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# FDMA1023PZ Dual P-Channel PowerTrench<sup>®</sup> MOSFET

-20V, -3.7A, 72mΩ

## Features

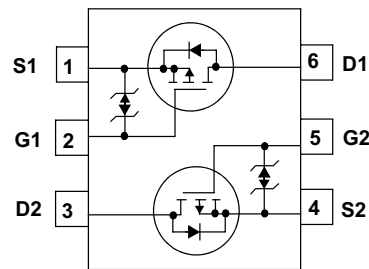
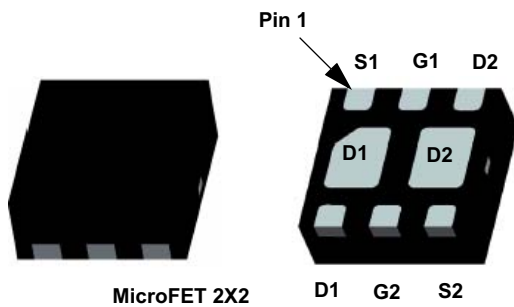
- Max  $r_{DS(on)}$  = 72mΩ at  $V_{GS} = -4.5V$ ,  $I_D = -3.7A$
- Max  $r_{DS(on)}$  = 95mΩ at  $V_{GS} = -2.5V$ ,  $I_D = -3.2A$
- Max  $r_{DS(on)}$  = 130mΩ at  $V_{GS} = -1.8V$ ,  $I_D = -2.0A$
- Max  $r_{DS(on)}$  = 195mΩ at  $V_{GS} = -1.5V$ ,  $I_D = -1.0A$
- Low profile - 0.8 mm maximum - in the new package MicroFET 2x2 mm
- HBM ESD protection level > 2kV typical (Note 3)
- RoHS Compliant
- Free from halogenated compounds and antimony oxides



## 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 two independent P-Channel MOSFETs with low on-state resistance for minimum conduction losses. When connected in the typical common source configuration, bi-directional current flow is possible.

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	Rated	Units
$V_{DS}$	Drain to Source Voltage	-20	V
$V_{GS}$	Gate to Source Voltage	±8	V
$I_D$	Drain Current -Continuous	(Note 1a) -3.7	A
	-Pulsed	-6	
$P_D$	Power Dissipation	(Note 1a) 1.5	W
		(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 for Single Operation, Junction to Ambient	(Note 1a) 86	°C/W
$R_{\theta JA}$	Thermal Resistance for Single Operation, Junction to Ambient	(Note 1b) 173	
$R_{\theta JA}$	Thermal Resistance for Dual Operation, Junction to Ambient	(Note 1c) 69	
$R_{\theta JA}$	Thermal Resistance for Dual Operation, Junction to Ambient	(Note 1d) 151	

## Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
023	FDMA1023PZ	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 $25^\circ\text{C}$		-11		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	-1.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = -250\mu\text{A}$ , referenced to $25^\circ\text{C}$		2.5		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On-Resistance	$V_{GS} = -4.5\text{V}, I_D = -3.7\text{A}$		60	72	m $\Omega$
		$V_{GS} = -2.5\text{V}, I_D = -3.2\text{A}$		75	95	
		$V_{GS} = -1.8\text{V}, I_D = -2.0\text{A}$		100	130	
		$V_{GS} = -1.5\text{V}, I_D = -1.0\text{A}$		130	195	
		$V_{GS} = -4.5\text{V}, I_D = -3.7\text{A}, T_J = 125^\circ\text{C}$		81	91	
$g_{FS}$	Forward Transconductance	$V_{DS} = -5\text{V}, I_D = -3.7\text{A}$		12		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = -10\text{V}, V_{GS} = 0\text{V},$ $f = 1\text{MHz}$		490	655	pF
$C_{oss}$	Output Capacitance			100	135	pF
$C_{rss}$	Reverse Transfer Capacitance			90	135	pF

**Switching Characteristics**

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -10\text{V}, I_D = -1\text{A}$ $V_{GS} = -4.5\text{V}, R_{GEN} = 6\Omega$		9	18	ns
$t_r$	Rise Time			12	22	ns
$t_{d(off)}$	Turn-Off Delay Time			64	103	ns
$t_f$	Fall Time			37	60	ns
$Q_{g(TOT)}$	Total Gate Charge	$V_{DD} = -10\text{V}, I_D = -3.7\text{A}$		8.6	12	nC
$Q_{gs}$	Gate to Source Gate Charge	$V_{GS} = -4.5\text{V}$		0.7		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			2.0		nC

**Drain-Source Diode Characteristics**

$I_S$	Maximum Continuous Source-Drain 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	$I_F = -3.7\text{A}, di/dt = 100\text{A}/\mu\text{s}$		32	48	ns
$Q_{rr}$	Reverse Recovery Charge			15	23	nC

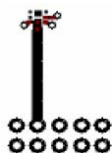
**Notes:**

1:  $R_{\theta JA}$  is determined with the device mounted on a 1 in<sup>2</sup> 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)  $R_{\theta JA} = 86^{\circ}\text{C/W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper, 1.5" x 1.5" x 0.062" thick PCB. For single operation.
- (b)  $R_{\theta JA} = 173^{\circ}\text{C/W}$  when mounted on a minimum pad of 2 oz copper. For single operation.
- (c)  $R_{\theta JA} = 69^{\circ}\text{C/W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper, 1.5" x 1.5" x 0.062" thick PCB, For dual operation.
- (d)  $R_{\theta JA} = 151^{\circ}\text{C/W}$  when mounted on a minimum pad of 2 oz copper. For dual operation.



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



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



c) 69°C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



d) 151°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 as protection against ESD. No gate overvoltage rating is implied.

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

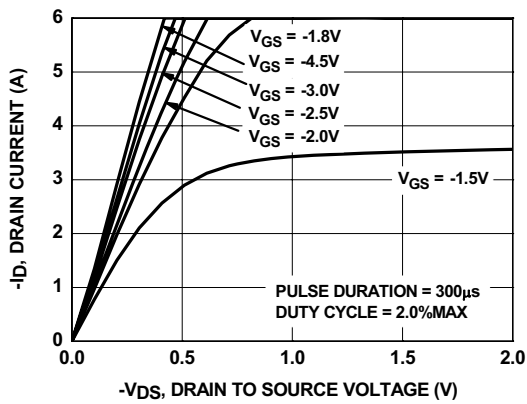


Figure 1. On Region Characteristics

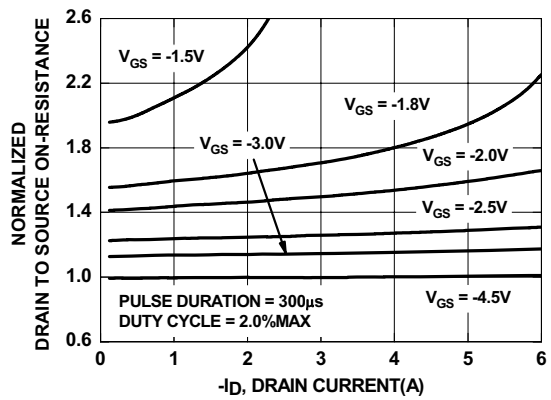


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

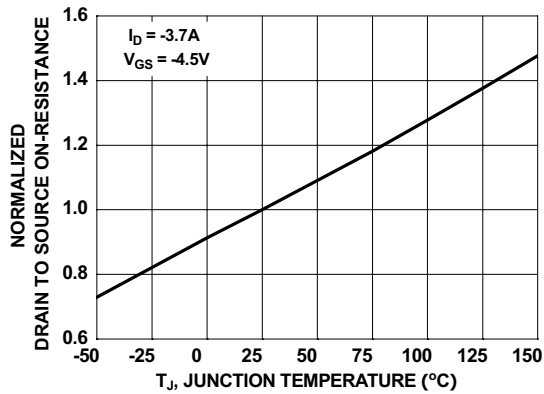


Figure 3. Normalized On-Resistance vs Junction Temperature

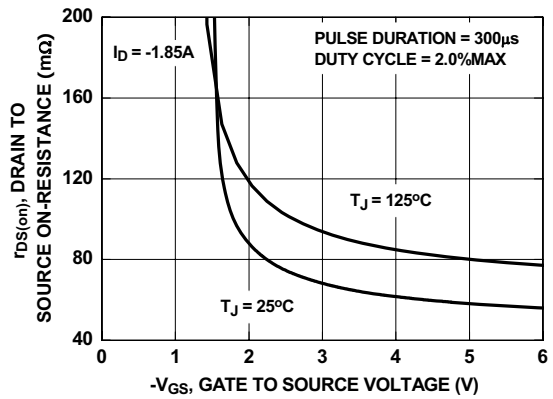


Figure 4. On-Resistance vs Gate to Source Voltage

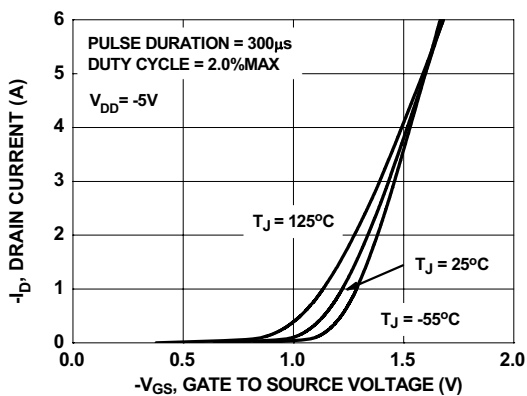


Figure 5. Transfer Characteristics

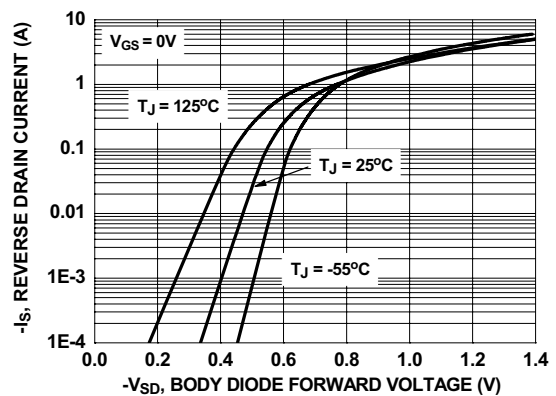
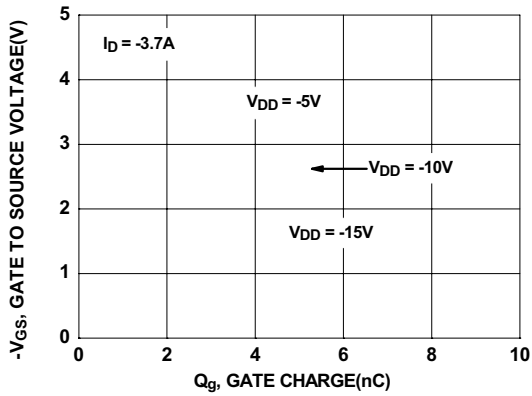
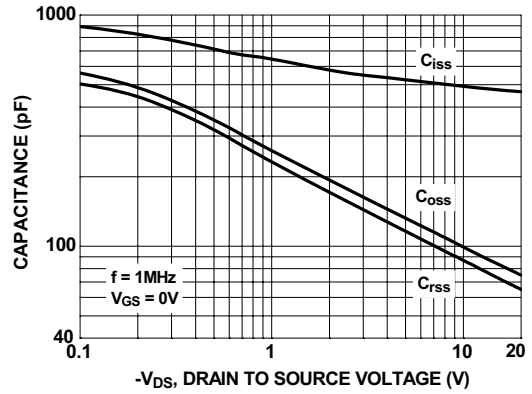


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

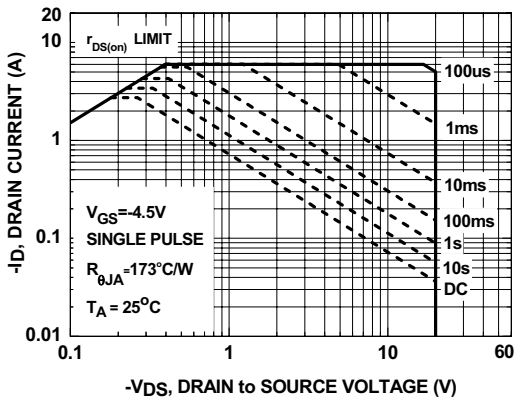
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



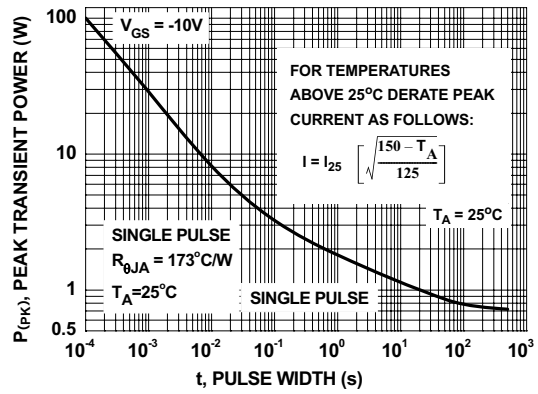
**Figure 7. Gate Charge Characteristics**



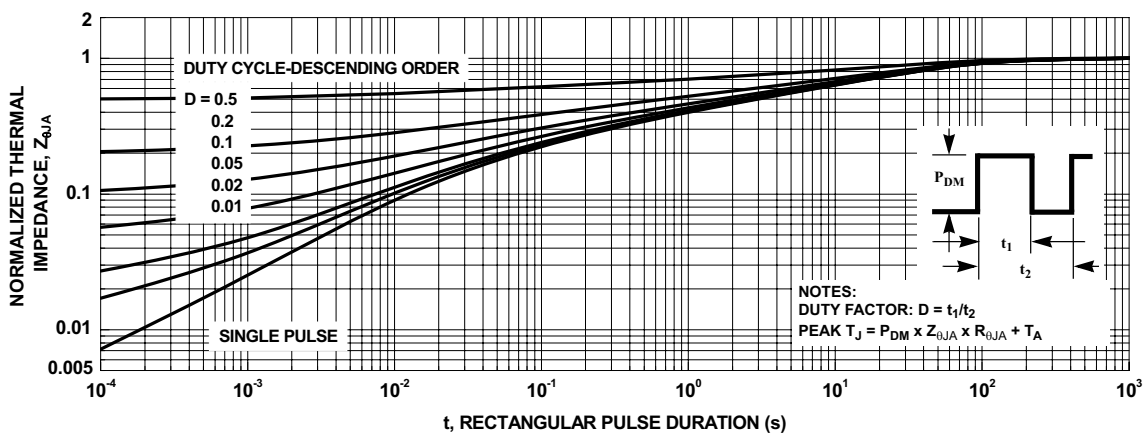
**Figure 8. Capacitance Characteristics**



**Figure 9. Forward Bias Safe Operating Area**

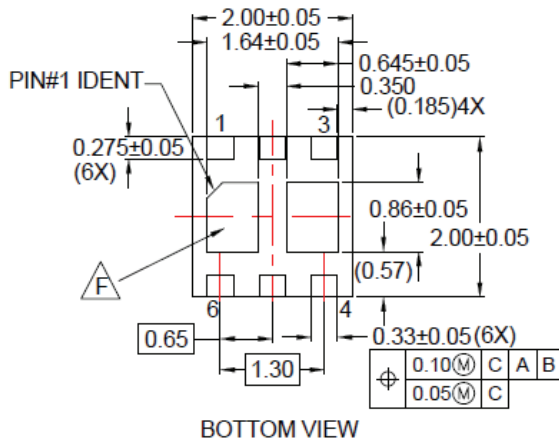
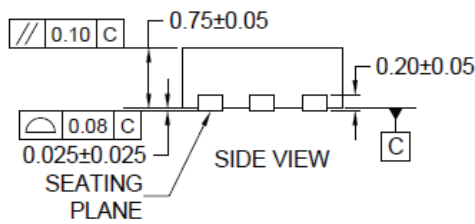
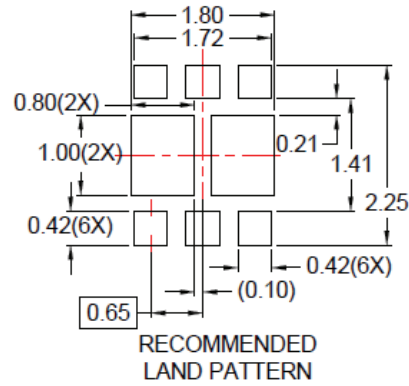
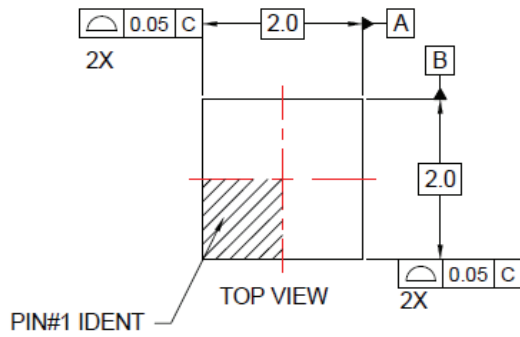


**Figure 10. Single Pulse Maximum Power Dissipation**



**Figure 11. Transient Thermal Response Curve**

## Dimensional Outline and Pad Layout



### NOTES:

- A. CONFORM TO JAEDEC 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.
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