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FDMC86012

N-Channel Power Trench® MOSFET

30 V, 88 A, 2.7 mΩ

Features

- Max $r_{DS(on)}$ = 2.7 mΩ at $V_{GS} = 4.5$ V, $I_D = 23$ A
- Max $r_{DS(on)}$ = 4.7 mΩ at $V_{GS} = 2.5$ V, $I_D = 17.5$ A
- High performance technology for extremely low $r_{DS(on)}$
- Termination is Lead-free
- 100% UIL Tested
- RoHS Compliant

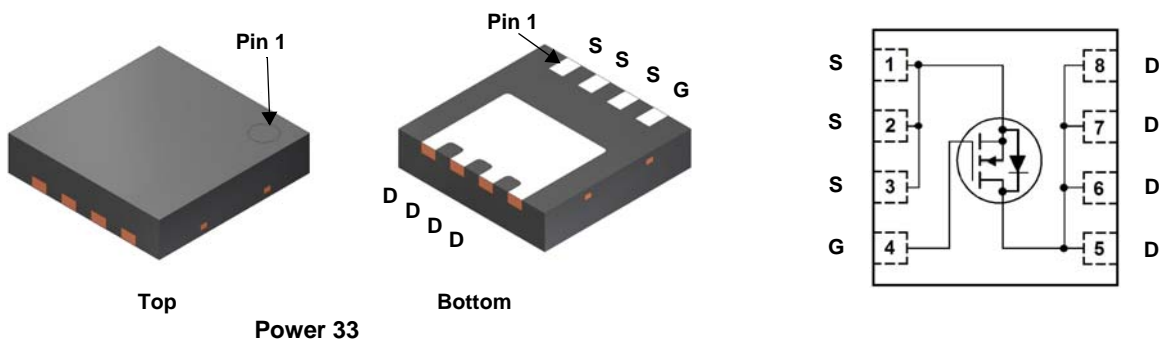


General Description

This device has been designed specifically to improve the efficiency of DC/DC converters. Using new techniques in MOSFET construction, the various components of gate charge and capacitance have been optimized to reduce switching losses. Low gate resistance and very low Miller charge enable excellent performance with both adaptive and fixed dead time gate drive circuits. Very low $r_{DS(on)}$ has been maintained to provide a sub logic-level device.

Applications

- 3.3 V input synchronous buck switch
- Synchronous rectifier



MOSFET Maximum Ratings $T_A = 25$ °C unless otherwise noted

| Symbol | Parameter | Rated | Units |
|----------------|--|-------------------------|-------|
| V_{DS} | Drain to Source Voltage | 30 | V |
| V_{GS} | Gate to Source Voltage | ±12 | V |
| I_D | Drain Current -Continuous | $T_C = 25$ °C | 88 |
| | -Continuous | $T_A = 25$ °C (Note 1a) | 23 |
| | -Pulsed | (Note 4) | 230 |
| E_{AS} | Single Pulse Avalanche Energy | (Note 3) | 337 |
| P_D | Power Dissipation | $T_C = 25$ °C | 54 |
| | Power Dissipation | $T_A = 25$ °C (Note 1a) | 2.3 |
| T_J, T_{STG} | Operating and Storage Junction Temperature Range | -55 to +150 | °C |

Thermal Characteristics

| | | | | |
|-----------------|---|-----------|-----|------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | (Note 1) | 2.3 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1a) | 53 | |

Package Marking and Ordering Information

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|----------------|-----------|---------|-----------|------------|------------|
| FDMC86012 | FDMC86012 | Power33 | 13 " | 12 mm | 3000 units |

Electrical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

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

Off Characteristics

| | | | | | | |
|--------------------------------------|---|---|----|----|-----------|----------------------|
| BV_{DSS} | Drain to Source Breakdown Voltage | $I_D = 250\text{ }\mu\text{A}$, $V_{GS} = 0\text{ V}$ | 30 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\text{ }\mu\text{A}$, referenced to $25\text{ }^\circ\text{C}$ | | 43 | | mV/ $^\circ\text{C}$ |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = 24\text{ V}$, $V_{GS} = 0\text{ V}$ | | | 1 | μA |
| I_{GSS} | Gate to Source Leakage Current | $V_{GS} = \pm 12\text{ V}$, $V_{DS} = 0\text{ V}$ | | | ± 100 | nA |

On Characteristics

| | | | | | | |
|--|--|---|-----|-----|-----|----------------------|
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{GS} = V_{DS}$, $I_D = 250\text{ }\mu\text{A}$ | 0.8 | 1.0 | 1.5 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D = 250\text{ }\mu\text{A}$, referenced to $25\text{ }^\circ\text{C}$ | | -4 | | mV/ $^\circ\text{C}$ |
| $r_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS} = 4.5\text{ V}$, $I_D = 23\text{ A}$ | | 2.2 | 2.7 | m Ω |
| | | $V_{GS} = 2.5\text{ V}$, $I_D = 17.5\text{ A}$ | | 3.4 | 4.7 | |
| | | $V_{GS} = 4.5\text{ V}$, $I_D = 23\text{ A}$, $T_J = 125\text{ }^\circ\text{C}$ | | 3.5 | 4.3 | |
| g_{FS} | Forward Transconductance | $V_{DD} = 5\text{ V}$, $I_D = 23\text{ A}$ | | 144 | | S |

Dynamic Characteristics

| | | | | | | |
|-----------|------------------------------|--|-----|------|------|----------|
| C_{iss} | Input Capacitance | $V_{DS} = 15\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$ | | 3625 | 5075 | pF |
| C_{oss} | Output Capacitance | | | 1230 | 1725 | pF |
| C_{rss} | Reverse Transfer Capacitance | | | 185 | 260 | pF |
| R_g | Gate Resistance | | 0.1 | 0.9 | 3.0 | Ω |

Switching Characteristics

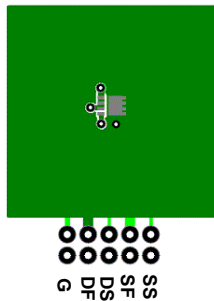
| | | | | | | | |
|--------------|-------------------------------|---|--|-----|----|----|----|
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD} = 15\text{ V}$, $I_D = 23\text{ A}$, $V_{GS} = 4.5\text{ V}$, $R_{GEN} = 6\text{ }\Omega$ | | 20 | 32 | ns | |
| t_r | Rise Time | | | 11 | 20 | ns | |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 43 | 69 | ns | |
| t_f | Fall Time | | | 8 | 16 | ns | |
| $Q_{g(TOT)}$ | Total Gate Charge | | $V_{GS} = 0\text{ V to } 4.5\text{ V}$ | | 27 | 38 | nC |
| $Q_{g(TOT)}$ | Total Gate Charge | | $V_{GS} = 0\text{ V to } 2.5\text{ V}$ | | 16 | 23 | nC |
| Q_{gs} | Gate to Source Charge | $V_{DD} = 15\text{ V}$, $I_D = 23\text{ A}$ | | 5.8 | | nC | |
| Q_{gd} | Gate to Drain "Miller" Charge | | | 5.4 | | nC | |

Drain-Source Diode Characteristics

| | | | | | | |
|----------|---------------------------------------|--|--|-----|-----|----|
| V_{SD} | Source to Drain Diode Forward Voltage | $V_{GS} = 0\text{ V}$, $I_S = 23\text{ A}$ (Note 2) | | 0.8 | 1.3 | V |
| | | $V_{GS} = 0\text{ V}$, $I_S = 1.9\text{ A}$ (Note 2) | | 0.7 | 1.2 | V |
| t_{rr} | Reverse Recovery Time | $I_F = 23\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ | | 40 | 64 | ns |
| Q_{rr} | Reverse Recovery Charge | | | 23 | 37 | nC |

Notes:

- $R_{\theta JA}$ is determined with the device mounted on a 1 in^2 pad of 2 oz copper pad on a $1.5 \times 1.5\text{ in}$ 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. $53\text{ }^\circ\text{C/W}$ when mounted on a 1 in^2 pad of 2 oz copper



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

- Pulse Test: Pulse Width $< 300\text{ }\mu\text{s}$, Duty cycle $< 2.0\%$.

- EAS of 337 mJ is based on starting $T_J = 25\text{ }^\circ\text{C}$; N-ch: L = 3 mH, IAS = 15 A, VDD = 30 V, VGS = 10 V. 100% test at L = 0.3 mH, IAS = 33 A.

- Pulsed Id limited by junction temperature, $t_d \leq 100\text{ }\mu\text{s}$, please refer to SOA curve for more details.

Typical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

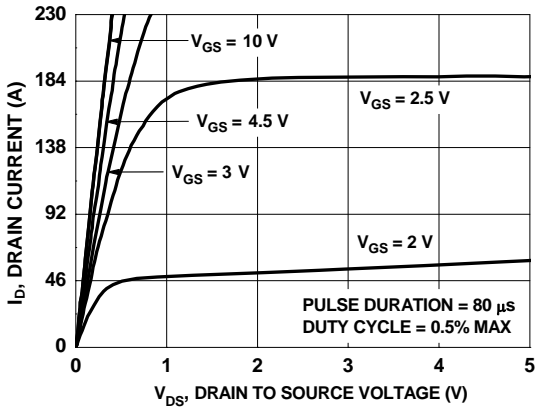


Figure 1. On-Region Characteristics

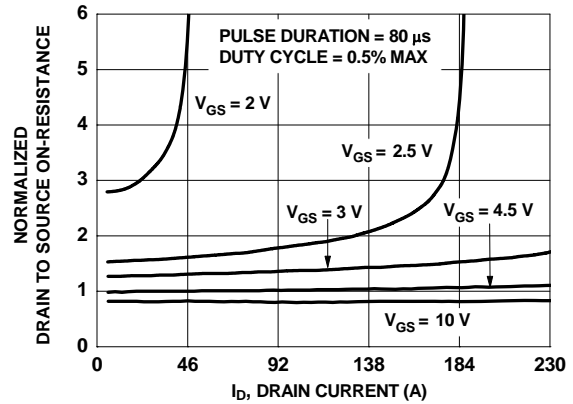


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

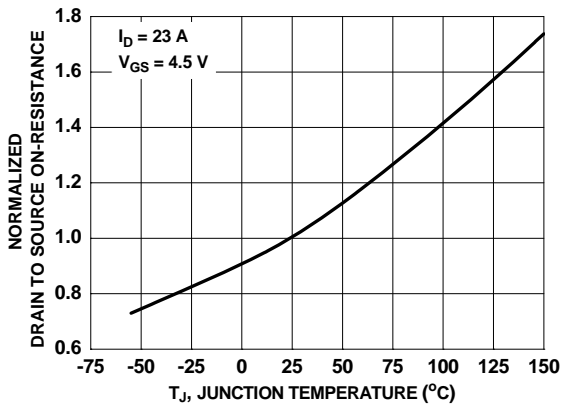


Figure 3. Normalized On-Resistance vs Junction Temperature

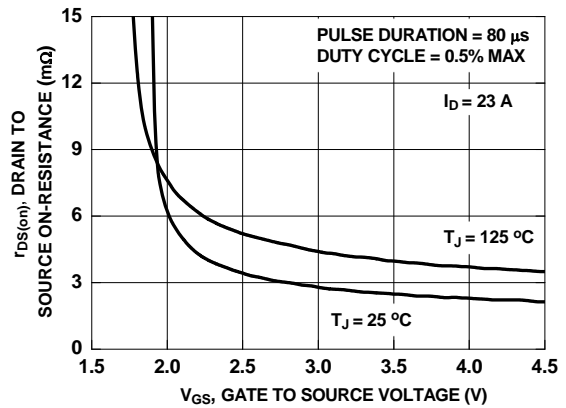


Figure 4. On-Resistance vs Gate to Source Voltage

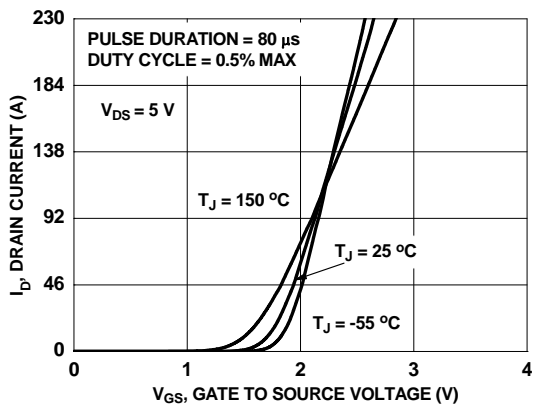


Figure 5. Transfer Characteristics

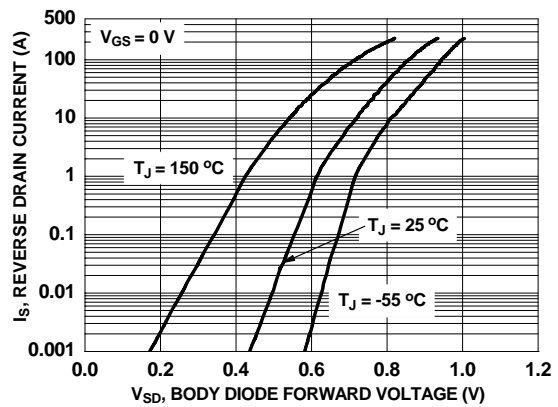


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

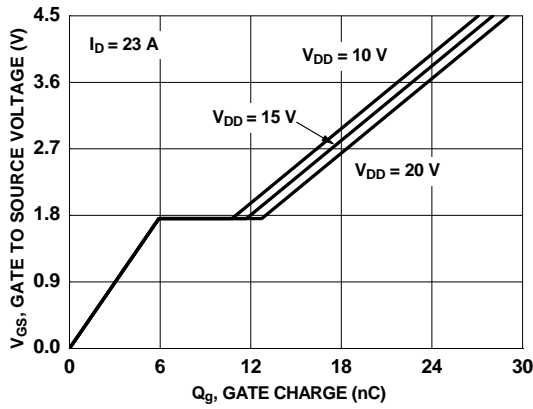


Figure 7. Gate Charge Characteristics

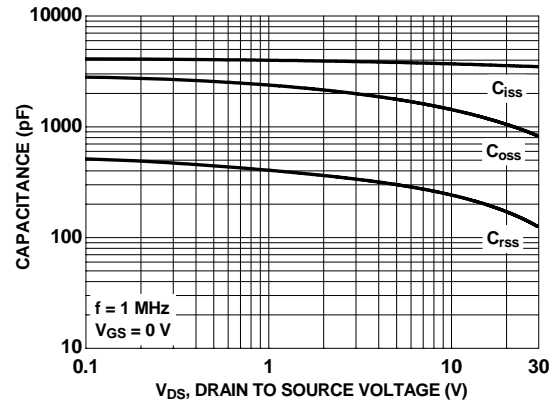


Figure 8. Capacitance vs Drain to Source Voltage

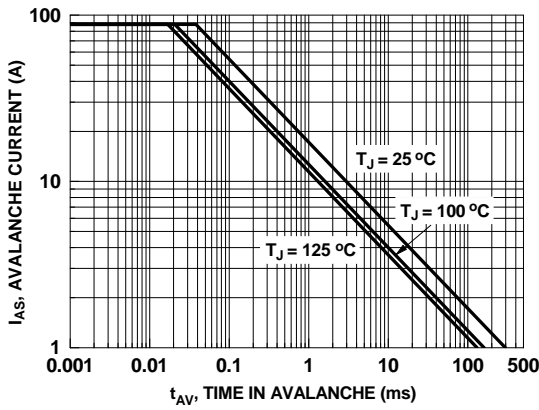


Figure 9. Unclamped Inductive Switching Capability

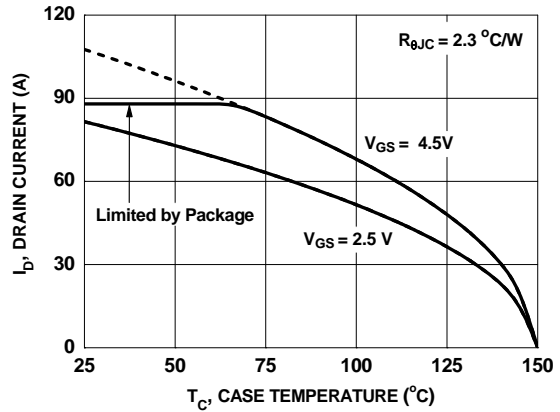


Figure 10. Maximum Continuous Drain Current vs Case Temperature

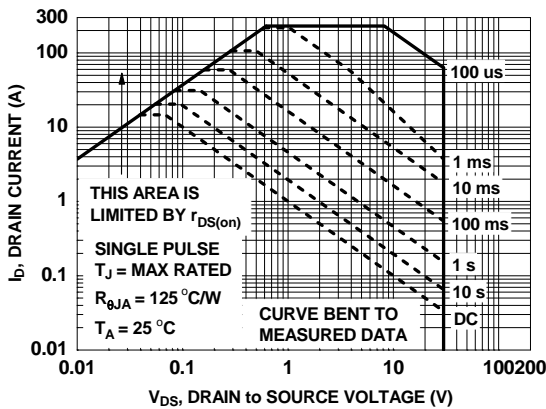


Figure 11. Forward Bias Safe Operating Area

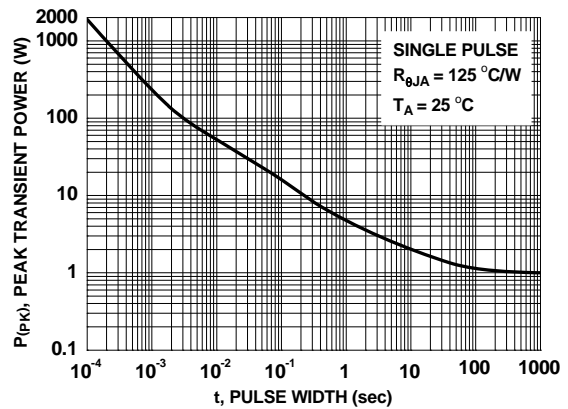


Figure 12. Single Pulse Maximum Power Dissipation

Typical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

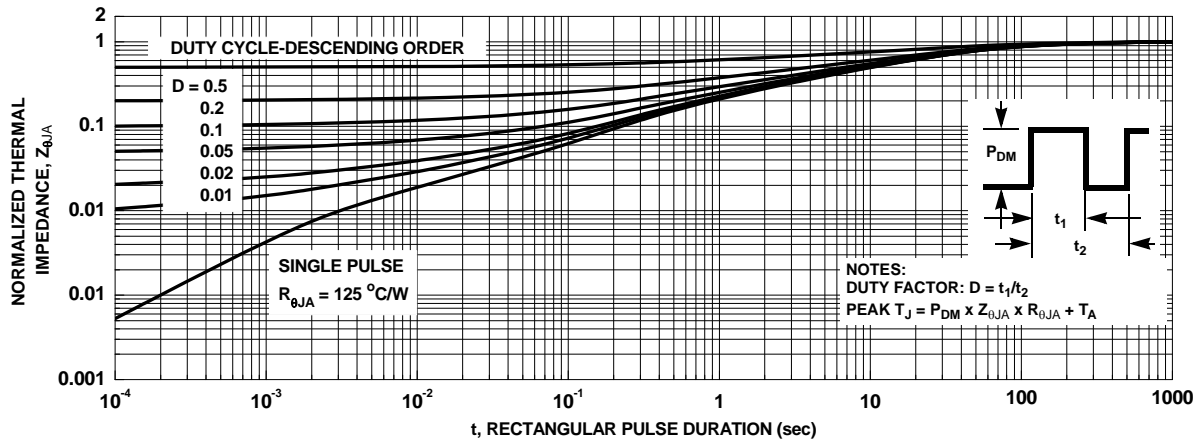
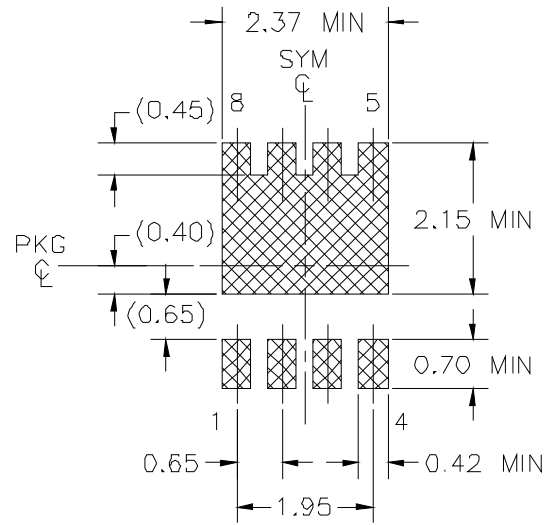
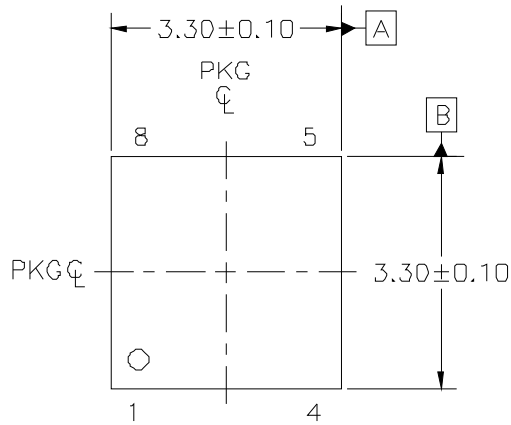
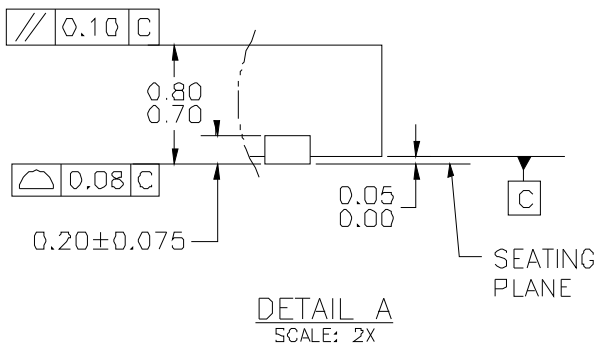
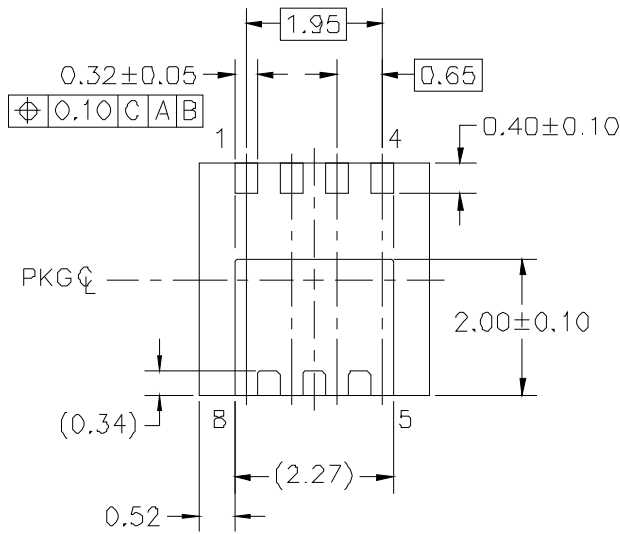
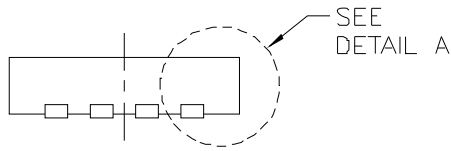


Figure 13. Junction-to-Ambient Transient Thermal Response Curve

Dimensional Outline and Pad Layout



LAND PATTERN RECOMMENDATION







NOTES: UNLESS OTHERWISE SPECIFIED

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- 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.



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