

# MOSFET – Single N-Channel, POWERTRENCH®

40 V, 10 A, 14 mΩ

## FDMA8051L

### 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.

### Features

- Max  $r_{DS(on)}$  = 14 mΩ at  $V_{GS} = 10$  V,  $I_D = 10$  A
- Max  $r_{DS(on)}$  = 18 mΩ at  $V_{GS} = 4.5$  V,  $I_D = 8.5$  A
- Low Profile – 0.8 mm maximum in the new package MicroFET 2 x 2 mm
- Free from halogenated compounds and antimony oxides
- RoHS Compliant

### Application

- DC–DC Buck Converters

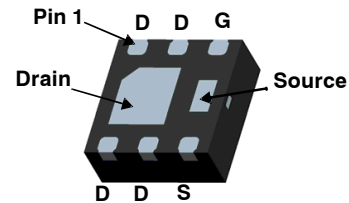
### MOSFET MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

| Symbol         | Parameter                                                     | Ratings         | Unit             |
|----------------|---------------------------------------------------------------|-----------------|------------------|
| $V_{DS}$       | Drain to Source Voltage                                       | 40              | V                |
| $V_{GS}$       | Gate to Source Voltage                                        | $\pm 20$        | V                |
| $I_D$          | Drain Current – Continuous $T_A = 25^\circ\text{C}$ (Note 1a) | 10              | A                |
|                | – Pulsed (Note 3)                                             | 80              |                  |
| $P_D$          | Power dissipation $T_A = 25^\circ\text{C}$ (Note 1a)          | 2.4             | W                |
|                | Power dissipation $T_A = 25^\circ\text{C}$ (Note 1b)          | 0.9             |                  |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range              | $-55$ to $+150$ | $^\circ\text{C}$ |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

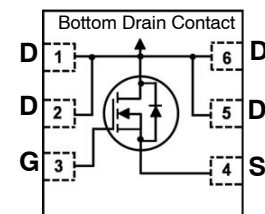
### THERMAL CHARACTERISTICS

| Symbol          | Parameter                                         | Ratings | Unit                      |
|-----------------|---------------------------------------------------|---------|---------------------------|
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1a) | 52      | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1b) | 145     |                           |



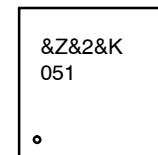
MicroFET 2x2  
(WDFN6 2x2, 0.65P)  
CASE 511DB

### ELECTRICAL CONNECTION



Single N-Channel MOSFET

### MARKING DIAGRAM



&Z = Assembly Plant Code  
 &2 = Numeric Date Code  
 &K = Lot Code  
 051 = Specific Device Code

### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

# FDMA8051L

## PACKAGE MARKING AND ORDERING INFORMATION

| Device Marking | Device    | Package      | Shipping <sup>†</sup>      |
|----------------|-----------|--------------|----------------------------|
| 051            | FDMA8051L | MicroFET 2x2 | 3000 Units/<br>Tape & Reel |

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise noted)

| Symbol | Parameter | Test Condition | Min | Typ | Max | Unit |
|--------|-----------|----------------|-----|-----|-----|------|
|--------|-----------|----------------|-----|-----|-----|------|

### OFF CHARACTERISTICS

|                                      |                                           |                                                     |    |    |     |         |
|--------------------------------------|-------------------------------------------|-----------------------------------------------------|----|----|-----|---------|
| BV <sub>DSS</sub>                    | Drain to Source Breakdown Voltage         | I <sub>D</sub> = 250 $\mu$ A, V <sub>GS</sub> = 0 V | 40 |    |     | V       |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | I <sub>D</sub> = 250 $\mu$ A, referenced to 25°C    |    | 22 |     | mV/°C   |
| I <sub>DSS</sub>                     | Zero Gate Voltage Drain Current           | V <sub>DS</sub> = 32 V, V <sub>GS</sub> = 0 V       |    |    | 1   | $\mu$ A |
| I <sub>GSS</sub>                     | Gate-to-Source Leakage Current            | V <sub>GS</sub> = $\pm$ 20 V, V <sub>DS</sub> = 0 V |    |    | 100 | nA      |

### ON CHARACTERISTICS

|                                        |                                                          |                                                                       |     |     |     |            |
|----------------------------------------|----------------------------------------------------------|-----------------------------------------------------------------------|-----|-----|-----|------------|
| V <sub>GS(th)</sub>                    | Gate to Source Threshold Voltage                         | V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 $\mu$ A      | 1.0 | 1.6 | 3.0 | V          |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | I <sub>D</sub> = 250 $\mu$ A, referenced to 25°C                      |     | -5  |     | mV/°C      |
| r <sub>DS(on)</sub>                    | Static Drain to Source On Resistance                     | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 10 A                         |     | 11  | 14  | m $\Omega$ |
|                                        |                                                          | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 8.5 A                       |     | 14  | 18  |            |
|                                        |                                                          | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 10 A, T <sub>J</sub> = 125°C |     | 15  | 19  |            |
| g <sub>FS</sub>                        | Forward Transconductance                                 | V <sub>DD</sub> = 5 V, I <sub>D</sub> = 10 A                          |     | 35  |     | S          |

### DYNAMIC CHARACTERISTICS

|                  |                              |                                                          |     |     |      |          |
|------------------|------------------------------|----------------------------------------------------------|-----|-----|------|----------|
| C <sub>iss</sub> | Input Capacitance            | V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V, f = 1 MHz |     | 901 | 1260 | pF       |
| C <sub>oss</sub> | Output Capacitance           |                                                          |     | 251 | 350  |          |
| C <sub>rss</sub> | Reverse Transfer Capacitance |                                                          |     | 16  | 25   |          |
| R <sub>g</sub>   | Gate Resistance              | f = 1 MHz                                                | 0.1 | 0.6 | 1.8  | $\Omega$ |

### SWITCHING CHARACTERISTICS

|                     |                       |                                                                                                         |  |     |     |    |
|---------------------|-----------------------|---------------------------------------------------------------------------------------------------------|--|-----|-----|----|
| t <sub>d(on)</sub>  | Turn – On Delay Time  | V <sub>DD</sub> = 20 V, I <sub>D</sub> = 10 A,<br>V <sub>GS</sub> = 10 V, R <sub>GEN</sub> = 6 $\Omega$ |  | 6.4 | 13  | ns |
| t <sub>r</sub>      | Rise Time             |                                                                                                         |  | 1.8 | 10  |    |
| t <sub>D(off)</sub> | Turn – Off Delay Time |                                                                                                         |  | 17  | 31  |    |
| t <sub>f</sub>      | Fall Time             |                                                                                                         |  | 1.8 | 10  |    |
| Q <sub>g</sub>      | Total Gate Charge     | V <sub>GS</sub> = 0V to 10 V                                                                            |  | 14  | 20  | nC |
| Q <sub>g</sub>      | Total Gate Charge     | V <sub>GS</sub> = 0V to 4.5 V<br>V <sub>DD</sub> = 20 V,<br>I <sub>D</sub> = 10 A                       |  | 6.4 | 9.0 |    |
| Q <sub>gs</sub>     | Total Gate Charge     |                                                                                                         |  | 2.4 | 3.7 |    |
| Q <sub>gd</sub>     | Gate to Source Charge |                                                                                                         |  | 1.8 | 2.5 |    |

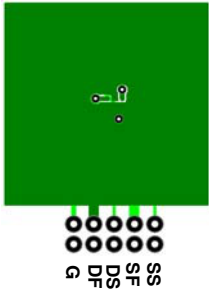
### DRAIN-SOURCE DIODE CHARACTERISTICS

|                 |                                       |                                                       |  |     |     |    |
|-----------------|---------------------------------------|-------------------------------------------------------|--|-----|-----|----|
| V <sub>SD</sub> | Source to Drain Diode Forward Voltage | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 2 A (Note 2)  |  | 0.7 | 1.2 | V  |
|                 |                                       | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 10 A (Note 2) |  | 0.8 | 1.2 |    |
| t <sub>rr</sub> | Reverse Recovery Time                 | I <sub>F</sub> = 10 A, di/dt = 100 A/ $\mu$ s         |  | 23  | 37  | ns |
| Q <sub>rr</sub> | Reverse Recovery Charge               |                                                       |  | 6.7 | 14  | nC |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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 × 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°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.

2. Pulse Test: Pulse Width < 300 μs, Duty cycle < 2.0%.
3. Pulsed  $I_D$  limited by junction temperature,  $t_d \leq 100 \mu s$ , please refer to SOA curve for more details.

TYPICAL CHARACTERISTICS  $T_J = 25^\circ\text{C}$  unless otherwise noted

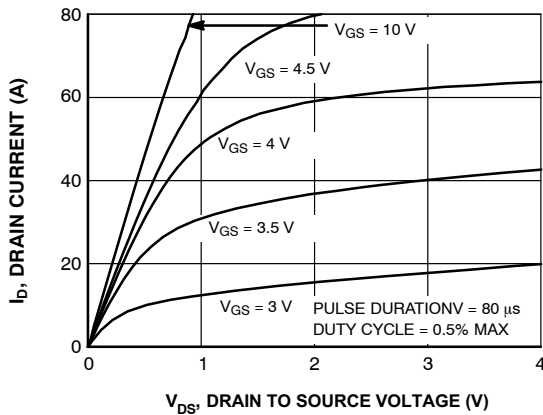


Figure 1. On Region Characteristics

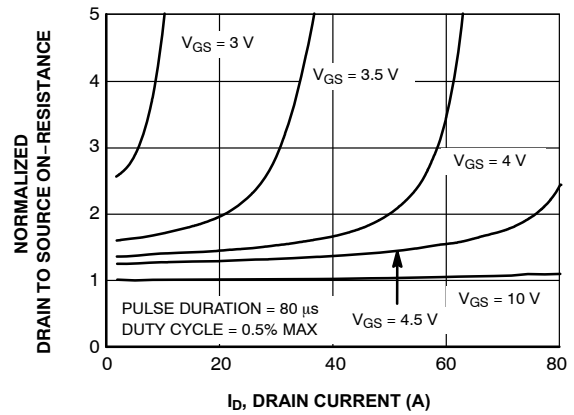


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

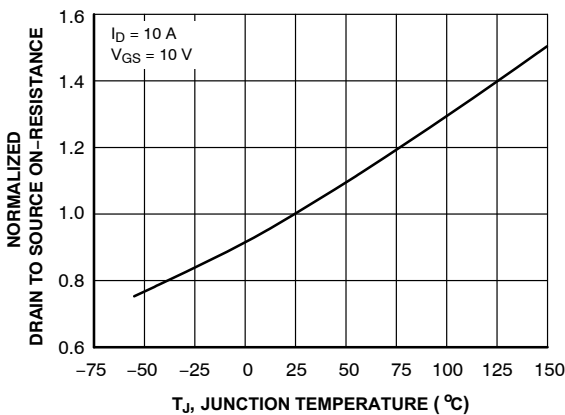


Figure 3. Normalized On Resistance vs. Junction Temperature

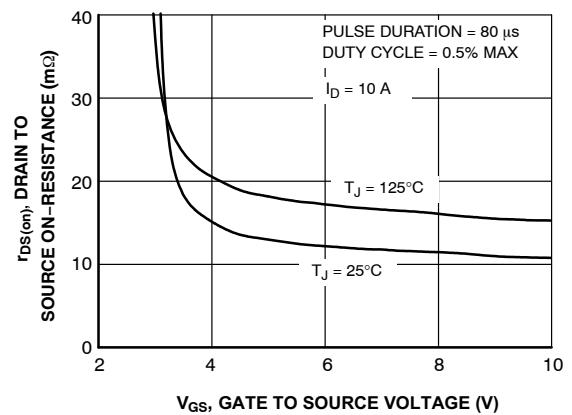


Figure 4. On-Resistance vs. Gate to Source Voltage

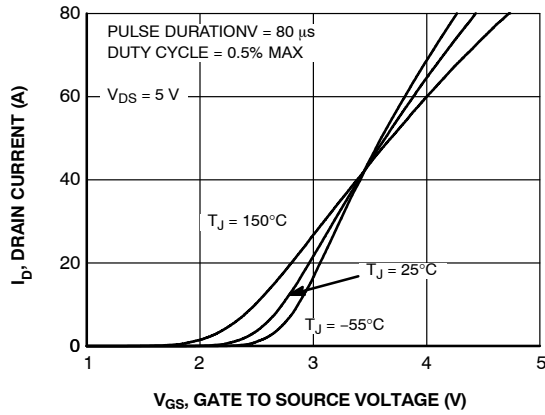
TYPICAL CHARACTERISTICS  $T_J = 25^\circ\text{C}$  unless otherwise noted (continued)

Figure 5. Transfer Characteristics

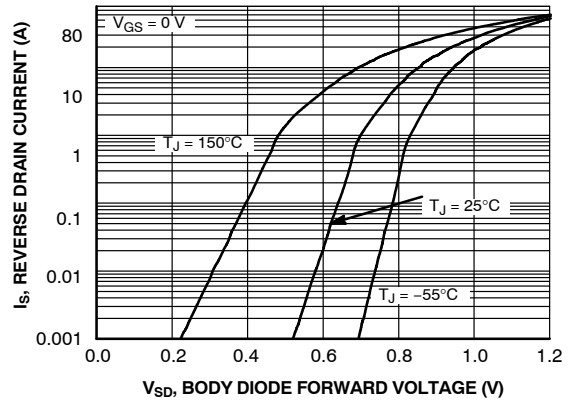


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

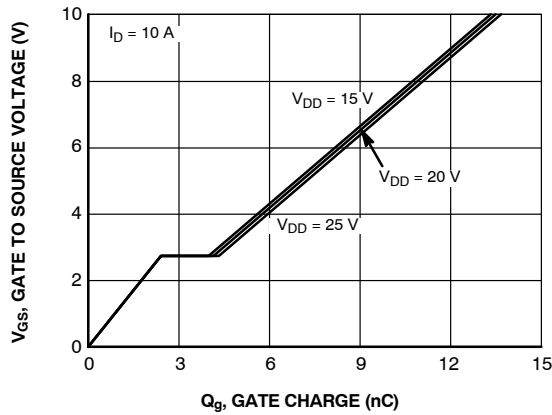


Figure 7. Gate Charge Characteristics

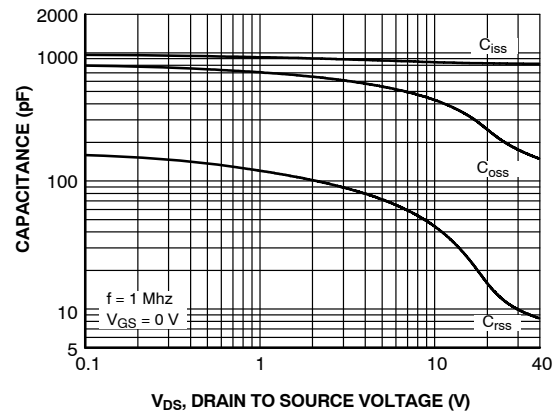


Figure 8. Capacitance vs. Drain to Source Voltage

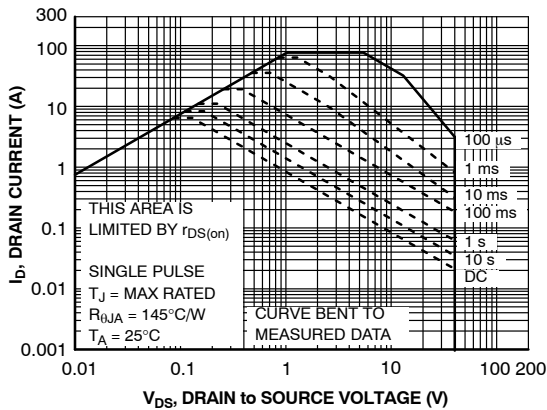


Figure 9. Forward Bias Safe Operating Area

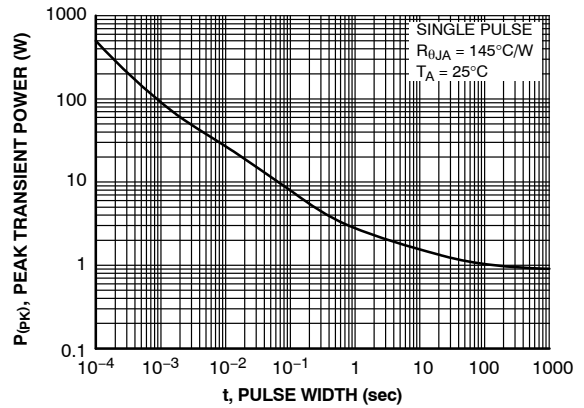


Figure 10. Single Pulse Maximum Power Dissipation

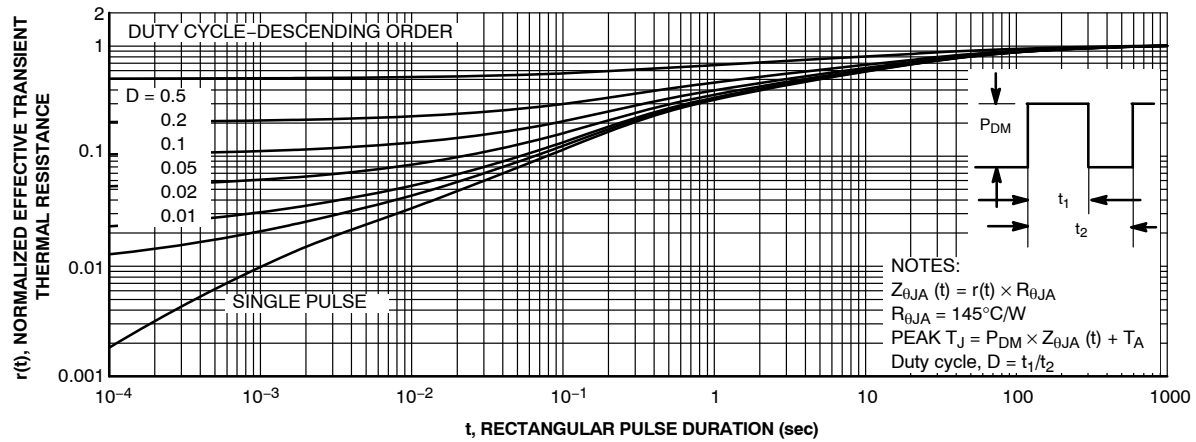
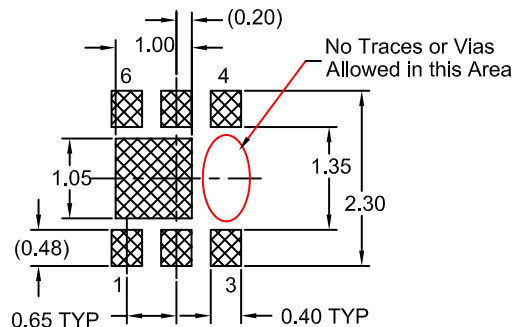
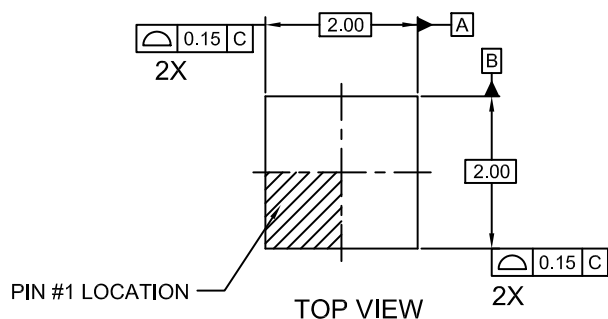
TYPICAL CHARACTERISTICS  $T_J = 25^\circ\text{C}$  unless otherwise noted (continued)

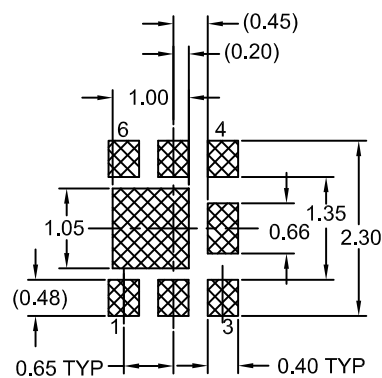
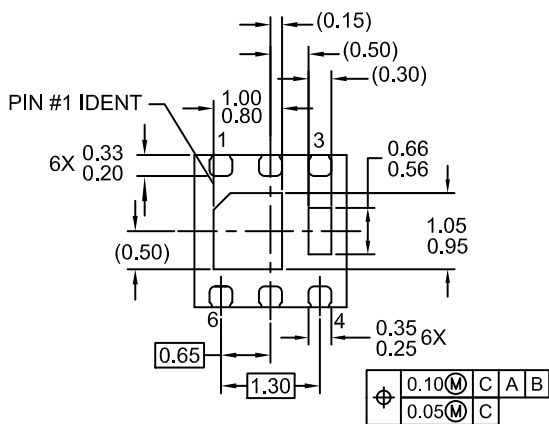
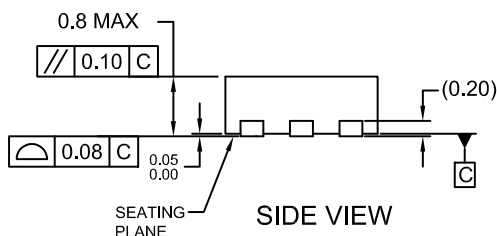
Figure 11. Single Pulse Junction-to-Ambient Transient Thermal Response Curve

**WDFN6 2x2, 0.65P**  
CASE 511DB  
ISSUE O

DATE 31 AUG 2016



RECOMMENDED LAND PATTERN OPT 1



## RECOMMENDED LAND PATTERN OPT 2

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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