

# FDMC6688P Datasheet



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|                              |   |
|------------------------------|---|
| DiGi Electronics Part Number | FDMC6688P-DG  |
| Manufacturer                 | <a href="#">onsemi</a>  |
| Manufacturer Product Number  | FDMC6688P   |
| Description                  | MOSFET P-CH 20V 14A/56A 8PQFN   |
| Detailed Description         | P-Channel 20 V 14A (Ta), 56A (Tc) 2.3W (Ta), 30W (Tc) Surface Mount 8-PQFN (3.3x3.3), Power33 |



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## Purchase and inquiry

Manufacturer Product Number:

FDMC6688P

Series:

PowerTrench®

FET Type:

P-Channel

Drain to Source Voltage (Vdss):

20 V

Drive Voltage (Max Rds On, Min Rds On):

1.8V, 4.5V

Vgs(th) (Max) @ Id:

1V @ 250µA

Vgs (Max):

±8V

FET Feature:

-

Operating Temperature:

-55°C ~ 150°C (Tj)

Supplier Device Package:

8-PQFN (3.3x3.3), Power33

Base Product Number:

FDMC6688

Manufacturer:

onsemi

Product Status:

Obsolete

Technology:

MOSFET (Metal Oxide)

Current - Continuous Drain (Id) @ 25°C:

14A (Ta), 56A (Tc)

Rds On (Max) @ Id, Vgs:

6.5mOhm @ 14A, 4.5V

Gate Charge (Qg) (Max) @ Vgs:

61 nC @ 4.5 V

Input Capacitance (Ciss) (Max) @ Vds:

7435 pF @ 10 V

Power Dissipation (Max):

2.3W (Ta), 30W (Tc)

Mounting Type:

Surface Mount

Package / Case:

8-PowerWDFN

## Environmental & Export classification

RoHS Status:

ROHS3 Compliant

REACH Status:

REACH Unaffected

HTSUS:

8541.29.0095

Moisture Sensitivity Level (MSL):

1 (Unlimited)

ECCN:

EAR99

# MOSFET – P-Channel, POWERTRENCH®

**-20 V, -56 A, 6.5 mΩ**

## FDMC6688P

### General Description

This P-Channel MOSFET is produced using onsemi’s advanced POWERTRENCH process that has been optimized for  $R_{DS(on)}$ , switching performance and ruggedness.

### Features

- Max  $R_{DS(on)}$  = 6.5 mΩ at  $V_{GS} = -4.5$  V,  $I_D = -14$  A
- Max  $R_{DS(on)}$  = 9.8 mΩ at  $V_{GS} = -2.5$  V,  $I_D = -11$  A
- Max  $R_{DS(on)}$  = 20 mΩ at  $V_{GS} = -1.8$  V,  $I_D = -9$  A
- High Performance Trench Technology for Extremely Low  $R_{DS(on)}$
- High Power and Current Handling Capability in a Widely Used Surface Mount Package
- This Device is Pb-Free, Halide Free and is RoHS Compliant

### Applications

- Load Switch
- Battery Management
- Power Management
- Reverse Polarity Protection

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

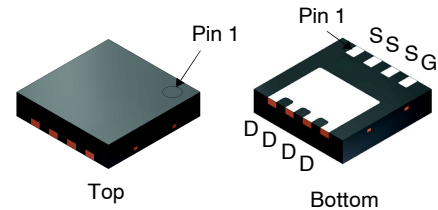
| Symbol         | Parameter   | Ratings            | Unit |
|----------------|---|--------------------|------|
| $V_{DS}$       | Drain to Source Voltage   | -20                | V    |
| $V_{GS}$       | Gate to Source Voltage  | ±8                 | V    |
| $I_D$          | Drain Current<br>-Continuous, $T_C = 25^\circ\text{C}$<br>-Continuous, $T_A = 25^\circ\text{C}$ (Note 1a)<br>-Pulsed (Note 3) | -56<br>-14<br>-226 | A    |
| $P_D$          | Power Dissipation<br>$T_C = 25^\circ\text{C}$<br>$T_A = 25^\circ\text{C}$ (Note 1a)   | 30<br>2.3          | W    |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range  | -55 to +150        | °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 ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

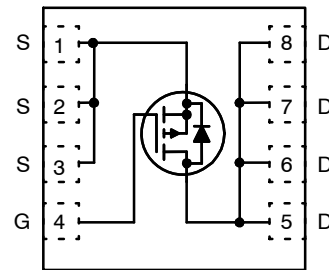
| Symbol          | Parameter   | Value | Unit |
|-----------------|---|-------|------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case              | 3.8   | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1a) | 53    | °C/W |

| $V_{DS}$ | $R_{DS(on)}$ MAX | $I_D$ MAX |
|----------|------------------|-----------|
| -20 V    | 6.5 mΩ @ -4.5 V  | -56 A     |
|          | 9.8 mΩ @ -2.5 V  |           |
|          | 20 mΩ @ -1.8 V   |           |

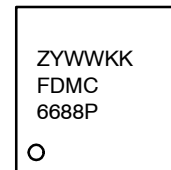


**PQFN8 3.3X3.3, 0.65P**  
**(Power 33)**  
**CASE 483AX**

### PIN ASSIGNMENT



### MARKING DIAGRAM



- Z = Assembly Plant Code
- YWW = Date Code (Year & Week)
- KK = Lot Traceability Code
- FDMC6688P = Specific Device Code

### ORDERING INFORMATION

| Device    | Package                          | Shipping†              |
|-----------|----------------------------------|------------------------|
| FDMC6688P | PQFN8<br>(Power 33)<br>(Pb-Free) | 3,000 /<br>Tape & Reel |

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

### FDMC6688P

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

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

**OFF CHARACTERISTICS**

|                                |   |  |     |     |           |                      |
|--------------------------------|---|--|-----|-----|-----------|----------------------|
| $BV_{DSS}$                     | Drain to Source Breakdown Voltage         | $I_D = -250 \mu\text{A}, V_{GS} = 0 \text{ V}$                 | -20 | -   | -         | V                    |
| $\Delta BV_{DSS} / \Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D = -250 \mu\text{A}$ ,<br>referenced to $25^\circ\text{C}$ | -   | -16 | -         | mV/ $^\circ\text{C}$ |
| $I_{DSS}$                      | Zero Gate Voltage Drain Current           | $V_{DS} = -16 \text{ V}, V_{GS} = 0 \text{ V}$                 | -   | -   | -1        | $\mu\text{A}$        |
| $I_{GSS}$                      | Gate to Source Leakage Current            | $V_{GS} = \pm 8 \text{ V}, V_{DS} = 0 \text{ V}$               | -   | -   | $\pm 100$ | nA                   |

**ON CHARACTERISTICS**

|                                  |  |   |      |       |     |                      |
|----------------------------------|--|---|------|-------|-----|----------------------|
| $V_{GS(th)}$                     | Gate to Source Threshold Voltage                         | $V_{GS} = V_{DS}, I_D = -250 \mu\text{A}$                                     | -0.4 | -0.75 | -1  | V                    |
| $\Delta V_{GS(th)} / \Delta T_J$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D = -250 \mu\text{A}$ ,<br>referenced to $25^\circ\text{C}$                | -    | 3     | -   | mV/ $^\circ\text{C}$ |
| $R_{DS(on)}$                     | Static Drain to Source On-Resistance                     | $V_{GS} = -4.5 \text{ V}, I_D = -14 \text{ A}$                                | -    | 5.3   | 6.5 | m $\Omega$           |
|                                  |  | $V_{GS} = -2.5 \text{ V}, I_D = -11 \text{ A}$                                | -    | 7     | 9.8 |                      |
|                                  |  | $V_{GS} = -1.8 \text{ V}, I_D = -9 \text{ A}$                                 | -    | 10.7  | 20  |                      |
|                                  |  | $V_{GS} = -4.5 \text{ V}, I_D = -14 \text{ A}$ ,<br>$T_J = 125^\circ\text{C}$ | -    | 7.3   | 11  |                      |
| $g_{FS}$                         | Forward Transconductance                                 | $V_{DS} = -5 \text{ V}, I_D = -14 \text{ A}$                                  | -    | 80    | -   | S                    |

**DYNAMIC CHARACTERISTICS**

|            |                              |   |   |      |      |          |
|------------|------------------------------|---|---|------|------|----------|
| $C_{iss}$  | Input Capacitance            | $V_{DS} = -10 \text{ V}, V_{GS} = 0 \text{ V}$ ,<br>$f = 1 \text{ MHz}$ | - | 4956 | 7435 | pF       |
| $C_{oss}$  | Output Capacitance           |   | - | 678  | 1020 | pF       |
| $C_{riss}$ | Reverse Transfer Capacitance |   | - | 618  | 930  | pF       |
| $R_g$      | Gate Resistance              |   | - | 4.5  | -    | $\Omega$ |

**SWITCHING CHARACTERISTICS**

|              |                               |  |   |     |     |    |
|--------------|-------------------------------|--|---|-----|-----|----|
| $t_{d(on)}$  | Turn-On Delay Time            | $V_{DD} = -10 \text{ V}, I_D = -14 \text{ A}$ ,<br>$V_{GS} = -4.5 \text{ V}, R_{GEN} = 6 \Omega$ | - | 19  | 35  | ns |
| $t_r$        | Rise Time                     |  | - | 33  | 53  | ns |
| $t_{d(off)}$ | Turn-Off Delay Time           |  | - | 119 | 190 | ns |
| $t_f$        | Fall Time                     |  | - | 68  | 109 | ns |
| $Q_g$        | Total Gate Charge             | $V_{DD} = -10 \text{ V}, I_D = -14 \text{ A}$ ,<br>$V_{GS} = -4.5 \text{ V}$                     | - | 44  | 61  | nC |
| $Q_{gs}$     | Gate to Source Charge         |  | - | 7.4 | -   | nC |
| $Q_{gd}$     | Gate to Drain "Miller" Charge |  | - | 11  | -   | nC |

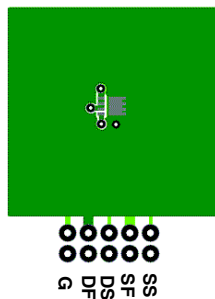
**DRAIN-SOURCE DIODE CHARACTERISTICS**

|          |                                       |  |   |      |      |    |
|----------|---------------------------------------|--|---|------|------|----|
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS} = 0 \text{ V}, I_S = -14 \text{ A}$ (Note 2)     | - | -0.8 | -1.2 | V  |
|          |                                       | $V_{GS} = 0 \text{ V}, I_S = -2 \text{ A}$ (Note 2)      | - | -0.6 | -1.2 |    |
| $t_{rr}$ | Reverse Recovery Time                 | $I_F = -14 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$ | - | 26   | 41   | ns |
| $Q_{rr}$ | Reverse Recovery Charge               |  | - | 10   | 20   | nC |

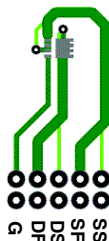
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

**NOTES:**

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



a.  $53^\circ\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



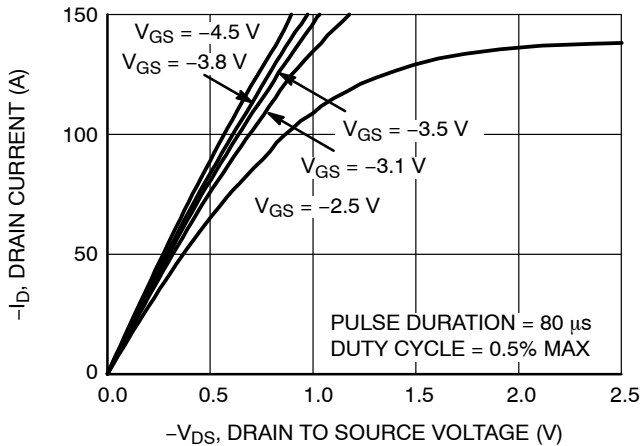
b.  $125^\circ\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper.

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

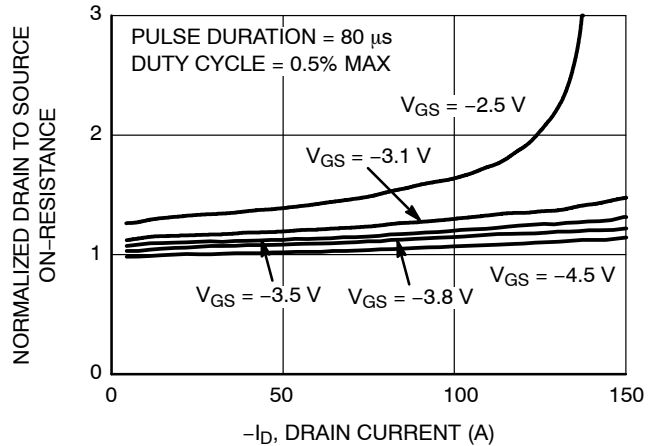
# FDMC6688P

## TYPICAL CHARACTERISTICS

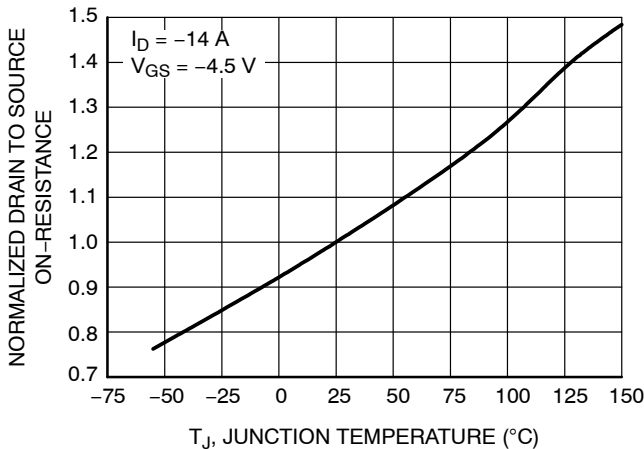
( $T_J = 25^\circ\text{C}$  Unless Otherwise Noted)



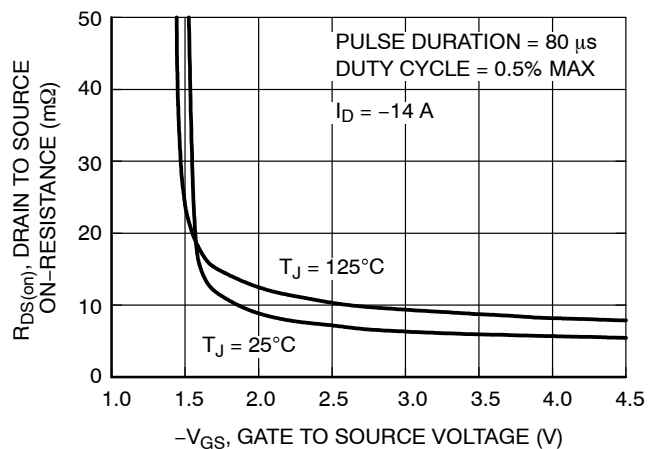
**Figure 1. On-Region Characteristics**



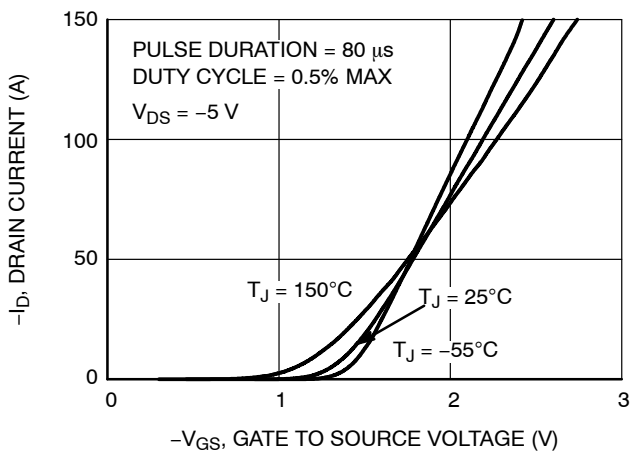
**Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage**



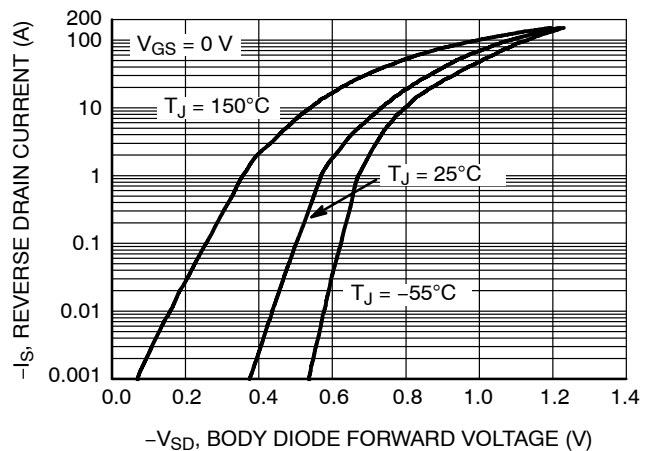
**Figure 3. Normalized On-Resistance vs. Junction Temperature**



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



**Figure 5. Transfer Characteristics**



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

# FDMC6688P

## TYPICAL PERFORMANCE CHARACTERISTICS (CONTINUED)

( $T_J = 25^\circ\text{C}$  Unless Otherwise Noted)

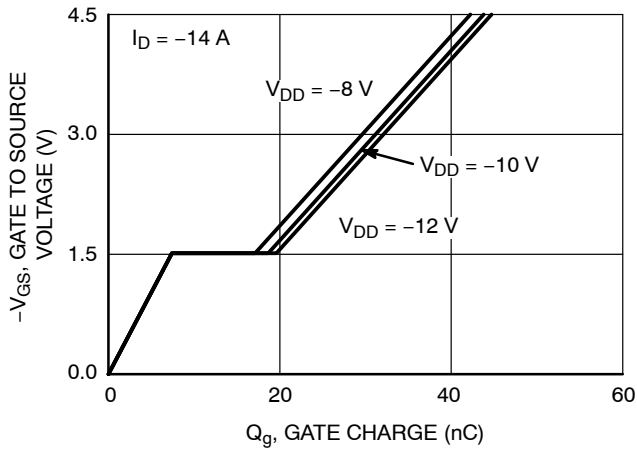


Figure 7. Gate Charge Characteristics

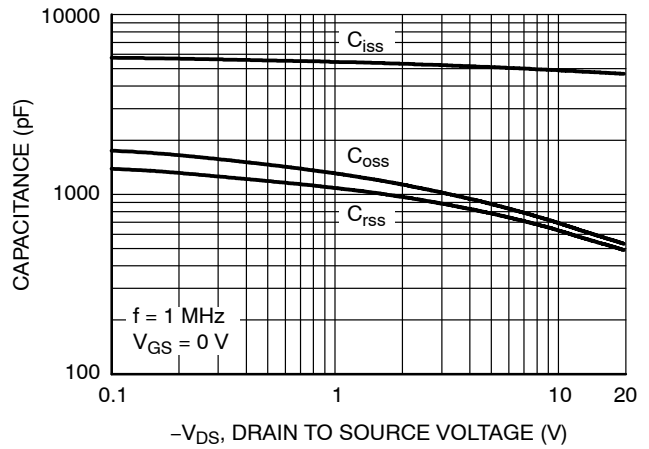


Figure 8. Capacitance vs. Drain to Source Voltage

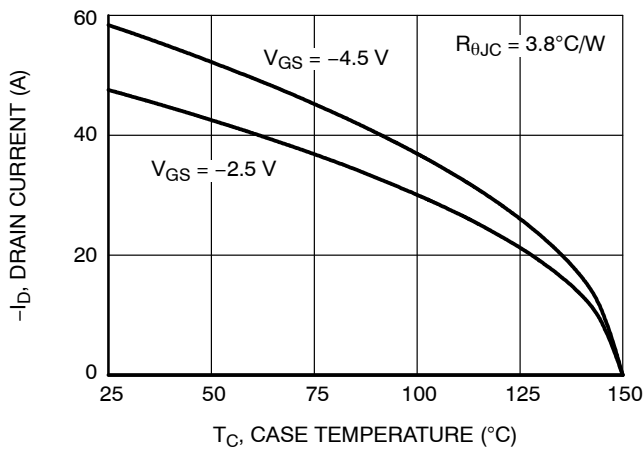


Figure 9. Maximum Continuous Drain Current vs. Case Temperature

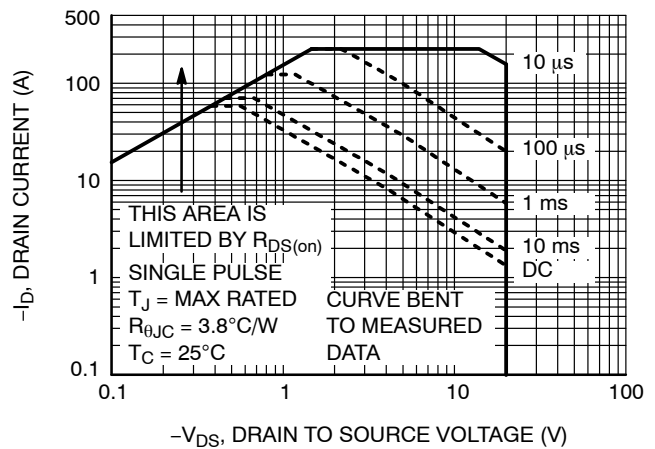


Figure 10. Forward Bias Safe Operating Area

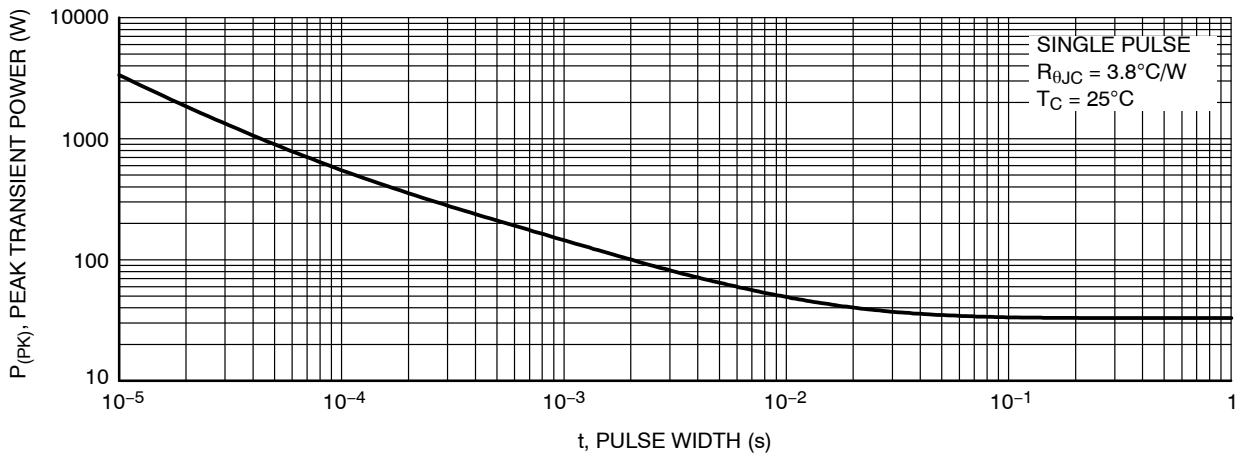


Figure 11. Single Pulse Maximum Power Dissipation

# FDMC6688P

## TYPICAL PERFORMANCE CHARACTERISTICS (CONTINUED)

( $T_J = 25^\circ\text{C}$  Unless Otherwise Noted)

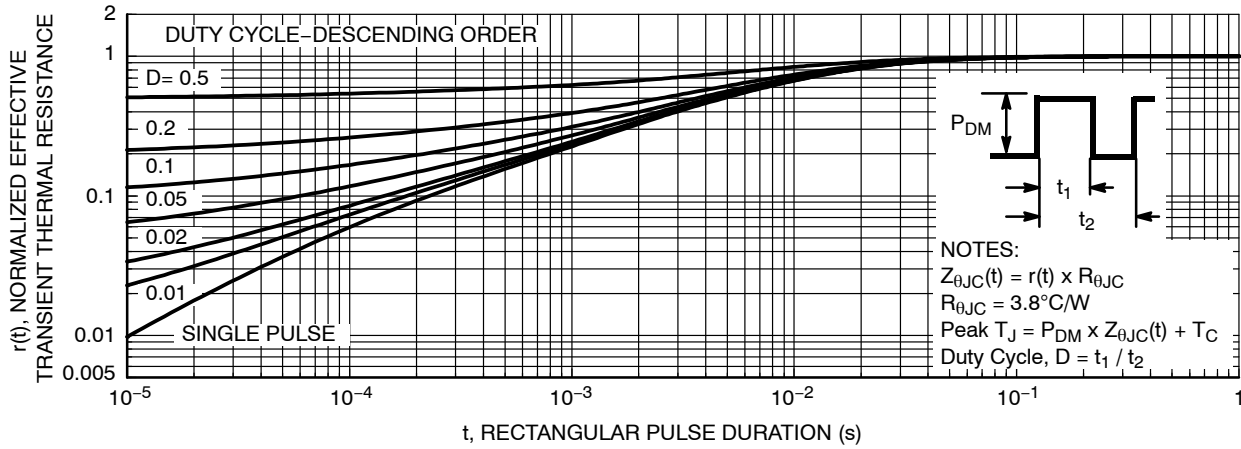
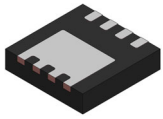


Figure 12. Junction-to-Case Transient Thermal Response Curve

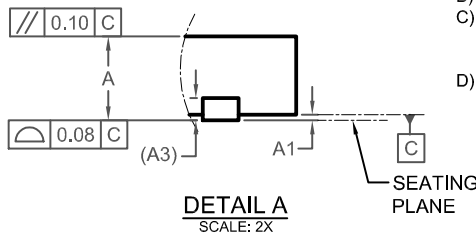
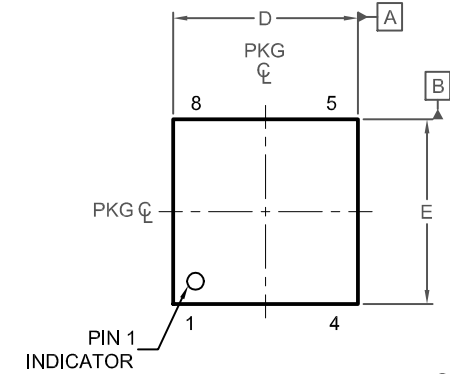


**MECHANICAL CASE OUTLINE  
PACKAGE DIMENSIONS**



**PQFN8 3.3X3.3, 0.65P  
CASE 483AX  
ISSUE B**

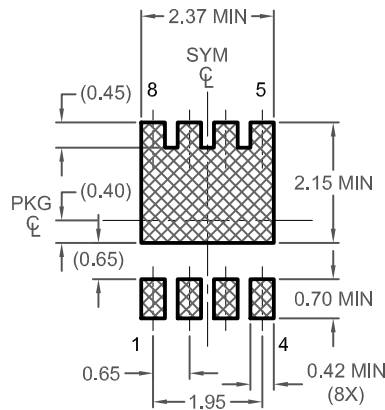
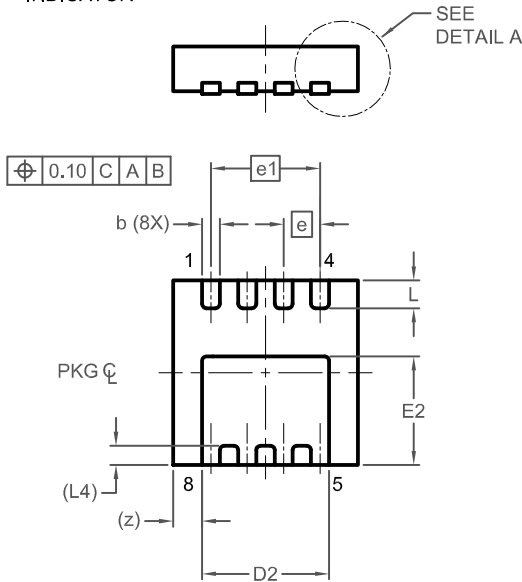
DATE 24 JUN 2022



NOTES: UNLESS OTHERWISE SPECIFIED

- A) PACKAGE STANDARD REFERENCE: JEDEC MO-240, ISSUE A, VAR. BA.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.
- D) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.

| DIM | MILLIMETERS |      |      |
|-----|-------------|------|------|
|     | MIN.        | NOM. | MAX. |
| A   | 0.70        | 0.75 | 0.80 |
| A1  | 0.00        | -    | 0.05 |
| A3  | 0.20 REF    |      |      |
| b   | 0.27        | 0.32 | 0.37 |
| D   | 3.20        | 3.30 | 3.40 |
| D2  | 2.17        | 2.27 | 2.37 |
| E   | 3.20        | 3.30 | 3.40 |
| E2  | 1.84        | 1.94 | 2.04 |
| e   | 0.65 BSC    |      |      |
| e1  | 1.95 BSC    |      |      |
| L   | 0.40        | 0.50 | 0.60 |
| L4  | 0.34 REF    |      |      |
| z   | 0.52 REF    |      |      |



**LAND PATTERN  
RECOMMENDATION**

\*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

|                         |                             |  |
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