CSD85301Q2 20 V Dual N-Channel NexFET™ Power MOSFETs

1 Features

- Low On-Resistance
- Dual Independent MOSFETs
- Space Saving SON 2 × 2 mm Plastic Package
- Optimized for 5 V Gate Driver
- Avalanche Rated
- Pb and Halogen Free
- RoHS Compliant

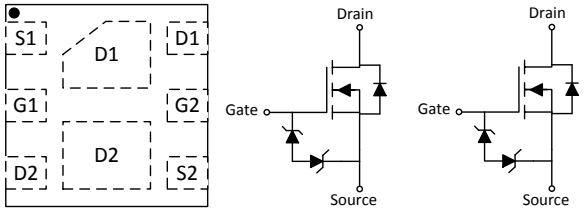
2 Applications

- 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 20 V, 23 mΩ N-Channel device with dual independent MOSFETs in a SON 2 x 2 mm 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



Product Summary

T_A = 25°C		TYPICAL VALUE		UNIT
V_{DS}	Drain-to-Source Voltage	20		V
Q_g	Gate Charge Total (4.5 V)	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 V	65	mΩ
		V_{GS} = 2.5 V	33	mΩ
		V_{GS} = 3.8 V	25	mΩ
		V_{GS} = 4.5 V	23	mΩ
$V_{GS(th)}$	Threshold Voltage	0.9		V

Ordering Information(1)

Device	Media	Qty	Package	Ship
CSD85301Q2	7-Inch Reel	3000	SON 2 x 2 mm 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.

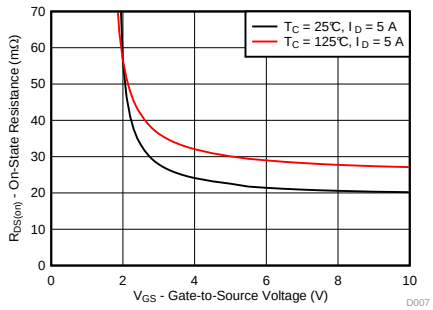
Absolute Maximum Ratings

T_A = 25°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(1)	26	A
P_D	Power Dissipation(2)	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 A, L = 0.1 mH, R_G = 25 Ω	3.8	mJ

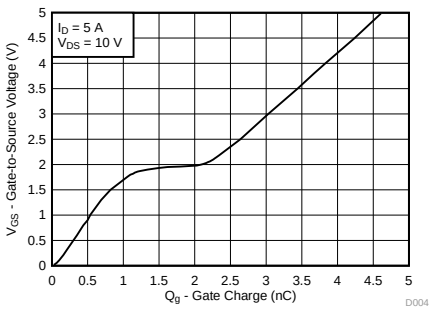
(1) Max $R_{\theta JA}$ = 185 °C/W, pulse duration ≤100 µs, duty cycle ≤1%.

(2) Typical $R_{\theta JA}$ = 55 °C/W on a 1 inch², 2 oz. Cu pad on a 0.06 inch thick FR4 PCB.

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



Gate Charge



An IMPORTANT NOTICE at the end of this data sheet addresses availability, warranty, changes, use in safety-critical applications, intellectual property matters and other important disclaimers. PRODUCTION DATA.

Table of Contents

1 **Features** ... 1
2 **Applications** ... 1
3 **Description** ... 1
4 **Revision History** ... 2
5 **Specifications** ... 3
5.1 Electrical Characteristics ... 3
5.2 Thermal Information ... 3
5.3 Typical MOSFET Characteristics ... 4
6 **Device and Documentation Support** ... 7
6.1 Trademarks ... 7
6.2 Electrostatic Discharge Caution ... 7
6.3 Glossary ... 7
7 **Mechanical, Packaging, and Orderable Information** ... 8
7.1 Package Dimensions ... 8
7.2 PCB Land Pattern ... 9
7.3 Recommended Stencil Opening ... 9
7.4 Q2 Tape and Reel Information ... 10

4 Revision History

DATE	REVISION	NOTES
December 2014	*	Initial release.

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5 Specifications

5.1 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} = 0 V, I_D = 250 µA	20			V
I_{DSS}	Drain-to-Source Leakage Current	V_{GS} = 0 V, V_{DS} = 16 V			1	µA
I_{GSS}	Gate-to-Source Leakage Current	V_{DS} = 0 V, V_{GS} = 10 V			10	µA
$V_{GS(th)}$	Gate-to-Source Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 µA	0.6	0.9	1.2	V
$R_{DS(on)}$	Drain-to-Source On-Resistance	V_{GS} = 1.8 V, I_D = 0.5 A		65	99	mΩ
		V_{GS} = 2.5 V, I_D = 5 A		33	39	mΩ
		V_{GS} = 3.8 V, I_D = 5 A		25	29	mΩ
		V_{GS} = 4.5 V, I_D = 5 A		23	27	mΩ
g_{fs}	Transconductance	V_{DS} = 2 V, I_D = 5 A		20		S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{GS} = 0 V, V_{DS} = 10 V, f = 1 MHz		361	469	pF
C_{oss}	Output Capacitance			68	89	pF
C_{rss}	Reverse Transfer Capacitance			48	62	pF
R_G	Series Gate Resistance			7.3		Ω
Q_g	Gate Charge Total (4.5 V)	V_{DS} = 10 V, I_D = 5 A		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} = 10 V, V_{GS} = 0 V		1.3		nC
$t_{d(on)}$	Turn On Delay Time	V_{DS} = 10 V, V_{GS} = 5 V, I_{DS} = 5 A, R_G = 0 Ω		6		ns
t_r	Rise Time			26		ns
$t_{d(off)}$	Turn Off Delay Time			14		ns
t_f	Fall Time			15		ns
DIODE CHARACTERISTICS						
V_{SD}	Diode Forward Voltage	I_{SD} = 5 A, V_{GS} = 0 V		0.8	1.0	V
Q_{rr}	Reverse Recovery Charge	V_{DS}= 10 V, I_F = 5 A, di/dt = 300 A/µs		7.2		nC
t_{rr}	Reverse Recovery Time			14		ns

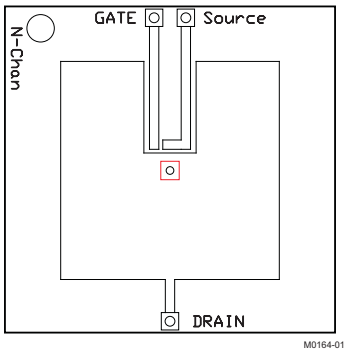
5.2 Thermal Information

(T_A = 25°C unless otherwise stated)

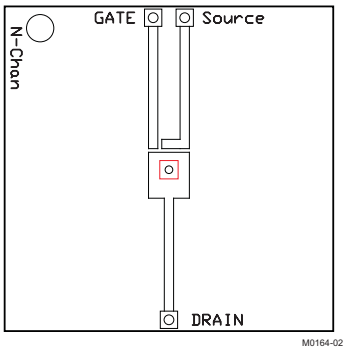
THERMAL METRIC		MIN	TYP	MAX	UNIT
$R_{\theta JA}$	Junction-to-Ambient Thermal Resistance(1)			70	°C/W
	Junction-to-Ambient Thermal Resistance(2)			185	

(1) Device mounted on FR4 material with 1 inch^2 (6.45 cm^2), 2 oz. (0.071 mm thick) Cu.
(2) Device mounted on FR4 material with minimum Cu mounting area.

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



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

5.3 Typical MOSFET Characteristics

(T_A = 25°C unless otherwise stated)

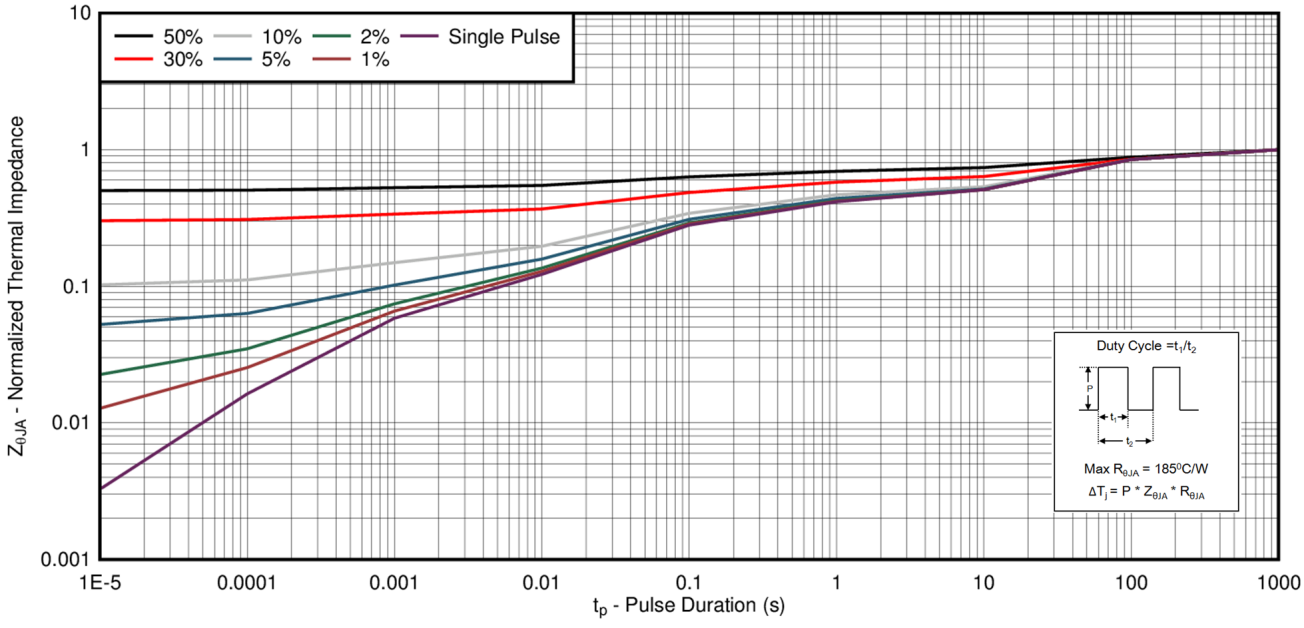


Figure 1. Transient Thermal Impedance

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Typical MOSFET Characteristics (continued)

(T_A = 25°C unless otherwise stated)

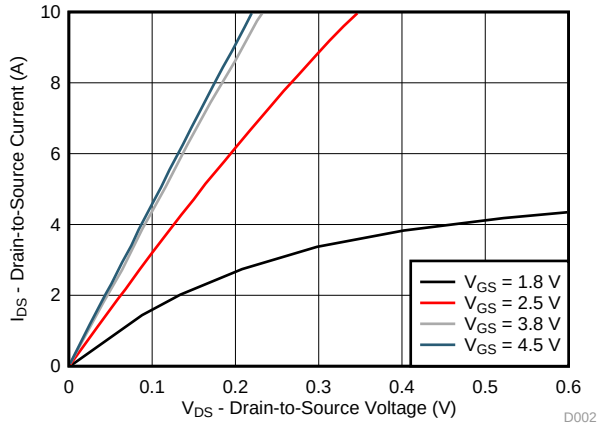


Figure 2. Saturation Characteristics

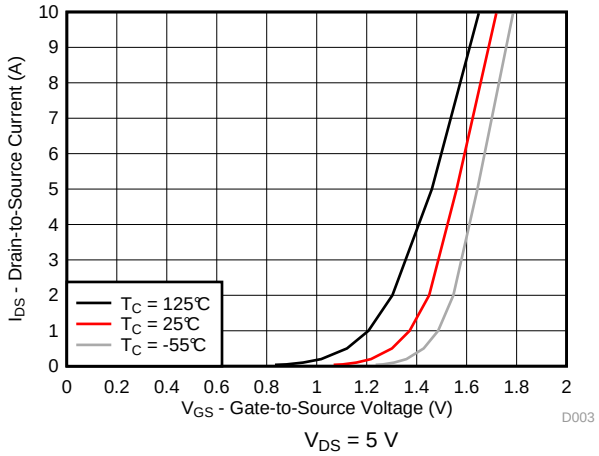


Figure 3. Transfer Characteristics

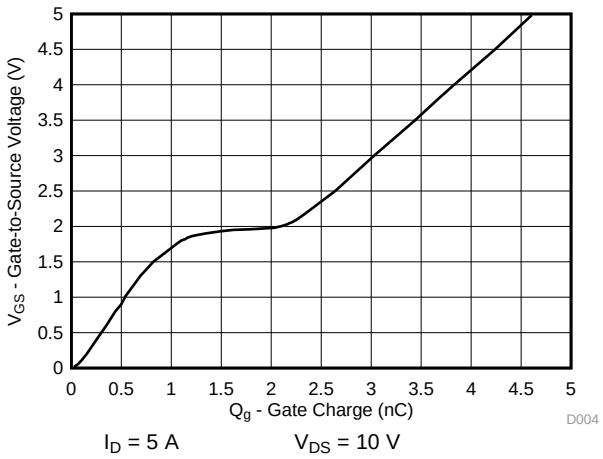


Figure 4. Gate Charge

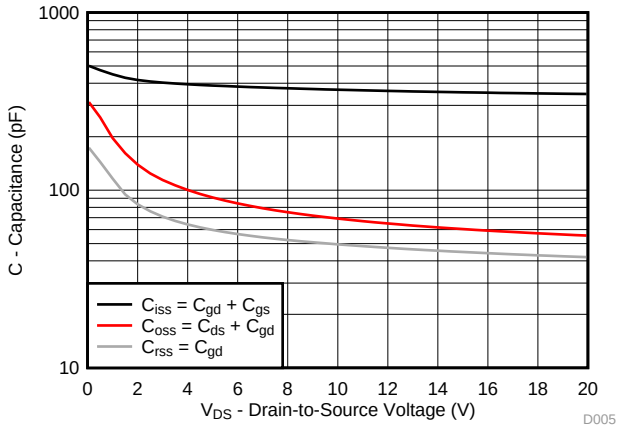


Figure 5. Capacitance

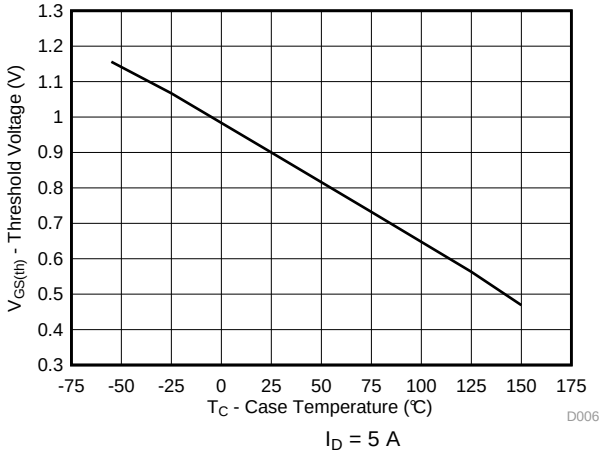


Figure 6. Threshold Voltage vs Temperature

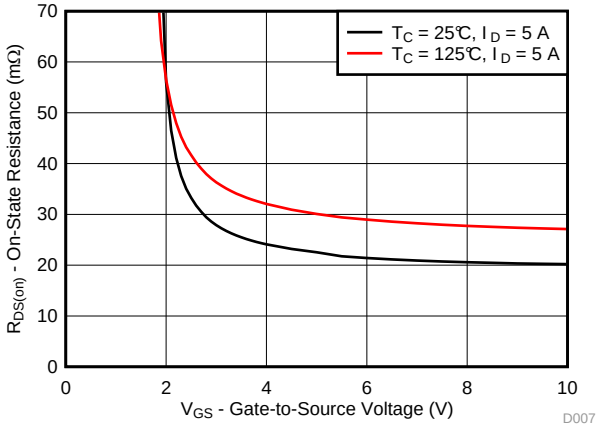


Figure 7. On-State Resistance vs Gate-to-Source Voltage

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Typical MOSFET Characteristics (continued)

(T_A = 25°C unless otherwise stated)

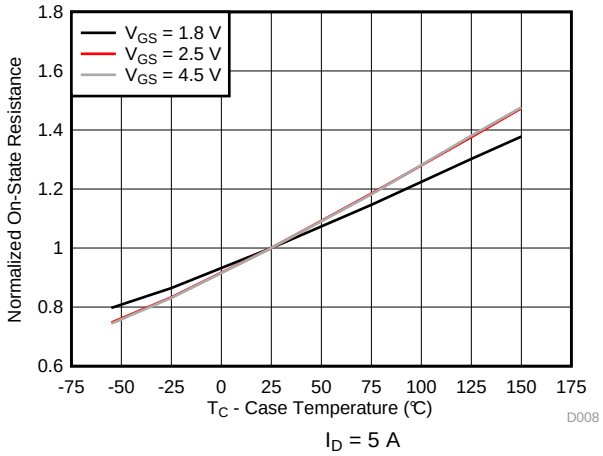


Figure 8. Normalized On-State Resistance vs Temperature

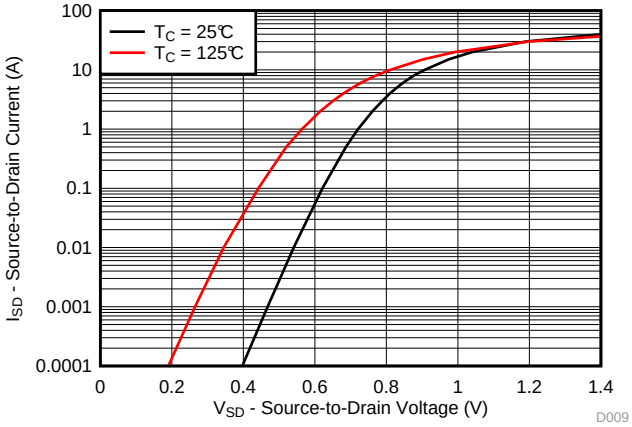


Figure 9. Typical Diode Forward Voltage

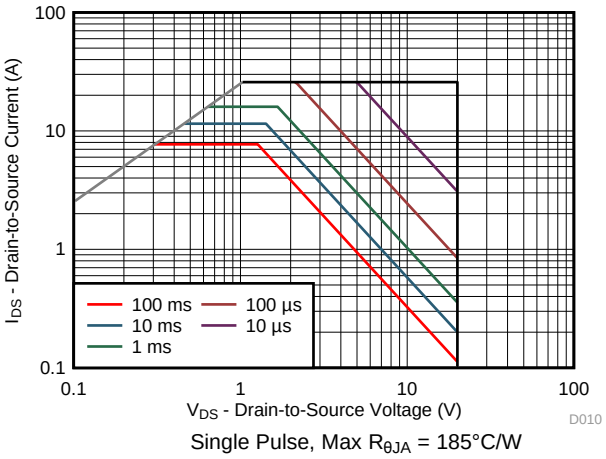


Figure 10. Maximum Safe Operating Area

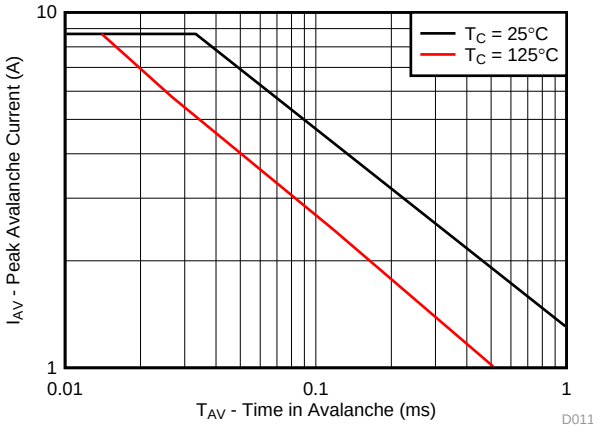


Figure 11. Single Pulse Unclamped Inductive Switching

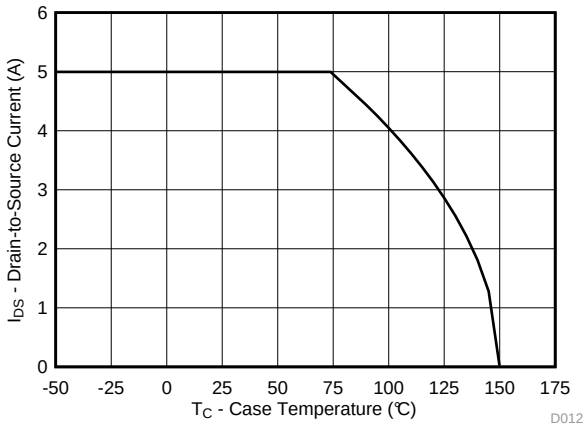


Figure 12. Maximum Drain Current vs Temperature

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6 Device and Documentation Support

6.1 Trademarks

NexFET is a trademark of Texas Instruments.
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6.2 Electrostatic Discharge Caution



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.

6.3 Glossary

SLYZ022 — *TI Glossary*.

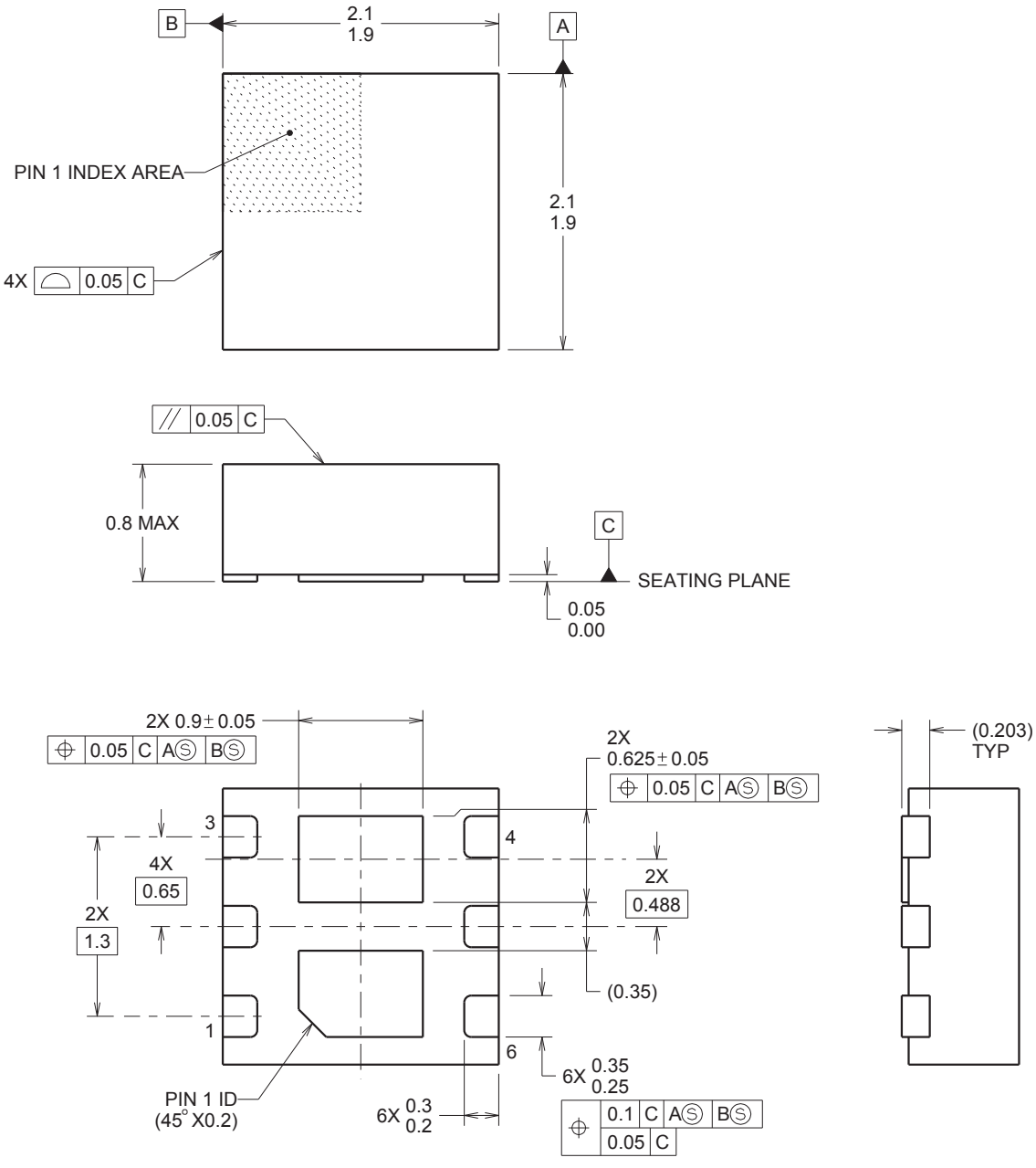
This glossary lists and explains terms, acronyms, and definitions.

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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.

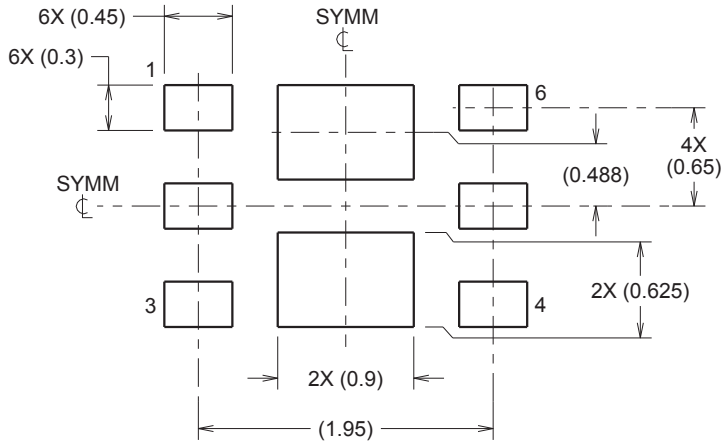
7.1 Package Dimensions



All dimensions are in mm, unless otherwise stated.

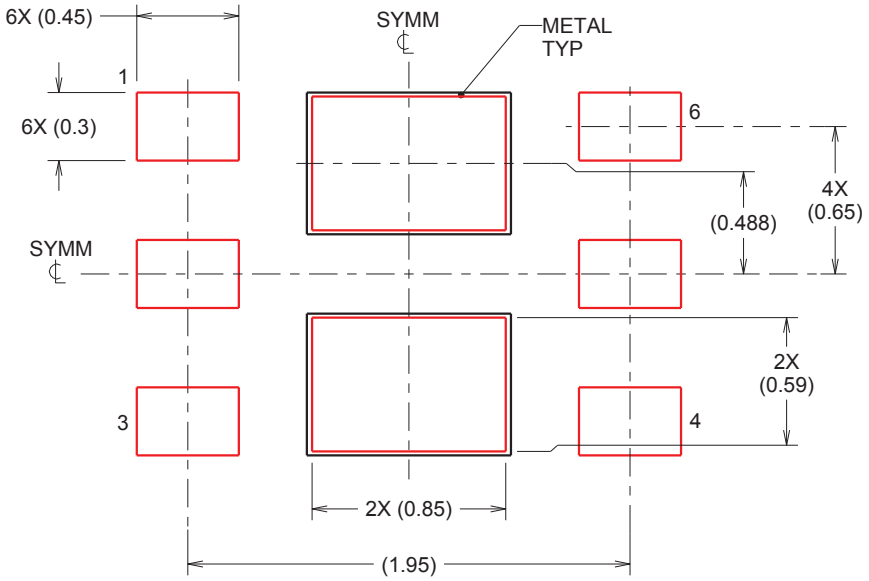
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7.2 PCB Land Pattern



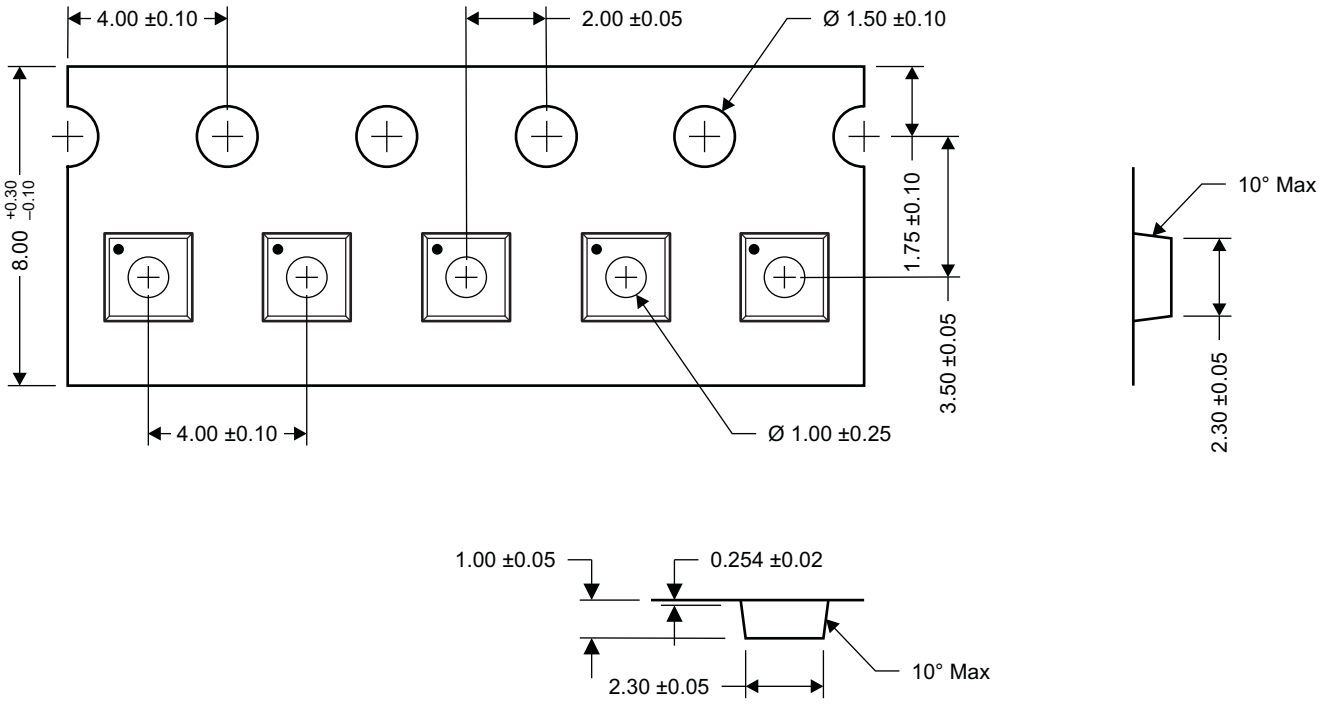
For recommended circuit layout for PCB designs, see application note SLPA005 – *Reducing Ringing Through PCB Layout Techniques*.

7.3 Recommended Stencil Opening



All dimensions are in mm, unless otherwise stated.

7.4 Q2 Tape and Reel Information



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 10^9 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/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
CSD85301Q2	ACTIVE	WSON	DQK	6	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		8531	Samples
CSD85301Q2T	ACTIVE	WSON	DQK	6	250	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		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.
OBSOLETE: 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.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(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.

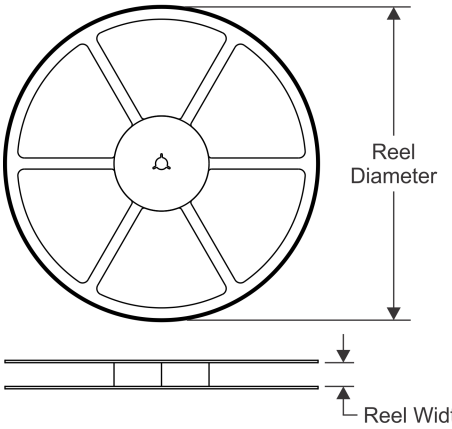
(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

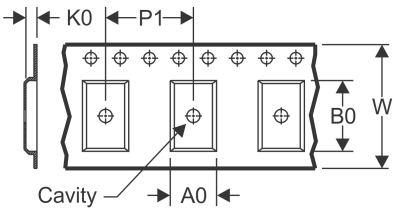
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

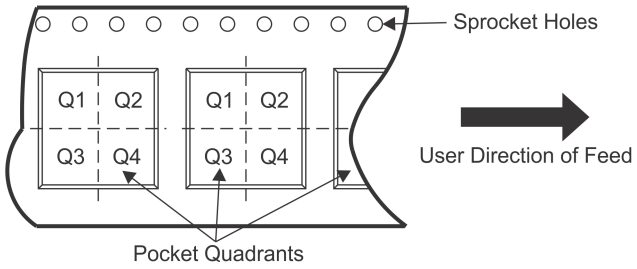


TAPE DIMENSIONS



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

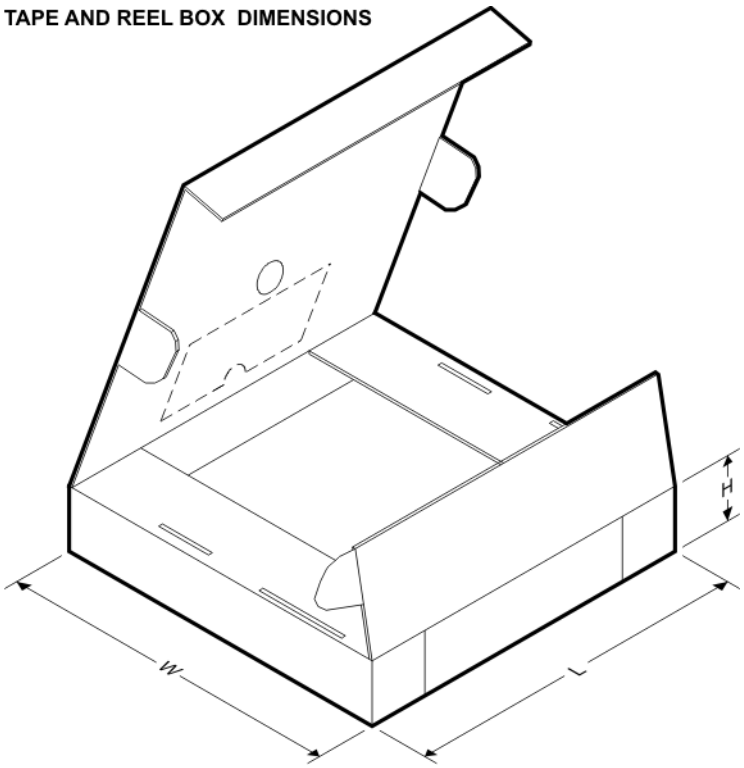
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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	WSON	DQK	6	3000	180.0	8.4	2.3	2.3	1.0	4.0	8.0	Q1
CSD85301Q2T	WSON	DQK	6	250	180.0	8.4	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	DQK	6	3000	550.0	455.0	55.0
CSD85301Q2T	WSON	DQK	6	250	550.0	455.0	55.0

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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.

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Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
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