

# CSD22205L –8-V P-Channel NexFET™ Power MOSFET

## 1 Features

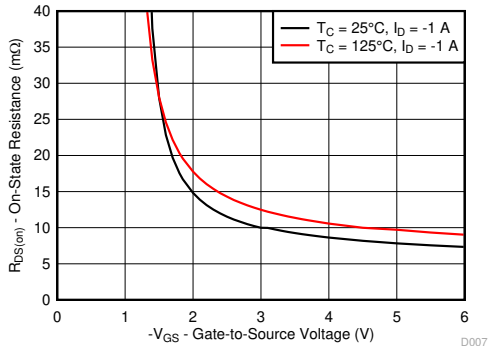
- Low resistance
- Small footprint 1.2 mm × 1.2 mm
- Low profile 0.36-mm height
- Lead free
- Gate-source voltage clamp
- Gate ESD protection
- RoHS compliant
- Halogen free

## 2 Applications

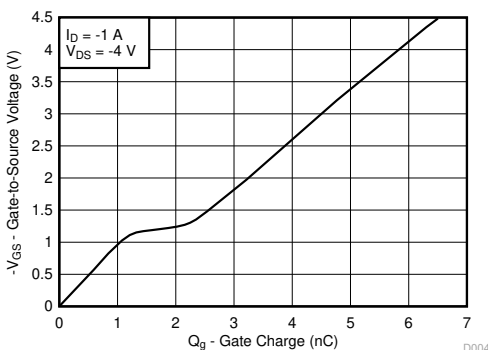
- Battery management
- Load switch
- Battery protection

## 3 Description

This –8-V, 8.2-mΩ, 1.2-mm × 1.2-mm Land Grid Array (LGA) NexFET™ device has been designed to deliver the lowest on-resistance and gate charge in the smallest outline possible with excellent thermal characteristics in an ultra-low profile. The Land Grid Array (LGA) package is a silicon chip scale package with metal pads instead of solder balls.



**R<sub>DS(on)</sub> vs V<sub>GS</sub>**



**R<sub>DS(on)</sub> vs V<sub>GS</sub>**

## Product Summary

T <sub>A</sub> = 25°C		VALUE	UNIT
V <sub>DS</sub>	Drain-to-Source Voltage	–8	V
Q <sub>g</sub>	Gate Charge Total (–4.5 V)	6.5	nC
Q <sub>gd</sub>	Gate Charge Gate-to-Drain	1.0	nC
R <sub>D<sub>DS</sub>(on)</sub>	Drain-to-Source On-Resistance	V <sub>GS</sub> = –1.5 V	30
		V <sub>GS</sub> = –1.8 V	20
		V <sub>GS</sub> = –2.5 V	11.5
		V <sub>GS</sub> = –4.5 V	8.2
V <sub>GS(th)</sub>	Threshold Voltage	–0.7	V

## Device Information<sup>(1)</sup>

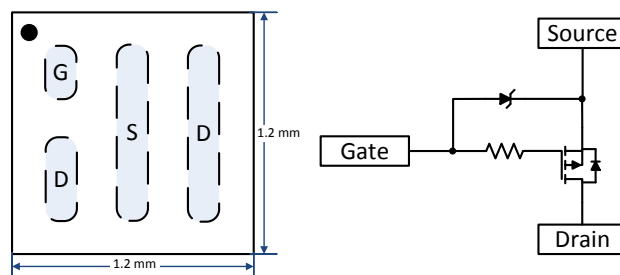
DEVICE	QTY	MEDIA	PACKAGE	SHIP
CSD22205L	3000	7-Inch Reel	1.20-mm × 1.20-mm Land Grid Array Package	Tape and Reel
CSD22205LT	250			

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

## Absolute Maximum Ratings

T <sub>A</sub> = 25°C		VALUE	UNIT
V <sub>DS</sub>	Drain-to-Source Voltage	–8	V
V <sub>GS</sub>	Gate-to-Source Voltage	–6	V
I <sub>D</sub>	Continuous Drain Current <sup>(1)</sup>	–7.4	A
I <sub>DM</sub>	Pulsed Drain Current <sup>(2)</sup>	–71	A
P <sub>D</sub>	Power Dissipation <sup>(1)</sup>	0.6	W
T <sub>J</sub> , T <sub>stg</sub>	Operating Junction Temperature, Storage Temperature	–55 to 150	°C

- (1) Min Cu R<sub>θJA</sub> = 225°C/W.  
 (2) Pulse width ≤ 100 μs, duty cycle ≤ 1%.



**Figure 3-1. Top View and Circuit Configuration**



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## 4 Revision History

<b>Changes from Revision A (August 2017) to Revision B (February 2022)</b>	<b>Page</b>
• Changed ultra-low profile bullet from 0.35 mm to 0.36 mm in height.....	1
• Changed CSD22205L Package Dimensions image height from 0.35 mm to 0.36 mm.....	8

<b>Changes from Revision * (May 2017) to Revision A (August 2017)</b>	<b>Page</b>
• Changed the units for timing parameters from $\mu\text{s}$ : to ns (nanoseconds) in the <a href="#">Section 5.1</a> table.....	3

## 5 Specifications

### 5.1 Electrical Characteristics

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

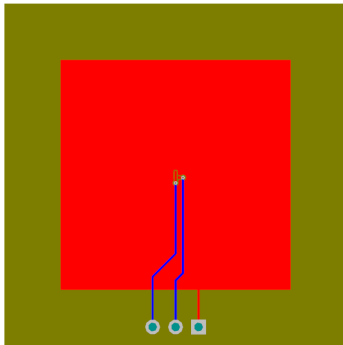
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>STATIC CHARACTERISTICS</b>						
$B_{V_{DS}}$	Drain-to-source voltage	$V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$	-8			V
$I_{DSS}$	Drain-to-source leakage current	$V_{GS} = 0\text{ V}, V_{DS} = -6.4\text{ V}$			-100	nA
$I_{GSS}$	Gate-to-source leakage current	$V_{DS} = 0\text{ V}, V_{GS} = -6\text{ V}$			-100	nA
$V_{GS(th)}$	Gate-to-source threshold voltage	$V_{DS} = V_{GS}, I_D = -250\ \mu\text{A}$	-0.4	-0.7	-1.05	V
$R_{DS(on)}$	Drain-to-source on-resistance	$V_{GS} = -1.5\text{ V}, I_D = -0.2\text{ A}$		30		m $\Omega$
		$V_{GS} = -1.8\text{ V}, I_D = -1\text{ A}$		20	40	
		$V_{GS} = -2.5\text{ V}, I_D = -1\text{ A}$		11.5	15.0	
		$V_{GS} = -4.5\text{ V}, I_D = -1\text{ A}$		8.2	9.9	
$g_{fs}$	Transconductance	$V_{DS} = -0.8\text{ V}, I_D = -1\text{ A}$		10.4		S
<b>DYNAMIC CHARACTERISTICS</b>						
$C_{ISS}$	Input capacitance	$V_{GS} = 0\text{ V}, V_{DS} = -4\text{ V}, f = 1\text{ MHz}$		1070	1390	pF
$C_{OSS}$	Output capacitance			560	730	pF
$C_{RSS}$	Reverse transfer capacitance			190	250	pF
$R_G$	Series gate resistance			30		$\Omega$
$Q_g$	Gate charge total (-4.5 V)	$V_{DS} = -4\text{ V}, I_D = -1\text{ A}$		6.5	8.5	nC
$Q_{gd}$	Gate charge gate-to-drain			1.0		nC
$Q_{gs}$	Gate charge gate-to-source			1.2		nC
$Q_{g(th)}$	Gate charge at $V_{th}$			0.7		nC
$Q_{OSS}$	Output charge	$V_{DS} = -4\text{ V}, V_{GS} = 0\text{ V}$		4.1		nC
$t_{d(on)}$	Turnon delay time	$V_{DS} = -4\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -1\text{ A}, R_G = 0\ \Omega$		30		ns
$t_r$	Rise time			14		ns
$t_{d(off)}$	Turnoff delay time			70		ns
$t_f$	Fall time			32		ns
<b>DIODE CHARACTERISTICS</b>						
$V_{SD}$	Diode forward voltage	$I_S = -1\text{ A}, V_{GS} = 0\text{ V}$		-0.68	-1.0	V
$Q_{rr}$	Reverse recovery charge	$V_{DS} = -4\text{ V}, I_F = -1\text{ A}, di/dt = 200\text{ A}/\mu\text{s}$		16		nC
$t_{rr}$	Reverse recovery time			38		ns

## 5.2 Thermal Information

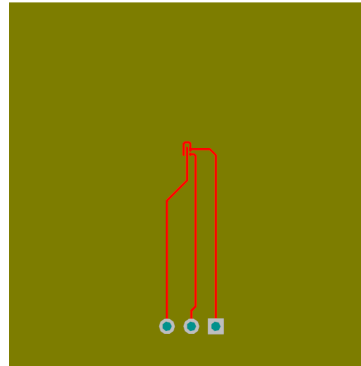
T<sub>A</sub> = 25°C (unless otherwise stated)

THERMAL METRIC		MIN	TYP	MAX	UNIT
R <sub>θJA</sub>	Junction-to-ambient thermal resistance <sup>(2)</sup>		75		°C/W
	Junction-to-ambient thermal resistance <sup>(1)</sup>		225		

- (1) Device mounted on FR4 material with minimum Cu mounting area.
- (2) Device mounted on FR4 material with 1-in<sup>2</sup> (6.45-cm<sup>2</sup>), 2-oz (0.071-mm) thick Cu.



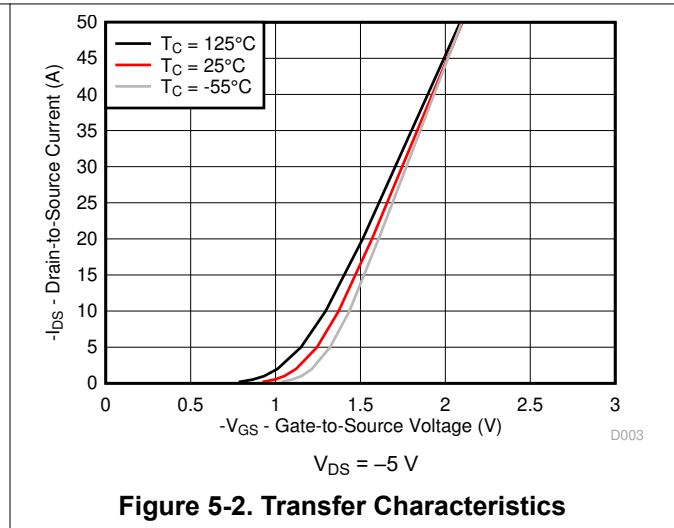
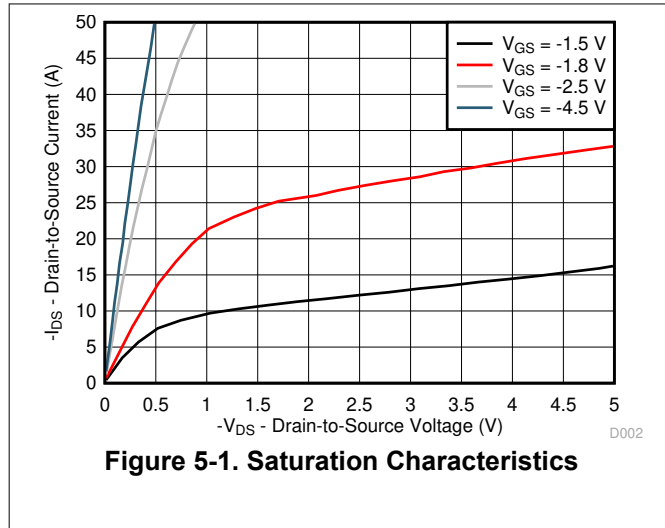
Typ R<sub>θJA</sub> = 75°C/W when mounted on 1 in<sup>2</sup> of 2-oz Cu.

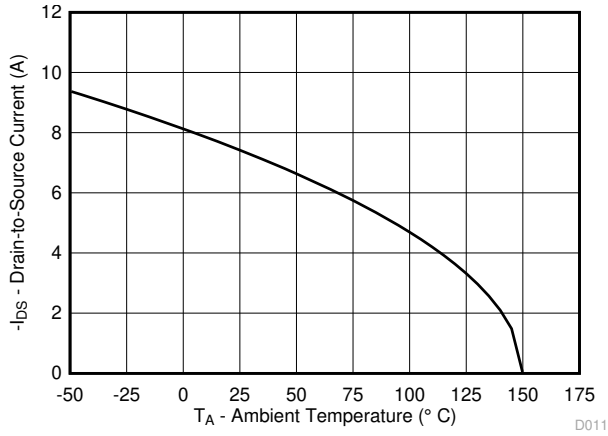


Typ R<sub>θJA</sub> = 225°C/W when mounted on minimum pad area of 2-oz Cu.

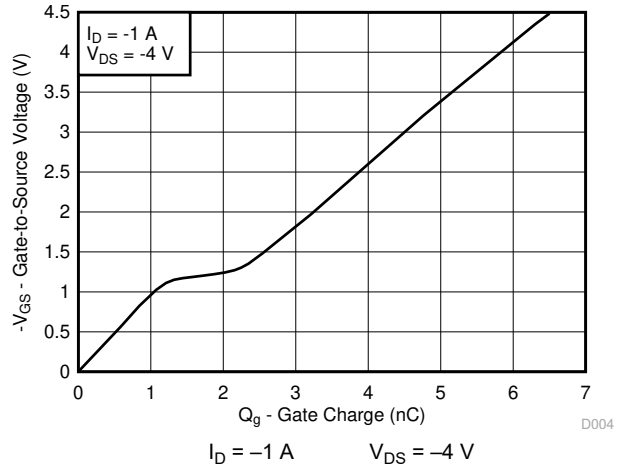
## 5.3 Typical MOSFET Characteristics

T<sub>A</sub> = 25°C (unless otherwise stated)

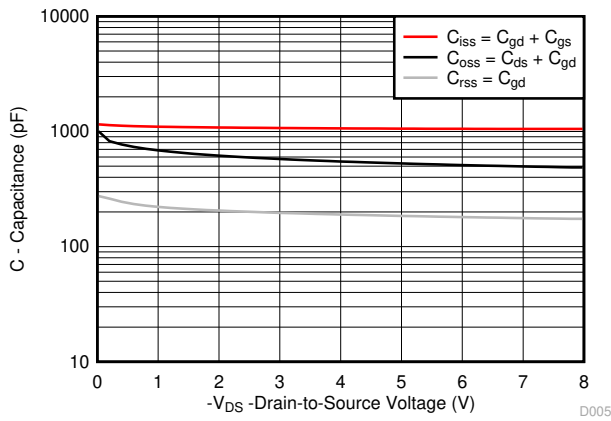




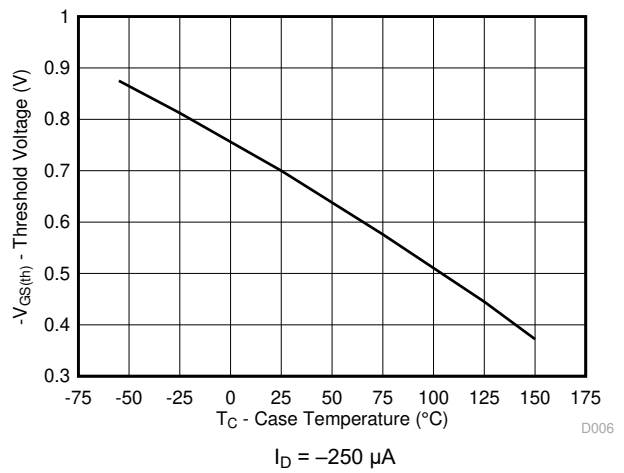
**Figure 5-3. Maximum Drain Current vs Temperature**



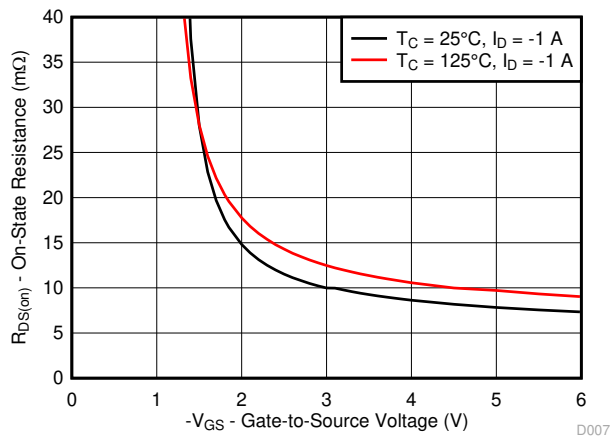
**Figure 5-4. Gate Charge**



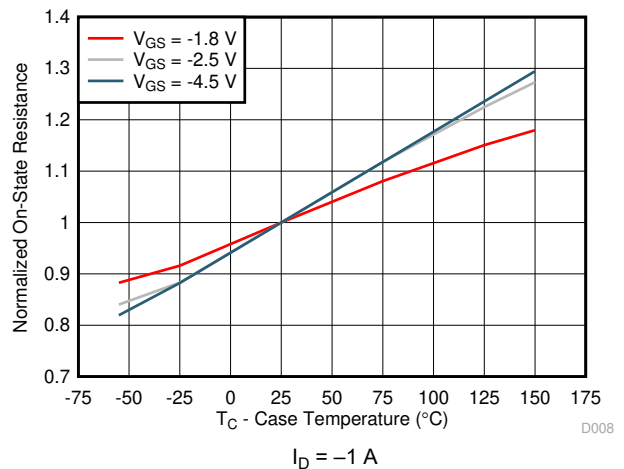
**Figure 5-5. Capacitance**



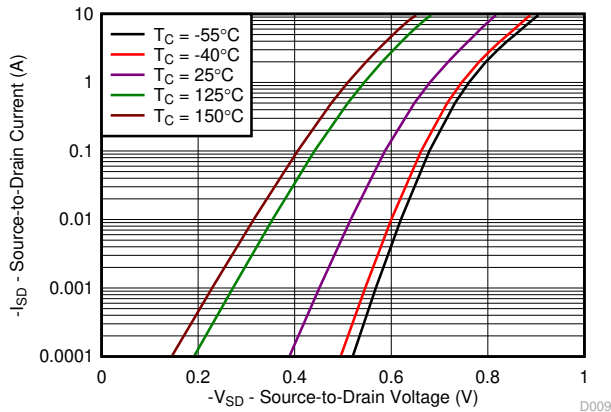
**Figure 5-6. Threshold Voltage vs Temperature**



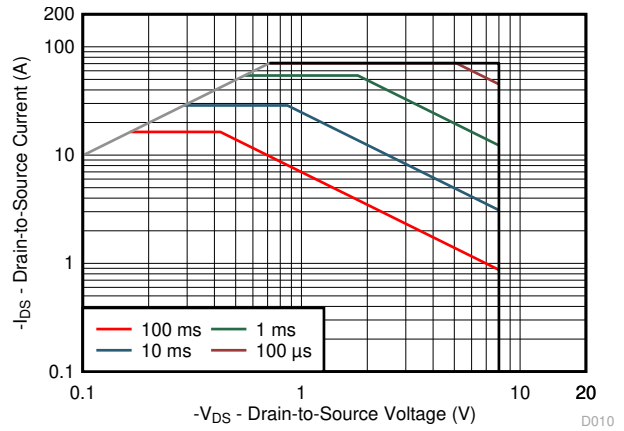
**Figure 5-7. On-State Resistance vs Gate-to-Source Voltage**



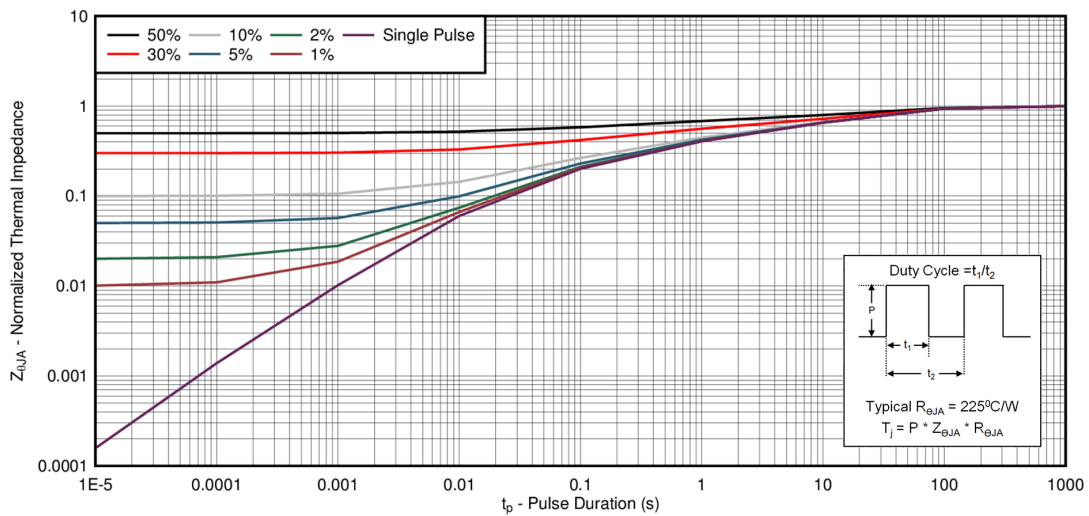
**Figure 5-8. Normalized On-State Resistance vs Temperature**



**Figure 5-9. Typical Diode Forward Voltage**



**Figure 5-10. Maximum Safe Operating Area**



**Figure 5-11. Transient Thermal Impedance**

## **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.

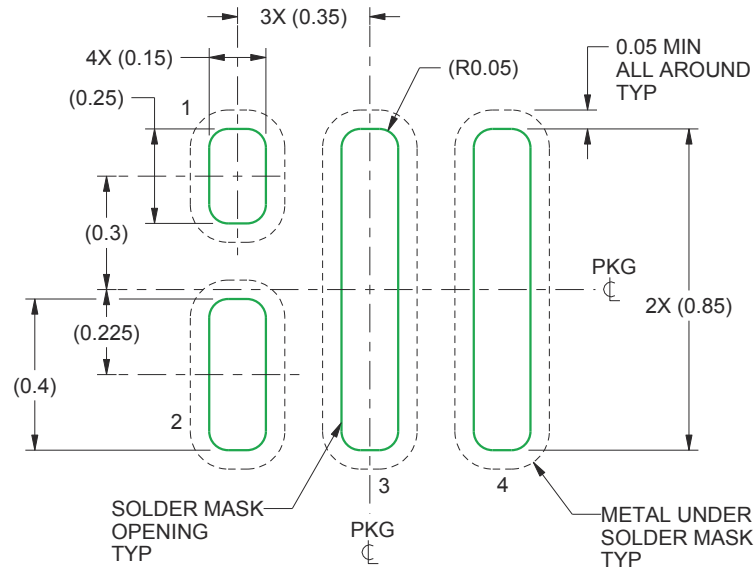
### **6.2 Trademarks**

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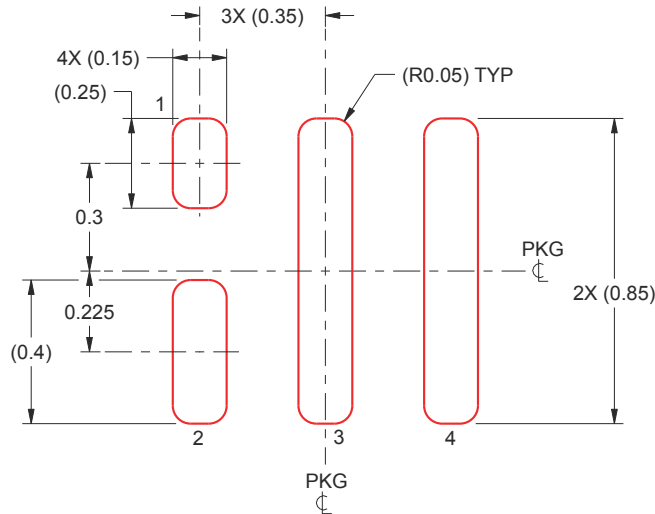




## 7.2 Land Pattern Recommendation



## 7.3 Stencil Recommendation



- A. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

**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
CSD22205L	ACTIVE	PICOSTAR	YMG	4	3000	RoHS & Green	NIAU	Level-1-260C-UNLIM	-55 to 150	205	<a href="#">Samples</a>
CSD22205LT	ACTIVE	PICOSTAR	YMG	4	250	RoHS & Green	NIAU	Level-1-260C-UNLIM	-55 to 150	205	<a href="#">Samples</a>

(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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**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
CSD22205L	PICOST AR	YMG	4	3000	180.0	8.4	1.26	1.26	0.42	4.0	8.0	Q1
CSD22205LT	PICOST AR	YMG	4	250	180.0	8.4	1.26	1.26	0.42	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)
CSD22205L	PICOSTAR	YMG	4	3000	182.0	182.0	20.0
CSD22205LT	PICOSTAR	YMG	4	250	182.0	182.0	20.0

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