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October 2014

# FDMA86551L

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

60 V, 7.5 A, 23 mΩ

### Features

- Max  $r_{DS(on)}$  = 23 mΩ at  $V_{GS} = 10\text{ V}$ ,  $I_D = 7.5\text{ A}$
- Max  $r_{DS(on)}$  = 35 mΩ at  $V_{GS} = 4.5\text{ V}$ ,  $I_D = 6\text{ A}$
- Low Profile - 0.8 mm maximum in the new package MicroFET 2x2 mm
- Free from halogenated compounds and antimony oxides
- RoHS Compliant

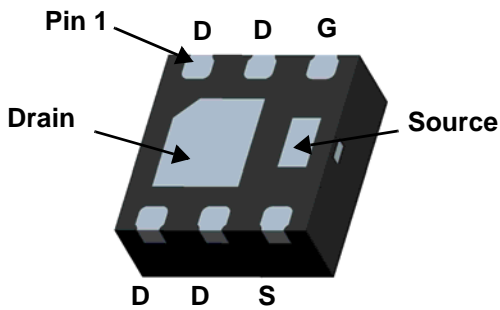


### General Description

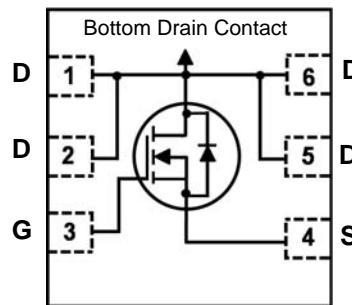
This device has been designed to provide maximum efficiency and thermal performance for synchronous buck converters. The low  $r_{DS(on)}$  and gate charge provide excellent switching performance.

### Application

- DC – DC Buck Converters



MicroFET 2X2 (Bottom View)



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

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain to Source Voltage	60	V
$V_{GS}$	Gate to Source Voltage	±20	V
$I_D$	Drain Current -Continuous	$T_A = 25\text{ °C}$ (Note 1a)	7.5
	-Pulsed	(Note 4)	45
EAS	Single Pulse Avalanche Energy	(Note 3)	37
$P_D$	Power Dissipation	$T_A = 25\text{ °C}$ (Note 1a)	2.4
	Power Dissipation	$T_A = 25\text{ °C}$ (Note 1b)	0.9
$T_J, T_{STG}$	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
551	FDMA86551L	MicroFET 2X2	7"	8 mm	3000 units

FDMA86551L Single N-Channel PowerTrench<sup>®</sup> MOSFET

## 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	$I_D = 250\text{ }\mu\text{A}, V_{GS} = 0\text{ V}$	60			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		31		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}$			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	$V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$	1.0	1.8	3.0	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 $25\text{ }^\circ\text{C}$		-5		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}, I_D = 7.5\text{ A}$		19	23	m $\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 6\text{ A}$		26	35	
		$V_{GS} = 10\text{ V}, I_D = 7.5\text{ A}, T_J = 125\text{ }^\circ\text{C}$		28	33	
$g_{FS}$	Forward Transconductance	$V_{DD} = 5\text{ V}, I_D = 7.5\text{ A}$		21		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		881	1235	pF
$C_{oss}$	Output Capacitance			182	255	pF
$C_{rss}$	Reverse Transfer Capacitance			6.1	15	pF
$R_g$	Gate Resistance		0.1	0.5	1.5	$\Omega$

### Switching Characteristics

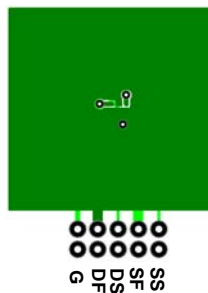
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 30\text{ V}, I_D = 7.5\text{ A}, V_{GS} = 10\text{ V}, R_{GEN} = 6\text{ }\Omega$		7.3	15	ns
$t_r$	Rise Time			1.7	10	ns
$t_{d(off)}$	Turn-Off Delay Time			16	29	ns
$t_f$	Fall Time			1.4	10	ns
$Q_{g(TOT)}$	Total Gate Charge		$V_{GS} = 0\text{ V to } 10\text{ V}$		12	17
$Q_{g(TOT)}$	Total Gate Charge	$V_{GS} = 0\text{ V to } 4.5\text{ V}$	$V_{DD} = 30\text{ V}, I_D = 7.5\text{ A}$	5.8	8.1	nC
$Q_{gs}$	Gate to Source Charge			2.7	3.8	nC
$Q_{gd}$	Gate to Drain "Miller" Charge			1.4	2.0	nC

### Drain-Source Diode Characteristics

$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 2\text{ A}$ (Note 2)		0.8	1.2	V
		$V_{GS} = 0\text{ V}, I_S = 7.5\text{ A}$ (Note 2)		0.9	1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F = 7.5\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$		23	37	ns
$Q_{rr}$	Reverse Recovery Charge			9.7	19	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.  $52\text{ }^\circ\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



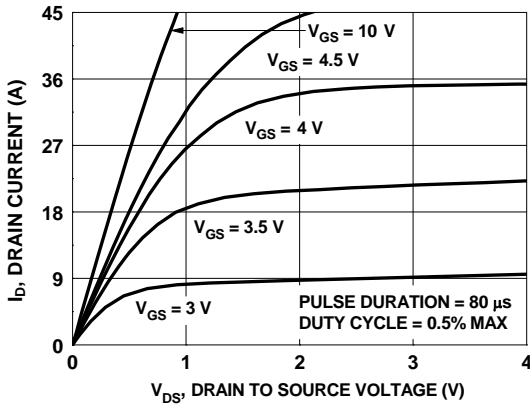
b.  $145\text{ }^\circ\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper.

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

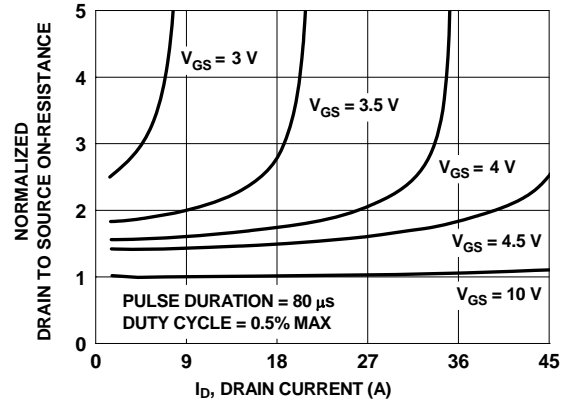
3.  $E_{AS}$  of 37 mJ is based on starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 3\text{ mH}$ ,  $I_{AS} = 5\text{ A}$ ,  $V_{DD} = 60\text{ V}$ ,  $V_{GS} = 10\text{ V}$ . 100% test at  $L = 0.1\text{ mH}$ ,  $I_{AS} = 16\text{ A}$ .

4. Pulse  $I_d$  measured at  $t_d \leq 250\text{ }\mu\text{s}$ , refer to Fig 11 SOA graph for more details.

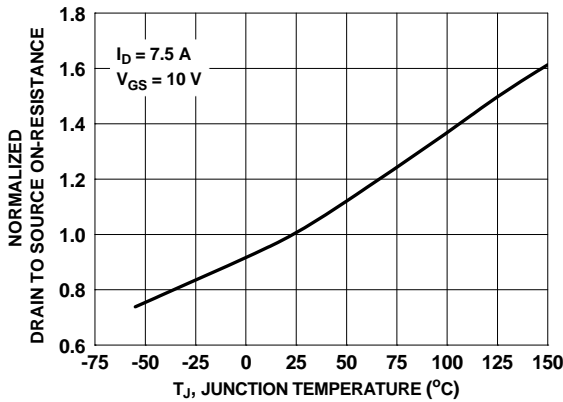
**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted



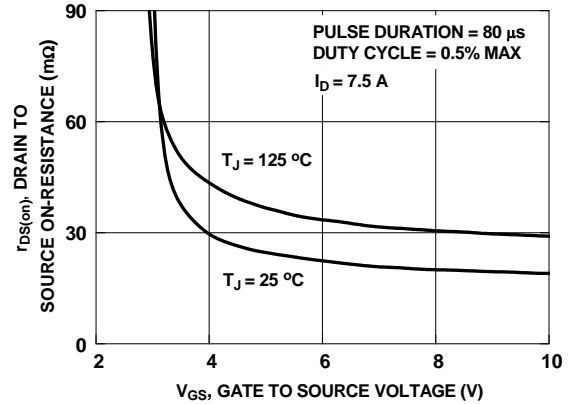
**Figure 1. On-Region Characteristics**



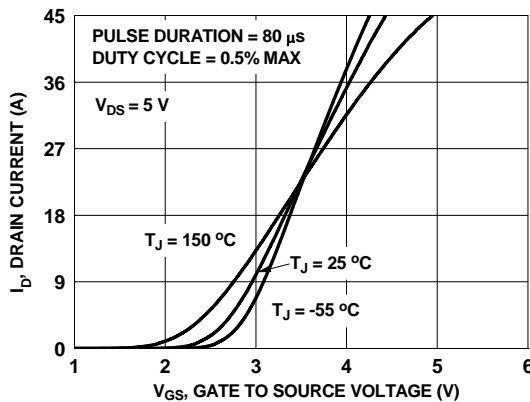
**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**



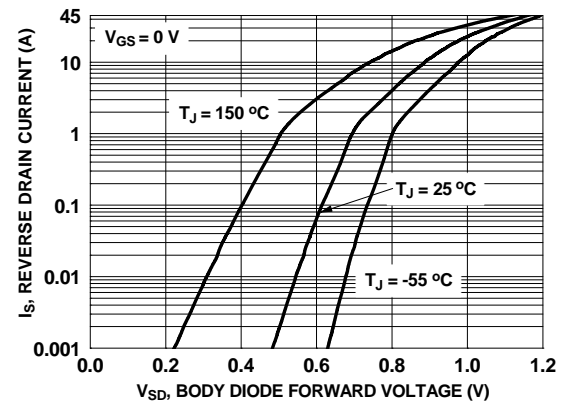
**Figure 3. Normalized On-Resistance vs Junction Temperature**



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

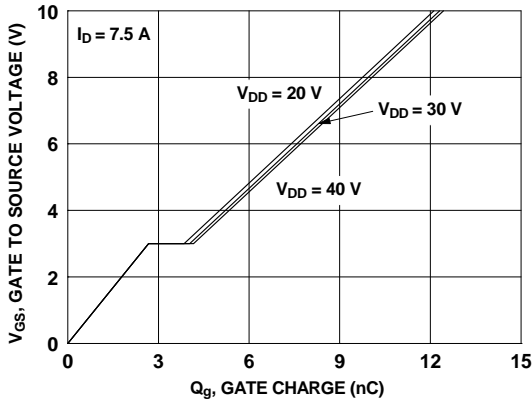


**Figure 5. Transfer Characteristics**

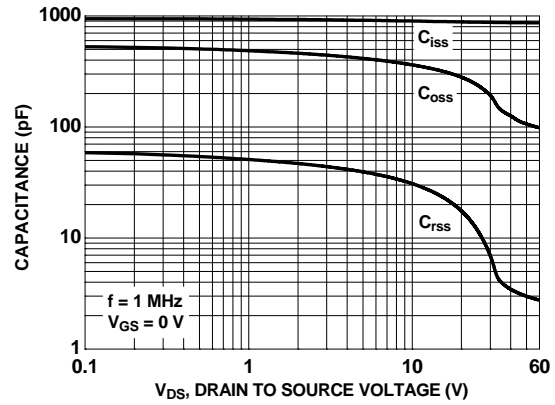


**Figure 6. Source to Drain Diode Forward Voltage vs Source Current**

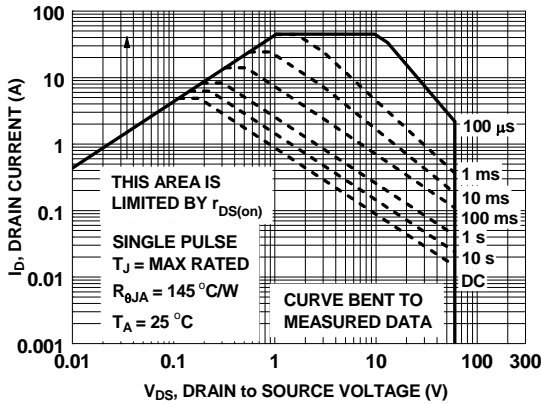
**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted



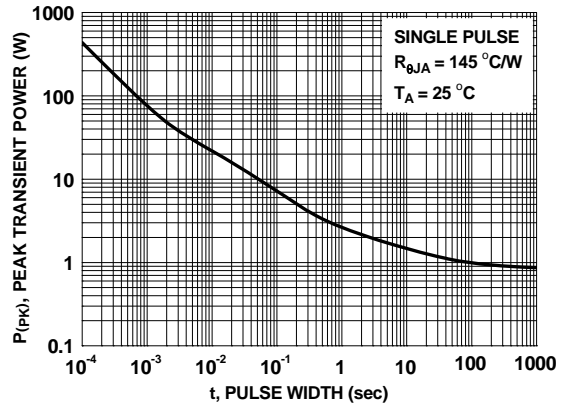
**Figure 7. Gate Charge Characteristics**



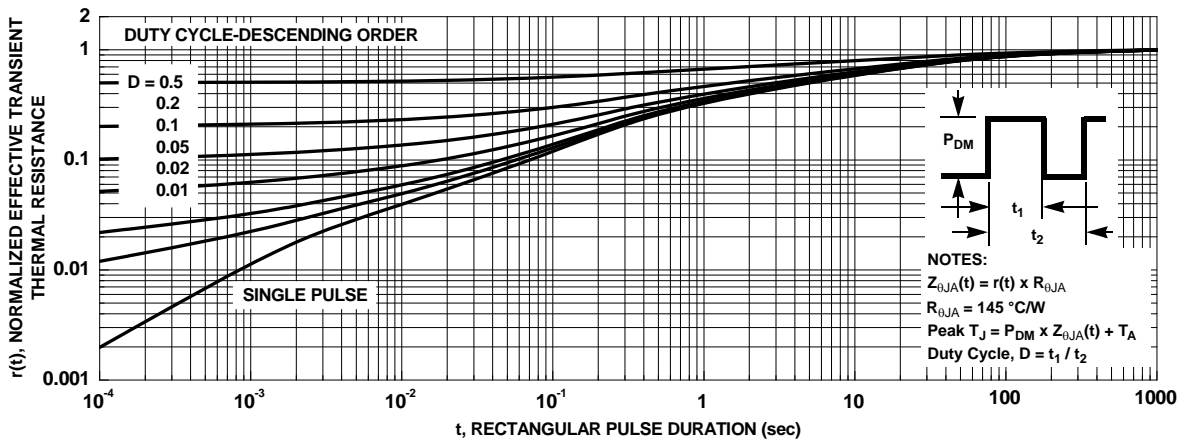
**Figure 8. Capacitance vs Drain to Source Voltage**



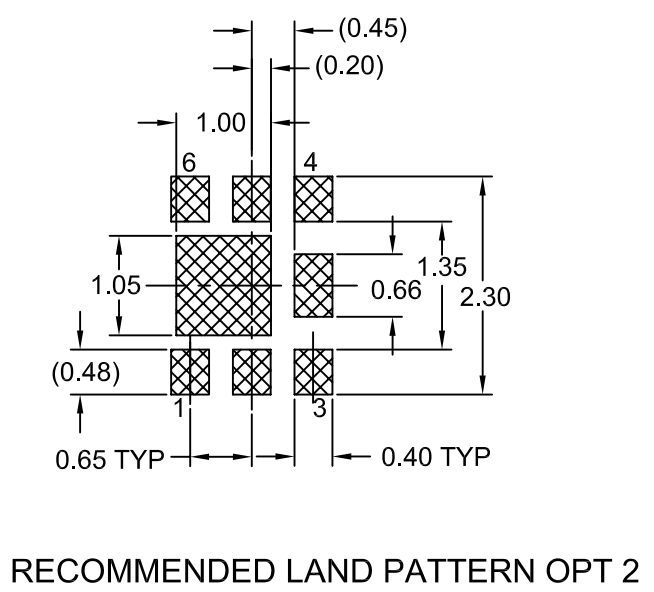
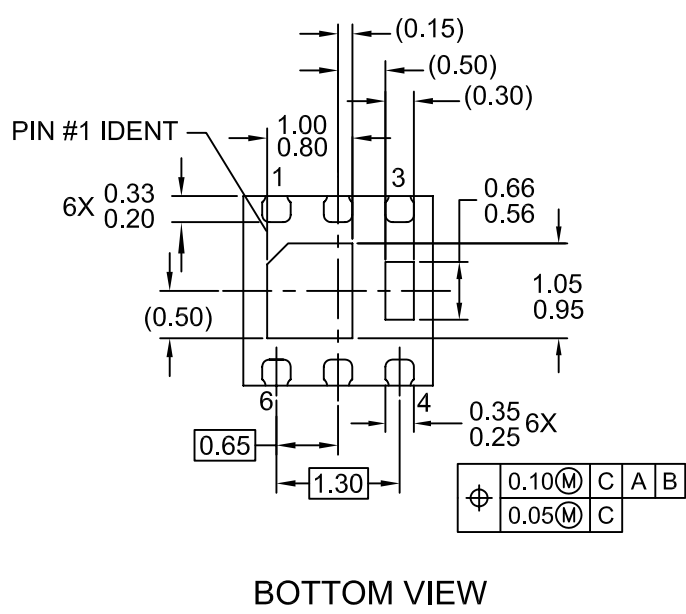
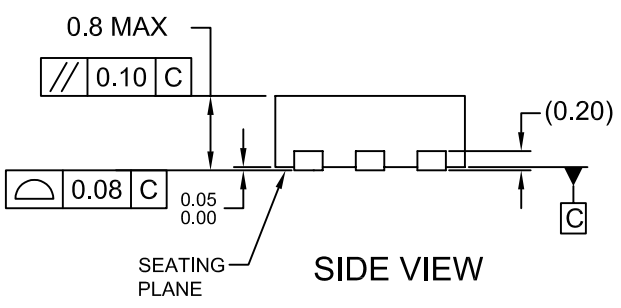
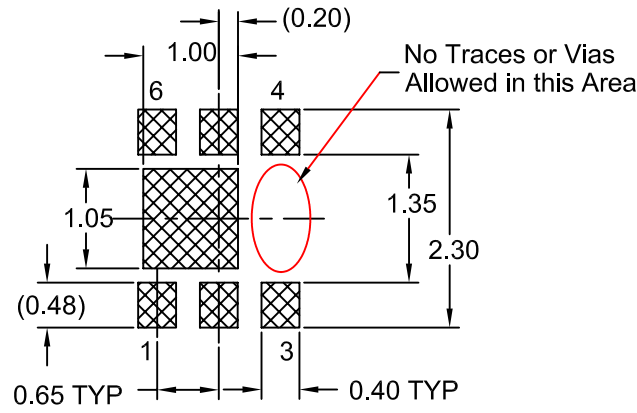
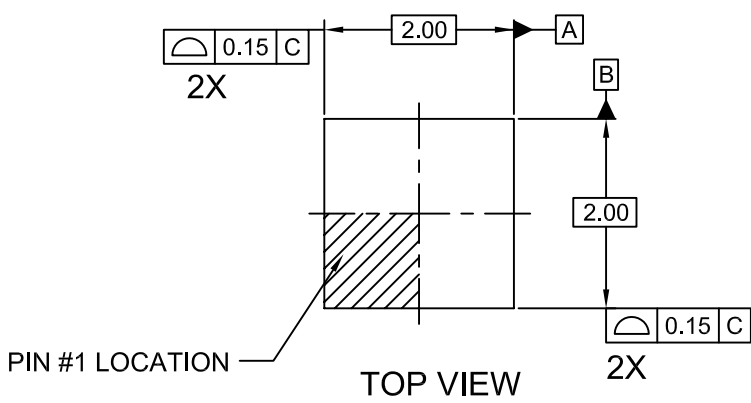
**Figure 9. Forward Bias Safe Operating Area**



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



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



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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