P-Channel NexFET™ Power MOSFET

Check for Samples: CSD25201W15

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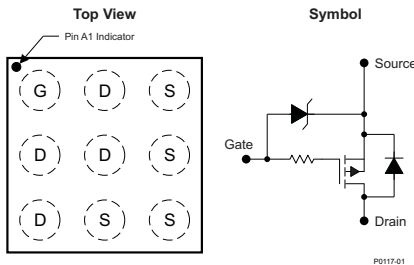
- **Low Resistance**
- **Small Footprint 1.5-mm × 1.5-mm**
- **Gate ESD Protection −3kV**
- **Pb Free**
- **RoHS Compliant**
- **Halogen Free**
- **Gate-Source Voltage Clamp**

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°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[1][2]	4	A
	Pulsed Drain Current[1][2]	4	A
I_G	Continuous Gate Current[1][2]	0.5	A
	Pulsed Gate Current[1][2]	7	A
P_D	Power Dissipation[1]	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

Top View / Symbol

P0117-01

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

I_D = -2A

T_J = 125°C

T_J = 25°C

$R_{DS(on)}$ - On-State Resistance - mΩ

-V_{GS} - Gate-to-Source Voltage - V

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GATE CHARGE

I_D = -2A
V_{DS} = -10V

-V_{GS} - Gate-to-Source Voltage - V

Q_g - Gate Charge - nC

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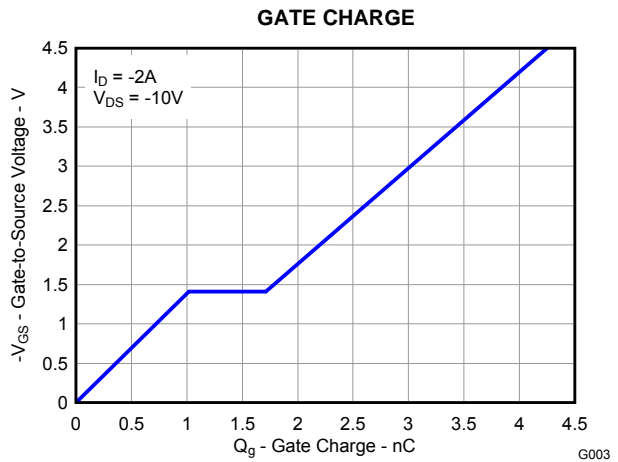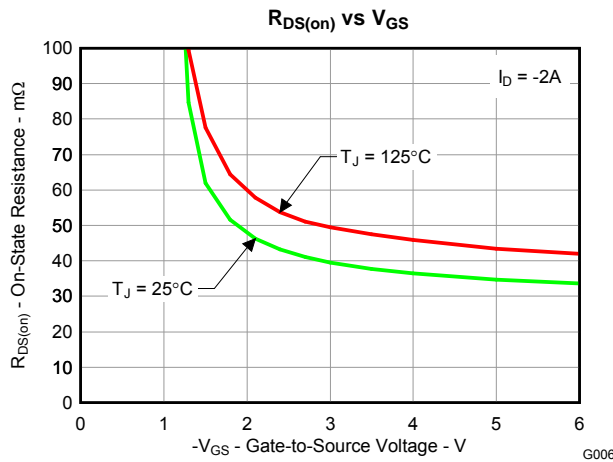
Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

> 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

$(T_A = 25°C$ unless otherwise stated)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Static Characteristics						
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_{DDS}	Drain to Source Leakage Current	$V_{GS} = 0V$, $V_{DS} = -16V$			−1	µA
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	mΩ
		$V_{GS} = -2.5V$, $I_{DS} = -2A$		42	50	mΩ
		$V_{GS} = -4.5V$, $I_{DS} = -2A$		33	40	mΩ
g_{fs}	Transconductance	$V_{DS} = -10V$, $I_{DS} = -2A$		12		S
Dynamic Characteristics						
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[1]			26	35	Ω
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 Vth			0.3		nC
Q_{OSS}	Output Charge	$V_{DS} = -9.5V$, $V_{GS} = 0V$		3.1		nC
$t_{d(on)}$	Turn On Delay Time[2]	$V_{DS} = -10V$, $V_{GS} = -4.5V$, $I_{DS} = -2A$, $R_G = 2Ω$		9.5		ns
t_r	Rise Time[2]			11		ns
$t_{d(off)}$	Turn Off Delay Time[2]			51		ns
t_f	Fall Time[2]			38		ns
Diode Characteristics						
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/µs		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

$(T_A = 25°C$ unless otherwise stated)

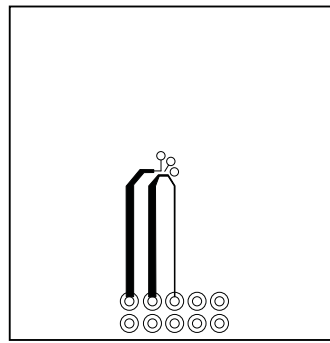| PARAMETER		MIN	TYP	MAX	UNIT
$R_{\theta JA}$	Junction to Ambient Thermal Resistance[1]			283	°C/W
	Junction to Ambient Thermal Resistance[2]			185	°C/W

(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.
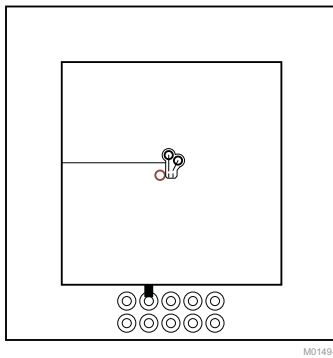
Max $R_{\theta JA}$ = 185°C/W when mounted on 1 inch^2 (6.45 cm^2) of 2-oz. (0.071-mm thick) Cu.
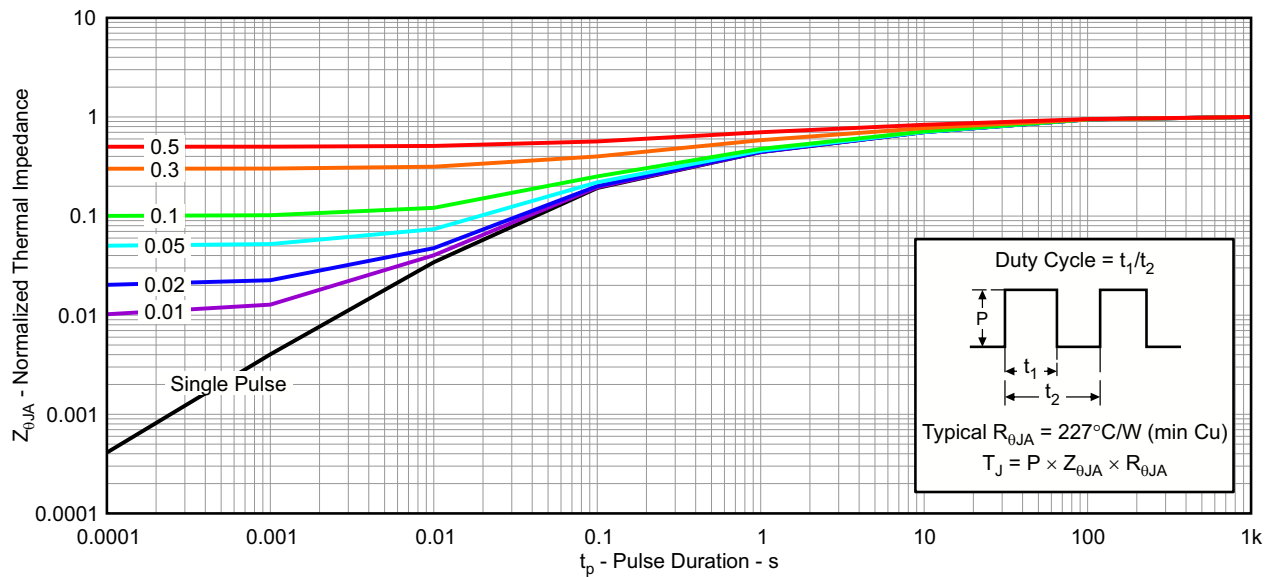
Max $R_{\theta JA}$ = 283°C/W when mounted on a minimum pad area of 2-oz. (0.071-mm thick) Cu.

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TYPICAL MOSFET CHARACTERISTICS
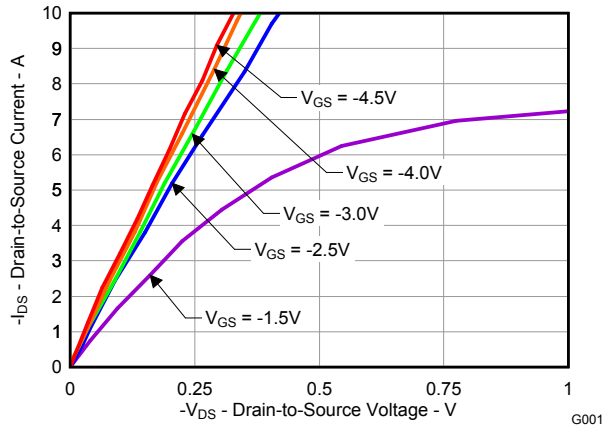
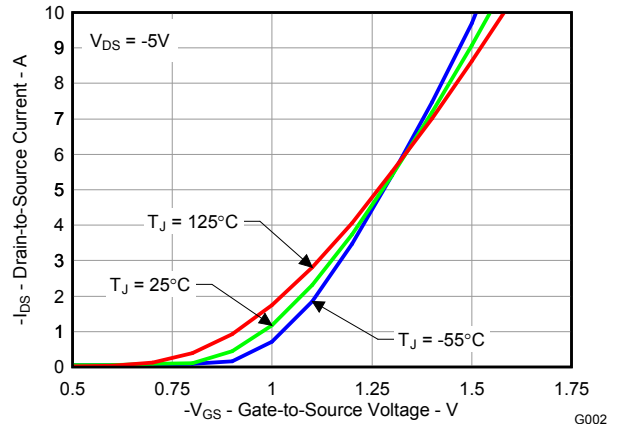T_A = 25°C, unless stated otherwise.

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Figure 1. Transient Thermal Impedance
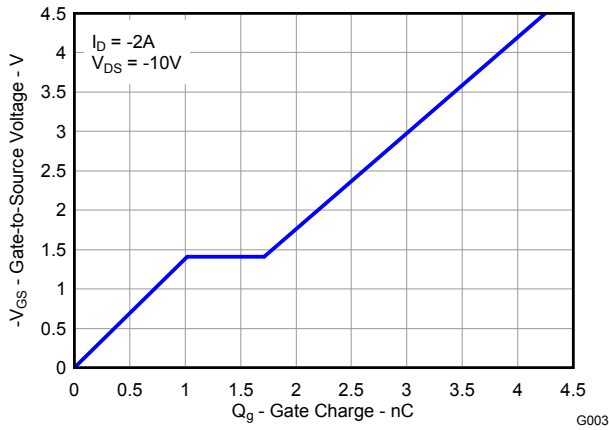
TYPICAL MOSFET CHARACTERISTICS (continued)
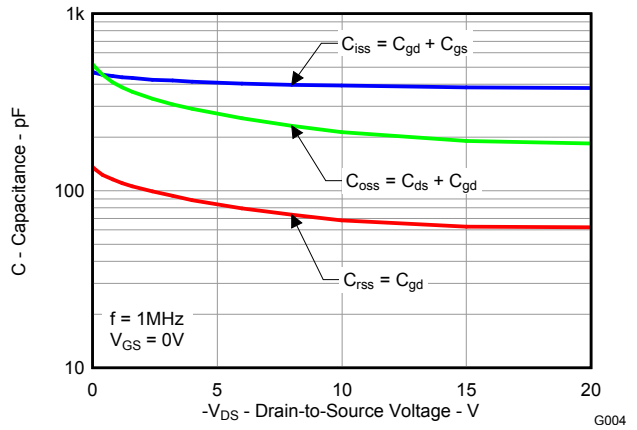
$T_A = 25°C$, unless stated otherwise.
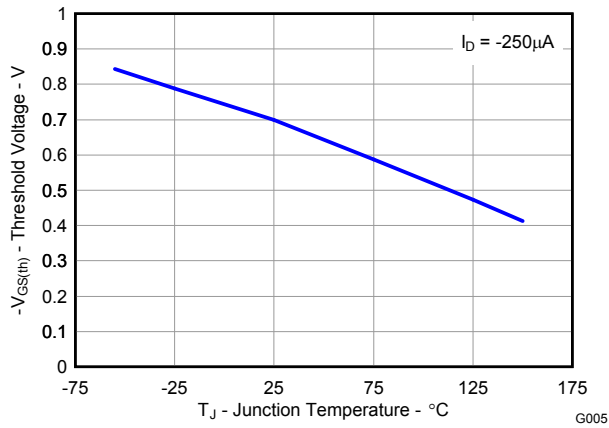

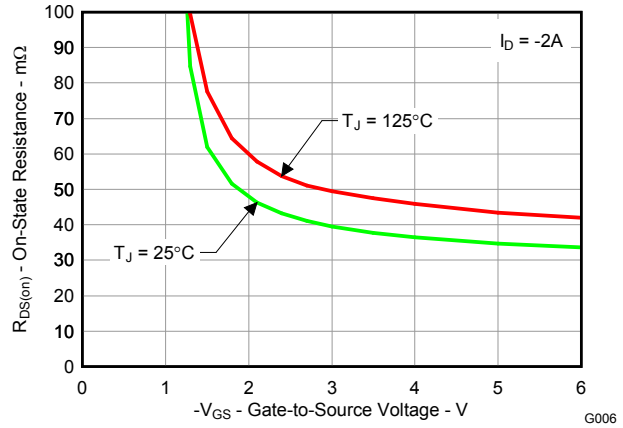Figure 2. Saturation Characteristics

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°C, unless stated otherwise.
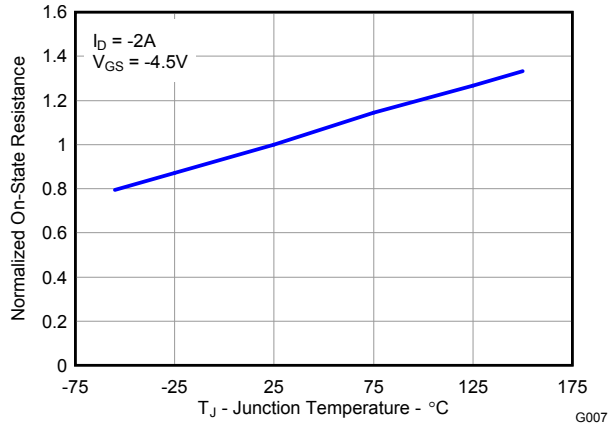
Figure 8. Normalized On-State Resistance vs. Temperature
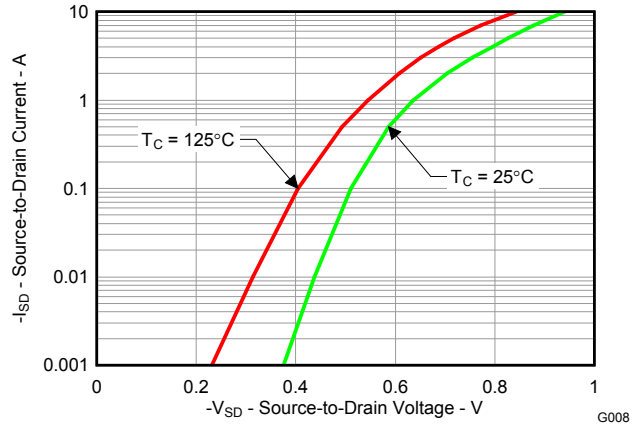
Figure 9. Typical Diode Forward Voltage

Figure 10. Maximum Safe Operating Area
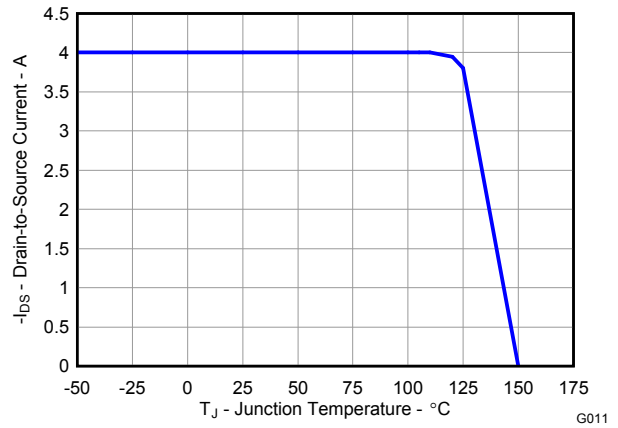
Figure 11. Maximum Drain Current vs. Temperature

MECHANICAL DATA

CSD25201W15 Package Dimensions

Top View

Side View

Bottom View

Front View
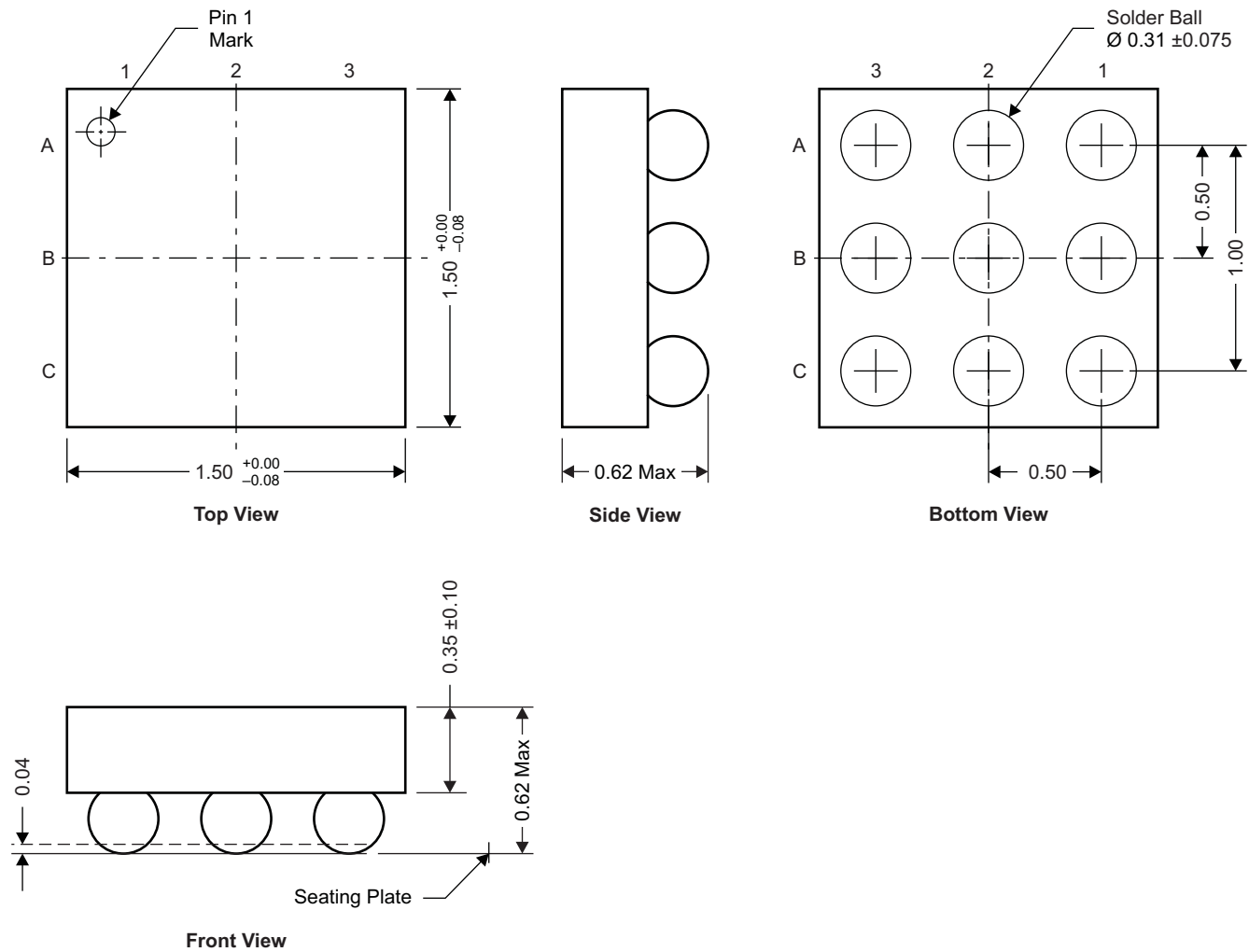
M0171-01

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

Ø 0.25

0.50

1.00

0.50
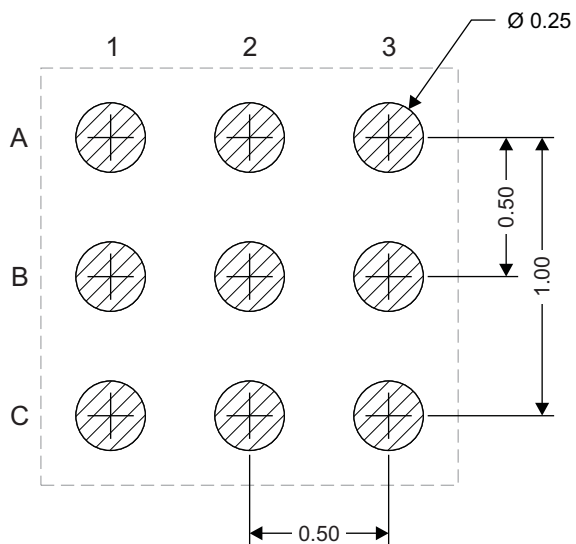
NOTE: All dimensions are in mm (unless otherwise specified)

M0172-01

Tape and Reel Information

4.00 ±0.10

2.00 ±0.05

Ø 1.50 ±0.10

8.00 +0.30 −0.10

1.75 ±0.10
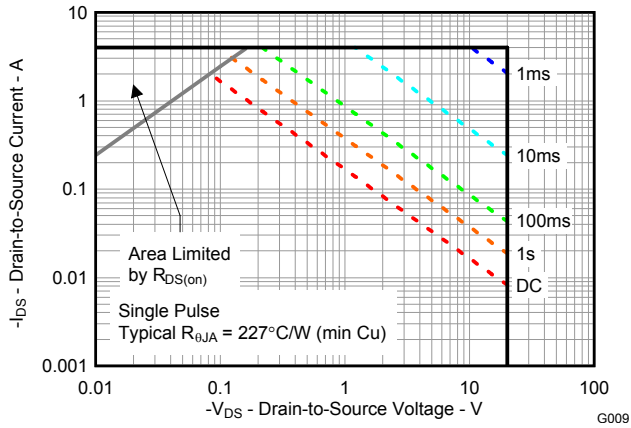
3.50 ±0.05

4.00 ±0.10

Ø 0.50 ±0.05

5° Max

1.60 ±0.05

0.86 ±0.05

0.254 ±0.02

1.60 ±0.05

5° Max
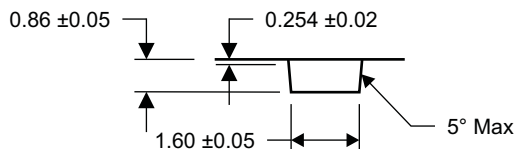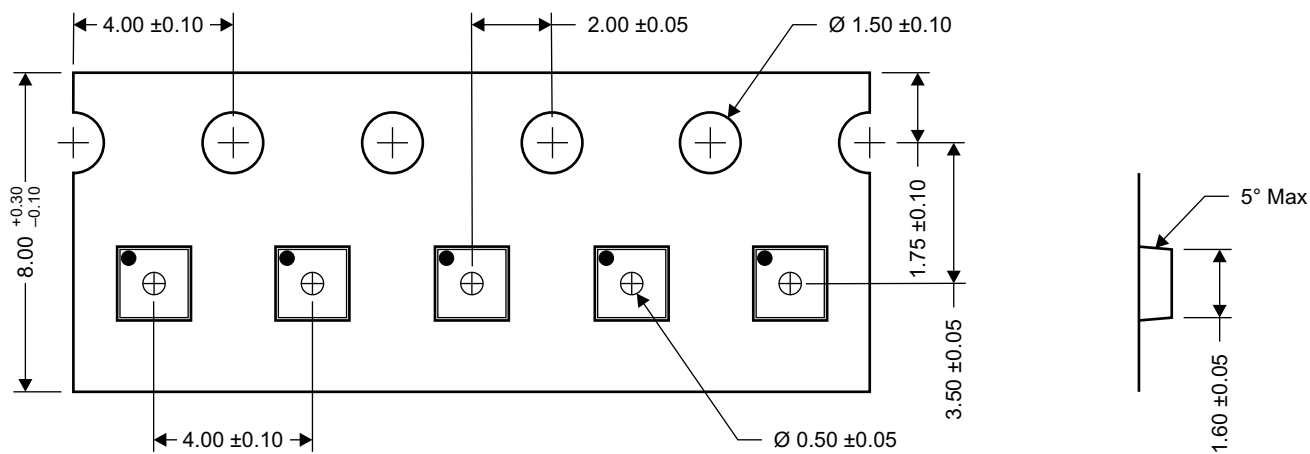
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NOTES: 1. 10-sprocket hole-pitch cumulative tolerance ±0.2

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 ±0.05mm

6. MSL1 260°C (IR and convection) PbF reflow compatible

REVISION HISTORY

Changes from Original (June 2010) to Revision A   **Page**

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
CSD25201W15	OBSOLETE	DSBGA	YZF	9		TBD	Call TI	Call TI	-55 to 150		

(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) 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)

(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/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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