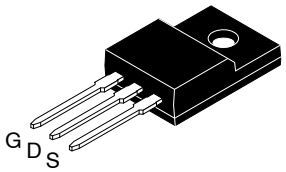
MOSFET – N-Channel, POWERTRENCH®

150 V, 15 A, 40 mΩ

FDPF390N15A

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

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.

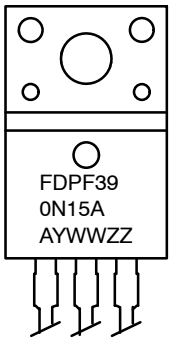
Features

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

Applications

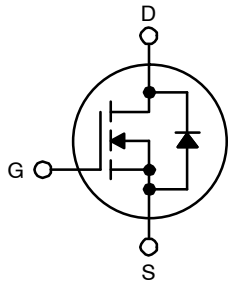
- Consumer Appliances
- LED TV
- Synchronous Rectification
- Uninterruptible Power Supply
- Motor Solar Inverter

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

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MOSFET 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

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°C, L = 3 mH, I_{SD} = 7.2 A
3. $I_{SD} \leq$ 15 A, di/dt $\leq$ 200 A/μs, $V_{DD} \leq BV_{DSS}$, starting T_J = 25°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	

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

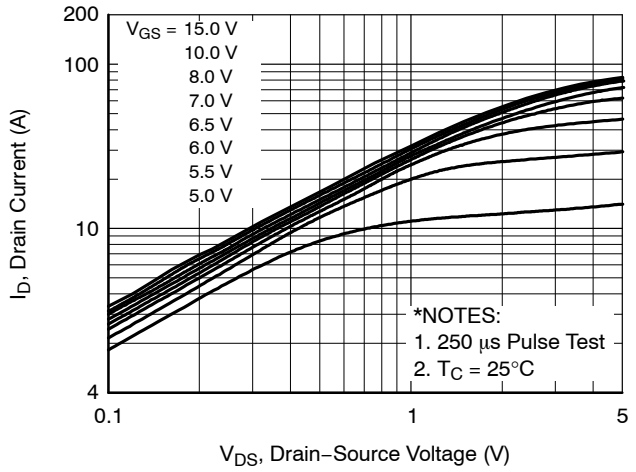

Figure 1. On−Region Characteristics

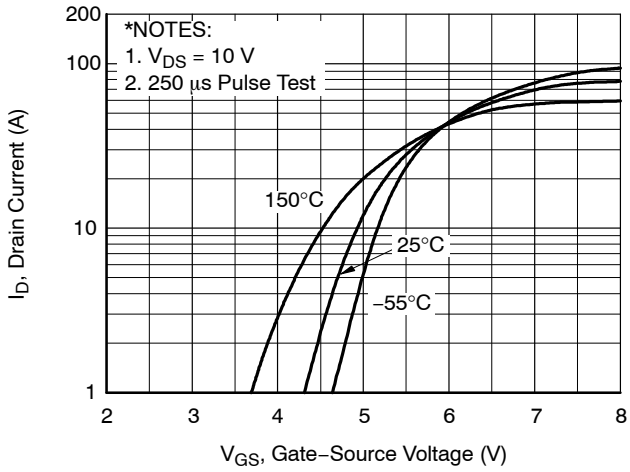

Figure 2. Transfer Characteristics

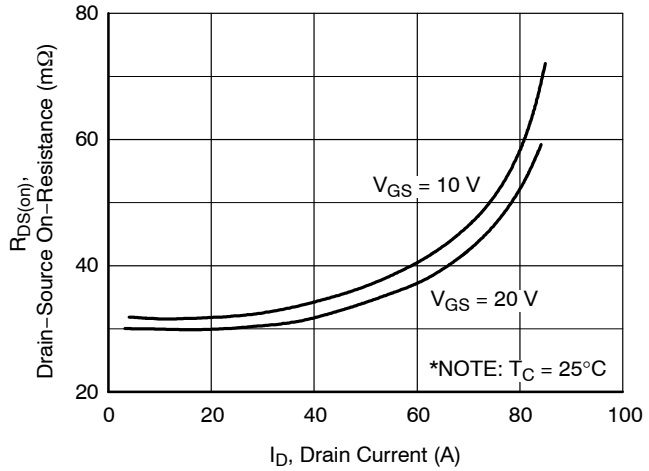

Figure 3. On−Resistance Variation vs. Drain Current and Gate Voltage

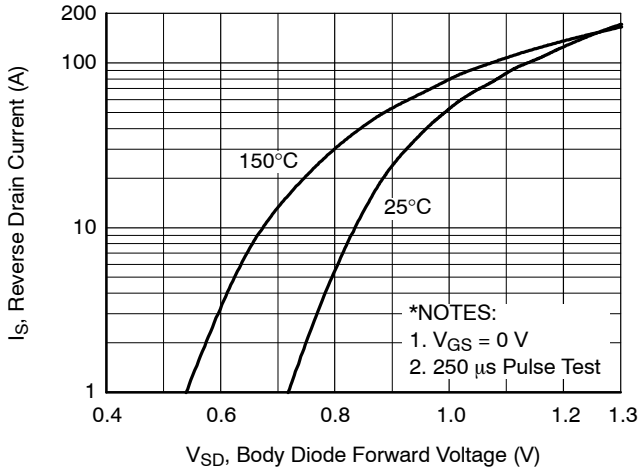

Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

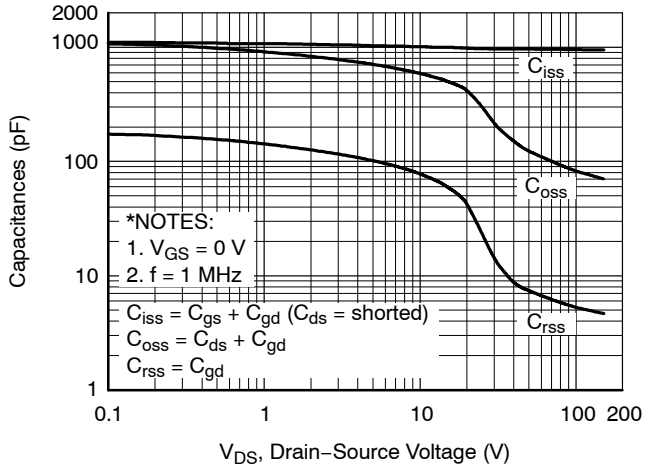

Figure 5. Capacitance Characteristics

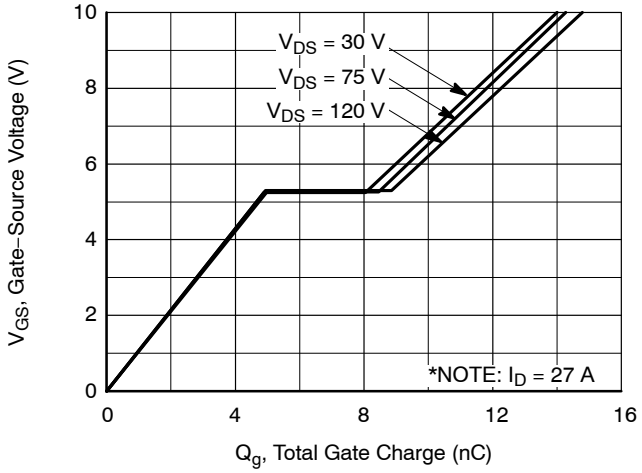

Figure 6. Gate Charge Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

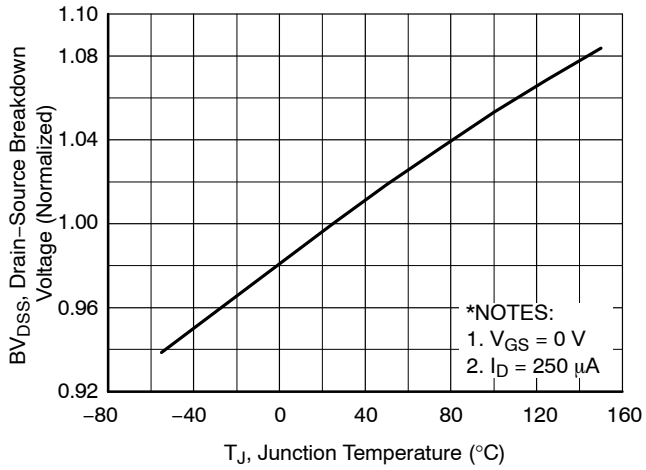

Figure 7. Breakdown Voltage Variation vs. Temperature

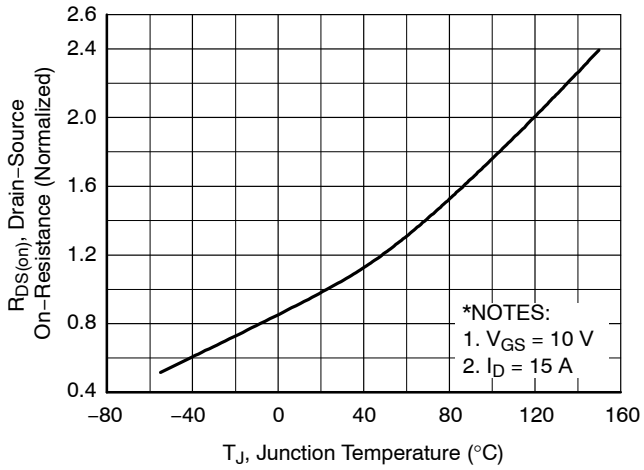

Figure 8. On−Resistance Variation vs. Temperature

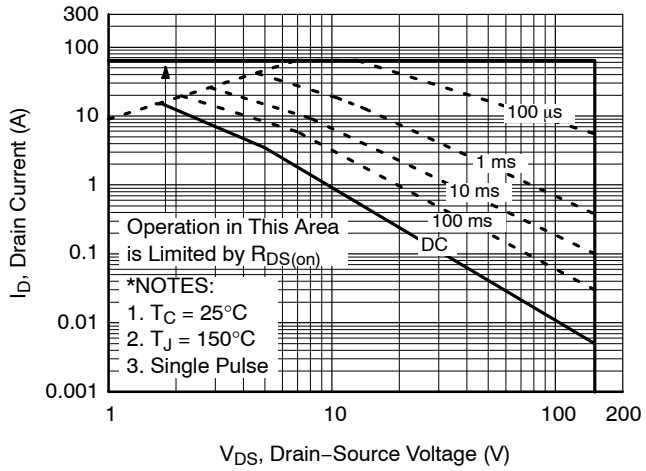

Figure 9. Maximum Safe Operating Area

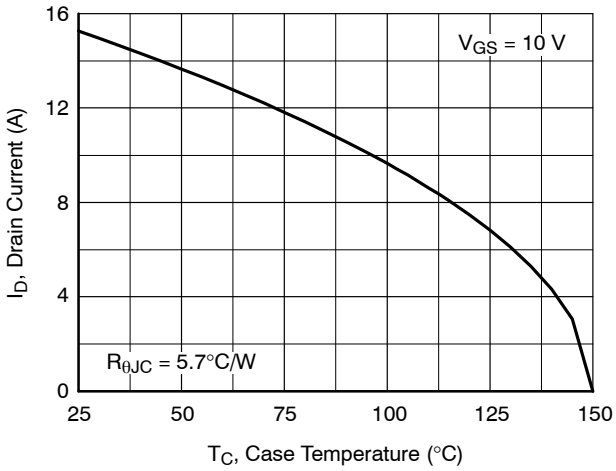

Figure 10. Maximum Drain Current vs. Case Temperature

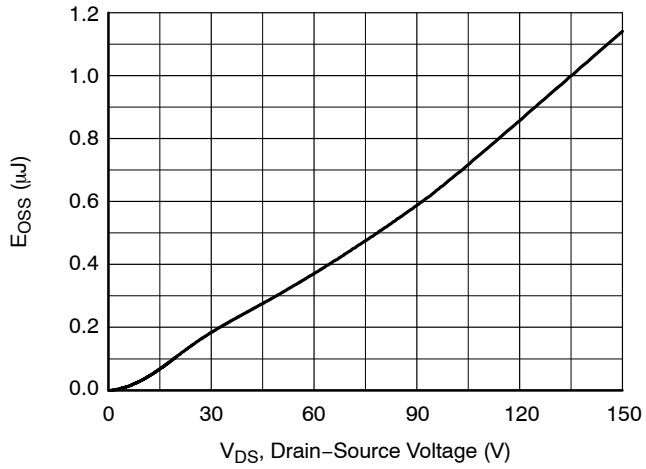

Figure 11. E_{OSS} vs. Drain to Source Voltage

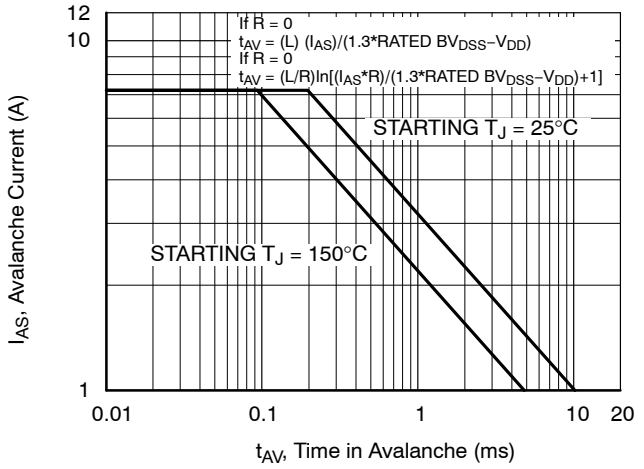

Figure 12. Unclamped Inductive Switching Capability

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

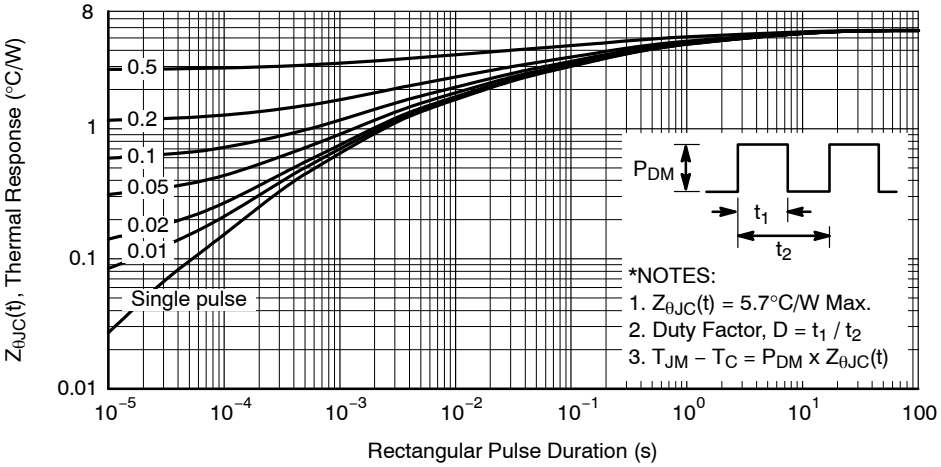

Figure 13. Transient Thermal Response Curve

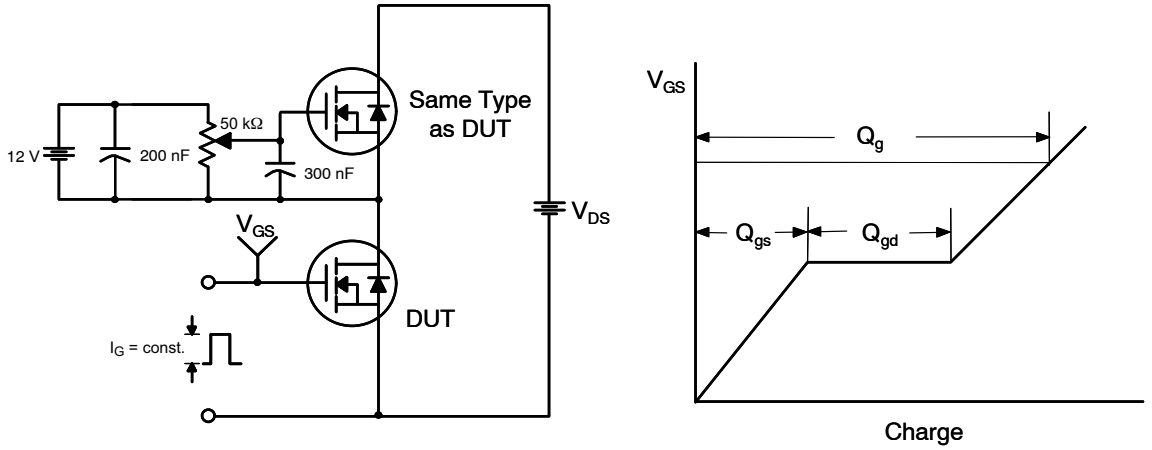

Figure 14. Gate Charge Test Circuit & Waveform

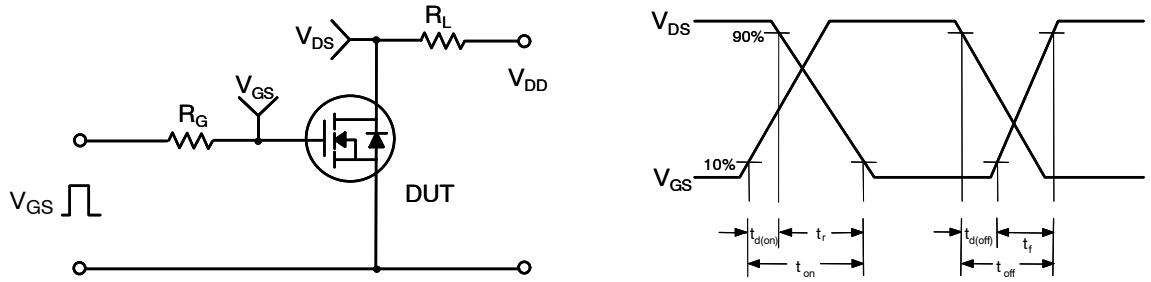

Figure 15. Resistive Switching Test Circuit & Waveforms

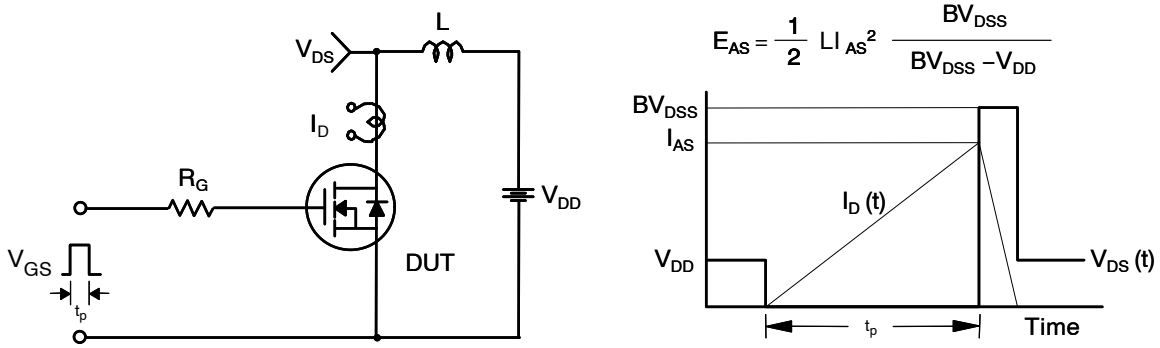

Figure 16. Unclamped Inductive Switching Test Circuit & Waveforms

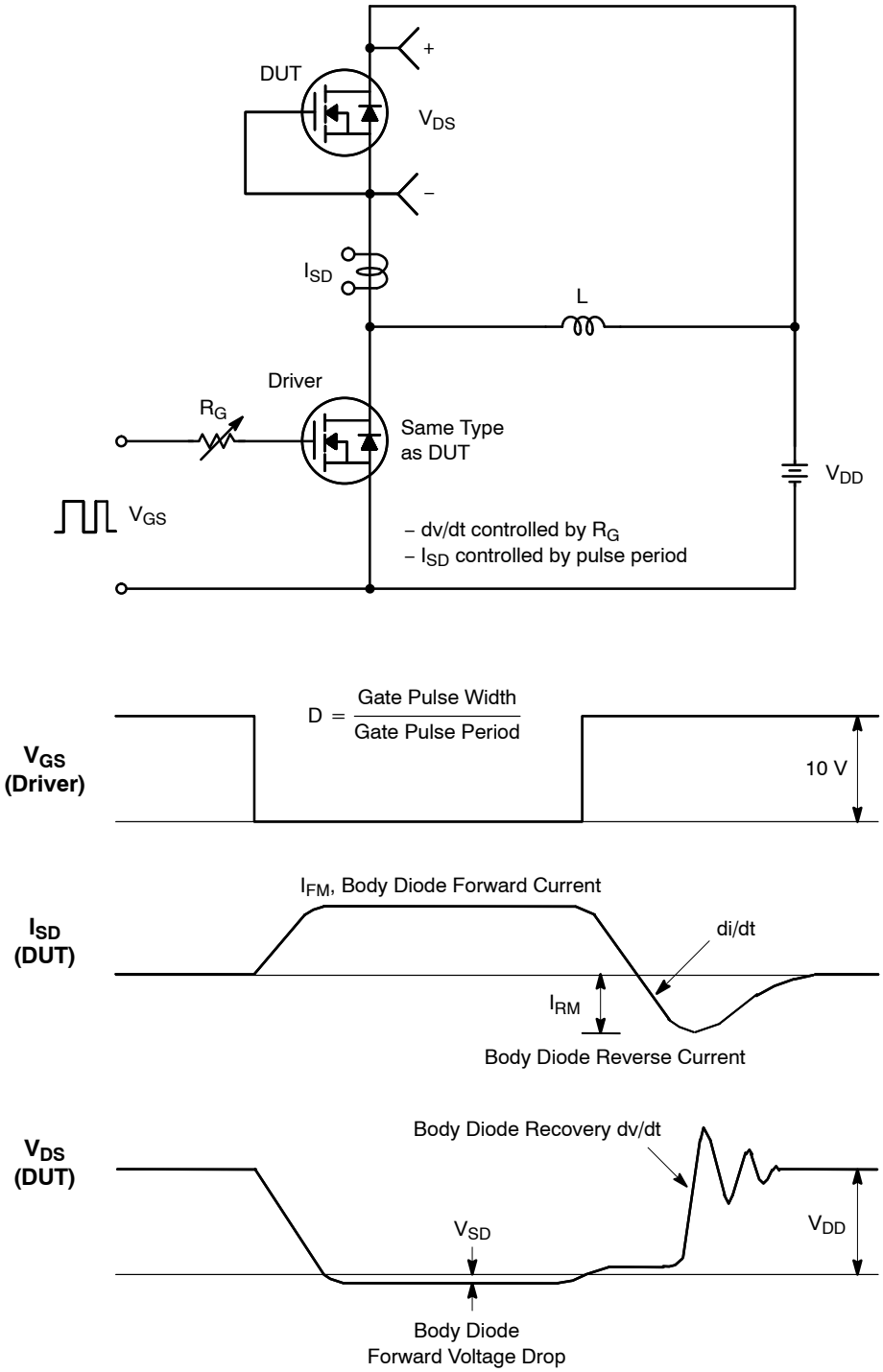

Figure 17. Peak Diode Recovery dv/dt Test Circuit & Waveforms

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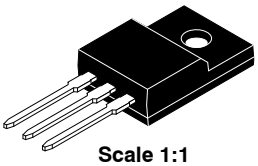
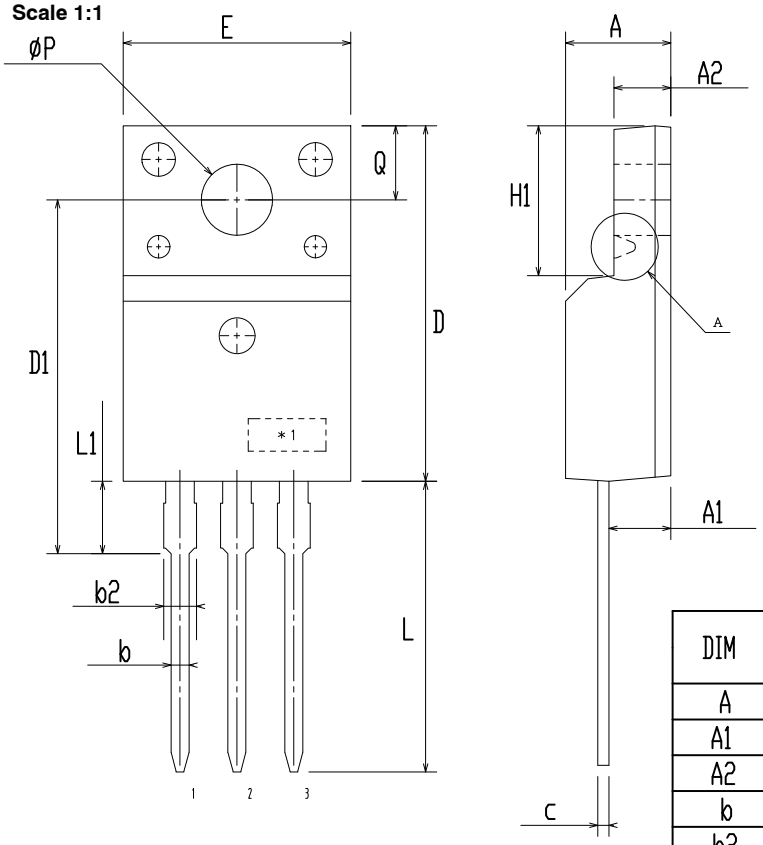
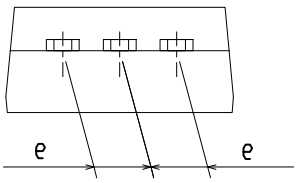
TO−220 Fullpack, 3−Lead / TO−220F−3SG
CASE 221AT
ISSUE B

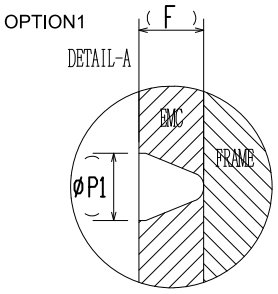
DATE 19 JAN 2021



Scale 1:1







DIM	MILLIMITERS		
	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
ø P	2.98	3.18	3.38
ø 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 PROTRUCSIONS.
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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