CSD17483F4 30-V N-Channel FemtoFET™ MOSFET

1 Features

- Low on-resistance
- Low Q_g and Q_{gd}
- Low-threshold voltage
- Ultra-small footprint (0402 case Size)
  - 1.0 mm × 0.6 mm
- Ultra-low profile
  - 0.36-mm height
- 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
- Single-cell battery applications
- Handheld and mobile applications

3 Description

This 200-mΩ, 30-V N-Channel FemtoFET™ MOSFET technology 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.

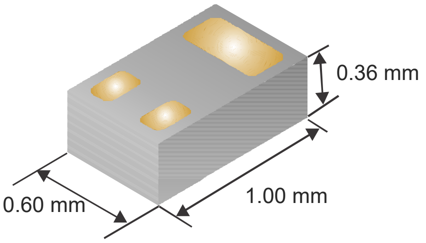

Figure 3-1. Typical Part Dimensions

Product Summary

T_A = 25°C		TYPICAL VALUE		UNIT
V_{DS}	Drain-to-Source Voltage	30		V
Q_g	Gate Charge Total (4.5 V)	1010		pC
Q_{gd}	Gate Charge Gate-to-Drain	130		pC
$R_{DS(on)}$	Drain-to-Source On-Resistance	V_{GS} = 1.8 V	370	mΩ
		V_{GS} = 2.5 V	240	
		V_{GS} = 4.5 V	200	
$V_{GS(th)}$	Threshold Voltage	0.85		V

Device Information

DEVICE(1)	QTY	MEDIA	PACKAGE	SHIP
CSD17483F4	3000	7-Inch Reel	Femto(0402) 1.00 mm × 0.60 mm SMD Lead Less	Tape and Reel
CSD17483F4T	250			

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

Absolute Maximum Ratings

T_A = 25°C unless otherwise stated		VALUE	UNIT
V_{DS}	Drain-to-Source Voltage	30	V
V_{GS}	Gate-to-Source Voltage	12	V
I_D	Continuous Drain Current, T_A = 25°C(1)	1.5	A
I_{DM}	Pulsed Drain Current, T_A = 25°C(2)	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	
T_J, T_{stg}	Operating Junction, Storage Temperature	–55 to 150	°C
E_{AS}	Avalanche Energy, Single Pulse I_D = 7.4 A, L = 0.1 mH, R_G = 25 Ω	2.7	mJ

(1) Typical $R_{\theta JA}$ = 90°C/W on 1-in^2 (6.45-cm^2), 2-oz (0.071-mm) thick Cu pad on a 0.06-in (1.52-mm) thick FR4 PCB.

(2) Pulse duration ≤ 300 μs, duty cycle ≤ 2%.

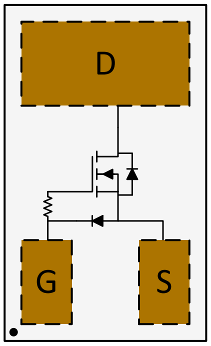

Figure 3-2. Top View

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4 Revision History

Changes from Revision E (April 2018) to Revision F (February 2022)	Page
• Changed ultra-low profile bullet from 0.35 mm to 0.36 mm in height	1
• Updated ultra-low profile image height from 0.35 mm to 0.36 mm	1
• Changed ultra-low profile image height from 0.35 mm to 0.36 mm	8
• Added FemtoFET Surface Mount Guide note	9

Changes from Revision D (Decermber 2016) to Revision E (April 2018)	Page
• Raised I_{DSS} Test Condition Voltage	3
• Raised I_{GSS} Test Condition Voltage	3

5 Specifications

5.1 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} = 0 V, I_{DS} = 250 μA	30			V
I_{DSS}	Drain-to-source leakage current	V_{GS} = 0 V, V_{DS} = 24 V			100	nA
I_{GSS}	Gate-to-source leakage current	V_{DS} = 0 V, V_{GS} = 10 V			50	nA
$V_{GS(th)}$	Gate-to-source threshold voltage	V_{DS} = V_{GS}, I_{DS} = 250 μA	0.65	0.85	1.10	V
$R_{DS(on)}$	Drain-to-source on-resistance	V_{GS} = 1.8 V, I_{DS} =0.5 A		370	550	mΩ
		V_{GS} = 2.5 V, I_{DS} =0.5 A		240	310	
		V_{GS} = 4.5 V, I_{DS} = 0.5 A		200	260	
		V_{GS} = 8 V, I_{DS} = 0.5 A		185	240	
g_{fs}	Transconductance	V_{DS} = 15 V, I_{DS} = 0.5 A		2.4		S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input capacitance	V_{GS} = 0 V, V_{DS} = 15 V, *f* = 1 MHz		145	190	pF
C_{oss}	Output capacitance			42	55	pF
C_{rss}	Reverse transfer capacitance			2	3	pF
R_G	Series gate resistance			23		Ω
Q_g	Gate charge total (4.5 V)	V_{DS} = 15 V, I_{DS} = 0.5 A		1010	1300	pC
Q_{gd}	Gate charge gate-to-drain			130		pC
Q_{gs}	Gate charge gate-to-source			220		pC
$Q_{g(th)}$	Gate charge at V_{th}			145		pC
Q_{oss}	Output charge	V_{DS} = 15 V, V_{GS} = 0 V		1095		pC
$t_{d(on)}$	Turnon delay time	V_{DS} = 15 V, V_{GS} = 4.5 V, I_{DS} = 0.5 A,R_G = 2 Ω		3.3		ns
t_r	Rise time			1.3		ns
$t_{d(off)}$	Turnoff delay time			10.6		ns
t_f	Fall time			3.4		ns
DIODE CHARACTERISTICS						
V_{SD}	Diode forward voltage	I_{SD} = 0.5 A, V_{GS} = 0 V		0.73	0.9	V
Q_{rr}	Reverse recovery charge	V_{DS}= 15 V, I_F = 0.5 A, di/dt = 300 A/μs		1475		pC
t_{rr}	Reverse recovery time			5.5		ns

5.2 Thermal Information

T_A = 25°C (unless otherwise stated)

THERMAL METRIC		TYPICAL VALUES	UNIT
$R_{\theta JA}$	Junction-to-ambient thermal resistance(1)	90	°C/W
	Junction-to-ambient thermal resistance(2)	250	

(1) Device mounted on FR4 material with 1-in^2 (6.45-cm^2), 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°C (unless otherwise stated)

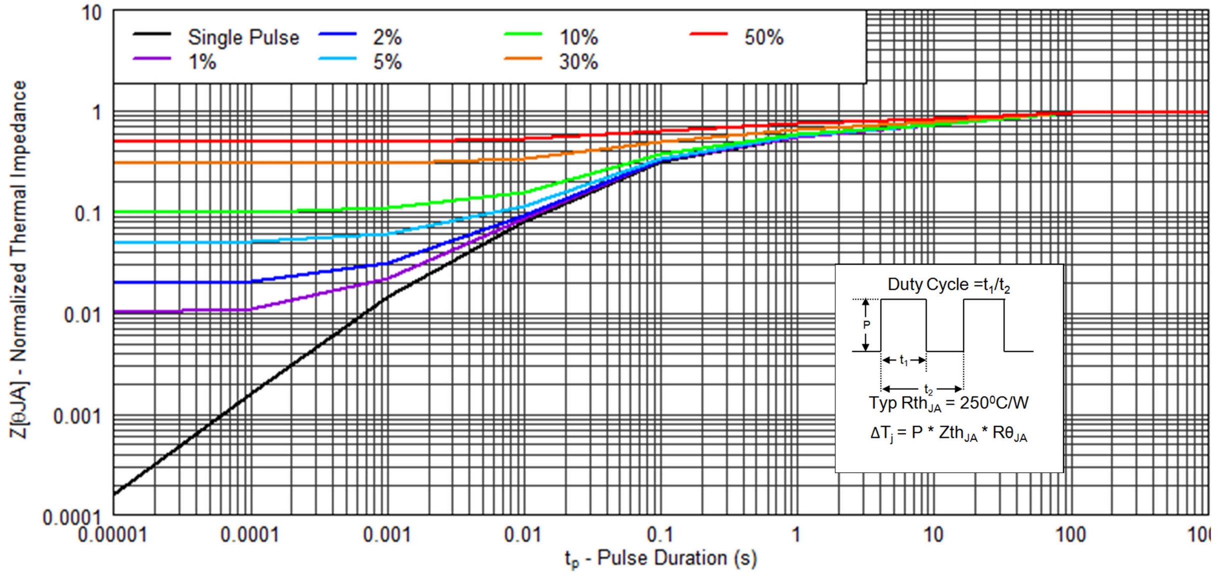

Figure 5-1. Transient Thermal Impedance

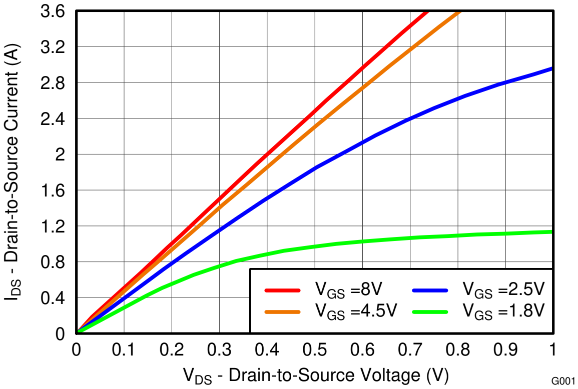

Figure 5-2. Saturation Characteristics

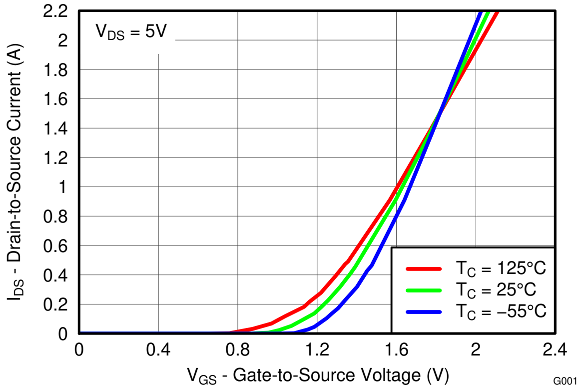

Figure 5-3. Transfer Characteristics

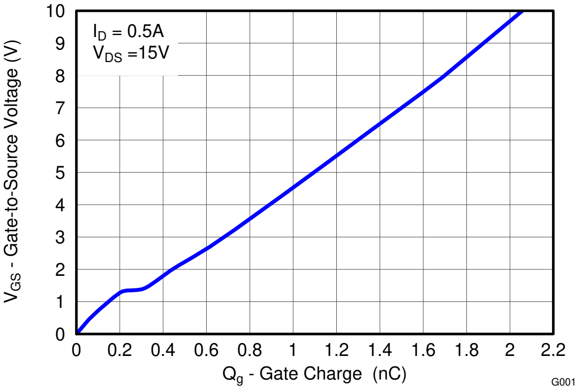

Figure 5-4. Gate Charge

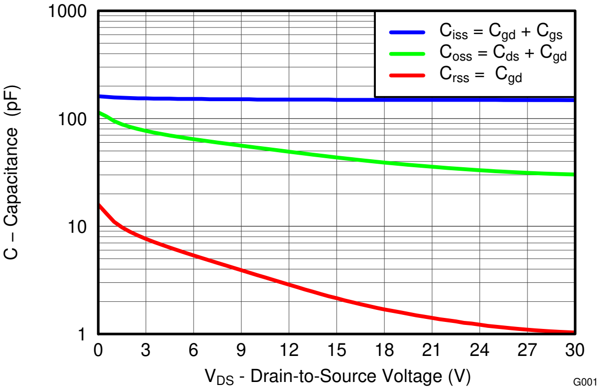

Figure 5-5. Capacitance

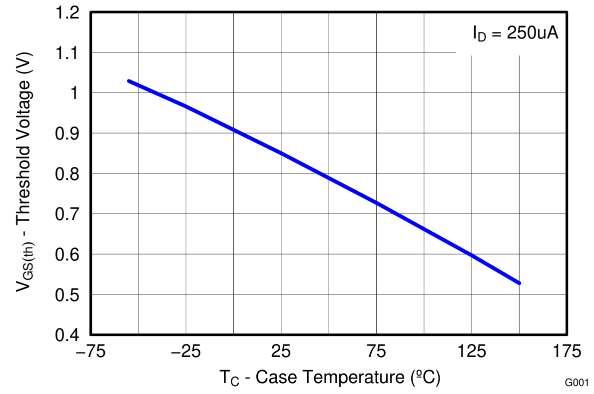

Figure 5-6. Threshold Voltage vs Temperature

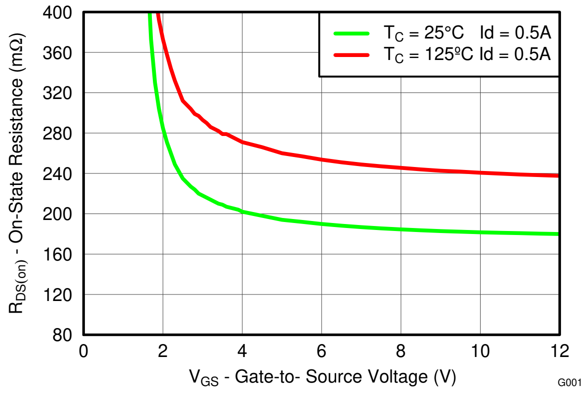

Figure 5-7. On-State Resistance vs Gate-to-Source Voltage

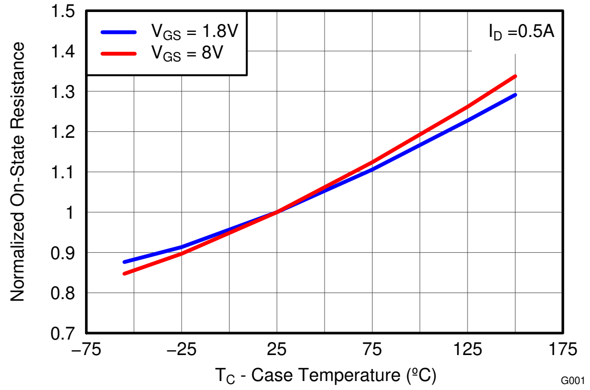

Figure 5-8. Normalized On-State Resistance vs Temperature

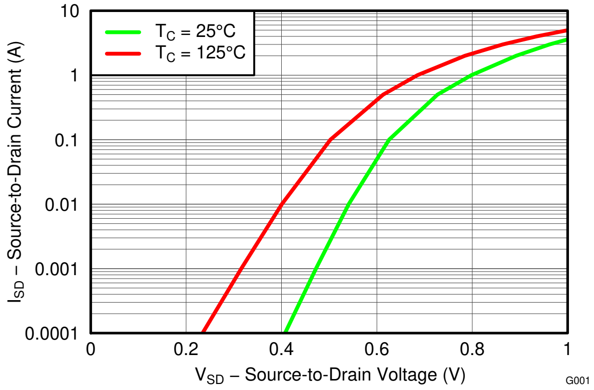

Figure 5-9. Typical Diode Forward Voltage

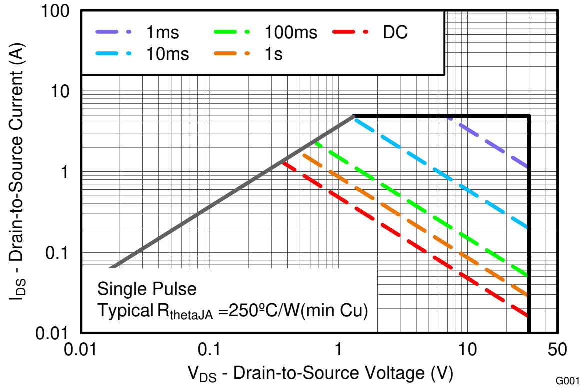

Figure 5-10. Maximum Safe Operating Area

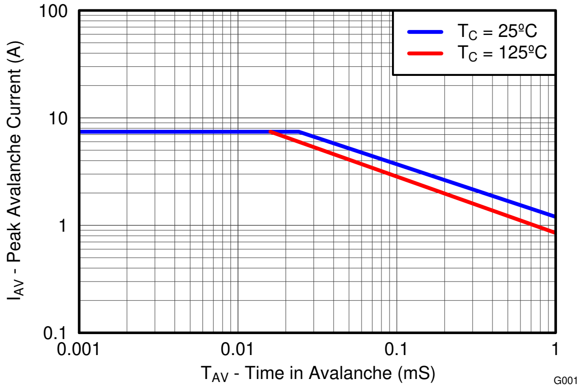

Figure 5-11. Single Pulse Unclamped Inductive Switching

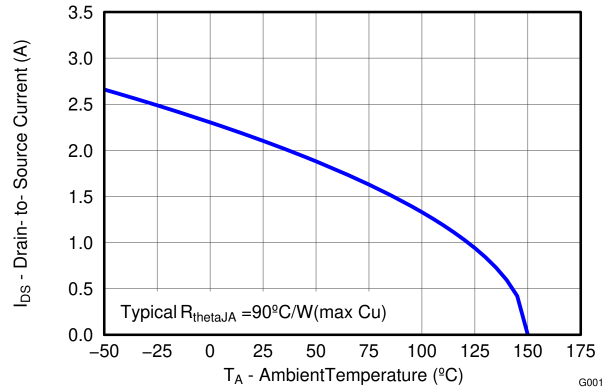

Figure 5-12. Maximum Drain Current vs Temperature

6 Device and Documentation Support

6.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. In the upper right corner, click on *Alert me* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

6.2 Trademarks

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6.3 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.

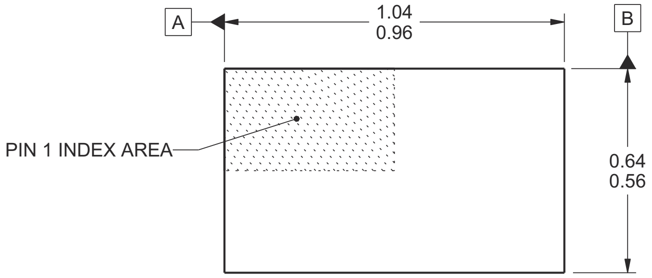
6.4 Glossary

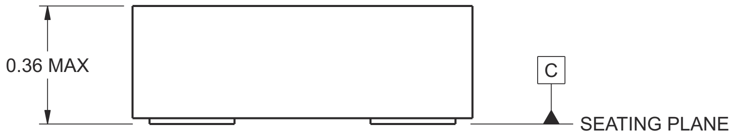
TI Glossary	This glossary lists and explains terms, acronyms, and definitions.

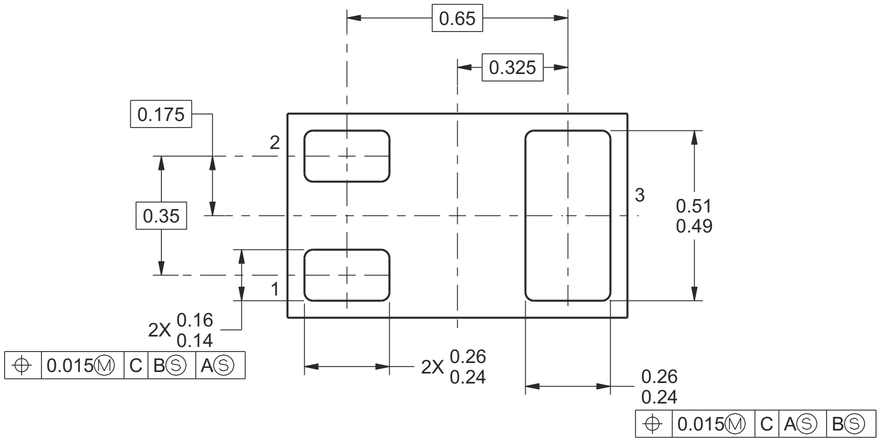
7 Mechanical, Packaging, and Orderable Information

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





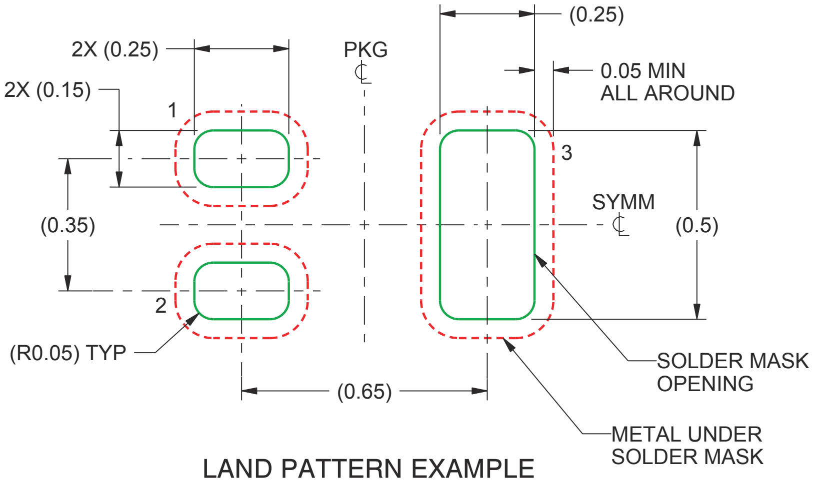


A. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.

B. This drawing is subject to change without notice.

C. This package is a Pb-free bump design. Bump finish may vary. To determine the exact finish, refer to the device data sheet or contact a local TI representative.

7.2 Recommended Minimum PCB Layout

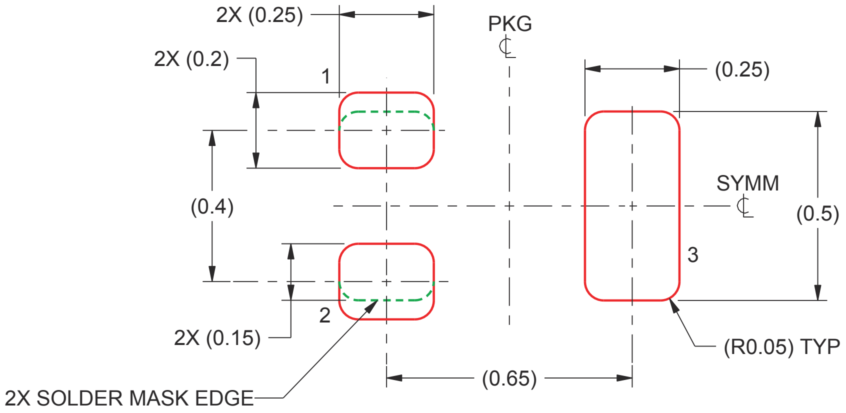


LAND PATTERN EXAMPLE
SOLDER MASK DEFINED

A. All dimensions are in millimeters.

B. For more information, see *FemtoFET Surface Mount Guide* (SLRA003D).

7.3 Recommended Stencil Pattern



SOLDER PASTE EXAMPLE

A. All dimensions are in millimeters.

B. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

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
CSD17483F4	ACTIVE	PICOSTAR	YJC	3	3000	RoHS & Green	NIAU	Level-1-260C-UNLIM	-55 to 150	DP	Samples
CSD17483F4T	ACTIVE	PICOSTAR	YJC	3	250	RoHS & Green	NIAU	Level-1-260C-UNLIM	-55 to 150	DP	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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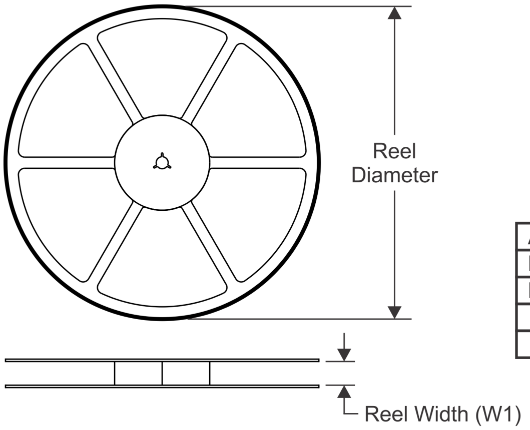
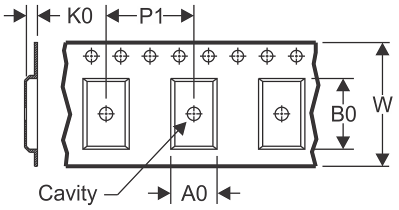
TAPE AND REEL INFORMATION

REEL DIMENSIONS

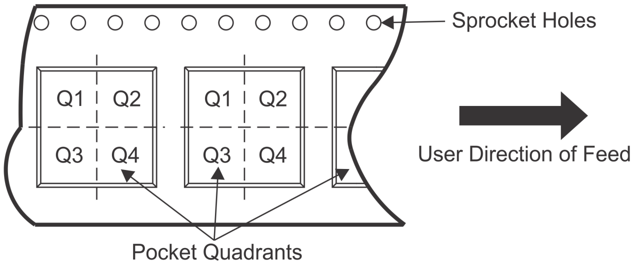


TAPE DIMENSIONS



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

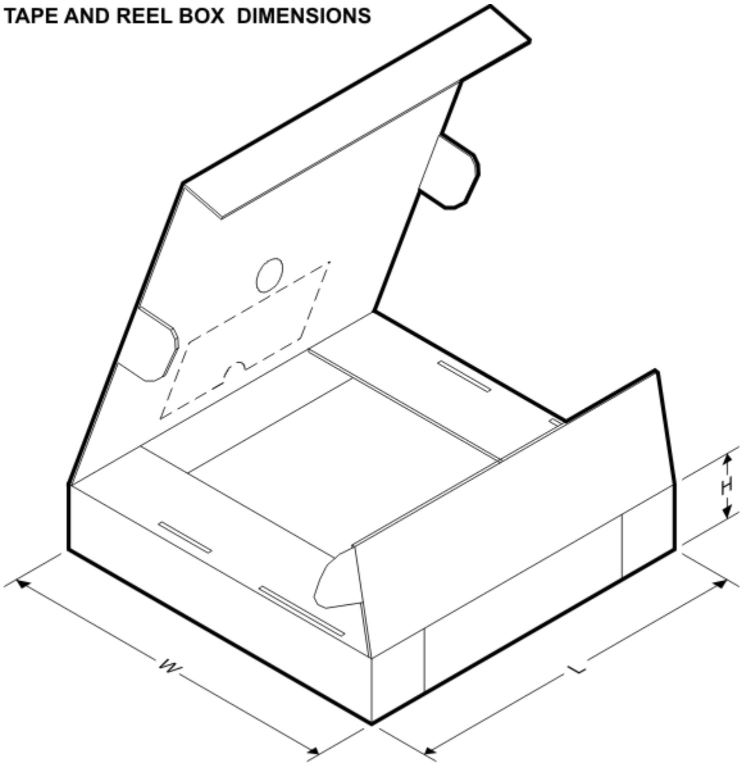
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
CSD17483F4	PICOSTAR	YJC	3	3000	180.0	8.4	0.7	1.1	0.46	4.0	8.0	Q2
CSD17483F4	PICOSTAR	YJC	3	3000	178.0	8.4	0.7	1.1	0.46	4.0	8.0	Q2
CSD17483F4T	PICOSTAR	YJC	3	250	180.0	8.4	0.7	1.1	0.46	4.0	8.0	Q2
CSD17483F4T	PICOSTAR	YJC	3	250	178.0	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)
CSD17483F4	PICOSTAR	YJC	3	3000	182.0	182.0	20.0
CSD17483F4	PICOSTAR	YJC	3	3000	220.0	220.0	35.0
CSD17483F4T	PICOSTAR	YJC	3	250	182.0	182.0	20.0
CSD17483F4T	PICOSTAR	YJC	3	250	220.0	220.0	35.0

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