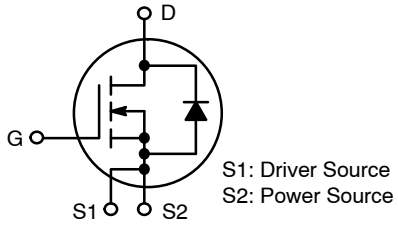
# MOSFET – Power, N-Channel, SUPERFET III, Easy Drive

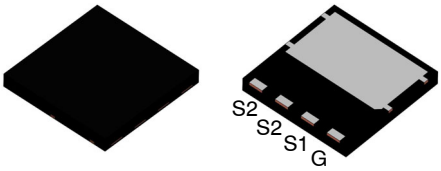
## 650 V, 30 A, 99 mΩ

# FCMT099N65S3

| $V_{DSS}$ | $R_{DS(ON)}$ MAX | $I_D$ MAX |
|---|---|---|
| 650 V | 99 mΩ @ 10 V | 30 A |




**POWER MOSFET**




**PQFN4 8X8 2P**
**CASE 483AP**

### Description

SUPERFET III MOSFET is **onsemi**'s brand−new high voltage super−junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on−resistance and lower gate charge performance. This advanced technology is tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate. Consequently, SUPERFET III MOSFET is very suitable for the switching power applications such as server / telecom power, adaptor and solar inverter applications.

The Power88 package is an ultra−slim surface−mount package (1 mm high) with a low profile and small footprint (8x8 $mm^2$). SUPERFET III MOSFET in a Power88 package offers excellent switching performance due to lower parasitic source inductance and separated power and drive sources. Power88 offers Moisture Sensitivity Level 1 (MSL 1).

### Features

- 700 V @ $T_J$ = 150°C
- Typ. $R_{DS(on)}$ = 87 mΩ
- Ultra Low Gate Charge (Typ. $Q_g$ = 56 nC)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)}$ = 500 pF)
- 100% Avalanche Tested
- These Devices are Pb−Free and are RoHS Compliant

### Applications

- Telecom / Server Power Supplies
- Industrial Power Supplies
- UPS / Solar

### MARKING DIAGRAM


| | |
|---|---|
| &Z | = Assembly Plant Code |
| &3 | = Data Code (Year & Week) |
| &K | = Lot Code |
| FCMT099N65S3 | = Specific Device Code |

### ORDERING INFORMATION

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

## ABSOLUTE MAXIMUM RATINGS ($T_C$ = 25°C, Unless otherwise specified)

| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| $V_{DSS}$ | Drain to Source Voltage | | 650 | V |
| $V_{GSS}$ | Gate to Source Voltage | DC | ±30 | V |
| | | AC (f > 1 Hz) | ±30 | V |
| $I_D$ | Drain Current | Continuous ($T_C$ = 25°C) | 30 | A |
| | | Continuous ($T_C$ = 100°C) | 19 | |
| $I_{DM}$ | Drain Current | Pulsed (Note 1) | 75 | A |
| $E_{AS}$ | Single Pulsed Avalanche Energy (Note 2) | | 145 | mJ |
| $I_{AS}$ | Avalanche Current (Note 1) | | 4.4 | A |
| $E_{AR}$ | Repetitive Avalanche Energy (Note 1) | | 2.27 | mJ |
| dv/dt | MOSFET dv/dt | | 100 | V/ns |
| | Peak Diode Recovery dv/dt (Note 3) | | 20 | |
| $P_D$ | Power Dissipation | ($T_C$ = 25°C) | 227 | W |
| | | Derate Above 25°C | 1.82 | W/°C |
| $T_J$, $T_{STG}$ | Operating and Storage Temperature Range | | −55 to +150 | °C |
| $T_L$ | Maximum Lead Temperature for Soldering, 1/8″ from Case for 5 s | | 300 | °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.

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. $I_{AS}$ = 4.4 A, $R_G$ = 25 Ω, starting $T_J$ = 25°C.
3. $I_{SD}$ ≤ 15 A, di/dt ≤ 200 A/μs, $V_{DD}$ ≤ 400 V, starting $T_J$ = 25°C.

## THERMAL CHARACTERISTICS

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case, Max. | 0.55 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient, Max. (Note 4) | 45 | |

4. Device on 1 $in^2$ pad 2 oz copper pad on 1.5 x 1.5 in. board of FR−4 material.

## PACKAGE MARKING AND ORDERING INFORMATION

| Part Number | Top Marking | Package | Reel Size | Tape Width | Shipping† |
|---|---|---|---|---|---|
| FCMT099N65S3 | FCMT099N65S3 | PQFN8 | – | – | 3000 / Tape & Reel |

†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** ($T_C$ = 25°C unless otherwise noted)

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| $BV_{DSS}$ | Drain to Source Breakdown Voltage | $V_{GS}$ = 0 V, $I_D$ = 1 mA, $T_J$ = 25°C | 650 | | | V |
| | | $V_{GS}$ = 0 V, $I_D$ = 1 mA, $T_J$ = 150°C | 700 | | | V |
| $\Delta BV_{DSS}/\Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 1 mA, Referenced to 25°C | | 0.68 | | V/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 650 V, $V_{GS}$ = 0 V | | | 10 | μA |
| | | $V_{DS}$ = 520 V, $T_C$ = 125°C | | 2.77 | | |
| $I_{GSS}$ | Gate to Body Leakage Current | $V_{GS}$ = ±30 V, $V_{DS}$ = 0 V | | | ±100 | nA |
| **ON CHARACTERISTICS** | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 0.7 mA | 2.5 | | 4.5 | V |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS}$ = 10 V, $I_D$ = 15 A | | 87 | 99 | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = 20 V, $I_D$ = 15 A | | 17 | | S |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 400 V, $V_{GS}$ = 0 V, f = 1 MHz | | 2270 | | pF |
| $C_{oss}$ | Output Capacitance | | | 50 | | pF |
| $C_{oss(eff.)}$ | Effective Output Capacitance | $V_{DS}$ = 0 V to 400 V, $V_{GS}$ = 0 V | | 500 | | pF |
| $C_{oss(er.)}$ | Energy Related Output Capacitance | $V_{DS}$ = 0 V to 400 V, $V_{GS}$ = 0 V | | 74 | | pF |
| $Q_{g(tot)}$ | Total Gate Charge at 10 V | $V_{DS}$ = 400 V, $I_D$ = 15 A, $V_{GS}$ = 10 V (Note 5) | | 56 | | nC |
| $Q_{gs}$ | Gate to Source Gate Charge | | | 13 | | nC |
| $Q_{gd}$ | Gate to Drain “Miller” Charge | | | 23 | | nC |
| ESR | Equivalent Series Resistance | f = 1 MHz | | 0.5 | | Ω |
| **SWITCHING CHARACTERISTICS** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD}$ = 400 V, $I_D$ = 15 A, $V_{GS}$ = 10 V, $R_g$ = 4.7 Ω (Note 5) | | 22 | | ns |
| $t_r$ | Turn-On Rise Time | | | 20 | | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 58 | | ns |
| $t_f$ | Turn-Off Fall Time | | | 5 | | ns |
| **SOURCE-DRAIN DIODE CHARACTERISTICS** | | | | | | |
| $I_S$ | Maximum Continuous Source to Drain Diode Forward Current | | | | 30 | A |
| $I_{SM}$ | Maximum Pulsed Source to Drain Diode Forward Current | | | | 75 | A |
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS}$ = 0 V, $I_{SD}$ = 15 A | | | 1.2 | V |
| $t_{rr}$ | Reverse Recovery Time | $V_{DD}$ = 400 V, $I_{SD}$ = 15 A, $dI_F/dt$ = 100 A/μs | | 352 | | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | | 6.5 | | μC |

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.

5. Essentially independent of operating temperature typical characteristics.

## TYPICAL PERFORMANCE CHARACTERISTICS

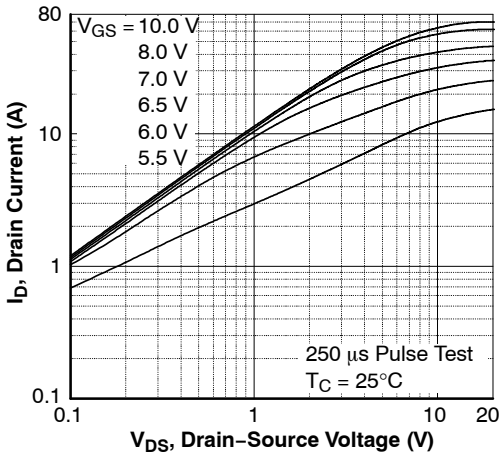



**Figure 1. On−Region Characteristics**

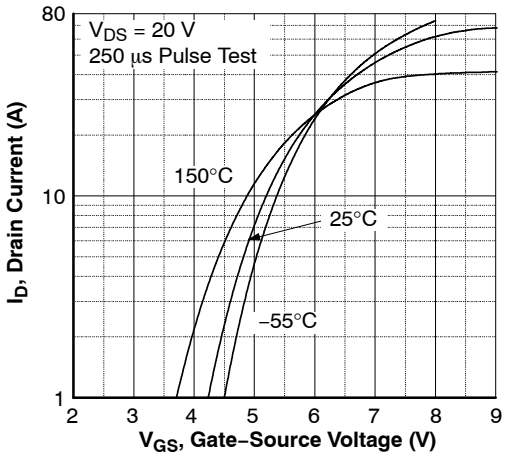



**Figure 2. Transfer Characteristics**

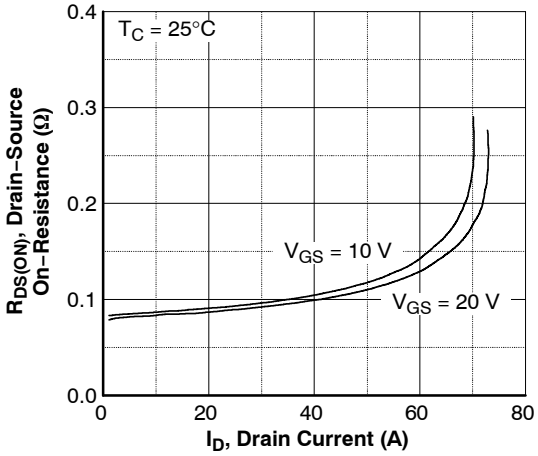



**Figure 3. On−Resistance Variation vs. Drain Current and Gate Voltage**

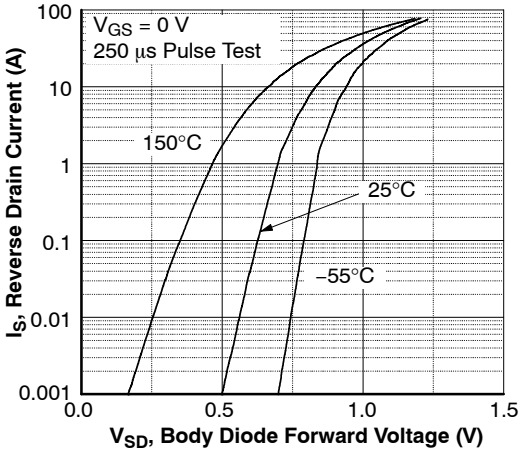



**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**

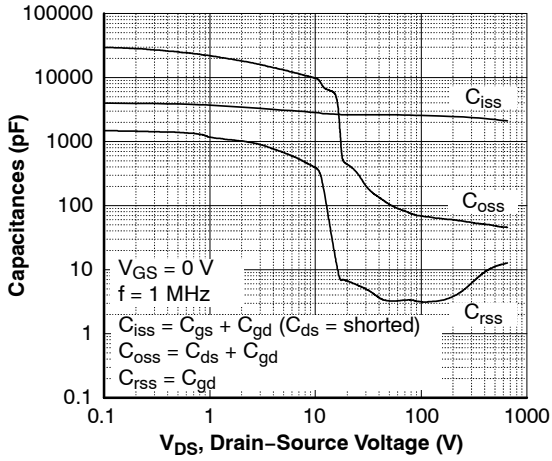



**Figure 5. Capacitance Characteristics**

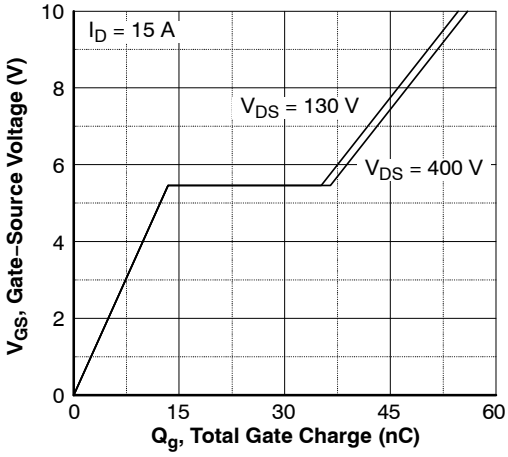



**Figure 6. Gate Charge Characteristics**

## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

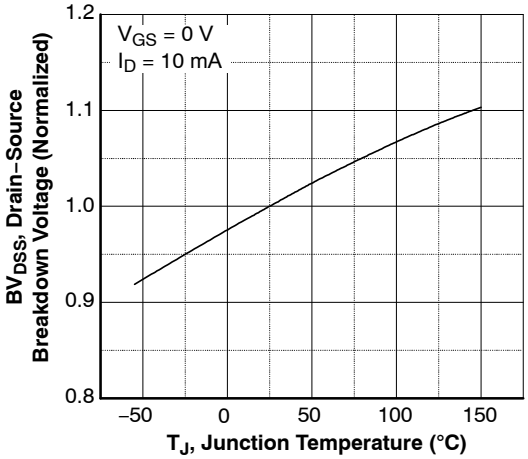



**Figure 7. Breakdown Voltage Variation vs. Temperature**

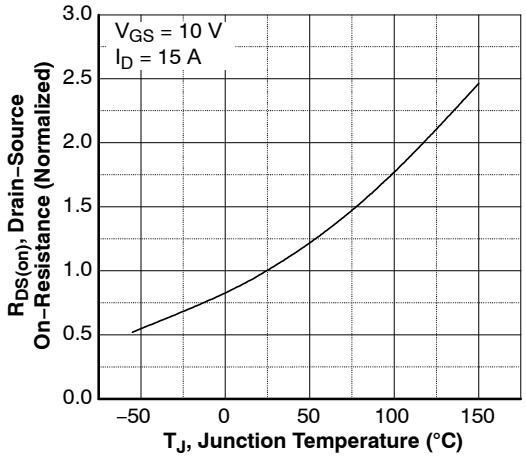



**Figure 8. On−Resistance Variation vs. Temperature**

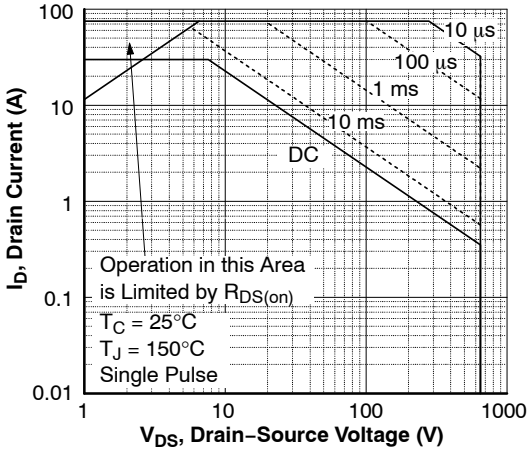



**Figure 9. Maximum Safe Operating Area**

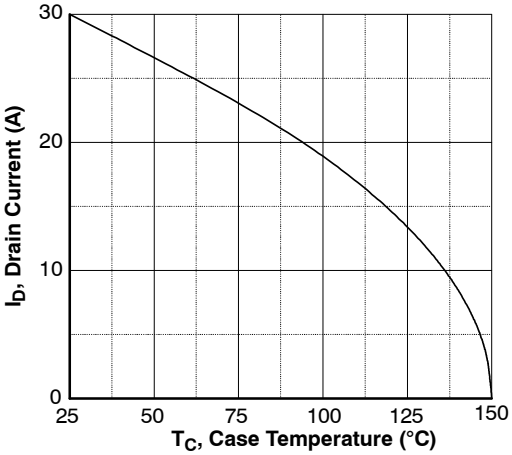



**Figure 10. Maximum Drain Current vs. Case Temperature**

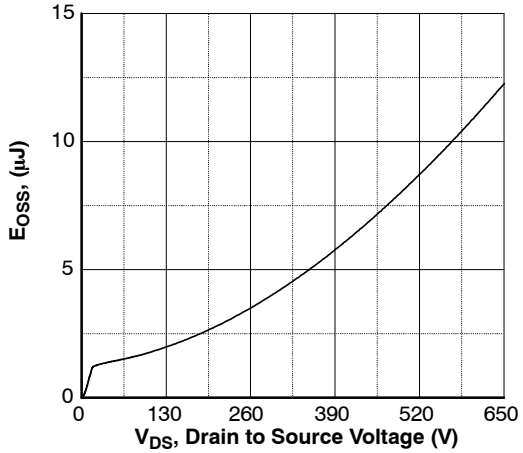



**Figure 11. $E_{OSS}$ vs. Drain to Source Voltage**

## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

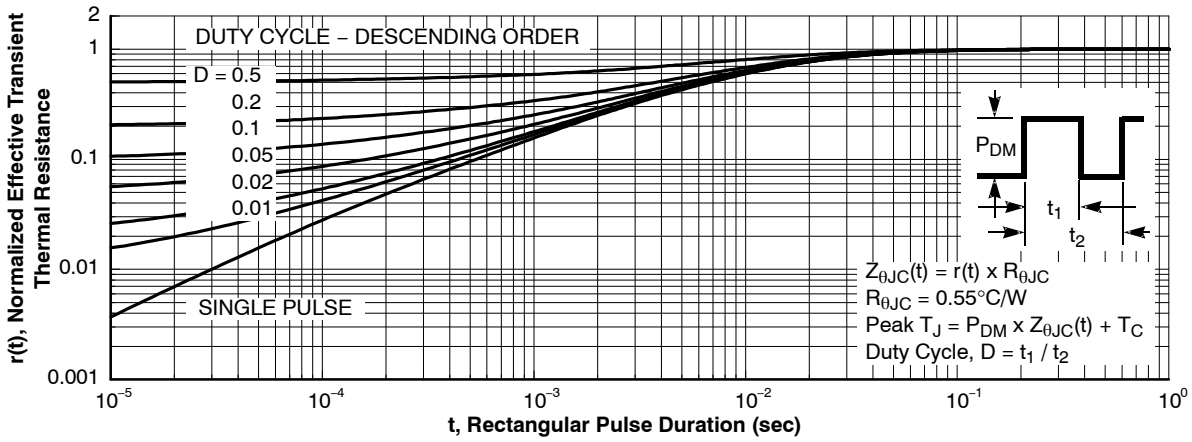



**Figure 12. Transient Thermal Response Curve**

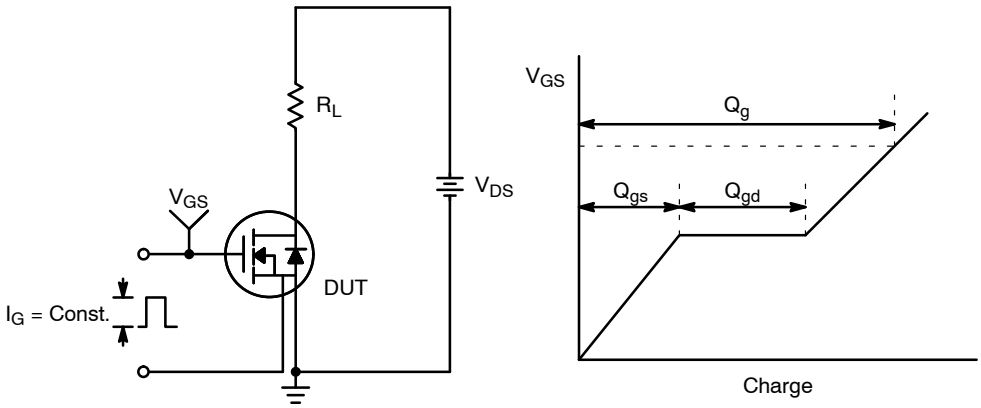



**Figure 13. Gate Charge Test Circuit & Waveform**

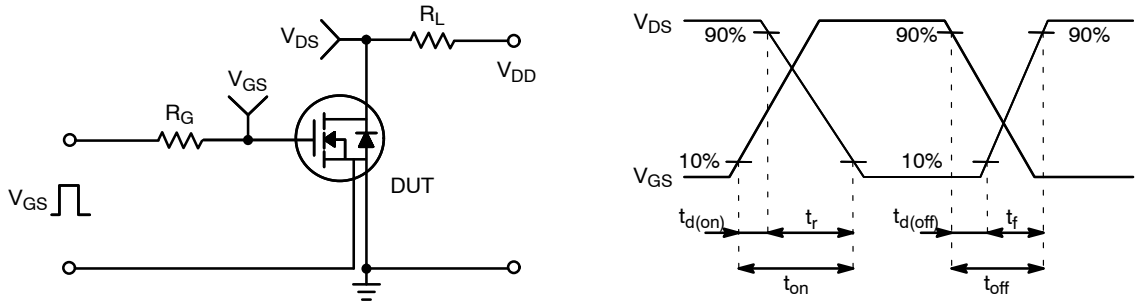



**Figure 14. Resistive Switching Test Circuit & Waveforms**

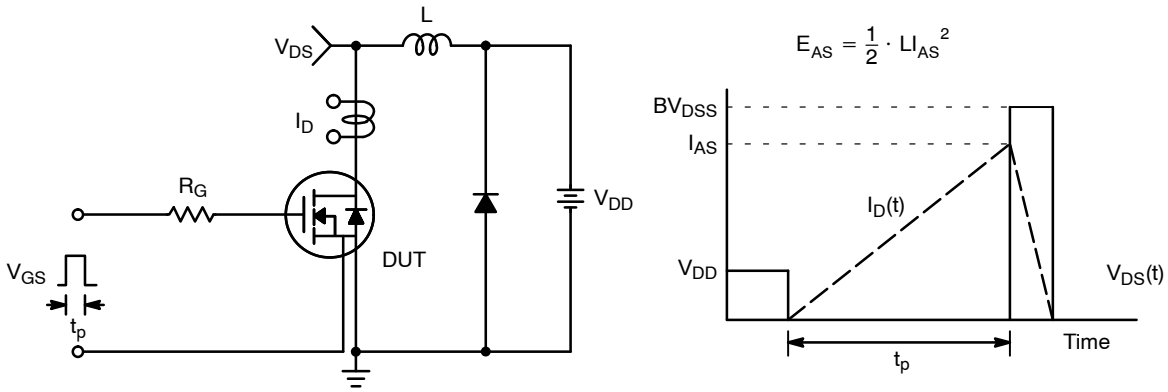



**Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms**

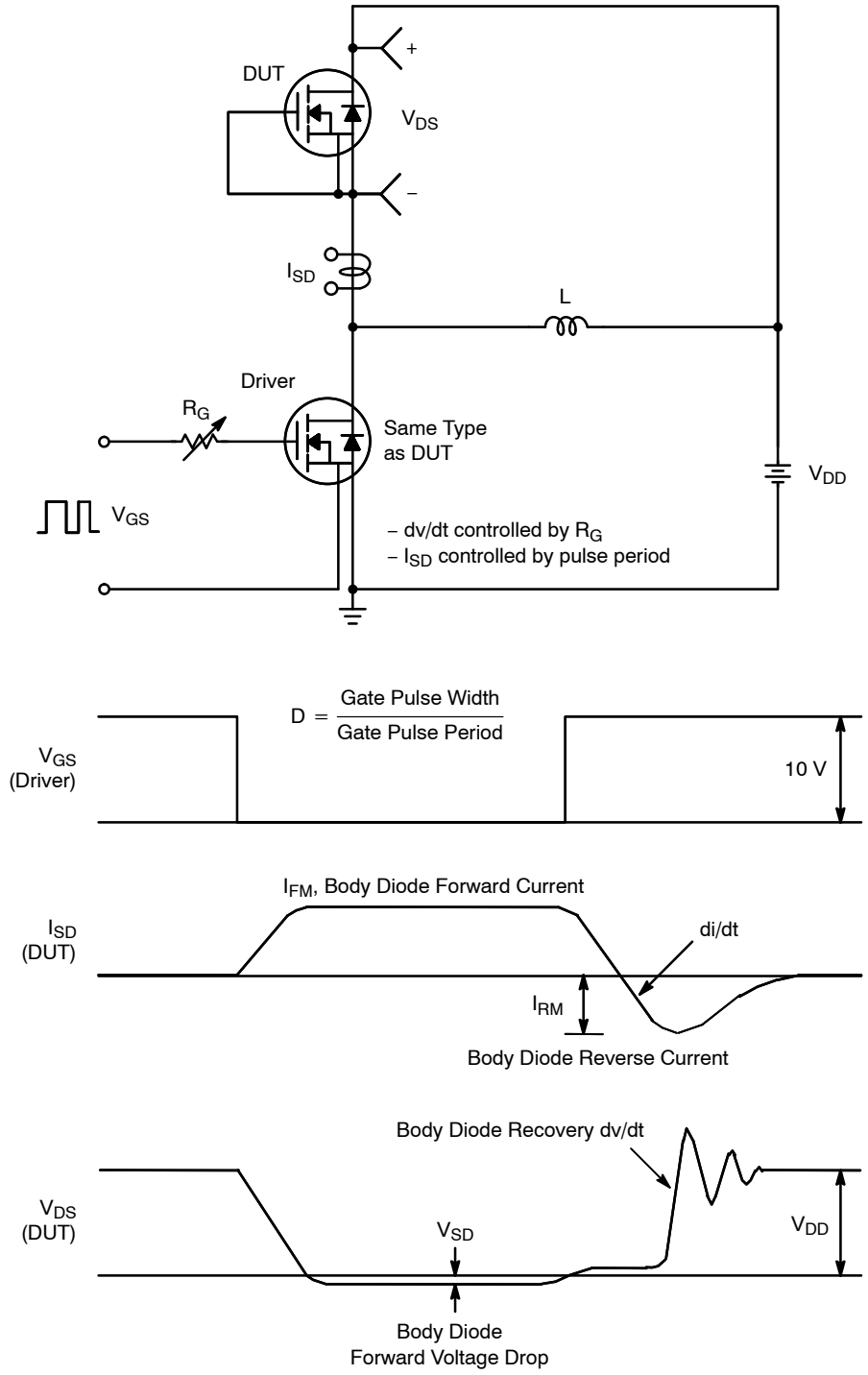
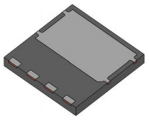



**Figure 16. Peak Diode Recovery dv/dt Test Circuit & Waveforms**



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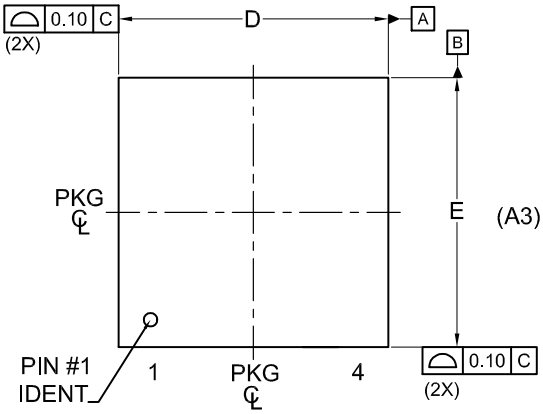
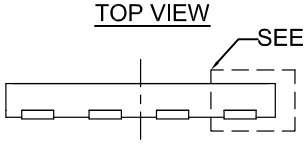
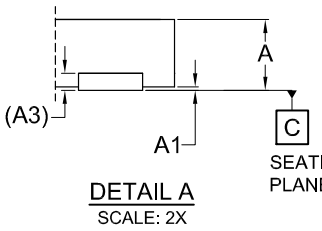
DATE 06 JUL 2021




TOP VIEW



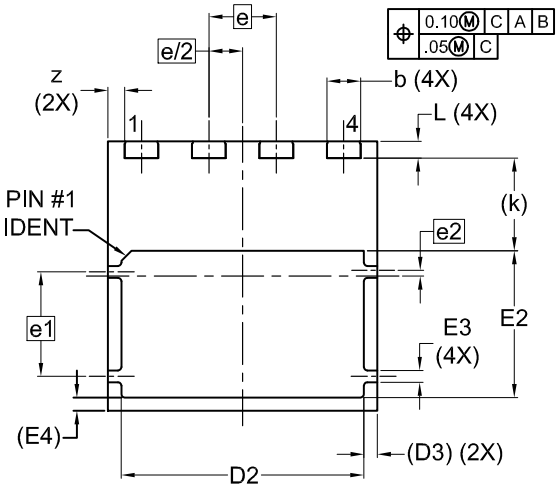

FRONT VIEW



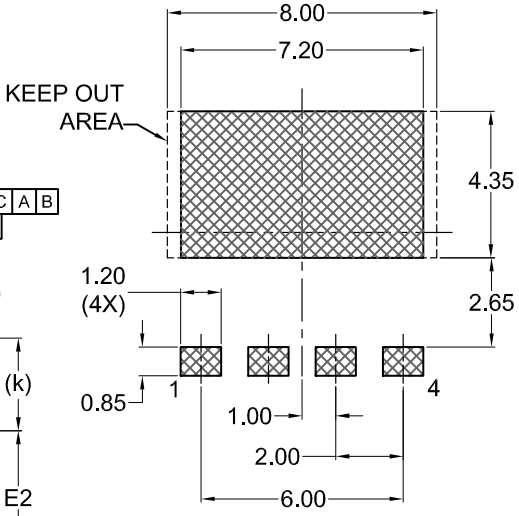

DETAIL A
SCALE: 2X

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
4. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
5. 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.
6. IT IS RECOMMENDED TO HAVE NO TRACES OR VIAS WITHIN THE KEEP OUT AREA.




BOTTOM VIEW




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.

| DIM | MILLIMETERS | | |
|---|---|---|---|
| | MIN. | NOM. | MAX. |
| A | 0.90 | 1.00 | 1.10 |
| A1 | 0.00 | - | 0.05 |
| A3 | | 0.20 REF | |
| b | 0.90 | 1.00 | 1.10 |
| D | 7.90 | 8.00 | 8.10 |
| D2 | 7.10 | 7.20 | 7.30 |
| D3 | | 0.40 REF | |
| E | 7.90 | 8.00 | 8.10 |
| E2 | 4.25 | 4.35 | 4.45 |
| E3 | 0.25 | 0.35 | 0.45 |
| E4 | | 0.40 REF | |
| e | | 2.00 BSC | |
| e/2 | | 1.00 BSC | |
| e1 | | 3.10 BSC | |
| e2 | | 0.17 BSC | |
| k | | 2.75 REF | |
| L | 0.40 | 0.50 | 0.60 |

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|---|---|---|---|
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| **DESCRIPTION:** | **PQFN4 8X8, 2P** | | **PAGE 1 OF 1** |

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