

# Amplifier Transistor

## NPN Silicon

2N4410

## MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CEO}$	80	Vdc
Collector-Base Voltage	$V_{CBO}$	120	Vdc
Emitter-Base Voltage	$V_{EBO}$	5.0	Vdc
Collector Current — Continuous	$I_C$	250	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	$^\circ\text{C}$

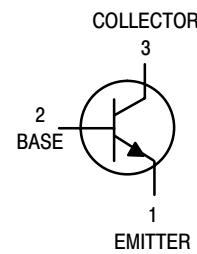
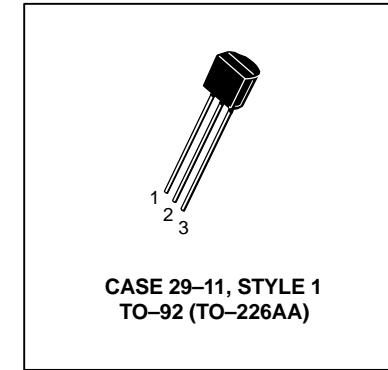
## THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	200	$^\circ\text{C/W}$
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> ( $I_C = 1.0$ mA, $I_B = 0$ )	$V_{(BR)CEO}$	80	—	Vdc
Collector-Emitter Breakdown Voltage ( $I_C = 500$ $\mu$ Adc, $V_{BE} = 5.0$ Vdc, $R_{BE} = 8.2$ k ohms)	$V_{(BR)CEX}$	120	—	Vdc
Collector-Base Breakdown Voltage ( $I_C = 10$ $\mu$ Adc, $I_E = 0$ )	$V_{(BR)CBO}$	120	—	Vdc
Emitter-Base Breakdown Voltage ( $I_E = 10$ $\mu$ Adc, $I_C = 0$ )	$V_{(BR)EBO}$	5.0	—	Vdc
Collector Cutoff Current ( $V_{CB} = 100$ Vdc, $I_E = 0$ ) ( $V_{CB} = 100$ Vdc, $I_E = 0$ , $T_A = 100^\circ\text{C}$ )	$I_{CBO}$	— —	0.01 1.0	$\mu$ Adc
Emitter Cutoff Current ( $V_{EB} = 4.0$ Vdc, $I_C = 0$ )	$I_{EBO}$	—	0.1	$\mu$ Adc

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

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## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted) (Continued)

Characteristic	Symbol	Min	Max	Unit
<b>ON CHARACTERISTICS</b>				
DC Current Gain (I <sub>C</sub> = 1.0 mAdc, V <sub>CE</sub> = 1.0 Vdc) (I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 1.0 Vdc)	h <sub>FE</sub>	60 60	— 400	—
Collector-Emitter Saturation Voltage (I <sub>C</sub> = 1.0 mAdc, I <sub>B</sub> = 0.1 mAdc)	V <sub>CE(sat)</sub>	—	0.2	Vdc
Base-Emitter Saturation Voltage (I <sub>C</sub> = 1.0 mAdc, I <sub>B</sub> = 0.1 mAdc)	V <sub>BE(sat)</sub>	—	0.8	Vdc
Base-Emitter On Voltage (I <sub>C</sub> = 1.0 mAdc, V <sub>CE</sub> = 5.0 Vdc)	V <sub>BE(on)</sub>	—	0.8	Vdc

## SMALL-SIGNAL CHARACTERISTICS

Current-Gain — Bandwidth Product <sup>(2)</sup> (I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 10 Vdc, f = 20 MHz)	f <sub>T</sub>	60	300	MHz
Collector-Base Capacitance (V <sub>CB</sub> = 10 Vdc, I <sub>E</sub> = 0, f = 1.0 MHz, emitter guarded)	C <sub>cb</sub>	—	12	pF
Emitter-Base Capacitance (V <sub>EB</sub> = 0.5 Vdc, I <sub>C</sub> = 0, f = 1.0 MHz, collector guarded)	C <sub>eb</sub>	—	50	pF

2. f<sub>T</sub> = |h<sub>fe</sub>| • f<sub>test</sub>.

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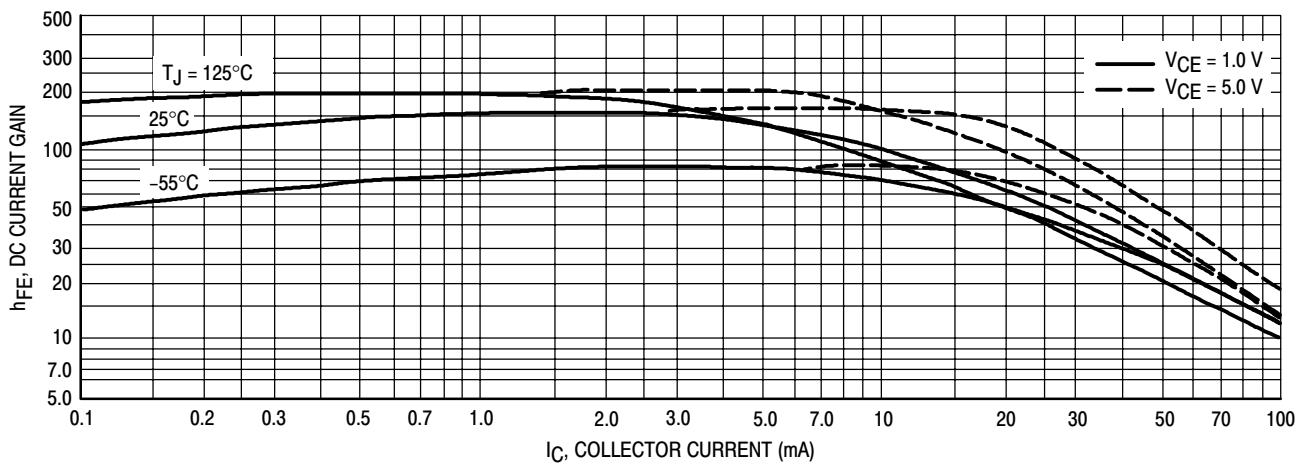


Figure 1. DC Current Gain

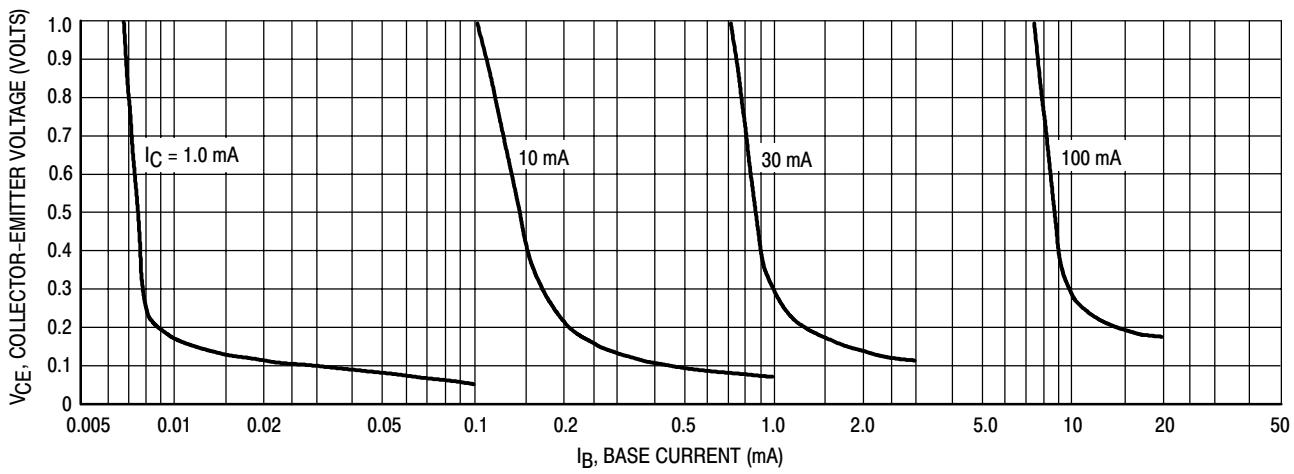


Figure 2. Collector Saturation Region

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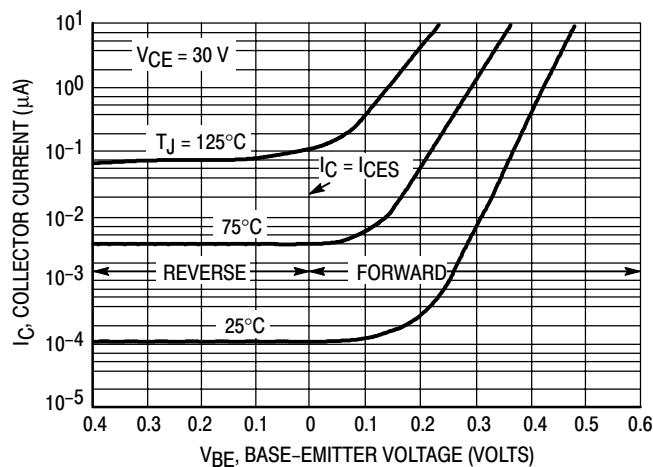


Figure 3. Collector Cut-Off Region

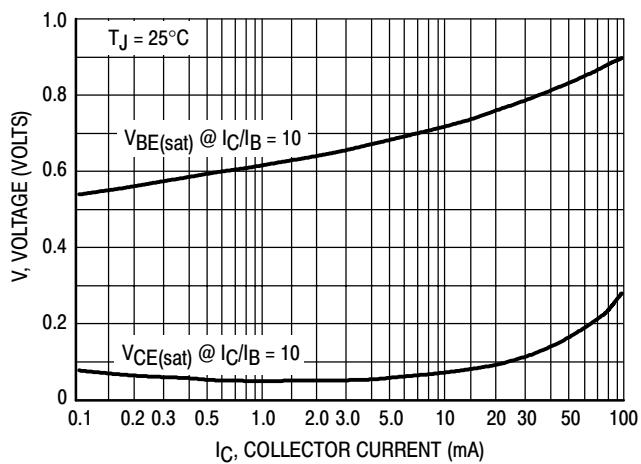


Figure 4. "On" Voltages

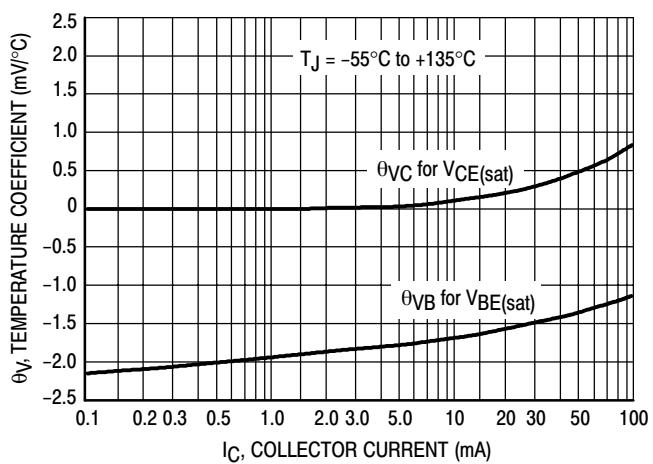
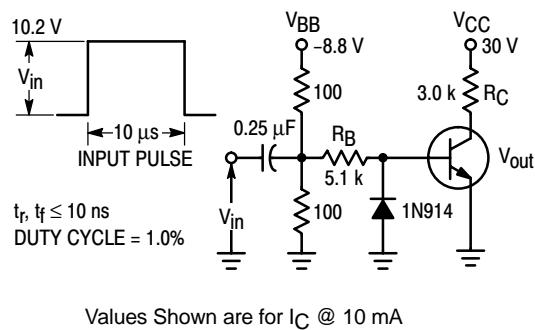


Figure 5. Temperature Coefficients



Values Shown are for  $I_C$  @ 10 mA

Figure 6. Switching Time Test Circuit

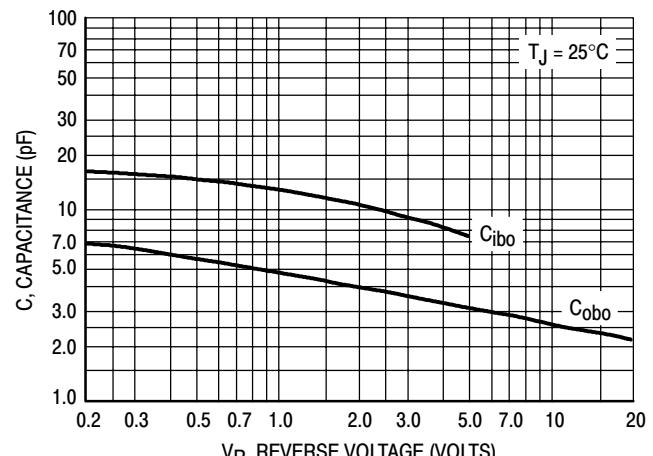


Figure 7. Capacitances

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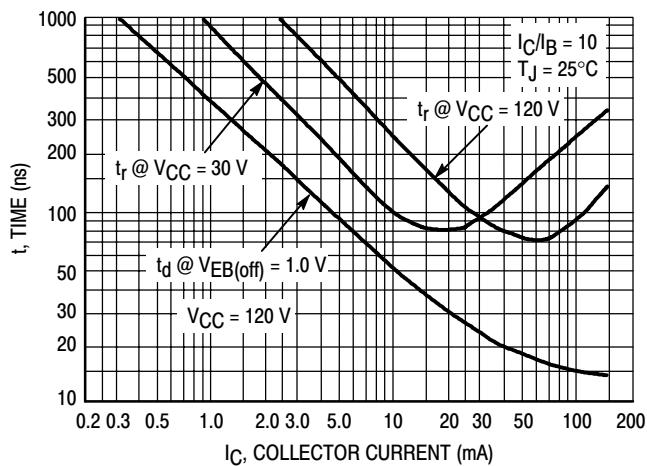


Figure 8. Turn-On Time

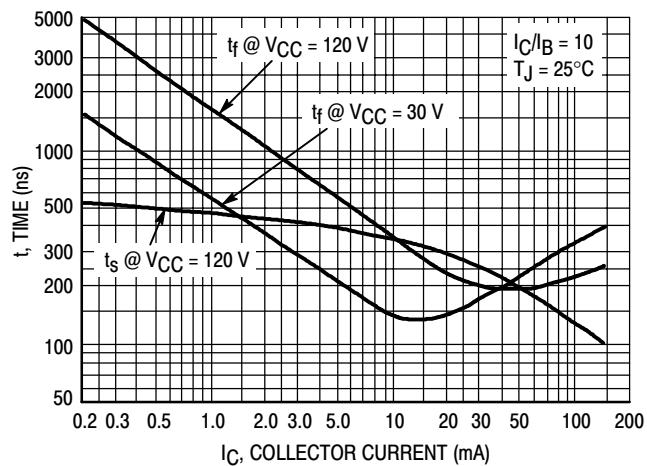
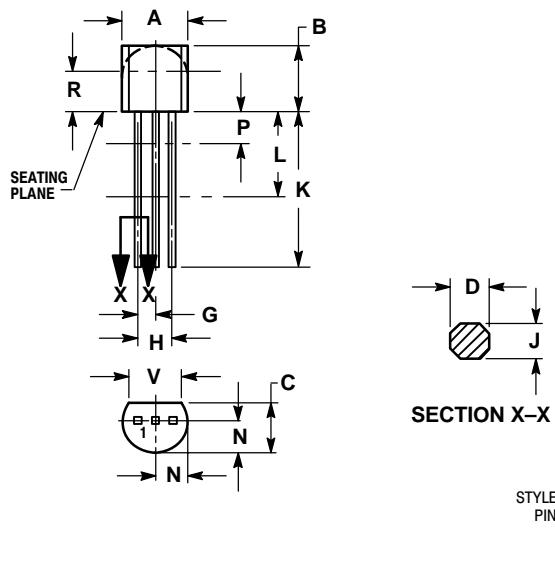


Figure 9. Turn-Off Time

## PACKAGE DIMENSIONS

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



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
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:  
 PIN 1. Emitter  
 2. Base  
 3. Collector

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