

# Darlington Complementary Silicon Power Transistors

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

- High DC Current Gain @  $I_C = 10 \text{ A dc}$  –  
 $h_{FE} = 2400 \text{ (Typ)} - 2N6284$   
 $= 4000 \text{ (Typ)} - 2N6287$
- Collector-Emitter Sustaining Voltage –  
 $V_{CEO(sus)} = 100 \text{ V dc (Min)}$
- Monolithic Construction with Built-In Base-Emitter Shunt Resistors

## \*MAXIMUM RATINGS

Rating	Symbol	2N6283 2N6286	2N6284 2N6287	Unit
Collector-Emitter Voltage	$V_{CEO}$	80	100	Vdc
Collector-Base Voltage	$V_{CB}$	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 Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	160 0.915		Watts W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-65 to +200		$^\circ\text{C}$

## \*THERMAL CHARACTERISTICS

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

\*Indicates JEDEC Registered Data.

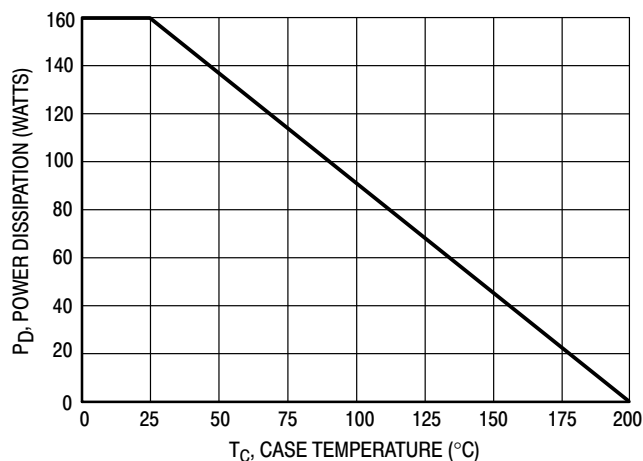
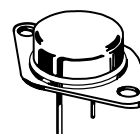


Figure 1. Power Derating

**NPN**  
**2N6283**  
**2N6284**  
**PNP**  
**2N6286**  
**2N6287**

**DARLINGTON**  
**20 AMPERE**  
**COMPLEMENTARY**  
**SILICON**  
**POWER TRANSISTORS**  
**100 VOLTS**  
**160 WATTS**



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

# 2N6283 2N6284 2N6286 2N6287

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

Characteristic	Symbol	Min	Max	Unit
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## OFF CHARACTERISTICS

Collector–Emitter Sustaining Voltage ( $I_C = 0.1\text{ A dc}$ , $I_B = 0$ ) 2N6283, 2N6286 2N6284, 2N6287	$V_{CEO(sus)}$	<b>80</b> 100	– –	Vdc
Collector Cutoff Current ( $V_{CE} = 40\text{ Vdc}$ , $I_B = 0$ ) ( $V_{CE} = 50\text{ Vdc}$ , $I_B = 0$ )	$I_{CEO}$	– –	1.0 1.0	mAdc
Collector Cutoff Current ( $V_{CE} = \text{Rated } V_{CB}$ , $V_{BE(off)} = 1.5\text{ Vdc}$ ) ( $V_{CE} = \text{Rated } V_{CB}$ , $V_{BE(off)} = 1.5\text{ Vdc}$ , $T_C = 150^\circ\text{C}$ )	$I_{CEX}$	– –	0.5 5.0	mAdc
Emitter Cutoff Current ( $V_{BE} = 5.0\text{ Vdc}$ , $I_C = 0$ )	$I_{EBO}$	–	2.0	mAdc

## ON CHARACTERISTICS (1)

DC Current Gain ( $I_C = 10\text{ A dc}$ , $V_{CE} = 3.0\text{ Vdc}$ ) ( $I_C = 20\text{ A dc}$ , $V_{CE} = 3.0\text{ Vdc}$ )	$h_{FE}$	750 100	18,000 –	–
Collector–Emitter Saturation Voltage ( $I_C = 10\text{ A dc}$ , $I_B = 40\text{ mAdc}$ ) ( $I_C = 20\text{ A dc}$ , $I_B = 200\text{ mAdc}$ )	$V_{CE(sat)}$	– –	2.0 3.0	Vdc
Base–Emitter On Voltage ( $I_C = 10\text{ A dc}$ , $V_{CE} = 3.0\text{ Vdc}$ )	$V_{BE(on)}$	–	2.8	Vdc
Base–Emitter Saturation Voltage ( $I_C = 20\text{ A dc}$ , $I_B = 200\text{ mAdc}$ )	$V_{BE(sat)}$	–	4.0	Vdc

## DYNAMIC CHARACTERISTICS

Magnitude of Common Emitter Small–Signal Short–Circuit Forward Current Transfer Ratio ( $I_C = 10\text{ A dc}$ , $V_{CE} = 3.0\text{ Vdc}$ , $f = 1.0\text{ MHz}$ )	$ h_{fe} $	4.0	–	MHz
Output Capacitance ( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f = 0.1\text{ MHz}$ ) 2N6283, 2N6284 2N6286, 2N6287	$C_{ob}$	– –	400 600	pF
Small–Signal Current Gain ( $I_C = 10\text{ A dc}$ , $V_{CE} = 3.0\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	$h_{fe}$	300	–	–

\*Indicates JEDEC Registered Data.

(1) Pulse test: Pulse Width = 300  $\mu\text{s}$ , Duty Cycle = 2%

# 2N6283 2N6284 2N6286 2N6287

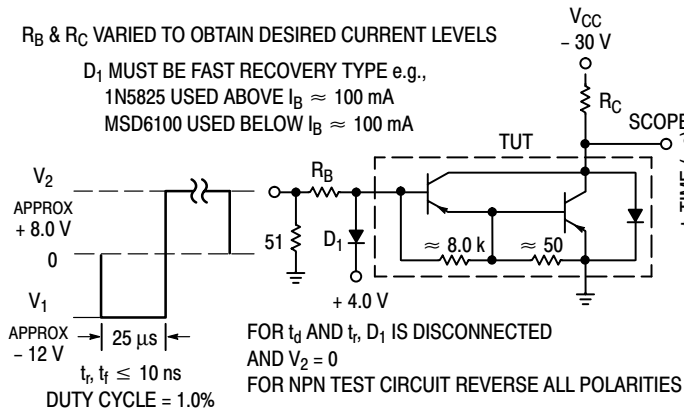


Figure 2. Switching Times Test Circuit

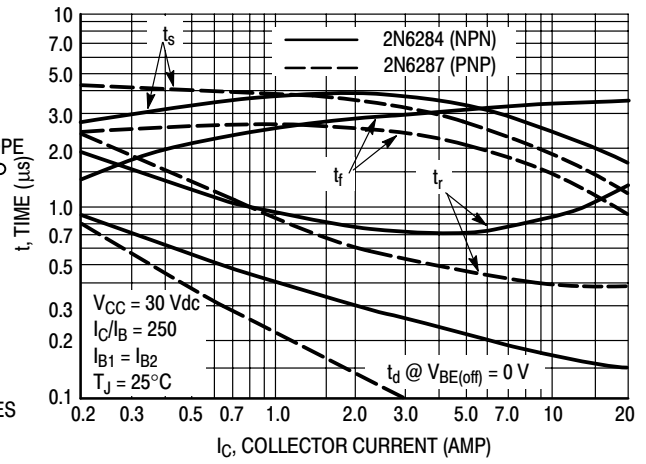


Figure 3. Switching Times

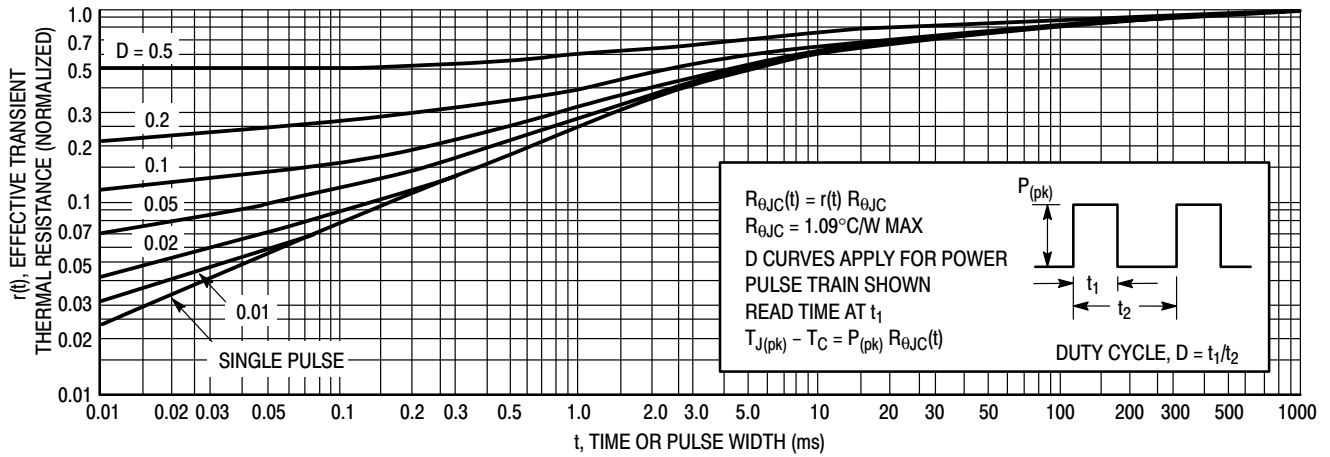


Figure 4. Thermal Response

ACTIVE-REGION SAFE OPERATING AREA

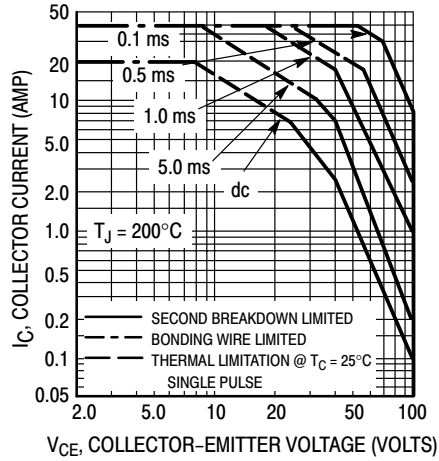


Figure 5. 2N6284, 2N6287

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.

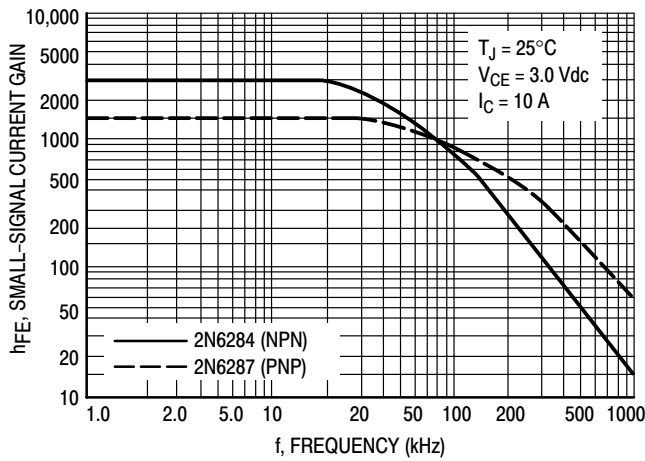


Figure 6. Small-Signal Current Gain

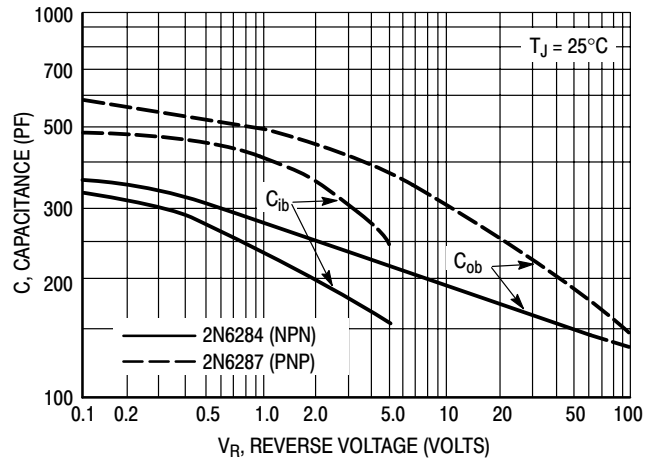
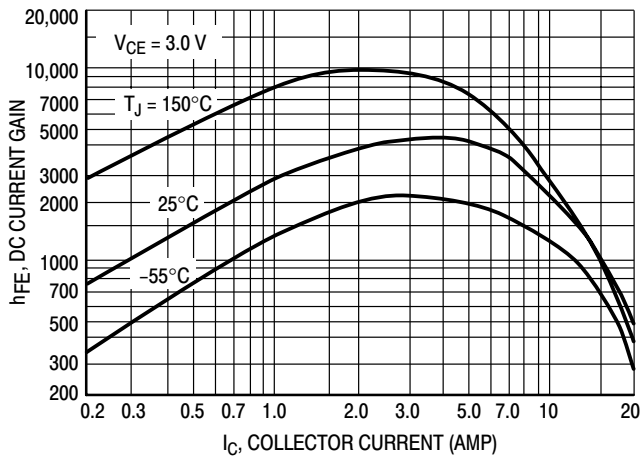


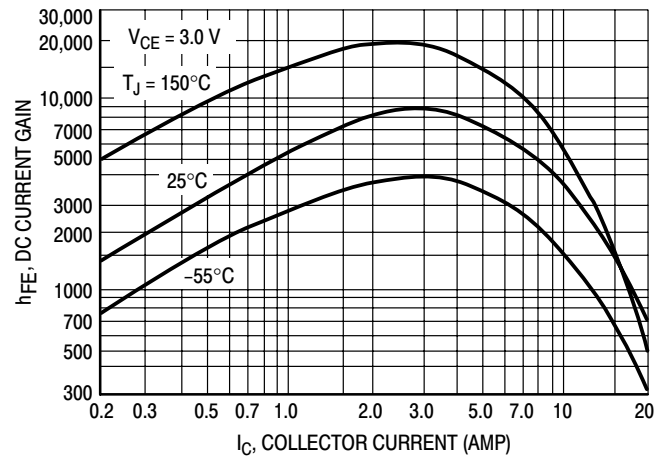
Figure 7. Capacitance

# 2N6283 2N6284 2N6286 2N6287

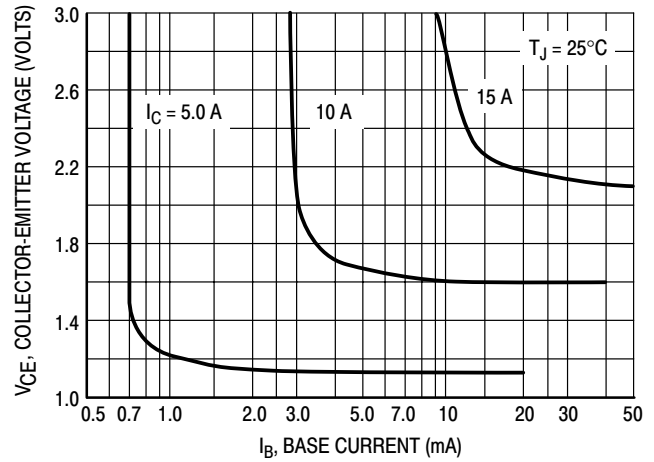
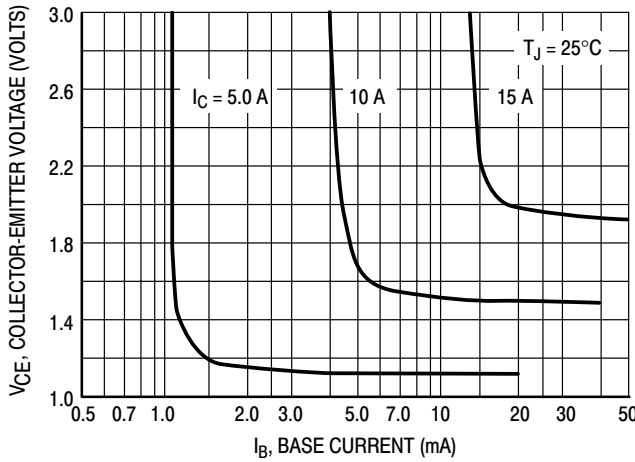
**NPN  
2N6284**



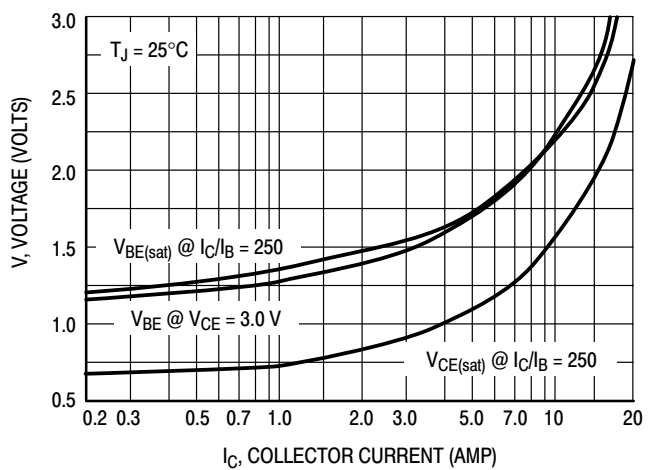
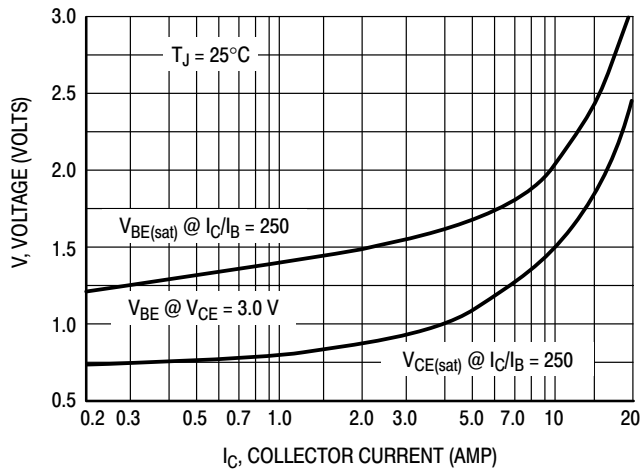
**PNP  
2N6287**



**Figure 8. DC Current Gain**



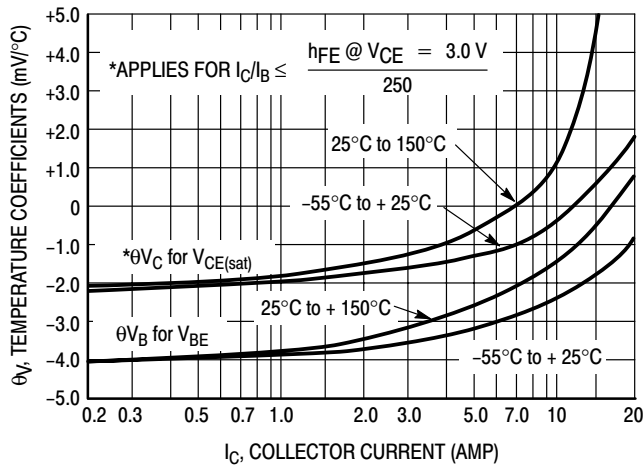
**Figure 9. Collector Saturation Region**



**Figure 10. "On" Voltages**

# 2N6283 2N6284 2N6286 2N6287

NPN  
2N6284



PNP  
2N6287

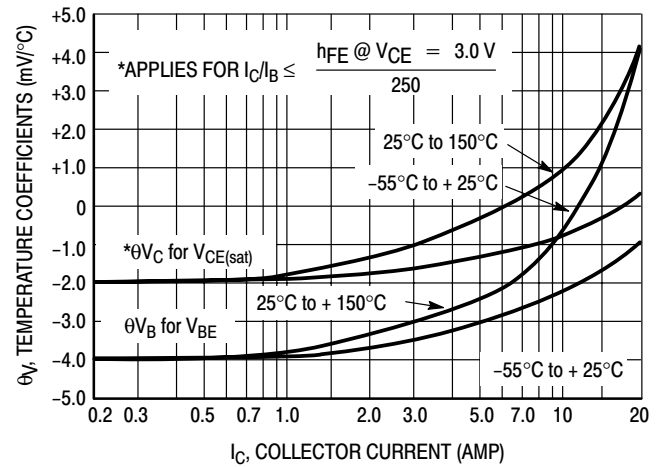


Figure 11. Temperature Coefficients

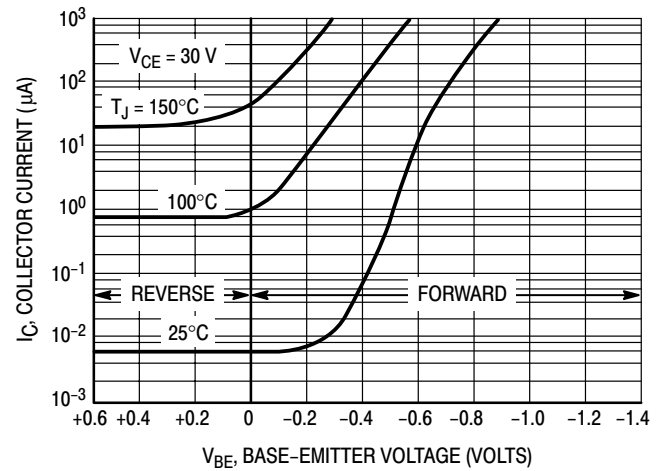
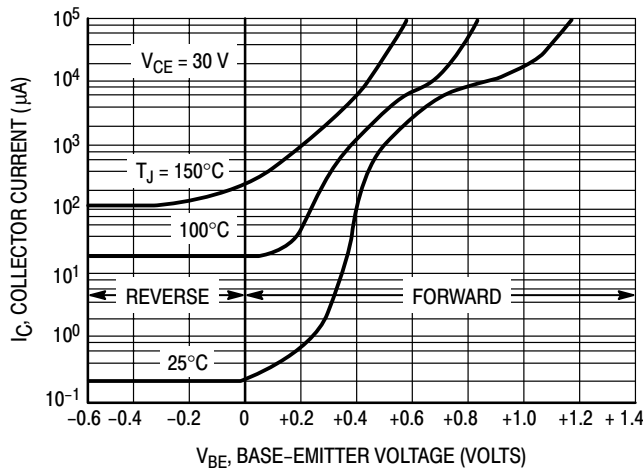


Figure 12. Collector Cut-Off Region

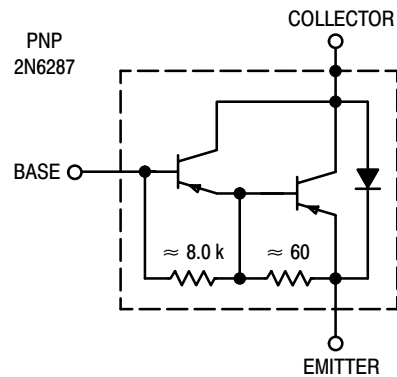
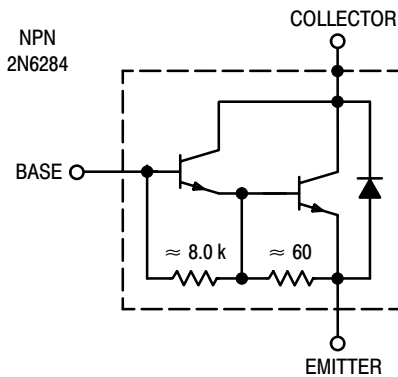
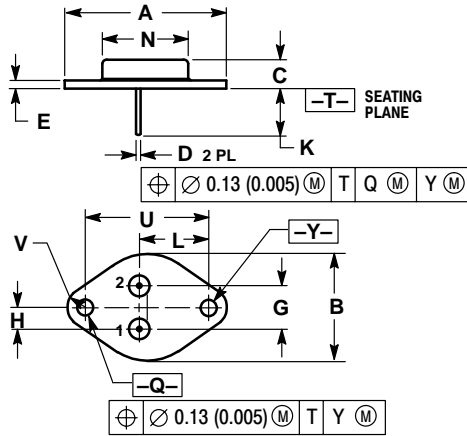


Figure 13. Darlington Schematic

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## PACKAGE DIMENSIONS

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



- 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

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

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