

# Darlington Complementary Silicon Power Transistors

## 2N6284 (NPN); 2N6286, 2N6287 (PNP)

These packages are designed for general-purpose amplifier and low-frequency switching applications.

### Features

- High DC Current Gain @  $I_C = 10 \text{ Adc}$  –  
 $h_{FE} = 2400 \text{ (Typ)} - 2N6284$   
 $= 4000 \text{ (Typ)} - 2N6287$
- Collector–Emitter Sustaining Voltage –  
 $V_{CEO(sus)} = 100 \text{ Vdc (Min)}$
- Monolithic Construction with Built–In Base–Emitter Shunt Resistors
- Pb–Free Packages are Available\*

### MAXIMUM RATINGS (Note 1)

Rating	Symbol	Value	Unit
Collector–Emitter Voltage 2N6286 2N6284/87	$V_{CEO}$	80 100	Vdc
Collector–Base Voltage 2N6286 2N6284/87	$V_{CB}$	80 100	Vdc
Emitter–Base Voltage	$V_{EB}$	5.0	Vdc
Collector Current – Continuous Peak	$I_C$	20 40	Adc
Base Current	$I_B$	0.5	Adc
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	160 0.915	W W/ $^\circ\text{C}$
Operating and Storage Temperature Range	$T_J, T_{stg}$	–65 to +200	$^\circ\text{C}$

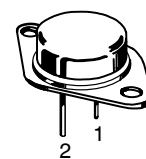
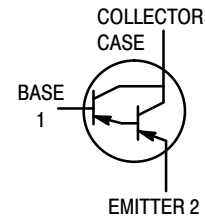
### THERMAL CHARACTERISTICS (Note 1)

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction–to–Case	$R_{\theta JC}$	1.09	$^\circ\text{C/W}$

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Indicates JEDEC Registered Data.

## 20 AMPERE COMPLEMENTARY SILICON POWER TRANSISTORS 100 VOLTS, 160 WATTS



TO-204AA (TO-3)  
CASE 1-07  
STYLE 1

### MARKING DIAGRAM



2N628x = Device Code  
 x = 4, 6 or 7  
 G = Pb–Free Package  
 A = Location Code  
 YY = Year  
 WW = Work Week  
 MEX = Country of Origin

### ORDERING INFORMATION

Device	Package	Shipping
2N6284	TO-3	100 Units/Tray
2N6284G	TO-3 (Pb–Free)	100 Units/Tray
2N6286	TO-3	100 Units/Tray
2N6286G	TO-3 (Pb–Free)	100 Units/Tray
2N6287	TO-3	100 Units/Tray
2N6287G	TO-3 (Pb–Free)	100 Units/Tray

\*For additional information on our Pb–Free strategy and soldering details, please download the onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

## 2N6284 (NPN); 2N6286, 2N6287 (PNP)

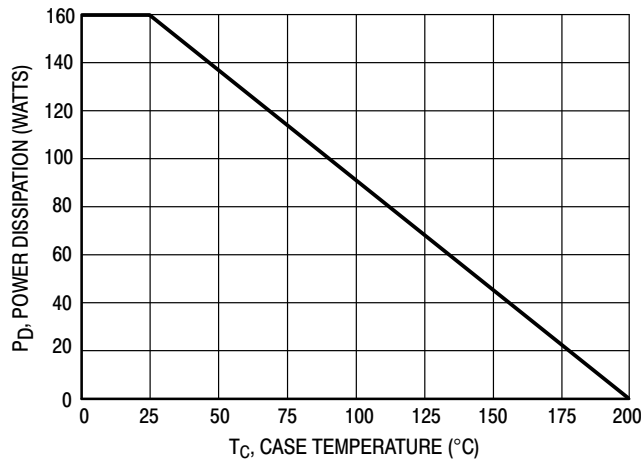


Figure 1. Power Derating

### ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise noted) (Note 2)

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector–Emitter Sustaining Voltage (I <sub>C</sub> = 0.1 Adc, I <sub>B</sub> = 0)	V <sub>CEO(sus)</sub>	80	–	Vdc
		100	–	
				2N6286 2N6284, 2N6287
Collector Cutoff Current (V <sub>CE</sub> = 40 Vdc, I <sub>B</sub> = 0)	I <sub>CEO</sub>	–	1.0	mAdc
(V <sub>CE</sub> = 50 Vdc, I <sub>B</sub> = 0)		–	1.0	
Collector Cutoff Current (V <sub>CE</sub> = Rated V <sub>CB</sub> , V <sub>BE(off)</sub> = 1.5 Vdc)	I <sub>CEX</sub>	–	0.5	mAdc
(V <sub>CE</sub> = Rated V <sub>CB</sub> , V <sub>BE(off)</sub> = 1.5 Vdc, T <sub>C</sub> = 150°C)		–	5.0	
Emitter Cutoff Current (V <sub>BE</sub> = 5.0 Vdc, I <sub>C</sub> = 0)	I <sub>EBO</sub>	–	2.0	mAdc

### ON CHARACTERISTICS (Note 3)

DC Current Gain (I <sub>C</sub> = 10 Adc, V <sub>CE</sub> = 3.0 Vdc)	h <sub>FE</sub>	750	18,000	–
(I <sub>C</sub> = 20 Adc, V <sub>CE</sub> = 3.0 Vdc)		100	–	
Collector–Emitter Saturation Voltage (I <sub>C</sub> = 10 Adc, I <sub>B</sub> = 40 mAdc)	V <sub>CE(sat)</sub>	–	2.0	Vdc
(I <sub>C</sub> = 20 Adc, I <sub>B</sub> = 200 mAdc)		–	3.0	
Base–Emitter On Voltage (I <sub>C</sub> = 10 Adc, V <sub>CE</sub> = 3.0 Vdc)	V <sub>BE(on)</sub>	–	2.8	Vdc
Base–Emitter Saturation Voltage (I <sub>C</sub> = 20 Adc, I <sub>B</sub> = 200 mAdc)	V <sub>BE(sat)</sub>	–	4.0	Vdc

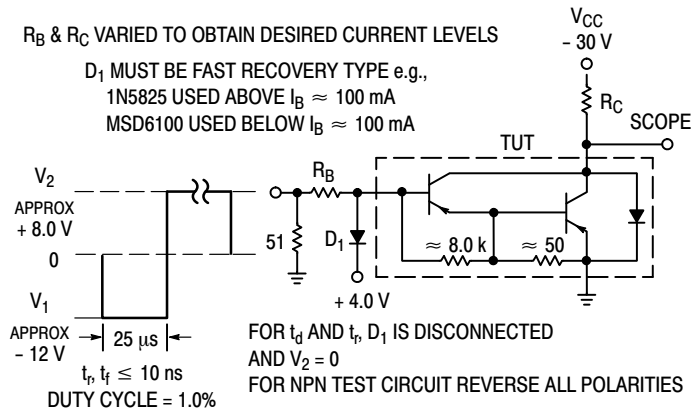
### DYNAMIC CHARACTERISTICS

Magnitude of Common Emitter Small–Signal Short–Circuit Forward Current Transfer Ratio (I <sub>C</sub> = 10 Adc, V <sub>CE</sub> = 3.0 Vdc, f = 1.0 MHz)	h <sub>fe</sub>	4.0	–	MHz
Output Capacitance (V <sub>CB</sub> = 10 Vdc, I <sub>E</sub> = 0, f = 0.1 MHz)	C <sub>ob</sub>	–	400	pF
		–	600	
				2N6284 2N6286, 2N6287
Small–Signal Current Gain (I <sub>C</sub> = 10 Adc, V <sub>CE</sub> = 3.0 Vdc, f = 1.0 kHz)	h <sub>fe</sub>	300	–	–

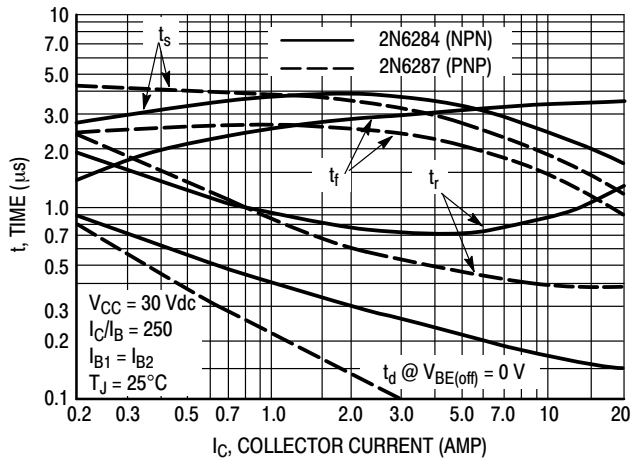
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

- Indicates JEDEC Registered Data.
- Pulse test: Pulse Width = 300 μs, Duty Cycle = 2%

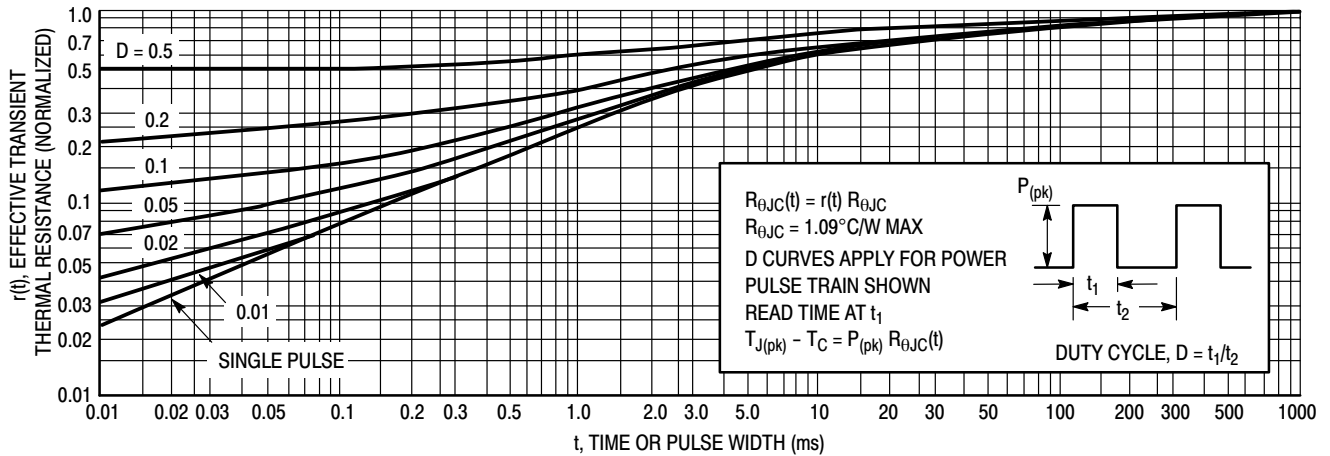
## 2N6284 (NPN); 2N6286, 2N6287 (PNP)



**Figure 2. Switching Times Test Circuit**



**Figure 3. Switching Times**



**Figure 4. Thermal Response**

## 2N6284 (NPN); 2N6286, 2N6287 (PNP)

### ACTIVE-REGION SAFE OPERATING AREA

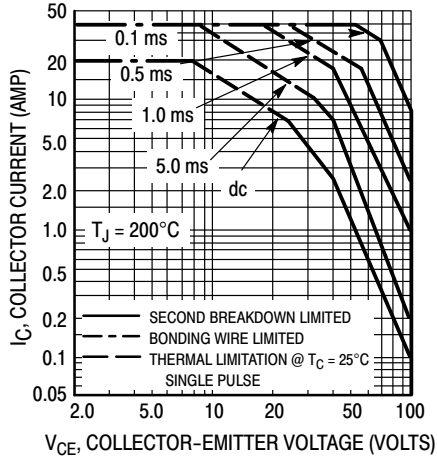


Figure 5. 2N6284, 2N6287

There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate  $I_C - V_{CE}$  limits of the transistor that must be observed for reliable operation; i.e. the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figure 5 is based on  $T_{J(pk)} = 200^\circ\text{C}$ ;  $T_C$  is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided  $T_{J(pk)} < 200^\circ\text{C}$ .  $T_{J(pk)}$  may be calculated from the data in Figure 4. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

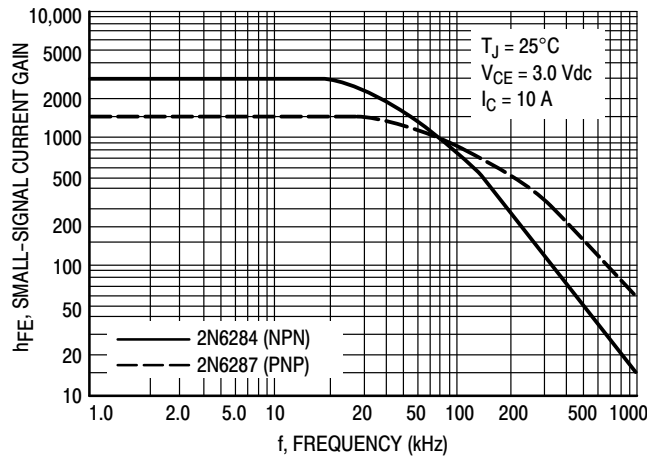


Figure 6. Small-Signal Current Gain

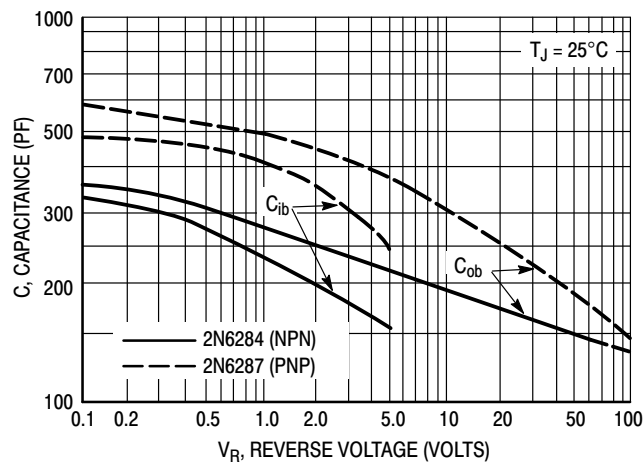
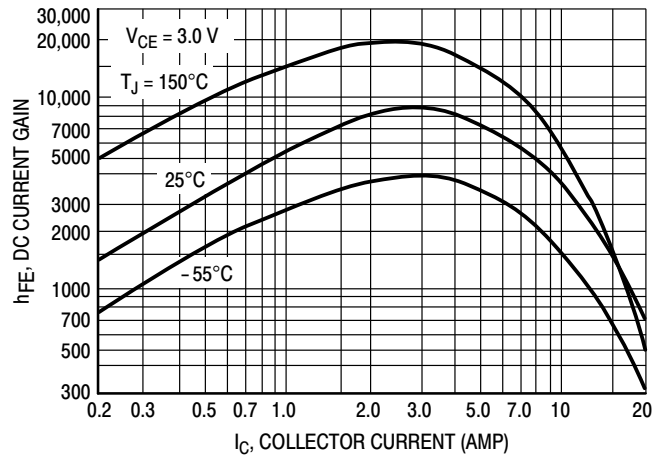
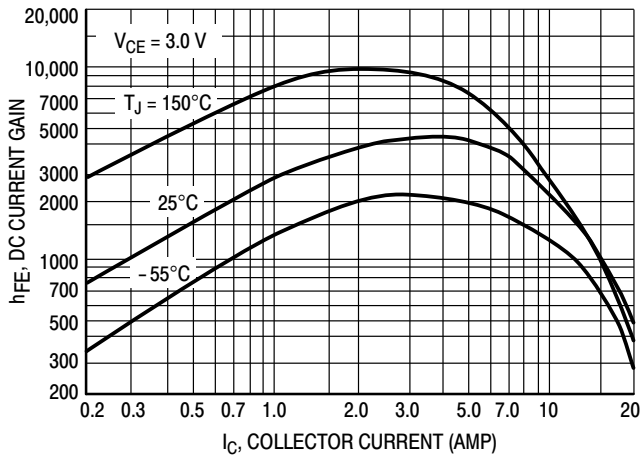


Figure 7. Capacitance

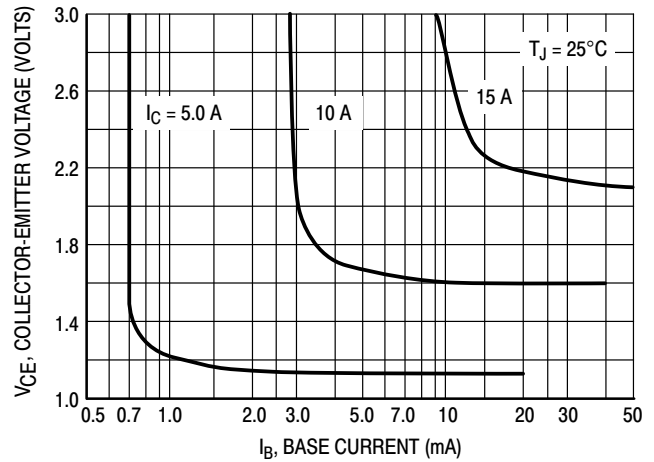
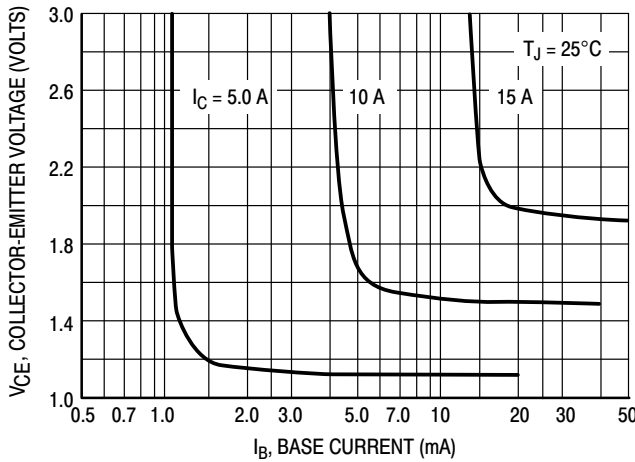
# 2N6284 (NPN); 2N6286, 2N6287 (PNP)

**NPN  
2N6284**

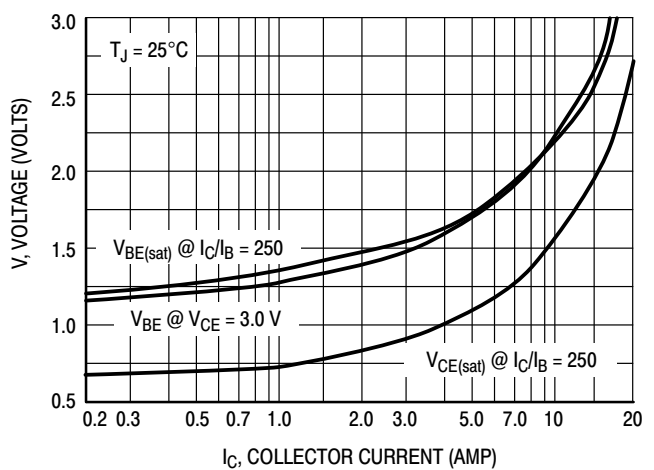
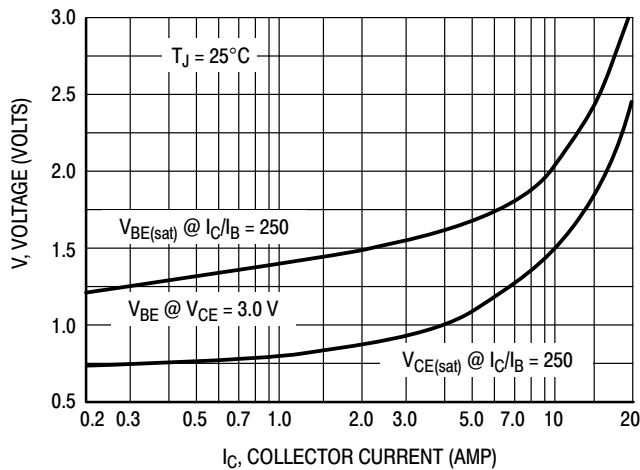
**PNP  
2N6287**



**Figure 8. DC Current Gain**

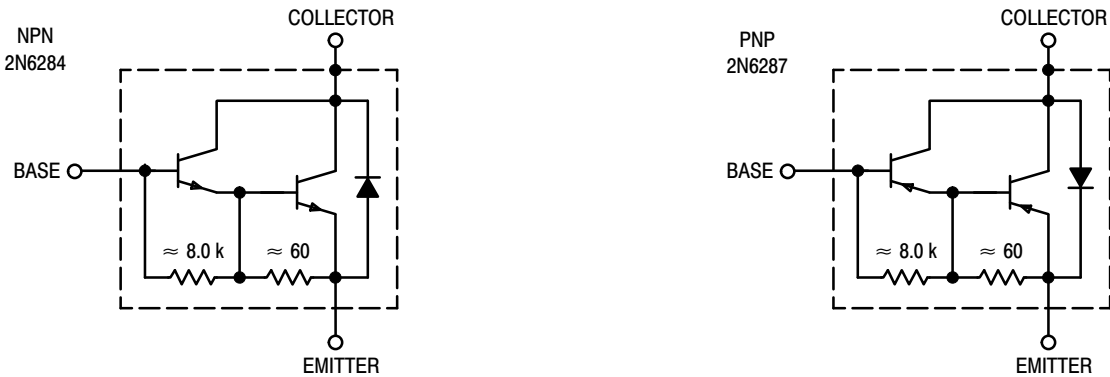
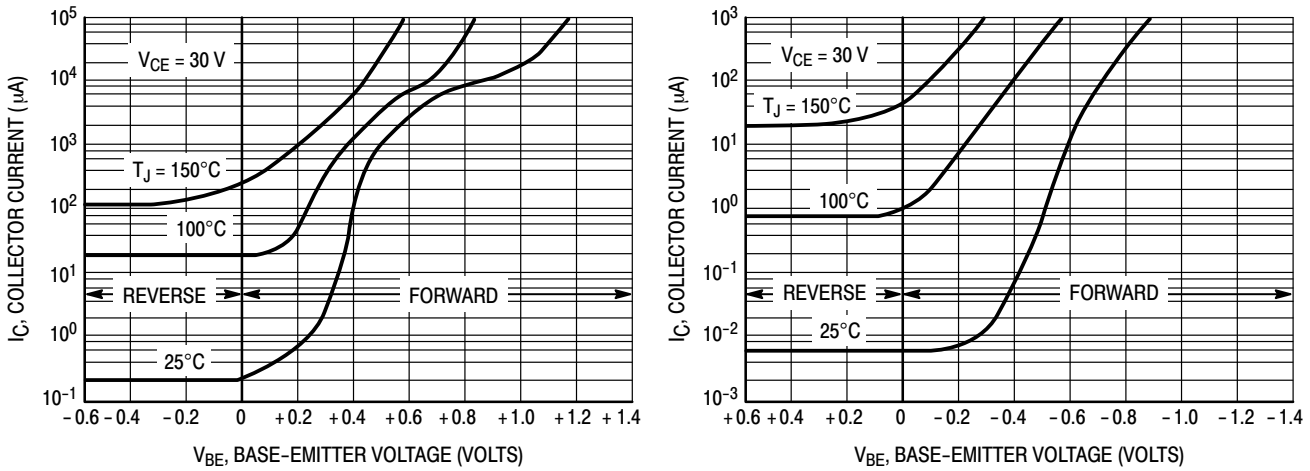
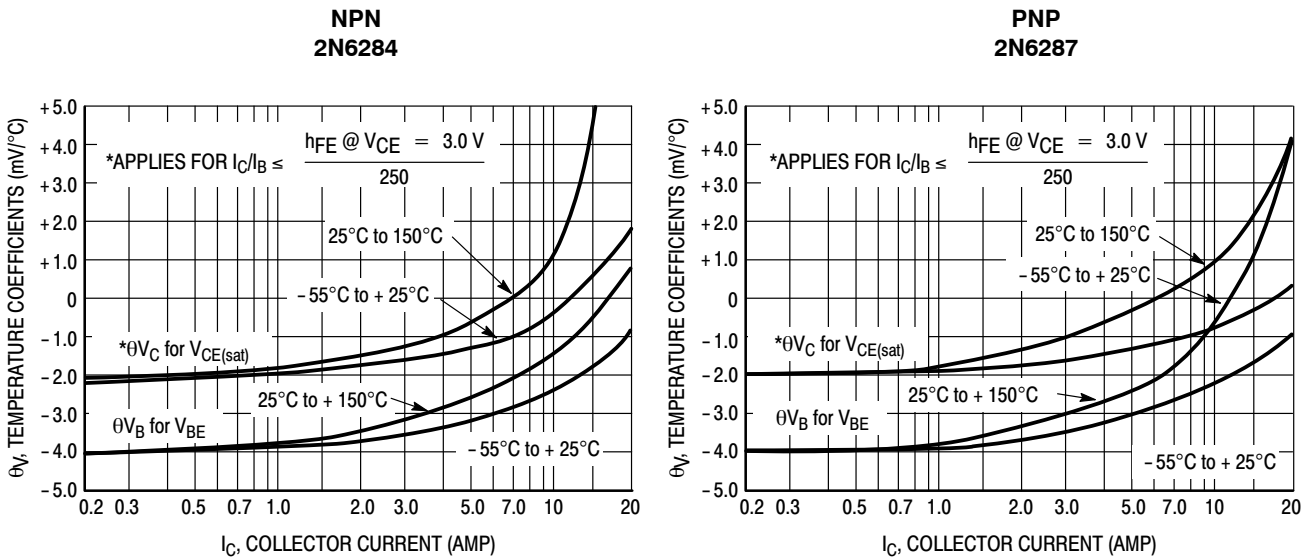


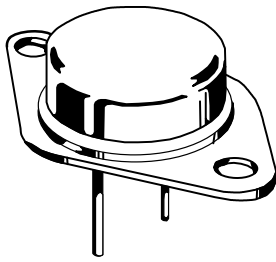
**Figure 9. Collector Saturation Region**



**Figure 10. "On" Voltages**

## 2N6284 (NPN); 2N6286, 2N6287 (PNP)

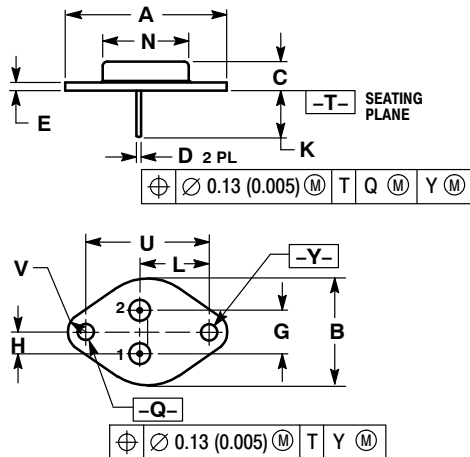




TO-204 (TO-3)  
CASE 1-07  
ISSUE Z

DATE 10 MAR 2000

SCALE 1:1



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. ALL RULES AND NOTES ASSOCIATED WITH REFERENCED TO-204AA OUTLINE SHALL APPLY.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	1.550 REF		39.37 REF	
B	---	1.050	---	26.67
C	0.250	0.335	6.35	8.51
D	0.038	0.043	0.97	1.09
E	0.055	0.070	1.40	1.77
G	0.430 BSC		10.92 BSC	
H	0.215 BSC		5.46 BSC	
K	0.440	0.480	11.18	12.19
L	0.665 BSC		16.89 BSC	
N	---	0.830	---	21.08
Q	0.151	0.165	3.84	4.19
U	1.187 BSC		30.15 BSC	
V	0.131	0.188	3.33	4.77

- |  |  |   |   |   |
|--|--|---|---|---|
| <p>STYLE 1:<br/>PIN 1. BASE<br/>2. EMITTER<br/>CASE: COLLECTOR</p> | <p>STYLE 2:<br/>PIN 1. BASE<br/>2. COLLECTOR<br/>CASE: EMITTER</p> | <p>STYLE 3:<br/>PIN 1. GATE<br/>2. SOURCE<br/>CASE: DRAIN</p>           | <p>STYLE 4:<br/>PIN 1. GROUND<br/>2. INPUT<br/>CASE: OUTPUT</p>       | <p>STYLE 5:<br/>PIN 1. CATHODE<br/>2. EXTERNAL TRIP/DELAY<br/>CASE: ANODE</p> |
| <p>STYLE 6:<br/>PIN 1. GATE<br/>2. EMITTER<br/>CASE: COLLECTOR</p> | <p>STYLE 7:<br/>PIN 1. ANODE<br/>2. OPEN<br/>CASE: CATHODE</p>     | <p>STYLE 8:<br/>PIN 1. CATHODE #1<br/>2. CATHODE #2<br/>CASE: ANODE</p> | <p>STYLE 9:<br/>PIN 1. ANODE #1<br/>2. ANODE #2<br/>CASE: CATHODE</p> |   |

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