

MOSFET – N-Channel, POWERTRENCH®

150 V, 15 A, 40 mΩ

FDPF390N15A

Description

This N-Channel MOSFET is produced using **onsemi**'s advanced POWERTRENCH process that has been tailored to minimize the on-state resistance while maintaining superior switching performance.

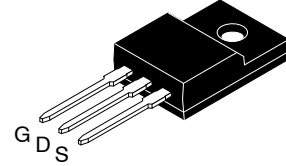
Features

- $R_{DS(on)} = 31 \text{ m}\Omega$ (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
- This Device is Pb-Free, Halide Free and RoHS Compliant

Applications

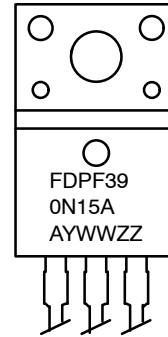
- Consumer Appliances
- LED TV
- Synchronous Rectification
- Uninterruptible Power Supply
- Motor Solar Inverter

V_{DSS}	$R_{DS(on)}$ MAX	I_D MAX
150 V	40 mΩ @ 10 V	15 A



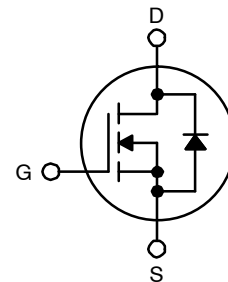
TO-220 Fullpack, 3-Lead / TO-220F-3SG
 CASE 221AT

MARKING DIAGRAM



FDPF390N15A = Specific Device Code
 A = Assembly Location
 YWW = Date Code (Year & Week)
 ZZ = Assembly Lot

N-CHANNEL MOSFET



ORDERING INFORMATION

Part Number	Package	Shipping
FDPF390N15A	TO-220F	1000 Units / Tube

FDPF390N15A

MOSFET 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	± 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	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	6.0	V/ns
P_D	Power Dissipation	($T_C = 25^\circ\text{C}$)	22
		- Derate Above 25°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	$^\circ\text{C}$

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. Starting $T_J = 25^\circ\text{C}$, $L = 3\text{ mH}$, $I_{SD} = 7.2\text{ A}$
3. $I_{SD} \leq 15\text{ A}$, $di/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, starting $T_J = 25^\circ\text{C}$.

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	

FDPF390N15A

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 = 15 A	–	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 10 V	V _{DS} = 75 V, I _D = 27 A, V _{GS} = 10 V (Note 4)	–	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		–	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 (Note 4)	–	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		–	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

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

4. Essentially independent of operating temperature typical characteristics.

TYPICAL PERFORMANCE CHARACTERISTICS

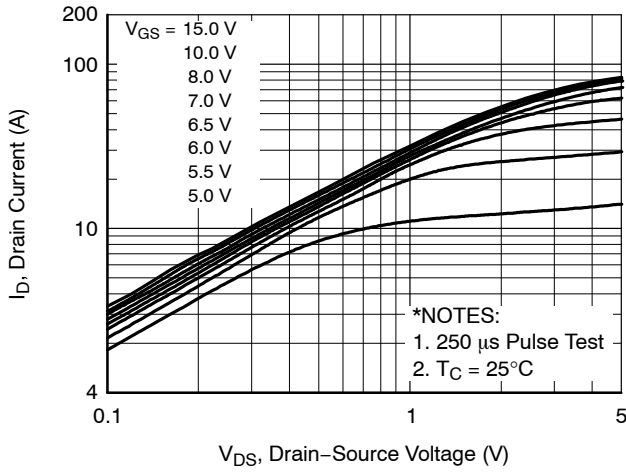


Figure 1. On-Region Characteristics

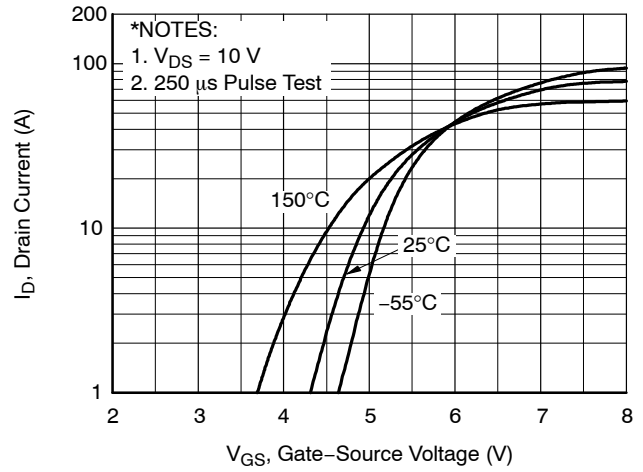


Figure 2. Transfer Characteristics

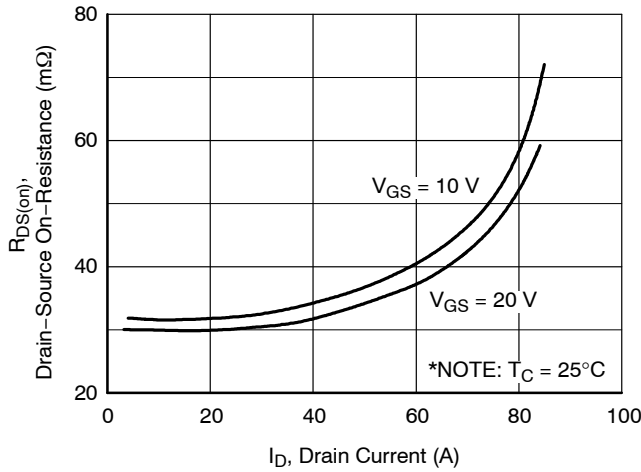


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

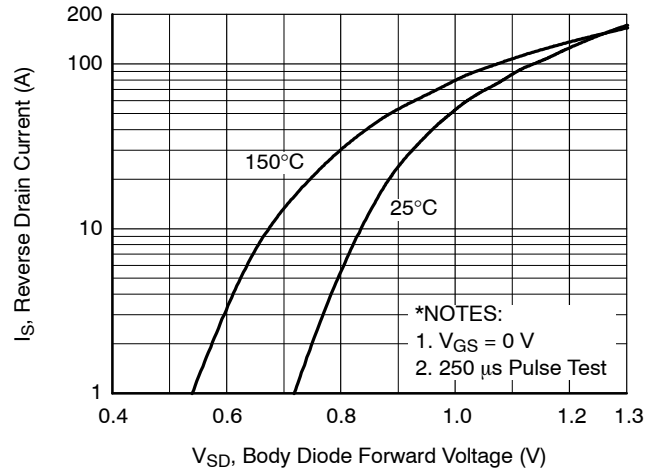


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

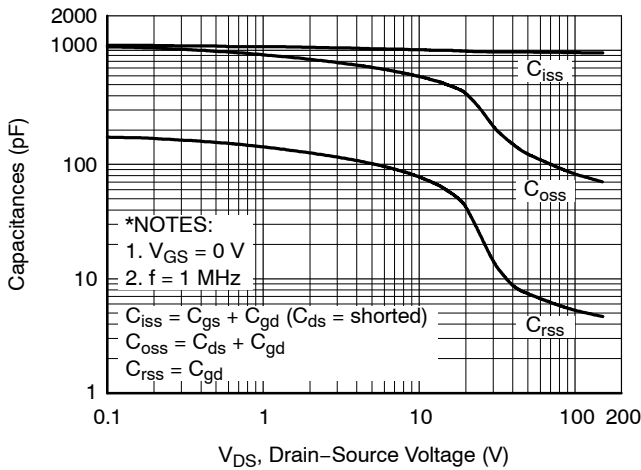


Figure 5. Capacitance Characteristics

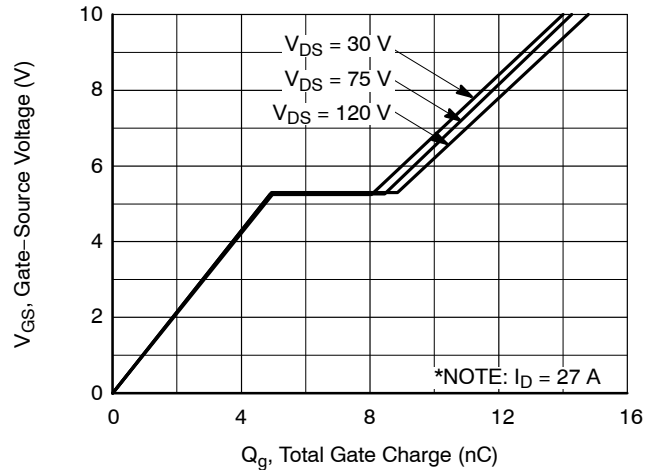


Figure 6. Gate Charge Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

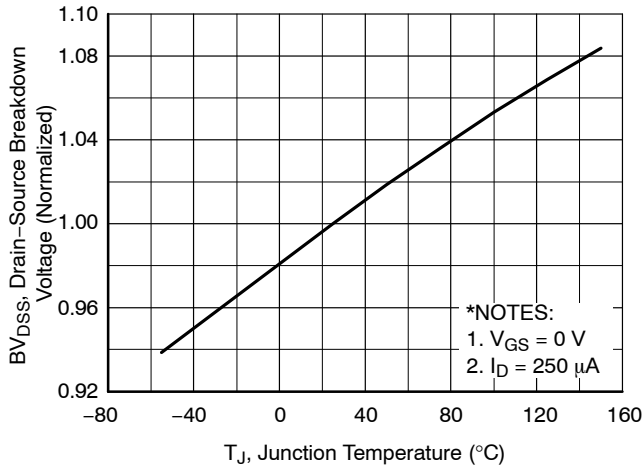


Figure 7. Breakdown Voltage Variation vs. Temperature

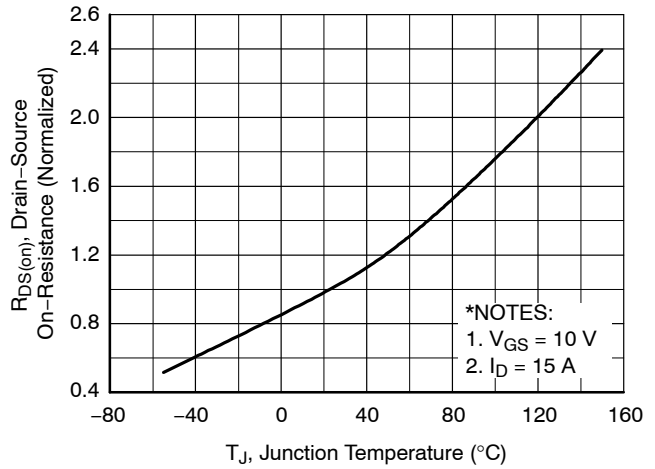


Figure 8. On-Resistance Variation vs. Temperature

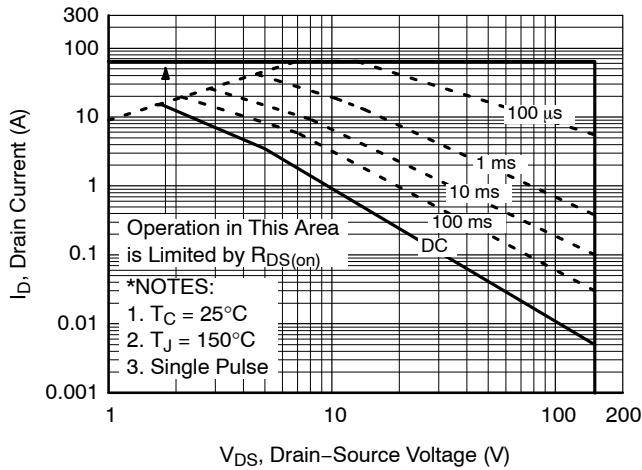


Figure 9. Maximum Safe Operating Area

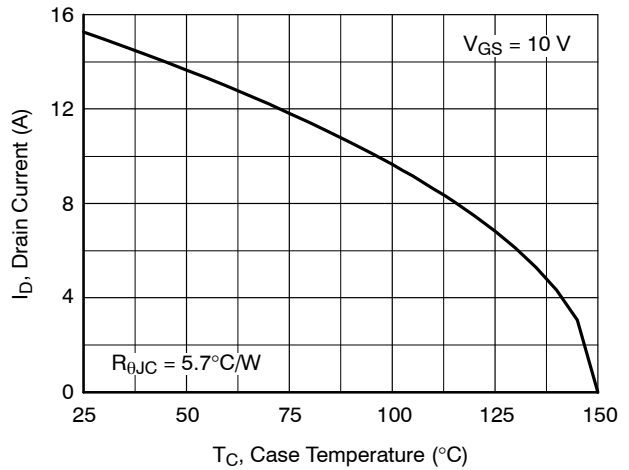


Figure 10. Maximum Drain Current vs. Case Temperature

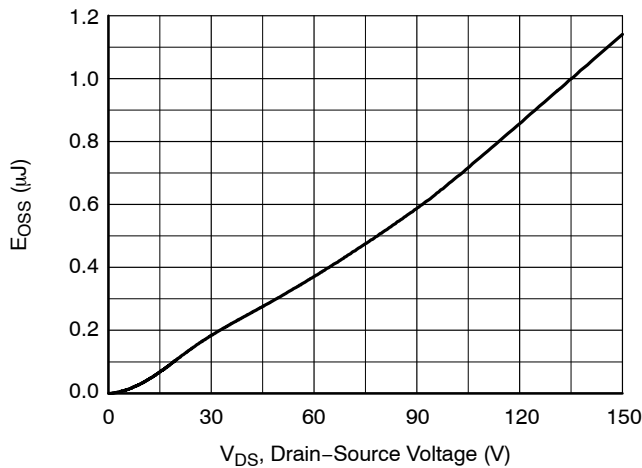


Figure 11. E_{OSS} vs. Drain to Source Voltage

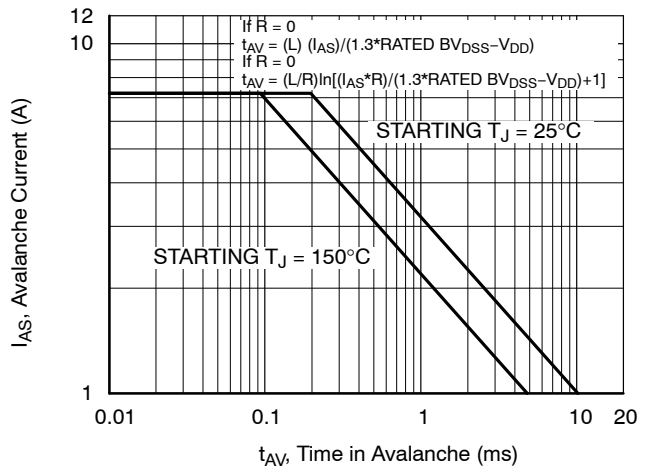


Figure 12. Unclamped Inductive Switching Capability

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TYPICAL PERFORMANCE CHARACTERISTICS (continued)

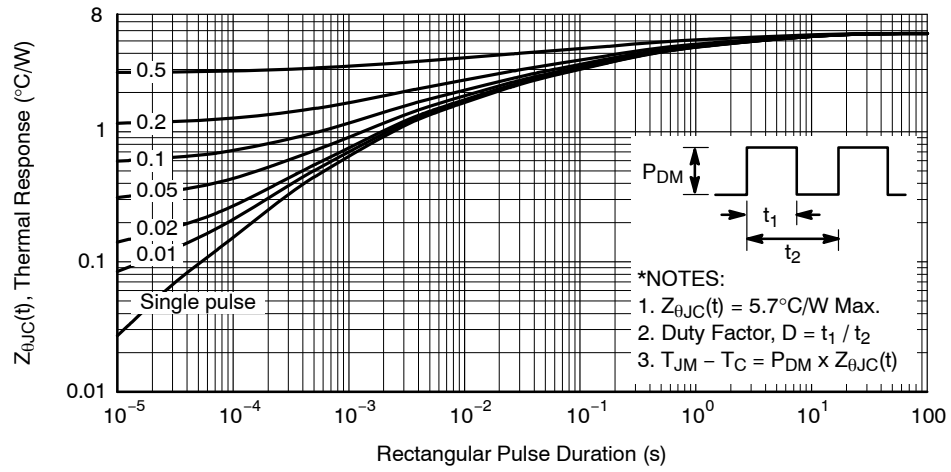


Figure 13. Transient Thermal Response Curve

FDPF390N15A

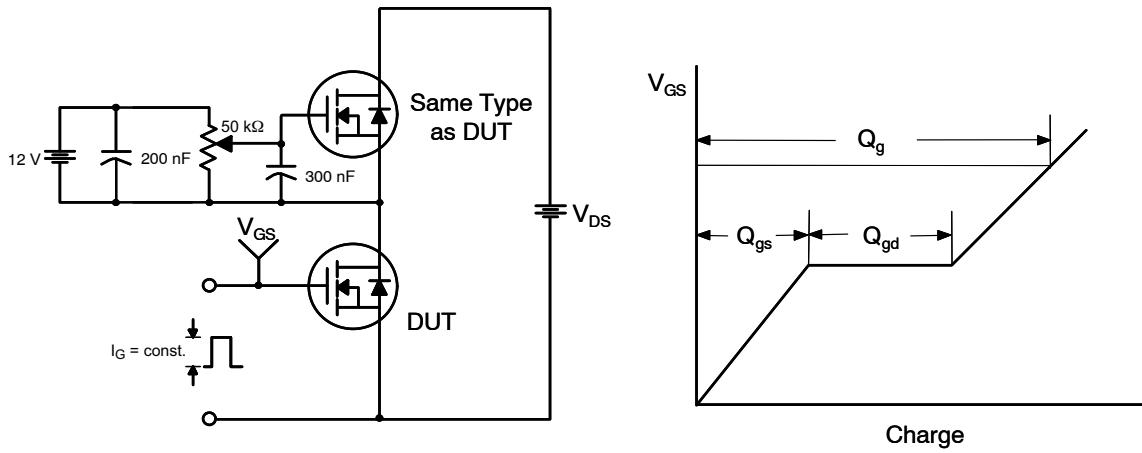


Figure 14. Gate Charge Test Circuit & Waveform

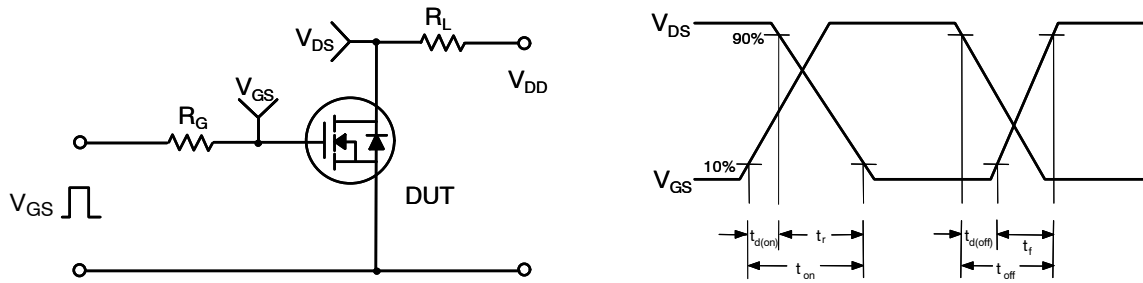


Figure 15. Resistive Switching Test Circuit & Waveforms

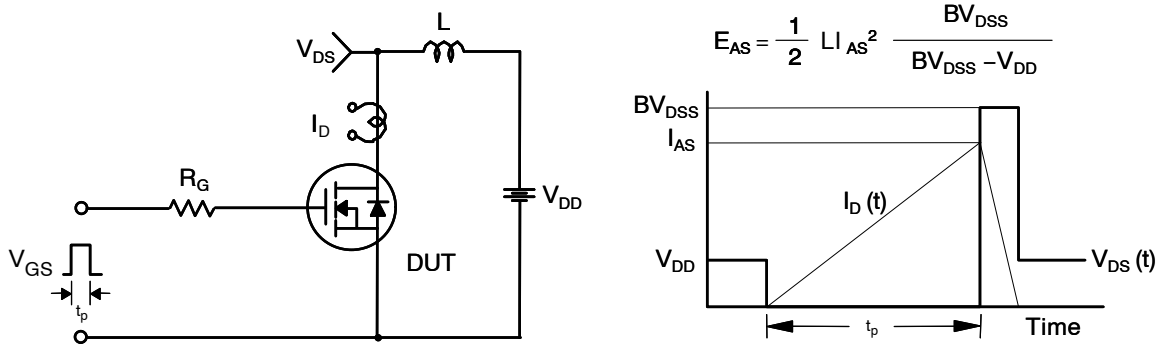


Figure 16. Unclamped Inductive Switching Test Circuit & Waveforms

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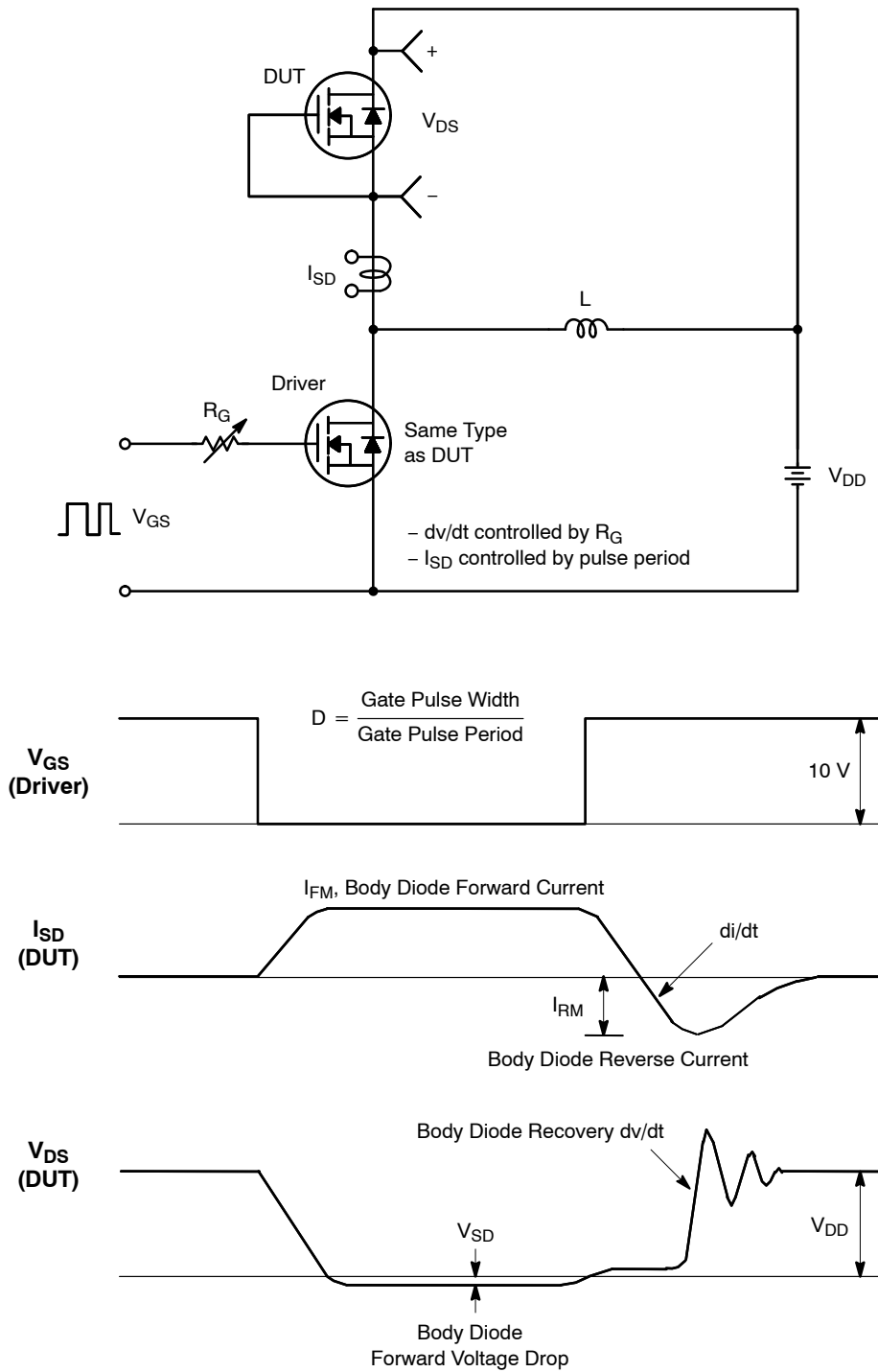


Figure 17. Peak Diode Recovery dv/dt Test Circuit & Waveforms

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

ON Semiconductor®

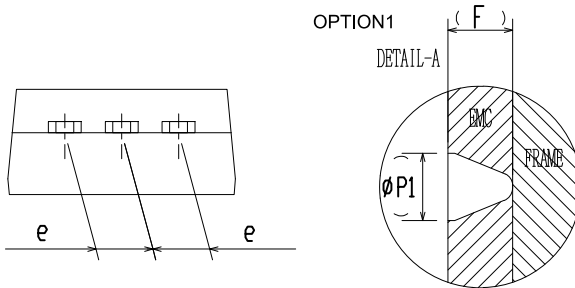
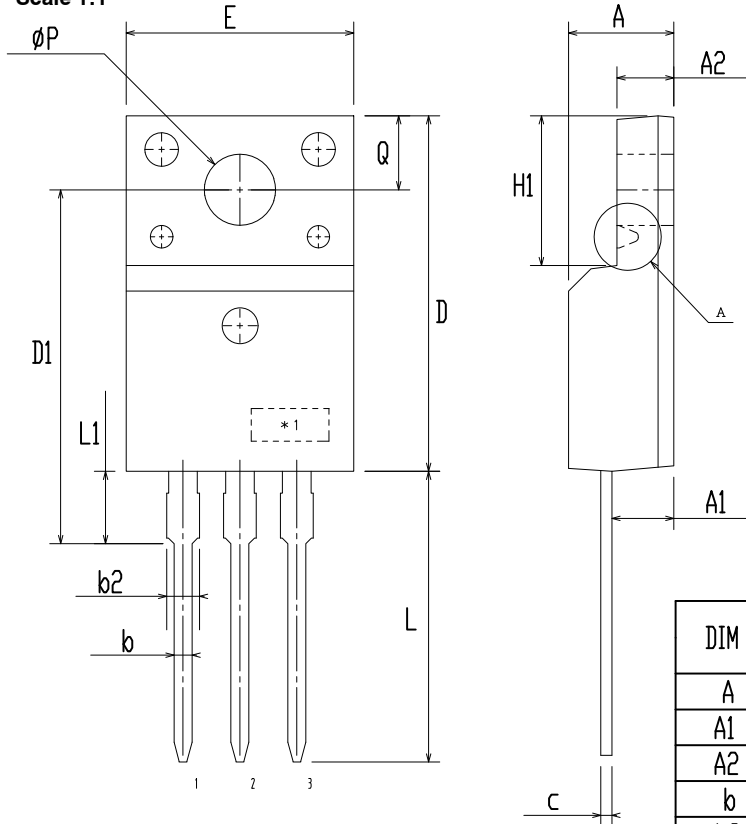


TO-220 Fullpack, 3-Lead / TO-220F-3SG CASE 221AT ISSUE B

DATE 19 JAN 2021



Scale 1:1



DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.50	4.70	4.90
A1	2.56	2.76	2.96
A2	2.34	2.54	2.74
b	0.70	0.80	0.90
b2	~	~	1.47
c	0.45	0.50	0.60
D	15.67	15.87	16.07
D1	15.60	15.80	16.00
E	9.96	10.16	10.36
e	2.34	2.54	2.74
F	~	0.84	~
H1	6.48	6.68	6.88
L	12.78	12.98	13.18
L1	3.03	3.23	3.43
phi P	2.98	3.18	3.38
phi P1	~	1.00	~
Q	3.20	3.30	3.40

NOTES:

- A. DIMENSION AND TOLERANCE AS ASME Y14.5-2009
- B. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUCTIONS.
- C. OPTION 1 - WITH SUPPORT PIN HOLE
OPTION 2 - NO SUPPORT PIN HOLE

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DESCRIPTION:	TO-220 FULLPACK, 3-LEAD / TO-220F-3SG	PAGE 1 OF 1

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