

# Complementary NPN-PNP Silicon Power Bipolar Transistors

## MJL4281A (NPN) MJL4302A (PNP)

The MJL4281A and MJL4302A are power transistors for high power audio.

### Features

- 350 V Collector-Emitter Sustaining Voltage
- Gain Complementary:
  - Gain Linearity from 100 mA to 5 A
  - High Gain – 80 to 240
  - $h_{FE} = 50$  (min) @  $I_C = 8$  A
- Low Harmonic Distortion
- High Safe Operation Area – 1.0 A/100 V @ 1 Second
- High  $f_T$
- Pb-Free Packages are Available\*

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

| Rating                                                                                | Symbol         | Value       | Unit      |
|---------------------------------------------------------------------------------------|----------------|-------------|-----------|
| Collector-Emitter Voltage                                                             | $V_{CEO}$      | 350         | Vdc       |
| Collector-Base Voltage                                                                | $V_{CBO}$      | 350         | Vdc       |
| Emitter-Base Voltage                                                                  | $V_{EBO}$      | 5.0         | Vdc       |
| Collector-Emitter Voltage – 1.5 V                                                     | $V_{CEX}$      | 350         | Vdc       |
| Collector Current – Continuous<br>– Peak (Note 1)                                     | $I_C$          | 15<br>30    | Adc       |
| Base Current – Continuous                                                             | $I_B$          | 1.5         | Adc       |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate Above $25^\circ\text{C}$ | $P_D$          | 230<br>1.84 | W<br>°C/W |
| Operating and Storage Junction<br>Temperature Range                                   | $T_J, T_{stg}$ | –65 to +150 | °C        |

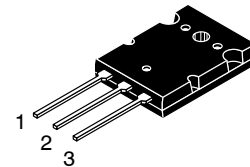
### THERMAL CHARACTERISTICS

| Characteristic                       | Symbol          | Max  | Unit |
|--------------------------------------|-----------------|------|------|
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | 0.54 | °C/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.

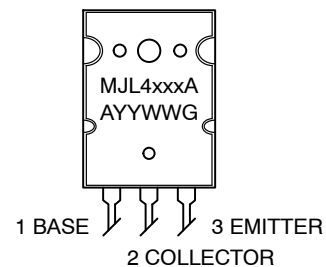
1. Pulse Test: Pulse Width = 5 ms, Duty Cycle < 10%.

15 AMPERES  
COMPLEMENTARY SILICON  
POWER TRANSISTORS  
350 VOLTS, 230 WATTS



TO-264  
CASE 340G  
STYLE 2

### MARKING DIAGRAM



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

### ORDERING INFORMATION

| Device    | Package             | Shipping      |
|-----------|---------------------|---------------|
| MJL4281A  | TO-264              | 25 Units/Rail |
| MJL4281AG | TO-264<br>(Pb-Free) | 25 Units/Rail |
| MJL4302A  | TO-264              | 25 Units/Rail |
| MJL4302AG | 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.

# MJL4281A (NPN) MJL4302A (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> = 50 mA, I <sub>B</sub> = 0) | V <sub>CE(sus)</sub> | 350 |     | Vdc  |
| Collector Cut-off Current<br>(V <sub>CE</sub> = 200 V, I <sub>B</sub> = 0)           | I <sub>CEO</sub>     |     | 100 | μAdc |
| Collector Cutoff Current<br>(V <sub>CB</sub> = 350 Vdc, I <sub>E</sub> = 0)          | I <sub>CBO</sub>     | –   | 50  | μAdc |
| Emitter Cutoff Current<br>(V <sub>EB</sub> = 5.0 Vdc, I <sub>C</sub> = 0)            | I <sub>EBO</sub>     | –   | 5.0 | μAdc |

### SECOND BREAKDOWN

|                                                                                                                                                                        |                  |            |        |     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------|--------|-----|
| Second Breakdown Collector with Base Forward Biased<br>(V <sub>CE</sub> = 50 Vdc, t = 1.0 s (non-repetitive)<br>(V <sub>CE</sub> = 100 Vdc, t = 1.0 s (non-repetitive) | I <sub>S/b</sub> | 4.5<br>1.0 | –<br>– | Adc |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------|--------|-----|

### ON CHARACTERISTICS

|                                                                                                                                                                                                                                                                                                                                                                       |                      |                                  |                                    |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|----------------------------------|------------------------------------|-----|
| DC Current Gain<br>(I <sub>C</sub> = 100 mAdc, V <sub>CE</sub> = 5.0 Vdc)<br>(I <sub>C</sub> = 1.0 Adc, V <sub>CE</sub> = 5.0 Vdc)<br>(I <sub>C</sub> = 3.0 Adc, V <sub>CE</sub> = 5.0 Vdc)<br>(I <sub>C</sub> = 5.0 Adc, V <sub>CE</sub> = 5.0 Vdc)<br>(I <sub>C</sub> = 8.0 Adc, V <sub>CE</sub> = 5.0 Vdc)<br>(I <sub>C</sub> = 15 Adc, V <sub>CE</sub> = 5.0 Vdc) | h <sub>FE</sub>      | 80<br>80<br>80<br>80<br>50<br>10 | 250<br>250<br>250<br>250<br>–<br>– | –   |
| Collector–Emitter Saturation Voltage<br>(I <sub>C</sub> = 8.0 Adc, I <sub>B</sub> = 0.8 Adc)                                                                                                                                                                                                                                                                          | V <sub>CE(sat)</sub> | –                                | 1.0                                | Vdc |
| Emitter–Base Saturation Voltage<br>(I <sub>C</sub> = 8.0 Adc, I <sub>B</sub> = 0.8 A)                                                                                                                                                                                                                                                                                 | V <sub>BE(sat)</sub> | –                                | 1.4                                | Vdc |
| Base–Emitter ON Voltage<br>(I <sub>C</sub> = 8.0 Adc, V <sub>CE</sub> = 5.0 Vdc)                                                                                                                                                                                                                                                                                      | V <sub>BE(on)</sub>  | –                                | 1.5                                | Vdc |

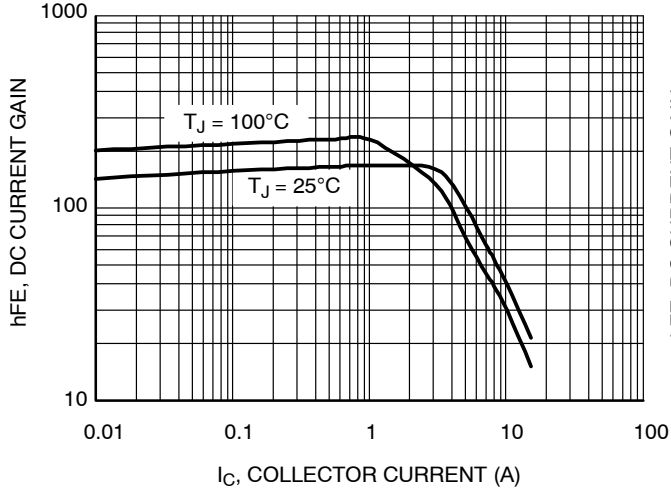
### DYNAMIC CHARACTERISTICS

|                                                                                                                        |                 |    |     |     |
|------------------------------------------------------------------------------------------------------------------------|-----------------|----|-----|-----|
| Current–Gain – Bandwidth Product<br>(I <sub>C</sub> = 1.0 Adc, V <sub>CE</sub> = 5.0 Vdc, f <sub>test</sub> = 1.0 MHz) | f <sub>T</sub>  | 35 | –   | MHz |
| Output Capacitance<br>(V <sub>CB</sub> = 10 Vdc, I <sub>E</sub> = 0, f <sub>test</sub> = 1.0 MHz)                      | C <sub>ob</sub> | –  | 600 | pF  |

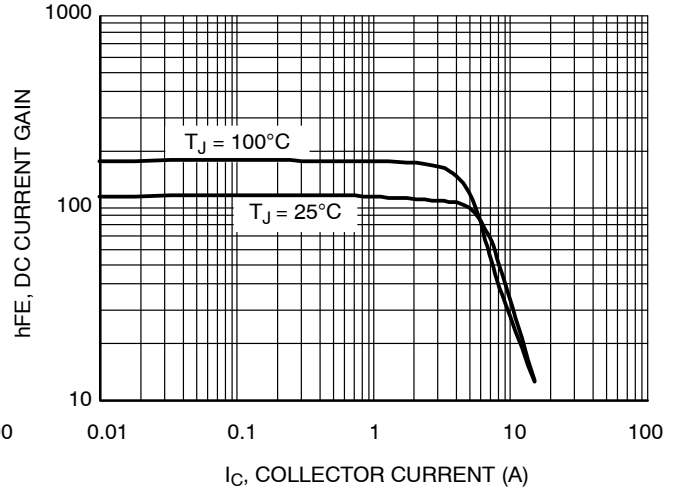
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

# MJL4281A (NPN) MJL4302A (PNP)

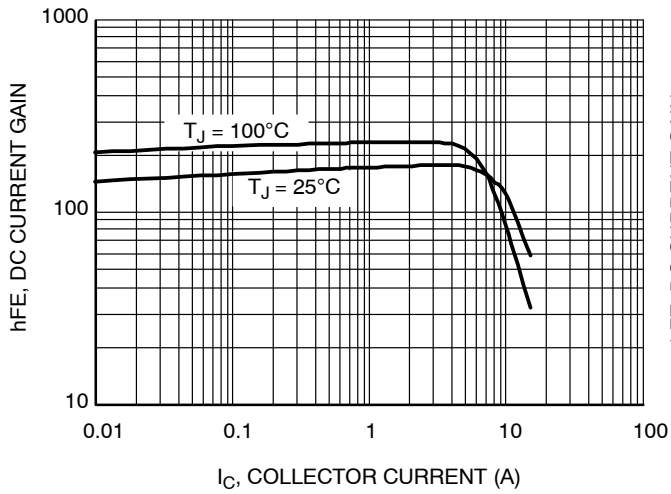
## TYPICAL CHARACTERISTICS



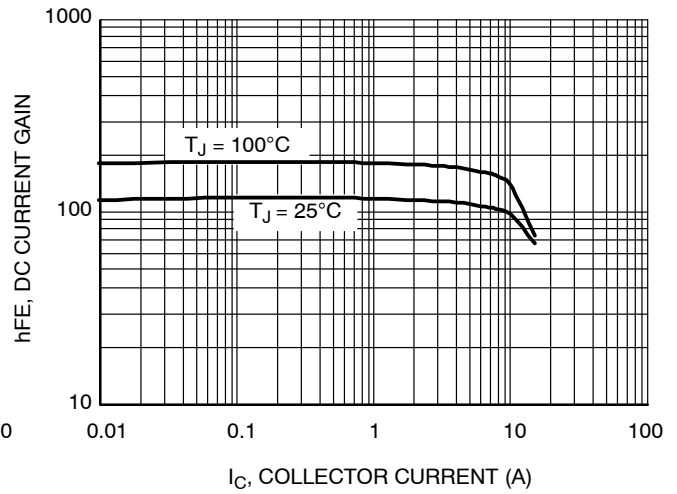
**Figure 1. DC Current Gain,  $V_{CE} = 5V$ ,  
NPN MJL4281A**



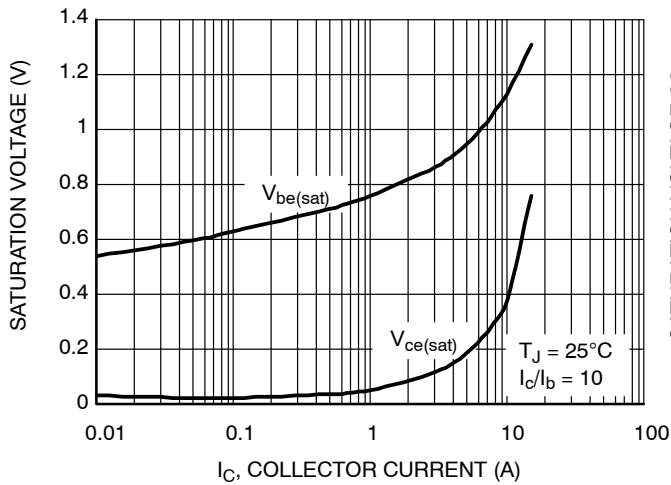
**Figure 2. DC Current Gain,  $V_{CE} = 5V$ ,  
PNP MJL4302A**



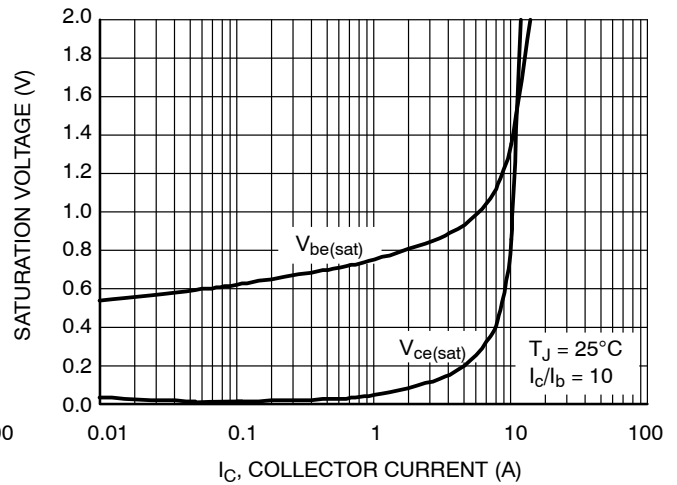
**Figure 3. DC Current Gain,  $V_{CE} = 20V$ ,  
NPN MJL4281A**



**Figure 4. DC Current Gain,  $V_{CE} = 20V$ ,  
PNP MJL4302A**



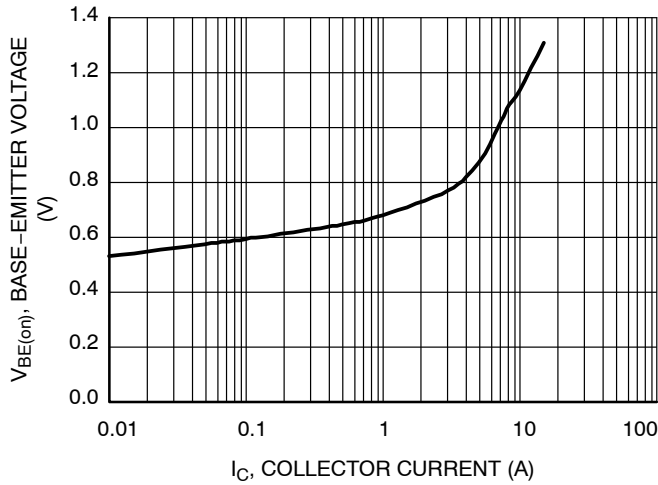
**Figure 5. Typical Saturation Voltage,  
NPN MJL4281A**



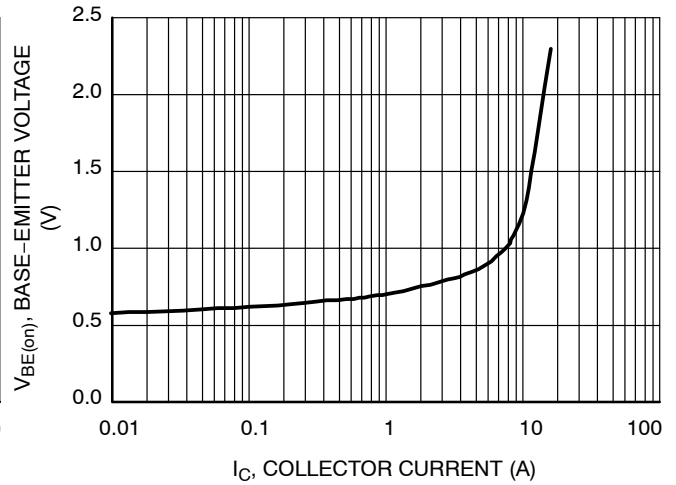
**Figure 6. Typical Saturation Voltage,  
PNP MJL4302A**

# MJL4281A (NPN) MJL4302A (PNP)

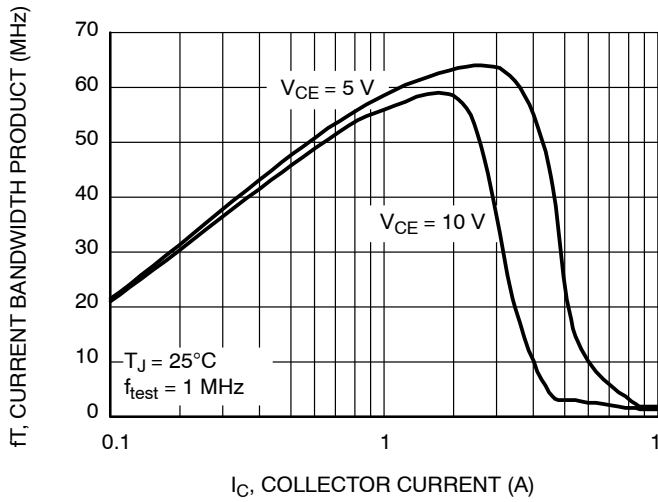
## TYPICAL CHARACTERISTICS



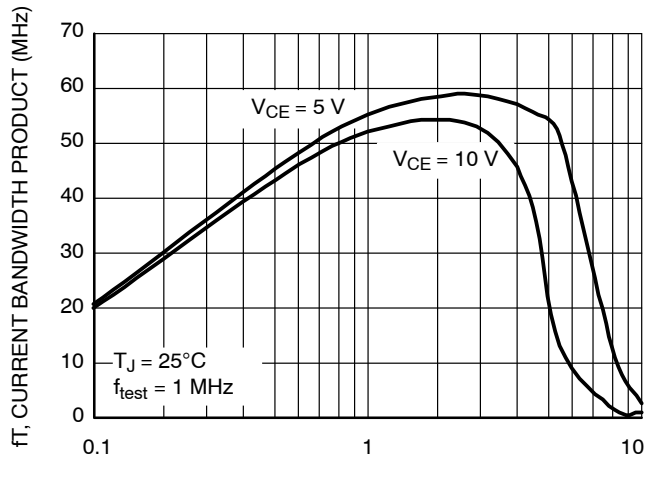
**Figure 7. Typical Base-Emitter Voltages, NPN MJL4281A**



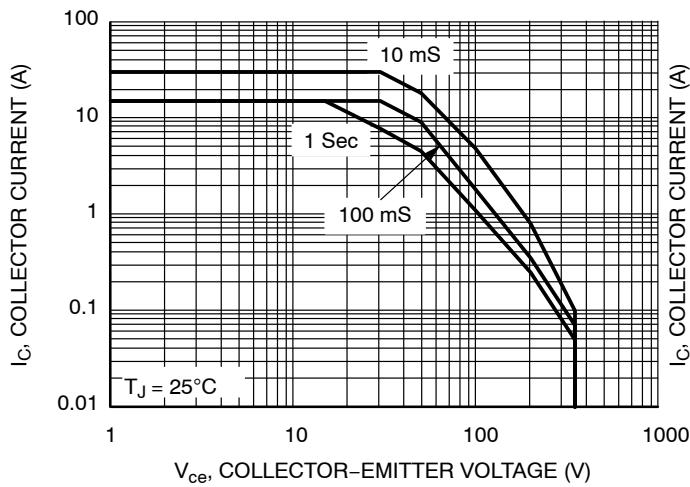
**Figure 8. Typical Base-Emitter Voltages, PNP MJL4302A**



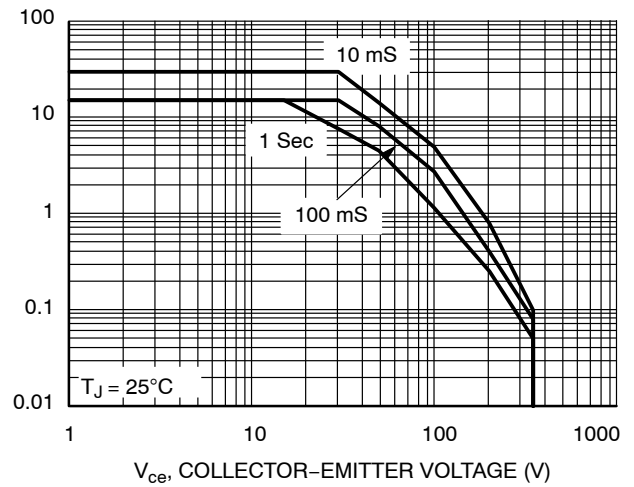
**Figure 9. Typical Current Gain Bandwidth Product, NPN MJL4281A**



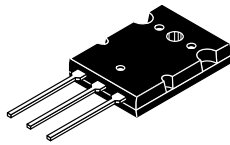
**Figure 10. Typical Current Gain Bandwidth Product, PNP MJL4302A**



**Figure 11. Active Region Safe Operating Area, NPN MJL4281A**



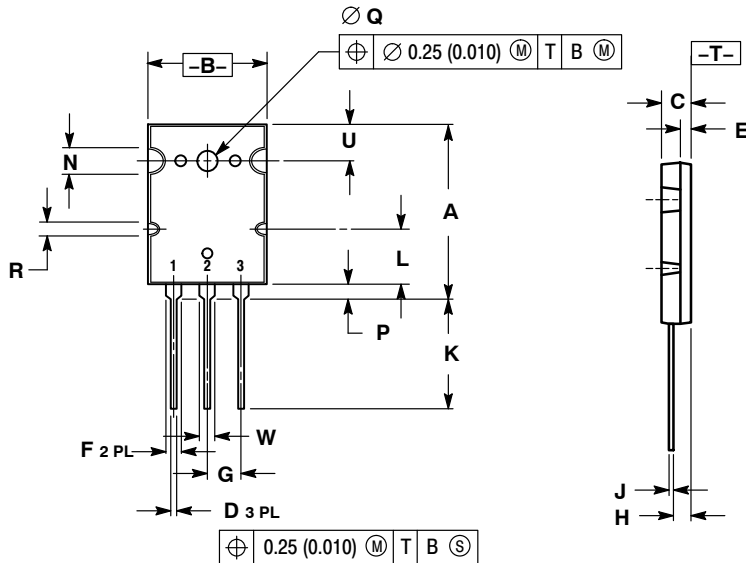
**Figure 12. Active Region Safe Operating Area, PNP MJL4302A**



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

DATE 17 DEC 2004

SCALE 1:2



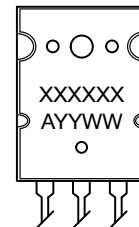
NOTES:

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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