

# MOSFET, N-Channel, POWERTRENCH®

Q1: 30 V, 66 A, 4 mΩ

Q2: 30 V, 42 A, 5.5 mΩ

## FDMD8900

### General Description

This device utilizes two optimized N-ch FETs in a dual 3.3 x 5 mm thermally enhanced power package. The HS Source and LS drain are internally connected providing a low source inductance package, helping to provide the best FOM.

### Features

Q1: N-Channel

- Max  $r_{DS(on)}$  = 4 mΩ at  $V_{GS} = 10$  V,  $I_D = 19$  A
- Max  $r_{DS(on)}$  = 5 mΩ at  $V_{GS} = 4.5$  V,  $I_D = 17$  A
- Max  $r_{DS(on)}$  = 6.5 mΩ at  $V_{GS} = 3.8$  V,  $I_D = 15$  A
- Max  $r_{DS(on)}$  = 8.3 mΩ at  $V_{GS} = 3.5$  V,  $I_D = 14$  A

Q2: N-Channel

- Max  $r_{DS(on)}$  = 5.5 mΩ at  $V_{GS} = 10$  V,  $I_D = 17$  A
- Max  $r_{DS(on)}$  = 6.5 mΩ at  $V_{GS} = 4.5$  V,  $I_D = 15$  A
- Max  $r_{DS(on)}$  = 9 mΩ at  $V_{GS} = 3.8$  V,  $I_D = 13$  A
- Max  $r_{DS(on)}$  = 12 mΩ at  $V_{GS} = 3.5$  V,  $I_D = 12$  A
- Ideal for Flexible Layout in Primary Side of Bridge Topology
- 100% UIL Tested
- Kelvin High Side MOSFET Drive Pin-out Capability
- This Device is Pb-Free and is RoHS Compliant

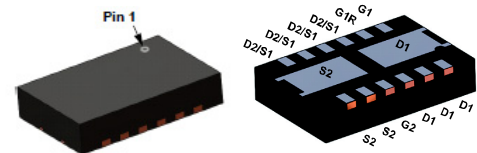
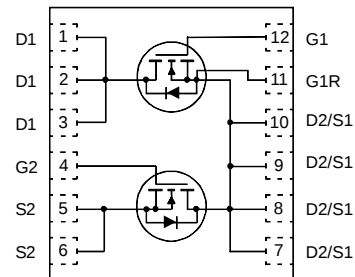
### Applications

- Computing
- Buck, Boost and Buck/Boost Applications
- General Purpose POL



ON Semiconductor®

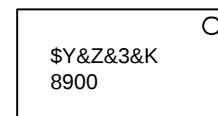
[www.onsemi.com](http://www.onsemi.com)



Power 3.3 x 5

PQFN12 3.3X5, 0.65P  
CASE 483BN

### MARKING DIAGRAM



|      |                         |
|------|-------------------------|
| \$Y  | = ON Semiconductor Logo |
| &Z   | = Assembly Plant Code   |
| &3   | = Numeric Date Code     |
| &K   | = Lot Code              |
| 8900 | = Specific Device Code  |

### ORDERING INFORMATION

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

# FDMD8900

## MOSFET MAXIMUM RATINGS (T<sub>A</sub> = 25°C, Unless otherwise noted)

| Symbol                            | Parameter                                        |             |                                 |           | Q1          | Q2  | Units |
|-----------------------------------|--------------------------------------------------|-------------|---------------------------------|-----------|-------------|-----|-------|
| V <sub>DS</sub>                   | Drain to Source Voltage                          |             |                                 |           | 30          | 30  | V     |
| V <sub>GS</sub>                   | Gate to Source Voltage                           |             |                                 |           | ±12         | ±12 | V     |
| I <sub>D</sub>                    | Drain Current                                    | –Continuous | T <sub>C</sub> = 25°C           | (Note 5)  | 66          | 42  | A     |
|                                   |                                                  | –Continuous | T <sub>C</sub> = 100°C          | (Note 5)  | 42          | 26  |       |
|                                   |                                                  | –Continuous | T <sub>A</sub> = 25°C           | (Note 1a) | 19          | 17  |       |
|                                   |                                                  | –Pulsed     |                                 | (Note 4)  | 280         | 210 |       |
| E <sub>AS</sub>                   | Single Pulse Avalanche Energy (Note 3)           |             |                                 |           | 73          | 54  | mJ    |
| P <sub>D</sub>                    | Power Dissipation                                |             | T <sub>C</sub> = 25°C           |           | 27          | 15  | W     |
|                                   | Power Dissipation                                |             | T <sub>A</sub> = 25°C (Note 1a) |           | 2.1         |     |       |
| T <sub>J</sub> , T <sub>STG</sub> | 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

| Symbol           | Parameter                                         | Value | Ratings | Unit |
|------------------|---------------------------------------------------|-------|---------|------|
| R <sub>θJC</sub> | Thermal Resistance, Junction to Case              | 4.7   | 8.4     | °C/W |
| R <sub>θJA</sub> | Thermal Resistance, Junction to Ambient (Note 1a) | 60    |         |      |

## PACKAGE MARKING AND ORDERING INFORMATION

| Device Marking | Device   | Package                       | Shipping <sup>†</sup>    |
|----------------|----------|-------------------------------|--------------------------|
| 8900           | FDMD8900 | PQFN12 3.3x5, 0.65P (Pb-Free) | 3000 units / 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

# FDMD8900

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

| Symbol | Parameter | Test Conditions | Type | Min. | Typ. | Max. | Units |
|--------|-----------|-----------------|------|------|------|------|-------|
|--------|-----------|-----------------|------|------|------|------|-------|

### OFF CHARACTERISTICS

|                                      |                                           |                                                                                                            |          |          |  |                        |         |
|--------------------------------------|-------------------------------------------|------------------------------------------------------------------------------------------------------------|----------|----------|--|------------------------|---------|
| BV <sub>DSS</sub>                    | Drain to Source Breakdown Voltage         | I <sub>D</sub> = 250 $\mu$ A, V <sub>GS</sub> = 0 V<br>I <sub>D</sub> = 250 $\mu$ A, V <sub>GS</sub> = 0 V | Q1<br>Q2 | 30<br>30 |  |                        | V       |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | I <sub>D</sub> = 250 $\mu$ A, referenced to 25°C<br>I <sub>D</sub> = 250 $\mu$ A, referenced to 25°C       | Q1<br>Q2 | 14<br>13 |  |                        | mV/°C   |
| I <sub>DSS</sub>                     | Zero Gate Voltage Drain Current           | V <sub>DS</sub> = 24 V, V <sub>GS</sub> = 0 V<br>V <sub>DS</sub> = 24 V, V <sub>GS</sub> = 0 V             | Q1<br>Q2 |          |  | 1<br>1                 | $\mu$ A |
| I <sub>GSS</sub>                     | Gate to Source Leakage Current            | V <sub>GS</sub> = $\pm$ 12 V, V <sub>DS</sub> = 0 V<br>V <sub>GS</sub> = $\pm$ 12 V, V <sub>DS</sub> = 0 V | Q1<br>Q2 |          |  | $\pm$ 100<br>$\pm$ 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<br>V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 $\mu$ A                                                                                                                                         | Q1<br>Q2 | 0.8<br>1 | 1.3<br>1.4                    | 2.5<br>2.5                   | V          |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | I <sub>D</sub> = 250 mA, referenced to 25°C<br>I <sub>D</sub> = 250 mA, referenced to 25°C                                                                                                                                                                                   | Q1<br>Q2 |          | -4<br>-4                      |                              | mV/°C      |
| r <sub>DS(on)</sub>                    | Drain to Source On Resistance                            | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 19 A<br>V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 17 A<br>V <sub>GS</sub> = 3.8 V, I <sub>D</sub> = 15 A<br>V <sub>GS</sub> = 3.5 V, I <sub>D</sub> = 14 A<br>V <sub>GS</sub> = 10 V, I <sub>D</sub> = 19 A, T <sub>J</sub> = 125°C | Q1       |          | 3.4<br>4<br>4.3<br>4.6<br>4.6 | 4<br>5<br>6.5<br>8.3<br>6    | m $\Omega$ |
|                                        |                                                          | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 17 A<br>V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 15 A<br>V <sub>GS</sub> = 3.8 V, I <sub>D</sub> = 13 A<br>V <sub>GS</sub> = 3.5 V, I <sub>D</sub> = 12 A<br>V <sub>GS</sub> = 10 V, I <sub>D</sub> = 17 A, T <sub>J</sub> = 125°C | Q2       |          | 4.5<br>5.4<br>6<br>6.6<br>5.8 | 5.5<br>6.5<br>9<br>12<br>6.9 |            |
| g <sub>FS</sub>                        | Forward Transconductance                                 | V <sub>DS</sub> = 5 V, I <sub>D</sub> = 19 A<br>V <sub>DS</sub> = 5 V, I <sub>D</sub> = 17 A                                                                                                                                                                                 | Q1<br>Q2 |          | 86<br>80                      |                              | S          |

### DYNAMIC CHARACTERISTICS

|                  |                              |                                                                                                                                        |          |  |              |              |    |
|------------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|----------|--|--------------|--------------|----|
| C <sub>iss</sub> | Input Capacitance            | Q1:<br>V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 0 V, f = 1 MHz<br><br>Q2:<br>V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 0 V, f = 1 MHz | Q1<br>Q2 |  | 1735<br>1210 | 2605<br>1815 | pF |
| C <sub>oss</sub> | Output Capacitance           |                                                                                                                                        | Q1<br>Q2 |  | 462<br>356   | 695<br>535   | pF |
| C <sub>rss</sub> | Reverse Transfer Capacitance |                                                                                                                                        | Q1<br>Q2 |  | 47<br>52     | 75<br>80     | pF |
| R <sub>g</sub>   | Gate Resistance              |                                                                                                                                        | Q1<br>Q2 |  | 0.8<br>1.9   |              | W  |

### SWITCHING CHARACTERISTICS

|                     |                               |                                                                                                                                                                                |                                                                                                                  |          |            |          |    |
|---------------------|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|----------|------------|----------|----|
| t <sub>d(on)</sub>  | Turn-On Delay Time            | Q1:<br>V <sub>DD</sub> = 15 V, I <sub>D</sub> = 19 A, R <sub>GEN</sub> = 6 $\Omega$<br><br>Q2:<br>V <sub>DD</sub> = 15 V, I <sub>D</sub> = 17 A, R <sub>GEN</sub> = 6 $\Omega$ | Q1<br>Q2                                                                                                         |          | 8.7<br>7.1 | 17<br>14 | ns |
| t <sub>r</sub>      | Rise Time                     |                                                                                                                                                                                | Q1<br>Q2                                                                                                         |          | 2.3<br>2   | 10<br>10 | ns |
| t <sub>d(off)</sub> | Turn-Off Delay Time           |                                                                                                                                                                                | Q1<br>Q2                                                                                                         |          | 25<br>22   | 40<br>35 | ns |
| t <sub>f</sub>      | Fall Time                     |                                                                                                                                                                                | Q1<br>Q2                                                                                                         |          | 2.4<br>2.3 | 10<br>10 | ns |
| Q <sub>g</sub>      | Total Gate Charge             | V <sub>GS</sub> = 0 V to 10 V                                                                                                                                                  | Q1:<br>V <sub>DD</sub> = 15 V, I <sub>D</sub> = 19 A<br><br>Q2:<br>V <sub>DD</sub> = 15 V, I <sub>D</sub> = 17 A | Q1<br>Q2 | 25<br>19   | 35<br>27 | nC |
| Q <sub>g</sub>      | Total Gate Charge             | V <sub>GS</sub> = 0 V to 4.5 V                                                                                                                                                 |                                                                                                                  | Q1<br>Q2 | 12<br>8.8  | 17<br>12 | nC |
| Q <sub>gs</sub>     | Gate to Source Gate Charge    |                                                                                                                                                                                |                                                                                                                  | Q1<br>Q2 | 3.6<br>2.7 |          | nC |
| Q <sub>gd</sub>     | Gate to Drain "Miller" Charge |                                                                                                                                                                                |                                                                                                                  | Q1<br>Q2 | 2.7<br>2.6 |          | nC |

# FDMD8900

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

| Symbol | Parameter | Test Conditions | Type | Min. | Typ. | Max. | Units |
|--------|-----------|-----------------|------|------|------|------|-------|
|--------|-----------|-----------------|------|------|------|------|-------|

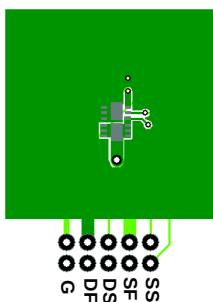
### DRAIN-SOURCE DIODE CHARACTERISTICS $T_J = 25^\circ\text{C}$ unless otherwise noted.

|          |                                       |                                                                                                        |          |  |            |            |    |
|----------|---------------------------------------|--------------------------------------------------------------------------------------------------------|----------|--|------------|------------|----|
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS} = 0\text{ V}, I_S = 19\text{ A}$ (Note 2)<br>$V_{GS} = 0\text{ V}, I_S = 17\text{ A}$ (Note 2) | Q1<br>Q2 |  | 0.8<br>0.8 | 1.2<br>1.2 | V  |
| $t_{rr}$ | Reverse Recovery Time                 | Q1:<br>$I_F = 19\text{ A}, \Delta i/\Delta t = 100\text{ A/ms}$                                        | Q1<br>Q2 |  | 26<br>22   | 42<br>35   | ns |
| $Q_{rr}$ | Reverse Recovery Charge               | Q2:<br>$I_F = 17\text{ A}, \Delta i/\Delta t = 100\text{ A/ms}$                                        | Q1<br>Q2 |  | 10<br>7.8  | 20<br>16   | nC |

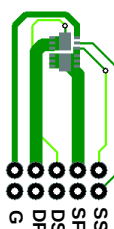
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

#### 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. 60 °C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



b. 130 °C/W when mounted on a minimum pad of 2 oz copper

- Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty cycle < 2.0 %.
- Q1:  $E_{AS}$  of 73 mJ is based on starting  $T_J = 25^\circ\text{C}$ ,  $L = 3\text{ mH}$ ,  $I_{AS} = 7\text{ A}$ ,  $V_{DD} = 30\text{ V}$ ,  $V_{GS} = 10\text{ V}$ . 100% tested at  $L = 0.1\text{ mH}$ ,  $I_{AS} = 25\text{ A}$ .  
Q2:  $E_{AS}$  of 54 mJ is based on starting  $T_J = 25^\circ\text{C}$ ,  $L = 3\text{ mH}$ ,  $I_{AS} = 6\text{ A}$ ,  $V_{DD} = 30\text{ V}$ ,  $V_{GS} = 10\text{ V}$ . 100% tested at  $L = 0.1\text{ mH}$ ,  $I_{AS} = 20\text{ A}$ .
- Pulse Id refers to Figure "Forward Bias Safe Operation Area".
- Computed continuous current limited to Max Junction Temperature only, actual continuous current will be limited by thermal & electro-mechanical application board design.

**TYPICAL CHARACTERISTICS (Q1 N-CHANNEL)**  $T_J = 25^\circ\text{C}$  unless otherwise noted.

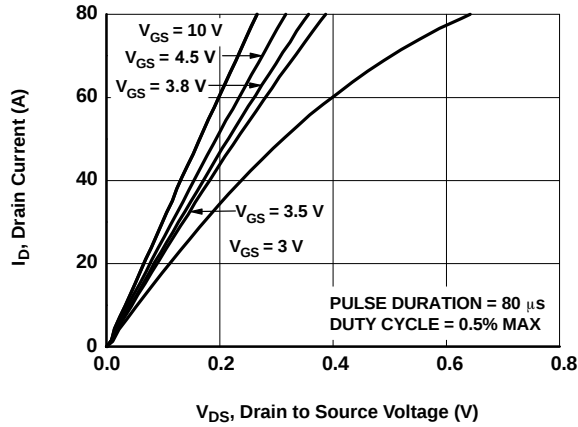


Figure 1. On-Region Characteristics

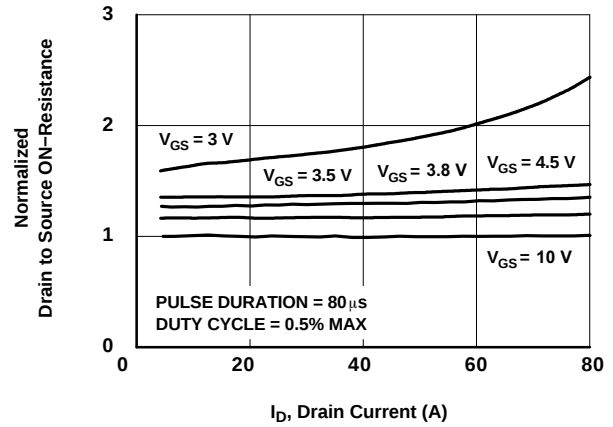


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

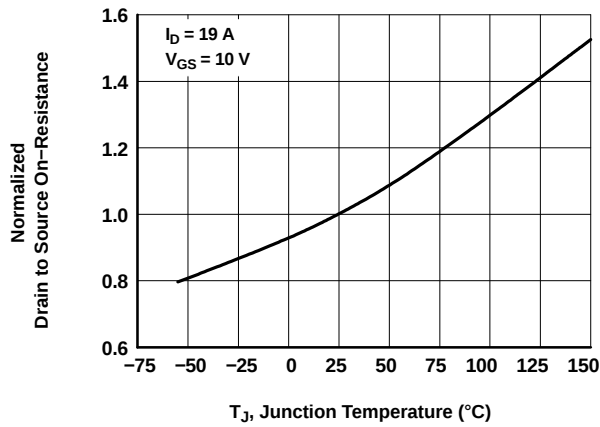


Figure 3. Normalized On Resistance vs. Junction Temperature

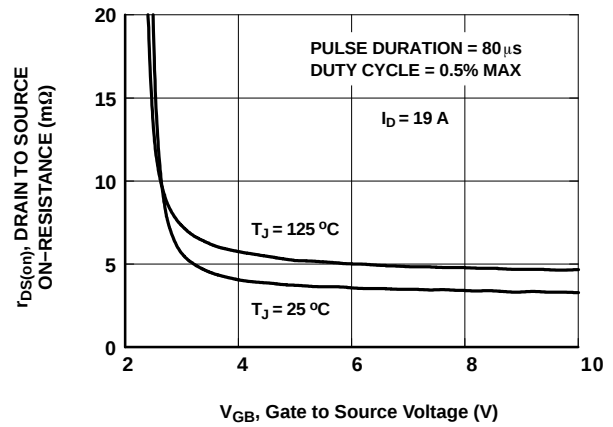


Figure 4. On Resistance vs. Gate to Source Voltage

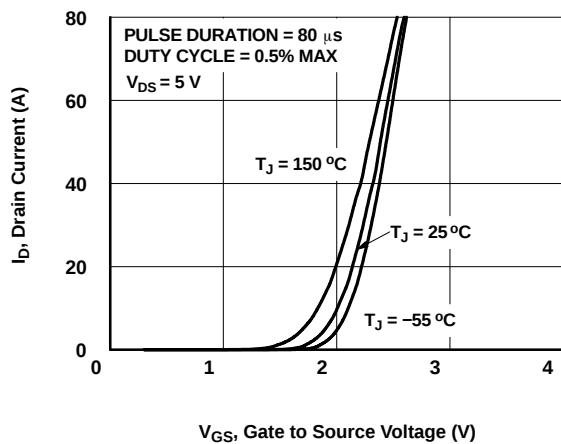


Figure 5. Transfer Characteristics

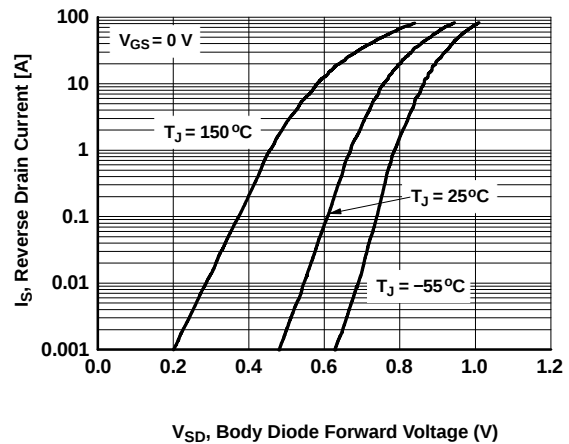


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

TYPICAL CHARACTERISTICS (Q1 N-CHANNEL)  $T_J = 25^\circ\text{C}$  unless otherwise noted.

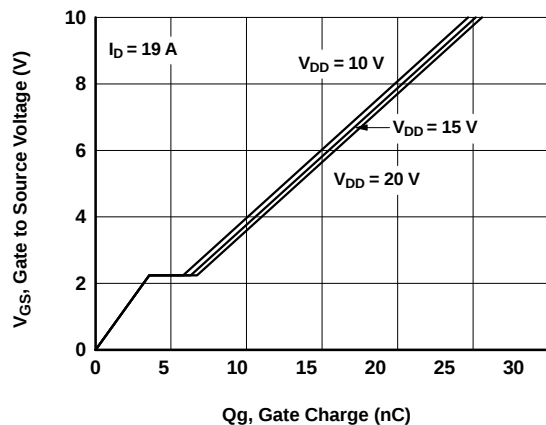


Figure 7. Gate Charge Characteristics

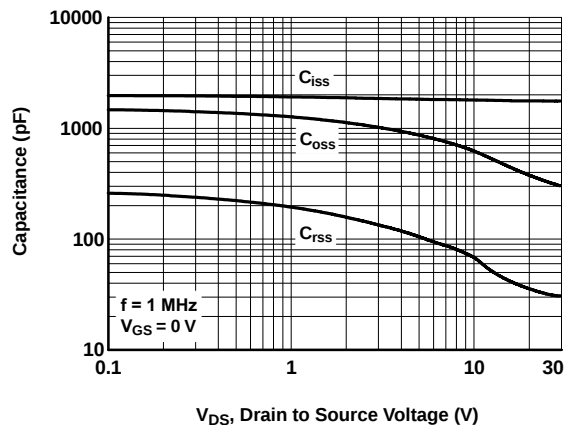


Figure 8. Capacitance vs. Drain to Source Voltage

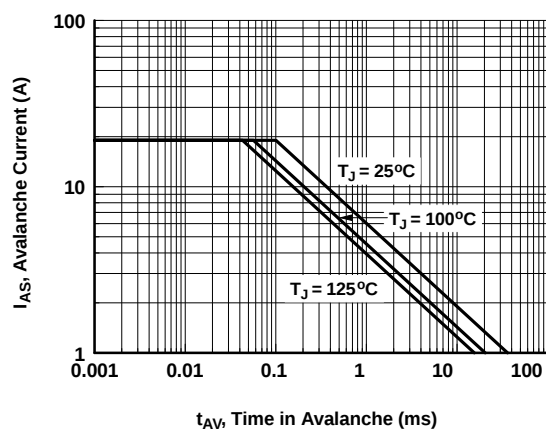


Figure 9. Unclamped Inductive Switching Capability

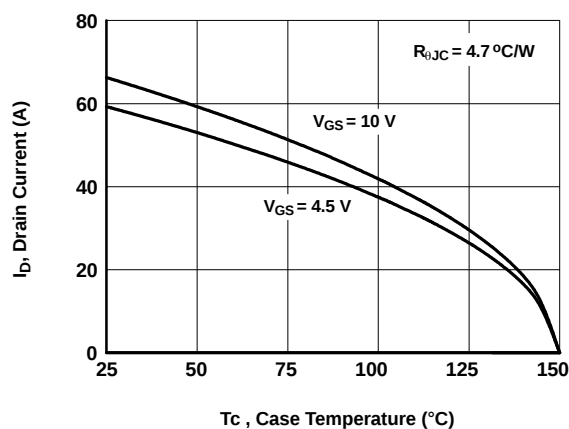


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

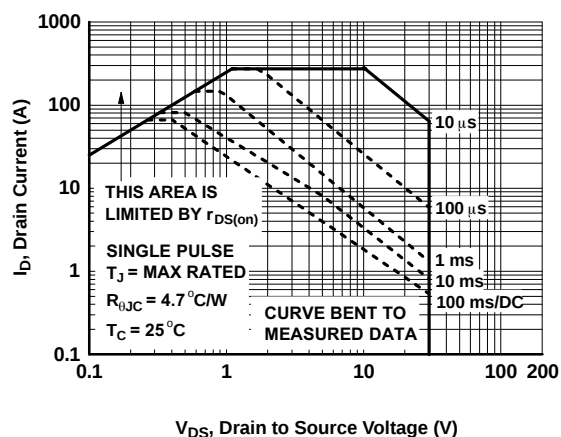


Figure 11. Forward Bias Safe Operating Area

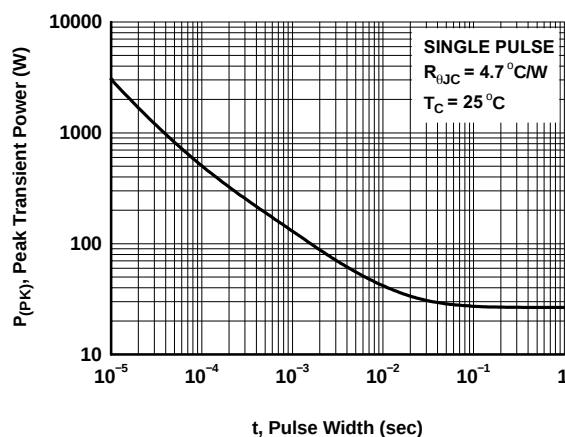


Figure 12. Single Pulse Maximum Power Dissipation

TYPICAL CHARACTERISTICS (Q1 N-CHANNEL)  $T_J = 25^\circ\text{C}$  unless otherwise noted.

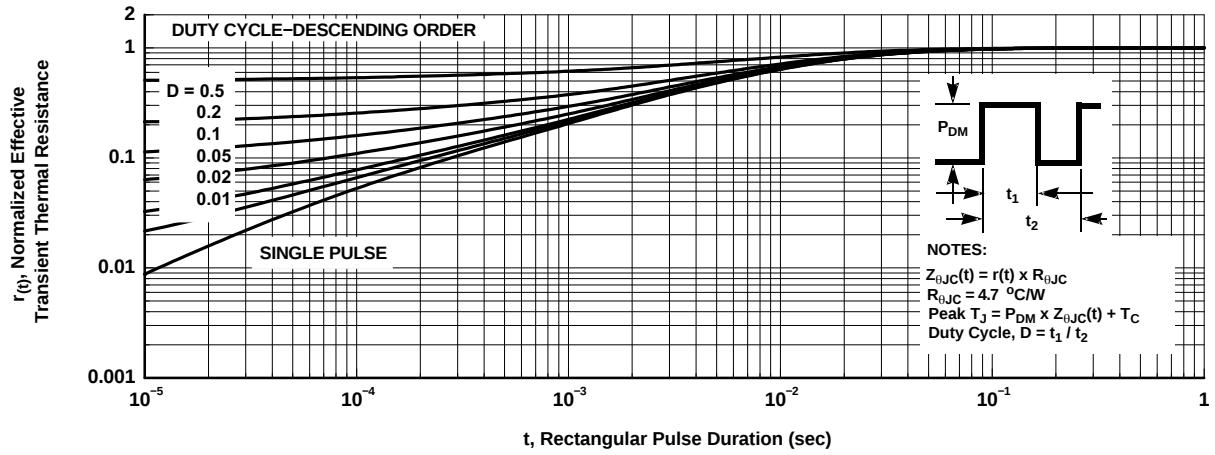


Figure 13. Junction-to-Case Transient Thermal Response Curve

TYPICAL CHARACTERISTICS (Q2 N-CHANNEL)  $T_J = 25^\circ\text{C}$  unless otherwise noted.

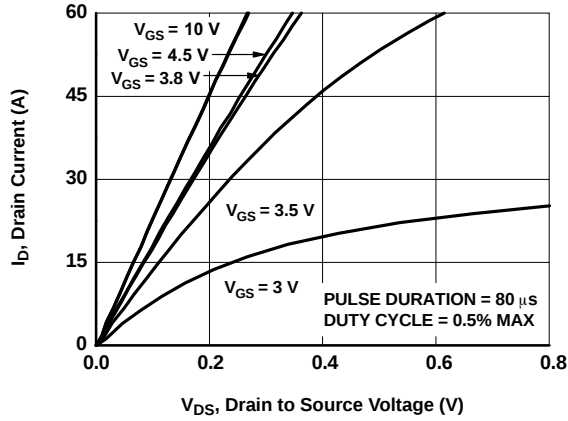


Figure 14. On-Region Characteristics

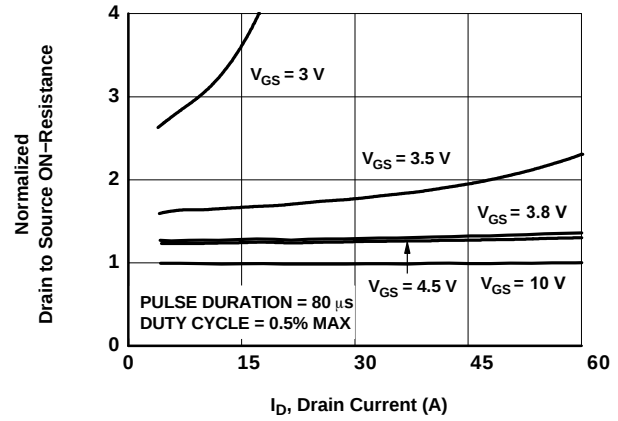


Figure 15. Normalized On-Resistance vs. Drain Current and Gate Voltage

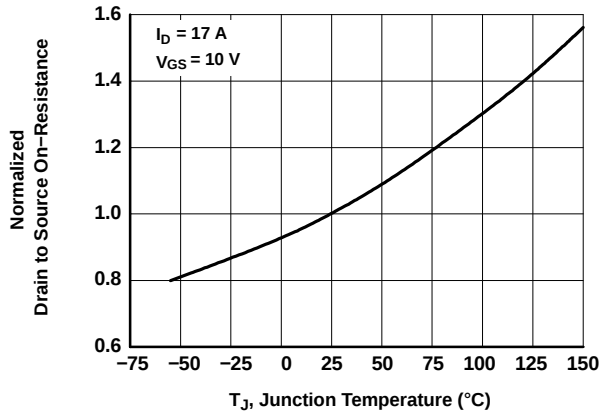


Figure 16. Normalized On-Resistance vs. Junction Temperature

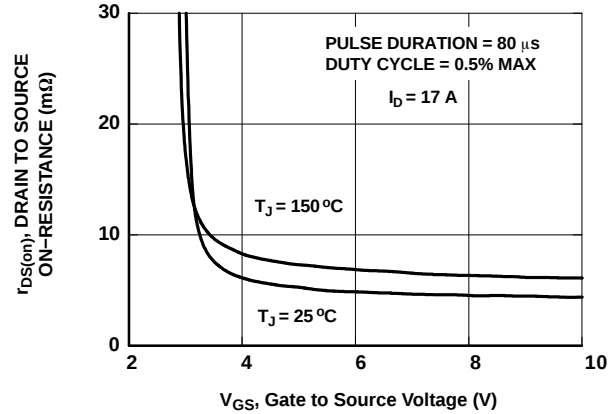


Figure 17. On Resistance vs. Gate to Source Voltage

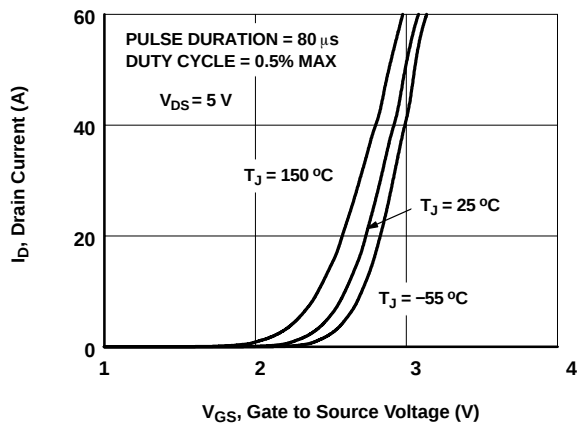


Figure 18. Transfer Characteristics

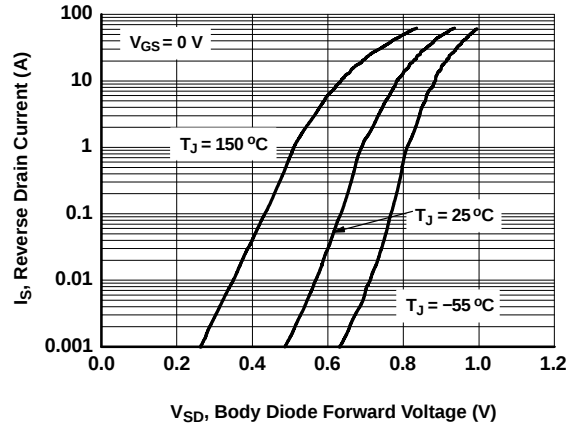


Figure 19. Source to Drain Diode Forward Voltage vs. Source Current

TYPICAL CHARACTERISTICS (Q2 N-CHANNEL)  $T_J = 25^\circ\text{C}$  unless otherwise noted.

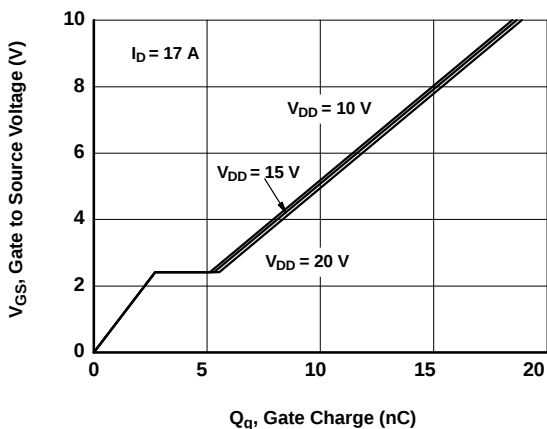


Figure 20. Gate Charge Characteristics

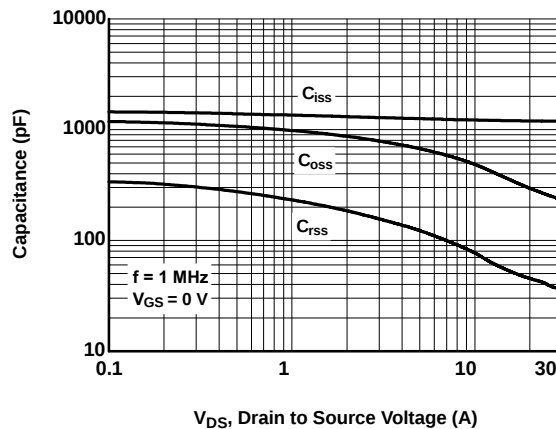


Figure 21. Capacitance vs. Drain to Source Voltage

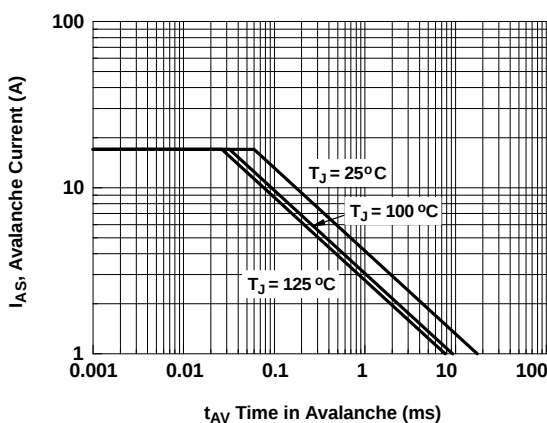


Figure 22. Unclamped Inductive Switching Capability

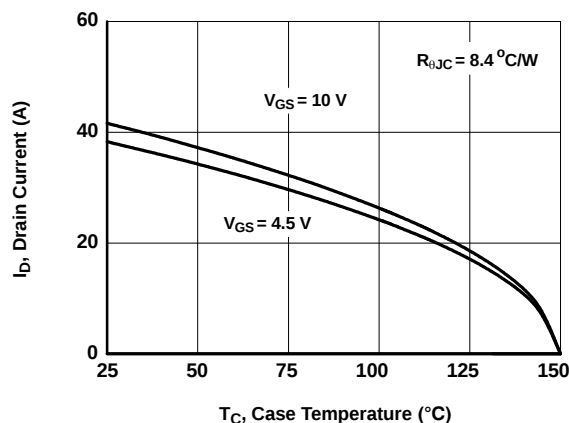


Figure 23. Maximum Continuous Drain Current vs. Case Temperature

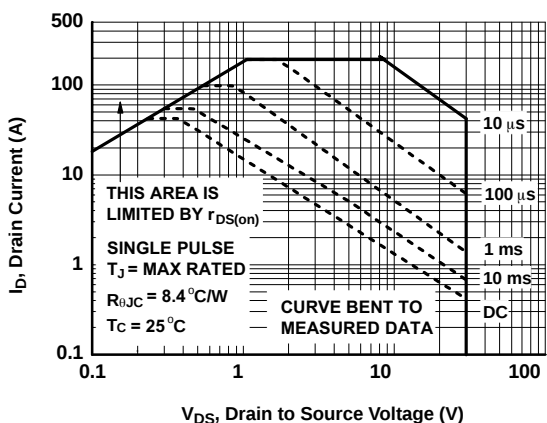


Figure 24. Forward Bias Safe Operating Area

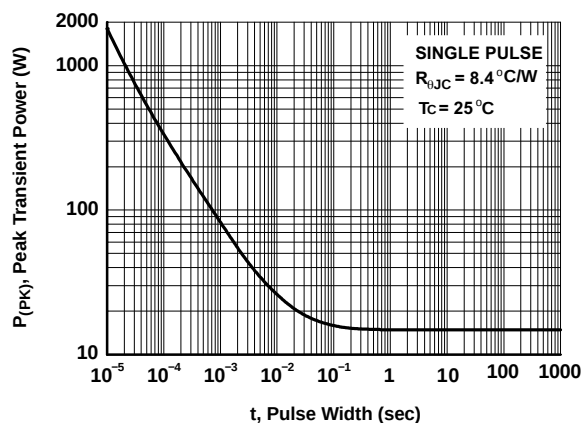


Figure 25. Single Pulse Maximum Power Dissipation

TYPICAL CHARACTERISTICS (Q2 N-CHANNEL)  $T_J = 25^\circ\text{C}$  unless otherwise noted.

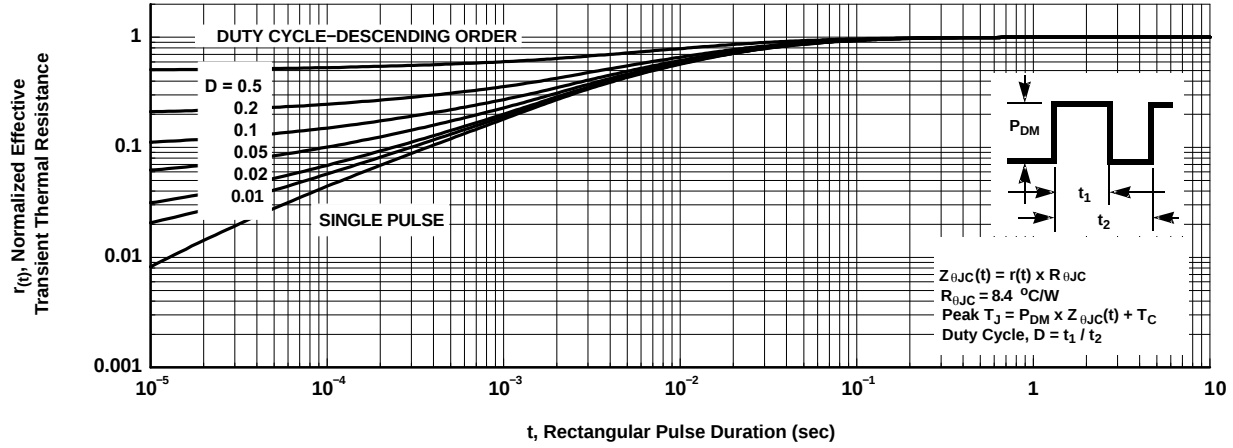
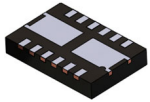
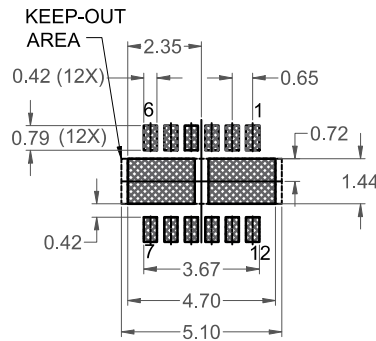
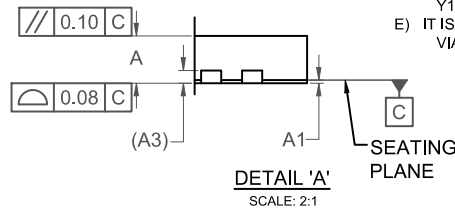
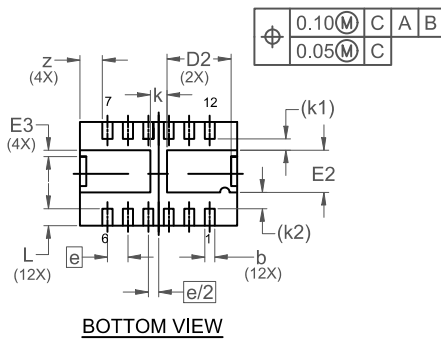
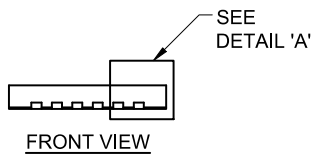
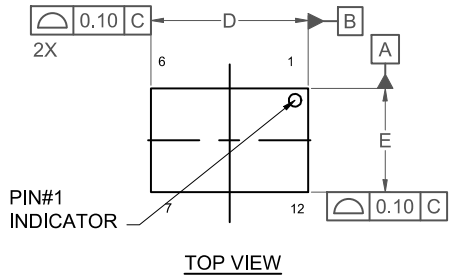


Figure 26. Junction-to-Case Transient Thermal Response Curve



**PQFN12 3.3X5, 0.65P**  
**CASE 483BN**  
**ISSUE A**

DATE 26 AUG 2021



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

- NOTES: UNLESS OTHERWISE SPECIFIED  
A) THIS PACKAGE CONFORMS TO JEDEC MO-240, VARIATION 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-1994.  
E) IT IS RECOMMENDED TO HAVE NO TRACES OR VIAS WITHIN THE KEEP OUT AREA.

| 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   | 4.90        | 5.00 | 5.10 |
| D2  | 1.92        | 2.04 | 2.14 |
| E   | 3.20        | 3.30 | 3.40 |
| E2  | 1.24        | 1.34 | 1.44 |
| E3  | 0.10        | 0.20 | 0.30 |
| e   | 0.65 BSC    |      |      |
| e/2 | 0.325 BSC   |      |      |
| k   | 0.53 REF    |      |      |
| k1  | 0.36 REF    |      |      |
| k2  | 0.52 REF    |      |      |
| L   | 0.44        | 0.54 | 0.64 |
| z   | 0.72 REF    |      |      |

**DOCUMENT NUMBER:** 98AON13670G

**DESCRIPTION:** PQFN12 3.3X5, 0.65P

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