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FDMC7208S

Dual N-Channel PowerTrench® MOSFET

Q1: 30 V, 12 A, 9.0 mΩ Q2: 30 V, 16 A, 6.4 mΩ

Features

Q1: N-Channel

- Max $r_{DS(on)}$ = 9.0 mΩ at $V_{GS} = 10\text{ V}$, $I_D = 12\text{ A}$
- Max $r_{DS(on)}$ = 11.0 mΩ at $V_{GS} = 4.5\text{ V}$, $I_D = 11\text{ A}$

Q2: N-Channel

- Max $r_{DS(on)}$ = 6.4 mΩ at $V_{GS} = 10\text{ V}$, $I_D = 16\text{ A}$
- Max $r_{DS(on)}$ = 7.5 mΩ at $V_{GS} = 4.5\text{ V}$, $I_D = 13.5\text{ A}$
- Termination is Lead-free and RoHS Compliant

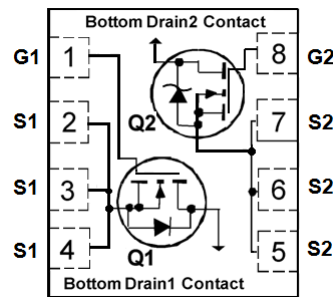
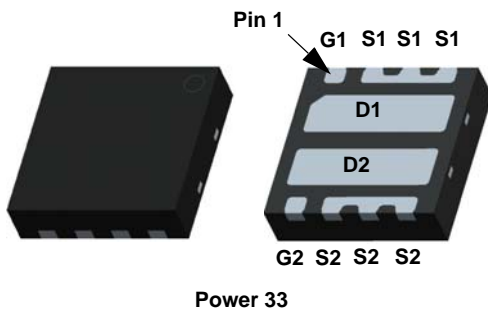


General Description

This device includes two 30V N-Channel MOSFETs in a dual Power 33 (3 mm X 3 mm MLP) package. The package is enhanced for exceptional thermal performance.

Applications

- Computing
- Communications
- General Purpose Point of Load
- Notebook System



MOSFET Maximum Ratings $T_A = 25^\circ\text{C}$ unless otherwise noted

| Symbol | Parameter | Q1 | Q2 | Units |
|----------------|--|-------------------|-------------------|------------------|
| V_{DS} | Drain to Source Voltage | 30 | 30 | V |
| V_{GS} | Gate to Source Voltage (Note 4) | ± 20 | ± 12 | V |
| I_D | Drain Current -Continuous (Package limited) $T_C = 25^\circ\text{C}$ | 22 | 26 | A |
| | -Continuous $T_A = 25^\circ\text{C}$ | 12 ^{1a} | 16 ^{1b} | |
| | -Pulsed | 60 | 80 | |
| E_{AS} | Single Pulse Avalanche Energy (Note 3) | 21 | 21 | mJ |
| P_D | Power Dissipation for Single Operation $T_A = 25^\circ\text{C}$ | 1.9 ^{1a} | 1.9 ^{1b} | W |
| | Power Dissipation for Single Operation $T_A = 25^\circ\text{C}$ | 0.8 ^{1c} | 0.8 ^{1d} | |
| T_J, T_{STG} | Operating and Storage Junction Temperature Range | -55 to +150 | | $^\circ\text{C}$ |

Thermal Characteristics

| | | | | |
|-----------------|---|-------------------|-------------------|--------------------|
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | 65 ^{1a} | 65 ^{1b} | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | 155 ^{1c} | 155 ^{1d} | |

Package Marking and Ordering Information

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|----------------|-----------|----------|-----------|------------|------------|
| FDMC7208S | FDMC7208S | Power 33 | 13" | 12 mm | 3000 units |

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

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

Off Characteristics

| | | | | | | | |
|--------------------------------------|---|--|----------|----------|----------|------------|----------------------|
| BV_{DSS} | Drain to Source Breakdown Voltage | $I_D = 250\text{ }\mu\text{A}$, $V_{GS} = 0\text{ V}$ $I_D = 1\text{ mA}$, $V_{GS} = 0\text{ V}$ | Q1 Q2 | 30 30 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\text{ }\mu\text{A}$, referenced to $25\text{ }^\circ\text{C}$ $I_D = 10\text{ mA}$, referenced to $25\text{ }^\circ\text{C}$ | Q1 Q2 | | 27 21 | | mV/ $^\circ\text{C}$ |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = 24\text{ V}$, $V_{GS} = 0\text{ V}$ | Q1 Q2 | | | 1 500 | μA |
| I_{GSS} | Gate to Source Leakage Current, Forward | $V_{GS} = 20\text{ V}$, $V_{DS} = 0\text{ V}$ $V_{GS} = 12\text{ V}$, $V_{DS} = 0\text{ V}$ | Q1 Q2 | | | 100 100 | nA |

On Characteristics

| | | | | | | | |
|--|--|---|----------|------------|-------------------|---------------------|----------------------|
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $I_D = 250\text{ }\mu\text{A}$, $V_{GS} = 0\text{ V}$ $I_D = 1\text{ mA}$, $V_{GS} = 0\text{ V}$ | Q1 Q2 | 1.2 1.2 | 1.7 1.6 | 3.0 3.0 | 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 $25\text{ }^\circ\text{C}$ $I_D = 10\text{ mA}$, referenced to $25\text{ }^\circ\text{C}$ | Q1 Q2 | | -5 -3 | | mV/ $^\circ\text{C}$ |
| $r_{DS(on)}$ | Drain to Source On Resistance | $V_{GS} = 10\text{ V}$, $I_D = 12\text{ A}$ $V_{GS} = 4.5\text{ V}$, $I_D = 11\text{ A}$ $V_{GS} = 10\text{ V}$, $I_D = 12\text{ A}$, $T_J = 125\text{ }^\circ\text{C}$ | Q1 | | 6.7 8.8 9.2 | 9.0 11.0 12.4 | m Ω |
| | | $V_{GS} = 10\text{ V}$, $I_D = 16\text{ A}$ $V_{GS} = 4.5\text{ V}$, $I_D = 13.5\text{ A}$ $V_{GS} = 10\text{ V}$, $I_D = 16\text{ A}$, $T_J = 125\text{ }^\circ\text{C}$ | Q2 | | 4.7 5.3 6.4 | 6.4 7.5 6.8 | |
| g_{FS} | Forward Transconductance | $V_{DS} = 5\text{ V}$, $I_D = 12\text{ A}$ $V_{DS} = 5\text{ V}$, $I_D = 16\text{ A}$ | Q1 Q2 | | 53 80 | | S |

Dynamic Characteristics

| | | | | | | | |
|------------|------------------------------|--|----------|------------|-------------|--------------|----------|
| C_{iss} | Input Capacitance | Q1: $V_{DS} = 15\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$ | Q1 Q2 | | 848 1685 | 1130 2245 | pF |
| C_{oss} | Output Capacitance | Q2: $V_{DS} = 15\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$ | Q1 Q2 | | 270 432 | 360 575 | pF |
| C_{riss} | Reverse Transfer Capacitance | $V_{DS} = 15\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$ | Q1 Q2 | | 36 42 | 55 65 | pF |
| R_g | Gate Resistance | | Q1 Q2 | 0.1 0.1 | 1.1 1.0 | 2.5 2.5 | Ω |

Switching Characteristics

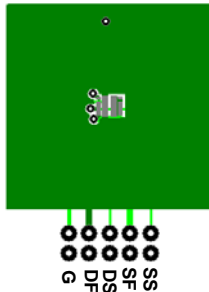
| | | | | | | | |
|--------------|-------------------------------|--|----------|--|---------------------------------------|----------|----|
| $t_{d(on)}$ | Turn-On Delay Time | Q1: $V_{DD} = 15\text{ V}$, $I_D = 12\text{ A}$, $R_{GEN} = 6\text{ }\Omega$ Q2: $V_{DD} = 15\text{ V}$, $I_D = 16\text{ A}$, $R_{GEN} = 6\text{ }\Omega$ | Q1 Q2 | | 6 7 | 12 14 | ns |
| t_r | Rise Time | | Q1 Q2 | | 2 3 | 10 10 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | Q1 Q2 | | 16 23 | 29 36 | ns |
| t_f | Fall Time | | Q1 Q2 | | 2 2 | 10 10 | ns |
| Q_g | Total Gate Charge | $V_{GS} = 0\text{ V}$ to 10 V | Q1 Q2 | | 13 26 | 18 36 | nC |
| | | | | | $V_{GS} = 0\text{ V}$ to 5 V | Q1 Q2 | |
| Q_{gs} | Gate to Source Gate Charge | Q2 $V_{DD} = 15\text{ V}$, $I_D = 16\text{ A}$ | Q1 Q2 | | 2.3 3.9 | | nC |
| Q_{gd} | Gate to Drain "Miller" Charge | | Q1 Q2 | | 1.8 2.7 | | nC |

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

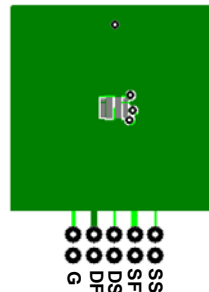
| Symbol | Parameter | Test Conditions | Type | Min | Typ | Max | Units |
|---|---------------------------------------|---|------|-----|------|-----|-------|
| Drain-Source Diode Characteristics | | | | | | | |
| V_{SD} | Source to Drain Diode Forward Voltage | $V_{GS} = 0\text{ V}, I_S = 2\text{ A}$ (Note 2) | Q1 | | 0.72 | 1.2 | V |
| | | $V_{GS} = 0\text{ V}, I_S = 12\text{ A}$ (Note 2) | Q1 | | 0.82 | 1.2 | |
| | | $V_{GS} = 0\text{ V}, I_S = 2\text{ A}$ (Note 2) | Q2 | | 0.70 | 1.2 | |
| | | $V_{GS} = 0\text{ V}, I_S = 16\text{ A}$ (Note 2) | Q2 | | 0.82 | 1.2 | |
| t_{rr} | Reverse Recovery Time | Q1 $I_F = 12\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$ | Q1 | | 21 | 34 | ns |
| | | | Q2 | | 21 | 33 | |
| Q_{rr} | Reverse Recovery Charge | Q2 $I_F = 16\text{ A}, di/dt = 300\text{ A}/\mu\text{s}$ | Q1 | | 6 | 12 | nC |
| | | | Q2 | | 16 | 28 | |

Notes:

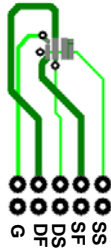
1. $R_{\theta JA}$ is determined with the device mounted on a 1 in² pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR-4 material. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



a. 65 °C/W when mounted on a 1 in² pad of 2 oz copper



b. 65 °C/W when mounted on a 1 in² pad of 2 oz copper



c. 155 °C/W when mounted on a minimum pad of 2 oz copper



d. 155 °C/W when mounted on a minimum pad of 2 oz copper

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

3. Q1: E_{AS} of 21 mJ is based on starting $T_J = 25\text{ }^\circ\text{C}$, $L = 0.3\text{ mH}$, $I_{AS} = 12\text{ A}$, $V_{DD} = 27\text{ V}$, $V_{GS} = 10\text{ V}$. 100% tested at $L = 3\text{ mH}$, $I_{AS} = 5.2\text{ A}$.

Q1: E_{AS} of 21 mJ is based on starting $T_J = 25\text{ }^\circ\text{C}$, $L = 0.3\text{ mH}$, $I_{AS} = 12\text{ A}$, $V_{DD} = 27\text{ V}$, $V_{GS} = 10\text{ V}$. 100% tested at $L = 3\text{ mH}$, $I_{AS} = 5.4\text{ A}$.

4. As an N-ch device, the negative Vgs rating is for low duty cycle pulse occurrence only. No continuous rating is implied

Typical Characteristics (Q1 N-Channel) $T_J = 25^\circ\text{C}$ unless otherwise noted

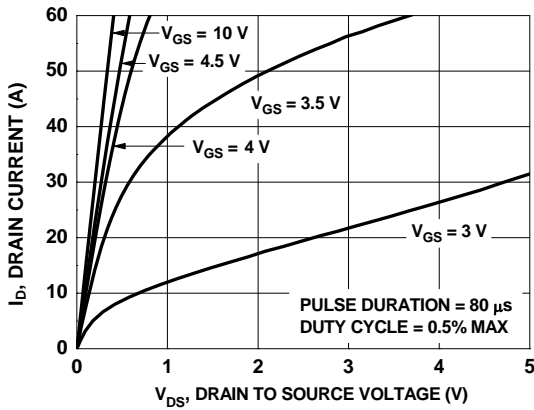


Figure 1. On Region Characteristics

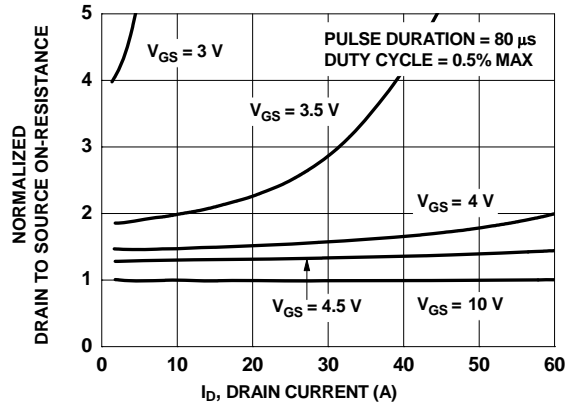


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

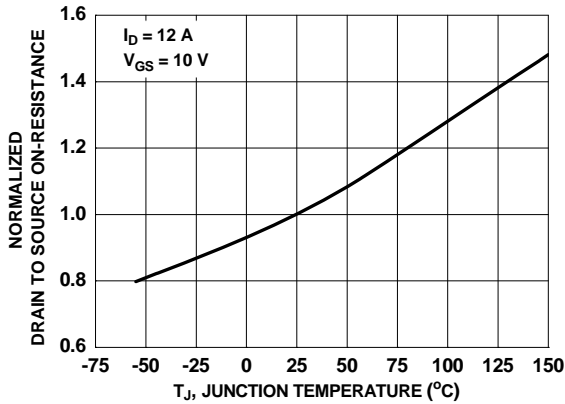


Figure 3. Normalized On Resistance vs Junction Temperature

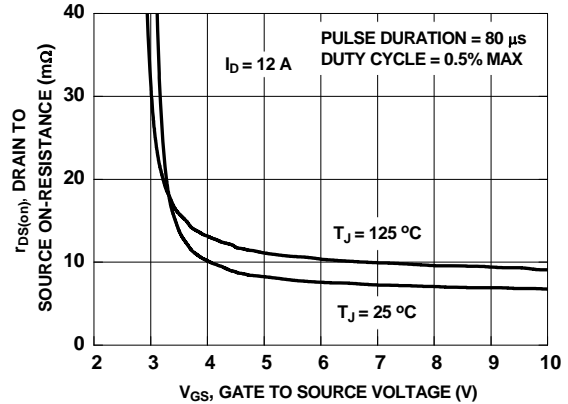


Figure 4. On-Resistance vs Gate to Source Voltage

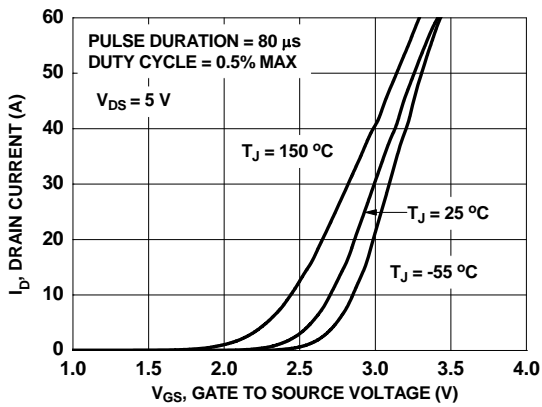


Figure 5. Transfer Characteristics

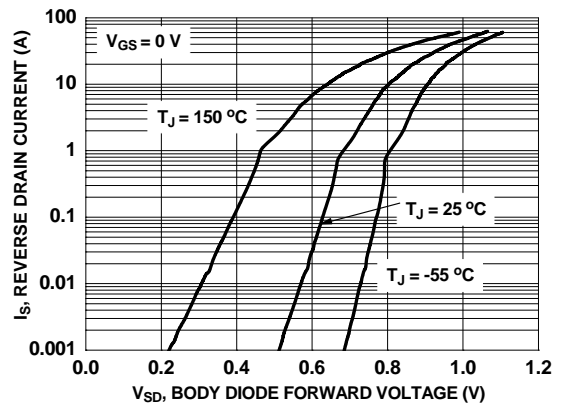


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics (Q1 N-Channel) $T_J = 25^\circ\text{C}$ unless otherwise noted

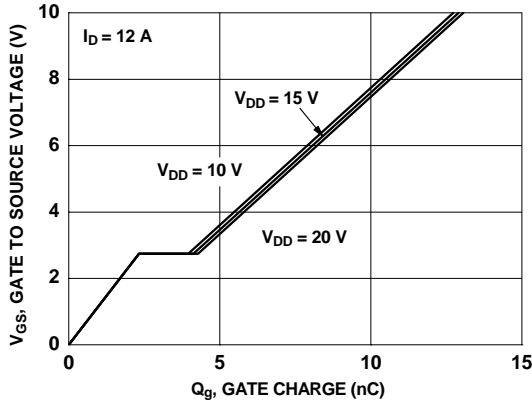


Figure 7. Gate Charge Characteristics

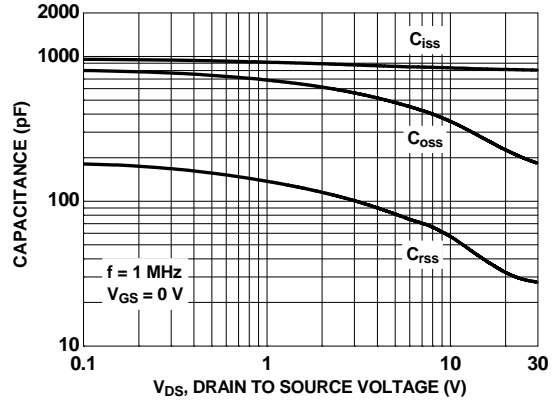


Figure 8. Capacitance vs Drain to Source Voltage

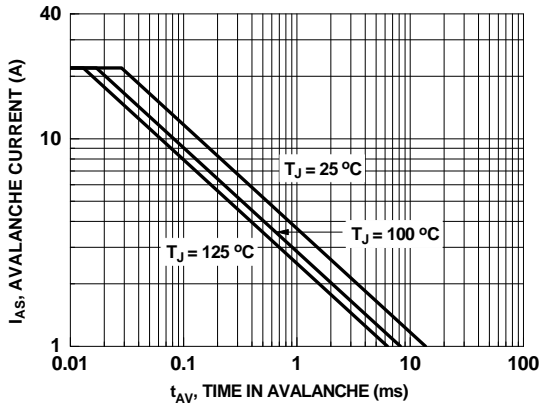


Figure 9. Unclamped Inductive Switching Capability

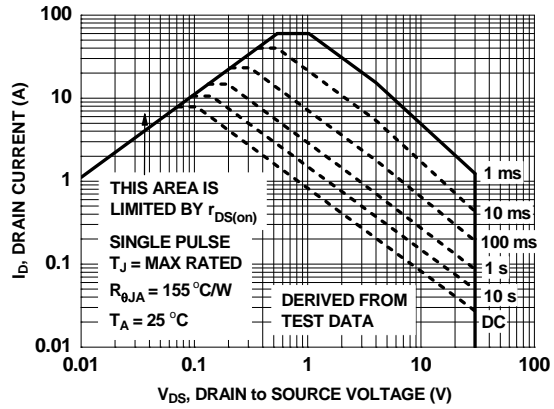


Figure 10. Forward Bias Safe Operating Area

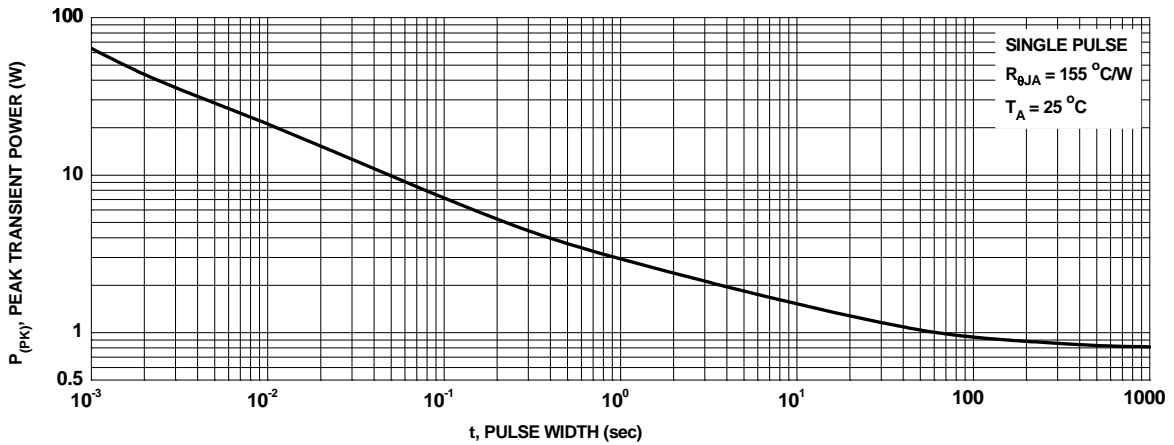


Figure 11. Single Pulse Maximum Power Dissipation

Typical Characteristics (Q1 N-Channel) $T_J = 25^\circ\text{C}$ unless otherwise noted

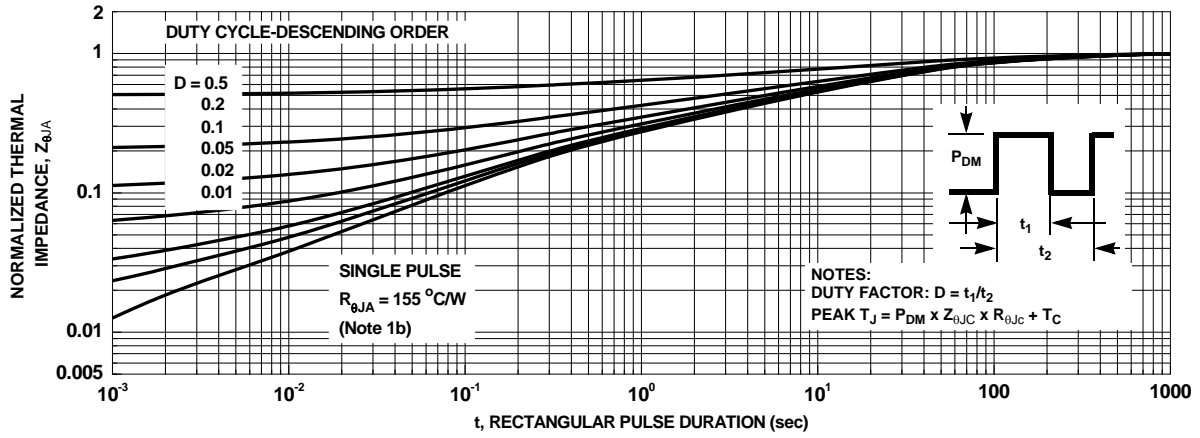


Figure 12. Junction-to-Ambient Transient Thermal Response Curve

Typical Characteristics (Q2 N-Channel) $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

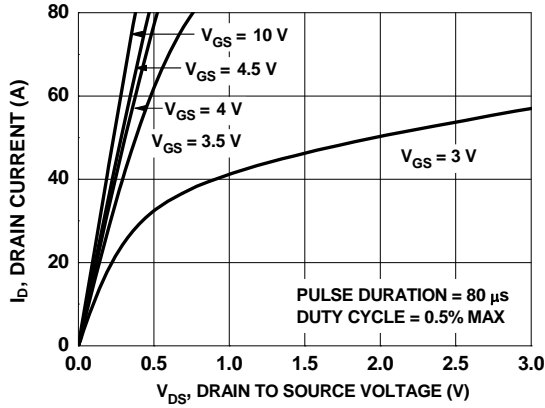


Figure 14. On-Region Characteristics

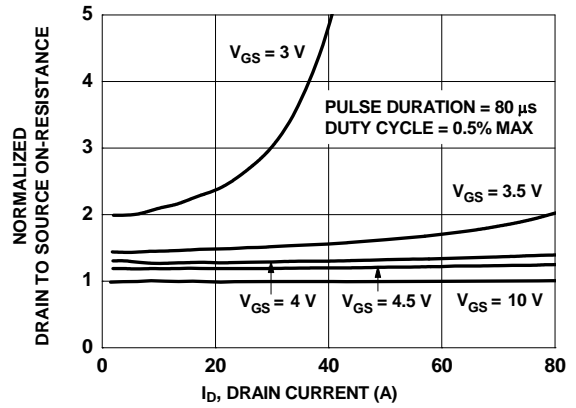


Figure 15. Normalized on-Resistance vs Drain Current and Gate Voltage

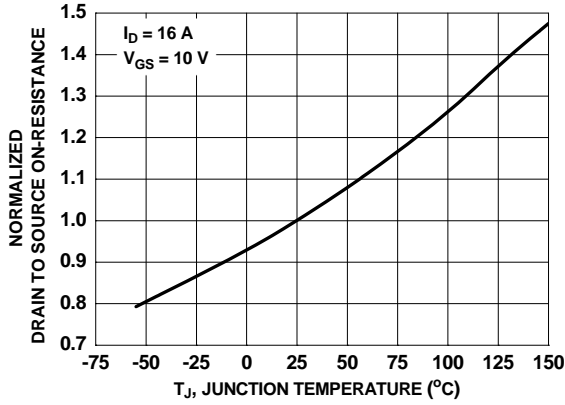


Figure 16. Normalized On-Resistance vs Junction Temperature

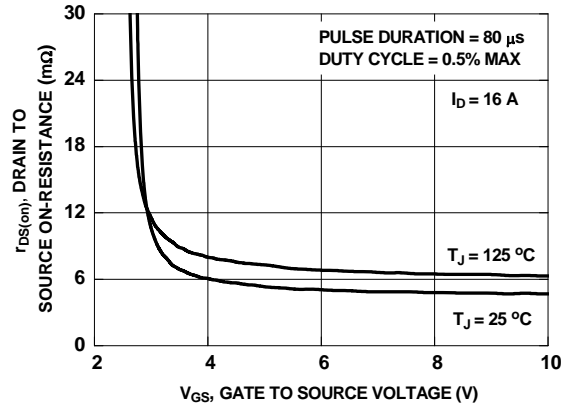


Figure 17. On-Resistance vs Gate to Source Voltage

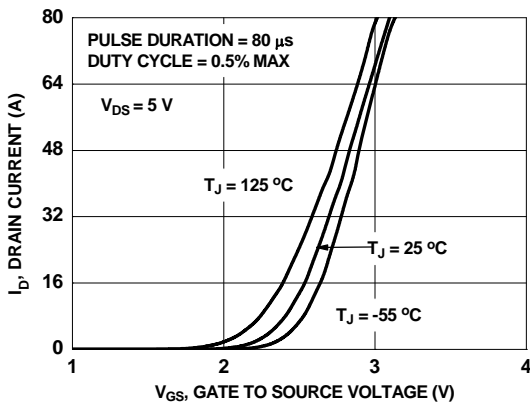


Figure 18. Transfer Characteristics

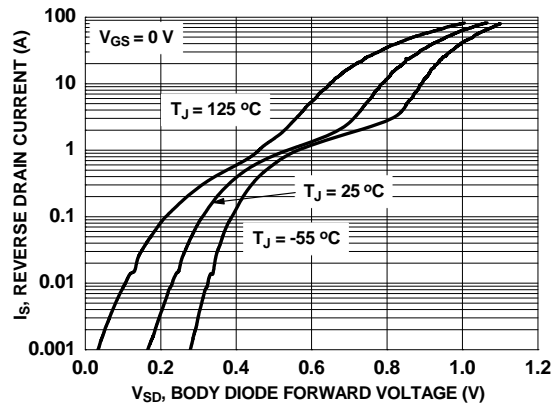


Figure 19. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics (Q2 N-Channel) $T_J = 25^\circ\text{C}$ unless otherwise noted

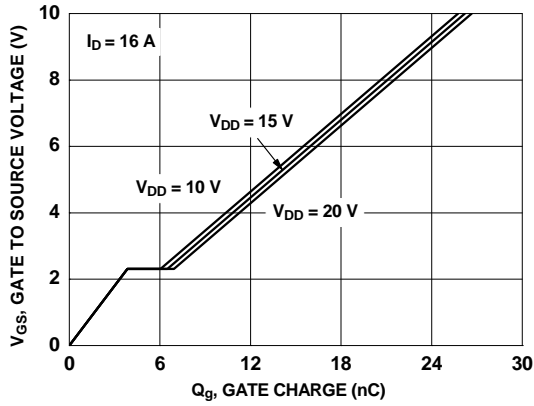


Figure 20. Gate Charge Characteristics

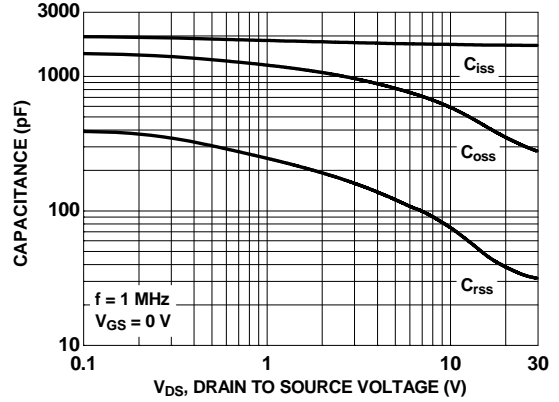


Figure 21. Capacitance vs Drain to Source Voltage

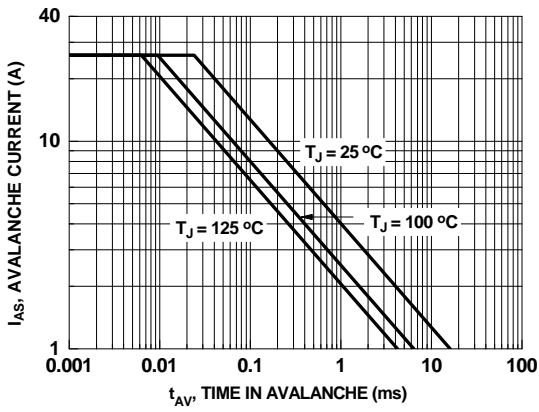


Figure 22. Unclamped Inductive Switching Capability

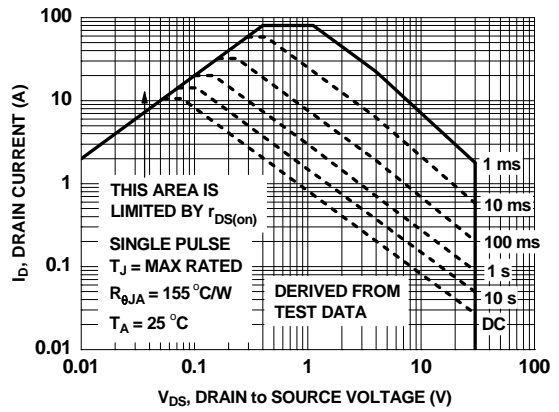


Figure 23. Forward Bias Safe Operating Area

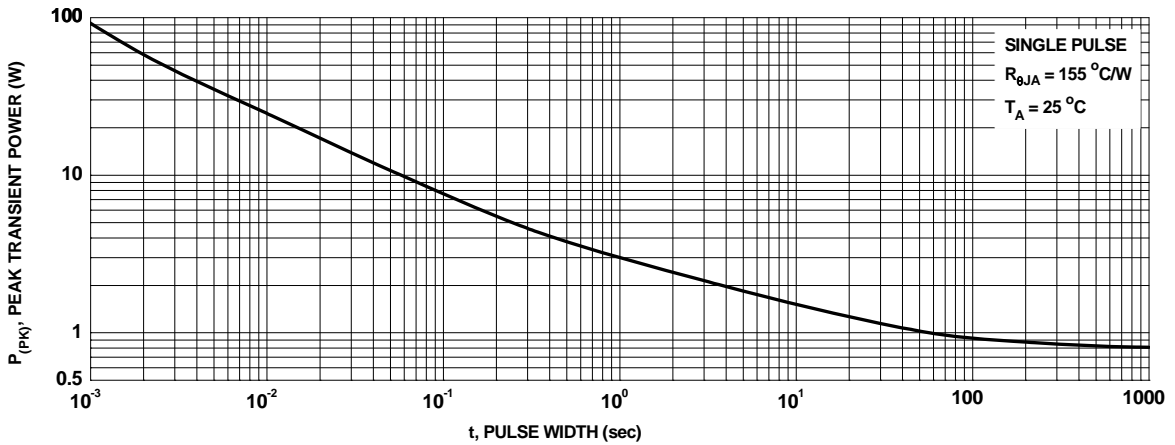


Figure 24. Single Pulse Maximum Power Dissipation

Typical Characteristics (Q2 N-Channel) $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

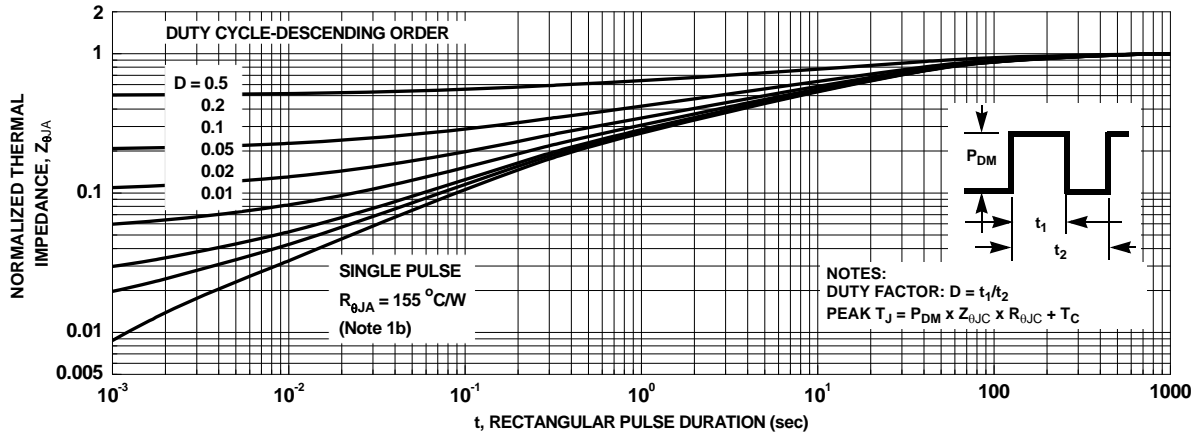


Figure 26. Junction-to-Ambient Transient Thermal Response Curve

Typical Characteristics (continued)

SyncFET[™] Schottky body diode Characteristics

Fairchild's SyncFET[™] process embeds a Schottky diode in parallel with PowerTrench MOSFET. This diode exhibits similar characteristics to a discrete external Schottky diode in parallel with a MOSFET. Figure 27 shows the reverse recovery characteristic of the FDMC7208S.

Schottky barrier diodes exhibit significant leakage at high temperature and high reverse voltage. This will increase the power in the device.

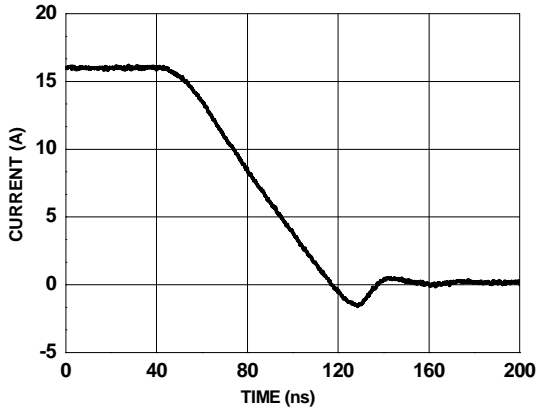


Figure 27. FDMC7208S SyncFET[™] body diode reverse recovery characteristic

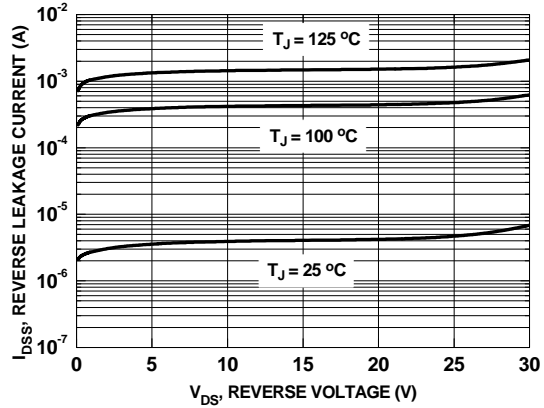
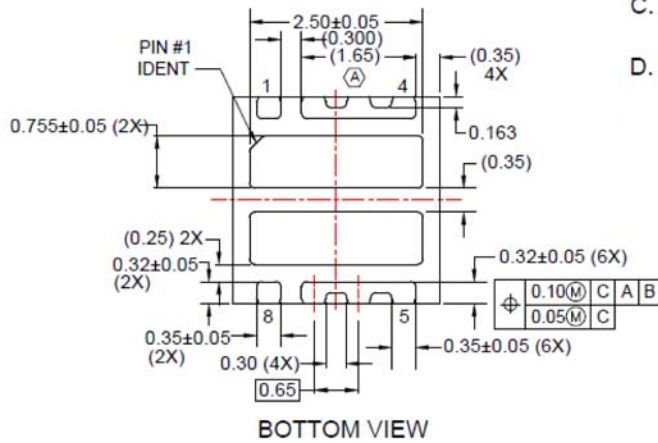
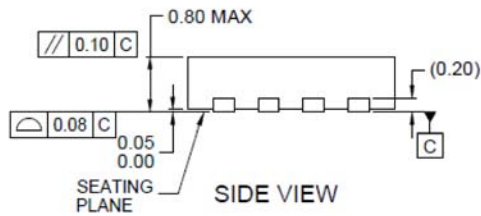
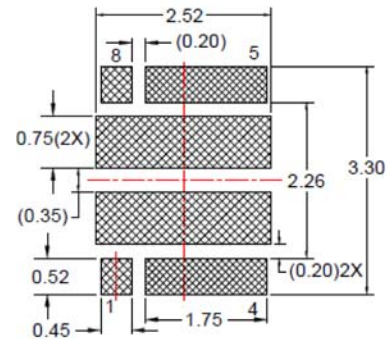
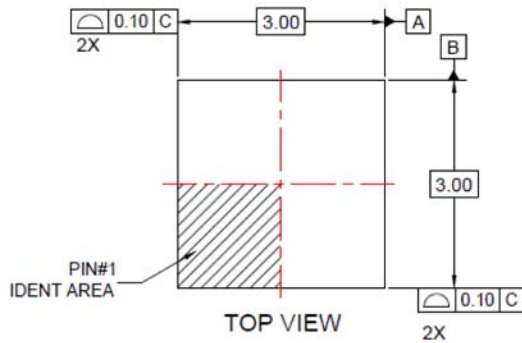


Figure 28. SyncFET[™] body diode reverse leakage versus drain-source voltage

Dimensional Outline and Pad Layout




NOTES:

- A. DOES NOT FULLY CONFORM TO JEDEC REGISTRATION, MO-229.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994
- D. LAND PATTERN RECOMMENDATION IS BASED ON FSC DESIGN ONLY



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| AccuPower™ | F-PFST™ | PowerXS™ | SYSTEM®* |
| AX-CAP®* | FRFET® | Programmable Active Droop™ | GENERAL |
| BitSiC™ | Global Power Resource SM | QFET® | TinyBoost™ |
| Build it Now™ | Green Bridge™ | QS™ | TinyBuck™ |
| CorePLUS™ | Green FPS™ | Quiet Series™ | TinyCalc™ |
| CorePOWER™ | Green FPS™ e-Series™ | RapidConfigure™ | TinyLogic® |
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