August 2014

FCP16N60 / FCPF16N60

N-Channel SuperFET® MOSFET

600 V, 16 A, 260 mΩ

Features

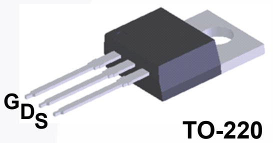
- 650V @ T_J = 150°C
- Typ. $R_{DS(on)}$ = 220 mΩ
- Ultra Low Gate Charge (Typ. Q_g = 55 nC)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)}$ = 110 pF)
- 100% Avalanche Tested

Applications

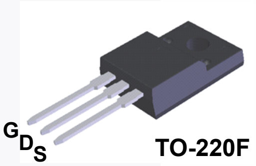
- Solar Inverter
- AC-DC Power Supply

Description

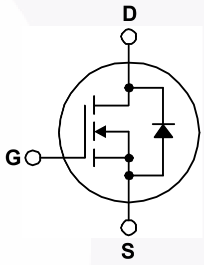
SuperFET® MOSFET is Fairchild Semiconductor's first generation of high voltage super-junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on-resistance and lower gate charge performance. This technology is tailored to minimize conduction loss, provide superior switching 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.



TO-220



TO-220F



Absolute Maximum Ratings

Symbol	Parameter		FCP16N60	FCPF16N60	Unit
V_{DSS}	Drain-Source Voltage		600		V
I_D	Drain Current - Continuous (T_C = 25°C) - Continuous (T_C = 100°C)		16 10.1	16* 10.1*	A A
I_{DM}	Drain Current - Pulsed	(Note 1)	48	48*	A
V_{GSS}	Gate-Source Voltage		± 30		V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	450		mJ
I_{AR}	Avalanche Current	(Note 1)	16		A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	20.8		mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	4.5		V/ns
P_D	Power Dissipation (T_C = 25°C) - Derate Above 25°C		167 1.33	37.9 0.3	W W/°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

*Drain current limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	FCP16N60	FCPF16N60	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.75	3.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	62.5	°C/W

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCP16N60	FCP16N60	TO-220	Tube	N/A	N/A	50 units
FCPF16N60	FCPF16N60	TO-220F	Tube	N/A	N/A	50 units

Electrical Characteristics $T_C = 25^oC$ unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit

Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = 250\ \mu A$, $V_{GS} = 0\ V$, $T_J = 25^oC$	600	-	-	V
		$I_D = 250\ \mu A$, $V_{GS} = 0\ V$, $T_J = 150^oC$	-	650	-	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu A$, Referenced to 25^oC	-	0.6	-	$V/^oC$
BV_{DS}	Drain-Source Avalanche Breakdown Voltage	$V_{GS} = 0\ V$, $I_D = 16\ A$	-	700	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 600\ V$, $V_{GS} = 0\ V$	-	-	1	µA
		$V_{DS} = 480\ V$, $T_C = 125^oC$	-	-	10	
I_{GSS}	Gate to Body Leakage Current	$V_{GS} = \pm 30\ V$, $V_{DS} = 0\ V$	-	-	±100	nA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 250\ \mu A$	3.0	-	5.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\ V$, $I_D = 8\ A$	-	0.55	0.26	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 40\ V$, $I_D = 8\ A$	-	11.5	-	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 25\ V$, $V_{GS} = 0\ V$, $f = 1\ MHz$	-	1730	2250	pF
C_{oss}	Output Capacitance		-	960	1150	pF
C_{rss}	Reverse Transfer Capacitance		-	85	-	pF
C_{oss}	Output Capacitance	$V_{DS} = 480\ V$, $V_{GS} = 0\ V$, $f = 1\ MHz$	-	45	60	pF
$C_{oss(eff.)}$	Effective Output Capacitance	$V_{DS} = 0\ V$ to $400\ V$, $V_{GS} = 0\ V$	-	110	-	pF
Q_g	Total Gate Charge at 10V	$V_{DS} = 480\ V$, $I_D = 16\ A$, $V_{GS} = 10\ V$ (Note 4)	-	55	70	nC
Q_{gs}	Gate to Source Gate Charge		-	10.5	13	nC
Q_{gd}	Gate to Drain “Miller” Charge		-	28	-	nC
ESR	Equivalent Series Resistance	$f = 1\ MHz$	-	1.7	-	Ω

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 300\ V$, $I_D = 16\ A$, $V_{GS} = 10\ V$, $R_G = 25\ \Omega$ (Note 4)	-	42	85	ns
t_r	Turn-On Rise Time		-	130	270	ns
$t_{d(off)}$	Turn-Off Delay Time		-	165	340	ns
t_f	Turn-Off Fall Time		-	90	190	ns

Drain-Source Diode Characteristics

I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	16	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	48	A
V_{SD}	Drain to Source Diode Forward Voltage	$V_{GS} = 0\ V$, $I_{SD} = 16\ A$	-	-	1.4	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0\ V$, $I_{SD} = 16\ A$, $dI_F/dt = 100\ A/\mu s$	-	435	-	ns
Q_{rr}	Reverse Recovery Charge		-	7.0	-	µC

Notes:

1: Repetitive rating: pulse-width limited by maximum junction temperature.

2: $I_{AS} = 8\ A$, $V_{DD} = 50\ V$, $R_G = 25\ \Omega$, starting $T_J = 25°C$.

3: $I_{SD} \leq 16\ A$, $di/dt \leq 200\ A/\mu s$, $V_{DD} \leq BV_{DSS}$, starting $T_J = 25°C$.

4: Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

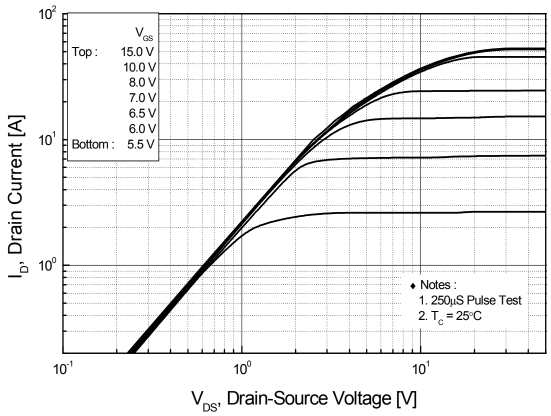


Figure 2. Transfer Characteristics

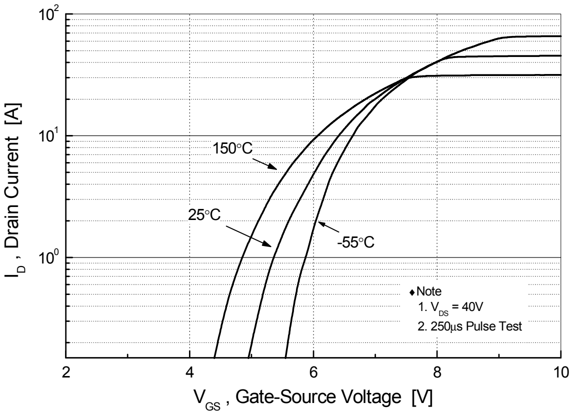


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

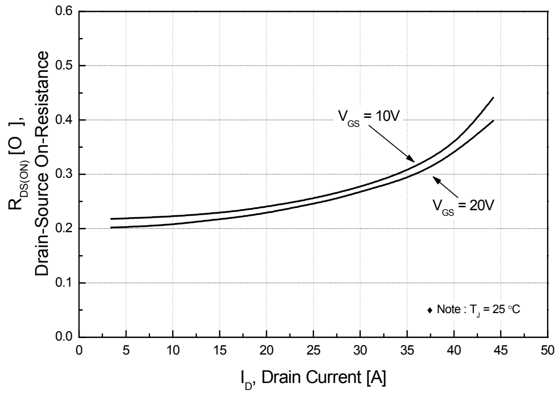


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

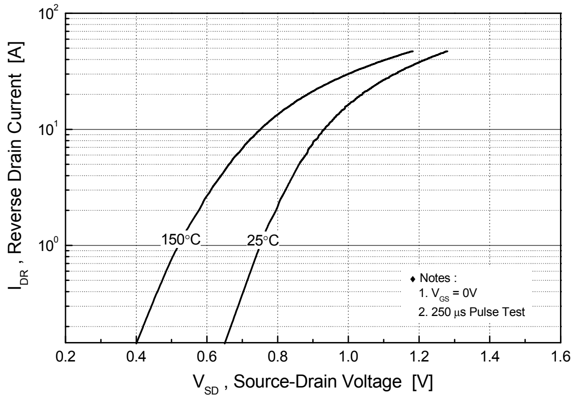


Figure 5. Capacitance Characteristics

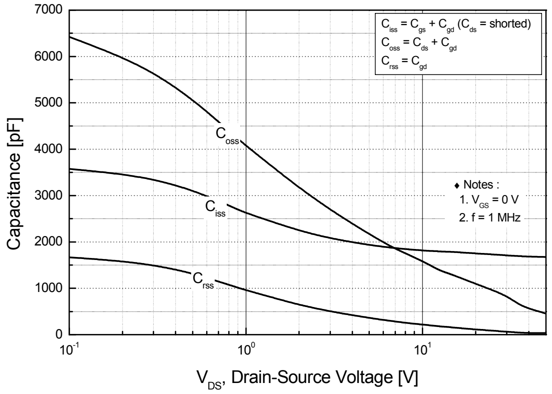
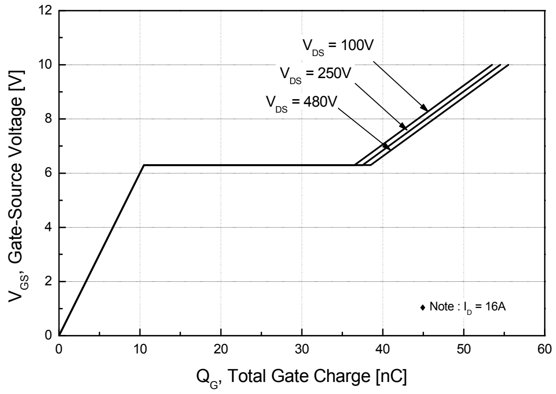


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

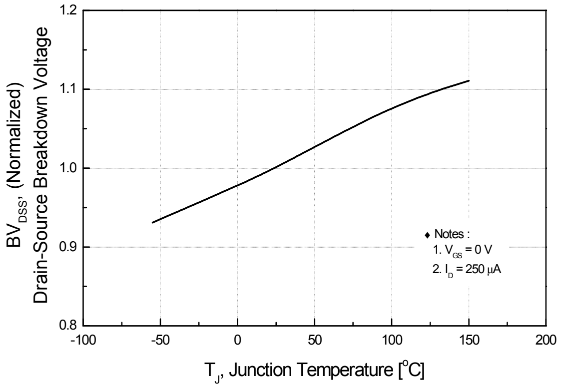


Figure 8. On-Resistance Variation vs. Temperature

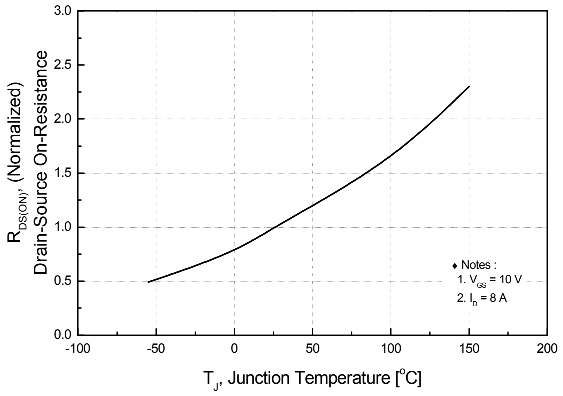


Figure 9-1. Maximum Safe Operating Area for FCP16N60

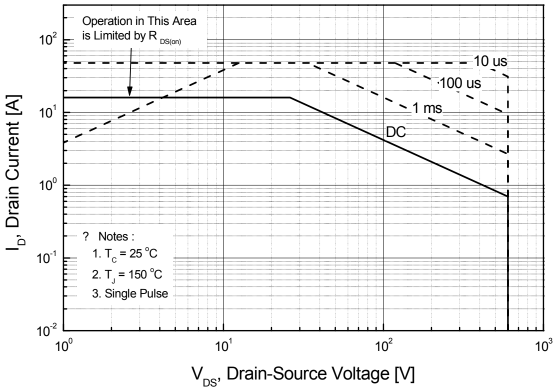


Figure 9-2. Maximum Safe Operating Area for FCPF16N60

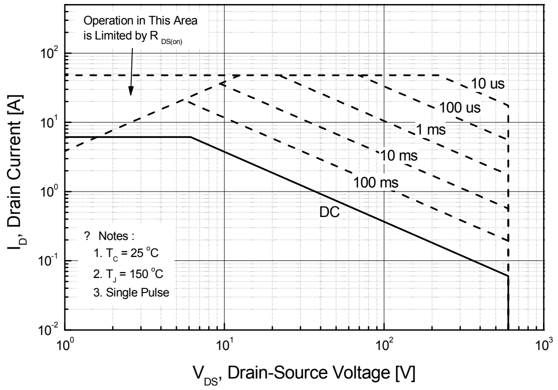
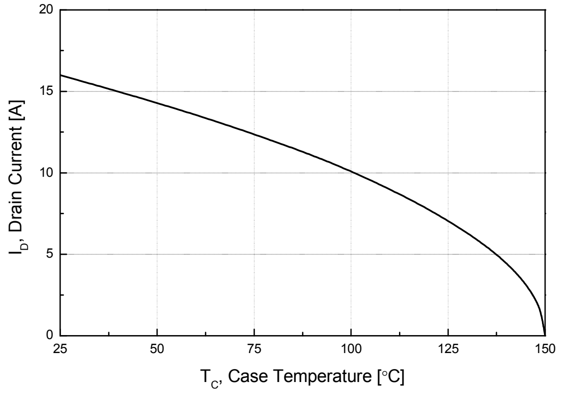


Figure 10. Maximum Drain Current vs. Case Temperature



Typical Performance Characteristics (Continued)

Figure 11-1. Transient Thermal Response Curve for FCP16N60

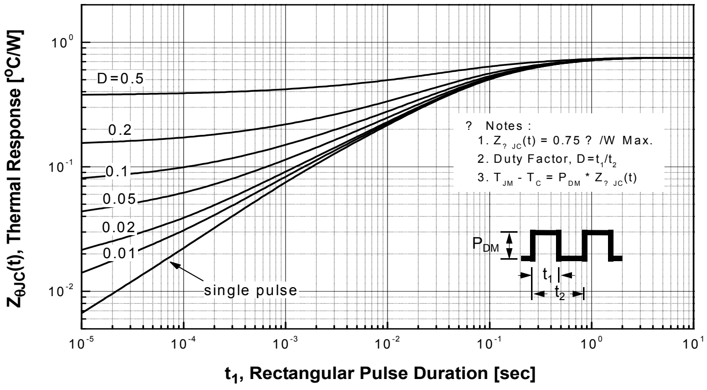
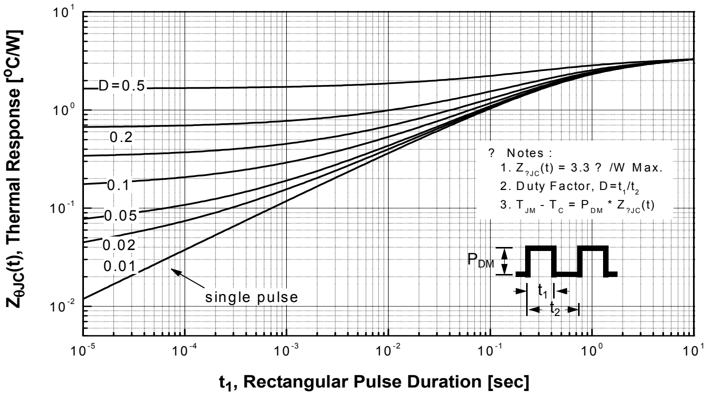


Figure 11-2. Transient Thermal Response Curve for FCPF16N60



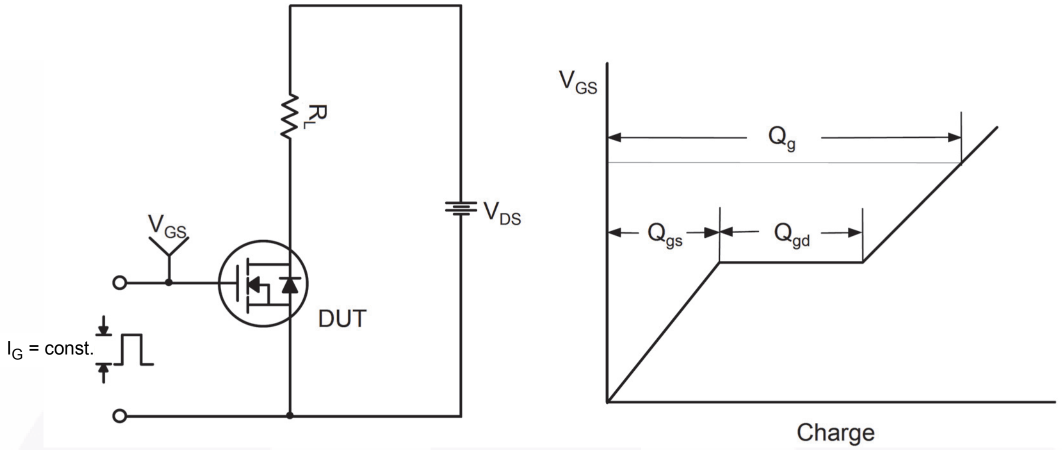


Figure 12. Gate Charge Test Circuit & Waveform

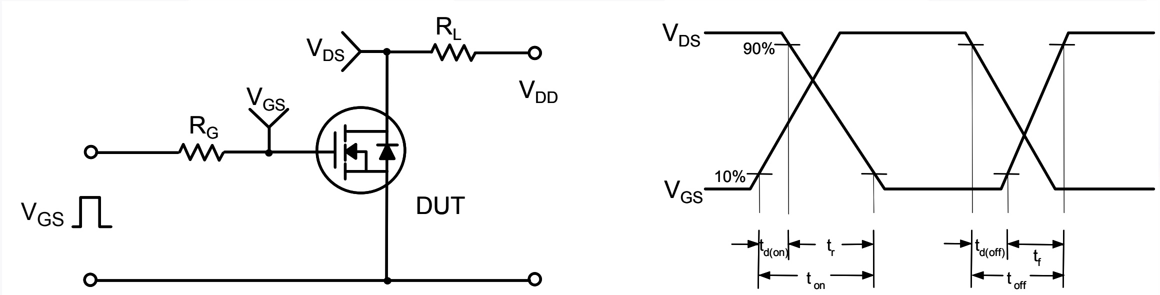


Figure 13. Resistive Switching Test Circuit & Waveforms

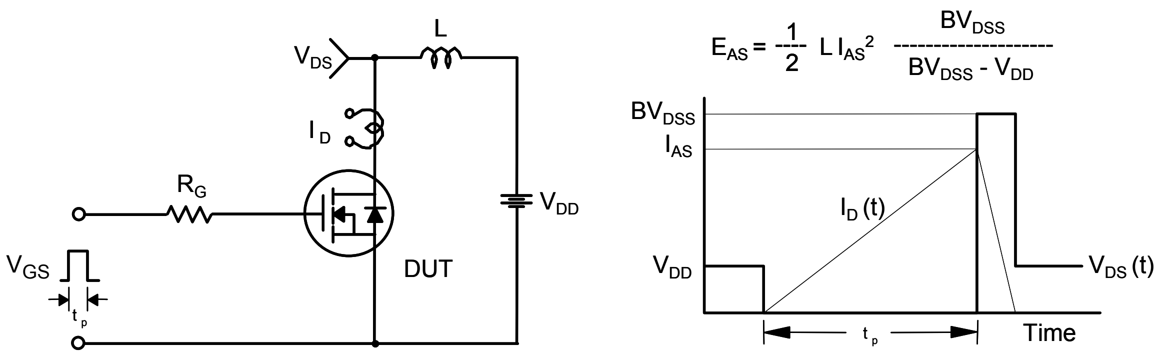


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

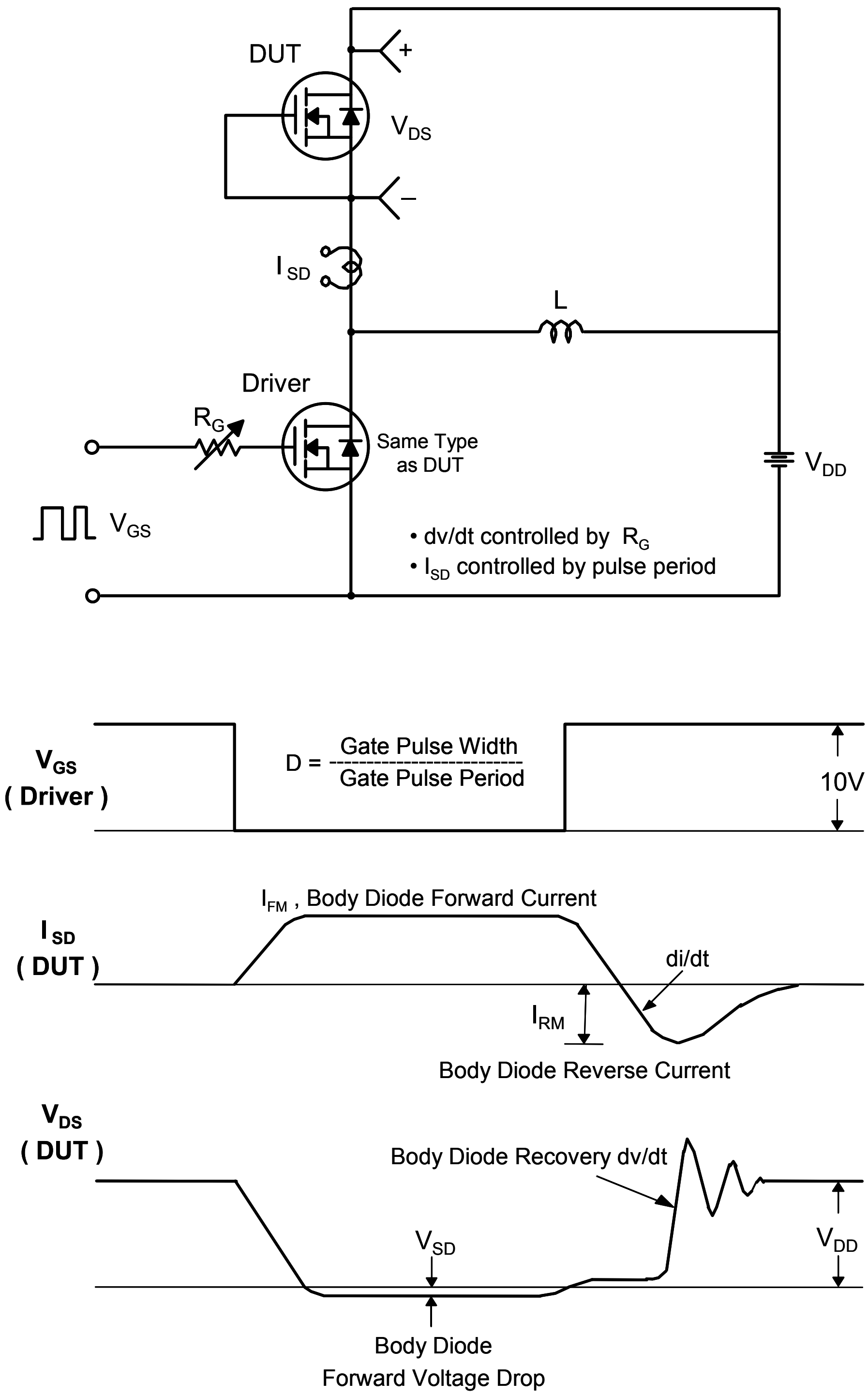
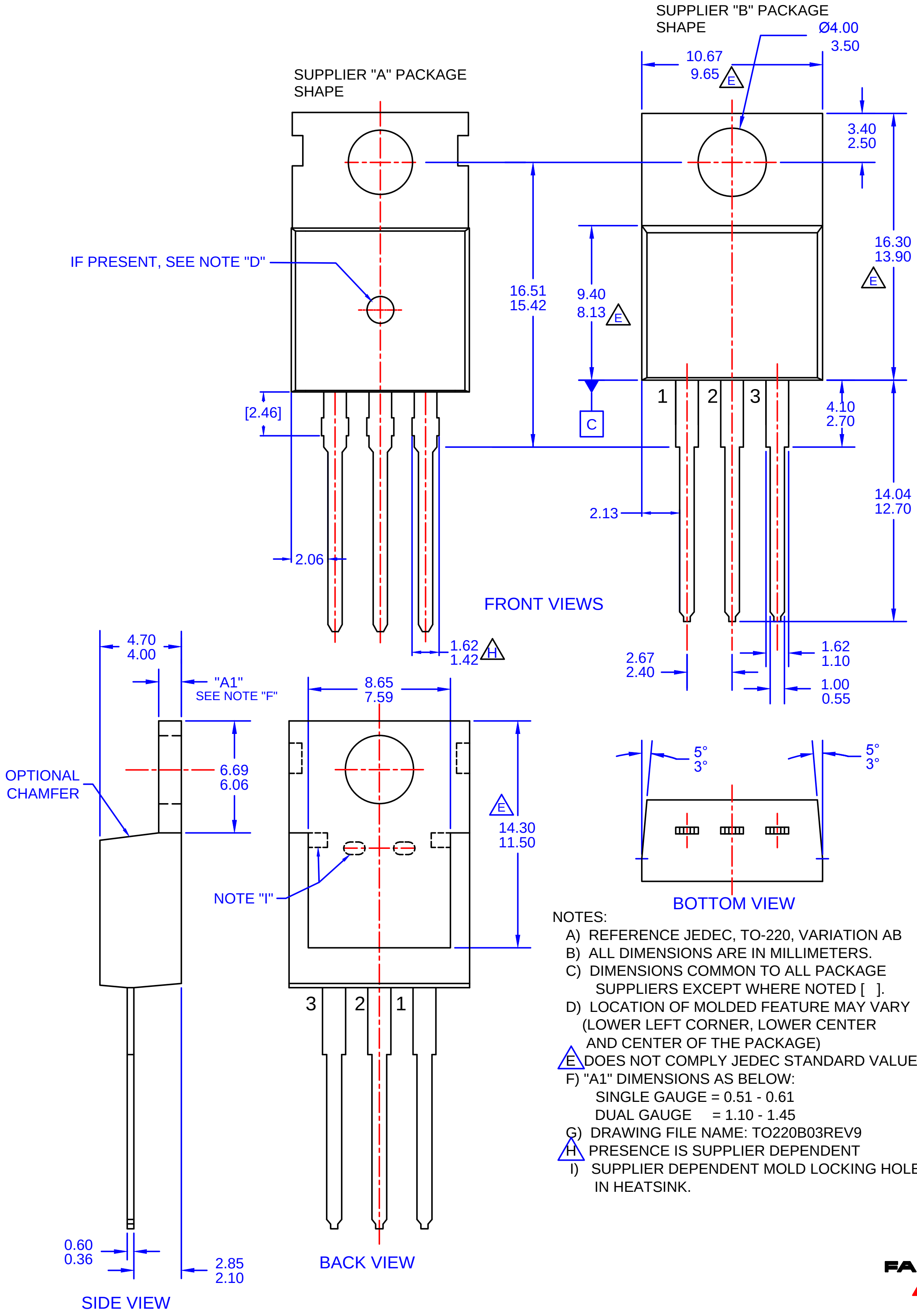


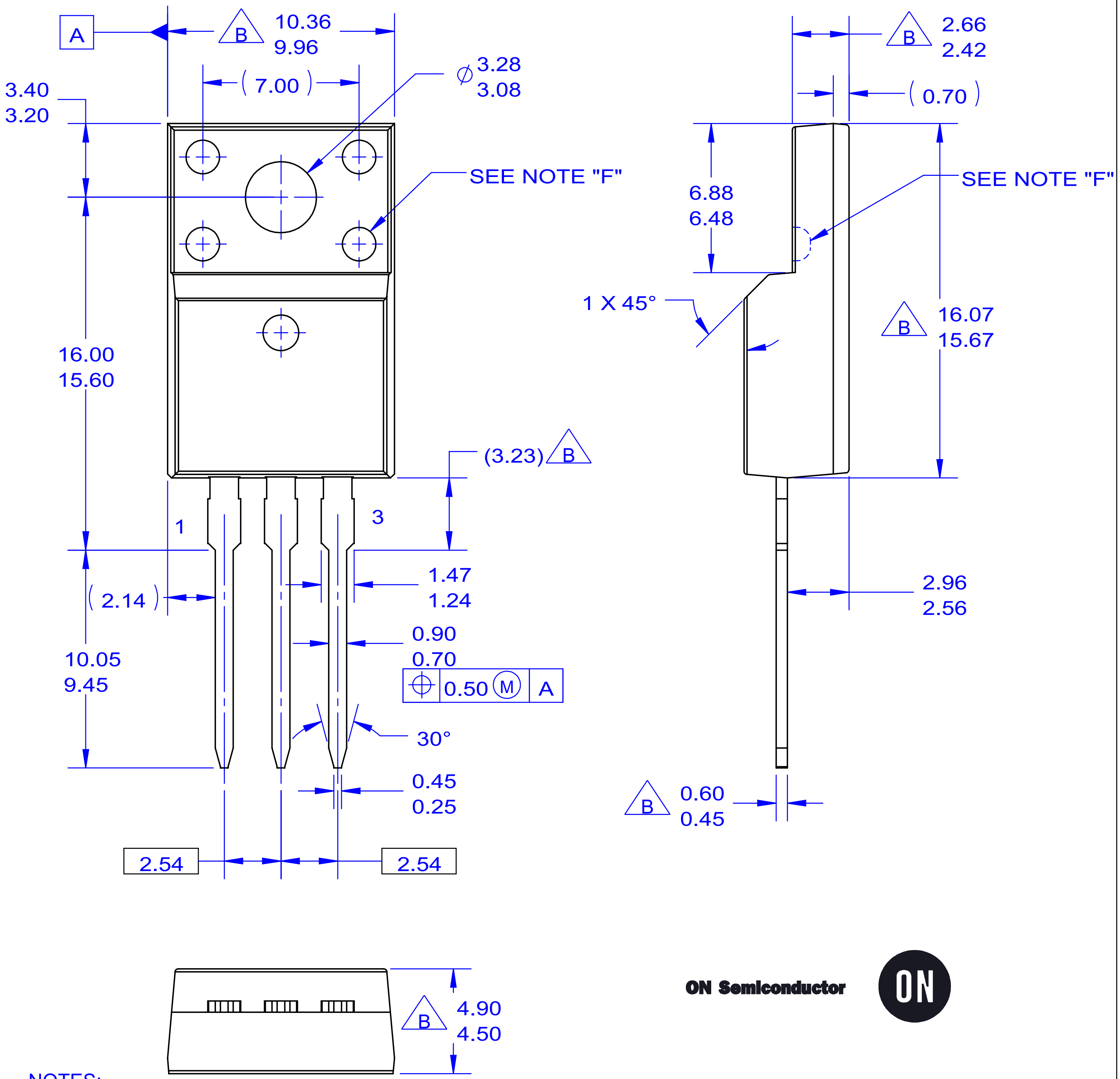
Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



NOTES:

A) REFERENCE JEDEC, TO-220, VARIATION AB
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONS COMMON TO ALL PACKAGE SUPPLIERS EXCEPT WHERE NOTED [ ].
D) LOCATION OF MOLDED FEATURE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF THE PACKAGE)
E DOES NOT COMPLY JEDEC STANDARD VALUE.
F) "A1" DIMENSIONS AS BELOW:
SINGLE GAUGE = 0.51 - 0.61
DUAL GAUGE = 1.10 - 1.45
G) DRAWING FILE NAME: TO220B03REV9
H PRESENCE IS SUPPLIER DEPENDENT
I) SUPPLIER DEPENDENT MOLD LOCKING HOLES IN HEATSINK.

FAIRCHILD™



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 ON 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

© Semiconductor Components Industries, LLC

Downloaded from Arrow.com.