

## N-Channel NexFET™ Power MOSFETs

 Check for Samples: [CSD16407Q5](#)

### FEATURES

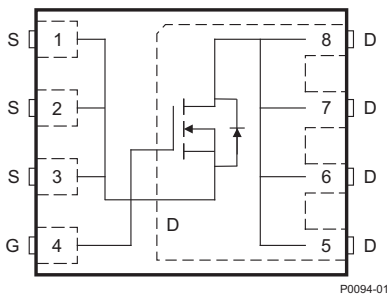
- **Ultralow Qg and Qgd**
- **Low Thermal Resistance**
- **Avalanche Rated**
- **SON 5-mm × 6-mm Plastic Package**

### 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

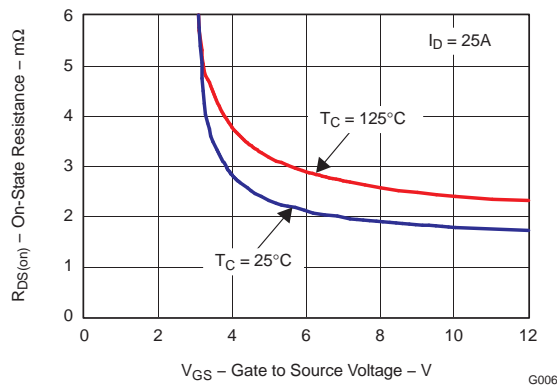
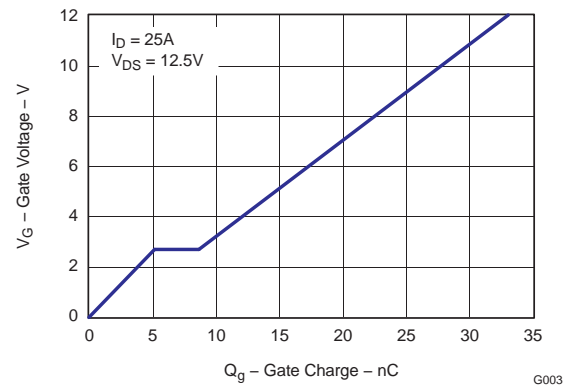
### ORDERING INFORMATION

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 <sup>(1)</sup>	31	A
$I_{DM}$	Pulsed drain current, $T_A = 25^\circ\text{C}$ <sup>(2)</sup>	200	A
$P_D$	Power dissipation <sup>(1)</sup>	3.1	W
$T_J$ , $T_{STG}$	Operating junction and storage temperature range	-55 to 150	°C
$E_{AS}$	Avalanche energy, single pulse $I_D = 66\text{ A}$ , $L = 0.1\text{ mH}$ , $R_G = 25\ \Omega$	218	mJ

- (1)  $R_{\theta JA} = 40^\circ\text{C/W}$  on 1 in<sup>2</sup> (6.45 cm<sup>2</sup>) 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<sub>A</sub> = 25°C unless otherwise stated)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>Static Characteristics</b>						
B <sub>V</sub> DSS	Drain-to-source voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	25			V
I <sub>DSS</sub>	Drain-to-source leakage current	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 20 V			1	μA
I <sub>GSS</sub>	Gate-to-source leakage current	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = 16 V to –12 V			100	nA
V <sub>GS(th)</sub>	Gate-to-source threshold voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	1.3	1.6	1.9	V
r <sub>DS(on)</sub>	Drain-to-source on-resistance	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 25 A		2.5	3.3	mΩ
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 25 A		1.8	2.4	mΩ
g <sub>fs</sub>	Transconductance	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 25 A		111		S
<b>Dynamic Characteristics</b>						
C <sub>ISS</sub>	Input capacitance	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 12.5 V, f = 1 MHz		2040	2660	pF
C <sub>OSS</sub>	Output capacitance			1600	2080	pF
C <sub>RSS</sub>	Reverse transfer capacitance			115	160	pF
R <sub>g</sub>	Series gate resistance	V <sub>DS</sub> = 12.5 V, I <sub>D</sub> = 25 A		1.2	2.4	Ω
Q <sub>g</sub>	Gate charge total (4.5 V)			13.3	18	nC
Q <sub>gd</sub>	Gate charge, gate-to-drain			3.5		nC
Q <sub>gs</sub>	Gate charge, gate-to-source			5.3		nC
Q <sub>g(th)</sub>	Gate charge at V <sub>th</sub>			3.1		nC
Q <sub>OSS</sub>	Output charge	V <sub>DS</sub> = 13.5 V, V <sub>GS</sub> = 0 V		33		nC
t <sub>d(on)</sub>	Turnon delay time	V <sub>DS</sub> = 12.5 V, V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 25 A R <sub>G</sub> = 2 Ω		11.9		ns
t <sub>r</sub>	Rise time			18.4		ns
t <sub>d(off)</sub>	Turnoff delay time			16		ns
t <sub>f</sub>	Fall time			9		ns
<b>Diode Characteristics</b>						
V <sub>SD</sub>	Diode forward voltage	I <sub>S</sub> = 25 A, V <sub>GS</sub> = 0 V		0.8	1	V
Q <sub>rr</sub>	Reverse recovery charge	V <sub>DD</sub> = 13.5 V, I <sub>F</sub> = 25 A, di/dt = 300 A/μs		41		nC
t <sub>rr</sub>	Reverse recovery time	V <sub>DD</sub> = 13.5 V, I <sub>F</sub> = 25 A, di/dt = 300 A/μs		34		ns

## THERMAL CHARACTERISTICS

(T<sub>A</sub> = 25°C unless otherwise stated)

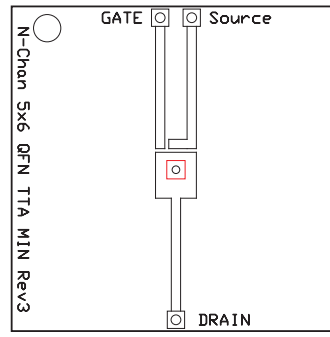
PARAMETER		MIN	TYP	MAX	UNIT
R <sub>θJC</sub>	Thermal resistance, junction-to-case <sup>(1)</sup>			1.1	°C/W
R <sub>θJA</sub>	Thermal resistance, junction-to-ambient <sup>(1) (2)</sup>			51	°C/W

- (1) R<sub>θJC</sub> 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<sub>θJC</sub> is specified by design, whereas R<sub>θJA</sub> is determined by the user's board design.
- (2) Device mounted on FR4 material with 1 inch<sup>2</sup> (6.45 cm<sup>2</sup>) of 2-oz. (0.071-mm thick) Cu.



M0137-01

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

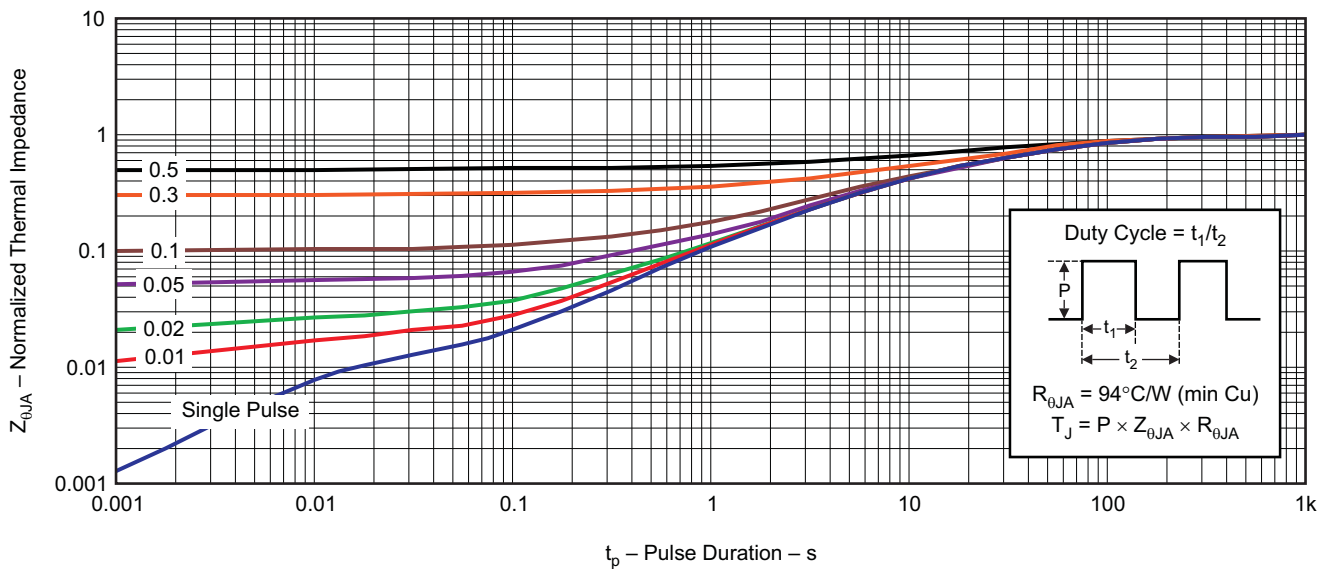


M0137-02

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 stated)

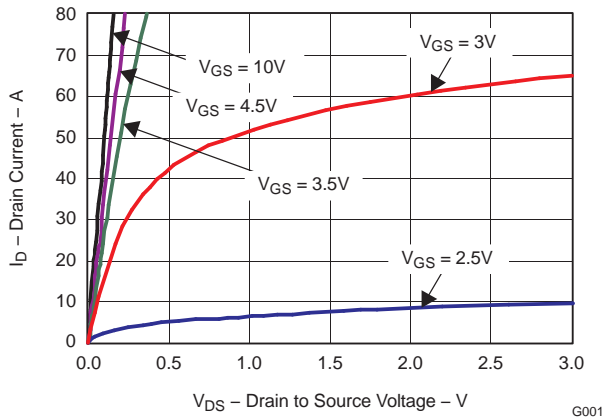


G012

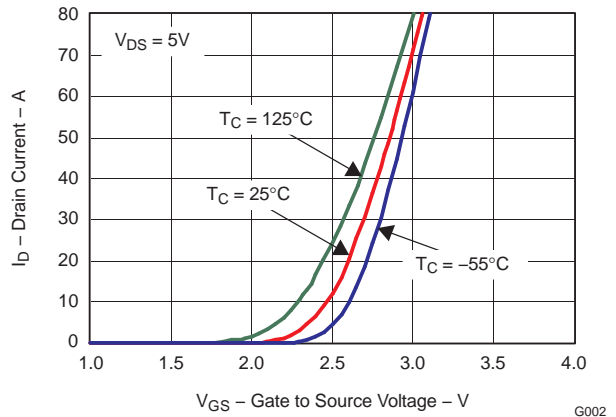
Figure 1. Transient Thermal Impedance

**TYPICAL MOSFET CHARACTERISTICS (continued)**

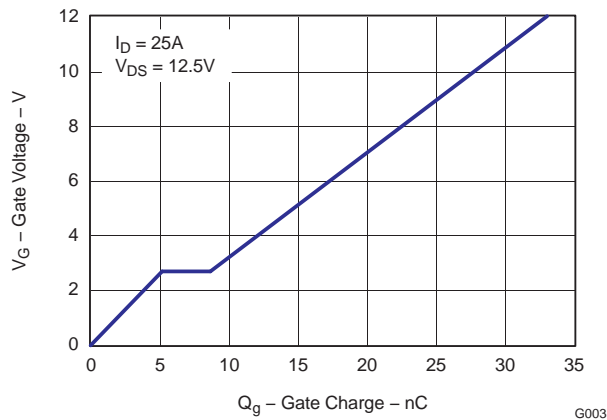
( $T_A = 25^\circ\text{C}$  unless otherwise stated)



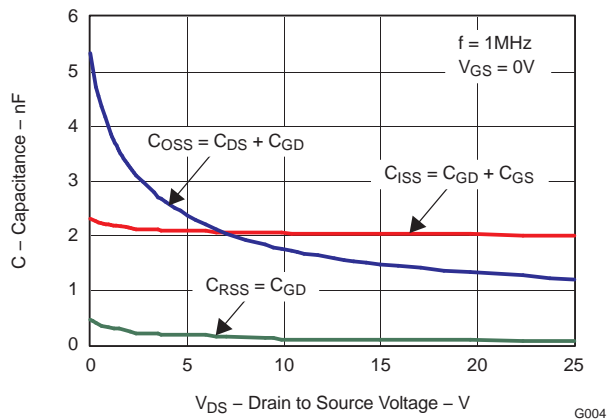
**Figure 2. Saturation Characteristics**



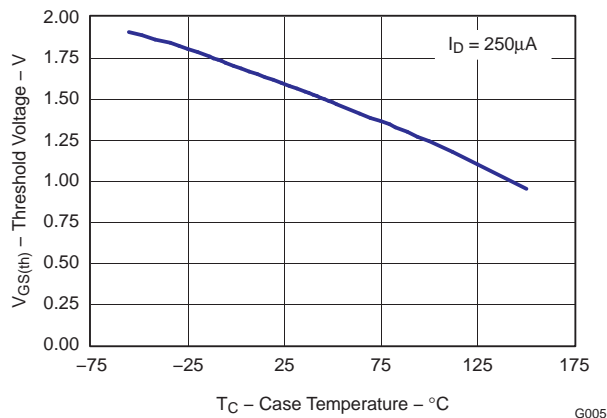
**Figure 3. Transfer Characteristics**



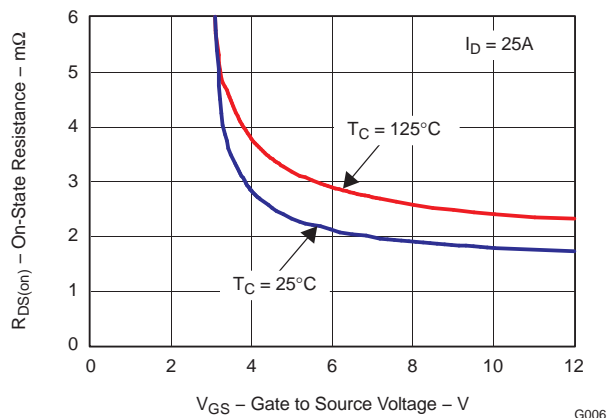
**Figure 4. Gate Charge**



**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)

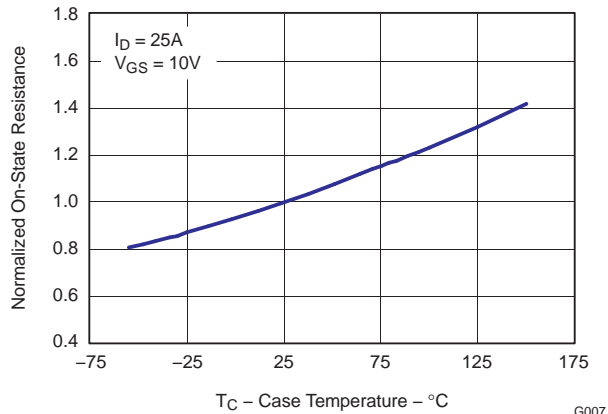


Figure 8. On Resistance vs. Temperature

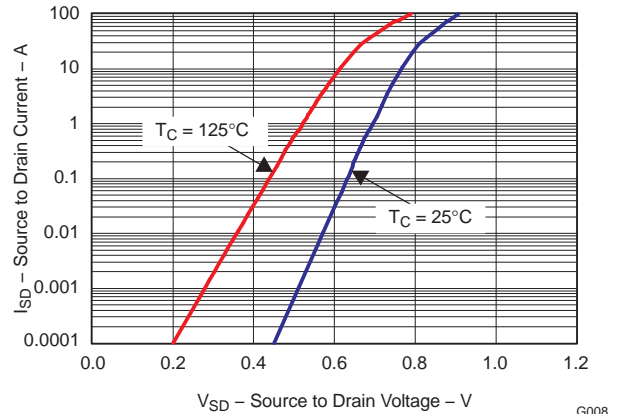


Figure 9. Typical Diode Forward Voltage

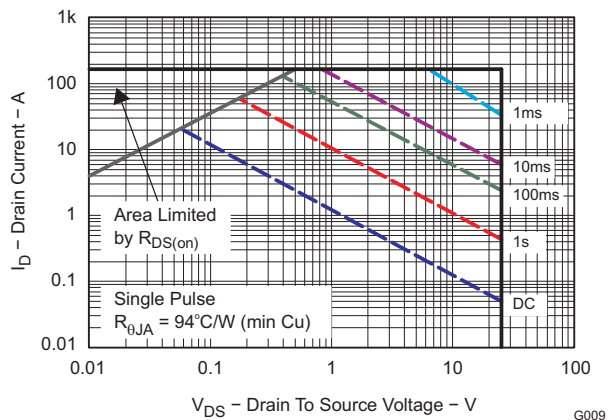


Figure 10. Maximum Safe Operating Area

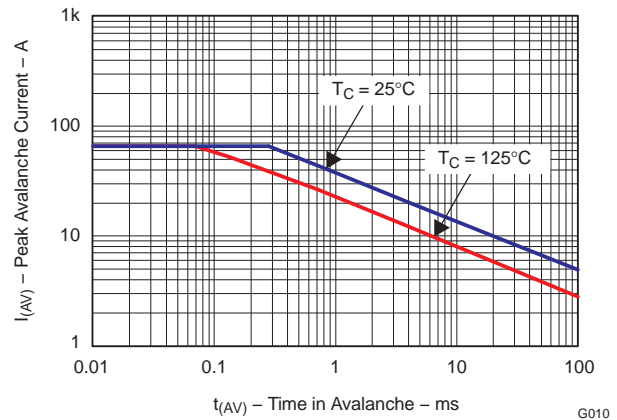


Figure 11. Single Pulse Unclamped Inductive Switching

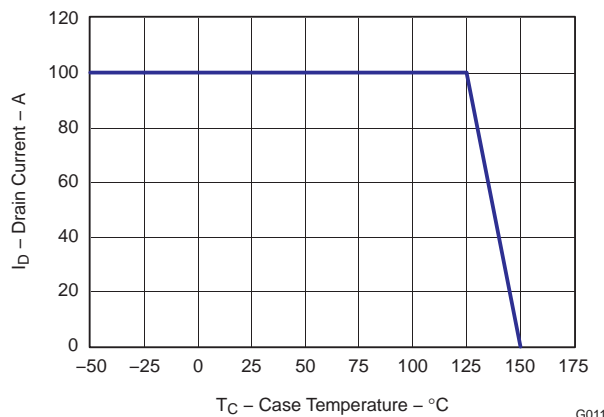
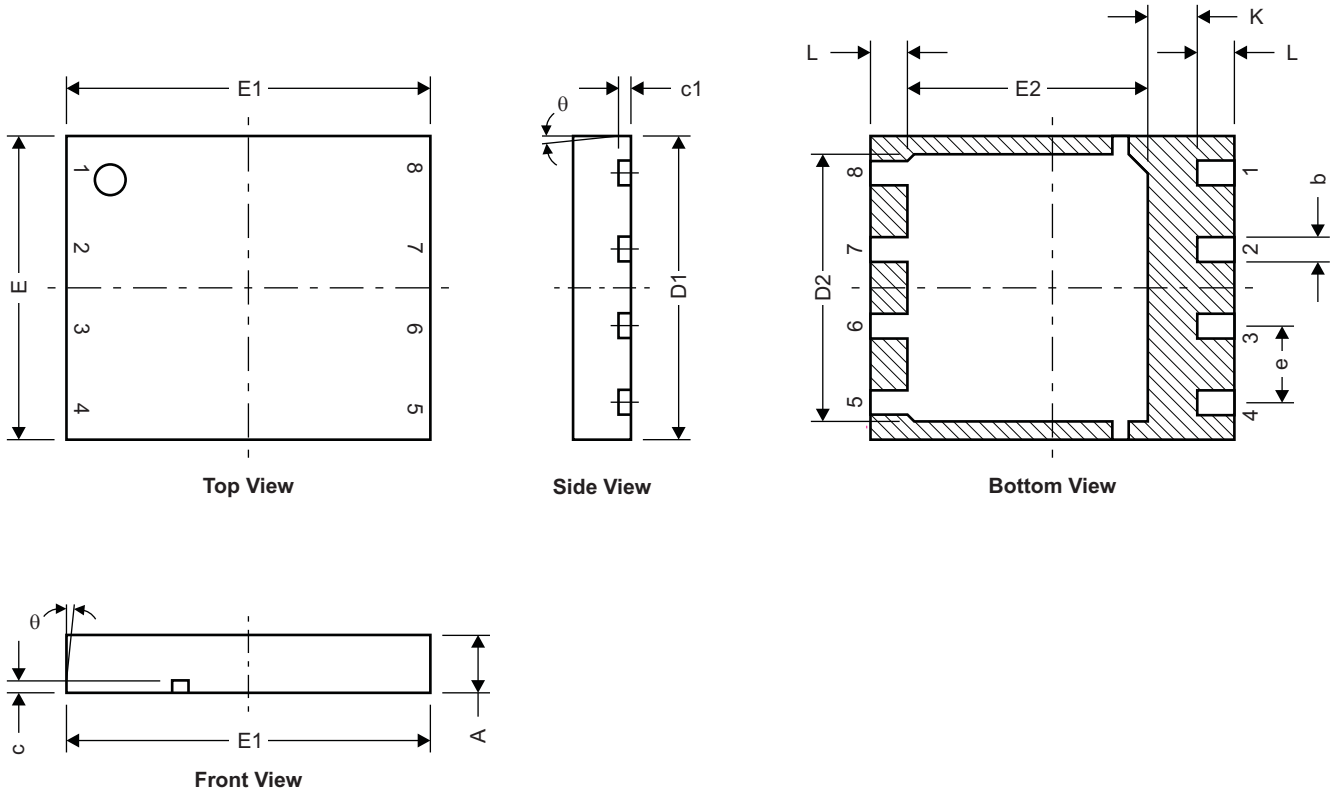


Figure 12. Maximum Drain Current vs. Temperature

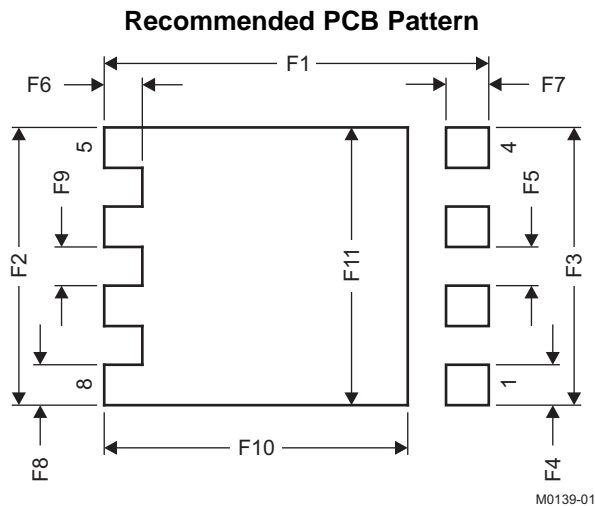
**MECHANICAL DATA**

**Q5 Package Dimensions**



M0140-01

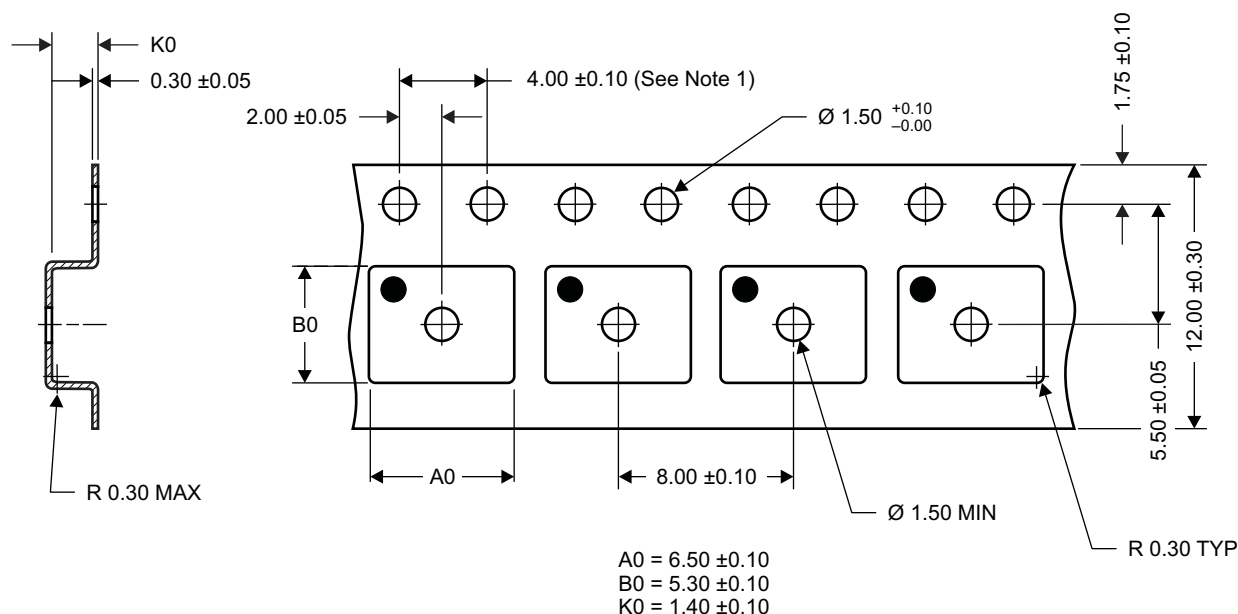
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.950	1.050	0.037	0.039
b	0.360	0.460	0.014	0.018
c	0.150	0.250	0.006	0.010
c1	0.150	0.250	0.006	0.010
D1	4.900	5.100	0.193	0.201
D2	4.320	4.520	0.170	0.178
E	4.900	5.100	0.193	0.201
E1	5.900	6.100	0.232	0.240
E2	3.920	4.12	0.154	0.162
e	1.27 TYP		0.050	
L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



### Notes:

- 10 sprocket hole pitch cumulative tolerance  $\pm 0.2$
- 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:  $0.30 \pm 0.05$  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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### Applications

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Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
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