

## P-Channel NexFET™ Power MOSFETs

 Check for Samples: [CSD25401Q3](#)

### FEATURES

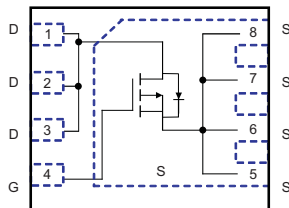
- Ultra Low  $Q_g$  and  $Q_{gd}$
- Low Thermal Resistance
- Low  $R_{DS(on)}$
- Pb Free Terminal Plating
- RoHS Compliant
- Halogen Free
- SON 3.3mm x 3.3mm Plastic Package

### 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.

**Figure 1. Top View**

**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

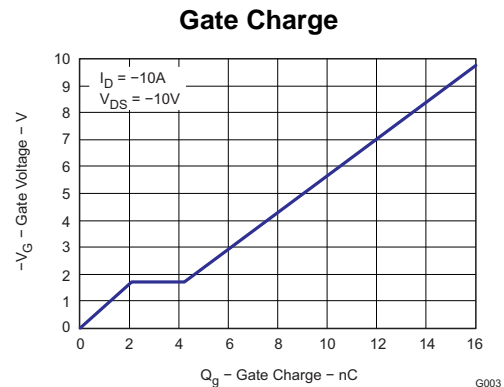
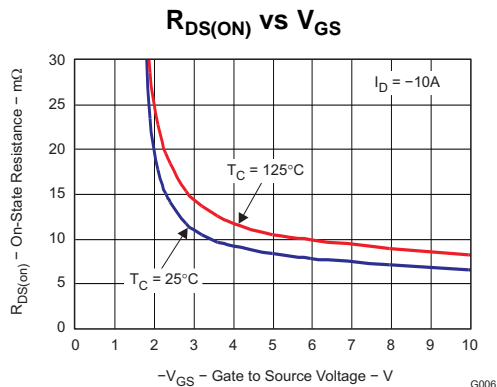
### ORDERING INFORMATION

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 <sup>(1)</sup>	-14	A
$I_{DM}$	Pulsed Drain Current, $T_A = 25^\circ\text{C}$ <sup>(2)</sup>	-82	A
$P_D$	Power Dissipation <sup>(1)</sup>	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 1inch<sup>2</sup> Cu (2 oz.) on 0.060" thick FR4 PCB.  
 (2) Pulse width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$



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## ELECTRICAL CHARACTERISTICS

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

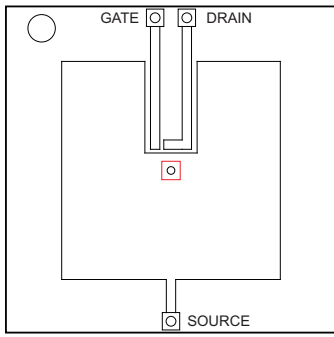
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>Static Characteristics</b>						
$BV_{DSS}$	Drain to Source Voltage	$V_{GS} = 0V, I_D = -250\mu A$	-20			V
$I_{DSS}$	Drain to Source Leakage Current	$V_{GS} = 0V, V_{DS} = -20V \text{ to } -16V$			-1	$\mu A$
$I_{GSS}$	Gate to Source Leakage Current	$V_{DS} = 0V, V_{GS} = \pm 12V$			-100	nA
$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{DS} = V_{GS}, I_D = -250\mu A$	-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	m $\Omega$
		$V_{GS} = -4.5V, I_D = -10A$		8.8	11.7	m $\Omega$
$g_{fs}$	Transconductance	$V_{DS} = -15V, I_D = -10A$		43		S
<b>Dynamic Characteristics</b>						
$C_{ISS}$	Input Capacitance	$V_{GS} = 0V, V_{DS} = -10V,$ $f = 1\text{MHz}$		1070	1400	pF
$C_{OSS}$	Output Capacitance			560	730	pF
$C_{RSS}$	Reverse Transfer Capacitance	$V_{DS} = -10V, I_D = -10A$		180	230	pF
$Q_g$	Gate Charge Total (4.5V)			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	$V_{DS} = -10V, V_{GS} = -4.5V,$ $I_D = -10A, R_G = 5.1\Omega$		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
<b>Diode Characteristics</b>						
$V_{SD}$	Diode Forward Voltage	$I_S = -10A, V_{GS} = 0V$		-0.7	-1	V
$Q_{rr}$	Reverse Recovery Charge	$V_{DD} = -12.5V, I_F = -10A,$ $di/dt = 300A/\mu s$		17.4		nC
$t_{rr}$	Reverse Recovery Time			21		ns

## THERMAL INFORMATION

THERMAL METRIC <sup>(1)(2)</sup>		CSD25401Q3	UNITS
		8 PIN	
$\theta_{JA}$	Junction-to-ambient thermal resistance	42.0	$^\circ\text{C/W}$
$\theta_{J\text{Ctop}}$	Junction-to-case (top) thermal resistance	20.6	
$\theta_{JB}$	Junction-to-board thermal resistance	8.8	
$\psi_{JT}$	Junction-to-top characterization parameter	0.3	
$\psi_{JB}$	Junction-to-board characterization parameter	8.7	
$\theta_{J\text{Cbot}}$	Junction-to-case (bottom) thermal resistance	0.1	

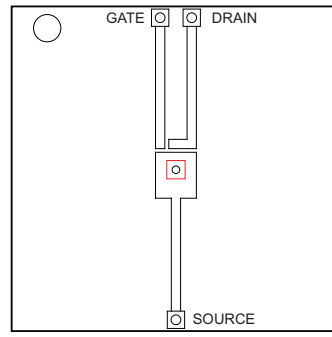
(1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, [SPRA953](#).

(2) For thermal estimates of this device based on PCB copper area, see the [TI PCB Thermal Calculator](#).



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

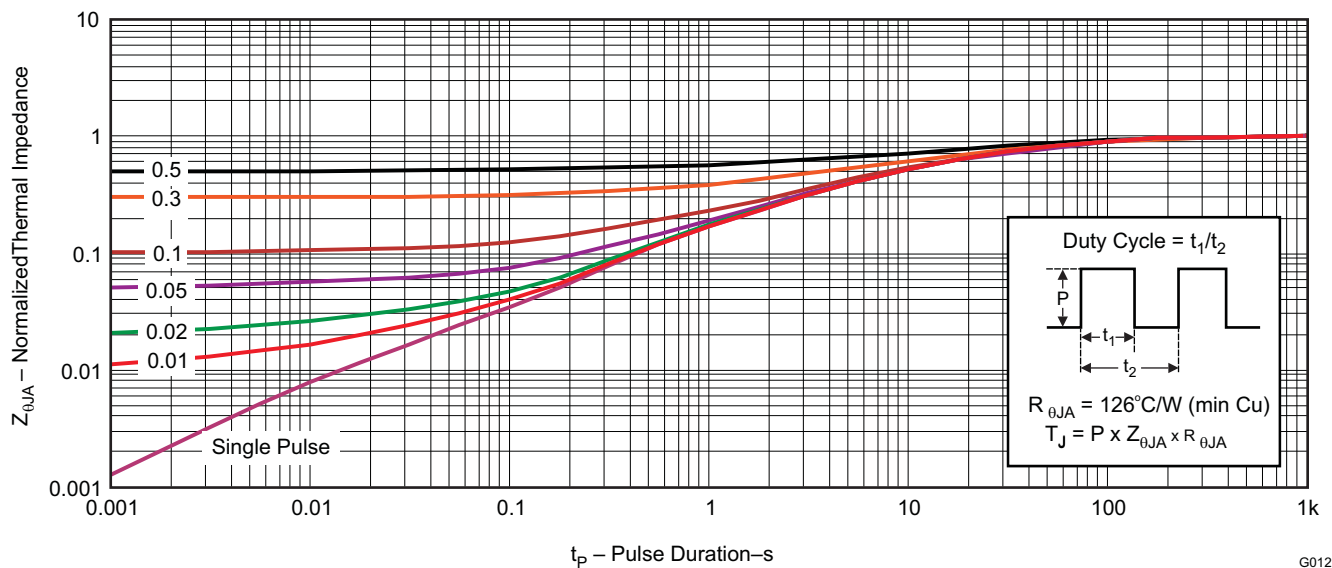


M0137-02

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)

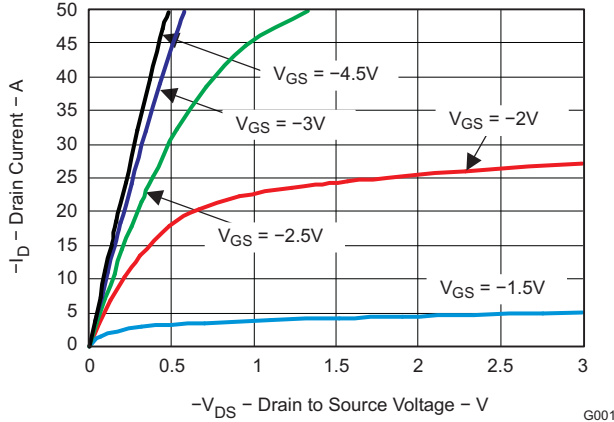


G012

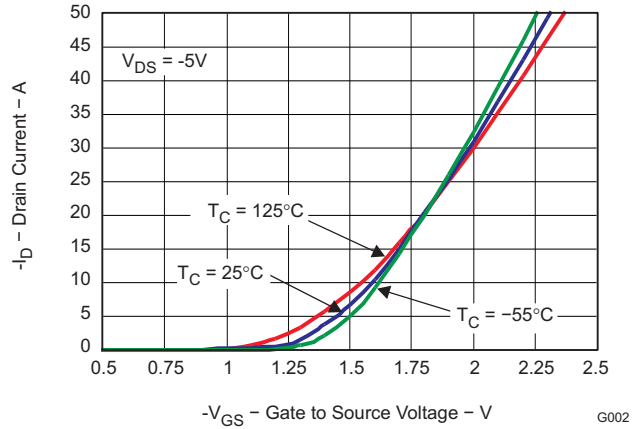
Figure 2. Transient Thermal Impedance

**TYPICAL MOSFET CHARACTERISTICS (continued)**

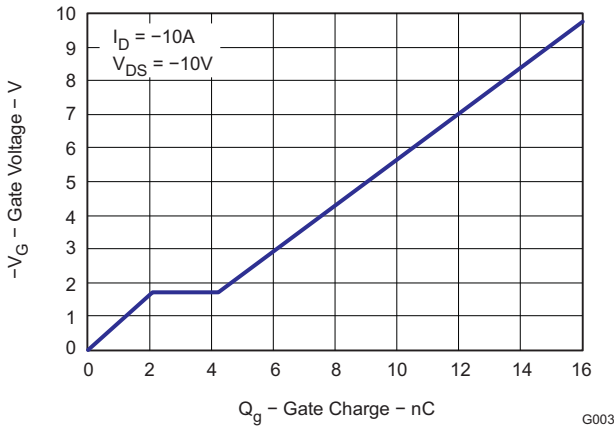
( $T_A = 25^\circ\text{C}$  unless otherwise stated)



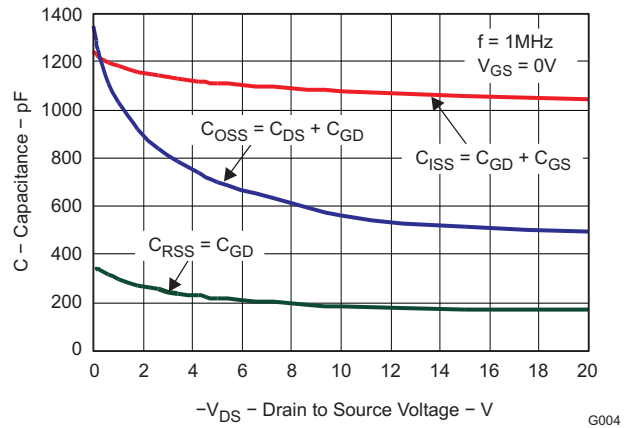
**Figure 3. Saturation Characteristics**



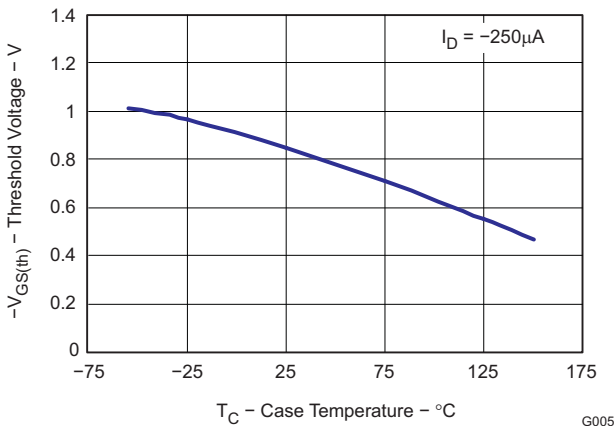
**Figure 4. Transfer Characteristics**



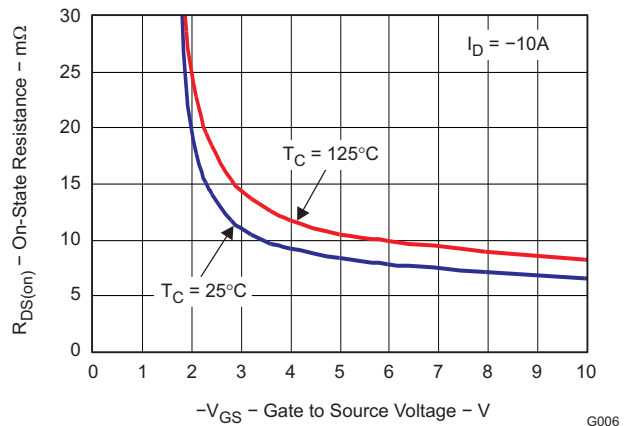
**Figure 5. Gate Charge**



**Figure 6. Capacitance**



**Figure 7. Threshold Voltage vs. Temperature**



**Figure 8. On Resistance vs. Gate Voltage**

TYPICAL MOSFET CHARACTERISTICS (continued)

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

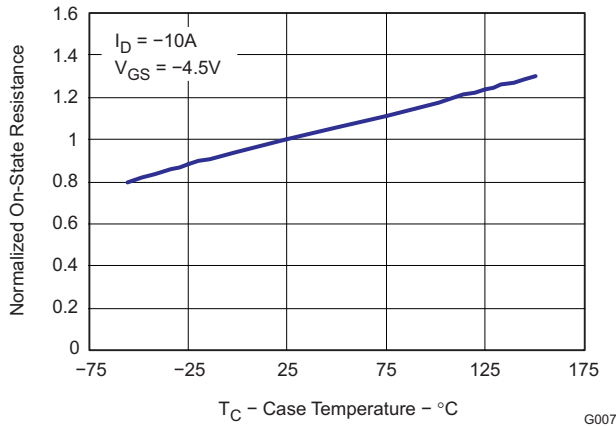


Figure 9. On Resistance vs. Temperature

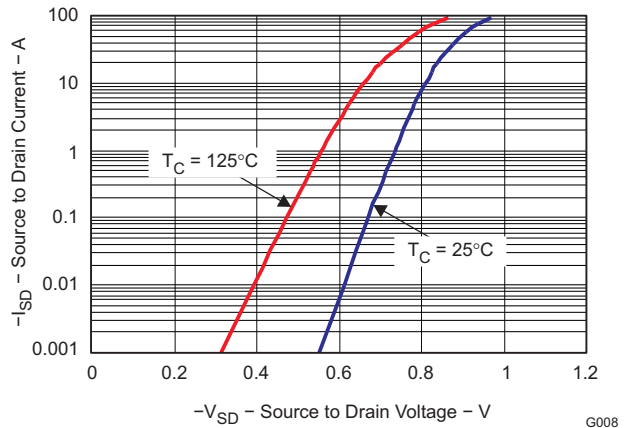


Figure 10. Typical Diode Forward Voltage

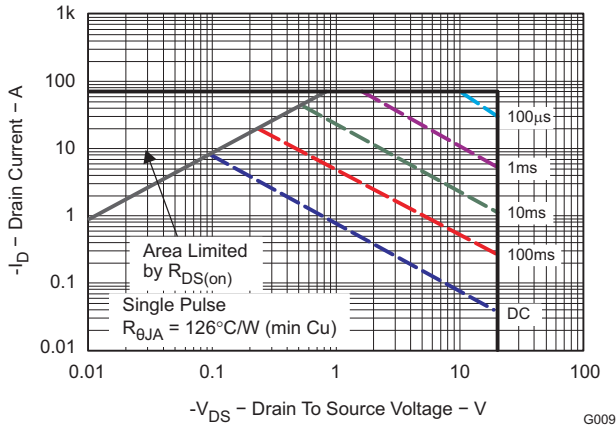


Figure 11. Maximum Safe Operating Area

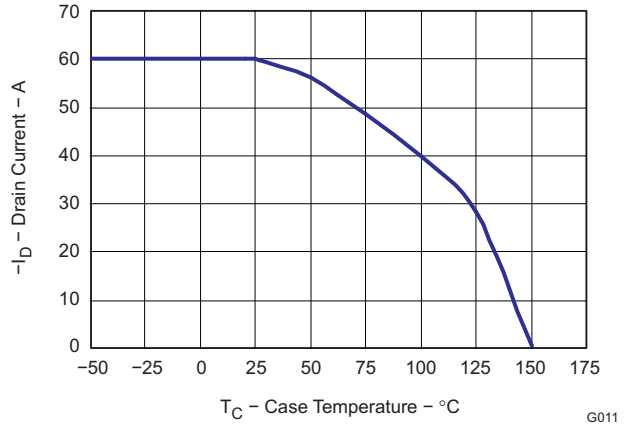
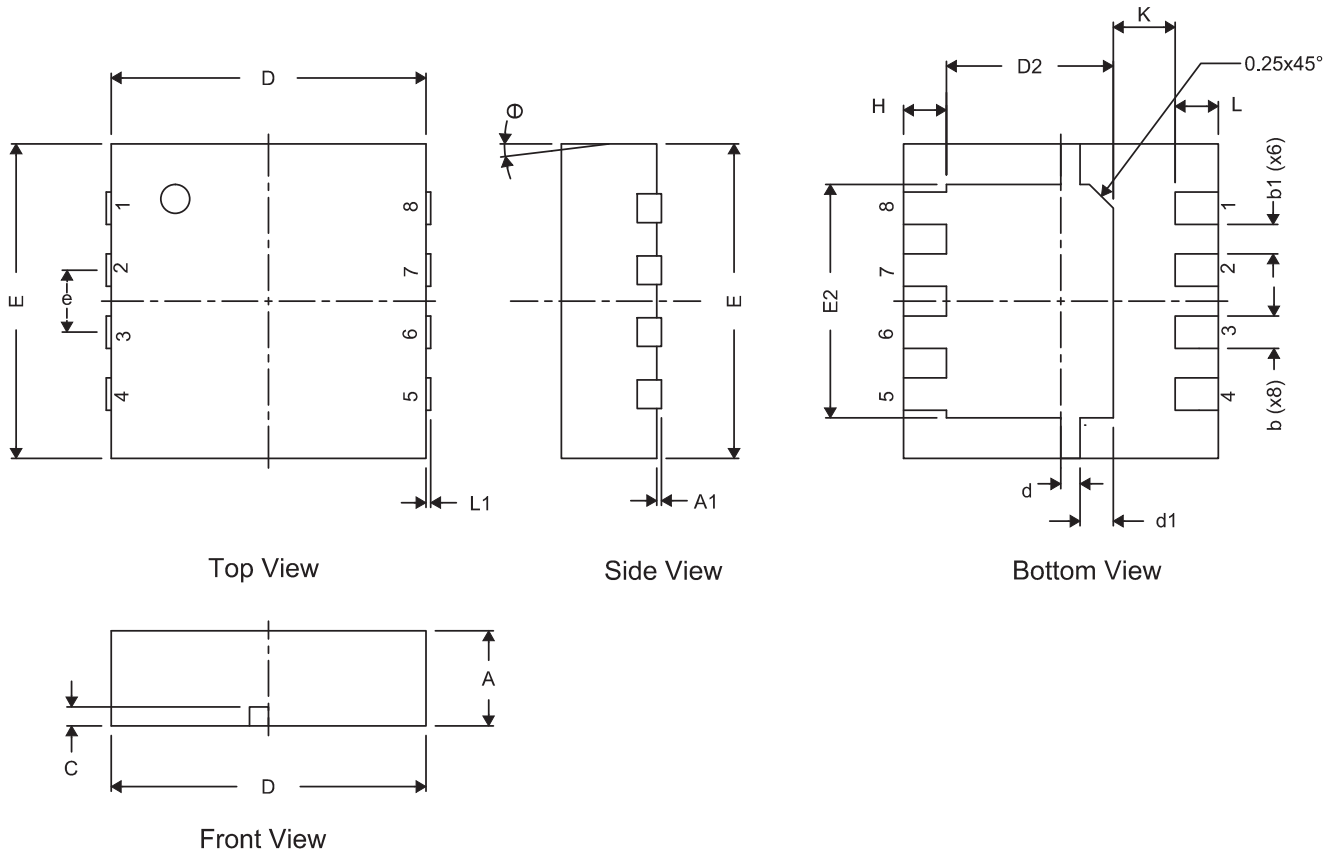


Figure 12. Maximum Drain Current vs. Temperature

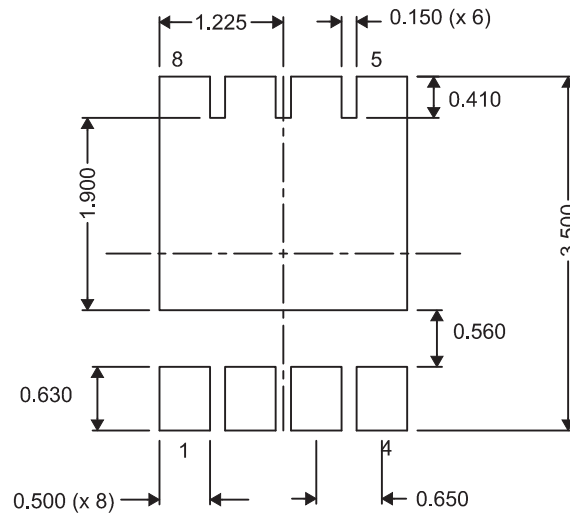
**MECHANICAL DATA**

**CSD25401Q3 Package Dimensions**

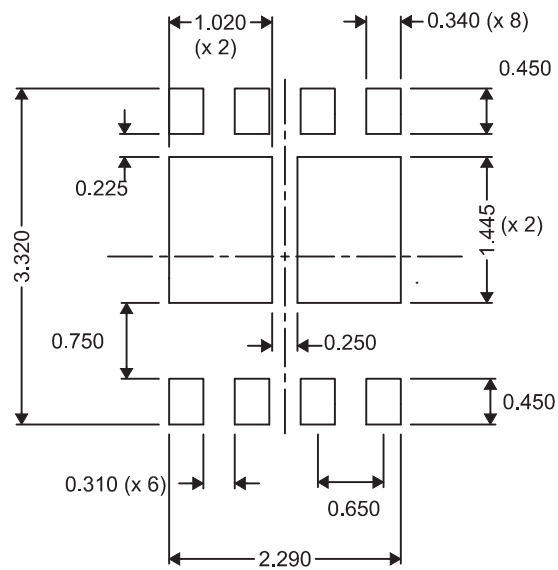


DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.950	1.000	1.100	0.037	0.039	0.043
A1	0.000	0.000	0.050	0.000	0.000	0.002
b	0.280	0.340	0.400	0.011	0.013	0.016
b1	0.310 NOM			0.012 NOM		
c	0.150	0.200	0.250	0.006	0.008	0.010
D	3.200	3.300	3.400	0.126	0.130	0.134
D2	1.650	1.750	1.800	0.065	0.069	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
$\theta$	0		0	0		0

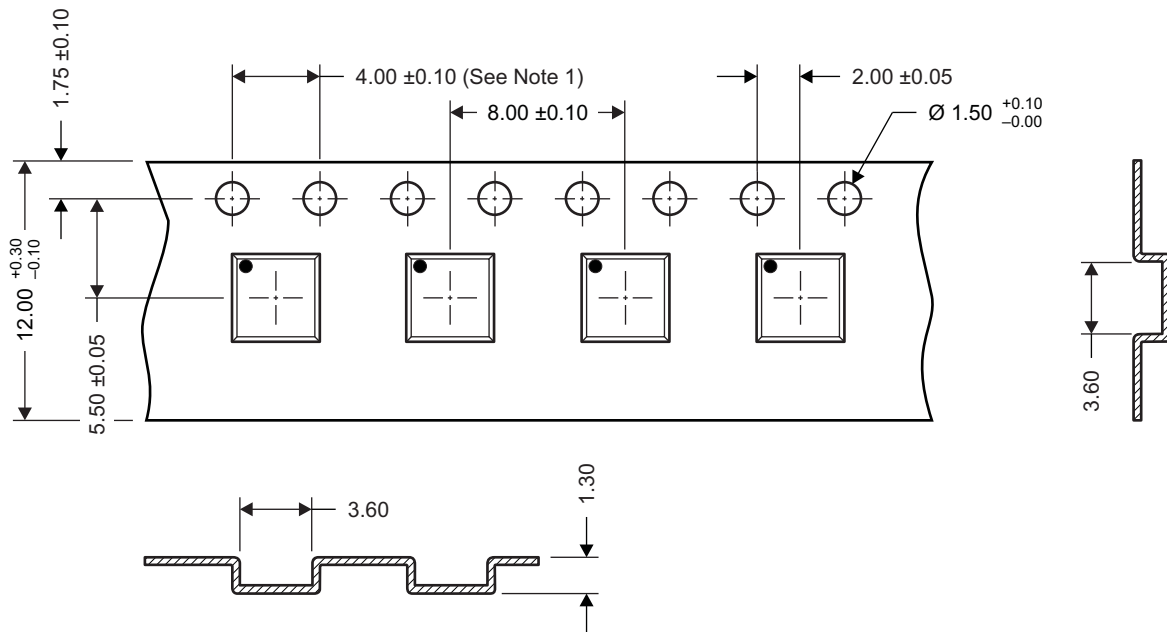
**Recommended PCB Pattern**



**Recommended Stencil Opening**



## Tape and Reel Information



M0144-01

### Notes:

1. 10 sprocket hole pitch cumulative tolerance  $\pm 0.2$
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:  $0.30 \pm 0.05$ mm
6. MSL1 260°C (IR and Conection) PbF Reflow Compatible



## REVISION HISTORY

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

- Changed 300s to 300 $\mu$ s in Note 2 of the Abs Max Ratings table ..... 1
  - Changed Q<sub>g</sub> 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
-

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