FAIRCHILD SEMICONDUCTOR®

March 2013

FDPF12N50FT

N-Channel UniFET™ FRFET® MOSFET

500 V, 11.5 A, 700 mΩ

Features

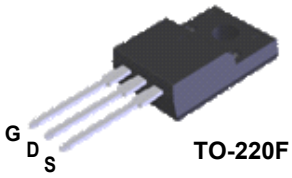
- $R_{DS(on)}$ = 650 mΩ (Typ.) @ V_{GS} = 10 V, I_D = 6 A
- Low Gate Charge (Typ. 21 nC)
- Low C_{rss} (Typ. 11 pF)
- 100% Avalanche Tested
- Improve dv/dt Capability
- RoHS Compliant

Applications

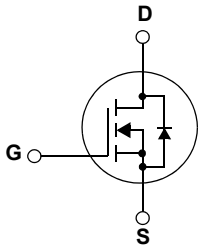
- LCD/LED/PDP TV
- Lighting
- Uninterruptible Power Supply

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. The body diode's reverse recovery performance of UniFET™ FRFET® MOSFET has been enhanced by lifetime control. Its t_{rr} is less than 100nsec and the reverse dv/dt immunity is 15V/ns while normal planar MOSFETs have over 200nsec and 4.5V/nsec respectively. Therefore, it can remove additional component and improve system reliability in certain applications in which the performance of MOSFET's body diode is significant. 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-220F



MOSFET Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter			FDPF12N50FT	Unit
V_{DSS}	Drain to Source Voltage			500	V
V_{GSS}	Gate to Source Voltage			±30	V
I_D	Drain Current	- Continuous (T_C = 25°C)		11.5*	A
		- Continuous (T_C = 100°C)		6.9*	
I_{DM}	Drain Current	- Pulsed	(Note 1)	46*	A
E_{AS}	Single Pulsed Avalanche Energy		(Note 2)	456	mJ
I_{AR}	Avalanche Current		(Note 1)	11.5	A
E_{AR}	Repetitive Avalanche Energy		(Note 1)	16.5	mJ
dv/dt	Peak Diode Recovery dv/dt		(Note 3)	20	V/ns
P_D	Power Dissipation	(T_C = 25°C)		42	W
		- Derate above 25°C		0.33	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	FDPF12N50FT	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	3.0	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	

Package Marking and Ordering Information $T_C = 25^oC$ unless otherwise noted

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDPF12N50FT	FDPF12N50FT	TO-220F	-	-	50

Electrical Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 250μA, V_{GS} = 0V, T_J = 25°C	500	-	-	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250μA, Referenced to 25°C	-	0.5	-	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 500V, V_{GS} = 0V	-	-	10	μA
		V_{DS} = 400V, T_C = 125°C	-	-	100	
I_{GSS}	Gate to Body Leakage Current	V_{GS} = ±30V, V_{DS} = 0V	-	-	±100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 250μA	3.0	-	5.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10V, I_D = 6A	-	0.59	0.7	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40V, I_D = 6A	-	12	-	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1MHz	-	1050	1395	pF
C_{oss}	Output Capacitance		-	135	180	pF
C_{rss}	Reverse Transfer Capacitance		-	11	17	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	V_{DS} = 400V, I_D = 11.5A, V_{GS} = 10V (Note 4)	-	21	30	nC
Q_{gs}	Gate to Source Gate Charge		-	6	-	nC
Q_{gd}	Gate to Drain “Miller” Charge		-	9	-	nC
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 250V, I_D = 11.5A, R_G = 25Ω (Note 4)	-	21	50	ns
t_r	Turn-On Rise Time		-	45	100	ns
$t_{d(off)}$	Turn-Off Delay Time		-	50	110	ns
t_f	Turn-Off Fall Time		-	35	80	ns
Drain-Source Diode Characteristics						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	11.5	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	46	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS} = 0V, I_{SD} = 11.5A	-	-	1.5	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0V, I_{SD} = 11.5A, dI_F/dt = 100A/μs	-	134	-	ns
Q_{rr}	Reverse Recovery Charge		-	0.37	-	μC

Notes:
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L = 6.9mH, I_{AS} = 11.5A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. $I_{SD} \le$ 11.5A, di/dt ≤ 200A/μs, $V_{DD} \le BV_{DSS}$, Starting T_J = 25°C
4. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

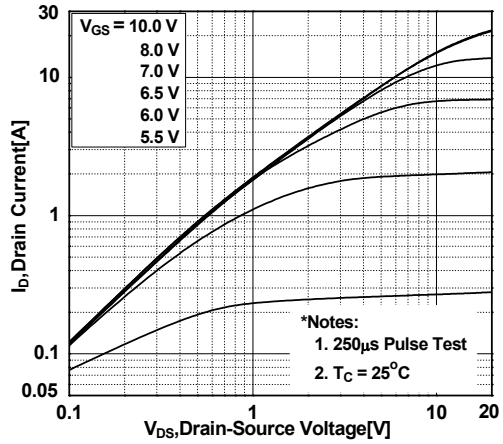


Figure 2. Transfer Characteristics

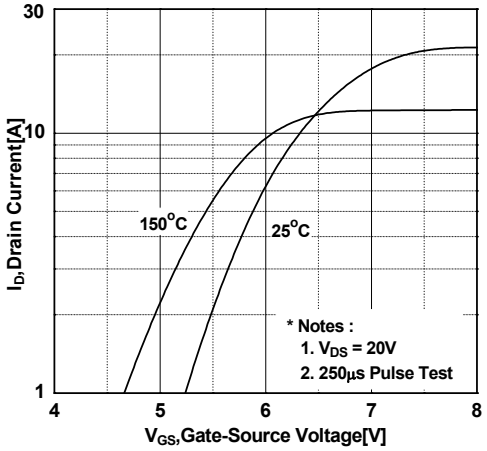


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

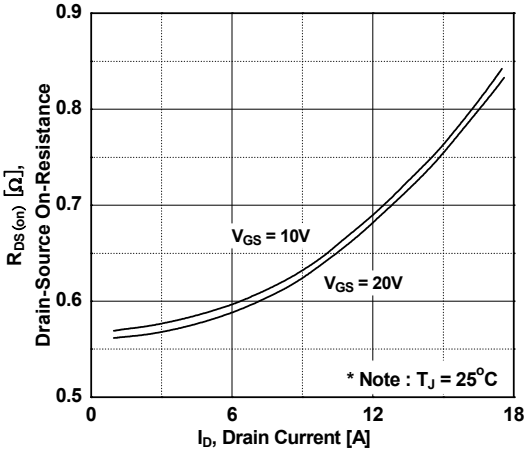


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

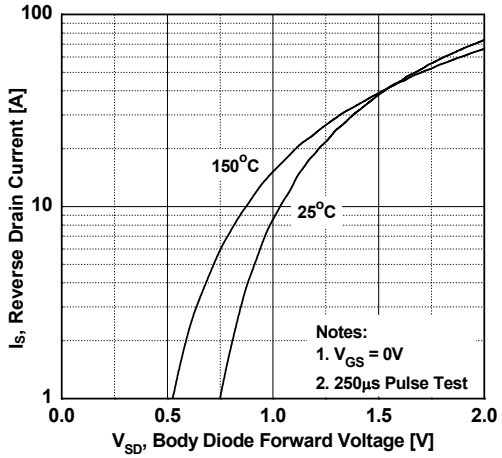


Figure 5. Capacitance Characteristics

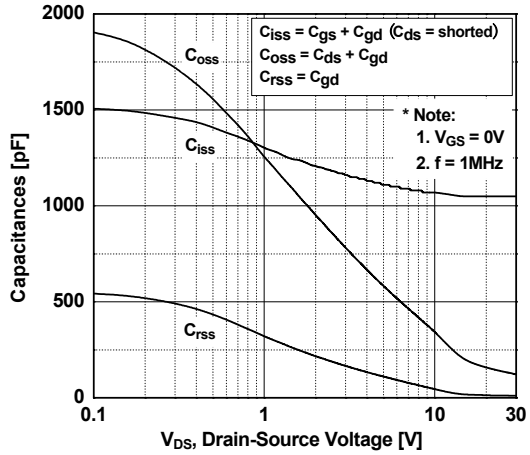
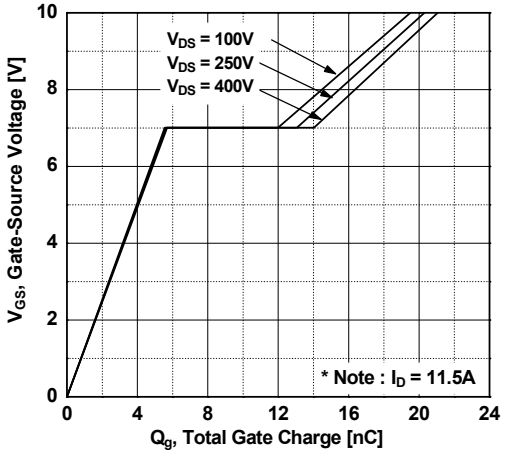


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

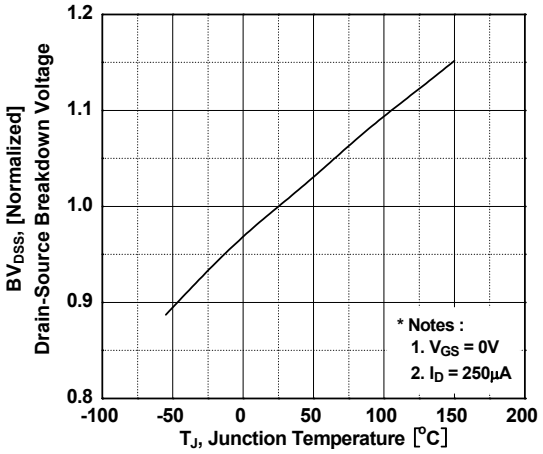


Figure 8. Maximum Safe Operating Area - FDP12N50F

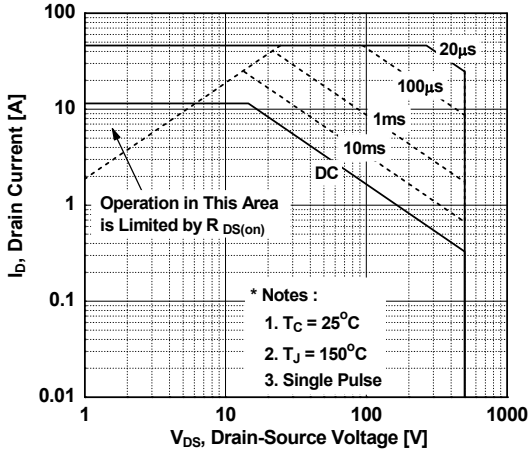


Figure 9. Maximum Safe Operating Area - FDPF12N50FT

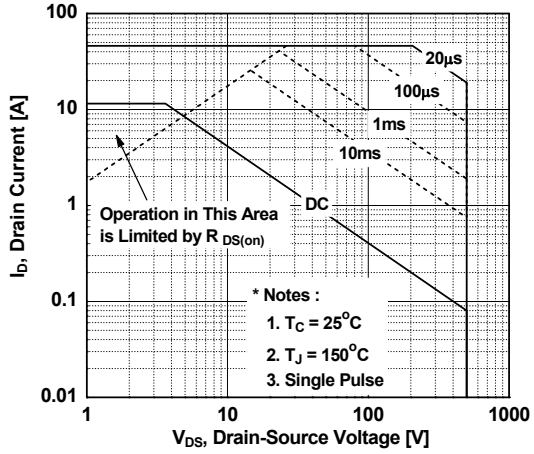


Figure 10. Maximum Drain Current vs. Case Temperature

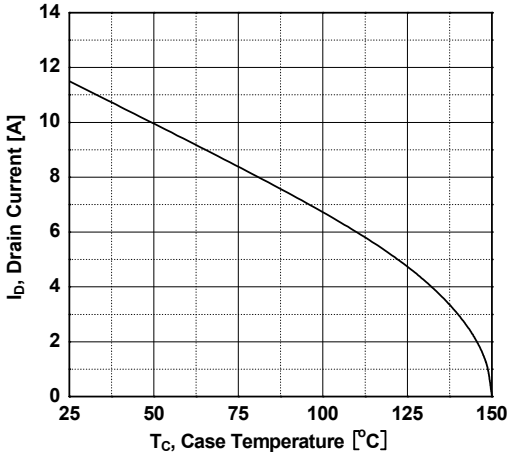
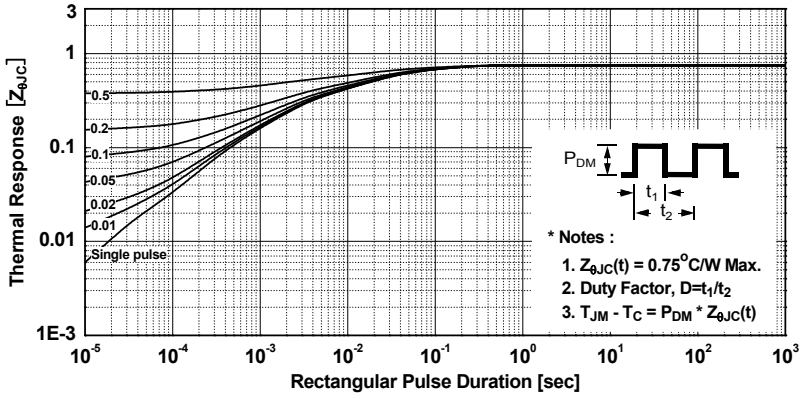
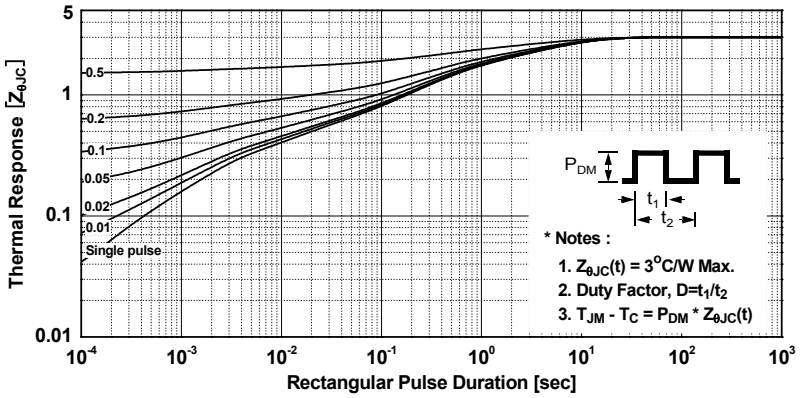


Figure 11. Transient Thermal Response Curve - FDP12N50F

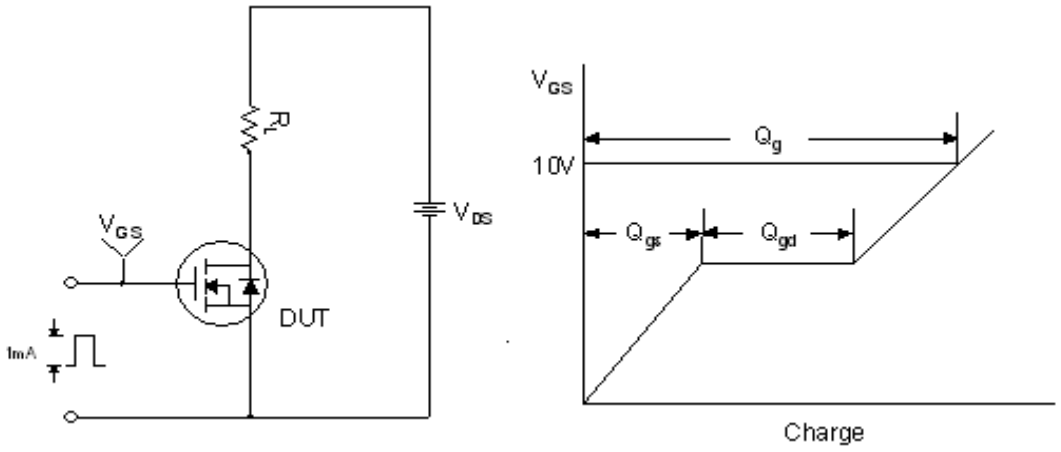


Typical Performance Characteristics (Continued)

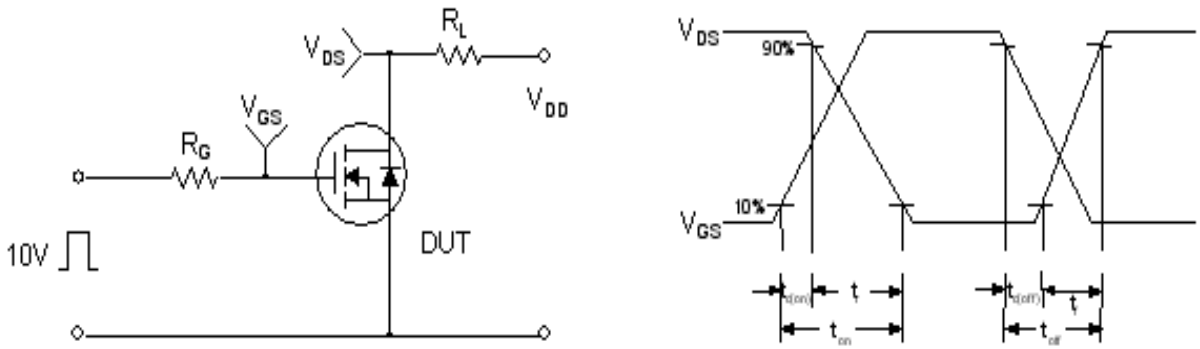
Figure 12. Transient Thermal Response Curve - FDPF12N50FT



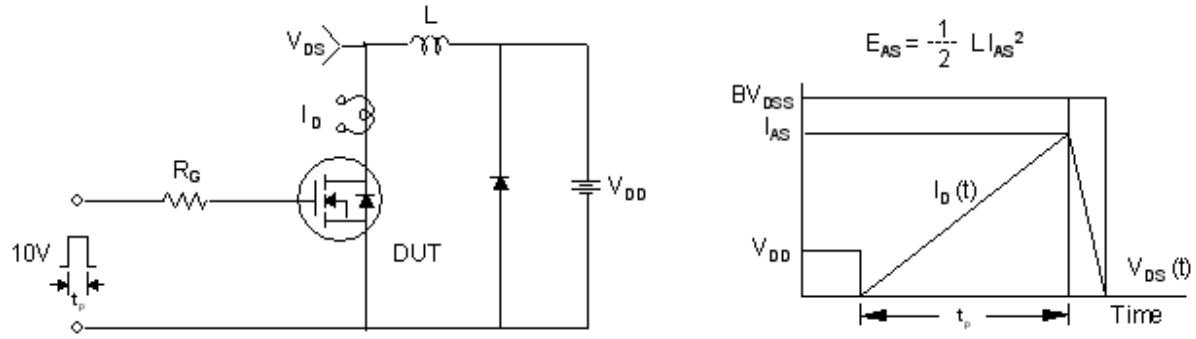
Gate Charge Test Circuit & Waveform



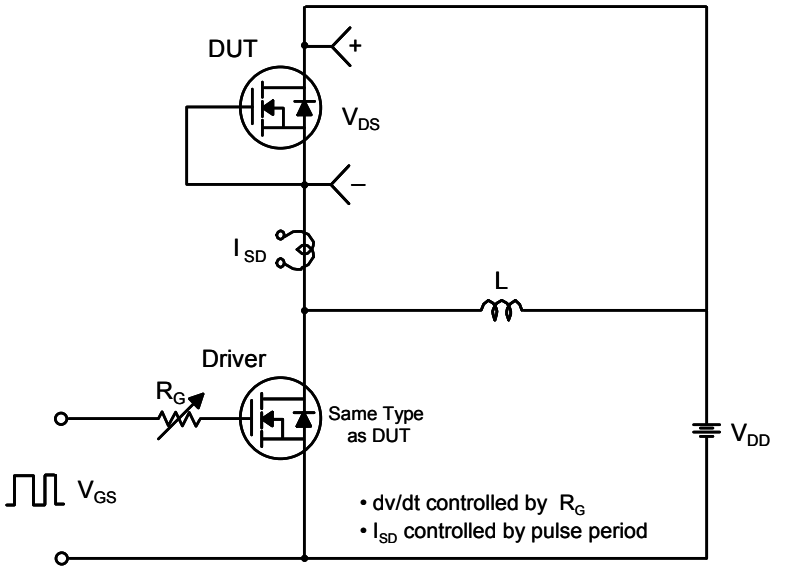
Resistive Switching Test Circuit & Waveforms

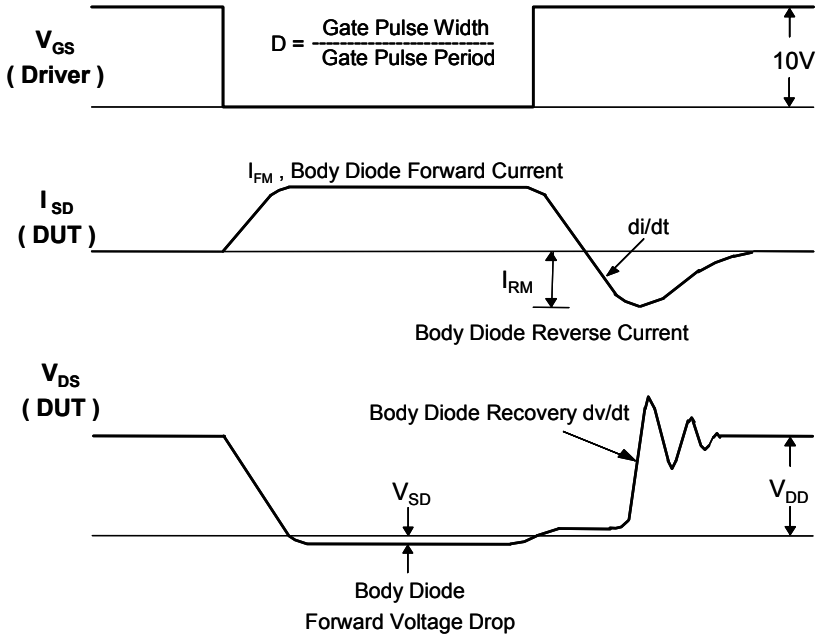


Unclamped Inductive Switching Test Circuit & Waveforms



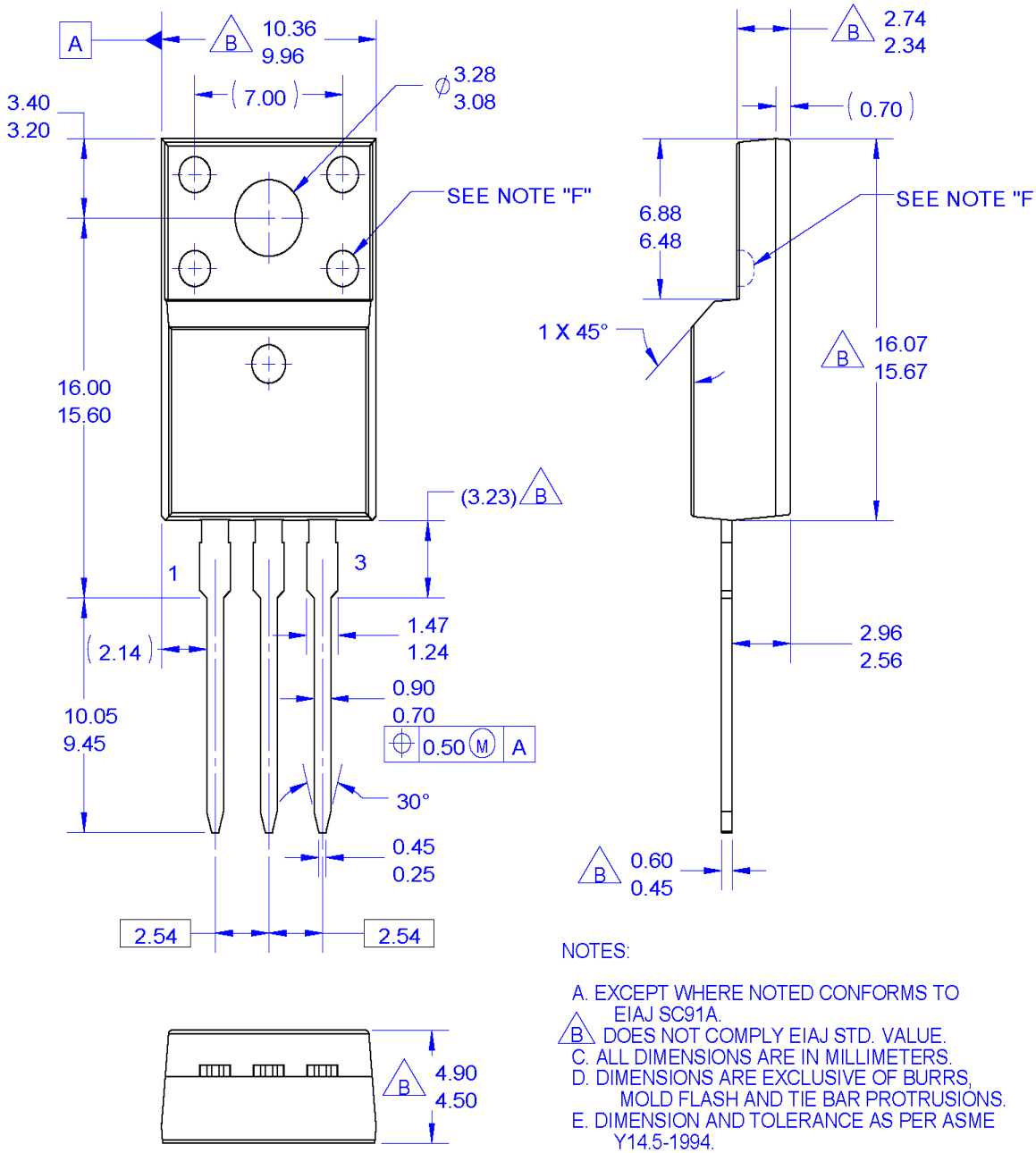
Peak Diode Recovery dv/dt Test Circuit & Waveforms





Mechanical Dimensions

TO-220M03



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

Dimensions 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.
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