

N-Channel NexFET™ Power MOSFETs

Check for Samples: [CSD16406Q3](#)

FEATURES

- Ultra Low Qg and Qgd
- Low Thermal Resistance
- Avalanche Rated
- Pb Free Terminal Plating
- RoHS Compliant
- Halogen Free
- SON 3.3mm x 3.3mm Plastic Package

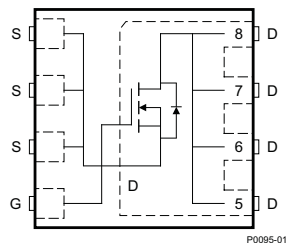
APPLICATIONS

- Point-of-Load Synchronous Buck Converter for Applications in Networking, Telecom and Computing Systems
- Optimized for Control or Synchronous FET Applications

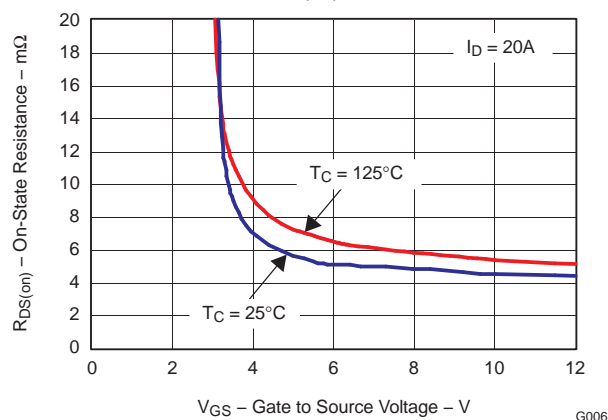
DESCRIPTION

The NexFET™ power MOSFET has been designed to minimize losses in power conversion applications.

Top View

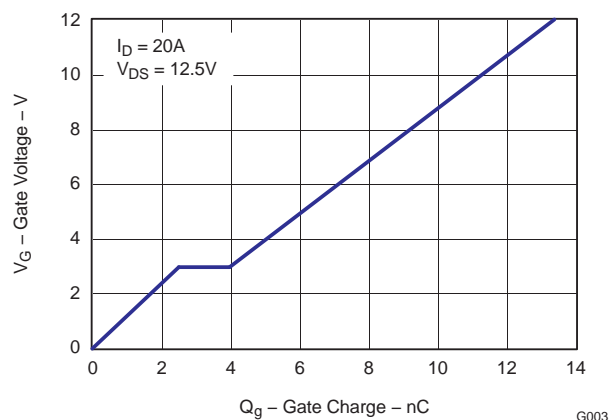


P0095-01

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


G006

Gate Charge



G003

PRODUCT SUMMARY

V _{DS}	Drain to Source Voltage	25	V
Q _g	Gate Charge Total (4.5V)	5.8	nC
Q _{gd}	Gate Charge Gate to Drain	1.5	nC
R _{DS(on)}	Drain to Source On Resistance	V _{GS} = 4.5V	5.9 mΩ
		V _{GS} = 10V	4.2 mΩ
V _{th}	Threshold Voltage	1.8	V

ORDERING INFORMATION

Device	Package	Media	Qty	Ship
CSD16406Q3	SON 3.3 × 3.3 Plastic Package	13-inch 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	+16 / -12	V
I _D	Continuous Drain Current, T _C = 25°C	60	A
	Continuous Drain Current ⁽¹⁾	19	A
I _{DM}	Pulsed Drain Current, T _A = 25°C ⁽²⁾	114	A
P _D	Power Dissipation ⁽¹⁾	2.7	W
T _J , T _{STG}	Operating Junction and Storage Temperature Range	-55 to 150	°C
E _{AS}	Avalanche Energy, single pulse I _D = 45A, L = 0.1mH, R _G = 25Ω	101	mJ

(1) R_{θJA} = 46°C/W on 1in² Cu (2 oz.) on 0.060" thick FR4 PCB.

(2) Pulse width ≤300μs, duty cycle ≤2%



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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	1.4	1.8	2.2	V
R _{DS(on)}	Drain to Source On Resistance	V _{GS} = 4.5V, I _D = 20A		5.9	7.4	mΩ
		V _{GS} = 10V, I _D = 20A		4.2	5.3	mΩ
g _{fs}	Transconductance	V _{DS} = 15V, I _D = 20A		53		S
Dynamic Characteristics						
C _{ISS}	Input Capacitance	V _{GS} = 0V, V _{DS} = 12.5V, f = 1MHz		840	1100	pF
C _{OSS}	Output Capacitance			680	950	pF
C _{RSS}	Reverse Transfer Capacitance			57	80	pF
R _g	Series Gate Resistance			1.2	2.4	Ω
Q _g	Gate Charge Total (4.5V)	V _{DS} = 12.5V, I _D = 20A		5.8	8.1	nC
Q _{gd}	Gate Charge Gate to Drain			1.5		nC
Q _{gs}	Gate Charge Gate to Source			2.5		nC
Q _{g(th)}	Gate Charge at V _{th}			1.5		nC
Q _{OSS}	Output Charge	V _{DS} = 13.6V, V _{GS} = 0V		13.9		nC
t _{d(on)}	Turn On Delay Time	V _{DS} = 12.5V, V _{GS} = 4.5V I _D = 20A R _G = 2Ω		7.3		ns
t _r	Rise Time			12.9		ns
t _{d(off)}	Turn Off Delay Time			8.5		ns
t _f	Fall Time			4.8		ns
Diode Characteristics						
V _{SD}	Diode Forward Voltage	I _S = 20A, V _{GS} = 0V		0.85	1.0	V
Q _{rr}	Reverse Recovery Charge	V _{DD} = 13.6V, I _F = 20A, di/dt = 300A/μs		18		nC
t _{rr}	Reverse Recovery Time	V _{DD} = 13.6V, I _F = 20A, di/dt = 300A/μs		22		ns

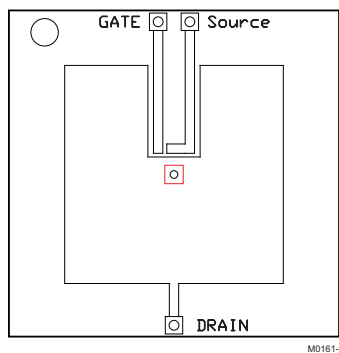
THERMAL CHARACTERISTICS

(T_A = 25°C unless otherwise stated)

PARAMETER		MIN	TYP	MAX	UNIT
R _{θJC}	Thermal Resistance Junction to Case ⁽¹⁾			2.7	°C/W
R _{θJA}	Thermal Resistance Junction to Ambient ^{(1) (2)}			58	°C/W

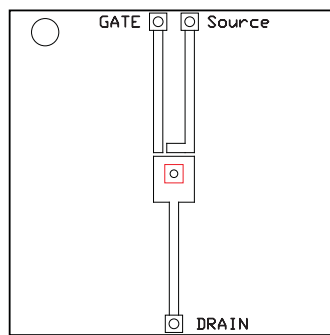
(1) R_{θJC} is determined with the device mounted on a 1 inch square 2 oz. Cu pad on a 1.5 × 1.5 in 0.06 inch thick FR4 board. R_{θJC} is specified by design while R_{θJA} is determined by the user's board design.

(2) Device mounted on FR4 Material with 1 inch² of 2 oz. Cu.



Max $R_{\theta JA} = 58^{\circ}\text{C/W}$
when mounted on 1
 inch^2 of 2 oz. Cu.

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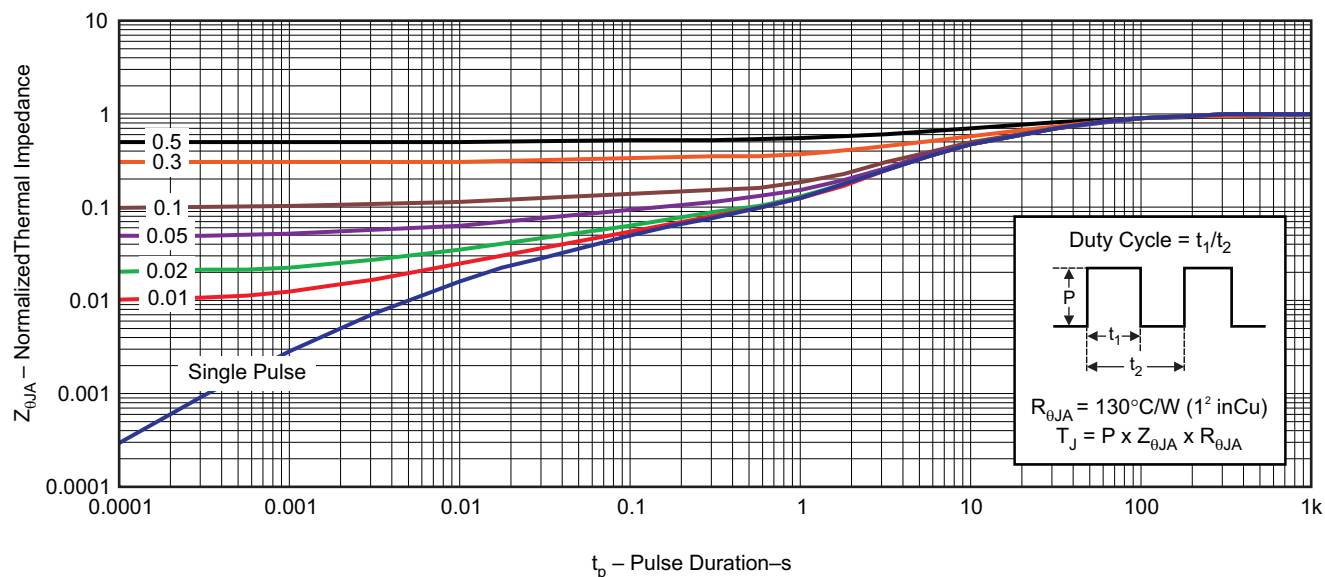


Max $R_{\theta JA} = 162^{\circ}\text{C/W}$
when mounted on
minimum pad area of 2
oz. Cu.

M0161-02

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)

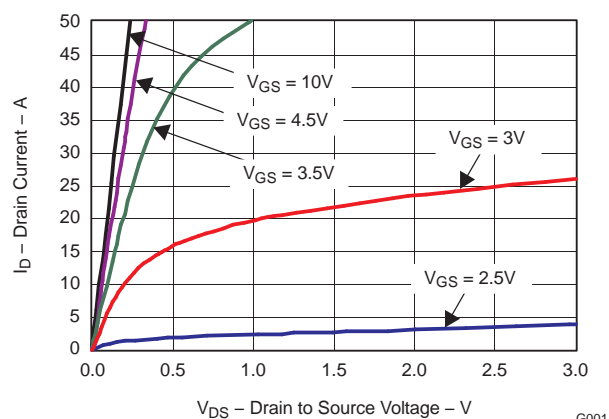


Figure 2. Saturation Characteristics

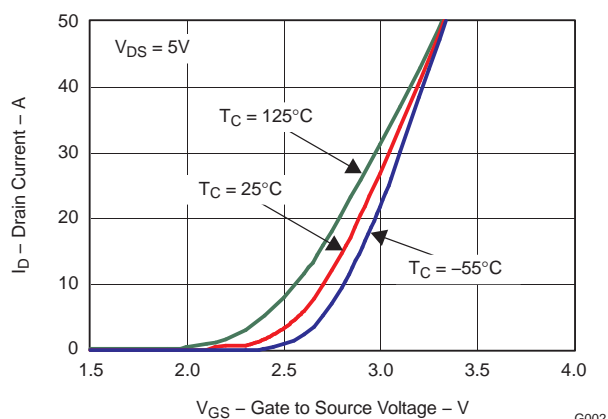


Figure 3. Transfer Characteristics

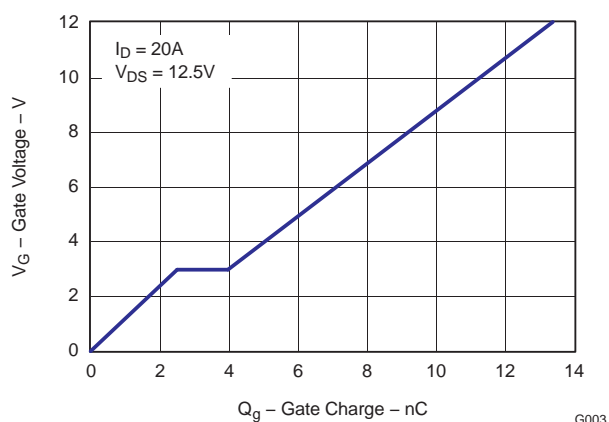


Figure 4. Gate Charge

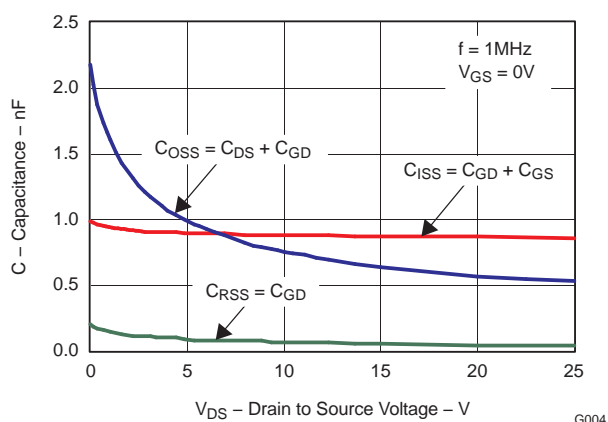


Figure 5. Capacitance

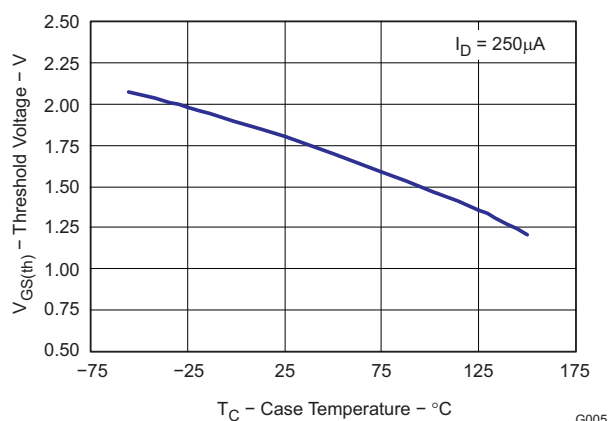


Figure 6. Threshold Voltage vs. Temperature

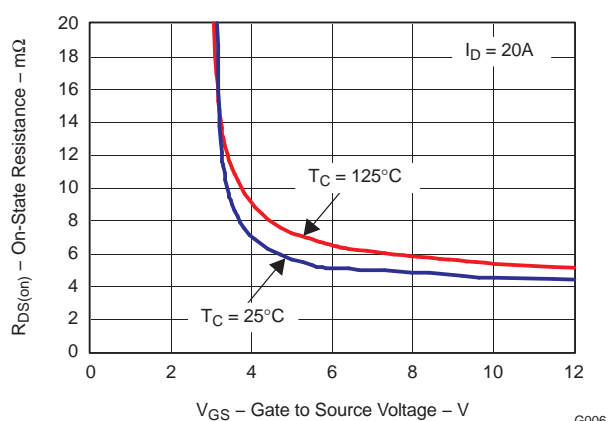


Figure 7. On Resistance vs. Gate Voltage

TYPICAL MOSFET CHARACTERISTICS (continued)

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

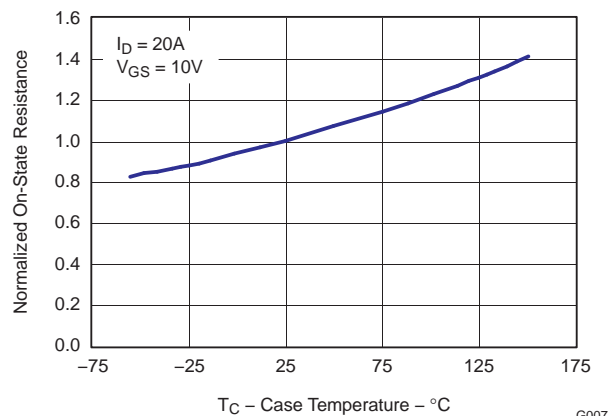


Figure 8. Normalized On Resistance vs. Temperature

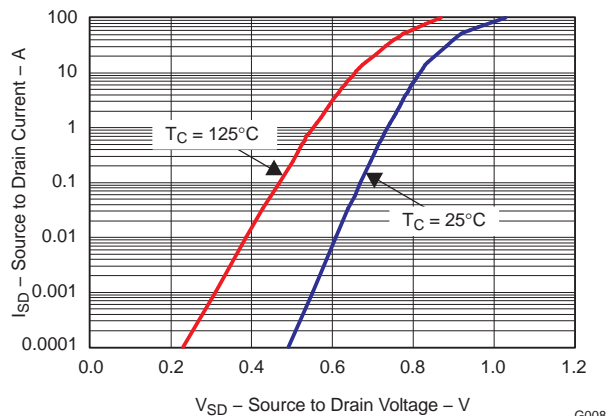


Figure 9. Typical Diode Forward Voltage

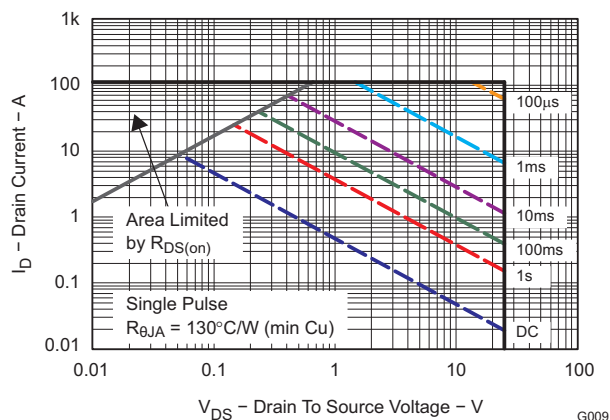


Figure 10. Maximum Safe Operating Area

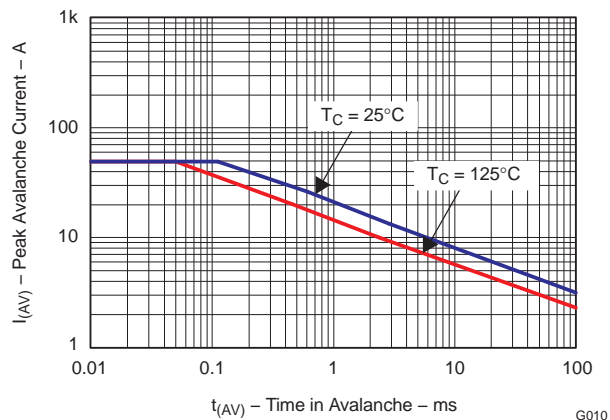


Figure 11. Single Pulse Unclamped Inductive Switching

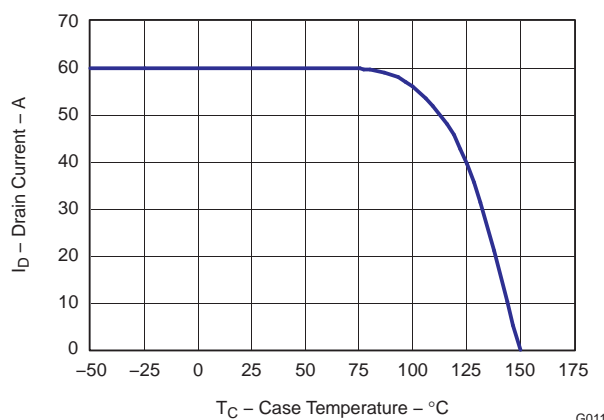
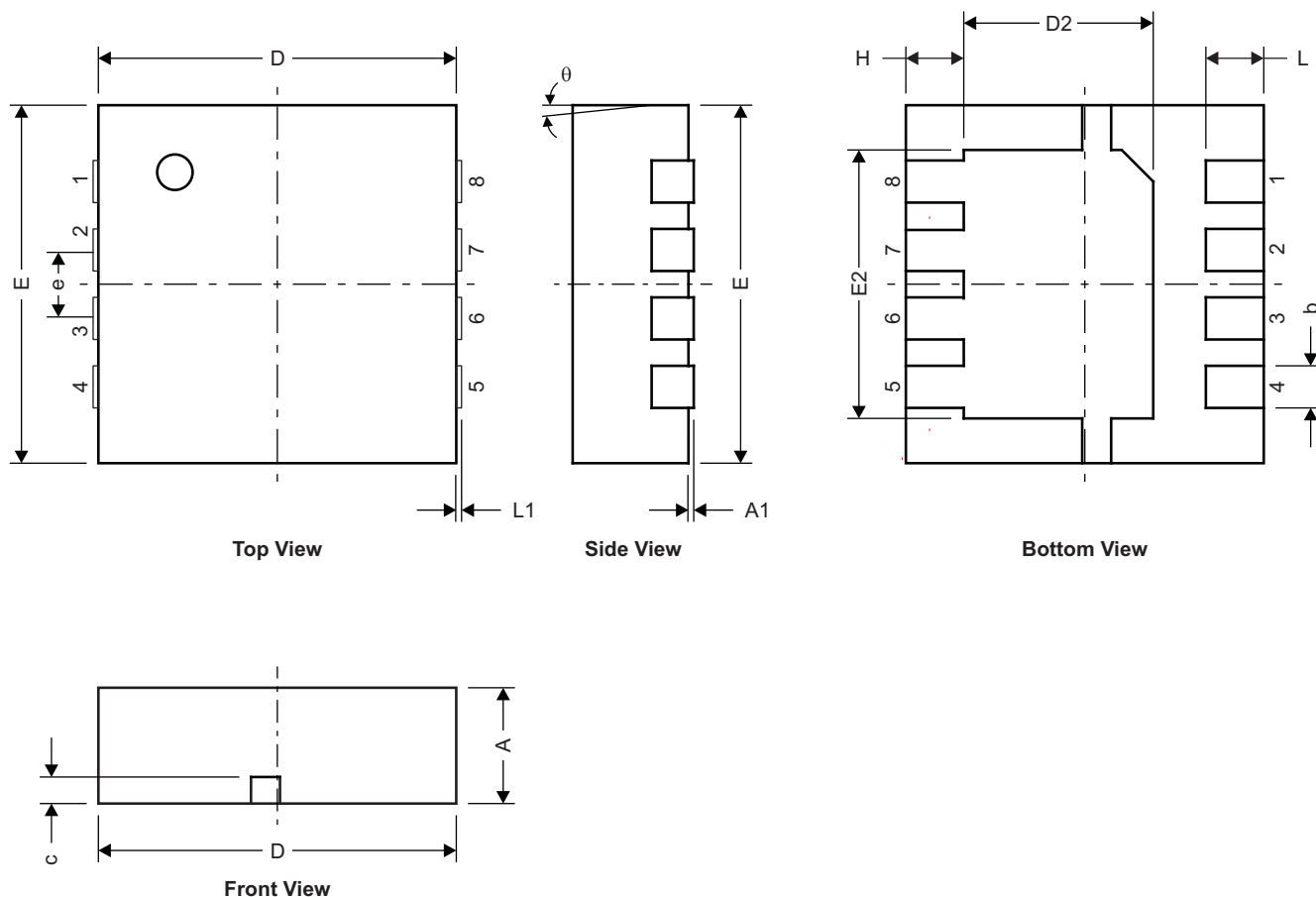


Figure 12. Maximum Drain Current vs. Temperature

MECHANICAL DATA

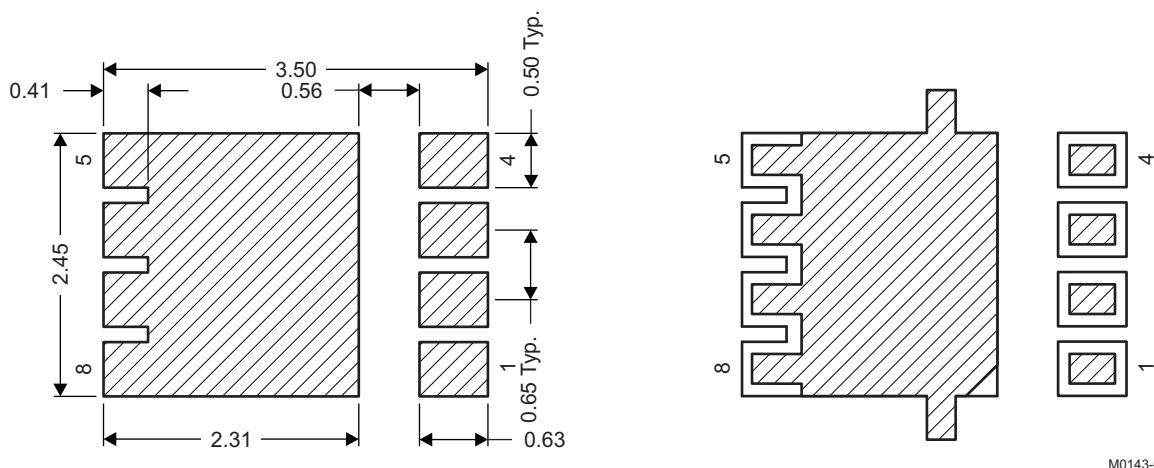
Q3 Package Dimensions



M0142-01

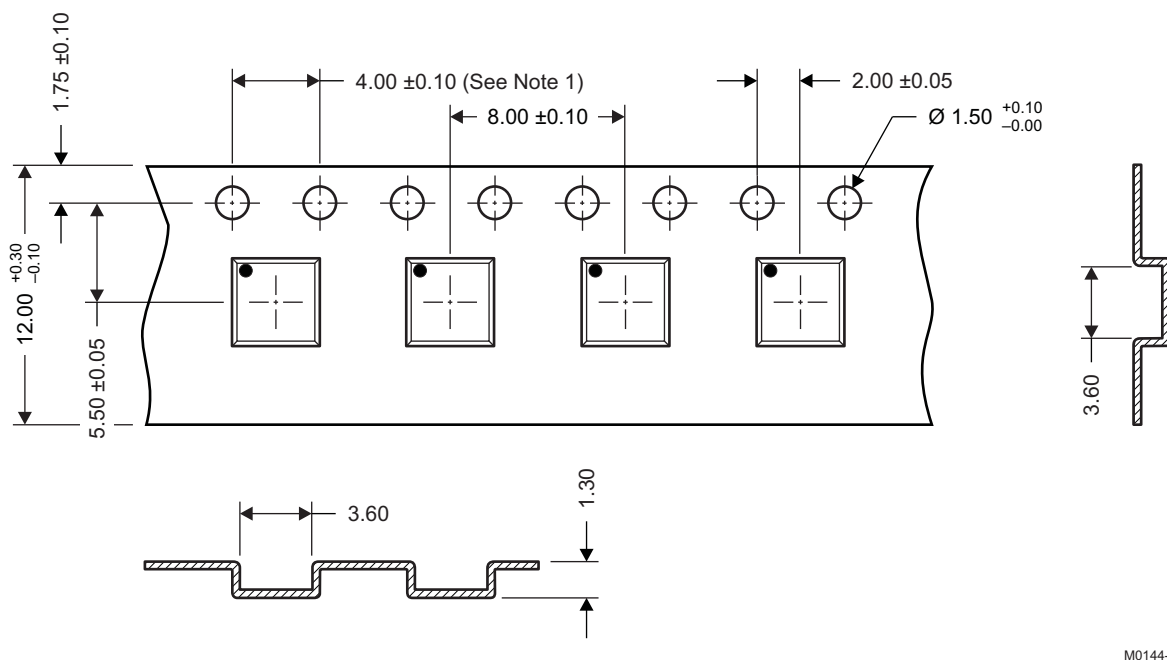
DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.950	1.000	1.100	0.037	0.039	0.043
A1	0.000	0.000	0.050	0.000	0.000	0.002
b	0.280	0.340	0.400	0.011	0.013	0.016
c	0.150	0.200	0.250	0.006	0.008	0.010
D	3.200	3.300	3.400	0.126	0.130	0.134
D1	–	–	–	–	–	–
D2	1.650	1.750	1.800	0.065	0.069	0.071
E	3.200	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 Pattern



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

Q3 Tape and Reel Information



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

TAPE AND REEL INFORMATION


*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
CSD16406Q3	VSON-CLIP	DQG	8	2500	330.0	12.4	3.6	3.6	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)
CSD16406Q3	VSON-CLIP	DQG	8	2500	336.6	336.6	41.3

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