![Texas Instruments logo] **TEXAS INSTRUMENTS**

CSD25401Q3

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 3×3 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 × 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		−20	V
V_{GS}	Gate to Source Voltage		+12 / -12	V
I_D	Continuous Drain Current, T_C = 25°C		−60	A
	Continuous Drain Current[1]		−14	A
I_{DM}	Pulsed Drain Current, T_A = 25°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	°C

(1) $R_{\theta JA}$ = 45°C/W on 1inch^2 Cu (2 oz.) on 0.060" thick FR4 PCB.

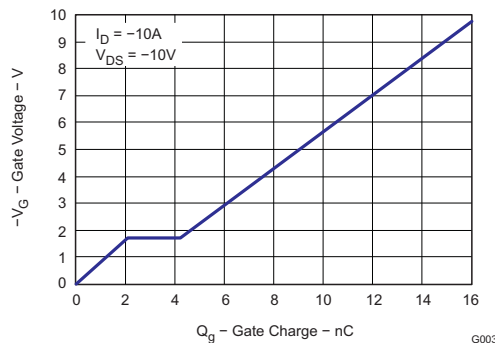(2) Pulse width ≤300µs , duty cycle ≤2%

Figure 1. Top View
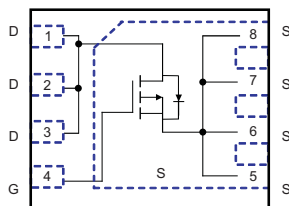
$R_{DS(ON)}$ vs V_{GS}
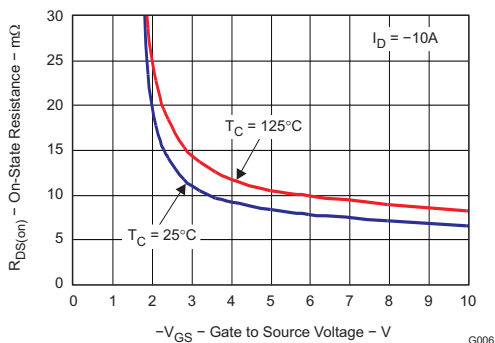
Gate Charge

⚠ 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.

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 Vth			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

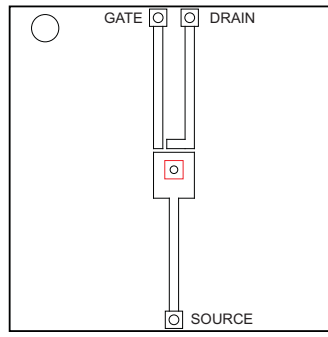| THERMAL METRIC[1][2]		CSD25401Q3	UNITS
		8 PIN	
$θ_{JA}$	Junction-to-ambient thermal resistance	42.0	°C/W
$θ_{JCtop}$	Junction-to-case (top) thermal resistance	20.6	
$θ_{JB}$	Junction-to-board thermal resistance	8.8	
$ψ_{JT}$	Junction-to-top characterization parameter	0.3	
$ψ_{JB}$	Junction-to-board 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.

Product Folder Links: *CSD25401Q3*

GATE ☐ ☐ DRAIN

SOURCE
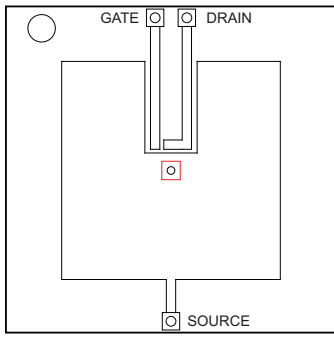
M0137-01

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

GATE ☐ ☐ DRAIN

SOURCE
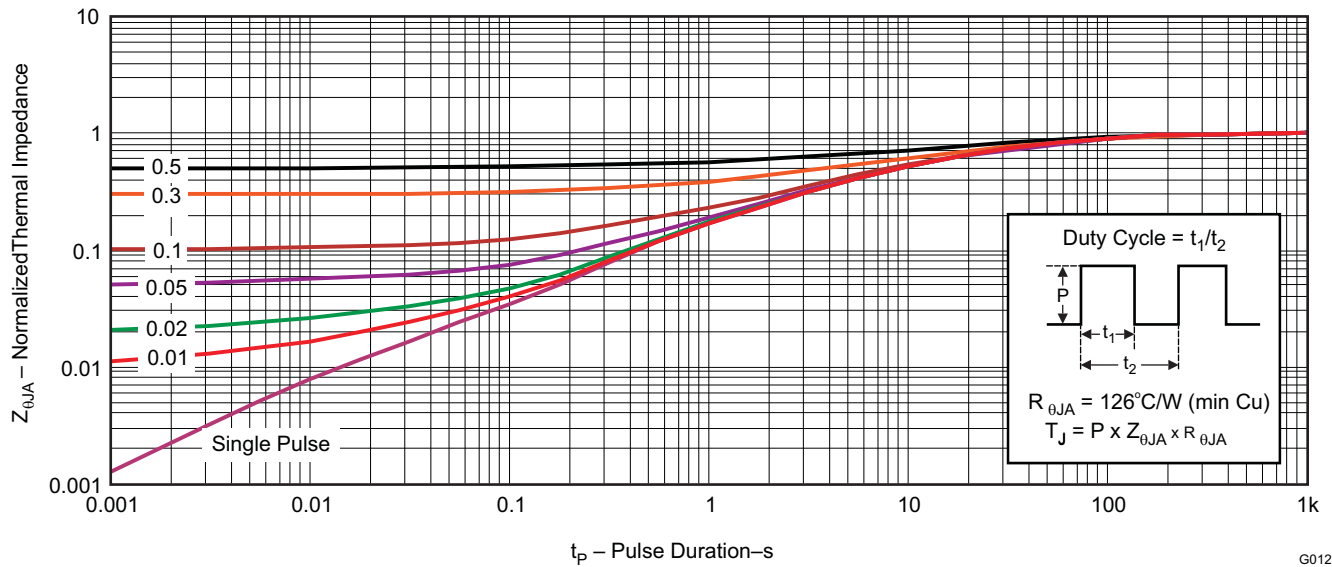
M0137-02

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

TYPICAL MOSFET CHARACTERISTICS

(T_A = 25°C unless otherwise stated)

$Z_{\theta JA}$ – NormalizedThermal Impedance

0.5
0.3
0.1
0.05
0.02
0.01

Single Pulse

Duty Cycle = t_1/t_2

P

t_1

t_2

$R_{\theta JA}$ = 126°C/W (min Cu)
T_J = P x $Z_{\theta JA}$ x $R_{\theta JA}$

t_P – Pulse Duration–s

G012

Figure 2. Transient Thermal Impedance

Product Folder Links: *CSD25401Q3*

TYPICAL MOSFET CHARACTERISTICS (continued)
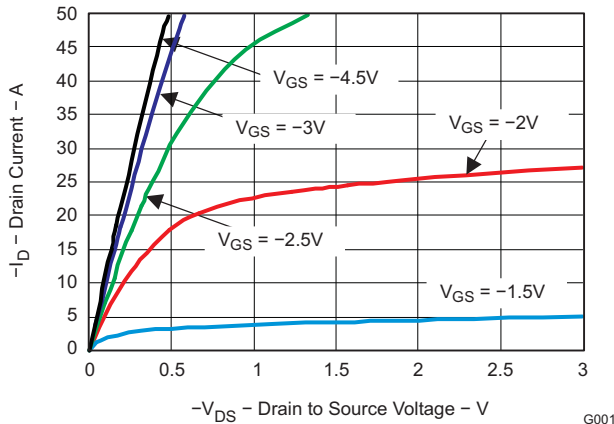
(T_A = 25°C unless otherwise stated)

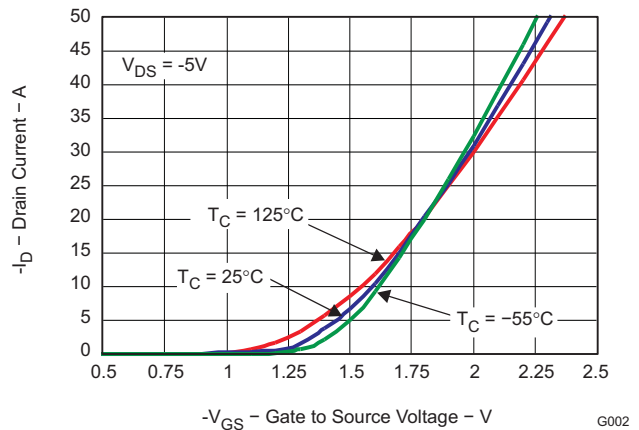**Figure 3. Saturation Characteristics**
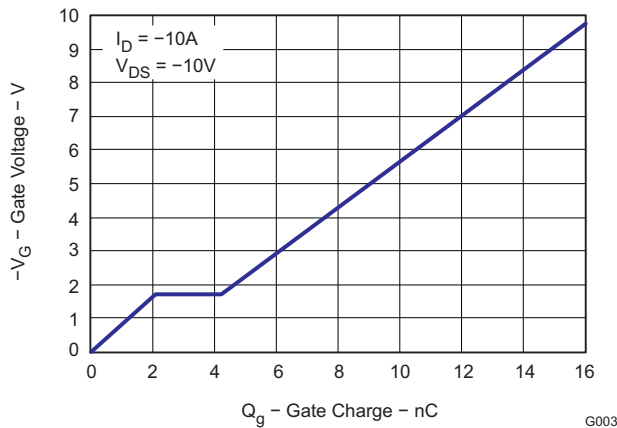

Figure 4. Transfer Characteristics

Figure 5. Gate Charge
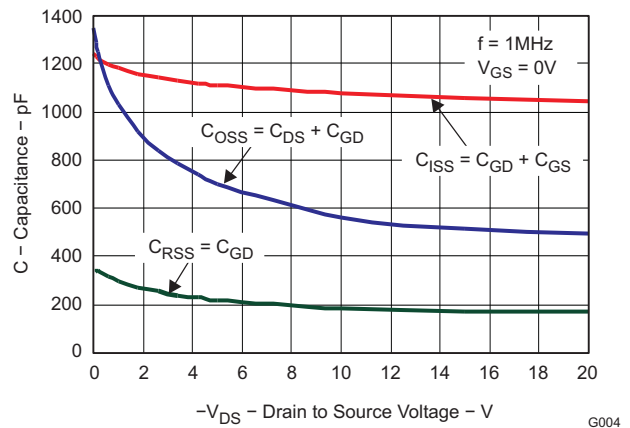
Figure 6. Capacitance
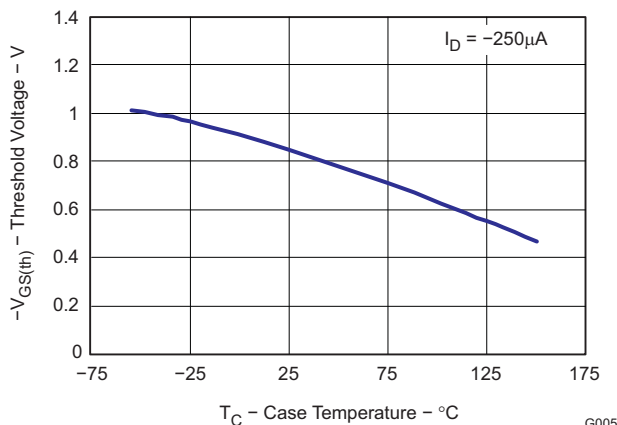
Figure 7. Threshold Voltage vs. Temperature
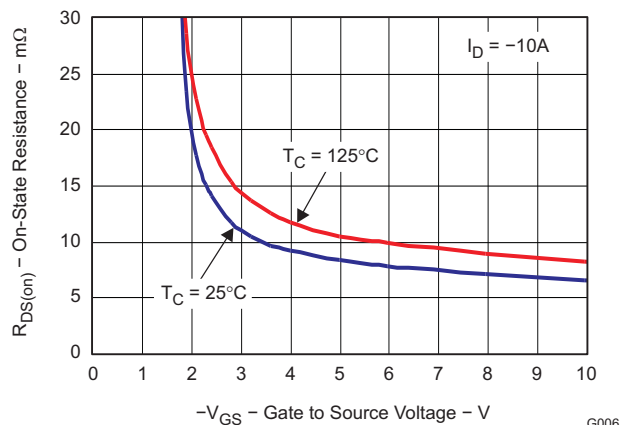
Figure 8. On Resistance vs. Gate Voltage

Product Folder Links: *CSD25401Q3*

TYPICAL MOSFET CHARACTERISTICS (continued)
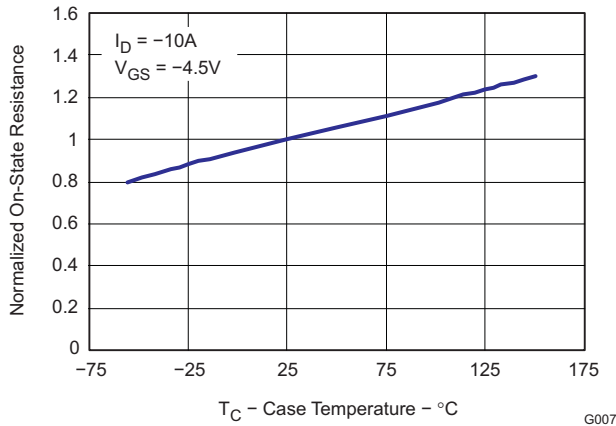
(T_A = 25°C unless otherwise stated)

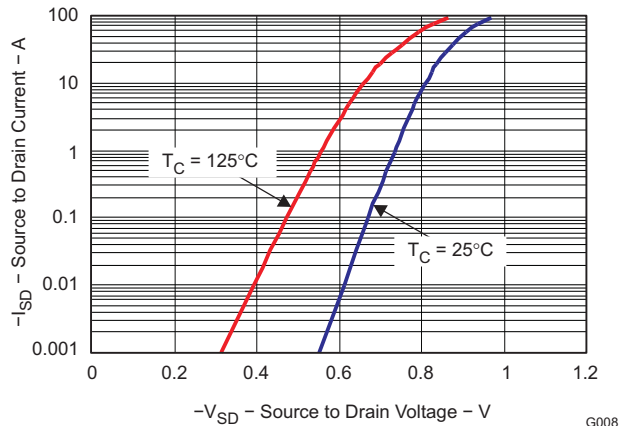**Figure 9. On Resistance vs. Temperature**
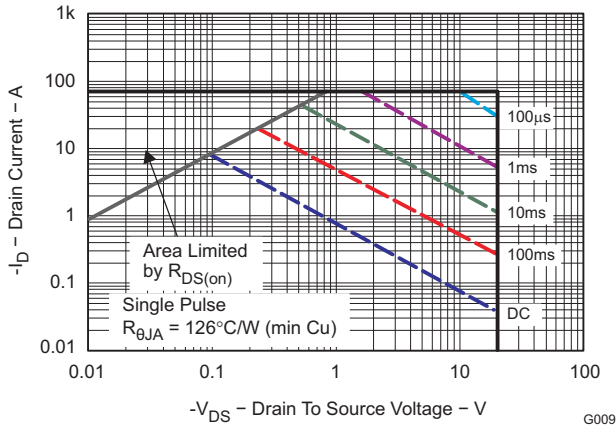

Figure 10. Typical Diode Forward Voltage
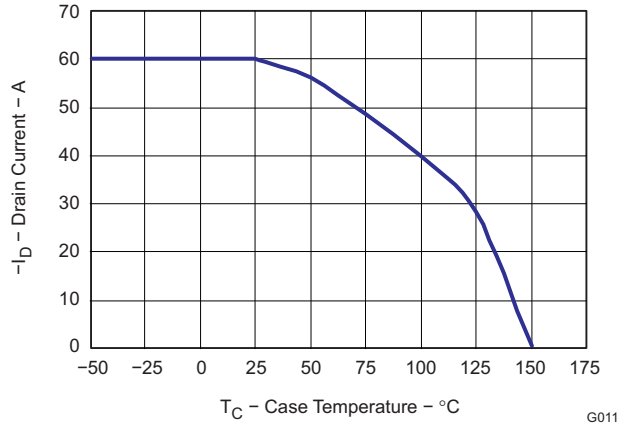

Figure 11. Maximum Safe Operating Area

Figure 12. Maximum Drain Current vs. Temperature

Product Folder Links: *CSD25401Q3*

MECHANICAL DATA

CSD25401Q3 Package Dimensions

Top View

Side View

Bottom View

Front View
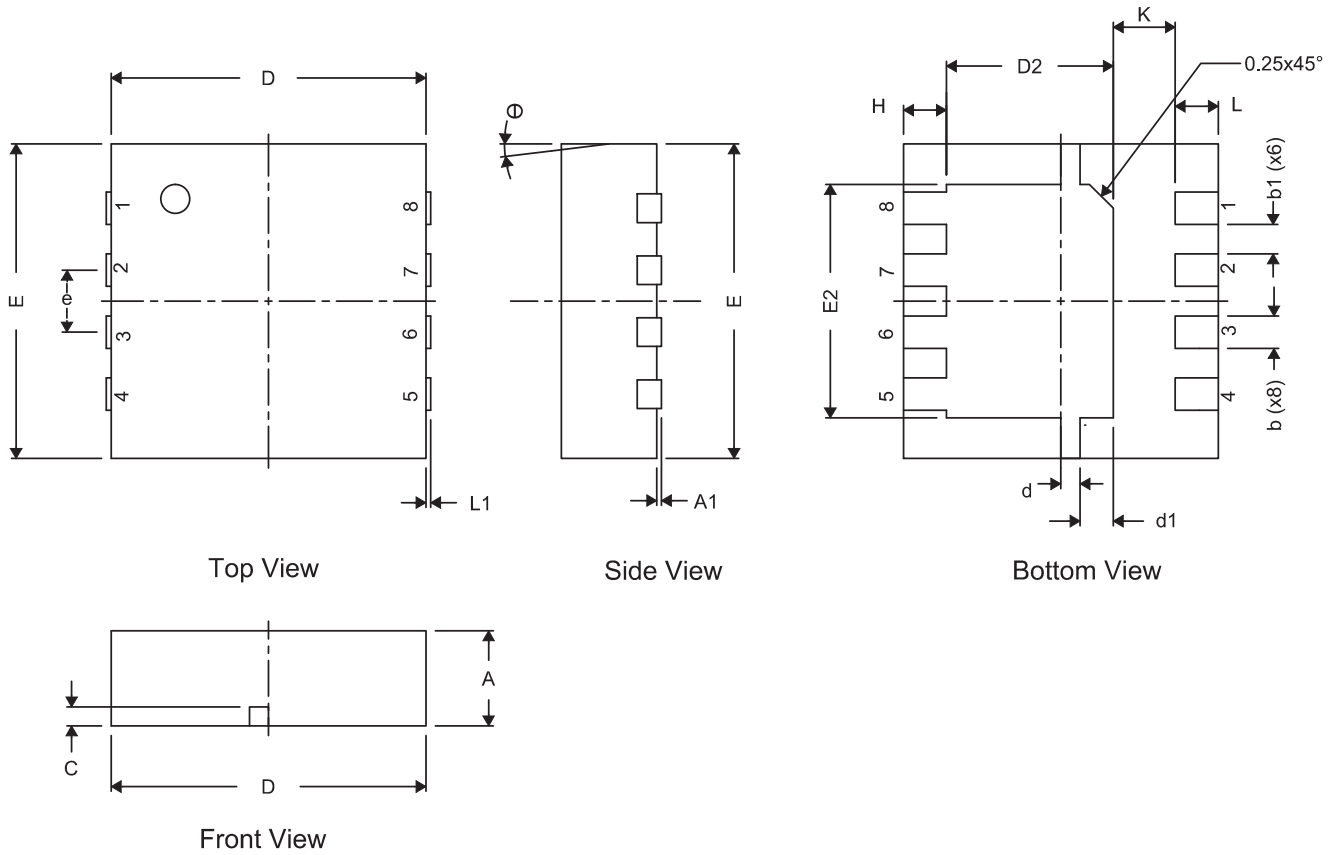
DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.950	1.000	1.100	0.037	0.039	0.043
A1	0.000	0.000	0.050	0.000	0.000	0.002
b	0.280	0.340	0.400	0.011	0.013	0.016
b1	0.310 NOM			0.012 NOM		
c	0.150	0.200	0.250	0.006	0.008	0.010
D	3.200	3.300	3.400	0.126	0.130	0.134
D2	1.650	1.750	1.800	0.065	0.069	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
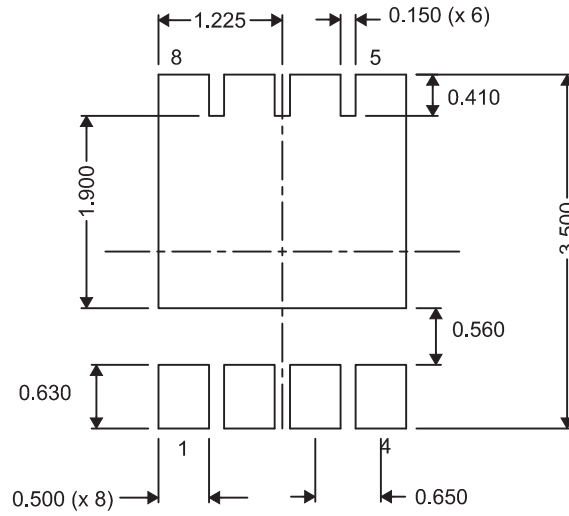
Recommended Stencil Opening

Product Folder Links: *CSD25401Q3*
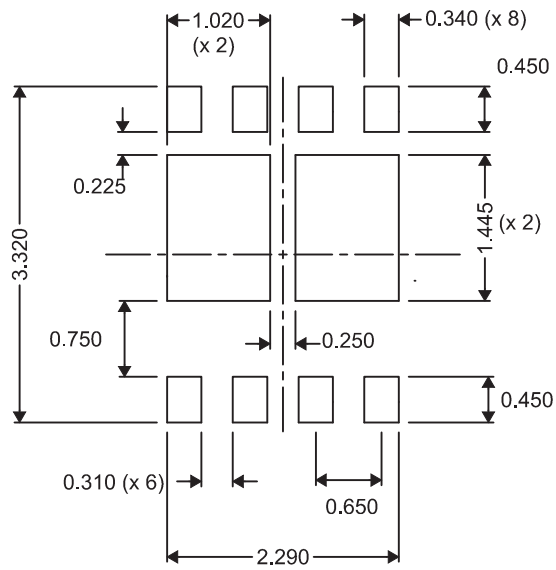
Tape and Reel Information
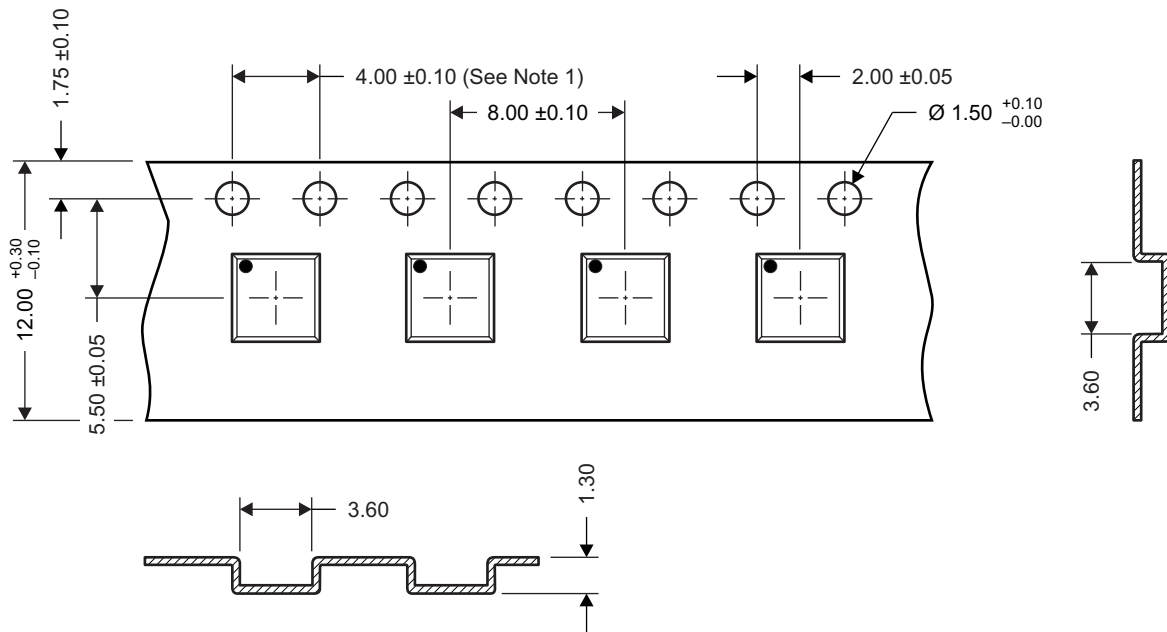
M0144-01

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 ±0.05mm
6. MSL1 260°C (IR and Conection) PbF Reflow Compatible

Product Folder Links: *CSD25401Q3*

REVISION HISTORY

![Texas Instruments logo]

PACKAGE MATERIALS INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS

Reel Diameter

Reel Width (W1)

TAPE DIMENSIONS

K0 ⊢ P1 →

B0 W

Cavity → A0 ←

A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE

Sprocket Holes

| Q1 | Q2 | Q1 | Q2 |
| Q3 | Q4 | Q3 | Q4 |

User Direction of Feed

Pocket Quadrants

*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	12.4	3.6	3.6	1.2	8.0	12.0	Q1
CSD25401Q3	VSON-CLIP	DQG	8	2500	330.0	12.8	3.6	3.6	1.2	8.0	12.0	Q1

PACKAGE MATERIALS INFORMATION

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	336.6	336.6	41.3
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		Applications	
Audio	www.ti.com/audio	Automotive and Transportation	www.ti.com/automotive
Amplifiers	amplifier.ti.com	Communications and Telecom	www.ti.com/communications
Data Converters	dataconverter.ti.com	Computers and Peripherals	www.ti.com/computers
DLP® Products	www.dlp.com	Consumer Electronics	www.ti.com/consumer-apps
DSP	dsp.ti.com	Energy and Lighting	www.ti.com/energy
Clocks and Timers	www.ti.com/clocks	Industrial	www.ti.com/industrial
Interface	interface.ti.com	Medical	www.ti.com/medical
Logic	logic.ti.com	Security	www.ti.com/security
Power Mgmt	power.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video
RFID	www.ti-rfid.com		
OMAP Applications Processors	www.ti.com/omap	**TI E2E Community**	e2e.ti.com
Wireless Connectivity	www.ti.com/wirelessconnectivity		