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August 2014

FDP39N20 / FDPF39N20

N-Channel UniFET™ MOSFET

200 V, 39 A, 66 mΩ

Features

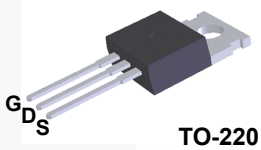
- $R_{DS(on)}$ = 66 mΩ (Max.) @ V_{GS} = 10 V, I_D = 19.5 A
- Low Gate Charge (Typ. 38 nC)
- Low C_{rss} (Typ. 57 pF)
- 100% Avalanche Tested

Applications

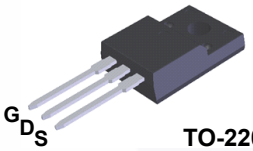
- PDP TV
- Lighting
- Uninterruptible Power Supply
- AC-DC Power Supply

Description

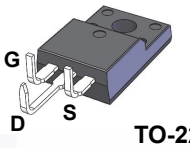
UniFET™ MOSFET is Fairchild Semiconductor's high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-state resistance, and to provide better switching performance and higher avalanche energy strength. This device family is suitable for switching power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



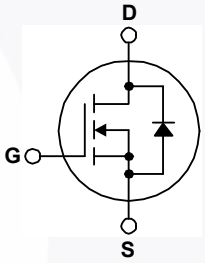
TO-220



TO-220F



TO-220F
(L-formed)



Absolute Maximum Ratings

T_C = 25°C unless otherwise noted.

Symbol	Parameter		FDP39N20	FDPF39N20 / FDPF39N20TLDTU	Unit
V_{DSS}	Drain-Source Voltage		200		V
I_D	Drain Current	- Continuous (T_C = 25°C) - Continuous (T_C = 100°C)	39 23.4	39 * 23.4 *	A A
I_{DM}	Drain Current	- Pulsed (Note 1)	156	156 *	A
V_{GSS}	Gate-Source voltage		±30		V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	860		mJ
I_{AR}	Avalanche Current	(Note 1)	39		A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	25.1		mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	4.5		V/ns
P_D	Power Dissipation	(T_C = 25°C) - Derate Above 25°C	251 2.0	37 0.29	W 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

* Drain current limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	FDP39N20	FDPF39N20 / FDPF39N20TLDTU	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	0.5	3.4	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	62.5	

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Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDP39N20	FDP39N20	TO-220	Tube	N/A	N/A	50 units
FDPF39N20	FDPF39N20	TO-220F	Tube	N/A	N/A	50 units
FDPF39N20TLDTU	FDPF39N20T	TO-220F (L-formed)	Tube	N/A	N/A	50 units

Electrical Characteristics T_C = 25°C unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA	200	--	--	V
ΔBV_{DSS} / ΔT_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 V_{DS} = 160 V, T_C = 125°C	-- --	-- --	1 10	μA μA
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 = 19.5 A	--	0.056	0.066	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40 V, I_D = 19.5 A	--	28.5	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	1640	2130	pF
C_{oss}	Output Capacitance		--	400	520	pF
C_{rss}	Reverse Transfer Capacitance		--	57	85	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 100 V, I_D = 39 A, V_{GS} = 10 V, R_G = 25 Ω	--	30	70	ns
t_r	Turn-On Rise Time		--	160	330	ns
$t_{d(off)}$	Turn-Off Delay Time		--	150	310	ns
t_f	Turn-Off Fall Time	(Note 4)	--	150	310	ns
Q_g	Total Gate Charge	V_{DS} = 160 V, I_D = 39 A, V_{GS} = 10 V	--	38	49	nC
Q_{gs}	Gate-Source Charge		--	11	--	nC
Q_{gd}	Gate-Drain Charge	(Note 4)	--	16.5	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	39	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	156	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 39 A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 39 A, dI_F/dt =100 A/μs	--	152	--	ns
Q_{rr}	Reverse Recovery Charge		--	1.1	--	μC

Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. L = 0.85 mH, I_{AS} = 39 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C.
3. I_{SD} ≤ 39 A, di/dt ≤ 200 A/μs, V_{DD} ≤ BV_{DSS}, starting T_J = 25°C.
4. Essentially independent of operating temperature typical characteristics.

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Typical Performance Characteristics

Figure 1. On-Region Characteristics

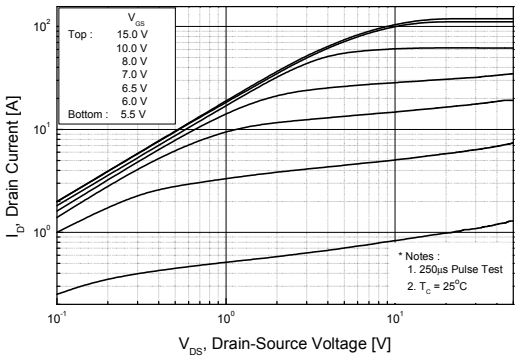


Figure 2. Transfer Characteristics

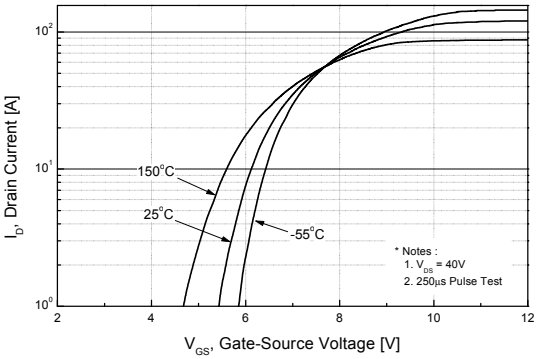


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

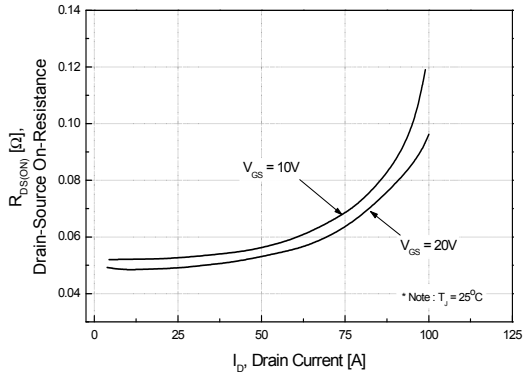


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

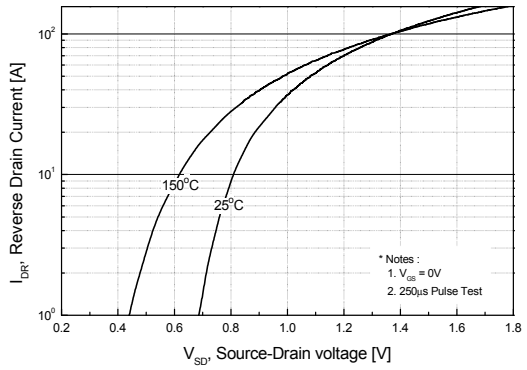


Figure 5. Capacitance Characteristics

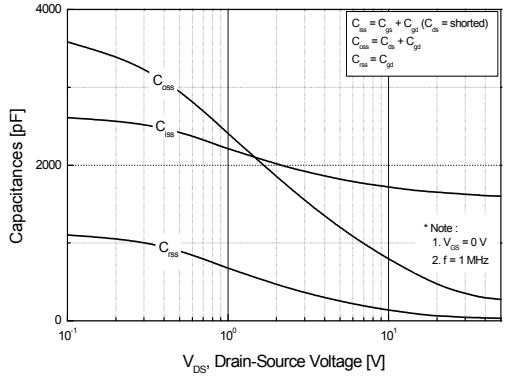
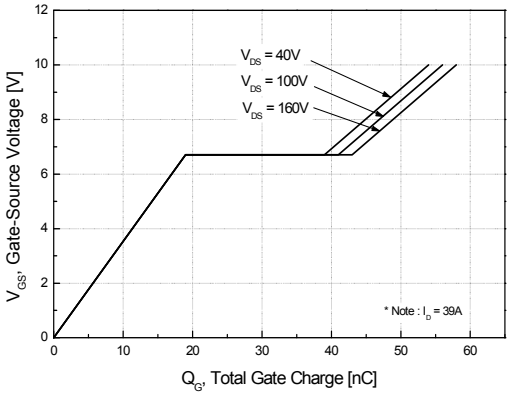


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

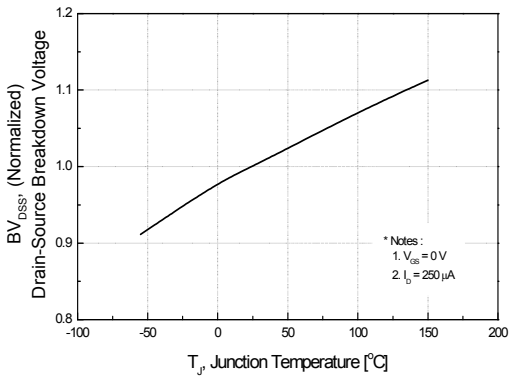


Figure 8. On-Resistance Variation vs. Temperature

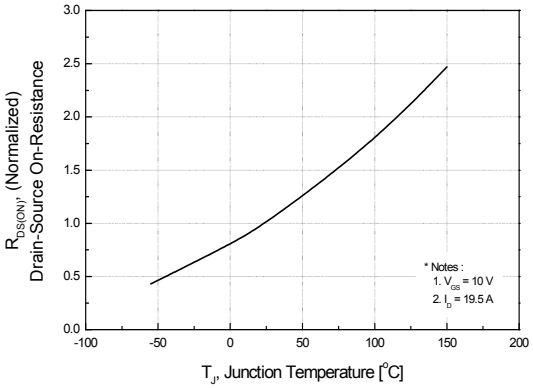


Figure 9-1. Maximum Safe Operating Area - FDP39N20

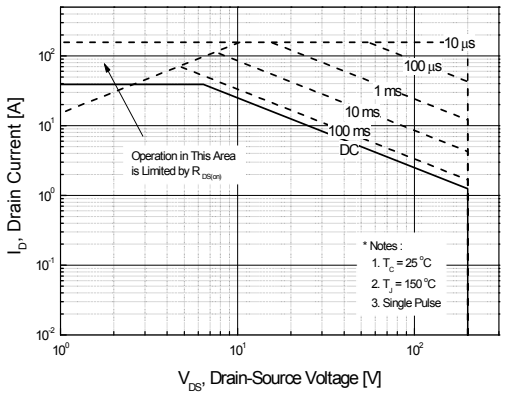


Figure 9-2. Maximum Safe Operating Area - FDPF39N20

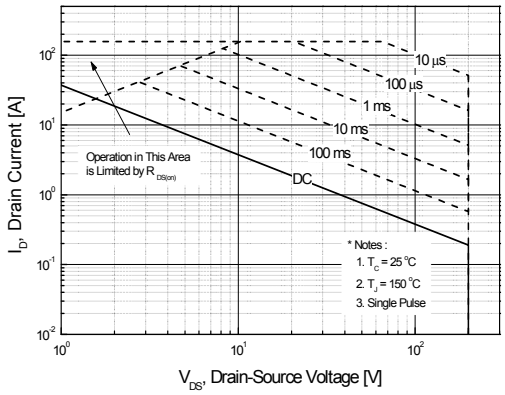
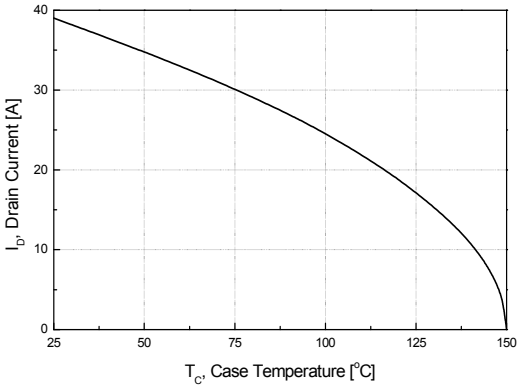


Figure 10. Maximum Drain Current vs. Case Temperature



Typical Performance Characteristics (Continued)

Figure 11-1. Transient Thermal Response Curve - FDP39N20

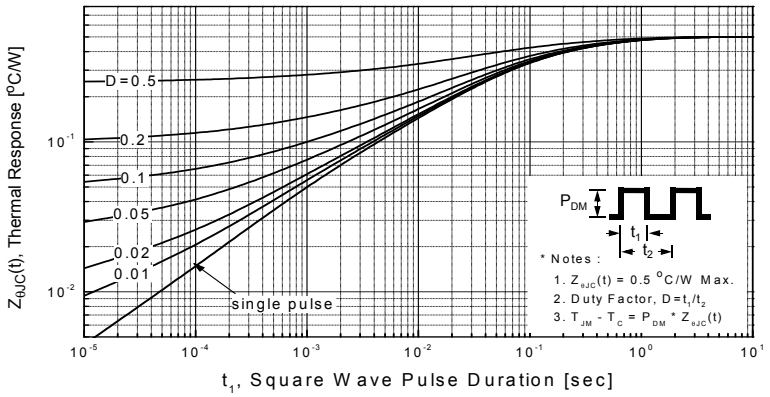
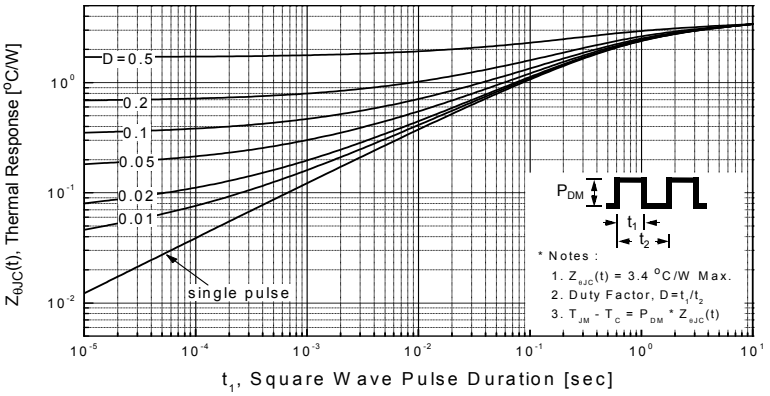


Figure 11-2. Transient Thermal Response Curve - FDPF39N20



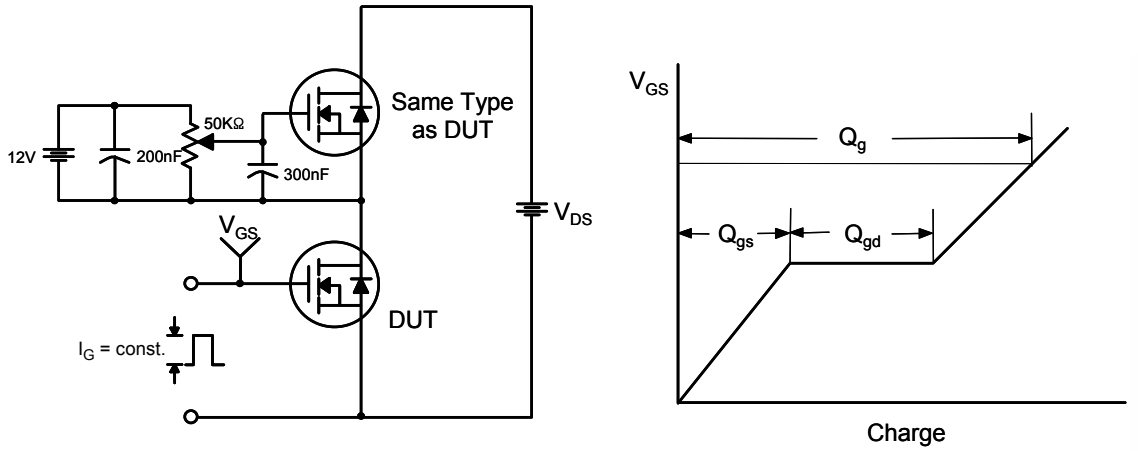


Figure 12. Gate Charge Test Circuit & Waveform

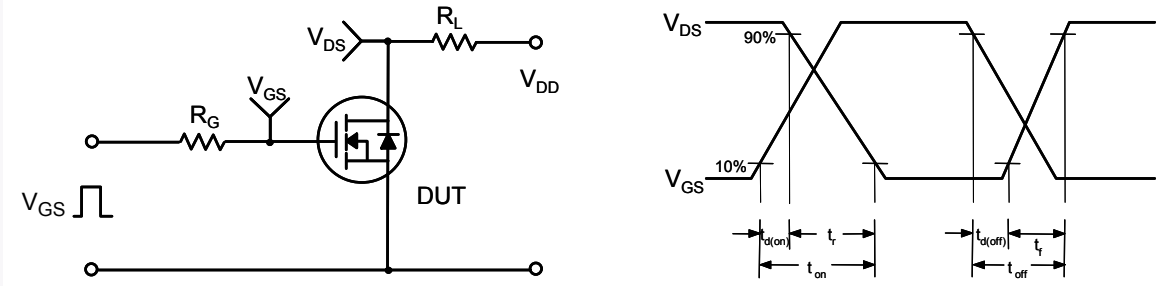


Figure 13. Resistive Switching Test Circuit & Waveforms

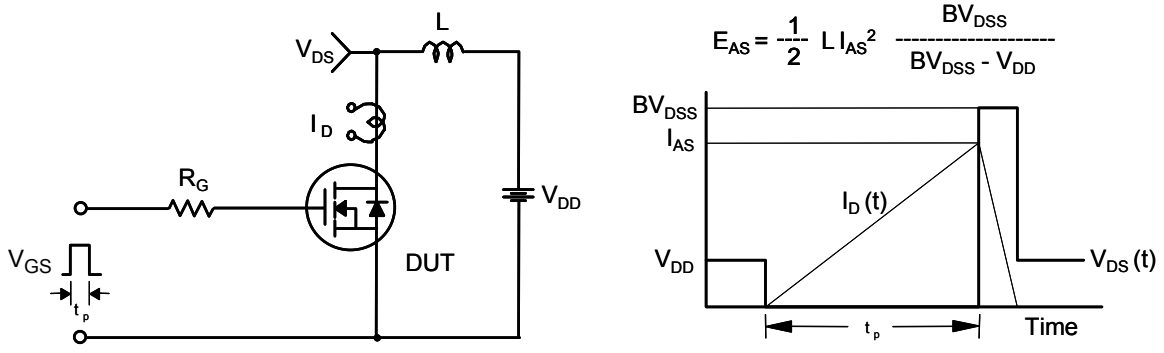


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

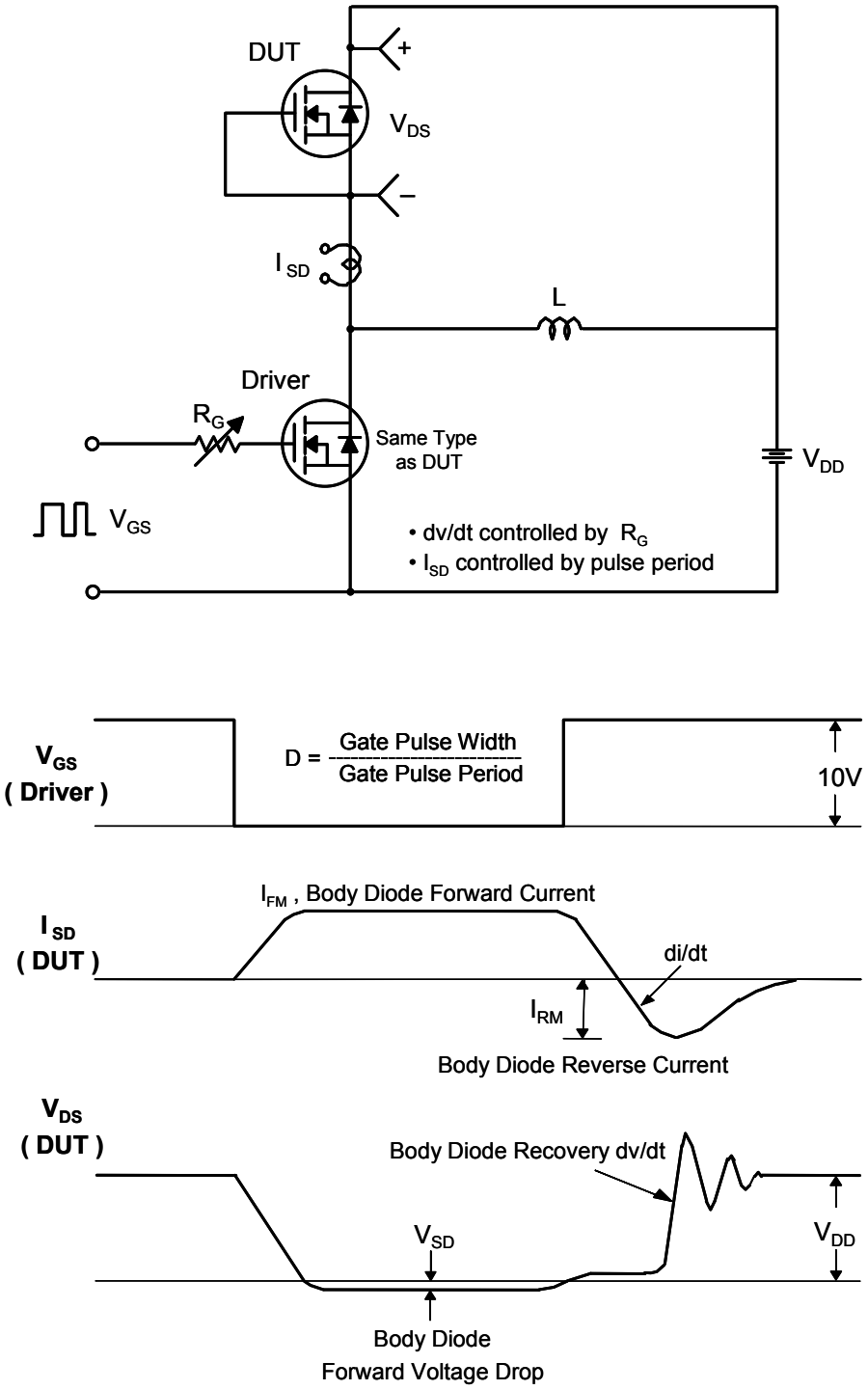
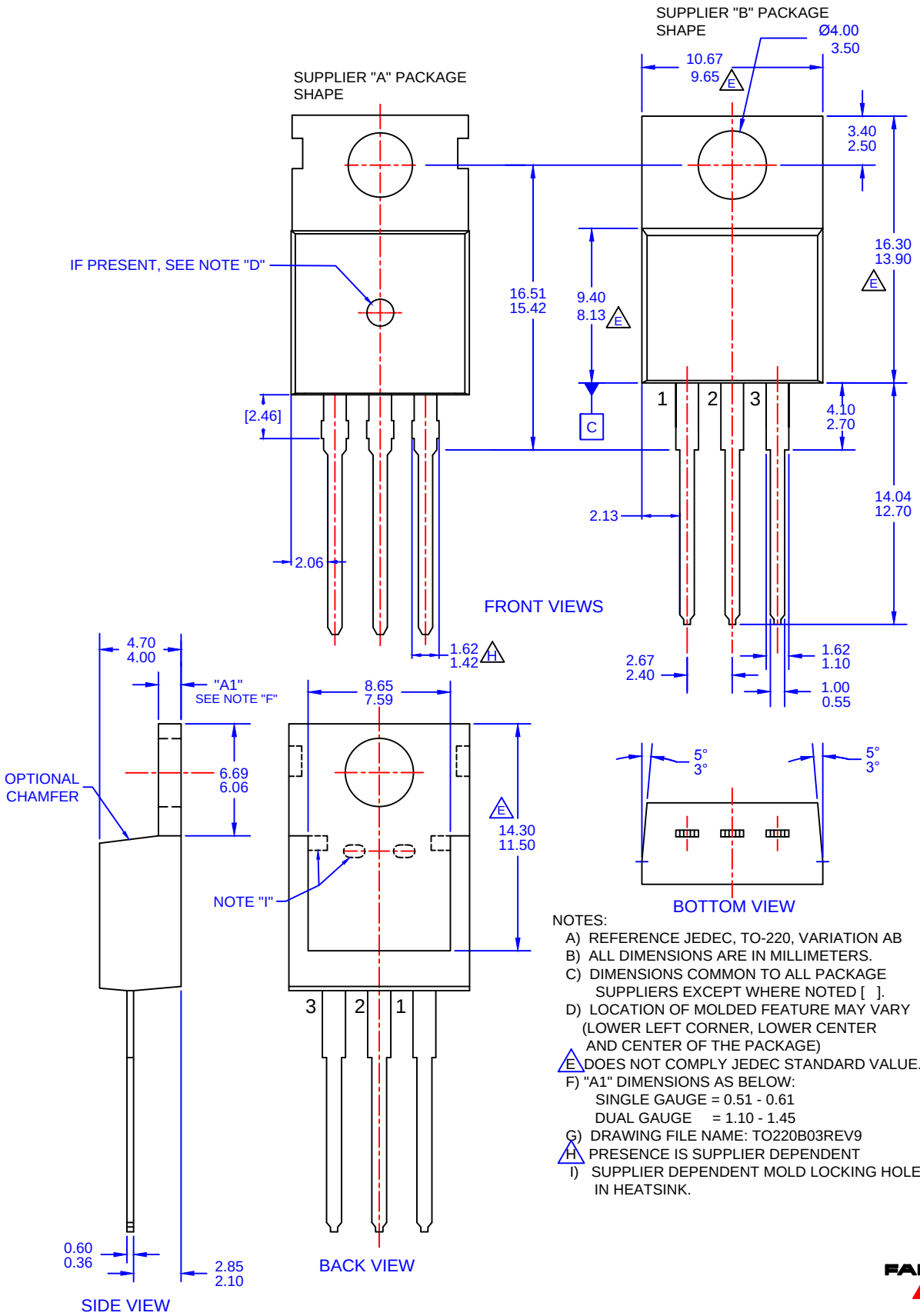


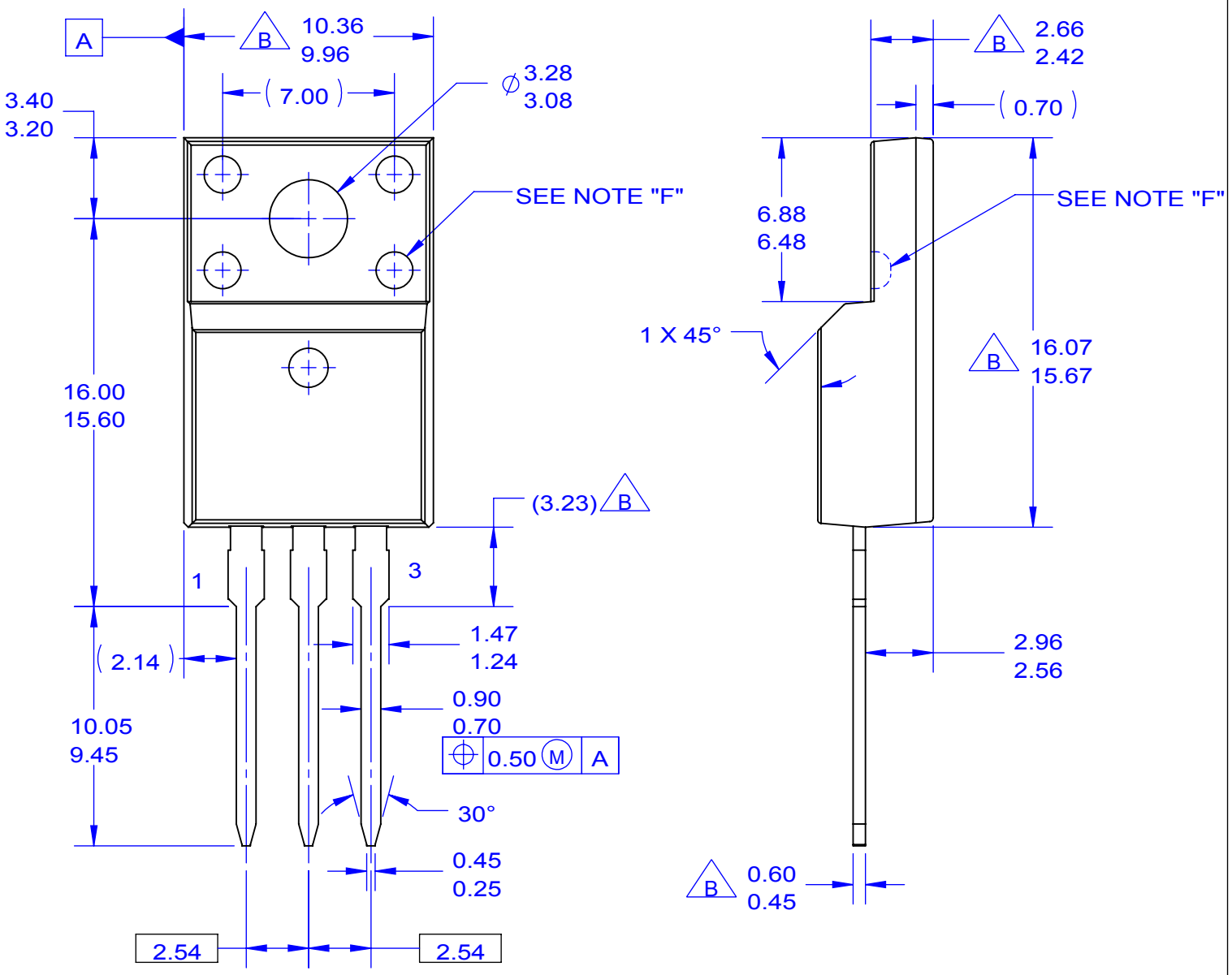
Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

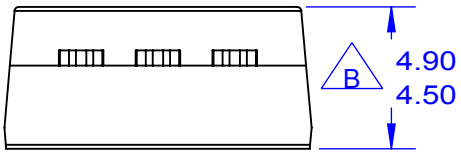


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C) DIMENSIONS COMMON TO ALL PACKAGE SUPPLIERS EXCEPT WHERE NOTED [ ].
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F) "A1" DIMENSIONS AS BELOW:
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DUAL GAUGE = 1.10 - 1.45
G) DRAWING FILE NAME: TO220B03REV9
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I) SUPPLIER DEPENDENT MOLD LOCKING HOLES IN HEATSINK.

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