

CSD25480F3 –20-V P-Channel FemtoFET™ MOSFET

1 Features

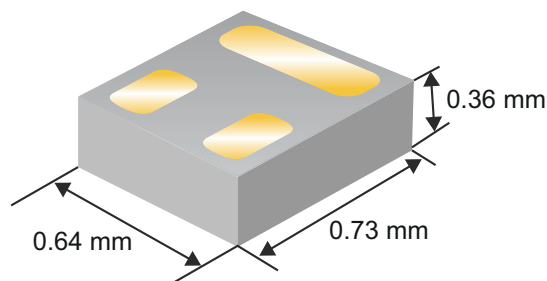
- Low on-resistance
- Ultra-low Q_g and Q_{gd}
- Ultra-small footprint
 - 0.73 mm × 0.64 mm
- Low profile
 - 0.36-mm max height
- Integrated ESD protection diode
- Lead and halogen free
- RoHS compliant

2 Applications

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

3 Description

This –20-V, 110-mΩ, 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 a substantial reduction in footprint size.



Typical Part 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)	0.7	nC
Q_{gd}	Gate Charge Gate-to-Drain	0.10	nC
$R_{DS(on)}$	Drain-to-Source On-Resistance	$V_{GS} = -1.8\text{ V}$	420
		$V_{GS} = -2.5\text{ V}$	203
		$V_{GS} = -4.5\text{ V}$	132
		$V_{GS} = -8.0\text{ V}$	110
$V_{GS(th)}$	Threshold Voltage	–0.95	V

Device Information⁽¹⁾

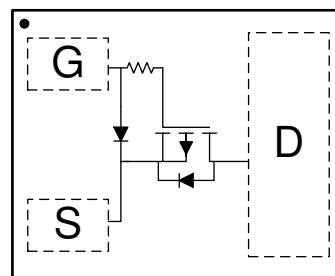
DEVICE	QTY	MEDIA	PACKAGE	SHIP
CSD25480F3	3000	7-Inch Reel	Femto 0.73-mm × 0.64-mm Land Grid Array (LGA)	Tape and Reel
CSD25480F3T	250			

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

Absolute Maximum Ratings

$T_A = 25^\circ\text{C}$ (unless otherwise stated)		VALUE	UNIT
V_{DS}	Drain-to-Source Voltage	–20	V
V_{GS}	Gate-to-Source Voltage	–12	V
I_D	Continuous Drain Current ⁽¹⁾	–1.7	A
I_{DM}	Pulsed Drain Current ^{(1) (2)}	–10.6	A
P_D	Power Dissipation ⁽¹⁾	500	mW
$V_{(ESD)}$	Human-Body Model (HBM)	4000	V
	Charged-Device Model (CDM)	2000	
$T_{J, T_{stg}}$	Operating Junction, Storage Temperature	–55 to 150	$^\circ\text{C}$

- (1) Typical $R_{\theta JA} = 255^\circ\text{C/W}$ mounted on FR4 material with minimum Cu mounting area.
 (2) Pulse duration $\leq 100\ \mu\text{s}$, duty cycle $\leq 1\%$.



Top View



Table of Contents

1 Features	1	6 Device and Documentation Support	7
2 Applications	1	6.1 Receiving Notification of Documentation Updates.....	7
3 Description	1	6.2 Trademarks.....	7
4 Revision History	2	7 Mechanical, Packaging, and Orderable Information	8
5 Specifications	3	7.1 Mechanical Dimensions.....	8
5.1 Electrical Characteristics.....	3	7.2 Recommended Minimum PCB Layout.....	9
5.2 Thermal Information.....	3	7.3 Recommended Stencil Pattern.....	9
5.3 Typical MOSFET Characteristics.....	4		

4 Revision History

Changes from Revision A (August 2017) to Revision B (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 * (April 2016) to Revision A (August 2017)	Page
• Added the Section 6.1 section in Section 6	7
• Added Recommended Minimum PCB Layout	9
• Updated the Section 7.3	9

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	$V_{GS} = 0\text{ V}, I_{DS} = -250\ \mu\text{A}$	-20			V
I_{DSS}	Drain-to-source leakage current	$V_{GS} = 0\text{ V}, V_{DS} = -16\text{ V}$			-50	nA
I_{GSS}	Gate-to-source leakage current	$V_{DS} = 0\text{ V}, V_{GS} = -12\text{ V}$			-25	nA
$V_{GS(th)}$	Gate-to-source threshold voltage	$V_{DS} = V_{GS}, I_{DS} = -250\ \mu\text{A}$	-0.70	-0.95	-1.20	V
$R_{DS(on)}$	Drain-to-source on-resistance	$V_{GS} = -1.8\text{ V}, I_{DS} = -0.1\text{ A}$		420	840	m Ω
		$V_{GS} = -2.5\text{ V}, I_{DS} = -0.4\text{ A}$		203	260	
		$V_{GS} = -4.5\text{ V}, I_{DS} = -0.4\text{ A}$		132	159	
		$V_{GS} = -8\text{ V}, I_{DS} = -0.4\text{ A}$		110	132	
g_{fs}	Transconductance	$V_{DS} = -10\text{ V}, I_{DS} = -0.4\text{ A}$		8.0		S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input capacitance	$V_{GS} = 0\text{ V}, V_{DS} = -10\text{ V},$ $f = 1\text{ MHz}$		119	155	pF
C_{oss}	Output capacitance			48	62	pF
C_{riss}	Reverse transfer capacitance			3.6	4.7	pF
R_G	Series gate resistance			16		Ω
Q_g	Gate charge total (-4.5 V)	$V_{DS} = -10\text{ V}, I_{DS} = -0.4\text{ A}$		0.70	0.91	nC
Q_{gd}	Gate charge gate-to-drain			0.10		nC
Q_{gs}	Gate charge gate-to-source			0.26		nC
$Q_{g(th)}$	Gate charge at V_{th}			0.15		nC
Q_{oss}	Output charge		$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}$		1.3	
$t_{d(on)}$	Turnon delay time			9		ns
t_r	Rise time	$V_{DS} = -10\text{ V}, V_{GS} = -4.5\text{ V},$ $I_{DS} = -0.4\text{ A}, R_G = 10\ \Omega$		5		ns
$t_{d(off)}$	Turnoff delay time			13		ns
t_f	Fall time			7		ns
DIODE CHARACTERISTICS						
V_{SD}	Diode forward voltage	$I_{SD} = -0.4\text{ A}, V_{GS} = 0\text{ V}$		-0.78	-1.0	V
Q_{rr}	Reverse recovery charge	$V_{DS} = -10\text{ V}, I_F = -0.4\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$		1.2		nC
t_{rr}	Reverse recovery time			6.4		ns

5.2 Thermal Information

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

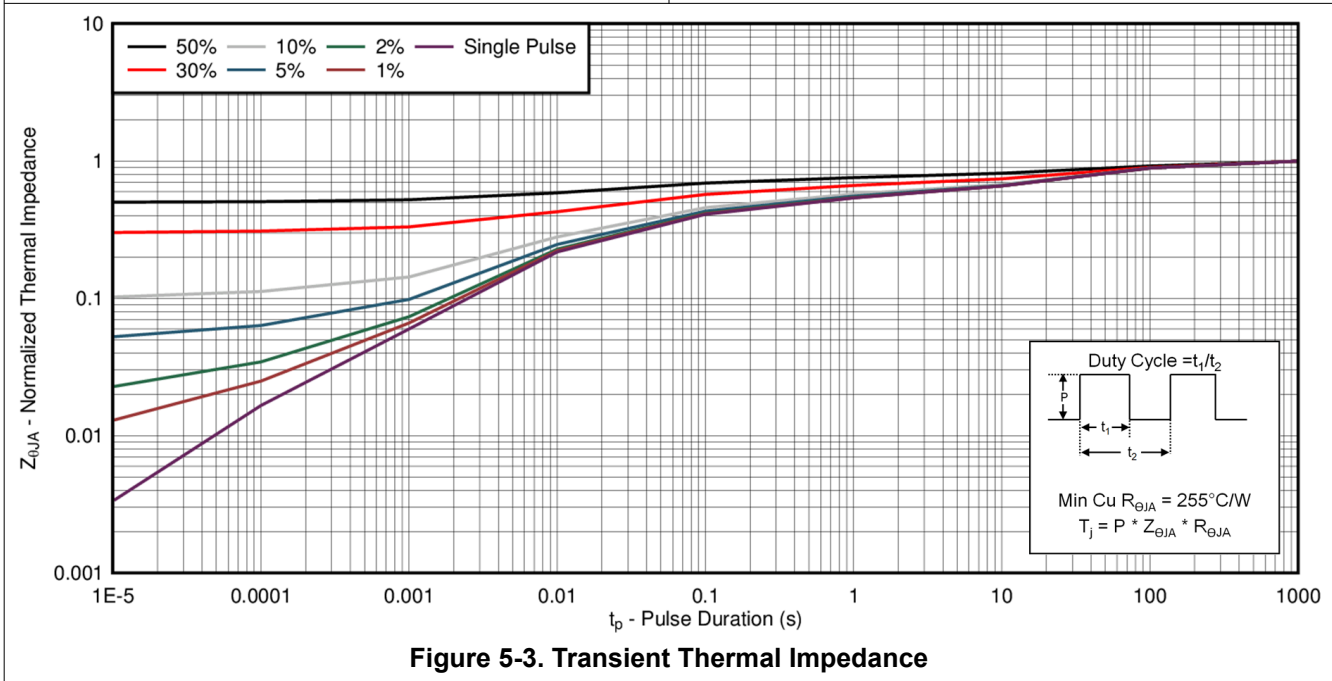
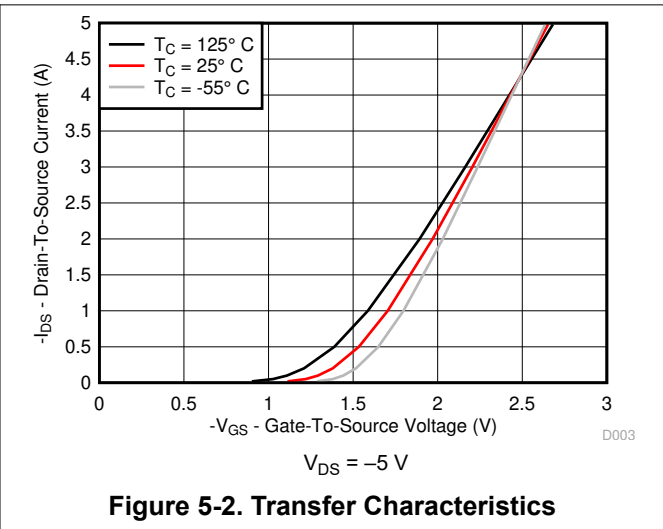
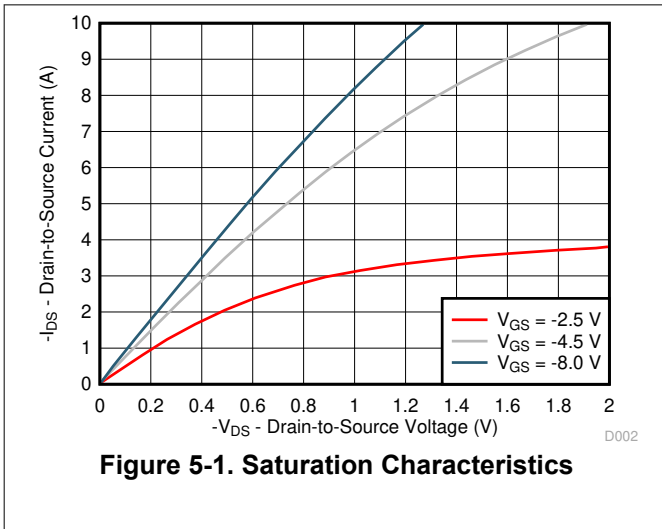
THERMAL METRIC		TYPICAL VALUES	UNIT
$R_{\theta JA}$	Junction-to-ambient thermal resistance ⁽¹⁾	90	$^\circ\text{C}/\text{W}$
	Junction-to-ambient thermal resistance ⁽²⁾	255	

(1) Device mounted on FR4 material with 1-in² (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)



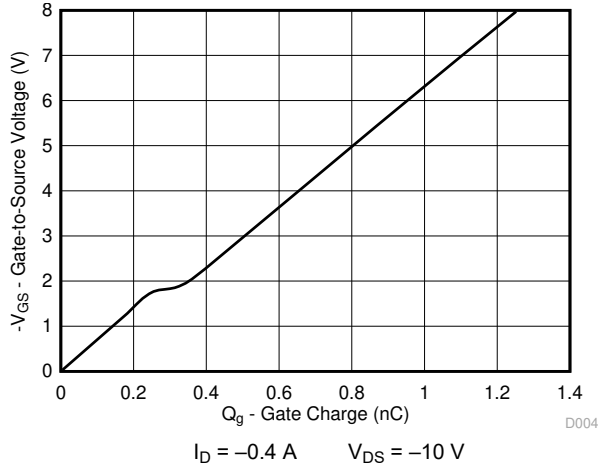


Figure 5-4. Gate Charge

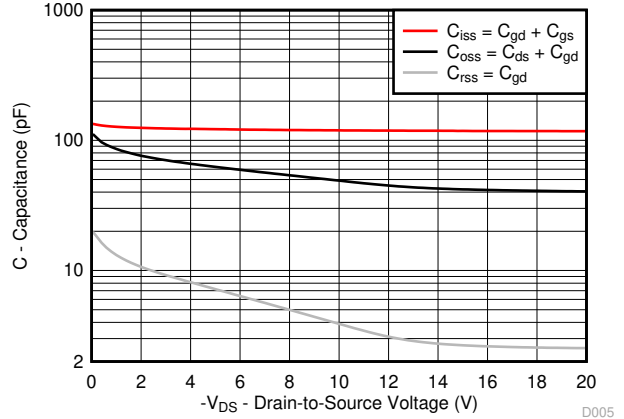


Figure 5-5. Capacitance

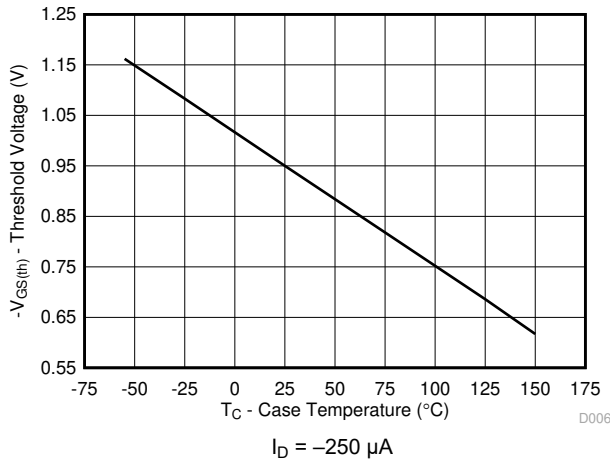


Figure 5-6. Threshold Voltage vs Temperature

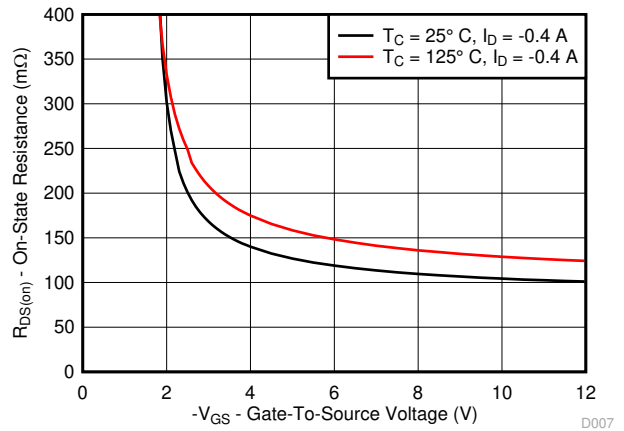


Figure 5-7. On-State Resistance vs Gate-to-Source Voltage

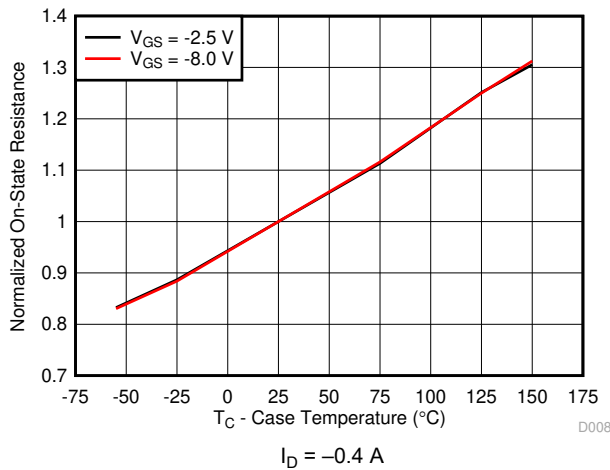


Figure 5-8. Normalized On-State Resistance vs Temperature

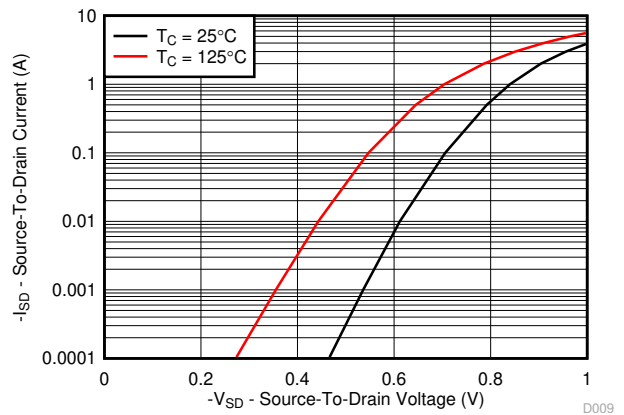


Figure 5-9. Typical Diode Forward Voltage

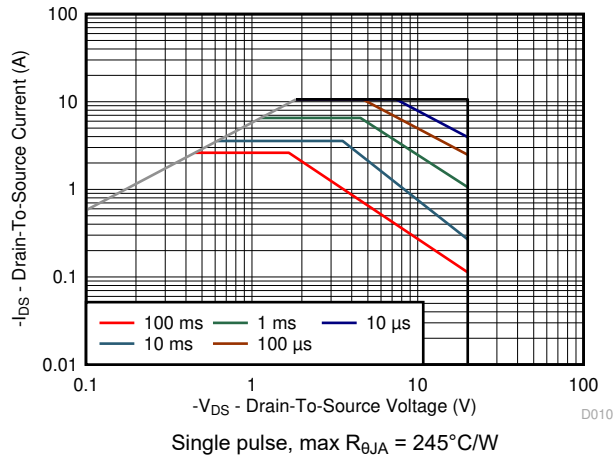


Figure 5-10. Maximum Safe Operating Area

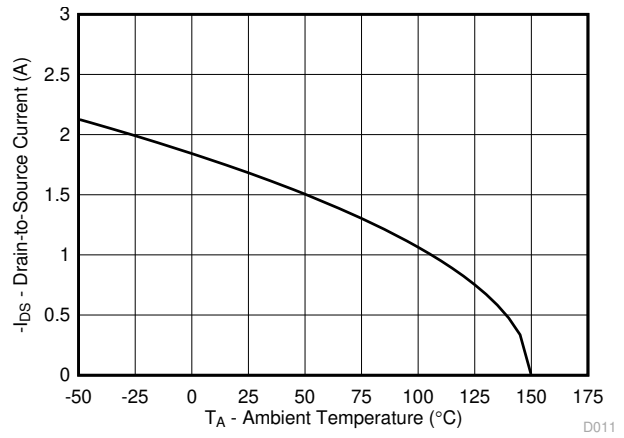


Figure 5-11. Maximum Drain Current vs Temperature

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.

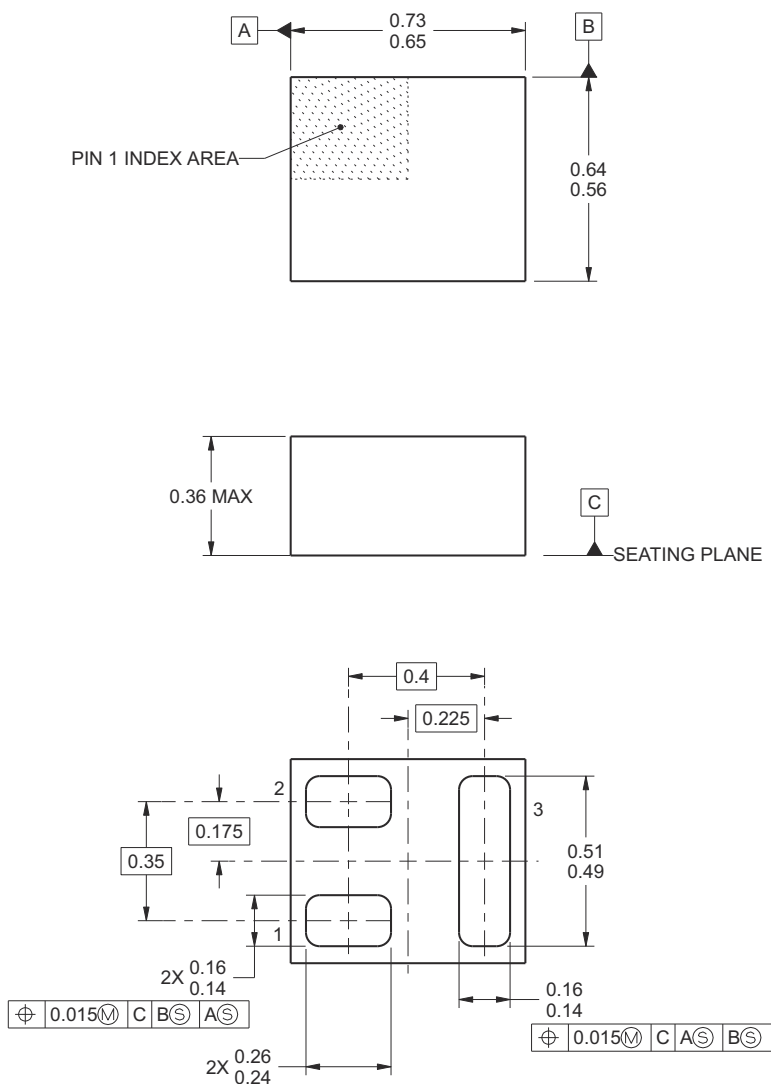
6.2 Trademarks

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

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

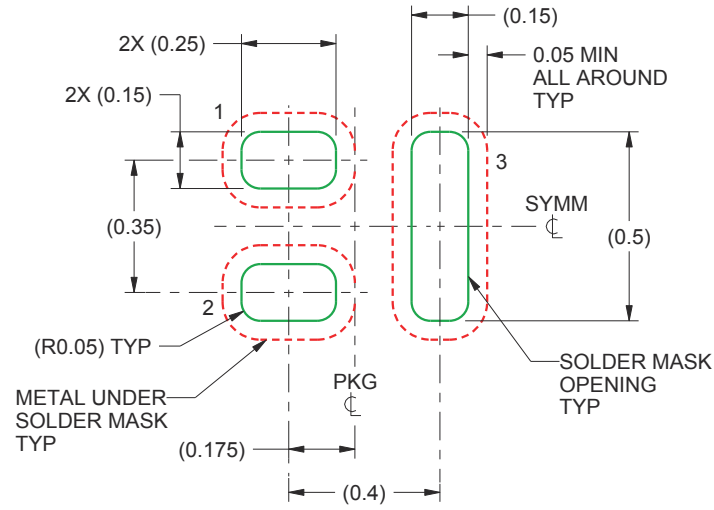


- A. All linear dimensions are in millimeters (dimensions and tolerancing per AME T14.5M-1994).
- B. This drawing is subject to change without notice.
- C. This package is a lead-free solder land design.

Table 7-1. Pin Configuration

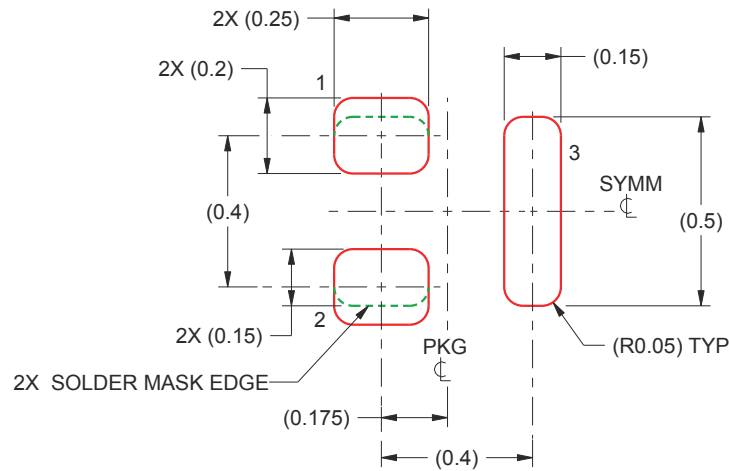
POSITION	DESIGNATION
Pin 1	Gate
Pin 2	Source
Pin 3	Drain

7.2 Recommended Minimum PCB Layout



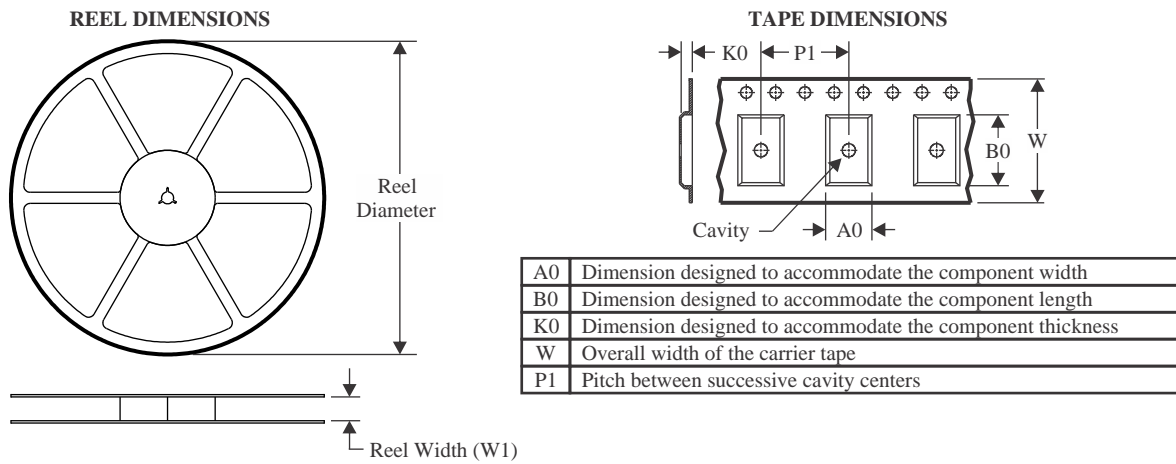
- A. All dimensions are in millimeters.
- B. For more information, see [FemtoFET Surface Mount Guide](#) (SLRA003D).

7.3 Recommended Stencil Pattern



- A. All dimensions are in millimeters.

TAPE AND REEL INFORMATION



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



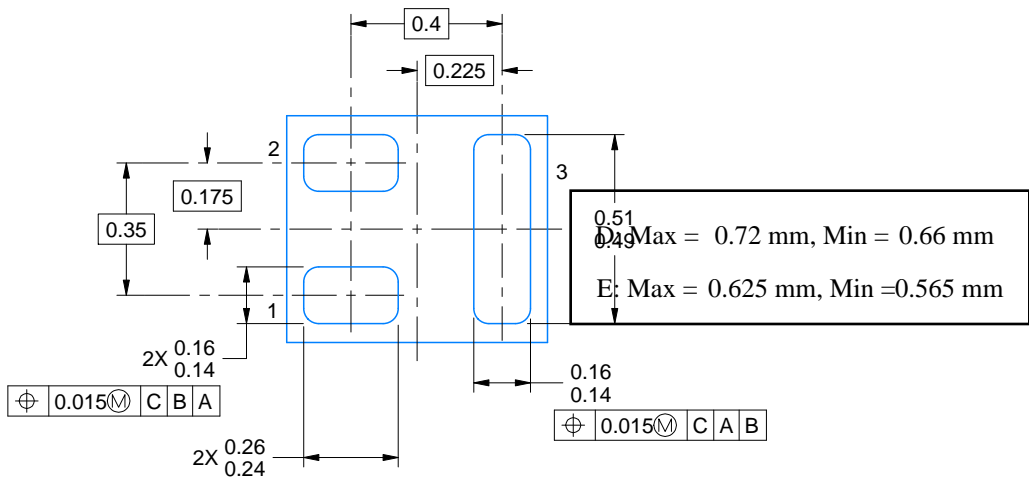
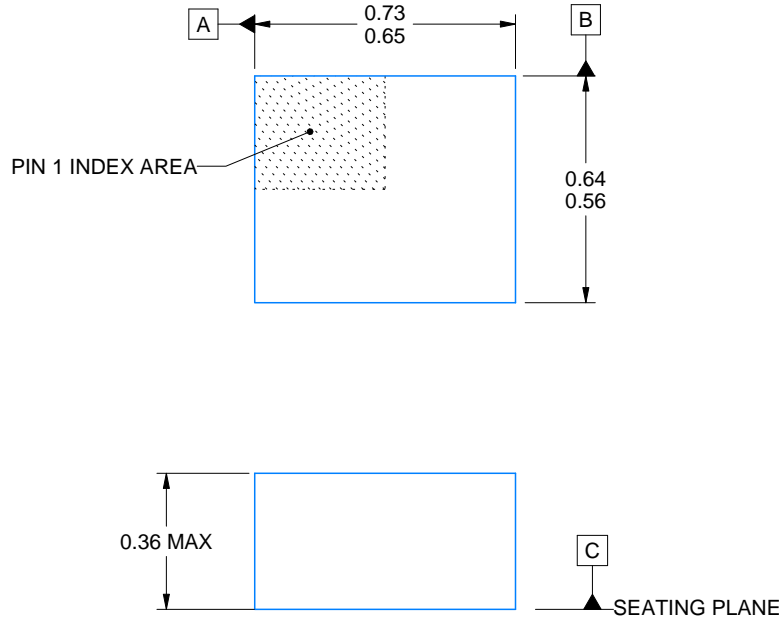
*All dimensions are nominal

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
CSD25480F3	PICOSTAR	YJM	3	3000	180.0	8.4	1.94	0.79	0.44	4.0	8.0	Q2
CSD25480F3T	PICOSTAR	YJM	3	250	180.0	8.4	1.94	0.79	0.44	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)
CSD25480F3	PICOSTAR	YJM	3	3000	182.0	182.0	20.0
CSD25480F3T	PICOSTAR	YJM	3	250	182.0	182.0	20.0



4222304/B 03/2022

NOTES:

PicoStar is a trademark of Texas Instruments.

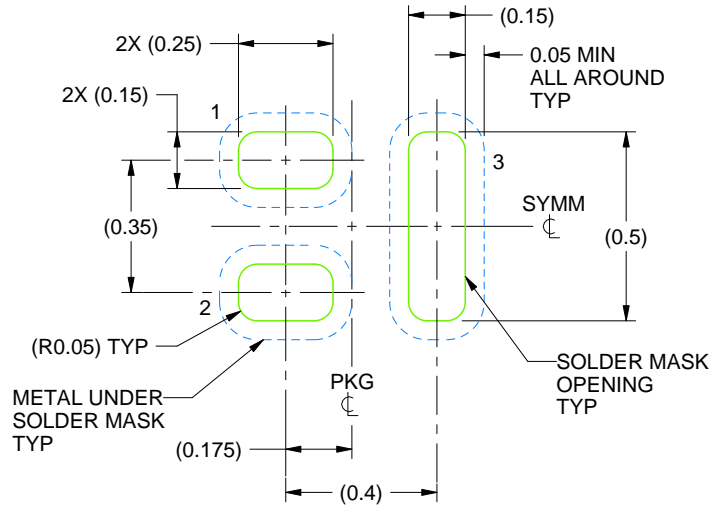
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M
2. This drawing is subject to change without notice.
3. This package is a Pb-free bump design. Bump finish may vary. To determine the exact finish, refer to the device datasheet or contact a local TI representative.

EXAMPLE BOARD LAYOUT

YJM0003A

PicoStar™ - 0.36 mm max height

PicoStar™

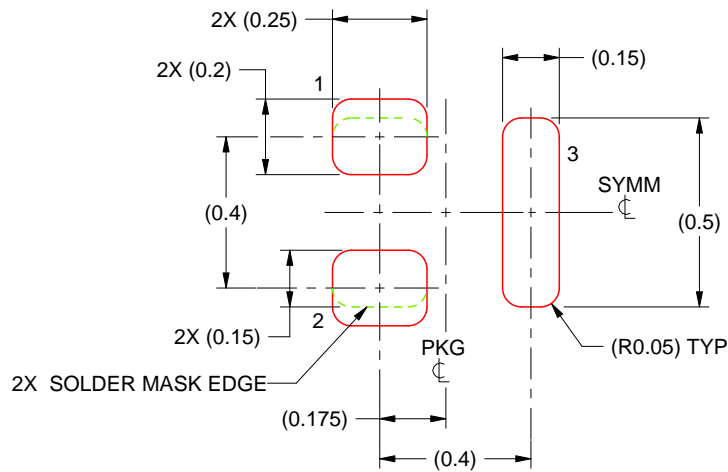


LAND PATTERN EXAMPLE
SOLDER MASK DEFINED
SCALE:50X

4222304/B 03/2022

NOTES: (continued)

4. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).



SOLDER PASTE EXAMPLE
BASED ON 0.075 - 0.1 mm THICK STENCIL
SCALE:50X

4222304/B 03/2022

NOTES: (continued)

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

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](https://www.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
Copyright © 2024, Texas Instruments Incorporated