

# Complementary Plastic Power Transistors

## NPN/PNP Silicon DPAK For Surface Mount Applications

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

- Collector-Emitter Sustaining Voltage —  
 $V_{CE(sus)} = 25 \text{ Vdc (Min) @ } I_C = 10 \text{ mAdc}$
- High DC Current Gain —  
 $h_{FE} = 70 \text{ (Min) @ } I_C = 500 \text{ mAdc}$   
 $= 45 \text{ (Min) @ } I_C = 2 \text{ Adc}$   
 $= 10 \text{ (Min) @ } I_C = 5 \text{ Adc}$
- Lead Formed for Surface Mount Applications in Plastic Sleeves (No Suffix)
- Straight Lead Version in Plastic Sleeves (“-1” Suffix)
- Lead Formed Version in 16 mm Tape and Reel (“T4” Suffix)
- Low Collector-Emitter Saturation Voltage —  
 $V_{CE(sat)} = 0.3 \text{ Vdc (Max) @ } I_C = 500 \text{ mAdc}$   
 $= 0.75 \text{ Vdc (Max) @ } I_C = 2.0 \text{ Adc}$
- High Current-Gain — Bandwidth Product —  
 $f_T = 65 \text{ MHz (Min) @ } I_C = 100 \text{ mAdc}$
- Annular Construction for Low Leakage —  
 $I_{CBO} = 100 \text{ nAdc @ Rated } V_{CB}$

### MAXIMUM RATINGS

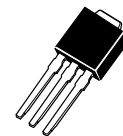
| Rating   | Symbol         | Value        | Unit                         |
|--|----------------|--------------|------------------------------|
| Collector-Base Voltage   | $V_{CB}$       | 40           | Vdc                          |
| Collector-Emitter Voltage  | $V_{CEO}$      | 25           | Vdc                          |
| Emitter-Base Voltage   | $V_{EB}$       | 8            | Vdc                          |
| Collector Current — Continuous<br>Peak   | $I_C$          | 5<br>10      | Adc                          |
| Base Current   | $I_B$          | 1            | Adc                          |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$   | $P_D$          | 12.5<br>0.1  | Watts<br>W/ $^\circ\text{C}$ |
| Total Device Dissipation @ $T_A = 25^\circ\text{C}^*$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 1.4<br>0.011 | Watts<br>W/ $^\circ\text{C}$ |
| Operating and Storage Junction<br>Temperature Range                                      | $T_J, T_{stg}$ | -65 to +150  | $^\circ\text{C}$             |

**NPN  
MJD200  
PNP  
MJD210**

**SILICON  
POWER TRANSISTORS  
5 AMPERES  
25 VOLTS  
12.5 WATTS**

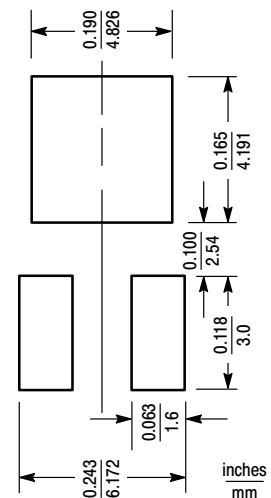


CASE 369A-13



CASE 369-07

### MINIMUM PAD SIZES RECOMMENDED FOR SURFACE MOUNTED APPLICATIONS



# MJD200 MJD210

## THERMAL CHARACTERISTICS

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

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

| Characteristic | Symbol | Min | Max | Unit |
|----------------|--------|-----|-----|------|
|----------------|--------|-----|-----|------|

## OFF CHARACTERISTICS

|   |               |        |            |      |
|---|---------------|--------|------------|------|
| Collector–Emitter Sustaining Voltage (1)<br>( $I_C = 10$ mAdc, $I_B = 0$ )  | $V_{CE(sus)}$ | 25     | —          | Vdc  |
| Collector Cutoff Current<br>( $V_{CB} = 40$ Vdc, $I_E = 0$ )<br>( $V_{CB} = 40$ Vdc, $I_E = 0$ , $T_J = 125^{\circ}C$ ) | $I_{CBO}$     | —<br>— | 100<br>100 | nAdc |
| Emitter Cutoff Current ( $V_{BE} = 8$ Vdc, $I_C = 0$ )  | $I_{EBO}$     | —      | 100        | nAdc |

## ON CHARACTERISTICS

|   |               |                |                    |     |
|---|---------------|----------------|--------------------|-----|
| DC Current Gain (2)<br>( $I_C = 500$ mAdc, $V_{CE} = 1$ Vdc)<br>( $I_C = 2$ Adc, $V_{CE} = 1$ Vdc)<br>( $I_C = 5$ Adc, $V_{CE} = 2$ Vdc)                  | $h_{FE}$      | 70<br>45<br>10 | —<br>180<br>—      | —   |
| Collector–Emitter Saturation Voltage (2)<br>( $I_C = 500$ mAdc, $I_B = 50$ mAdc)<br>( $I_C = 2$ Adc, $I_B = 200$ mAdc)<br>( $I_C = 5$ Adc, $I_B = 1$ Adc) | $V_{CE(sat)}$ | —<br>—<br>—    | 0.3<br>0.75<br>1.8 | Vdc |
| Base–Emitter Saturation Voltage (1) ( $I_C = 5$ Adc, $I_B = 1$ Adc)   | $V_{BE(sat)}$ | —              | 2.5                | Vdc |
| Base–Emitter On Voltage (1) ( $I_C = 2$ Adc, $V_{CE} = 1$ Vdc)  | $V_{BE(on)}$  | —              | 1.6                | Vdc |

## DYNAMIC CHARACTERISTICS

|   |                              |        |           |     |
|---|------------------------------|--------|-----------|-----|
| Current–Gain — Bandwidth Product (3)<br>( $I_C = 100$ mAdc, $V_{CE} = 10$ Vdc, $f_{test} = 10$ MHz) | $f_T$                        | 65     | —         | MHz |
| Output Capacitance<br>( $V_{CB} = 10$ Vdc, $I_E = 0$ , $f = 0.1$ MHz)                               | MJD200<br>MJD210<br>$C_{ob}$ | —<br>— | 80<br>120 | pF  |

\*When surface mounted on minimum pad sizes recommended.

(continued)

(1) Pulse Test: Pulse Width = 300  $\mu s$ , Duty Cycle  $\approx$  2%.

(2) Pulse Test: Pulse Width = 300  $\mu s$ , Duty Cycle  $\approx$  2%.

(3)  $f_T = |h_{fe}| \cdot f_{test}$ .

# MJD200 MJD210

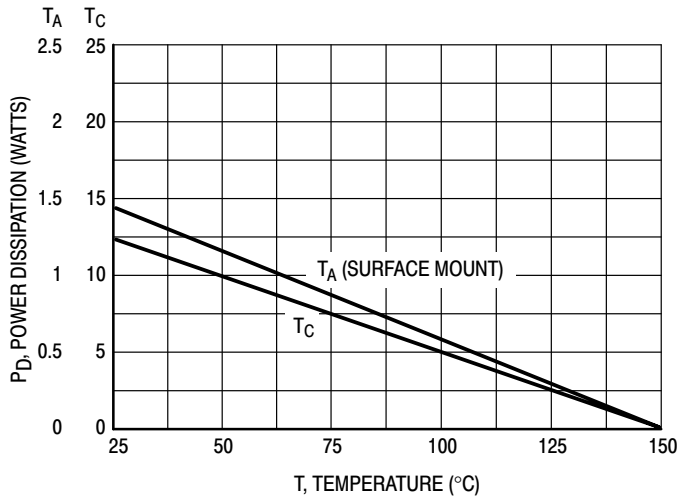


Figure 1. Power Derating

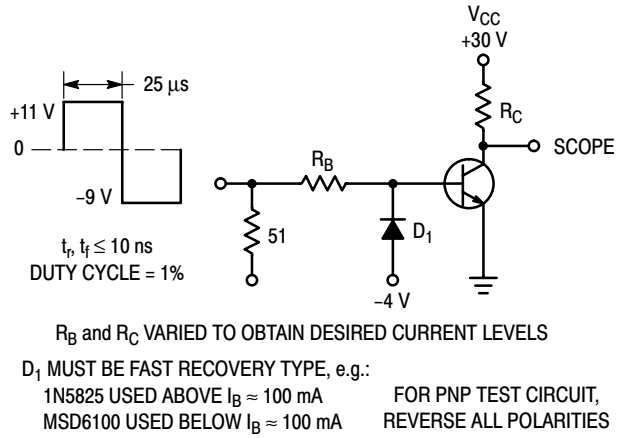


Figure 2. Switching Time Test Circuit

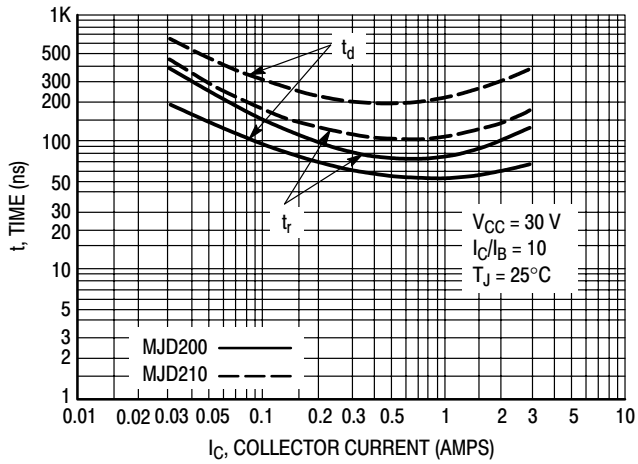


Figure 3. Turn-On Time

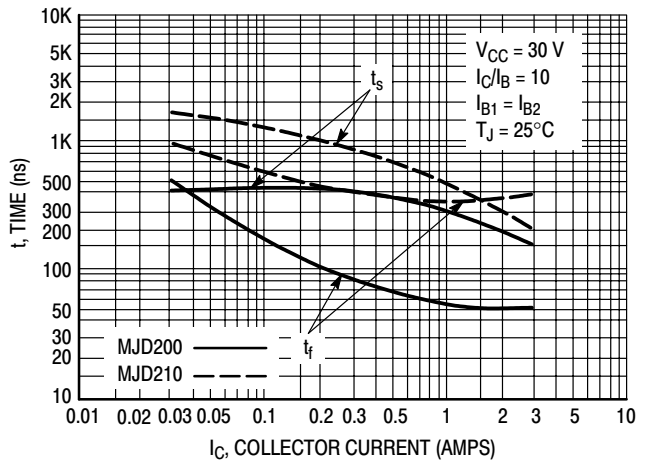
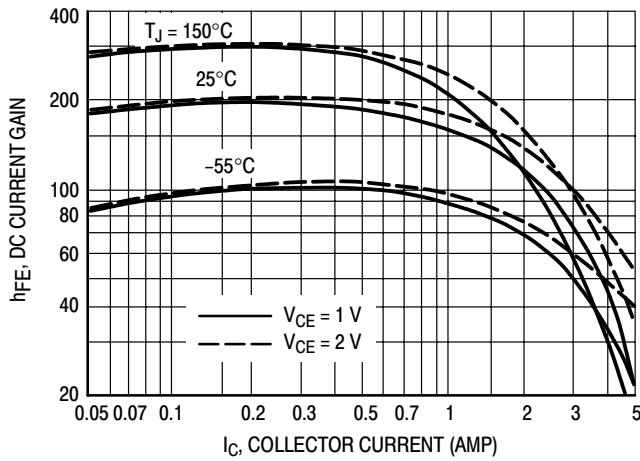


Figure 4. Turn-Off Time

# MJD200 MJD210

**NPN  
MJD200**



**PNP  
MJD210**

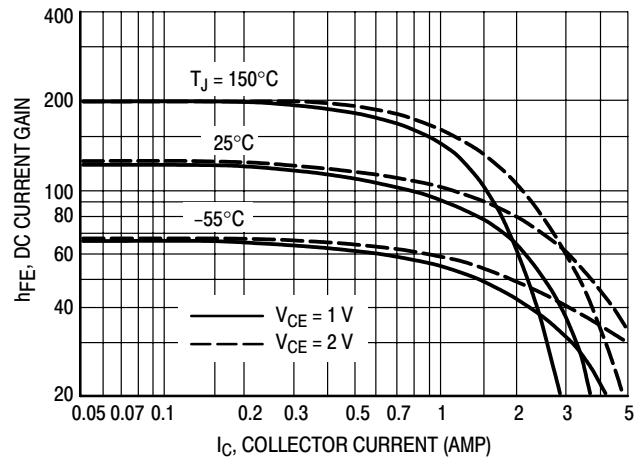


Figure 5. DC Current Gain

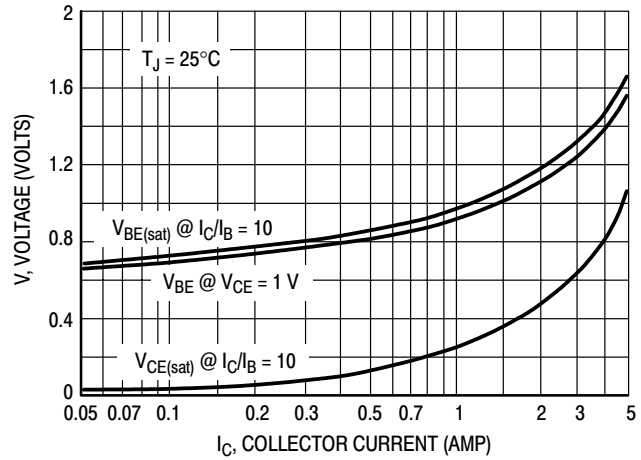
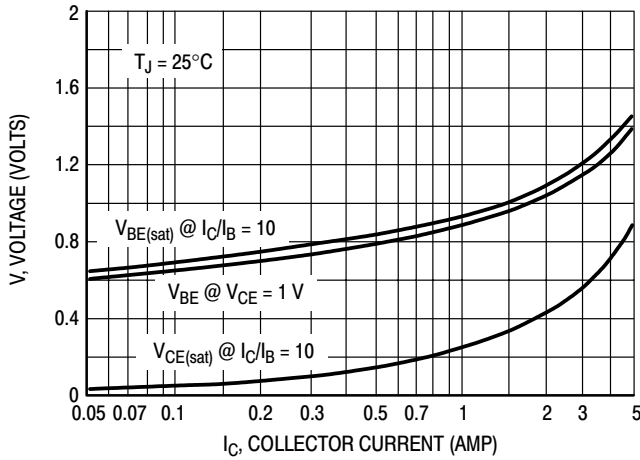


Figure 6. "On" Voltage

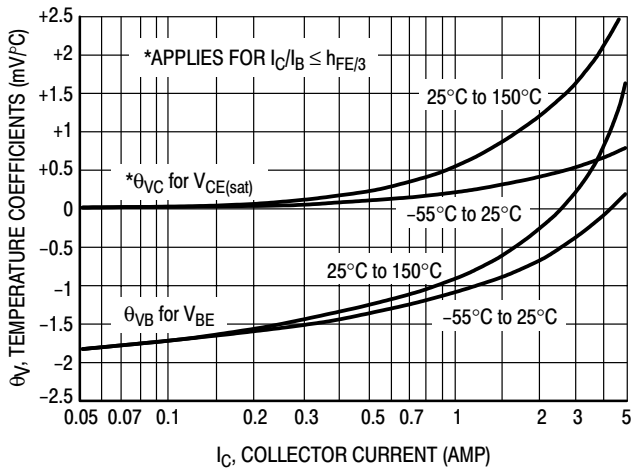
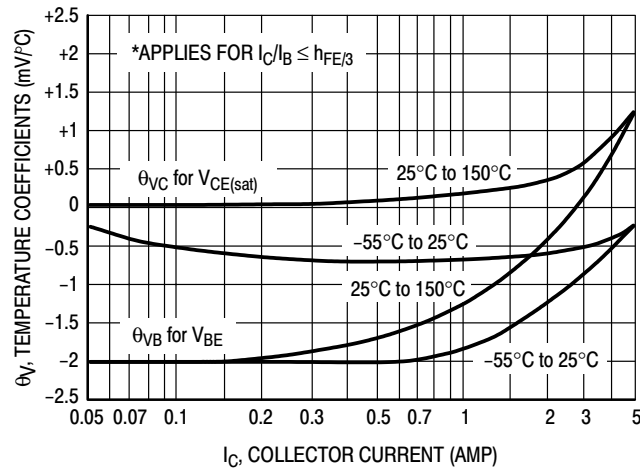


Figure 7. Temperature Coefficients

# MJD200 MJD210

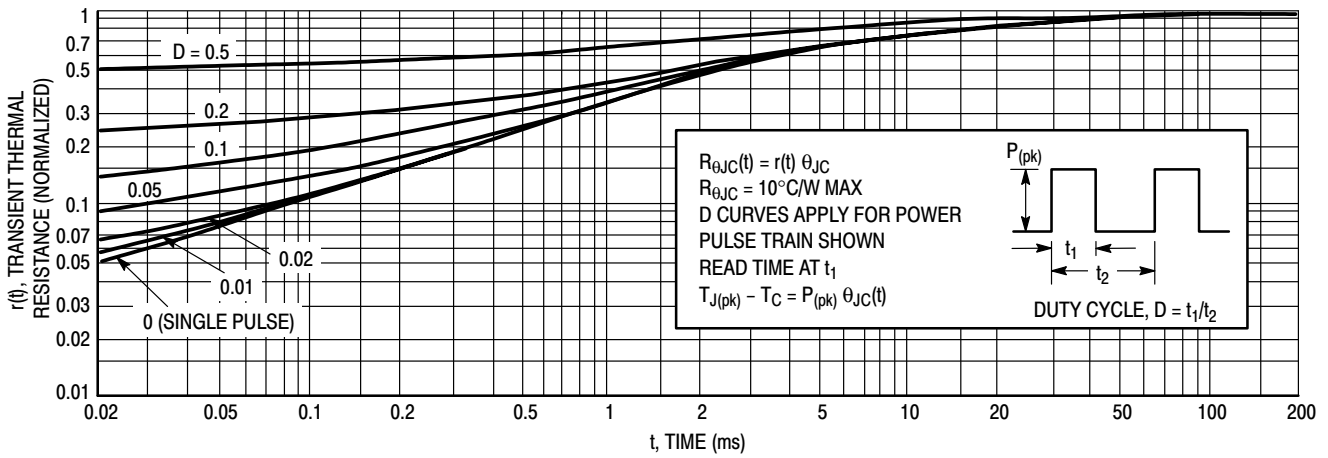


Figure 8. Thermal Response

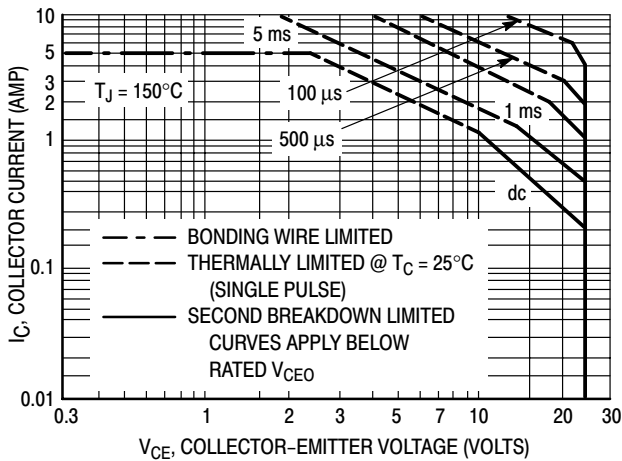


Figure 9. Active Region Safe Operating Area

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.

Case 369 may be ordered by adding a “-1” suffix to the device title (i.e. MJD200-1)

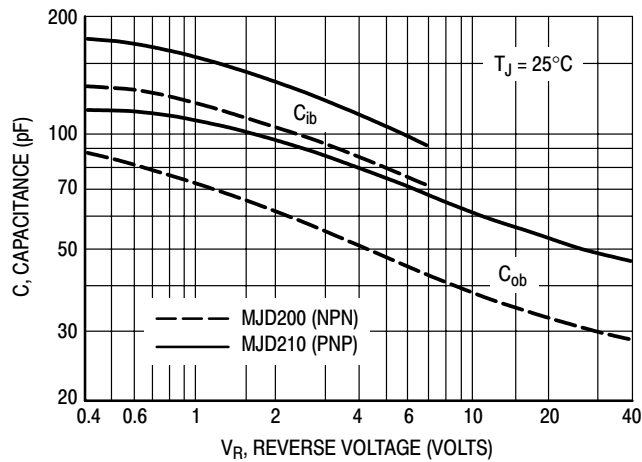
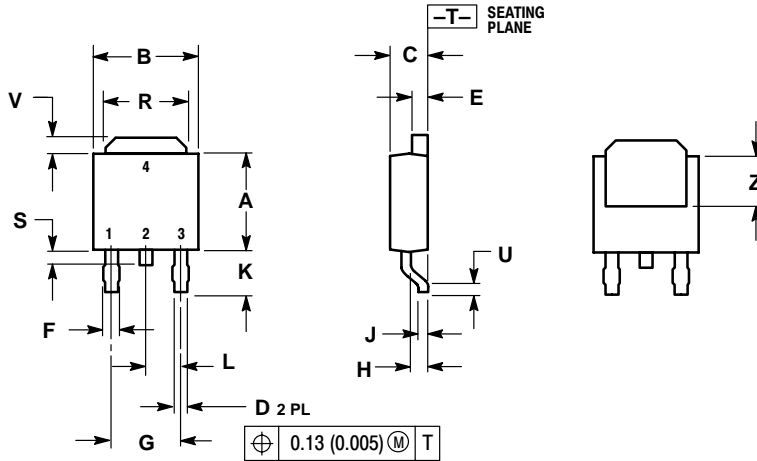


Figure 10. Capacitance

# MJD200 MJD210

## PACKAGE DIMENSIONS

### DPAK CASE 369A-13 ISSUE AA



NOTES:

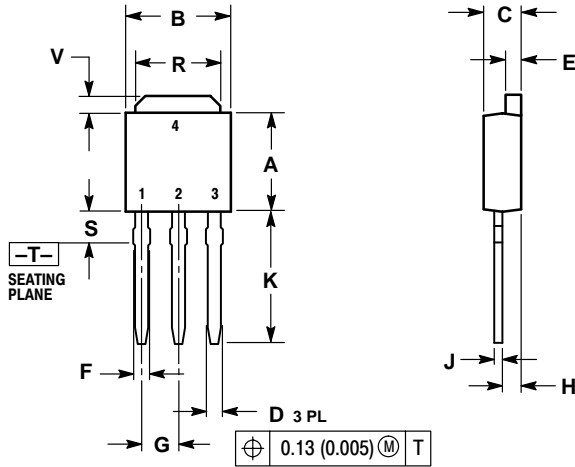
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

| DIM | INCHES    |       | MILLIMETERS |      |
|-----|-----------|-------|-------------|------|
|     | MIN       | MAX   | MIN         | MAX  |
| A   | 0.235     | 0.250 | 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   | 0.033     | 0.040 | 0.84        | 1.01 |
| F   | 0.037     | 0.047 | 0.94        | 1.19 |
| 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   | 0.175     | 0.215 | 4.45        | 5.46 |
| S   | 0.020     | 0.050 | 0.51        | 1.27 |
| U   | 0.020     | ---   | 0.51        | ---  |
| V   | 0.030     | 0.050 | 0.77        | 1.27 |
| Z   | 0.138     | ---   | 3.51        | ---  |

# MJD200 MJD210

## PACKAGE DIMENSIONS

### DPAK CASE 369-07 ISSUE M



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

| DIM | INCHES    |       | MILLIMETERS |      |
|-----|-----------|-------|-------------|------|
|     | MIN       | MAX   | MIN         | MAX  |
| A   | 0.235     | 0.250 | 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   | 0.033     | 0.040 | 0.84        | 1.01 |
| F   | 0.037     | 0.047 | 0.94        | 1.19 |
| 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   | 0.175     | 0.215 | 4.45        | 5.46 |
| S   | 0.050     | 0.090 | 1.27        | 2.28 |
| V   | 0.030     | 0.050 | 0.77        | 1.27 |

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