

# Complementary Plastic Silicon Power Transistors

## BD787G (NPN), BD788G (PNP)

**4 AMPERES  
 POWER TRANSISTORS  
 COMPLEMENTARY SILICON  
 60 VOLTS, 15 WATTS**

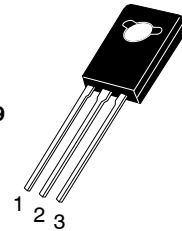
### Description

These devices are designed for lower power audio amplifier and low current, high-speed switching applications.

### Features

- Low Collector–Emitter Sustaining Voltage
- High Current–Gain – Bandwidth Product
- These Devices are Pb–Free and are RoHS Compliant\*

TO-225  
 CASE 77-09  
 STYLE 1



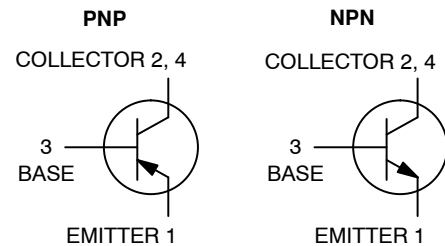
### MAXIMUM RATINGS

| Rating   | Symbol         | Value       | Unit                      |
|--|----------------|-------------|---------------------------|
| Collector–Emitter Voltage  | $V_{CEO}$      | 60          | Vdc                       |
| Collector–Base Voltage   | $V_{CBO}$      | 80          | Vdc                       |
| Emitter Base Voltage   | $V_{EBO}$      | 6.0         | Vdc                       |
| Collector Current – Continuous   | $I_C$          | 4.0         | Adc                       |
| Collector Current – Peak   | $I_{CM}$       | 8.0         | Adc                       |
| Base Current – Continuous  | $I_B$          | 1.0         | Adc                       |
| Total Power Dissipation<br>@ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 15<br>0.12  | W<br>mW/ $^\circ\text{C}$ |
| Operating and Storage Junction<br>Temperature Range                                      | $T_J, T_{stg}$ | –65 to +150 | $^\circ\text{C}$          |

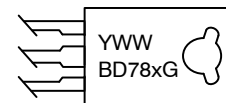
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

### THERMAL CHARACTERISTICS

| Characteristic                       | Symbol          | Max  | Unit                      |
|--------------------------------------|-----------------|------|---------------------------|
| Thermal Resistance, Junction–to–Case | $R_{\theta JC}$ | 8.34 | $^\circ\text{C}/\text{W}$ |



### MARKING DIAGRAM



- Y = Year
- WW = Work Week
- BD78x = Device Code  
 x = 7 or 8
- G = Pb–Free Package

### ORDERING INFORMATION

| Device | Package             | Shipping      |
|--------|---------------------|---------------|
| BD787G | TO-225<br>(Pb–Free) | 500 Units/Box |

### DISCONTINUED (Note 1)

|        |                     |               |
|--------|---------------------|---------------|
| BD788G | TO-225<br>(Pb–Free) | 500 Units/Box |
|--------|---------------------|---------------|

†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](#).

1. **DISCONTINUED:** This device is not recommended for new design. Please contact your **onsemi** representative for information. The most current information on this device may be available on [www.onsemi.com](http://www.onsemi.com).

\*For additional information on our Pb–Free strategy and soldering details, please download the **onsemi** Soldering and Mounting Techniques Reference Manual, [SOLDERRM/D](#).

## BD787G (NPN), BD788G (PNP)

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

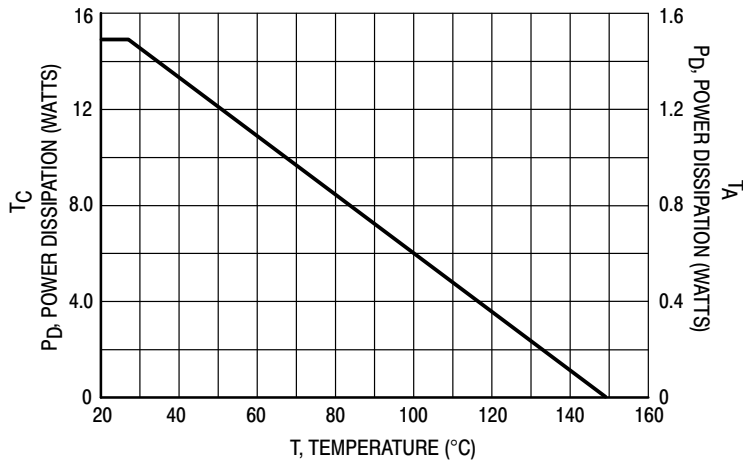
| Characteristic  | Symbol         | Min                   | Max                      | Unit                      |
|---|----------------|-----------------------|--------------------------|---------------------------|
| <b>OFF CHARACTERISTICS</b>  |                |                       |                          |                           |
| Collector-Emitter Sustaining Voltage (Note 2)<br>( $I_C = 10\text{ mAdc}$ , $I_B = 0$ )   | $V_{CEO(sus)}$ | 60                    | -                        | Vdc                       |
| Collector Cutoff Current<br>( $V_{CE} = 20\text{ Vdc}$ , $I_B = 0$ )<br>( $V_{CE} = 30\text{ Vdc}$ , $I_B = 0$ )  | $I_{CEO}$      | -                     | 100                      | $\mu\text{A dc}$          |
| Collector Cutoff Current<br>( $V_{CE} = 80\text{ Vdc}$ , $V_{BE(off)} = 1.5\text{ Vdc}$ )<br>( $V_{CE} = 40\text{ Vdc}$ , $V_{BE(off)} = 1.5\text{ Vdc}$ , $T_C = 125^\circ\text{C}$ )  | $I_{CEX}$      | -<br>-                | 1.0<br>0.1               | $\mu\text{A dc}$<br>mA dc |
| Emitter Cutoff Current<br>( $V_{EB} = 6.0\text{ Vdc}$ , $I_C = 0$ )   | $I_{EBO}$      | -                     | 1.0                      | $\mu\text{A dc}$          |
| <b>ON CHARACTERISTICS (Note 2)</b>  |                |                       |                          |                           |
| DC Current Gain<br>( $I_C = 200\text{ mAdc}$ , $V_{CE} = 3.0\text{ Vdc}$ )<br>( $I_C = 1.0\text{ A dc}$ , $V_{CE} = 3.0\text{ Vdc}$ )<br>( $I_C = 2.0\text{ A dc}$ , $V_{CE} = 3.0\text{ Vdc}$ )<br>( $I_C = 4.0\text{ A dc}$ , $V_{CE} = 3.0\text{ Vdc}$ )                 | $h_{FE}$       | 40<br>25<br>20<br>5.0 | 250<br>-<br>-<br>-       | -                         |
| Collector-Emitter Saturation Voltage<br>( $I_C = 500\text{ mAdc}$ , $I_B = 50\text{ mA dc}$ )<br>( $I_C = 1.0\text{ A dc}$ , $I_B = 100\text{ mA dc}$ )<br>( $I_C = 2.0\text{ A dc}$ , $I_B = 200\text{ mA dc}$ )<br>( $I_C = 4.0\text{ A dc}$ , $I_B = 800\text{ mA dc}$ ) | $V_{CE(sat)}$  | -<br>-<br>-<br>-      | 0.4<br>0.6<br>0.8<br>2.5 | Vdc                       |
| Base-Emitter Saturation Voltage<br>( $I_C = 2.0\text{ A dc}$ , $I_B = 200\text{ mA dc}$ )   | $V_{BE(sat)}$  | -                     | 2.0                      | Vdc                       |
| Base-Emitter On Voltage<br>( $I_C = 2.0\text{ A dc}$ , $V_{CE} = 3.0\text{ Vdc}$ )  | $V_{BE(on)}$   | -                     | 1.8                      | Vdc                       |
| <b>DYNAMIC CHARACTERISTICS</b>  |                |                       |                          |                           |
| Current-Gain - Bandwidth Product<br>( $I_C = 100\text{ mA dc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 10\text{ MHz}$ )   | $f_T$          | 50                    | -                        | MHz                       |
| Output Capacitance<br>( $V_{CB} = 10\text{ Vdc}$ , $I_C = 0$ )<br>BD787G<br>( $f = 0.1\text{ MHz}$ )<br>BD788G  | $C_{ob}$       | -<br>-                | 50<br>70                 | pF                        |
| Small-Signal Current Gain<br>( $I_C = 200\text{ mA dc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )   | $h_{fe}$       | 10                    | -                        | -                         |

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.

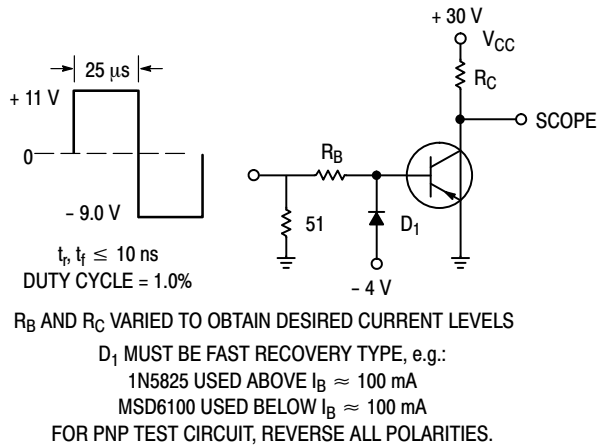
\*Indicates JEDEC Registered Data

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

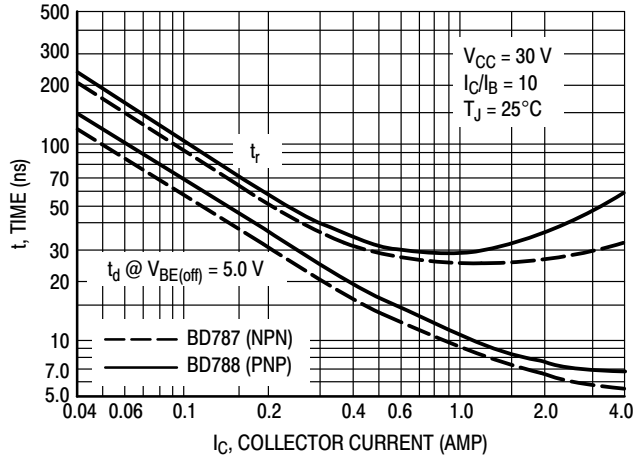
# BD787G (NPN), BD788G (PNP)



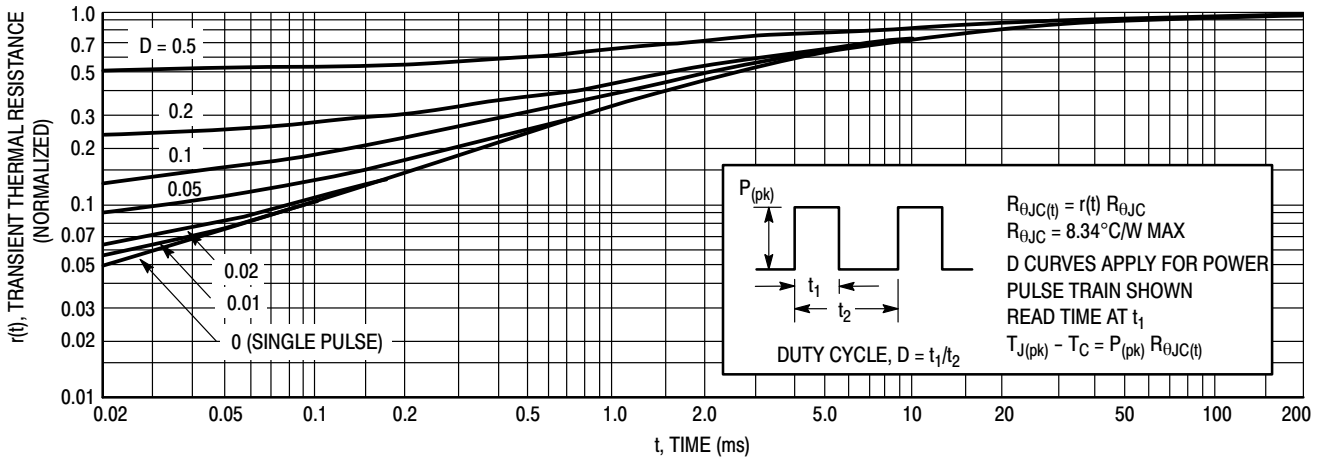
**Figure 1. Power Derating**



**Figure 2. Switching Time Test Circuit**



**Figure 3. Turn-On Time**



**Figure 4. Thermal Response**

# BD787G (NPN), BD788G (PNP)

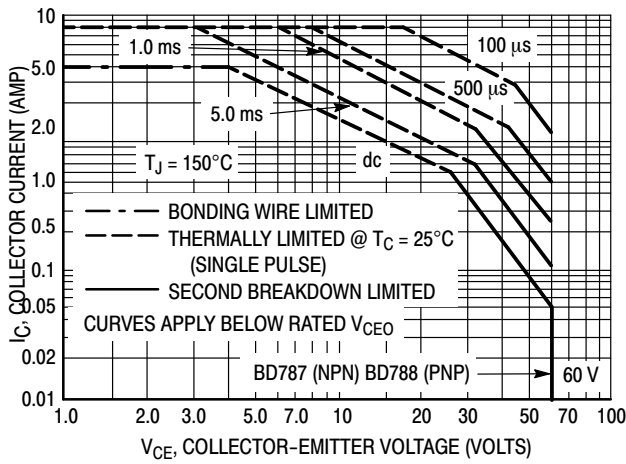


Figure 5. Active Region Safe Operating Area

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 than the curves indicate.

The data of Figure 5 is based on  $T_{J(pk)} = 150^\circ\text{C}$ ;  $T_C$  is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided  $T_{J(pk)} \leq 150^\circ\text{C}$ ,  $T_{J(pk)}$  may be calculated from the data in Figure 4. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

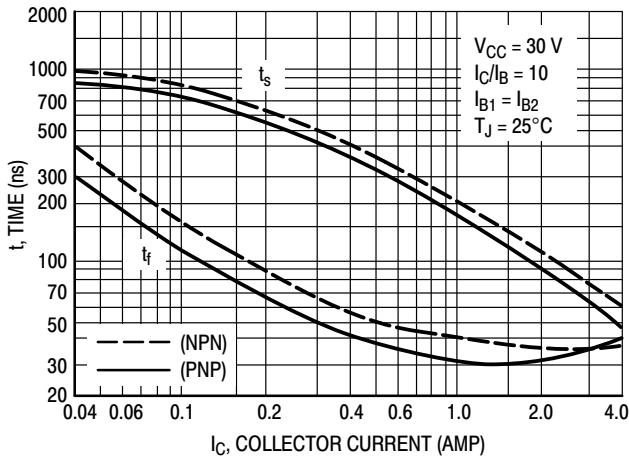


Figure 6. Turn-Off Time

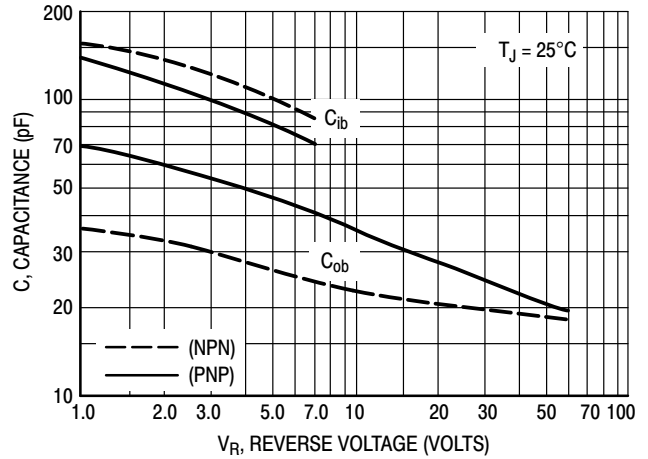


Figure 7. Capacitance

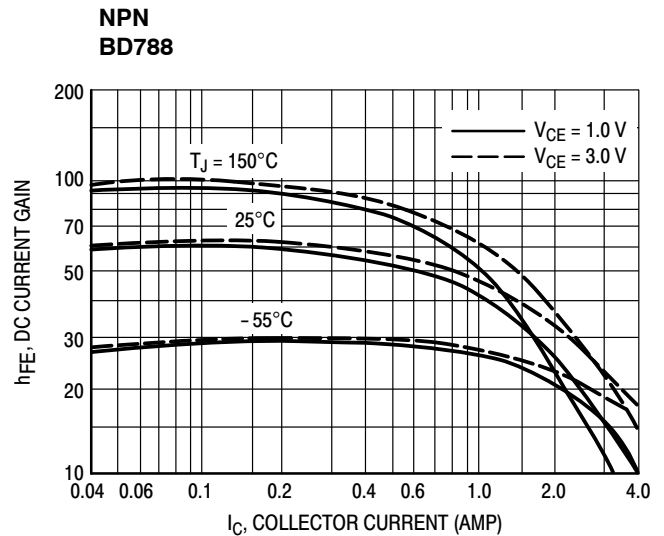
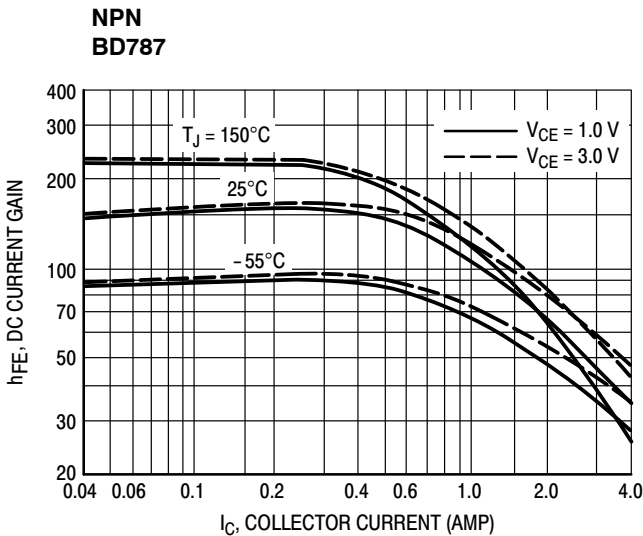


Figure 8. DC Current Gain

# BD787G (NPN), BD788G (PNP)

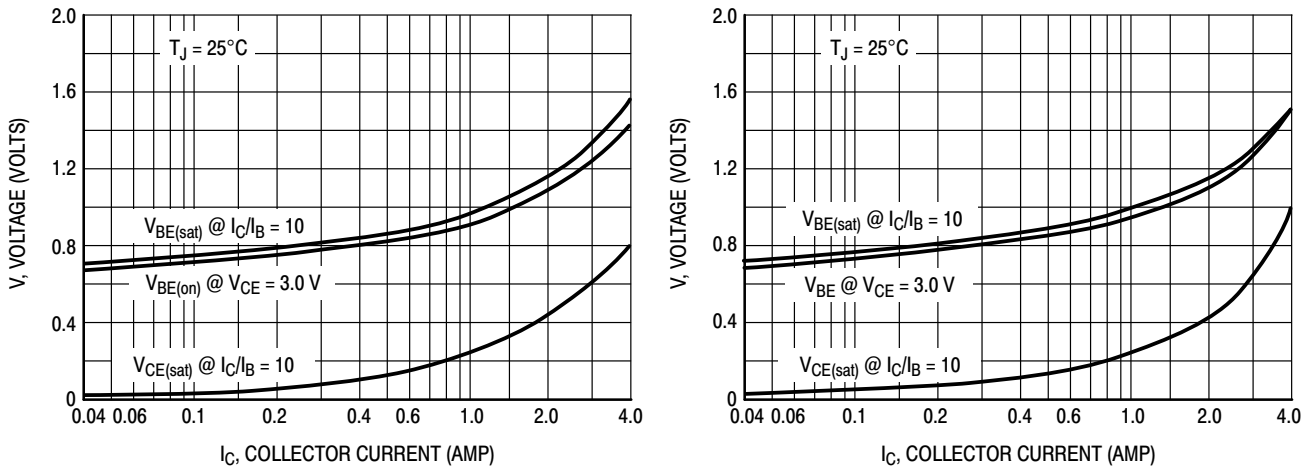


Figure 9. "On" Voltages

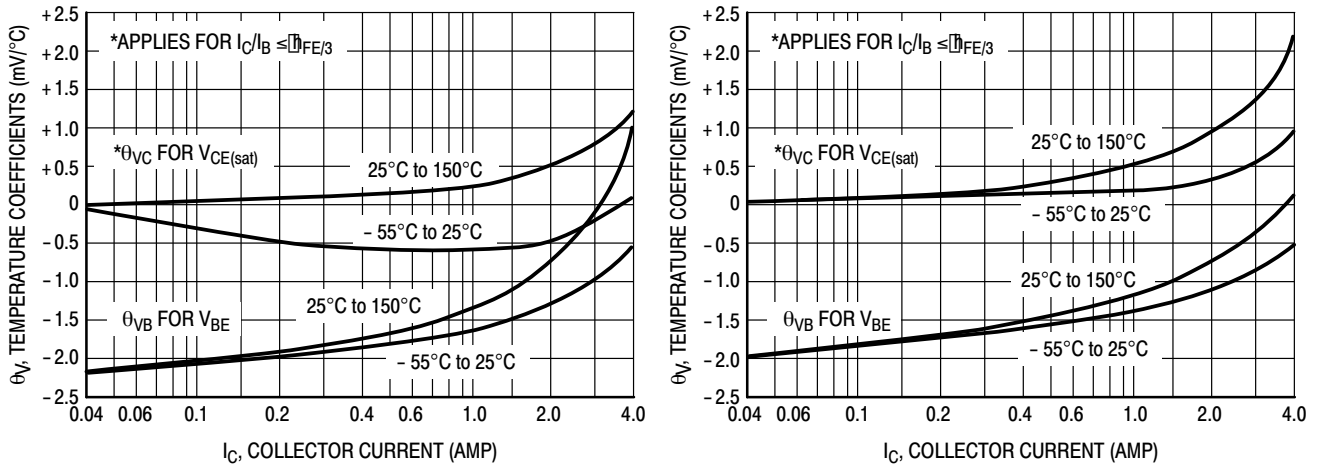
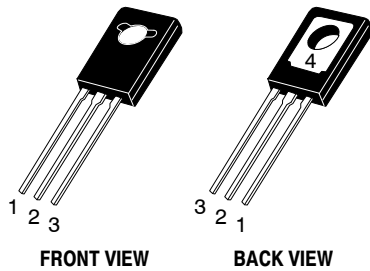


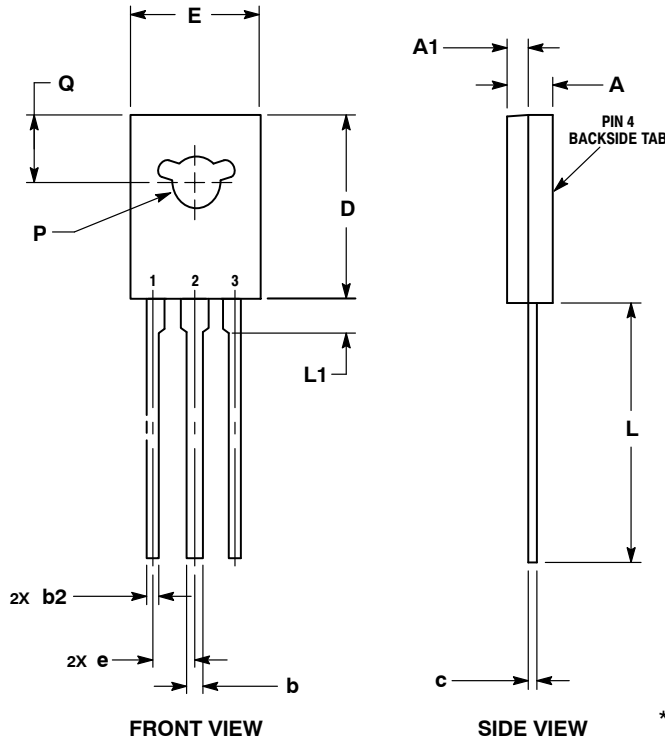
Figure 10. Temperature Coefficients



TO-225  
CASE 77-09  
ISSUE AD

DATE 25 MAR 2015

SCALE 1:1

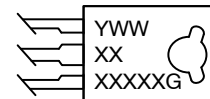


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. NUMBER AND SHAPE OF LUGS OPTIONAL.

| MILLIMETERS |       |       |
|-------------|-------|-------|
| DIM         | MIN   | MAX   |
| A           | 2.40  | 3.00  |
| A1          | 1.00  | 1.50  |
| b           | 0.60  | 0.90  |
| b2          | 0.51  | 0.88  |
| c           | 0.39  | 0.63  |
| D           | 10.60 | 11.10 |
| E           | 7.40  | 7.80  |
| e           | 2.04  | 2.54  |
| L           | 14.50 | 16.63 |
| L1          | 1.27  | 2.54  |
| P           | 2.90  | 3.30  |
| Q           | 3.80  | 4.20  |

GENERIC MARKING DIAGRAM\*



- Y = Year
- WW = Work Week
- XXXXX = Device Code
- G = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "μ", may or may not be present. Some products may not follow the Generic Marking.

|   |   |   |   |   |
|---|---|---|---|---|
| STYLE 1:<br>PIN 1. EMITTER<br>2., 4. COLLECTOR<br>3. BASE | STYLE 2:<br>PIN 1. CATHODE<br>2., 4. ANODE<br>3. GATE | STYLE 3:<br>PIN 1. BASE<br>2., 4. COLLECTOR<br>3. EMITTER | STYLE 4:<br>PIN 1. ANODE 1<br>2., 4. ANODE 2<br>3. GATE | STYLE 5:<br>PIN 1. MT 1<br>2., 4. MT 2<br>3. GATE     |
| STYLE 6:<br>PIN 1. CATHODE<br>2., 4. GATE<br>3. ANODE     | STYLE 7:<br>PIN 1. MT 1<br>2., 4. GATE<br>3. MT 2     | STYLE 8:<br>PIN 1. SOURCE<br>2., 4. GATE<br>3. DRAIN      | STYLE 9:<br>PIN 1. GATE<br>2., 4. DRAIN<br>3. SOURCE    | STYLE 10:<br>PIN 1. SOURCE<br>2., 4. DRAIN<br>3. GATE |

|                  |             |   |
|------------------|-------------|---|
| DOCUMENT NUMBER: | 98ASB42049B | Electronic versions are uncontrolled except when accessed directly from the Document Repository.<br>Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| DESCRIPTION:     | TO-225      | 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)