# MJD6039

# Darlington Power Transistors

## DPAK For Surface Mount Applications

Designed for general purpose power and switching such as output or driver stages in applications such as switching regulators, convertors, and power amplifiers.

### Features

- Lead Formed for Surface Mount Applications in Plastic Sleeves (No Suffix)
- Straight Lead Version in Plastic Sleeves ("−1" Suffix)
- Monolithic Construction With Built−in Base−Emitter Shunt Resistors
- High DC Current Gain − $h_{FE}$ = 2500 (Typ) @ $I_C$ = 4.0 Adc
- Epoxy Meets UL 94 V−0 @ 0.125 in
- ESD Ratings: Human Body Model, 3B > 8000 V
  Machine Model, C > 400 V
- Pb−Free Package is Available

**MAXIMUM RATINGS**

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Collector−Emitter Voltage | $V_{CEO}$ | 80 | Vdc |
| Collector−Base Voltage | $V_{CB}$ | 80 | Vdc |
| Emitter−Base Voltage | $V_{EB}$ | 5 | Vdc |
| Collector Current − Continuous<br>− Peak | $I_C$ | 4<br>8 | Adc |
| Base Current | $I_B$ | 100 | mAdc |
| Total Power Dissipation @ $T_C$ = 25°C<br>Derate above 25°C | $P_D$ | 20<br>0.16 | W<br>W/°C |
| Total Power Dissipation (Note 1)<br>@ $T_A$ = 25°C<br>Derate above 25°C | $P_D$ | 1.75<br>0.014 | W<br>W/°C |
| Operating and Storage Junction Temperature Range | $T_J$, $T_{stg}$ | −65 to +150 | °C |

**THERMAL CHARACTERISTICS**

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction−to−Case | $R_{\theta JC}$ | 6.25 | °C/W |
| Thermal Resistance, Junction−to−Ambient (Note 1) | $R_{\theta JA}$ | 71.4 | °C/W |

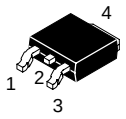
Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1. These ratings are applicable when surface mounted on the minimum pad sizes recommended.

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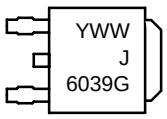
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**SILICON POWER TRANSISTORS 4 AMPERES, 80 VOLTS, 20 WATTS**




**DPAK**
**CASE 369C**
**STYLE 1**

**MARKING DIAGRAM**




Y = Year
WW = Work Week
J6039 = Device Code
G = Pb−Free Package

**ORDERING INFORMATION**

| Device | Package | Shipping† |
|---|---|---|
| MJD6039T4 | DPAK | 2500 / Tape & Reel |
| MJD6039T4G | DPAK (Pb−Free) | 2500 / Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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

| Characteristic | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | |
| Collector−Emitter Sustaining Voltage ($I_C$ = 30 mAdc, $I_B$ = 0) | $V_{CEO(sus)}$ | 80 | − | Vdc |
| Collector−Cutoff Current ($V_{CE}$ = 40 Vdc, $I_B$ = 0) | $I_{CEO}$ | − | 10 | μAdc |
| **ON CHARACTERISTICS** (Note 2) | | | | |
| DC Current Gain ($I_C$ = 1 Adc, $V_{CE}$ = 4 Vdc) ($I_C$ = 2 Adc, $V_{CE}$ = 4 Vdc) | $h_{FE}$ | 1000 500 | − − | − |
| Collector−Emitter Saturation Voltage ($I_C$ = 2 Adc, $I_B$ = 8 mAdc) | $V_{CE(sat)}$ | − | 2.5 | Vdc |
| Base−Emitter On Voltage ($I_C$ = 2 Adc, $V_{CE}$ = 4 Vdc) | $V_{BE(on)}$ | − | 2.8 | Vdc |
| **DYNAMIC CHARACTERISTICS** | | | | |
| Small−Signal Current Gain ($I_C$ = 0.75 Adc, $V_{CE}$ = 10 Vdc, f = 1 kHz) | $h_{fe}$ | 25 | − | − |
| Output Capacitance ($V_{CB}$ = 10 Vdc, $I_E$ = 0, f = 0.1 MHz) | $C_{ob}$ | − | 100 | pF |

2. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

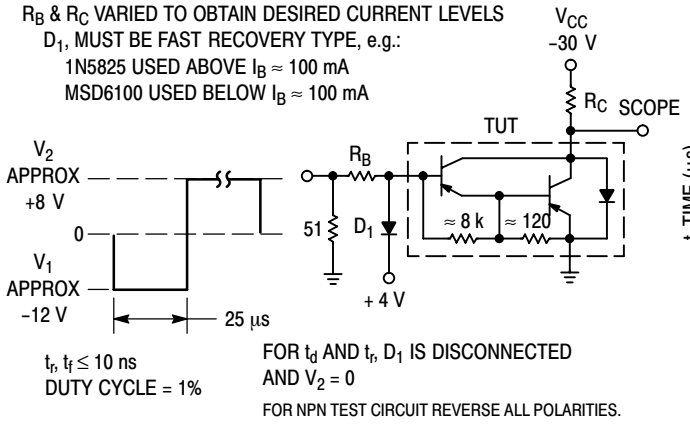



**Figure 1. Switching Times Test Circuit**

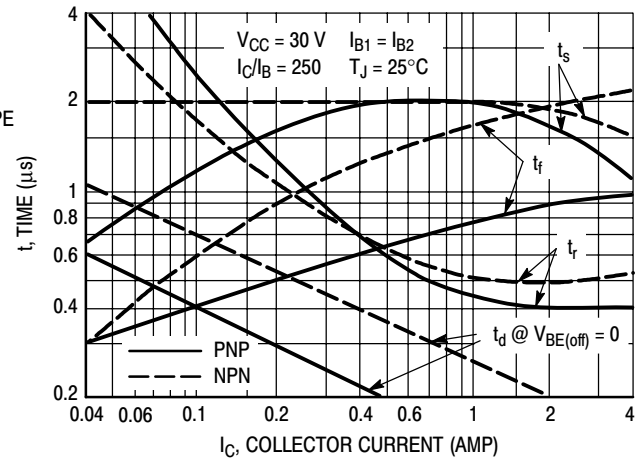



**Figure 2. Switching Times**

## TYPICAL ELECTRICAL CHARACTERISTICS

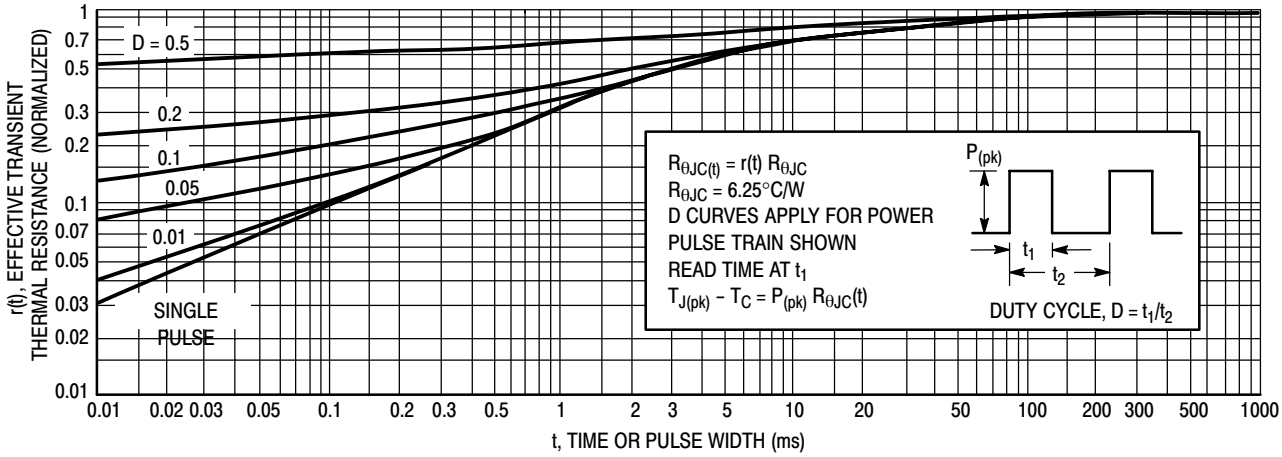



**Figure 3. Thermal Response**

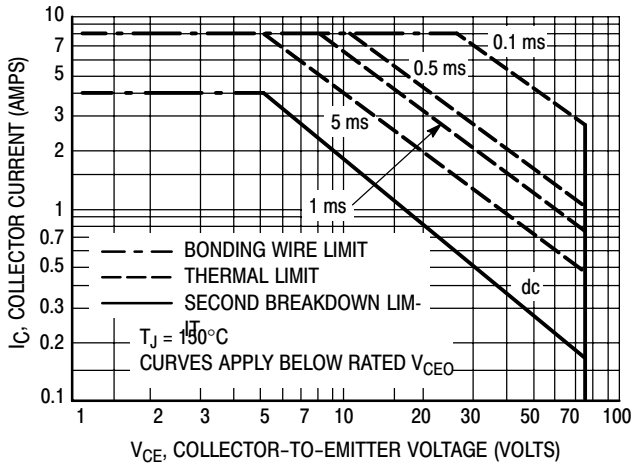



**Figure 4. Maximum Rated Forward Biased Safe Operating Area**

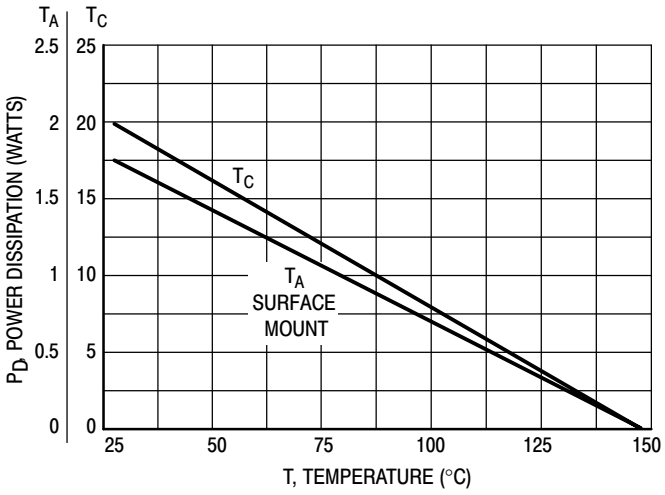



**Figure 5. Power Derating**

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 Figures 6 and 7 is based on $T_{J(pk)} = 150°C$; $T_C$ is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} < 150°C$. $T_{J(pk)}$ may be calculated from the data in Figure 5. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

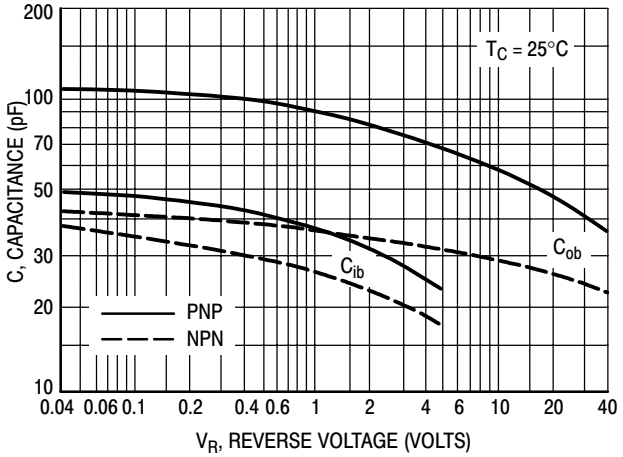



**Figure 6. Capacitance**

## TYPICAL ELECTRICAL CHARACTERISTICS

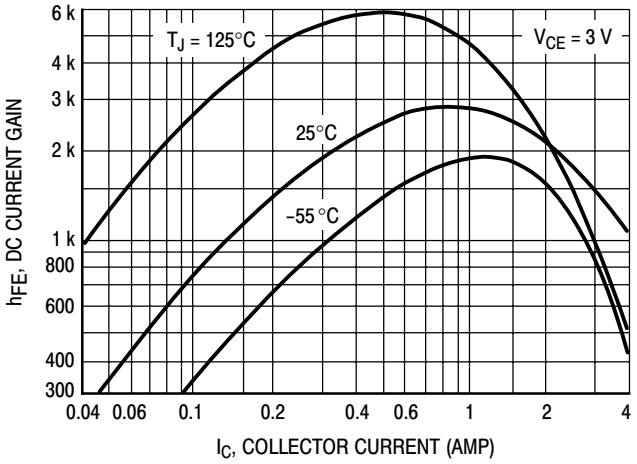



**Figure 7. DC Current Gain**

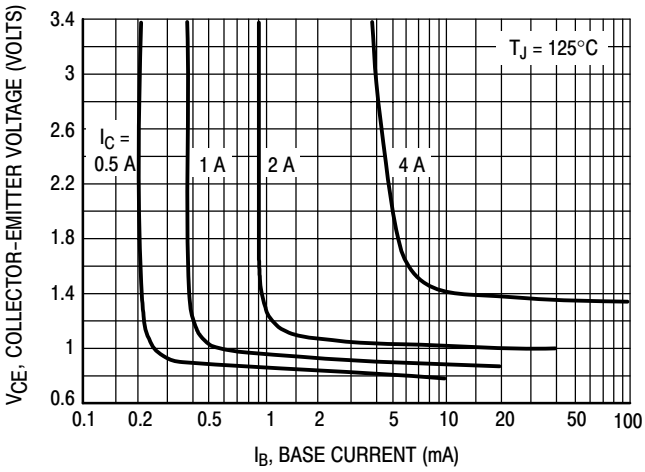



**Figure 8. Collector Saturation Region**

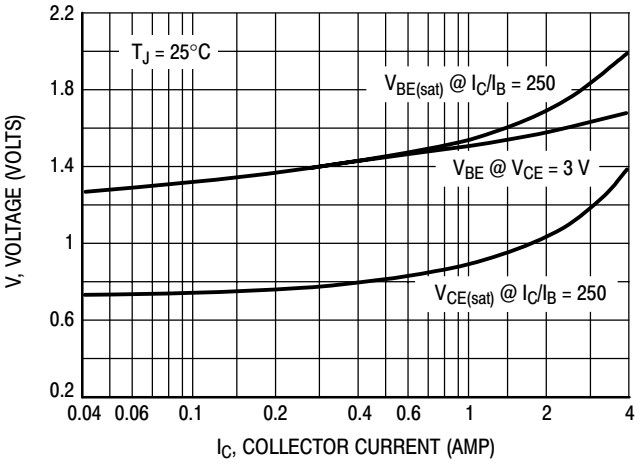



**Figure 9. “On” Voltages**

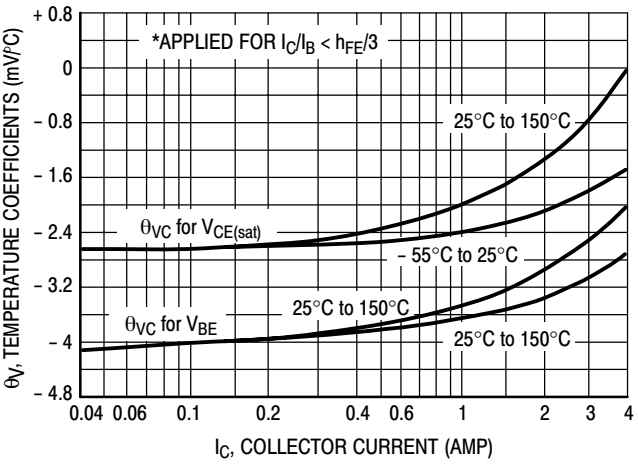



**Figure 10. Temperature Coefficients**

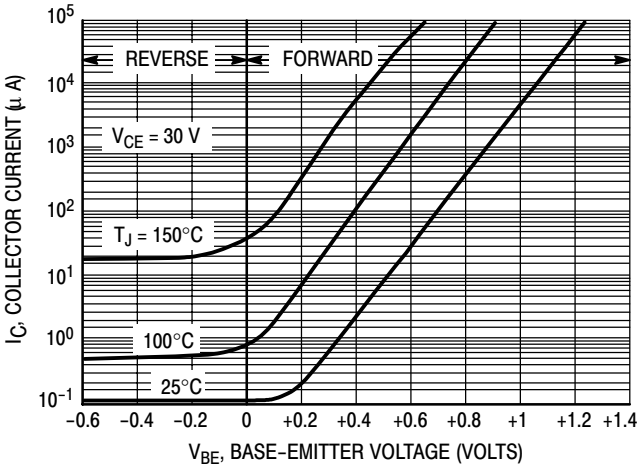



**Figure 11. Collector Cut−Off Region**

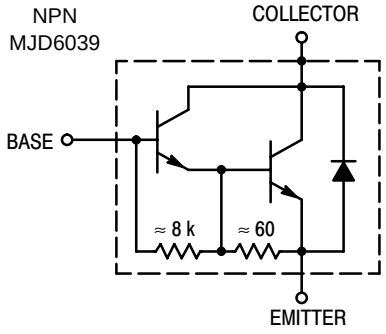
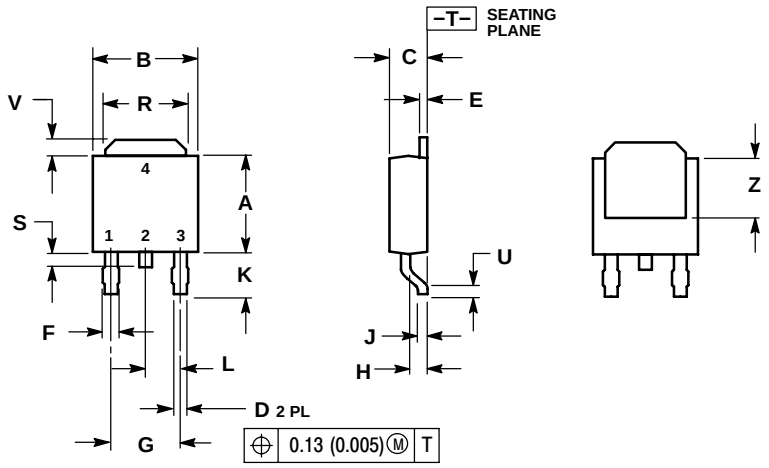



**Figure 12. Darlington Schematic**

# MJD6039

## PACKAGE DIMENSIONS

**DPAK**
CASE 369C
ISSUE O

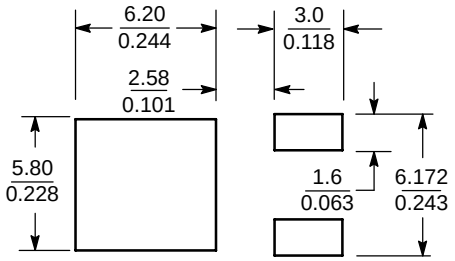



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 0.235 | 0.245 | 5.97 | 6.22 |
| B | 0.250 | 0.265 | 6.35 | 6.73 |
| C | 0.086 | 0.094 | 2.19 | 2.38 |
| D | 0.027 | 0.035 | 0.69 | 0.88 |
| E | 0.018 | 0.023 | 0.46 | 0.58 |
| F | 0.037 | 0.045 | 0.94 | 1.14 |
| G | 0.180 BSC | | 4.58 BSC | |
| H | 0.034 | 0.040 | 0.87 | 1.01 |
| J | 0.018 | 0.023 | 0.46 | 0.58 |
| K | 0.102 | 0.114 | 2.60 | 2.89 |
| L | 0.090 BSC | | 2.29 BSC | |
| R | 0.180 | 0.215 | 4.57 | 5.45 |
| S | 0.025 | 0.040 | 0.63 | 1.01 |
| U | 0.020 | −−− | 0.51 | −−− |
| V | 0.035 | 0.050 | 0.89 | 1.27 |
| Z | 0.155 | −−− | 3.93 | −−− |

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

### SOLDERING FOOTPRINT*




SCALE 3:1 (mm / inches)

*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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