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October 2014

### FDMA86551L

## Single N-Channel PowerTrench® MOSFET

#### **60 V, 7.5 A, 23 m**Ω

#### **Features**

- Max  $r_{DS(on)} = 23 \text{ m}\Omega$  at  $V_{GS} = 10 \text{ V}$ ,  $I_D = 7.5 \text{ A}$
- Max  $r_{DS(on)} = 35 \text{ m}\Omega$  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

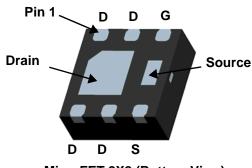


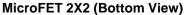
#### **General Description**

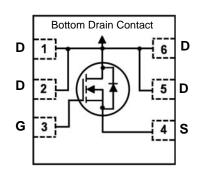
This device has been designed to provide maximum efficiency and thermal performance for synchronous buck converters. The low rDS(on) and gate charge provide excellent switching performance.

#### **Application**

■ DC – DC Buck Converters







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

Symbol	Paramet	ter		Ratings	Units
$V_{DS}$	Drain to Source Voltage			60	V
$V_{GS}$	Gate to Source Voltage			±20	V
	Drain Current -Continuous	T <sub>A</sub> = 25 °C	(Note 1a)	7.5	A
'D	-Pulsed		(Note 4)	45	_ ^
Eas	Single Pulse Avalanche Energy		(Note 3)	37	mJ
P <sub>D</sub>	Power Dissipation	T <sub>A</sub> = 25 °C	(Note 1a)	2.4	W
	Power Dissipation	T <sub>A</sub> = 25 °C	(Note 1b)	0.9	- vv
$T_J, T_{STG}$	Operating and Storage Junction Temperat	ure 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	0/44

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

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
551	FDMA86551L	MicroFET 2X2	7 "	8 mm	3000 units

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

Symbol	Parameter	Test Conditions	Min	Тур	Max	Units
Off Chara	cteristics					
$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250 \mu A, V_{GS} = 0 V$	60			V
$\frac{\Delta BV_{DSS}}{\Delta T_{J}}$	Breakdown Voltage Temperature Coefficient	$I_D$ = 250 $\mu$ A, referenced to 25 °C		31		mV/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 48 V, V <sub>GS</sub> = 0 V			1	μΑ
I <sub>GSS</sub>	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	$V_{GS} = V_{DS}, I_D = 250 \mu A$	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 $\mu$ A, referenced to 25 °C		-5		mV/°C
r <sub>DS(on)</sub>	Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}, I_D = 7.5 \text{ A}$		19	23	mΩ
		$V_{GS} = 4.5 \text{ V}, I_D = 6 \text{ A}$		26	35	
		$V_{GS} = 10 \text{ V}, I_D = 7.5 \text{ A},$ $T_J = 125 ^{\circ}\text{C}$		28	33	
9 <sub>FS</sub>	Forward Transconductance	$V_{DD} = 5 \text{ V}, I_{D} = 7.5 \text{ A}$		21		S

#### **Dynamic Characteristics**

C <sub>iss</sub>	Input Capacitance	V 20 V V 0 V		881	1235	pF
Coss	Output Capacitance	$V_{DS} = 30 \text{ V}, V_{GS} = 0 \text{ V},$ $f = 1 \text{ MHz}$		182	255	pF
C <sub>rss</sub>	Reverse Transfer Capacitance	1 - 1 1011 12		6.1	15	pF
$R_g$	Gate Resistance		0.1	0.5	1.5	Ω

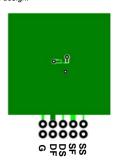
#### **Switching Characteristics**

t <sub>d(on)</sub>	Turn-On Delay Time	.,	7.3	15	ns
t <sub>r</sub>	Rise Time	$V_{DD} = 30 \text{ V}, I_{D} = 7.5 \text{ A},$ $V_{GS} = 10 \text{ V}, R_{GEN} = 6 \Omega$	1.7	10	ns
t <sub>d(off)</sub>	Turn-Off Delay Time	$V_{GS} = 10 \text{ V}, K_{GEN} = 6.12$	16	29	ns
t <sub>f</sub>	Fall Time		1.4	10	ns
$Q_{g(TOT)}$	Total Gate Charge	V <sub>GS</sub> = 0 V to 10 V	12	17	nC
$Q_{g(TOT)}$	Total Gate Charge	$V_{GS} = 0 \text{ V to } 4.5 \text{ V}$ $V_{DD} = 30 \text{ V}$ ,	5.8	8.1	nC
$Q_{gs}$	Gate to Source Charge	I <sub>D</sub> = 7.5 A	2.7	3.8	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		1.4	2.0	nC

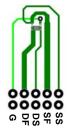
#### **Drain-Source Diode Characteristics**

V <sub>SD</sub>	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	٧
t <sub>rr</sub>	Reverse Recovery Time	$I_E = 7.5 \text{ A, di/dt} = 100 \text{ A/}\mu\text{s}$	23	37	ns
Q <sub>rr</sub>	Reverse Recovery Charge	1F = 7.3 A, α/αι = 100 A/μS	9.7	19	nC

<sup>1.</sup> R<sub>8JA</sub> 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<sub>8JC</sub> is guaranteed by design while R<sub>8JA</sub> is determined by the user's board design.



a. 52 °C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



b. 145 °C/W when mounted on a minimum pad of 2 oz copper.

<sup>2.</sup> Pulse Test: Pulse Width < 300  $\mu$ s, Duty cycle < 2.0%. 
3. E<sub>AS</sub> of 37 mJ is based on starting T<sub>J</sub> = 25 °C, L = 3 mH, I<sub>AS</sub> = 5 A, V<sub>DD</sub> = 60 V, V<sub>GS</sub> = 10 V. 100% test at L = 0.1 mH, I<sub>AS</sub> = 16 A.

<sup>4.</sup> Pulse Id measured at td <= 250  $\mu s,$  refer to Fig 11 SOA graph for more details.

#### Typical Characteristics T<sub>J</sub> = 25 °C unless otherwise noted

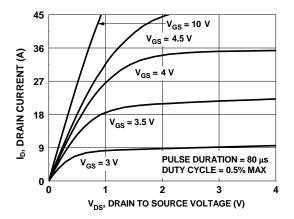


Figure 1. On-Region Characteristics

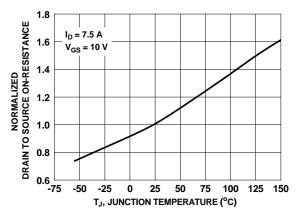


Figure 3. Normalized On-Resistance vs Junction Temperature

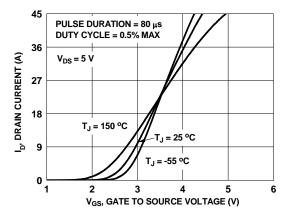


Figure 5. Transfer Characteristics

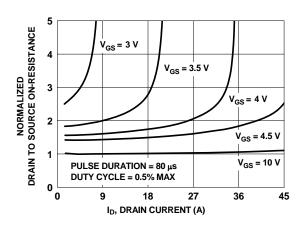


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

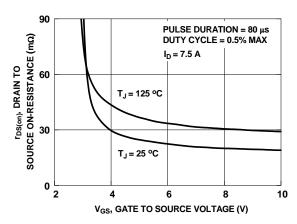


Figure 4. On-Resistance vs Gate to Source Voltage

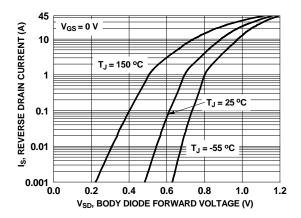


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

## **Typical Characteristics** $T_J = 25$ °C unless otherwise noted

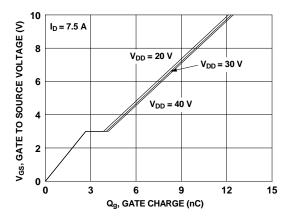


Figure 7. Gate Charge Characteristics

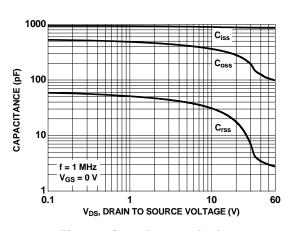


Figure 8. Capacitance vs Drain to Source Voltage

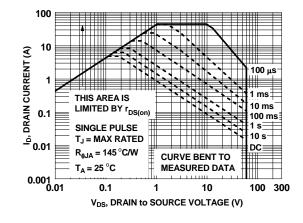


Figure 9. Forward Bias Safe Operating Area

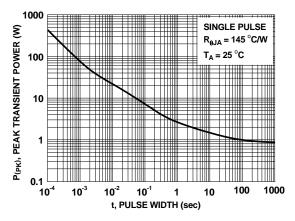


Figure 10. Single Pulse Maximum Power Dissipation

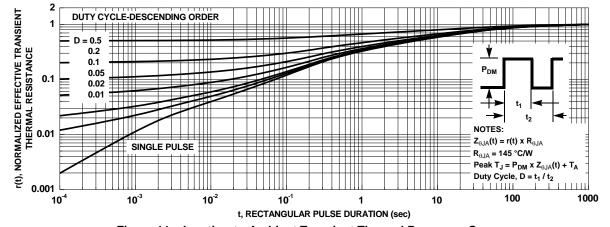
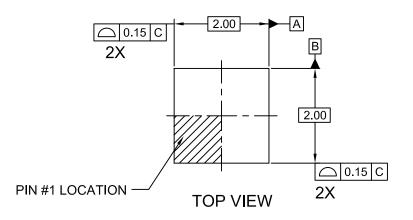
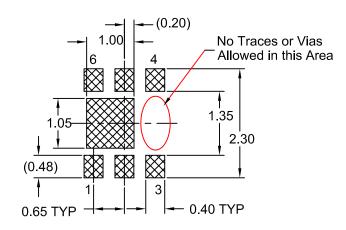
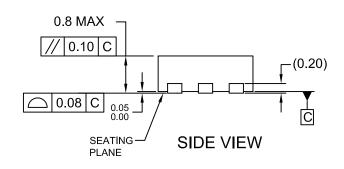


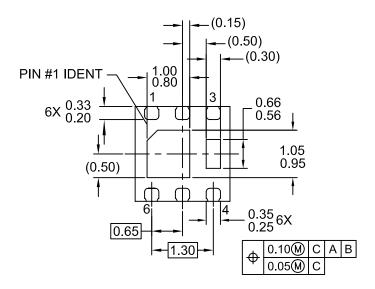
Figure 11. Junction-to-Ambient Transient Thermal Response Curve

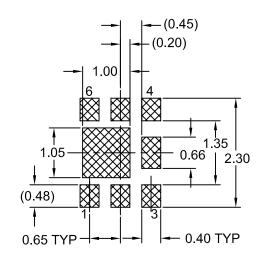




## RECOMMENDED LAND PATTERN OPT 1







**RECOMMENDED LAND PATTERN OPT 2** 

#### NOTES:

A. DOES NOT FULLY CONFORM TO JEDEC REGISTRATION MO-229 DATED AUG/2003

**BOTTOM VIEW** 

- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994
- D. DRAWING FILENAME: MKT-MLP06Prev1.

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