

# Switch-mode Soft Recovery Power Rectifier

## MSR1560G, MSRF1560G

These state-of-the-art devices are designed for boost converter or hard-switched converter applications, especially for Power Factor Correction application. It could also be used as a free wheeling diode in variable speed motor control applications and switching mode power supplies.

### Features

- Soft Recovery with Low Reverse Recovery Charge ( $Q_{RR}$ ) and Peak Reverse Recovery Current ( $I_{RRM}$ )
- Epoxy meets UL 94 V-0 @ 0.125 in
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction
- These are Pb-Free Devices

### Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.9 Grams (Approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds

### MAXIMUM RATINGS

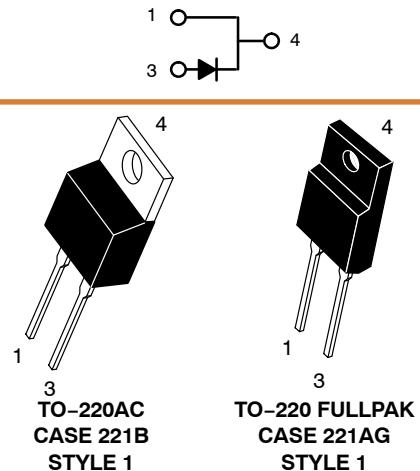
Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	$V_{RRM}$ $V_{RWM}$ $V_R$	600	V
Average Rectified Forward Current (At Rated $V_R$ , $T_C = 125^\circ\text{C}$ )	$I_O$	15	A
Peak Repetitive Forward Current (At Rated $V_R$ , Square Wave, 20 kHz, $T_C = 125^\circ\text{C}$ )	$I_{FRM}$	30	A
Non-Repetitive Peak Surge Current (Surge applied at rated load conditions, halfwave, single phase, 60 Hz)	$I_{FSM}$	100	A
Operating Junction and Storage Temperature Range	$T_J$ , $T_{stg}$	-65 to +150	°C

### THERMAL CHARACTERISTICS

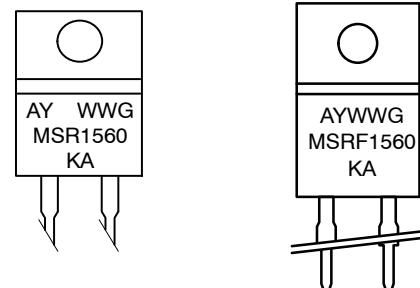
Parameter	Symbol	Value	Unit
MSR1560G: Thermal Resistance Junction-to-Case Junction-to-Ambient	$R_{\theta JC}$ $R_{\theta JA}$	1.6 72.8	°C/W
MSRF1560G: Thermal Resistance Junction-to-Case Junction-to-Ambient	$R_{\theta JC}$ $R_{\theta JA}$	4.25 75	°C/W

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.

### SOFT RECOVERY POWER RECTIFIER 15 AMPERES, 600 VOLTS



### MARKING DIAGRAM



A = Assembly Location  
 Y = Year  
 WW = Work Week  
 G = Pb-Free Package  
 KA = Diode Polarity

### ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
MSR1560G	TO-220AC (Pb-Free)	50 Units / Rail

### DISCONTINUED (Note 1)

MSRF1560G	TO-220FP (Pb-Free)	50 Units / Rail
-----------	--------------------	-----------------

<sup>†</sup>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](#).

## ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Value		Unit
Instantaneous Forward Voltage (Note 1) ( $I_F = 15$ A) Maximum Typical	$V_F$	$T_J = 25^\circ\text{C}$	$T_J = 150^\circ\text{C}$	V
		1.8 1.5	1.4 1.2	
Instantaneous Reverse Current ( $V_R = 600$ V) Maximum Typical	$I_R$	$T_J = 25^\circ\text{C}$	$T_J = 150^\circ\text{C}$	$\mu\text{A}$
		15 0.4	5000 100	
Reverse Recovery Time (Note 2) ( $V_R = 30$ V, $I_F = 1$ A, $di/dt = 100$ A/ $\mu\text{s}$ ) Maximum Typical	$t_{rr}$	$T_J = 25^\circ\text{C}$	$T_J = 100^\circ\text{C}$	ns
		45 35	65 54	
Typical Recovery Softness Factor ( $V_R = 30$ V, $I_F = 1$ A, $di/dt = 100$ A/ $\mu\text{s}$ )	$s = t_b/t_a$	0.67	0.74	
Typical Peak Reverse Recovery Current ( $V_R = 30$ V, $I_F = 1$ A, $di/dt = 100$ A/ $\mu\text{s}$ )	$I_{RRM}$	2.3	3.2	A
Typical Reverse Recovery Charge ( $V_R = 30$ V, $I_F = 1$ A, $di/dt = 100$ A/ $\mu\text{s}$ )	$Q_{RR}$	31	78	nC

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  $\leq 380$   $\mu\text{s}$ , Duty Cycle  $\leq 2\%$
2.  $T_{RR}$  measured projecting from 25% of  $I_{RRM}$  to zero current

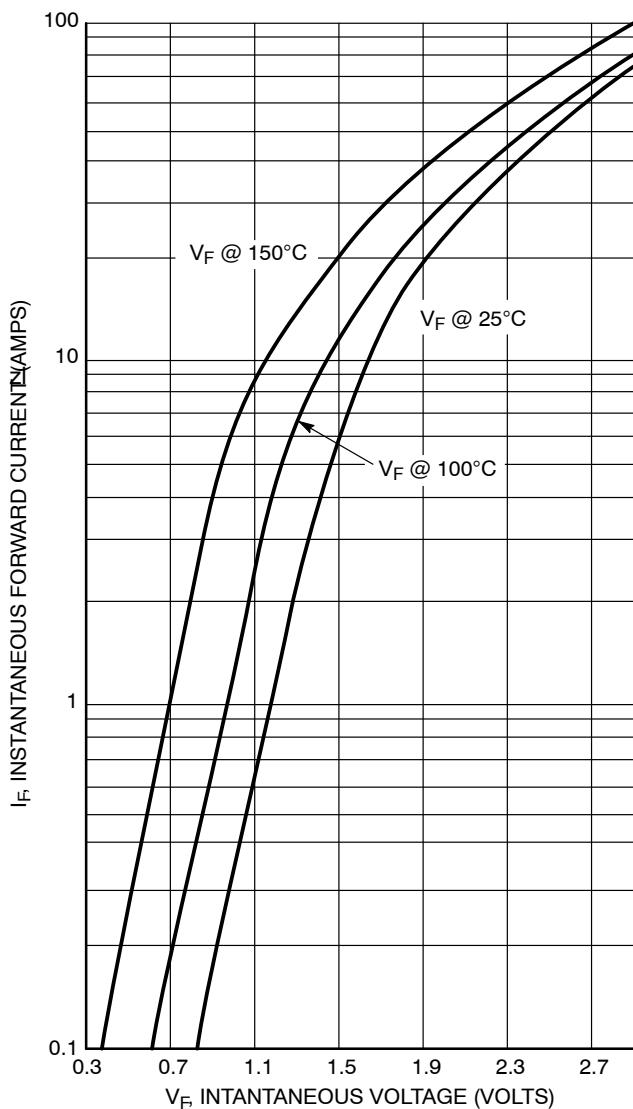


Figure 1. Maximum Forward Voltage

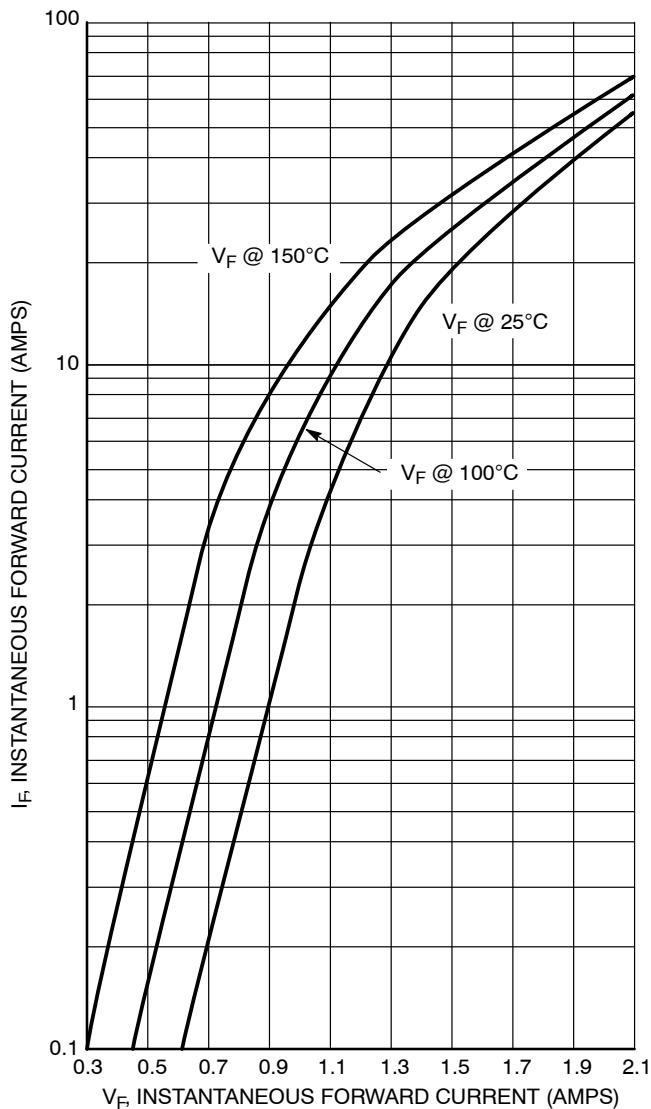


Figure 2. Typical Forward Voltage

# MSR1560G, MSRF1560G

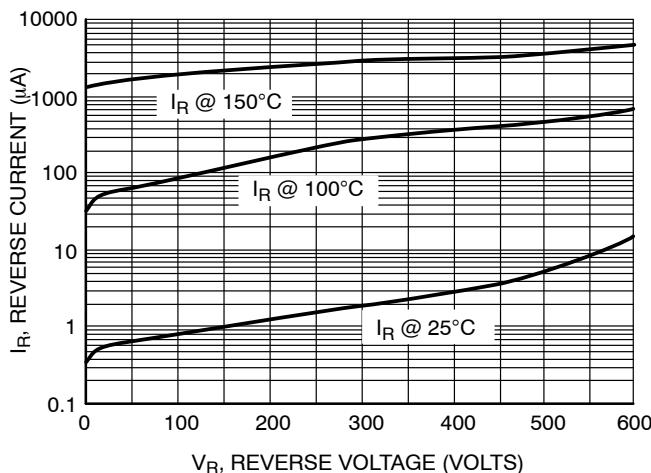


Figure 3. Maximum Reverse Current

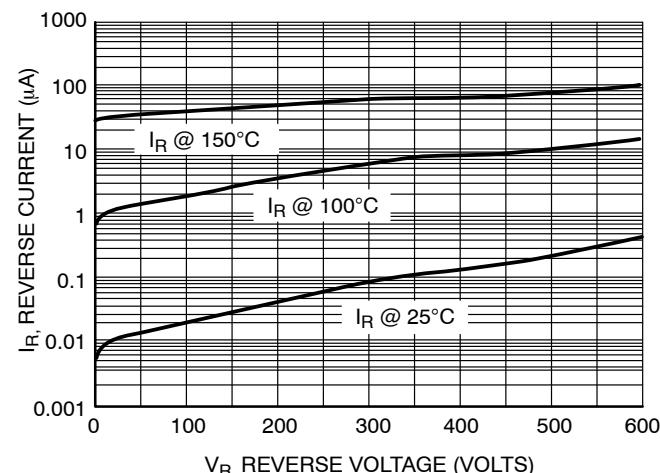


Figure 4. Typical Reverse Current

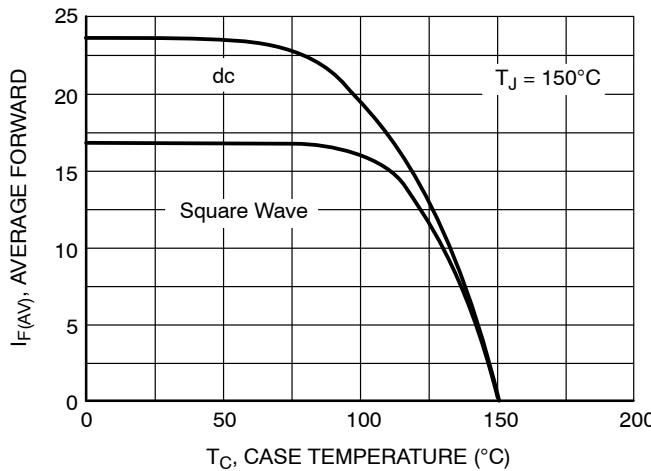


Figure 5. Current Derating

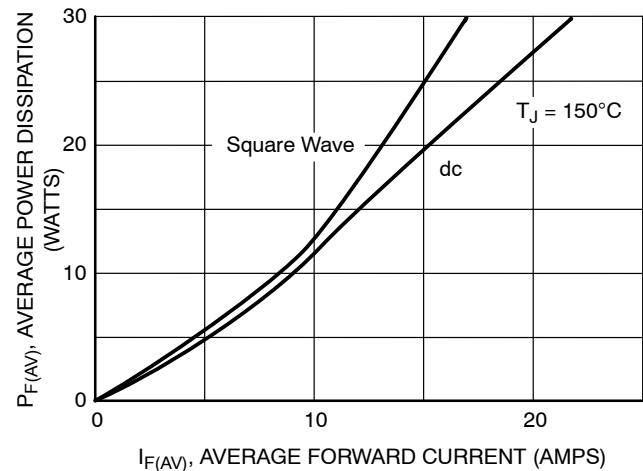


Figure 6. Power Dissipation

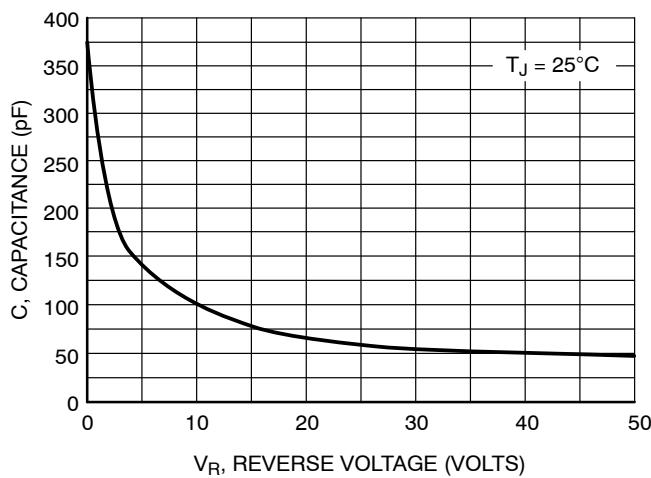


Figure 7. Maximum Capacitance

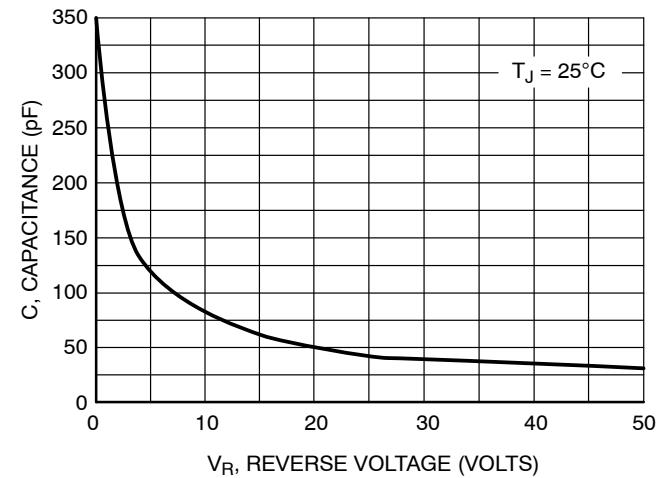


Figure 8. Typical Capacitance

# MSR1560G, MSRF1560G

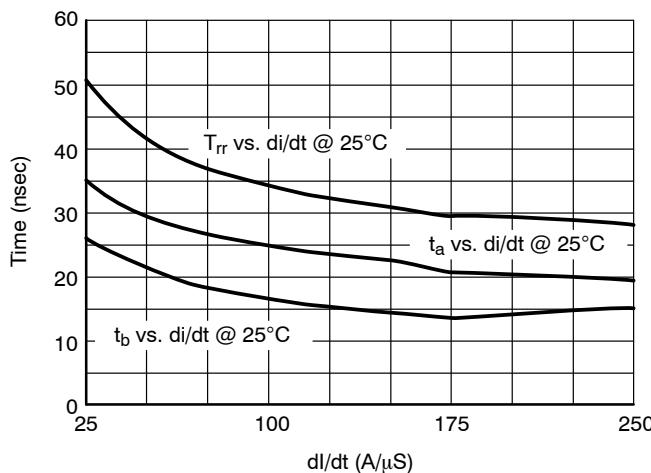


Figure 9. Typical Trr vs. di/dt

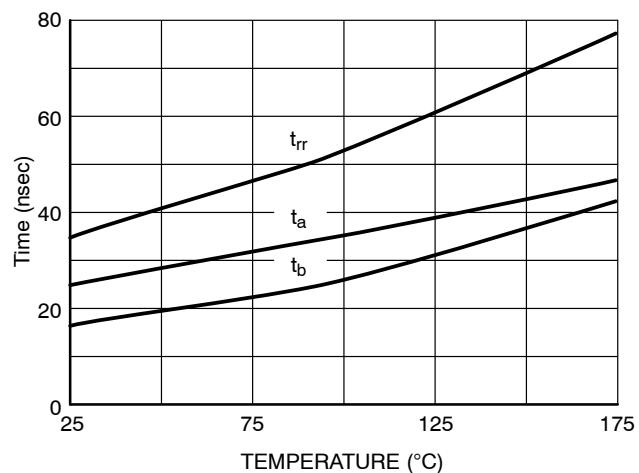


Figure 10. Typical Trr vs. Temperature

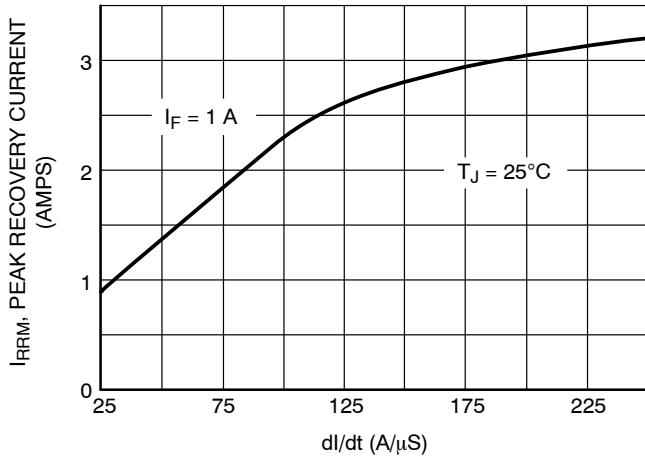


Figure 11. Typical Peak Reverse Recovery Current

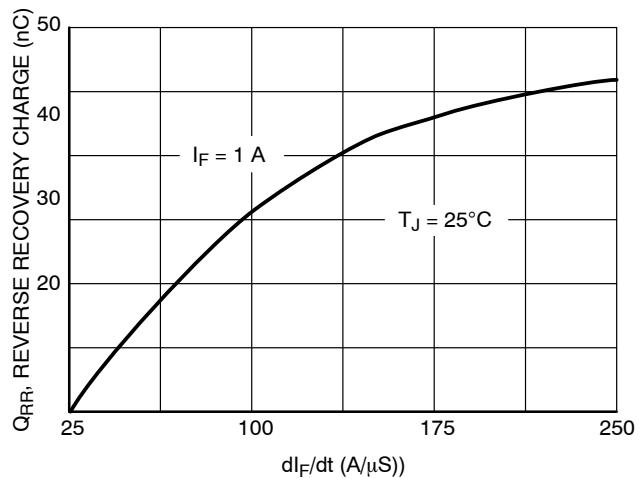


Figure 12. Typical Reverse Recovery Charge

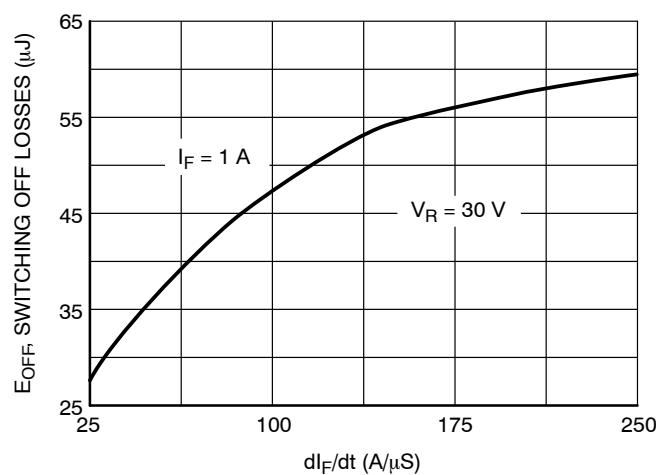


Figure 13. Typical Switching Off Losses

## MSR1560G, MSRF1560G

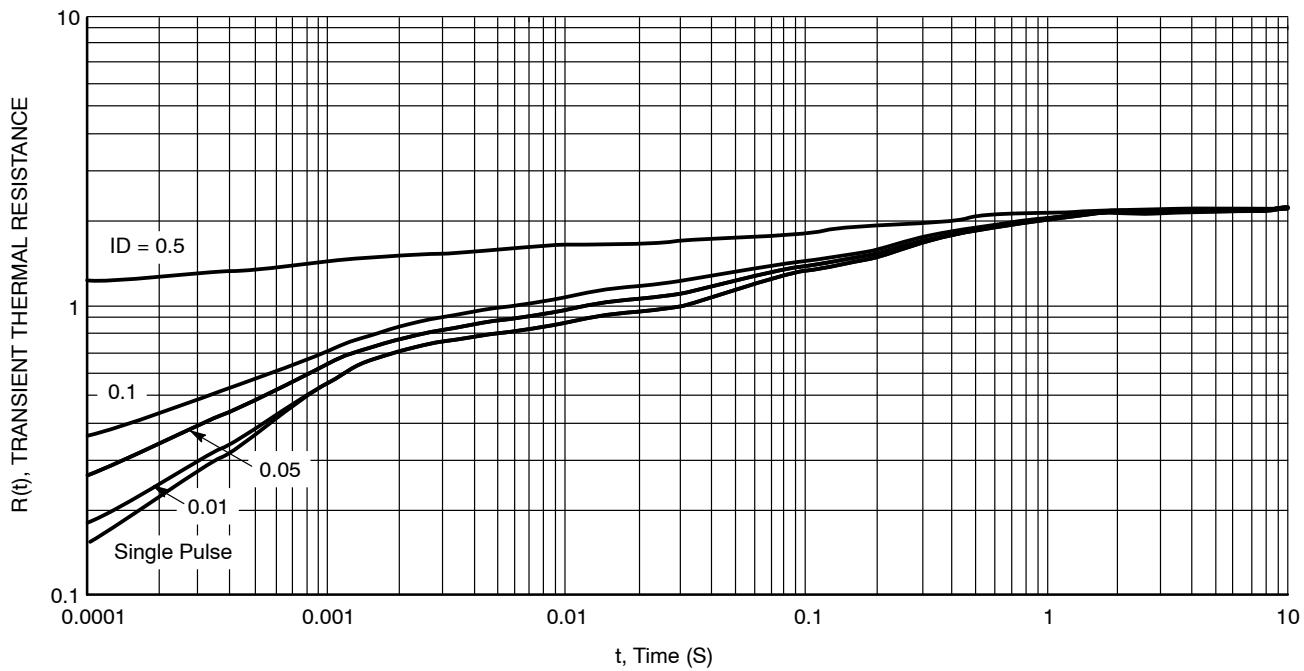


Figure 14. Transient Thermal Response

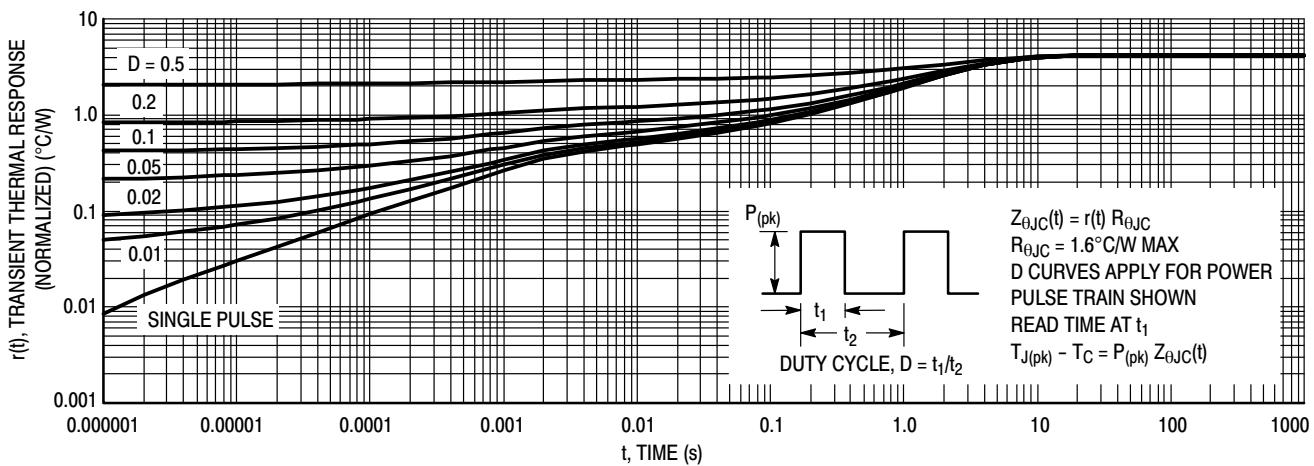


Figure 15. Thermal Response, (MSRF1560) Junction-to-Case ( $R_{\theta_{JC}}$ )

## MSR1560G, MSRF1560G

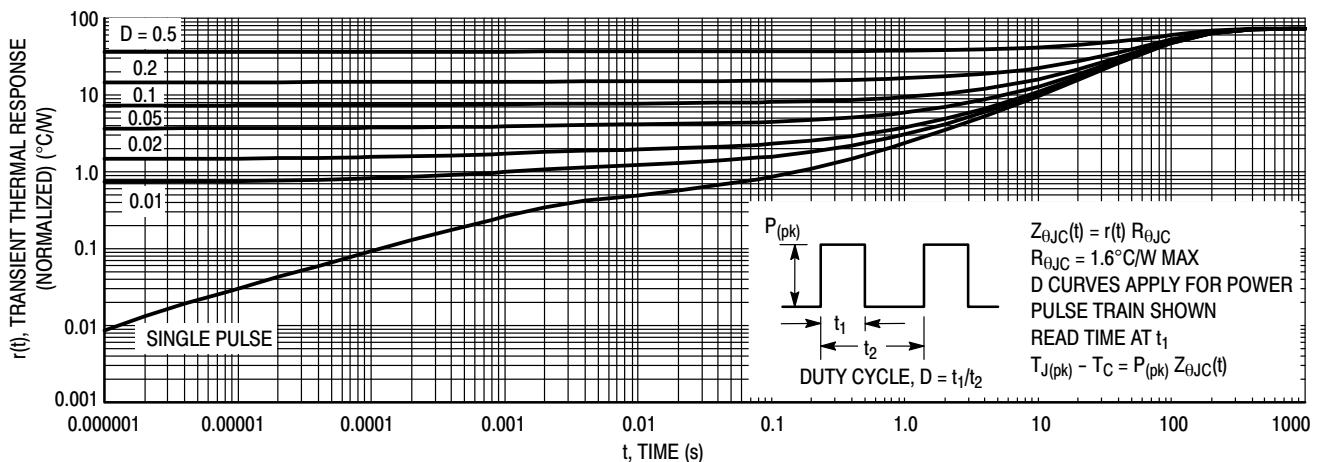
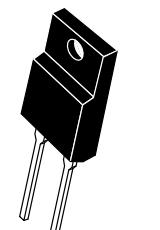
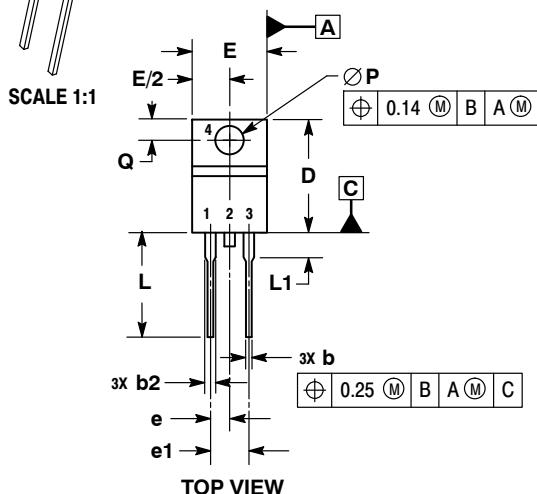


Figure 16. Thermal Response, (MSRF1560) Junction-to-Ambient ( $R_{\theta\text{JA}}$ )

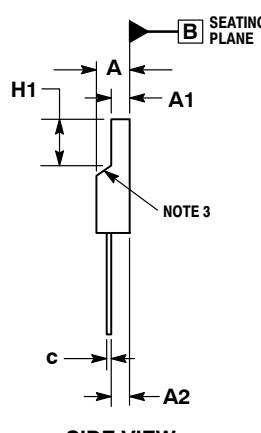


**TO-220 FULLPACK, 2-LEAD  
CASE 221AG  
ISSUE B**

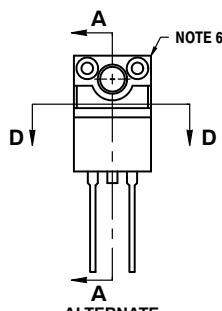
DATE 27 AUG 2015



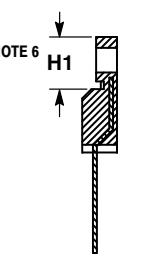
### TOP VIEW



### SIDE VIEW



## ALTERNATE CONSTRUCTION



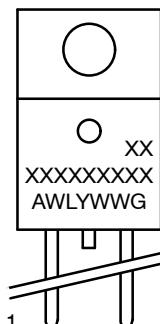
## SECTION A-A

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. CONTOUR UNCONTROLLED IN THIS AREA.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH AND GATE PROTRUSIONS. MOLD FLASH AND GATE PROTRUSIONS NOT TO EXCEED 0.13 PER SIDE. THESE DIMENSIONS ARE TO BE MEASURED AT OUTERMOST EXTREME OF THE PLASTIC BODY.
5. DIMENSION  $b_2$  DOES NOT INCLUDE DAMBAR PROTRUSION. LEAD WIDTH INCLUDING PROTRUSION SHALL NOT EXCEED 2.00.

MILLIMETERS		
DIM	MIN	MAX
A	4.30	4.70
A1	2.50	2.90
A2	2.50	2.90
b	0.54	0.84
b2	1.10	1.40
c	0.49	0.79
D	14.22	15.88
E	9.65	10.67
e	2.54	BSC
e1	5.08	BSC
H1	6.40	6.90
L	12.70	14.73
L1	---	2.80
P	3.00	3.40
Q	2.80	3.20

## GENERIC MARKING DIAGRAM\*

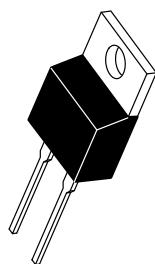


A = Assembly Location  
WL = Wafer Lot  
Y = Year  
WW = Work Week  
G = Pb-Free Package

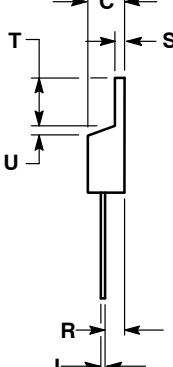
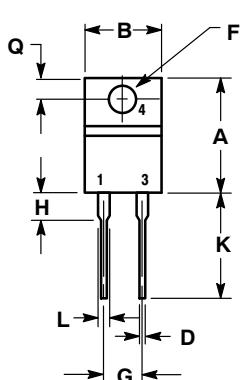
\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "■", may or may not be present.

<b>DOCUMENT NUMBER:</b>	<b>98AON52563E</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>DESCRIPTION:</b>	<b>TO-220 FULLPACK, 2-LEAD</b>	<b>PAGE 1 OF 1</b>

**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.



SCALE 1:1

TO-220, 2-LEAD  
CASE 221B-04  
ISSUE F

DATE 12 APR 2013

## NOTES:

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

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.595	0.620	15.11	15.75
B	0.380	0.405	9.65	10.29
C	0.160	0.190	4.06	4.82
D	0.025	0.039	0.64	1.00
F	0.142	0.161	3.61	4.09
G	0.190	0.210	4.83	5.33
H	0.110	0.130	2.79	3.30
J	0.014	0.025	0.36	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.14	1.52
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.14	1.39
T	0.235	0.255	5.97	6.48
U	0.000	0.050	0.000	1.27

STYLE 1:  
PIN 1. CATHODE  
2. N/A  
3. ANODE  
4. CATHODE

STYLE 2:  
PIN 1. ANODE  
2. N/A  
3. CATHODE  
4. ANODE

DOCUMENT NUMBER:	98ASB42149B	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, 2-LEAD	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)

