ON Semiconductor®

FDPF7N50U

N-Channel UniFET™ Ultra FRFET™ MOSFET

500 V, 5 A, 1.5 Ω

Features

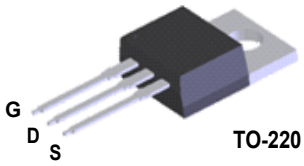
- $R_{DS(on)}$ = 1.5 Ω (Max.) @ V_{GS} = 10 V, I_D = 2.5 A
- Low Gate Charge (Typ.12.8 nC)
- Low C_{rss} (Typ. 9 pF)
- 100% Avalanche Tested
- Improved dv/dt Capability

Applications

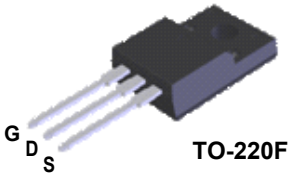
- LCD/LED TV
- Lighting
- Uninterruptible Power Supply
- AC-DC Power Supply

Description

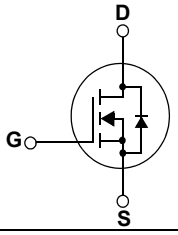
UniFET™ MOSFET is ON Semiconductor's high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-state resistance, and to provide better switching performance and higher avalanche energy strength. UniFET Ultra FRFET™ MOSFET has much superior body diode reverse recovery performance. Its t_{rr} is less than 50nsec and the reverse dv/dt immunity is 20V/nsec while normal planar MOSFETs have over 200nsec and 4.5V/nsec respectively. Therefore UniFET Ultra FRFET MOSFET can remove additional component and improve system reliability in certain applications that require performance improvement of the MOSFET's body diode. 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



Absolute Maximum Ratings

Symbol	Parameter		FDPF7N50U	Unit
V_{DSS}	Drain-Source Voltage		500	V
I_D	Drain Current	- Continuous (T_C = 25°C) - Continuous (T_C = 100°C)	5 * 3.0 *	A A
I_{DM}	Drain Current	- Pulsed (Note 1)	20 *	A
V_{GSS}	Gate-Source voltage		±30	V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	125	mJ
I_{AR}	Avalanche Current	(Note 1)	5	A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	8.9	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	20	V/ns
P_D	Power Dissipation	(T_C = 25°C) - Derate above 25°C	31.3 0.25	W 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	FDPF7N50U	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	4.0	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	

October-2017,Rev.3

Publication Order Number:
FDPF7N50U/D

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDPF7N50U	FDPF7N50U	TO-220F	--	--	50

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} = 0V, I_D = 250μA	500	--	--	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	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 V_{DS} = 400V, T_C = 125°C	-- --	-- --	25 250	μA μA
I_{GSSF}	Gate-Body Leakage Current, Forward	V_{GS} = 30V, V_{DS} = 0V	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	V_{GS} = -30V, V_{DS} = 0V	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250μA	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10V, I_D = 2.5A	--	1.2	1.5	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40V, I_D = 2.5A	--	2.5	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz	--	720	940	pF
C_{oss}	Output Capacitance		--	95	190	pF
C_{rss}	Reverse Transfer Capacitance		--	9	13.5	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 250V, I_D = 5A R_G = 25Ω (Note 4)	--	6	20	ns
t_r	Turn-On Rise Time		--	55	120	ns
$t_{d(off)}$	Turn-Off Delay Time		--	25	60	ns
t_f	Turn-Off Fall Time		--	35	80	ns
Q_g	Total Gate Charge	V_{DS} = 400V, I_D = 5A V_{GS} = 10V (Note 4)	--	12.8	16.6	nC
Q_{gs}	Gate-Source Charge		--	3.7	--	nC
Q_{gd}	Gate-Drain Charge		--	5.8	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	5	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	20	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0V, I_S = 5A	--	--	1.6	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0V, I_S = 5A dI_F/dt =100A/μs	--	40	--	ns
Q_{rr}	Reverse Recovery Charge		--	0.04	--	μC

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I_{AS} = 5A, V_{DD} = 50V, L=10mH, R_G = 25Ω, Starting T_J = 25°C
3. $I_{SD} \leq$ 5A, di/dt ≤ 200A/μs, $V_{DD} \leq BV_{DSS}$, Starting T_J = 25°C
4. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

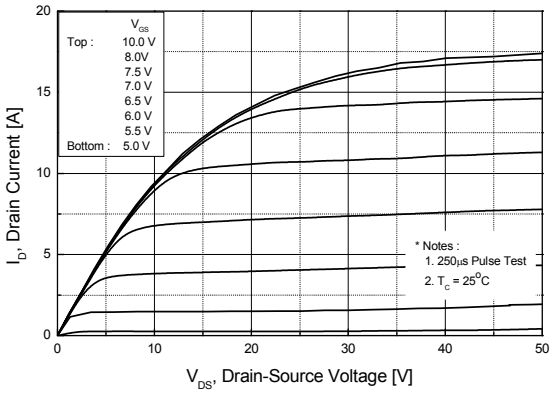


Figure 2. Transfer Characteristics

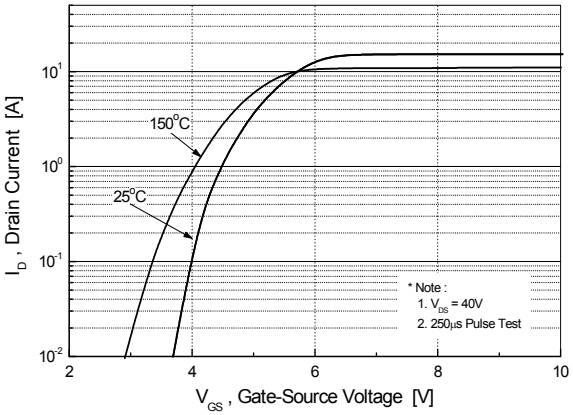


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

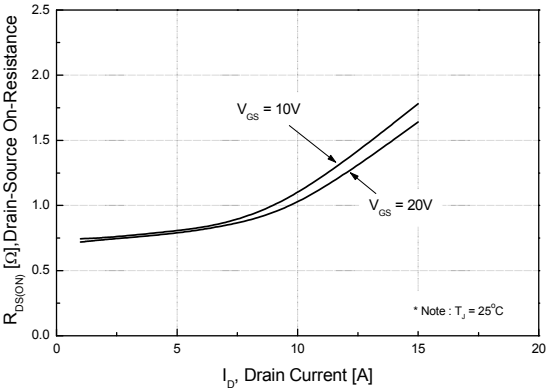


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

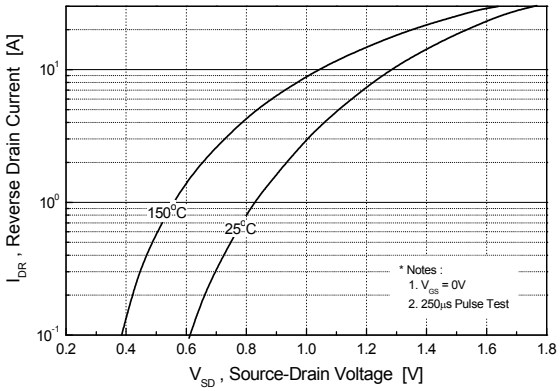


Figure 5. Capacitance Characteristics

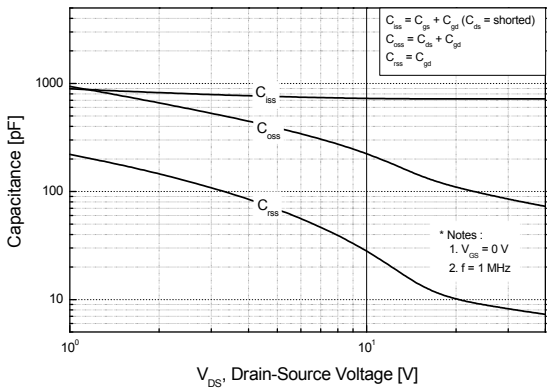
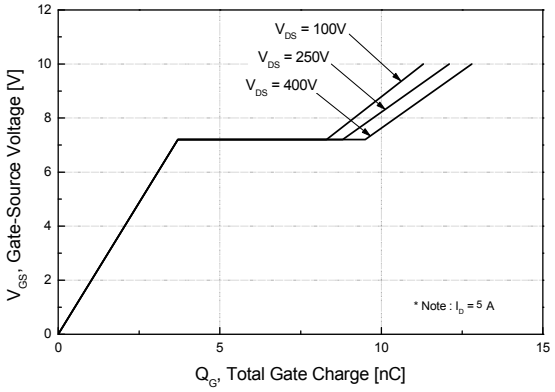


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

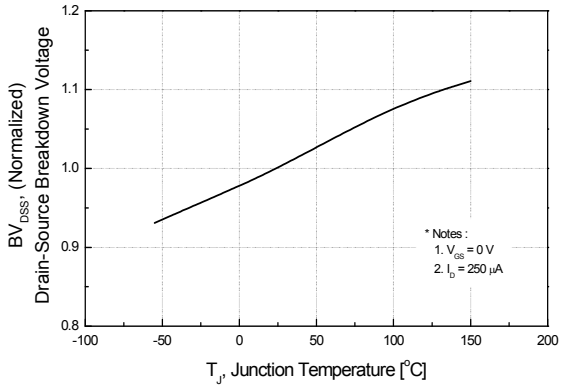


Figure 8. Maximum Drain Current Vs. Case Temperature

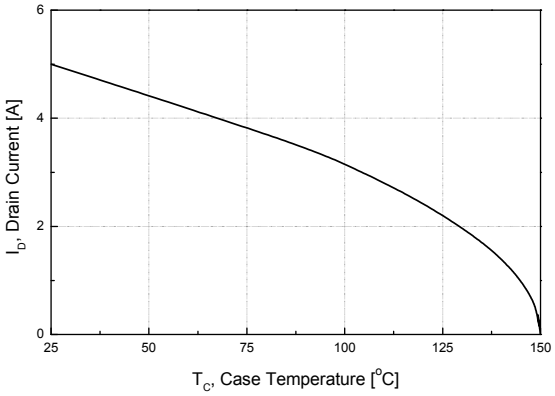


Figure 9. Maximum Safe Operating Area - FDPF7N50U

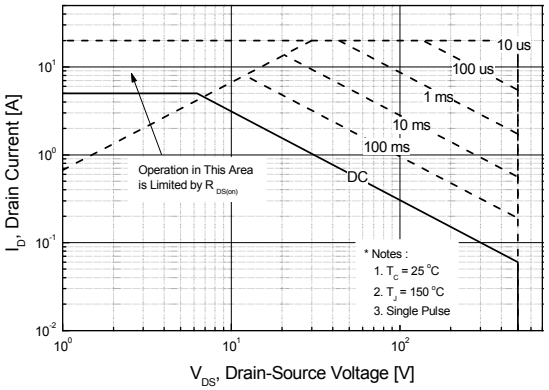
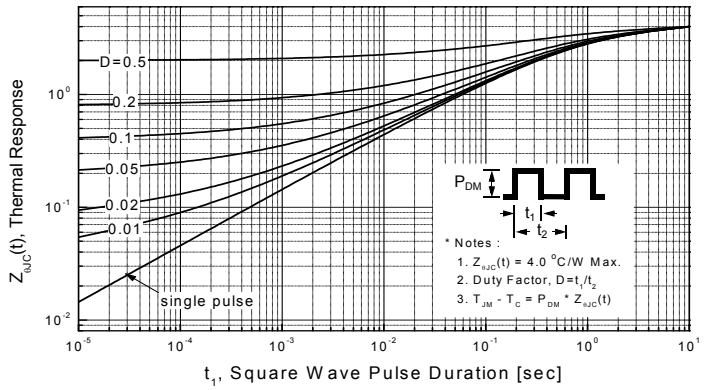
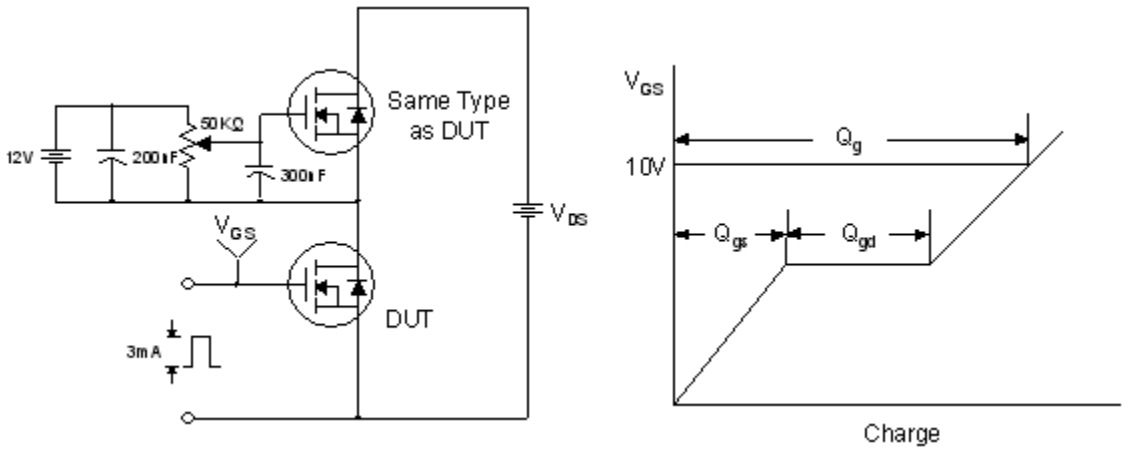


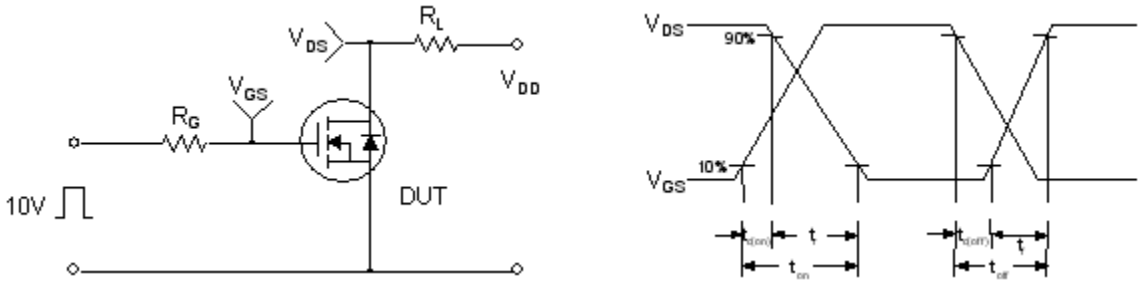
Figure 10. Transient Thermal Response Curve



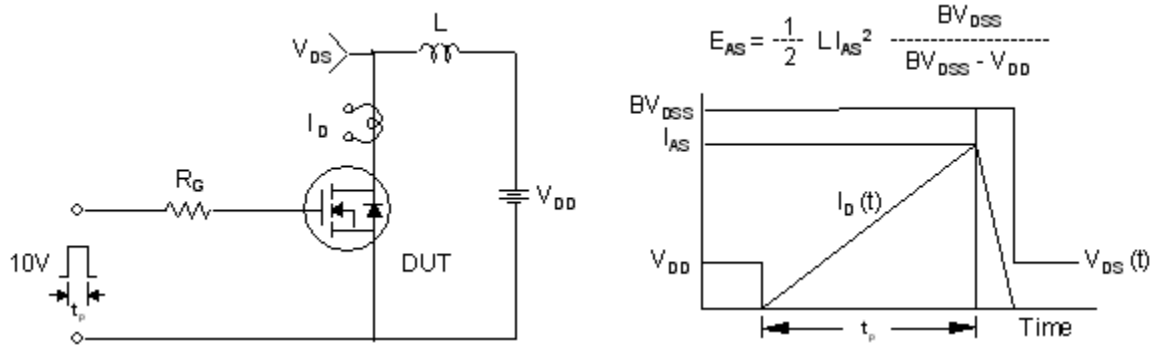
Gate Charge Test Circuit & Waveform



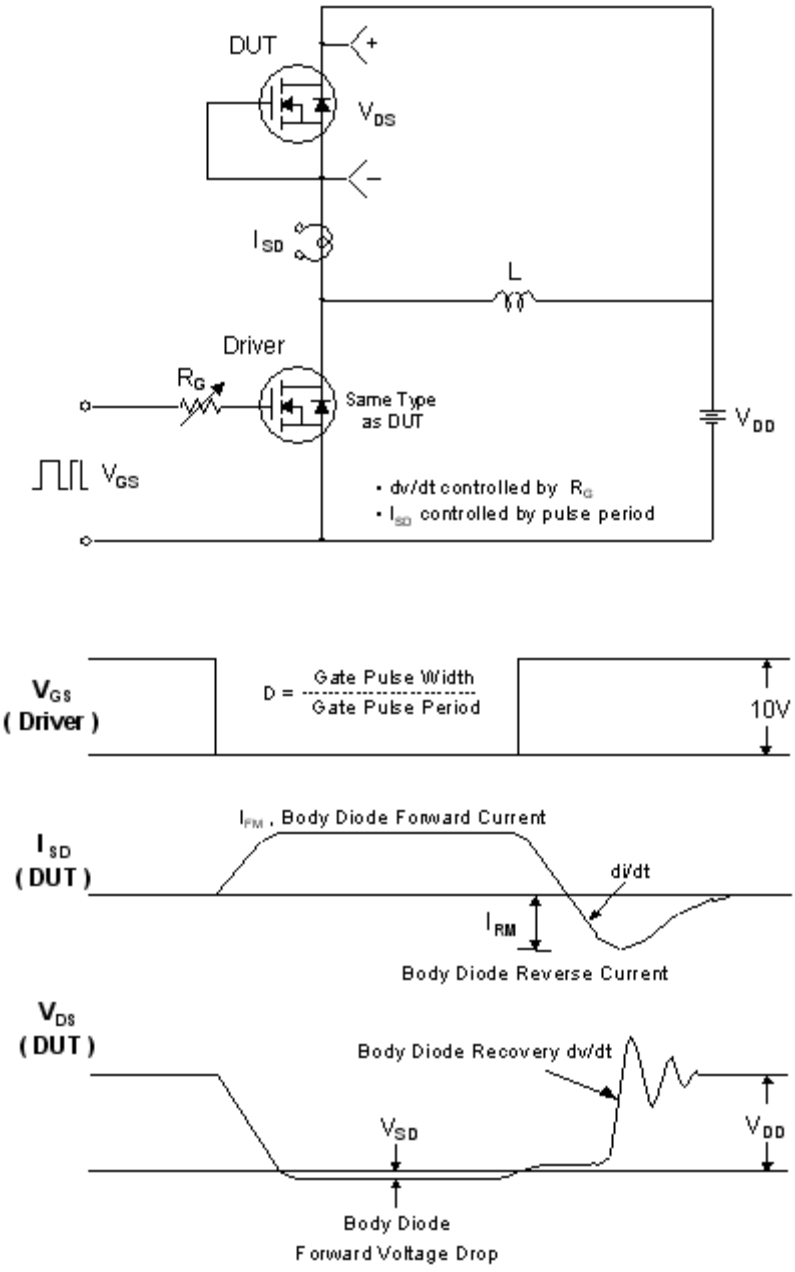
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

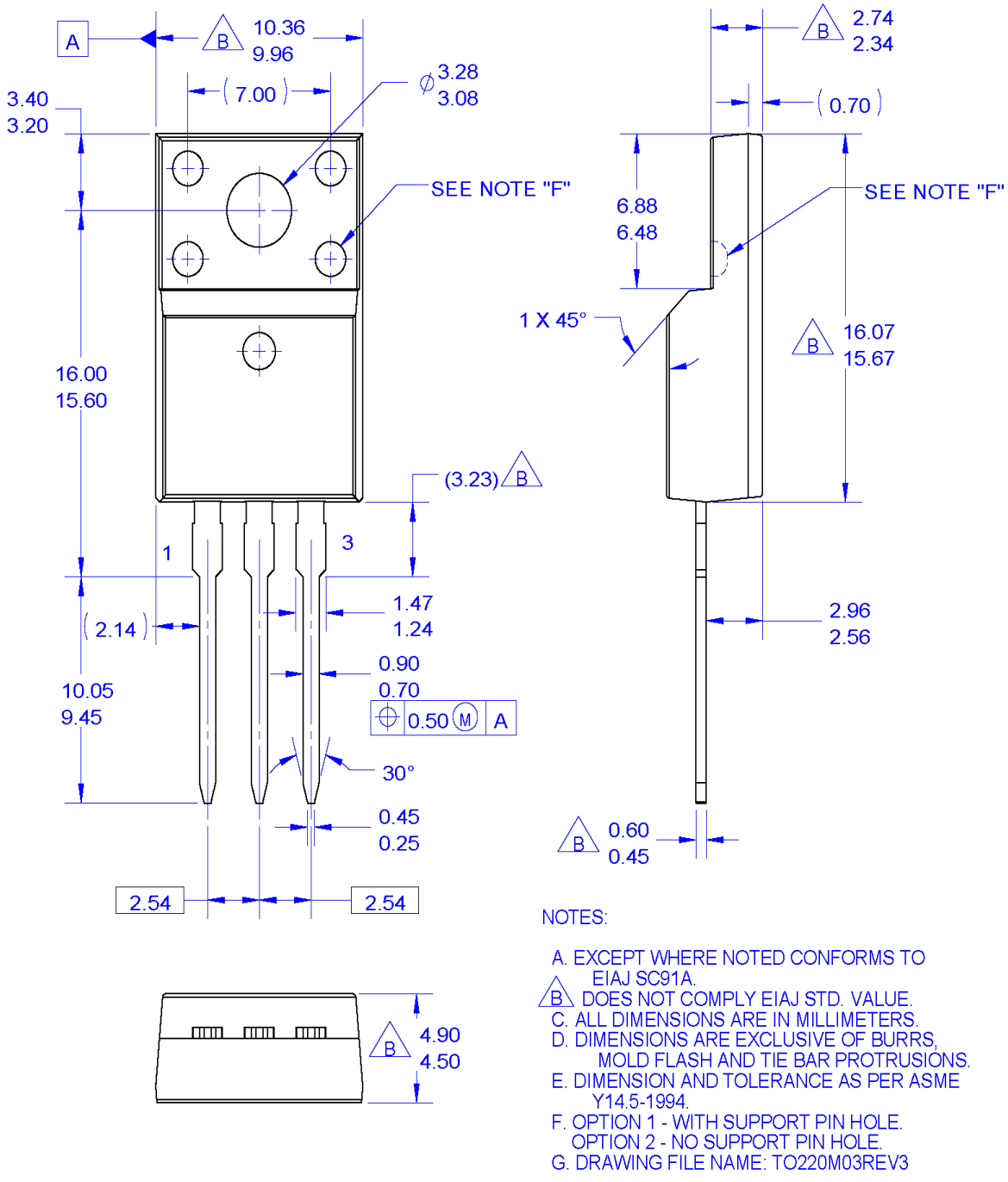


Peak Diode Recovery dv/dt Test Circuit & Waveforms



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

PUBLICATION ORDERING INFORMATION

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