

# MJH6284 (NPN), MJH6287 (PNP)

## Darlington Complementary Silicon Power Transistors

These devices are designed for general-purpose amplifier and low-speed switching motor control applications.

### Features

- Similar to the Popular NPN 2N6284 and the PNP 2N6287
- Rugged RBSOA Characteristics
- Monolithic Construction with Built-in Collector-Emitter Diode
- These are Pb-Free Devices\*

### MAXIMUM RATINGS

| Rating                                                                                 | Symbol         | Max         | Unit                     |
|----------------------------------------------------------------------------------------|----------------|-------------|--------------------------|
| Collector-Emitter Voltage                                                              | $V_{CEO}$      | 100         | Vdc                      |
| Collector-Base Voltage                                                                 | $V_{CB}$       | 100         | Vdc                      |
| Emitter-Base Voltage                                                                   | $V_{EB}$       | 5.0         | Vdc                      |
| Collector Current – Continuous<br>– Peak                                               | $I_C$          | 20<br>40    | Adc                      |
| Base Current                                                                           | $I_B$          | 0.5         | Adc                      |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 160<br>1.28 | W<br>W/ $^\circ\text{C}$ |
| 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 | $R_{\theta JC}$ | 0.78 | $^\circ\text{C/W}$ |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

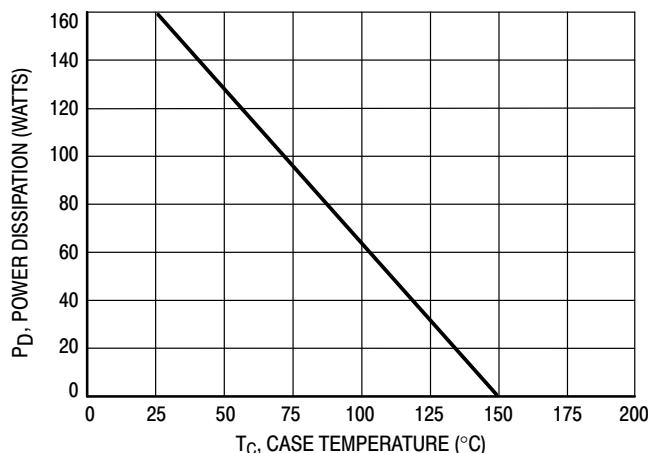


Figure 1. Power Derating

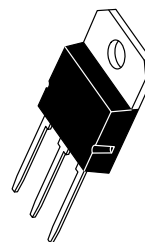
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



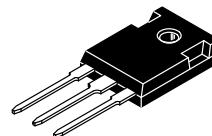
ON Semiconductor®

<http://onsemi.com>

## DARLINGTON 20 AMPERE COMPLEMENTARY SILICON POWER TRANSISTORS 100 VOLTS, 160 WATTS



SOT-93  
(TO-218)  
CASE 340D



TO-247  
CASE 340L  
STYLE 3

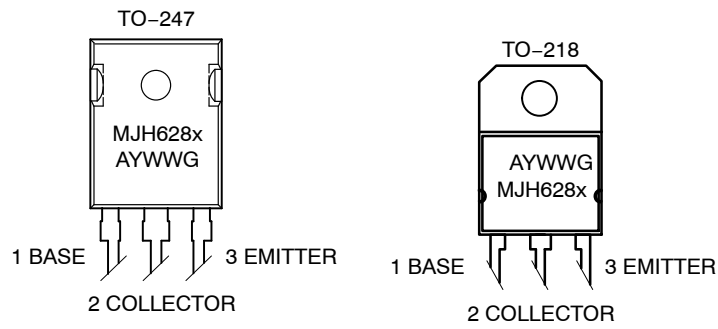
**NOTE:** Effective June 2012 this device will be available only in the TO-247 package. Reference FPCN# 16827.

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

# MJH6284 (NPN), MJH6287 (PNP)

## MARKING DIAGRAMS



MJH628x = Device Code  
x = 4 or 7  
A = Assembly Location  
Y = Year  
WW = Work Week  
G = Pb-Free Package

## ORDERING INFORMATION

| Device Order Number | Package Type        | Shipping        |
|---------------------|---------------------|-----------------|
| MJH6284G            | TO-218<br>(Pb-Free) | 30 Units / Rail |
| MJH6287G            | TO-218<br>(Pb-Free) | 30 Units / Rail |
| MJH6284G            | TO-247<br>(Pb-Free) | 30 Units / Rail |
| MJH6287G            | TO-247<br>(Pb-Free) | 30 Units / Rail |

# MJH6284 (NPN), MJH6287 (PNP)

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

| Characteristic                                                                                                                                                                                               | Symbol                | Min | Max        | Unit |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----|------------|------|
| <b>OFF CHARACTERISTICS</b>                                                                                                                                                                                   |                       |     |            |      |
| Collector-Emitter Sustaining Voltage (I <sub>C</sub> = 0.1 Adc, I <sub>B</sub> = 0)                                                                                                                          | V <sub>CEO(sus)</sub> | 100 | –          | Vdc  |
| Collector Cutoff Current (V <sub>CE</sub> = 50 Vdc, I <sub>B</sub> = 0)                                                                                                                                      | I <sub>CEO</sub>      | –   | 1.0        | mAdc |
| Collector Cutoff Current<br>(V <sub>CE</sub> = Rated V <sub>CB</sub> , V <sub>BE(off)</sub> = 1.5 Vdc)<br>(V <sub>CE</sub> = Rated V <sub>CB</sub> , V <sub>BE(off)</sub> = 1.5 Vdc, T <sub>C</sub> = 150°C) | I <sub>CEX</sub>      | –   | 0.5<br>5.0 | mAdc |
| Emitter Cutoff Current (V <sub>BE</sub> = 5.0 Vdc, I <sub>C</sub> = 0)                                                                                                                                       | I <sub>EBO</sub>      | –   | 2.0        | mAdc |

## ON CHARACTERISTICS (Note 1)

|                                                                                                                                                     |                      |            |             |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|------------|-------------|-----|
| DC Current Gain<br>(I <sub>C</sub> = 10 Adc, V <sub>CE</sub> = 3.0 Vdc)<br>(I <sub>C</sub> = 20 Adc, V <sub>CE</sub> = 3.0 Vdc)                     | h <sub>FE</sub>      | 750<br>100 | 18,000<br>– | –   |
| Collector-Emitter Saturation Voltage<br>(I <sub>C</sub> = 10 Adc, I <sub>B</sub> = 40 mAdc)<br>(I <sub>C</sub> = 20 Adc, I <sub>B</sub> = 200 mAdc) | V <sub>CE(sat)</sub> | –<br>–     | 2.0<br>3.0  | Vdc |
| Base-Emitter On Voltage (I <sub>C</sub> = 10 Adc, V <sub>CE</sub> = 3.0 Vdc)                                                                        | V <sub>BE(on)</sub>  | –          | 2.8         | Vdc |
| Base-Emitter Saturation Voltage (I <sub>C</sub> = 20 Adc, I <sub>B</sub> = 200 mAdc)                                                                | V <sub>BE(sat)</sub> | –          | 4.0         | Vdc |

## DYNAMIC CHARACTERISTICS

|                                                                                                  |                 |        |            |     |
|--------------------------------------------------------------------------------------------------|-----------------|--------|------------|-----|
| Current-Gain Bandwidth Product (I <sub>C</sub> = 10 Adc, V <sub>CE</sub> = 3.0 Vdc, f = 1.0 MHz) | f <sub>T</sub>  | 4.0    | –          | MHz |
| Output Capacitance<br>(V <sub>CB</sub> = 10 Vdc, I <sub>E</sub> = 0, f = 0.1 MHz)                | C <sub>ob</sub> | –<br>– | 400<br>600 | pF  |
| Small-Signal Current Gain (I <sub>C</sub> = 10 Adc, V <sub>CE</sub> = 3.0 Vdc, f = 1.0 kHz)      | h <sub>fe</sub> | 300    | –          | –   |

## SWITCHING CHARACTERISTICS

| Resistive Load |                                                                                                                      | Symbol         | Typical |     | Unit |
|----------------|----------------------------------------------------------------------------------------------------------------------|----------------|---------|-----|------|
|                |                                                                                                                      |                | NPN     | PNP |      |
| Delay Time     | V <sub>CC</sub> = 30 Vdc, I <sub>C</sub> = 10 Adc<br>I <sub>B1</sub> = I <sub>B2</sub> = 100 mA<br>Duty Cycle = 1.0% | t <sub>d</sub> | 0.1     | 0.1 | μs   |
| Rise Time      |                                                                                                                      | t <sub>r</sub> | 0.3     | 0.3 |      |
| Storage Time   |                                                                                                                      | t <sub>s</sub> | 1.0     | 1.0 |      |
| Fall Time      |                                                                                                                      | t <sub>f</sub> | 3.5     | 2.0 |      |

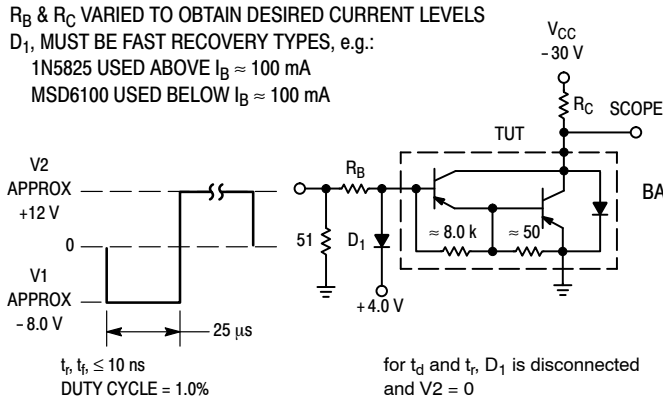
1. Pulse test: Pulse Width = 300 μs, Duty Cycle = 2.0%.

R<sub>B</sub> & R<sub>C</sub> VARIED TO OBTAIN DESIRED CURRENT LEVELS

D<sub>1</sub>, MUST BE FAST RECOVERY TYPES, e.g.:

1N5825 USED ABOVE I<sub>B</sub> ≈ 100 mA

MSD6100 USED BELOW I<sub>B</sub> ≈ 100 mA



For NPN test circuit reverse diode and voltage polarities.

Figure 2. Switching Times Test Circuit

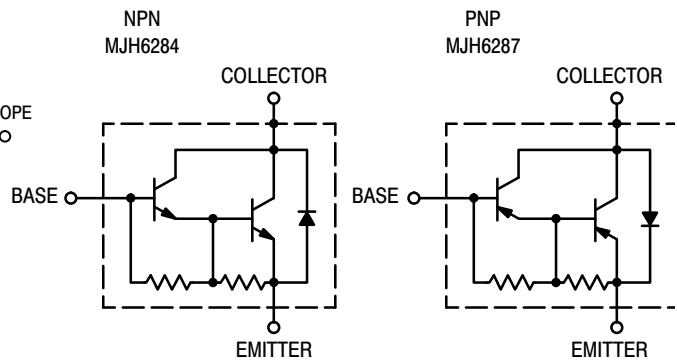


Figure 3. Darlington Schematic

## MJH6284 (NPN), MJH6287 (PNP)

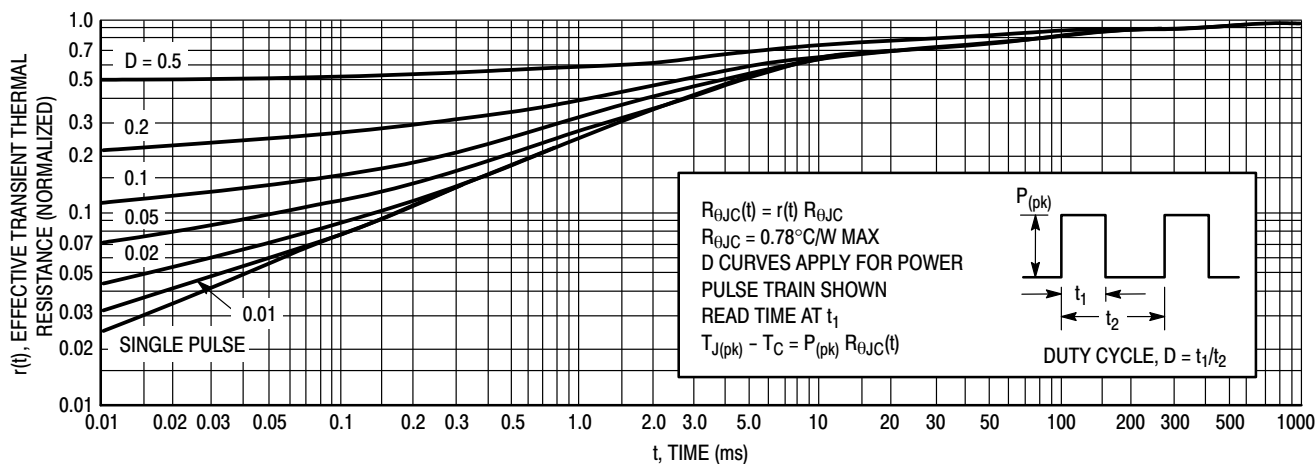


Figure 4. Thermal Response

### FBSOA, FORWARD BIAS SAFE OPERATING AREA

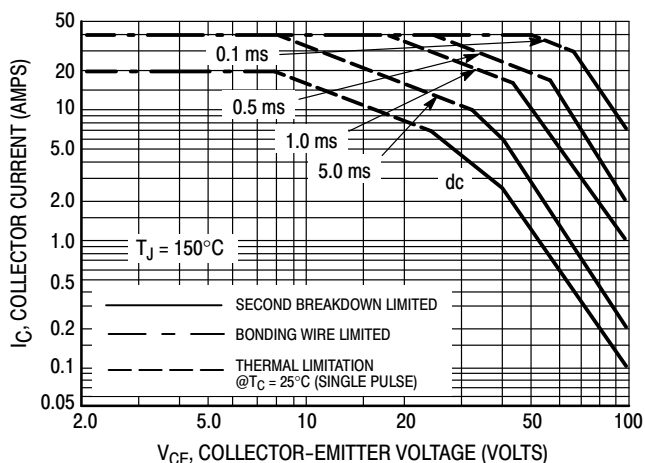


Figure 5. MJH6284, MJH6287

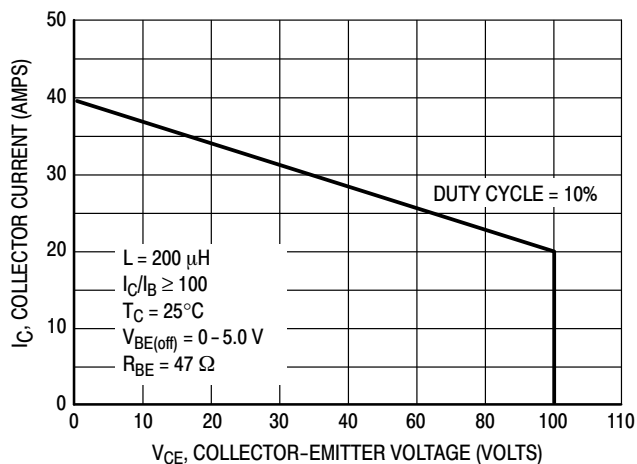


Figure 6. Maximum RBSOA, Reverse Bias Safe Operating Area

### FORWARD BIAS

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.

# MJH6284 (NPN), MJH6287 (PNP)

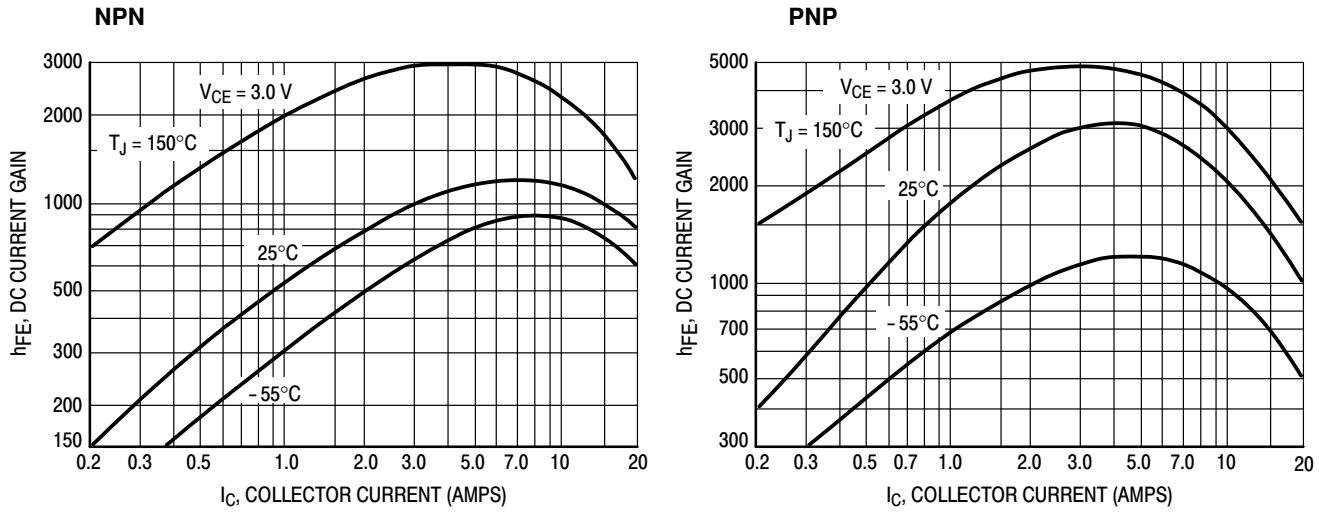


Figure 7. DC Current Gain

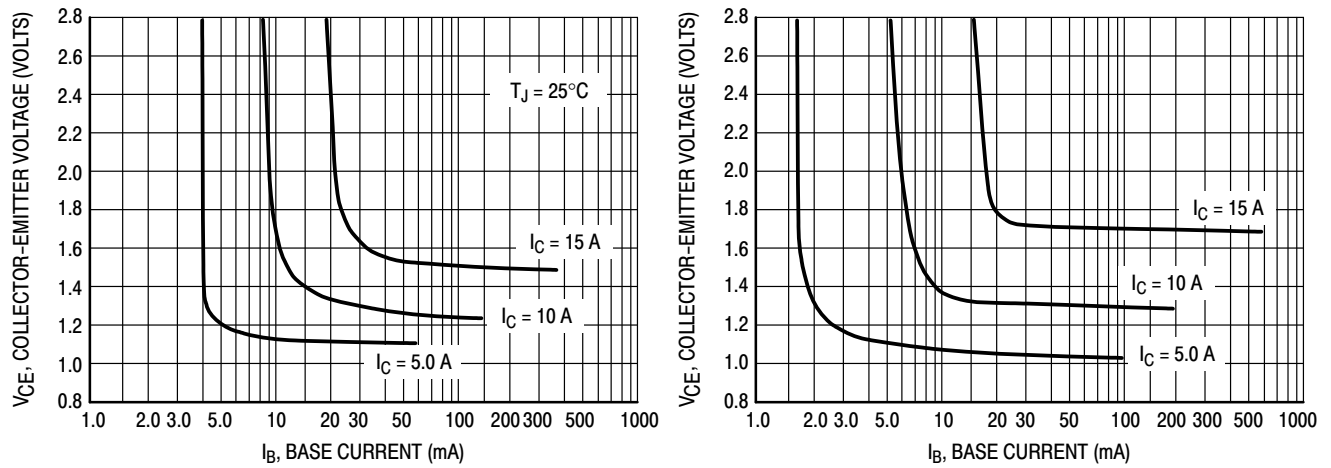


Figure 8. Collector Saturation Region

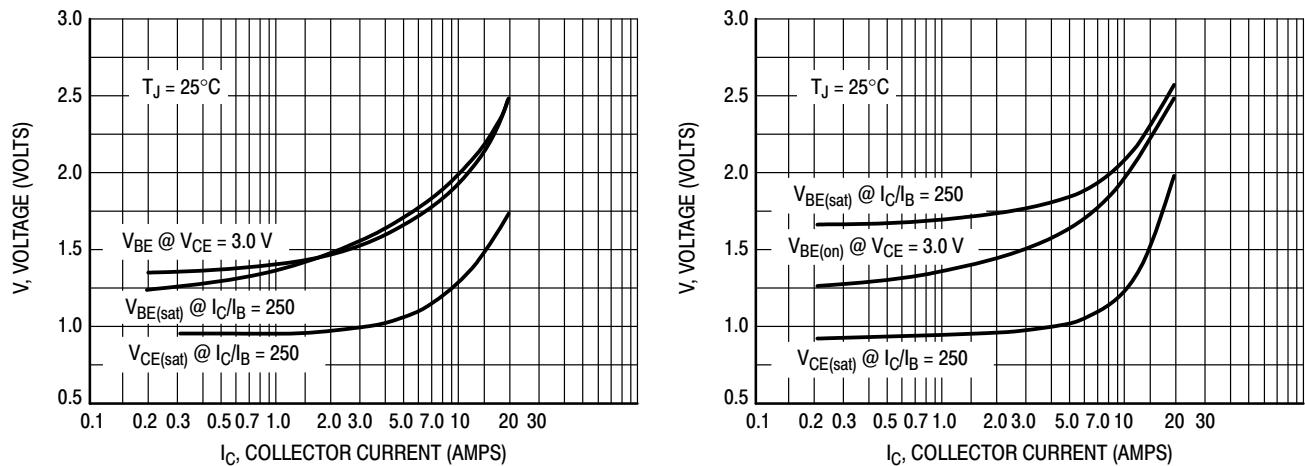


Figure 9. "On" Voltages

# MECHANICAL CASE OUTLINE

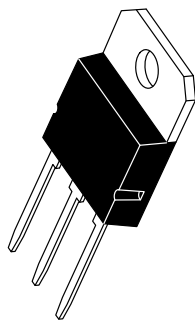
## PACKAGE DIMENSIONS

ON Semiconductor®

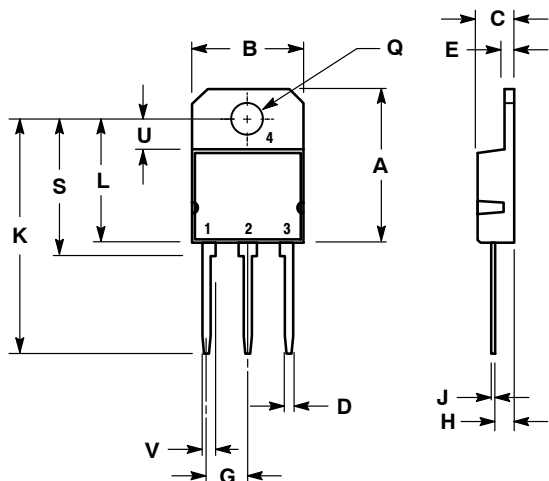


### SOT-93 (TO-218) CASE 340D-02 ISSUE E

DATE 01/03/2002



SCALE 1:1



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

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

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

| DIM | MILLIMETERS |       | INCHES    |       |
|-----|-------------|-------|-----------|-------|
|     | MIN         | MAX   | MIN       | MAX   |
| A   | ---         | 20.35 | ---       | 0.801 |
| B   | 14.70       | 15.20 | 0.579     | 0.598 |
| C   | 4.70        | 4.90  | 0.185     | 0.193 |
| D   | 1.10        | 1.30  | 0.043     | 0.051 |
| E   | 1.17        | 1.37  | 0.046     | 0.054 |
| G   | 5.40        | 5.55  | 0.213     | 0.219 |
| H   | 2.00        | 3.00  | 0.079     | 0.118 |
| J   | 0.50        | 0.78  | 0.020     | 0.031 |
| K   | 31.00 REF   |       | 1.220 REF |       |
| L   | ---         | 16.20 | ---       | 0.638 |
| Q   | 4.00        | 4.10  | 0.158     | 0.161 |
| S   | 17.80       | 18.20 | 0.701     | 0.717 |
| U   | 4.00 REF    |       | 0.157 REF |       |
| V   | 1.75 REF    |       | 0.069     |       |

### MARKING DIAGRAM

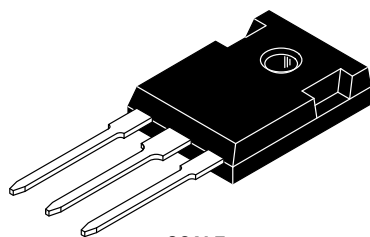


A = Assembly Location  
Y = Year  
WW = Work Week  
xxxxx = Device Code

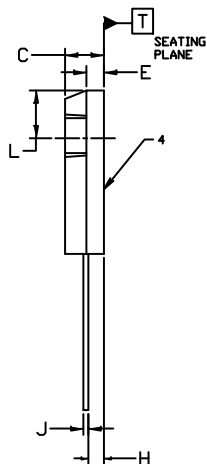
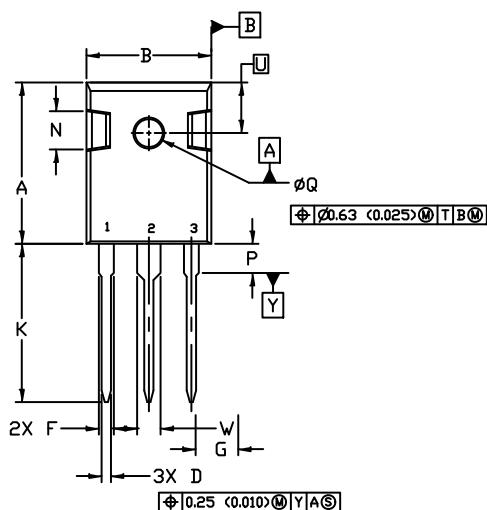
|                  |             |                                                                                                                                                                                     |
|------------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DOCUMENT NUMBER: | 98ASB42643B | 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:     | SOT-93      | PAGE 1 OF 1                                                                                                                                                                         |

ON Semiconductor and are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor 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. ON Semiconductor does not convey any license under its patent rights nor the rights of others.

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



SCALE 1:1



TO-247  
CASE 340L  
ISSUE G

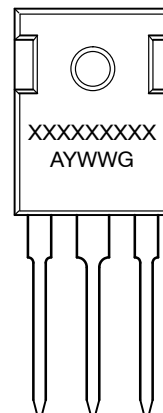
DATE 06 OCT 2021

## NOTES:

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

| DIM | MILLIMETERS |       | INCHES |       |
|-----|-------------|-------|--------|-------|
|     | MIN.        | MAX.  | MIN.   | MAX.  |
| A   | 20.32       | 21.08 | 0.800  | 0.830 |
| B   | 15.75       | 16.26 | 0.620  | 0.640 |
| C   | 4.70        | 5.30  | 0.185  | 0.209 |
| D   | 1.00        | 1.40  | 0.040  | 0.055 |
| E   | 1.90        | 2.60  | 0.075  | 0.102 |
| F   | 1.65        | 2.13  | 0.065  | 0.084 |
| G   | 5.45        | BSC   | 0.215  | BSC   |
| H   | 1.50        | 2.49  | 0.059  | 0.098 |
| J   | 0.40        | 0.80  | 0.016  | 0.031 |
| K   | 19.81       | 20.83 | 0.780  | 0.820 |
| L   | 5.40        | 6.20  | 0.212  | 0.244 |
| N   | 4.32        | 5.49  | 0.170  | 0.216 |
| P   | ----        | 4.50  | ----   | 0.177 |
| Q   | 3.55        | 3.65  | 0.140  | 0.144 |
| U   | 6.15        | BSC   | 0.242  | BSC   |
| W   | 2.87        | 3.12  | 0.113  | 0.123 |

## GENERIC MARKING DIAGRAM\*



### STYLE 1:

- PIN 1. GATE  
2. DRAIN  
3. SOURCE  
4. DRAIN

### STYLE 2:

- PIN 1. ANODE  
2. CATHODE (S)  
3. ANODE 2  
4. CATHODES (S)

### STYLE 3:

- PIN 1. BASE  
2. COLLECTOR  
3. EMITTER  
4. COLLECTOR

### STYLE 4:

- PIN 1. GATE  
2. COLLECTOR  
3. EMITTER  
4. COLLECTOR

### STYLE 5:

- PIN 1. CATHODE  
2. ANODE  
3. GATE  
4. ANODE

### STYLE 6:

- PIN 1. MAIN TERMINAL 1  
2. MAIN TERMINAL 2  
3. GATE  
4. MAIN TERMINAL 2

XXXXXX = Specific Device Code

A = Assembly Location

Y = Year

WW = Work Week

G = Pb-Free Package

\*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. Some products may not follow the Generic Marking.

|                  |             |                                                                                                                                                                                  |
|------------------|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DOCUMENT NUMBER: | 98ASB15080C | 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-247      | 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.

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:

Email Requests to: [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**onsemi Website:** [www.onsemi.com](http://www.onsemi.com)

### TECHNICAL SUPPORT

**North American Technical Support:**

Voice Mail: 1 800-282-9855 Toll Free USA/Canada

Phone: 011 421 33 790 2910

**Europe, Middle East and Africa Technical Support:**

Phone: 00421 33 790 2910

For additional information, please contact your local Sales Representative