ON Semiconductor®

FDB12N50F

N-Channel UniFET™ FRFET® MOSFET

500 V, 11.5 A, 700 mΩ

Features

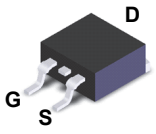
- $R_{DS(on)}$ = 590 mΩ (Typ.) @ V_{GS} = 10 V, I_D = 6 A
- Low Gate Charge (Typ. 21 nC)
- Low C_{rss} (Typ. 11 pF)
- 100% Avalanche Tested
- Improve dv/dt Capability
- RoHS Compliant

Applications

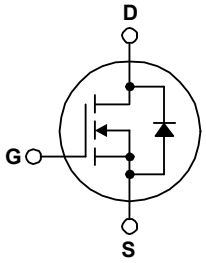
- Lighting
- Uninterruptible Power Supply
- AC-DC Power Supply

Description

UniFET™ MOSFET is ON 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. The body diode's reverse recovery performance of UniFET FRFET® MOSFET has been enhanced by lifetime control. Its t_{rr} is less than 100nsec and the reverse dv/dt immunity is 15V/ns while normal planar MOSFETs have over 200nsec and 4.5V/nsec respectively. Therefore, it can remove additional component and improve system reliability in certain applications in which the performance of MOSFET's body diode is significant. 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.



D^2-PAK



MOSFET Maximum Ratings T_C = 25°C unless otherwise noted.

Symbol	Parameter			FDB12N50FTM-WS	Unit
V_{DSS}	Drain to Source Voltage			500	V
V_{GSS}	Gate to Source Voltage			±30	V
I_D	Drain Current	- Continuous (T_C = 25°C)		11.5	A
		- Continuous (T_C = 100°C)		6.9	
I_{DM}	Drain Current	- Pulsed	(Note 1)	46	A
E_{AS}	Single Pulsed Avalanche Energy		(Note 2)	456	mJ
I_{AR}	Avalanche Current		(Note 1)	11.5	A
E_{AR}	Repetitive Avalanche Energy		(Note 1)	16.5	mJ
dv/dt	Peak Diode Recovery dv/dt		(Note 3)	20	V/ns
P_D	Power Dissipation	(T_C = 25°C)		165	W
		- Derate above 25°C		1.33	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range			-55 to +150	°C
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds			300	°C

Thermal Characteristics

Symbol	Parameter	FQB12N50FTM_WS	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max	0.75	°C/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^2 pad of 2 oz copper), Max.	40	

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Publication Order Number:
FDB12N50F/D

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDB12N50F	FDB12N50FTM_WS	D2-PAK	330mm	24mm	800 units

Electrical Characteristics $T_C = 25^oC$ unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 250μA, V_{GS} = 0V, T_J = 25°C	500	-	-	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250μA, Referenced to 25°C	-	0.5	-	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 500V, V_{GS} = 0V	-	-	10	μA
		V_{DS} = 400V, T_C = 125°C	-	-	100	
I_{GSS}	Gate to Body Leakage Current	V_{GS} = ±30V, V_{DS} = 0V	-	-	±100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 250μA	3.0	-	5.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10V, I_D = 6A	-	0.59	0.7	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40V, I_D = 6A	-	12	-	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1MHz	-	1050	1395	pF
C_{oss}	Output Capacitance		-	135	180	pF
C_{rss}	Reverse Transfer Capacitance		-	11	17	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	V_{DS} = 400V, I_D = 11.5A, V_{GS} = 10V (Note 4)	-	21	30	nC
Q_{gs}	Gate to Source Gate Charge		-	6	-	nC
Q_{gd}	Gate to Drain “Miller” Charge		-	9	-	nC
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 250V, I_D = 11.5A, R_G = 25Ω (Note 4)	-	21	50	ns
t_r	Turn-On Rise Time		-	45	100	ns
$t_{d(off)}$	Turn-Off Delay Time		-	50	110	ns
t_f	Turn-Off Fall Time		-	35	80	ns
Drain-Source Diode Characteristics						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	11.5	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	46	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS} = 0V, I_{SD} = 11.5A	-	-	1.5	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0V, I_{SD} = 11.5A, dI_F/dt = 100A/μs	-	134	-	ns
Q_{rr}	Reverse Recovery Charge		-	0.37	-	μC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L = 6.9mH, I_{AS} = 11.5A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. I_{SD} ≤ 11.5A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C
4. Essentially Independent of Operating Temperature Typical Characteristics

Typical Characteristics

Figure 1. On-Region Characteristics

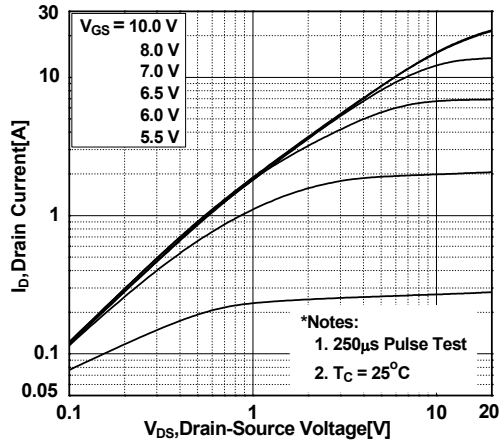


Figure 2. Transfer Characteristics

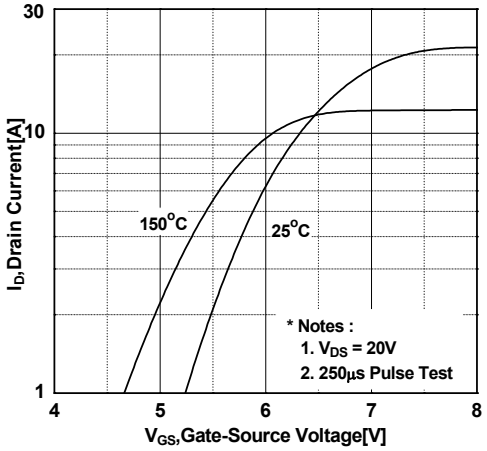


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

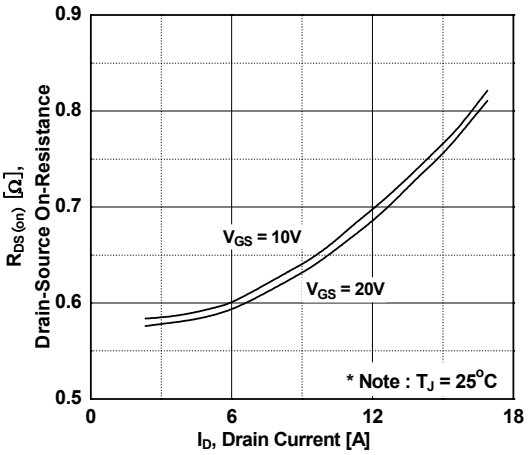


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

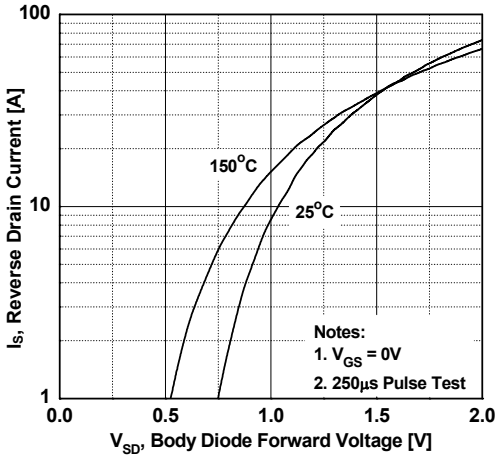


Figure 5. Capacitance Characteristics

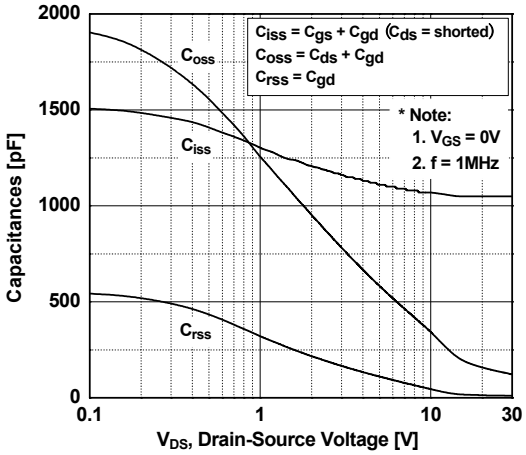
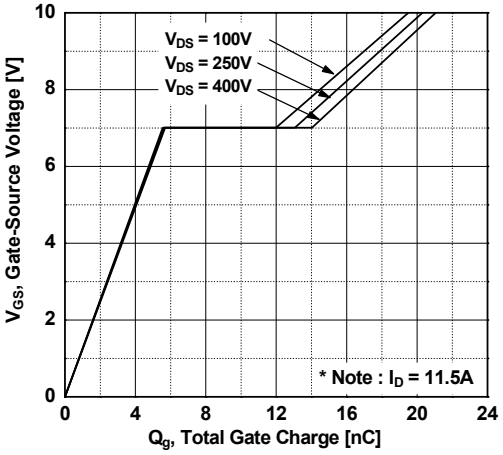


Figure 6. Gate Charge Characteristics



Typical Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

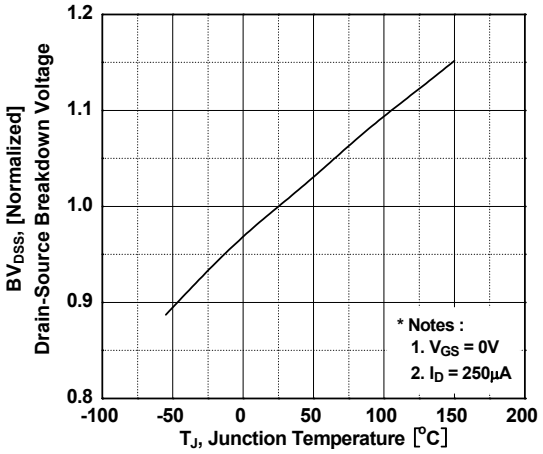


Figure 8. Maximum Safe Operating Area

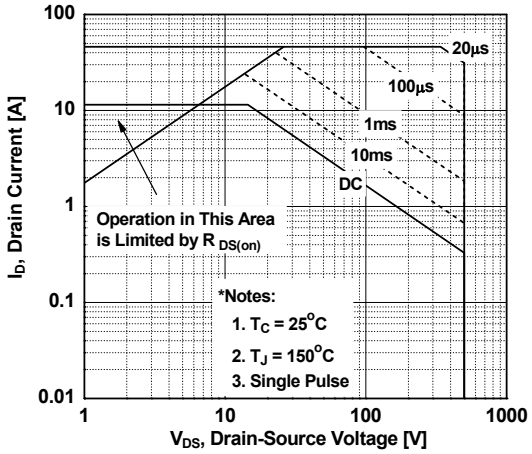


Figure 9. Maximum Drain Current vs. Case Temperature

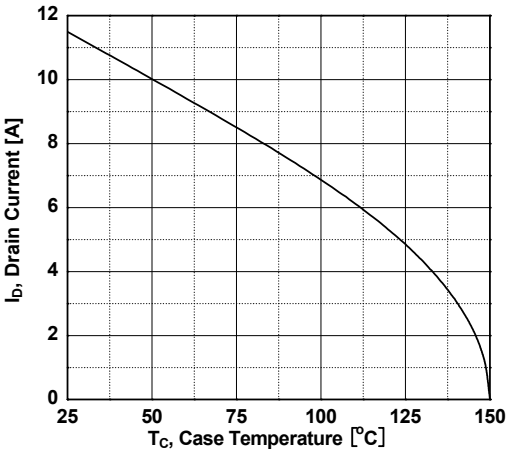


Figure 10. Transient Thermal Response Curve

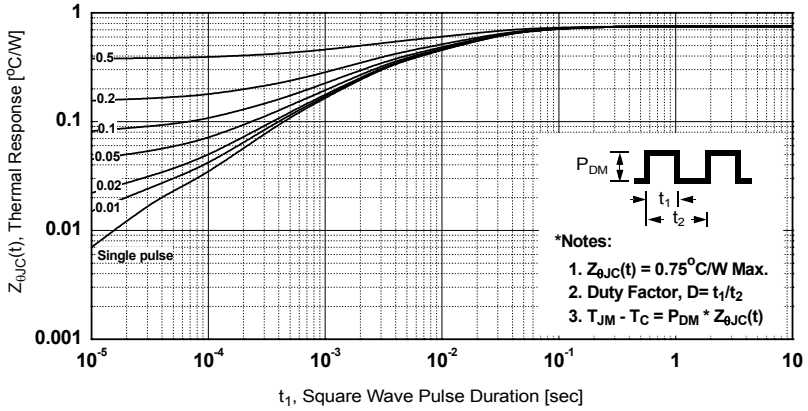


Figure 11. Gate Charge Test Circuit & Waveform

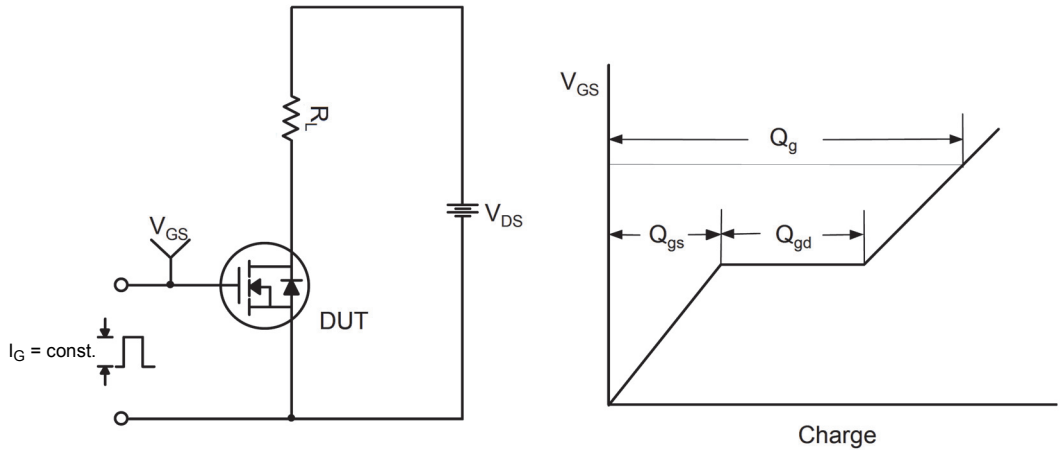


Figure 12. Resistive Switching Test Circuit & Waveforms

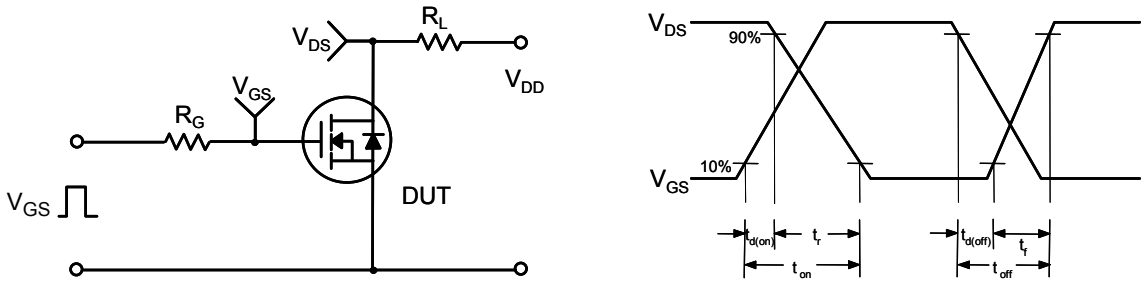


Figure 13. Unclamped Inductive Switching Test Circuit & Waveforms

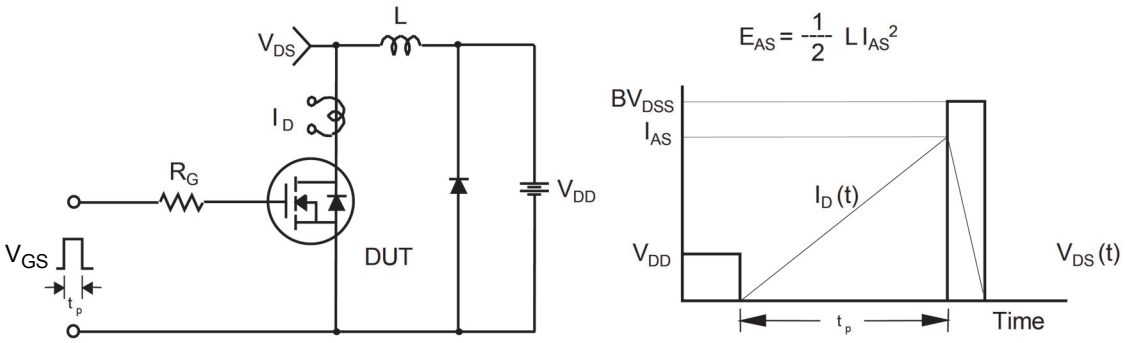
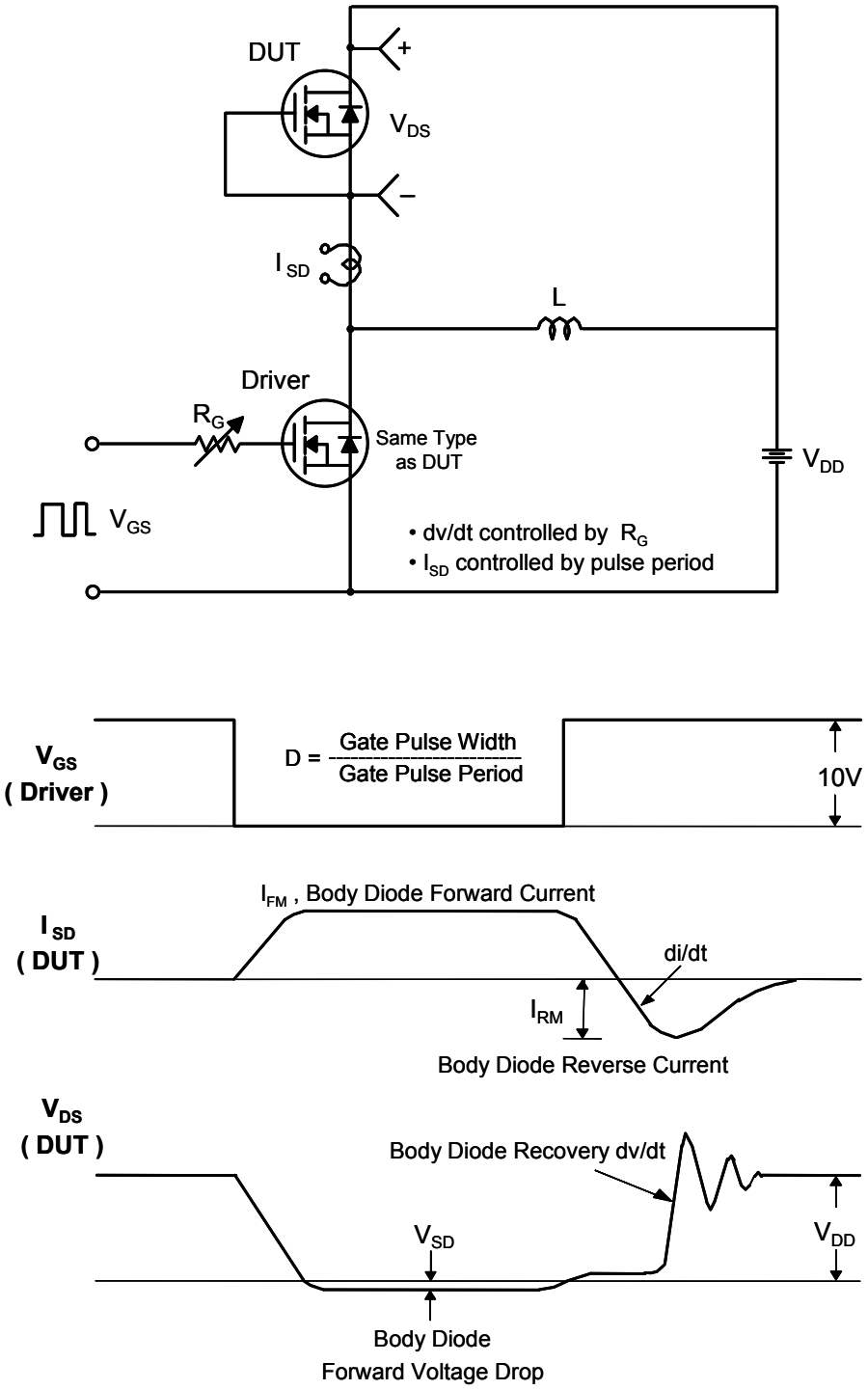


Figure 14. Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

TO-263 2L (D^{2}PAK)

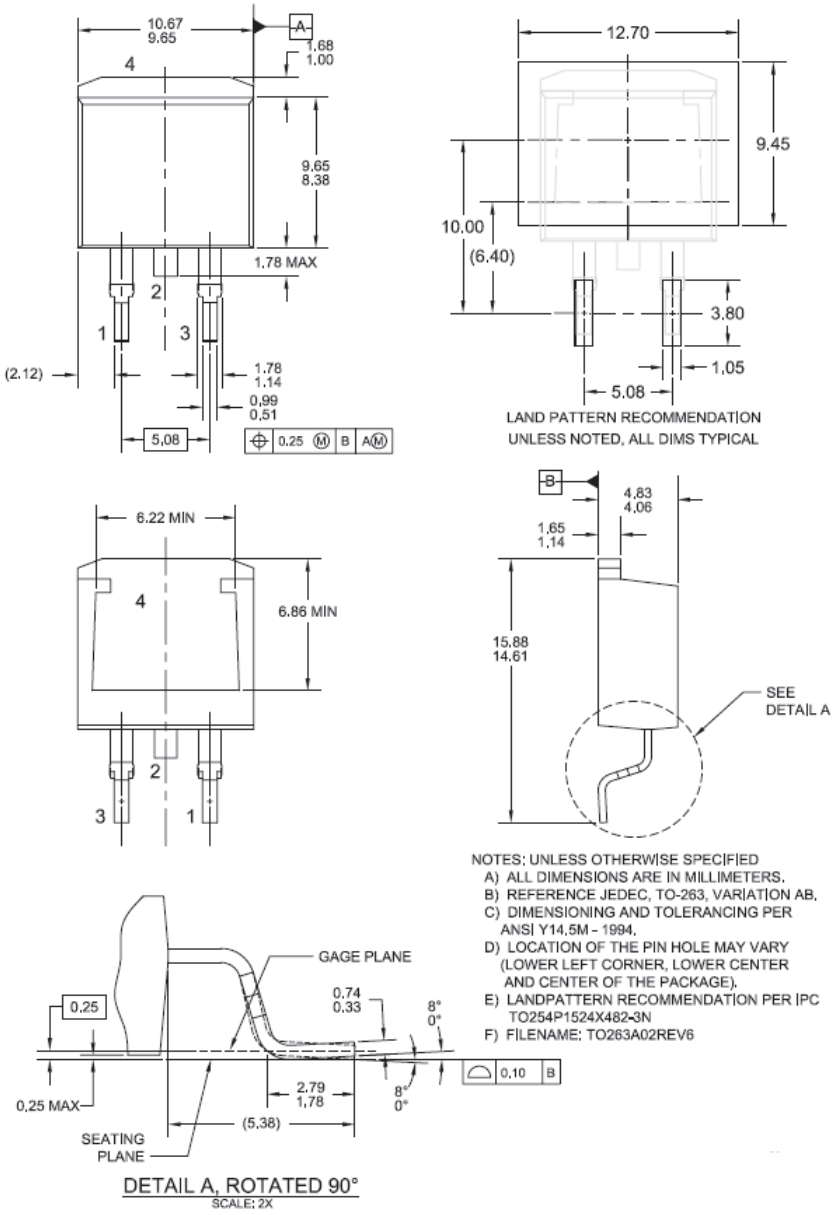


Figure 15. 2LD,TO263, Surface Mount

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Dimension in Millimeters

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