

# Complementary Bipolar Power Transistors

## MJL3281A (NPN) MJL1302A (PNP)

### Features

- Exceptional Safe Operating Area
- NPN/PNP Gain Matching within 10% from 50 mA to 5 A
- Excellent Gain Linearity
- High BVCEO
- High Frequency
- These Devices are Pb-Free and are RoHS Compliant\*

### Benefits

- Reliable Performance at Higher Powers
- Symmetrical Characteristics in Complementary Configurations
- Accurate Reproduction of Input Signal
- Greater Dynamic Range
- High Amplifier Bandwidth

### Applications

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

### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

| Rating                                                                                | Symbol         | Value           | Unit                         |
|---------------------------------------------------------------------------------------|----------------|-----------------|------------------------------|
| Collector-Emitter Voltage                                                             | $V_{CEO}$      | 260             | Vdc                          |
| Collector-Base Voltage                                                                | $V_{CBO}$      | 260             | Vdc                          |
| Emitter-Base Voltage                                                                  | $V_{EBO}$      | 5.0             | Vdc                          |
| Collector-Emitter Voltage – 1.5 V                                                     | $V_{CEX}$      | 260             | Vdc                          |
| Collector Current – Continuous                                                        | $I_C$          | 15              | Adc                          |
| Collector Current – Peak (Note 1)                                                     | $I_{CM}$       | 25              | Adc                          |
| Base Current – Continuous                                                             | $I_B$          | 1.5             | Adc                          |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate Above $25^\circ\text{C}$ | $P_D$          | 200<br>1.43     | Watts<br>W/ $^\circ\text{C}$ |
| Operating and Storage Junction Temperature Range                                      | $T_J, T_{stg}$ | – 65 to<br>+150 | $^\circ\text{C}$             |

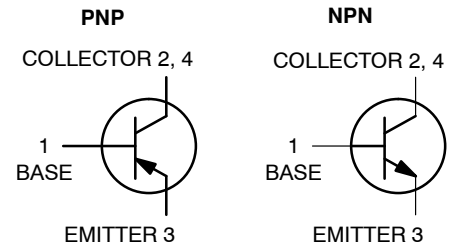
### THERMAL CHARACTERISTICS

| Characteristic                       | Symbol          | Max   | Unit                      |
|--------------------------------------|-----------------|-------|---------------------------|
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | 0.625 | $^\circ\text{C}/\text{W}$ |

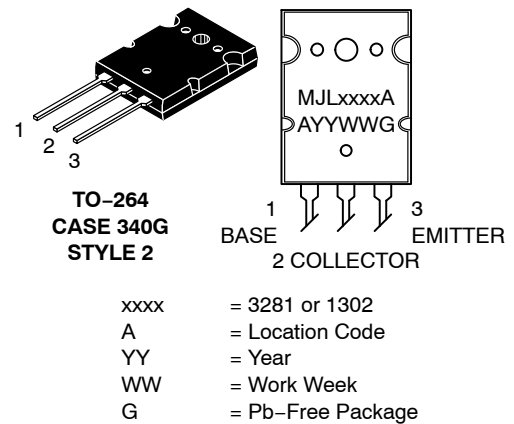
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

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

15 AMPERES  
COMPLEMENTARY  
SILICON POWER  
TRANSISTORS  
260 VOLTS  
200 WATTS



### MARKING DIAGRAM



### ORDERING INFORMATION

| Device    | Package             | Shipping      |
|-----------|---------------------|---------------|
| MJL3281AG | TO-264<br>(Pb-Free) | 25 Units/Rail |
| MJL1302AG | TO-264<br>(Pb-Free) | 25 Units/Rail |

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

# MJL3281A (NPN) MJL1302A (PNP)

## ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise noted)

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

### OFF CHARACTERISTICS

|                                                                                                      |                       |     |    |                  |
|------------------------------------------------------------------------------------------------------|-----------------------|-----|----|------------------|
| Collector-Emitter Sustaining Voltage<br>(I <sub>C</sub> = 100 mA <sub>dc</sub> , I <sub>B</sub> = 0) | V <sub>CEO(sus)</sub> | 260 | –  | V <sub>dc</sub>  |
| Collector Cutoff Current<br>(V <sub>CB</sub> = 260 V <sub>dc</sub> , I <sub>E</sub> = 0)             | I <sub>CBO</sub>      | –   | 50 | μA <sub>dc</sub> |
| Emitter Cutoff Current<br>(V <sub>EB</sub> = 5 V <sub>dc</sub> , I <sub>C</sub> = 0)                 | I <sub>EBO</sub>      | –   | 5  | μA <sub>dc</sub> |

### SECOND BREAKDOWN

|                                                                                                                                                                                              |                  |        |        |                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------|--------|-----------------|
| Second Breakdown Collector with Base Forward Biased<br>(V <sub>CE</sub> = 50 V <sub>dc</sub> , t = 1 s (non-repetitive)<br>(V <sub>CE</sub> = 100 V <sub>dc</sub> , t = 1 s (non-repetitive) | I <sub>S/b</sub> | 4<br>1 | –<br>– | A <sub>dc</sub> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------|--------|-----------------|

### ON CHARACTERISTICS

|                                                                                                                                                                                                                                                                                                                                                                                                                               |                      |                            |                               |                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|----------------------------|-------------------------------|-----------------|
| DC Current Gain<br>(I <sub>C</sub> = 500 mA <sub>dc</sub> , V <sub>CE</sub> = 5 V <sub>dc</sub> )<br>(I <sub>C</sub> = 1 A <sub>dc</sub> , V <sub>CE</sub> = 5 V <sub>dc</sub> )<br>(I <sub>C</sub> = 3 A <sub>dc</sub> , V <sub>CE</sub> = 5 V <sub>dc</sub> )<br>(I <sub>C</sub> = 5 A <sub>dc</sub> , V <sub>CE</sub> = 5 V <sub>dc</sub> )<br>(I <sub>C</sub> = 8 A <sub>dc</sub> , V <sub>CE</sub> = 5 V <sub>dc</sub> ) | h <sub>FE</sub>      | 75<br>75<br>75<br>75<br>45 | 150<br>150<br>150<br>150<br>– |                 |
| Collector-Emitter Saturation Voltage<br>(I <sub>C</sub> = 10 A <sub>dc</sub> , I <sub>B</sub> = 1 A <sub>dc</sub> )                                                                                                                                                                                                                                                                                                           | V <sub>CE(sat)</sub> | –                          | 3                             | V <sub>dc</sub> |

### DYNAMIC CHARACTERISTICS

|                                                                                                                                            |                 |    |     |     |
|--------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----|-----|-----|
| Current-Gain – Bandwidth Product<br>(I <sub>C</sub> = 1 A <sub>dc</sub> , V <sub>CE</sub> = 5 V <sub>dc</sub> , f <sub>test</sub> = 1 MHz) | f <sub>T</sub>  | 30 | –   | MHz |
| Output Capacitance<br>(V <sub>CB</sub> = 10 V <sub>dc</sub> , I <sub>E</sub> = 0, f <sub>test</sub> = 1 MHz)                               | C <sub>ob</sub> | –  | 600 | pF  |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be

indicated by the Electrical Characteristics if operated under different conditions.

# MJL3281A (NPN) MJL1302A (PNP)

## TYPICAL CHARACTERISTICS

PNP MJL1302A

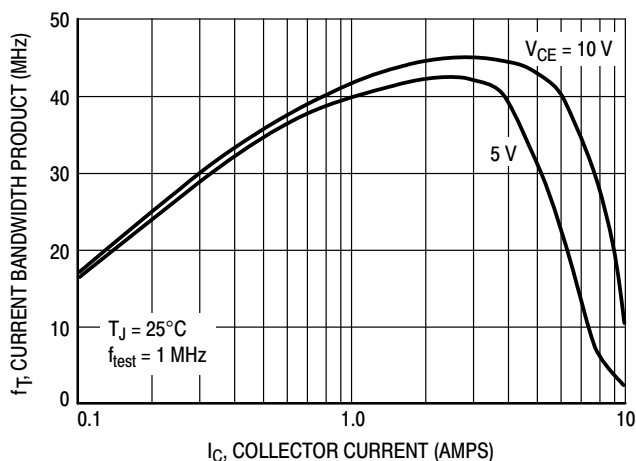


Figure 1. Typical Current Gain Bandwidth Product

NPN MJL3281A

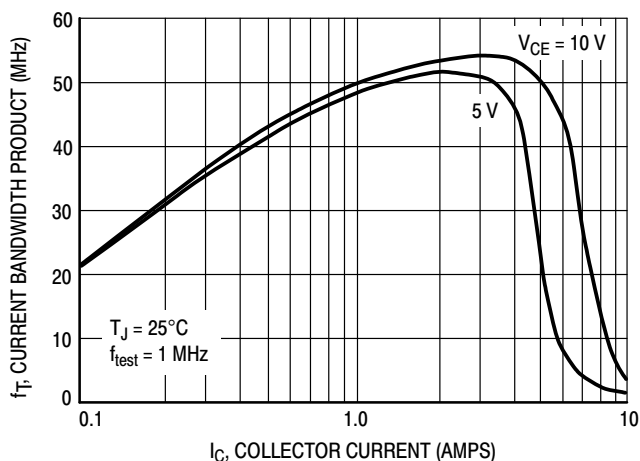


Figure 2. Typical Current Gain Bandwidth Product

PNP MJL1302A

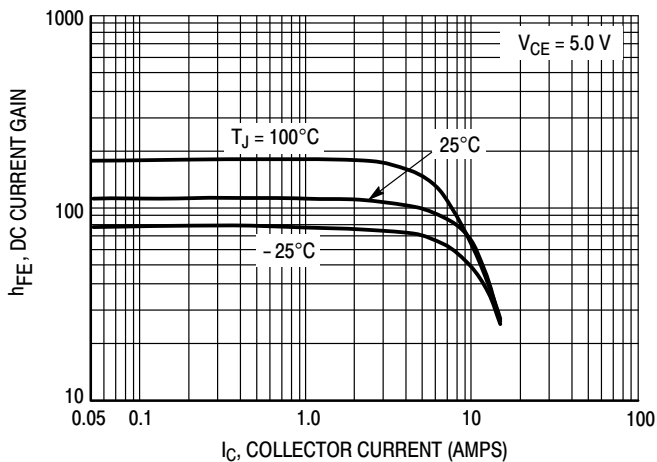


Figure 3. DC Current Gain

NPN MJL3281A

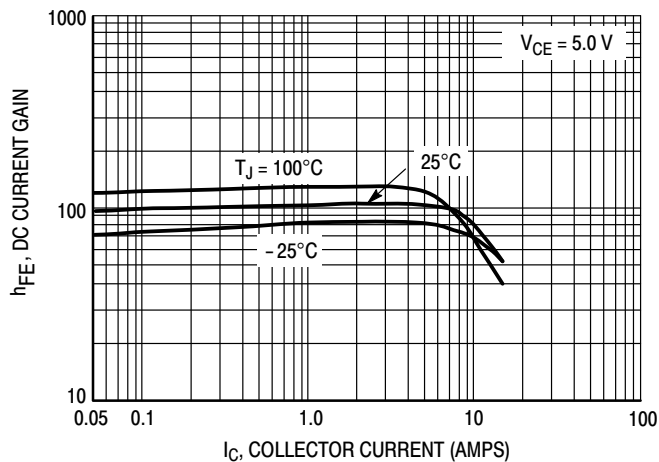


Figure 4. DC Current Gain

PNP MJL1302A

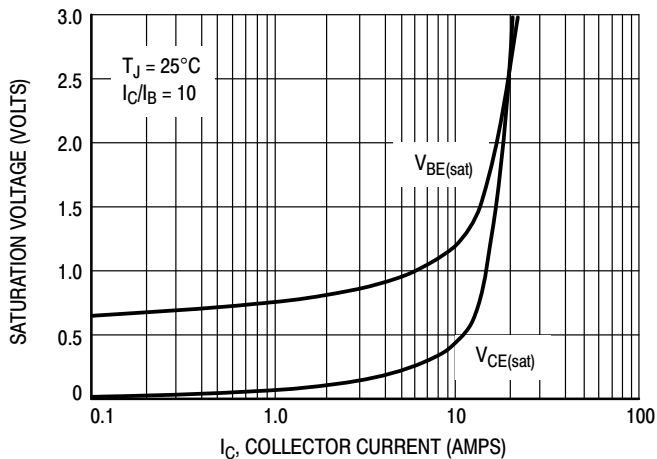


Figure 5. Typical Saturation Voltages

NPN MJL3281A

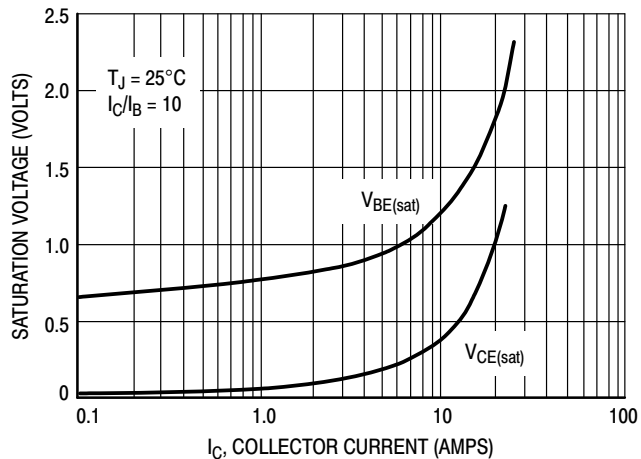


Figure 6. Typical Saturation Voltages

# MJL3281A (NPN) MJL1302A (PNP)

## TYPICAL CHARACTERISTICS

PNP MJL1302A

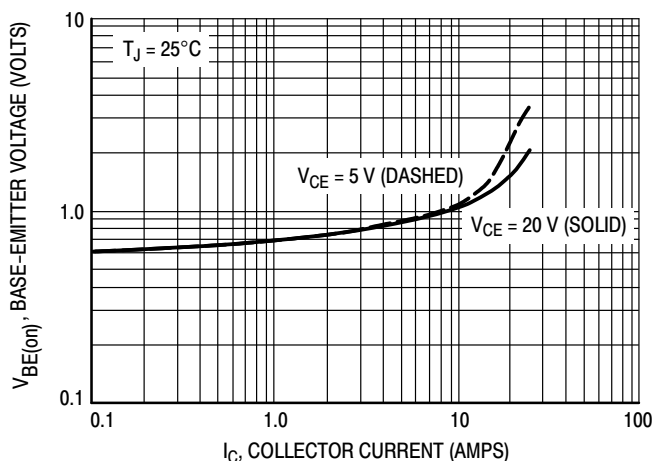


Figure 7. Typical Base-Emitter Voltage

NPN MJL3281A

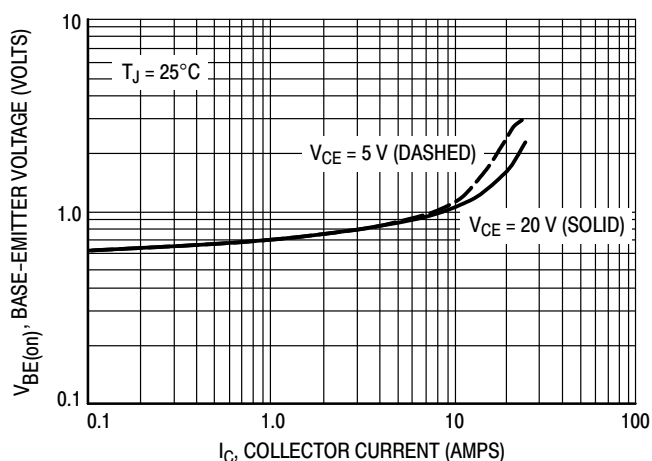


Figure 8. Typical Base-Emitter Voltage

PNP MJL1302A

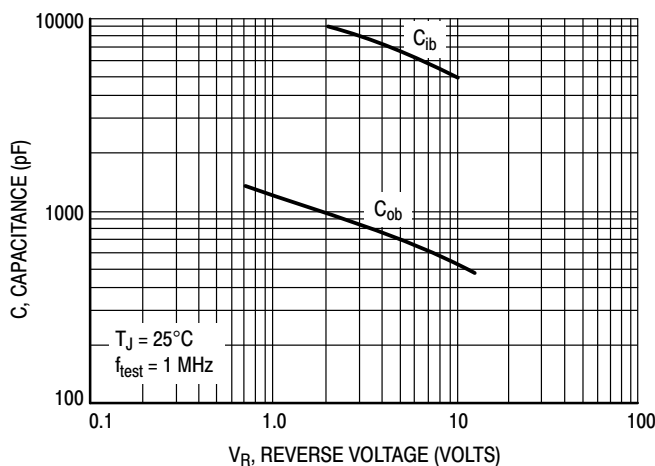


Figure 9. MJL1302A Typical Capacitance

NPN MJL3281A

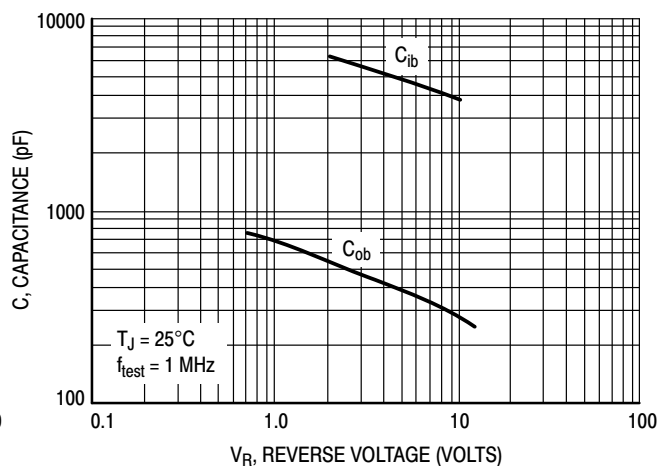


Figure 10. MJL3281A Typical Capacitance

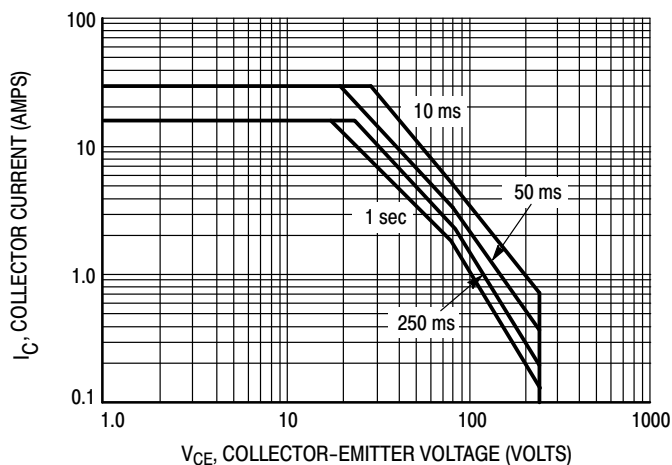
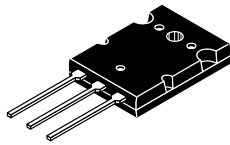


Figure 11. Active Region Safe Operating Area

There are two limitations on the power handling ability of a transistor; average junction temperature and secondary 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.

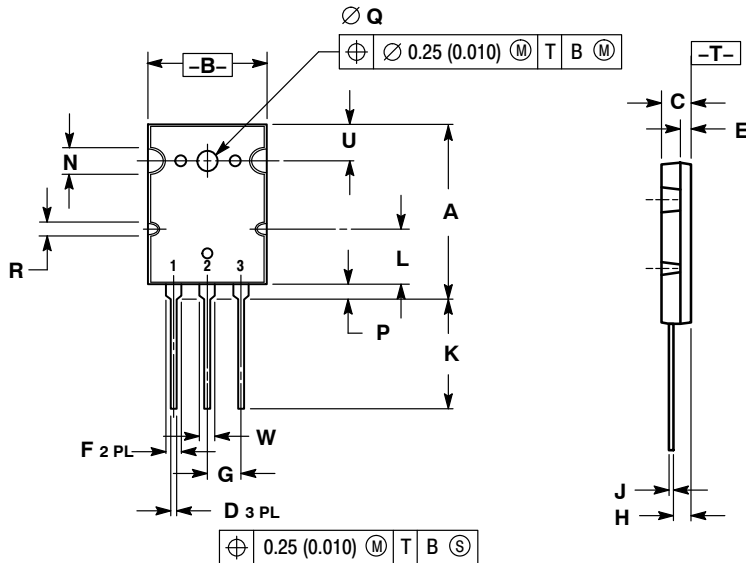
The data of Figure 11 is based on  $T_{J(pk)} = 150^\circ\text{C}$ ;  $T_C$  is variable depending on conditions. At high case temperatures, thermal limitations will reduce the power than can be handled to values less than the limitations imposed by second breakdown.



TO-3BPL (TO-264)  
CASE 340G-02  
ISSUE J

DATE 17 DEC 2004

SCALE 1:2



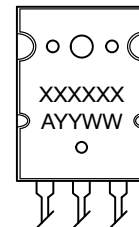
NOTES:

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

| DIM | MIN      | MAX  | MIN       | MAX   |
|-----|----------|------|-----------|-------|
| A   | 28.0     | 29.0 | 1.102     | 1.142 |
| B   | 19.3     | 20.3 | 0.760     | 0.800 |
| C   | 4.7      | 5.3  | 0.185     | 0.209 |
| D   | 0.93     | 1.48 | 0.037     | 0.058 |
| E   | 1.9      | 2.1  | 0.075     | 0.083 |
| F   | 2.2      | 2.4  | 0.087     | 0.102 |
| G   | 5.45 BSC |      | 0.215 BSC |       |
| H   | 2.6      | 3.0  | 0.102     | 0.118 |
| J   | 0.43     | 0.78 | 0.017     | 0.031 |
| K   | 17.6     | 18.8 | 0.693     | 0.740 |
| L   | 11.2 REF |      | 0.411 REF |       |
| N   | 4.35 REF |      | 0.172 REF |       |
| P   | 2.2      | 2.6  | 0.087     | 0.102 |
| Q   | 3.1      | 3.5  | 0.122     | 0.137 |
| R   | 2.25 REF |      | 0.089 REF |       |
| U   | 6.3 REF  |      | 0.248 REF |       |
| W   | 2.8      | 3.2  | 0.110     | 0.125 |

GENERIC  
MARKING DIAGRAM\*

- STYLE 1:  
PIN 1. GATE  
2. DRAIN  
3. SOURCE
- STYLE 2:  
PIN 1. BASE  
2. COLLECTOR  
3. EMITTER
- STYLE 3:  
PIN 1. GATE  
2. SOURCE  
3. DRAIN
- STYLE 4:  
PIN 1. DRAIN  
2. SOURCE  
3. GATE
- STYLE 5:  
PIN 1. GATE  
2. COLLECTOR  
3. EMITTER



XXXXXX = Specific Device Code  
A = Location Code  
YY = Year  
WW = Work Week

\*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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