

# N-Channel NexFET™ Power MOSFETs

 Check for Samples: [CSD16325Q5](#)

## FEATURES

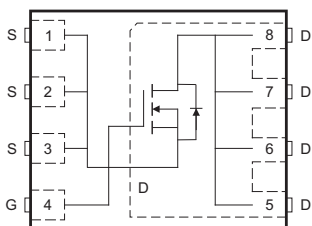
- Optimized for 5V Gate Drive
- Ultralow  $Q_g$  and  $Q_{gd}$
- Low Thermal Resistance
- Avalanche Rated
- Pb Free Terminal Plating
- RoHS Compliant
- Halogen Free
- SON 5-mm x 6-mm Plastic Package

## APPLICATIONS

- Point-of-Load Synchronous Buck 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 and optimized for 5V gate drive applications.

**Top View**


P0094-01

## PRODUCT SUMMARY

$V_{DS}$	Drain to Source Voltage	25	V
$Q_g$	Gate Charge Total (4.5V)	18	nC
$Q_{gd}$	Gate Charge Gate to Drain	3.5	nC
$R_{DS(on)}$	Drain to Source On Resistance	$V_{GS} = 3V$	2.1 mΩ
		$V_{GS} = 4.5V$	1.7 mΩ
		$V_{GS} = 8V$	1.5 mΩ
$V_{GS(th)}$	Threshold Voltage	1.1	V

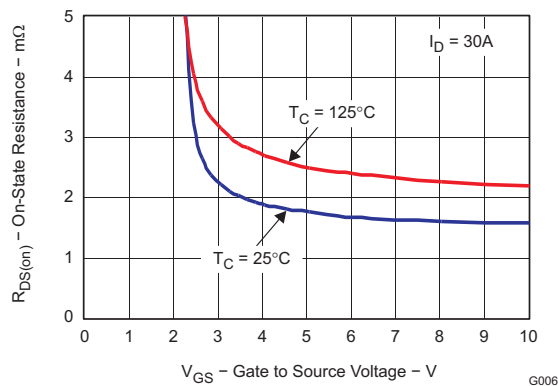
## ORDERING INFORMATION

Device	Package	Media	Qty	Ship
CSD16325Q5	SON 5-mm x 6-mm Plastic Package	13-Inch Reel	2500	Tape and Reel

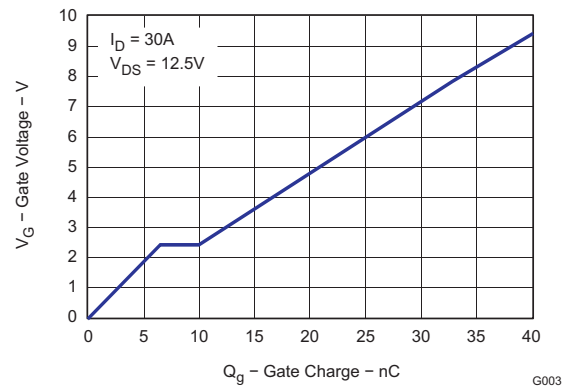
## ABSOLUTE MAXIMUM RATINGS

$T_A = 25^\circ\text{C}$ unless otherwise stated		VALUE	UNIT
$V_{DS}$	Drain to Source Voltage	25	V
$V_{GS}$	Gate to Source Voltage	+10 / -8	V
$I_D$	Continuous Drain Current, $T_C = 25^\circ\text{C}$	100	A
	Continuous Drain Current <sup>(1)</sup>	33	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	$^\circ\text{C}$
$E_{AS}$	Avalanche Energy, single pulse $I_D = 100\text{A}, L = 0.1\text{mH}, R_G = 25\Omega$	500	mJ

- (1) Typical  $R_{\theta JA} = 38^\circ\text{C/W}$  on 1-inch<sup>2</sup> (6.45-cm<sup>2</sup>), 2-oz. (0.071-mm thick) Cu pad on a 0.06-inch (1.52-mm) thick FR4 PCB.  
 (2) Pulse duration  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$

 **$R_{DS(on)}$  vs  $V_{GS}$** 


G006

**Gate Charge**


G003



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

NexFET is a trademark of Texas Instruments.



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

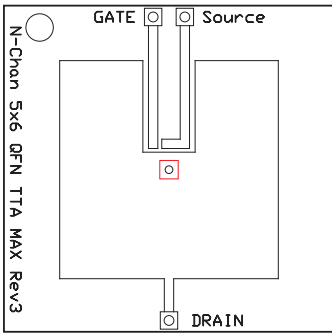
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>Static Characteristics</b>						
B <sub>V</sub> DSS	Drain to Source Voltage	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA	25			V
I <sub>DSS</sub>	Drain to Source Leakage Current	V <sub>GS</sub> = 0V, V <sub>DS</sub> = 20V			1	μA
I <sub>GSS</sub>	Gate to Source Leakage Current	V <sub>DS</sub> = 0V, V <sub>GS</sub> = +10/-8V			100	nA
V <sub>GS(th)</sub>	Gate to Source Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	0.9	1.1	1.4	V
R <sub>DS(on)</sub>	Drain to Source On Resistance	V <sub>GS</sub> = 3V, I <sub>D</sub> = 30A		2.1	2.9	mΩ
		V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 30A		1.7	2.2	mΩ
		V <sub>GS</sub> = 8V, I <sub>D</sub> = 30A		1.5	2	mΩ
g <sub>fs</sub>	Transconductance	V <sub>DS</sub> = 15V, I <sub>D</sub> = 30A		159		S
<b>Dynamic Characteristics</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> = 0V, V <sub>DS</sub> = 12.5V, f = 1MHz	3070	4000		pF
C <sub>oss</sub>	Output Capacitance		2190	2850		pF
C <sub>rss</sub>	Reverse Transfer Capacitance		120	150		pF
R <sub>G</sub>	Series Gate Resistance		1.6	3.2		Ω
Q <sub>g</sub>	Gate Charge Total (4.5V)	V <sub>DS</sub> = 12.5V, I <sub>DS</sub> = 30A	18	25		nC
Q <sub>gd</sub>	Gate Charge – Gate to Drain		3.5			nC
Q <sub>gs</sub>	Gate Charge – Gate to Source		6.6			nC
Q <sub>g(th)</sub>	Gate Charge at V <sub>th</sub>		3.3			nC
Q <sub>oss</sub>	Output Charge	V <sub>DS</sub> = 13V, V <sub>GS</sub> = 0V	43			nC
t <sub>d(on)</sub>	Turn On Delay Time	V <sub>DS</sub> = 12.5V, V <sub>GS</sub> = 4.5V, I <sub>DS</sub> = 30A, R <sub>G</sub> = 2Ω	10.5			ns
t <sub>r</sub>	Rise Time		16			ns
t <sub>d(off)</sub>	Turn Off Delay Time		32			ns
t <sub>f</sub>	Fall Time		12			ns
<b>Diode Characteristics</b>						
V <sub>SD</sub>	Diode Forward Voltage	I <sub>DS</sub> = 30A, V <sub>GS</sub> = 0V	0.8	1		V
Q <sub>rr</sub>	Reverse Recovery Charge	V <sub>DD</sub> = 10V, I <sub>F</sub> = 30A, di/dt = 300A/μs	63			nC
t <sub>rr</sub>	Reverse Recovery Time	V <sub>DD</sub> = 10V, I <sub>F</sub> = 30A, di/dt = 300A/μs	47			ns

## THERMAL CHARACTERISTICS

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

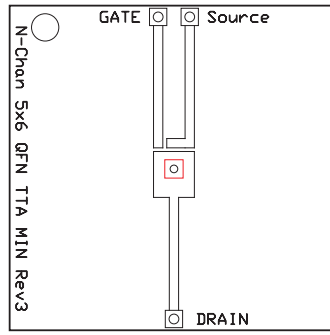
PARAMETER		MIN	TYP	MAX	UNIT
R <sub>θJC</sub>	Thermal Resistance Junction to Case <sup>(1)</sup>			1	°C/W
R <sub>θJA</sub>	Thermal Resistance Junction to Ambient <sup>(1) (2)</sup>			50	°C/W

- (1) R<sub>θJC</sub> is determined with the device mounted on a 1-inch<sup>2</sup> (6.45-cm<sup>2</sup>), 2-oz. (0.071-mm thick) Cu pad on a 1.5-inch × 1.5-inch (3.81-cm × 3.81-cm), 0.06-inch (1.52-mm) thick FR4 PCB. 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>), 2-oz. (0.071-mm thick) Cu.



M0137-01

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

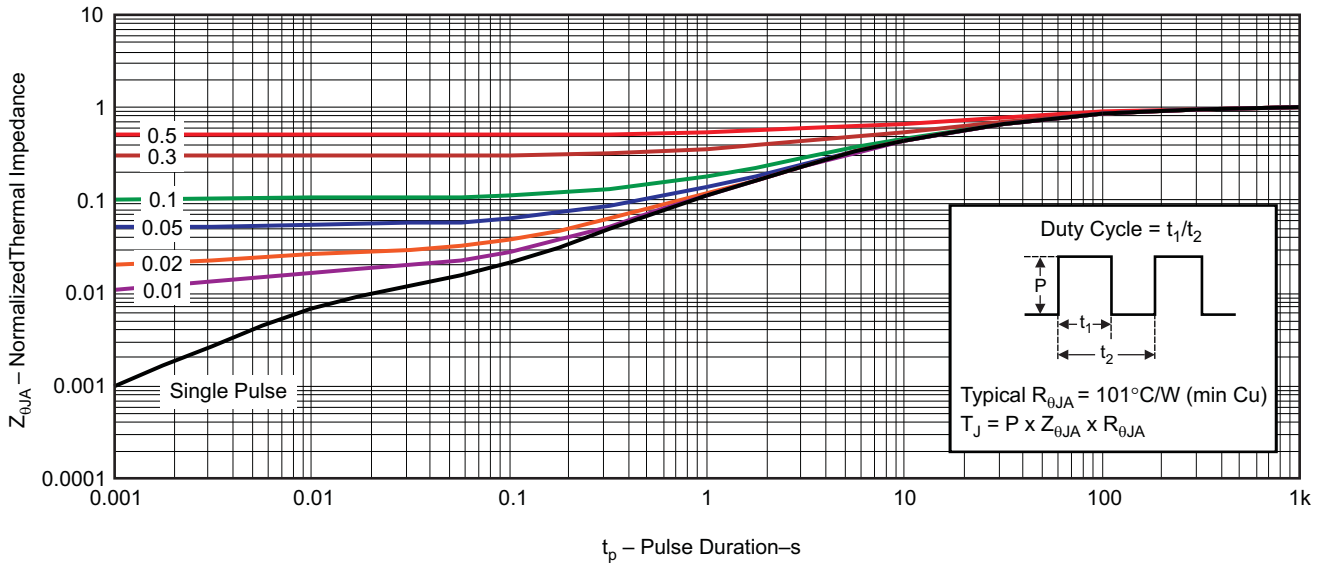


M0137-02

Max  $R_{\theta JA} = 126^{\circ}\text{C/W}$   
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)

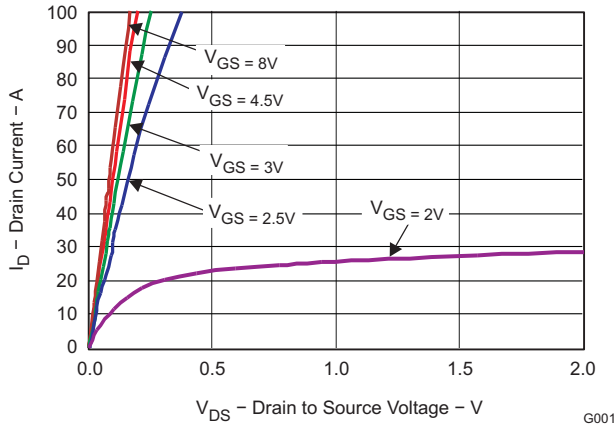


G012

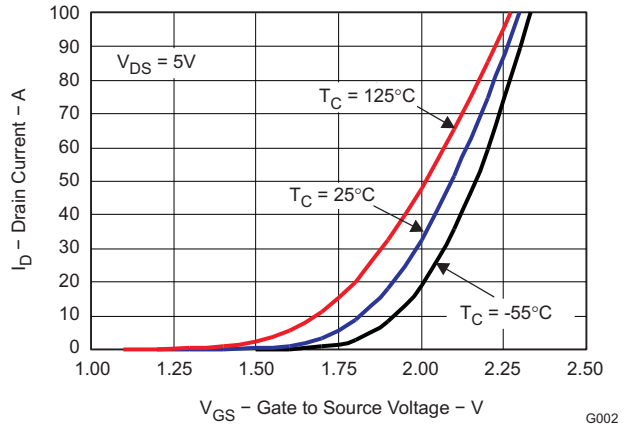
Figure 1. Transient Thermal Impedance

**TYPICAL MOSFET CHARACTERISTICS (continued)**

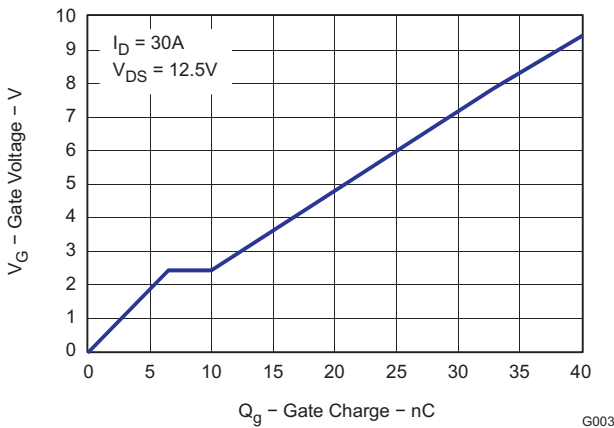
( $T_A = 25^\circ\text{C}$  unless otherwise stated)



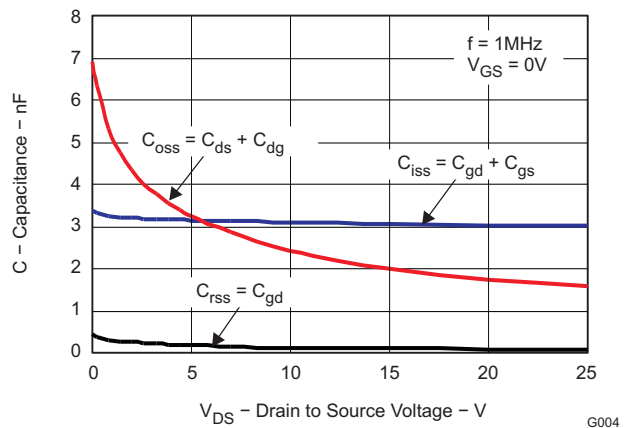
**Figure 2. Saturation Characteristics**



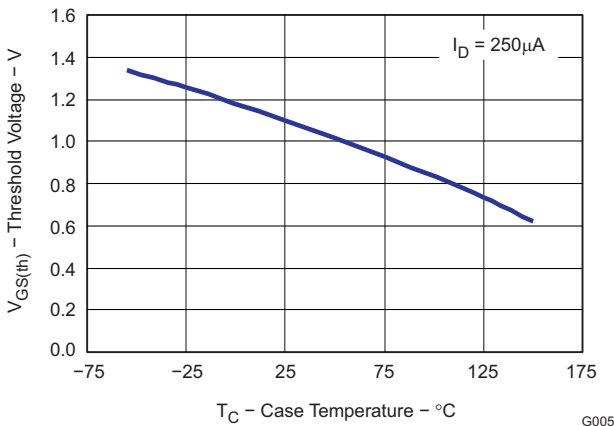
**Figure 3. Transfer Characteristics**



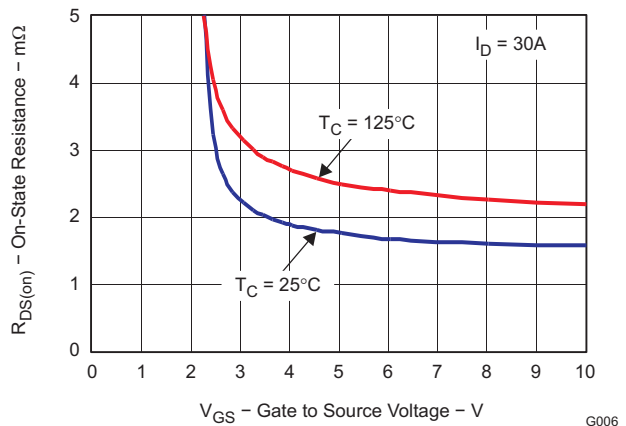
**Figure 4. Gate Charge**



**Figure 5. Capacitance**



**Figure 6. Threshold Voltage vs. Temperature**



**Figure 7. On-State Resistance vs. Gate to Source Voltage**

TYPICAL MOSFET CHARACTERISTICS (continued)

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

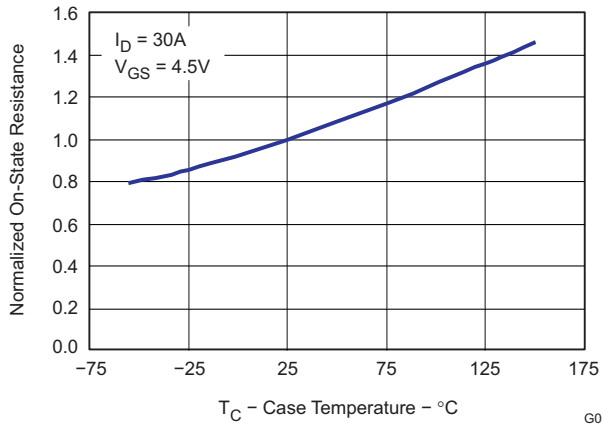


Figure 8. Normalized On-State Resistance vs. Temperature

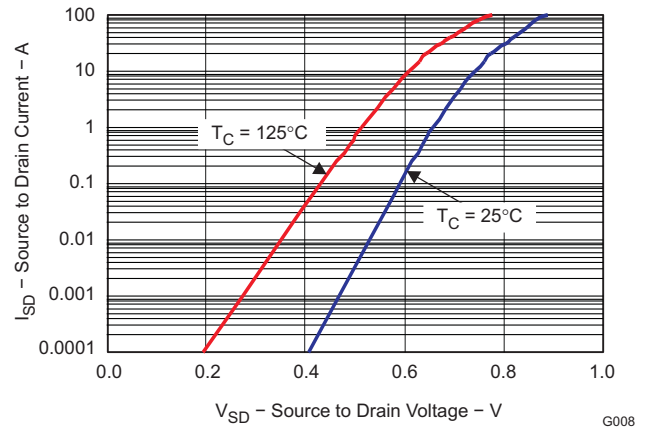


Figure 9. Typical Diode Forward Voltage

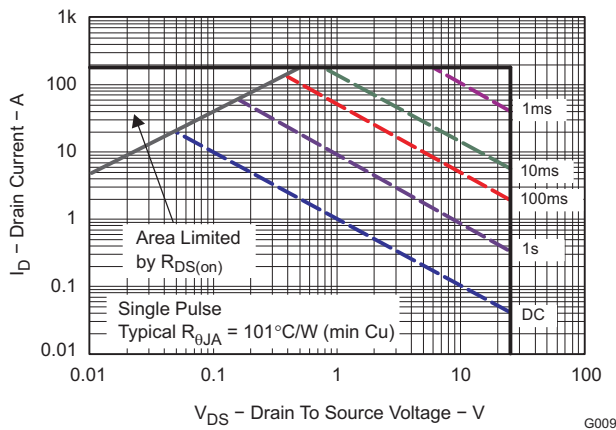


Figure 10. Maximum Safe Operating Area

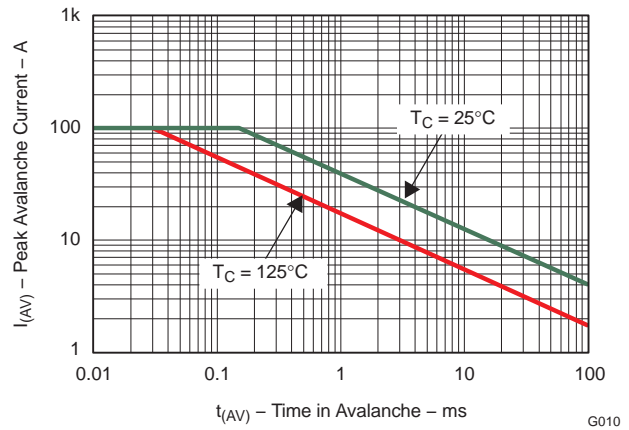


Figure 11. Single Pulse Unclamped Inductive Switching

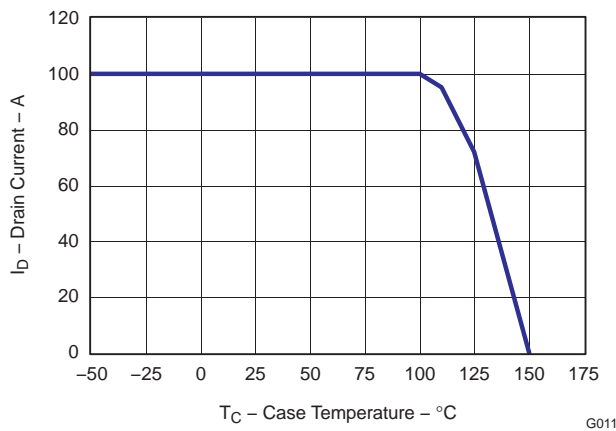
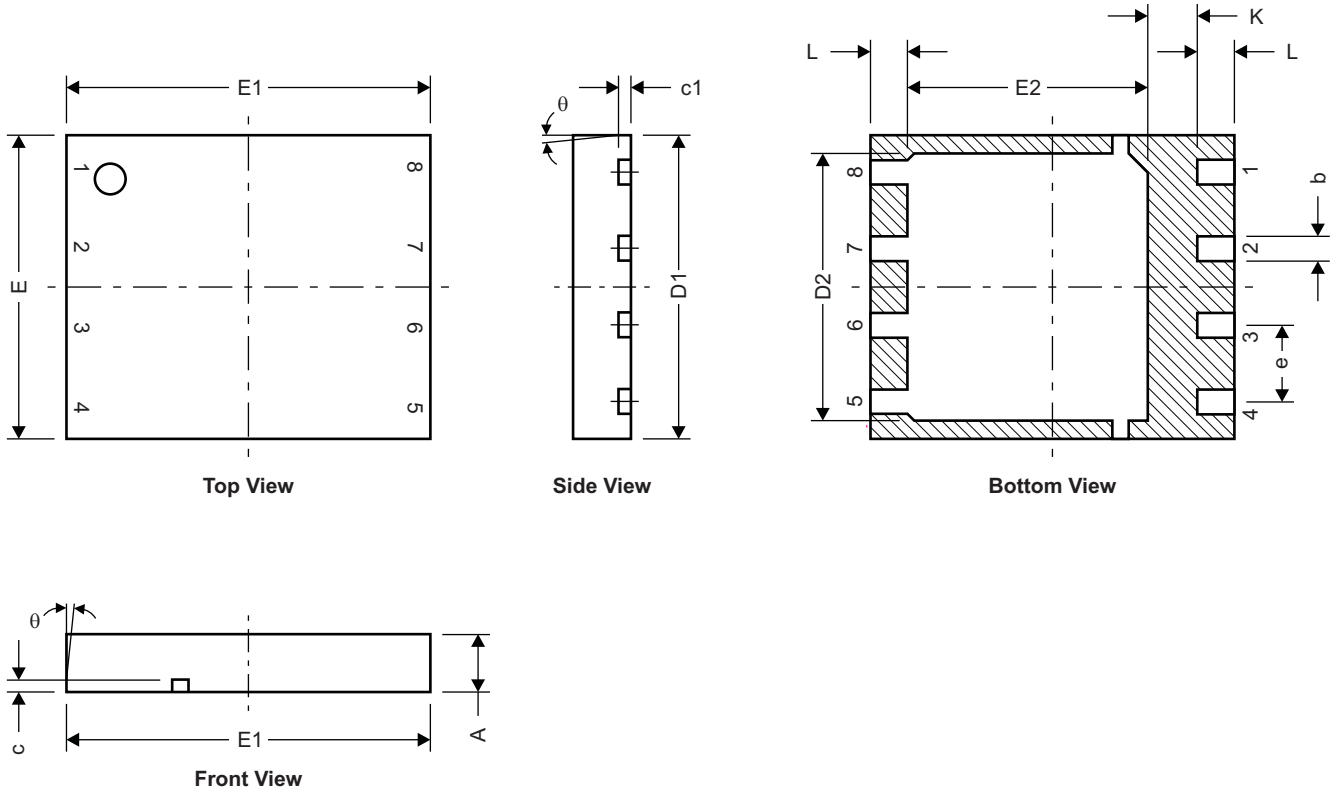


Figure 12. Maximum Drain Current vs. Temperature

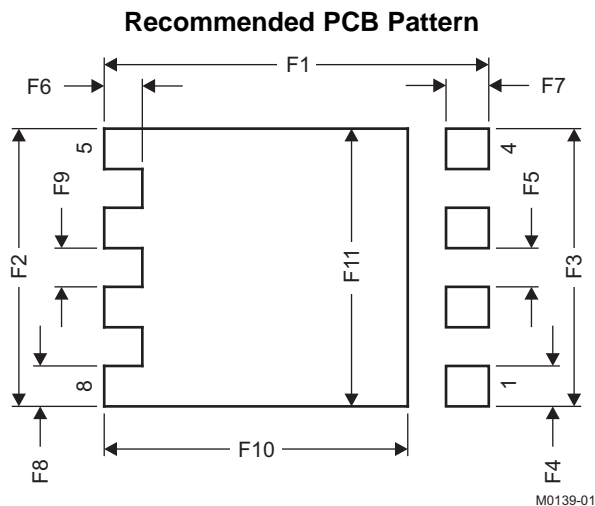
**MECHANICAL DATA**

**Q5 Package Dimensions**



M0140-01

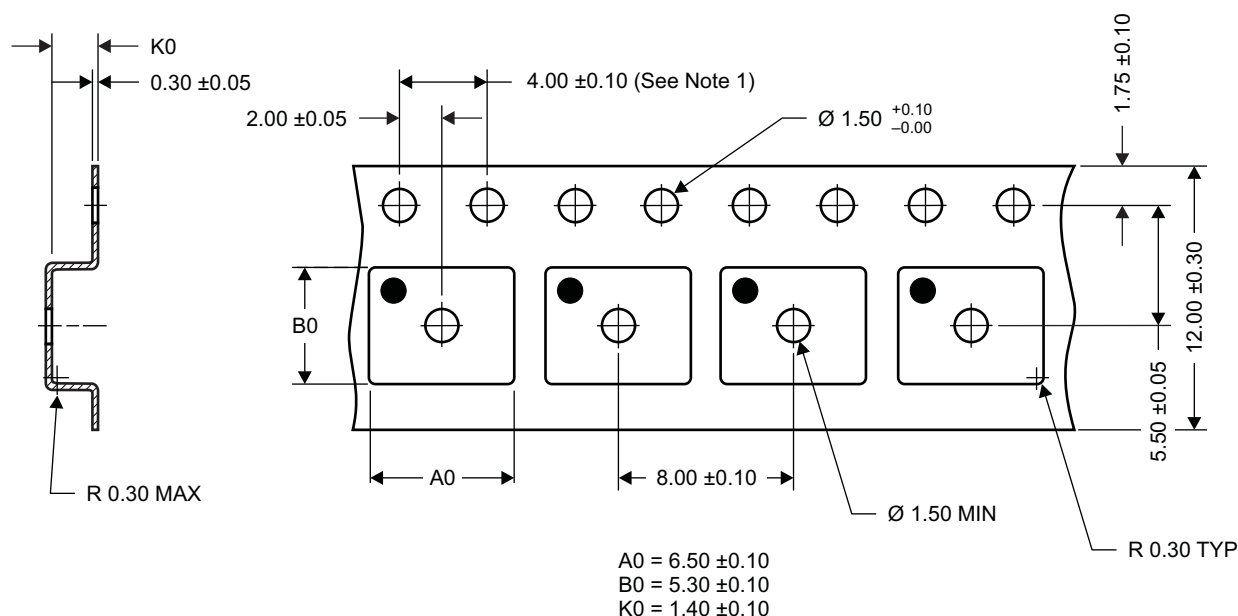
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.950	1.050	0.037	0.039
b	0.360	0.460	0.014	0.018
c	0.150	0.250	0.006	0.010
c1	0.150	0.250	0.006	0.010
D1	4.900	5.100	0.193	0.201
D2	4.320	4.520	0.170	0.178
E	4.900	5.100	0.193	0.201
E1	5.900	6.100	0.232	0.240
E2	3.920	4.12	0.154	0.162
e	1.27 TYP		0.050	
L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



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

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 ±0.2
- Camber not to exceed 1mm in 100mm, noncumulative over 250mm
- Material: black static-dissipative polystyrene
- All dimensions are in mm, unless otherwise specified.
- A0 and B0 measured on a plane 0.3mm above the bottom of the pocket
- MSL1 260°C (IR and convection) PbF reflow compatible

## REVISION HISTORY

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

- Changed  $Q_{rr}$  Reverse Recovery Charge typical value From: 102nC To: 63nC ..... **2**
- 

### Changes from Revision A (September 2009) to Revision B Page

- Changed Note 1 of the ABSOLUTE MAXIMUM RATINGS From:  $R_{\theta JA} = 38^{\circ}\text{C/W}$  To: Typical  $R_{\theta JA} = 38^{\circ}\text{C/W}$  ..... **1**
  - Changed  $I_{DM}$  Pulsed Drain Current in the ABSOLUTE MAXIMUM RATINGS From: 210A To: 200A ..... **1**
  - Changed From: Max  $R_{\theta JA} = 48^{\circ}\text{C/W}$  To: Max  $R_{\theta JA} = 50^{\circ}\text{C/W}$  ..... **3**
  - Changed From: Max  $R_{\theta JA} = 113^{\circ}\text{C/W}$  To: Max  $R_{\theta JA} = 126^{\circ}\text{C/W}$  ..... **3**
  - Changed [Figure 1](#) text - From:  $R_{\theta JA} = 101^{\circ}\text{C/W}$  To: Typical  $R_{\theta JA} = 101^{\circ}\text{C/W}$  ..... **3**
  - Changed [Figure 10](#) text - From:  $R_{\theta JA} = 101^{\circ}\text{C/W}$  To: Typical  $R_{\theta JA} = 101^{\circ}\text{C/W}$  ..... **5**
- 

### Changes from Revision B (April 2010) to Revision C Page

- Changed  $R_{DS(on)}$  -  $V_{GS} = 3\text{V}$  in the Electrical Characteristics table From: 2.7 to 2.9 in the max column ..... **2**
  - 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
CSD16325Q5	VSON-CLIP	DQH	8	2500	330.0	12.4	6.3	5.3	1.2	8.0	12.0	Q1

**TAPE AND REEL BOX DIMENSIONS**

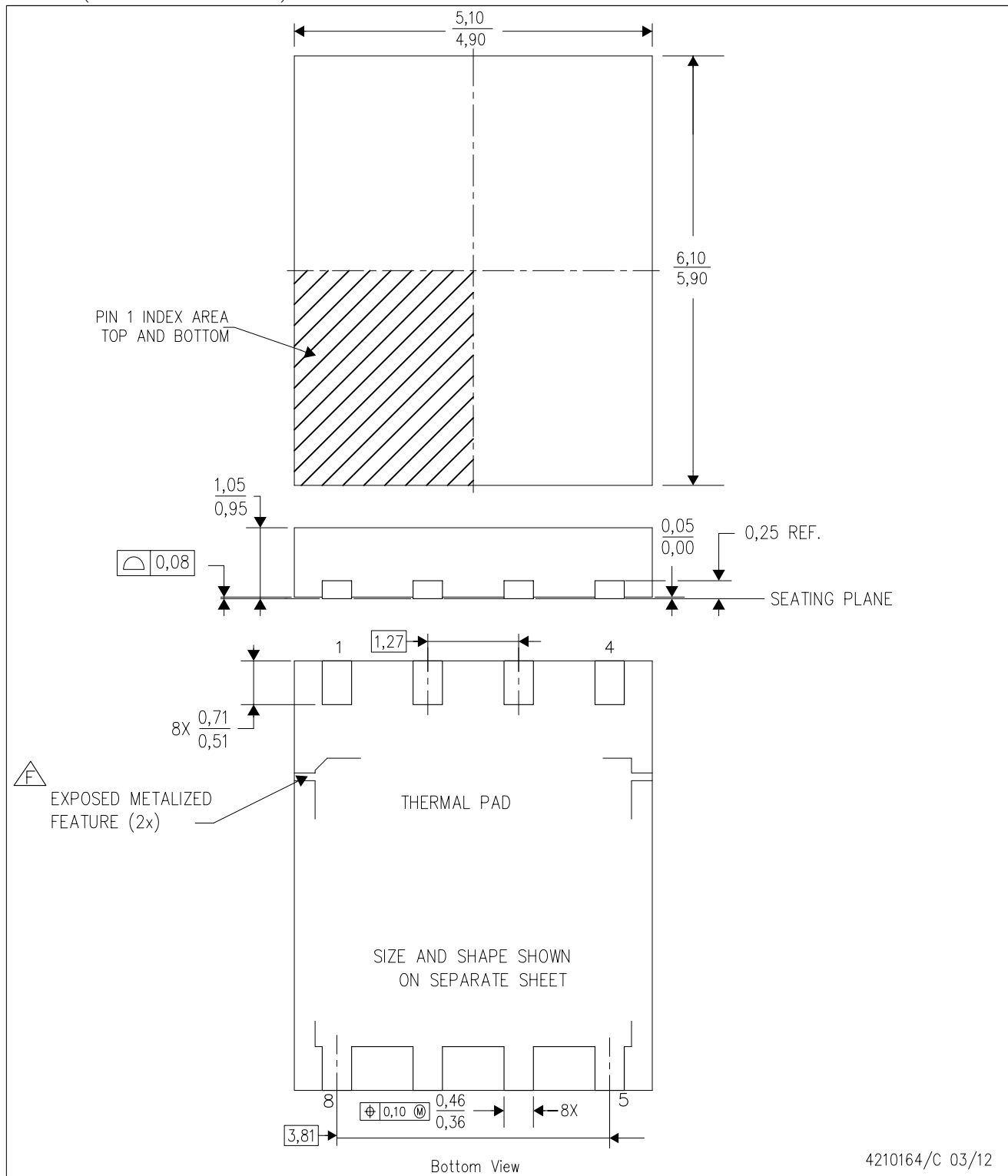



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CSD16325Q5	VSON-CLIP	DQH	8	2500	336.6	336.6	41.3

DQH (R-PVSON-N8)

PLASTIC SMALL OUTLINE NO-LEAD



- NOTES:
- All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - This drawing is subject to change without notice.
  - Small Outline No-Lead (SON) package configuration.
  - The package thermal pad must be soldered to the board for thermal and mechanical performance.
  - See the additional figure in the Product Data Sheet for details regarding the exposed thermal pad features and dimensions.
-  Metalized features are supplier options and may not be on the package.

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DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Applications Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>

### Applications

Automotive and Transportation	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
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>
Space, Avionics and Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>

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