

Complementary Darlington Power Transistors

DPAK For Surface Mount Applications

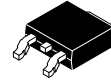
MJD112 (NPN), MJD117 (PNP)

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

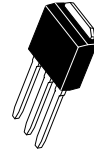
Features

- Lead Formed for Surface Mount Applications in Plastic Sleeves (No Suffix)
- Straight Lead Version in Plastic Sleeves (“-1” Suffix)
- Electrically Similar to Popular TIP31 and TIP32 Series
- NJV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free and are RoHS Compliant*

SILICON
 POWER TRANSISTORS
 2 AMPERES
 100 VOLTS, 20 WATTS

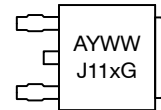


DPAK
CASE 369C

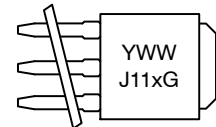


DPAK-3
CASE 369D

MARKING DIAGRAMS



DPAK



DPAK-3

- A = Assembly Location
- Y = Year
- WW = Work Week
- x = 2 or 7
- G = Pb-Free Package

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 8 of this data sheet.

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

MJD112 (NPN), MJD117 (PNP)

MAXIMUM RATINGS

| Rating | Symbol | Max | Unit |
|--|----------------|---------------|--------------------------|
| Collector–Emitter Voltage | V_{CEO} | 100 | Vdc |
| Collector–Base Voltage | V_{CB} | 100 | Vdc |
| Emitter–Base Voltage | V_{EB} | 5 | Vdc |
| Collector Current Continuous Peak | I_C | 2 4 | Adc |
| Base Current | I_B | 50 | mAdc |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C | P_D | 20 0.16 | W W/ $^\circ\text{C}$ |
| Total Power Dissipation (Note1) @ $T_A = 25^\circ\text{C}$ Derate above 25°C | P_D | 1.75 0.014 | W W/ $^\circ\text{C}$ |
| Operating and Storage Junction 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.

THERMAL CHARACTERISTICS

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

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

MJD112 (NPN), MJD117 (PNP)

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

| Characteristic | Symbol | Min | Max | Unit |
|--|-----------------------|--------------------|------------------|------------------|
| OFF CHARACTERISTICS | | | | |
| Collector–Emitter Sustaining Voltage (Note 2) (I _C = 30 mA _{dc} , I _B = 0) | V _{CEO(sus)} | 100 | – | V _{dc} |
| Collector Cutoff Current (V _{CE} = 50 V _{dc} , I _B = 0) | I _{CEO} | – | 20 | μA _{dc} |
| Collector Cutoff Current (V _{CB} = 100 V _{dc} , I _E = 0) | I _{CBO} | – | 20 | μA _{dc} |
| Emitter Cutoff Current (V _{BE} = 5 V _{dc} , I _C = 0) | I _{EBO} | – | 2 | mA _{dc} |
| Collector–Cutoff Current (V _{CB} = 80 V _{dc} , I _E = 0) | I _{CBO} | – | 10 | μA _{dc} |
| Emitter–Cutoff Current (V _{BE} = 5 V _{dc} , I _C = 0) | I _{EBO} | – | 2 | mA _{dc} |
| ON CHARACTERISTICS | | | | |
| DC Current Gain (I _C = 0.5 A _{dc} , V _{CE} = 3 V _{dc}) (I _C = 2 A _{dc} , V _{CE} = 3 V _{dc}) (I _C = 4 A _{dc} , V _{CE} = 3 V _{dc}) | h _{FE} | 500 1000 200 | – 12,000 – | – |
| Collector–Emitter Saturation Voltage (I _C = 2 A _{dc} , I _B = 8 mA _{dc}) (I _C = 4 A _{dc} , I _B = 40 mA _{dc}) | V _{CE(sat)} | – – | 2 3 | V _{dc} |
| Base–Emitter Saturation Voltage (I _C = 4 A _{dc} , I _B = 40 mA _{dc}) | V _{BE(sat)} | – | 4 | V _{dc} |
| Base–Emitter On Voltage (I _C = 2 A _{dc} , V _{CE} = 3 V _{dc}) | V _{BE(on)} | – | 2.8 | V _{dc} |
| DYNAMIC CHARACTERISTICS | | | | |
| Current–Gain – Bandwidth Product (I _C = 0.75 A _{dc} , V _{CE} = 10 V _{dc} , f = 1 MHz) | f _T | 25 | – | MHz |
| Output Capacitance (V _{CB} = 10 V _{dc} , I _E = 0, f = 0.1 MHz) MJD117, NJVMJD117T4G MJD112, NJVMJD112G, NJVMJD112T4G | C _{ob} | – – | 200 100 | pF |

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

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

MJD112 (NPN), MJD117 (PNP)

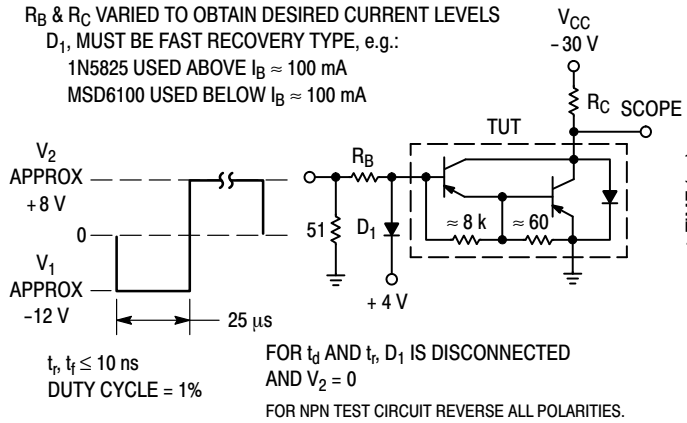


Figure 1. Switching Times Test Circuit

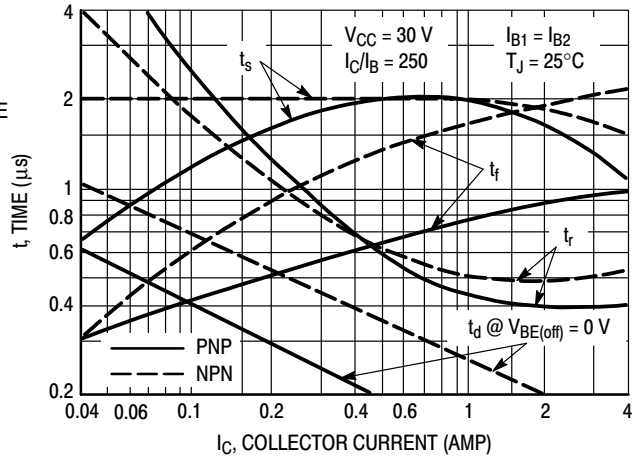


Figure 2. Switching Times

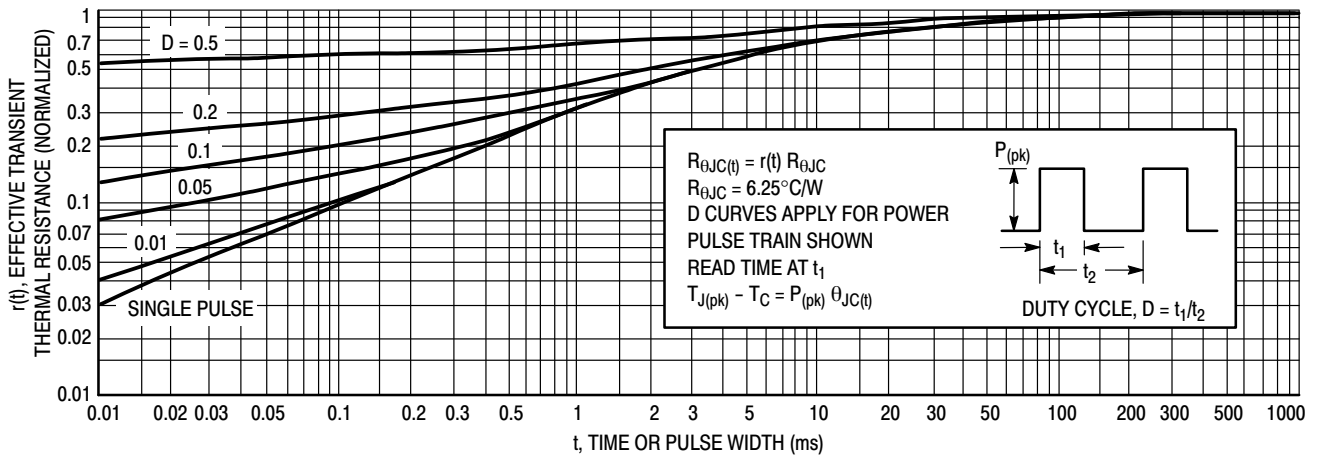


Figure 3. Thermal Response

MJD112 (NPN), MJD117 (PNP)

ACTIVE-REGION SAFE-OPERATING AREA

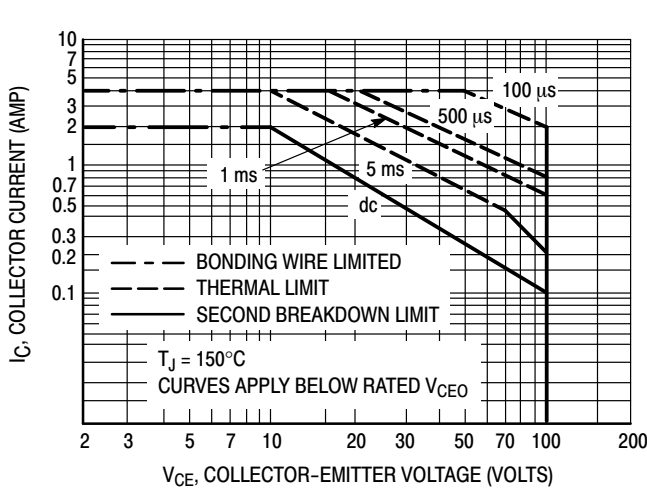


Figure 4. Maximum Rated Forward Biased Safe Operating Area

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 Figures 5 and 6 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.

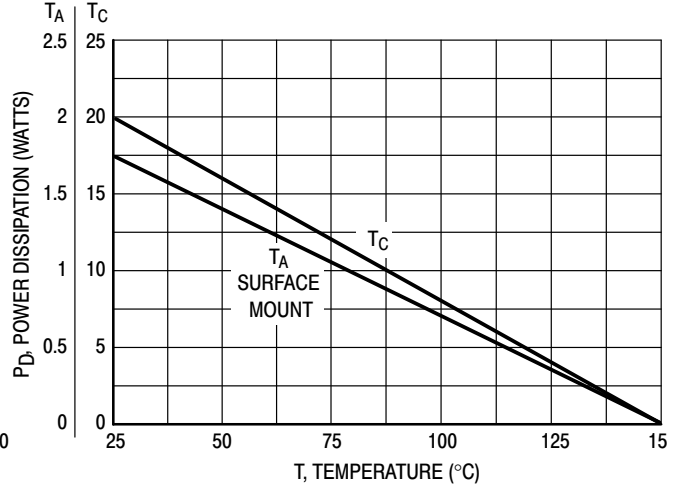


Figure 5. Power Derating

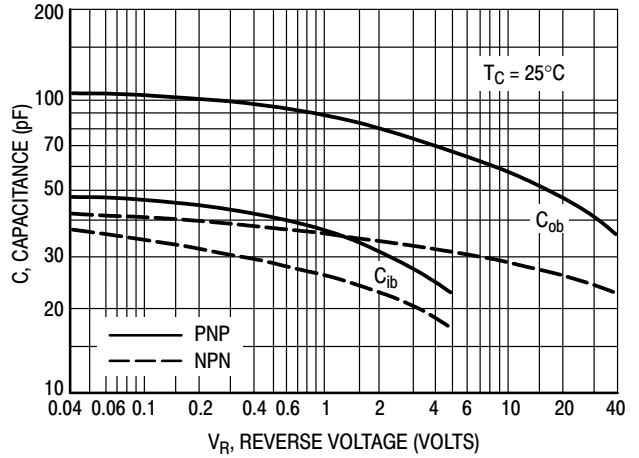


Figure 6. Capacitance

MJD112 (NPN), MJD117 (PNP)

TYPICAL ELECTRICAL CHARACTERISTICS

NPN MJD112

PNP MJD117

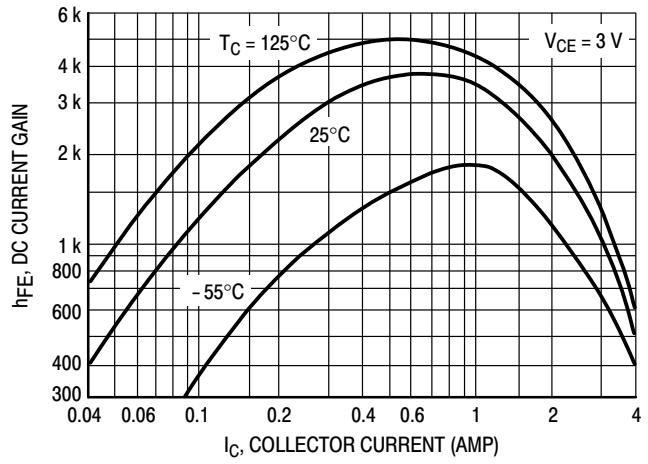
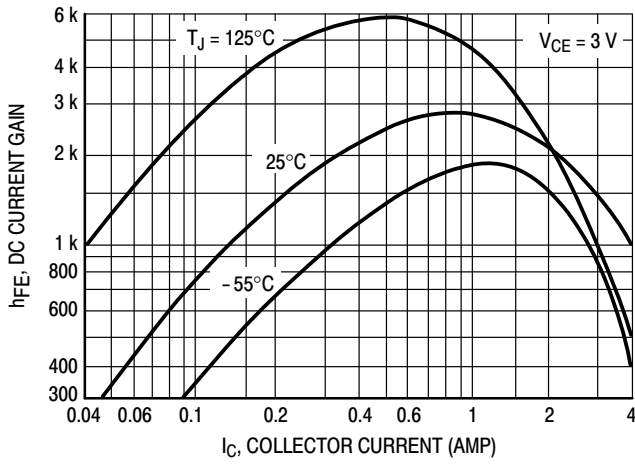


Figure 7. DC Current Gain

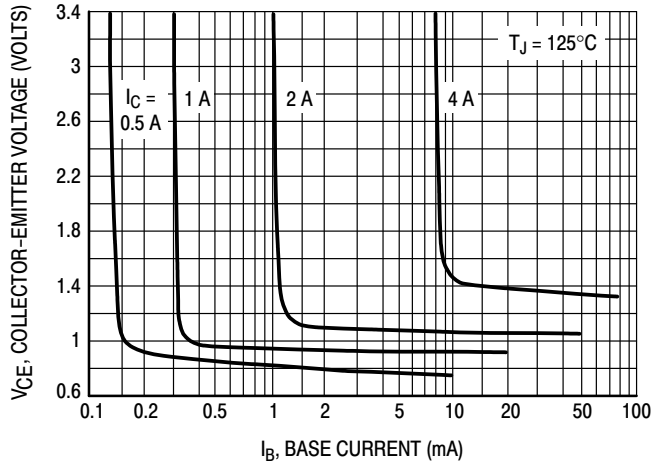
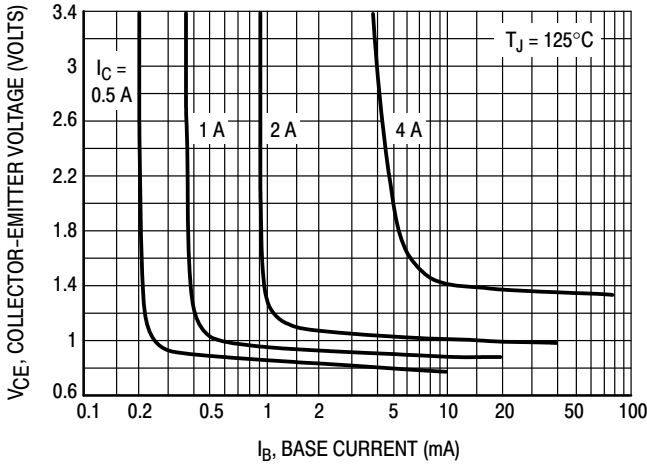


Figure 8. Collector Saturation Region

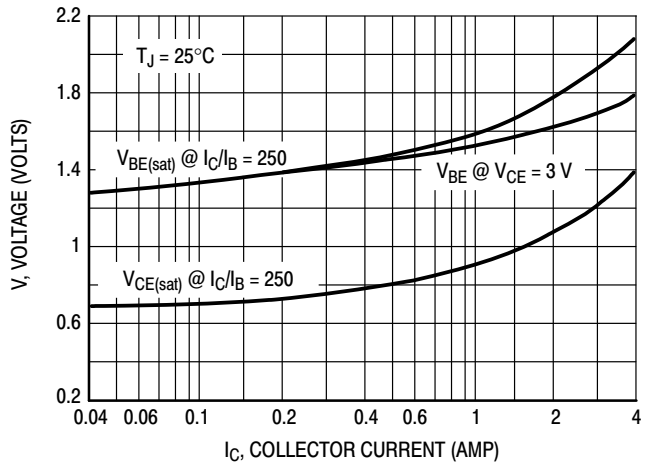
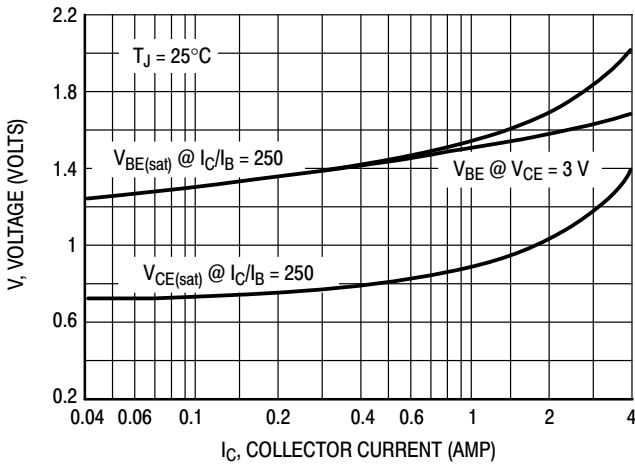


Figure 9. "On Voltages"

MJD112 (NPN), MJD117 (PNP)

NPN MJD112

PNP MJD117

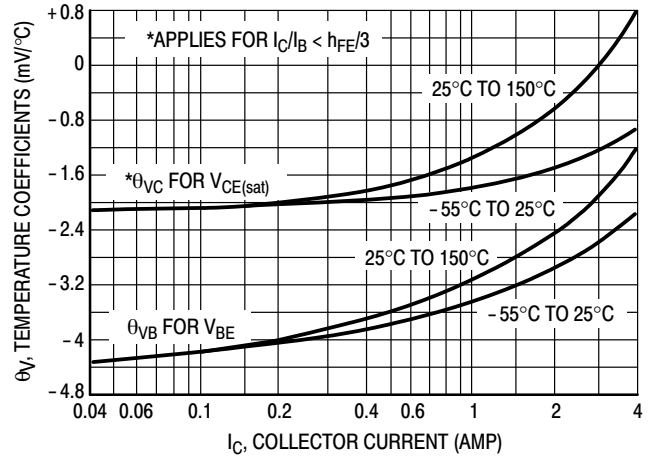
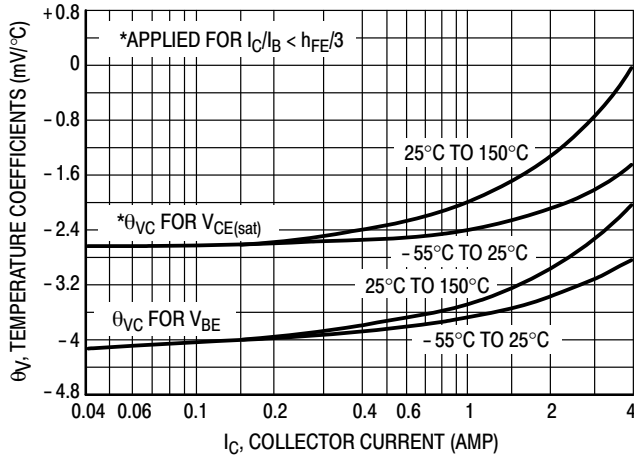


Figure 10. Temperature Coefficients

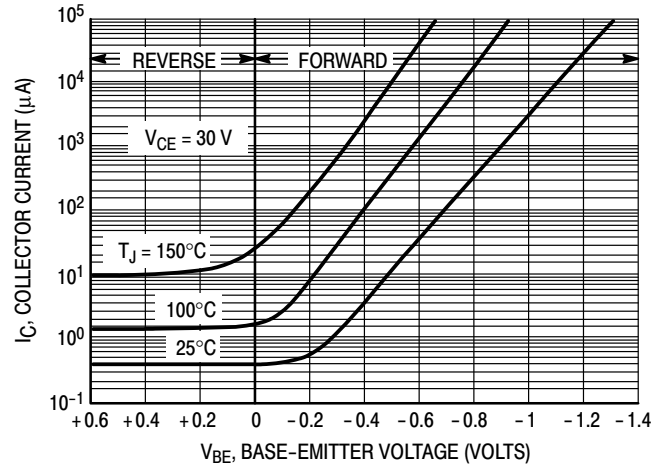
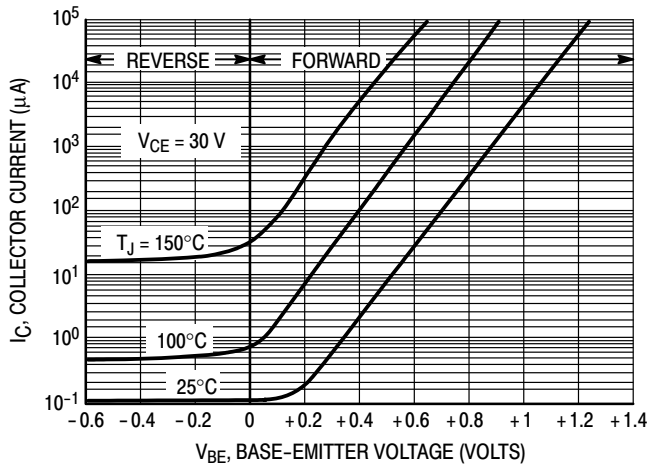


Figure 11. Collector Cut-Off Region

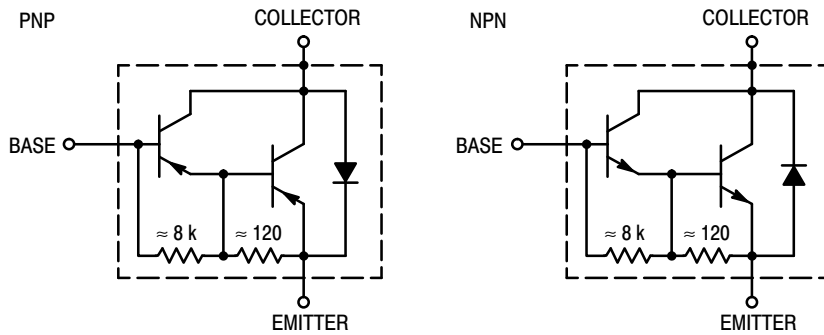


Figure 12. Darlington Schematic

MJD112 (NPN), MJD117 (PNP)

ORDERING INFORMATION

| Device | Package Type | Package | Shipping [†] |
|---------------|---------------------|---------|-----------------------|
| MJD112G | DPAK (Pb-Free) | 369C | 75 Units / Rail |
| NJVMJD112G* | DPAK (Pb-Free) | 369C | 75 Units / Rail |
| MJD112-1G | DPAK-3 (Pb-Free) | 369D | 75 Units / Rail |
| MJD112RLG | DPAK (Pb-Free) | 369C | 1,800 Tape & Reel |
| MJD112T4G | DPAK (Pb-Free) | 369C | 2,500 Tape & Reel |
| NJVMJD112T4G* | DPAK (Pb-Free) | 369C | 2,500 Tape & Reel |
| MJD117G | DPAK (Pb-Free) | 369C | 75 Units / Rail |
| MJD117-1G | DPAK-3 (Pb-Free) | 369D | 75 Units / Rail |
| MJD117RLG | DPAK (Pb-Free) | 369C | 1,800 Tape & Reel |
| MJD117T4G | DPAK (Pb-Free) | 369C | 2,500 Tape & Reel |
| NJVMJD117T4G* | DPAK (Pb-Free) | 369C | 2,500 Tape & Reel |

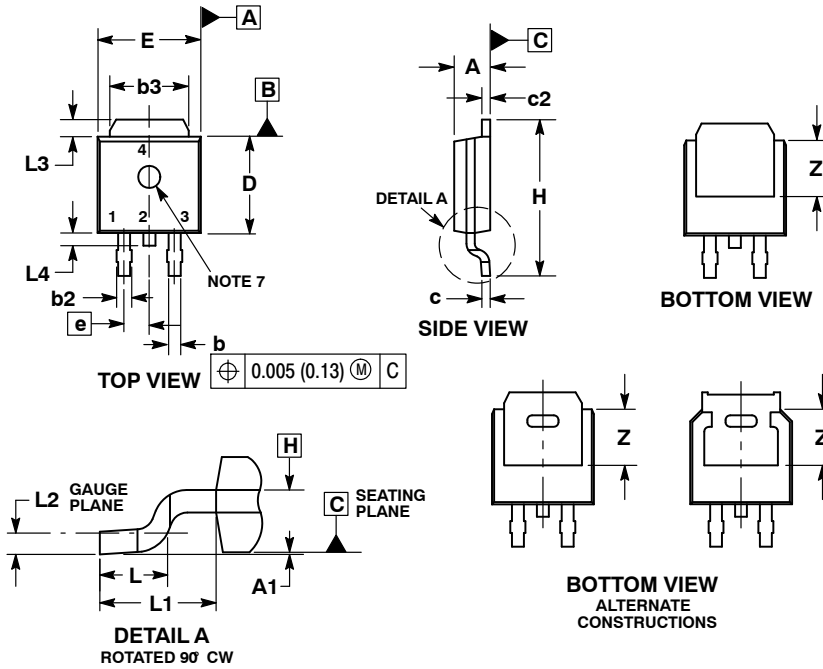
[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

*NJV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable.

MJD112 (NPN), MJD117 (PNP)

PACKAGE DIMENSIONS

DPAK (SINGLE GAUGE) CASE 369C ISSUE F



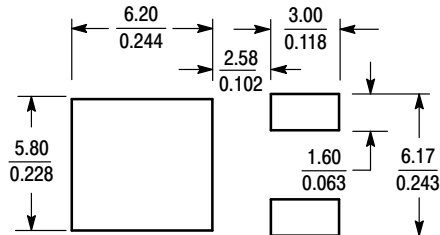
NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b3, L3 and Z.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.006 INCHES PER SIDE.
5. DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
6. DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.
7. OPTIONAL MOLD FEATURE.

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.086 | 0.094 | 2.18 | 2.38 |
| A1 | 0.000 | 0.005 | 0.00 | 0.13 |
| b | 0.025 | 0.035 | 0.63 | 0.89 |
| b2 | 0.028 | 0.045 | 0.72 | 1.14 |
| b3 | 0.180 | 0.215 | 4.57 | 5.46 |
| c | 0.018 | 0.024 | 0.46 | 0.61 |
| c2 | 0.018 | 0.024 | 0.46 | 0.61 |
| D | 0.235 | 0.245 | 5.97 | 6.22 |
| E | 0.250 | 0.265 | 6.35 | 6.73 |
| e | 0.090 BSC | | 2.29 BSC | |
| H | 0.370 | 0.410 | 9.40 | 10.41 |
| L | 0.055 | 0.070 | 1.40 | 1.78 |
| L1 | 0.114 REF | | 2.90 REF | |
| L2 | 0.020 BSC | | 0.51 BSC | |
| L3 | 0.035 | 0.050 | 0.89 | 1.27 |
| L4 | --- | 0.040 | --- | 1.01 |
| Z | 0.155 | --- | 3.93 | --- |

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

SOLDERING FOOTPRINT*



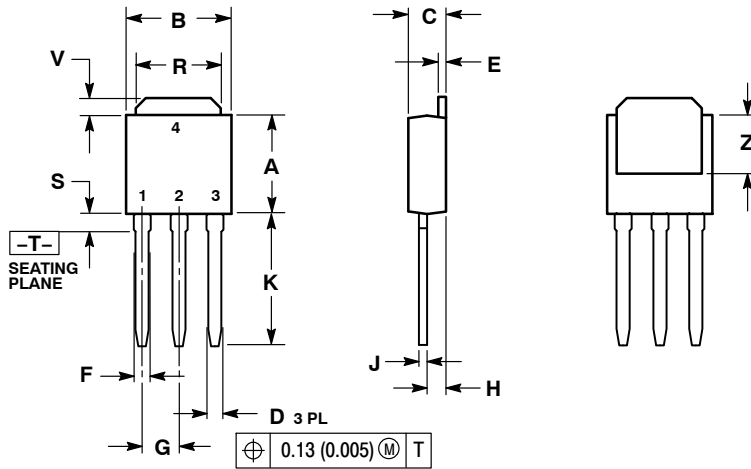
SCALE 3:1 $\left(\frac{\text{mm}}{\text{inches}} \right)$

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

MJD112 (NPN), MJD117 (PNP)

PACKAGE DIMENSIONS

IPAK CASE 369D ISSUE C



NOTES:

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

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|------|
| | MIN | MAX | MIN | MAX |
| A | 0.235 | 0.245 | 5.97 | 6.35 |
| 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 | 0.090 BSC | | 2.29 BSC | |
| H | 0.034 | 0.040 | 0.87 | 1.01 |
| J | 0.018 | 0.023 | 0.46 | 0.58 |
| K | 0.350 | 0.380 | 8.89 | 9.65 |
| R | 0.180 | 0.215 | 4.45 | 5.45 |
| S | 0.025 | 0.040 | 0.63 | 1.01 |
| 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

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