

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

### 1 Features

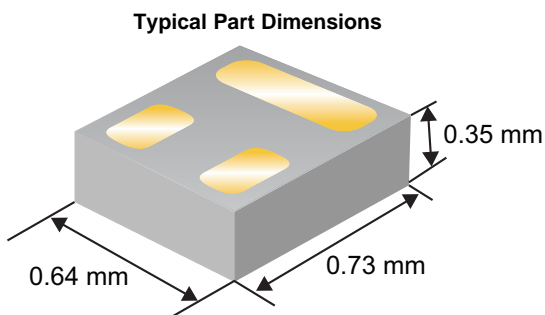
- Low On-Resistance
- Ultra-Low  $Q_g$  and  $Q_{gd}$
- Ultra-Small Footprint
  - 0.73 mm × 0.64 mm
- Low Profile
  - 0.35-mm Max Height
- Integrated ESD Protection Diode
- Lead and Halogen Free
- RoHS Compliant

### 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	Tape and Reel
CSD25480F3T	250		0.73-mm × 0.64-mm Land Grid Array (LGA)	

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

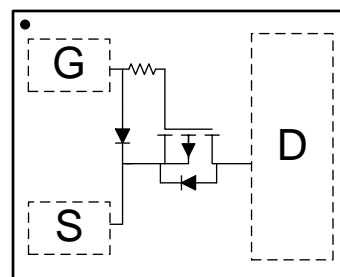
### Absolute Maximum Ratings

$T_A = 25^\circ\text{C}$ (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 Information</b> .....	<b>8</b>
5.2 Thermal Information .....	<b>3</b>	7.1 Mechanical Dimensions .....	<b>8</b>
5.3 Typical MOSFET Characteristics .....	<b>4</b>	7.2 Recommended Minimum PCB Layout .....	<b>9</b>
<b>6 Device and Documentation Support</b> .....	<b>7</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)

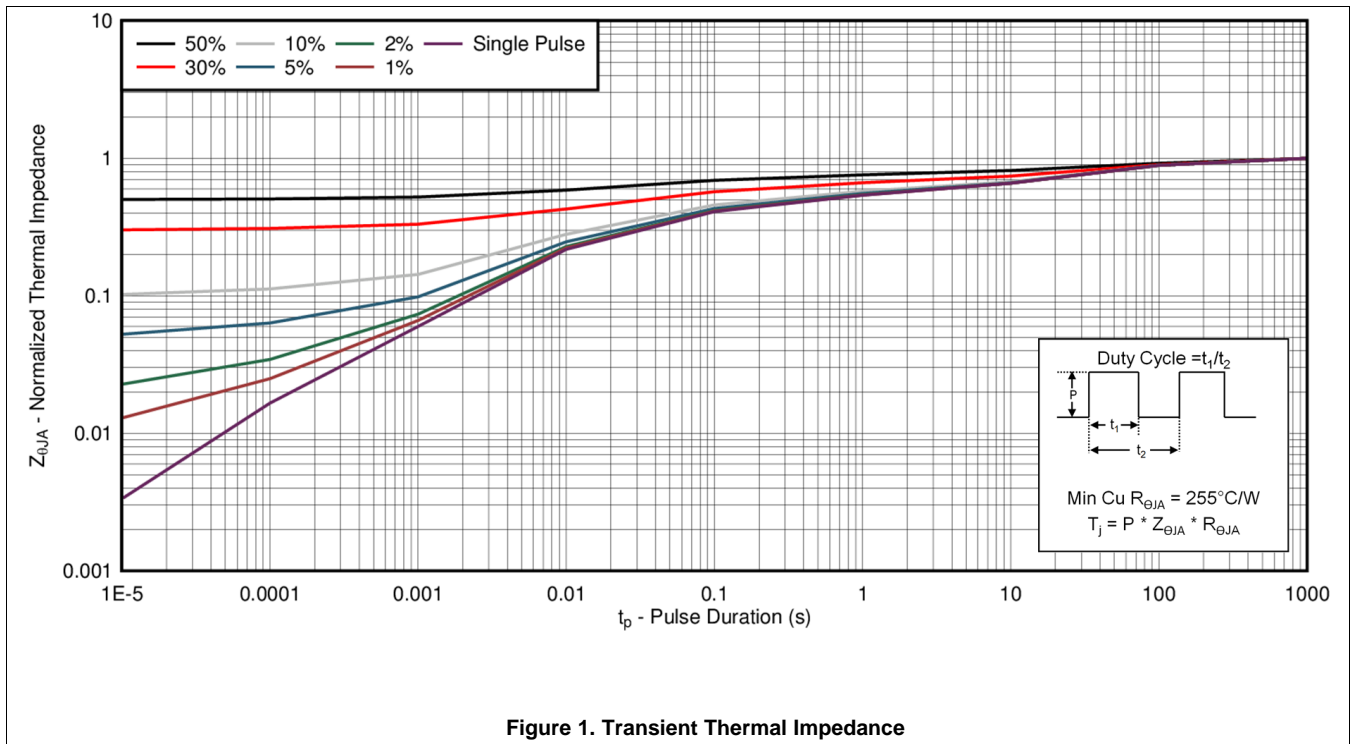


Figure 1. Transient Thermal Impedance

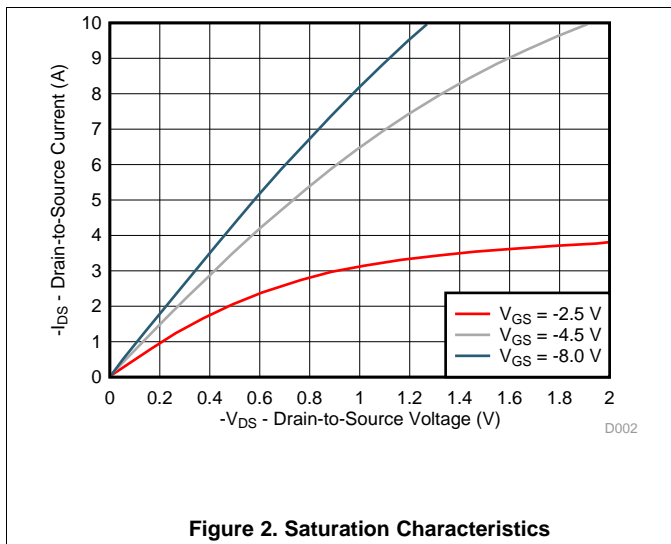


Figure 2. Saturation Characteristics

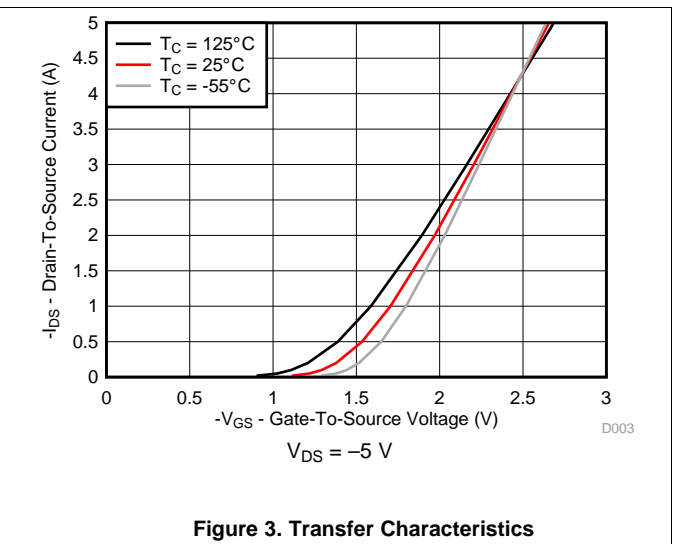
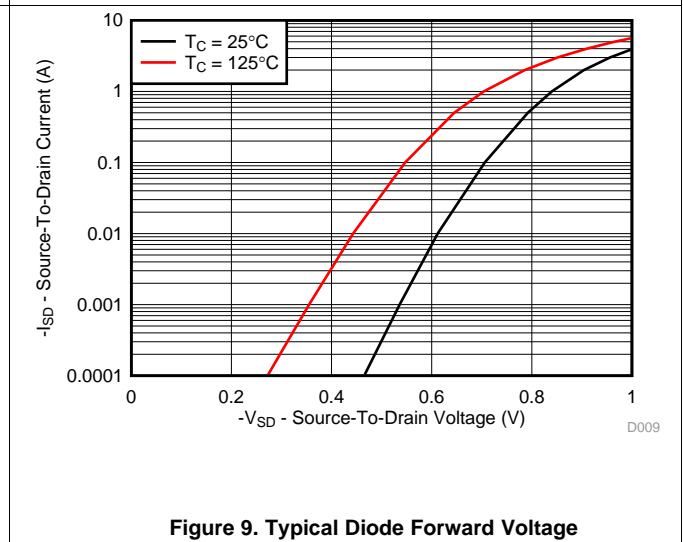
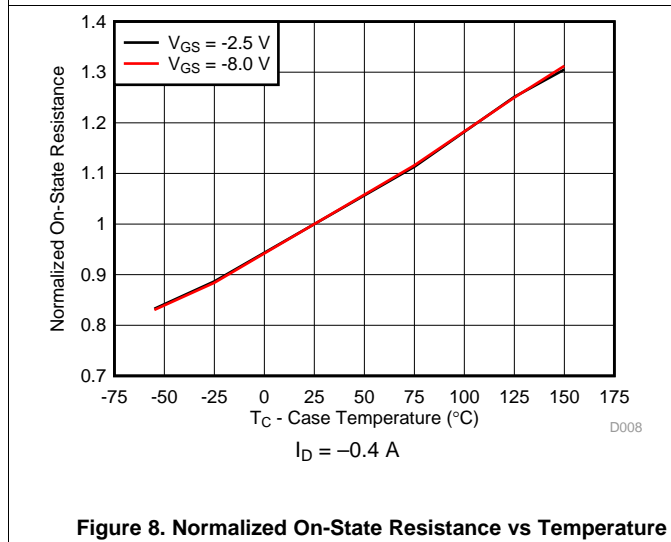
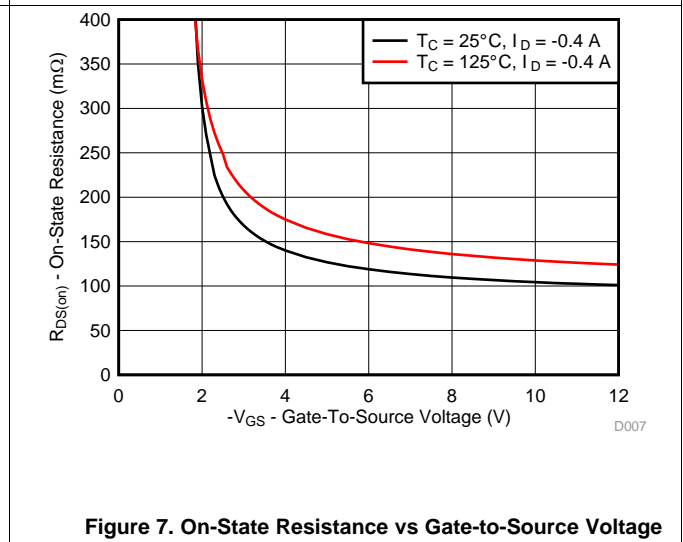
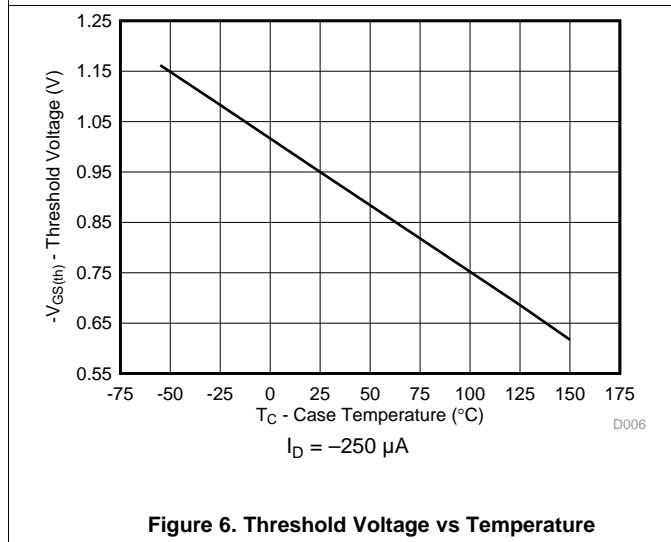
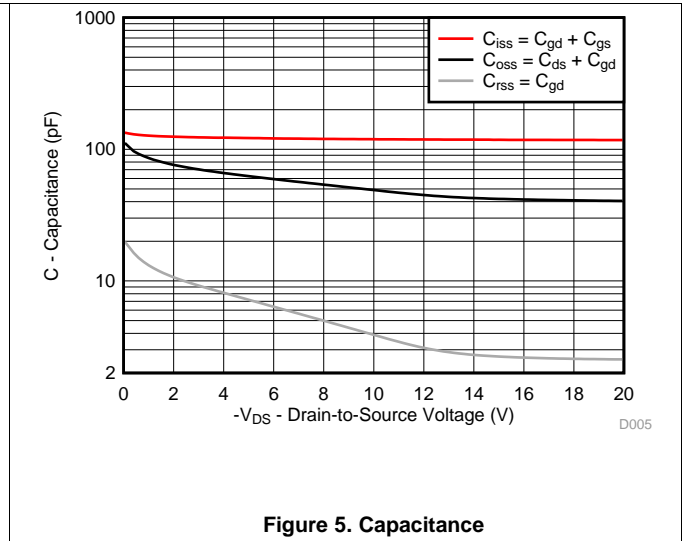
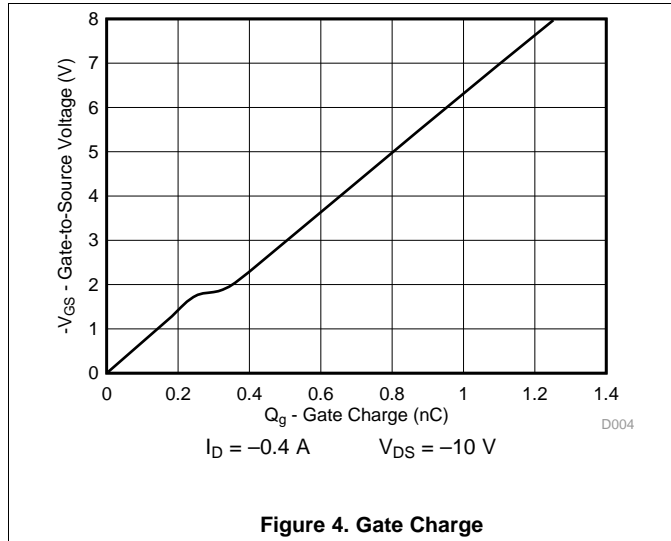


Figure 3. Transfer Characteristics

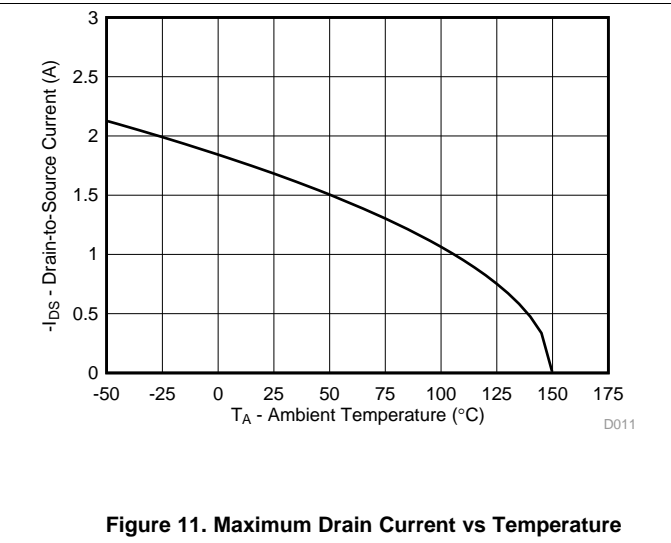
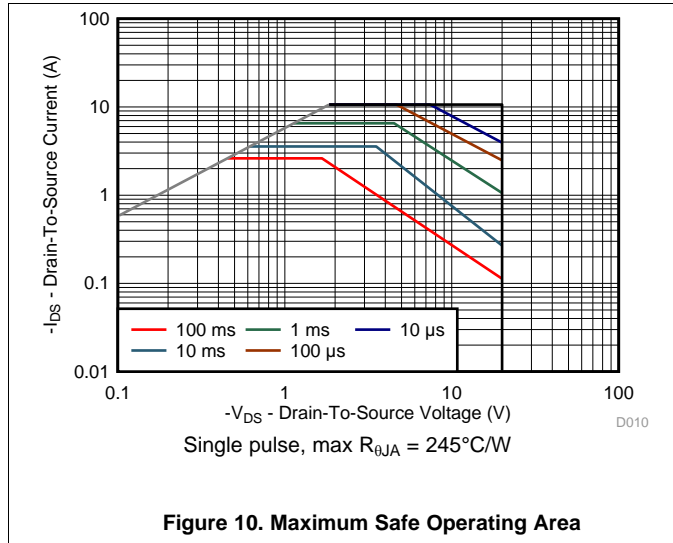
Typical MOSFET Characteristics (continued)

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

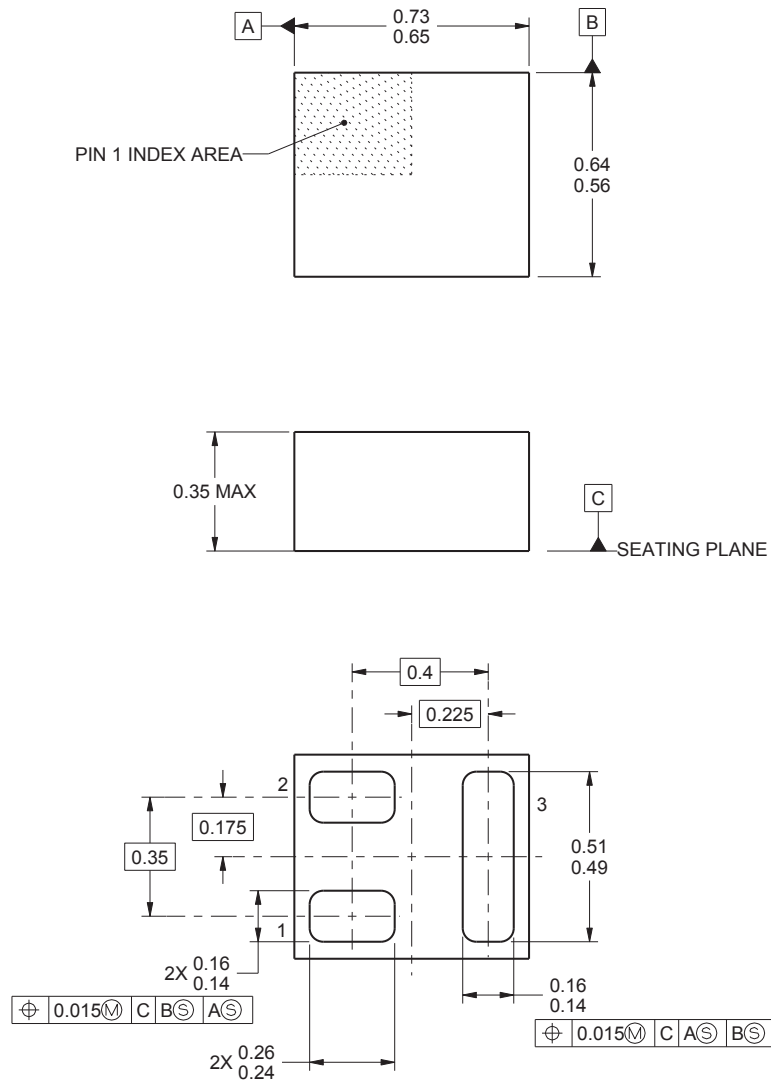
[SLYZ022](#) — *TI Glossary*.

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



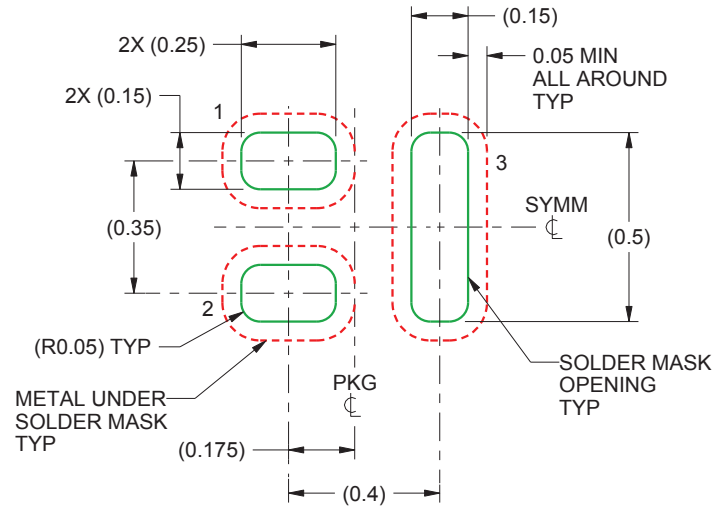
- (1) All linear dimensions are in millimeters (dimensions and tolerancing per AME T14.5M-1994).
- (2) This drawing is subject to change without notice.
- (3) This package is a lead-free solder land design.

**Table 1. Pin Configuration**

POSITION	DESIGNATION
Pin 1	Gate
Pin 2	Source
Pin 3	Drain

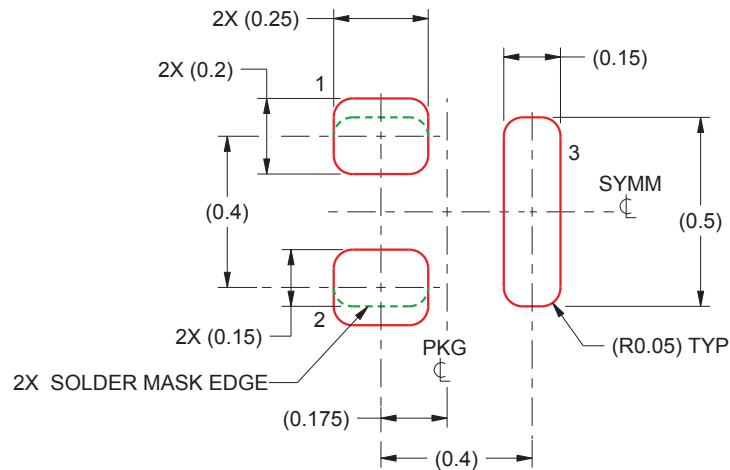


## 7.2 Recommended Minimum PCB Layout



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

## IMPORTANT NOTICE

Texas Instruments Incorporated (TI) reserves the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete.

TI's published terms of sale for semiconductor products (<http://www.ti.com/sc/docs/stdterms.htm>) apply to the sale of packaged integrated circuit products that TI has qualified and released to market. Additional terms may apply to the use or sale of other types of TI products and services.

Reproduction of significant portions of TI information in TI data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such reproduced documentation. Information of third parties may be subject to additional restrictions. Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyers and others who are developing systems that incorporate TI products (collectively, "Designers") understand and agree that Designers remain responsible for using their independent analysis, evaluation and judgment in designing their applications and that Designers have full and exclusive responsibility to assure the safety of Designers' applications and compliance of their applications (and of all TI products used in or for Designers' applications) with all applicable regulations, laws and other applicable requirements. Designer represents that, with respect to their applications, Designer has all the necessary expertise to create and implement safeguards that (1) anticipate dangerous consequences of failures, (2) monitor failures and their consequences, and (3) lessen the likelihood of failures that might cause harm and take appropriate actions. Designer agrees that prior to using or distributing any applications that include TI products, Designer will thoroughly test such applications and the functionality of such TI products as used in such applications.

TI's provision of technical, application or other design advice, quality characterization, reliability data or other services or information, including, but not limited to, reference designs and materials relating to evaluation modules, (collectively, "TI Resources") are intended to assist designers who are developing applications that incorporate TI products; by downloading, accessing or using TI Resources in any way, Designer (individually or, if Designer is acting on behalf of a company, Designer's company) agrees to use any particular TI Resource solely for this purpose and subject to the terms of this Notice.

TI's provision of TI Resources does not expand or otherwise alter TI's applicable published warranties or warranty disclaimers for TI products, and no additional obligations or liabilities arise from TI providing such TI Resources. TI reserves the right to make corrections, enhancements, improvements and other changes to its TI Resources. TI has not conducted any testing other than that specifically described in the published documentation for a particular TI Resource.

Designer is authorized to use, copy and modify any individual TI Resource only in connection with the development of applications that include the TI product(s) identified in such TI Resource. NO OTHER LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE TO ANY OTHER TI INTELLECTUAL PROPERTY RIGHT, AND NO LICENSE TO ANY TECHNOLOGY OR INTELLECTUAL PROPERTY RIGHT OF TI OR ANY THIRD PARTY IS GRANTED HEREIN, including but not limited to any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information regarding or referencing third-party products or services does not constitute a license to use such products or services, or a warranty or endorsement thereof. Use of TI Resources may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

TI RESOURCES ARE PROVIDED "AS IS" AND WITH ALL FAULTS. TI DISCLAIMS ALL OTHER WARRANTIES OR REPRESENTATIONS, EXPRESS OR IMPLIED, REGARDING RESOURCES OR USE THEREOF, INCLUDING BUT NOT LIMITED TO ACCURACY OR COMPLETENESS, TITLE, ANY EPIDEMIC FAILURE WARRANTY AND ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT OF ANY THIRD PARTY INTELLECTUAL PROPERTY RIGHTS. TI SHALL NOT BE LIABLE FOR AND SHALL NOT DEFEND OR INDEMNIFY DESIGNER AGAINST ANY CLAIM, INCLUDING BUT NOT LIMITED TO ANY INFRINGEMENT CLAIM THAT RELATES TO OR IS BASED ON ANY COMBINATION OF PRODUCTS EVEN IF DESCRIBED IN TI RESOURCES OR OTHERWISE. IN NO EVENT SHALL TI BE LIABLE FOR ANY ACTUAL, DIRECT, SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF TI RESOURCES OR USE THEREOF, AND REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Unless TI has explicitly designated an individual product as meeting the requirements of a particular industry standard (e.g., ISO/TS 16949 and ISO 26262), TI is not responsible for any failure to meet such industry standard requirements.

Where TI specifically promotes products as facilitating functional safety or as compliant with industry functional safety standards, such products are intended to help enable customers to design and create their own applications that meet applicable functional safety standards and requirements. Using products in an application does not by itself establish any safety features in the application. Designers must ensure compliance with safety-related requirements and standards applicable to their applications. Designer may not use any TI products in life-critical medical equipment unless authorized officers of the parties have executed a special contract specifically governing such use. Life-critical medical equipment is medical equipment where failure of such equipment would cause serious bodily injury or death (e.g., life support, pacemakers, defibrillators, heart pumps, neurostimulators, and implantables). Such equipment includes, without limitation, all medical devices identified by the U.S. Food and Drug Administration as Class III devices and equivalent classifications outside the U.S.

TI may expressly designate certain products as completing a particular qualification (e.g., Q100, Military Grade, or Enhanced Product). Designers agree that it has the necessary expertise to select the product with the appropriate qualification designation for their applications and that proper product selection is at Designers' own risk. Designers are solely responsible for compliance with all legal and regulatory requirements in connection with such selection.

Designer will fully indemnify TI and its representatives against any damages, costs, losses, and/or liabilities arising out of Designer's non-compliance with the terms and provisions of this Notice.