

# Amplifier Transistors

## PNP Silicon

# 2N5401\*

\*ON Semiconductor Preferred Device

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

### THERMAL CHARACTERISTICS

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

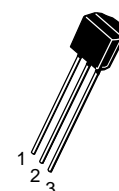
### ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
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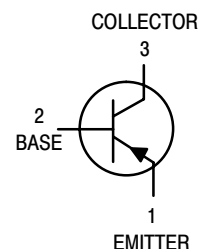
### OFF CHARACTERISTICS

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

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



CASE 29–11, STYLE 1  
TO–92 (TO–226AA)



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

## 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 ( $I_C = 1.0\text{ mA}$ , $V_{CE} = 5.0\text{ Vdc}$ ) ( $I_C = 10\text{ mA}$ , $V_{CE} = 5.0\text{ Vdc}$ ) ( $I_C = 50\text{ mA}$ , $V_{CE} = 5.0\text{ Vdc}$ )	$h_{FE}$	50 60 50	— 240 —	—
Collector–Emitter Saturation Voltage ( $I_C = 10\text{ mA}$ , $I_B = 1.0\text{ mA}$ ) ( $I_C = 50\text{ mA}$ , $I_B = 5.0\text{ mA}$ )	$V_{CE(sat)}$	— —	0.2 0.5	Vdc
Base–Emitter Saturation Voltage ( $I_C = 10\text{ mA}$ , $I_B = 1.0\text{ mA}$ ) ( $I_C = 50\text{ mA}$ , $I_B = 5.0\text{ mA}$ )	$V_{BE(sat)}$	— —	1.0 1.0	Vdc
<b>SMALL–SIGNAL CHARACTERISTICS</b>				
Current–Gain — Bandwidth Product ( $I_C = 10\text{ mA}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 100\text{ MHz}$ )	$f_T$	100	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 ( $I_C = 1.0\text{ mA}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	$h_{fe}$	40	200	—
Noise Figure ( $I_C = 250\text{ }\mu\text{A}$ , $V_{CE} = 5.0\text{ Vdc}$ , $R_S = 1.0\text{ k}\Omega$ , $f = 1.0\text{ kHz}$ )	NF	—	8.0	dB

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

# 2N5401

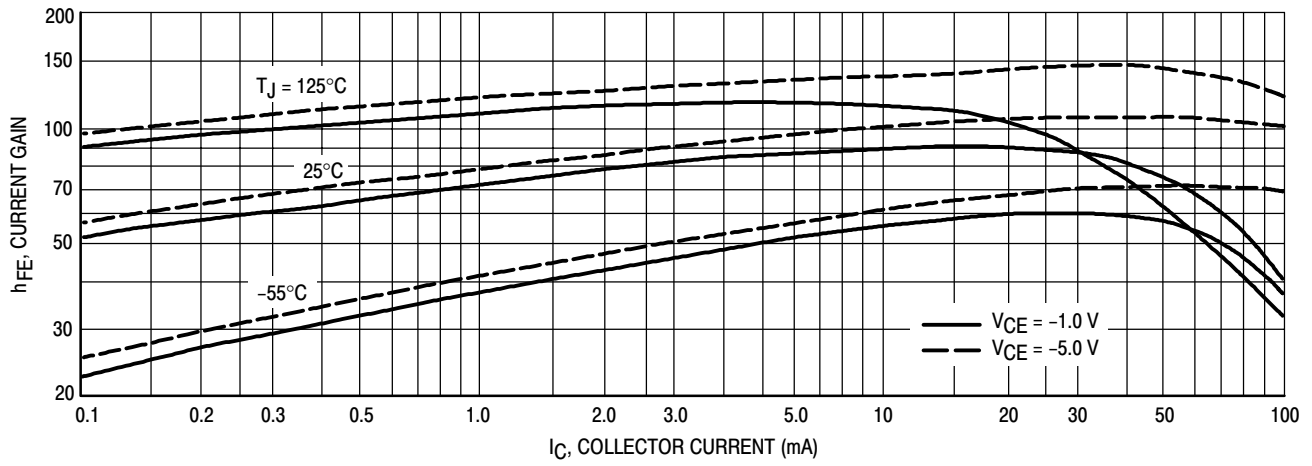


Figure 1. DC Current Gain

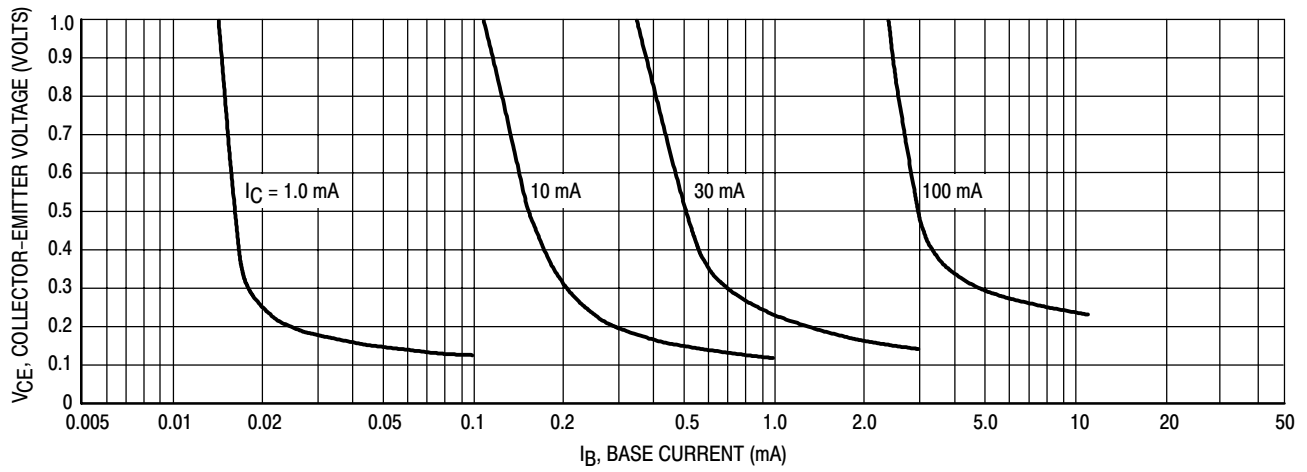


Figure 2. Collector Saturation Region

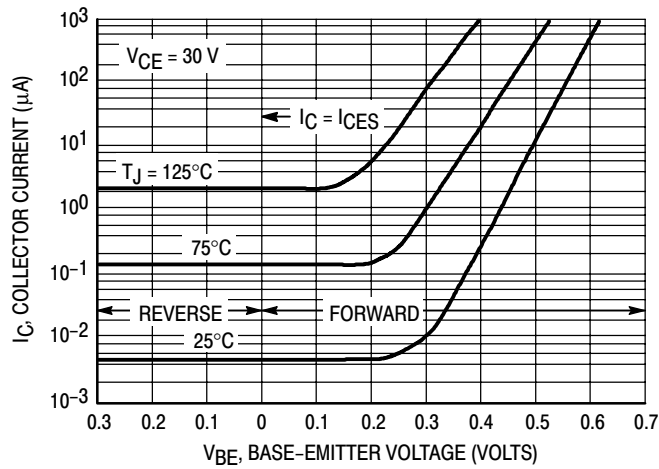


Figure 3. Collector Cut-Off Region

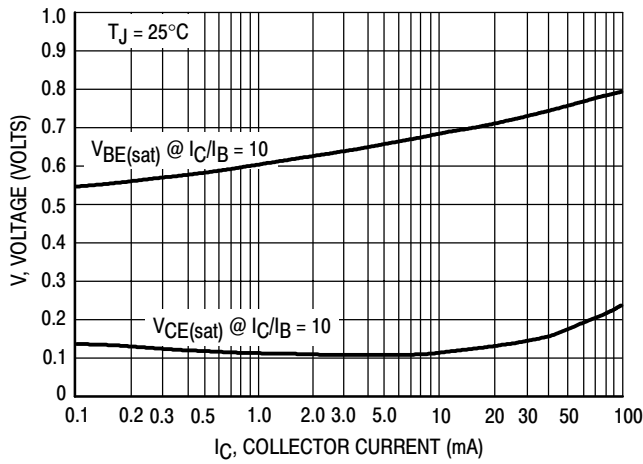


Figure 4. "On" Voltages

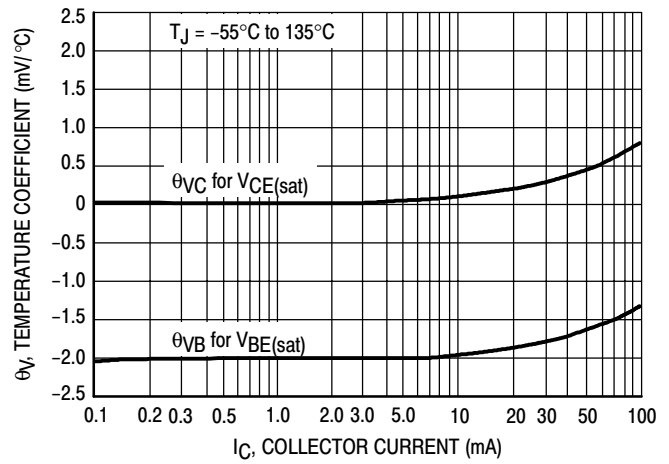


Figure 5. Temperature Coefficients

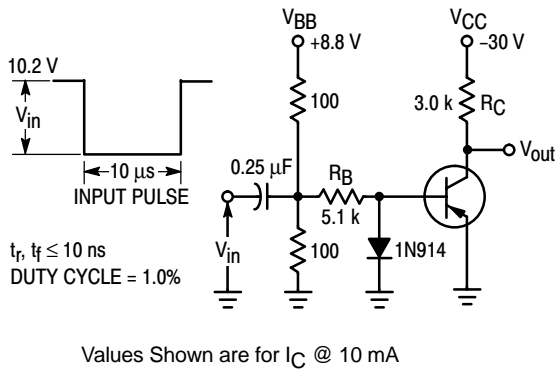


Figure 6. Switching Time Test Circuit

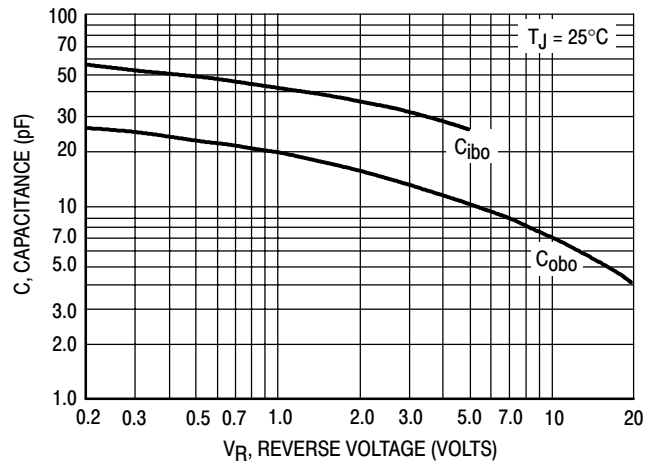


Figure 7. Capacitances

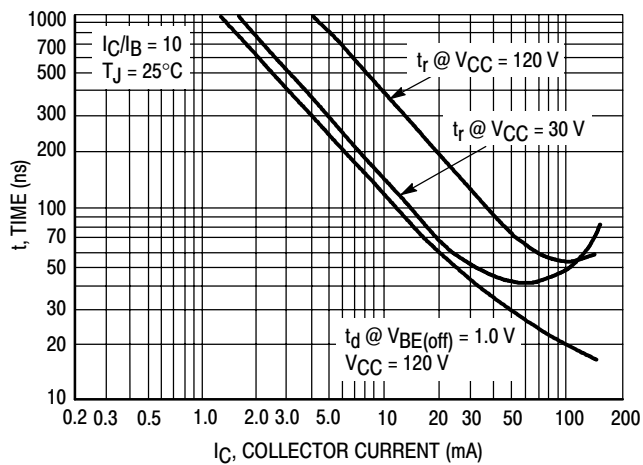


Figure 8. Turn-On Time

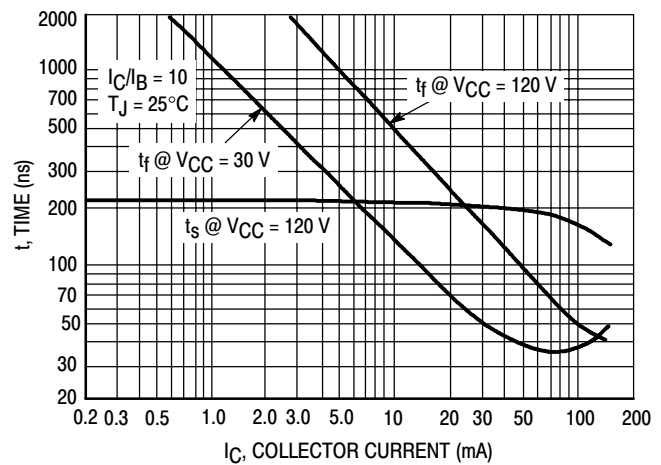
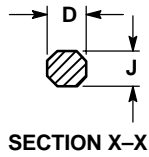
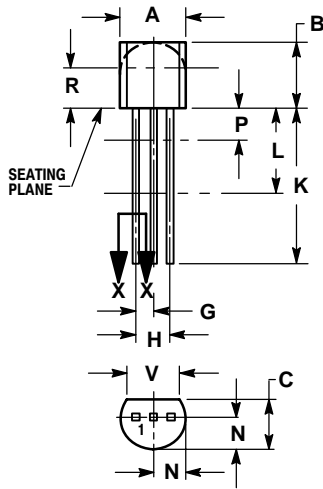


Figure 9. Turn-Off Time

# 2N5401

## PACKAGE DIMENSIONS

### TO-92 (TO-226) CASE 29-11 ISSUE AL



STYLE 1:  
PIN 1. EMITTER  
2. BASE  
3. COLLECTOR


#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. 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	0.021	0.407	0.533
E	0.045	0.055	1.15	1.39
F	0.095	0.105	2.42	2.66
G	0.015	0.020	0.39	0.50
H	0.500	---	12.70	---
I	0.250	---	6.35	---
J	0.080	0.105	2.04	2.66
K	---	0.100	---	2.54
L	0.115	---	2.93	---
M	0.135	---	3.43	---

## **Notes**

## **Notes**

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