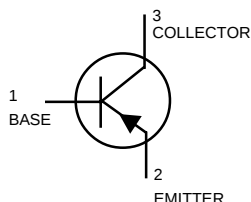
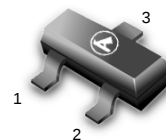


# General Purpose Transistors

## PNP Silicon



### MMBT3906LT1



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 | $I_C$     | - 200 | mAdc |

### THERMAL CHARACTERISTICS

| Characteristic                                                                                                 | Symbol          | Max         | Unit                       |
|----------------------------------------------------------------------------------------------------------------|-----------------|-------------|----------------------------|
| Total Device Dissipation FR- 5 Board(1)<br>$T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$         | $P_D$           | 225<br>1.8  | mW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance Junction to Ambient                                                                         | $R_{\theta JA}$ | 556         | $^\circ\text{C/W}$         |
| Total Device Dissipation<br>Alumina Substrate, (2) $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$           | 300<br>2.4  | mW<br>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

MMBT3906LT1 = 2A

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

| Characteristic | Symbol | Min | Max | Unit |
|----------------|--------|-----|-----|------|
|----------------|--------|-----|-----|------|

### OFF CHARACTERISTICS

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

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

**MMBT3906LT1**
**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted) (Continued)

| Characteristic                                                                                                                                                                                                                                                                                                       | Symbol        | Min                         | Max                     | Unit |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------------|-------------------------|------|
| <b>ON CHARACTERISTICS (2)</b>                                                                                                                                                                                                                                                                                        |               |                             |                         |      |
| DC Current Gain<br>( $I_C = -0.1\text{ mA}$ , $V_{CE} = -1.0\text{ Vdc}$ )<br>( $I_C = -1.0\text{ mA}$ , $V_{CE} = -1.0\text{ Vdc}$ )<br>( $I_C = -10\text{ mA}$ , $V_{CE} = -1.0\text{ Vdc}$ )<br>( $I_C = -50\text{ mA}$ , $V_{CE} = -1.0\text{ Vdc}$ )<br>( $I_C = -100\text{ mA}$ , $V_{CE} = -1.0\text{ Vdc}$ ) | $h_{FE}$      | 60<br>80<br>100<br>60<br>30 | —<br>—<br>300<br>—<br>— | —    |
| Collector-Emitter Saturation Voltage<br>( $I_C = -10\text{ mA}$ , $I_B = -1.0\text{ mA}$ )<br>( $I_C = -50\text{ mA}$ , $I_B = -5.0\text{ mA}$ )                                                                                                                                                                     | $V_{CE(sat)}$ | —<br>—                      | -0.25<br>-0.4           | Vdc  |
| Base-Emitter Saturation Voltage<br>( $I_C = -10\text{ mA}$ , $I_B = -1.0\text{ mA}$ )<br>( $I_C = -50\text{ mA}$ , $I_B = -5.0\text{ mA}$ )                                                                                                                                                                          | $V_{BE(sat)}$ | -0.65<br>—                  | -0.85<br>-0.95          | Vdc  |

**SMALL-SIGNAL CHARACTERISTICS**

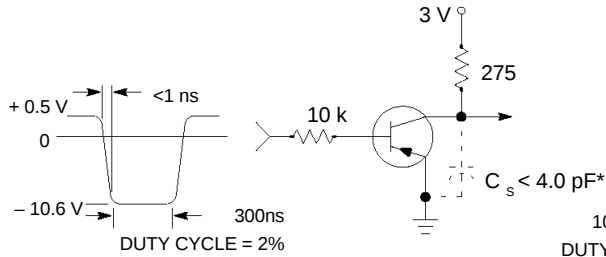
|                                                                                                                                      |            |     |     |                  |
|--------------------------------------------------------------------------------------------------------------------------------------|------------|-----|-----|------------------|
| Current-Gain — Bandwidth Product<br>( $I_C = -10\text{ mA}$ , $V_{CE} = -20\text{ Vdc}$ , $f = 100\text{ MHz}$ )                     | $f_T$      | 250 | —   | MHz              |
| Output Capacitance<br>( $V_{CB} = -5.0\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )                                              | $C_{obo}$  | —   | 4.5 | pF               |
| Input Capacitance<br>( $V_{EB} = -0.5\text{ Vdc}$ , $I_C = 0$ , $f = 1.0\text{ MHz}$ )                                               | $C_{ibo}$  | —   | 10  | pF               |
| Input Impedance<br>( $V_{CE} = -10\text{ Vdc}$ , $I_C = -1.0\text{ mA}$ , $f = 1.0\text{ kHz}$ )                                     | $h_{ie}$   | 2.0 | 12  | k $\Omega$       |
| Voltage Feedback Ratio<br>( $V_{CE} = -10\text{ Vdc}$ , $I_C = -1.0\text{ mA}$ , $f = 1.0\text{ kHz}$ )                              | $h_{re}$   | 0.1 | 10  | $\times 10^{-4}$ |
| Small-Signal Current Gain<br>( $V_{CE} = -10\text{ Vdc}$ , $I_C = -1.0\text{ mA}$ , $f = 1.0\text{ kHz}$ )                           | $h_{fe}$   | 100 | 400 | —                |
| Output Admittance<br>( $V_{CE} = -10\text{ Vdc}$ , $I_C = -1.0\text{ mA}$ , $f = 1.0\text{ kHz}$ )                                   | * $h_{oe}$ | 3.0 | 60  | $\mu\text{mhos}$ |
| Noise Figure<br>( $V_{CE} = -5.0\text{ Vdc}$ , $I_C = -100\text{ }\mu\text{A}$ , $R_s = 1.0\text{ k}\Omega$ , $f = 1.0\text{ kHz}$ ) | NF         | —   | 4.0 | dB               |

**SWITCHING CHARACTERISTICS**

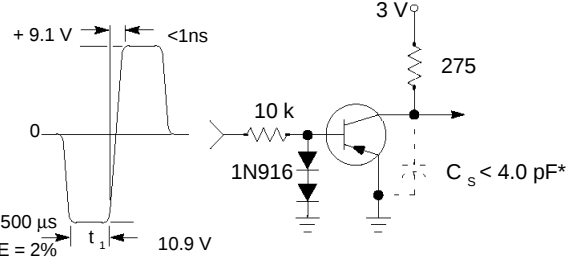
|              |                                                                                                                  |       |   |     |    |
|--------------|------------------------------------------------------------------------------------------------------------------|-------|---|-----|----|
| Delay Time   | $(V_{CC} = -3.0\text{ Vdc}$ , $V_{BE} = 0.5\text{ Vdc}$ ,<br>$I_C = -10\text{ mA}$ , $I_{B1} = -1.0\text{ mA}$ ) | $t_d$ | — | 35  | ns |
| Rise Time    |                                                                                                                  | $t_r$ | — | 35  |    |
| Storage Time | $(V_{CC} = -3.0\text{ Vdc}$ , $I_C = -10\text{ mA}$ ,<br>$I_{B1} = I_{B2} = -1.0\text{ mA}$ )                    | $t_s$ | — | 225 | ns |
| Fall Time    |                                                                                                                  | $t_f$ | — | 75  |    |

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

## MMBT3906LT1



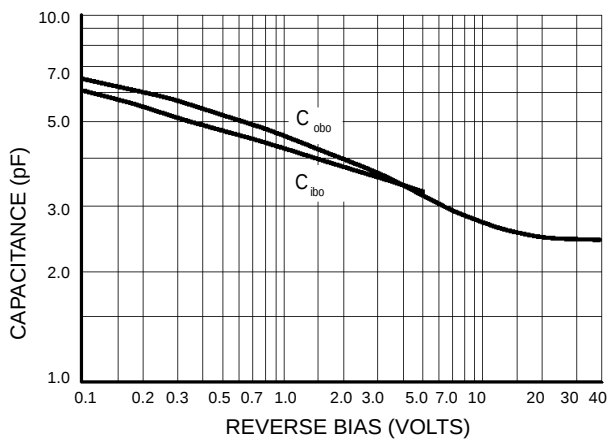
**Figure 1. Delay and Rise Time  
Equivalent Test Circuit**



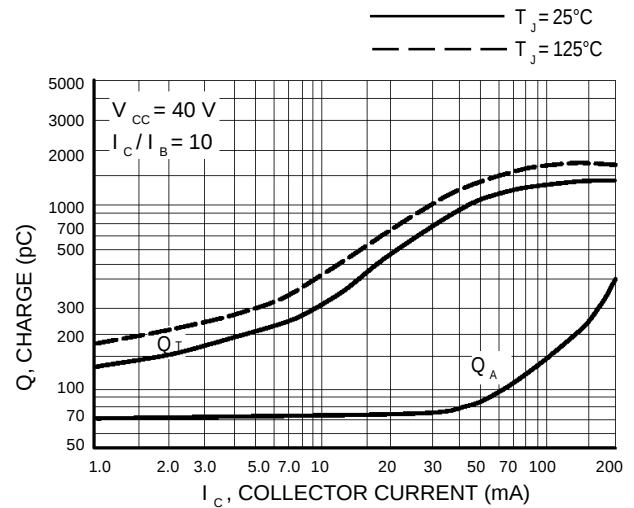
**Figure 2. Storage and Fall Time  
Equivalent Test Circuit**

\*Total shunt capacitance of test jig and connectors

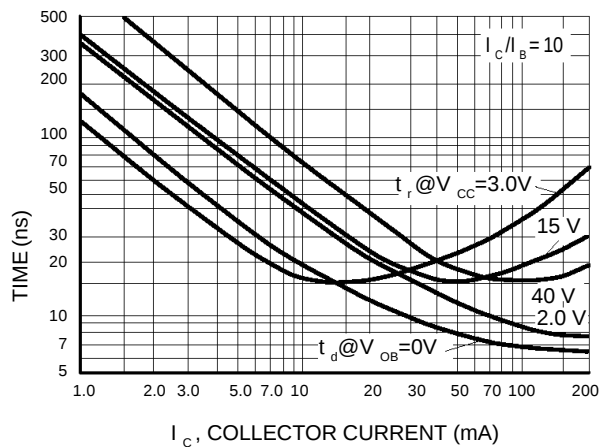
### TYPICAL TRANSIENT CHARACTERISTICS



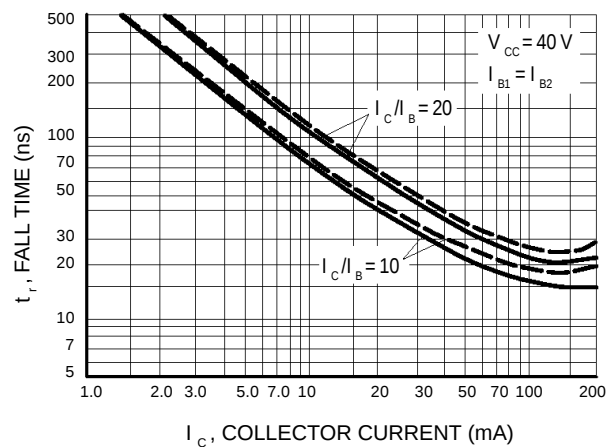
**Figure 3. Capacitance**



**Figure 4. Charge Data**



**Figure 5. Turn-On Time**



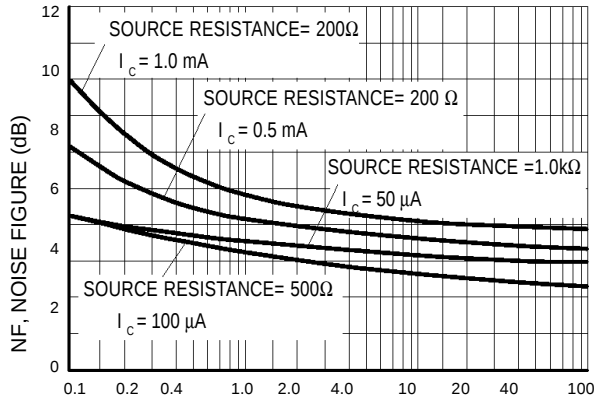
**Figure 6. Fall Time**

MMBT3906LT1

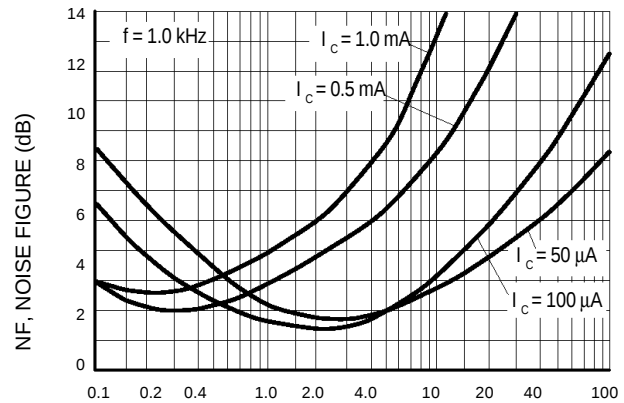
TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS

NOISE FIGURE VARIATIONS

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



f, FREQUENCY (kHz)  
Figure 7. Noise Figure



$R_g$ , SOURCE RESISTANCE (kΩ)  
Figure 8. Noise Figure

h PARAMETERS

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

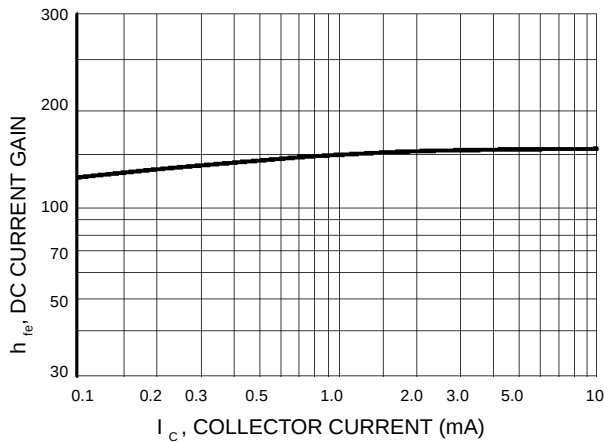


Figure 9. Current Gain

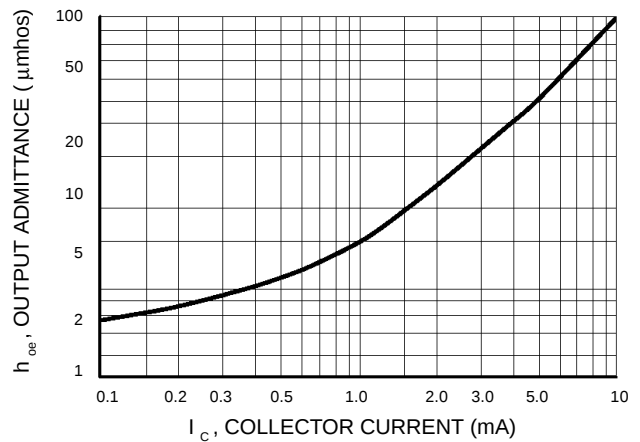


Figure 10. Output Admittance

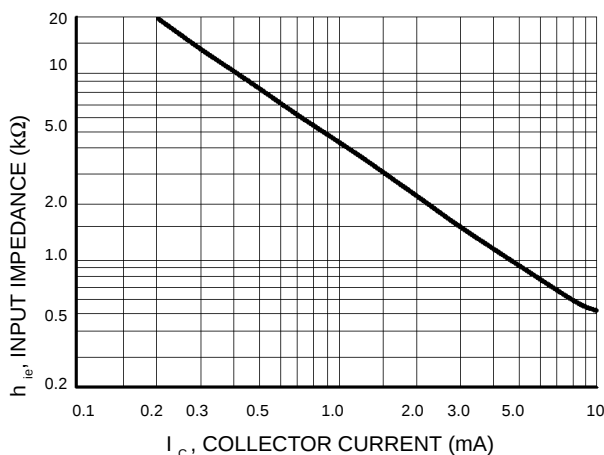


Figure 11. Input Impedance

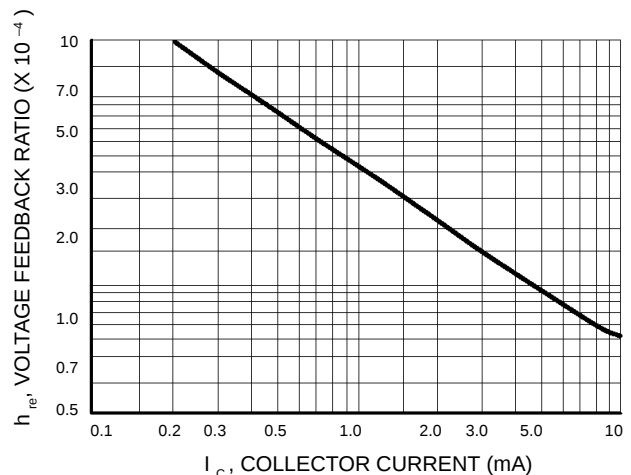


Figure 12. Voltage Feedback Ratio

# MMBT3906LT1

## TYPICAL STATIC CHARACTERISTICS

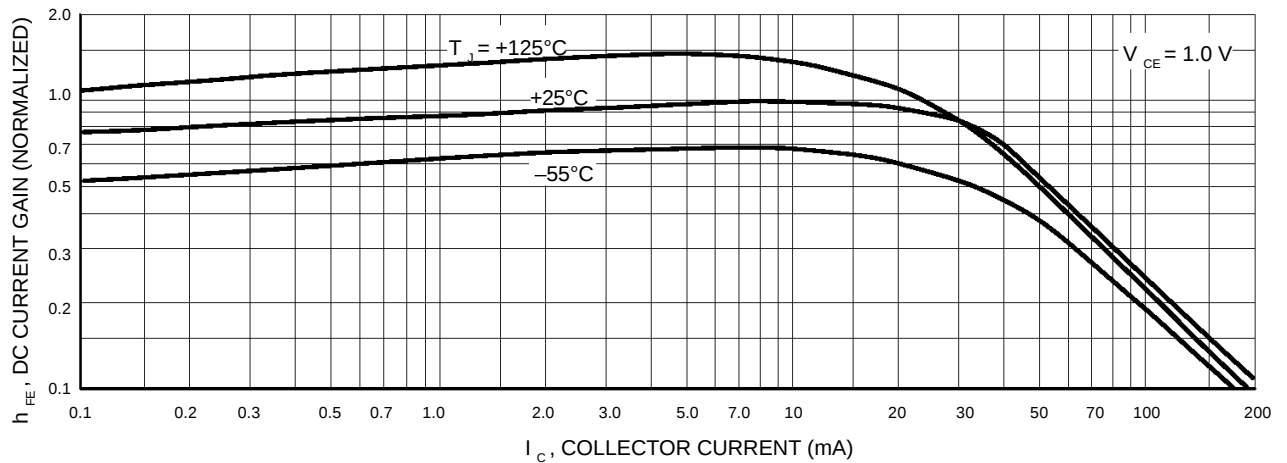


Figure 13. DC Current Gain

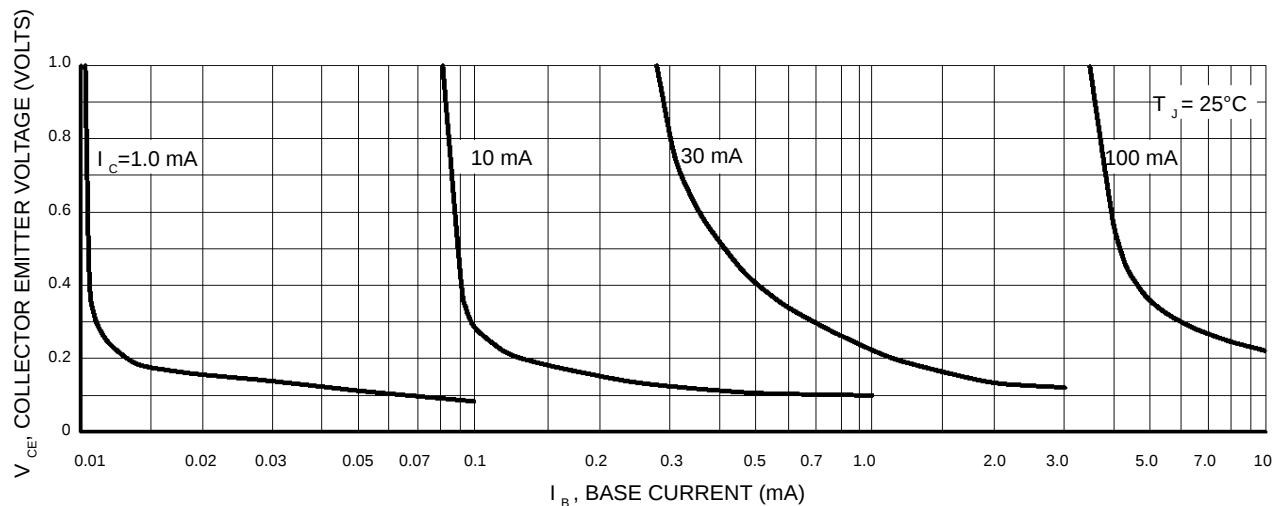


Figure 14. Collector Saturation Region

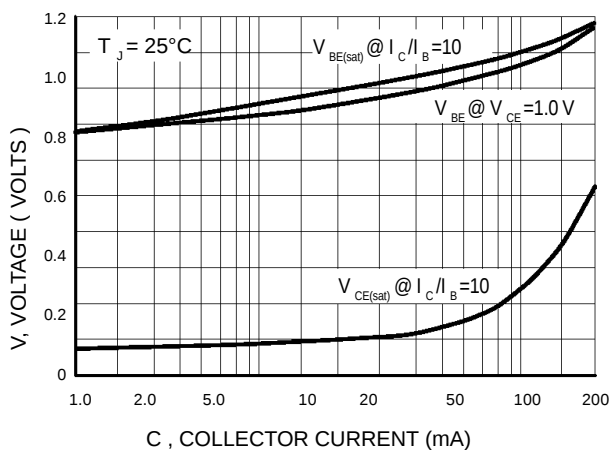


Figure 15. "ON" Voltages

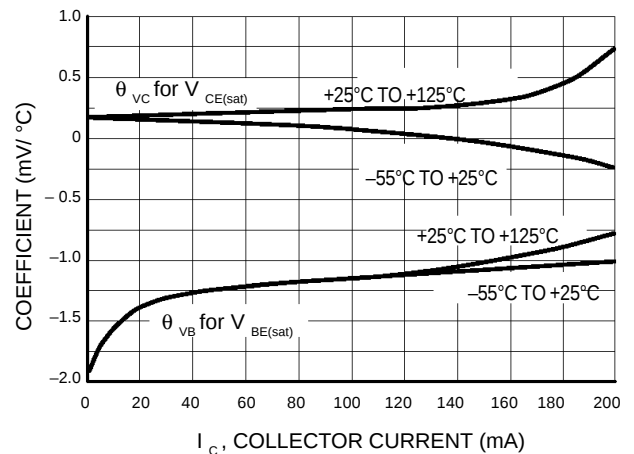


Figure 16. Temperature Coefficients