CSD13201W10 N-Channel NexFET™ Power MOSFET

1 Features

- Ultra-Low Q_g and Q_{gd}
- Small Footprint (1 mm × 1 mm)
- Low Profile 0.62-mm Height
- Pb-Free
- RoHS Compliant
- Halogen-Free
- Gate-Source Voltage Clamp

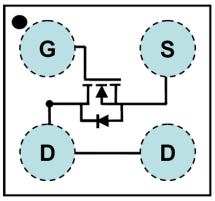
2 Applications

- Battery Management
- Load Switch
- Battery Protection

3 Description

This 12-V, 26-mΩ, N-Channel device is designed to deliver the lowest on resistance and gate charge in the smallest outline possible with excellent thermal characteristics in an ultra-low profile.

Top View



Product Summary

T_A = 25°C		TYPICAL VALUE		UNIT
V_{DS}	Drain-to-Source Voltage	12		V
Q_g	Gate Charge Total (4.5 V)	2.3		nC
Q_{gd}	Gate Charge Gate-to-Drain	0.3		nC
$R_{DS(on)}$	Drain-to-Source On Resistance	V_{GS} = 1.8 V	38	mΩ
		V_{GS} = 2.5 V	29	
		V_{GS} = 4.5 V	26	mΩ
$V_{GS(th)}$	Threshold Voltage	0.8		V

Device Information(1)

PART NUMBER	PACKAGE	MEDIA	QTY	SHIP
CSD13201W10	1 mm × 1 mm Wafer Level Package	7-inch reel	3000	Tape and Reel

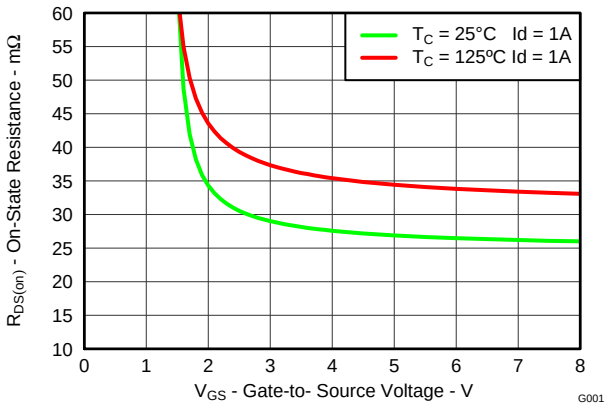
(1) For all available packages, see the orderable addendum at the end of the data sheet.

Absolute Maximum Ratings

T_A = 25°C		VALUE	UNIT
V_{DS}	Drain-to-Source Voltage	12	V
V_{GS}	Gate-to-Source Voltage	±8	V
I_D	Continuous Drain Current, T_A = 25°C(1)	1.6	A
I_{DM}	Pulsed Drain Current, T_A = 25°C(2)	20.2	A
P_D	Power Dissipation(1)	1.2	W
T_J, T_{stg}	Operating Junction and Storage Temperature Range	–55 to 150	°C

(1) $R_{\theta JA}$ = 105°C/W on 1in² Cu (2 oz.) on 0.060" thick FR4 PCB.

(2) Pulse width ≤ 300 µs, duty cycle ≤ 2%



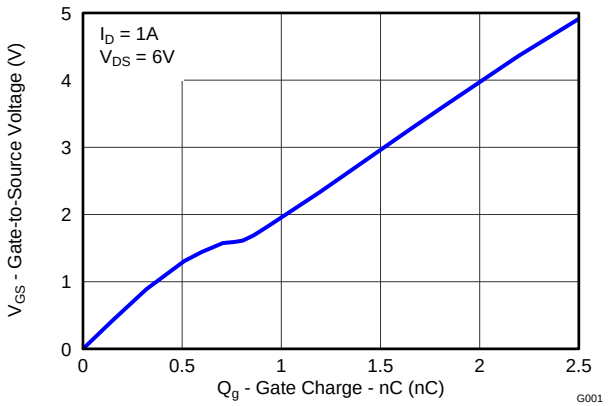


Table of Contents

4 Revision History

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

Changes from Original (May 2012) to Revision A	Page
• Added part number to title	1
• Enhanced *Description*	1
• Added *Device and Documentation Support* section.	7

5 Specifications

5.1 Electrical Characteristics

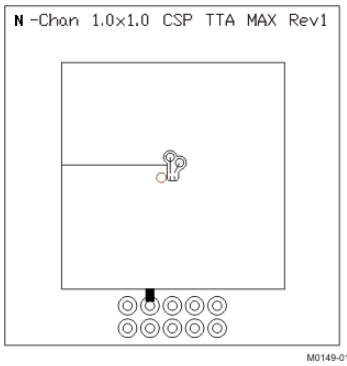
T_A = 25°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
STATIC CHARACTERISTICS						
BV_{DSS}	Drain-to-source voltage	V_{GS} = 0 V, I_D = 250 µA	12			V
I_{DSS}	Drain-to-source leakage current	V_{GS} = 0 V, V_{DS} = 9.6 V			1	µA
I_{GSS}	Gate-to-source leakage current	V_{DS} = 0 V, V_{GS} = 8 V			100	nA
$V_{GS(th)}$	Gate-to-source threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	0.65	0.8	1.1	V
$R_{DS(on)}$	Drain-to-source on resistance	V_{GS} = 1.8 V, I_D = 1 A		38	53	mΩ
		V_{GS} = 2.5 V, I_D = 1 A		29	39	
		V_{GS} = 4.5 V, I_D = 1 A		26	34	
g_{fs}	Transconductance	V_{DS} = 6 V, I_D = 1 A		23		S
DYNAMIC CHARACTERISTICS						
C_{ISS}	Input capacitance	V_{GS} = 0 V, V_{DS} = 6 V, f = 1 MHz		385	462	pF
C_{OSS}	Output capacitance			245	294	pF
C_{RSS}	Reverse transfer capacitance			18.1	22.6	pF
R_g	Series gate resistance			3		Ω
Q_g	Gate charge total (4.5 V)	V_{DS} = 6 V, I_D = 1 A		2.3	2.9	nC
Q_{gd}	Gate charge gate-to-drain			0.3		nC
Q_{gs}	Gate charge gate-to-source			0.5		nC
$Q_{g(th)}$	Gate charge at Vth			0.3		nC
Q_{OSS}	Output charge	V_{DS} = 6.0 V, V_{GS} = 0 V		1.8		nC
$t_{d(on)}$	Turn on delay time	V_{DS} = 6 V, V_{GS} = 4.5 V, I_D = 1 A, R_G = 20 Ω		3.9		ns
t_r	Rise time			5.9		ns
$t_{d(off)}$	Turn off delay time			14.4		ns
t_f	Fall time			9.7		ns
DIODE CHARACTERISTICS						
V_{SD}	Diode forward voltage	I_S = 1 A, V_{GS} = 0 V		0.7	1	V
Q_{rr}	Reverse recovery charge	V_{DS}= 6 V, I_S = 1 A, di/dt = 100 A/µs		2.4		nC
t_{rr}	Reverse recovery time			11.5		ns

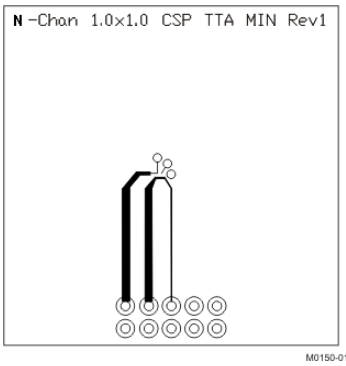
5.2 Thermal Information

(T_A = 25°C unless otherwise stated)

THERMAL METRIC		MIN	TYP	MAX	UNIT
$R_{\theta JA}$	Thermal resistance junction-to-ambient (minimum Cu area)			228.6	°C/W
$R_{\theta JA}$	Thermal resistance junction-to-ambient (1 in^2 Cu area)			131.1	°C/W



Max $R_{\theta JA}$ = 131.1°C/W when mounted on 1 inch^2 of 2 oz. Cu.



Max $R_{\theta JA}$ = 228.6°C/W when mounted on minimum pad area of 2 oz. Cu.

5.3 Typical MOSFET Characteristics

T_A = 25°C (unless otherwise noted)

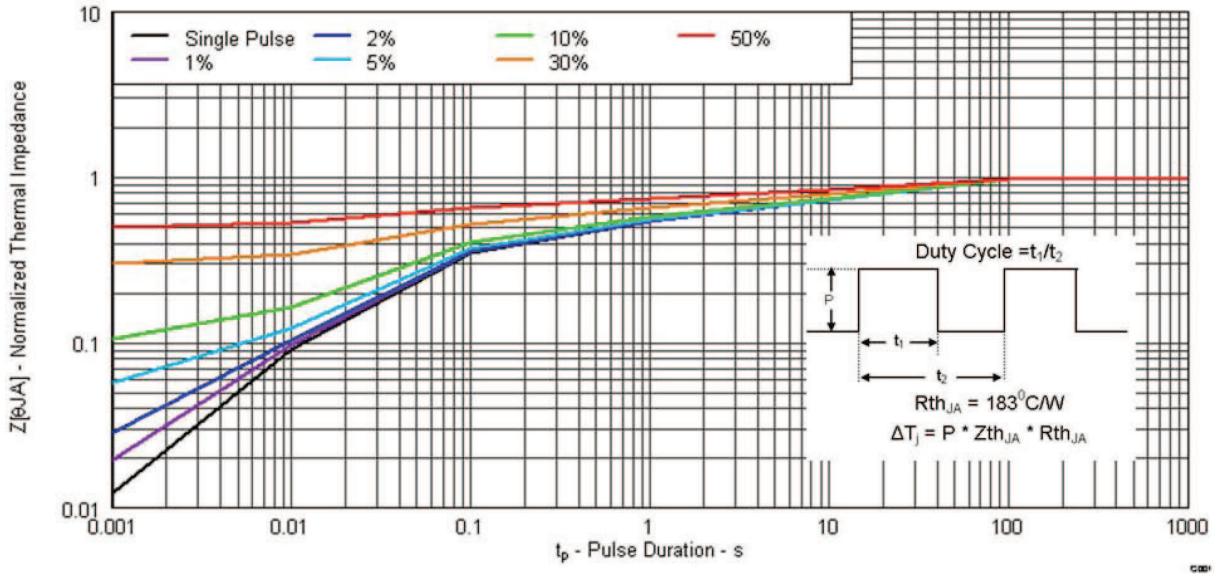


Figure 1. Transient Thermal Impedance

Typical MOSFET Characteristics (continued)

T_A = 25°C (unless otherwise noted)

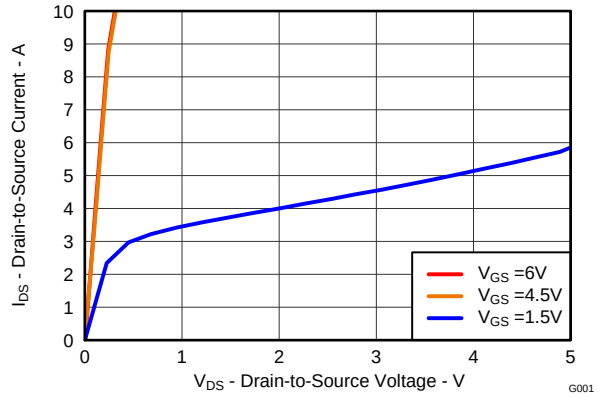


Figure 2. Saturation Characteristics

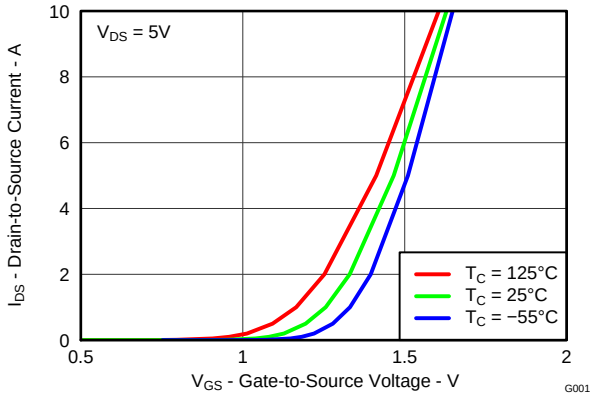


Figure 3. Transfer Characteristics

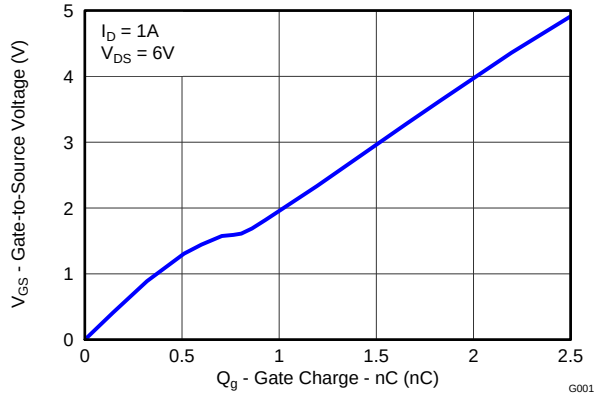


Figure 4. Gate Charge

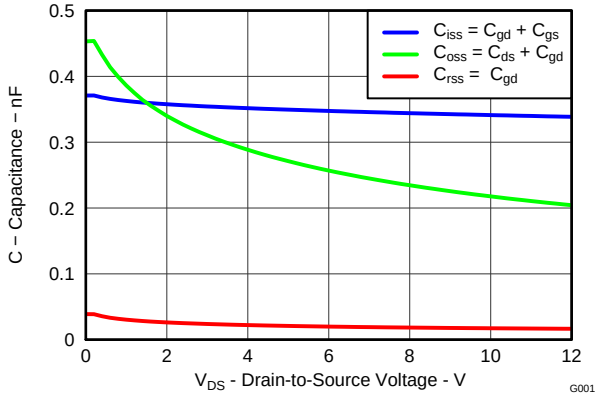


Figure 5. Capacitance

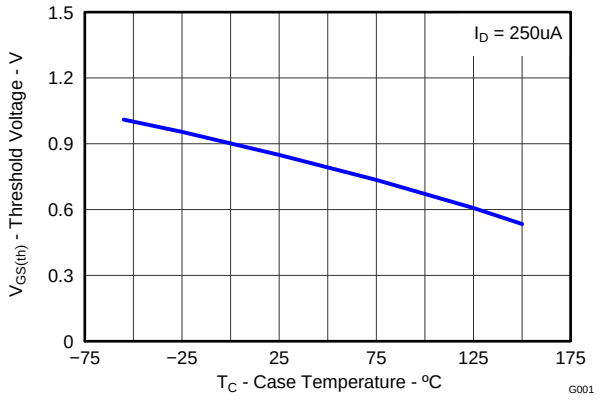


Figure 6. Threshold Voltage vs Temperature

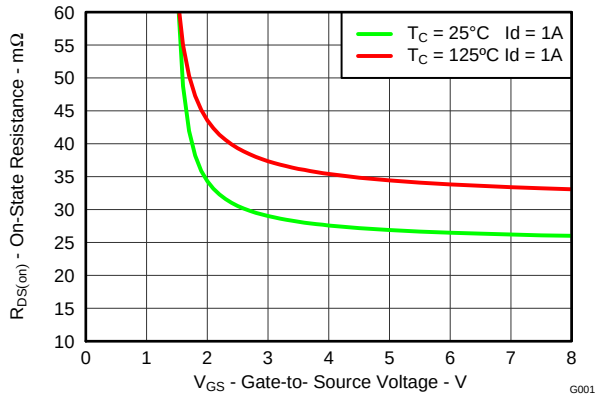


Figure 7. On Resistance vs Gate Voltage

Typical MOSFET Characteristics (continued)

T_A = 25°C (unless otherwise noted)

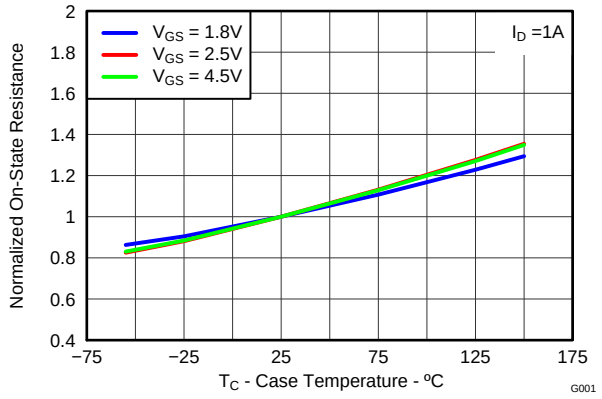


Figure 8. On Resistance vs Temperature

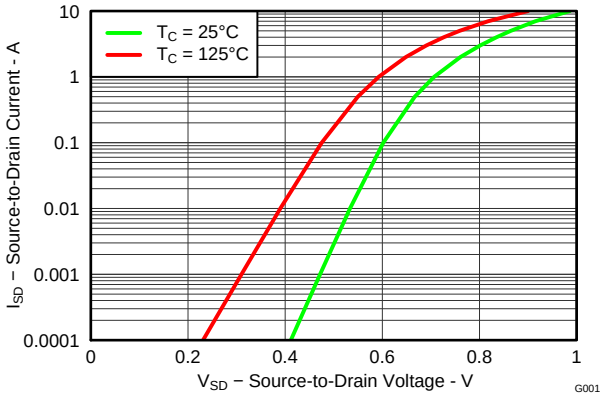


Figure 9. Typical Diode Forward Voltage

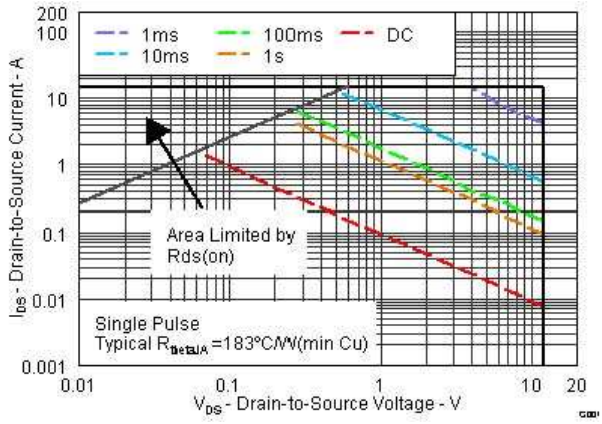


Figure 10. Maximum Safe Operating Area

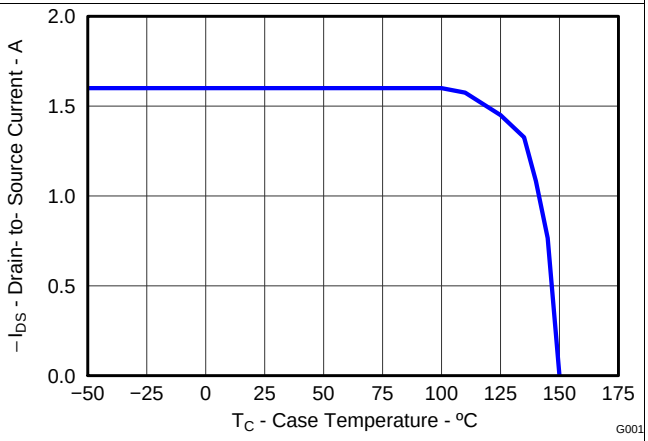


Figure 11. Maximum Drain Current vs Temperature

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, 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

E2E is a trademark 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

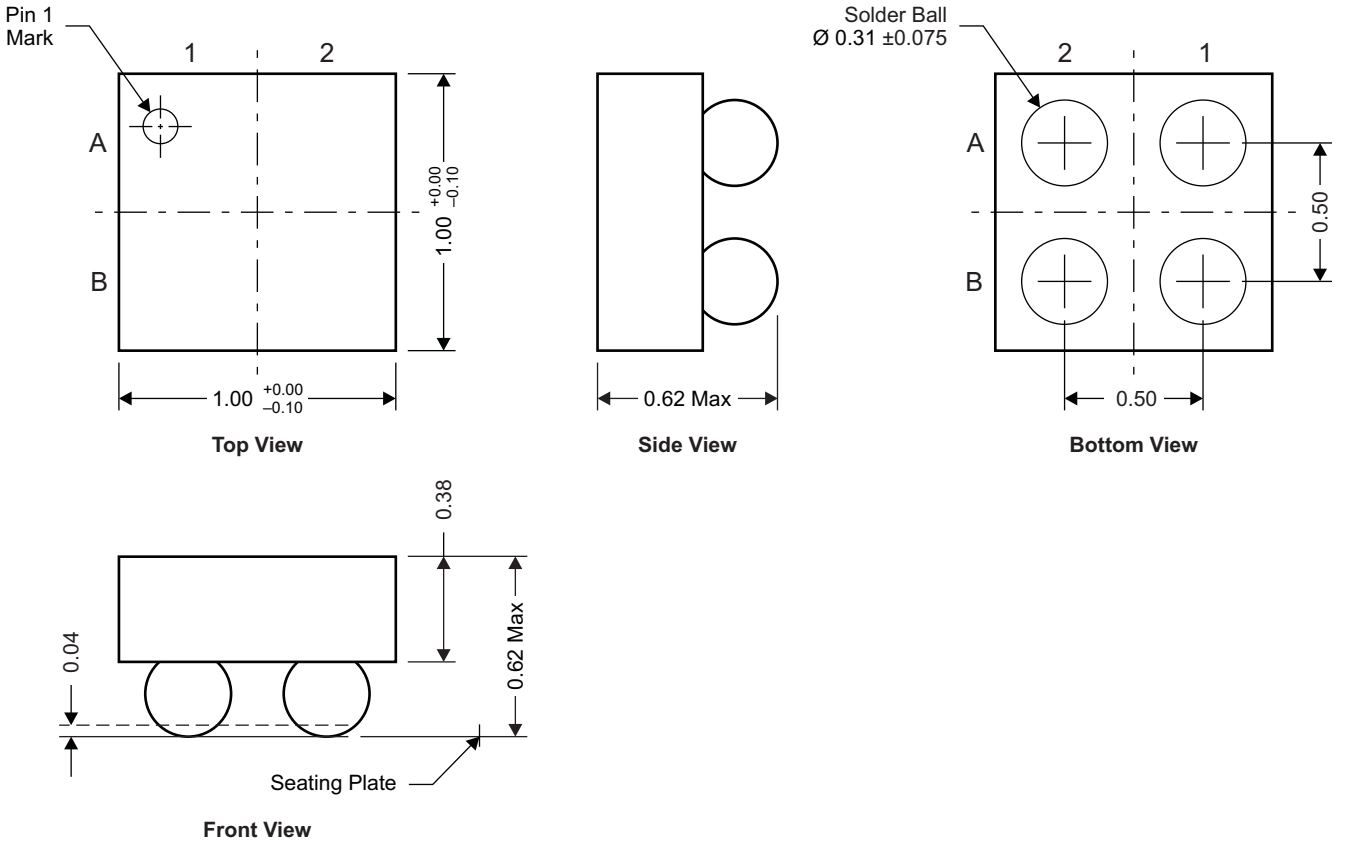
SLYZ022 — *TI Glossary*.

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

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 CSD13201W10 Package Dimensions

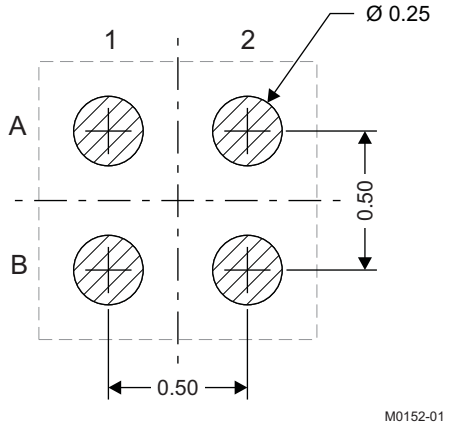


NOTE: All dimensions are in mm (unless otherwise specified)

Pin Configuration Table

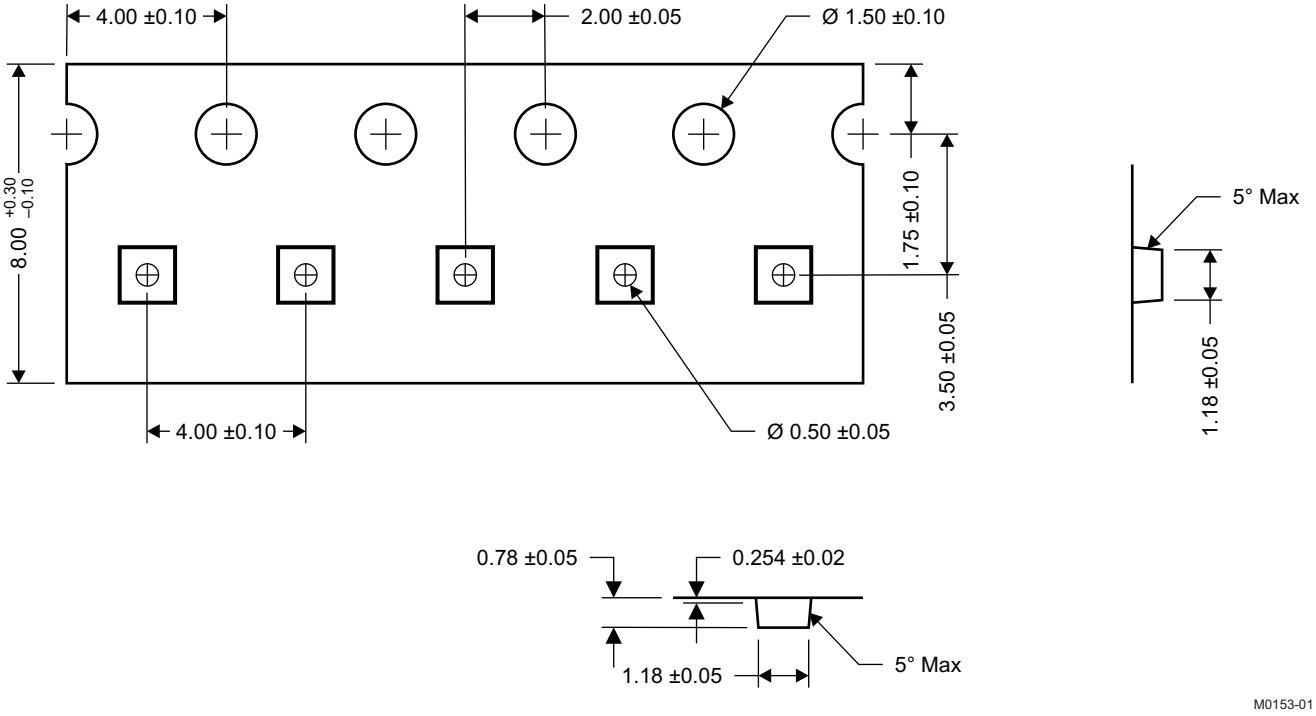
POSITION	DESIGNATION
A2	Source
A1	Gate
B1, B2	Drain

7.2 Land Pattern Recommendation



NOTE: All dimensions are in mm (unless otherwise specified)

7.3 Tape and Reel Information



NOTE: All dimensions are in mm (unless otherwise specified)

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
CSD13201W10	ACTIVE	DSBGA	YZB	4	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-55 to 150	201	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)

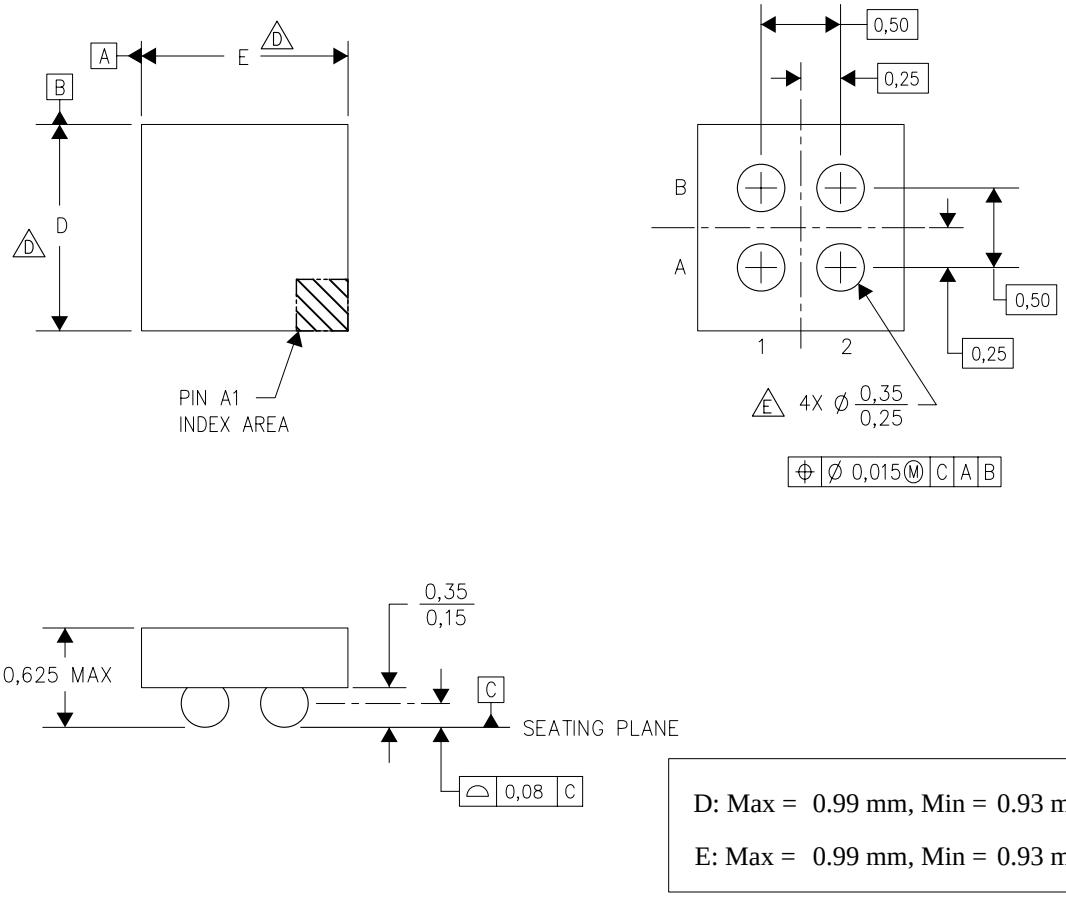
(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(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.

YZB (S–XBGA–N4) DIE–SIZE BALL GRID ARRAY



NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. NanoFree™ package configuration.
D. Devices in YZB package can have dimension D ranging from 0.94 to 1.65 mm and dimension E ranging from 0.94 to 1.65 mm. To determine the exact package size of a particular device, refer to the device datasheet or contact a local TI representative.
E. Reference Product Data Sheet for array population. 2 x 2 matrix pattern is shown for illustration only.
F. This package contains lead–free balls. Refer to YEB (Drawing #4204178) for tin–lead (SnPb) balls.

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