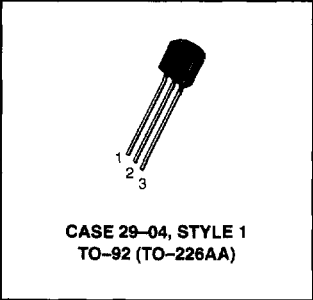
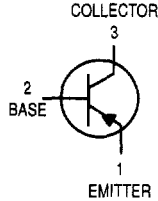


General Purpose Transistors
PNP Silicon

2N3905
2N3906*

*Motorola Preferred Device



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 |
| Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C | P_D | 625 5.0 | mW mW/ $^\circ\text{C}$ |
| Total Power Dissipation @ $T_A = 60^\circ\text{C}$ | P_D | 250 | mW |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C | P_D | 1.5 12 | Watts mW/ $^\circ\text{C}$ |
| Operating and Storage Junction Temperature Range | T_J, T_{stg} | -55 to +150 | $^\circ\text{C}$ |

THERMAL CHARACTERISTICS(1)

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

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

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

OFF CHARACTERISTICS

| | | | | |
|---|---------------|-----|----|------|
| Collector-Emitter Breakdown Voltage (2) ($I_C = 1.0 \text{ mAdc}, I_B = 0$) | $V_{(BR)CEO}$ | 40 | — | Vdc |
| Collector-Base Breakdown Voltage ($I_C = 10 \mu\text{Adc}, I_E = 0$) | $V_{(BR)CBO}$ | 40 | — | Vdc |
| Emitter-Base Breakdown Voltage ($I_E = 10 \mu\text{Adc}, I_C = 0$) | $V_{(BR)EBO}$ | 5.0 | — | 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 |

1. Indicates Data in addition to JEDEC Requirements.
2. Pulse Test: Pulse Width $\leq 300 \mu\text{s}$; Duty Cycle $\leq 2.0\%$.

Preferred devices are Motorola recommended choices for future use and best overall value.

2N3905 2N3906

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

| Characteristic | Symbol | Min | Max | Unit |
|--|---------------|-----------|--------------|------|
| ON CHARACTERISTICS(1) | | | | |
| DC Current Gain ($I_C = 0.1 \text{ mAdc}$, $V_{CE} = 1.0 \text{ Vdc}$) ($I_C = 1.0 \text{ mAdc}$, $V_{CE} = 1.0 \text{ Vdc}$) ($I_C = 10 \text{ mAdc}$, $V_{CE} = 1.0 \text{ Vdc}$) ($I_C = 50 \text{ mAdc}$, $V_{CE} = 1.0 \text{ Vdc}$) ($I_C = 100 \text{ mAdc}$, $V_{CE} = 1.0 \text{ Vdc}$) | 2N3905 | 30 | — | — |
| | 2N3906 | 60 | — | — |
| | 2N3905 | 40 | — | — |
| | 2N3906 | 80 | — | — |
| | 2N3905 | 50 | 150 | — |
| | 2N3906 | 100 | 300 | — |
| | 2N3905 | 30 | — | — |
| | 2N3906 | 60 | — | — |
| | 2N3905 | 15 | — | — |
| | 2N3906 | 30 | — | — |
| Collector–Emitter Saturation Voltage ($I_C = 10 \text{ mAdc}$, $I_B = 1.0 \text{ mAdc}$) ($I_C = 50 \text{ mAdc}$, $I_B = 5.0 \text{ mAdc}$) | $V_{CE(sat)}$ | — | 0.25 0.4 | Vdc |
| Base–Emitter Saturation Voltage ($I_C = 10 \text{ mAdc}$, $I_B = 1.0 \text{ mAdc}$) ($I_C = 50 \text{ mAdc}$, $I_B = 5.0 \text{ mAdc}$) | $V_{BE(sat)}$ | 0.65 — | 0.85 0.95 | Vdc |

SMALL–SIGNAL CHARACTERISTICS

| | | | | | |
|--|------------------|-----------|------------|------------|------------------|
| Current–Gain — Bandwidth Product ($I_C = 10 \text{ mAdc}$, $V_{CE} = 20 \text{ Vdc}$, $f = 100 \text{ MHz}$) | 2N3905 2N3906 | f_T | 200 250 | — — | MHz |
| Output Capacitance ($V_{CB} = 5.0 \text{ Vdc}$, $I_E = 0$, $f = 1.0 \text{ MHz}$) | | C_{obo} | — | 4.5 | pF |
| Input Capacitance ($V_{EB} = 0.5 \text{ Vdc}$, $I_C = 0$, $f = 1.0 \text{ MHz}$) | | C_{ibo} | — | 10.0 | pF |
| Input Impedance ($I_C = 1.0 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$, $f = 1.0 \text{ kHz}$) | 2N3905 2N3906 | h_{ie} | 0.5 2.0 | 8.0 12 | k Ω |
| Voltage Feedback Ratio ($I_C = 1.0 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$, $f = 1.0 \text{ kHz}$) | 2N3905 2N3906 | h_{re} | 0.1 0.1 | 5.0 10 | $\times 10^{-4}$ |
| Small–Signal Current Gain ($I_C = 1.0 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$, $f = 1.0 \text{ kHz}$) | 2N3905 2N3906 | h_{fe} | 50 100 | 200 400 | — |
| Output Admittance ($I_C = 1.0 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$, $f = 1.0 \text{ kHz}$) | 2N3905 2N3906 | h_{oe} | 1.0 3.0 | 40 60 | μmhos |
| Noise Figure ($I_C = 100 \mu\text{A}$, $V_{CE} = 5.0 \text{ Vdc}$, $R_S = 1.0 \text{ k}\Omega$, $f = 1.0 \text{ kHz}$) | 2N3905 2N3906 | NF | — — | 5.0 4.0 | 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 | $(V_{CC} = 3.0 \text{ Vdc}$, $I_C = 10 \text{ mAdc}$, $I_{B1} = I_{B2} = 1.0 \text{ mA}$) | t_s | — | 200 225 | ns |
| Fall Time | | t_f | — | 60 75 | ns |

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

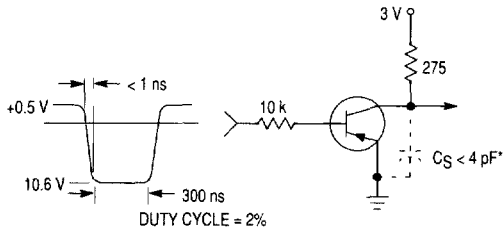


Figure 1. Delay and Rise Time Equivalent Test Circuit

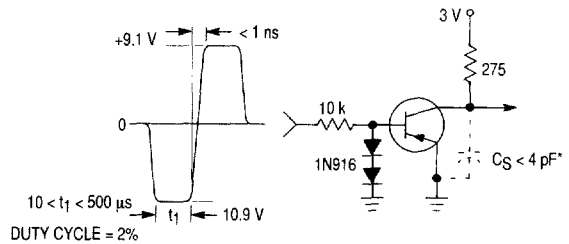


Figure 2. Storage and Fall Time Equivalent Test Circuit

* Total shunt capacitance of test jig and connectors

TYPICAL TRANSIENT CHARACTERISTICS

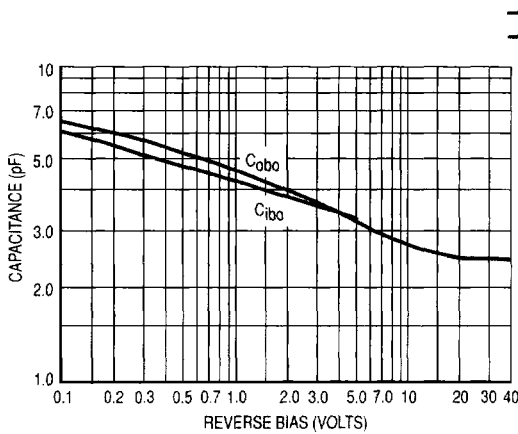


Figure 3. Capacitance

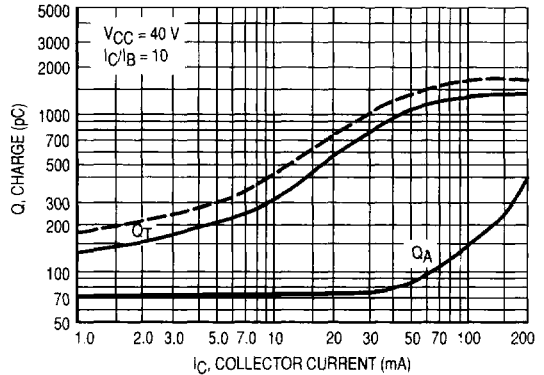


Figure 4. Charge Data

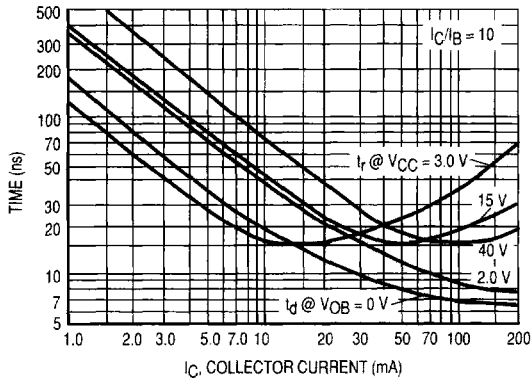


Figure 5. Turn-On Time

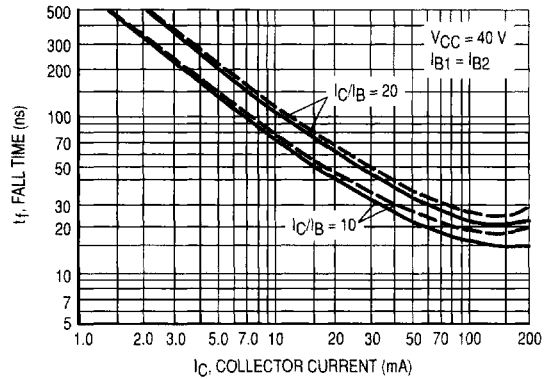


Figure 6. Fall Time

TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS
NOISE FIGURE VARIATIONS

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

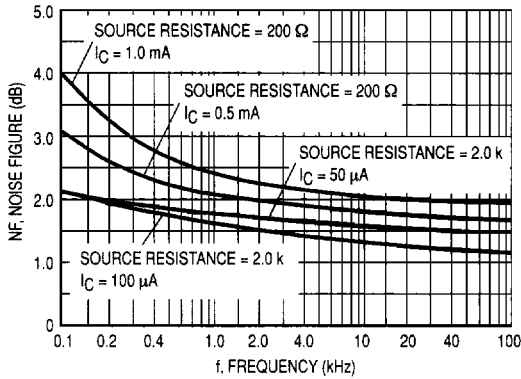


Figure 7.

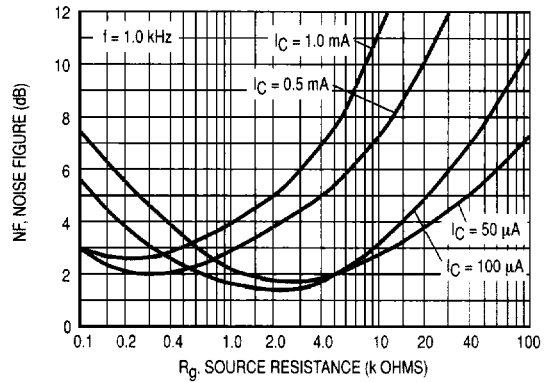


Figure 8.

h PARAMETERS

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

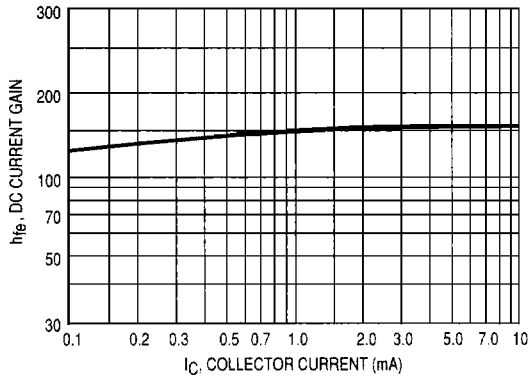


Figure 9. Current Gain

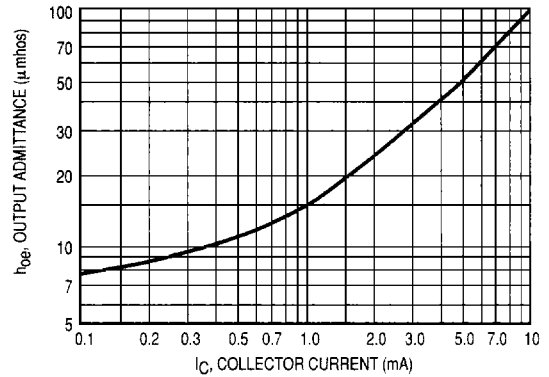


Figure 10. Output Admittance

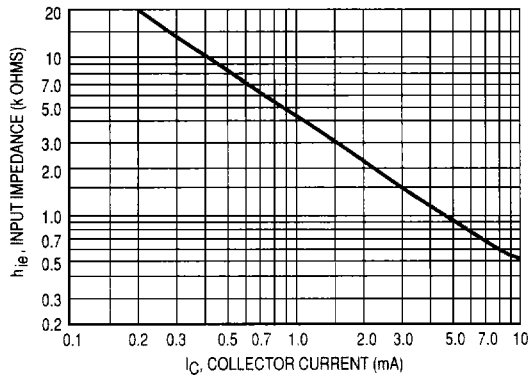


Figure 11. Input Impedance

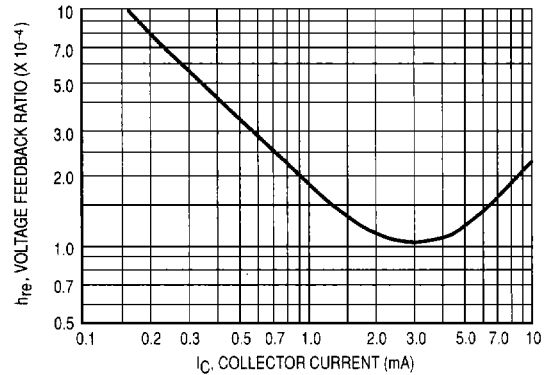


Figure 12. Voltage Feedback Ratio

TYPICAL STATIC CHARACTERISTICS

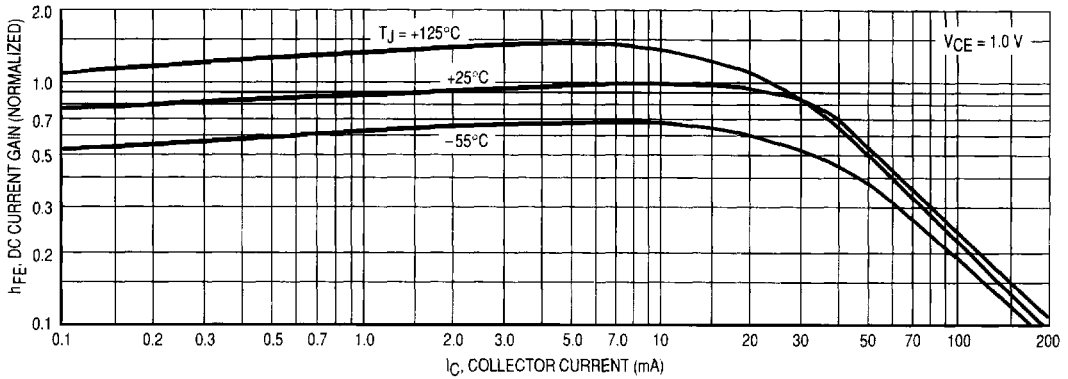


Figure 13. DC Current Gain

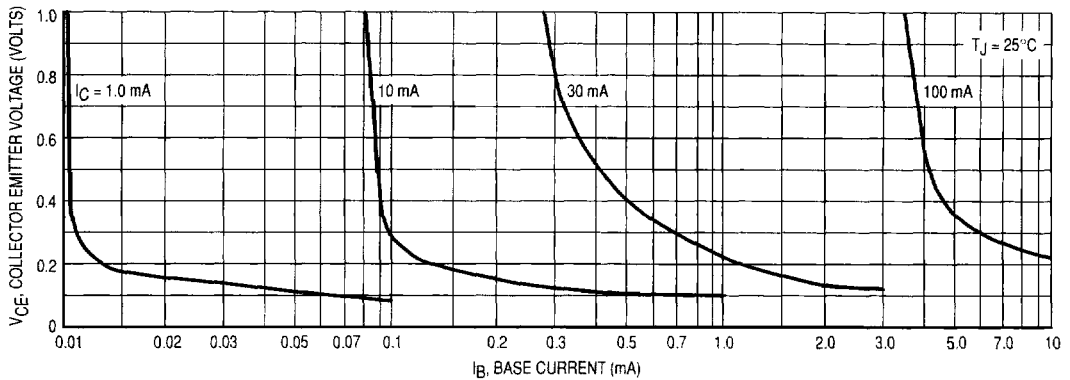


Figure 14. Collector Saturation Region

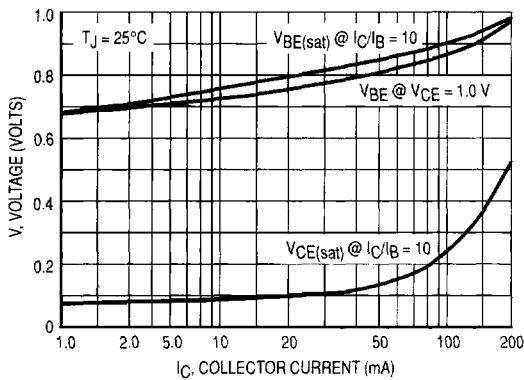


Figure 15. "ON" Voltages

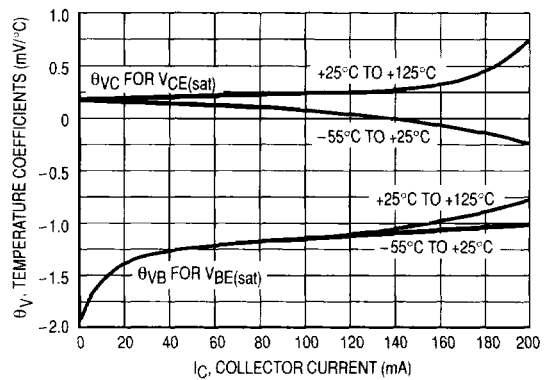


Figure 16. Temperature Coefficients