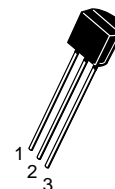
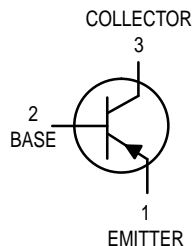


# Amplifier Transistors

## 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 @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	625	5.0	mW mW/ $^\circ\text{C}$
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	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

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
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### OFF CHARACTERISTICS

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

1. Pulse Test: Pulse Width = 300  $\mu\text{s}$ , 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(1)</b>					
DC Current Gain ( $I_C = 1.0 \text{ mAdc}$ , $V_{CE} = 5.0 \text{ Vdc}$ )  ( $I_C = 10 \text{ mAdc}$ , $V_{CE} = 5.0 \text{ Vdc}$ )  ( $I_C = 50 \text{ mAdc}$ , $V_{CE} = 5.0 \text{ Vdc}$ )	2N5400	$h_{FE}$	30	—	—
	2N5401		50	—	
	2N5400		40	180	
	2N5401		60	240	
	2N5400		40	—	
	2N5401		50	—	
Collector–Emitter Saturation Voltage ( $I_C = 10 \text{ mAdc}$ , $I_B = 1.0 \text{ mAdc}$ ) ( $I_C = 50 \text{ mAdc}$ , $I_B = 5.0 \text{ mAdc}$ )		$V_{CE(sat)}$	—	0.2	Vdc
			—	0.5	
Base–Emitter Saturation Voltage ( $I_C = 10 \text{ mAdc}$ , $I_B = 1.0 \text{ mAdc}$ ) ( $I_C = 50 \text{ mAdc}$ , $I_B = 5.0 \text{ mAdc}$ )		$V_{BE(sat)}$	—	1.0	Vdc
			—	1.0	
<b>SMALL–SIGNAL CHARACTERISTICS</b>					
Current–Gain — Bandwidth Product ( $I_C = 10 \text{ mAdc}$ , $V_{CE} = 10 \text{ Vdc}$ , $f = 100 \text{ MHz}$ )	2N5400 2N5401	$f_T$	100 100	400 300	MHz
Output Capacitance ( $V_{CB} = 10 \text{ Vdc}$ , $I_E = 0$ , $f = 1.0 \text{ MHz}$ )		$C_{obo}$	—	6.0	pF
Small–Signal Current Gain ( $I_C = 1.0 \text{ mAdc}$ , $V_{CE} = 10 \text{ Vdc}$ , $f = 1.0 \text{ kHz}$ )	2N5400 2N5401	$h_{fe}$	30 40	200 200	—
Noise Figure ( $I_C = 250 \mu\text{Adc}$ , $V_{CE} = 5.0 \text{ Vdc}$ , $R_S = 1.0 \text{ k}\Omega$ , $f = 1.0 \text{ kHz}$ )		NF	—	8.0	dB

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

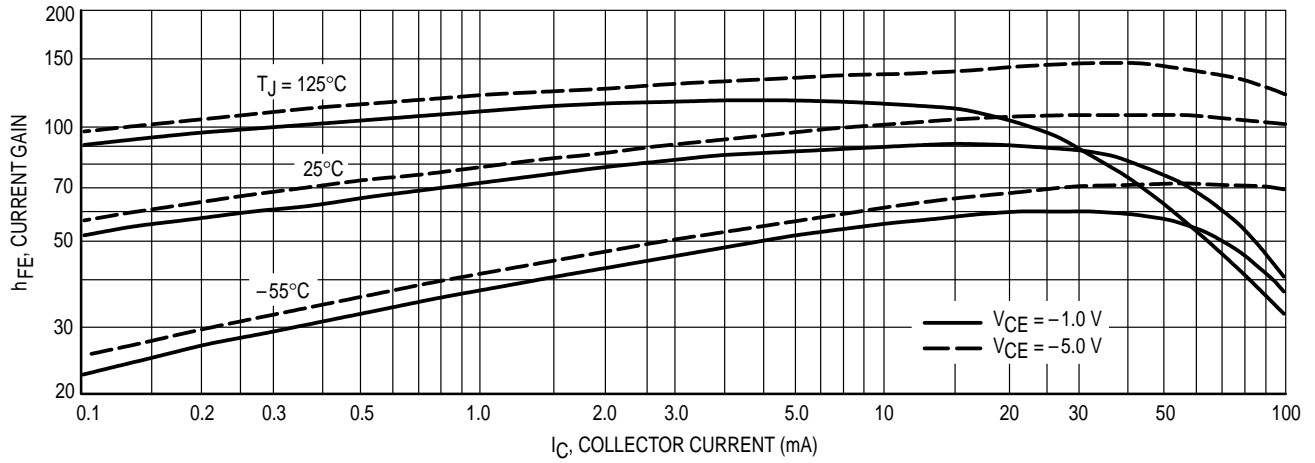


Figure 1. DC Current Gain

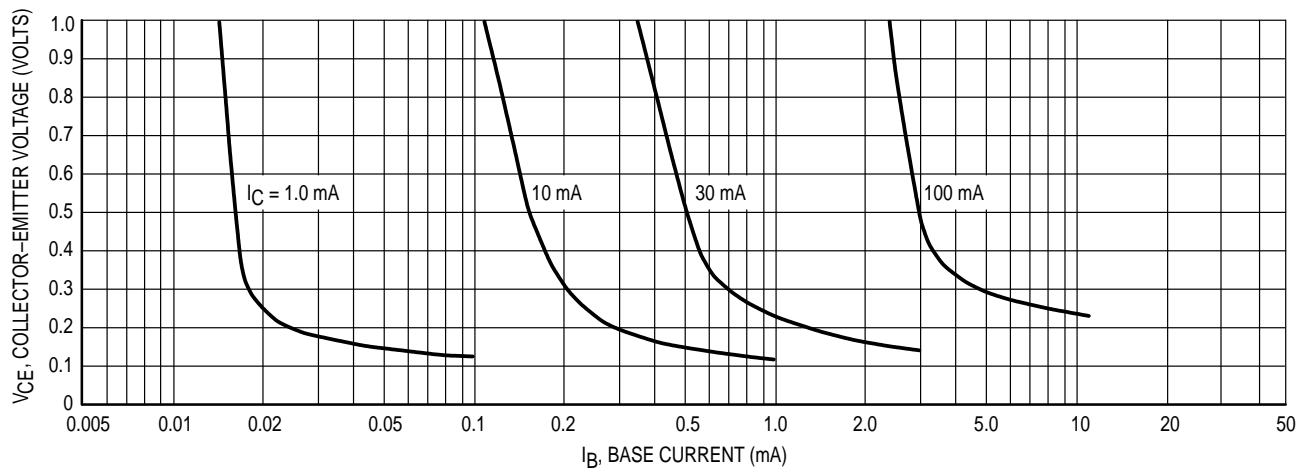


Figure 2. Collector Saturation Region

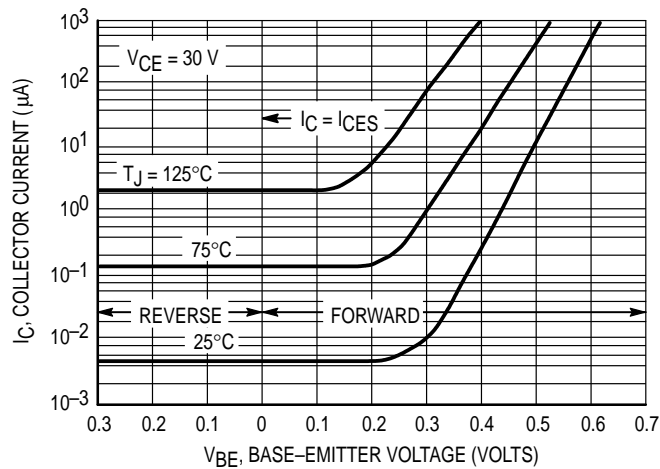


Figure 3. Collector Cut-Off Region

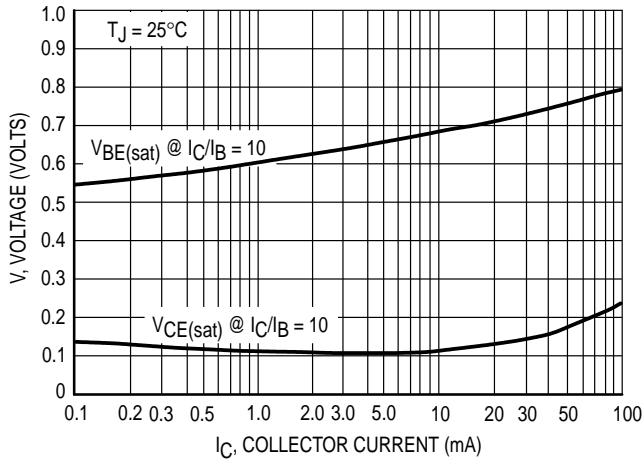


Figure 4. "On" Voltages

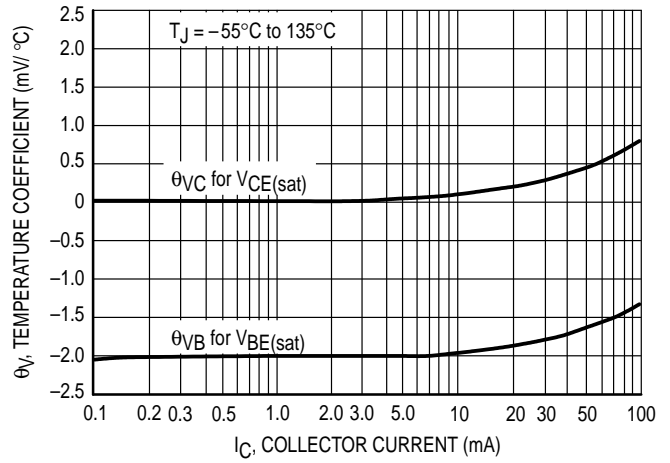


Figure 5. Temperature Coefficients

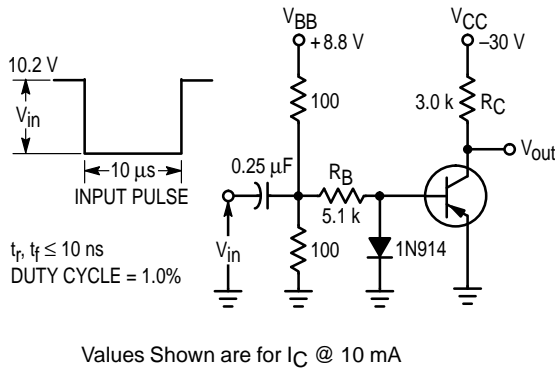


Figure 6. Switching Time Test Circuit

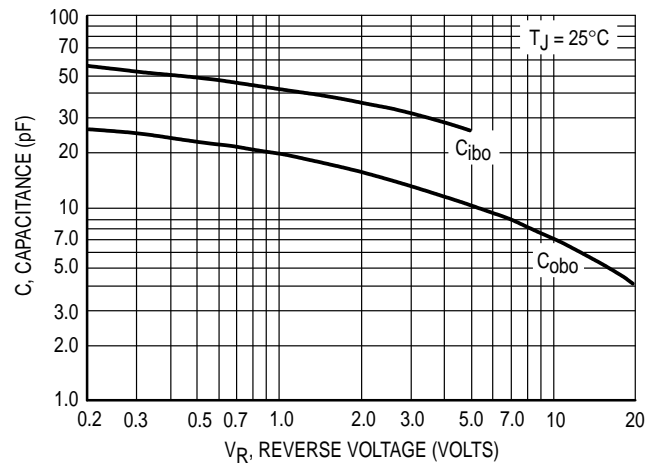


Figure 7. Capacitances

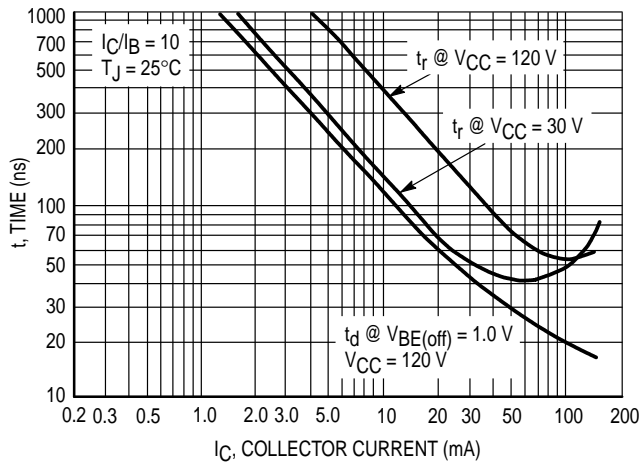


Figure 8. Turn-On Time

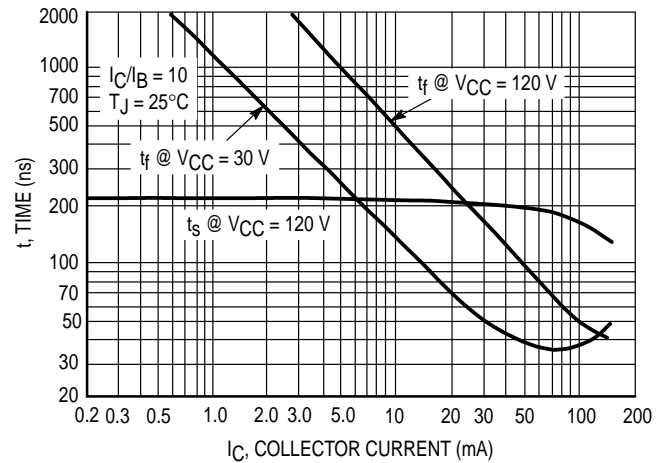


Figure 9. Turn-Off Time

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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