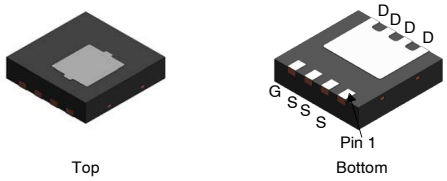
# MOSFET – N-Channel, DUAL COOL® 33, POWERTRENCH®

## 30 V, 157 A, 1.28 mΩ

# FDMC8010DC




**PQFN8 3.3X3.3, 0.65P**
**CASE 483AY**
**DUAL COOL 33**

### 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 $r_{DS(on)}$ = 1.28 mΩ at $V_{GS}$ = 10 V, $I_D$ = 37 A
- Max $r_{DS(on)}$ = 1.74 mΩ at $V_{GS}$ = 4.5 V, $I_D$ = 32 A
- High Performance Technology for Extremely Low $r_{DS(on)}$
- These Devices are Pb−Free and are RoHS Compliant

### Applications

- Load Switch
- Motor Bridge Switch
- Synchronous Rectifier

### MOSFET MAXIMUM RATINGS ($T_A$ = 25°C Unless Otherwise Noted)

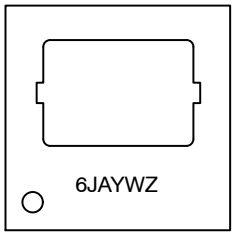
| Symbol | Parameter | Ratings | Units |
|---|---|---|---|
| $V_{DS}$ | Drain to Source Voltage | 30 | V |
| $V_{GS}$ | Gate to Source Volage (Note 4) | ±20 | V |
| $I_D$ | Drain Current<br>−Continuous $T_C$ = 25°C (Note 6)<br>−Continuous $T_C$ = 100°C (Note 6)<br>−Continuous $T_A$ = 25°C (Note 1a)<br>−Pulsed (Note 5) | <br>157<br>99<br>37<br>788 | A |
| $E_{AS}$ | Single Pulse Avalance Energy (Note 3) | 337 | mJ |
| $P_D$ | Power Dissipation $T_C$ = 25°C | 50 | W |
| | Power Dissipation $T_A$ = 25°C (Note 1a) | 3.0 | |
| $T_J$, $T_{STG}$ | 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

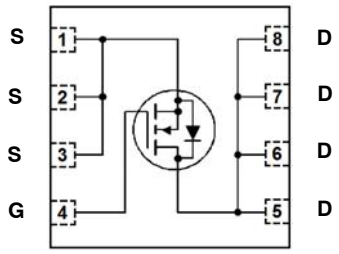
| Symbol | Parameter | Ratings | Unit |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case (Bottom Drain) | 2.5 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1a) | 42 | |

### MARKING DIAGRAM




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

### PIN CONNECTIONS




### ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 2 of this data sheet.

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## PACKAGE MARKING AND ORDERING INFORMATION

| Device | Device Marking | Package | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|
| FDMC8010DC | 6J | DUAL COOL 33 | 13” | 12 mm | 3000 Units |

## ELECTRICAL CHARACTERISTICS ($T_J$ = 25°C unless otherwise noted)

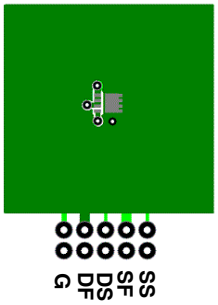
| Symbol | Parameter | Test Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| $BV_{DSS}$ | Drain to Source Breakdown Voltage | $I_D$ = 250 μA, $V_{GS}$ = 0 V | 30 | | | V |
| $\Delta BV_{DSS}/\Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 250 μA, referenced to 25°C | | 15 | | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 24 V, $V_{GS}$ = 0 V | | | 10 | μA |
| $I_{GSS}$ | Gate to Source Leakage Current | $V_{GS}$ = 20 V, $V_{DS}$ = 0 V | | | 100 | nA |
| **ON CHARACTERISTICS** | | | | | | |
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 250 μA | 1.0 | 1.4 | 3.0 | V |
| $\Delta V_{GS(th)}/\Delta T_J$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D$ = 250 μA, referenced to 25°C | | −5 | | mV/°C |
| $r_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS}$ = 10 V, $I_D$ = 37 A | | 0.91 | 1.28 | mΩ |
| | | $V_{GS}$ = 4.5 V, $I_D$ = 32 A | | 1.2 | 1.74 | |
| | | $V_{GS}$ = 10 V, $I_D$ = 37 A, $T_J$ = 125°C | | 1.34 | 1.89 | |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = 5 V, $I_D$ = 37 A | | 231 | | S |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 15 V, $V_{GS}$ = 0 V, f = 1 MHz | | 4720 | 7080 | pF |
| $C_{oss}$ | Output Capacitance | | | 1540 | 2310 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 136 | 205 | pF |
| $R_g$ | Gate Resistance | | 0.1 | 0.5 | 1.1 | Ω |
| **SWITCHING CHARACTERISTICS** | | | | | | |
| $t_{d(on)}$ | Turn−On Delay Time | $V_{DD}$ = 15 V, $I_D$ = 37 A, $V_{GS}$ = 10 V, $R_{GEN}$ = 6 Ω | | 15 | 26 | ns |
| $t_r$ | Rise Time | | | 7 | 14 | ns |
| $t_{d(off)}$ | Turn−Off Delay Time | | | 40 | 64 | ns |
| $t_f$ | Fall Time | | | 5 | 10 | ns |
| $Q_{g(TOT)}$ | Total Gate Charge at 10 V | $V_{DD}$ = 15 V, $I_D$ = 37 A | | 67 | 94 | nC |
| $Q_{g(TOT)}$ | Total Gate Charge at 4.5 V | | | 32 | 44 | nC |
| $Q_{gs}$ | Gate to Source Charge | | | 10 | | nC |
| $Q_{gd}$ | Gate to Drain “Miller” Charge | | | 7.5 | | nC |
| **DRAIN−SOURCE DIODE CHARACTERISTICS** | | | | | | |
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS}$ = 0 V, $I_S$ = 2.3 A (Note 2) | | 0.7 | 1.2 | V |
| | | $V_{GS}$ = 0 V, $I_S$ = 37 A (Note 2) | | 0.8 | 1.3 | |
| $t_{rr}$ | Reverse Recovery Time | $I_F$ = 37 A, di/dt = 100 A/μs | | 55 | 88 | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | | 48 | 76 | nC |

## THERMAL CHARACTERISTICS

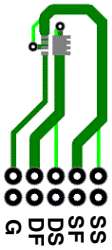
| | | | | |
|---|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | (Top Source) | 5.0 | °C/W |
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | (Bottom Drain) | 2.5 | |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1a) | 42 | |
| $R_{\theta JA}$ | 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:

1. $R_{\theta JA}$ is determined with the device mounted on a 1 $in^2$ 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. 42°C/W when mounted on a 1 $in^2$ pad of 2 oz copper




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

c. Still air, 20.9x10.4x12.7 mm Aluminum Heat Sink, 1 $in^2$ pad of 2 oz copper.
d. Still air, 20.9x10.4x12.7 mm Aluminum Heat Sink, minimum pad of 2 oz copper.
e. Still air, 45.2x41.4x11.7 mm Aavid Thermalloy Part # 10−L41B−11 Heat Sink, 1 $in^2$ pad of 2 oz copper.
f. Still air, 45.2x41.4x11.7 mm Aavid Thermalloy Part # 10−L41B−11 Heat Sink, minimum pad of 2 oz copper.
g. 200FPM Airflow, No Heat Sink,1 $in^2$ pad of 2 oz copper.
h. 200FPM Airflow, No Heat Sink, minimum pad of 2 oz copper.
i. 200FPM Airflow, 20.9x10.4x12.7 mm Aluminum Heat Sink, 1 $in^2$ pad of 2 oz copper.
j. 200FPM Airflow, 20.9x10.4x12.7 mm Aluminum Heat Sink, minimum pad of 2 oz copper.
k. 200FPM Airflow, 45.2x41.4x11.7 mm Aavid Thermalloy Part # 10−L41B−11 Heat Sink, 1 $in^2$ pad of 2 oz copper.
l. 200FPM Airflow, 45.2x41.4x11.7 mm Aavid Thermalloy Part # 10−L41B−11 Heat Sink, minimum pad of 2 oz copper.

2. Pulse Test: Pulse Width < 300 μs, Duty cycle < 2.0%.
3. $E_{AS}$ of 337 mJ is based on starting $T_J$ = 25°C, L = 3 mH, $I_{AS}$ = 15 A, $V_{DD}$ = 30 V, $V_{GS}$ = 10 V, 100% test at L = 0.1 mH, $I_{AS}$ = 49 A.
4. As an N−ch device, the negative Vgs rating is for low duty cycle pulse occurrence only. No continuous rating is implied.
5. Pulse Id measured at 250 μs, refer to Figure 11 SOA graph for more details.
6. Computed continuous current limited to Max Junction Temperature only, actual continuous current will be limited by thermal & electro−mechanical application board design.

## TYPICAL CHARACTERISTICS

$T_J$ = 25°C Unless Otherwise Noted

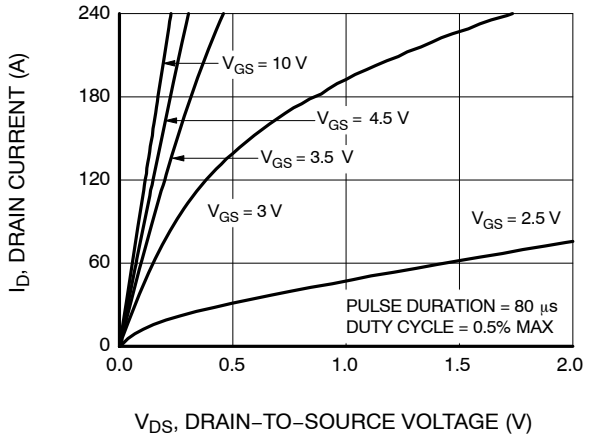



**Figure 1. On−Region Characteristics**

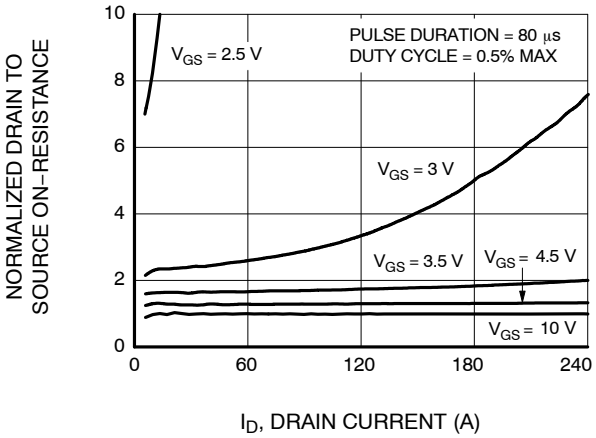



**Figure 2. Normalized On−Resistance vs Drain Current and Gate Voltage**

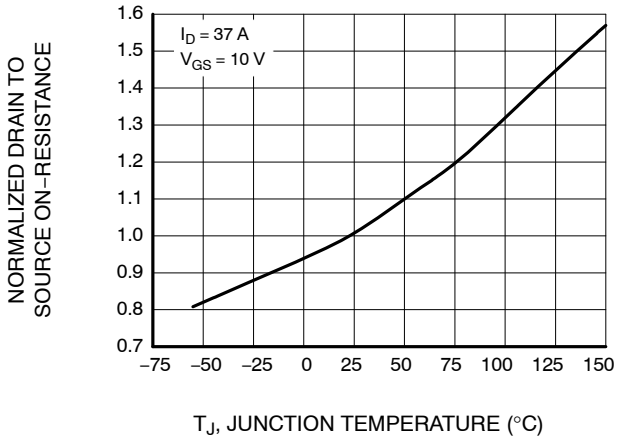



**Figure 3. Normalized On Resistance vs Junction Temperature**

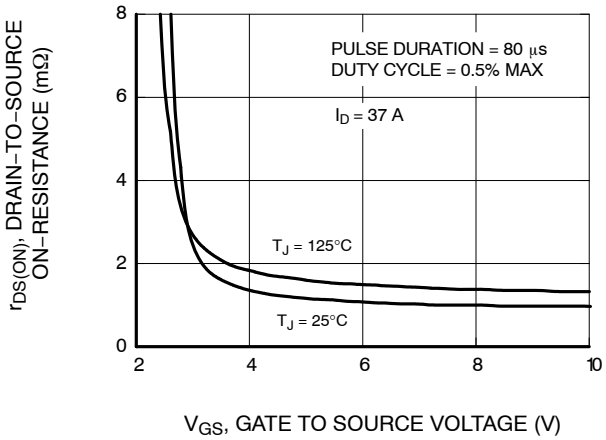



**Figure 4. On−Resistance vs Gate to Source Voltage**

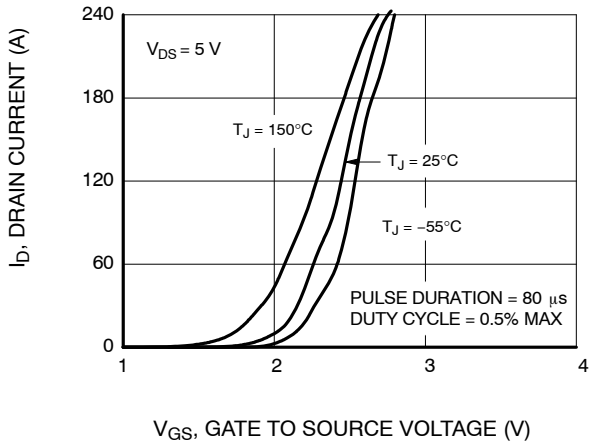



**Figure 5. Transfer Characteristics**

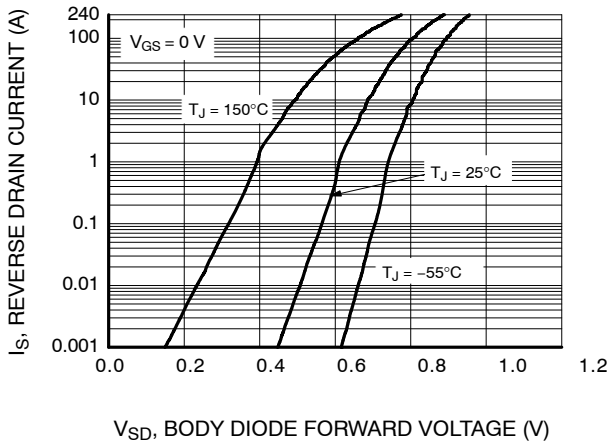



**Figure 6. Source to Drain Diode Forward Voltage vs Source Current**

## TYPICAL CHARACTERISTICS (continued)

$T_J$ = 25°C Unless Otherwise Noted

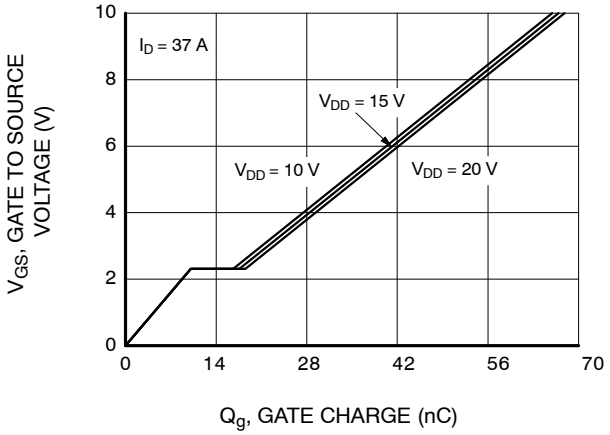



**Figure 7. Gate Charge Characteristics**

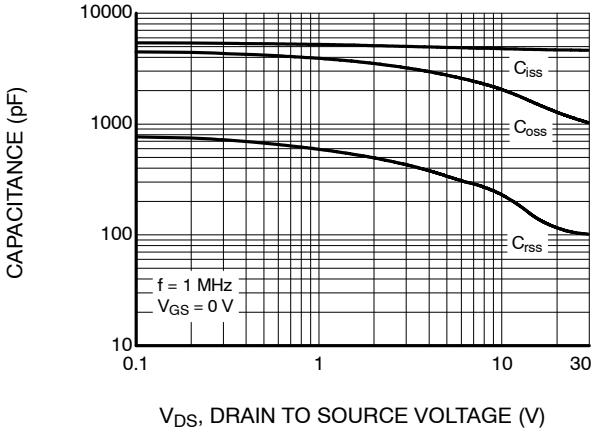



**Figure 8. Capacitance vs Drain to Source Voltage**

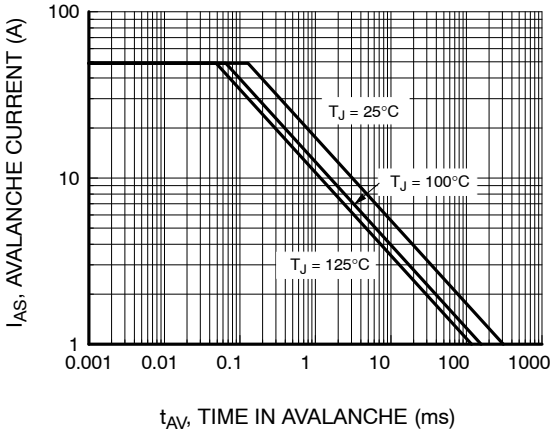



**Figure 9. Unclamped Inductive Switching Capability**

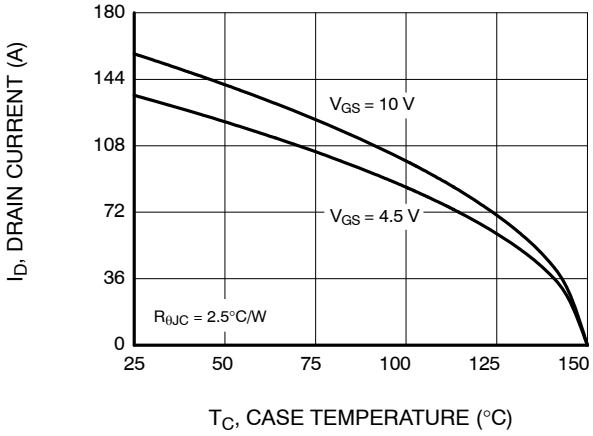



**Figure 10. Maximum Continuous Drain Current vs Case Temperature**

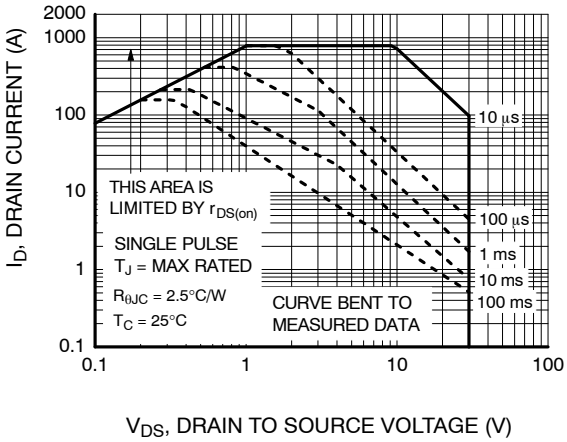



**Figure 11. Forward Bias Safe Operating Area**

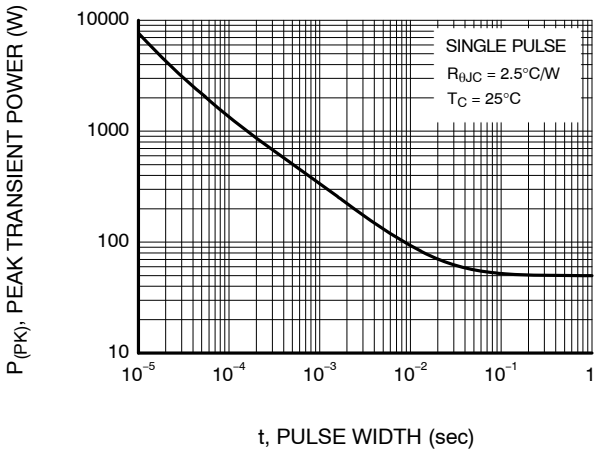



**Figure 12. Single Pulse Maximum Power Dissipation**

## TYPICAL CHARACTERISTICS (continued)

$T_J$ = 25°C Unless Otherwise Noted

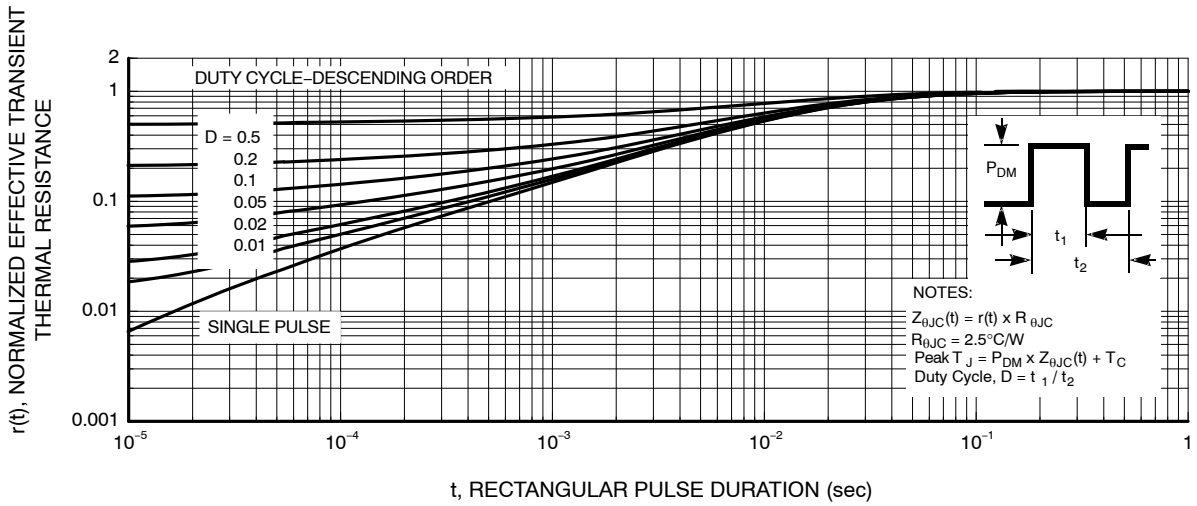



**Figure 13. Junction to Case Transient Thermal Response Curve**

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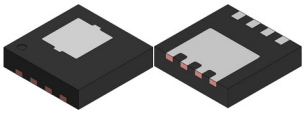

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ISSUE A

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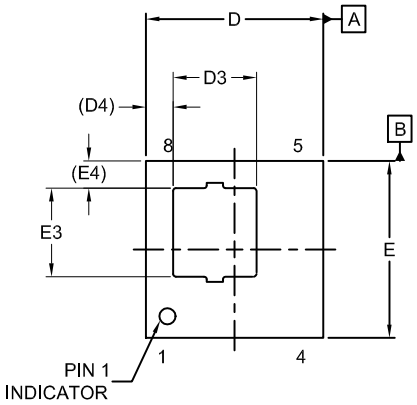
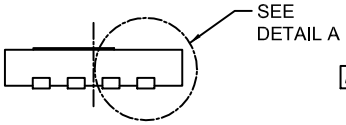



TOP VIEW

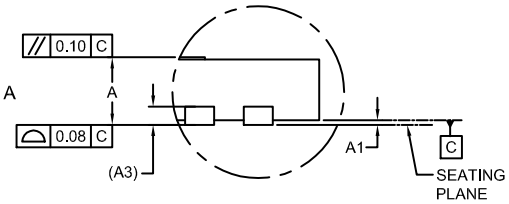
NOTES:

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.

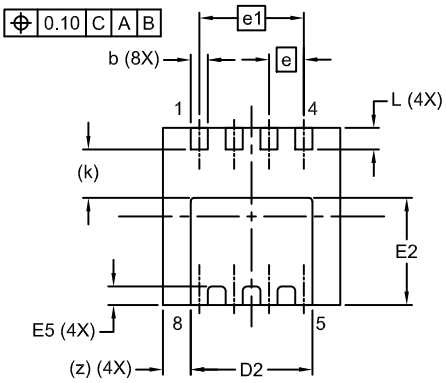
| DIM | MILLIMETERS | | |
|---|---|---|---|
| | MIN. | NOM. | MAX. |
| A | 0.70 | 0.75 | 0.80 |
| A1 | 0.00 | - | 0.05 |
| A3 | 0.20 REF | | |
| b | 0.27 | 0.32 | 0.37 |
| D | 3.20 | 3.30 | 3.40 |
| D2 | 2.17 | 2.27 | 2.37 |
| D3 | 1.45 | 1.55 | 1.65 |
| D4 | 0.51 REF | | |
| E | 3.20 | 3.30 | 3.40 |
| E2 | 1.85 | 1.95 | 2.05 |
| E3 | 1.55 | 1.65 | 1.75 |
| E4 | 0.51 REF | | |
| E5 | 0.24 | 0.34 | 0.44 |
| e | 0.65 BSC | | |
| e1 | 1.95 BSC | | |
| k | 0.90 REF | | |
| L | 0.30 | 0.40 | 0.50 |
| z | 0.52 REF | | |



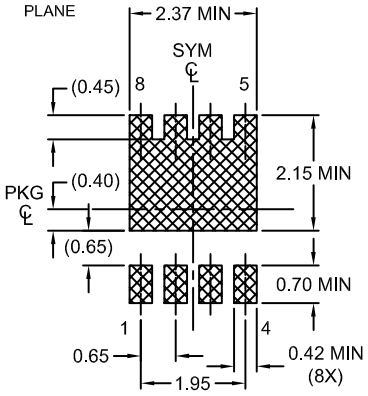

FRONT VIEW




DETAIL A
SCALE: 2X




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.

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| **DESCRIPTION:** | **PQFN8 3.3X3.3, 0.65P** | **PAGE 1 OF 1** |

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