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# FDB38N30U

## N-Channel UniFET™ Ultra FRFET™ MOSFET

300 V, 38 A, 120 mΩ

### Features

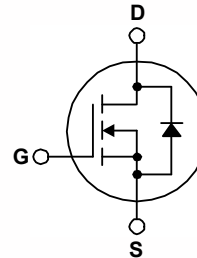
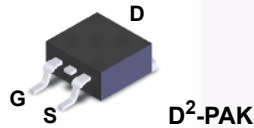
- $R_{DS(on)} = 120\text{ m}\Omega$  (Max.) @  $V_{GS} = 10\text{ V}$ ,  $I_D = 19\text{ A}$
- Low Gate Charge (Typ. 56 nC)
- Low  $C_{rss}$  (Typ. 55 pF)
- 100% Avalanche Tested
- RoHS Compliant

### Applications

- Uninterruptible Power Supply
- LCD/LED/PDP TV
- AC-DC Power Supply

### Description

UniFET™ MOSFET is Fairchild Semiconductor's high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-state resistance, and to provide better switching performance and higher avalanche energy strength. UniFET Ultra FRFET™ MOSFET has much superior body diode reverse recovery performance. Its  $t_{rr}$  is less than 50nsec and the reverse  $dv/dt$  immunity is 20V/nsec while normal planar MOSFETs have over 200nsec and 4.5V/nsec respectively. Therefore UniFET Ultra FRFET MOSFET can remove additional component and improve system reliability in certain applications that require performance improvement of the MOSFET's body diode. This device family is suitable for switching power converter applications such as power factor correction (PFC), flat panel display (FPD) TV power, ATX and electronic lamp ballasts.



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

Symbol	Parameter	FDB38N30U	Unit
$V_{DSS}$	Drain to Source Voltage	300	V
$V_{GSS}$	Gate to Source Voltage	$\pm 30$	V
$I_D$	Drain Current	- Continuous ( $T_C = 25^\circ\text{C}$ )	38
		- Continuous ( $T_C = 100^\circ\text{C}$ )	22.8
$I_{DM}$	Drain Current	- Pulsed (Note 1)	152
$E_{AS}$	Single Pulsed Avalanche Energy	(Note 2)	722
$I_{AR}$	Avalanche Current	(Note 1)	38
$E_{AR}$	Repetitive Avalanche Energy	(Note 1)	31.3
$dv/dt$	Peak Diode Recovery $dv/dt$	(Note 3)	20
$P_D$	Power Dissipation	( $T_C = 25^\circ\text{C}$ )	313
		- Derate Above $25^\circ\text{C}$	2.5
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
$T_L$	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds	300	$^\circ\text{C}$

### Thermal Characteristics

Symbol	Parameter	FDB38N30U	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.4	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	

## Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDB38N30U	FDB38N30U	D <sup>2</sup> -PAK	Tape and Reel	330 mm	24 mm	800 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	$I_D = 250 \mu\text{A}, V_{GS} = 0 \text{V}, T_J = 25^\circ\text{C}$	300	-	-	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , Referenced to $25^\circ\text{C}$	-	0.33	-	$\text{V}/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 300 \text{V}, V_{GS} = 0 \text{V}$	-	-	25	$\mu\text{A}$
		$V_{DS} = 240 \text{V}, T_C = 125^\circ\text{C}$	-	-	250	
$I_{GSS}$	Gate to Body Leakage Current	$V_{GS} = \pm 30 \text{V}, V_{DS} = 0 \text{V}$	-	-	$\pm 100$	nA

### On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250 \mu\text{A}$	3.0	-	5.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10 \text{V}, I_D = 19 \text{A}$	-	0.103	0.120	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 20 \text{V}, I_D = 19 \text{A}$	-	30	-	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25 \text{V}, V_{GS} = 0 \text{V}, f = 1 \text{MHz}$	-	2510	3340	pF
$C_{oss}$	Output Capacitance		-	470	625	pF
$C_{rss}$	Reverse Transfer Capacitance		-	55	85	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 240 \text{V}, I_D = 38 \text{A}, V_{GS} = 10 \text{V}$	-	56	73	nC
$Q_{gs}$	Gate to Source Gate Charge		-	14	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		(Note 4)	-	24	-

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 150 \text{V}, I_D = 38 \text{A}, V_{GS} = 10 \text{V}, R_G = 25 \Omega$	-	33	76	ns
$t_r$	Turn-On Rise Time		-	80	170	ns
$t_{d(off)}$	Turn-Off Delay Time		-	133	276	ns
$t_f$	Turn-Off Fall Time		(Note 4)	-	62	134

### Drain-Source Diode Characteristics

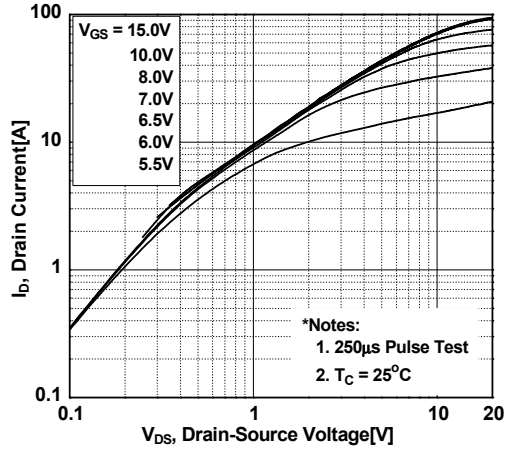
$I_S$	Maximum Continuous Drain to Source Diode Forward Current	-	-	38	A	
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current	-	-	152	A	
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0 \text{V}, I_{SD} = 38 \text{A}$	-	-	1.4	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0 \text{V}, I_{SD} = 38 \text{A}, di_F/dt = 100 \text{A}/\mu\text{s}$	-	60	-	ns
$Q_{rr}$	Reverse Recovery Charge		-	0.097	-	$\mu\text{C}$

#### Notes:

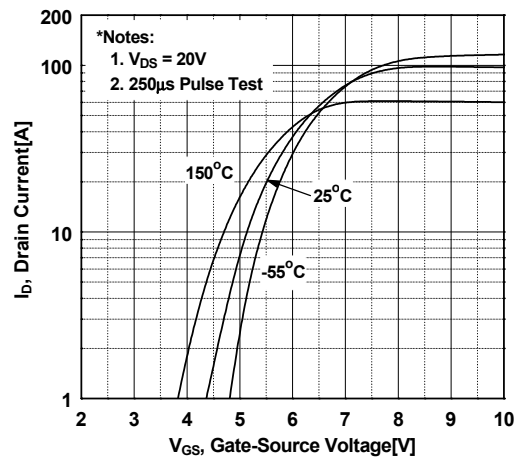
- 1: Repetitive rating; pulse-width limited by maximum junction temperature.
- 2:  $L = 1 \text{mH}, I_{AS} = 38 \text{A}, V_{DD} = 50 \text{V}, R_G = 25 \Omega$ , starting  $T_J = 25^\circ\text{C}$ .
- 3:  $I_{SD} \leq 38 \text{A}, di/dt \leq 200 \text{A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .
- 4: Essentially Independent of Operating Temperature Typical Characteristics.

## Typical Performance Characteristics

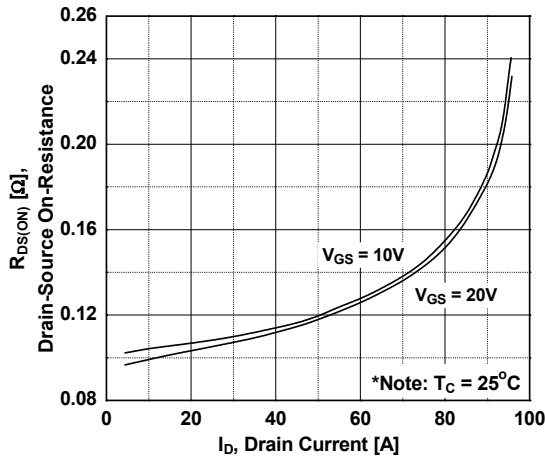
**Figure 1. On-Region Characteristics**



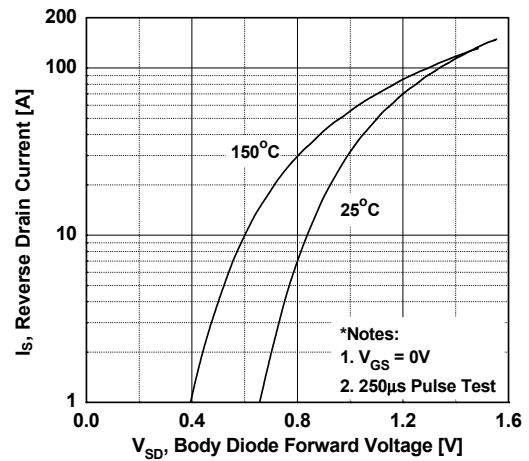
**Figure 2. Transfer Characteristics**



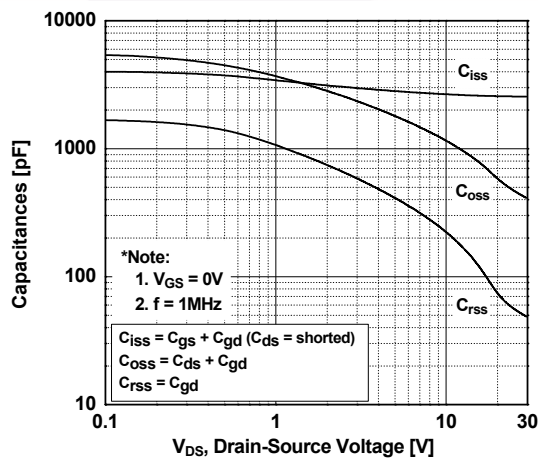
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



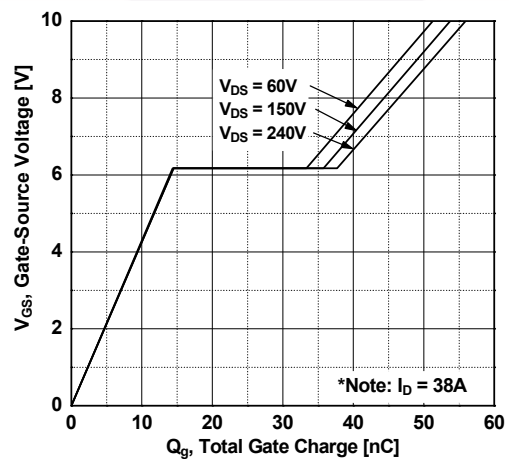
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**



**Figure 6. Gate Charge Characteristics**



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

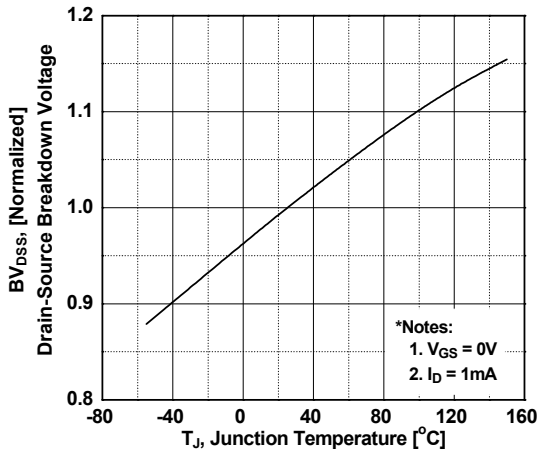


Figure 8. Maximum Safe Operating Area

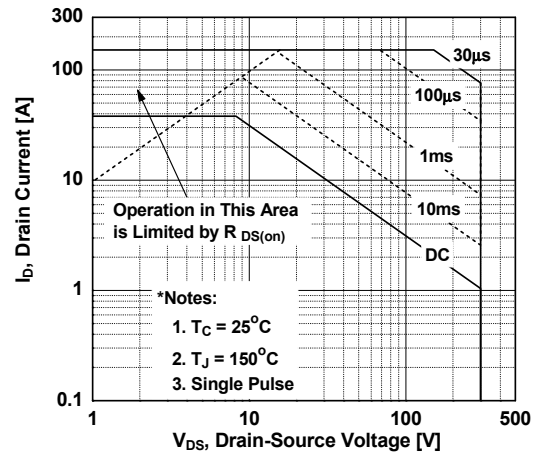


Figure 9. Maximum Drain Current vs. Case Temperature

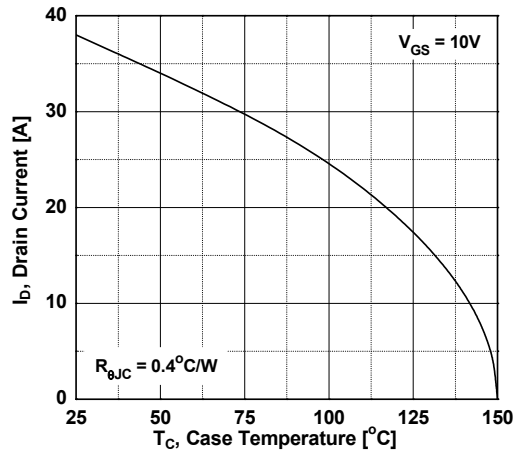


Figure 10. Unclamped Inductive Switching Capability

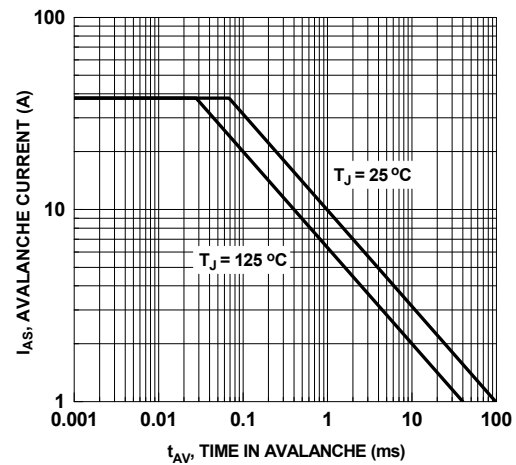
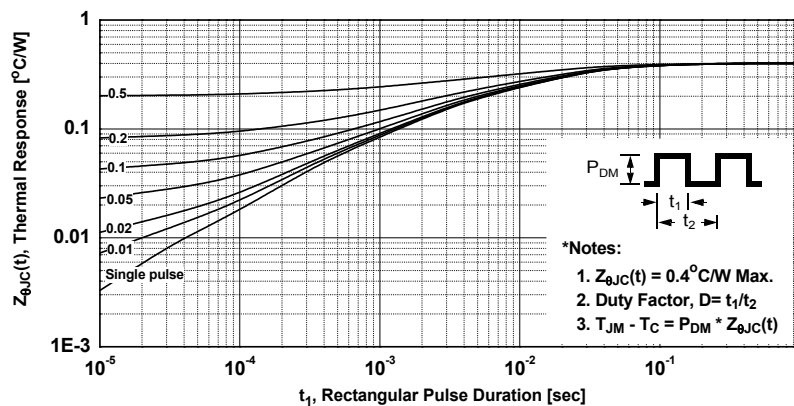
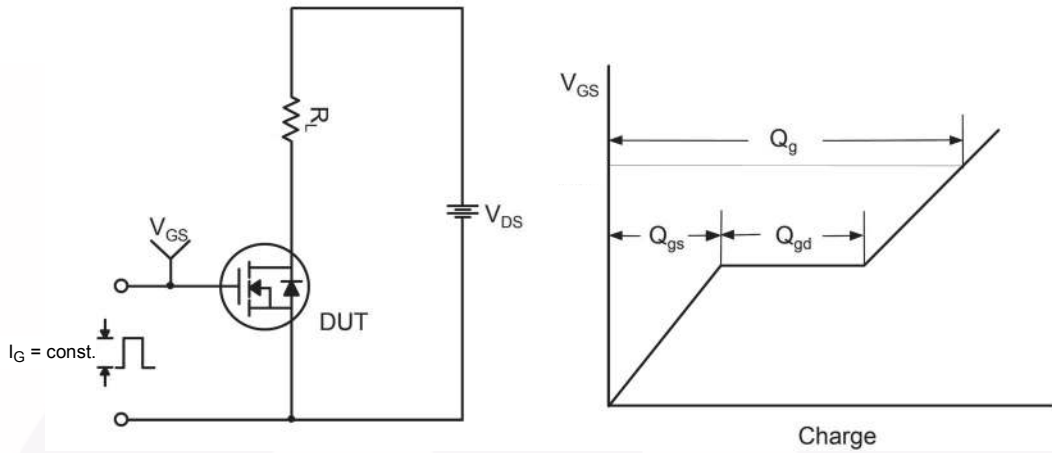


Figure 11. Transient Thermal Response Curve





**Figure 12. Gate Charge Test Circuit & Waveform**



**Figure 13. Resistive Switching Test Circuit & Waveforms**



**Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms**

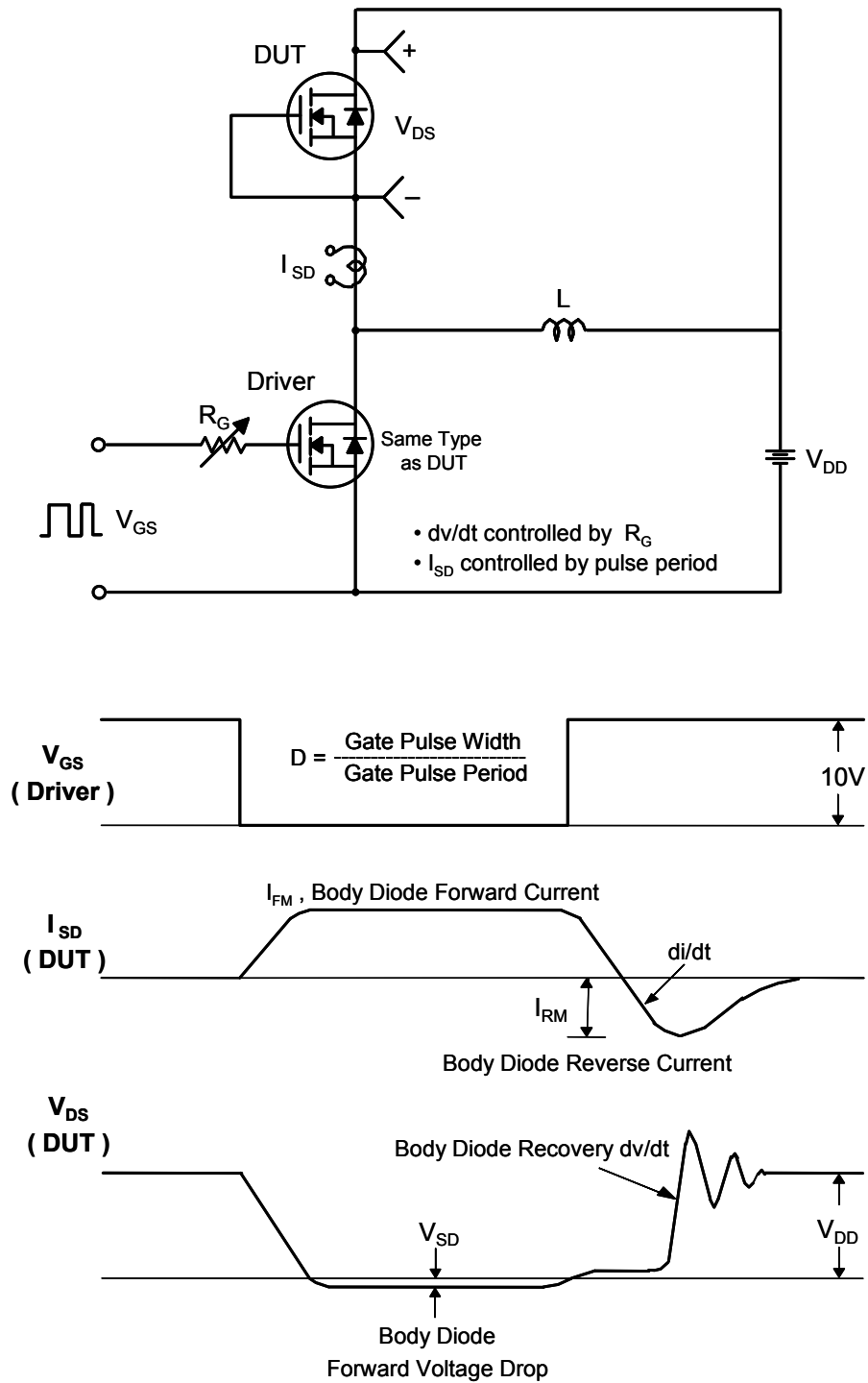
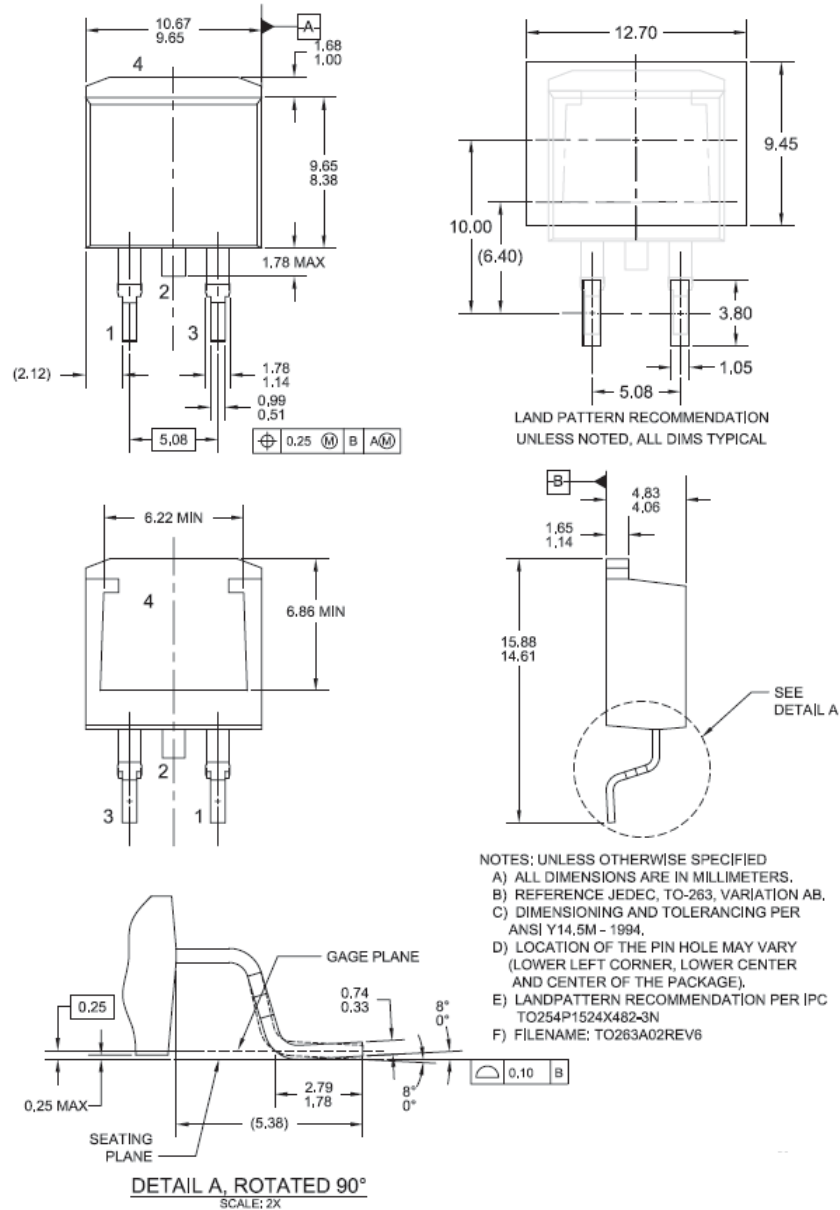


Figure 15. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

## Mechanical Dimensions



**Figure 16. TO263 (D<sup>2</sup>PAK), Molded, 2-Lead, Surface Mount**

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