P-Channel NexFET™ Power MOSFET

Check for Samples: CSD25213W10

FEATURES

- **Ultra Low Qg and Qgd**
- **Small Footprint 1mm × 1mm**
- **Low Profile 0.62mm Height**
- **Pb Free**
- **Gate-Source Voltage Clamp**
- **Gate ESD Protection**
- **RoHS Compliant**
- **Halogen Free**

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

V_{DS}	Drain to Source Voltage	–20		V
Q_g	Gate Charge Total (4.5V)	2.2		nC
Q_{gd}	Gate Charge Gate to Drain	0.14		nC
$R_{DS(on)}$	Drain to Source On Resistance	V_{GS} = –2.5V	54	mΩ
		V_{GS} = –4.5V	39	mΩ
$V_{GS(th)}$	Threshold Voltage	–0.85		V

ORDERING INFORMATION

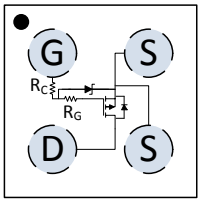
Device	Package	Media	Qty	Ship
CSD25213W10	1 × 1 Wafer Level Package	7-inch reel	3000	Tape and Reel

ABSOLUTE MAXIMUM RATINGS

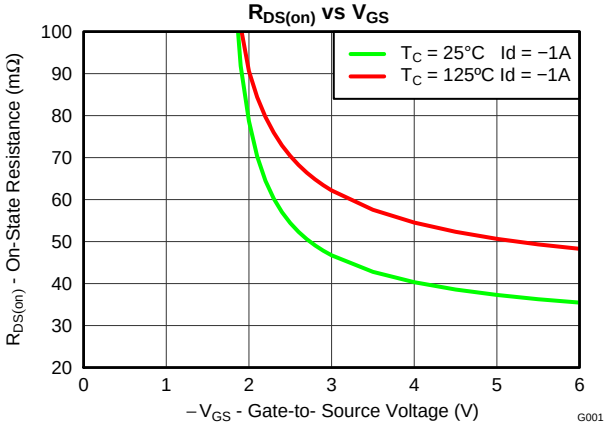
T_A = 25°C unless otherwise stated		VALUE	UNIT
V_{DS}	Drain to Source Voltage	–20	V
V_{GS}	Gate to Source Voltage	–6.0	V
I_D	Continuous Drain Current, T_A = 25°C(1)	-1.6	A
I_{DM}	Pulsed Drain Current, T_A = 25°C(2)	-16	A
I_G	Continuous Gate Clamp Current(3)	-5	mA
P_D	Power Dissipation(1)	1	W
T_J, T_{STG}	Operating Junction and Storage Temperature Range	–55 to 150	°C

(1) $R_{\theta JA}$ = 75°C/W on 1in^2 Cu (2 oz.) on 0.060" thick FR4 PCB.
(2) Pulse width ≤300µs, duty cycle ≤2%
(3) Limited by gate resistance.

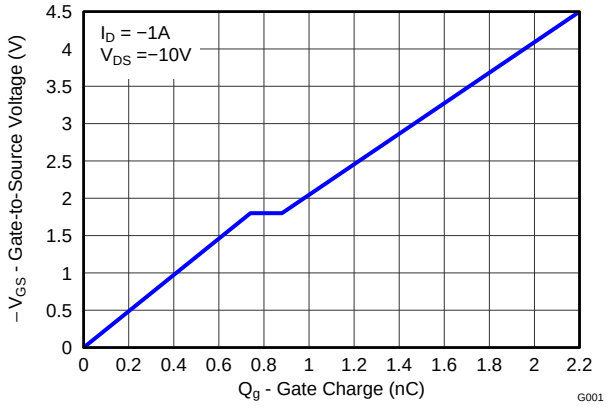
Top View



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



GATE CHARGE



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)

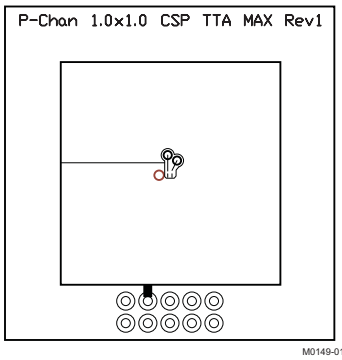
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Static Characteristics						
BV_{DSS}	Drain to Source Voltage	V_{GS} = 0V, I_D = –250µA	–20			V
BV_{GSS}	Gate to Source Voltage;	V_{DS} = 0V, I_G = –250µA	–6.0			V
I_{DSS}	Drain to Source Leakage Current	V_{GS} = 0V, V_{DS} = –10V			–1	µA
I_{GSS}	Gate to Source Leakage Current	V_{DS} = 0V, V_{GS} = –6V			–100	nA
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{DS} = V_{GS}, I_D = –250µA	–0.60	–0.85	–1.10	V
$R_{DS(on)}$	Drain to Source On Resistance	V_{GS} = –2.5V, I_D = –1A		54	67	mΩ
		V_{GS} = –4.5V, I_D = –1A		39	47	mΩ
g_{fs}	Transconductance	V_{DS} = –10V, I_D = –1A		6.2		S
Dynamic Characteristics						
C_{ISS}	Input Capacitance	V_{GS} = 0V, V_{DS} = –10V, f = 10kHz		368	478	pF
C_{OSS}	Output Capacitance			148	192	pF
C_{RSS}	Reverse Transfer Capacitance			7.8	10.1	pF
R_G	Series Gate Resistance			20		Ω
R_C	Series Clamp Resistance			5000		Ω
Q_g	Gate Charge Total (–4.5V)	V_{DS} = –10V, I_D = –1A		2.2	2.9	nC
Q_{gd}	Gate Charge Gate to Drain			0.14		nC
Q_{gs}	Gate Charge Gate to Source			0.74		nC
$Q_{g(th)}$	Gate Charge at Vth			0.43		nC
Q_{OSS}	Output Charge	V_{DS} = –10V, V_{GS} = 0V		2.5		nC
$t_{d(on)}$	Turn On Delay Time	V_{DS} = –10V, V_{GS} = –2.5V, I_D = –1A, R_G = 10Ω		510		ns
t_r	Rise Time			520		ns
$t_{d(off)}$	Turn Off Delay Time			1000		ns
t_f	Fall Time			970		ns
Diode Characteristics						
V_{SD}	Diode Forward Voltage	I_S = –1A, V_{GS} = 0V		–0.77	–1	V
Q_{rr}	Reverse Recovery Charge	V_{DS}= –10V, I_F = –1A, di/dt = 200A/µs		4.0		nC
t_{rr}	Reverse Recovery Time	V_{DS}= –10V, I_F = –1A, di/dt = 200A/µs		11		ns

THERMAL CHARACTERISTICS

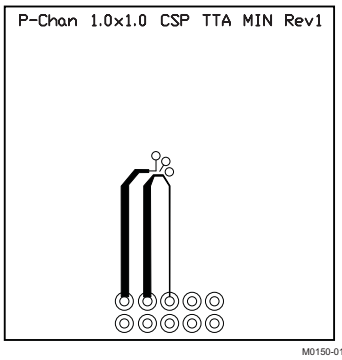
(T_A = 25°C unless otherwise stated)

PARAMETER		MIN	TYP	MAX	UNIT
$R_{\theta JA}$	Junction to Ambient Thermal Resistance(1)		75		°C/W
	Junction to Ambient Thermal Resistance(2)		265		°C/W

(1) Device mounted on FR4 material with 1-inch^2 (6.45-cm^2), 2-oz. (0.071-mm thick) Cu.
(2) Device mounted on FR4 material with minimum Cu mounting area.



Max $R_{\theta JA}$ = 90°C/W when mounted on 1inch^2 of 2 oz. Cu.



Max $R_{\theta JA}$ = 333°C/W when mounted on minimum pad area of 2 oz. Cu.

TYPICAL MOSFET CHARACTERISTICS

(T_A = 25°C unless otherwise stated)

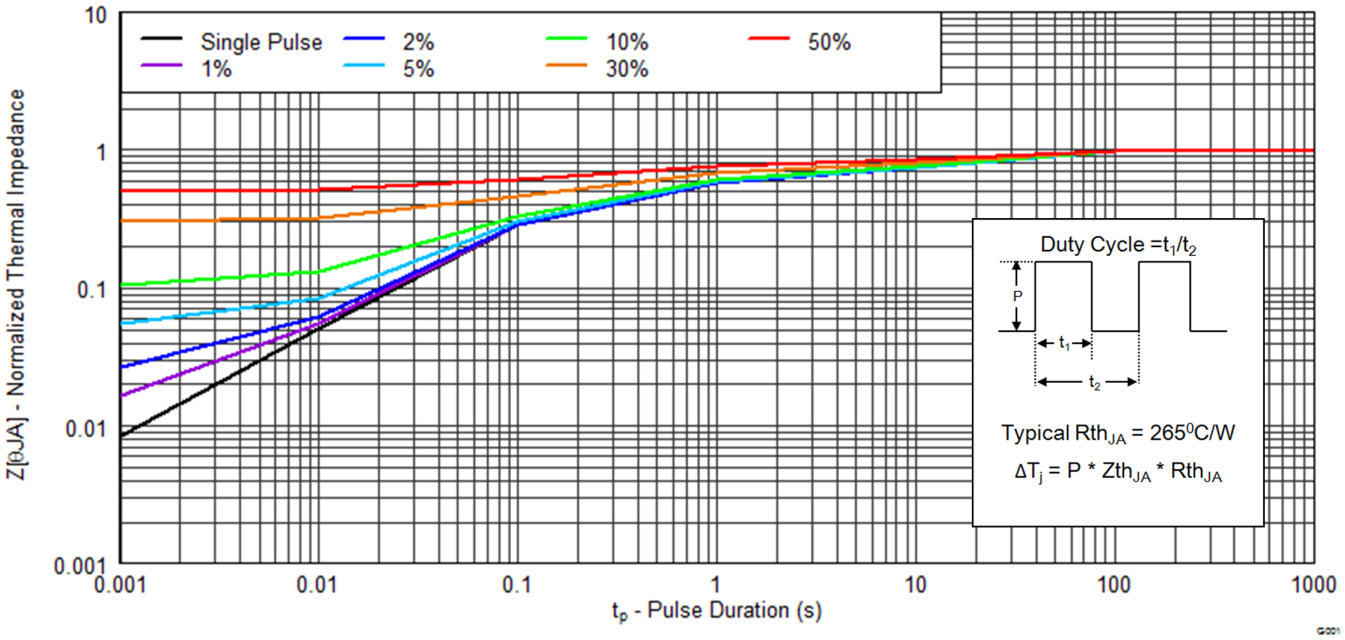


Figure 1. Transient Thermal Impedance

TYPICAL MOSFET CHARACTERISTICS (continued)

(T_A = 25°C unless otherwise stated)

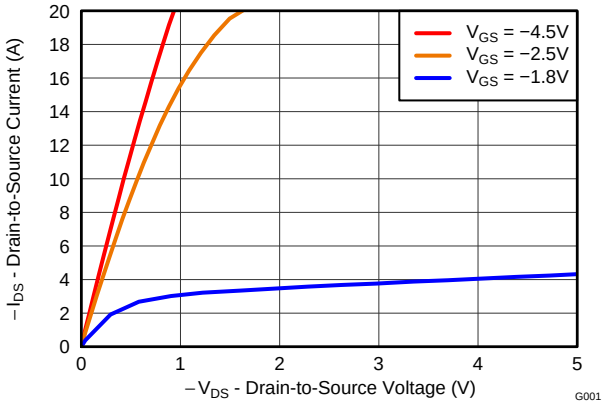


Figure 2. Saturation Characteristics

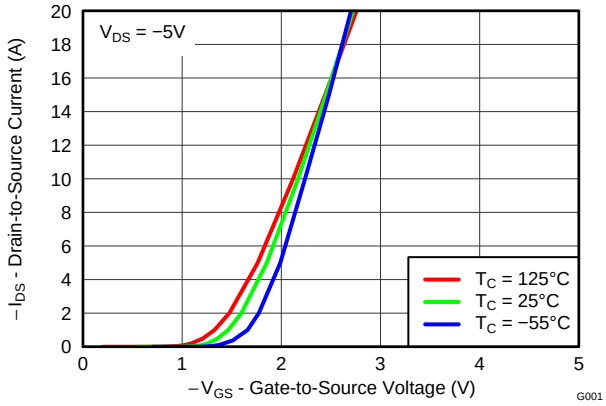


Figure 3. Transfer Characteristics

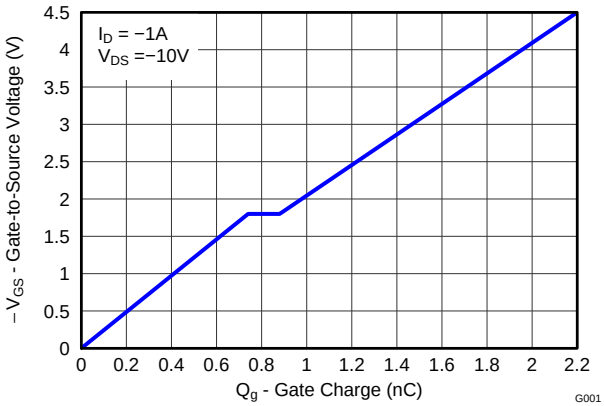


Figure 4. Gate Charge

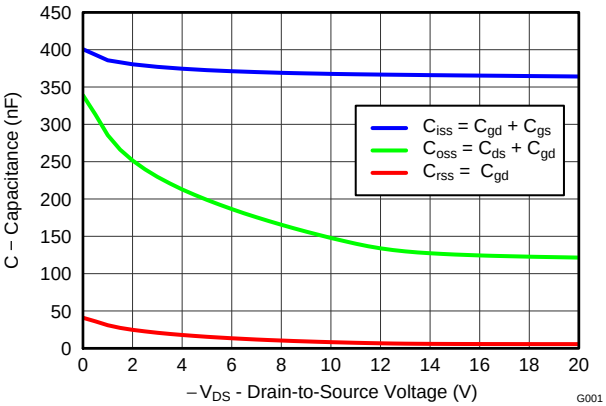


Figure 5. Capacitance

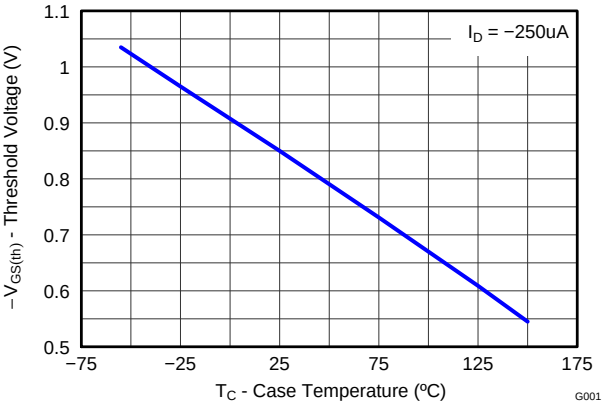


Figure 6. Threshold Voltage vs. Temperature

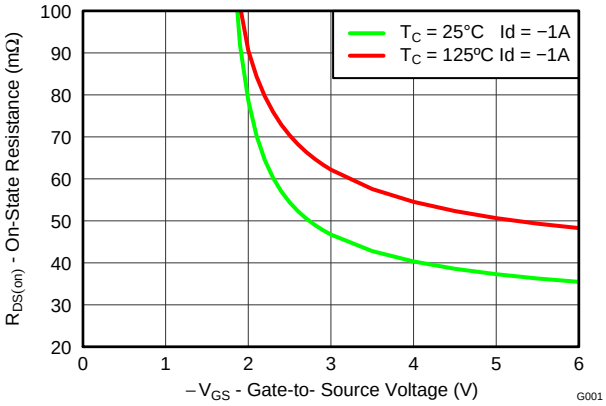


Figure 7. On-State Resistance vs. Gate-to-Source Voltage

TYPICAL MOSFET CHARACTERISTICS (continued)

(T_A = 25°C unless otherwise stated)

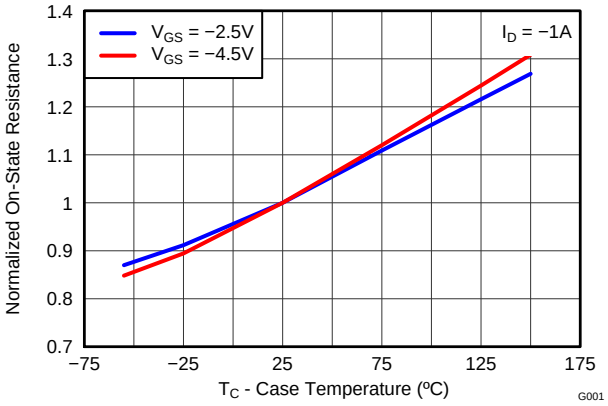


Figure 8. Normalized On-State Resistance vs. Temperature

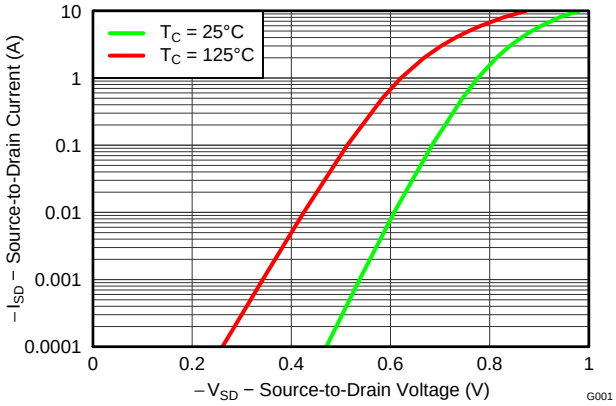


Figure 9. Typical Diode Forward Voltage

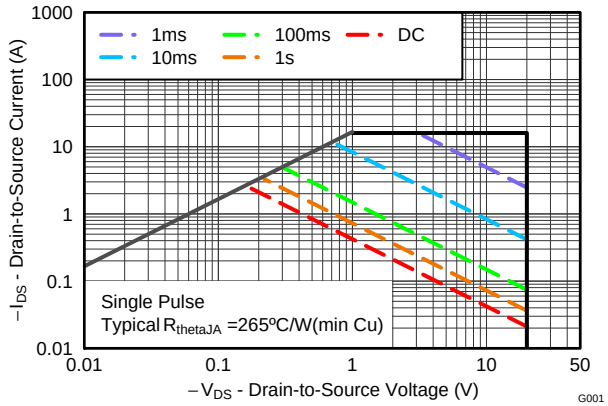


Figure 10. Maximum Safe Operating Area

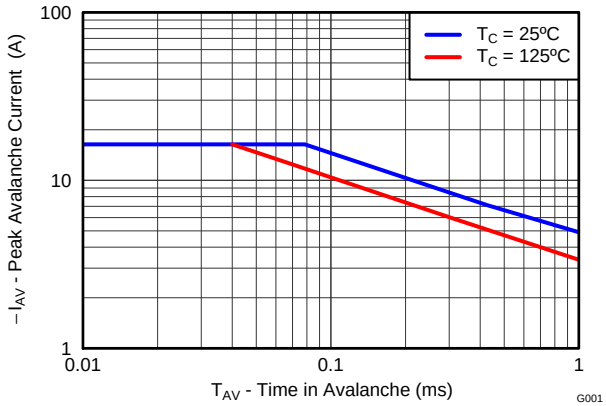


Figure 11. Single Pulse Unclamped Inductive Switching

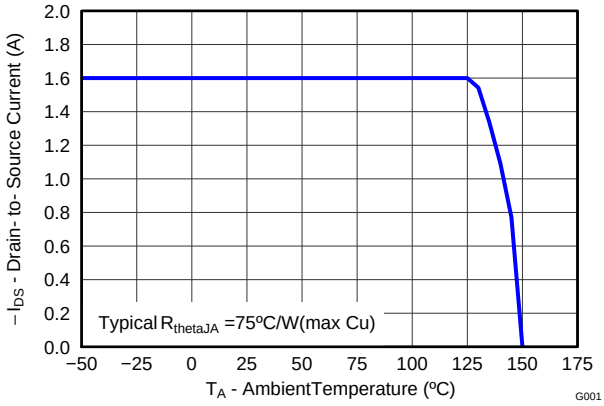
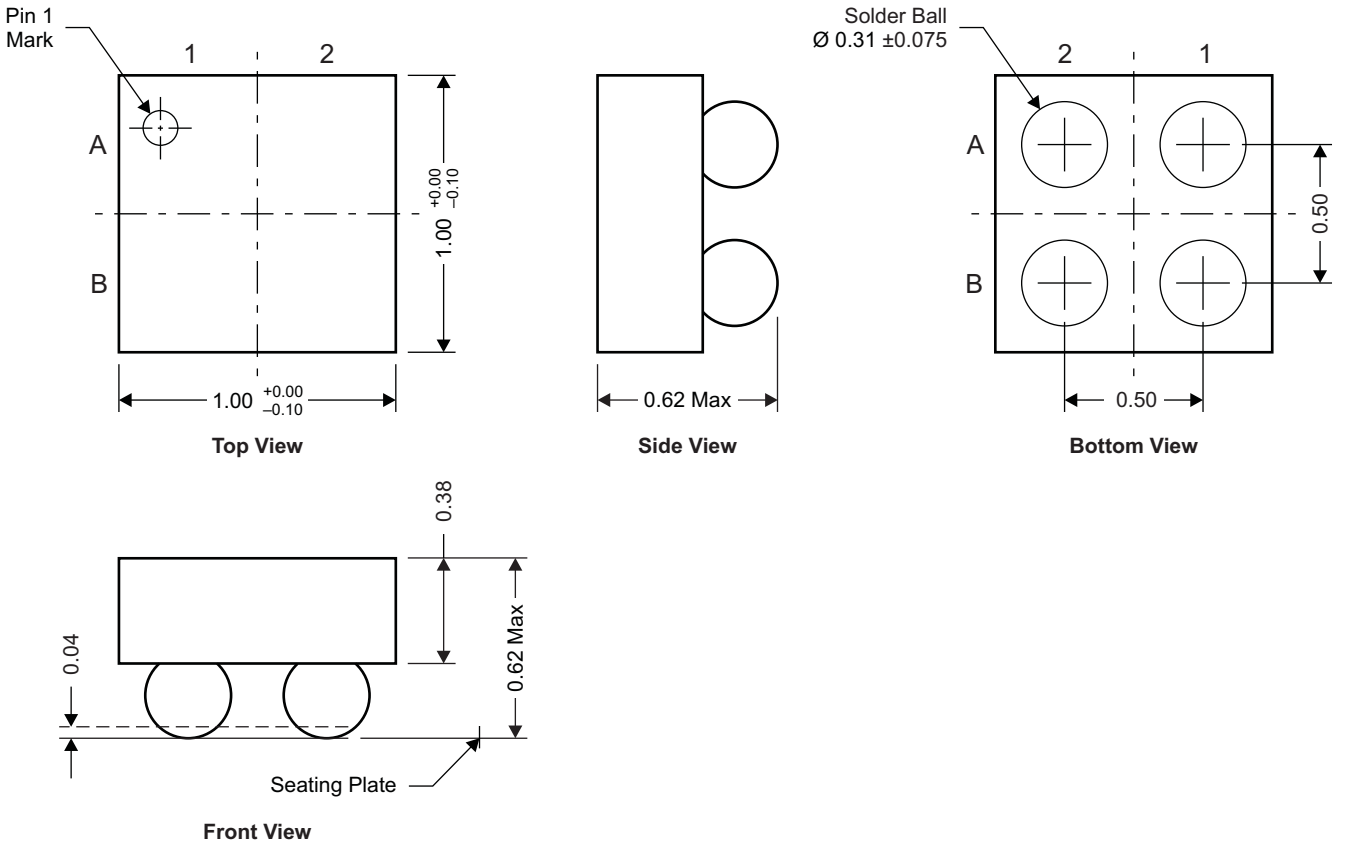


Figure 12. Maximum Drain Current vs. Temperature

MECHANICAL DATA

CSD25213W10 Package Dimensions



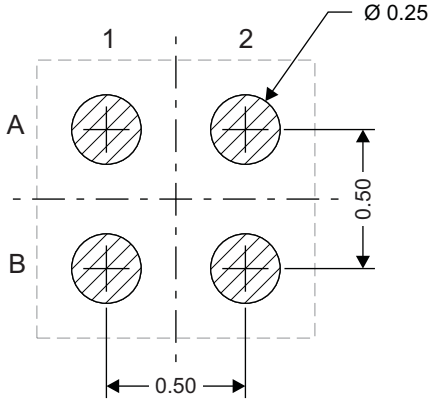
M0151-01

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

Pin Configuration Table

POSITION	DESIGNATION
A1	Gate
B1	Drain
A2, B2	Source

Land Pattern Recommendation



M0152-01

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

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
CSD25213W10	ACTIVE	DSBGA	YZB	4	3000	RoHS & Green	SNAGCU	Level-1-260C-UNLIM	-55 to 150	213	Samples

(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.

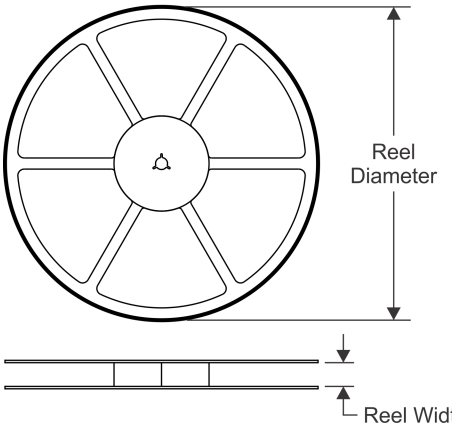
(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(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.

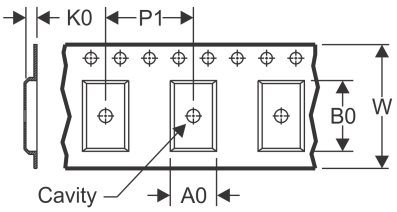
(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

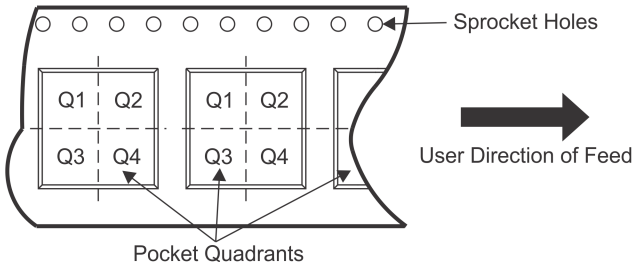


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

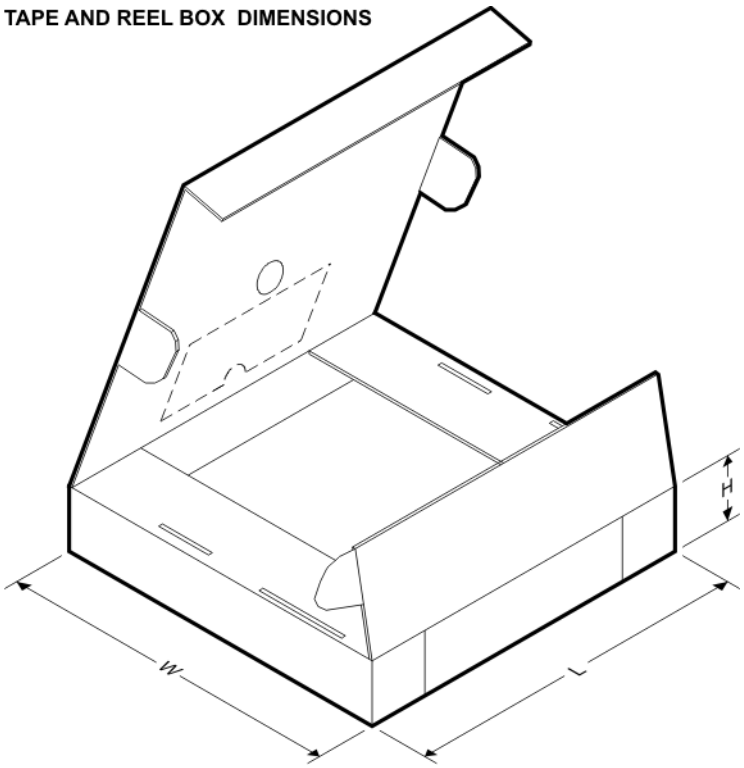
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
CSD25213W10	DSBGA	YZB	4	3000	180.0	8.4	1.06	1.06	0.69	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)
CSD25213W10	DSBGA	YZB	4	3000	182.0	182.0	20.0

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