

# Complementary Plastic Power Transistors

## NPN/PNP Silicon DPAK For Surface Mount Applications

### MJD200 (NPN), MJD210 (PNP)

Designed for low voltage, low-power, high-gain audio amplifier applications.

#### Features

- High DC Current Gain
- Lead Formed for Surface Mount Applications in Plastic Sleeves (No Suffix)
- Low Collector-Emitter Saturation Voltage
- High Current-Gain – Bandwidth Product
- Annular Construction for Low Leakage
- Epoxy Meets UL 94 V-0 @ 0.125 in
- 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

#### MAXIMUM RATINGS

| Rating                                                                                            | Symbol         | Max          | Unit                     |
|---------------------------------------------------------------------------------------------------|----------------|--------------|--------------------------|
| Collector-Base Voltage                                                                            | $V_{CB}$       | 40           | Vdc                      |
| Collector-Emitter Voltage                                                                         | $V_{CEO}$      | 25           | Vdc                      |
| Emitter-Base Voltage                                                                              | $V_{EB}$       | 8.0          | Vdc                      |
| Collector Current – Continuous                                                                    | $I_C$          | 5.0          | Adc                      |
| Collector Current – Peak                                                                          | $I_{CM}$       | 10           | Adc                      |
| Base Current                                                                                      | $I_B$          | 1.0          | Adc                      |
| Total Power Dissipation<br>@ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$          | $P_D$          | 12.5<br>0.1  | W<br>W/ $^\circ\text{C}$ |
| Total Power Dissipation (Note 1)<br>@ $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 1.4<br>0.011 | W<br>W/ $^\circ\text{C}$ |
| Operating and Storage Junction Temperature Range                                                  | $T_J, T_{stg}$ | -65 to +150  | $^\circ\text{C}$         |
| ESD – Human Body Model                                                                            | HBM            | 3B           | V                        |
| ESD – Machine Model                                                                               | MM             | C            | V                        |

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

#### THERMAL CHARACTERISTICS

| Characteristic                                   | Symbol          | Max  | Unit               |
|--------------------------------------------------|-----------------|------|--------------------|
| Thermal Resistance, Junction-to-Case             | $R_{\theta JC}$ | 10   | $^\circ\text{C/W}$ |
| Thermal Resistance, Junction-to-Ambient (Note 2) | $R_{\theta JA}$ | 89.3 | $^\circ\text{C/W}$ |

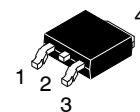
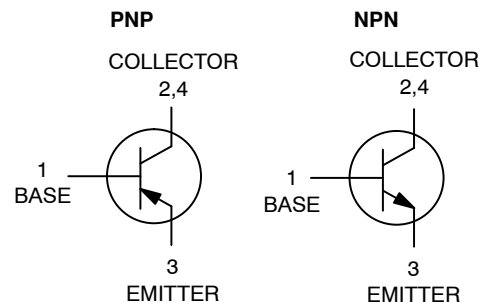
2. These ratings are applicable when surface mounted on the minimum pad sizes recommended.



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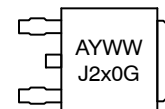
[www.onsemi.com](http://www.onsemi.com)

### SILICON POWER TRANSISTORS 5 AMPERES 25 VOLTS, 12.5 WATTS



**DPAK  
CASE 369C  
STYLE 1**

#### MARKING DIAGRAM



A = Assembly Location  
Y = Year  
WW = Work Week  
x = 1 or 0  
G = Pb-Free Package

#### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

# MJD200 (NPN), MJD210 (PNP)

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

| Characteristic                                                                                                                                                                                                 | Symbol         | Min            | Max                | Unit                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------|--------------------|-------------------------|
| <b>OFF CHARACTERISTICS</b>                                                                                                                                                                                     |                |                |                    |                         |
| Collector-Emitter Sustaining Voltage (Note 3)<br>( $I_C = 10\text{ mAdc}$ , $I_B = 0$ )                                                                                                                        | $V_{CEO(sus)}$ | 25             | –                  | Vdc                     |
| Collector Cutoff Current<br>( $V_{CB} = 40\text{ Vdc}$ , $I_E = 0$ )<br>( $V_{CB} = 40\text{ Vdc}$ , $I_E = 0$ , $T_J = 125^\circ\text{C}$ )                                                                   | $I_{CBO}$      | –              | 100<br>100         | nAdc<br>$\mu\text{Adc}$ |
| Emitter Cutoff Current<br>( $V_{BE} = 8\text{ Vdc}$ , $I_C = 0$ )                                                                                                                                              | $I_{EBO}$      | –              | 100                | nAdc                    |
| <b>ON CHARACTERISTICS</b>                                                                                                                                                                                      |                |                |                    |                         |
| C Current Gain (Note 3),<br>( $I_C = 500\text{ mAdc}$ , $V_{CE} = 1\text{ Vdc}$ )<br>( $I_C = 2\text{ Adc}$ , $V_{CE} = 1\text{ Vdc}$ )<br>( $I_C = 5\text{ Adc}$ , $V_{CE} = 2\text{ Vdc}$ )                  | $h_{FE}$       | 70<br>45<br>10 | –<br>180<br>–      | –                       |
| Collector-Emitter Saturation Voltage (Note 3)<br>( $I_C = 500\text{ mAdc}$ , $I_B = 50\text{ mAdc}$ )<br>( $I_C = 2\text{ Adc}$ , $I_B = 200\text{ mAdc}$ )<br>( $I_C = 5\text{ Adc}$ , $I_B = 1\text{ Adc}$ ) | $V_{CE(sat)}$  | –<br>–<br>–    | 0.3<br>0.75<br>1.8 | Vdc                     |
| Base-Emitter Saturation Voltage (Note 3)<br>( $I_C = 5\text{ Adc}$ , $I_B = 1\text{ Adc}$ )                                                                                                                    | $V_{BE(sat)}$  | –              | 2.5                | Vdc                     |
| Base-Emitter On Voltage (Note 3)<br>( $I_C = 2\text{ Adc}$ , $V_{CE} = 1\text{ Vdc}$ )                                                                                                                         | $V_{BE(on)}$   | –              | 1.6                | Vdc                     |
| <b>DYNAMIC CHARACTERISTICS</b>                                                                                                                                                                                 |                |                |                    |                         |
| Current-Gain – Bandwidth Product (Note 4)<br>( $I_C = 100\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f_{test} = 10\text{ MHz}$ )                                                                               | $f_T$          | 65             | –                  | MHz                     |
| Output Capacitance<br>( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f = 0.1\text{ MHz}$ )<br>MJD200<br>MJD210, NJVMJD210T4G                                                                                        | $C_{ob}$       | –<br>–         | 80<br>120          | pF                      |

3. Pulse Test: Pulse Width = 300  $\mu\text{s}$ , Duty Cycle  $\approx 2\%$ .

4.  $f_T = |h_{fe}| \cdot f_{test}$ .

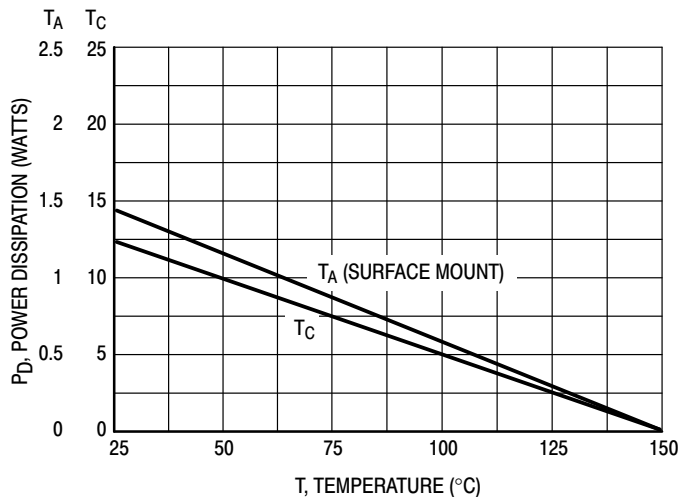


Figure 1. Power Derating

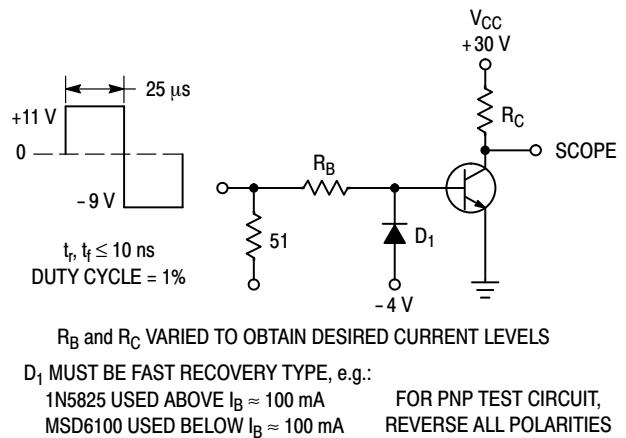


Figure 2. Switching Time Test Circuit

## MJD200 (NPN), MJD210 (PNP)

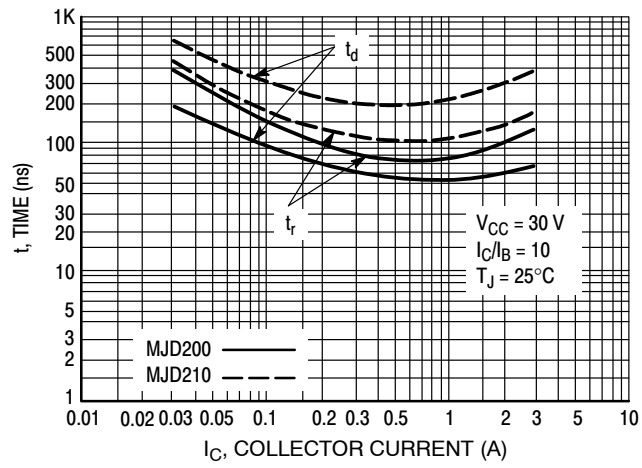


Figure 3. Turn-On Time

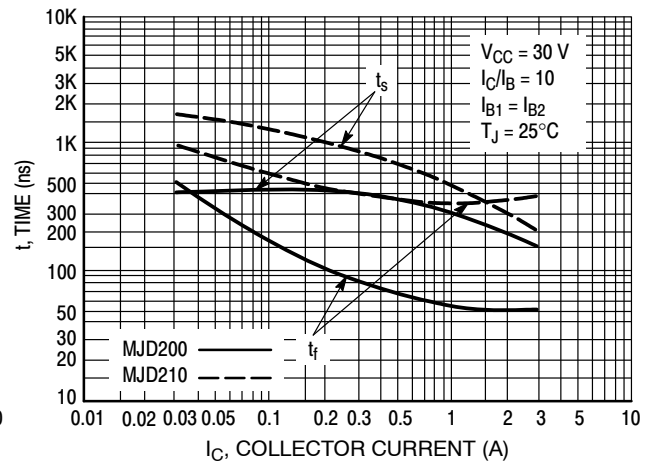


Figure 4. Turn-Off Time

# MJD200 (NPN), MJD210 (PNP)

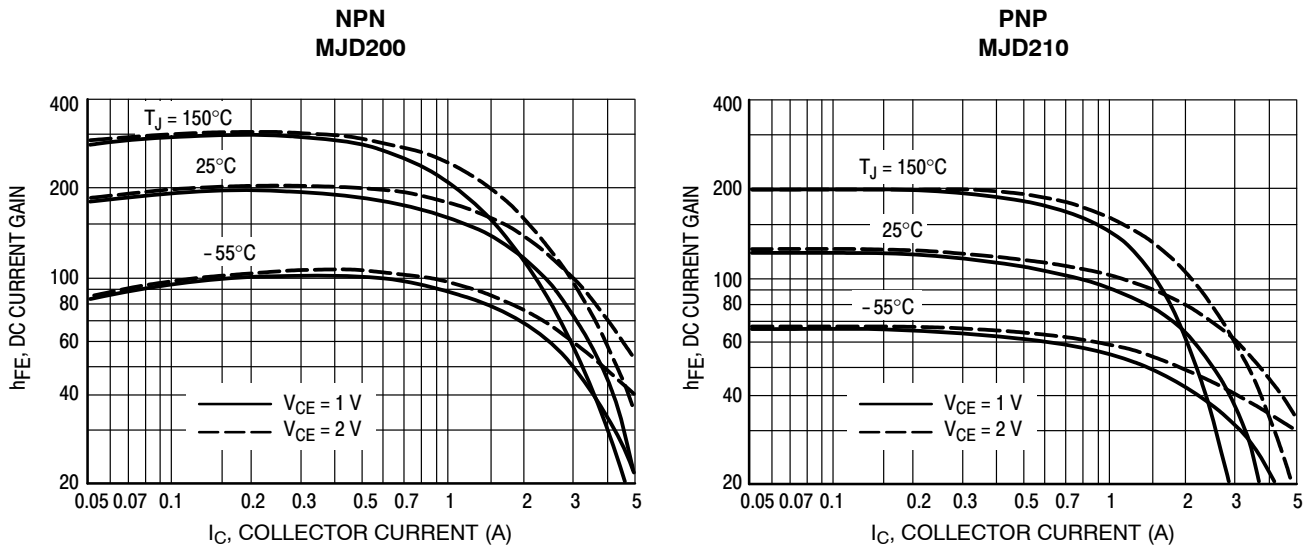


Figure 5. DC Current Gain

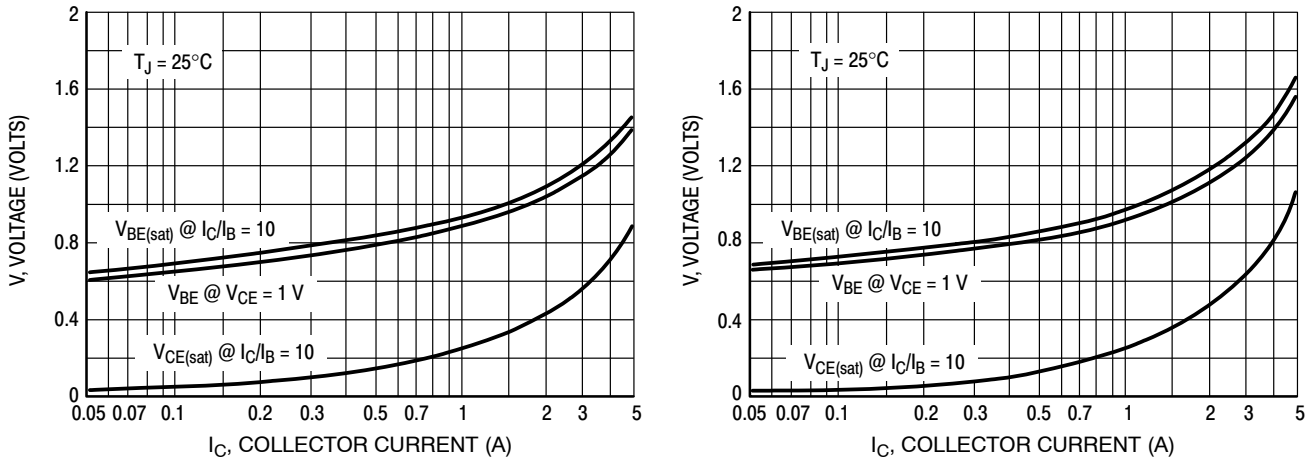


Figure 6. "On" Voltage

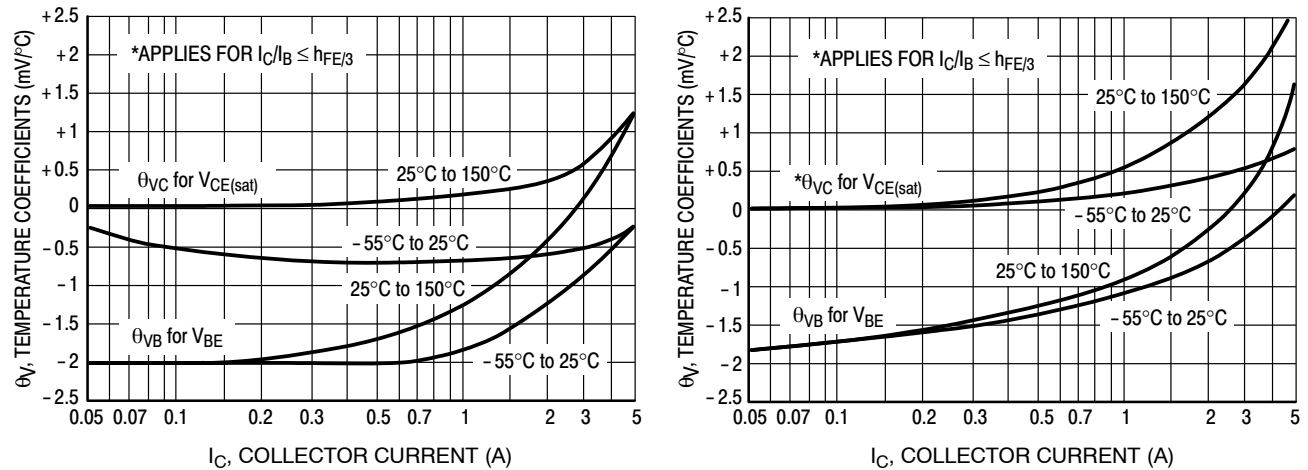


Figure 7. Temperature Coefficients

## MJD200 (NPN), MJD210 (PNP)

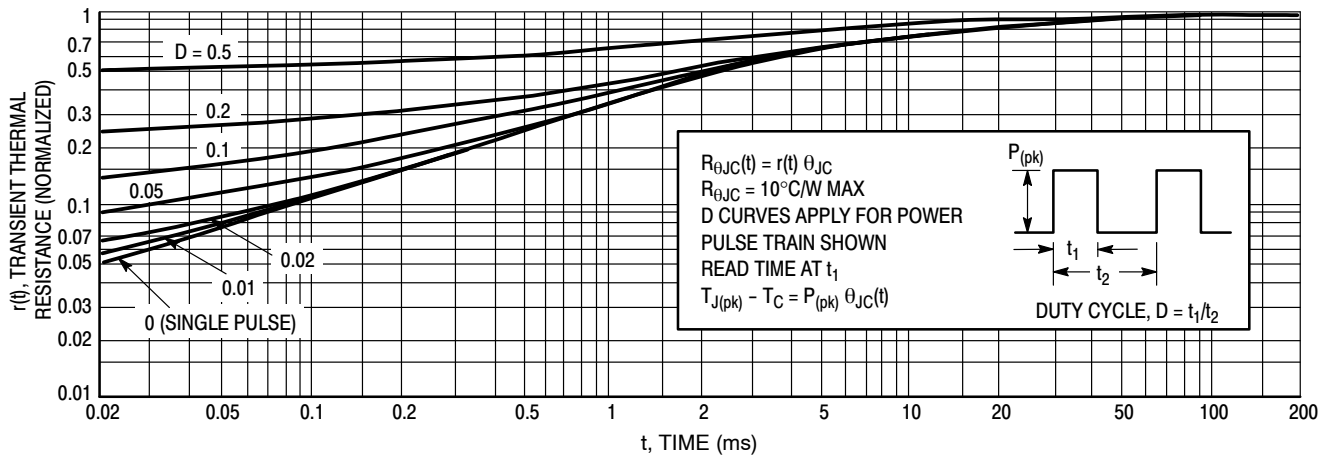


Figure 8. Thermal Response

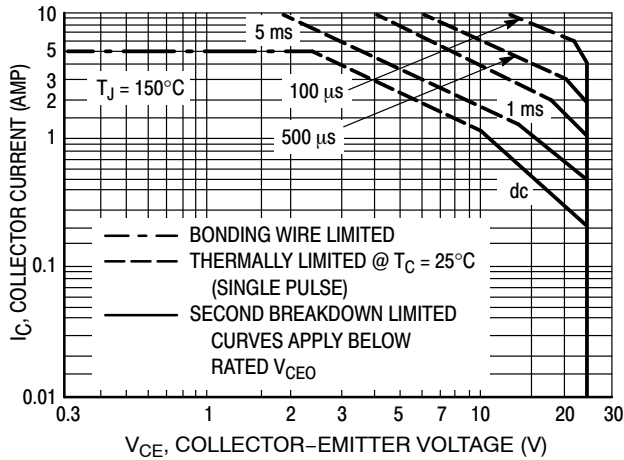


Figure 9. Active Region Safe Operating Area

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 9 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  $T_{J(pk)} \leq 150^\circ\text{C}$ .  $T_{J(pk)}$  may be calculated from the data in Figure 8. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

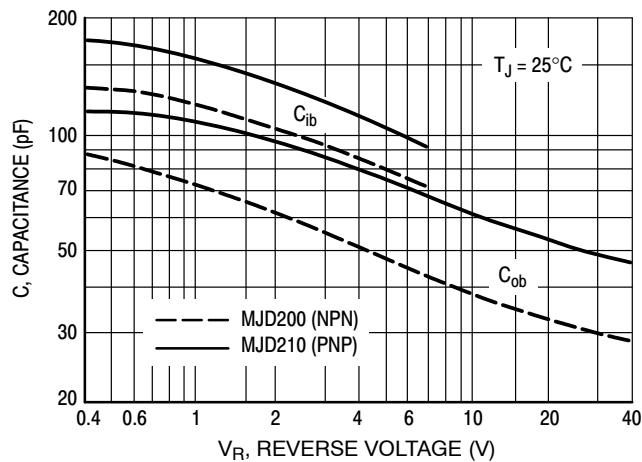


Figure 10. Capacitance

## MJD200 (NPN), MJD210 (PNP)

### ORDERING INFORMATION

| Device        | Package Type      | Shipping†           |
|---------------|-------------------|---------------------|
| MJD200G       | DPAK<br>(Pb-Free) | 75 Units / Rail     |
| MJD200RLG     | DPAK<br>(Pb-Free) | 1,800 / Tape & Reel |
| MJD200T4G     | DPAK<br>(Pb-Free) | 2,500 / Tape & Reel |
| MJD210G       | DPAK<br>(Pb-Free) | 75 Units / Rail     |
| MJD210RLG     | DPAK<br>(Pb-Free) | 1,800 / Tape & Reel |
| MJD210T4G     | DPAK<br>(Pb-Free) | 2,500 / Tape & Reel |
| NJVMJD210T4G* | DPAK<br>(Pb-Free) | 2,500 / Tape & Reel |

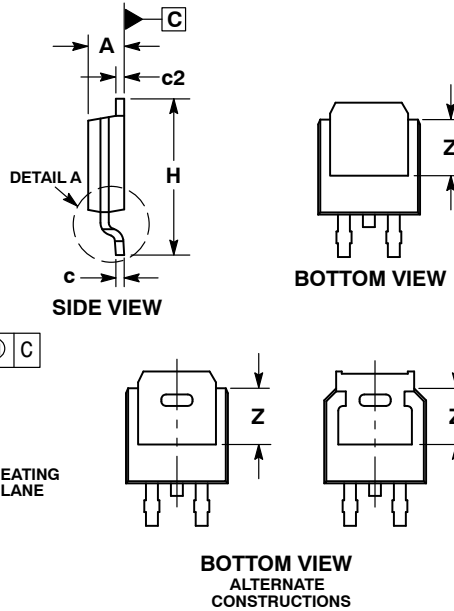
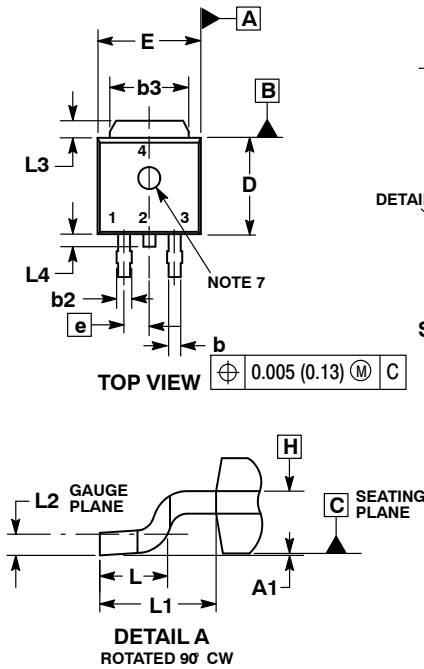
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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

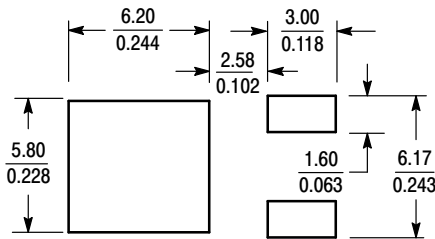
# MJD200 (NPN), MJD210 (PNP)

## PACKAGE DIMENSIONS

### DPAK CASE 369C ISSUE F



### SOLDERING FOOTPRINT\*



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

#### 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:

1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

\*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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