FAIRCHILD SEMICONDUCTOR®

March 2013

FQB13N50C / FQI13N50C

N-Channel QFET MOSFET

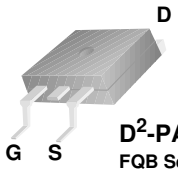
500 V, 13 A, 480 mΩ

Description

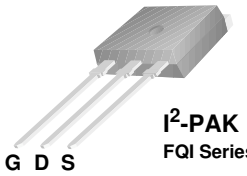
This N-Channel enhancement mode power MOSFET is produced using Fairchild Semiconductor®'s proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy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

Features

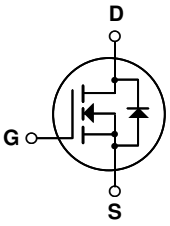
- 13 A, 500 V, $R_{DS(on)}$ = 480 mΩ (Max) @V_{GS} = 10 V, I_D = 6.5 A
- Low Gate Charge (Typ. 43 nC)
- Low Crss (Typ. 20 pF)
- 100% Avalanche Tested
- RoHS compliant



D^2-PAK
FQB Series



I^2-PAK
FQI Series



Absolute Maximum Ratings

T_C = 25°C unless otherwise noted

Symbol	Parameter		FQB13N50C / FQI13N50C	Units
V_{DSS}	Drain-Source Voltage		500	V
I_D	Drain Current - Continuous (T_C = 25°C)		13	A
	- Continuous (T_C = 100°C)		8	A
I_{DM}	Drain Current - Pulsed	(Note 1)	52	A
V_{GSS}	Gate-Source Voltage		± 30	V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	860	mJ
I_{AR}	Avalanche Current	(Note 1)	13	A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	19.5	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	4.5	V/ns
P_D	Power Dissipation (T_C = 25°C)		195	W
	- Derate above 25°C		1.56	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150	°C
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds		300	°C

Thermal Characteristics

Symbol	Parameter	Typ	Max	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	0.64	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient *	--	40	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	62.5	°C/W

* When mounted on the minium pad size recommended (PCB Mount).

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Electrical Characteristics

T_C = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA	500	--	--	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	--	0.5	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 500 V, V_{GS} = 0 V	--	--	1	μA
		V_{DS} = 400 V, T_C = 125°C	--	--	10	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	V_{GS} = 30 V, V_{DS} = 0 V	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	V_{GS} = -30 V, V_{DS} = 0 V	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 μA	2.0	--	4.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 6.5 A	--	0.39	0.48	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40 V, I_D = 6.5 A (Note 4)	--	15	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	1580	2055	pF
C_{oss}	Output Capacitance		--	180	235	pF
C_{rss}	Reverse Transfer Capacitance		--	20	25	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 250 V, I_D = 13 A, R_G = 25 Ω (Note 4, 5)	--	25	60	ns
t_r	Turn-On Rise Time		--	100	210	ns
$t_{d(off)}$	Turn-Off Delay Time		--	130	270	ns
t_f	Turn-Off Fall Time		--	100	210	ns
Q_g	Total Gate Charge	V_{DS} = 400 V, I_D = 13 A, V_{GS} = 10 V (Note 4, 5)	--	43	56	nC
Q_{gs}	Gate-Source Charge		--	7.5	--	nC
Q_{gd}	Gate-Drain Charge		--	18.5	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	13	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	52	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 13 A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 13 A, dI_F / dt = 100 A/μs (Note 4)	--	410	--	ns
Q_{rr}	Reverse Recovery Charge		--	4.5	--	μC

Notes:
1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L =6.0 mH, I_{AS} = 13A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C
3. I_{SD} ≤ 13A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C
4. Pulse Test : Pulse width ≤ 300μs, Duty cycle ≤ 2%
5. Essentially independent of operating temperature

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Typical Characteristics

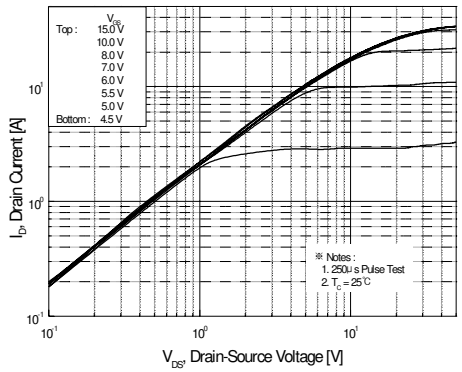

Figure 1. On-Region Characteristics

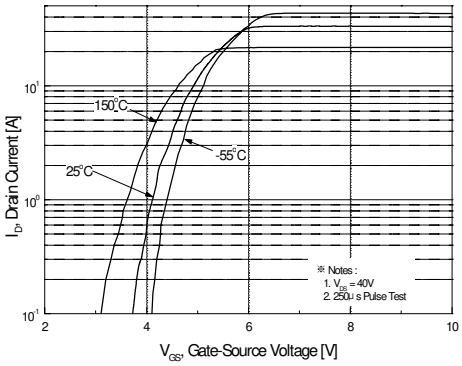

Figure 2. Transfer Characteristics

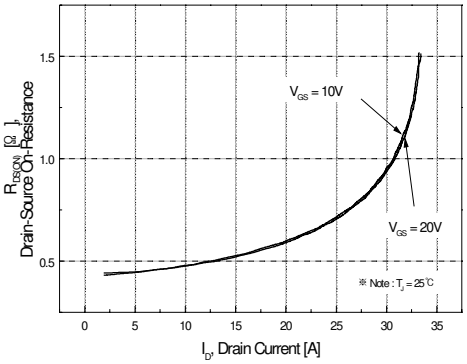

Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

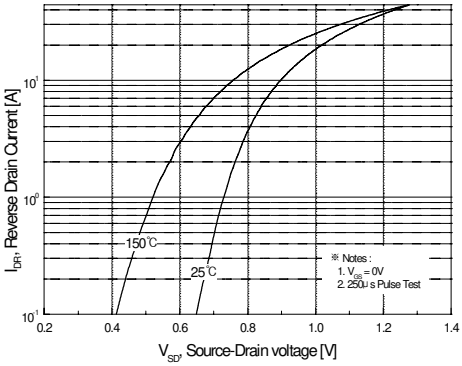

Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

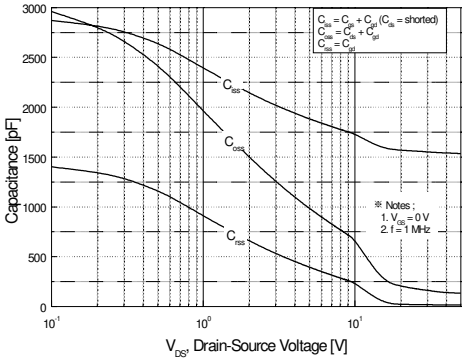

Figure 5. Capacitance Characteristics

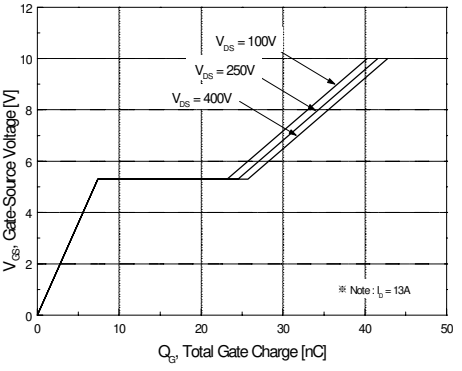

Figure 6. Gate Charge Characteristics

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Package Dimensions (Continued)

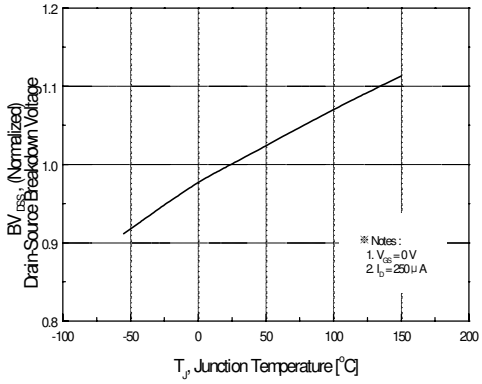


Figure 7. Breakdown Voltage Variation vs Temperature

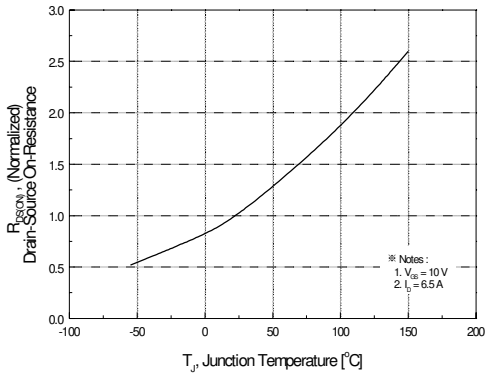


Figure 8. On-Resistance Variation vs Temperature

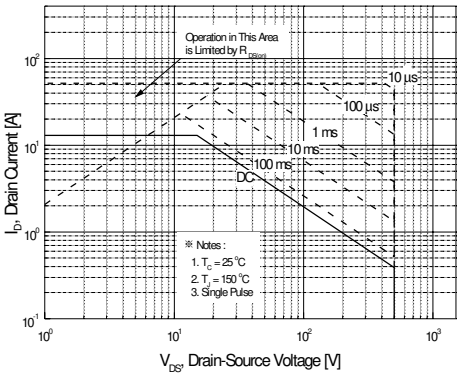


Figure 9. Maximum Safe Operating Area

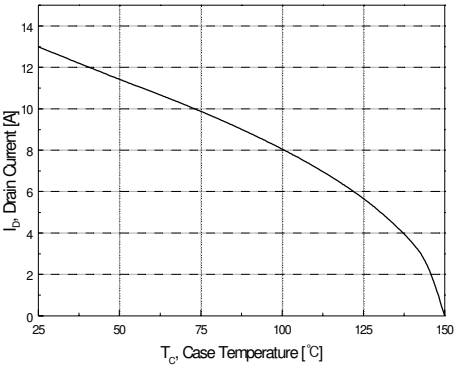


Figure 10. Maximum Drain Current vs Case Temperature

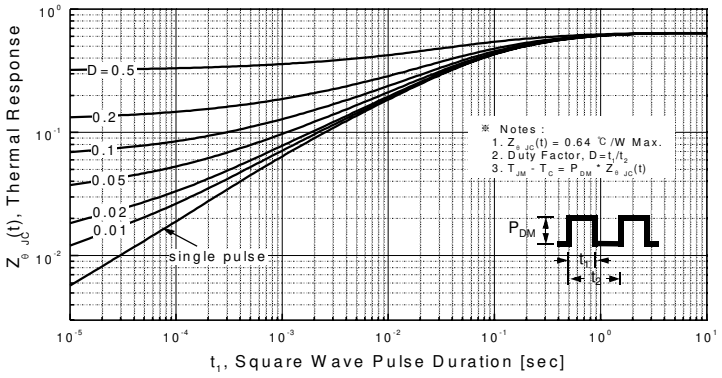
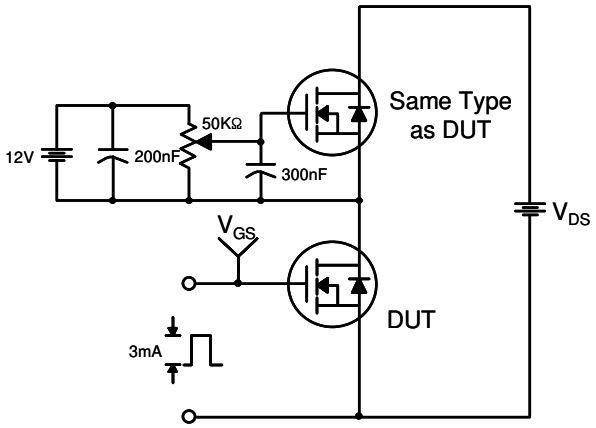
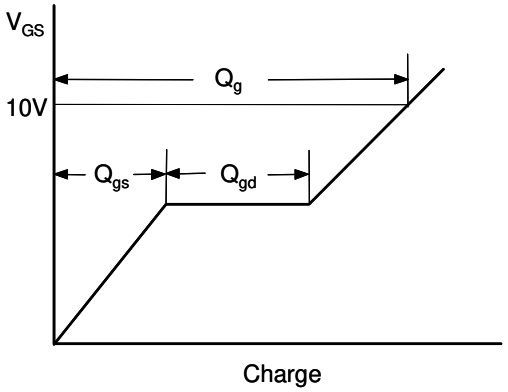


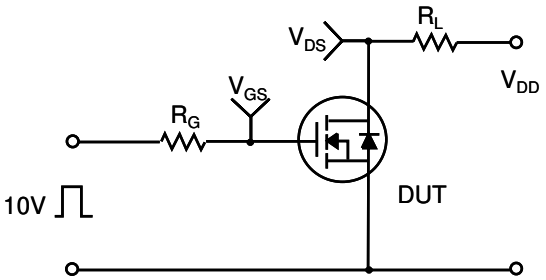
Figure 11. Transient Thermal Response Curve

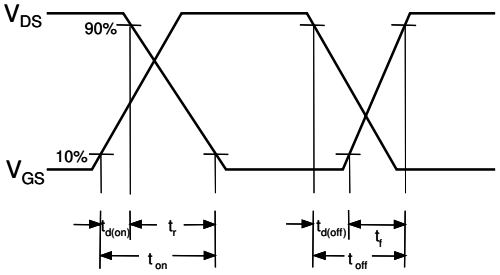
Gate Charge Test Circuit & Waveform



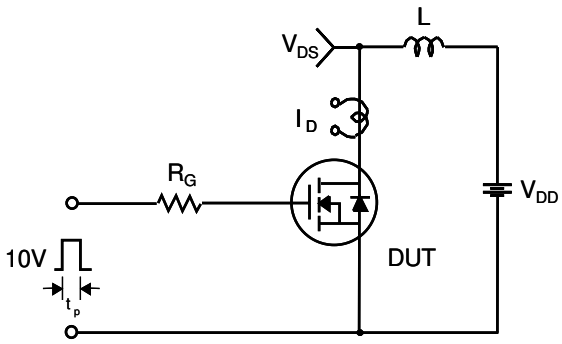


Resistive Switching Test Circuit & Waveforms

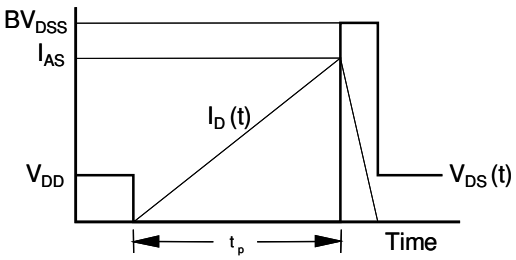




Unclamped Inductive Switching Test Circuit & Waveforms



$$E_{AS} = \frac{1}{2} L I_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$



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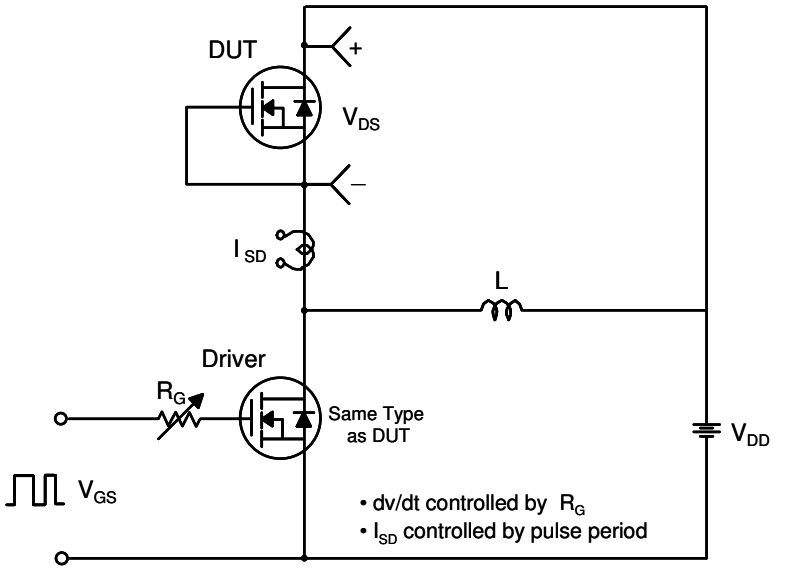
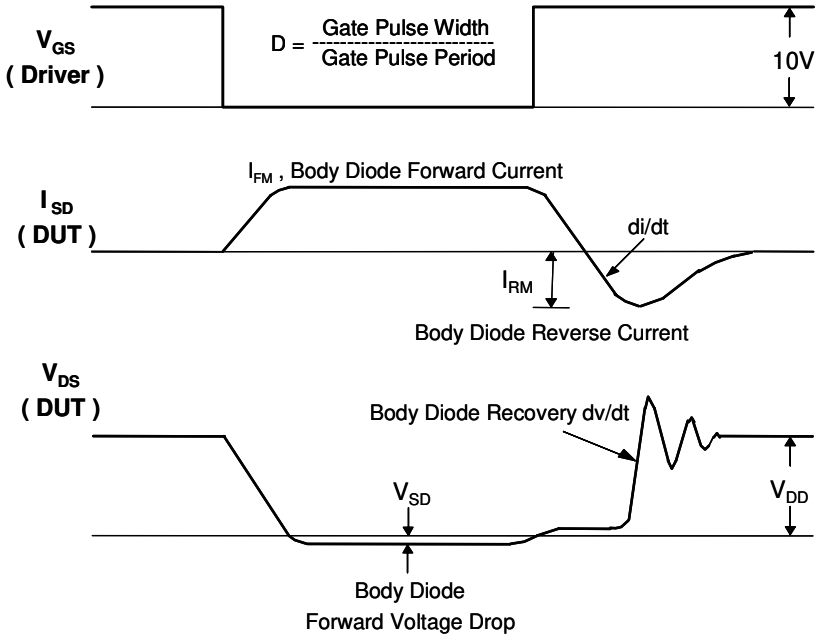
Peak Diode Recovery dv/dt Test Circuit & Waveforms





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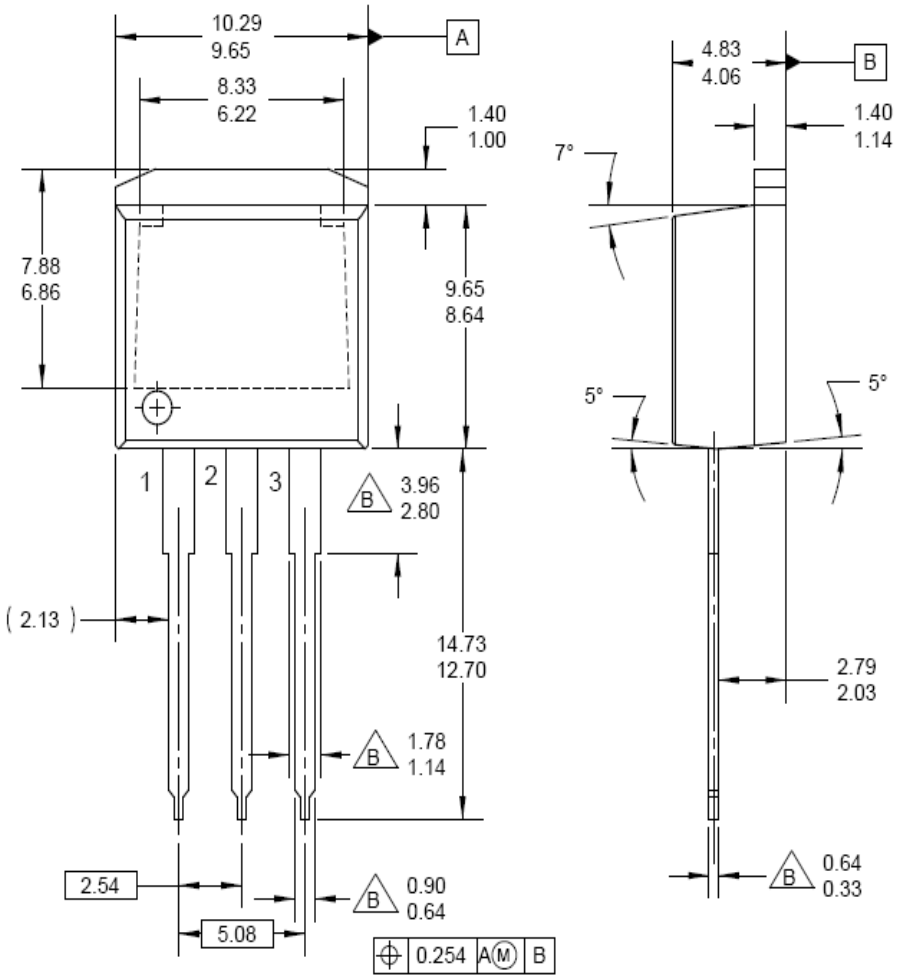
Mechanical Dimensions

I^2 - PAK



Dimensions in Millimeters

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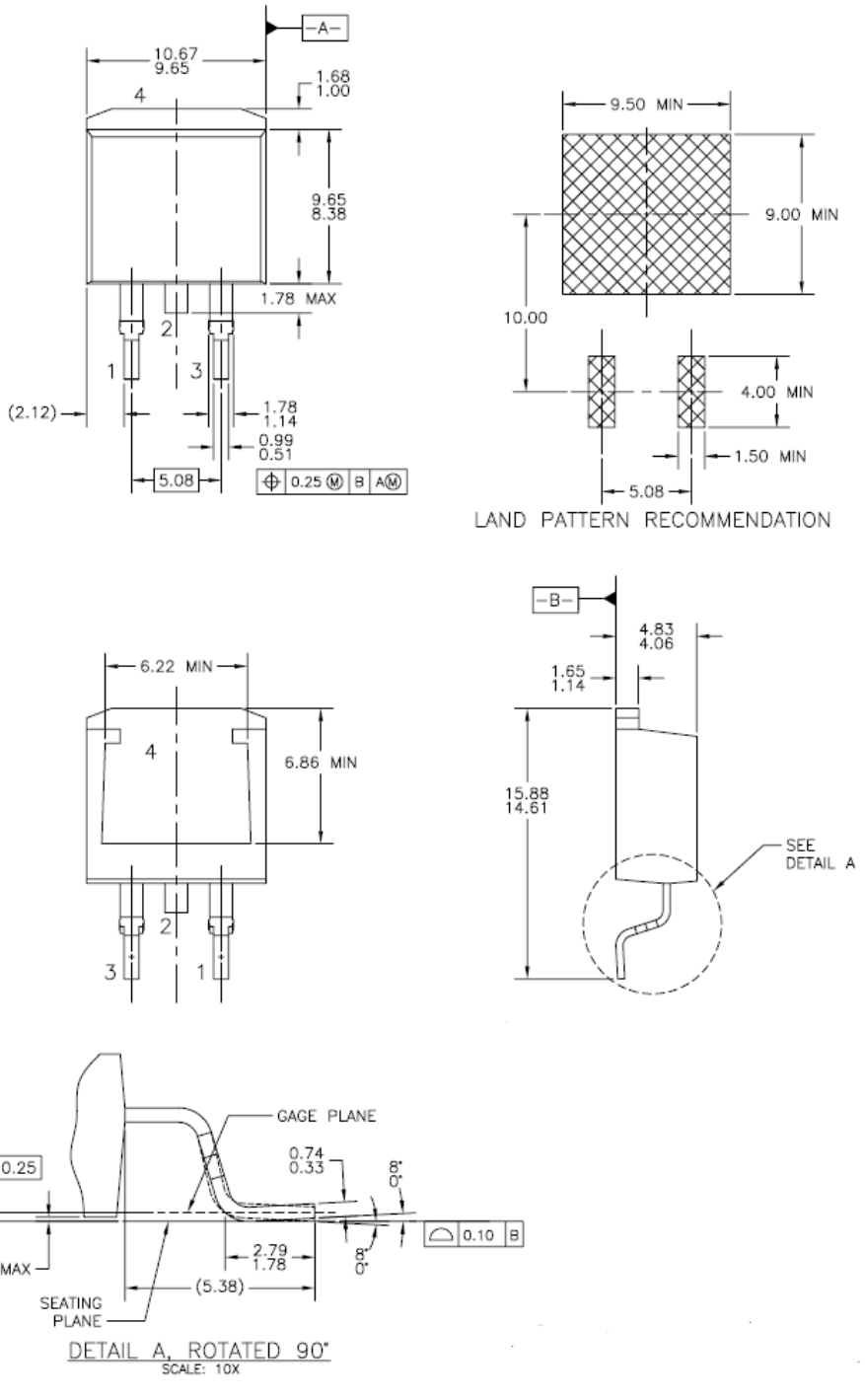
Mechanical Dimensions

D^2 - PAK



Dimensions in Millimeters

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No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
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