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FCB20N60F

N-Channel SuperFET® FRFET® MOSFET

600 V, 20 A, 190 mΩ

Features

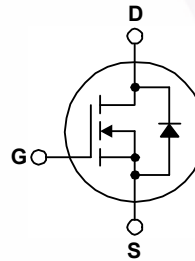
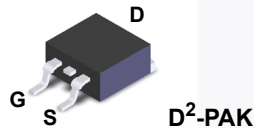
- 650 V @ $T_J = 150^\circ\text{C}$
- Typ. $R_{DS(on)} = 150\text{ m}\Omega$
- Ultra Low Gate Charge (Typ. $Q_g = 75\text{ nC}$)
- Low Effective Output Capacitance (Typ. $C_{oss,eff} = 165\text{ pF}$)
- 100% Avalanche Tested
- RoHS Compliant

Applications

- Lighting
- AC-DC Power Supply
- Solar Inverter

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 $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	FCB20N60FTM	Unit
V_{DSS}	Drain to Source Voltage	600	V
I_D	Drain Current	- Continuous ($T_C = 25^\circ\text{C}$)	20
		- Continuous ($T_C = 100^\circ\text{C}$)	12.5
I_{DM}	Drain Current	- Pulsed (Note 1)	60
V_{GSS}	Gate to Source Voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	690
I_{AR}	Avalanche Current	(Note 1)	20
E_{AR}	Repetitive Avalanche Energy	(Note 1)	20.8
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	50
P_D	Power Dissipation	($T_C = 25^\circ\text{C}$)	208
		- Derate above 25°C	1.67
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	FCB20N60FTM	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.6	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (minimum pad of 2 oz copper), Max.	62.5	
		Thermal Resistance, Junction to Ambient (1 in 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 $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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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
$\Delta\text{BV}_{\text{DSS}} / \Delta T_J$	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	
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 _{riss}	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	-	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		(Note 4)	-	65	140	ns
Q _{g(tot)}	Total Gate Charge at 10V		V _{DS} = 480 V, I _D = 20 A, V _{GS} = 10 V	-	75	98	nC
Q _{gs}	Gate to Source Gate Charge	(Note 4)	-	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	-	160	-	ns
Q _{rr}	Reverse Recovery Charge	dI _F /dt = 100 A/ μs	-	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} \leq 20 A, di/dt \leq 1200 A/ μs , V_{DD} \leq BV_{DSS}, Starting T_J = 25°C
4. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

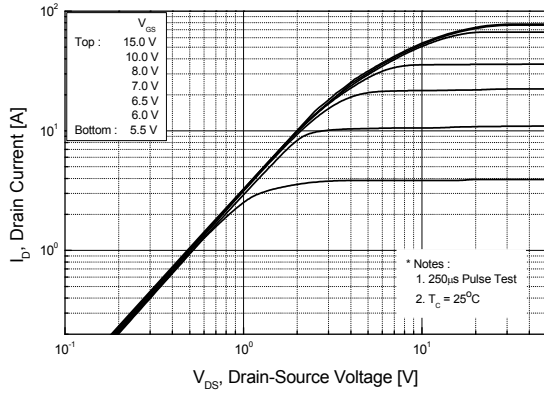


Figure 2. Transfer Characteristics

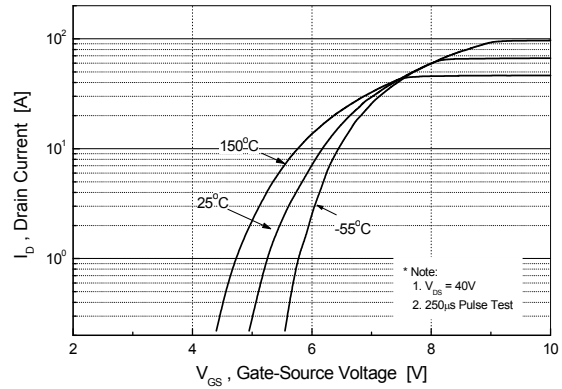


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

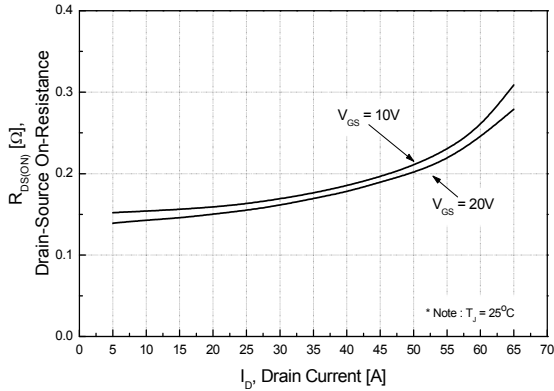


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

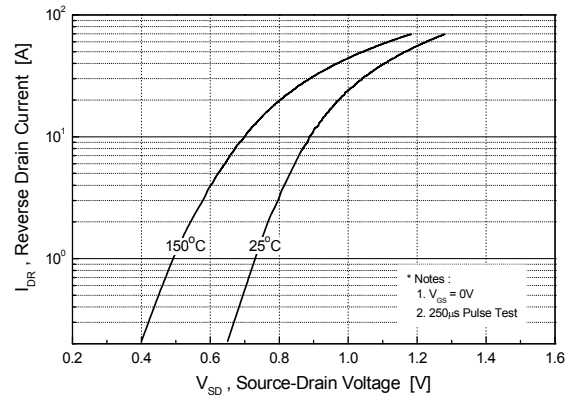


Figure 5. Capacitance Characteristics

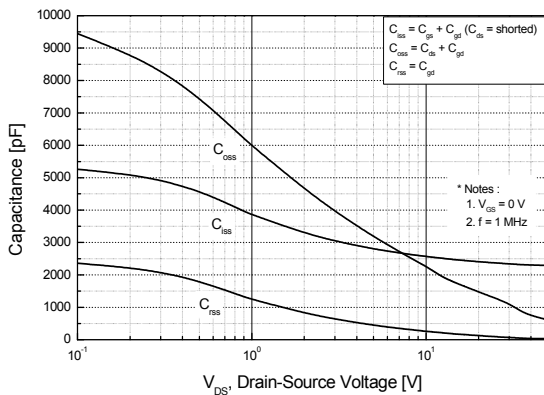
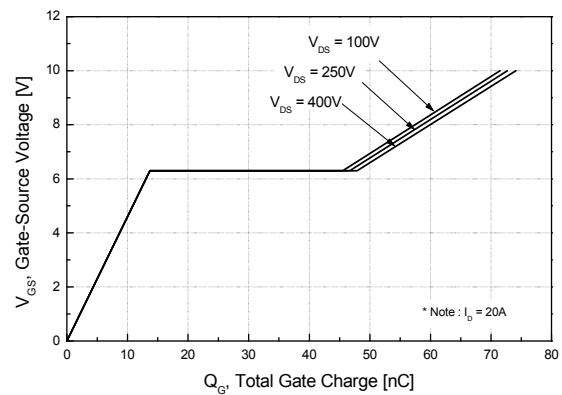


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

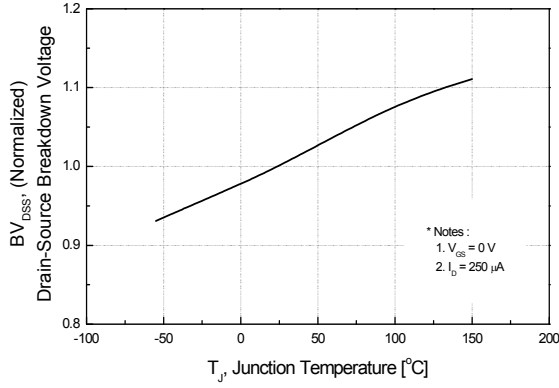


Figure 8. On-Resistance Variation vs. Temperature

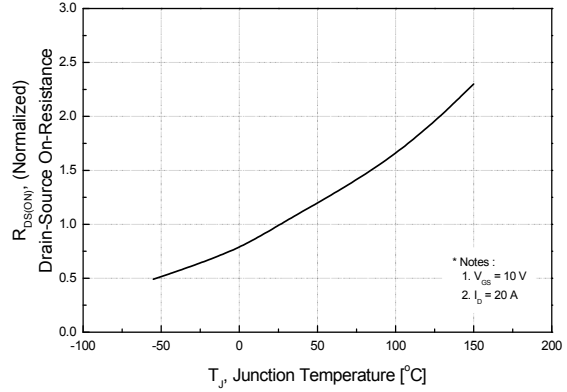


Figure 9. Maximum Safe Operating Area

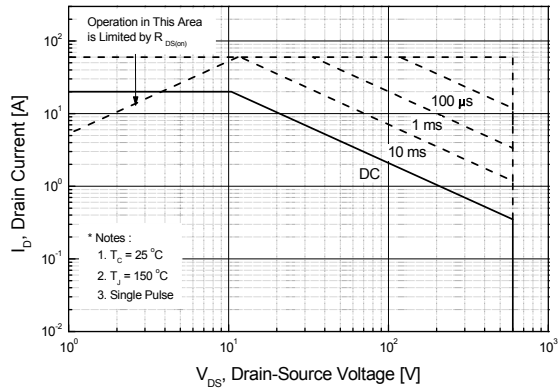


Figure 10. Maximum Drain Current vs. Case Temperature

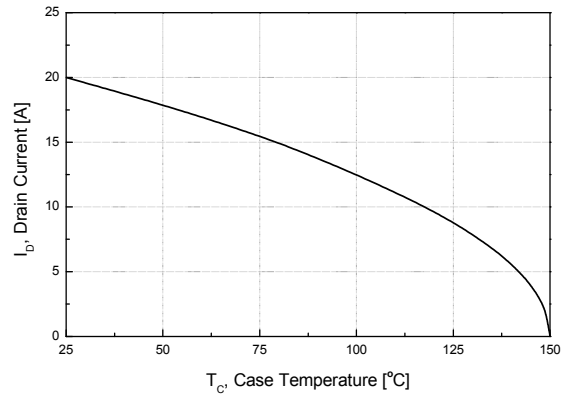


Figure 11. Transient Thermal Response Curve

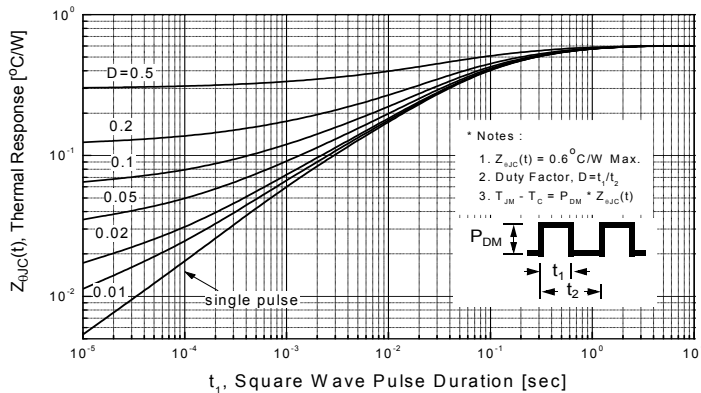


Figure 12. Gate Charge Test Circuit & Waveform

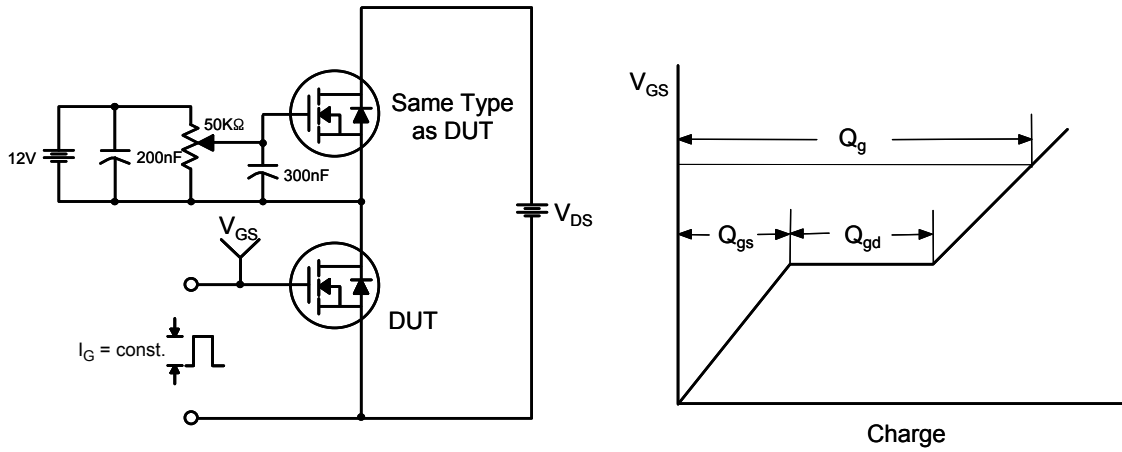


Figure 13. Resistive Switching Test Circuit & Waveforms



Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms



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



Mechanical Dimensions

TO-263 2L (D²PAK)

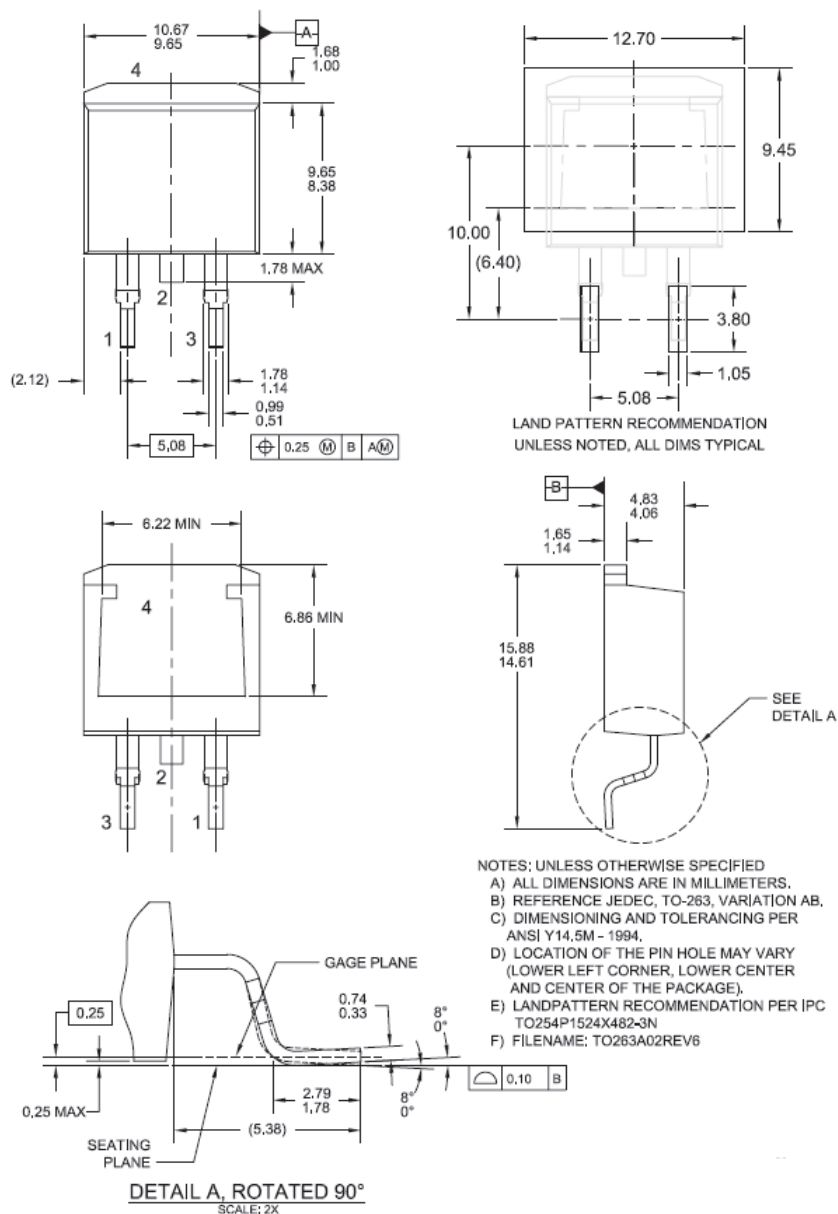


Figure 16. 2LD, TO263, Surface Mount

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Dimension in Millimeters



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