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# FDFMJ2P023Z

## Integrated P-Channel PowerTrench® MOSFET and Schottky Diode –20V, –2.9A, 112mΩ

### Features

#### MOSFET

- Max  $r_{DS(on)}$  = 112mΩ at  $V_{GS} = -4.5V$ ,  $I_D = -2.9A$
- Max  $r_{DS(on)}$  = 160mΩ at  $V_{GS} = -2.5V$ ,  $I_D = -2.4A$
- Max  $r_{DS(on)}$  = 210mΩ at  $V_{GS} = -1.8V$ ,  $I_D = -2.1A$
- Max  $r_{DS(on)}$  = 300mΩ at  $V_{GS} = -1.5V$ ,  $I_D = -1.0A$
- Low gate charge, high power and current handline capability
- HBM ESD protection level > 1.5KV typical (Note 3)

#### Schottky

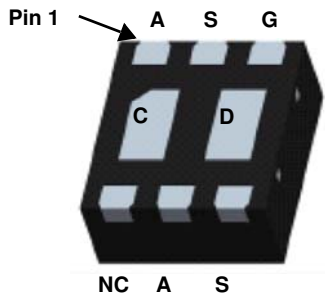
- $V_F < 400mV$  @ 100mA
- RoHS Compliant



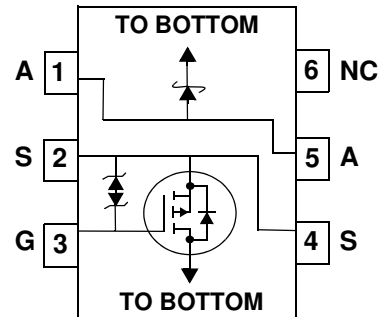
### General Description

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 SC-75 MicroFET package offers exceptional thermal performance for it's physical size and is well suited to linear mode applications.



SC-75 MicroFET



### 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	$\pm 8$	V
$I_D$	Drain Current -Continuous	(Note 1a) -2.9	A
	-Pulsed	-12	
$P_D$	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	$^\circ C$
$V_{RRM}$	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) 89	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	(Note 1b) 182	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
.P23	FDFMJ2P023Z	SC-75 MicroFET	7"	8 mm	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 $25^\circ\text{C}$		-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	-1.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = -250\mu\text{A}$ , referenced to $25^\circ\text{C}$		2.3		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = -4.5\text{V}, I_D = -2.9\text{A}$		93	112	m $\Omega$
		$V_{GS} = -2.5\text{V}, I_D = -2.4\text{A}$		128	160	
		$V_{GS} = -1.8\text{V}, I_D = -2.1\text{A}$		173	210	
		$V_{GS} = -1.5\text{V}, I_D = -1.0\text{A}$		217	300	
		$V_{GS} = -4.5\text{V}, I_D = -2.9\text{A}, T_J = 125^\circ\text{C}$		130	160	
$g_{FS}$	Forward Transconductance	$V_{DS} = -5\text{V}, I_D = -2.9\text{A}$		7		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = -10\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$		300	400	pF
$C_{oss}$	Output Capacitance			55	75	pF
$C_{rss}$	Reverse Transfer Capacitance			45	70	pF

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -10\text{V}, I_D = -2.9\text{A}$ $V_{GS} = -4.5\text{V}, R_{GEN} = 6\Omega$		5	10	ns
$t_r$	Rise Time			4	10	ns
$t_{d(off)}$	Turn-Off Delay Time			23	37	ns
$t_f$	Fall Time			12	22	ns
$Q_g$	Total Gate Charge	$V_{DD} = -5\text{V}, I_D = -2.9\text{A}$ $V_{GS} = -4.5\text{V}$		4.6	6.5	nC
$Q_{gs}$	Gate to Source Charge			0.6		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			1.0		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	$V_{GS} = 0\text{V}, I_S = -1.1\text{A}$		-0.9	-1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F = -2.9\text{A}, di/dt = 100\text{A}/\mu\text{s}$		28	45	ns
$Q_{rr}$	Reverse Recovery Charge			15	27	nC

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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#### Schottky Diode Characteristics

$V_R$	Reverse Voltage	$I_R = 100\text{mA}$	$T_J = 25^\circ\text{C}$	30		V
$I_R$	Reverse Leakage	$V_R = 10\text{V}$	$T_J = 25^\circ\text{C}$		0.39	2 $\mu\text{A}$
			$T_J = 85^\circ\text{C}$		0.04	0.2 mA
			$T_J = 125^\circ\text{C}$		0.4	2 mA
$I_R$	Reverse Leakage	$V_R = 20\text{V}$	$T_J = 25^\circ\text{C}$		0.86	4 $\mu\text{A}$
			$T_J = 85^\circ\text{C}$		0.06	0.3 mA
			$T_J = 125^\circ\text{C}$		0.62	3 mA
$V_F$	Forward Voltage	$I_F = 100\text{mA}$	$T_J = 25^\circ\text{C}$		380	400 mV
			$T_J = 85^\circ\text{C}$		300	350 mV
			$T_J = 125^\circ\text{C}$		250	300 mV
$V_F$	Forward Voltage	$I_F = 1\text{A}$	$T_J = 25^\circ\text{C}$		570	615 mV
			$T_J = 85^\circ\text{C}$		540	590 mV
			$T_J = 125^\circ\text{C}$		530	580 mV

**Notes:**

1.  $R_{\theta JA}$  is determined with the device mounted on a 1 in<sup>2</sup> pad 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  $R_{\theta CA}$  is determined by the user's board design.



a. 89°C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper

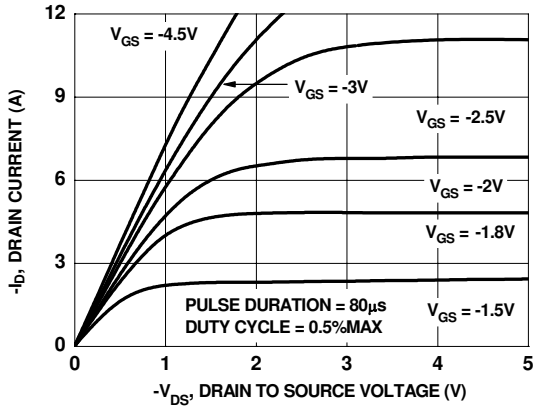


b. 182°C/W when mounted on a minimum pad of 2 oz copper

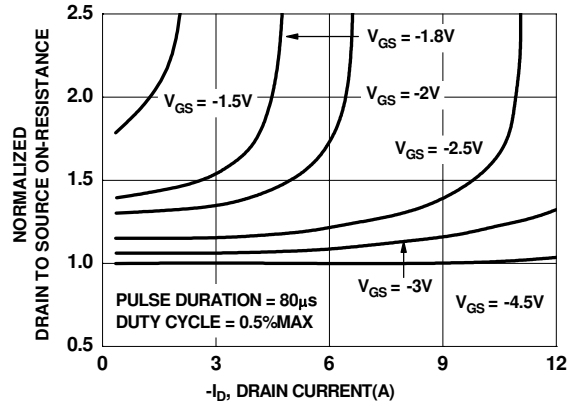
2. Pulse Test: Pulse Width < 300 $\mu\text{s}$ , Duty cycle < 2.0%.

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

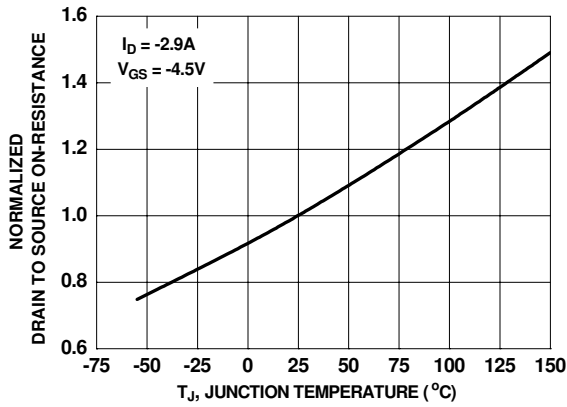
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



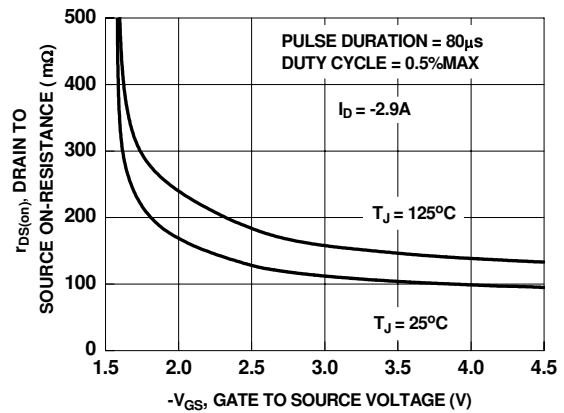
**Figure 1. On-Region Characteristics**



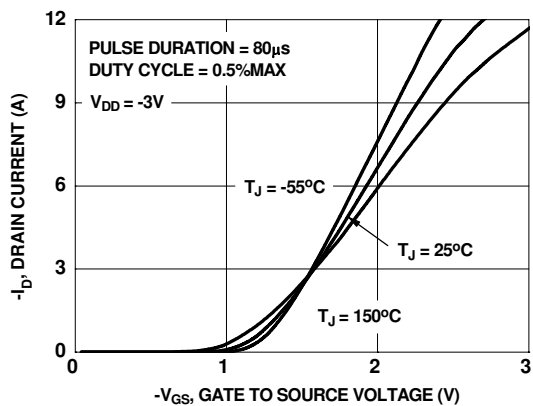
**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**



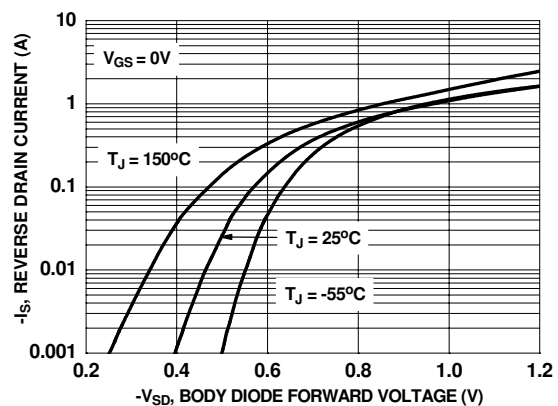
**Figure 3. Normalized On-Resistance vs Junction Temperature**



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

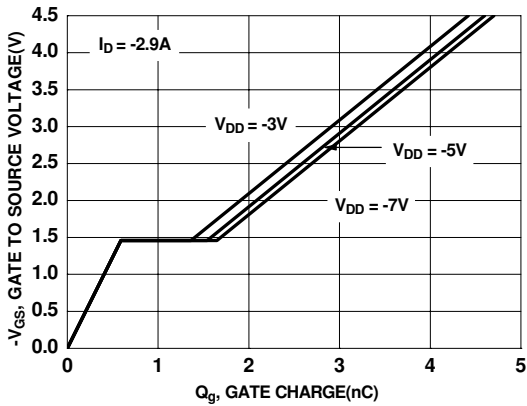


**Figure 5. Transfer Characteristics**

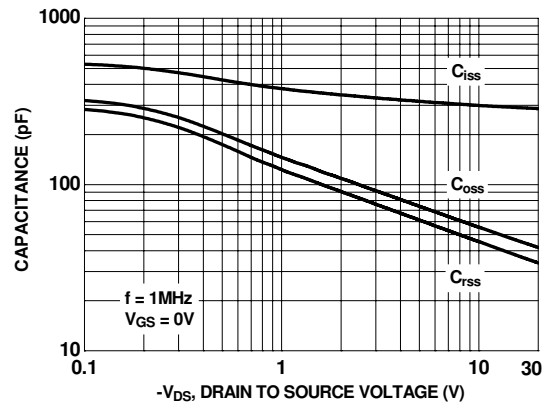


**Figure 6. Source to Drain Diode Forward Voltage vs Source Current**

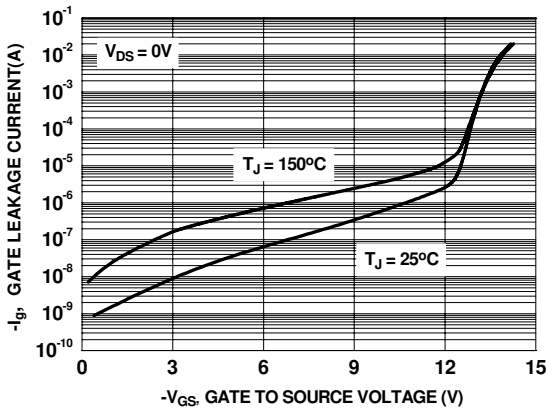
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



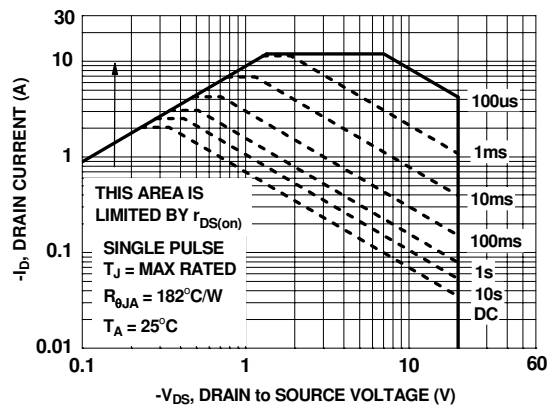
**Figure 7. Gate Charge Characteristics**



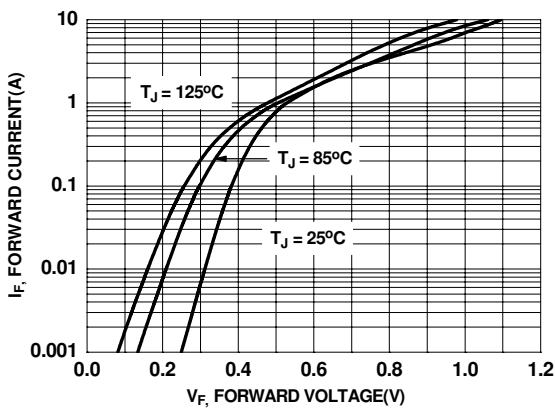
**Figure 8. Capacitance vs Drain to Source Voltage**



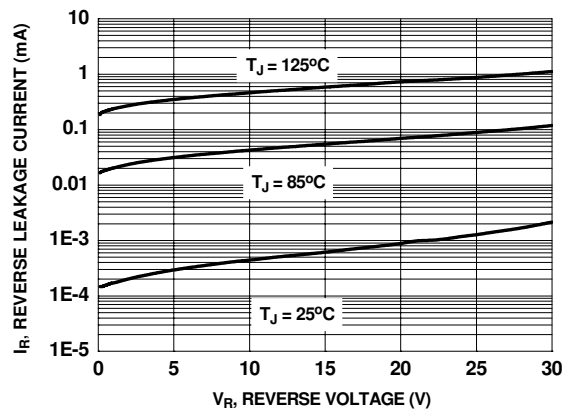
**Figure 9. Gate Leakage Current vs Gate to Source Voltage**



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

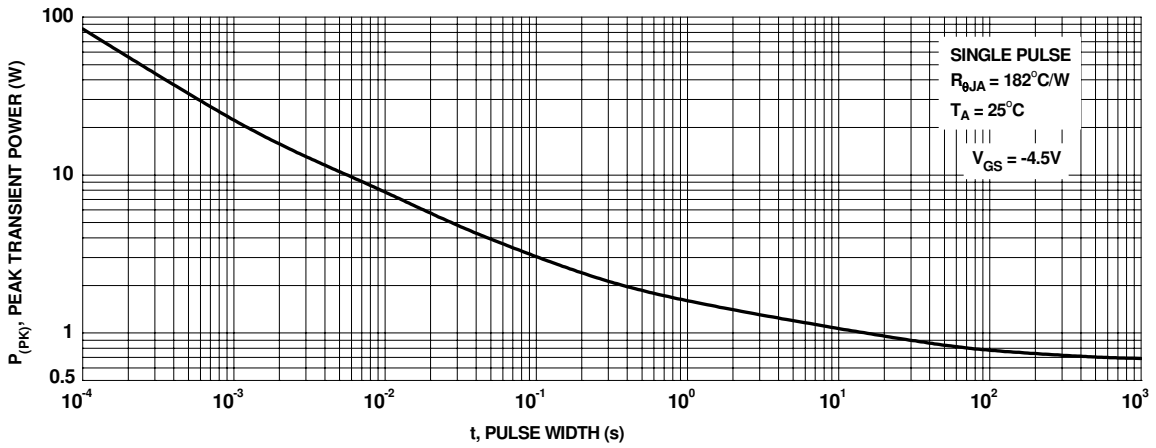


**Figure 11. Schottky Diode Forward Voltage**

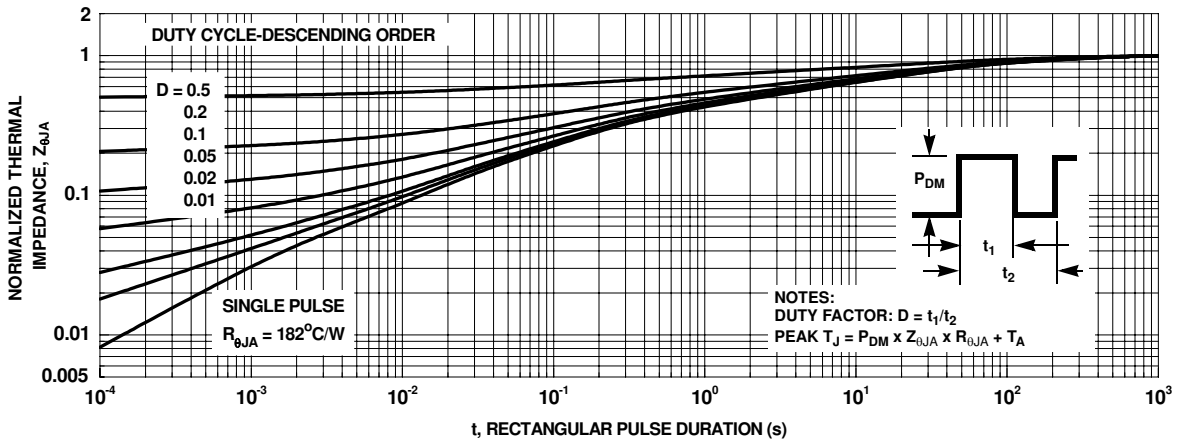


**Figure 12. Schottky Diode Reverse Current**

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

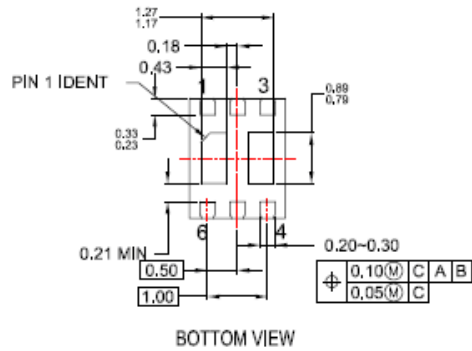
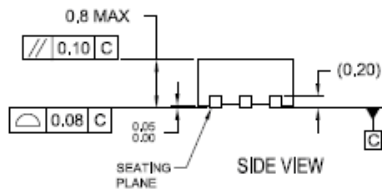
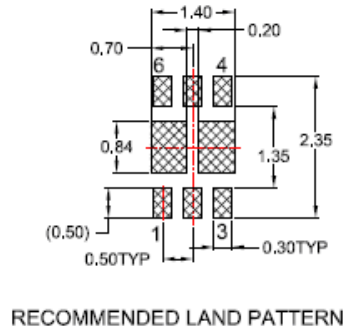
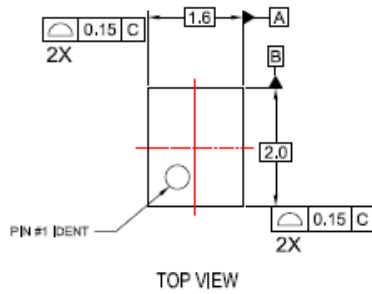


**Figure 13. Single Pulse Maximum Power Dissipation**



**Figure 14. Transient Thermal Response Curve**

## Dimensional Outline and Pad Layout





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