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Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

December 2013

FDPF390N15A

N-Channel PowerTrench® MOSFET

150 V, 15 A, 40 mΩ

Features

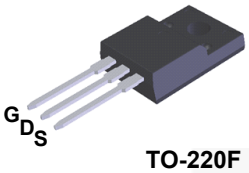
- $R_{DS(on)}$ = 31 mΩ (Typ.) @ V_{GS} = 10 V, I_D = 15 A
- Fast Switching Speed
- Low Gate Charge, Q_G = 14.3 nC (Typ.)
- High Performance Trench Technology for Extremely Low $R_{DS(on)}$
- High Power and Current Handling Capability
- RoHS Compliant

Description

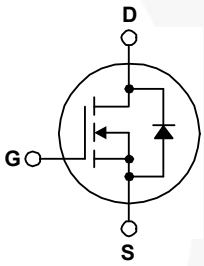
This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench® process that has been tailored to minimize the on-state resistance while maintain-ing superior switching performance.

Applications

- Consumer Appliances
- LED TV
- Synchronous Rectification
- Uninterruptible Power Supply
- Motor Solar Inverter



TO-220F



Absolute Maximum Ratings T_C = 25°C unless otherwise noted.

Symbol	Parameter		FDPF390N15A	Unit
V_{DSS}	Drain to Source Voltage		150	V
V_{GSS}	Gate to Source Voltage		±20	V
I_D	Drain Current	- Continuous (T_C = 25°C,Silicon Limited)	15	A
		- Continuous (T_C = 100°C,Silicon Limited)	10	
I_{DM}	Drain Current	- Pulsed (Note 1)	60	A
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	78	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	6.0	V/ns
P_D	Power Dissipation	(T_C = 25°C)	22	W
		- Derate above 25°C	0.18	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +175	°C
T_L	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds.		300	°C

Thermal Characteristics

Symbol	Parameter	FDPF390N15A	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	5.7	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDPF390N15A	FDPF390N15A	TO-220F	Tube	N/A	N/A	50 units

Electrical Characteristics T_C = 25°C unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 250 μA, V_{GS} = 0 V	150	-	-	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	-	0.1	-	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 120 V, V_{GS} = 0 V	-	-	1	μA
		V_{DS} = 120 V, T_C = 125°C	-	-	500	
I_{GSS}	Gate to Body Leakage Current	V_{GS} = ±20 V, V_{DS} = 0 V	-	-	±100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 250 μA	2.0	-	4.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 15A	-	31	40	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 10 V, I_D = 15 A	-	32	-	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 75 V, V_{GS} = 0 V, f = 1 MHz	-	965	1285	pF
C_{oss}	Output Capacitance		-	96	130	pF
C_{rss}	Reverse Transfer Capacitance		-	5.8	-	pF
$C_{oss(er)}$	Energy Related Output Capacitance	V_{DS} = 75 V,V_{GS} = 0 V		169	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	V_{DS} = 75 V,I_D = 27 A, V_{GS} = 10 V	-	14.3	18.6	nC
Q_{gs}	Gate to Source Gate Charge			5.0	-	nC
Q_{gs2}	Gate Charge Threshold to Plateau		-	2.0	-	nC
Q_{gd}	Gate to Drain “Miller” Charge	(Note 4)	-	3.5	-	nC
ESR	Equivalent Series Resistance (G-S)	f = 1 MHz	-	1.4	-	Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 75 V, I_D = 27 A, V_{GS} = 10 V, R_G = 4.7 Ω	-	14	38	ns
t_r	Turn-On Rise Time		-	10	30	ns
$t_{d(off)}$	Turn-Off Delay Time		-	20	50	ns
t_f	Turn-Off Fall Time	(Note 4)	-	5	20	ns
Drain-Source Diode Characteristics						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	15	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	64	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS} = 0 V, I_{SD} = 15 A	-	-	1.25	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_{SD} = 27 A, dI_F/dt = 100 A/μs	-	63	-	ns
Q_{rr}	Reverse Recovery Charge		-	131	-	nC

Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. Starting T_J = 25°C, L = 3 mH, I_{SD} = 7.2 A
3. I_{SD} ≤ 15 A, di/dt ≤ 200 A/μs, V_{DD} ≤ BV_{DSS}, starting T_J = 25°C
4. Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

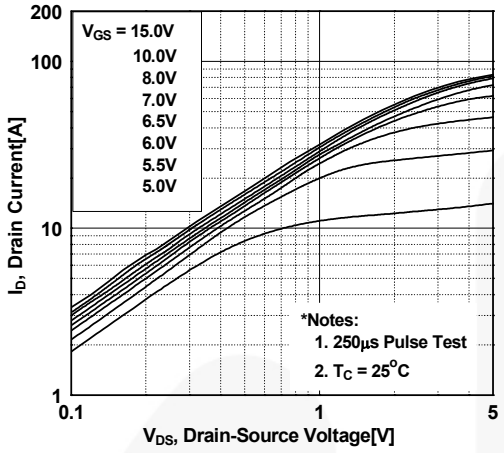


Figure 2. Transfer Characteristics

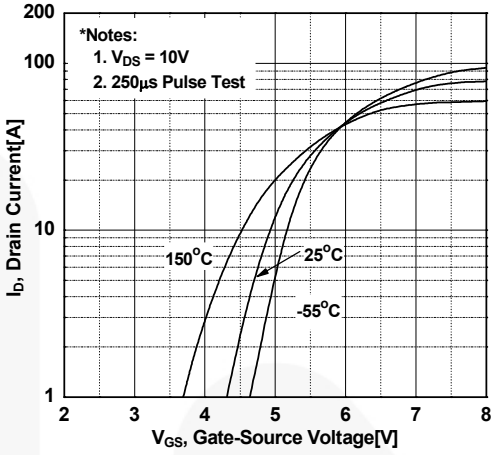


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

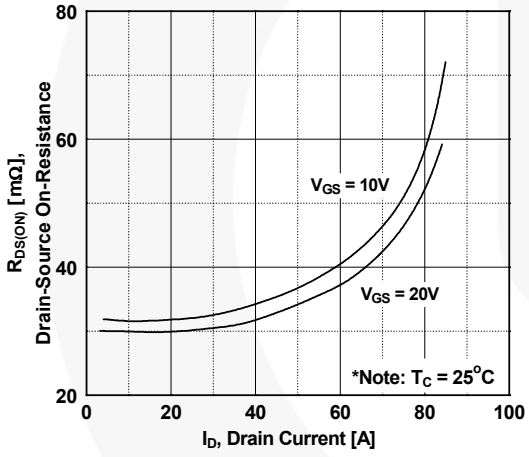


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

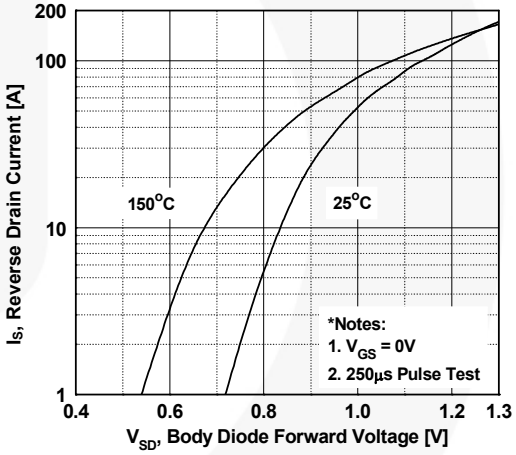


Figure 5. Capacitance Characteristics

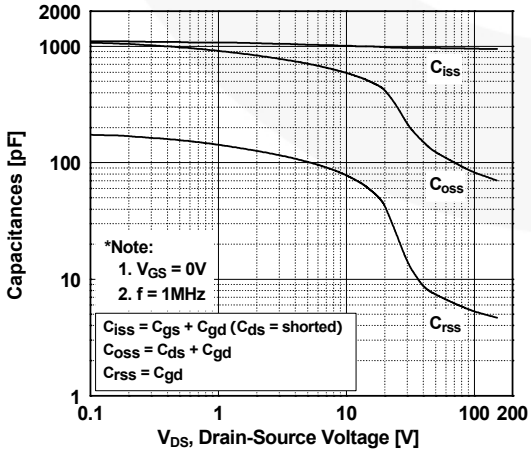
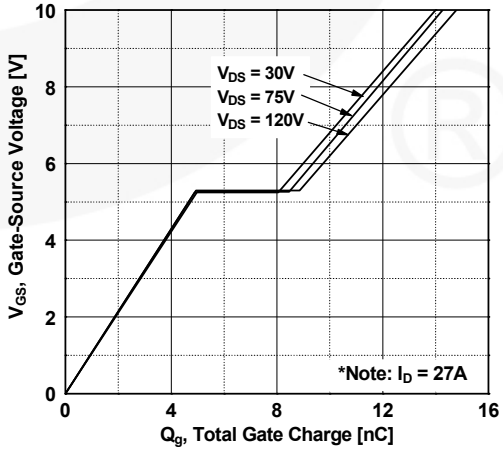


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

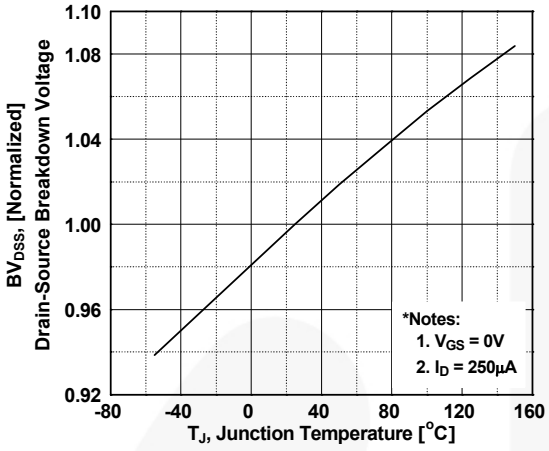


Figure 8. On-Resistance Variation vs. Temperature

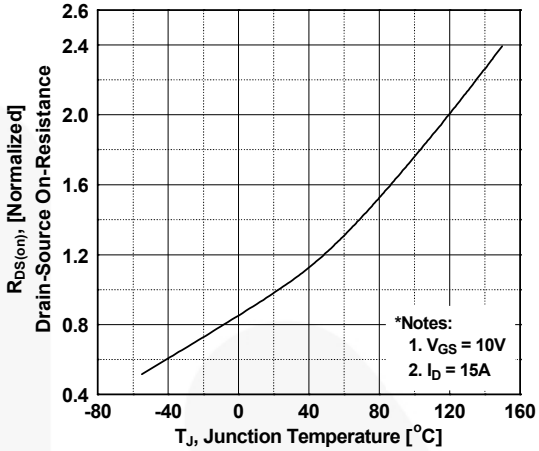


Figure 9. Maximum Safe Operating Area

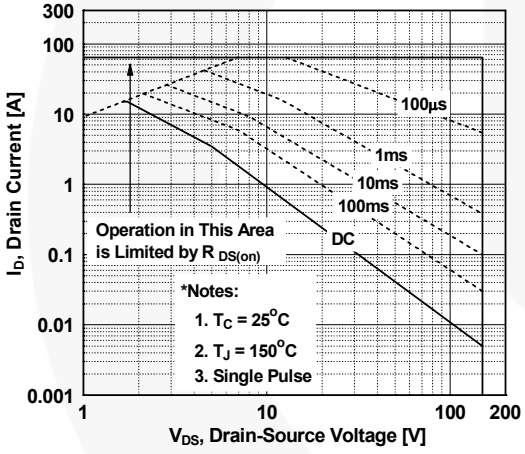


Figure 10. Maximum Drain Current vs. Case Temperature

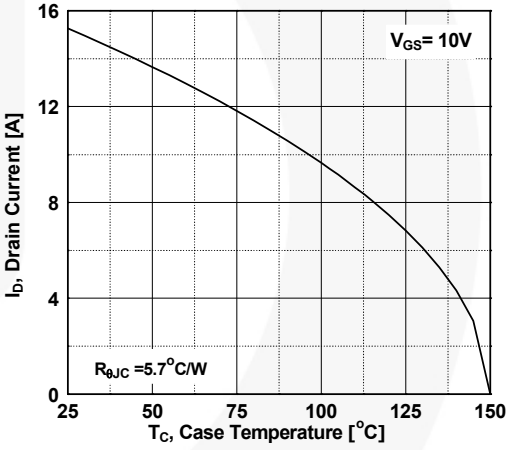


Figure 11. Eoss vs. Drain to Source Volatage

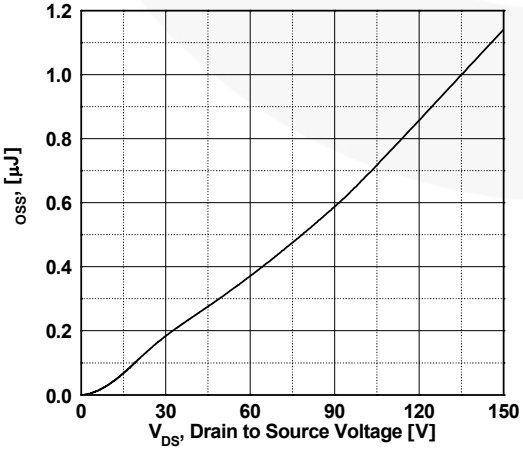
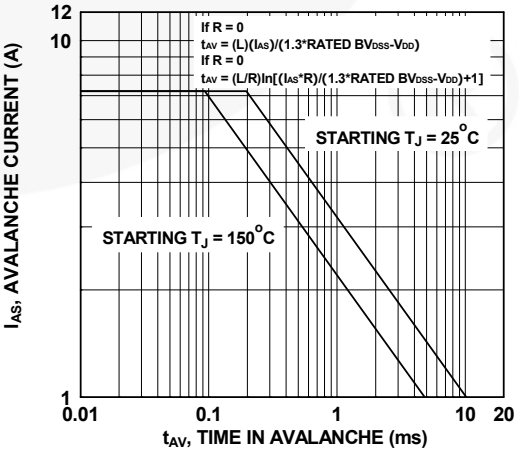
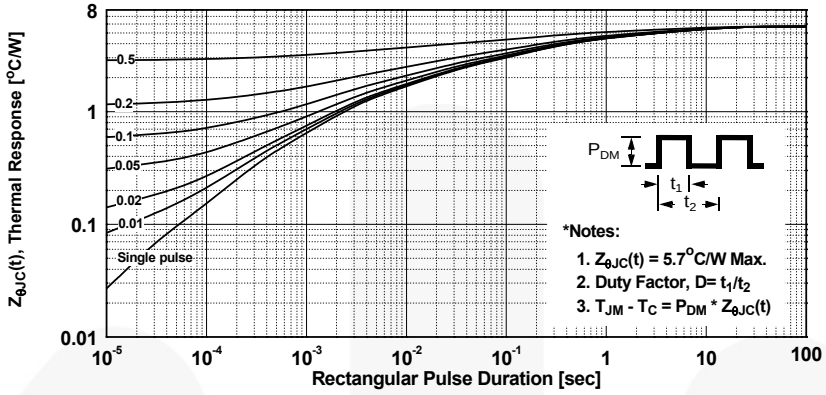


Figure 12. Unclamped Inductive Switching Capability



Typical Performance Characteristics (Continued)

Figure 13. Transient Thermal Response Curve



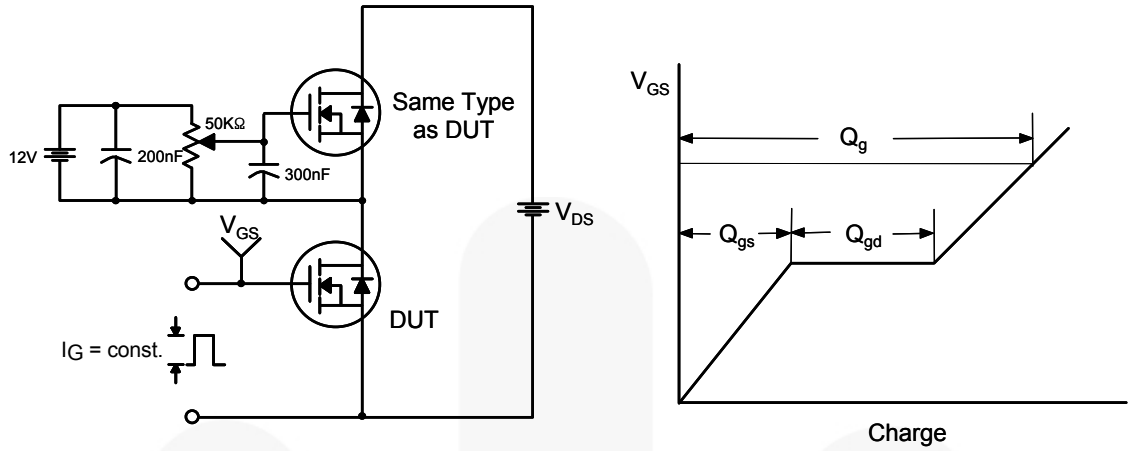


Figure 14. Gate Charge Test Circuit & Waveform

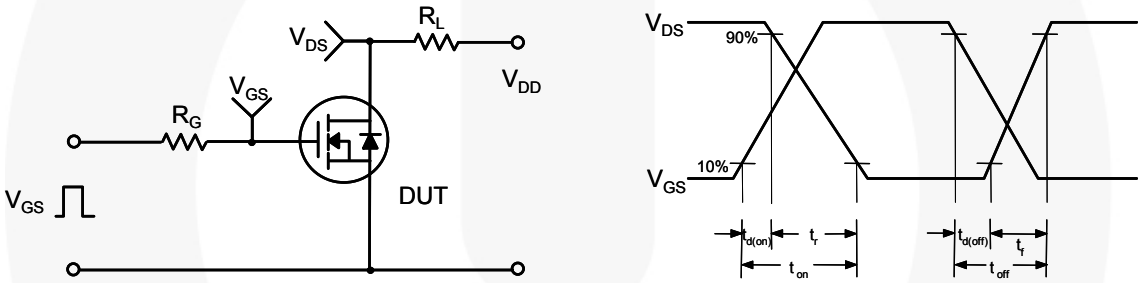


Figure 15. Resistive Switching Test Circuit & Waveforms

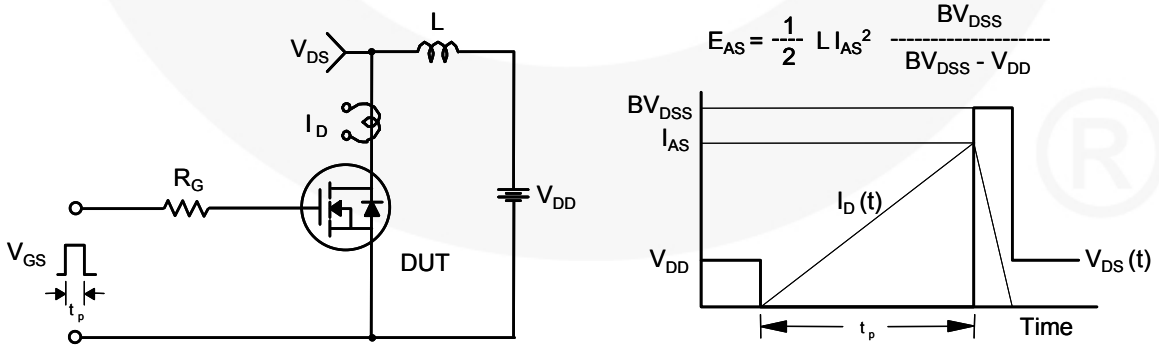


Figure 16. Unclamped Inductive Switching Test Circuit & Waveforms

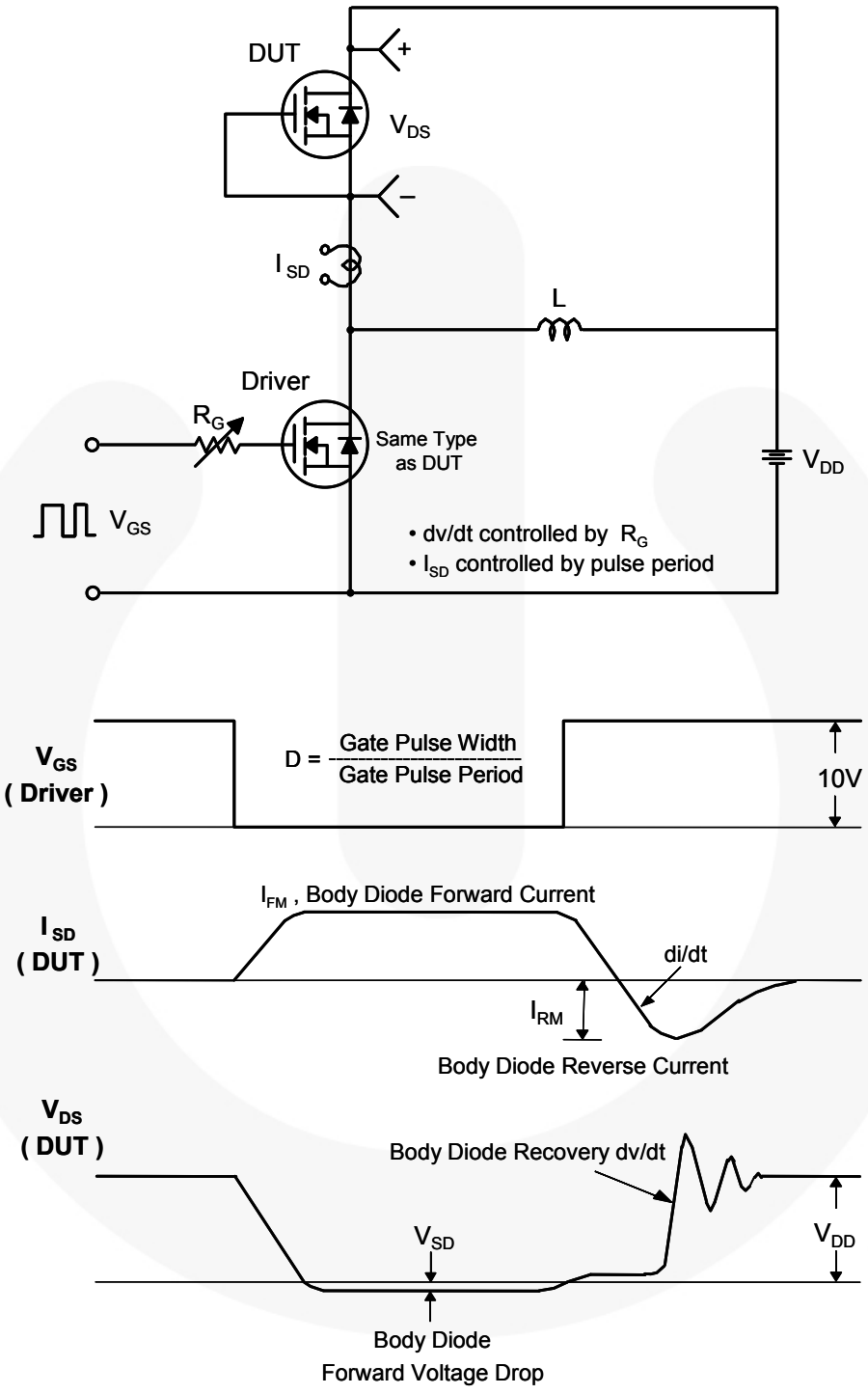
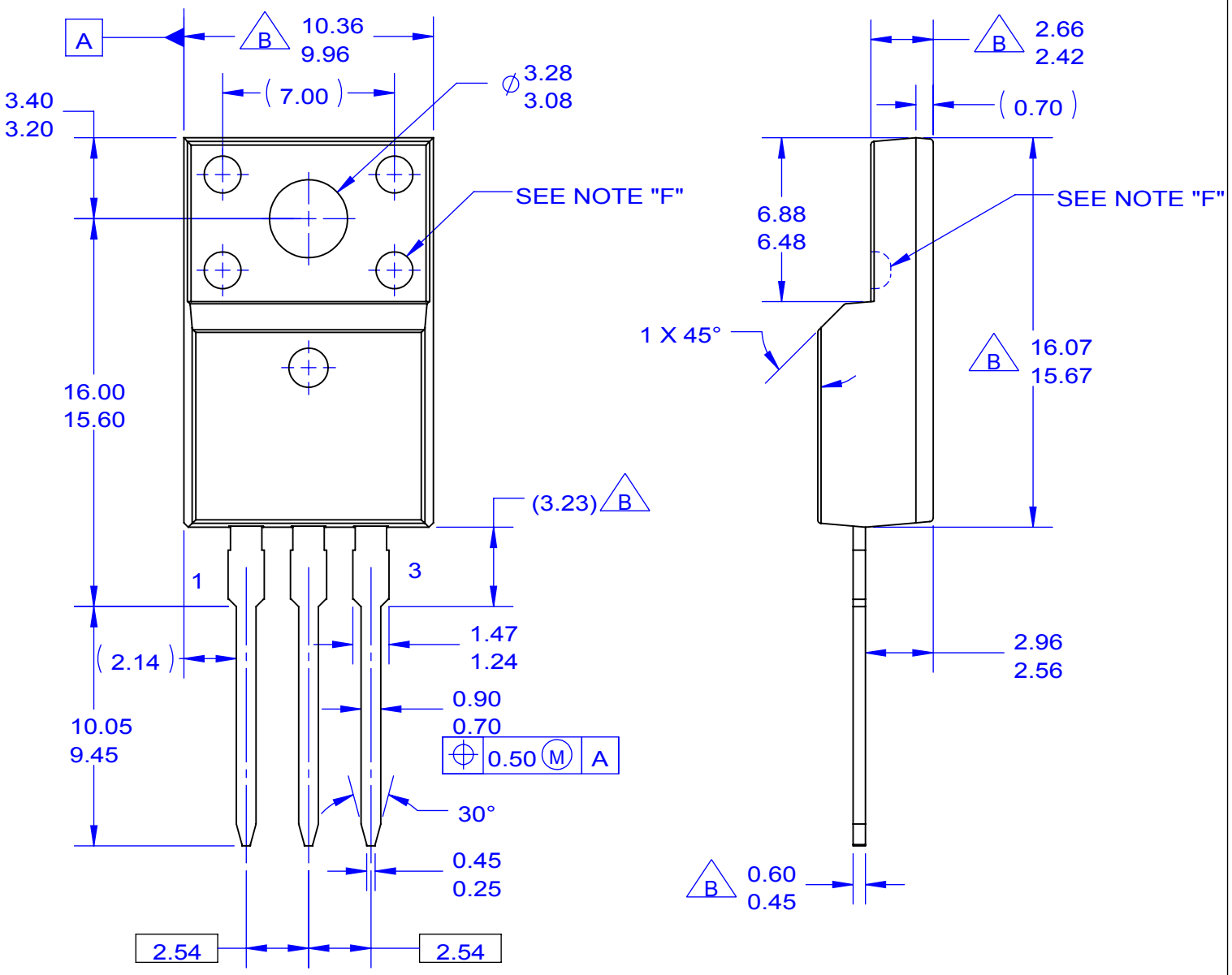
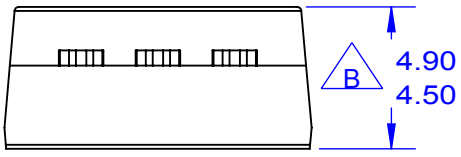


Figure 17. Peak Diode Recovery dv/dt Test Circuit & Waveforms





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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

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
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