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ON Semiconductor®

# FDMQ8203

## GreenBridge™ Series of High-Efficiency Bridge Rectifiers
## Dual N-Channel and Dual P-Channel PowerTrench® MOSFET
### N-Channel: 100 V, 6 A, 110 mΩ  P-Channel: -80 V, -6 A, 190 mΩ

### Features

Q1/Q4: N-Channel

- Max $r_{DS(on)}$ = 110 mΩ at $V_{GS}$ = 10 V, $I_D$ = 3 A
- Max $r_{DS(on)}$ = 175 mΩ at $V_{GS}$ = 6 V, $I_D$ = 2.4 A

Q2/Q3: P-Channel

- Max $r_{DS(on)}$ = 190 mΩ at $V_{GS}$ = -10 V, $I_D$ = -2.3 A
- Max $r_{DS(on)}$ = 235 mΩ at $V_{GS}$ = -4.5 V, $I_D$ = -2.1 A
- Substantial efficiency benefit in PD solutions
- RoHS Compliant

### General Description

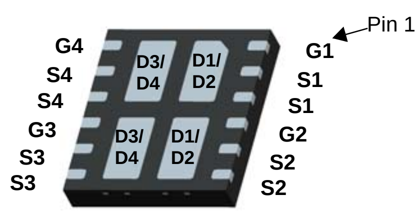
This quad mosfet solution provides ten-fold improvement in power dissipation over diode bridge.

### Application

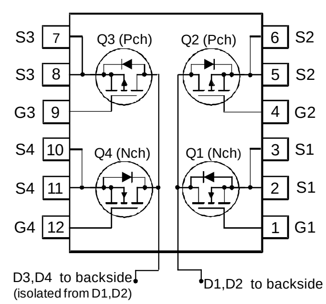
- High-Efficiency Bridge Rectifiers

Top

Bottom




MLP 4.5x5




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

| Symbol | Parameter | | | Q1/Q4 | Q2/Q3 | Units |
|---|---|---|---|---|---|---|
| $V_{DS}$ | Drain to Source Voltage | | | 100 | -80 | V |
| $V_{GS}$ | Gate to Source Voltage | | | ±20 | ±20 | V |
| $I_D$ | Drain Current -Continuous (Package limited) | $T_C$ = 25 °C | | 6 | -6 | A |
| | -Continuous (Silicon limited) | $T_C$ = 25 °C | | 10 | -10 | |
| | -Continuous | $T_A$ = 25 °C | (Note 1a) | 3.4 | -2.6 | |
| | -Pulsed | | | 12 | -10 | |
| $P_D$ | Power Dissipation for Single Operation | $T_C$ = 25 °C | | 22 | 37 | W |
| | Power Dissipation for Dual Operation | $T_A$ = 25 °C | (Note 1a) | 2.5 | | |
| $T_J$, $T_{STG}$ | Operating and Storage Junction Temperature Range | | | -55 to +150 | | °C |

### Thermal Characteristics

| | | | | |
|---|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1a) | 50 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1b) | 160 | |

### Package Marking and Ordering Information

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|
| FDMQ8203 | FDMQ8203 | MLP4.5x5 | 13 ” | 12 mm | 3000 units |

## Electrical Characteristics $T_J$ = 25 °C unless otherwise noted

### Off Characteristics

| Symbol | Parameter | Test Conditions | Type | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain to Source Breakdown Voltage | $I_D$ = 250 μA, $V_{GS}$ = 0 V<br>$I_D$ = -250 μA, $V_{GS}$ = 0 V | Q1/Q4<br>Q2/Q3 | 100<br>-80 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 250 μA, referenced to 25 °C<br>$I_D$ = -250 μA, referenced to 25 °C | Q1/Q4<br>Q2/Q3 | | 72<br>-79 | | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 80 V, $V_{GS}$ = 0 V<br>$V_{DS}$ = -64 V, $V_{GS}$ = 0 V | Q1/Q4<br>Q2/Q3 | | | 1<br>-1 | μA<br>μA |
| $I_{GSS}$ | Gate to Source Leakage Current | $V_{GS}$ = ±20 V, $V_{DS}$= 0 V | Q1/Q4<br>Q2/Q3 | | | ±100<br>±100 | nA<br>nA |

### On Characteristics

| Symbol | Parameter | Test Conditions | Type | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 250 μA<br>$V_{GS}$ = $V_{DS}$, $I_D$ = -250 μA | Q1/Q4<br>Q2/Q3 | 2<br>-1 | 3<br>-1.6 | 4<br>-3 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D$ = 250 μA, referenced to 25 °C<br>$I_D$ = -250 μA, referenced to 25 °C | Q1/Q4<br>Q2/Q3 | | -8<br>5 | | mV/°C |
| $r_{DS(on)}$ | Drain to Source On Resistance | $V_{GS}$ = 10 V, $I_D$ = 3 A<br>$V_{GS}$ = 6 V, $I_D$ = 2.4 A<br>$V_{GS}$ = 10 V, $I_D$ = 3 A , $T_J$ = 125 °C | Q1/Q4 | | 85<br>118<br>147 | 110<br>175<br>191 | mΩ |
| | | $V_{GS}$ = -10 V, $I_D$ = -2.3 A<br>$V_{GS}$ = -4.5 V, $I_D$ = -2.1 A<br>$V_{GS}$ = -10 V, $I_D$ = -2.3 A, $T_J$ = 125 °C | Q2/Q3 | | 161<br>188<br>273 | 190<br>235<br>323 | |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = 10 V, $I_D$ = 3 A<br>$V_{DS}$ = -10 V, $I_D$ = -2.3 A | Q1/Q4<br>Q2/Q3 | | 6<br>6 | | S |

### Dynamic Characteristics

| Symbol | Parameter | Test Conditions | Type | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| $C_{iss}$ | Input Capacitance | Q1/Q4:<br>$V_{DS}$ = 50 V, $V_{GS}$ = 0 V, f = 1 MHZ<br>Q2/Q3:<br>$V_{DS}$ = -40 V, $V_{GS}$ = 0 V, f = 1 MHZ | Q1/Q4<br>Q2/Q3 | | 158<br>639 | 210<br>850 | pF |
| $C_{oss}$ | Output Capacitance | | Q1/Q4<br>Q2/Q3 | | 41<br>46 | 55<br>65 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | Q1/Q4<br>Q2/Q3 | | 2.6<br>24 | 5<br>40 | pF |

### Switching Characteristics

| Symbol | Parameter | Test Conditions | Type | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-On Delay Time | Q1/Q4:<br>$V_{DD}$ = 50 V, $I_D$ = 3 A,<br>$V_{GS}$ = 10 V, $R_{GEN}$ = 6 Ω<br>Q2/Q3:<br>$V_{DD}$ = -40 V, $I_D$ = -2.3 A,<br>$V_{GS}$ = -10 V, $R_{GEN}$ = 6 Ω | Q1/Q4<br>Q2/Q3 | | 3.8<br>4.7 | 10<br>10 | ns |
| $t_r$ | Rise Time | | Q1/Q4<br>Q2/Q3 | | 1.3<br>2.8 | 10<br>10 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | Q1/Q4<br>Q2/Q3 | | 7.5<br>22 | 15<br>35 | ns |
| $t_f$ | Fall Time | | Q1/Q4<br>Q2/Q3 | | 1.9<br>2.7 | 10<br>10 | ns |
| $Q_g$ | Total Gate Charge | VGS = 0 V to 10 V<br>VGS = 0 V to -10 V | Q1/Q4<br>Q2/Q3 | | 2.9<br>13 | 5<br>19 | nC |
| $Q_g$ | Total Gate Charge | VGS = 0 V to 5 V<br>VGS = 0 V to -4.5 V | Q1/Q4<br>Q2/Q3 | | 1.6<br>6.4 | 3<br>10 | nC |
| $Q_{gs}$ | Gate to Source Gate Charge | Q1/Q4:<br>$V_{DD}$ = 50 V,<br>$I_D$ = 3 A<br>Q2/Q3:<br>$V_{DD}$ = -40 V,<br>$I_D$ = -2.3A | Q1/Q4<br>Q2/Q3 | | 0.8<br>1.6 | | nC |
| $Q_{gd}$ | Gate to Drain “Miller” Charge | | Q1/Q4<br>Q2/Q3 | | 0.8<br>2.6 | | nC |

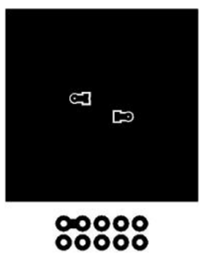
## Electrical Characteristics $T_J$ = 25 °C unless otherwise noted

### Drain-Source Diode Characteristics

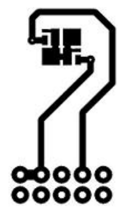
| Symbol | Parameter | Test Conditions | Type | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS}$ = 0 V, $I_S$ = 3 A (Note 2)<br>$V_{GS}$ = 0 V, $I_S$ = -2.3 A (Note 2) | Q1/Q4<br>Q2/Q3 | | 0.86<br>-0.82 | 1.3<br>-1.3 | V |
| $t_{rr}$ | Reverse Recovery Time | Q1/Q4:<br>$I_F$ = 3 A, di/dt = 100 A/μs | Q1/Q4<br>Q2/Q3 | | 32<br>26 | 52<br>42 | ns |
| $Q_{rr}$ | Reverse Recovery Charge | Q2/Q3:<br>$I_F$ = -2.3 A, di/dt = 100 A/μs | Q1/Q4<br>Q2/Q3 | | 21<br>26 | 34<br>42 | nC |

**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. 50 °C/W when mounted on a 1 in$^2$ pad of 2 oz copper, the board designed Q1+Q3 or Q2+Q4.



b. 160 °C/W when mounted on a minimum pad of 2 oz copper, the board designed Q1+Q3 or Q2+Q4.

**2:** Pulse Test: Pulse Width < 300 μs, Duty cycle < 2.0%.

## Typical Characteristics (N-Channel) $T_J$ = 25 °C unless otherwise noted

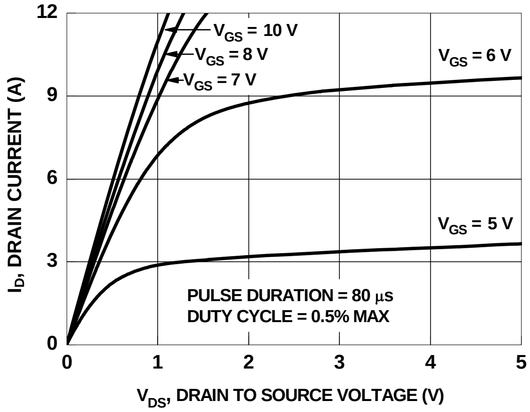



**Figure 1. On Region Characteristics**

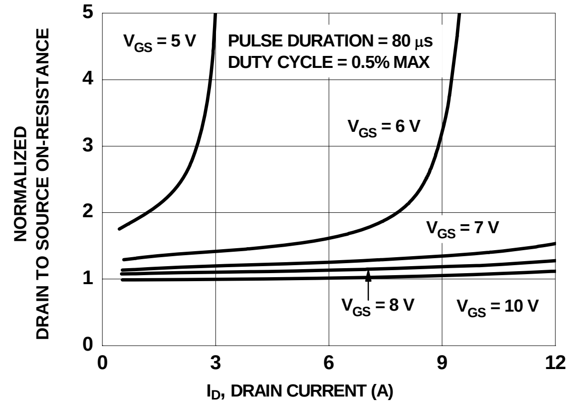



**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**

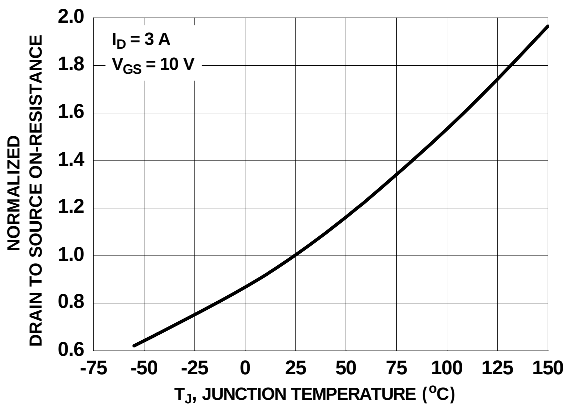



**Figure 3. Normalized On Resistance vs Junction Temperature**

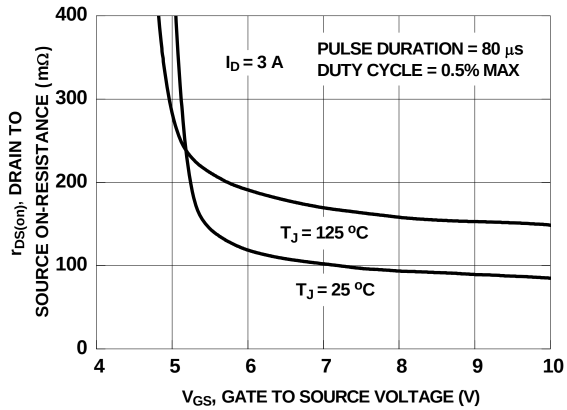



**Figure 4. On-Resistance vs Gate to Source Voltage**

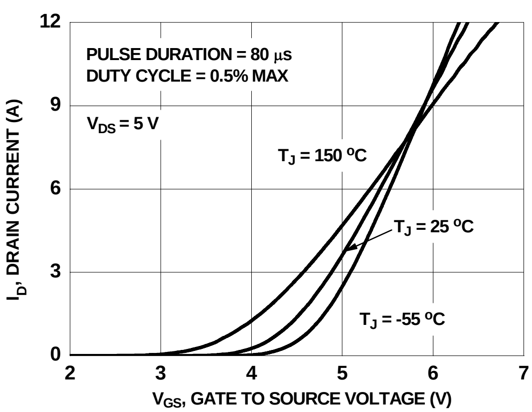



**Figure 5. Transfer Characteristics**

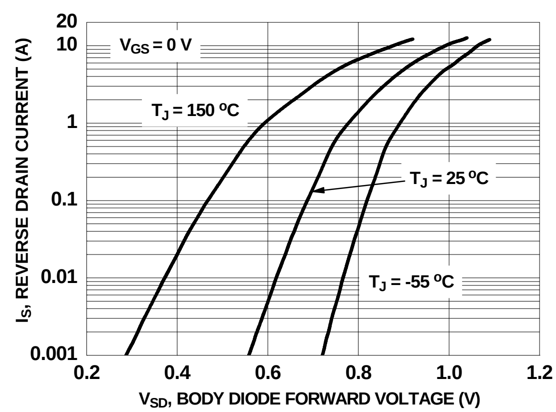



**Figure 6. Source to Drain Diode Forward Voltage vs Source Current**

## Typical Characteristics (N-Channel) $T_J$ = 25 °C unless otherwise noted

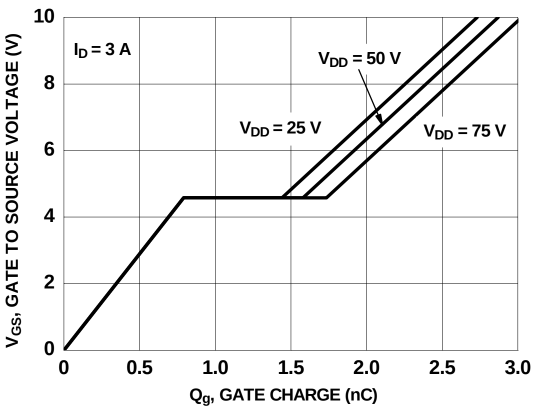



**Figure 7. Gate Charge Characteristics**

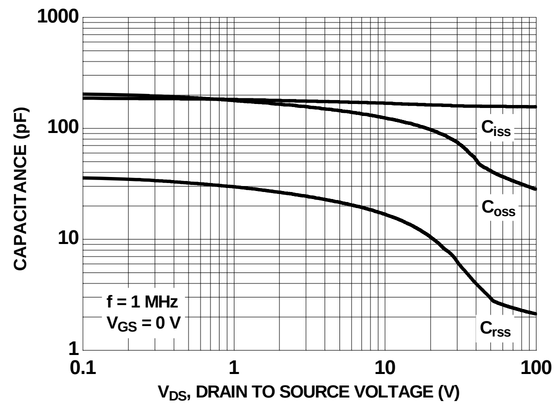



**Figure 8. Capacitance vs Drain to Source Voltage**

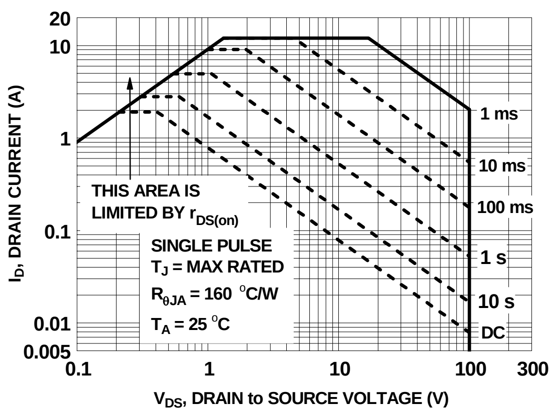



**Figure 9. Forward Bias Safe Operating Area**

## Typical Characteristics (P-Channel) $T_J$ = 25 °C unlenss otherwise noted

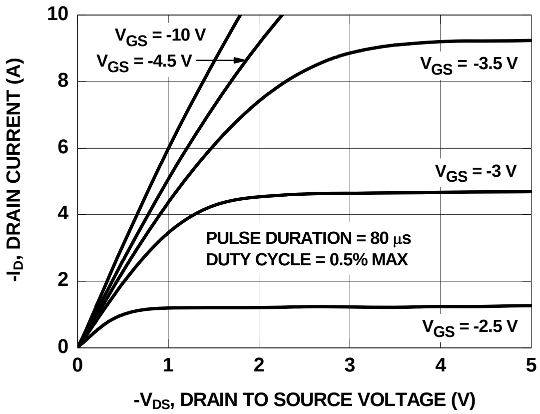



**Figure 10. On-Region Characteristics**

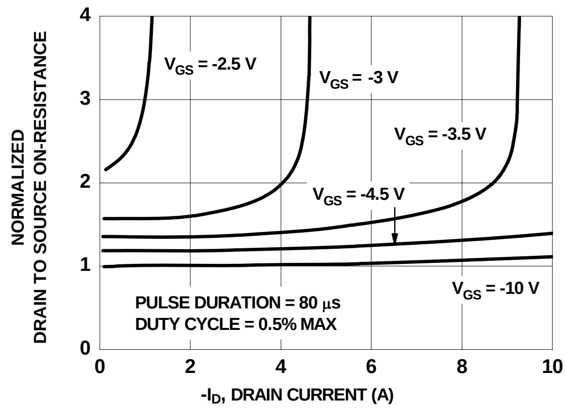



**Figure 11. Normalized on-Resistance vs Drain Current and Gate Voltage**

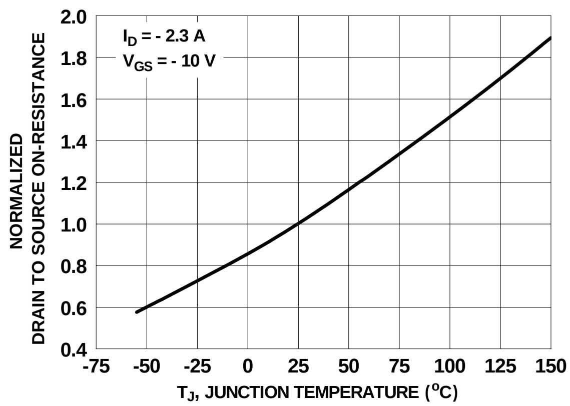



**Figure 12. Normalized On-Resistance vs Junction Temperature**

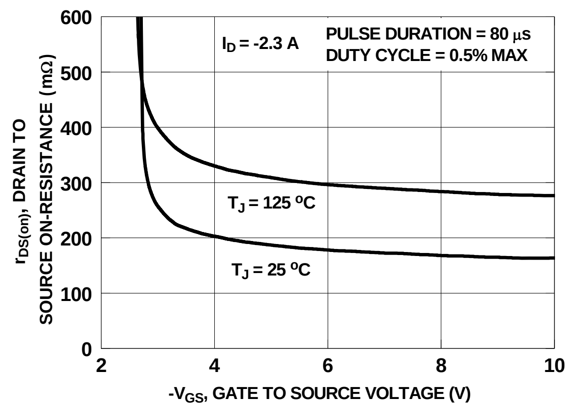



**Figure 13. On-Resistance vs Gate to Source Voltage**

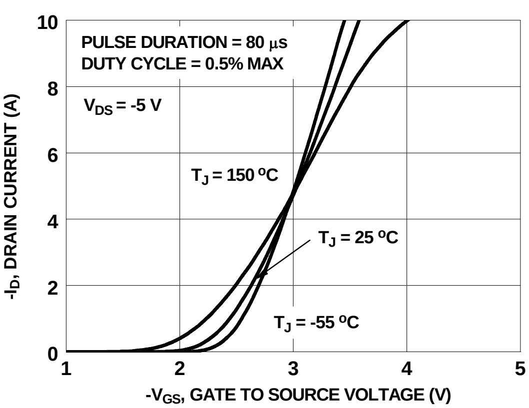



**Figure 14. Transfer Characteristics**

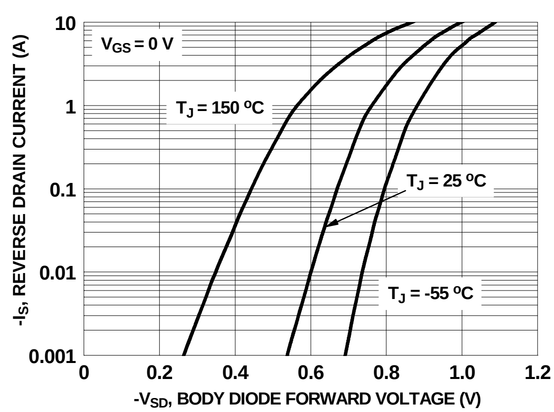



**Figure 15. Source to Drain Diode Forward Voltage vs Source Current**

## Typical Characteristics (P-Channel) $T_J$ = 25 °C unlenss otherwise noted

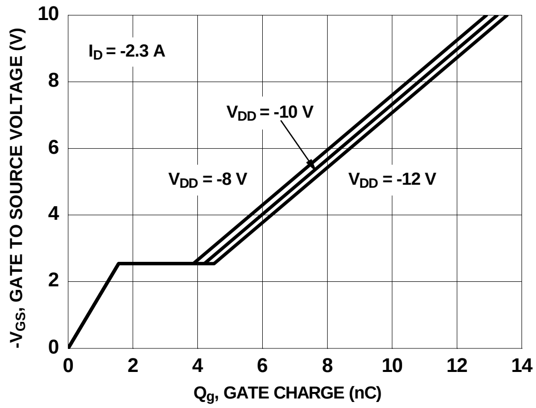



**Figure 16. Gate Charge Characteristics**

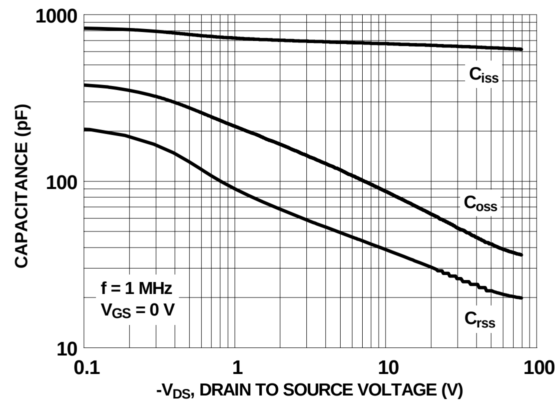



**Figure 17. Capacitance vs Drain to Source Voltage**

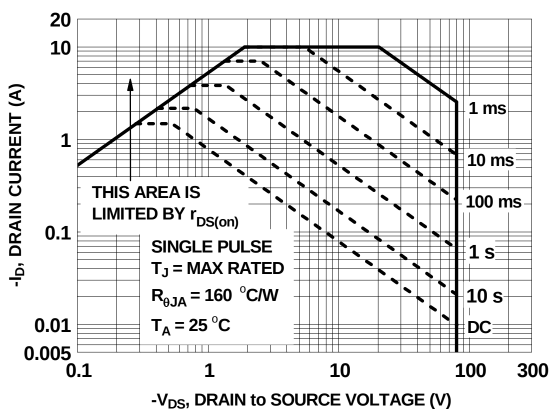



**Figure 18. Forward Bias Safe Operating Area**

## Typical Characteristics $T_J$ = 25 °C unlenss otherwise noted


**Figure 19. Single Pulse Maximum Power Dissipation**

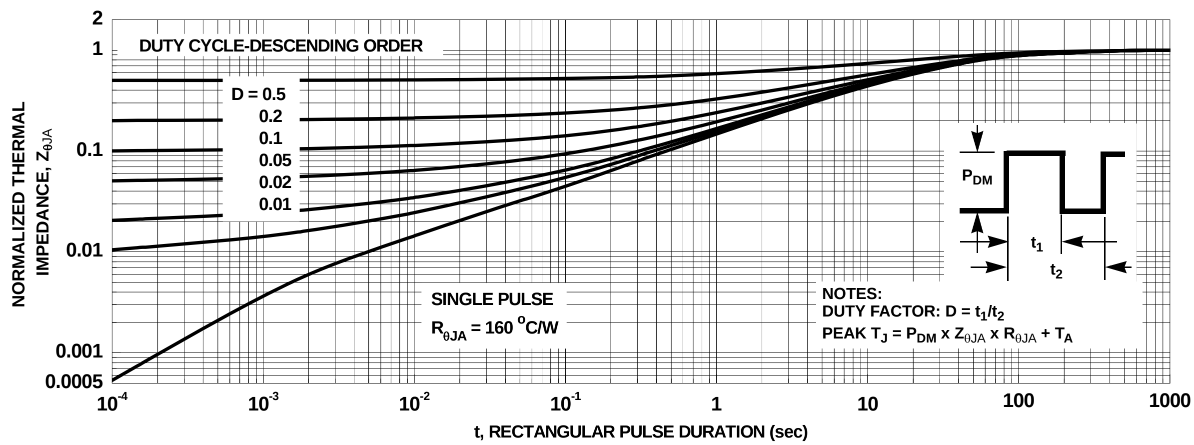
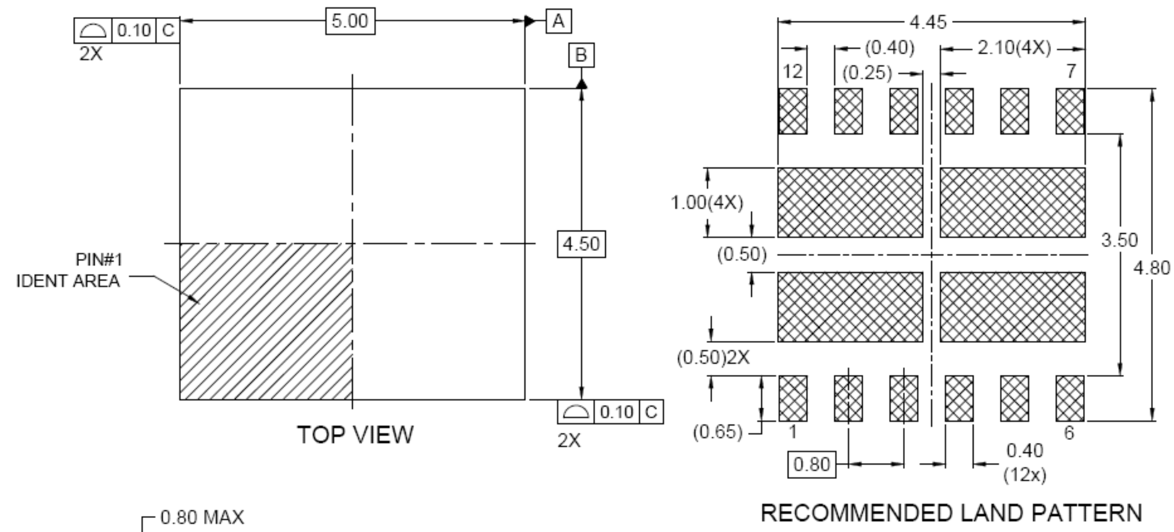
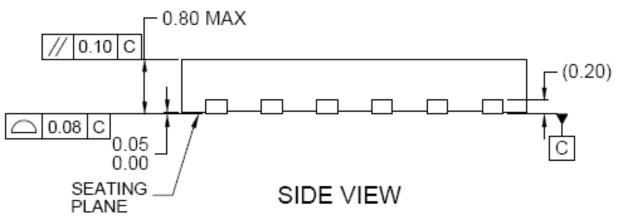
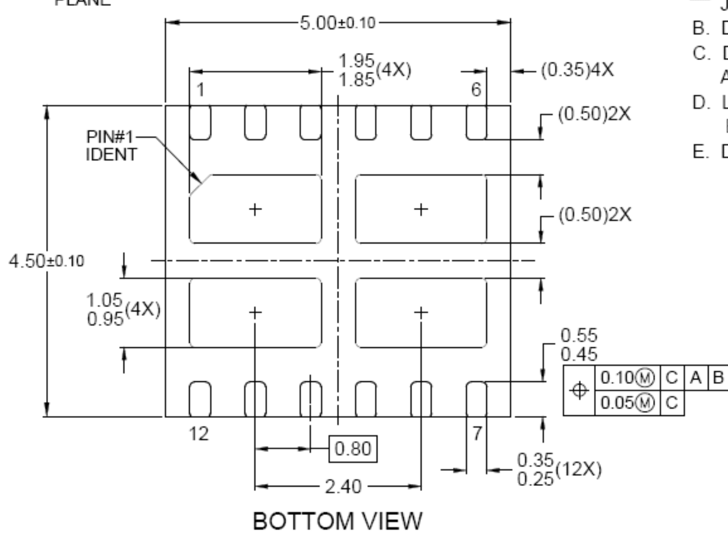



**Figure 20. Junction-to-Ambient Transient Thermal Response Curve**

## Dimensional Outline and Pad Layout




NOTES:

A. PACKAGE DOES NOT FULLY CONFORM TO JEDEC MO-229 REGISTRATION

B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.

D. LAND PATTERN RECOMMENDATION IS BASED ON FSC DESIGN ONLY.

E. DRAWING FILENAME: MKT-MLP12Erev2.

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