

# 2N6387, 2N6388

## Plastic Medium-Power Silicon Transistors

These devices are designed for general-purpose amplifier and low-speed switching applications.

### Features

- High DC Current Gain –  $h_{FE} = 2500$  (Typ) @  $I_C = 4.0$  Adc
- Collector–Emitter Sustaining Voltage – @ 100 mAcd  
 $V_{CEO(sus)} = 60$  Vdc (Min) – 2N6387  
 $= 80$  Vdc (Min) – 2N6388
- Low Collector–Emitter Saturation Voltage –  
 $V_{CE(sat)} = 2.0$  Vdc (Max) @  $I_C = 5.0$  Adc – 2N6387, 2N6388
- Monolithic Construction with Built–In Base–Emitter Shunt Resistors
- TO–220AB Compact Package
- These Devices are Pb–Free and are RoHS Compliant\*

### MAXIMUM RATINGS (Note 1)

| Rating  | Symbol                        | Value        | Unit                     |
|---|-------------------------------|--------------|--------------------------|
| Collector–Emitter Voltage   | 2N6387<br>2N6388<br>$V_{CEO}$ | 60<br>80     | Vdc                      |
| Collector–Base Voltage  | 2N6387<br>2N6388<br>$V_{CB}$  | 60<br>80     | Vdc                      |
| Emitter–Base Voltage  | $V_{EB}$                      | 5.0          | Vdc                      |
| Collector Current – Continuous<br>– Peak  | $I_C$                         | 10<br>15     | Adc                      |
| Base Current  | $I_B$                         | 250          | mAdc                     |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$                         | 65<br>0.52   | W<br>W/ $^\circ\text{C}$ |
| Total Power Dissipation @ $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$                         | 2.0<br>0.016 | W<br>W/ $^\circ\text{C}$ |
| Operating and Storage Junction,<br>Temperature Range                                  | $T_J, T_{stg}$                | –65 to +150  | $^\circ\text{C}$         |

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.

### THERMAL CHARACTERISTICS

| Characteristics                         | Symbol          | Max  | Unit               |
|---|-----------------|------|--------------------|
| Thermal Resistance, Junction–to–Case    | $R_{\theta JC}$ | 1.92 | $^\circ\text{C/W}$ |
| Thermal Resistance, Junction–to–Ambient | $R_{\theta JA}$ | 62.5 | $^\circ\text{C/W}$ |

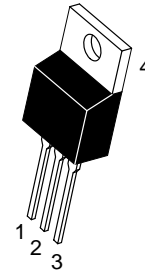
\*For additional information on our Pb–Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



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## DARLINGTON NPN SILICON POWER TRANSISTORS 8 AND 10 AMPERES 65 WATTS, 60 – 80 VOLTS



TO–220  
CASE 221A  
STYLE 1

### MARKING DIAGRAM



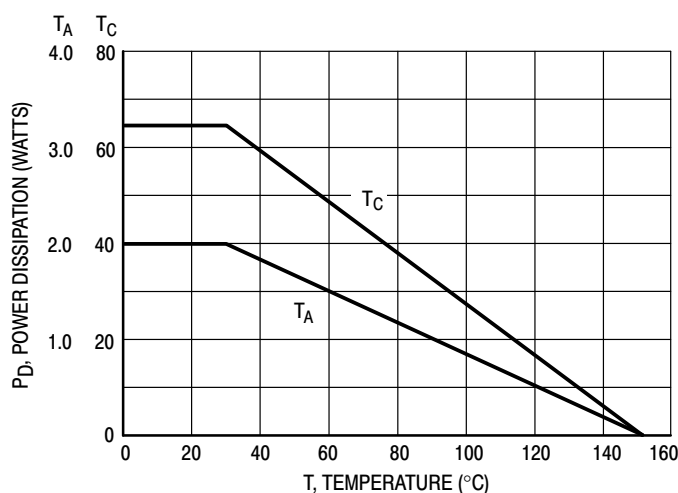
2N638x = Device Code  
x = 7 or 8

G = Pb–Free Package  
A = Assembly Location  
Y = Year  
WW = Work Week

### ORDERING INFORMATION

| Device  | Package             | Shipping        |
|---------|---------------------|-----------------|
| 2N6387G | TO–220<br>(Pb–Free) | 50 Units / Rail |
| 2N6388G | TO–220<br>(Pb–Free) | 50 Units / Rail |

## 2N6387, 2N6388



**Figure 1. Power Derating**

### ELECTRICAL CHARACTERISTICS ( $T_C = 25^\circ\text{C}$ unless otherwise noted) (Note 2)

| Characteristic   | Symbol                               | Min           | Max              | Unit  |
|--|--------------------------------------|---------------|------------------|---|
| <b>OFF CHARACTERISTICS</b>   |                                      |               |                  |   |
| Collector-Emitter Sustaining Voltage (Note 3)<br>( $I_C = 200\text{ mA}$ , $I_B = 0$ )   | 2N6387<br>2N6388                     | $V_{CE(sus)}$ | 60<br>80         | –<br>–<br>Vdc                                   |
| Collector Cutoff Current<br>( $V_{CE} = 60\text{ Vdc}$ , $I_B = 0$ )<br>( $V_{CE} = 80\text{ Vdc}$ , $I_B = 0$ )   | 2N6387<br>2N6388                     | $I_{CEO}$     | –<br>–           | 1.0<br>1.0<br>mA                                |
| Collector Cutoff Current<br>( $V_{CE} = 60\text{ Vdc}$ , $V_{EB(off)} = 1.5\text{ Vdc}$ )<br>( $V_{CE} = 80\text{ Vdc}$ , $V_{EB(off)} = 1.5\text{ Vdc}$ )<br>( $V_{CE} = 60\text{ Vdc}$ , $V_{EB(off)} = 1.5\text{ Vdc}$ , $T_C = 125^\circ\text{C}$ )<br>( $V_{CE} = 80\text{ Vdc}$ , $V_{EB(off)} = 1.5\text{ Vdc}$ , $T_C = 125^\circ\text{C}$ ) | 2N6387<br>2N6388<br>2N6387<br>2N6388 | $I_{CEX}$     | –<br>–<br>–<br>– | 300<br>300<br>3.0<br>3.0<br>$\mu\text{A}$<br>mA |
| Emitter Cutoff Current ( $V_{BE} = 5.0\text{ Vdc}$ , $I_C = 0$ )   |                                      | $I_{EBO}$     | –                | 5.0<br>mA                                       |
| <b>ON CHARACTERISTICS (Note 3)</b>   |                                      |               |                  |   |
| DC Current Gain<br>( $I_C = 5.0\text{ A}$ , $V_{CE} = 3.0\text{ Vdc}$ )<br>( $I_C = 1.0\text{ A}$ , $V_{CE} = 3.0\text{ Vdc}$ )  | 2N6387, 2N6388<br>2N6387, 2N6388     | $h_{FE}$      | 1000<br>100      | 20,000<br>–<br>–                                |
| Collector-Emitter Saturation Voltage<br>( $I_C = 5.0\text{ A}$ , $I_B = 0.01\text{ A}$ )<br>( $I_C = 1.0\text{ A}$ , $I_B = 0.1\text{ A}$ )  | 2N6387, 2N6388<br>2N6387, 2N6388     | $V_{CE(sat)}$ | –<br>–           | 2.0<br>3.0<br>Vdc                               |
| Base-Emitter On Voltage<br>( $I_C = 5.0\text{ A}$ , $V_{CE} = 3.0\text{ Vdc}$ )<br>( $I_C = 1.0\text{ A}$ , $V_{CE} = 3.0\text{ Vdc}$ )  | 2N6387, 2N6388<br>2N6387, 2N6388     | $V_{BE(on)}$  | –<br>–           | 2.8<br>4.5<br>Vdc                               |
| <b>DYNAMIC CHARACTERISTICS</b>   |                                      |               |                  |   |
| Small-Signal Current Gain ( $I_C = 1.0\text{ A}$ , $V_{CE} = 5.0\text{ Vdc}$ , $f_{test} = 1.0\text{ MHz}$ )   |                                      | $ h_{fe} $    | 20               | –<br>–  |
| Output Capacitance ( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )   |                                      | $C_{ob}$      | –                | 200<br>pF                                       |
| Small-Signal Current Gain ( $I_C = 1.0\text{ A}$ , $V_{CE} = 5.0\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )  |                                      | $h_{fe}$      | 1000             | –<br>–  |

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.

2. Indicates JEDEC Registered Data.

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

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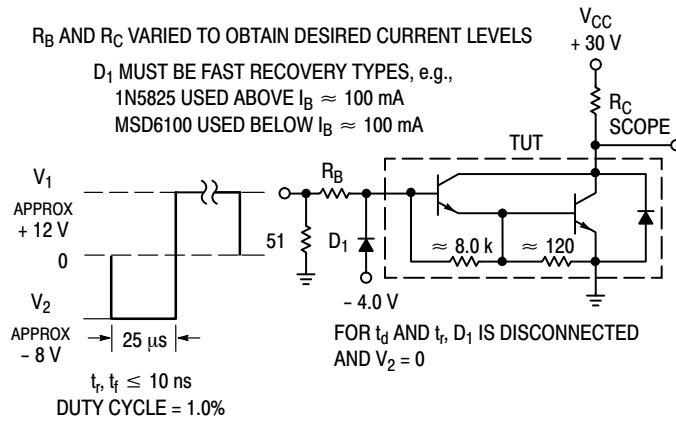


Figure 2. Switching Times Test Circuit

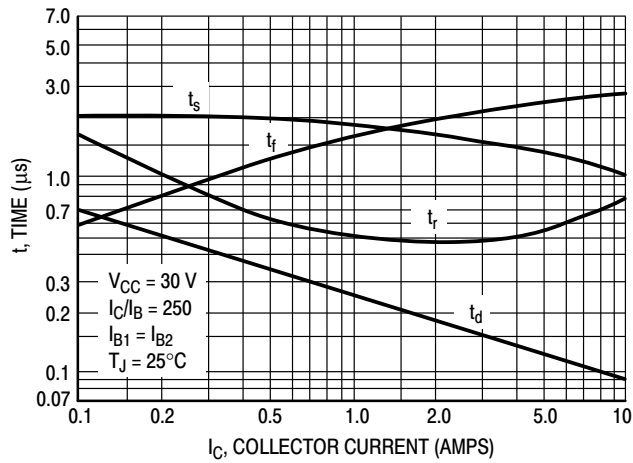


Figure 3. Switching Times

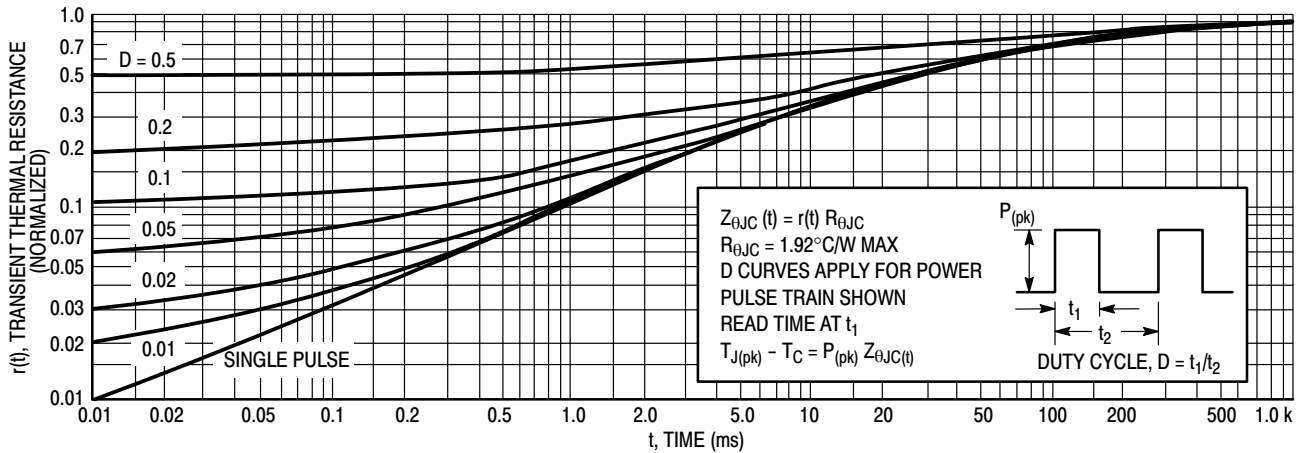


Figure 4. Thermal Response

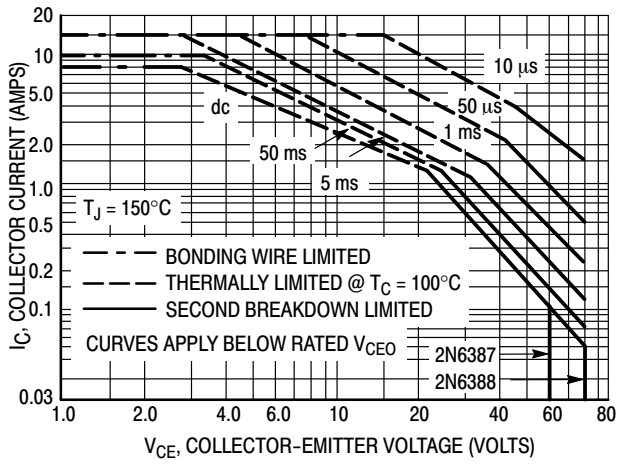


Figure 5. Active-Region Safe Operating Area

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  $T_{J(pk)} = 150^\circ\text{C}$ ;  $T_C$  is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided  $T_{J(pk)} < 150^\circ\text{C}$ .  $T_{J(pk)}$  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

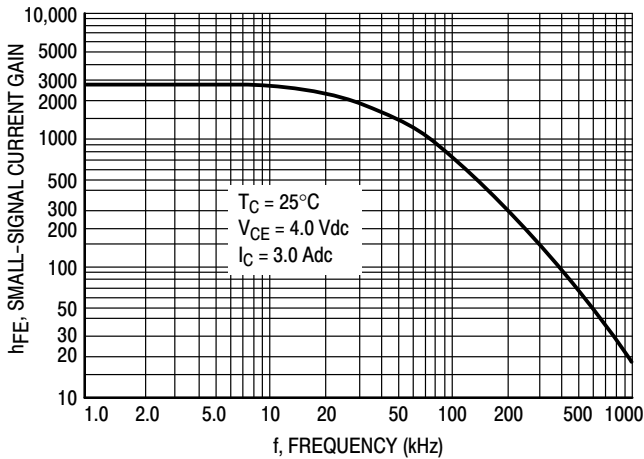


Figure 6. Small-Signal Current Gain

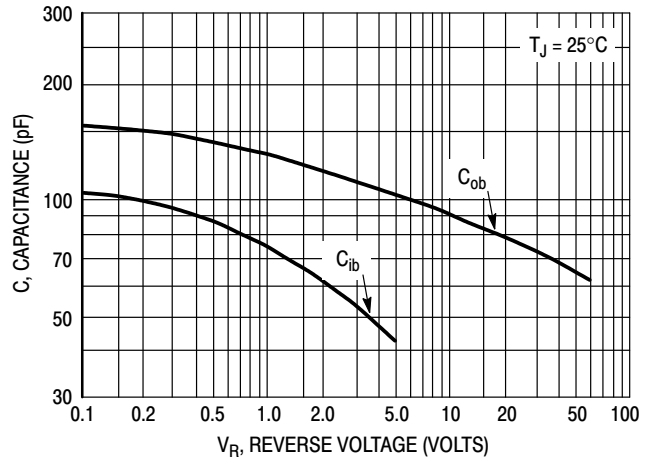


Figure 7. Capacitance

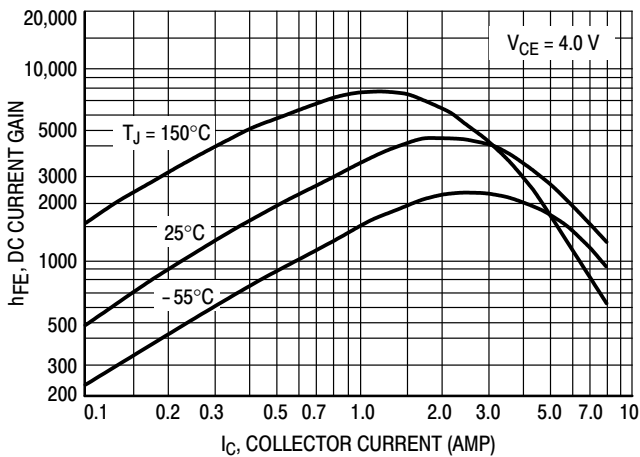


Figure 8. DC Current Gain

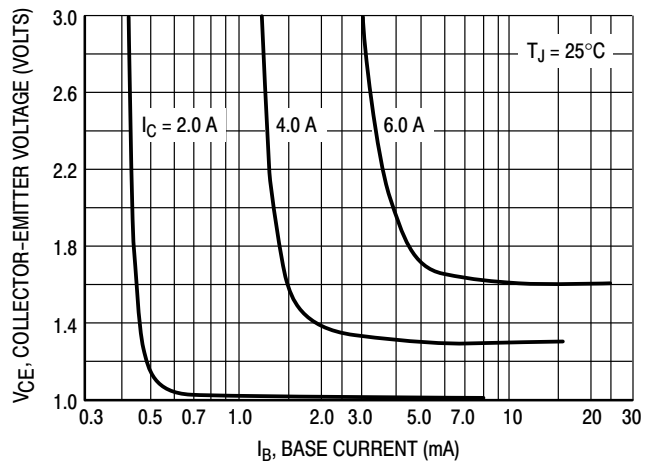


Figure 9. Collector Saturation Region

2N6387, 2N6388

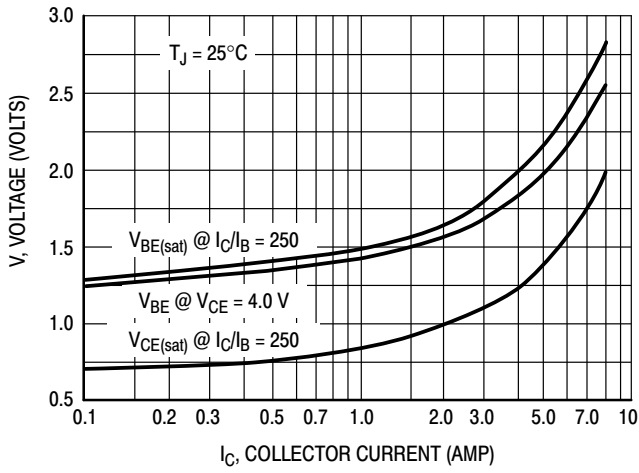


Figure 10. "On" Voltages

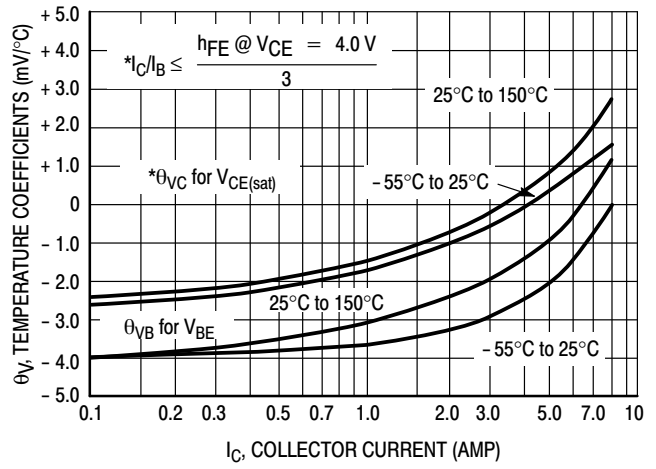


Figure 11. Temperature Coefficients

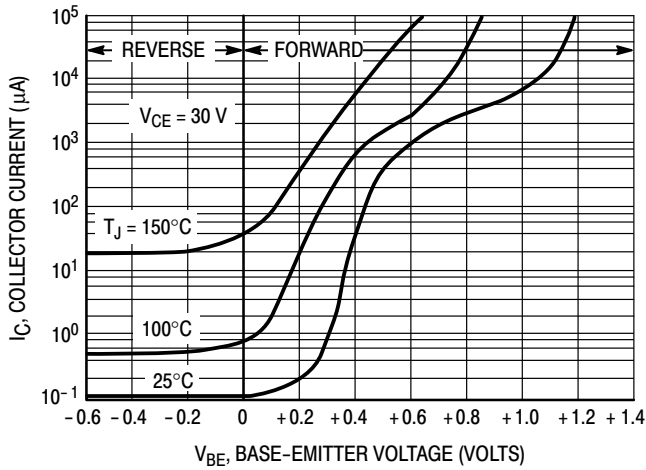


Figure 12. Collector Cut-Off Region

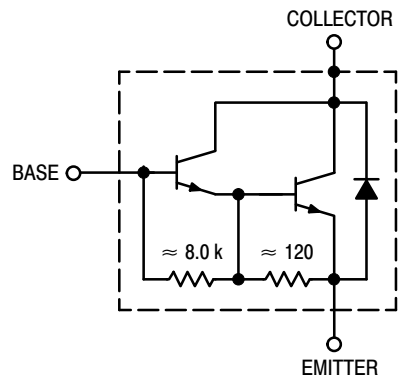


Figure 13. Darlington Schematic

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