# MJD243 (NPN), MJD253 (PNP)

Preferred Device

# Complementary Silicon Plastic Power Transistor

## DPAK for Surface Mount Applications

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

- Collector−Emitter Sustaining Voltage −
  $V_{CEO(sus)}$ = 100 Vdc (Min) @ $I_C$
  = 10 mAdc
- High DC Current Gain −
  $h_{FE}$ = 40 (Min) @ $I_C$
  = 200 mAdc
  = 15 (Min) @ $I_C$ = 1.0 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 Vdc (Max) @ $I_C$
  = 500 mAdc
  = 0.6 Vdc (Max) @ $I_C$ = 1.0 Adc
- High Current−Gain − Bandwidth Product −
  $f_T$ = 40 MHz (Min) @ $I_C$
  = 100 mAdc
- Annular Construction for Low Leakage −
  $I_{CBO}$ = 100 nAdc @ Rated $V_{CB}$
- Epoxy Meets UL 94, V−0 @ 0.125 in.
- ESD Ratings: Human Body Model, 3B > 8000 V
  Machine Model, C > 400 V

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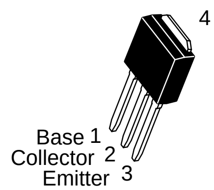
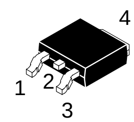
**4.0 AMPERES**
**100 VOLTS**
**12.5 WATTS**
**POWER TRANSISTOR**

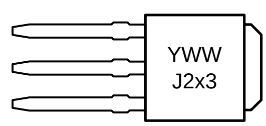


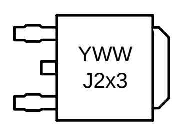

**DPAK**
**CASE 369D**
**STYLE 1**




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

### MARKING DIAGRAMS




Y = Year
WW = Work Week
J2x3 = Device Code
x = 4 or 5

### MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Collector−Base Voltage | $V_{CB}$ | 100 | Vdc |
| Collector−Emitter Voltage | $V_{CEO}$ | 100 | Vdc |
| Emitter−Base Voltage | $V_{EB}$ | 7.0 | Vdc |
| Collector Current − Continuous<br>− Peak | $I_C$ | 4.0<br>8.0 | Adc |
| Base Current | $I_B$ | 1.0 | Adc |
| Total Device Dissipation @ $T_C$ = 25°C<br>Derate above 25°C | $P_D$ | 12.5<br>0.1 | Watts<br>W/°C |
| Total Device Dissipation @ $T_A$ = 25°C (Note 1)<br>Derate above 25°C | $P_D$ | 1.4<br>0.011 | Watts<br>W/°C |
| Operating and Storage Junction Temperature Range | $T_J$, $T_{stg}$ | −65 to +150 | °C |

1. When surface mounted on minimum pad sizes recommended.

### ORDERING INFORMATION

| Device | Package | Shipping |
|---|---|---|
| MJD243 | DPAK | 75 Units/Rail |
| MJD243T4 | DPAK | 2500/Tape & Reel |
| MJD253−1 | DPAK | 75 Units/Rail |
| MJD253T4 | DPAK | 2500/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

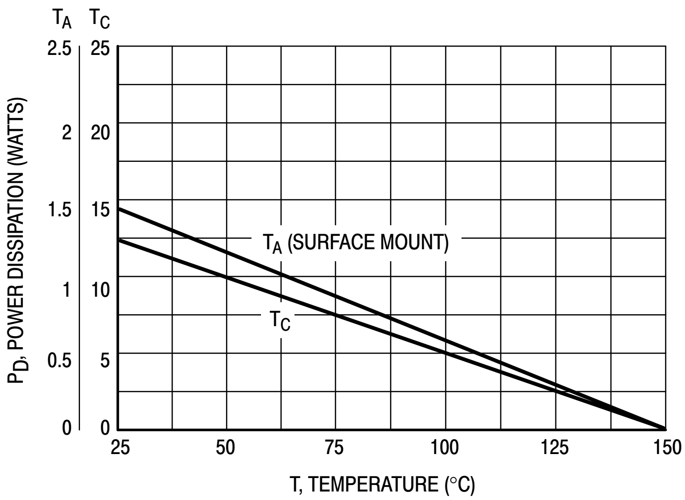



**Figure 1. Power Derating**

## THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case<br>Junction to Ambient (Note 2) | $R_{\theta JC}$<br>$R_{\theta JA}$ | 10<br>89.3 | °C/W |

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

| Characteristic | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | |
| Collector−Emitter Sustaining Voltage (Note 3) ($I_C$ = 10 mAdc, $I_B$ = 0) | $V_{CEO(sus)}$ | 100 | − | Vdc |
| Collector Cutoff Current ($V_{CB}$ = 100 Vdc, $I_E$ = 0)<br>($V_{CB}$ = 100 Vdc, $I_E$ = 0, $T_J$ = 125°C) | $I_{CBO}$ | −<br>− | 100<br>100 | nAdc<br>μAdc |
| Emitter Cutoff Current ($V_{BE}$ = 7.0 Vdc, $I_C$ = 0) | $I_{EBO}$ | − | 100 | nAdc |
| DC Current Gain (Note 3) ($I_C$ = 200 mAdc, $V_{CE}$ = 1.0 Vdc)<br>($I_C$ = 1.0 Adc, $V_{CE}$ = 1.0 Vdc) | $h_{FE}$ | 40<br>15 | 180<br>− | − |
| Collector−Emitter Saturation Voltage (Note 3)<br>($I_C$ = 500 mAdc, $I_B$ = 50 mAdc)<br>($I_C$ = 1.0 Adc, $I_B$ = 100 mAdc) | $V_{CE(sat)}$ | <br>−<br>− | <br>0.3<br>0.6 | Vdc |
| Base−Emitter Saturation Voltage (Note 3) ($I_C$ = 2.0 Adc, $I_B$ = 200 mAdc) | $V_{BE(sat)}$ | − | 1.8 | Vdc |
| Base−Emitter On Voltage (Note 3) ($I_C$ = 500 mAdc, $V_{CE}$ = 1.0 Vdc) | $V_{BE(on)}$ | − | 1.5 | Vdc |
| **DYNAMIC CHARACTERISTICS** | | | | |
| Current−Gain − Bandwidth Product (Note 4)<br>($I_C$ = 100 mAdc, $V_{CE}$ = 10 Vdc, $f_{test}$ = 10 MHz) | $f_T$ | 40 | − | MHz |
| Output Capacitance ($V_{CB}$ = 10 Vdc, $I_E$ = 0, f = 0.1 MHz) | $C_{ob}$ | − | 50 | pF |

2. When surface mounted on minimum pad sizes recommended.
3. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≈ 2%.
4. $f_T = |h_{FE}| \bullet f_{test}$.

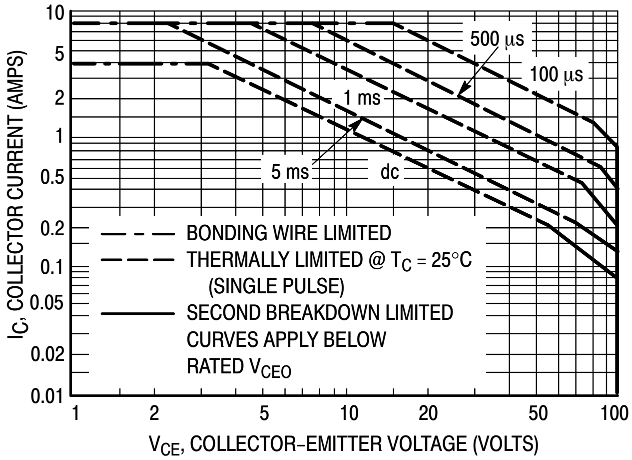



**Figure 2. Active Region Maximum Safe Operating Area**

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 2 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 $T_{J(pk)} \leq 150°C$. $T_{J(pk)}$ may be calculated from the data in Figure 3. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

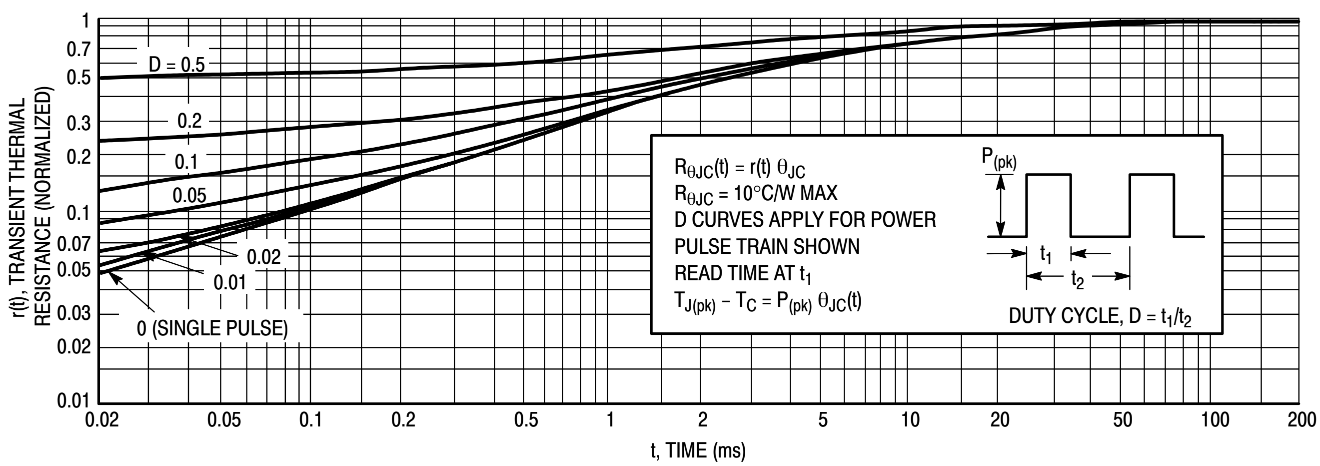



**Figure 3. Thermal Response**

**NPN**
**MJD243**

**PNP**
**MJD253**

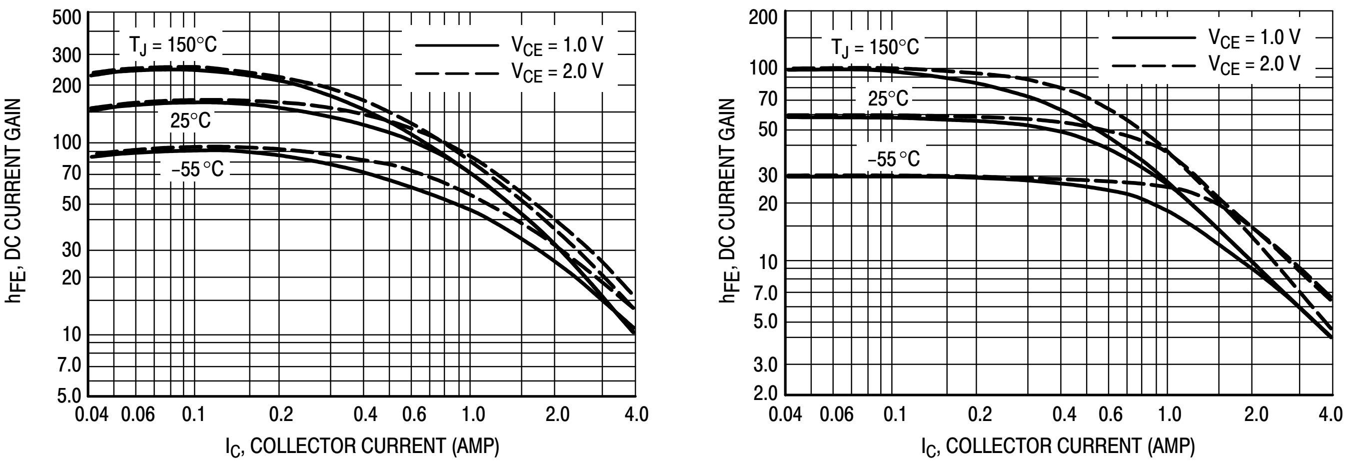



**Figure 4. DC Current Gain**

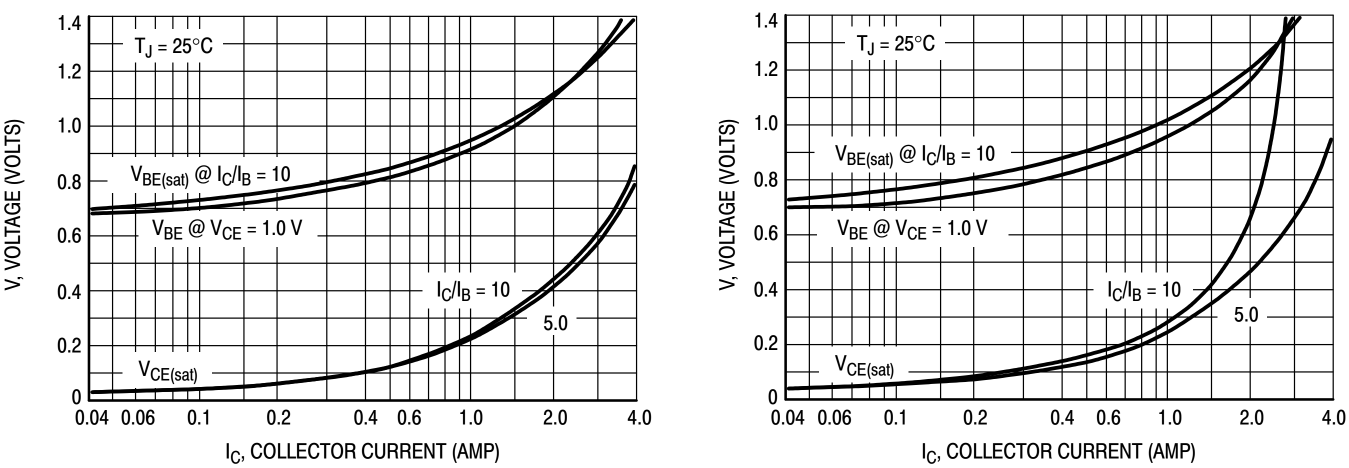



**Figure 5. “On” Voltages**

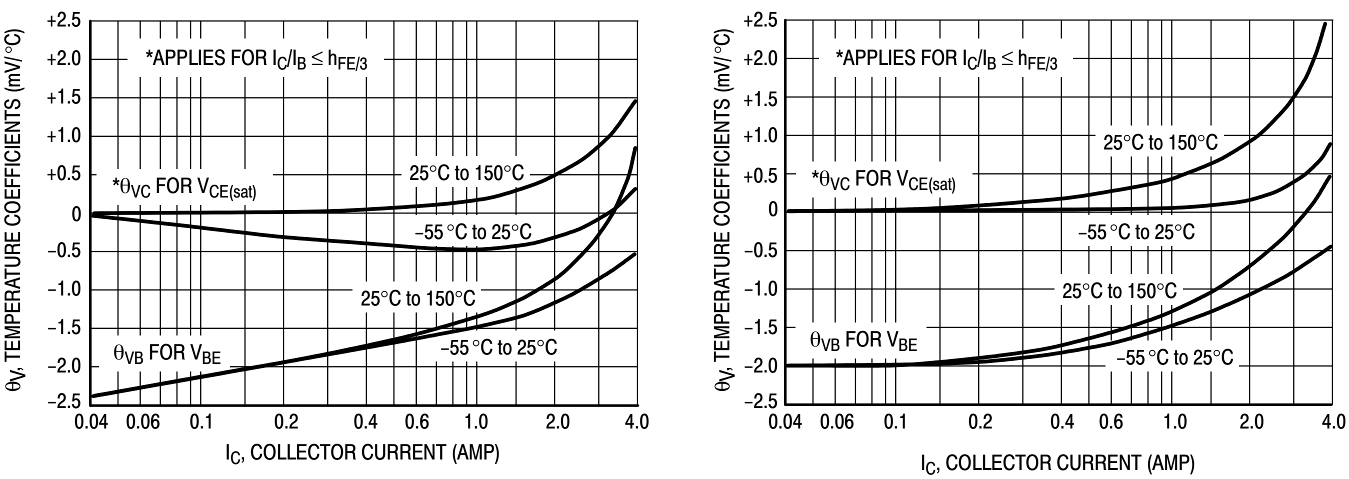



**Figure 6. Temperature Coefficients**

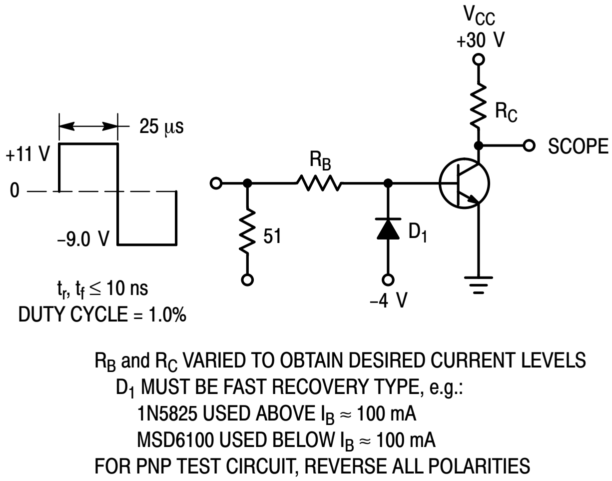



**Figure 7. Switching Time Test Circuit**

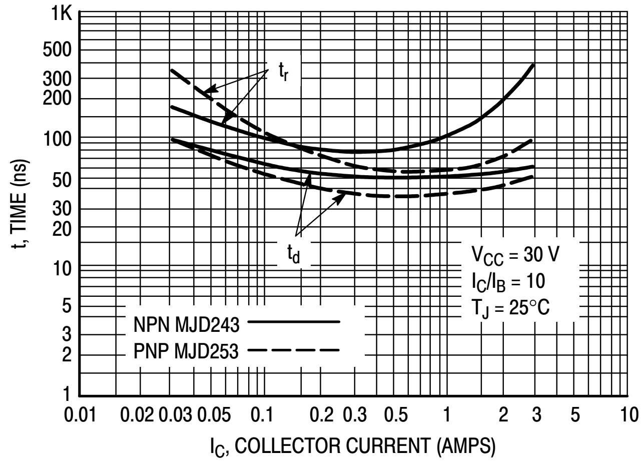



**Figure 8. Turn−On Time**

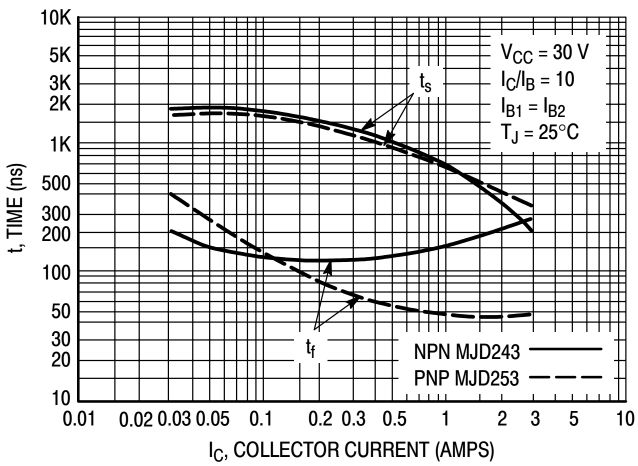



**Figure 9. Turn−Off Time**

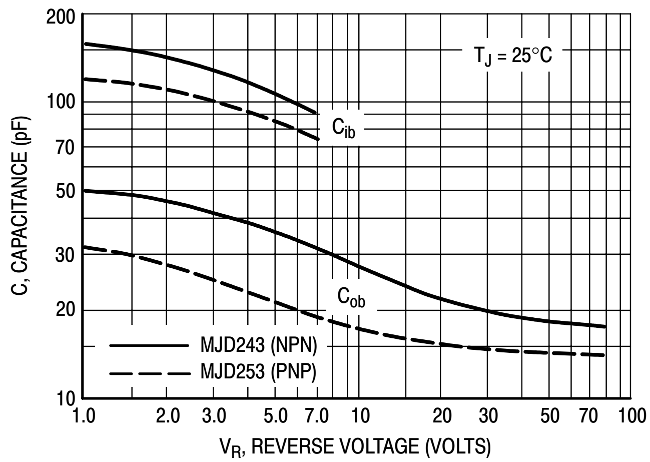



**Figure 10. Capacitance**

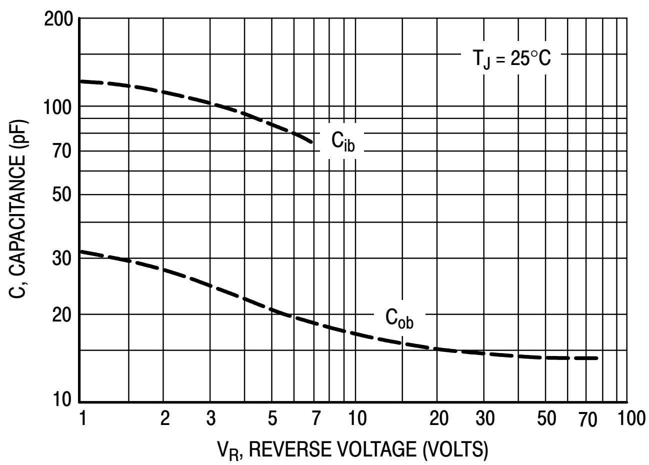



**Figure 11. Capacitance**

## TYPICAL SOLDER HEATING PROFILE

For any given circuit board, there will be a group of control settings that will give the desired heat pattern. The operator must set temperatures for several heating zones, and a figure for belt speed. Taken together, these control settings make up a heating "profile" for that particular circuit board. On machines controlled by a computer, the computer remembers these profiles from one operating session to the next. Figure 12 shows a typical heating profile for use when soldering a surface mount device to a printed circuit board. This profile will vary among soldering systems but it is a good starting point. Factors that can affect the profile include the type of soldering system in use, density and types of components on the board, type of solder used, and the type of board or substrate material being used. This profile shows temperature versus time. The line on the graph shows the actual temperature that might be experienced on the surface of a test board at or near a central solder joint. The two profiles are based on a high density and a low density board. The Vitronics SMD310 convection/infrared reflow soldering system was used to generate this profile. The type of solder used was 62/36/2 Tin Lead Silver with a melting point between 177−189°C. When this type of furnace is used for solder reflow work, the circuit boards and solder joints tend to heat first. The components on the board are then heated by conduction. The circuit board, because it has a large surface area, absorbs the thermal energy more efficiently, then distributes this energy to the components. Because of this effect, the main body of a component may be up to 30 degrees cooler than the adjacent solder joints.

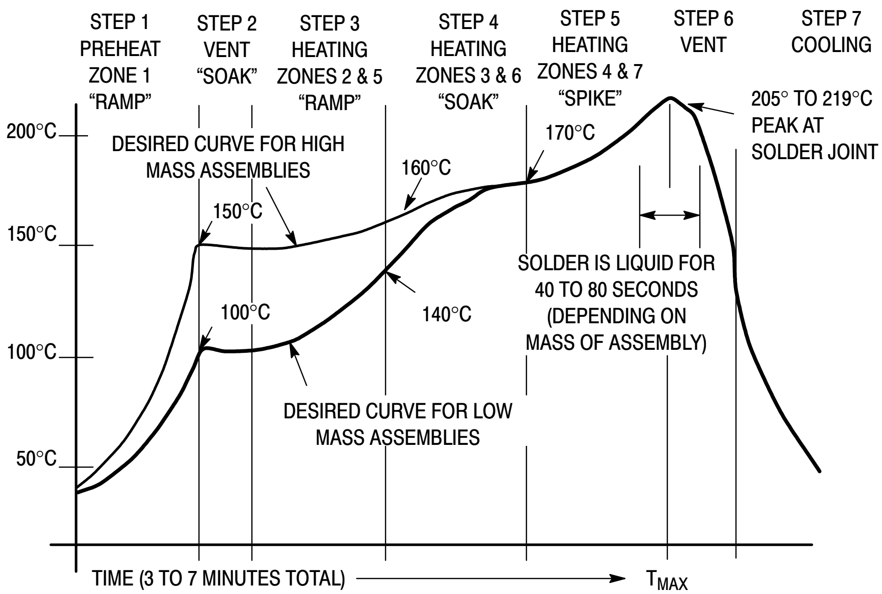
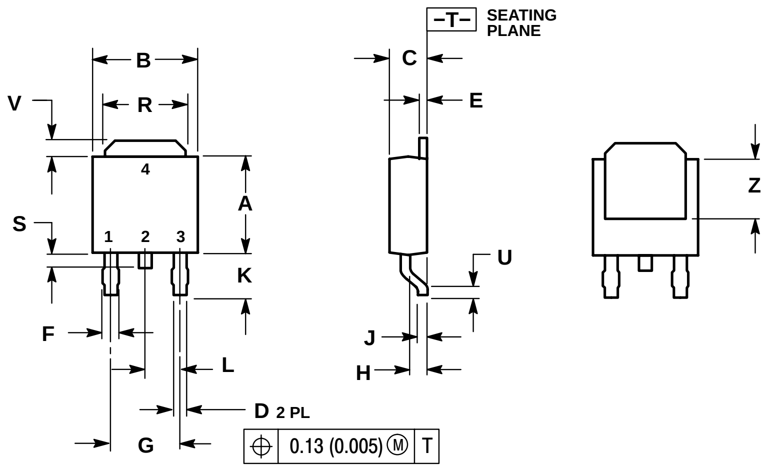



**Figure 12. Typical Solder Heating Profile**

## PACKAGE DIMENSIONS

**DPAK**
CASE 369C−01
ISSUE O

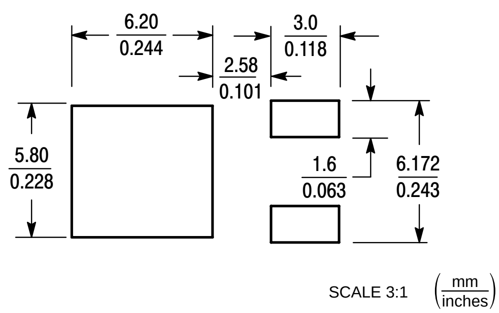



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

| | 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

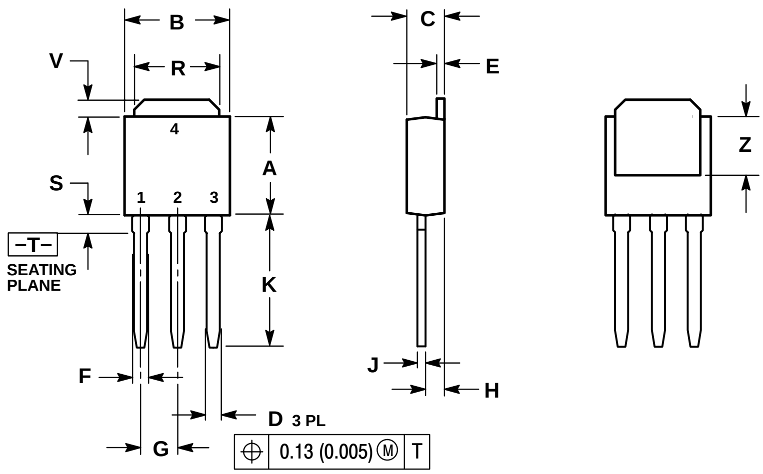
### Minimum Pad Sizes Recommended for Surface Mounted Applications




**DPAK**

## PACKAGE DIMENSIONS

### DPAK (SINGLE GAUGE)
CASE 369D−01
ISSUE O




NOTES:
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| 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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