

# FFH60UP60S, FFH60UP60S3

## 60 A, 600 V Ultrafast Rectifier

### Description

The FFH60UP60S, FFH60UP60S3 is an ultrafast diode with low forward voltage drop and rugged UIS capability. This device is intended for use as freewheeling and clamping diodes in a variety of switching power supplies and other power switching applications. It is specially suited for use in switching power supplies and industrial applications as welder and UPS application.

### Features

- Ultrafast Recovery,  $t_{rr} = 80 \text{ ns}$  (@  $I_F = 60 \text{ A}$ )
- Max Forward Voltage,  $V_F = 1.7 \text{ V}$  (@  $T_C = 25^\circ\text{C}$ )
- Avalanche Energy Rated
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### Applications

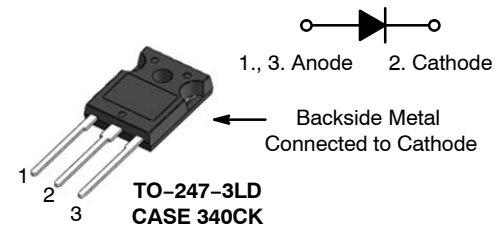
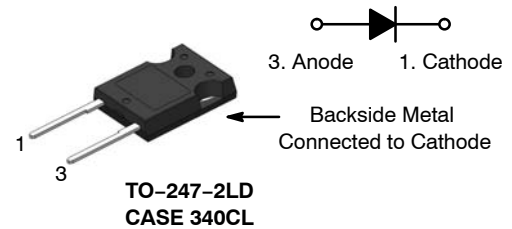
- General Purpose
- SMPS, Welder, UPS
- Free-wheeling Diode for Motor Application
- Power Switching Circuits



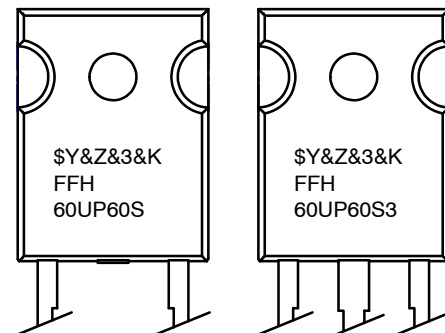
ON Semiconductor®

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

### PIN ASSIGNMENTS



### MARKING DIAGRAM



\$Y	= ON Semiconductor Logo
&Z	= Assembly Plant Code
&3	= Numeric Date Code
&K	= Lot Code
FFH60UP60Sx	= Specific Device Code

### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

# FFH60UP60S, FFH60UP60S3

## ABSOLUTE MAXIMUM RATINGS (T<sub>C</sub> = 25°C unless otherwise noted)

Symbol	Parameter	Value	Unit
V <sub>RRM</sub>	Peak Repetitive Reverse Voltage	600	V
V <sub>RWM</sub>	Working Peak Reverse Voltage	600	V
V <sub>R</sub>	DC Blocking Voltage	600	V
I <sub>F(AV)</sub>	Average Rectified Forward Current @ T <sub>C</sub> = 93°C	60	A
I <sub>FSM</sub>	Non-repetitive Peak Surge Current 60 Hz Single Half-Sine Wave	600	A
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range	-65 to +175	°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

Symbol	Parameter	Value	Unit
R <sub>θJC</sub>	Maximum Thermal Resistance, Junction to Case	0.7	°C/W

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

Symbol	Parameter	Min	Typ	Max	Unit	
V <sub>F</sub> (Note 1)	I <sub>F</sub> = 60 A	T <sub>C</sub> = 25°C	-	1.4	1.7	V
		T <sub>C</sub> = 125°C	-	1.3	-	
I <sub>R</sub> (Note 1)	V <sub>R</sub> = 600 V	T <sub>C</sub> = 25°C	-	-	100	μA
		T <sub>C</sub> = 125°C	-	-	500	
t <sub>rr</sub>	I <sub>F</sub> = 60 A, di <sub>F</sub> /dt = 200 A/μs, V <sub>R</sub> = 390 V	T <sub>C</sub> = 25°C	-	60	80	ns
		T <sub>C</sub> = 125°C	-	138	-	
W <sub>AVL</sub>	Avalanche Energy (L = 40 mH)	50	-	-	mJ	

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%

## ORDERING INFORMATION

Part Number	Device Marking	Package	Shipping
FFH60UP60S	FFH60UP60S	TO-247-2LD (Pb-Free / Halogen Free)	450 Units / Tube
FFH60UP60S3	FFH60UP60S3	TO-247-3LD (Pb-Free / Halogen Free)	450 Units / Tube

# FFH60UP60S, FFH60UP60S3

## TEST CIRCUIT AND WAVEFORM

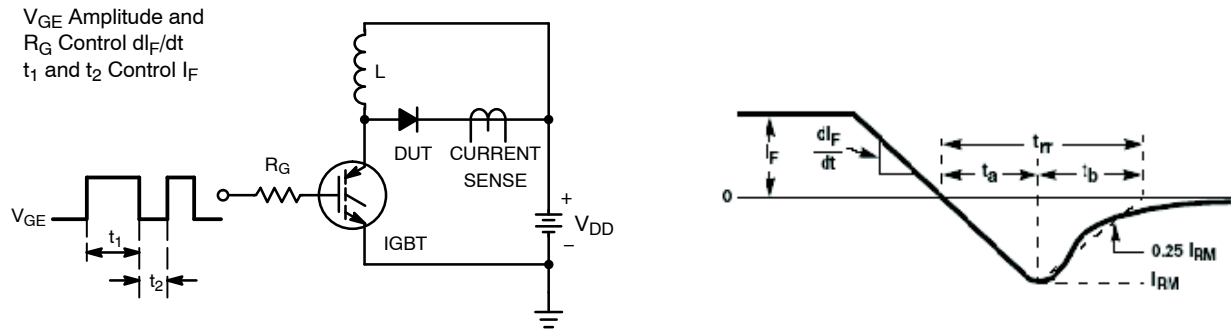


Figure 1. Diode Reverse Recovery Test Circuit and Waveform

$L = 40 \text{ mH}$   
 $R < 0.1 \Omega$   
 $V_{DD} = 50 \text{ V}$   
 $E_{AVL} = 1/2LI^2 [V_{R(AVL)} / (V_{R(AVL)} - V_{DD})]$   
 $Q1 = \text{IGBT (} BV_{CES} > \text{DUT } V_{R(AVL)} \text{)}$

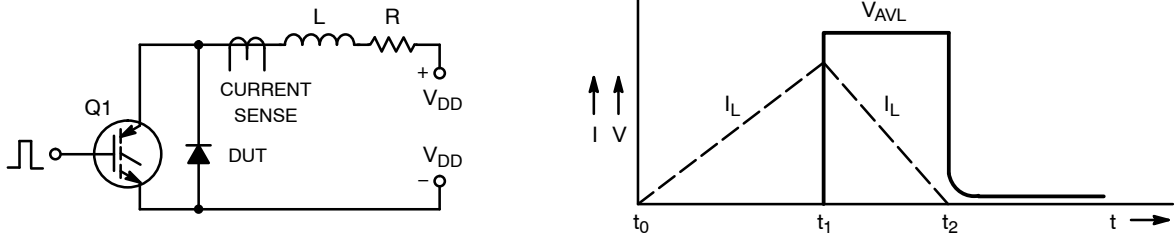


Figure 2. Unclamped Inductive Switching Test Circuit & Waveform

TYPICAL PERFORMANCE CHARACTERISTICS

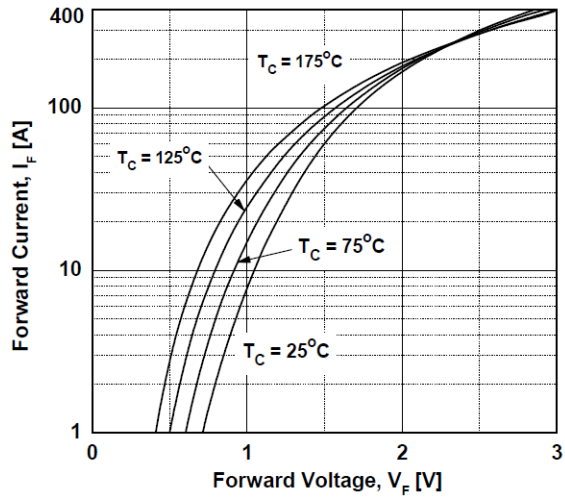


Figure 3. Typical Forward Voltage Drop vs. Forward Current

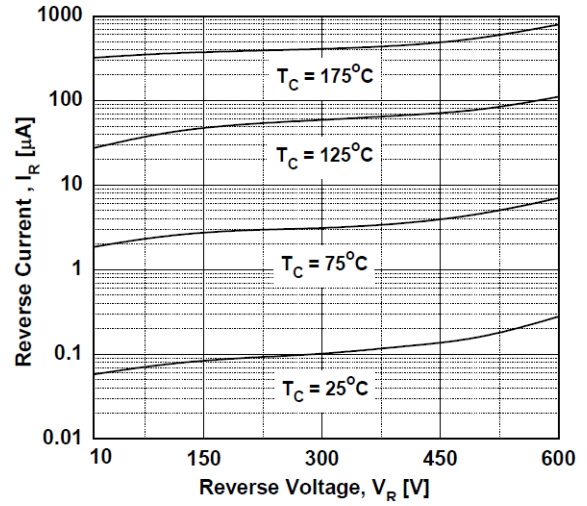


Figure 4. Typical Reverse Current vs. Reverse Voltage

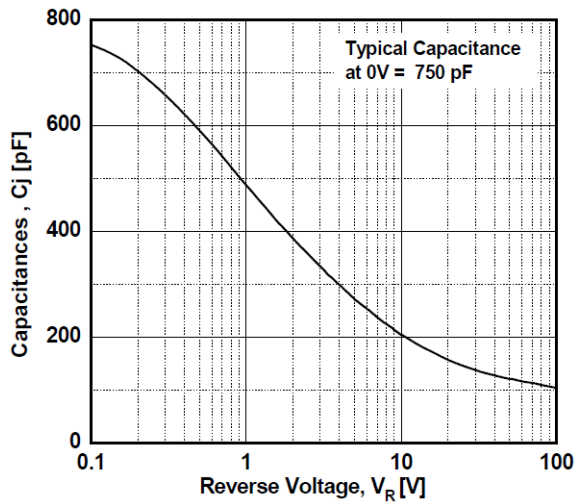


Figure 5. Typical Junction Capacitance

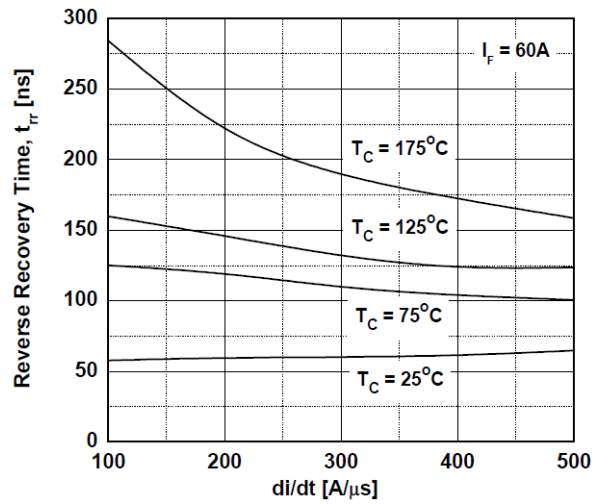


Figure 6. Typical Reverse Recovery Time vs.  $di_F/dt$

# FFH60UP60S, FFH60UP60S3

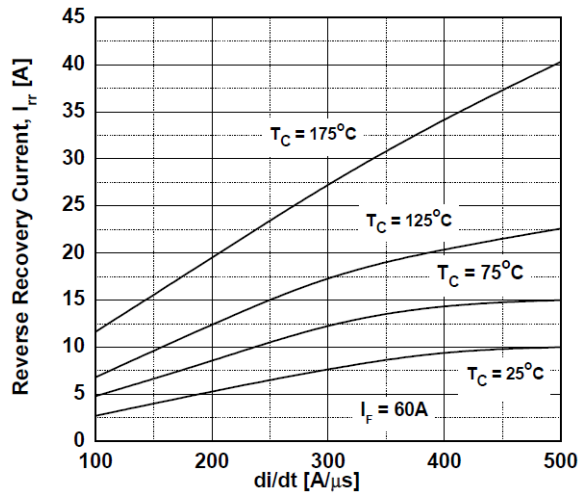


Figure 7. Typical Reverse Recovery Current vs.  $di_F/dt$

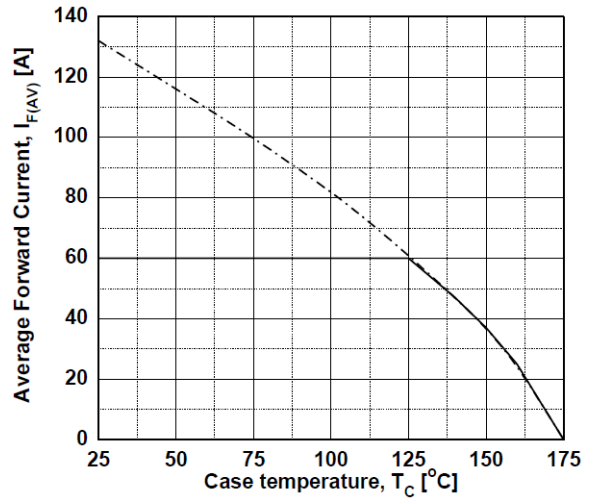


Figure 8. Forward Current Derating Curve

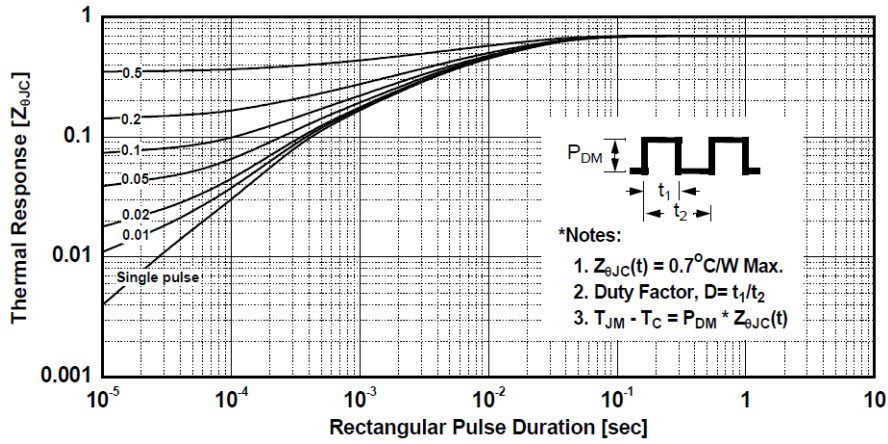
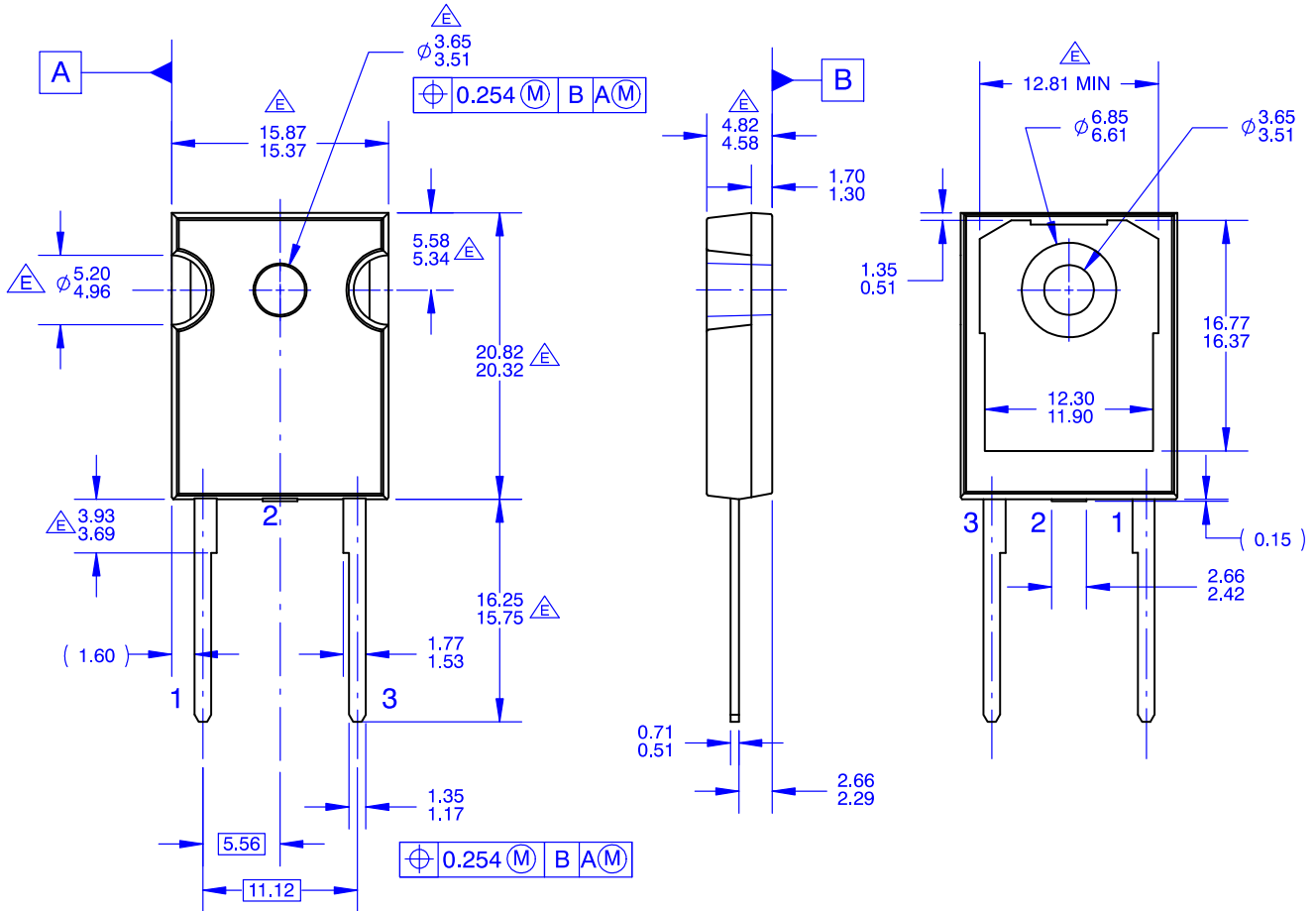


Figure 9. Transient Thermal Response Curve

**MECHANICAL CASE OUTLINE**  
**PACKAGE DIMENSIONS**

**TO-247-2LD**  
**CASE 340CL**  
**ISSUE O**

DATE 31 OCT 2016



NOTES: UNLESS OTHERWISE SPECIFIED.

- A. PACKAGE REFERENCE: JEDEC TO-247, ISSUE E, VARIATION AB.
- B. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- C. ALL DIMENSIONS ARE IN MILLIMETERS.
- D. DRAWING CONFORMS TO ASME Y14.5 – 2009.

**E** DOES NOT COMPLY JEDEC STANDARD VALUE.

<b>DOCUMENT NUMBER:</b>	<b>98AON13850G</b>	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
<b>STATUS:</b>	<b>ON SEMICONDUCTOR STANDARD</b>	
<b>NEW STANDARD:</b>		
<b>DESCRIPTION:</b>	<b>TO-247-2LD</b>	<b>PAGE 1 OF 2</b>

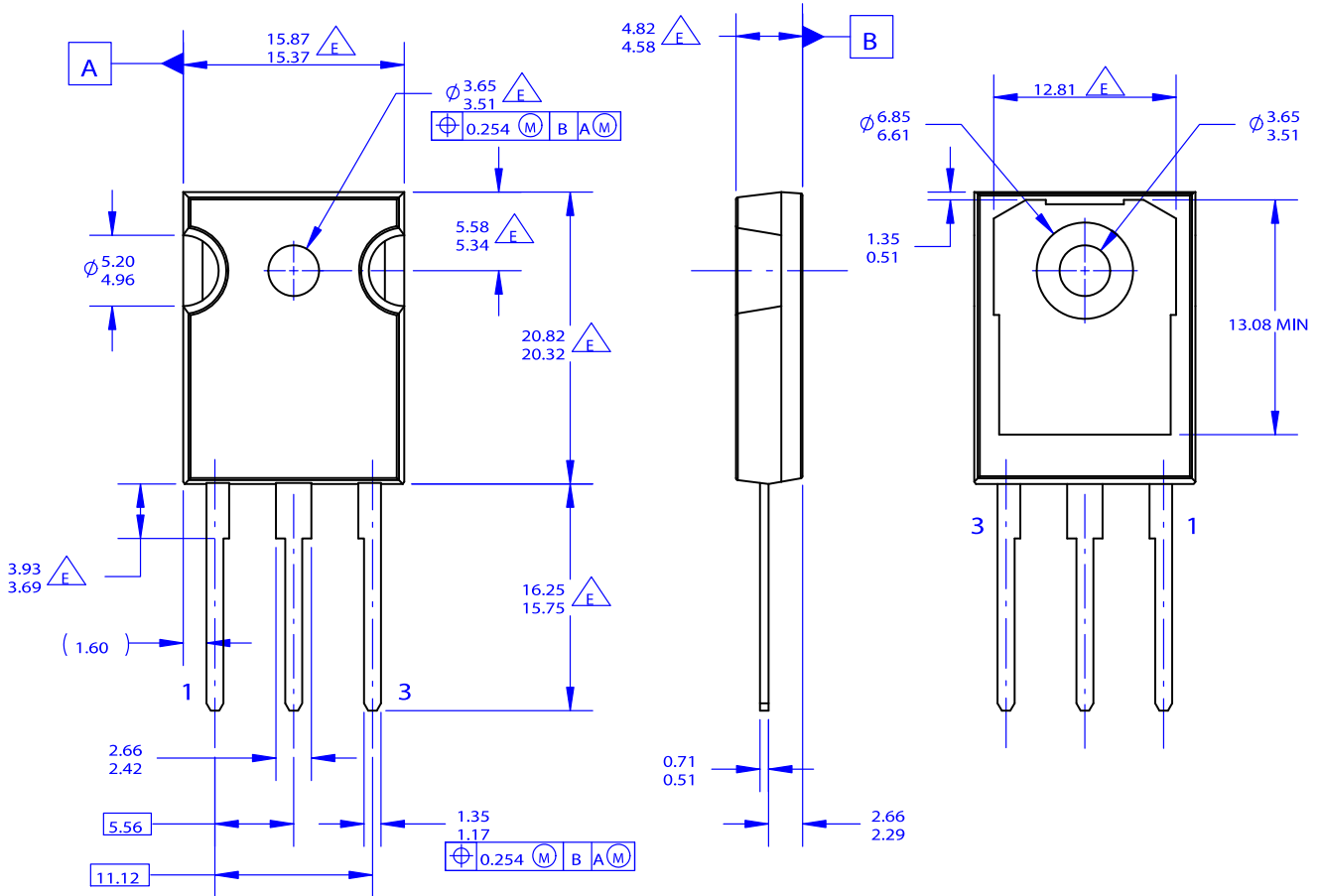


# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

TO-247-3LD  
CASE 340CK  
ISSUE O

DATE 31 OCT 2016




NOTES: UNLESS OTHERWISE SPECIFIED.

- A. PACKAGE REFERENCE: JEDEC TO-247, ISSUE E, VARIATION AB, DATED JUNE, 2004.
- B. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- C. ALL DIMENSIONS ARE IN MILLIMETERS.
- D. DRAWING CONFORMS TO ASME Y14.5 - 1994

 DOES NOT COMPLY JEDEC STANDARD VALUE

<b>DOCUMENT NUMBER:</b>	<b>98AON13851G</b>	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
<b>STATUS:</b>	<b>ON SEMICONDUCTOR STANDARD</b>	
<b>NEW STANDARD:</b>		
<b>DESCRIPTION:</b>	<b>TO-247-3LD</b>	<b>PAGE 1 OF 2</b>



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 owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor'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). 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. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor 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. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor 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 ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor 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 ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor 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:

Literature Distribution Center for ON Semiconductor  
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada  
**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910

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

**Order Literature:** <http://www.onsemi.com/orderlit>

For additional information, please contact your local  
Sales Representative