FAIRCHILD SEMICONDUCTOR®

March 2010

UniFET-II™

FDP5N50NZ / FDPF5N50NZ

N-Channel MOSFET

500V, 4.5A, 1.5Ω

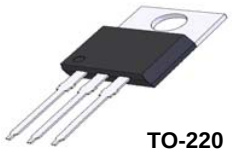
Features

- $R_{DS(on)}$ = 1.38Ω (Typ.)@ V_{GS} = 10V, I_D = 2.25A
- Low Gate Charge (Typ. 9nC)
- Low C_{rss} (Typ. 4pF)
- Fast Switching
- 100% Avalanche Tested
- Improved dv/dt Capability
- ESD Imoroved Capability
- RoHS Compliant

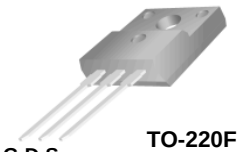
Description

These N-Channel enhancement mode power field effect transis tors are produced using Fairchild's proprietary, planar stripe, DMOS technology.

This advance technology has been especially tailored to mini mize on-state resistance, provide superior switching perfor mance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high effi cient switching mode power supplies and active power factor correction.

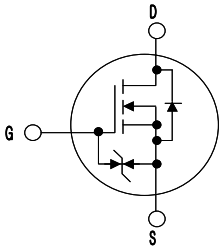


TO-220
FDP Series



G D S

TO-220F
FDPF Series
(potted)



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

Symbol	Parameter			FDP5N50NZ	FDPF5N50NZ	Units
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)		4.5	4.5*	A
		-Continuous (T_C = 100°C)		2.7	2.7*	
I_{DM}	Drain Current	- Pulsed	(Note 1)	18	18*	A
E_{AS}	Single Pulsed Avalanche Energy		(Note 2)	160		mJ
I_{AR}	Avalanche Current		(Note 1)	4.5		A
E_{AR}	Repetitive Avalanche Energy		(Note 1)	7.8		mJ
dv/dt	Peak Diode Recovery dv/dt		(Note 3)	10		V/ns
P_D	Power Dissipation	(T_C = 25°C)		78	30	W
		- Derate above 25°C		0.62	0.24	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	FDP5N50NZ	FDPF5N50NZ	Units
$R_{\theta JC}$	Thermal Resistance, Junction to Case	1.6	4.1	°C/W
$R_{\theta CS}$	Thermal Resistance, Case to Sink Typ.	-	-	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	62.5	62.5	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDP5N50NZ	FDP5N50NZ	TO-220	-	-	50
FDPF5N50NZ	FDPF5N50NZ	TO-220F	-	-	50

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 250μA, V_{GS} = 0V, T_C = 25°C	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	-	-	1	μA
		V_{DS} = 400V, V_{GS} = 0V, T_C = 125°C	-	-	10	
I_{GSS}	Gate to Body Leakage Current	V_{GS} = ±25V, V_{DS} = 0V	-	-	±10	μA
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 = 2.25A	-	1.38	1.5	Ω
g_{FS}	Forward Transconductance	V_{DS} = 20V, I_D = 2.25A (Note 4)	-	3.54	-	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1MHz	-	330	440	pF
C_{oss}	Output Capacitance		-	50	70	pF
C_{rss}	Reverse Transfer Capacitance		-	4	8	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	V_{DS} = 400V I_D = 4.5A, V_{GS} = 10V (Note 4,5)	-	9	12	nC
Q_{gs}	Gate to Source Gate Charge		-	2	-	nC
Q_{gd}	Gate to Drain “Miller” Charge		-	4	-	nC
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 250V, I_D = 4.5A, V_{GS} = 10V, R_{GEN} = 25Ω (Note 4,5)	-	12	35	ns
t_r	Turn-On Rise Time		-	22	55	ns
$t_{d(off)}$	Turn-Off Delay Time		-	28	65	ns
t_f	Turn-Off Fall Time		-	21	50	ns
Drain-Source Diode Characteristics						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	4.5	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	18	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS} = 0V, I_{SD} = 4.5A	-	-	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0V, I_{SD} = 4.5A, dI_F/dt = 100A/μs (Note 4)	-	210	-	ns
Q_{rr}	Reverse Recovery Charge		-	1.1	-	μC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L = 15.8mH, I_{AS} = 4.5A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. I_{SD} ≤ 2.8A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C
4. Pulse Test: Pulse Width ≤ 300 μs, Duty cycle ≤ 2.0%
5. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

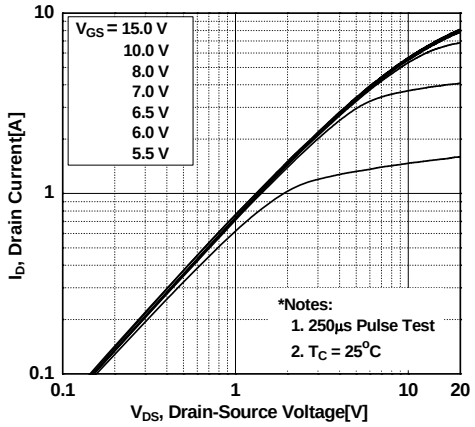


Figure 2. Transfer Characteristics

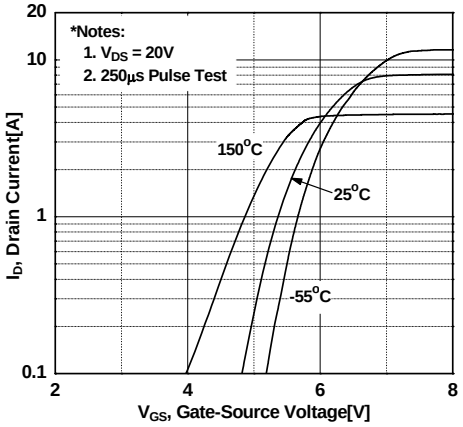


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

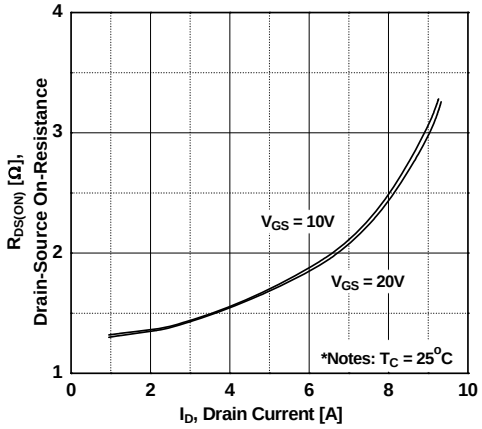


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

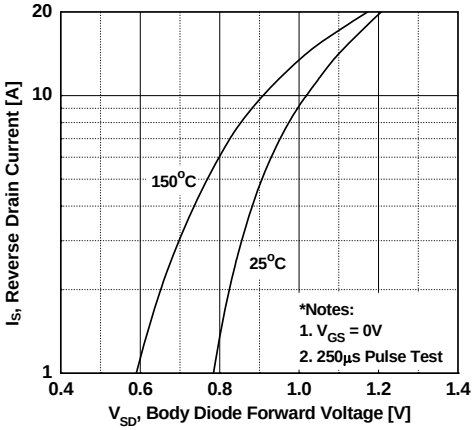


Figure 5. Capacitance Characteristics

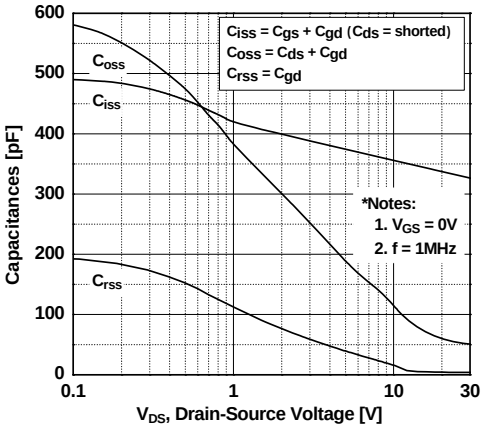
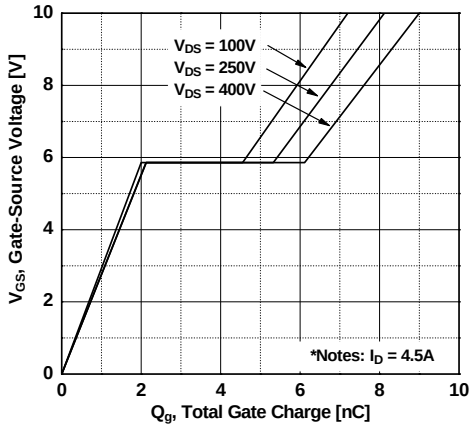


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

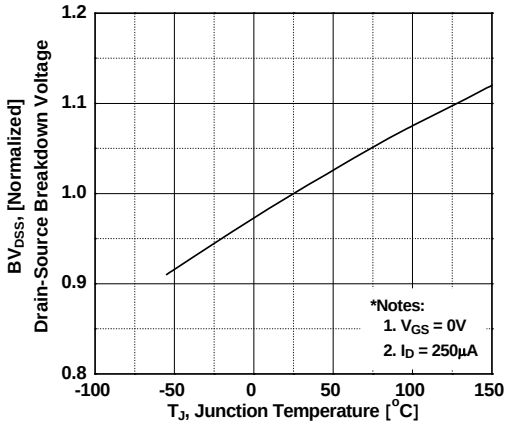


Figure 8. On-Resistance Variation vs. Temperature

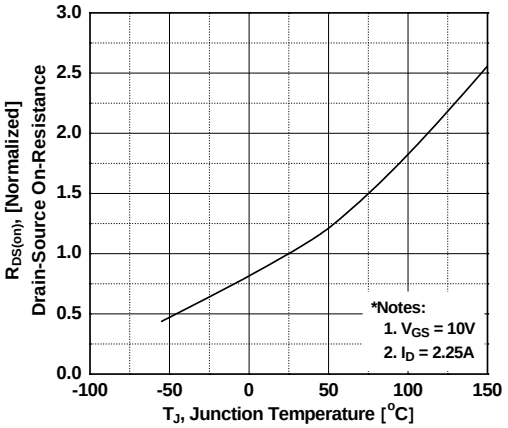


Figure 9. Maximum Safe Operating Area vs. Case Temperature-FDP5N50NZ

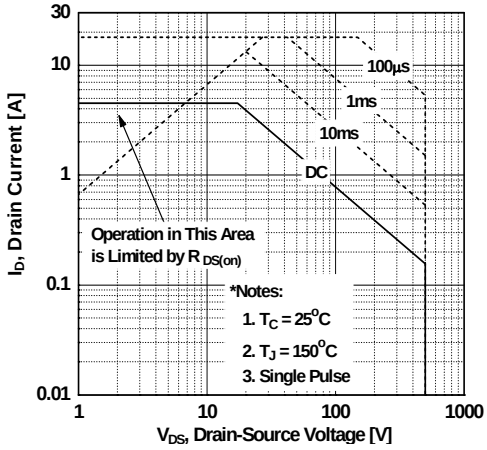


Figure 10. Maximum Safe Operating Area vs. Case Temperature-FDPF5N50NZ

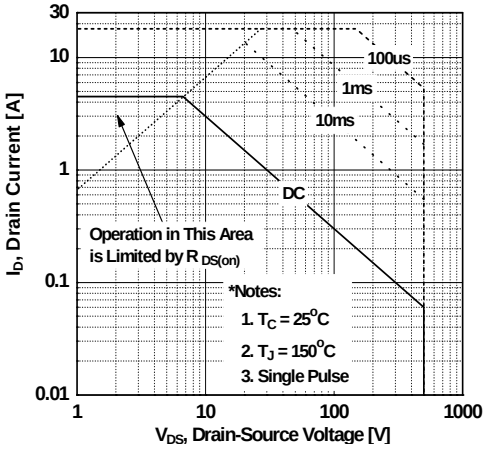
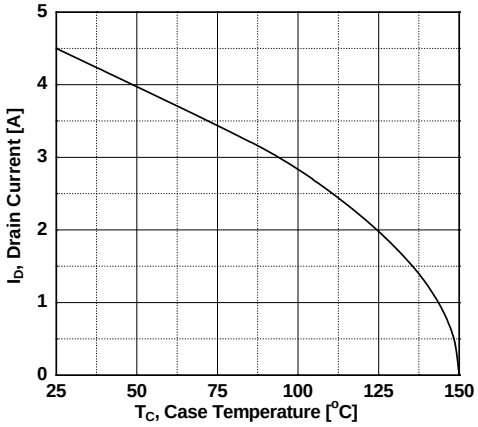


Figure 11. Maximum Drain Current



Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve-FDP5N50NZ

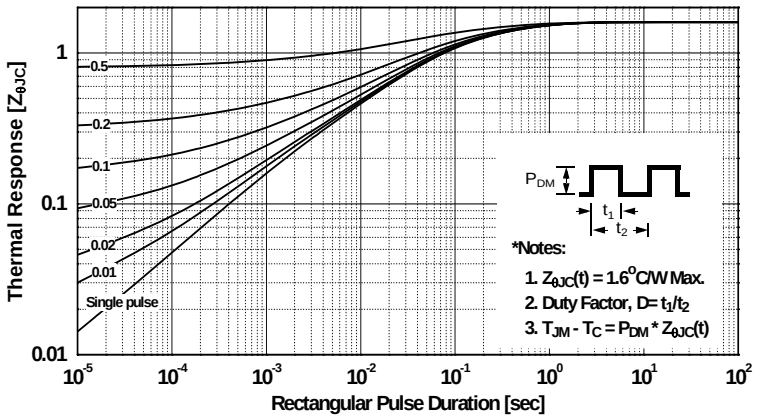
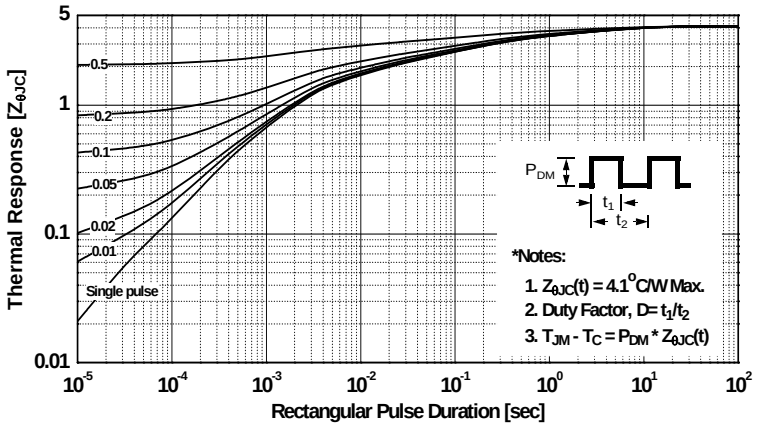
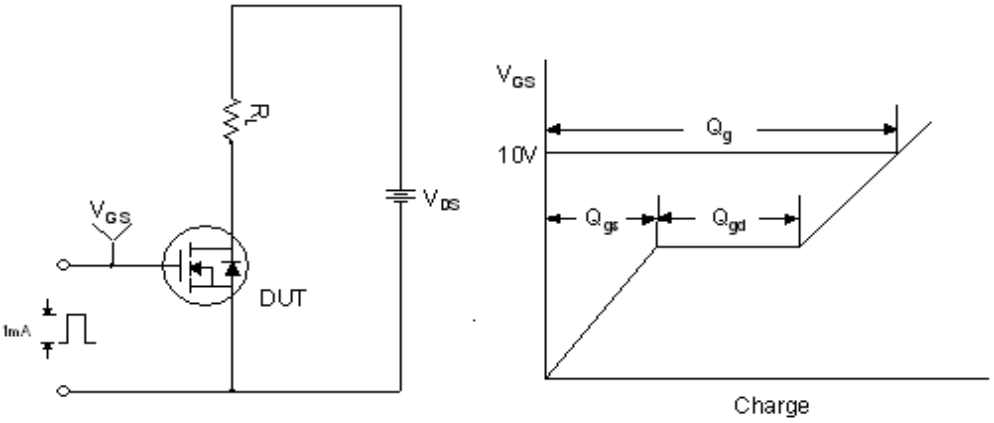


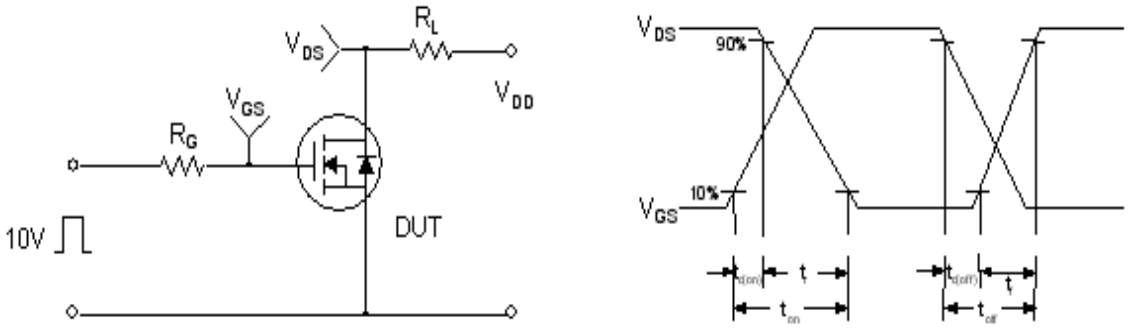
Figure 13. Transient Thermal Response Curve-FDPF5N50NZ



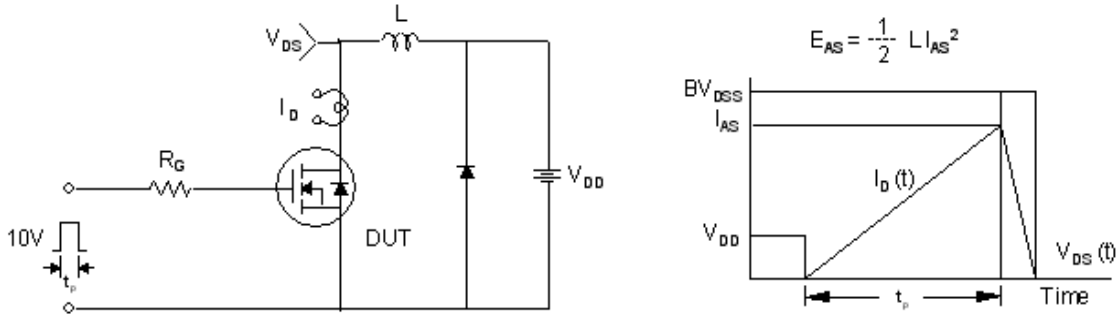
Gate Charge Test Circuit & Waveform



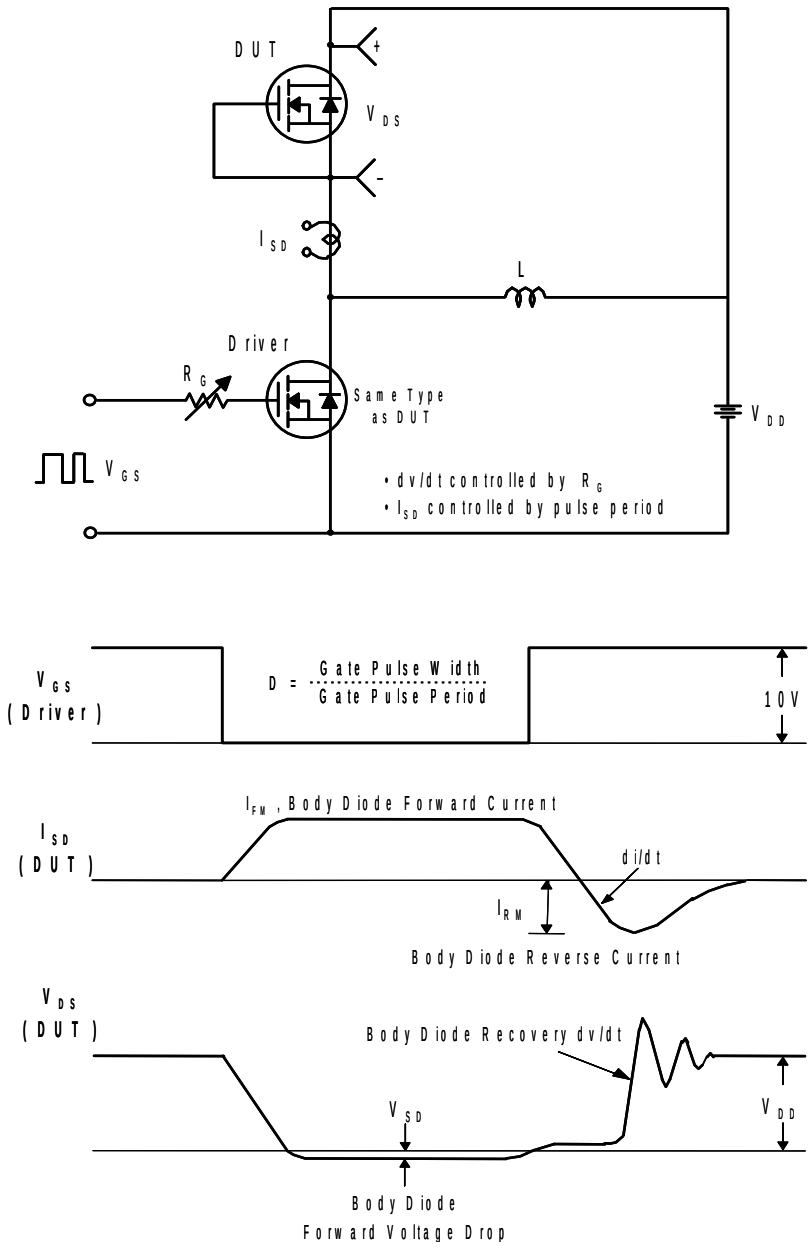
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

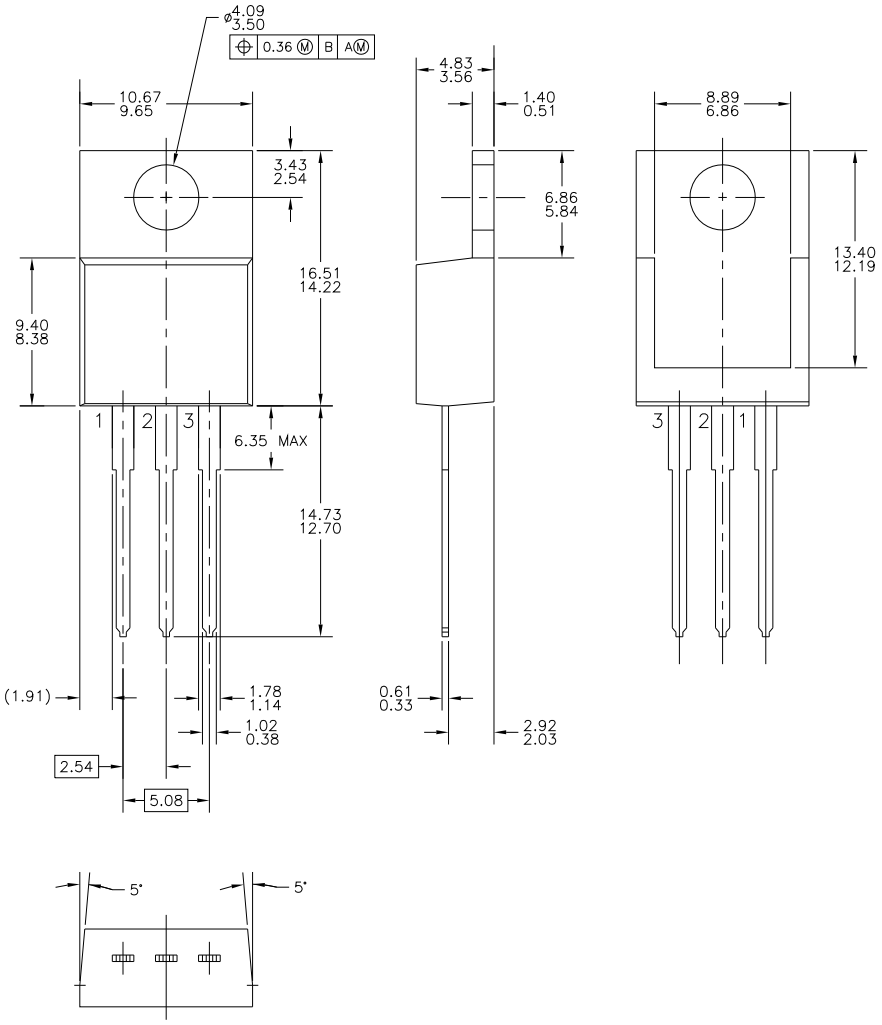


Peak Diode Recovery dv/dt Test Circuit & Waveforms



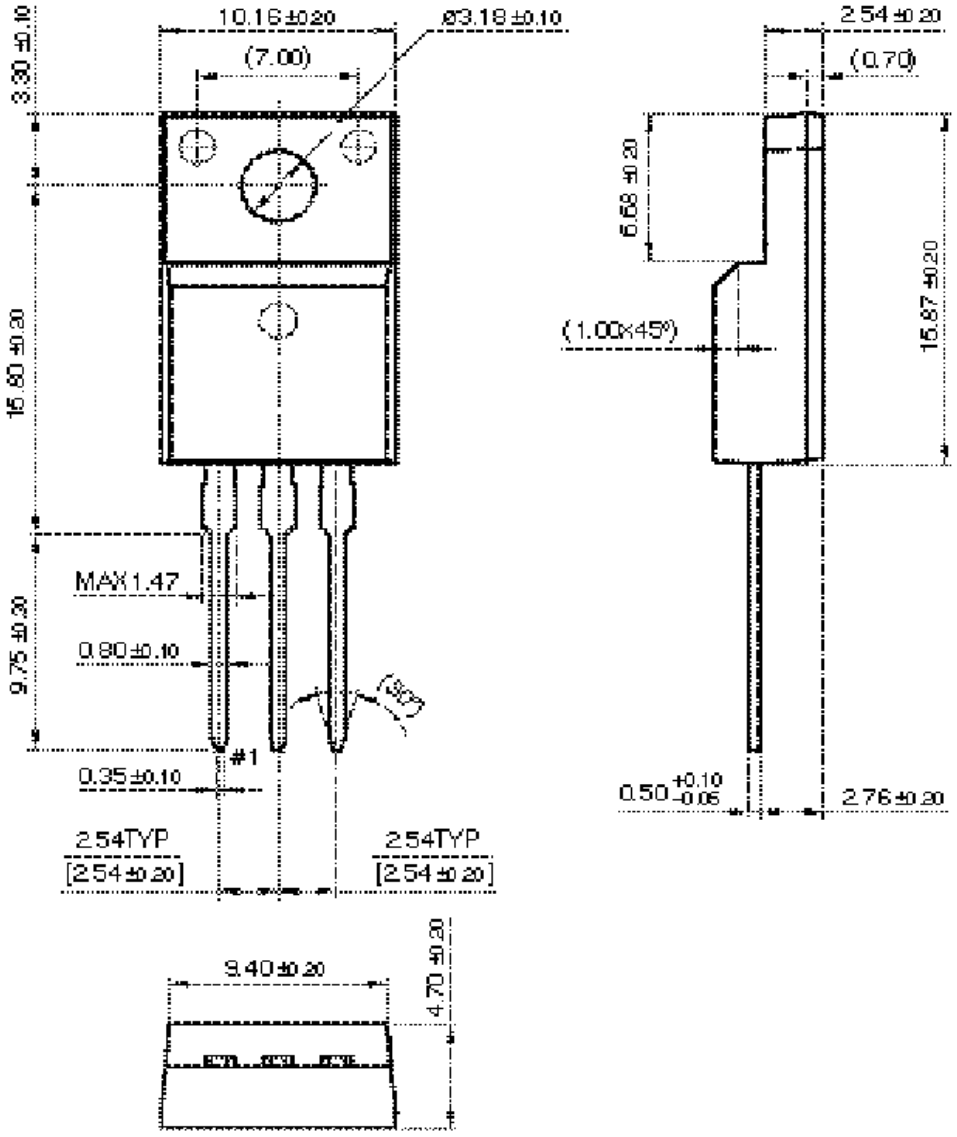
Package Dimensions

TO-220



Package Dimensions

TO-220F



* Front/Back Side Isolation Voltage : AC2500V

Dimensions in Millimeters

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