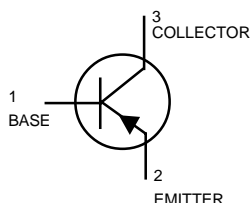
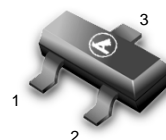


# General Purpose Transistors

## PNP Silicon



### MMBT4403LT1



CASE 318-08, STYLE 6  
SOT-23 (TO-236AB)

### 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	$I_C$	-600	mAdc

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation FR-5 Board (1) $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	225	mW
		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) $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	300	mW
		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

MMBT4403LT1 = 2T

### 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) ( $I_C = -1.0\text{ mAdc}, I_B = 0$ )	$V_{(BR)CEO}$	-40	—	Vdc
Collector-Base Breakdown Voltage ( $I_C = -0.1\text{ mAdc}, I_E = 0$ )	$V_{(BR)CBO}$	-40	—	Vdc
Emitter-Base Breakdown Voltage ( $I_E = -0.1\text{ mAdc}, I_C = 0$ )	$V_{(BR)EBO}$	-5.0	—	Vdc
Base Cutoff Current ( $V_{CE} = -35\text{ Vdc}, V_{EB} = -0.4\text{ Vdc}$ )	$I_{BEV}$	—	-0.1	$\mu\text{Adc}$
Collector Cutoff Current ( $V_{CE} = -35\text{ Vdc}, V_{EB} = -0.4\text{ Vdc}$ )	$I_{CEX}$	—	-0.1	$\mu\text{Adc}$

1. FR-5 =  $1.0 \times 0.75 \times 0.062$  in.

2. Alumina =  $0.4 \times 0.3 \times 0.024$  in. 99.5% alumina.

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

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

Characteristic	Symbol	Min	Max	Unit
<b>ON CHARACTERISTICS</b>				
DC Current Gain ( $I_C = -0.1 \text{ mAdc}$ , $V_{CE} = -1.0 \text{ Vdc}$ ) ( $I_C = -1.0 \text{ mAdc}$ , $V_{CE} = -1.0 \text{ Vdc}$ ) ( $I_C = -10 \text{ mAdc}$ , $V_{CE} = -1.0 \text{ Vdc}$ ) ( $I_C = -150 \text{ mAdc}$ , $V_{CE} = -2.0 \text{ Vdc}$ )(3) ( $I_C = -500 \text{ mAdc}$ , $V_{CE} = -2.0 \text{ Vdc}$ )(3)	$h_{FE}$	30 60 100 100 20	— — — 300 —	—
Collector–Emitter Saturation Voltage(3) ( $I_C = -150\text{mAdc}$ , $I_B = -15 \text{ mAdc}$ ) ( $I_C = -500 \text{ mAdc}$ , $I_B = -50 \text{ mAdc}$ )	$V_{CE(sat)}$	— —	- 0.4 - 0.75	Vdc
Base–Emitter Saturation Voltage (3) ( $I_C = -150 \text{ mAdc}$ , $I_B = -15 \text{ mAdc}$ ) ( $I_C = -500 \text{ mAdc}$ , $I_B = -50 \text{ mAdc}$ )	$V_{BE(sat)}$	- 0.75 —	- 0.95 - 1.3	Vdc

**SMALL-SIGNAL CHARACTERISTICS**

Current–Gain — Bandwidth Product ( $I_C = -20\text{mAdc}$ , $V_{CE} = -10 \text{ Vdc}$ , $f = 100 \text{ MHz}$ )	$f_T$	200	—	MHz
Collector–Base Capacitance ( $V_{CB} = -10 \text{ Vdc}$ , $I_E = 0$ , $f = 1.0 \text{ MHz}$ )	$C_{cb}$	—	8.5	pF
Emitter–Base Capacitance ( $V_{BE} = -0.5 \text{ Vdc}$ , $I_C = 0$ , $f = 1.0 \text{ MHz}$ )	$C_{eb}$	—	30	pF
Input Impedance ( $V_{CE} = -10 \text{ Vdc}$ , $I_C = -1.0 \text{ mAdc}$ , $f = 1.0 \text{ kHz}$ )	$h_{ie}$	1.5	15	$k\Omega$
Voltage Feedback Ratio ( $V_{CE} = -10 \text{ Vdc}$ , $I_C = -1.0 \text{ mAdc}$ , $f = 1.0 \text{ kHz}$ )	$h_{re}$	0.1	8.0	$\times 10^{-4}$
Small–Signal Current Gain ( $V_{CE} = -10 \text{ Vdc}$ , $I_C = -1.0 \text{ mAdc}$ , $f = 1.0 \text{ kHz}$ )	$h_{fe}$	60	500	—
Output Admittance ( $V_{CE} = -10 \text{ Vdc}$ , $I_C = -1.0 \text{ mAdc}$ , $f = 1.0 \text{ kHz}$ )	$h_{oe}$	1.0	100	$\mu\text{mhos}$

**SWITCHING CHARACTERISTICS**

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

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

**SWITCHING TIME EQUIVALENT TEST CIRCUITS**

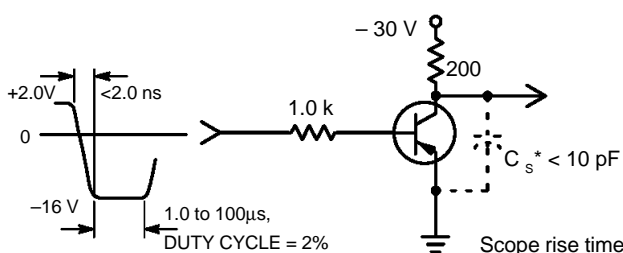


Figure 1. Turn–On Time

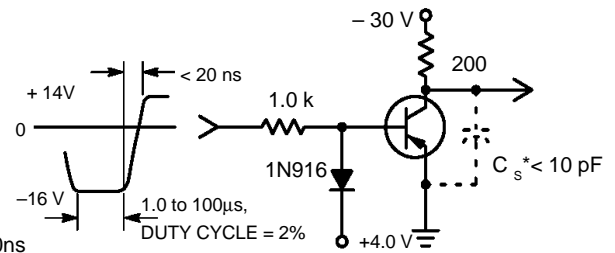


Figure 2. Turn–Off Time

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TYPICAL TRANSIENT CHARACTERISTICS

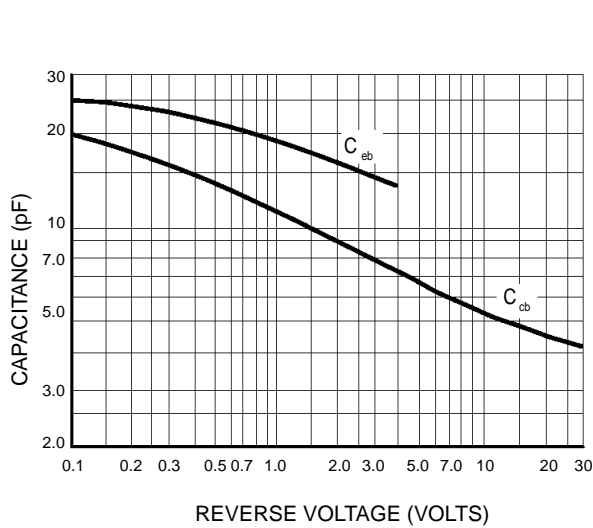


Figure 3. Capacitance

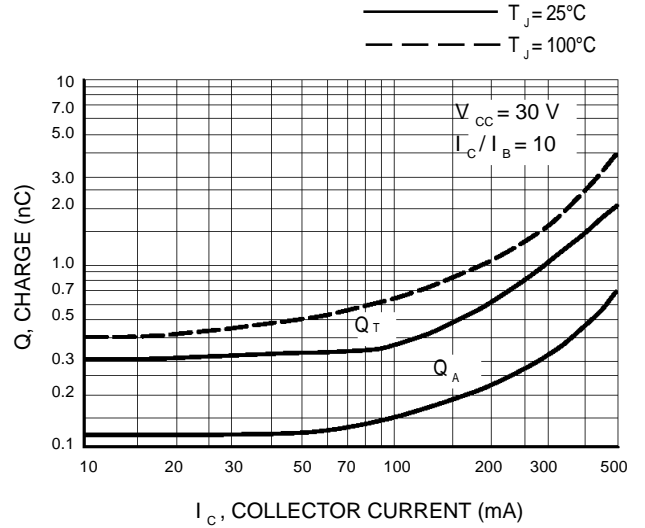


Figure 4. Charge Data

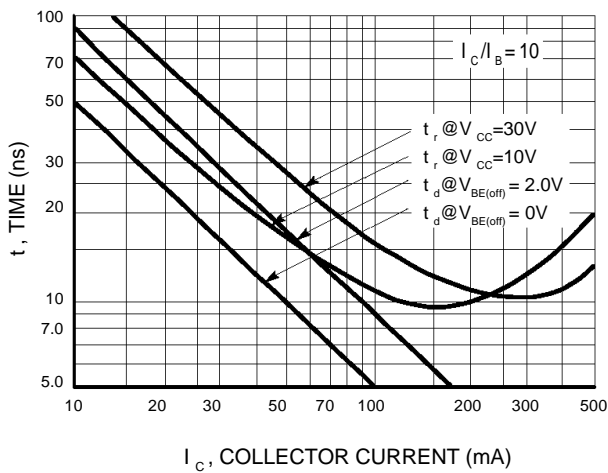


Figure 5. Turn-On Time

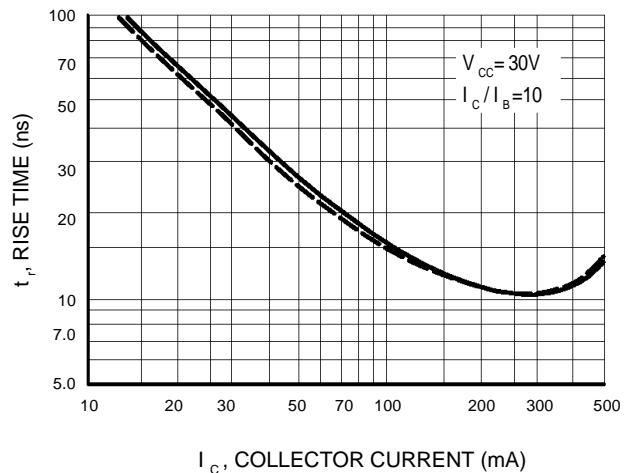


Figure 6. Rise Time

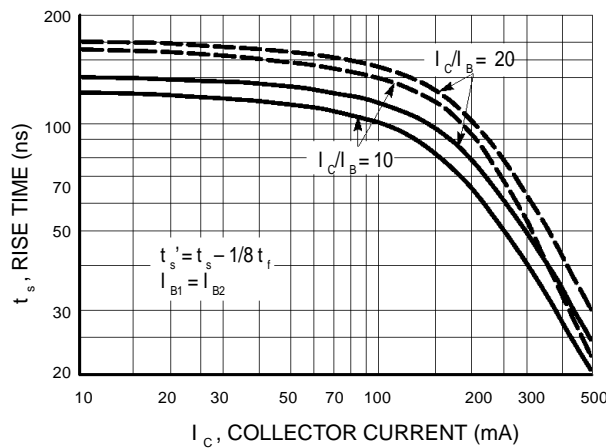


Figure 7. Storage Time

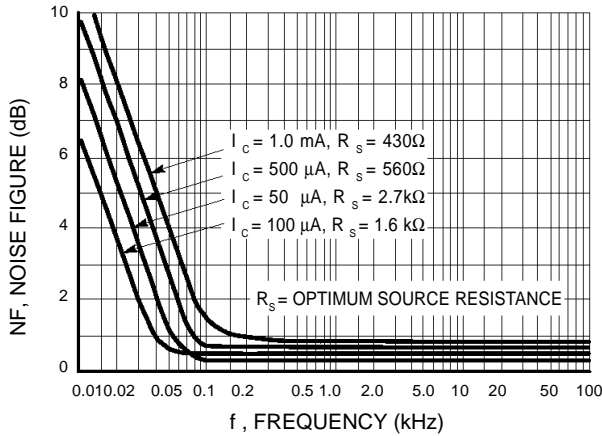
**MMBT4403LT1**

**SMALL-SIGNAL CHARACTERISTICS**

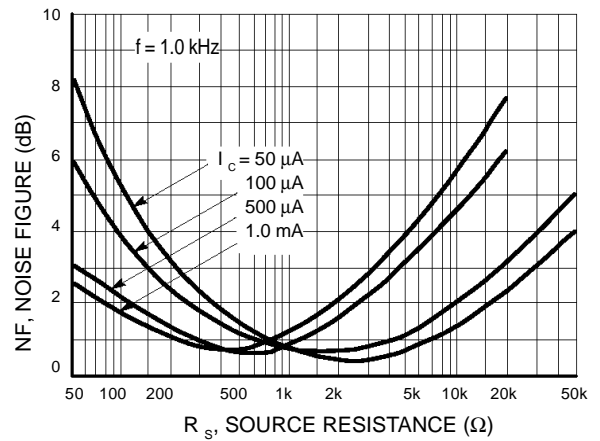
**NOISE FIGURE**

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

Bandwidth = 1.0 Hz



**Figure 8. Frequency Effects**

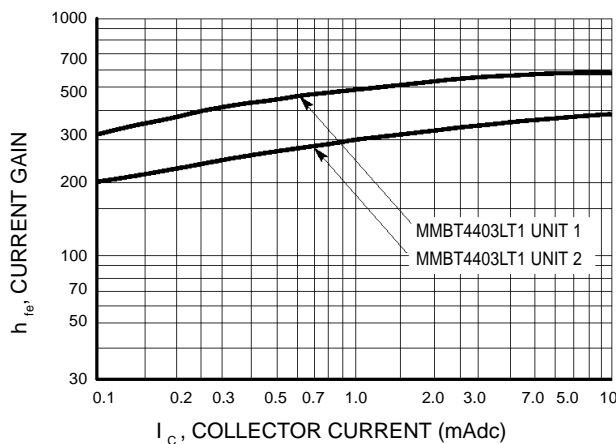


**Figure 9. Source Resistance Effects**

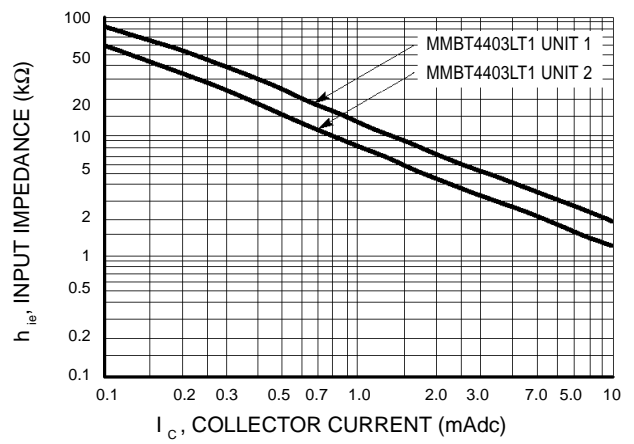
**h PARAMETERS**

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

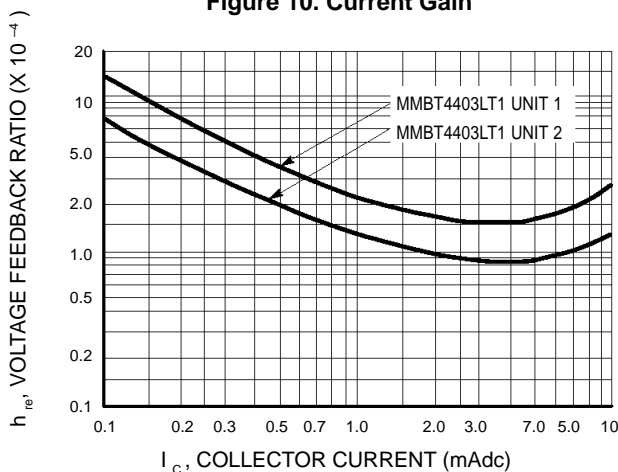
This group of graphs illustrates the relationship between  $h_{fe}$  and other "h" parameters for this series of transistors. To obtain these curves, a high-gain and a low-gain unit were selected from the MMBT4401LT1 lines, and the same units were used to develop the correspondingly numbered curves on each graph.



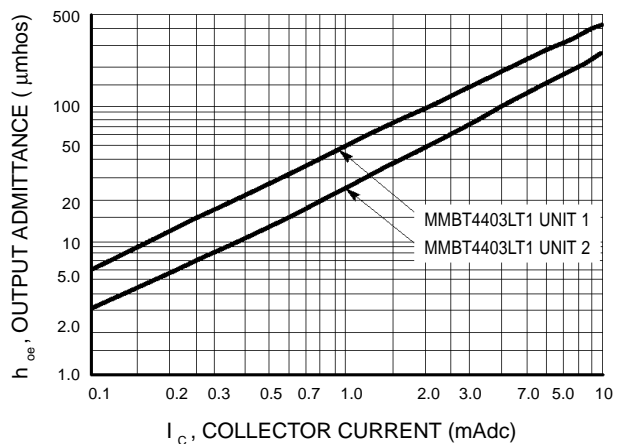
**Figure 10. Current Gain**



**Figure 11. Input Impedance**



**Figure 12. Voltage Feedback Ratio**



**Figure 13. Output Admittance**

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STATIC CHARACTERISTICS

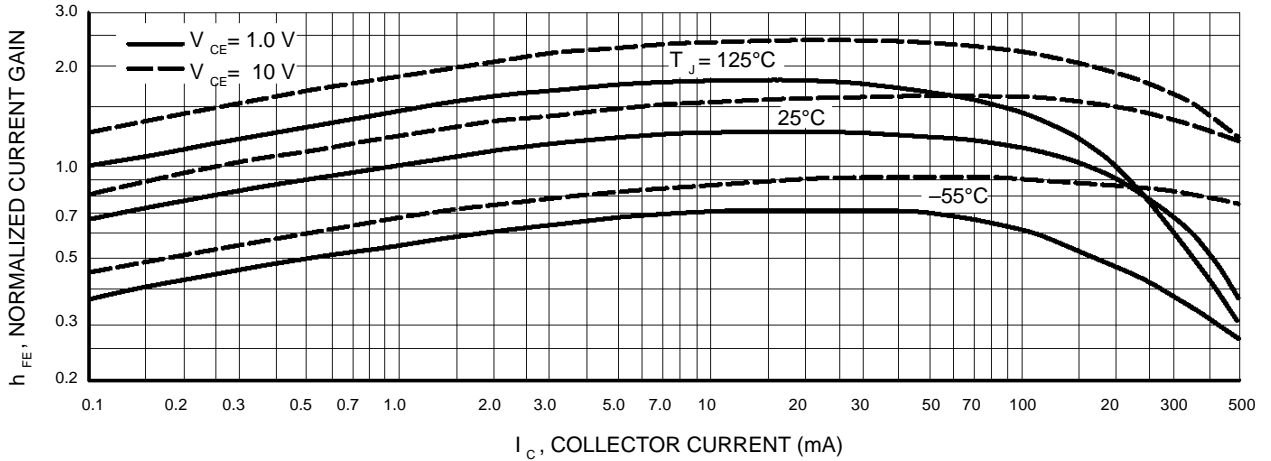


Figure 14. DC Current Gain

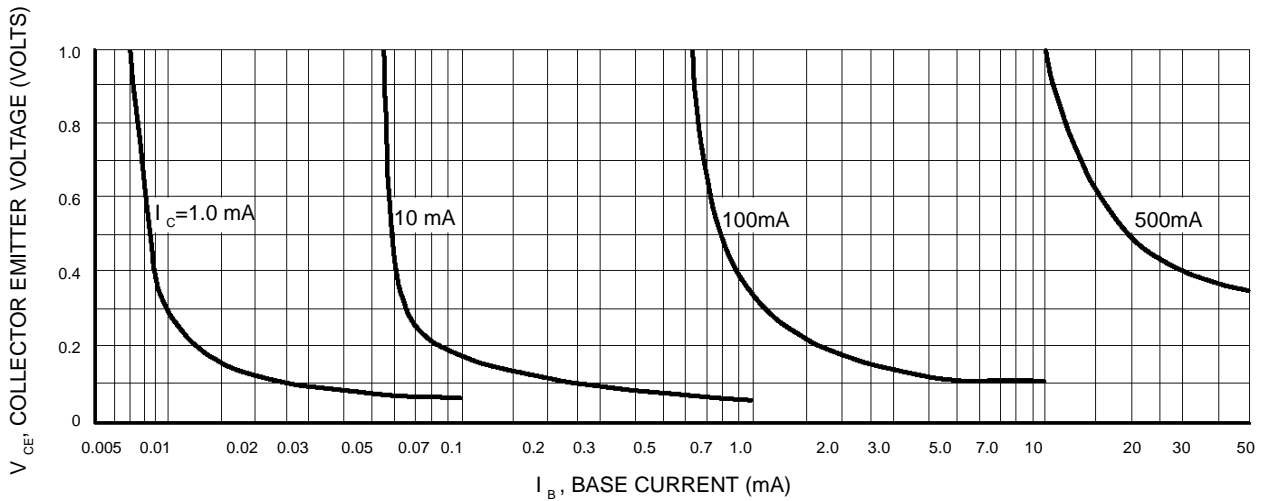


Figure 15. Collector Saturation Region

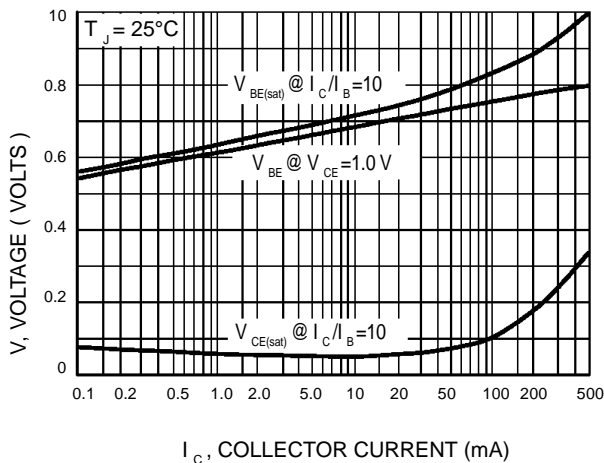


Figure 16. "On" Voltages

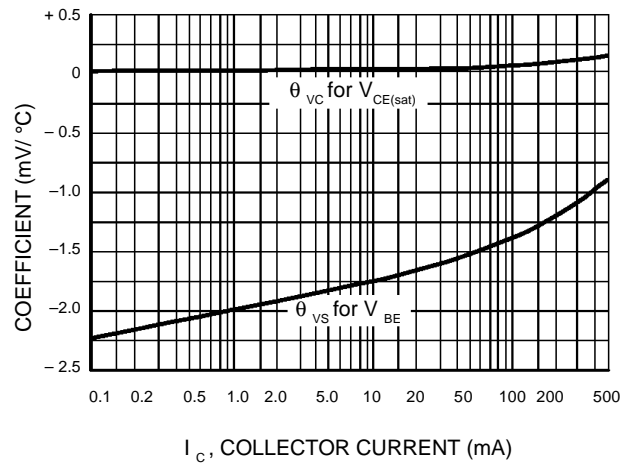


Figure 17. Temperature Coefficients