

General Purpose Transistor

• We declare that the material of product compliance with RoHS requirements.

Pb-Free package is available

RoHS product for packing code suffix "G"

Halogen free product for packing code suffix "H"

ORDERING INFORMATION

Device	Marking	Shipping
MMBT4401LT1	2X	3000/Tape & Reel

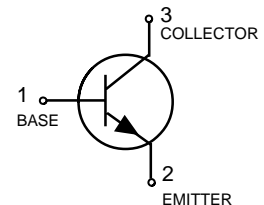
MAXIMUM RATINGS

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, (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	$^\circ\text{C}/\text{W}$
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	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature	T_J, T_{stg}	-55 to +150	$^\circ\text{C}$



DEVICE MARKING

MMBT4401LT1 = 2X

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) ($I_C = 1.0 \text{ mAdc}, I_E = 0$)	$V_{(BR)CEO}$	40	—	Vdc
Collector–Base Breakdown Voltage ($I_C = 0.1 \text{ mAdc}, I_E = 0$)	$V_{(BR)CBO}$	60	—	Vdc
Emitter–Base Breakdown Voltage ($I_E = 0.1 \text{ mAdc}, I_C = 0$)	$V_{(BR)EBO}$	6.0	—	Vdc
Base Cutoff Current ($V_{CE} = 35 \text{ Vdc}, V_{EB} = 0.4 \text{ Vdc}$)	I_{BEV}	—	0.1	μAdc
Collector Cutoff Current ($V_{CE} = 35 \text{ Vdc}, V_{EB} = 0.4 \text{ Vdc}$)	I_{CEX}	—	0.1	μAdc

- FR–5 = $1.0 \times 0.75 \times 0.062$ in.
- Alumina = $0.4 \times 0.3 \times 0.024$ in. 99.5% alumina.
- Pulse Test: Pulse Width $< 300 \mu\text{s}$; Duty Cycle $< 2.0\%$.

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

Characteristic	Symbol	Min	Max	Unit
ON CHARACTERISTICS (3)				
DC Current Gain ($I_C = 0.1 \text{ mA}$, $V_{CE} = 1.0 \text{ Vdc}$)	h_{FE}	20	—	—
($I_C = 1.0 \text{ mA}$, $V_{CE} = 1.0 \text{ Vdc}$)		40	—	
($I_C = 10 \text{ mA}$, $V_{CE} = 1.0 \text{ Vdc}$)		80	—	
($I_C = 150 \text{ mA}$, $V_{CE} = 1.0 \text{ Vdc}$)		100	300	
($I_C = 500 \text{ mA}$, $V_{CE} = 2.0 \text{ Vdc}$)		40	—	
Collector–Emitter Saturation Voltage ($I_C = 150 \text{ mA}$, $I_B = 15 \text{ mA}$)	$V_{CE(sat)}$	—	0.4	Vdc
($I_C = 500 \text{ mA}$, $I_B = 50 \text{ mA}$)		—	0.75	
Base–Emitter Saturation Voltage ($I_C = 150 \text{ mA}$, $I_B = 15 \text{ mA}$)	$V_{BE(sat)}$	0.75	0.95	Vdc
($I_C = 500 \text{ mA}$, $I_B = 50 \text{ mA}$)		—	1.2	

SMALL-SIGNAL CHARACTERISTICS

Current–Gain — Bandwidth Product ($I_C = 20 \text{ mA}$, $V_{CE} = 10 \text{ Vdc}$, $f = 100 \text{ MHz}$)	f_T	250	—	MHz
Collector–Base Capacitance ($V_{CB} = 5.0 \text{ Vdc}$, $I_E = 0$, $f = 1.0 \text{ MHz}$)	C_{cb}	—	6.5	pF
Emitter–Base Capacitance ($V_{EB} = 0.5 \text{ Vdc}$, $I_C = 0$, $f = 1.0 \text{ MHz}$)	C_{eb}	—	30	pF
Input Impedance ($V_{CE} = 10 \text{ Vdc}$, $I_C = 1.0 \text{ mA}$, $f = 1.0 \text{ kHz}$)	h_{ie}	1.0	15	k Ω
Voltage Feedback Ratio ($V_{CE} = 10 \text{ Vdc}$, $I_C = 1.0 \text{ mA}$, $f = 1.0 \text{ kHz}$)	h_{re}	0.1	8.0	$\times 10^{-4}$
Small–Signal Current Gain ($V_{CE} = 10 \text{ Vdc}$, $I_C = 1.0 \text{ mA}$, $f = 1.0 \text{ kHz}$)	h_{fe}	40	500	—
Output Admittance ($V_{CE} = 10 \text{ Vdc}$, $I_C = 1.0 \text{ mA}$, $f = 1.0 \text{ kHz}$)	h_{oe}	1.0	30	μmhos

SWITCHING CHARACTERISTICS

Delay Time	($V_{CC} = 30 \text{ Vdc}$, $V_{EB} = 2.0 \text{ Vdc}$)	t_d	—	15	ns
Rise Time	($I_C = 150 \text{ mA}$, $I_{B1} = 15 \text{ mA}$)	t_r	—	20	
Storage Time	($V_{CC} = 30 \text{ Vdc}$, $I_C = 150 \text{ mA}$)	t_s	—	225	ns
Fall Time	($I_{B1} = I_{B2} = 15 \text{ mA}$)	t_f	—	30	

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

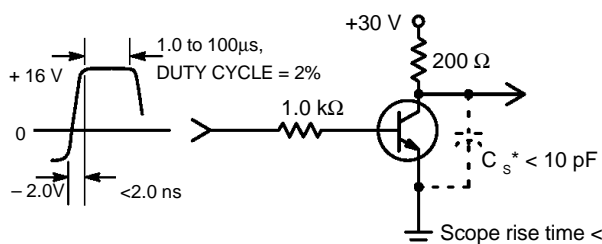
SWITCHING TIME EQUIVALENT TEST CIRCUITS


Figure 1. Turn–On Time

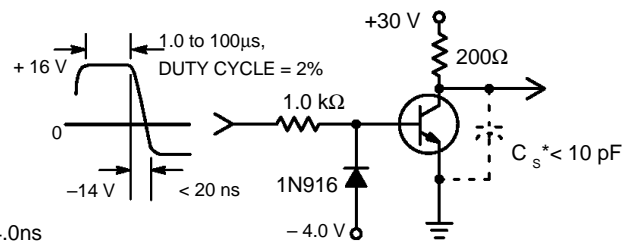
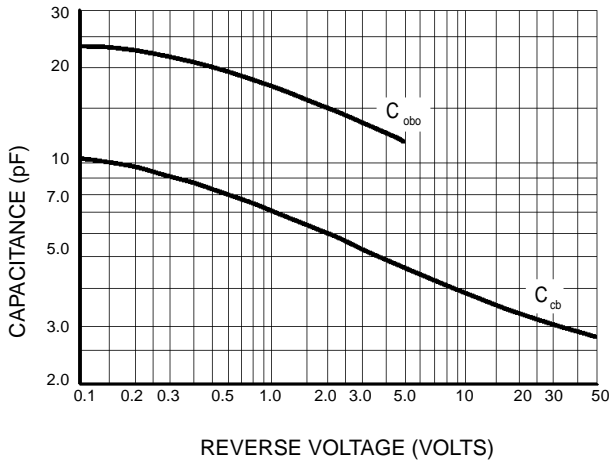


Figure 2. Turn–Off Time

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TRANSIENT CHARACTERISTICS



REVERSE VOLTAGE (VOLTS)
Figure 3. Capacitance

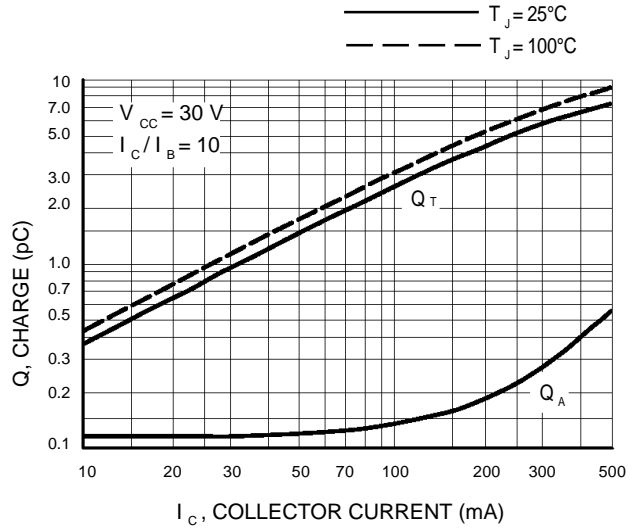


Figure 4. Charge Data

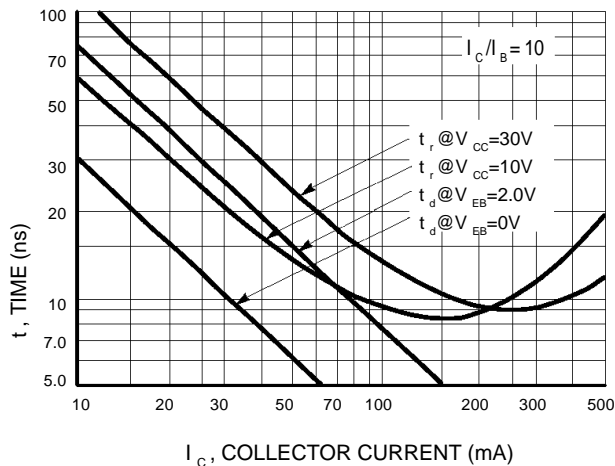


Figure 5. Turn-On Time

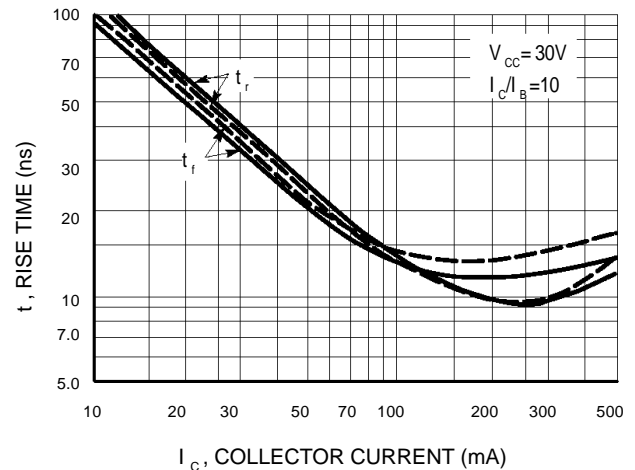


Figure 6. Rise and Fall Time

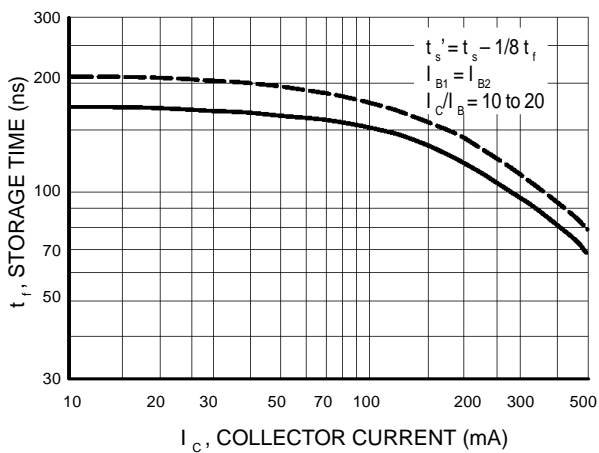


Figure 7. Storage Time

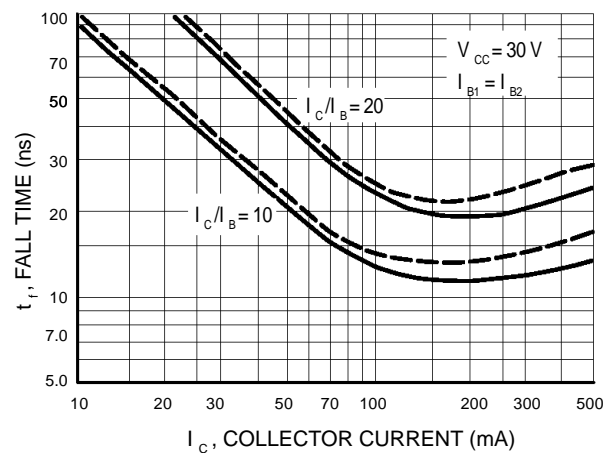


Figure 8. Fall Time

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SMALL-SIGNAL CHARACTERISTICS

NOISE FIGURE

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

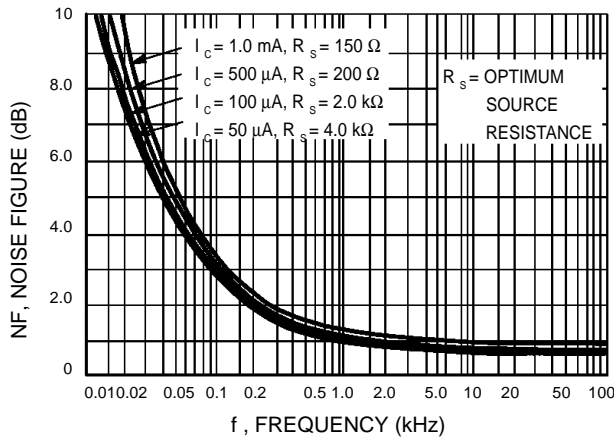


Figure 9. Frequency Effects

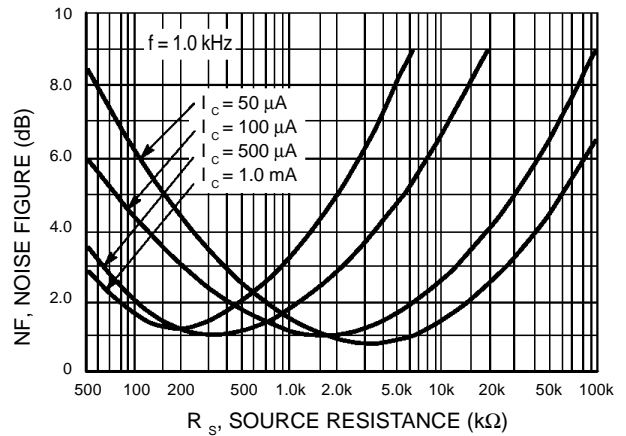


Figure 10. Source Resistance Effects

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 LMBT4401LT1 lines, and the same units were used to develop the correspondingly numbered curves on each graph.

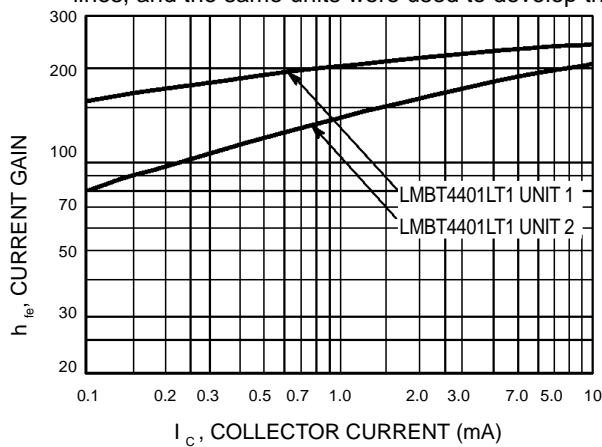


Figure 11. Current Gain

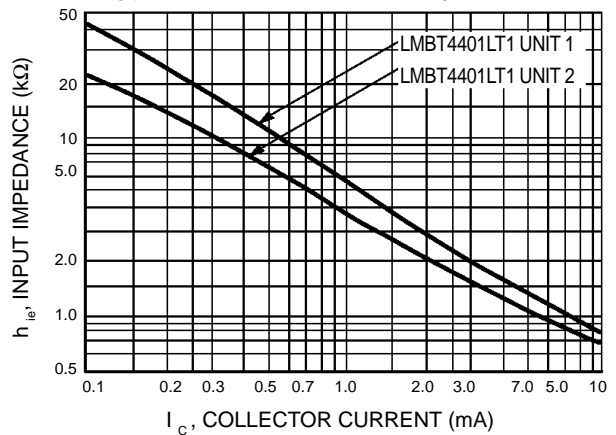


Figure 12. Input Impedance

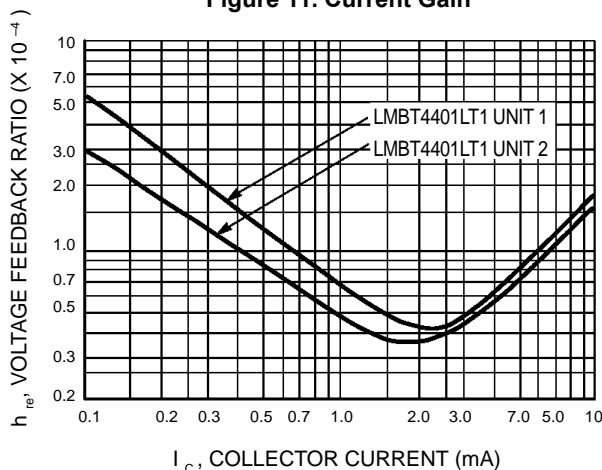


Figure 13. Voltage Feedback Ratio

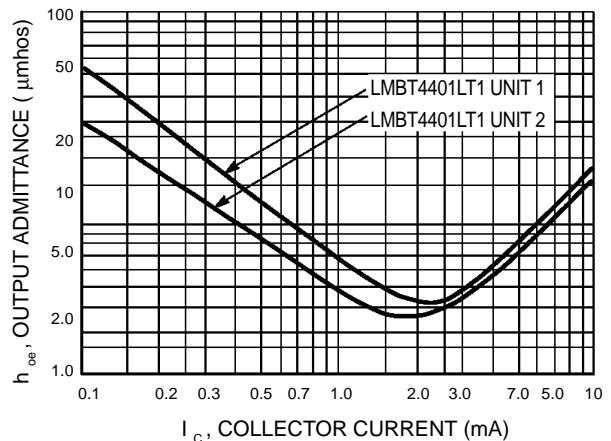


Figure 14. Output Admittance

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STATIC CHARACTERISTICS

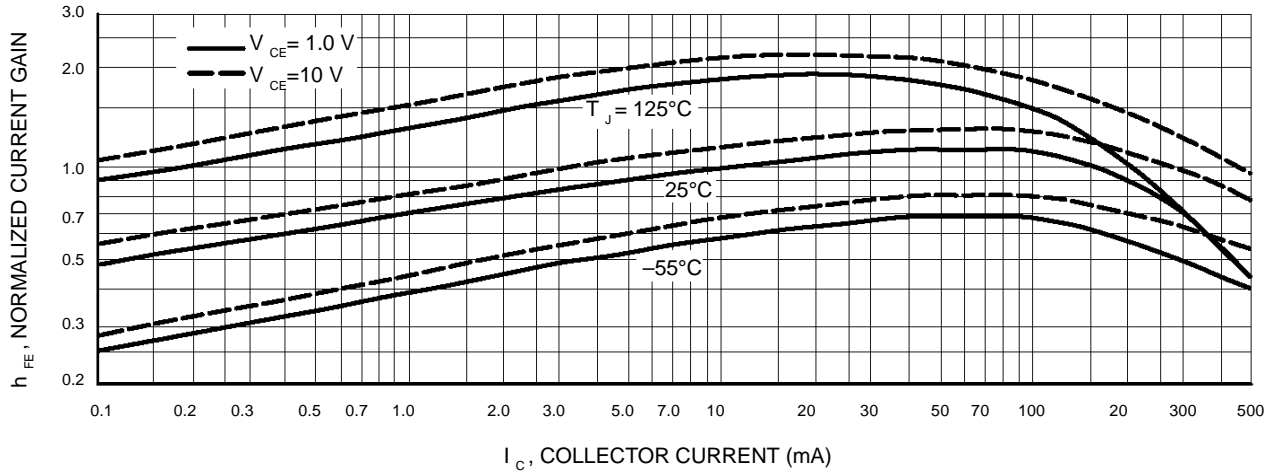


Figure 15. DC Current Gain

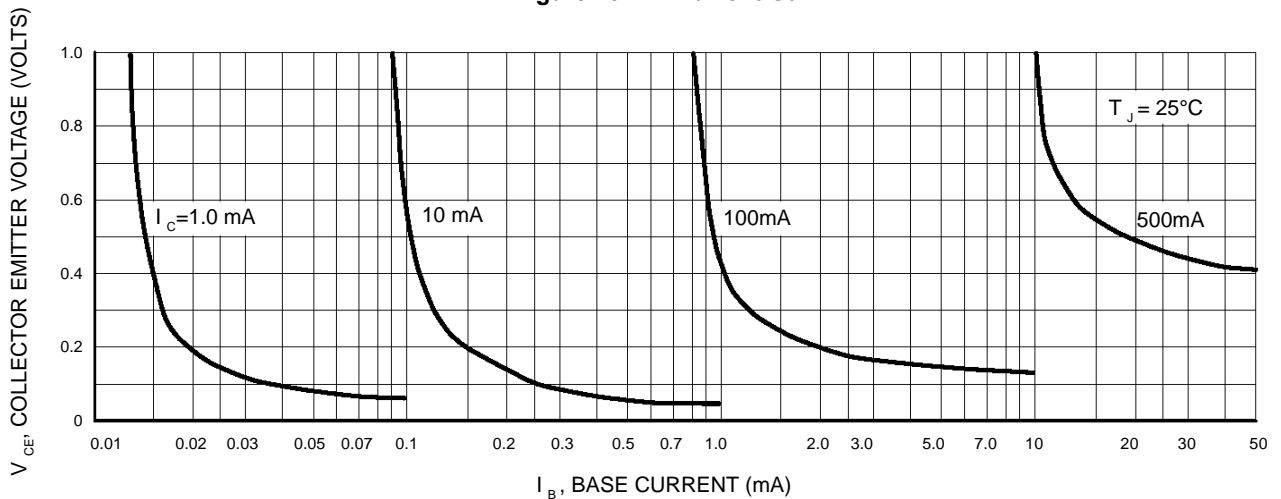


Figure 16. Collector Saturation Region

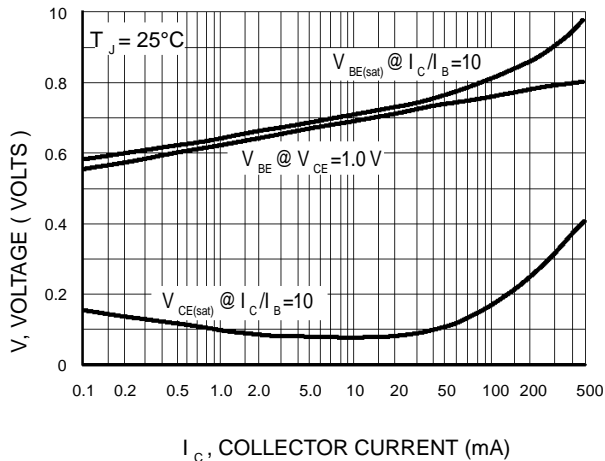


Figure 17. "On" Voltages

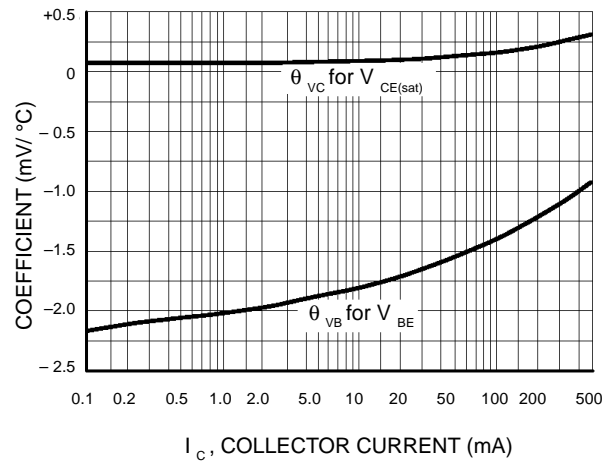
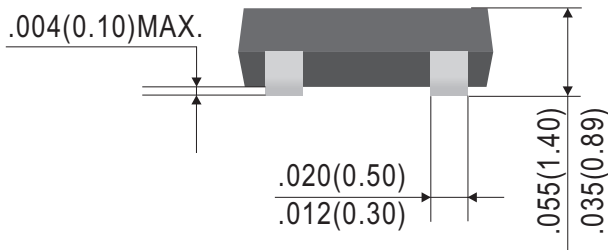
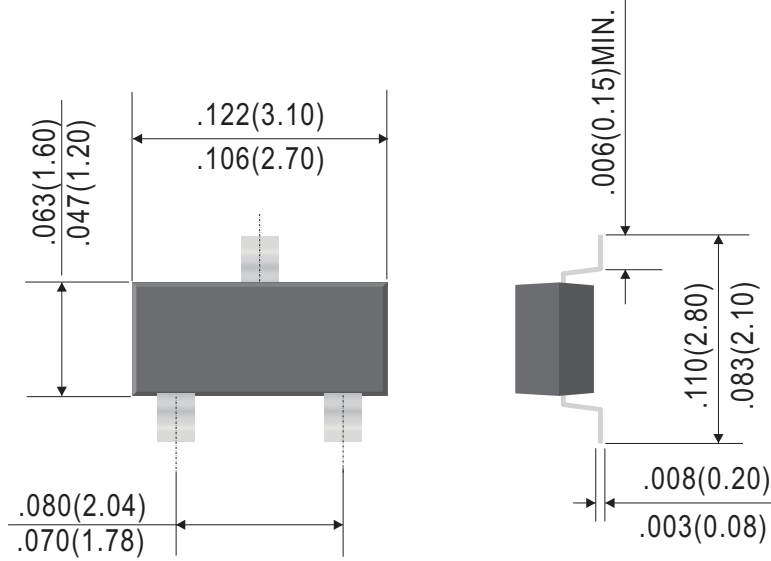


Figure 18. Temperature Coefficients

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SOT-23



Dimensions in inches and (millimeters)

