

# MOSFET – N-Channel, DUAL COOL<sup>®</sup> 33, POWERTRENCH<sup>®</sup>

**30 V, 40 A, 2.2 mΩ**

## FDMC7660DC

### General Description

This N-Channel MOSFET is produced using onsemi's advanced POWERTRENCH process. Advancements in both silicon and DUAL COOL package technologies have been combined to offer the lowest  $R_{DS(on)}$  while maintaining excellent switching performance by extremely low Junction-to-Ambient thermal resistance.

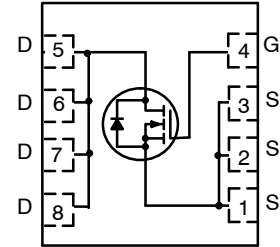
### Features

- DUAL COOL Top Side Cooling PQFN Package
- Max  $R_{DS(on)}$  = 2.2 mΩ at  $V_{GS}$  = 10 V,  $I_D$  = 22 A
- Max  $R_{DS(on)}$  = 3.3 mΩ at  $V_{GS}$  = 4.5 V,  $I_D$  = 18 A
- High Performance Technology for Extremely Low  $R_{DS(on)}$
- SyncFET<sup>™</sup> Schottky Body Diode
- Pb-Free, Halide Free and RoHS Compliant

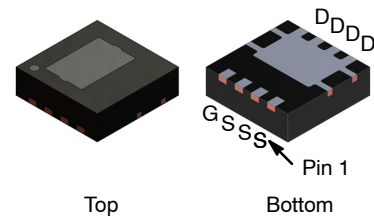
### Applications

- Synchronous Rectifier for DC/DC Converters
- Telecom Secondary Side Rectification
- High End Server/Workstation

| $V_{DS}$ | $R_{DS(on)}$ MAX | $I_D$ MAX |
|----------|------------------|-----------|
| 30 V     | 2.2 mΩ @ 10 V    | 40 A      |
|          | 3.3 mΩ @ 4.5 V   |           |

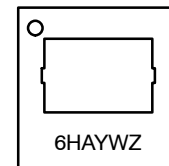


**N-CHANNEL MOSFET**



**PQFN8 3.3 × 3.3, 0.65P  
(DUAL COOL 33)  
CASE 483AL**

### MARKING DIAGRAM



- 6H = Specific Device Code
- A = Assembly Plant Code
- YW = Date Code (Year and Week)
- Z = Lot Code

### ORDERING INFORMATION

| Device     | Package                            | Shipping <sup>†</sup> |
|------------|------------------------------------|-----------------------|
| FDMC7660DC | PQFN8<br>(Pb-Free,<br>Halide Free) | 3000 /<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](#).

# FDMC7660DC

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

| Symbol         | Parameter                                        |                              |                          | Value       | Unit             |
|----------------|--------------------------------------------------|------------------------------|--------------------------|-------------|------------------|
| $V_{DS}$       | Drain to Source Voltage                          |                              |                          | 30          | V                |
| $V_{GS}$       | Gate to Source Voltage (Note 4)                  |                              |                          | $\pm 20$    | V                |
| $I_D$          | Drain Current                                    | Continuous (Package limited) | $T_C = 25^\circ\text{C}$ | 40          | A                |
|                |                                                  | Continuous (Silicon limited) | $T_C = 25^\circ\text{C}$ | 150         |                  |
|                |                                                  | Continuous (Note 1a)         | $T_A = 25^\circ\text{C}$ | 30          |                  |
|                |                                                  | Pulsed                       |                          | 200         |                  |
| $E_{AS}$       | Single Pulse Avalanche Energy (Note 3)           |                              |                          | 220         | mJ               |
| $dv/dt$        | Peak Diode Recovery $dv/dt$ (Note 5)             |                              |                          | 1.0         | V/ns             |
| $P_D$          | Power Dissipation                                |                              | $T_C = 25^\circ\text{C}$ | 78          | W                |
|                | Power Dissipation (Note 1a)                      |                              | $T_A = 25^\circ\text{C}$ | 3.0         |                  |
| $T_J, T_{STG}$ | 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               |
|-----------------|-----------------------------------------------------|-------|--------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case (Top Source)   | 4.3   | $^\circ\text{C/W}$ |
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case (Bottom Drain) | 1.6   |                    |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1a)   | 42    |                    |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1b)   | 105   |                    |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1i)   | 17    |                    |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1j)   | 26    |                    |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1k)   | 12    |                    |

# FDMC7660DC

## 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 μA, V <sub>GS</sub> = 0 V | 30 | –  | –   | V     |
| ΔBV <sub>DSS</sub> / ΔT <sub>J</sub> | Breakdown Voltage Temperature Coefficient | I <sub>D</sub> = 250 μA, referenced to 25°C    | –  | 15 | –   | mV/°C |
| I <sub>DSS</sub>                     | Zero Gate Voltage Drain Current           | V <sub>DS</sub> = 24 V, V <sub>GS</sub> = 0 V  | –  | –  | 1   | μA    |
| I <sub>GSS</sub>                     | Gate to Source Leakage Current, Forward   | V <sub>GS</sub> = 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 μA           | 1.2 | 2   | 2.5 | V     |
| ΔV <sub>GS(th)</sub> / ΔT <sub>J</sub> | Gate to Source Threshold Voltage Temperature Coefficient | I <sub>D</sub> = 250 μA, referenced to 25°C                           | –   | –7  | –   | mV/°C |
| R <sub>DS(on)</sub>                    | Static Drain to Source On Resistance                     | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 22 A                         | –   | 1.6 | 2.2 | mΩ    |
|                                        |                                                          | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 18 A                        | –   | 2.5 | 3.3 |       |
|                                        |                                                          | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 22 A, T <sub>J</sub> = 125°C | –   | 2.2 | 3.3 |       |
| g <sub>FS</sub>                        | Forward Transconductance                                 | V <sub>DS</sub> = 5 V, I <sub>D</sub> = 22 A                          | –   | 147 | –   | S     |

### DYNAMIC CHARACTERISTICS

|                  |                              |                                                          |   |      |      |    |
|------------------|------------------------------|----------------------------------------------------------|---|------|------|----|
| C <sub>iss</sub> | Input Capacitance            | V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 0 V, f = 1 MHz | – | 3885 | 5170 | pF |
| C <sub>oss</sub> | Output Capacitance           |                                                          | – | 1215 | 1620 | pF |
| C <sub>rss</sub> | Reverse Transfer Capacitance |                                                          | – | 100  | 150  | pF |
| R <sub>g</sub>   | Gate Resistance              |                                                          | – | 0.7  | 1.5  | Ω  |

### SWITCHING CHARACTERISTICS

|                     |                               |                                                                                               |   |     |    |    |
|---------------------|-------------------------------|-----------------------------------------------------------------------------------------------|---|-----|----|----|
| t <sub>d(on)</sub>  | Turn-On Delay Time            | V <sub>DD</sub> = 15 V, I <sub>D</sub> = 22 A, V <sub>GS</sub> = 10 V, R <sub>GEN</sub> = 6 Ω | – | 17  | 31 | ns |
| t <sub>r</sub>      | Rise Time                     |                                                                                               | – | 6.6 | 13 | ns |
| t <sub>d(off)</sub> | Turn-Off Delay Time           |                                                                                               | – | 36  | 58 | ns |
| t <sub>f</sub>      | Fall Time                     |                                                                                               | – | 5   | 10 | ns |
| Q <sub>g</sub>      | Total Gate Charge             | V <sub>GS</sub> = 0 V to 10 V, V <sub>DD</sub> = 15 V, I <sub>D</sub> = 22 A                  | – | 54  | 76 | nC |
|                     |                               | V <sub>GS</sub> = 0 V to 4.5 V, V <sub>DD</sub> = 15 V, I <sub>D</sub> = 22 A                 | – | 24  | 34 | nC |
| Q <sub>gs</sub>     | Gate to Source Charge         | V <sub>DD</sub> = 15 V, I <sub>D</sub> = 22 A                                                 | – | 13  | –  | nC |
| Q <sub>gd</sub>     | Gate to Drain "Miller" Charge |                                                                                               | – | 5.5 | –  | nC |

### DRAIN-SOURCE DIODE CHARACTERISTICS

|                 |                                    |                                                        |   |     |     |    |
|-----------------|------------------------------------|--------------------------------------------------------|---|-----|-----|----|
| V <sub>SD</sub> | Source-Drain Diode Forward Voltage | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 22 A (Note 2)  | – | 0.8 | 1.2 | V  |
|                 |                                    | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 1.9 A (Note 2) | – | 0.7 | 1.2 |    |
| t <sub>rr</sub> | Reverse Recovery Time              | I <sub>F</sub> = 22 A, di/dt = 100 A/μs                | – | 43  | 69  | ns |
| Q <sub>rr</sub> | Reverse Recovery Charge            |                                                        | – | 24  | 38  | nC |

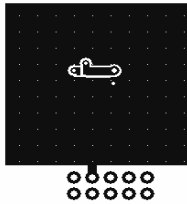
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

# THERMAL CHARACTERISTICS

| Symbol          | Characteristic                                      | Value | Unit |
|-----------------|-----------------------------------------------------|-------|------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case (Top Source)   | 4.3   | °C/W |
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case (Bottom Drain) | 1.6   |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1a)   | 42    |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1b)   | 105   |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1c)   | 29    |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1d)   | 40    |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1e)   | 19    |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1f)   | 23    |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1g)   | 30    |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1h)   | 79    |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1i)   | 17    |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1j)   | 26    |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1k)   | 12    |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1l)   | 16    |      |

## NOTES:

- $R_{\theta JA}$  is determined with the device mounted on a FR-4 board using a specified pad of 2 oz copper as shown below.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



- 42°C/W when mounted on a 1 in² pad of 2 oz copper.



- 105°C/W when mounted on a minimum pad of 2 oz copper.

- Still air, 20.9 × 10.4 × 12.7 mm Aluminum Heat Sink, 1 in² pad of 2 oz copper
  - Still air, 20.9 × 10.4 × 12.7 mm Aluminum Heat Sink, minimum pad of 2 oz copper
  - Still air, 45.2 × 41.4 × 11.7 mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, 1 in² pad of 2 oz copper
  - Still air, 45.2 × 41.4 × 11.7 mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, minimum pad of 2 oz copper
  - 200FPM Airflow, No Heat Sink, 1 in² pad of 2 oz copper
  - 200FPM Airflow, No Heat Sink, minimum pad of 2 oz copper
  - 200FPM Airflow, 20.9 × 10.4 × 12.7 mm Aluminum Heat Sink, 1 in² pad of 2 oz copper
  - 200FPM Airflow, 20.9 × 10.4 × 12.7 mm Aluminum Heat Sink, minimum pad of 2 oz copper
  - 200FPM Airflow, 45.2 × 41.4 × 11.7 mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, 1 in² pad of 2 oz copper
  - 200FPM Airflow, 45.2 × 41.4 × 11.7 mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, minimum pad of 2 oz copper
- Pulse Test: Pulse Width < 300 μs, Duty cycle < 2.0%.
  - $E_{AS}$  of 220 mJ is based on starting  $T_J = 25^\circ\text{C}$ , N-ch:  $L = 1\text{ mH}$ ,  $I_{AS} = 21\text{ A}$ ,  $V_{DD} = 27\text{ V}$ ,  $V_{GS} = 10\text{ V}$ . 100% test at  $L = 0.3\text{ mH}$ ,  $I_{AS} = 33.5\text{ A}$ .
  - As an N-ch device, the negative  $V_{GS}$  rating is for low duty cycle pulse occurrence only. No continuous rating is implied.
  - $I_{SD} \leq 22\text{ A}$ ,  $di/dt \leq 100\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$ .

TYPICAL CHARACTERISTICS

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

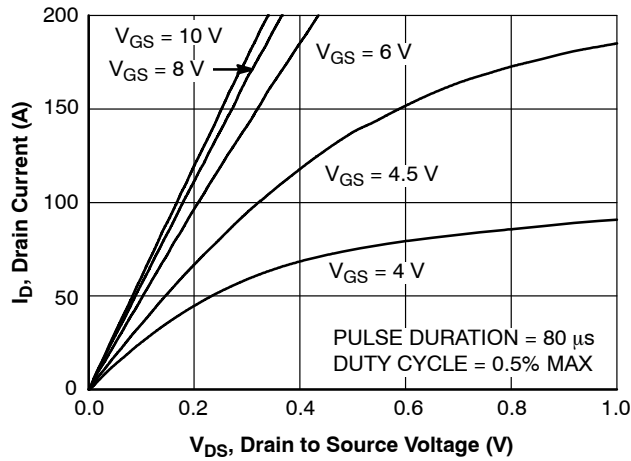


Figure 1. On-Region Characteristics

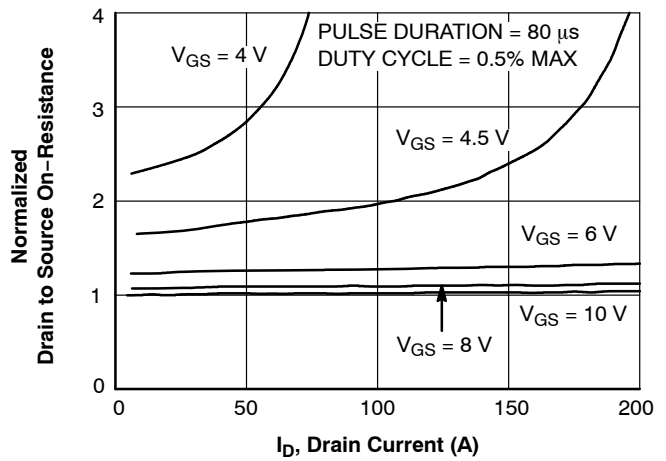


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

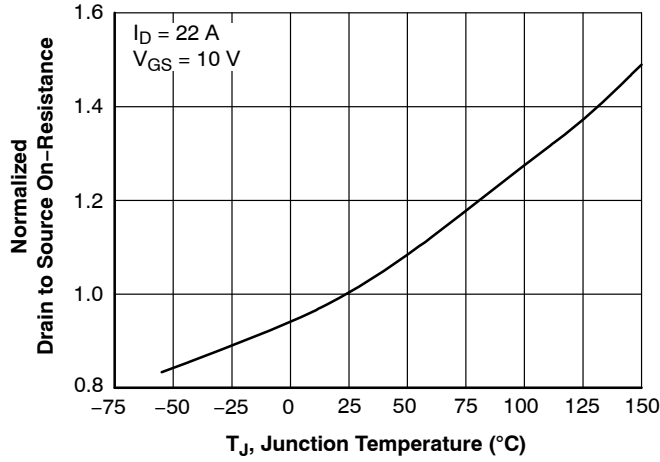


Figure 3. Normalized On-Resistance vs. Junction Temperature

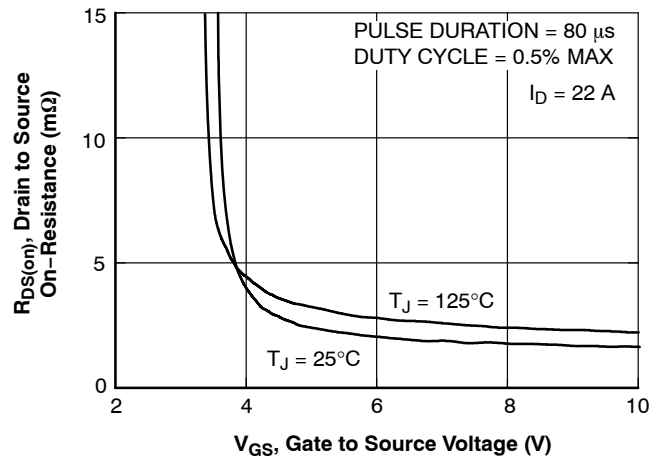


Figure 4. On-Resistance vs. Gate to Source Voltage

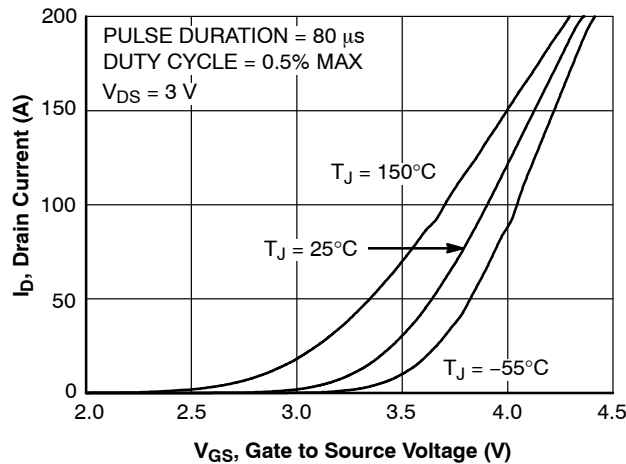


Figure 5. Transfer Characteristics

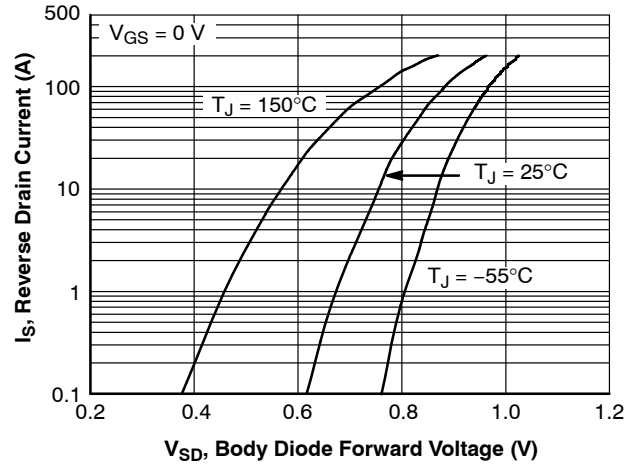


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

TYPICAL CHARACTERISTICS (continued)

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

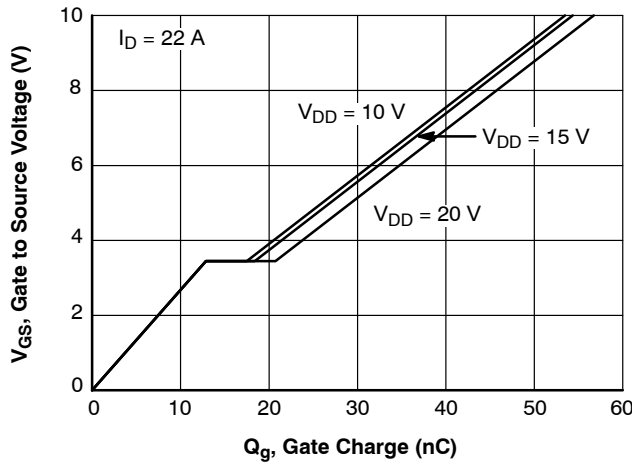


Figure 7. Gate Charge Characteristics

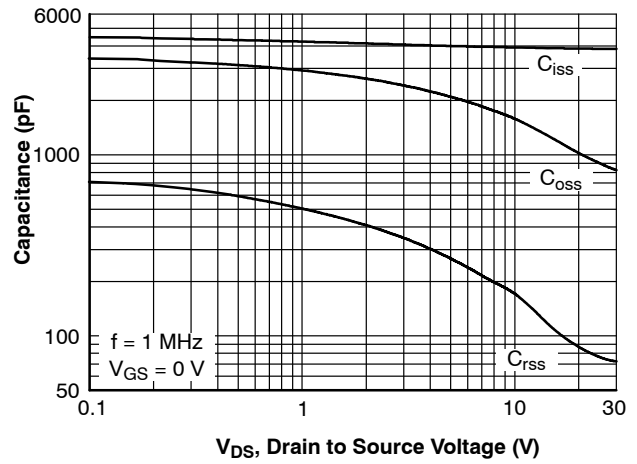


Figure 8. Capacitance vs. Drain to Source Voltage

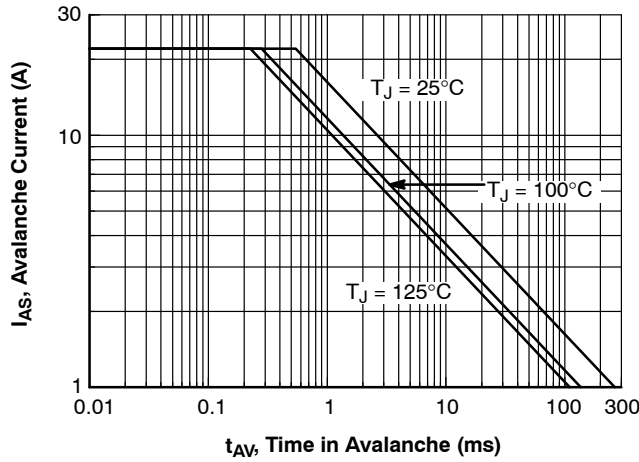


Figure 9. Unclamped Inductive Switching Capability

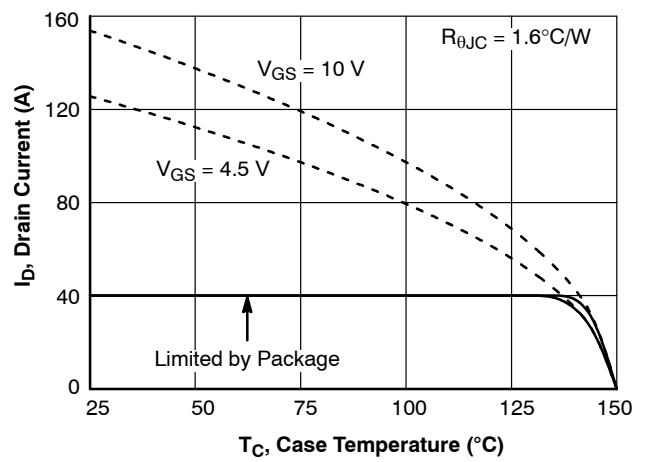


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

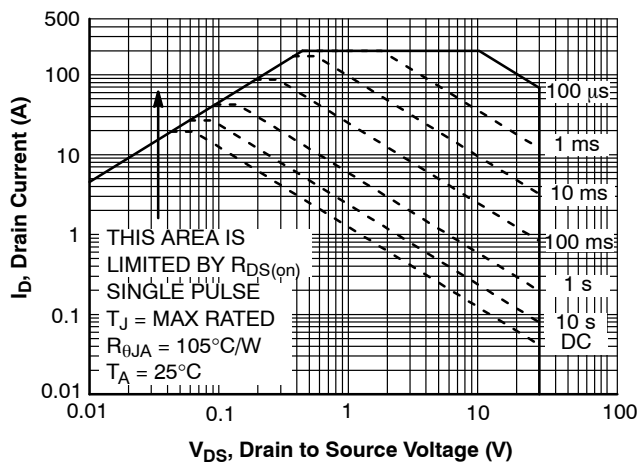


Figure 11. Forward Bias Safe Operating Area

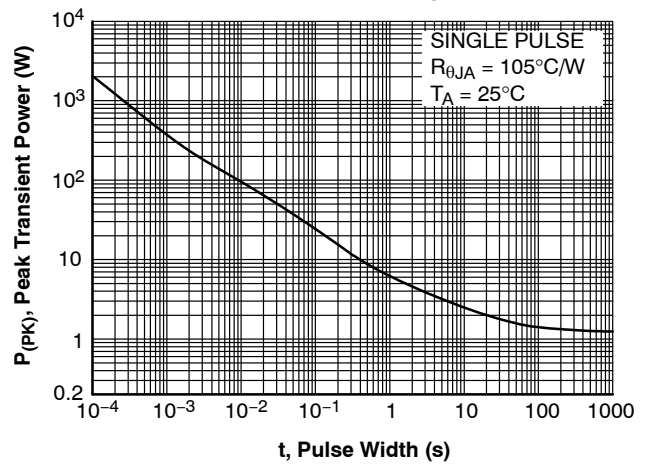


Figure 12. Single Pulse Maximum Power Dissipation

TYPICAL CHARACTERISTICS (continued)

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

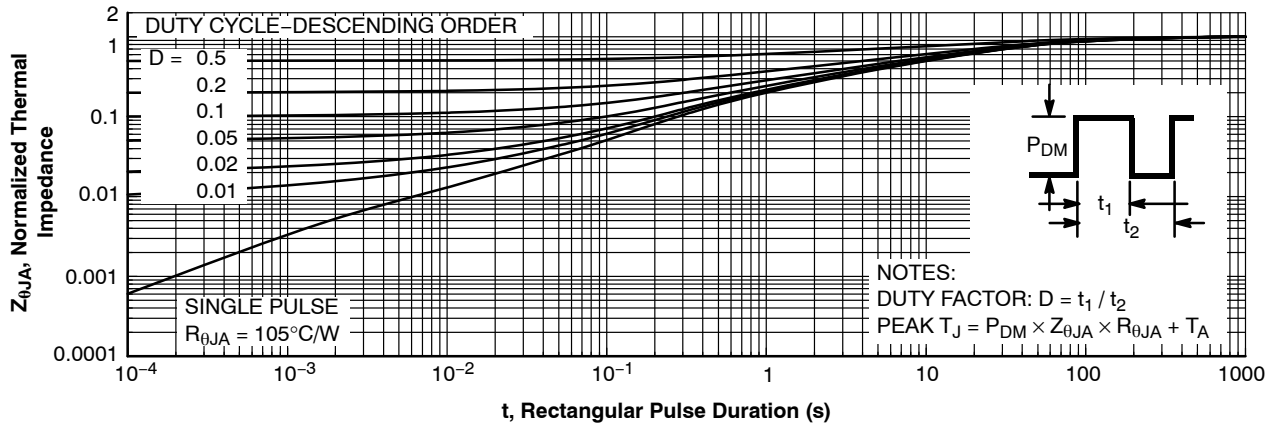
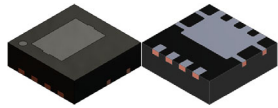


Figure 13. Junction-to-Ambient Transient Thermal Response Curve

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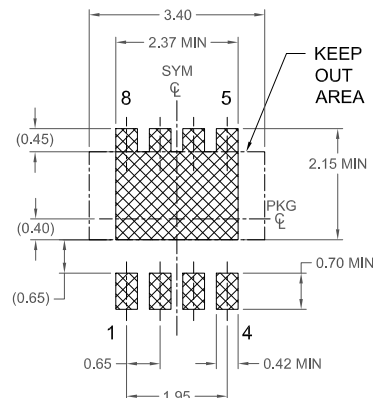
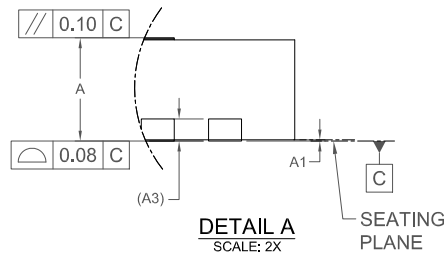
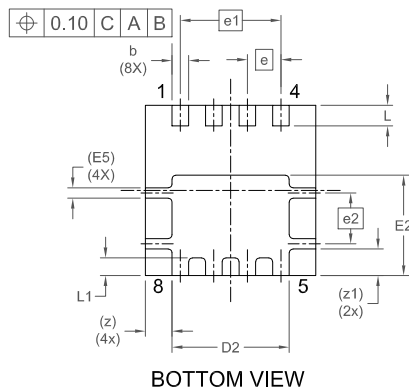
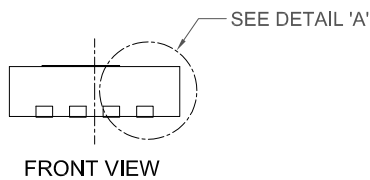
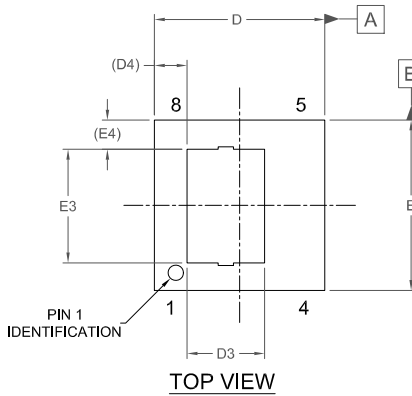
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# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



**PQFN8 3.30x3.30x1.00, 0.65P**  
**CASE 483AL**  
**ISSUE B**

DATE 20 DEC 2023



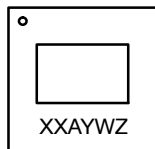
\*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERM/D.

## NOTES:

- A. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.
- B. ALL DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.

| DIM | MILLIMETERS |      |      |
|-----|-------------|------|------|
|     | MIN.        | NOM. | MAX. |
| A   | 0.90        | 1.00 | 1.10 |
| A1  | 0.00        | -    | 0.05 |
| b   | 0.27        | 0.32 | 0.37 |
| A3  | 0.20 REF    |      |      |
| D   | 3.20        | 3.30 | 3.40 |
| D2  | 2.17        | 2.27 | 2.37 |
| D3  | 1.40        | 1.55 | 1.70 |
| D4  | 0.63 REF    |      |      |
| E   | 3.20        | 3.30 | 3.40 |
| E2  | 1.90        | 2.00 | 2.10 |
| E3  | 2.10        | 2.25 | 2.40 |
| E4  | 0.56 REF    |      |      |
| E5  | 0.20 REF    |      |      |
| e   | 0.65 BSC    |      |      |
| e1  | 1.95 BSC    |      |      |
| e2  | 0.98 BSC    |      |      |
| L   | 0.30        | 0.40 | 0.50 |
| L4  | 0.29        | 0.39 | 0.49 |
| z   | 0.52 REF    |      |      |
| z1  | 0.52 REF    |      |      |

## GENERIC MARKING DIAGRAM\*



- XX = Specific Device Code
- A = Assembly Location
- Y = Year
- W = Work Week
- Z = Assembly Lot Code

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.

|                         |                                    |                                                                                                                                                                                  |
|-------------------------|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>DOCUMENT NUMBER:</b> | <b>98AON13661G</b>                 | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| <b>DESCRIPTION:</b>     | <b>PQFN8 3.30x3.30x1.00, 0.65P</b> | <b>PAGE 1 OF 1</b>                                                                                                                                                               |

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