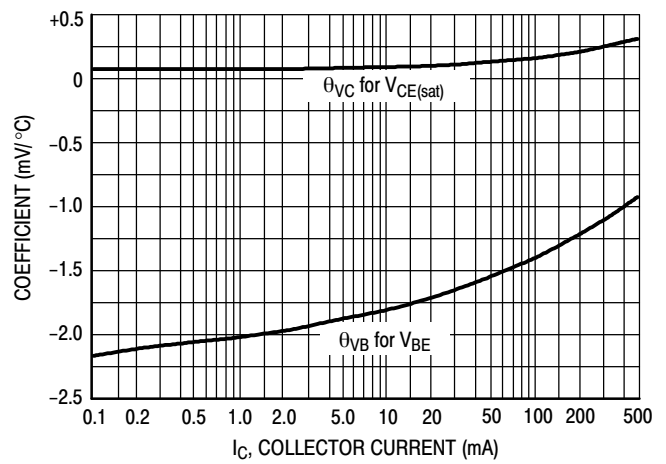
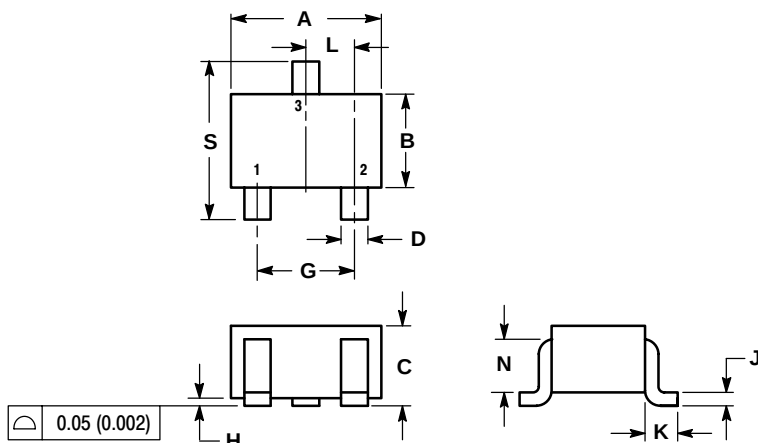


Figure 18. Temperature Coefficients

MMBT4401WT1

PACKAGE DIMENSIONS

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

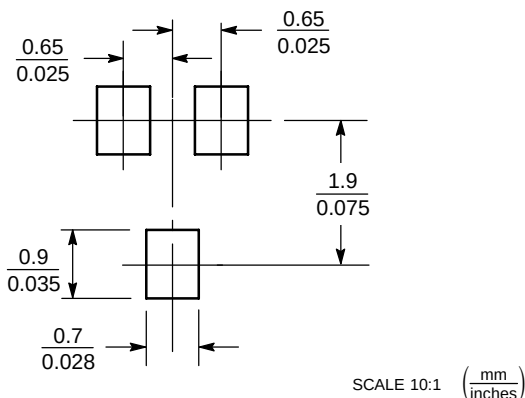


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

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
2. EMITTER
3. COLLECTOR

SOLDERING FOOTPRINT*



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.

ON Semiconductor and  are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada

Japan: ON Semiconductor, Japan Customer Focus Center
2-9-1 Kamimeguro, Meguro-ku, Tokyo, Japan 153-0051
Phone: 81-3-5773-3850

ON Semiconductor Website: <http://onsemi.com>

Order Literature: <http://www.onsemi.com/litorder>

For additional information, please contact your local Sales Representative.