

RoHS Compliant Product
A suffix of "-C" specifies halogen & lead-free

FEATURES

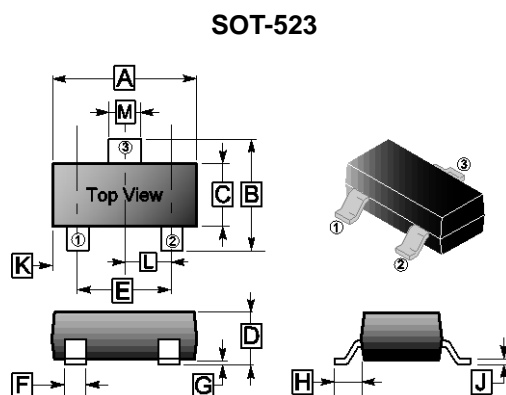
- Simplifies Circuit Design.
- We Declare that the material of product compliance with RoHS requirements.

MARKING

2A

PACKAGE INFORMATION

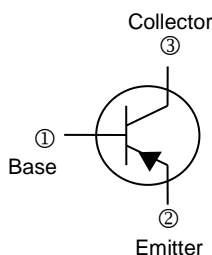
| Package | MPQ | Leader Size |
|---------|-----|-------------|
| SOT-523 | 3K | 7 inch |



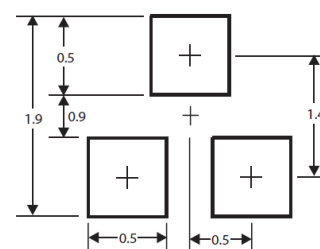
| REF. | Millimeter | | REF. | Millimeter | |
|------|------------|------|------|------------|------|
| | Min. | Max. | | Min. | Max. |
| A | 1.50 | 1.70 | G | - | 0.10 |
| B | 1.45 | 1.75 | H | 0.55 REF. | |
| C | 0.70 | 0.90 | J | 0.08 | 0.20 |
| D | 0.60 | 0.90 | K | - | |
| E | 0.90 | 1.10 | L | 0.50 TYP. | |
| F | 0.15 | 0.35 | M | 0.25 | 0.40 |

ORDER INFORMATION

| Part Number | Type |
|-------------|---------------------------------|
| MMBT3906T-C | Lead (Pb)-free and Halogen-free |



Mounting Pad Layout



*Dimensions in millimeters

MAXIMUM RATINGS (at $T_A=25^\circ\text{C}$ unless otherwise specified)

| Parameter | Symbol | Ratings | Unit |
|--|---------------------------------|---------|---------------------------|
| Collector-Base Voltage | V_{CBO} | -40 | V |
| Collector-Emitter Voltage | V_{CEO} | -40 | |
| Emitter-Base Voltage | V_{EBO} | -5 | |
| Continuous Collector Current | I_C | -200 | mA |
| Total Device Dissipation FR-4 Board ¹ | $T_A=25^\circ\text{C}$ | 200 | mW |
| | Derate above 25°C | 1.6 | mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-Ambient | $R_{\theta JA}$ | 600 | $^\circ\text{C}/\text{W}$ |
| Total Device Dissipation FR-4 Board ² | $T_A=25^\circ\text{C}$ | 300 | mW |
| | Derate above 25°C | 2.4 | mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-Ambient | $R_{\theta JA}$ | 400 | $^\circ\text{C}/\text{W}$ |
| Junction & Storage Temperature Range | T_J, T_{STG} | -55~150 | $^\circ\text{C}$ |

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

| Parameter | Symbol | Min. | Max. | Unit | Test Conditions |
|---|---------------|-------|-------|------------------|---|
| Collector-Emitter Breakdown Voltage ³ | $V_{(BR)CEO}$ | -40 | - | V | $I_C = -1\text{mA}, I_B = 0$ |
| Collector-Base Breakdown Voltage | $V_{(BR)CBO}$ | -40 | - | V | $I_C = -10\mu\text{A}, I_E = 0$ |
| Emitter-Base Breakdown Voltage | $V_{(BR)EBO}$ | -5.0 | - | V | $I_E = -10\mu\text{A}, I_C = 0$ |
| Collector Cut-Off Current | I_{BL} | - | -50 | nA | $V_{CE} = -30\text{V}, V_{EB} = -3\text{V}$ |
| Emitter Cut-Off Current | I_{CEX} | - | -50 | nA | $V_{CE} = -30\text{V}, V_{BE} = -3\text{V}$ |
| DC Current Gain ³ | h_{FE} | 60 | - | | $I_C = -0.1\text{mA}, V_{CE} = -1\text{V}$ |
| | | 80 | - | | $I_C = -1\text{mA}, V_{CE} = -1\text{V}$ |
| | | 100 | 300 | | $I_C = -10\text{mA}, V_{CE} = -1\text{V}$ |
| | | 60 | - | | $I_C = -50\text{mA}, V_{CE} = -1\text{V}$ |
| | | 30 | - | | $I_C = -100\text{mA}, V_{CE} = -1\text{V}$ |
| Collector-Emitter Saturation Voltage ³ | $V_{CE(sat)}$ | - | -0.25 | V | $I_C = -10\text{mA}, I_B = -1\text{mA}$ |
| | | - | -0.4 | | $I_C = -50\text{mA}, I_B = -5\text{mA}$ |
| Base-Emitter Saturation Voltage ³ | $V_{BE(sat)}$ | -0.65 | -0.85 | V | $I_C = -10\text{mA}, I_B = -1\text{mA}$ |
| | | - | -0.95 | | $I_C = -50\text{mA}, I_B = -5\text{mA}$ |
| Current-Gain-Bandwidth Product | f_T | 250 | - | MHz | $V_{CE} = -20\text{V}, I_C = -10\text{mA}, f = 100\text{MHz}$ |
| Output Capacitance | C_{obo} | - | 4.5 | pF | $V_{CB} = -5\text{V}, I_E = 0, f = 1\text{MHz}$ |
| Input Capacitance | C_{ibo} | - | 10 | pF | $V_{BE} = -0.5\text{V}, I_E = 0, f = 1\text{MHz}$ |
| Input Impedance | h_{ie} | 2.0 | 12 | pF | $V_{CE} = -10\text{V}, I_C = -1\text{mA}, f = 1\text{kHz}$ |
| Voltage Feedback Ratio | h_{re} | 0.1 | 10 | $\times 10^{-4}$ | $V_{CE} = -10\text{V}, I_C = -1\text{mA}, f = 1\text{kHz}$ |
| Small-Signal Current Gain | h_{fe} | 100 | 400 | - | $V_{CE} = -10\text{V}, I_C = -1\text{mA}, f = 1\text{kHz}$ |
| Output Admittance | $*h_{oe}$ | 3.0 | 60 | μmhos | $V_{CE} = -10\text{V}, I_C = -1\text{mA}, f = 1\text{kHz}$ |
| Noise Figure | NF | - | 4.0 | dB | $V_{CE} = -5\text{V}, I_C = -100\mu\text{A}, R_S = 1\text{k}\Omega, f = 1\text{kHz}$ |
| Delay Time | T_d | - | 35 | nS | $V_{CC} = -3\text{V}, V_{BE} = 0.5\text{V}, I_C = -10\text{mA}, I_{B1} = -1\text{mA}$ |
| Rise Time | T_r | - | 35 | | |
| Storage Time | T_s | - | 225 | nS | $V_{CC} = -3\text{V}, I_C = -10\text{mA}, I_{B1} = I_{B2} = -1\text{mA}$ |
| Fall Time | T_f | - | 75 | | |

Notes:

- FR-4 Minimum Pad.
- FR-4 1.0 X 1.0 Inch Pad.
- Pulse Test: Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$.

CHARACTERISTIC CURVES

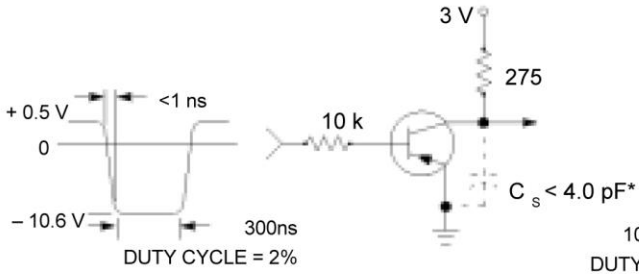


Figure 1. Delay and Rise Time
Equivalent Test Circuit

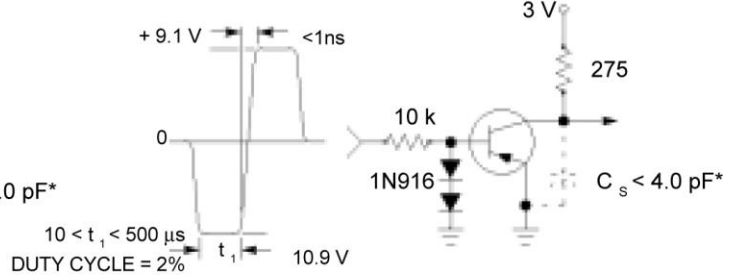


Figure 2. Storage and Fall Time
Equivalent Test Circuit

*Total shunt capacitance of test jig and connectors

TYPICAL TRANSIENT CHARACTERISTICS

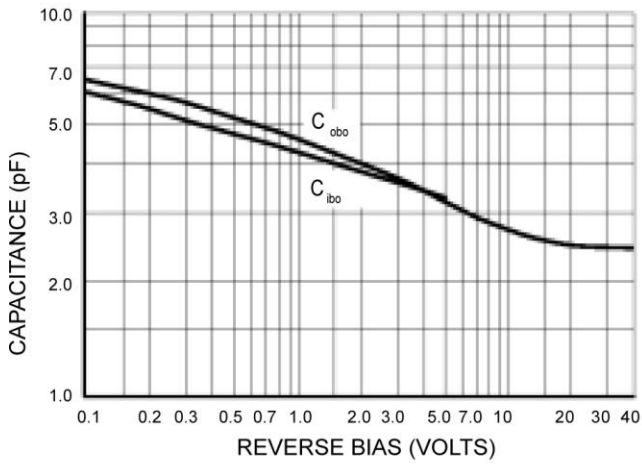


Figure 3. Capacitance

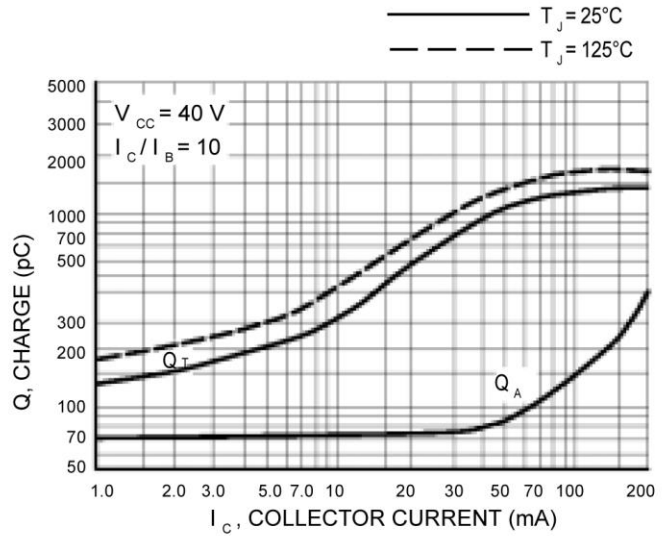


Figure 4. Charge Data

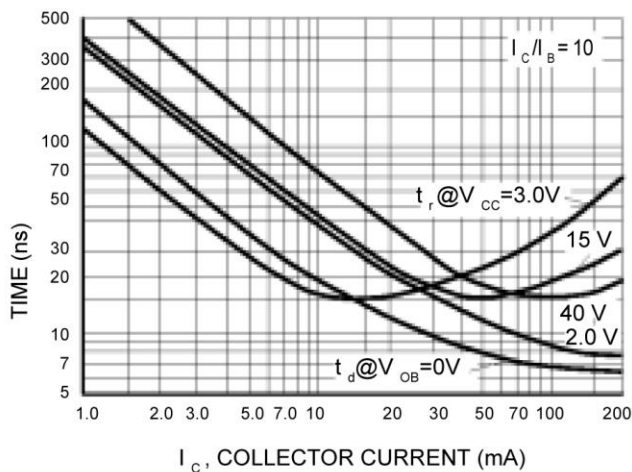


Figure 5. Turn-On Time

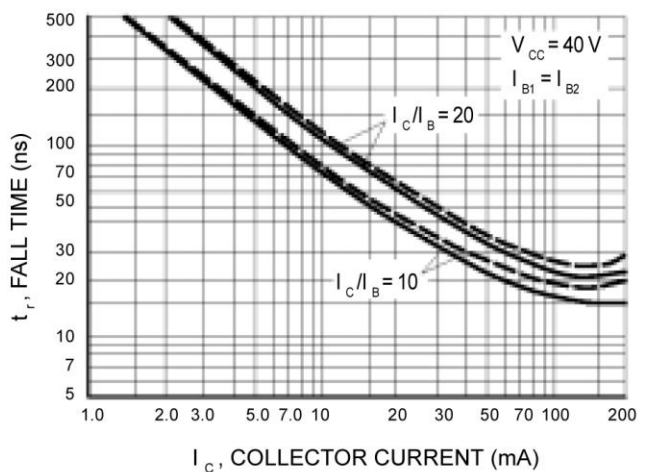


Figure 6. Fall Time

CHARACTERISTIC CURVES

TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS NOISE FIGURE VARIATIONS

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

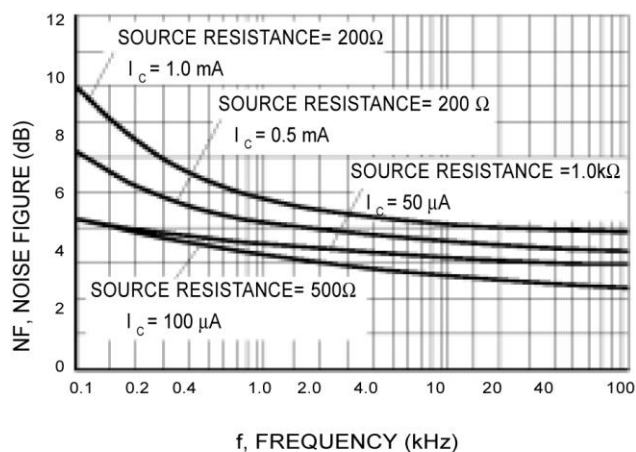


Figure 7. Noise Figure

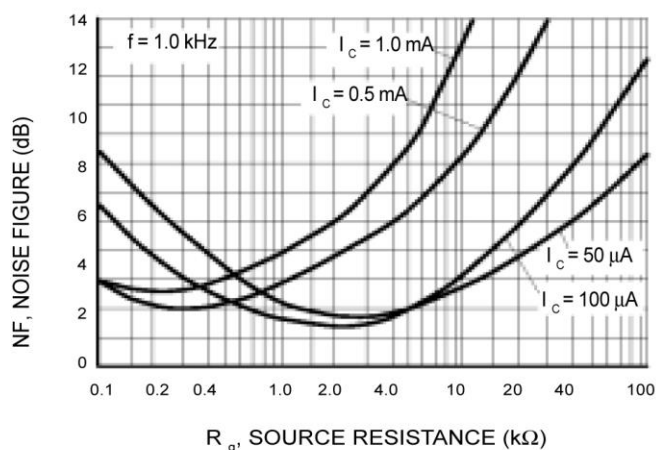


Figure 8. Noise Figure

h PARAMETERS

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

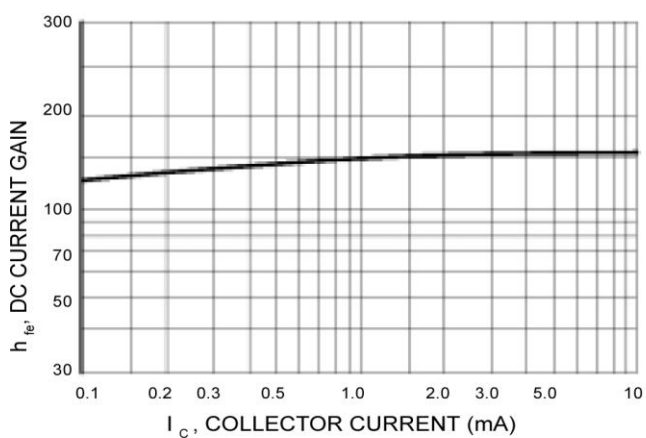


Figure 9. Current Gain

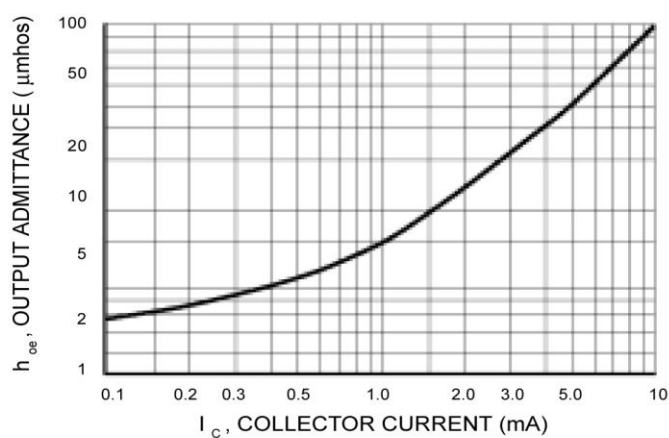


Figure 10. Output Admittance

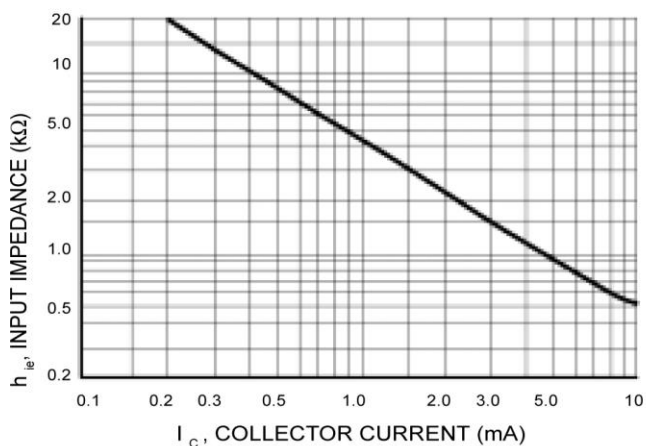


Figure 11. Input Impedance

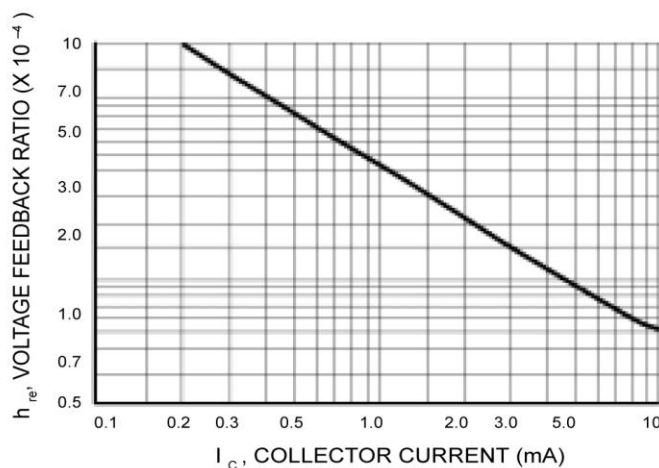


Figure 12. Voltage Feedback Ratio

CHARACTERISTIC CURVES

TYPICAL STATIC CHARACTERISTICS

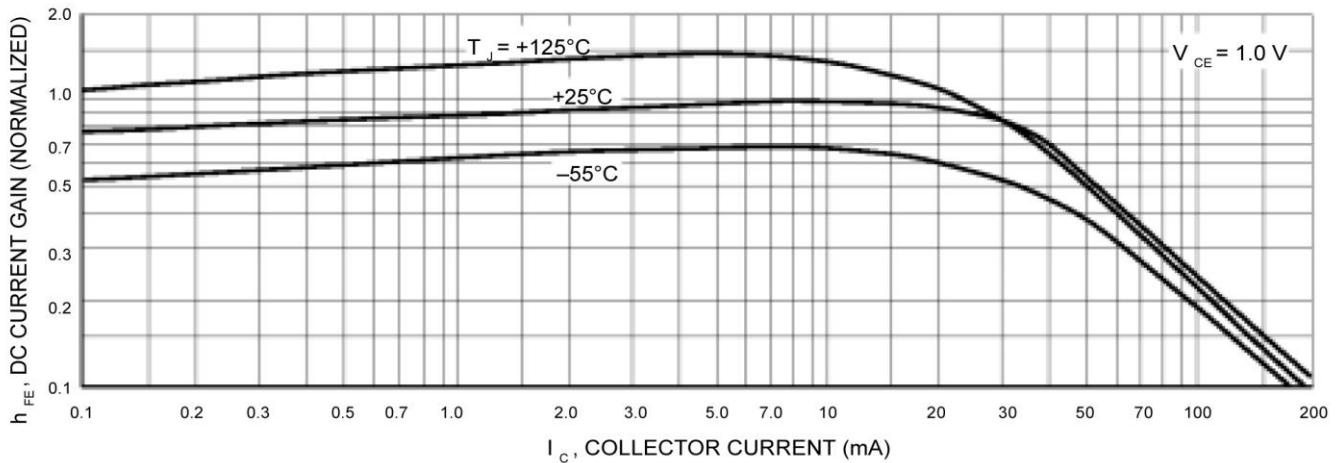


Figure 13. DC Current Gain

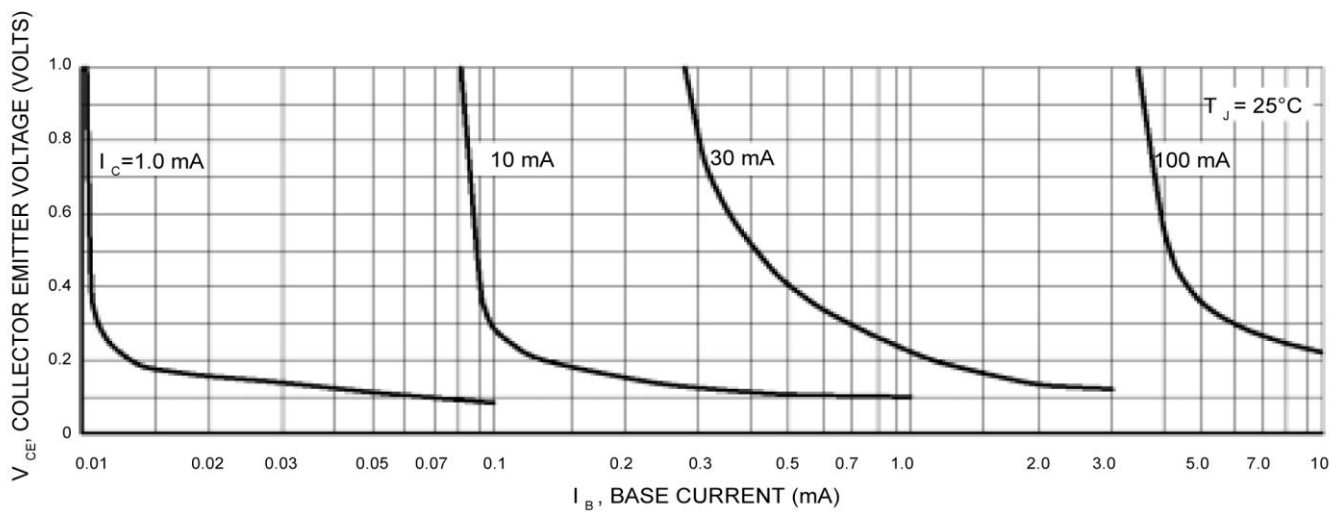


Figure 14. Collector Saturation Region

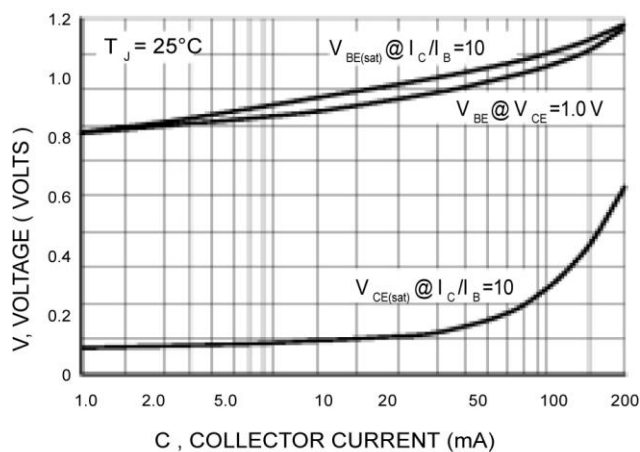


Figure 15. "ON" Voltages

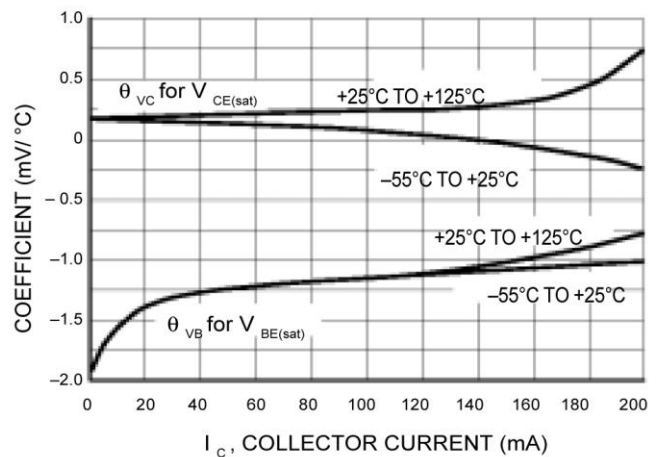


Figure 16. Temperature Coefficients