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ON Semiconductor®

# FDMA510PZ

## Single P-Channel PowerTrench® MOSFET

-20V, -7.8A, 30mΩ

### Features

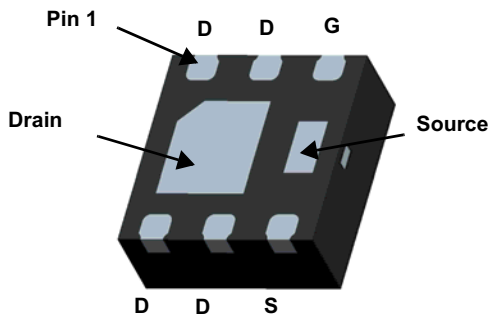
- Max  $r_{DS(on)}$  = 30mΩ at  $V_{GS} = -4.5V$ ,  $I_D = -7.8A$
- Max  $r_{DS(on)}$  = 37mΩ at  $V_{GS} = -2.5V$ ,  $I_D = -6.6A$
- Max  $r_{DS(on)}$  = 50mΩ at  $V_{GS} = -1.8V$ ,  $I_D = -5.5A$
- Max  $r_{DS(on)}$  = 90mΩ at  $V_{GS} = -1.5V$ ,  $I_D = -2.0A$
- Low profile - 0.8mm maximum - in the new package MicroFET 2X2 mm
- HBM ESD protection level > 3KV typical (Note 3)
- Free from halogenated compounds and antimony oxides
- RoHS Compliant



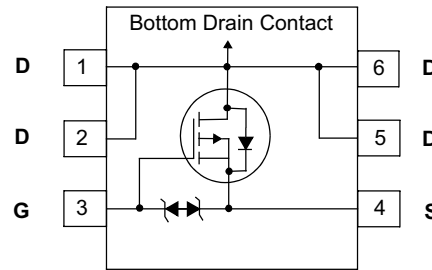
### General Description

This device is designed specifically for battery charge or load switching in cellular handset and other ultraportable applications. It features a MOSFET with low on-state resistance.

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



MicroFET 2X2 (Bottom View)



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

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain to Source Voltage	-20	V
$V_{GS}$	Gate to Source Voltage	±8	V
$I_D$	Drain Current -Continuous (Note 1a)	-7.8	A
	-Pulsed	-24	
$P_D$	Power Dissipation (Note 1a)	2.4	W
	Power Dissipation (Note 1b)	0.9	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	°C

### Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	52	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1b)	145	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
510	FDMA510PZ	MicroFET 2X2	7"	8mm	3000units

## 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 $25^\circ\text{C}$		-13		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -16\text{V}, V_{GS} = 0\text{V}$			-1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 8\text{V}, V_{DS} = 0\text{V}$			$\pm 10$	$\mu\text{A}$

### On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = -250\mu\text{A}$	-0.4	-0.7	-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 $25^\circ\text{C}$		3		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = -4.5\text{V}, I_D = -7.8\text{A}$		27	30	m $\Omega$
		$V_{GS} = -2.5\text{V}, I_D = -6.6\text{A}$		34	37	
		$V_{GS} = -1.8\text{V}, I_D = -5.5\text{A}$		46	50	
		$V_{GS} = -1.5\text{V}, I_D = -2.0\text{A}$		60	90	
		$V_{GS} = -4.5\text{V}, I_D = -7.8\text{A}, T_J = 125^\circ\text{C}$		36	40	
$g_{FS}$	Forward Transconductance	$V_{DD} = -5\text{V}, I_D = -7.8\text{A}$		26		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = -10\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$		1110	1480	pF
$C_{oss}$	Output Capacitance			205	275	pF
$C_{rss}$	Reverse Transfer Capacitance			185	280	pF

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -10\text{V}, I_D = -7.8\text{A}, V_{GS} = -4.5\text{V}, R_{GEN} = 6\Omega$		7	14	ns
$t_r$	Rise Time			9	18	ns
$t_{d(off)}$	Turn-Off Delay Time			125	200	ns
$t_f$	Fall Time			64	103	ns
$Q_g$	Total Gate Charge			19	27	nC
$Q_{gs}$	Gate to Source Charge	$V_{DD} = -5\text{V}, I_D = -7.8\text{A}, V_{GS} = -4.5\text{V}$		2.1		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			4.2		nC

### Drain-Source Diode Characteristics

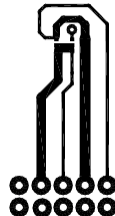
$I_S$	Maximum Continuous Drain-Source Diode Forward Current			-2	A	
$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{V}, I_S = -2\text{A}$		-0.8	-1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F = -7.8\text{A}, di/dt = 100\text{A}/\mu\text{s}$		66	106	ns
$Q_{rr}$	Reverse Recovery Charge			44	71	nC

#### Notes:

- $R_{\theta JA}$  is determined with the device mounted on a  $1\text{in}^2$  pad 2 oz copper pad on a  $1.5 \times 1.5\text{in.}$  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.  $52^\circ\text{C}/\text{W}$  when mounted on a  $1\text{in}^2$  pad of 2 oz copper.

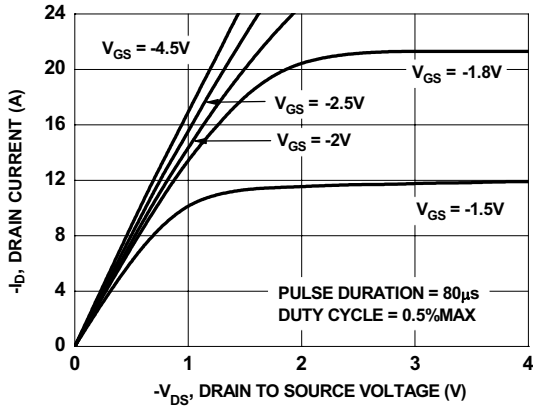


b.  $145^\circ\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper.

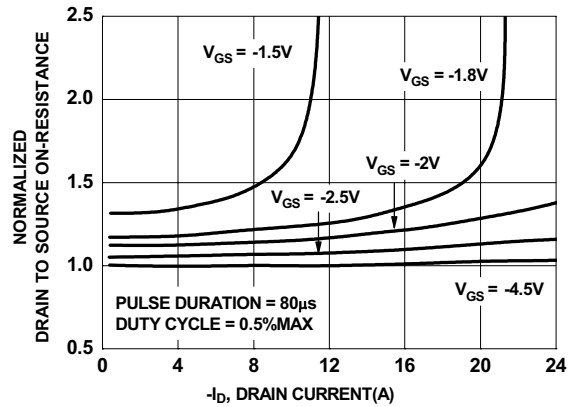
- Pulse Test: Pulse Width  $< 300\mu\text{s}$ , Duty cycle  $< 2.0\%$ .

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

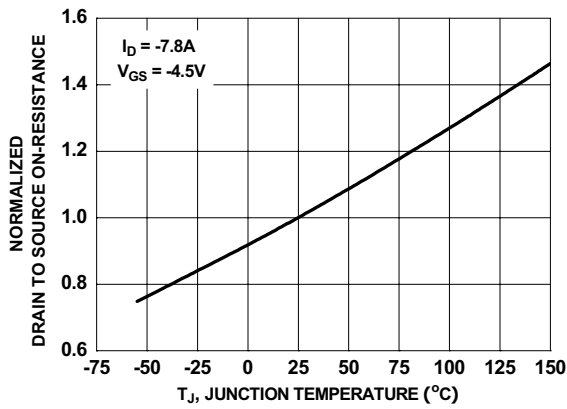
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



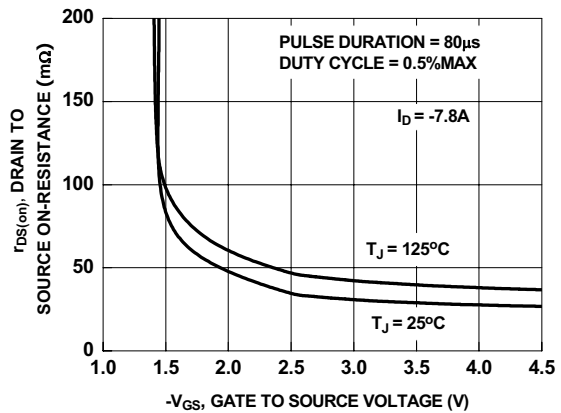
**Figure 1. On-Region Characteristics**



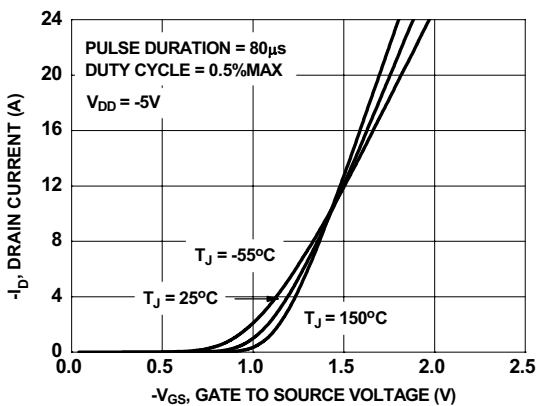
**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**



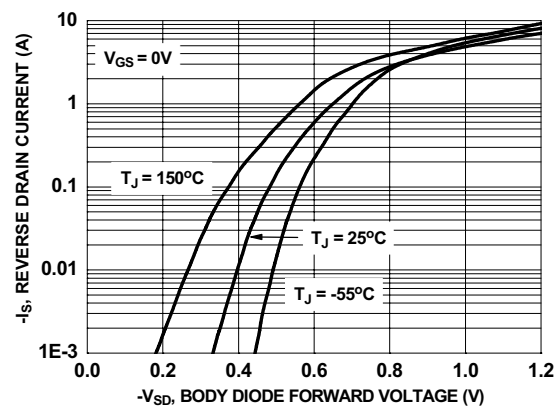
**Figure 3. Normalized On-Resistance vs Junction Temperature**



**Figure 4. On-Resistance vs Gate to Source Voltage**

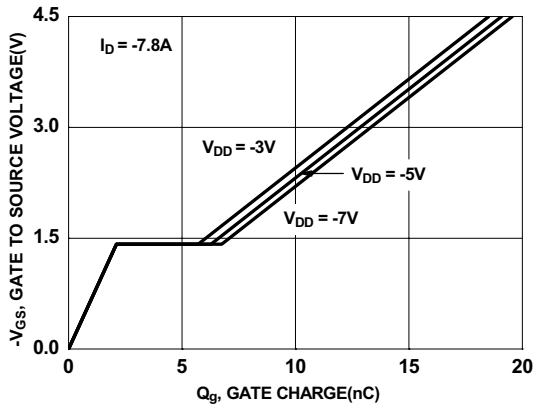


**Figure 5. Transfer Characteristics**

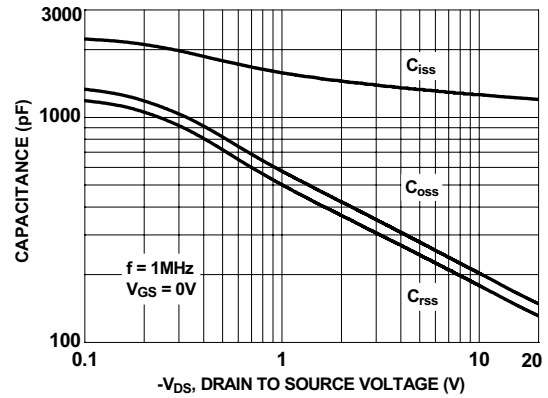


**Figure 6. Source to Drain Diode Forward Voltage vs Source Current**

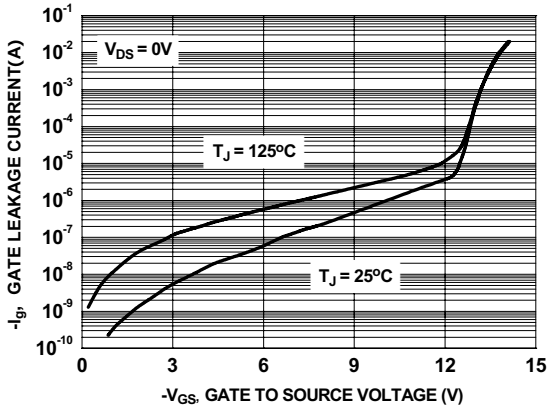
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



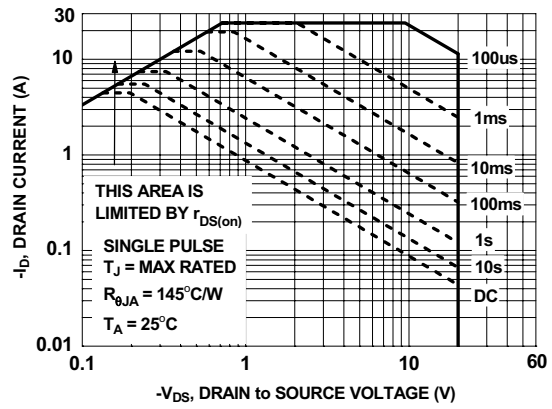
**Figure 7. Gate Charge Characteristics**



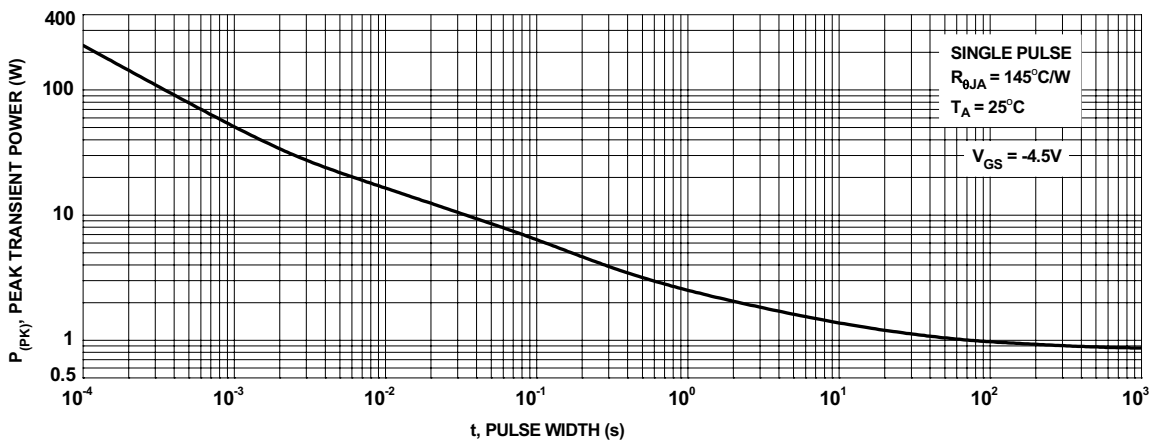
**Figure 8. Capacitance vs Drain to Source Voltage**



**Figure 9. Gate Leakage Current vs Gate to Source Voltage**

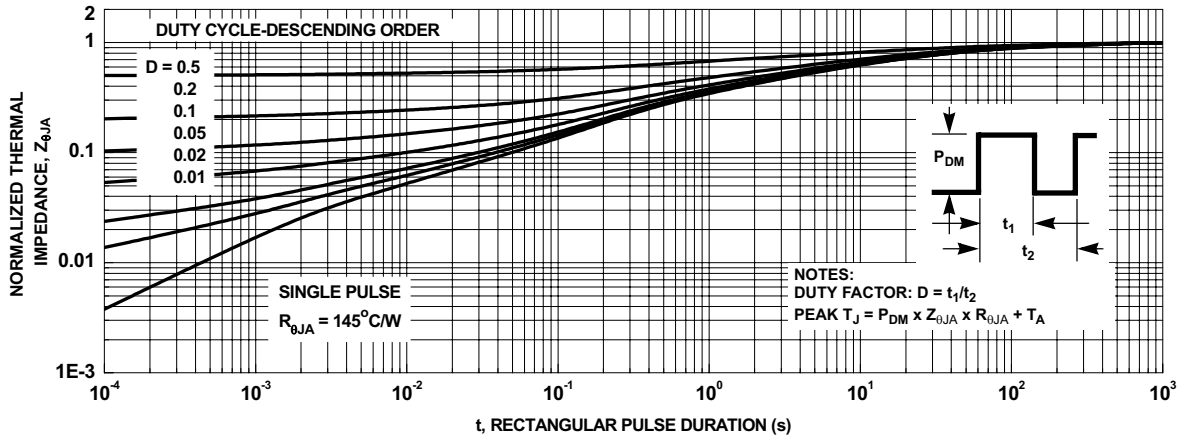


**Figure 10. Forward Bias Safe Operating Area**



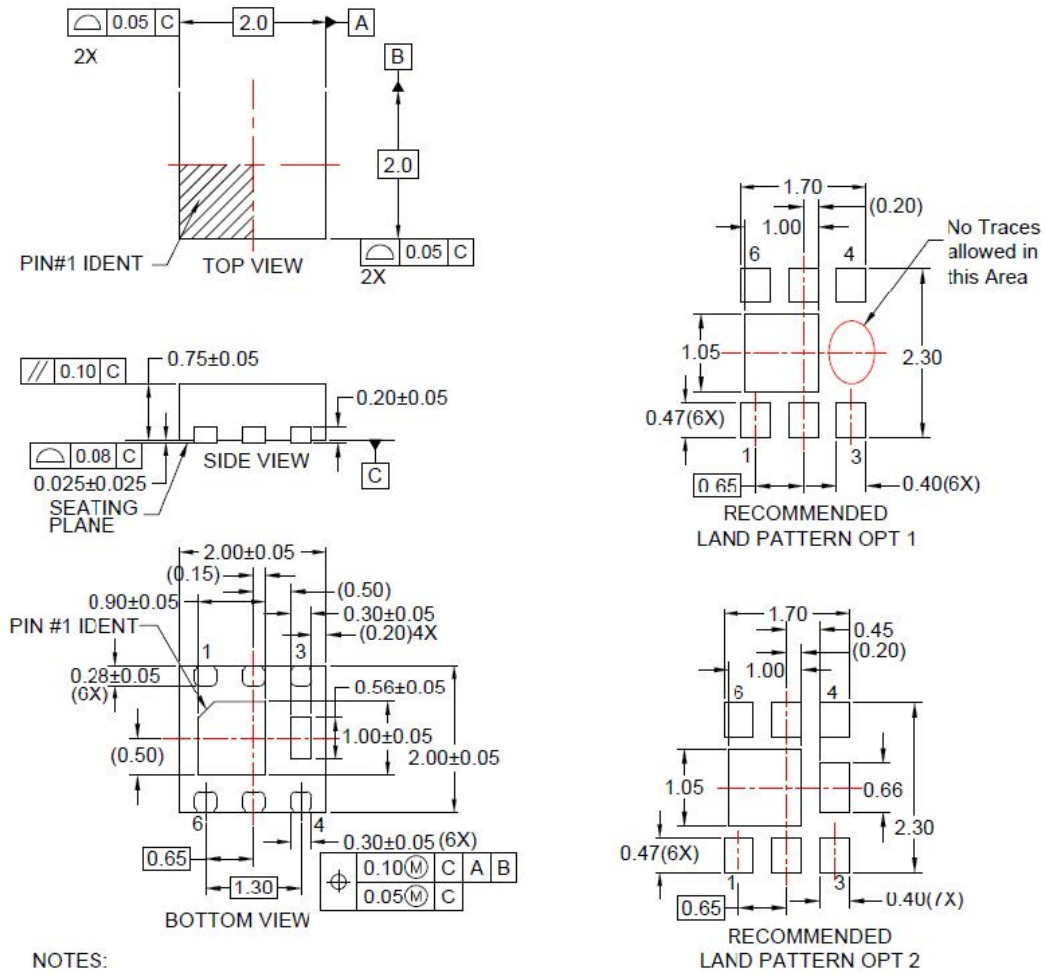
**Figure 11. Single Pulse Maximum Power Dissipation**

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



**Figure 12. Transient Thermal Response Curve**

## Dimensional Outline and Pad Layout



### NOTES:

- A. PACKAGE DOES NOT FULLY CONFORM TO JEDEC MO-229 REGISTRATION
- 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-MLP06Lrev4.

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