



August 2014

FDP51N25 / FDPF51N25

N-Channel UniFET™ MOSFET

250 V, 51 A, 60 mΩ

Features

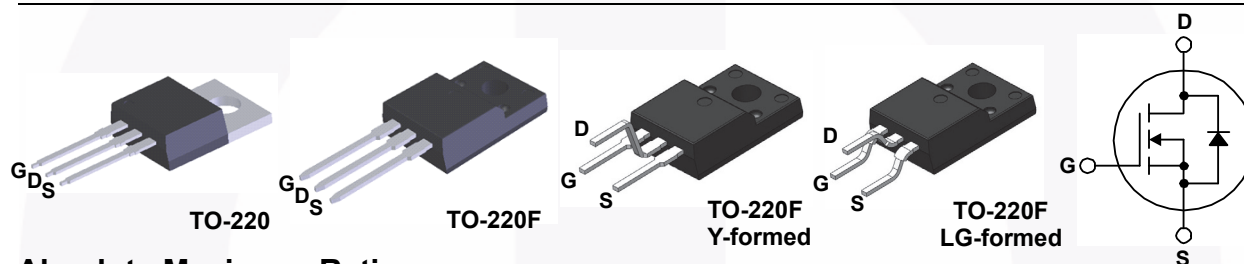
- $R_{DS(on)} = 48 \text{ m}\Omega$ (Typ.) @ $V_{GS} = 10 \text{ V}$, $I_D = 25.5 \text{ A}$
- Low Gate Charge (Typ. 55 nC)
- Low C_{rss} (Typ. 63 pF)

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.



Absolute Maximum Ratings

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

Symbol	Parameter		FDP51N25	FDPF51N25 FDPF51N25YDTU FDPF51N25RDTU	Unit
V _{DSS}	Drain-Source Voltage		250		V
I _D	Drain Current	- Continuous (T _C = 25°C)	51	51*	A
		- Continuous (T _C = 100°C)	30	30*	A
I _{DM}	Drain Current	- Pulsed (Note 1)	204	204*	A
V _{GSS}	Gate-Source voltage		± 30		V
E _{AS}	Single Pulsed Avalanche Energy (Note 2)		1111		mJ
I _{AR}	Avalanche Current (Note 1)		51		A
E _{AR}	Repetitive Avalanche Energy (Note 1)		32		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)		4.5		V/ns
P _D	Power Dissipation	(T _C = 25°C)	320	38	W
		- Derate Above 25°C	3.7	0.3	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	FDP51N25	FDPF51N25 FDPF51N25YDTU FDPF51N25RDTU	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	0.39	3.3	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	62.5	$^\circ\text{C/W}$

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDP51N25	FDP51N25	TO-220	Tube	N/A	N/A	50 units
FDPF51N25	FDPF51N25	TO-220F	Tube	N/A	N/A	50 units
FDPF51N25YDTU	FDPF51N25	TO-220F (Y-formed)	Tube	N/A	N/A	50 units
FDPF51N25RDTU	FDPF51N25	TO-220F (LG-formed)	Tube	N/A	N/A	50 units

Electrical Characteristics $T_C = 25^\circ\text{C}$ 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, 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 V _{DS} = 200 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} = 0V	--	--	-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 = 25.5 A	--	0.048	0.060	Ω
g _{FS}	Forward Transconductance	V _{DS} = 40 V, I _D = 25.5 A	--	43	--	S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 25 V, V _{GS} = 0 V, f = 1 MHz	--	2620	3410	pF
C _{oss}	Output Capacitance		--	530	690	pF
C _{rss}	Reverse Transfer Capacitance		--	63	90	pF
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	V _{DD} = 125 V, I _D = 51 A, V _{GS} = 10 V, R _G = 25 Ω	--	62	135	ns
t _r	Turn-On Rise Time		--	465	940	ns
t _{d(off)}	Turn-Off Delay Time		--	98	205	ns
t _f	Turn-Off Fall Time		(Note 4) --	130	270	ns
Q _g	Total Gate Charge	V _{DS} = 200 V, I _D = 51 A, V _{GS} = 10 V	--	55	70	nC
Q _{gs}	Gate-Source Charge		--	16	--	nC
Q _{gd}	Gate-Drain Charge		(Note 4) --	27	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	51	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	204	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 51 A	--	--	1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 51 A, dI _F /dt =100 A/μs	--	178	--	ns
Q _{rr}	Reverse Recovery Charge		--	4.0	--	μC

Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. $L = 0.68\text{ mH}, I_{AS} = 51\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\text{ }\Omega$, starting $T_J = 25^\circ\text{C}$.
3. $I_{SD} \leq 51\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$, starting $T_J = 25^\circ\text{C}$.
4. Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

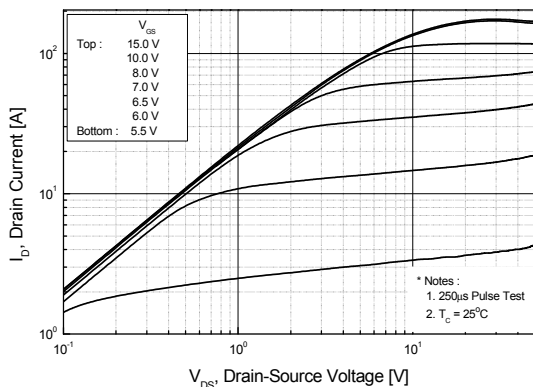


Figure 2. Transfer Characteristics

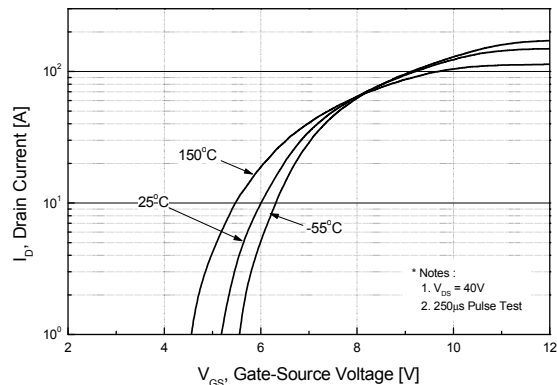


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

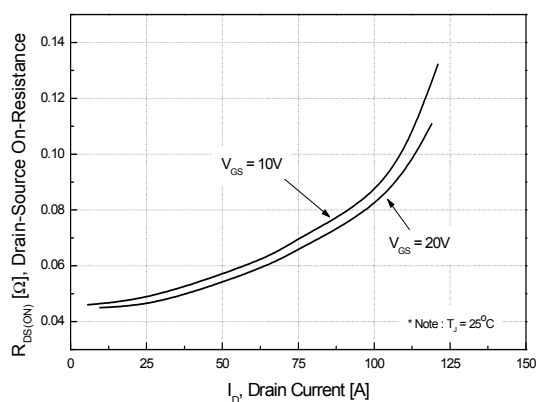


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

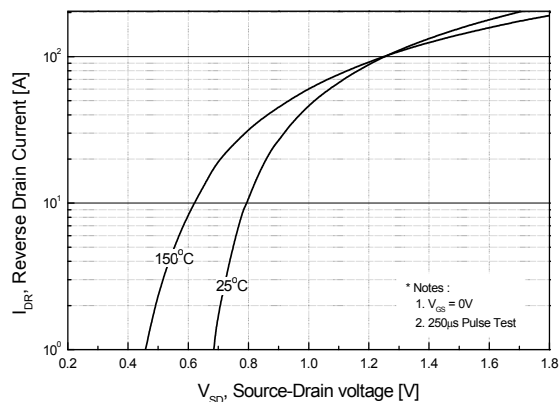


Figure 5. Capacitance Characteristics

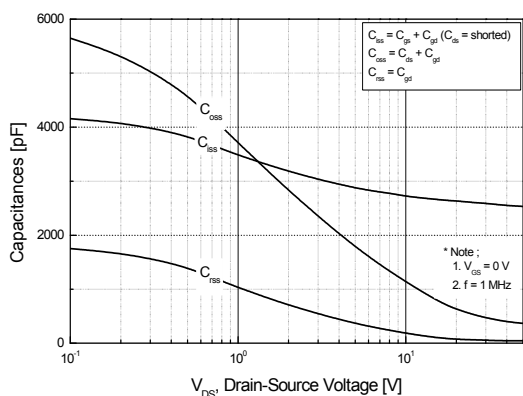
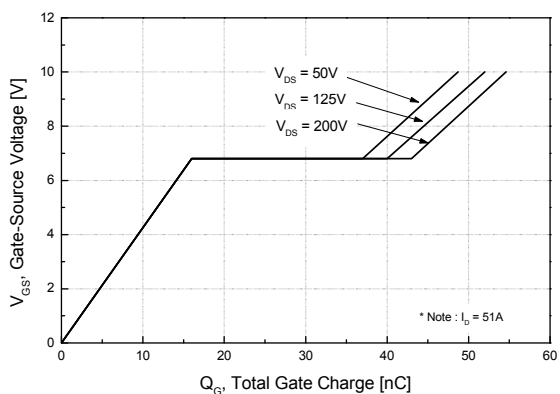


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

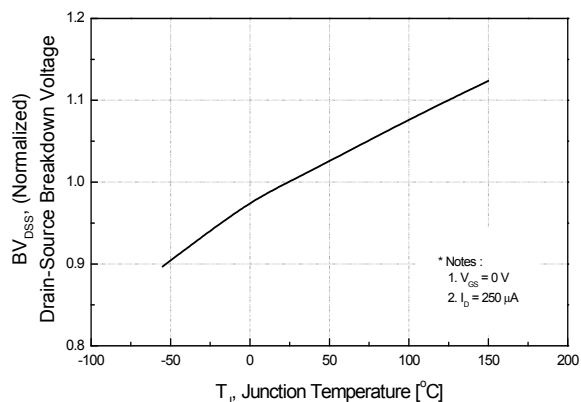


Figure 8. On-Resistance Variation vs. Temperature

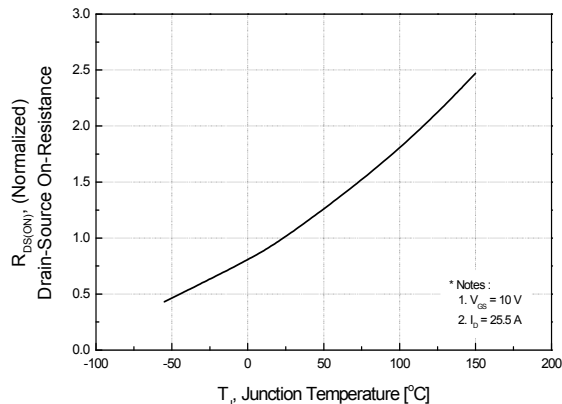


Figure 9-1. Maximum Safe Operating Area for FDP51N25

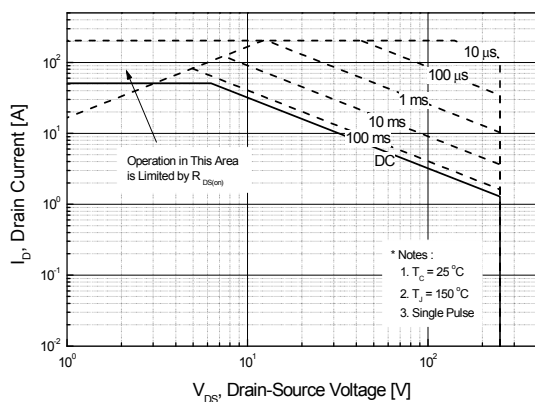


Figure 9-2. Maximum Safe Operating Area for FDPF51N25 / FDPF51N25YDTU

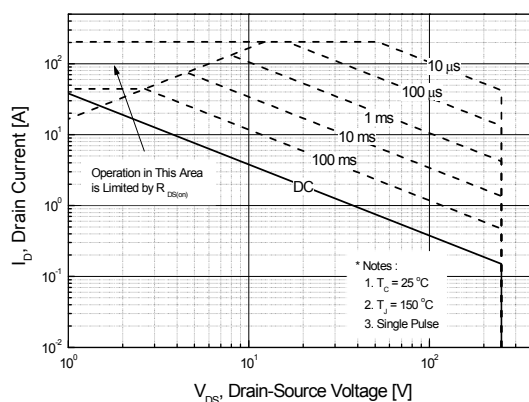
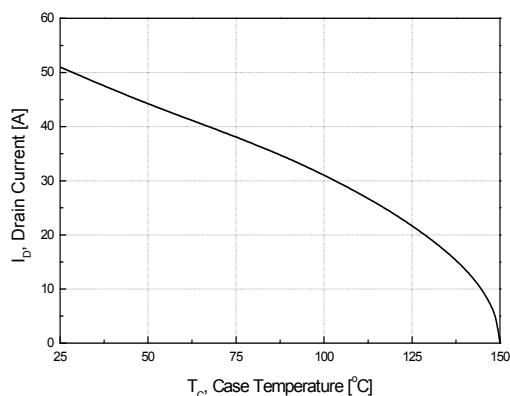


Figure 10. Maximum Drain Current vs. Case Temperature



Typical Performance Characteristics (Continued)

Figure 11-1. Transient Thermal Response Curve for FDP51N25

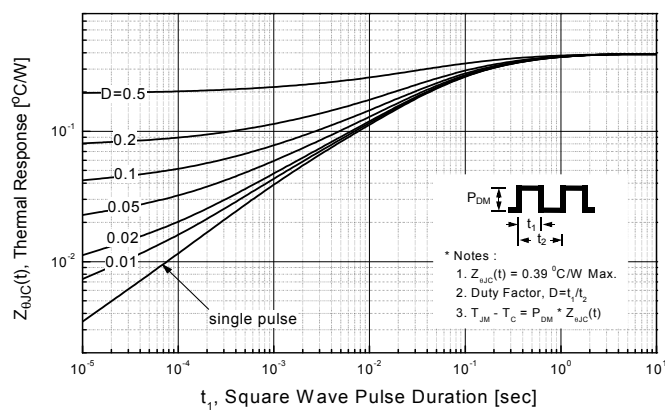
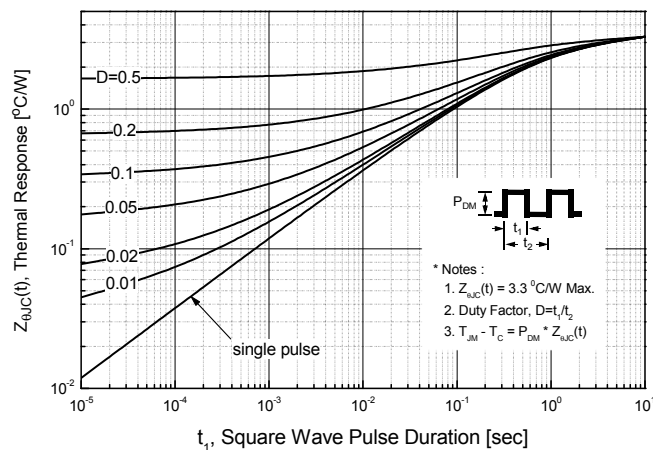


Figure 11-2. Transient Thermal Response Curve for FDPF51N25 / FDPF51N25YDTU



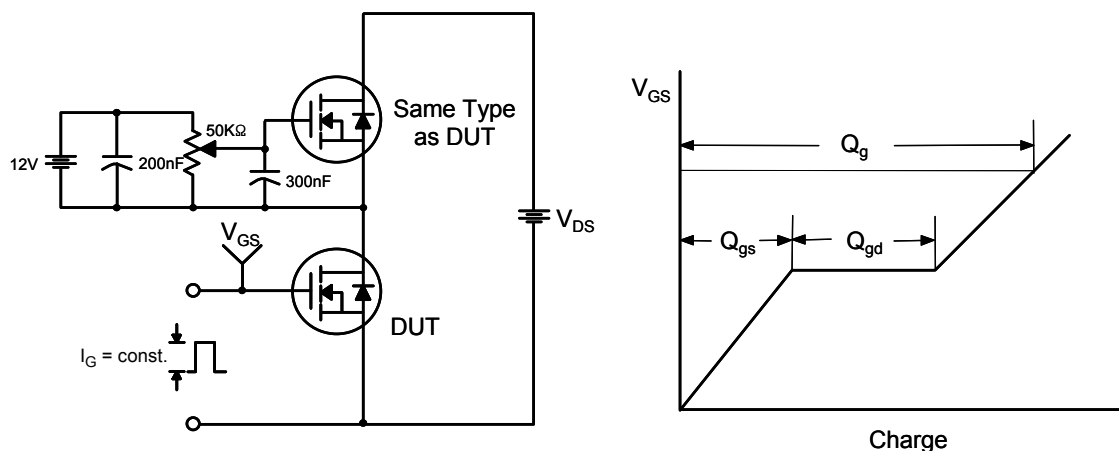


Figure 12. Gate Charge Test Circuit & Waveform



Figure 13. Resistive Switching Test Circuit & Waveforms



Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

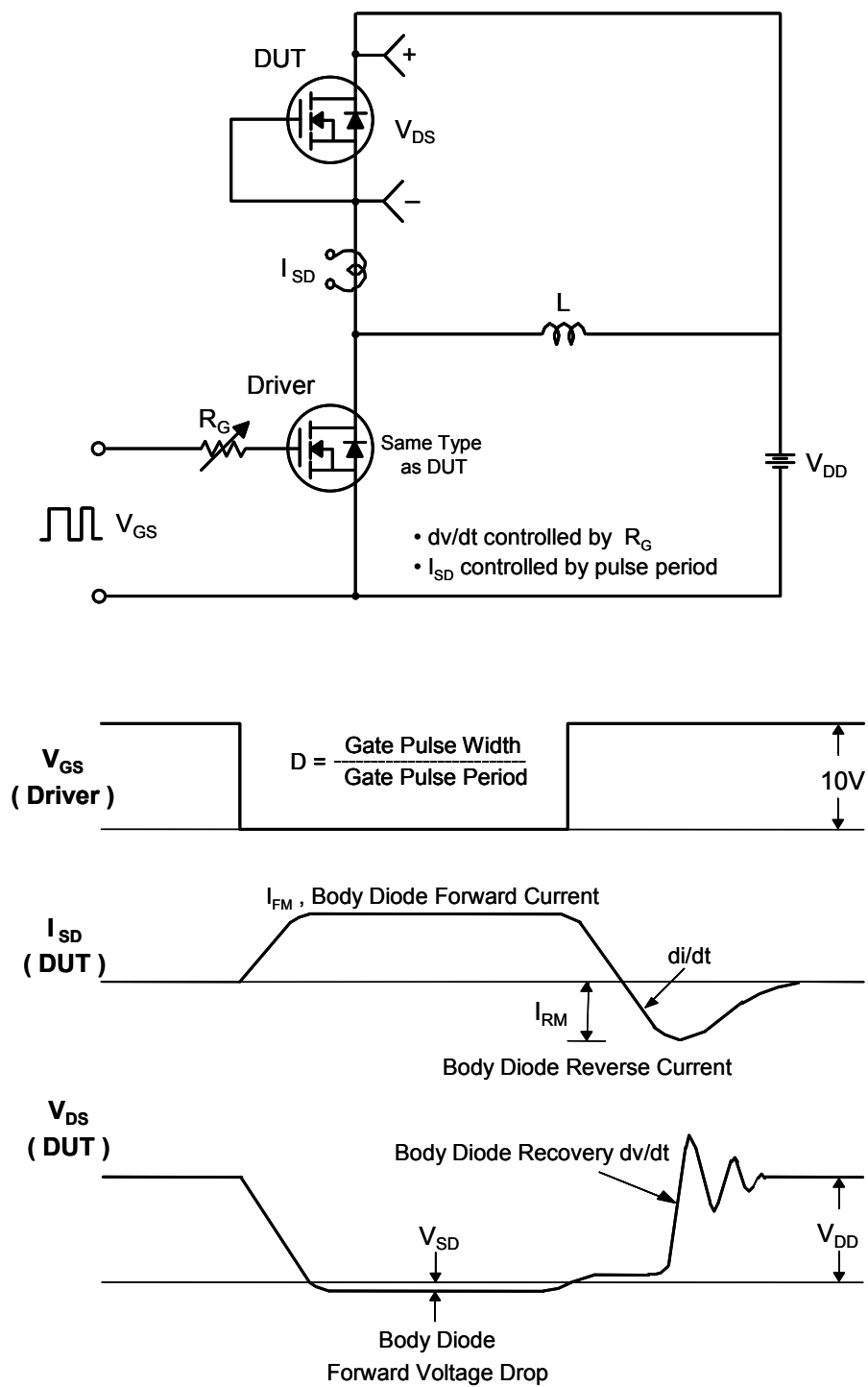
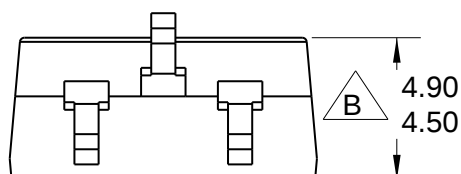
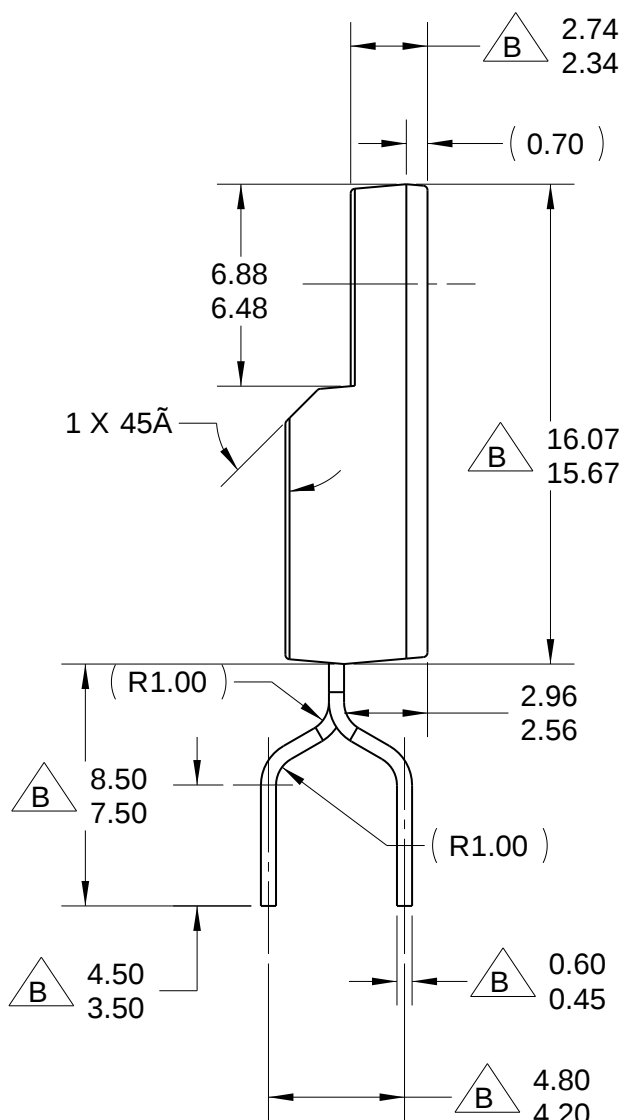
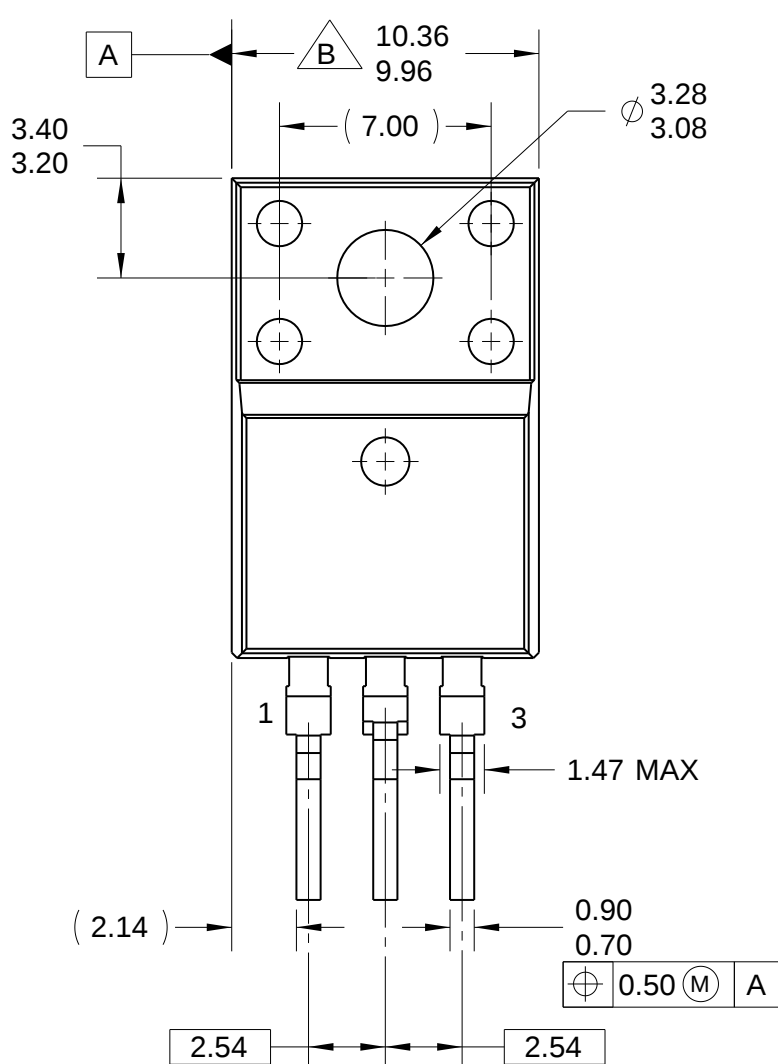


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

REVISIONS

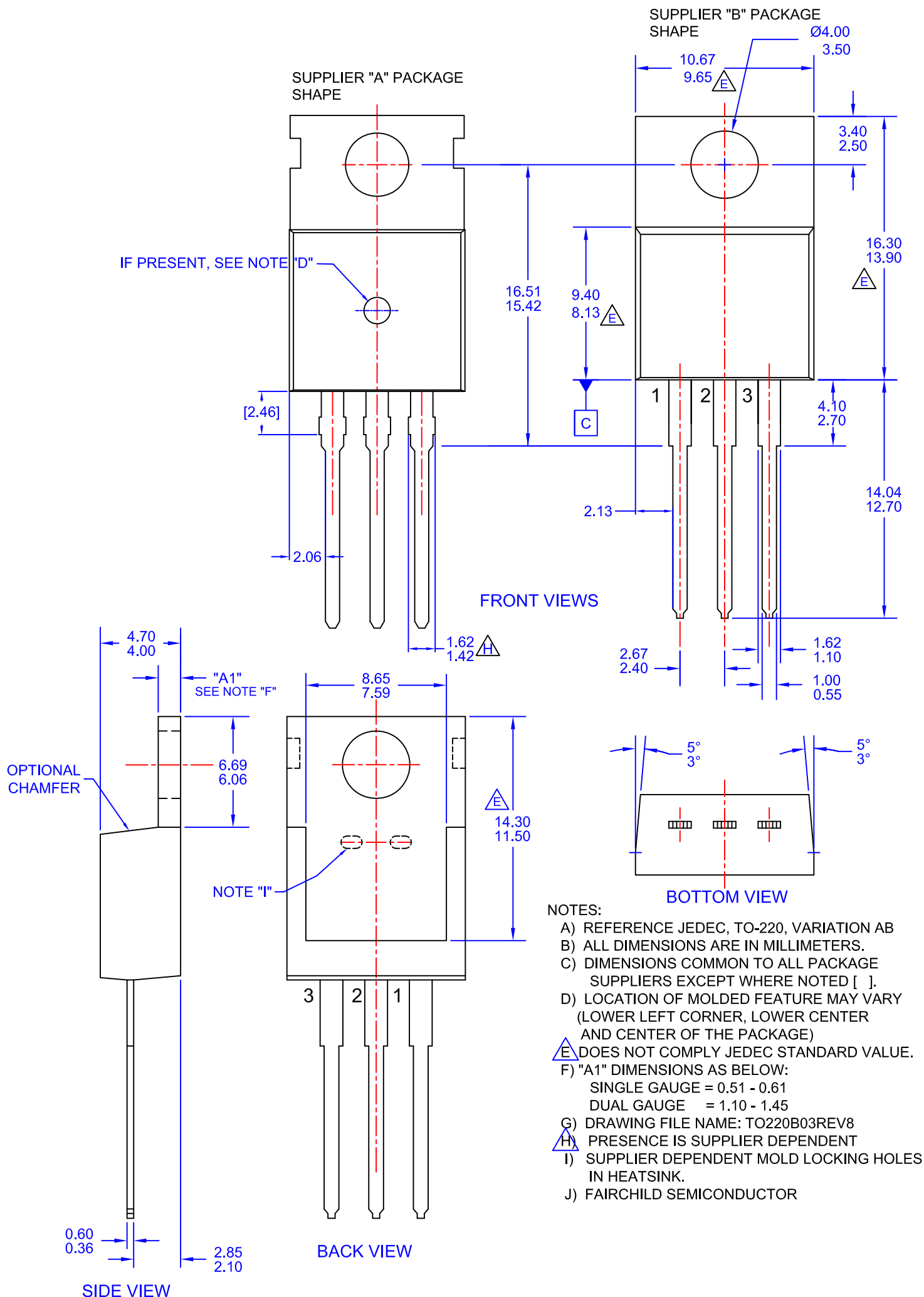
NBR	DESCRIPTION	DATE	BY/APP'D
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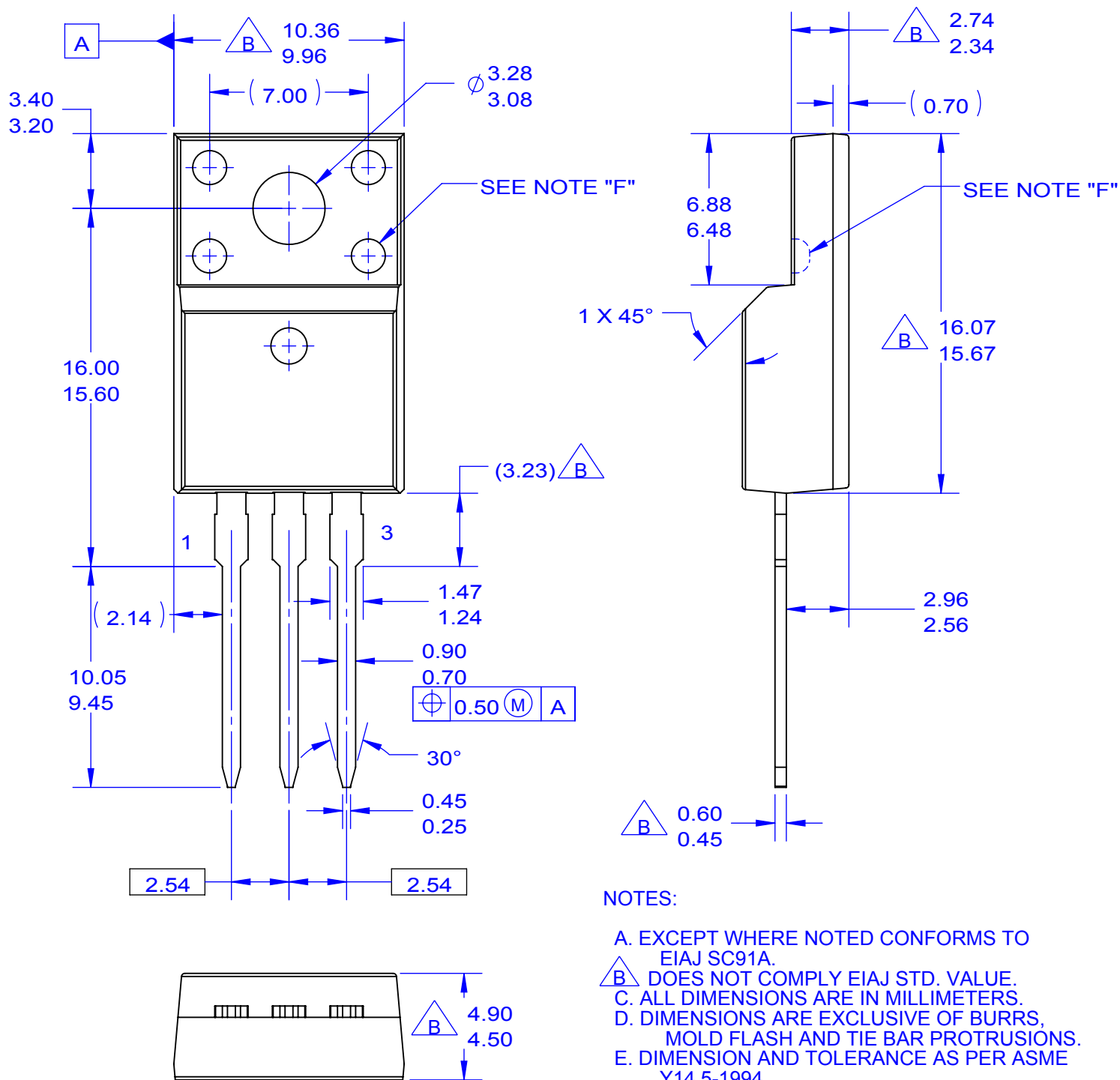


NOTES:

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- DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
- DIMENSION AND TOLERANCE AS PER ASME Y14.5-1994.
- DRAWING FILE NAME: TO220N03REV1

APPROVALS	DATE	FAIRCHILD SEMICONDUCTOR™			
DRAWN: BOBOY MALDO	04JUN08				
CHECKED: SD LEE		TO220, MOLDED, 3LD, FULL PACK, EIAJ SC91, LG FORM			
APPROVED: BY HUANG					
APPROVED: HOWARD ALLEN					
PROJECTION	[MM] INCH	SCALE	SIZE	DRAWING NUMBER	REV
		1:1	N/A	MKT-TO220N03	1
		FORMERLY: N/A		SHEET: 1 OF 1	





NOTES:

- A. EXCEPT WHERE NOTED CONFORMS TO EIAJ SC91A.
- B. DOES NOT COMPLY EIAJ STD. VALUE.
- C. ALL DIMENSIONS ARE IN MILLIMETERS.
- D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
- E. DIMENSION AND TOLERANCE AS PER ASME Y14.5-1994.
- F. OPTION 1 - WITH SUPPORT PIN HOLE.
OPTION 2 - NO SUPPORT PIN HOLE.
- G. DRAWING FILE NAME: TO220M03REV3



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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.
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