

# 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>$^\circ\text{C/W}$ |
| Operating and Storage Junction<br>Temperature Range                                   | $T_J, T_{stg}$ | -65 to +150 | $^\circ\text{C}$        |

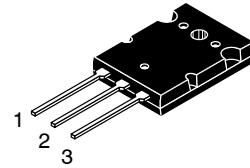
### THERMAL CHARACTERISTICS

| Characteristic                       | Symbol          | Max  | Unit               |
|--------------------------------------|-----------------|------|--------------------|
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | 0.54 | $^\circ\text{C/W}$ |

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.

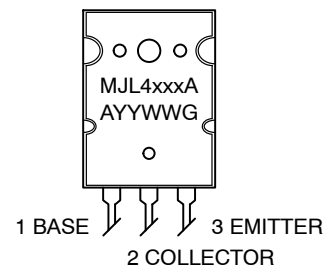
1. Pulse Test: Pulse Width = 5 ms, Duty Cycle < 10%.

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 ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

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

### OFF CHARACTERISTICS

|                                                                              |               |     |     |                 |
|------------------------------------------------------------------------------|---------------|-----|-----|-----------------|
| Collector Emitter Sustaining Voltage<br>( $I_C = 50\text{ mA}$ , $I_B = 0$ ) | $V_{CE(sus)}$ | 350 |     | Vdc             |
| Collector Cut-off Current<br>( $V_{CE} = 200\text{ V}$ , $I_B = 0$ )         | $I_{CEO}$     |     | 100 | $\mu\text{Adc}$ |
| Collector Cutoff Current<br>( $V_{CB} = 350\text{ Vdc}$ , $I_E = 0$ )        | $I_{CBO}$     | –   | 50  | $\mu\text{Adc}$ |
| Emitter Cutoff Current<br>( $V_{EB} = 5.0\text{ Vdc}$ , $I_C = 0$ )          | $I_{EBO}$     | –   | 5.0 | $\mu\text{Adc}$ |

### SECOND BREAKDOWN

|                                                                                                                                                                                                |           |            |        |     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------|--------|-----|
| Second Breakdown Collector with Base Forward Biased<br>( $V_{CE} = 50\text{ Vdc}$ , $t = 1.0\text{ s}$ (non-repetitive))<br>( $V_{CE} = 100\text{ Vdc}$ , $t = 1.0\text{ s}$ (non-repetitive)) | $I_{S/b}$ | 4.5<br>1.0 | –<br>– | Adc |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------|--------|-----|

### ON CHARACTERISTICS

|                                                                                                                                                                                                                                                                                                                                                                             |               |                                  |                                    |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------------------------------|------------------------------------|-----|
| DC Current Gain<br>( $I_C = 100\text{ mAdc}$ , $V_{CE} = 5.0\text{ Vdc}$ )<br>( $I_C = 1.0\text{ Adc}$ , $V_{CE} = 5.0\text{ Vdc}$ )<br>( $I_C = 3.0\text{ Adc}$ , $V_{CE} = 5.0\text{ Vdc}$ )<br>( $I_C = 5.0\text{ Adc}$ , $V_{CE} = 5.0\text{ Vdc}$ )<br>( $I_C = 8.0\text{ Adc}$ , $V_{CE} = 5.0\text{ Vdc}$ )<br>( $I_C = 15\text{ Adc}$ , $V_{CE} = 5.0\text{ Vdc}$ ) | $h_{FE}$      | 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>( $I_C = 8.0\text{ Adc}$ , $I_B = 0.8\text{ Adc}$ )                                                                                                                                                                                                                                                                                 | $V_{CE(sat)}$ | –                                | 1.0                                | Vdc |
| Emitter–Base Saturation Voltage<br>( $I_C = 8.0\text{ Adc}$ , $I_B = 0.8\text{ A}$ )                                                                                                                                                                                                                                                                                        | $V_{BE(sat)}$ | –                                | 1.4                                | Vdc |
| Base–Emitter ON Voltage<br>( $I_C = 8.0\text{ Adc}$ , $V_{CE} = 5.0\text{ Vdc}$ )                                                                                                                                                                                                                                                                                           | $V_{BE(on)}$  | –                                | 1.5                                | Vdc |

### DYNAMIC CHARACTERISTICS

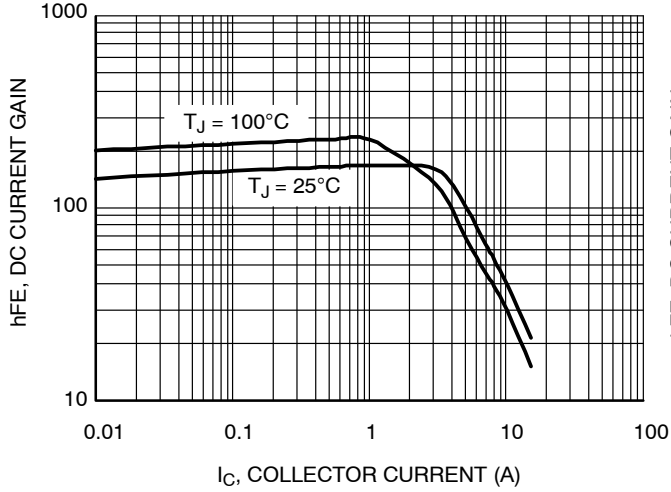
|                                                                                                                          |          |    |     |     |
|--------------------------------------------------------------------------------------------------------------------------|----------|----|-----|-----|
| Current–Gain – Bandwidth Product<br>( $I_C = 1.0\text{ Adc}$ , $V_{CE} = 5.0\text{ Vdc}$ , $f_{test} = 1.0\text{ MHz}$ ) | $f_T$    | 35 | –   | MHz |
| Output Capacitance<br>( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f_{test} = 1.0\text{ MHz}$ )                             | $C_{ob}$ | –  | 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.

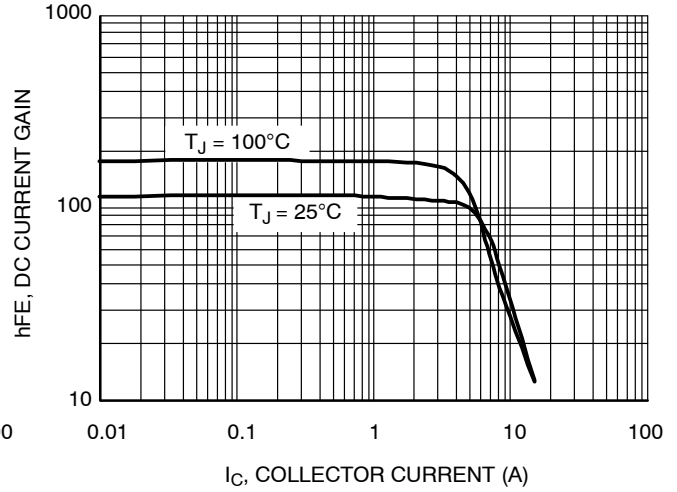


# MJL4281A (NPN) MJL4302A (PNP)

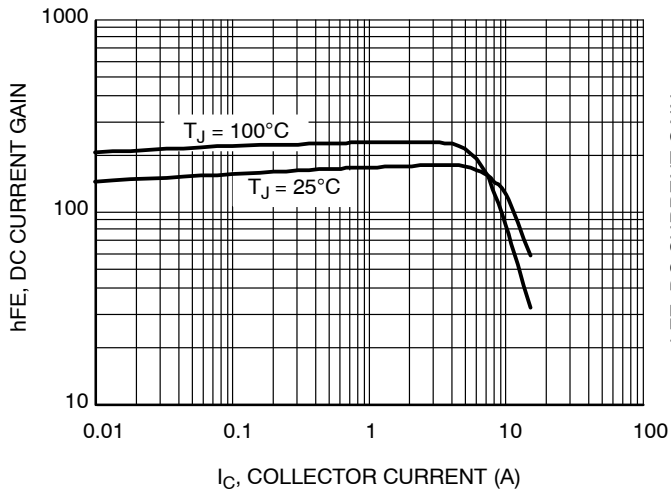
## TYPICAL CHARACTERISTICS



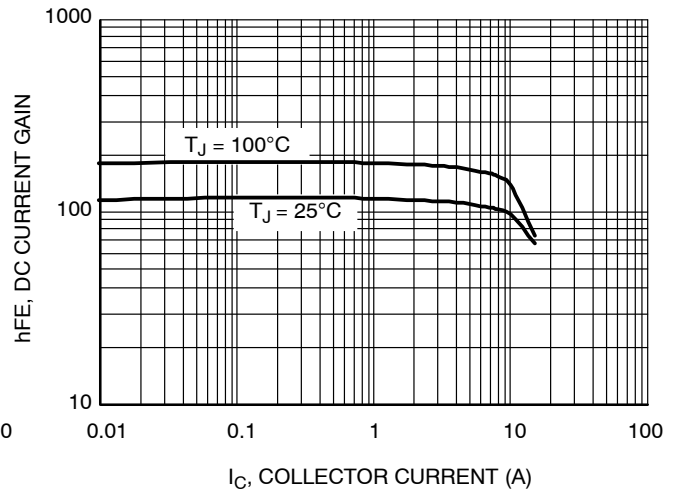
**Figure 1. DC Current Gain,  $V_{CE} = 5\text{ V}$ , NPN MJL4281A**



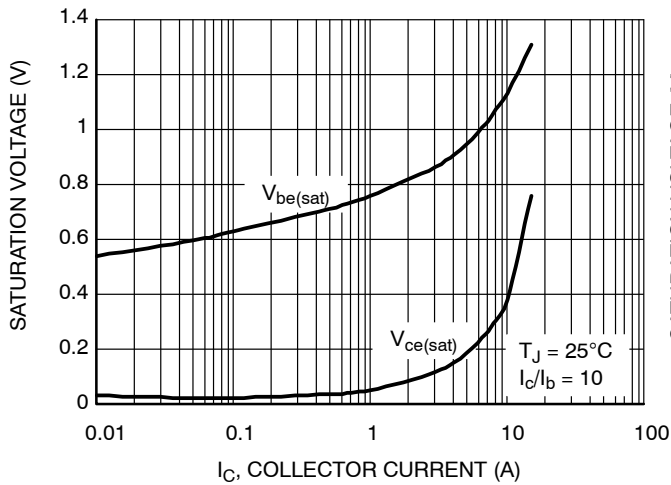
**Figure 2. DC Current Gain,  $V_{CE} = 5\text{ V}$ , PNP MJL4302A**



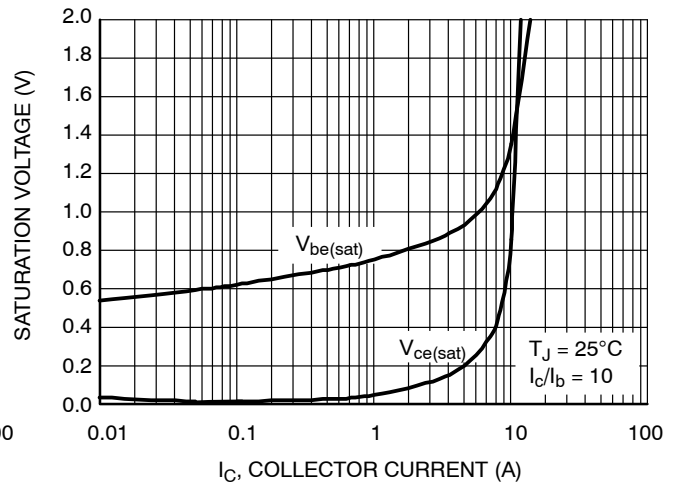
**Figure 3. DC Current Gain,  $V_{CE} = 20\text{ V}$ , NPN MJL4281A**



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



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

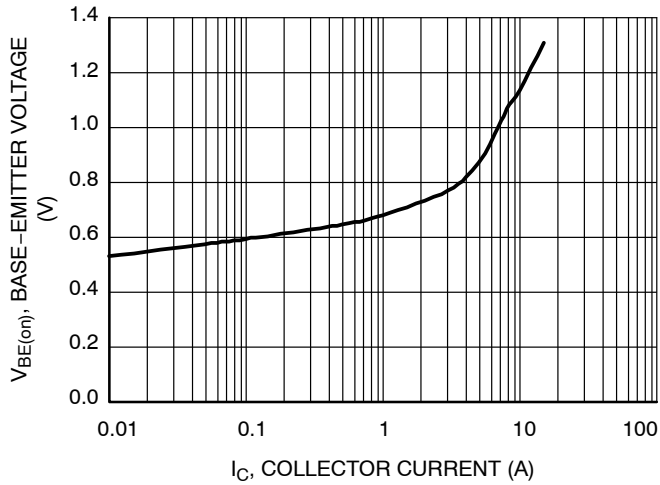


**Figure 6. Typical Saturation Voltage, PNP MJL4302A**

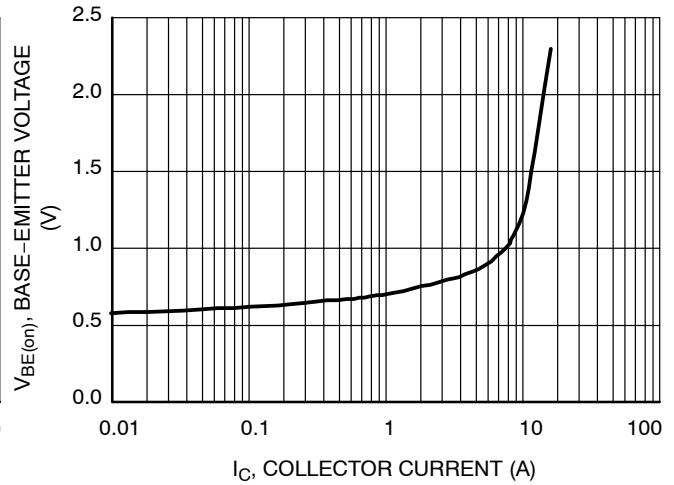


# MJL4281A (NPN) MJL4302A (PNP)

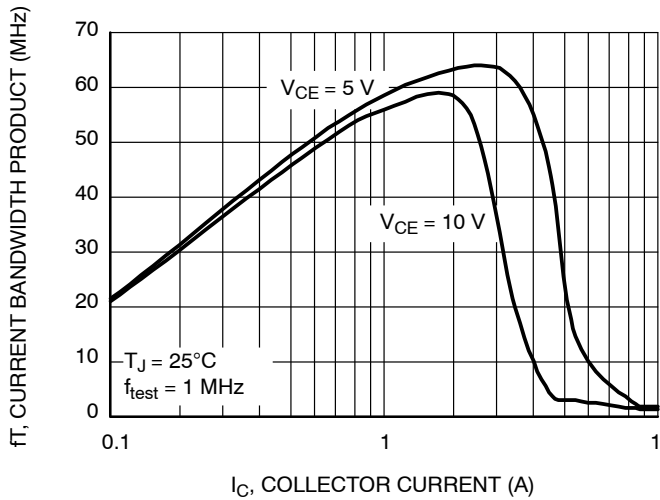
## TYPICAL CHARACTERISTICS



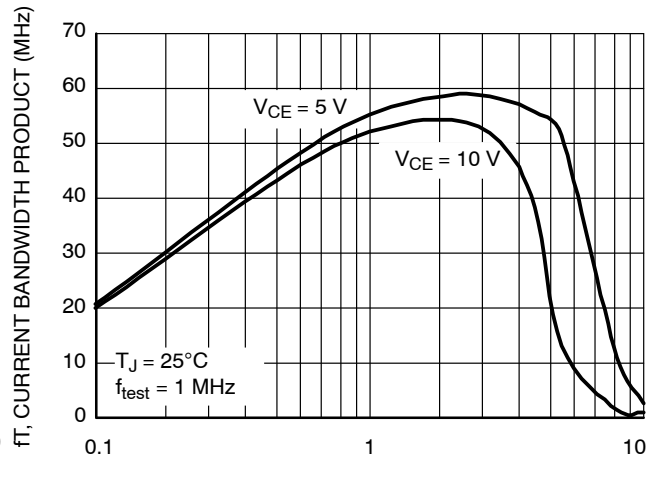
**Figure 7. Typical Base-Emitter Voltages, NPN MJL4281A**



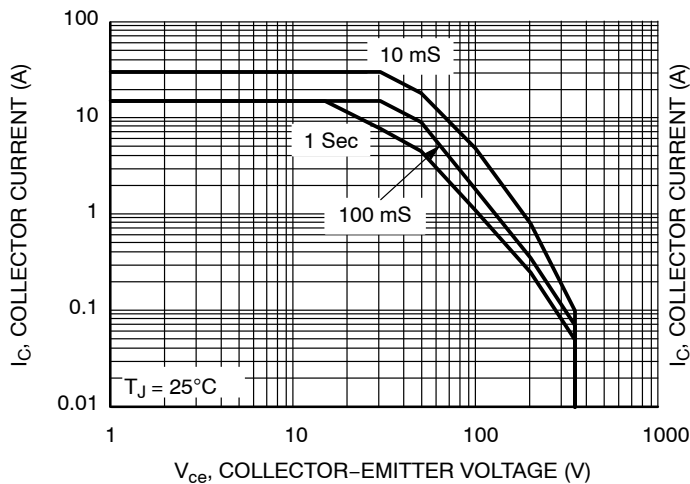
**Figure 8. Typical Base-Emitter Voltages, PNP MJL4302A**



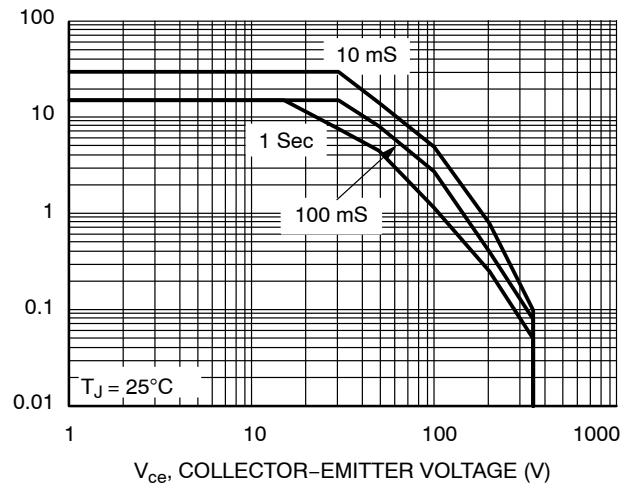
**Figure 9. Typical Current Gain Bandwidth Product, NPN MJL4281A**



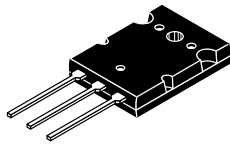
**Figure 10. Typical Current Gain Bandwidth Product, PNP MJL4302A**



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



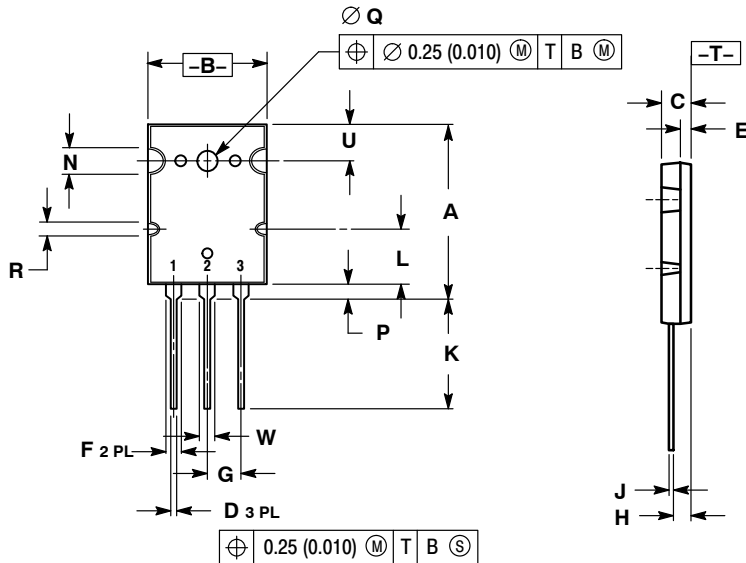
**Figure 12. Active Region Safe Operating Area, PNP MJL4302A**



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

DATE 17 DEC 2004

SCALE 1:2



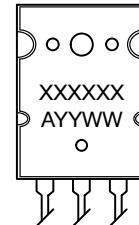
NOTES:

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

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | 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:<br>PIN 1. GATE<br>2. DRAIN<br>3. SOURCE | STYLE 2:<br>PIN 1. BASE<br>2. COLLECTOR<br>3. EMITTER | STYLE 3:<br>PIN 1. GATE<br>2. SOURCE<br>3. DRAIN | STYLE 4:<br>PIN 1. DRAIN<br>2. SOURCE<br>3. GATE | STYLE 5:<br>PIN 1. GATE<br>2. COLLECTOR<br>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.

|                  |                  |                                                                                                                                                                                  |
|------------------|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DOCUMENT NUMBER: | 98ASB42780B      | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| DESCRIPTION:     | TO-3BPL (TO-264) | PAGE 1 OF 1                                                                                                                                                                      |

onsemi and onsemi are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. onsemi does not convey any license under its patent rights nor the rights of others.

**onsemi**, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## ADDITIONAL INFORMATION

### TECHNICAL PUBLICATIONS:

Technical Library: [www.onsemi.com/design/resources/technical-documentation](http://www.onsemi.com/design/resources/technical-documentation)  
onsemi Website: [www.onsemi.com](http://www.onsemi.com)

### ONLINE SUPPORT: [www.onsemi.com/support](http://www.onsemi.com/support)

For additional information, please contact your local Sales Representative at  
[www.onsemi.com/support/sales](http://www.onsemi.com/support/sales)