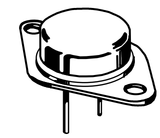
# Darlington Complementary Silicon Power Transistors

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

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

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

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



**CASE 1–07**
**TO–204AA**
**(TO–3)**

### *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<br>Peak | $I_C$ | 20<br>40 | | Adc |
| Base Current | $I_B$ | 0.5 | | Adc |
| Total Device Dissipation @ $T_C$ = 25°C<br>Derate above 25°C | $P_D$ | 160<br>0.915 | | Watts<br>W/°C |
| Operating and Storage Junction Temperature Range | $T_J, T_{stg}$ | –65 to +200 | | °C |

### *THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 1.09 | °C/W |

*Indicates JEDEC Registered Data.

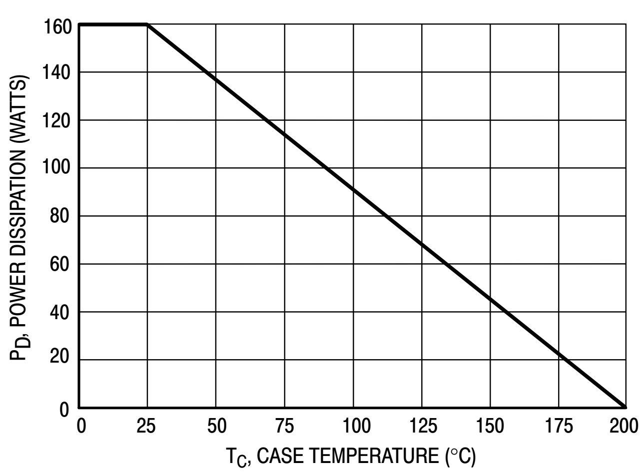



**Figure 1. Power Derating**





May, 2001 – Rev. 1

Publication Order Number:
2N6284/D

***ELECTRICAL CHARACTERISTICS** ($T_C$ = 25°C unless otherwise noted)

| Characteristic | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | |
| Collector–Emitter Sustaining Voltage ($I_C$ = 0.1 Adc, $I_B$ = 0) 2N6283, 2N6286 | $V_{CEO(sus)}$ | **80** | – | Vdc |
| 2N6284, 2N6287 | | 100 | – | |
| Collector Cutoff Current ($V_{CE}$ = 40 Vdc, $I_B$ = 0) | $I_{CEO}$ | – | 1.0 | mAdc |
| ($V_{CE}$ = 50 Vdc, $I_B$ = 0) | | – | 1.0 | |
| Collector Cutoff Current ($V_{CE}$ = Rated $V_{CB}$, $V_{BE(off)}$ = 1.5 Vdc) | $I_{CEX}$ | – | 0.5 | mAdc |
| ($V_{CE}$ = Rated $V_{CB}$, $V_{BE(off)}$ = 1.5 Vdc, $T_C$ = 150°C) | | – | 5.0 | |
| Emitter Cutoff Current ($V_{BE}$ = 5.0 Vdc, $I_C$ = 0) | $I_{EBO}$ | – | 2.0 | mAdc |
| **ON CHARACTERISTICS (1)** | | | | |
| DC Current Gain ($I_C$ = 10 Adc, $V_{CE}$ = 3.0 Vdc) | $h_{FE}$ | 750 | 18,000 | – |
| ($I_C$ = 20 Adc, $V_{CE}$ = 3.0 Vdc) | | 100 | – | |
| Collector–Emitter Saturation Voltage ($I_C$ = 10 Adc, $I_B$ = 40 mAdc) | $V_{CE(sat)}$ | – | 2.0 | Vdc |
| ($I_C$ = 20 Adc, $I_B$ = 200 mAdc) | | – | 3.0 | |
| Base–Emitter On Voltage ($I_C$ = 10 Adc, $V_{CE}$ = 3.0 Vdc) | $V_{BE(on)}$ | – | 2.8 | Vdc |
| Base–Emitter Saturation Voltage ($I_C$ = 20 Adc, $I_B$ = 200 mAdc) | $V_{BE(sat)}$ | – | 4.0 | Vdc |
| **DYNAMIC CHARACTERISTICS** | | | | |
| Magnitude of Common Emitter Small–Signal Short–Circuit Forward Current Transfer Ratio ($I_C$ = 10 Adc, $V_{CE}$ = 3.0 Vdc, f = 1.0 MHz) | $\|h_{fe}\|$ | 4.0 | – | MHz |
| Output Capacitance ($V_{CB}$ = 10 Vdc, $I_E$ = 0, f = 0.1 MHz) 2N6283, 2N6284 | $C_{ob}$ | – | 400 | pF |
| 2N6286, 2N6287 | | – | 600 | |
| Small–Signal Current Gain ($I_C$ = 10 Adc, $V_{CE}$ = 3.0 Vdc, f = 1.0 kHz) | $h_{fe}$ | 300 | – | – |

*Indicates JEDEC Registered Data.
(1) Pulse test: Pulse Width = 300 μs, Duty Cycle = 2%

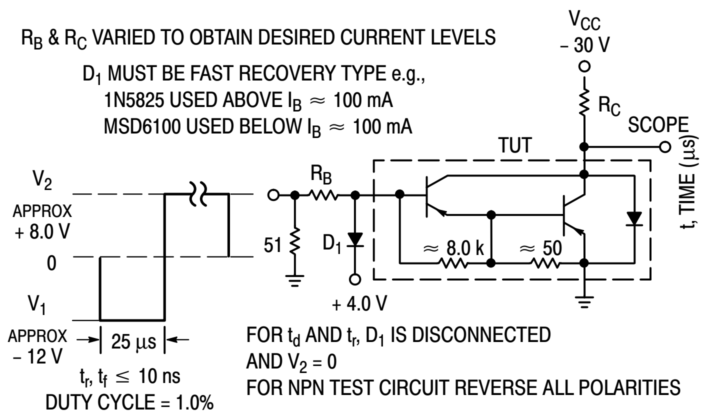



**Figure 2. Switching Times Test Circuit**

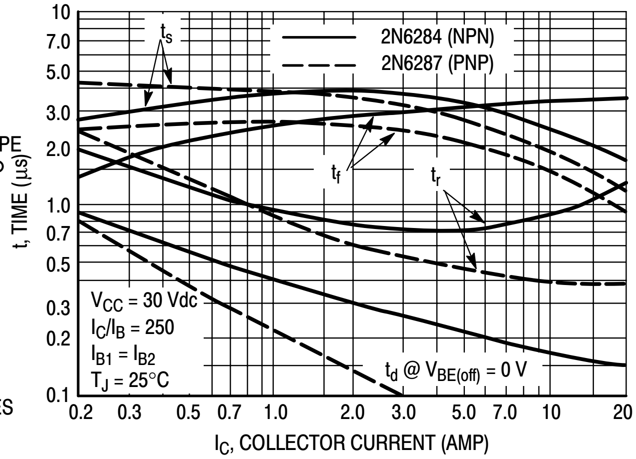



**Figure 3. Switching Times**

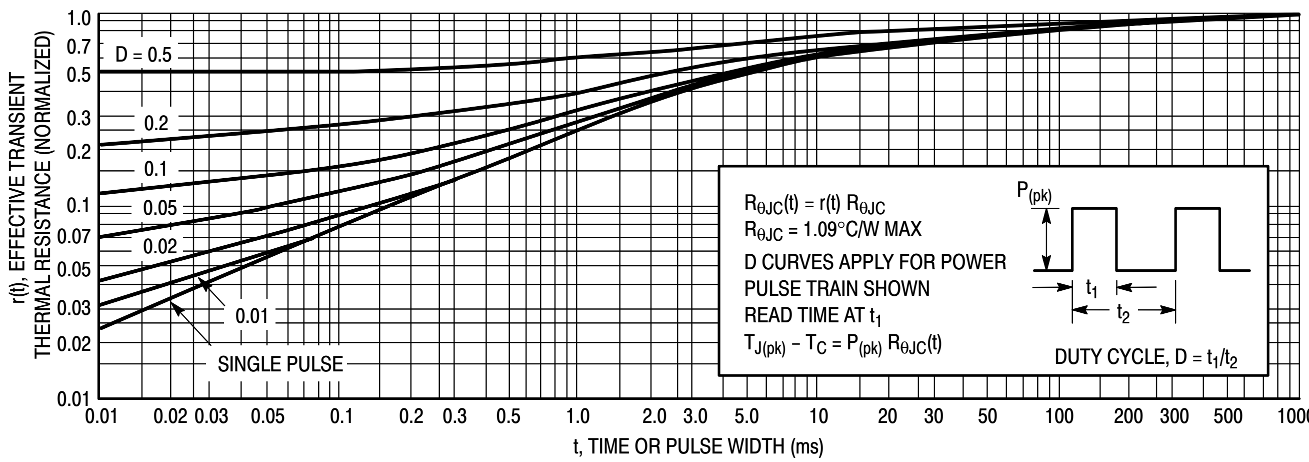



**Figure 4. Thermal Response**

## ACTIVE–REGION SAFE OPERATING AREA

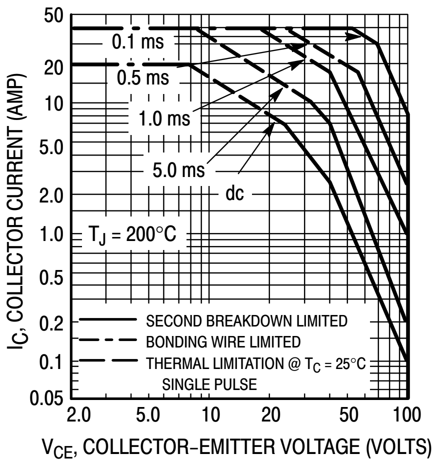



**Figure 5. 2N6284, 2N6287**

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 $T_{J(pk)} = 200°C$; $T_C$ is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} <$ 200°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.

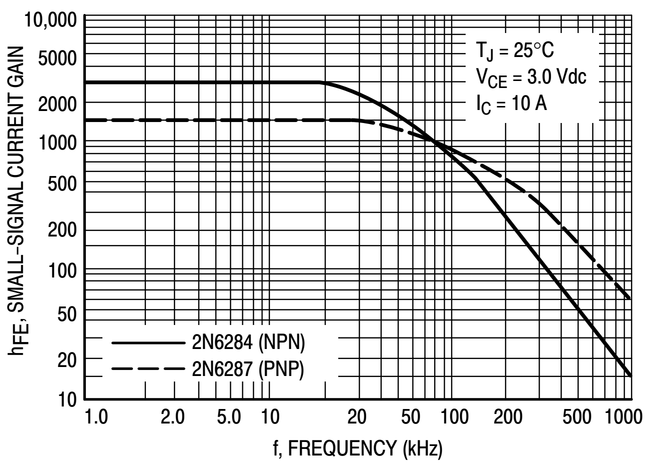



**Figure 6. Small–Signal Current Gain**

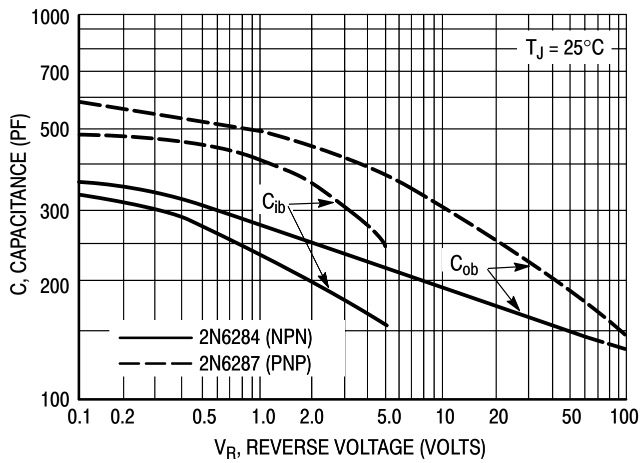



**Figure 7. Capacitance**

**NPN**
**2N6284**

**PNP**
**2N6287**

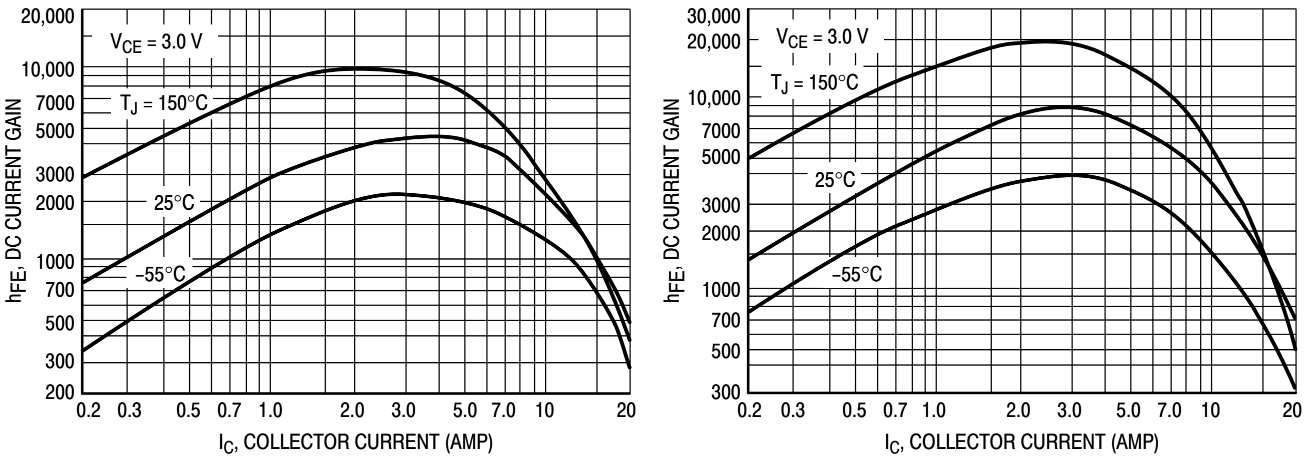



**Figure 8. DC Current Gain**

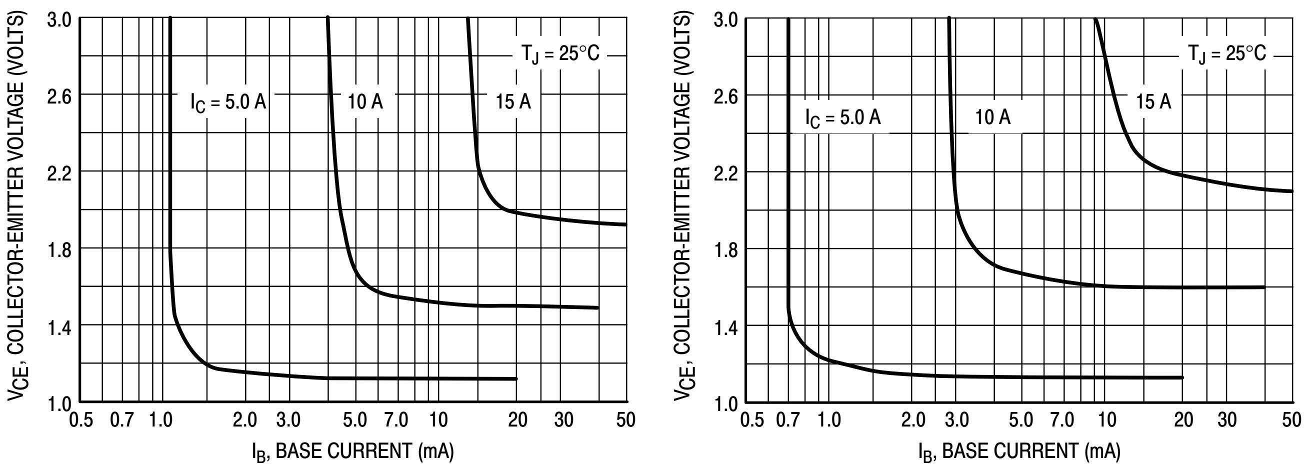



**Figure 9. Collector Saturation Region**

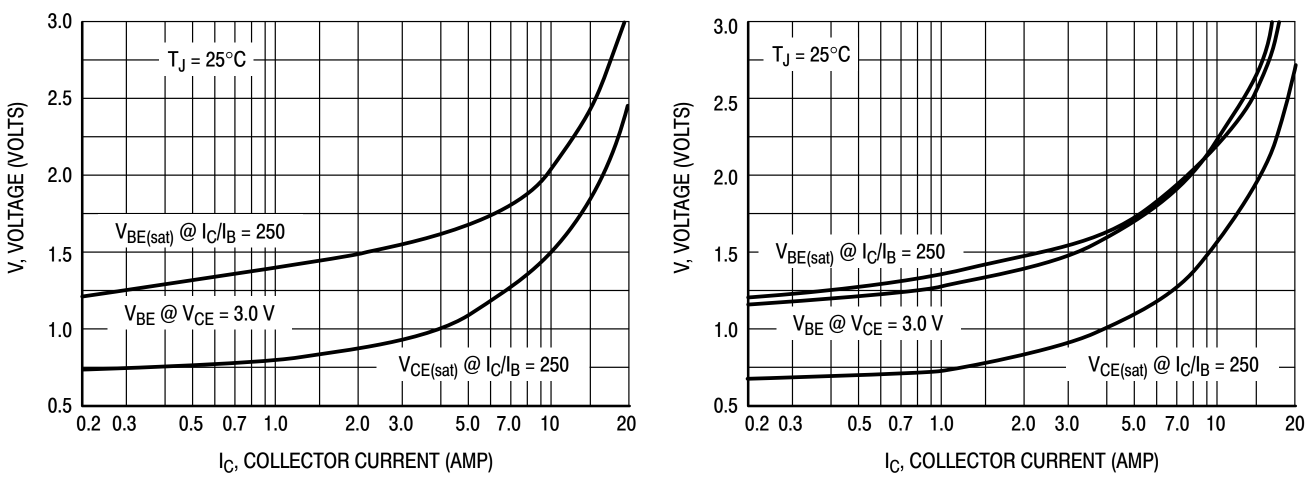



**Figure 10. “On” Voltages**

**NPN**
**2N6284**

**PNP**
**2N6287**

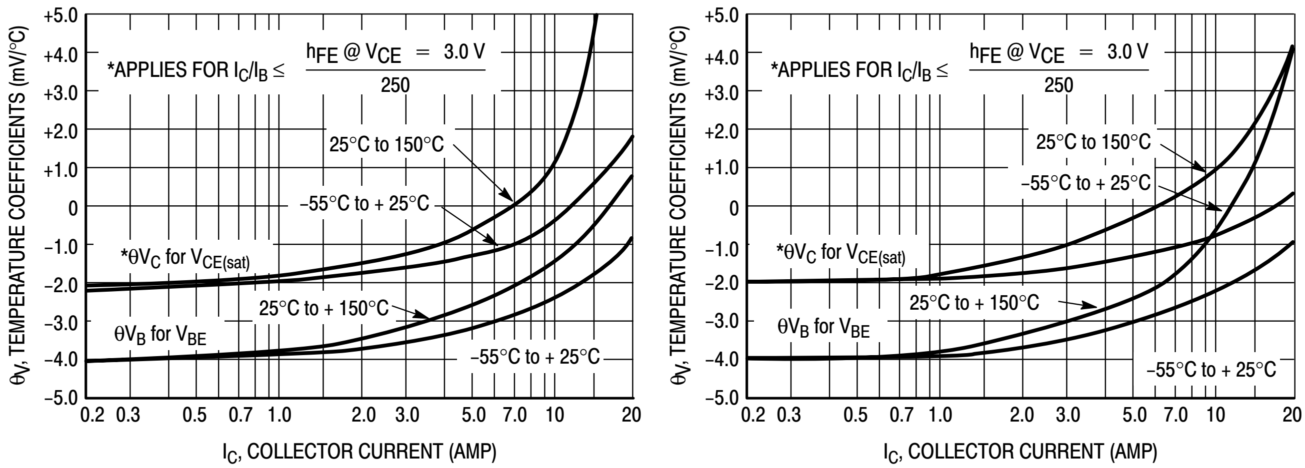



**Figure 11. Temperature Coefficients**

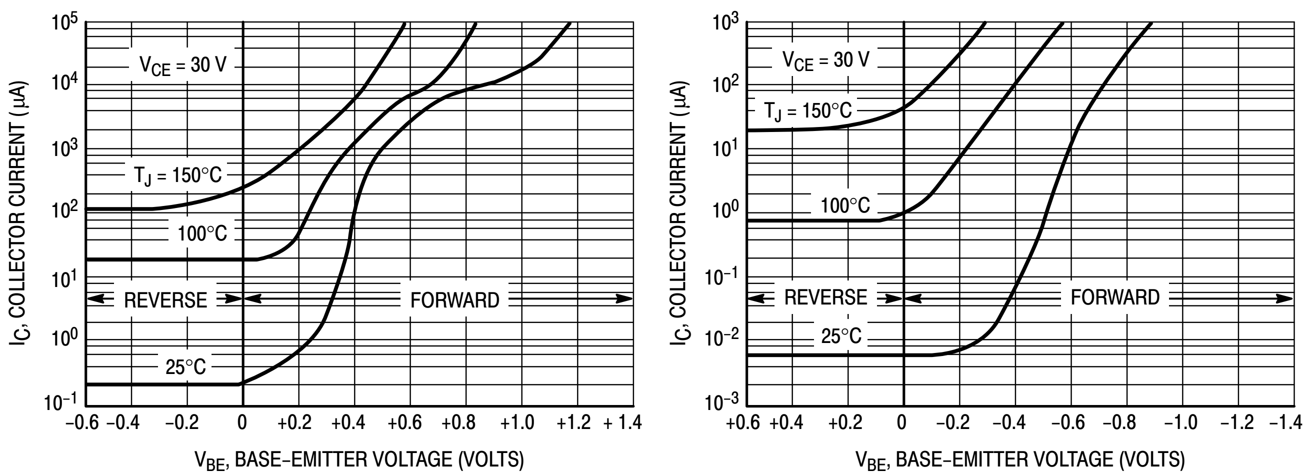



**Figure 12. Collector Cut−Off Region**

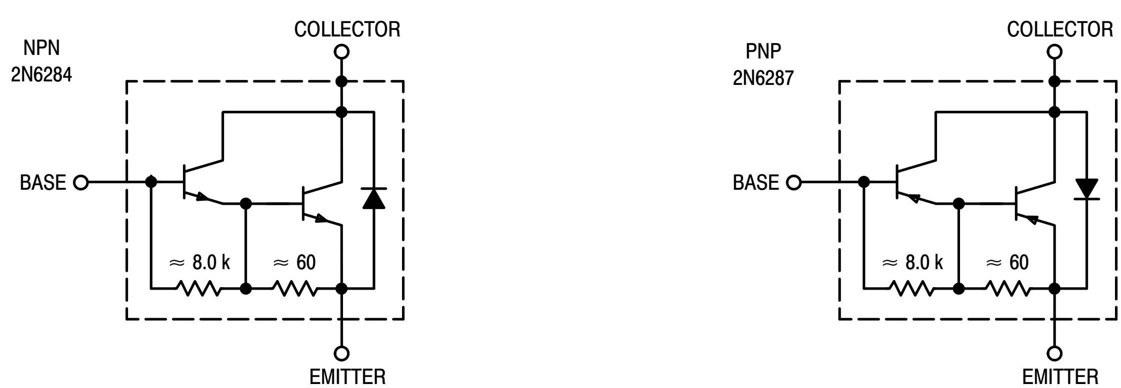
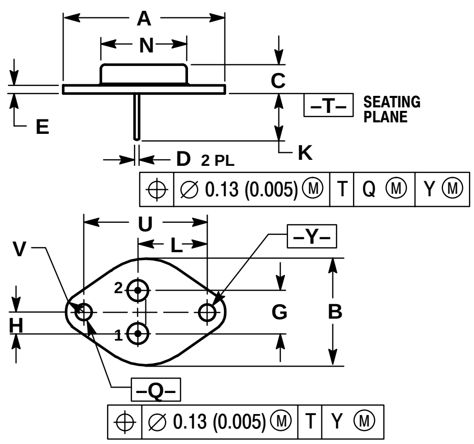



**Figure 13. Darlington Schematic**

## 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 MIN | INCHES MAX | MILLIMETERS MIN | MILLIMETERS 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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