

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
- Lead Free
- RoHS Compliant
- Halogen Free
- CSP 1-mm x 1.5-mm Wafer Level Package

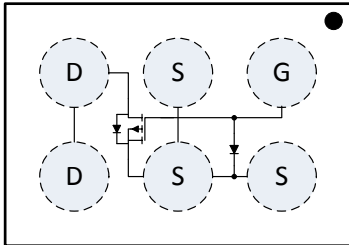
2 Applications

- Battery Management
- Load Switch
- Battery Protection

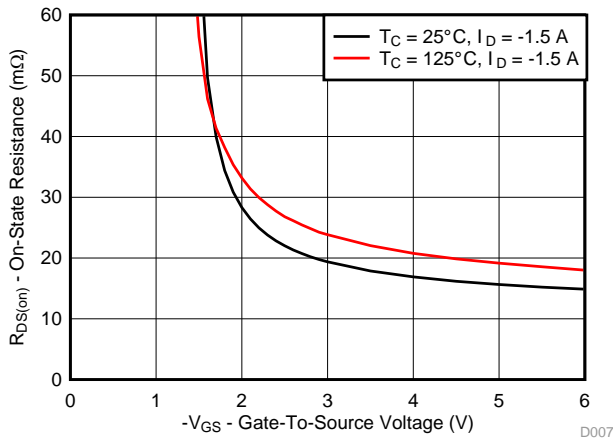
3 Description

This 16.2-m Ω , –8-V, P-Channel device is designed to deliver the lowest on-resistance and gate charge in a small 1 x 1.5 mm outline with excellent thermal characteristics in an ultra-low profile.

Top View



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



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	m Ω
		$V_{GS} = -2.5\text{ V}$	22	m Ω
		$V_{GS} = -4.5\text{ V}$	16.2	m Ω
$V_{GS(th)}$	Voltage Threshold	–0.8		V

Device Information⁽¹⁾

DEVICE	QTY	MEDIA	PACKAGE	SHIP
CSD23203W	3000	7-Inch Reel	1.00-mm x 1.50-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	A
I_{DM}	Pulsed Drain Current ⁽²⁾	–54	A
P_D	Power Dissipation	0.75	W
T_J, T_{stg}	Operating Junction, Storage Temperature	–55 to 150	$^\circ\text{C}$

(1) Device operating at a temperature of 105 $^\circ\text{C}$.

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

Gate Charge

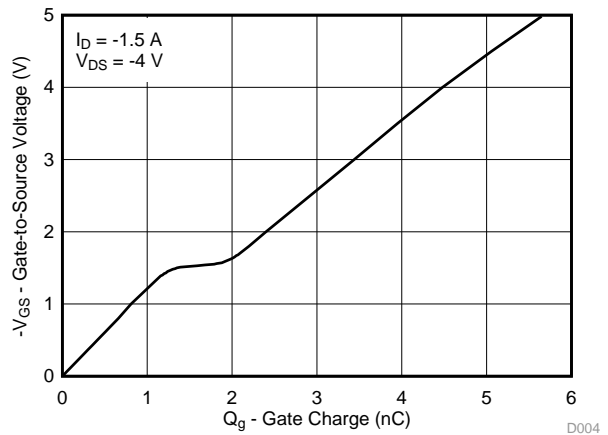


Table of Contents

1 Features	1	6.1 Receiving Notification of Documentation Updates	7
2 Applications	1	6.2 Community Resources	7
3 Description	1	6.3 Trademarks	7
4 Revision History	2	6.4 Electrostatic Discharge Caution	7
5 Specifications	3	6.5 Glossary	7
5.1 Electrical Characteristics	3	7 Mechanical, Packaging, and Orderable	
5.2 Thermal Information	3	Information	8
5.3 Typical MOSFET Characteristics	4	7.1 CSD23203W Package Dimensions	8
6 Device and Documentation Support	7	7.2 Land Pattern Recommendation	9
		7.3 Tape and Reel Information	9

4 Revision History

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

Changes from Original (December 2014) to Revision A	Page
• Corrected MOSFET body tie in <i>Top View</i> image.	1
• Added <i>Receiving Notification of Documentation Updates</i> and <i>Community Resources</i> sections	7

5 Specifications

5.1 Electrical Characteristics

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
STATIC CHARACTERISTICS						
V_{DSS}	Drain-to-source voltage	$V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$	-8			V
I_{DSS}	Drain-to-source leakage current	$V_{GS} = 0\text{ V}, V_{DS} = -6.4\text{ V}$			-1	μA
I_{GSS}	Gate-to-source leakage current	$V_{DS} = 0\text{ V}, V_{GS} = -6\text{ V}$			-100	nA
$V_{GS(th)}$	Gate-to-source threshold voltage	$V_{DS} = V_{GS}, I_D = -250\ \mu\text{A}$	-0.6	-0.8	-1.1	V
$R_{DS(on)}$	Drain-to-source on-resistance	$V_{GS} = -1.8\text{ V}, I_D = -1.5\text{ A}$		35	53	m Ω
		$V_{GS} = -2.5\text{ V}, I_D = -1.5\text{ A}$		22	26.5	m Ω
		$V_{GS} = -4.5\text{ V}, I_D = -1.5\text{ A}$		16.2	19.4	m Ω
g_{fs}	Transconductance	$V_{DS} = -0.8\text{ V}, I_D = -1.5\text{ A}$		14		S
DYNAMIC CHARACTERISTICS						
C_{ISS}	Input capacitance	$V_{GS} = 0\text{ V}, V_{DS} = -4\text{ V}, f = 1\text{ MHz}$		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)	$V_{DS} = -4\text{ V}, I_D = -1.5\text{ A}$		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		$V_{DS} = -4\text{ V}, V_{GS} = 0\text{ V}$		1.9	
$t_{d(on)}$	Turnon delay time	$V_{DS} = -4\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -1.5\text{ A}$ $R_G = 10\ \Omega$		14		ns
t_r	Rise time			12		ns
$t_{d(off)}$	Turnoff delay time			58		ns
t_f	Fall time			27		ns
DIODE CHARACTERISTICS						
V_{SD}	Diode forward voltage	$I_S = -1.5\text{ A}, V_{GS} = 0\text{ V}$	-0.75		-1	V
Q_{rr}	Reverse recovery charge	$V_{DS} = -4.7\text{ V}, I_F = -1.5\text{ A}$		6.1		nC
t_{rr}	Reverse recovery time	$di/dt = 100\text{ A}/\mu\text{s}$		21		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 ⁽¹⁾		170		$^\circ\text{C}/\text{W}$
	Junction-to-ambient thermal resistance ⁽²⁾		55		

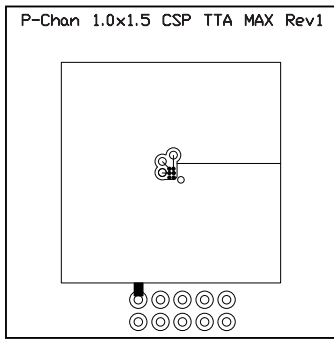
(1) Device mounted on FR4 material with minimum Cu mounting area.

(2) Device mounted on FR4 material with 1-in² (6.45-cm²), 2-oz (0.071-mm) thick Cu.

CSD23203W

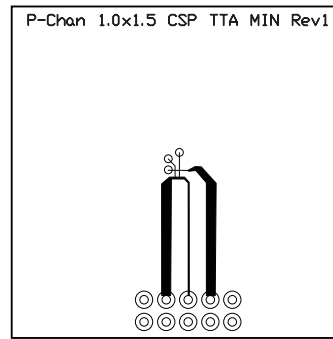
SLPS533A – DECEMBER 2014 – REVISED AUGUST 2016

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

M0155-01

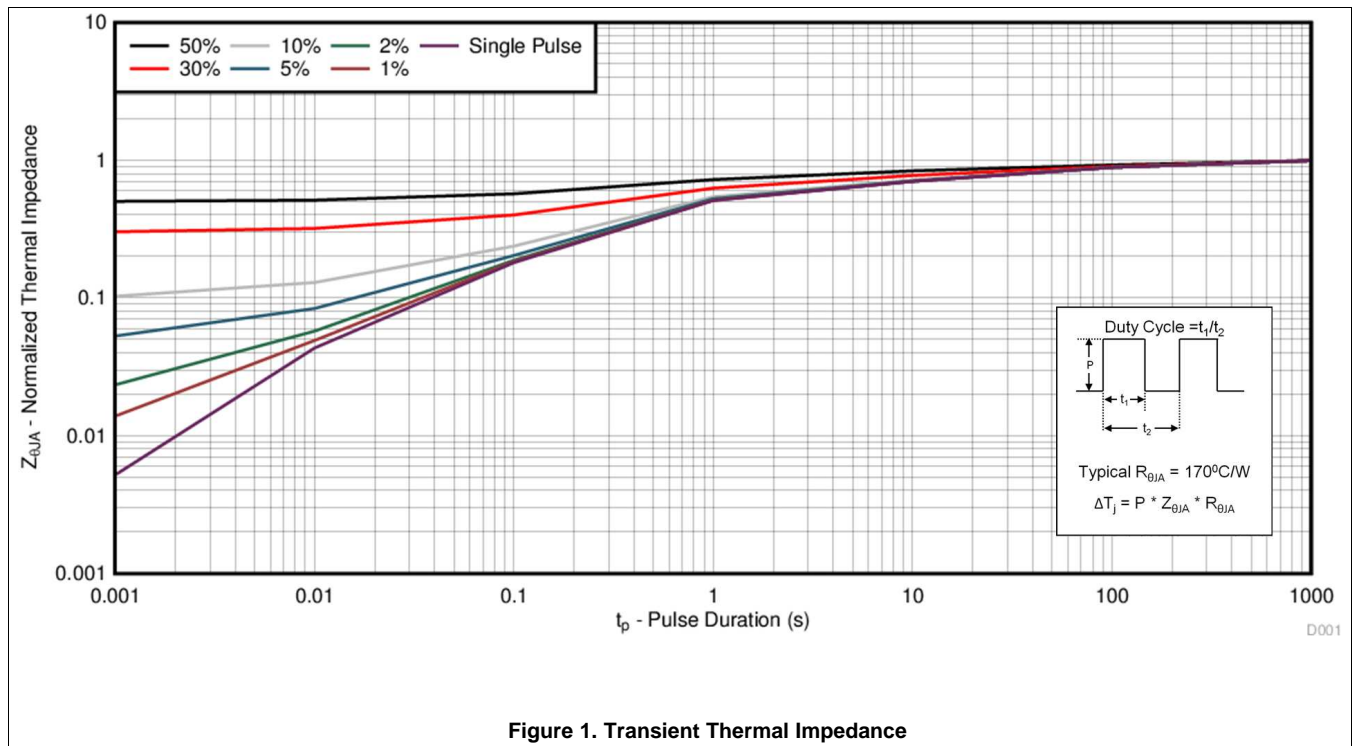


Typ $R_{\theta JA} = 170^{\circ}\text{C/W}$
when mounted on
minimum pad area of
2-oz Cu.

M0156-01

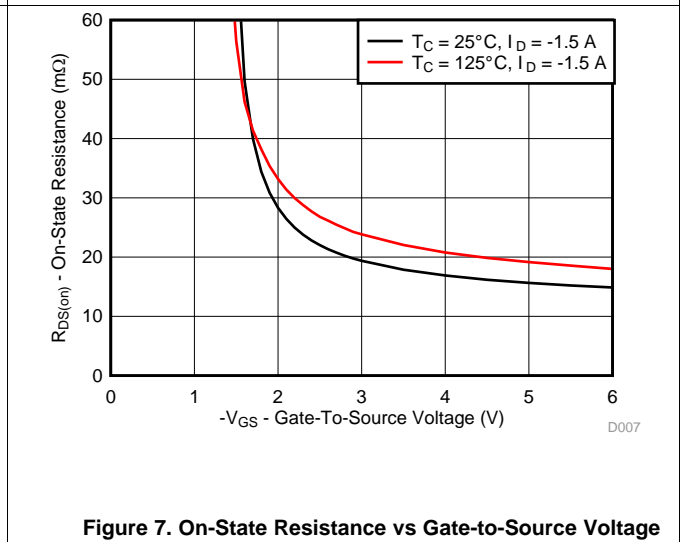
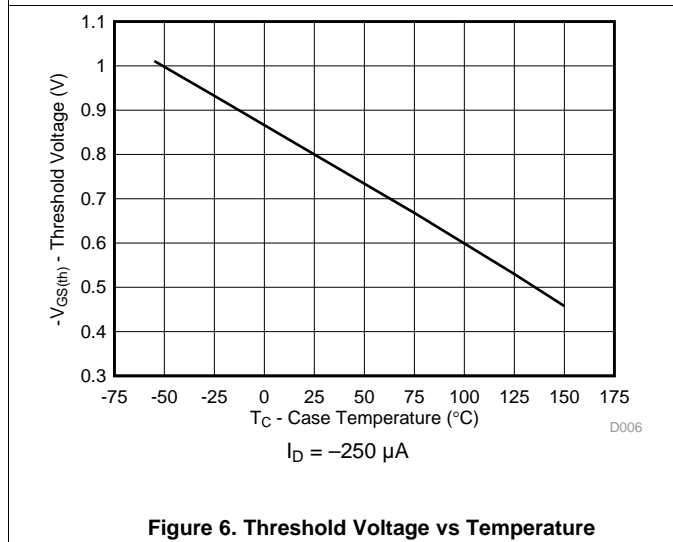
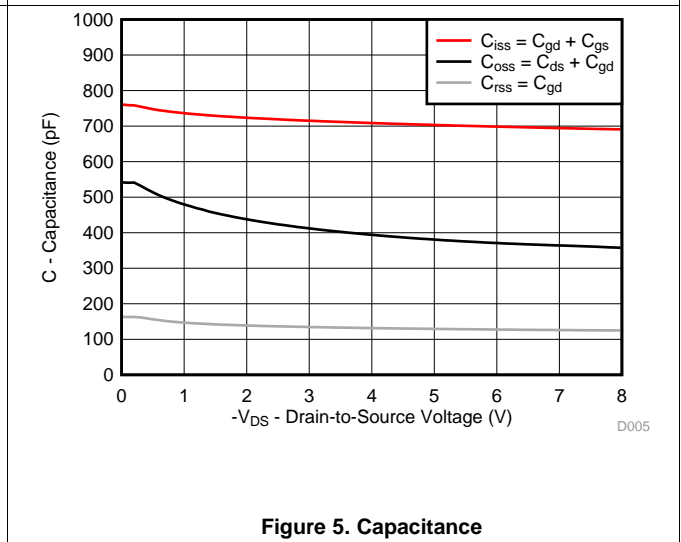
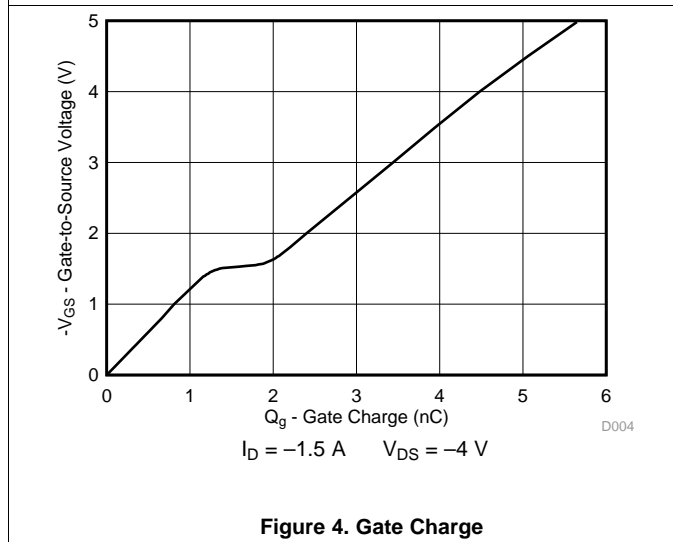
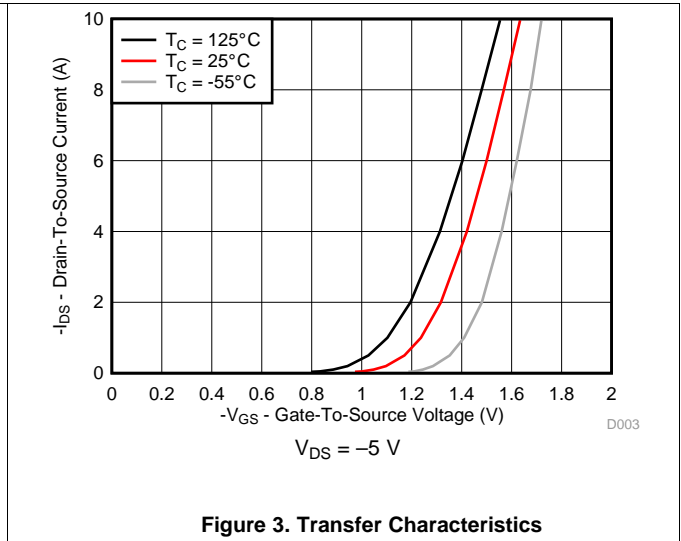
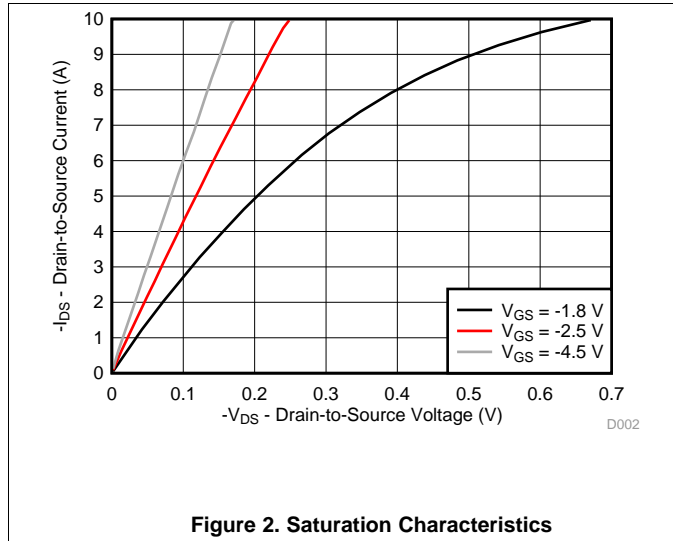
5.3 Typical MOSFET Characteristics

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



Typical MOSFET Characteristics (continued)

T_A = 25°C (unless otherwise stated)



Typical MOSFET Characteristics (continued)

T_A = 25°C (unless otherwise stated)

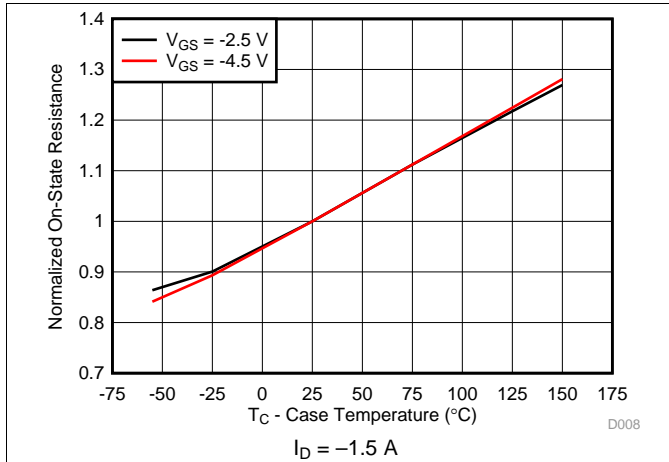


Figure 8. Normalized On-State Resistance vs Temperature

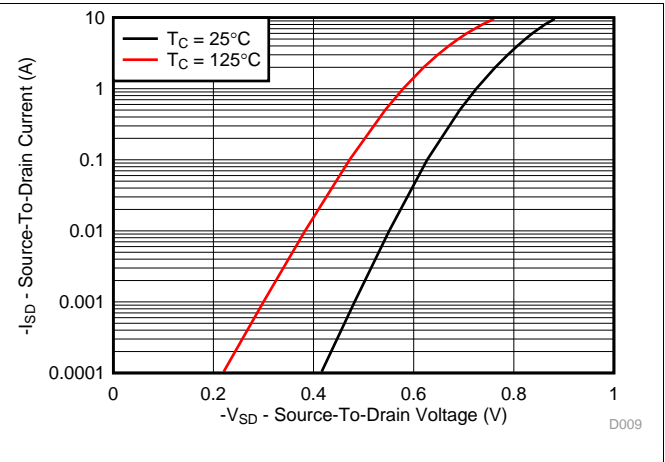


Figure 9. Typical Diode Forward Voltage

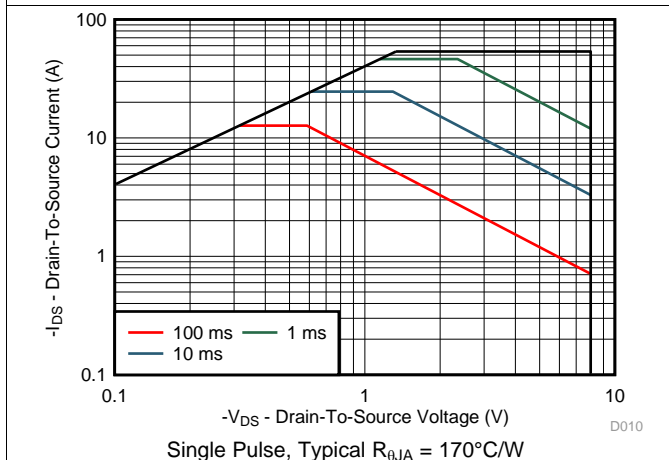


Figure 10. Maximum Safe Operating Area

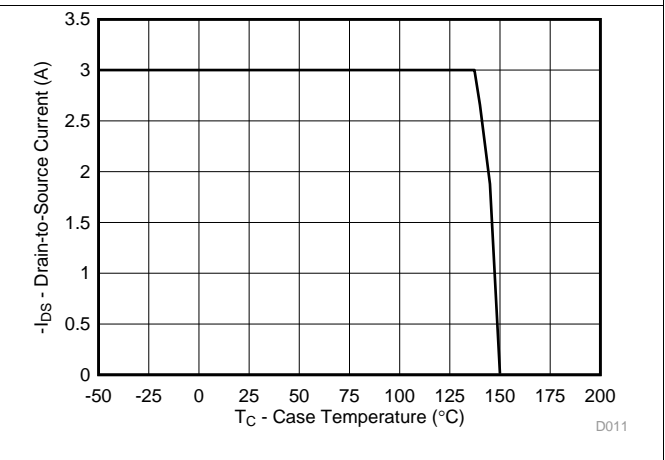


Figure 11. Maximum Drain Current vs Temperature

6 Device and Documentation Support

6.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. In the upper right corner, click on *Alert me* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

6.2 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.

6.3 Trademarks

NexFET, E2E are trademarks of Texas Instruments.
All other trademarks are the property of their respective owners.

6.4 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.

6.5 Glossary

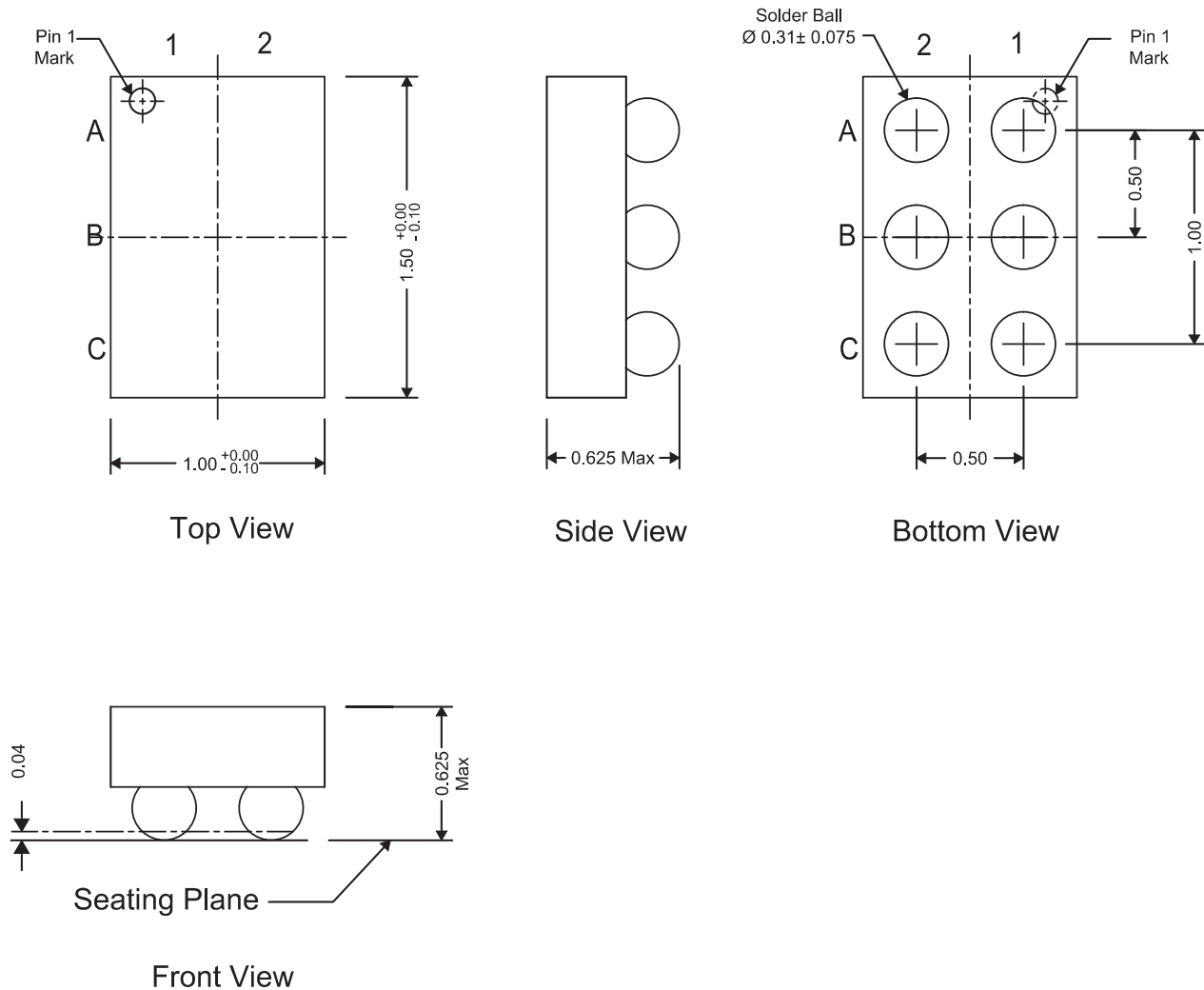
[SLYZ022](#) — *TI Glossary*.

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

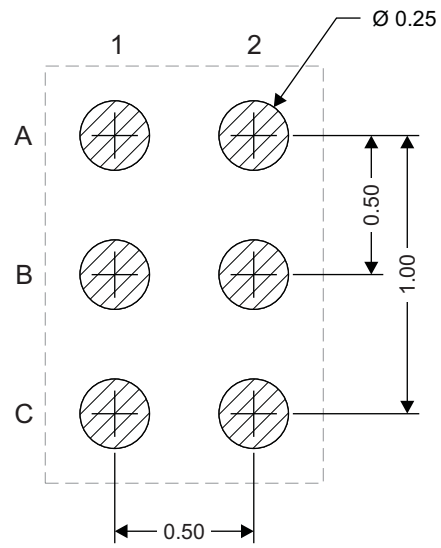


NOTE: All dimensions are in mm (unless otherwise specified).

Table 1. 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).

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
CSD23203W	ACTIVE	DSBGA	YZC	6	3000	RoHS & Green	SNAGCU	Level-1-260C-UNLIM		23203	Samples
CSD23203WT	ACTIVE	DSBGA	YZC	6	250	RoHS & Green	SNAGCU	Level-1-260C-UNLIM	-55 to 150	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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(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 finish/Ball material - Orderable Devices 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.

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PACKAGING INFORMATION

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CSD23203WT	ACTIVE	DSBGA	YZC	6	250	RoHS & Green	SNAGCU	Level-1-260C-UNLIM	-55 to 150	23203	Samples

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TAPE AND REEL INFORMATION



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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	20.0
CSD23203WT	DSBGA	YZC	6	250	182.0	182.0	20.0

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