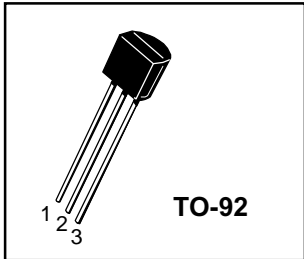


General Purpose Transistors

NPN Silicon

L2N3904

L2N3904



MAXIMUM RATINGS

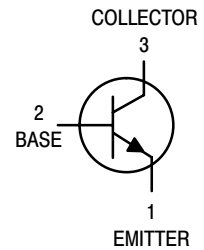
| Rating | Symbol | Value | Unit |
|---|----------------|-------------|----------------------------|
| Collector – Emitter Voltage | V_{CEO} | 40 | Vdc |
| Collector – Base Voltage | V_{CBO} | 60 | Vdc |
| Emitter – Base Voltage | V_{EBO} | 6.0 | Vdc |
| Collector Current – Continuous | I_C | 200 | mAdc |
| Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C | P_D | 625 5.0 | mW mW/ $^\circ\text{C}$ |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C | P_D | 1.5 12 | W mW/ $^\circ\text{C}$ |
| Operating and Storage Junction Temperature Range | T_J, T_{stg} | -55 to +150 | $^\circ\text{C}$ |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

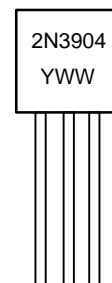
THERMAL CHARACTERISTICS (Note 1)

| Characteristic | Symbol | Max | Unit |
|--|-----------------|------|--------------------|
| Thermal Resistance, Junction-to-Ambient | $R_{\theta JA}$ | 200 | $^\circ\text{C/W}$ |
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | 83.3 | $^\circ\text{C/W}$ |

1. Indicates Data in addition to JEDEC Requirements.



MARKING DIAGRAM



Y = Year
WW = Work Week

L2N3904
ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

| Characteristic | Symbol | Min | Max | Unit |
|--|---------------|-----|-----|------|
| OFF CHARACTERISTICS | | | | |
| Collector–Emitter Breakdown Voltage (Note 2) ($I_C = 1.0\text{ mAdc}$, $I_B = 0$) | $V_{(BR)CEO}$ | 40 | – | Vdc |
| Collector–Base Breakdown Voltage ($I_C = 10\ \mu\text{Adc}$, $I_E = 0$) | $V_{(BR)CBO}$ | 60 | – | Vdc |
| Emitter–Base Breakdown Voltage ($I_E = 10\ \mu\text{Adc}$, $I_C = 0$) | $V_{(BR)EBO}$ | 6.0 | – | Vdc |
| Base Cutoff Current ($V_{CE} = 30\text{ Vdc}$, $V_{EB} = 3.0\text{ Vdc}$) | I_{BL} | – | 50 | nAdc |
| Collector Cutoff Current ($V_{CE} = 30\text{ Vdc}$, $V_{EB} = 3.0\text{ Vdc}$) | I_{CEX} | – | 50 | nAdc |

ON CHARACTERISTICS

| | | | | |
|---|---------------|-----------|--------------|-----|
| DC Current Gain (Note 2) ($I_C = 0.1\text{ mAdc}$, $V_{CE} = 1.0\text{ Vdc}$) | h_{FE} | 40 | – | – |
| ($I_C = 1.0\text{ mAdc}$, $V_{CE} = 1.0\text{ Vdc}$) | | 70 | – | – |
| ($I_C = 10\text{ mAdc}$, $V_{CE} = 1.0\text{ Vdc}$) | | 100 | 300 | – |
| ($I_C = 50\text{ mAdc}$, $V_{CE} = 1.0\text{ Vdc}$) | | 60 | – | – |
| ($I_C = 100\text{ mAdc}$, $V_{CE} = 1.0\text{ Vdc}$) | | 30 | – | – |
| Collector–Emitter Saturation Voltage (Note 2) ($I_C = 10\text{ mAdc}$, $I_B = 1.0\text{ mAdc}$) ($I_C = 50\text{ mAdc}$, $I_B = 5.0\text{ mAdc}$) | $V_{CE(sat)}$ | – – | 0.2 0.3 | Vdc |
| Base–Emitter Saturation Voltage (Note 2) ($I_C = 10\text{ mAdc}$, $I_B = 1.0\text{ mAdc}$) ($I_C = 50\text{ mAdc}$, $I_B = 5.0\text{ mAdc}$) | $V_{BE(sat)}$ | 0.65 – | 0.85 0.95 | Vdc |

SMALL–SIGNAL CHARACTERISTICS

| | | | | |
|--|-----------|-----|-----|------------------|
| Current–Gain – Bandwidth Product ($I_C = 10\text{ mAdc}$, $V_{CE} = 20\text{ Vdc}$, $f = 100\text{ MHz}$) | f_T | 300 | – | MHz |
| Output Capacitance ($V_{CB} = 5.0\text{ Vdc}$, $I_E = 0$, $f = 1.0\text{ MHz}$) | C_{obo} | – | 4.0 | pF |
| Input Capacitance ($V_{EB} = 0.5\text{ Vdc}$, $I_C = 0$, $f = 1.0\text{ MHz}$) | C_{ibo} | – | 8.0 | pF |
| Input Impedance ($I_C = 1.0\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$, $f = 1.0\text{ kHz}$) | h_{ie} | 1.0 | 10 | k Ω |
| Voltage Feedback Ratio ($I_C = 1.0\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$, $f = 1.0\text{ kHz}$) | h_{re} | 0.5 | 8.0 | $\times 10^{-4}$ |
| Small–Signal Current Gain ($I_C = 1.0\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$, $f = 1.0\text{ kHz}$) | h_{fe} | 100 | 400 | – |
| Output Admittance ($I_C = 1.0\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$, $f = 1.0\text{ kHz}$) | h_{oe} | 1.0 | 40 | μhos |
| Noise Figure ($I_C = 100\ \mu\text{Adc}$, $V_{CE} = 5.0\text{ Vdc}$, $R_S = 1.0\text{ k}\ \Omega$, $f = 1.0\text{ kHz}$) | NF | – | 5.0 | dB |

SWITCHING CHARACTERISTICS

| | | | | | |
|--------------|---|-------|---|-----|----|
| Delay Time | $(V_{CC} = 3.0\text{ Vdc}$, $V_{BE} = 0.5\text{ Vdc}$, $I_C = 10\text{ mAdc}$, $I_{B1} = 1.0\text{ mAdc}$) | t_d | – | 35 | ns |
| Rise Time | | t_r | – | 35 | ns |
| Storage Time | $(V_{CC} = 3.0\text{ Vdc}$, $I_C = 10\text{ mAdc}$, $I_{B1} = I_{B2} = 1.0\text{ mAdc}$) | t_s | – | 200 | ns |
| Fall Time | | t_f | – | 50 | ns |

 2. Pulse Test: Pulse Width $\leq 300\ \mu\text{s}$; Duty Cycle $\leq 2\%$.

TYPICAL TRANSIENT CHARACTERISTICS

L2N3904

— $T_J = 25^\circ\text{C}$
 - - - $T_J = 125^\circ\text{C}$

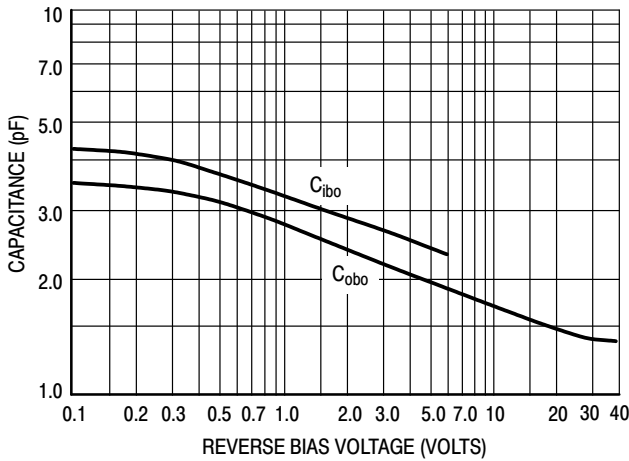


Figure 1. Capacitance

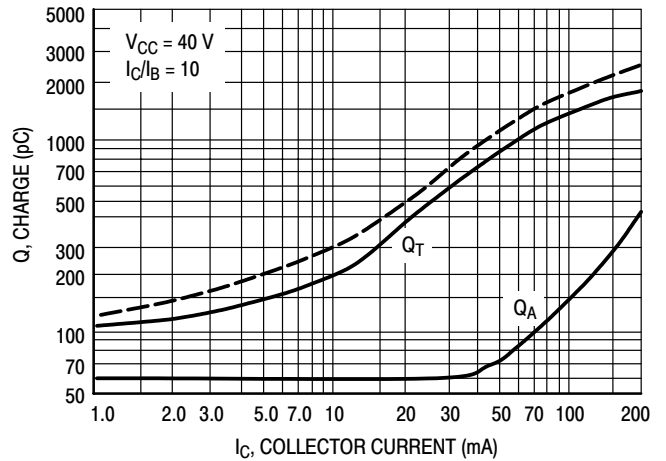


Figure 2. Charge Data

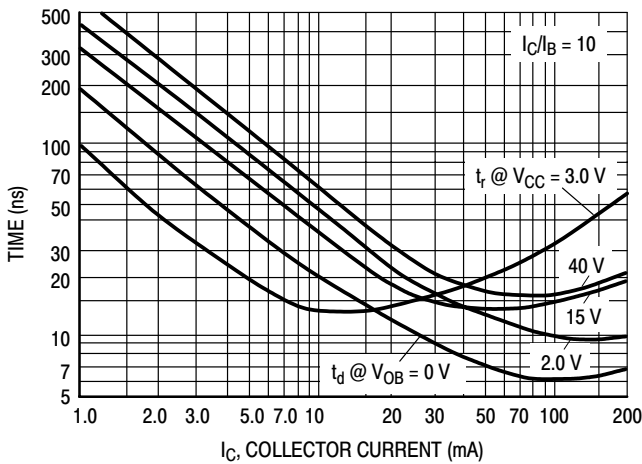


Figure 3. Turn-On Time

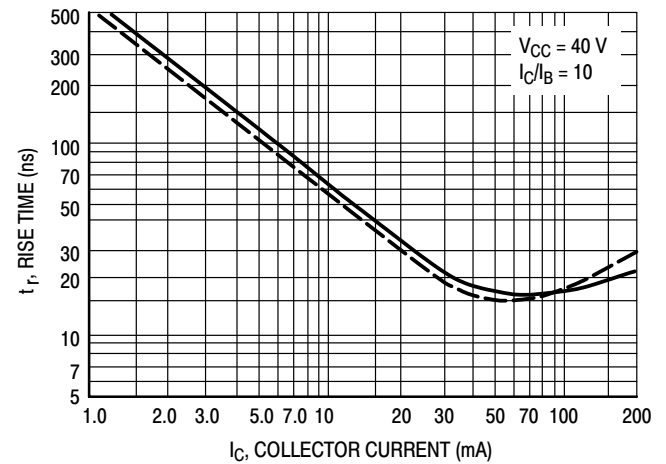


Figure 4. Rise Time

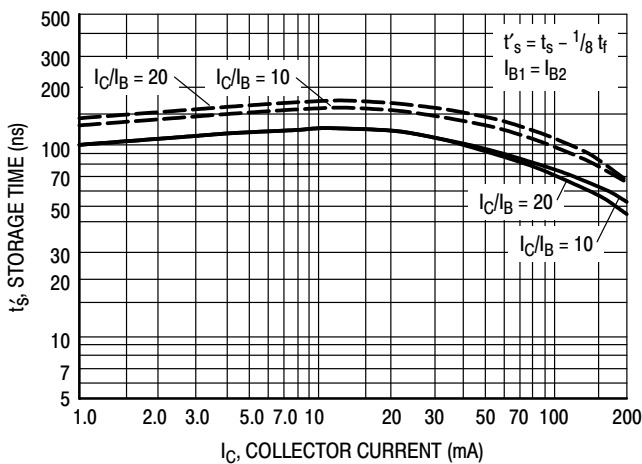


Figure 5. Storage Time

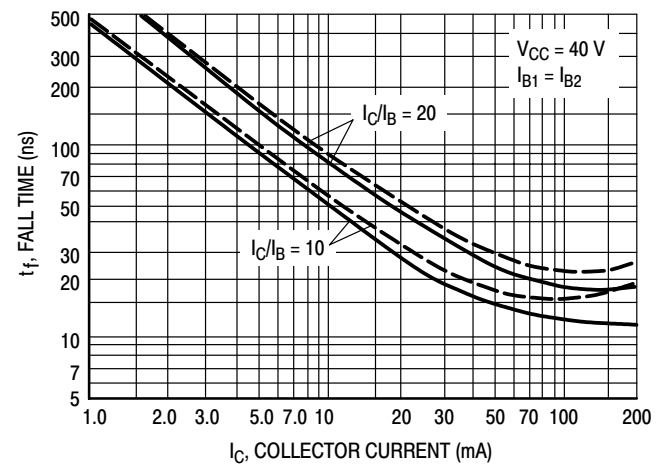


Figure 6. Fall Time

**TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS
NOISE FIGURE VARIATIONS**

L2N3904

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

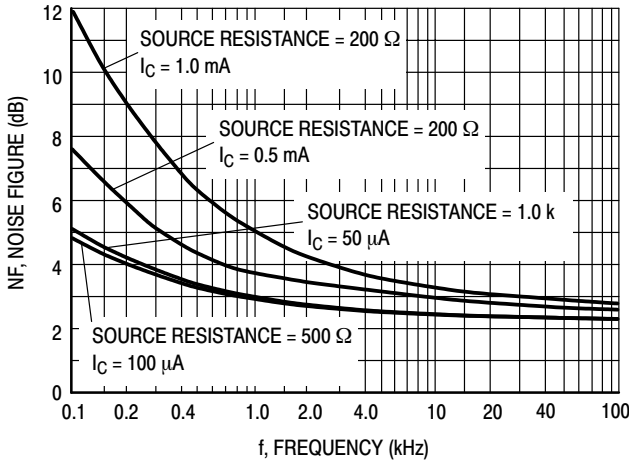


Figure 7.

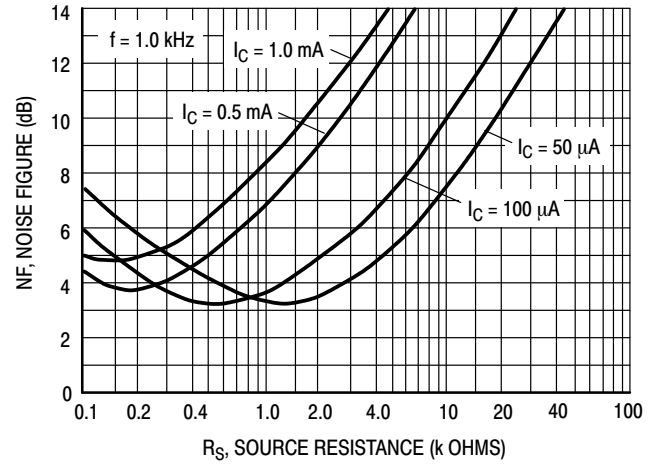


Figure 8.

h PARAMETERS

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

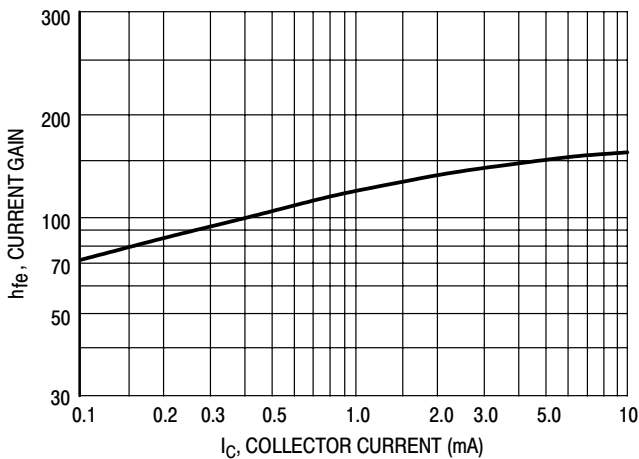


Figure 9. Current Gain

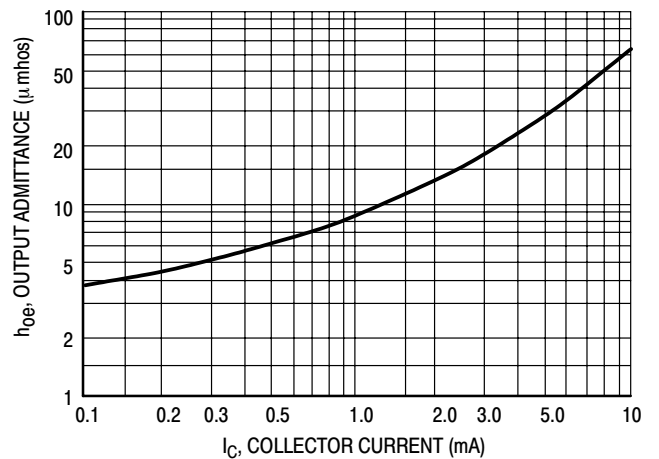


Figure 10. Output Admittance

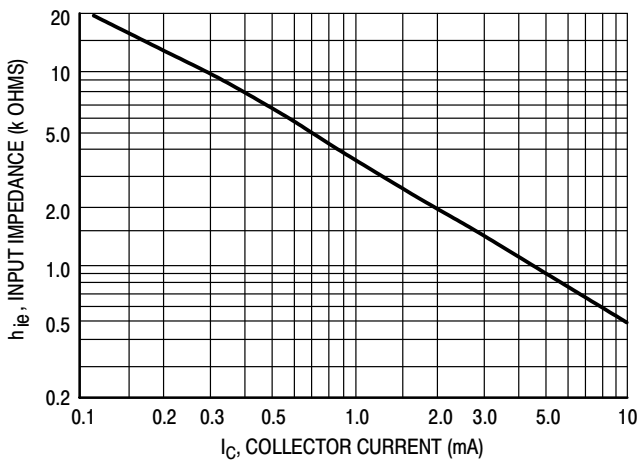


Figure 11. Input Impedance

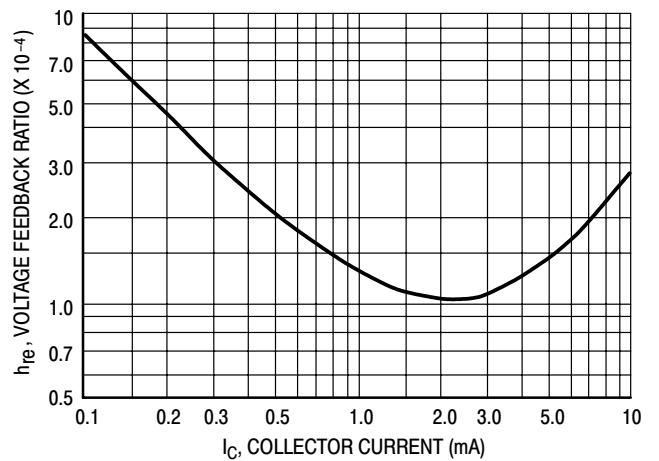


Figure 12. Voltage Feedback Ratio

TYPICAL STATIC CHARACTERISTICS

L2N3904

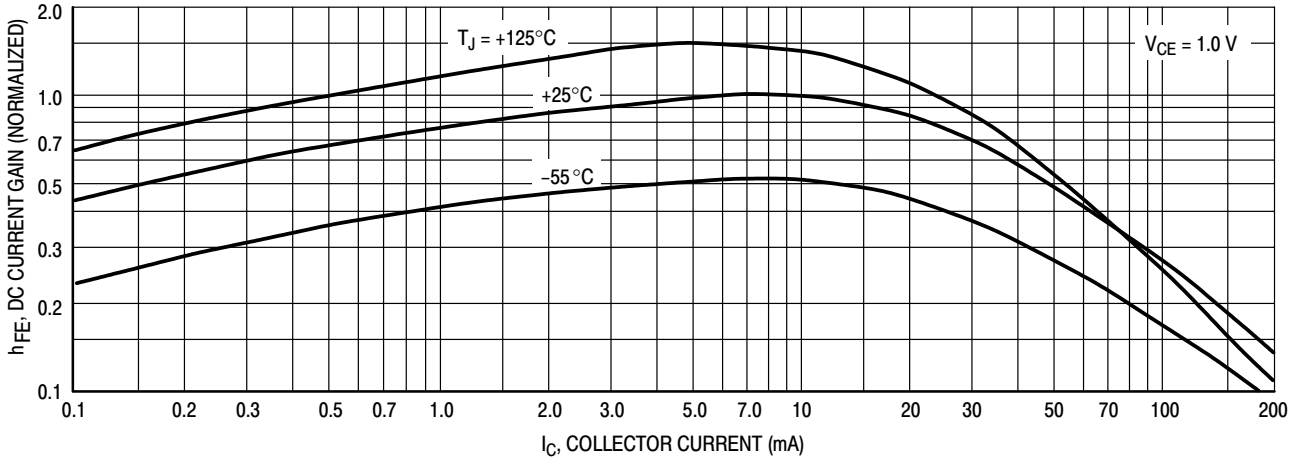


Figure 13. DC Current Gain

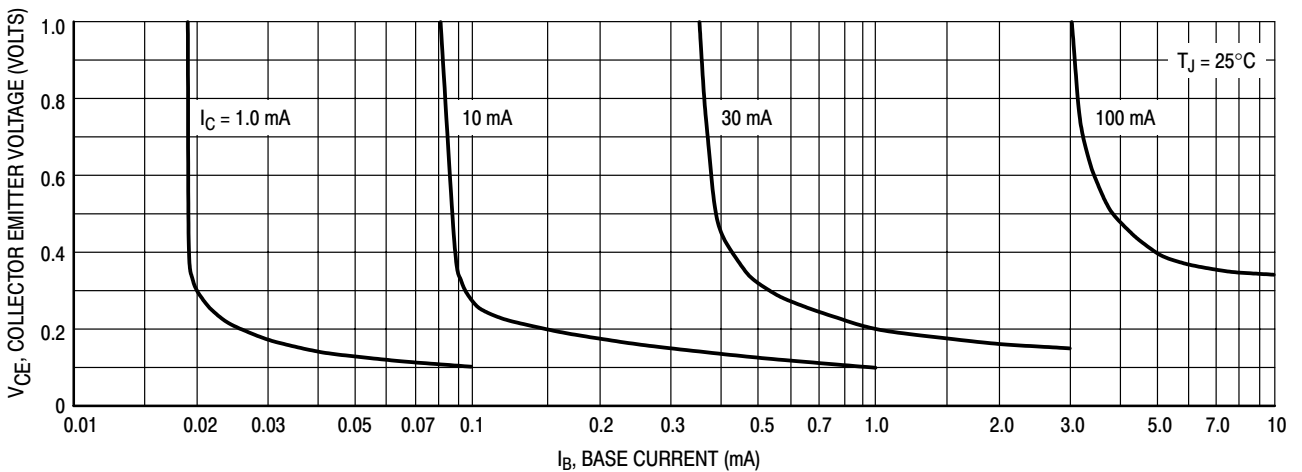


Figure 14. Collector Saturation Region

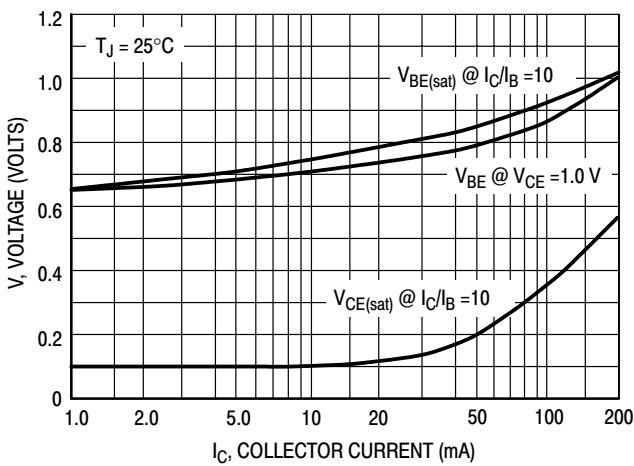


Figure 15. "ON" Voltages

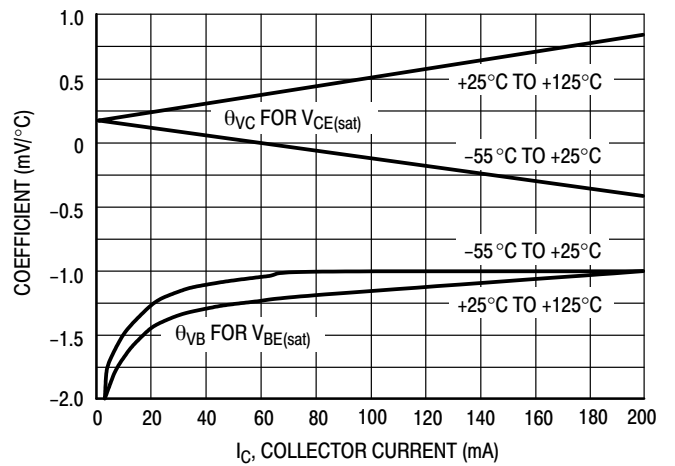


Figure 16. Temperature Coefficients

L2N3904

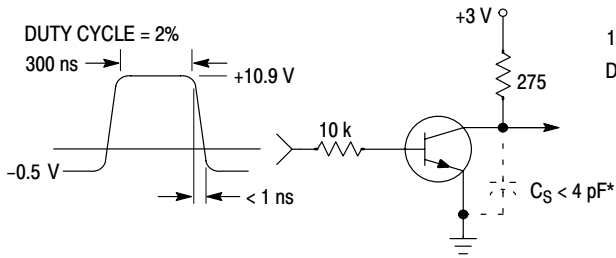


Figure 17. Delay and Rise Time Equivalent Test Circuit

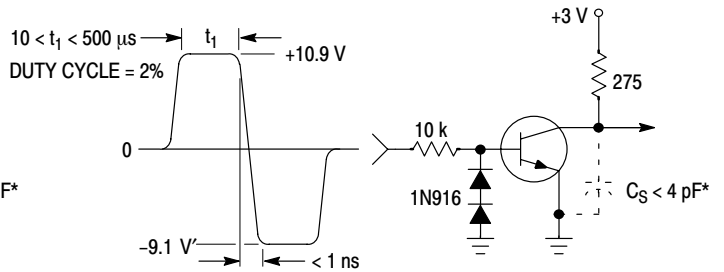


Figure 18. Storage and Fall Time Equivalent Test Circuit

* Total shunt capacitance of test jig and connectors