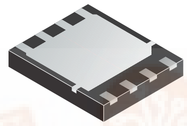


N-Channel NexFET™ Power MOSFET

Check for Samples: CSD16401Q5

FEATURES

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

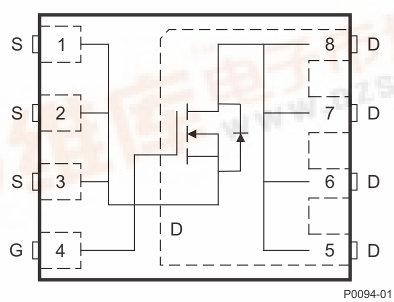
APPLICATIONS

- **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 V	1.8	mΩ
		V_{GS} = 10 V	1.3	mΩ
$V_{GS(th)}$	Threshold voltage	1.5		V

ORDERING INFORMATION

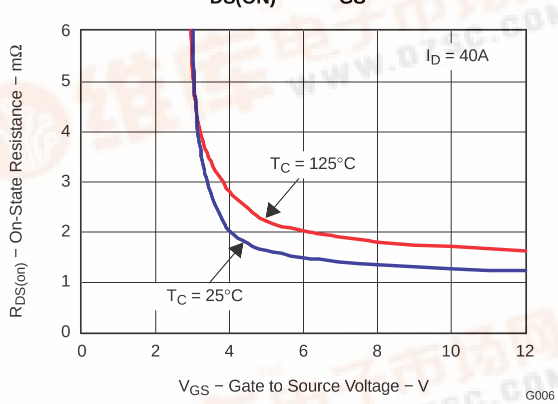
Device	Package	Media	Qty	Ship
CSD16401Q5	SON 5-mm × 6-mm plastic package	13-inch (33-cm) reel	2500	Tape and reel

ABSOLUTE MAXIMUM RATINGS

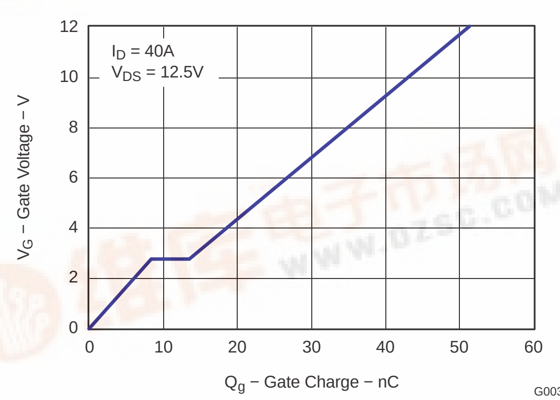
T_A = 25°C unless otherwise stated		VALUE	UNIT
V_{DS}	Drain-to-source voltage	25	V
V_{GS}	Gate-to-source voltage	–12 to 16	V
I_D	Continuous drain current, T_C = 25°C	100	A
	Continuous drain current(1)	38	A
I_{DM}	Pulsed drain current, T_A = 25°C(2)	240	A
P_D	Power dissipation(1)	3.1	W
T_J, T_{STG}	Operating junction and storage temperature range	–55 to 150	°C
E_{AS}	Avalanche energy, single-pulse I_D = 100 A, L = 0.1 mH, R_G = 25 Ω	500	mJ

(1) $R_{\theta JA}$ = 40°C/W on 1-in^2 (6.45-cm^2) Cu [2 oz. (0.071-mm thick)] on 0.060-inch (1.52-mm) thick FR4 PCB.
(2) Pulse duration ≤300 μs, duty cycle ≤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						
BV_{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, ID = 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
Qg(th)	Gate charge at Vth			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

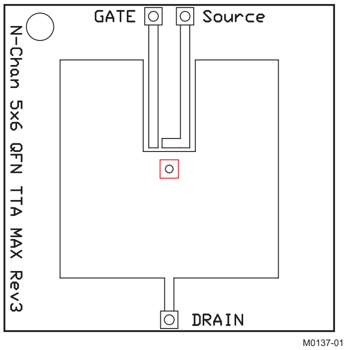
THERMAL CHARACTERISTICS

(T_A = 25°C unless otherwise stated)

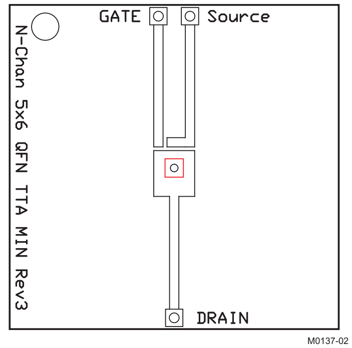
PARAMETER		MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Thermal resistance, junction-to-case (1)			1.1	°C/W
$R_{\theta JA}$	Thermal resistance, junction-to-ambient (1) (2)			50	°C/W

(1) $R_{\theta JC}$ 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. $R_{\theta JC}$ is specified by design, whereas $R_{\theta JA}$ is determined by the user's board design.

(2) Device mounted on FR4 material with 1 inch^2 (6.45 cm^2) of 2-oz. (0.071-mm thick) Cu.



Max $R_{\theta JA}$ = 50°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°C/W when mounted on minimum pad area of 2-oz. (0.071-mm thick) Cu.

TYPICAL MOSFET CHARACTERISTICS

(T_A = 25°C unless otherwise stated)

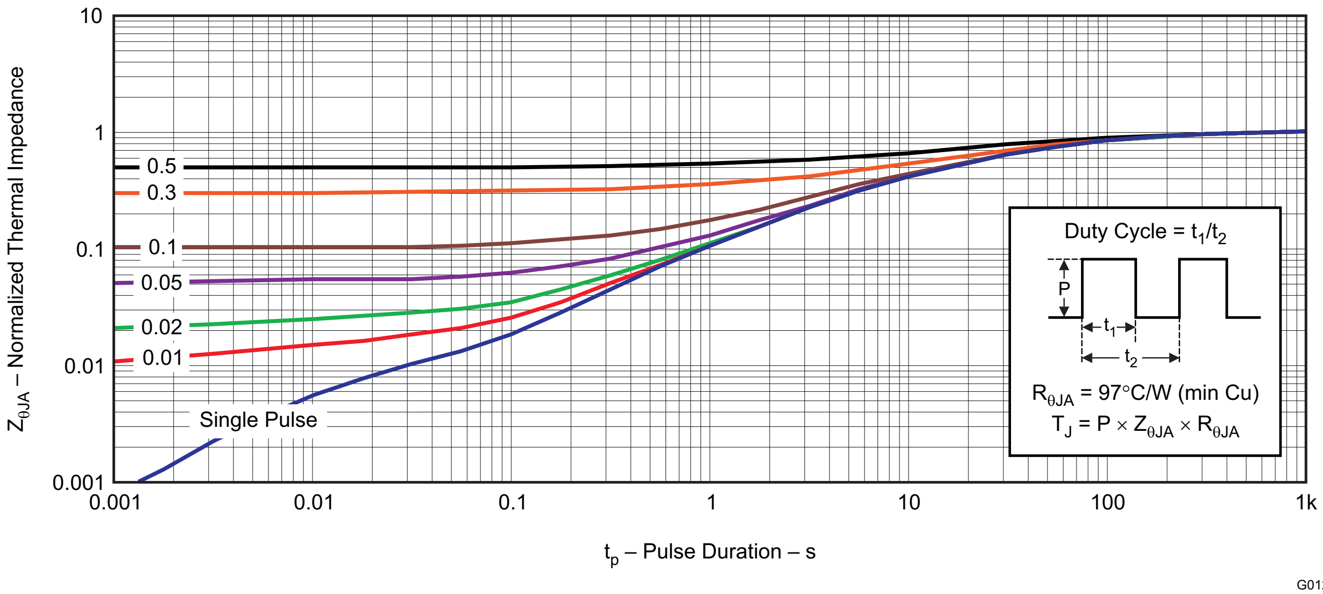


Figure 1. Transient Thermal Impedance

TYPICAL MOSFET CHARACTERISTICS (continued)

(T_A = 25°C unless otherwise stated)

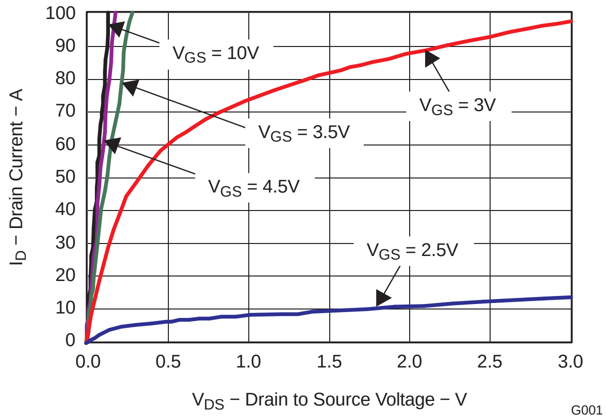


Figure 2. Saturation Characteristics

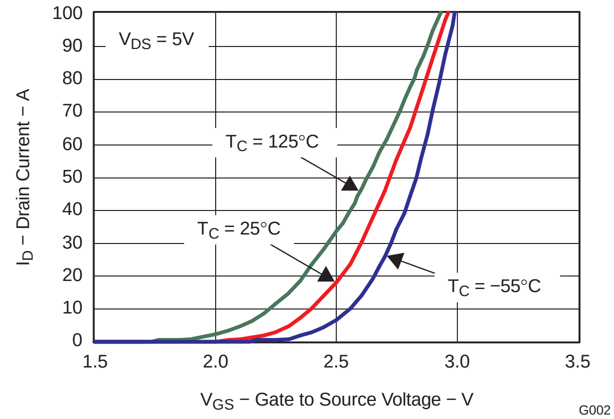


Figure 3. Transfer Characteristics

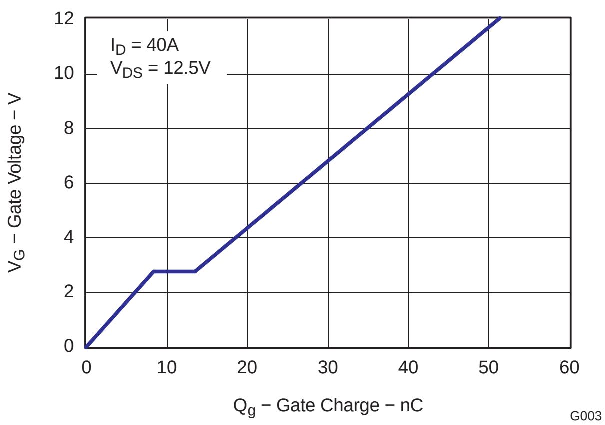


Figure 4. Gate Charge

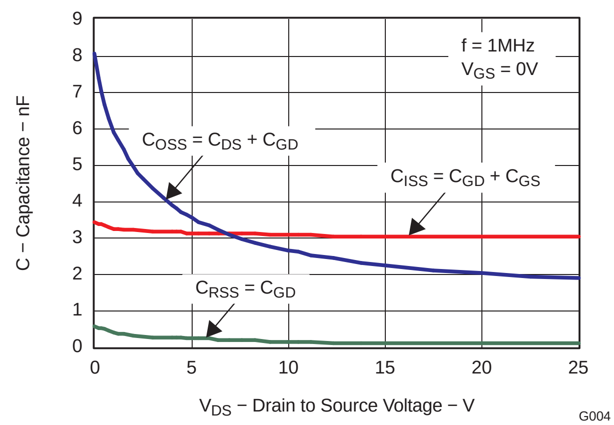


Figure 5. Capacitance

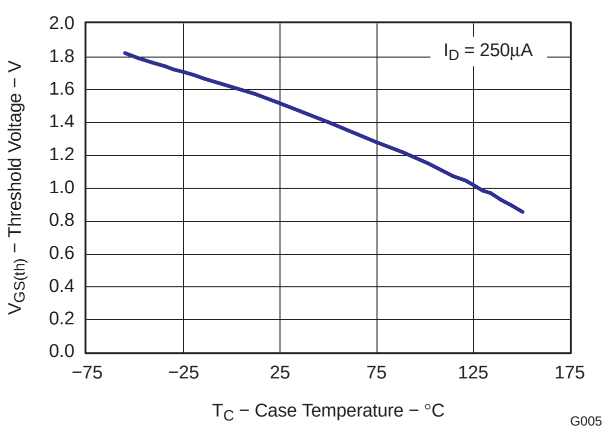


Figure 6. Threshold Voltage vs. Temperature

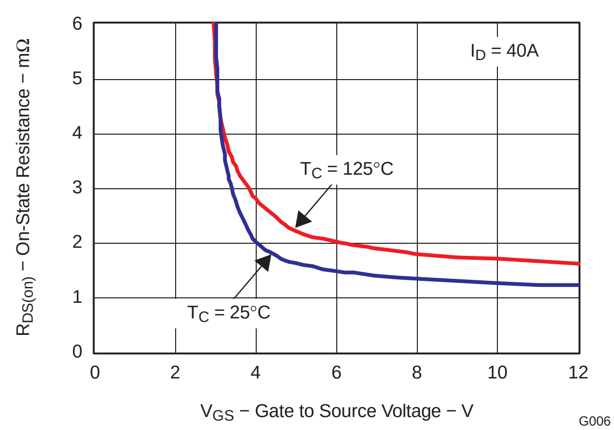


Figure 7. On-Resistance vs. Gate Voltage

TYPICAL MOSFET CHARACTERISTICS (continued)

(T_A = 25°C unless otherwise stated)

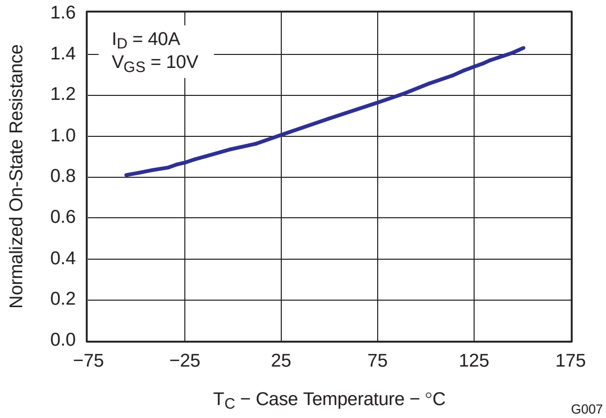


Figure 8. On-Resistance vs. Temperature

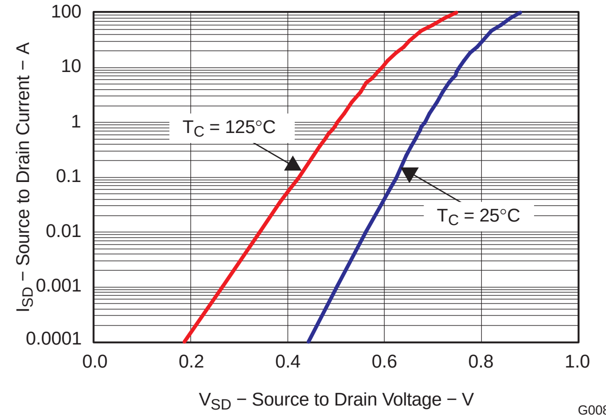


Figure 9. Typical Diode Forward Voltage

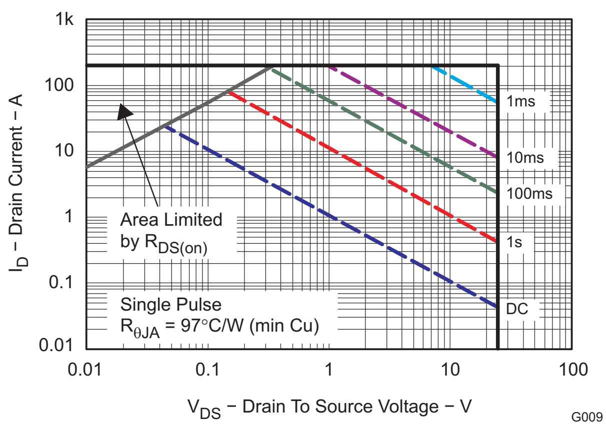


Figure 10. Maximum Safe Operating Area

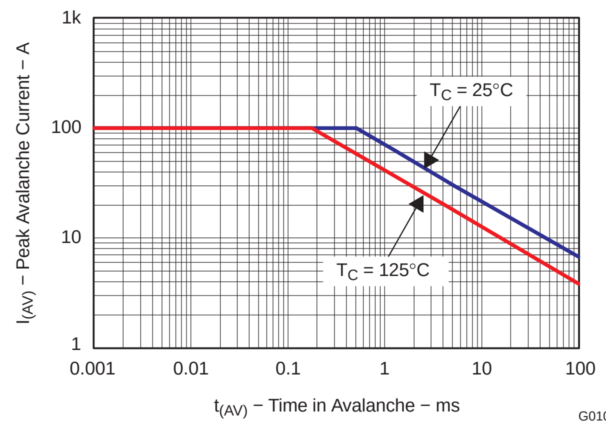


Figure 11. Single-Pulse Unclamped Inductive Switching

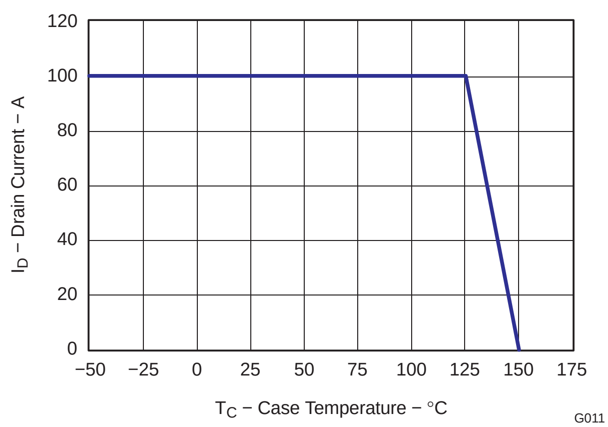
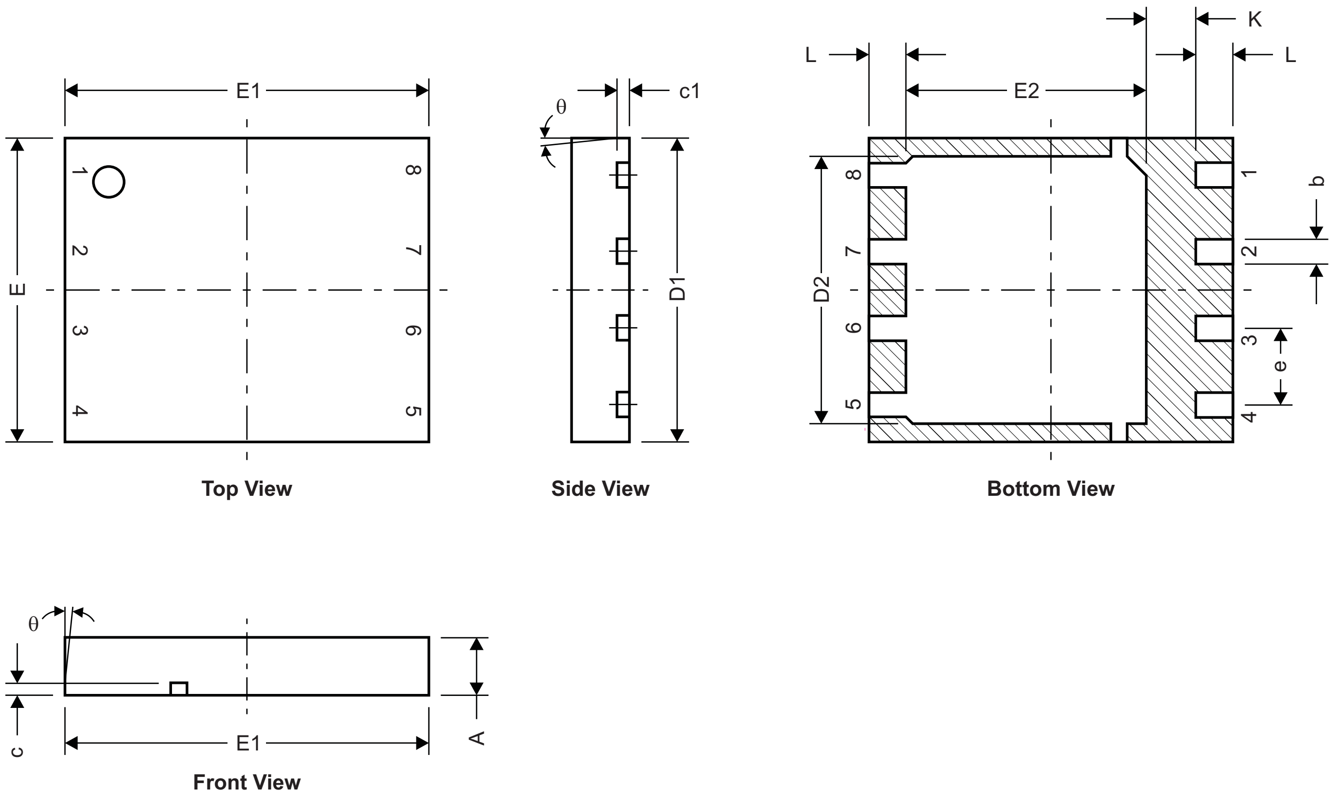


Figure 12. Maximum Drain Current vs. Temperature

MECHANICAL DATA

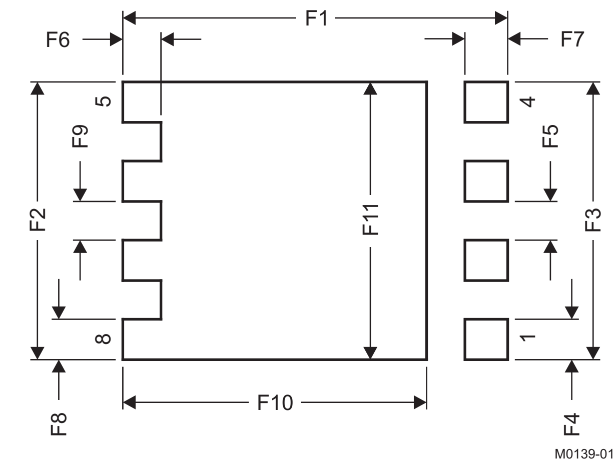
Q5 Package Dimensions



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	
K	0.760		0.030	
L	0.510	0.710	0.020	0.028
θ	0.00			

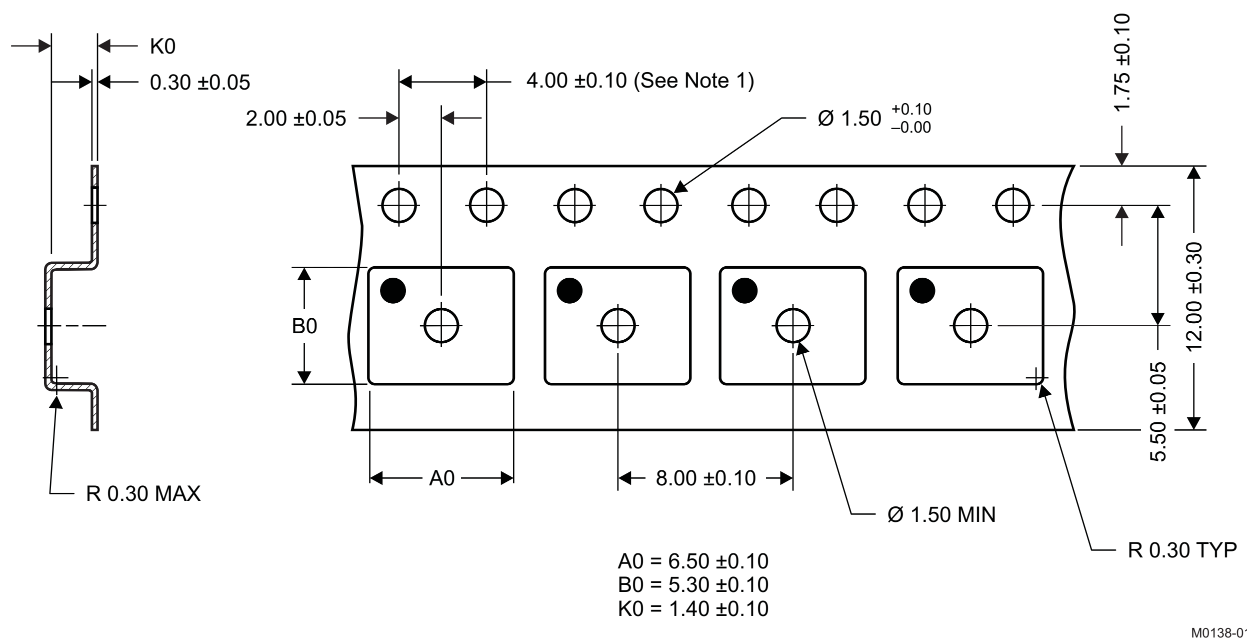
Recommended PCB Pattern



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



Notes:

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

REVISION HISTORY

Changes from Revision Original (August 2009) to Revision A **Page**

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/ Ball Finish	MSL Pea
CSD16401Q5	ACTIVE	SON	DQH	8	2500	Pb-Free (RoHS Exempt)	CU SN	Level-1-260

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.t
information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all
lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable fo
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package,
the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retard
in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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