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

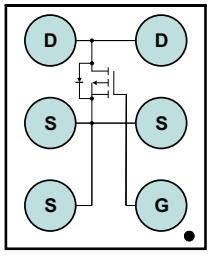
2 Applications

- 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.

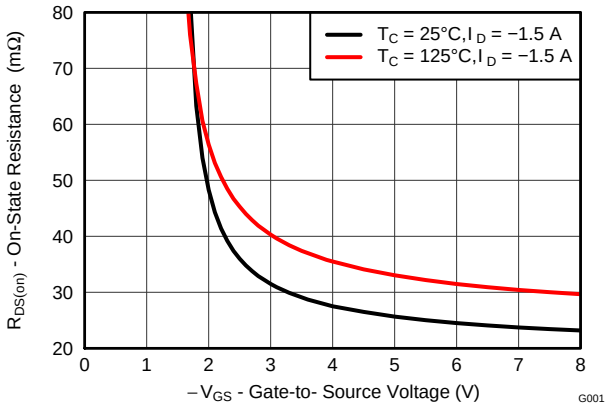
Absolute Maximum Ratings

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

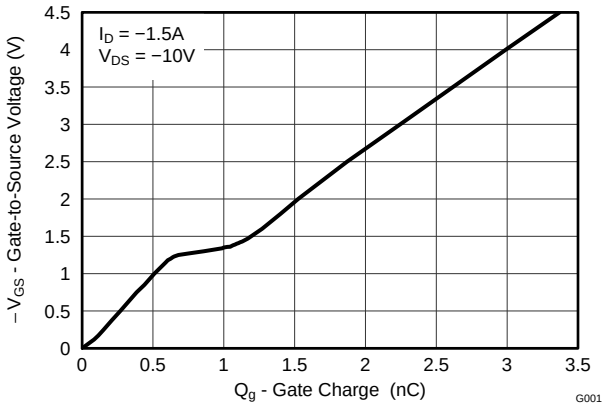
(1) Device operating at a temperature of 105ºC

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

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



Gate Charge



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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

5 Specifications

5.1 Electrical Characteristics

(T_A = 25°C unless otherwise stated)

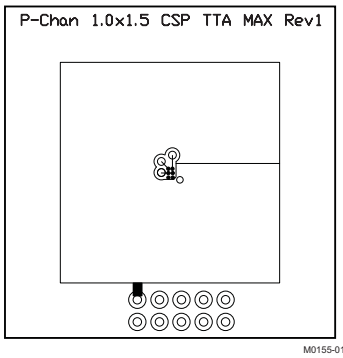
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
STATIC CHARACTERISTICS						
BV_{DSS}	Drain-to-Source Voltage	V_{GS} = 0 V, I_D = –250 µA	–20			V
I_{DSS}	Drain-to-Source Leakage Current	V_{GS} = 0 V, V_{DS} = –16 V			–1	µA
I_{GSS}	Gate-to-Source Leakage Current	V_{DS} = 0 V, V_{GS} = ±8 V			–100	nA
$V_{GS(th)}$	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

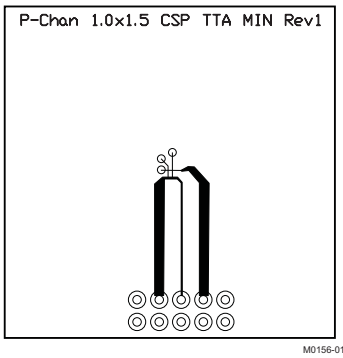
(T_A = 25°C unless otherwise stated)

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.



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)

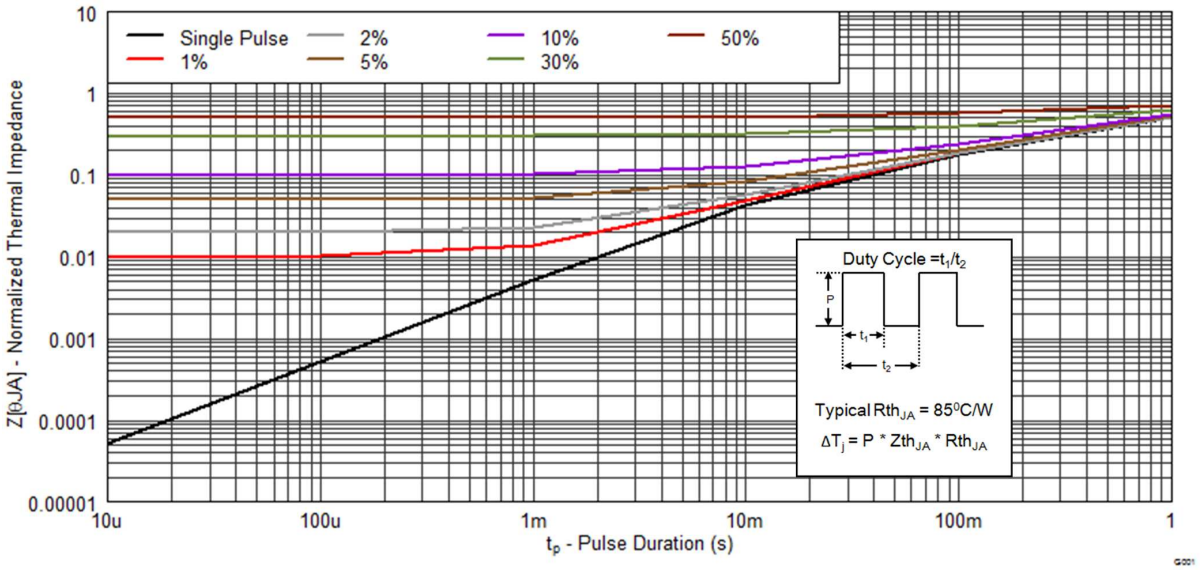


Figure 1. Transient Thermal Impedance

Typical MOSFET Characteristics (continued)

(T_A = 25°C unless otherwise stated)

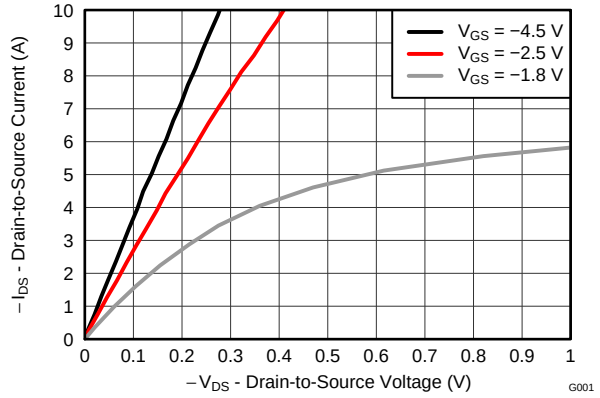


Figure 2. Saturation Characteristics

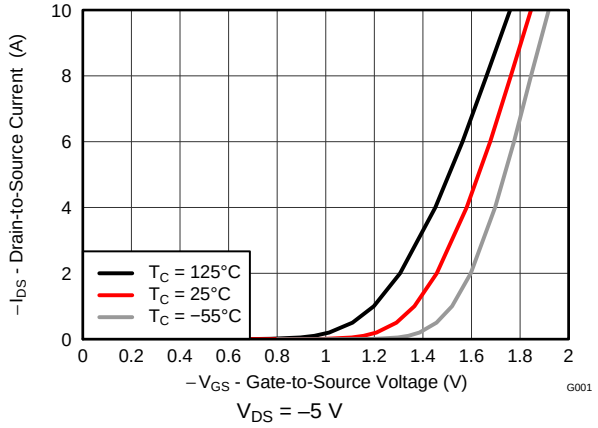


Figure 3. Transfer Characteristics

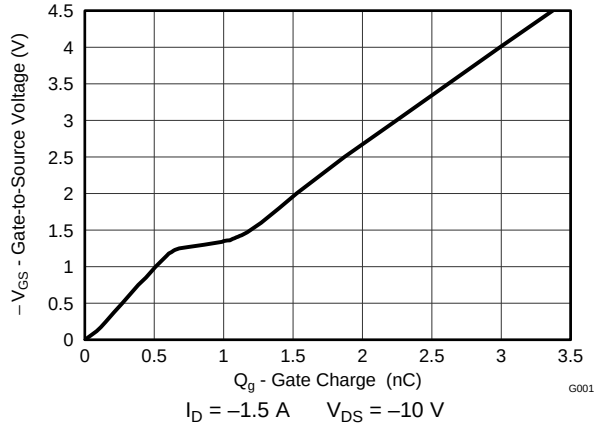


Figure 4. Gate Charge

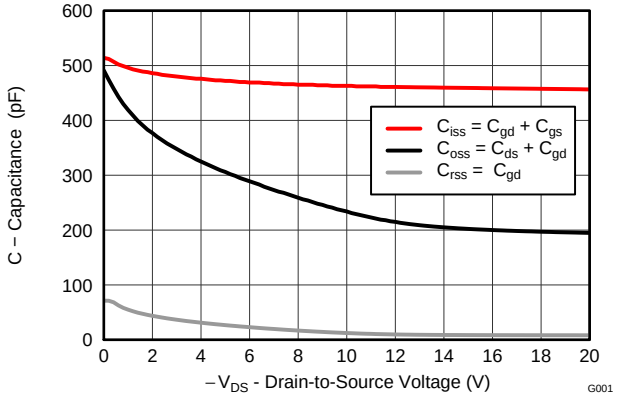


Figure 5. Capacitance

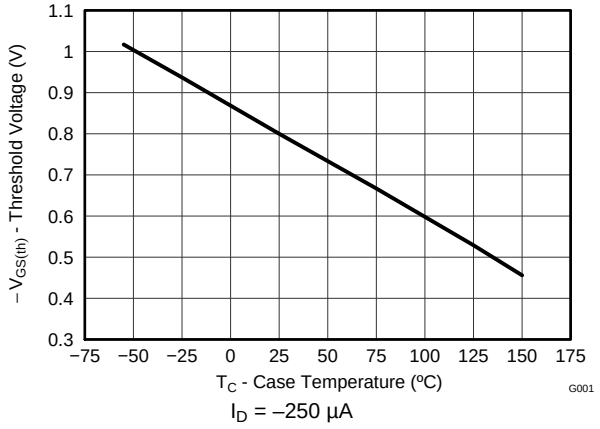


Figure 6. Threshold Voltage vs Temperature

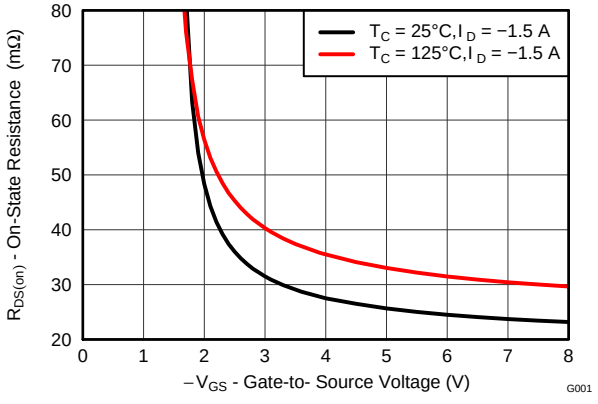


Figure 7. On-State Resistance vs Gate-to-Source Voltage

Typical MOSFET Characteristics (continued)

(T_A = 25°C unless otherwise stated)

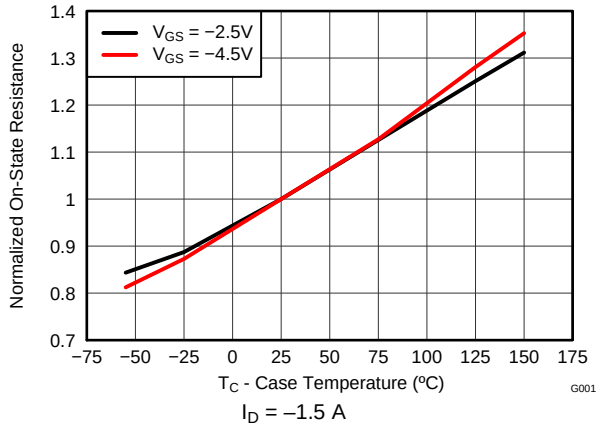


Figure 8. Normalized On-State Resistance vs Temperature

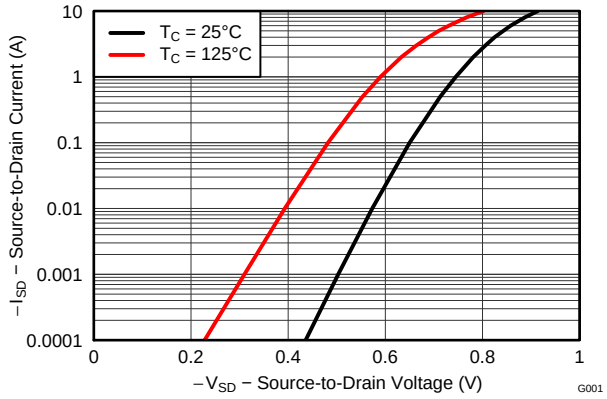


Figure 9. Typical Diode Forward Voltage

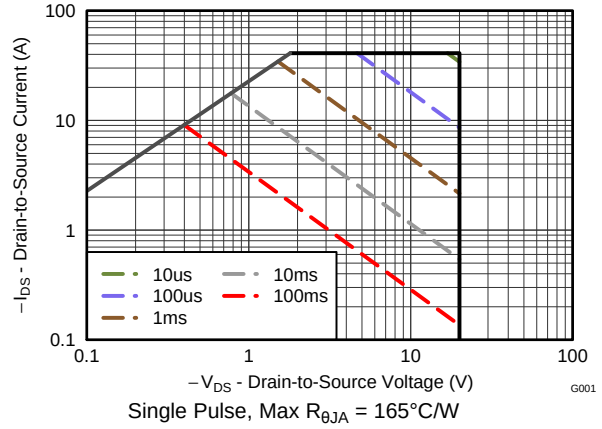


Figure 10. Maximum Safe Operating Area

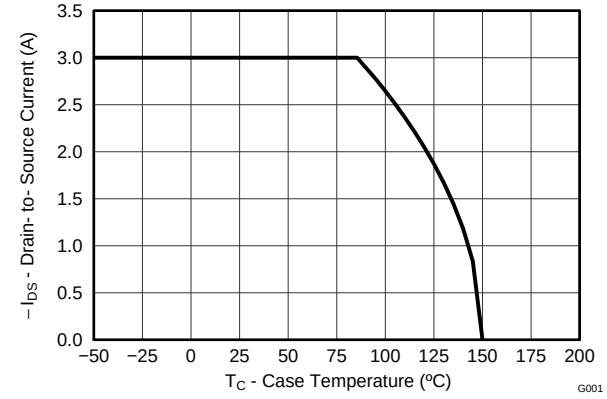


Figure 11. Maximum Drain Current vs Temperature

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

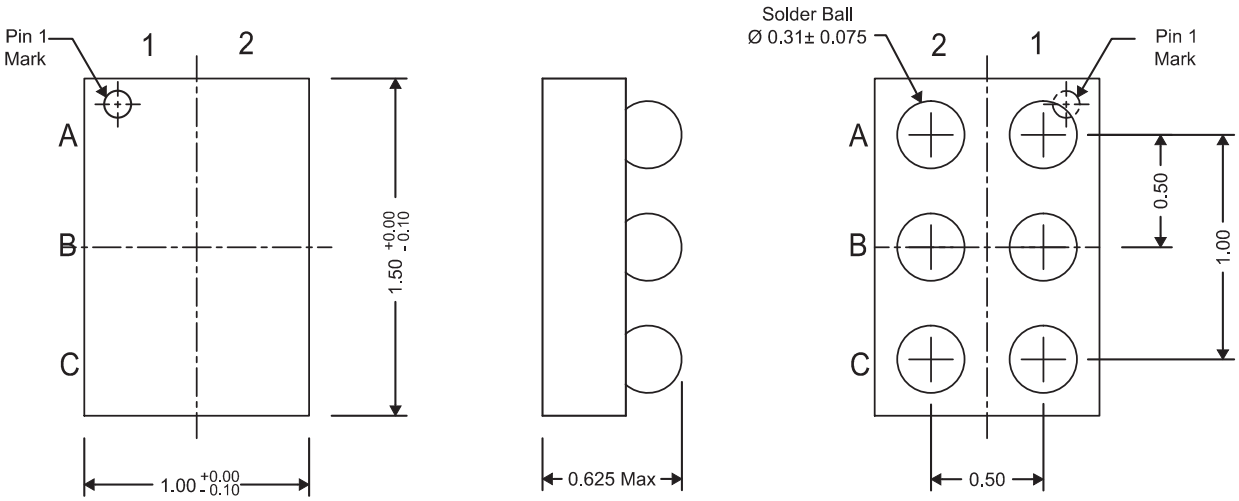
SLYZ022 — *TI Glossary*.

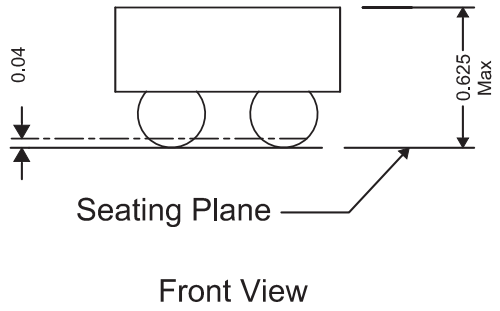
This glossary lists and explains terms, acronyms, and definitions.

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



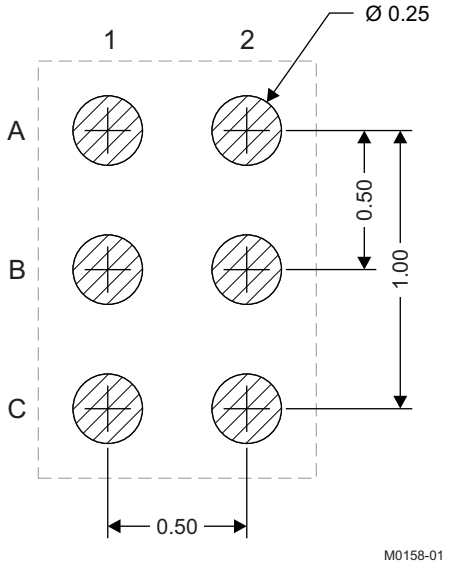


NOTE: All dimensions are in mm (unless otherwise specified).

Pinout

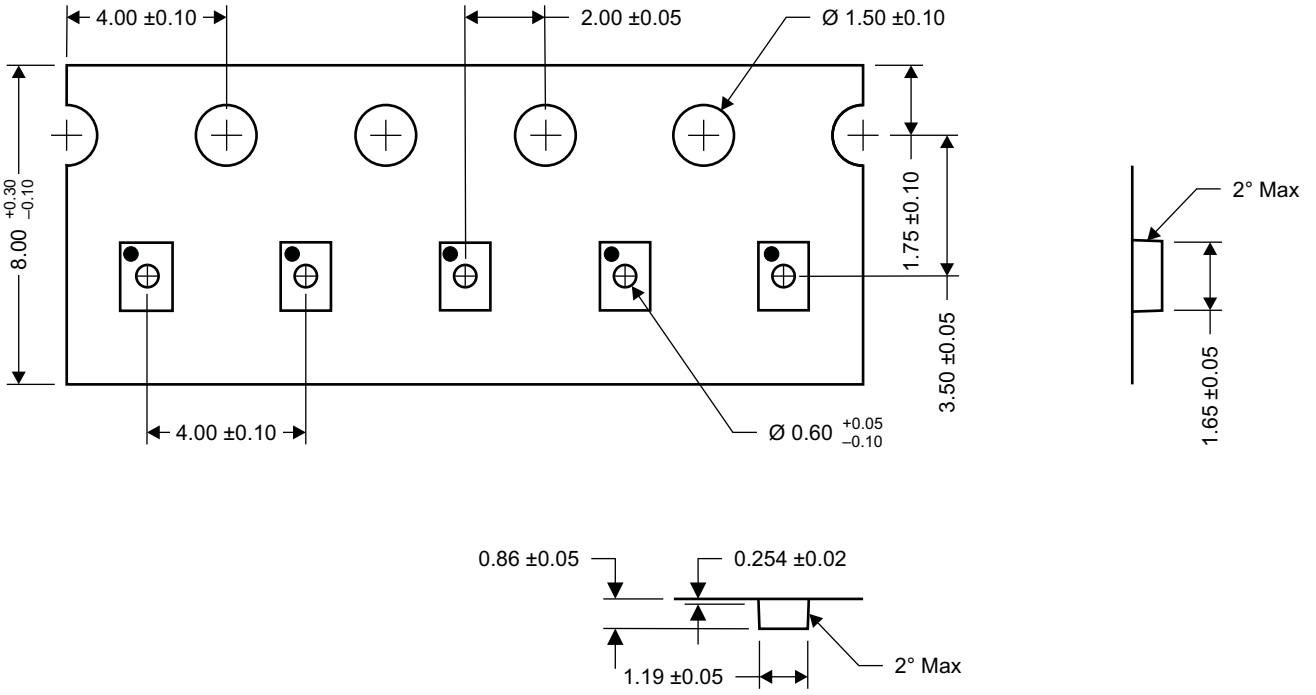
Position	Designation
C1, C2	Drain
A1	Gate
A2, B1, B2	Source

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 part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
CSD25304W1015	Active	Production	DSBGA (YZC) | 6	3000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-	25304
CSD25304W1015.B	Active	Production	DSBGA (YZC) | 6	3000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-55 to 150	25304
CSD25304W1015T	Active	Production	DSBGA (YZC) | 6	250 | SMALL T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-55 to 150	25304
CSD25304W1015T.B	Active	Production	DSBGA (YZC) | 6	250 | SMALL T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-55 to 150	25304

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **Lead finish/Ball material:** Parts 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.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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