

## CSD87502Q2 30 V Dual N-Channel NexFET™ Power MOSFETs

### 1 Features

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

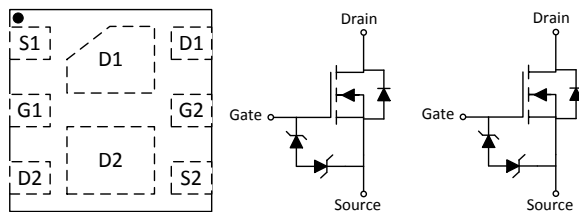
### 2 Applications

- 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

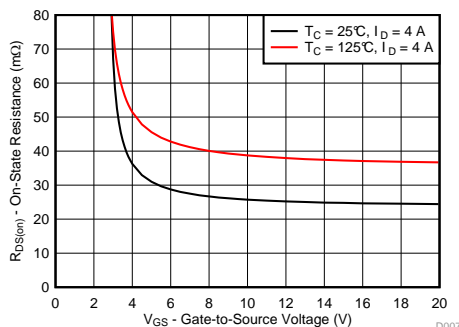
### 3 Description

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.

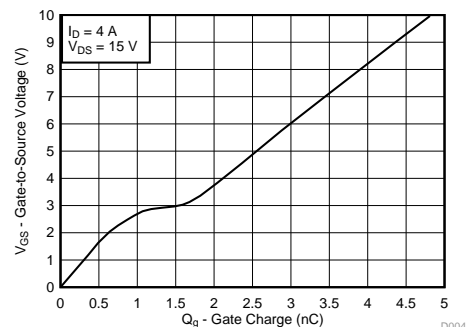
Top View and Circuit Image



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



Gate Charge



### Product Summary

$T_A = 25^\circ\text{C}$		TYPICAL VALUE		UNIT
$V_{DS}$	Drain-to-Source Voltage	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	$V_{GS} = 3.8\text{ V}$	42.0	mΩ
		$V_{GS} = 4.5\text{ V}$	35.5	mΩ
		$V_{GS} = 10\text{ V}$	27.0	mΩ
$V_{GS(th)}$	Threshold Voltage	1.6		V

### Ordering Information<sup>(1)</sup>

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

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

(1) Max  $R_{\theta JA} = 185\ ^\circ\text{C}/\text{W}$ , pulse duration  $\leq 100\ \mu\text{s}$ , duty cycle  $\leq 1\%$ .

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



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## 4 Revision History

DATE	REVISION	NOTES
December 2015	*	Initial release.

## 5 Specifications

### 5.1 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	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	30			V
$I_{DSS}$	Drain-to-source leakage current	$V_{GS} = 0\text{ V}, V_{DS} = 24\text{ V}$			1	$\mu\text{A}$
$I_{GSS}$	Gate-to-source leakage current	$V_{DS} = 0\text{ V}, V_{GS} = 20\text{ V}$			4	$\mu\text{A}$
$V_{GS(th)}$	Gate-to-source threshold voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	1.2	1.6	2.0	V
$R_{DS(on)}$	Drain-to-source on-resistance	$V_{GS} = 3.8\text{ V}, I_D = 4\text{ A}$		42.0	60.0	m $\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 4\text{ A}$		35.5	42.0	m $\Omega$
		$V_{GS} = 10\text{ V}, I_D = 4\text{ A}$		27.0	32.4	m $\Omega$
$g_{fs}$	Transconductance	$V_{DS} = 3\text{ V}, I_D = 4\text{ A}$		75		S
<b>DYNAMIC CHARACTERISTICS</b>						
$C_{iss}$	Input capacitance	$V_{GS} = 0\text{ V}, V_{DS} = 15\text{ V}, f = 1\text{ MHz}$		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		$\Omega$
$Q_g$	Gate charge total (4.5 V)	$V_{DS} = 15\text{ V}, I_D = 4\text{ A}$		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		$V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V}$		1.4	
$t_{d(on)}$	Turn on delay time	$V_{DS} = 15\text{ V}, V_{GS} = 5\text{ V}, I_{DS} = 4\text{ A}, R_G = 0\ \Omega$		3		ns
$t_r$	Rise time			11		ns
$t_{d(off)}$	Turn off delay time			12		ns
$t_f$	Fall time			3		ns
<b>DIODE CHARACTERISTICS</b>						
$V_{SD}$	Diode forward voltage	$I_{SD} = 4\text{ A}, V_{GS} = 0\text{ V}$		0.85	1.0	V
$Q_{rr}$	Reverse recovery charge	$V_{DS} = 15\text{ V}, I_F = 4\text{ A}, di/dt = 300\text{ A}/\mu\text{s}$		4.0		nC
$t_{rr}$	Reverse recovery time			6.4		ns

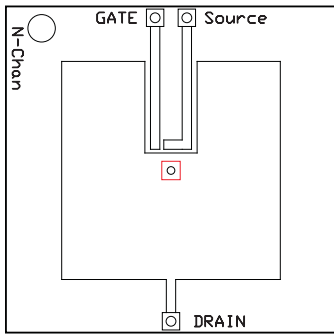
### 5.2 Thermal Information

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

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

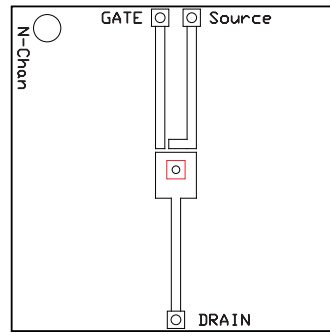
(1) Device mounted on FR4 material with 1 inch<sup>2</sup> (6.45 cm<sup>2</sup>), 2 oz. (0.071 mm thick) Cu.

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



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

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

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### 5.3 Typical MOSFET Characteristics

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

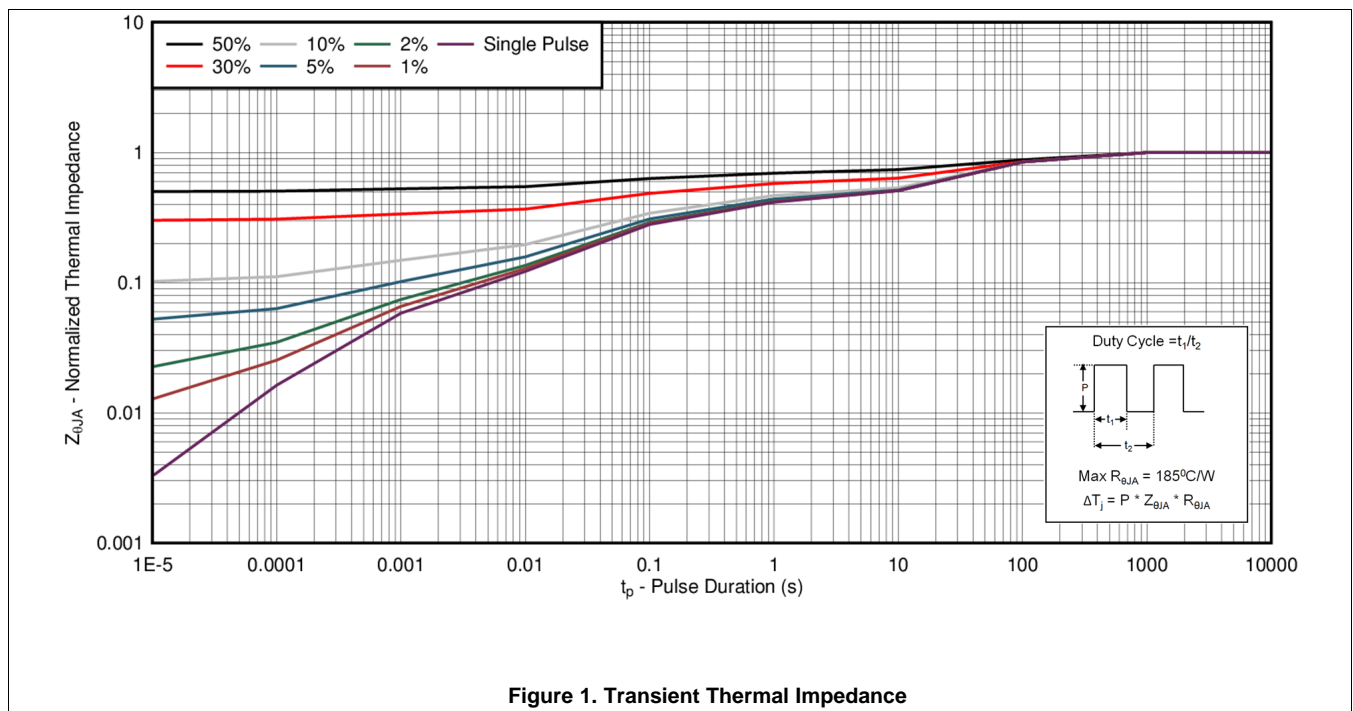


Figure 1. Transient Thermal Impedance

Typical MOSFET Characteristics (continued)

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

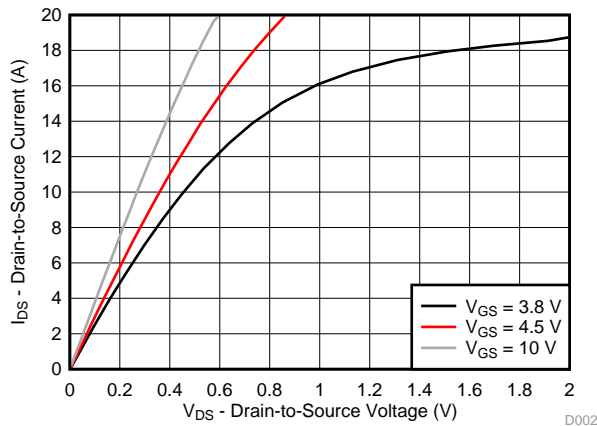


Figure 2. Saturation Characteristics

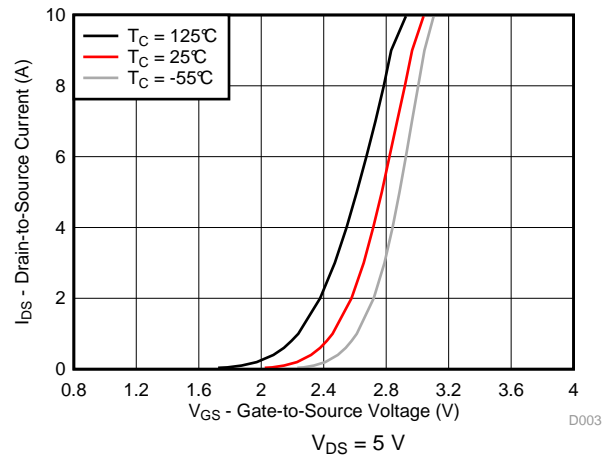


Figure 3. Transfer Characteristics

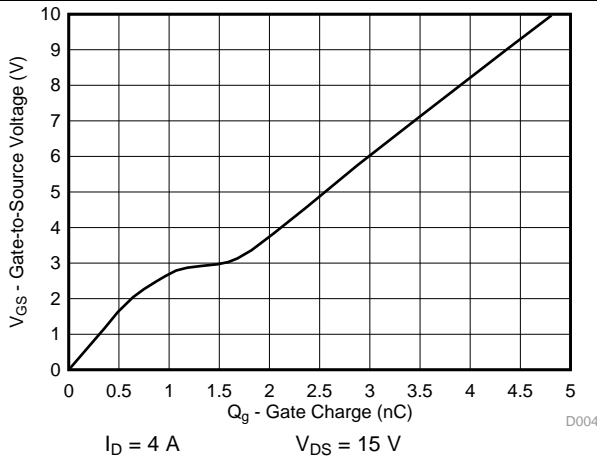


Figure 4. Gate Charge

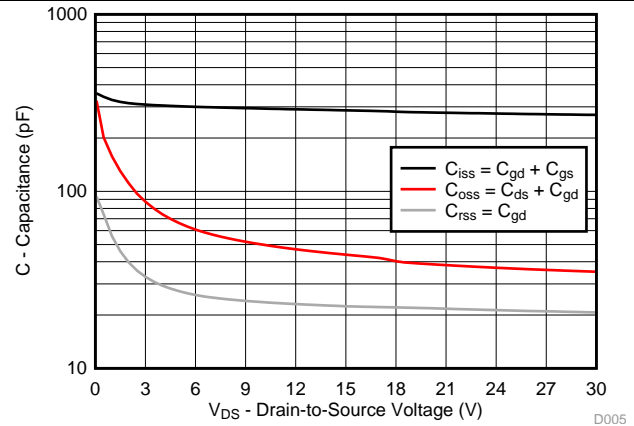


Figure 5. Capacitance

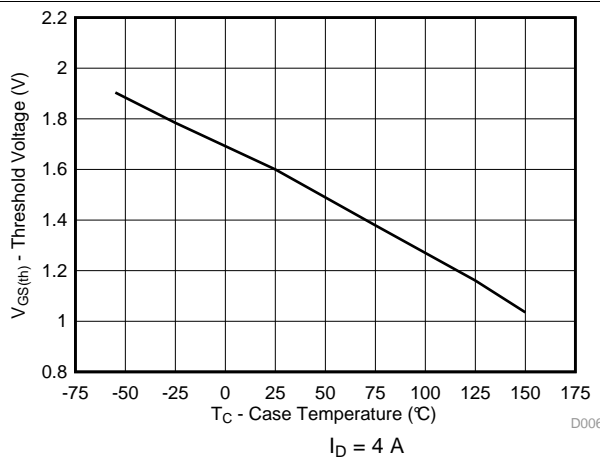


Figure 6. Threshold Voltage vs Temperature

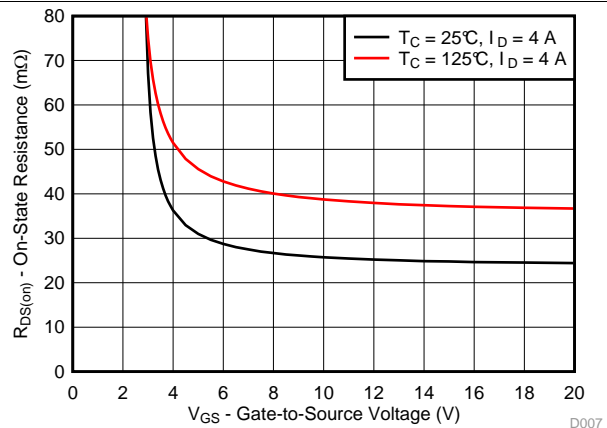


Figure 7. On-State Resistance vs Gate-to-Source Voltage

Typical MOSFET Characteristics (continued)

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

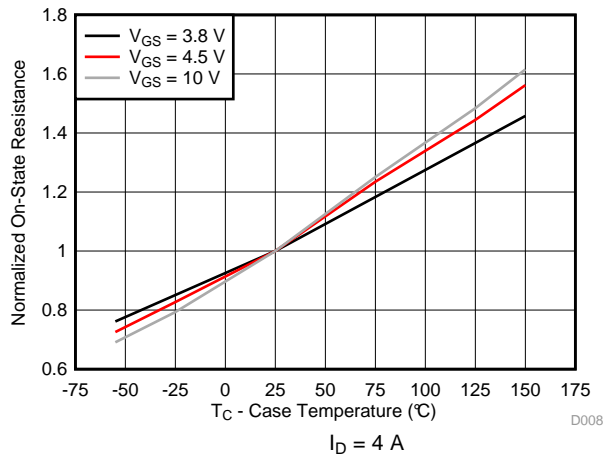


Figure 8. Normalized On-State Resistance vs Temperature

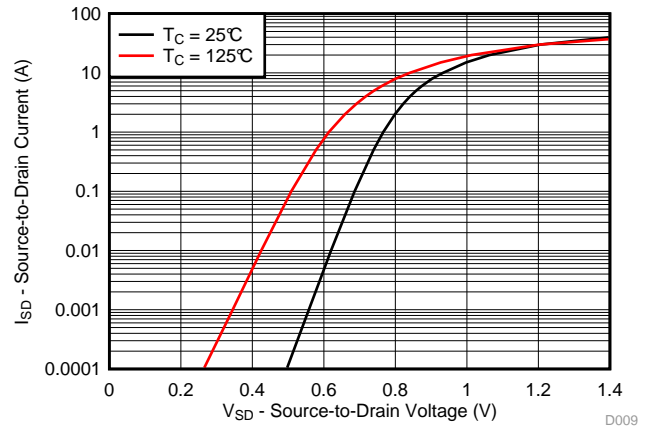


Figure 9. Typical Diode Forward Voltage

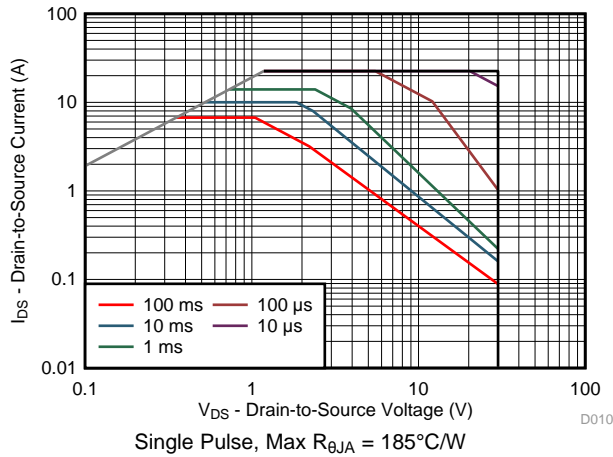


Figure 10. Maximum Safe Operating Area

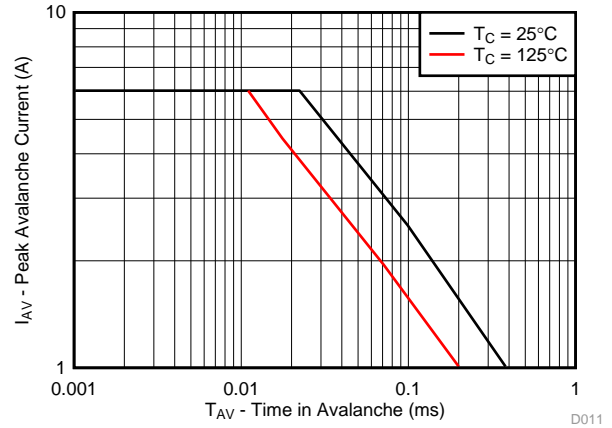


Figure 11. Single Pulse Unclamped Inductive Switching

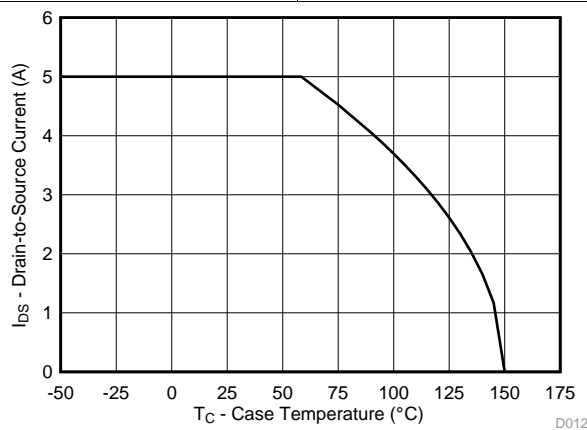


Figure 12. Maximum Drain Current vs Temperature

## 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](http://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

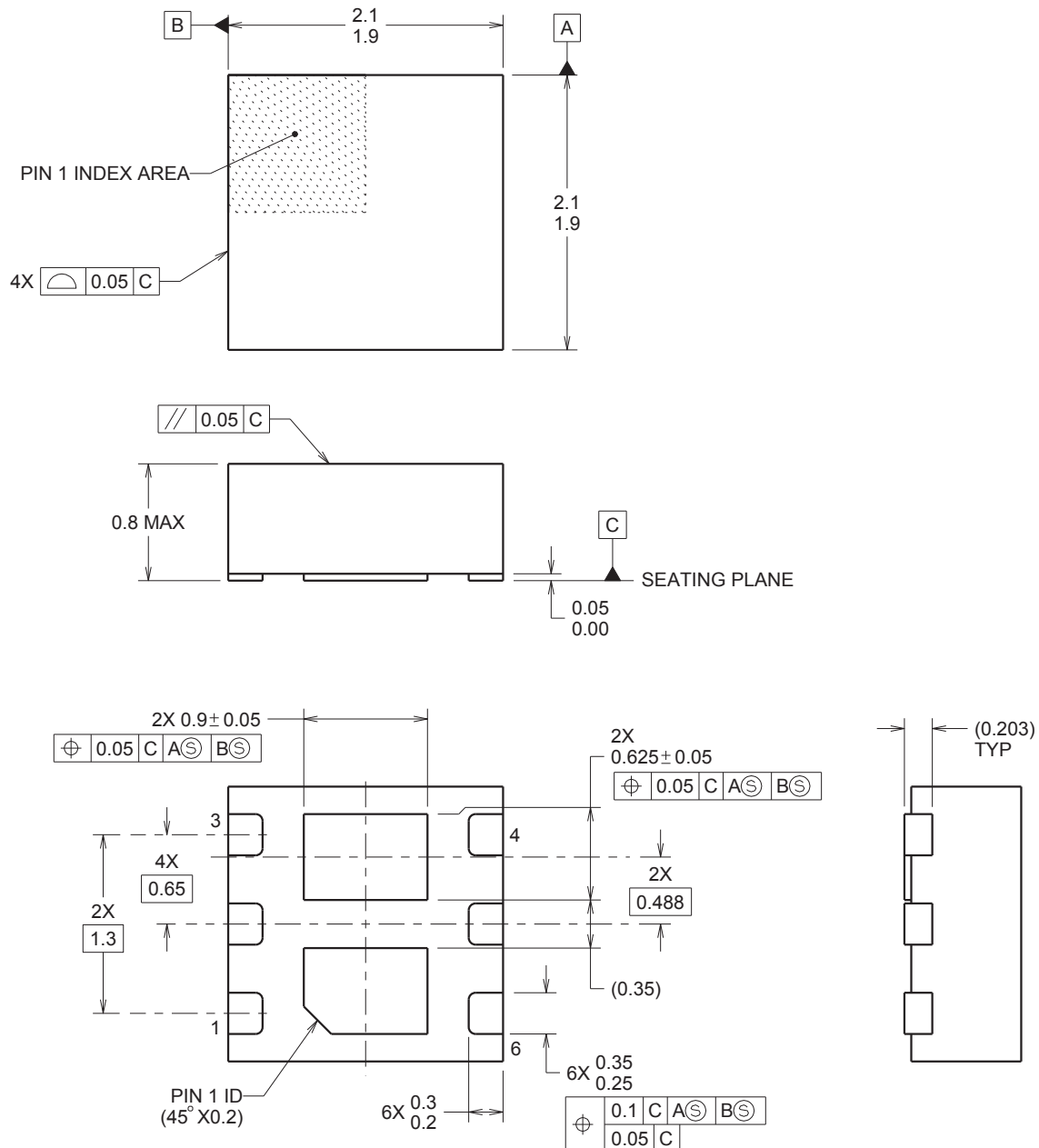
[SLYZ022](#) — *TI Glossary*.

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

## 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.

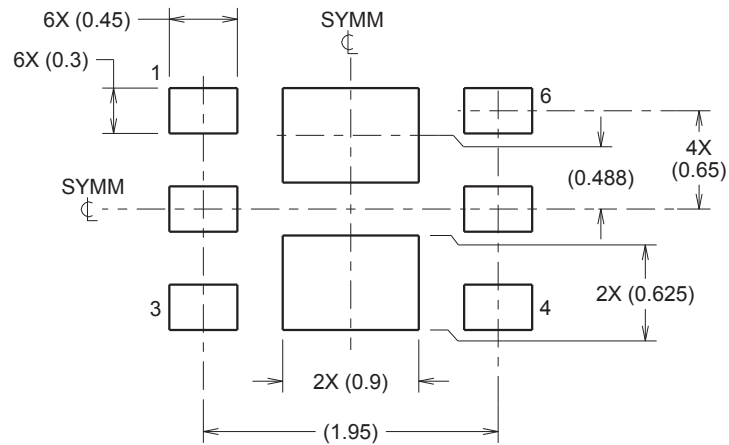
### 7.1 Package Dimensions



All dimensions are in mm, unless otherwise stated.

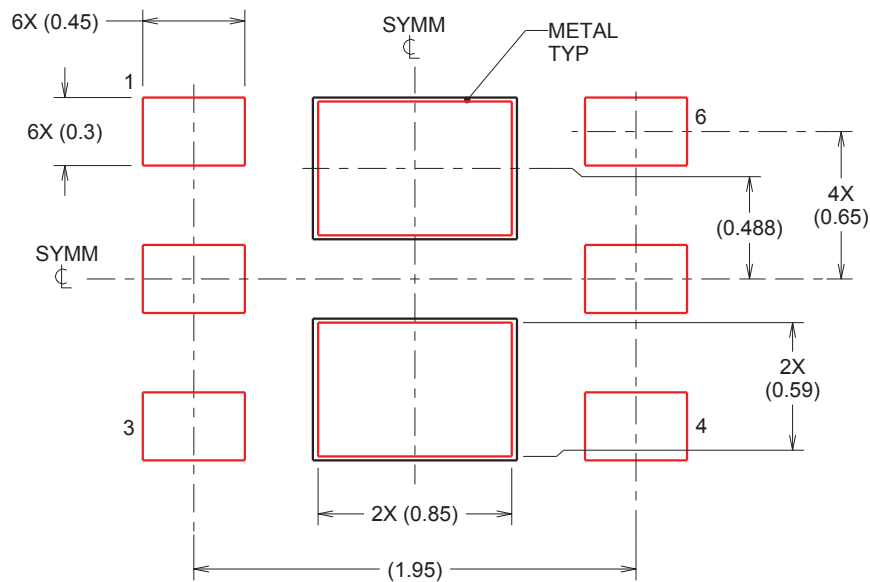


## 7.2 PCB Land Pattern



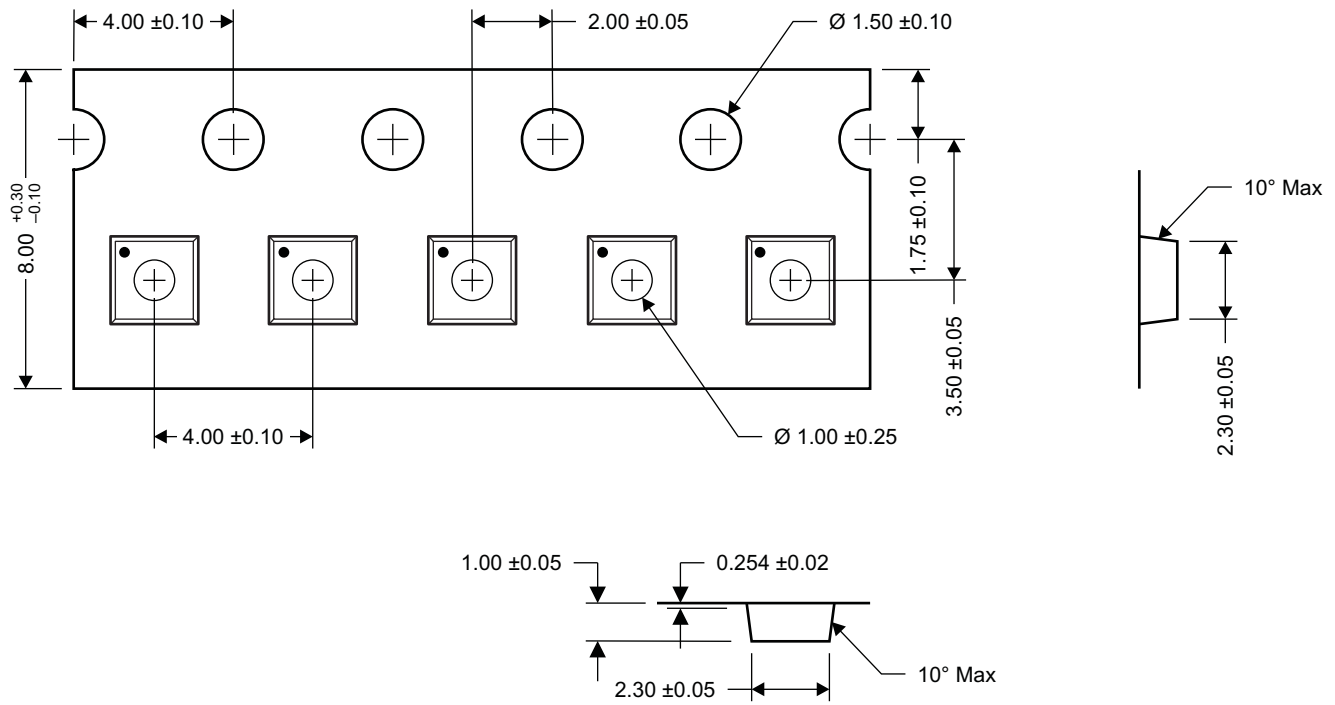
For recommended circuit layout for PCB designs, see application note [SLPA005](#) – *Reducing Ringing Through PCB Layout Techniques*.

## 7.3 Recommended Stencil Opening



All dimensions are in mm, unless otherwise stated.

## 7.4 Q2 Tape and Reel Information



- Notes:
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/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
CSD87502Q2	ACTIVE	WSO8	DQK	6	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-55 to 150	8752	<a href="#">Samples</a>
CSD87502Q2T	ACTIVE	WSO8	DQK	6	250	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-55 to 150	8752	<a href="#">Samples</a>

(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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### Products

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Applications Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>

### Applications

Automotive and Transportation	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
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>
Space, Avionics and Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
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