

# FDPF390N15A

## N-Channel PowerTrench® MOSFET

150 V, 15 A, 40 mΩ

### Features

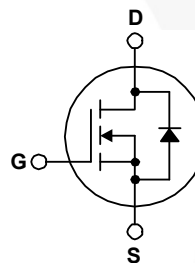
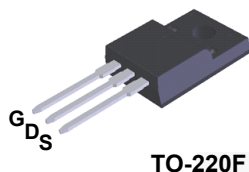
- $R_{DS(on)} = 31 \text{ m}\Omega$  (Typ.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 15 \text{ A}$
- Fast Switching Speed
- Low Gate Charge,  $Q_G = 14.3 \text{ nC}$  (Typ.)
- High Performance Trench Technology for Extremely Low  $R_{DS(on)}$
- High Power and Current Handling Capability
- RoHS Compliant

### 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 maintaining superior switching performance.

### Applications

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



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

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

### Thermal Characteristics

Symbol	Parameter	FDPF390N15A	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	5.7	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	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<sub>C</sub> = 25°C unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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### Off Characteristics

BV <sub>DSS</sub>	Drain to Source Breakdown Voltage	I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0 V	150	-	-	V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25°C	-	0.1	-	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 120 V, V <sub>GS</sub> = 0 V	-	-	1	μA
		V <sub>DS</sub> = 120 V, T <sub>C</sub> = 125°C	-	-	500	
I <sub>GSS</sub>	Gate to Body Leakage Current	V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V	-	-	±100	nA

### On Characteristics

V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 μA	2.0	-	4.0	V
R <sub>DS(on)</sub>	Static Drain to Source On Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 15 A	-	31	40	mΩ
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 15 A	-	32	-	S

### Dynamic Characteristics

C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 75 V, V <sub>GS</sub> = 0 V f = 1 MHz	-	965	1285	pF
C <sub>oss</sub>	Output Capacitance		-	96	130	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		-	5.8	-	pF
C <sub>oss(er)</sub>	Energy Related Output Capacitance	V <sub>DS</sub> = 75 V, V <sub>GS</sub> = 0 V	-	169	-	pF
Q <sub>g(tot)</sub>	Total Gate Charge at 10V	V <sub>DS</sub> = 75 V, I <sub>D</sub> = 27 A V <sub>GS</sub> = 10 V	-	14.3	18.6	nC
Q <sub>gs</sub>	Gate to Source Gate Charge		-	5.0	-	nC
Q <sub>gs2</sub>	Gate Charge Threshold to Plateau		-	2.0	-	nC
Q <sub>gd</sub>	Gate to Drain "Miller" Charge		(Note 4)	-	3.5	-
ESR	Equivalent Series Resistance (G-S)	f = 1 MHz	-	1.4	-	Ω

### Switching Characteristics

t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 75 V, I <sub>D</sub> = 27 A V <sub>GS</sub> = 10 V, R <sub>G</sub> = 4.7 Ω	-	14	38	ns
t <sub>r</sub>	Turn-On Rise Time		-	10	30	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		-	20	50	ns
t <sub>f</sub>	Turn-Off Fall Time		(Note 4)	-	5	20

### Drain-Source Diode Characteristics

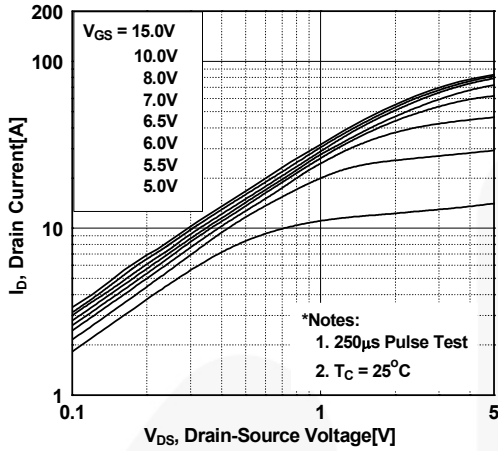
I <sub>S</sub>	Maximum Continuous Drain to Source Diode Forward Current	-	-	15	A	
I <sub>SM</sub>	Maximum Pulsed Drain to Source Diode Forward Current	-	-	64	A	
V <sub>SD</sub>	Drain to Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 15 A	-	-	1.25	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 27 A	-	63	-	ns
Q <sub>rr</sub>	Reverse Recovery Charge	di/dt = 100 A/μs	-	131	-	nC

#### Notes:

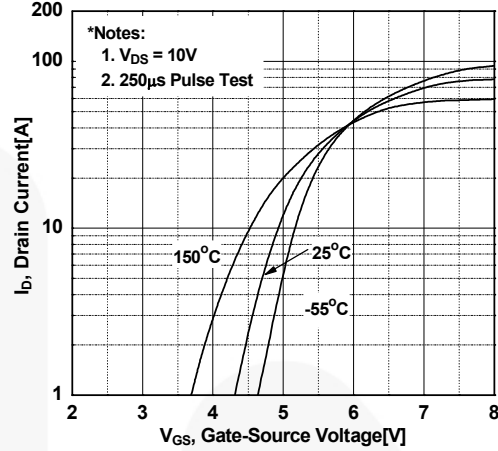
1. Repetitive rating; pulse-width limited by maximum junction temperature.
2. Starting T<sub>J</sub> = 25°C, L = 3 mH, I<sub>SD</sub> = 7.2 A
3. I<sub>SD</sub> ≤ 15 A, di/dt ≤ 200 A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, starting T<sub>J</sub> = 25°C
4. Essentially independent of operating temperature typical characteristics.

## Typical Performance Characteristics

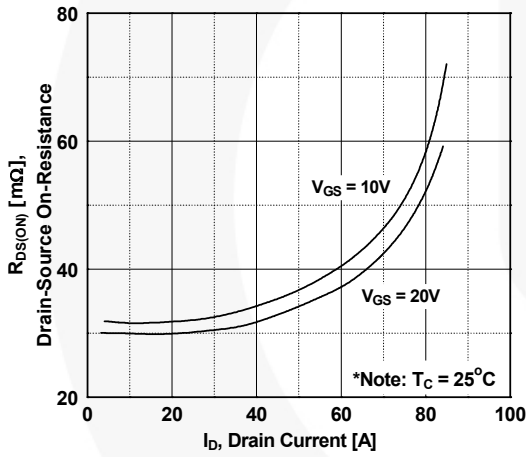
**Figure 1. On-Region Characteristics**



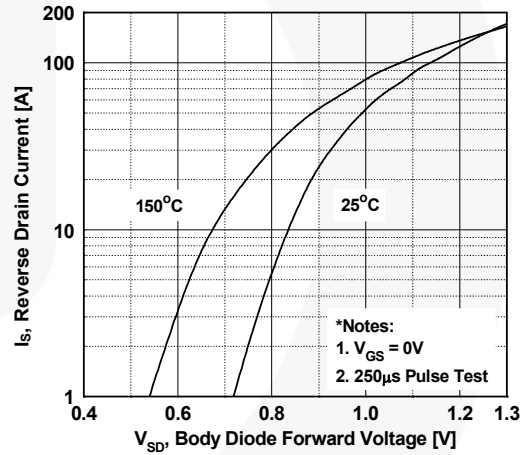
**Figure 2. Transfer Characteristics**



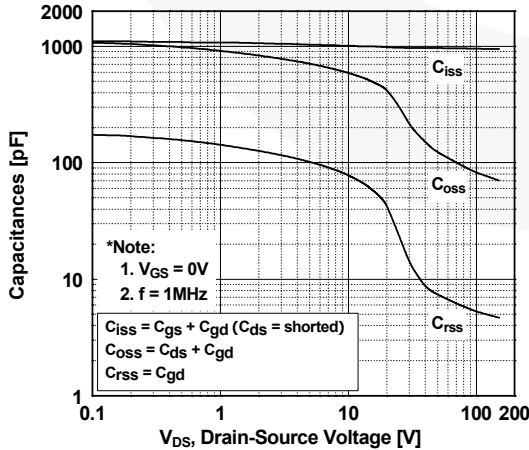
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



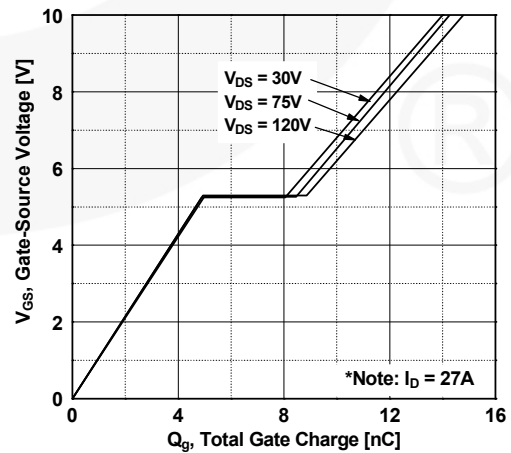
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**



**Figure 6. Gate Charge Characteristics**



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

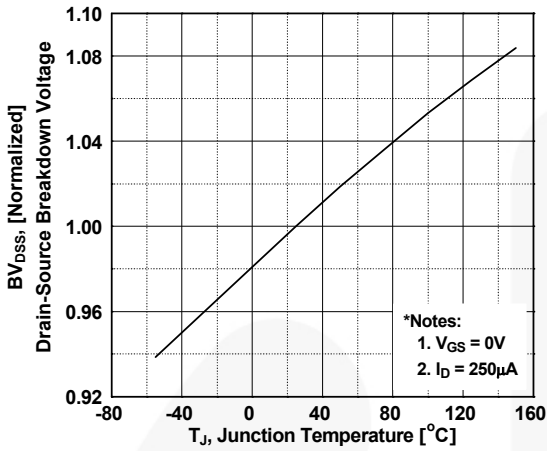


Figure 8. On-Resistance Variation vs. Temperature

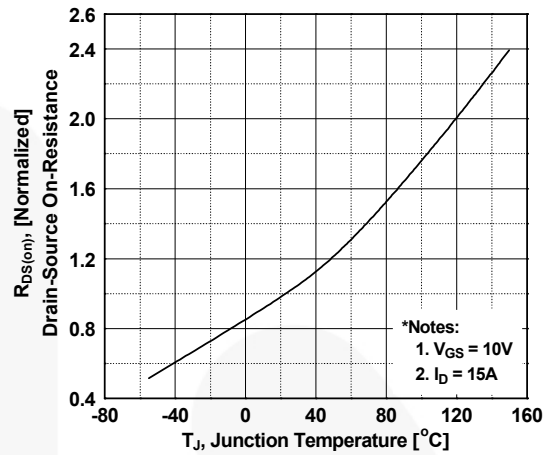


Figure 9. Maximum Safe Operating Area

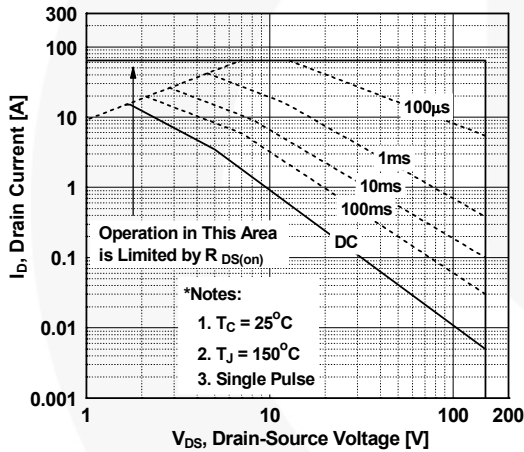


Figure 10. Maximum Drain Current vs. Case Temperature

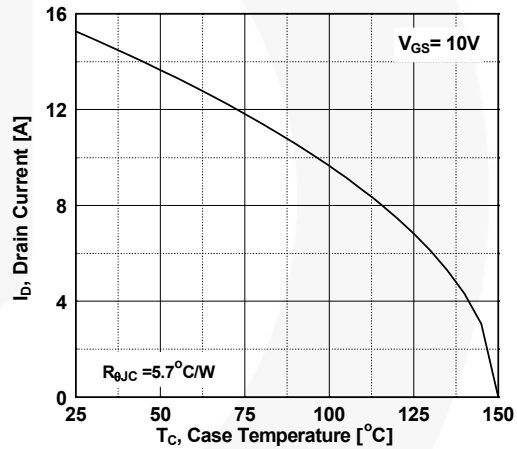


Figure 11. E\_oss vs. Drain to Source Voltage

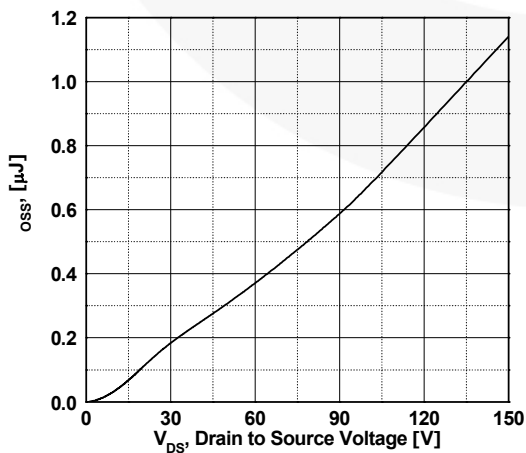
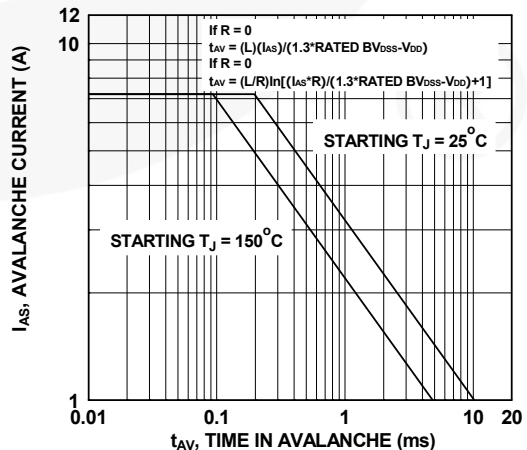
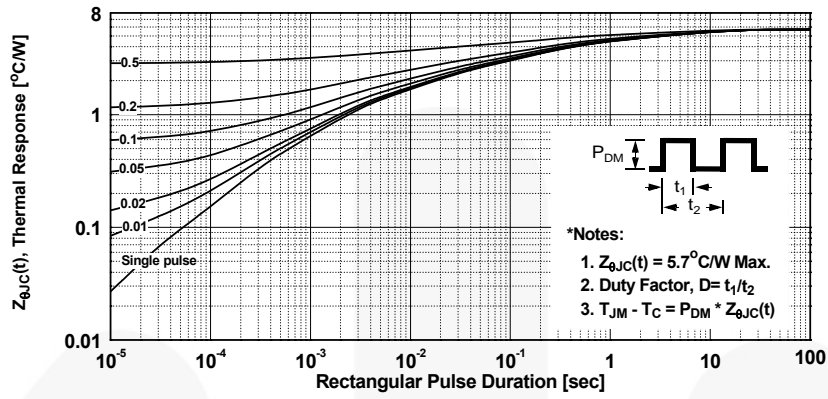


Figure 12. Unclamped Inductive Switching Capability



Typical Performance Characteristics (Continued)

Figure 13. Transient Thermal Response Curve



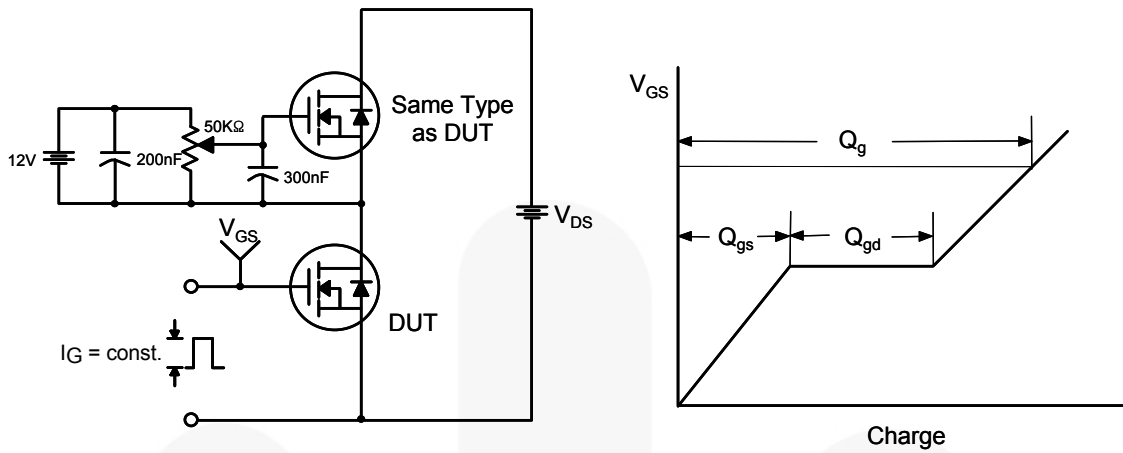


Figure 14. Gate Charge Test Circuit & Waveform



Figure 15. Resistive Switching Test Circuit & Waveforms

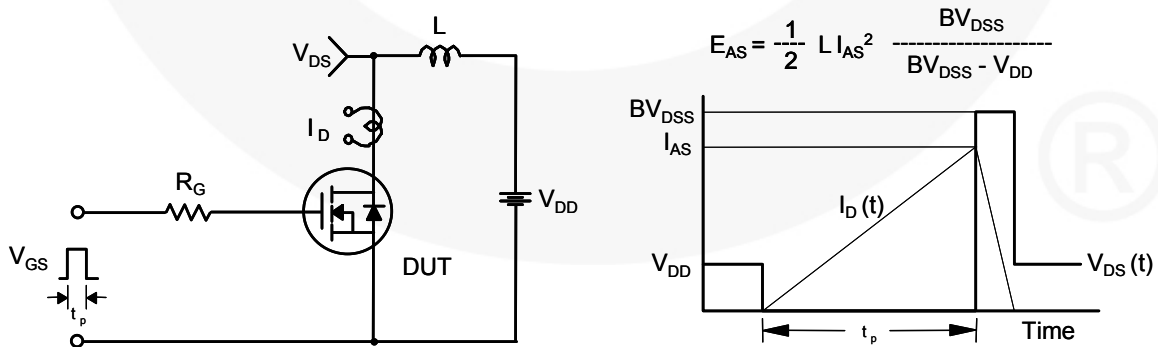


Figure 16. Unclamped Inductive Switching Test Circuit & Waveforms

$$E_{AS} = \frac{1}{2} L I_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$

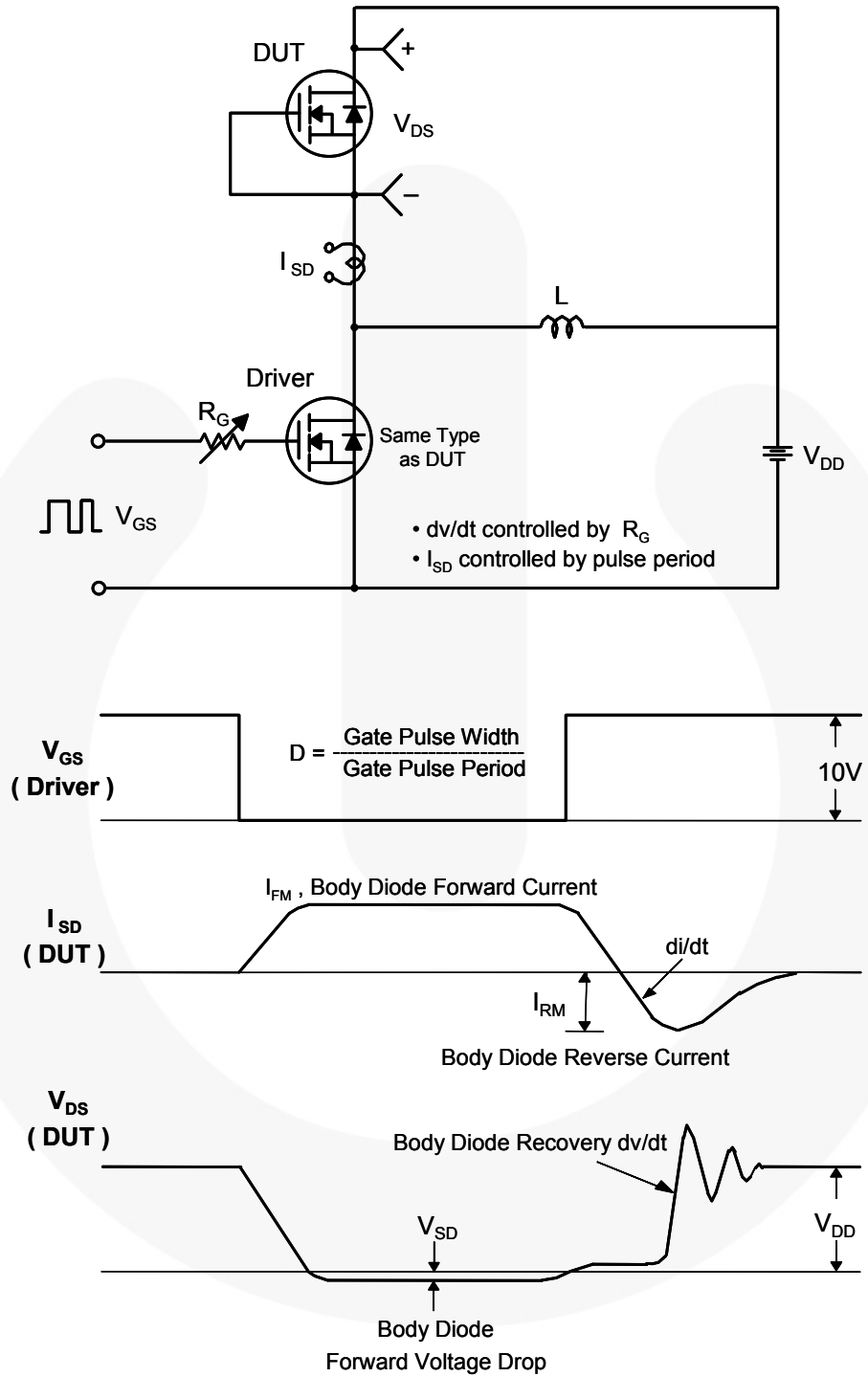
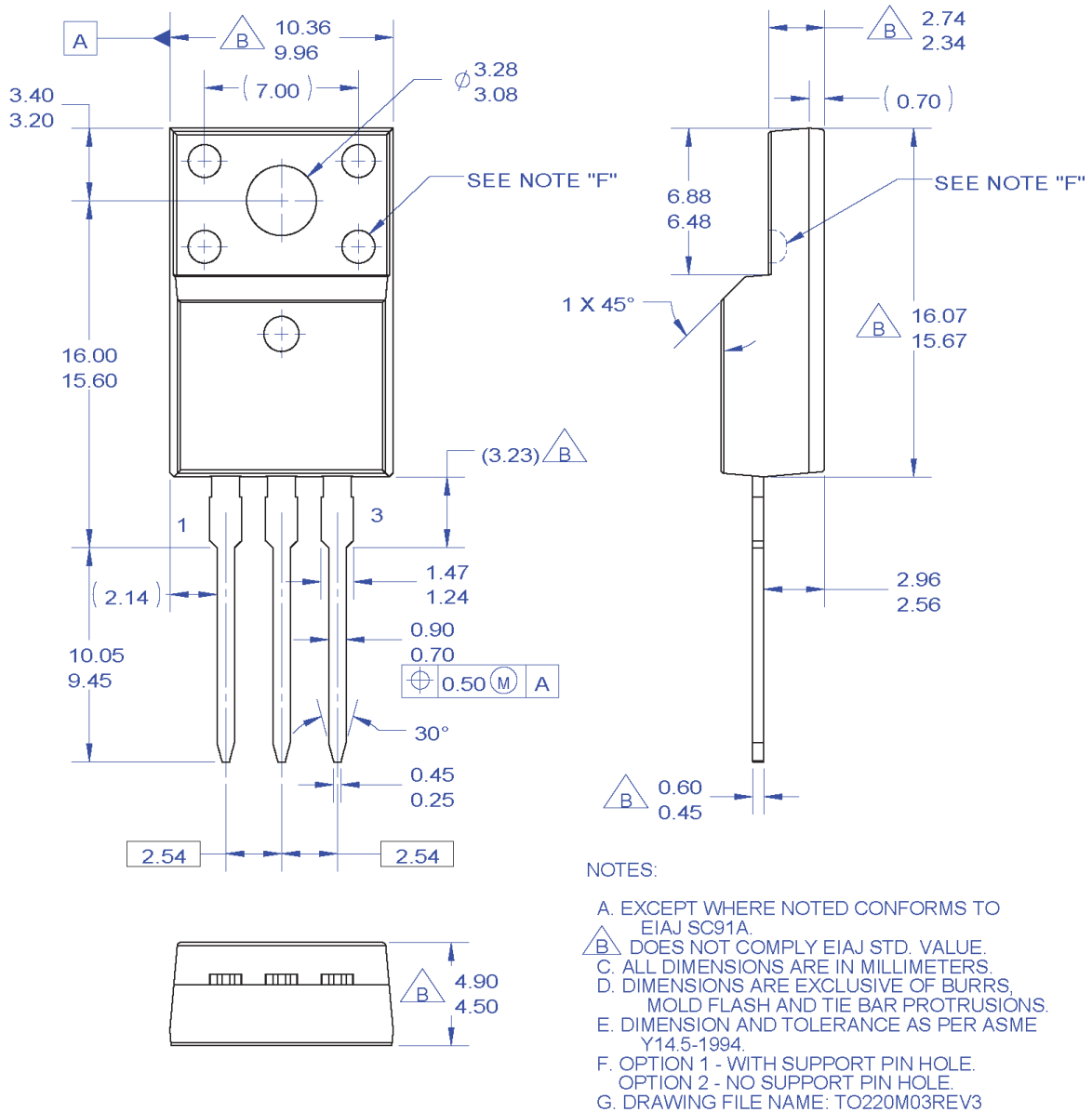


Figure 17. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

## Mechanical Dimensions



**Figure 18. TO220, Molded, 3-Lead, Full Pack, EIAJ SC91, Straight Lead**

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| FPS™                     |   |                          |
|                          | PowerTrench®                                    |                          |
|                          | PowerXS™  |                          |
|                          | Programmable Active Droop™                      |                          |
|                          | QFET®   |                          |
|                          | QS™   |                          |
|                          | Quiet Series™                                   |                          |
|                          | RapidConfigure™                                 |                          |
|                          | Saving our world, 1mW/W/kW at a time™           |                          |
|                          | SignalWise™                                     |                          |
|                          | SmartMax™                                       |                          |
|                          | SMART START™                                    |                          |
|                          | Solutions for Your Success™                     |                          |
|                          | SPM®  |                          |
|                          | STEALTH™  |                          |
|                          | SuperFET®                                       |                          |
|                          | SuperSOT™-3                                     |                          |
|                          | SuperSOT™-6                                     |                          |
|                          | SuperSOT™-8                                     |                          |
|                          | SupreMOS®                                       |                          |
|                          | SyncFET™  |                          |

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