



April 2007
UniFET™

FDP33N25 / FDPF33N25 250V N-Channel MOSFET

Features

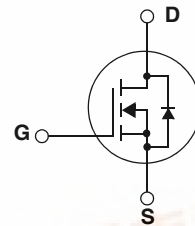
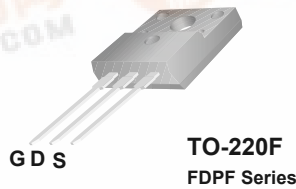
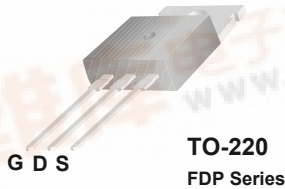
- 33A, 250V, $R_{DS(on)} = 0.094\Omega$ @ $V_{GS} = 10V$
- Low gate charge (typical 36.8 nC)
- Low C_{rss} (typical 39 pF)
- Fast switching
- Improved dv/dt capability



Description

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

This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficient switched mode power supplies and active power factor correction.



Absolute Maximum Ratings

Symbol	Parameter	FDP33N25	FDPF33N25	Unit
V_{DSS}	Drain-Source Voltage	250		V
I_D	Drain Current	33		A
		20.4		A
I_{DM}	Drain Current - Pulsed (Note 1)	132	132*	A
V_{GSS}	Gate-Source voltage	± 30		V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	918		mJ
I_{AR}	Avalanche Current (Note 1)	33		A
E_{AR}	Repetitive Avalanche Energy (Note 1)	23.5		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5		V/ns
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$)	235		W
		1.89		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	FDP33N25	FDPF33N25	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.53	3.4	°C/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink Typ.	0.5	--	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	62.5	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDP33N25	FDP33N25	TO-220	-	-	50
FDPF33N25	FDPF33N25	TO-220F	-	-	50

Electrical Characteristics T_C = 25°C unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
Off Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0V, I _D = 250μA, T _J = 25°C	250	--	--	V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250μA, Referenced to 25°C	--	0.25	--	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 250V, V _{GS} = 0V V _{DS} = 200V, T _C = 125°C	-- --	-- --	1 10	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 = 16.5A	--	0.077	0.094	Ω
g _{FS}	Forward Transconductance	V _{DS} = 40V, I _D = 16.5A (Note 4)	--	26.6	--	S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 25V, V _{GS} = 0V, f = 1.0MHz	--	1640	2135	pF
C _{oss}	Output Capacitance		--	330	430	pF
C _{rss}	Reverse Transfer Capacitance		--	39	59	pF
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	V _{DD} = 125V, I _D = 33A R _G = 25Ω (Note 4, 5)	--	35	80	ns
t _r	Turn-On Rise Time		--	230	470	ns
t _{d(off)}	Turn-Off Delay Time		--	75	160	ns
t _f	Turn-Off Fall Time		--	120	250	ns
Q _g	Total Gate Charge	V _{DS} = 200V, I _D = 33A V _{GS} = 10V (Note 4, 5)	--	36.8	48	nC
Q _{gs}	Gate-Source Charge		--	10	--	nC
Q _{gd}	Gate-Drain Charge		--	17	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	33	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	132	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0V, I _S = 33A	--	--	1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0V, I _S = 33A dI _F /dt = 100A/μs (Note 4)	--	220	--	ns
Q _{rr}	Reverse Recovery Charge		--	1.71	--	μC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L = 1.35mH, I_{AS} = 33A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. I_{SD} ≤ 33A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C
4. Pulse Test: Pulse width ≤ 300μs, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

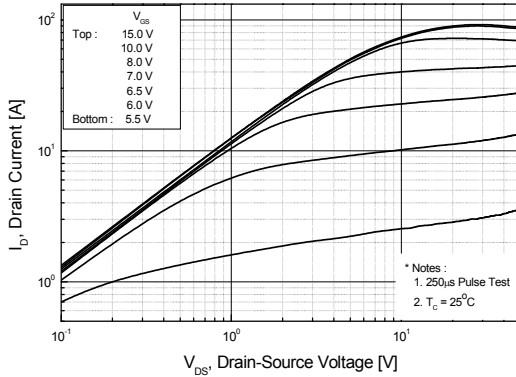


Figure 2. Transfer Characteristics

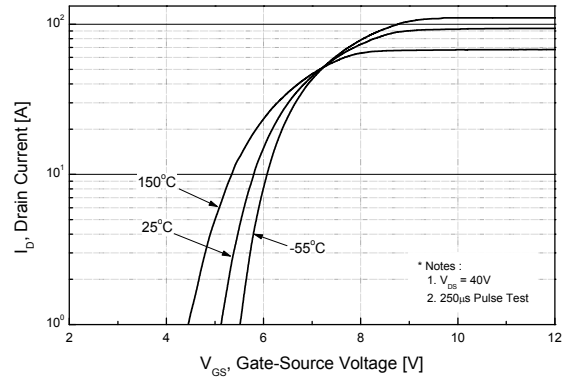


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

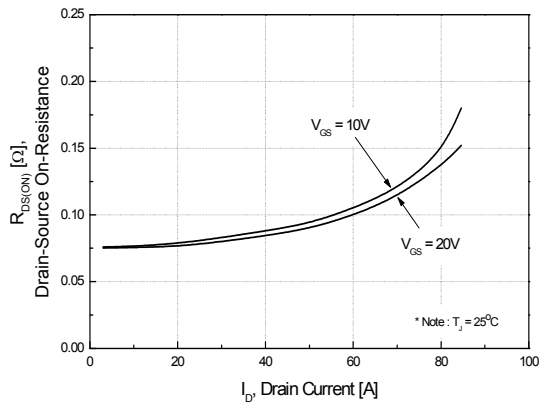


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

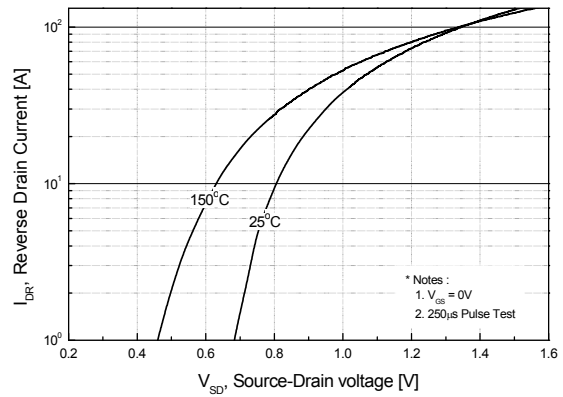


Figure 5. Capacitance Characteristics

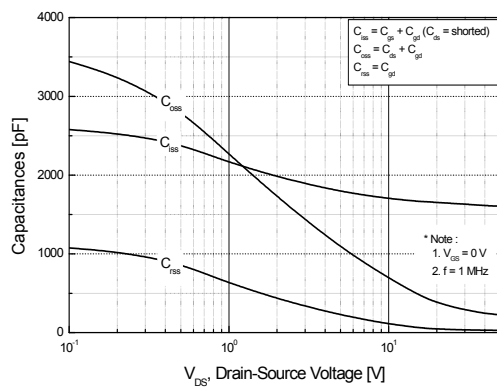
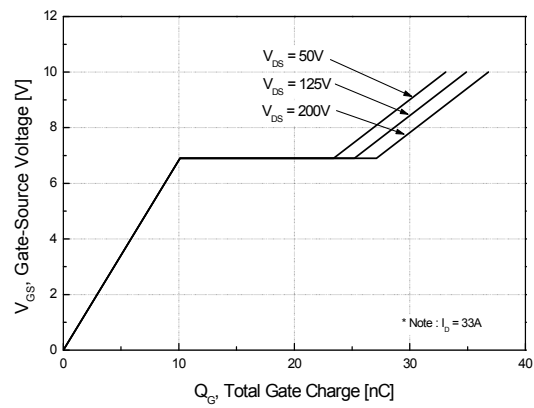


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

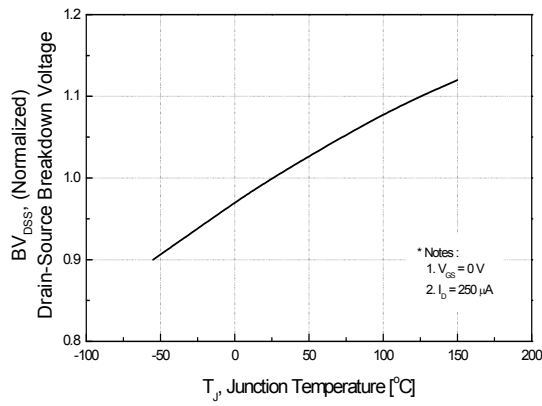


Figure 8. On-Resistance Variation vs. Temperature

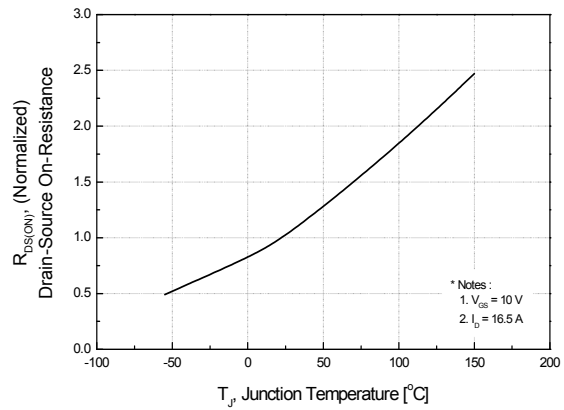


Figure 9-1. Maximum Safe Operating Area for FDP33N25

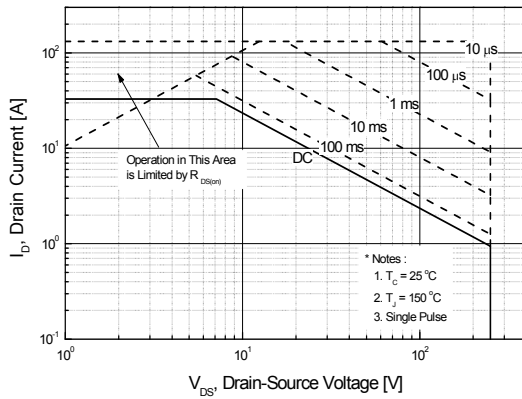


Figure 9-2. Maximum Safe Operating Area for FDPF33N25

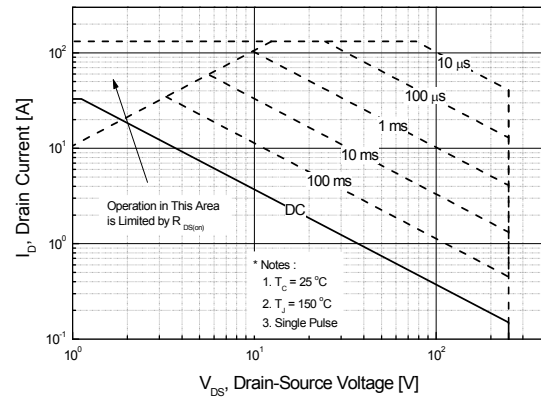
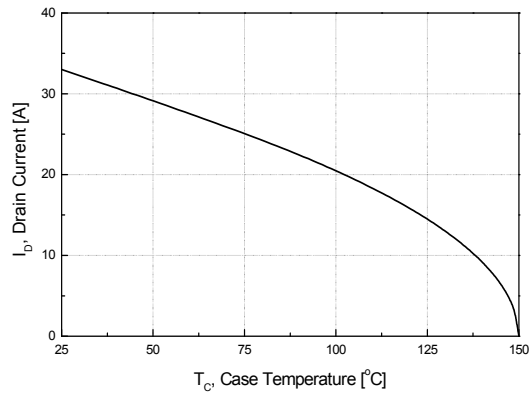


Figure 10. Maximum Drain Current vs. Case Temperature



Typical Performance Characteristics (Continued)

Figure 11-1. Transient Thermal Response Curve for FDP33N25

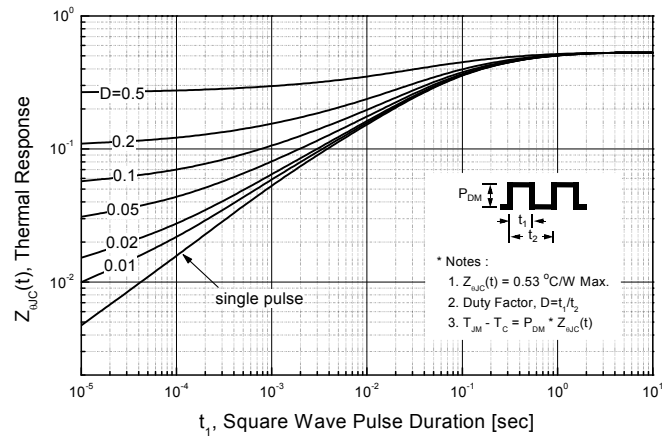
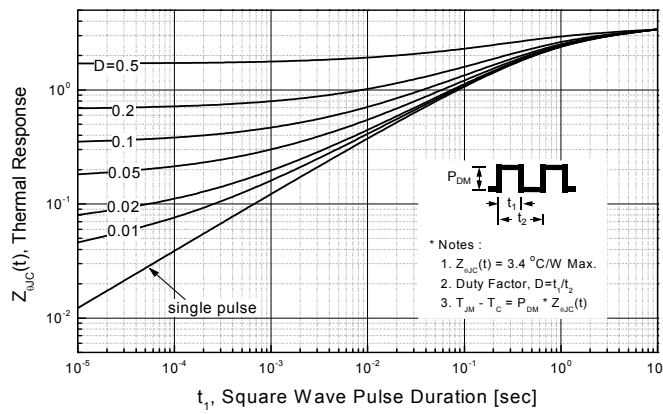
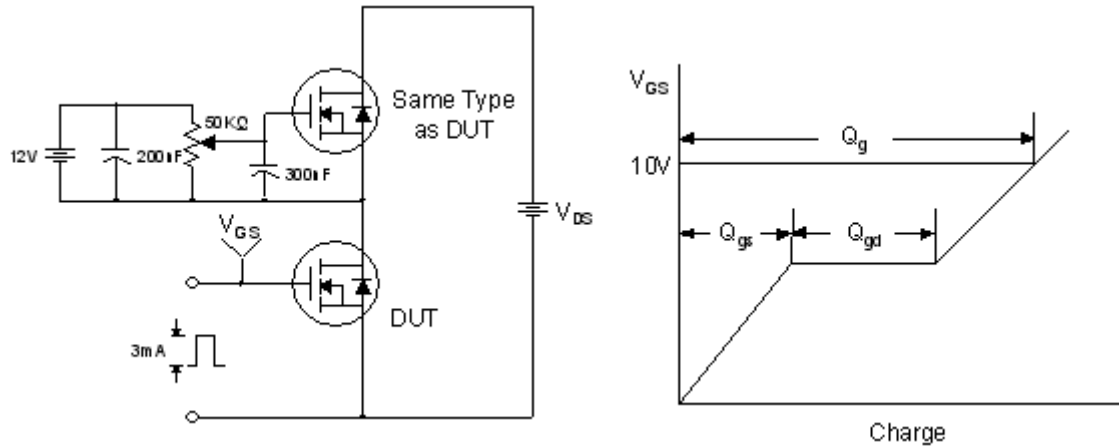


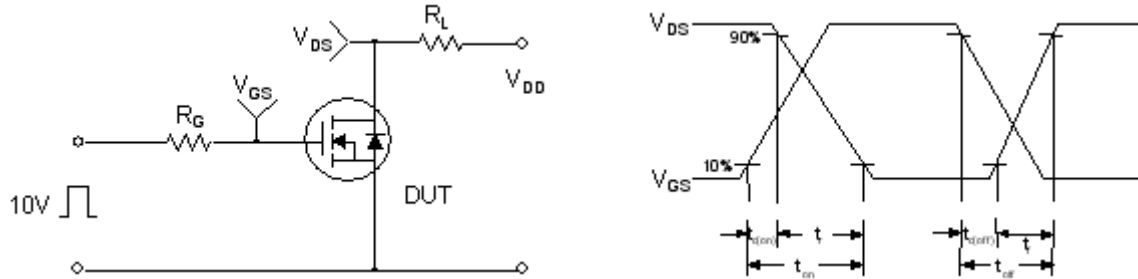
Figure 11-2. Transient Thermal Response Curve for FDPF33N25



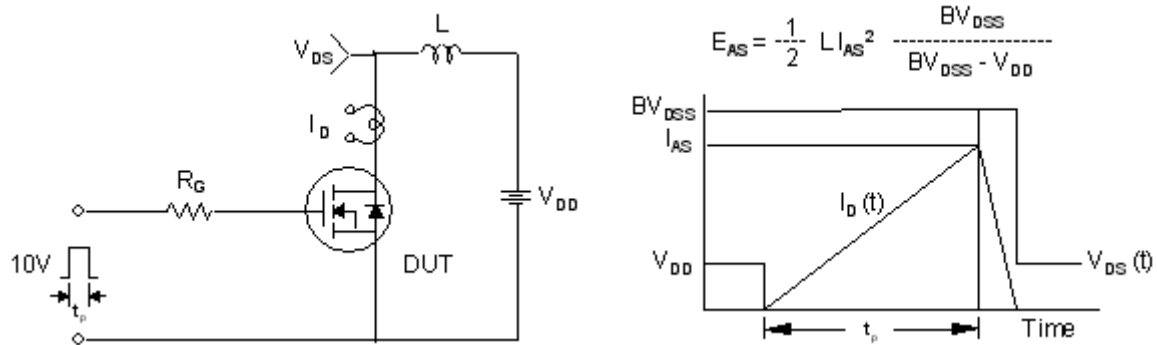
Gate Charge Test Circuit & Waveform



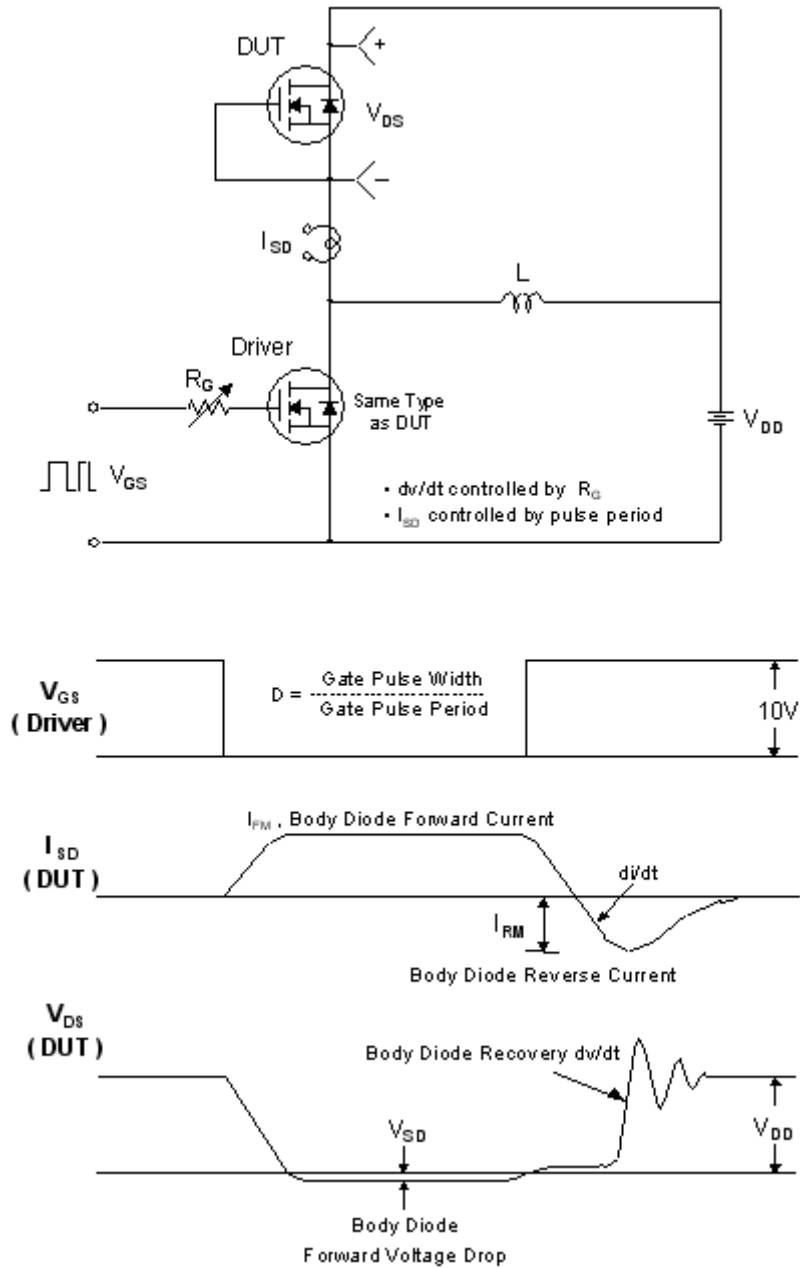
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

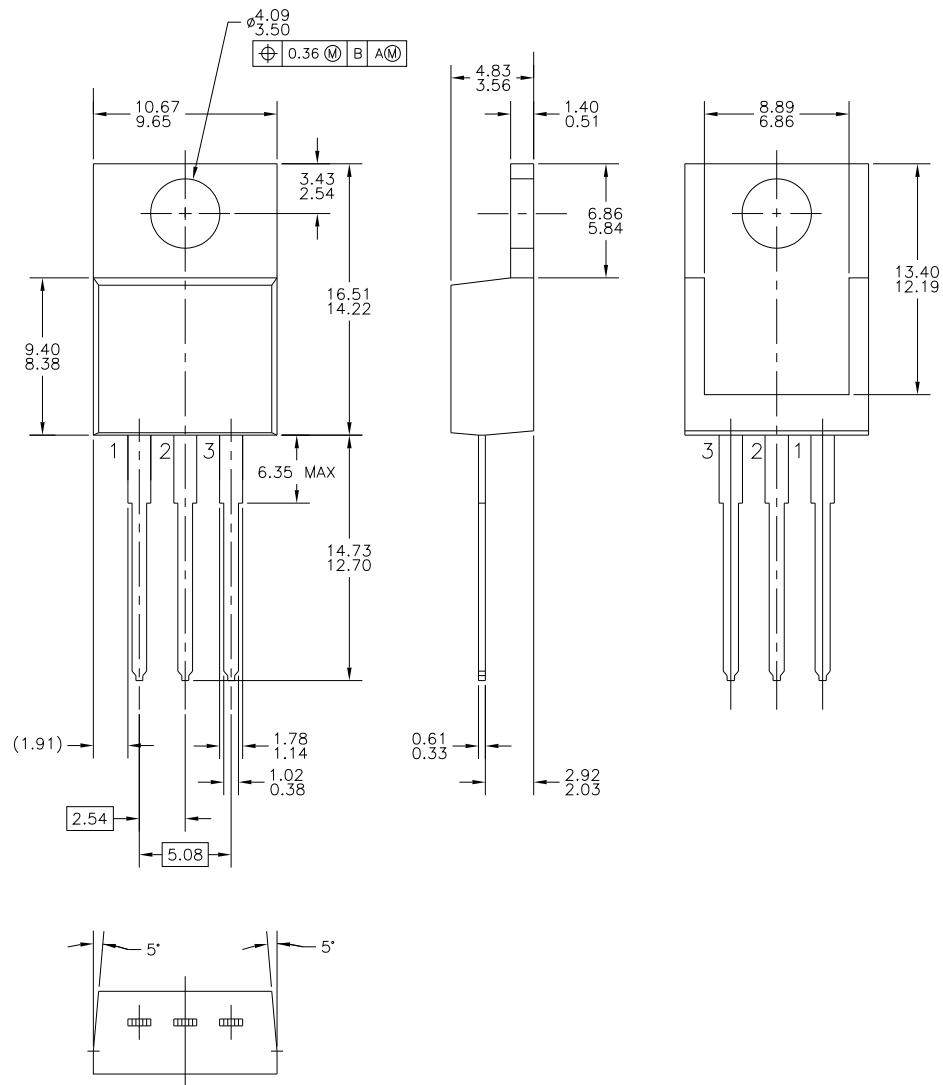


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

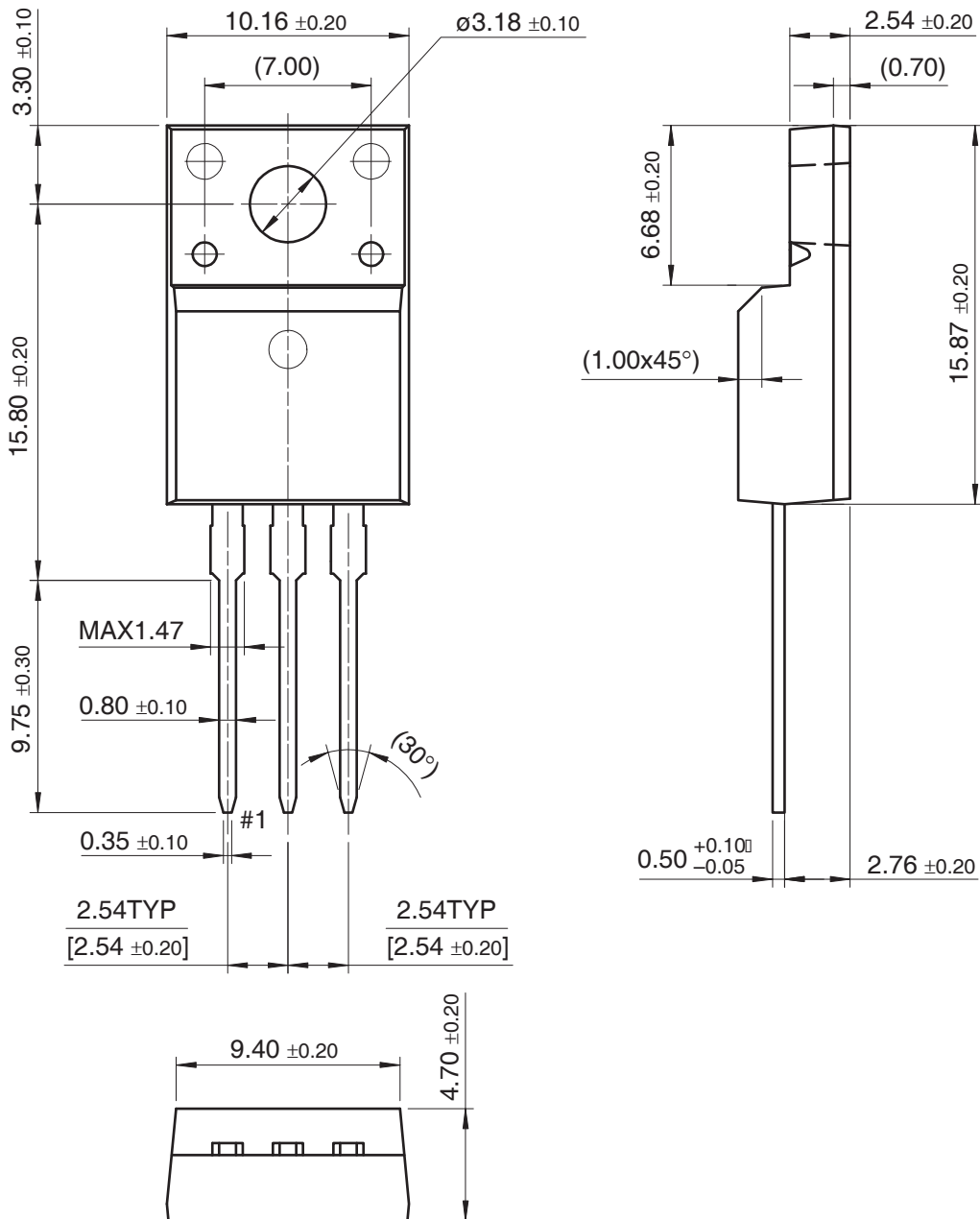
TO-220



Dimensions in Millimeters

Mechanical Dimensions (Continued)

TO-220F



Dimensions in Millimeters

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