

MOSFET – N-Channel, UniFET™

250 V, 33 A, 94 mΩ

FDP33N25

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

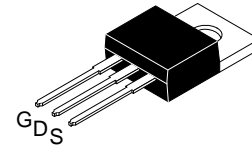
ABSOLUTE MAXIMUM RATINGS (T_C = 25°C, unless otherwise noted)

Symbol	Parameter	FDP33N25	Unit
V_{DSS}	Drain-Source Voltage	250	V
I_D	Drain Current	– Continuous (T_C = 25°C)	33
		– Continuous (T_C = 100°C)	20.4
I_{DM}	Drain Current	– Pulsed (Note 1)	132
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
		– Derate Above 25°C	1.89
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.

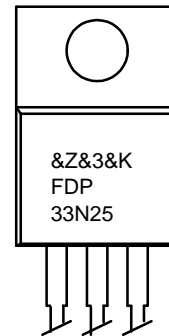
1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. L = 1.35 mH, I_{AS} = 33 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C.
3. I_{SD} ≤ 33 A, di/dt ≤ 200 A/μs, V_{DD} ≤ BV_{DSS} , starting T_J = 25°C.

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



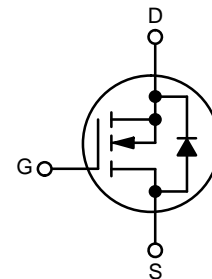
TO-220-3LD
CASE 340AT

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



ORDERING INFORMATION

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

FDP33N25

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 ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}, T_J = 25^\circ\text{C}$	250	–	–	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$, Referenced to 25°C	–	0.25	–	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 250\text{ V}, V_{GS} = 0\text{ V}$	–	–	1	μA
		$V_{DS} = 200\text{ V}, T_C = 125^\circ\text{C}$	–	–	10	
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$	–	–	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$	–	–	-100	nA

ON CHARACTERISTICS

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	3.0	–	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 16.5\text{ A}$	–	0.077	0.094	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 40\text{ V}, I_D = 16.5\text{ A}$	–	26.6	–	S

DYNAMIC CHARACTERISTICS

C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$	–	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	$V_{DD} = 125\text{ V}, I_D = 33\text{ A}, V_{GS} = 10\text{ V}, R_G = 25\text{ }\Omega$ (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	$V_{DS} = 200\text{ V}, I_D = 33\text{ A}, V_{GS} = 10\text{ V}$ (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

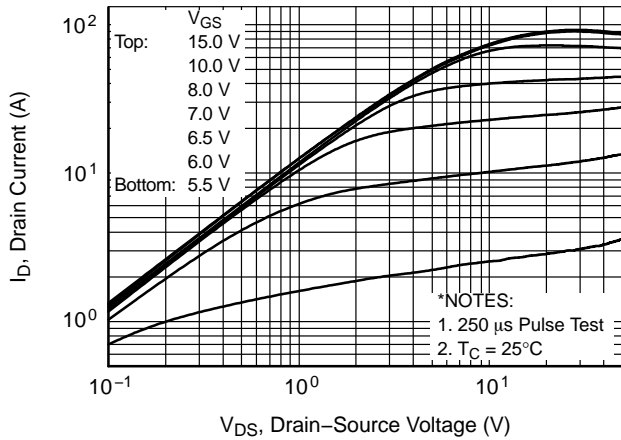


Figure 1. On-Region Characteristics

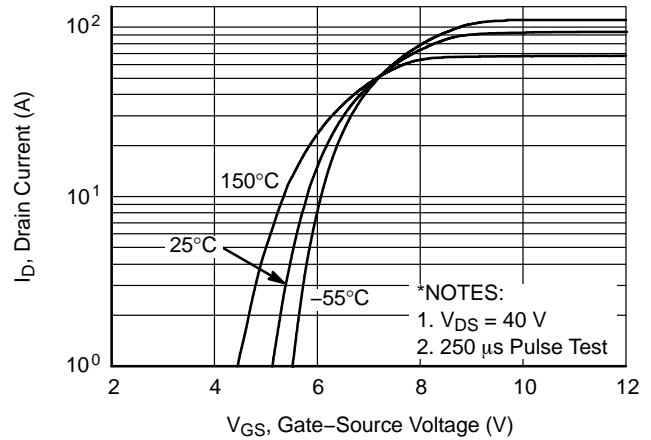


Figure 2. Transfer Characteristics

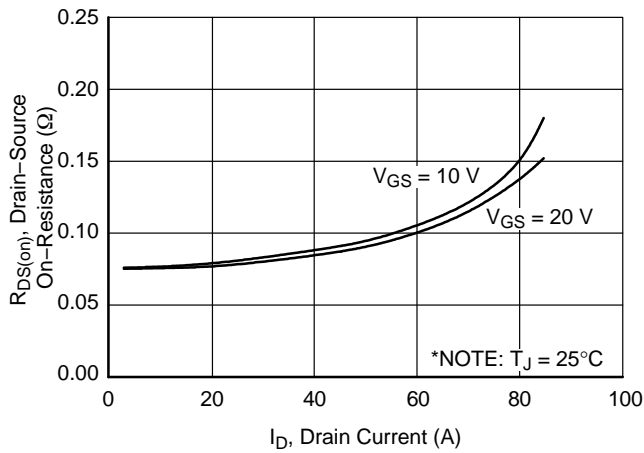


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

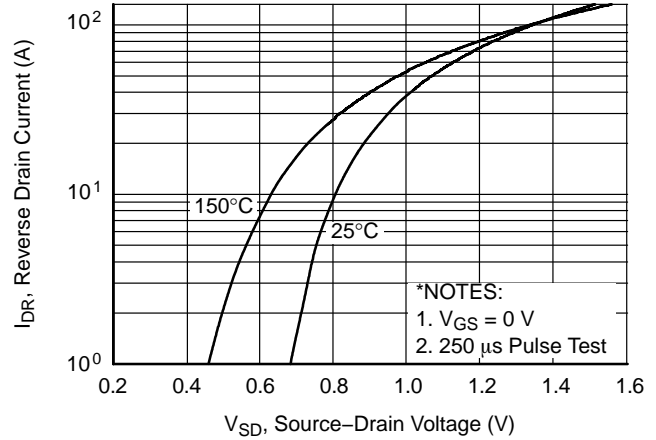


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

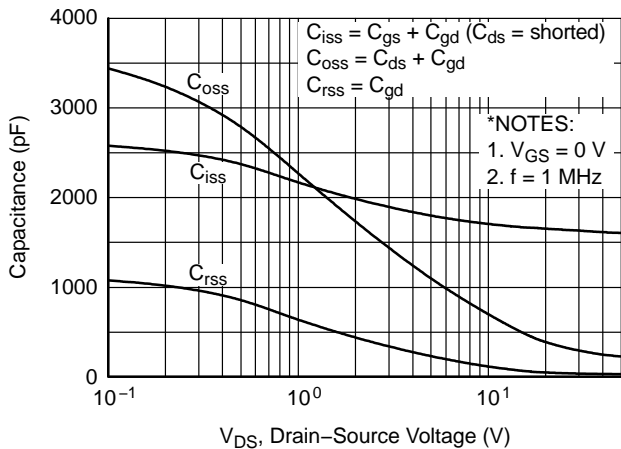


Figure 5. Capacitance Characteristics

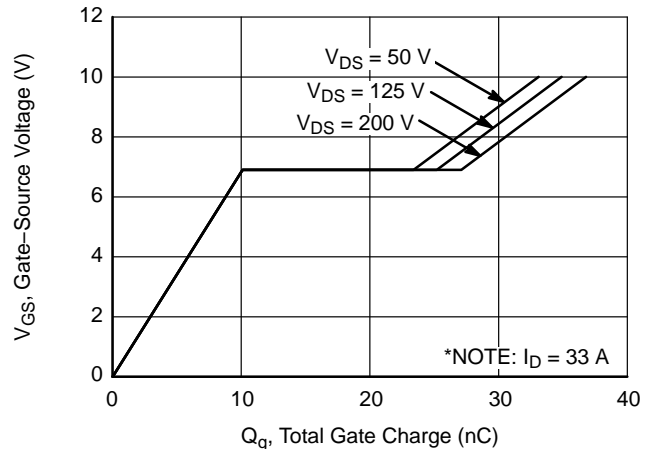


Figure 6. Gate Charge Characteristics

TYPICAL CHARACTERISTICS (CONTINUED)

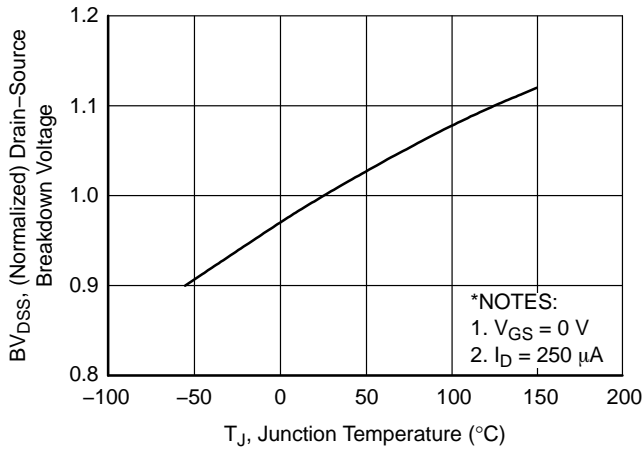


Figure 7. Breakdown Voltage Variation vs. Temperature

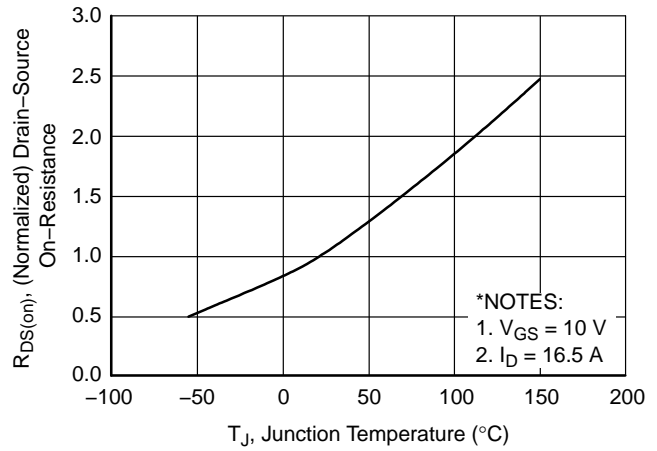


Figure 8. On-Resistance Variation vs. Temperature

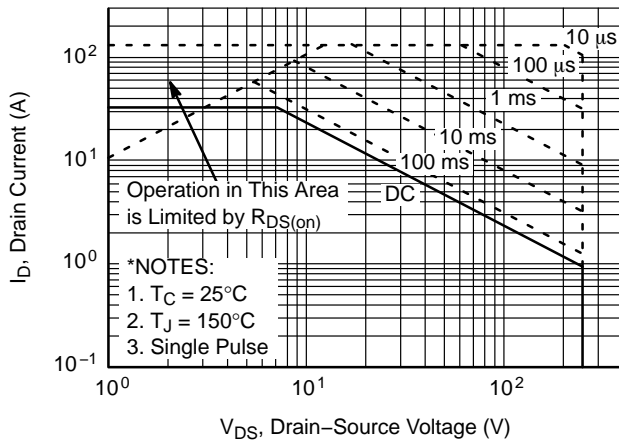


Figure 9. Maximum Safe Operating Area

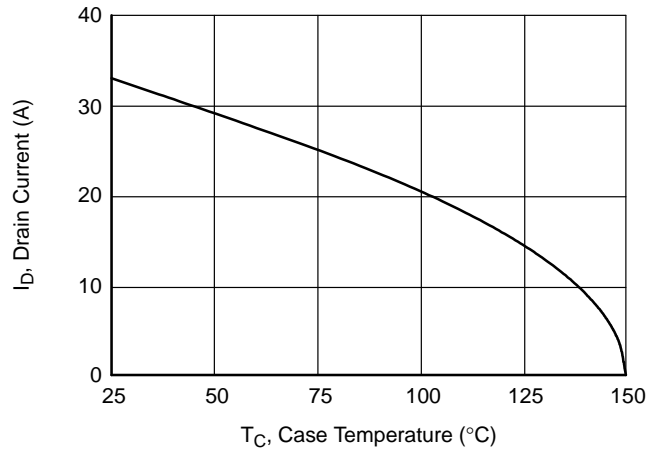


Figure 10. Maximum Drain Current vs. Case Temperature

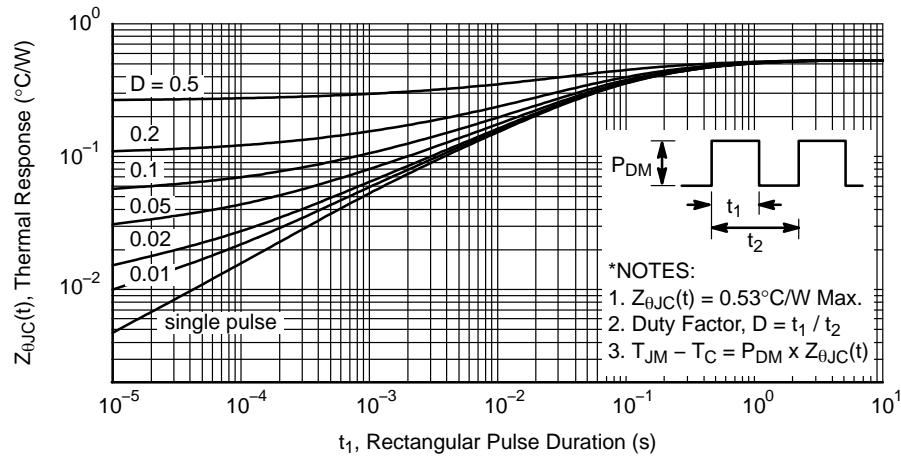


Figure 11. Transient Thermal Response Curve

FDP33N25

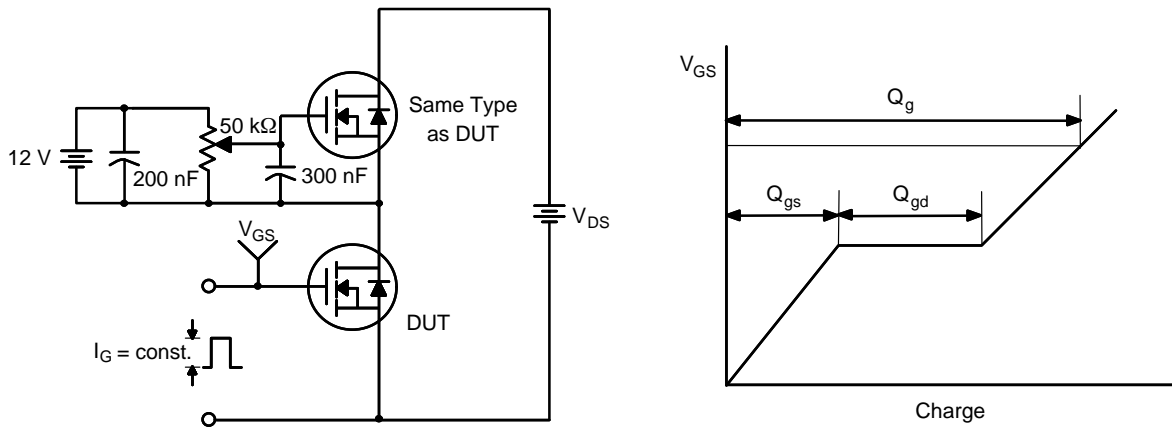


Figure 12. Gate Charge Test Circuit & Waveform

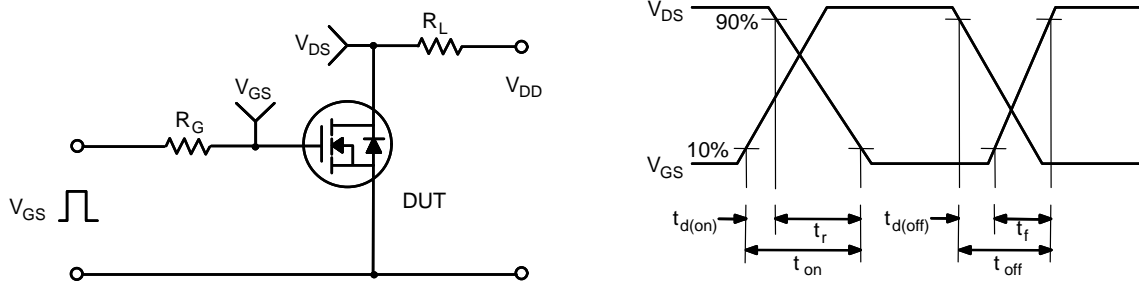


Figure 13. Resistive Switching Test Circuit & Waveforms

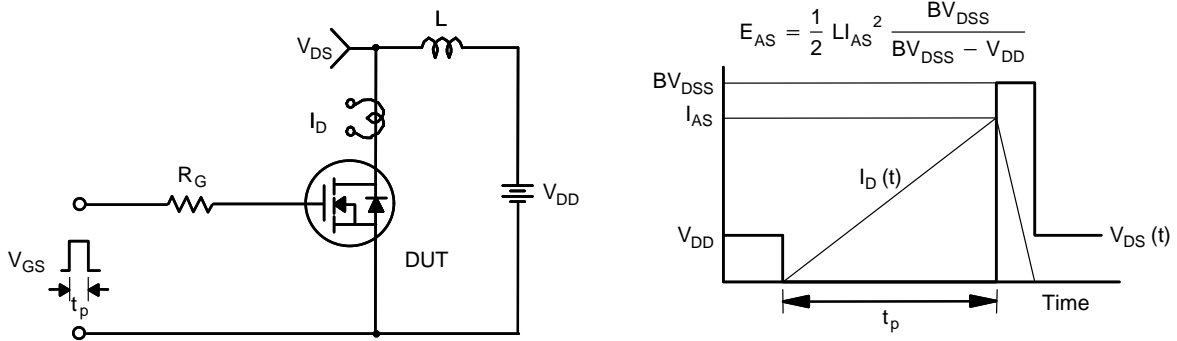


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

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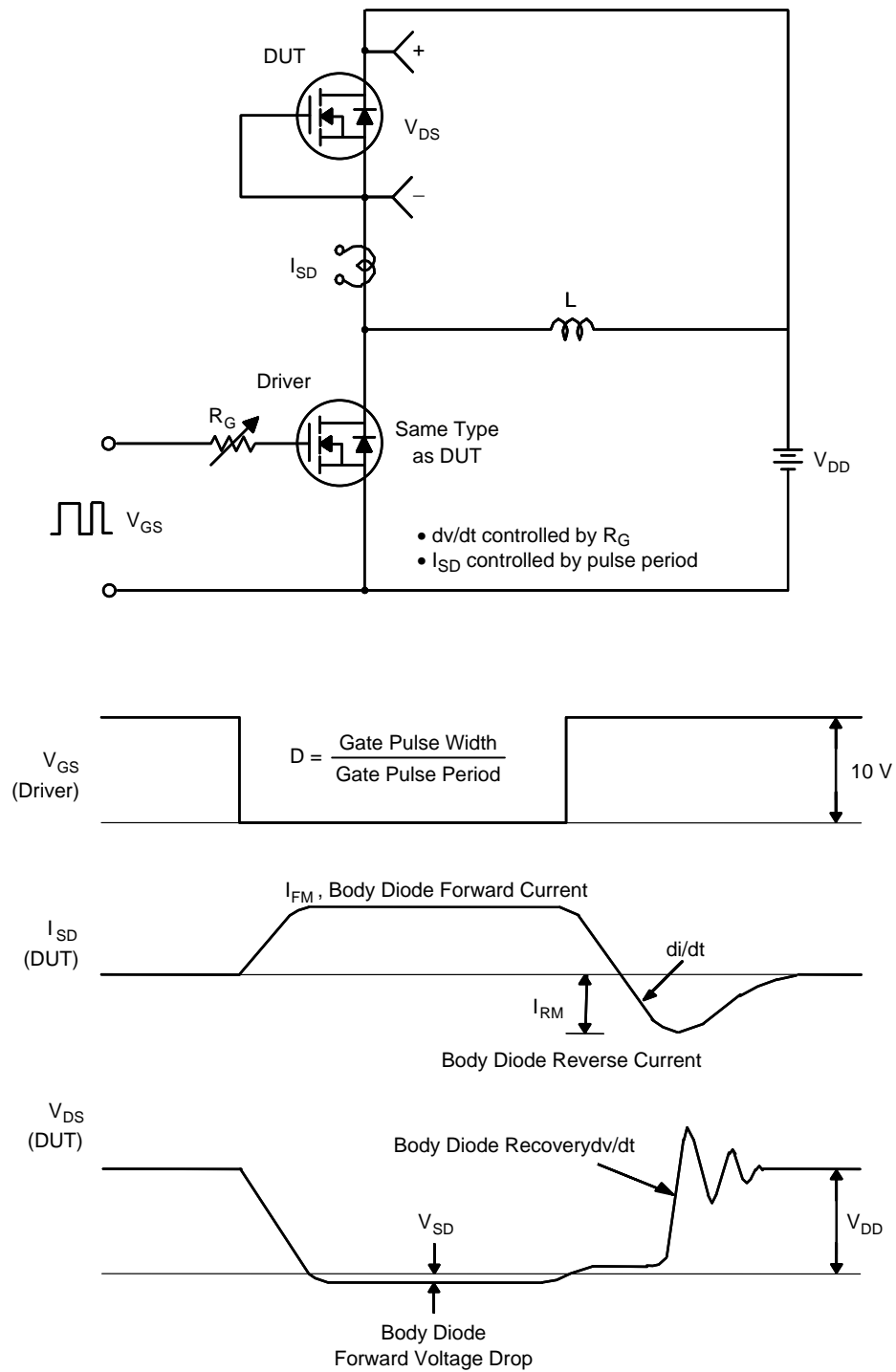
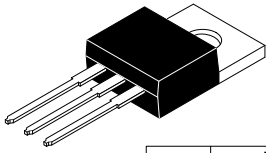


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



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°

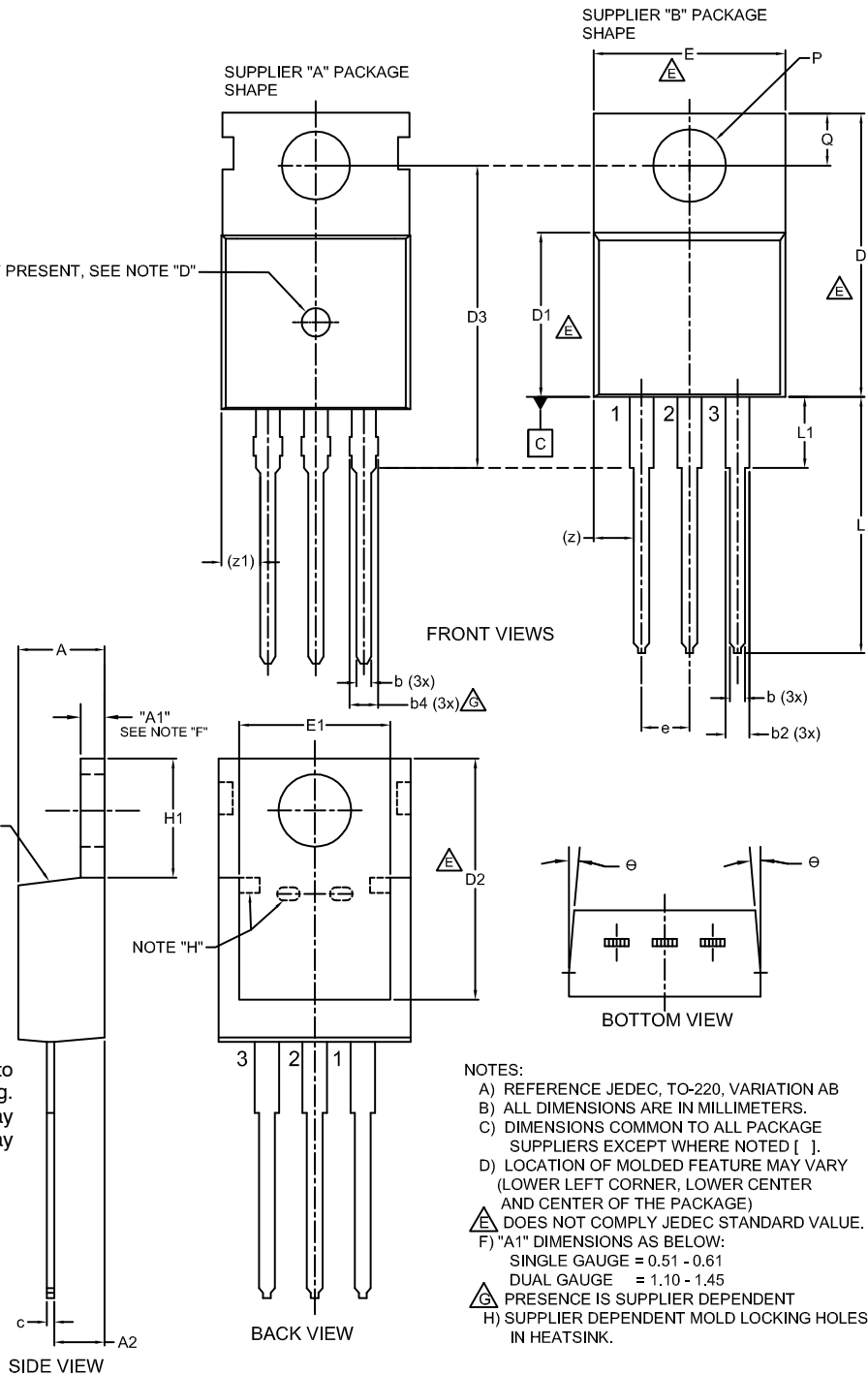
IF PRESENT, SEE NOTE "D"

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
- PRESENCE IS SUPPLIER DEPENDENT
- H) SUPPLIER DEPENDENT MOLD LOCKING HOLES IN HEATSINK.

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