

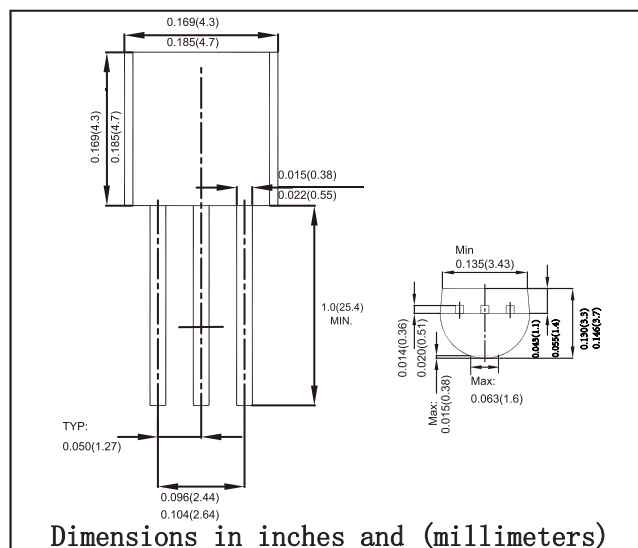
## TO-92 Plastic-Encapsulate Transistors

### FEATURES

- Switching and amplification in high voltage
- Applications such as telephony
- Low current
- High voltage
- NPN Transistors

### MECHANICAL DATA

- Case style: TO-92 molded plastic
- Mounting position: any



### MAXIMUM RATINGS AND CHARACTERISTICS

@ 25°C Ambient Temperature (unless otherwise noted)

| Parameter                                   | Symbol    | Value    | Unit  |
|---------------------------------------------|-----------|----------|-------|
| Collector-Base Voltage                      | $V_{CBO}$ | 0        | V     |
| Collector-Emitter Voltage                   | $V_{CEO}$ | 40       | V     |
| Emitter-Base Voltage                        | $V_{EBO}$ | 3        | V     |
| Collector Current -Continuous               | $I_C$     | 0.6      | A     |
| Collector Power Dissipation                 | $P_D$     | 625      | mW    |
| Thermal Resistance From Junction To Ambient | $R_{KJA}$ | 200      | °C /W |
| Junction Temperature                        | $T_J$     | 100      | °C    |
| Storage Temperature                         | $T_{stg}$ | -55~+150 | °C    |

| Parameter                            | Symbol        | Test conditions                        | Min  | Typ | Max  | Unit |
|--------------------------------------|---------------|----------------------------------------|------|-----|------|------|
| Collector-base breakdown voltage     | $V_{(BR)CBO}$ | $I_C = 0.1mA, I_E = 0$                 | 60   |     |      | V    |
| Collector-emitter breakdown voltage  | $V_{(BR)CEO}$ | $I_C = 1mA, I_B = 0$                   | 40   |     |      | V    |
| Emitter-base breakdown voltage       | $V_{(BR)EBO}$ | $I_E = 0.1mA, I_C = 0$                 | 6    |     |      | V    |
| Collector cut-off current            | $I_{CBO}$     | $V_{CB} = 60V, I_E = 0$                |      | 0.1 |      | μA   |
| Emitter cut-off current              | $I_{EBO}$     | $V_{EB} = 6V, I_C = 0$                 |      | 0.1 |      | μA   |
| DC current gain                      | $H_{FE}$      | $V_{CE} = 1V, I_C = 1mA$               | 20   |     |      |      |
|                                      |               | $V_{CE} = 1V, I_C = 10mA$              | 40   |     |      |      |
|                                      |               | $V_{CE} = 1V, I_C = 150mA$             | 50   |     | 150  |      |
|                                      |               | $V_{CE} = 2V, I_C = 500mA$             | 20   |     |      |      |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $I_C = 150mA, I_B = 15mA$              |      | 0.4 |      | V    |
|                                      |               | $I_C = 500mA, I_B = 50mA$              |      |     | 0.75 |      |
| Base-emitter saturation voltage      | $V_{BE(sat)}$ | $I_C = 150mA, I_B = 15mA$              | 0.75 |     | 0.95 |      |
|                                      |               | $I_C = 500mA, I_B = 50mA$              |      |     | 1.2  | V    |
| Collector output capacitance         | $C_{ob}$      | $V_{CB} = 5V, I_E = 0, f = 1MHz$       |      |     | 6.5  | pF   |
| Emitter input capacitance            | $C_{ib}$      | $V_{EB} = 5V, I_C = 0, f = 1MHz$       |      |     | 30   | pF   |
| Transition frequency                 | $f_T$         | $V_{CE} = 10V, I_C = 20mA, f = 100MHz$ | 200  |     |      | MHz  |

\* Pulse test: pulse width ≤300μs, duty cycles ≤ 2.0%.

## RATINGS AND CHARACTERISTIC CURVES

### SWITCHING TIME EQUIVALENT TEST CIRCUITS

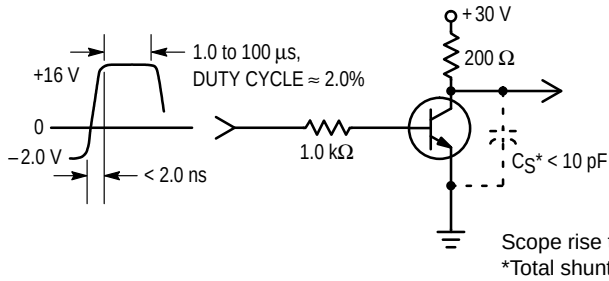


Figure 1. Turn-On Time

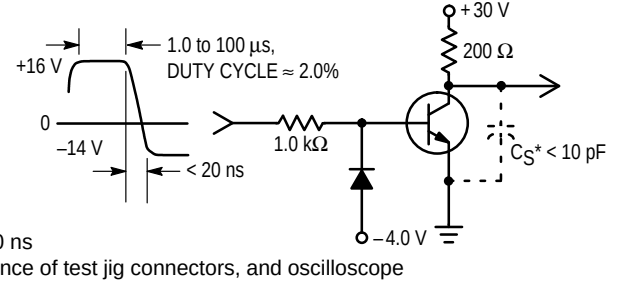


Figure 2. Turn-Off Time

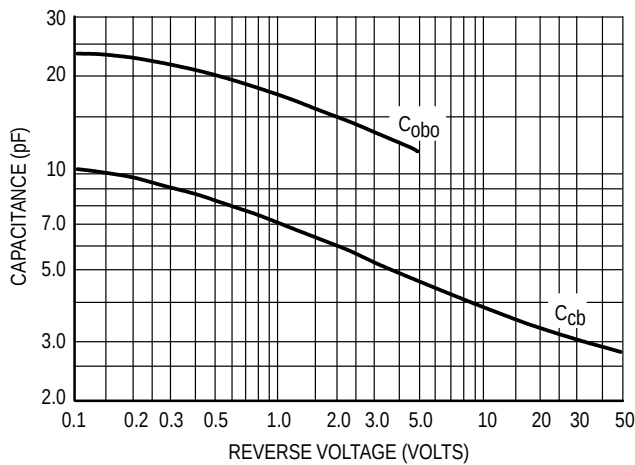


Figure 3. Capacitances

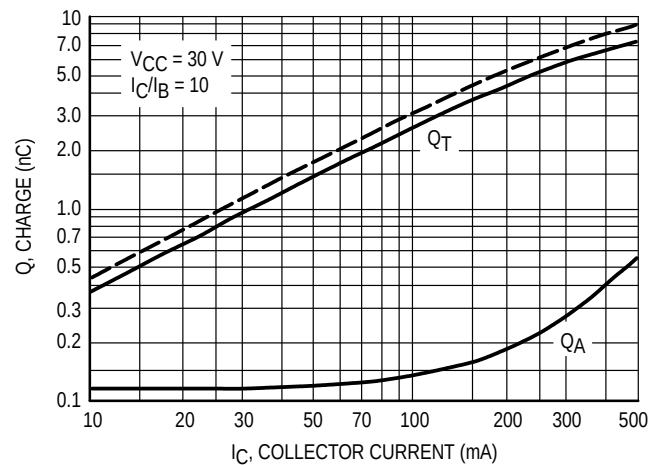


Figure 4. Charge Data

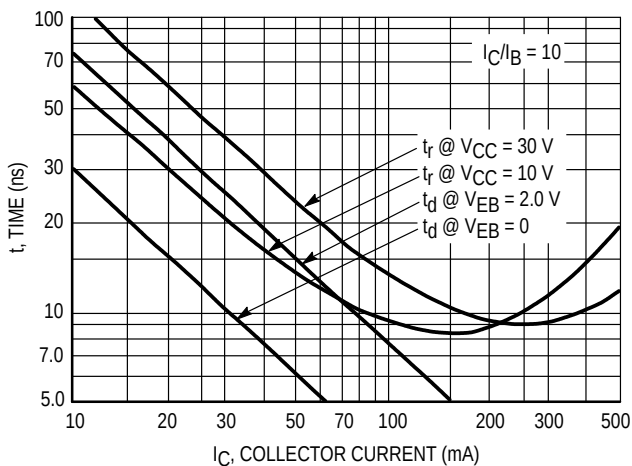


Figure 5. Turn-On Time

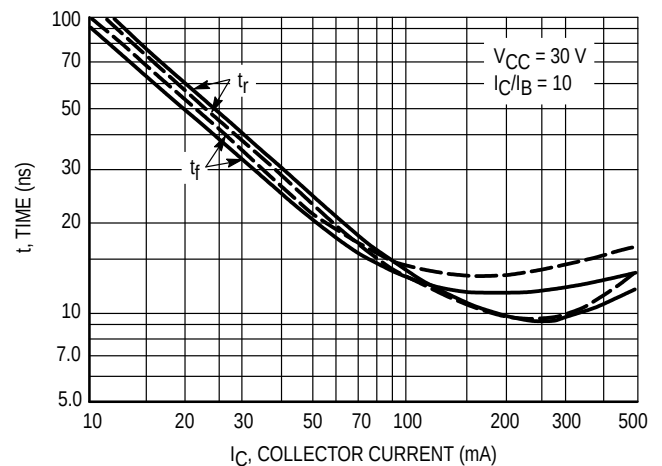


Figure 6. Rise and Fall Times

## RATINGS AND CHARACTERISTIC CURVES

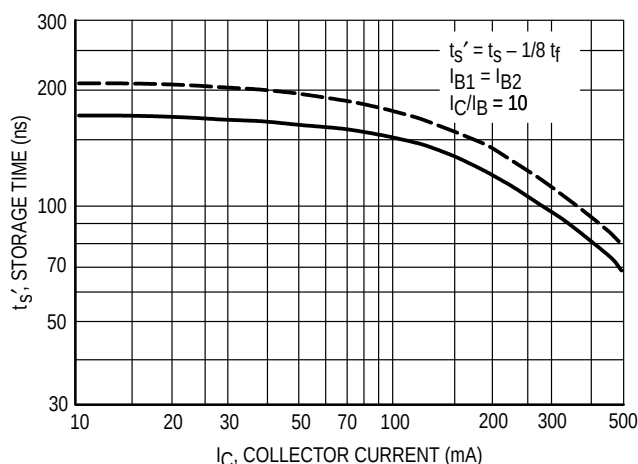


Figure 7. Storage Time

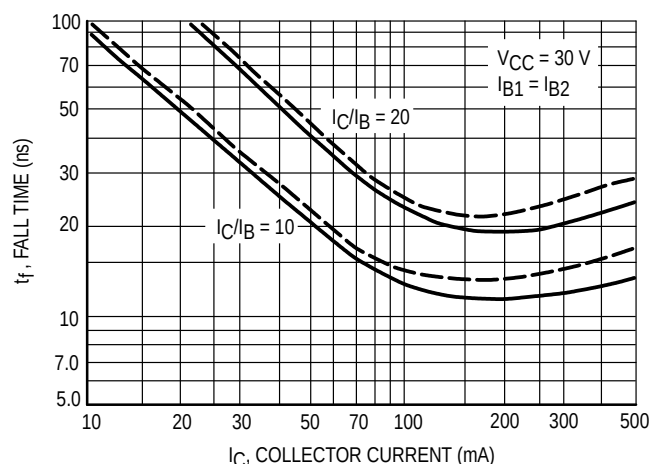


Figure 8. Fall Time

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

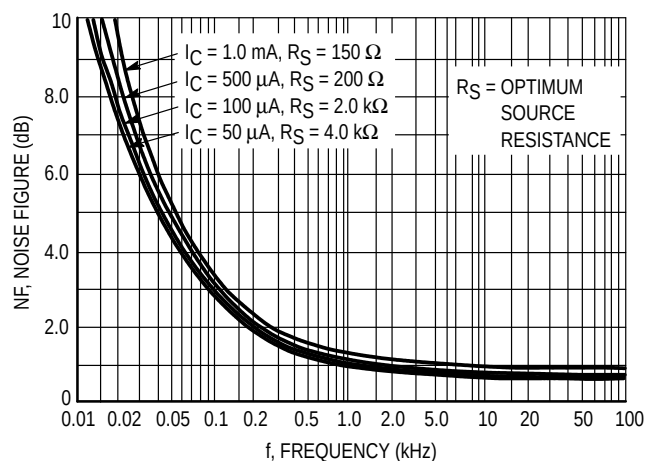


Figure 9. Frequency Effects

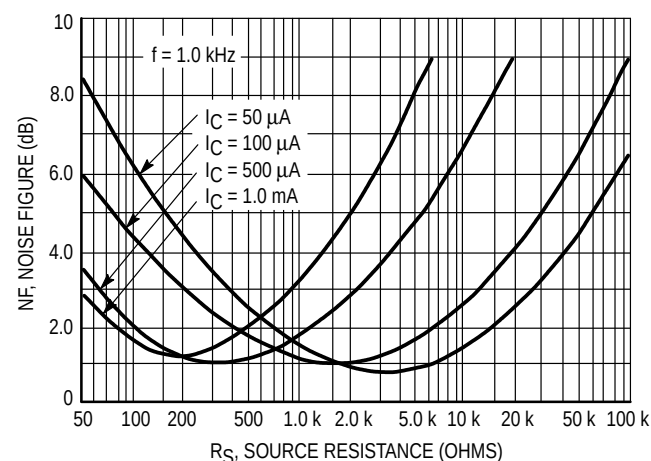


Figure 10. Source Resistance Effects

### 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 both the 2N4400 and 2N4401 lines, and the same units were used to develop the correspondingly numbered curves on each graph.

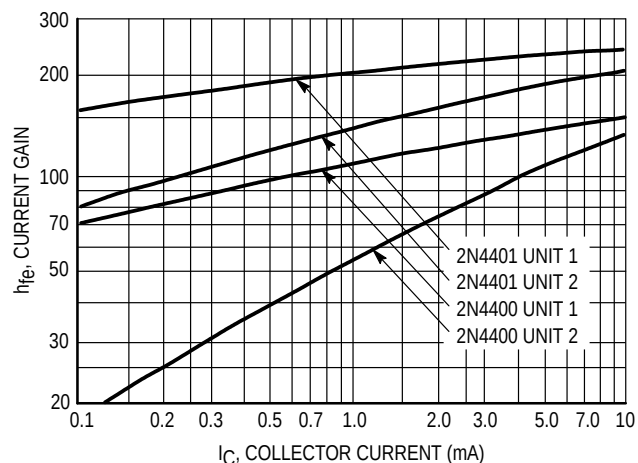


Figure 11. Current Gain

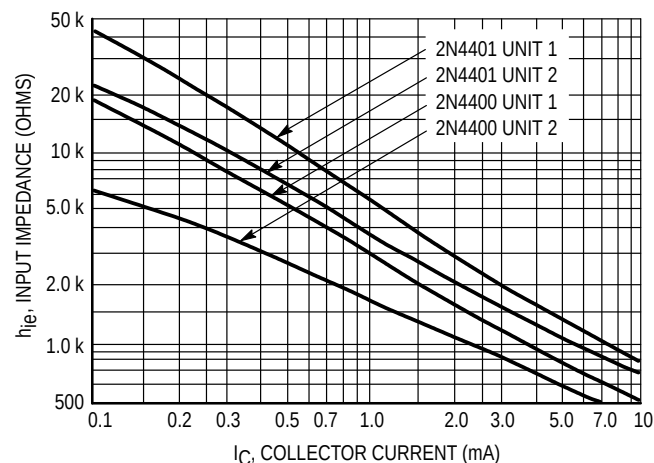


Figure 12. Input Impedance

## RATINGS AND CHARACTERISTIC CURVES

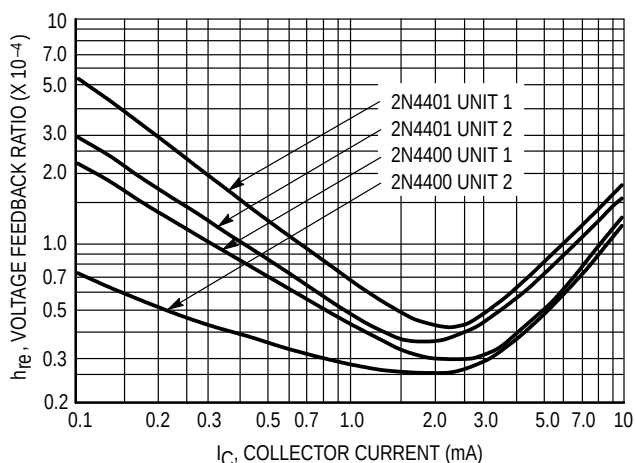


Figure 13. Voltage Feedback Ratio

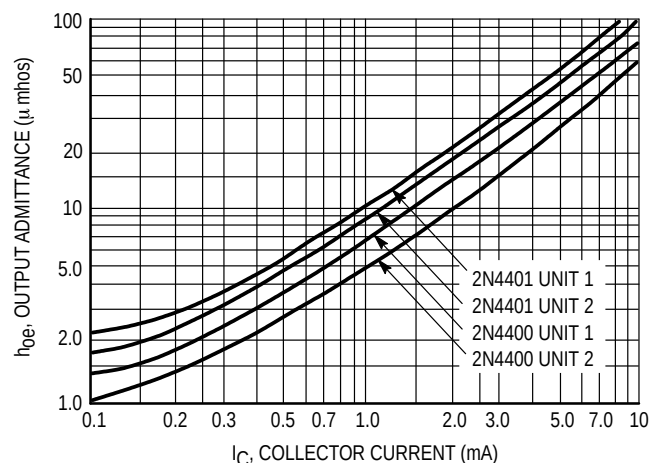


Figure 14. Output Admittance

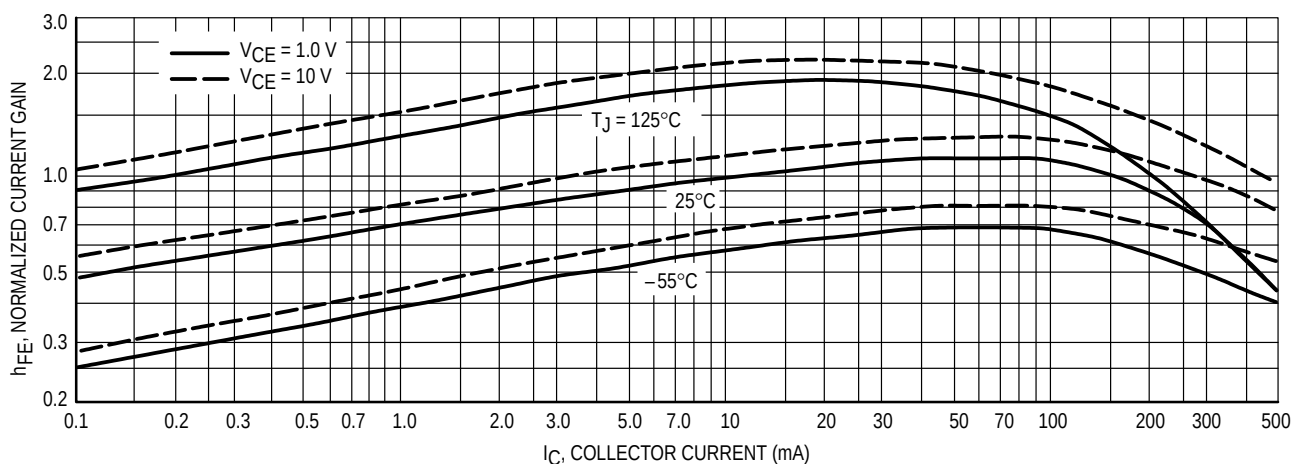


Figure 15. DC Current Gain

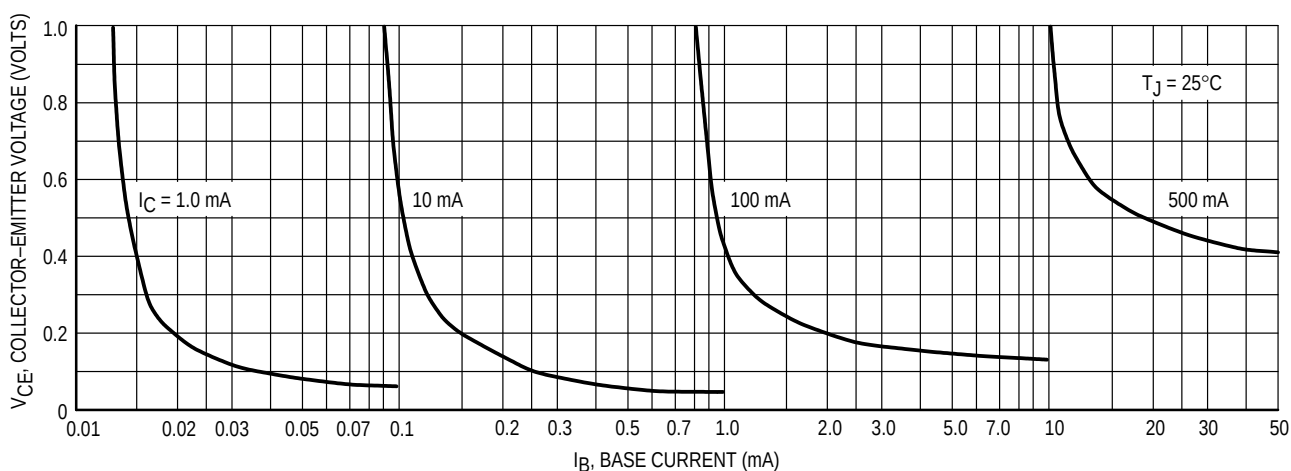


Figure 16. Collector Saturation Region

## RATINGS AND CHARACTERISTIC CURVES

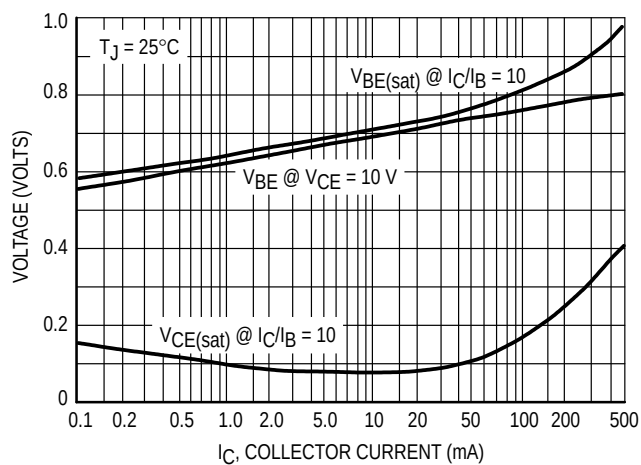


Figure 17. "On" Voltages

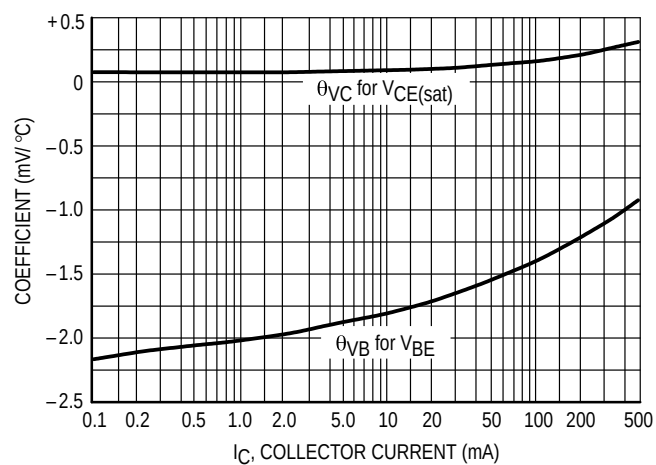


Figure 18. Temperature Coefficients