

CSD25483F4 20-V P-Channel FemtoFET™ MOSFET

1 Features

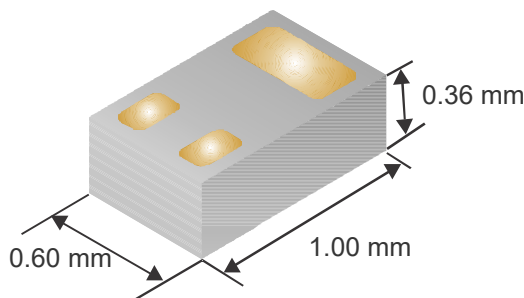
- Ultra-low on-resistance
- Ultra-low Q_g and Q_{gd}
- High operating drain current
- Ultra-small footprint (0402 case size)
 - 1.0 mm × 0.6 mm
- Ultra-low profile
 - Maximum height: 0.36-mm
- Integrated ESD protection diode
 - Rated > 4-kV HBM
 - Rated > 2-kV CDM
- Lead and halogen free
- RoHS compliant

2 Applications

- Optimized for load switch applications
- Optimized for general purpose switching applications
- Battery applications
- Handheld and mobile applications

3 Description

This 210-mΩ, 20-V P-Channel FemtoFET™ MOSFET is designed and optimized to minimize the footprint in many handheld and mobile applications. This technology is capable of replacing standard small signal MOSFETs while providing at least a 60% reduction in footprint size.



Typical Device Dimensions

Product Summary

$T_A = 25^\circ\text{C}$		TYPICAL VALUE	UNIT
V_{DS}	Drain-to-source voltage	-20	V
Q_g	Gate charge total (-4.5 V)	959	pC
Q_{gd}	Gate charge gate-to-drain	161	pC
$R_{DS(on)}$	Drain-to-source on-resistance	$V_{GS} = -1.8\text{ V}$	530 mΩ
		$V_{GS} = -2.5\text{ V}$	338 mΩ
		$V_{GS} = -4.5\text{ V}$	210 mΩ
$V_{GS(th)}$	Threshold voltage	-0.95	V

Ordering Information⁽¹⁾

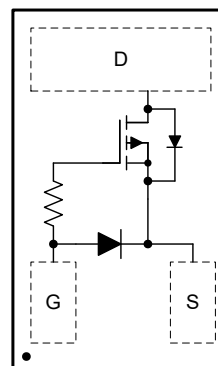
DEVICE	QTY	MEDIA	PACKAGE	SHIP
CSD25483F4	3000	7-Inch Reel	Femto (0402)	Tape and Reel
CSD25483F4T	250		1.0-mm × 0.6-mm Land Grid Array (LGA)	

- (1) For all available packages, see the orderable addendum at the end of the data sheet.

Absolute Maximum Ratings

$T_A = 25^\circ\text{C}$		VALUE	UNIT
V_{DS}	Drain-to-source voltage	-20	V
V_{GS}	Gate-to-source voltage	-12	V
I_D	Continuous drain current ⁽¹⁾	-1.6	A
I_{DM}	Pulsed drain current ⁽²⁾	-6.5	A
I_G	Continuous gate clamp current	-35	mA
	Pulsed gate clamp current ⁽²⁾	-350	
P_D	Power dissipation ⁽¹⁾	500	mW
$V_{(ESD)}$	Human body model (HBM)	4	kV
	Charged device model (CDM)	2	kV
T_J, T_{stg}	Operating junction and storage temperature range	-55 to 150	°C

- (1) Typical $R_{\theta JA} = 85^\circ\text{C/W}$ on 1-inch² (6.45 cm²), 2-oz. (0.071 mm thick) Cu pad on a 0.06-inch (1.52 mm) thick FR4 PCB.
- (2) Pulse duration $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$



Top View



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4 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision E (October 2021) to Revision F (January 2022)	Page
• Changed Maximum height from "0.35 mm" to "0.36 mm" in <i>Features</i>	1
• Changed height dimension from "0.35 mm" to "0.36 mm" in <i>Typical Device Dimensions</i>	1
• Changed maximum height dimension from "0.35 mm" to "0.36 mm" in <i>Mechanical Dimensions</i>	7
Changes from Revision D (October 2014) to Revision E (October 2021)	Page
• Updated the numbering format for tables, figures, and cross-references throughout the document.....	1
• Added footnote with link to support document.....	8
Changes from Revision C (July 2014) to Revision D (October 2014)	Page
• Corrected timing V_{DS} to read -10 V	3
Changes from Revision B (February 2014) to Revision C (July 2014)	Page
• Corrected capacitance units to read pF in Figure 5-5	4
Changes from Revision A (December 2013) to Revision B (February 2014)	Page
• Updated lead and halogen free in features	1
• Added I_G parameter.....	1
• Lowered I_{DSS} limit.....	3
• Lowered I_{GSS} limit.....	3
Changes from Revision * (October 2013) to Revision A (December 2013)	Page
• Fixed resistance typo.....	1
• Added small reel.....	1

5 Specifications

5.1 Electrical Characteristics

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
STATIC CHARACTERISTICS						
BV _{DSS}	Drain-to-Source Voltage	V _{GS} = 0 V, I _{DS} = −250 μA	−20			V
I _{DSS}	Drain-to-Source Leakage Current	V _{GS} = 0 V, V _{DS} = −16 V	−100			nA
I _{GSS}	Gate-to-Source Leakage Current	V _{DS} = 0 V, V _{GS} = −12 V	−50			nA
V _{GS(th)}	Gate-to-Source Threshold Voltage	V _{DS} = V _{GS} , I _{DS} = −250 μA	−0.70	−0.95	−1.2	V
R _{DS(on)}	Drain-to-Source On-Resistance	V _{GS} = −1.8 V, I _{DS} = −0.1 A		530	1070	mΩ
		V _{GS} = −2.5 V, I _{DS} = −0.5 A		338	390	mΩ
		V _{GS} = −4.5 V, I _{DS} = −0.5 A		210	245	mΩ
		V _{GS} = −8 V, I _{DS} = −0.5 A		175	205	mΩ
g _{fs}	Transconductance	V _{DS} = −10 V, I _{DS} = −0.5 A	1.4			S
DYNAMIC CHARACTERISTICS						
C _{iss}	Input Capacitance	V _{GS} = 0 V, V _{DS} = −10 V, f = 1 MHz	198			pF
C _{oss}	Output Capacitance		82			pF
C _{rss}	Reverse Transfer Capacitance		5.8			pF
R _G	Series Gate Resistance		20			Ω
Q _g	Gate Charge Total (4.5 V)	V _{DS} = −10 V, I _{DS} = −0.5 A	959			pC
Q _{gd}	Gate Charge Gate-to-Drain		160			pC
Q _{gs}	Gate Charge Gate-to-Source		252			pC
Q _{g(th)}	Gate Charge at V _{th}		122			pC
Q _{oss}	Output Charge	V _{DS} = −10 V, V _{GS} = 0 V	1081			pC
t _{d(on)}	Turn On Delay Time	V _{DS} = −10 V, V _{GS} = −4.5 V, I _{DS} = −0.5 A, R _G = 2 Ω	4.3			ns
t _r	Rise Time		3.7			ns
t _{d(off)}	Turn Off Delay Time		17.4			ns
t _f	Fall Time		7			ns
DIODE CHARACTERISTICS						
V _{SD}	Diode Forward Voltage	I				

5.2 Thermal Information

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

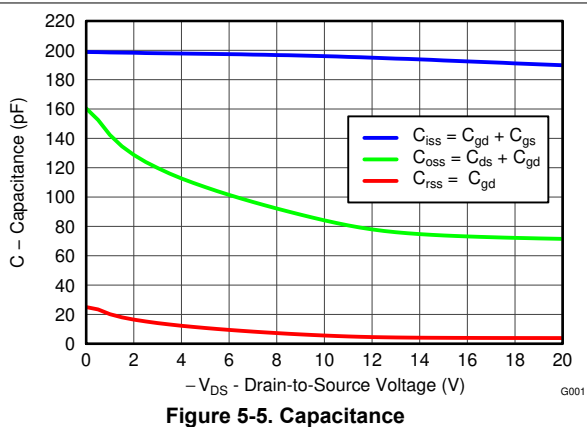
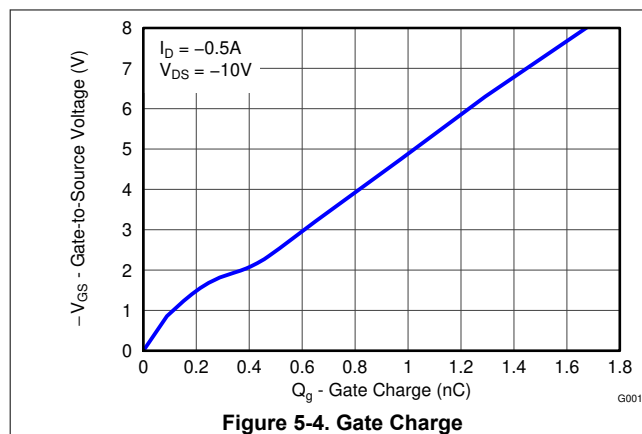
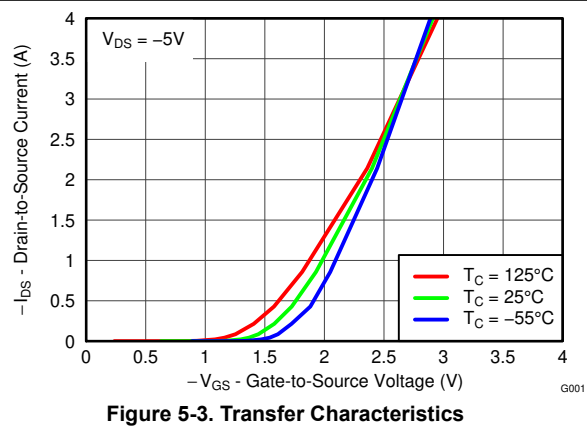
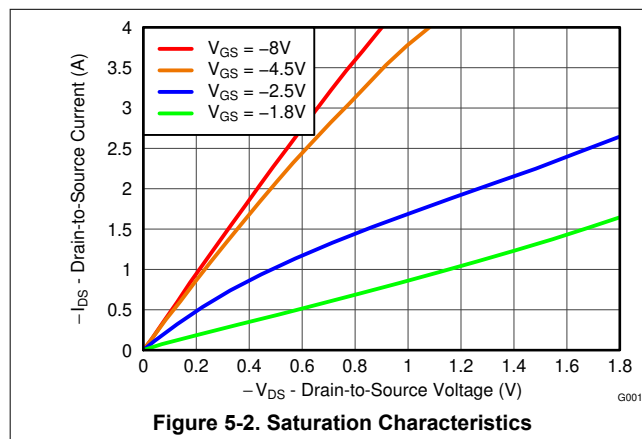
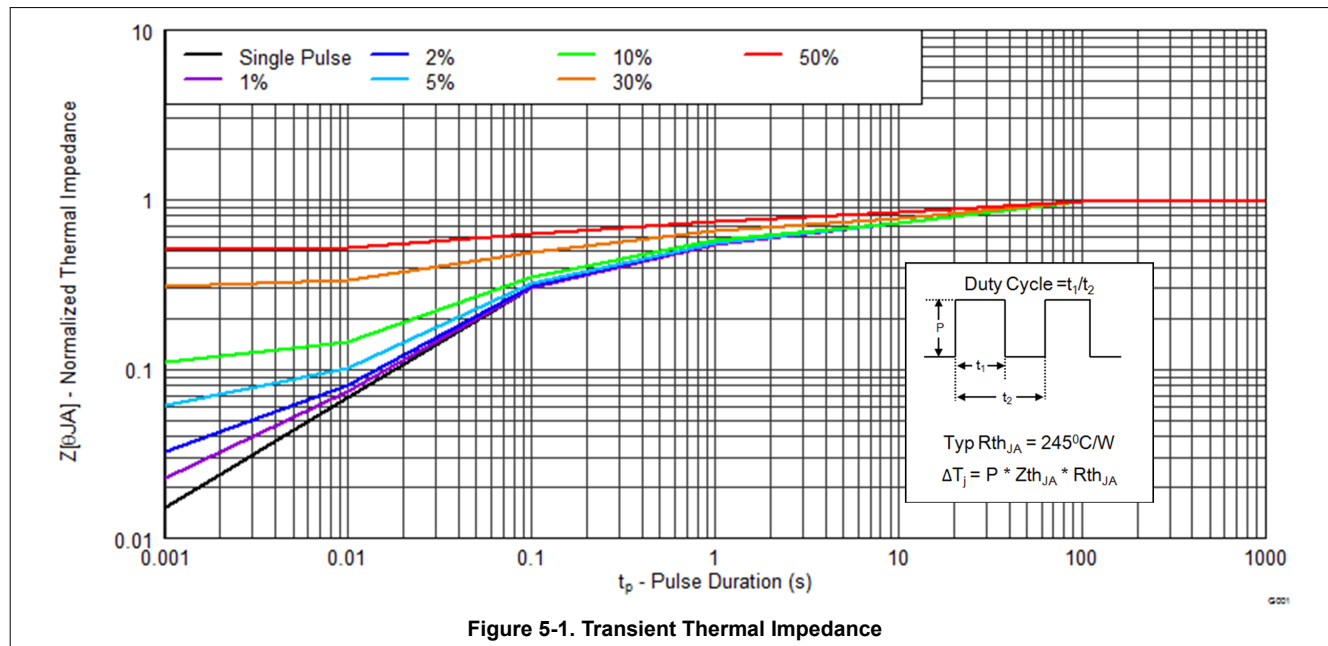
THERMAL METRIC		TYPICAL VALUES	UNIT
$R_{\theta JA}$	Junction-to-Ambient Thermal Resistance ⁽¹⁾	85	$^\circ\text{C}/\text{W}$
	Junction-to-Ambient Thermal Resistance ⁽²⁾	245	

(1) Device mounted on FR4 material with 1-inch² (6.45 cm²), 2-oz. (0.071-mm thick) Cu.

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

5.3 Typical MOSFET Characteristics

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



5.3 Typical MOSFET Characteristics (continued)

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

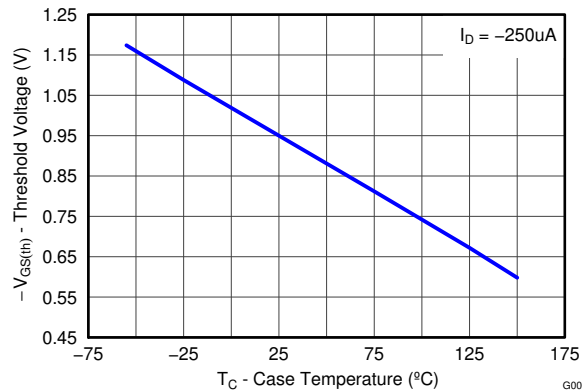


Figure 5-6. Threshold Voltage vs Temperature

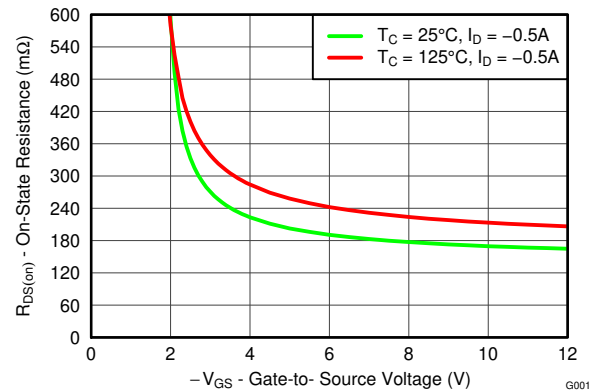


Figure 5-7. On-State Resistance vs Gate-to-Source Voltage

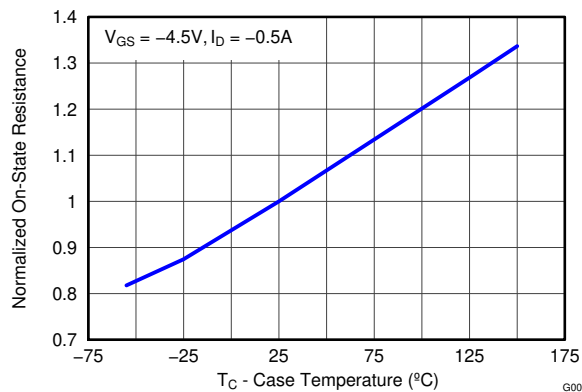


Figure 5-8. Normalized On-State Resistance vs Temperature

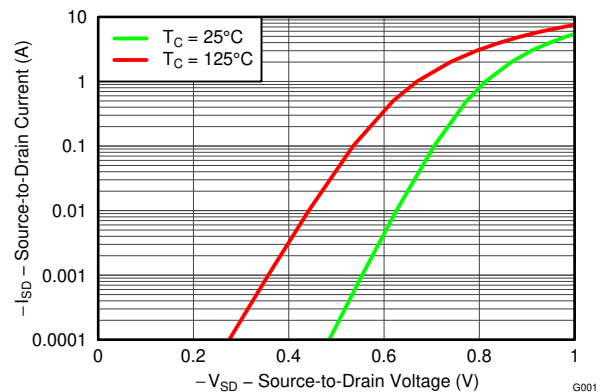


Figure 5-9. Typical Diode Forward Voltage

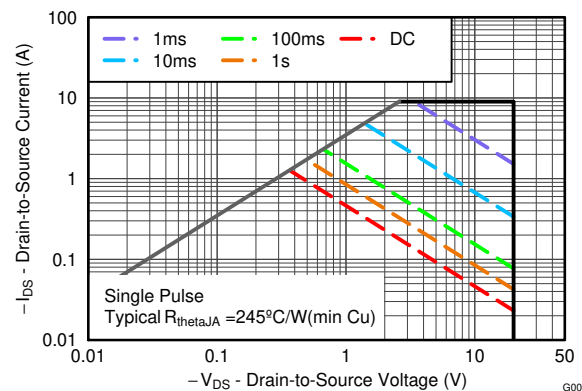


Figure 5-10. Maximum Safe Operating Area

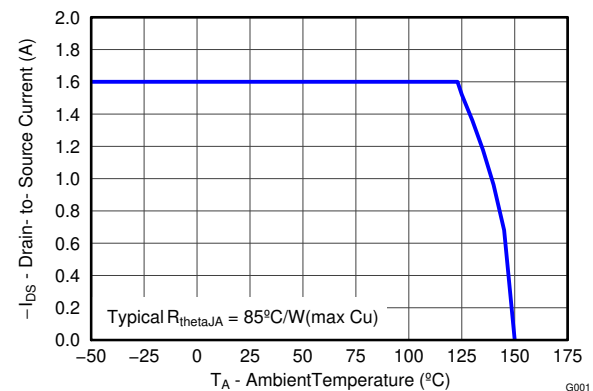


Figure 5-11. Maximum Drain Current vs Temperature

6 Device and Documentation Support

6.1 Trademarks

FemtoFET™ is a trademark of Texas Instruments.

All trademarks are the property of their respective owners.

6.2 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

6.3 Glossary

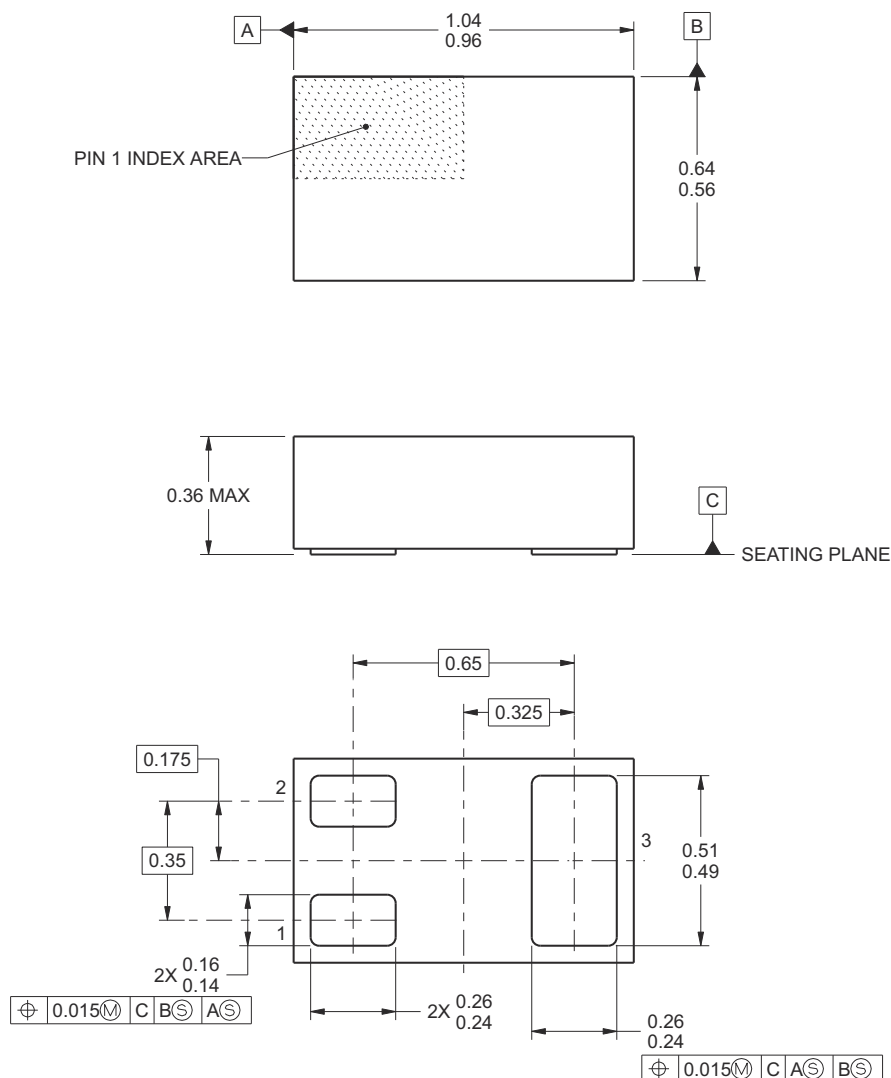
[TI Glossary](#)

This glossary lists and explains terms, acronyms, and definitions.

7 Mechanical Data

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

7.1 Mechanical Dimensions

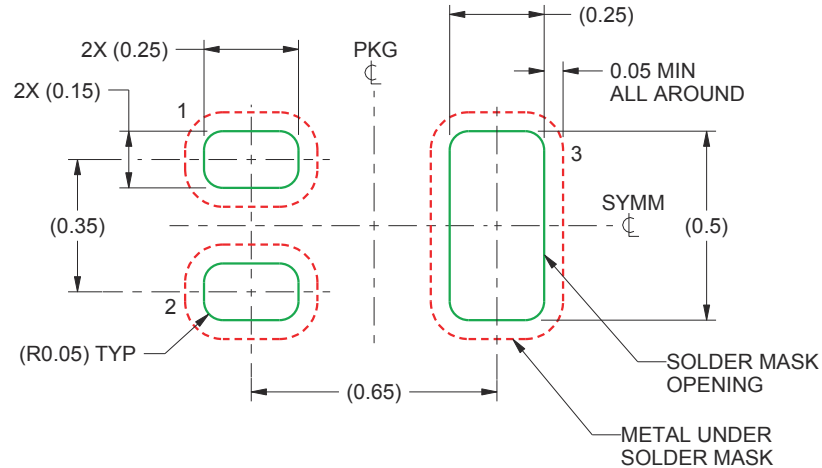


- A. All linear dimensions are in millimeters (dimensions and tolerancing per AME T14.5M-1994).
- B. This drawing is subject to change without notice.
- C. This package is a PB-free solder land design.

Pin Configuration

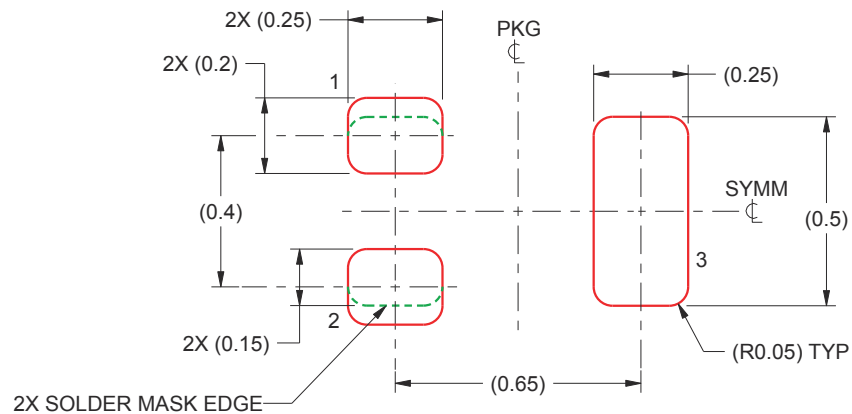
Position	Designation
Pin 1	Gate
Pin 2	Source
Pin 3	Drain

7.2 Recommended Minimum PCB Layout



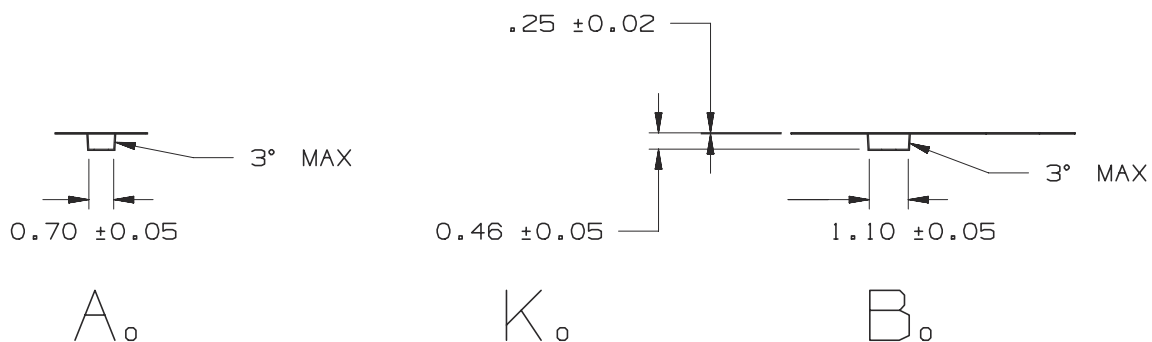
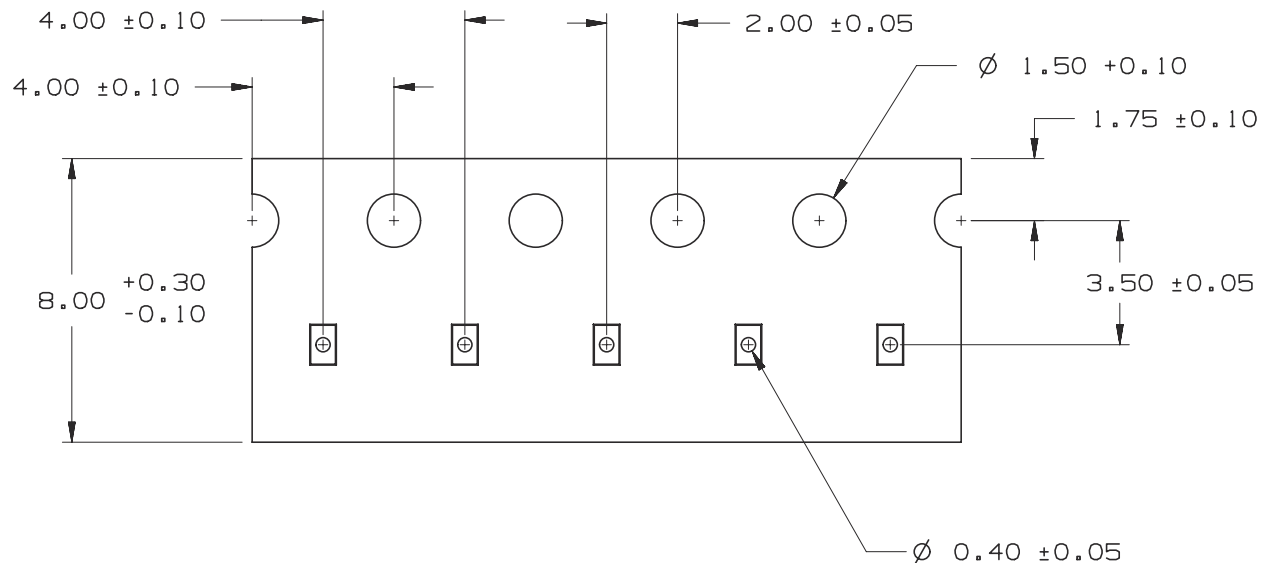
- A. All dimensions are in millimeters.
- B. For more information, see [FemtoFET Surface Mount Guide](#) (SLRA003D).

7.3 Recommended Stencil Pattern



- A. All dimensions are in millimeters.

7.4 CSD25483F4 Embossed Carrier Tape Dimensions



- A. Pin 1 is oriented in the top-right quadrant of the tape enclosure (quadrant 2), closest to the carrier tape sprocket holes.

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
CSD25483F4	ACTIVE	PICOSTAR	YJC	3	3000	RoHS & Green	NIAU	Level-1-260C-UNLIM	-55 to 150	DR	Samples
CSD25483F4T	ACTIVE	PICOSTAR	YJC	3	250	RoHS & Green	NIAU	Level-1-260C-UNLIM	-55 to 150	DR	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.

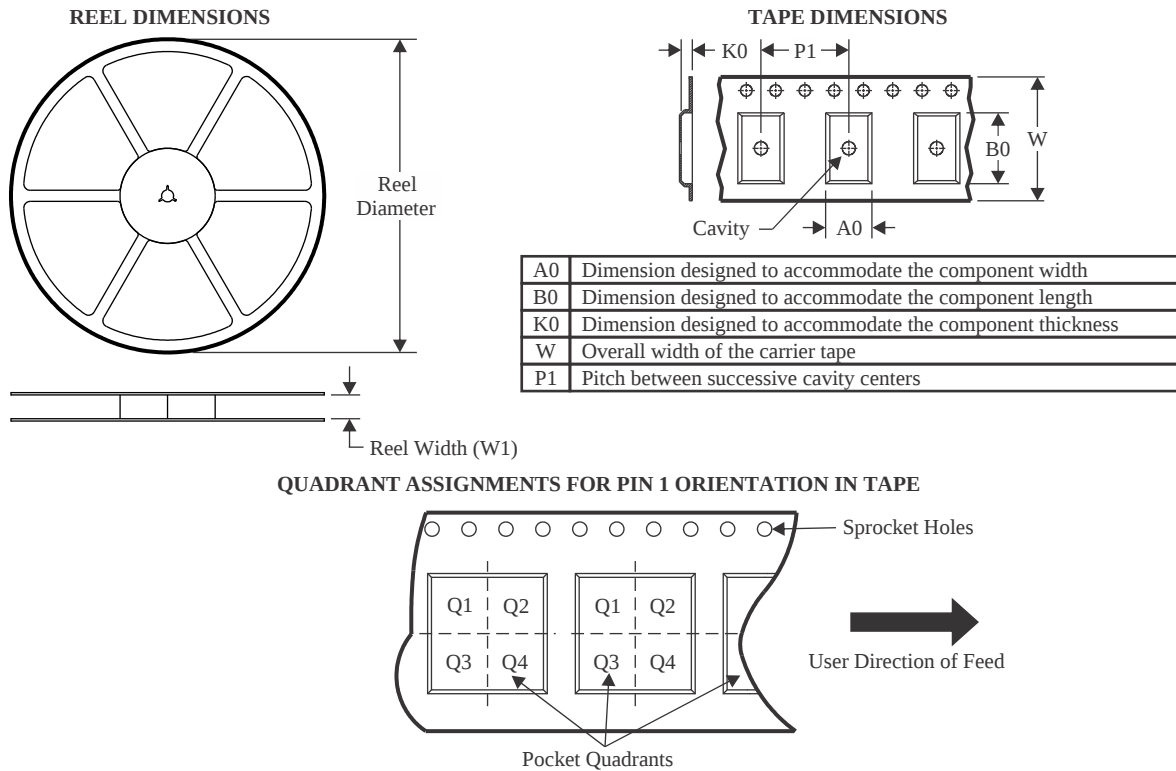
⁽⁵⁾ Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

⁽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.

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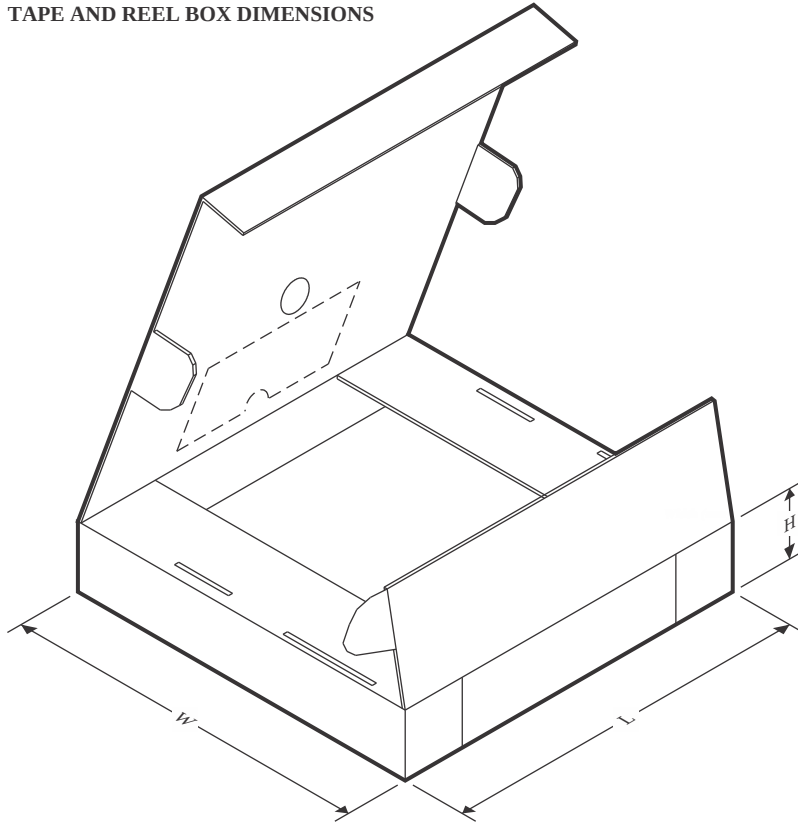
TAPE AND REEL INFORMATION



*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
CSD25483F4	PICOSTAR	YJC	3	3000	178.0	8.4	0.7	1.1	0.46	4.0	8.0	Q2
CSD25483F4	PICOSTAR	YJC	3	3000	180.0	8.4	0.7	1.1	0.46	4.0	8.0	Q2
CSD25483F4T	PICOSTAR	YJC	3	250	180.0	8.4	0.7	1.1	0.46	4.0	8.0	Q2

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CSD25483F4	PICOSTAR	YJC	3	3000	220.0	220.0	35.0
CSD25483F4	PICOSTAR	YJC	3	3000	182.0	182.0	20.0
CSD25483F4T	PICOSTAR	YJC	3	250	182.0	182.0	20.0

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