

**Single N-Channel 1.5 V Specified PowerTrench® MOSFET**  
**20 V, 9.4 A, 14.5 mΩ**

**Features**

- Max  $r_{DS(on)}$  = 14.5 mΩ at  $V_{GS} = 4.5$  V,  $I_D = 9.4$  A
- Max  $r_{DS(on)}$  = 18.2 mΩ at  $V_{GS} = 2.5$  V,  $I_D = 8.3$  A
- Max  $r_{DS(on)}$  = 23.3 mΩ at  $V_{GS} = 1.8$  V,  $I_D = 7.3$  A
- Max  $r_{DS(on)}$  = 32.3 mΩ at  $V_{GS} = 1.5$  V,  $I_D = 6.2$  A
- Low Profile-0.8 mm maximum in the new package MicroFET 2x2 mm
- RoHS Compliant

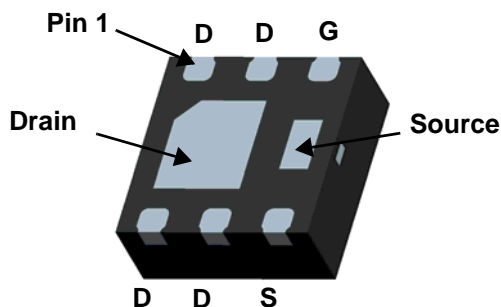


**General Description**

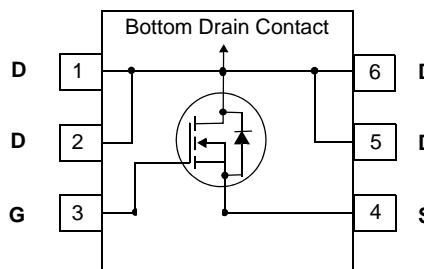
This Single N-Channel MOSFET has been designed using Fairchild Semiconductor's advanced Power Trench® process to optimize the  $r_{DS(ON)}$  @  $V_{GS} = 1.5$  V on special MicroFET leadframe.

**Applications**

- Li-Ion Battery Pack
- DC-DC Buck Converters



**MicroFET 2X2 (Bottom View)**



**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
$I_D$	-Continuous	$T_A = 25$ °C (Note 1a)	9.4
	-Pulsed		54
$P_D$	Power Dissipation	$T_A = 25$ °C (Note 1a)	1.9
	Power Dissipation	$T_A = 25$ °C (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, Junction to Ambient	(Note 1a)	65	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	(Note 1b)	180	

**Package Marking and Ordering Information**

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
104	FDMA0104	MicroFET 2X2	7 "	12 mm	3000 units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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**Off Characteristics**

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ , $V_{GS} = 0\text{ V}$	20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		15		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	$V_{GS} = \pm 8\text{ V}$ , $V_{DS} = 0\text{ V}$			$\pm 100$	nA

**On Characteristics**

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$ , $I_D = 250\text{ }\mu\text{A}$	0.4	0.6	1.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		-3		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 4.5\text{ V}$ , $I_D = 9.4\text{ A}$		11.3	14.5	m $\Omega$
		$V_{GS} = 2.5\text{ V}$ , $I_D = 8.3\text{ A}$		12.7	18.2	
		$V_{GS} = 1.8\text{ V}$ , $I_D = 7.3\text{ A}$		15.0	23.3	
		$V_{GS} = 1.5\text{ V}$ , $I_D = 6.2\text{ A}$		18.3	32.3	
		$V_{GS} = 4.5\text{ V}$ , $I_D = 9.4\text{ A}$ , $T_J = 125\text{ }^\circ\text{C}$		14.7	18.3	
$g_{FS}$	Forward Transconductance	$V_{DD} = 5\text{ V}$ , $I_D = 9.4\text{ A}$		56		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 10\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$		1260	1680	pF
$C_{oss}$	Output Capacitance			180	240	pF
$C_{rss}$	Reverse Transfer Capacitance			122	185	pF
$R_g$	Gate Resistance			1.9		$\Omega$

**Switching Characteristics**

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 10\text{ V}$ , $I_D = 9.4\text{ A}$ , $V_{GS} = 4.5\text{ V}$ , $R_{GEN} = 6\text{ }\Omega$		9	17	ns	
$t_r$	Rise Time			6	11	ns	
$t_{d(off)}$	Turn-Off Delay Time			37	58	ns	
$t_f$	Fall Time			6	11	ns	
$Q_g$	Total Gate Charge		$V_{GS} = 0\text{ V to } 4.5\text{ V}$		17.5		nC
	Total Gate Charge	$V_{GS} = 0\text{ V to } 2.5\text{ V}$		10.0		nC	
	Total Gate Charge	$V_{GS} = 0\text{ V to } 1.8\text{ V}$	$V_{DD} = 10\text{ V}$ , $I_D = 9.4\text{ A}$		7.4		nC
	Total Gate Charge	$V_{GS} = 0\text{ V to } 1.5\text{ V}$			6.2		nC
$Q_{gs}$	Gate to Source Charge			1.7		nC	
$Q_{gd}$	Gate to Drain "Miller" Charge			2.7		nC	

**Drain-Source Diode Characteristics**

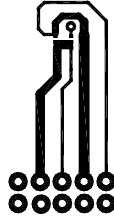
$I_S$	Maximum Continuous Drain-Source Diode Forward Current			2.0		A
$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}$ , $I_S = 2.0\text{ A}$ (Note 2)		0.63	1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F = 9.4\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$		16	29	ns
$Q_{rr}$	Reverse Recovery Charge			5	10	nC

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  $R_{\theta JA}$  is determined by the user's board design.



a. 65 °C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



b. 180 °C/W when mounted on a minimum pad of 2 oz copper.

2. Pulse Test: Pulse Width < 300 μs, Duty cycle < 2.0%.

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

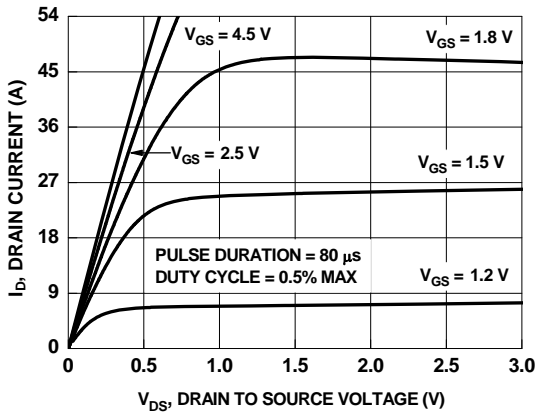


Figure 1. On Region Characteristics

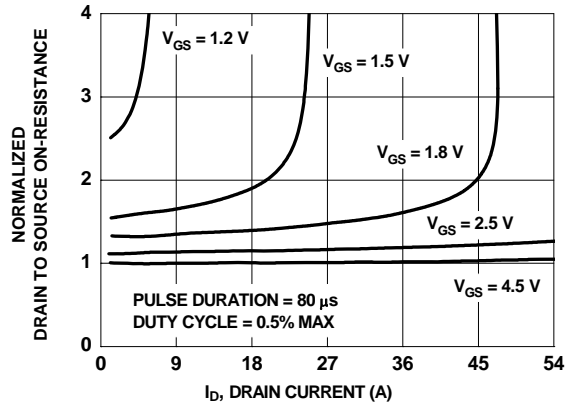


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

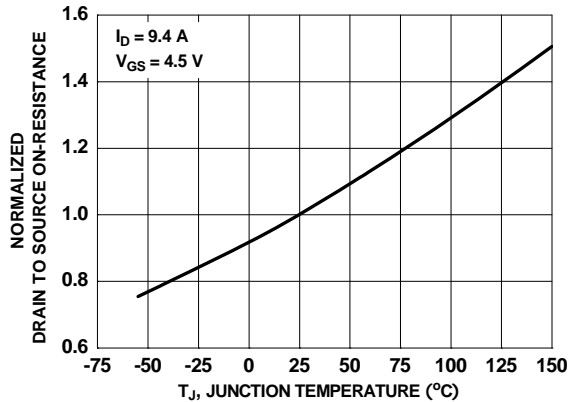


Figure 3. Normalized On Resistance vs Junction Temperature

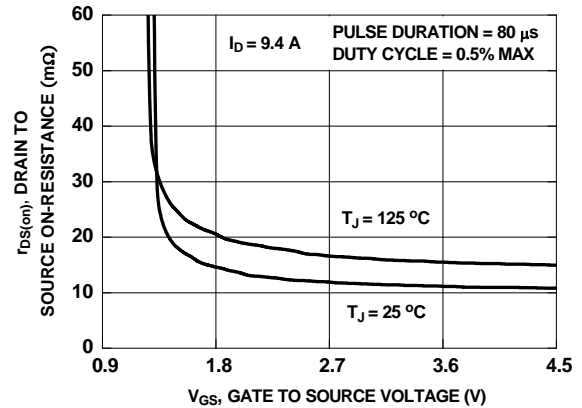


Figure 4. On-Resistance vs Gate to Source Voltage

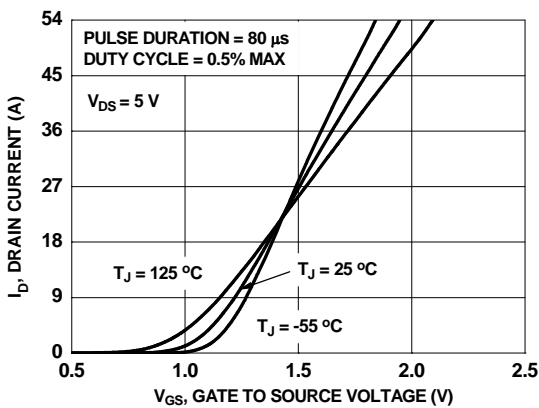


Figure 5. Transfer Characteristics

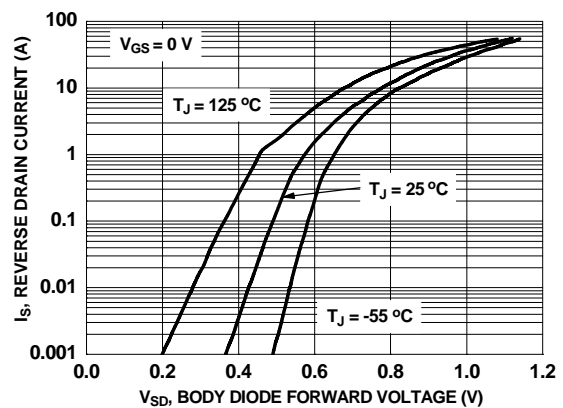
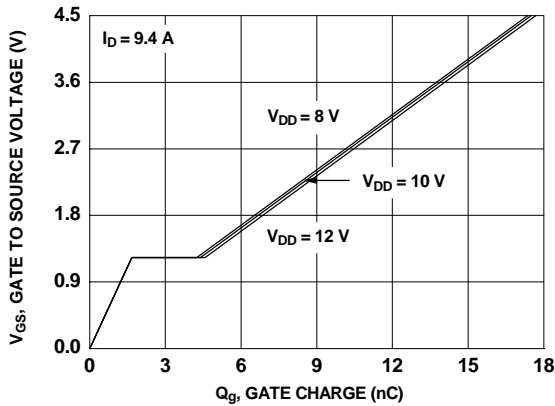
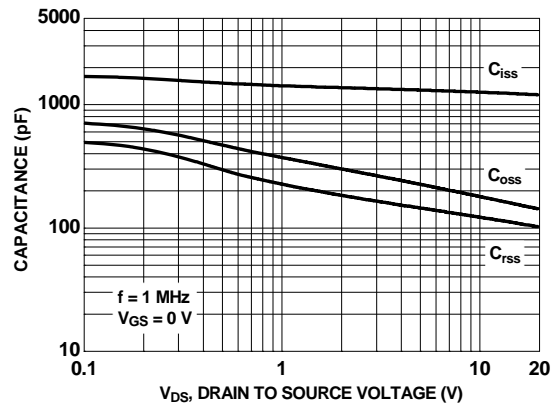


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

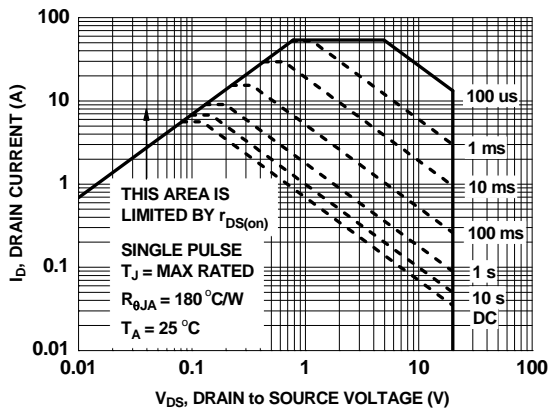
**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted



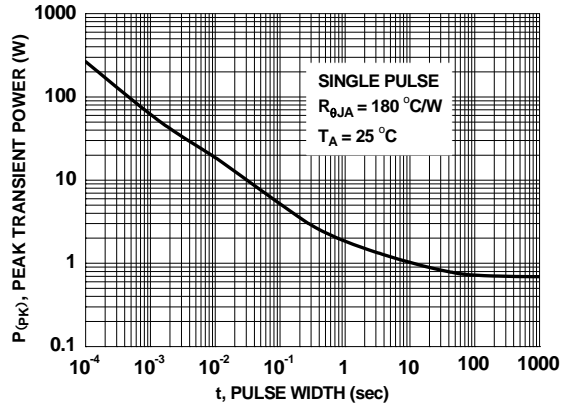
**Figure 7. Gate Charge Characteristics**



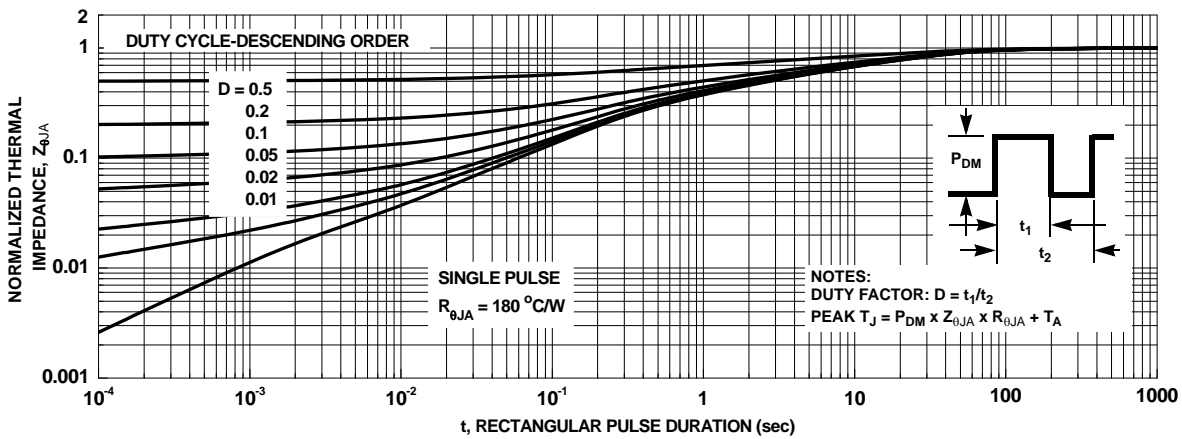
**Figure 8. Capacitance vs Drain to Source Voltage**



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

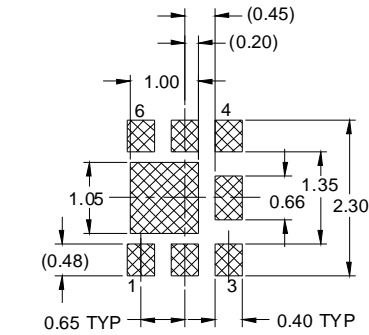
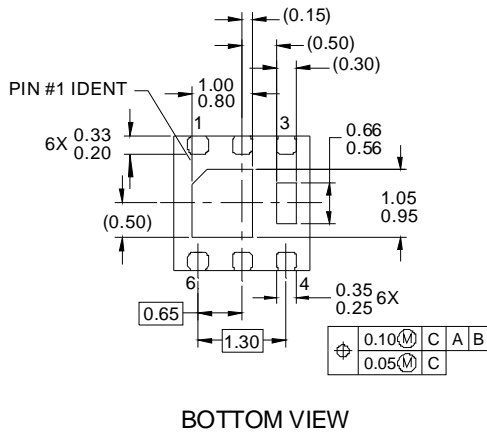
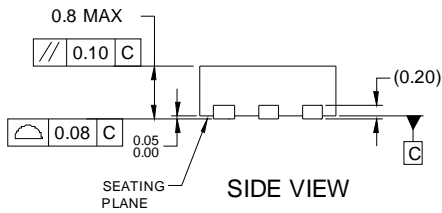
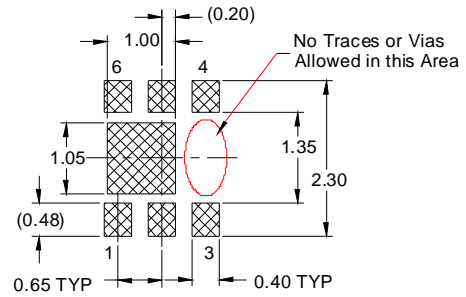
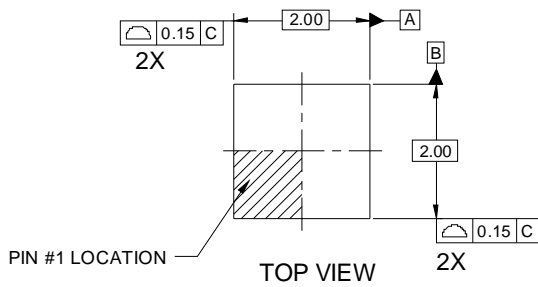


**Figure 10. Single Pulse Maximum Power Dissipation**



**Figure 11. Junction-to-Ambient Transient Thermal Response Curve**

## Dimensional Outline and Pad Layout








### NOTES:

- A. DOES NOT FULLY CONFORM TO JEDEC REGISTRATION MO-229 DATED AUG/2003
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994



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| Auto-SPM™                                                                         | F-PFS™                                                                            | PowerTrench®                                                                      | The Right Technology for Your Success™                                              |
| AX-CAP™*                                                                          | FRFET®                                                                            | PowerXS™                                                                          | the                                                                                 |
| BitSiC®                                                                           | Global Power Resource <sup>SM</sup>                                               | Programmable Active Droop™                                                        | <b>power</b>                                                                        |
| Build it Now™                                                                     | Green FPS™                                                                        | QFET®                                                                             | franchise                                                                           |
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| CROSSVOLT™                                                                        | GTO™                                                                              | RapidConfigure™                                                                   | TinyCalc™                                                                           |
| CTL™                                                                              | IntelliMAX™                                                                       |  | TinyLogic®                                                                          |
| Current Transfer Logic™                                                           | ISOPLANAR™                                                                        | Saving our world, 1mW/W/kW at a time™                                             | TINYOPTO™                                                                           |
| DEUXPEED®                                                                         | MegaBuck™                                                                         | SignalWise™                                                                       | TinyPower™                                                                          |
| Dual Cool™                                                                        | MICROCOUPLER™                                                                     | SmartMax™                                                                         | TinyPWM™                                                                            |
| EcoSPARK®                                                                         | MicroFET™                                                                         | SMART START™                                                                      | TinyWire™                                                                           |
| EfficientMax™                                                                     | MicroPak™                                                                         | SPM®                                                                              | TranSiC®                                                                            |
| ESBC™                                                                             | MicroPak2™                                                                        | STEALTH™                                                                          | TriFault Detect™                                                                    |
|  | MillerDrive™                                                                      | SuperFET®                                                                         | TRUECURRENT®*                                                                       |
| Fairchild®                                                                        | MotionMax™                                                                        | SuperSOT™-3                                                                       | μSerDes™                                                                            |
| Fairchild Semiconductor®                                                          | Motion-SPM™                                                                       | SuperSOT™-6                                                                       |  |
| FACT Quiet Series™                                                                | mWSaver™                                                                          | SuperSOT™-8                                                                       | UHC®                                                                                |
| FACT®                                                                             | OptiHiT™                                                                          | SupreMOS®                                                                         | Ultra FRFET™                                                                        |
| FAST®                                                                             | OPTOLOGIC®                                                                        | SyncFET™                                                                          | UniFET™                                                                             |
| FastvCore™                                                                        | OPTOPLANAR®                                                                       | Sync-Lock™                                                                        | VCX™                                                                                |
| FETBench™                                                                         |  |  | VisualMax™                                                                          |
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