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FAIRCHILD SEMICONDUCTOR®

October 2013

FDP8N50NZ / FDPF8N50NZ

N-Channel UniFET^{TM} II MOSFET

500 V, 8 A, 850 mΩ

Features

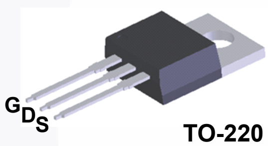
- $R_{DS(on)}$ = 770 mΩ (Typ.) @ V_{GS} = 10 V, I_D = 4 A
- Low Gate Charge (Typ. 14 nC)
- Low C_{rss} (Typ. 5 pF)
- 100% Avalanche Tested
- Improve dv/dt Capability
- ESD Improved Capability
- RoHS Compliant

Applications

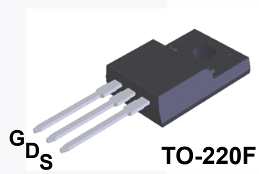
- LCD/LED TV
- Lighting
- Uninterruptible Power Supply
- AC-DC Power Supply

Description

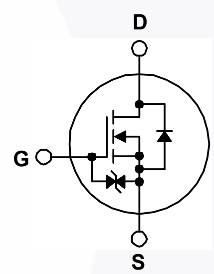
UniFET^{TM} II MOSFET is Fairchild Semiconductor's high voltage MOSFET family based on advanced planar stripe and DMOS technology. This advanced MOSFET family has the smallest on-state resistance among the planar MOSFET, and also provides superior switching performance and higher avalanche energy strength. In addition, internal gate-source ESD diode allows UniFET II MOSFET to withstand over 2kV HBM surge stress. 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



MOSFET Maximum Ratings T_C = 25°C unless otherwise noted*

Symbol	Parameter		FDP8N50NZ	FDPF8N50NZ	Unit
V_{DSS}	Drain to Source Voltage		500		V
V_{GSS}	Gate to Source Voltage		±25		V
I_D	Drain Current	- Continuous (T_C = 25°C)	8	8*	A
		- Continuous (T_C = 100°C)	4.8	4.8*	
I_{DM}	Drain Current	- Pulsed (Note 1)	32	32*	A
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		122		mJ
I_{AR}	Avalanche Current (Note 1)		8		A
E_{AR}	Repetitive Avalanche Energy (Note 1)		13		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)		10		V/ns
P_D	Power Dissipation	(T_C = 25°C)	130	40.3	W
		- Derate above 25°C	1	0.3	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150		°C
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds		300		°C

*Drain current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	FDP8N50NZ	FDPF8N50NZ	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.96	3.1	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	62.5	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDP8N50NZ	FDP8N50NZ	TO-220	Tube	N/A	50 units
FDPF8N50NZ	FDPF8N50NZ	TO-220F	Tube	N/A	50 units

Electrical Characteristics $T_C = 25^oC$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = 250\mu A$, $V_{GS} = 0V$, $T_C = 25^oC$	500	-	-	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu A$, Referenced to 25^oC	-	0.5	-	$V/^oC$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 500V$, $V_{GS} = 0V$	-	-	1	μA
		$V_{DS} = 400V$, $T_C = 125^oC$	-	-	10	
I_{GSS}	Gate to Body Leakage Current	$V_{GS} = \pm 25V$, $V_{DS} = 0V$	-	-	±10	μA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 250\mu A$	3.0	-	5.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10V$, $I_D = 4A$	-	0.77	0.85	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 20V$, $I_D = 4A$	-	6.3	-	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = 25V$, $V_{GS} = 0V$ f = 1MHz	-	565	735	pF
C_{oss}	Output Capacitance		-	80	105	pF
C_{rss}	Reverse Transfer Capacitance		-	5	8	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 400V$, $I_D = 8A$ $V_{GS} = 10V$ (Note 4)	-	14	18	nC
Q_{gs}	Gate to Source Gate Charge		-	4	-	nC
Q_{gd}	Gate to Drain “Miller” Charge		-	6	-	nC
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 250V$, $I_D = 8A$ $R_G = 25\Omega$, $V_{GS} = 10V$ (Note 4)	-	17	45	ns
t_r	Turn-On Rise Time		-	34	80	ns
$t_{d(off)}$	Turn-Off Delay Time		-	43	95	ns
t_f	Turn-Off Fall Time		-	27	60	ns
Drain-Source Diode Characteristics						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	8	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	30	A
V_{SD}	Drain to Source Diode Forward Voltage	$V_{GS} = 0V$, $I_{SD} = 8A$	-	-	1.4	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0V$, $I_{SD} = 8A$ $dI_F/dt = 100A/\mu s$	-	228	-	ns
Q_{rr}	Reverse Recovery Charge		-	1.43	-	μC

Notes:
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L = 3.8mH, $I_{AS} = 8A$, $V_{DD} = 50V$, $R_G = 25\Omega$, Starting $T_J = 25°C$
3. $I_{SD} \leq 8A$, $di/dt \leq 200A/\mu s$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25°C$
4. Essentially Independent of Operating Temperature Typical Characteristics

Typical Characteristics

Figure 1. On-Region Characteristics

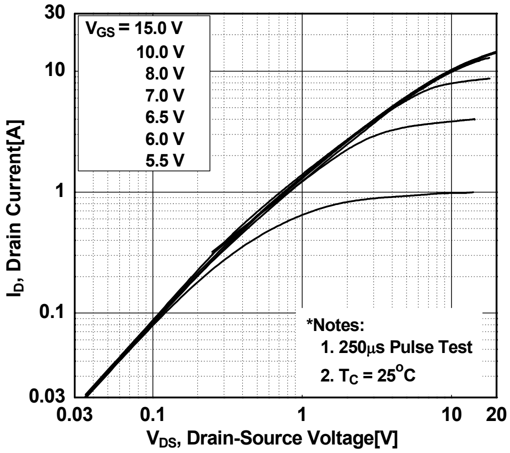


Figure 2. Transfer Characteristics

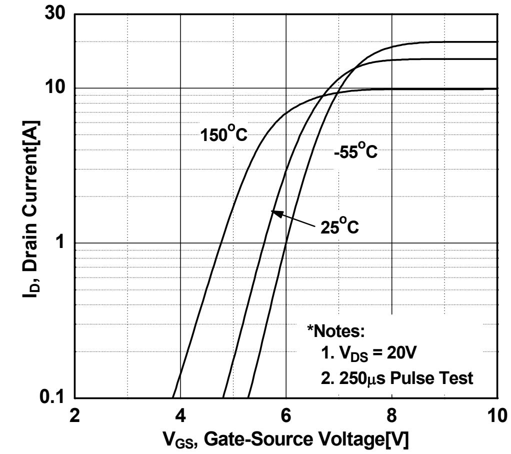


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

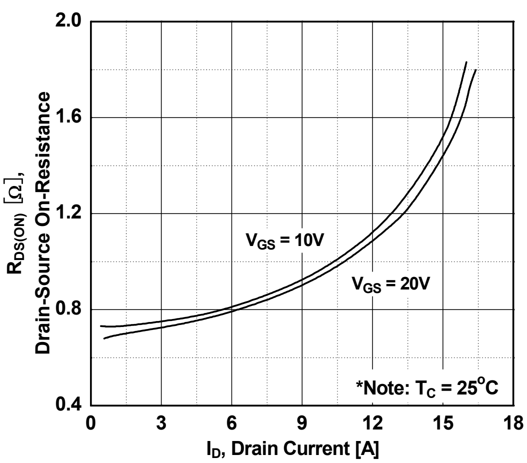


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

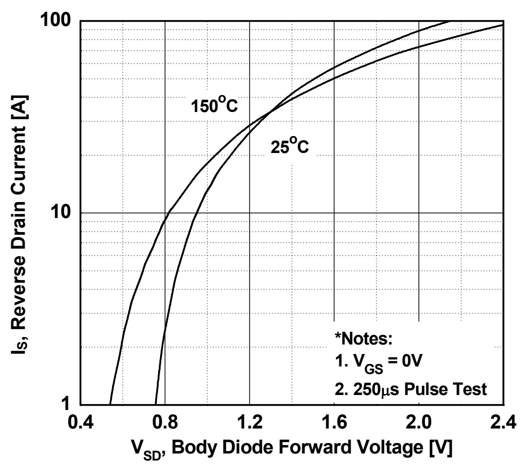


Figure 5. Capacitance Characteristics

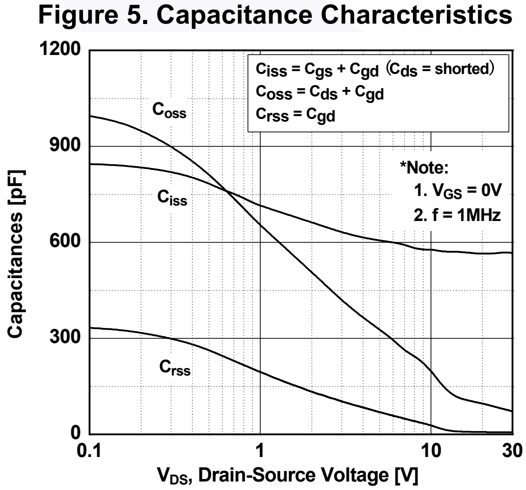
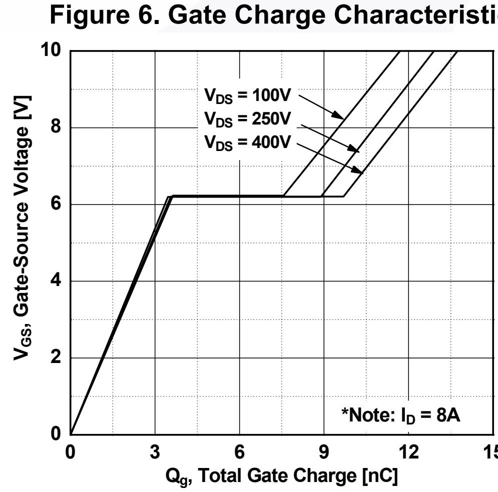


Figure 6. Gate Charge Characteristics



Typical Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

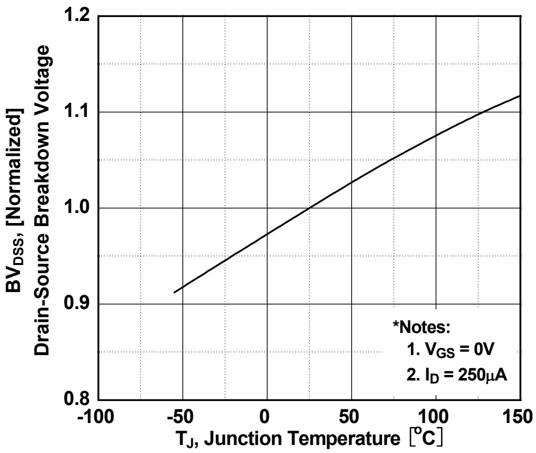


Figure 8. On-Resistance Variation vs. Temperature

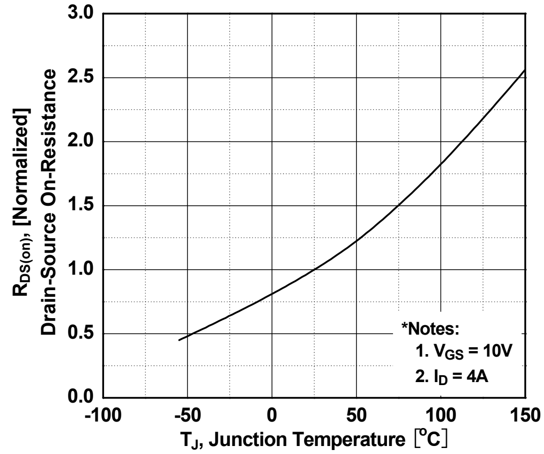


Figure 9. Maximum Safe Operating Area - FDP8N50NZ

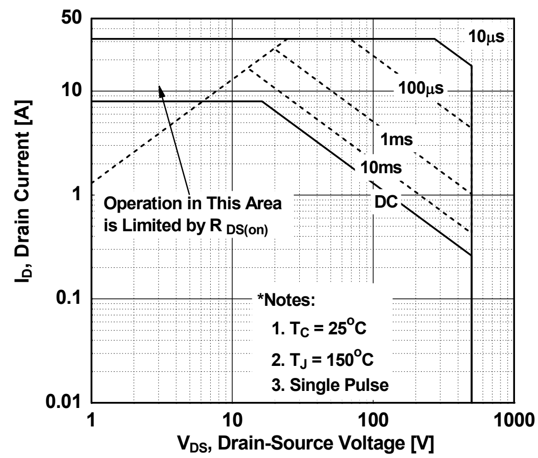


Figure 10. Maximum Safe Operating Area - FDPF8N50NZ

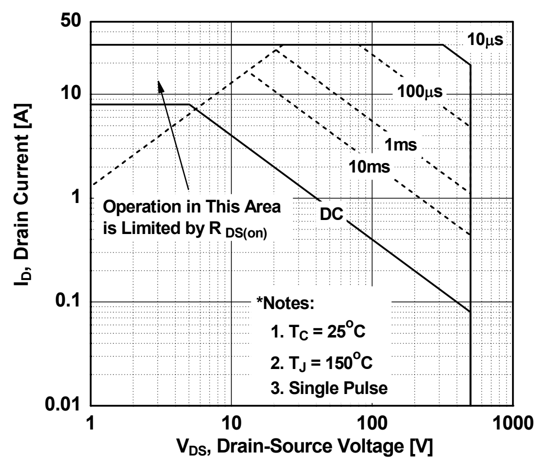


Figure 11. Maximum Drain Current vs. Case Temperature

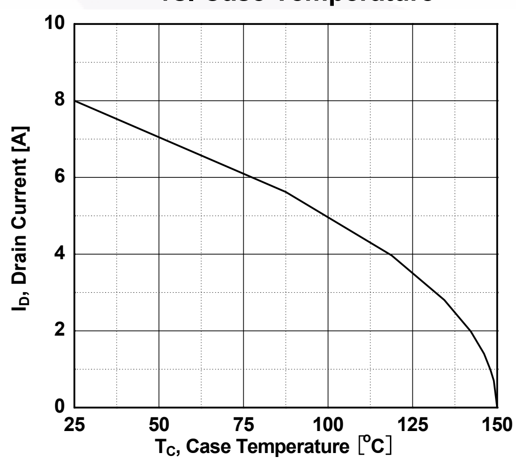
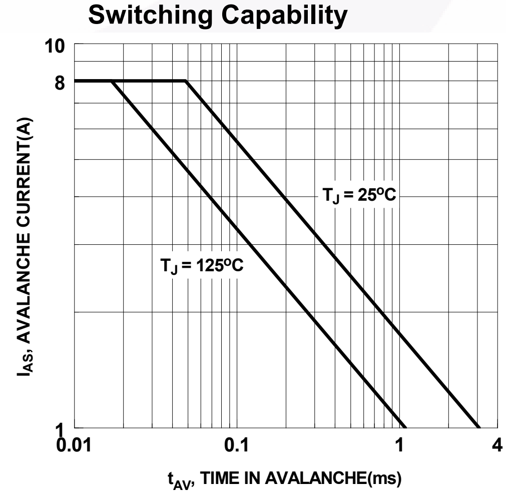


Figure 12. Unclamped Inductive Switching Capability



Typical Characteristics (Continued)

Figure 13. Transient Thermal Response Curve - FDP8N50NZ

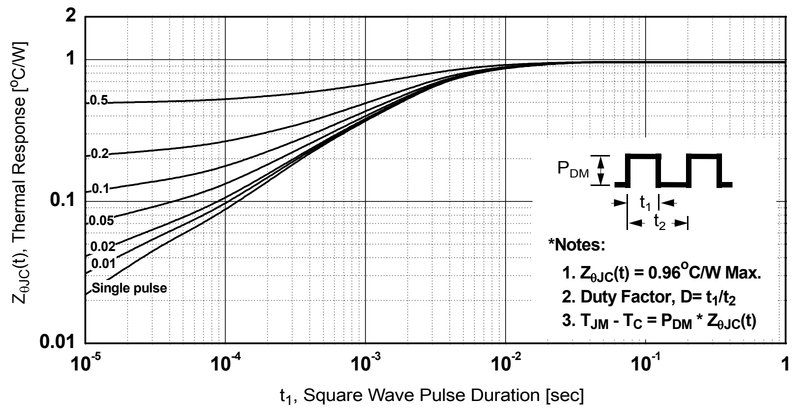


Figure 14. Transient Thermal Response Curve - FDPF8N50NZ

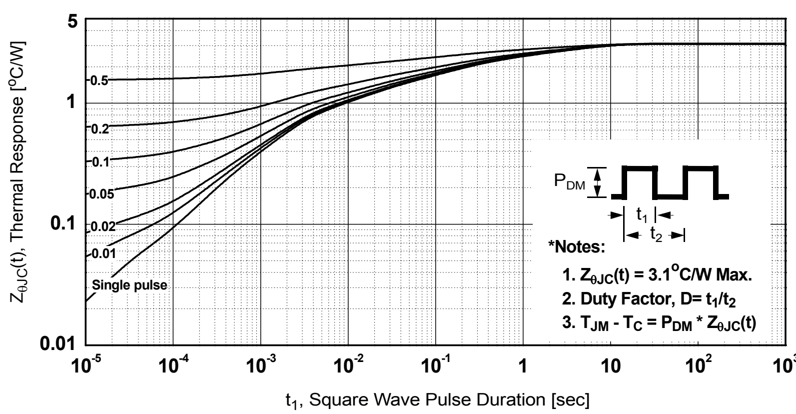


Figure 15. Gate Charge Test Circuit & Waveform

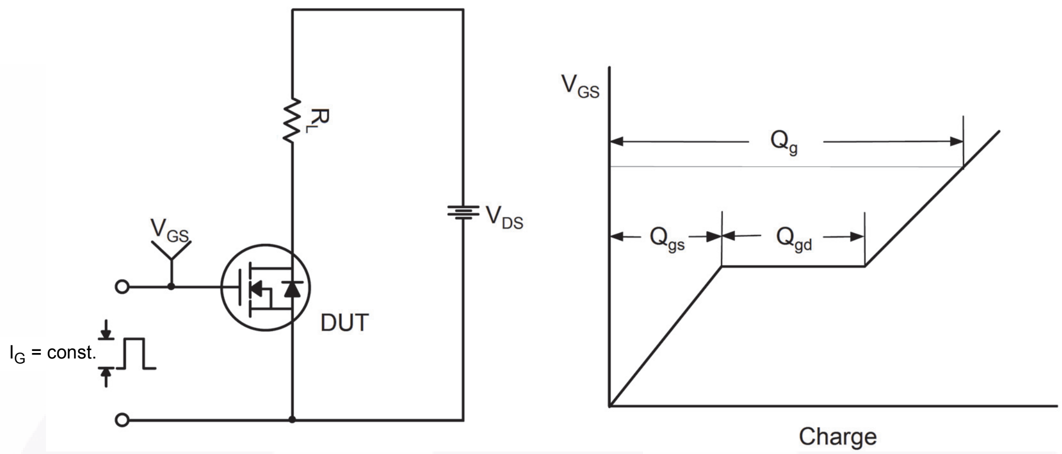


Figure 16. Resistive Switching Test Circuit & Waveforms

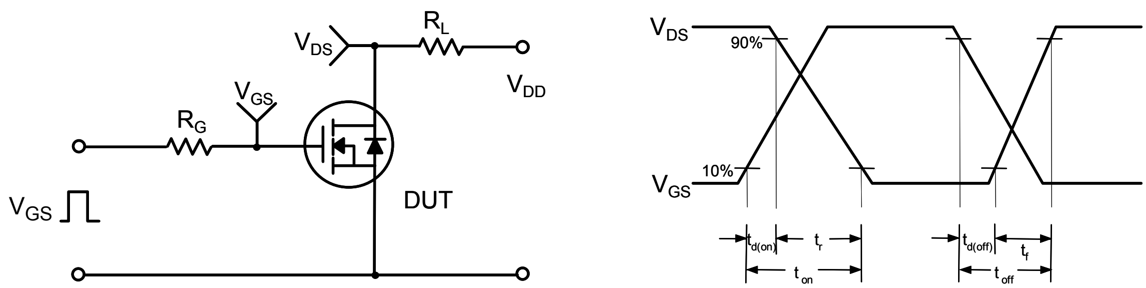


Figure 17. Unclamped Inductive Switching Test Circuit & Waveforms

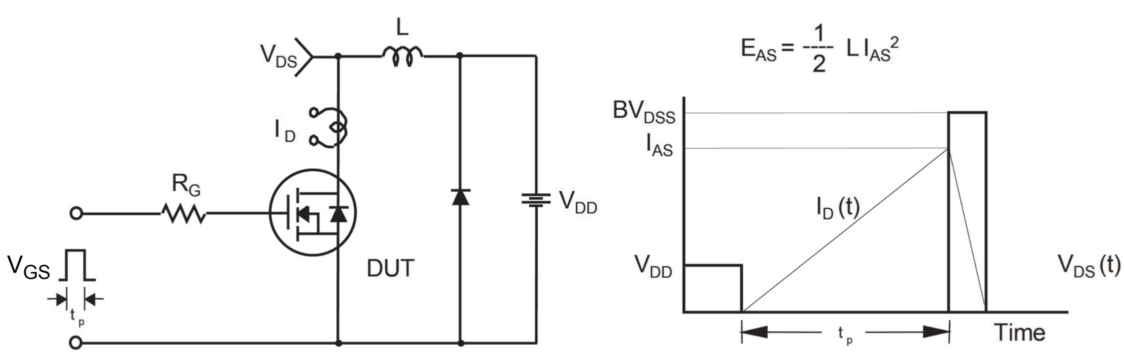
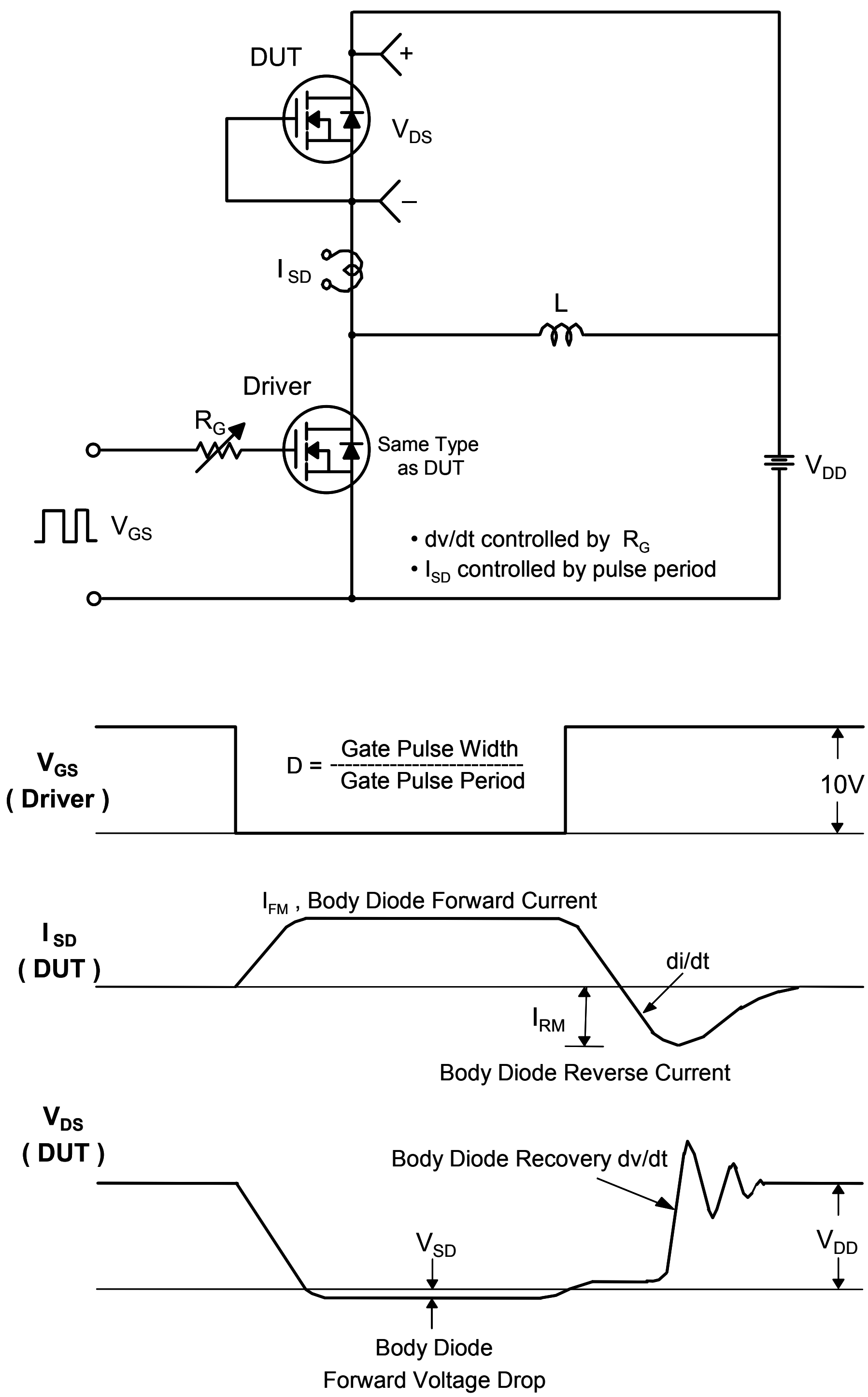


Figure 18. Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

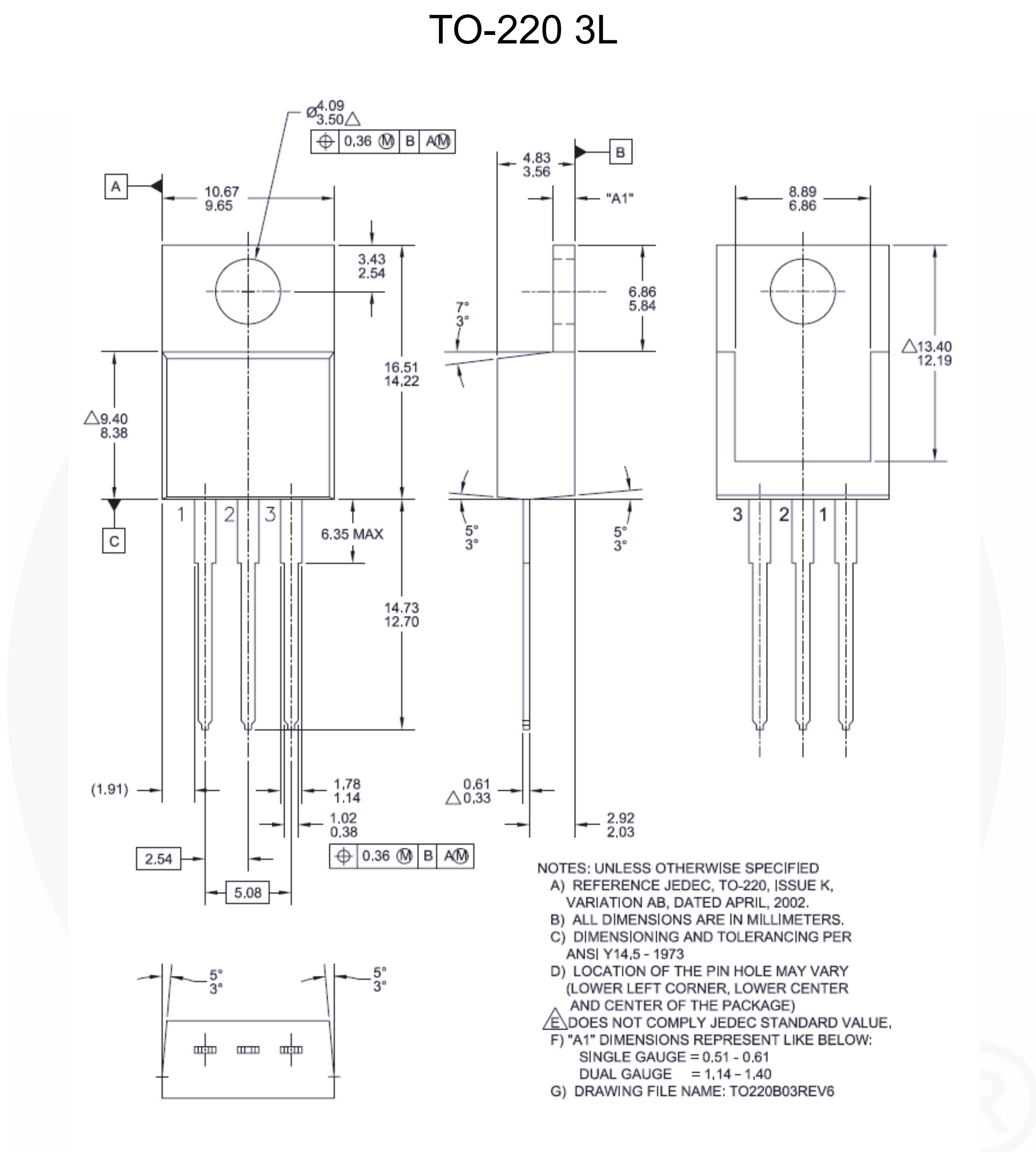


Figure 19. TO-220, Molded, 3Lead, Jedec Variation AB

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Dimension in Millimeters

Mechanical Dimensions

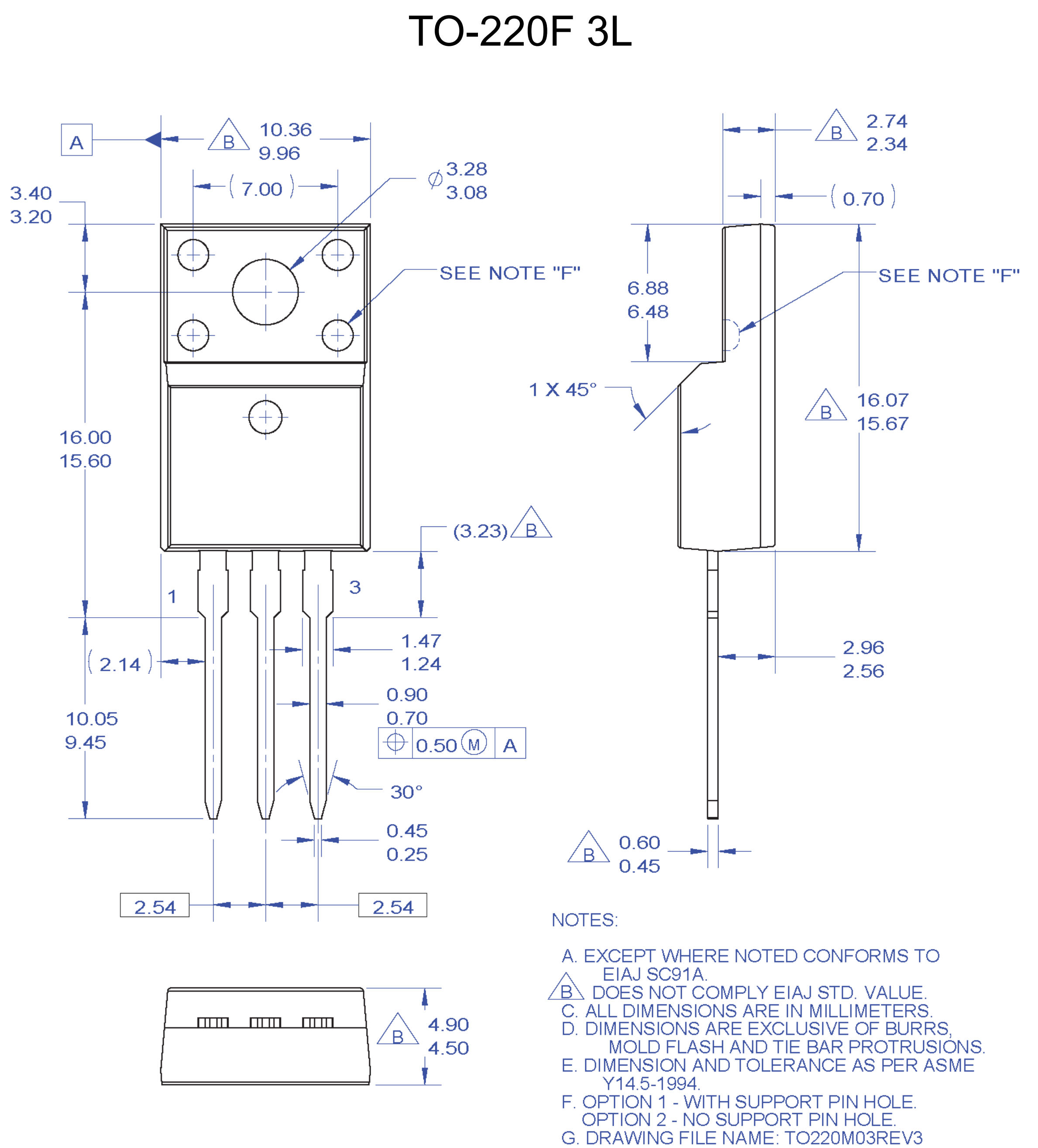

Figure 20. TO220, Molded, 3LD, Full Pack, EIAJ SC91, Straight Lead

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Dimension in Millimeters

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Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

Rev. I66

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