

# FDP090N10

## N-Channel PowerTrench® MOSFET

### 100V, 75A, 9mΩ

#### Features

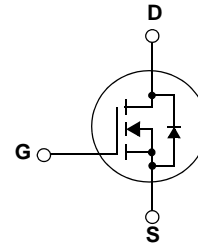
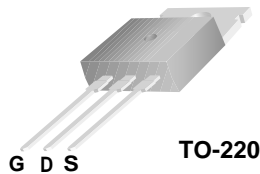
- $R_{DS(on)} = 7.2m\Omega$  (Typ.) @  $V_{GS} = 10V, I_D = 75A$
- Fast switching speed
- Low gate charge
- High performance trench technology for extremely low  $R_{DS(on)}$
- High power and current handling capability
- RoHS compliant

#### Application

- DC to DC converters / Synchronous Rectification

#### General Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench process that has been especially tailored to minimize the on-state resistance and yet maintain superior switching performance.



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

Symbol	Parameter	Ratings	Units
$V_{DSS}$	Drain to Source Voltage	100	V
$V_{GSS}$	Gate to Source Voltage	$\pm 20$	V
$I_D$	Drain Current	-Continuous ( $T_C = 85^\circ C$ )	75
$I_{DM}$	Drain Current	- Pulsed (Note 1)	300
$E_{AS}$	Single Pulsed Avalanche Energy	(Note 2)	309
$I_{AR}$	Avalanche Current	(Note 1)	75
$E_{AR}$	Repetitive Avalanche Energy	(Note 1)	20.8
$dv/dt$	Peak Diode Recovery $dv/dt$	(Note 3)	5.6
$P_D$	Power Dissipation	( $T_C = 25^\circ C$ )	208
		- Derate above $25^\circ C$	1.39
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +175	$^\circ C$
$T_L$	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	Ratings	Units
$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.72	$^\circ C/W$
$R_{\theta CS}$	Thermal Resistance, Case to Sink Typ.	0.5	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	62.5	

**Package Marking and Ordering Information**  $T_C = 25^\circ\text{C}$  unless otherwise noted

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDP090N10	FDP090N10	TO-220	-	-	50

**Electrical Characteristics**

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

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}, T_C = 25^\circ\text{C}$	100	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , Referenced to $25^\circ\text{C}$	-	0.1	-	$\text{V}/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 100\text{V}, V_{GS} = 0\text{V}$	-	-	1	$\mu\text{A}$
		$V_{DS} = 100\text{V}, V_{GS} = 0\text{V}, T_C = 150^\circ\text{C}$	-	-	500	
$I_{GSS}$	Gate to Body Leakage Current	$V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$	-	-	$\pm 100$	nA

**On Characteristics**

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	2.5	3.5	4.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{V}, I_D = 75\text{A}$	-	7.2	9	$\text{m}\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 10\text{V}, I_D = 37.5\text{A}$ (Note 4)	-	100	-	S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{V}, V_{GS} = 0\text{V}$ $f = 1\text{MHz}$	-	6185	8225	pF
$C_{oss}$	Output Capacitance		-	585	775	pF
$C_{rss}$	Reverse Transfer Capacitance		-	235	355	pF

**Switching Characteristics**

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 50\text{V}, I_D = 75\text{A}$ $V_{GS} = 10\text{V}, R_{GEN} = 25\Omega$ (Note 4, 5)	-	107	224	ns
$t_r$	Turn-On Rise Time		-	322	655	ns
$t_{d(off)}$	Turn-Off Delay Time		-	166	342	ns
$t_f$	Turn-Off Fall Time		-	149	309	ns
$Q_{g(tot)}$	Total Gate Charge at 10V		-	89	116	nC
$Q_{gs}$	Gate to Source Gate Charge	$V_{DS} = 50\text{V}, I_D = 75\text{A}$ $V_{GS} = 10\text{V}$ (Note 4, 5)	-	37	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		-	22	-	nC

**Drain-Source Diode Characteristics**

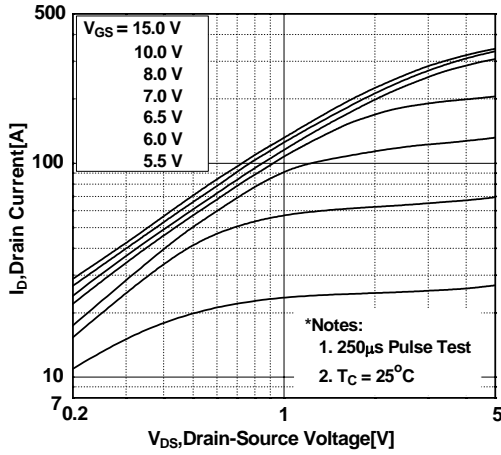
$I_S$	Maximum Continuous Drain to Source Diode Forward Current	-	-	75	A	
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current	-	-	300	A	
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0\text{V}, I_{SD} = 75\text{A}$	-	-	1.25	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{V}, I_{SD} = 75\text{A}$	-	73	-	ns
$Q_{rr}$	Reverse Recovery Charge	$di_F/dt = 100\text{A}/\mu\text{s}$ (Note 4)	-	166	-	nC

**Notes:**

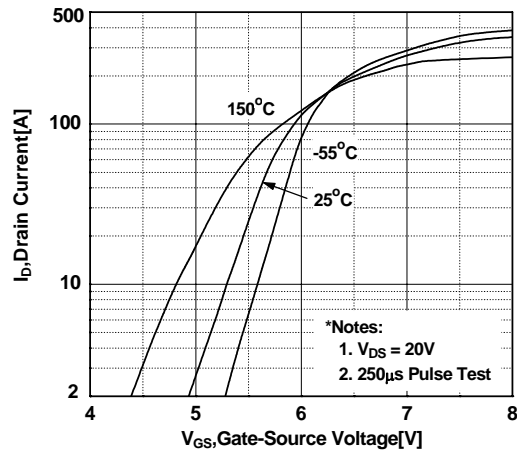
- 1: Repetitive Rating: Pulse width limited by maximum junction temperature
- 2:  $L = 0.11\text{mH}, I_{AS} = 75\text{A}, V_{DD} = 50\text{V}, R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$
- 3:  $I_{SD} \leq 75\text{A}, di/dt \leq 200\text{A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$
- 4: Pulse Test: Pulse width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$
- 5: Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

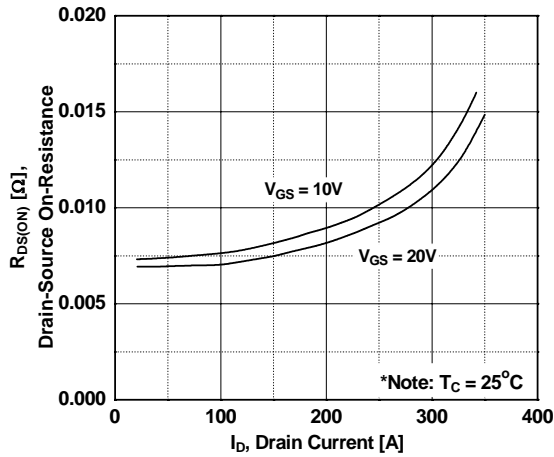
**Figure 1. On-Region Characteristics**



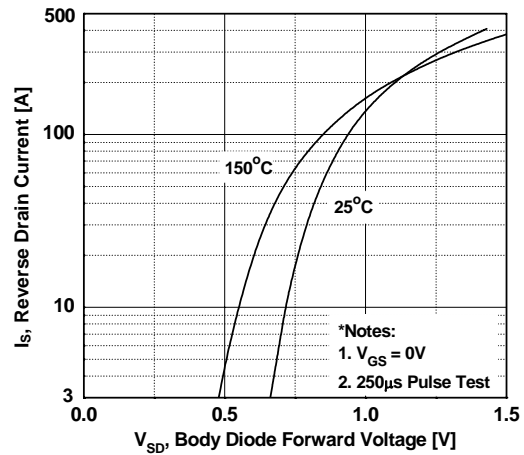
**Figure 2. Transfer Characteristics**



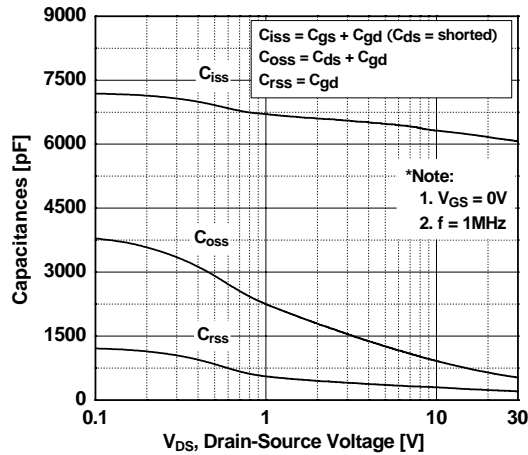
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



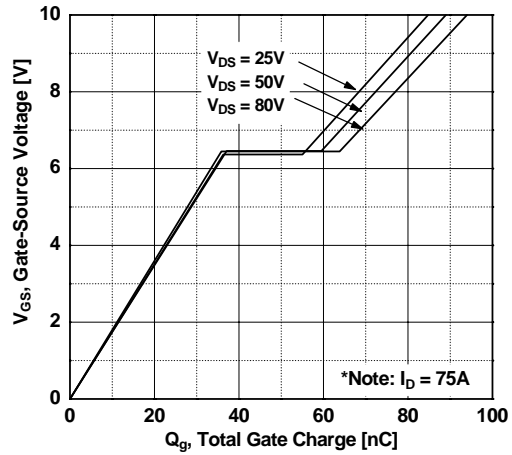
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**

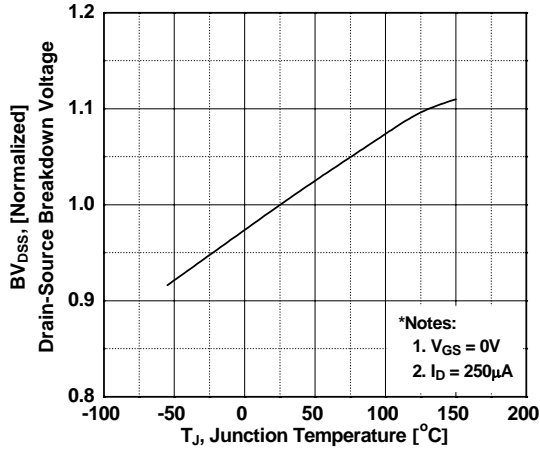


**Figure 6. Gate Charge Characteristics**

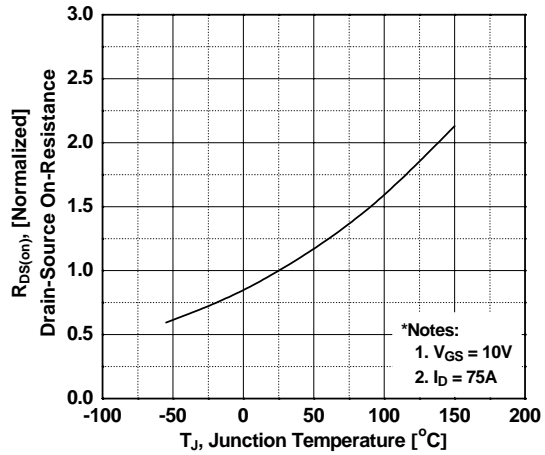


**Typical Performance Characteristics** (Continued)

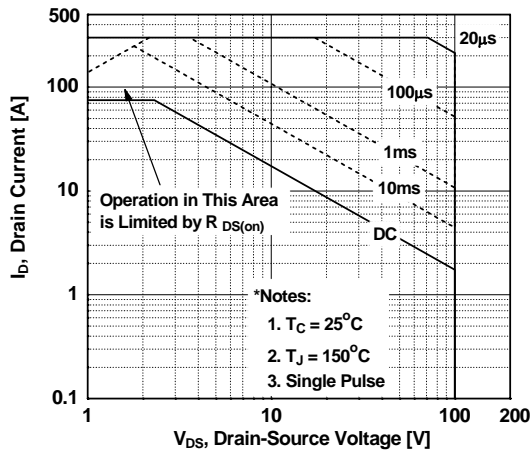
**Figure 7. Breakdown Voltage Variation vs. Temperature**



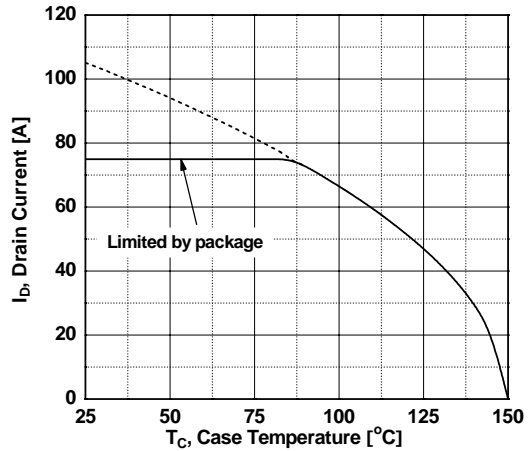
**Figure 8. On-Resistance Variation vs. Temperature**



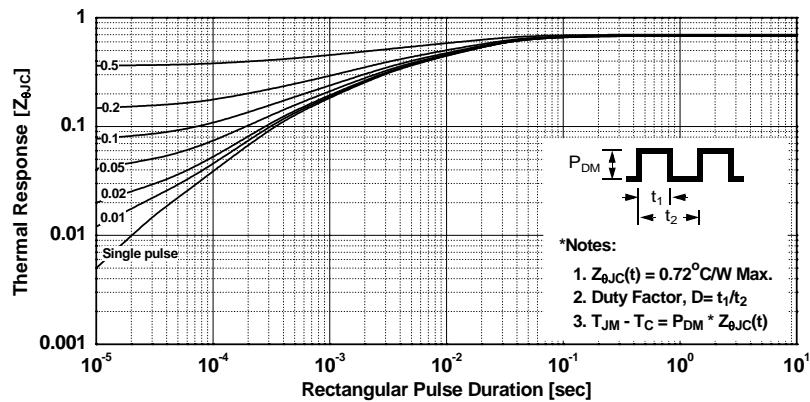
**Figure 9. Maximum Safe Operating Area**



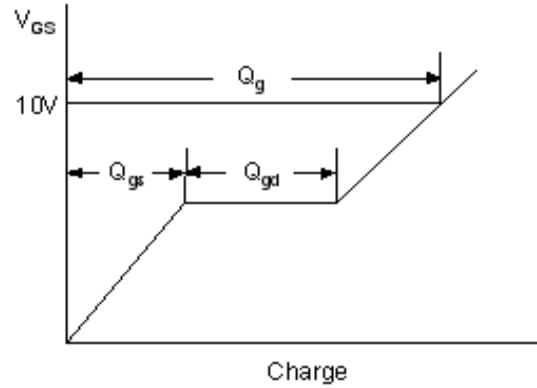
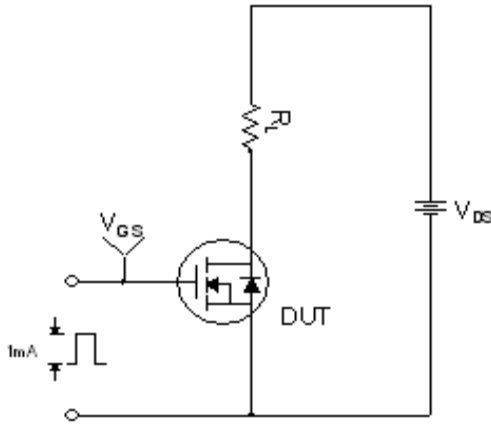
**Figure 10. Maximum Drain Current vs. Case Temperature**



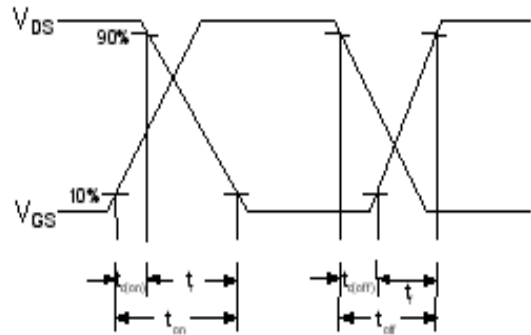
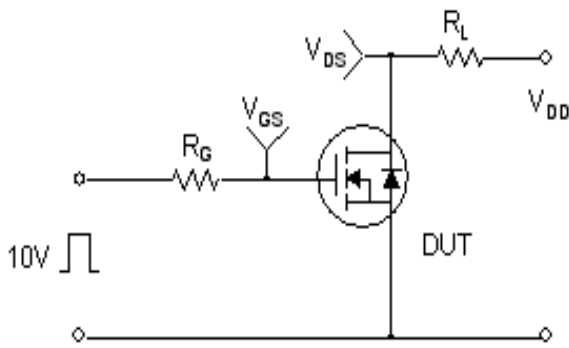
**Figure 11. Transient Thermal Response Curve**



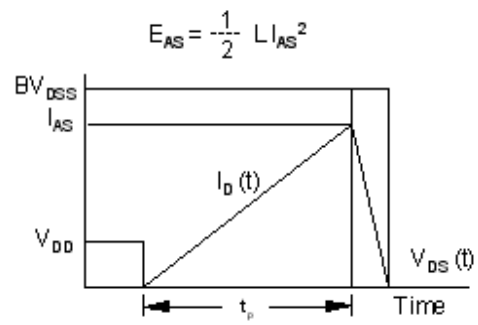
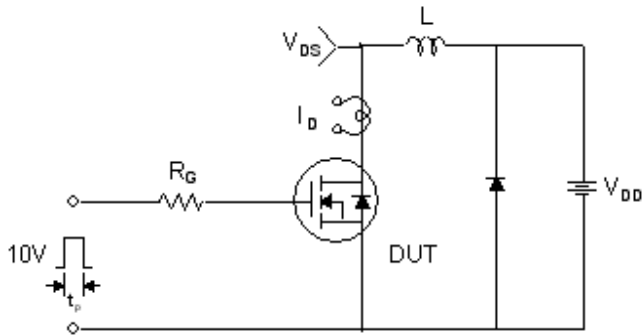
**Gate Charge Test Circuit & Waveform**



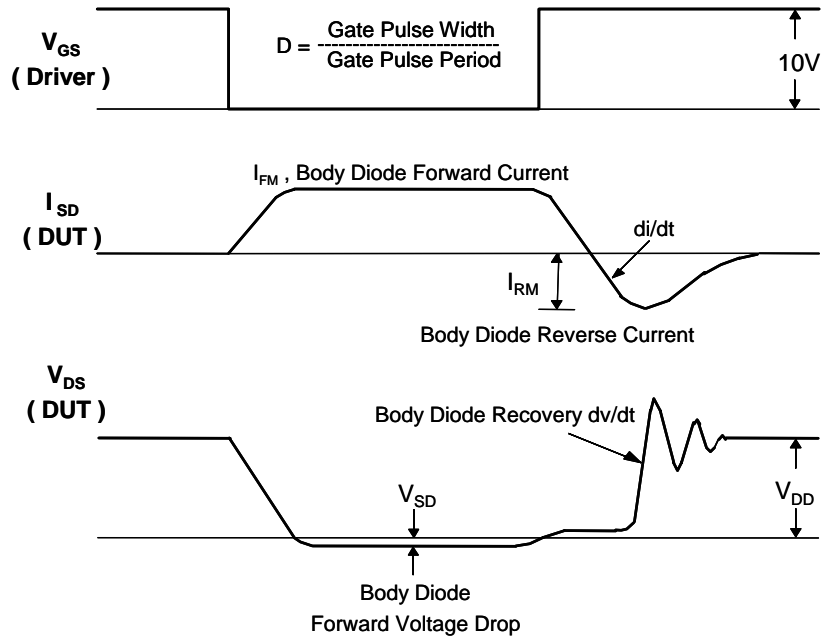
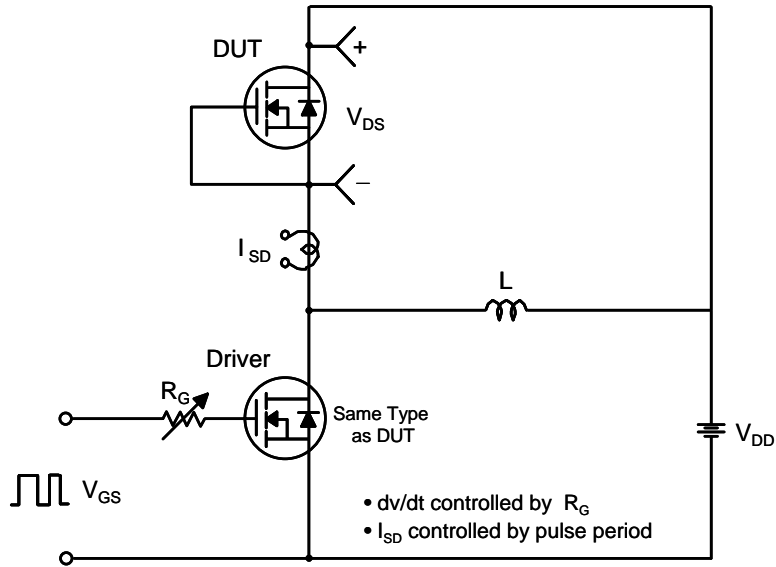
**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**

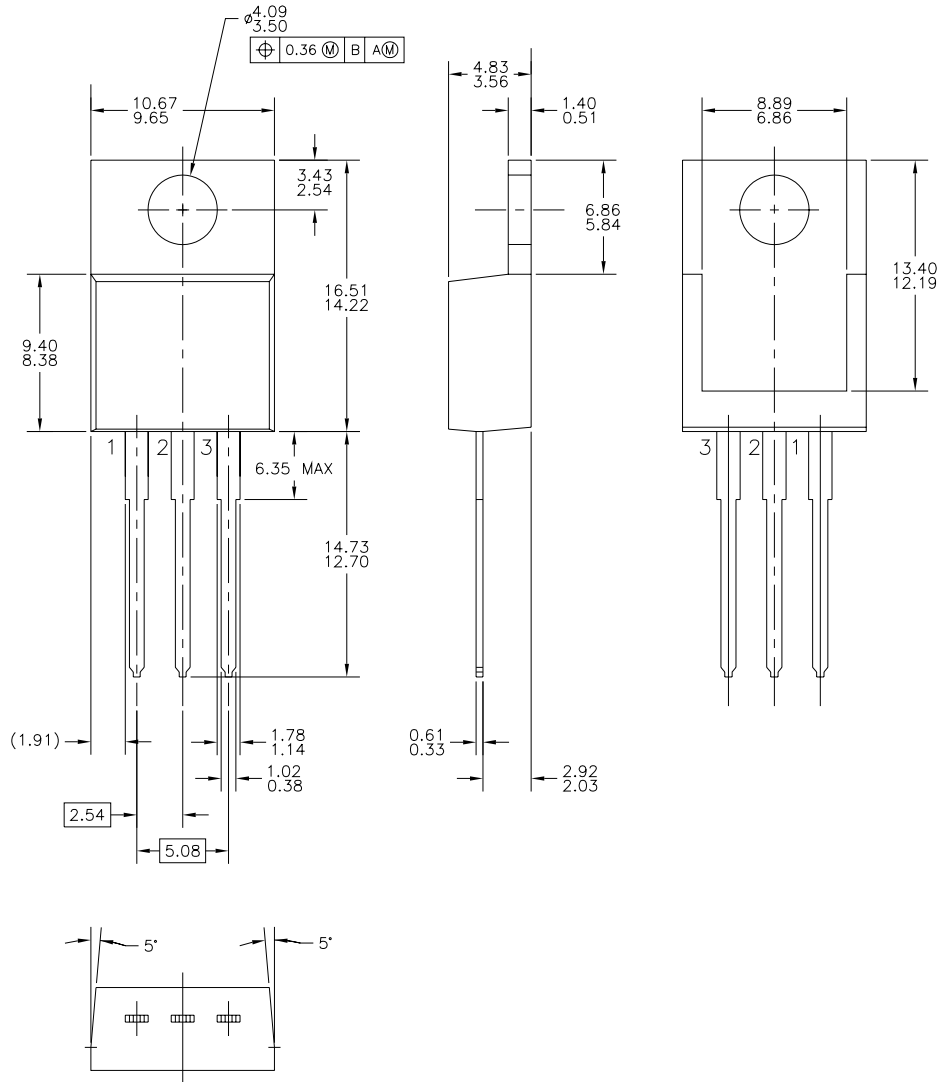


Peak Diode Recovery dv/dt Test Circuit & Waveforms



**Mechanical Dimensions**

**TO-220**





FDP090N10 N-Channel PowerTrench<sup>®</sup> MOSFET



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