

# MOSFET – N-Channel, UniFET™

**250 V, 33 A, 94 mΩ**

## FDPF33N25T

### Description

UniFET MOSFET is onsemi's high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-state resistance, and to provide better switching performance and higher avalanche energy strength. This device family is suitable for switching power converter applications such as power factor correction (PFC), flat panel display (FPD) TV power, ATX and electronic lamp ballasts.

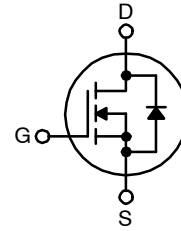
### Features

- $R_{DS(on)} = 94 \text{ m}\Omega$  (Max.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 16.5 \text{ A}$
- Low Gate Charge (Typ. 36.8 nC)
- Low  $C_{rss}$  (Typ. 39 pF)
- 100% Avalanche Tested

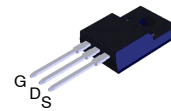
### Applications

- PDP TV
- Lighting
- Uninterruptible Power Supply
- AC-DC Power Supply

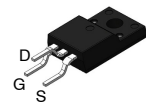
$V_{DSS}$	$R_{DS(on)}$ MAX	$I_D$ MAX
250 V	94 mΩ @ 10 V	33 A



N-Channel MOSFET

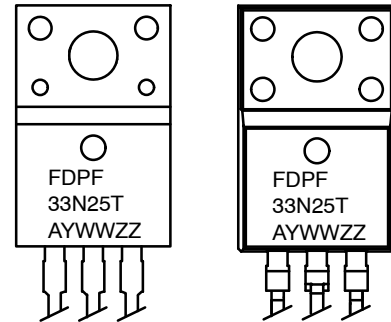


TO-220 Fullpack,  
 3-Lead /  
 TO-220F-3SG  
 CASE 221AT



TO-220-3LD LF  
 (LG-formed)  
 CASE 340BL

### MARKING DIAGRAM



FDPF33N25T = Specific Device Code  
 A = Assembly Location  
 YWW = Date Code (Year & Week)  
 ZZ = Assembly Lot

### ORDERING INFORMATION

See detailed ordering and shipping information on page 3 of this data sheet.

# FDPF33N25T

## ABSOLUTE MAXIMUM RATINGS (T<sub>C</sub> = 25°C unless otherwise noted)

Symbol	Parameter	FDPF33N25T FDPF33N25TRDTU	Unit
V <sub>DSS</sub>	Drain-Source Voltage	250	V
I <sub>D</sub>	Drain Current	- Continuous (T <sub>C</sub> = 25°C) - Continuous (T <sub>C</sub> = 100°C)	33* 20.4*
I <sub>DM</sub>	Drain Current	- Pulsed (Note 1)	132*
V <sub>GSS</sub>	Gate-Source Voltage	±30	V
E <sub>AS</sub>	Single Pulsed Avalanche Energy (Note 2)	918	mJ
I <sub>AR</sub>	Avalanche Current (Note 1)	33	A
E <sub>AR</sub>	Repetitive Avalanche Energy (Note 1)	23.5	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5	V/ns
P <sub>D</sub>	Power Dissipation	(T <sub>C</sub> = 25°C) - Derate Above 25°C	37 0.29
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range	-55 to +150	°C
T <sub>L</sub>	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.

\*Drain current limited by maximum junction temperature.

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. L = 1.35 mH, I<sub>AS</sub> = 33 A, V<sub>DD</sub> = 50 V, R<sub>G</sub> = 25 Ω, starting T<sub>J</sub> = 25°C.
3. I<sub>SD</sub> ≤ 33 A, di/dt ≤ 200 A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, starting T<sub>J</sub> = 25°C.

## THERMAL CHARACTERISTICS

Symbol	Parameter	FDPF33N25T FDPF33N25TRDTU	Unit
R <sub>θJC</sub>	Thermal Resistance, Junction-to-Case, Max.	3.4	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction-to-Ambient, Max.	62.5	°C/W

# FDPF33N25T

## ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA, T <sub>J</sub> = 25°C	250	-	-	V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25°C	-	0.25	-	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 250 V, V <sub>GS</sub> = 0 V V <sub>DS</sub> = 200 V, T <sub>C</sub> = 125°C	-	-	1 10	μA μA
I <sub>GSSF</sub>	Gate-Body Leakage Current, Forward	V <sub>GS</sub> = 30 V, V <sub>DS</sub> = 0 V	-	-	100	nA
I <sub>GSSR</sub>	Gate-Body Leakage Current, Reverse	V <sub>GS</sub> = -30 V, V <sub>DS</sub> = 0V	-	-	-100	nA

## ON CHARACTERISTICS

V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	3.0	-	5.0	V
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 16.5 A	-	0.077	0.094	Ω
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 40 V, I <sub>D</sub> = 16.5 A	-	26.6	-	S

## DYNAMIC CHARACTERISTICS

C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V, f = 1.0 MHz	-	1640	2135	pF
C <sub>oss</sub>	Output Capacitance		-	330	430	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		-	39	59	pF

## SWITCHING CHARACTERISTICS

t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 125 V, I <sub>D</sub> = 33 A, V <sub>GS</sub> = 10 V, R <sub>G</sub> = 25 Ω (Note 4)	-	35	80	ns
t <sub>r</sub>	Turn-On Rise Time		-	230	470	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		-	75	160	ns
t <sub>f</sub>	Turn-Off Fall Time		-	120	250	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 200 V, I <sub>D</sub> = 33 A, V <sub>GS</sub> = 10 V (Note 4)	-	36.8	48	nC
Q <sub>gs</sub>	Gate-Source Charge		-	10	-	nC
Q <sub>gd</sub>	Gate-Drain Charge		-	17	-	nC

## DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current	-	-	33	A	
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current	-	-	132	A	
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 33 A	-	-	1.4	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 33 A, di <sub>F</sub> /dt = 100 A/μs	-	220	-	ns
Q <sub>rr</sub>	Reverse Recovery Charge		-	1.71	-	μC

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.

## PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Mark	Package	Shipping
FDPF33N25T	FDPF33N25T	TO-220 Fullpack, 3-Lead / TO-220F-3SG CASE 221AT	1000 Units / Tube
FDPF33N25TRDTU	FDPF33N25T	TO-220-3LD LF (LG-formed) CASE 340BL	800 Units / Tube

TYPICAL PERFORMANCE CHARACTERISTICS

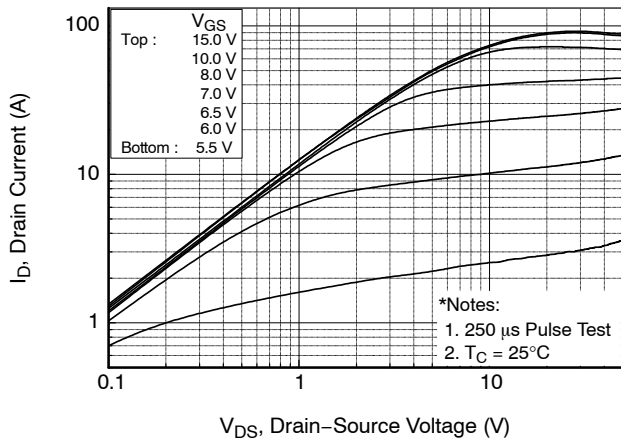


Figure 1. On-Region Characteristics

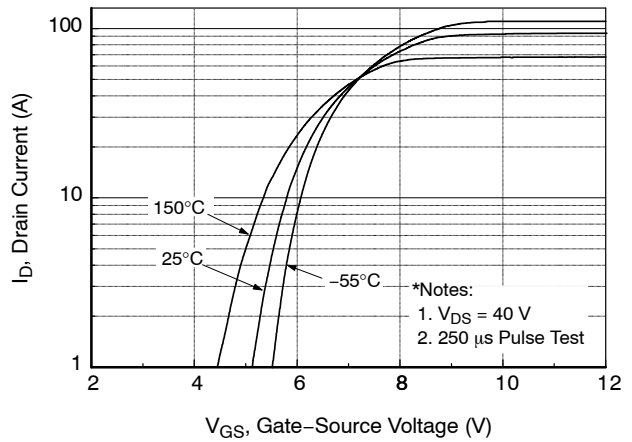


Figure 2. Transfer Characteristics

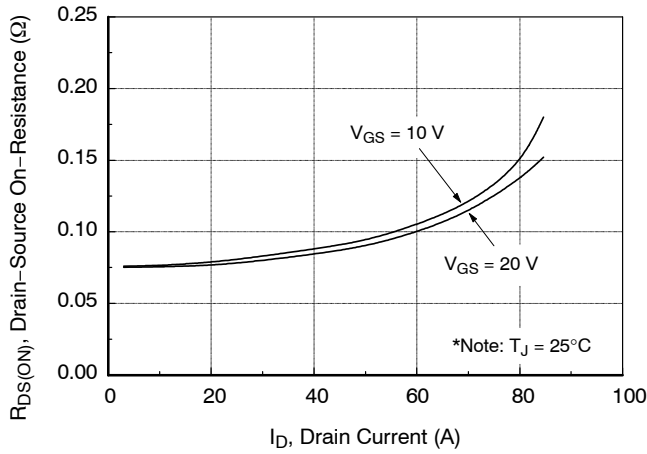


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

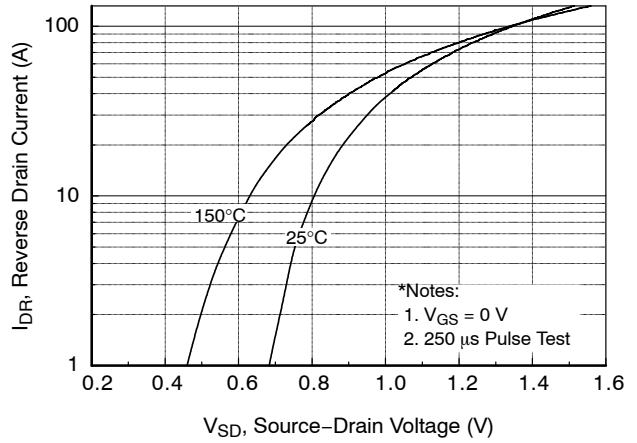


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

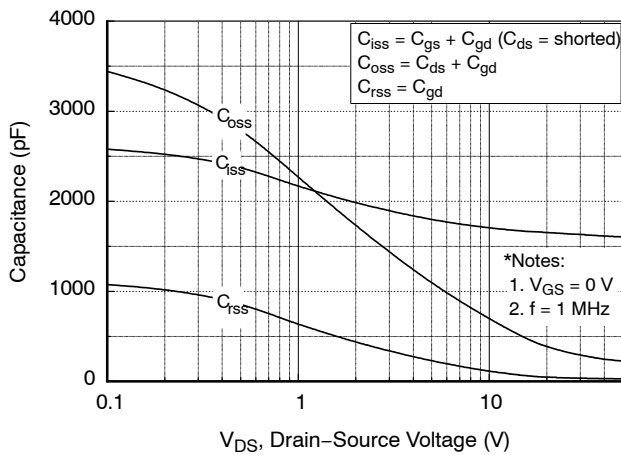


Figure 5. Capacitance Characteristics

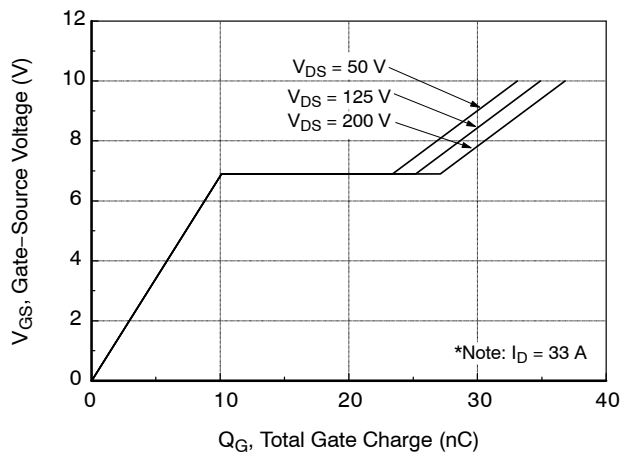
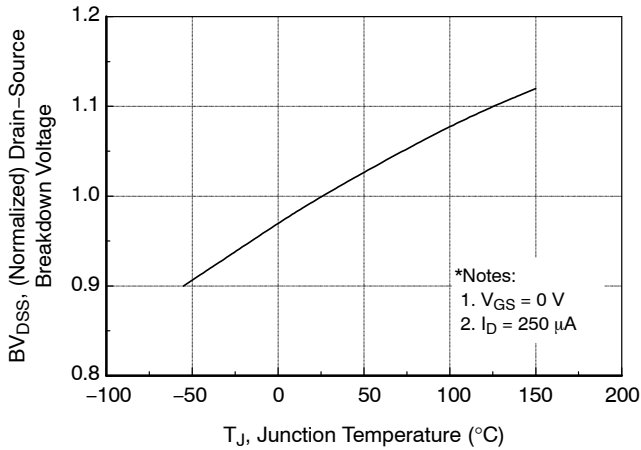


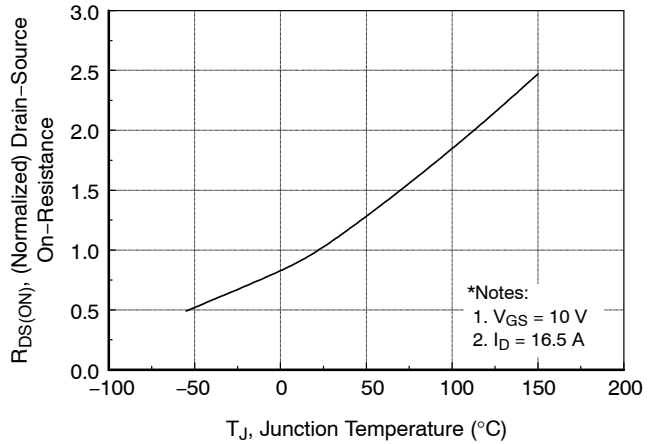
Figure 6. Gate Charge Characteristics

# FDPF33N25T

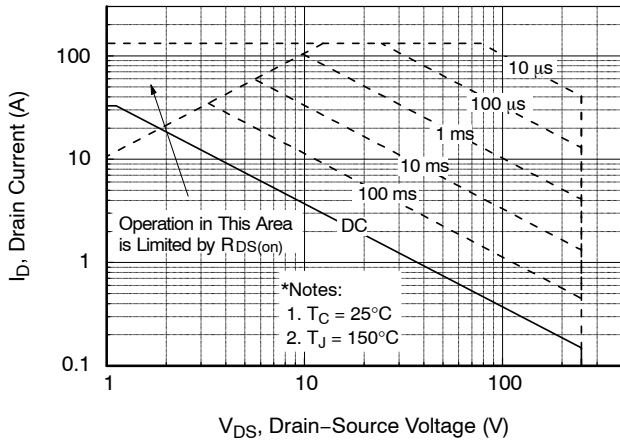
## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)



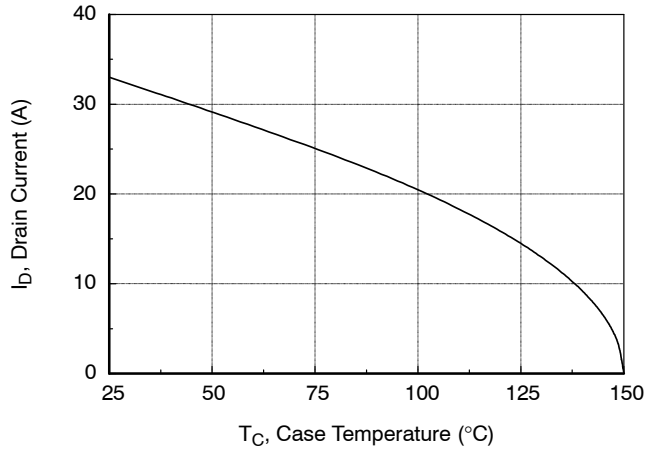
**Figure 7. Breakdown Voltage Variation vs. Temperature**



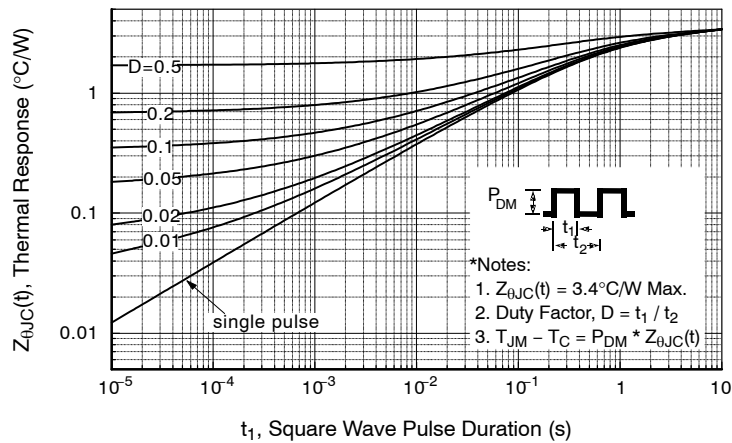
**Figure 8. On-Resistance Variation vs. Temperature**



**Figure 9. Maximum Safe Operating Area**



**Figure 10. Maximum Drain Current vs. Case Temperature**



**Figure 11. Transient Thermal Response Curve**

# FDPF33N25T

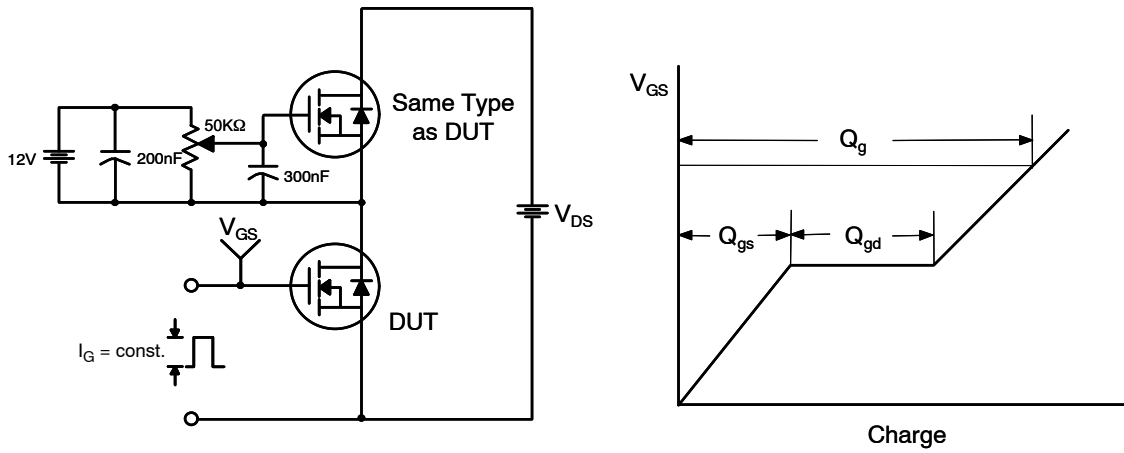


Figure 12. Gate Charge Test Circuit & Waveform

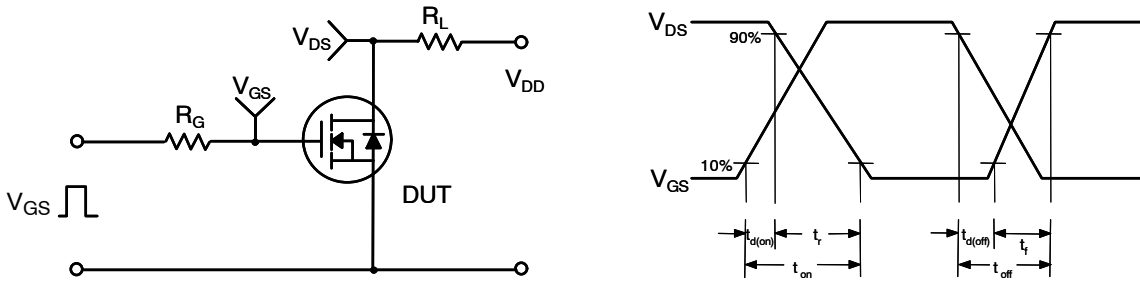


Figure 13. Resistive Switching Test Circuit & Waveforms

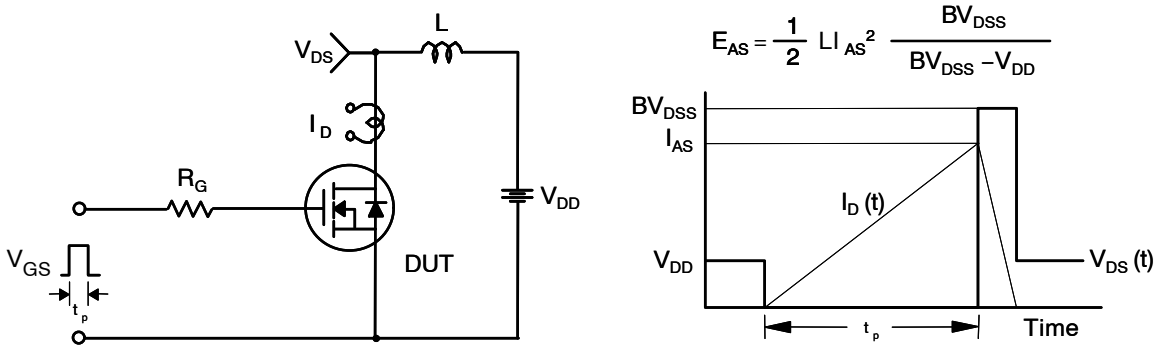


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

# FDPF33N25T

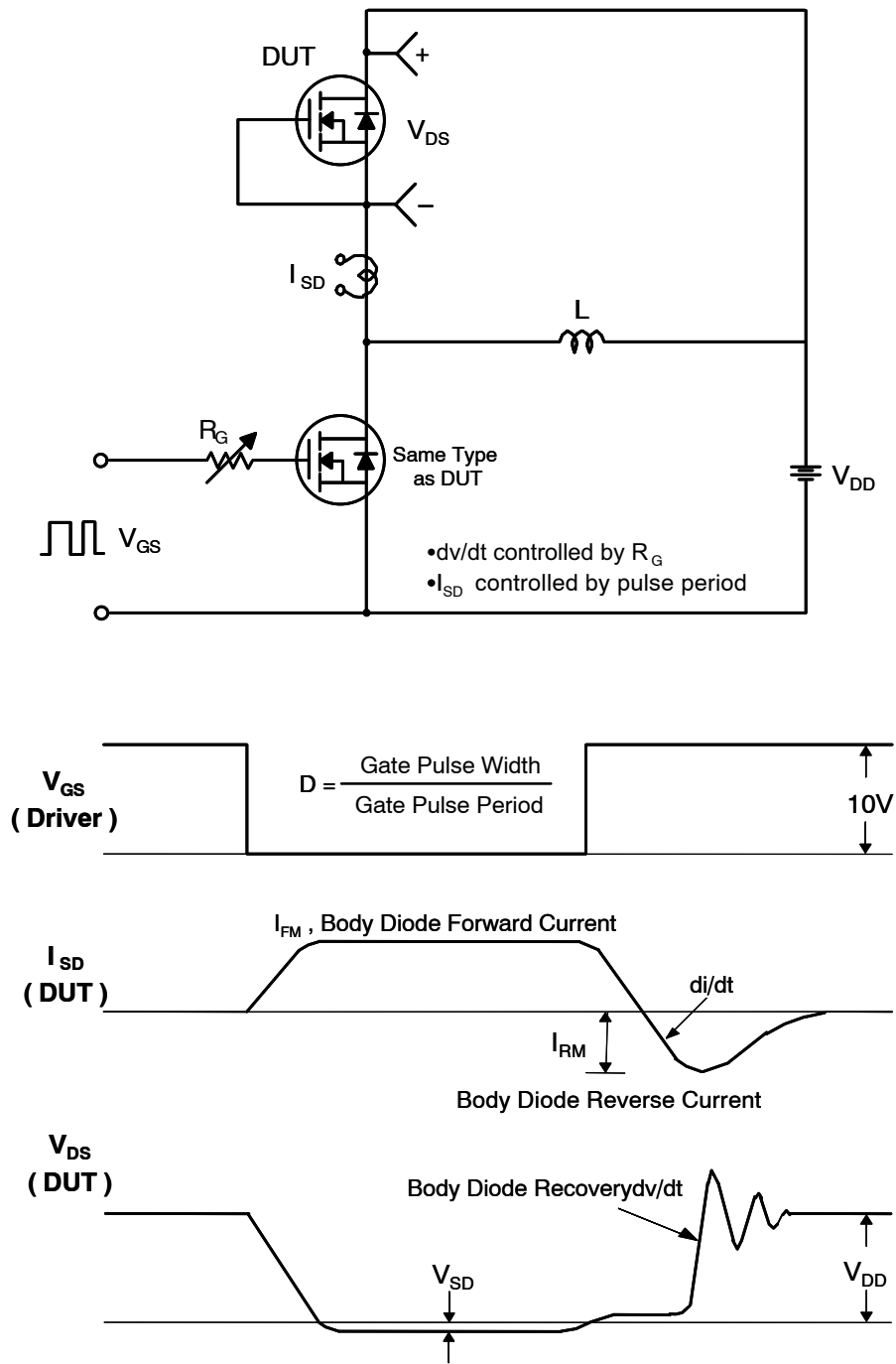


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

# MECHANICAL CASE OUTLINE

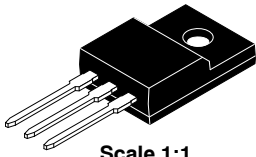
## PACKAGE DIMENSIONS

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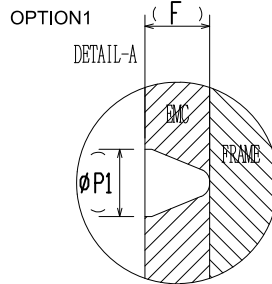
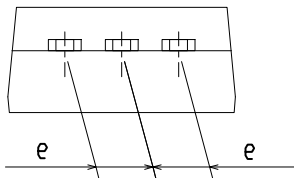
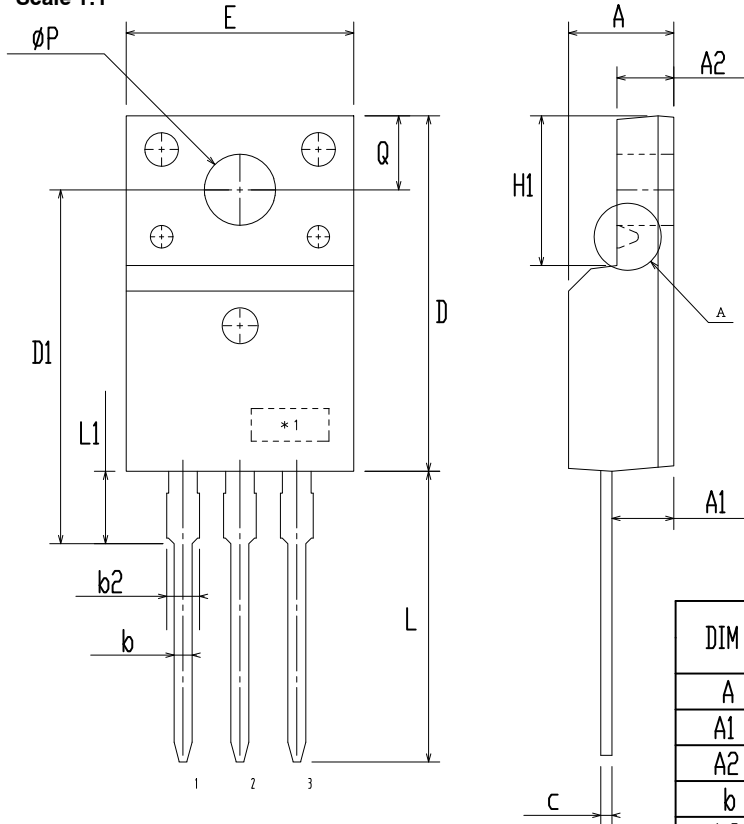


TO-220 Fullpack, 3-Lead / TO-220F-3SG  
CASE 221AT  
ISSUE B

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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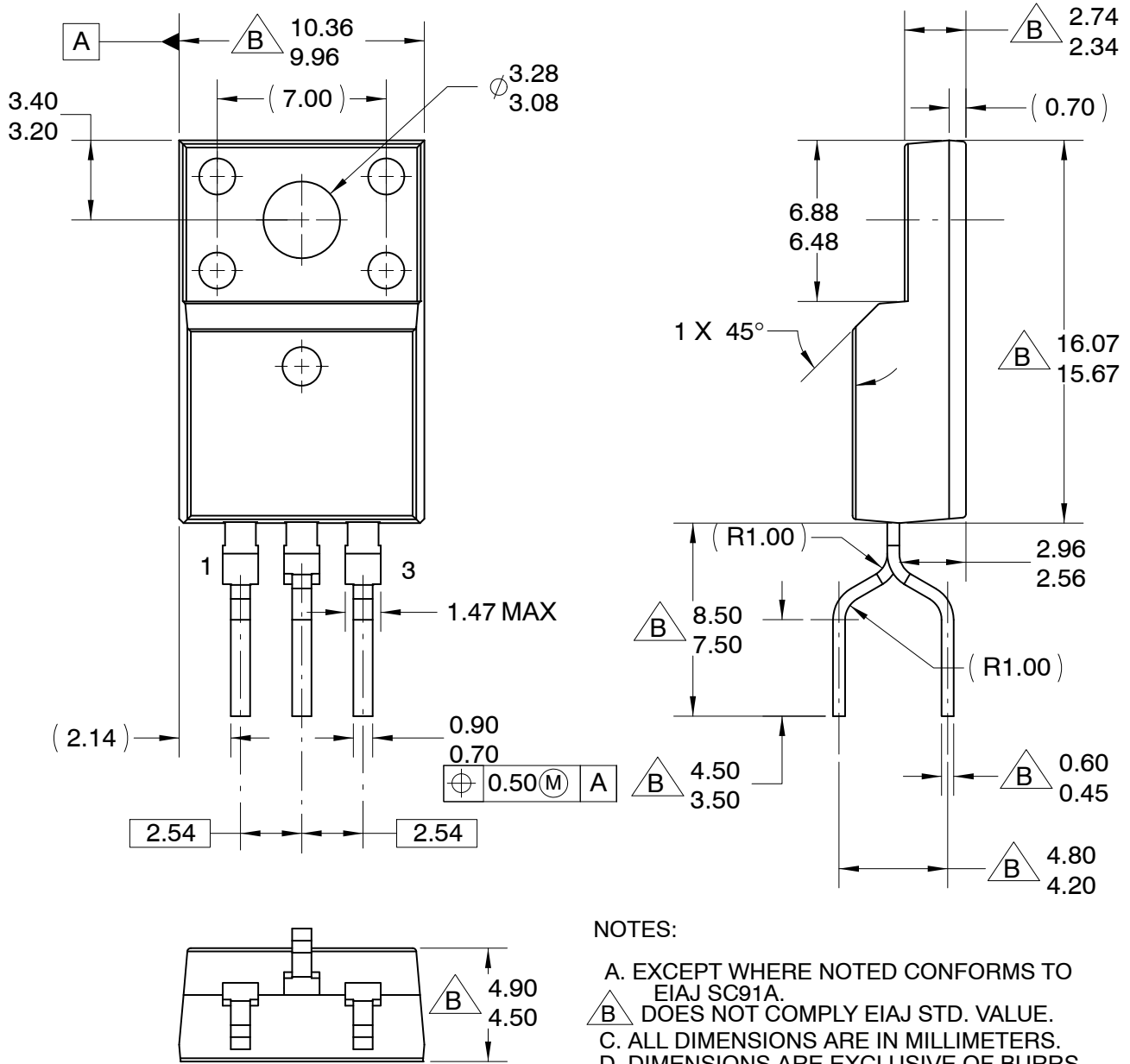
**MECHANICAL CASE OUTLINE**  
**PACKAGE DIMENSIONS**

ON Semiconductor®



TO-220-3LD LF  
CASE 340BL  
ISSUE O

DATE 31 AUG 2016



**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.

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