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

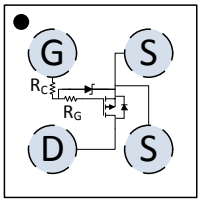
Device	Package	Media	Qty	Ship
CSD25213W10	1 × 1 Wafer Level Package	7-inch reel	3000	Tape and Reel

ABSOLUTE MAXIMUM RATINGS

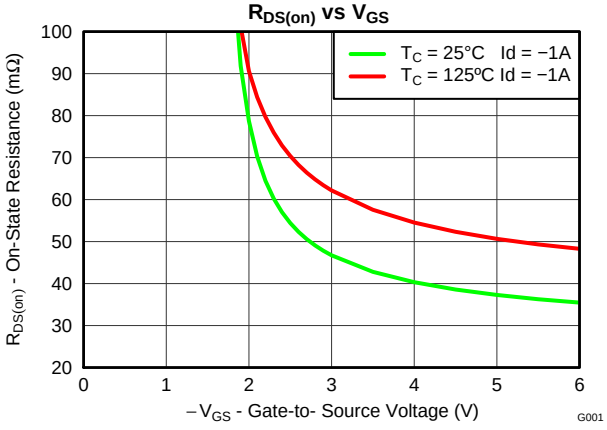
T_A = 25°C unless otherwise stated		VALUE	UNIT
V_{DS}	Drain to Source Voltage	–20	V
V_{GS}	Gate to Source Voltage	–6.0	V
I_D	Continuous Drain Current, T_A = 25°C(1)	-1.6	A
I_{DM}	Pulsed Drain Current, T_A = 25°C(2)	-16	A
I_G	Continuous Gate Clamp Current(3)	-5	mA
P_D	Power Dissipation(1)	1	W
T_J, T_{STG}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

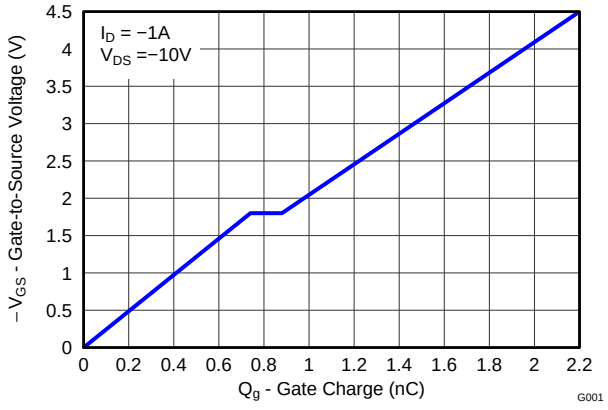
Top View



$R_{DS(on)}$ 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)

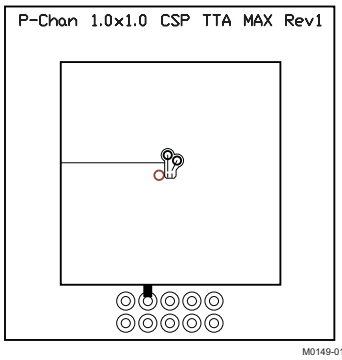
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Static Characteristics						
BV_{DSS}	Drain to Source Voltage	V_{GS} = 0V, I_D = –250µA	–20			V
BV_{GSS}	Gate to Source Voltage;	V_{DS} = 0V, I_G = –250µA	–6.0			V
I_{DSS}	Drain to Source Leakage Current	V_{GS} = 0V, V_{DS} = –10V			–1	µA
I_{GSS}	Gate to Source 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

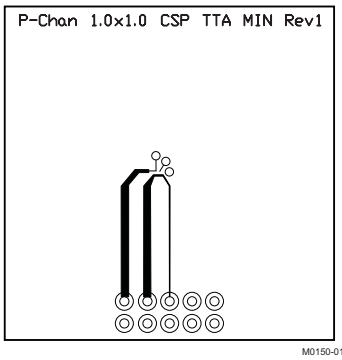
(T_A = 25°C unless otherwise stated)

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)

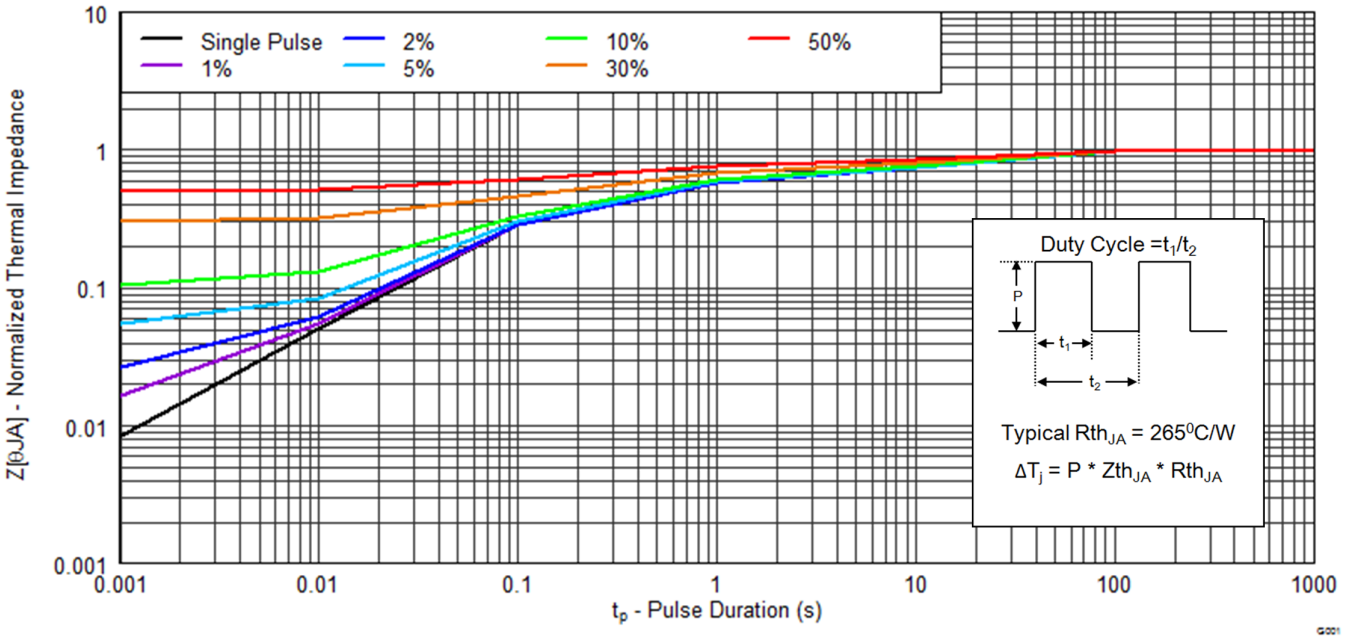


Figure 1. Transient Thermal Impedance

TYPICAL MOSFET CHARACTERISTICS (continued)

(T_A = 25°C unless otherwise stated)

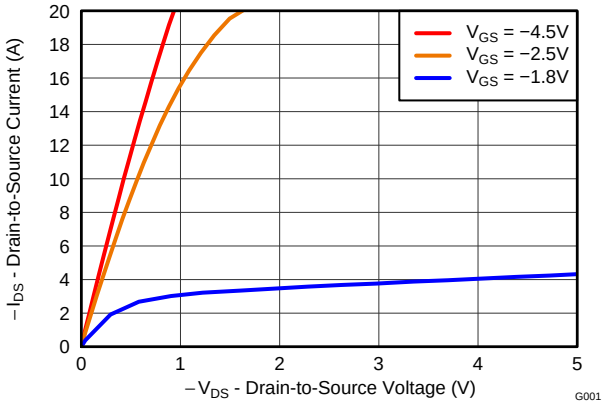


Figure 2. Saturation Characteristics

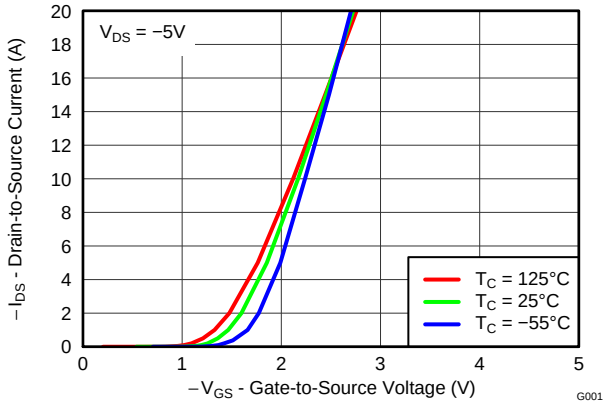


Figure 3. Transfer Characteristics

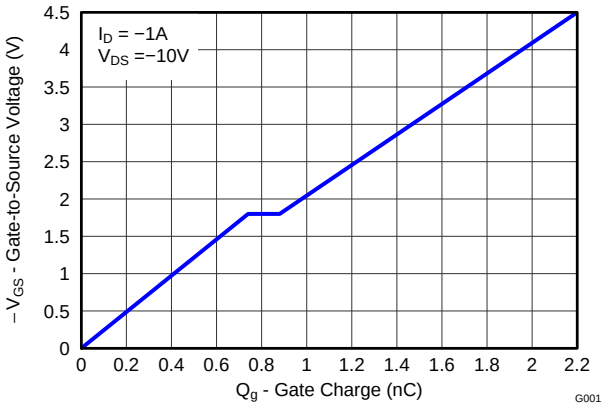


Figure 4. Gate Charge

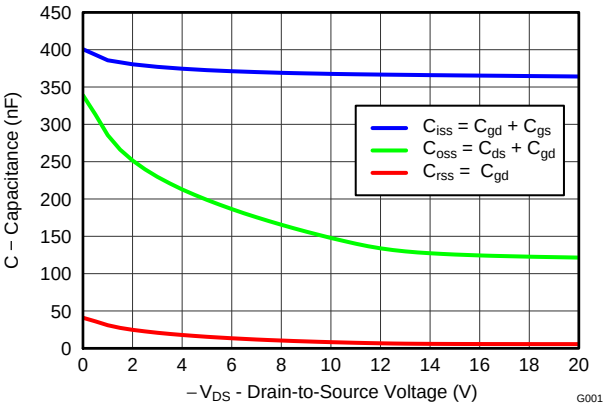


Figure 5. Capacitance

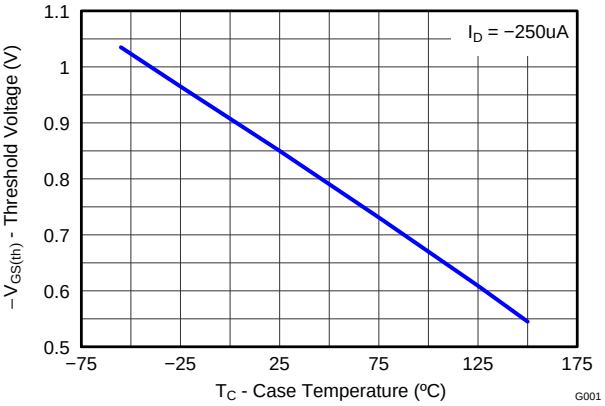


Figure 6. Threshold Voltage vs. Temperature

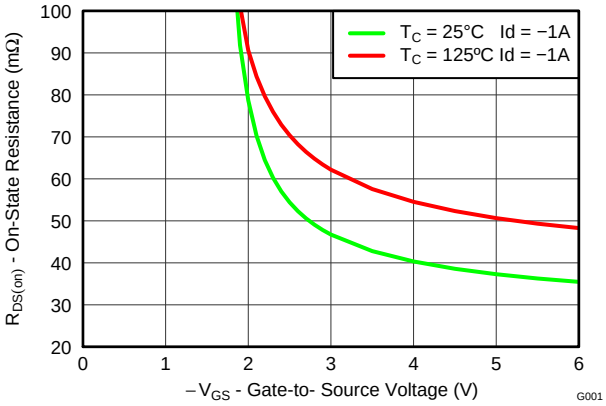


Figure 7. On-State Resistance vs. Gate-to-Source Voltage

TYPICAL MOSFET CHARACTERISTICS (continued)

(T_A = 25°C unless otherwise stated)

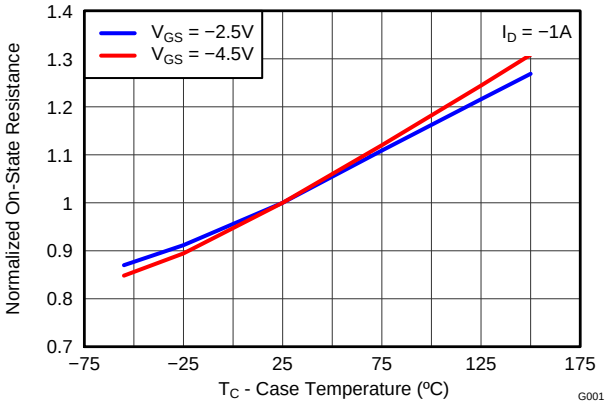


Figure 8. Normalized On-State Resistance vs. Temperature

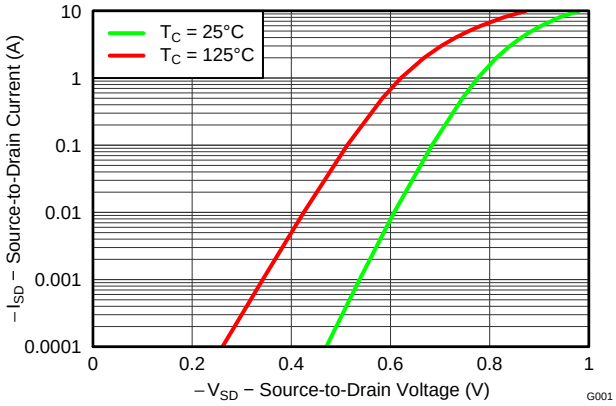


Figure 9. Typical Diode Forward Voltage

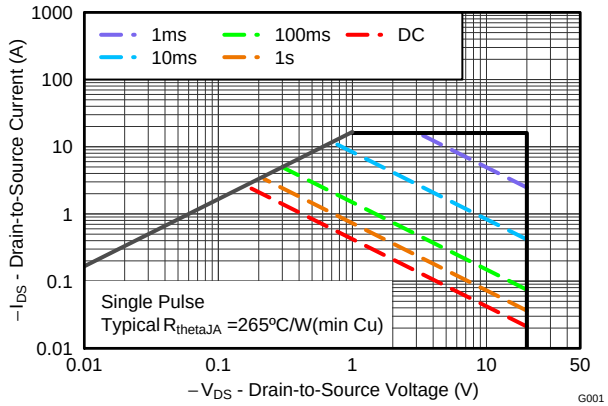


Figure 10. Maximum Safe Operating Area

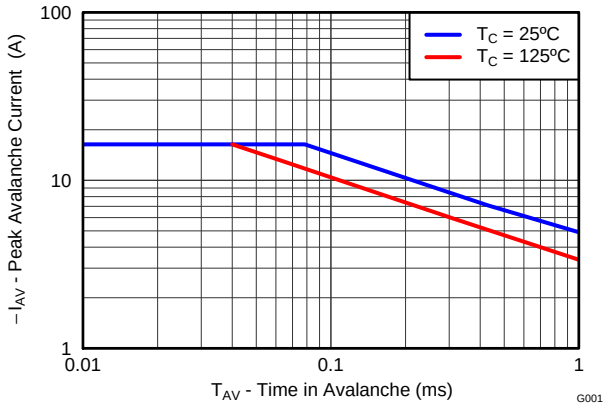


Figure 11. Single Pulse Unclamped Inductive Switching

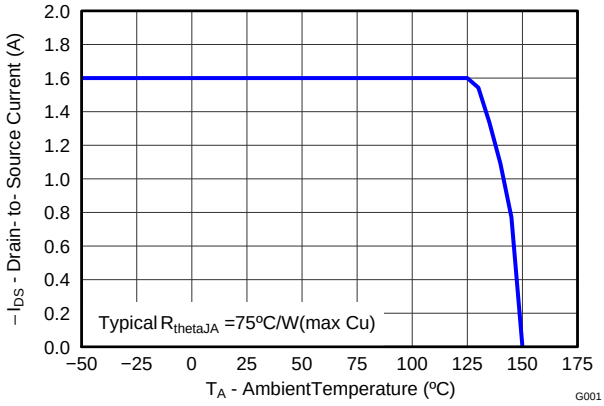
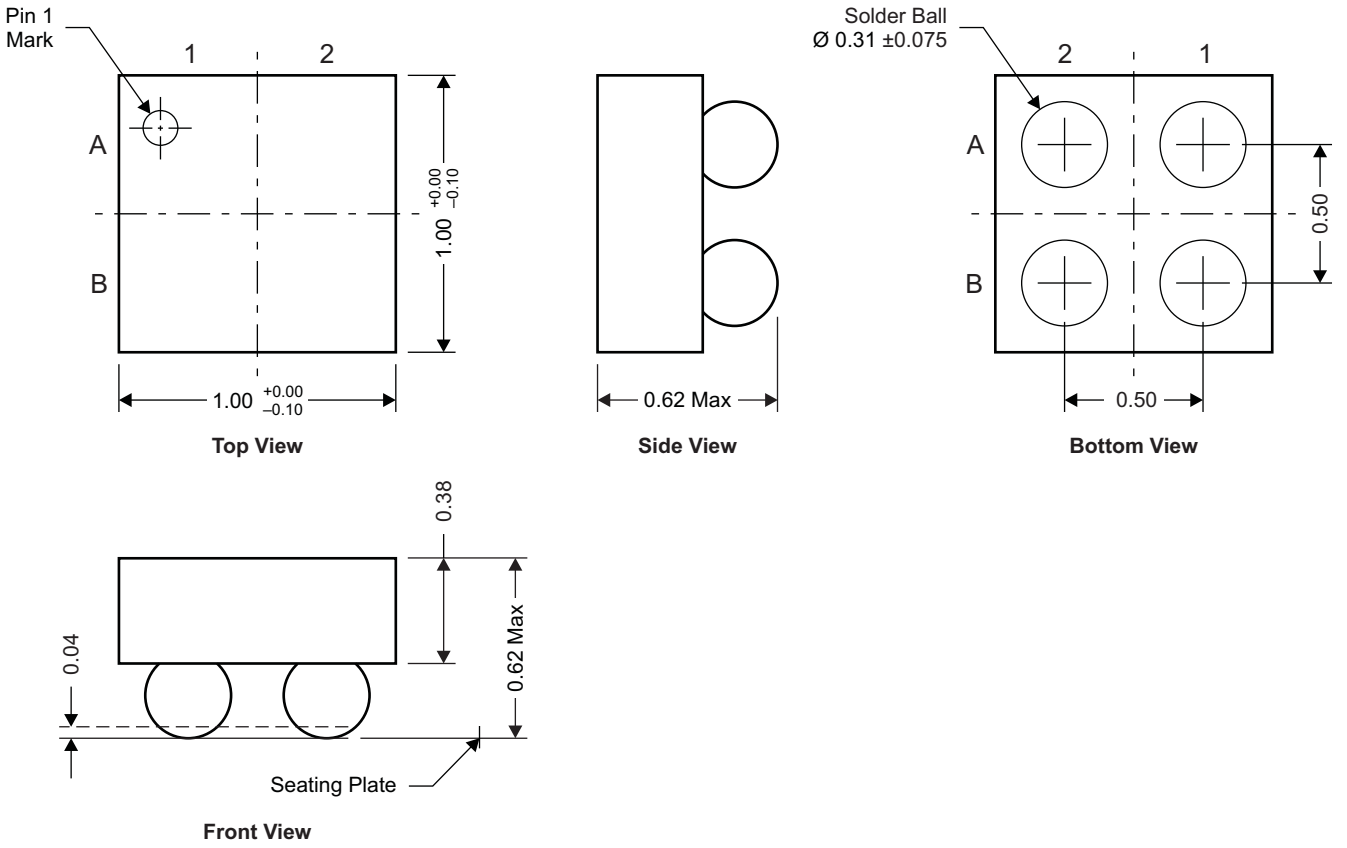


Figure 12. Maximum Drain Current vs. Temperature

MECHANICAL DATA

CSD25213W10 Package Dimensions



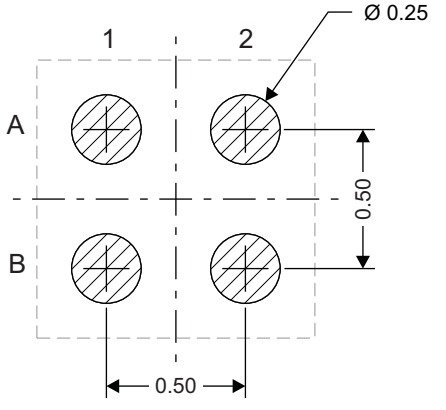
M0151-01

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 part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
CSD25213W10	Active	Production	DSBGA (YZB) | 4	3000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-55 to 150	213
CSD25213W10.B	Active	Production	DSBGA (YZB) | 4	3000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-55 to 150	213

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **Lead finish/Ball material:** Parts 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.

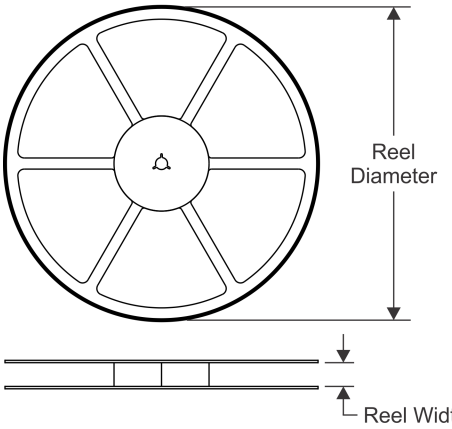
(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

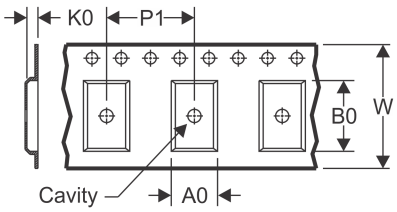
Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

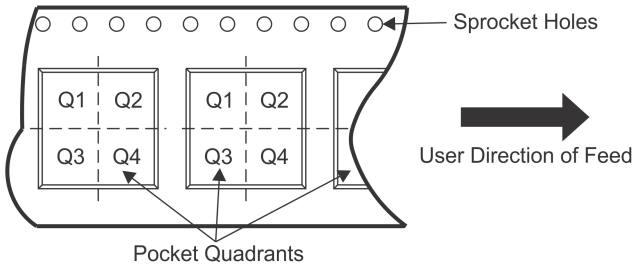


TAPE DIMENSIONS



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

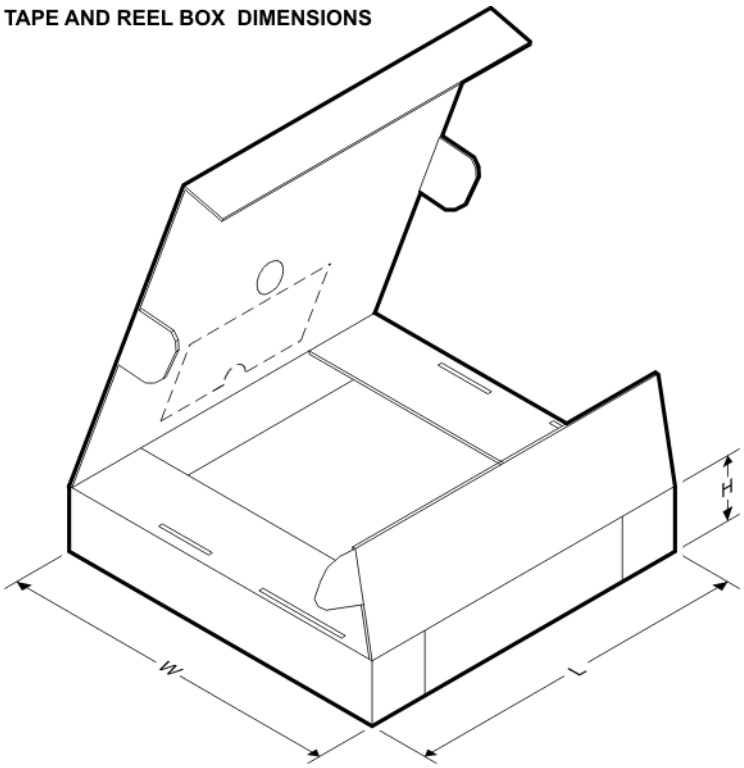
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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	2.0	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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