

FDP51N25 / FDPF51N25 250V N-Channel MOSFET

Features

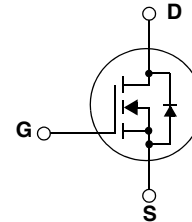
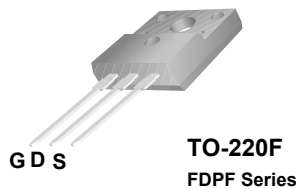
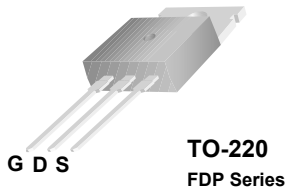
- 51A, 250V, $R_{DS(on)} = 0.06\Omega @ V_{GS} = 10V$
- Low gate charge (typical 55 nC)
- Low Crss (typical 63 pF)
- Fast switching
- Improved dv/dt capability



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	FDP51N25	FDPF51N25	Unit
V_{DSS}	Drain-Source Voltage	250		V
I_D	Drain Current	- Continuous ($T_C = 25^\circ\text{C}$)	51	51*
		- Continuous ($T_C = 100^\circ\text{C}$)	30	30*
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 ($T_C = 25^\circ\text{C}$) - Derate above 25°C	320	38	W
		3.7	0.3	W/ $^\circ\text{C}$
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150		$^\circ\text{C}$
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300		$^\circ\text{C}$

*Drain current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	FDP51N25	FDPF51N25	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.39	3.3	$^\circ\text{C}/\text{W}$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink Typ.	0.5	--	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	62.5	$^\circ\text{C}/\text{W}$

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDP51N25	FDP51N25	TO-220	-	-	50
FDPF51N25	FDPF51N25	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 = 25.5A	--	0.048	0.060	Ω
g _{FS}	Forward Transconductance	V _{DS} = 40V, I _D = 25.5A (Note 4)	--	43	--	S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 25V, V _{GS} = 0V, f = 1.0MHz	--	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} = 125V, I _D = 51A R _G = 25Ω (Note 4, 5)	--	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		--	130	270	ns
Q _g	Total Gate Charge	V _{DS} = 200V, I _D = 51A V _{GS} = 10V (Note 4, 5)	--	55	70	nC
Q _{gs}	Gate-Source Charge		--	16	--	nC
Q _{gd}	Gate-Drain Charge		--	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} = 0V, I _S = 51A	--	--	1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0V, I _S = 51A di _f /dt = 100A/μs (Note 4)	--	178	--	ns
Q _{rr}	Reverse Recovery Charge		--	4.0	--	μC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L = 0.68mH, I_{AS} = 51A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. I_{SD} ≤ 51A, 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

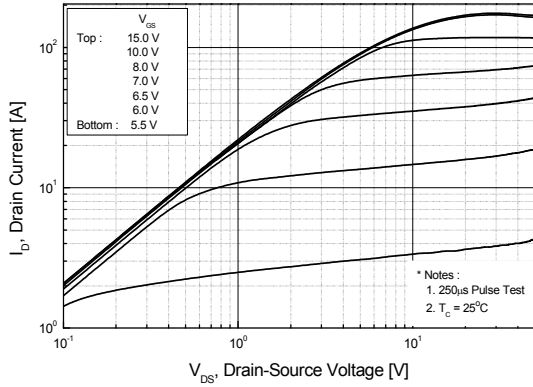


Figure 2. Transfer Characteristics

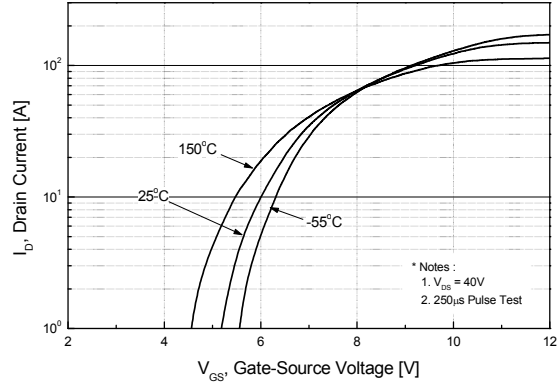


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

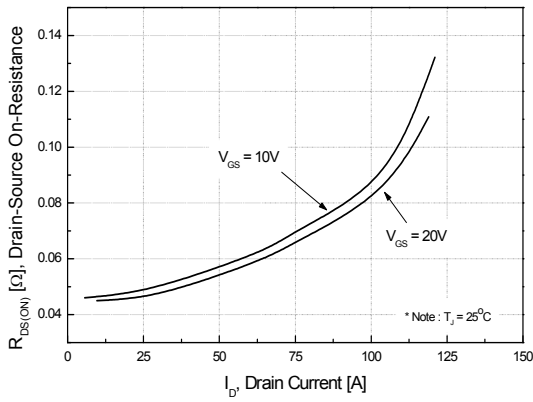


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

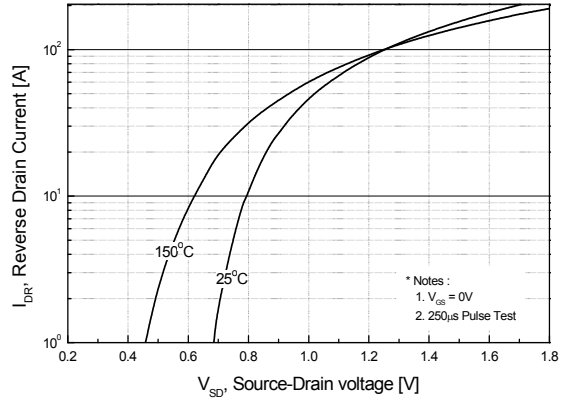


Figure 5. Capacitance Characteristics

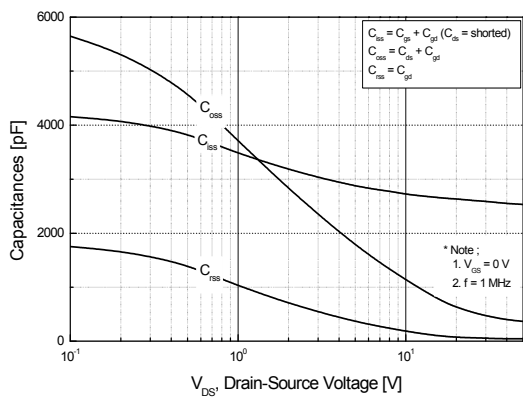
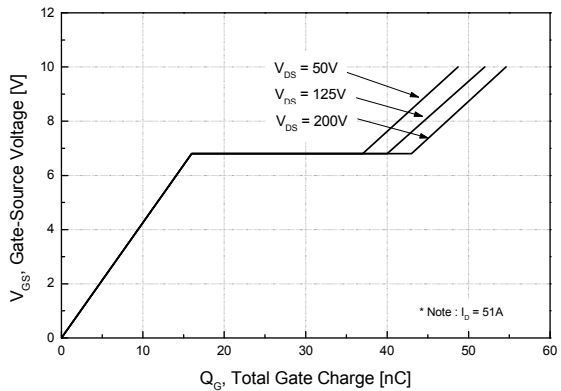


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

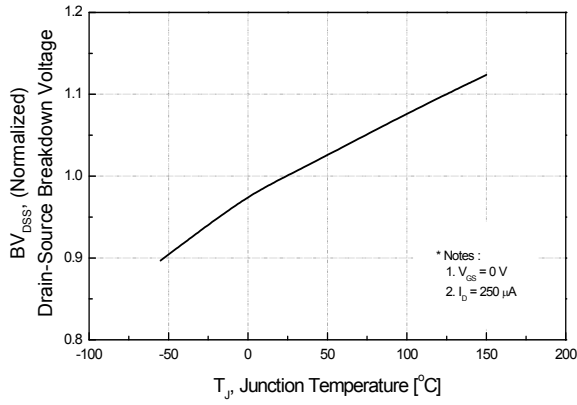


Figure 8. On-Resistance Variation vs. Temperature

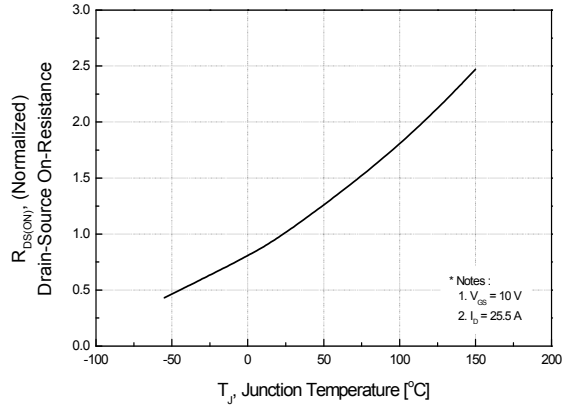


Figure 9-1. Maximum Safe Operating Area for FDP51N25

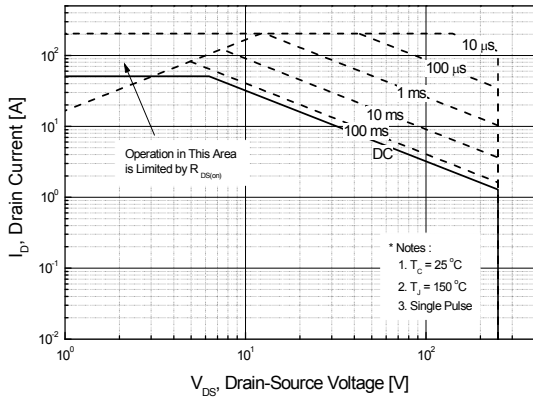


Figure 9-2. Maximum Safe Operating Area for FDPF51N25

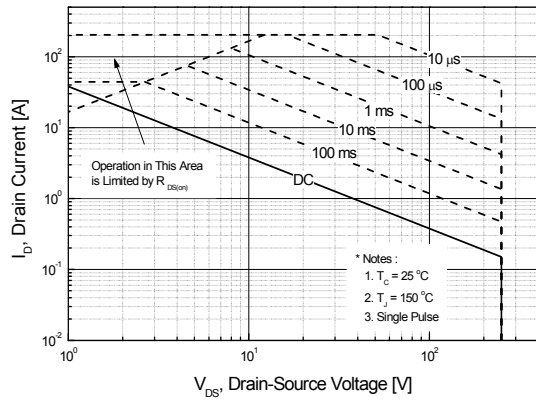
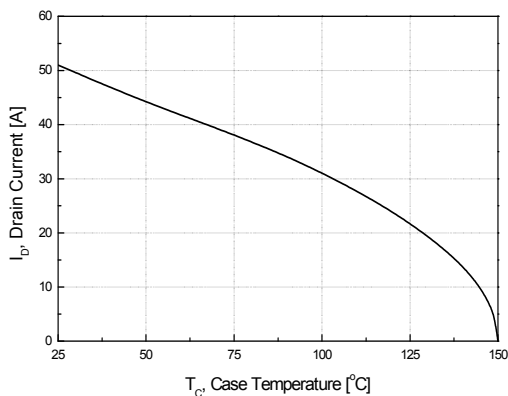


Figure 10. Maximum Drain Current vs. Case Temperature



Typical Performance Characteristics (Continued)

Figure 11-1. Transient Thermal Response Curve for FDP51N25

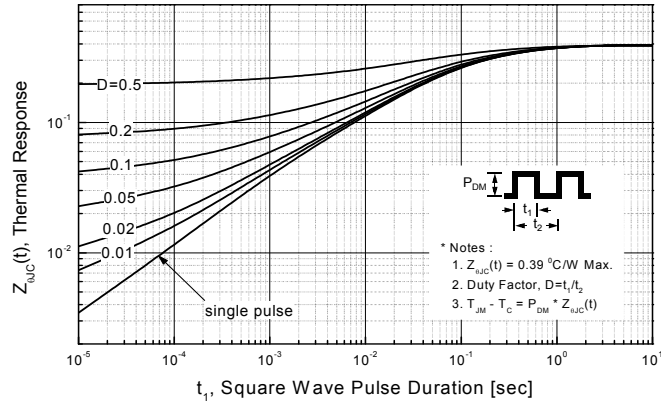
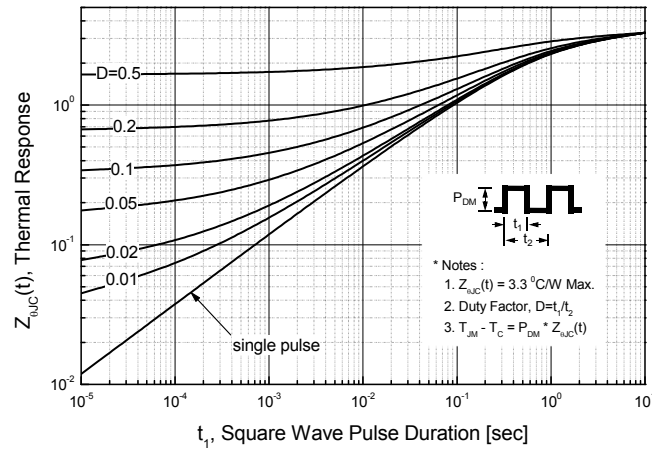
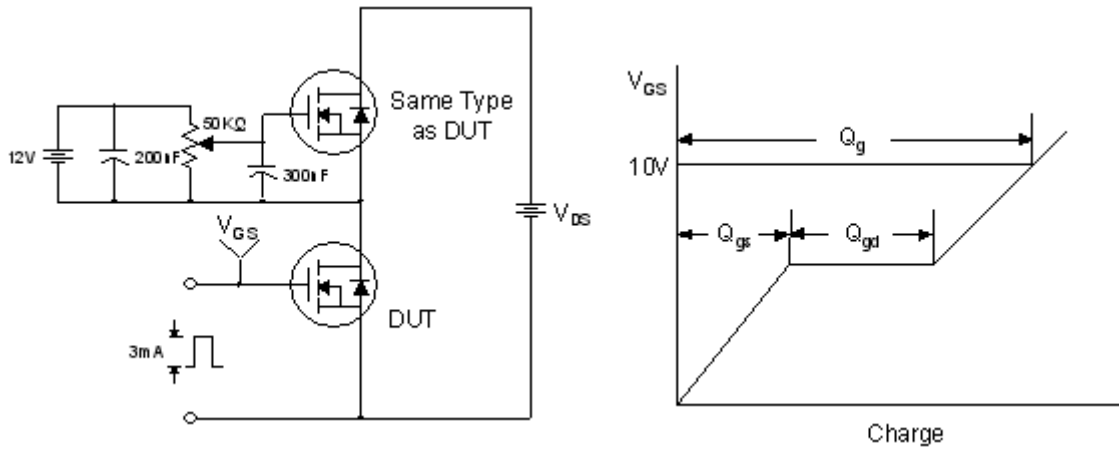


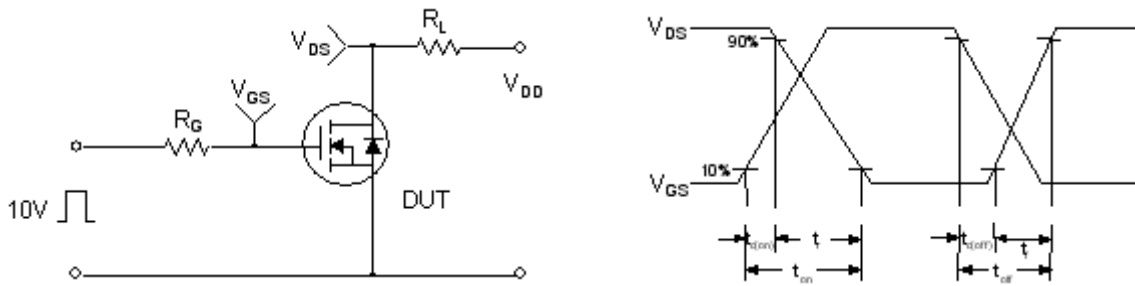
Figure 11-2. Transient Thermal Response Curve for FDPF51N25



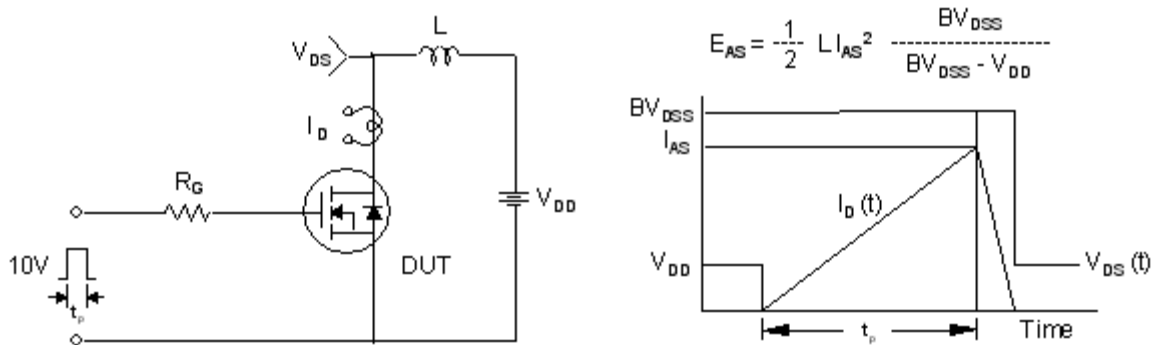
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

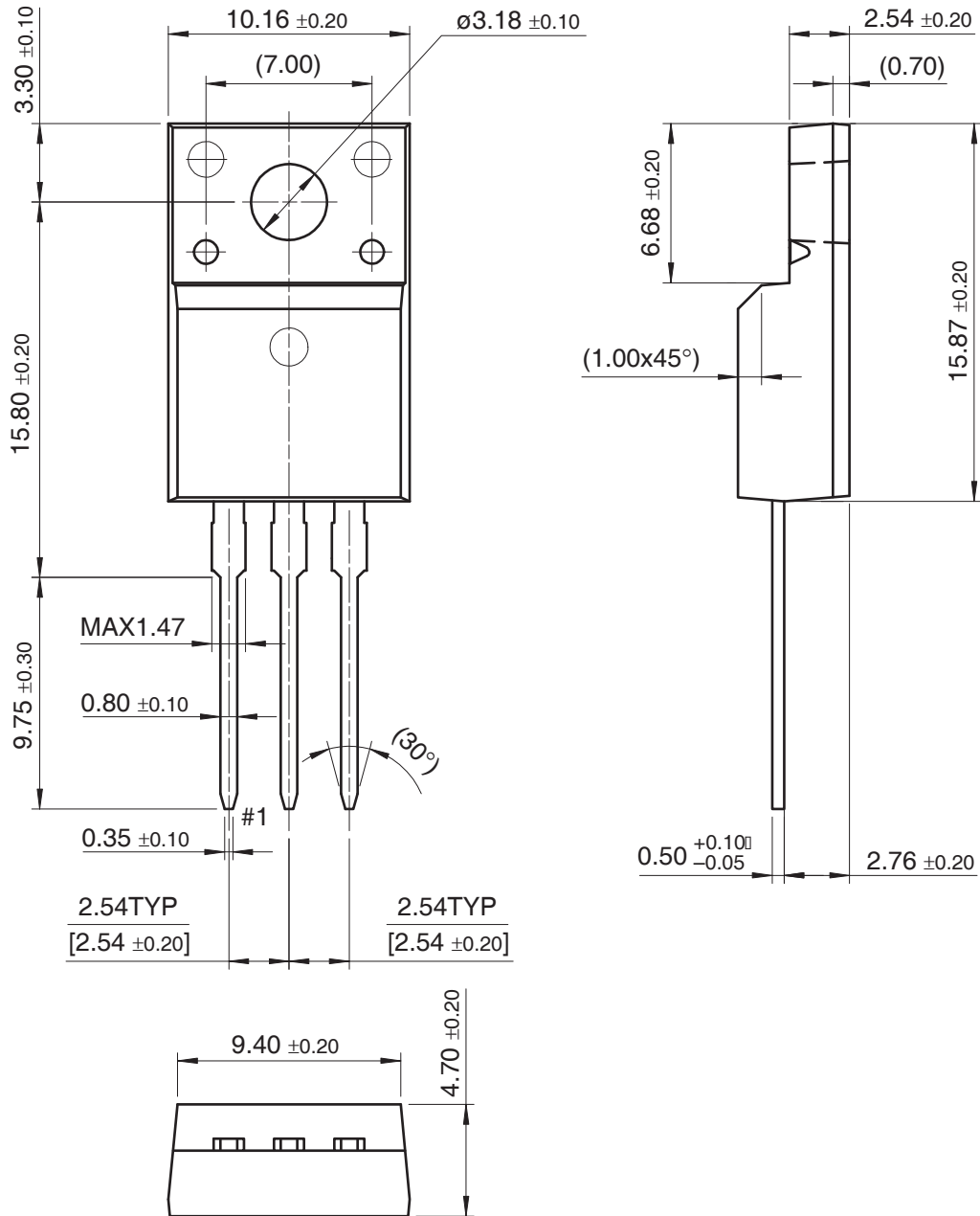


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions (Continued)

TO-220F



Dimensions in Millimeters



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