CSD25304W1015 20-V P-Channel NexFET™ Power MOSFET

1 Features

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

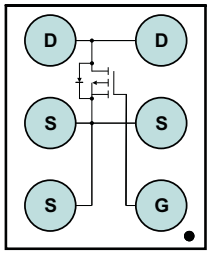
2 Applications

- Battery Management
- Load Switch
- Battery Protection

3 Description

This 27 mΩ, –20 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



Product Summary

T_A = 25°C		TYPICAL VALUE		UNIT
V_{DS}	Drain-to-Source Voltage	–20		V
Q_g	Gate Charge Total (4.5 V)	3.3		nC
Q_{gd}	Gate Charge Gate-to-Drain	0.5		nC
$R_{DS(on)}$	Drain-to-Source On-Resistance	V_{GS} = –1.8 V	65	mΩ
		V_{GS} = –2.5 V	36	mΩ
		V_{GS} = –4.5 V	27	mΩ
$V_{GS(th)}$	Voltage Threshold	–0.8		V

Ordering Information(1)

Device	Qty	Media	Package	Ship
CSD25304W1015	3000	7-Inch Reel	1.0 mm × 1.5 mm Wafer Level Package	Tape and Reel
CSD25304W1015T	250	7-Inch Reel		

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

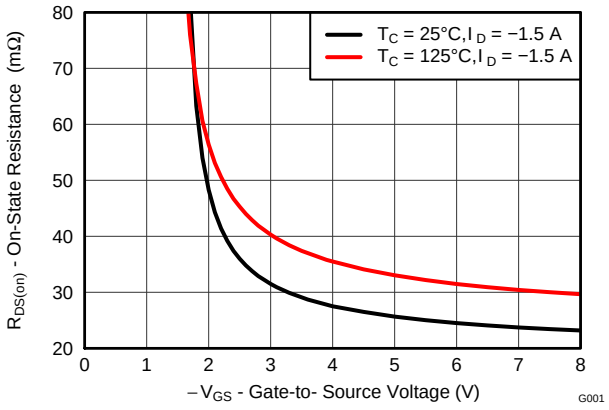
Absolute Maximum Ratings

T_A = 25°C		VALUE	UNIT
V_{DS}	Drain-to-Source Voltage	–20	V
V_{GS}	Gate-to-Source Voltage	±8	V
I_D	Continuous Drain Current(1)	–3.0	A
I_{DM}	Pulsed Drain Current(2)	–41	A
P_D	Power Dissipation	0.75	W
T_J, T_{stg}	Operating Junction and Storage Temperature Range	–55 to 150	°C

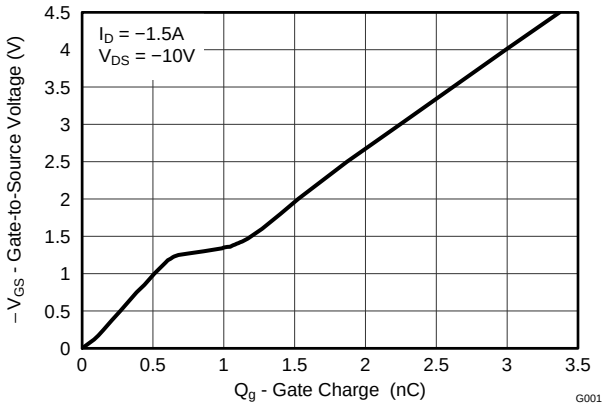
(1) Device operating at a temperature of 105ºC

(2) Typ $R_{\theta JA}$ = 165°C/W, Pulse width ≤100 µs, duty cycle ≤1%

$R_{DS(on)}$ 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.

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4 Revision History

Changes from Original (July 2014) to Revision A **Page**

- Reduced power dissipation rating to 0.75 W (min Cu calculation) ... 1
- Corrected Min Thermal Information from 85 to 165 ... 3
- Corrected Max Thermal Information from 165 to 85 ... 3
- Updated the mechanical drawing to add more precision ... 8

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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	–20			V
I_{DSS}	Drain-to-Source Leakage Current	V_{GS} = 0 V, V_{DS} = –16 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	–0.55	–0.8	–1.15	V
$R_{DS(on)}$	Drain-to-Source On-Resistance	V_{GS} = –1.8 V, I_D = –1.5 A		65	92	mΩ
		V_{GS} = –2.5 V, I_D = –1.5 A		36	45.5	mΩ
		V_{GS} = –4.5 V, I_D = –1.5 A		27	32.5	mΩ
g_{fs}	Transconductance	V_{DS} = –10 V, I_D = –1.5 A		12		S
DYNAMIC CHARACTERISTICS						
C_{ISS}	Input Capacitance	V_{GS} = 0 V, V_{DS} = –10 V, f = 1 MHz		458	595	pF
C_{OSS}	Output Capacitance			231	300	pF
C_{RSS}	Reverse Transfer Capacitance			12	15.6	pF
Q_g	Gate Charge Total (–4.5 V)	V_{DS} = –10 V, I_D = –1.5 A		3.3	4.4	nC
Q_{gd}	Gate Charge Gate-to-Drain			0.5		nC
Q_{gs}	Gate Charge Gate-to-Source			0.7		nC
$Q_{g(th)}$	Gate Charge at V_{th}			0.4		nC
Q_{OSS}	Output Charge	V_{DS} = –10 V, V_{GS} = 0 V		3.7		nC
$t_{d(on)}$	Turn On Delay Time	V_{DS} = –10 V, V_{GS} = –4.5 V, I_D = –1.5 A, R_G = 20 Ω		6		ns
t_r	Rise Time			4		ns
$t_{d(off)}$	Turn Off Delay Time			24		ns
t_f	Fall Time			10		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}= –10 V, I_F = –1.5 A, di/dt = 200 A/µs		7.2		nC
t_{rr}	Reverse Recovery Time	V_{DS}= –10 V, I_F = –1.5 A, di/dt = 200 A/µs		11.6		ns

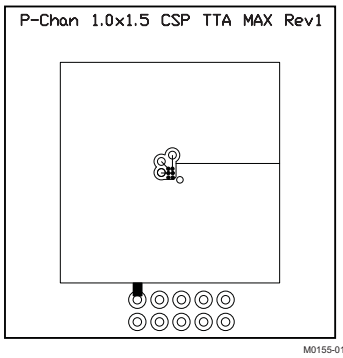
5.2 Thermal Information

(T_A = 25°C unless otherwise stated)

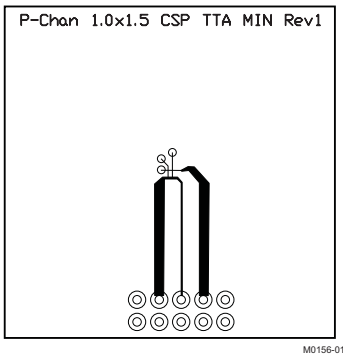
THERMAL METRIC		MIN	TYP	MAX	UNIT
$R_{\theta JA}$	Junction-to-Ambient Thermal Resistance(1)		165		°C/W
	Junction-to-Ambient Thermal Resistance(2)		85		

(1) Device mounted on FR4 material with minimum Cu mounting area.
(2) Device mounted on FR4 material with 1-inch^2 (6.45-cm^2), 2-oz. (0.071-mm thick) Cu.

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Typ $R_{\theta JA}$ = 85°C/W when mounted on 1 inch^2 of 2 oz. Cu.



Typ $R_{\theta JA}$ = 165°C/W when mounted on minimum pad area of 2 oz. Cu.

5.3 Typical MOSFET Characteristics

(T_A = 25°C unless otherwise stated)

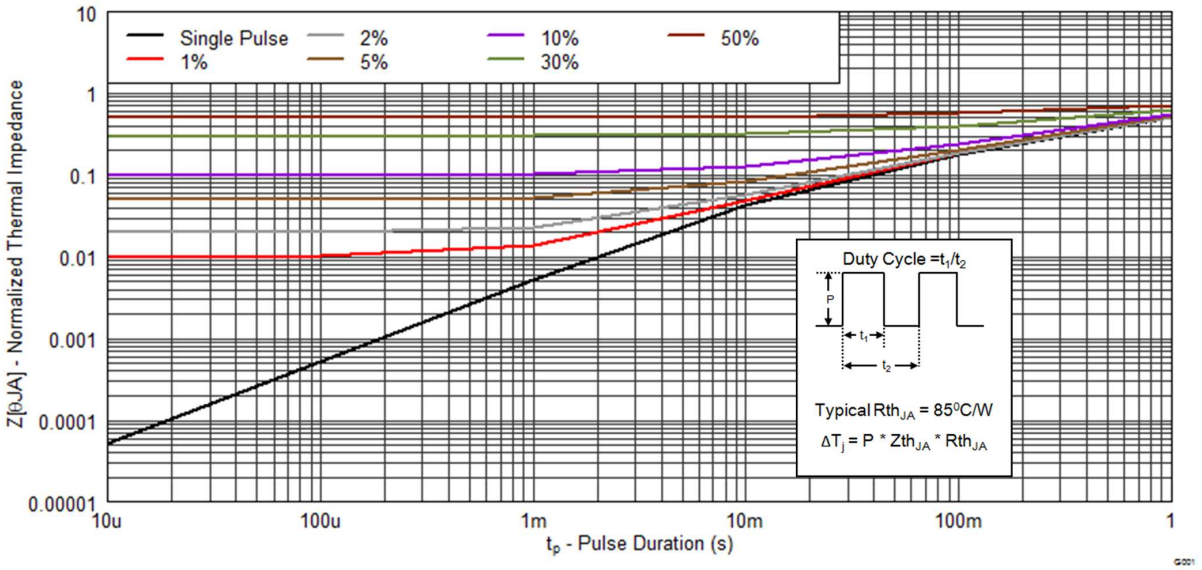


Figure 1. Transient Thermal Impedance

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Typical MOSFET Characteristics (continued)

(T_A = 25°C unless otherwise stated)

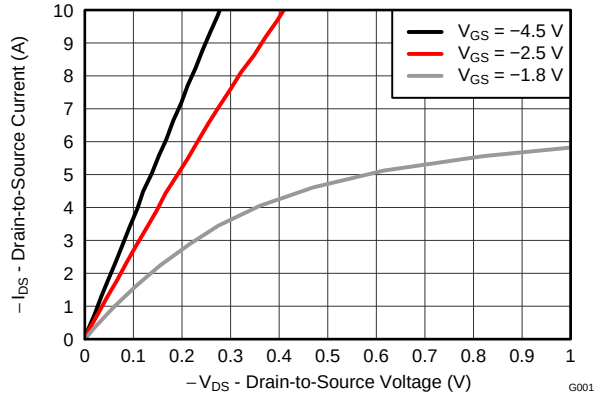


Figure 2. Saturation Characteristics

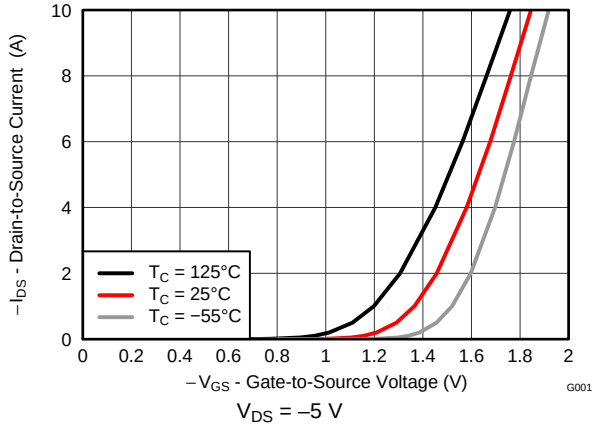


Figure 3. Transfer Characteristics

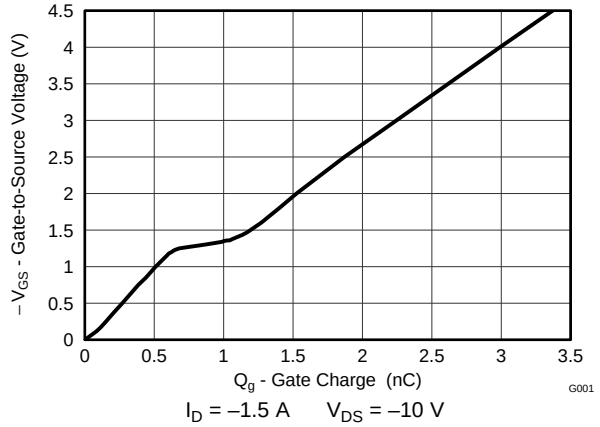


Figure 4. Gate Charge

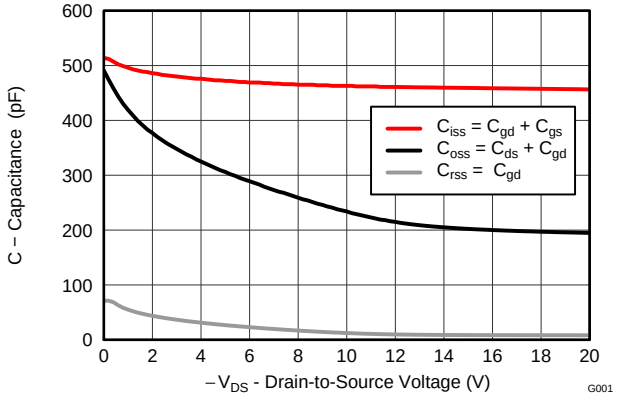


Figure 5. Capacitance

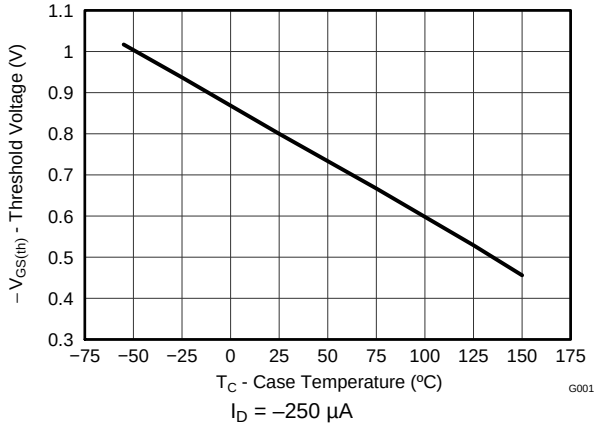


Figure 6. Threshold Voltage vs Temperature

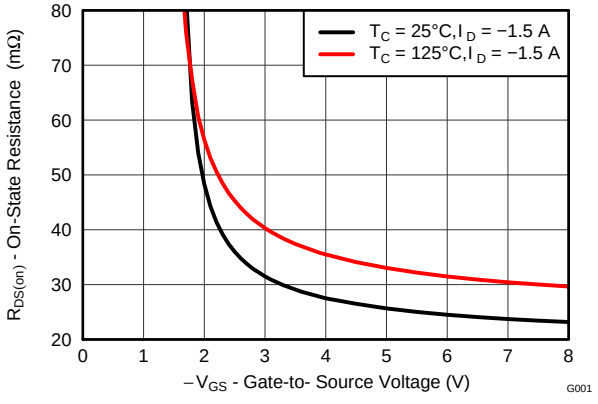


Figure 7. On-State Resistance vs Gate-to-Source Voltage

Typical MOSFET Characteristics (continued)

(T_A = 25°C unless otherwise stated)

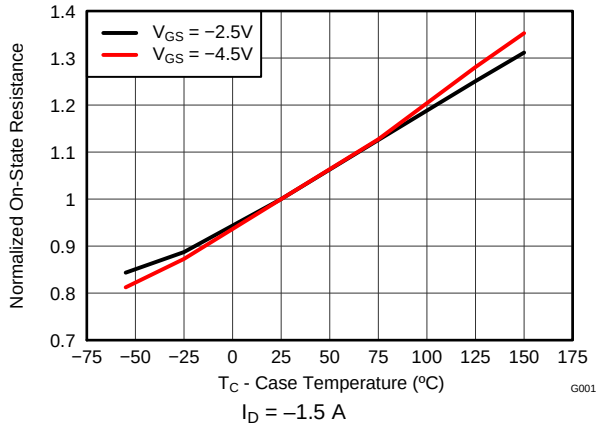


Figure 8. Normalized On-State Resistance vs Temperature

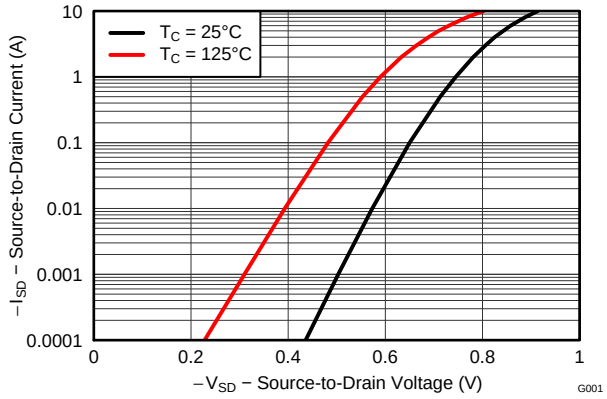


Figure 9. Typical Diode Forward Voltage

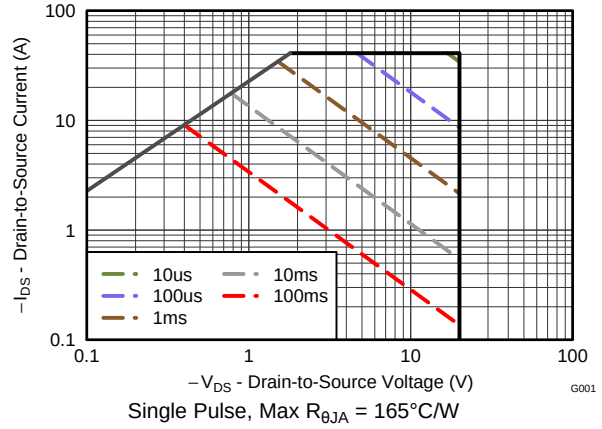


Figure 10. Maximum Safe Operating Area

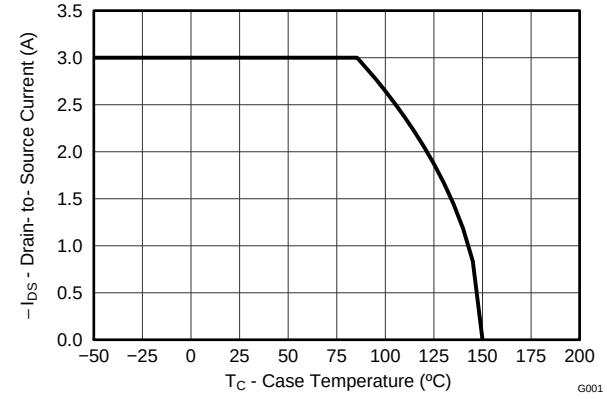


Figure 11. Maximum Drain Current vs Temperature

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6 Device and Documentation Support

6.1 Trademarks

NexFET is a trademark of Texas Instruments.

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*.

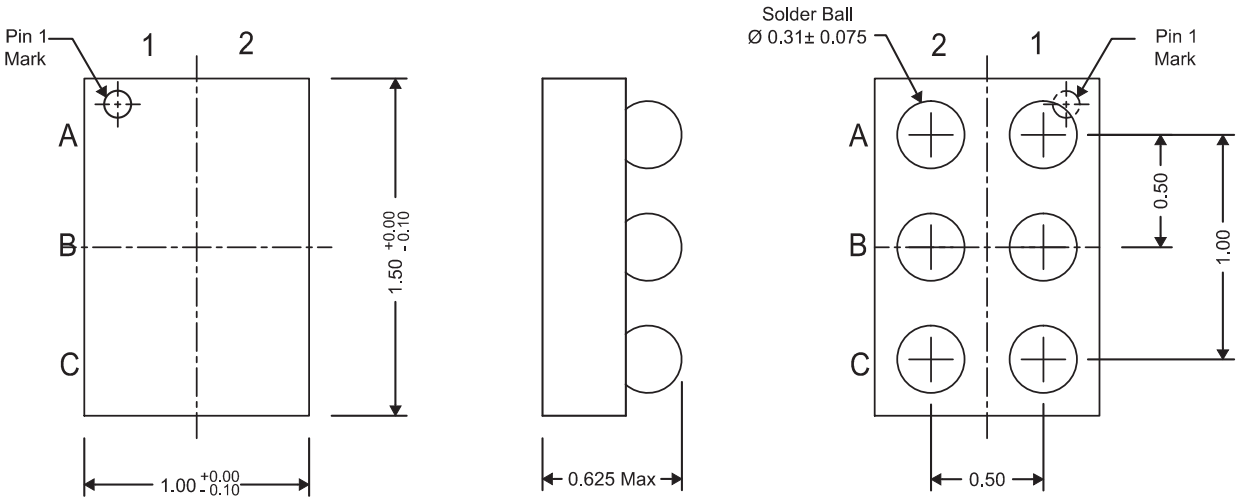
This glossary lists and explains terms, acronyms, and definitions.

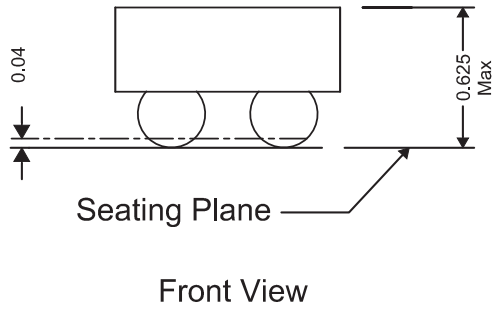
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7 Mechanical, Packaging, and Orderable Information

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 CSD25304W1015 Package Dimensions





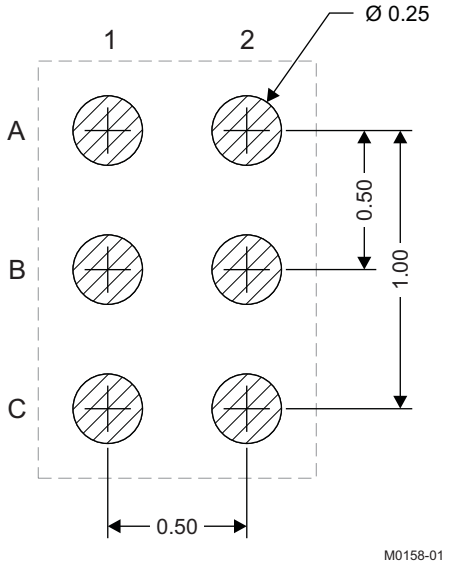
NOTE: All dimensions are in mm (unless otherwise specified).

Pinout

Position	Designation
C1, C2	Drain
A1	Gate
A2, B1, B2	Source

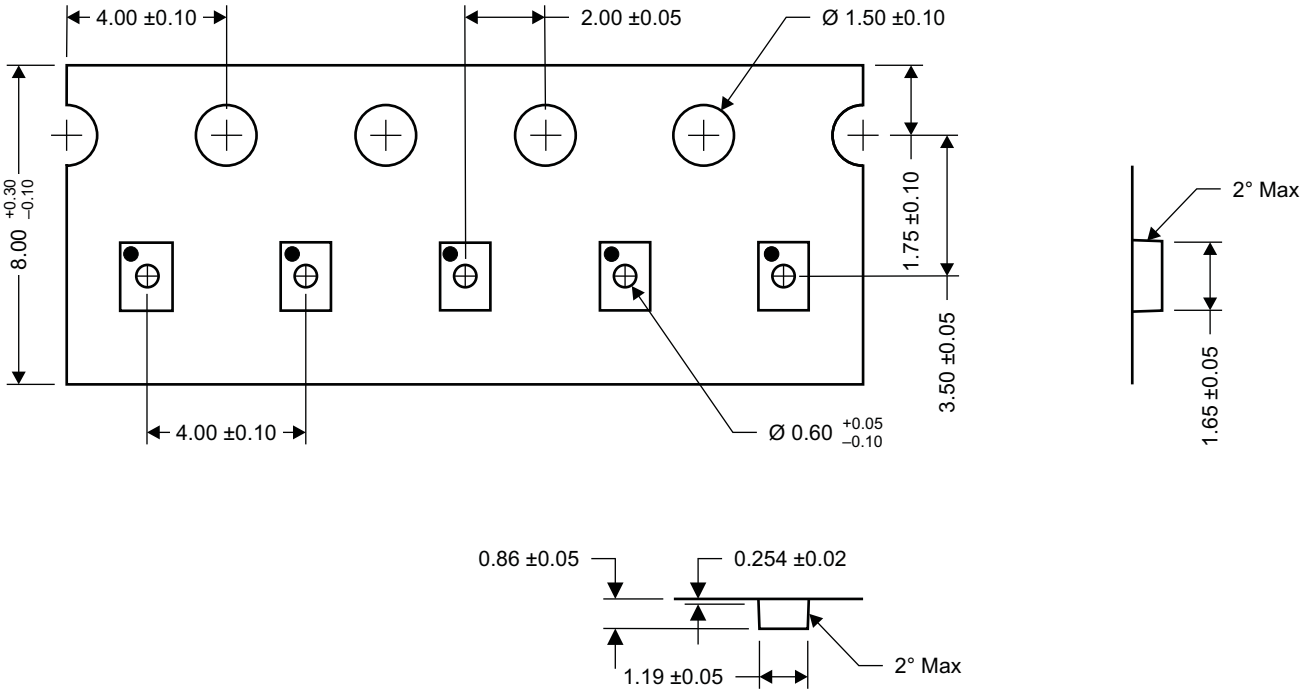
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7.2 Land Pattern Recommendation



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
CSD25304W1015	ACTIVE	DSBGA	YZC	6	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM		25304	Samples
CSD25304W1015T	ACTIVE	DSBGA	YZC	6	250	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-55 to 150	25304	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/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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