

P-Channel NexFET™ Power MOSFETs

Check for Samples: [CSD25401Q3](#)

FEATURES

- Ultra Low Q_g and Q_{gd}
- Low Thermal Resistance
- Low $R_{DS(on)}$
- Pb Free Terminal Plating
- RoHS Compliant
- Halogen Free
- SON 3.3mm x 3.3mm Plastic Package

APPLICATIONS

- DC-DC Converters
- Battery Management
- Load Switch
- Battery Protection

DESCRIPTION

The NexFET™ power MOSFET has been designed to minimize losses in power conversion load management applications. The SON 3x3 package offers excellent thermal performance for the size of the package.

Table 1. PRODUCT SUMMARY

V _{DS}	Drain to Source Voltage	–20		V
Q _g	Gate Charge Total (4.5V)	8.8		nC
Q _{gd}	Gate Charge Gate to Drain	2.1		nC
R _{DS(on)}	Drain to Source On Resistance	V _{GS} = –2.5V	13.5	mΩ
		V _{GS} = –4.5V	8.8	mΩ
V _{th}	Threshold Voltage	–0.85		V

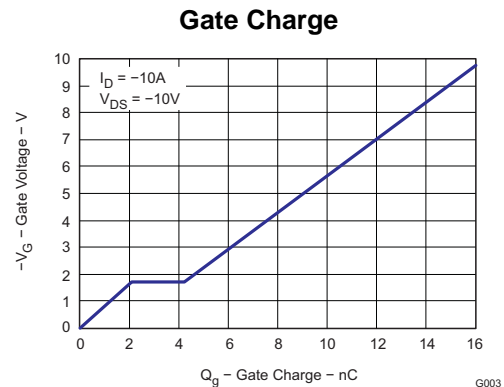
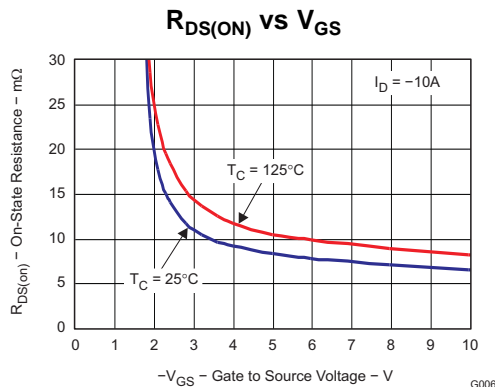
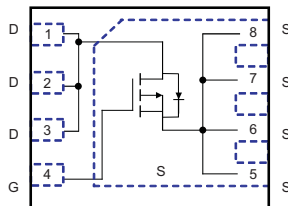
ORDERING INFORMATION

Device	Package	Media	Qty	Ship
CSD25401Q3	SON 3 x 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	–20	V
V_{GS}	Gate to Source Voltage	+12 / –12	V
I_D	Continuous Drain Current, $T_C = 25^\circ\text{C}$	–60	A
	Continuous Drain Current ⁽¹⁾	–14	A
I_{DM}	Pulsed Drain Current, $T_A = 25^\circ\text{C}$ ⁽²⁾	–82	A
P_D	Power Dissipation ⁽¹⁾	2.8	W
T_J, T_{STG}	Operating Junction and Storage Temperature Range	–55 to 150	$^\circ\text{C}$

- (1) $R_{\theta JA} = 45^\circ\text{C/W}$ on 1inch² Cu (2 oz.) on 0.060" thick FR4 PCB.
 (2) Pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$

Figure 1. Top View


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.

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.

ELECTRICAL CHARACTERISTICS

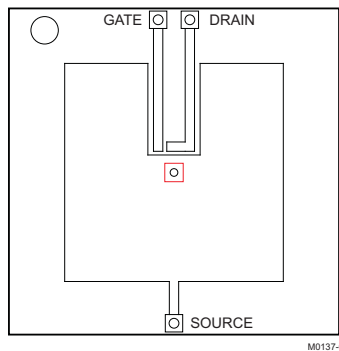
(T_A = 25°C unless otherwise stated)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT	
Static Characteristics							
BV _{DSS}	Drain to Source Voltage	V _{GS} = 0V, I _D = -250μA	-20			V	
I _{DSS}	Drain to Source Leakage Current	V _{GS} = 0V, V _{DS} = -20V to -16V	-1			μA	
I _{GSS}	Gate to Source Leakage Current	V _{DS} = 0V, V _{GS} = ±12V	-100			nA	
V _{GS(th)}	Gate to Source Threshold Voltage	V _{DS} = V _{GS} , I _D = -250μA	-0.6	-0.85	-1.2	V	
R _{DS(on)}	Drain to Source On Resistance	V _{GS} = -2.5V, I _D = -10A	13.5			18.2	mΩ
		V _{GS} = -4.5V, I _D = -10A	8.8			11.7	mΩ
g _{fs}	Transconductance	V _{DS} = -15V, I _D = -10A	43			S	
Dynamic Characteristics							
C _{ISS}	Input Capacitance	V _{GS} = 0V, V _{DS} = -10V, f = 1MHz	1070			1400	pF
C _{OSS}	Output Capacitance		560			730	pF
C _{RSS}	Reverse Transfer Capacitance		180			230	pF
Q _g	Gate Charge Total (4.5V)	V _{DS} = -10V, I _D = -10A	8.8			12.3	nC
Q _{gd}	Gate Charge Gate to Drain		2.1				nC
Q _{gs}	Gate Charge Gate to Source		2.1				nC
Q _{g(th)}	Gate Charge at V _{th}		0.9				nC
Q _{OSS}	Output Charge	V _{DS} = -10V, V _{GS} = 0V	8.2				nC
t _{d(on)}	Turn On Delay Time	V _{DS} = -10V, V _{GS} = -4.5V, I _D = -10A , R _G = 5.1Ω	8.1				ns
t _r	Rise Time		3.9				ns
t _{d(off)}	Turn Off Delay Time		13.5				ns
t _f	Fall Time		12.6				ns
Diode Characteristics							
V _{SD}	Diode Forward Voltage	I _S = -10A, V _{GS} = 0V	-0.7			-1	V
Q _{rr}	Reverse Recovery Charge	V _{DD} = -12.5V, I _F = -10A, di/dt = 300A/μs	17.4				nC
t _{rr}	Reverse Recovery Time		21				ns

THERMAL INFORMATION

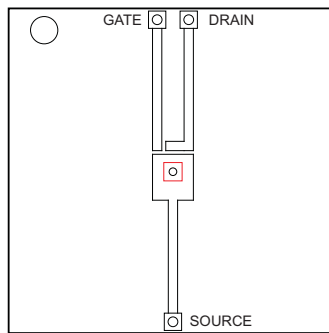
THERMAL METRIC ⁽¹⁾⁽²⁾		CSD25401Q3	UNITS
		8 PIN	
θ _{JA}	Junction-to-ambient thermal resistance	42.0	°C/W
θ _{JCtop}	Junction-to-case (top) thermal resistance	20.6	
θ _{JB}	Junction-to-board thermal resistance	8.8	
ψ _{JT}	Junction-to-top characterization parameter	0.3	
ψ _{JB}	Junction-to-board characterization parameter	8.7	
θ _{JCbot}	Junction-to-case (bottom) thermal resistance	0.1	

(1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, [SPRA953](#).(2) For thermal estimates of this device based on PCB copper area, see the [TI PCB Thermal Calculator](#).



M0137-01

Max $R_{\theta JA} = 57^{\circ}\text{C/W}$
when mounted on
1inch² of 2 oz. Cu.

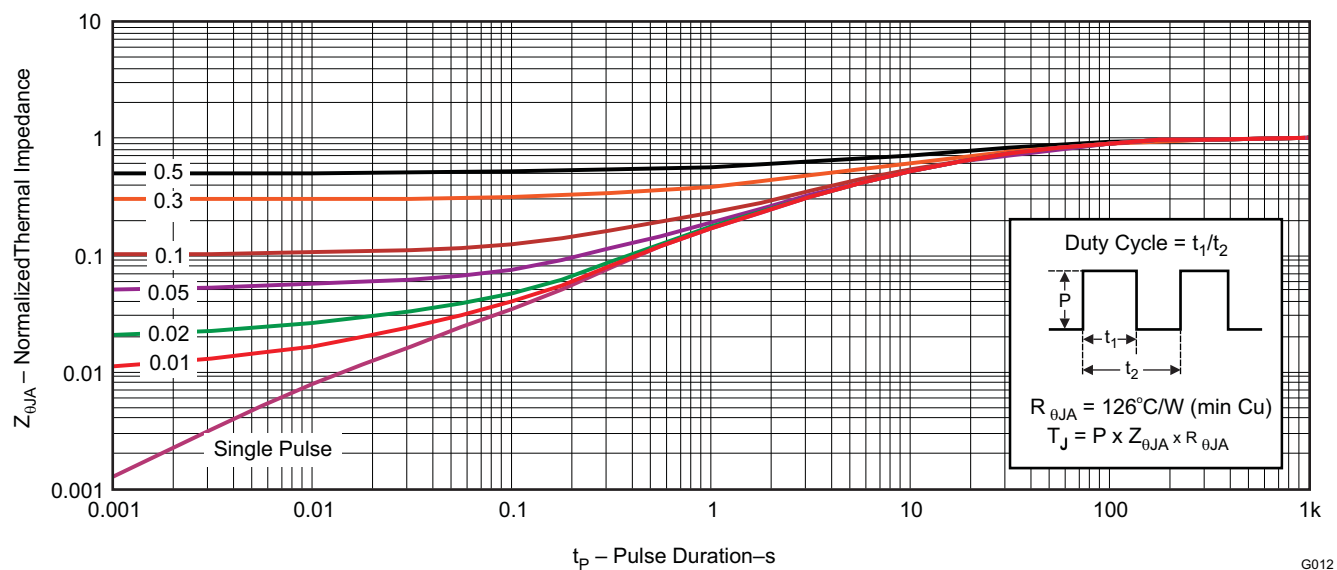


M0137-02

Max $R_{\theta JA} = 158^{\circ}\text{C/W}$
when mounted on
minimum pad area of 2
oz. Cu.

TYPICAL MOSFET CHARACTERISTICS

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

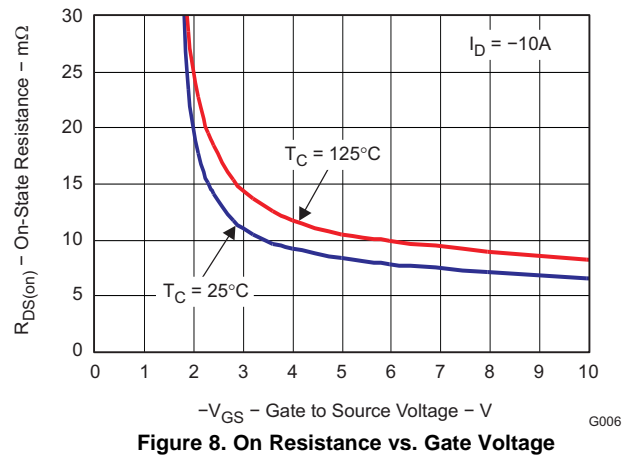
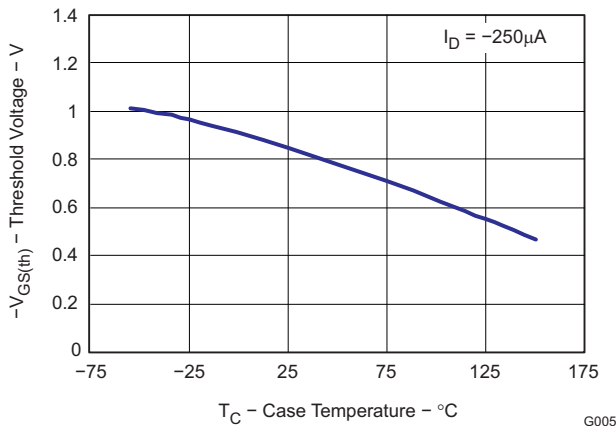
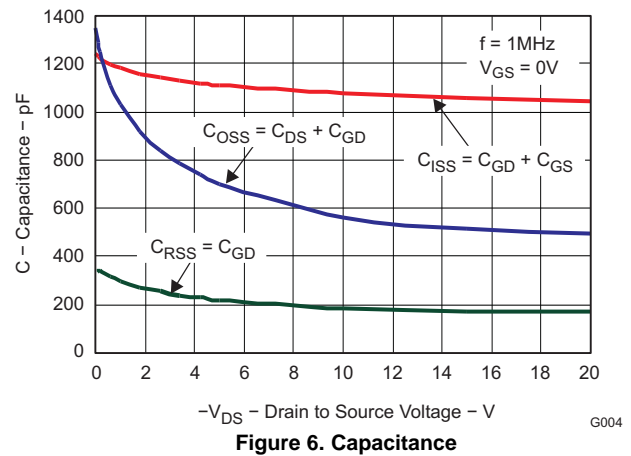
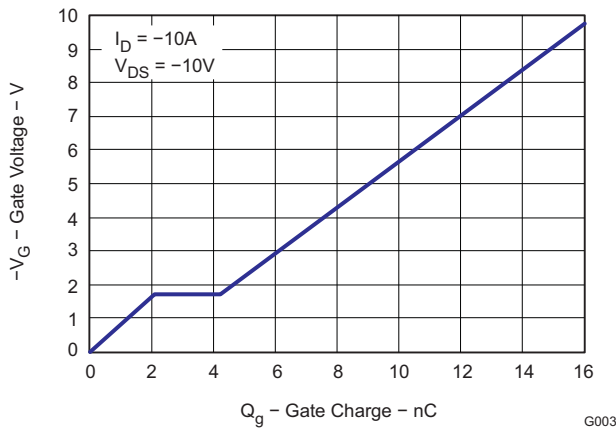
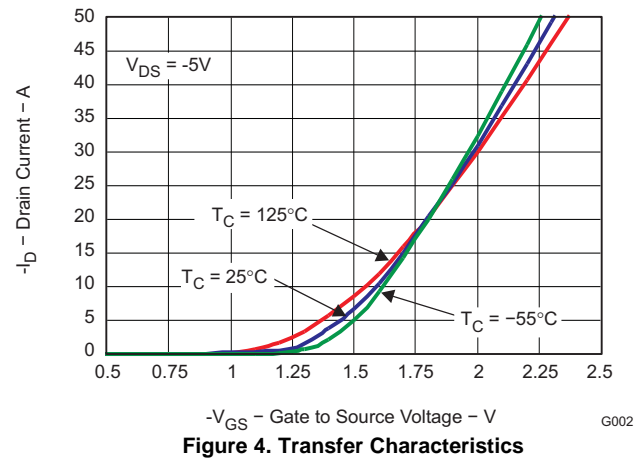
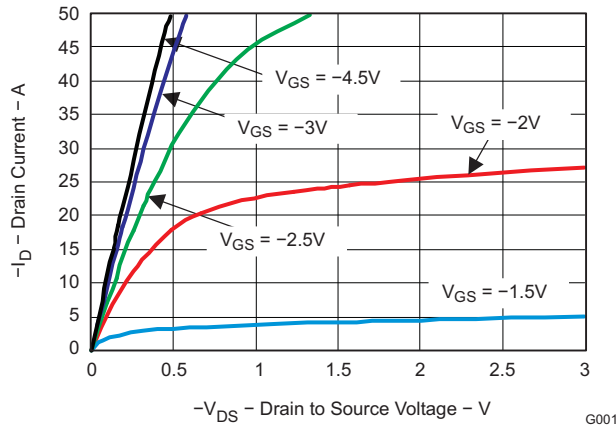


G012

Figure 2. Transient Thermal Impedance

TYPICAL MOSFET CHARACTERISTICS (continued)

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



TYPICAL MOSFET CHARACTERISTICS (continued)

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

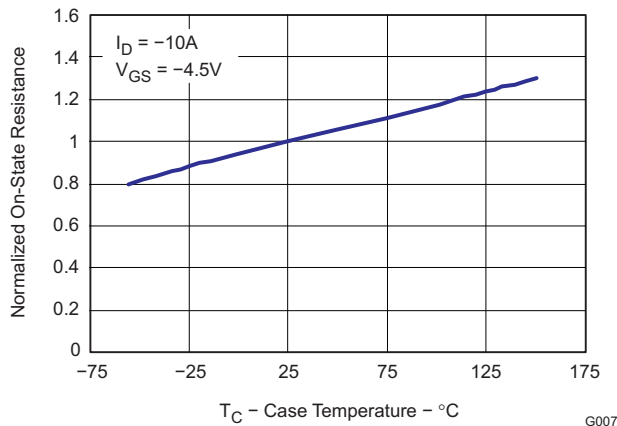


Figure 9. On Resistance vs. Temperature

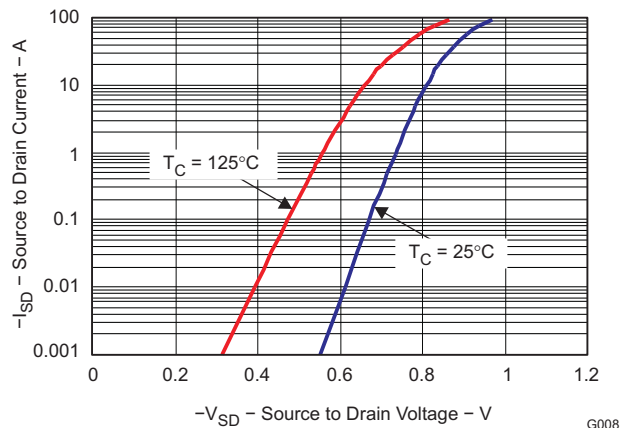


Figure 10. Typical Diode Forward Voltage

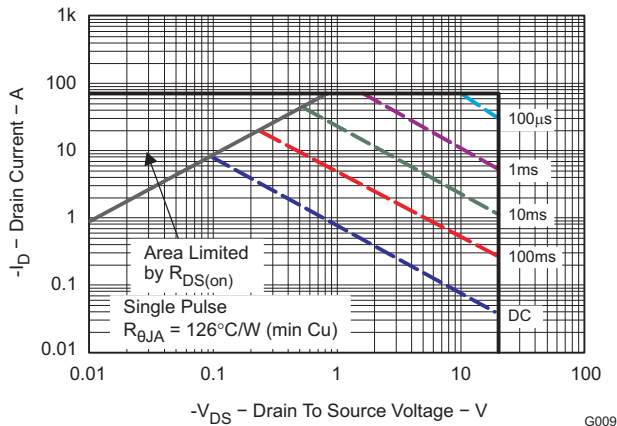


Figure 11. Maximum Safe Operating Area

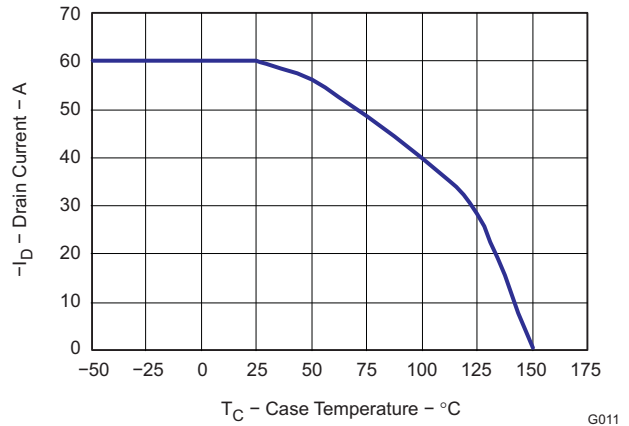
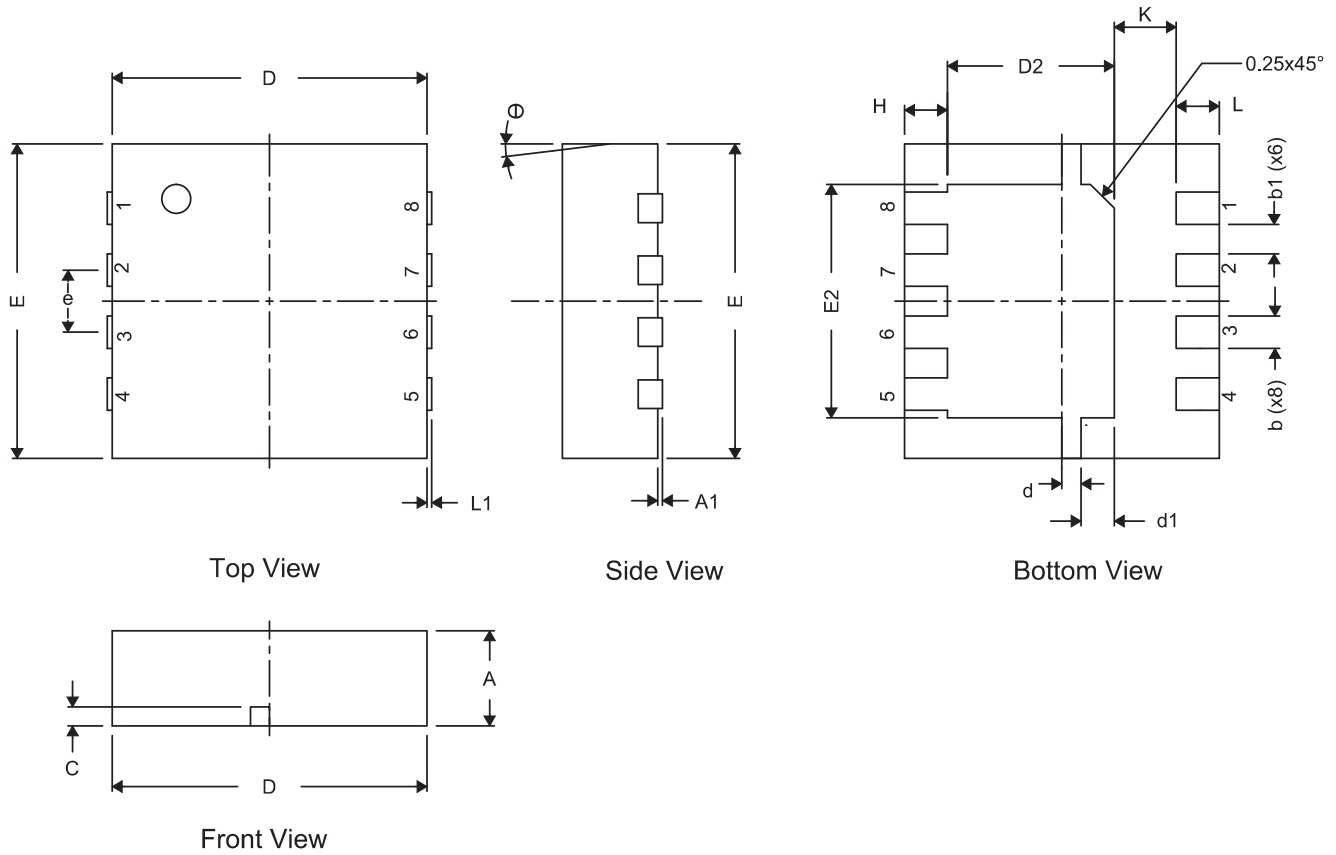
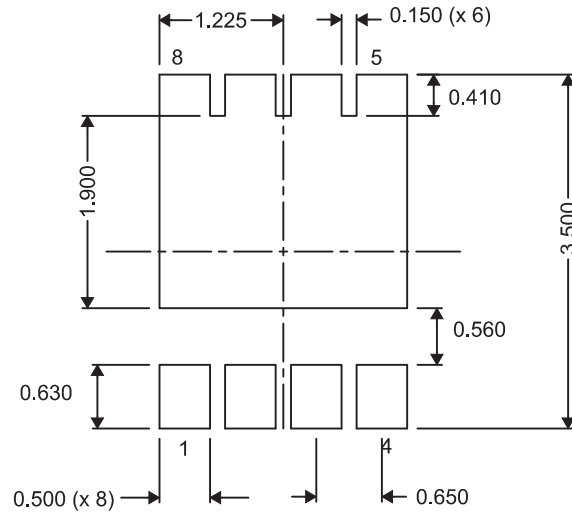


Figure 12. Maximum Drain Current vs. Temperature

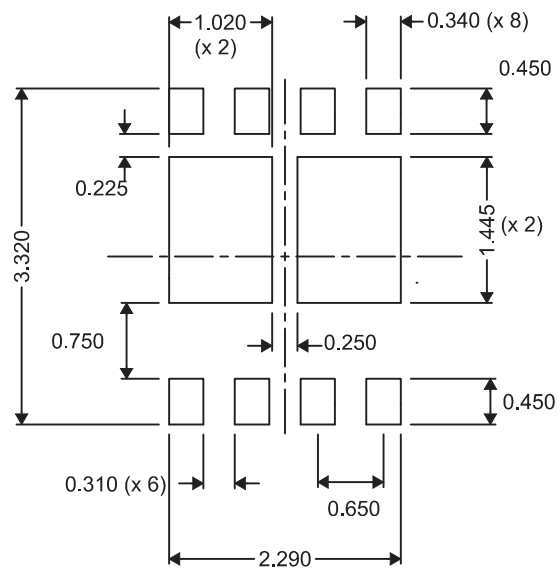
MECHANICAL DATA**CSD25401Q3 Package Dimensions**

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
b1	0.310 NOM			0.012 NOM		
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
D2	1.650	1.750	1.800	0.065	0.069	0.071
d	0.150	0.200	0.250	0.006	0.008	0.010
d1	0.300	0.350	0.400	0.012	0.014	0.016
E	3.200	3.300	3.400	0.126	0.130	0.134
E2	2.350	2.450	2.550	0.093	0.096	0.100
e	0.650 TYP			0.026 TYP		
H	0.35	0.450	0.550	0.014	0.018	0.022
K	0.650 TYP			0.026 TYP		
L	0.35	0.450	0.550	0.014	0.018	0.022
L1	0		0	0		0
θ	0		0	0		0

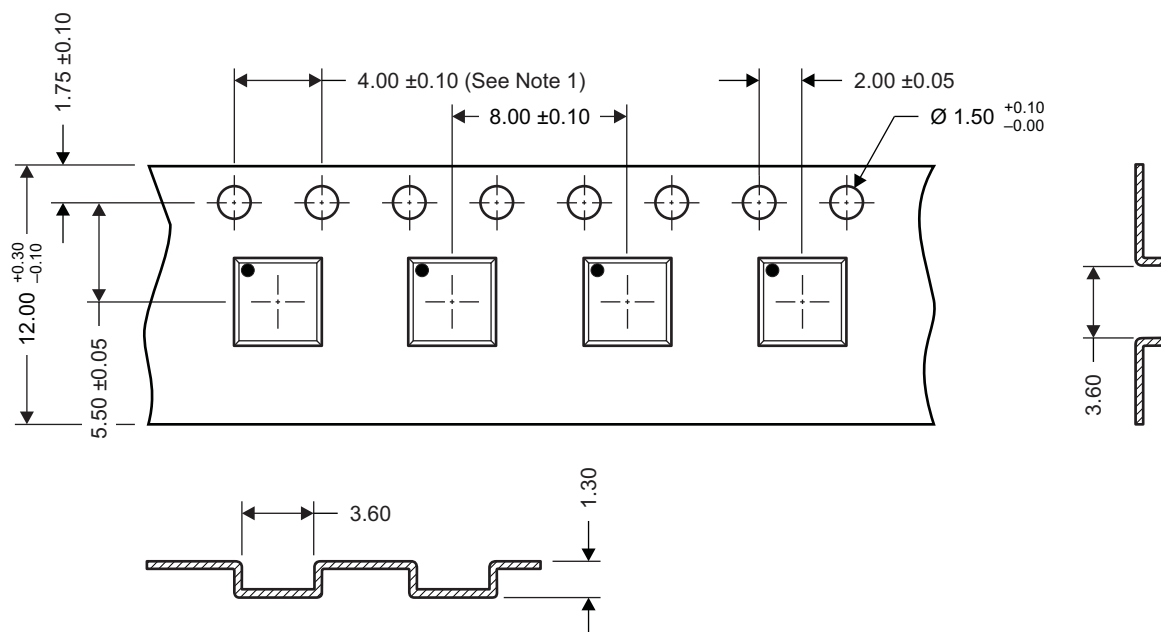
Recommended PCB Pattern



Recommended Stencil Opening



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 Conection) PbF Reflow Compatible

REVISION HISTORY

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

- | | |
|--|-------------------|
| • Changed 300s to 300µs in Note 2 of the Abs Max Ratings table | 1 |
| • Changed Q _g Gate Charge Total (4.5V) - max value From: 2.3 To: 12.3 | 2 |
-

Changes from Revision A (October 2009) to Revision B	Page
--	------

- | | |
|---|-------------------|
| • Deleted the Package Marking Information section | 8 |
|---|-------------------|
-

Changes from Revision B (October 2010) to Revision C	Page
--	------

- | | |
|---|-------------------|
| • Replaced the THERMAL CHARACTERISTICS table with the new Thermal Information Table | 2 |
| • Changed the CSD25401Q3 Package Dimensions section | 6 |
| • Changed the Recommended PCB Pattern 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
CSD25401Q3	VSON-CLIP	DQG	8	2500	330.0	12.8	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)
CSD25401Q3	VSON-CLIP	DQG	8	2500	335.0	335.0	32.0

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