



ON Semiconductor®

FDD6N50 / FDU6N50

N-Channel UniFET™ MOSFET

500 V, 6 A, 900 mΩ

Features

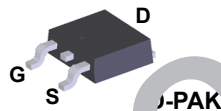
- $R_{DS(on)} = 900\text{ m}\Omega$ (Max.) @ $V_{GS} = 10\text{ V}$, $I_D = 3\text{ A}$
- Low Gate Charge (Typ. 12.8 nC)
- Low C_{rss} (Typ. 9 pF)
- 100% Avalanche Tested
- Improved dv/dt Capability

Applications

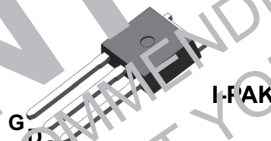
- LCD/LED/PDP TV
- Lighting
- Uninterruptible Power Supply
- AC-DC Power Supply

Description

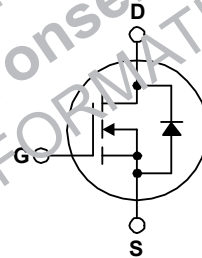
UniFET™ MOSFET is ON Semiconductor's high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-resistance, and to provide better switching performance and higher avalanche energy strength. This device family is suitable for switching power converter applications such as power factor correction (PFC), flat panel display (PDP) TV power supply and electronic lamp ballasts.



DPAK



I-PAK



Absolute Maximum Ratings

$T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	FDD6N50TM / FDD6N50TM-WS / FDU6N50TU	Unit
V_{GS}	Gate-Source Voltage	500	V
I_D	Drain Current	6 3.8	A
		- Continuous ($T_C = 25^\circ\text{C}$) - Continuous ($T_C = 100^\circ\text{C}$)	A
I_{DM}	Drain Current	24	A
		- Pulsed (Note 1)	
V_{GSS}	Gate-Source voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy	270	mJ
I_{AR}	Avalanche Current	6	A
		(Note 1)	
E_{AR}	Repetitive Avalanche Energy	8.9	mJ
		(Note 1)	
dv/dt	Peak Diode Recovery dv/dt	4.5	V/ns
		(Note 3)	
P_D	Power Dissipation	89 0.71	W W/°C
		($T_C = 25^\circ\text{C}$) - Derate Above 25°C	
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	°C
T_L	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds	300	°C

Thermal Characteristics

Symbol	Parameter	FDD6N50TM / FDD6N50TM-WS / FDU6N50TU	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	1.4	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	83	

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDD6N50TM	FDD6N50	DPAK	Tape and Reel	330 mm	16 mm	2500 units
FDD6N50TM-WS	FDD6N50S	DPAK	Tape and Reel	330 mm	16 mm	2500 units
FDU6N50TU	FDU6N50	IPAK	Tube	N/A	N/A	75 units

Electrical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max	Unit
Off Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0 V, I _D = 250 μA	500	--	--	V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250 μA, Referenced to 25°C	--	--	--	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 500 V, V _{GS} = 0 V V _{DS} = 400 V, T _C = 125°C	--	--	1 10	μA μA
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 = 3 A	--	0.70	0.9	Ω
g _{FS}	Forward Transconductance	V _{DS} = 4 V, I _D = 3 A	--	2.5	--	S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 25 V, V _{GS} = 0 V	--	720	940	pF
C _{oss}	Output Capacitance	f = 1 MHz	--	95	190	pF
C _{rss}	Reverse Transfer Capacitance		--	9	13.5	pF
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	V _{DD} = 250 V, I _D = 6 A, V _{GS} = 10 V, R _G = 25 Ω	--	6	20	ns
t _r	Turn-On Rise Time		--	55	120	ns
t _{d(off)}	Turn-Off Delay Time		--	25	60	ns
t _f	Turn-Off Fall Time	(Note 4)	--	35	80	ns
Q _{gs}	Turn-On Gate Charge	V _{DS} = 400 V, I _D = 6 A, V _{GS} = 10 V	--	12.8	16.6	nC
Q _{gd}	Gate-Source Charge		--	3.7	--	nC
Q _{gd}	Gate-Drain Charge		(Note 4)	--	5.8	--
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	6	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	24	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 6 A	--	--	1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 6 A, dI _F /dt = 100 A/μs	--	275	--	ns
Q _{rr}	Reverse Recovery Charge		--	1.7	--	μC

Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. $I_{AS} = 6\text{ A}$, $V_{DD} = 50\text{ V}$, $L = 13.5\text{ mH}$, $R_G = 25\text{ }\Omega$, starting $T_J = 25^\circ\text{C}$.
3. $I_{SD} \leq 6\text{ A}$, $di/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, starting $T_J = 25^\circ\text{C}$.
4. Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

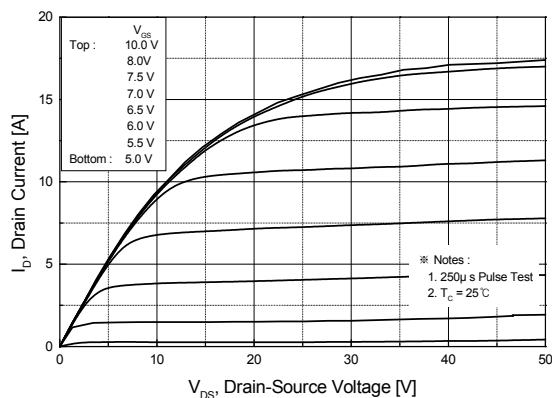


Figure 2. Transfer Characteristics

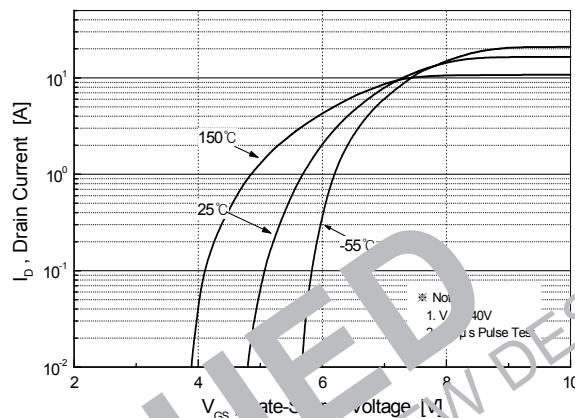


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

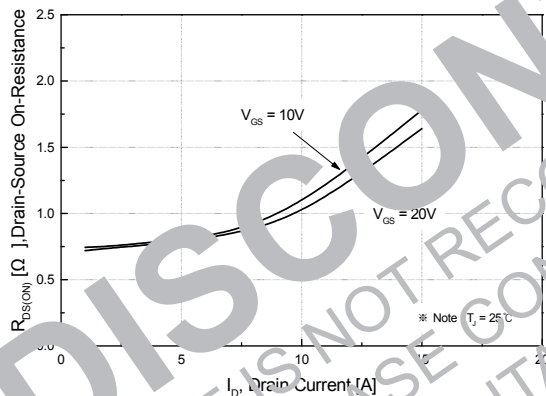


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

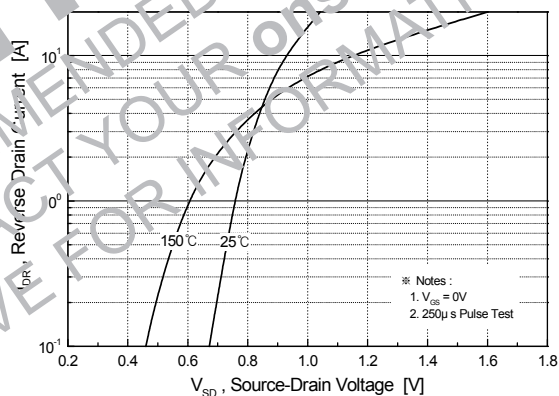


Figure 5. Capacitance Characteristics

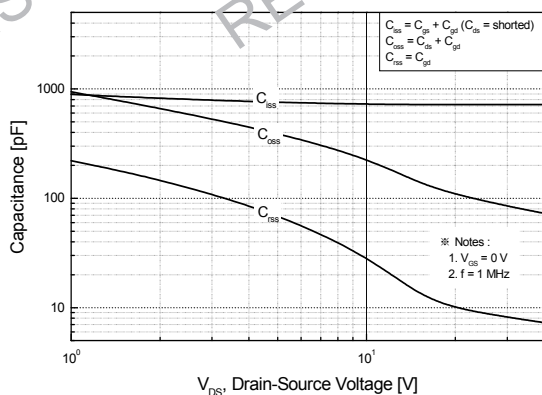
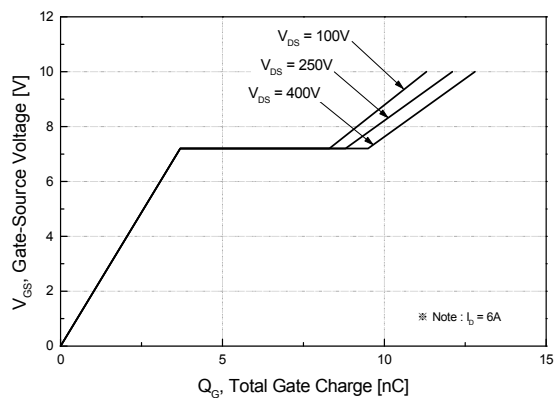


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

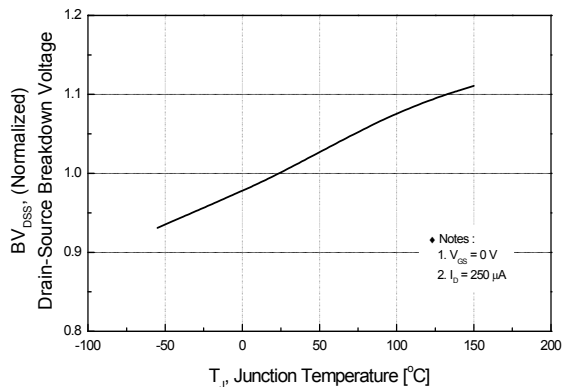


Figure 8. On-Resistance Variation vs. Temperature

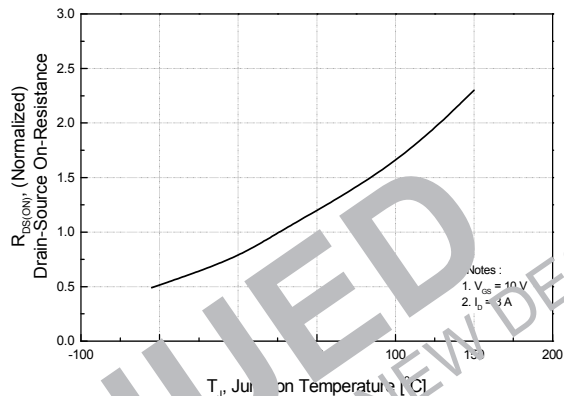


Figure 9. Maximum Safe Operating Area

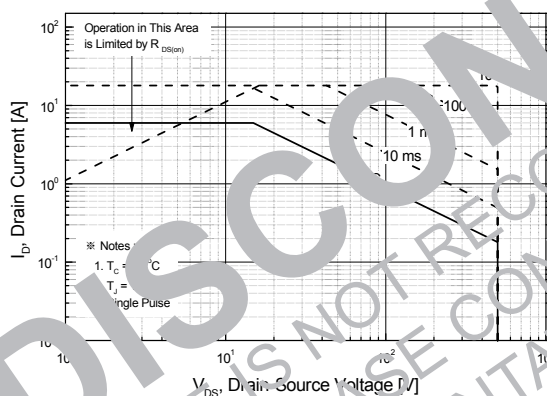


Figure 10. Maximum Drain Current vs. Case Temperature

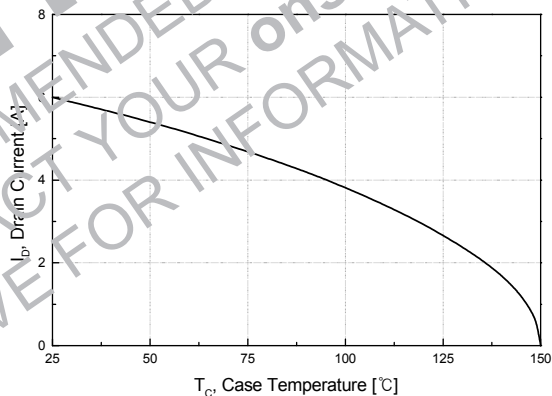
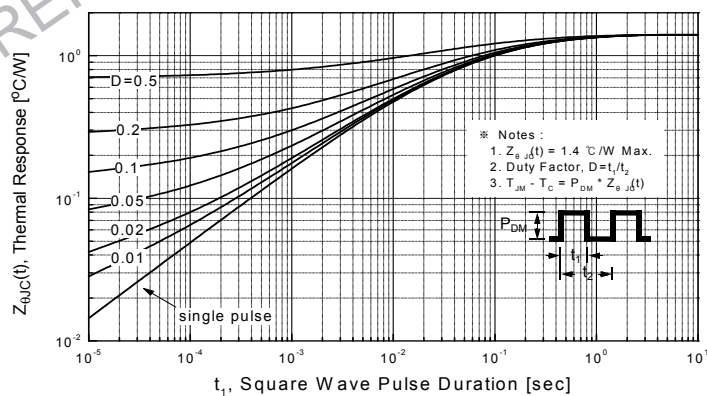


Figure 11. Transient Thermal Response Curve



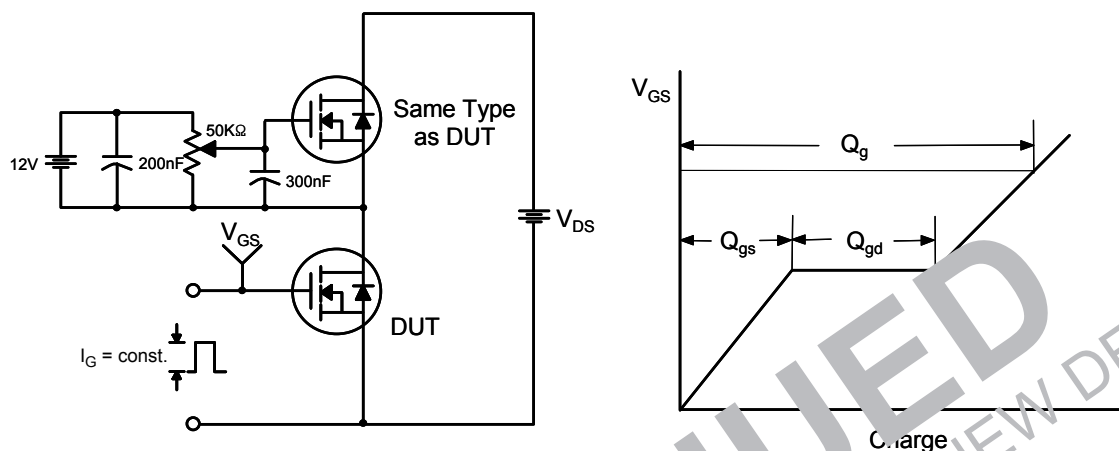


Figure 12. Gate Charge Test Circuit & Waveform



Figure 13. Resistive Switching Test Circuit & Waveforms

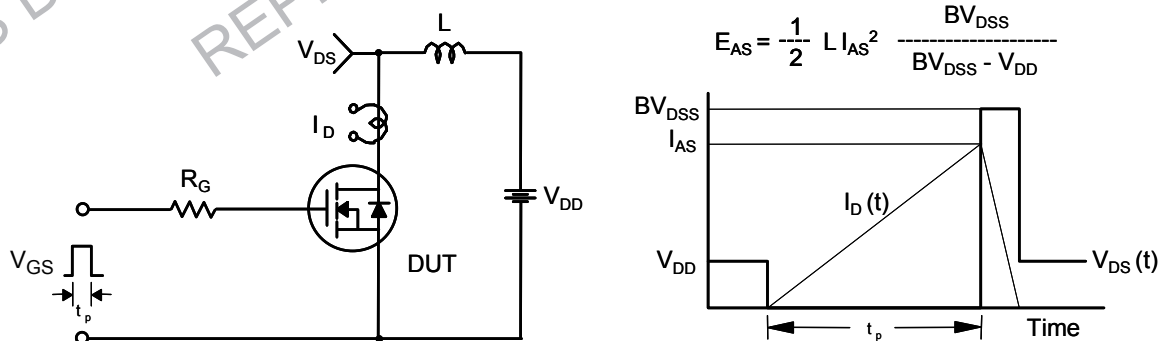
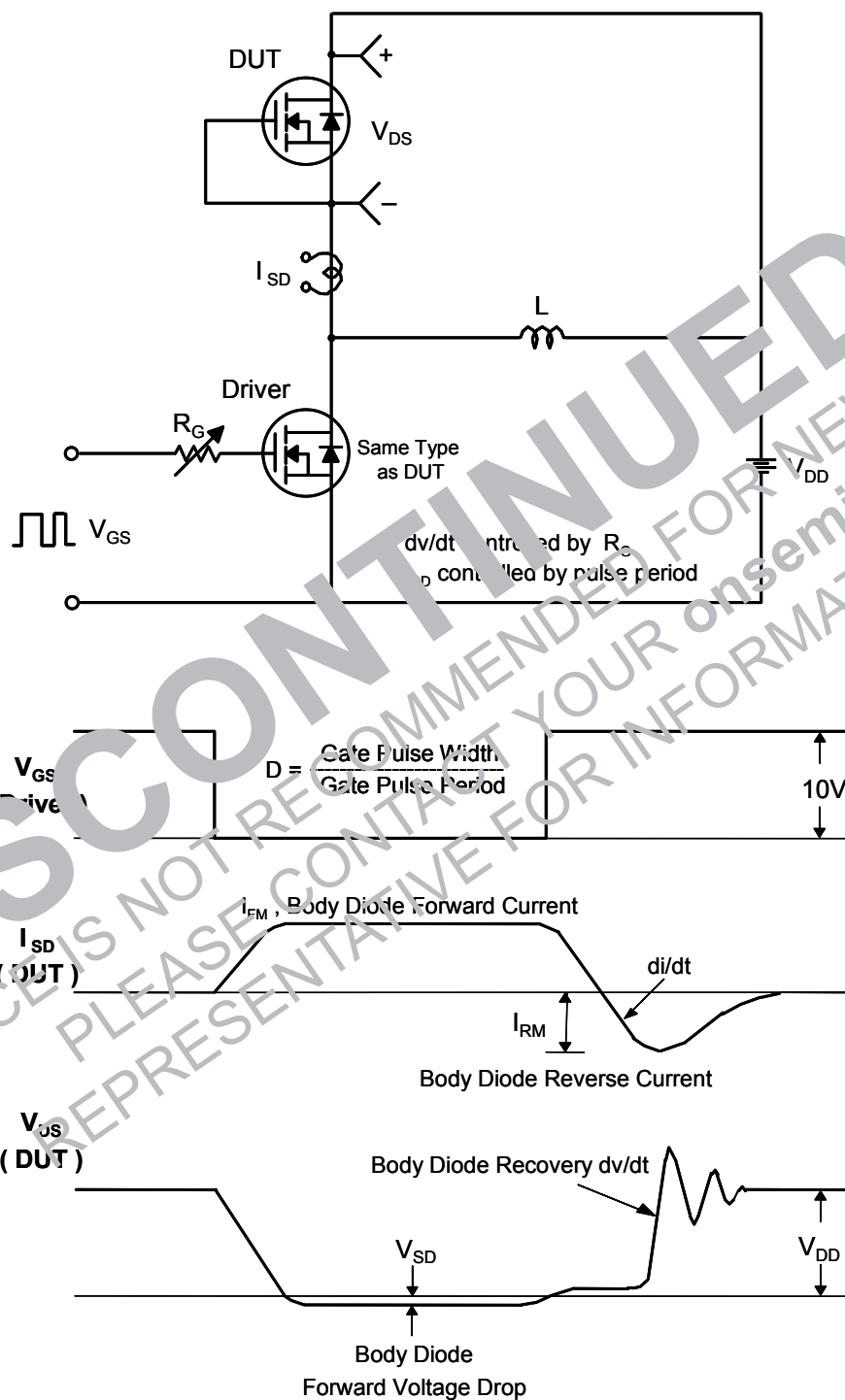


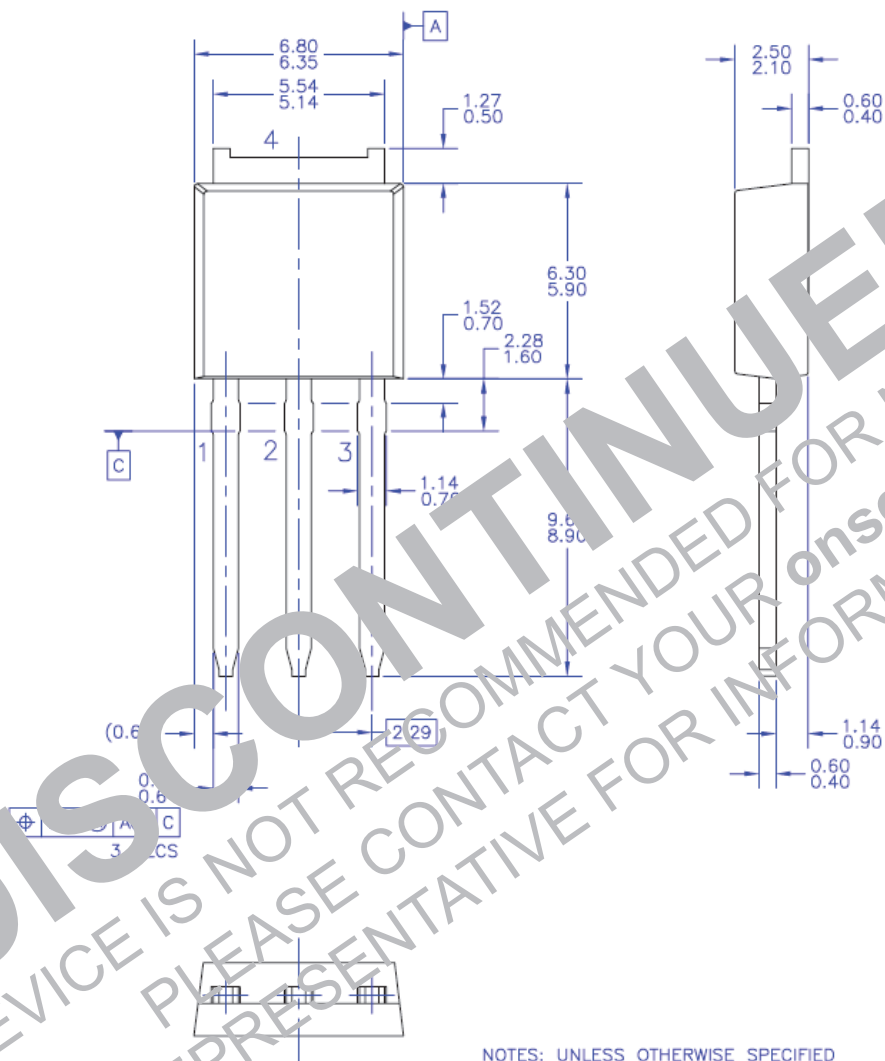
Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms





www.onsemi.com

Mechanical Dimensions



NOTES: UNLESS OTHERWISE SPECIFIED

- A) ALL DIMENSIONS ARE IN MILLIMETERS.
- B) THIS PACKAGE CONFORMS TO JEDEC, TO-251, ISSUE C, VARIATION AA, DATED SEP 1988.
- C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.

Figure 17. TO-251 (I-PAK), Molded, 3-Lead, Option AA

Package drawings are provided as a service to customers considering ON Semiconductor components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a ON Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of ON Semiconductor's worldwide terms and conditions, specifically the warranty therein, which covers ON Semiconductor products.

DISCONTINUED

THIS DEVICE IS NOT RECOMMENDED FOR NEW DESIGN
PLEASE CONTACT YOUR onsemi
REPRESENTATIVE FOR INFORMATION

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. 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

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada

Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910

Japan Customer Focus Center
Phone: 81-3-5817-1050

ON Semiconductor Website: www.onsemi.com

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

For additional information, please contact your local
Sales Representative