

# P-Channel NexFET™ Power MOSFET

Check for Samples: [CSD25201W15](#)

## FEATURES

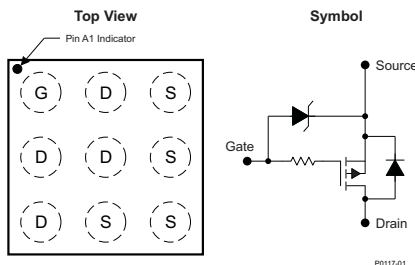
- Low Resistance
- Small Footprint 1.5-mm × 1.5-mm
- Gate ESD Protection –3kV
- Pb Free
- RoHS Compliant
- Halogen Free
- Gate-Source Voltage Clamp

## APPLICATIONS

- Battery Management
- 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. Low on resistance coupled with the small footprint and low profile make the device ideal for battery operated space constrained applications.



## PRODUCT SUMMARY

|              |                               |                  |       |
|--------------|-------------------------------|------------------|-------|
| $V_{DS}$     | Drain to Drain Voltage        | –20              | V     |
| $Q_g$        | Gate Charge Total (–4.5V)     | 4.3              | nC    |
| $Q_{gd}$     | Gate Charge Gate to Drain     | 0.7              | nC    |
| $R_{DS(on)}$ | Drain to Source On Resistance | $V_{GS} = -1.8V$ | 52 mΩ |
|              |                               | $V_{GS} = -2.5V$ | 42 mΩ |
|              |                               | $V_{GS} = -4.5V$ | 33 mΩ |
| $V_{GS(th)}$ | Threshold Voltage             | –0.7             | V     |

## ORDERING INFORMATION

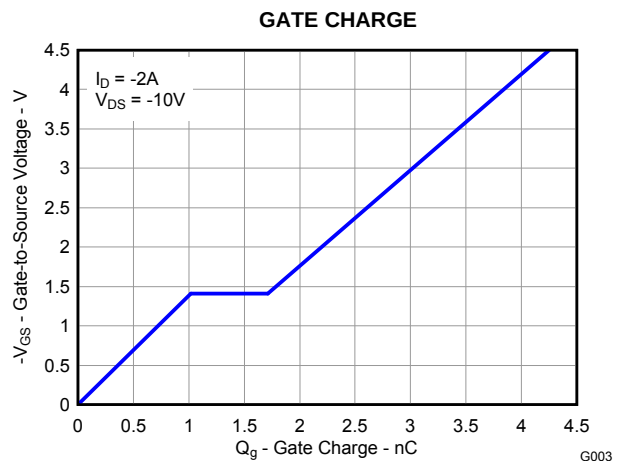
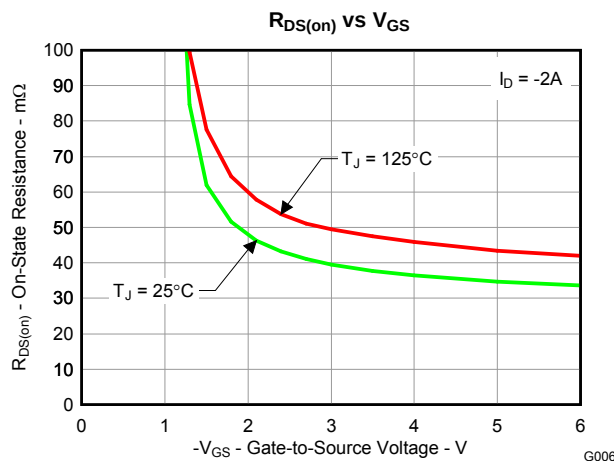
| Device      | Package                             | Media       | Qty  | Ship          |
|-------------|-------------------------------------|-------------|------|---------------|
| CSD25201W15 | 1.5-mm × 1.5-mm Wafer Level Package | 7-Inch Reel | 3000 | Tape and Reel |

## 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                           | –6         | V    |
| $I_D$                                            | Continuous Drain Current <sup>(1)(2)</sup>       | 4          | A    |
|                                                  | Pulsed Drain Current <sup>(1)(2)</sup>           | 4          | A    |
| $I_G$                                            | Continuous Gate Current <sup>(1)(2)</sup>        | 0.5        | A    |
|                                                  | Pulsed Gate Current <sup>(1)(2)</sup>            | 7          | A    |
| $P_D$                                            | Power Dissipation <sup>(1)</sup>                 | 1.5        | W    |
| $T_J, T_{STG}$                                   | Operating Junction and Storage Temperature Range | –55 to 150 | °C   |

(1) Based on Min Cu footprint

(2) Ball limited



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

| PARAMETER               |                                       | TEST CONDITIONS                                                                                | MIN  | TYP  | MAX  | UNIT |
|-------------------------|---------------------------------------|------------------------------------------------------------------------------------------------|------|------|------|------|
| Static Characteristics  |                                       |                                                                                                |      |      |      |      |
| BV <sub>DSS</sub>       | Drain to Source Voltage               | V <sub>GS</sub> = 0V, I <sub>DS</sub> = −250μA                                                 | −20  |      |      | V    |
| BV <sub>GSS</sub>       | Gate to Source Voltage                | V <sub>DS</sub> = 0V, I <sub>G</sub> = −250μA                                                  | −6.1 |      | −7.2 | V    |
| I <sub>DDs</sub>        | Drain to Source Leakage Current       | V <sub>GS</sub> = 0V, V <sub>DS</sub> = −16V                                                   |      |      | −1   | μA   |
| I <sub>GSS</sub>        | Gate to Source Leakage Current        | V <sub>DS</sub> = 0V, V <sub>GS</sub> = −6V                                                    |      |      | −100 | nA   |
| V <sub>GS(th)</sub>     | Gate to Source Threshold Voltage      | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>DS</sub> = −250μA                                   | −0.4 | −0.7 | −1.1 | V    |
| R <sub>DS(on)</sub>     | Drain to Source On Resistance         | V <sub>GS</sub> = −1.8V, I <sub>DS</sub> = −2A                                                 |      | 52   | 70   | mΩ   |
|                         |                                       | V <sub>GS</sub> = −2.5V, I <sub>DS</sub> = −2A                                                 |      | 42   | 50   | mΩ   |
|                         |                                       | V <sub>GS</sub> = −4.5V, I <sub>DS</sub> = −2A                                                 |      | 33   | 40   | mΩ   |
| g <sub>fs</sub>         | Transconductance                      | V <sub>DS</sub> = −10V, I <sub>DS</sub> = −2A                                                  |      | 12   |      | S    |
| Dynamic Characteristics |                                       |                                                                                                |      |      |      |      |
| C <sub>ISS</sub>        | Input Capacitance                     | V <sub>GS</sub> = 0V, V <sub>DS</sub> = −10V,<br>f = 1MHz                                      |      | 490  | 640  | pF   |
| C <sub>OSS</sub>        | Output Capacitance                    |                                                                                                |      | 215  | 280  | pF   |
| C <sub>RSS</sub>        | Reverse Transfer Capacitance          |                                                                                                |      | 70   | 91   | pF   |
| R <sub>G</sub>          | Series Gate Resistance <sup>(1)</sup> |                                                                                                |      | 26   | 35   | Ω    |
| Q <sub>g</sub>          | Gate Charge Total (−4.5V)             | V <sub>DS</sub> = −10V,<br>I <sub>O</sub> = −2A                                                |      | 4.3  | 5.6  | nC   |
| Q <sub>gd</sub>         | Gate Charge - Gate to Drain           |                                                                                                |      | 0.7  |      | nC   |
| Q <sub>gs</sub>         | Gate Charge - Gate to Source          |                                                                                                |      | 1    |      | nC   |
| Q <sub>g(th)</sub>      | Gate Charge at V <sub>th</sub>        |                                                                                                |      | 0.3  |      | nC   |
| Q <sub>OSS</sub>        | Output Charge                         | V <sub>DS</sub> = −9.5V, V <sub>GS</sub> = 0V                                                  |      | 3.1  |      | nC   |
| t <sub>d(on)</sub>      | Turn On Delay Time <sup>(2)</sup>     | V <sub>DS</sub> = −10V, V <sub>GS</sub> = −4.5V,<br>I <sub>DS</sub> = −2A, R <sub>G</sub> = 2Ω |      | 9.5  |      | ns   |
| t <sub>r</sub>          | Rise Time <sup>(2)</sup>              |                                                                                                |      | 11   |      | ns   |
| t <sub>d(off)</sub>     | Turn Off Delay Time <sup>(2)</sup>    |                                                                                                |      | 51   |      | ns   |
| t <sub>f</sub>          | Fall Time <sup>(2)</sup>              |                                                                                                |      | 38   |      | ns   |
| Diode Characteristics   |                                       |                                                                                                |      |      |      |      |
| V <sub>SD</sub>         | Diode Forward Voltage                 | I <sub>DS</sub> = −2A, V <sub>GS</sub> = 0V                                                    |      | 0.7  | 1    | V    |
| Q <sub>rr</sub>         | Reverse Recovery Charge               | V <sub>DD</sub> = −9.5V, I <sub>F</sub> = −2A,<br>di/dt = 200A/μs                              |      | 5.7  |      | nC   |
| t <sub>rr</sub>         | Reverse Recovery Time                 |                                                                                                |      | 10   |      | ns   |

(1) Includes gate clamp resistor

(2) External R<sub>G</sub> is in addition to the internal gate clamp resistor

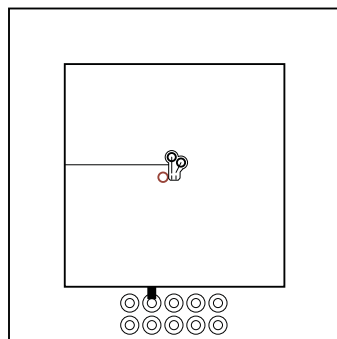
## THERMAL CHARACTERISTICS

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

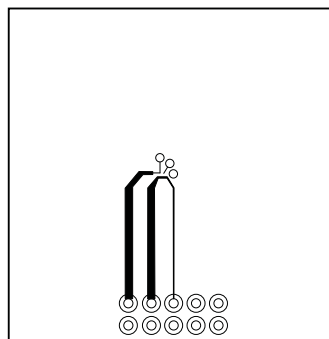
| PARAMETER        |                                                       | MIN | TYP | MAX | UNIT |
|------------------|-------------------------------------------------------|-----|-----|-----|------|
| R <sub>θJA</sub> | Junction to Ambient Thermal Resistance <sup>(1)</sup> |     |     | 283 | °C/W |
|                  | Junction to Ambient Thermal Resistance <sup>(2)</sup> |     |     | 185 | °C/W |

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

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



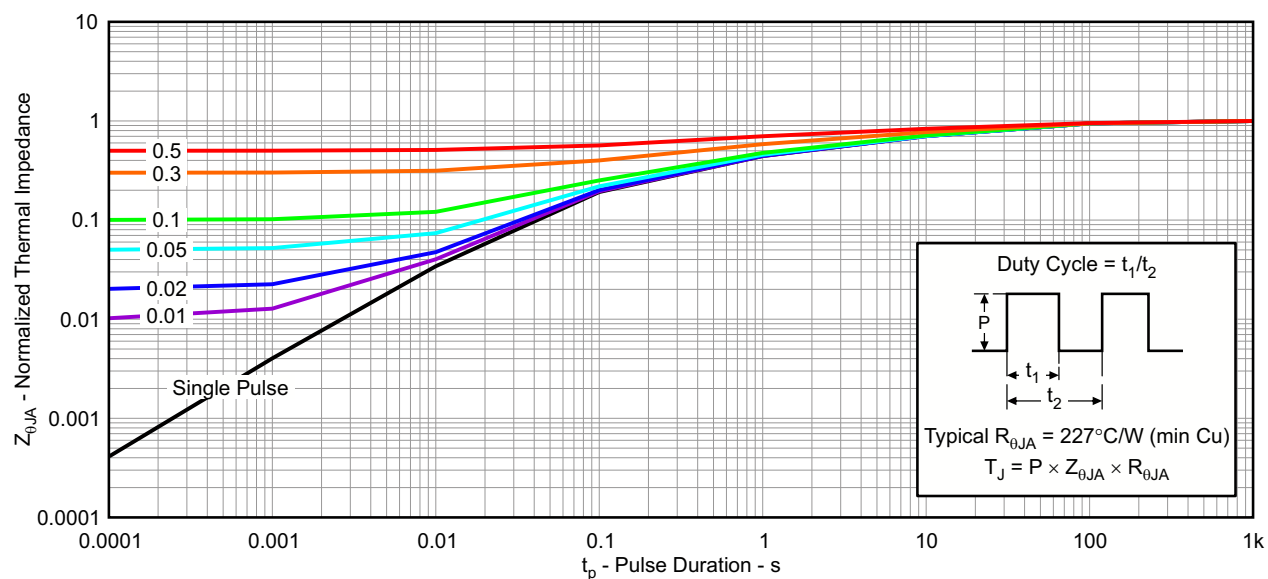
Max  $R_{\theta JA} = 185^{\circ}\text{C/W}$   
when mounted on  
1 inch<sup>2</sup> (6.45 cm<sup>2</sup>) of  
2-oz. (0.071-mm thick)  
Cu.



Max  $R_{\theta JA} = 283^{\circ}\text{C/W}$   
when mounted on a  
minimum pad area of  
2-oz. (0.071-mm thick)  
Cu.

## TYPICAL MOSFET CHARACTERISTICS

$T_A = 25^{\circ}\text{C}$ , unless stated otherwise.



G012

Figure 1. Transient Thermal Impedance

## TYPICAL MOSFET CHARACTERISTICS (continued)

$T_A = 25^\circ\text{C}$ , unless stated otherwise.

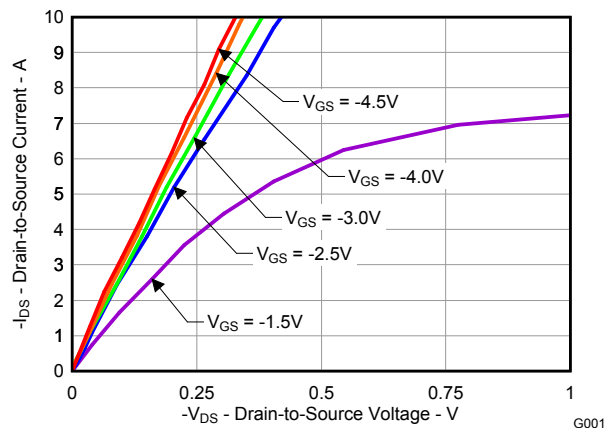


Figure 2. Saturation Characteristics

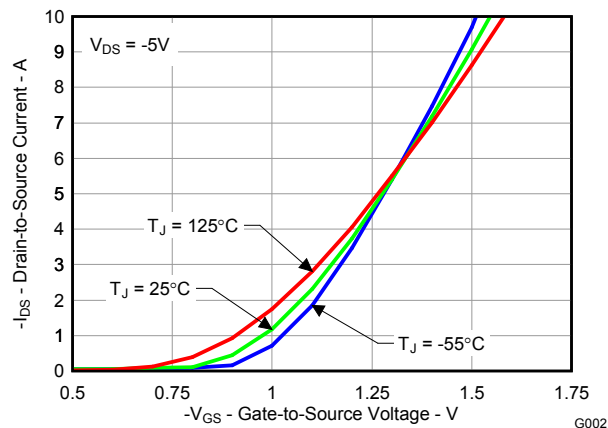


Figure 3. Transfer Characteristics

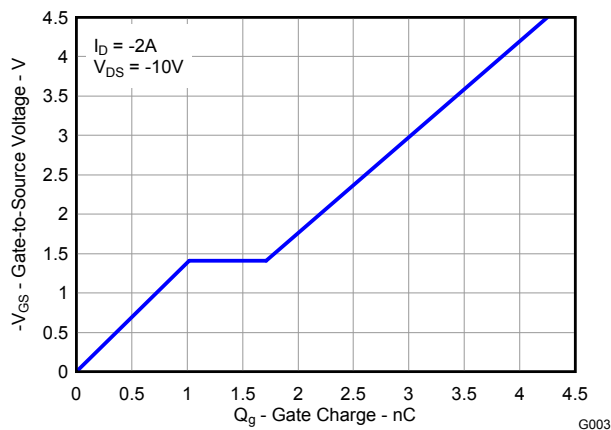


Figure 4. Gate Charge

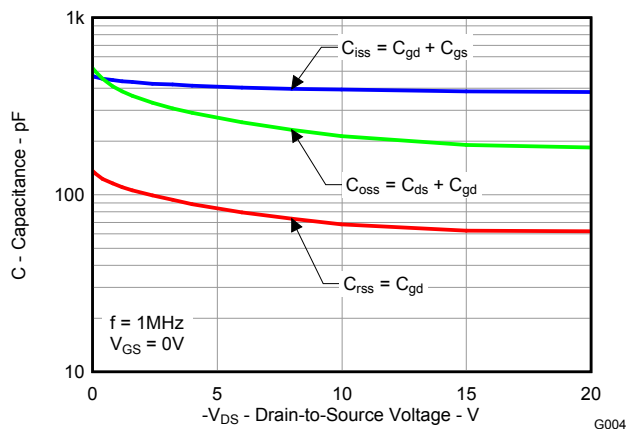


Figure 5. Capacitance

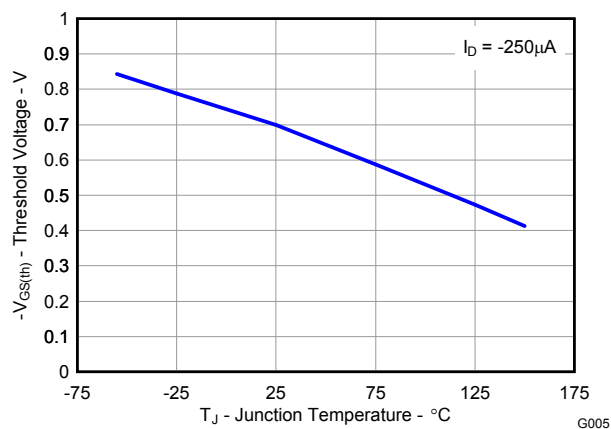


Figure 6. Threshold Voltage vs. Temperature

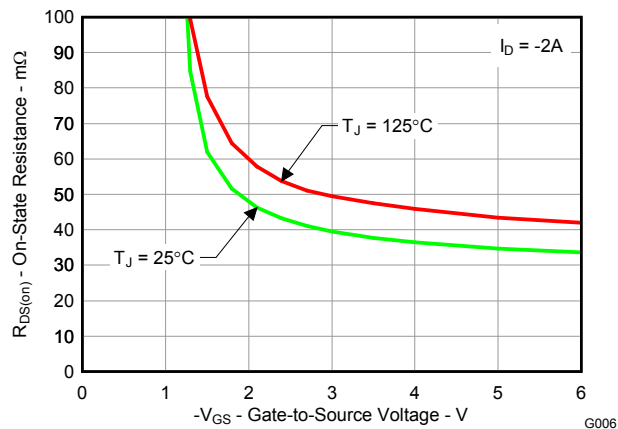


Figure 7. On-State Resistance vs. Gate-to-Source Voltage

## TYPICAL MOSFET CHARACTERISTICS (continued)

$T_A = 25^\circ\text{C}$ , unless stated otherwise.

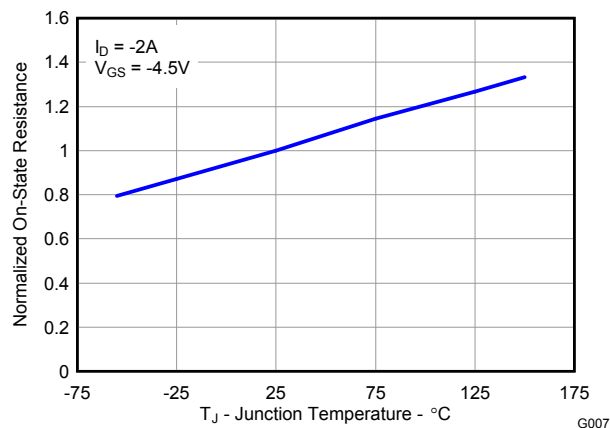


Figure 8. Normalized On-State Resistance vs. Temperature

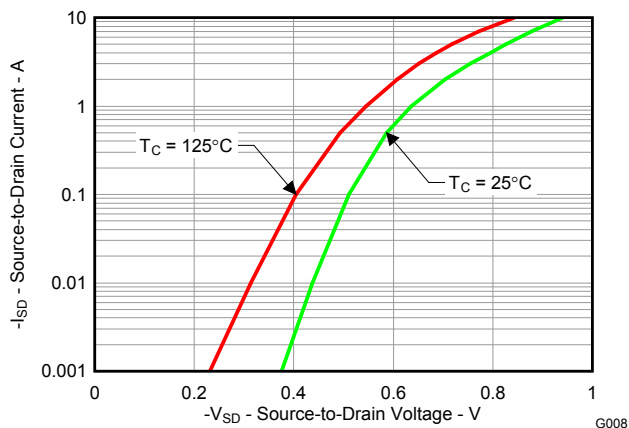


Figure 9. Typical Diode Forward Voltage

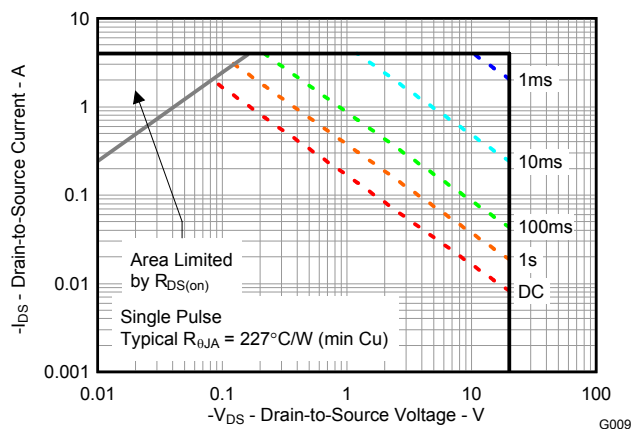


Figure 10. Maximum Safe Operating Area

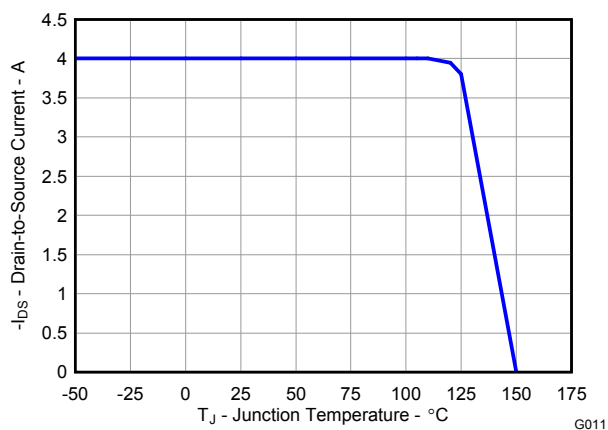
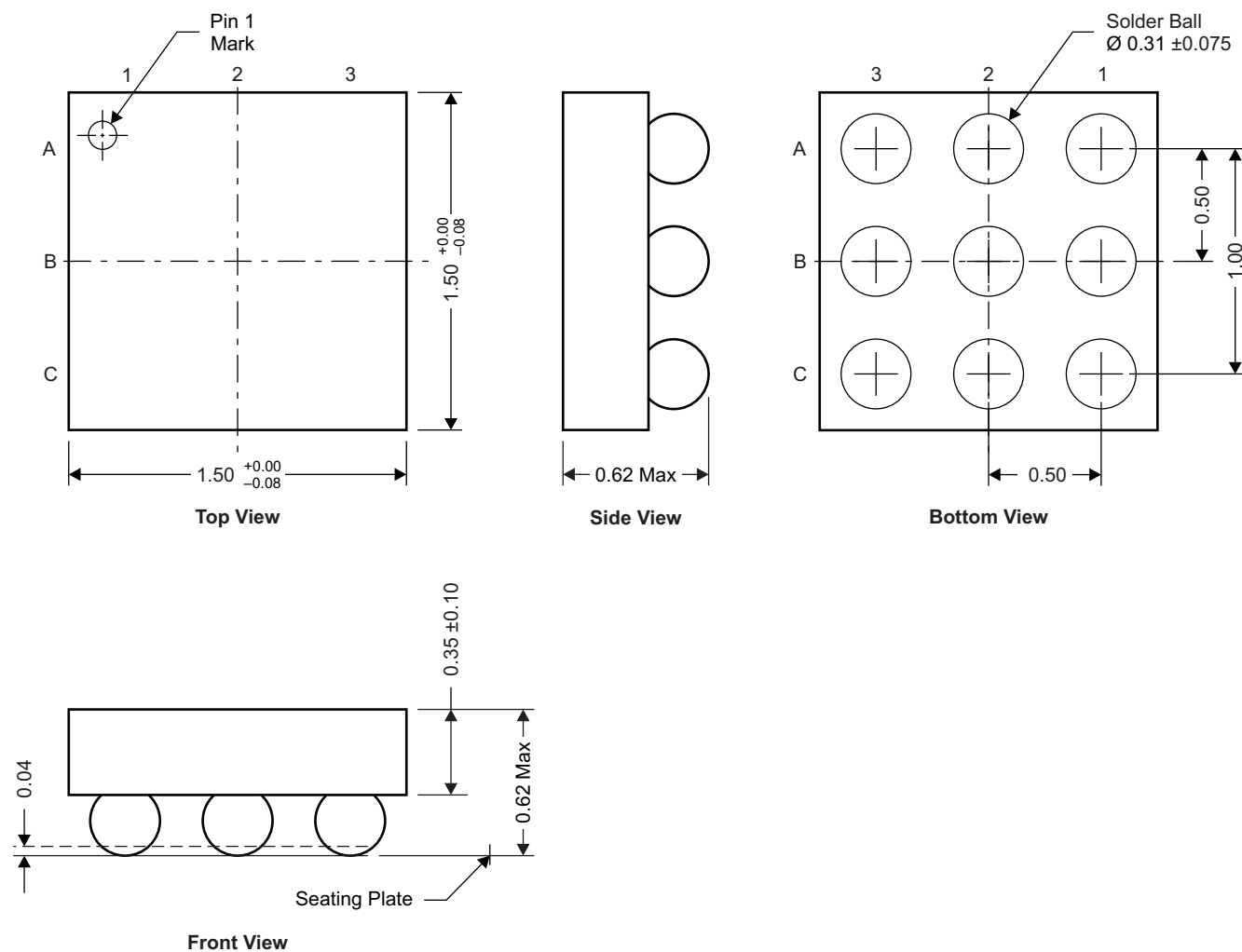


Figure 11. Maximum Drain Current vs. Temperature

**MECHANICAL DATA****CSD25201W15 Package Dimensions**

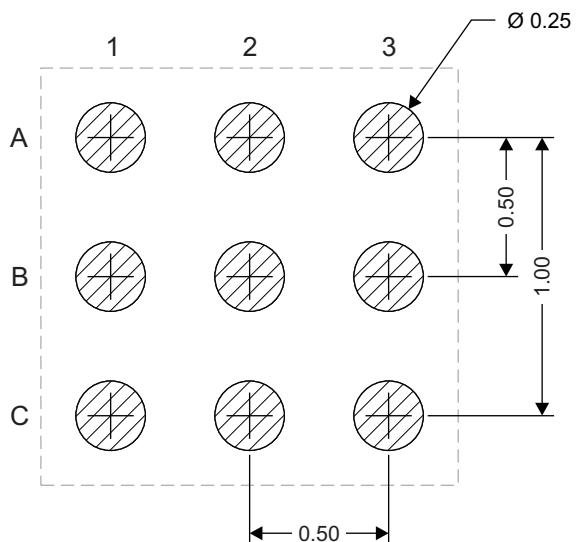
NOTE: All dimensions are in mm (unless otherwise specified)

M0171-01

**Pinout**

| POSITION       | DESIGNATION |
|----------------|-------------|
| A1             | Gate        |
| A2, B1, B2, C1 | Drain       |
| A3, B3, C2, C3 | Source      |

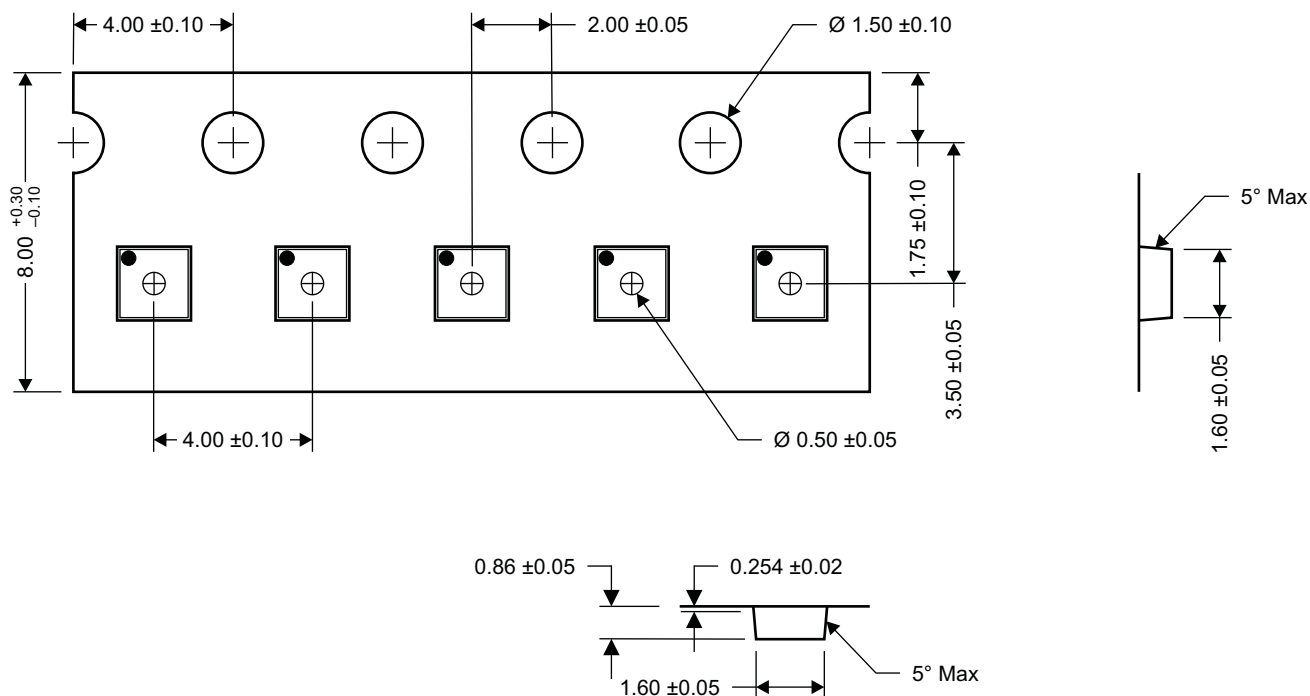
## Recommended Land Pattern



M0172-01

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

## Tape and Reel Information



M0173-01

- NOTES:
1. 10-sprocket hole-pitch cumulative tolerance  $\pm 0.2$
  2. Camber not to exceed 1mm in 100mm, noncumulative over 250mm
  3. Material: black static-dissipative polystyrene
  4. All dimensions are in mm (unless otherwise specified)
  5. Thickness:  $0.30 \pm 0.05$ mm
  6. MSL1 260°C (IR and convection) PbF reflow compatible

## REVISION HISTORY

| Changes from Original (June 2010) to Revision A                                                            | Page              |
|------------------------------------------------------------------------------------------------------------|-------------------|
| • Changed the $C_{ISS}$ Input Capacitance Typ and Max Values From: 390 and 510 pF To: 490 and 640 pF ..... | <a href="#">2</a> |

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### Applications

|                               |                                                                                          |
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