# Complementary Silicon Plastic Power Transistors

# MJE15028, MJE15030 (NPN), MJE15029, MJE15031 (PNP)

These devices are designed for use as high−frequency drivers in audio amplifiers.

### Features

- High Current Gain − Bandwidth Product
- TO−220 Compact Package
- These Devices are Pb−Free and are RoHS Compliant*

### MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Collector−Emitter Voltage<br>MJE15028G, MJE15029G<br>MJE15030G, MJE15031G | $V_{CEO}$ | <br>120<br>150 | Vdc |
| Collector−Base Voltage<br>MJE15028G, MJE15029G<br>MJE15030G, MJE15031G | $V_{CB}$ | <br>120<br>150 | Vdc |
| Emitter−Base Voltage | $V_{EB}$ | 5.0 | Vdc |
| Collector Current − Continuous | $I_C$ | 8.0 | Adc |
| Collector Current − Peak | $I_{CM}$ | 16 | Adc |
| Base Current | $I_B$ | 2.0 | Adc |
| Total Device Dissipation<br>@ $T_C$ = 25°C<br>Derate above 25°C | $P_D$ | <br>50<br>0.40 | <br>W<br>W/°C |
| Total Device Dissipation<br>@ $T_A$ = 25°C<br>Derate above 25°C | $P_D$ | <br>2.0<br>0.016 | <br>W<br>W/°C |
| Operating and Storage Junction Temperature Range | $T_J$, $T_{stg}$ | −65 to +150 | °C |

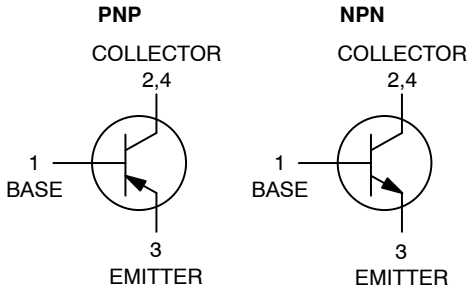
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

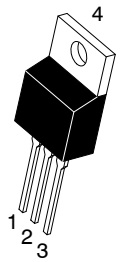
### THERMAL CHARACTERISTICS

| Characteristics | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction−to−Case | $R_{\theta JC}$ | 2.5 | °C/W |
| Thermal Resistance, Junction−to−Ambient | $R_{\theta JA}$ | 62.5 | °C/W |

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

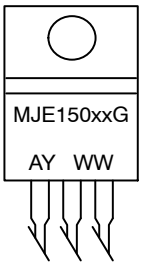
## 8 AMPERE POWER TRANSISTORS COMPLEMENTARY SILICON 120−150 VOLTS, 50 WATTS




**TO−220**
**CASE 221A**
**STYLE 1**

### MARKING DIAGRAM




MJE150xx = Device Code
x = 28, 29, 30, or 31
A = Assembly Location
Y = Year
WW = Work Week
G = Pb−Free Package

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

© Semiconductor Components Industries, LLC, 2014

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

| Characteristic | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | |
| Collector−Emitter Sustaining Voltage (Note 1)<br>($I_C$ = 10 mAdc, $I_B$ = 0)<br>MJE15028, MJE15029<br>MJE15030, MJE15031 | $V_{CEO(sus)}$ | <br><br>120<br>150 | <br><br>–<br>– | Vdc |
| Collector Cutoff Current<br>($V_{CE}$ = 120 Vdc, $I_B$ = 0)<br>MJE15028, MJE15029<br>($V_{CE}$ = 150 Vdc, $I_B$ = 0)<br>MJE15030, MJE15031 | $I_{CEO}$ | <br><br>–<br><br>– | <br><br>0.1<br><br>0.1 | mAdc |
| Collector Cutoff Current<br>($V_{CB}$ = 120 Vdc, $I_E$ = 0)<br>MJE15028, MJE15029<br>($V_{CB}$ = 150 Vdc, $I_E$ = 0)<br>MJE15030, MJE15031 | $I_{CBO}$ | <br><br>–<br><br>– | <br><br>10<br><br>10 | μAdc |
| Emitter Cutoff Current<br>($V_{BE}$ = 5.0 Vdc, $I_C$ = 0) | $I_{EBO}$ | <br>– | <br>10 | μAdc |
| **ON CHARACTERISTICS** (Note 1) | | | | |
| DC Current Gain<br>($I_C$ = 0.1 Adc, $V_{CE}$ = 2.0 Vdc)<br>($I_C$ = 2.0 Adc, $V_{CE}$ = 2.0 Vdc)<br>($I_C$ = 3.0 Adc, $V_{CE}$ = 2.0 Vdc)<br>($I_C$ = 4.0 Adc, $V_{CE}$ = 2.0 Vdc) | $h_{FE}$ | <br>40<br>40<br>40<br>20 | <br>–<br>–<br>–<br>– | – |
| DC Current Gain Linearity<br>($V_{CE}$ From 2.0 V to 20 V, $I_C$ From 0.1 A to 3 A)<br>(NPN to PNP) | $h_{FE}$ | **Typ**<br>2<br>3 | | |
| Collector−Emitter Saturation Voltage<br>($I_C$ = 1.0 Adc, $I_B$ = 0.1 Adc) | $V_{CE(sat)}$ | <br>– | <br>0.5 | Vdc |
| Base−Emitter On Voltage<br>($I_C$ = 1.0 Adc, $V_{CE}$ = 2.0 Vdc) | $V_{BE(on)}$ | <br>– | <br>1.0 | Vdc |
| **DYNAMIC CHARACTERISTICS** | | | | |
| Current Gain − Bandwidth Product (Note 2)<br>($I_C$ = 500 mAdc, $V_{CE}$ = 10 Vdc, $f_{test}$ = 10 MHz) | $f_T$ | <br>30 | <br>– | MHz |

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.

1. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.
2. $f_T = |h_{fe}| \bullet f_{test}$.

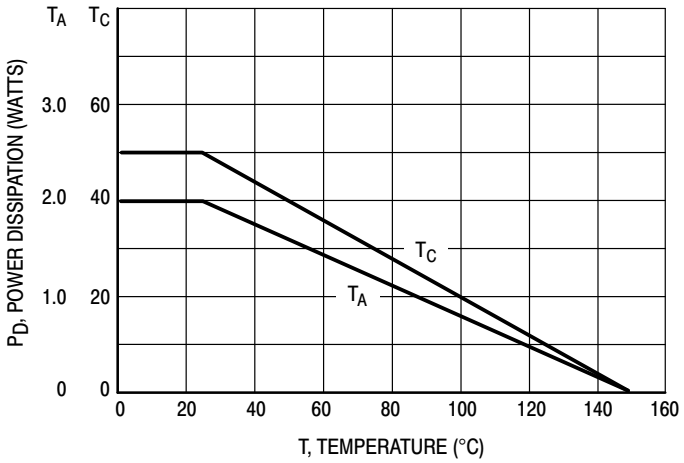



**Figure 1. Power Derating**

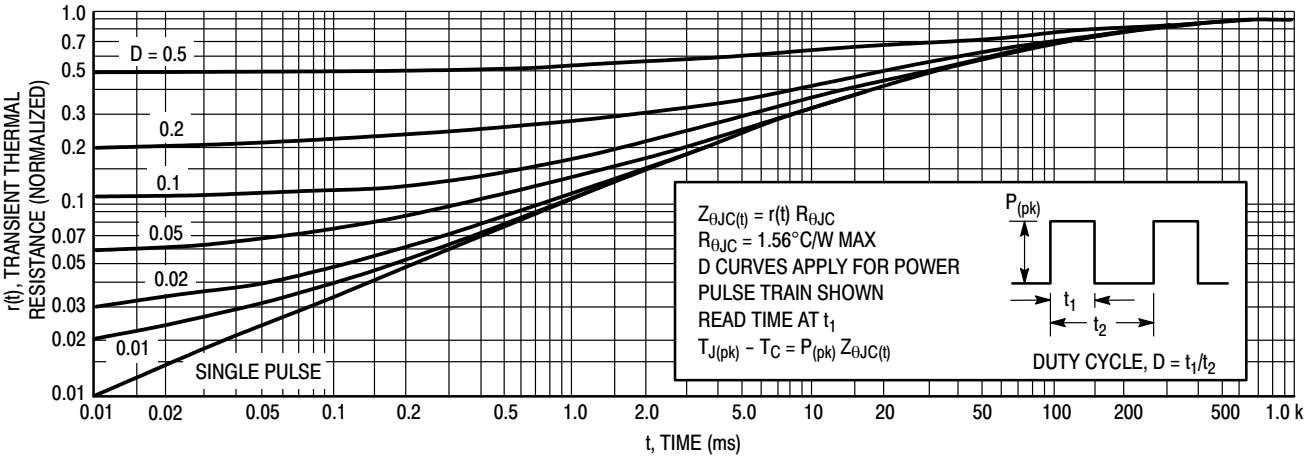



**Figure 2. Thermal Response**

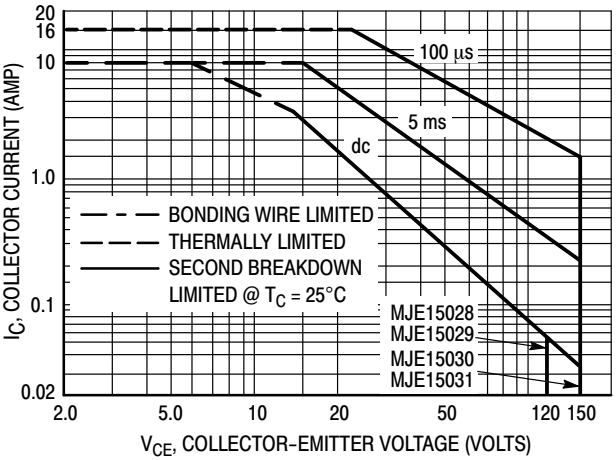



**Figure 3. Forward Bias Safe Operating Area**

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 then the curves indicate.

The data of Figures 3 and 4 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 $T_{J(pk)}$ < 150°C. $T_{J(pk)}$ may be calculated from the data in Figure 2. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

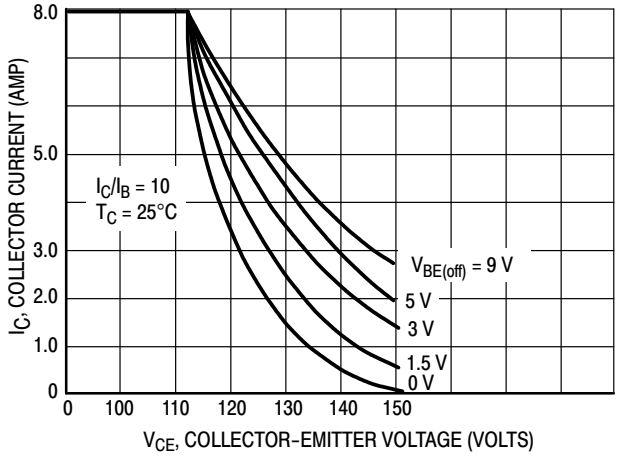



**Figure 4. Reverse−Bias Switching Safe Operating Area**

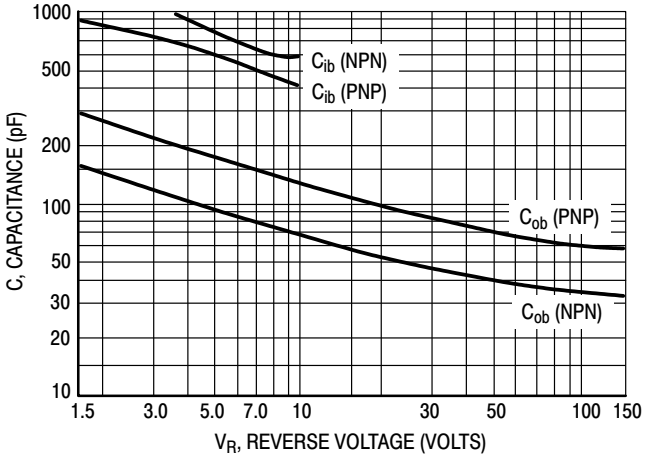



**Figure 5. Capacitances**

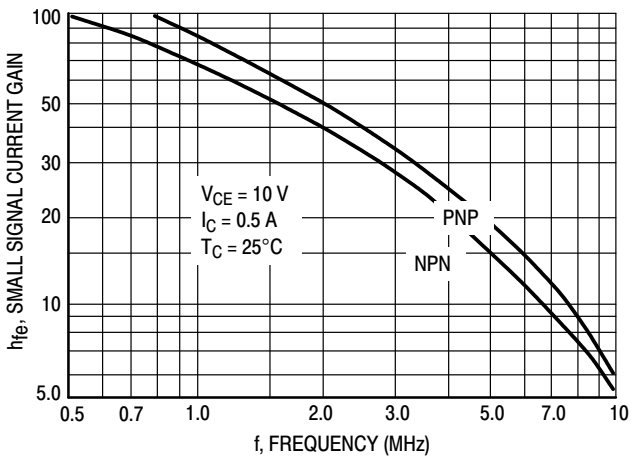



**Figure 6. Small−Signal Current Gain**

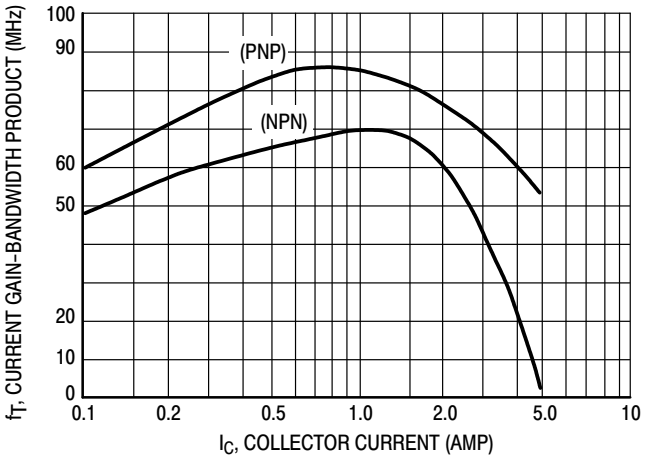



**Figure 7. Current Gain−Bandwidth Product**

**NPN — MJE15028 MJE15030**

**PNP — MJE15029 MJE15031**

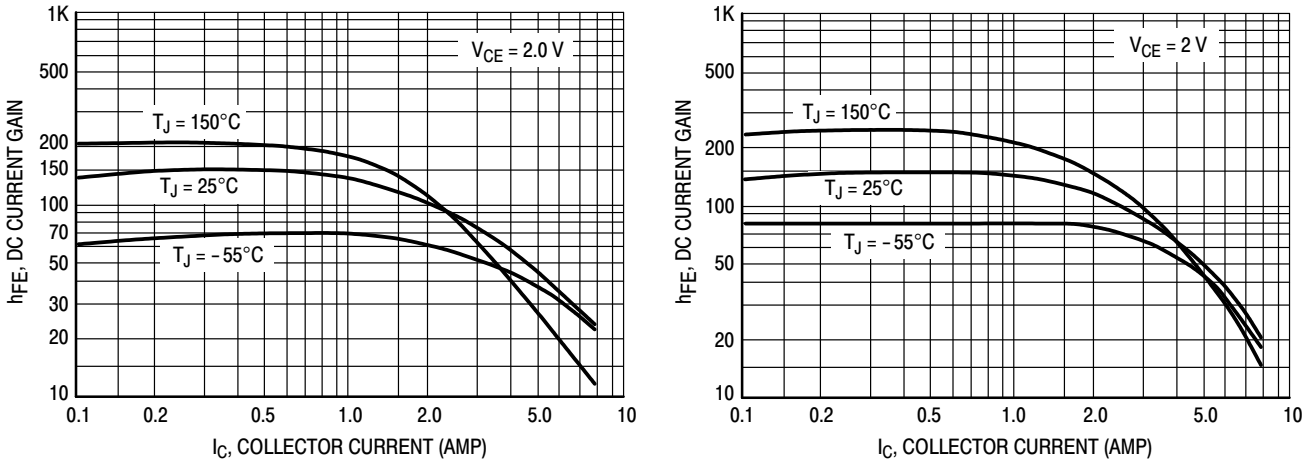



**Figure 8. DC Current Gain**

**NPN**

**PNP**

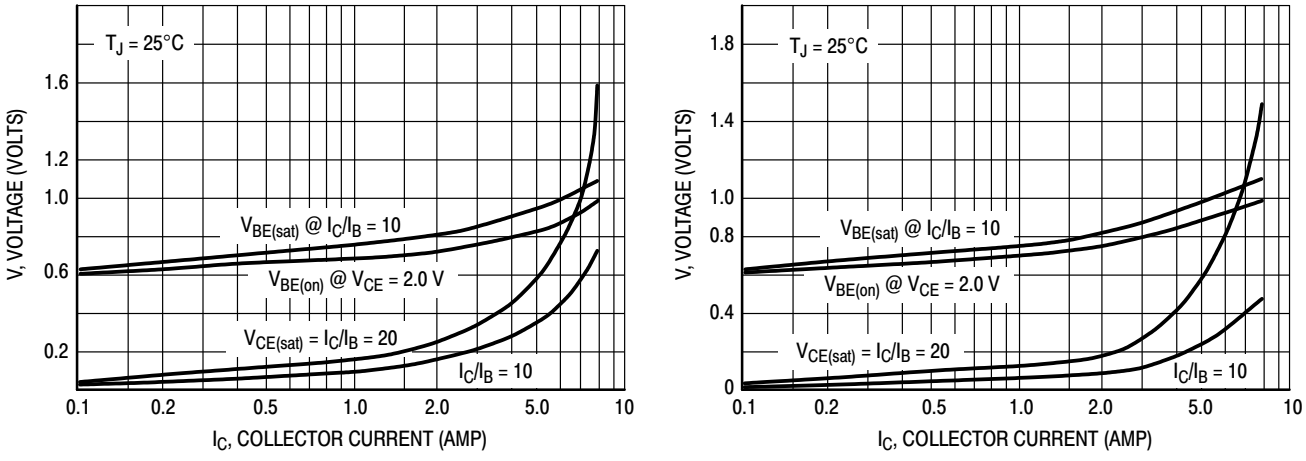



**Figure 9. “On” Voltage**

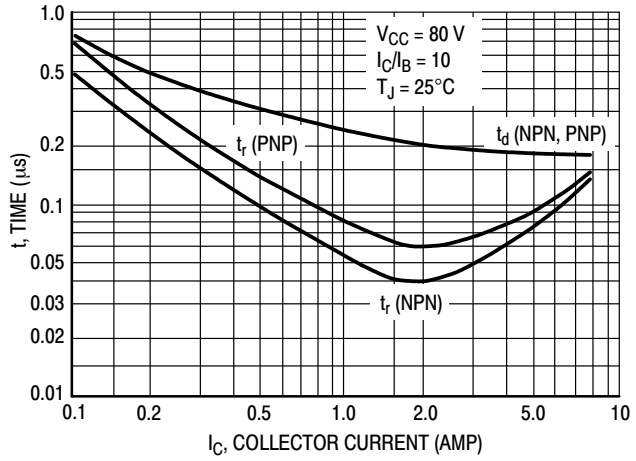



**Figure 10. Turn−On Times**

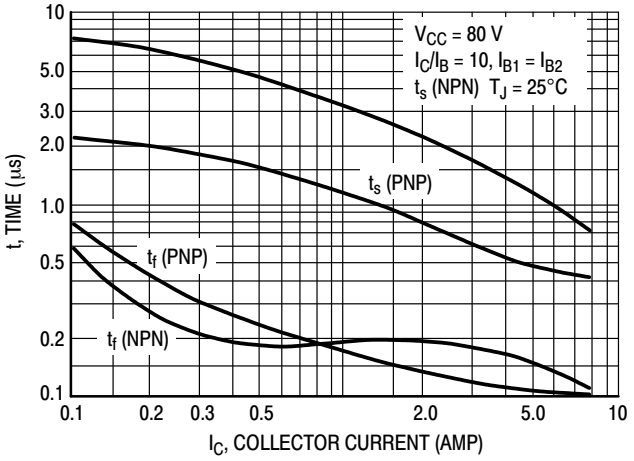
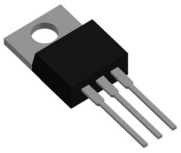



**Figure 11. Turn−Off Times**

## ORDERING INFORMATION

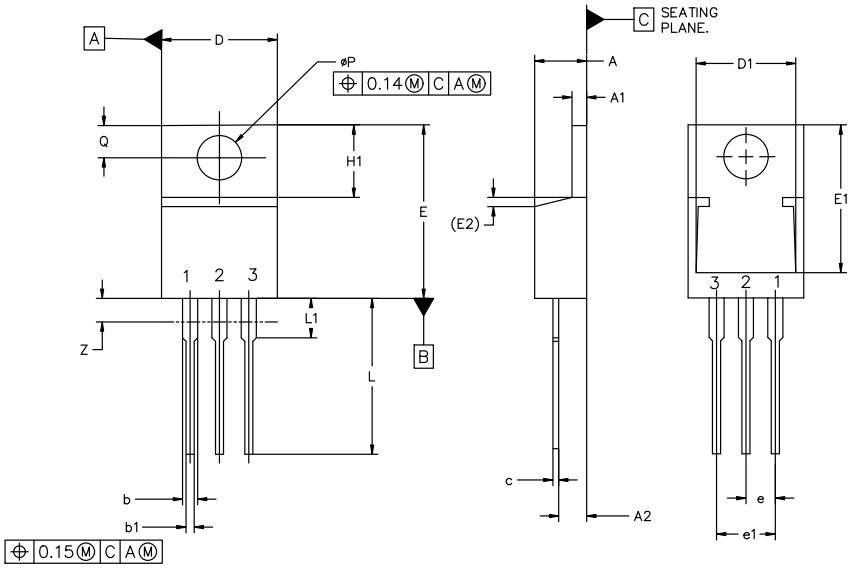
| Device | Package | Shipping |
|---|---|---|
| MJE15028G | TO−220 (Pb−Free) | 50 Units / Rail |
| MJE15029G | TO−220 (Pb−Free) | 50 Units / Rail |
| MJE15030G | TO−220 (Pb−Free) | 50 Units / Rail |
| MJE15031G | TO−220 (Pb−Free) | 50 Units / Rail |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.



**TO−220−3 10.10x15.12x4.45, 2.54P**
CASE 221A
ISSUE AL

DATE 05 FEB 2025




| MILLIMETERS | | | |
|---|---|---|---|
| DIM | MIN | NOM | MAX |
| A | 4.07 | 4.45 | 4.83 |
| A1 | 1.15 | 1.28 | 1.41 |
| A2 | 2.04 | 2.42 | 2.79 |
| b | 1.15 | 1.34 | 1.52 |
| b1 | 0.64 | 0.80 | 0.96 |
| c | 0.36 | 0.49 | 0.61 |
| D | 9.66 | 10.10 | 10.53 |
| D1 | 8.43 | 8.63 | 8.83 |
| E | 14.48 | 15.12 | 15.75 |
| E1 | 12.58 | 12.78 | 12.98 |
| E2 | 1.27 REF | | |

| MILLIMETERS | | | |
|---|---|---|---|
| DIM | MIN | NOM | MAX |
| e | 2.42 | 2.54 | 2.66 |
| e1 | 4.83 | 5.08 | 5.33 |
| H1 | 5.97 | 6.22 | 6.47 |
| L | 12.70 | 13.49 | 14.27 |
| L1 | 2.80 | 3.45 | 4.10 |
| Q | 2.54 | 2.79 | 3.04 |
| øP | 3.60 | 3.85 | 4.09 |
| Z | −.−− | −.−− | 3.48 |

NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 2:
PIN 1. BASE
2. EMITTER
3. COLLECTOR
4. EMITTER

STYLE 3:
PIN 1. CATHODE
2. ANODE
3. GATE
4. ANODE

STYLE 4:
PIN 1. MAIN TERMINAL 1
2. MAIN TERMINAL 2
3. GATE
4. MAIN TERMINAL 2

STYLE 5:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

STYLE 6:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

STYLE 7:
PIN 1. CATHODE
2. ANODE
3. CATHODE
4. ANODE

STYLE 8:
PIN 1. CATHODE
2. ANODE
3. EXTERNAL TRIP/DELAY
4. ANODE

STYLE 9:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 10:
PIN 1. GATE
2. SOURCE
3. DRAIN
4. SOURCE

STYLE 11:
PIN 1. DRAIN
2. SOURCE
3. GATE
4. SOURCE

STYLE 12:
PIN 1. MAIN TERMINAL 1
2. MAIN TERMINAL 2
3. GATE
4. NOT CONNECTED

| | | |
|---|---|---|
| **DOCUMENT NUMBER:** | **98ASB42148B** | 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−220−3 10.10x15.12x4.45, 2.54P** | **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**, , 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. **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
**onsemi Website:** www.onsemi.com

**ONLINE SUPPORT**: www.onsemi.com/support
**For additional information, please contact your local Sales Representative at** www.onsemi.com/support/sales