

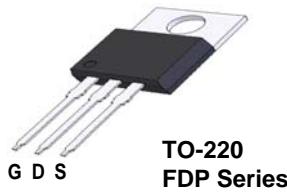
## FDP4N60NZ / FDPF4N60NZ

### N-Channel MOSFET

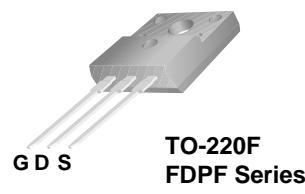
600V, 3.8A, 2.5Ω

#### Features

- $R_{DS(on)} = 1.9\Omega$  (Typ.) @  $V_{GS} = 10V$ ,  $I_D = 1.9A$
- Low Gate Charge (Typ. 8.3nC)
- Low  $C_{rss}$  (Typ. 3.7pF)
- Fast Switching
- 100% Avalanche Tested
- Improved dv/dt Capability
- ESD Improved Capability
- RoHS Compliant



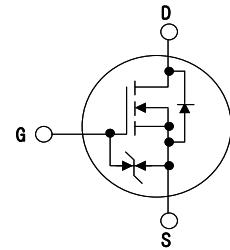
TO-220  
FDP Series



#### 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 switching mode power supplies and active power factor correction.



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

Symbol	Parameter		FDP4N60NZ	FDPF4N60NZ	Units
$V_{DSS}$	Drain to Source Voltage		600		V
$V_{GSS}$	Gate to Source Voltage		$\pm 25$		V
$I_D$	Drain Current	-Continuous ( $T_C = 25^\circ\text{C}$ )	3.8	3.8*	A
		-Continuous ( $T_C = 100^\circ\text{C}$ )	2.3	2.3*	
$I_{DM}$	Drain Current	- Pulsed	(Note 1)	15	15*
$E_{AS}$	Single Pulsed Avalanche Energy		(Note 2)	223.8	mJ
$I_{AR}$	Avalanche Current		(Note 1)	3.8	A
$E_{AR}$	Repetitive Avalanche Energy		(Note 1)	8.9	mJ
$dv/dt$	Peak Diode Recovery $dv/dt$		(Note 3)	10	V/ns
$P_D$	Power Dissipation	( $T_C = 25^\circ\text{C}$ )	89	28	W
		- Derate above $25^\circ\text{C}$	0.71	0.22	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	FDP4N60NZ	FDPF4N60NZ	Units
$R_{\theta JC}$	Thermal Resistance, Junction to Case	1.4	4.5	$^\circ\text{C}/\text{W}$
$R_{\theta CS}$	Thermal Resistance, Case to 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
FDP4N60NZ	FDP4N60NZ	TO-220			50
FDPF4N60NZ	FDPF4N60NZ	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

$\text{BV}_{\text{DSS}}$	Drain to Source Breakdown Voltage	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}, T_C = 25^\circ\text{C}$	600	-	-	V
$\Delta \text{BV}_{\text{DSS}}$ $\Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , Referenced to $25^\circ\text{C}$	-	0.6	-	$\text{V}/^\circ\text{C}$
$I_{\text{DSS}}$	Zero Gate Voltage Drain Current	$V_{DS} = 600\text{V}, V_{GS} = 0\text{V}$	-	-	1	$\mu\text{A}$
		$V_{DS} = 480\text{V}, V_{GS} = 0\text{V}, T_C = 125^\circ\text{C}$	-	-	10	
$I_{\text{GSS}}$	Gate to Body Leakage Current	$V_{GS} = \pm 25\text{V}, V_{DS} = 0\text{V}$	-	-	$\pm 10$	$\mu\text{A}$

### On Characteristics

$V_{GS(\text{th})}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	3.0	-	5.0	V
$R_{DS(\text{on})}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{V}, I_D = 1.9\text{A}$	-	1.9	2.5	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 20\text{V}, I_D = 1.9\text{A}$ (Note 4)	-	3.3	-	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{V}, V_{GS} = 0\text{V}$	-	385	510	pF
$C_{oss}$	Output Capacitance	$f = 1\text{MHz}$	-	40	60	pF
$C_{rss}$	Reverse Transfer Capacitance		-	3.7	5	pF
$Q_{g(\text{tot})}$	Total Gate Charge at $10\text{V}$		-	8.3	10.8	nC
$Q_{gs}$	Gate to Source Gate Charge	$V_{DS} = 480\text{V}, I_D = 3.8\text{A}$ $V_{GS} = 10\text{V}$	-	2.1	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge	(Note 4, 5)	-	3.3	-	nC

### Switching Characteristics

$t_{d(\text{on})}$	Turn-On Delay Time	$V_{DD} = 300\text{V}, I_D = 3.8\text{A}$	-	12.7	35.4	ns
$t_r$	Turn-On Rise Time	$R_G = 25\Omega$	-	15.1	40.2	ns
$t_{d(\text{off})}$	Turn-Off Delay Time		-	30.2	70.4	ns
$t_f$	Turn-Off Fall Time	(Note 4, 5)	-	12.8	35.6	ns

### Drain-Source Diode Characteristics

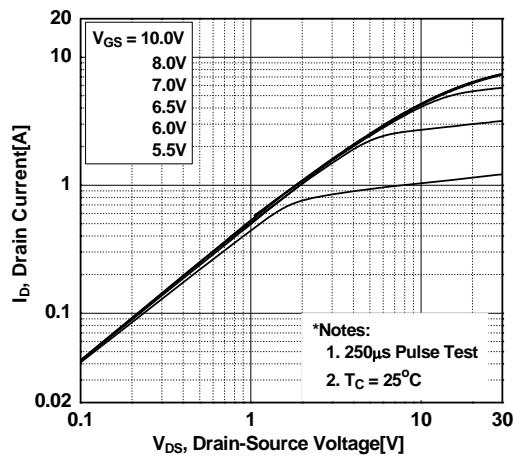
$I_S$	Maximum Continuous Drain to Source Diode Forward Current	-	-	3.8	A	
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current	-	-	15	A	
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0\text{V}, I_{SD} = 3.8\text{A}$	-	-	1.4	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{V}, I_{SD} = 3.8\text{A}$	-	168	-	ns
$Q_{rr}$	Reverse Recovery Charge	$dI_F/dt = 100\text{A}/\mu\text{s}$	(Note 4)	0.7	-	$\mu\text{C}$

#### Notes:

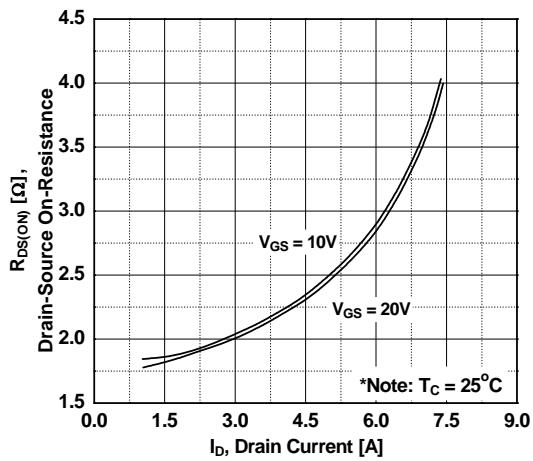
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2.  $L = 31\text{mH}, I_{AS} = 3.8\text{A}, V_{DD} = 50\text{V}, R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 3.8\text{A}, dI/dt \leq 200\text{A}/\mu\text{s}, V_{DD} \leq \text{BV}_{\text{DSS}}$ , Starting  $T_J = 25^\circ\text{C}$
4. Pulse Test: Pulse width  $\leq 300\mu\text{s}$ , Dual Cycle  $\leq 2\%$
5. Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

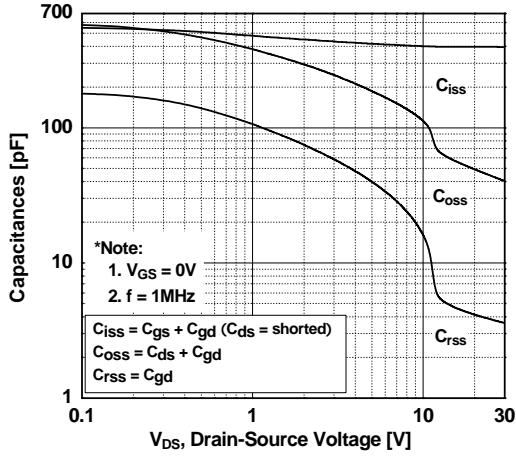
**Figure 1. On-Region Characteristics**



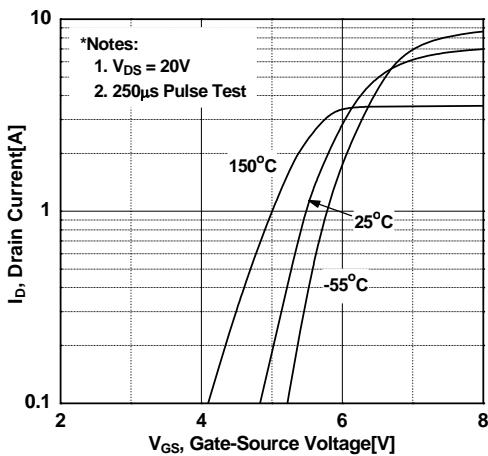
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



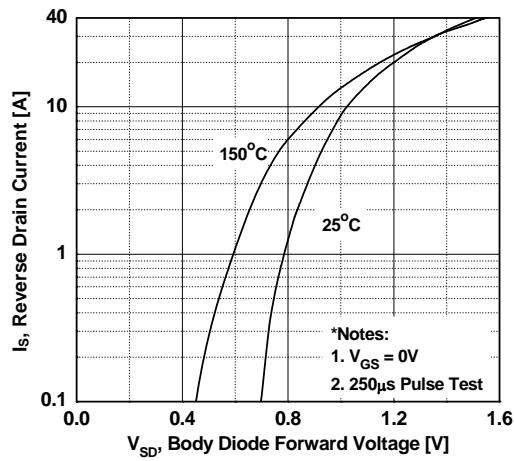
**Figure 5. Capacitance Characteristics**



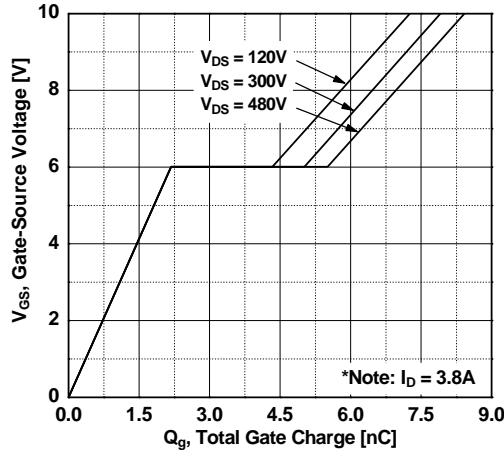
**Figure 2. Transfer Characteristics**



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

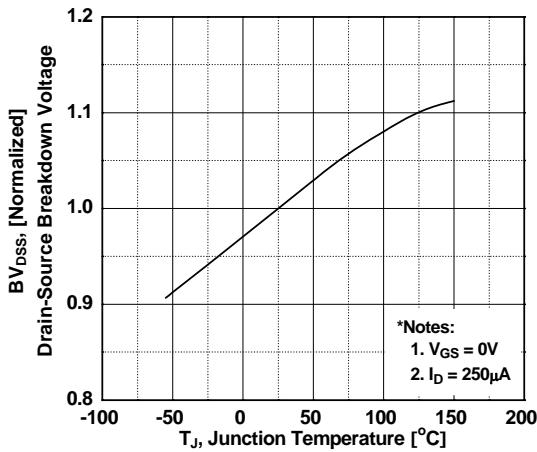


**Figure 6. Gate Charge Characteristics**

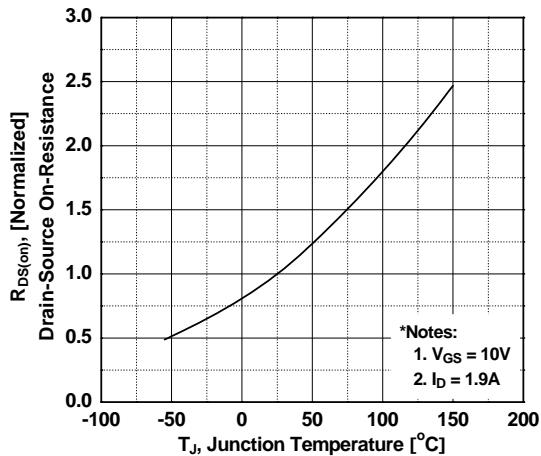


**Typical Performance Characteristics** (Continued)

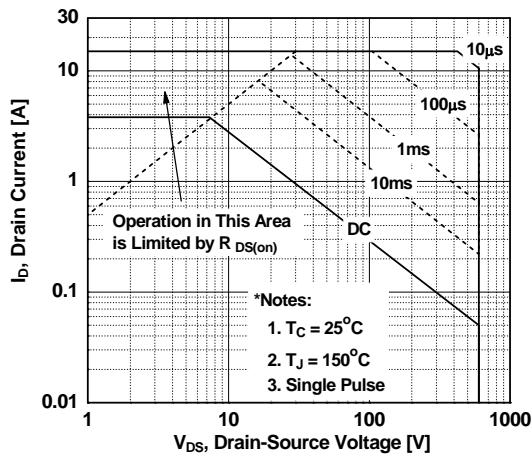
**Figure 7. Breakdown Voltage Variation vs. Temperature**



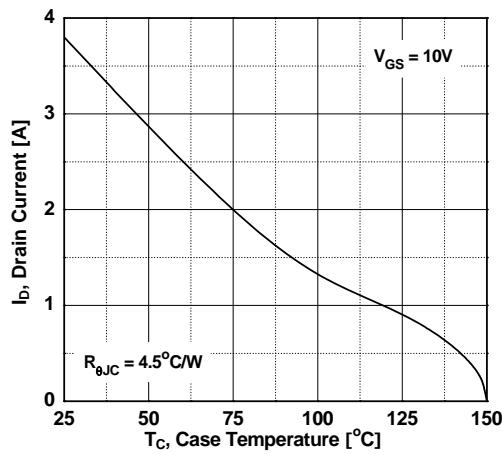
**Figure 8. On-Resistance Variation vs. Temperature**



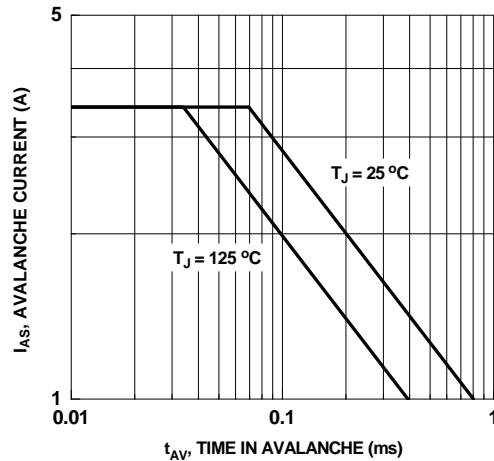
**Figure 9. Maximum Safe Operating Area vs. Case Temperature**



**Figure 10. Maximum Drain Current**

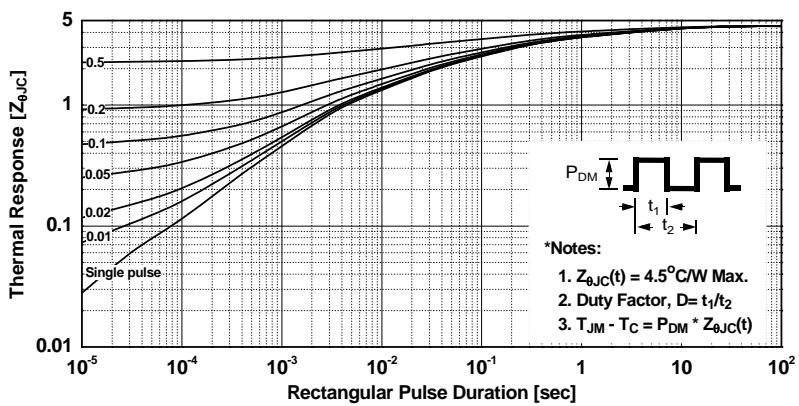


**Figure 11. Unclamped Inductive Switching Capability**

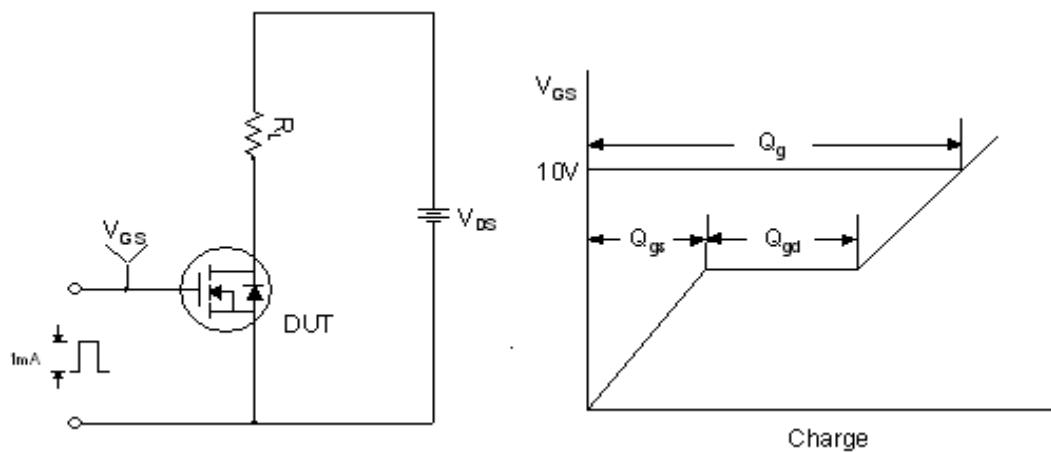


## Typical Performance Characteristics (Continued)

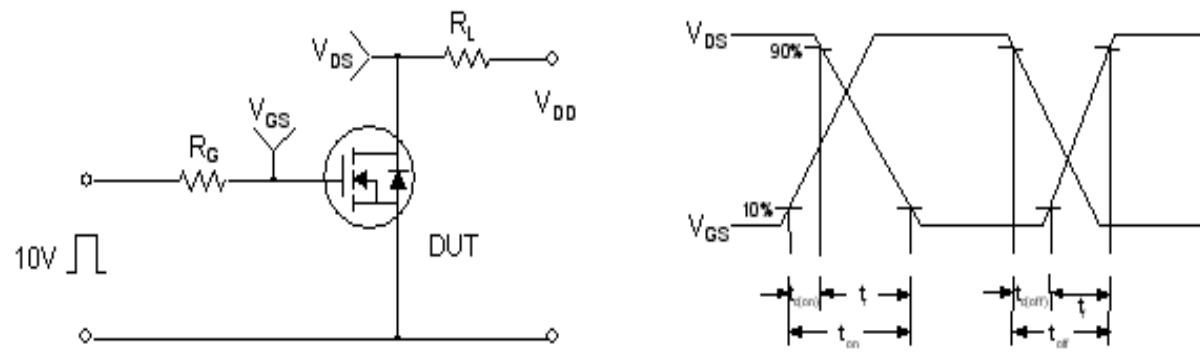
Figure 12. Transient Thermal Response Curve



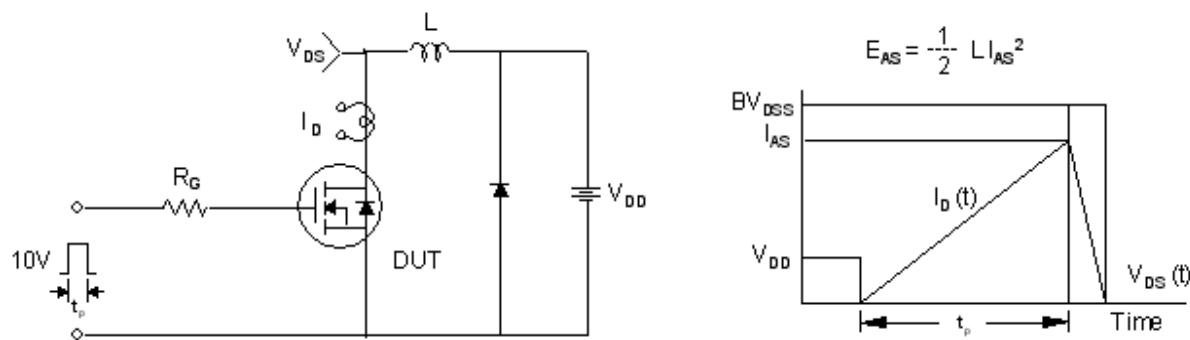
Gate Charge Test Circuit & Waveform



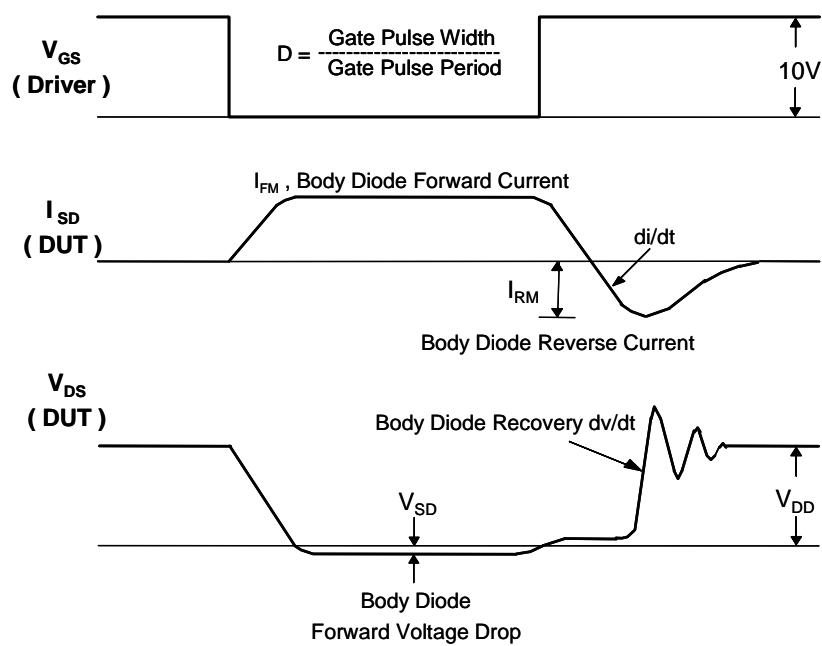
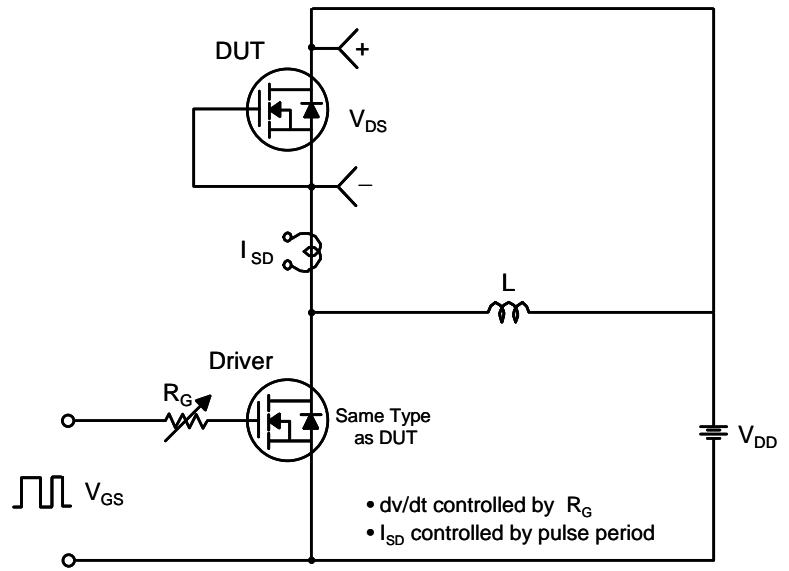
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

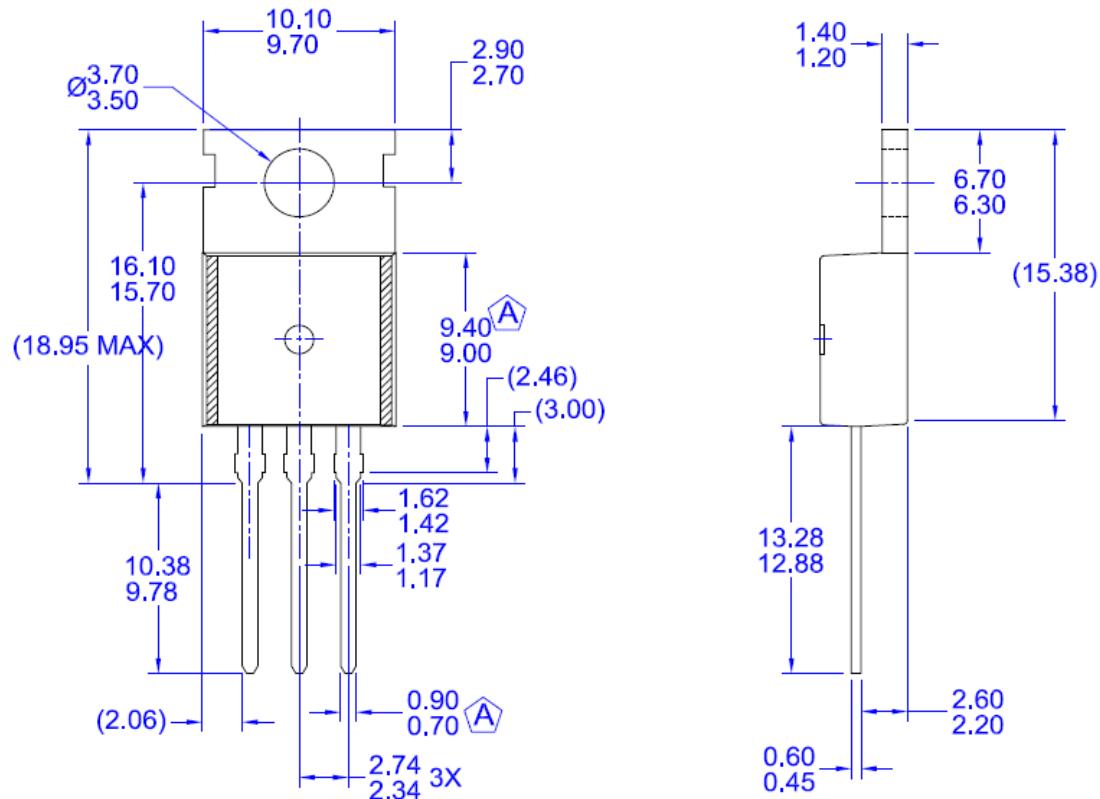


## Peak Diode Recovery dv/dt Test Circuit & Waveforms



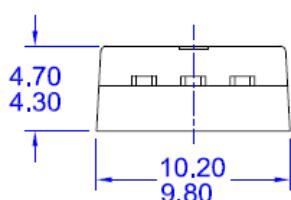
## Package Dimensions

TO-220



## NOTES:

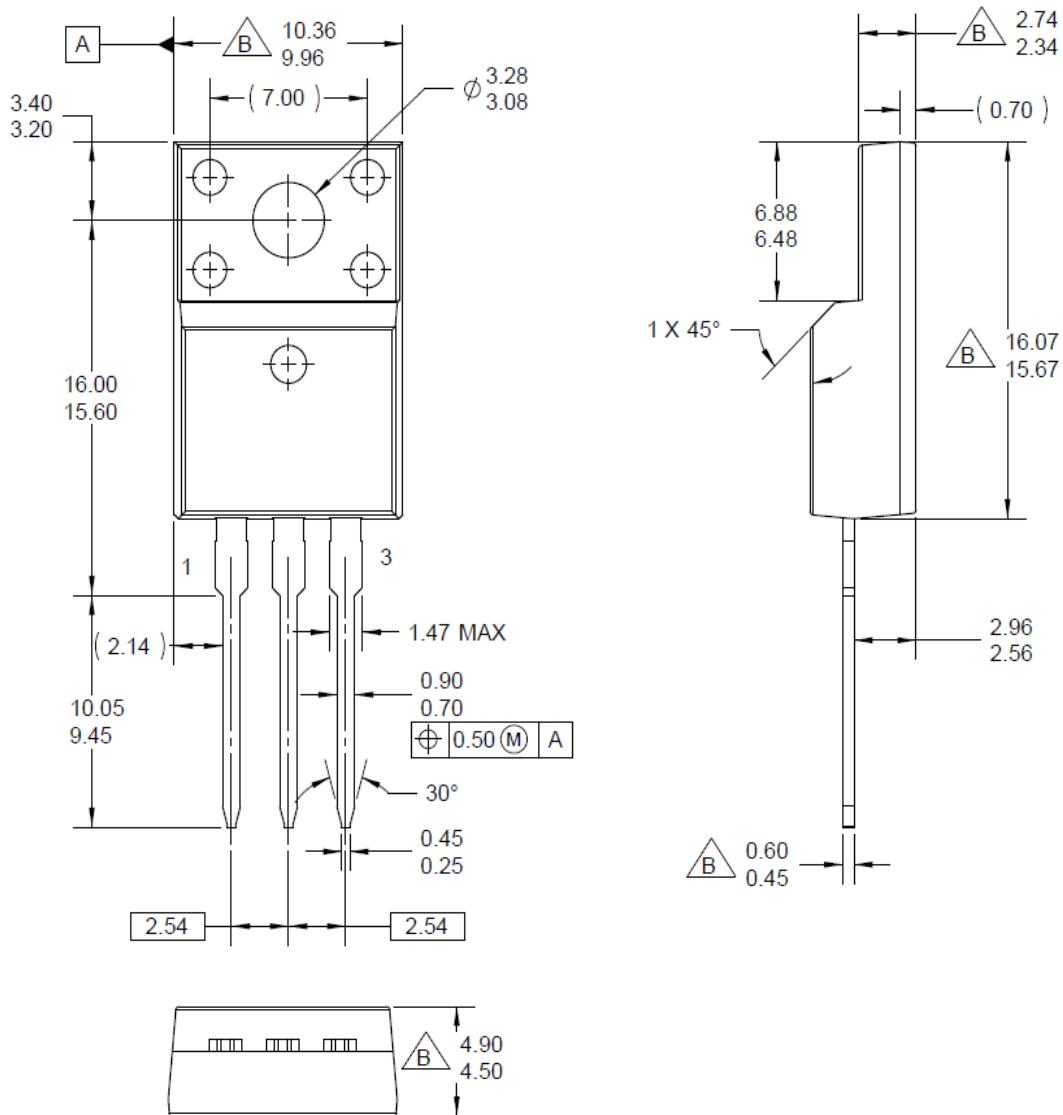
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- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- D) DRAWING FILE/REVISION: MKT-TO220Y03REV1



Dimensions in Millimeters

## Package Dimensions

TO-220F



\* Front/Back Side Isolation Voltage : AC 2500V

Dimensions in Millimeters

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