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.

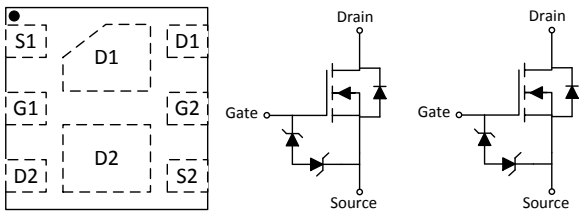
Absolute Maximum Ratings

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

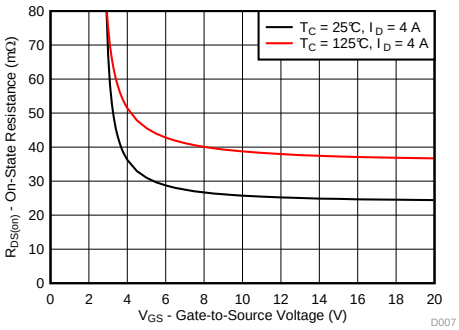
(1) Max $R_{\theta JA}$ = 185 °C/W, pulse duration ≤100 µs, duty cycle ≤1%.

(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.

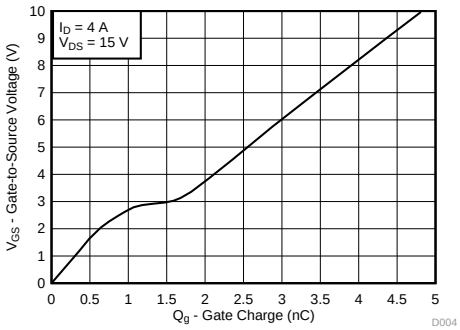
Top View and Circuit Image



$R_{DS(on)}$ 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.

Table of Contents

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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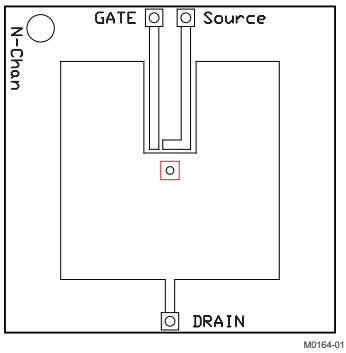
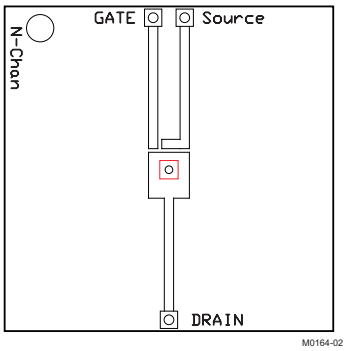


Max $R_{\theta JA}$ = 70 when mounted on 1 inch^2 (6.45 cm^2) of 2 oz. (0.071 mm thick) Cu.



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)

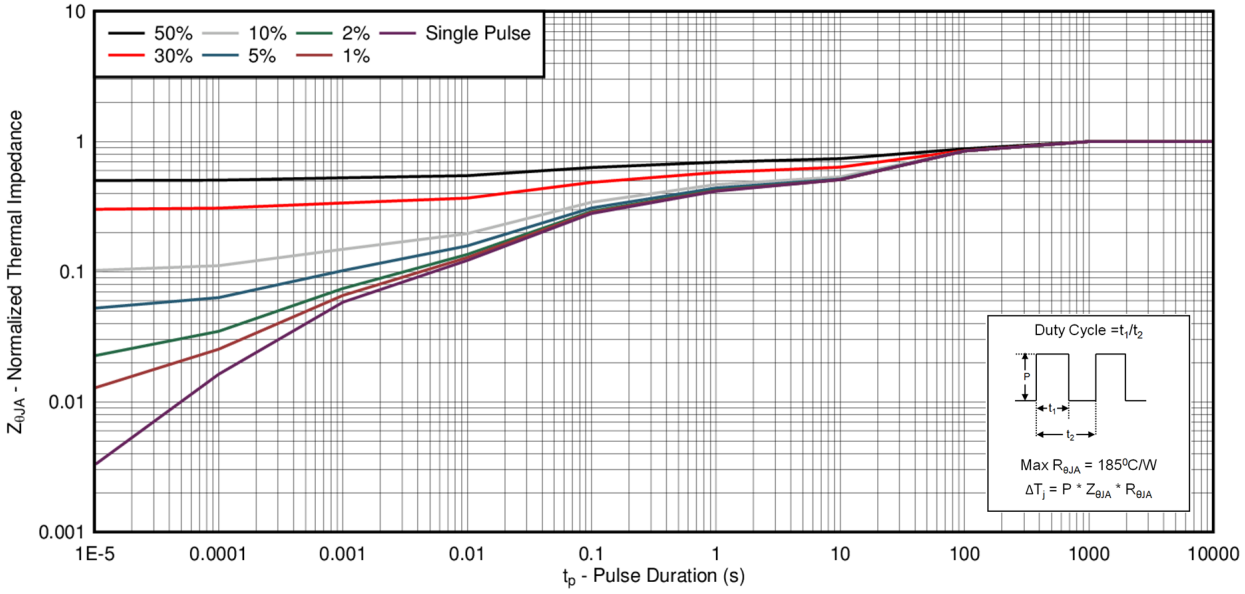


Figure 1. Transient Thermal Impedance

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Typical MOSFET Characteristics (continued)

(T_A = 25°C unless otherwise stated)

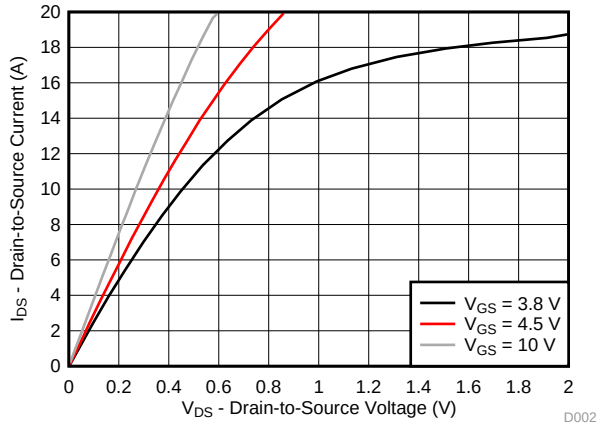

Figure 2. Saturation Characteristics

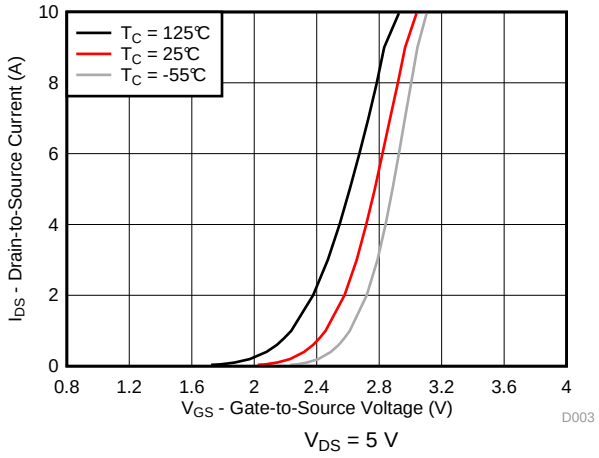

Figure 3. Transfer Characteristics

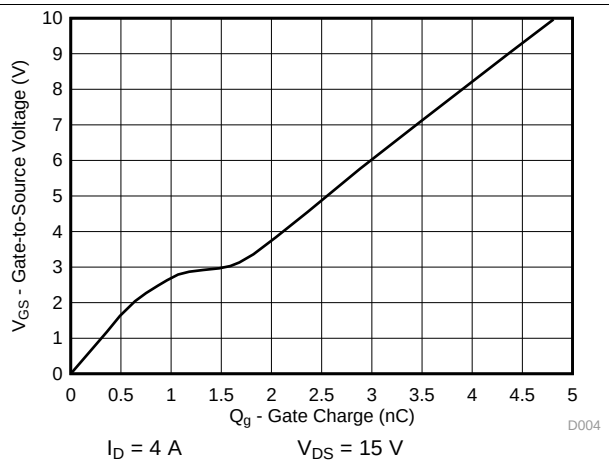

Figure 4. Gate Charge

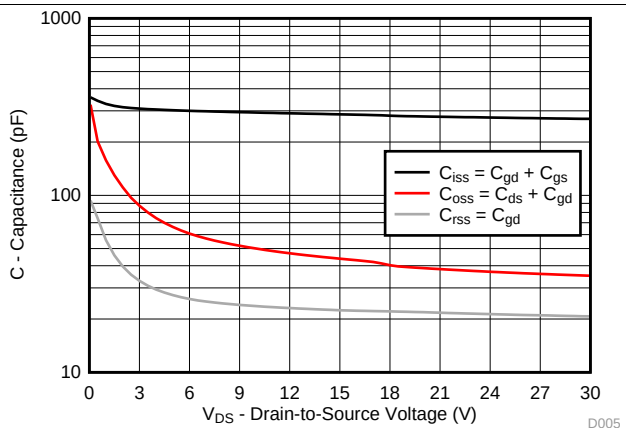

Figure 5. Capacitance

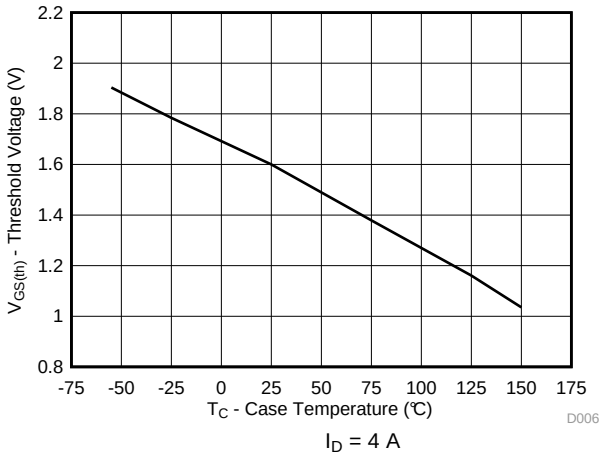

Figure 6. Threshold Voltage vs Temperature

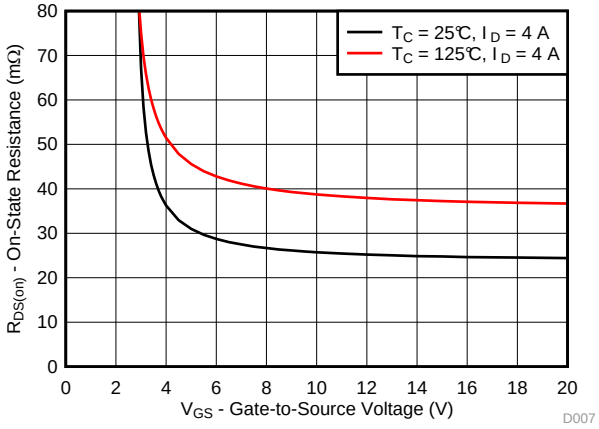

Figure 7. On-State Resistance vs Gate-to-Source Voltage

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Typical MOSFET Characteristics (continued)

(T_A = 25°C unless otherwise stated)

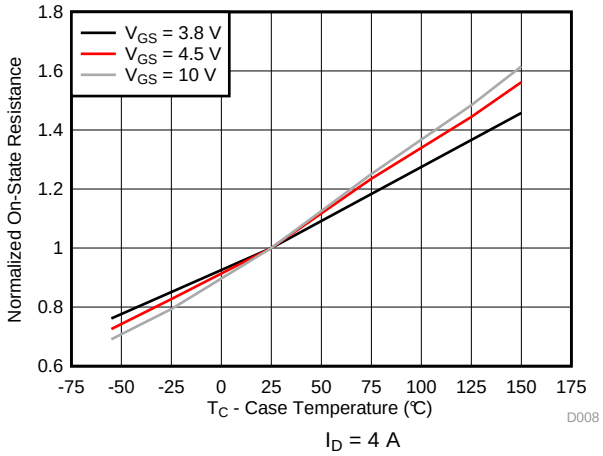

Figure 8. Normalized On-State Resistance vs Temperature

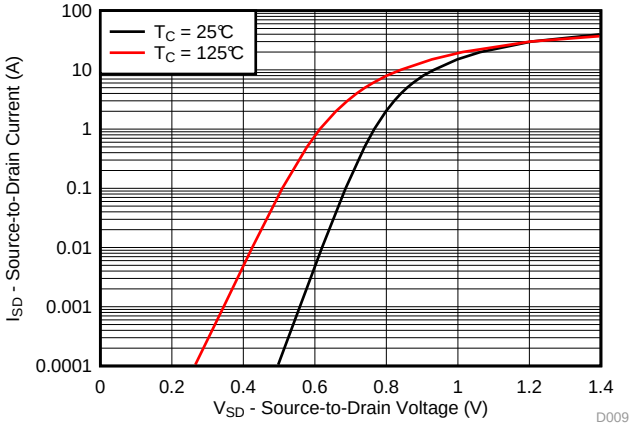

Figure 9. Typical Diode Forward Voltage

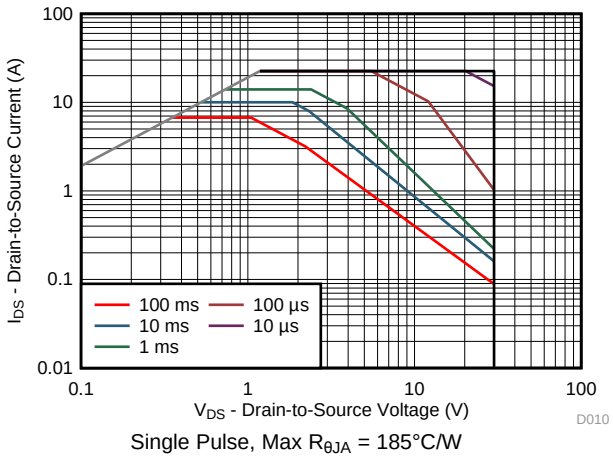

Figure 10. Maximum Safe Operating Area

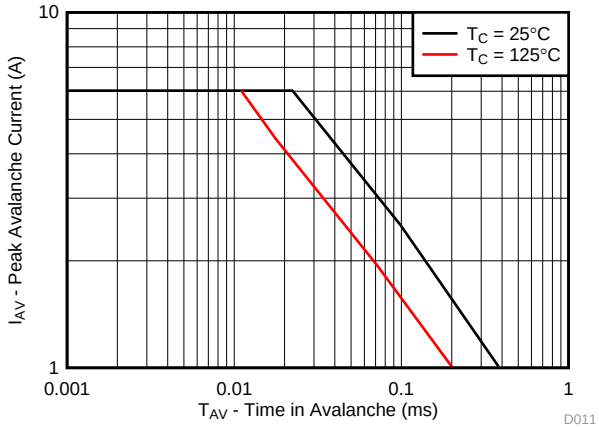

Figure 11. Single Pulse Unclamped Inductive Switching

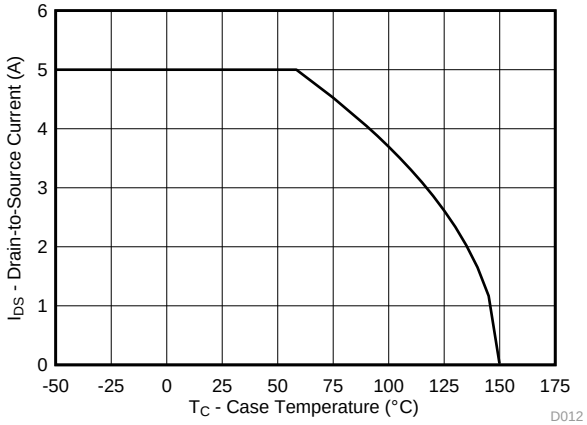

Figure 12. Maximum Drain Current vs Temperature

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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.
All other trademarks are the property of their respective owners.

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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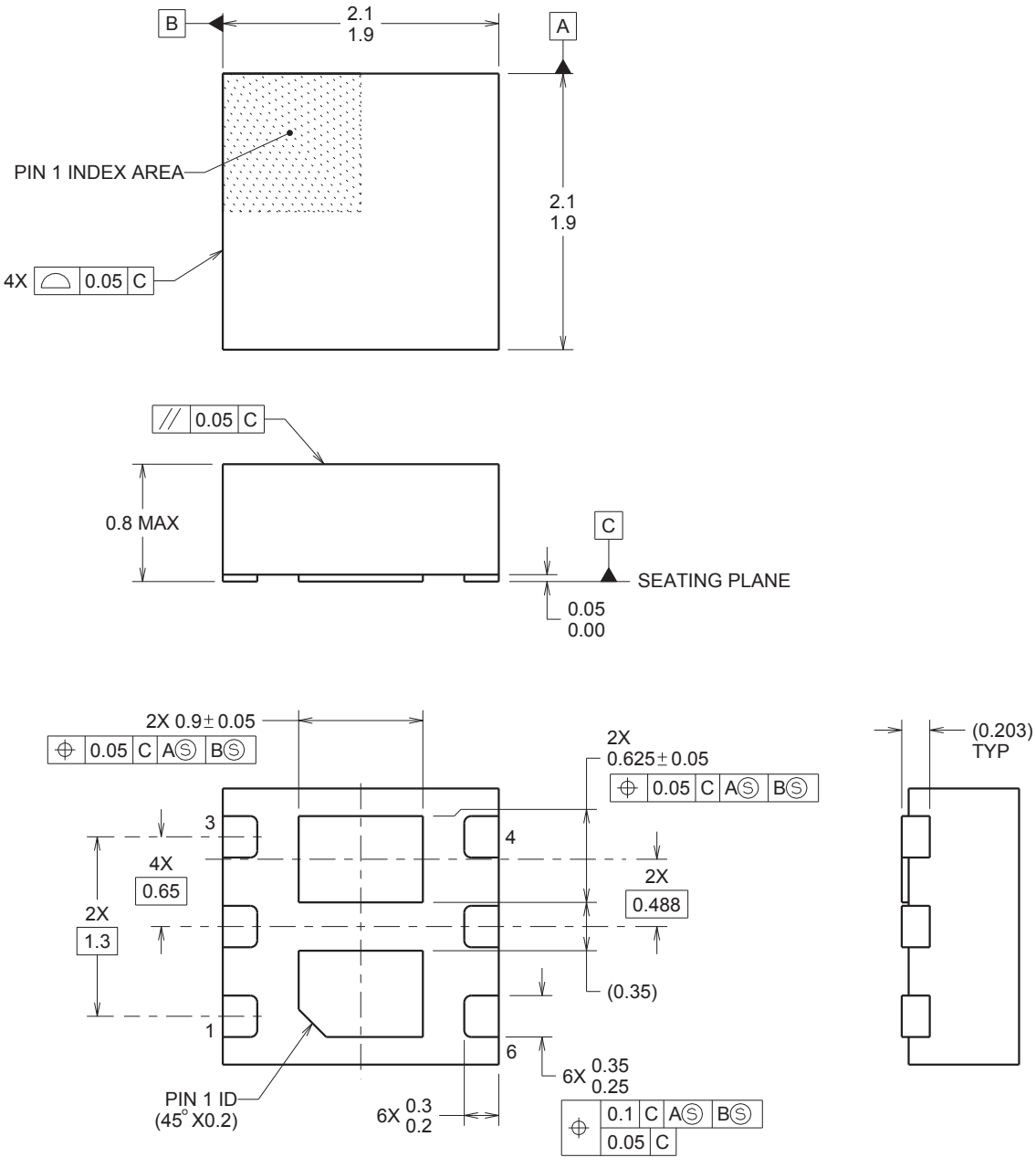
7 Mechanical, Packaging, and Orderable Information

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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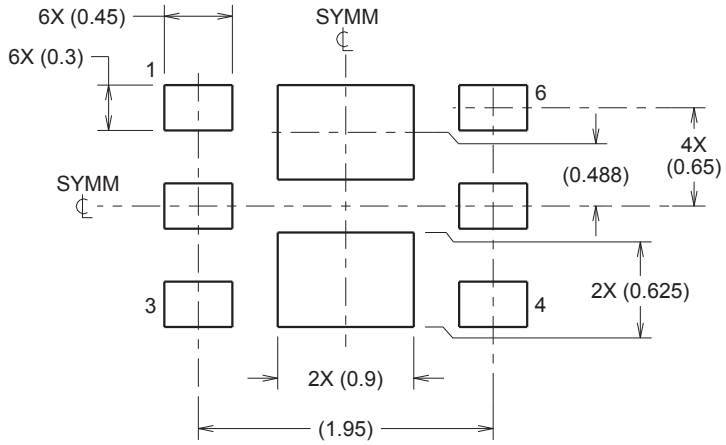
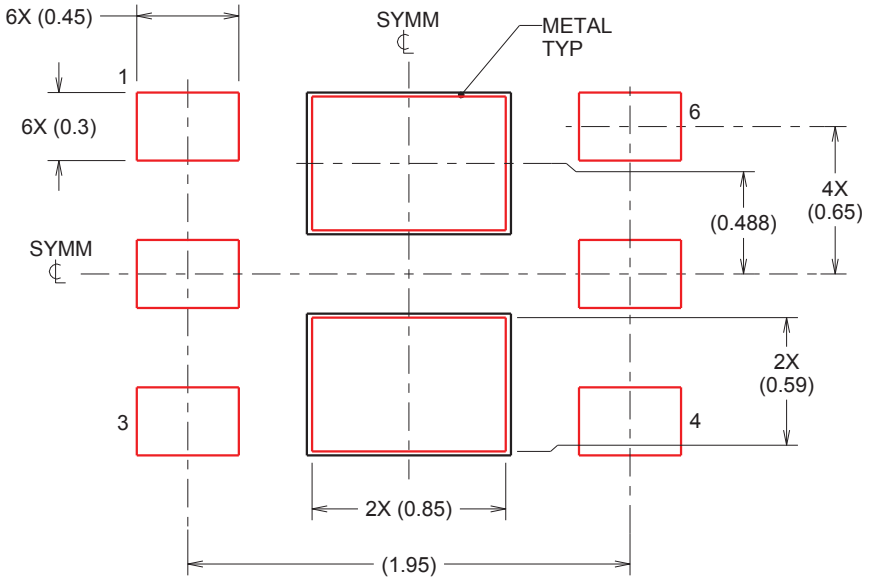
7.2 PCB Land Pattern



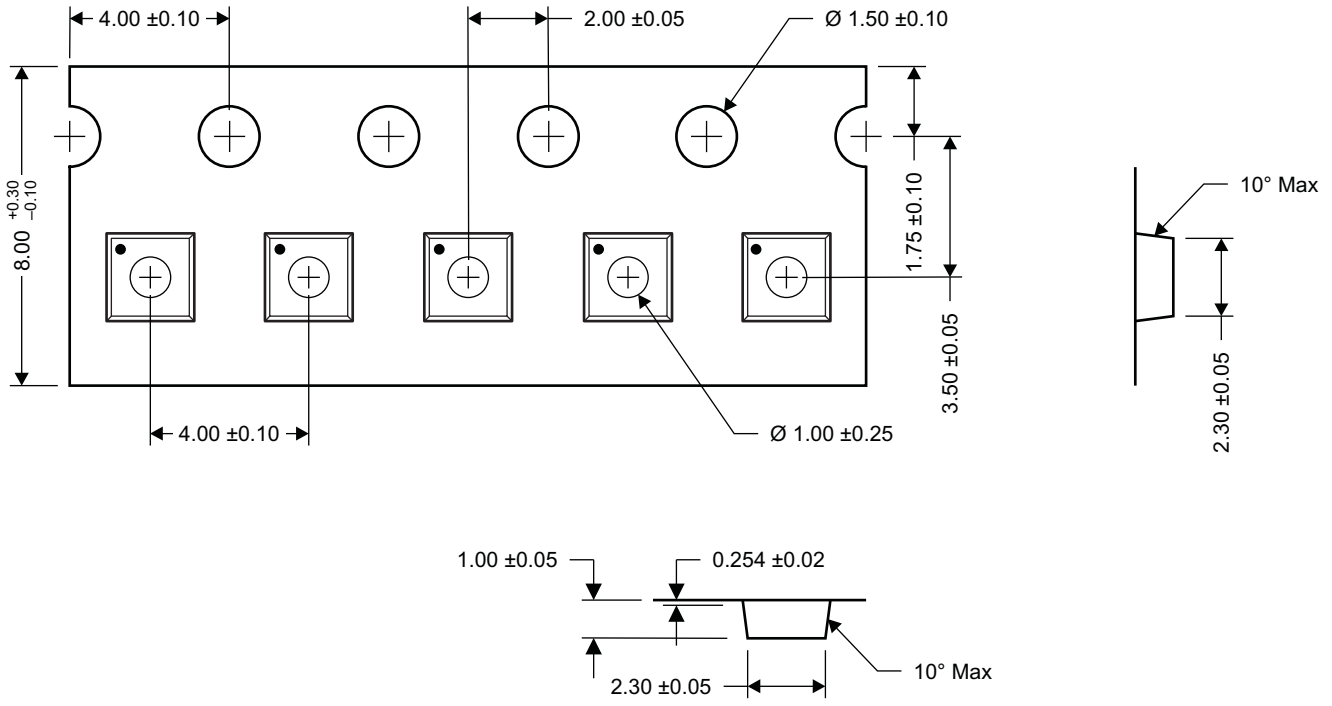
For recommended circuit layout for PCB designs, see application note SLPA005 – *Reducing Ringing Through PCB Layout Techniques*.

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 part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
CSD87502Q2	Active	Production	WSON (DLV) | 6	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 150	8752
CSD87502Q2.B	Active	Production	WSON (DLV) | 6	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 150	8752
CSD87502Q2G4.B	Active	Production	WSON (DLV) | 6	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 150	8752
CSD87502Q2T	Active	Production	WSON (DLV) | 6	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 150	8752
CSD87502Q2T.B	Active	Production	WSON (DLV) | 6	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 150	8752

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **Lead finish/Ball material:** Parts 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.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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