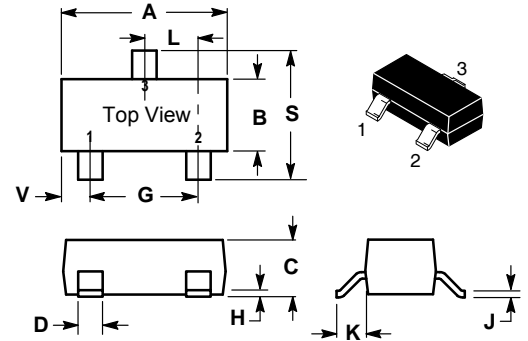
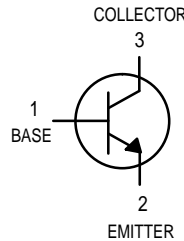


RoHS Compliant Product

A suffix of "-C" specifies halogen & lead-free

FEATURES

- Epitaxial Planar Die Construction
- Complementary PNP Type Available (MMBT2907A)
- Ideal for Medium Power Amplification and Switching



MAXIMUM RATINGS

| Rating | Symbol | 2222 | 2222A | Unit |
|--------------------------------|-----------|------|-------|------|
| Collector–Emitter Voltage | V_{CEO} | 30 | 40 | Vdc |
| Collector–Base Voltage | V_{CBO} | 60 | 75 | Vdc |
| Emitter–Base Voltage | V_{EBO} | 5.0 | 6.0 | Vdc |
| Collector Current — Continuous | I_C | 600 | | mAdc |

| SOT-23 | | |
|---------------------|-------|-------|
| Dim | Min | Max |
| A | 2.800 | 3.040 |
| B | 1.200 | 1.400 |
| C | 0.890 | 1.110 |
| D | 0.370 | 0.500 |
| G | 1.780 | 2.040 |
| H | 0.013 | 0.100 |
| J | 0.085 | 0.177 |
| K | 0.450 | 0.600 |
| L | 0.890 | 1.020 |
| S | 2.100 | 2.500 |
| V | 0.450 | 0.600 |
| All Dimension in mm | | |

THERMAL CHARACTERISTICS

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

| |
|--------------------------------|
| MMBT2222 = M1B; MMBT2222A = 1P |
|--------------------------------|

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

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

OFF CHARACTERISTICS

| | | | | | |
|---|--|---------------|------------------|--------------------------|-----------------|
| Collector–Emitter Breakdown Voltage ($I_C = 10 \text{ mAdc}, I_B = 0$) | MMBT2222 MMBT2222A | $V_{(BR)CEO}$ | 30 40 | — — | Vdc |
| Collector–Base Breakdown Voltage ($I_C = 10 \text{ }\mu\text{Adc}, I_E = 0$) | MMBT2222 MMBT2222A | $V_{(BR)CBO}$ | 60 75 | — — | Vdc |
| Emitter–Base Breakdown Voltage ($I_E = 10 \text{ }\mu\text{Adc}, I_C = 0$) | MMBT2222 MMBT2222A | $V_{(BR)EBO}$ | 5.0 6.0 | — — | Vdc |
| Collector Cutoff Current ($V_{CE} = 60 \text{ Vdc}, V_{EB(off)} = 3.0 \text{ Vdc}$) | MMBT2222A | I_{CEX} | — | 10 | nAdc |
| Collector Cutoff Current ($V_{CB} = 50 \text{ Vdc}, I_E = 0$) ($V_{CB} = 60 \text{ Vdc}, I_E = 0$) ($V_{CB} = 50 \text{ Vdc}, I_E = 0, T_A = 125^\circ\text{C}$) ($V_{CB} = 60 \text{ Vdc}, I_E = 0, T_A = 125^\circ\text{C}$) | MMBT2222 MMBT2222A MMBT2222 MMBT2222A | I_{CBO} | — — — — | 0.01 0.01 10 10 | μAdc |
| Emitter Cutoff Current ($V_{EB} = 3.0 \text{ Vdc}, I_C = 0$) | MMBT2222A | I_{EBO} | — | 100 | nAdc |
| Base Cutoff Current ($V_{CE} = 60 \text{ Vdc}, V_{EB(off)} = 3.0 \text{ Vdc}$) | MMBT2222A | I_{BL} | — | 20 | nAdc |

1. FR±5 = 1.0 x 0.75 x 0.062 in.

2. Alumina = 0.4 x 0.3 x 0.024 in. 99.5% alumina.

REM : Thermal Clad is a trademark of the Bergquist Company.

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

| Characteristic | Symbol | Min | Max | Unit |
|--|---------------|---|--|-----------------------|
| ON CHARACTERISTICS | | | | |
| DC Current Gain ($I_C = 0.1 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$) ($I_C = 1.0 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$) ($I_C = 10 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$) ($I_C = 10 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$, $T_A = -55^\circ\text{C}$) ($I_C = 150 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$) (3) ($I_C = 150 \text{ mAdc}$, $V_{CE} = 1.0 \text{ Vdc}$) (3) ($I_C = 500 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$) (3) | h_{FE} | 35 50 75 35 100 50 30 40 | — — — — 300 — — — | — |
| | | | | MMBT2222A only |
| | | | | MMBT2222 MMBT2222A |
| 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 0.3 1.6 1.0 | Vdc |
| | | | | MMBT2222 MMBT2222A |
| | | | | MMBT2222 MMBT2222A |
| Base–Emitter Saturation Voltage (3) ($I_C = 150 \text{ mAdc}$, $I_B = 15 \text{ mAdc}$) ($I_C = 500 \text{ mAdc}$, $I_B = 50 \text{ mAdc}$) | $V_{BE(sat)}$ | — 0.6 — — | 1.3 1.2 2.6 2.0 | Vdc |
| | | | | MMBT2222 MMBT2222A |
| | | | | MMBT2222 MMBT2222A |

SMALL–SIGNAL CHARACTERISTICS

| | | | | |
|--|------------|-------------|-------------|------------------------|
| Current–Gain — Bandwidth Product (4) ($I_C = 20 \text{ mAdc}$, $V_{CE} = 20 \text{ Vdc}$, $f = 100 \text{ MHz}$) | f_T | 250 300 | — — | MHz |
| | | | | MMBT2222 MMBT2222A |
| Output Capacitance ($V_{CB} = 10 \text{ Vdc}$, $I_E = 0$, $f = 1.0 \text{ MHz}$) | C_{obo} | — | 8.0 | pF |
| Input Capacitance ($V_{EB} = 0.5 \text{ Vdc}$, $I_C = 0$, $f = 1.0 \text{ MHz}$) | C_{ibo} | — — | 30 25 | pF |
| | | | | MMBT2222 MMBT2222A |
| Input Impedance ($I_C = 1.0 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$, $f = 1.0 \text{ kHz}$) ($I_C = 10 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$, $f = 1.0 \text{ kHz}$) | h_{ie} | 2.0 0.25 | 8.0 1.25 | k Ω |
| | | | | MMBT2222A MMBT2222A |
| Voltage Feedback Ratio ($I_C = 1.0 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$, $f = 1.0 \text{ kHz}$) ($I_C = 10 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$, $f = 1.0 \text{ kHz}$) | h_{re} | — — | 8.0 4.0 | $\times 10^{-4}$ |
| | | | | MMBT2222A MMBT2222A |
| Small–Signal Current Gain ($I_C = 1.0 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$, $f = 1.0 \text{ kHz}$) ($I_C = 10 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$, $f = 1.0 \text{ kHz}$) | h_{fe} | 50 75 | 300 375 | — |
| | | | | MMBT2222A MMBT2222A |
| Output Admittance ($I_C = 1.0 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$, $f = 1.0 \text{ kHz}$) ($I_C = 10 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$, $f = 1.0 \text{ kHz}$) | h_{oe} | 5.0 25 | 35 200 | μmhos |
| | | | | MMBT2222A MMBT2222A |
| Collector Base Time Constant ($I_E = 20 \text{ mAdc}$, $V_{CB} = 20 \text{ Vdc}$, $f = 31.8 \text{ MHz}$) | r_b, C_C | — | 150 | ps |
| Noise Figure ($I_C = 100 \mu\text{Adc}$, $V_{CE} = 10 \text{ Vdc}$, $R_S = 1.0 \text{ k}\Omega$, $f = 1.0 \text{ kHz}$) | NF | — | 4.0 | dB |
| | | | | MMBT2222A |

SWITCHING CHARACTERISTICS (MMBT2222A only)

| | | | | | |
|--------------|--|-------|---|-----|----|
| Delay Time | $(V_{CC} = 30 \text{ Vdc}$, $V_{BE(off)} = -0.5 \text{ Vdc}$, $I_C = 150 \text{ mAdc}$, $I_{B1} = 15 \text{ mAdc}$) | t_d | — | 10 | ns |
| Rise Time | | t_r | — | 25 | |
| 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 | — | 60 | |

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

4. f_T is defined as the frequency at which $|h_{fe}|$ extrapolates to unity.

SWITCHING TIME EQUIVALENT TEST CIRCUITS

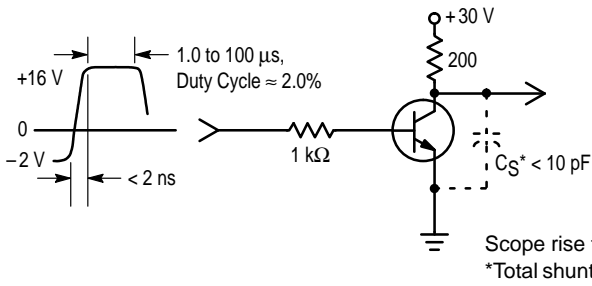


Figure 1. Turn-On Time

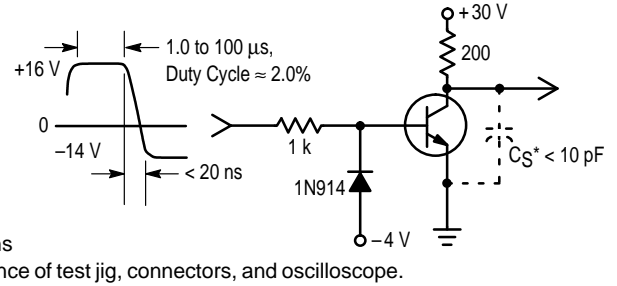


Figure 2. Turn-Off Time

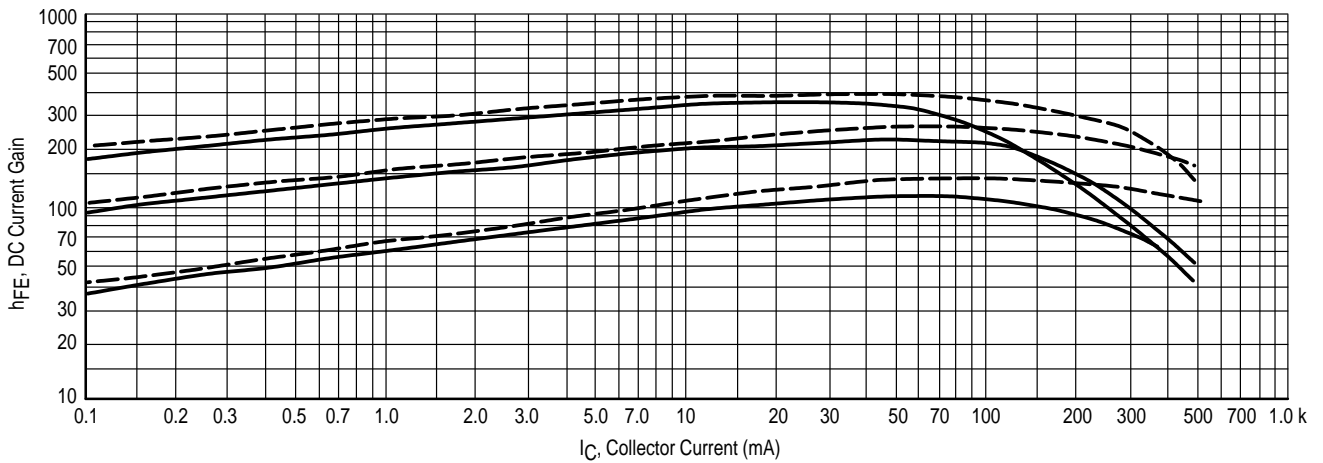


Figure 3. DC Current Gain

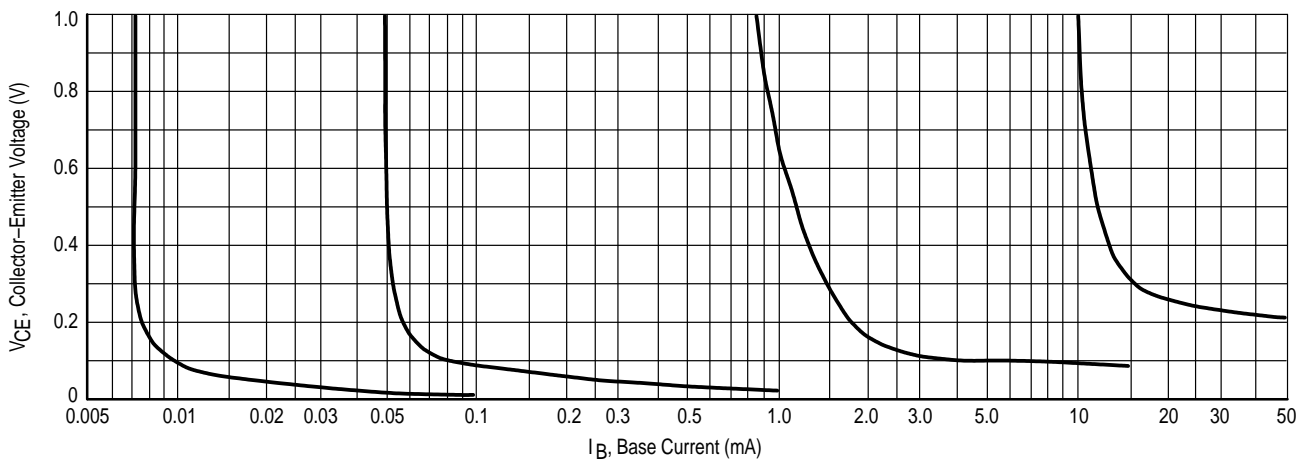


Figure 4. Collector Saturation Region

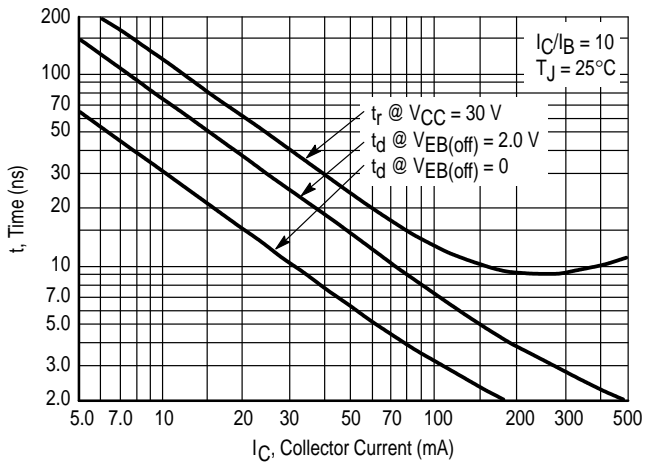


Figure 5. Turn-On Time

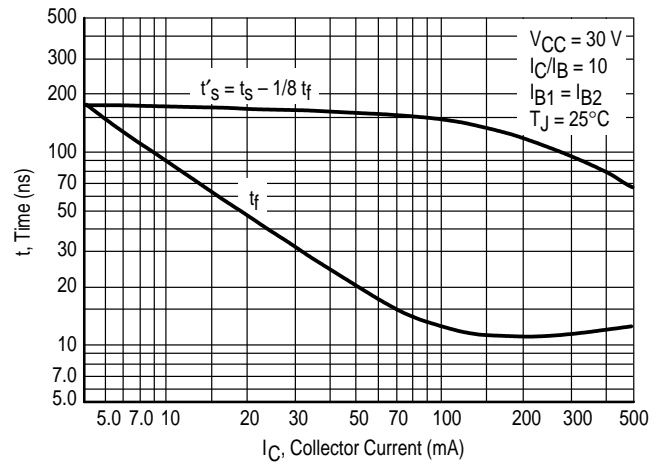


Figure 6. Turn-Off Time

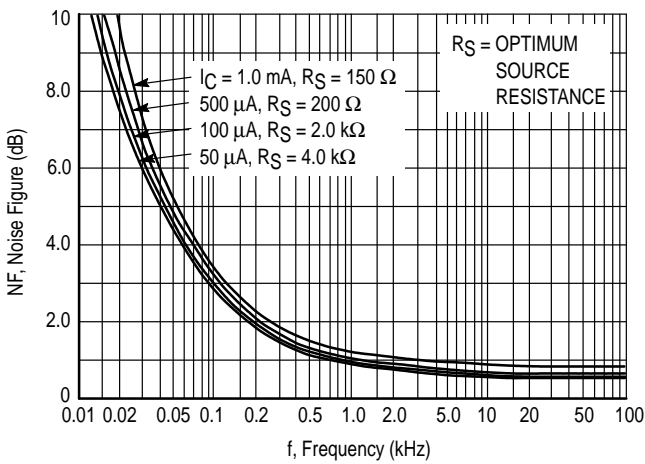


Figure 7. Frequency Effects

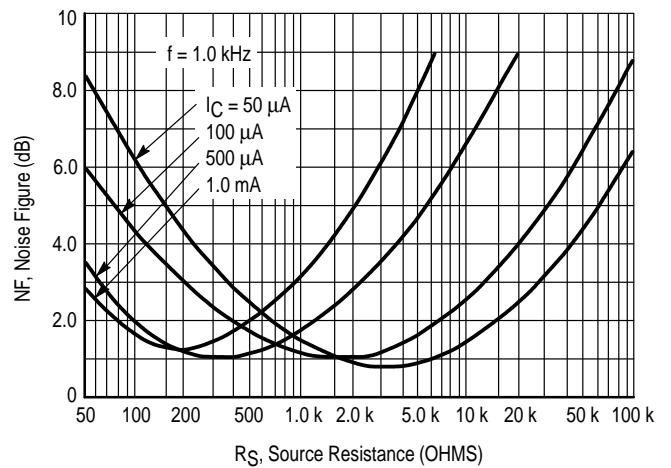


Figure 8. Source Resistance Effects

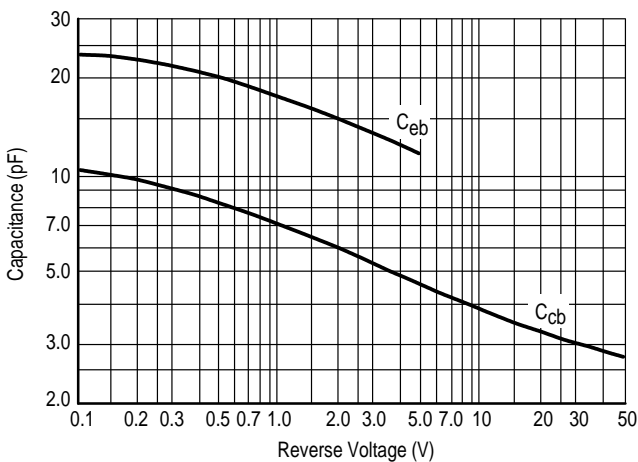


Figure 9. Capacitances

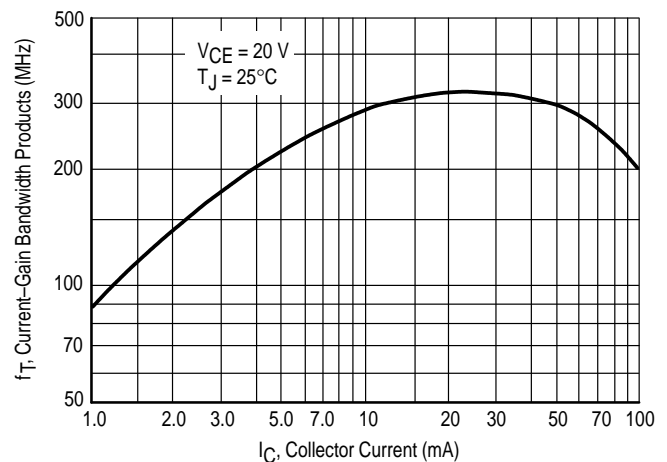


Figure 10. Current-Gain Bandwidth Product

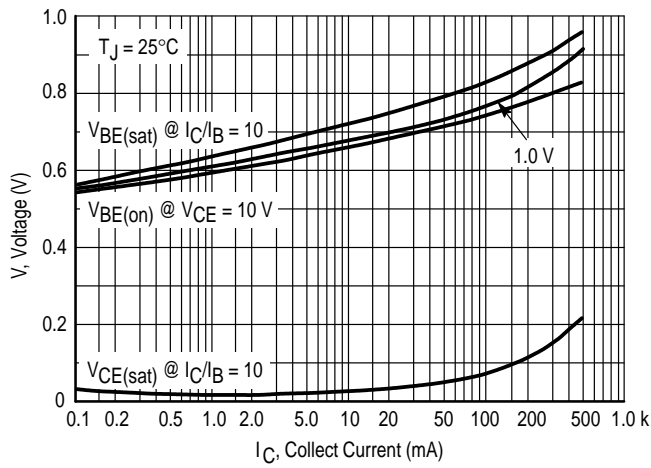


Figure 11. "On" Voltages

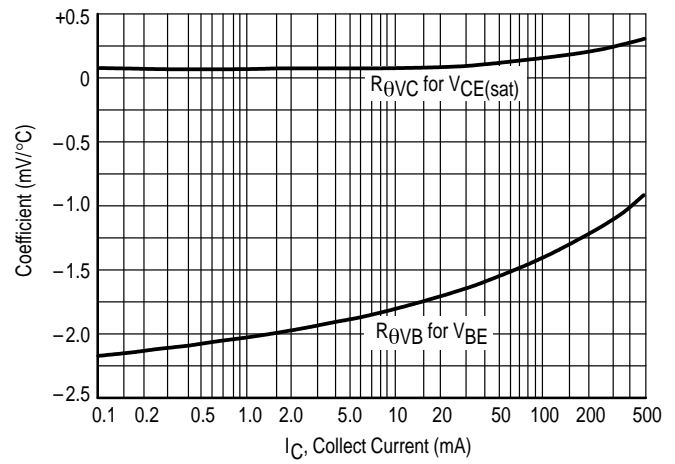


Figure 12. Temperature Coefficients