



March 2016

FDP51N25 / FDPF51N25

N-Channel UniFET™ MOSFET

250 V, 51 A, 60 mΩ

Features

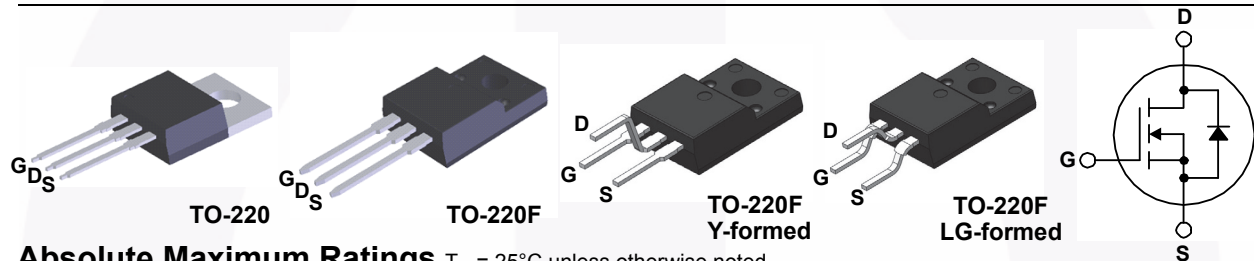
- $R_{DS(on)} = 48 \text{ m}\Omega$ (Typ.) @ $V_{GS} = 10 \text{ V}$, $I_D = 25.5 \text{ A}$
- Low Gate Charge (Typ. 55 nC)
- Low C_{RSS} (Typ. 63 pF)

Applications

- PDP TV
- Lighting
- Uninterruptible Power Supply
- AC-DC Power Supply

Description

UniFET™ MOSFET is Fairchild Semiconductor's high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-state 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 (FPD) TV power, ATX and electronic lamp ballasts.



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

Symbol	Parameter	FDP51N25	FDPF51N25 FDPF51N25YDTU FDPF51N25RDTU	Unit
V_{DSS}	Drain-Source Voltage	250		V
I_D	Drain Current	- Continuous ($T_C = 25^\circ\text{C}$)	51	A
		- Continuous ($T_C = 100^\circ\text{C}$)	30	A
I_{DM}	Drain Current - Pulsed (Note 1)	204	204*	A
V_{GSS}	Gate-Source voltage	± 30		V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	1111		mJ
I_{AR}	Avalanche Current (Note 1)	51		A
E_{AR}	Repetitive Avalanche Energy (Note 1)	32		mJ
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink ($t=0.3\text{sec}$; $T_C = 25^\circ\text{C}$)	N/A	2500	V
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5		V/ns
P_D	Power Dissipation	($T_C = 25^\circ\text{C}$)	320	W
		- Derate Above 25°C	3.7	W/ $^\circ\text{C}$
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to $+150$		$^\circ\text{C}$
T_L	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds	300		$^\circ\text{C}$

*Drain current limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	FDP51N25	FDPF51N25 FDPF51N25YDTU FDPF51N25RDTU	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	0.39	3.3	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	62.5	$^\circ\text{C/W}$

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDP51N25	FDP51N25	TO-220	Tube	N/A	N/A	50 units
FDPF51N25	FDPF51N25	TO-220F	Tube	N/A	N/A	50 units
FDPF51N25YDTU	FDPF51N25	TO-220F (Y-formed)	Tube	N/A	N/A	50 units
FDPF51N25RDTU	FDPF51N25	TO-220F (LG-formed)	Tube	N/A	N/A	50 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, T _J = 25 °C	250	--	--	V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250 μA, Referenced to 25°C	--	0.25	--	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 250 V, V _{GS} = 0 V V _{DS} = 200 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} = 0V	--	--	-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 = 25.5 A	--	0.048	0.060	Ω
g _{FS}	Forward Transconductance	V _{DS} = 40 V, I _D = 25.5 A	--	43	--	S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 25 V, V _{GS} = 0 V, f = 1 MHz	--	2620	3410	pF
C _{oss}	Output Capacitance		--	530	690	pF
C _{rss}	Reverse Transfer Capacitance		--	63	90	pF
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	V _{DD} = 125 V, I _D = 51 A, V _{GS} = 10 V, R _G = 25 Ω (Note 4)	--	62	135	ns
t _r	Turn-On Rise Time		--	465	940	ns
t _{d(off)}	Turn-Off Delay Time		--	98	205	ns
t _f	Turn-Off Fall Time		--	130	270	ns
Q _g	Total Gate Charge	V _{DS} = 200 V, I _D = 51 A, V _{GS} = 10 V (Note 4)	--	55	70	nC
Q _{gs}	Gate-Source Charge		--	16	--	nC
Q _{gd}	Gate-Drain Charge		--	27	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	51	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	204	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 51 A	--	--	1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 51 A, dI _F /dt =100 A/μs	--	178	--	ns
Q _{rr}	Reverse Recovery Charge		--	4.0	--	μC

Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. $L = 0.68\text{ mH}$, $I_{AS} = 51\text{ A}$, $V_{DD} = 50\text{ V}$, $R_G = 25\text{ }\Omega$ starting $T_J = 25^\circ\text{C}$.
3. $I_{SD} \leq 51\text{ A}$, $di/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, starting $T_J = 25^\circ\text{C}$.
4. Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

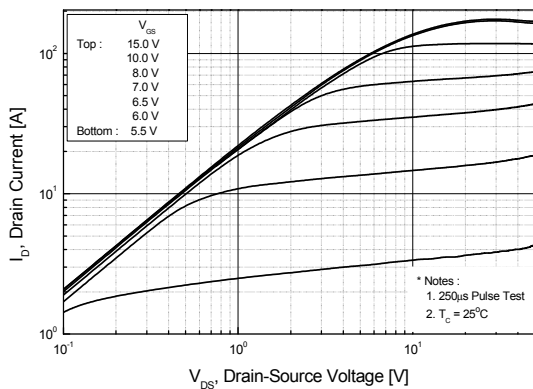


Figure 2. Transfer Characteristics

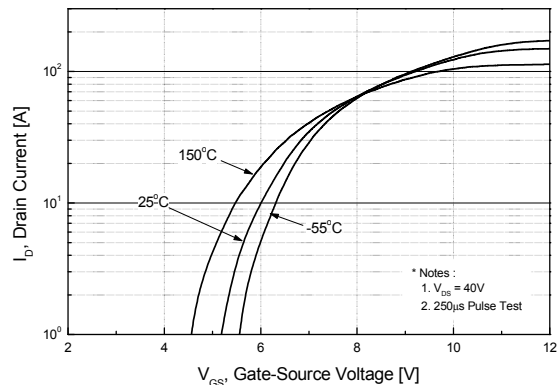


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

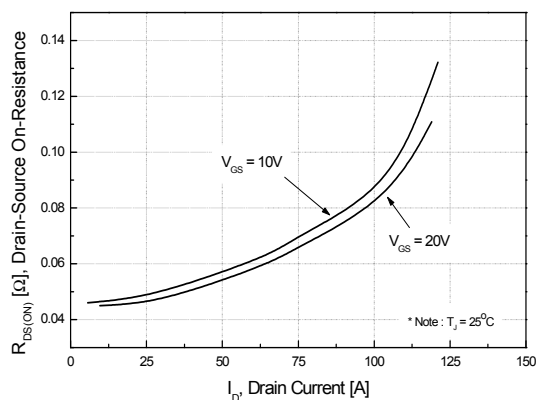


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

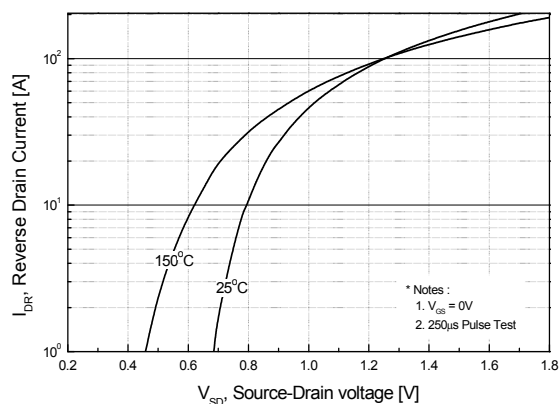


Figure 5. Capacitance Characteristics

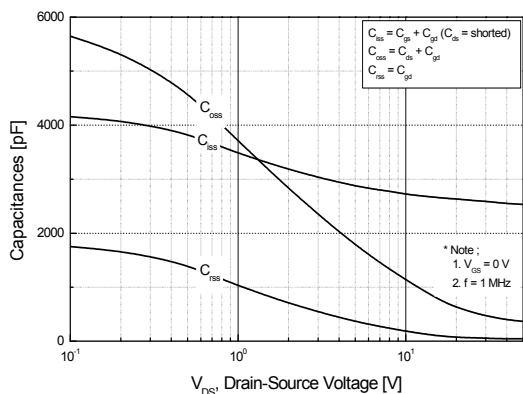
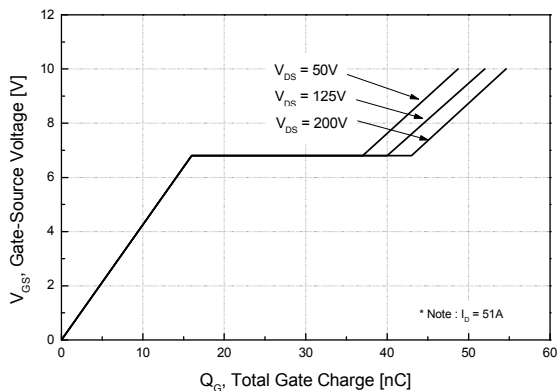


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

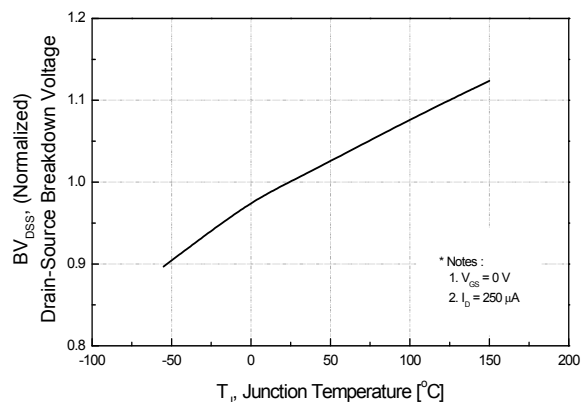


Figure 8. On-Resistance Variation vs. Temperature

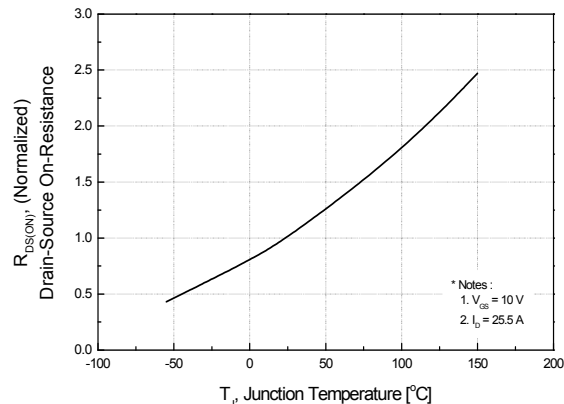


Figure 9-1. Maximum Safe Operating Area for FDP51N25

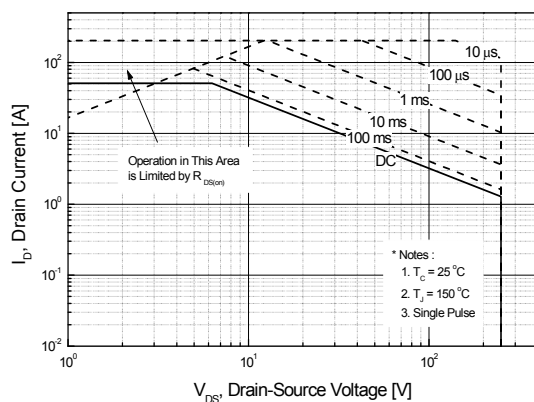


Figure 9-2. Maximum Safe Operating Area for FDPF51N25 / FDPF51N25YDTU

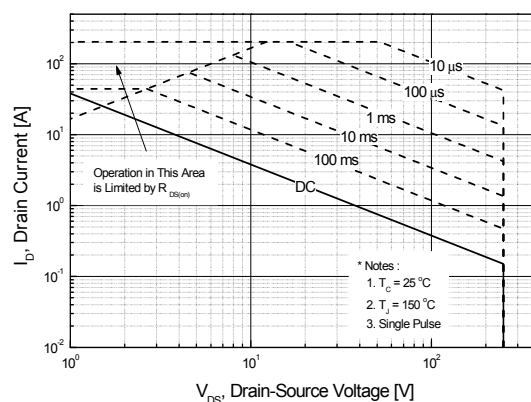
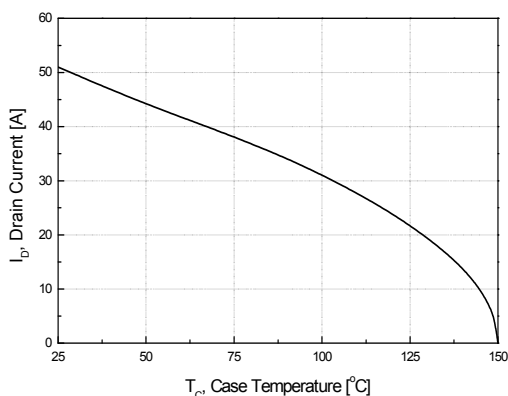


Figure 10. Maximum Drain Current vs. Case Temperature



Typical Performance Characteristics (Continued)

Figure 11-1. Transient Thermal Response Curve for FDP51N25

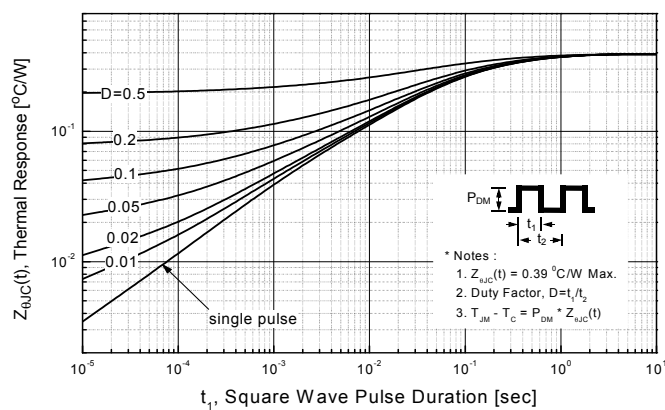
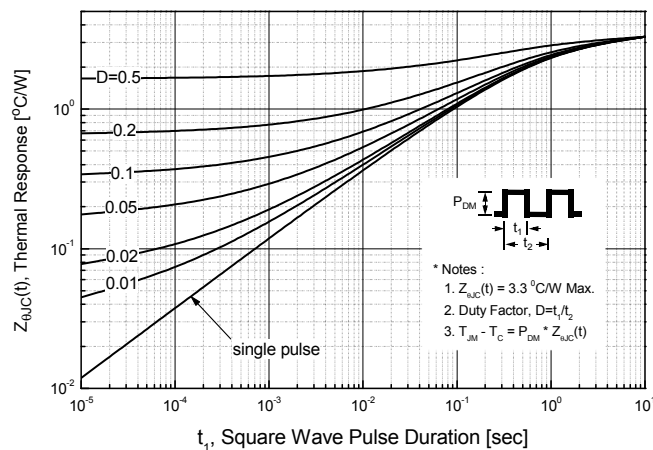


Figure 11-2. Transient Thermal Response Curve for FDPF51N25 / FDPF51N25YDTU



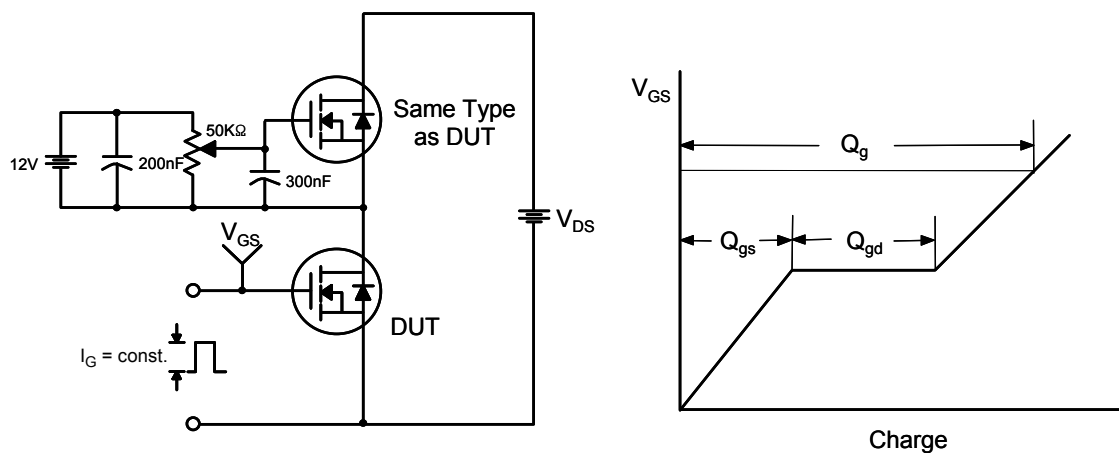


Figure 12. Gate Charge Test Circuit & Waveform

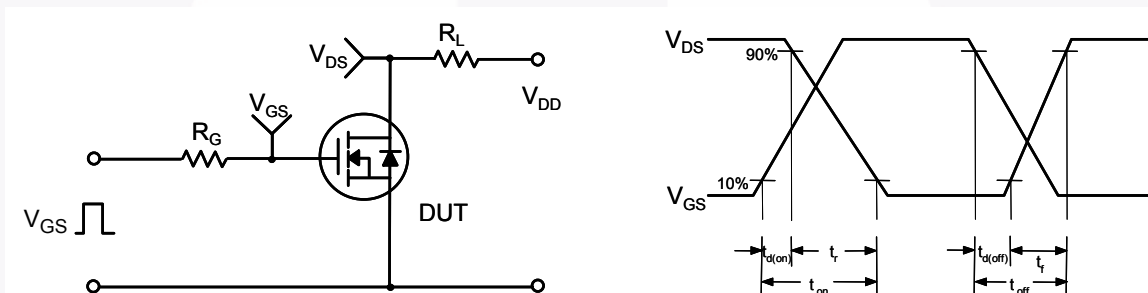


Figure 13. Resistive Switching Test Circuit & Waveforms

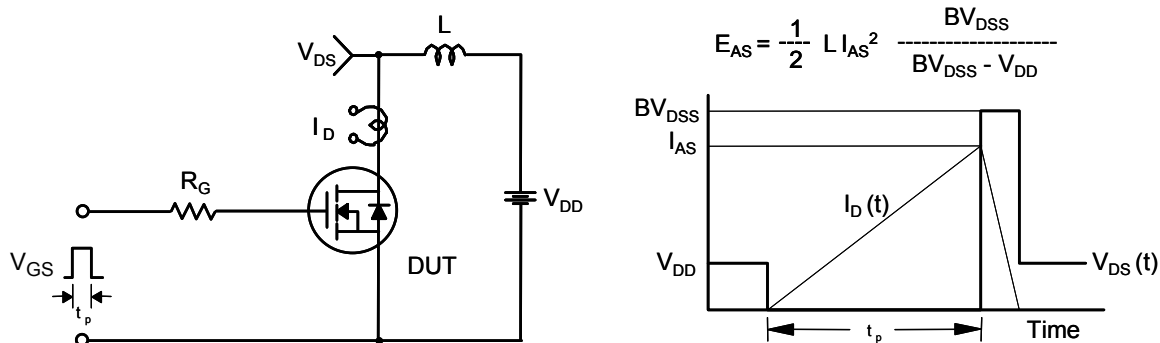


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

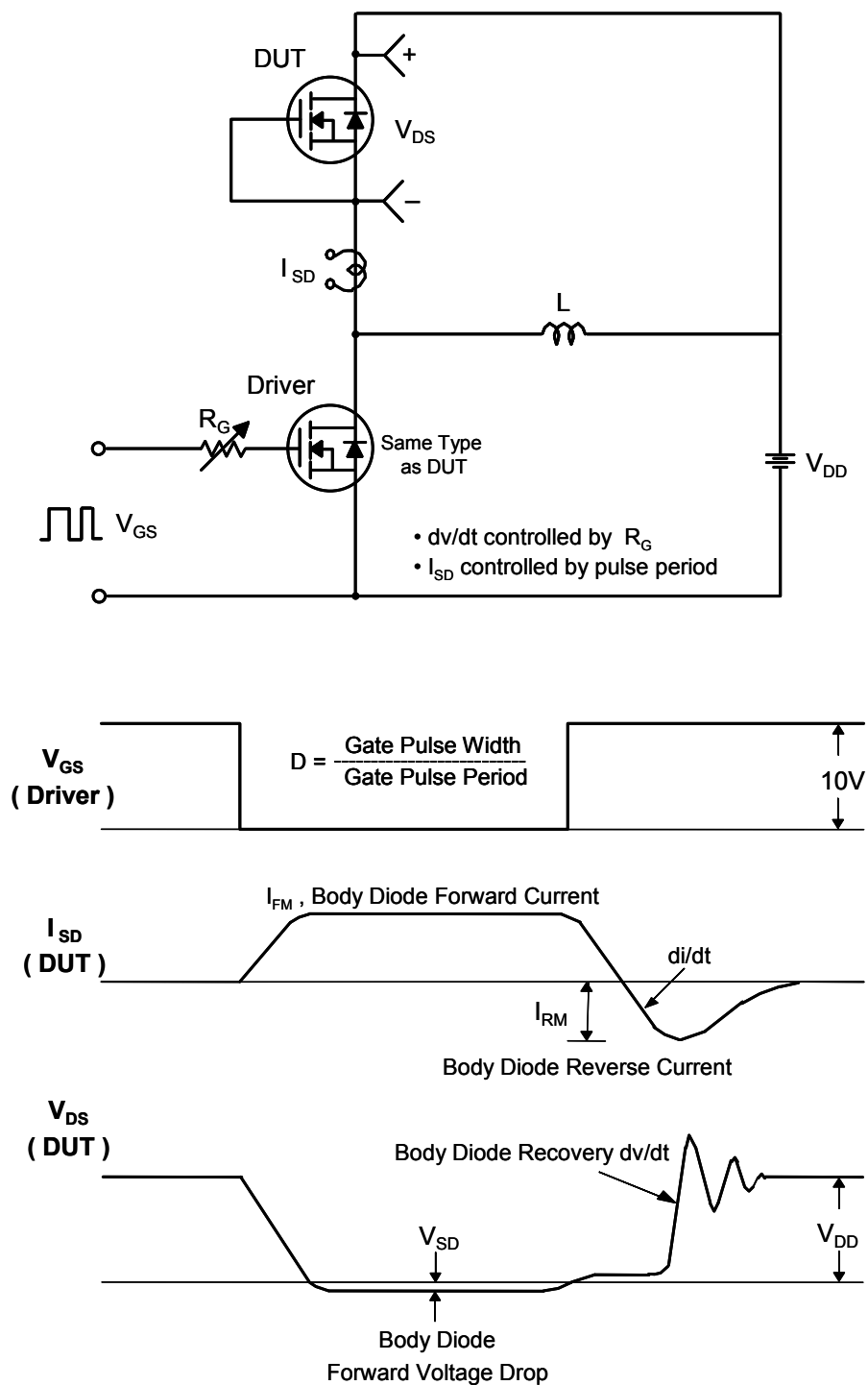
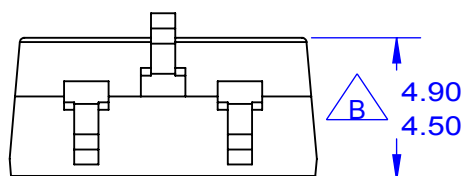
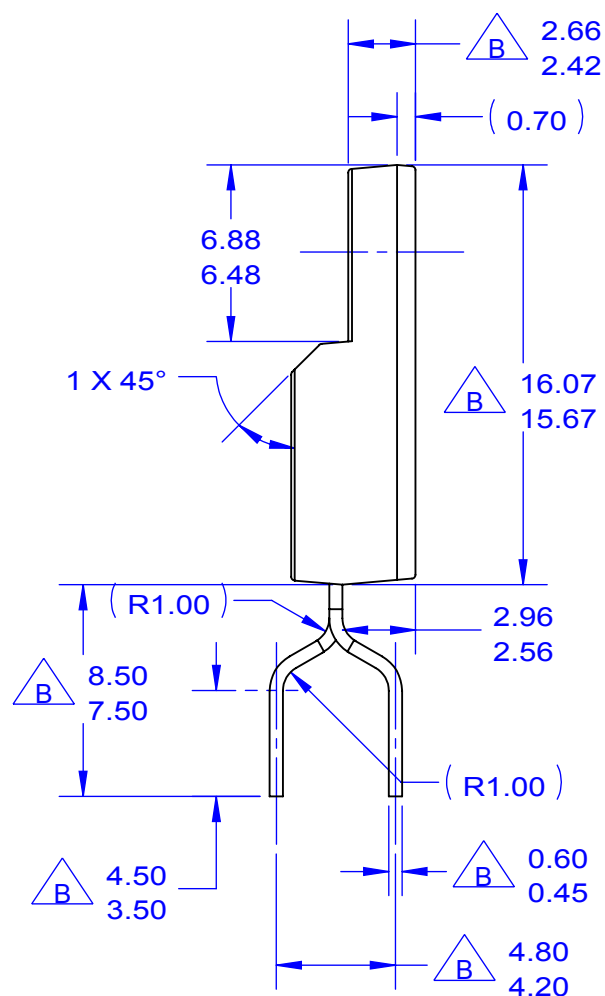
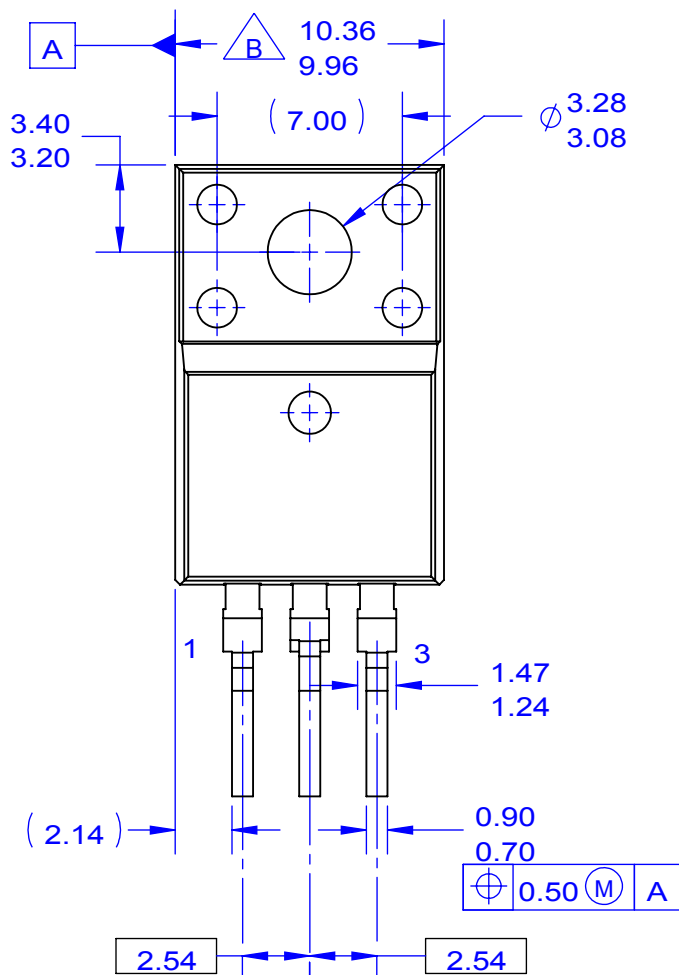


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

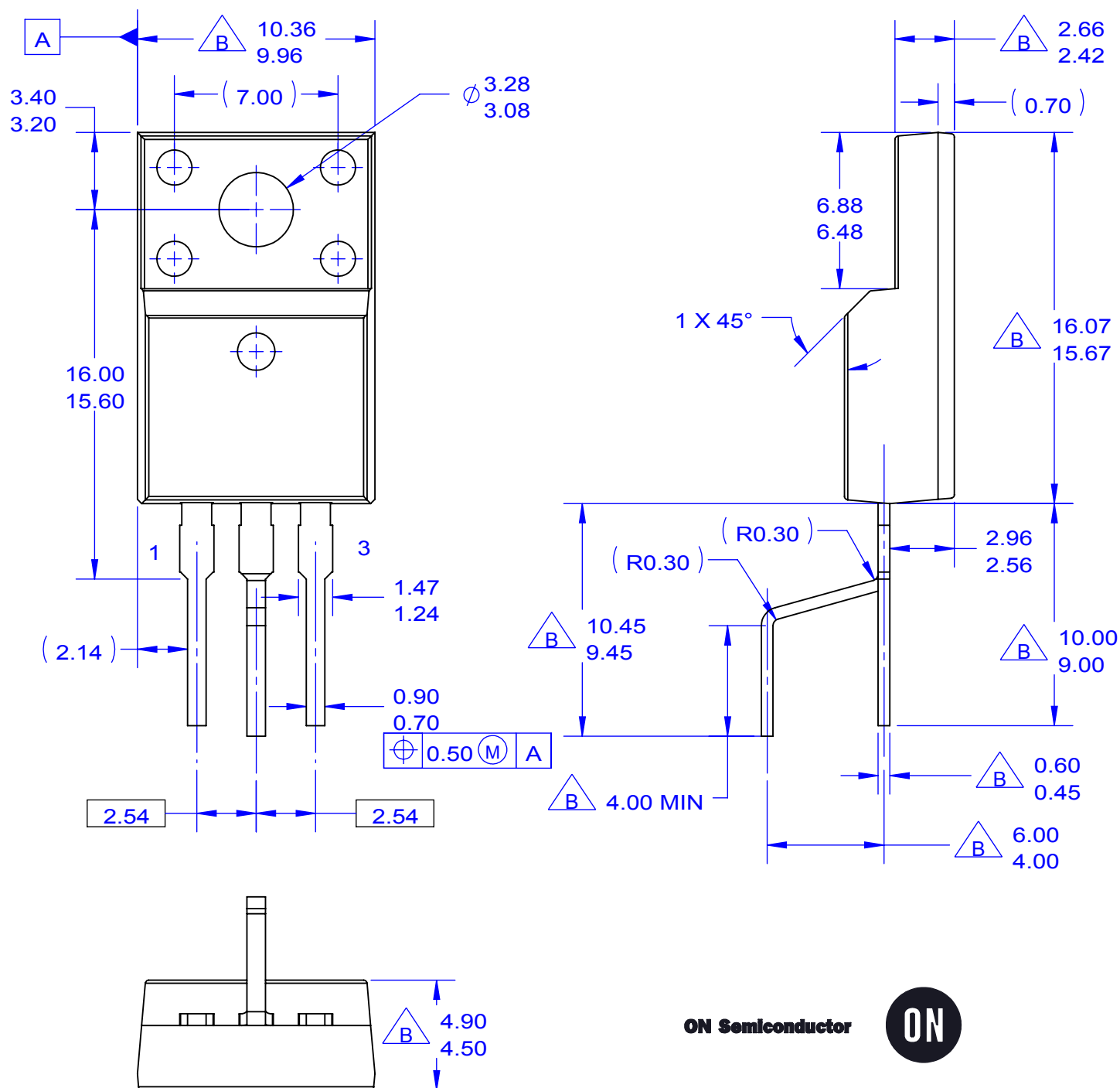


ON Semiconductor



NOTES:

- EXCEPT WHERE NOTED CONFORMS TO EIAJ SC91A.
- DOES NOT COMPLY EIAJ STD. VALUE.
- ALL DIMENSIONS ARE IN MILLIMETERS.
- DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
- DIMENSION AND TOLERANCE AS PER ASME Y14.5-1994.
- DRAWING FILE NAME: TO220N03REV2

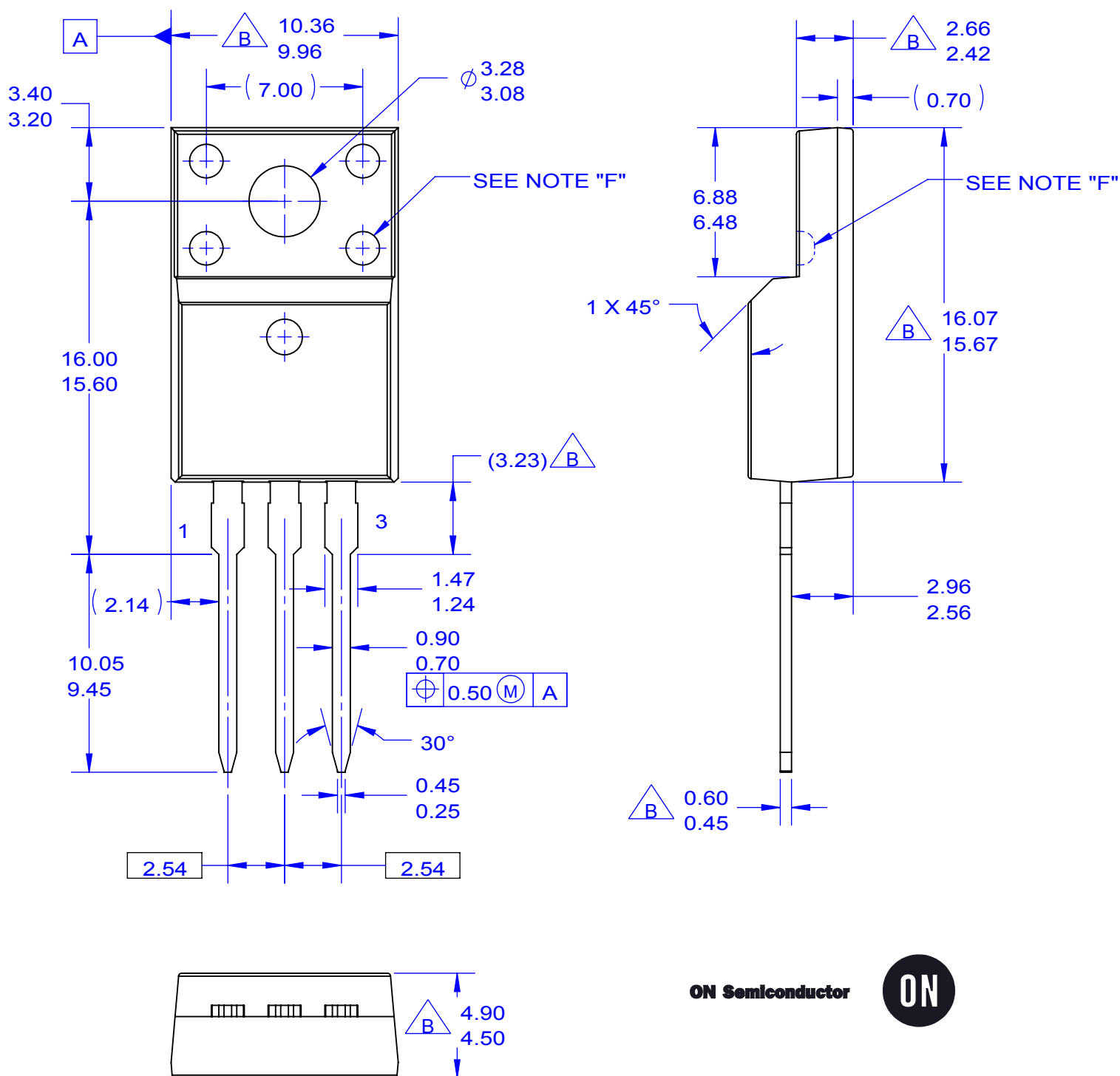


ON Semiconductor



NOTES:

- EXCEPT WHERE NOTED CONFORMS TO EIAJ SC91A.
- DOES NOT COMPLY EIAJ STD. VALUE.
- ALL DIMENSIONS ARE IN MILLIMETERS.
- DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
- DIMENSION AND TOLERANCE AS PER ASME Y14.5-1994.
- DRAWING FILE NAME: TO220Q03REV2



ON Semiconductor



NOTES:

- A. EXCEPT WHERE NOTED CONFORMS TO EIAJ SC91A.
- B. DOES NOT COMPLY EIAJ STD. VALUE.
- C. ALL DIMENSIONS ARE IN MILLIMETERS.
- D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
- E. DIMENSION AND TOLERANCE AS PER ASME Y14.5-1994.
- F. OPTION 1 - WITH SUPPORT PIN HOLE.
OPTION 2 - NO SUPPORT PIN HOLE.
- G. DRAWING FILE NAME: TO220M03REV5

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