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April 2015

# FDD390N15A

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

150 V, 26 A, 40 mΩ



### Features

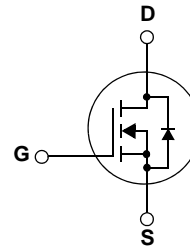
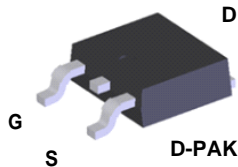
- $R_{DS(on)} = 33.5 \text{ m}\Omega$  (Typ.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 26 \text{ A}$
- Fast Switching Speed
- Low Gate Charge,  $Q_G = 14.3 \text{ nC}$  (Typ.)
- High Performance Trench Technology for Extremely Low  $R_{DS(on)}$
- High Power and Current Handling Capability
- RoHS Compliant

### Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench<sup>®</sup> process that has been tailored to minimize the on-state resistance while maintaining superior switching performance.

### Applications

- Consumer Appliances
- LED TV
- Synchronous Rectification
- Uninterruptible Power Supply
- Micro Solar Inverter



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

Symbol	Parameter	FDD390N15A	Unit
$V_{DSS}$	Drain to Source Voltage	150	V
$V_{GSS}$	Gate to Source Voltage	- DC	$\pm 20$
		- AC (f > 1 Hz)	$\pm 30$
$I_D$	Drain Current	- Continuous ( $T_C = 25^\circ\text{C}$ , Silicon Limited)	26
		- Continuous ( $T_C = 100^\circ\text{C}$ , Silicon Limited)	17
$I_{DM}$	Drain Current - Pulsed (Note 1)	104	A
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	78	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	6.0	V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ )		63
		- Derate above $25^\circ\text{C}$	0.5
$T_J, T_{STG}$	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	$^\circ\text{C}$

### Thermal Characteristics

Symbol	Parameter	FDD390N15A	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	2.0	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	87	

FDD390N15A — N-Channel PowerTrench<sup>®</sup> MOSFET

## Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDD390N15A	FDD390N15A	DKPAK	Tape and Reel	330 mm	16 mm	2500 units

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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### Off Characteristics

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250 \mu\text{A}, V_{GS} = 0 \text{ V}$	150	-	-	V
$\Delta BV_{DSS} / \Delta T_J$	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	$V_{DS} = 120 \text{ V}, V_{GS} = 0 \text{ V}$ $V_{DS} = 120 \text{ V}, T_C = 125^\circ\text{C}$	-	-	1 500	$\mu\text{A}$
$I_{GSS}$	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	$V_{GS} = V_{DS}, I_D = 250 \mu\text{A}$	2.0	-	4.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}, I_D = 26 \text{ A}$	-	33.5	40	$\text{m}\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 10 \text{ V}, I_D = 26 \text{ A}$	-	33	-	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 75 \text{ V}, V_{GS} = 0 \text{ V}$ $f = 1 \text{ MHz}$	-	965	1285	pF
$C_{oss}$	Output Capacitance		-	96	130	pF
$C_{riss}$	Reverse Transfer Capacitance		-	5.8	-	pF
$C_{oss(er)}$	Energy Related Output Capacitance	$V_{DS} = 75 \text{ V}, V_{GS} = 0 \text{ V}$	-	169	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 75 \text{ V}, I_D = 27 \text{ A}$ $V_{GS} = 10 \text{ V}$	-	14.3	18.6	nC
$Q_{gs}$	Gate to Source Gate Charge		-	5.0	-	nC
$Q_{gs2}$	Gate Charge Threshold to Plateau		-	2.0	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		(Note 4)	-	3.5	-
ESR	Equivalent Series Resistance (G-S)	$f = 1 \text{ MHz}$	-	1.4	-	$\Omega$

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 75 \text{ V}, I_D = 27 \text{ A}$ $V_{GS} = 10 \text{ V}, R_{GEN} = 4.7 \Omega$	-	14	38	ns
$t_r$	Turn-On Rise Time		-	10	30	ns
$t_{d(off)}$	Turn-Off Delay Time		-	20	50	ns
$t_f$	Turn-Off Fall Time		(Note 4)	-	5	20

### Drain-Source Diode Characteristics

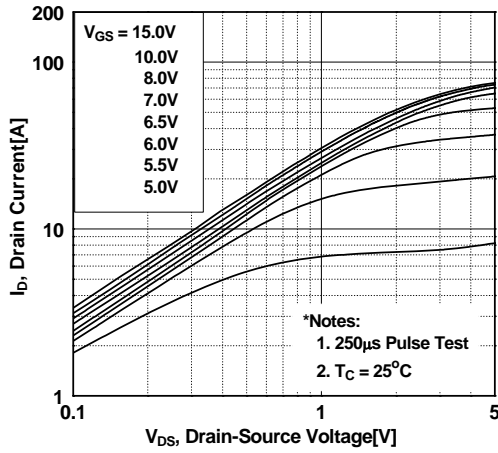
$I_S$	Maximum Continuous Drain to Source Diode Forward Current	-	-	26	A	
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current	-	-	104	A	
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0 \text{ V}, I_{SD} = 26 \text{ A}$	-	-	1.25	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0 \text{ V}, I_{SD} = 27 \text{ A}, V_{DD} = 75 \text{ V}$	-	63	-	ns
$Q_{rr}$	Reverse Recovery Charge	$di_F/dt = 100 \text{ A}/\mu\text{s}$	-	131	-	nC

#### Notes:

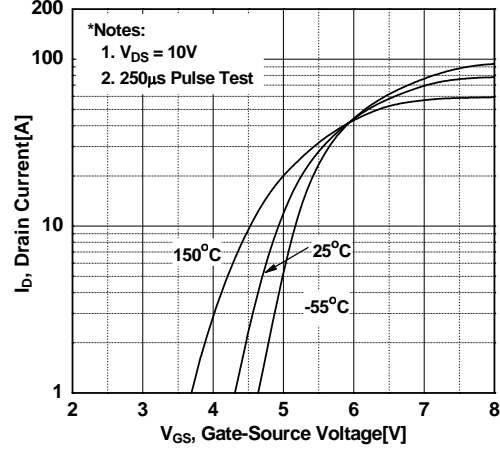
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. Starting  $T_J = 25^\circ\text{C}$ ,  $L = 3 \text{ mH}$ ,  $I_{SD} = 7.2 \text{ A}$
3.  $I_{SD} \leq 26 \text{ A}$ ,  $di/dt \leq 200 \text{ A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$
4. Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

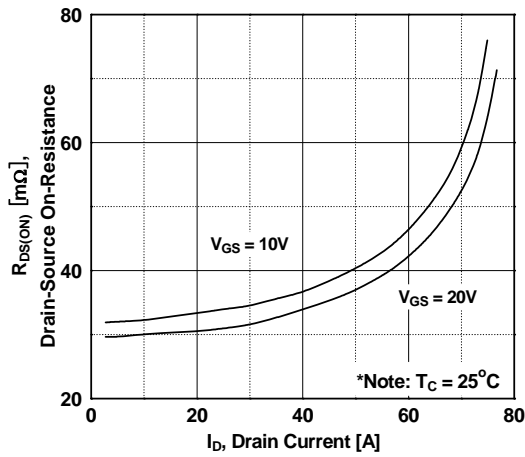
**Figure 1. On-Region Characteristics**



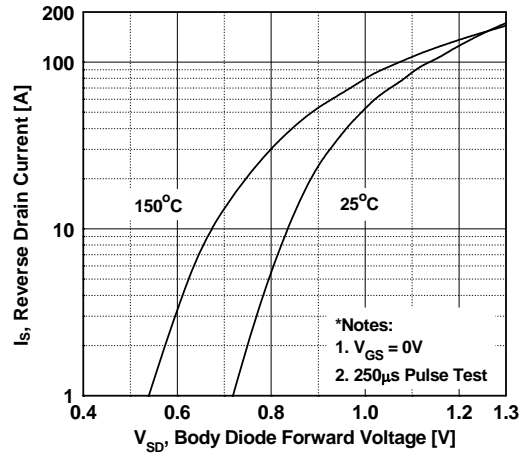
**Figure 2. Transfer Characteristics**



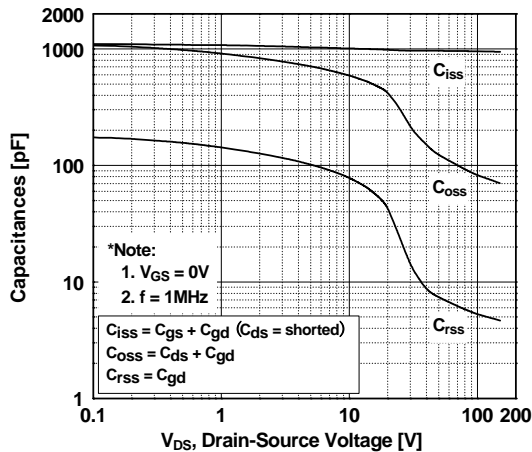
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



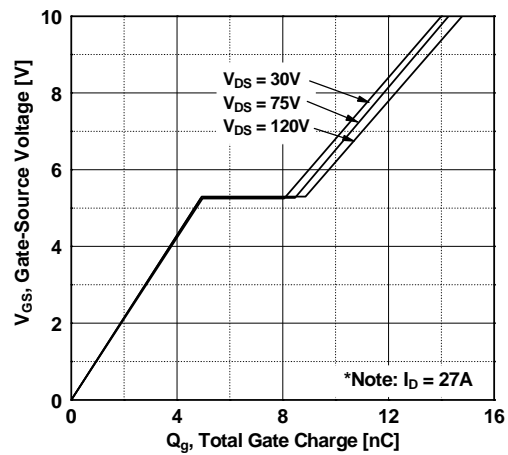
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**

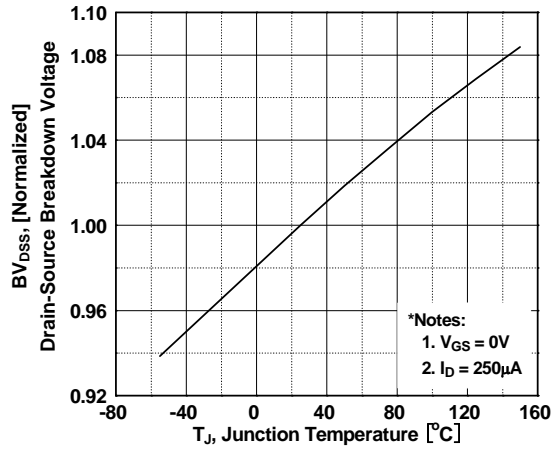


**Figure 6. Gate Charge Characteristics**

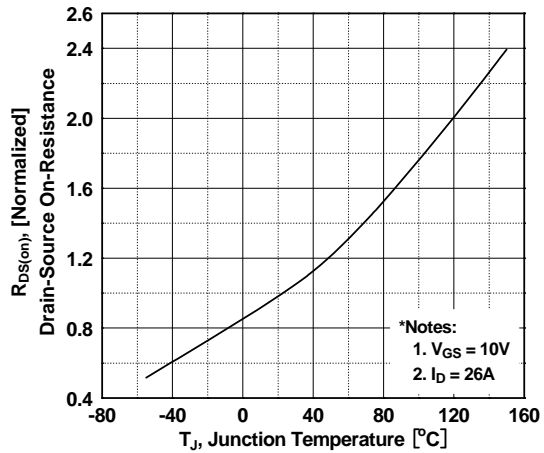


**Typical Performance Characteristics** (Continued)

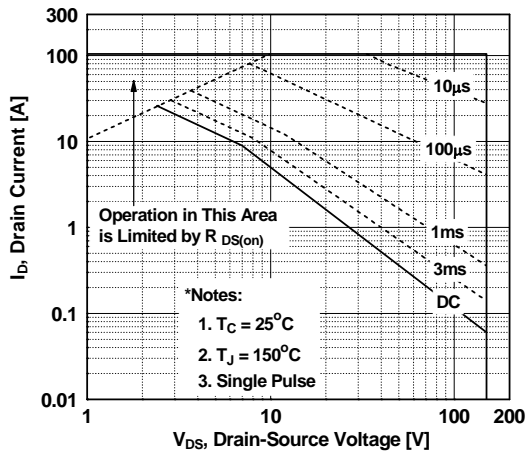
**Figure 7. Breakdown Voltage Variation vs. Temperature**



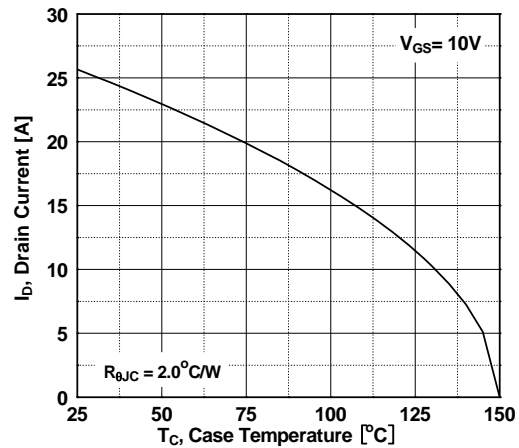
**Figure 8. On-Resistance Variation vs. Temperature**



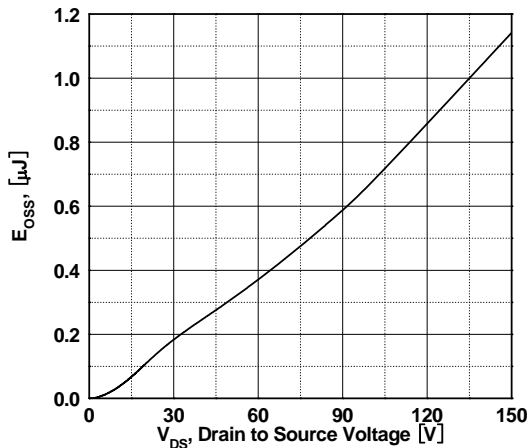
**Figure 9. Maximum Safe Operating Area**



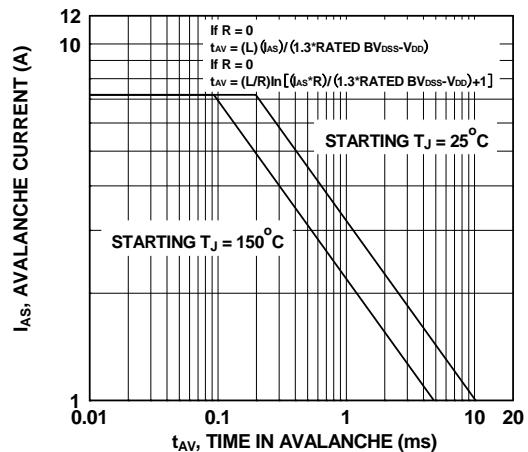
**Figure 10. Maximum Drain Current vs. Case Temperature**



**Figure 11. E\_oss vs. Drain to Source Voltage**

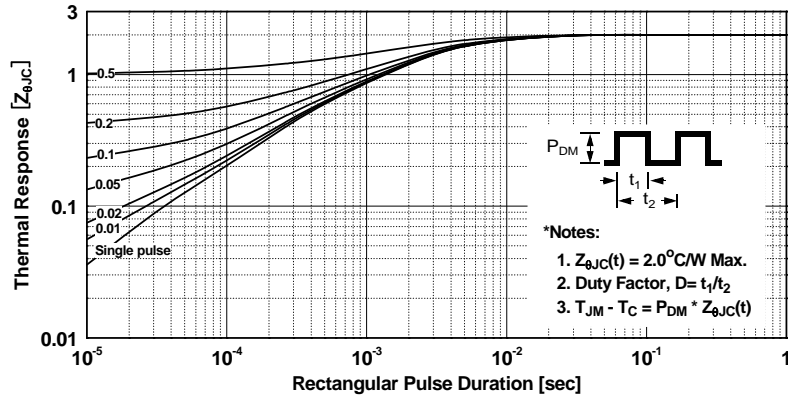


**Figure 12. Unclamped Inductive Switching Capability**



Typical Performance Characteristics (Continued)

Figure 13. Transient Thermal Response Curve



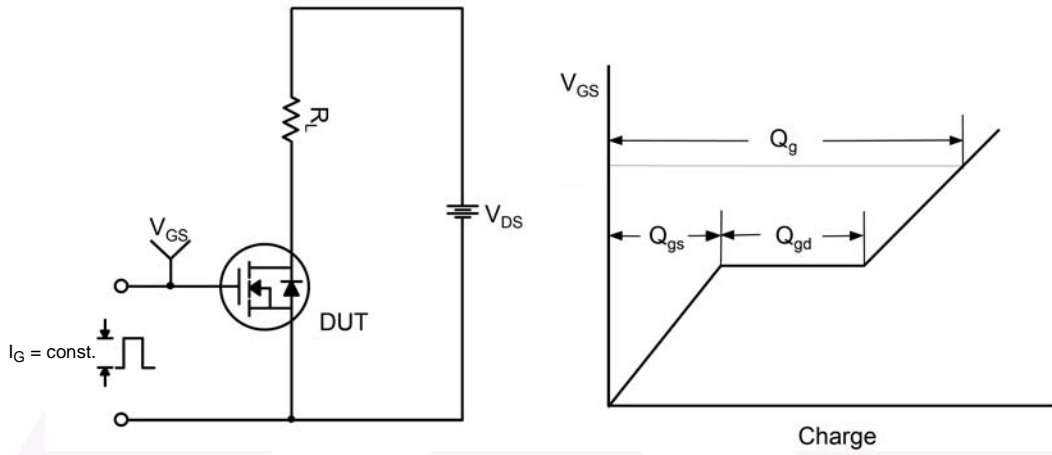


Figure 14. Gate Charge Test Circuit & Waveform

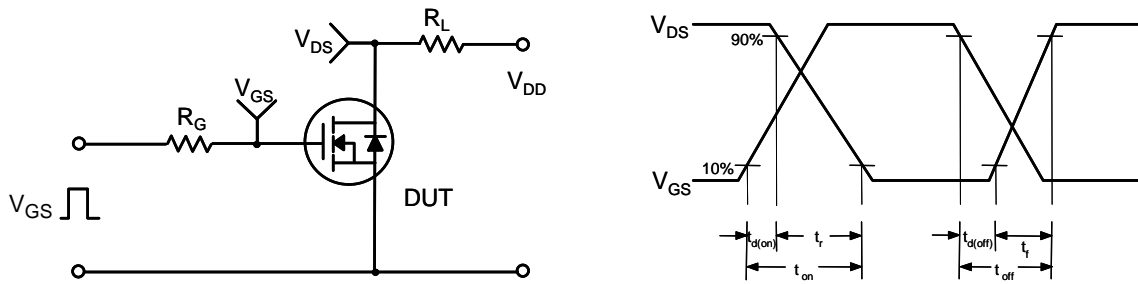


Figure 15. Resistive Switching Test Circuit & Waveforms

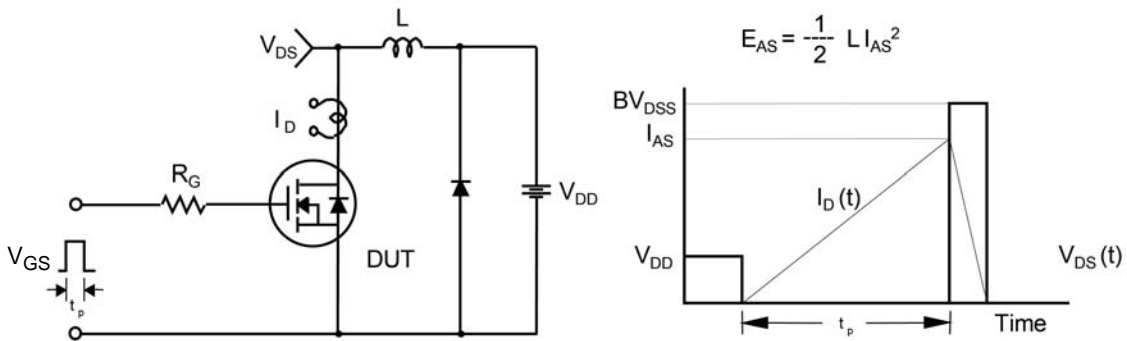


Figure 16. Unclamped Inductive Switching Test Circuit & Waveforms

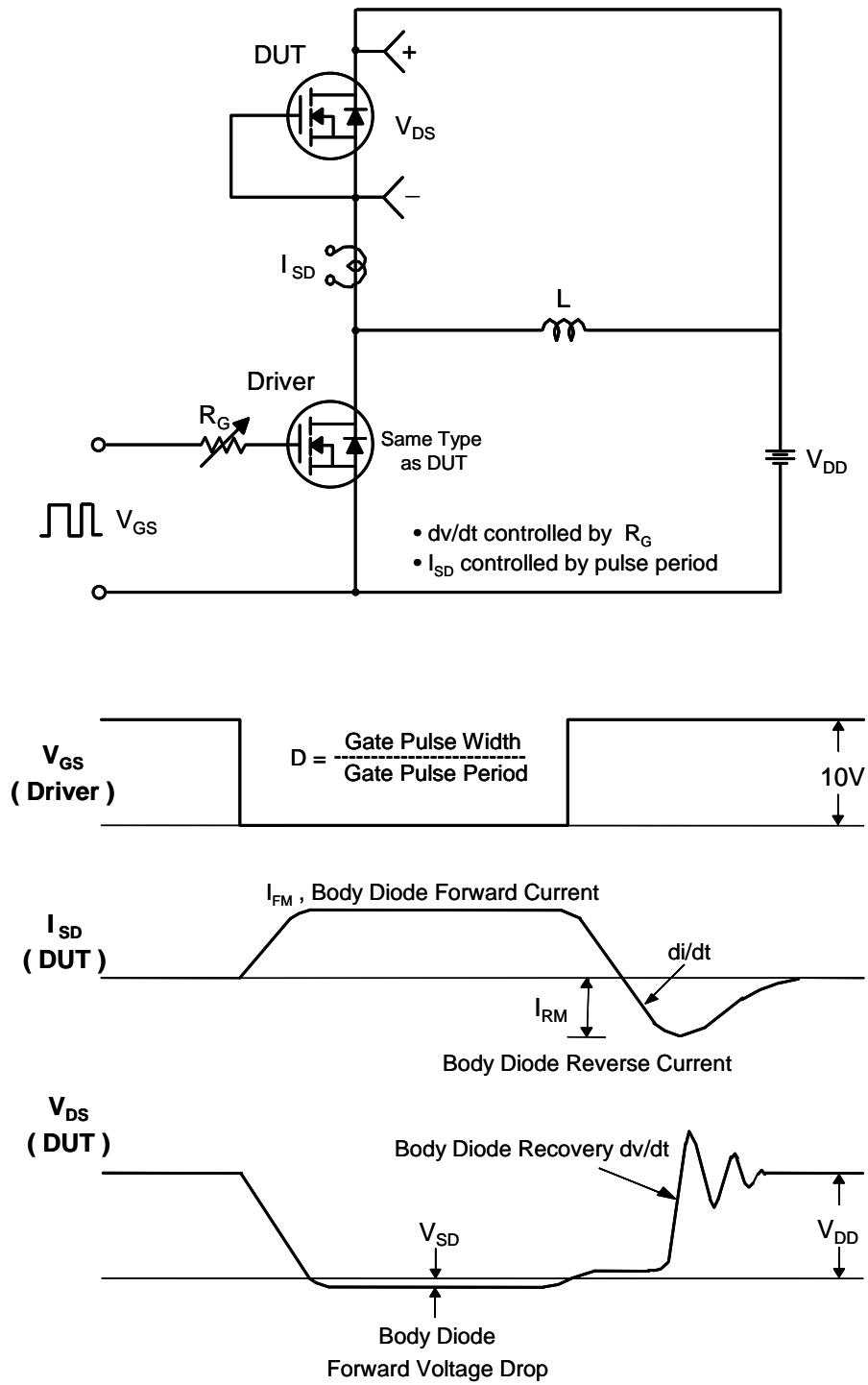
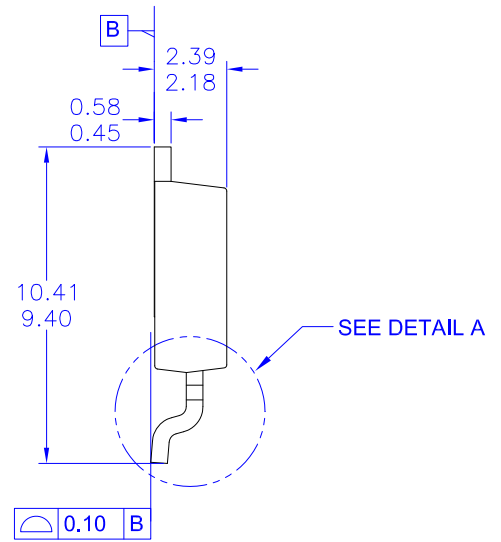
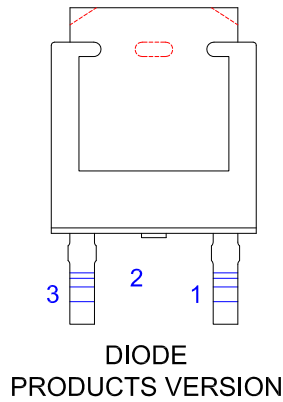
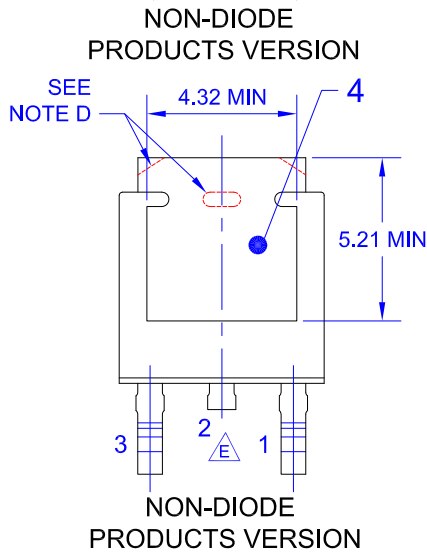
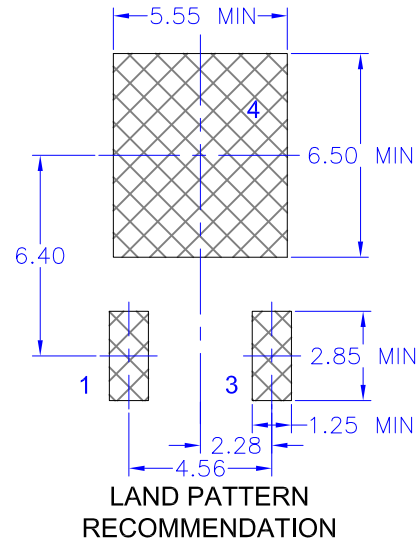
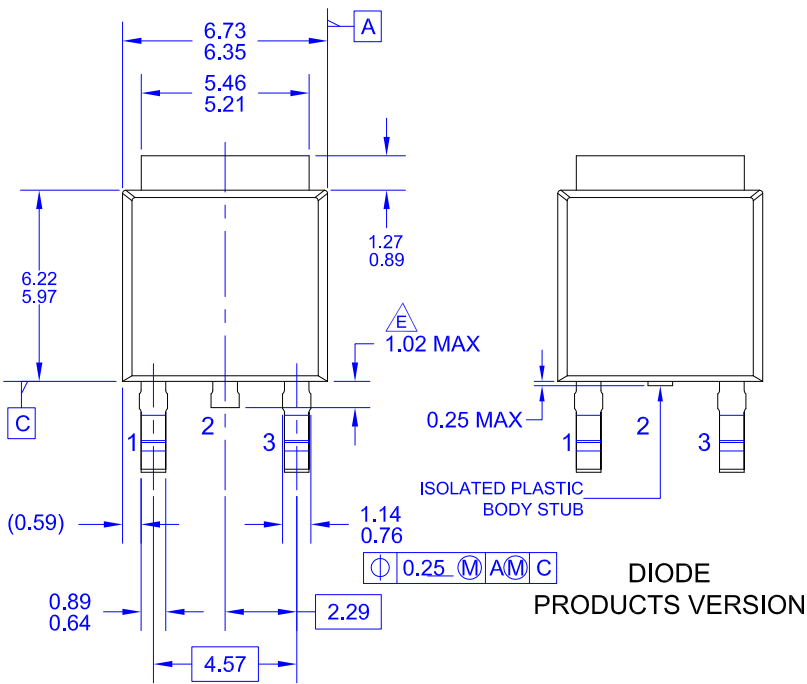
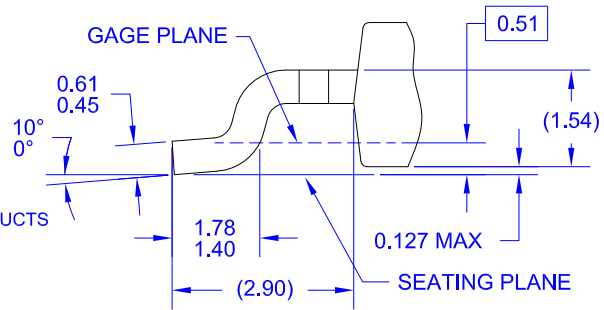


Figure 17. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms





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  - E) TRIMMED METAL CENTER LEAD IS PRESENT ON FOR NON-DIODE PRODUCTS
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  - G) LAND PATTERN RECOMMENDATION IS BASED ON IPC7351A STD TO228P991X239-3N.
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