FAIRCHILD SEMICONDUCTOR®

May 2011

FDMA0104

Single N-Channel 1.5 V Specified PowerTrench® MOSFET

20 V, 9.4 A, 14.5 mΩ

Features

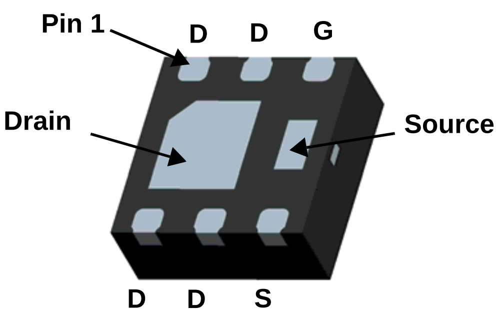
- Max $r_{DS(on)}$ = 14.5 mΩ at V_{GS} = 4.5 V, I_D = 9.4 A
- Max $r_{DS(on)}$ = 18.2 mΩ at V_{GS} = 2.5 V, I_D = 8.3 A
- Max $r_{DS(on)}$ = 23.3 mΩ at V_{GS} = 1.8 V, I_D = 7.3 A
- Max $r_{DS(on)}$ = 32.3 mΩ at V_{GS} = 1.5 V, I_D = 6.2 A
- Low Profile-0.8 mm maximum in the new package MicroFET 2x2 mm
- RoHS Compliant

General Description

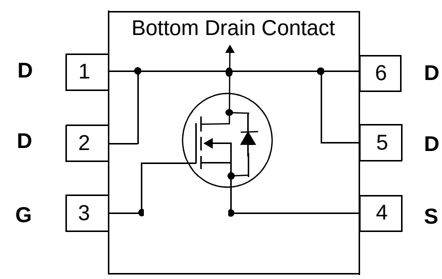
This Single N-Channel MOSFET has been designed using Fairchild Semiconductor's advanced Power Trench® process to optimize the $r_{DS(ON)}$ @ V_{GS} = 1.5 V on special MicroFET leadframe.

Applications

- Li-Ion Battery Pack
- DC-DC Buck Converters



MicroFET 2X2 (Bottom View)



MOSFET Maximum Ratings T_A = 25 °C unless otherwise noted

Symbol	Parameter	Ratings	Units
V_{DS}	Drain to Source Voltage	20	V
V_{GS}	Gate to Source Voltage	±8	V
I_D	-Continuous T_A = 25 °C (Note 1a)	9.4	A
	-Pulsed	54	
P_D	Power Dissipation T_A = 25 °C (Note 1a)	1.9	W
	Power Dissipation T_A = 25 °C (Note 1b)	0.7	
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to +150	°C

Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	65	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1b)	180	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
104	FDMA0104	MicroFET 2X2	7 ”	12 mm	3000 units

Electrical Characteristics T_J = 25 °C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units

Off Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 250 μA, V_{GS} = 0 V	20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, referenced to 25 °C		15		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 16 V, V_{GS} = 0 V			1	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±8 V, V_{DS} = 0 V			±100	nA

On Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, I_D = 250 μA	0.4	0.6	1.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = 250 μA, referenced to 25 °C		-3		mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 4.5 V, I_D = 9.4 A		11.3	14.5	mΩ
		V_{GS} = 2.5 V, I_D = 8.3 A		12.7	18.2	
		V_{GS} = 1.8 V, I_D = 7.3 A		15.0	23.3	
		V_{GS} = 1.5 V, I_D = 6.2 A		18.3	32.3	
		V_{GS} = 4.5 V, I_D = 9.4 A, T_J = 125 °C		14.7	18.3	
g_{FS}	Forward Transconductance	V_{DD} = 5 V, I_D = 9.4 A		56		S

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
C_{iss}	Input Capacitance	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz		1260	1680	pF
C_{oss}	Output Capacitance			180	240	pF
C_{rss}	Reverse Transfer Capacitance			122	185	pF
R_g	Gate Resistance			1.9		Ω

Switching Characteristics

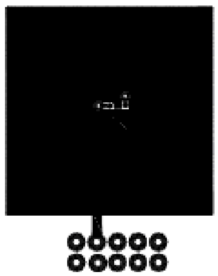
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 10 V, I_D = 9.4 A, V_{GS} = 4.5 V, R_{GEN} = 6 Ω		9	17	ns
t_r	Rise Time			6	11	ns
$t_{d(off)}$	Turn-Off Delay Time			37	58	ns
t_f	Fall Time			6	11	ns
Q_g	Total Gate Charge	V_{GS} = 0 V to 4.5 V; V_{DD} = 10 V, I_D = 9.4 A		17.5		nC
	Total Gate Charge	V_{GS} = 0 V to 2.5 V		10.0		nC
	Total Gate Charge	V_{GS} = 0 V to 1.8 V		7.4		nC
	Total Gate Charge	V_{GS} = 0 V to 1.5 V		6.2		nC
Q_{gs}	Gate to Source Charge			1.7		nC
Q_{gd}	Gate to Drain “Miller” Charge			2.7		nC

Drain-Source Diode Characteristics

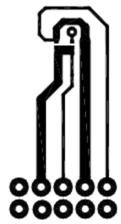
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
I_S	Maximum Continuous Drain-Source Diode Forward Current				2.0	A
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0 V, I_S = 2.0 A (Note 2)		0.63	1.2	V
t_{rr}	Reverse Recovery Time	I_F = 9.4 A, di/dt = 100 A/μs		16	29	ns
Q_{rr}	Reverse Recovery Charge			5	10	nC

NOTES:

1. $R_{\theta JA}$ is determined with the device mounted on a 1 in^2 pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR-4 material. $R_{\theta JC}$ is guaranteed by design while $R_{\theta JA}$ is determined by the user's board design.



a.65 °C/W when mounted on a 1 in^2 pad of 2 oz copper.



b. 180 °C/W when mounted on a minimum pad of 2 oz copper.

2. Pulse Test: Pulse Width < 300 μs, Duty cycle < 2.0%.

Typical Characteristics T_J = 25 °C unless otherwise noted

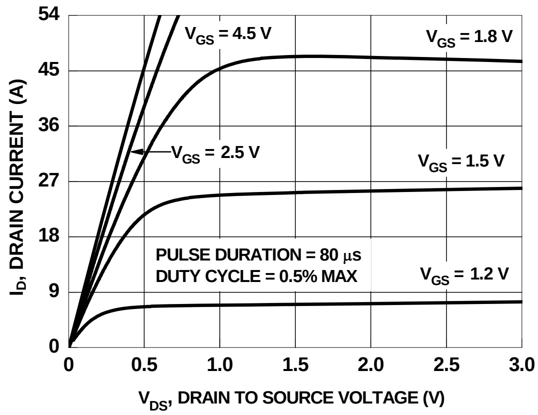


Figure 1. On Region Characteristics

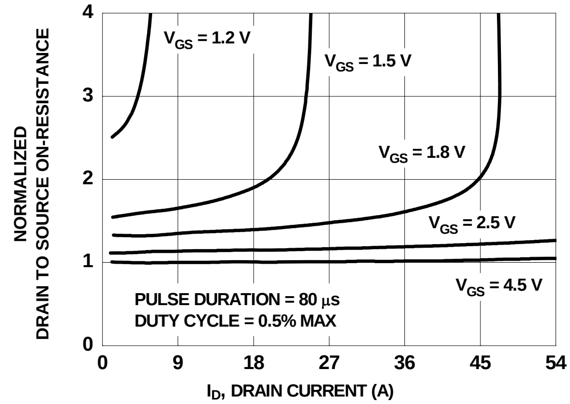


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

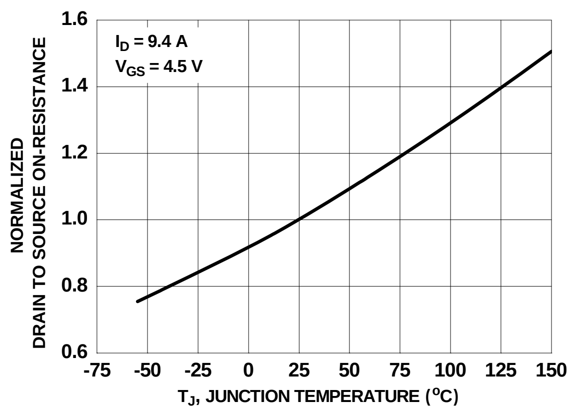


Figure 3. Normalized On Resistance vs Junction Temperature

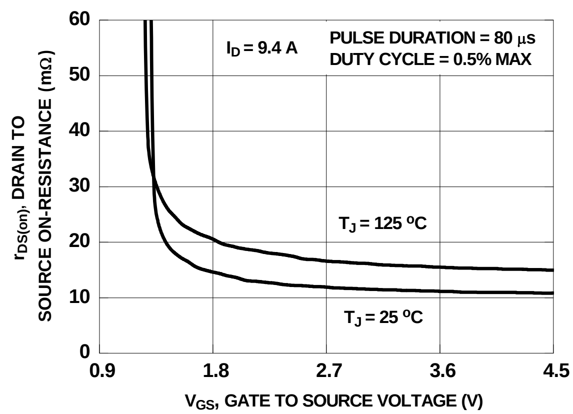


Figure 4. On-Resistance vs Gate to Source Voltage

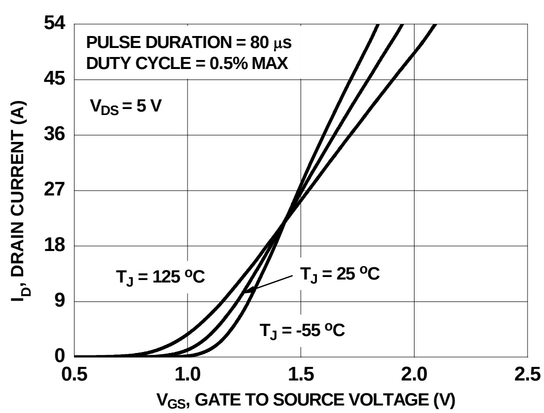


Figure 5. Transfer Characteristics

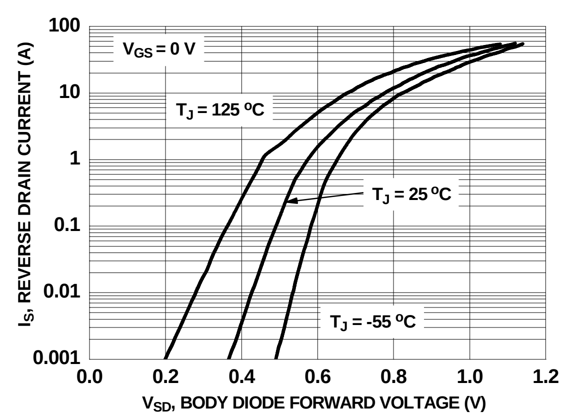


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics T_J = 25 °C unless otherwise noted

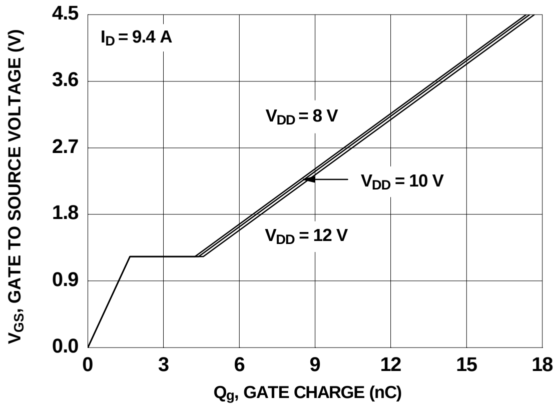


Figure 7. Gate Charge Characteristics

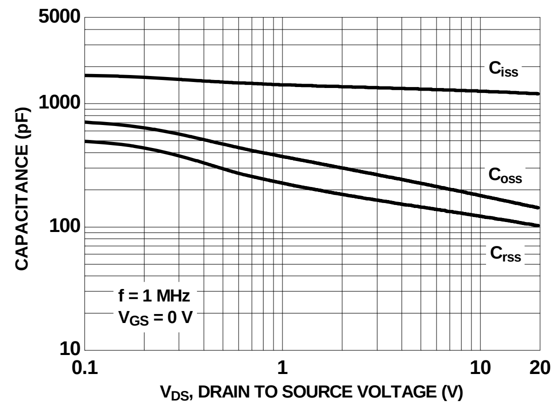


Figure 8. Capacitance vs Drain to Source Voltage

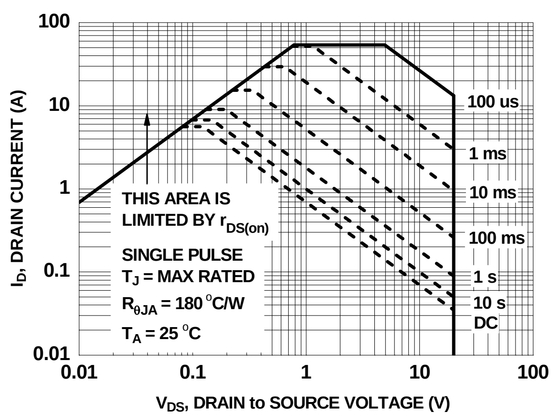


Figure 9. Forward Bias Safe Operating Area

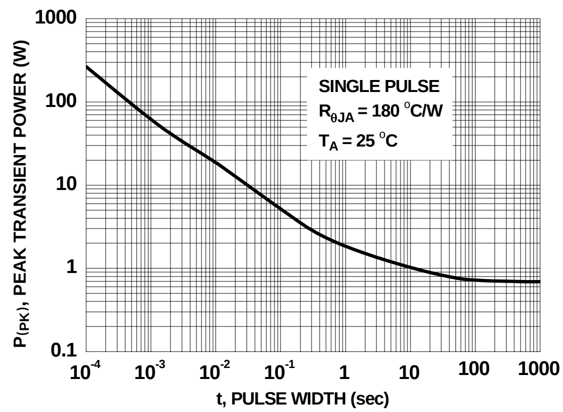


Figure 10. Single Pulse Maximum Power Dissipation

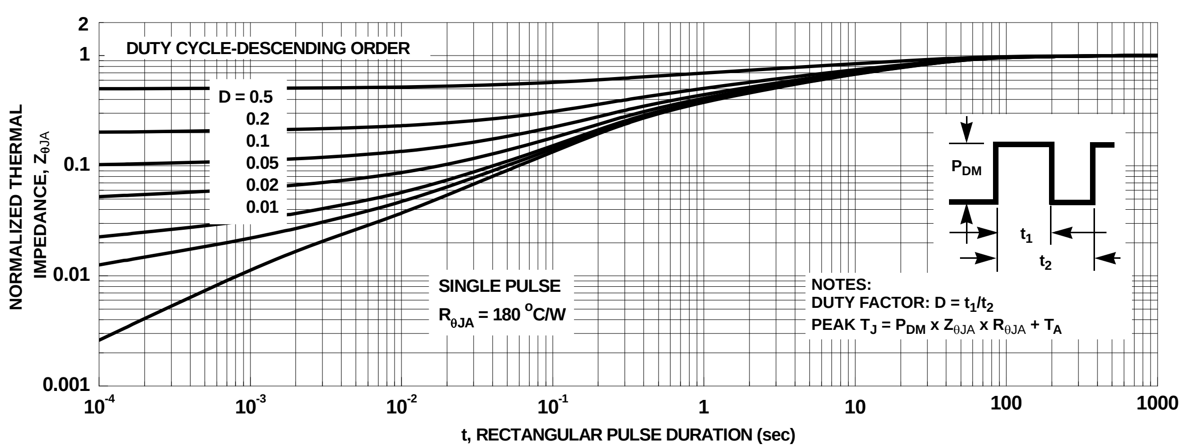
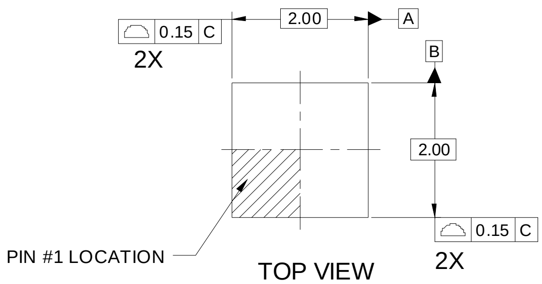
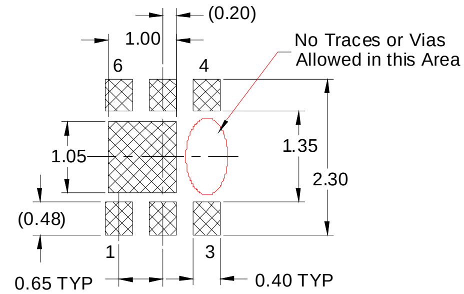


Figure 11. Junction-to-Ambient Transient Thermal Response Curve

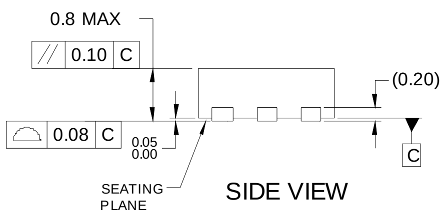
Dimensional Outline and Pad Layout



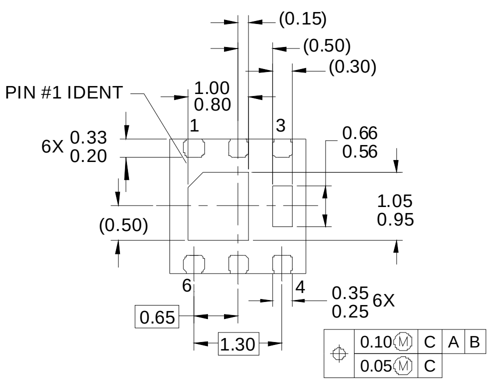
TOP VIEW



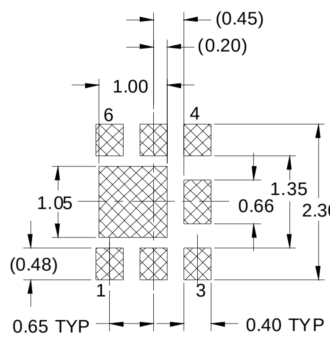
RECOMMENDED LAND PATTERN OPT 1



SIDE VIEW



BOTTOM VIEW



RECOMMENDED LAND PATTERN OPT 2

NOTES:

A. DOES NOT FULLY CONFORM TO JEDEC REGISTRATION MO-229 DATED AUG/2003

B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994

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Rev. I54