

## CSD25480F3 –20-V P-Channel FemtoFET™ MOSFET

### 1 Features

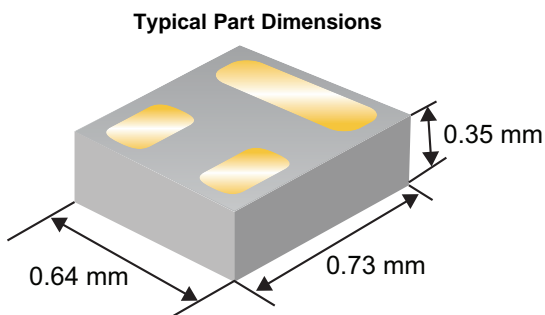
- Low On-Resistance
- Ultra-Low  $Q_g$  and  $Q_{gd}$
- Ultra-Small Footprint
  - 0.73 mm × 0.64 mm
- Low Profile
  - 0.35-mm Max Height
- Integrated ESD Protection Diode
- Lead and Halogen Free
- RoHS Compliant

### 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-m $\Omega$ , 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.



### 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<sup>(1)</sup>

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.

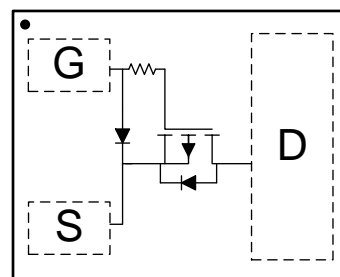
### Absolute Maximum Ratings

$T_A = 25^\circ\text{C}$ (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 <sup>(1)</sup>	–1.7	A
$I_{DM}$	Pulsed Drain Current <sup>(1)(2)</sup>	–10.6	A
$P_D$	Power Dissipation <sup>(1)</sup>	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

<b>1 Features</b> .....	<b>1</b>	6.1 Receiving Notification of Documentation Updates ....	<b>7</b>
<b>2 Applications</b> .....	<b>1</b>	6.2 Community Resources .....	<b>7</b>
<b>3 Description</b> .....	<b>1</b>	6.3 Trademarks .....	<b>7</b>
<b>4 Revision History</b> .....	<b>2</b>	6.4 Electrostatic Discharge Caution .....	<b>7</b>
<b>5 Specifications</b> .....	<b>3</b>	6.5 Glossary .....	<b>7</b>
5.1 Electrical Characteristics .....	<b>3</b>	<b>7 Mechanical, Packaging, and Orderable</b>	
5.2 Thermal Information .....	<b>3</b>	<b>Information</b> .....	<b>8</b>
5.3 Typical MOSFET Characteristics .....	<b>4</b>	7.1 Mechanical Dimensions .....	<b>8</b>
<b>6 Device and Documentation Support</b> .....	<b>7</b>	7.2 Recommended Minimum PCB Layout .....	<b>9</b>
		7.3 Recommended Stencil Pattern .....	<b>9</b>

## 4 Revision History

Changes from Original (April 2016) to Revision A	Page
• Added the <a href="#">Receiving Notification of Documentation Updates</a> section in <a href="#">Device and Documentation Support</a> .....	<b>7</b>
• Updated the <a href="#">Recommended Stencil Pattern</a> .....	<b>9</b>

## 5 Specifications

### 5.1 Electrical Characteristics

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>STATIC CHARACTERISTICS</b>						
$BV_{DSS}$	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 $\Omega$
		$V_{GS} = -2.5\text{ V}, I_{DS} = -0.4\text{ A}$		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
<b>DYNAMIC CHARACTERISTICS</b>						
$C_{iss}$	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
$C_{rss}$	Reverse transfer capacitance			3.6	4.7	pF
$R_G$	Series gate resistance			16		$\Omega$
$Q_g$	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
<b>DIODE CHARACTERISTICS</b>						
$V_{SD}$	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 <sup>(1)</sup>	90	$^\circ\text{C}/\text{W}$
	Junction-to-ambient thermal resistance <sup>(2)</sup>	255	

(1) Device mounted on FR4 material with 1-in<sup>2</sup> (6.45-cm<sup>2</sup>), 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)

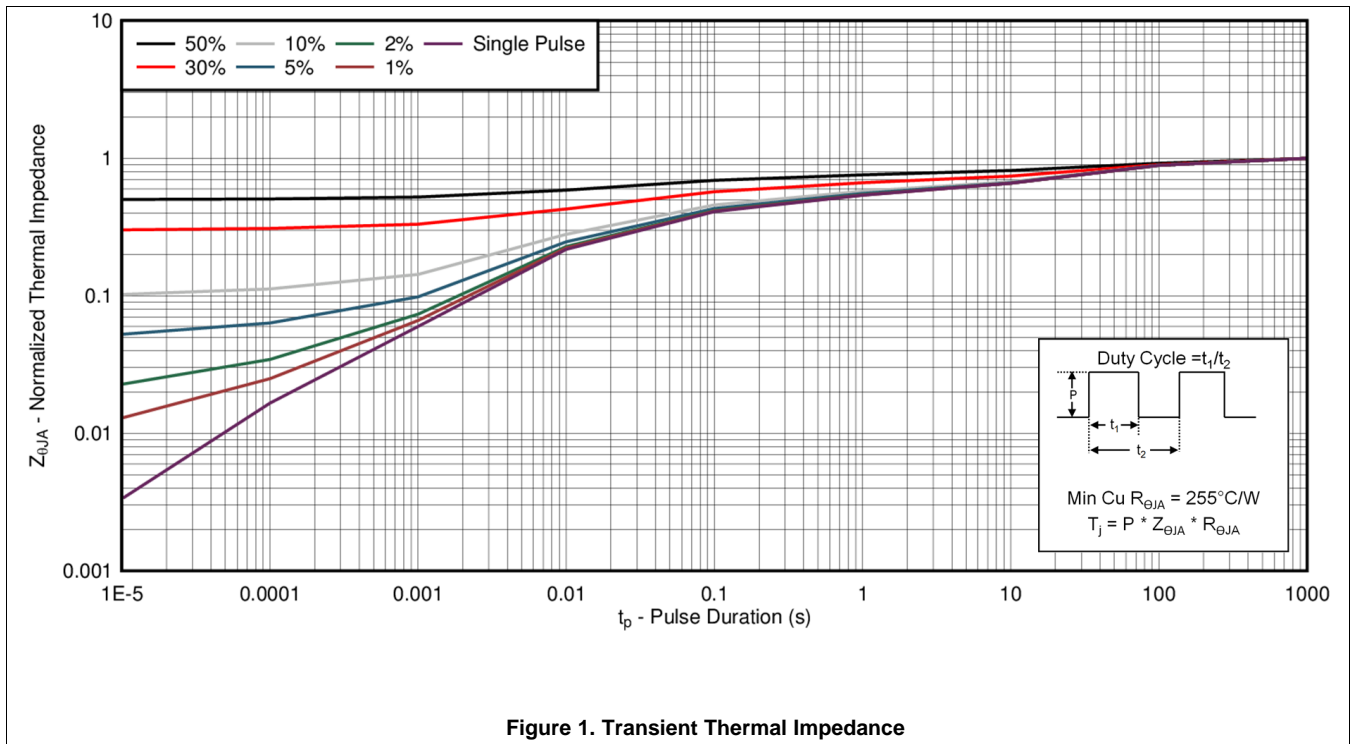


Figure 1. Transient Thermal Impedance

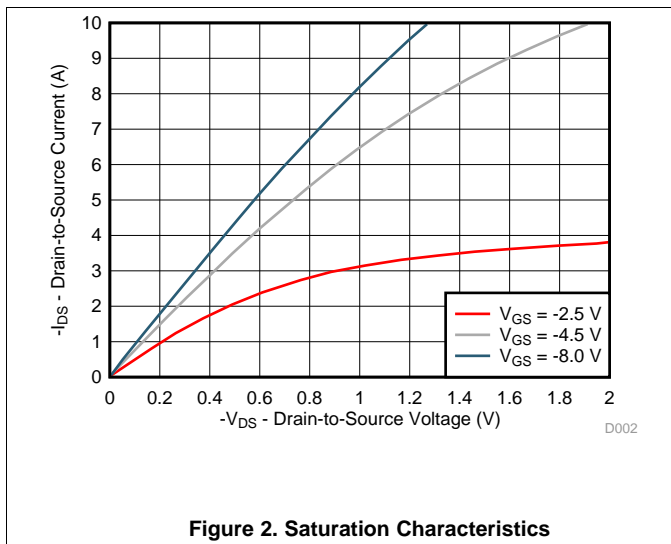


Figure 2. Saturation Characteristics

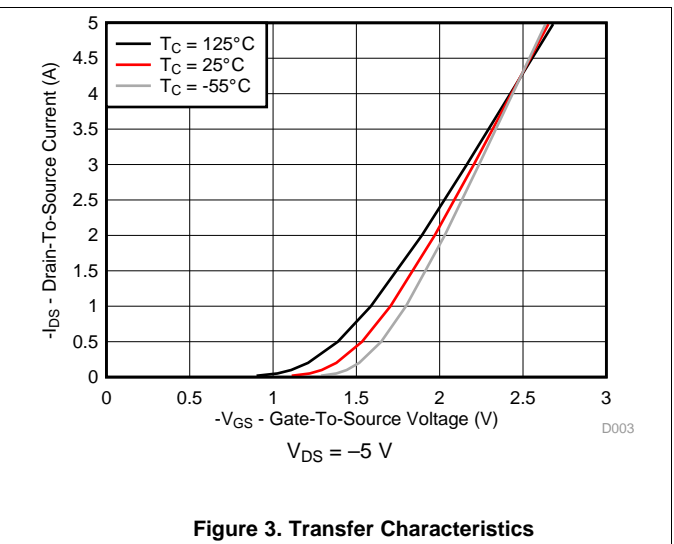
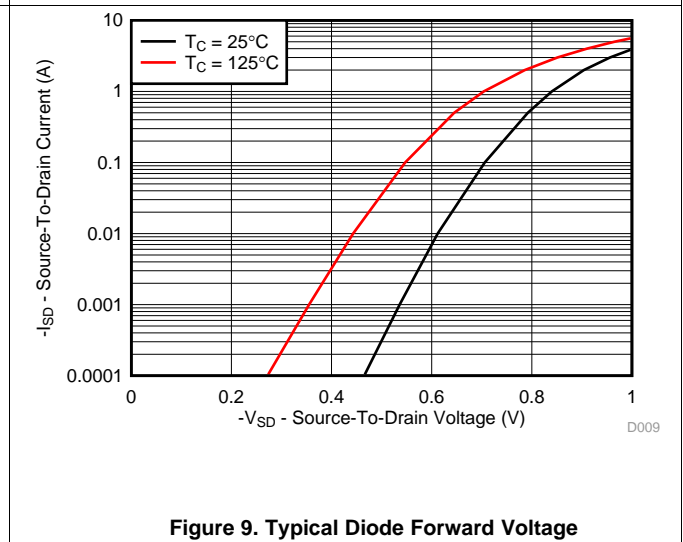
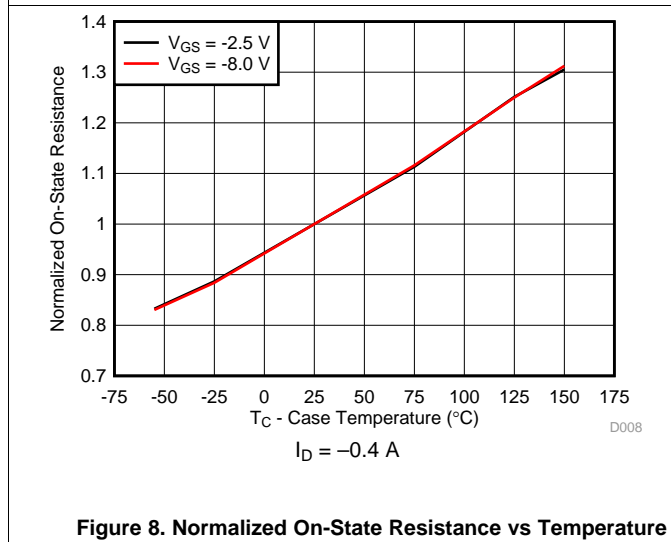
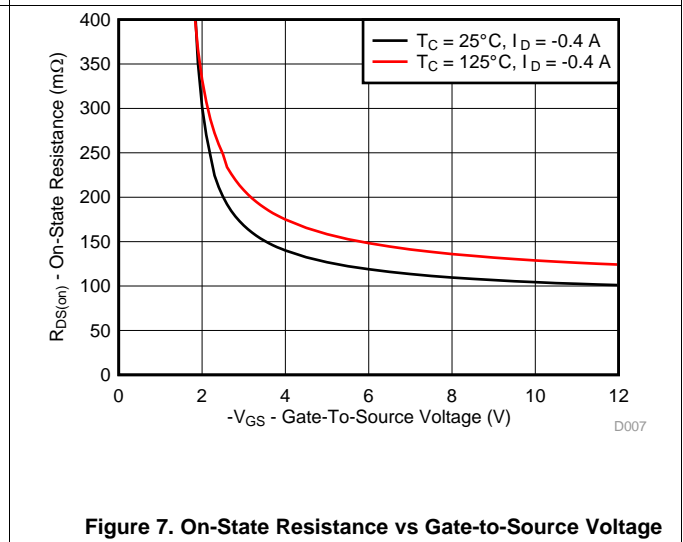
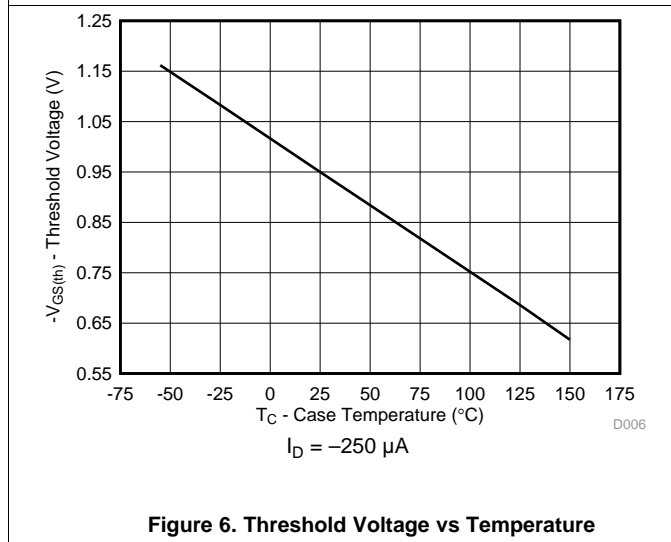
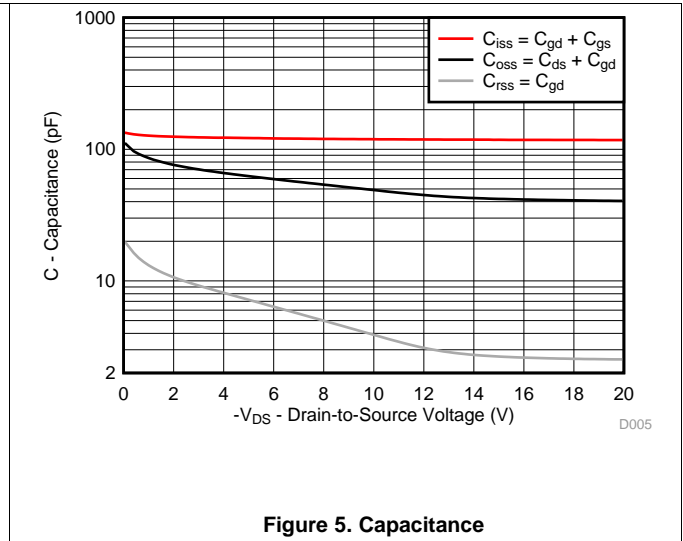
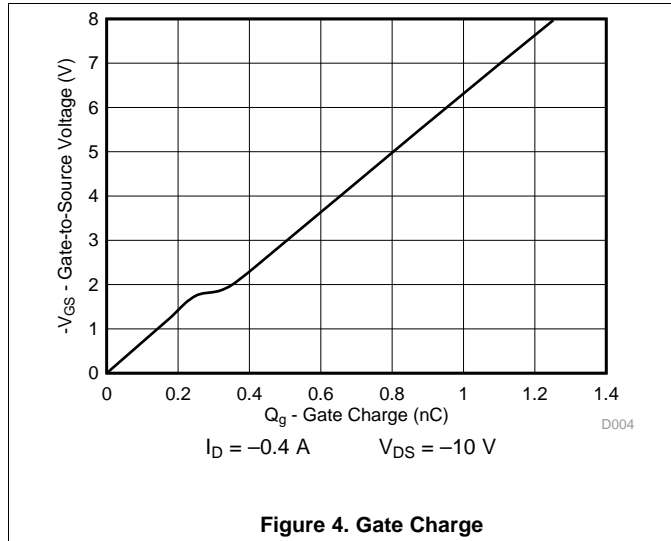


Figure 3. Transfer Characteristics

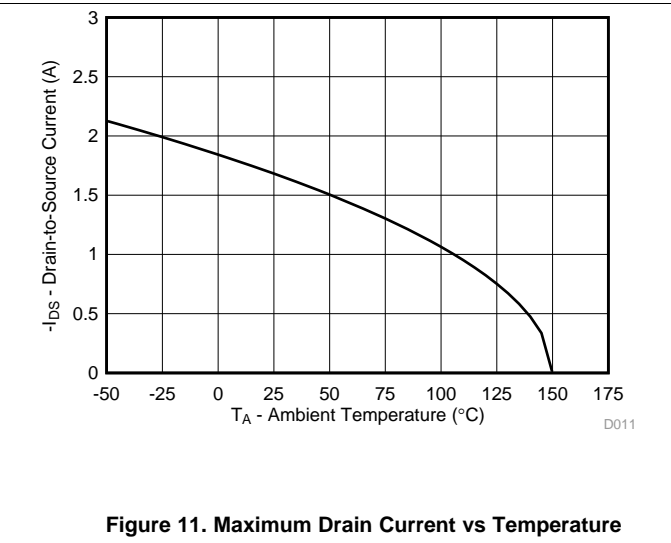
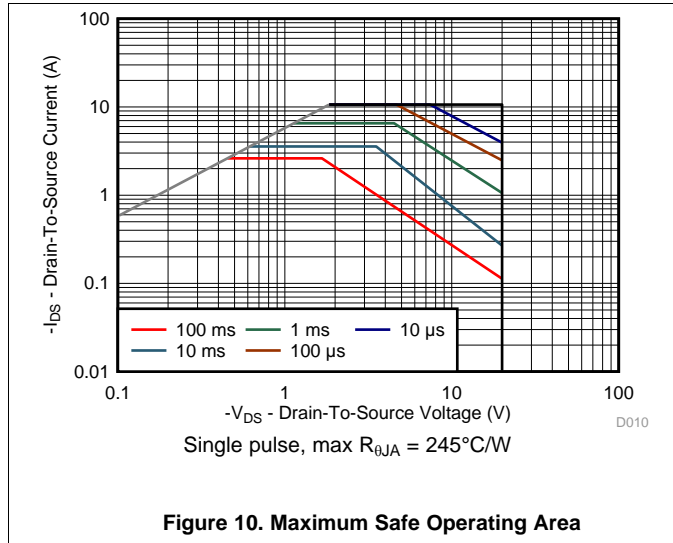
Typical MOSFET Characteristics (continued)

T<sub>A</sub> = 25°C (unless otherwise stated)



**Typical MOSFET Characteristics (continued)**

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



## 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 Community Resources

The following links connect to TI community resources. Linked contents are 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](#).

**TI E2E™ Online Community** *TI's Engineer-to-Engineer (E2E) Community*. Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

**Design Support** *TI's Design Support* Quickly find helpful E2E forums along with design support tools and contact information for technical support.

### 6.3 Trademarks

FemtoFET, E2E are trademarks of Texas Instruments.  
All other trademarks are the property of their respective owners.

### 6.4 Electrostatic Discharge Caution



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.

### 6.5 Glossary

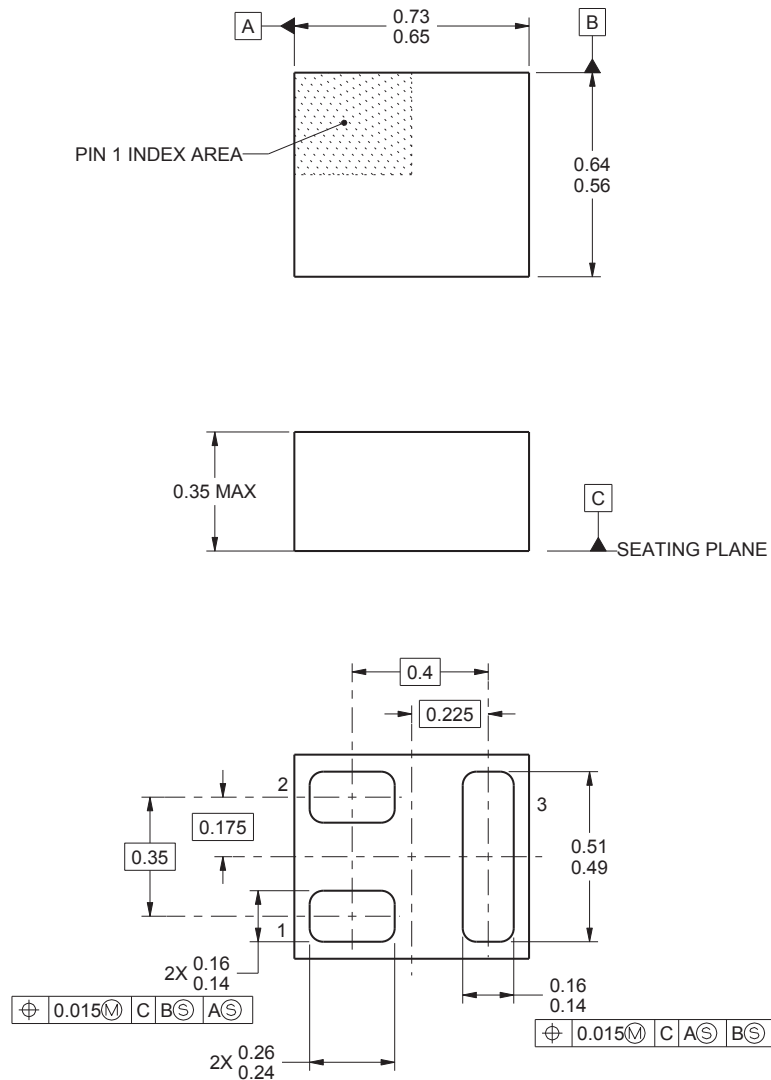
[SLYZ022](#) — *TI Glossary*.

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



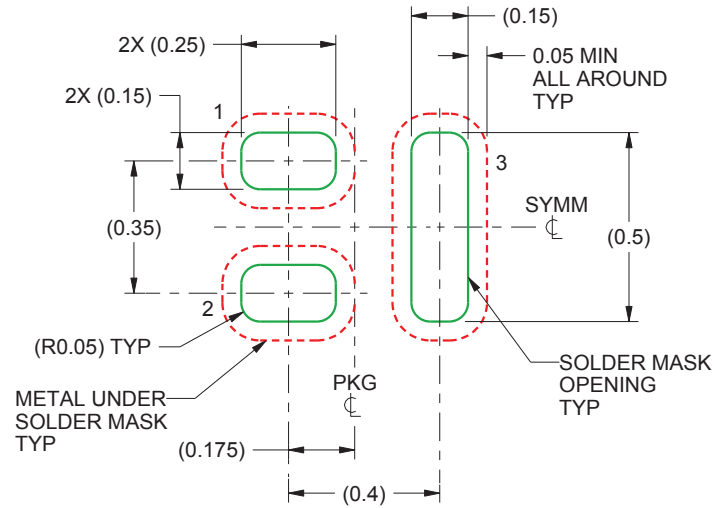
- (1) All linear dimensions are in millimeters (dimensions and tolerancing per AME T14.5M-1994).
- (2) This drawing is subject to change without notice.
- (3) This package is a lead-free solder land design.

**Table 1. Pin Configuration**

POSITION	DESIGNATION
Pin 1	Gate
Pin 2	Source
Pin 3	Drain

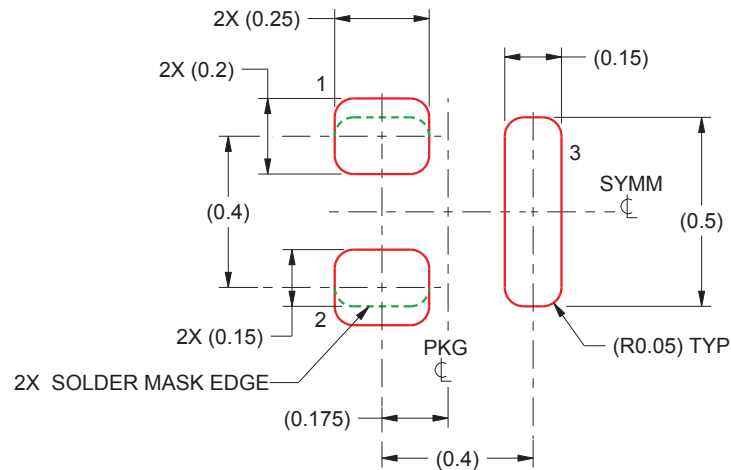


## 7.2 Recommended Minimum PCB Layout



(1) All dimensions are in millimeters.

## 7.3 Recommended Stencil Pattern



(1) 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	PICOST AR	YJM	3	3000	178.0	8.4	0.7	0.79	0.44	4.0	8.0	Q2
CSD25480F3	PICOST AR	YJM	3	3000	180.0	8.4	0.7	0.79	0.44	4.0	8.0	Q2
CSD25480F3T	PICOST AR	YJM	3	250	178.0	8.4	0.7	0.79	0.44	4.0	8.0	Q2
CSD25480F3T	PICOST AR	YJM	3	250	180.0	8.4	0.7	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	220.0	220.0	35.0
CSD25480F3	PICOSTAR	YJM	3	3000	182.0	182.0	20.0
CSD25480F3T	PICOSTAR	YJM	3	250	220.0	220.0	35.0
CSD25480F3T	PICOSTAR	YJM	3	250	182.0	182.0	20.0

## IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), 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, 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 ([www.ti.com/legal/termsofsale.html](http://www.ti.com/legal/termsofsale.html)) or other applicable terms available either on [ti.com](http://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.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2020, Texas Instruments Incorporated