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October 2015

# FDMA86251

## Single N-Channel PowerTrench<sup>®</sup> MOSFET

150 V, 2.4 A, 175 mΩ

### Features

- Max  $r_{DS(on)}$  = 175 mΩ at  $V_{GS} = 10\text{ V}$ ,  $I_D = 2.4\text{ A}$
- Max  $r_{DS(on)}$  = 237 mΩ at  $V_{GS} = 6\text{ V}$ ,  $I_D = 2.0\text{ A}$
- Low Profile - 0.8 mm maximum in the new package MicroFET 2x2 mm
- Free from halogenated compounds and antimony oxides
- RoHS Compliant

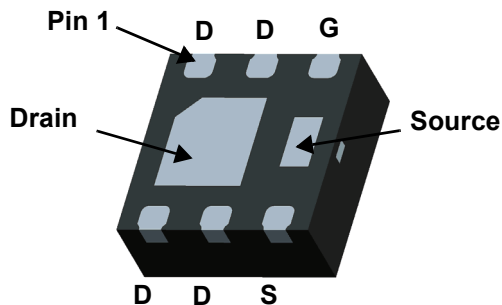


### General Description

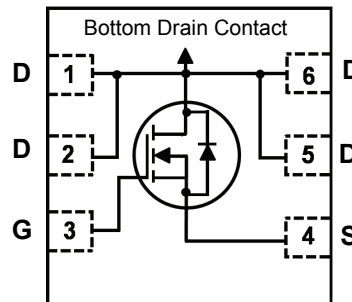
This device has been designed to provide maximum efficiency and thermal performance for synchronous buck converters. The low  $r_{DS(on)}$  and gate charge provide excellent switching performance.

### Applications

- DC – DC Primary Switch
- Load Switch



MicroFET 2X2 (Bottom View)



### MOSFET Maximum Ratings $T_A = 25\text{ °C}$ unless otherwise noted.

Symbol	Parameter	Rated	Units
$V_{DS}$	Drain to Source Voltage	150	V
$V_{GS}$	Gate to Source Voltage	±20	V
$I_D$	Drain Current -Continuous	$T_A = 25\text{ °C}$ (Note 1a)	A
	-Pulsed	(Note 4)	
$E_{AS}$	Single Pulse Avalanche Energy	(Note 3)	mJ
$P_D$	Power Dissipation	$T_A = 25\text{ °C}$ (Note 1a)	W
	Power Dissipation	$T_A = 25\text{ °C}$ (Note 1b)	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	°C

### Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1a)	52	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1b)	145	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
251	FDMA86251	MicroFET 2X2	7"	8 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	$I_D = 250\text{ }\mu\text{A}, V_{GS} = 0\text{ V}$	150			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		108		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 120\text{ V}, V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$			100	nA

### On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$	2.0	2.8	4.0	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 $25\text{ }^\circ\text{C}$		-9		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}, I_D = 2.4\text{ A}$		148	175	m $\Omega$
		$V_{GS} = 6\text{ V}, I_D = 2.0\text{ A}$		175	237	
		$V_{GS} = 10\text{ V}, I_D = 2.4\text{ A}, T_J = 125\text{ }^\circ\text{C}$		272	333	
$g_{FS}$	Forward Transconductance	$V_{DD} = 5\text{ V}, I_D = 2.4\text{ A}$		4.7		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 75\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		259	363	pF
$C_{oss}$	Output Capacitance			24	34	pF
$C_{rss}$	Reverse Transfer Capacitance			1.5	2.4	pF
$R_g$	Gate Resistance		0.1	1.5	3.0	$\Omega$

### Switching Characteristics

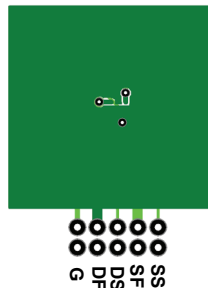
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 75\text{ V}, I_D = 2.4\text{ A}, V_{GS} = 10\text{ V}, R_{GEN} = 6\text{ }\Omega$		5.9	12	ns
$t_r$	Rise Time			1.7	10	ns
$t_{d(off)}$	Turn-Off Delay Time			10	20	ns
$t_f$	Fall Time			2.3	10	ns
$Q_{g(TOT)}$	Total Gate Charge	$V_{GS} = 0\text{ V to } 10\text{ V}$	$V_{DD} = 75\text{ V}, I_D = 2.4\text{ A}$	4.1	5.8	nC
$Q_{g(TOT)}$	Total Gate Charge	$V_{GS} = 0\text{ V to } 6\text{ V}$		2.7	3.8	nC
$Q_{gs}$	Gate to Source Charge			1.2		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			1.0		nC

### Drain-Source Diode Characteristics

$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 2.4\text{ A}$ (Note 2)		0.8	1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F = 2.4\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$		49	79	ns
$Q_{rr}$	Reverse Recovery Charge			38	61	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. 52  $^\circ\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



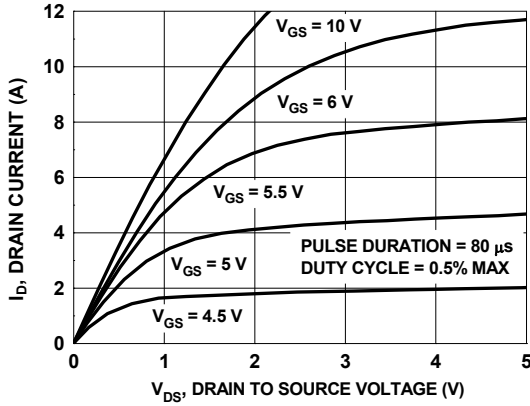
b. 145  $^\circ\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper.

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

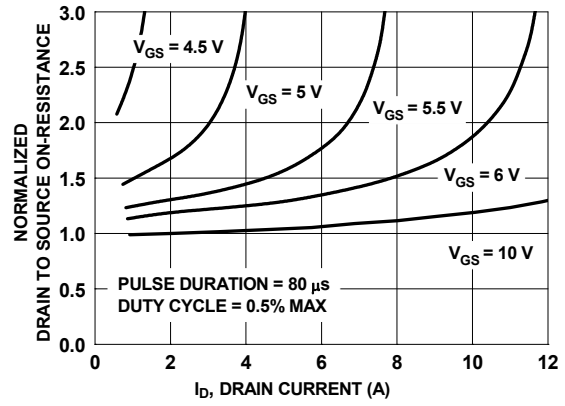
3:  $E_{AS}$  of 13 mJ is based on starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 3\text{ mH}$ ,  $I_{AS} = 3\text{ A}$ ,  $V_{DD} = 150\text{ V}$ ,  $V_{GS} = 10\text{ V}$ . 100% tested at  $L = 0.3\text{ mH}$ ,  $I_{AS} = 8\text{ A}$ .

4: Pulsed  $I_D$  please refer to Fig 9 SOA graph for more details.

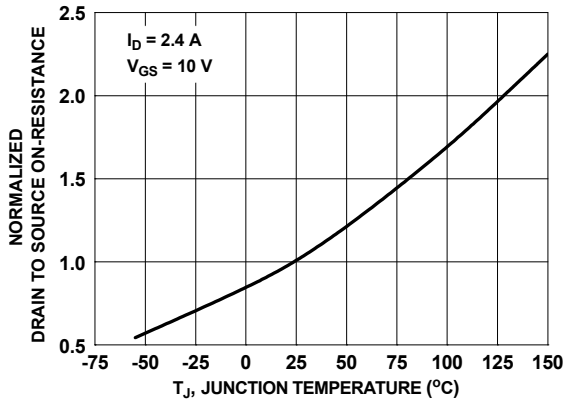
**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted.



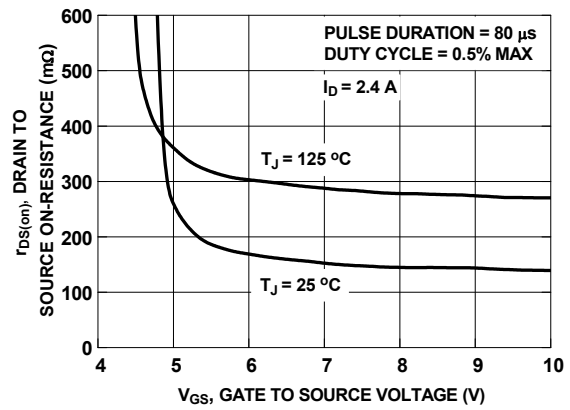
**Figure 1. On Region Characteristics**



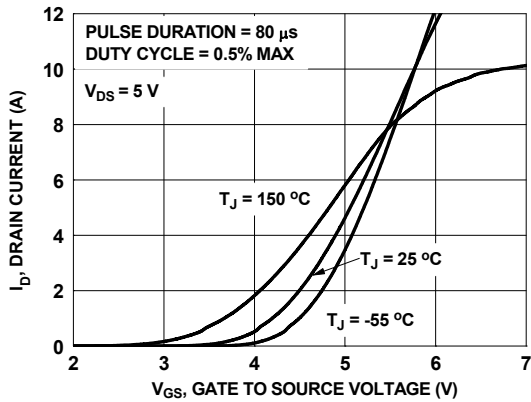
**Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage**



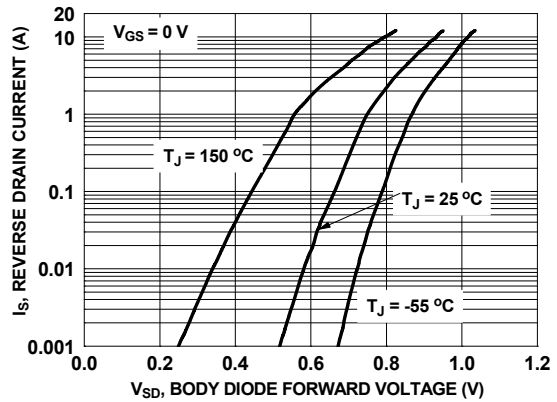
**Figure 3. Normalized On Resistance vs. Junction Temperature**



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

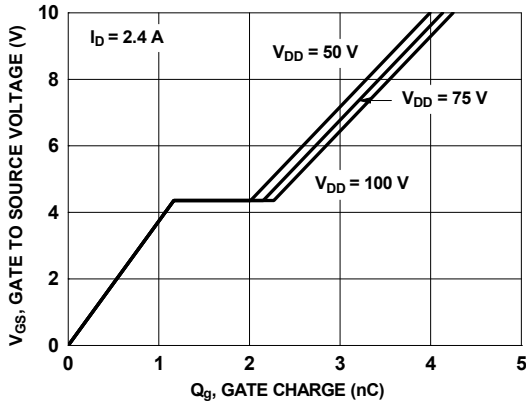


**Figure 5. Transfer Characteristics**

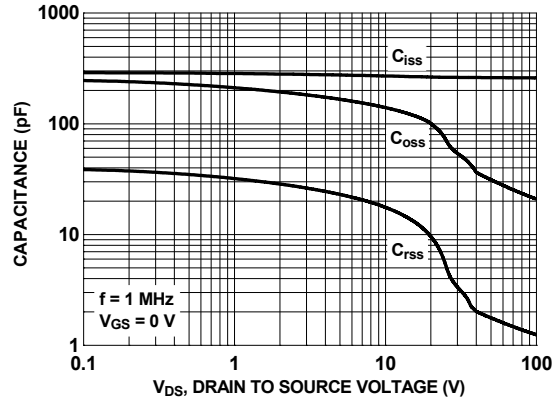


**Figure 6. Source to Drain Diode Forward Voltage vs. Source Current**

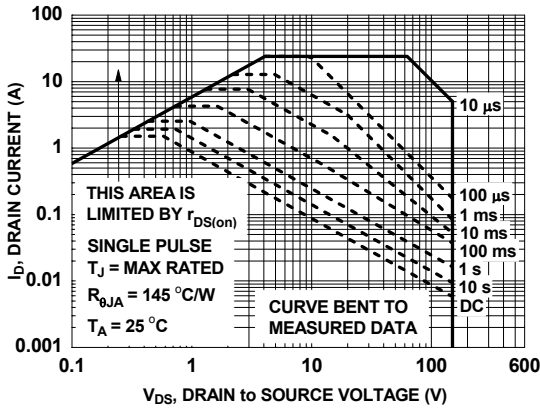
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted.



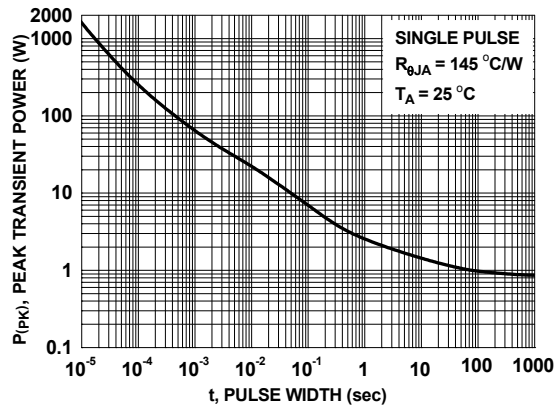
**Figure 7. Gate Charge Characteristics**



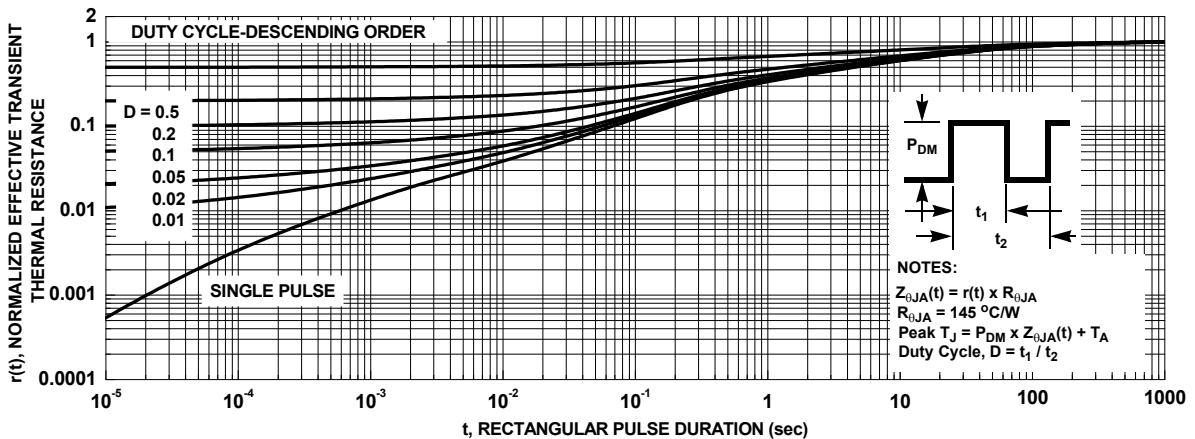
**Figure 8. Capacitance vs. Drain to Source Voltage**



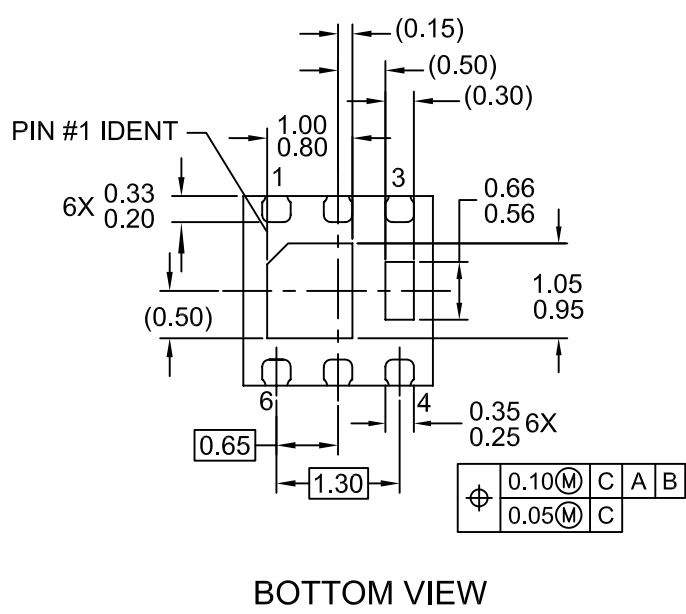
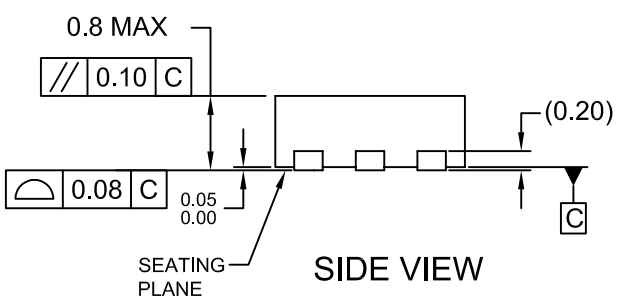
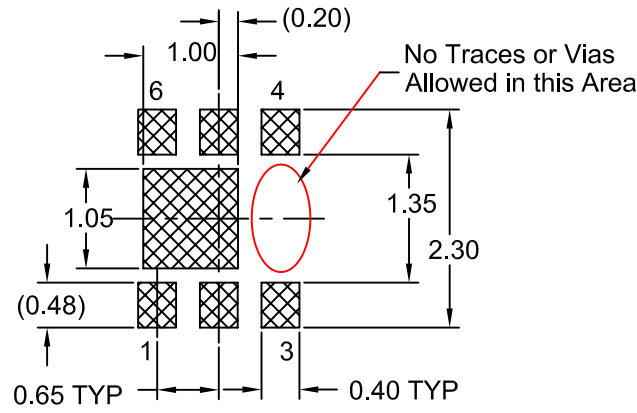
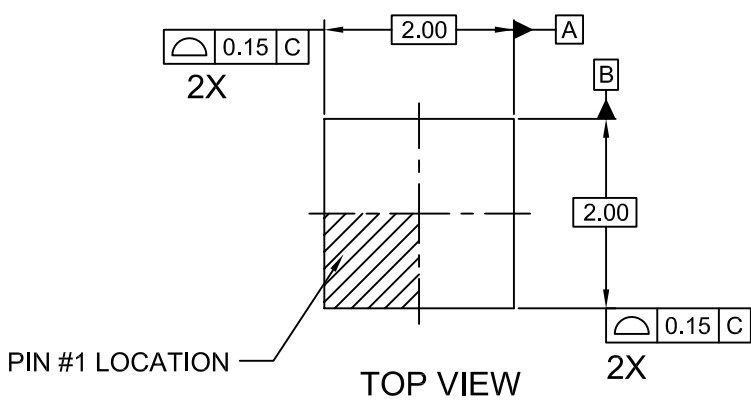
**Figure 9. Forward Bias Safe Operating Area**



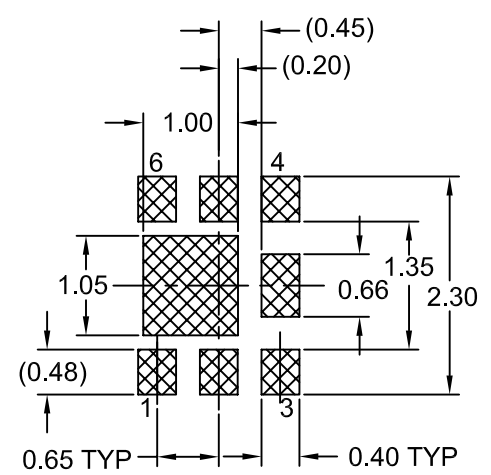
**Figure 10. Single Pulse Maximum Power Dissipation**



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



RECOMMENDED LAND PATTERN OPT 1



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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