

FDFMA2P859T

Integrated P-Channel PowerTrench® MOSFET and Schottky Diode

-20 V, -3.0 A, 120 mΩ

Features

MOSFET:

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

Schottky:

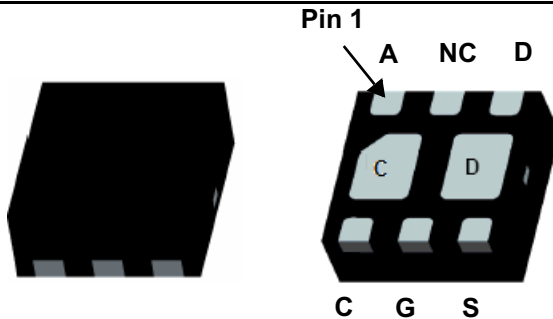
- $V_F < 0.54$ V @ 1 A
- Low profile - 0.55 mm maximum - in the new package MicroFET 2x2 Thin
- Free from halogenated compounds and antimony oxides
- RoHS compliant



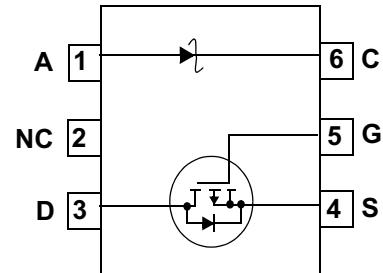
General Description

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 Thin package offers exceptional thermal performance for its physical size and is well suited to linear mode applications.



MicroFET 2x2 Thin



MOSFET Maximum Ratings $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Rated	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	$^\circ\text{C}$
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	$^\circ\text{C/W}$
$R_{\theta JA}$	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
59	FDFMA2P859T	MicroFET 2x2 Thin	7"	8 mm	3000 units

Electrical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = -250\text{ }\mu\text{A}$, $V_{GS} = 0\text{ V}$	-20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\text{ }\mu\text{A}$, referenced to $25\text{ }^\circ\text{C}$		-12		mV/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = -16\text{ V}$, $V_{GS} = 0\text{ V}$			-1	μA
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = \pm 8\text{ V}$, $V_{DS} = 0\text{ V}$			± 100	nA

On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = -250\text{ }\mu\text{A}$	-0.4	-0.7	-1.3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = -250\text{ }\mu\text{A}$, referenced to $25\text{ }^\circ\text{C}$		2		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = -4.5\text{ V}$, $I_D = -3.0\text{ A}$		90	120	m Ω
		$V_{GS} = -2.5\text{ V}$, $I_D = -2.5\text{ A}$		120	160	
		$V_{GS} = -1.8\text{ V}$, $I_D = -1.0\text{ A}$		172	240	
		$V_{GS} = -4.5\text{ V}$, $I_D = -3.0\text{ A}$ $T_J = 125\text{ }^\circ\text{C}$		118	160	
g_{FS}	Forward Transconductance	$V_{DS} = -5\text{ V}$, $I_D = -3.0\text{ A}$		7		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = -10\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1.0\text{ MHz}$		435		pF
C_{oss}	Output Capacitance			80		pF
C_{rss}	Reverse Transfer Capacitance			45		pF

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -10\text{ V}$, $I_D = -1.0\text{ A}$ $V_{GS} = -4.5\text{ V}$, $R_{GEN} = 6\text{ }\Omega$		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			4	6	nC
Q_{gs}	Gate to Source Gate Charge	$V_{DD} = -10\text{ V}$, $I_D = -3.0\text{ A}$ $V_{GS} = -4.5\text{ V}$		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	$V_{GS} = 0\text{ V}$, $I_S = -1.1\text{ A}$ (Note 2)		-0.8	-1.2	V
t_{rr}	Reverse Recovery Time	$I_F = -3.0\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$		17		ns
Q_{rr}	Reverse Recovery Charge			6		nC

Schottky Diode Characteristics

I_R	Reverse Leakage	$V_R = 10\text{ V}$	$T_J = 25\text{ }^\circ\text{C}$		0.3	1.0	μA
			$T_J = 85\text{ }^\circ\text{C}$		25	40	μA
			$T_J = 125\text{ }^\circ\text{C}$		0.28	0.37	mA
I_R	Reverse Leakage	$V_R = 20\text{ V}$	$T_J = 25\text{ }^\circ\text{C}$		1.0	2.5	μA
			$T_J = 85\text{ }^\circ\text{C}$		74	110	μA
			$T_J = 125\text{ }^\circ\text{C}$		0.73	1.00	mA
V_F	Forward Voltage	$I_F = 100\text{ mA}$	$T_J = 25\text{ }^\circ\text{C}$		0.40	0.41	V
			$T_J = 85\text{ }^\circ\text{C}$		0.31	0.33	V
			$T_J = 125\text{ }^\circ\text{C}$		0.26	0.27	V
V_F	Forward Voltage	$I_F = 1\text{ A}$	$T_J = 25\text{ }^\circ\text{C}$		0.52	0.54	V
			$T_J = 85\text{ }^\circ\text{C}$		0.45	0.47	V
			$T_J = 125\text{ }^\circ\text{C}$		0.41	0.43	V

Electrical Characteristics $T_A = 25\text{ }^\circ\text{C}$ unless otherwise noted

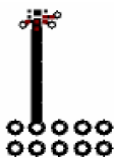
Notes:

1: $R_{\theta JA}$ is determined with the device mounted on a 1 in² oz. copper pad on a 1.5 x 1.5 in. board of FR-4 material. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.

- (a) MOSFET $R_{\theta JA} = 86\text{ }^\circ\text{C/W}$ when mounted on a 1 in² pad of 2 oz copper, 1.5" x 1.5" x 0.062" thick PCB.
- (b) MOSFET $R_{\theta JA} = 173\text{ }^\circ\text{C/W}$ when mounted on a minimum pad of 2 oz copper.
- (c) Schottky $R_{\theta JA} = 86\text{ }^\circ\text{C/W}$ when mounted on a 1 in² pad of 2 oz copper, 1.5" x 1.5" x 0.062" thick PCB.
- (d) Schottky $R_{\theta JA} = 140\text{ }^\circ\text{C/W}$ when mounted on a minimum pad of 2 oz copper.



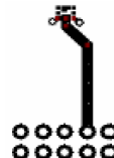
a) 86 °C/W when mounted on a 1 in² pad of 2 oz copper.



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



c) 86 °C/W when mounted on a 1 in² pad of 2 oz copper.



d) 140 °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 $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

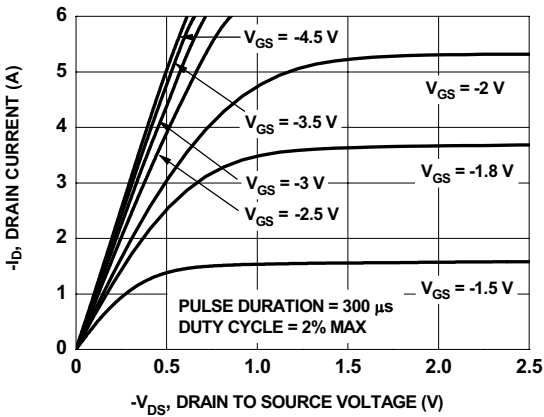


Figure 1. On-Region Characteristics

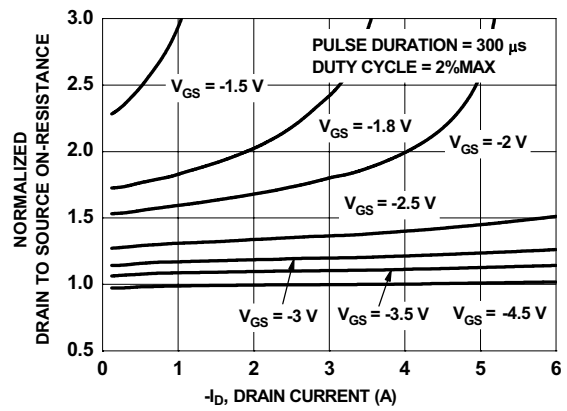


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

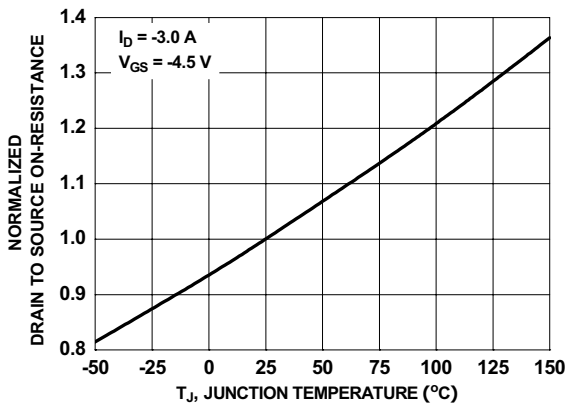


Figure 3. Normalized On-Resistance vs Junction Temperature

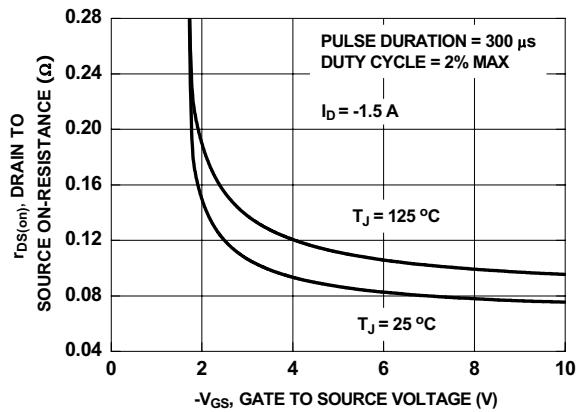


Figure 4. On-Resistance vs Gate to Source Voltage

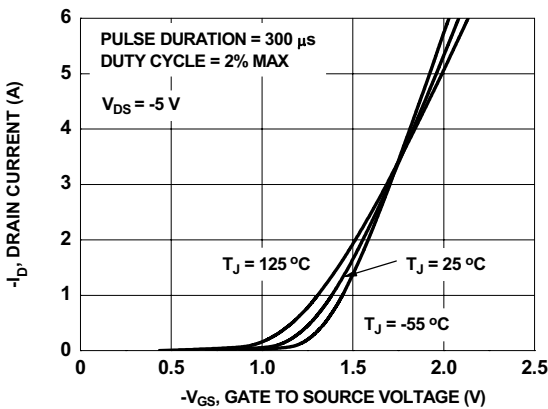


Figure 5. Transfer Characteristics

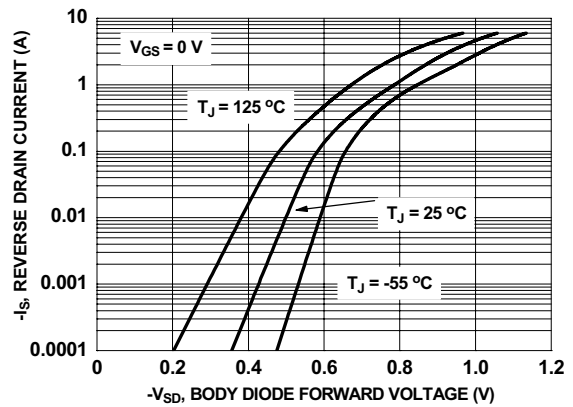


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted

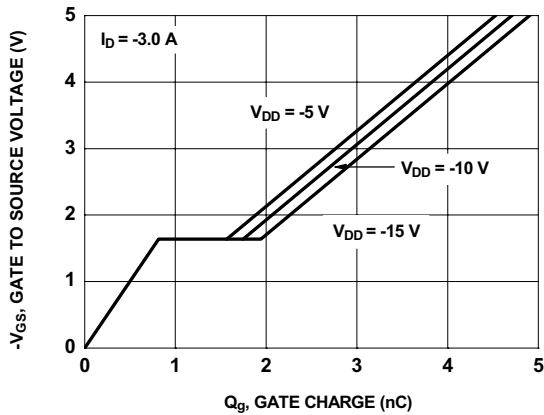


Figure 7. Gate Charge Characteristics

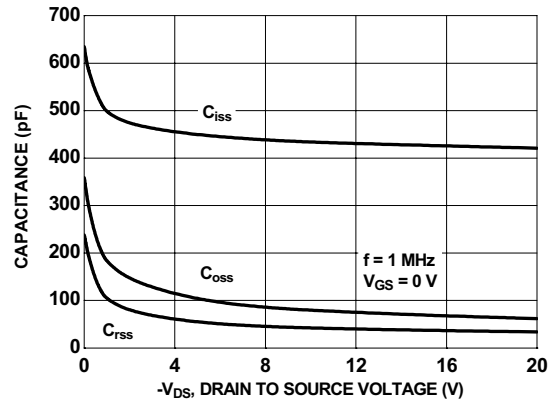


Figure 8. Capacitance vs Drain to Source Voltage

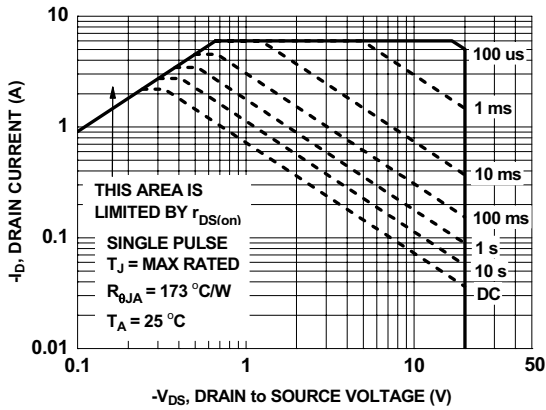


Figure 9. Forward Bias Safe Operating Area

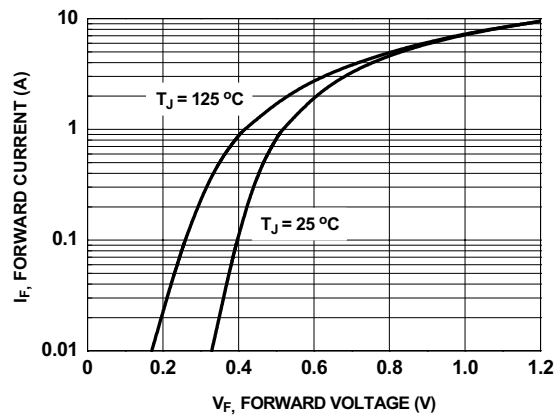


Figure 10. Schottky Diode Forward Voltage

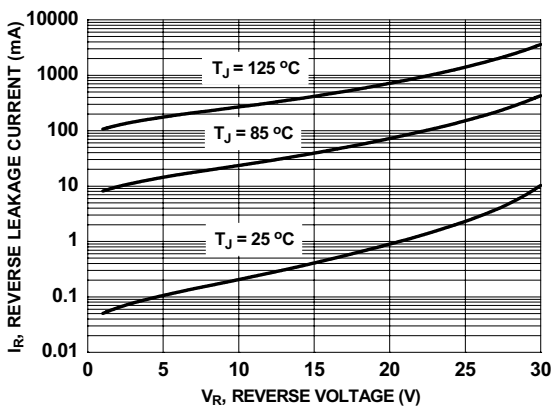


Figure 11. Schottky Diode Reverse Current

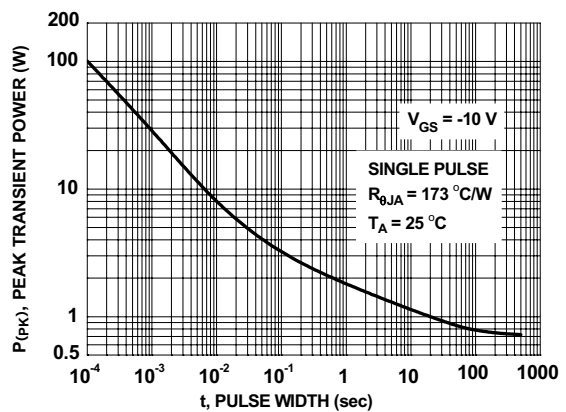


Figure 12. Single Pulse Maximum Power Dissipation

Typical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

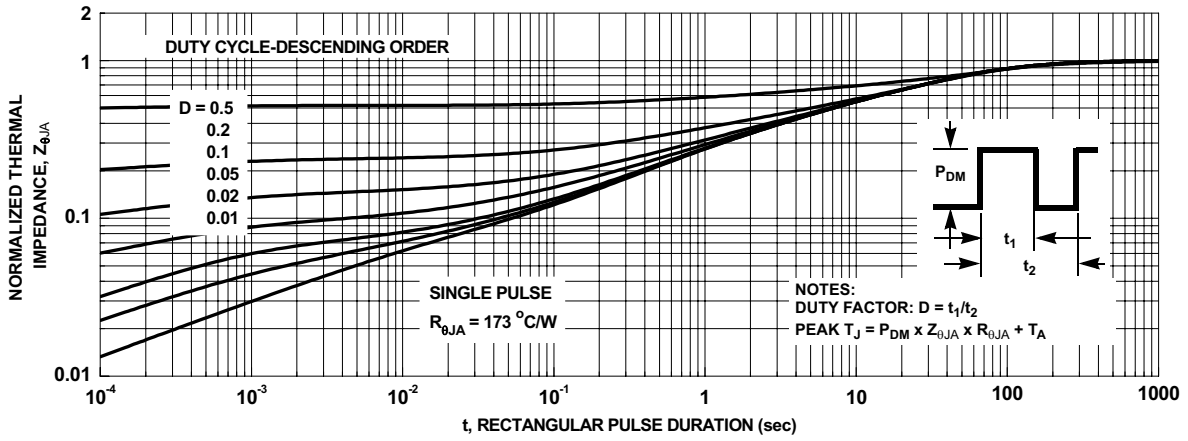
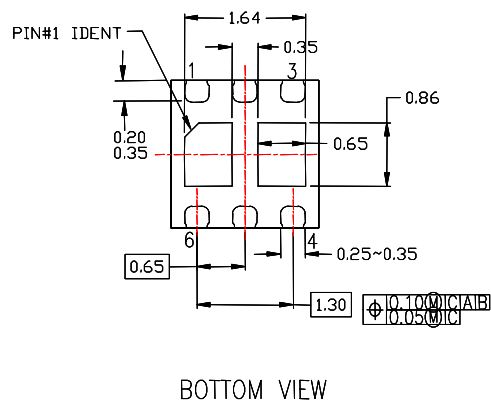
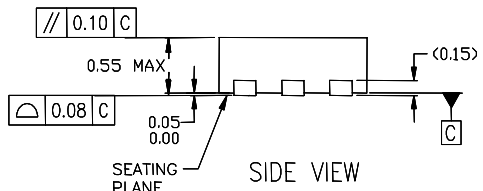
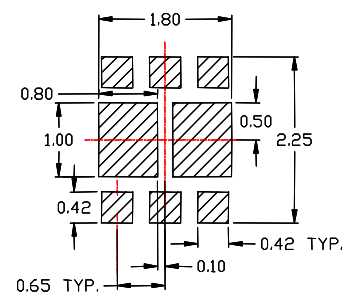
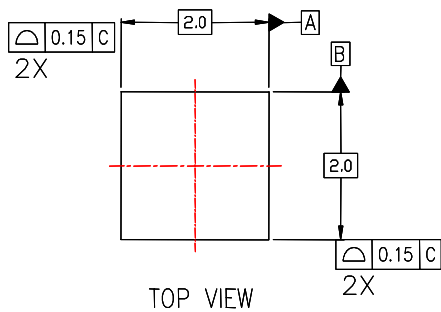


Figure 13. Junction to Ambient Transient Thermal Response Curve

Dimensional Outline and Pad Layout



NOTES:







- A. NON CONFORMS TO JEDEC REGISTRATION MO-288,
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994

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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.
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