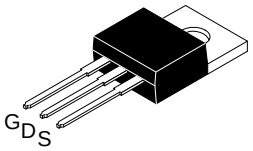
MOSFET – N-Channel, UniFET™

250 V, 33 A, 94 mΩ

FDP33N25

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



TO−220−3LD
CASE 340AT

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.

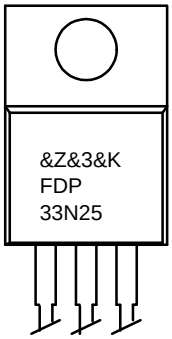
Features

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

Applications

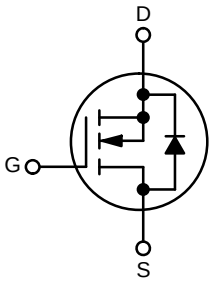
- PDP TV
- Lighting
- Uninterruptible Power Supply
- AC−DC Power Supply

MARKING DIAGRAM



&Z	= Assembly Plant Code
&3	= 3−Digit Date Code
&K	= 2−Digits Lot Run Traceability Code
FDP33N25	= Specific Device Code

N−CHANNEL MOSFET



ABSOLUTE MAXIMUM RATINGS (T_C = 25°C, unless otherwise noted)

Symbol	Parameter		FDP33N25	Unit
V_{DSS}	Drain−Source Voltage		250	V
I_D	Drain Current	− Continuous (T_C = 25°C)	33	A
		− Continuous (T_C = 100°C)	20.4	
I_{DM}	Drain Current	− Pulsed (Note 1)	132	A
V_{GSS}	Gate−Source Voltage		±30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		918	mJ
I_{AR}	Avalanche Current (Note 1)		33	A
E_{AR}	Repetitive Avalanche Energy (Note 1)		23.5	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)		4.5	V/ns
P_D	Power Dissipation	(T_C = 25°C)	235	W
		− Derate Above 25°C	1.89	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		−55 to +150	°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. L = 1.35 mH, I_{AS} = 33 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C.
3. I_{SD} ≤ 33 A, di/dt ≤ 200 A/μs, V_{DD} ≤ BV_{DSS}, starting T_J = 25°C.

ORDERING INFORMATION

Part Number	Package	Shipping
FDP33N25	TO−220−3LD (Pb−Free, Halide Free)	1000 Units / Tube

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THERMAL CHARACTERISTICS

Symbol	Parameter	FDP33N25	Unit
$R_{\theta JC}$	Thermal Resistance, Junction−to−Case, Max.	0.53	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction−to−Ambient, Max.	62.5	°C/W

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
BV_{DSS}	Drain−Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA, T_J = 25°C	250	−	−	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	−	0.25	−	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 250 V, V_{GS} = 0 V	−	−	1	μA
		V_{DS} = 200 V, T_C = 125°C	−	−	10	
I_{GSSF}	Gate−Body Leakage Current, Forward	V_{GS} = 30 V, V_{DS} = 0 V	−	−	100	nA
I_{GSSR}	Gate−Body Leakage Current, Reverse	V_{GS} = −30 V, V_{DS} = 0 V	−	−	−100	nA
ON CHARACTERISTICS						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 μA	3.0	−	5.0	V
$R_{DS(on)}$	Static Drain−Source On−Resistance	V_{GS} = 10 V, I_D = 16.5 A	−	0.077	0.094	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40 V, I_D = 16.5 A	−	26.6	−	S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	−	1640	2135	pF
C_{oss}	Output Capacitance		−	330	430	pF
C_{rss}	Reverse Transfer Capacitance		−	39	59	pF
SWITCHING CHARACTERISTICS						
$t_{d(on)}$	Turn−On Delay Time	V_{DD} = 125 V, I_D = 33 A, V_{GS} = 10 V, R_G = 25 Ω (Note 4)	−	35	80	ns
t_r	Turn−On Rise Time		−	230	470	ns
$t_{d(off)}$	Turn−Off Delay Time		−	75	160	ns
t_f	Turn−Off Fall Time		−	120	250	ns
Q_g	Total Gate Charge	V_{DS} = 200 V, I_D = 33 A, V_{GS} = 10 V (Note 4)	−	36.8	48	nC
Q_{gs}	Gate−Source Charge		−	10	−	nC
Q_{gd}	Gate−Drain Charge		−	17	−	nC
DRAIN−SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
I_S	Maximum Continuous Drain−Source Diode Forward Current		−	−	33	A
I_{SM}	Maximum Pulsed Drain−Source Diode Forward Current		−	−	132	A
V_{SD}	Drain−Source Diode Forward Voltage	V_{GS} = 0 V, I_{SD} = 33 A	−	−	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_{SD} = 33 A, dI_F/dt = 100 A/μs	−	220	−	ns
Q_{rr}	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.

TYPICAL CHARACTERISTICS

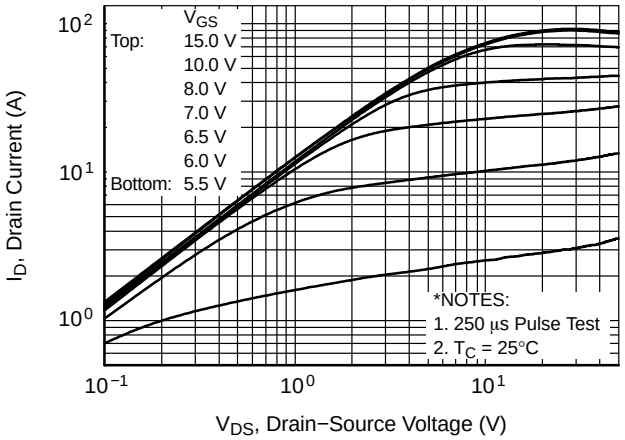

Figure 1. On−Region Characteristics

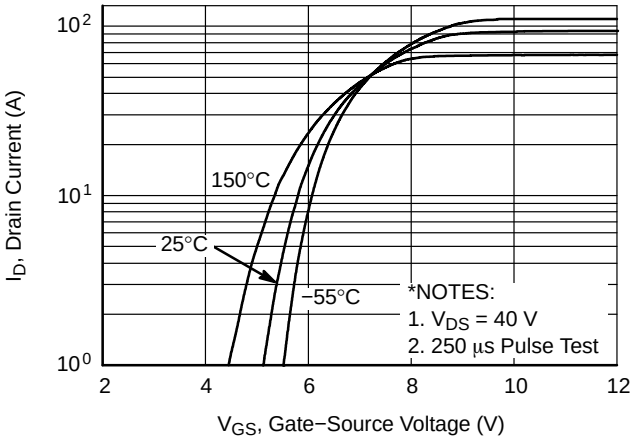

Figure 2. Transfer Characteristics

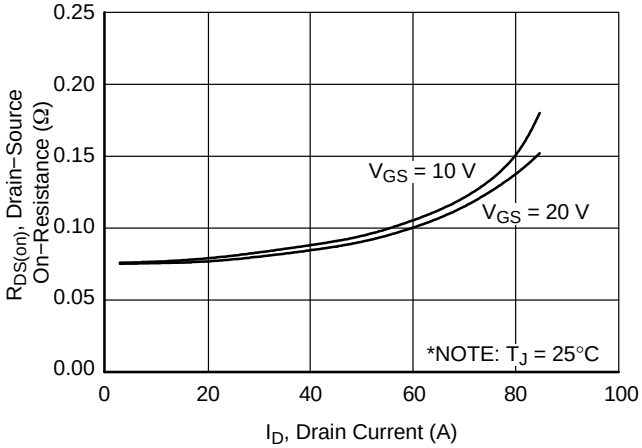

Figure 3. On−Resistance Variation vs. Drain Current and Gate Voltage

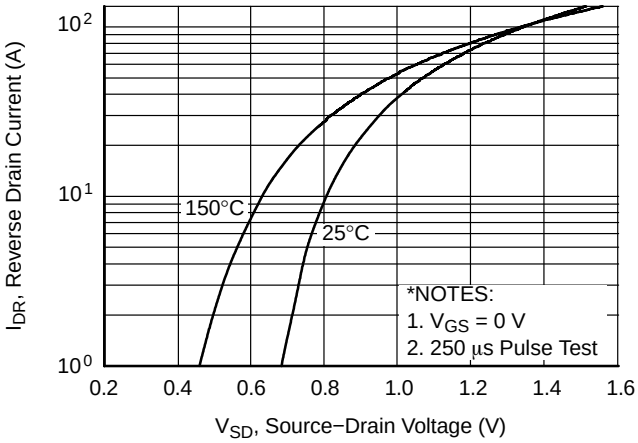

Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

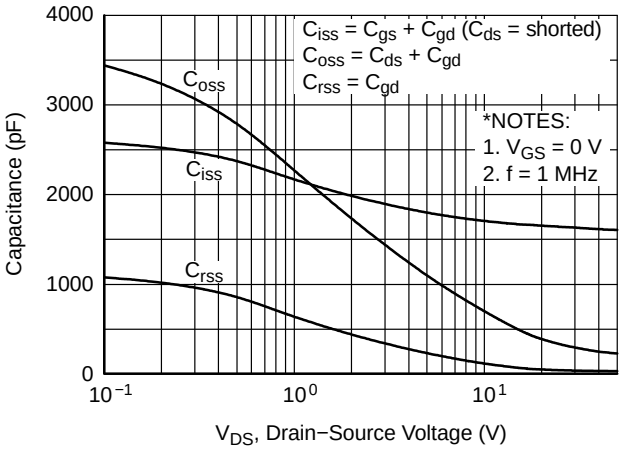

Figure 5. Capacitance Characteristics

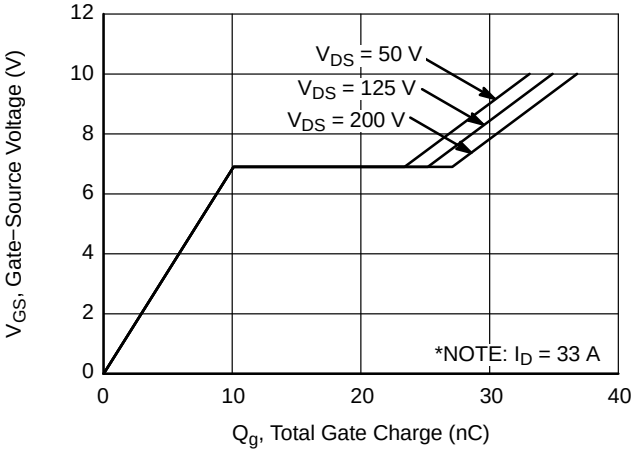

Figure 6. Gate Charge Characteristics

TYPICAL CHARACTERISTICS (CONTINUED)

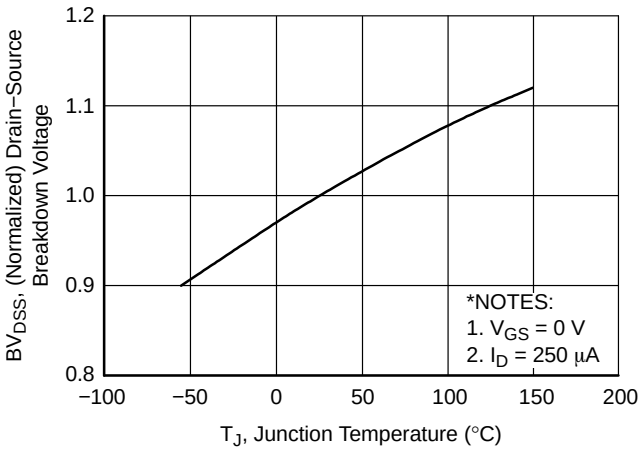

Figure 7. Breakdown Voltage Variation vs. Temperature

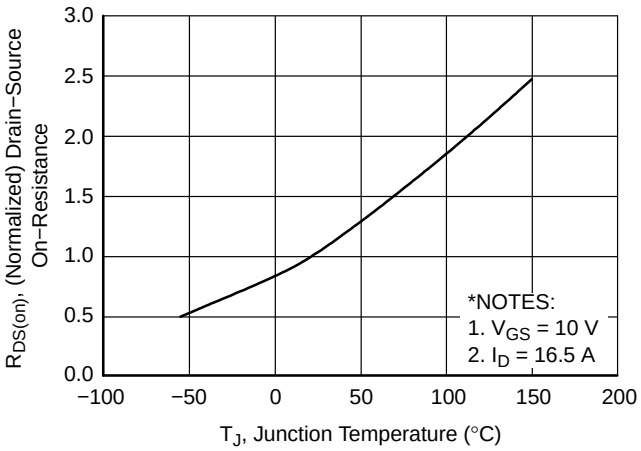

Figure 8. On−Resistance Variation vs. Temperature

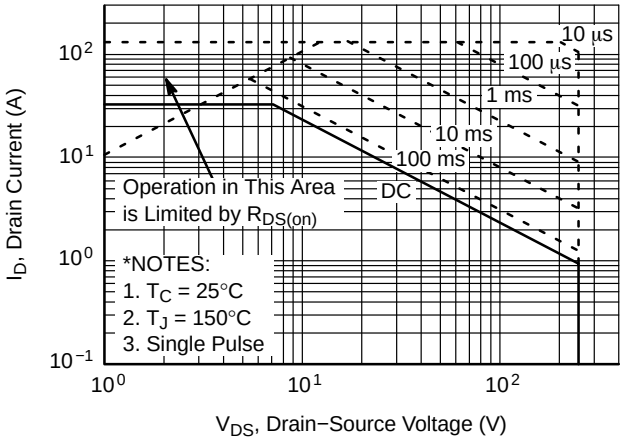

Figure 9. Maximum Safe Operating Area

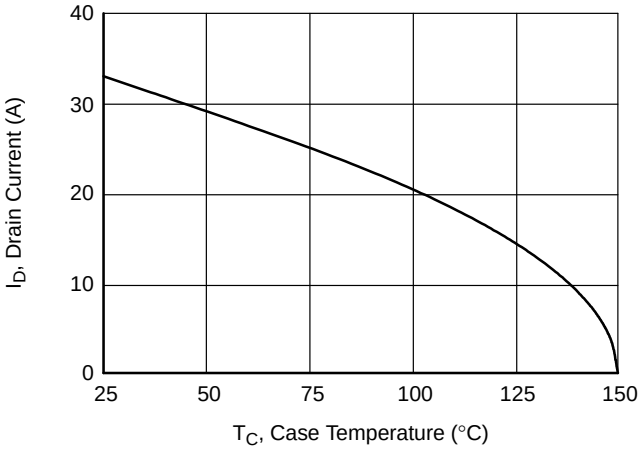

Figure 10. Maximum Drain Current vs. Case Temperature

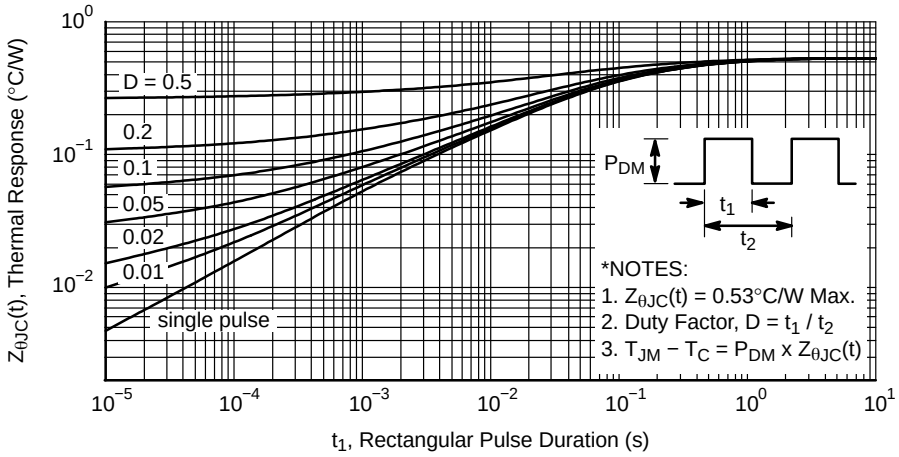

Figure 11. Transient Thermal Response Curve

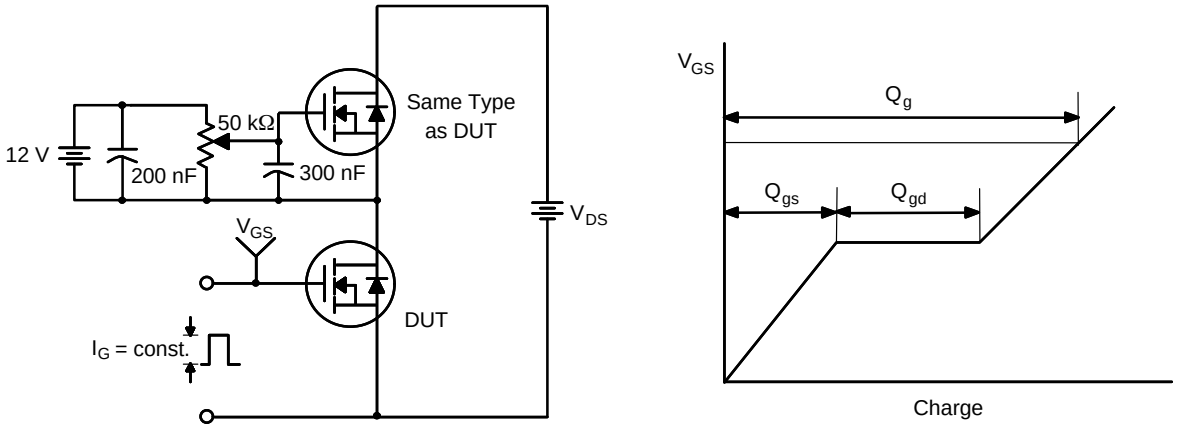

Figure 12. Gate Charge Test Circuit & Waveform

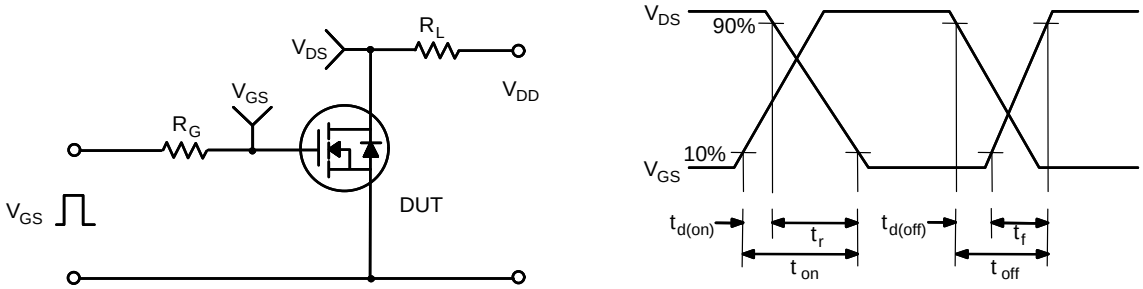

Figure 13. Resistive Switching Test Circuit & Waveforms

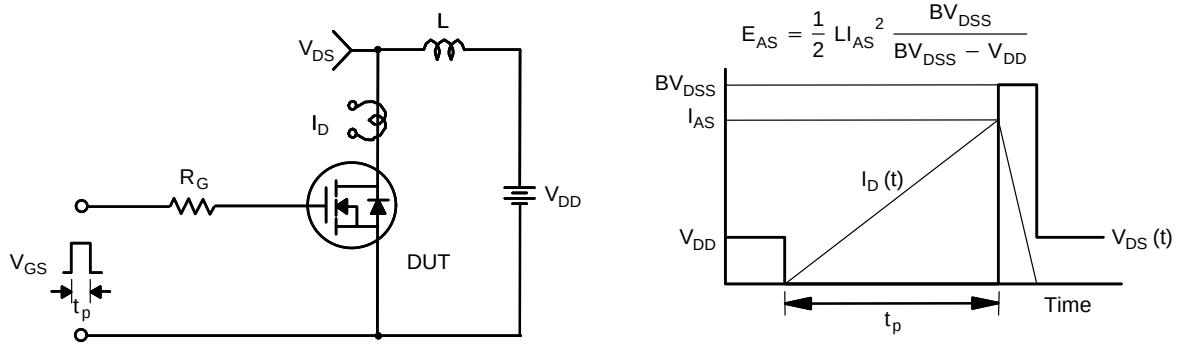

Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

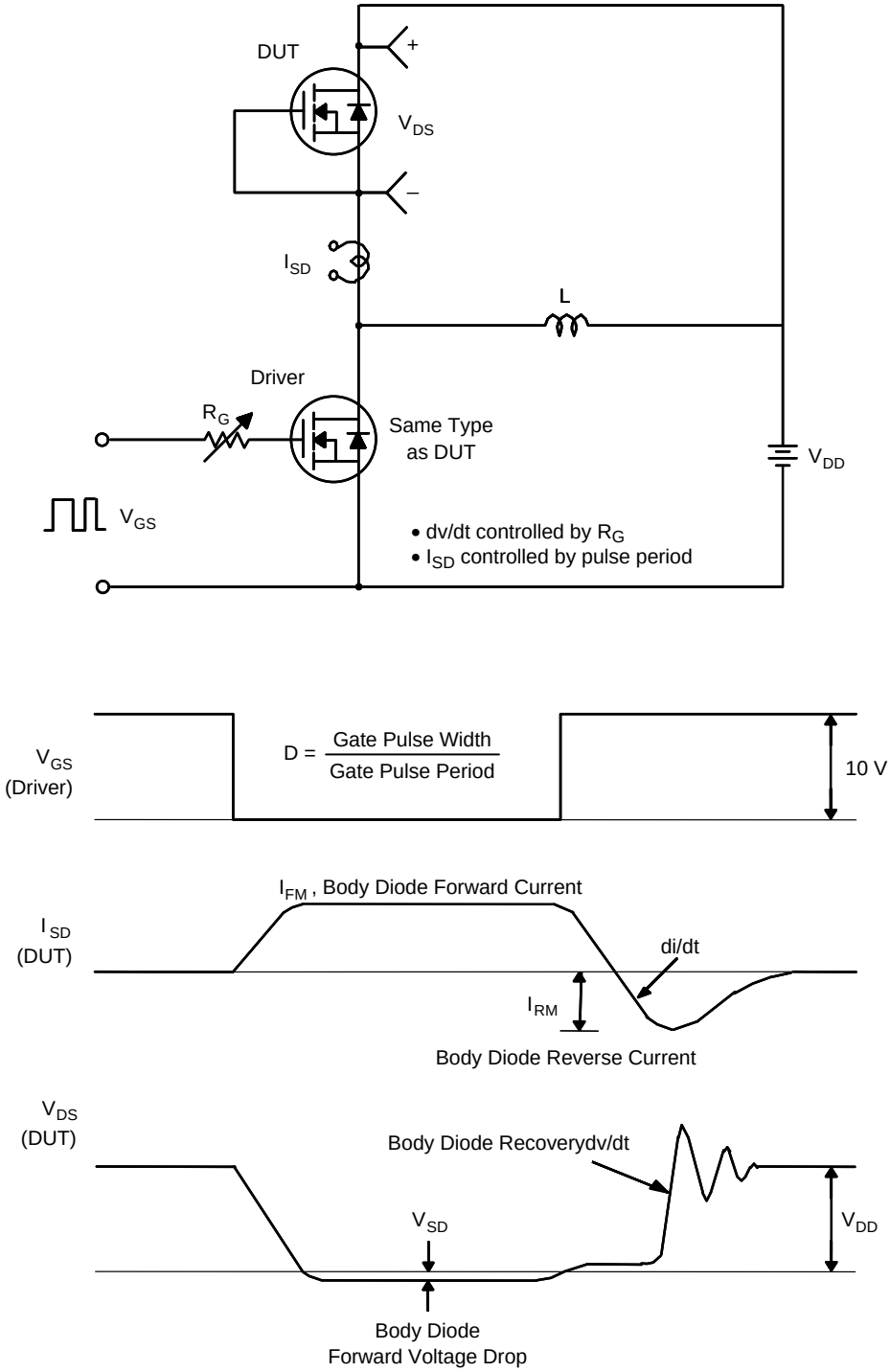

Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

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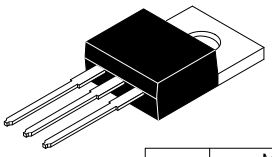
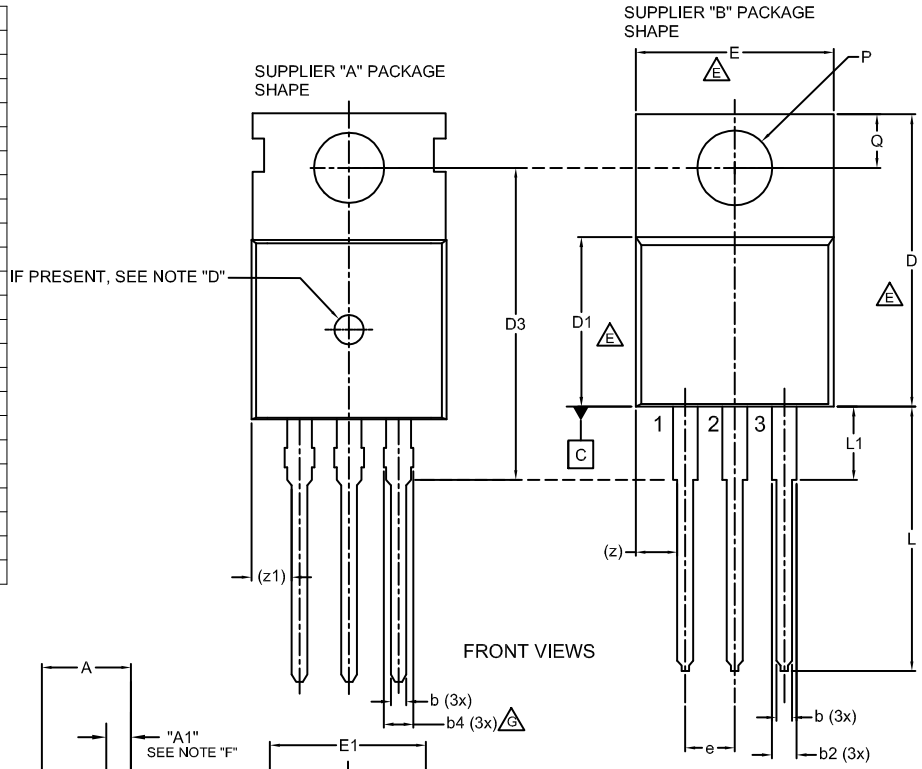
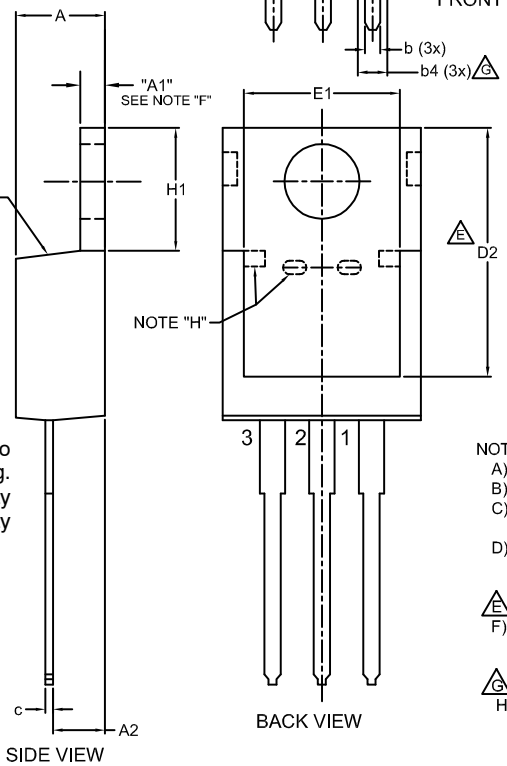


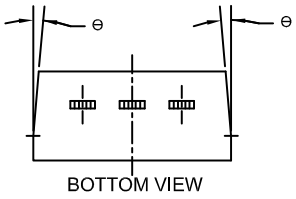
TO−220−3LD
CASE 340AT
ISSUE B

DATE 08 AUG 2022

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	4.00	--	4.70
A1	SEE NOTE "F"		
A2	2.10	--	2.85
b	0.55	--	1.00
b2	1.10	--	1.62
b4	1.42	--	1.62
c	0.36	--	0.60
D	13.90	--	16.30
D1	8.13	--	9.40
D2	11.50	--	14.30
D3	15.42	--	16.51
E	9.65	--	10.67
E1	7.59	--	8.65
e	2.40	--	2.67
H1	6.06	--	6.69
L	12.70	--	14.04
L1	2.70	--	4.10
P	3.50	--	4.00
Q	2.50	--	3.40
z	2.13 REF		
z1	2.06 REF		
Θ	3°	–	5°







GENERIC MARKING DIAGRAM*

XXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
ZZ = Assembly Lot Code

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “▪”, may or may not be present. Some products may not follow the Generic Marking.

NOTES:
A) REFERENCE JEDEC, TO-220, VARIATION AB
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONS COMMON TO ALL PACKAGE SUPPLIERS EXCEPT WHERE NOTED [ ].
D) LOCATION OF MOLDED FEATURE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF THE PACKAGE)
E) DOES NOT COMPLY JEDEC STANDARD VALUE.
F) "A1" DIMENSIONS AS BELOW:
SINGLE GAUGE = 0.51 - 0.61
DUAL GAUGE = 1.10 - 1.45
G) PRESENCE IS SUPPLIER DEPENDENT
H) SUPPLIER DEPENDENT MOLD LOCKING HOLES IN HEATSINK.

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DESCRIPTION:	**TO−220−3LD**	**PAGE 1 OF 1**

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