

# P-Channel NexFET™ Power MOSFET

 Check for Samples: [CSD25201W15](#)

## FEATURES

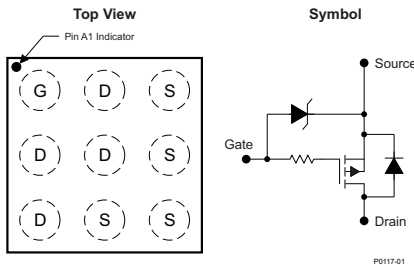
- Low Resistance
- Small Footprint 1.5-mm × 1.5-mm
- Gate ESD Protection –3kV
- Pb Free
- RoHS Compliant
- Halogen Free
- Gate-Source Voltage Clamp

## 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

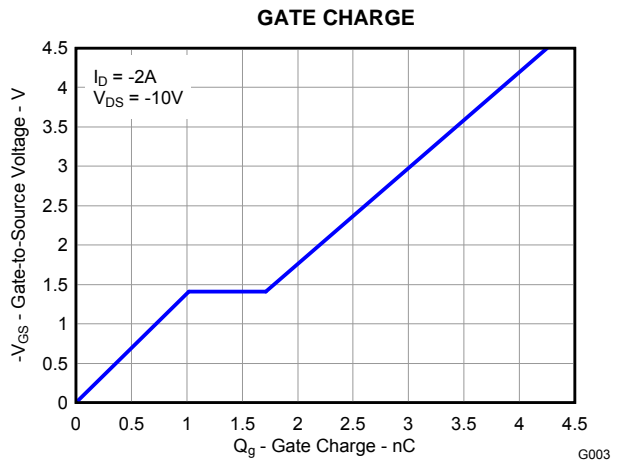
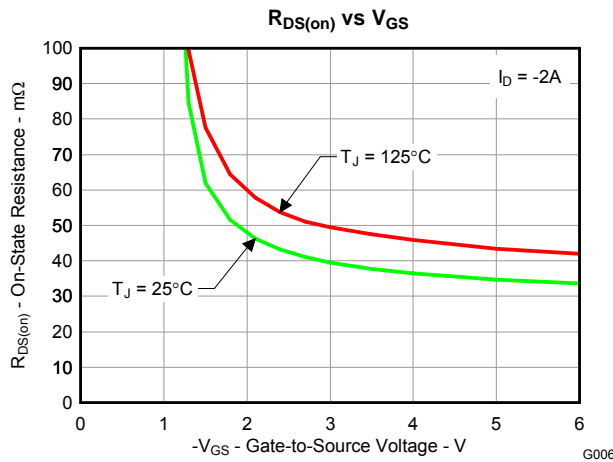
Device	Package	Media	Qty	Ship
CSD25201W15	1.5-mm × 1.5-mm Wafer Level Package	7-Inch Reel	3000	Tape and Reel

## 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

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>Static Characteristics</b>						
$BV_{DSS}$	Drain to Source Voltage	$V_{GS} = 0V, I_{DS} = -250\mu A$	-20			V
$BV_{GSS}$	Gate to Source Voltage	$V_{DS} = 0V, I_G = -250\mu A$	-6.1		-7.2	V
$I_{DSS}$	Drain to Source Leakage Current	$V_{GS} = 0V, V_{DS} = -16V$			-1	$\mu A$
$I_{GSS}$	Gate to Source Leakage Current	$V_{DS} = 0V, V_{GS} = -6V$			-100	nA
$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{DS} = V_{GS}, I_{DS} = -250\mu A$	-0.4	-0.7	-1.1	V
$R_{DS(on)}$	Drain to Source On Resistance	$V_{GS} = -1.8V, I_{DS} = -2A$		52	70	m $\Omega$
		$V_{GS} = -2.5V, I_{DS} = -2A$		42	50	m $\Omega$
		$V_{GS} = -4.5V, I_{DS} = -2A$		33	40	m $\Omega$
$g_{fs}$	Transconductance	$V_{DS} = -10V, I_{DS} = -2A$		12		S
<b>Dynamic Characteristics</b>						
$C_{ISS}$	Input Capacitance	$V_{GS} = 0V, V_{DS} = -10V,$ $f = 1MHz$		490	640	pF
$C_{OSS}$	Output Capacitance			215	280	pF
$C_{RSS}$	Reverse Transfer Capacitance			70	91	pF
$R_G$	Series Gate Resistance <sup>(1)</sup>			26	35	$\Omega$
$Q_g$	Gate Charge Total (-4.5V)	$V_{DS} = -10V,$ $I_O = -2A$		4.3	5.6	nC
$Q_{gd}$	Gate Charge - Gate to Drain			0.7		nC
$Q_{gs}$	Gate Charge - Gate to Source			1		nC
$Q_{g(th)}$	Gate Charge at $V_{th}$			0.3		nC
$Q_{OSS}$	Output Charge	$V_{DS} = -9.5V, V_{GS} = 0V$		3.1		nC
$t_{d(on)}$	Turn On Delay Time <sup>(2)</sup>	$V_{DS} = -10V, V_{GS} = -4.5V,$ $I_{DS} = -2A, R_G = 2\Omega$		9.5		ns
$t_r$	Rise Time <sup>(2)</sup>			11		ns
$t_{d(off)}$	Turn Off Delay Time <sup>(2)</sup>			51		ns
$t_f$	Fall Time <sup>(2)</sup>			38		ns
<b>Diode Characteristics</b>						
$V_{SD}$	Diode Forward Voltage	$I_{DS} = -2A, V_{GS} = 0V$		0.7	1	V
$Q_{rr}$	Reverse Recovery Charge	$V_{DD} = -9.5V, I_F = -2A,$ $di/dt = 200A/\mu s$		5.7		nC
$t_{rr}$	Reverse Recovery Time			10		ns

(1) Includes gate clamp resistor

(2) External  $R_G$  is in addition to the internal gate clamp resistor

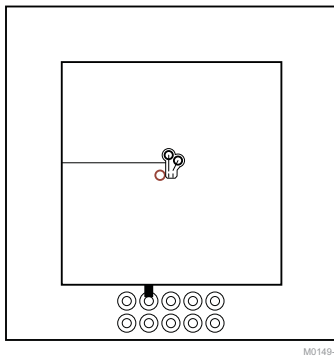
## THERMAL CHARACTERISTICS

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

PARAMETER		MIN	TYP	MAX	UNIT
$R_{\theta JA}$	Junction to Ambient Thermal Resistance <sup>(1)</sup>			283	$^\circ\text{C/W}$
	Junction to Ambient Thermal Resistance <sup>(2)</sup>			185	$^\circ\text{C/W}$

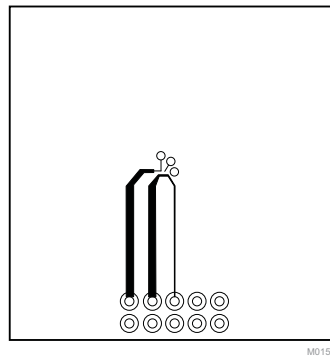
(1) Device mounted on FR4 material with minimum Cu mounting area.

(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.

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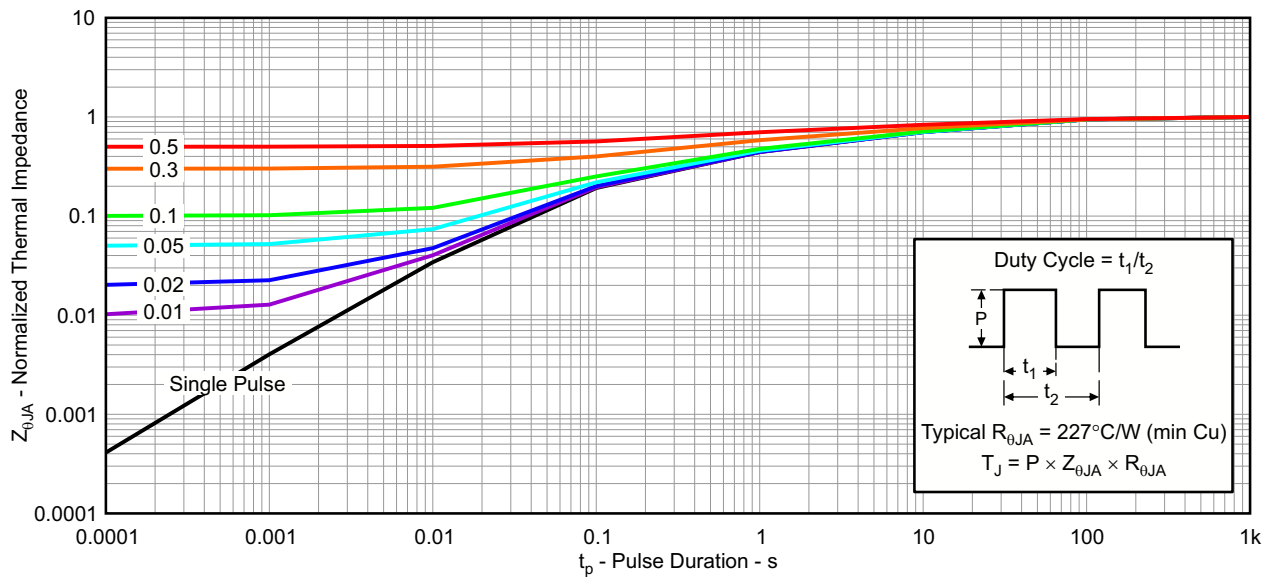


Max  $R_{\theta JA} = 283^{\circ}\text{C/W}$   
when mounted on a  
minimum pad area of  
2-oz. (0.071-mm thick)  
Cu.

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### TYPICAL MOSFET CHARACTERISTICS

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

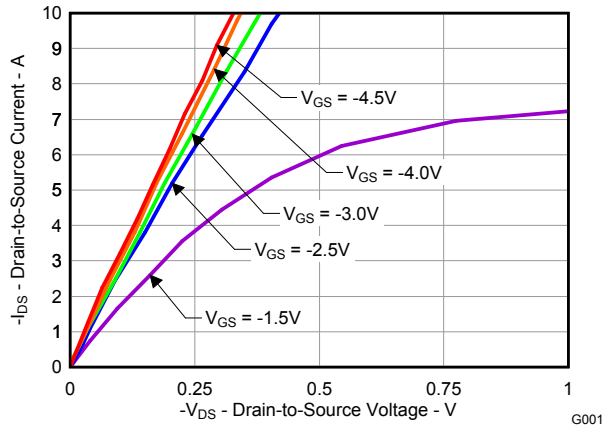


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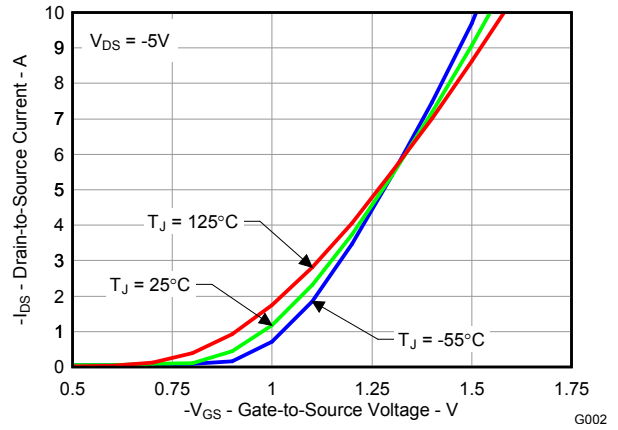
Figure 1. Transient Thermal Impedance

**TYPICAL MOSFET CHARACTERISTICS (continued)**

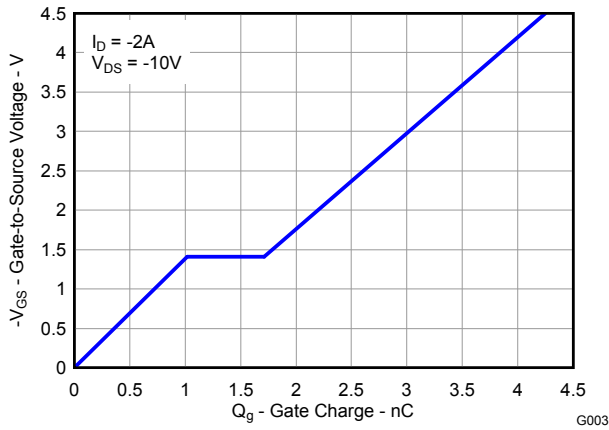
T<sub>A</sub> = 25°C, unless stated otherwise.



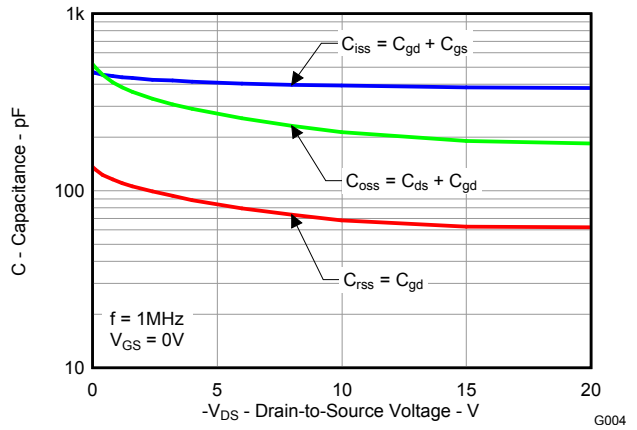
**Figure 2. Saturation Characteristics**



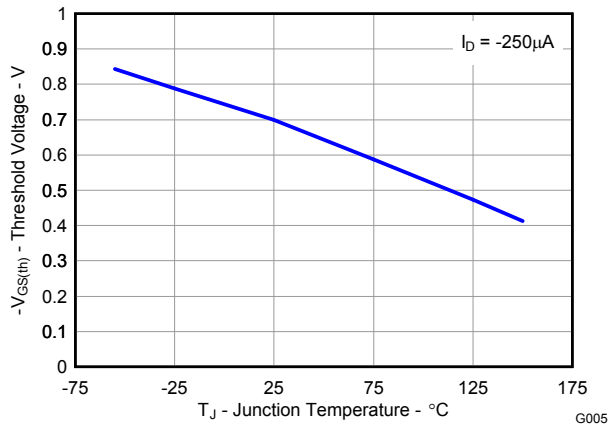
**Figure 3. Transfer Characteristics**



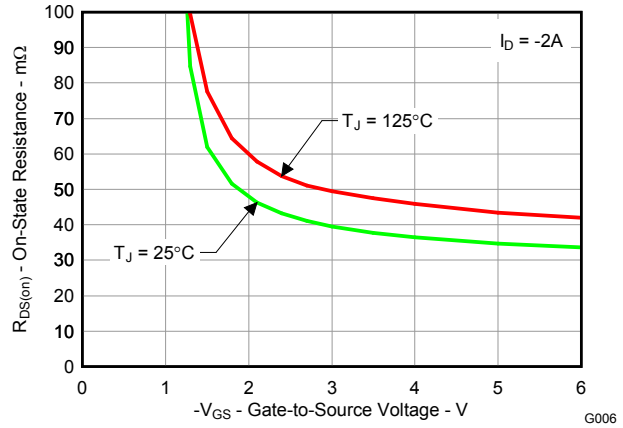
**Figure 4. Gate Charge**



**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.

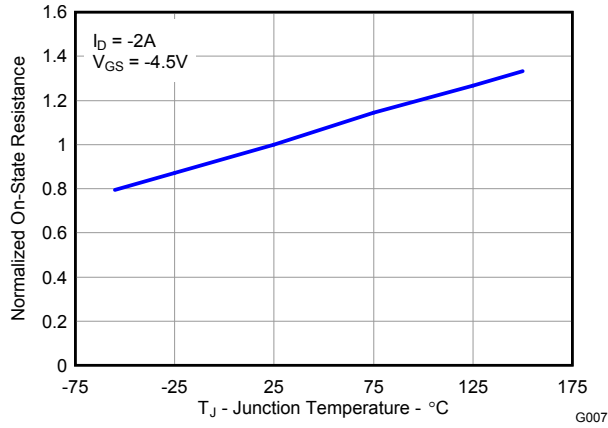


Figure 8. Normalized On-State Resistance vs. Temperature

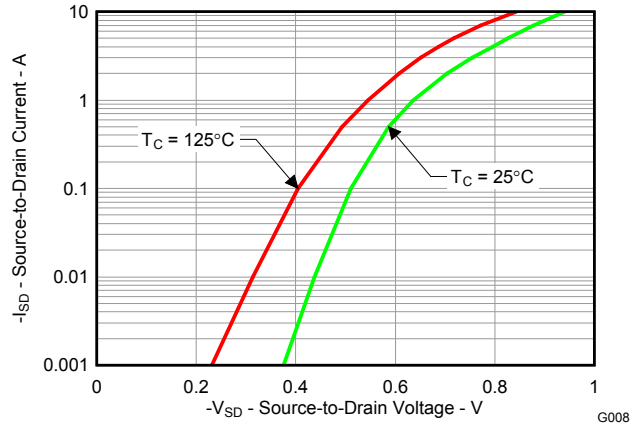


Figure 9. Typical Diode Forward Voltage

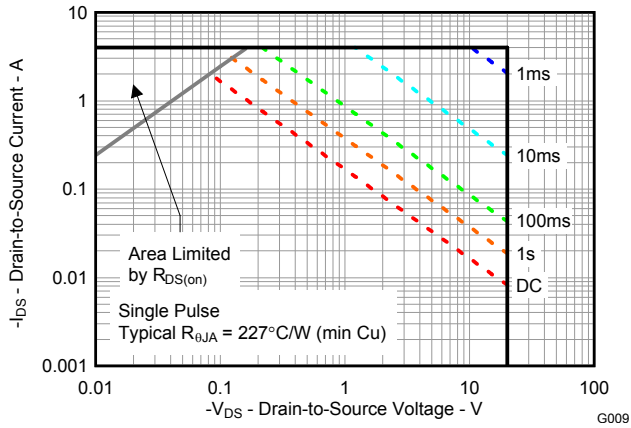


Figure 10. Maximum Safe Operating Area

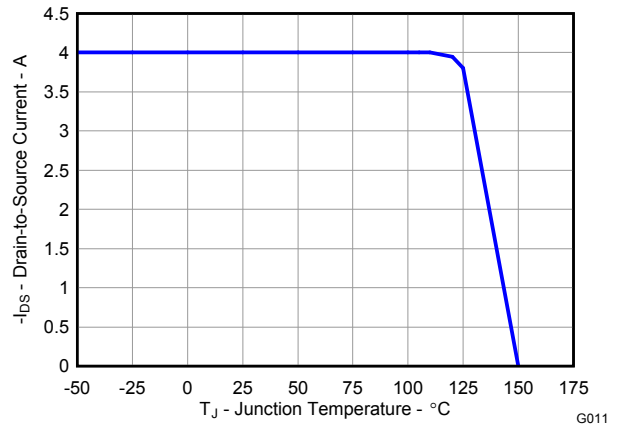
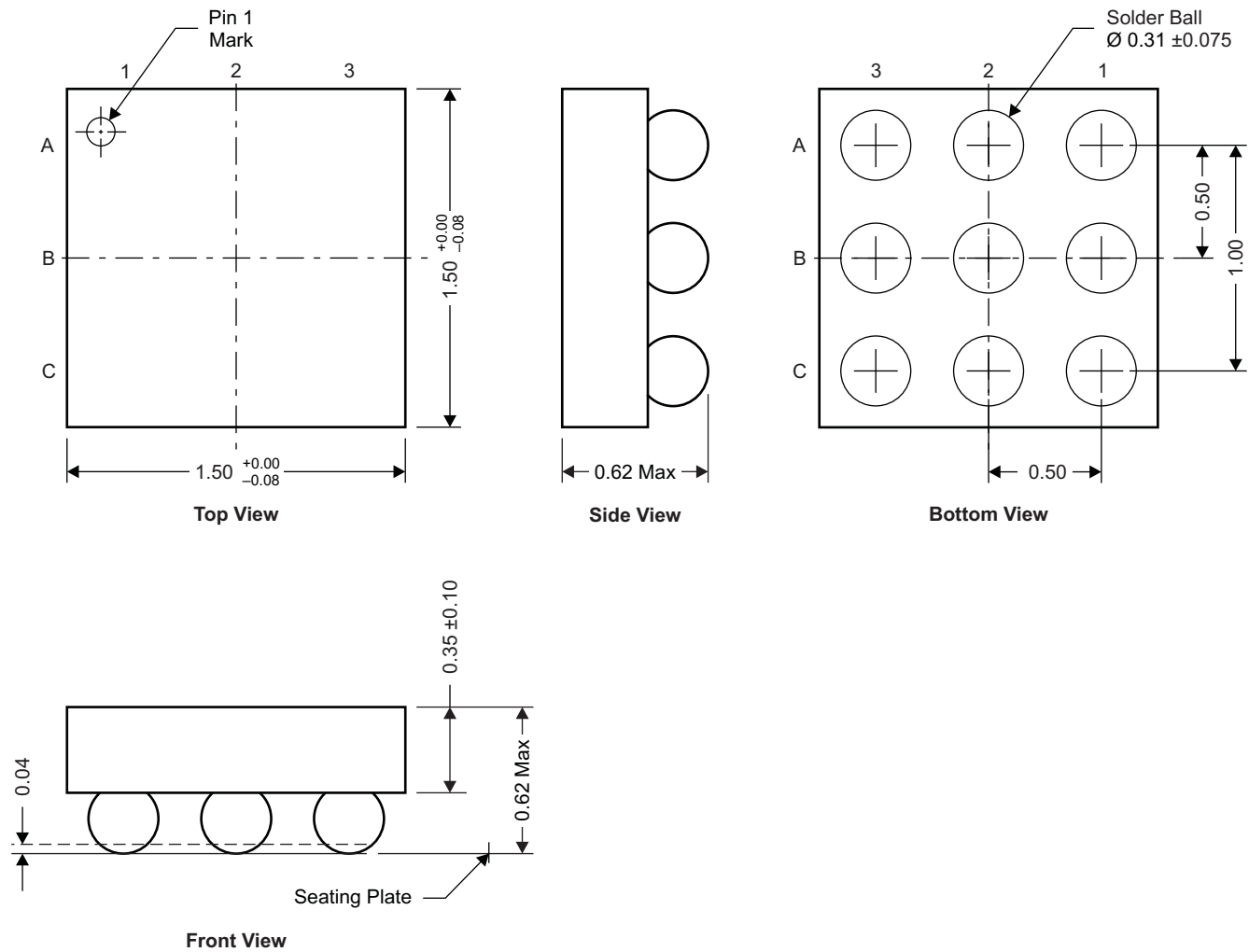


Figure 11. Maximum Drain Current vs. Temperature

**MECHANICAL DATA**

**CSD25201W15 Package Dimensions**



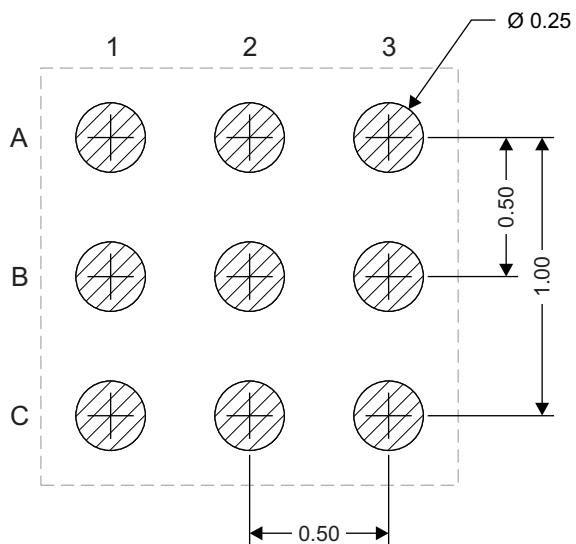
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NOTE: All dimensions are in mm (unless otherwise specified)

**Pinout**

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

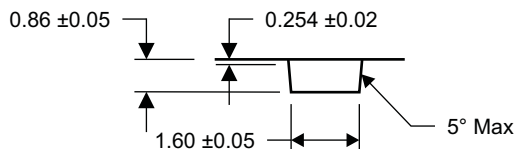
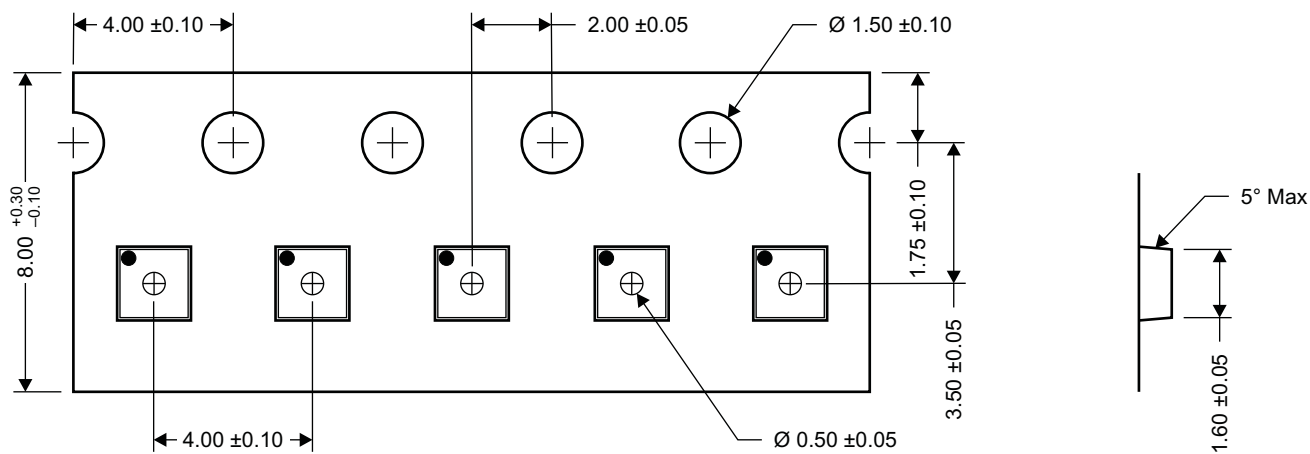
### Recommended Land Pattern



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

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## REVISION HISTORY

Changes from Original (June 2010) to Revision A	Page
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- Changed the  $C_{ISS}$  Input Capacitance Typ and Max Values From: 390 and 510 pF To: 490 and 640 pF ..... 2
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