

N-Channel NexFET™ Power MOSFETs

 Check for Samples: [CSD16407Q5](#)

FEATURES

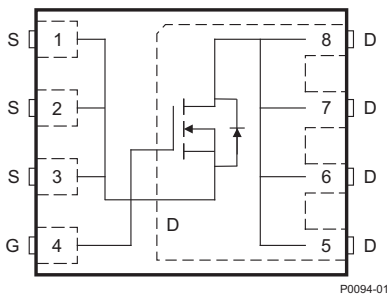
- **Ultralow Qg and Qgd**
- **Low Thermal Resistance**
- **Avalanche Rated**
- **SON 5-mm × 6-mm Plastic Package**

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.

Top View


PRODUCT SUMMARY

| | | | |
|--------------|-------------------------------|-------------------------|--------|
| V_{DS} | Drain-to-source voltage | 25 | V |
| Q_g | Gate charge, total (4.5 V) | 13.3 | nC |
| Q_{gd} | Gate charge, gate-to-drain | 3.5 | nC |
| $R_{DS(on)}$ | Drain-to-source on-resistance | $V_{GS} = 4.5\text{ V}$ | 2.5 mΩ |
| | | $V_{GS} = 10\text{ V}$ | 1.8 mΩ |
| $V_{GS(th)}$ | Threshold voltage | 1.6 | V |

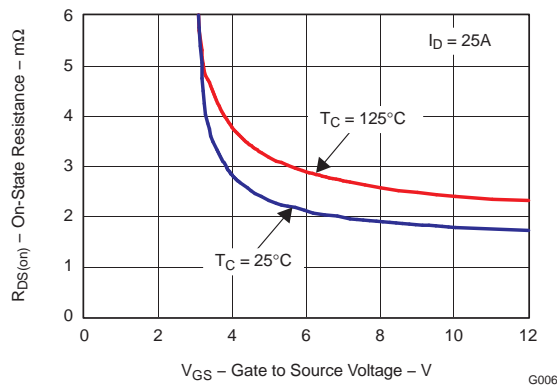
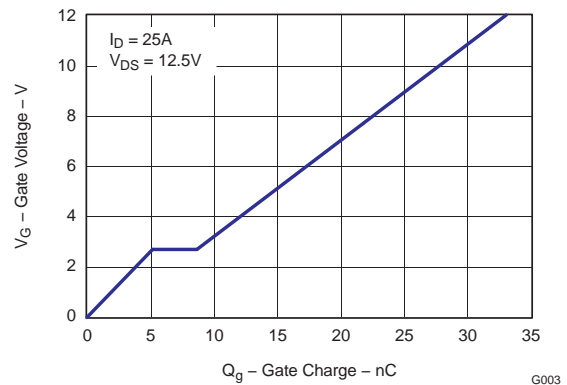
ORDERING INFORMATION

| Device | Package | Media | Qty | Ship |
|------------|---------------------------|--------------|------|---------------|
| CSD16407Q5 | SON 5 × 6 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 | $^\circ\text{C}$ |
| E_{AS} | Avalanche energy, single pulse $I_D = 66\text{ A}, L = 0.1\text{ mH}, R_G = 25\ \Omega$ | 218 | mJ |

- (1) $R_{\theta JA} = 40^\circ\text{C/W}$ on 1 in² (6.45 cm²) Cu [2 oz. (0.071 mm thick)] on 0.060-inch (1.52-mm) thick FR4 PCB.
- (2) Pulse duration $\leq 300\ \mu\text{s}$, duty cycle $\leq 2\%$

 $r_{DS(on)}$ vs V_{GS}

Gate Charge


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ELECTRICAL CHARACTERISTICS

(T_A = 25°C unless otherwise stated)

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|--------------------------------|----------------------------------|--|-----|------|------|------|
| Static Characteristics | | | | | | |
| B _V DSS | Drain-to-source voltage | V _{GS} = 0 V, I _D = 250 μA | 25 | | | V |
| I _{DSS} | Drain-to-source leakage current | V _{GS} = 0 V, V _{DS} = 20 V | | | 1 | μA |
| I _{GSS} | Gate-to-source leakage current | V _{DS} = 0 V, V _{GS} = 16 V to –12 V | | | 100 | nA |
| V _{GS(th)} | Gate-to-source threshold voltage | V _{DS} = V _{GS} , I _D = 250 μA | 1.3 | 1.6 | 1.9 | V |
| r _{DS(on)} | Drain-to-source on-resistance | V _{GS} = 4.5 V, I _D = 25 A | | 2.5 | 3.3 | mΩ |
| | | V _{GS} = 10 V, I _D = 25 A | | 1.8 | 2.4 | mΩ |
| g _{fs} | Transconductance | V _{DS} = 15 V, I _D = 25 A | | 111 | | S |
| Dynamic Characteristics | | | | | | |
| C _{ISS} | Input capacitance | V _{GS} = 0 V, V _{DS} = 12.5 V, f = 1 MHz | | 2040 | 2660 | pF |
| C _{OSS} | Output capacitance | | | 1600 | 2080 | pF |
| C _{RSS} | Reverse transfer capacitance | | | 115 | 160 | pF |
| R _g | Series gate resistance | V _{DS} = 12.5 V, I _D = 25 A | | 1.2 | 2.4 | Ω |
| Q _g | Gate charge total (4.5 V) | | | 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} = 13.5 V, V _{GS} = 0 V | | 33 | | nC |
| t _{d(on)} | Turnon delay time | V _{DS} = 12.5 V, V _{GS} = 4.5 V, I _D = 25 A R _G = 2 Ω | | 11.9 | | ns |
| t _r | Rise time | | | 18.4 | | ns |
| t _{d(off)} | Turnoff delay time | | | 16 | | ns |
| t _f | Fall time | | | 9 | | ns |
| Diode Characteristics | | | | | | |
| V _{SD} | Diode forward voltage | I _S = 25 A, V _{GS} = 0 V | | 0.8 | 1 | V |
| Q _{rr} | Reverse recovery charge | V _{DD} = 13.5 V, I _F = 25 A, di/dt = 300 A/μs | | 41 | | nC |
| t _{rr} | Reverse recovery time | V _{DD} = 13.5 V, I _F = 25 A, di/dt = 300 A/μs | | 34 | | ns |

THERMAL CHARACTERISTICS

(T_A = 25°C unless otherwise stated)

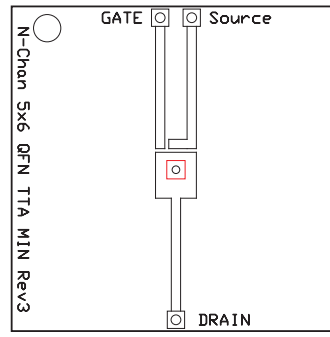
| PARAMETER | | MIN | TYP | MAX | UNIT |
|------------------|--|-----|-----|-----|------|
| R _{θJC} | Thermal resistance, junction-to-case ⁽¹⁾ | | | 1.1 | °C/W |
| R _{θJA} | Thermal resistance, junction-to-ambient ^{(1) (2)} | | | 51 | °C/W |

- (1) R_{θJC} is determined with the device mounted on a 1-inch (2.54-cm) square 2-oz (0.071-mm thick) Cu pad on a 1.5-inch (3.81-cm) × 1.5-inch (3.81-cm) × 0.060-inch (1.52-mm) thick FR4 board. R_{θJC} is specified by design, whereas R_{θJA} is determined by the user's board design.
- (2) Device mounted on FR4 material with 1 inch² (6.45 cm²) of 2-oz. (0.071-mm thick) Cu.



M0137-01

Max $R_{\theta JA} = 50^{\circ}\text{C/W}$
when mounted on 1
 inch^2 (6.45 cm^2) of
2-oz. (0.071-mm thick)
Cu.

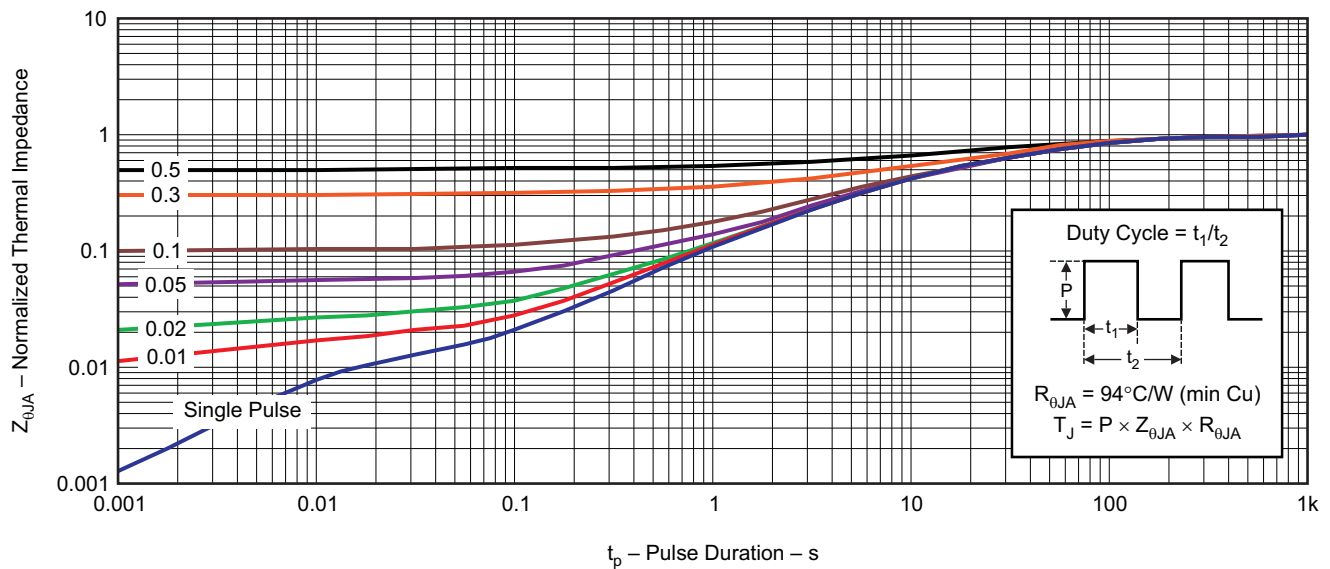


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Max $R_{\theta JA} = 121^{\circ}\text{C/W}$
when mounted on
minimum pad area of
2-oz. (0.071-mm thick)
Cu.

TYPICAL MOSFET CHARACTERISTICS

($T_A = 25^{\circ}\text{C}$ unless otherwise stated)



G012

Figure 1. Transient Thermal Impedance

TYPICAL MOSFET CHARACTERISTICS (continued)

($T_A = 25^\circ\text{C}$ unless otherwise stated)

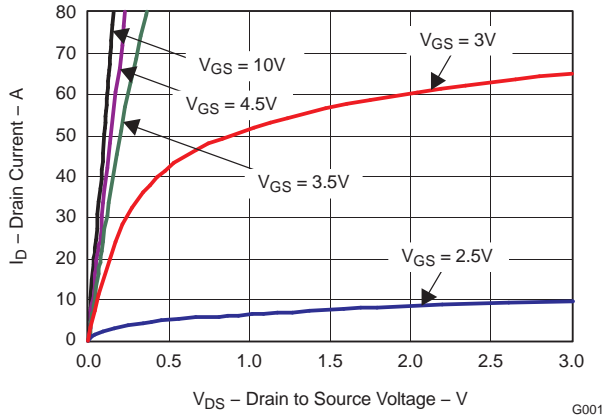


Figure 2. Saturation Characteristics

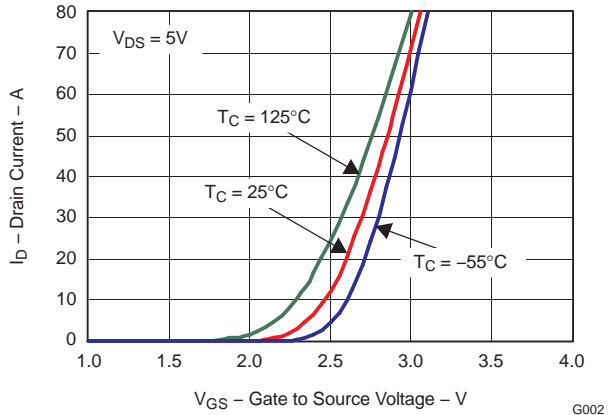


Figure 3. Transfer Characteristics

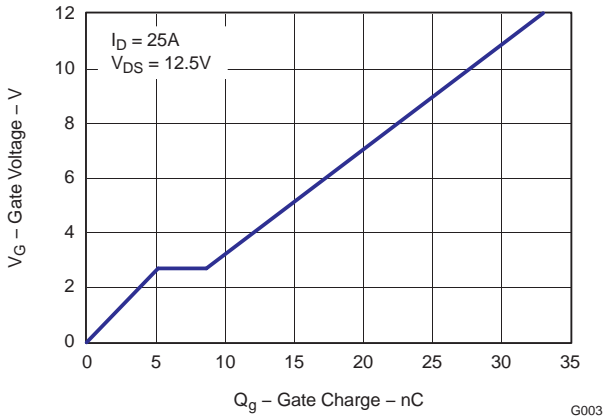


Figure 4. Gate Charge

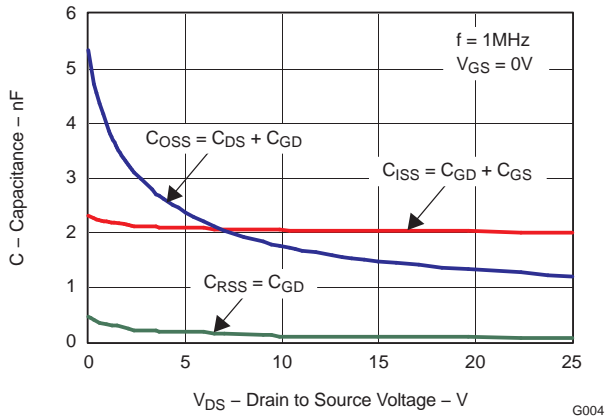


Figure 5. Capacitance

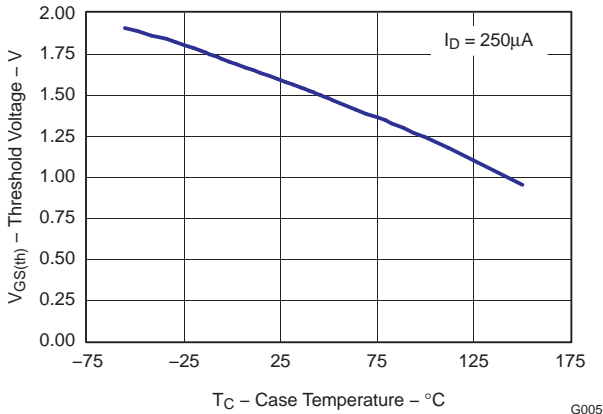


Figure 6. Threshold Voltage vs. Temperature

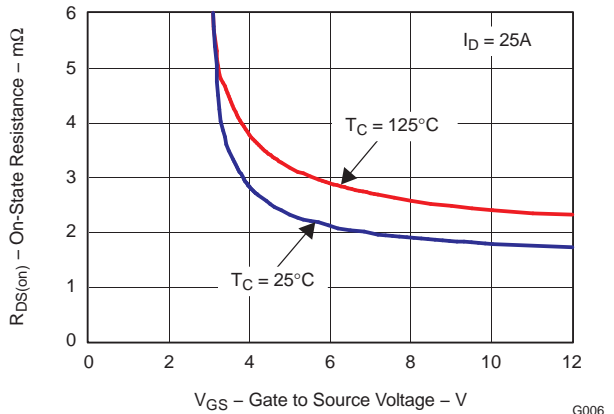


Figure 7. On Resistance vs. Gate Voltage

TYPICAL MOSFET CHARACTERISTICS (continued)

($T_A = 25^\circ\text{C}$ unless otherwise stated)

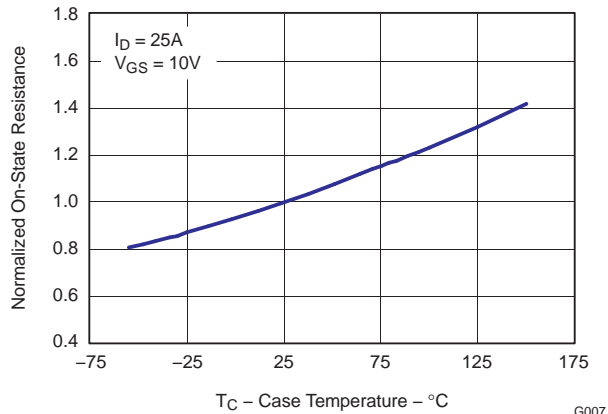


Figure 8. On Resistance vs. Temperature

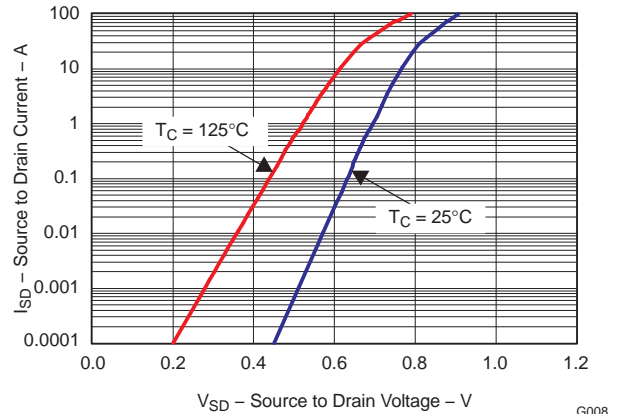


Figure 9. Typical Diode Forward Voltage

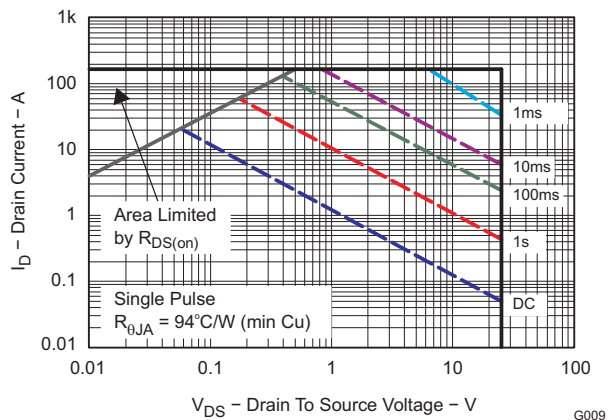


Figure 10. Maximum Safe Operating Area

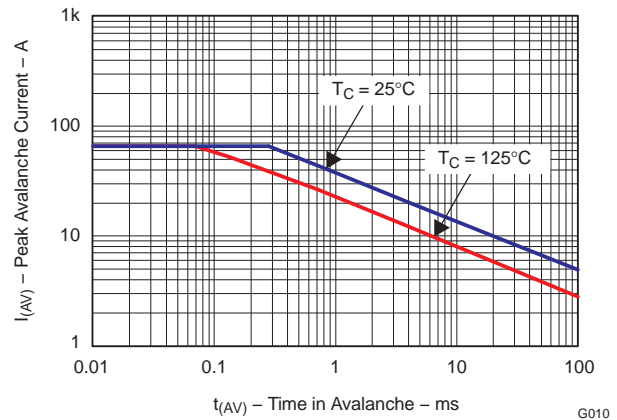


Figure 11. Single Pulse Unclamped Inductive Switching

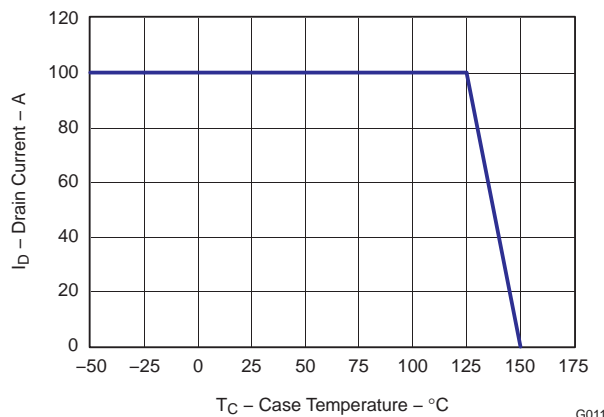
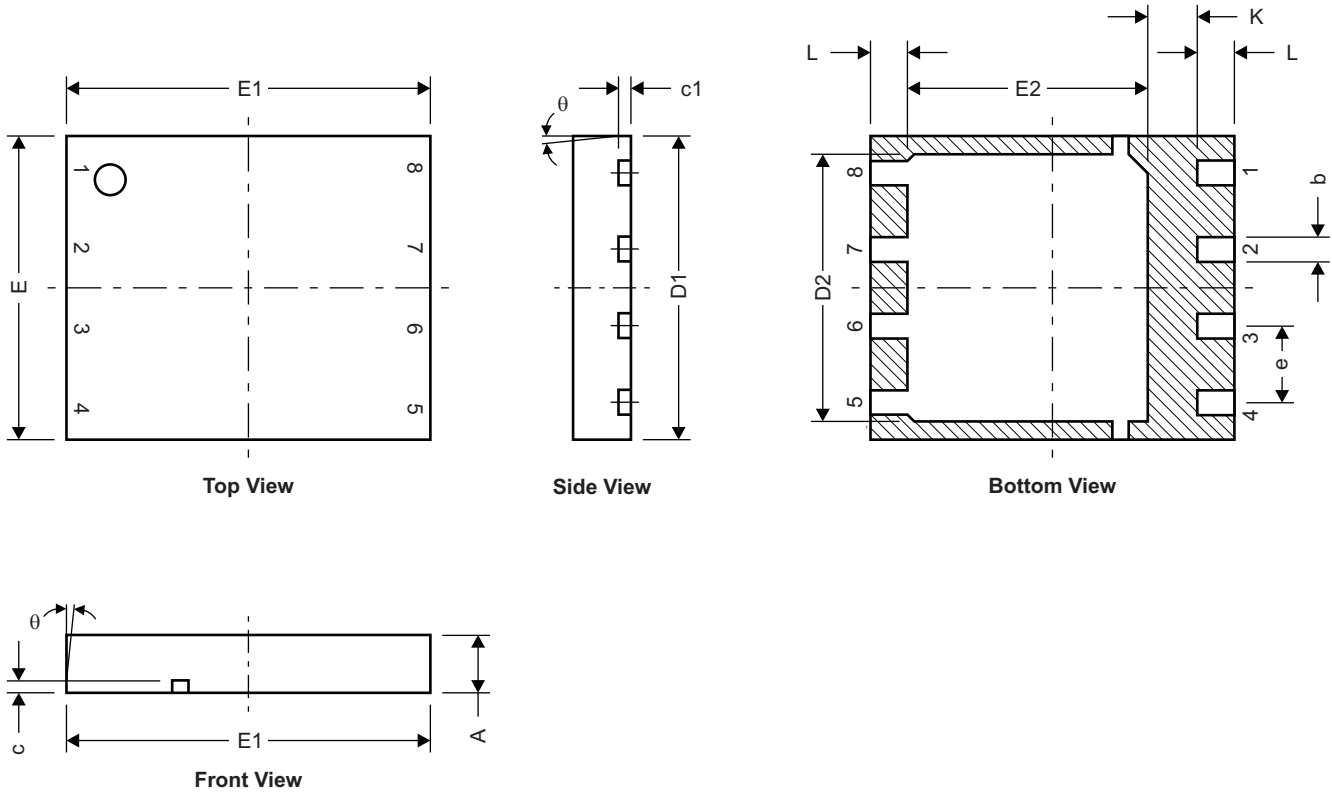


Figure 12. Maximum Drain Current vs. Temperature

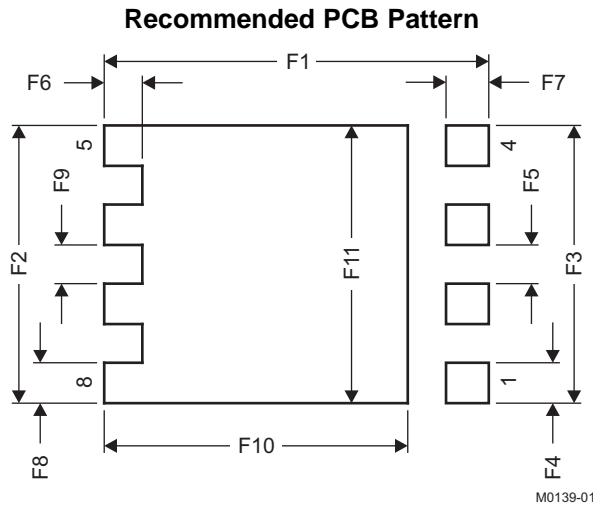
MECHANICAL DATA

Q5 Package Dimensions



M0140-01

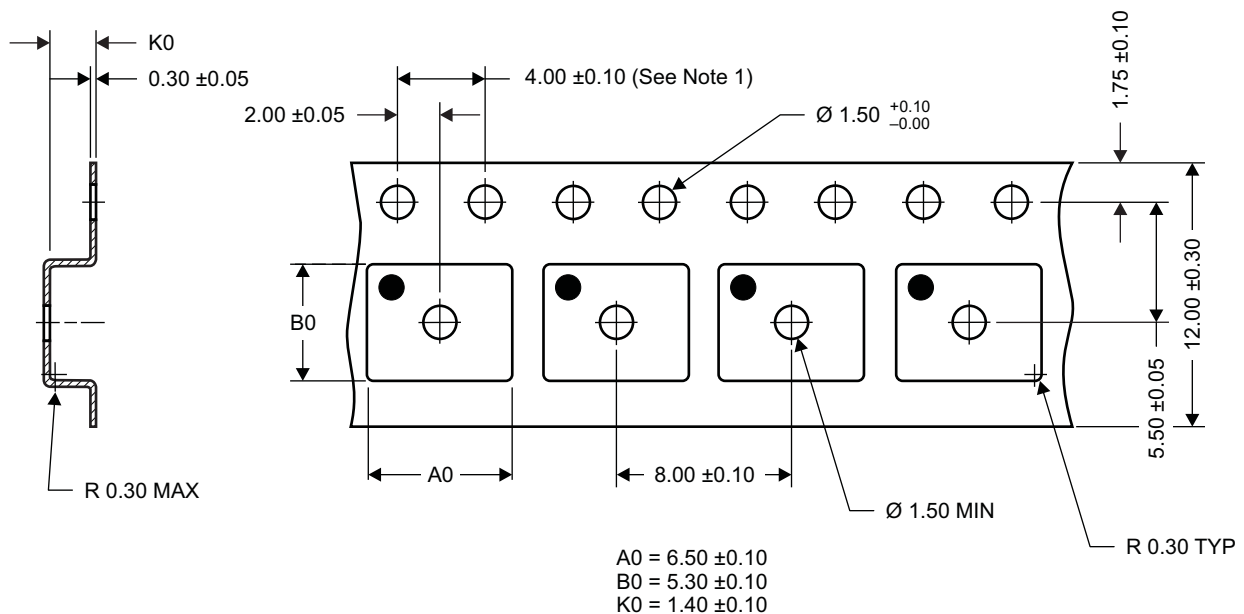
| DIM | MILLIMETERS | | INCHES | |
|----------|-------------|-------|--------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.950 | 1.050 | 0.037 | 0.039 |
| b | 0.360 | 0.460 | 0.014 | 0.018 |
| c | 0.150 | 0.250 | 0.006 | 0.010 |
| c1 | 0.150 | 0.250 | 0.006 | 0.010 |
| D1 | 4.900 | 5.100 | 0.193 | 0.201 |
| 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 | |
| L | 0.510 | 0.710 | 0.020 | 0.028 |
| θ | 0.00 | - | - | - |
| K | 0.760 | - | 0.030 | - |



| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|-------|--------|-------|
| | MIN | MAX | MIN | MAX |
| F1 | 6.205 | 6.305 | 0.2440 | 0.248 |
| F2 | 4.460 | 4.560 | 0.1760 | 0.180 |
| F3 | 4.460 | 4.560 | 0.1760 | 0.180 |
| F4 | 0.650 | 0.700 | 0.0260 | 0.028 |
| F5 | 0.620 | 0.670 | 0.0240 | 0.026 |
| F6 | 0.630 | 0.680 | 0.0250 | 0.027 |
| F7 | 0.70 | 0.800 | 0.0380 | 0.031 |
| F8 | 0.650 | 0.700 | 0.0260 | 0.028 |
| F9 | 0.620 | 0.670 | 0.0240 | 0.026 |
| F10 | 4.900 | 5.000 | 0.1930 | 0.197 |
| F11 | 4.460 | 4.560 | 0.1760 | 0.180 |

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

Q5 Tape and Reel Information



M0138-01

Notes:

- 10 sprocket hole pitch cumulative tolerance ± 0.2
- Camber not to exceed 1 mm IN 100 mm, noncumulative over 250 mm
- 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 Revision Original (August 2009) to Revision A | Page |
|--|------|
| • Deleted environmental bullets from features list | 1 |
| • Deleted package marking at end of data sheet | 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 |
|------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| CSD16407Q5 | SON | DQH | 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) |
|------------|--------------|-----------------|------|------|-------------|------------|-------------|
| CSD16407Q5 | SON | DQH | 8 | 2500 | 335.0 | 335.0 | 32.0 |

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