FAIRCHILD SEMICONDUCTOR®

August 2007

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)

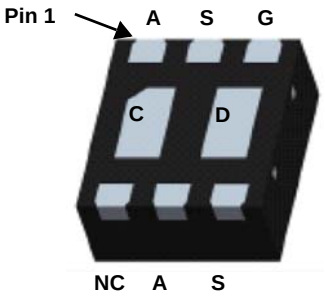
Schottky

- V_F < 400mV @ 100mA
- RoHS Compliant

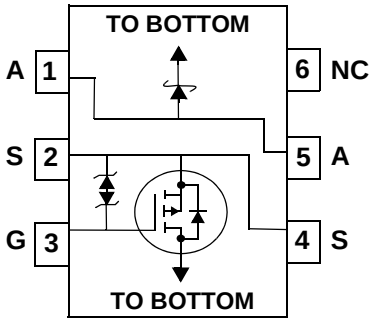
General Description

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°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)	–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	°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	°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°C unless otherwise noted

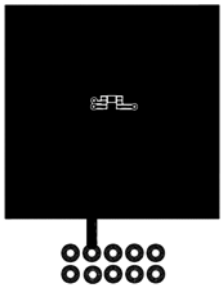
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = –250μA, V_{GS} = 0V	–20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = –250μA, referenced to 25°C		–13		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = –16V, V_{GS} = 0V			–1	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±8V, V_{DS} = 0V			±10	μA
On Characteristics						
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = –250μA	–0.4	–0.7	–1.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = –250μA, referenced to 25°C		2.3		mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = –4.5V, I_D = –2.9A		93	112	mΩ
		V_{GS} = –2.5V, I_D = –2.4A		128	160	
		V_{GS} = –1.8V, I_D = –2.1A		173	210	
		V_{GS} = –1.5V, I_D = –1.0A		217	300	
		V_{GS} = –4.5V, I_D = –2.9A ,T_J = 125°C		130	160	
g_{FS}	Forward Transconductance	V_{DS} = –5V, I_D = –2.9A		7		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = –10V, V_{GS} = 0V, f = 1MHz		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} = –10V, I_D = –2.9A, V_{GS} = –4.5V, R_{GEN} = 6Ω		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} = –5V, I_D = –2.9A, V_{GS} = –4.5V		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} = 0V, I_S = –1.1A		–0.9	–1.2	V
t_{rr}	Reverse Recovery Time	I_F = –2.9A, di/dt = 100A/μs		28	45	ns
Q_{rr}	Reverse Recovery Charge			15	27	nC

Electrical Characteristics T_J = 25°C unless otherwise noted

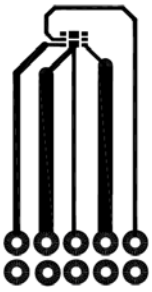
Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
Schottky Diode Characteristics							
V_R	Reverse Voltage	I_R = 100mA	T_J = 25°C	30			V
I_R	Reverse Leakage	V_R = 10V	T_J = 25°C		0.39	2	μA
			T_J = 85°C		0.04	0.2	mA
			T_J = 125°C		0.4	2	mA
I_R	Reverse Leakage	V_R = 20V	T_J = 25°C		0.86	4	μA
			T_J = 85°C		0.06	0.3	mA
			T_J = 125°C		0.62	3	mA
V_F	Forward Voltage	I_F = 100mA	T_J = 25°C		380	400	mV
			T_J = 85°C		300	350	mV
			T_J = 125°C		250	300	mV
V_F	Forward Voltage	I_F = 1A	T_J = 25°C		570	615	mV
			T_J = 85°C		540	590	mV
			T_J = 125°C		530	580	mV

Notes:

1. $R_{\theta JA}$ is determined with the device mounted on a 1in^2 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^2 pad of 2 oz copper



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

2. Pulse Test: Pulse Width < 300μs, 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°C unless otherwise noted

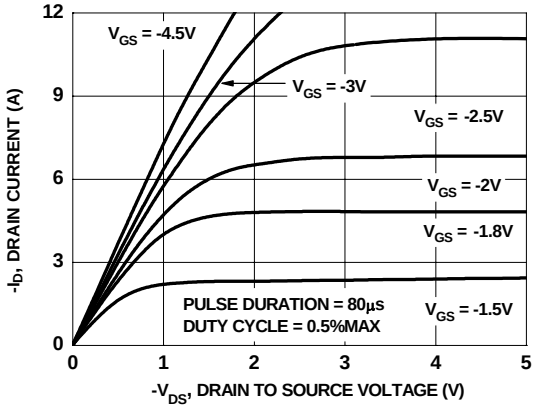


Figure 1. On-Region Characteristics

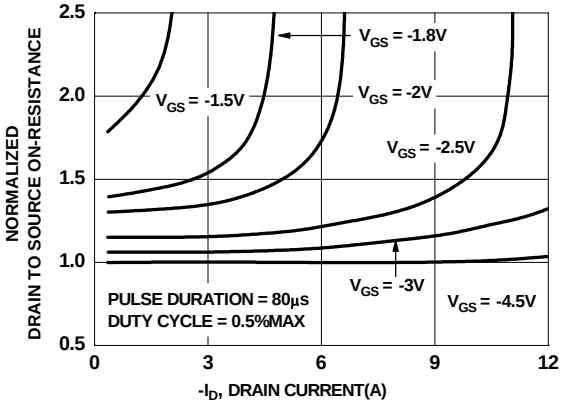


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

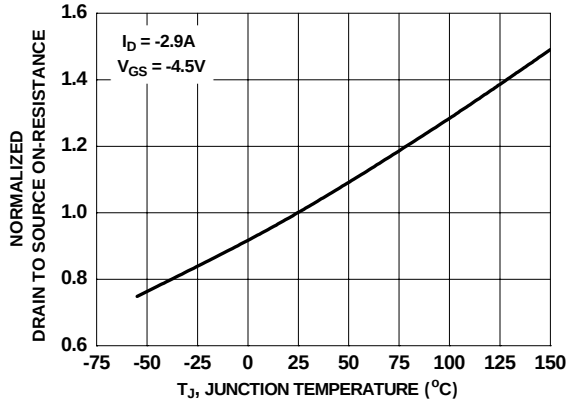


Figure 3. Normalized On-Resistance vs Junction Temperature

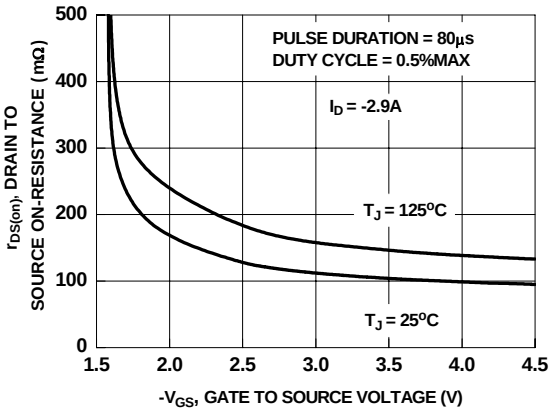


Figure 4. On-Resistance vs Gate to Source Voltage

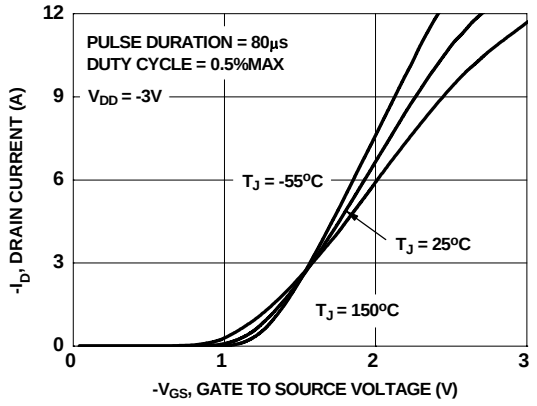


Figure 5. Transfer Characteristics

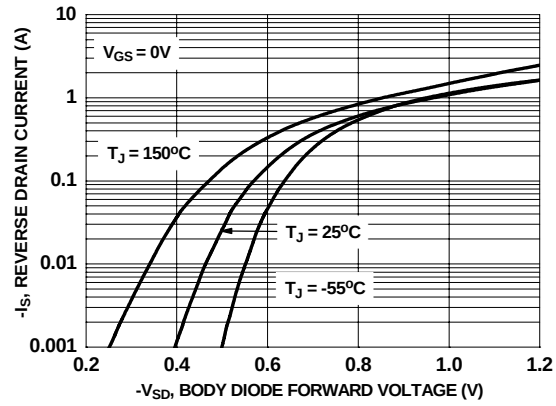


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics T_J = 25°C unless otherwise noted

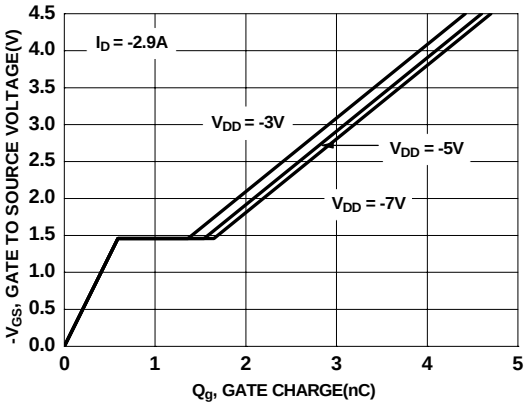


Figure 7. Gate Charge Characteristics

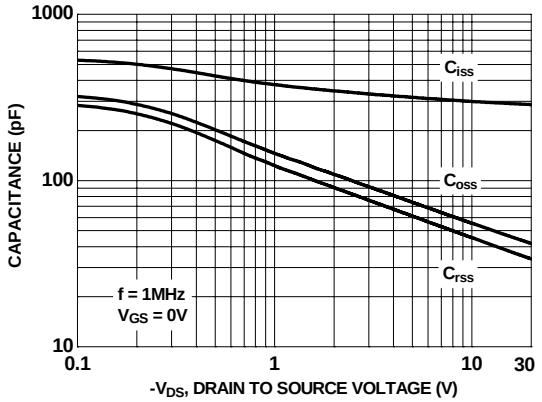


Figure 8. Capacitance vs Drain to Source Voltage

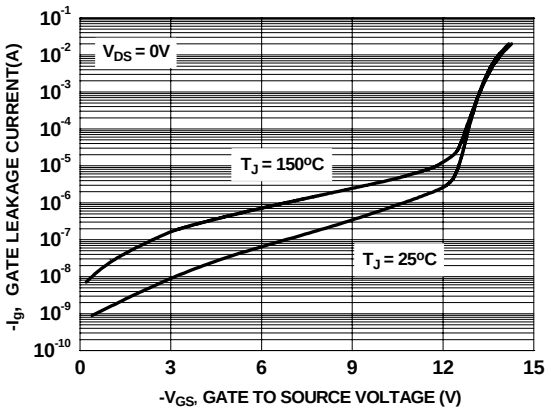


Figure 9. Gate Leakage Current vs Gate to Source Voltage

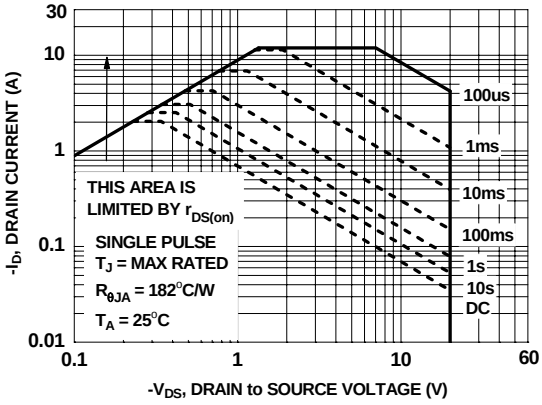


Figure 10. Forward Bias Safe Operating Area

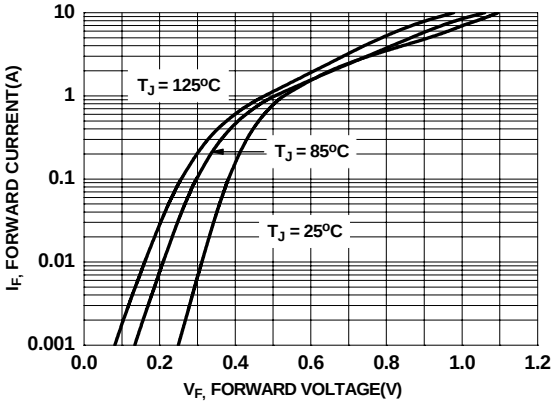


Figure 11. Schottky Diode Forward Voltage

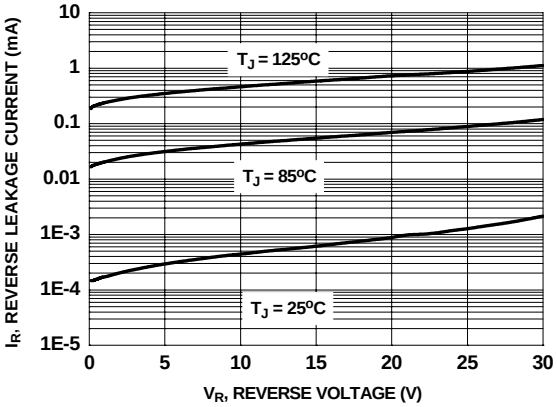


Figure 12. Schottky Diode Reverse Current

Typical Characteristics T_J = 25°C unless otherwise noted

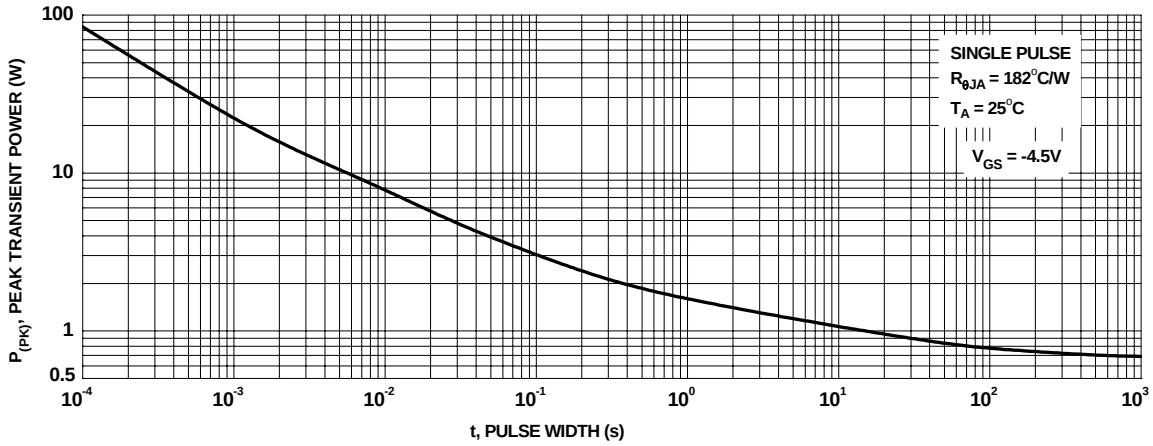


Figure 13. Single Pulse Maximum Power Dissipation

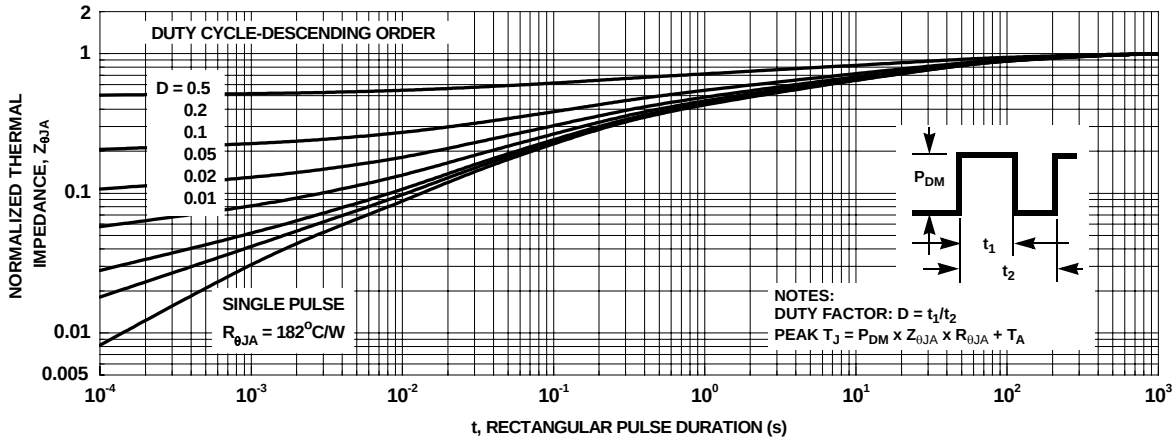
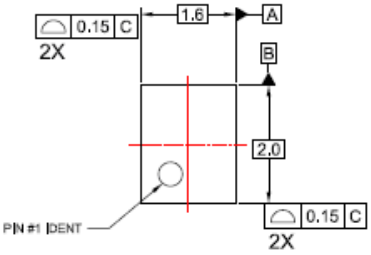
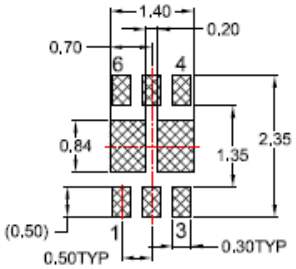


Figure 14. Transient Thermal Response Curve

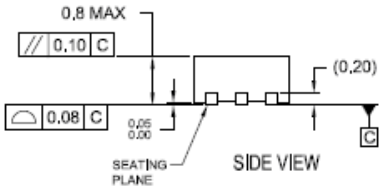
Dimensional Outline and Pad Layout



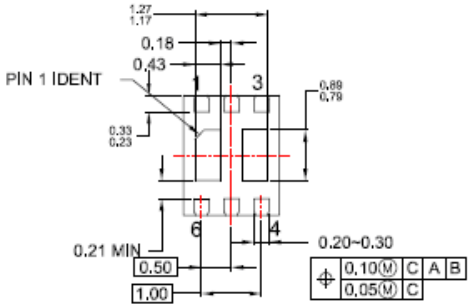
TOP VIEW



RECOMMENDED LAND PATTERN



SIDE VIEW



BOTTOM VIEW

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