CSD87502Q2 30 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 CSD87502Q2 is a 30 V, 27 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, these NexFET™ power MOSFETs 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.

Product Summary

T_A = 25°C		TYPICAL VALUE		UNIT
V_{DS}	Drain-to-Source Voltage	30		V
Q_g	Gate Charge Total (4.5 V)	2.2		nC
Q_{gd}	Gate Charge Gate to Drain	0.5		nC
$R_{DS(on)}$	Drain-to-Source On Resistance	V_{GS} = 3.8 V	42.0	mΩ
		V_{GS} = 4.5 V	35.5	mΩ
		V_{GS} = 10 V	27.0	mΩ
$V_{GS(th)}$	Threshold Voltage	1.6		V

Ordering Information(1)

DEVICE	MEDIA	QTY	PACKAGE	SHIP
CSD87502Q2	7-Inch Reel	3000	SON 2 x 2 mm Plastic Package	Tape and Reel
CSD87502Q2T	7-Inch Reel	250		

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

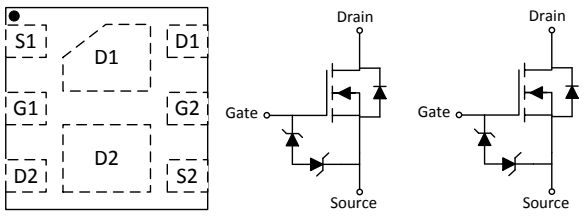
Absolute Maximum Ratings

T_A = 25°C		VALUE	UNIT
V_{DS}	Drain-to-Source Voltage	30	V
V_{GS}	Gate-to-Source Voltage	±20	V
I_D	Continuous Drain Current (Package limited)	5.0	A
I_{DM}	Pulsed Drain Current(1)	23	A
P_D	Power Dissipation(2)	2.3	W
T_J, T_{stg}	Operating Junction Temperature, Storage Temperature	–55 to 150	°C
E_{AS}	Avalanche Energy, single pulse I_D = 7.9 A, L = 0.1 mH, R_G = 25 Ω	3.1	mJ

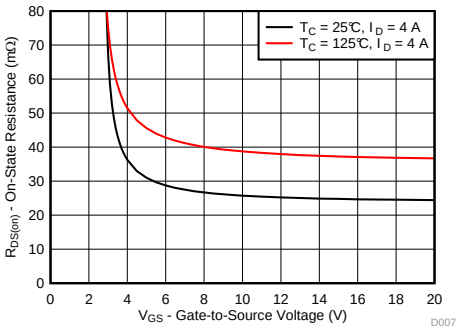
(1) Max $R_{\theta JA}$ = 185 °C/W, pulse duration ≤100 µs, duty cycle ≤1%.

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

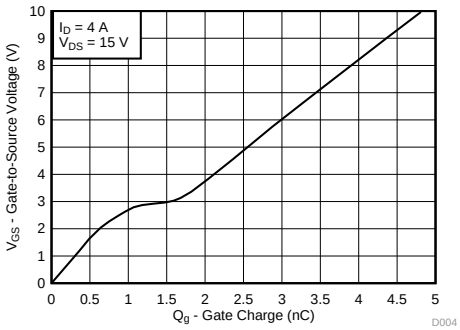
Top View and Circuit Image



$R_{DS(on)}$ 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.

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4 Revision History

DATE	REVISION	NOTES
December 2015	*	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	30			V
I_{DSS}	Drain-to-source leakage current	V_{GS} = 0 V, V_{DS} = 24 V			1	µA
I_{GSS}	Gate-to-source leakage current	V_{DS} = 0 V, V_{GS} = 20 V			4	µA
$V_{GS(th)}$	Gate-to-source threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	1.2	1.6	2.0	V
$R_{DS(on)}$	Drain-to-source on-resistance	V_{GS} = 3.8 V, I_D = 4 A		42.0	60.0	mΩ
		V_{GS} = 4.5 V, I_D = 4 A		35.5	42.0	mΩ
		V_{GS} = 10 V, I_D = 4 A		27.0	32.4	mΩ
g_{fs}	Transconductance	V_{DS} = 3 V, I_D = 4 A		75		S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input capacitance	V_{GS} = 0 V, V_{DS} = 15 V, f = 1 MHz		272	353	pF
C_{oss}	Output capacitance			42	55	pF
C_{rss}	Reverse transfer capacitance			22	29	pF
R_G	Series gate resistance			6.9		Ω
Q_g	Gate charge total (4.5 V)	V_{DS} = 15 V, I_D = 4 A		2.2	2.9	nC
Q_g	Gate charge total (10 V)			4.6	6.0	nC
Q_{gd}	Gate charge gate to drain			0.5		nC
Q_{gs}	Gate charge gate to source			1.0		nC
$Q_{g(th)}$	Gate charge at V_{th}			0.5		nC
Q_{oss}	Output charge	V_{DS} = 15 V, V_{GS} = 0 V		1.4		nC
$t_{d(on)}$	Turn on delay time	V_{DS} = 15 V, V_{GS} = 5 V, I_{DS} = 4 A, R_G = 0 Ω		3		ns
t_r	Rise time			11		ns
$t_{d(off)}$	Turn off delay time			12		ns
t_f	Fall time			3		ns
DIODE CHARACTERISTICS						
V_{SD}	Diode forward voltage	I_{SD} = 4 A, V_{GS} = 0 V		0.85	1.0	V
Q_{rr}	Reverse recovery charge	V_{DS}= 15 V, I_F = 4 A, di/dt = 300 A/µs		4.0		nC
t_{rr}	Reverse recovery time			6.4		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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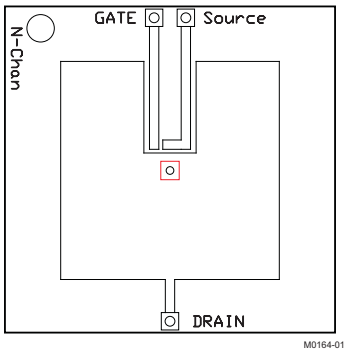
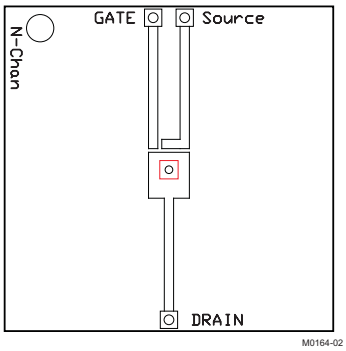


Max $R_{\theta JA}$ = 70 when mounted on 1 inch^2 (6.45 cm^2) of 2 oz. (0.071 mm thick) Cu.



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)

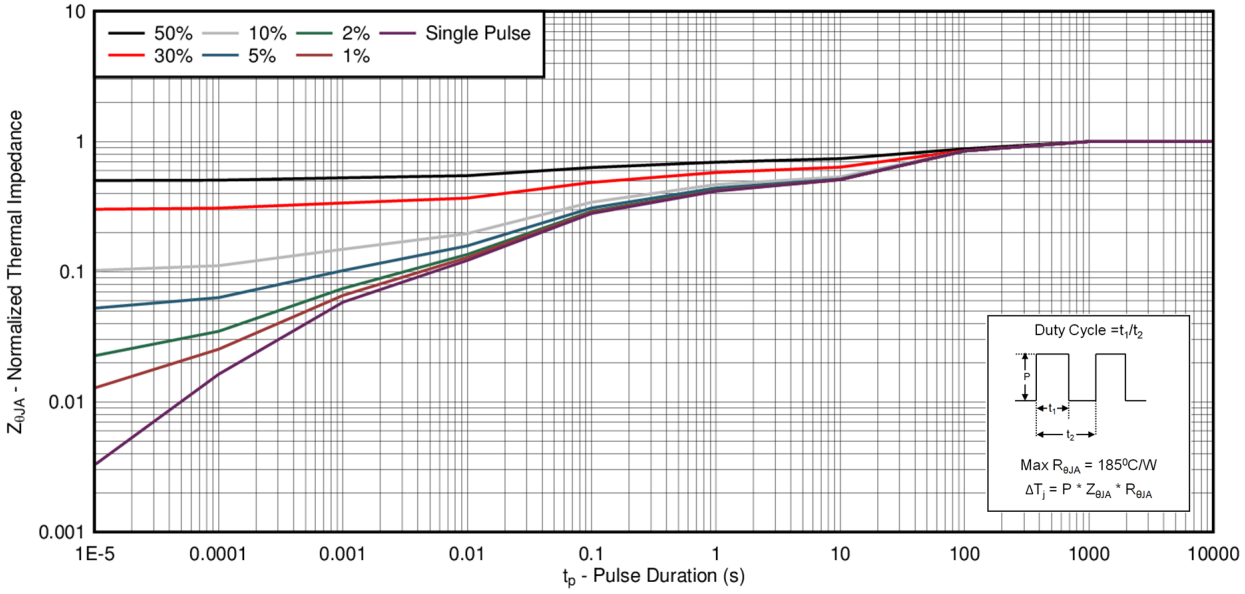


Figure 1. Transient Thermal Impedance

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Typical MOSFET Characteristics (continued)

(T_A = 25°C unless otherwise stated)

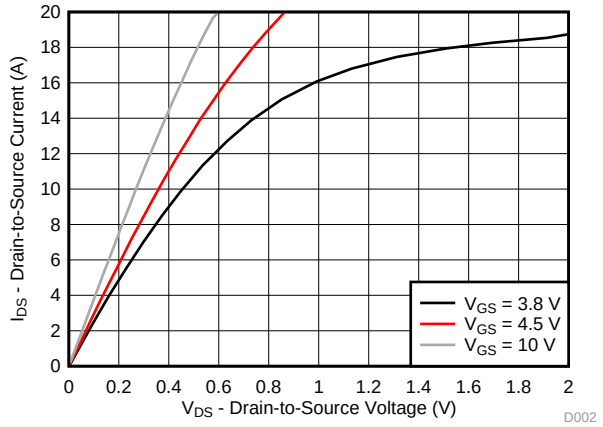

Figure 2. Saturation Characteristics

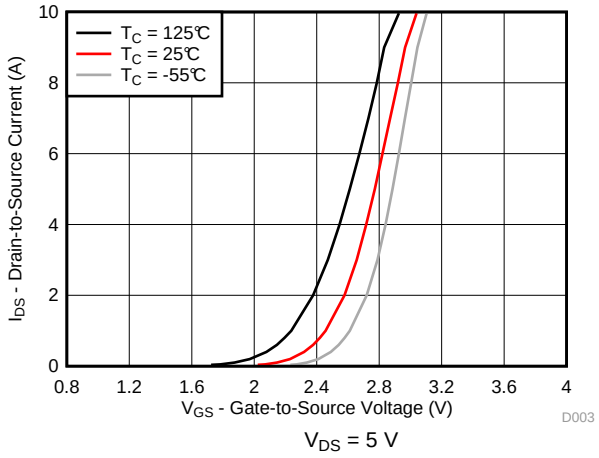

Figure 3. Transfer Characteristics

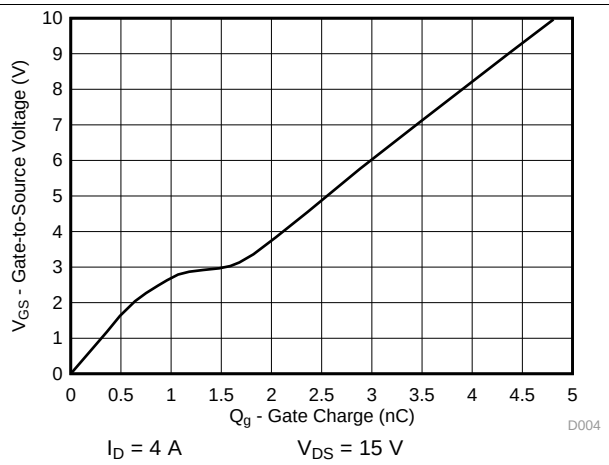

Figure 4. Gate Charge

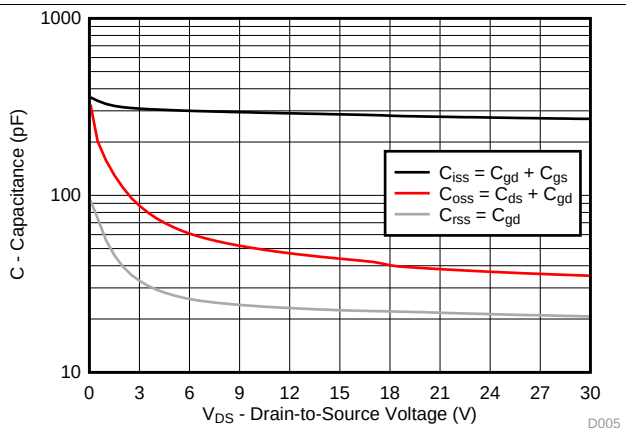

Figure 5. Capacitance

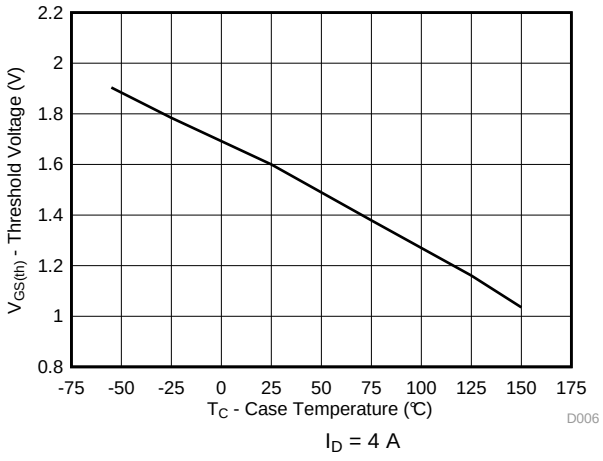

Figure 6. Threshold Voltage vs Temperature

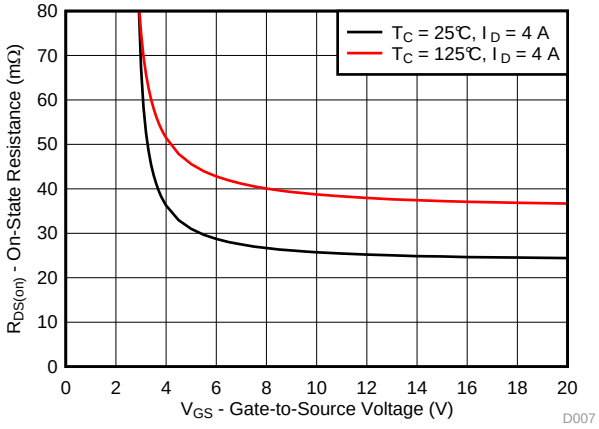

Figure 7. On-State Resistance vs Gate-to-Source Voltage

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Typical MOSFET Characteristics (continued)

(T_A = 25°C unless otherwise stated)

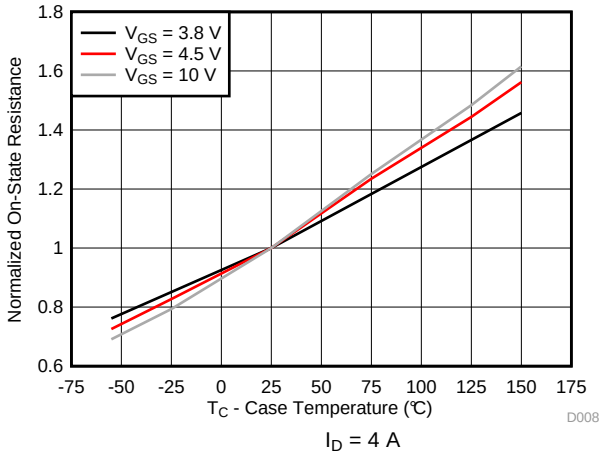

Figure 8. Normalized On-State Resistance vs Temperature

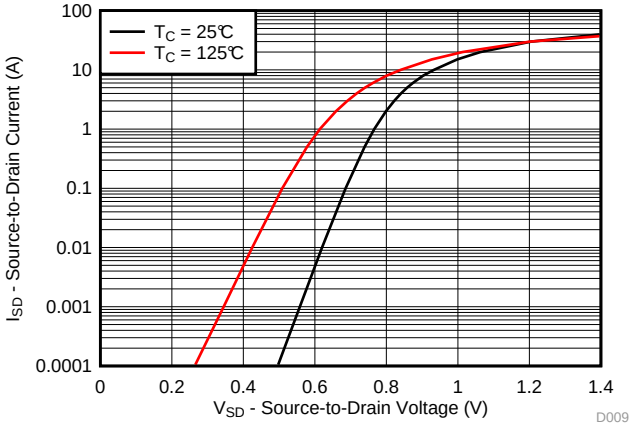

Figure 9. Typical Diode Forward Voltage

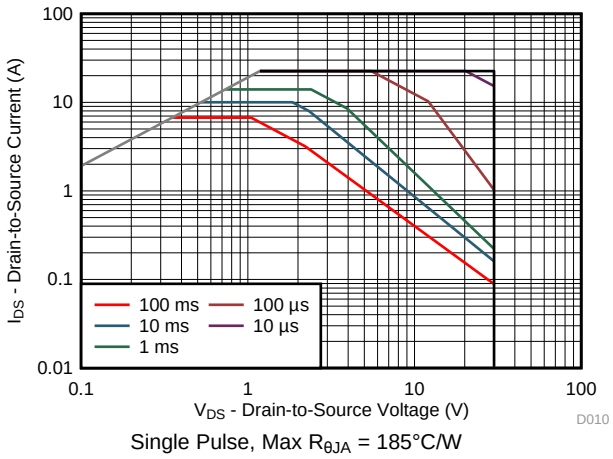

Figure 10. Maximum Safe Operating Area

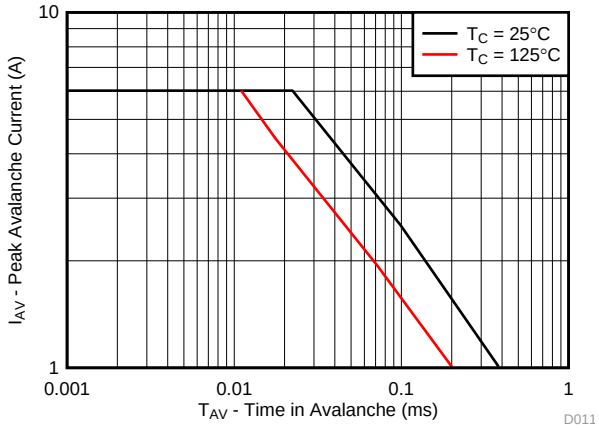

Figure 11. Single Pulse Unclamped Inductive Switching

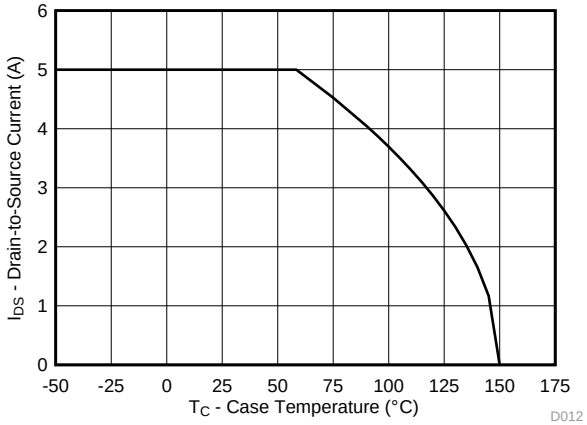

Figure 12. Maximum Drain Current vs Temperature

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6 Device and Documentation Support

6.1 Community Resources

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

TI E2E™ Online Community ***TI's Engineer-to-Engineer (E2E) Community.*** Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

Design Support ***TI's Design Support*** Quickly find helpful E2E forums along with design support tools and contact information for technical support.

6.2 Trademarks

NexFET, E2E are trademarks of Texas Instruments.
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6.3 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.

6.4 Glossary

SLYZ022 — *TI Glossary*.

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

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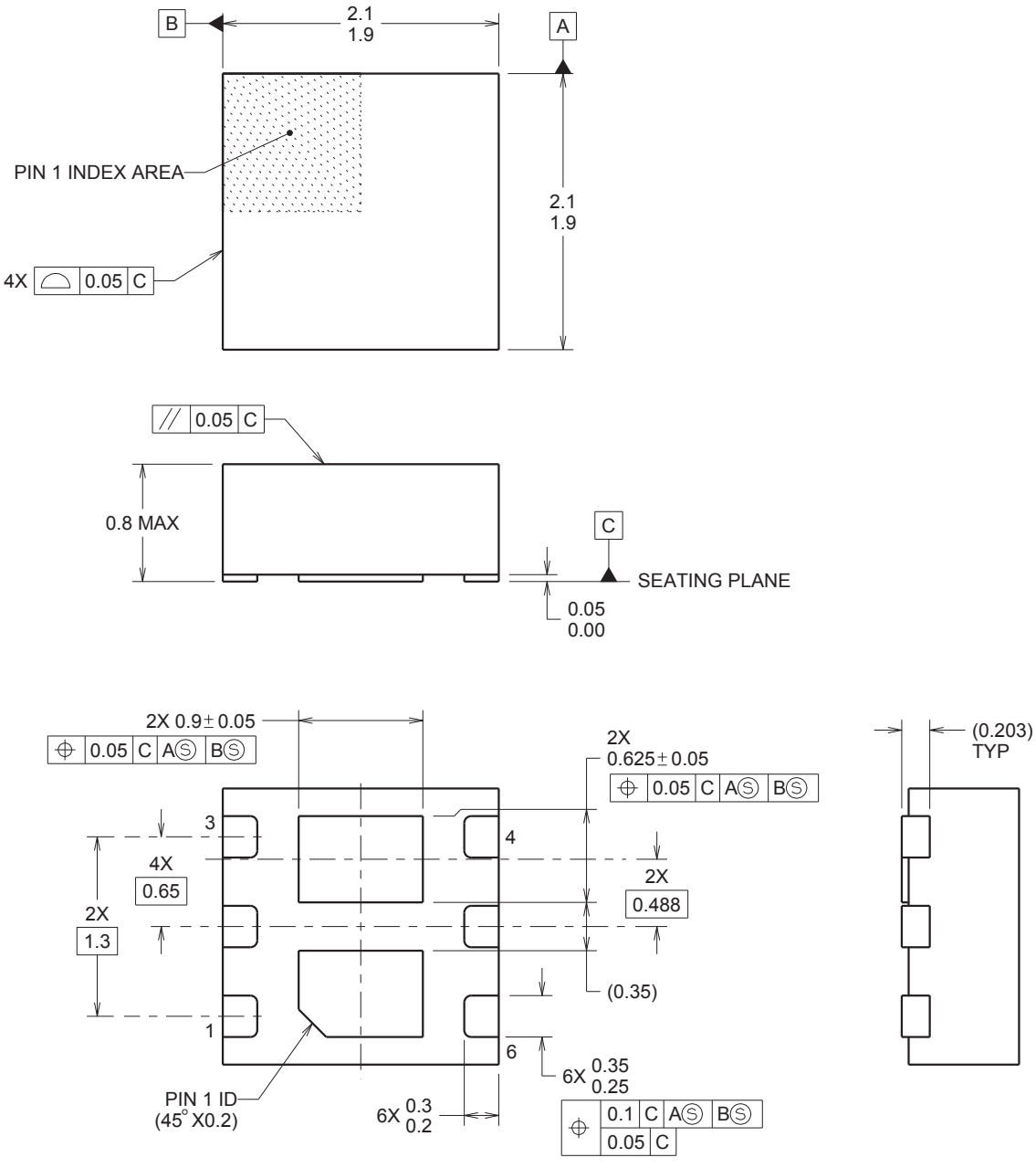
7 Mechanical, Packaging, and Orderable Information

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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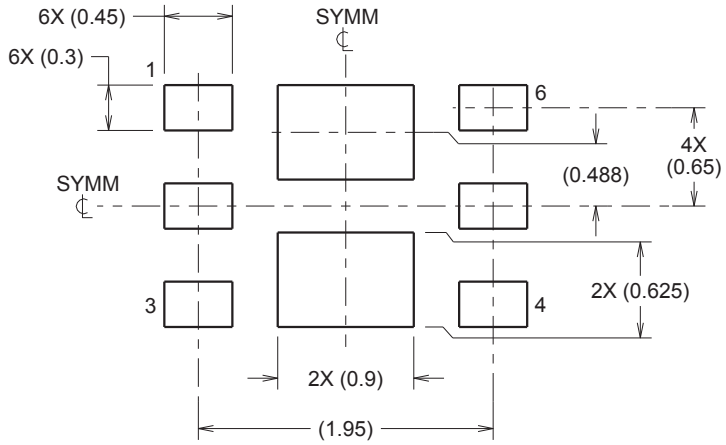
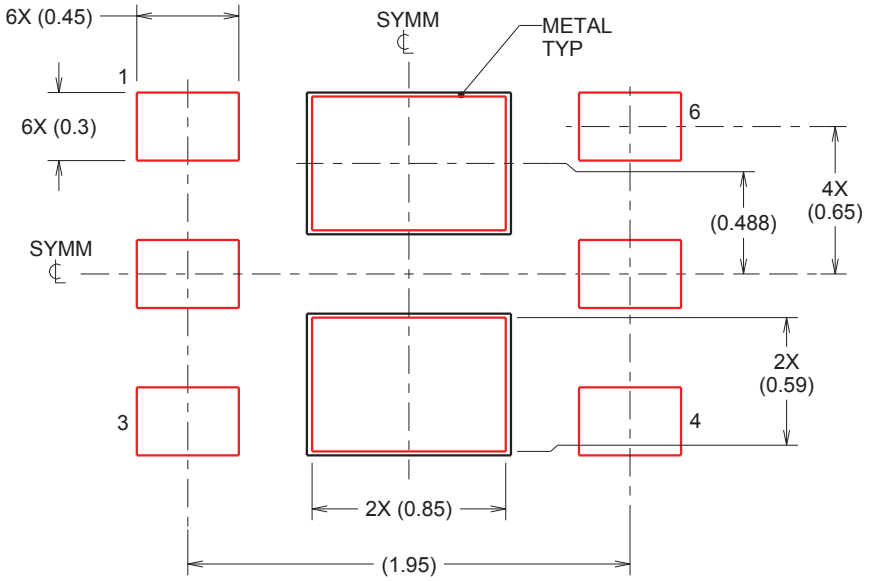
7.2 PCB Land Pattern



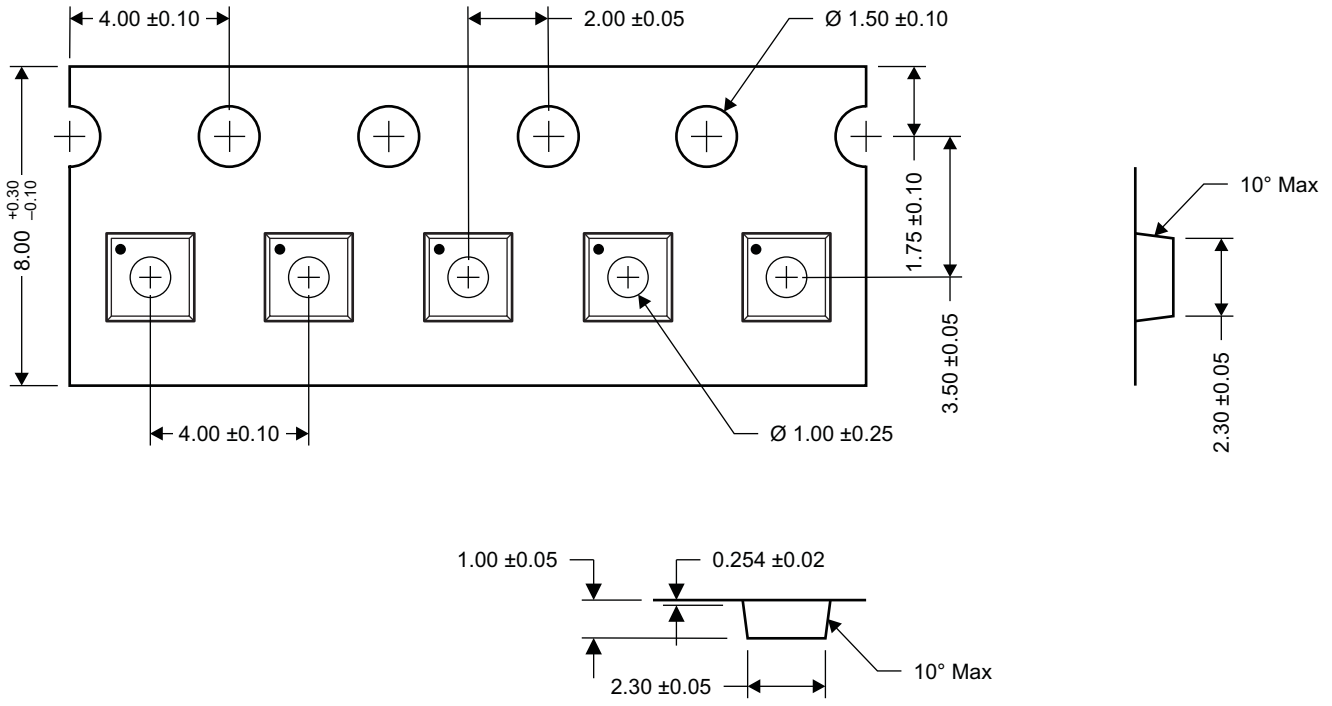
For recommended circuit layout for PCB designs, see application note SLPA005 – *Reducing Ringing Through PCB Layout Techniques*.

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
CSD87502Q2	ACTIVE	WSON	DQK	6	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-55 to 150	8752	Samples
CSD87502Q2T	ACTIVE	WSON	DQK	6	250	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-55 to 150	8752	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.

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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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Audio	www.ti.com/audio	Automotive and Transportation	www.ti.com/automotive
Amplifiers	amplifier.ti.com	Communications and Telecom	www.ti.com/communications
Data Converters	dataconverter.ti.com	Computers and Peripherals	www.ti.com/computers
DLP® Products	www.dlp.com	Consumer Electronics	www.ti.com/consumer-apps
DSP	dsp.ti.com	Energy and Lighting	www.ti.com/energy
Clocks and Timers	www.ti.com/clocks	Industrial	www.ti.com/industrial
Interface	interface.ti.com	Medical	www.ti.com/medical
Logic	logic.ti.com	Security	www.ti.com/security
Power Mgmt	power.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video
RFID	www.ti-rfid.com		
OMAP Applications Processors	www.ti.com/omap	**TI E2E Community**	e2e.ti.com
Wireless Connectivity	www.ti.com/wirelessconnectivity		

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