

N-Channel NexFET™ Power MOSFET

 Check for Samples: [CSD16404Q5A](#)

FEATURES

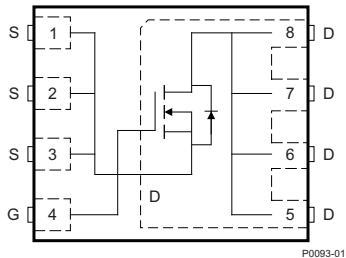
- Ultralow Q_g and Q_{gd}
- Low Thermal Resistance
- Avalanche Rated
- Pb Free Terminal Plating
- RoHS Compliant
- Halogen Free
- SON 5-mm x 6-mm Plastic Package

APPLICATIONS

- Point-of-Load Synchronous Buck 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.

Top View


PRODUCT SUMMARY

V_{DS}	Drain to Source Voltage	25	V
Q_g	Gate Charge Total (4.5V)	6.5	nC
Q_{gd}	Gate Charge Gate to Drain	1.7	nC
$R_{DS(on)}$	Drain to Source On Resistance	$V_{GS} = 4.5V$	5.7 mΩ
		$V_{GS} = 10V$	4.1 mΩ
$V_{GS(th)}$	Threshold Voltage	1.8	V

ORDERING INFORMATION

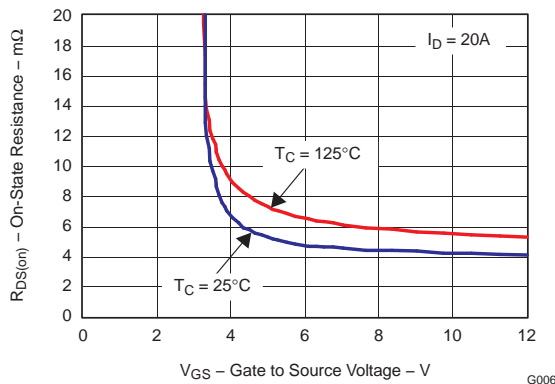
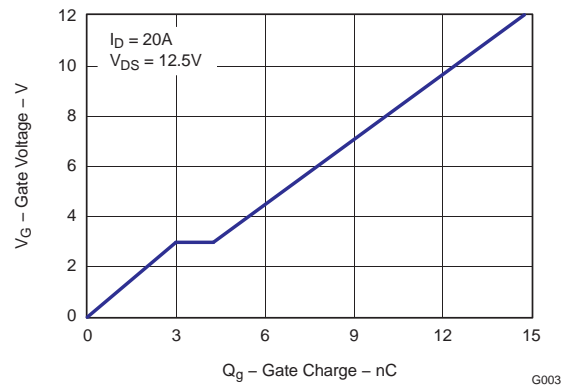
Device	Package	Media	Qty	Ship
CSD16404Q5A	SON 5-mm x 6-mm Plastic Package	13-Inch Reel	2500	Tape and Reel

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	+16 / -12	V
I_D	Continuous Drain Current, $T_C = 25^\circ\text{C}$	81	A
	Continuous Drain Current ⁽¹⁾	21	A
I_{DM}	Pulsed Drain Current, $T_A = 25^\circ\text{C}$ ⁽²⁾	135	A
P_D	Power Dissipation ⁽¹⁾	3	W
T_J, T_{STG}	Operating Junction and Storage Temperature Range	-55 to 150	$^\circ\text{C}$
E_{AS}	Avalanche Energy, single pulse $I_D = 40A, L = 0.1mH, R_G = 25\Omega$	80	mJ

(1) $R_{\theta JA} = 41^\circ\text{C/W}$ on 1-inch² (6.45-cm²), 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}

GATE CHARGE


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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

$T_A = 25^\circ\text{C}$, unless otherwise specified

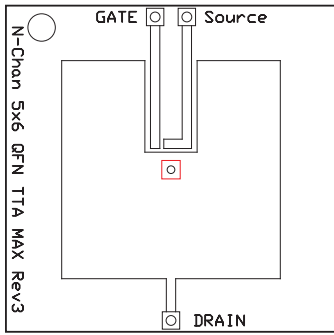
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Static Characteristics						
V_{DSS}	Drain to Source Voltage	$V_{GS} = 0V, I_D = 250\mu\text{A}$	25			V
I_{DSS}	Drain to Source Leakage Current	$V_{GS} = 0V, V_{DS} = 20V$			1	μA
I_{GSS}	Gate to Source Leakage Current	$V_{DS} = 0V, V_{GS} = +16/-12V$			100	nA
$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$	1.4	1.8	2.1	V
$R_{DS(on)}$	Drain to Source On Resistance	$V_{GS} = 4.5V, I_D = 20A$		5.7	7.2	m Ω
		$V_{GS} = 10V, I_D = 20A$		4.1	5.1	m Ω
g_{fs}	Transconductance	$V_{DS} = 15V, I_D = 20A$		57		S
Dynamic Characteristics						
C_{ISS}	Input Capacitance	$V_{GS} = 0V, V_{DS} = 12.5V, f = 1\text{MHz}$		940	1220	pF
C_{OSS}	Output Capacitance			810	1050	pF
C_{RSS}	Reverse Transfer Capacitance			62	80	pF
R_g	Series Gate Resistance			0.9	1.8	Ω
Q_g	Gate Charge Total (4.5V)	$V_{DS} = 12.5V, I_D = 20A$		6.5	8.5	nC
Q_{gd}	Gate Charge Gate to Drain			1.7		nC
Q_{gs}	Gate Charge Gate to Source			3		nC
$Q_{g(th)}$	Gate Charge at V_{th}			1.5		nC
Q_{OSS}	Output Charge	$V_{DS} = 13V, V_{GS} = 0V$		16		nC
$t_{d(on)}$	Turn On Delay Time	$V_{DS} = 12.5V, V_{GS} = 4.5V, I_D = 20A, R_G = 2\Omega$		7.8		ns
t_r	Rise Time			13.4		ns
$t_{d(off)}$	Turn Off Delay Time			8.4		ns
t_f	Fall Time			4.6		ns
Diode Characteristics						
V_{SD}	Diode Forward Voltage	$I_S = 20A, V_{GS} = 0V$		0.85	1	V
Q_{rr}	Reverse Recovery Charge	$V_{DD} = 13V, I_F = 20A, di/dt = 300A/\mu\text{s}$		20		nC
t_{rr}	Reverse Recovery Time	$V_{DD} = 13V, I_F = 20A, di/dt = 300A/\mu\text{s}$		22		ns

THERMAL CHARACTERISTICS

$T_A = 25^\circ\text{C}$, unless otherwise specified

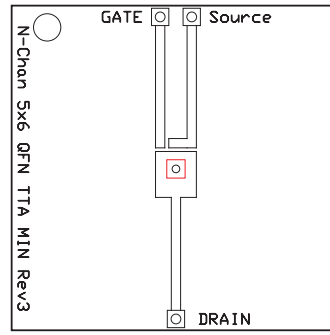
PARAMETER		MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Thermal Resistance Junction to Case ⁽¹⁾			3.3	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance Junction to Ambient ^{(1) (2)}			52	$^\circ\text{C/W}$

- $R_{\theta JC}$ is determined with the device mounted on a 1-inch² (6.45-cm²), 2-oz. (0.071-mm thick) Cu pad on a 1.5-inch x 1.5-inch (3.81-cm x 3.81-cm), 0.06-inch (1.52-mm) thick FR4 PCB. $R_{\theta JC}$ is specified by design, whereas $R_{\theta JA}$ is determined by the user's board design.
- Device mounted on FR4 material with 1-inch² (6.45-cm²), 2-oz. (0.071-mm thick) Cu.



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Max $R_{\theta JA} = 52^{\circ}\text{C/W}$
when mounted on
1 inch² (6.45 cm²) of
2-oz. (0.071-mm thick)
Cu.

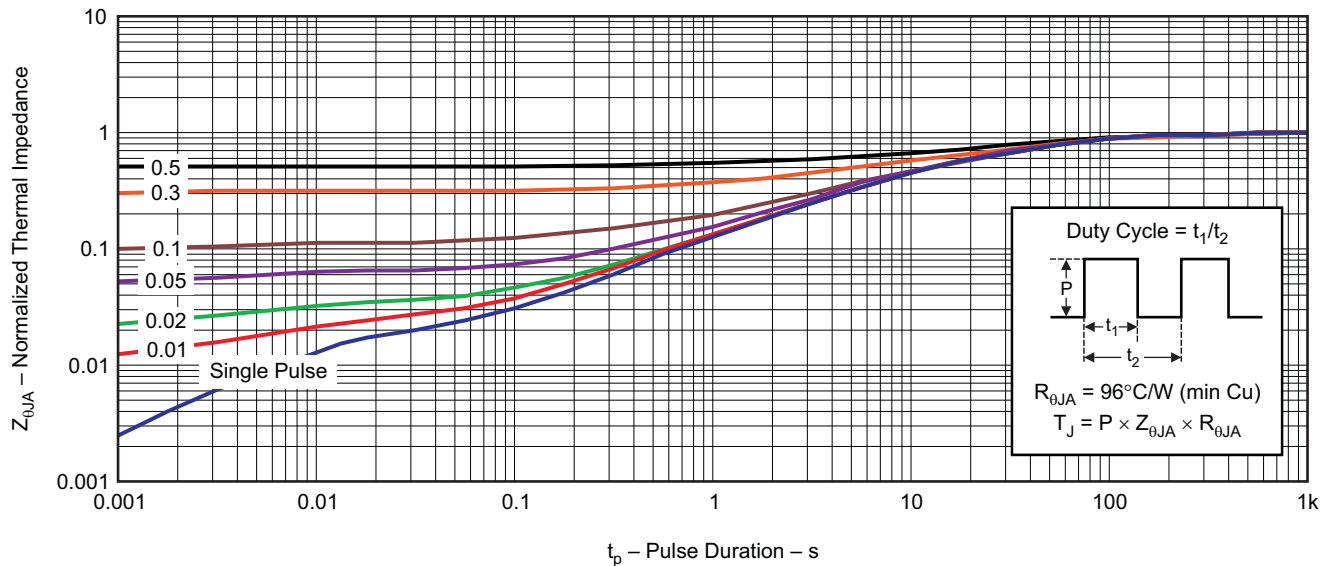


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Max $R_{\theta JA} = 120^{\circ}\text{C/W}$
when mounted on
minimum pad area of
2-oz. (0.071-mm thick)
Cu.

TYPICAL MOSFET CHARACTERISTICS

$T_A = 25^{\circ}\text{C}$, unless otherwise specified



G012

Figure 1. Transient Thermal Impedance

TYPICAL MOSFET CHARACTERISTICS (continued)

$T_A = 25^\circ\text{C}$, unless otherwise specified

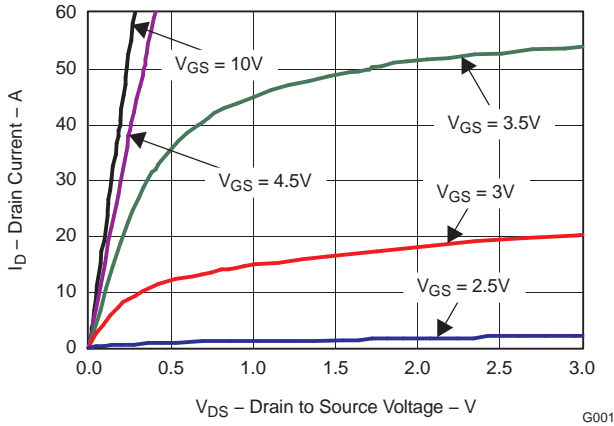


Figure 2. Saturation Characteristics

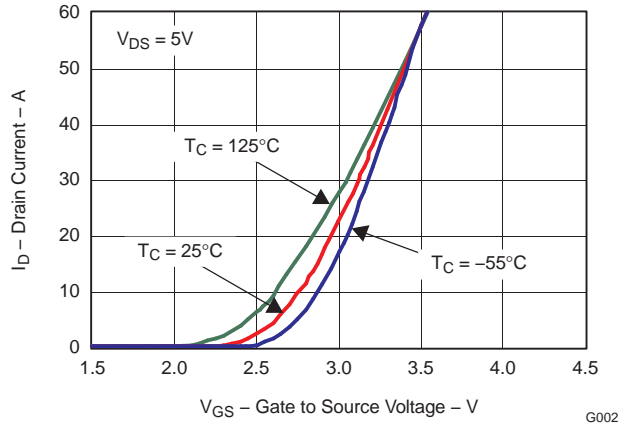


Figure 3. Transfer Characteristics

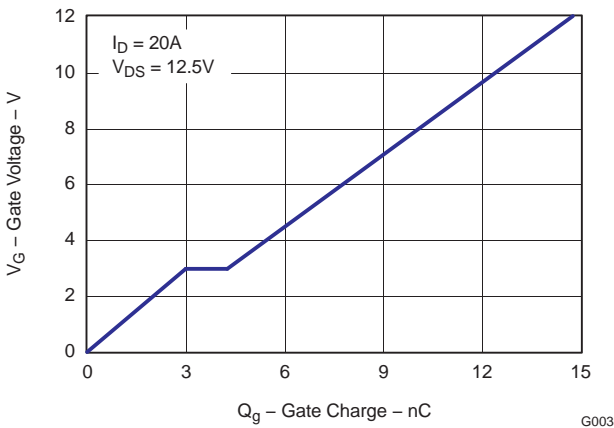


Figure 4. Gate Charge

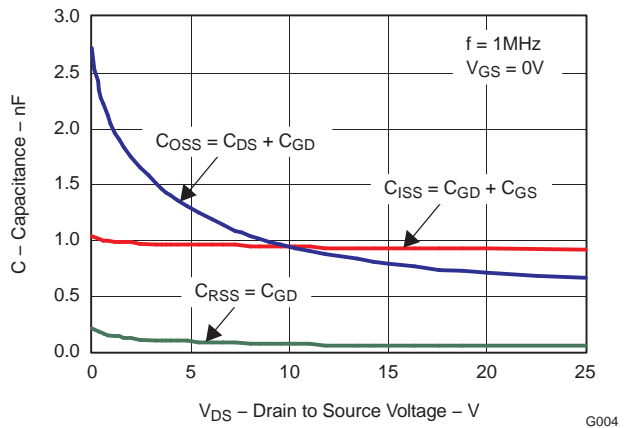


Figure 5. Capacitance

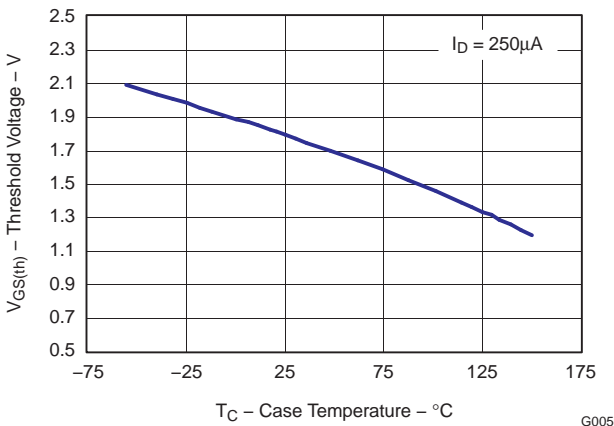


Figure 6. Threshold Voltage vs. Temperature

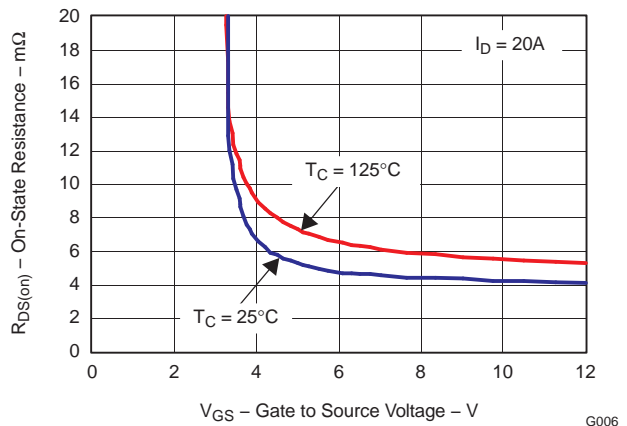


Figure 7. On-State Resistance vs. Gate to Source Voltage

TYPICAL MOSFET CHARACTERISTICS (continued)

T_A = 25°C, unless otherwise specified

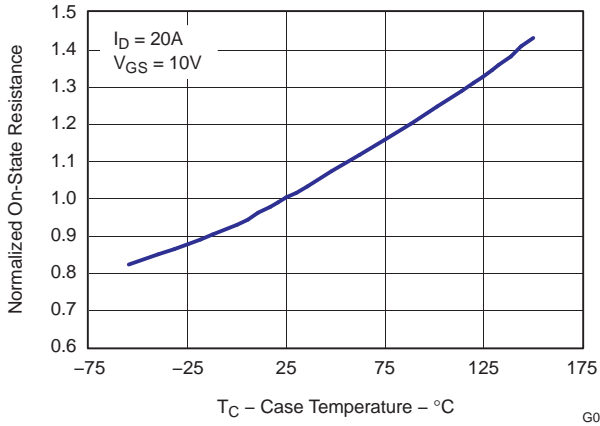


Figure 8. Normalized On-State Resistance vs. Temperature

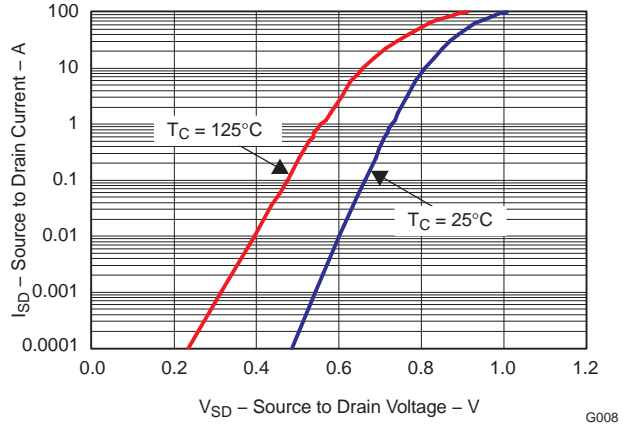


Figure 9. Typical Diode Forward Voltage

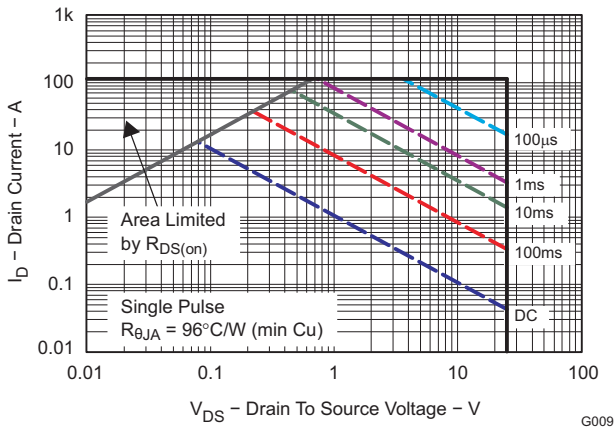


Figure 10. Maximum Safe Operating Area

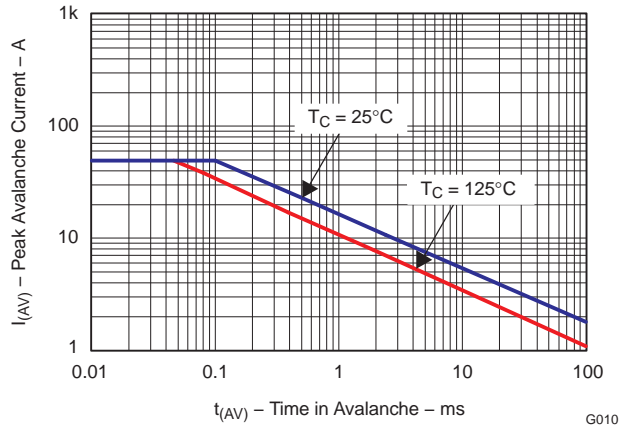


Figure 11. Single Pulse Unclamped Inductive Switching

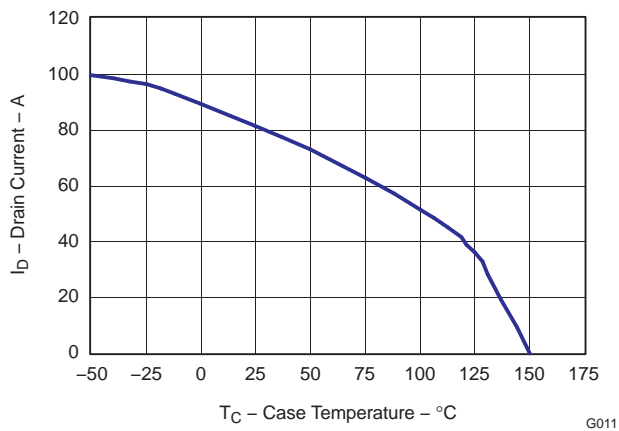
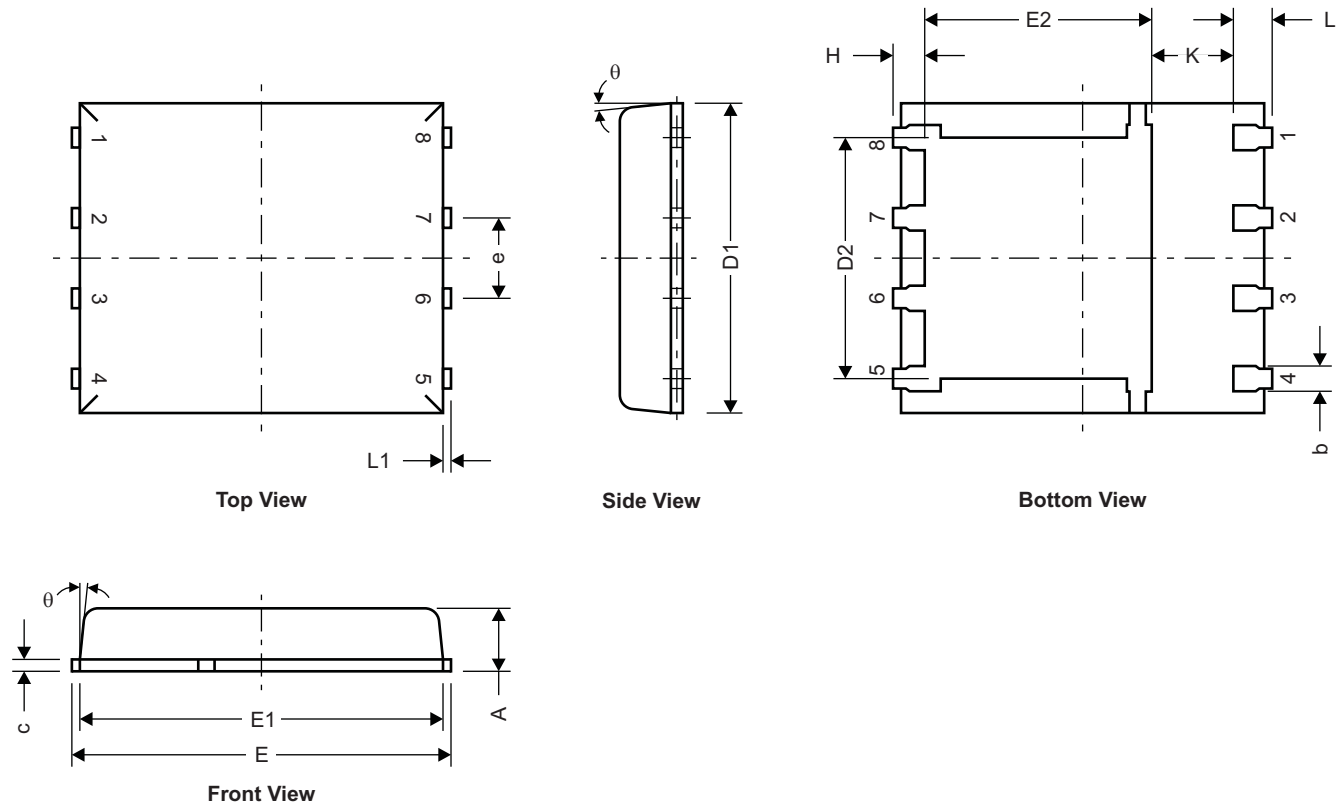


Figure 12. Maximum Drain Current vs. Temperature

MECHANICAL DATA

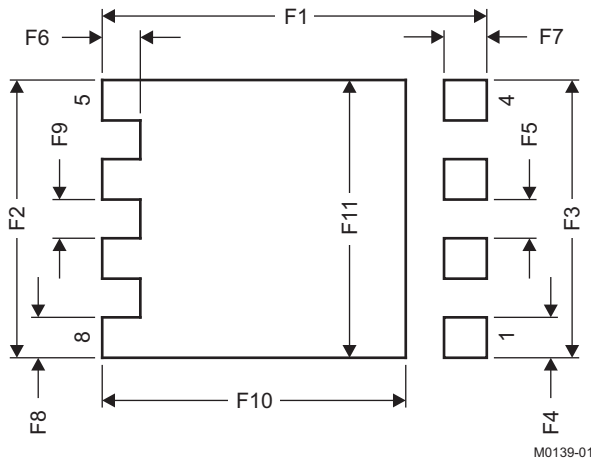
Q5A Package Dimensions



M0135-01

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.90	1.00	1.10
b	0.33	0.41	0.51
c	0.20	0.25	0.30
D1	4.80	4.90	5.00
D2	3.61	3.81	3.96
E	5.90	6.00	6.10
E1	5.70	5.75	5.80
E2	3.38	3.58	3.78
e	1.27 BSC		
H	0.41	0.51	0.61
K	1.10		
L	0.51	0.61	0.71
L1	0.06	0.13	0.20
θ	0°		12°

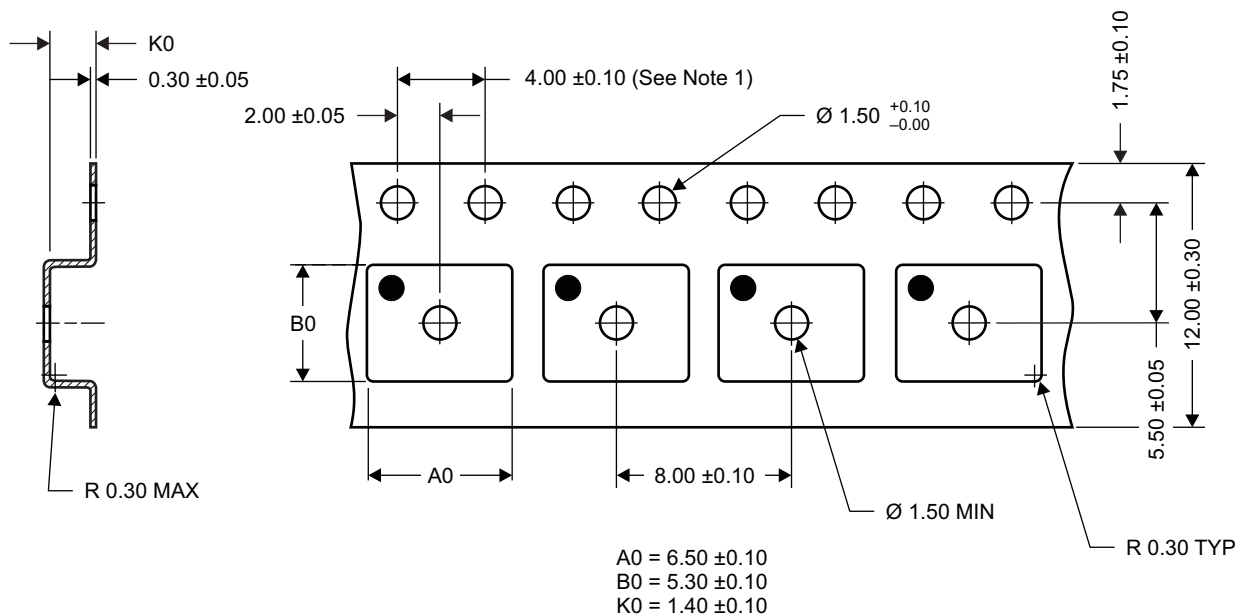
Recommended PCB Pattern



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](#).

Q5A Tape and Reel Information



- Notes:
- 10-sprocket hole-pitch cumulative tolerance ± 0.22
 - 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

M0138-01

REVISION HISTORY

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

- Changed [Figure 10](#) - Maximum Safe Operating Area, Drain Current top scale From: 100ms To: 100µs **5**
-

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

- 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
CSD16404Q5A	VSONP	DQJ	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)
CSD16404Q5A	VSONP	DQJ	8	2500	340.0	340.0	38.0

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