



February 2010  
UniFET-II™

## FDP5N50NZF / FDPF5N50NZF

### N-Channel MOSFET

500V, 4.2A, 1.75Ω

#### Features

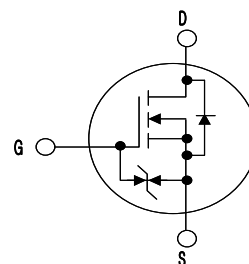
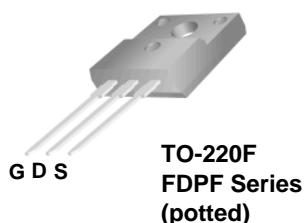
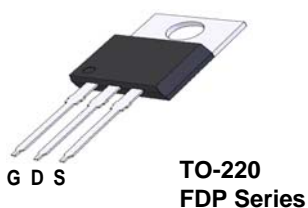
- $R_{DS(on)} = 1.57\Omega$  (Typ.) @  $V_{GS} = 10V$ ,  $I_D = 2.1A$
- Low Gate Charge (Typ. 9nC)
- Low  $C_{rss}$  (Typ. 4pF)
- Fast Switching
- 100% Avalanche Tested
- Improved dv/dt Capability
- ESD Improved Capability
- RoHS Compliant



#### Description

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

This advance 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 switching mode power supplies and active power factor correction.



#### MOSFET Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted\*

Symbol	Parameter	FDP5N50NZF	FDPF5N50NZF	Units
$V_{DSS}$	Drain to Source Voltage	500		V
$V_{GSS}$	Gate to Source Voltage	±25		V
$I_D$	Drain Current	4.2	4.2*	A
		2.5	2.5*	
$I_{DM}$	Drain Current - Pulsed (Note 1)	16	16*	A
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	165		mJ
$I_{AR}$	Avalanche Current (Note 1)	4.2		A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	7.8		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	15		V/ns
$P_D$	Power Dissipation	78	30	W
		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	FDP5N50NZF	FDPF5N50NZF	Units
$R_{\theta JC}$	Thermal Resistance, Junction to Case	1.6	4.1	°C/W
$R_{\theta CS}$	Thermal Resistance, Case to Heat Sink Typ.	0.5	-	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	62.5	62.5	

**Package Marking and Ordering Information**

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDP5N50NZF	FDP5N50NZF	TO-220	-	-	50
FDPF5N50NZF	FDPF5N50NZF	TO-220F	-	-	50

**Electrical Characteristics**  $T_C = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
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**Off Characteristics**

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250\mu\text{A}$ , $V_{GS} = 0\text{V}$ , $T_C = 25^\circ\text{C}$	500	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , Referenced to $25^\circ\text{C}$	-	0.5	-	V/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 500\text{V}$ , $V_{GS} = 0\text{V}$	-	-	10	$\mu\text{A}$
		$V_{DS} = 400\text{V}$ , $V_{GS} = 0\text{V}$ , $T_C = 125^\circ\text{C}$	-	-	100	$\mu\text{A}$
$I_{GSS}$	Gate to Body Leakage Current	$V_{GS} = \pm 25\text{V}$ , $V_{DS} = 0\text{V}$	-	-	$\pm 10$	$\mu\text{A}$

**On Characteristics**

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}$ , $I_D = 250\mu\text{A}$	3.0	-	5.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{V}$ , $I_D = 2.1\text{A}$	-	1.57	1.75	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 20\text{V}$ , $I_D = 2.1\text{A}$ (Note 4)	-	4.2	-	S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{V}$ , $V_{GS} = 0\text{V}$ $f = 1\text{MHz}$	-	365	485	pF
$C_{oss}$	Output Capacitance		-	50	65	pF
$C_{rss}$	Reverse Transfer Capacitance		-	4	8	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 400\text{V}$ , $I_D = 4.2\text{A}$ $V_{GS} = 10\text{V}$ (Note 4)	-	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	$V_{DD} = 250\text{V}$ , $I_D = 4.2\text{A}$ $V_{GS} = 10\text{V}$ , $R_{GEN} = 25\Omega$ (Note 4)	-	12	35	ns
$t_r$	Turn-On Rise Time		-	19	50	ns
$t_{d(off)}$	Turn-Off Delay Time		-	31	70	ns
$t_f$	Turn-Off Fall Time		-	22	55	ns

**Drain-Source Diode Characteristics**

I <sub>S</sub>	Maximum Continuous Drain to Source Diode Forward Current		-	-	4.2	A
I <sub>SM</sub>	Maximum Pulsed Drain to Source Diode Forward Current		-	-	16	A
V <sub>SD</sub>	Drain to Source Diode Forward Voltage	V <sub>GS</sub> = 0V, I <sub>SD</sub> = 4.2A	-	-	1.5	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0V, I <sub>SD</sub> = 4.2A	-	87	-	ns
Q <sub>rr</sub>	Reverse Recovery Charge	dI <sub>F</sub> /dt = 100A/μs (Note 4)	-	0.15	-	μC

**Notes:**

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2.  $L = 18.7\text{mH}$ ,  $I_{AS} = 4.2\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 4.2\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$
4. Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

Figure 1. On-Region Characteristics

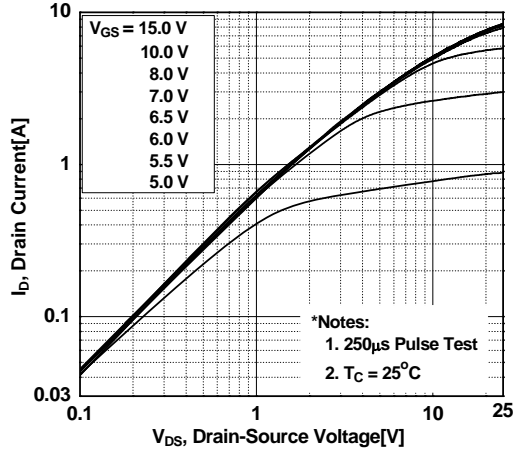


Figure 2. Transfer Characteristics

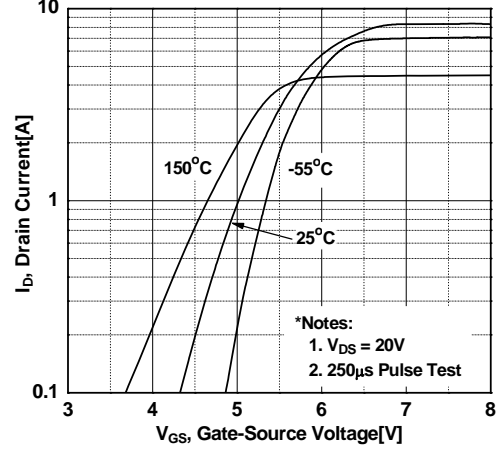


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

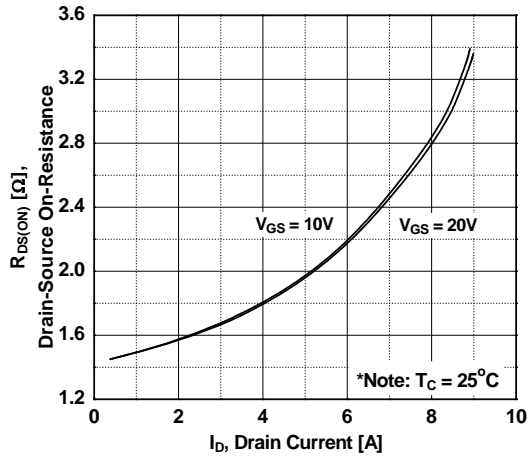


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

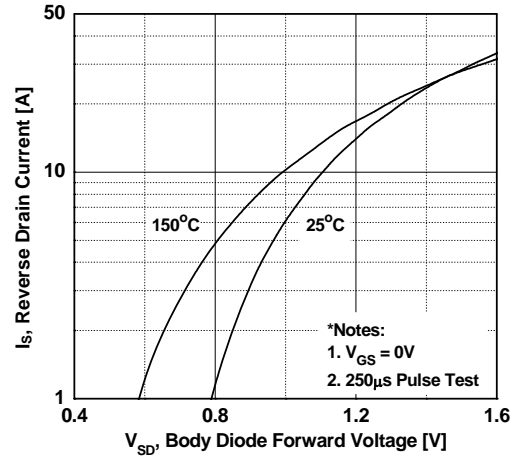


Figure 5. Capacitance Characteristics

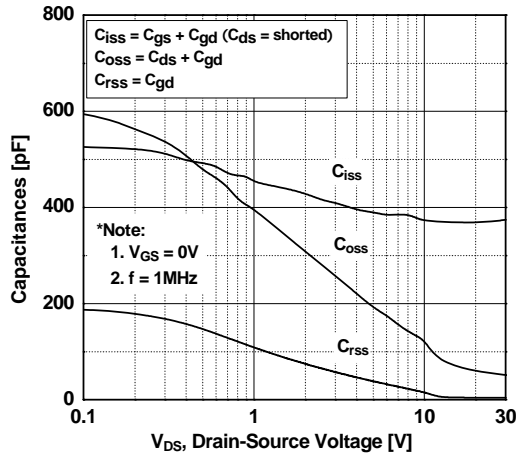
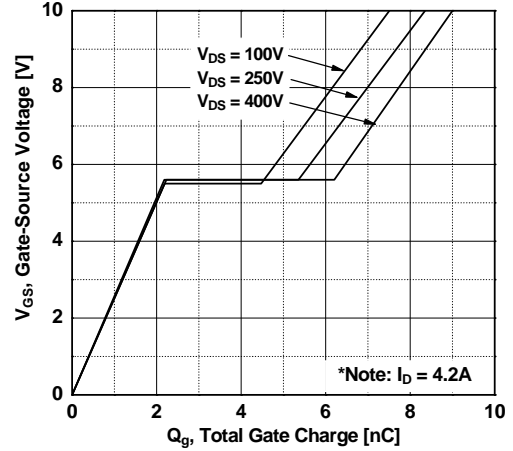


Figure 6. Gate Charge Characteristics



## Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

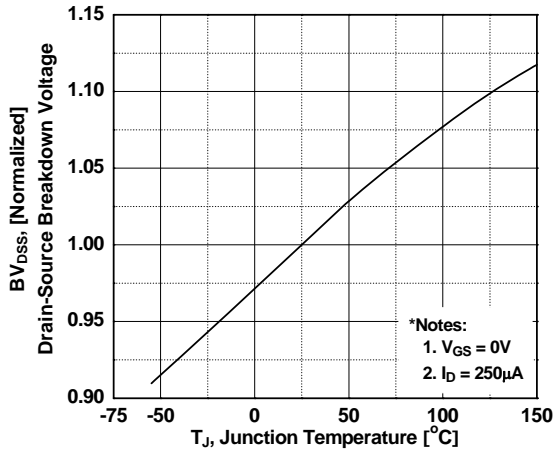


Figure 8. Maximum Safe Operating Area vs. Case Temperature-FDPF5N50NZF

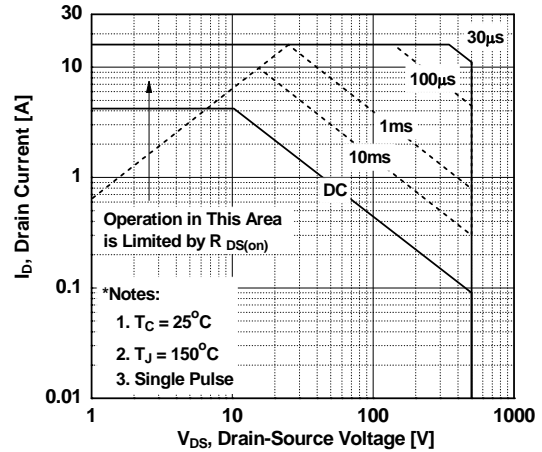


Figure 9. Maximum Drain Current

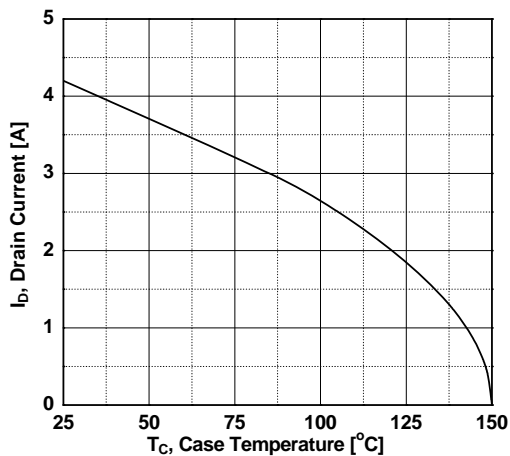
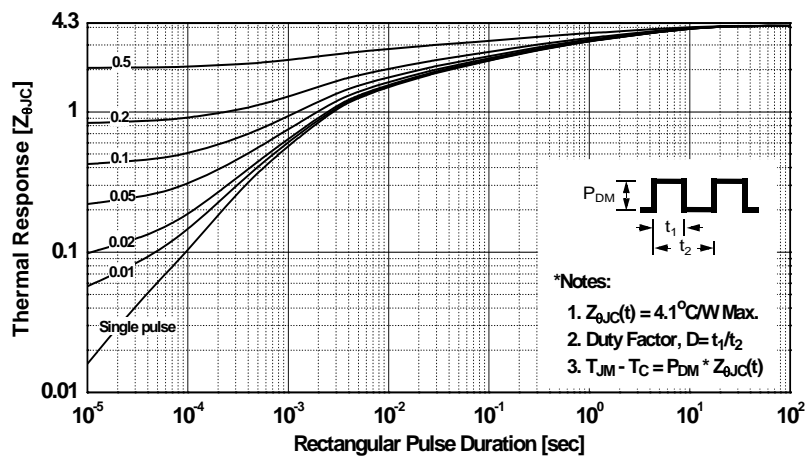
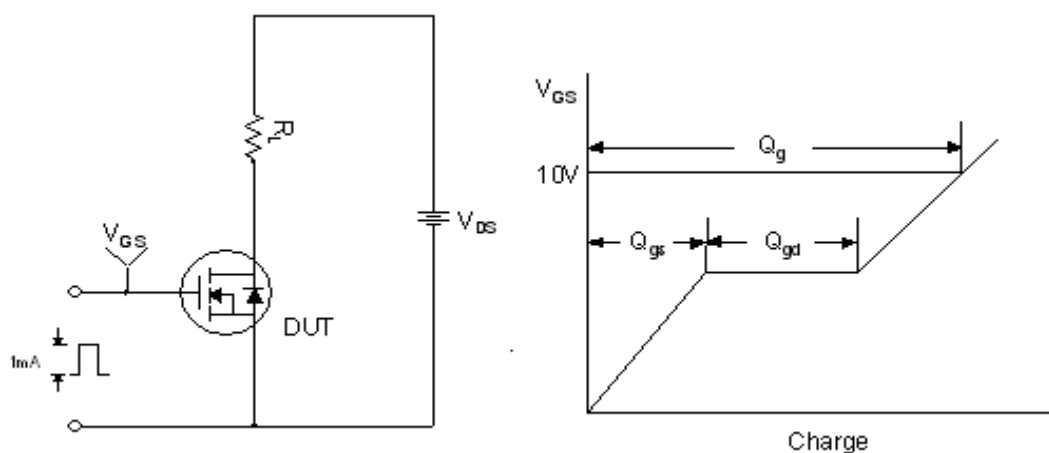


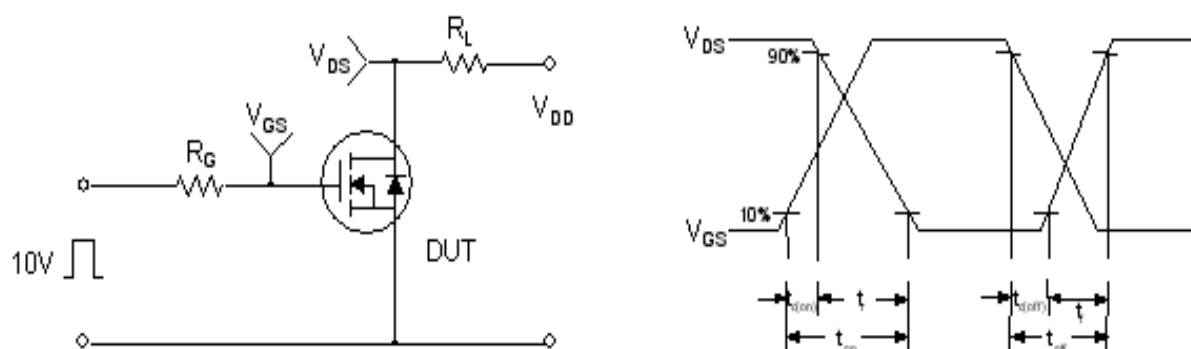
Figure 10. Transient Thermal Response Curve-FDPF5N50NZF



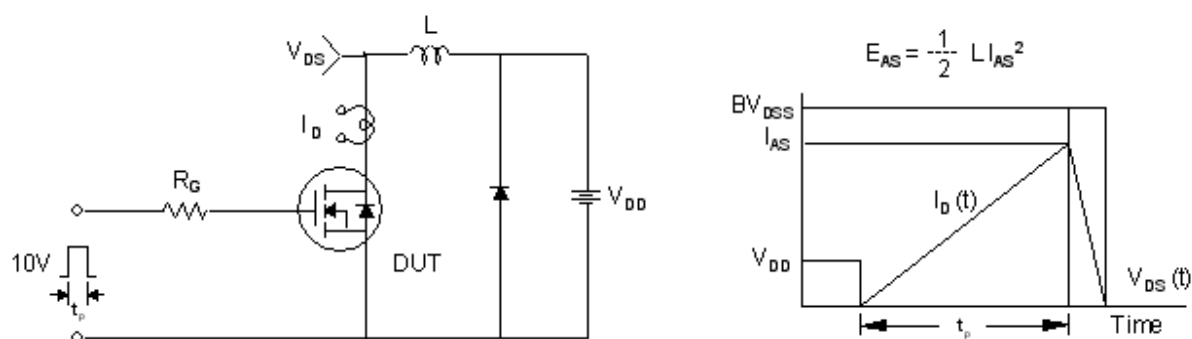
Gate Charge Test Circuit & Waveform



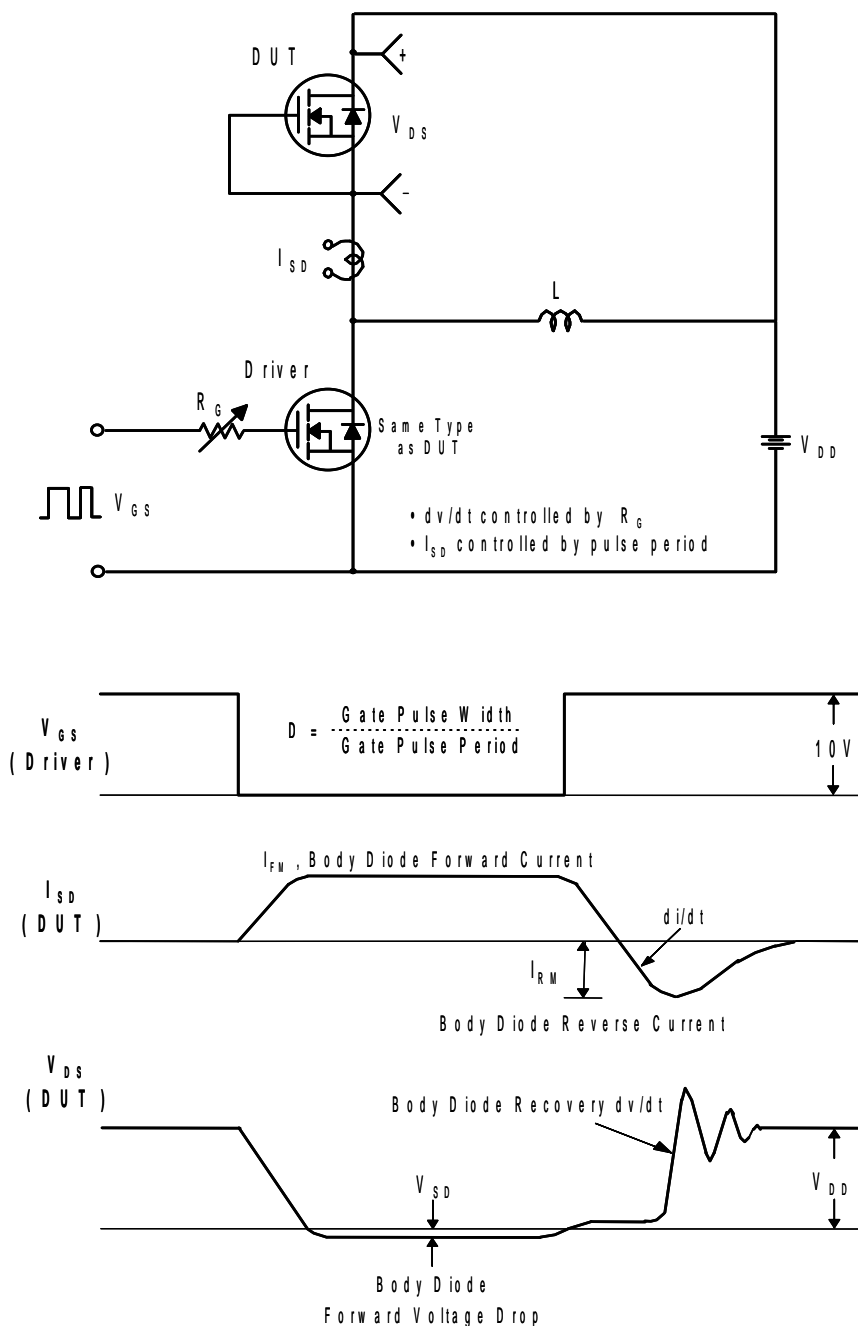
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

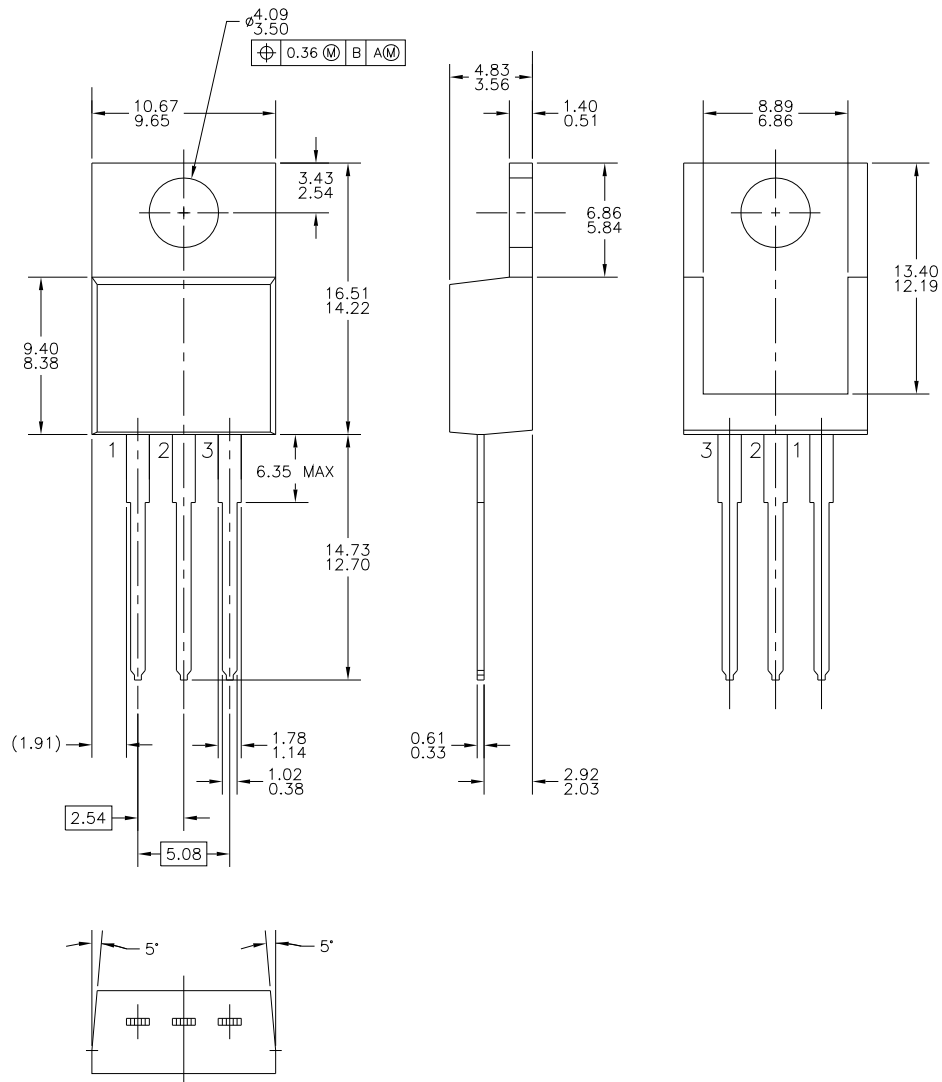


Peak Diode Recovery dv/dt Test Circuit & Waveforms



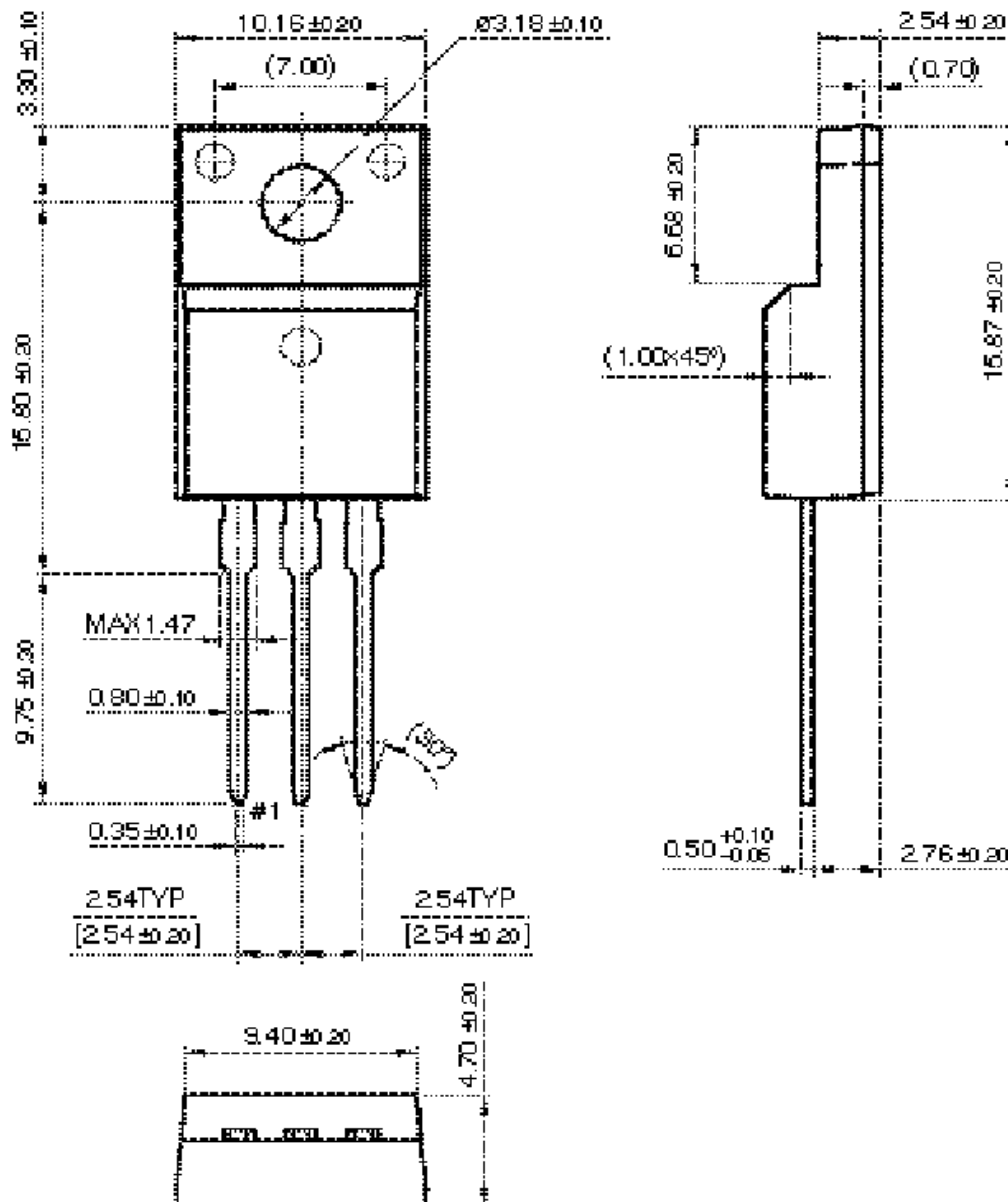
## Package Dimensions

### TO-220



# Package Dimensions

## TO-220F







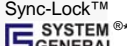
\* Front/Back Side Isolation Voltage : 2500V

Dimensions in Millimeters



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Rev. I47