

# CSD85301Q2 20V Dual N-Channel NexFET™ Power MOSFETs

## 1 Features

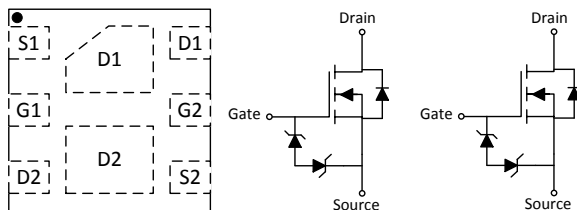
- Low on-resistance
- Dual independent MOSFETs
- Space saving SON 2mm × 2mm plastic package
- Optimized for 5V gate driver
- Avalanche rated
- Pb and halogen free
- RoHS compliant

## 2 Applications

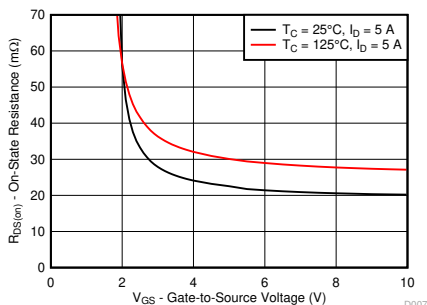
- Point-of-load synchronous buck converter for applications in networking, telecom, and computing systems
- Adaptor or USB input protection for notebook PCs and tablets
- Battery protection

## 3 Description

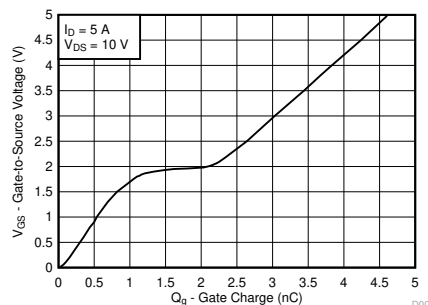
The CSD85301Q2 is a 20V, 23mΩ N-Channel device with dual independent MOSFETs in a SON 2mm x 2mm plastic package. The two FETs were designed to be used in a half bridge configuration for synchronous buck and other power supply applications. Additionally, this part can be used for adaptor, USB input protection and battery charging applications. The dual FETs feature low drain to source on-resistance that minimizes losses and offers low component count for space constrained applications.



Top View and Circuit Image



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



Gate Charge

## Product Summary

$T_A = 25^\circ\text{C}$		TYPICAL VALUE		UNIT
$V_{DS}$	Drain-to-Source Voltage	20		V
$Q_g$	Gate Charge Total (4.5V)	4.2		nC
$Q_{gd}$	Gate Charge Gate to Drain	1.0		nC
$R_{DS(on)}$	Drain-to-Source On Resistance	$V_{GS} = 1.8\text{V}$	65	mΩ
		$V_{GS} = 2.5\text{V}$	33	mΩ
		$V_{GS} = 3.8\text{V}$	25	mΩ
		$V_{GS} = 4.5\text{V}$	23	mΩ
$V_{GS(th)}$	Threshold Voltage	0.9		V

## Ordering Information

Device <sup>(1)</sup>	Media	Qty	Package	Ship
CSD85301Q2	7-Inch Reel	3000	SON 2mm x 2mm Plastic Package	Tape and Reel
CSD85301Q2T	7-Inch Reel	250		

- (1) For all available packages, see the orderable addendum at the end of the data sheet.

## Absolute Maximum Ratings

$T_A = 25^\circ\text{C}$		VALUE	UNIT
$V_{DS}$	Drain-to-Source Voltage	20	V
$V_{GS}$	Gate-to-Source Voltage	±10	V
$I_D$	Continuous Drain Current (Package limited)	5.0	A
$I_{DM}$	Pulsed Drain Current <sup>(1)</sup>	26	A
$P_D$	Power Dissipation <sup>(2)</sup>	2.3	W
$T_J, T_{stg}$	Operating Junction and Storage Temperature Range	-55 to 150	°C
$E_{AS}$	Avalanche Energy, single pulse $I_D = 8.7\text{A}, L = 0.1\text{mH}, R_G = 25\Omega$	3.8	mJ

- (1) Max  $R_{\theta JA} = 185^\circ\text{C/W}$ , pulse duration  $\leq 100\mu\text{s}$ , duty cycle  $\leq 1\%$ .  
 (2) Typical  $R_{\theta JA} = 55^\circ\text{C/W}$  on a 1 inch<sup>2</sup>, 2oz. Cu pad on a 0.06 inch thick FR4 PCB.



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## 4 Specifications

### 4.1 Electrical Characteristics

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>STATIC CHARACTERISTICS</b>						
$V_{DSS}$	Drain-to-Source Voltage	$V_{GS} = 0V, I_D = 250\mu A$	20			V
$I_{DSS}$	Drain-to-Source Leakage Current	$V_{GS} = 0V, V_{DS} = 16V$			1	$\mu A$
$I_{GSS}$	Gate-to-Source Leakage Current	$V_{DS} = 0V, V_{GS} = 10V$			10	$\mu A$
$V_{GS(th)}$	Gate-to-Source Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	0.6	0.9	1.2	V
$R_{DS(on)}$	Drain-to-Source On-Resistance	$V_{GS} = 1.8V, I_D = 0.5A$		65	99	m $\Omega$
		$V_{GS} = 2.5V, I_D = 5A$		33	39	m $\Omega$
		$V_{GS} = 3.8V, I_D = 5A$		25	29	m $\Omega$
		$V_{GS} = 4.5V, I_D = 5A$		23	27	m $\Omega$
$g_{fs}$	Transconductance	$V_{DS} = 2V, I_D = 5A$		20		S
<b>DYNAMIC CHARACTERISTICS</b>						
$C_{iss}$	Input Capacitance	$V_{GS} = 0V, V_{DS} = 10V, f = 1MHz$		361	469	pF
$C_{oss}$	Output Capacitance			68	89	pF
$C_{riss}$	Reverse Transfer Capacitance			48	62	pF
$R_G$	Series Gate Resistance			7.3		$\Omega$
$Q_g$	Gate Charge Total (4.5V)	$V_{DS} = 10V, I_D = 5A$		4.2	5.4	nC
$Q_{gd}$	Gate Charge Gate-to-Drain			1.0		nC
$Q_{gs}$	Gate Charge Gate-to-Source			1.1		nC
$Q_{g(th)}$	Gate Charge at $V_{th}$			0.5		nC
$Q_{oss}$	Output Charge	$V_{DS} = 10V, V_{GS} = 0V$		1.3		nC
$t_{d(on)}$	Turn On Delay Time	$V_{DS} = 10V, V_{GS} = 5V,$ $I_{DS} = 5A, R_G = 0\Omega$		6		ns
$t_r$	Rise Time			26		ns
$t_{d(off)}$	Turn Off Delay Time			14		ns
$t_f$	Fall Time			15		ns
<b>DIODE CHARACTERISTICS</b>						
$V_{SD}$	Diode Forward Voltage	$I_{SD} = 5A, V_{GS} = 0V$		0.8	1.0	V
$Q_{rr}$	Reverse Recovery Charge	$V_{DS} = 10V, I_F = 5A,$ $di/dt = 300A/\mu s$		7.2		nC
$t_{rr}$	Reverse Recovery Time			14		ns

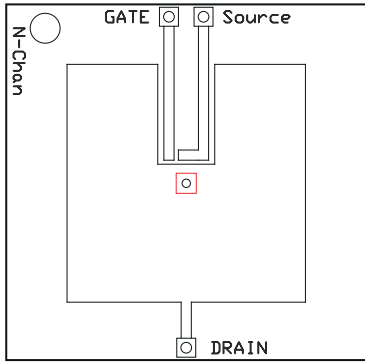
### 4.2 Thermal Information

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

THERMAL METRIC		MIN	TYP	MAX	UNIT
$R_{\theta JA}$	Junction-to-Ambient Thermal Resistance <sup>(1)</sup>			70	$^\circ\text{C/W}$
	Junction-to-Ambient Thermal Resistance <sup>(2)</sup>			185	

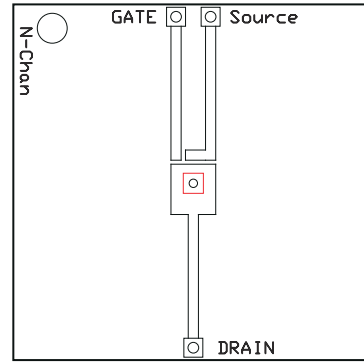
(1) Device mounted on FR4 material with 1 inch<sup>2</sup> (6.45cm<sup>2</sup>), 2oz. (0.071mm thick) Cu.

(2) Device mounted on FR4 material with minimum Cu mounting area.



Max  $R_{\theta JA}$  = 70 when mounted on 1 inch<sup>2</sup> (6.45cm<sup>2</sup>) of 2oz. (0.071mm thick) Cu.

M0164-01



Max  $R_{\theta JA}$  = 185 when mounted on minimum pad area of 2oz. (0.071mm thick) Cu.

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### 4.3 Typical MOSFET Characteristics

( $T_A$  = 25°C unless otherwise stated)

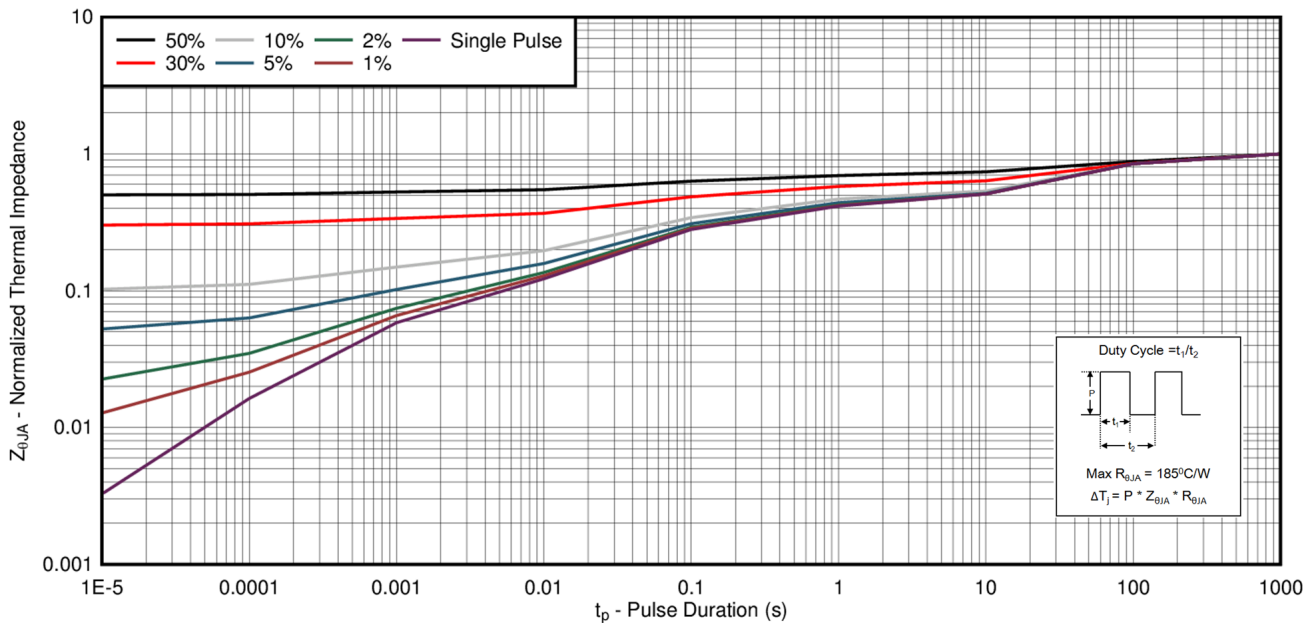
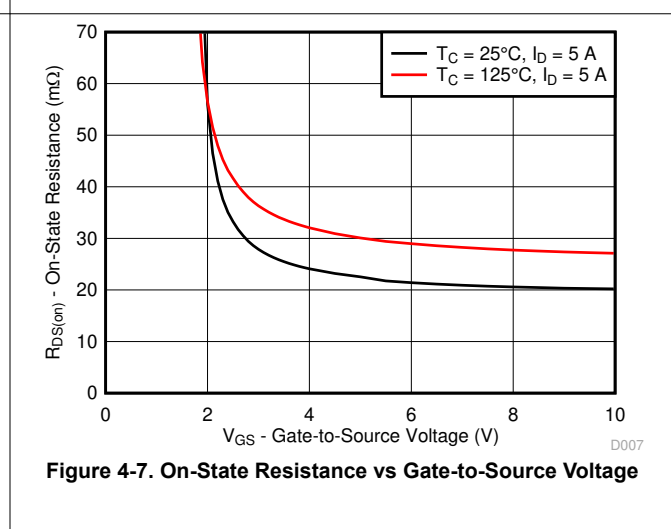
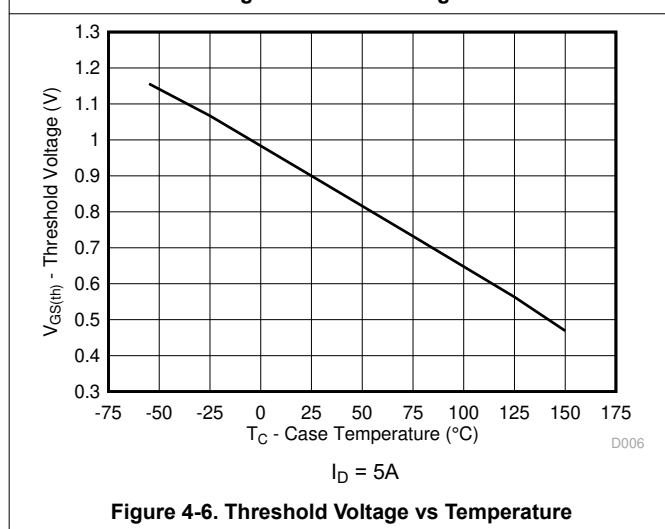
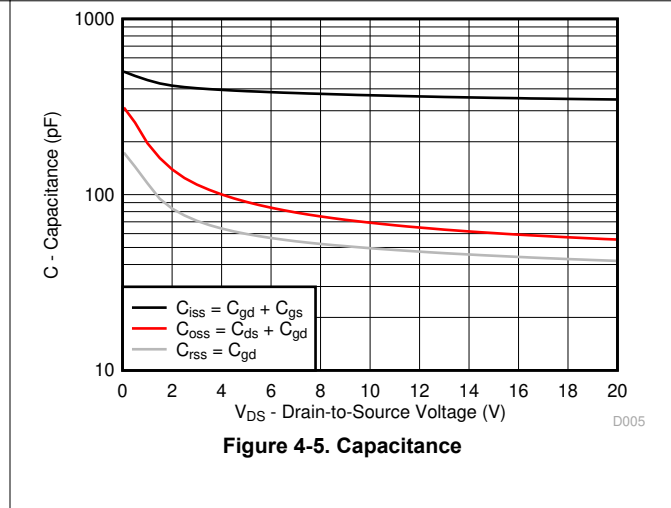
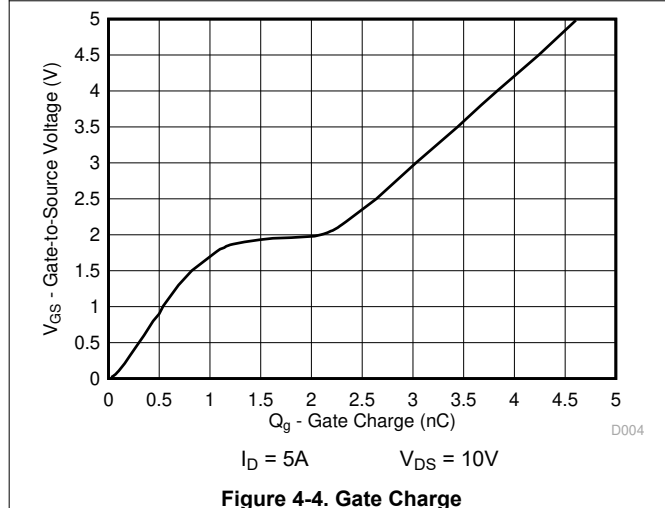
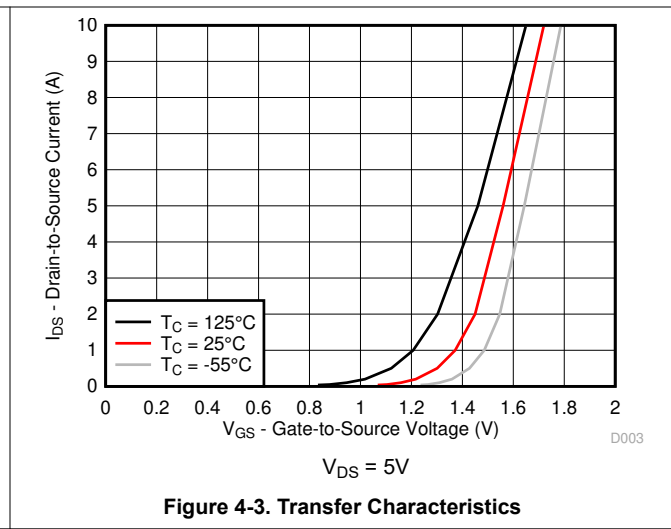
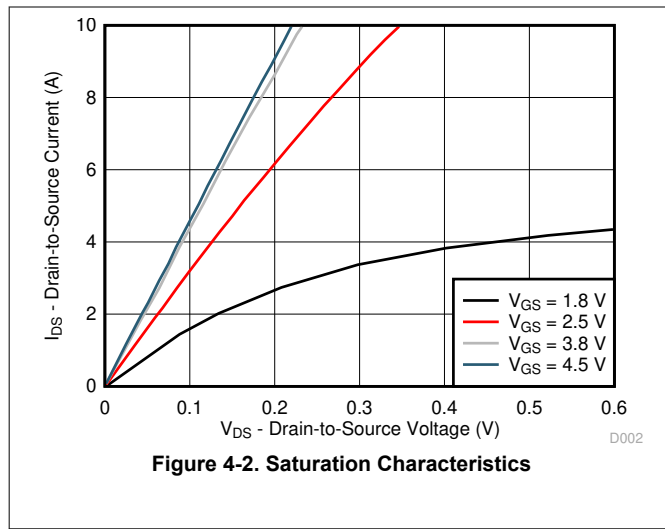


Figure 4-1. Transient Thermal Impedance

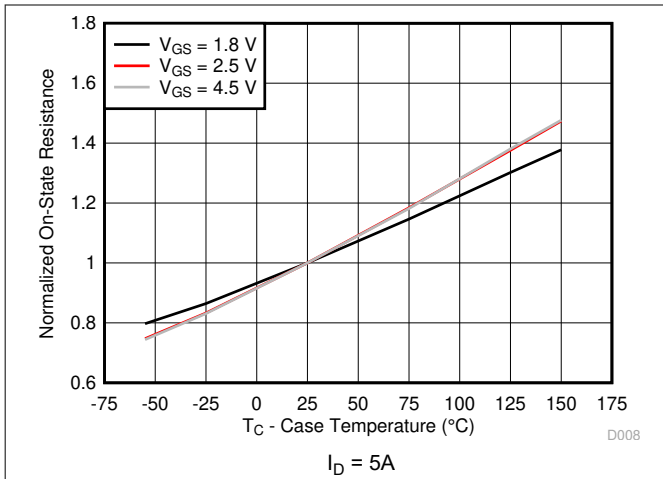
### 4.3 Typical MOSFET Characteristics (continued)

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

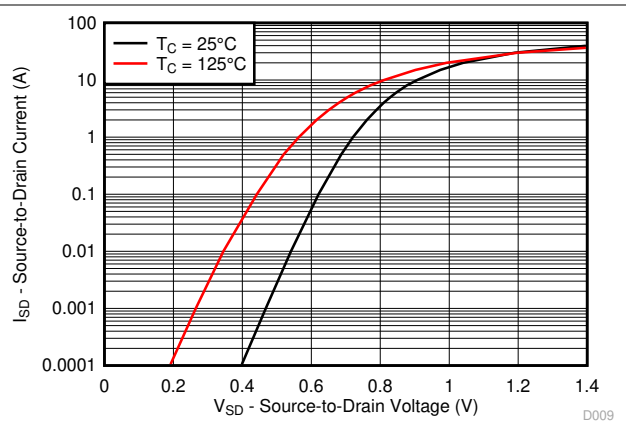


### 4.3 Typical MOSFET Characteristics (continued)

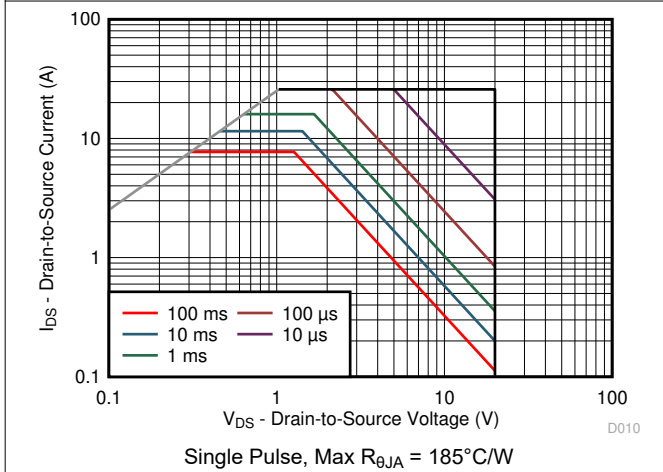
( $T_A = 25^\circ\text{C}$  unless otherwise stated)



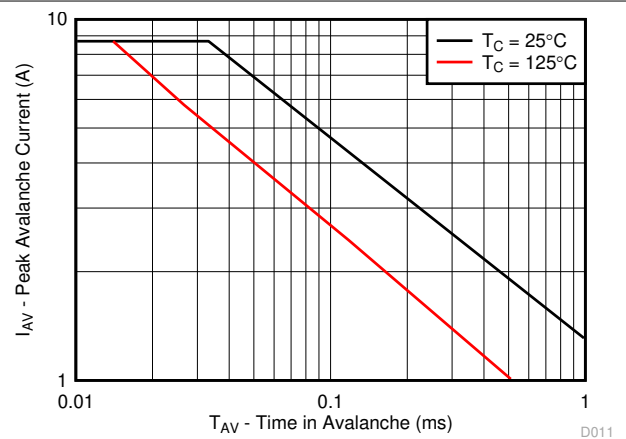
**Figure 4-8. Normalized On-State Resistance vs Temperature**



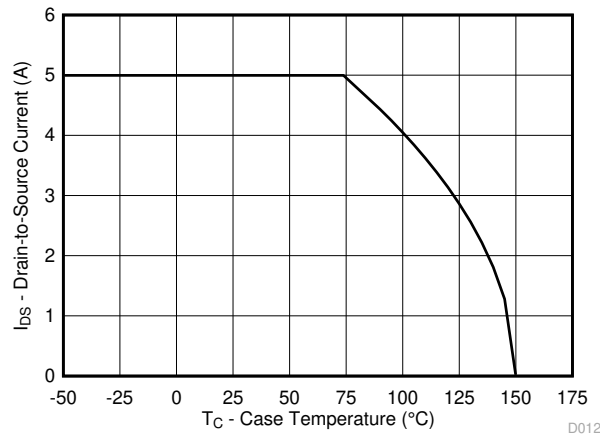
**Figure 4-9. Typical Diode Forward Voltage**



**Figure 4-10. Maximum Safe Operating Area**



**Figure 4-11. Single Pulse Unclamped Inductive Switching**



**Figure 4-12. Maximum Drain Current vs Temperature**

## 5 Device and Documentation Support

### 5.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on [ti.com](http://ti.com). Click on *Notifications* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

### 5.2 Support Resources

[TI E2E™ support forums](#) are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

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### 5.3 Trademarks

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All trademarks are the property of their respective owners.

### 5.4 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

### 5.5 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

## 6 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

<b>Changes from Revision * (December 2014) to Revision A (May 2024)</b>	<b>Page</b>
• Updated the numbering format for tables, figures, and cross-references throughout the document.....	<b>1</b>

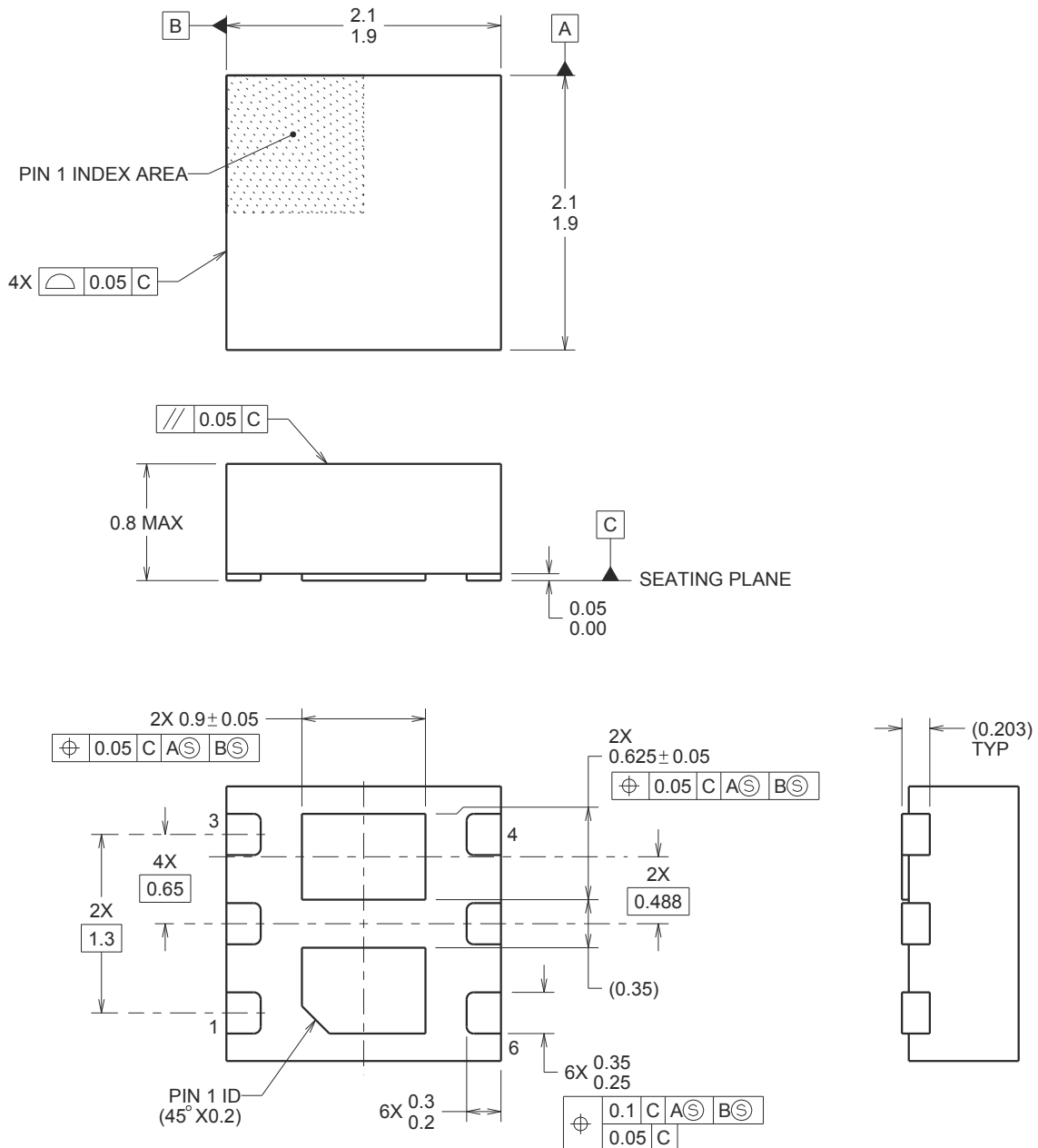
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## 7 Mechanical, Packaging, and Orderable Information

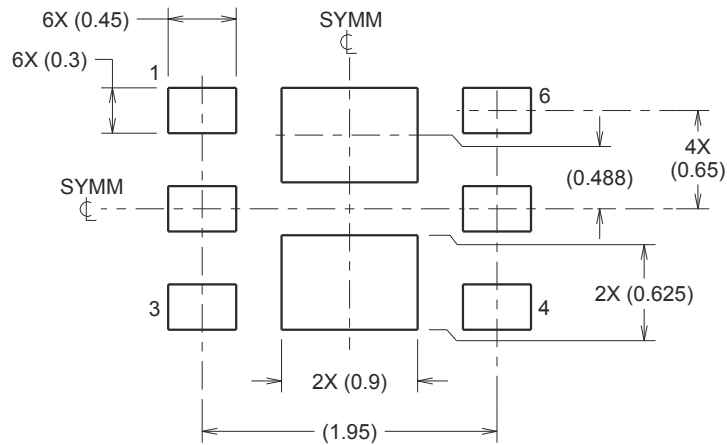
The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

### 7.1 Package Dimensions



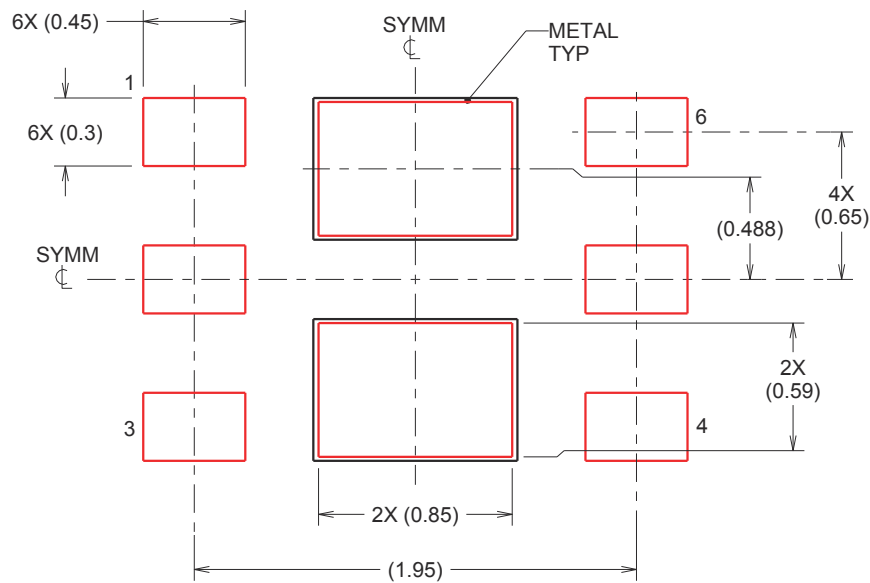
All dimensions are in mm, unless otherwise stated.

## 7.2 PCB Land Pattern



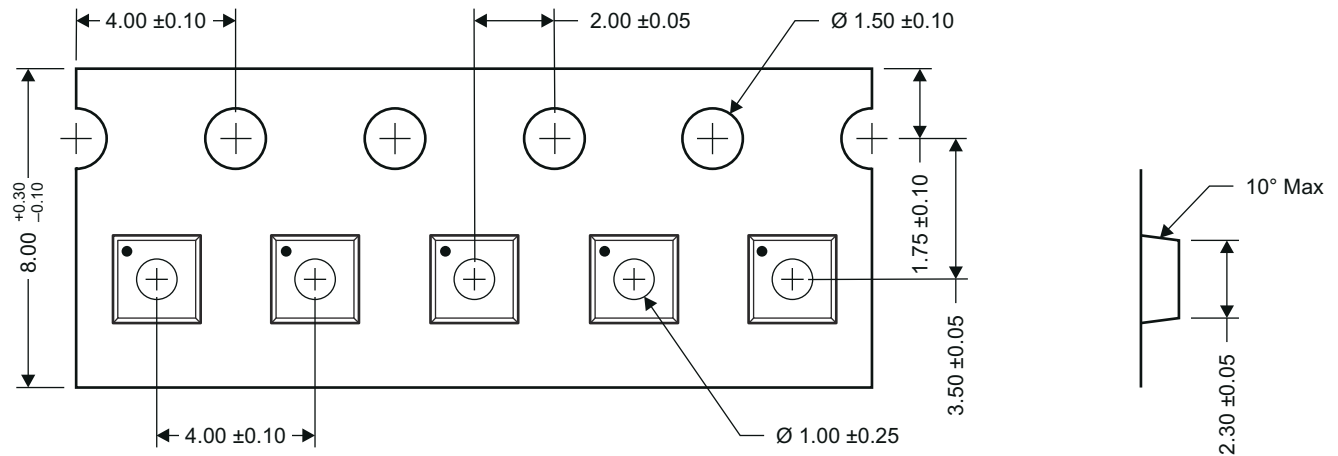
For recommended circuit layout for PCB designs, see application note [SLPA005](#) – *Reducing Ringing Through PCB Layout Techniques*.

## 7.3 Recommended Stencil Opening



All dimensions are in mm, unless otherwise stated.

## 7.4 Q2 Tape and Reel Information



1. Measured from centerline of sprocket hole to centerline of pocket
2. Cumulative tolerance of 10 sprocket holes is  $\pm 0.20$
3. Other material available
4. Typical SR of form tape Max  $10^9$  OHM/SQ
5. All dimensions are in mm, unless otherwise specified.

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**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
CSD85301Q2	ACTIVE	WSON	DLV	6	3000	RoHS & Green	NIPDAU   SN	Level-1-260C-UNLIM	-55 to 150	8531	Samples
CSD85301Q2T	ACTIVE	WSON	DLV	6	250	RoHS & Green	NIPDAU   SN	Level-1-260C-UNLIM	-55 to 150	8531	Samples

(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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

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**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*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
CSD85301Q2	WSO	DLV	6	3000	180.0	9.5	2.3	2.3	1.0	4.0	8.0	Q1
CSD85301Q2T	WSO	DLV	6	250	180.0	9.5	2.3	2.3	1.0	4.0	8.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CSD85301Q2	WSON	DLV	6	3000	189.0	185.0	36.0
CSD85301Q2T	WSON	DLV	6	250	189.0	185.0	36.0

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