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ON Semiconductor®

# FQB10N50CF

## N-Channel QFET® FRFET® MOSFET

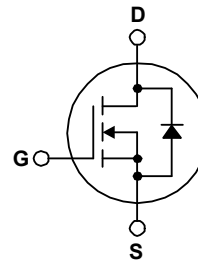
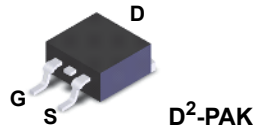
500 V, 10 A, 610 mΩ

### Features

- 10 A, 500 V,  $R_{DS(on)} = 610 \text{ m}\Omega$  (Max.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 5 \text{ A}$
- Low gate charge ( Typ. 45 nC)
- Low  $C_{rss}$  ( Typ. 17.5 pF)
- 100% avalanche tested
- Fast recovery body diode

### Description

This N-Channel enhancement mode power MOSFET is produced using ON Semiconductor's proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength. These devices are suitable for switched mode power supplies, active power factor correction (PFC), and electronic lamp ballasts.



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

Symbol	Parameter	FQB10N50CFM-WS	Unit
$V_{DSS}$	Drain to Source Voltage	500	V
$V_{GSS}$	Gate to Source Voltage	$\pm 30$	V
$I_D$	Drain Current	- Continuous ( $T_C = 25^\circ\text{C}$ )	10
		- Continuous ( $T_C = 100^\circ\text{C}$ )	6.35
$I_{DM}$	Drain Current	- Pulsed (Note 1)	40
$E_{AS}$	Single Pulsed Avalanche Energy	(Note 2)	825
$I_{AR}$	Avalanche Current	(Note 1)	10
$E_{AR}$	Repetitive Avalanche Energy	(Note 1)	14.3
$dv/dt$	Peak Diode Recovery $dv/dt$	(Note 3)	2.0
$P_D$	Power Dissipation	( $T_C = 25^\circ\text{C}$ )	143
		- Derate above $25^\circ\text{C}$	1.14
$T_J, T_{STG}$	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	FQB10N50CFM-WS	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max	0.87	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (minimum pad of 2 oz copper), Max.	62.5	
		Thermal Resistance, Junction to Ambient (1 in <sup>2</sup> pad of 2 oz copper), Max.	40

FQB10N50CF — N-Channel QFET® FRFET® MOSFET

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

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FQB10N50CF	FQB10N50CFM-WS	D2-PAK	330mm	24mm	800

## Electrical Characteristics

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

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}, T_J = 25^\circ\text{C}$	500	-	-	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , Referenced to $25^\circ\text{C}$	-	0.5	-	$V/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 500\text{V}, V_{GS} = 0\text{V}$	-	-	10	$\mu\text{A}$
		$V_{DS} = 400\text{V}, T_C = 125^\circ\text{C}$	-	-	100	
$I_{GSS}$	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	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	2.0	-	4.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{V}, I_D = 5\text{A}$	-	0.51	0.61	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 20\text{V}, I_D = 5\text{A}$	-	105	-	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{V}, V_{GS} = 0\text{V}$ $f = 1\text{MHz}$	-	1660	2210	pF
$C_{oss}$	Output Capacitance		-	182	240	pF
$C_{rss}$	Reverse Transfer Capacitance		-	17.5	26	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 400\text{V}, I_D = 10\text{A}$ $V_{GS} = 10\text{V}$	-	45	60	nC
$Q_{gs}$	Gate to Source Gate Charge		-	8	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		(Note 4)	-	19	-

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 250\text{V}, I_D = 10\text{A}$ $R_G = 25\Omega$	-	25	60	ns
$t_r$	Turn-On Rise Time		-	47	105	ns
$t_{d(off)}$	Turn-Off Delay Time		-	138	285	ns
$t_f$	Turn-Off Fall Time		(Note 4)	-	55	120

### Drain-Source Diode Characteristics

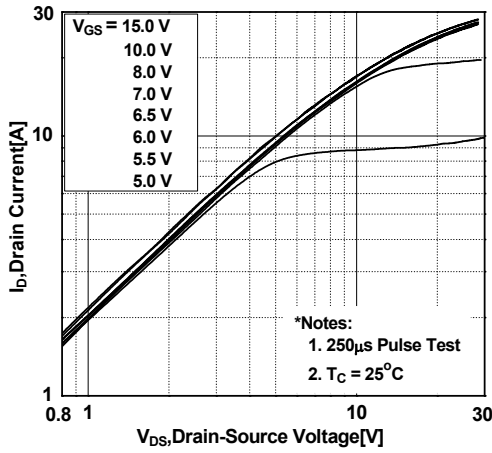
$I_S$	Maximum Continuous Drain to Source Diode Forward Current	-	-	10	A	
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current	-	-	40	A	
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0\text{V}, I_{SD} = 10\text{A}$	-	-	1.4	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{V}, I_{SD} = 10\text{A}$	-	91	-	ns
$Q_{rr}$	Reverse Recovery Charge	$di_F/dt = 100\text{A}/\mu\text{s}$	-	220	-	nC

#### Notes:

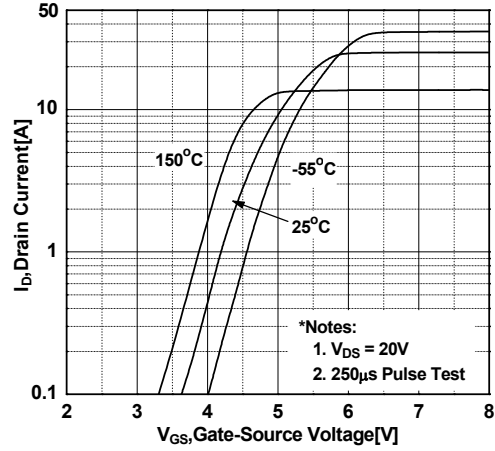
- 1: Repetitive Rating: Pulse width limited by maximum junction temperature
- 2:  $L = 16.5\text{mH}, I_{AS} = 10\text{A}, V_{DD} = 50\text{V}, R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$
- 3:  $I_{SD} \leq 10\text{A}, di/dt \leq 200\text{A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$
- 4: Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

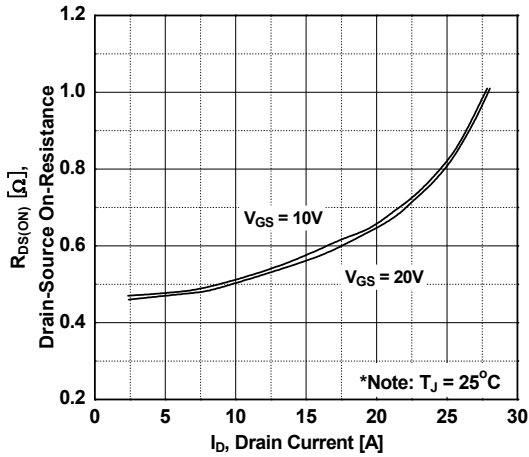
**Figure 1. On-Region Characteristics**



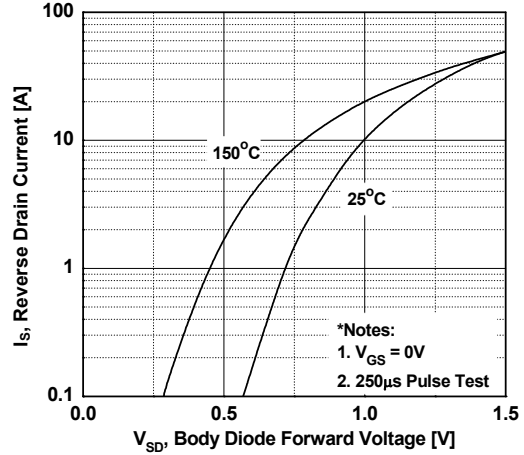
**Figure 2. Transfer Characteristics**



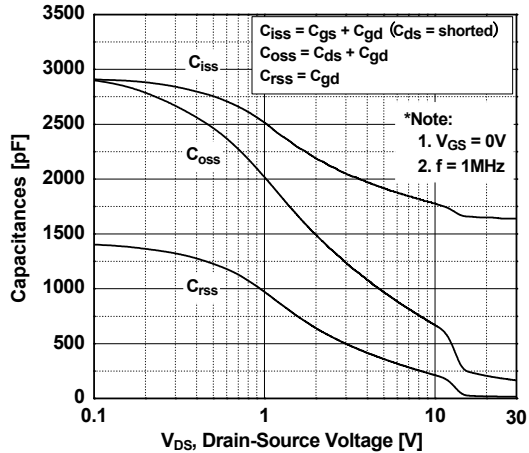
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



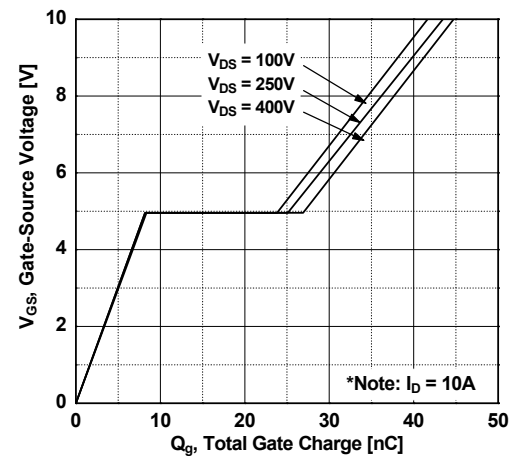
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**

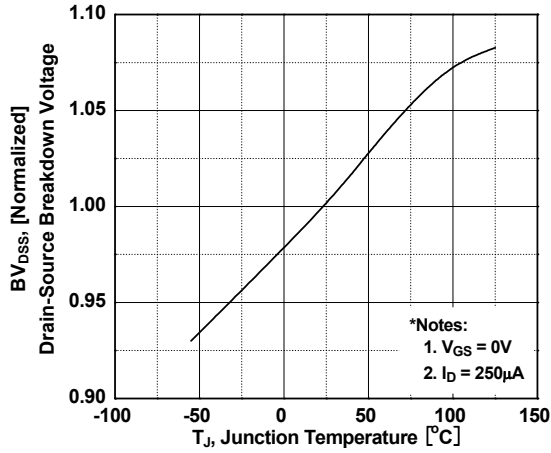


**Figure 6. Gate Charge Characteristics**

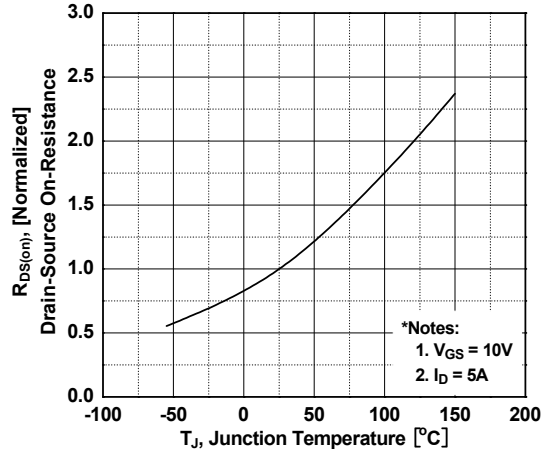


**Typical Performance Characteristics** (Continued)

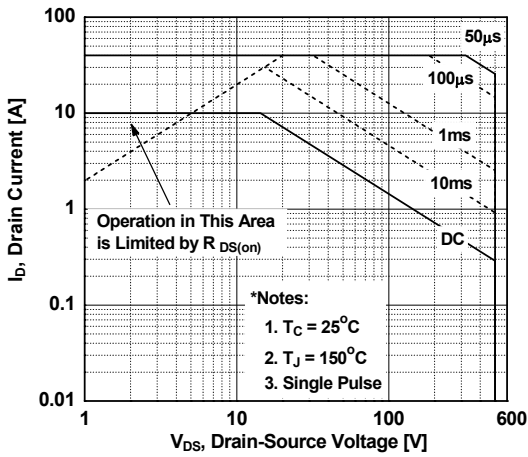
**Figure 7. Breakdown Voltage Variation vs. Temperature**



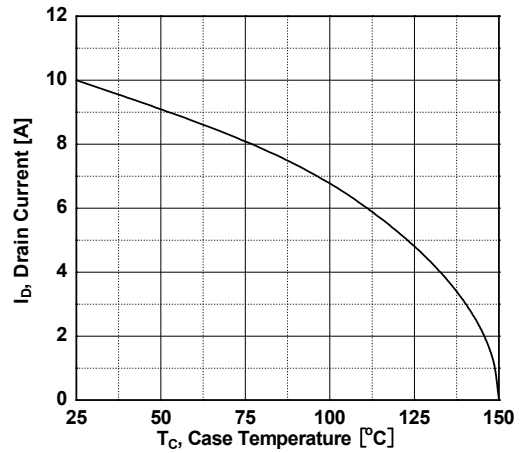
**Figure 8. On-Resistance Variation vs. Temperature**



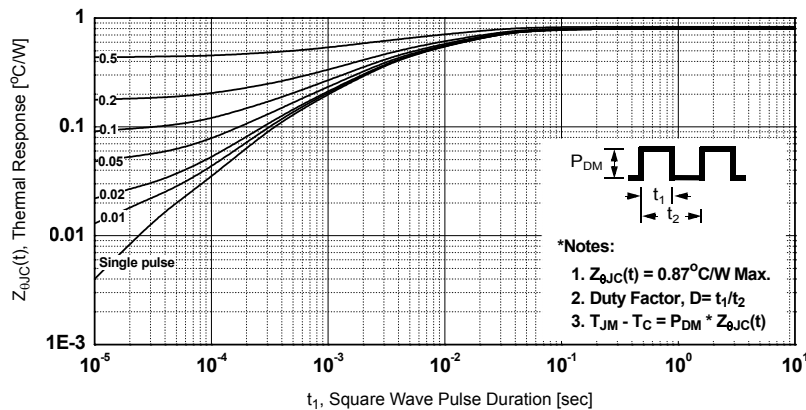
**Figure 9. Maximum Safe Operating Area**



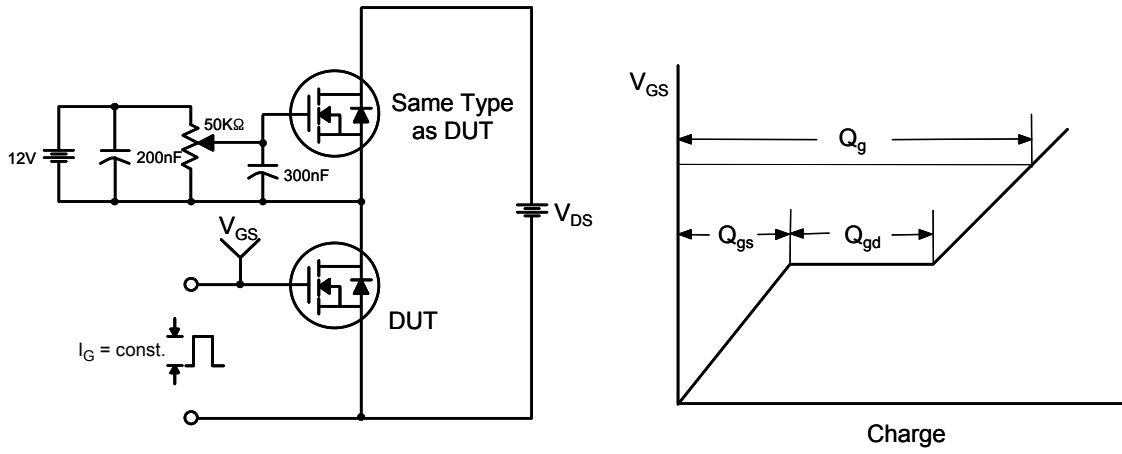
**Figure 10. Maximum Drain Current vs. Case Temperature**



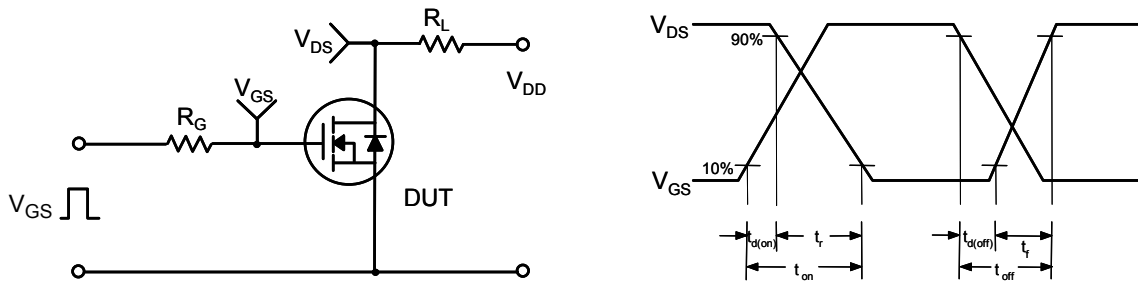
**Figure 11. Transient Thermal Response Curve**



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



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



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

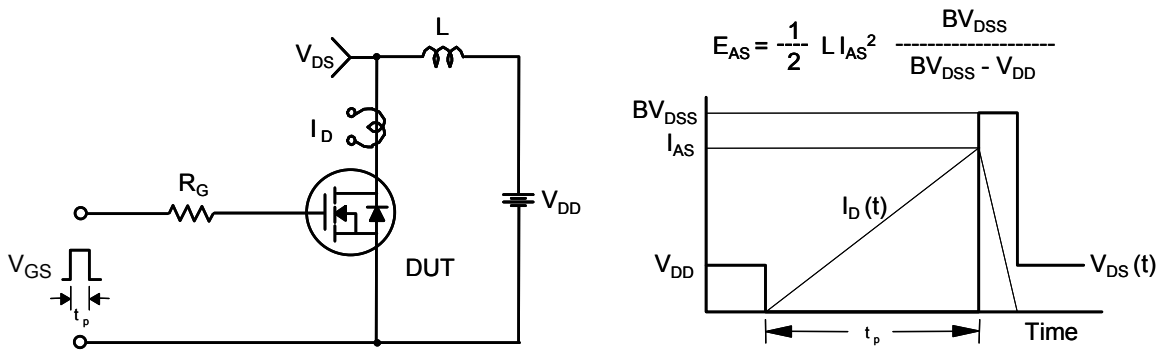
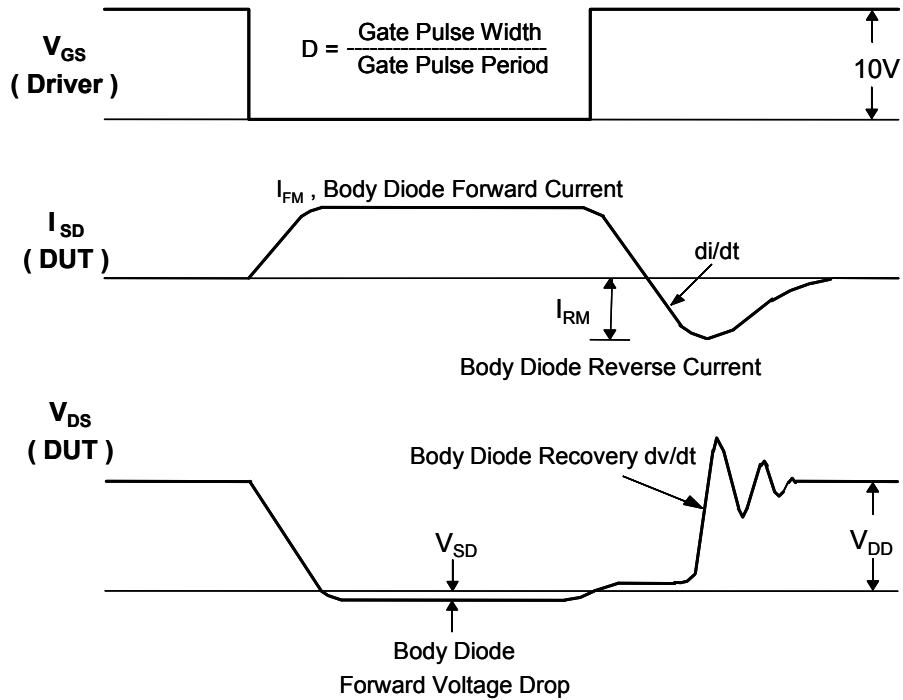
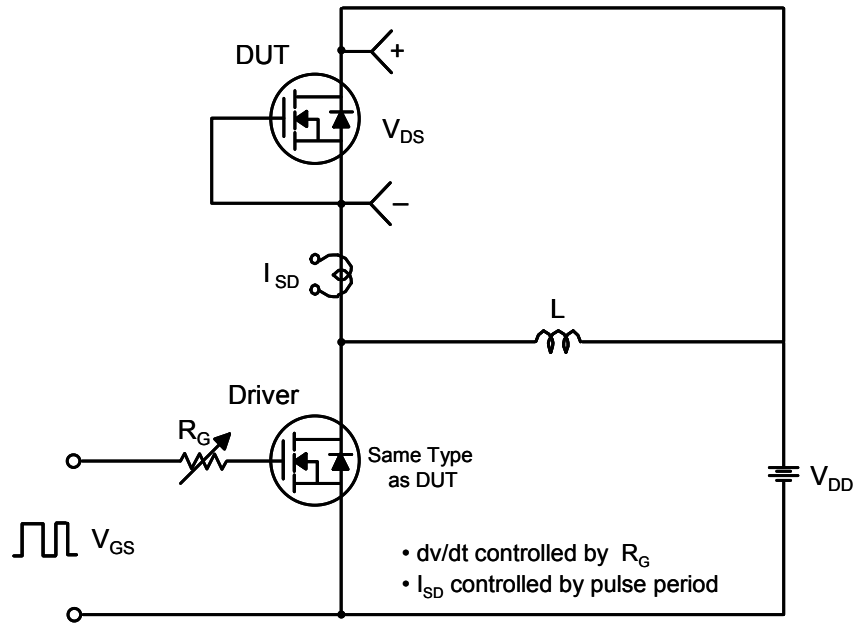
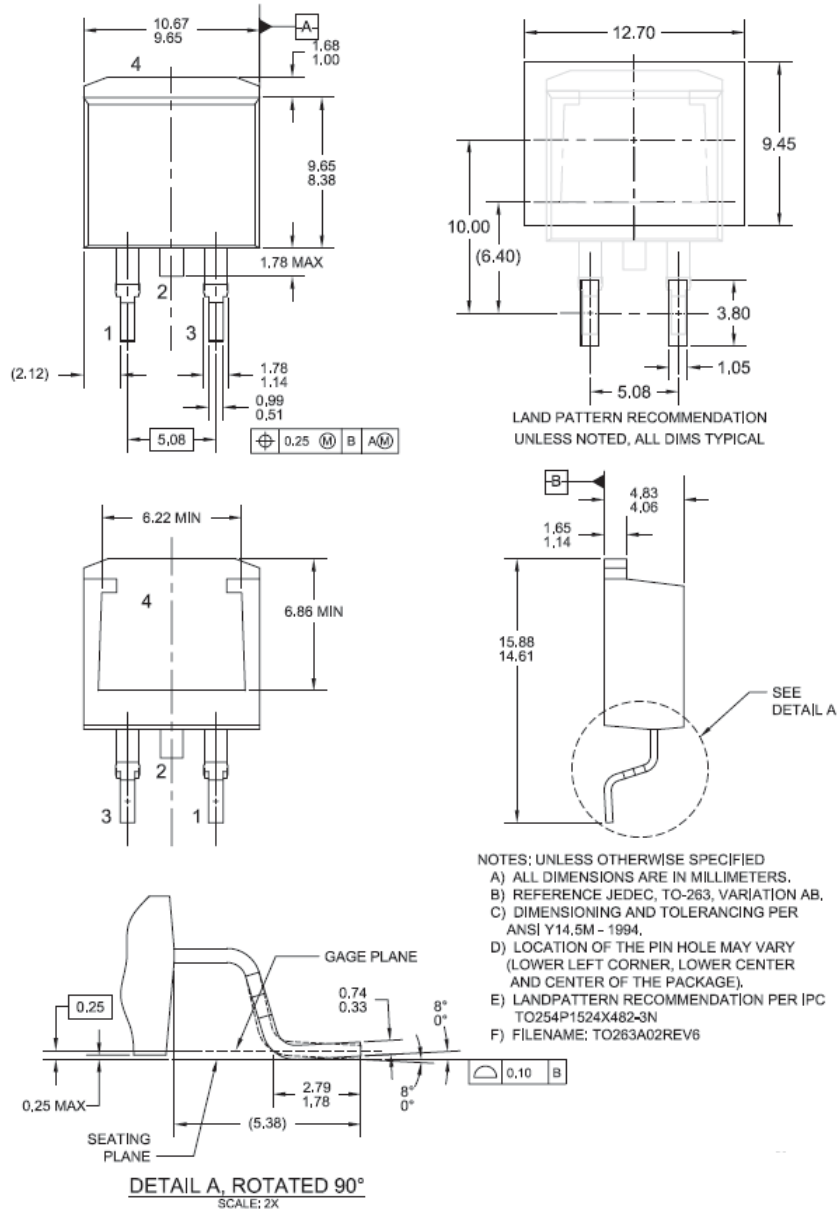


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



**Mechanical Dimensions**

**TO-263 2L (D<sup>2</sup>PAK)**




**Figure 16. 2LD, TO263, Surface Mount**

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Dimension in Millimeters



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