



February 2007

UniFET™

# FDP16N50 / FDPF16N50

## 500V N-Channel MOSFET

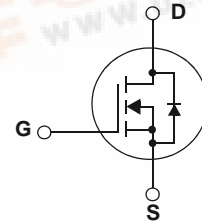
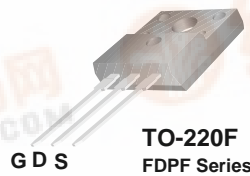
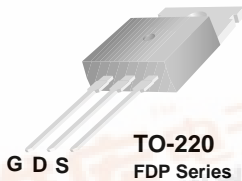
### Features

- 16A, 500V,  $R_{DS(on)} = 0.38\Omega @ V_{GS} = 10V$
- Low gate charge ( typical 32 nC)
- Low  $C_{rSS}$  ( typical 20 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	FDP16N50	FDPF16N50	Unit
$V_{DSS}$	Drain-Source Voltage	500		V
$I_D$	Drain Current	- Continuous ( $T_C = 25^\circ C$ )	16	16 *
		- Continuous ( $T_C = 100^\circ C$ )	9.6	9.6 *
$I_{DM}$	Drain Current - Pulsed (Note 1)	64	64 *	A
$V_{GSS}$	Gate-Source voltage	$\pm 30$		V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	780		mJ
$I_{AR}$	Avalanche Current (Note 1)	16		A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	20		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 $25^\circ C$	200	52	W
		1.59	0.41	W/ $^\circ C$
$T_J, T_{STG}$	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	FDP16N50	FDPF16N50	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.63	2.4	$^\circ C/W$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink Typ.	0.5	--	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	62.5	$^\circ C/W$

FDP16N50 / FDPF16N50 500V N-Channel MOSFET



## Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDP16N50	FDP16N50	TO-220	-	-	50
FDPF16N50	FDPF16N50	TO-220F	-	-	50

## Electrical Characteristics T<sub>C</sub> = 25°C unless otherwise noted

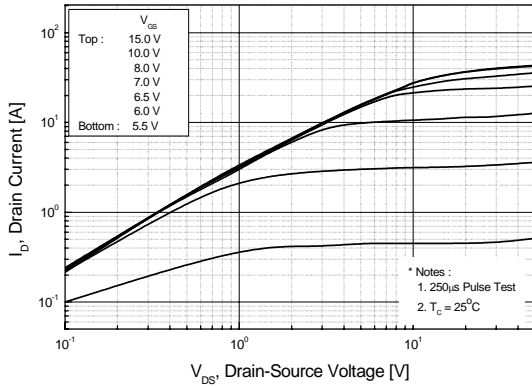
Symbol	Parameter	Conditions	Min.	Typ.	Max	Units
<b>Off Characteristics</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA	500	--	--	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250μA, Referenced to 25°C	--	0.5	--	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 500V, V <sub>GS</sub> = 0V V <sub>DS</sub> = 400V, T <sub>C</sub> = 125°C	--	--	1 10	μA μA
I <sub>GSSF</sub>	Gate-Body Leakage Current, Forward	V <sub>GS</sub> = 30V, V <sub>DS</sub> = 0V	--	--	100	nA
I <sub>GSSR</sub>	Gate-Body Leakage Current, Reverse	V <sub>GS</sub> = -30V, V <sub>DS</sub> = 0V	--	--	-100	nA
<b>On Characteristics</b>						
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	3.0	--	5.0	V
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 8A	--	0.31	0.38	Ω
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 40V, I <sub>D</sub> = 8A (Note 4)	--	23	--	S
<b>Dynamic Characteristics</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1.0MHz	--	1495	1945	pF
C <sub>oss</sub>	Output Capacitance		--	235	310	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		--	20	30	pF
<b>Switching Characteristics</b>						
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 250V, I <sub>D</sub> = 16A R <sub>G</sub> = 25Ω	--	40	90	ns
t <sub>r</sub>	Turn-On Rise Time		--	150	310	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		--	65	140	ns
t <sub>f</sub>	Turn-Off Fall Time		(Note 4, 5)	--	80	170
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 400V, I <sub>D</sub> = 16A V <sub>GS</sub> = 10V	--	32	45	nC
Q <sub>gs</sub>	Gate-Source Charge		--	8.5	--	nC
Q <sub>gd</sub>	Gate-Drain Charge		(Note 4, 5)	--	14	--
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current		--	--	9.2	A
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current		--	--	37	A
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0V, I <sub>S</sub> = 16A	--	--	1.4	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0V, I <sub>S</sub> = 16A di <sub>F</sub> /dt = 100A/μs (Note 4)	--	490	--	ns
Q <sub>rr</sub>	Reverse Recovery Charge		--	5.0	--	μC

### NOTES:

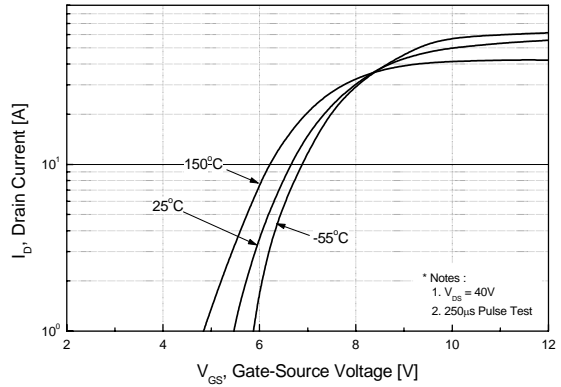
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L = 5.5mH, I<sub>AS</sub> = 16A, V<sub>DD</sub> = 50V, R<sub>G</sub> = 25Ω, Starting T<sub>J</sub> = 25°C
3. I<sub>SD</sub> ≤ 16A, di/dt ≤ 200A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub> = 25°C
4. Pulse Test: Pulse width ≤ 300μs, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

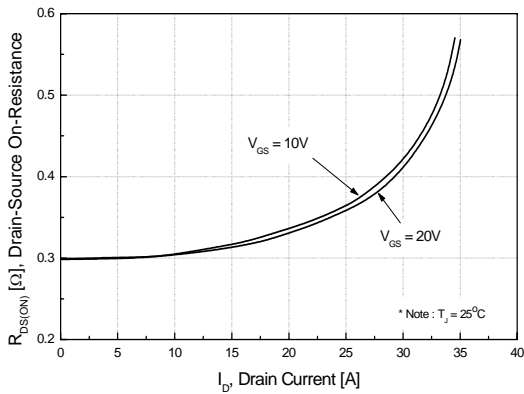
**Figure 1. On-Region Characteristics**



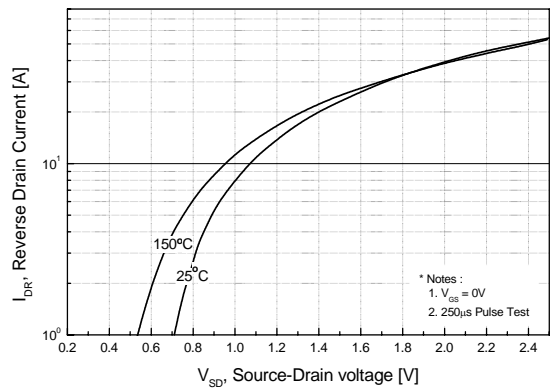
**Figure 2. Transfer Characteristics**



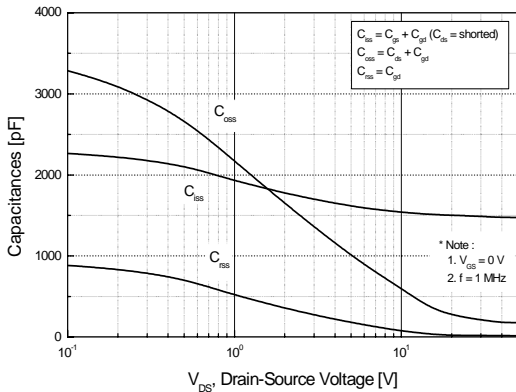
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



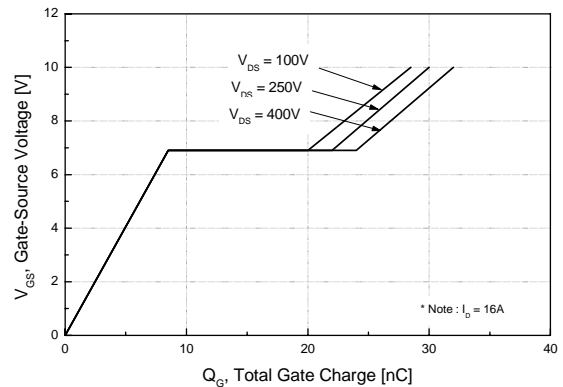
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**

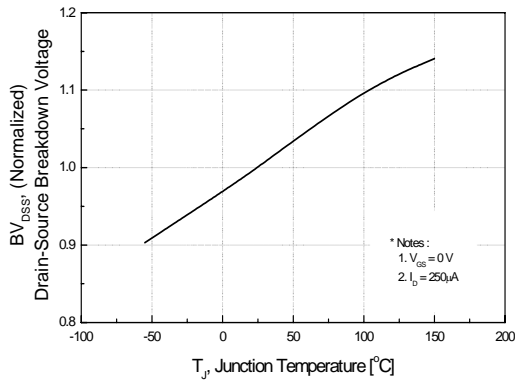


**Figure 6. Gate Charge Characteristics**

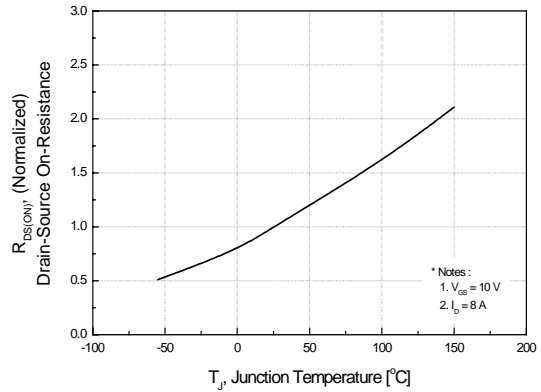


**Typical Performance Characteristics** (Continued)

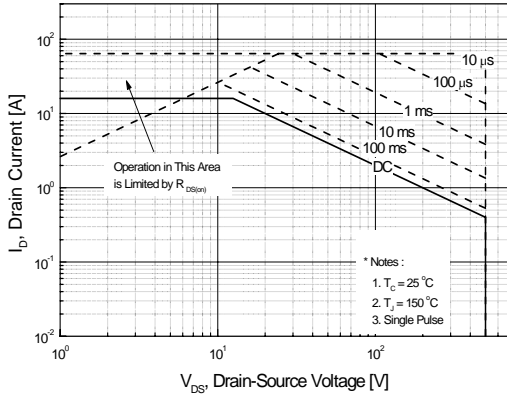
**Figure 7. Breakdown Voltage Variation vs. Temperature**



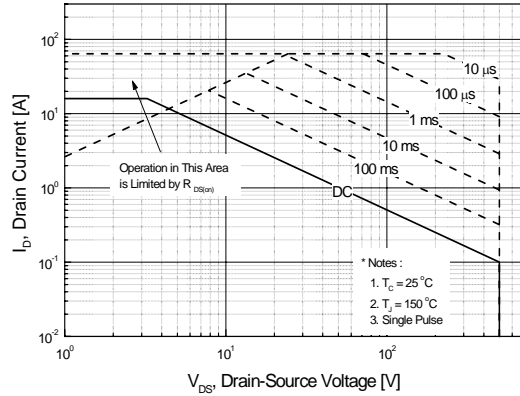
**Figure 8. On-Resistance Variation vs. Temperature**



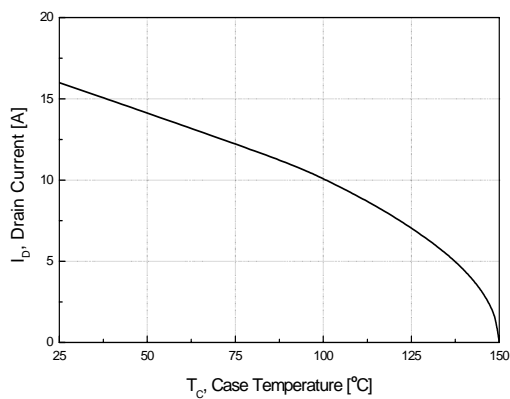
**Figure 9-1. Maximum Safe Operating Area - FDP16N50**



**Figure 9-2. Maximum Safe Operating Area - FDPF16N50**



**Figure 10. Maximum Drain Current vs. Case Temperature**



Typical Performance Characteristics (Continued)

Figure 11-1. Transient Thermal Response Curve - FDP16N50

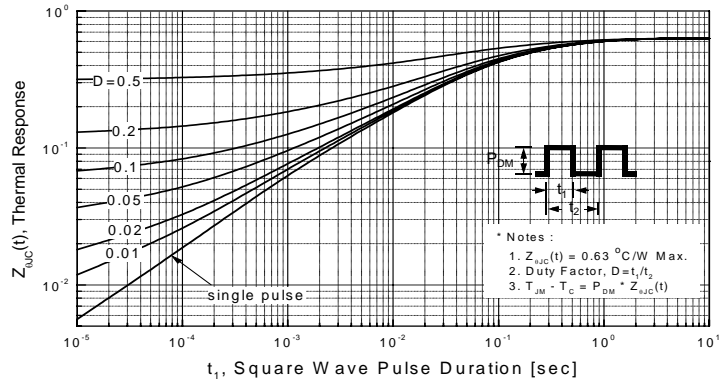
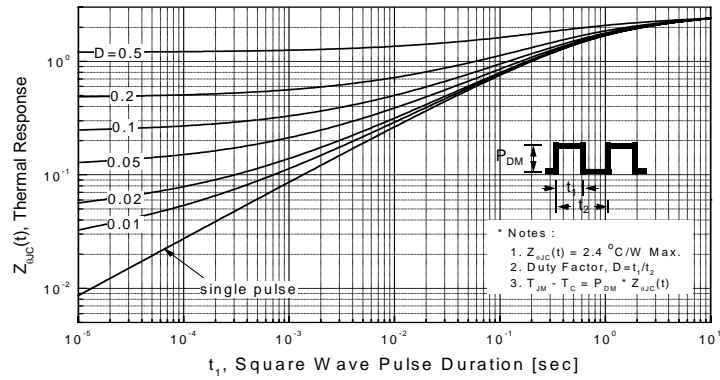
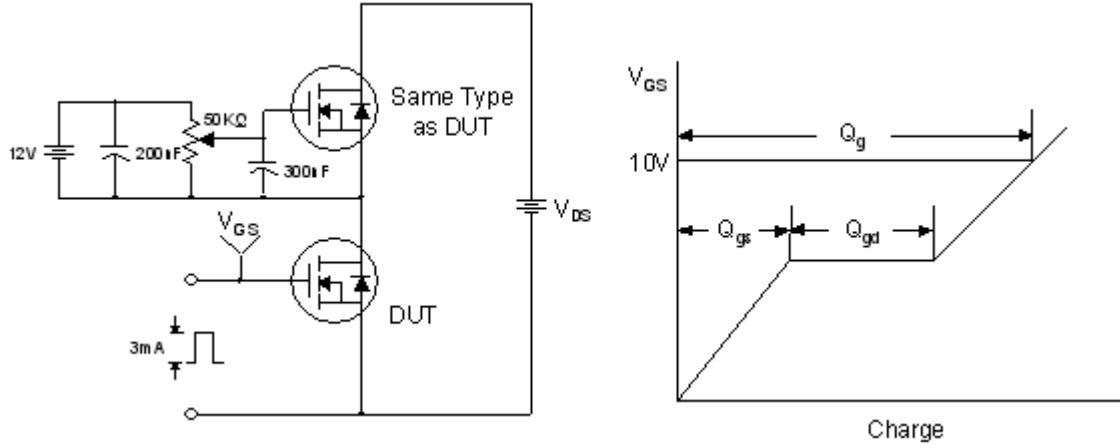


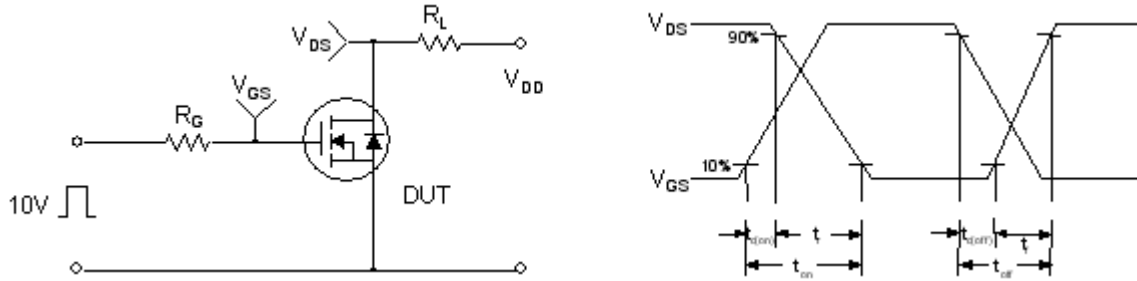
Figure 11-2. Transient Thermal Response Curve - FDPF16N50



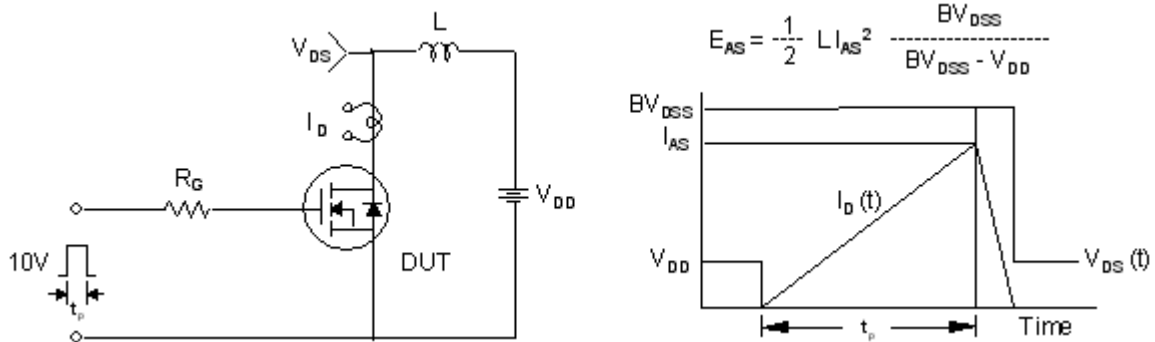
**Gate Charge Test Circuit & Waveform**



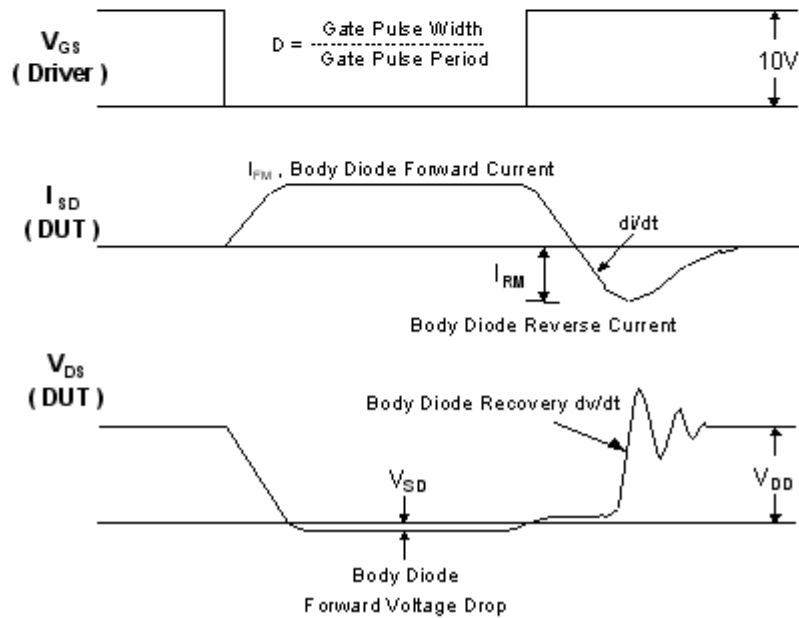
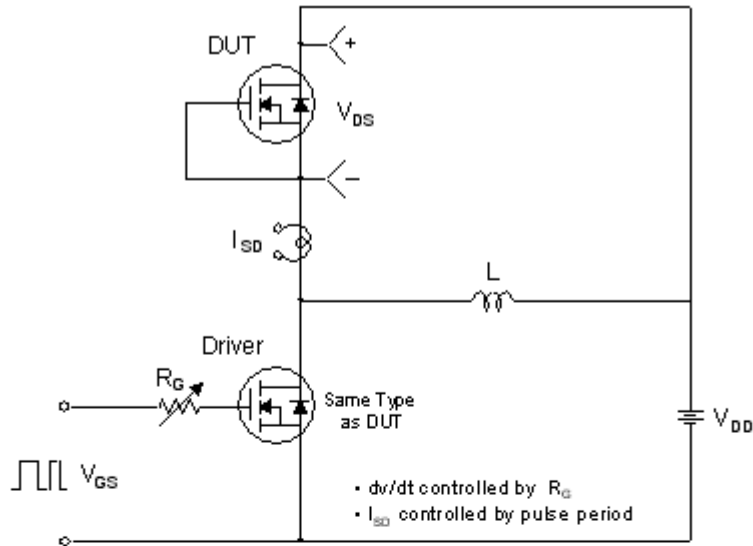
**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**

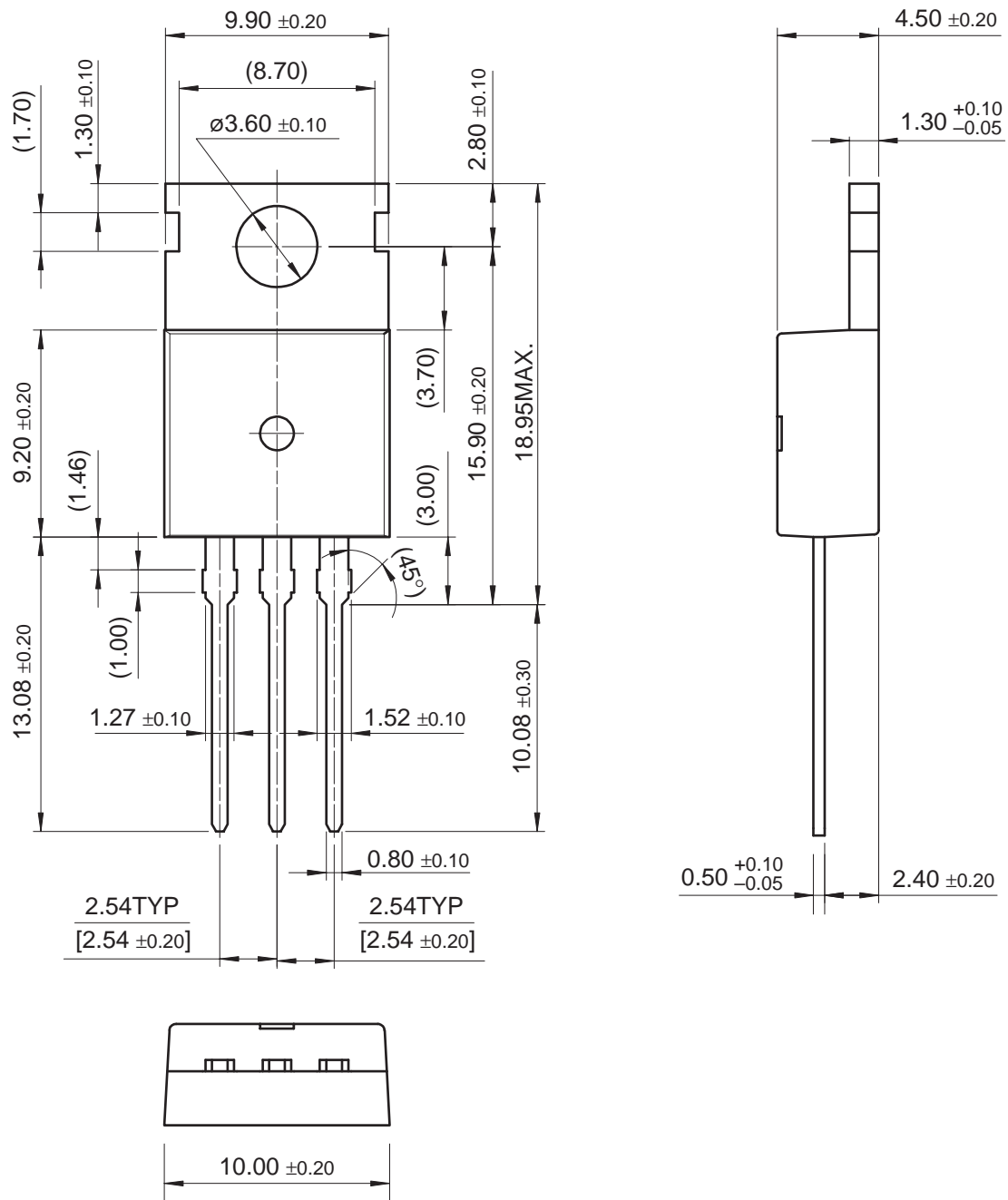


Peak Diode Recovery dv/dt Test Circuit & Waveforms



# Mechanical Dimensions

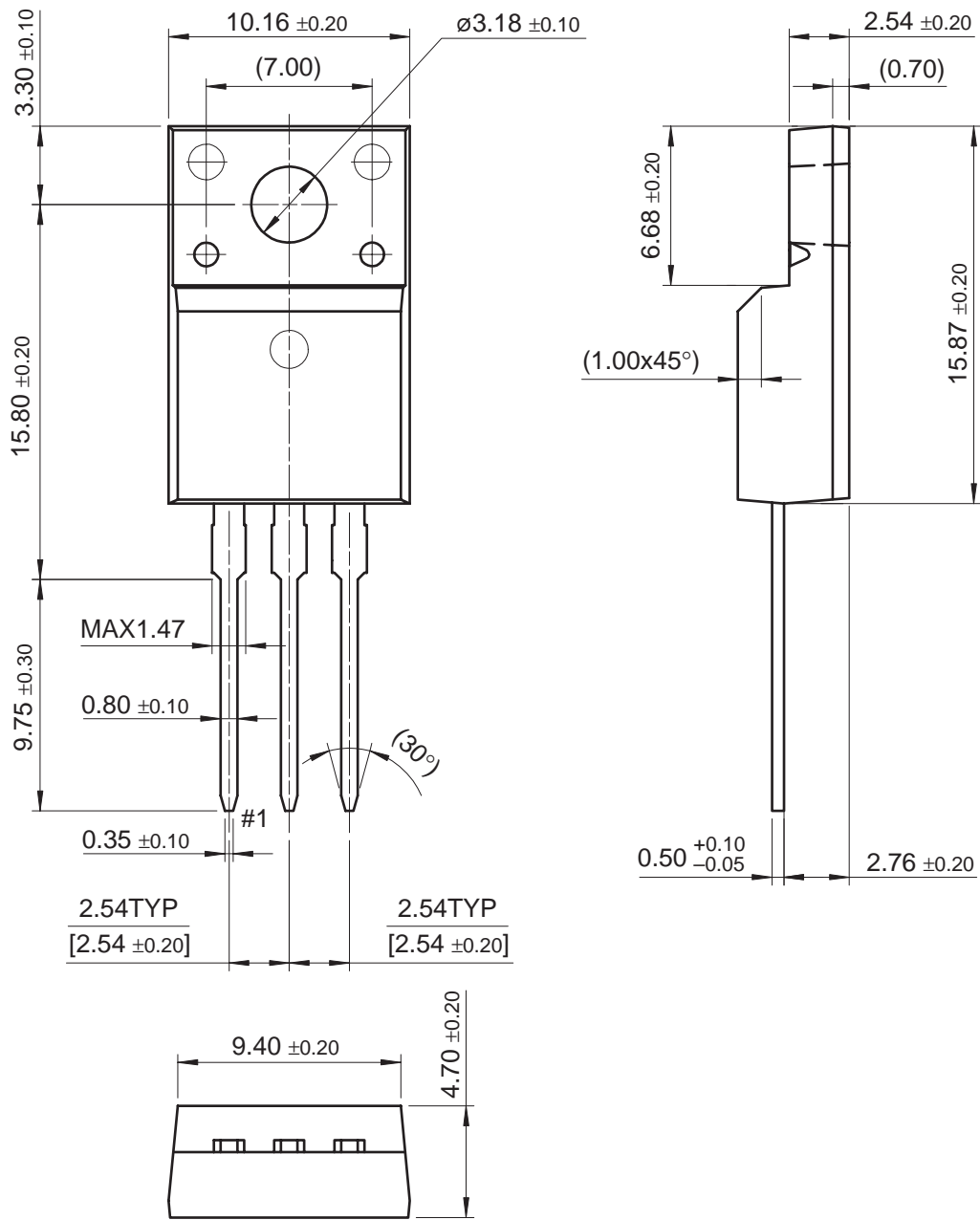
## TO-220





# Mechanical Dimensions

## TO-220F



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