



CSD23203W 8 V P-Channel NexFET™ Power MOSFET

1 Features

- Ultra-Low Q_g and Q_{gd}
- Low $R_{DS(on)}$
- Small Footprint
- Low Profile 0.62 mm Height
- Pb Free
- RoHS Compliant
- Halogen Free
- CSP 1 × 1.5 mm Wafer Level Package

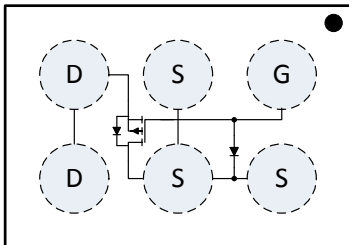
2 Applications

- Battery Management
- Load Switch
- Battery Protection

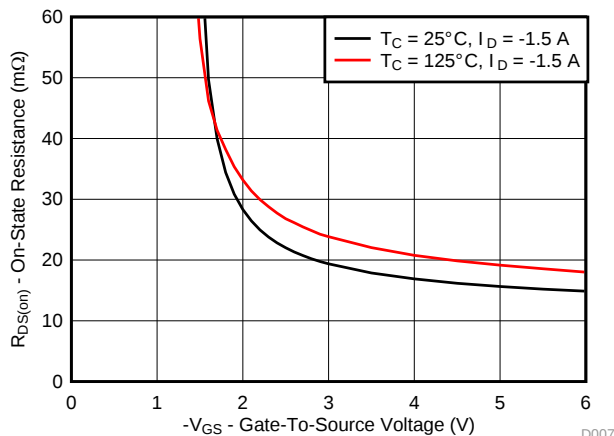
3 Description

This 16.2 mΩ, –8 V, P-Channel device is designed to deliver the lowest on-resistance and gate charge in a small 1.0 × 1.5 mm outline with excellent thermal characteristics in an ultra-low profile.

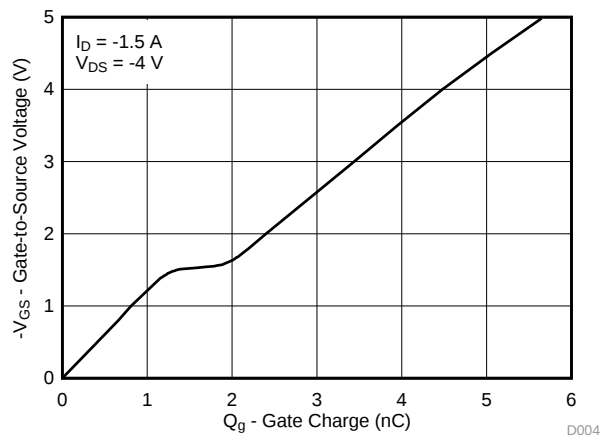
Top View



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



Gate Charge



Product Summary

$T_A = 25^\circ\text{C}$		TYPICAL VALUE		UNIT
V_{DS}	Drain-to-Source Voltage	–8		V
Q_g	Gate Charge Total (–4.5 V)	4.9		nC
Q_{gd}	Gate Charge Gate-to-Drain	0.6		nC
$R_{DS(on)}$	Drain-to-Source On-Resistance	$V_{GS} = -1.8\text{ V}$	35.0	mΩ
		$V_{GS} = -2.5\text{ V}$	22.0	mΩ
		$V_{GS} = -4.5\text{ V}$	16.2	mΩ
$V_{GS(th)}$	Voltage Threshold	–0.8		V

Ordering Information⁽¹⁾

Device	Qty	Media	Package	Ship
CSD23203W	3000	7-Inch Reel	1.0 mm × 1.5 mm Wafer Level Package	Tape and Reel
CSD23203WT	250	7-Inch Reel		

(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	–8	V
V_{GS}	Gate-to-Source Voltage	–6	V
I_D	Continuous Drain Current ⁽¹⁾	–3.0	A
I_{DM}	Pulsed Drain Current ⁽²⁾	–54	A
P_D	Power Dissipation	0.75	W
T_J , T_{stg}	Operating Junction and Storage Temperature Range	–55 to 150	$^\circ\text{C}$

(1) Device operating at a temperature of 105°C

(2) Typ $R_{\theta JA} = 170^\circ\text{C/W}$, Pulse width $\leq 100\text{ }\mu\text{s}$, duty cycle $\leq 1\%$



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4 Revision History

DATE	REVISION	NOTES
December 2014	*	Initial release.

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	–8			V
I _{DSS}	Drain-to-Source Leakage Current	V _{GS} = 0 V, V _{DS} = –6.4 V			–1	μA
I _{GSS}	Gate-to-Source Leakage Current	V _{DS} = 0 V, V _{GS} = –6 V			–100	nA
V _{GS(th)}	Gate-to-Source Threshold Voltage	V _{DS} = V _{GS} , I _D = –250 μA	–0.6	–0.8	–1.1	V
R _{DS(on)}	Drain-to-Source On-Resistance	V _{GS} = –1.8 V, I _D = –1.5 A	35		53	mΩ
		V _{GS} = –2.5 V, I _D = –1.5 A	22		26.5	mΩ
		V _{GS} = –4.5 V, I _D = –1.5 A	16.2		19.4	mΩ
g _{fs}	Transconductance	V _{DS} = –0.8 V, I _D = –1.5 A	14			S
DYNAMIC CHARACTERISTICS						
C _{ISS}	Input Capacitance	V _{GS} = 0 V, V _{DS} = –4 V, f = 1 MHz	703		914	pF
C _{OSS}	Output Capacitance		391		508	pF
C _{RSS}	Reverse Transfer Capacitance		133		172	pF
Q _g	Gate Charge Total (–4.5 V)	V _{DS} = –4 V, I _D = –1.5 A	4.9		6.3	nC
Q _{gd}	Gate Charge Gate-to-Drain		0.6			nC
Q _{gs}	Gate Charge Gate-to-Source		1.3			nC
Q _{g(th)}	Gate Charge at V _{th}		0.6			nC
Q _{OSS}	Output Charge	V _{DS} = –4 V, V _{GS} = 0 V	1.9			nC
t _{d(on)}	Turn On Delay Time	V _{DS} = –4 V, V _{GS} = –4.5 V, I _D = –1.5 A R _G = 10 Ω	14			ns
t _r	Rise Time		12			ns
t _{d(off)}	Turn Off Delay Time		58			ns
t _f	Fall Time		27			ns
DIODE CHARACTERISTICS						
V _{SD}	Diode Forward Voltage	I _S = –1.5 A, V _{GS} = 0 V	–0.75		–1	V
Q _{rr}	Reverse Recovery Charge	V _{DS} = –4.7 V, I _F = –1.5 A	6.1			nC
t _{rr}	Reverse Recovery Time	di/dt = 100 A/μs	21			ns

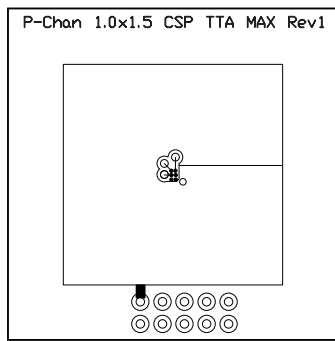
5.2 Thermal Information

(T_A = 25°C unless otherwise stated)

THERMAL METRIC		MIN	TYP	MAX	UNIT
R _{θJA}	Junction-to-Ambient Thermal Resistance ⁽¹⁾		170		°C/W
	Junction-to-Ambient Thermal Resistance ⁽²⁾		55		

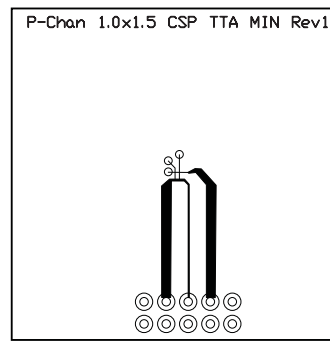
(1) Device mounted on FR4 material with minimum Cu mounting area.

(2) Device mounted on FR4 material with 1 inch² (6.45 cm²), 2 oz. (0.071 mm thick) Cu.



M0155-01

Typ $R_{\theta JA} = 55^{\circ}\text{C/W}$
when mounted on
1 inch² of 2 oz. Cu.

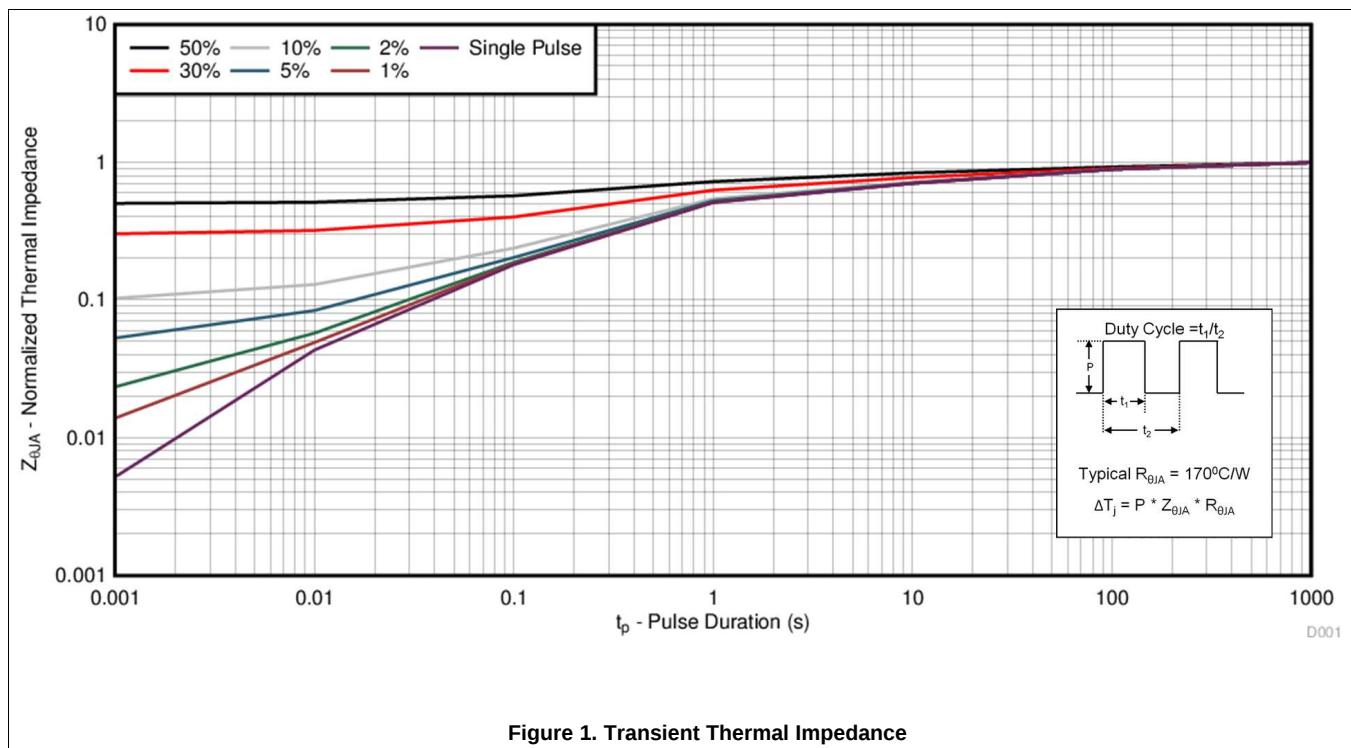


M0156-01

Typ $R_{\theta JA} = 170^{\circ}\text{C/W}$
when mounted on
minimum pad area of
2 oz. Cu.

5.3 Typical MOSFET Characteristics

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



Typical MOSFET Characteristics (continued)

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

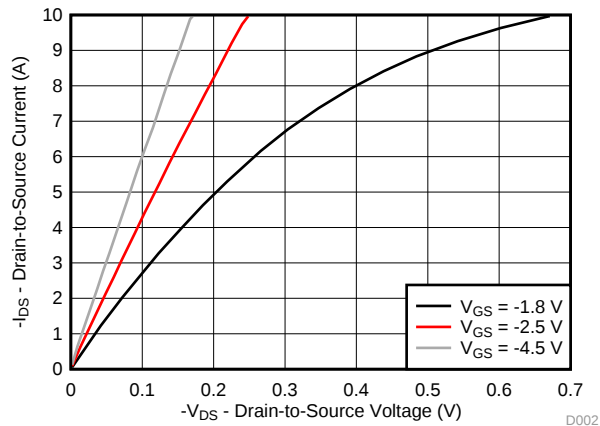


Figure 2. Saturation Characteristics

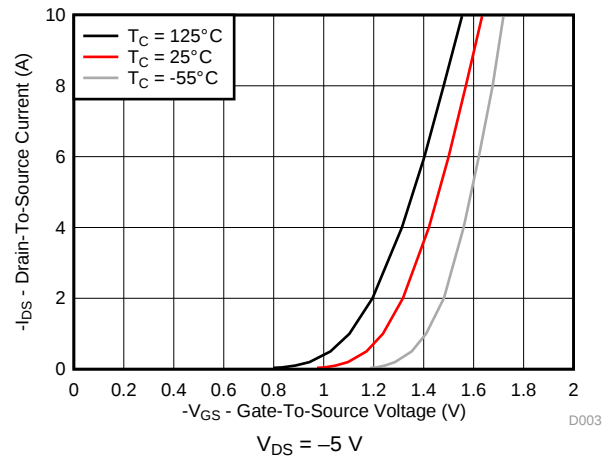


Figure 3. Transfer Characteristics

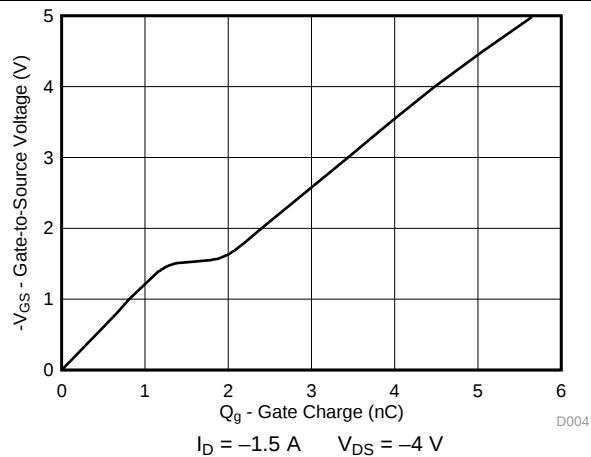


Figure 4. Gate Charge

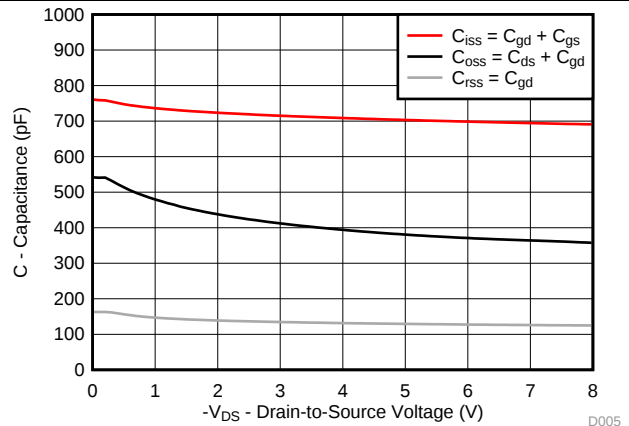


Figure 5. Capacitance

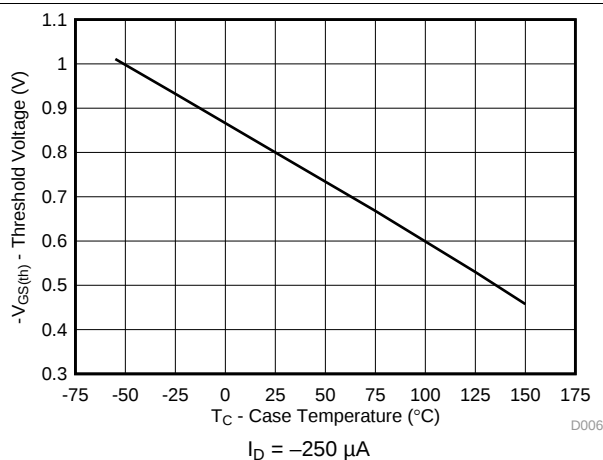


Figure 6. Threshold Voltage vs Temperature

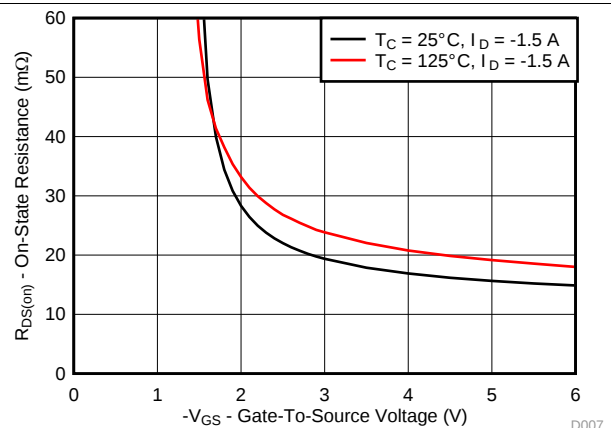


Figure 7. On-State Resistance vs Gate-to-Source Voltage

Typical MOSFET Characteristics (continued)

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

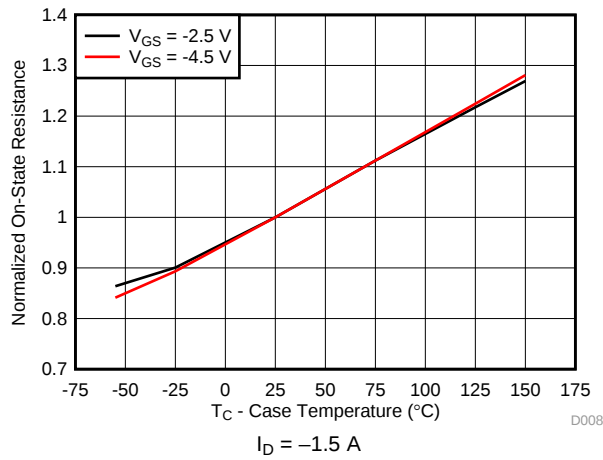


Figure 8. Normalized On-State Resistance vs Temperature

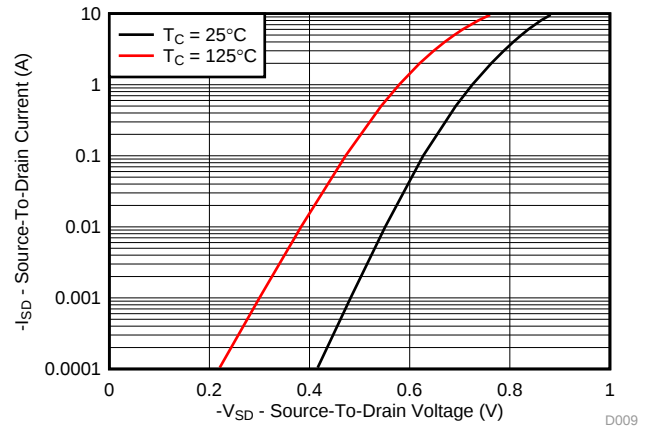


Figure 9. Typical Diode Forward Voltage

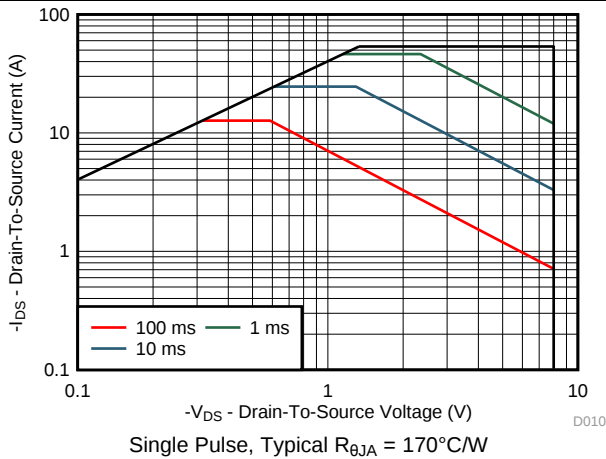


Figure 10. Maximum Safe Operating Area

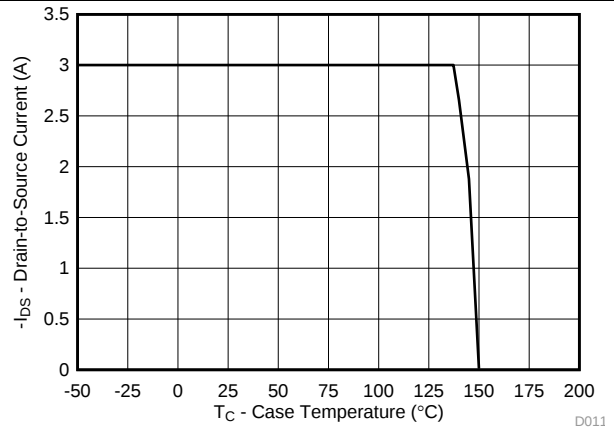


Figure 11. Maximum Drain Current vs Temperature

6 Device and Documentation Support

6.1 Trademarks

NexFET is a trademark of Texas Instruments.
All other trademarks are the property of their respective owners.

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

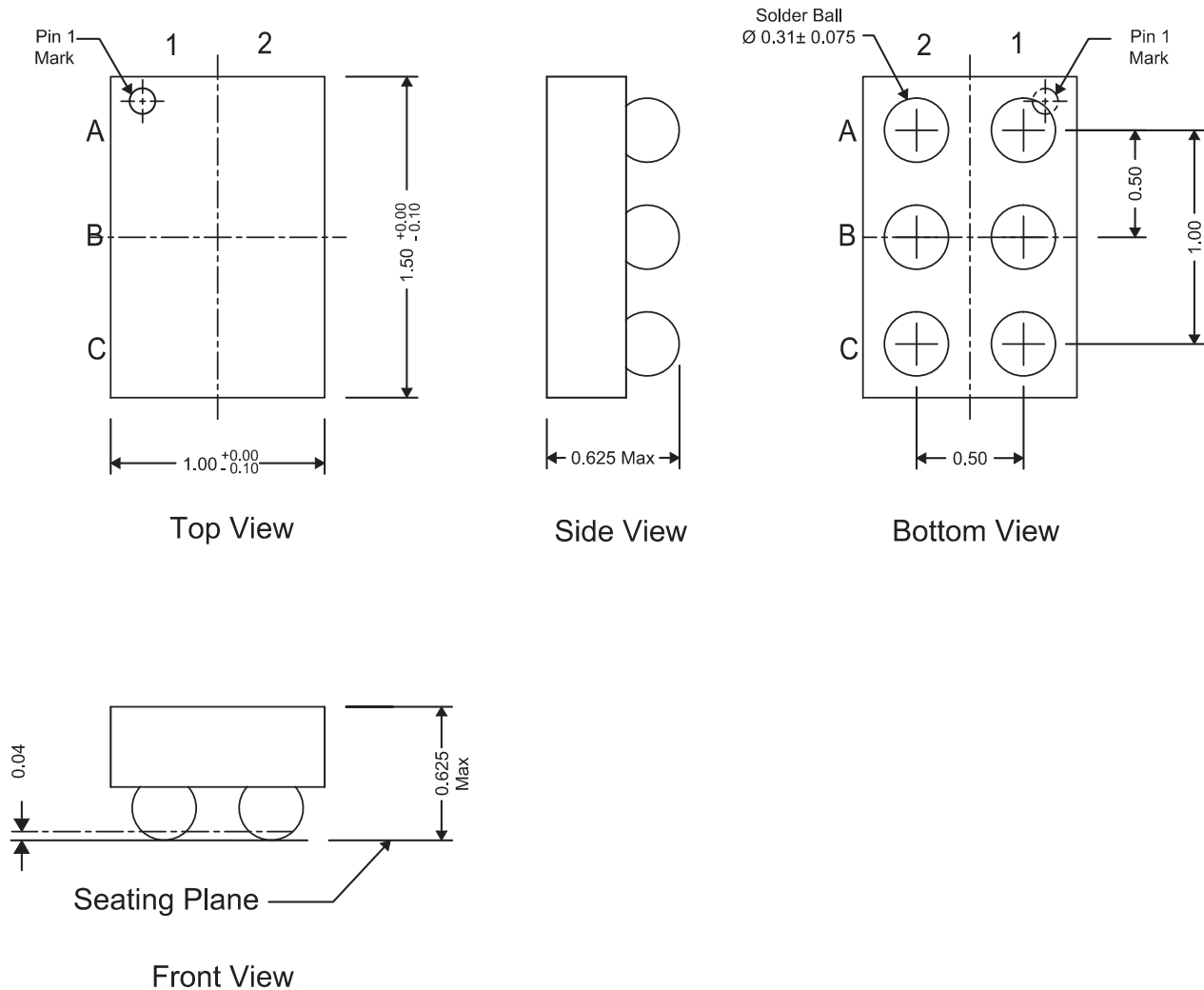
[SLYZ022](#) — *TI Glossary*.

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

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 CSD23203W Package Dimensions

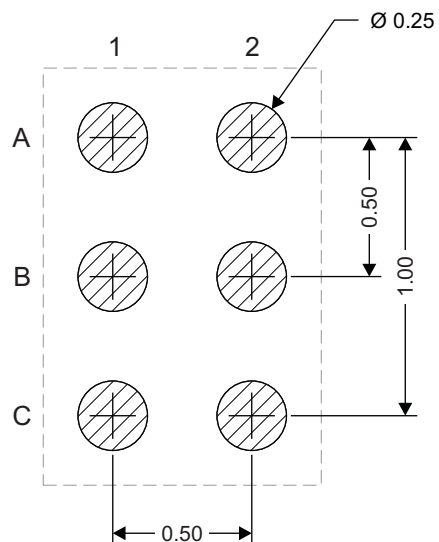


NOTE: All dimensions are in mm (unless otherwise specified).

Pinout

POSITION	DESIGNATION
C1, C2	Drain
A1	Gate
A2, B1, B2	Source

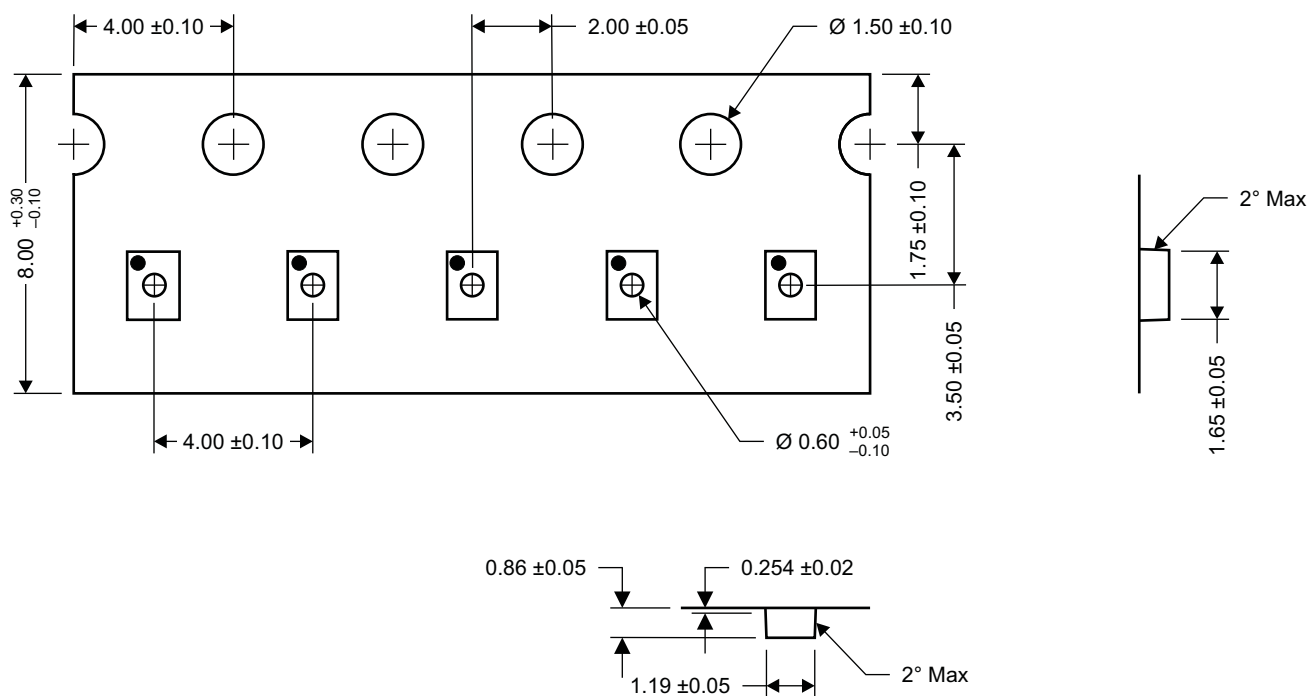
7.2 Land Pattern Recommendation



M0158-01

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

7.3 Tape and Reel Information



M0159-01

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
CSD23203W	ACTIVE	DSBGA	YZC	6	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM		23203	Samples
CSD23203WT	ACTIVE	DSBGA	YZC	6	250	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM		23203	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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TAPE AND REEL INFORMATION


*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
CSD23203W	DSBGA	YZC	6	3000	180.0	8.4	1.18	1.68	0.83	4.0	8.0	Q1
CSD23203WT	DSBGA	YZC	6	250	180.0	8.4	1.18	1.68	0.83	4.0	8.0	Q1

TAPE AND REEL BOX DIMENSIONS

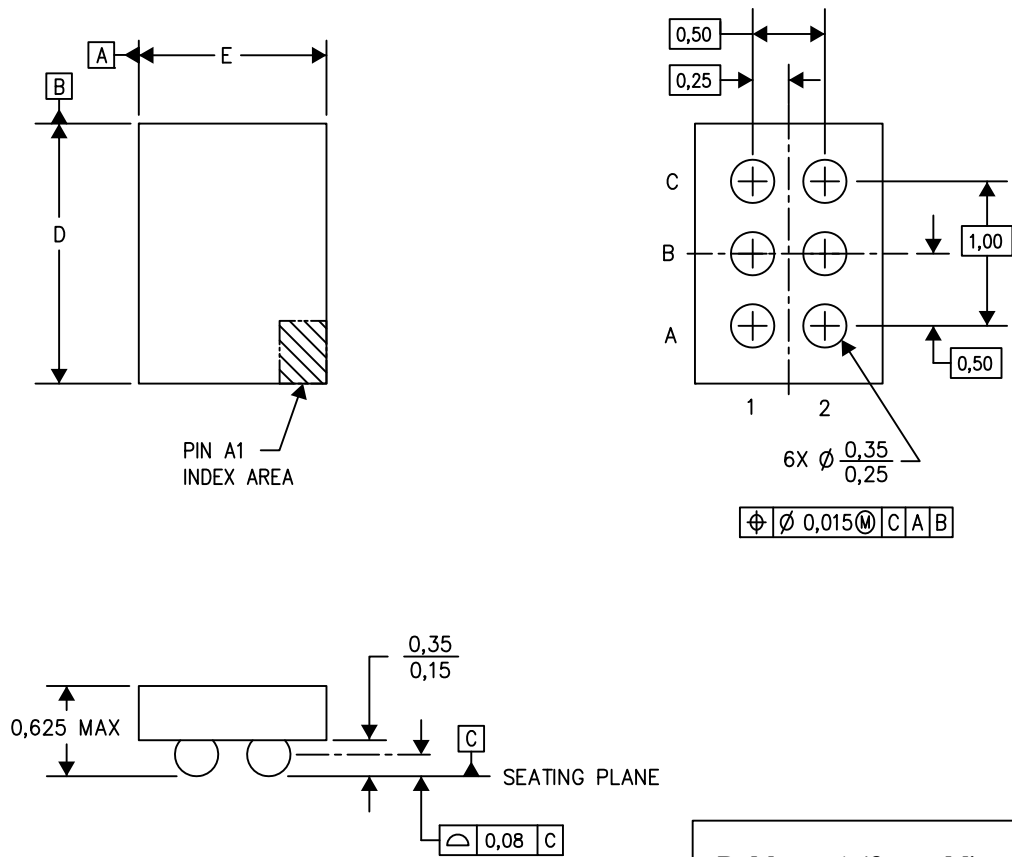


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CSD23203W	DSBGA	YZC	6	3000	182.0	182.0	17.0
CSD23203WT	DSBGA	YZC	6	250	182.0	182.0	17.0

YZC (R-XBGA-N6)

DIE-SIZE BALL GRID ARRAY



D: Max = 1.49 mm, Min = 1.43 mm

E: Max = 0.996 mm, Min = 0.936 mm

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- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - B. This drawing is subject to change without notice.
 - C. NanoFree™ package configuration.

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