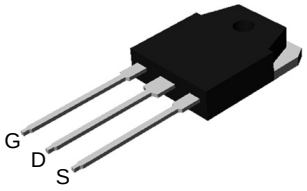
MOSFET – N-Channel, SUPERFET®

600 V, 47 A, 70 mΩ

FCA47N60, FCA47N60-F109

V_{DSS}	$R_{DS(on)}$ MAX	I_D MAX
600 V	70 mΩ @ 10 V	47 A



TO−3P−3LD / EIAJ SC−65, ISOLATED
CASE 340BZ

Description

SUPERFET MOSFET is **onsemi**'s first generation of high voltage super−junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on−resistance and lower gate charge performance. This technology is tailored to minimize conduction loss, provide superior switching performance, dv/dt rate and higher avalanche energy. Consequently, SUPERFET MOSFET is very suitable for the switching power applications such as PFC, server/telecom power, FPD TV power, ATX power and industrial power applications.

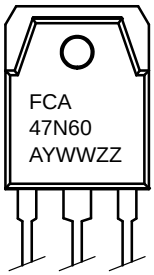
Features

- 650 V @ T_J = 150°C
- Typ. $R_{DS(on)}$ = 58 mΩ
- Ultra Low Gate Charge (Typ. Q_g = 210 nC)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)}$ = 420 pF)
- 100% Avalanche Tested

Applications

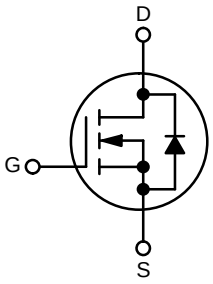
- Solar Inverter
- AC−DC Power Supply

MARKING DIAGRAM



FCA47N60	= Specific Device Code
A	= Assembly Location
YWW	= Date Code (Year & Week)
ZZ	= Assembly Lot

N−CHANNEL MOSFET



ORDERING INFORMATION

Part Number	Package	Shipping
FCA47N60	TO−3P−3LD (Pb−Free)	450 Units / Tube
FCA47N60−F109		450 Units / Tube

© Semiconductor Components Industries, LLC, 2010

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter		FCA47N60	FCA47N60−F109	Unit
V_{DSS}	Drain−Source Voltage		600		V
I_D	Drain Current	− Continuous (T_C = 25°C)	47		A
		− Continuous (T_C = 100°C)	29.7		
I_{DM}	Drain Current	− Pulsed (Note 1)	141		A
V_{GSS}	Gate−Source Voltage		±30		V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		1800		mJ
I_{AR}	Avalanche Current (Note 1)		47		A
E_{AR}	Repetitive Avalanche Energy (Note 1)		41.7		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)		4.5		V/ns
P_D	Power Dissipation	(T_C = 25°C)	417		W
		− Derate above 25°C	3.33		W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		−55 to +150		°C
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8” from Case for 5 Seconds		300		°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.

1. Repetitive Rating: Pulse−width limited by maximum junction temperature.
2. I_{AS} = 18 A, R_G = 25 Ω, starting T_J = 25°C.
3. I_{SD} ≤ 47 A, di/dt ≤ 200 A/μs, V_{DD} = 380 V, starting T_J = 25°C.

THERMAL CHARACTERISTICS

Symbol	Parameter	Typ	Max	Unit
$R_{\theta JC}$	Thermal Resistance, Junction−to−Case, Max.	−	0.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction−to−Ambient, Max.	−	41.7	°C/W

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
BV_{DSS}	Drain−Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA, T_J = 25°C	600	−	−	V
		V_{GS} = 0 V, I_D = 250 μA, T_J = 150°C	−	650	−	
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	−	0.6	−	V/°C
BV_{DS}	Drain−Source Avalanche Breakdown Voltage	V_{GS} = 0 V, I_D = 47 A	−	700	−	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 600 V, V_{GS} = 0 V	−	−	10	μA
		V_{DS} = 480 V, T_C = 125°C	−	−	100	
I_{GSSF}	Gate−Body Leakage Current, Forward	V_{GS} = 30 V, V_{DS} = 0 V	−	−	100	nA
I_{GSSR}	Gate−Body Leakage Current, Reverse	V_{GS} = −30 V, V_{DS} = 0 V	−	−	−100	nA
ON CHARACTERISTICS						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 μA	3.0	−	5.0	V
$R_{DS(on)}$	Static Drain−Source On−Resistance	V_{GS} = 10 V, I_D = 23.5 A	−	0.058	0.07	Ω
g_{FS}	Forward Transconductance	V_{DS} = 20 V, I_D = 23.5 A	−	40	−	S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	−	5900	8000	pF
C_{oss}	Output Capacitance		−	3200	4200	pF
C_{rss}	Reverse Transfer Capacitance		−	250	−	pF
C_{oss}	Output Capacitance	V_{DS} = 480 V, V_{GS} = 0 V, f = 1.0 MHz	−	160	−	pF
C_{oss} eff.	Effective Output Capacitance	V_{DS} = 0 to 400 V, V_{GS} = 0 V	−	420	−	pF
SWITCHING CHARACTERISTICS						
$t_{d(on)}$	Turn−On Delay Time	V_{DD} = 300 V, I_D = 47 A, R_G = 25 Ω (Note 4)	−	185	430	ns
t_r	Turn−On Rise Time		−	210	450	ns
$t_{d(off)}$	Turn−Off Delay Time		−	520	1100	ns
t_f	Turn−Off Fall Time		−	75	160	ns
Q_g	Total Gate Charge	V_{DS} = 480 V, I_D = 47 A, V_{GS} = 10 V (Note 4)	−	210	270	nC
Q_{gs}	Gate−Source Charge		−	38	−	nC
Q_{gd}	Gate−Drain Charge		−	110	−	nC
DRAIN−SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
I_S	Maximum Continuous Drain−Source Diode Forward Current		−	−	47	A
I_{SM}	Maximum Pulsed Drain−Source Diode Forward Current		−	−	141	A
V_{SD}	Drain−Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 47 A	−	−	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 47 A, dI_F/dt = 100 A/μs (Note 4)	−	590	−	ns
Q_{rr}	Reverse Recovery Charge		−	25	−	μC

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.

4. Essentially independent of operating temperature typical characteristics.

TYPICAL CHARACTERISTICS

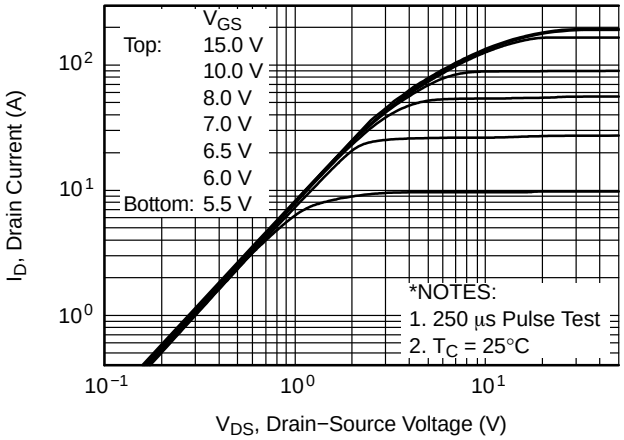


Figure 1. On−Region Characteristics

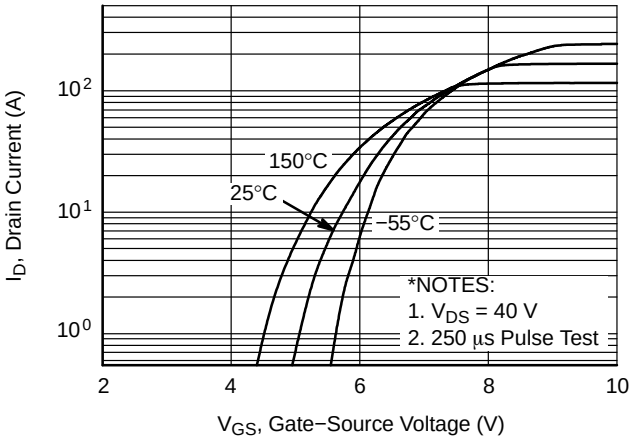


Figure 2. Transfer Characteristics

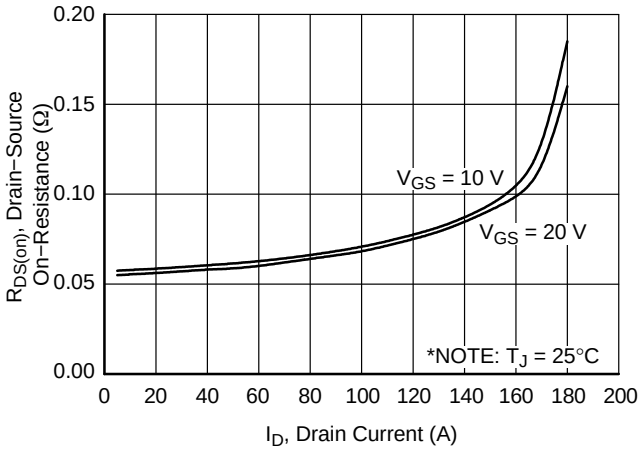


Figure 3. On−Resistance Variation vs. Drain Current and Gate Voltage

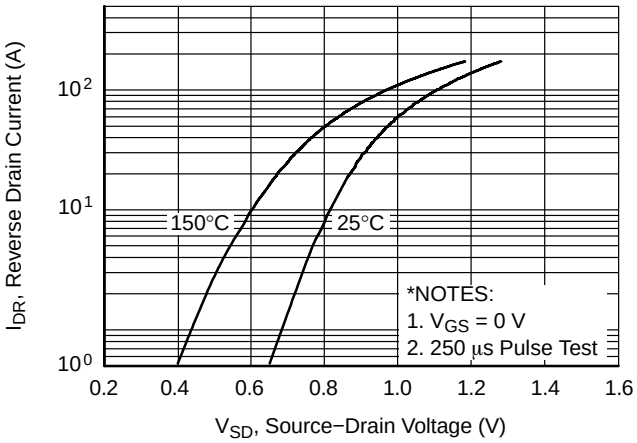


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

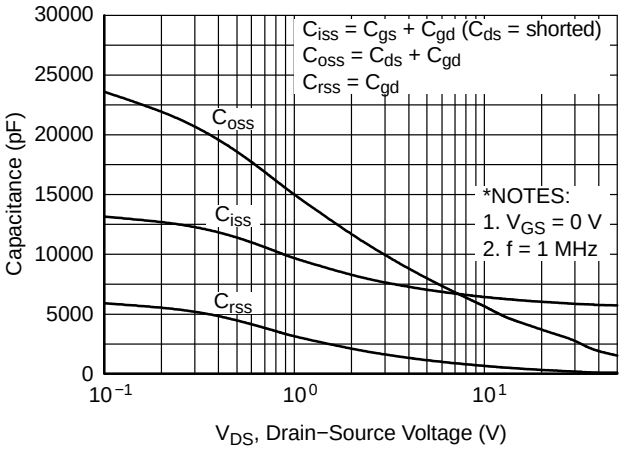


Figure 5. Capacitance Characteristics

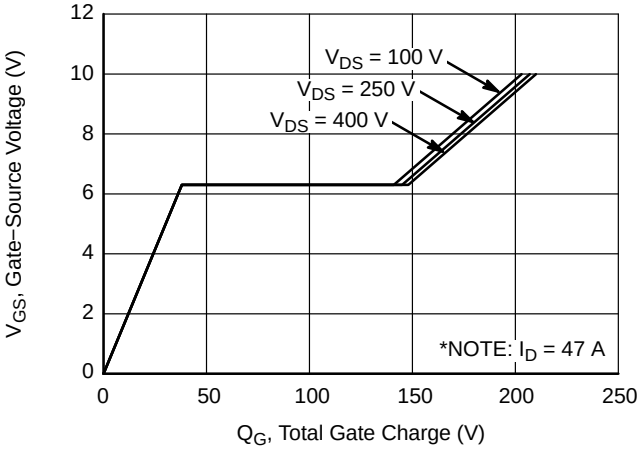


Figure 6. Gate Charge Characteristics

TYPICAL CHARACTERISTICS (CONTINUED)

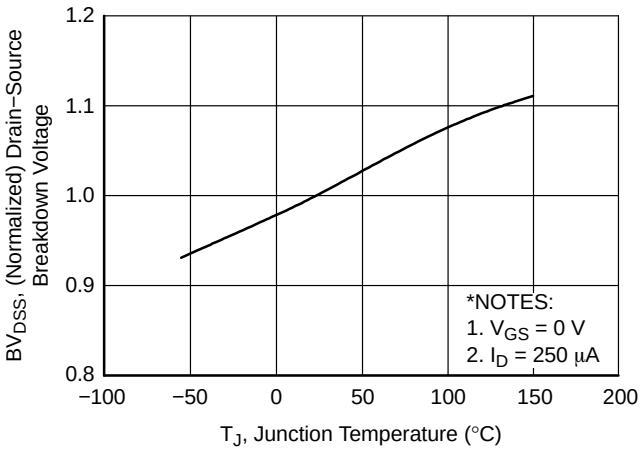


Figure 7. Breakdown Voltage Variation vs. Temperature

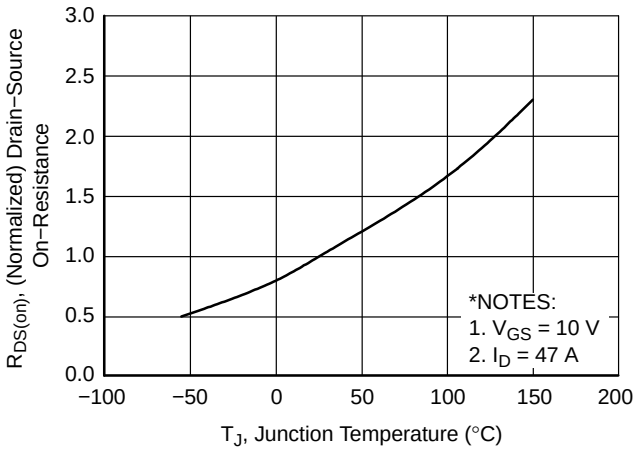


Figure 8. On−Resistance Variation vs. Temperature

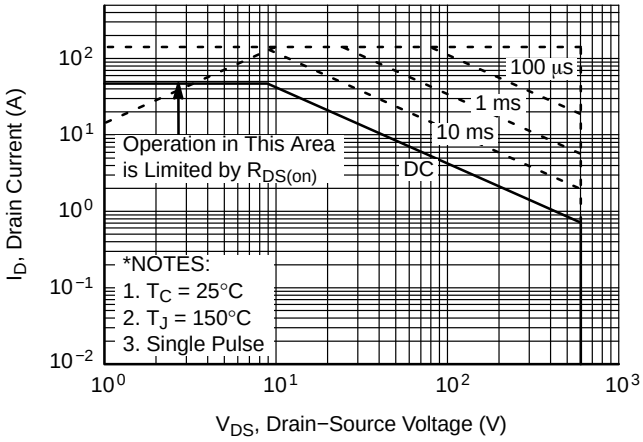


Figure 9. Safe Operating Area

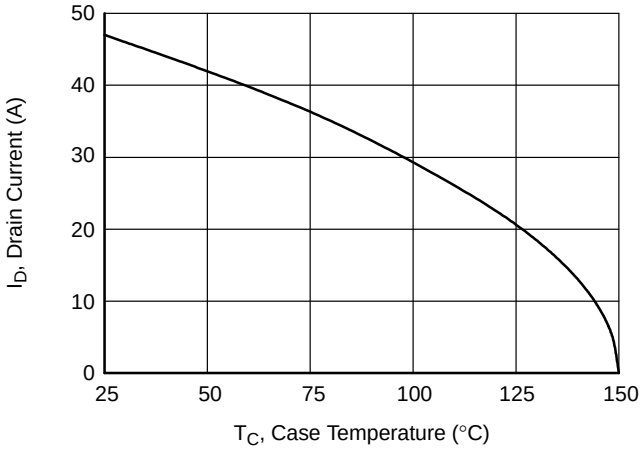


Figure 10. Maximum Drain Current vs. Case Temperature

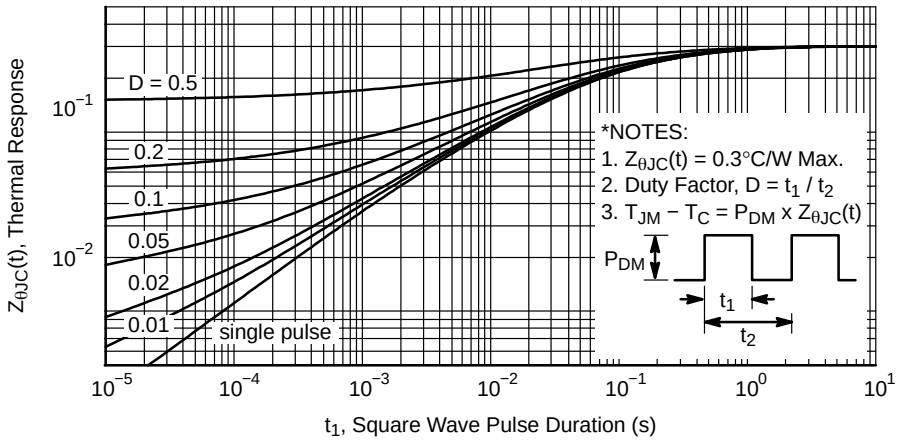


Figure 11. Transient Thermal Response Curve

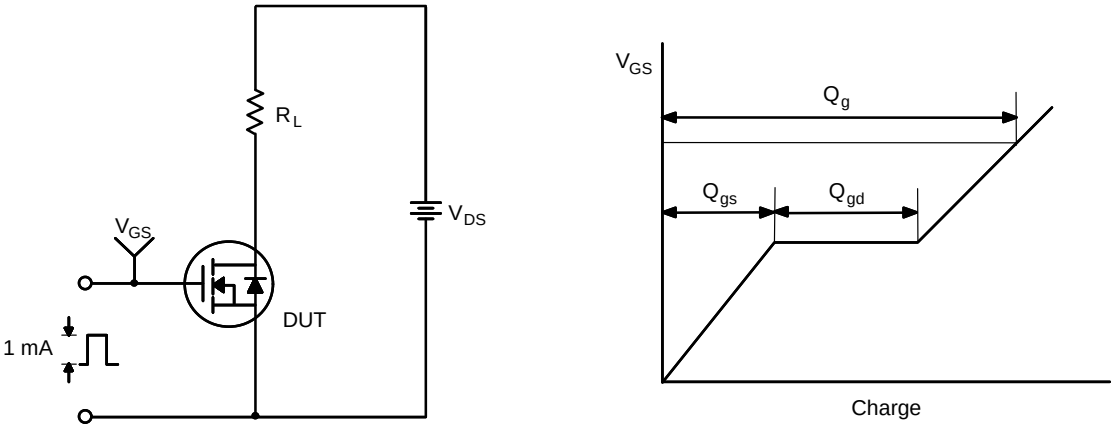


Figure 12. Gate Charge Test Circuit & Waveform

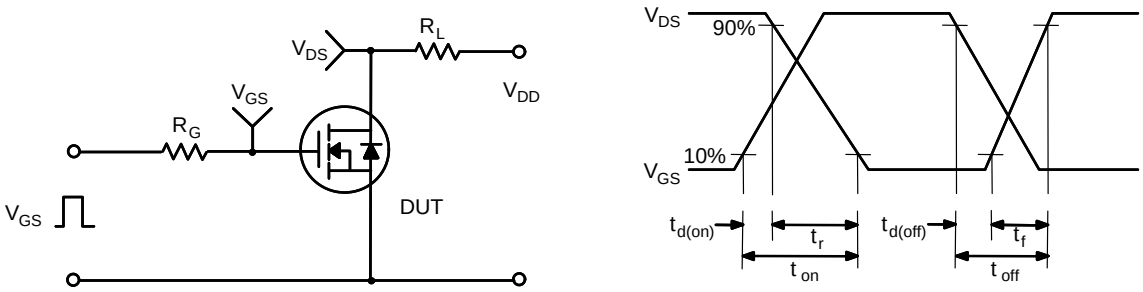


Figure 13. Resistive Switching Test Circuit & Waveforms

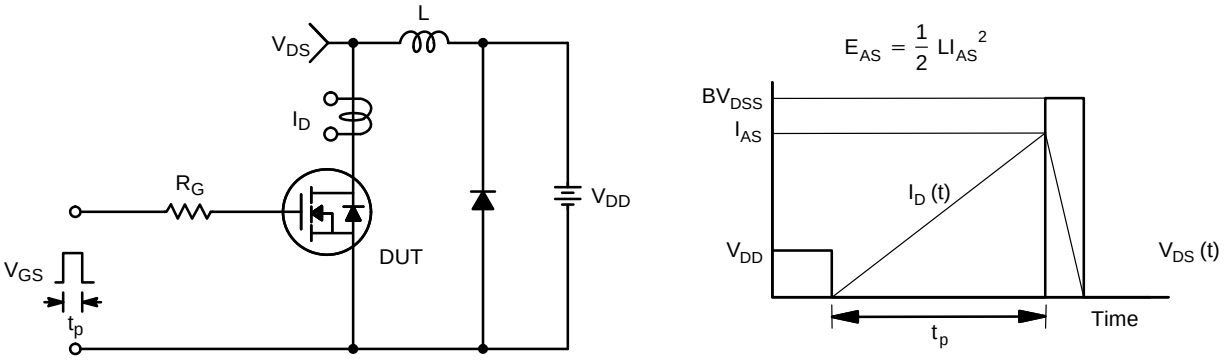


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

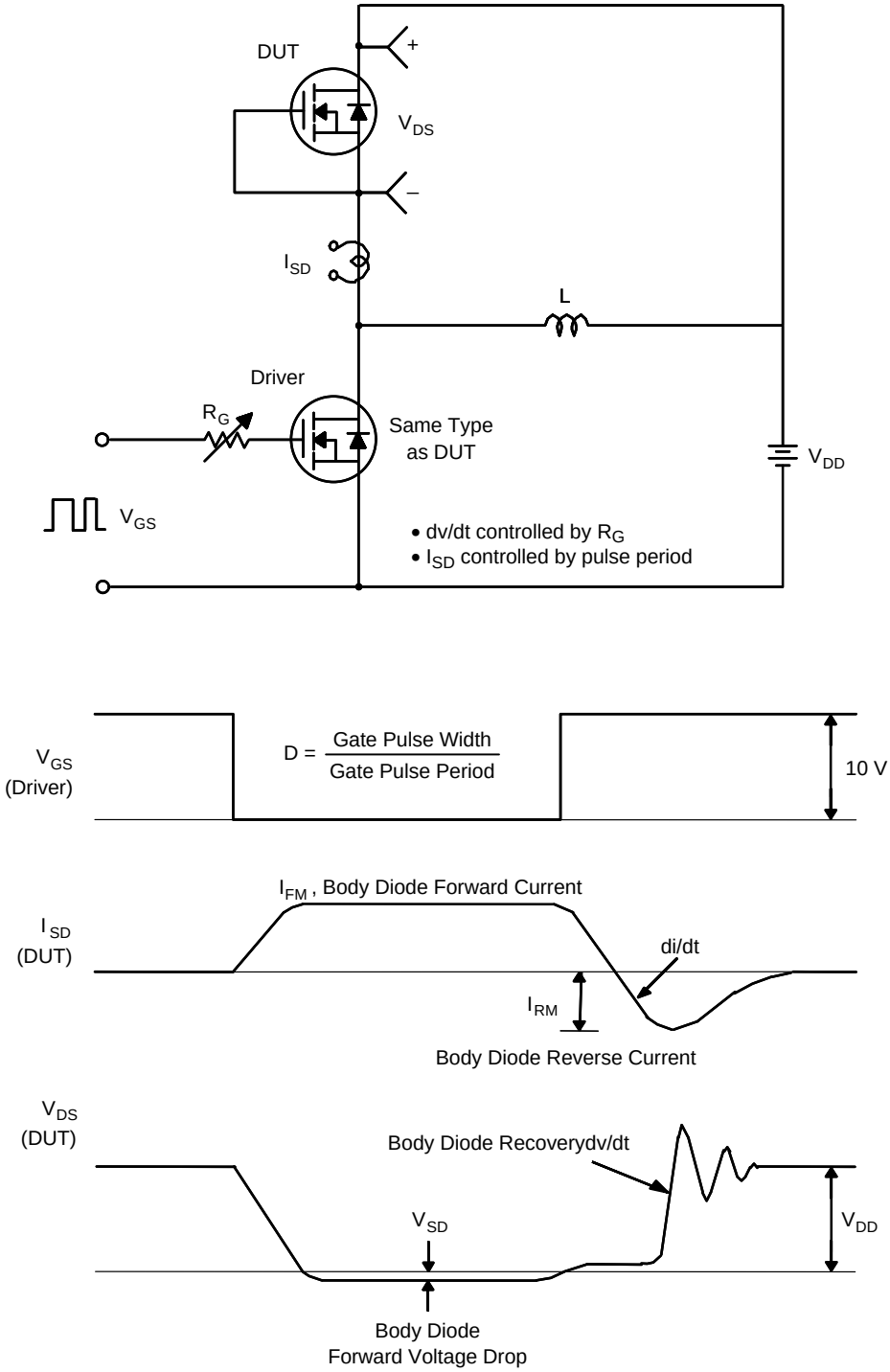
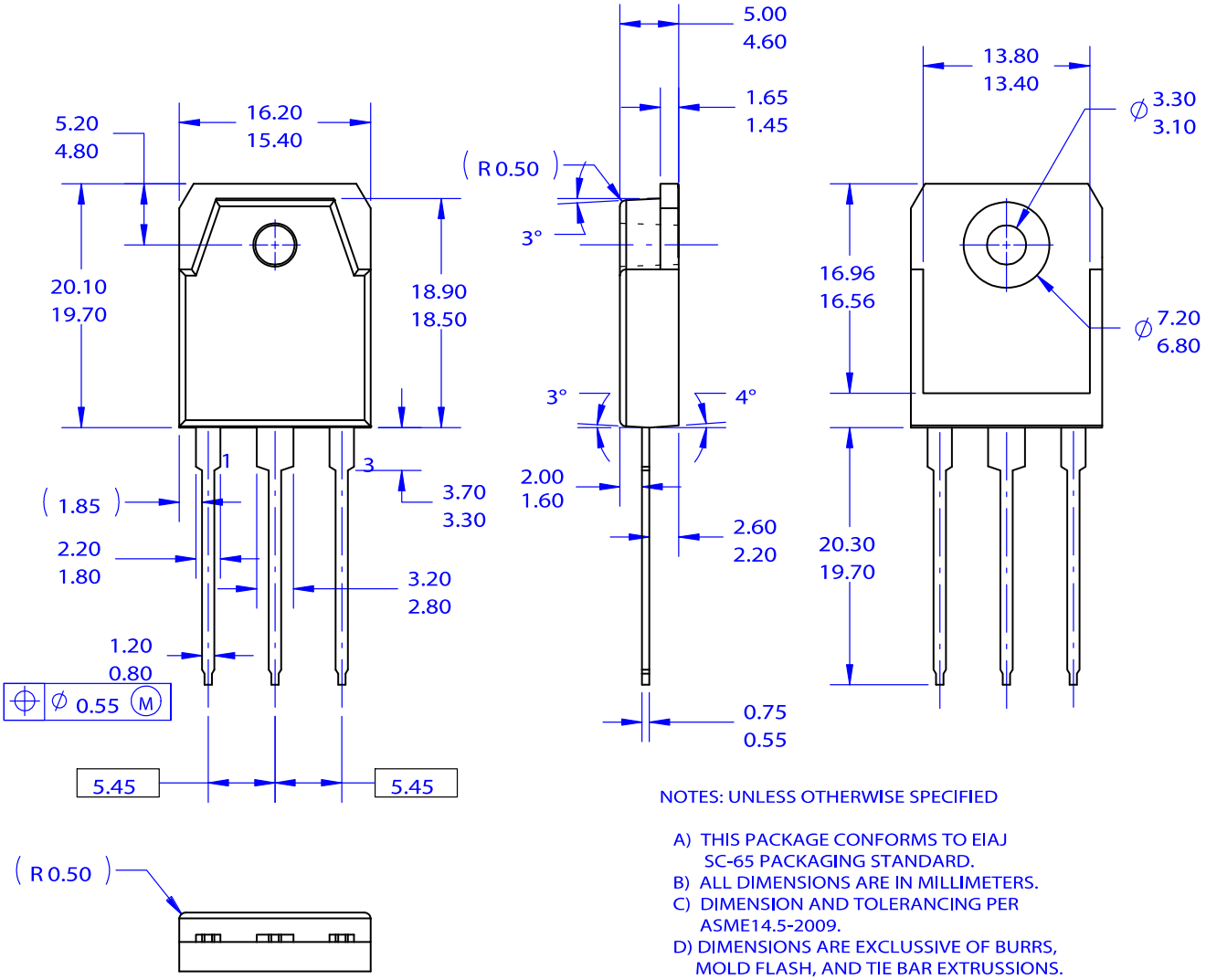


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

SUPERFET is registered trademark of Semiconductor Components Industries, LLC dba “**onsemi**” or its affiliates and/or subsidiaries in the United States and/or other countries.

TO−3P−3LD / EIAJ SC−65, ISOLATED
CASE 340BZ
ISSUE O

DATE 31 OCT 2016



NOTES: UNLESS OTHERWISE SPECIFIED

A) THIS PACKAGE CONFORMS TO EIAJ SC-65 PACKAGING STANDARD.
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSION AND TOLERANCING PER ASME14.5-2009.
D) DIMENSIONS ARE EXCLUSSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSSIONS.

DOCUMENT NUMBER:	**98AON13862G**	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−3P−3LD / EIAJ SC−65, ISOLATED**		**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. **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