CSD17382F4 30-V N-Channel FemtoFET™ MOSFET

1 Features

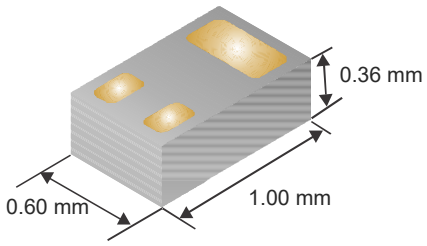
- Low on-resistance
- Low Q_g and Q_{gd}
- Low threshold voltage
- Ultra-small footprint (0402 case size)
  - 1.0 mm × 0.6 mm
- Ultra-low profile
  - 0.36-mm height
- Integrated ESD protection diode
  - Rated > 3-kV HBM
  - Rated > 2-kV CDM
- Lead and halogen free
- RoHS compliant

2 Applications

- Optimized for load switch applications
- Optimized for general purpose switching applications
- Single-cell battery applications
- Handheld and mobile applications

3 Description

This 30-V, 54-mΩ, 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.



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)	2.1		nC
Q_{gd}	Gate Charge Gate-to-Drain	0.63		nC
$R_{DS(on)}$	Drain-to-Source On-Resistance	V_{GS} = 1.8 V	110	mΩ
		V_{GS} = 2.5 V	67	mΩ
		V_{GS} = 4.5 V	56	mΩ
		V_{GS} = 8.0 V	54	mΩ
$V_{GS(th)}$	Threshold Voltage	0.9		V

Device Information

DEVICE(1)	QTY	MEDIA	PACKAGE	SHIP
CSD17382F4	3000	7-Inch Reel	Femto (0402) 1.0-mm × 0.6-mm SMD Lead Less	Tape and Reel
CSD17382F4T	250			

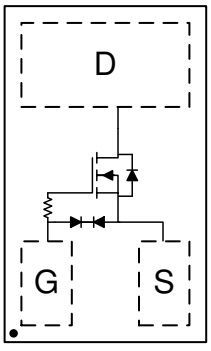
(1) For all available packages, see the orderable addendum at the end of the data sheet.

Absolute Maximum Ratings

T_A = 25°C		VALUE	UNIT
V_{DS}	Drain-to-Source Voltage	30	V
V_{GS}	Gate-to-Source Voltage	10	V
I_D	Continuous Drain Current(1)	2.3	A
I_{DM}	Pulsed Drain Current(2)	14.8	A
P_D	Power Dissipation(1)	500	mW
ESD Rating	Human Body Model (HBM)	3000	V
	Charged Device Model (CDM)	2000	V
T_J, T_{stg}	Operating Junction, Storage Temperature	–55 to 150	°C
E_{AS}	Avalanche Energy, Single Pulse I_D = 6.5 A, L = 0.1 mH, R_G = 25 Ω	2.1	mJ

(1) Typical $R_{\theta JA}$ = 245°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 ≤100 µs, duty cycle ≤1%.



Top View

Table of Contents

4 Revision History

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

Changes from Revision B (October 2021) to Revision C (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 A (December 2016) to Revision B (October 2021) **Page**

- Updated the numbering format for tables, figures, and cross-references throughout the document.... 1

Changes from Revision * (April 2016) to Revision A (December 2016) **Page**

- Changed the TEST CONDITIONS for g_{fs} Transconductance From: V_{DS} = 15 V To: V_{DS} = 3 V in the Section 5.1 section.... 3
- Added Section 6.2 in the Section 6 section.... 7
- Updated all mechanical drawings.... 8

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			1	µA
I_{GSS}	Gate-to-source leakage current	V_{DS} = 0 V, V_{GS} = 10 V			5	µA
$V_{GS(th)}$	Gate-to-source threshold voltage	V_{DS} = V_{GS}, I_{DS} = 250 µA	0.7	0.9	1.2	V
$R_{DS(on)}$	Drain-to-source on-resistance	V_{GS} = 1.8 V, I_{DS} =0.5 A		110	180	mΩ
		V_{GS} = 2.5 V, I_{DS} =0.5 A		67	82	mΩ
		V_{GS} = 4.5 V, I_{DS} = 0.5 A		56	67	mΩ
		V_{GS} = 8.0 V, I_{DS} = 0.5 A		54	64	mΩ
g_{fs}	Transconductance	V_{DS} = 3 V, I_{DS} = 0.5 A		5.9		S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input capacitance	V_{GS} = 0 V, V_{DS} = 15 V, f = 1 MHz		267	347	pF
C_{oss}	Output capacitance			31.0	40.3	pF
C_{rss}	Reverse transfer capacitance			15.0	19.5	pF
R_G	Series gate resistance			220		Ω
Q_g	Gate charge total (4.5 V)	V_{DS} = 15 V, I_{DS} = 0.5 A		2.1	2.7	nC
Q_{gd}	Gate charge gate-to-drain			0.63		nC
Q_{gs}	Gate charge gate-to-source			0.41		nC
$Q_{g(th)}$	Gate charge at V_{th}			0.12		nC
Q_{oss}	Output charge	V_{DS} = 15 V, V_{GS} = 0 V		1.53		nC
$t_{d(on)}$	Turn on delay time	V_{DS} = 15 V, V_{GS} = 4.5 V, I_{DS} = 0.5 A, R_G = 0 Ω		59		ns
t_r	Rise time			111		ns
$t_{d(off)}$	Turn off delay time			279		ns
t_f	Fall time			270		ns
DIODE CHARACTERISTICS						
V_{SD}	Diode forward voltage	I_{SD} = 0.5 A, V_{GS} = 0 V		0.7	1.0	V

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)	85	°C/W
	Junction-to-ambient thermal resistance(2)	245	°C/W

(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)

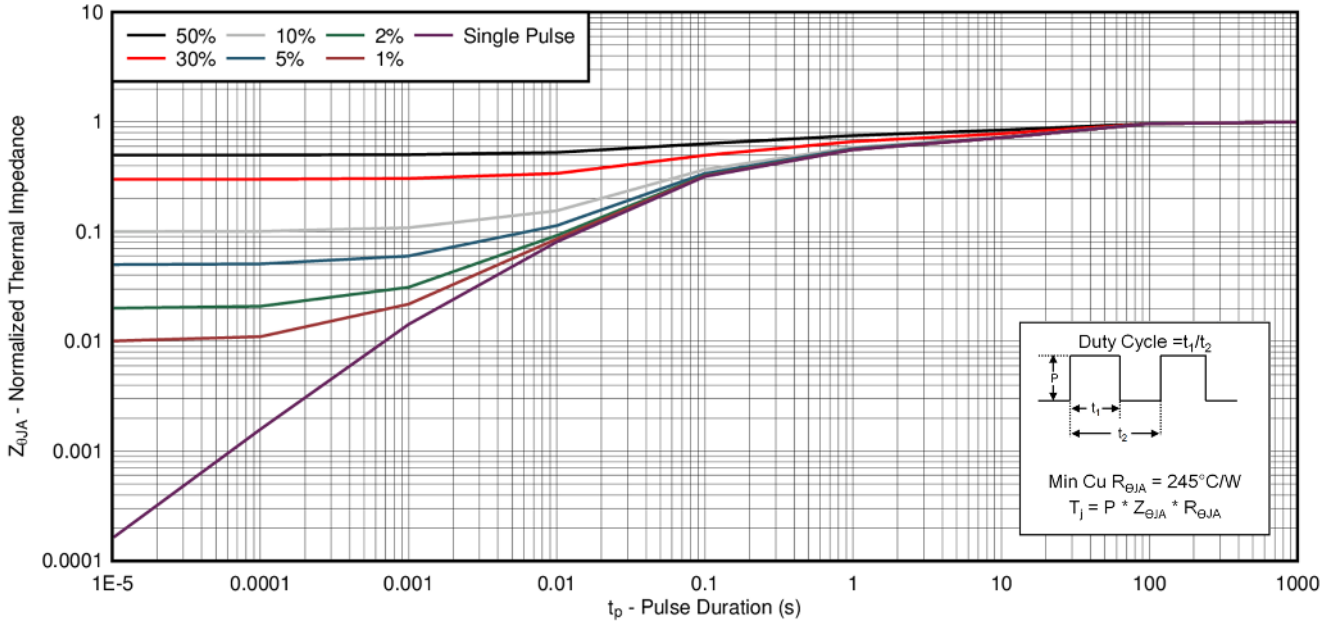


Figure 5-1. Transient Thermal Impedance

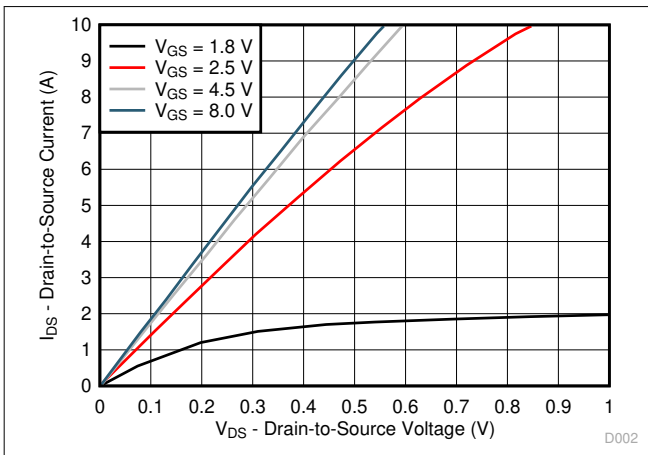
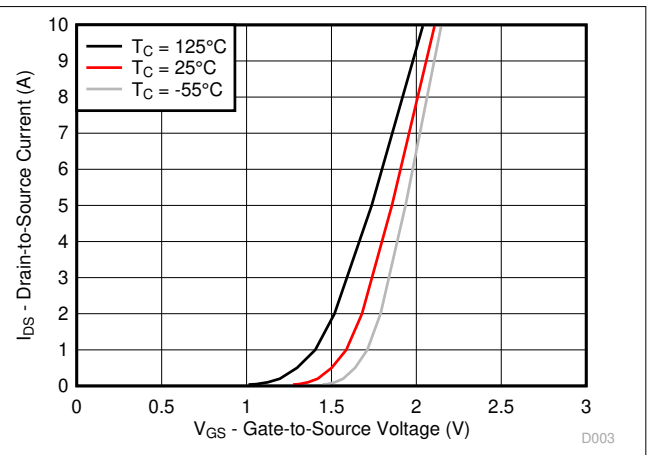
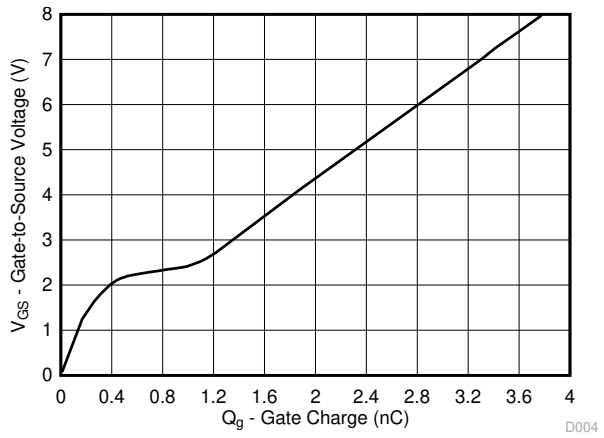


Figure 5-2. Saturation Characteristics



VDS = 5 V

Figure 5-3. Transfer Characteristics



I_D = 0.5 A V_{DS} = 15 V

Figure 5-4. Gate Charge

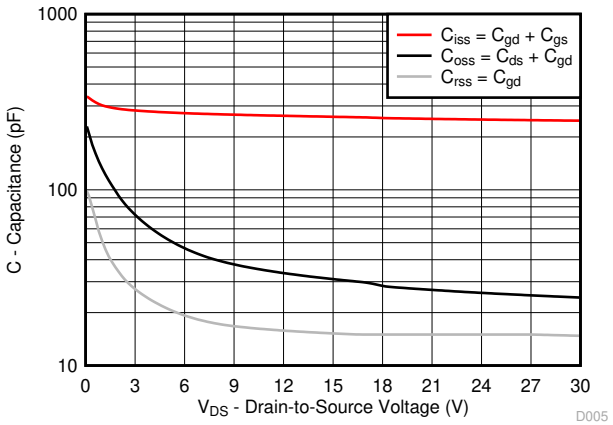
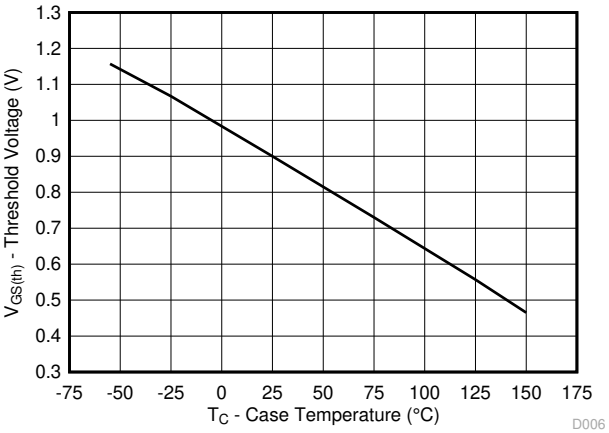


Figure 5-5. Capacitance



I_D = 250 µA

Figure 5-6. Threshold Voltage vs Temperature

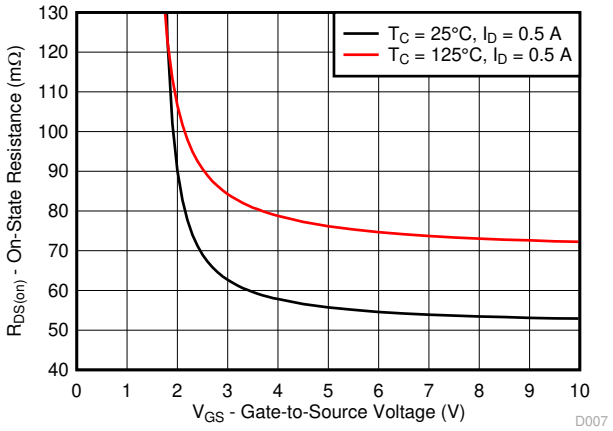
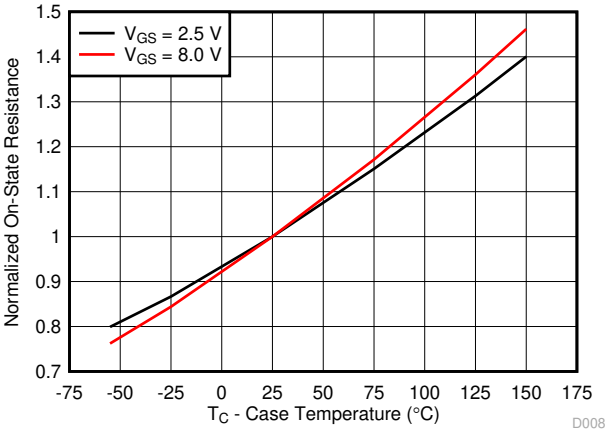


Figure 5-7. On-State Resistance vs Gate-to-Source Voltage



I_D = 0.5 A

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

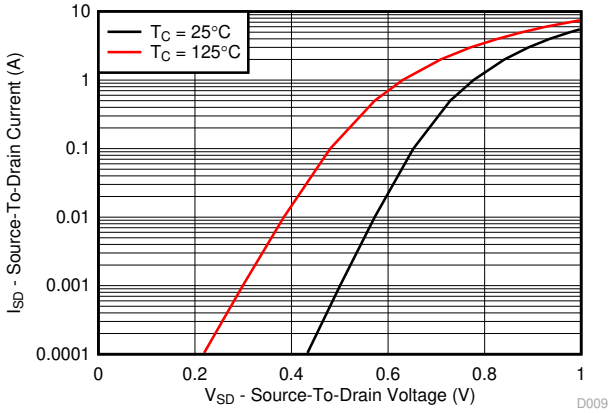
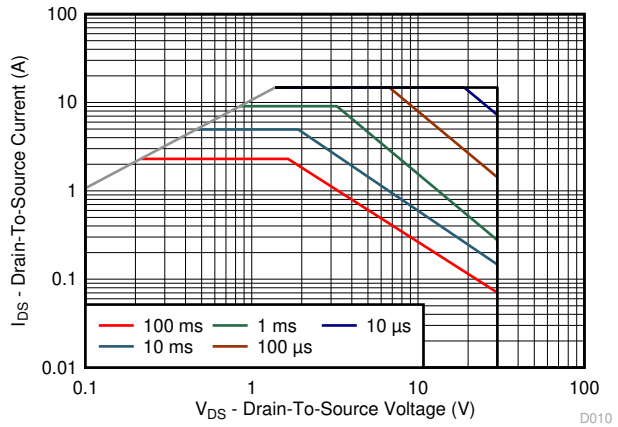


Figure 5-9. Typical Diode Forward Voltage



Single Pulse, Typ $R_{\theta JA}$ = 245°C/W (min Cu)

Figure 5-10. Maximum Safe Operating Area (SOA)

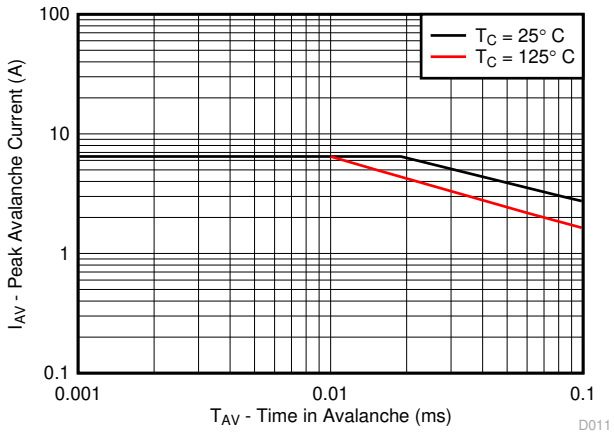
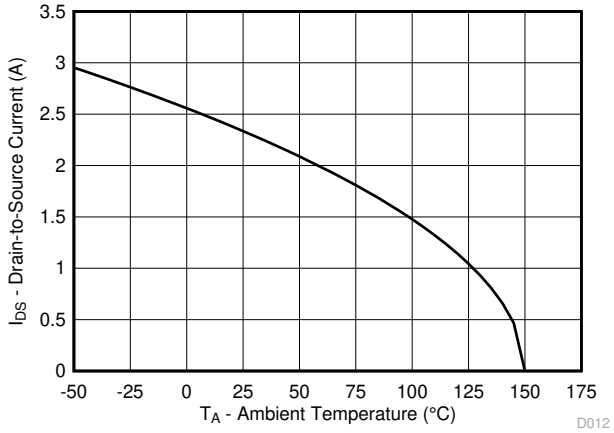


Figure 5-11. Single Pulse Unclamped Inductive Switching



Typical $R_{\theta JA}$ = 245°C/W (min Cu)

Figure 5-12. Maximum Drain Current vs Temperature

6 Device and Documentation Support

6.1 Support Resources

TI E2E™ support forums are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

6.2 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.

6.3 Trademarks

FemtoFET™ is a trademark of Texas Instruments.
TI E2E™ is a trademark of Texas Instruments.
All trademarks are the property of their respective owners.

6.4 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.

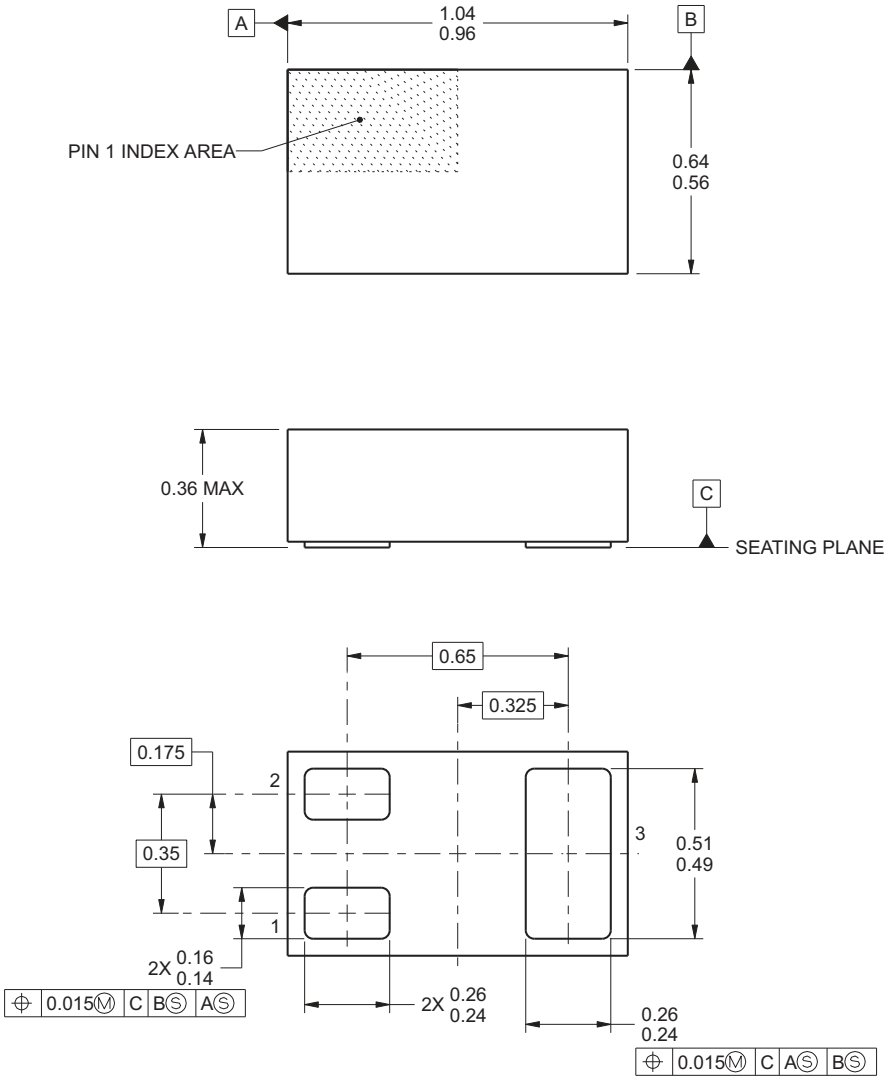
6.5 Glossary

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

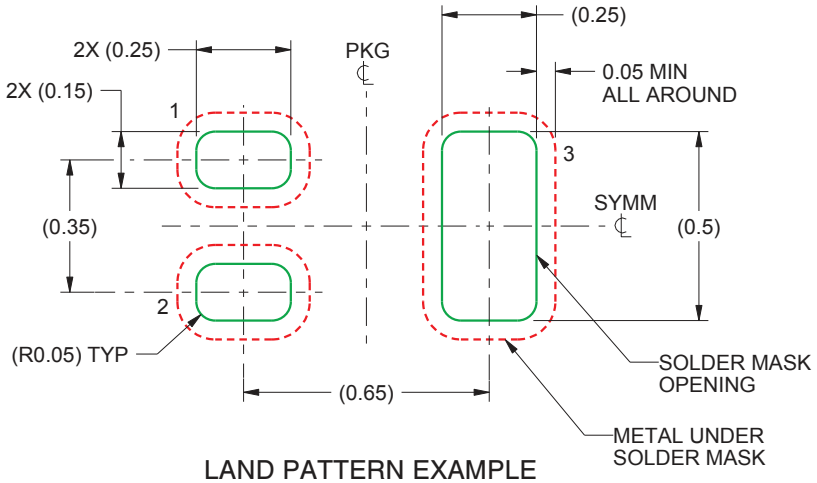


A. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.

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 datasheet or contact a local TI representative.

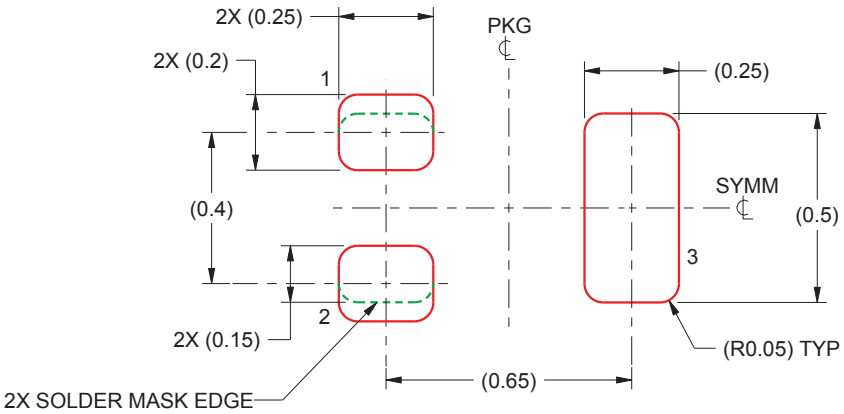
7.2 Recommended Minimum PCB Layout



LAND PATTERN EXAMPLE
SOLDER MASK DEFINED

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

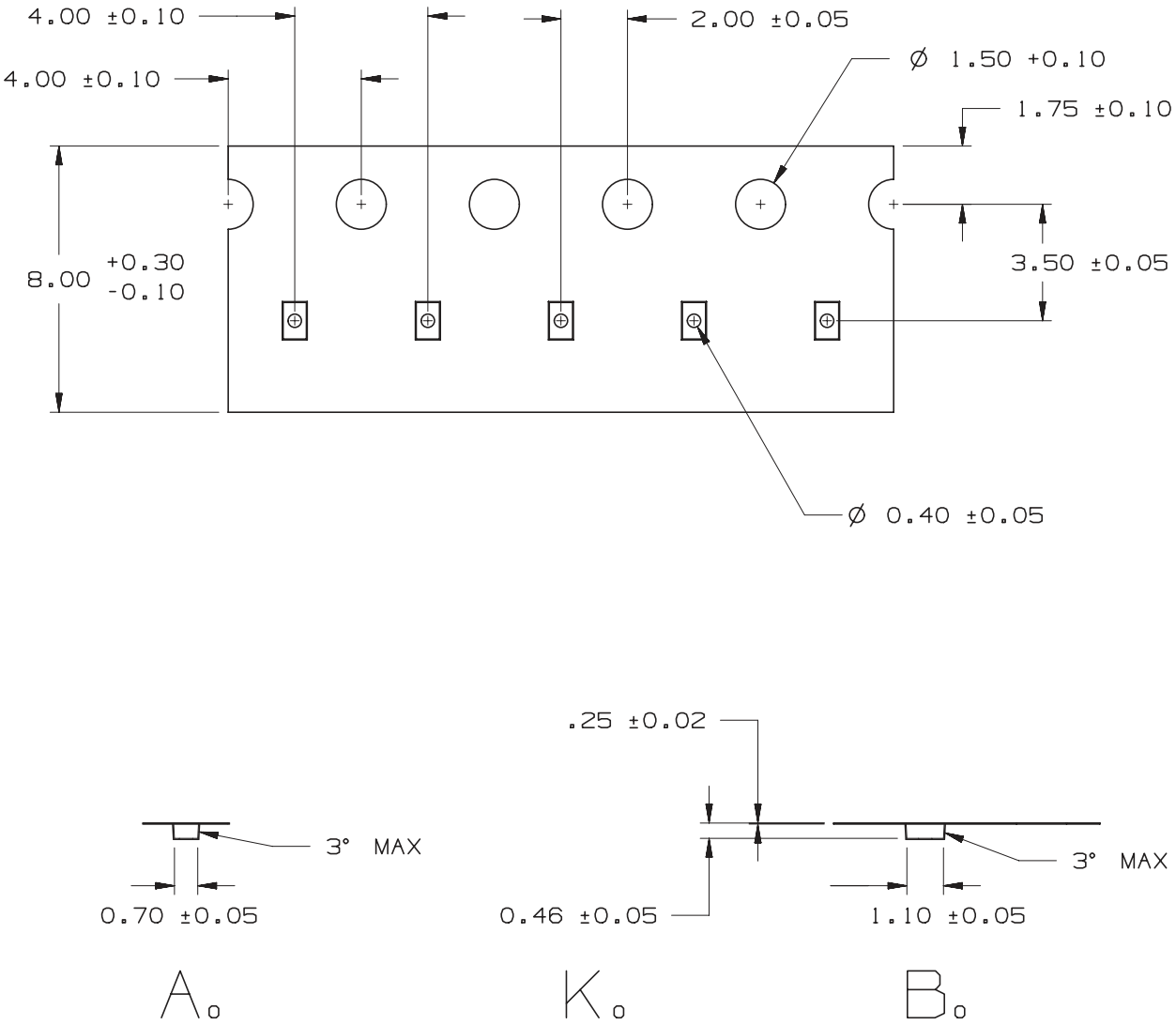
7.3 Recommended Stencil Pattern



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.

7.4 CSD17382F4 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
CSD17382F4	ACTIVE	PICOSTAR	YJC	3	3000	RoHS & Green	NIAU	Level-1-260C-UNLIM	-55 to 150	HM	Samples
CSD17382F4T	ACTIVE	PICOSTAR	YJC	3	250	RoHS & Green	NIAU	Level-1-260C-UNLIM	-55 to 150	HM	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.

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI’s products are provided subject to TI’s Terms of Sale or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI’s provision of these resources does not expand or otherwise alter TI’s applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265