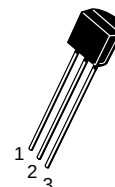
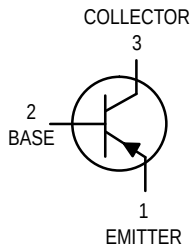


# Amplifier Transistors

## PNP Silicon

**2N5400**  
**2N5401\***

\*Motorola Preferred Device



CASE 29-04, STYLE 1  
TO-92 (TO-226AA)

### MAXIMUM RATINGS

| Rating                                                                                 | Symbol         | 2N5400      | 2N5401 | Unit                          |
|----------------------------------------------------------------------------------------|----------------|-------------|--------|-------------------------------|
| Collector–Emitter Voltage                                                              | $V_{CEO}$      | 120         | 150    | Vdc                           |
| Collector–Base Voltage                                                                 | $V_{CBO}$      | 130         | 160    | Vdc                           |
| Emitter–Base Voltage                                                                   | $V_{EBO}$      | 5.0         |        | Vdc                           |
| Collector Current — Continuous                                                         | $I_C$          | 600         |        | mAdc                          |
| Total Device Dissipation @ $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 625<br>5.0  |        | mW<br>mW/ $^\circ\text{C}$    |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 1.5<br>12   |        | Watts<br>mW/ $^\circ\text{C}$ |
| Operating and Storage Junction<br>Temperature Range                                    | $T_J, T_{stg}$ | –55 to +150 |        | $^\circ\text{C}$              |

### THERMAL CHARACTERISTICS

| 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 | $^\circ\text{C/W}$ |

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

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

### OFF CHARACTERISTICS

|                                                                                                                                                                                                                                      |                                      |               |                  |                        |                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------|------------------|------------------------|-----------------------|
| Collector–Emitter Breakdown Voltage <sup>(1)</sup><br>( $I_C = 1.0$ mAdc, $I_E = 0$ )                                                                                                                                                | 2N5400<br>2N5401                     | $V_{(BR)CEO}$ | 120<br>150       | —<br>—                 | Vdc                   |
| Collector–Base Breakdown Voltage<br>( $I_C = 100$ $\mu$ Adc, $I_E = 0$ )                                                                                                                                                             | 2N5400<br>2N5401                     | $V_{(BR)CBO}$ | 130<br>160       | —<br>—                 | Vdc                   |
| Emitter–Base Breakdown Voltage<br>( $I_E = 10$ $\mu$ Adc, $I_C = 0$ )                                                                                                                                                                |                                      | $V_{(BR)EBO}$ | 5.0              | —                      | Vdc                   |
| Collector Cutoff Current<br>( $V_{CB} = 100$ Vdc, $I_E = 0$ )<br>( $V_{CB} = 120$ Vdc, $I_E = 0$ )<br>( $V_{CB} = 100$ Vdc, $I_E = 0$ , $T_A = 100^\circ\text{C}$ )<br>( $V_{CB} = 120$ Vdc, $I_E = 0$ , $T_A = 100^\circ\text{C}$ ) | 2N5400<br>2N5401<br>2N5400<br>2N5401 | $I_{CBO}$     | —<br>—<br>—<br>— | 100<br>50<br>100<br>50 | nAdc<br><br>$\mu$ Adc |
| Emitter Cutoff Current<br>( $V_{EB} = 3.0$ Vdc, $I_C = 0$ )                                                                                                                                                                          |                                      | $I_{EBO}$     | —                | 50                     | nAdc                  |

1. Pulse Test: Pulse Width = 300  $\mu$ s, Duty Cycle = 2.0%.

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

**2N5400 2N5401****ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted) (Continued)

| Characteristic                                                                                                                               |                  | Symbol        | Min      | Max        | Unit |
|----------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------|----------|------------|------|
| <b>ON CHARACTERISTICS<sup>(1)</sup></b>                                                                                                      |                  |               |          |            |      |
| DC Current Gain<br>( $I_C = 1.0\text{ mA}$ , $V_{CE} = 5.0\text{ Vdc}$ )                                                                     | 2N5400<br>2N5401 | $h_{FE}$      | 30<br>50 | —<br>—     | —    |
| ( $I_C = 10\text{ mA}$ , $V_{CE} = 5.0\text{ Vdc}$ )                                                                                         | 2N5400<br>2N5401 |               | 40<br>60 | 180<br>240 |      |
| ( $I_C = 50\text{ mA}$ , $V_{CE} = 5.0\text{ Vdc}$ )                                                                                         | 2N5400<br>2N5401 |               | 40<br>50 | —<br>—     |      |
| Collector–Emitter Saturation Voltage<br>( $I_C = 10\text{ mA}$ , $I_B = 1.0\text{ mA}$ )<br>( $I_C = 50\text{ mA}$ , $I_B = 5.0\text{ mA}$ ) |                  | $V_{CE(sat)}$ | —<br>—   | 0.2<br>0.5 | Vdc  |
| Base–Emitter Saturation Voltage<br>( $I_C = 10\text{ mA}$ , $I_B = 1.0\text{ mA}$ )<br>( $I_C = 50\text{ mA}$ , $I_B = 5.0\text{ mA}$ )      |                  | $V_{BE(sat)}$ | —<br>—   | 1.0<br>1.0 | Vdc  |

**SMALL–SIGNAL CHARACTERISTICS**

|                                                                                                                                    |                  |           |            |            |     |
|------------------------------------------------------------------------------------------------------------------------------------|------------------|-----------|------------|------------|-----|
| Current–Gain — Bandwidth Product<br>( $I_C = 10\text{ mA}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 100\text{ MHz}$ )                     | 2N5400<br>2N5401 | $f_T$     | 100<br>100 | 400<br>300 | MHz |
| Output Capacitance<br>( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )                                              |                  | $C_{obo}$ | —          | 6.0        | pF  |
| Small–Signal Current Gain<br>( $I_C = 1.0\text{ mA}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )                           | 2N5400<br>2N5401 | $h_{fe}$  | 30<br>40   | 200<br>200 | —   |
| Noise Figure<br>( $I_C = 250\text{ }\mu\text{A}$ , $V_{CE} = 5.0\text{ Vdc}$ , $R_S = 1.0\text{ k}\Omega$ , $f = 1.0\text{ kHz}$ ) |                  | NF        | —          | 8.0        | dB  |

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

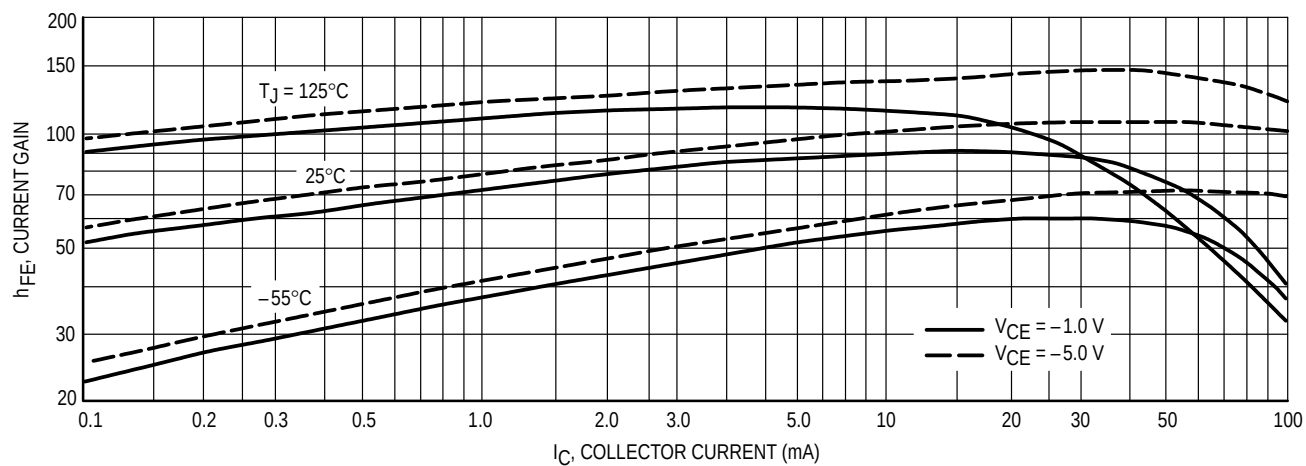


Figure 1. DC Current Gain

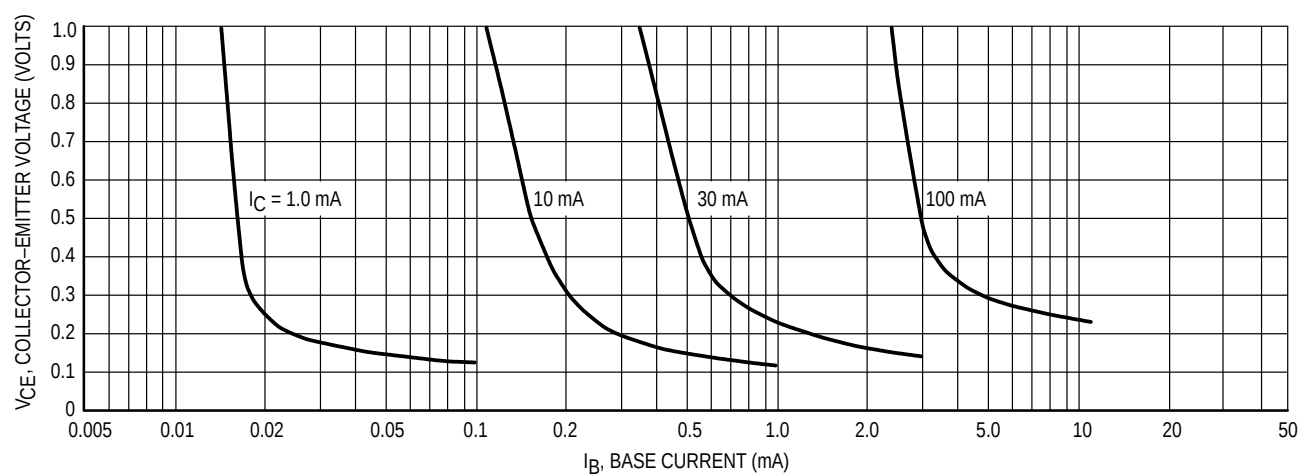


Figure 2. Collector Saturation Region

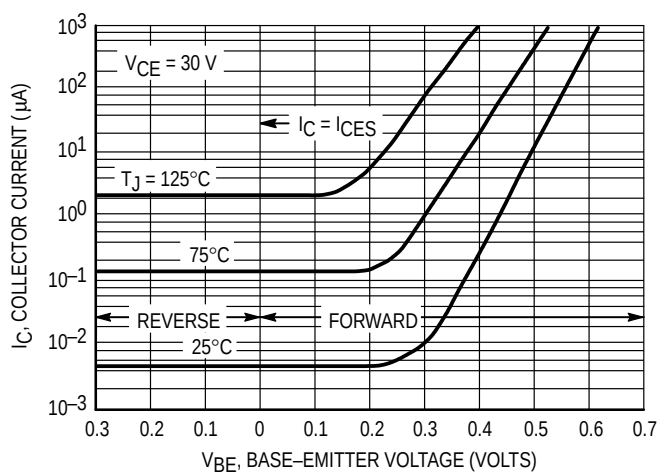


Figure 3. Collector Cut-Off Region

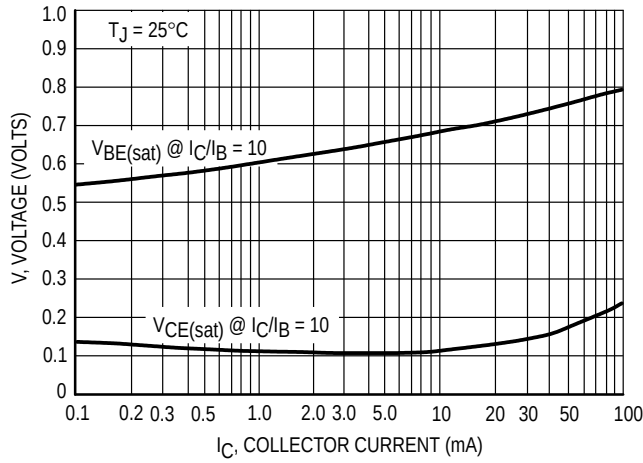


Figure 4. "On" Voltages

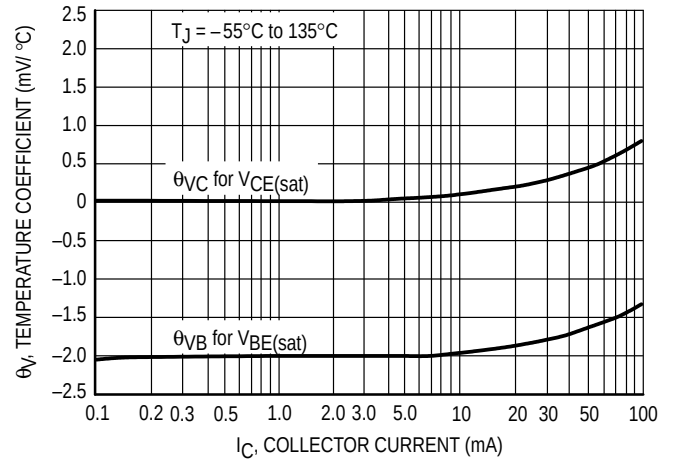


Figure 5. Temperature Coefficients

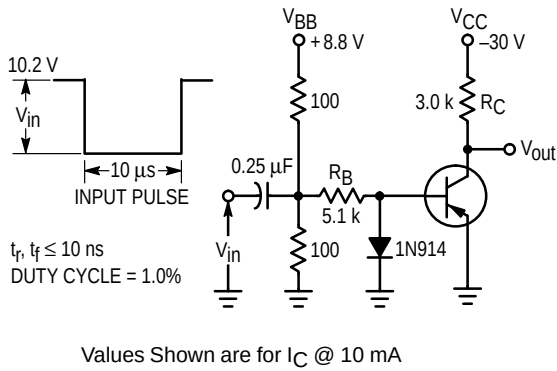


Figure 6. Switching Time Test Circuit

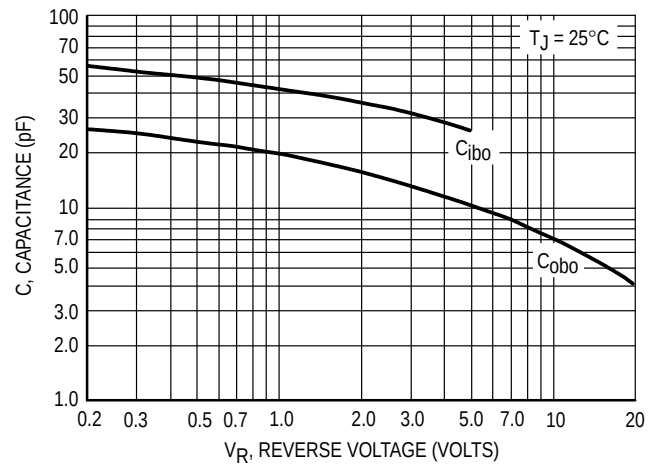


Figure 7. Capacitances

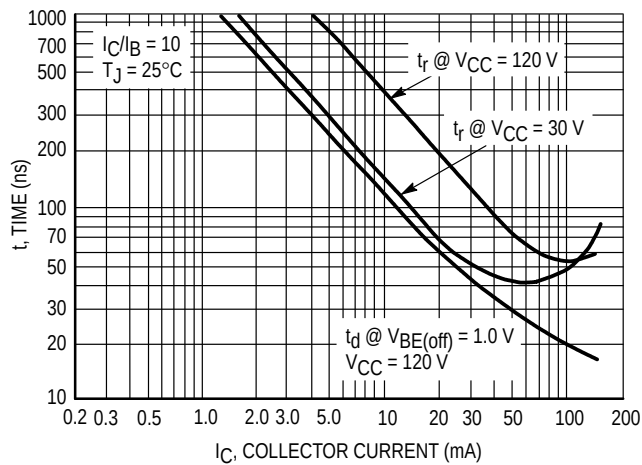


Figure 8. Turn-On Time

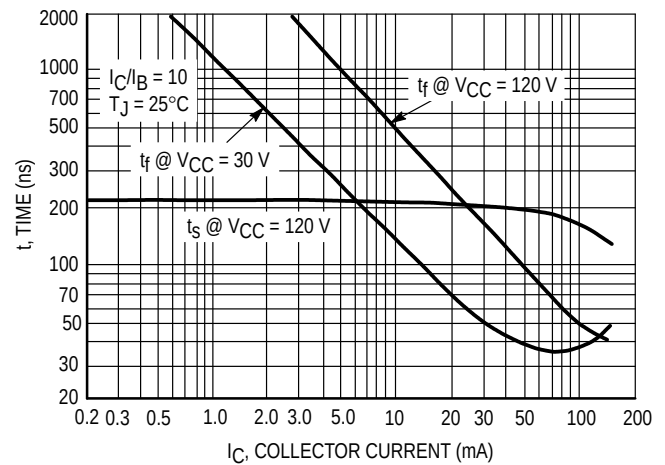
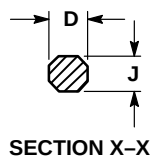
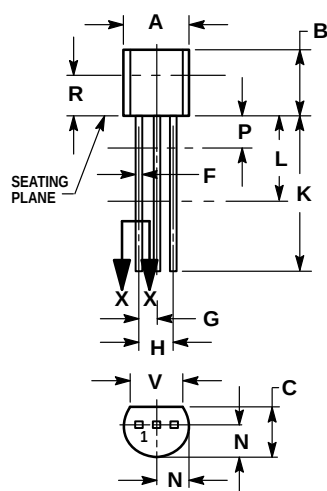


Figure 9. Turn-Off Time

## PACKAGE DIMENSIONS



**CASE 029-04  
(TO-226AA)  
ISSUE AD**

## NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. DIMENSION F APPLIES BETWEEN P AND L. DIMENSION D AND J APPLY BETWEEN L AND K. MINIMUM LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

| DIM | INCHES |       | MILLIMETERS |      |
|-----|--------|-------|-------------|------|
|     | MIN    | MAX   | MIN         | MAX  |
| A   | 0.175  | 0.205 | 4.45        | 5.20 |
| B   | 0.170  | 0.210 | 4.32        | 5.33 |
| C   | 0.125  | 0.165 | 3.18        | 4.19 |
| D   | 0.016  | 0.022 | 0.41        | 0.55 |
| F   | 0.016  | 0.019 | 0.41        | 0.48 |
| G   | 0.045  | 0.055 | 1.15        | 1.39 |
| H   | 0.095  | 0.105 | 2.42        | 2.66 |
| J   | 0.015  | 0.020 | 0.39        | 0.50 |
| K   | 0.500  | —     | 12.70       | —    |
| L   | 0.250  | —     | 6.35        | —    |
| N   | 0.080  | 0.105 | 2.04        | 2.66 |
| P   | —      | 0.100 | —           | 2.54 |
| R   | 0.115  | —     | 2.93        | —    |
| V   | 0.135  | —     | 3.43        | —    |

## STYLE 1:

1. EMITTER
2. BASE
3. COLLECTOR

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