

## 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

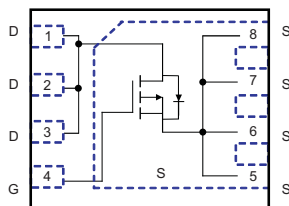
Device	Package	Media	Qty	Ship
CSD25401Q3	SON 3 x 3 Plastic Package	13-inch reel	2500	Tape and Reel

### ABSOLUTE MAXIMUM RATINGS

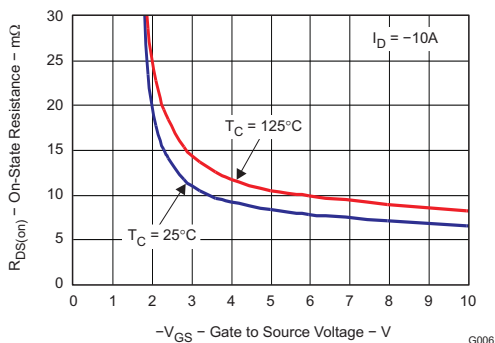
$T_A = 25^\circ\text{C}$ unless otherwise stated		VALUE	UNIT
$V_{DS}$	Drain to Source Voltage	-20	V
$V_{GS}$	Gate to Source Voltage	+12 / -12	V
$I_D$	Continuous Drain Current, $T_C = 25^\circ\text{C}$	-60	A
	Continuous Drain Current <sup>(1)</sup>	-14	A
$I_{DM}$	Pulsed Drain Current, $T_A = 25^\circ\text{C}$ <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  $\leq 2\%$

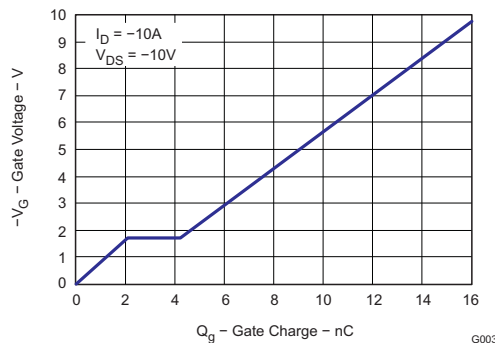
Figure 1. Top View



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



Gate Charge



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## ELECTRICAL CHARACTERISTICS

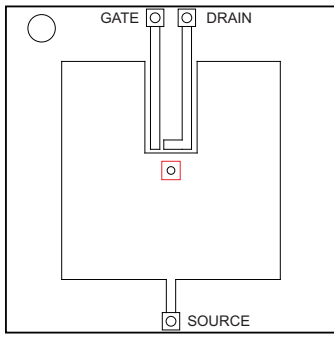
(T<sub>A</sub> = 25°C unless otherwise stated)

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

## THERMAL INFORMATION

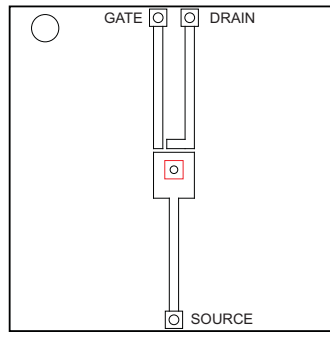
THERMAL METRIC <sup>(1)(2)</sup>		CSD25401Q3	UNITS
		8 PIN	
θ <sub>JA</sub>	Junction-to-ambient thermal resistance	42.0	°C/W
θ <sub>JCtop</sub>	Junction-to-case (top) thermal resistance	20.6	
θ <sub>JB</sub>	Junction-to-board thermal resistance	8.8	
ψ <sub>JT</sub>	Junction-to-top characterization parameter	0.3	
ψ <sub>JB</sub>	Junction-to-board characterization parameter	8.7	
θ <sub>JCbot</sub>	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.

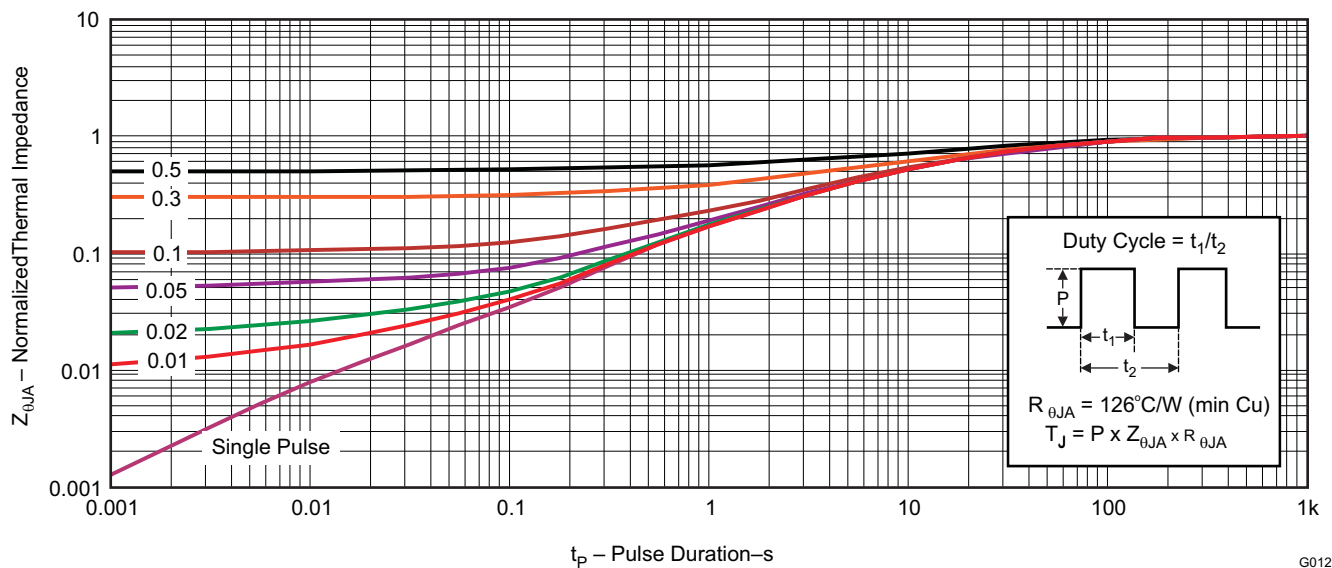


M0137-02

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)

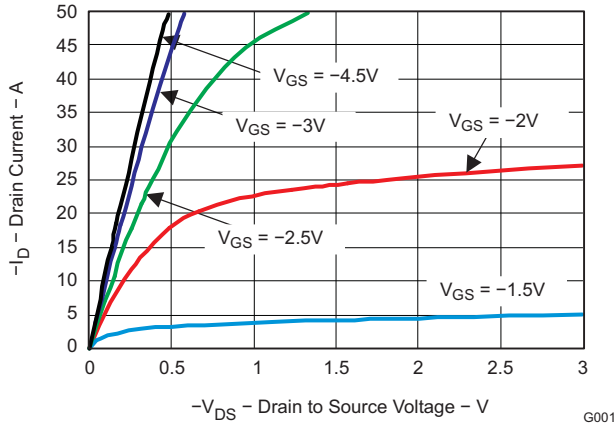


G012

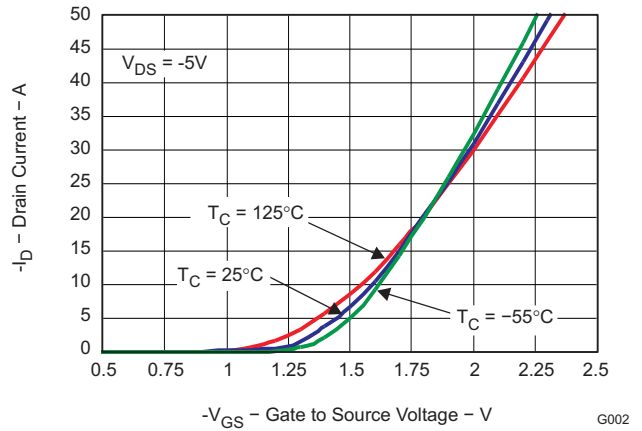
Figure 2. Transient Thermal Impedance

**TYPICAL MOSFET CHARACTERISTICS (continued)**

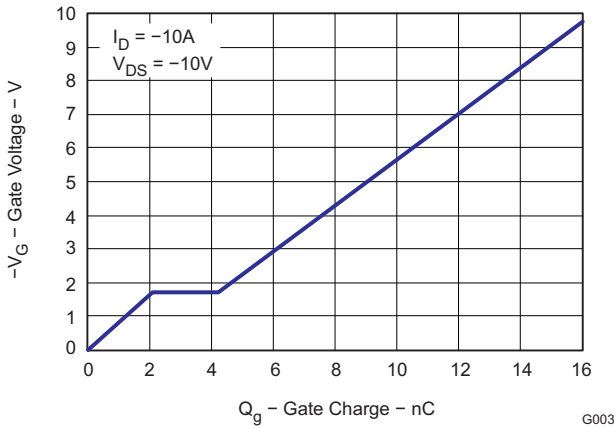
( $T_A = 25^\circ\text{C}$  unless otherwise stated)



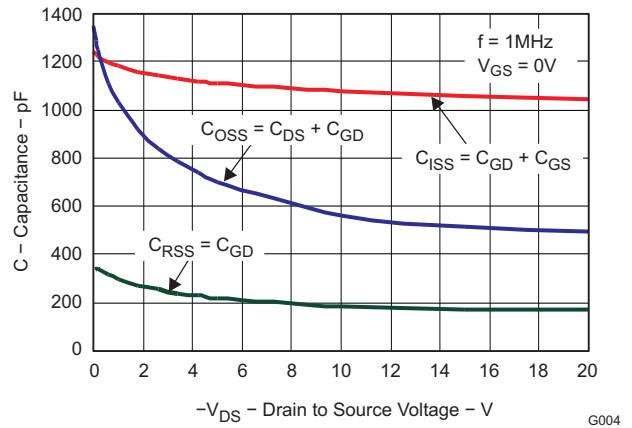
**Figure 3. Saturation Characteristics**



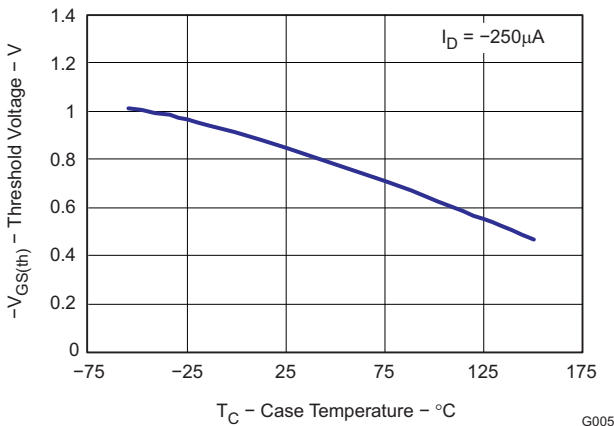
**Figure 4. Transfer Characteristics**



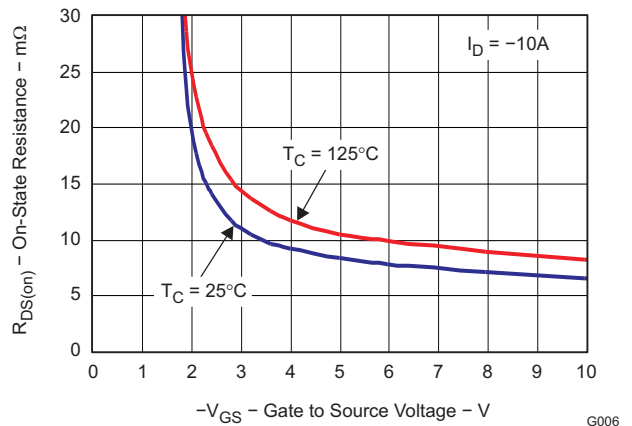
**Figure 5. Gate Charge**



**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)

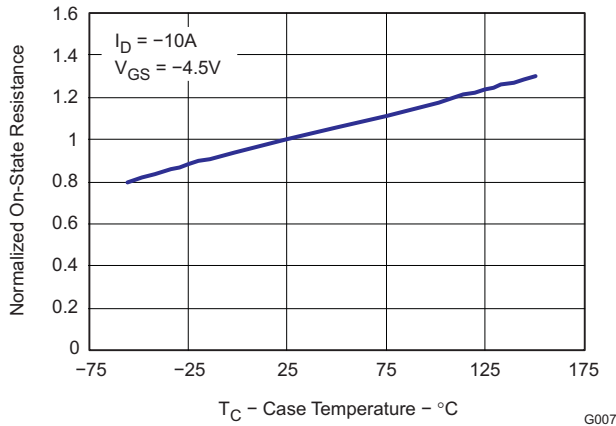


Figure 9. On Resistance vs. Temperature

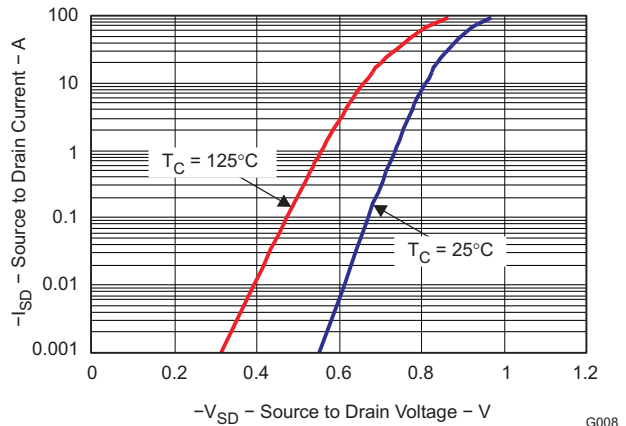


Figure 10. Typical Diode Forward Voltage

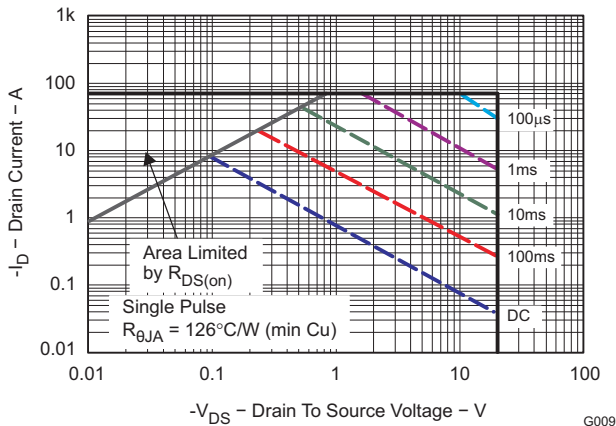


Figure 11. Maximum Safe Operating Area

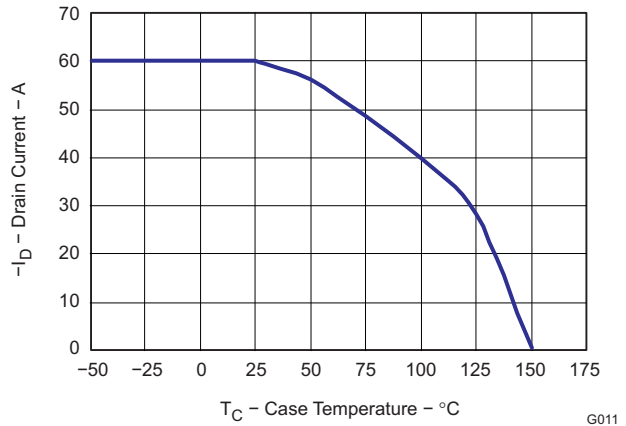
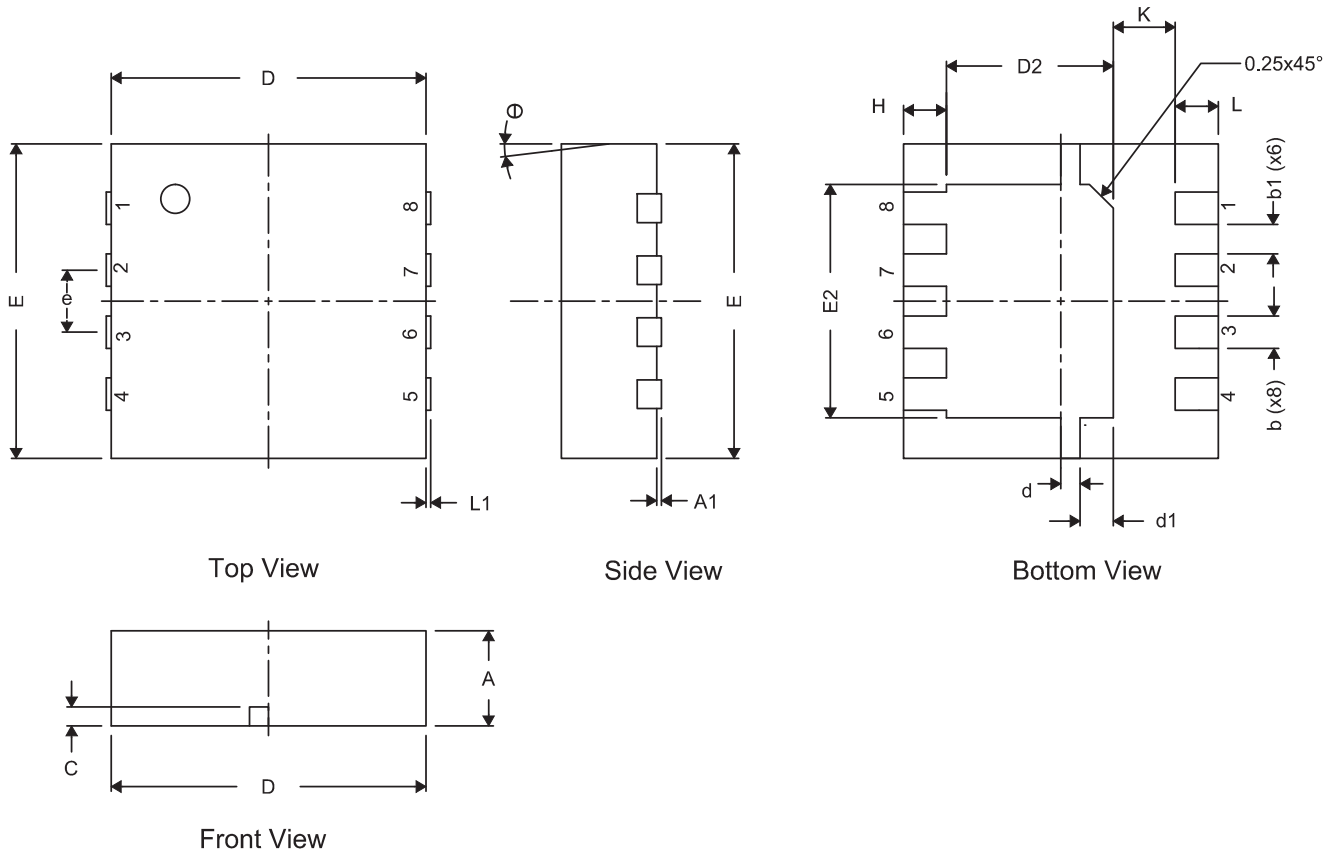


Figure 12. Maximum Drain Current vs. Temperature

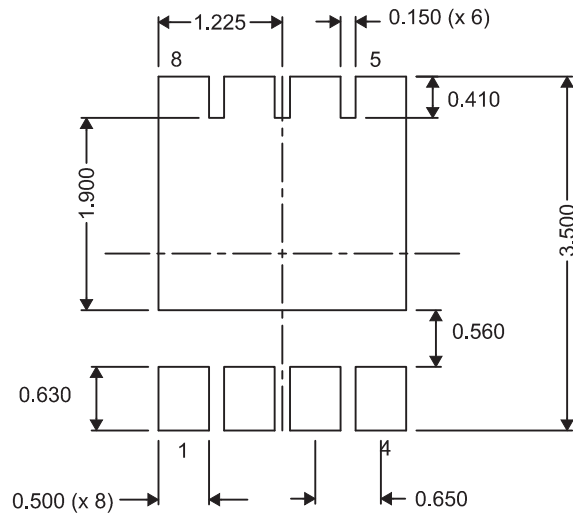
MECHANICAL DATA

CSD25401Q3 Package Dimensions

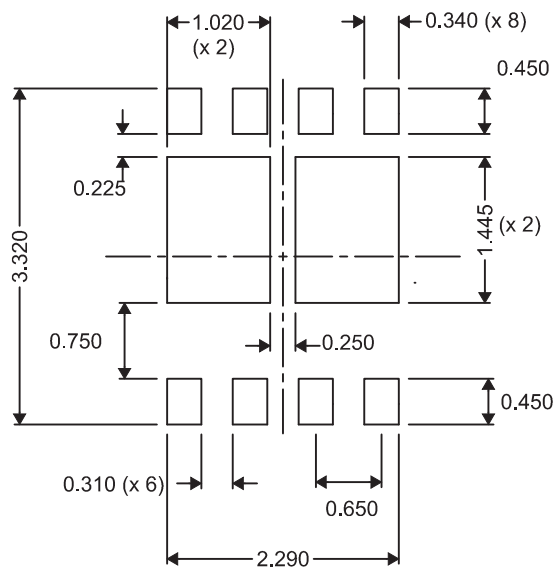


DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.950	1.000	1.100	0.037	0.039	0.043
A1	0.000	0.000	0.050	0.000	0.000	0.002
b	0.280	0.340	0.400	0.011	0.013	0.016
b1	0.310 NOM			0.012 NOM		
c	0.150	0.200	0.250	0.006	0.008	0.010
D	3.200	3.300	3.400	0.126	0.130	0.134
D2	1.650	1.750	1.800	0.065	0.069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

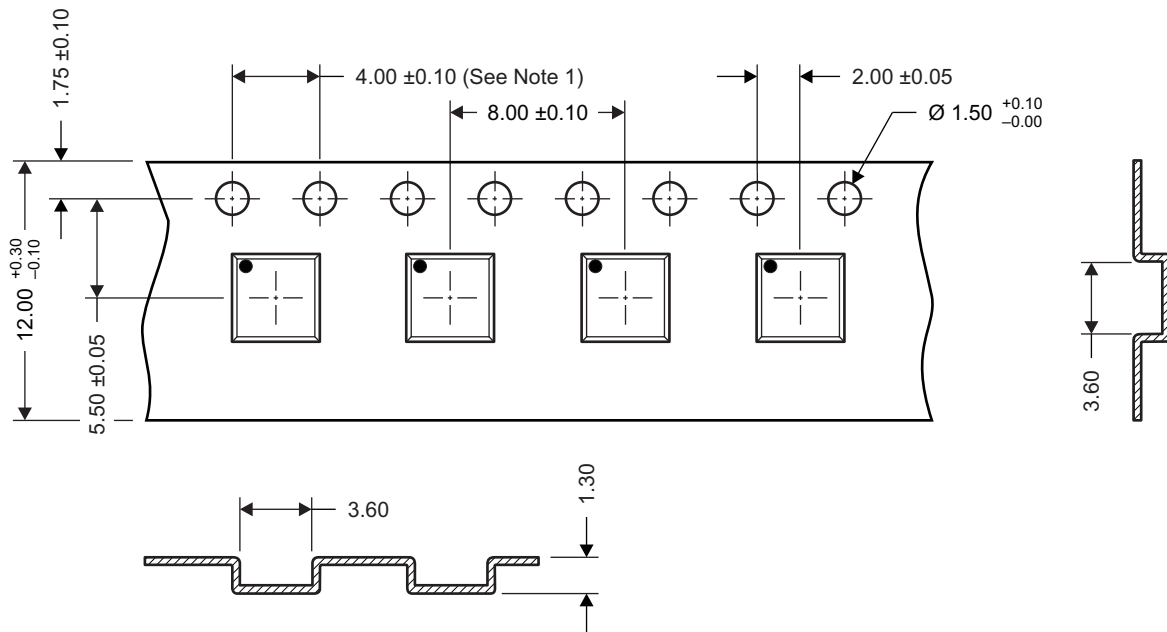
**Recommended PCB Pattern**



**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****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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