



DualCool™ N-Channel NexFET™ Power MOSFET

 Check for Samples: [CSD16407Q5C](#)

FEATURES

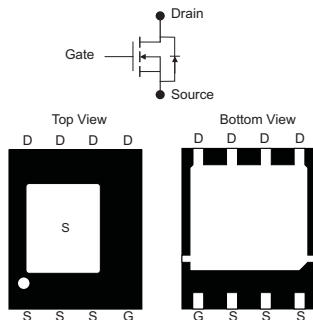
- **Ultralow Q_g and Q_{gd}**
- **DualCool™ Package**
- **Optimized for Two Sided Cooling**
- **Avalanche Rated**
- **Pb Free Terminal Plating**
- **RoHS Compliant**
- **Halogen Free**
- **SON 5-mm × 6-mm Plastic Package**

APPLICATIONS

- **Point-of-Load Synchronous Buck Converter for Applications in Networking, Telecom and Computing Systems**
- **Optimized for Synchronous FET Applications**

DESCRIPTION

The NexFET™ power MOSFET has been designed to minimize losses in power conversion applications.



PRODUCT SUMMARY

| | | | |
|--------------|-------------------------------|-----------------|--------|
| V_{DS} | Drain to Source Voltage | 25 | V |
| Q_g | Gate Charge Total (4.5V) | 13.3 | nC |
| Q_{gd} | Gate Charge Gate to Drain | 3.5 | nC |
| $R_{DS(on)}$ | Drain to Source On Resistance | $V_{GS} = 4.5V$ | 2.5 mΩ |
| | | $V_{GS} = 10V$ | 1.8 mΩ |
| $V_{(th)}$ | Threshold Voltage | 1.6 | V |

ORDERING INFORMATION

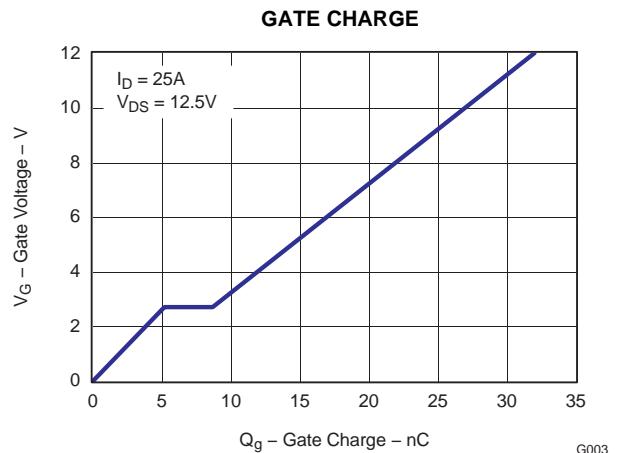
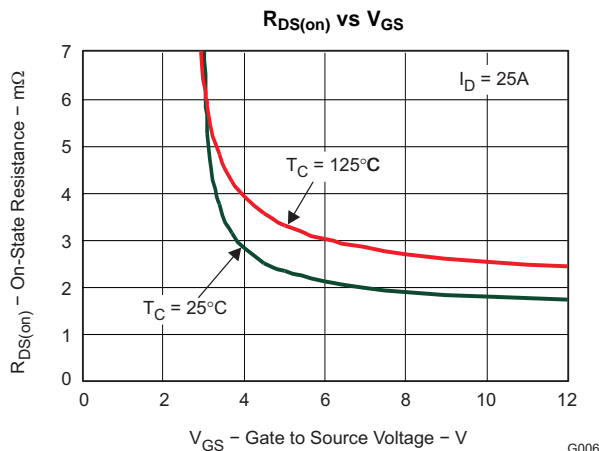
| Device | Package | Media | Qty | Ship |
|-------------|---------------------------------|--------------|------|---------------|
| CSD16407Q5C | SON 5-mm × 6-mm Plastic Package | 13-Inch Reel | 2500 | Tape and Reel |

ABSOLUTE MAXIMUM RATINGS

| $T_A = 25^\circ\text{C}$ unless otherwise stated | | VALUE | UNIT |
|--|---|------------|------|
| V_{DS} | Drain to Source Voltage | 25 | V |
| V_{GS} | Gate to Source Voltage | +16 / -12 | V |
| I_D | Continuous Drain Current, $T_C = 25^\circ\text{C}$ | 100 | A |
| | Continuous Drain Current ⁽¹⁾ | 31 | A |
| I_{DM} | Pulsed Drain Current, $T_A = 25^\circ\text{C}$ ⁽²⁾ | 200 | A |
| P_D | Power Dissipation ⁽¹⁾ | 3.1 | W |
| T_J, T_{STG} | Operating Junction and Storage Temperature Range | -55 to 150 | °C |
| E_{AS} | Avalanche Energy, single pulse $I_D = 66A, L = 0.1\text{mH}, R_G = 25\Omega$ | 218 | mJ |

(1) Typical $R_{\theta JA} = 40^\circ\text{C/W}$ on 1-inch² (6.45-cm²), 2-oz. (0.071-mm thick) Cu pad on a 0.06-inch (1.52-mm) thick FR4 PCB.

(2) Pulse duration $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$



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These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

ELECTRICAL CHARACTERISTICS

$T_A = 25^\circ\text{C}$, unless otherwise specified

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|--------------------------------|----------------------------------|---|-----|------|------|------------|
| Static Characteristics | | | | | | |
| BV_{DSS} | Drain to Source Voltage | $V_{GS} = 0V, I_D = 250\mu A$ | 25 | | | V |
| I_{DSS} | Drain to Source Leakage Current | $V_{GS} = 0V, V_{DS} = 20V$ | | | 1 | μA |
| I_{GSS} | Gate to Source Leakage Current | $V_{DS} = 0V, V_{GS} = +16V / -12V$ | | | 100 | nA |
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{DS} = V_{GS}, I_D = 250\mu A$ | 1.3 | 1.6 | 1.9 | V |
| $R_{DS(on)}$ | Drain to Source On Resistance | $V_{GS} = 4.5V, I_D = 25A$ | | 2.5 | 3.3 | m Ω |
| | | $V_{GS} = 10V, I_D = 25A$ | | 1.8 | 2.4 | m Ω |
| g_{fs} | Transconductance | $V_{DS} = 15V, I_D = 25A$ | | 111 | | S |
| Dynamic Characteristics | | | | | | |
| C_{ISS} | Input Capacitance | $V_{GS} = 0V, V_{DS} = 12.5V, f = 1MHz$ | | 2040 | 2660 | pF |
| C_{OSS} | Output Capacitance | | | 1600 | 2080 | pF |
| C_{RSS} | Reverse Transfer Capacitance | | | 115 | 160 | pF |
| R_g | Series Gate Resistance | | | 1.2 | 2.4 | Ω |
| Q_g | Gate Charge Total (4.5V) | $V_{DS} = 12.5V, I_D = 25A$ | | 13.3 | 18 | nC |
| Q_{gd} | Gate Charge Gate to Drain | | | 3.5 | | nC |
| Q_{gs} | Gate Charge Gate to Source | | | 5.3 | | nC |
| $Q_{g(th)}$ | Gate Charge at V_{th} | | | 3.1 | | nC |
| Q_{OSS} | Output Charge | $V_{DS} = 13.5V, V_{GS} = 0V$ | | 33 | | nC |
| $t_{d(on)}$ | Turn On Delay Time | $V_{DS} = 12.5V, V_{GS} = 4.5V, I_D = 25A, R_G = 2\Omega$ | | 11.9 | | ns |
| t_r | Rise Time | | | 18.4 | | ns |
| $t_{d(off)}$ | Turn Off Delay Time | | | 16 | | ns |
| t_f | Fall Time | | | 9 | | ns |
| Diode Characteristics | | | | | | |
| V_{SD} | Diode Forward Voltage | $I_S = 25A, V_{GS} = 0V$ | | 0.8 | 1 | V |
| Q_{rr} | Reverse Recovery Charge | $V_{DD} = 13.5V, I_F = 25A, di/dt = 300A/\mu s$ | | 42 | | nC |
| t_{rr} | Reverse Recovery Time | $V_{DD} = 13.5V, I_F = 25A, di/dt = 300A/\mu s$ | | 34 | | ns |

THERMAL CHARACTERISTICS

$T_A = 25^\circ\text{C}$, unless otherwise specified

| PARAMETER | | MIN | TYP | MAX | UNIT |
|-----------------|---|-----|-----|-----|--------------------|
| $R_{\theta JC}$ | Thermal Resistance Junction to Case (Top Source) ⁽¹⁾ | | | 1.2 | $^\circ\text{C/W}$ |
| $R_{\theta JC}$ | Thermal Resistance Junction to Case (Bottom Drain) ⁽¹⁾ | | | 1.1 | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance Junction to Ambient ^{(1) (2)} | | | 51 | $^\circ\text{C/W}$ |

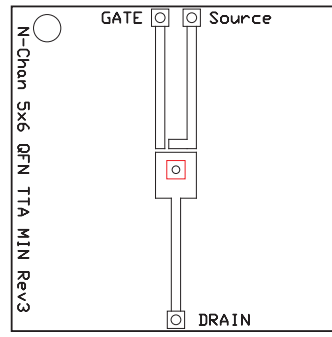
(1) $R_{\theta JC}$ is determined with the device mounted on a 1-inch² (6.45-cm²), 2-oz. (0.071-mm thick) Cu pad on a 1.5-inch × 1.5-inch (3.81-cm × 3.81-cm), 0.06-inch (1.52-mm) thick FR4 PCB. $R_{\theta JC}$ is specified by design, whereas $R_{\theta JA}$ is determined by the user's board design.

(2) Device mounted on FR4 material with 1-inch² (6.45-cm²), 2-oz. (0.071-mm thick) Cu.



M0137-01

Max $R_{\theta JA} = 51^{\circ}\text{C/W}$
when mounted on
1 inch² (6.45 cm²) of
2-oz. (0.071-mm thick)
Cu.

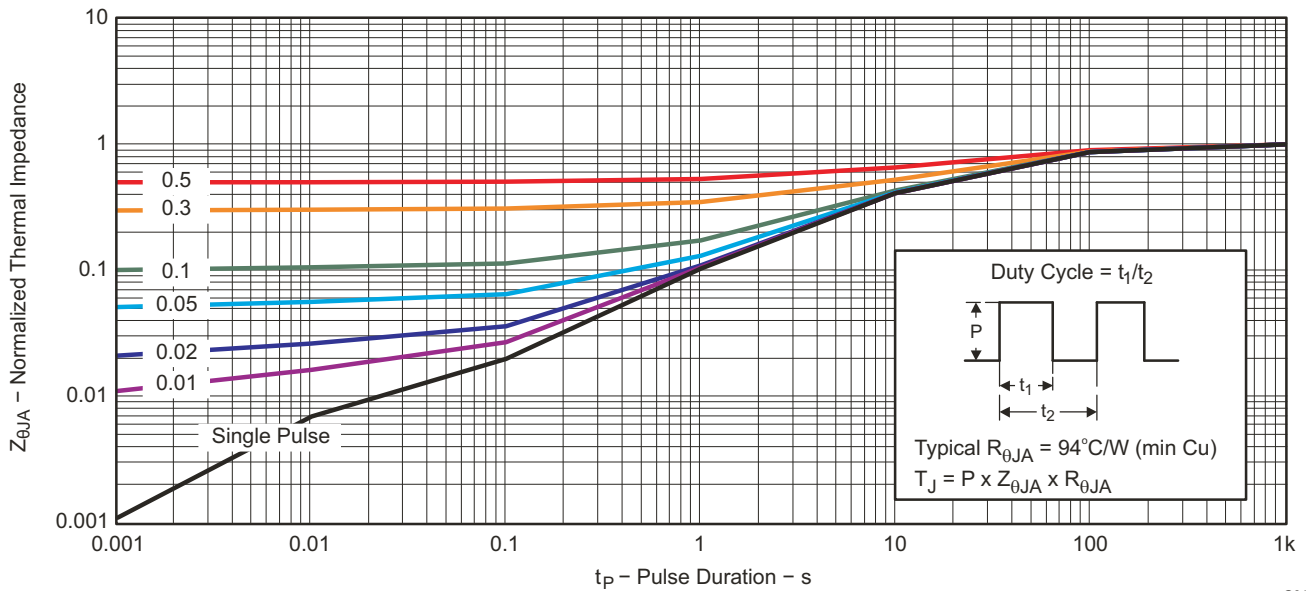


M0137-02

Max $R_{\theta JA} = 121^{\circ}\text{C/W}$
when mounted on
minimum pad area of
2-oz. (0.071-mm thick)
Cu.

TYPICAL MOSFET CHARACTERISTICS

$T_A = 25^{\circ}\text{C}$, unless otherwise specified



G012

Figure 1. Transient Thermal Impedance

TYPICAL MOSFET CHARACTERISTICS (continued)

$T_A = 25^\circ\text{C}$, unless otherwise specified

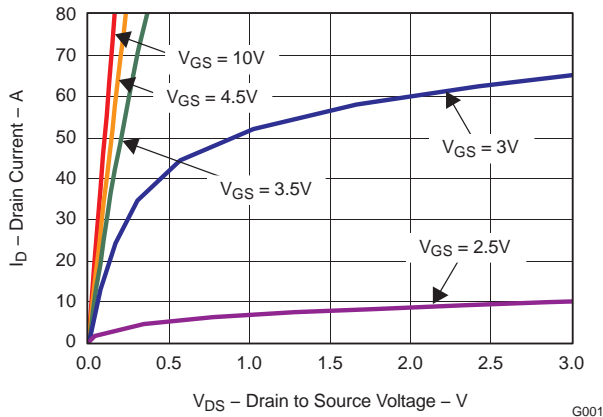


Figure 2. Saturation Characteristics

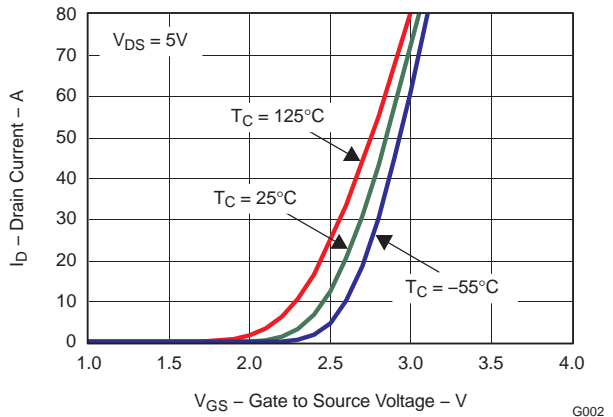


Figure 3. Transfer Characteristics

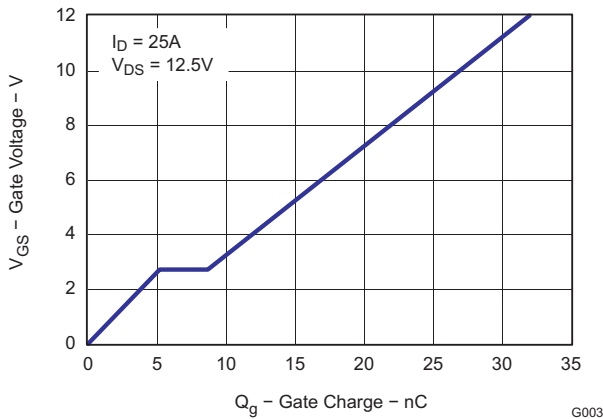


Figure 4. Gate Charge

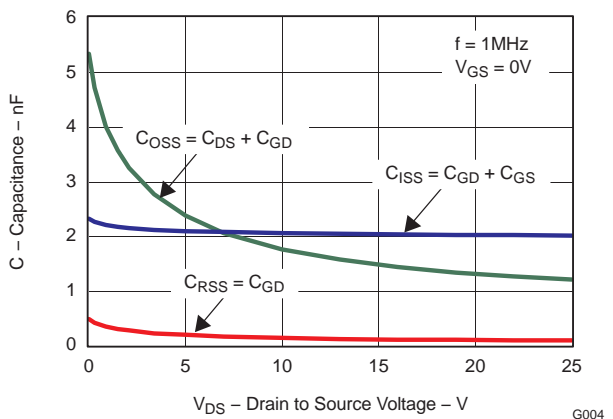


Figure 5. Capacitance

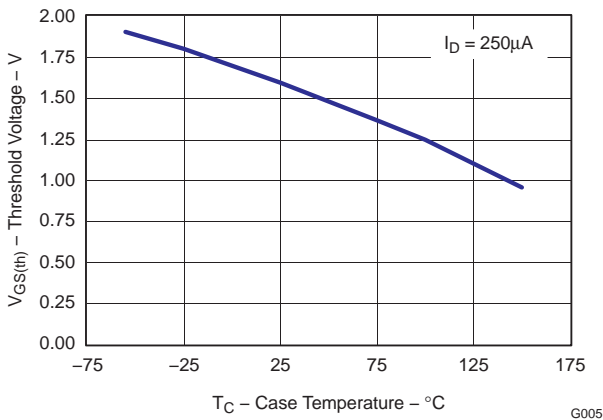


Figure 6. Threshold Voltage vs. Temperature

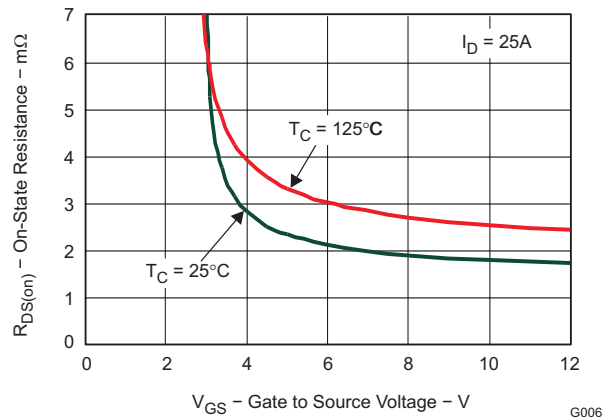


Figure 7. On-State Resistance vs. Gate to Source Voltage

TYPICAL MOSFET CHARACTERISTICS (continued)

T_A = 25°C, unless otherwise specified

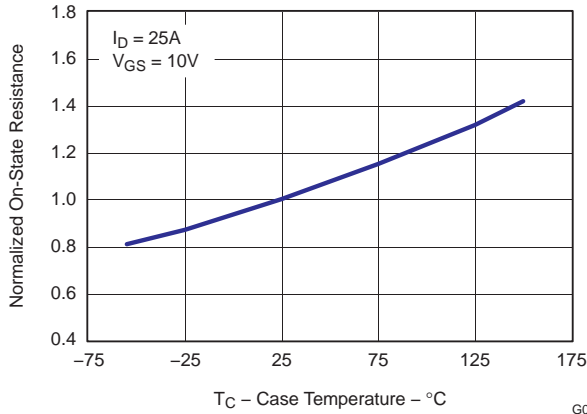


Figure 8. Normalized On-State Resistance vs. Temperature

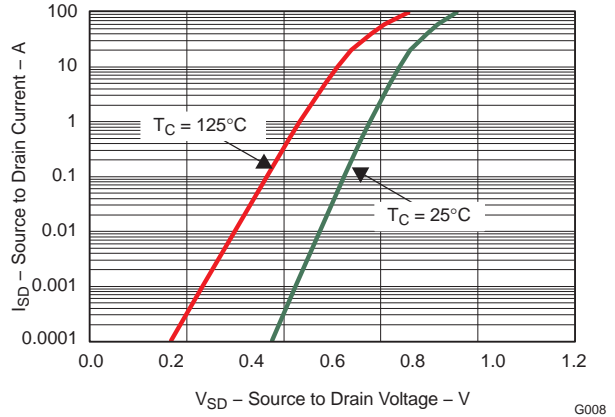


Figure 9. Typical Diode Forward Voltage

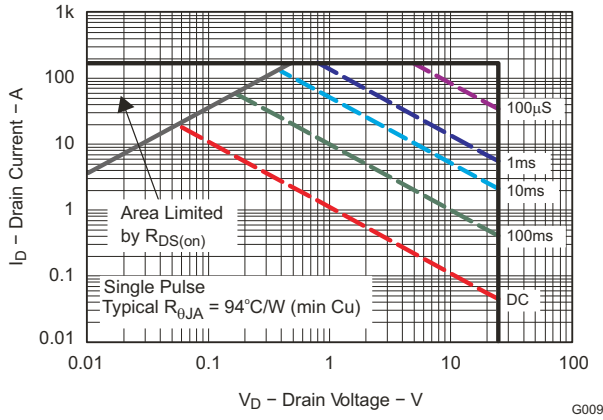


Figure 10. Maximum Safe Operating Area

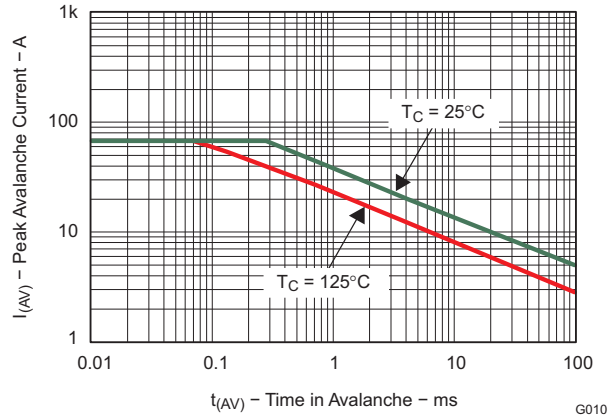


Figure 11. Single Pulse Unclamped Inductive Switching

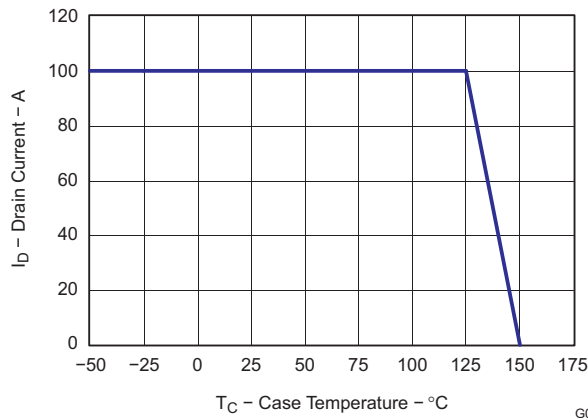
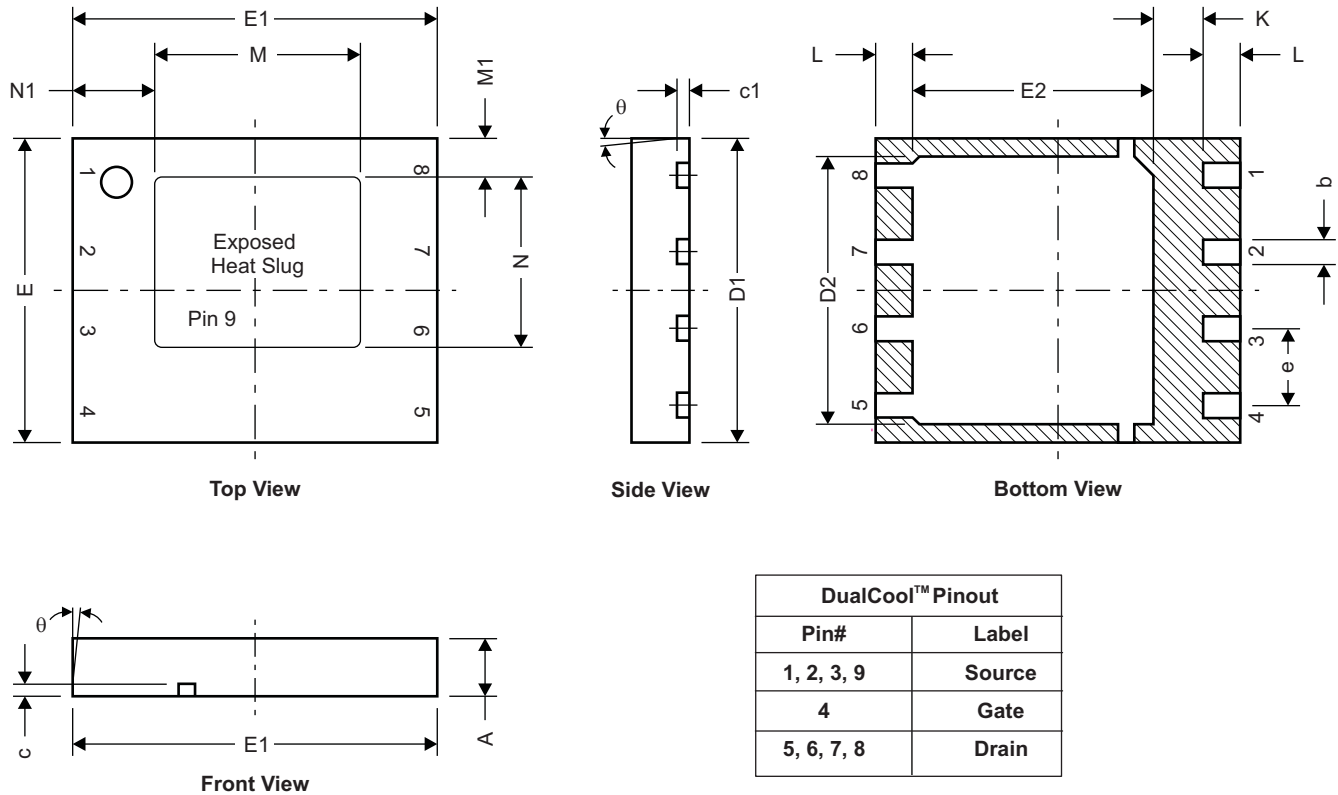


Figure 12. Maximum Drain Current vs. Temperature

MECHANICAL DATA

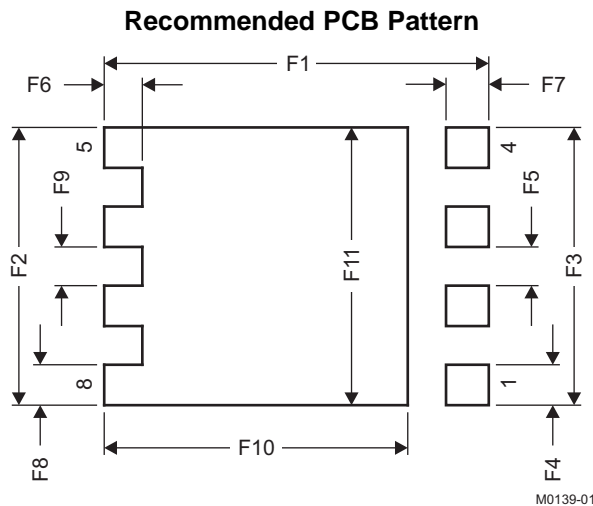
Q5C Package Dimensions



| DualCool™ Pinout | |
|------------------|--------|
| Pin# | Label |
| 1, 2, 3, 9 | Source |
| 4 | Gate |
| 5, 6, 7, 8 | Drain |

M0162-01

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|-------|--------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.950 | 1.050 | 0.037 | 0.039 |
| b | 0.360 | 0.460 | 0.014 | 0.018 |
| c | 0.150 | 0.250 | 0.006 | 0.010 |
| c1 | 0.150 | 0.250 | 0.006 | 0.010 |
| D1 | 4.900 | 5.100 | 0.193 | 0.201 |
| D2 | 4.320 | 4.520 | 0.170 | 0.178 |
| E | 4.900 | 5.100 | 0.193 | 0.201 |
| E1 | 5.900 | 6.100 | 0.232 | 0.240 |
| E2 | 3.920 | 4.12 | 0.154 | 0.162 |
| e | 1.27 TYP | | 0.050 | |
| K | 0.760 | – | 0.030 | – |
| L | 0.510 | 0.710 | 0.020 | 0.028 |
| θ | – | – | – | – |
| M | 3.260 | 3.460 | 0.128 | 0.136 |
| M1 | 0.520 | 0.720 | 0.020 | 0.028 |
| N | 2.720 | 2.920 | 0.107 | 0.115 |
| N1 | 1.227 | 1.427 | 0.048 | 0.056 |



| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|-------|--------|-------|
| | MIN | MAX | MIN | MAX |
| F1 | 6.205 | 6.305 | 0.244 | 0.248 |
| F2 | 4.460 | 4.560 | 0.176 | 0.180 |
| F3 | 4.460 | 4.560 | 0.176 | 0.180 |
| F4 | 0.650 | 0.700 | 0.026 | 0.028 |
| F5 | 0.620 | 0.670 | 0.024 | 0.026 |
| F6 | 0.630 | 0.680 | 0.025 | 0.027 |
| F7 | 0.700 | 0.800 | 0.028 | 0.031 |
| F8 | 0.650 | 0.700 | 0.026 | 0.028 |
| F9 | 0.620 | 0.670 | 0.024 | 0.026 |
| F10 | 4.900 | 5.000 | 0.193 | 0.197 |
| F11 | 4.460 | 4.560 | 0.176 | 0.180 |

For recommended circuit layout for PCB designs, see application note [SLPA005 – Reducing Ringing Through PCB Layout Techniques](#).

Q5C Tape and Reel Information



M0138-01

Notes:

- 10-sprocket hole-pitch cumulative tolerance ± 0.2
- Camber not to exceed 1mm in 100mm, noncumulative over 250mm
- Material: black static-dissipative polystyrene
- All dimensions are in mm, unless otherwise specified.
- Thickness: 0.30 ± 0.05 mm
- MSL1 260°C (IR and convection) PbF reflow compatible

REVISION HISTORY

| Changes from Original (October 2009) to Revision A | Page |
|--|-------------|
| • Changed the device From: Procut Preview To: Production | 1 |
| • Changed Application - From: Optimized for Control FET Applications To: Optimized for Synchronous FET Applications | 1 |
| • Changed the pinout illustration. | 1 |
| • Changed the Q5C Package Dimensions illustration | 6 |
| Changes from Revision A (December 2009) to Revision B | Page |
| • Changed the ABSOLUTE MAXIMUM RATINGS table, I_D - Continuous Drain Current value From: 30A To: 31A | 1 |
| • Changed Note 1 of the ABSOLUTE MAXIMUM RATINGS table From: Typical $R_{\theta JA} = 41^\circ\text{C}$ To: Typical $R_{\theta JA} = 40^\circ\text{C}$ | 1 |
| • Changed Figure 1 - From: Typical $R_{\theta JA} = 98^\circ\text{C/W}$ To: Typical $R_{\theta JA} = 94^\circ\text{C/W}$ | 3 |
| • Changed Figure 10 - From: Typical $R_{\theta JA} = 98^\circ\text{C/W}$ To: Typical $R_{\theta JA} = 94^\circ\text{C/W}$ | 5 |
| • Changed Figure 11 - X axis values | 5 |
| Changes from Revision B (January 2010) to Revision C | Page |
| • Changed the labels on the Bottom View pinout image | 1 |
| Changes from Revision C (February 2010) to Revision D | Page |
| • Deleted the Package Marking Information section | 7 |

TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|-------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| CSD16407Q5C | SON | DQU | 8 | 2500 | 330.0 | 12.8 | 6.5 | 5.3 | 1.4 | 8.0 | 12.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|-------------|--------------|-----------------|------|------|-------------|------------|-------------|
| CSD16407Q5C | SON | DQU | 8 | 2500 | 335.0 | 335.0 | 32.0 |

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| | |
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| Medical | www.ti.com/medical |
| Security | www.ti.com/security |
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