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FAIRCHILD SEMICONDUCTOR®

October 2013

FQB10N50CF

N-Channel QFET® FRFET® MOSFET

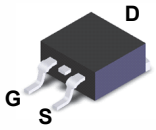
500 V, 10 A, 610 mΩ

Features

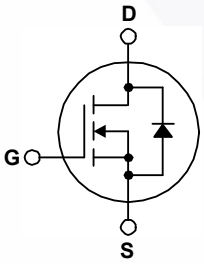
- 10 A, 500 V, $R_{DS(on)}$ = 610 mΩ (Max.) @ V_{GS} = 10 V, I_D = 5 A
- Low gate charge (Typ. 45 nC)
- Low Crss (Typ. 17.5 pF)
- 100% avalanche tested
- Fast recovery body diode

Description

This N-Channel enhancement mode power MOSFET is produced using Fairchild 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.



D^2-PAK



MOSFET Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter		FQB10N50CFTM_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)	10	A
		- Continuous (T_C = 100°C)	6.35	
I_{DM}	Drain Current	- Pulsed (Note 1)	40	A
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		825	mJ
I_{AR}	Avalanche Current (Note 1)		10	A
E_{AR}	Repetitive Avalanche Energy (Note 1)		14.3	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)		2.0	V/ns
P_D	Power Dissipation	(T_C = 25°C)	143	W
		- Derate above 25°C	1.14	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	FQB10N50CFTM_WS	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max	0.87	°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	

Package Marking and Ordering Information $T_C = 25^oC$ unless otherwise noted

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FQB10N50CF	FQB10N50CFTM_WS	D2-PAK	330mm	24mm	800

Electrical Characteristics

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	2.0	-	4.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10V, I_D = 5A	-	0.51	0.61	Ω
g_{FS}	Forward Transconductance	V_{DS} = 20V, I_D = 5A	-	105	-	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V f = 1MHz	-	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} = 400V, I_D = 10A V_{GS} = 10V (Note 4)	-	45	60	nC
Q_{gs}	Gate to Source Gate Charge		-	8	-	nC
Q_{gd}	Gate to Drain “Miller” Charge		-	19	-	nC
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 250V, I_D = 10A R_G = 25Ω (Note 4)	-	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		-	55	120	ns
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} = 0V, I_{SD} = 10A	-	-	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0V, I_{SD} = 10A dI_F/dt = 100A/μs	-	91	-	ns
Q_{rr}	Reverse Recovery Charge		-	220	-	nC

Notes:
1: Repetitive Rating: Pulse width limited by maximum junction temperature
2: L = 16.5mH, I_{AS} = 10A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3: $I_{SD} \le$ 10A, di/dt ≤ 200A/μs, $V_{DD} \le BV_{DSS}$, Starting T_J = 25°C
4: Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

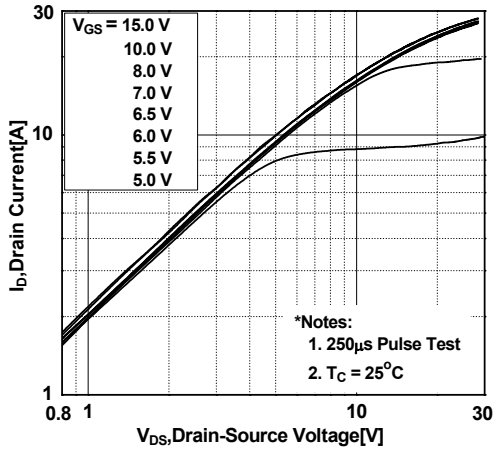


Figure 2. Transfer Characteristics

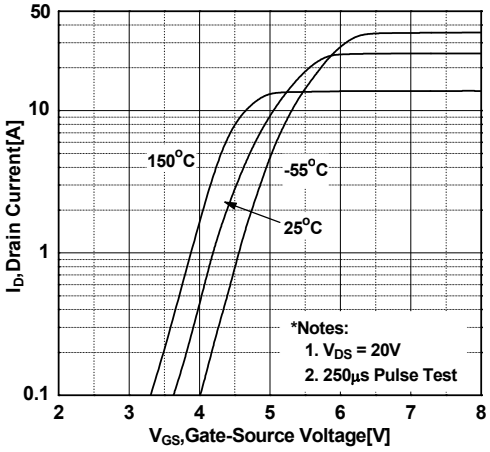


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

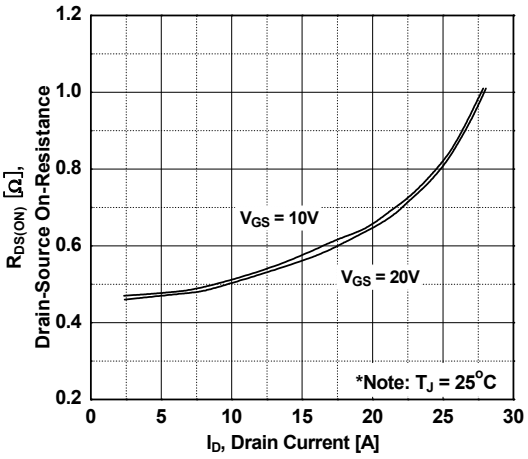


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

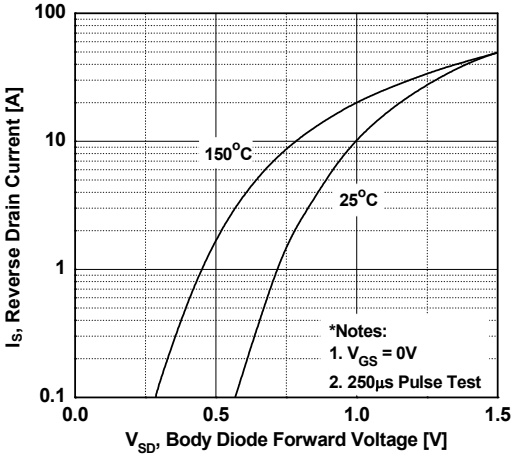


Figure 5. Capacitance Characteristics

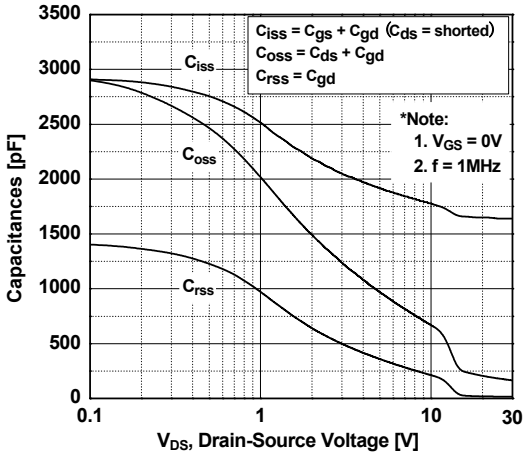
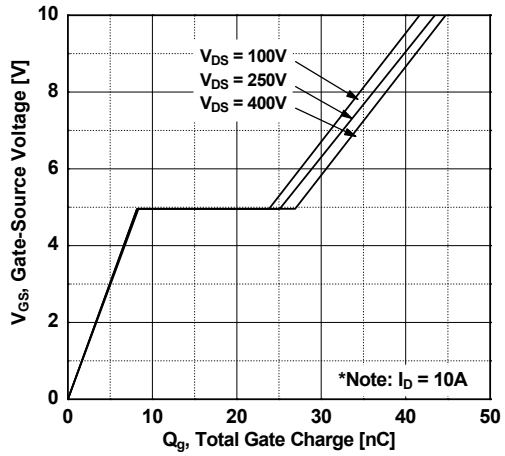


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

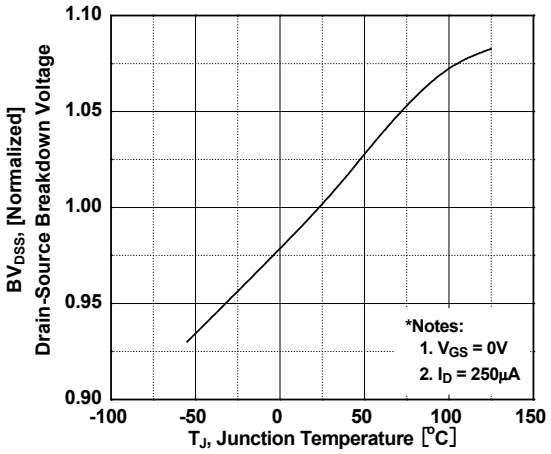


Figure 8. On-Resistance Variation vs. Temperature

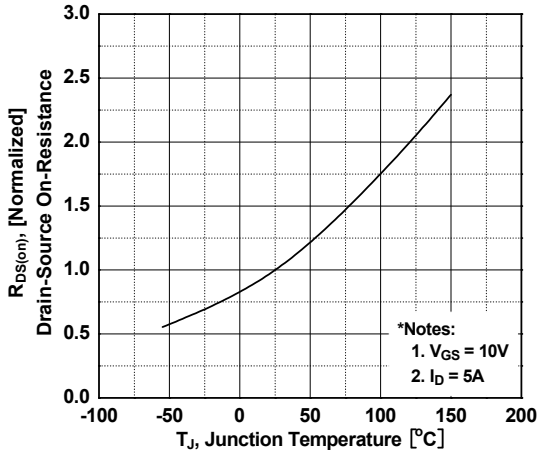


Figure 9. Maximum Safe Operating Area

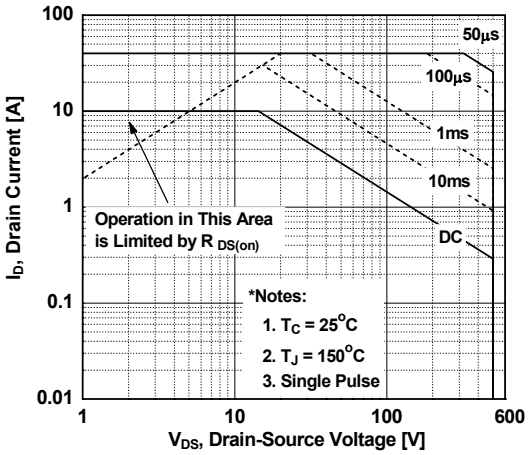


Figure 10. Maximum Drain Current vs. Case Temperature

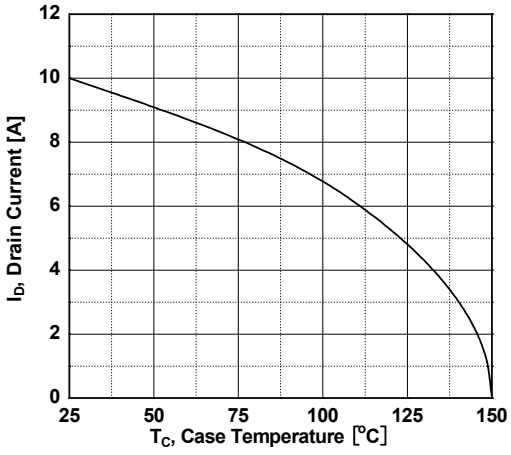


Figure 11. Transient Thermal Response Curve

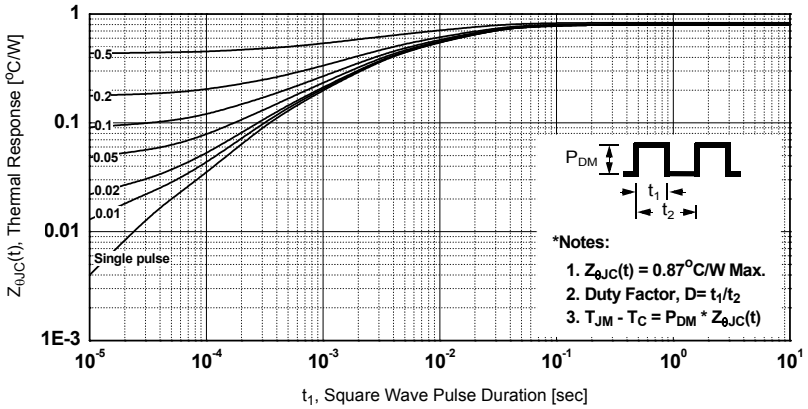


Figure 12. Gate Charge Test Circuit & Waveform

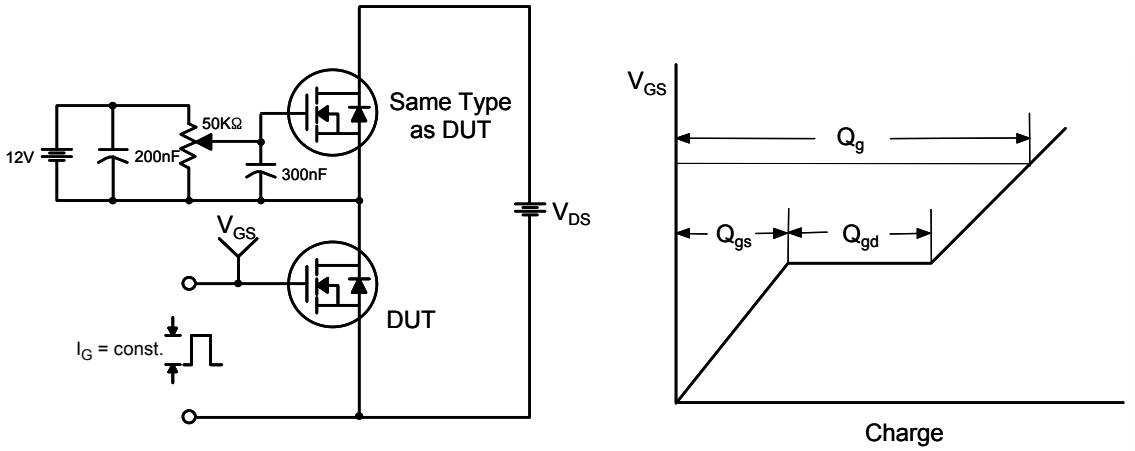


Figure 13. Resistive Switching Test Circuit & Waveforms

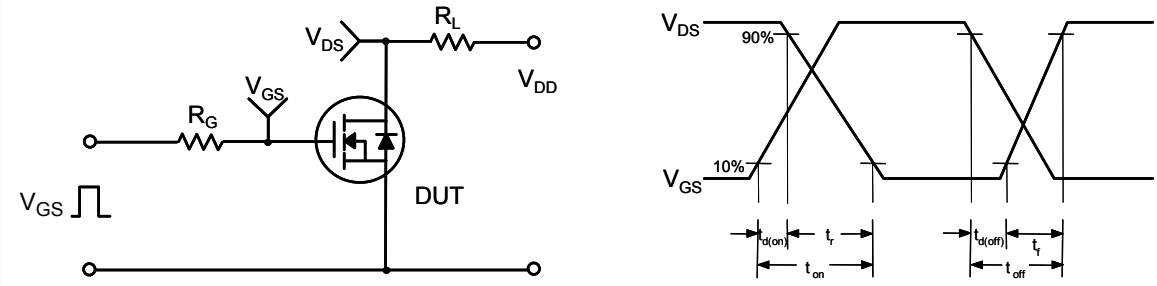


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

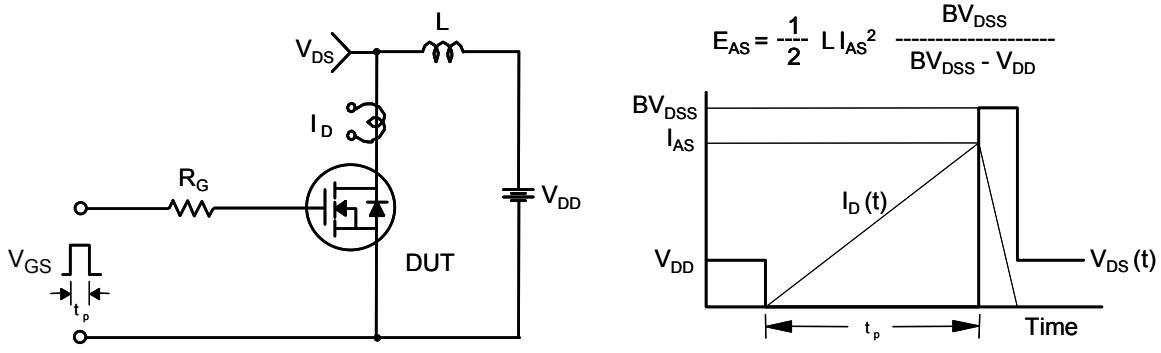
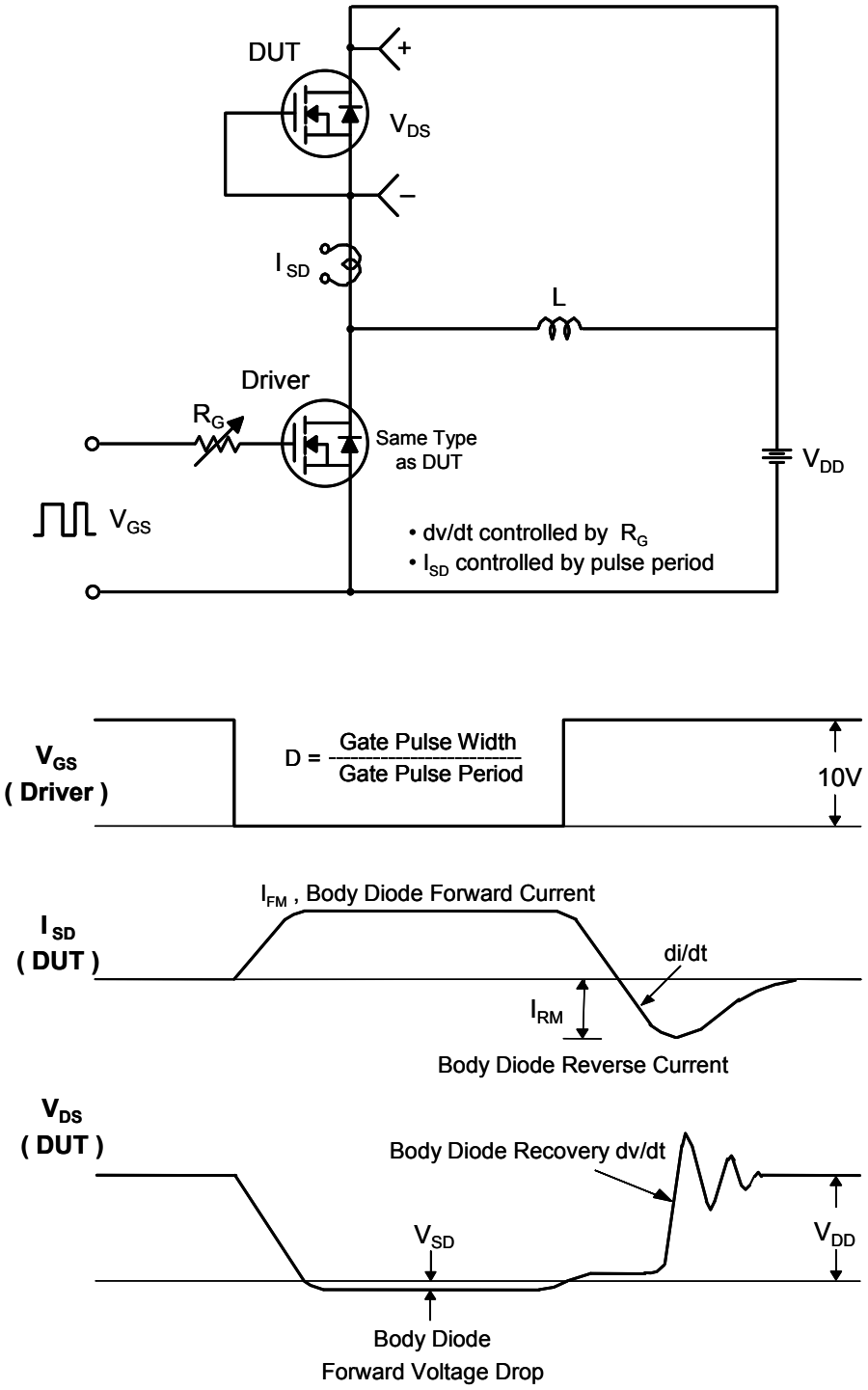


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

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

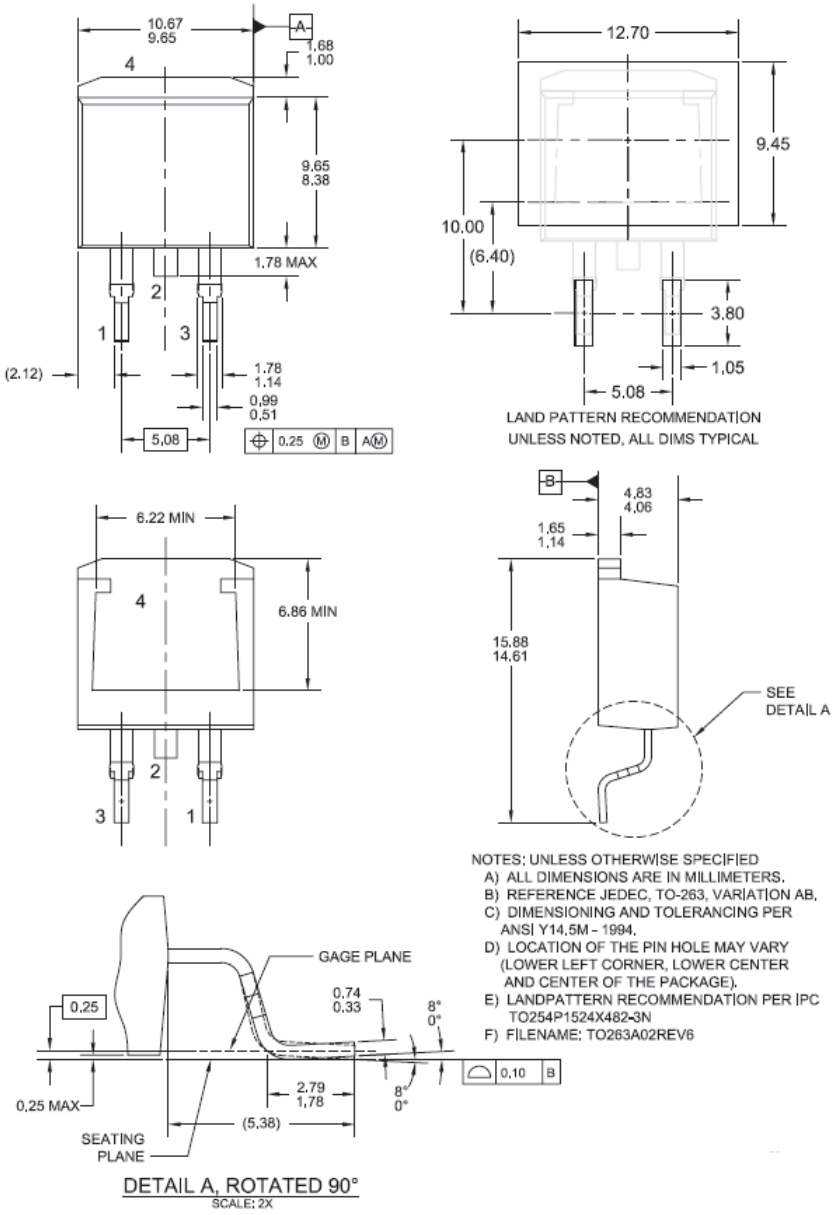


Figure 16. 2LD,TO263, Surface Mount

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Dimension in Millimeters

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