

## P-Channel NexFET™ Power MOSFET

 Check for Samples: [CSD25303W1015](#)

### FEATURES

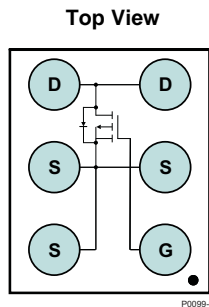
- Ultra Low Qg and Qgd
- Small Footprint
- Low Profile 0.62mm Height
- Pb Free
- RoHS Compliant
- Halogen Free
- CSP 1 × 1.5 mm Wafer Level Package

### APPLICATIONS

- Battery Management
- Load Switch
- Battery Protection

### DESCRIPTION

The 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.



### PRODUCT SUMMARY

$T_A = 25^\circ\text{C}$ unless otherwise stated		TYPICAL VALUE	UNIT
$V_{DS}$	Drain to Source Voltage	-20	V
$Q_g$	Gate Charge Total (4.5V)	3.3	nC
$Q_{gd}$	Gate Charge Gate to Drain	0.6	nC
$R_{DS(on)}$	Drain to Source On Resistance	$V_{GS} = -1.8\text{V}$	72 mΩ
		$V_{GS} = -2.5\text{V}$	56 mΩ
		$V_{GS} = -4.5\text{V}$	46 mΩ
$V_{GS(th)}$	Voltage Threshold	-0.65	V

### ORDERING INFORMATION

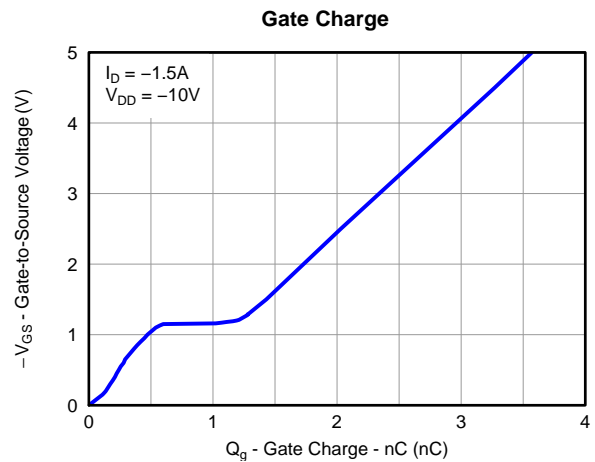
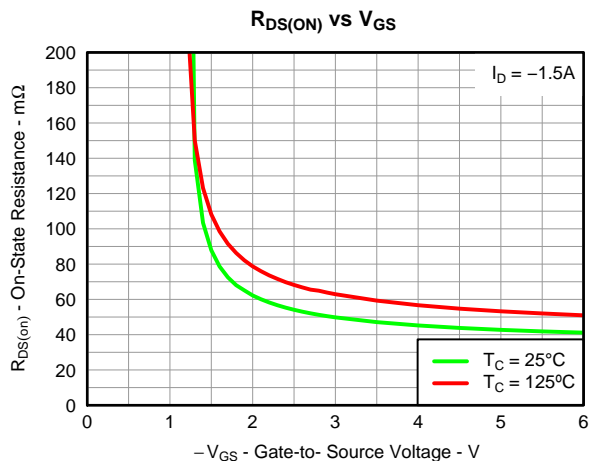
Device	Package	Media	Qty	Ship
CSD25303W1015	1 × 1.5 Wafer Level Package	7-inch reel	3000	Tape and Reel

### ABSOLUTE MAXIMUM RATINGS

$T_A = 25^\circ\text{C}$ unless otherwise stated		VALUE	UNIT
$V_{DS}$	Drain to Source Voltage	-20	V
$V_{GS}$	Gate to Source Voltage	±8	V
$I_D$	Continuous Drain Current, $T_C = 25^\circ\text{C}^{(1)}$	-3	A
$I_{DM}$	Pulsed Drain Current, $T_A = 25^\circ\text{C}^{(2)}$	-9	A
$P_D$	Power Dissipation <sup>(1)</sup>	1.5	W
$T_{STG}$	Storage Temperature Range	-55 to 150	°C
$T_J$	Operating Junction Temperature Range		

(1) Typical  $R_{\theta JA} = 90^\circ\text{C/W}$  on 1in<sup>2</sup> Cu (2 oz.) on 0.060" thick FR4 PCB.

(2) Pulse width ≤1ms, duty cycle ≤2%



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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.

## ELECTRICAL CHARACTERISTICS

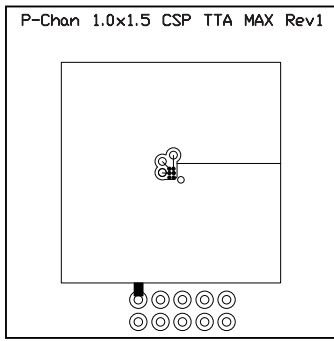
( $T_A = 25^\circ\text{C}$  unless otherwise stated)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>Static Characteristics</b>						
$BV_{DSS}$	Drain to Source Voltage	$V_{GS} = 0V, I_D = -250\mu A$	-20			V
$I_{DSS}$	Drain to Source Leakage Current	$V_{GS} = 0V, V_{DS} = -16V$			-1	$\mu A$
$I_{GSS}$	Gate to Source Leakage Current	$V_{DS} = 0V, V_{GS} = \pm 8V$			-100	nA
$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{DS} = V_{GS}, I_D = -250\mu A$	-0.4	-0.65	-1	V
$R_{DS(on)}$	Drain to Source On Resistance	$V_{GS} = -1.8V, I_D = -1.5A$		72	92	m $\Omega$
		$V_{GS} = -2.5V, I_D = -1.5A$		56	71	m $\Omega$
		$V_{GS} = -4.5V, I_D = -1.5A$		46	58	m $\Omega$
$g_{fs}$	Transconductance	$V_{DS} = -10V, I_D = -1.5A$		9.6		S
<b>Dynamic Characteristics</b>						
$C_{ISS}$	Input Capacitance	$V_{GS} = 0V, V_{DS} = -10V, f = 1MHz$		335	435	pF
$C_{OSS}$	Output Capacitance			149	191	pF
$C_{RSS}$	Reverse Transfer Capacitance			50	65	pF
$R_g$	Gate Charge Total (-4.5V)	$V_{DS} = -10V, I_D = -1.5A$		0.6	1.2	$\Omega$
$Q_g$	Gate Charge Total (-4.5V)			3.3	4.3	nC
$Q_{gd}$	Gate Charge Gate to Drain			0.6		nC
$Q_{gs}$	Gate Charge Gate to Source			0.6		nC
$Q_{g(th)}$	Gate Charge at $V_{th}$			0.3		nC
$Q_{OSS}$	Output Charge	$V_{DS} = -11V, V_{GS} = 0V$		2.5		nC
$t_{d(on)}$	Turn On Delay Time	$V_{DS} = -10V, V_{GS} = -4.5V, I_D = -1.5A$ $R_G = 4\Omega$		3.9		ns
$t_r$	Rise Time			8.6		ns
$t_{d(off)}$	Turn Off Delay Time			11.3		ns
$t_f$	Fall Time			7.8		ns
<b>Diode Characteristics</b>						
$V_{SD}$	Diode Forward Voltage	$I_S = -1.5A, V_{GS} = 0V$	-0.72		-1	V
$Q_{rr}$	Reverse Recovery Charge	$V_{dd} = -11V, I_F = -1.5A, di/dt = 200A/\mu s$		3.6		nC
$t_{rr}$	Reverse Recovery Time			11.3		ns

## THERMAL CHARACTERISTICS

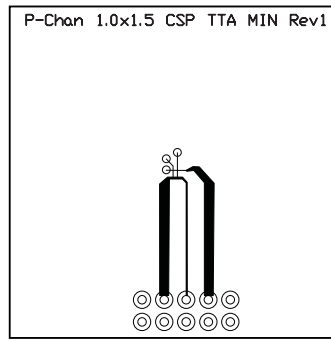
( $T_A = 25^\circ\text{C}$  unless otherwise stated)

PARAMETER		MIN	TYP	MAX	UNIT
$R_{\theta JA}$	Thermal Resistance Junction to Ambient (Minimum Cu area)			198	$^\circ\text{C}/\text{W}$
	Thermal Resistance Junction to Ambient (1 in <sup>2</sup> Cu area)			112	$^\circ\text{C}/\text{W}$



Max  $R_{\theta JA} = 112^{\circ}\text{C/W}$   
when mounted on 1  
 $\text{inch}^2$  of 2 oz. Cu.

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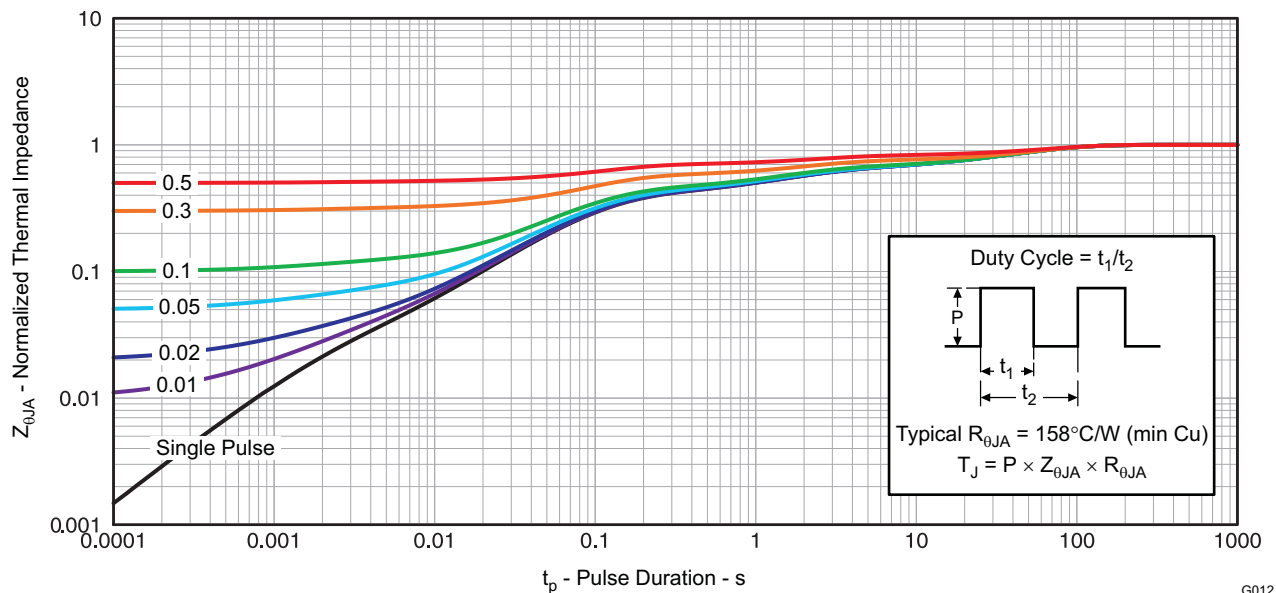


Max  $R_{\theta JA} = 198^{\circ}\text{C/W}$   
when mounted on  
minimum pad area of 2  
oz. Cu.

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### TYPICAL MOSFET CHARACTERISTICS

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

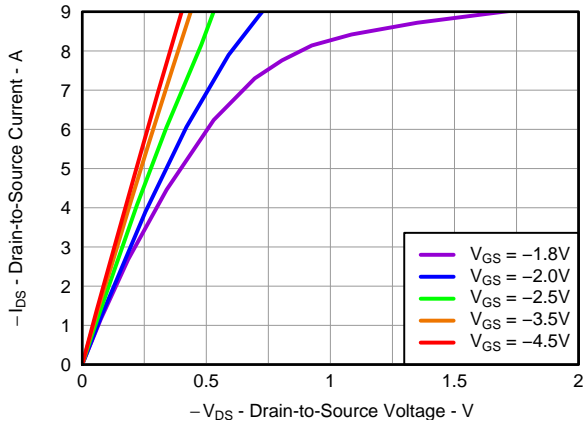


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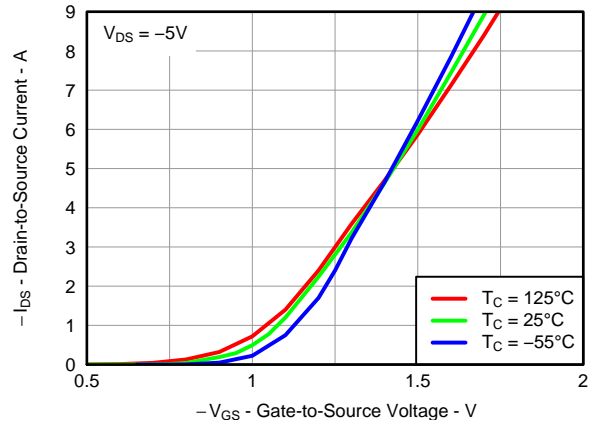
Figure 1. Transient Thermal Impedance

**TYPICAL MOSFET CHARACTERISTICS (continued)**

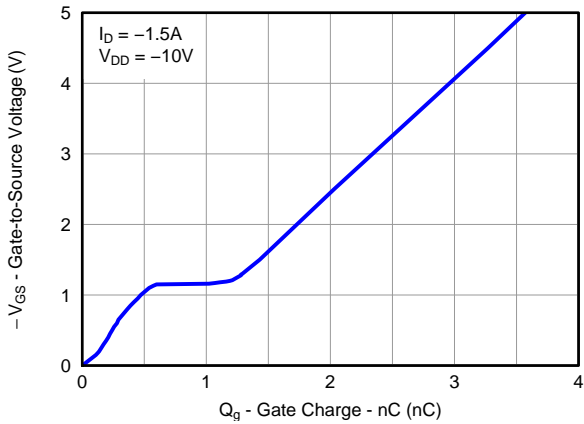
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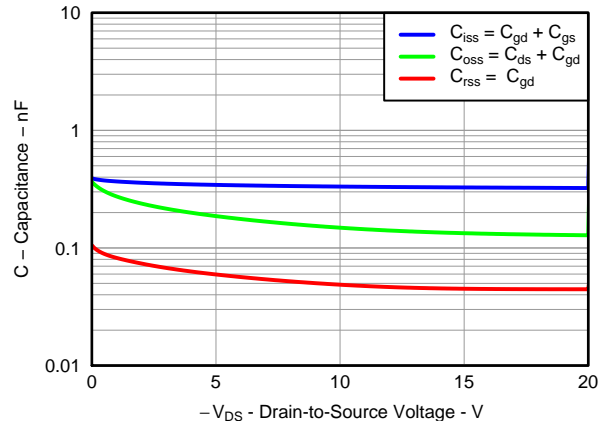
**Figure 2. Saturation Characteristics**



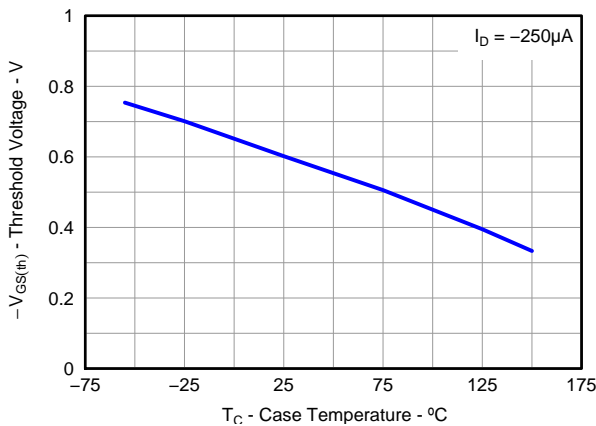
**Figure 3. Transfer Characteristics**



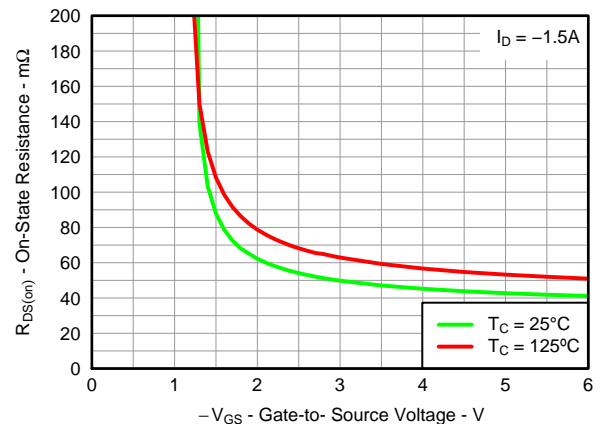
**Figure 4. Gate Charge**



**Figure 5. Capacitance**



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



**Figure 7. On Resistance vs. Gate Voltage**

TYPICAL MOSFET CHARACTERISTICS (continued)

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

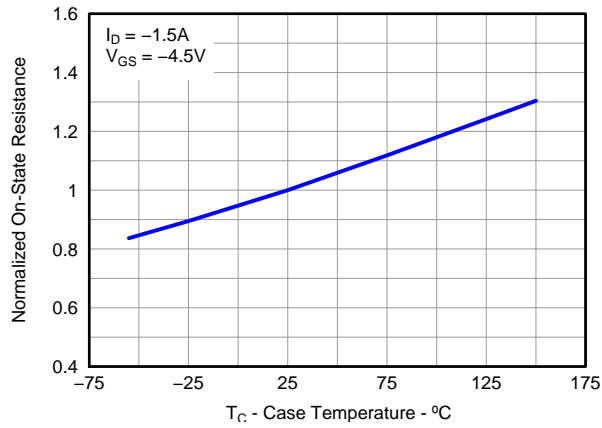


Figure 8. On Resistance vs. Temperature

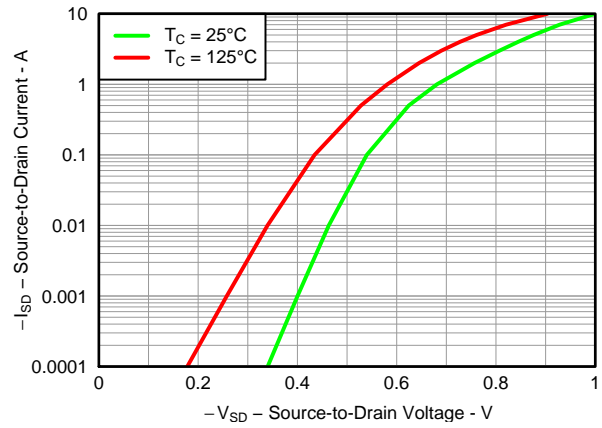


Figure 9. Typical Diode Forward Voltage

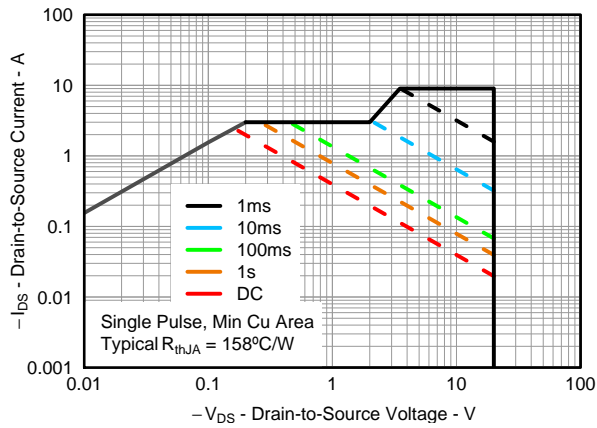


Figure 10. Maximum Safe Operating Area

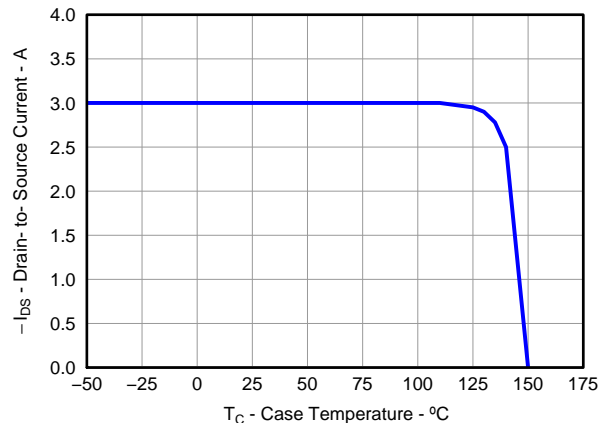
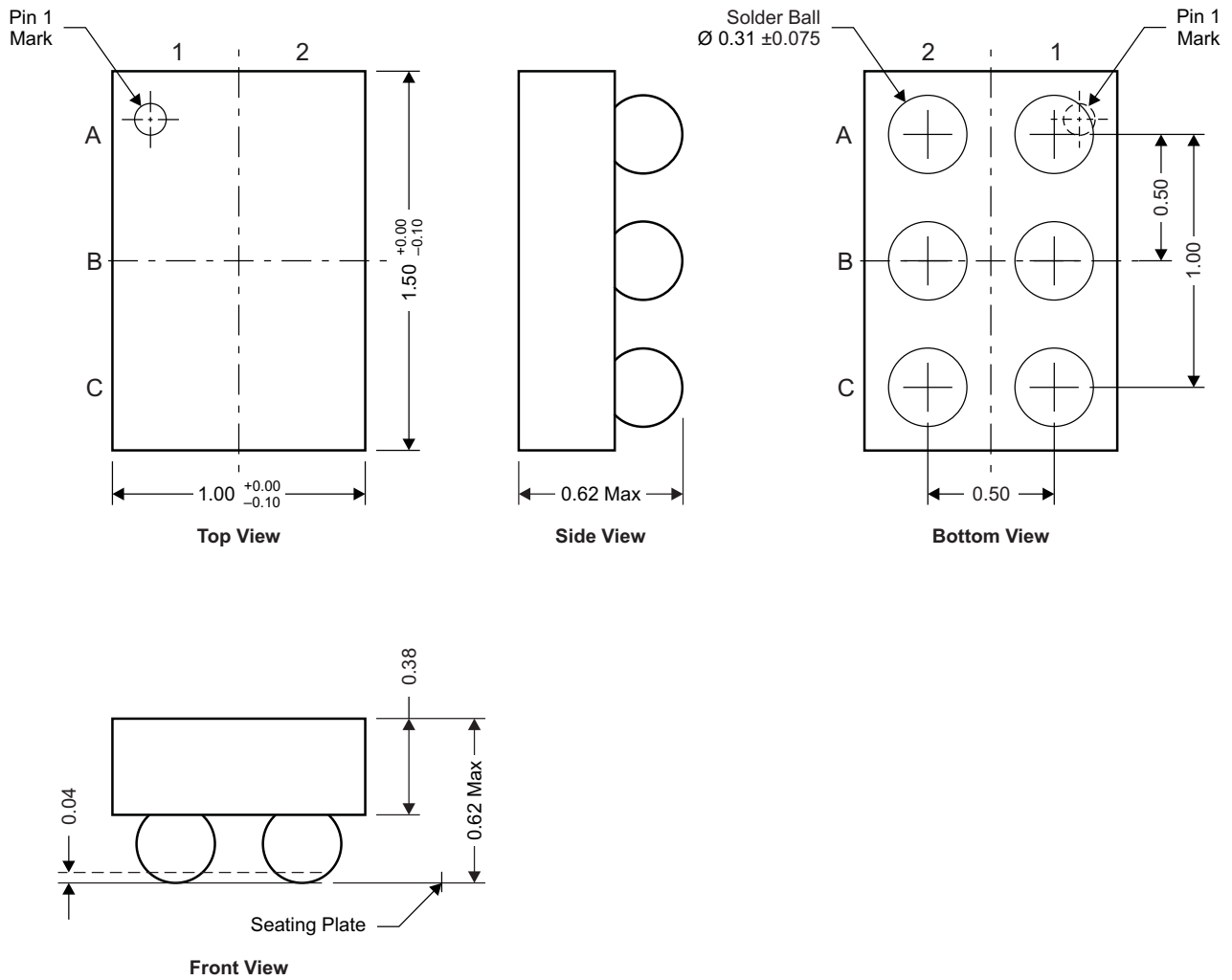


Figure 11. Maximum Drain Current vs. Temperature

**MECHANICAL DATA**

**CSD25303W1015 Package Dimensions**



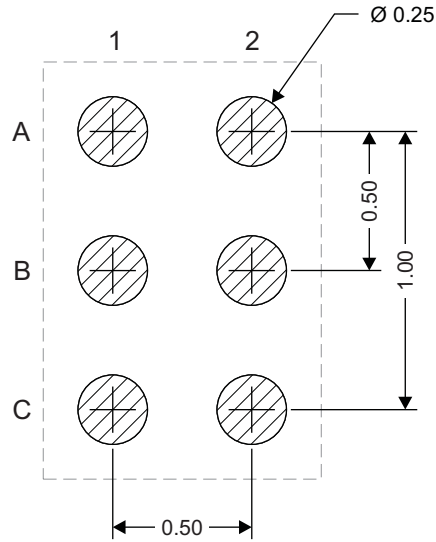
NOTE: All dimensions are in mm (unless otherwise specified)

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**Pinout**

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

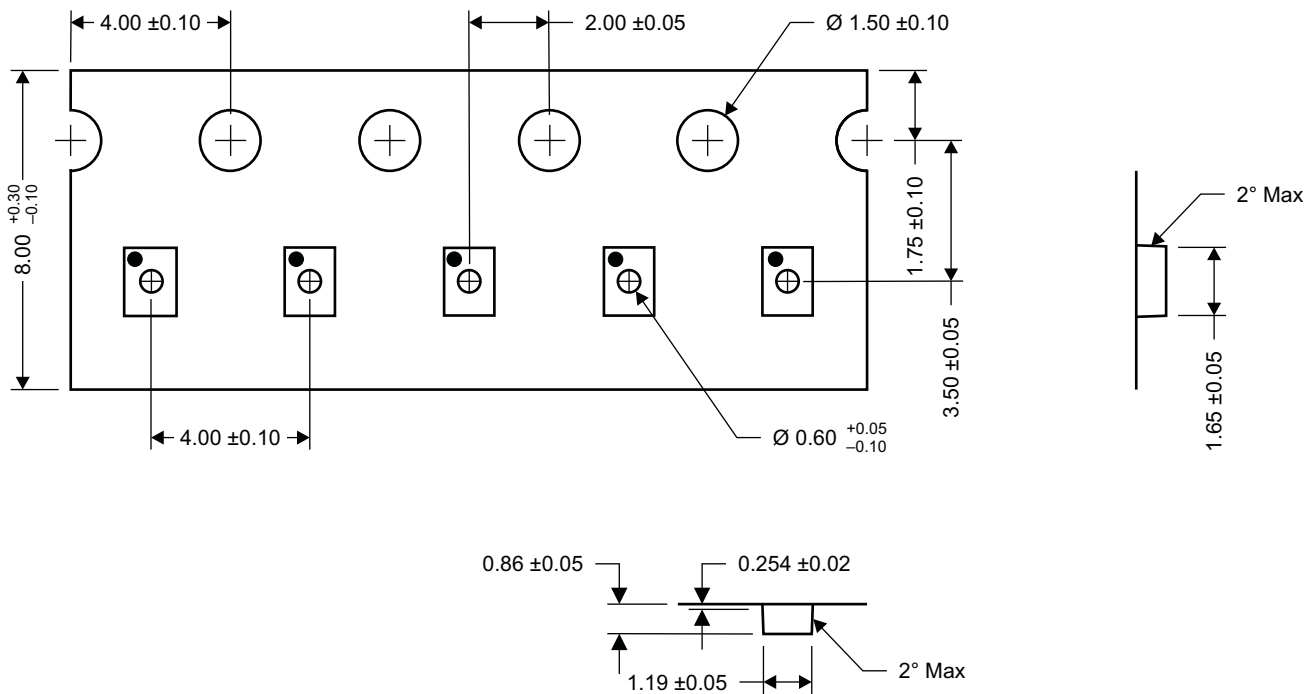
**Land Pattern Recommendation**



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

**Tape and Reel Information**



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

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
CSD25303W1015	ACTIVE	DSBGA	YZC	6	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	

<sup>(1)</sup> 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.

<sup>(2)</sup> 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)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

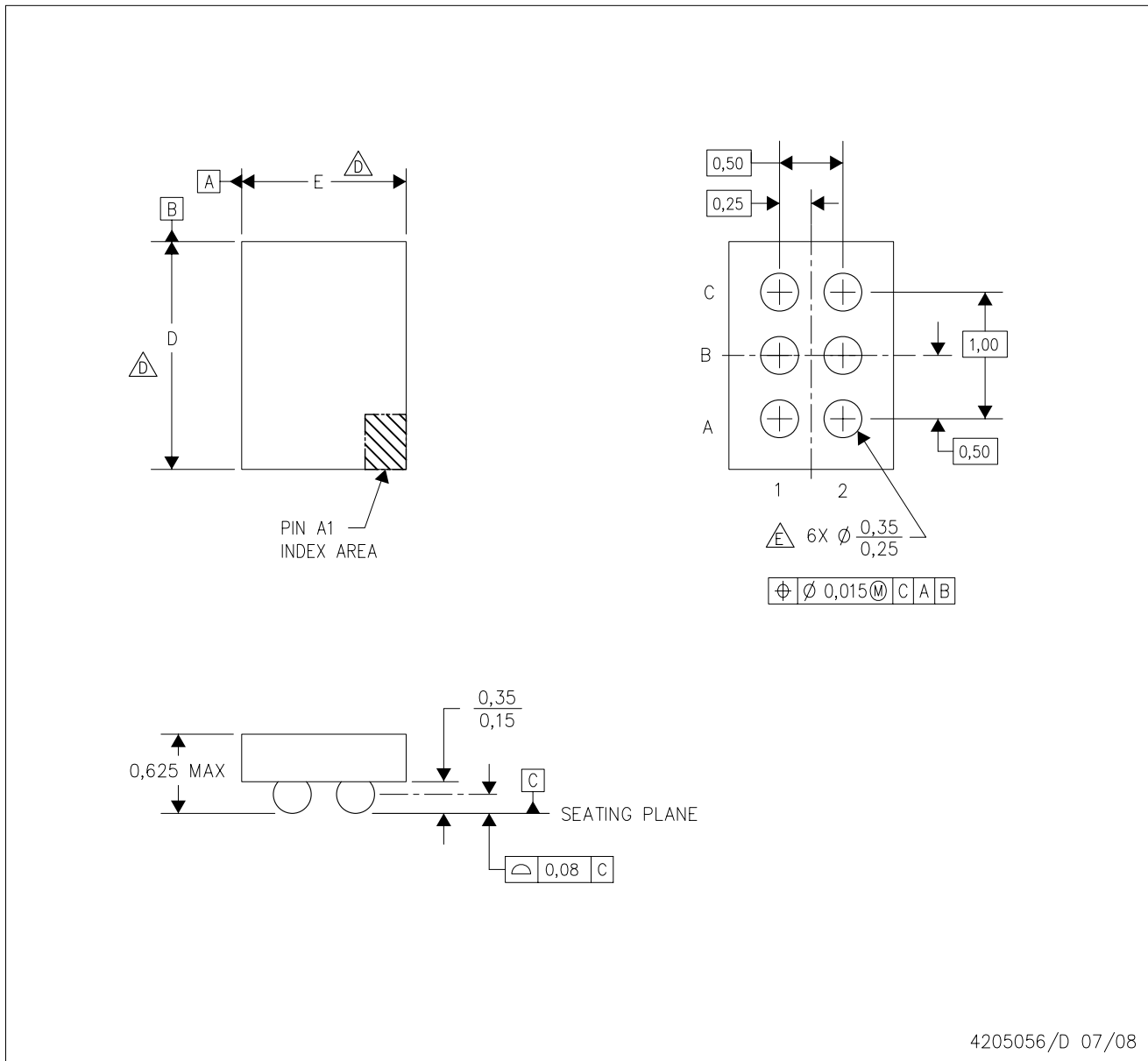
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YZC (R-XBGA-N6)

DIE-SIZE BALL GRID ARRAY



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. NanoFree™ package configuration.
  - $\triangle D$  Devices in YZC package can have dimension D ranging from 1.44 to 2.15 mm and dimension E ranging from 0.94 to 1.65 mm. To determine the exact package size of a particular device, refer to the device datasheet or contact a local TI representative.
  - E. Reference Product Data Sheet for array population.  
3 x 2 matrix pattern is shown for illustration only.
  - F. This package contains lead-free balls.  
Refer to YEC (Drawing #4204179) for tin-lead (SnPb) balls.

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