

## 20-V N-Channel NexFET™ Power MOSFETs

 Check for Samples: [CSD15571Q2](#)

### FEATURES

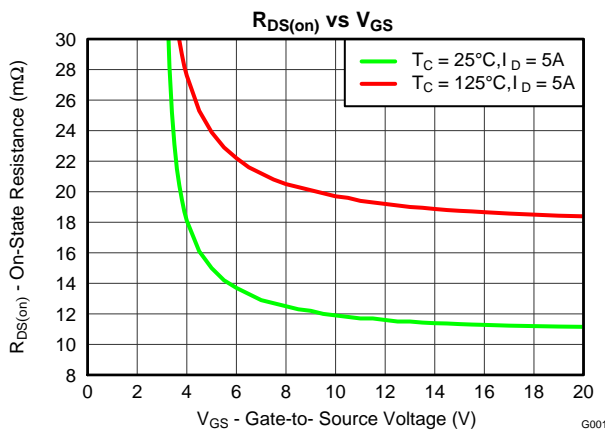
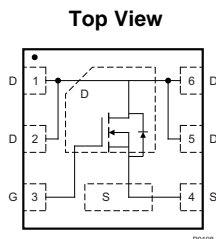
- Ultralow  $Q_g$  and  $Q_{gd}$
- Low Thermal Resistance
- Avalanche Rated
- Pb Free Terminal Plating
- RoHS Compliant
- Halogen Free
- SON 2-mm x 2-mm Plastic Package

### APPLICATIONS

- Optimized for Load Switch Applications
- Storage, Tablets, and Handheld Devices
- Optimized for Control FET Applications
- Point of Load Synchronous Buck Converters

### DESCRIPTION

The NexFET™ power MOSFET has been designed to minimize losses in power conversion and load management applications. The SON 2x2 offers excellent thermal performance for the size of the package.



### PRODUCT SUMMARY

$V_{DS}$	Drain to Source Voltage	20	V
$Q_g$	Gate Charge Total (4.5V)	2.5	nC
$Q_{gd}$	Gate Charge Gate to Drain	0.66	nC
$R_{DS(on)}$	Drain to Source On Resistance	$V_{GS} = 4.5\text{V}$	16 m $\Omega$
		$V_{GS} = 10\text{V}$	12 m $\Omega$
$V_{GS(th)}$	Threshold Voltage	1.45	V

### ORDERING INFORMATION

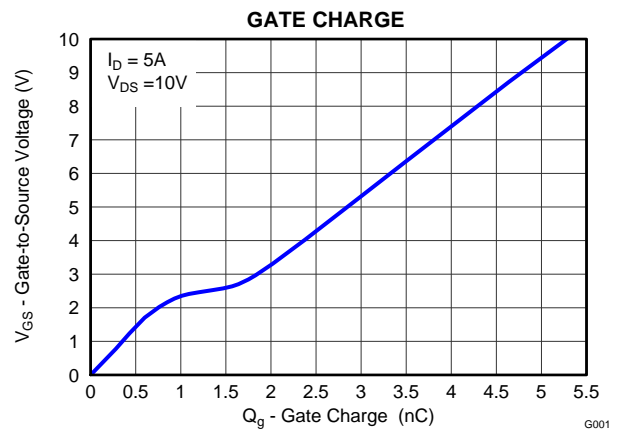
Device	Package	Media	Qty	Ship
CSD15571Q2	SON 2-mm x 2-mm Plastic Package	7-Inch Reel	3000	Tape and Reel

### 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	$\pm 20$	V
$I_D$	Continuous Drain Current (Package Limit)	22	A
	Continuous Drain Current <sup>(1)</sup>	10	A
$I_{DM}$	Pulsed Drain Current, $T_A = 25^\circ\text{C}$ <sup>(2)</sup>	52	A
$P_D$	Power Dissipation <sup>(1)</sup>	2.5	W
$T_J, T_{STG}$	Operating Junction and Storage Temperature Range	-55 to 150	$^\circ\text{C}$
$E_{AS}$	Avalanche Energy, single pulse $I_D = 19\text{A}, L = 0.1\text{mH}, R_G = 25\Omega$	18	mJ

(1)  $R_{\theta JA} = 50$  on 1in<sup>2</sup> Cu (2 oz.) on .060" thick FR4 PCB.

(2) Pulse duration 10 $\mu\text{s}$ , 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

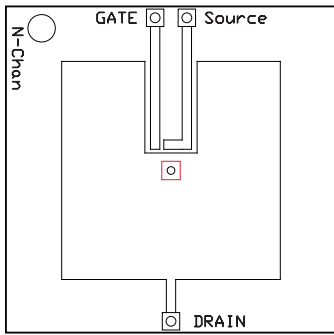
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>Static Characteristics</b>						
$BV_{DSS}$	Drain to Source Voltage	$V_{GS} = 0V, I_D = 250\mu A$	20			V
$I_{DSS}$	Drain to Source Leakage Current	$V_{GS} = 0V, V_{DS} = 20V$			1	$\mu A$
$I_{GSS}$	Gate to Source Leakage Current	$V_{DS} = 0V, V_{GS} = 20V$			100	nA
$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{DS} = V_{GS}, I_{DS} = 250\mu A$	1.10	1.45	1.90	V
$R_{DS(on)}$	Drain to Source On Resistance	$V_{GS} = 4.5V, I_{DS} = 5A$		16.0	19.2	$m\Omega$
		$V_{GS} = 10V, I_{DS} = 5A$		12.0	15.0	$m\Omega$
$g_{fs}$	Transconductance	$V_{DS} = 16V, I_{DS} = 5A$		25		S
<b>Dynamic Characteristics</b>						
$C_{ISS}$	Input Capacitance	$V_{GS} = 0V, V_{DS} = 10V, f = 1MHz$		320	419	pF
$C_{OSS}$	Output Capacitance			184	239	pF
$C_{RSS}$	Reverse Transfer Capacitance			32	42	pF
$R_g$	Series Gate Resistance		3.8	7.6	$\Omega$	
$Q_g$	Gate Charge Total (4.5V)	$V_{DS} = 10V, I_{DS} = 5A$		2.5	3.3	nC
$Q_g$	Gate Charge Total (10V)			5.1	6.7	nC
$Q_{gd}$	Gate Charge – Gate to Drain			0.66		nC
$Q_{gs}$	Gate Charge Gate to Source			0.93		nC
$Q_{g(th)}$	Gate Charge at $V_{th}$			0.52		nC
$Q_{OSS}$	Output Charge		$V_{DS} = 10V, V_{GS} = 0V$		4.1	
$t_{d(on)}$	Turn On Delay Time	$V_{DS} = 10V, V_{GS} = 4.5V, I_{DS} = 5A$ $R_G = 2\Omega$		4.7		ns
$t_r$	Rise Time			17.2		ns
$t_{d(off)}$	Turn Off Delay Time			9.9		ns
$t_f$	Fall Time			4.1		ns
<b>Diode Characteristics</b>						
$V_{SD}$	Diode Forward Voltage	$I_{DS} = 5A, V_{GS} = 0V$	0.82	1		V
$Q_{rr}$	Reverse Recovery Charge	$V_{DD} = 10V, I_F = 5A, di/dt = 300A/\mu s$		10.7		nC
$t_{rr}$	Reverse Recovery Time			19		ns

## THERMAL CHARACTERISTICS

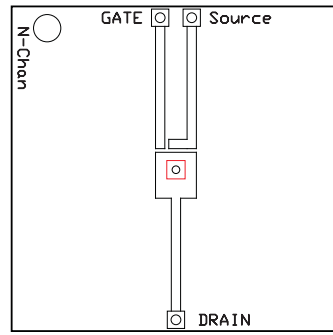
( $T_A = 25^\circ\text{C}$  unless otherwise stated)

PARAMETER		MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Thermal Resistance Junction to Case <sup>(1)</sup>			4.5	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance Junction to Ambient <sup>(1)(2)</sup>			65	$^\circ\text{C/W}$

- (1)  $R_{\theta JC}$  is determined with the device mounted on a 1-inch<sup>2</sup> (6.45-cm<sup>2</sup>), 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.
- (2) Device mounted on FR4 material with 1-inch<sup>2</sup> (6.45-cm<sup>2</sup>), 2-oz. (0.071-mm thick) Cu.



Max  $R_{\theta JA} = 65$  when mounted on 1 inch<sup>2</sup> (6.45 cm<sup>2</sup>) of 2-oz. (0.071-mm thick) Cu.



Max  $R_{\theta JA} = 235$  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 stated)

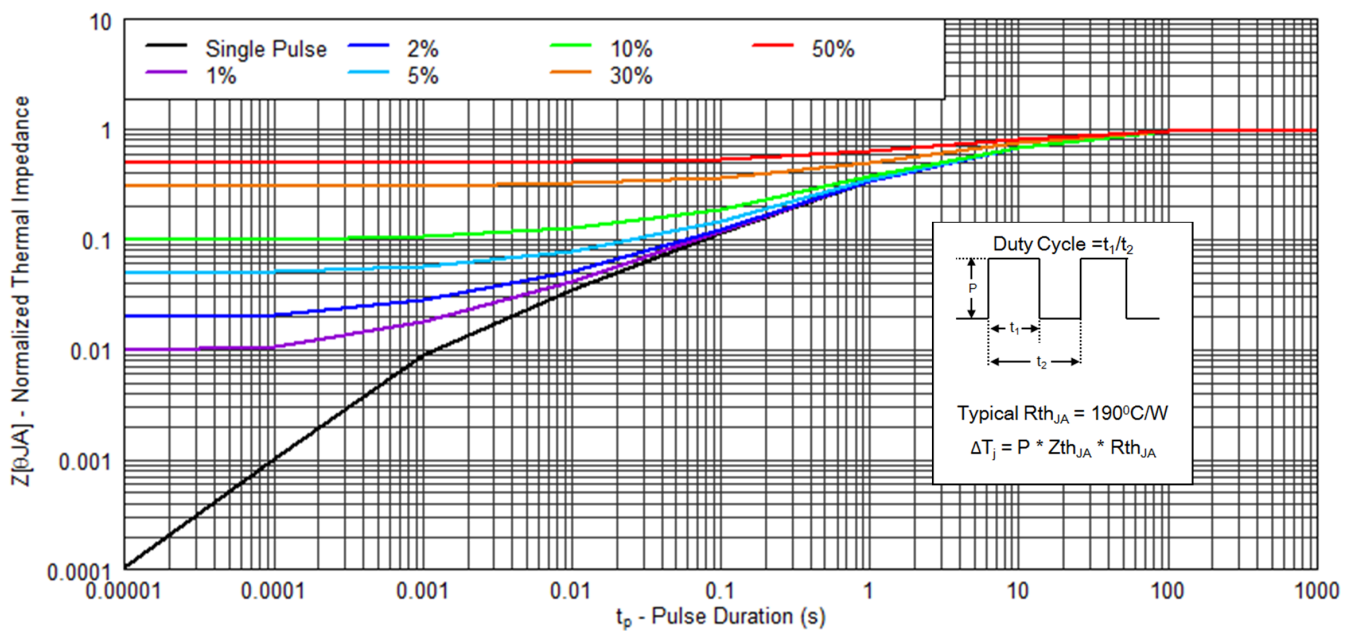


Figure 1. Transient Thermal Impedance

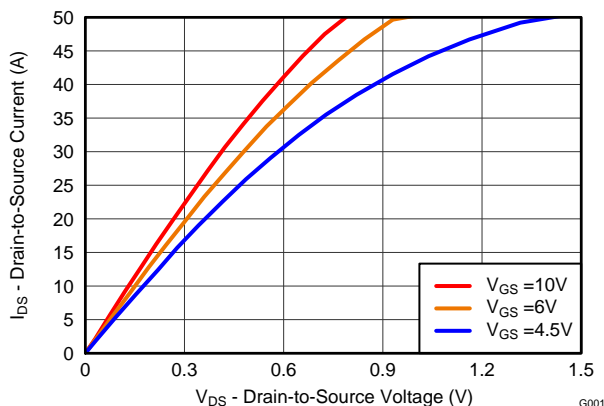


Figure 2. Saturation Characteristics

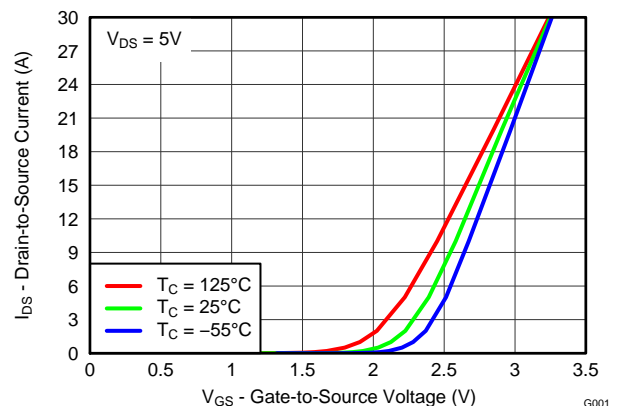
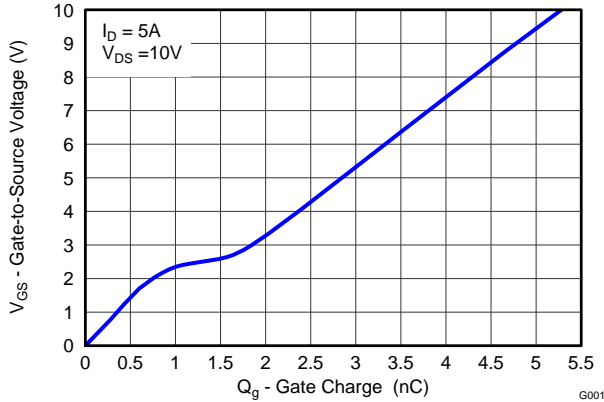


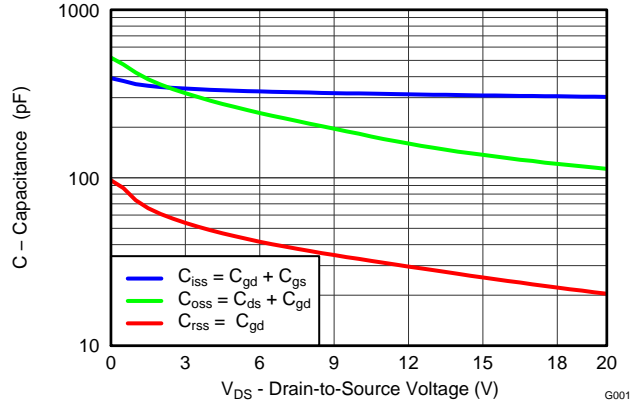
Figure 3. Transfer Characteristics

**TYPICAL MOSFET CHARACTERISTICS (continued)**

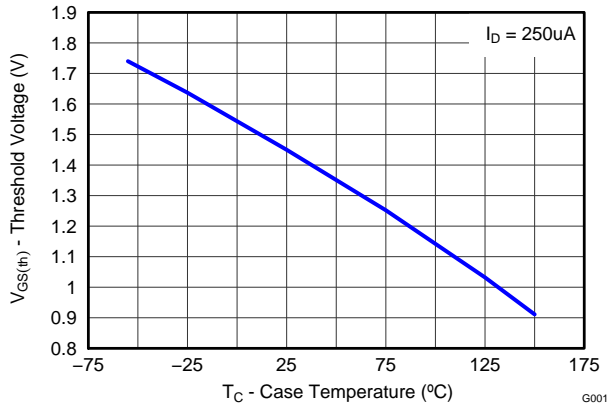
( $T_A = 25^\circ\text{C}$  unless otherwise stated)



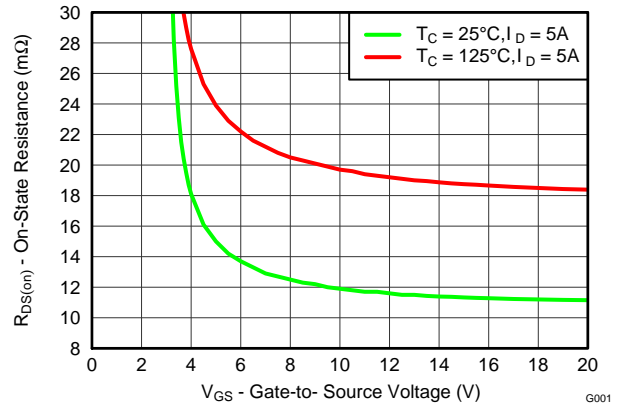
**Figure 4. Gate Charge**



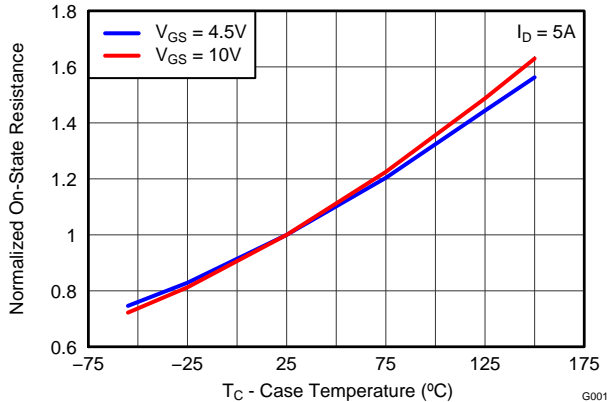
**Figure 5. Capacitance**



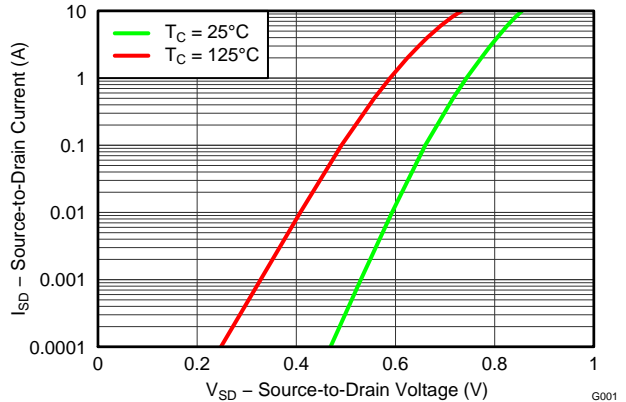
**Figure 6. Threshold Voltage vs. Temperature**



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



**Figure 8. Normalized On-State Resistance vs. Temperature**



**Figure 9. Typical Diode Forward Voltage**

TYPICAL MOSFET CHARACTERISTICS (continued)

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

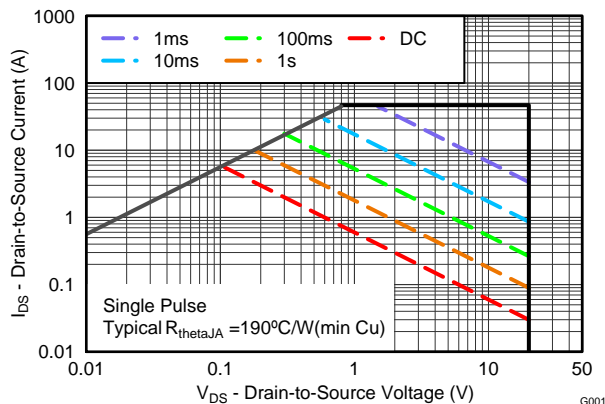


Figure 10. Maximum Safe Operating Area

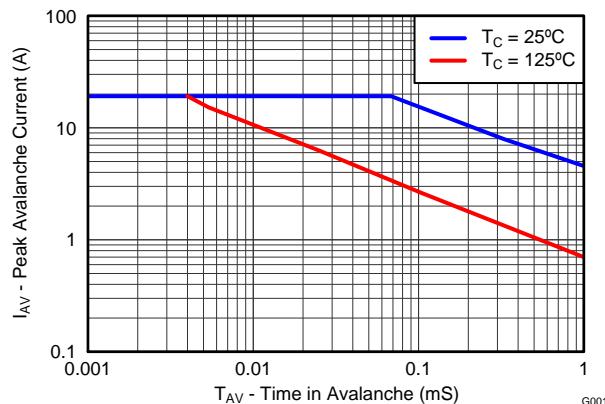


Figure 11. Single Pulse Unclamped Inductive Switching

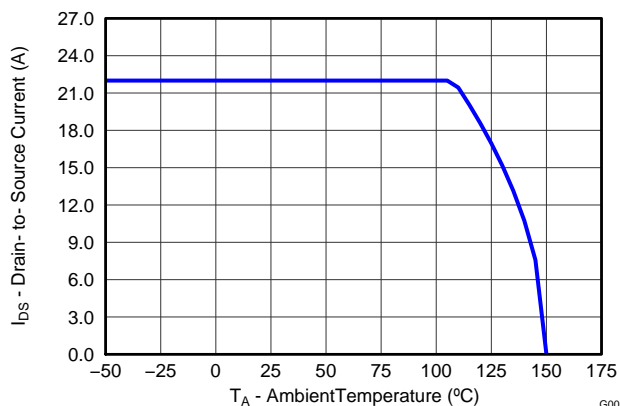
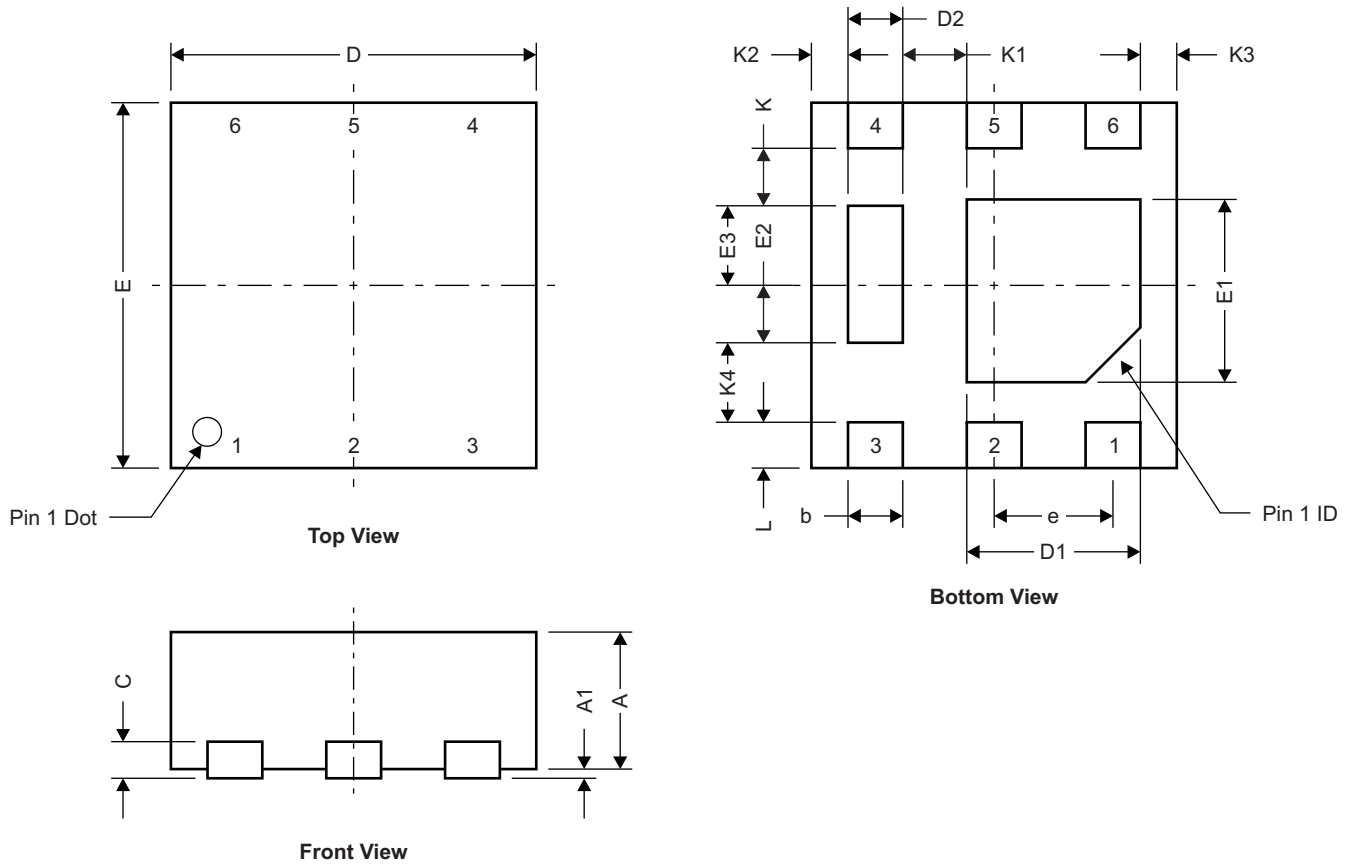


Figure 12. Maximum Drain Current vs. Temperature

**MECHANICAL DATA**

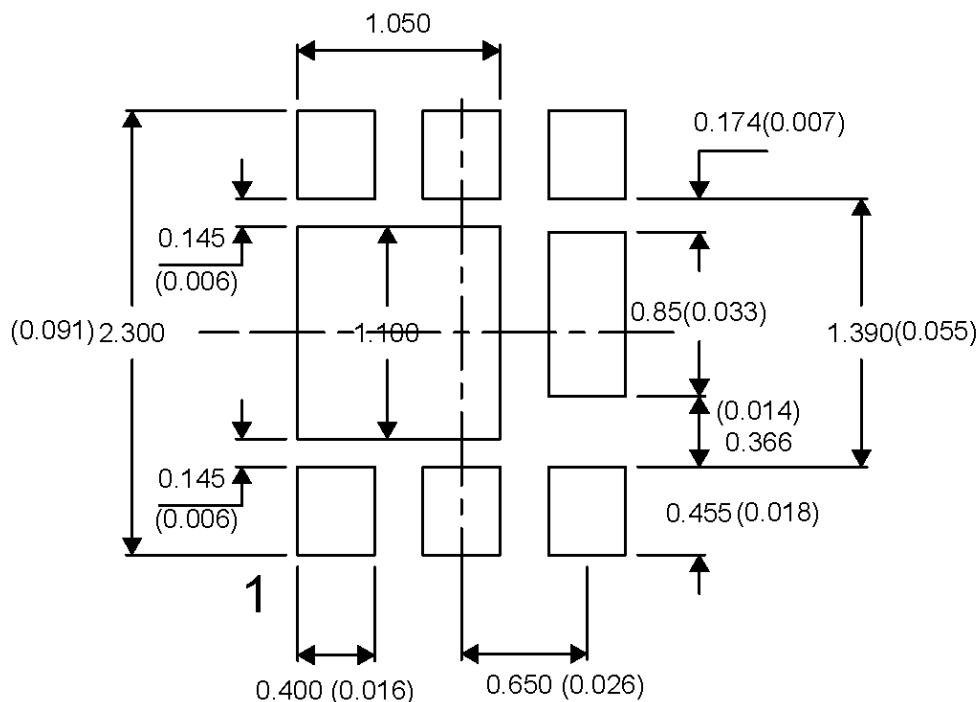
**Q2 Package Dimensions**



M0165-01

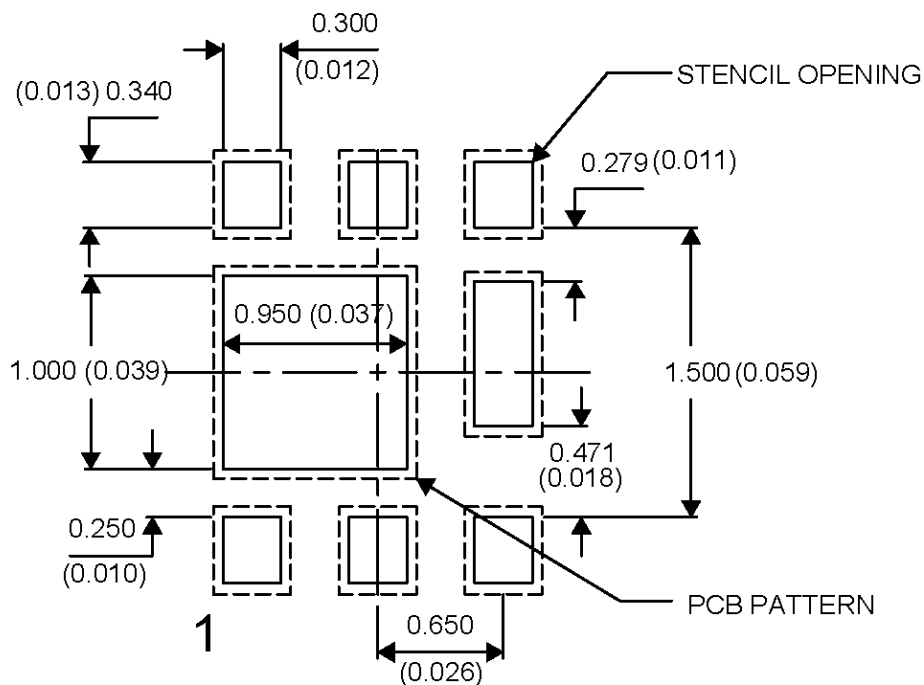
DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.700	0.750	0.800	0.028	0.030	0.032
A1	0.000		0.050	0.000		0.002
b	0.250	0.300	0.350	0.010	0.012	0.014
C	0.203 TYP			0.008 TYP		
D	2.000 TYP			0.080 TYP		
D1	0.900	0.950	1.000	0.036	0.038	0.040
D2	0.300 TYP			0.012 TYP		
E	2.000 TYP			0.080 TYP		
E1	0.900	1.000	1.100	0.036	0.040	0.044
E2	0.280 TYP			0.0112 TYP		
E3	0.470 TYP			0.0188 TYP		
e	0.650 BSC			0.026 TYP		
K	0.280 TYP			0.0112 TYP		
K1	0.350 TYP			0.014 TYP		
K2	0.200 TYP			0.008 TYP		
K3	0.200 TYP			0.008 TYP		
K4	0.470 TYP			0.0188 TYP		
L	0.200	0.25	0.300	0.008	0.010	0.012

**Recommended PCB Pattern**



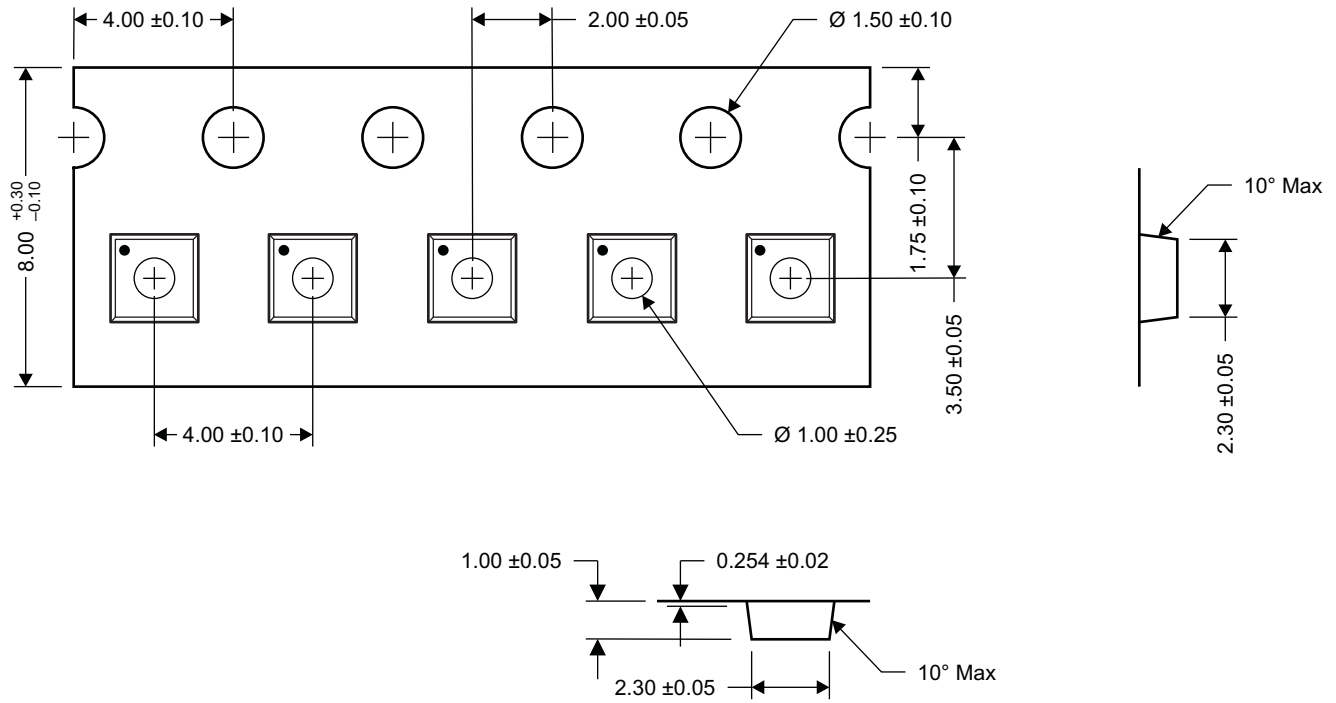
For recommended circuit layout for PCB designs, see application note [SLPA005 – Reducing Ringing Through PCB Layout Techniques](#).

**Recommended Stencil Pattern**



Note: All dimensions are in mm, unless otherwise specified.

**Q2 Tape and Reel Information**



- Notes:
1. Measured from centerline of sprocket hole to centerline of pocket
  2. Cumulative tolerance of 10 sprocket holes is ±0.20
  3. Other material available
  4. Typical SR of form tape Max 10<sup>9</sup> OHM/SQ
  5. All dimensions are in mm, unless otherwise specified.

M0168-01



**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
CSD15571Q2	ACTIVE	WSON	DQK	6	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-55 to 150	1551	<b>Samples</b>

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSELETE:** TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

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(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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### Applications

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Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
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