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ON Semiconductor®

FDFMA2P029Z

Integrated P-Channel PowerTrench® MOSFET and Schottky Diode –20V, –3.1A, 95mΩ

Features

MOSFET

- Max $r_{DS(on)}$ = 95mΩ at $V_{GS} = -4.5V$, $I_D = -3.1A$
- Max $r_{DS(on)}$ = 141mΩ at $V_{GS} = -2.5V$, $I_D = -2.5A$
- HBM ESD protection level > 2.5kV (Note 3)

Schottky

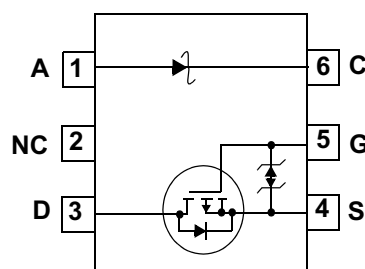
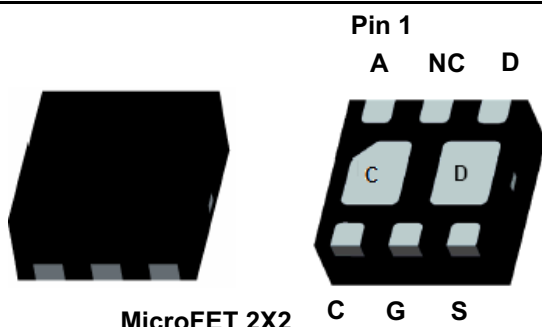
- $V_F < 0.37V$ @ 500mA
- Low profile - 0.8 mm maximum - in the new package MicroFET 2x2 mm
- RoHS Compliant



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 very low on-state resistance and an independently connected low forward voltage schottky diode allows for minimum conduction losses.

The MicroFET 2X2 package offers exceptional thermal performance for its physical size and is well suited to linear mode applications.



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

Symbol	Parameter	Ratings	Units
V_{DS}	Drain to Source Voltage	–20	V
V_{GS}	Gate to Source Voltage	±12	V
I_D	Drain Current -Continuous	–3.1	A
	-Pulsed	–6	
P_D	Power Dissipation	1.4	W
		0.7	
T_J, T_{STG}	Operating and Storage Junction Temperature Range	–55 to +150	°C
V_{RRM}	Schottky Repetitive Peak Reverse Voltage	20	V
I_O	Schottky Average Forward Current	2	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
.P29	FDFMA2P029Z	MicroFET 2X2	7"	8mm	3000 units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = -250\mu\text{A}$, $V_{GS} = 0\text{V}$	-20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\mu\text{A}$, referenced to 25°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	$V_{GS} = \pm 12\text{V}$, $V_{DS} = 0\text{V}$			± 10	μA

On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = -250\mu\text{A}$	-0.6	-1.0	-1.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = -250\mu\text{A}$, referenced to 25°C		4		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On-Resistance	$V_{GS} = -4.5\text{V}$, $I_D = -3.1\text{A}$		60	95	m Ω
		$V_{GS} = -2.5\text{V}$, $I_D = -2.5\text{A}$		88	141	
		$V_{GS} = -4.5\text{V}$, $I_D = -3.1\text{A}$, $T_J = 125^\circ\text{C}$		87	140	
g_{FS}	Forward Transconductance	$V_{DS} = -10\text{V}$, $I_D = -3.1\text{A}$		-11		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = -10\text{V}$, $V_{GS} = 0\text{V}$, $f = 1\text{MHz}$		540	720	pF
C_{oss}	Output Capacitance			120	160	pF
C_{rss}	Reverse Transfer Capacitance			100	150	pF

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -10\text{V}$, $I_D = -1\text{A}$ $V_{GS} = -4.5\text{V}$, $R_{GEN} = 6\Omega$		13	24	ns
t_r	Rise Time			11	20	ns
$t_{d(off)}$	Turn-Off Delay Time			37	59	ns
t_f	Fall Time			36	58	ns
$Q_{g(TOT)}$	Total Gate Charge	$V_{DD} = -10\text{V}$, $I_D = -3.1\text{A}$		7	10	nC
Q_{gs}	Gate to Source Gate Charge	$V_{GS} = -4.5\text{V}$		1.1		nC
Q_{gd}	Gate to Drain "Miller" Charge			2.4		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	$I_F = -3.1\text{A}$, $di/dt = 100\text{A}/\mu\text{s}$		25		ns
Q_{rr}	Reverse Recovery Charge			9		nC

Schottky Diode Characteristics

V_R	Reverse Voltage	$I_R = 1\text{mA}$	$T_J = 25^\circ\text{C}$	20			V
I_R	Reverse Leakage	$V_R = 20\text{V}$	$T_J = 25^\circ\text{C}$		30	300	μA
			$T_J = 125^\circ\text{C}$		10	45	mA
V_F	Forward Voltage	$I_F = 500\text{mA}$	$T_J = 25^\circ\text{C}$		0.32	0.37	V
			$T_J = 125^\circ\text{C}$		0.21	0.26	
		$I_F = 1\text{A}$	$T_J = 25^\circ\text{C}$		0.37	0.435	
			$T_J = 125^\circ\text{C}$		0.28	0.33	

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 $R_{\theta JA}$ is determined by the user's board design.

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

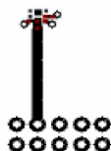
(b) MOSFET $R_{\theta JA} = 173^{\circ}\text{C/W}$ when mounted on a minimum pad of 2 oz copper

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

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



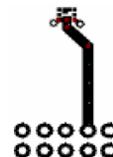
a) 86°C/W
when mounted
on a 1 in² pad of
2 oz copper.



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 < 300us, Duty Cycle < 2.0%

3. The diode connected between the gate and source serves only protection against ESD. No gate overvoltage rating is implied.

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

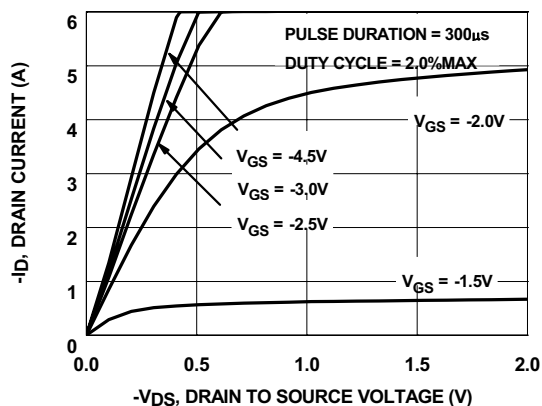


Figure 1. On Region Characteristics

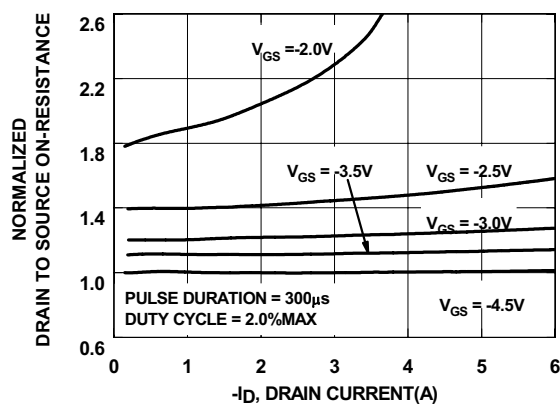


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

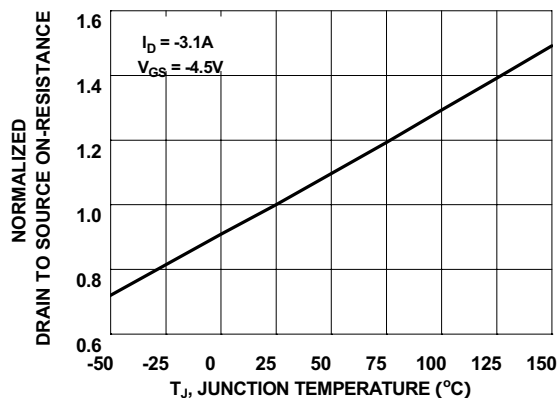


Figure 3. Normalized On-Resistance vs Junction Temperature

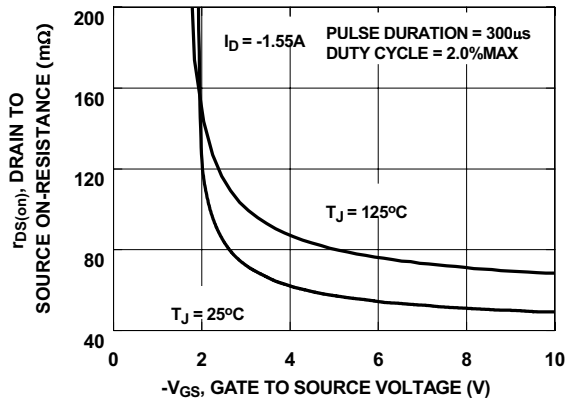


Figure 4. On-Resistance vs Gate to Source Voltage

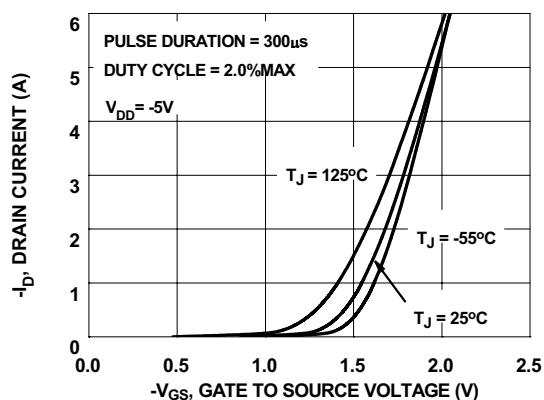


Figure 5. Transfer Characteristics

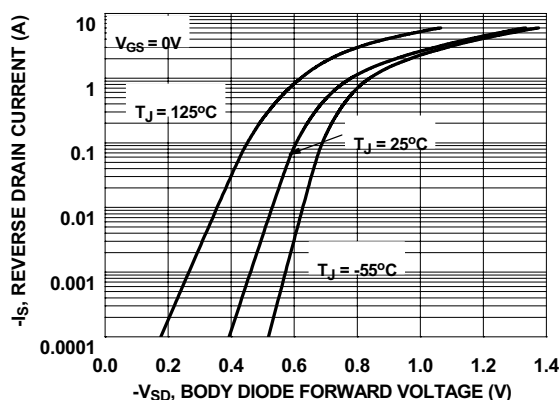


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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

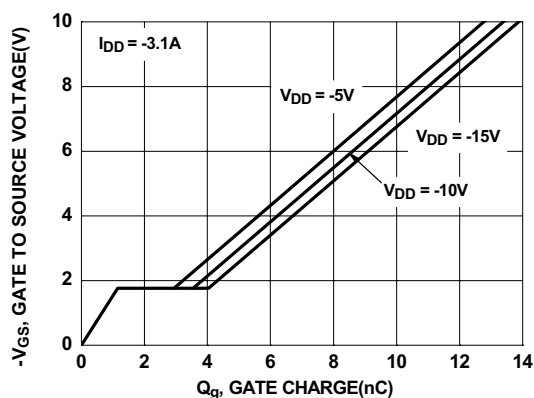


Figure 7. Gate Charge Characteristics

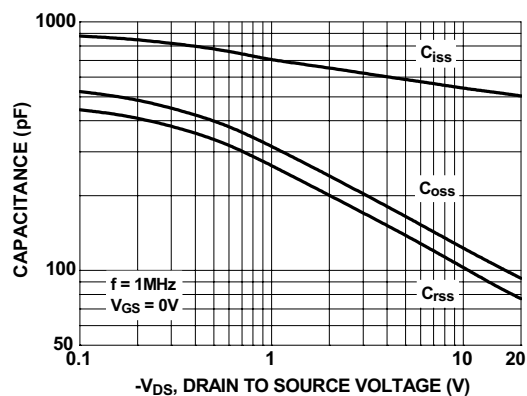


Figure 8. Capacitance Characteristics

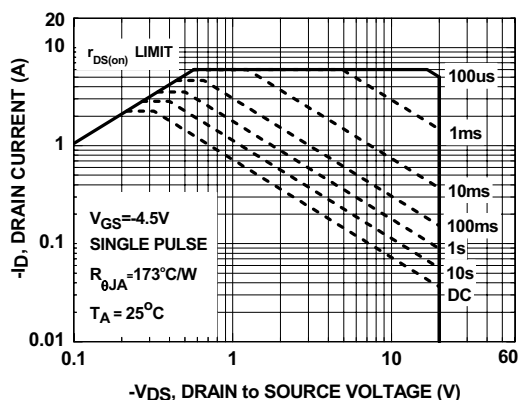


Figure 9. Forward Bias Safe Operating Area

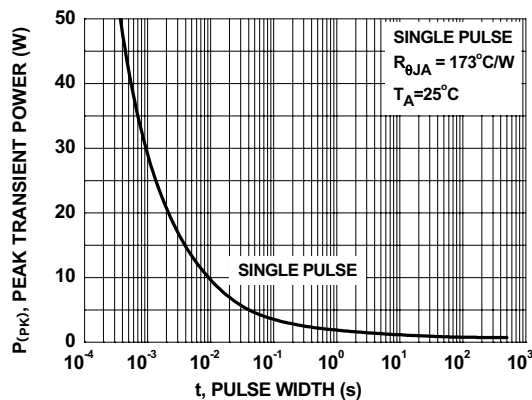


Figure 10. Single Pulse Maximum Power Dissipation

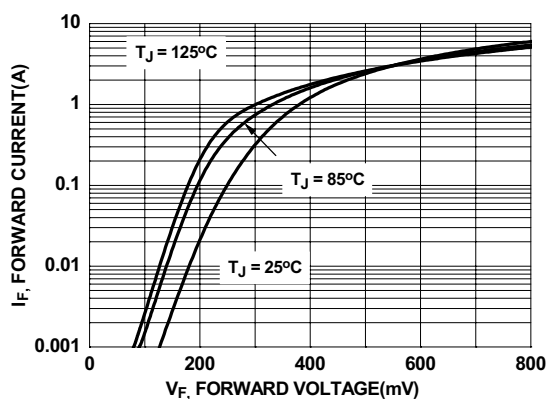


Figure 11. Schottky Diode Forward Voltage

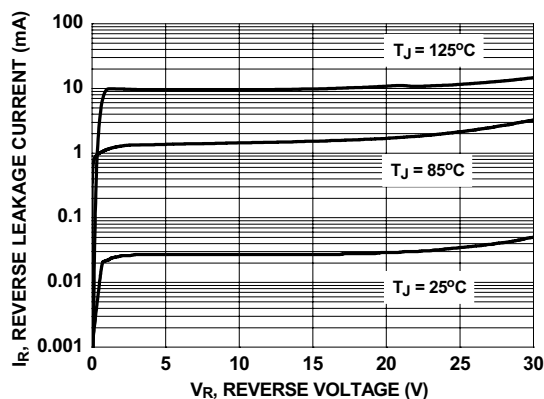


Figure 12. Schottky Diode Reverse Current

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

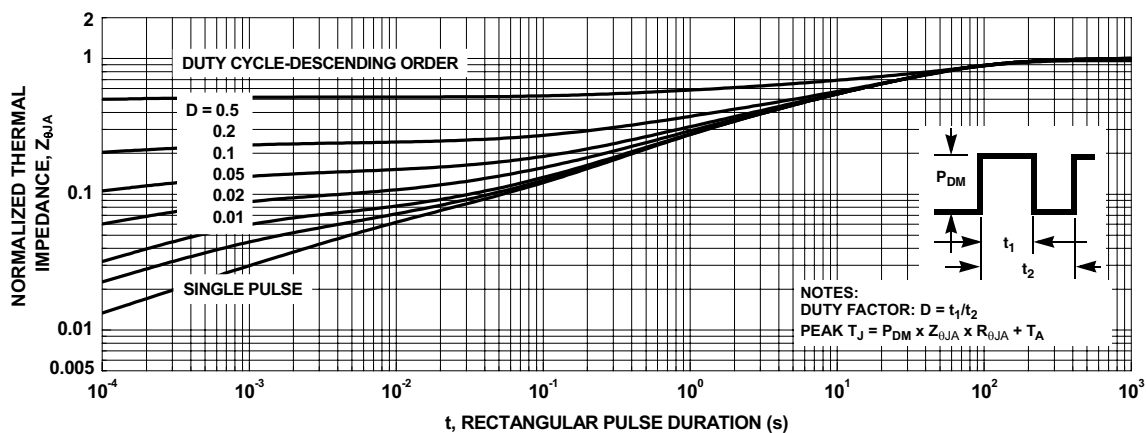
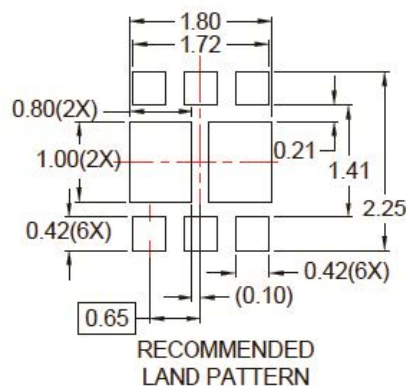
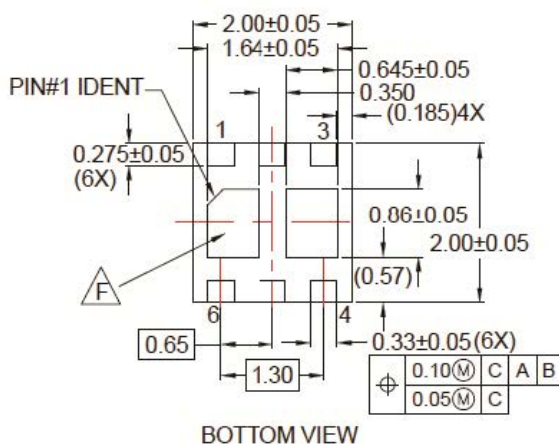
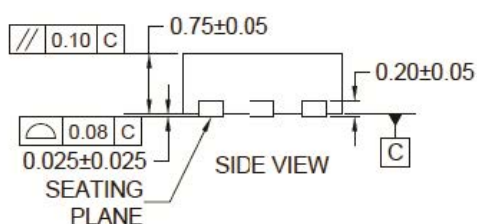
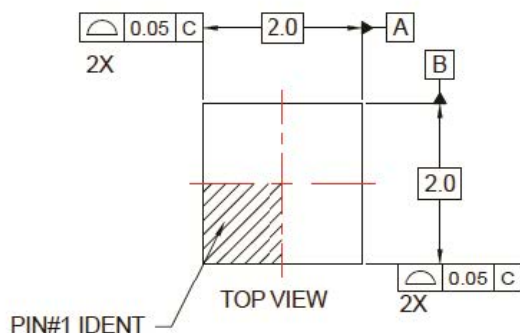


Figure 13. Transient Thermal Response Curve

Dimensional Outline and Pad Layout




NOTES:

- CONFORM TO JEDEC REGISTRATIONS MO-229, VARIATION VCCC, EXCEPT WHERE NOTED.
- DIMENSIONS ARE IN MILLIMETERS.
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