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August 2014

# FCMT299N60

## N-Channel SuperFET® II MOSFET

### 600 V, 12 A, 299 mΩ

## Features

- 650 V @ $T_J$ = 150°C
- $R_{DS(on)}$ = 250 mΩ (Typ.)
- Ultra Low Gate Charge (Typ. $Q_g$ = 39 nC)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)}$ = 127 pF)
- 100% Avalanche Tested
- RoHS Compliant

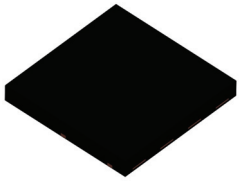
## Applications

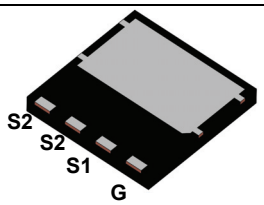
- Server and Telecom Power Supplies
- Solar Inverters
- Adaptors

## Description

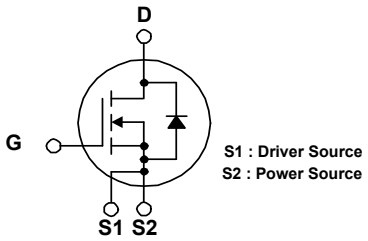
SuperFET® II MOSFET is Fairchild Semiconductor's brand-new high voltage super-junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on-resistance and lower gate charge performance. This technology is tailored to minimize conduction loss, provide superior switching performance, dv/dt rate and higher avalanche energy. Consequently, SuperFET II 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 II 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).






Power88




## Absolute Maximum Ratings $T_C$ = 25°C unless otherwise noted.

| Symbol | Parameter | | FCMT299N60 | Unit |
|---|---|---|---|---|
| $V_{DSS}$ | Drain to Source Voltage | | 600 | V |
| $V_{GSS}$ | Gate to Source Voltage | -DC | ±20 | V |
| | | -AC (f > 1 Hz) | ±30 | |
| $I_D$ | Drain Current | -Continuous ($T_C$ = 25°C) | 12 | A |
| | | -Continuous ($T_C$ = 100°C) | 7.9 | |
| $I_{DM}$ | Drain Current | - Pulsed (Note 1) | 36 | A |
| $E_{AS}$ | Single Pulsed Avalanche Energy | (Note 2) | 234 | mJ |
| $I_{AR}$ | Avalanche Current | (Note 1) | 2.5 | A |
| $E_{AR}$ | Repetitive Avalanche Energy | (Note 1) | 1.25 | mJ |
| dv/dt | Peak Diode Recovery dv/dt | (Note 3) | 20 | V/ns |
| | MOSFET dv/dt | | 100 | V/ns |
| $P_D$ | Power Dissipation | ($T_C$ = 25°C) | 125 | W |
| | | - Derate above 25°C | 1 | 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 Seconds | | 300 | °C |

## Thermal Characteristics

| Symbol | Parameter | FCMT299N60 | Unit |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case, Max. | 1.0 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (* 1 $in^2$ pad of 2 oz copper), Max. | 45 | |

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## Package Marking and Ordering Information

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|
| FCMT299N60 | FCMT299N60 | Power88 | - | - | 3000 |

## 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, $I_D$ = 10 mA, $T_C$ = 25°C | 600 | - | - | V |
| | | $V_{GS}$ = 0 V, $I_D$ = 10 mA, $T_C$ = 150°C | 650 | - | - | |
| $\Delta BV_{DSS}$ / $\Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 10 mA, Referenced to 25°C | - | 0.67 | - | V/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 600 V, $V_{GS}$ = 0 V | - | - | 1 | μA |
| | | $V_{DS}$ = 480 V, $V_{GS}$ = 0 V, $T_C$ = 125°C | - | 1.2 | - | |
| $I_{GSS}$ | Gate to Body Leakage Current | $V_{GS}$ = ±20 V, $V_{DS}$ = 0 V | - | - | ±100 | nA |
| **On Characteristics** | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 250 μA | 2.5 | - | 3.5 | V |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS}$ = 10 V, $I_D$ = 6 A | - | 0.25 | 0.299 | Ω |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = 20 V, $I_D$ = 6 A | - | 12 | - | S |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 380 V, $V_{GS}$ = 0 V, f = 1 MHz | - | 1465 | 1948 | pF |
| $C_{oss}$ | Output Capacitance | | - | 30 | 40 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | - | 4.87 | - | pF |
| $C_{oss}$ eff. | Effective Output Capacitance | $V_{DS}$ = 0 V to 480 V, $V_{GS}$ = 0 V | - | 127 | - | pF |
| $Q_{g(tot)}$ | Total Gate Charge at 10V | $V_{DS}$ = 380 V, $I_D$ = 6 A, $V_{GS}$ = 10 V (Note 4) | - | 39 | 51 | nC |
| $Q_{gs}$ | Gate to Source Gate Charge | | - | 6 | - | nC |
| $Q_{gd}$ | Gate to Drain “Miller” Charge | | - | 14 | - | nC |
| ESR | Equivalent Series Resistance | f = 1 MHz | - | 0.8 | - | Ω |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD}$ = 380 V, $I_D$ = 6 A, $V_{GS}$ = 10 V, $R_g$ = 4.7 Ω (Note 4) | - | 19 | 48 | ns |
| $t_r$ | Turn-On Rise Time | | - | 9 | 28 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | - | 51 | 112 | ns |
| $t_f$ | Turn-Off Fall Time | | - | 7 | 24 | ns |
| **Drain-Source Diode Characteristics** | | | | | | |
| $I_S$ | Maximum Continuous Drain to Source Diode Forward Current | | - | - | 12 | A |
| $I_{SM}$ | Maximum Pulsed Drain to Source Diode Forward Current | | - | - | 36 | A |
| $V_{SD}$ | Drain to Source Diode Forward Voltage | $V_{GS}$ = 0 V, $I_{SD}$ = 6 A | - | - | 1.2 | V |
| $t_{rr}$ | Reverse Recovery Time | $V_{GS}$ = 0 V, $I_{SD}$ = 6 A, $dI_F/dt$ = 100 A/μs | - | 262 | - | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | - | 3.8 | - | μC |

**Notes:**

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $I_{AS}$ = 2.5A, $R_G$ = 25Ω, Starting $T_J$ = 25°C
3. $I_{SD}$ ≤ 6A, di/dt ≤ 200A/μs, $V_{DD}$ ≤ BVDSS, Starting $T_J$ = 25°C
4. Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

**Figure 1. On-Region Characteristics**

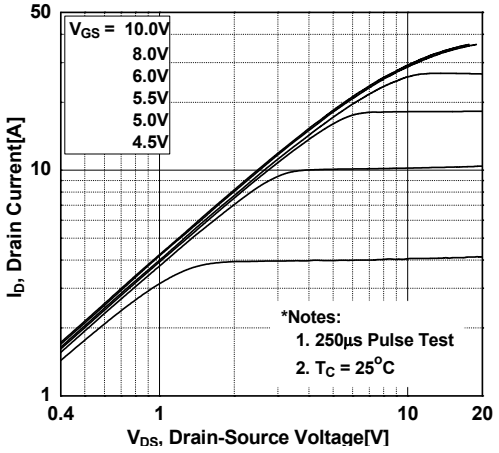



**Figure 2. Transfer Characteristics**

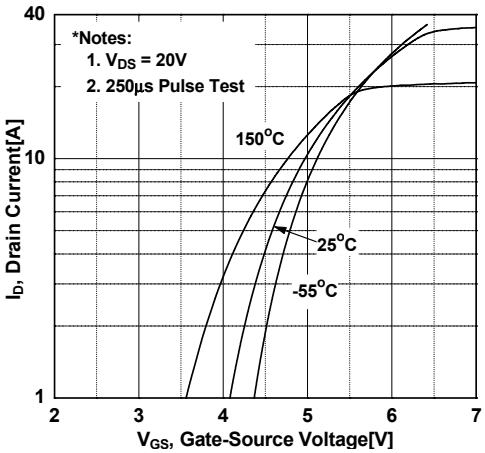



**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**

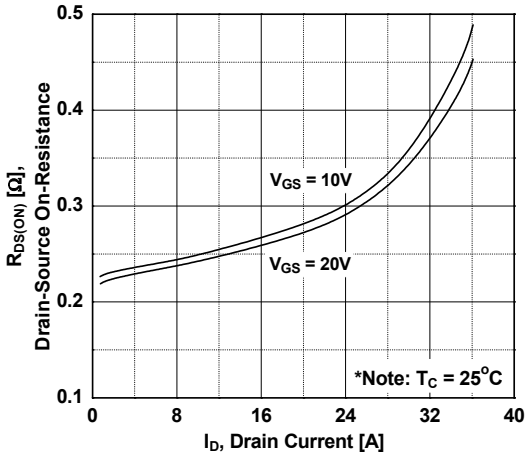



**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**

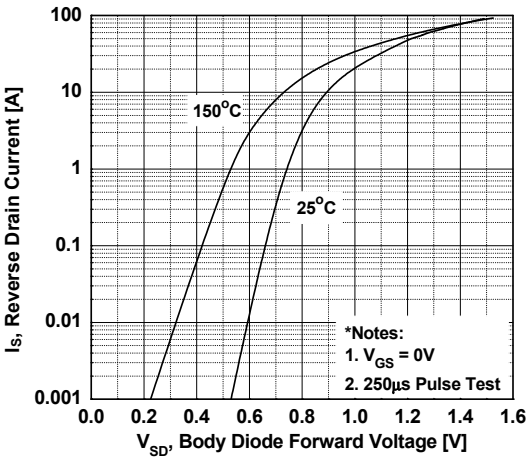



**Figure 5. Capacitance Characteristics**

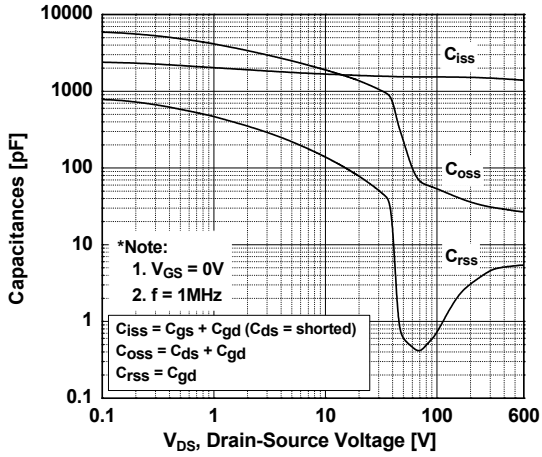
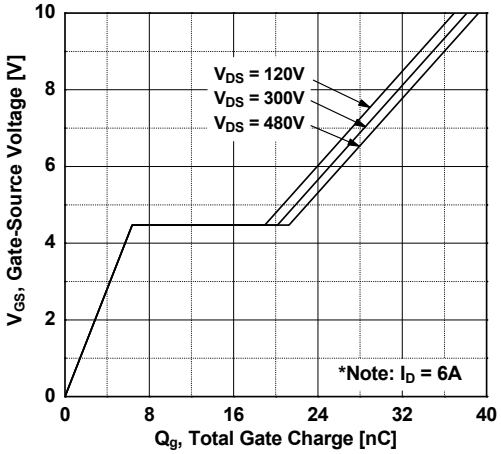



**Figure 6. Gate Charge Characteristics**



## Typical Performance Characteristics (Continued)

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

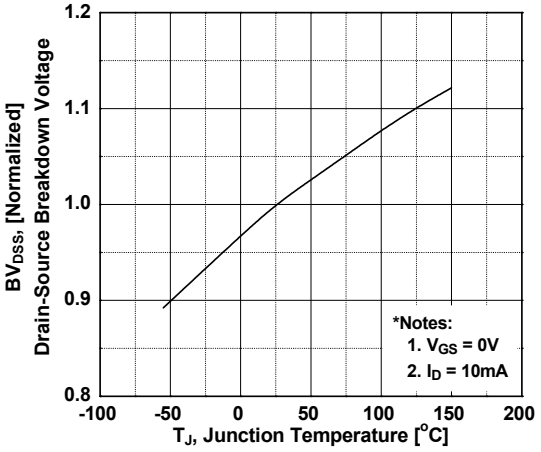



**Figure 8. On-Resistance Variation vs. Temperature**

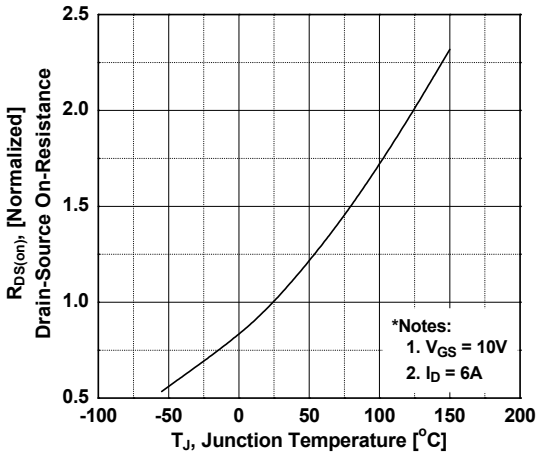



**Figure 9. Maximum Safe Operating Area**

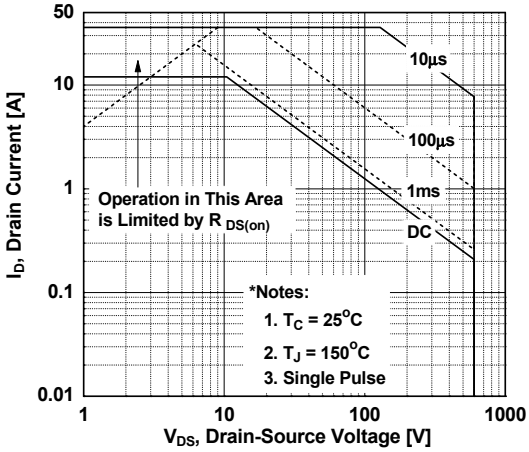



**Figure 10. Maximum Drain Current vs. Case Temperature**

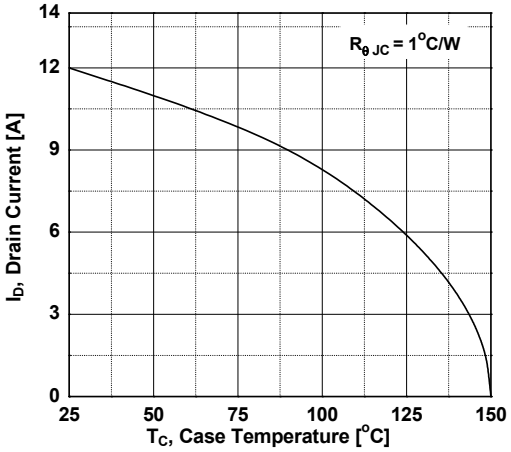
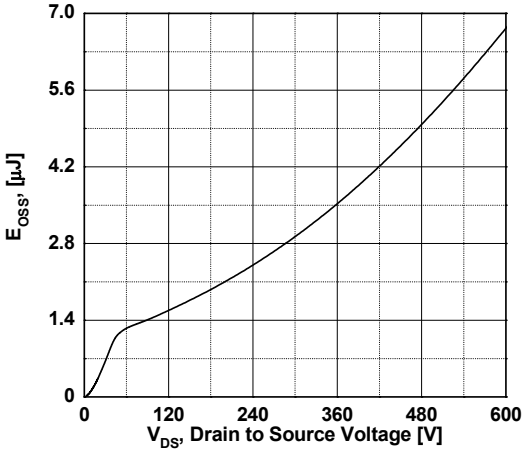
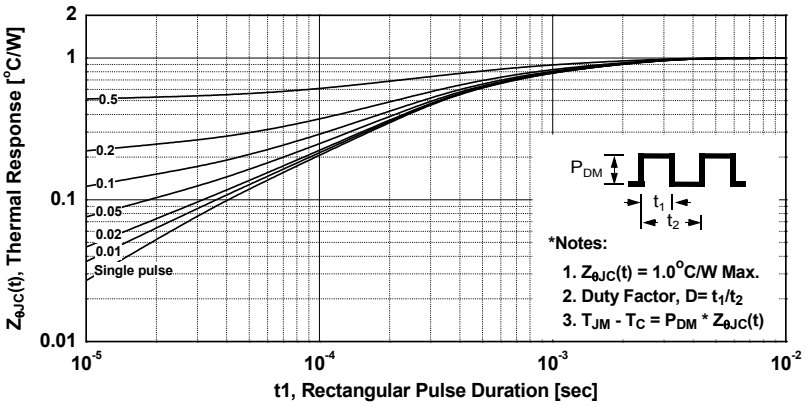



**Figure 11. Eoss vs. Drain to Source Voltage**

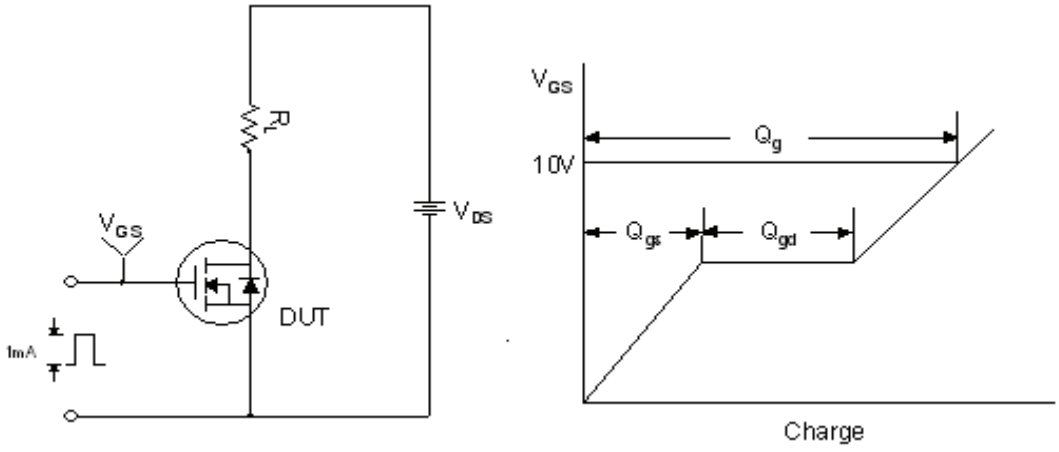


## Typical Performance Characteristics (Continued)

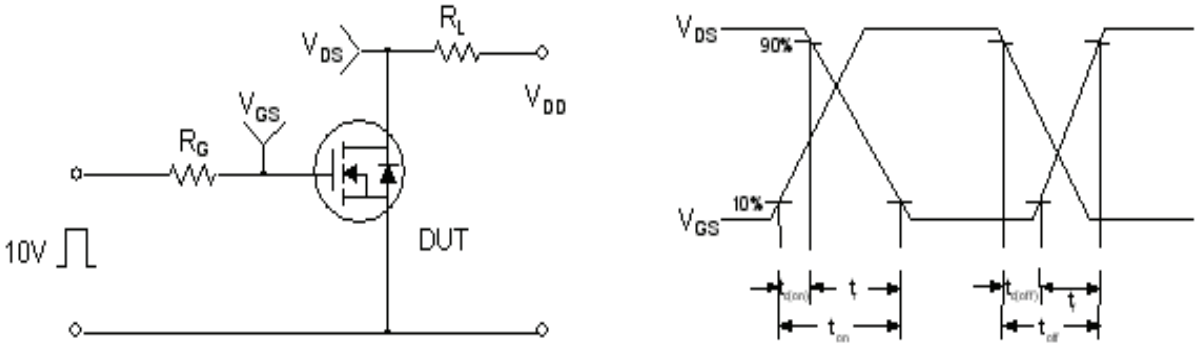
**Figure 12. Transient Thermal Response Curve**



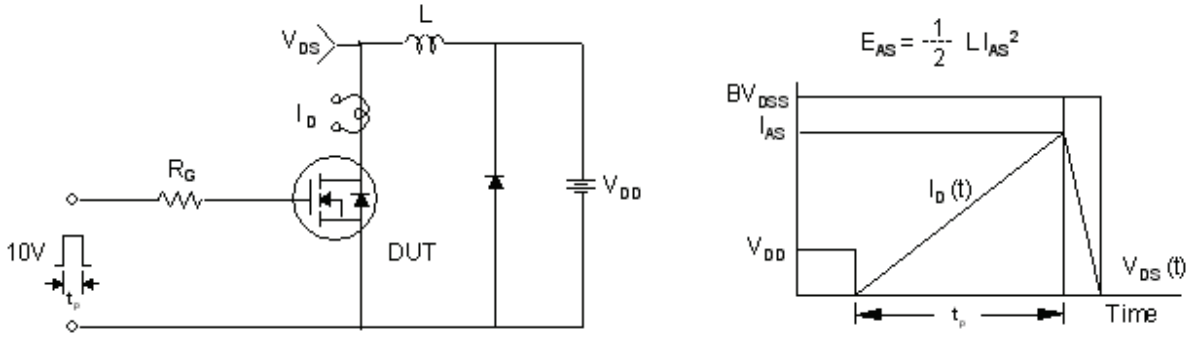
**Gate Charge Test Circuit & Waveform**



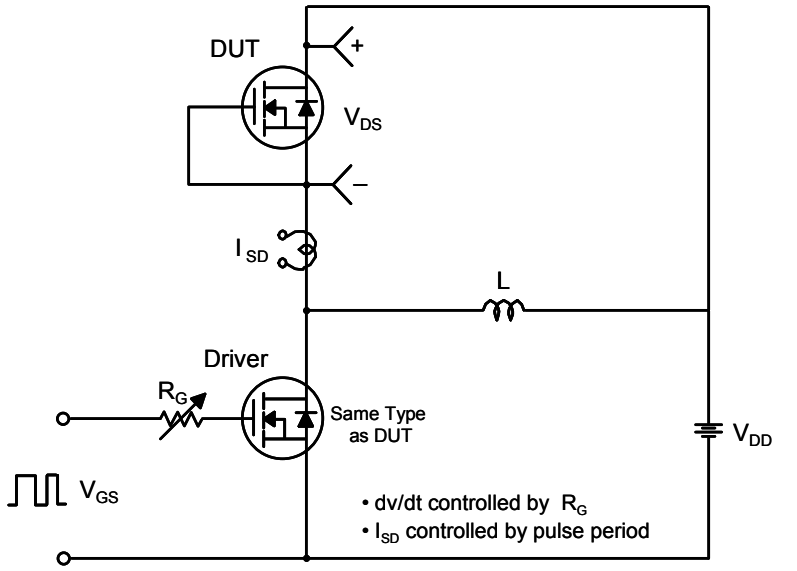

**Resistive Switching Test Circuit & Waveforms**

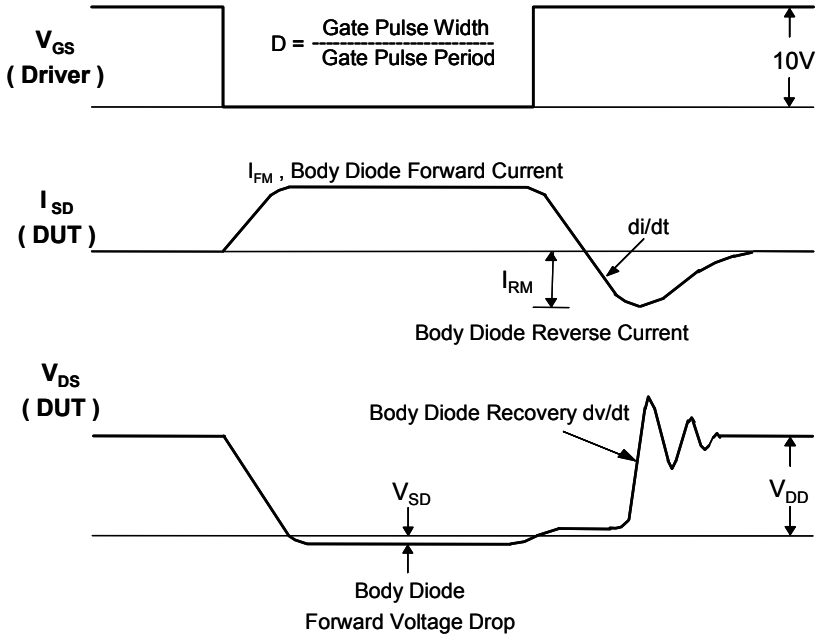



**Unclamped Inductive Switching Test Circuit & Waveforms**



**Peak Diode Recovery dv/dt Test Circuit & Waveforms**



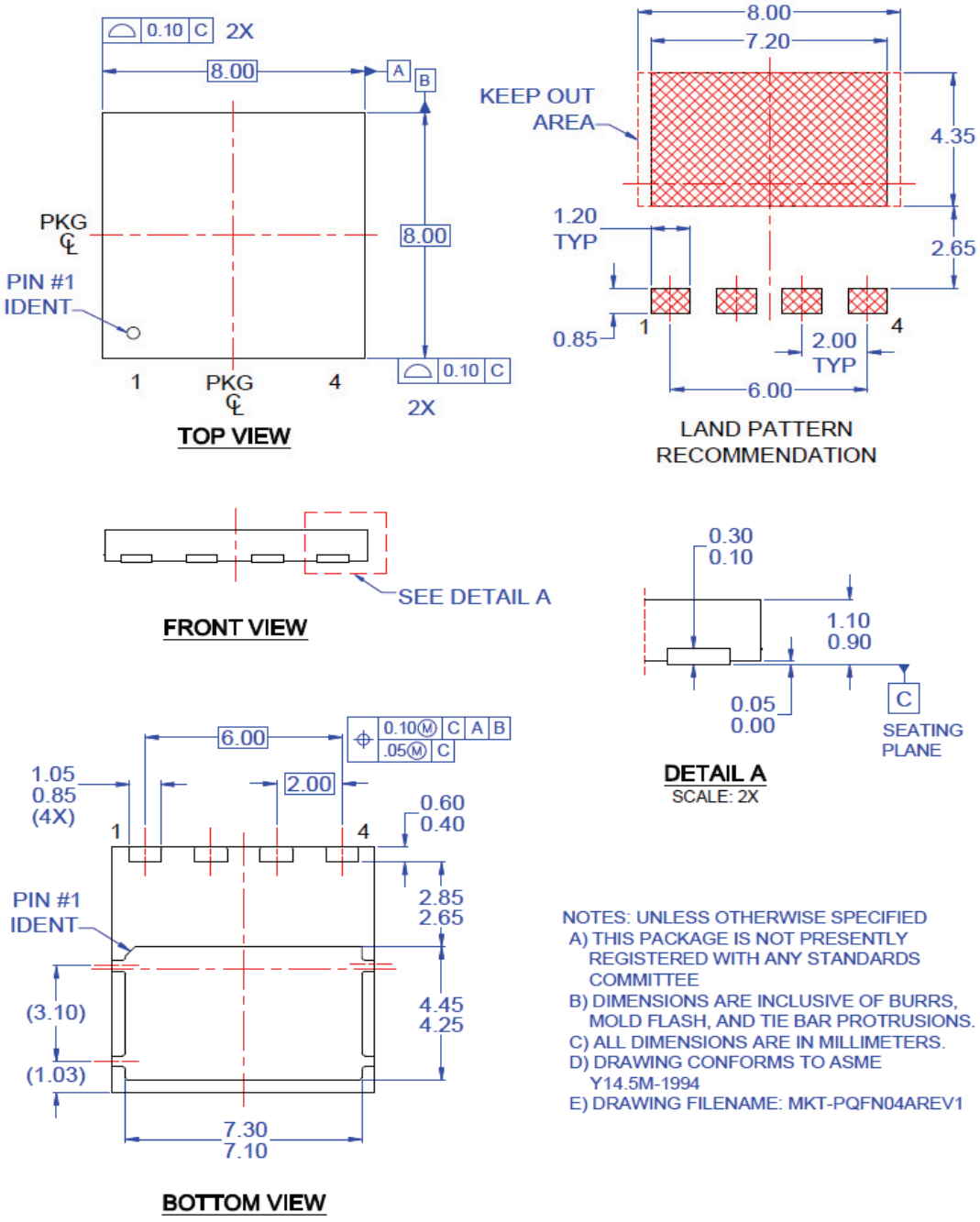



**Figure 17. Molded Package, Power88, 4 Lead**

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