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July 2014

# Dual P-Channel PowerTrench® MOSFET

#### **General Description**

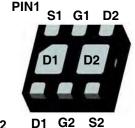
This device is designed specifically as a single package solution for the battery charge switch in cellular handset and other ultra-portable applications. It features two independent P-Channel MOSFETs with low on-state resistance for minimum conduction losses. When connected in the typical common source configuration, bi-directional current flow is possible.

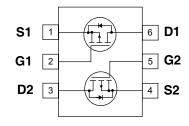
The MicroFET 2x2 package offers exceptional thermal performance for it's physical size and is well suited to linear mode applications.

#### **Features**

- -3.0 A, -20V.  $R_{DS(ON)} = 120 \text{ m}\Omega$  @  $V_{GS} = -4.5 \text{ V}$ 
  - $R_{DS(ON)} = 160 \text{ m}\Omega$  @  $V_{GS} = -2.5 \text{ V}$
  - $R_{DS(ON)} = 240 \text{ m}\Omega$  @  $V_{GS} = -1.8 \text{ V}$
- Low Profile 0.8 mm maximun in the new package MicroFET 2x2 mm
- RoHS Compliant
- Free from halogenated compounds and antimony oxides







MicroFET 2X2 D1 G2

#### Absolute Maximum Ratings T<sub>A</sub> = 25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V <sub>DSS</sub>	MOSFET Drain-Source Voltage		-20	V
V <sub>GSS</sub>	MOSFET Gate-Source Voltage		±8	V
	Drain Current -Continuous	(Note 1a)	-3.0	Α
ID	-Pulsed		-6	] ^
	Power dissipation	(Note 1a)	1.4	
P <sub>D</sub>	·	(Note 1b)	0.7	] ,,,
b		(Note 1c)	1.8	W
		(Note 1d)	0.8	
T <sub>J</sub> , T <sub>STG</sub>	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	
$R_{\theta JA}$	Thermal Resistance for Single Operation, Junction-to-Ambient	(Note 1b)	173	°C/W
$R_{\theta JA}$	Thermal Resistance for Dual Operation, Junction-to-Ambient	(Note 1c)	69	1 0/00
$R_{\theta JA}$	Thermal Resistance for Dual Operation, Junction-to-Ambient	(Note 1d)	151	

#### **Package Marking and Ordering Information**

Device Marking	Device	Reel Size	Tape Width	Quantity
027	FDMA1027P	7"	8mm	3000 units

Electrical C	haracteristics <b>T</b>	$\Gamma_{\Delta} = 25^{\circ}$ C unless otherwise noted
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Symbol	Parameter	Test Conditions	Min	Тур	Max	Units
Off Chara	cteristics					
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = -250\mu A$	-20	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_{J}}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\mu A$ , Referenced to 25°C	-	-12	-	mV/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = -16V, V <sub>GS</sub> = 0V	-	-	-1	μΑ
I <sub>GSS</sub>	Gate-Body Leakage,	$V_{GS} = \pm 8V, V_{DS} = 0V$	-	-	±100	nA

### On Characteristics (Note 2)

V <sub>GS(th)</sub>	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_{D} = -250 \mu A$	-0.4	-0.7	-1.3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = -250\mu A$ , Referenced to 25°C	-	2	-	mV/°C
		$V_{GS} = -4.5V, I_D = -3.0A$	-	90	120	
		$V_{GS} = -2.5V, I_D = -2.5A$	-	120	160	
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	$V_{GS} = -1.8V, I_D = -1.0A$	-	172	240	mΩ
		$V_{GS} = -4.5V, I_D = -3.0A$ $T_J = 125^{\circ}C$	-	118	160	
I <sub>D(on)</sub>	On-State Drain Current	$V_{GS} = -4.5V, V_{DS} = -5V$	-20	-	-	Α
9 <sub>FS</sub>	Forward Transconductance	$V_{DS} = -5V, I_{D} = -3.0A$	-	7	-	S

# **Dynamic Characteristics**

C <sub>iss</sub>	Input Capacitance	V 10V V 0V	-	435	-	pF
C <sub>oss</sub>	Output Capacitance	V <sub>DS</sub> = -10V, V <sub>GS</sub> = 0V, f = 1.0MHz	-	80	-	pF
C <sub>rss</sub>	Reverse Transfer Capacitance	1 - 1.500112	-	45	-	pF

# **Switching Characteristics** (Note 2)

t <sub>d(on)</sub>	Turn-On Delay Time		-	9	18	ns
t <sub>r</sub>	Turn-On Rise Time	V <sub>DD</sub> = -10V, I <sub>D</sub> = -1A	-	11	19	ns
t <sub>d(off)</sub>	Turn-Off Delay Time	$V_{GS}$ = -4.5V, $R_{GEN}$ = $6\Omega$	-	15	27	ns
t <sub>f</sub>	Turn-Off Fall Time		-	6	12	ns
$Q_g$	Total Gate Charge	101/ 1 0 0 1	-	4	6	nC
$Q_{gs}$	Gate-Source Charge	$V_{DS} = -10V, I_D = -3.0A,$ $V_{GS} = -4.5V$	-	0.8	-	nC
$Q_{gd}$	Gate-Drain Charge	v GS = -4.5 v	-	0.9	-	nC

## **Drain-Source Diode Characteristics and Maximum Ratings**

I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current		-	-	-1.1	Α
$V_{SD}$	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0V, I <sub>S</sub> = -1.1 A (Note 2)	-	-0.8	-1.2	V
t <sub>rr</sub>	Diode Reverse Recovery Time	I <sub>F</sub> = -3.0A, dI <sub>F</sub> /dt=100A/μs	-	17	-	ns
Q <sub>rr</sub>	Diode Reverse Recovery Charge	IF= -3.0A, αΙΕ/αί=100A/μS	-	6	-	nC

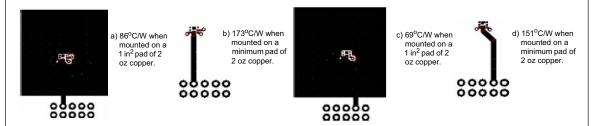
2

## **Electrical Characteristics** $T_A = 25$ °C unless otherwise noted

- 1: R<sub>0JA</sub> 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<sub>0JC</sub>is guaranteed by design while R<sub>0JA</sub> is determined by the user's board design.

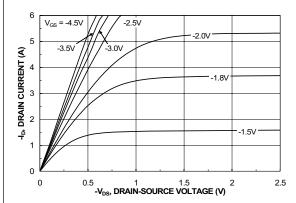
  (a) R<sub>0JA</sub> = 86°C/W when mounted on a 1in<sup>2</sup> pad of 2 oz copper, 1.5" x 1.5" x 0.062" thick PCB. For single operation.

  - (b)  $\rm R_{\theta JA}$  = 173°C/W when mounted on a minimum pad of 2 oz copper. For single operation.
  - (c)  $R_{0JA} = 69^{\circ}$ C/W when mounted on a 1in<sup>2</sup> pad of 2 oz copper, 1.5" x 1.5" x 0.062" thick PCB, For dual operation, configured in parallel.
  - (d)  $R_{\theta JA} = 151^{\circ}$ C/W when mounted on a minimum pad of 2 oz copper. For dual operation, configured in parallel.



2: Pulse Test : Pulse Width < 300us, Duty Cycle < 2.0%

## **Typical Characteristics**



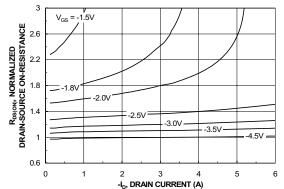
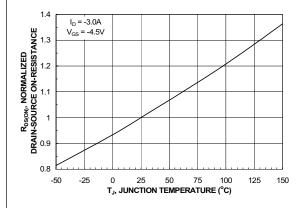


Figure 1. On-Region Characteristics

Figure 2. On-Resistance Variation with Drain Current and Gate Voltage



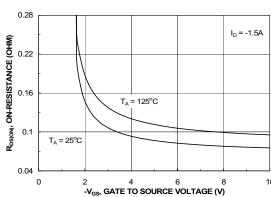
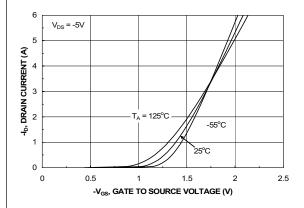


Figure 3. On-Resistance Variation with Temperature

Figure 4. On-Resistance Variation with Gate-to-Source Voltage



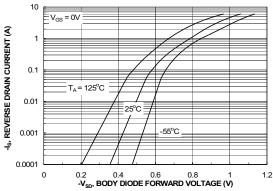


Figure 5. Transfer Characteristics

Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

### **Typical Characteristics** 700 I<sub>D</sub> = -3.0A -V<sub>cs</sub>, GATE-SOURCE VOLTAGE (V) 600 CAPACITANCE (pF) 400 300 200 -15V 10V 2 100 0 0 $\frac{2}{\mathbf{Q_g}}$ , GATE CHARGE (nC) 1 8 12 16 -V<sub>DS</sub>, **DRAIN TO SOURCE VOLTAGE (V)** 0 0 Figure 7. Gate Charge Characteristics Figure 8. Capacitance Characteristics SINGLEPULSE PIDKY PEAK TRANSIENT POWER (W) 10 ID, DRAIN CURRENT (A) 20 0.1 SINGLE PULSE 10 $R_{\theta,JA} = 173^{\circ}C/W$ T<sub>A</sub> = 25°C 0.01 0.1 1 t<sub>i</sub>, TIME (sec) 0.1 1 10 V<sub>DS</sub>, **DRAIN-SOURCE VOLTAGE (V)** 0.0001 0.001 0.01 100 0.01 Figure 9. Maximum Safe Operation Area Figure 10. Single Pulse Maximum Power Dissipation $R_{\rm ol}(t) = r(t)^{\times} R_{\rm ol}$ R<sub>644</sub>=173 °C/W

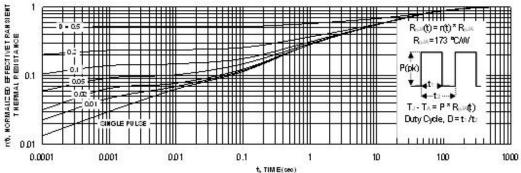
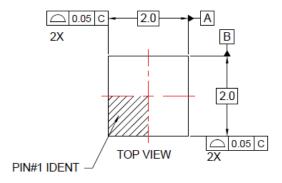
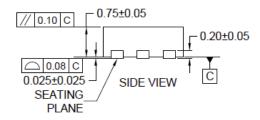


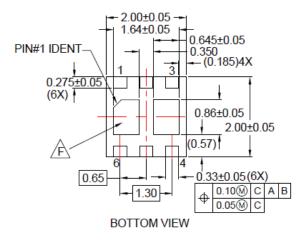
Figure 11. Transient Thermal Response Curve

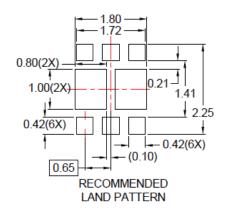
Thermal characterization performed using the conditions described in Note 1b. Transient thermal response will change depending on the circuit board design.

### **Dimensional Outline and Pad Layout**









#### NOTES:

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