



N-Channel NexFET™ Power MOSFETs

 Check for Samples: **CSD16403Q5A**

FEATURES

- Ultra Low Q_g and Q_{gd}
- Low Thermal Resistance
- Avalanche Rated
- Pb Free Terminal Plating
- RoHS Compliant
- Halogen Free
- SON 5mm x 6mm Plastic Package

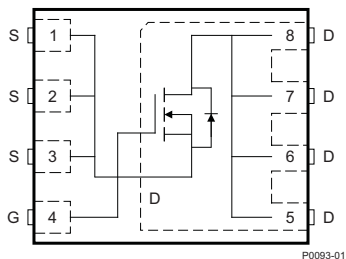
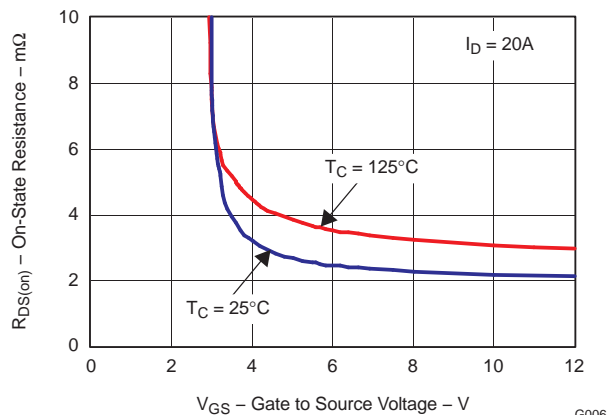
APPLICATIONS

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

DESCRIPTION

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

Top View


 $R_{DS(ON)}$ vs V_{GS}


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 | $V_{GS} = 4.5V$ | 2.9 mΩ |
| | | $V_{GS} = 10V$ | 2.2 mΩ |
| $V_{GS(th)}$ | Threshold Voltage | 1.6 | V |

ORDERING INFORMATION

| Device | Package | Media | Qty | Ship |
|-------------|-------------------------|--------------|------|---------------|
| CSD16403Q5A | SON 5X6 Plastic Package | 13-inch reel | 2500 | Tape and Reel |

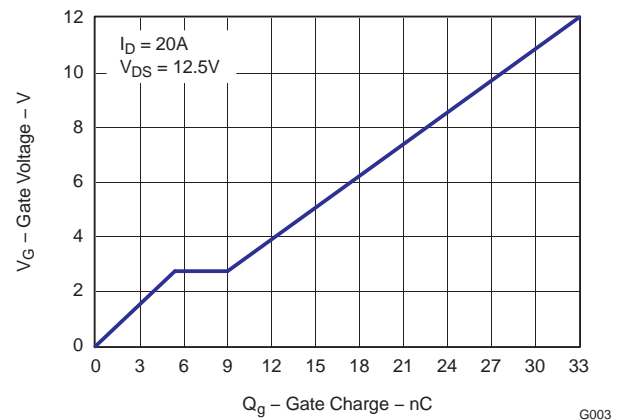
ABSOLUTE MAXIMUM RATINGS

| $T_A = 25^\circ\text{C}$ 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⁾ | 28 | A |
| I_{DM} | Pulsed Drain Current, $T_A = 25^\circ\text{C}$ ⁽²⁾ | 184 | 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 $I_D = 67A, L = 0.1\text{mH}, R_G = 25\Omega$ | 224 | mJ |

(1) $R_{\theta JA} = 41^\circ\text{C/W}$ on 1in² Cu FR4 PCB.

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

Gate Charge



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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 stated)

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|--------------------------------|----------------------------------|---|-----|------|------|------------|
| Static Characteristics | | | | | | |
| V_{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 | $V_{DS} = 0V, V_{GS} = +16/-12V$ | | | 100 | nA |
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{DS} = V_{GS}, I_D = 250\mu A$ | 1.2 | 1.6 | 1.9 | V |
| $R_{DS(on)}$ | Drain to Source On Resistance | $V_{GS} = 4.5V, I_D = 20A$ | | 2.9 | 3.7 | m Ω |
| | | $V_{GS} = 10V, I_D = 20A$ | | 2.2 | 2.8 | m Ω |
| g_{fs} | Transconductance | $V_{DS} = 15V, I_D = 20A$ | | 91 | | 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) | $V_{DS} = 12.5V, I_D = 20A$ | | 13.3 | 18 | nC |
| Q_{gd} | Gate Charge Gate to Drain | | | 3.5 | | nC |
| Q_{gs} | Gate Charge Gate to Source | | | 5.5 | | 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 | $V_{DS} = 12.5V, V_{GS} = 4.5V, I_D = 20A, R_G = 2\Omega$ | | 11.8 | | ns |
| t_r | Rise Time | | | 18.3 | | ns |
| $t_{d(off)}$ | Turn Off Delay Time | | | 15.2 | | ns |
| t_f | Fall Time | | | 9.2 | | ns |
| Diode Characteristics | | | | | | |
| V_{SD} | Diode Forward Voltage | $I_S = 20A, V_{GS} = 0V$ | | 0.8 | 1.0 | V |
| Q_{rr} | Reverse Recovery Charge | $V_{DD} = 13.5V, I_F = 20A, di/dt = 300A/\mu s$ | | 47 | | nC |
| t_{rr} | Reverse Recovery Time | $V_{DD} = 13.5V, I_F = 20A, di/dt = 300A/\mu s$ | | 35 | | ns |

THERMAL CHARACTERISTICS

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

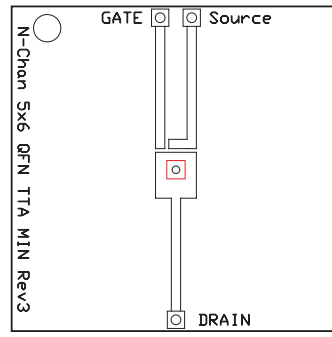
| PARAMETER | | MIN | TYP | MAX | UNIT |
|-----------------|---|-----|-----|-----|--------------------|
| $R_{\theta JC}$ | Thermal Resistance Junction to Case ⁽¹⁾ | | | 1.8 | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance Junction to Ambient ^{(1) (2)} | | | 51 | $^\circ\text{C/W}$ |

(1) $R_{\theta JC}$ is determined with the device mounted on a 1 inch square 2 oz. Cu pad on a 1.5 x 1.5 in 0.060 inch thick FR4 board. $R_{\theta JC}$ is specified by design while $R_{\theta JA}$ is determined by the user's board design.

(2) Device mounted on FR4 Material with 1 inch² of 2 oz. Cu.



Max $R_{\theta JA} = 51^{\circ}\text{C/W}$
when mounted on 1
 inch^2 of 2 oz. Cu.



Max $R_{\theta JA} = 118^{\circ}\text{C/W}$
when mounted on
minimum pad area of 2
oz. Cu.

TYPICAL MOSFET CHARACTERISTICS

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

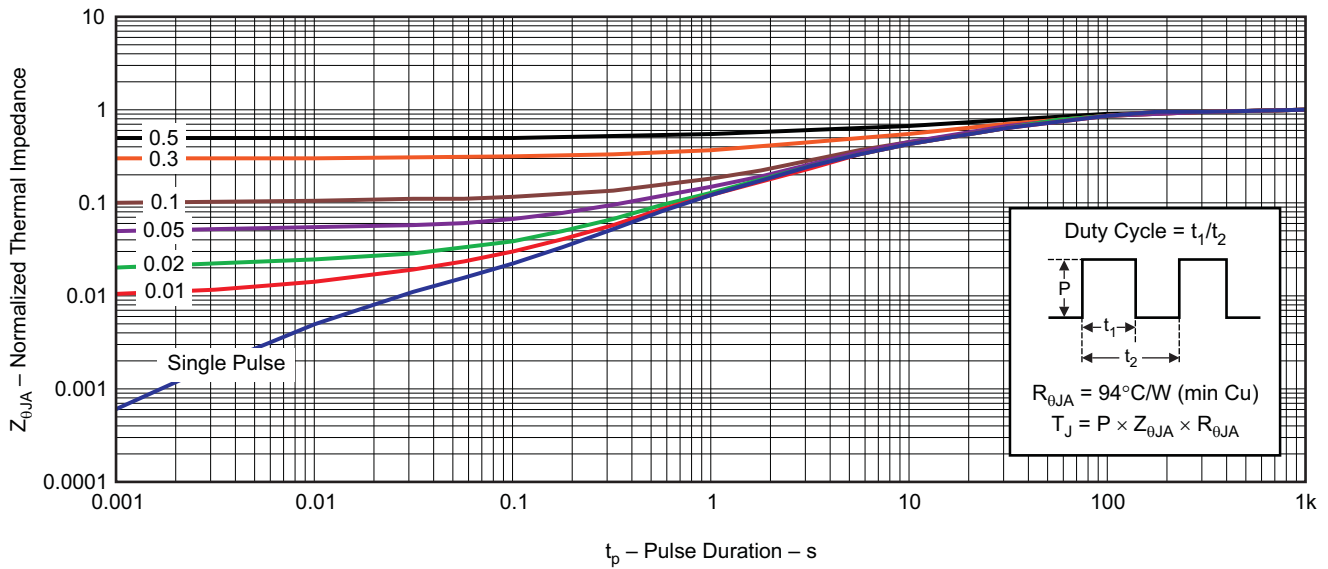


Figure 1. Transient Thermal Impedance

G012

TYPICAL MOSFET CHARACTERISTICS (continued)

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

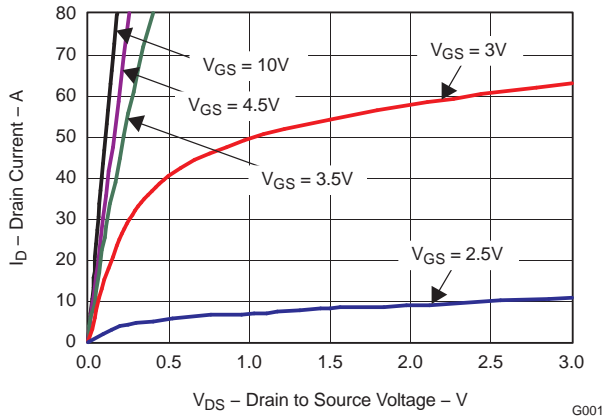


Figure 2. Saturation Characteristics

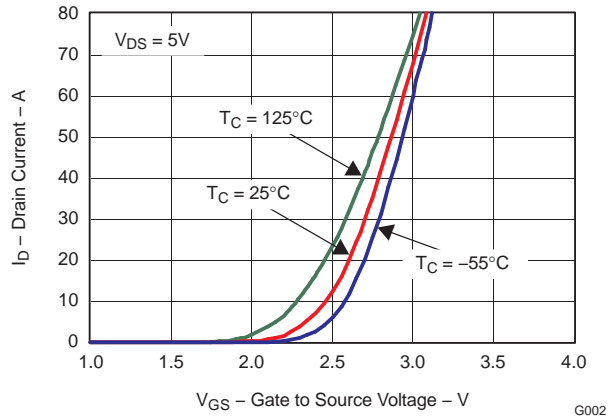


Figure 3. Transfer Characteristics

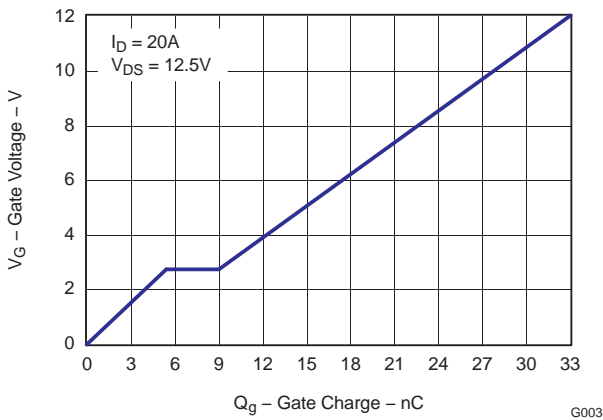


Figure 4. Gate Charge

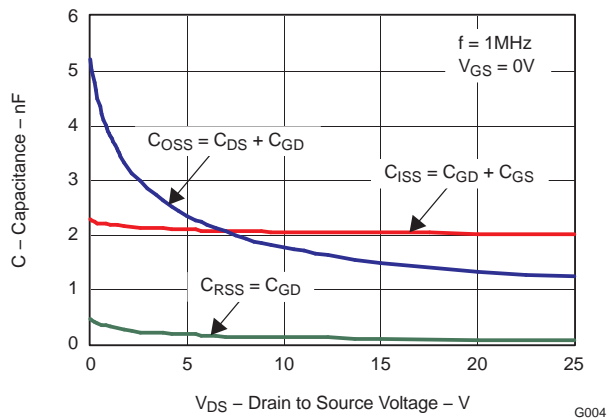


Figure 5. Capacitance

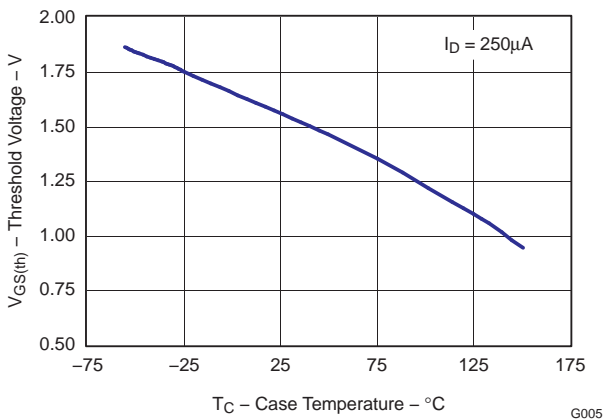


Figure 6. Threshold Voltage vs Temperature

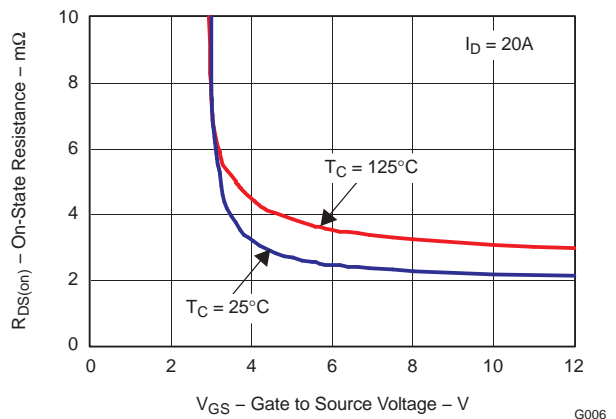


Figure 7. On Resistance vs Gate Voltage

TYPICAL MOSFET CHARACTERISTICS (continued)

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

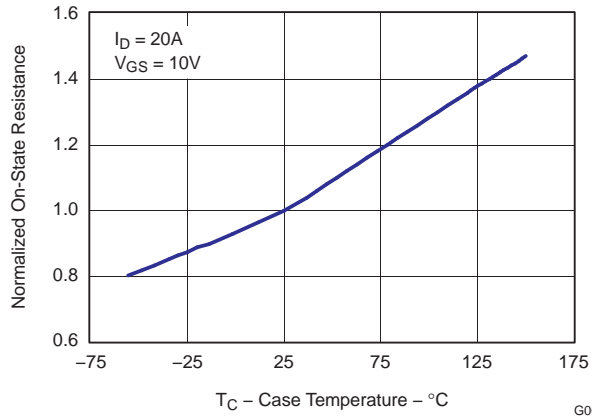


Figure 8. On Resistance vs Temperature

G007

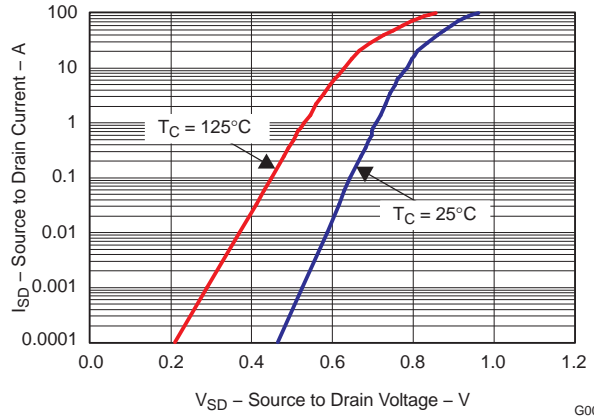


Figure 9. Typical Diode Forward Voltage

G008

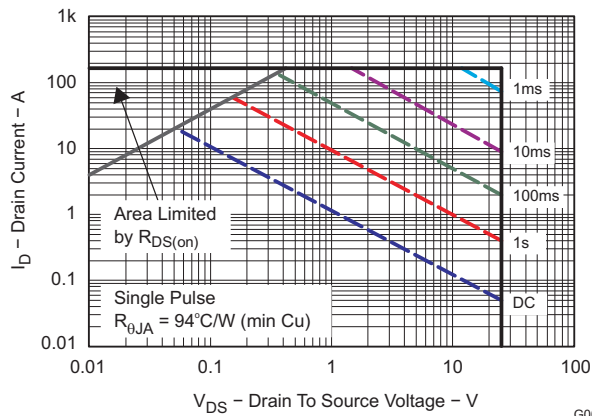


Figure 10. Maximum Safe Operating Area

G009

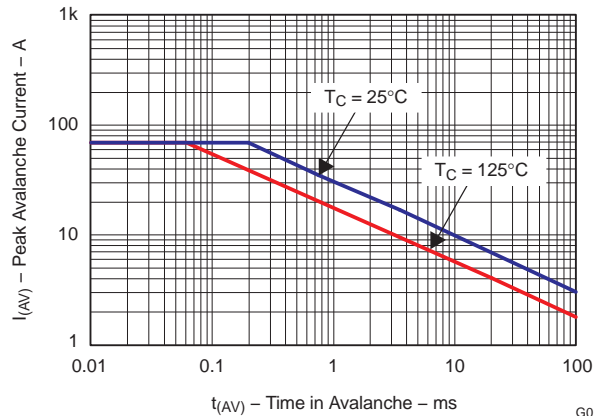


Figure 11. Single Pulse Unclamped Inductive Switching

G010

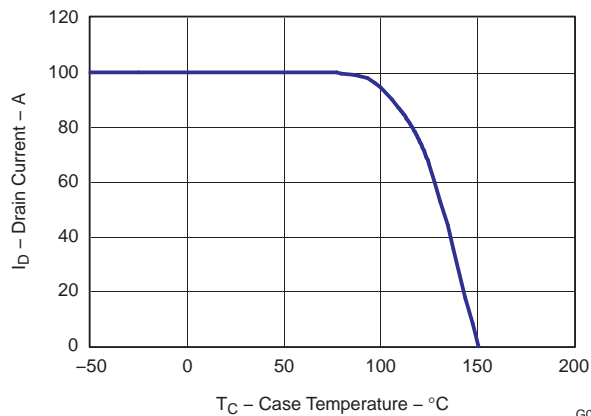


Figure 12. Maximum Drain Current vs Temperature

G011

MECHANICAL DATA

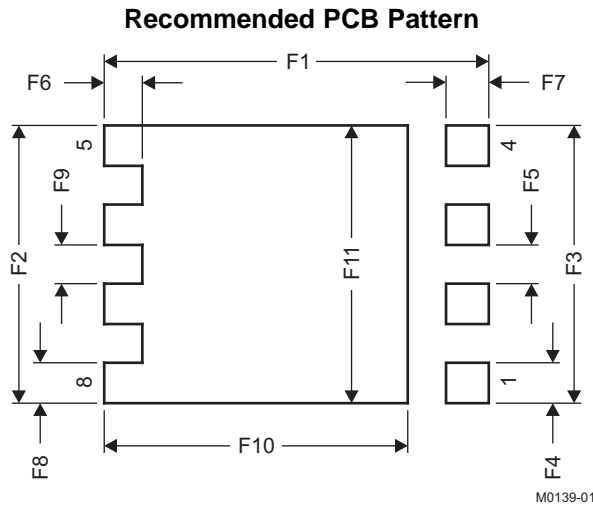
Q5A Package Dimensions



M0135-01

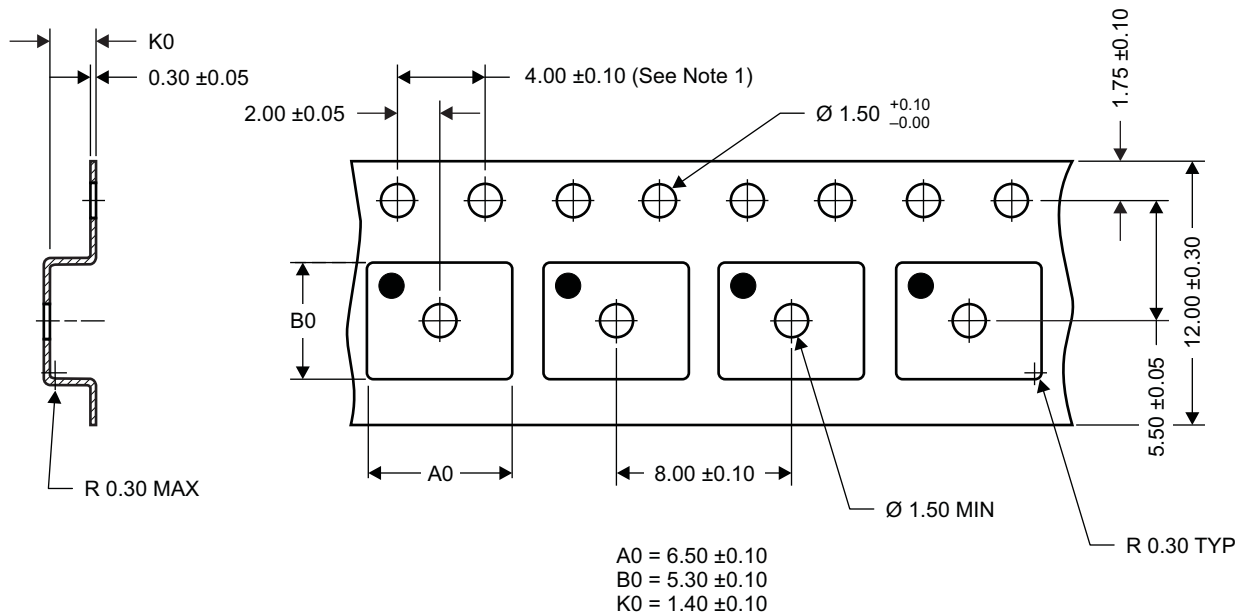
| DIM | MILLIMETERS | | |
|----------|-------------|------|------|
| | MIN | NOM | MAX |
| A | 0.90 | 1.00 | 1.10 |
| b | 0.33 | 0.41 | 0.51 |
| c | 0.20 | 0.25 | 0.30 |
| D1 | 4.80 | 4.90 | 5.00 |
| D2 | 3.61 | 3.81 | 3.96 |
| E | 5.90 | 6.00 | 6.10 |
| E1 | 5.70 | 5.75 | 5.80 |
| E2 | 3.38 | 3.58 | 3.78 |
| e | 1.27 BSC | | |
| H | 0.41 | 0.51 | 0.61 |
| K | 1.10 | | |
| L | 0.51 | 0.61 | 0.71 |
| L1 | 0.06 | 0.13 | 0.20 |
| θ | 0° | | 12° |

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



| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|-------|--------|-------|
| | MIN | MAX | MIN | MAX |
| F1 | 6.205 | 6.305 | 0.244 | 0.248 |
| F2 | 4.46 | 4.56 | 0.176 | 0.18 |
| F3 | 4.46 | 4.56 | 0.176 | 0.18 |
| F4 | 0.65 | 0.7 | 0.026 | 0.028 |
| F5 | 0.62 | 0.67 | 0.024 | 0.026 |
| F6 | 0.63 | 0.68 | 0.025 | 0.027 |
| F7 | 0.7 | 0.8 | 0.028 | 0.031 |
| F8 | 0.65 | 0.7 | 0.026 | 0.028 |
| F9 | 0.62 | 0.67 | 0.024 | 0.026 |
| F10 | 4.9 | 5 | 0.193 | 0.197 |
| F11 | 4.46 | 4.56 | 0.176 | 0.18 |

Q5A Tape and Reel Information



Notes:

1. 10 sprocket hole pitch cumulative tolerance ±0.2
2. Camber not to exceed 1mm IN 100mm, noncumulative over 250mm
3. Material:black static dissipative polystyrene
4. All dimensions are in mm (unless otherwise specified)
5. A0 and B0 measured on a plane 0.3mm above the bottom of the pocket
6. MSL1 260°C (IR and Convection) PbF Reflow Compatible

REVISION HISTORY

Changes from Original (August 2009) to Revision A

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 |
|-------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| CSD16403Q5A | SON | DQJ | 8 | 2500 | 330.0 | 12.4 | 6.3 | 5.3 | 1.2 | 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) |
|-------------|--------------|-----------------|------|------|-------------|------------|-------------|
| CSD16403Q5A | SON | DQJ | 8 | 2500 | 340.0 | 340.0 | 38.0 |

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