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FAIRCHILD SEMICONDUCTOR

October 2013

FCB20N60F

N-Channel SuperFET® FRFET® MOSFET

600 V, 20 A, 190 mΩ

Features

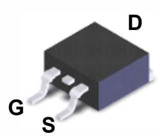
- 650 V @T_J = 150 °C
- Typ. $R_{DS(on)}$ = 150 mΩ
- Ultra Low Gate Charge (Typ. Q_g = 75 nC)
- Low Effective Output Capacitance (Typ. C_{oss}.eff = 165 pF)
- 100% Avalanche Tested
- RoHS Compliant

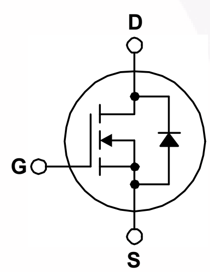
Applications

- Lighting
- Solar Inverter
- AC-DC Power Supply

Description

SuperFET® MOSFET is Fairchild Semiconductor's first generation of high voltage super-junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on-resistance and lower gate charge performance. This technology is tailored to minimize conduction loss, provide superior switching performance, dv/dt rate and higher avalanche energy. Consequently, SuperFET MOSFET is very suitable for the switching power applications such as PFC, server/telecom power, FPD TV power, ATX power and industrial power applications. SuperFET FRFET® MOSFET's optimized body diode reverse recovery performance can remove additional component and improve system reliability.





MOSFET Maximum Ratings T_C = 25°C unless otherwis noted

Symbol	Parameter		FCB20N60FTM	Unit
V_{DSS}	Drain to Source Voltage		600	V
I_D	Drain Current	- Continuous (T_C = 25°C)	20	A
		- Continuous (T_C = 100°C)	12.5	
I_{DM}	Drain Current	- Pulsed (Note 1)	60	A
V_{GSS}	Gate to Source Voltage		±30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		690	mJ
I_{AR}	Avalanche Current (Note 1)		20	A
E_{AR}	Repetitive Avalanche Energy (Note 1)		20.8	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)		50	V/ns
P_D	Power Dissipation	(T_C = 25°C)	208	W
		- Derate above 25°C	1.67	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	FCB20N60FTM	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.6	°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

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FCB20N60F	FCB20N60FTM	D^2-PAK	330mm	24m	800

Electrical Characteristics T_C = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA, T_C = 25°C	600	-	-	V
		V_{GS} = 0 V, I_D = 250 μA, T_C = 150°C	-	650	-	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	-	0.6	-	V/°C
BV_{DS}	Drain-Source Avalanche Breakdown Voltage	V_{GS} = 0 V, I_D = 20 A	-	700	-	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 600 V, V_{GS} = 0 V	-	-	1	μA
		V_{DS} = 480 V, V_{GS} = 0 V, T_C = 125°C	-	-	10	μA
I_{GSS}	Gate to Body Leakage Current	V_{GS} = ±30 V, V_{DS} = 0 V	-	-	±100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 250 μA	3.0	-	5.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 10 A	-	0.15	0.19	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40 V, I_D = 10 A	-	17	-	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V f = 1.0 MHz	-	2370	3080	pF
C_{oss}	Output Capacitance		-	1280	1665	pF
C_{rss}	Reverse Transfer Capacitance		-	95	-	pF
C_{oss}	Output Capacitance	V_{DS} = 480 V, V_{GS} = 0 V, f = 1.0 MHz	-	65	85	pF
C_{oss}eff.	Effective Output Capacitance	V_{DS} = 0 V to 400 V, V_{GS} = 0 V	-	165	-	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 300 V, I_D = 20 A R_G = 25 Ω (Note 4)	-	62	135	ns
t_r	Turn-On Rise Time		-	140	290	ns
$t_{d(off)}$	Turn-Off Delay Time		-	230	470	ns
t_f	Turn-Off Fall Time		-	65	140	ns
$Q_{g(tot)}$	Total Gate Charge at 10V	V_{DS} = 480 V, I_D = 20 A, V_{GS} = 10 V (Note 4)	-	75	98	nC
Q_{gs}	Gate to Source Gate Charge		-	13.5	18	nC
Q_{gd}	Gate to Drain "Miller" Charge		-	36	-	nC
Drain-Source Diode Characteristics						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	20	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	60	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS} = 0 V, I_{SD} = 20 A	-	-	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_{SD} = 20 A dI_F/dt = 100 A/μs	-	160	-	ns
Q_{rr}	Reverse Recovery Charge		-	1.1	-	μC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I_{AS} = 10 A, V_{DD} = 50 V, R_G = 25 Ω, Starting T_J = 25°C
3. I_{SD} ≤ 20 A, di/dt ≤ 1200 A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C
4. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

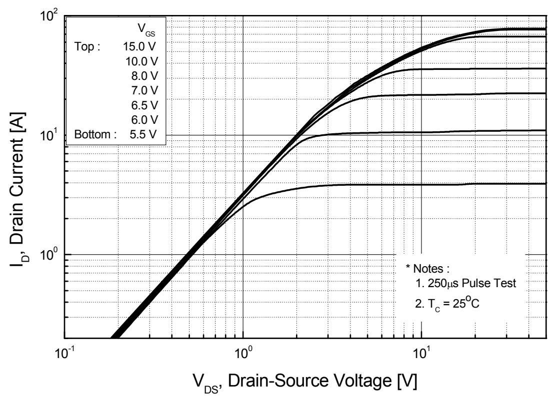


Figure 2. Transfer Characteristics

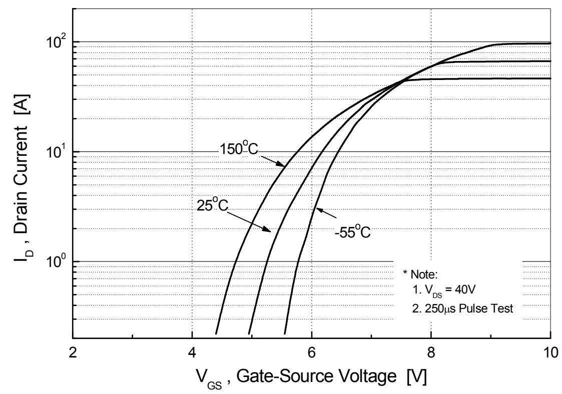


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

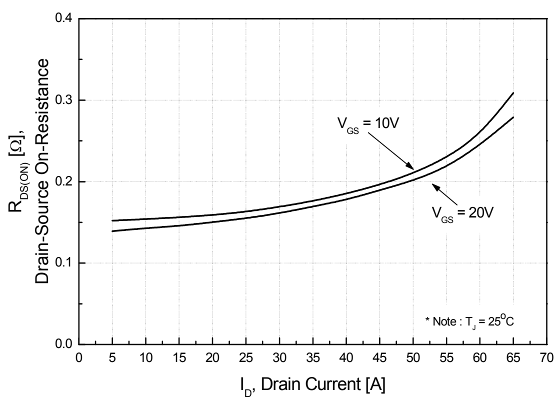


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

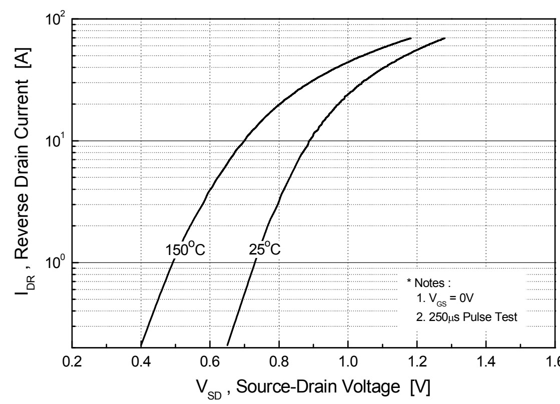


Figure 5. Capacitance Characteristics

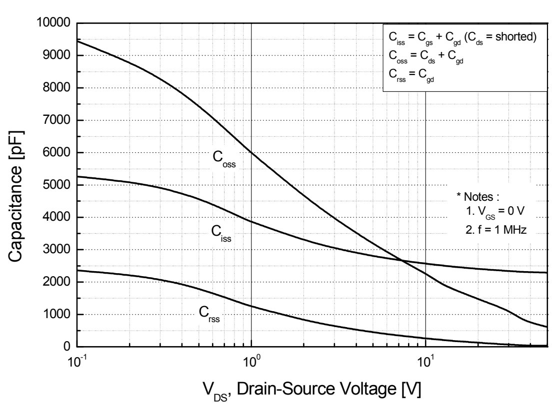
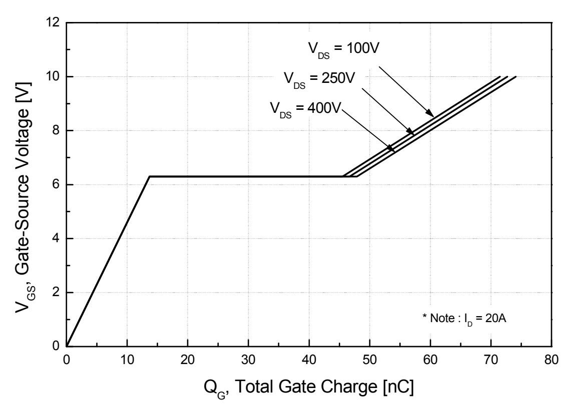


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

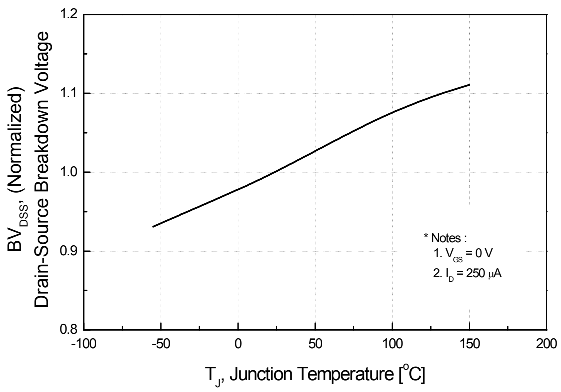


Figure 8. On-Resistance Variation vs. Temperature

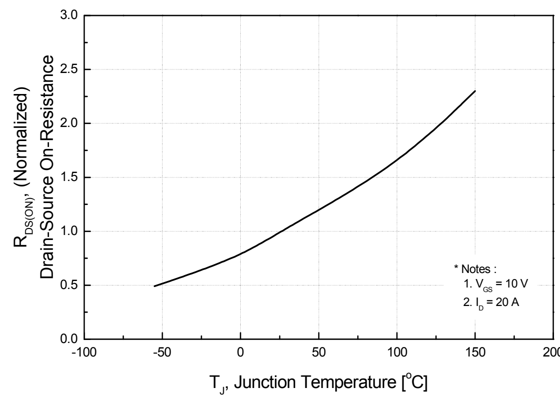


Figure 9. Maximum Safe Operating Area

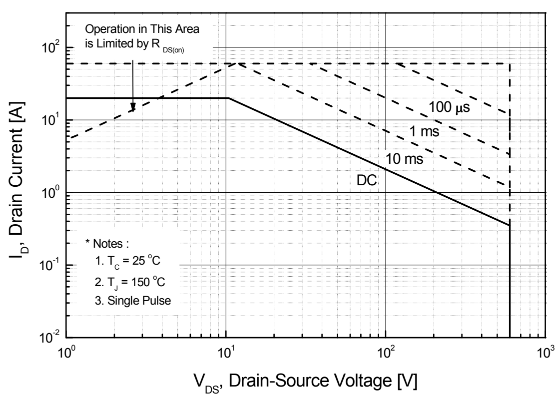


Figure 10. Maximum Drain Current vs. Case Temperature

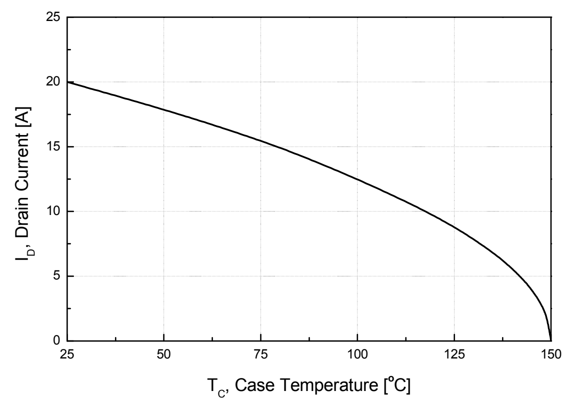


Figure 11. Transient Thermal Response Curve

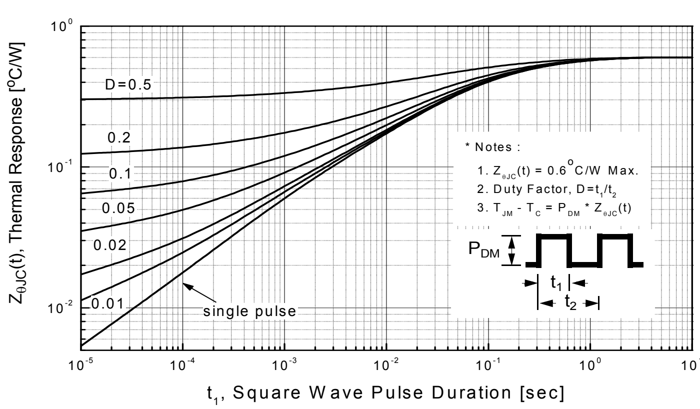


Figure 12. Gate Charge Test Circuit & Waveform

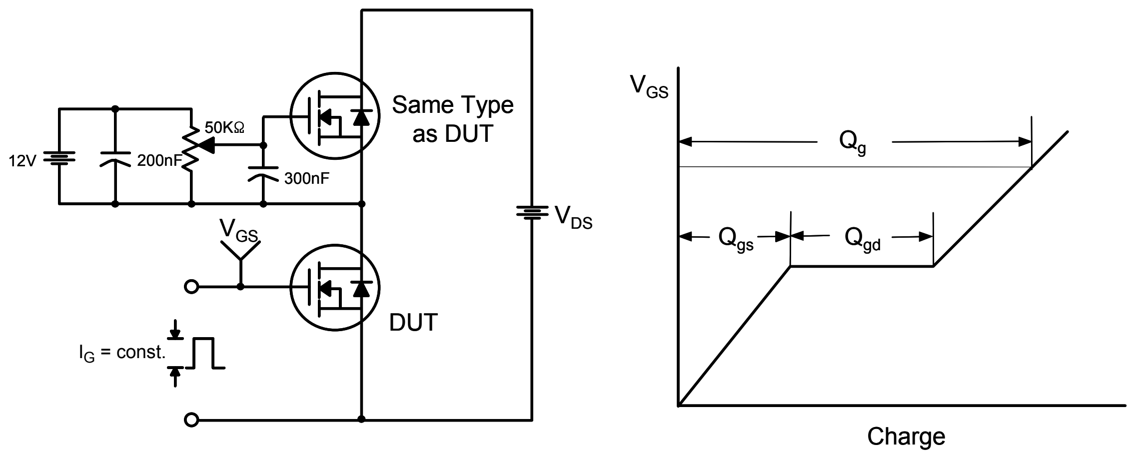


Figure 13. Resistive Switching Test Circuit & Waveforms

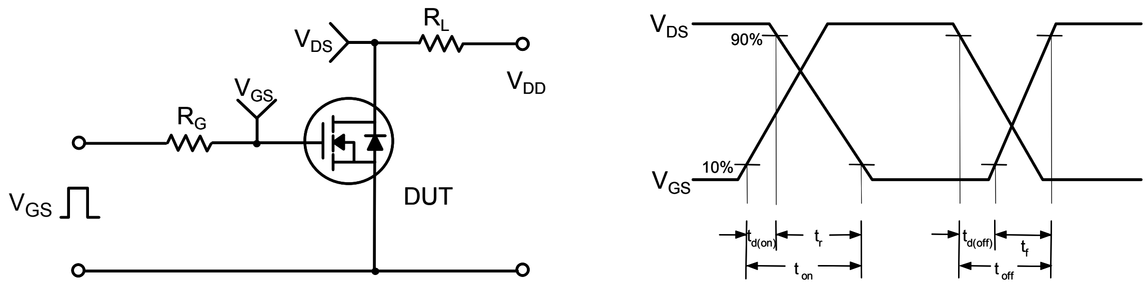


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

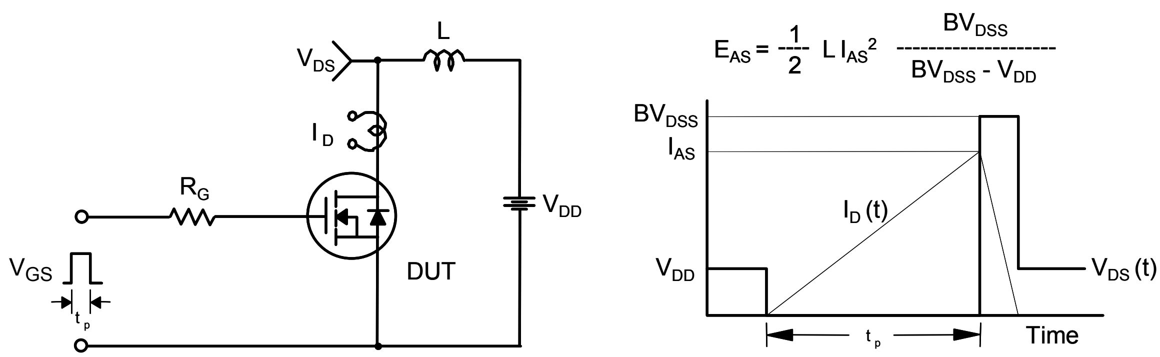
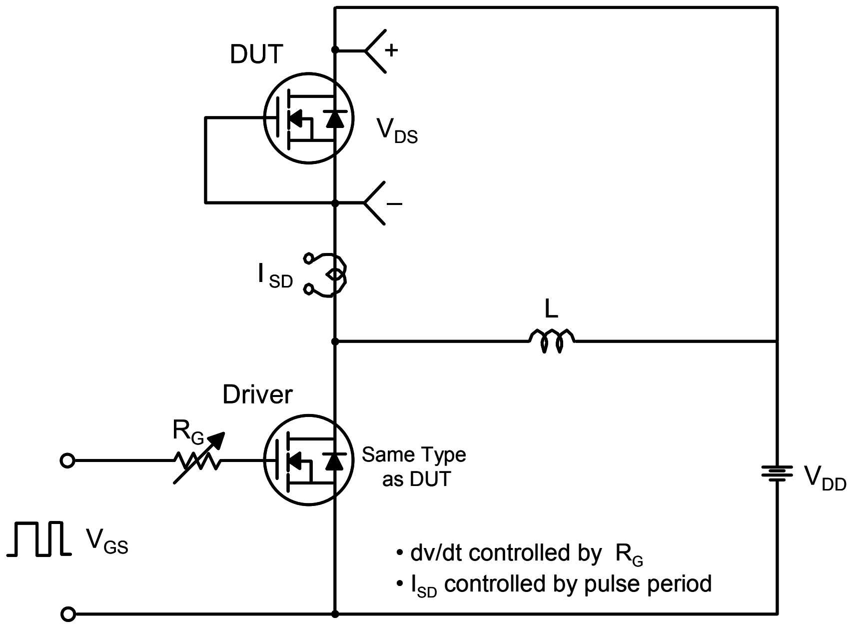
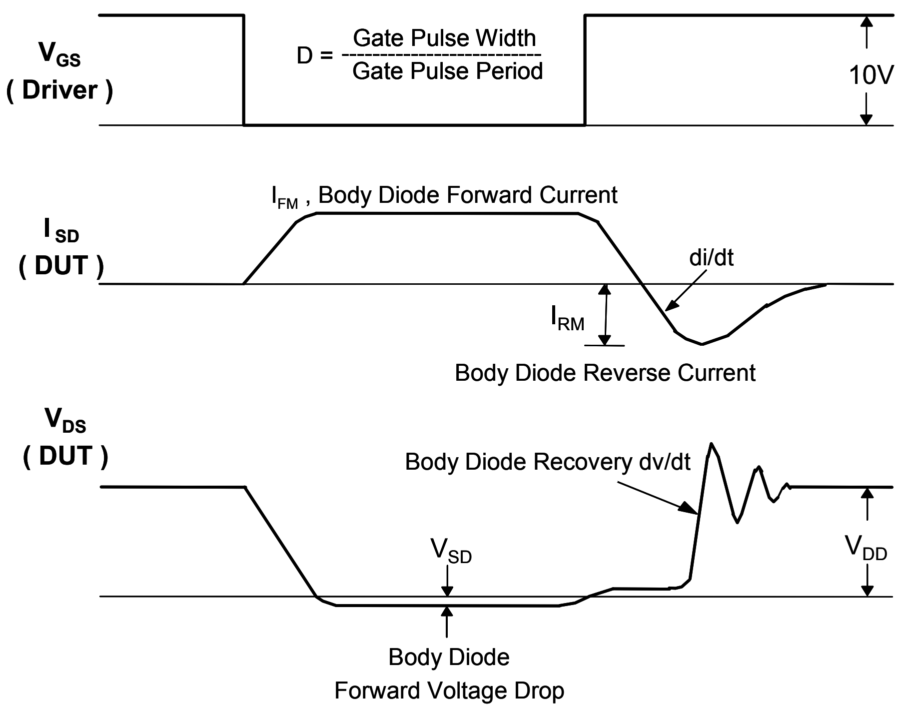


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms





Mechanical Dimensions

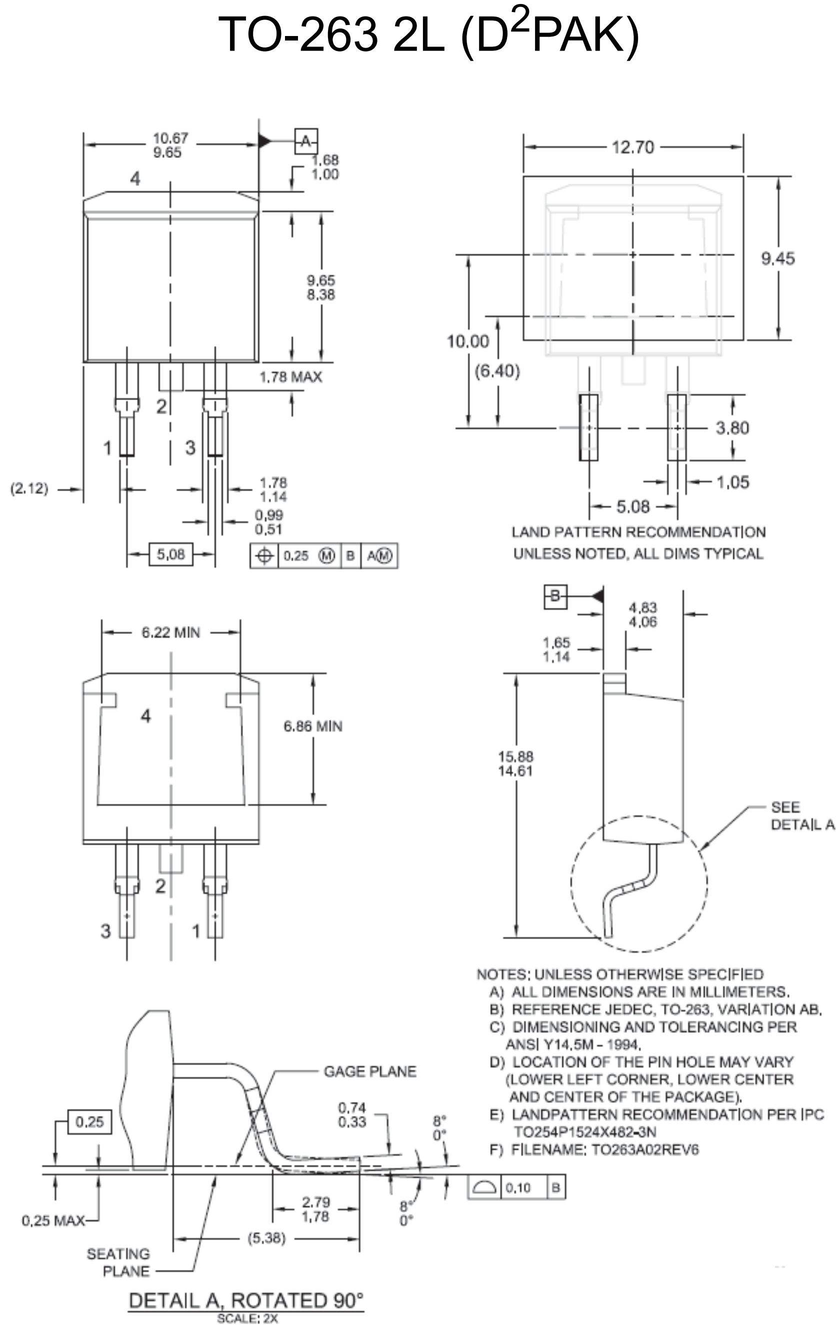


Figure 16. 2LD,TO263, Surface Mount

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Dimension in Millimeters

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Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
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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