

N-Channel NexFET™ Power MOSFET

 Check for Samples: [CSD16401Q5](#)

FEATURES

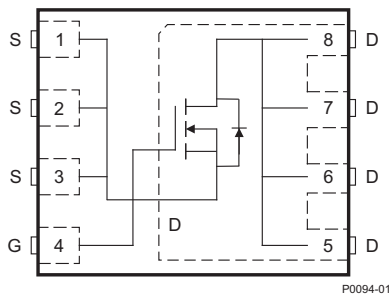
- **Ultralow Qg and Qgd**
- **Low Thermal Resistance**
- **Avalanche Rated**
- **SON 5-mm × 6-mm Plastic Package**

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)	21	nC
Q_{gd}	Gate charge, gate-to-drain	5.2	nC
$r_{DS(on)}$	Drain-to-source on-resistance	$V_{GS} = 4.5\text{ V}$	1.8 mΩ
		$V_{GS} = 10\text{ V}$	1.3 mΩ
$V_{GS(th)}$	Threshold voltage	1.5	V

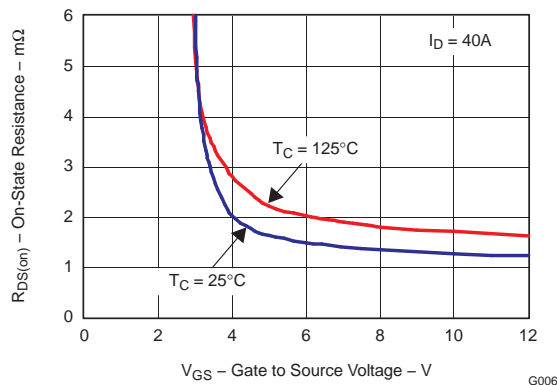
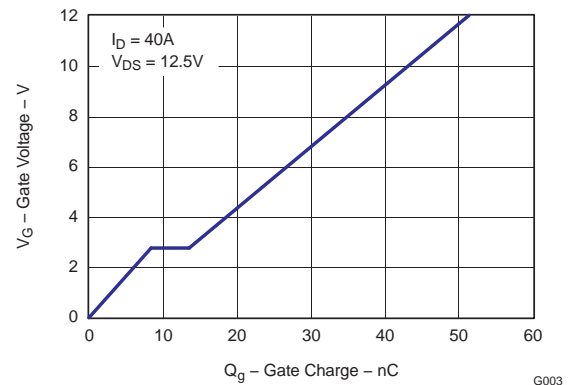
ORDERING INFORMATION

Device	Package	Media	Qty	Ship
CSD16401Q5	SON 5-mm × 6-mm plastic package	13-inch (33-cm) 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	-12 to 16	V
I_D	Continuous drain current, $T_C = 25^\circ\text{C}$	100	A
	Continuous drain current ⁽¹⁾	38	A
I_{DM}	Pulsed drain current, $T_A = 25^\circ\text{C}$ ⁽²⁾	240	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 $I_D = 100\text{ A}$, $L = 0.1\text{ mH}$, $R_G = 25\ \Omega$	500	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)

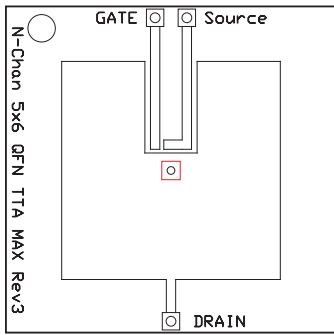
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Static Characteristics						
B _V DSS	Drain-to-source voltage	V _{GS} = 0 V, I _D = 250 μA	25			V
I _{DSS}	Drain-to-source leakage current	V _{GS} = 0 V, V _{DS} = 20 V			1	μA
I _{GSS}	Gate-to-source leakage current	V _{DS} = 0 V, V _{GS} = -12 V to 16 V			100	nA
V _{GS(th)}	Gate-to-source threshold voltage	V _{DS} = V _{GS} , I _D = 250 μA	1.2	1.5	1.9	V
r _{DS(on)}	Drain-to-source on-resistance	V _{GS} = 4.5 V, I _D = 40 A		1.8	2.3	mΩ
		V _{GS} = 10 V, I _D = 40 A		1.3	1.6	mΩ
g _{fs}	Transconductance	V _{DS} = 15 V, I _D = 40 A		168		S
Dynamic Characteristics						
C _{ISS}	Input capacitance	V _{GS} = 0 V, V _{DS} = 12.5 V, f = 1 MHz		3150	4100	pF
C _{OSS}	Output capacitance			2530	3300	pF
C _{RSS}	Reverse transfer capacitance			175	230	pF
R _g	Series gate resistance		1.2	2.4		Ω
Q _g	Gate charge total (4.5 V)	V _{DS} = 12.5 V, I _D = 40 A		21	29	nC
Q _{gd}	Gate charge, gate-to-drain			5.2		nC
Q _{gs}	Gate charge, gate-to-source			8.3		nC
Q _{g(th)}	Gate charge at V _{th}			4.8		nC
Q _{OSS}	Output charge	V _{DS} = 15 V, V _{GS} = 0 V		55		nC
t _{d(on)}	Turnon delay time	V _{DS} = 12.5 V, V _{GS} = 4.5 V, I _D = 40 A R _G = 2 Ω		16.6		ns
t _r	Rise time			30		ns
t _{d(off)}	Turnoff delay time			20		ns
t _f	Fall time			12.7		ns
Diode Characteristics						
V _{SD}	Diode forward voltage	I _S = 40 A, V _{GS} = 0 V	0.85		1	V
Q _{rr}	Reverse recovery charge	V _{DD} = 15 V, I _F = 40 A, di/dt = 300 A/μs		72		nC
t _{rr}	Reverse recovery time	V _{DD} = 15 V, I _F = 40 A, di/dt = 300 A/μs		45		ns

THERMAL CHARACTERISTICS

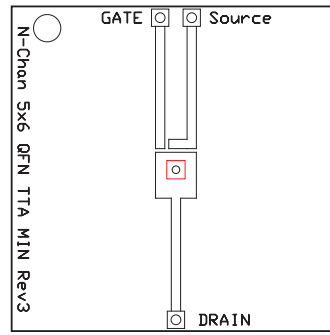
(T_A = 25°C unless otherwise stated)

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)}			50	°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 × 1.5-inch (3.81-cm × 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.



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.



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)

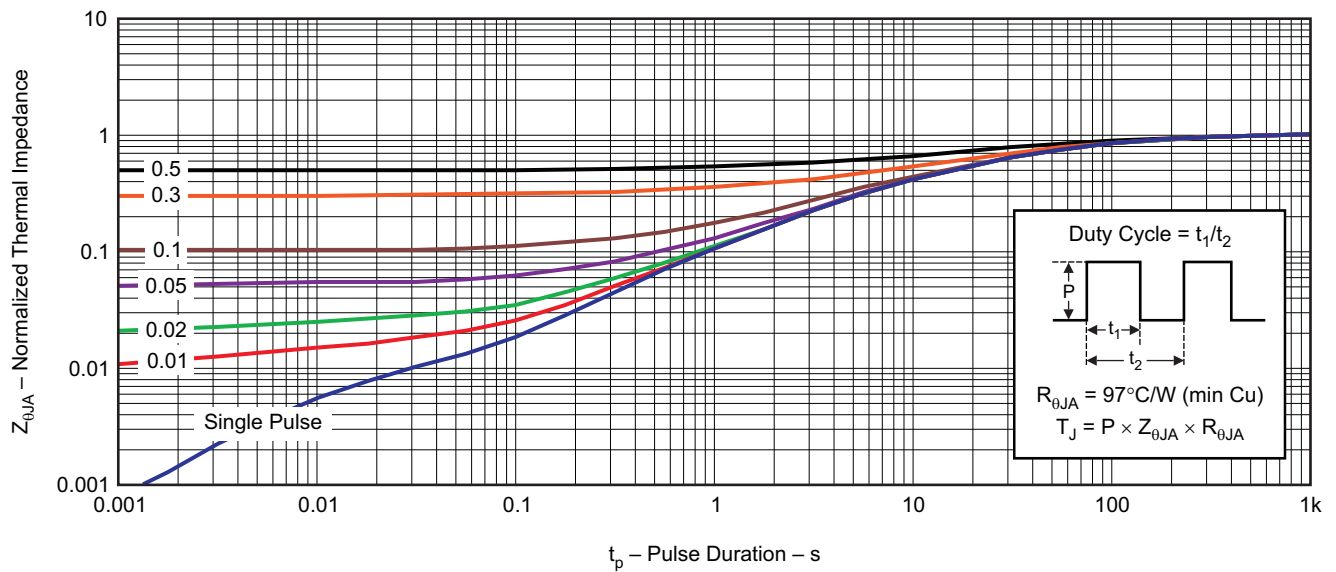


Figure 1. Transient Thermal Impedance

G012

TYPICAL MOSFET CHARACTERISTICS (continued)

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

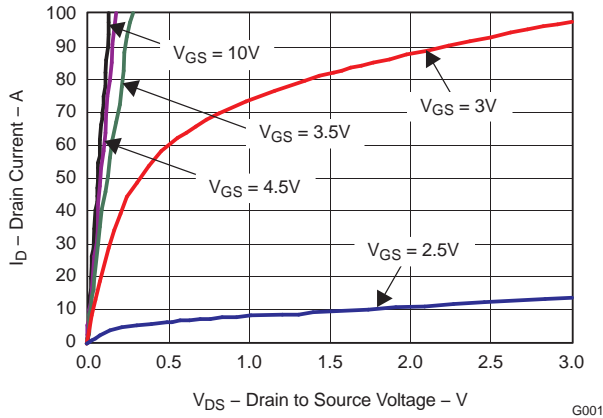


Figure 2. Saturation Characteristics

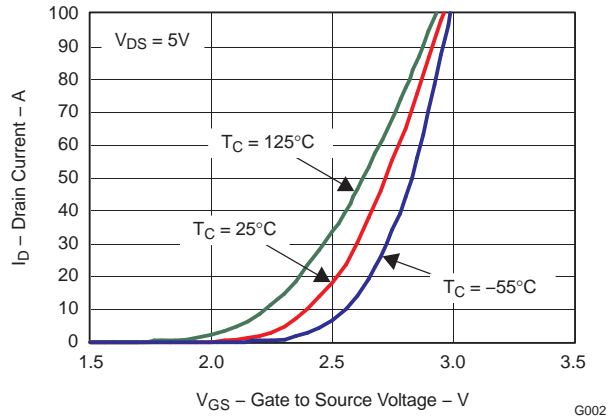


Figure 3. Transfer Characteristics

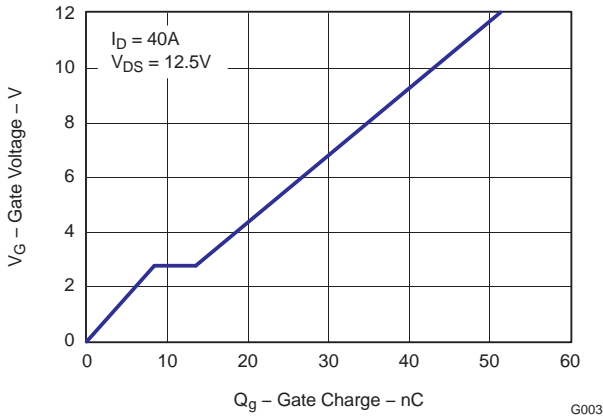


Figure 4. Gate Charge

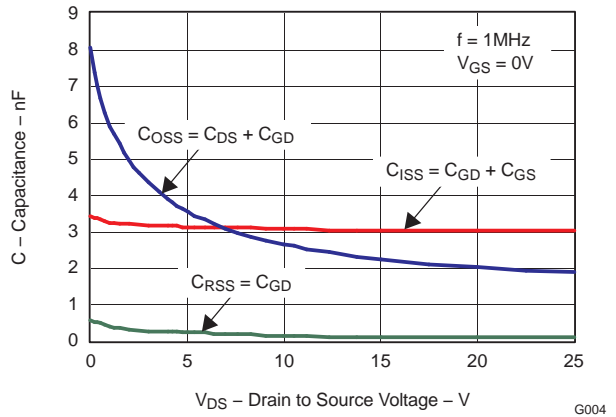


Figure 5. Capacitance

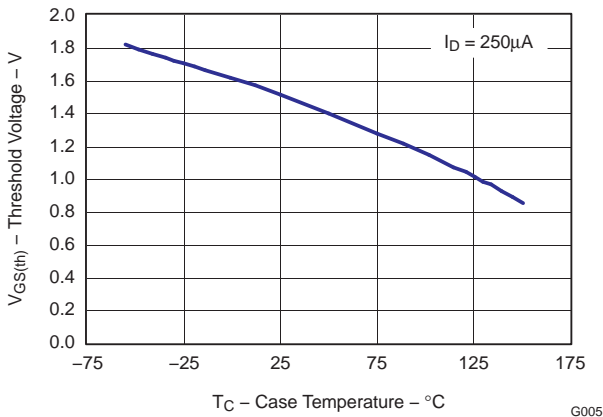


Figure 6. Threshold Voltage vs. Temperature

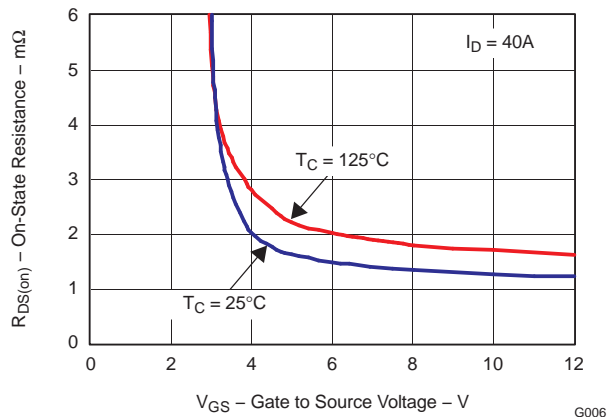


Figure 7. On-Resistance vs. Gate Voltage

TYPICAL MOSFET CHARACTERISTICS (continued)

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

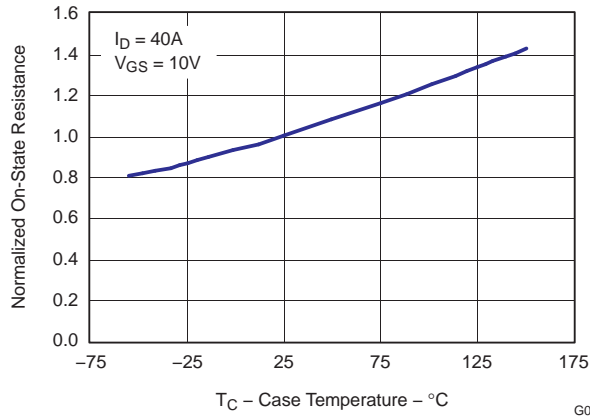


Figure 8. On-Resistance vs. Temperature

G007

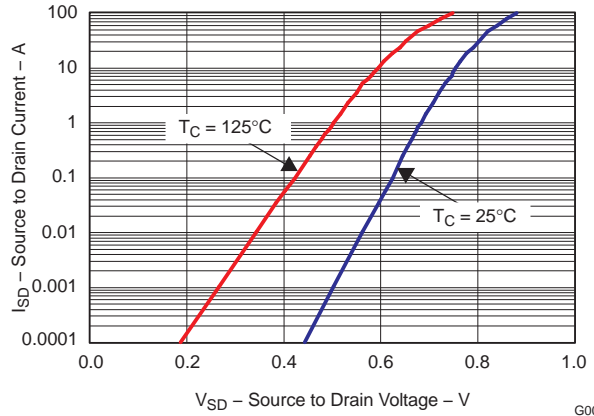


Figure 9. Typical Diode Forward Voltage

G008

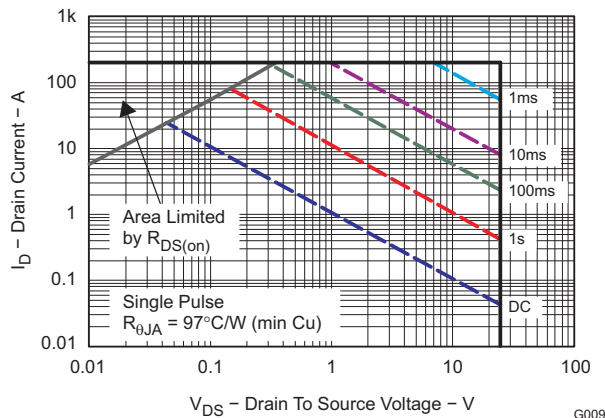


Figure 10. Maximum Safe Operating Area

G009

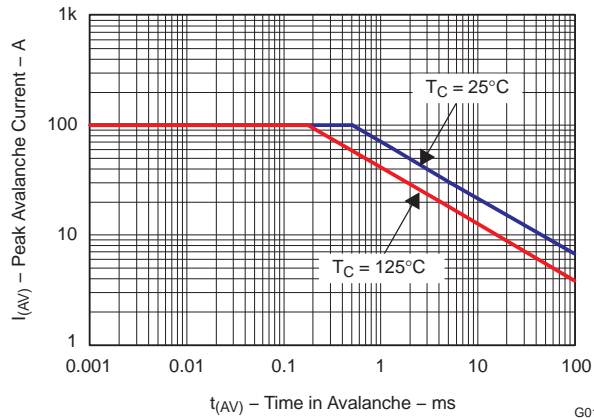


Figure 11. Single-Pulse Unclamped Inductive Switching

G010

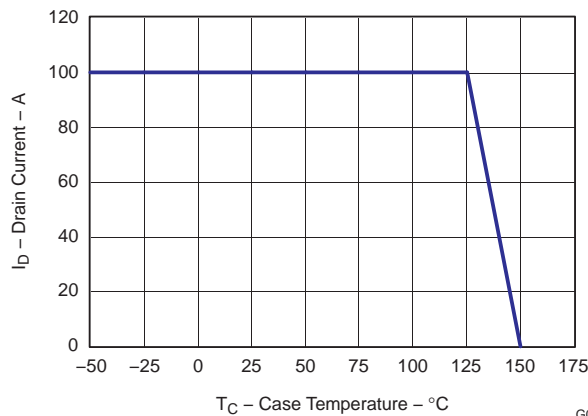
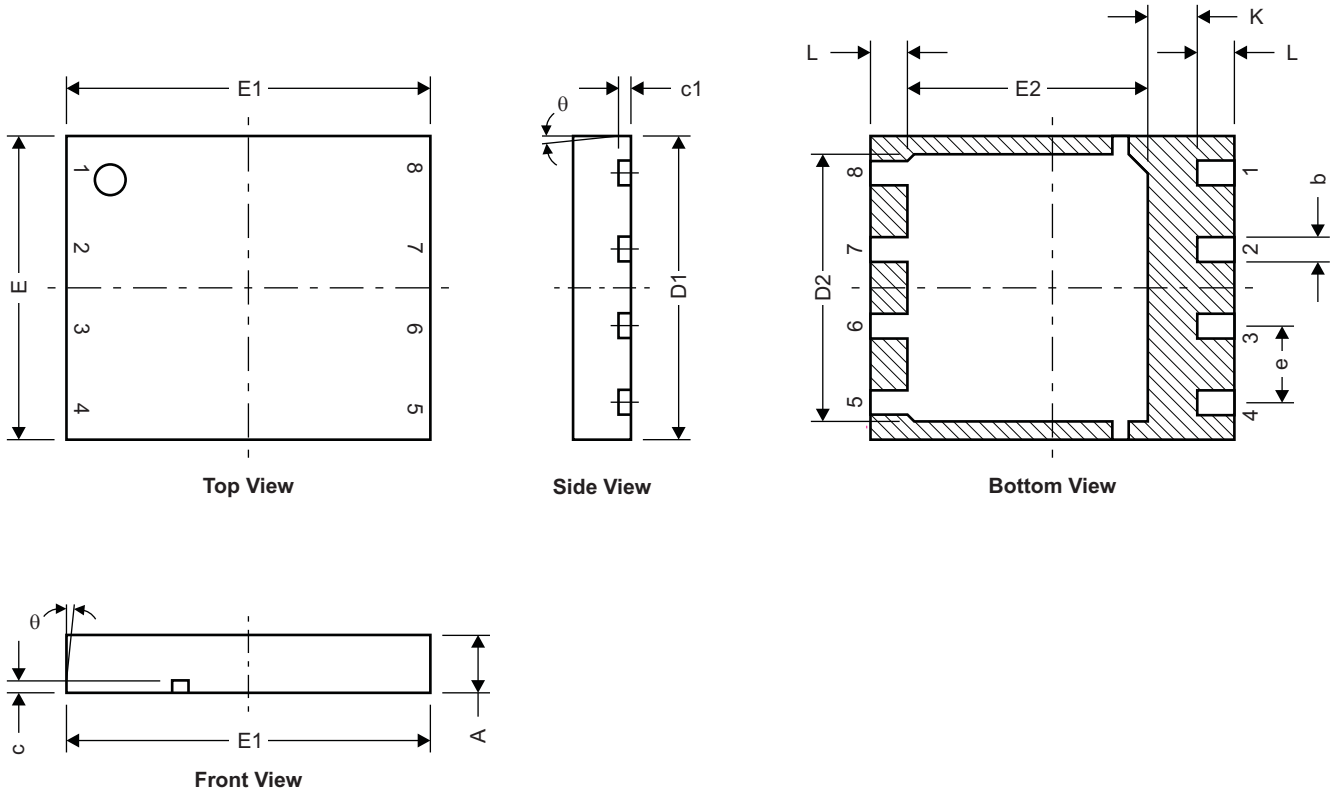


Figure 12. Maximum Drain Current vs. Temperature

G011

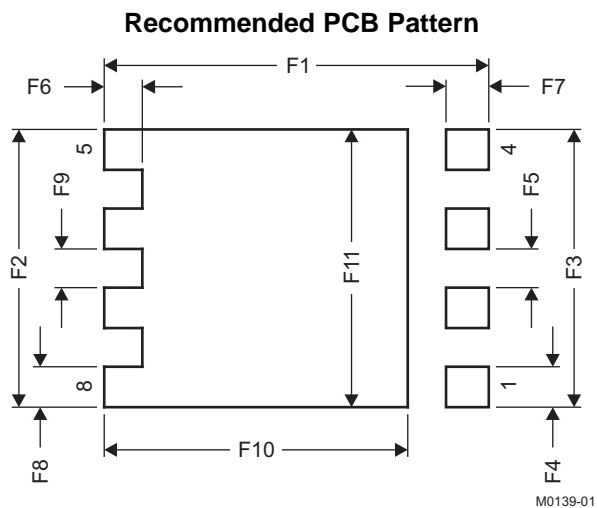
MECHANICAL DATA

Q5 Package Dimensions



M0140-01

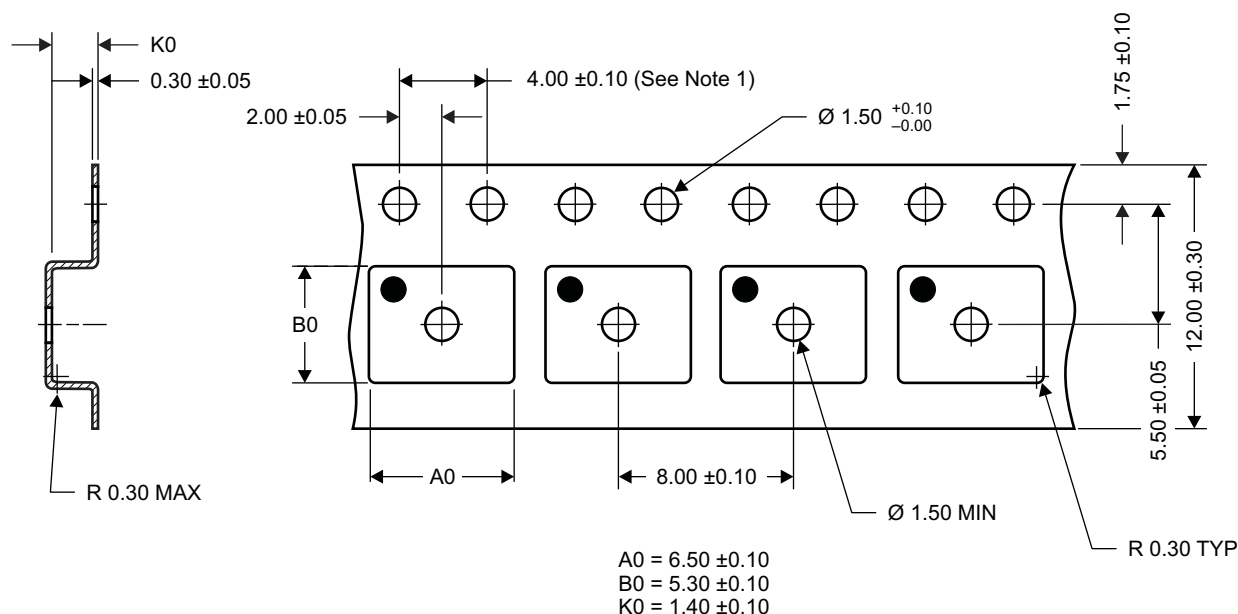
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.950	1.050	0.037	0.039
b	0.360	0.460	0.014	0.018
c	0.150	0.250	0.006	0.010
c1	0.150	0.250	0.006	0.010
D1	4.900	5.100	0.193	0.201
D2	4.320	4.520	0.170	0.178
E	4.900	5.100	0.193	0.201
E1	5.900	6.100	0.232	0.240
E2	3.920	4.12	0.154	0.162
e	1.27 TYP		0.050	
K	0.760		0.030	
L	0.510	0.710	0.020	0.028
θ	0.00			



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](#).

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)
- A0 and B0 measured on a plane 0.3 mm above the bottom of the pocket
- 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 <i>Package Marking Information</i> section at the end of the 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
CSD16401Q5	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)
CSD16401Q5	SON	DQH	8	2500	335.0	335.0	32.0

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