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January 2009

# FDP8440

## N-Channel PowerTrench® MOSFET

### 40V, 277A, 2.2mΩ

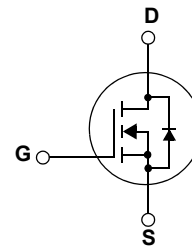
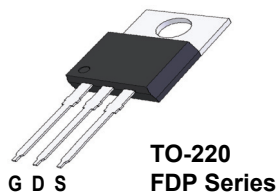
#### Features

- $R_{DS(on)} = 1.64m\Omega$  (Typ.) @  $V_{GS} = 10V, I_D = 80A$
- $Q_{g(tot)} = 345nC$  (Typ.) @  $V_{GS} = 10V$
- Low Miller Charge
- Low  $Q_{RR}$  Body Diode
- UIS Capability (Single Pulse and Repetitive Pulse)
- RoHS Compliant



#### Application

- Automotive Engine Control
- Powertrain Management
- Motors, Solenoids
- Electronic Steering
- Integrated Starter/ Alternator
- Distributed Power Architectures and VRMs
- Primary Switch for 12V Systems



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

Symbol	Parameter	Ratings	Units
$V_{DSS}$	Drain to Source Voltage	40	V
$V_{GSS}$	Gate to Source Voltage	$\pm 20$	V
$I_D$	Drain Current	- Continuous ( $T_C = 25^\circ C$ , Silicon Limited)	277*
		- Continuous ( $T_C = 100^\circ C$ , Silicon Limited)	196*
		- Continuous ( $T_C = 25^\circ C$ , Package Limited)	100
$I_{DM}$	Drain Current	- Pulsed (Note 1)	500
$E_{AS}$	Single Pulsed Avalanche Energy	(Note 2)	1682
$P_D$	Power Dissipation	( $T_C = 25^\circ C$ )	306
		- Derate above $25^\circ C$	2.04
$T_J, T_{STG}$	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	$^\circ C$

\*Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 100A.

#### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.49	$^\circ C/W$
$R_{\theta CS}$	Thermal Resistance, Case to Sink (Typ.)	0.5	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	62.5	$^\circ C/W$

## Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDP8440	FDP8440	TO-220	N/A	N/A	50units

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

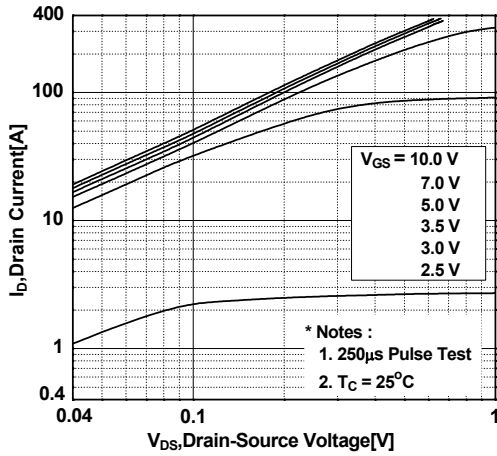
Symbol	Parameter	Conditions	Min	Typ	Max	Units	
<b>Off Characteristics</b>							
BV <sub>DSS</sub>	Drain to Source Breakdown Voltage	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA	40	--	--	V	
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 32V	--	--	1	μA	
		V <sub>GS</sub> = 0V T <sub>C</sub> = 150°C	--	--	250	μA	
I <sub>GSS</sub>	Gate to Body Leakage Current	V <sub>GS</sub> = ±20V	--	--	±100	nA	
<b>On Characteristics</b>							
V <sub>GS(th)</sub>	Gate to Source Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	1	--	3	V	
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 80A	--	1.88	2.4	mΩ	
		V <sub>GS</sub> = 10V, I <sub>D</sub> = 80A	--	1.64	2.2		
		V <sub>GS</sub> = 10V, I <sub>D</sub> = 80A, T <sub>C</sub> = 175°C	--	3.00	4.4		
<b>Dynamic Characteristics</b>							
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1.0MHz	--	18600	24740	pF	
C <sub>oss</sub>	Output Capacitance		--	1840	2450	pF	
C <sub>rss</sub>	Reverse Transfer Capacitance		--	1400	2100	pF	
R <sub>G</sub>	Gate Resistance	V <sub>GS</sub> = 0.5V, f = 1MHz	--	1.1	--	Ω	
Q <sub>g(tot)</sub>	Total Gate Charge at 10V	V <sub>GS</sub> = 0V to 10V	V <sub>DD</sub> = 20V I <sub>D</sub> = 80A I <sub>g</sub> = 1.0mA	--	345	450	nC
Q <sub>g(2)</sub>	Threshold Gate Charge	V <sub>GS</sub> = 0V to 2V		--	32.5	--	nC
Q <sub>gs</sub>	Gate to Source Gate Charge			--	49	--	nC
Q <sub>gs2</sub>	Gate Charge Threshold to Plateau			--	16.5	--	nC
Q <sub>gd</sub>	Gate to Drain "Miller" Charge			--	74	--	nC
<b>Switching Characteristics (V<sub>GS</sub> = 10V)</b>							
t <sub>ON</sub>	Turn-On Time	V <sub>DD</sub> = 20V, I <sub>D</sub> = 80A V <sub>GS</sub> = 10V, R <sub>GEN</sub> = 7Ω	--	175	360	ns	
t <sub>d(on)</sub>	Turn-On Delay Time		--	43	95	ns	
t <sub>r</sub>	Rise Time		--	130	275	ns	
t <sub>d(off)</sub>	Turn-Off Delay Time		--	435	875	ns	
t <sub>f</sub>	Fall Time		--	290	590	ns	
t <sub>OFF</sub>	Turn-Off Time		--	730	1470	ns	
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>							
V <sub>SD</sub>	Source to Drain Diode Voltage	I <sub>SD</sub> = 80A	--	--	1.25	V	
		I <sub>SD</sub> = 40A	--	--	1.0	V	
t <sub>rr</sub>	Reverse Recovery Time	I <sub>SD</sub> = 75A, dI <sub>SD</sub> /dt = 100A/μs	--	59	--	ns	
Q <sub>RR</sub>	Reverse Recovery Charge	I <sub>SD</sub> = 75A, dI <sub>SD</sub> /dt = 100A/μs	--	77	--	nC	

### NOTES:

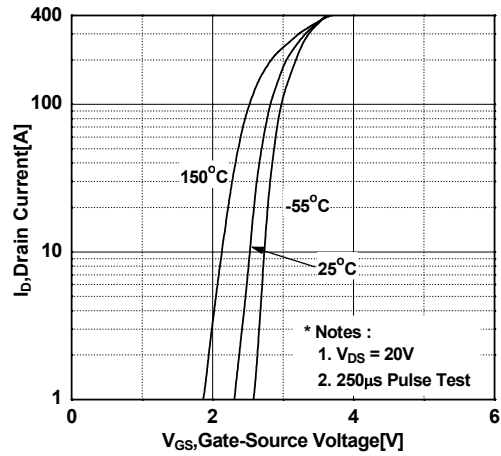
- 1: Pulse width limited by maximum junction temperature.
- 2: Starting T<sub>J</sub> = 25°C, L = 1mH, I<sub>AS</sub> = 58A, V<sub>DD</sub> = 36V, V<sub>GS</sub> = 10V.

### Typical Performance Characteristics

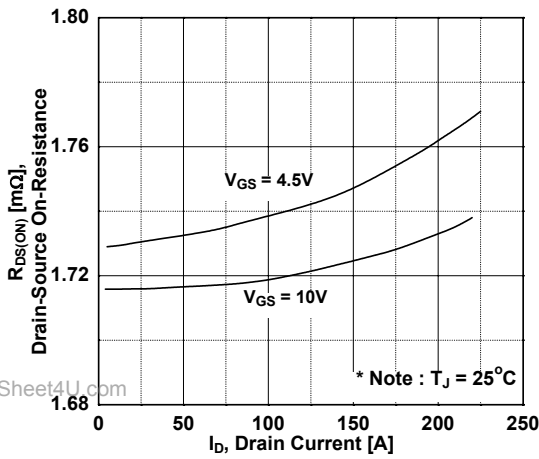
**Figure 1. On-Region Characteristics**



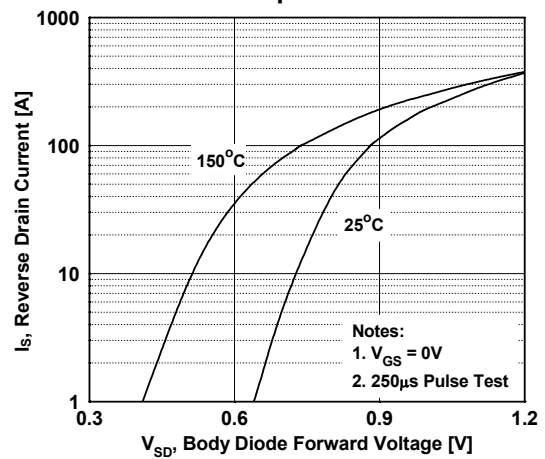
**Figure 2. Transfer Characteristics**



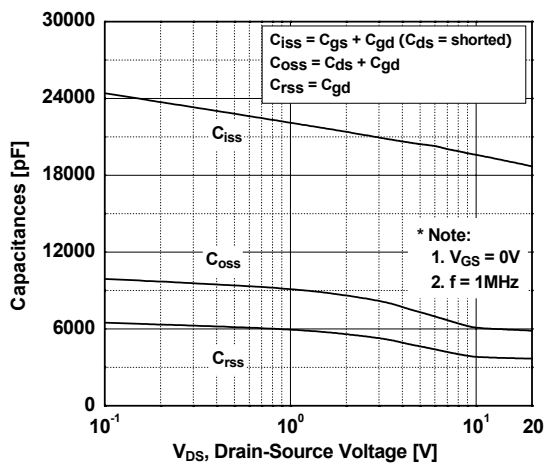
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



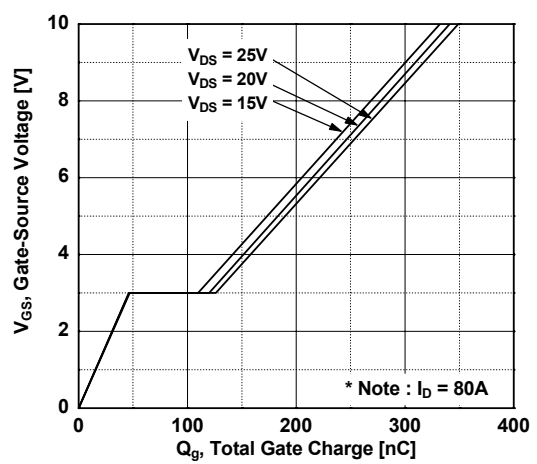
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**



**Figure 6. Gate Charge Characteristics**



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

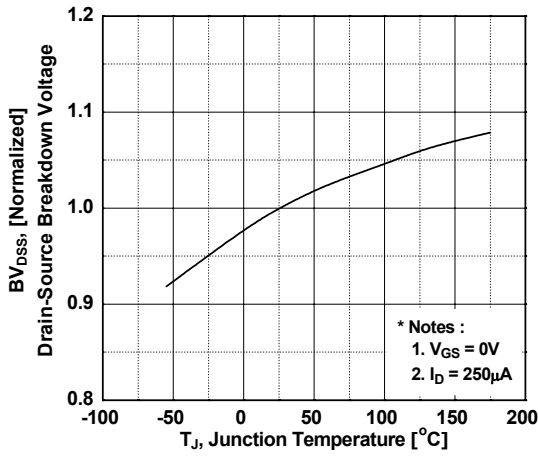


Figure 8. On-Resistance Variation vs. Temperature

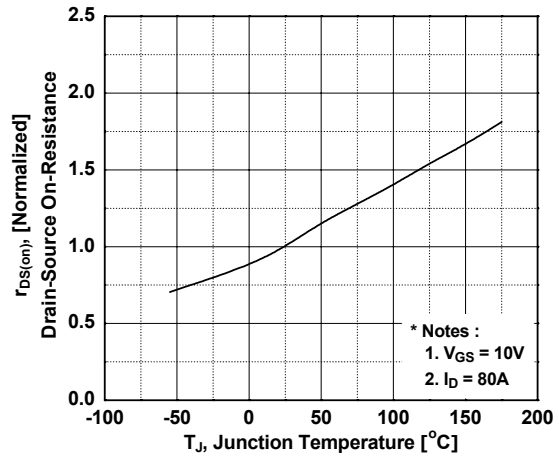


Figure 9. Unclamped Inductive Switching Capability

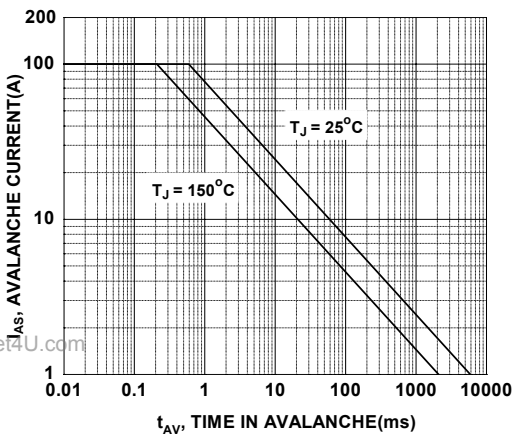


Figure 10. Safe Operating Area

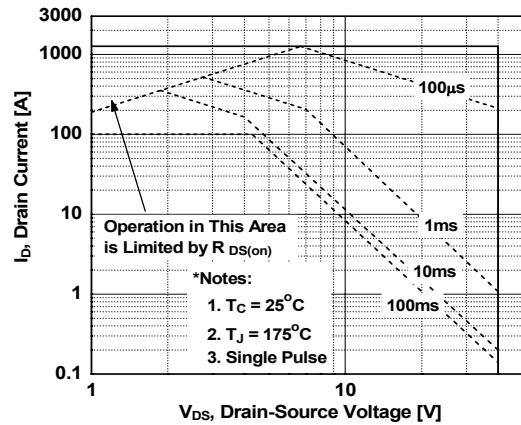
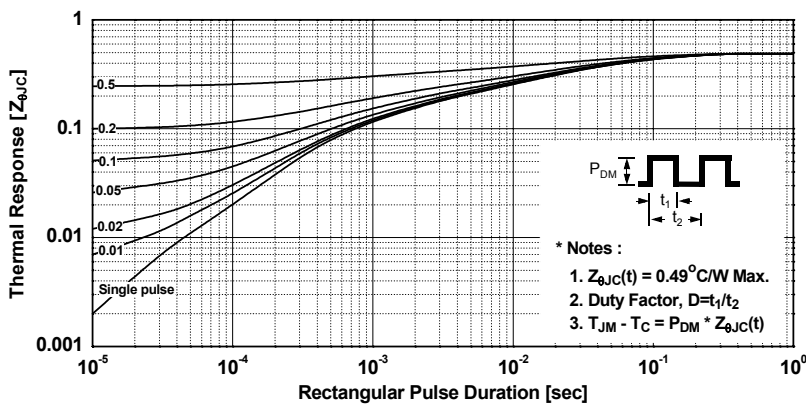
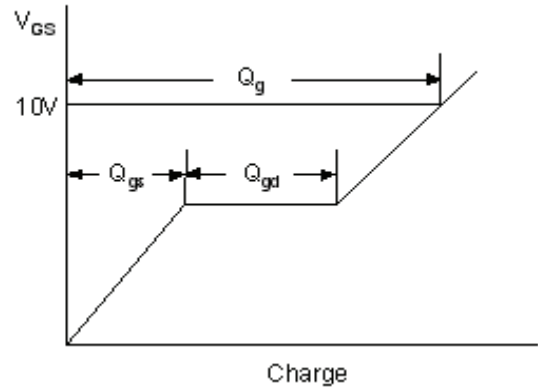
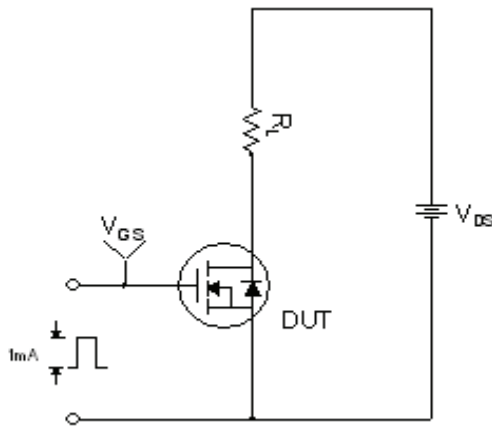


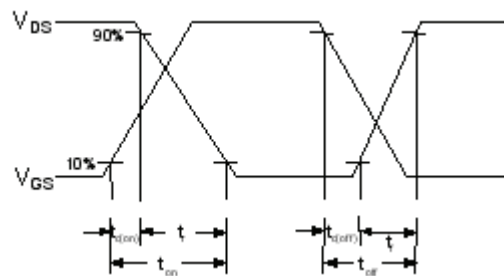
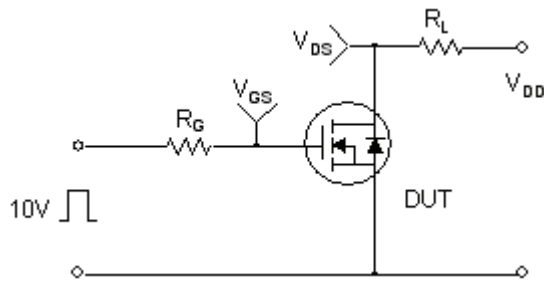
Figure 11. Transient Thermal Response Curve



**Gate Charge Test Circuit & Waveform**

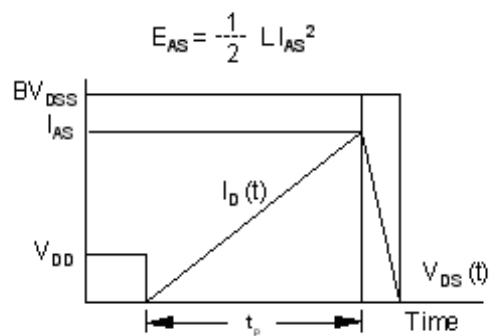
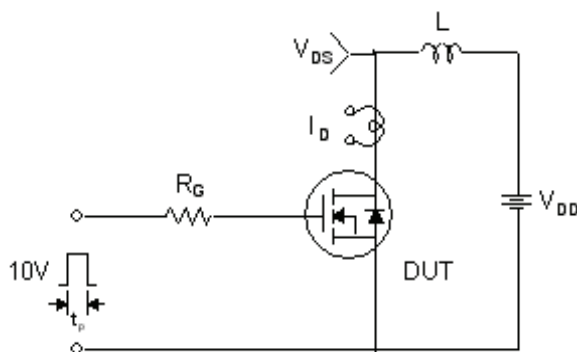


**Resistive Switching Test Circuit & Waveforms**

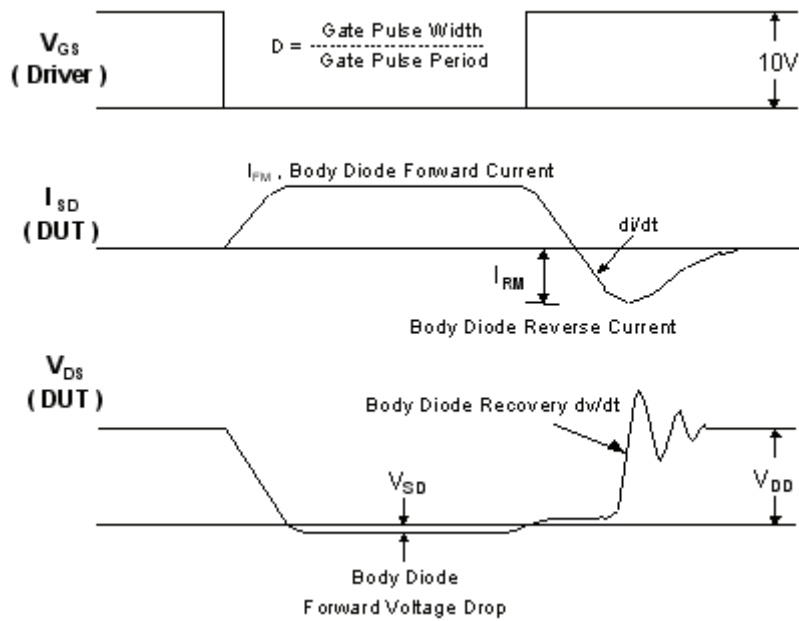
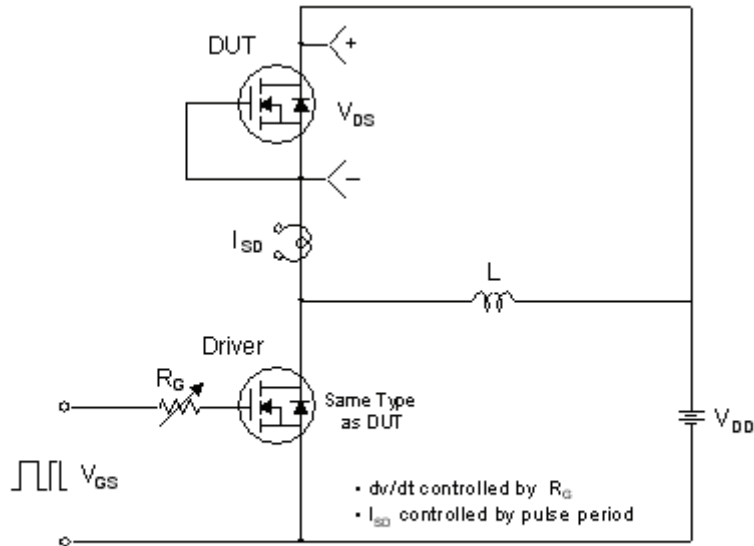


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**Unclamped Inductive Switching Test Circuit & Waveforms**



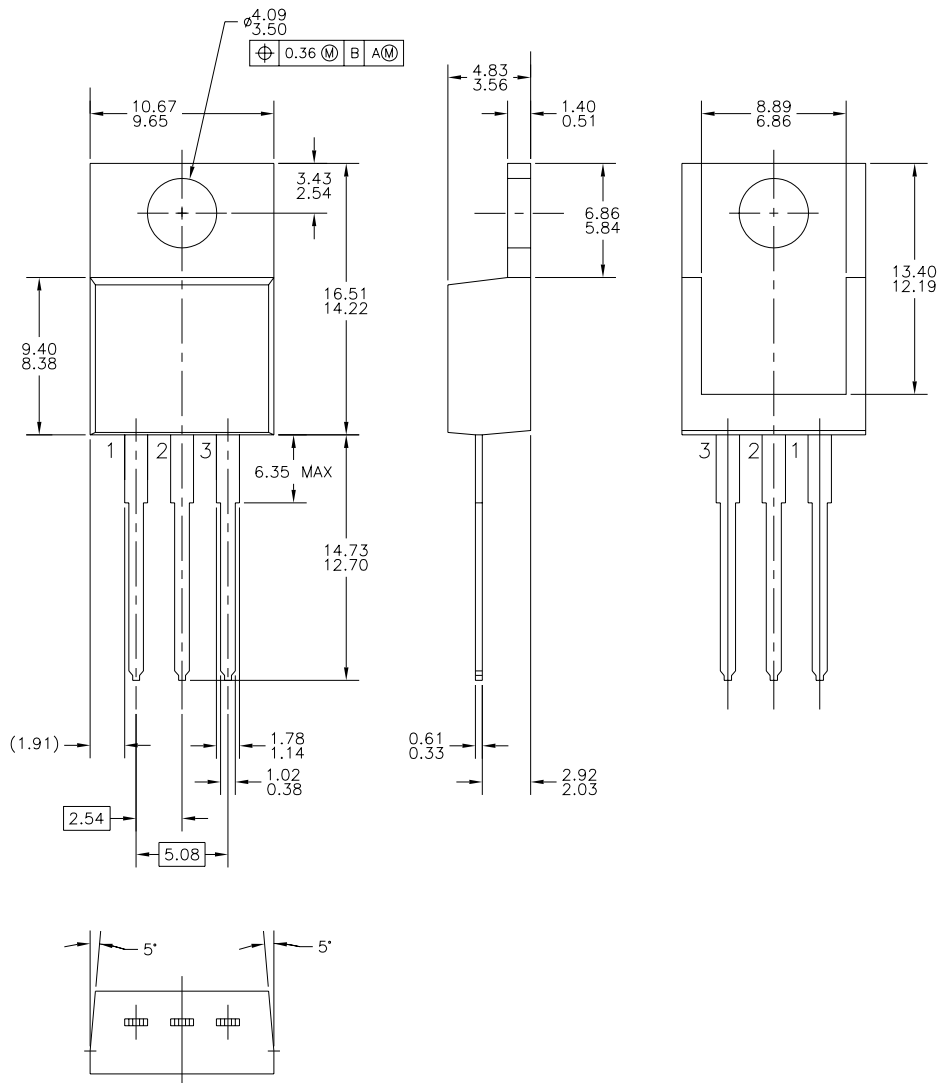
Peak Diode Recovery dv/dt Test Circuit & Waveforms



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Mechanical Dimensions

TO-220



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