

N-Channel NexFET™ Power MOSFET

 Check for Samples: [CSD16404Q5A](#)

FEATURES

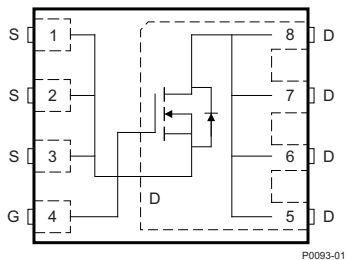
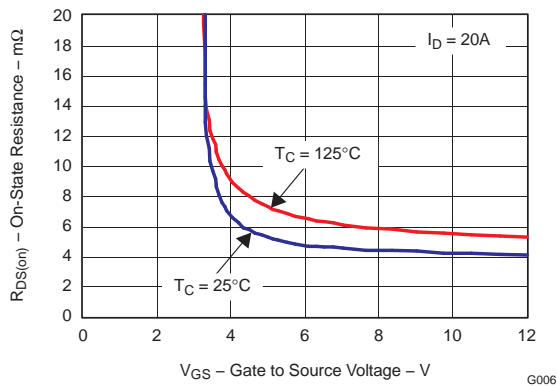
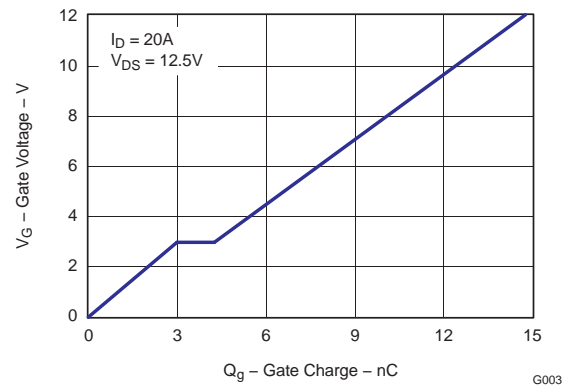
- Ultralow Q_g and Q_{gd}
- Low Thermal Resistance
- Avalanche Rated
- Pb Free Terminal Plating
- RoHS Compliant
- Halogen Free
- SON 5-mm x 6-mm Plastic Package

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

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

GATE CHARGE


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 $I_D = 40A, L = 0.1\text{mH}, R_G = 25\Omega$	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 $\leq 2\%$



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

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

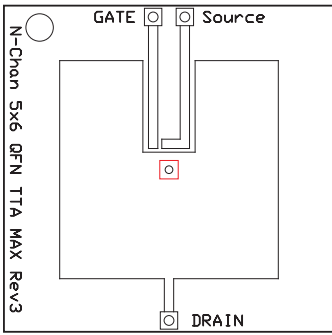
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Static Characteristics						
BV_{DSS}	Drain to Source Voltage	$V_{GS} = 0V, I_D = 250\mu\text{A}$	25			V
I_{DSS}	Drain to Source Leakage Current	$V_{GS} = 0V, V_{DS} = 20V$			1	μA
I_{GSS}	Gate to Source Leakage Current	$V_{DS} = 0V, V_{GS} = +16/-12V$			100	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

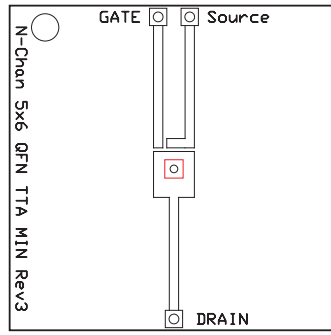
PARAMETER		MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Thermal Resistance Junction to Case ⁽¹⁾			3.3	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance Junction to Ambient ^{(1) (2)}			52	$^\circ\text{C}/\text{W}$

- $R_{\theta JC}$ 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.



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.

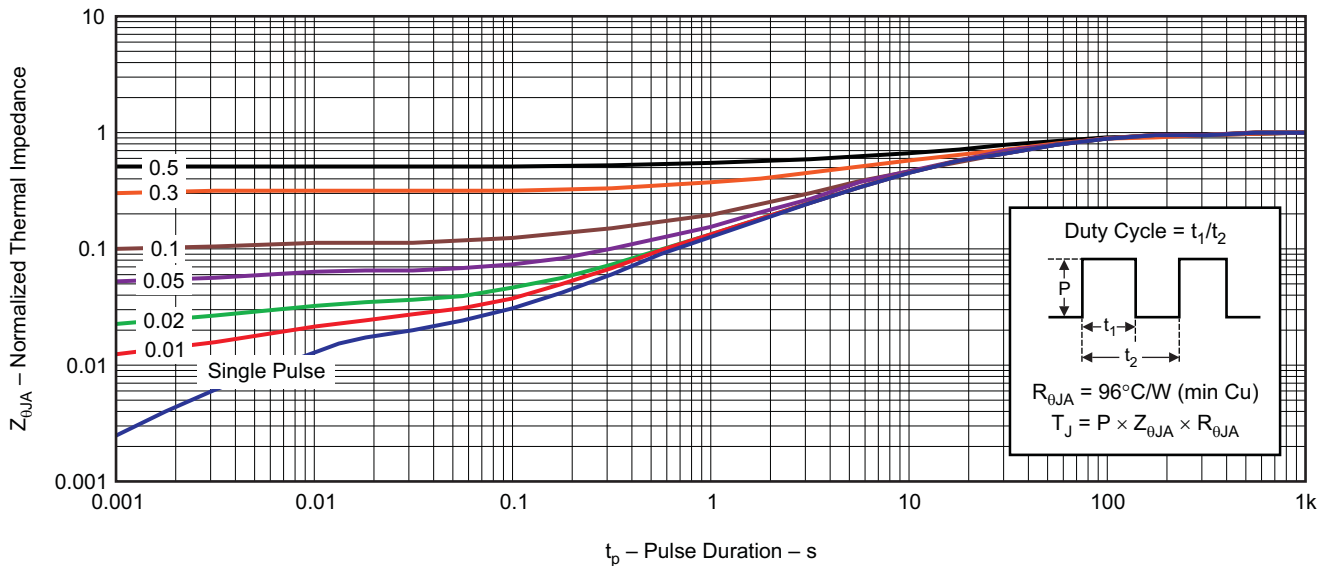


M0137-02

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

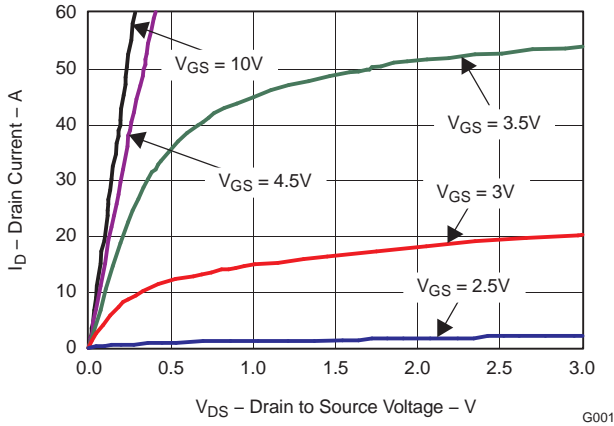


Figure 2. Saturation Characteristics

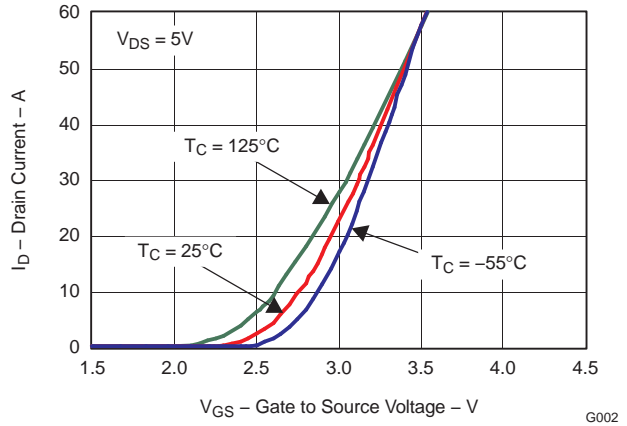


Figure 3. Transfer Characteristics

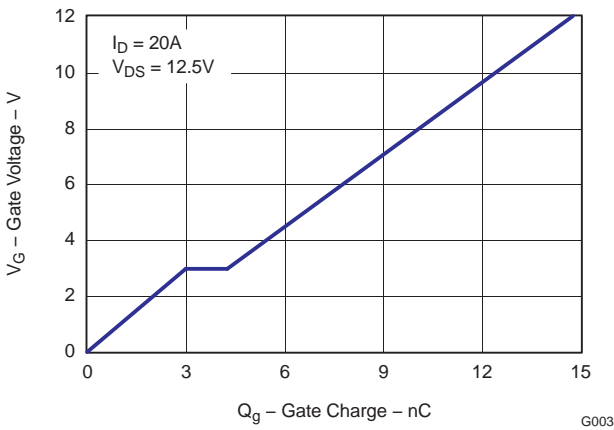


Figure 4. Gate Charge

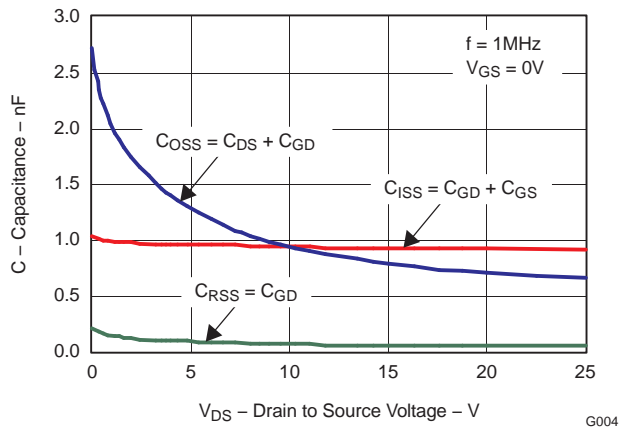


Figure 5. Capacitance

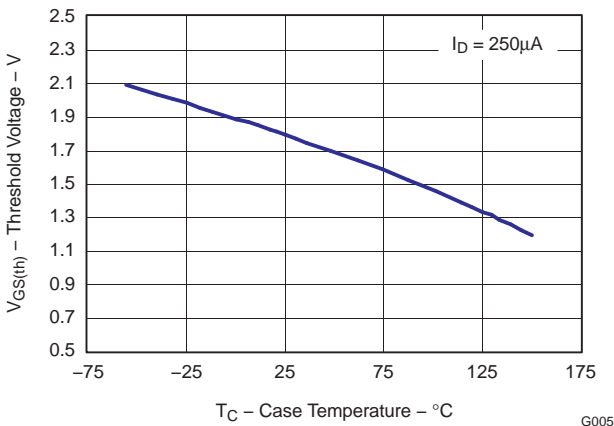


Figure 6. Threshold Voltage vs. Temperature

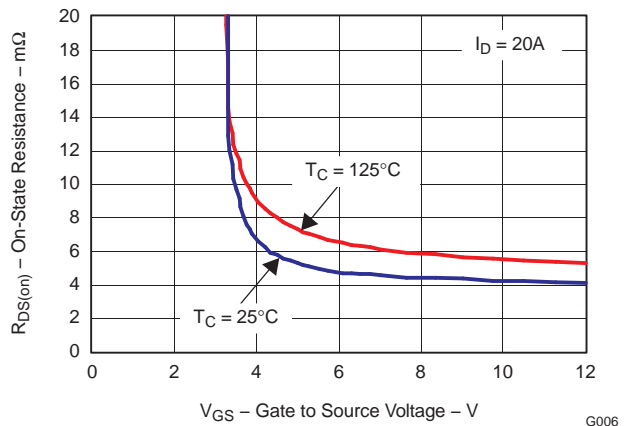


Figure 7. On-State Resistance vs. Gate to Source Voltage

TYPICAL MOSFET CHARACTERISTICS (continued)

T_A = 25°C, unless otherwise specified

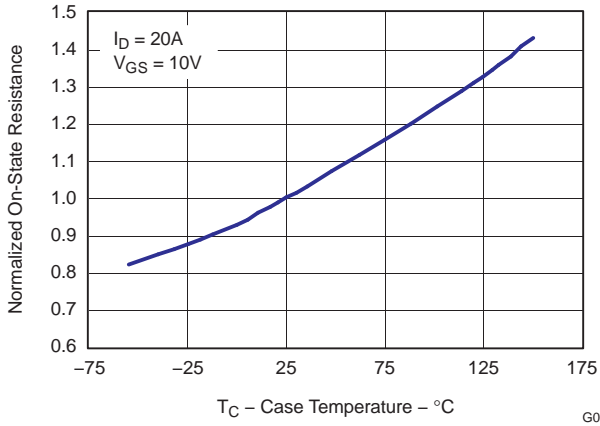


Figure 8. Normalized On-State Resistance vs. Temperature

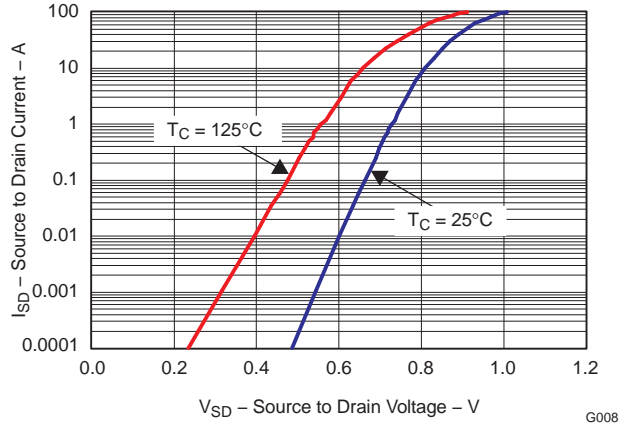


Figure 9. Typical Diode Forward Voltage

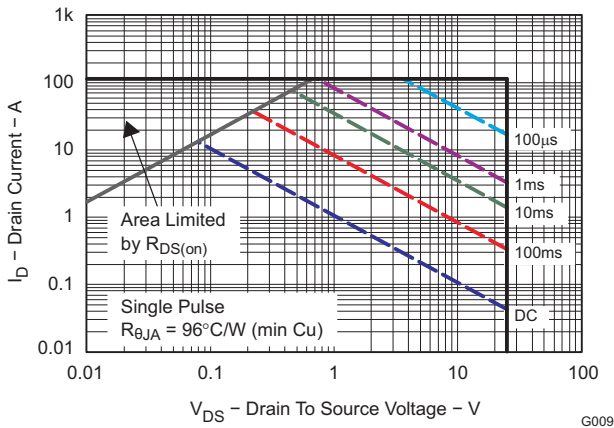


Figure 10. Maximum Safe Operating Area

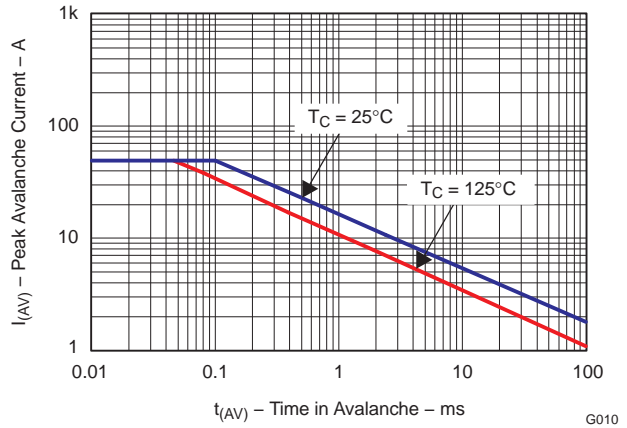


Figure 11. Single Pulse Unclamped Inductive Switching

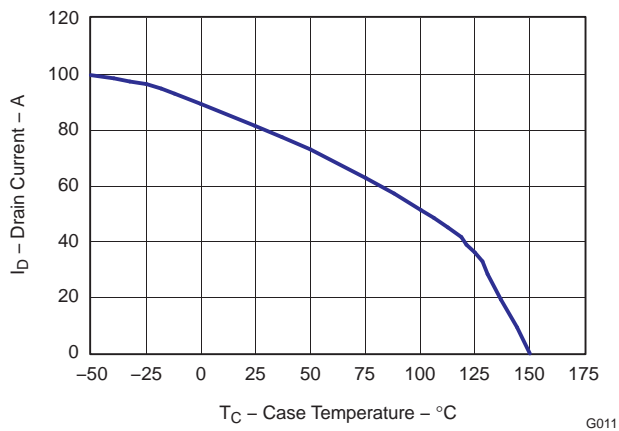
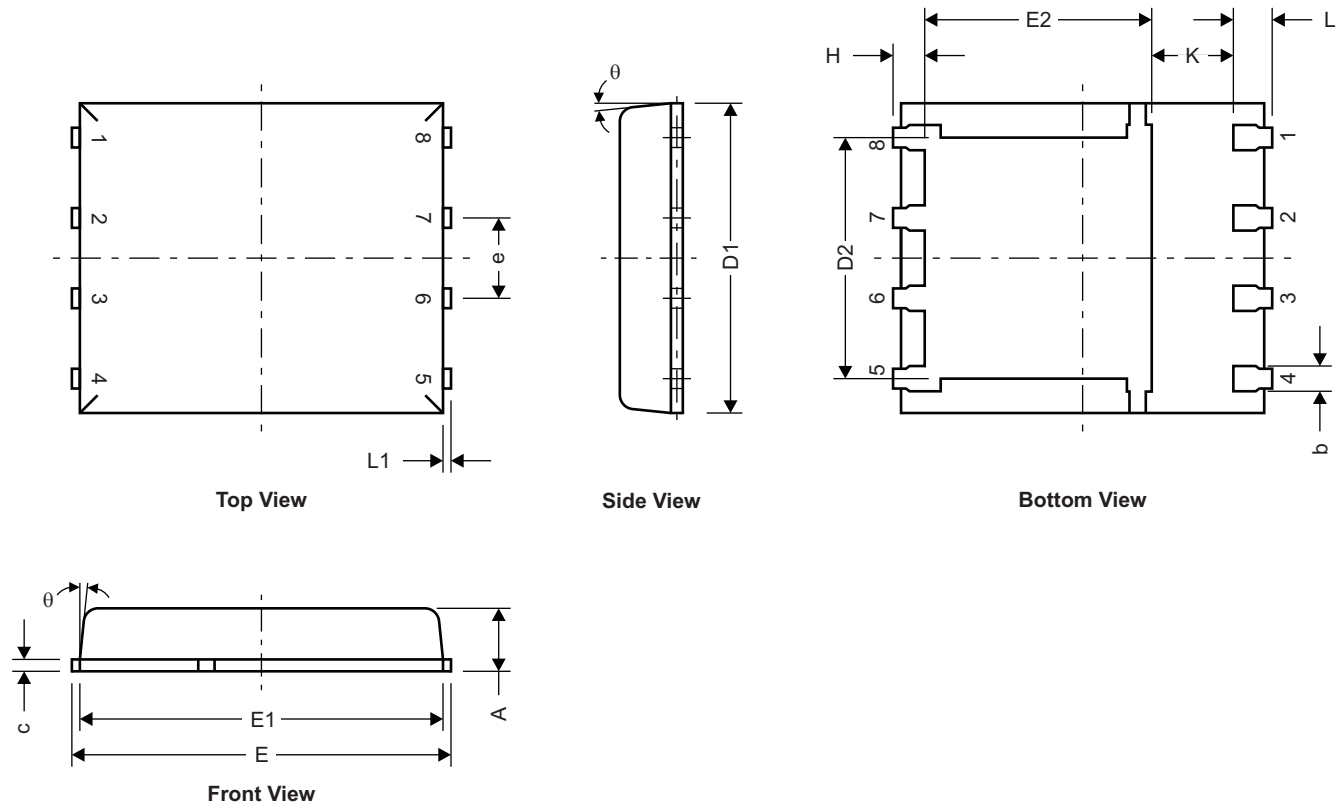


Figure 12. Maximum Drain Current vs. Temperature

MECHANICAL DATA

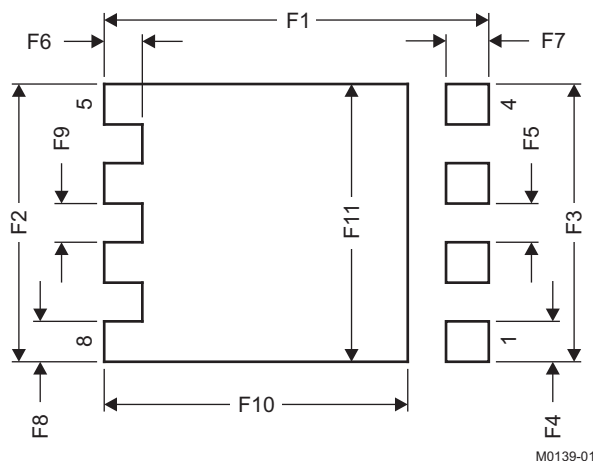
Q5A Package Dimensions



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°

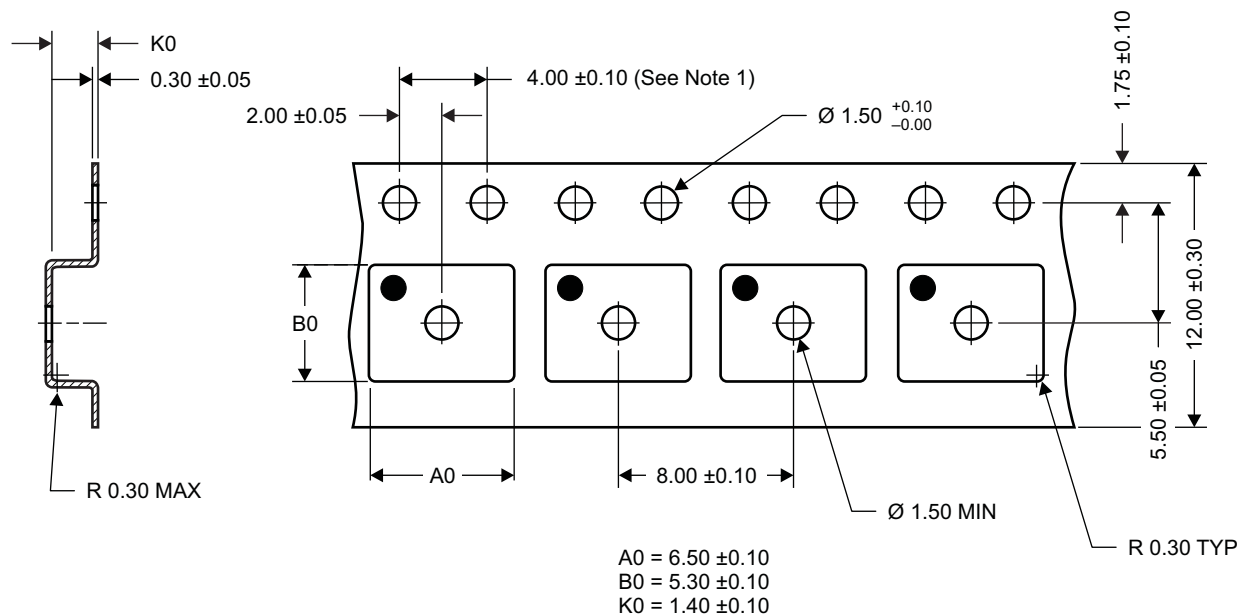
Recommended PCB Pattern



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: 100 μ s **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

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Applications Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Automotive and Transportation	www.ti.com/automotive
Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Video and Imaging	www.ti.com/video

TI E2E Community

e2e.ti.com

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[Texas Instruments:](#)

[CSD16404Q5A](#)