

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 × 6-mm Plastic Package

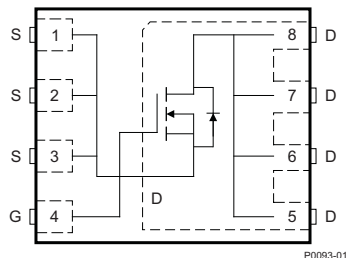
APPLICATIONS

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

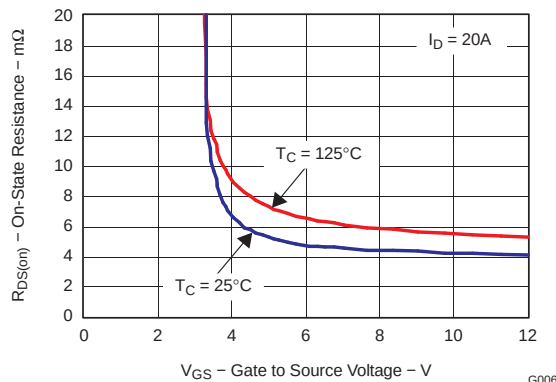
DESCRIPTION

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

Top View

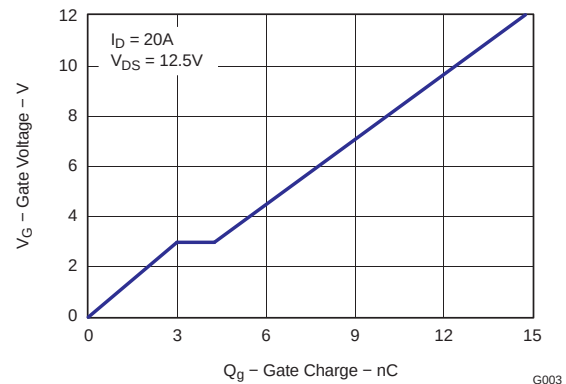


P0093-01

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


G006

GATE CHARGE



G003

PRODUCT SUMMARY

V_{DS}	Drain to Source Voltage	25	V
Q_g	Gate Charge Total (4.5V)	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 × 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 $\leq 2\%$



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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

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

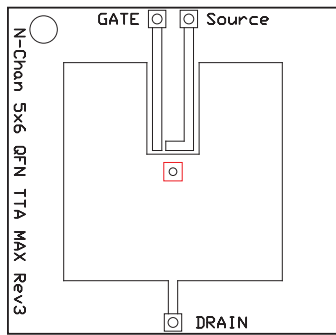
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT	
Static Characteristics							
BV _{DSS}	Drain to Source Voltage	V _{GS} = 0V, I _D = 250μA	25			V	
I _{DSS}	Drain to Source Leakage Current	V _{GS} = 0V, V _{DS} = 20V	1			μA	
I _{GSS}	Gate to Source Leakage Current	V _{DS} = 0V, V _{GS} = +16/-12V	100			nA	
V _{GS(th)}	Gate to Source Threshold Voltage	V _{DS} = V _{GS} , I _D = 250μA	1.4	1.8	2.1	V	
R _{DS(on)}	Drain to Source On Resistance	V _{GS} = 4.5V, I _D = 20A	5.7			7.2	mΩ
		V _{GS} = 10V, I _D = 20A	4.1			5.1	mΩ
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 = 1MHz	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 = 2Ω	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/μs	20			nC	
t _{rr}	Reverse Recovery Time	V _{DD} = 13V, I _F = 20A, di/dt = 300A/μs	22			ns	

THERMAL CHARACTERISTICS

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

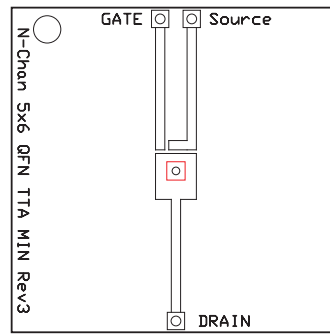
PARAMETER		MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Thermal Resistance Junction to Case ⁽¹⁾			3.3	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance Junction to Ambient ^{(1) (2)}			52	$^\circ\text{C/W}$

- (1) $R_{\theta JC}$ 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 × 1.5-inch (3.81-cm × 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.
- (2) Device mounted on FR4 material with 1-inch² (6.45-cm²), 2-oz. (0.071-mm thick) Cu.



M0137-01

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.

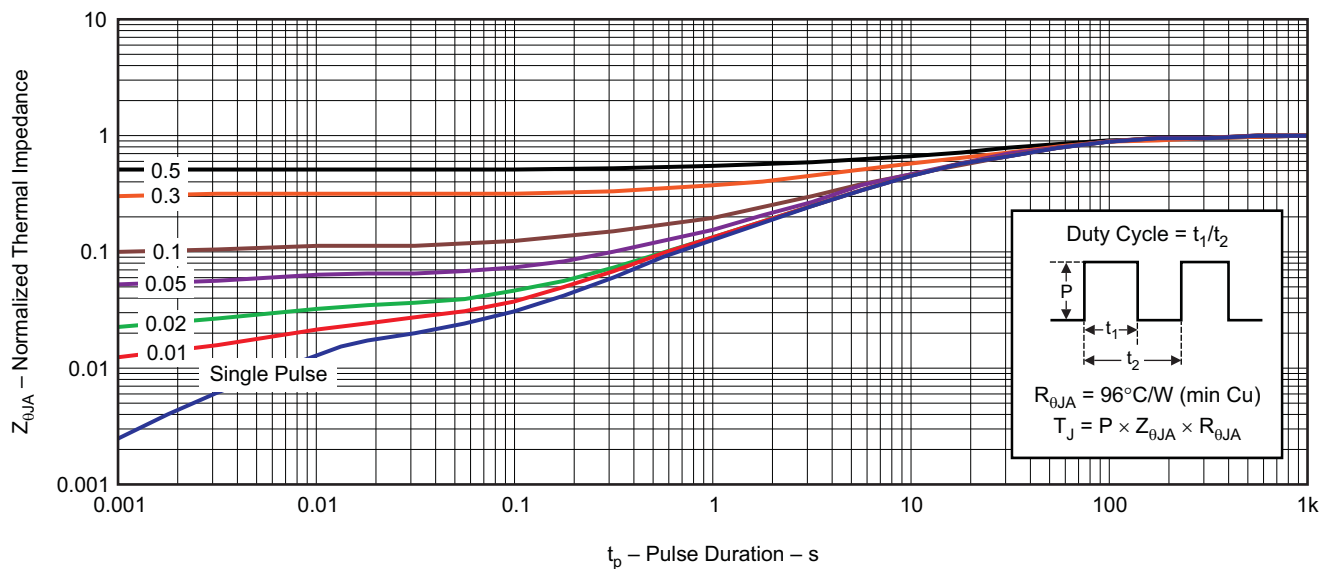


M0137-02

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

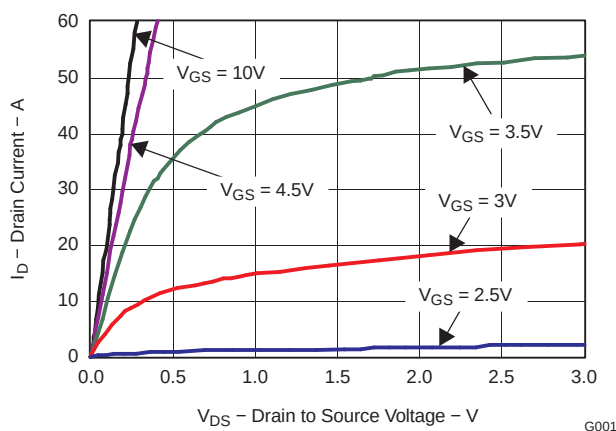


Figure 2. Saturation Characteristics

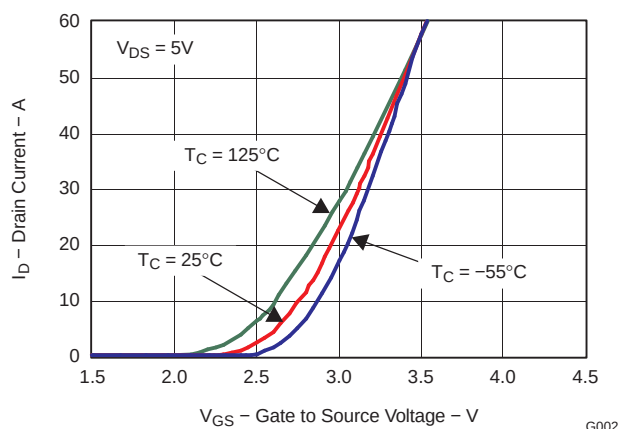


Figure 3. Transfer Characteristics

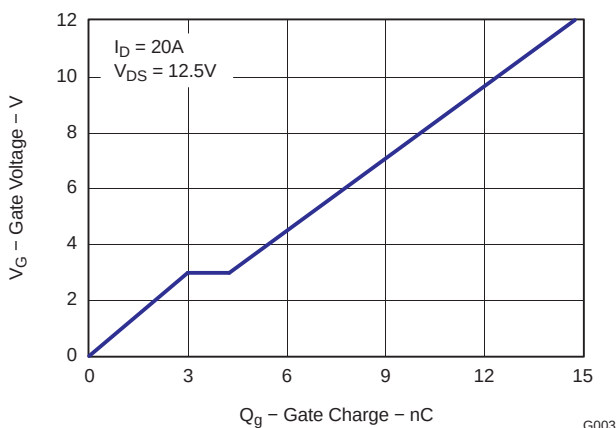


Figure 4. Gate Charge

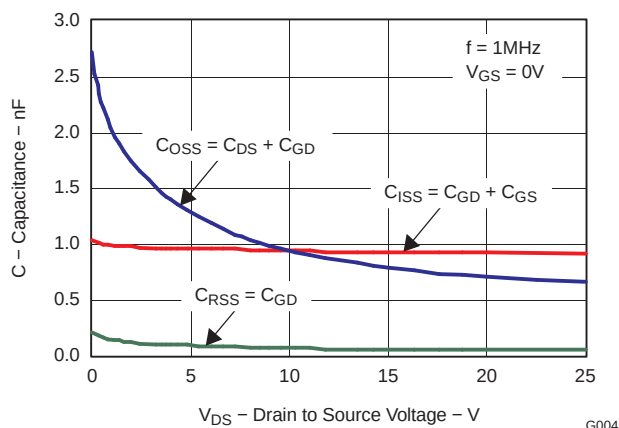


Figure 5. Capacitance

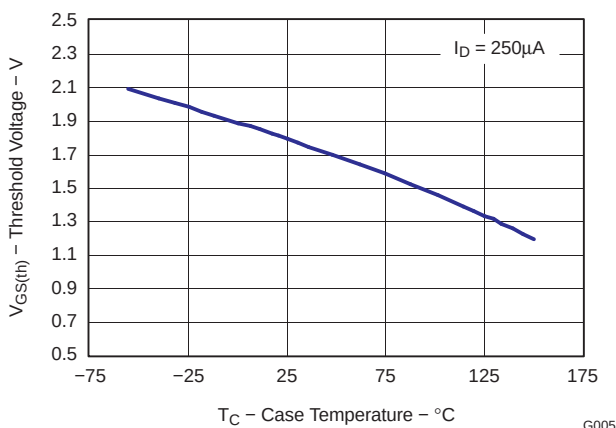


Figure 6. Threshold Voltage vs. Temperature

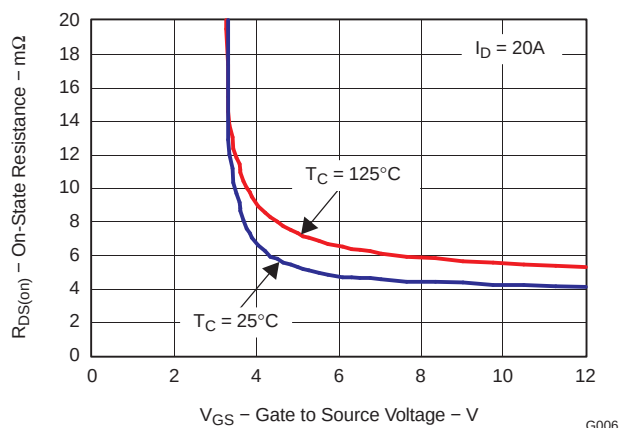


Figure 7. On-State Resistance vs. Gate to Source Voltage

TYPICAL MOSFET CHARACTERISTICS (continued)

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

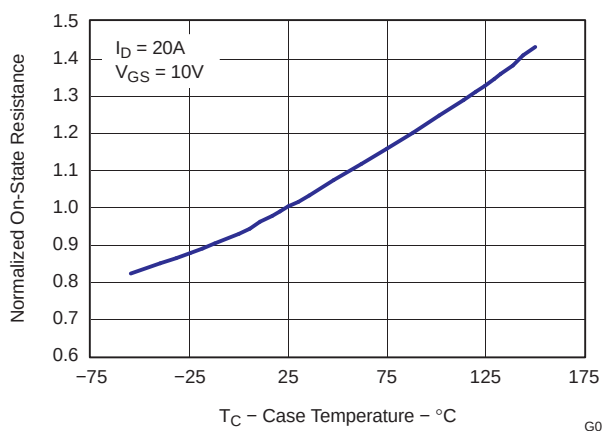


Figure 8. Normalized On-State Resistance vs. Temperature

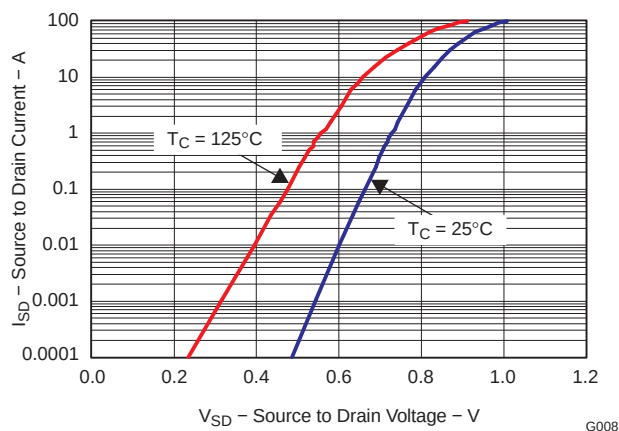


Figure 9. Typical Diode Forward Voltage

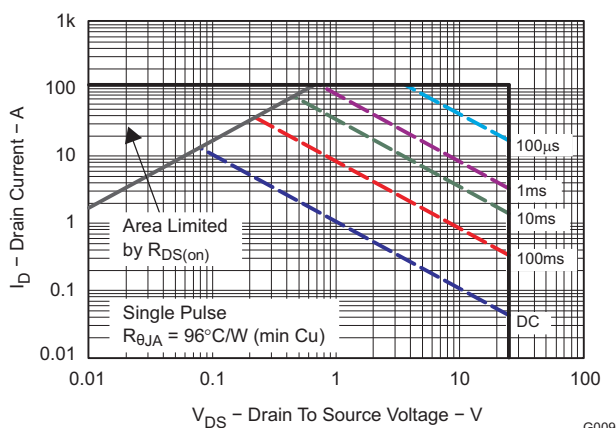


Figure 10. Maximum Safe Operating Area

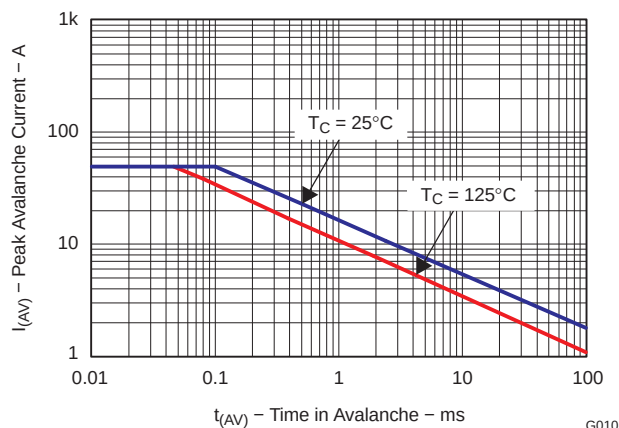


Figure 11. Single Pulse Unclamped Inductive Switching

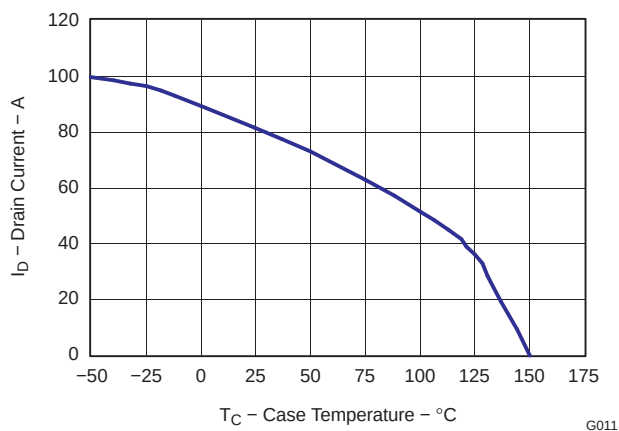
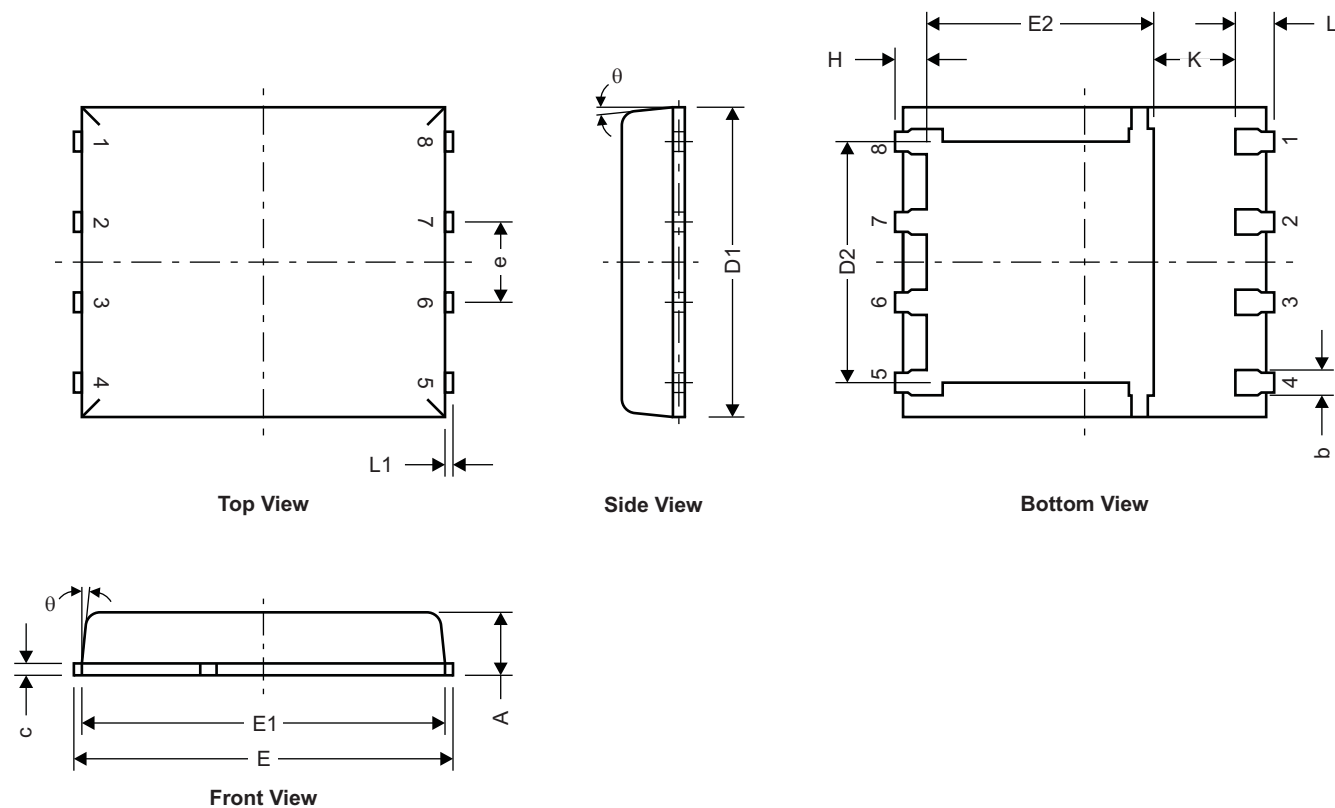


Figure 12. Maximum Drain Current vs. Temperature

MECHANICAL DATA

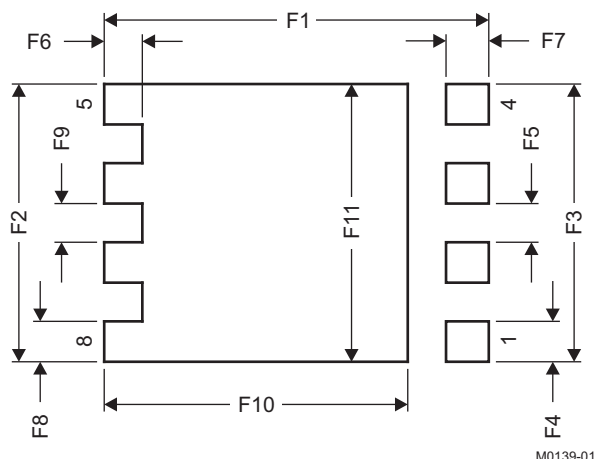
Q5A Package Dimensions



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°

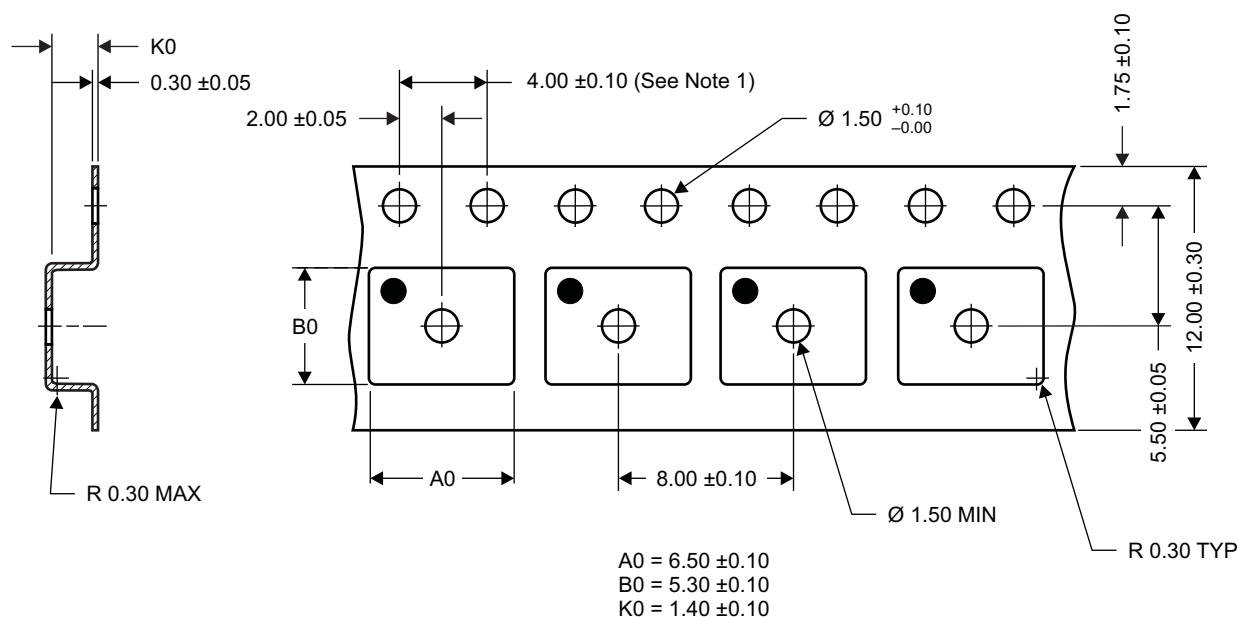
Recommended PCB Pattern



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](#).

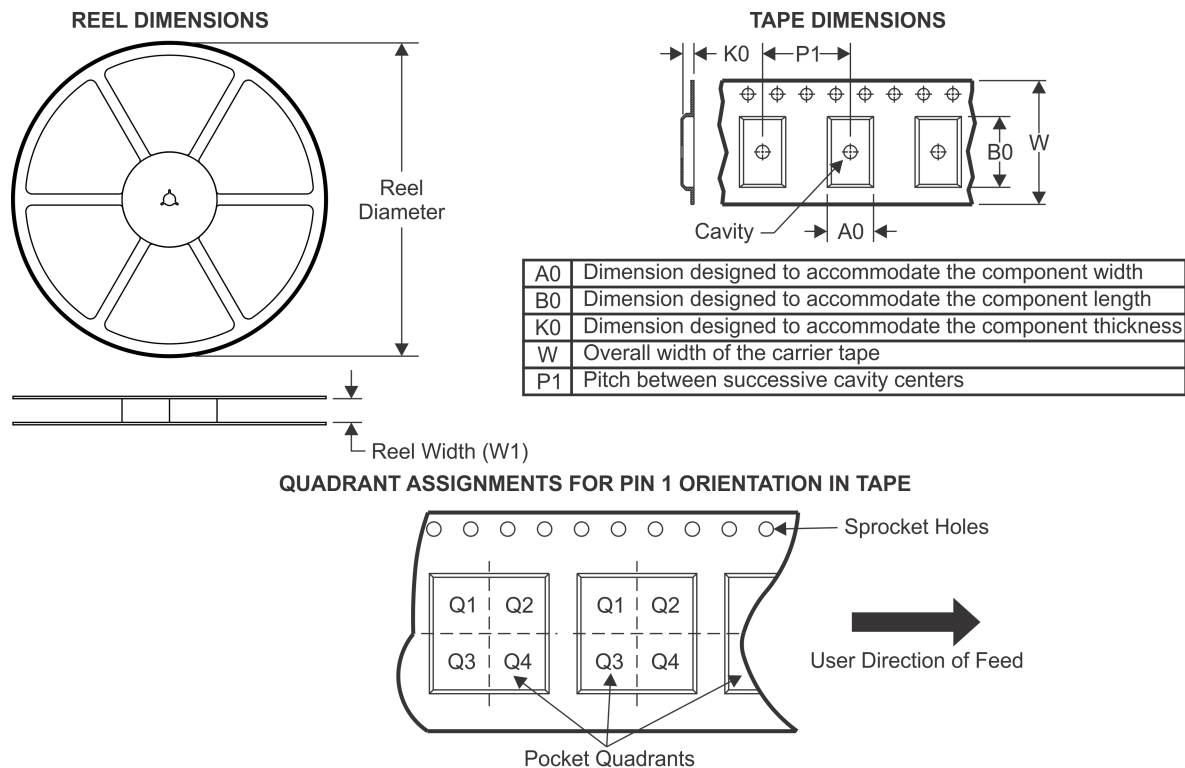
Q5A Tape and Reel Information



- Notes:
1. 10-sprocket hole-pitch cumulative tolerance ± 0.22
 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. A0 and B0 measured on a plane 0.3mm above the bottom of the pocket
 6. MSL1 260°C (IR and convection) PbF reflow compatible

REVISION HISTORY

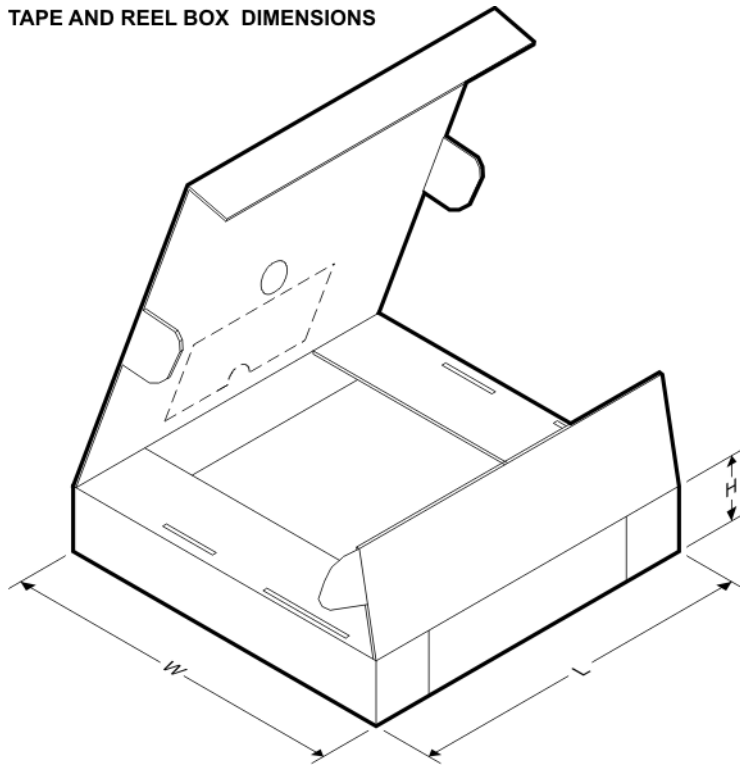
Changes from Original (August 2009) to Revision A	Page
Changed Figure 10 - Maximum Safe Operating Area, Drain Current top scale From: 100ms To: 100μs	5
Changes from Revision A (September 2009) to Revision B	Page
Deleted the Package Marking Information section	7

TAPE AND REEL INFORMATION


*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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