

# MOSFET – Single, P-Channel, POWERTRENCH®

**-30 V, -11 A, 13.5 mΩ**

## FDMA6676PZ

### Description

This device is an ultra low resistance P-Channel FET. It is designed for power line load switching applications and reverse polarity protection. It is especially optimized for voltage rails that can climb as high as 25 V. Typical end systems include laptop computers, tablets and mobile phone. Applications include battery protection, input power line protection and charge path protection, including USB and other charge paths. The FDMA6676PZ has an enhanced  $V_{GS}$  rating of 25 V specifically designed to simplify installation. When used as reverse polarity protection, with gate tied to ground and drain tied to V input, it is designed to support operating input voltages that can raise as high as 25 V without the need for external Zener protection on the gate. Its small 2 x 2 x 0.8 mm form factor make it an ideal part for mobile and space constrained applications.

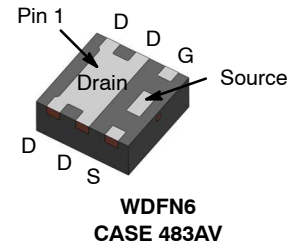
### Features

- Max  $r_{DS(on)}$  = 13.5 mΩ @  $V_{GS} = -10$  V
- 25 V  $V_{GS}$  Extended Operating Rating
- 30 V  $V_{DS}$  Blocking
- 2 x 2 mm Form Factor
- Low Profile – 0.8 mm Maximum
- Integrated Protection Diode
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

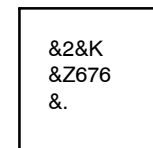


**ON Semiconductor®**

[www.onsemi.com](http://www.onsemi.com)

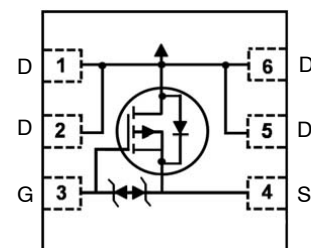


### MARKING DIAGRAM



|     |                        |
|-----|------------------------|
| &2  | = 2-Digit Date Code    |
| &K  | = Lot Code             |
| &Z  | = Assembly Plant Code  |
| 676 | = Specific Device Code |
| &   | = Pin 1 Dot            |

### PIN CONNECTION



### ORDERING INFORMATION

See detailed ordering and shipping information on page 3 of this data sheet.

# FDMA6676PZ

## ABSOLUTE MAXIMUM RATINGS

| Symbol         | Parameter                                                      | Ratings     | Unit             |
|----------------|----------------------------------------------------------------|-------------|------------------|
| $V_{DS}$       | Drain to Source Voltage                                        | -30         | V                |
| $V_{GS}$       | Gate to Source Voltage                                         | $\pm 25$    | V                |
| $I_D$          | Drain Current – Continuous, $T_A = 25^\circ\text{C}$ (Note 1a) | -11         | A                |
|                | – Pulsed (Note 3)                                              | -165        |                  |
| $P_D$          | 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          | Characteristic                                    | Value | Unit               |
|-----------------|---------------------------------------------------|-------|--------------------|
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1a) | 52    | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1b) | 145   |                    |

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

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

### OFF CHARACTERISTICS

|                                |                                           |                                                              |     |     |          |                            |
|--------------------------------|-------------------------------------------|--------------------------------------------------------------|-----|-----|----------|----------------------------|
| $BV_{DSS}$                     | Drain to Source Breakdown Voltage         | $I_D = -250\ \mu\text{A}, V_{GS} = 0\ \text{V}$              | -30 |     |          | V                          |
| $\Delta BV_{DSS} / \Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D = -250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$ |     | -19 |          | $\text{mV}/^\circ\text{C}$ |
| $I_{DSS}$                      | Zero Gate Voltage Drain Current           | $V_{DS} = -24\ \text{V}, V_{GS} = 0\ \text{V}$               |     |     | -1       | $\mu\text{A}$              |
| $I_{GSS}$                      | Gate to Source Leakage Current            | $V_{GS} = \pm 25\ \text{V}, V_{DS} = 0\ \text{V}$            |     |     | $\pm 10$ | $\mu\text{A}$              |

### ON CHARACTERISTICS

|                                  |                                                          |                                                                        |      |      |      |                            |
|----------------------------------|----------------------------------------------------------|------------------------------------------------------------------------|------|------|------|----------------------------|
| $V_{GS(th)}$                     | Gate to Source Threshold Voltage                         | $V_{GS} = V_{DS}, I_D = -250\ \mu\text{A}$                             | -1.2 | -2   | -2.6 | V                          |
| $\Delta V_{GS(th)} / \Delta T_J$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D = -250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$           |      | 5.9  |      | $\text{mV}/^\circ\text{C}$ |
| $r_{DS(on)}$                     | Static Drain to Source On Resistance                     | $V_{GS} = -10\ \text{V}, I_D = -11\ \text{A}$                          |      | 11   | 13.5 | $\text{m}\Omega$           |
|                                  |                                                          | $V_{GS} = -4.5\ \text{V}, I_D = -8\ \text{A}$                          |      | 19   | 27   |                            |
|                                  |                                                          | $V_{GS} = -10\ \text{V}, I_D = -11\ \text{A}, T_J = 125^\circ\text{C}$ |      | 14.5 | 21   |                            |
| $g_{FS}$                         | Forward Transconductance                                 | $V_{DD} = -5\ \text{V}, I_D = -11\ \text{A}$                           |      | 38   |      | S                          |

### DYNAMIC CHARACTERISTICS

|           |                              |                                                                   |  |      |      |          |
|-----------|------------------------------|-------------------------------------------------------------------|--|------|------|----------|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = -15\ \text{V}, V_{GS} = 0\ \text{V}, f = 1\ \text{MHz}$ |  | 1440 | 2160 | pF       |
| $C_{oss}$ | Output Capacitance           |                                                                   |  | 477  | 720  | pF       |
| $C_{rss}$ | Reverse Transfer Capacitance |                                                                   |  | 458  | 690  | pF       |
| $R_g$     | Gate Resistance              |                                                                   |  | 12   |      | $\Omega$ |

### SWITCHING CHARACTERISTICS

|              |                     |                                                                                            |  |     |     |    |
|--------------|---------------------|--------------------------------------------------------------------------------------------|--|-----|-----|----|
| $t_{d(on)}$  | Turn-On Delay Time  | $V_{DD} = -15\ \text{V}, I_D = -11\ \text{A}, V_{GS} = -10\ \text{V}, R_{GEN} = 6\ \Omega$ |  | 8.8 | 18  | ns |
| $t_r$        | Rise Time           |                                                                                            |  | 19  | 34  | ns |
| $t_{d(off)}$ | Turn-Off Delay Time |                                                                                            |  | 87  | 139 | ns |
| $t_f$        | Fall Time           |                                                                                            |  | 72  | 115 | ns |
| $Q_g$        | Total Gate Charge   | $V_{GS} = 0\ \text{V}$ to $-10\ \text{V}$ , $V_{DD} = -15\ \text{V}, I_D = -11\ \text{A}$  |  | 33  | 46  | nC |

# FDMA6676PZ

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

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

### SWITCHING CHARACTERISTICS

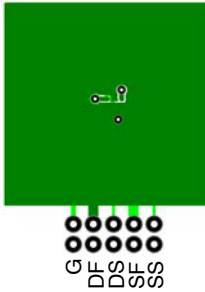
|          |                               |                                                                                             |  |     |    |    |
|----------|-------------------------------|---------------------------------------------------------------------------------------------|--|-----|----|----|
| $Q_g$    | Total Gate Charge             | $V_{GS} = 0\text{ V to } -4.5\text{ V}$ ,<br>$V_{DD} = -15\text{ V}$ , $I_D = -11\text{ A}$ |  | 20  | 28 | nC |
| $Q_{gs}$ | Gate to Source Charge         | $V_{DD} = -15\text{ V}$ , $I_D = -11\text{ A}$                                              |  | 4.5 |    | nC |
| $Q_{gd}$ | Gate to Drain "Miller" Charge | $V_{DD} = -15\text{ V}$ , $I_D = -11\text{ A}$                                              |  | 13  |    | nC |

### DRAIN-SOURCE DIODE CHARACTERISTICS

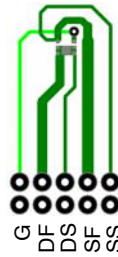
|          |                                       |                                                           |  |      |      |    |
|----------|---------------------------------------|-----------------------------------------------------------|--|------|------|----|
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS} = 0\text{ V}$ , $I_S = -2\text{ A}$ (Note 2)      |  | -0.7 | -1.2 | V  |
|          |                                       | $V_{GS} = 0\text{ V}$ , $I_S = -11\text{ A}$ (Note 2)     |  | -0.9 | -1.4 | V  |
| $t_{rr}$ | Reverse Recovery Time                 | $I_F = -11\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ |  | 31   | 50   | ns |
| $Q_{rr}$ | Reverse Recovery Charge               |                                                           |  | 9    | 18   | 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.

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



a.  $52^\circ\text{C/W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



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

- Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty cycle < 2.0%.
- Pulse  $I_D$  refers to Forward Bias Safe Operation Area.

## ORDERING INFORMATION

| Device Marking | Device     | Package | Package Method <sup>†</sup> |
|----------------|------------|---------|-----------------------------|
| 676            | FDMA6676PZ | WDFN-6  | 3000 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.

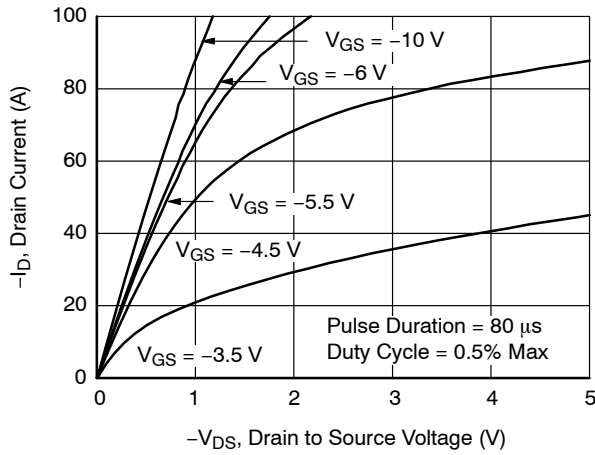
TYPICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$  unless otherwise noted)

Figure 1. On-Region Characteristics

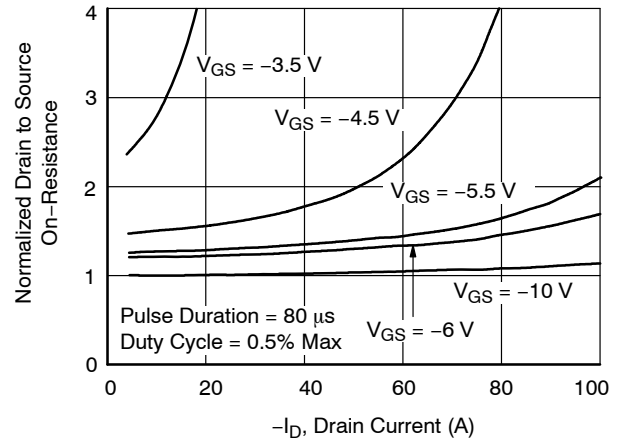


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

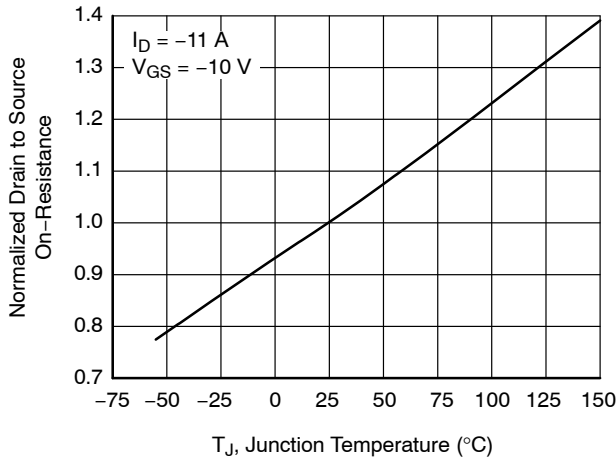


Figure 3. Normalized On-Resistance vs. Junction Temperature

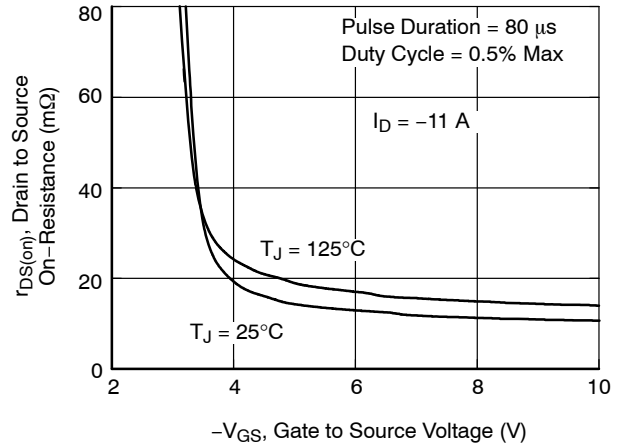


Figure 4. On-Resistance vs. Gate to Source Voltage

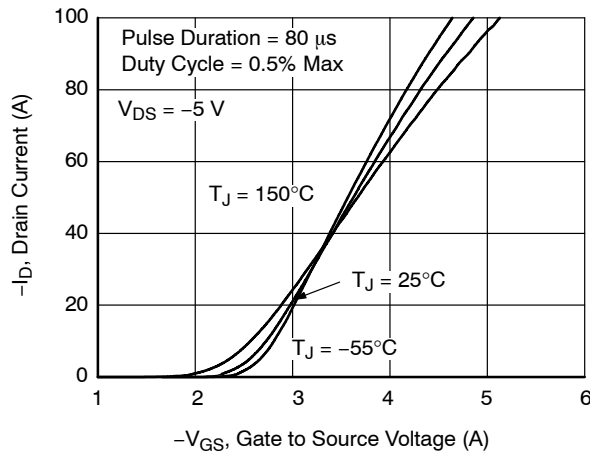


Figure 5. Transfer Characteristics

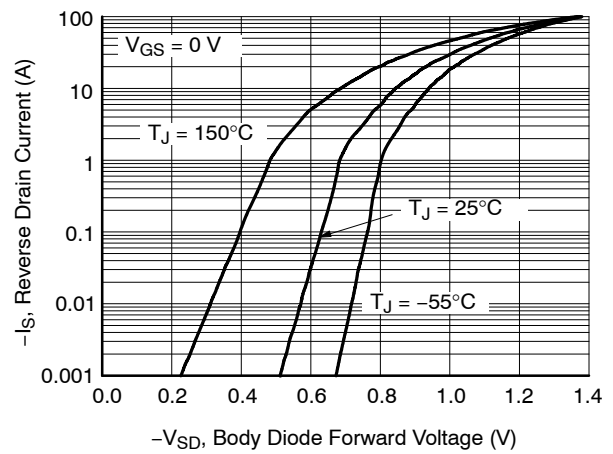


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

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

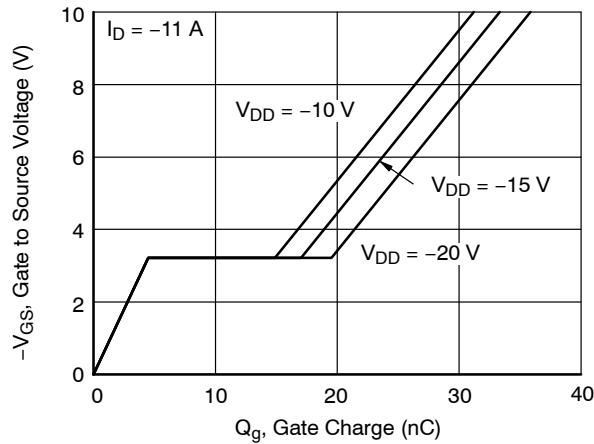


Figure 7. Gate Charge Characteristics

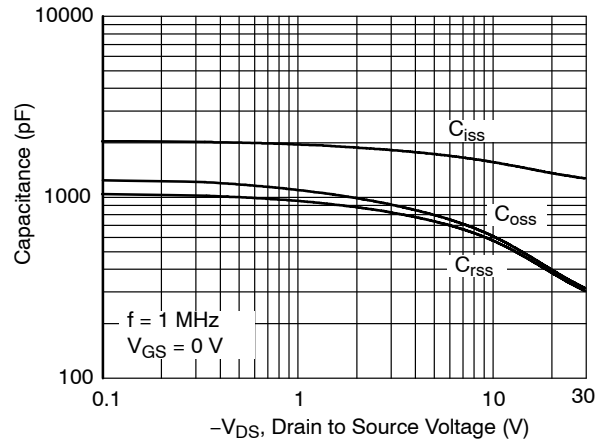


Figure 8. Capacitance vs. Drain to Source Voltage

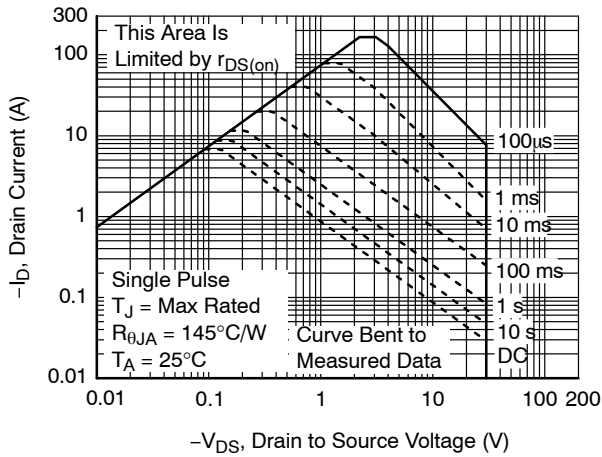


Figure 9. Forward Bias Safe Operating Area

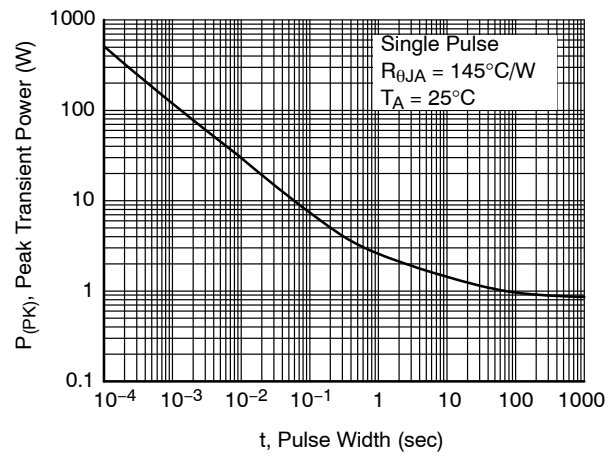


Figure 10. Single Pulse Maximum Power Dissipation

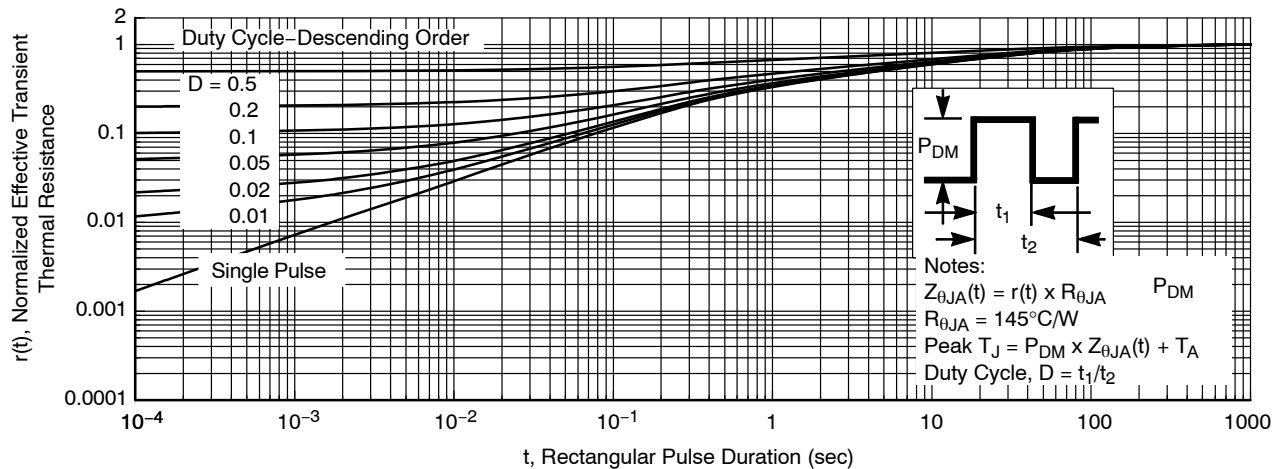
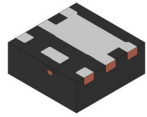
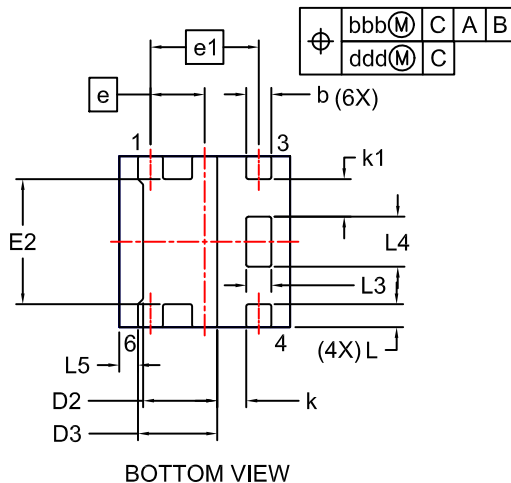
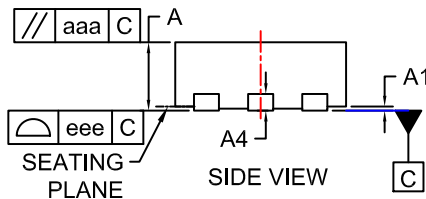
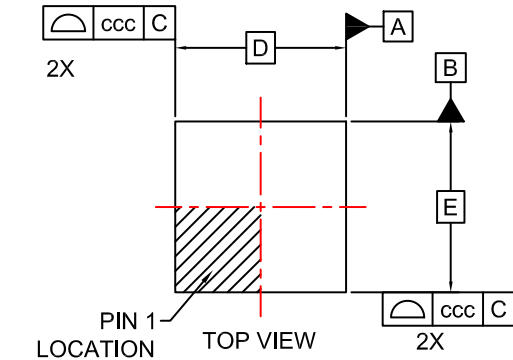
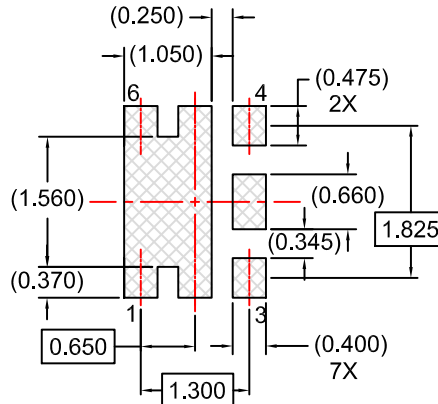


Figure 11. Junction-to-Ambient Transient Thermal Response Curve


**WDFN6 2.05X2.05, 0.65P**  
CASE 483AV  
ISSUE A

DATE 02 APR 2019


**LAND PATTERN RECOMMENDATION**

**NOTES:**

1. CONTROLLING DIMENSION: MILLIMETERS.
2. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
4. SEATING PLANE IS DEFINED BY THE TERMINALS. "A1" IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.

| DIM | MILLIMETERS |      |      |
|-----|-------------|------|------|
|     | MIN.        | NOM. | MAX. |
| A   | 0.60        | 0.70 | 0.80 |
| A1  | 0.00        | -    | 0.05 |
| A4  | (0.20)      |      |      |
| b   | 0.25        | 0.30 | 0.35 |
| D   | 1.95        | 2.05 | 2.15 |
| D2  | 0.84        | 0.89 | 0.94 |
| D3  | (0.95)      |      |      |
| E   | 1.95        | 2.05 | 2.15 |
| E2  | 1.45        | 1.50 | 1.55 |
| e   | 0.65 BSC    |      |      |
| e1  | 1.30 BSC    |      |      |
| k   | (0.35)      |      |      |
| k1  | (0.45)      |      |      |
| L   | 0.18        | 0.28 | 0.38 |
| L3  | 0.25        | 0.30 | 0.35 |
| L4  | 0.55        | 0.60 | 0.65 |
| L5  | (0.23)      |      |      |
| aaa | 0.10        |      |      |
| bbb | 0.10        |      |      |
| ccc | 0.05        |      |      |
| ddd | 0.05        |      |      |
| eee | 0.05        |      |      |

**DOCUMENT NUMBER:** 98AON13671G

Electronic versions are uncontrolled except when accessed directly from the Document Repository.  
Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.

**DESCRIPTION:** WDFN6 2.05X2.05, 0.65P

**PAGE 1 OF 1**

onsemi and Onsemi are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. onsemi does not convey any license under its patent rights nor the rights of others.

**onsemi**, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## ADDITIONAL INFORMATION

### TECHNICAL PUBLICATIONS:

Technical Library: [www.onsemi.com/design/resources/technical-documentation](http://www.onsemi.com/design/resources/technical-documentation)  
onsemi Website: [www.onsemi.com](http://www.onsemi.com)

### ONLINE SUPPORT: [www.onsemi.com/support](http://www.onsemi.com/support)

For additional information, please contact your local Sales Representative at  
[www.onsemi.com/support/sales](http://www.onsemi.com/support/sales)