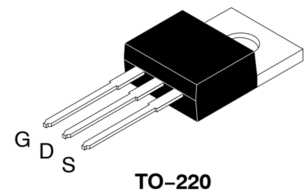
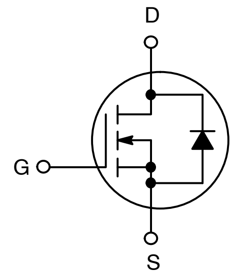
MOSFET – N-Channel, UniFET™

200 V, 52 A, 49 mΩ

FDP52N20



TO−220
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

- $R_{DS(on)}$ = 41 mΩ (Typ.) @ V_{GS} = 10 V, I_D = 26 A
- Low Gate Charge (Typ. 49 nC)
- Low C_{RSS} (Typ. 66 pF)
- 100% Avalanche Tested
- These Devices are Pb−Free and are RoHS Compliant

Applications

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

MARKING DIAGRAM

&Z&3&K
FDP
52N20

&Z	=	Assembly Code
&3	=	Date Code (Year & Week)
&K	=	Lot Run Traceability Code
FDP52N20	=	Specific Device Code

ORDERING INFORMATION

See detailed ordering and shipping information on page 7 of this data sheet.

ABSOLUTE MAXIMUM RATINGS (T_C = 25°C, Unless otherwise specified)

Symbol	Parameter		Value	Unit
V_{DSS}	Drain to Source Voltage		200	V
V_{GSS}	Gate to Source Voltage		±30	V
I_D	Drain Current	Continuous (T_C = 25°C)	52	A
		Continuous (T_C = 100°C)	33	
I_{DM}	Drain Current	Pulsed (Note 1)	208	A
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		2520	mJ
I_{AR}	Avalanche Current (Note 1)		52	A
E_{AR}	Repetitive Avalanche Energy (Note 1)		35.7	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)		4.5	V/ns
P_D	Power Dissipation	(T_C = 25°C)	357	W
		Derate Above 25°C	2.86	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 s		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 = 1.4 mH, I_{AS} = 52 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C.
3. $I_{SD} \le 52$ A, di/dt ≤ 200 A/μs, $V_{DD} \le BV_{DSS}$, starting T_J = 25°C.
4. Essentially independent of operating temperature typical characteristics.

THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.35	°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	V_{GS} = 0 V, I_D = 250 μA, T_J = 25°C	200	–	–	V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	–	0.2	–	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 200 V, V_{GS} = 0 V	–	–	1	μA
		V_{DS} = 160 V, T_C = 125°C	–	–	10	
I_{GSS}	Gate to Body Leakage Current	V_{GS} = ±30 V, V_{DS} = 0 V	–	–	±100	nA
ON CHARACTERISTICS						
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 250 μA	3.0	–	5.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 26 A	–	0.041	0.049	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40 V, I_D = 26 A	–	35	–	S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1 MHz	–	2230	2900	pF
C_{oss}	Output Capacitance		–	540	700	pF
C_{rss}	Reverse Transfer Capacitance		–	66	100	pF
$Q_{g(tot)}$	Total Gate Charge at 10 V	V_{DS} = 160 V, I_D = 52 A, V_{GS} = 10 V (Note 5)	–	49	63	nC
Q_{gs}	Gate to Source Gate Charge		–	19	–	nC
Q_{gd}	Gate to Drain “Miller” Charge		–	24	–	nC

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
SWITCHING CHARACTERISTICS						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 100 V, I_D = 20 A, R_G = 25 Ω (Note 5)	–	53	115	ns
t_r	Turn-On Rise Time		–	175	359	ns
$t_{d(off)}$	Turn-Off Delay Time		–	48	107	ns
t_f	Turn-Off Fall Time		–	29	68	ns
DRAIN−SOURCE DIODE CHARACTERISTICS						
I_S	Maximum Continuous Drain to Source Diode Forward Current		–	–	52	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		–	–	204	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS} = 0 V, I_{SD} = 52 A	–	–	1.5	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_{SD} = 52 A, dI_F/dt = 100 A/μs	–	162	–	ns
Q_{rr}	Reverse Recovery Charge		–	1.3	–	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.

5. Essentially independent of operating temperature typical characteristics.

TYPICAL PERFORMANCE CHARACTERISTICS

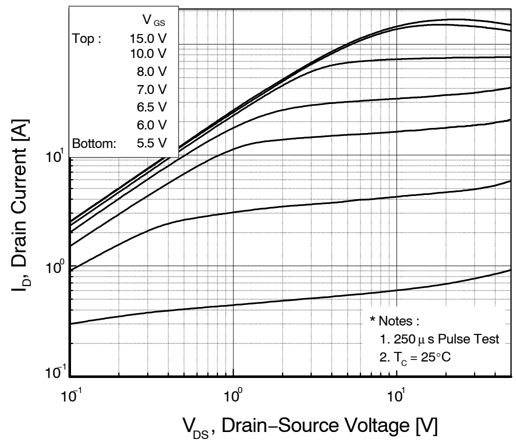


Figure 1. On-Region Characteristics

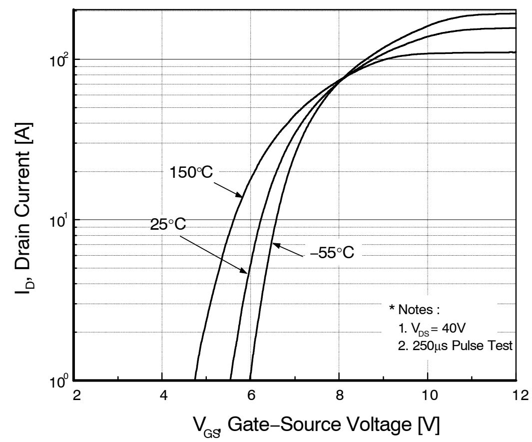


Figure 2. Transfer Characteristics

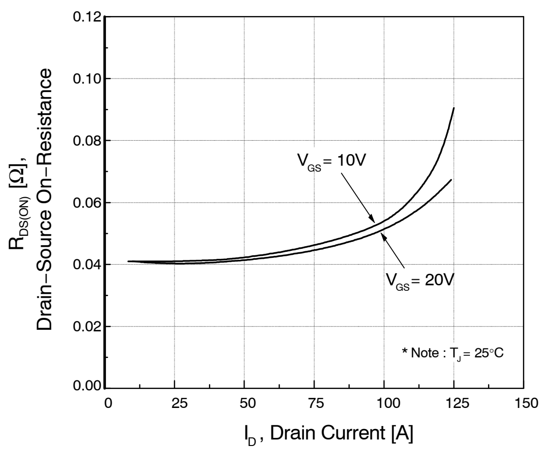


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

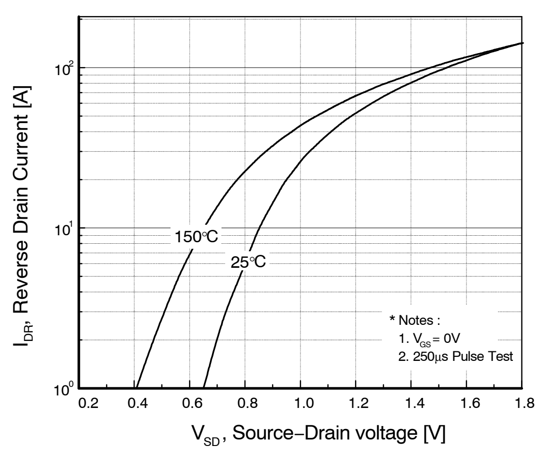


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

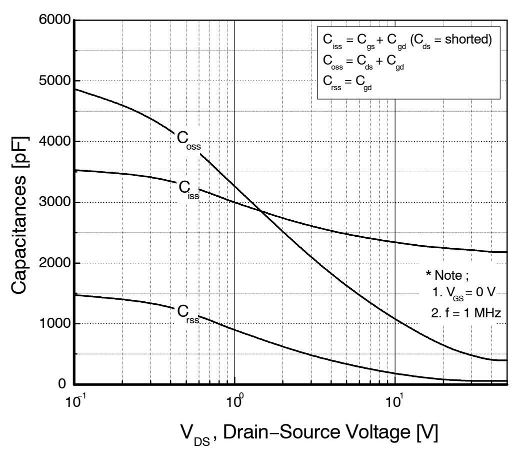


Figure 5. Capacitance Characteristics

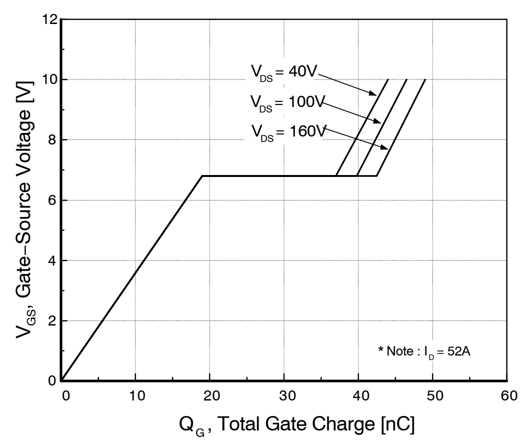


Figure 6. Gate Charge Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS

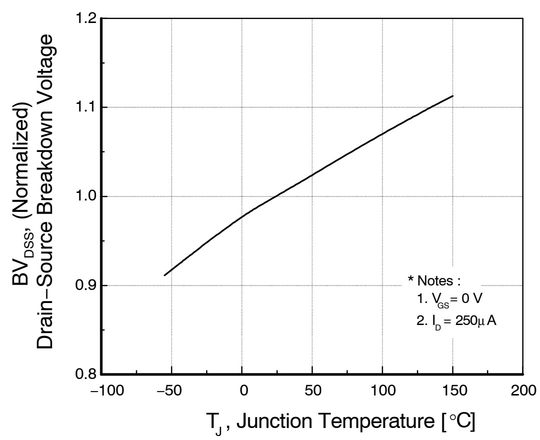


Figure 7. Breakdown Voltage Variation vs. Temperature

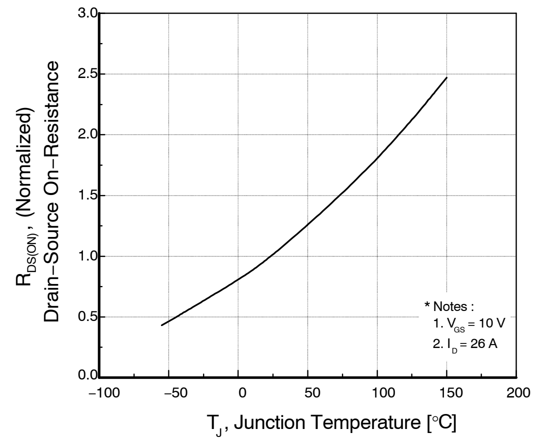


Figure 8. On-Resistance Variation vs. Temperature

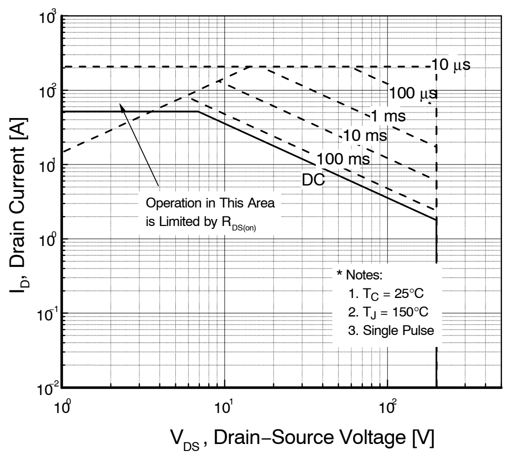


Figure 9. Maximum Safe Operation Area

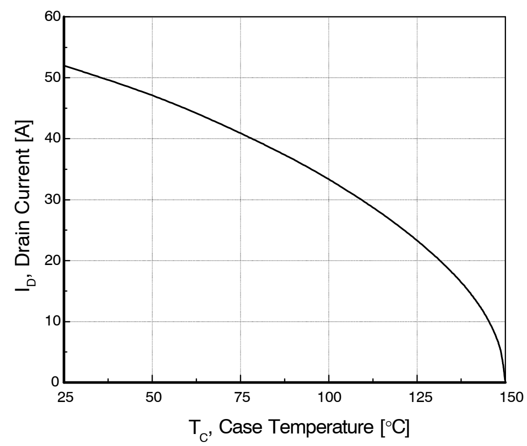


Figure 10. Maximum Drain Current

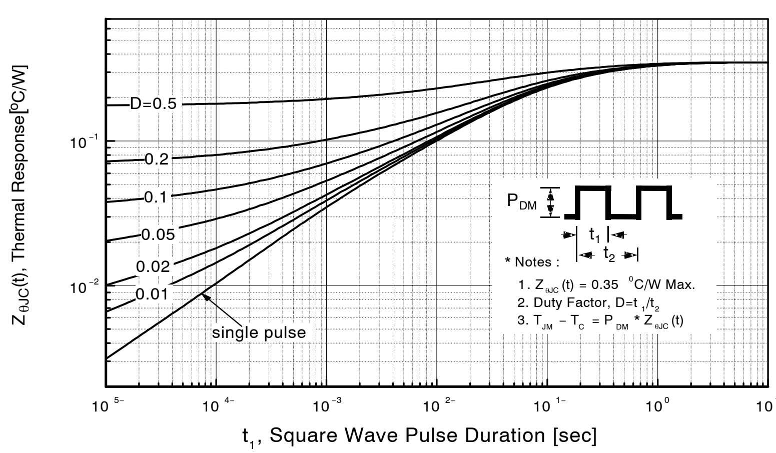


Figure 11. Transient Thermal Response Curve

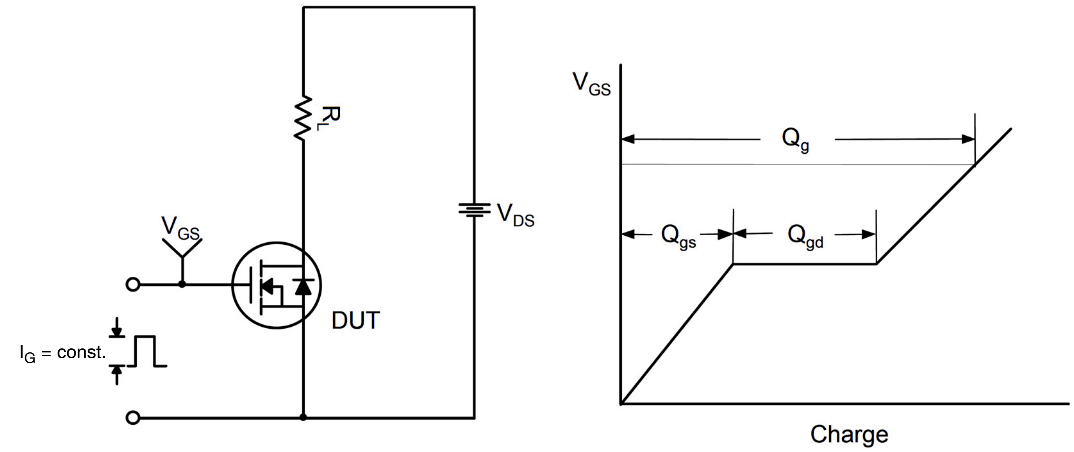


Figure 12. Gate Charge Test Circuit & Waveform

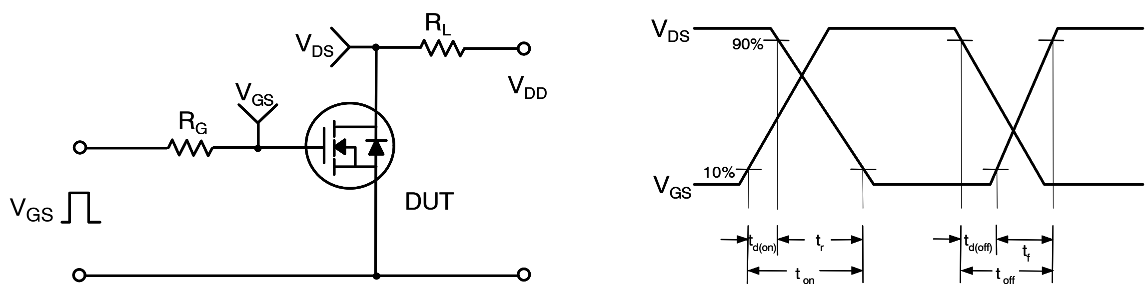


Figure 13. Resistive Switching Test Circuit & Waveforms

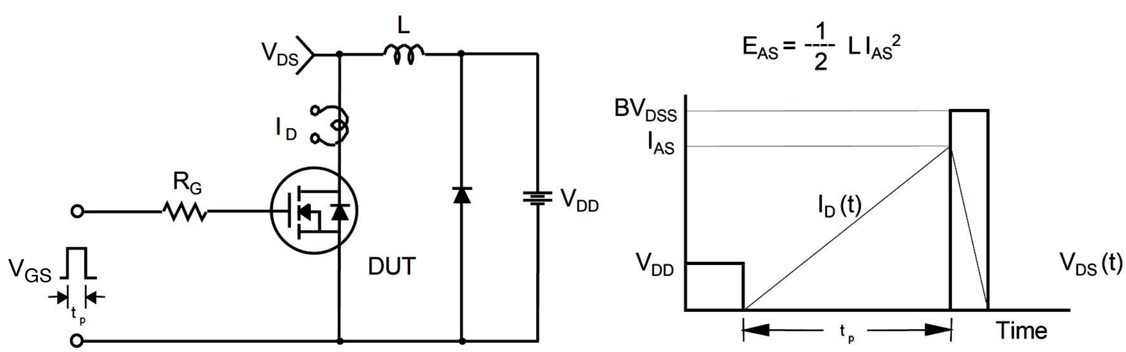


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

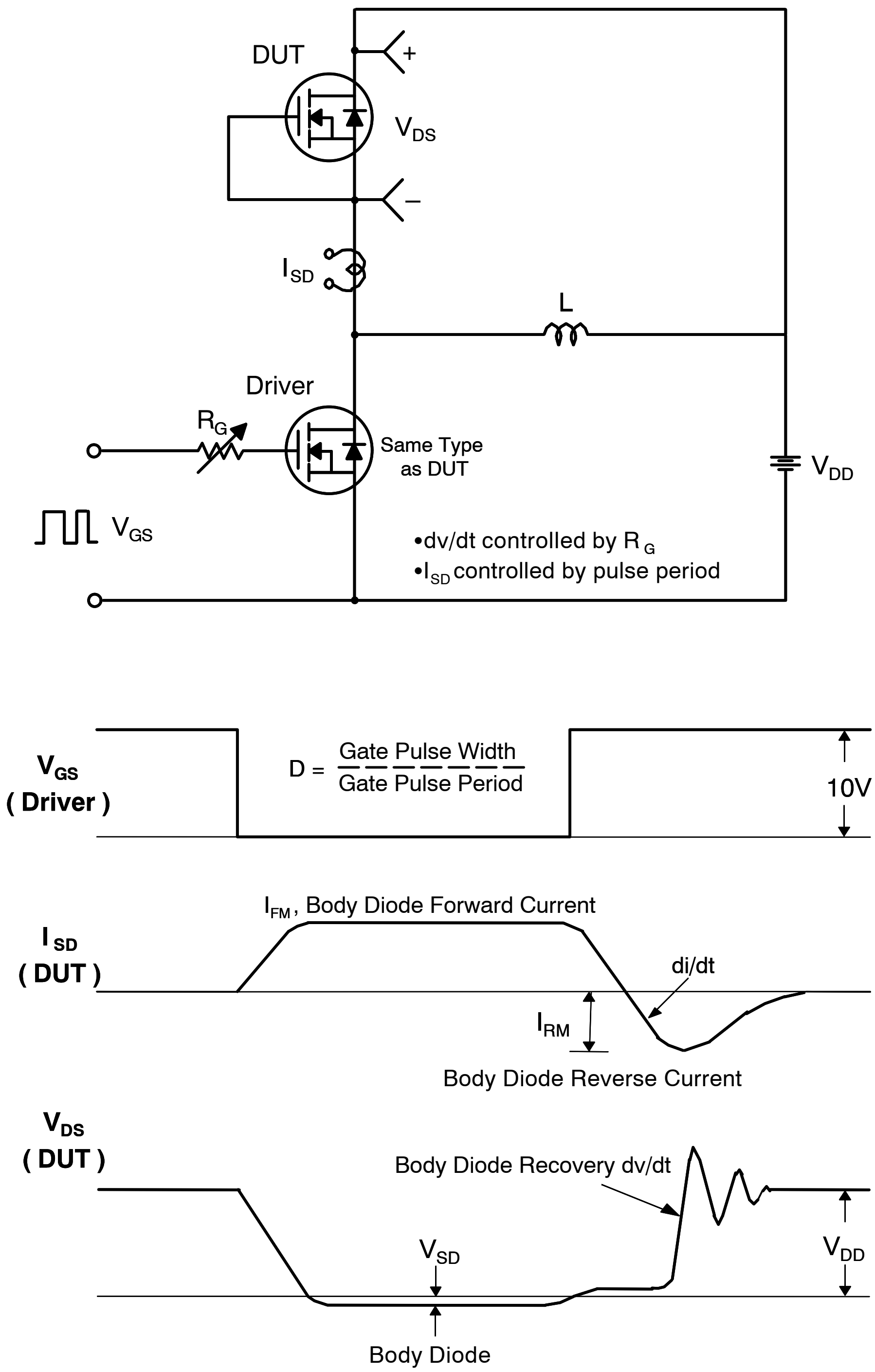
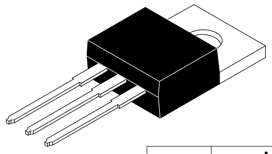


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

PACKAGE MARKING AND ORDERING INFORMATION

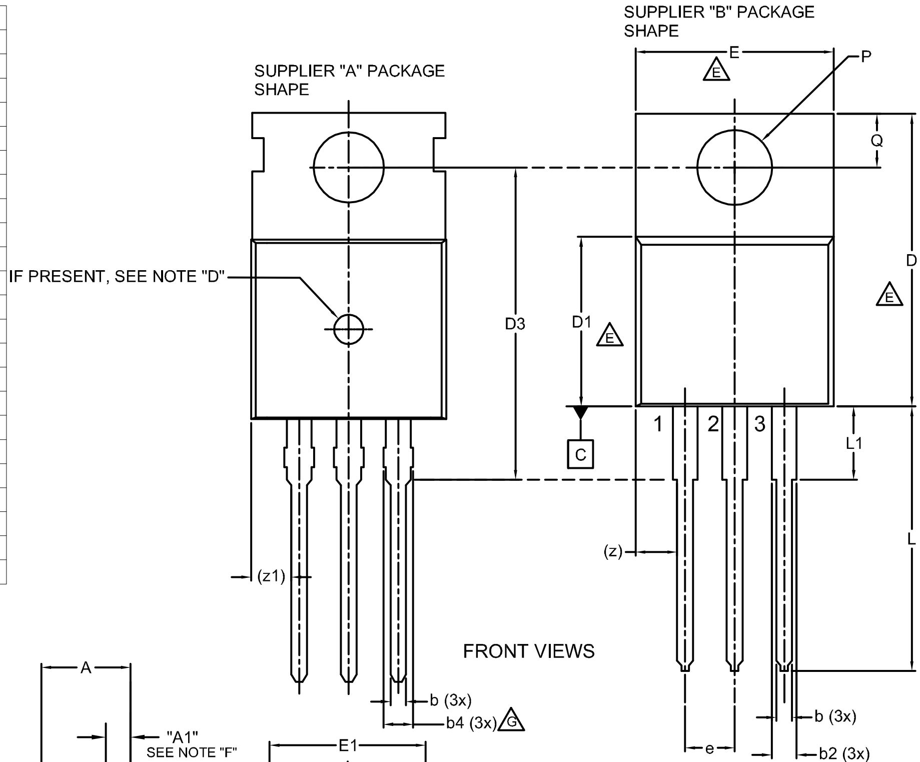
Device	Device Marking	Package	Packing Method	Reel Size	Tape Width	Quantity
FDP52N20	FDP52N20	TO−220	Tube	N/A	N/A	1,000 Units / Tube



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°

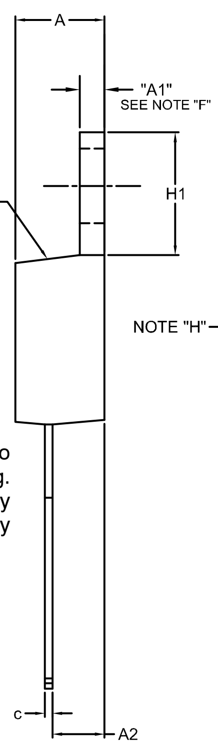


GENERIC MARKING DIAGRAM*

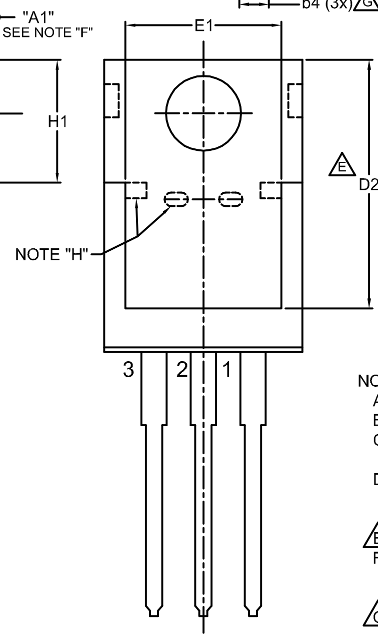
XXXXX
XXXXX
AYWWZZ

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

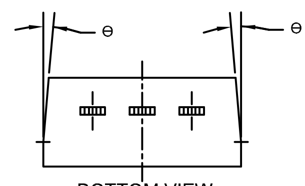
*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “▪”, may or may not be present. Some products may not follow the Generic Marking.



SIDE VIEW



BACK VIEW



BOTTOM VIEW

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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