FAIRCHILD

July 2014

FDFMA2P857

Integrated P-Channel PowerTrench® MOSFET and Schottky Diode

–20V, –3.0A, 120mΩ

Features

MOSFET:

- Max $r_{DS(on)}$ = 120mΩ at V_{GS} = –4.5V, I_D = –3.0A
- Max $r_{DS(on)}$ = 160mΩ at V_{GS} = –2.5V, I_D = –2.5A
- Max $r_{DS(on)}$ = 240mΩ at V_{GS} = –1.8V, I_D = –1.0A

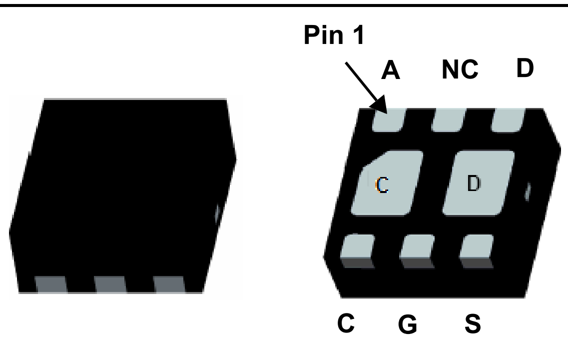
Schottky:

- V_F < 0.54V @ 1A
- Low profile - 0.8 mm maximum - in the new package MicroFET 2x2 mm
- RoHS Compliant

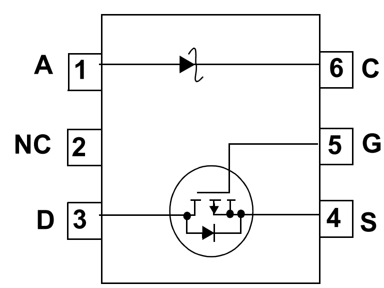
General Description

This device is designed specifically as a single package solution for the battery charge switch in cellular handset and other ultra-portable applications. It features a MOSFET with low on-state resistance and an independently connected low forward voltage schottky diode for minimum conduction losses.

The MicroFET 2x2 package offers exceptional thermal performance for it's physical size and is well suited to linear mode applications.



MicroFET 2x2



MOSFET Maximum Ratings T_A = 25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DSS}	Drain to Source Voltage		20	V
V_{GSS}	Gate to Source Voltage		±8	V
I_D	Drain Current -Continuous	(Note 1a)	–3	A
	-Pulsed		–6	
P_D	Power Dissipation	(Note 1a)	1.4	W
	Power Dissipation	(Note 1b)	0.7	
T_J, T_{STG}	Operating and Storage Junction Temperature Range		–55 to +150	°C
V_{RRM}	Schottky Repetitive Peak Reverse Voltage		30	V
I_O	Schottky Average Forward Current		1	A

Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	(Note 1a)	86	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	(Note 1b)	173	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	(Note 1c)	86	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	(Note 1d)	140	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
.857	FDFMA2P857	MicroFET 2x2	7''	8mm	3000 units

Electrical Characteristics T_J = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = –250μA, V_{GS} = 0V	–20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = –250μA, referenced to 25°C		–12		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = –16V, V_{GS} = 0V			–1	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±8V, V_{DS} = 0V			±100	nA
On Characteristics						
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = –250μA	–0.4	–0.7	–1.3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = –250μA, referenced to 25°C		2		mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = –4.5V, I_D = –3.0A		90	120	mΩ
		V_{GS} = –2.5V, I_D = –2.5A		120	160	
		V_{GS} = –1.8V, I_D = –1.0A		172	240	
		V_{GS} = –4.5V, I_D = –3.0A, T_J = 125°C		118	160	
g_{FS}	Forward Transconductance	V_{DS} = –5V, I_D = –3.0A		7		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = –10V, V_{GS} = 0V, f = 1.0MHz		435		pF
C_{oss}	Output Capacitance			80		pF
C_{rss}	Reverse Transfer Capacitance			45		pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = –10V, I_D = –1A V_{GS} = –4.5V, R_{GEN} = 6Ω		9	18	ns
t_r	Rise Time			11	19	ns
$t_{d(off)}$	Turn-Off Delay Time			15	27	ns
t_f	Fall Time			6	12	ns
$Q_{g(TOT)}$	Total Gate Charge	V_{DS} = –10V I_D = –3.0A V_{GS} = –4.5V		4	6	nC
Q_{gs}	Gate to Source Gate Charge			0.8		nC
Q_{gd}	Gate to Drain “Miller” Charge			0.9		nC
Drain-Source Diode Characteristics						
I_S	Maximum Continuous Drain-Source Diode Forward Current				–1.1	A
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0V, I_S = –1.1A (Note 2)		–0.8	–1.2	V
t_{rr}	Reverse Recovery Time	I_F = –3.0A, di/dt = 100A/μs		17		ns
Q_{rr}	Reverse Recovery Charge			6		nC

Schottky Diode Characteristics

I_R	Reverse Leakage	V_R = 10V	T_J = 25°C		0.5	4.5	μA
			T_J = 85°C		0.05	1.0	mA
			T_J = 125°C		0.6	8.4	mA
I_R	Reverse Leakage	V_R = 20V	T_J = 25°C		1.1	8.0	μA
			T_J = 85°C		0.09	1.6	mA
			T_J = 125°C		0.9	10	mA
V_F	Forward Voltage	I_F = 100mA	T_J = 25°C		0.37	0.40	V
			T_J = 85°C		0.29	0.35	V
			T_J = 125°C		0.23	0.29	V
V_F	Forward Voltage	I_F = 1A	T_J = 25°C		0.5	0.54	V
			T_J = 85°C		0.46	0.51	V
			T_J = 125°C		0.43	0.48	V

Electrical Characteristics T_A = 25°C unless otherwise noted

Notes:

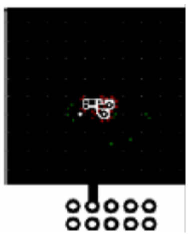
1: $R_{\theta JA}$ is determined with the device mounted on a 1in^2 oz. copper pad on a 1.5 x 1.5 in. board of FR-4 material. $R_{\theta JC}$ is guaranteed by design while $R_{\theta JA}$ is determined by the user's board design.

(a) MOSFET $R_{\theta JA}$ = 86°C/W when mounted on a 1in^2 pad of 2 oz copper, 1.5" x 1.5" x 0.062" thick PCB.

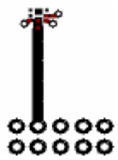
(b) MOSFET $R_{\theta JA}$ = 173°C/W when mounted on a minimum pad of 2 oz copper.

(c) Schottky $R_{\theta JA}$ = 86°C/W when mounted on a 1in^2 pad of 2 oz copper, 1.5" x 1.5" x 0.062" thick PCB.

(d) Schottky $R_{\theta JA}$ = 140°C/W when mounted on a minimum pad of 2 oz copper.

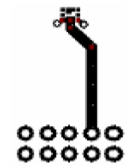


a)86°C/W when mounted on a 1in^2 pad of 2 oz copper.



b)173°C/W when mounted on a minimum pad of 2 oz copper.

c)86°C/W when mounted on a 1in^2 pad of 2 oz copper.



d)140°C/W when mounted on a minimum pad of 2 oz copper.

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

Typical Characteristics T_A = 25°C unless otherwise noted

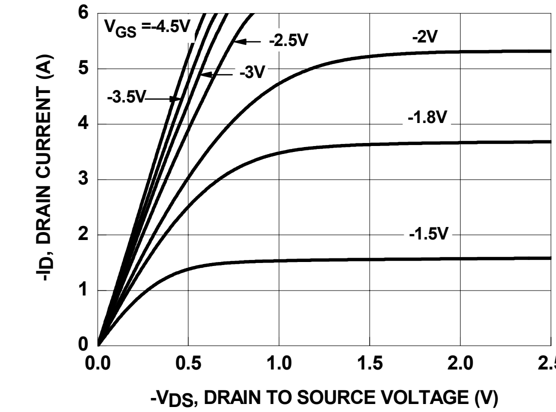


Figure 1. On-Region Characteristics

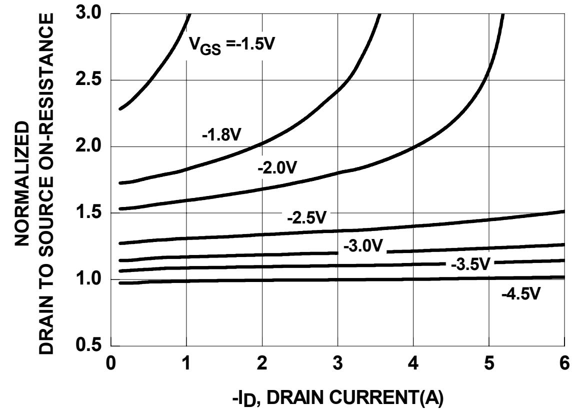


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

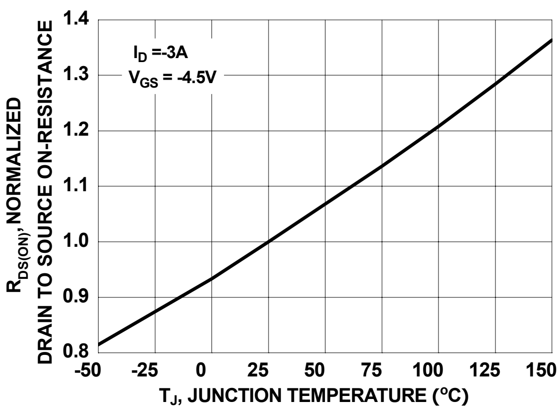


Figure 3. Normalized On-Resistance vs Junction Temperature

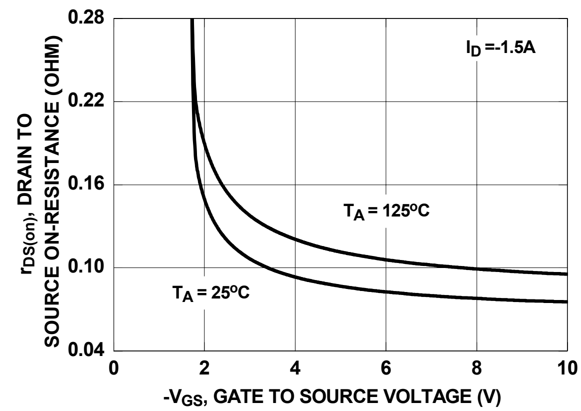


Figure 4. On-Resistance vs Gate to Source Voltage

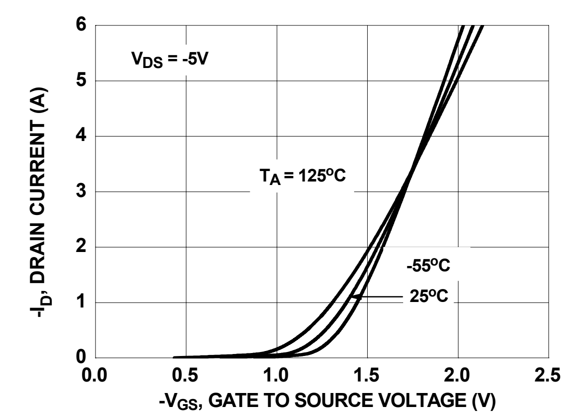


Figure 5. Transfer Characteristics

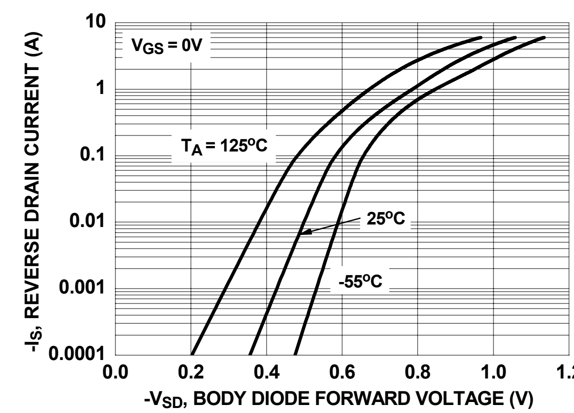


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics T_A = 25°C unless otherwise noted

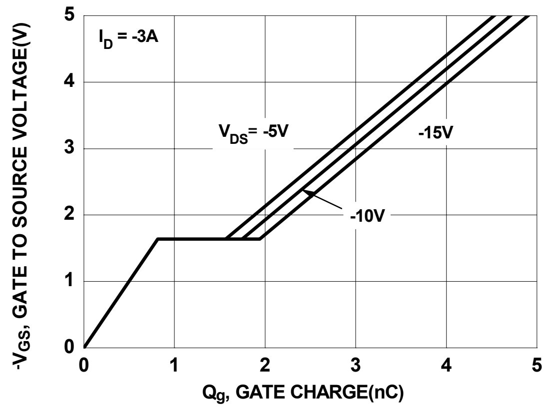


Figure 7. Gate Charge Characteristics

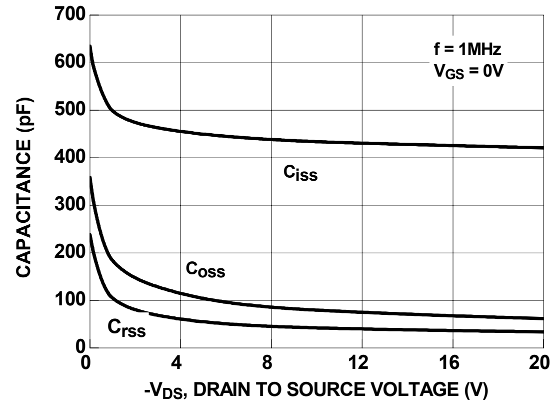


Figure 8. Capacitance Characteristics

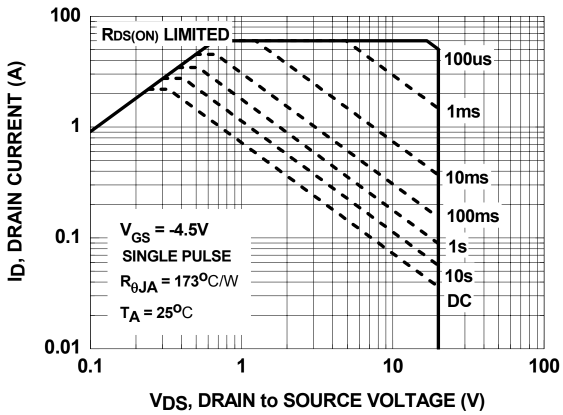


Figure 9. Forward Bias Safe Operating Area

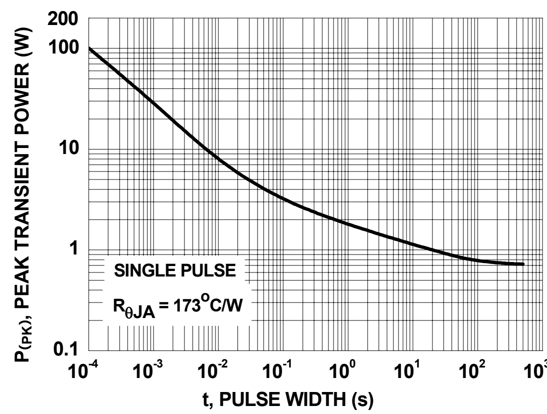


Figure 10. Single Pulse Maximum Power Dissipation

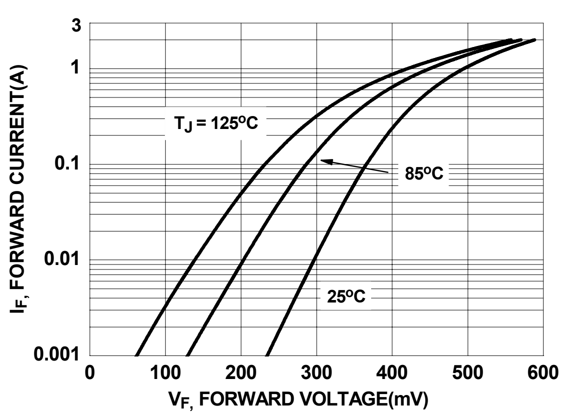


Figure 11. Schottky Diode Forward Current

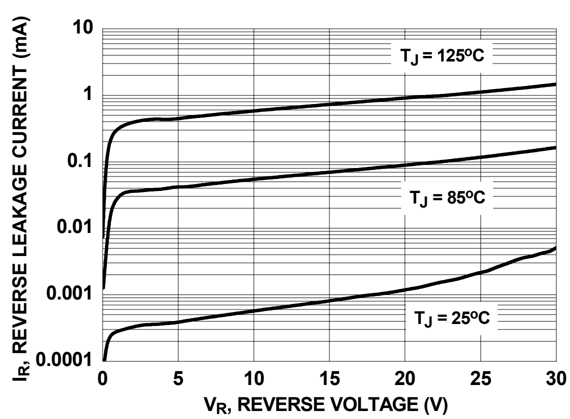


Figure 12. Schottky Diode Reverse Current

Typical Characteristics $T_A = 25°C$ unless otherwise noted

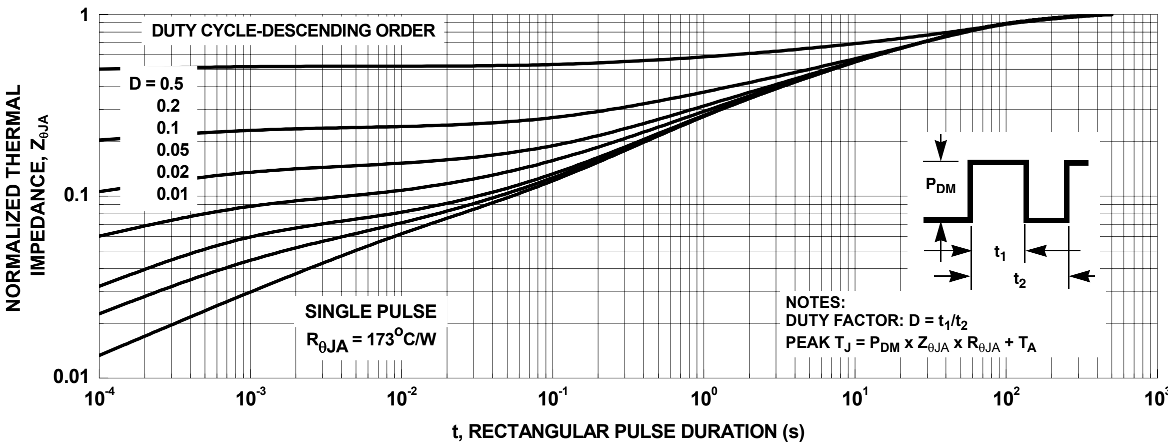
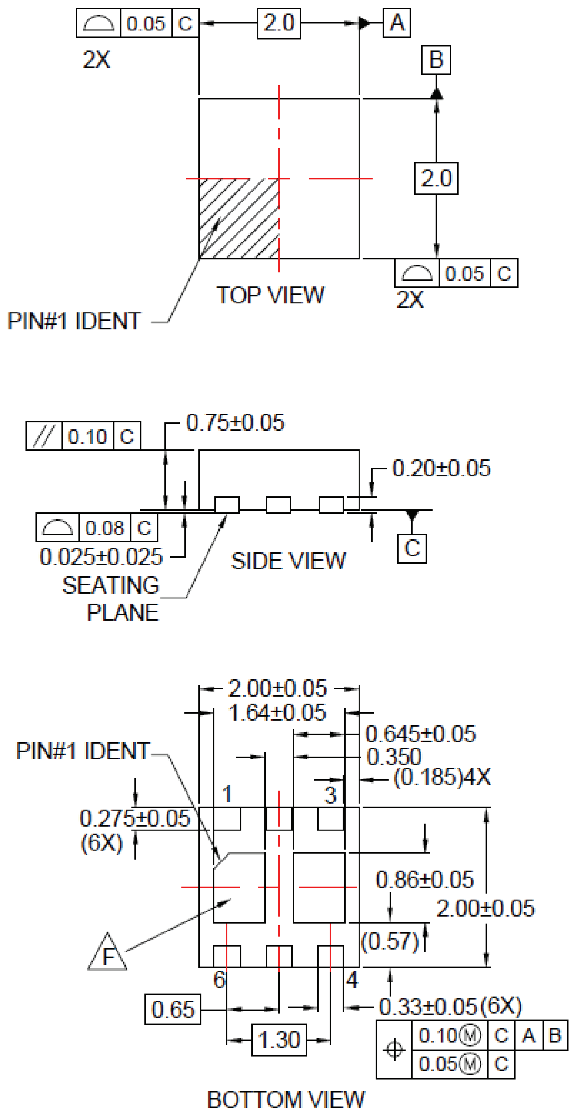
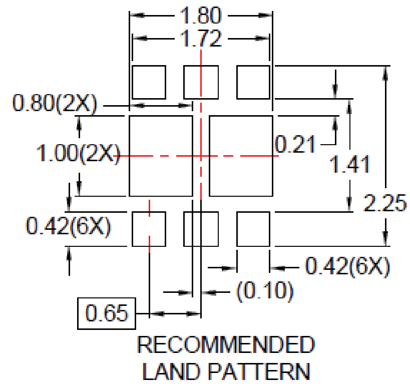


Figure 13. Transient Thermal Response Curve

Dimensional Outline and Pad Layout





NOTES:

A. CONFORM TO JADEC REGISTRATIONS MO-229, VARIATION VCCC, EXCEPT WHERE NOTED.

B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.

D. LAND PATTERN RECOMMENDATION IS EXISTING INDUSTRY LAND PATTERN.

E. DRAWING FILENAME: MKT-UMLP16Erev4

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