

# NJL0281D (NPN) NJL0302D (PNP)

## Complementary ThermalTrak™ Transistors

The ThermalTrak family of devices has been designed to eliminate thermal equilibrium lag time and bias trimming in audio amplifier applications. They can also be used in other applications as transistor die protection devices.

### Features

- Thermally Matched Bias Diode
- Instant Thermal Bias Tracking
- Absolute Thermal Integrity
- High Safe Operating Area
- Pb-Free Packages are Available\*

### Benefits

- Eliminates Thermal Equilibrium Lag Time and Bias Trimming
- Superior Sound Quality Through Improved Dynamic Temperature Response
- Significantly Improved Bias Stability
- Simplified Assembly
  - ◆ Reduced Labor Costs
  - ◆ Reduced Component Count
- High Reliability

### Applications

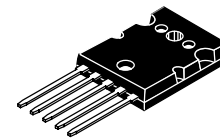
- High-End Consumer Audio Products
  - ◆ Home Amplifiers
  - ◆ Home Receivers
- Professional Audio Amplifiers
  - ◆ Theater and Stadium Sound Systems
  - ◆ Public Address Systems (PAs)



**ON Semiconductor®**

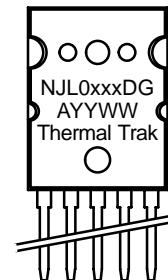
<http://onsemi.com>

**BIPOLAR POWER  
TRANSISTORS  
15 AMP, 260 VOLT, 180 WATT**

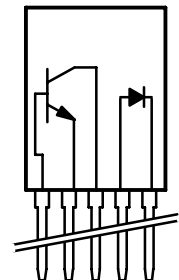


TO-264, 5 LEAD  
CASE 340AA  
STYLE 1

### MARKING DIAGRAM



### SCHEMATIC



NJL0xxxD = Device Code  
 xxx = 281 or 302  
 G = Pb-Free Package  
 A = Assembly Location  
 YY = Year  
 WW = Work Week

### ORDERING INFORMATION

| Device    | Package             | Shipping        |
|-----------|---------------------|-----------------|
| NJL0281D  | TO-264              | 25 Units / Rail |
| NJL0281DG | TO-264<br>(Pb-Free) | 25 Units / Rail |
| NJL0302D  | TO-264              | 25 Units / Rail |
| NJL0302DG | TO-264<br>(Pb-Free) | 25 Units / Rail |

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

## NJL0281D (NPN) NJL0302D (PNP)

### MAXIMUM RATINGS (T<sub>J</sub> = 25°C unless otherwise noted)

| Rating   | Symbol                            | Value        | Unit      |
|--|-----------------------------------|--------------|-----------|
| Collector–Emitter Voltage  | V <sub>CEO</sub>                  | 260          | Vdc       |
| Collector–Base Voltage   | V <sub>CBO</sub>                  | 260          | Vdc       |
| Emitter–Base Voltage   | V <sub>EBO</sub>                  | 5            | Vdc       |
| Collector–Emitter Voltage – 1.5 V                                    | V <sub>CEX</sub>                  | 260          | Vdc       |
| Collector Current<br>– Continuous<br>– Peak (Note 1)                 | I <sub>C</sub>                    | 15<br>25     | Adc       |
| Base Current – Continuous  | I <sub>B</sub>                    | 1.5          | Adc       |
| Total Power Dissipation @ T <sub>C</sub> = 25°C<br>Derate Above 25°C | P <sub>D</sub>                    | 180<br>1.43  | W<br>W/°C |
| Operating and Storage Junction Temperature Range                     | T <sub>J</sub> , T <sub>stg</sub> | – 65 to +150 | °C        |
| DC Blocking Voltage  | V <sub>R</sub>                    | 200          | V         |
| Average Rectified Forward Current                                    | I <sub>F(AV)</sub>                | 1.0          | A         |

### THERMAL CHARACTERISTICS

| Characteristic                       | Symbol           | Max   | Unit |
|--------------------------------------|------------------|-------|------|
| Thermal Resistance, Junction–to–Case | R <sub>θJC</sub> | 0.694 | °C/W |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Pulse Test: Pulse Width = 5 ms, Duty Cycle < 10%.

### ATTRIBUTES

| Characteristic                                      | Value                |
|---|----------------------|
| ESD Protection<br>Human Body Model<br>Machine Model | >8000 V<br>> 400 V   |
| Flammability Rating                                 | UL 94 V–0 @ 0.125 in |

# NJL0281D (NPN) NJL0302D (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<br>( $I_C = 100\text{ mAdc}$ , $I_B = 0$ )  | $V_{CE(sus)}$ | 260            | -                 | Vdc             |
| Collector Cutoff Current<br>( $V_{CB} = 260\text{ Vdc}$ , $I_E = 0$ )  | $I_{CBO}$     | -              | 10                | $\mu\text{Adc}$ |
| Emitter Cutoff Current<br>( $V_{EB} = 5\text{ Vdc}$ , $I_C = 0$ )  | $I_{EBO}$     | -              | 5                 | $\mu\text{Adc}$ |
| <b>ON CHARACTERISTICS</b>  |               |                |                   |                 |
| DC Current Gain<br>( $I_C = 500\text{ mAdc}$ , $V_{CE} = 5\text{ Vdc}$ )<br>( $I_C = 1\text{ Adc}$ , $V_{CE} = 5\text{ Vdc}$ )<br>( $I_C = 3\text{ Adc}$ , $V_{CE} = 5\text{ Vdc}$ ) | $h_{FE}$      | 75<br>75<br>75 | 150<br>150<br>150 |                 |
| Collector-Emitter Saturation Voltage<br>( $I_C = 5\text{ Adc}$ , $I_B = 0.5\text{ Adc}$ )  | $V_{CE(sat)}$ | -              | 1.0               | Vdc             |
| Base-Emitter On Voltage<br>( $I_C = 5\text{ Adc}$ , $V_{CE} = 5\text{ Vdc}$ )  | $V_{CE(on)}$  | -              | 1.2               | Vdc             |
| <b>DYNAMIC CHARACTERISTICS</b>   |               |                |                   |                 |
| Current-Gain - Bandwidth Product<br>( $I_C = 1\text{ Adc}$ , $V_{CE} = 5\text{ Vdc}$ , $f_{test} = 1\text{ MHz}$ )   | $f_T$         | 30             | -                 | MHz             |
| Output Capacitance<br>( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f_{test} = 1\text{ MHz}$ )   | $C_{ob}$      | -              | 400               | pF              |
| Maximum Instantaneous Forward Voltage (Note 2)<br>( $i_F = 1.0\text{ A}$ , $T_J = 25^\circ\text{C}$ )<br>( $i_F = 1.0\text{ A}$ , $T_J = 150^\circ\text{C}$ )                        | $V_F$         | 1.1<br>0.93    |                   | V               |
| Maximum Instantaneous Reverse Current (Note 2)<br>(Rated dc Voltage, $T_J = 25^\circ\text{C}$ )<br>(Rated dc Voltage, $T_J = 150^\circ\text{C}$ )                                    | $i_R$         | 10<br>100      |                   | $\mu\text{A}$   |
| Maximum Reverse Recovery Time<br>( $i_F = 1.0\text{ A}$ , $di/dt = 50\text{ A}/\mu\text{s}$ )  | $t_{rr}$      | 100            |                   | ns              |

2. Diode Pulse Test: Pulse Width = 300  $\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

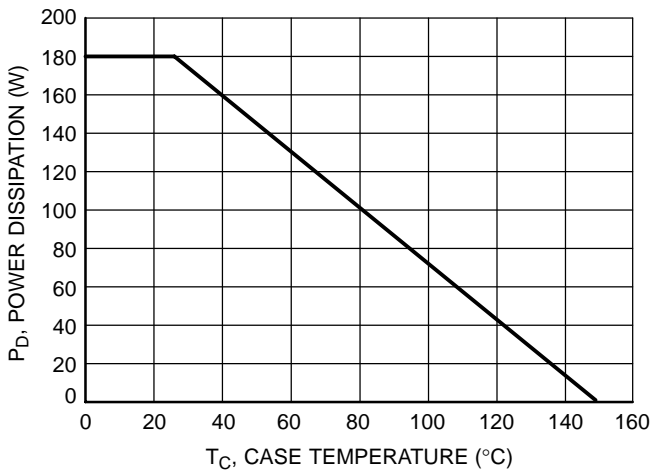


Figure 1. Power Derating

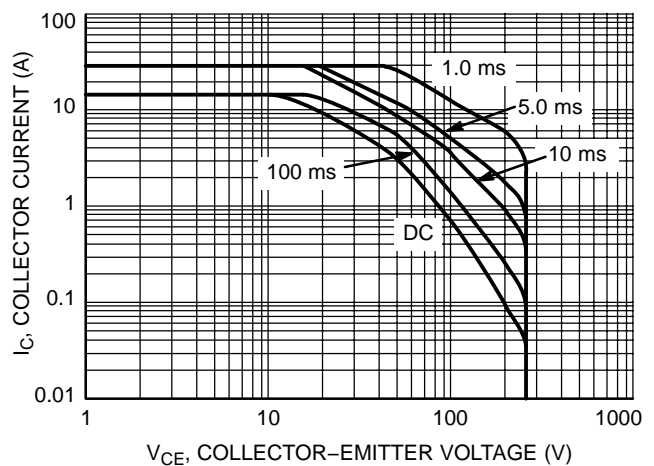
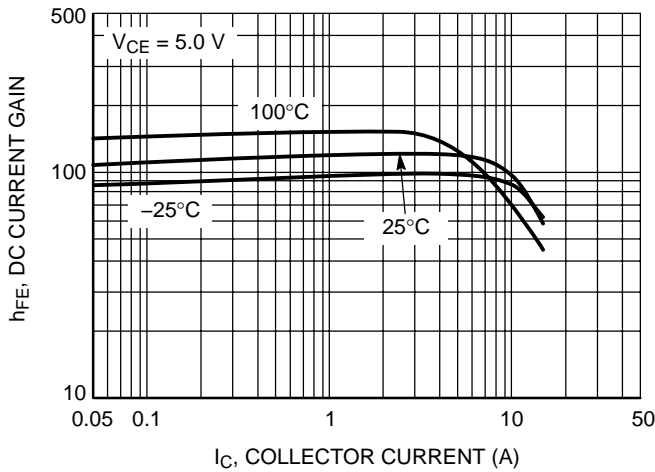
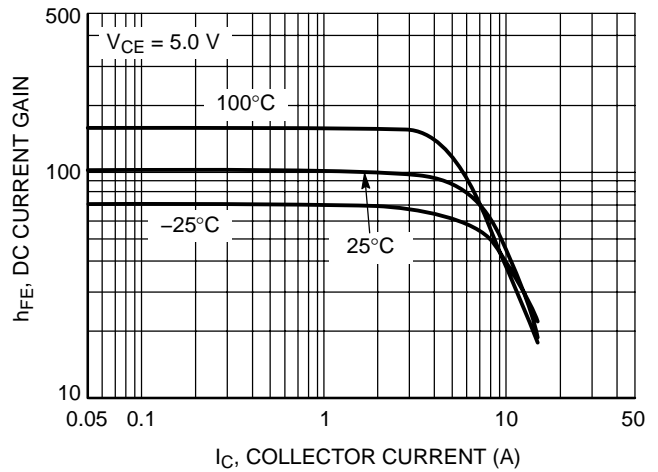


Figure 2. Safe Operating Area

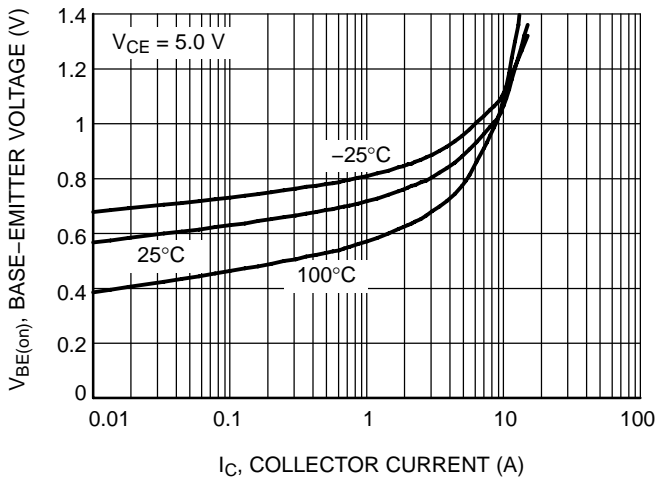
# NJL0281D (NPN) NJL0302D (PNP)



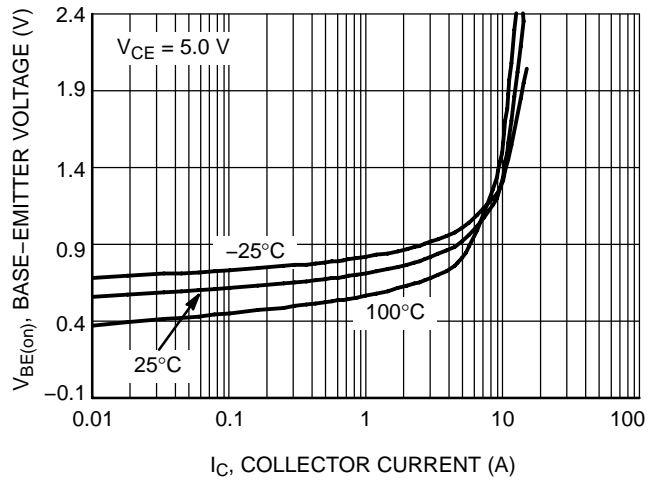
**Figure 3. NJL0281A DC Current Gain**



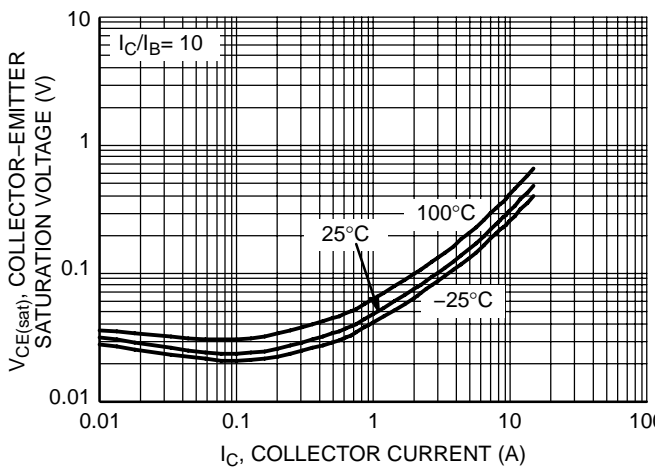
**Figure 4. NJL0302A DC Current Gain**



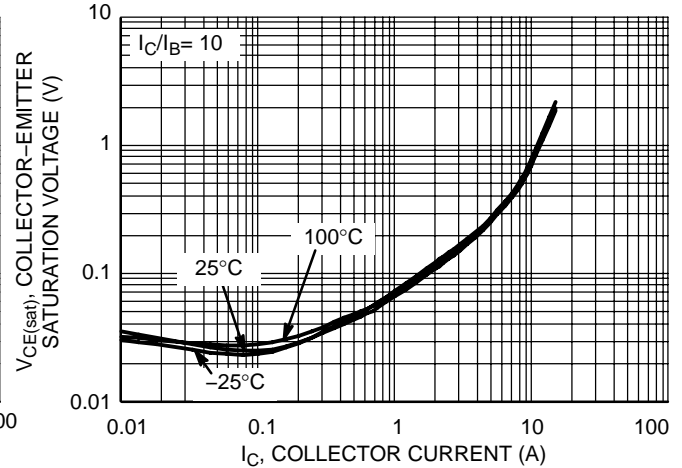
**Figure 5. NJL0281A Base-Emitter Voltage**



**Figure 6. NJL0302A Base-Emitter Voltage**

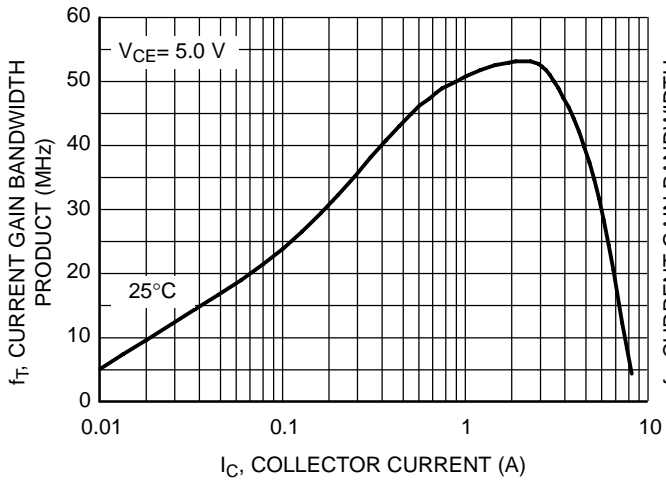


**Figure 7. NJL0281A Saturation Voltage**

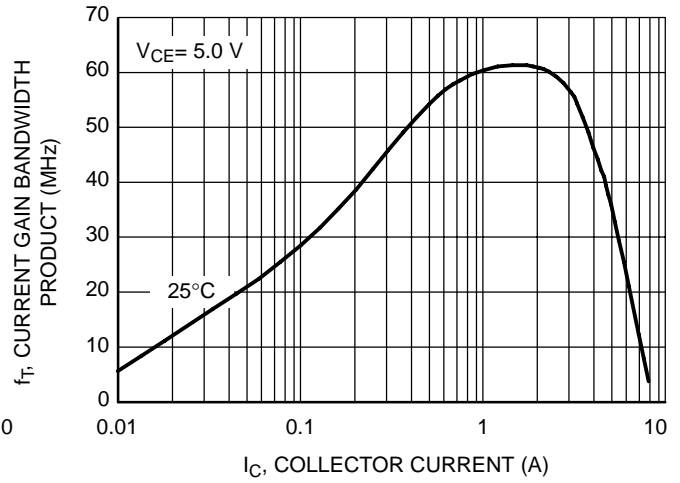


**Figure 8. NJL0302A Saturation Voltage**

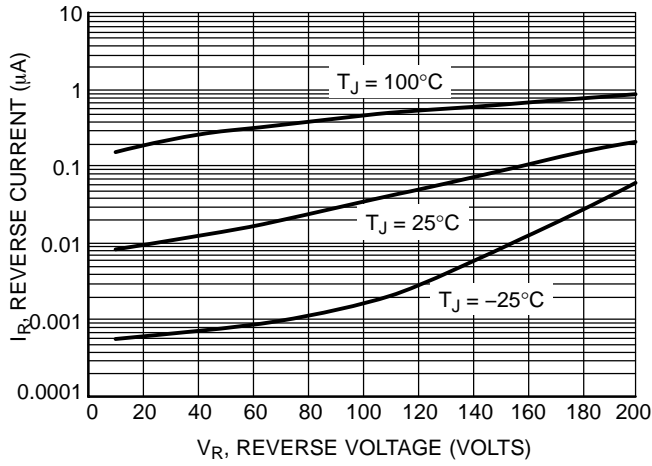
## NJL0281D (NPN) NJL0302D (PNP)



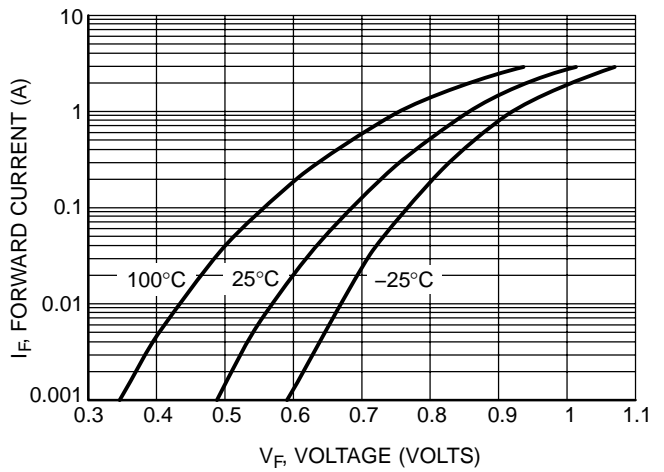
**Figure 9. NJL0281A Current Gain Bandwidth Product**



**Figure 10. NJL0302A Current Gain Bandwidth Product**



**Figure 11. Typical Reverse Current**



**Figure 12. Typical Forward Voltage**

# MECHANICAL CASE OUTLINE

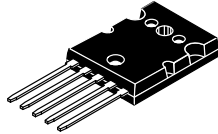
## PACKAGE DIMENSIONS

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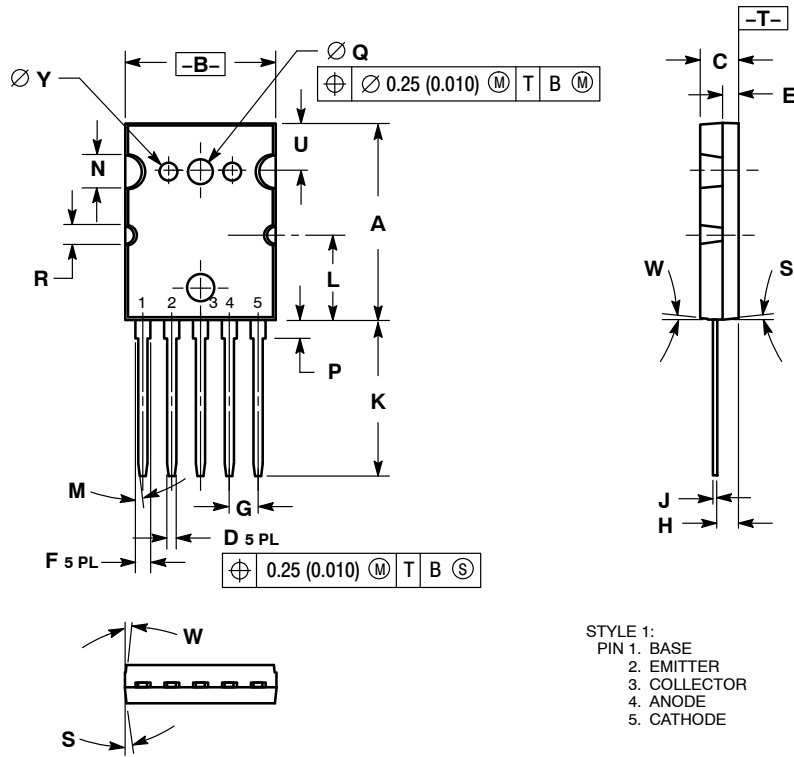


TO-264, 5 LEAD  
CASE 340AA-01  
ISSUE O

DATE 03 FEB 2005



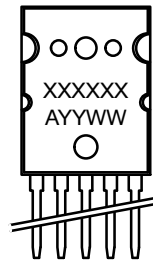
SCALE 1:2



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

| DIM | MILLIMETERS |        |        | INCHES     |        |        |
|-----|-------------|--------|--------|------------|--------|--------|
|     | MIN         | NOM    | MAX    | MIN        | NOM    | MAX    |
| A   | 25.857      | 25.984 | 26.111 | 1.018      | 1.023  | 1.028  |
| B   | 19.761      | 19.888 | 20.015 | 0.778      | 0.783  | 0.788  |
| C   | 4.699       | 4.890  | 5.182  | 0.185      | 0.199  | 0.204  |
| D   | 1.219 BSC   |        |        | 0.0480 BSC |        |        |
| E   | 1.890       | 2.042  | 2.184  | 0.0748     | 0.0804 | 0.0860 |
| F   | 1.981 BSC   |        |        | 0.0780 BSC |        |        |
| G   | 3.81 BSC    |        |        | 0.150 BSC  |        |        |
| H   | 2.667       | 2.718  | 2.769  | 0.1050     | 0.1070 | 0.1090 |
| J   | 0.584 BSC   |        |        | 0.0230 BSC |        |        |
| K   | 20.422      | 20.549 | 20.676 | 0.804      | 0.809  | 0.814  |
| L   | 11.28 REF   |        |        | 0.444 REF  |        |        |
| M   | 0°          | ---    | 7°     | 0°         | ---    | 7°     |
| N   | 4.57 REF    |        |        | 0.180 REF  |        |        |
| P   | 2.259       | 2.386  | 2.513  | 0.0889     | 0.0939 | 0.0989 |
| Q   | 3.480 BSC   |        |        | 0.1370 BSC |        |        |
| R   | 2.54 REF    |        |        | 0.100 REF  |        |        |
| S   | 0°          | ---    | 8°     | 0°         | ---    | 8°     |
| U   | 6.17 REF    |        |        | 0.243 REF  |        |        |
| W   | 0°          | ---    | 6°     | 0°         | ---    | 6°     |
| Y   | 2.388 BSC   |        |        | 0.0940 BSC |        |        |

### GENERIC MARKING DIAGRAM\*



XXXXXX = Specific Device Code  
A = Assembly Location  
YY = Year  
WW = Work Week  
G or ■ = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "■", may or may not be present.

|                  |                |  |
|------------------|----------------|--|
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| DESCRIPTION:     | TO-264, 5 LEAD | PAGE 1 OF 1  |

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