

FAIRCHILD
SEMICONDUCTOR®

March 2007

UniFET™

FDP7N50/FDPF7N50
500V N-Channel MOSFET

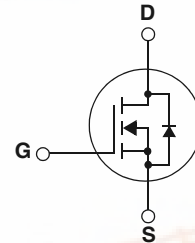
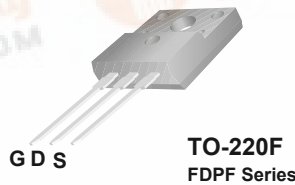
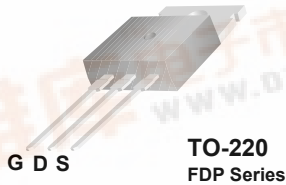
Features

- 7A, 500V, $R_{DS(on)} = 0.9\Omega @ V_{GS} = 10V$
- Low gate charge (typical 12.8 nC)
- Low C_{rss} (typical 9 pF)
- Fast switching
- 100% avalanche tested
- 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

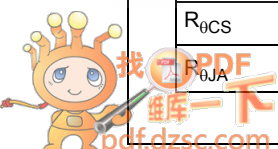
Symbol	Parameter	FDP7N50	FDPF7N50	Unit
V_{DSS}	Drain-Source Voltage	500		V
I_D	Drain Current	- Continuous ($T_C = 25^\circ C$)	7	7 *
		- Continuous ($T_C = 100^\circ C$)	4.2	4.2 *
I_{DM}	Drain Current - Pulsed (Note 1)	28	28 *	A
V_{GSS}	Gate-Source voltage	± 30		V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	270		mJ
I_{AR}	Avalanche Current (Note 1)	7		A
E_{AR}	Repetitive Avalanche Energy (Note 1)	8.9		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5		V/ns
P_D	Power Dissipation ($T_C = 25^\circ C$)	- Derate above $25^\circ C$	89	39
			0.71	0.31
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150		$^\circ C$
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300		$^\circ C$

* Drain current limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	FDP7N50	FDPF7N50	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.4	3.2	$^\circ C/W$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink Typ.	0.5	--	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	62.5	$^\circ C/W$

FDP7N50/FDPF7N50 500V N-Channel MOSFET



Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDP7N50	FDP7N50	TO-220	--	--	50
FDPF7N50	FDPF7N50	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	$V_{GS} = 0V, I_D = 250\mu A$	500	--	--	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu A$, Referenced to 25°C	--	0.5	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 500V, V_{GS} = 0V$ $V_{DS} = 400V, T_C = 125^\circ C$	--	--	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	$V_{DS} = V_{GS}, I_D = 250\mu A$	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10V, I_D = 3.5A$	--	0.76	0.9	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 40V, I_D = 3.5A$ (Note 4)	--	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	$V_{DD} = 250V, I_D = 7A$ $R_G = 25\Omega$	--	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		(Note 4, 5)	--	35	80
Q_g	Total Gate Charge	$V_{DS} = 400V, I_D = 7A$ $V_{GS} = 10V$	--	12.8	16.6	nC
Q_{gs}	Gate-Source Charge		--	3.7	--	nC
Q_{gd}	Gate-Drain Charge		(Note 4, 5)	--	5.8	--
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	7	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	28	A
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0V, I_S = 7A$	--	--	1.4	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0V, I_S = 7A$ $di_F/dt = 100A/\mu s$	--	275	--	ns
Q_{rr}	Reverse Recovery Charge		(Note 4)	--	0.04	--

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $I_{AS} = 7A, V_{DD} = 50V, L = 10mH, R_G = 25\Omega$, Starting $T_J = 25^\circ C$
3. $I_{SD} \leq 7A, di/dt \leq 200A/\mu s, V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ C$
4. Pulse Test: Pulse width $\leq 300\mu s$, Duty Cycle $\leq 2\%$
5. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

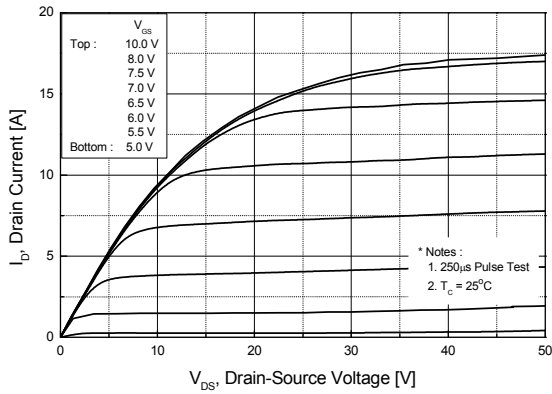


Figure 2. Transfer Characteristics

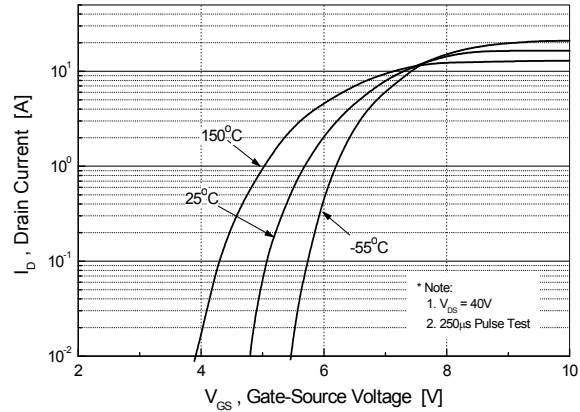


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

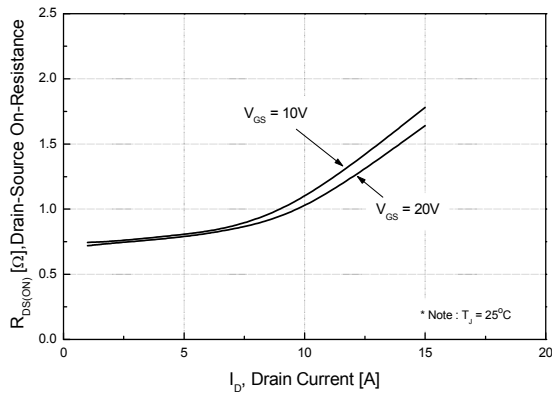


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

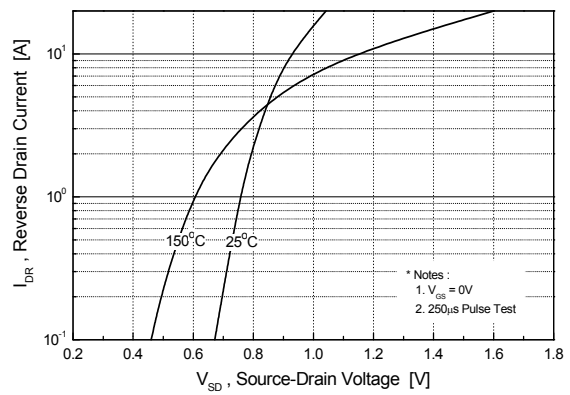


Figure 5. Capacitance Characteristics

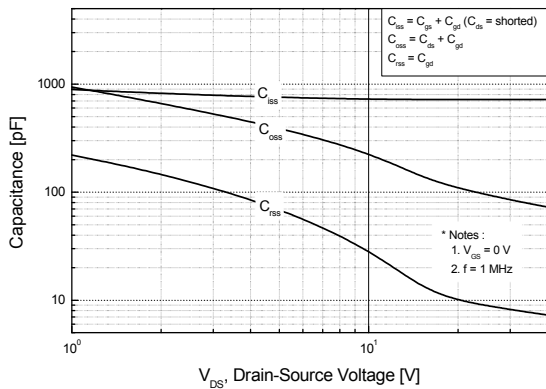
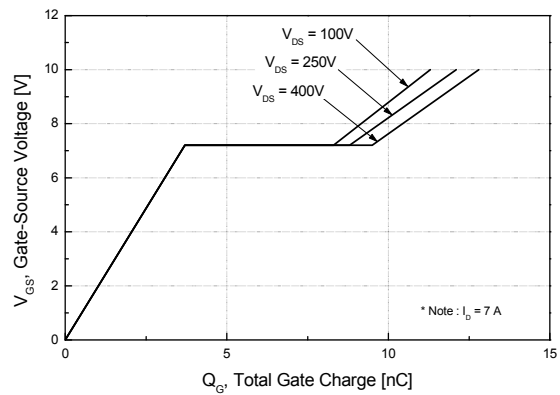


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

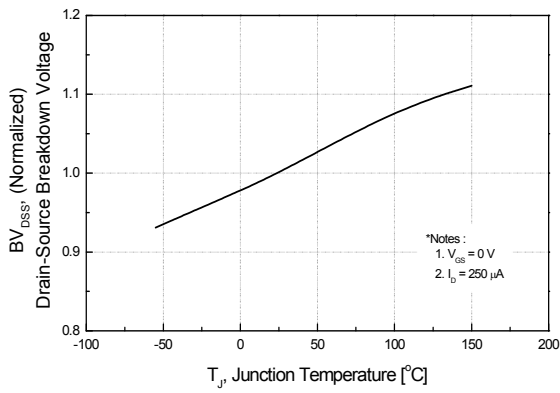


Figure 8. On-Resistance Variation vs. Temperature

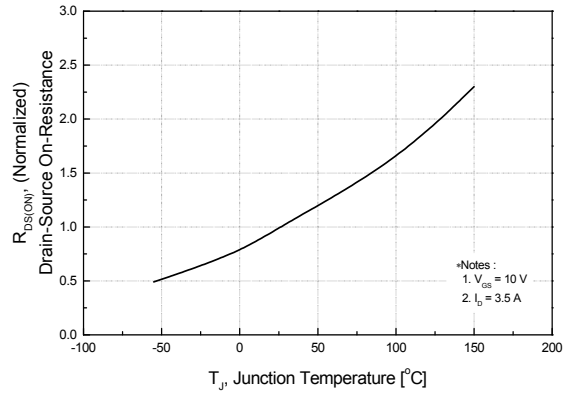


Figure 9-1. Maximum Safe Operating Area - FDP7N50

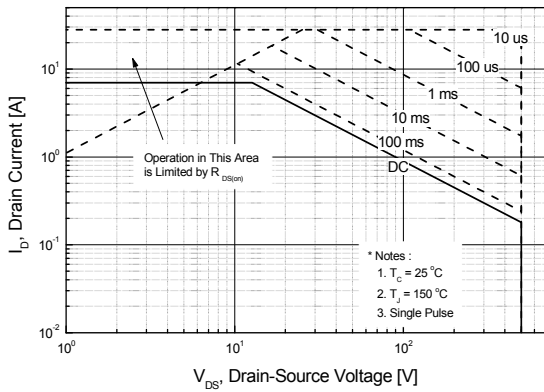


Figure 9-2. Maximum Safe Operating Area - FDPF7N50

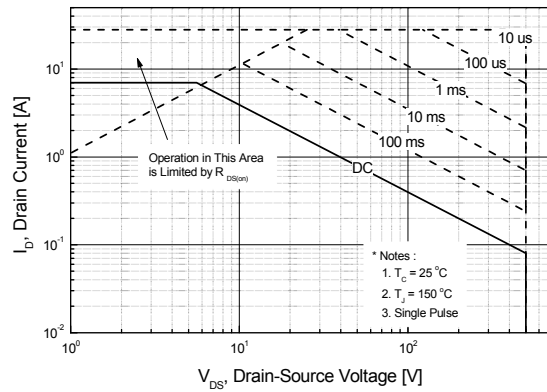


Figure 10. Maximum Drain Current Vs. Case Temperature

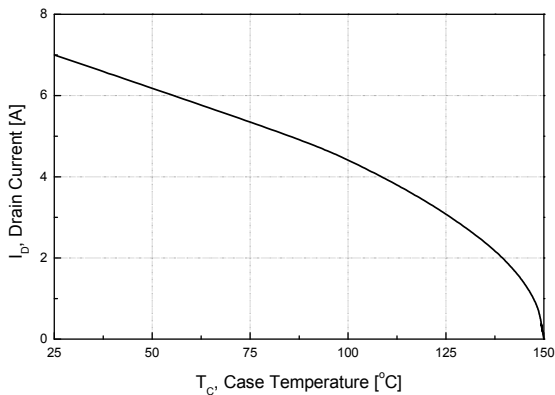


Figure 11-1. Transient Thermal Response Curve - FDP7N50

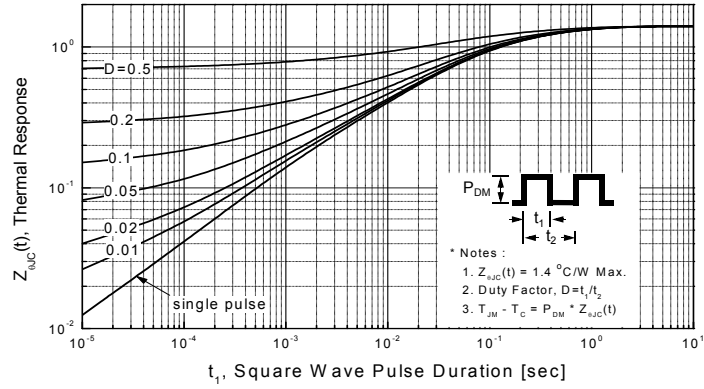
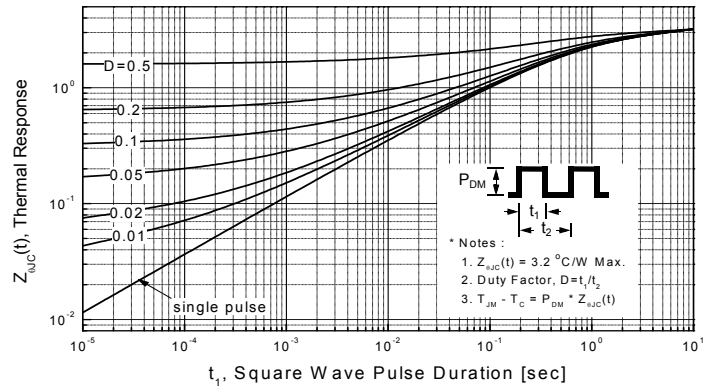
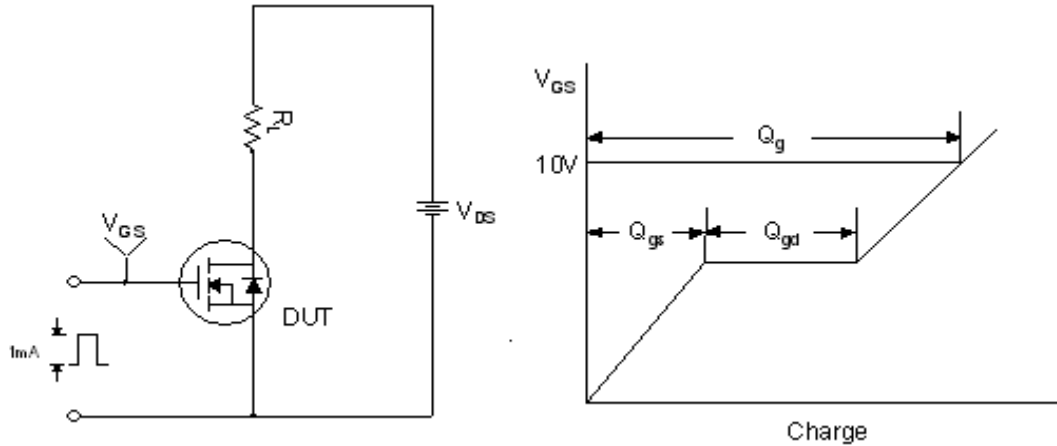


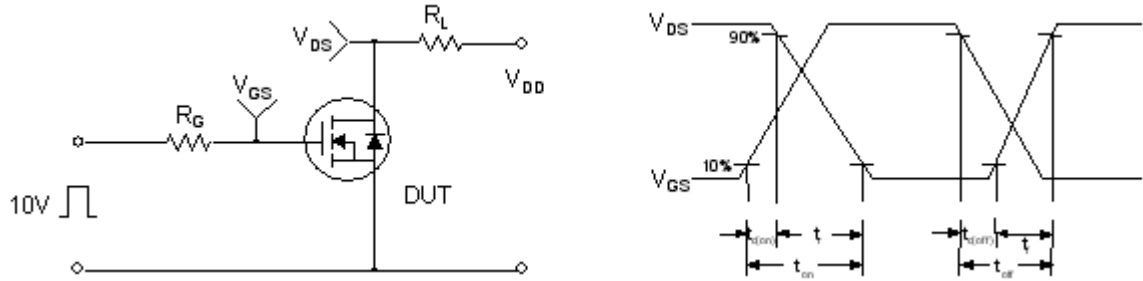
Figure 11-2. Transient Thermal Response Curve - FDPF7N50



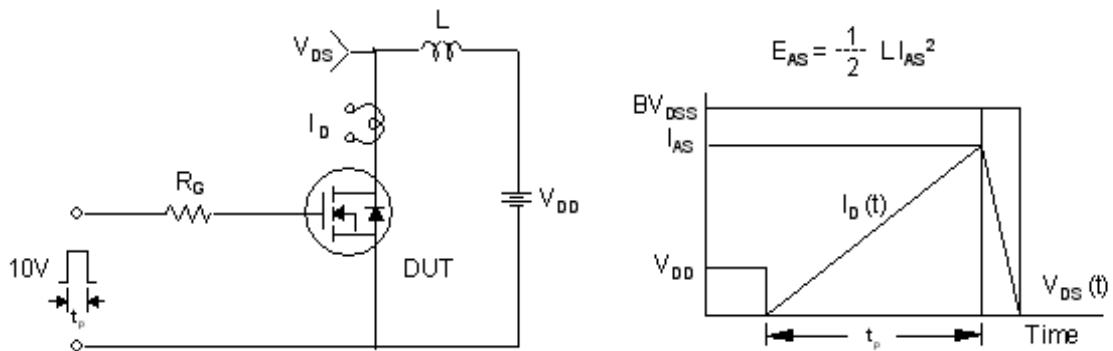
Gate Charge Test Circuit & Waveform



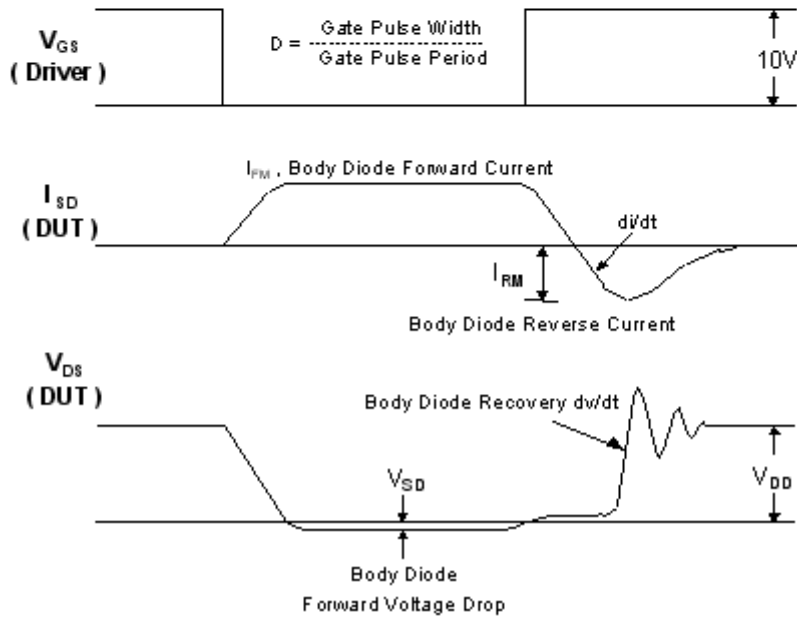
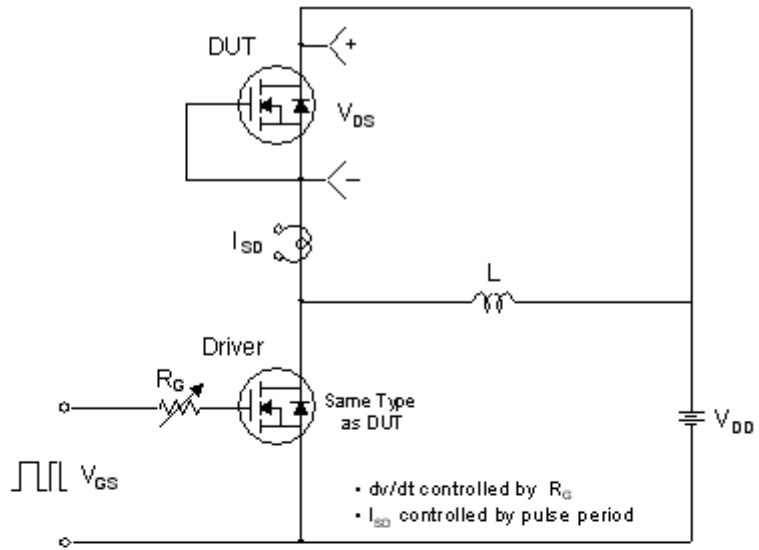
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

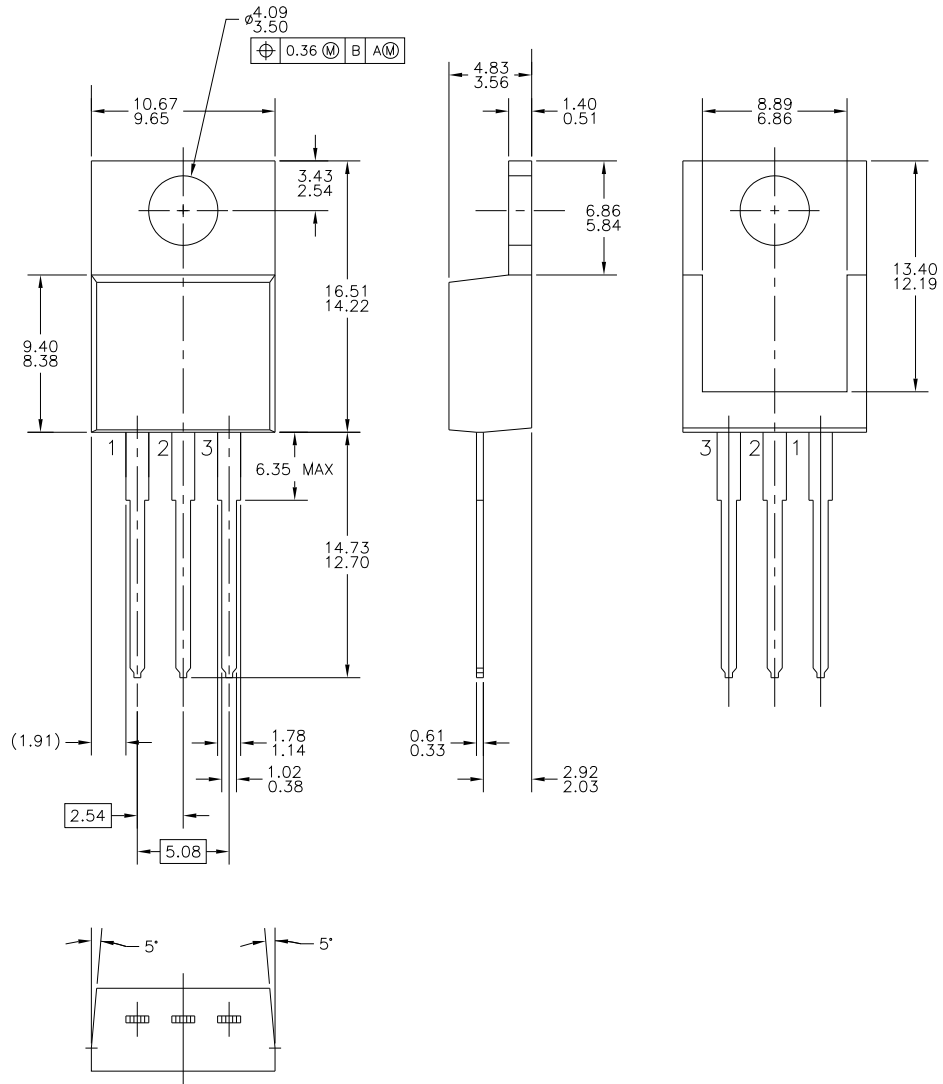


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

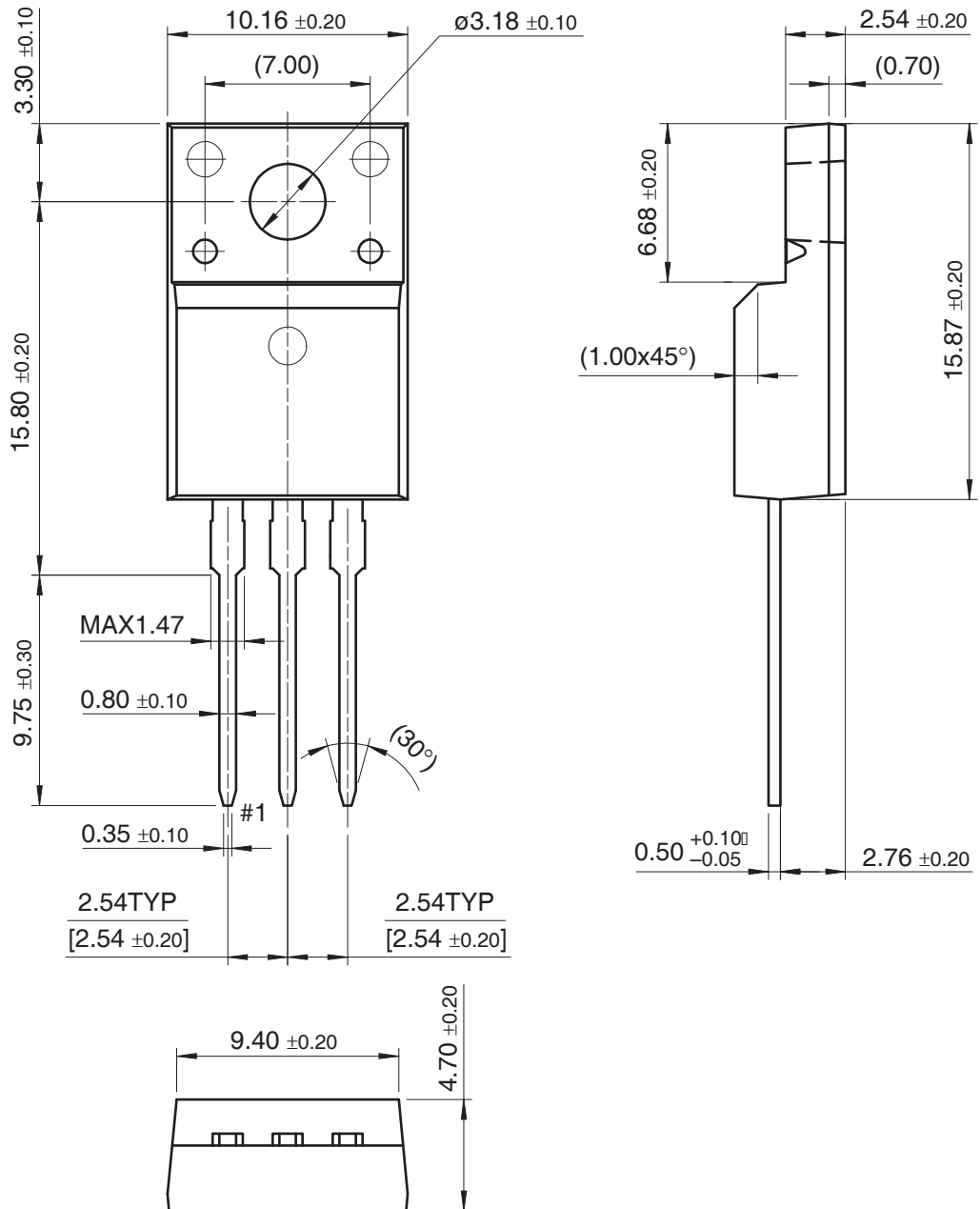
TO-220



Dimensions in Millimeters

Mechanical Dimensions (Continued)

TO-220F




Dimensions in Millimeters



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