

N-Channel NexFET™ Power MOSFETs

Check for Samples: [CSD16409Q3](#)

FEATURES

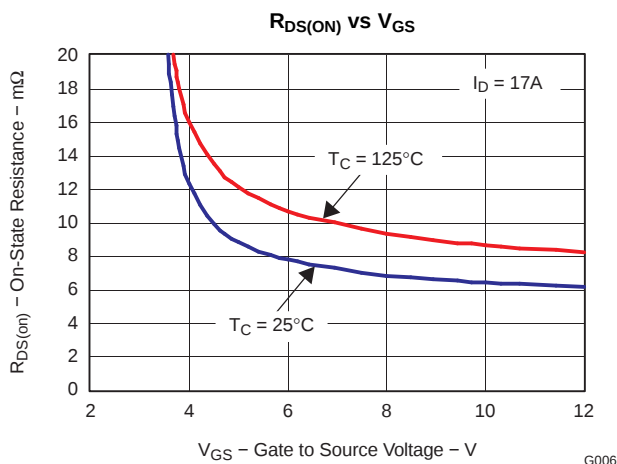
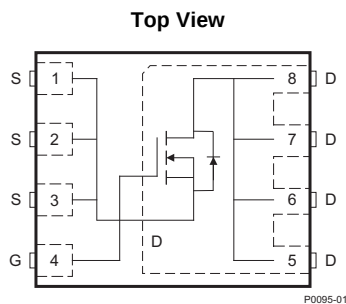
- Ultra Low Q_g and Q_{gd}
- Low Thermal Resistance
- Avalanche Rated
- Pb Free Terminal Plating
- RoHS Compliant
- Halogen Free
- SON 3.3mm x 3.3mm Plastic Package

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.



PRODUCT SUMMARY				
V_{DS}	Drain to Source Voltage	25	V	
Q_g	Gate Charge Total (4.5V)	4	nC	
Q_{gd}	Gate Charge Gate to Drain	1	nC	
$R_{DS(on)}$	Drain to Source On Resistance	$V_{GS} = 4.5V$	9.5	mΩ
		$V_{GS} = 10V$	6.2	mΩ
V_{th}	Threshold Voltage	2	V	

ORDERING INFORMATION

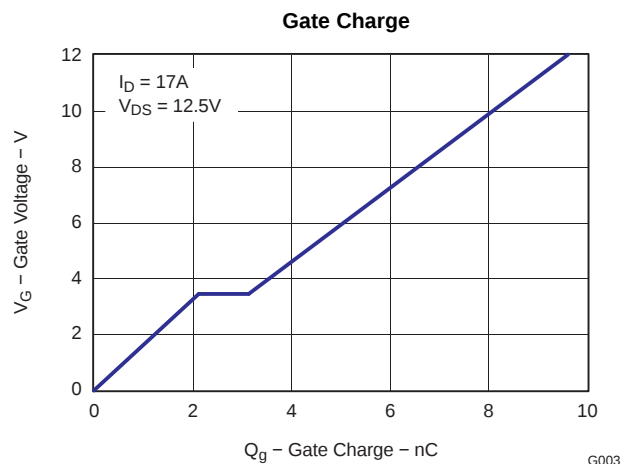
Device	Package	Media	Qty	Ship
CSD16409Q3	SON 3.3 × 3.3 Plastic Package	13-inch reel	2500	Tape and Reel

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, $T_C = 25^\circ\text{C}$	60	A
	Continuous Drain Current ⁽¹⁾	15	A
I_{DM}	Pulsed Drain Current, $T_A = 25^\circ\text{C}$ ⁽²⁾	90	A
P_D	Power Dissipation ⁽¹⁾	2.6	W
T_J , T_{STG}	Operating Junction and Storage Temperature Range	-55 to 150	$^\circ\text{C}$
E_{AS}	Avalanche Energy, single pulse $I_D = 38A$, $L = 0.1mH$, $R_G = 25\Omega$	72	mJ

(1) $R_{\theta JA} = 47^\circ\text{C/W}$ on 1in² Cu (2 oz.) on 0.060" thick FR4 PCB.

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



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of the Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



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°C unless otherwise stated)

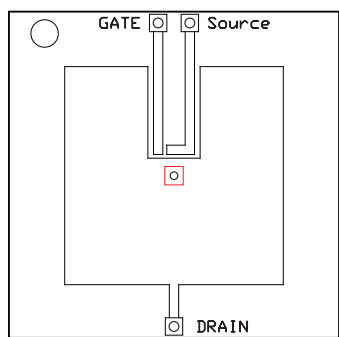
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Static Characteristics						
BV _{DSS}	Drain to Source Voltage	V _{GS} = 0V, I _D = 250μA	25			V
I _{DSS}	Drain to Source Leakage Current	V _{GS} = 0V, V _{DS} = 20V			1	μA
I _{GSS}	Gate to Source Leakage Current	V _{DS} = 0V, V _{GS} = +16/-12V			100	nA
V _{GS(th)}	Gate to Source Threshold Voltage	V _{DS} = V _{GS} , I _D = 250μA	1.7	2	2.3	V
R _{DS(on)}	Drain to Source On Resistance	V _{GS} = 4.5V, I _D = 17A		9.5	12.4	mΩ
		V _{GS} = 10V, I _D = 17A		6.2	8.2	mΩ
g _{fs}	Transconductance	V _{DS} = 15V, I _D = 17A		38		S
Dynamic Characteristics						
C _{ISS}	Input Capacitance	V _{GS} = 0V, V _{DS} = 12.5V , f = 1MHz		600	800	pF
C _{OSS}	Output Capacitance			480	635	pF
C _{RSS}	Reverse Transfer Capacitance			40	55	pF
R _g	Series Gate Resistance			0.9	1.8	Ω
Q _g	Gate Charge Total (4.5V)	V _{DS} = 12.5V, I _D = 17A		4	5.6	nC
Q _{gd}	Gate Charge Gate to Drain			1		nC
Q _{gs}	Gate Charge Gate to Source			2.1		nC
Q _{g(th)}	Gate Charge at V _{th}			1.1		nC
Q _{OSS}	Output Charge	V _{DS} = 12.9V, V _{GS} = 0V		9.1		nC
t _{d(on)}	Turn On Delay Time	V _{DS} = 12.5V, V _{GS} = 4.5V, I _D = 17A, R _G = 2Ω		6.5		ns
t _r	Rise Time			10.6		ns
t _{d(off)}	Turn Off Delay Time			6.3		ns
t _f	Fall Time			3.4		ns
Diode Characteristics						
V _{SD}	Diode Forward Voltage	I _S = 17A, V _{GS} = 0V		0.85	1	V
Q _{rr}	Reverse Recovery Charge	V _{DD} = 12.9V, I _F = 17A, di/dt = 300A/μs		13.8		nC
t _{rr}	Reverse Recovery Time	V _{DD} = 12.9V, I _F = 17A, di/dt = 300A/μs		17.5		ns

THERMAL CHARACTERISTICS

(T_A = 25°C unless otherwise stated)

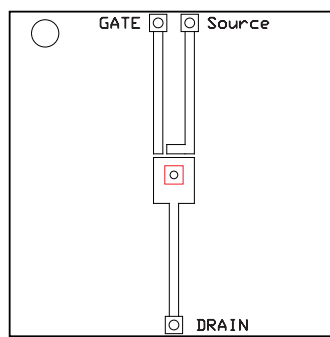
PARAMETER		MIN	TYP	MAX	UNIT
R _{θJC}	Thermal Resistance Junction to Case ⁽¹⁾			3.5	°C/W
R _{θJA}	Thermal Resistance Junction to Ambient ^{(1) (2)}			59	°C/W

- (1) R_{θJC} is determined with the device mounted on a 1 inch square 2 oz. Cu pad on a 1.5 × 1.5 in 0.06 inch thick FR4 board. R_{θJC} is specified by design while R_{θJA} is determined by the user's board design.
 (2) Device mounted on FR4 Material with 1 inch² of 2 oz. Cu.



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Max $R_{\theta JA} = 59^{\circ}\text{C/W}$
when mounted on 1
 inch^2 of 2 oz. Cu.

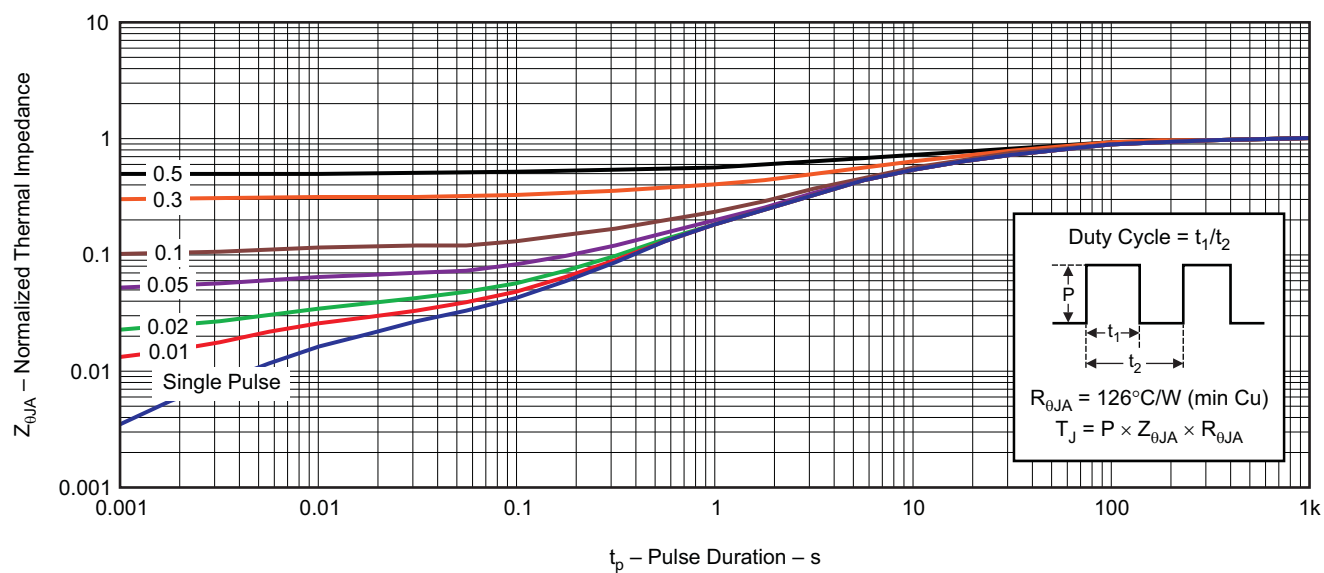


M0161-02

Max $R_{\theta JA} = 157^{\circ}\text{C/W}$
when mounted on
minimum pad area of 2
oz. Cu.

TYPICAL MOSFET CHARACTERISTICS

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



G012

Figure 1. Transient Thermal Impedance

TYPICAL MOSFET CHARACTERISTICS (continued)

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

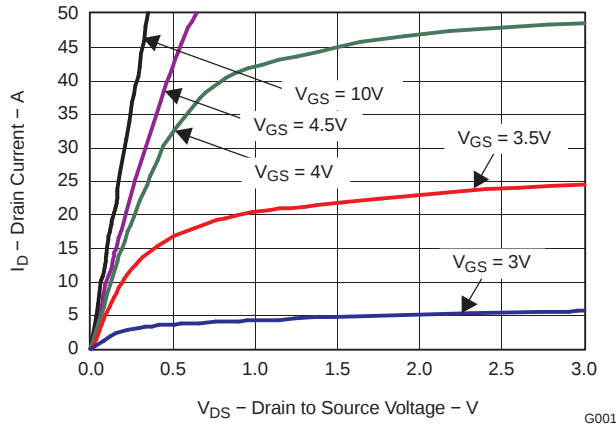


Figure 2. Saturation Characteristics

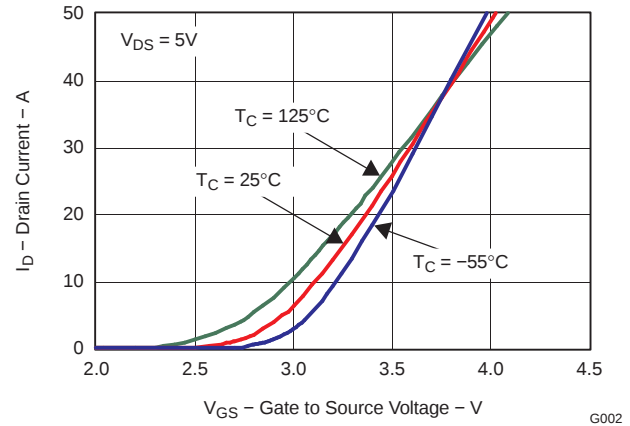


Figure 3. Transfer Characteristics

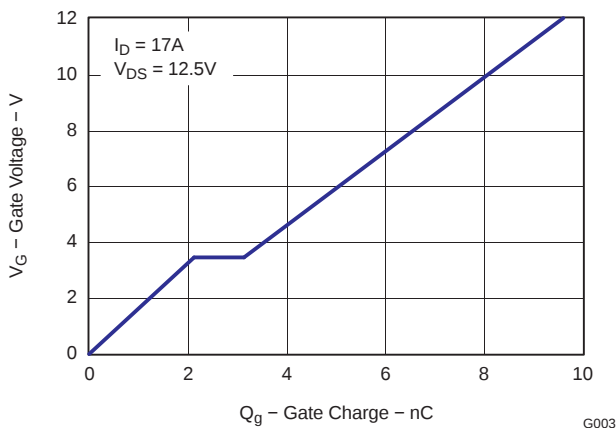


Figure 4. Gate Charge

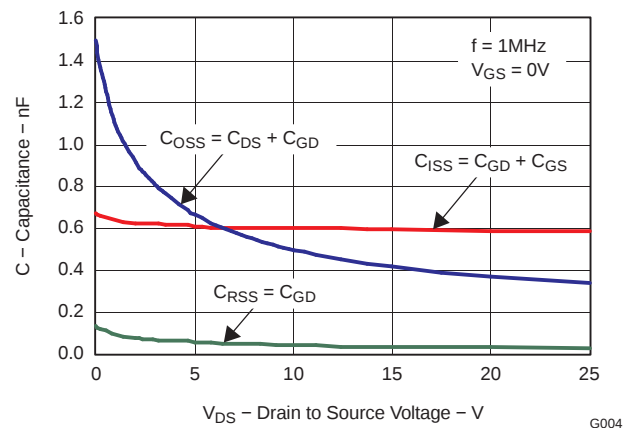


Figure 5. Capacitance

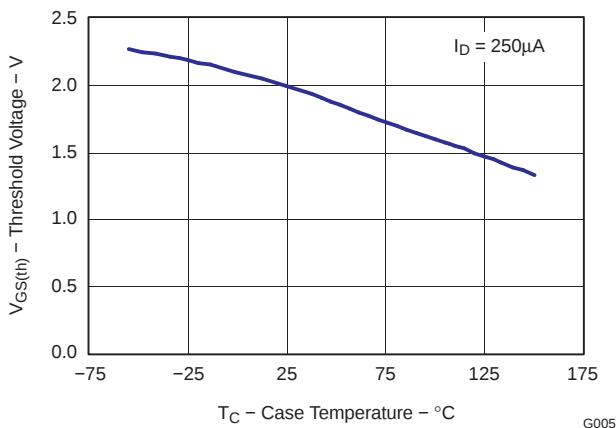


Figure 6. Threshold Voltage vs. Temperature

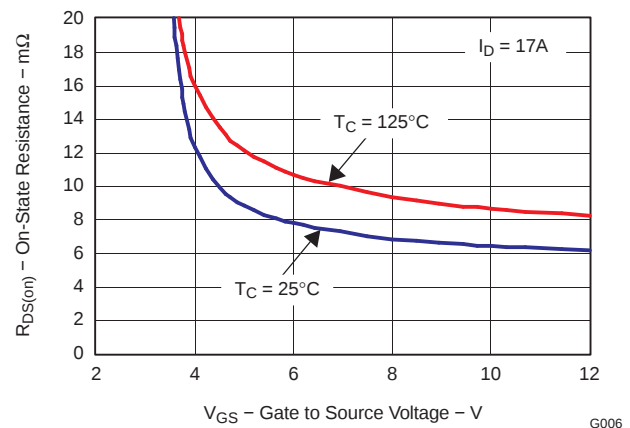


Figure 7. On Resistance vs. Gate Voltage

TYPICAL MOSFET CHARACTERISTICS (continued)

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

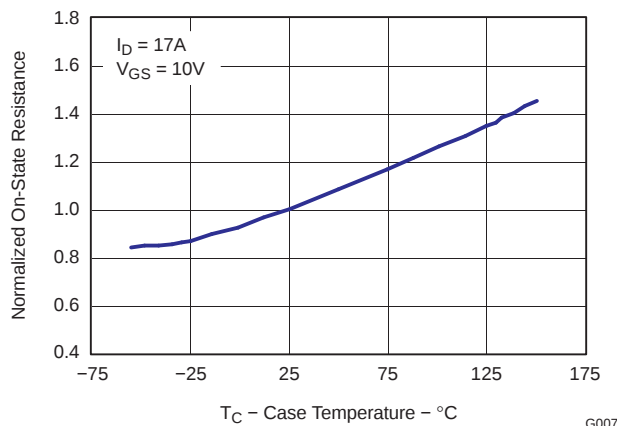


Figure 8. Normalized On Resistance vs. Temperature

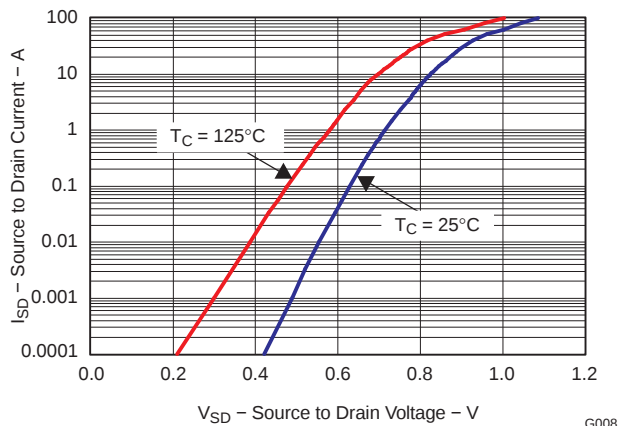


Figure 9. Typical Diode Forward Voltage

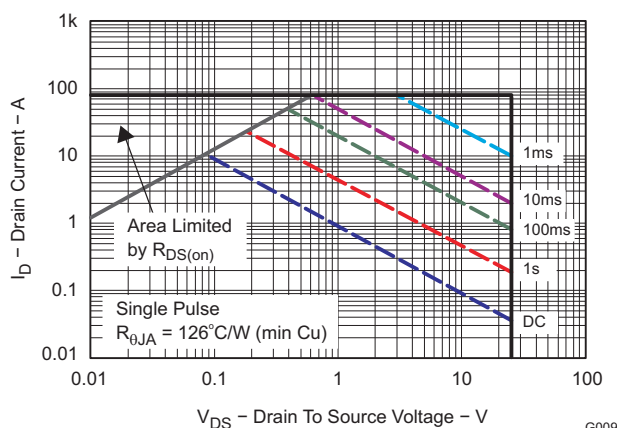


Figure 10. Maximum Safe Operating Area

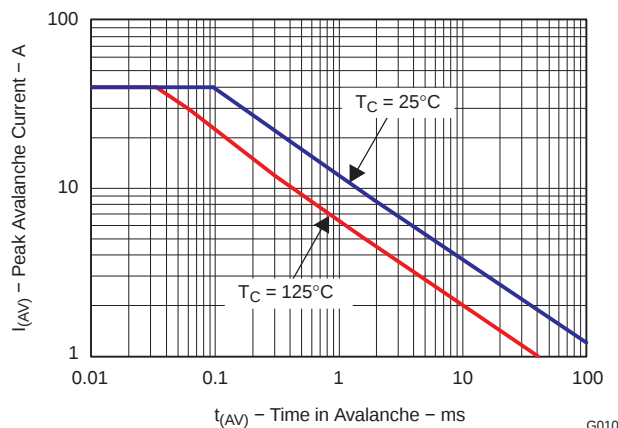


Figure 11. Single Pulse Unclamped Inductive Switching

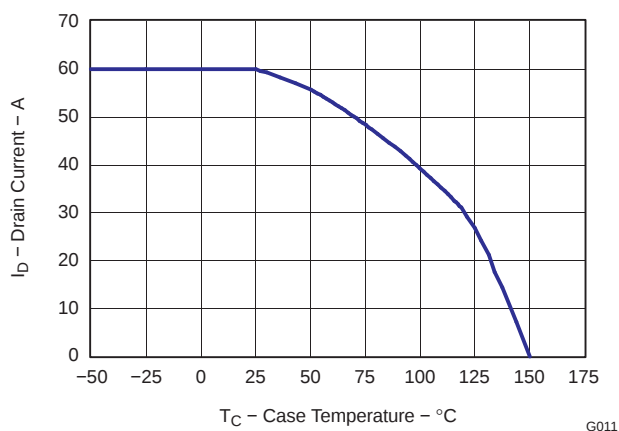
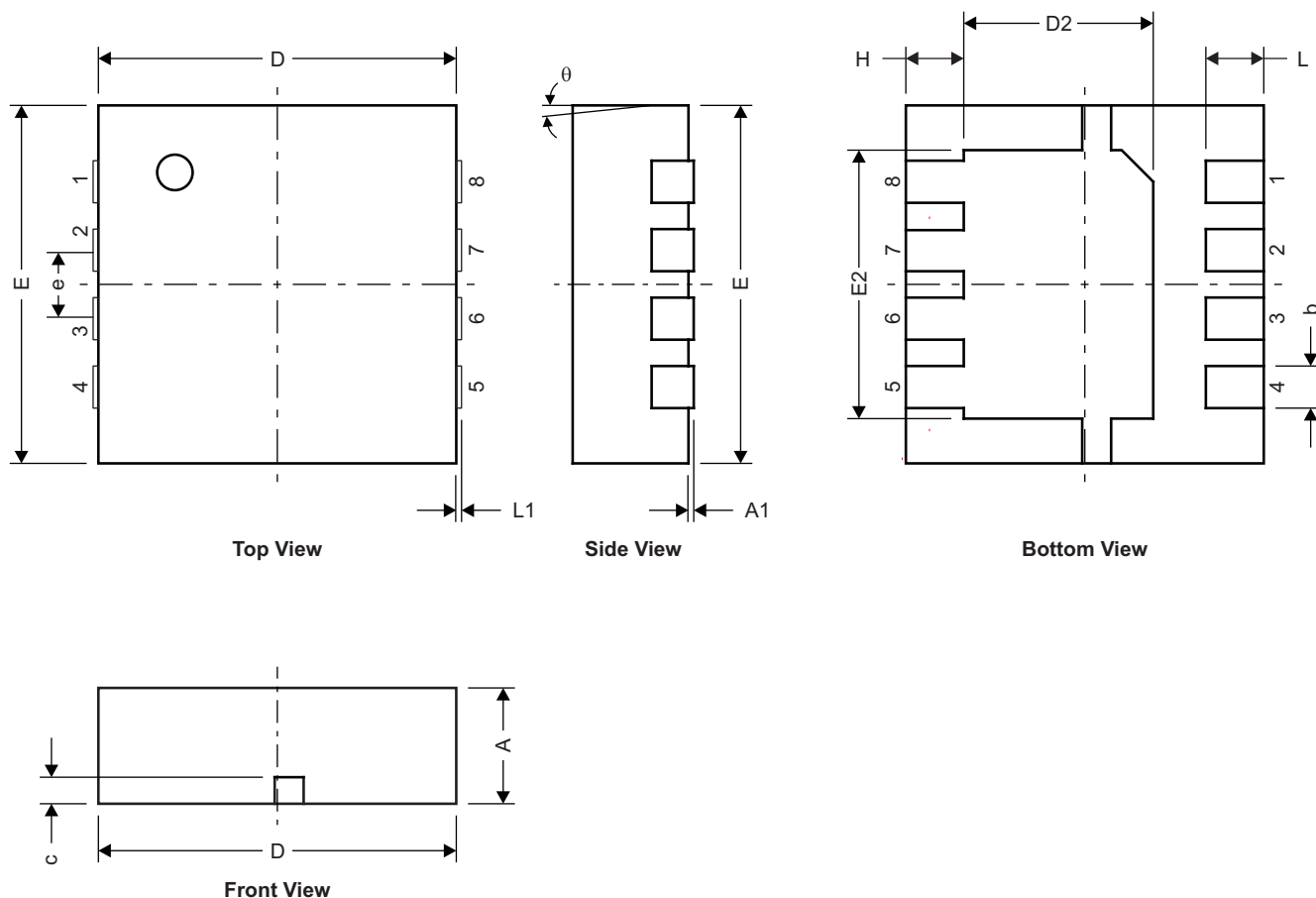


Figure 12. Maximum Drain Current vs. Temperature

MECHANICAL DATA

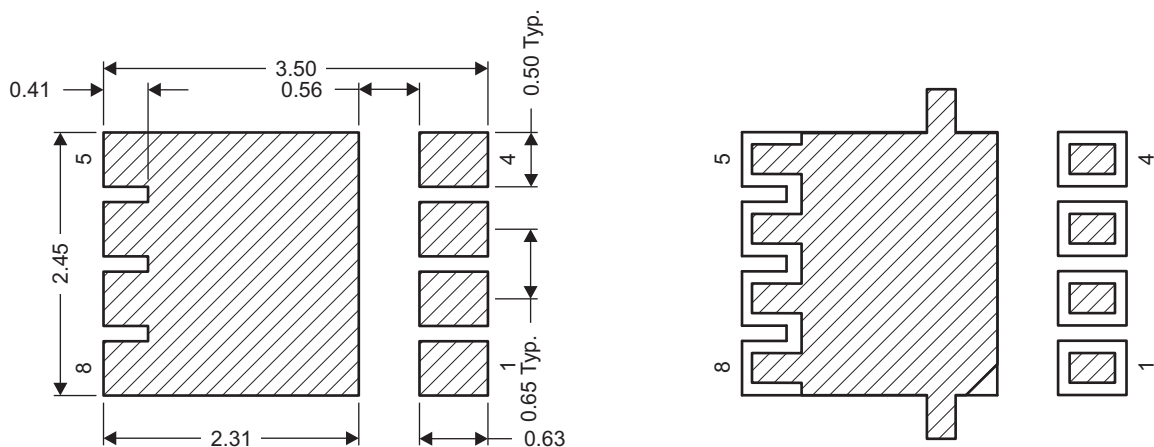
Q3 Package Dimensions



M0142-01

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.950	1.000	1.100	0.037	0.039	0.043
A1	0.000	0.000	0.050	0.000	0.000	0.002
b	0.280	0.340	0.400	0.011	0.013	0.016
c	0.150	0.200	0.250	0.006	0.008	0.010
D	3.200	3.300	3.400	0.126	0.130	0.134
D1	–	–	–	–	–	–
D2	1.650	1.750	1.800	0.065	0.069	0.071
E	3.200	3.300	3.400	0.126	0.130	0.134
E1	–	–	–	–	–	–
E2	2.350	2.450	2.550	0.093	0.096	0.100
e	0.650 TYP			0.026		
H	0.35	0.450	0.550	0.014	0.018	0.022
L	0.35	0.450	0.550	0.014	0.018	0.022
L1	–	–	–	–	–	–
θ	–	–	–	–	–	–

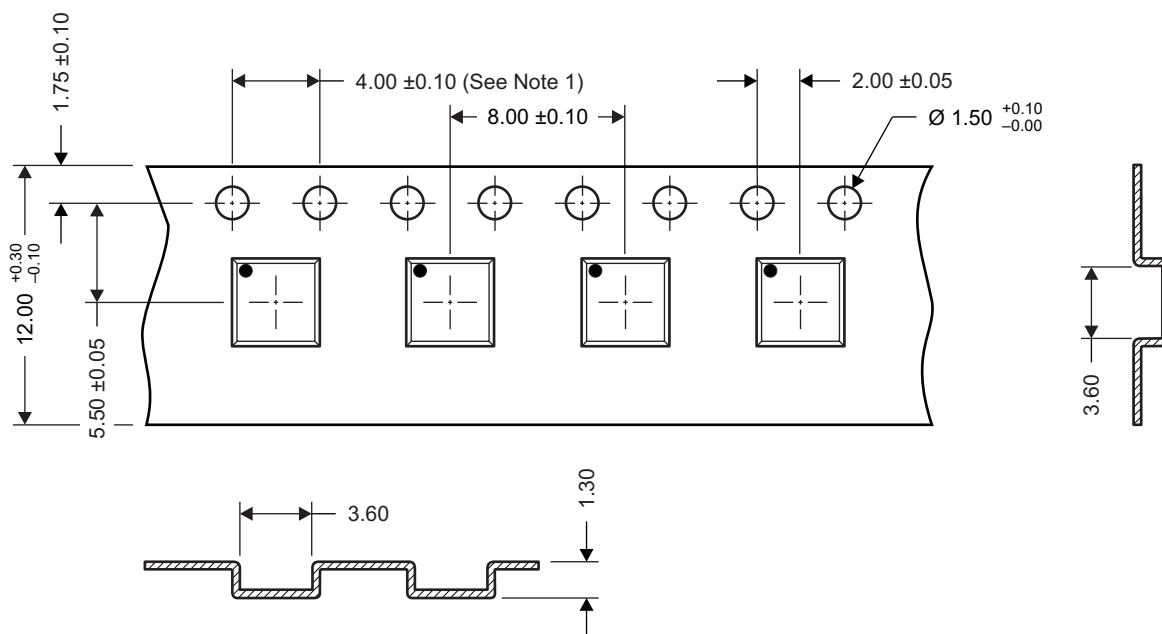
Recommended PCB Land Pattern



M0143-01

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

Q3 Tape and Reel Information



M0144-01

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. Thickness: 0.30 ± 0.05 mm
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

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
CSD16409Q3	Active	Production	VSON-CLIP (DQG) 8	2500 LARGE T&R	ROHS Exempt	SN	Level-1-260C-UNLIM	-55 to 150	CSD16409
CSD16409Q3.B	Active	Production	VSON-CLIP (DQG) 8	2500 LARGE T&R	ROHS Exempt	SN	Level-1-260C-UNLIM	-55 to 150	CSD16409

- ⁽¹⁾ **Status:** For more details on status, see our [product life cycle](#).
- ⁽²⁾ **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.
- ⁽³⁾ **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.
- ⁽⁴⁾ **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.
- ⁽⁵⁾ **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.
- ⁽⁶⁾ **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "-" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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