

CSD13385F5 12V N 沟道 FemtoFET™ MOSFET

1 特性

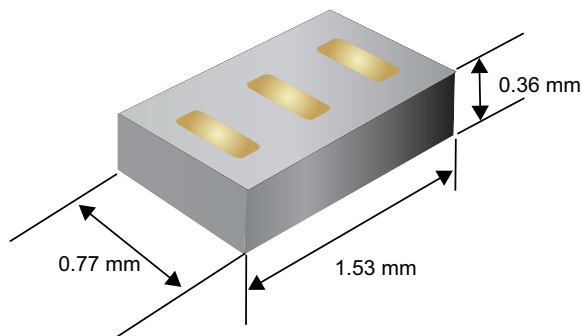
- 低导通电阻
- 低 Q_g 和 Q_{gd}
- 超小尺寸
 - 1.53mm x 0.77mm
- 薄型封装
 - 厚度为 0.36mm
- 集成型 ESD 保护二极管
 - 额定值 > 4kV HBM
 - 额定值 > 2kV CDM
- 无铅且无卤素
- 符合 RoHS

2 应用

- 针对工业负载开关应用进行了优化
- 针对通用开关应用进行了优化

3 说明

该 12V、15mΩ N 沟道 FemtoFET™ MOSFET 技术经过设计和优化，能够最大限度地减小在许多手持式和移动应用中占用的空间。这项技术能够在替代标准小信号 MOSFET 的同时大幅减小封装尺寸。



典型器件尺寸

产品概要

$T_A = 25^\circ\text{C}$		典型值	单位
V_{DS}	漏源电压	12	V
Q_g	栅极电荷总量 (4.5V)	3.9	nC
Q_{gd}	栅极电荷 (栅极到漏极)	0.39	nC
$R_{DS(on)}$	漏源导通电阻	$V_{GS} = 1.8\text{V}$	26
		$V_{GS} = 2.5\text{V}$	18
		$V_{GS} = 4.5\text{V}$	15
$V_{GS(th)}$	阈值电压	0.8	V

器件信息⁽¹⁾

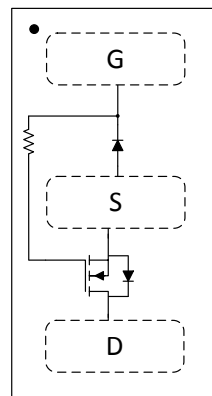
器件	数量	介质	封装	配送
CSD13385F5	3000	7 英寸卷带	Femto	卷带包装
CSD13385F5T	250		1.53mm × 0.77mm 无引线 SMD	

(1) 如需了解所有可用封装，请参阅数据表末尾的可订购产品附录。

绝对最大额定值

$T_A = 25^\circ\text{C}$		值	单位
V_{DS}	漏源电压	12	V
V_{GS}	栅源电压	8	V
I_D	持续漏极电流 ⁽¹⁾	4.3	A
	持续漏极电流 ⁽²⁾	7.1	
I_{DM}	脉冲漏极电流 ^{(1) (3)}	41	A
P_D	功率耗散 ⁽¹⁾	0.5	W
	功率耗散 ⁽²⁾	1.4	
$V_{(ESD)}$	人体放电模型 (HBM)	4	kV
	带电器件模型 (CDM)	2	
T_J 、 T_{stg}	工作结温、 贮存温度	-55 至 150	$^\circ\text{C}$

- (1) $R_{\theta JA} = 245^\circ\text{C/W}$ (覆铜面积最小时的典型值)。
 (2) $R_{\theta JA} = 90^\circ\text{C/W}$ (覆铜面积最大时的典型值)。
 (3) 脉冲持续时间 $\leq 100 \mu\text{s}$ ，占空比 $\leq 1\%$ 。



顶视图



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4 Revision History

注：以前版本的页码可能与当前版本的页码不同

Changes from Revision A (May 2017) to Revision B (February 2022)	Page
• 将超薄型封装要点中的厚度从 0.35mm 更改为 0.36mm.....	1
• 将超薄型封装图片中的厚度从 0.35mm 更新为 0.36mm。.....	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 * (October 2016) to Revision A (May 2017)	Page
• Changed I_{DSS} and I_{GSS} unit value from μA to nA in the <i>Electrical Characteristics</i> table.	3

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 V, I _{DS} = 250 μA	12			V
I _{DSS}	Drain-to-source leakage current	V _{GS} = 0 V, V _{DS} = 9.6 V			50	nA
I _{GSS}	Gate-to-source leakage current	V _{DS} = 0 V, V _{GS} = 8 V			25	nA
V _{GS(th)}	Gate-to-source threshold voltage	V _{DS} = V _{GS} , I _{DS} = 250 μA	0.5	0.8	1.2	V
R _{DS(on)}	Drain-to-source on resistance	V _{GS} = 1.8 V, I _{DS} = 0.1 A	26		50	mΩ
		V _{GS} = 2.5 V, I _{DS} = 0.9 A	18		23	
		V _{GS} = 4.5 V, I _{DS} = 0.9 A	15		19	
g _{fs}	Transconductance	V _{DS} = 1.2 V, I _{DS} = 0.9 A	11.3			S
DYNAMIC CHARACTERISTICS						
C _{iss}	Input capacitance	V _{GS} = 0 V, V _{DS} = 6 V, f = 1 MHz	519		674	pF
C _{oss}	Output capacitance		305		396	pF
C _{rss}	Reverse transfer capacitance		29		38	pF
R _G	Series gate resistance		20			Ω
Q _g	Gate charge total (4.5 V)	V _{DS} = 6 V, I _{DS} = 0.9 A	3.9		5.0	nC
Q _{gd}	Gate charge gate-to-drain		0.39			nC
Q _{gs}	Gate charge gate-to-source		0.74			nC
Q _{g(th)}	Gate charge at V _{th}		0.46			nC
Q _{oss}	Output charge	V _{DS} = 6 V, V _{GS} = 0 V	2.5			nC
t _{d(on)}	Turnon delay time	V _{DS} = 6 V, V _{GS} = 4.5 V, I _{DS} = 0.9 A, R _G = 2 Ω	7			ns
t _r	Rise time		10			ns
t _{d(off)}	Turnoff delay time		33			ns
t _f	Fall time		10			ns
DIODE CHARACTERISTICS						
V _{SD}	Diode forward voltage	I _{SD} = 0.9 A, V _{GS} = 0 V	0.67		1.0	V

5.2 Thermal Information

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

THERMAL METRIC		MIN	TYP	MAX	UNIT
$R_{\theta JA}$	Junction-to-ambient thermal resistance ⁽¹⁾		90		$^\circ\text{C/W}$
	Junction-to-ambient thermal resistance ⁽²⁾		245		

(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)

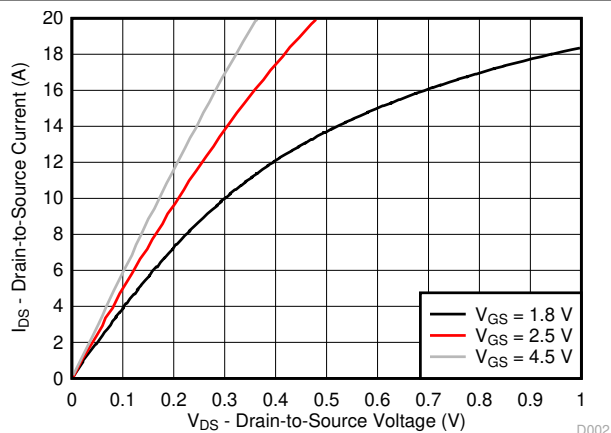


图 5-1. Saturation Characteristics

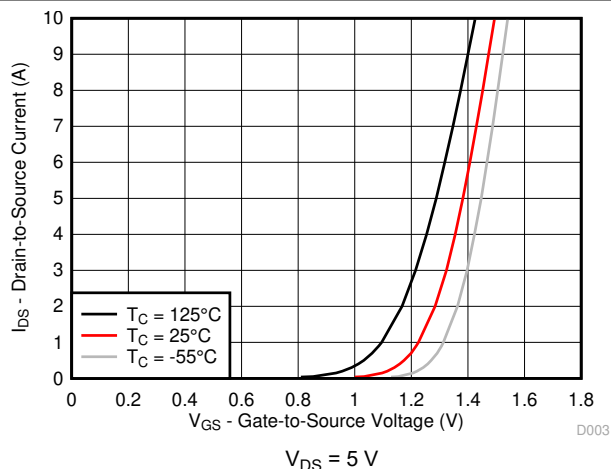


图 5-2. Transfer Characteristics

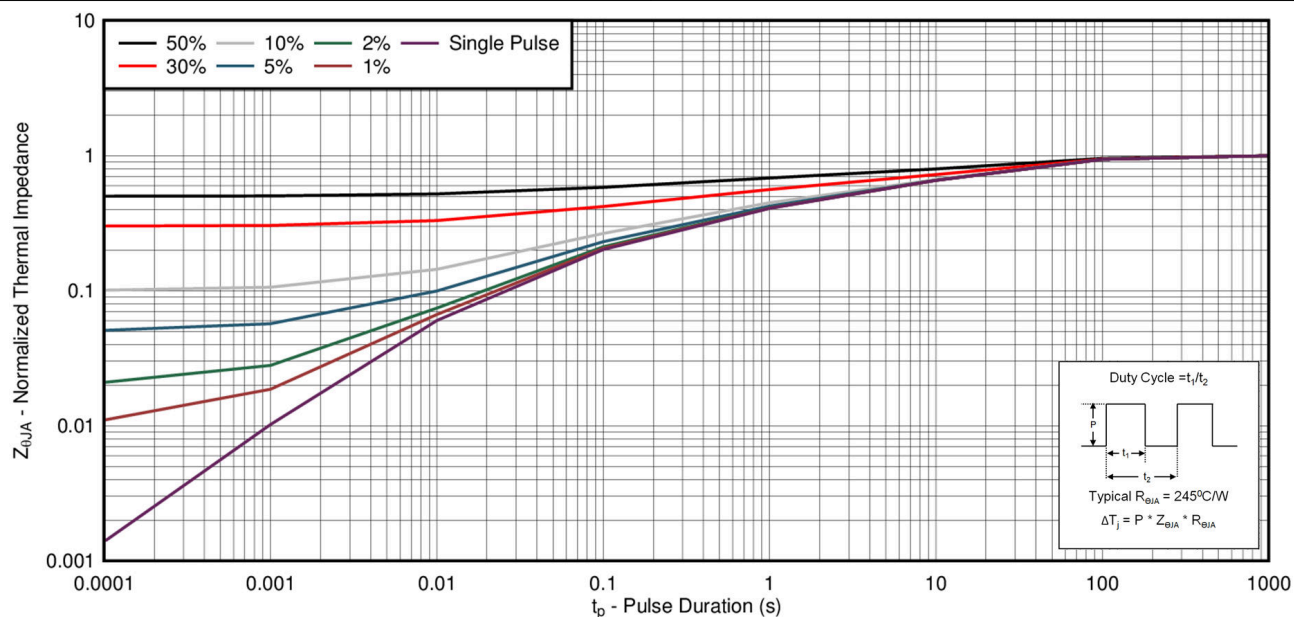


图 5-3. Transient Thermal Impedance

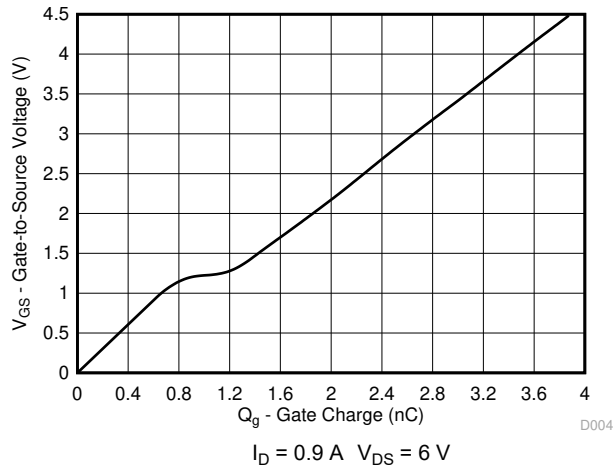


图 5-4. Gate Charge

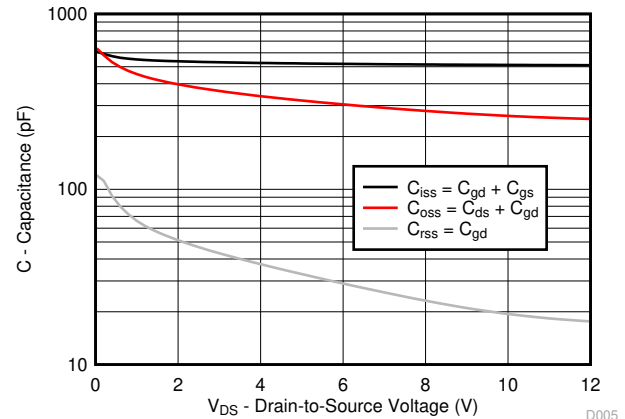


图 5-5. Capacitance

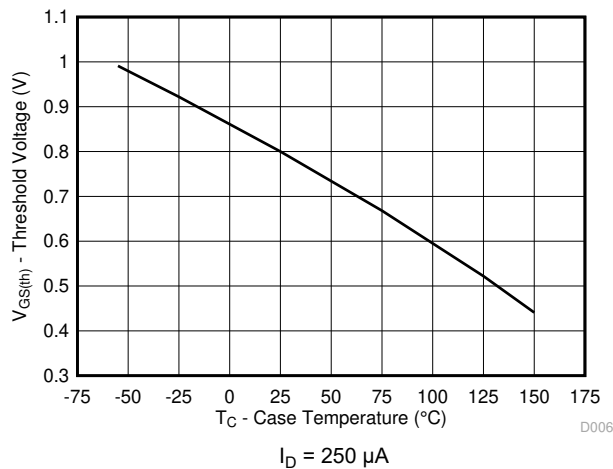


图 5-6. Threshold Voltage vs Temperature

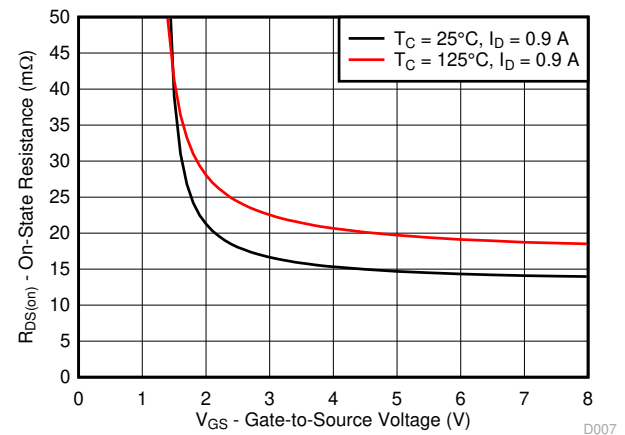


图 5-7. On-State Resistance vs Gate-to-Source Voltage

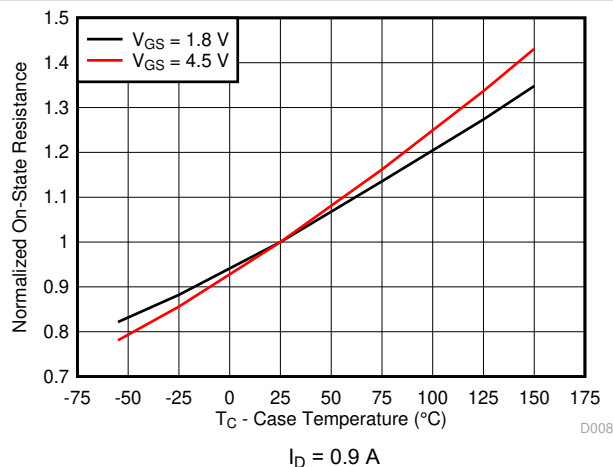


图 5-8. Normalized On-State Resistance vs Temperature

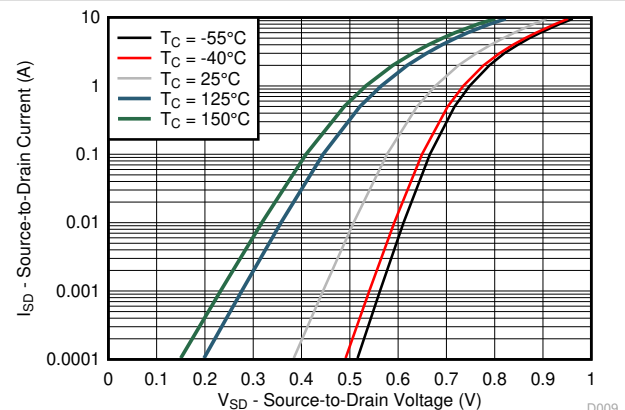


图 5-9. Typical Diode Forward Voltage

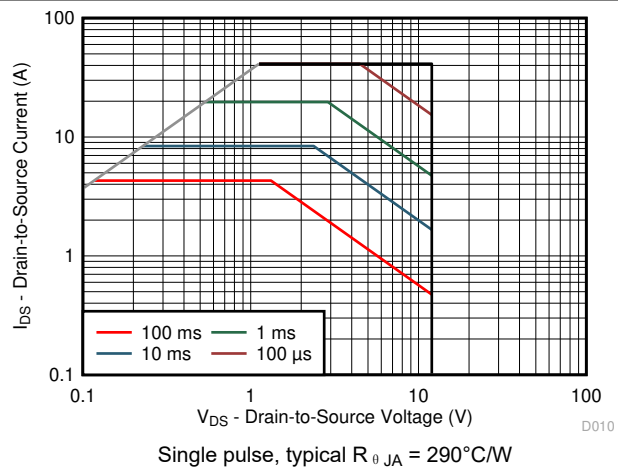


图 5-10. Maximum Safe Operating Area (SOA)

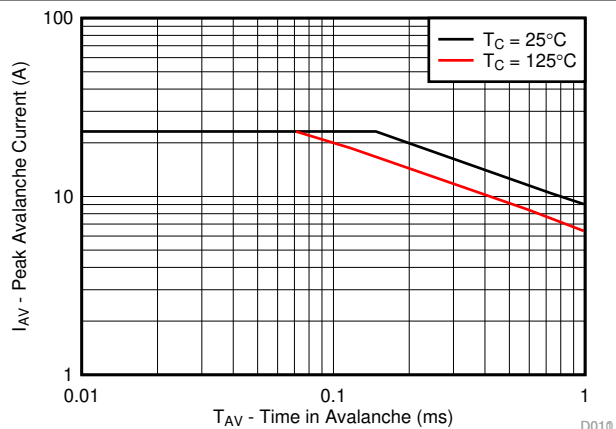


图 5-11. Single Pulse Unclamped Inductive Switching

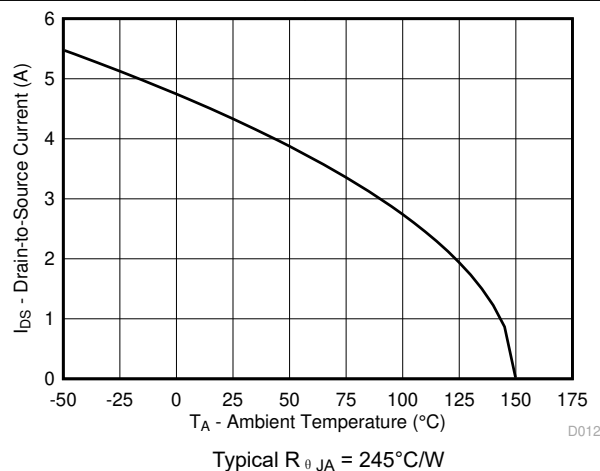


图 5-12. Maximum Drain Current vs Temperature

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

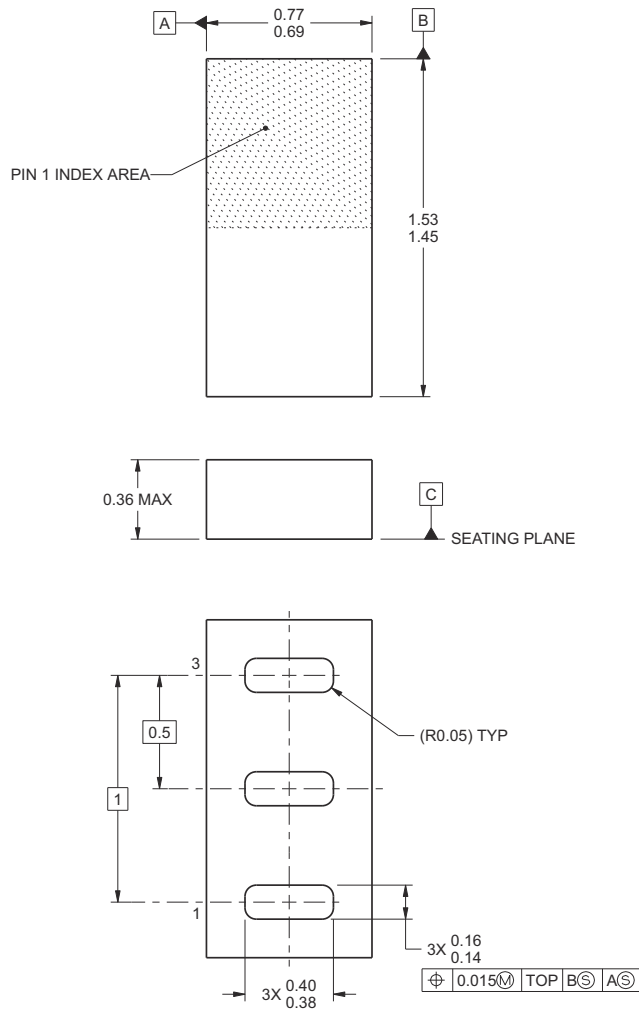
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7 Mechanical, Packaging, and Orderable Information

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



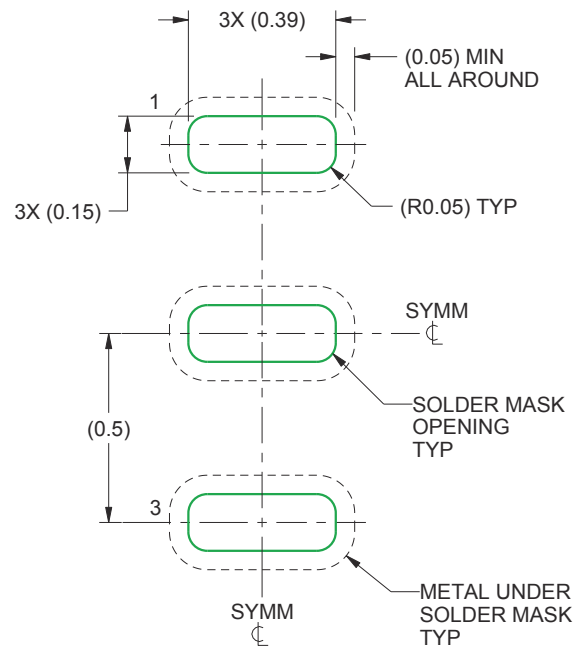
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- A. All linear dimensions are in millimeters (dimensions and tolerancing per AME T14.5M-1994).
- B. This drawing is subject to change without notice.
- C. This package is a PB-free solder land design.

表 7-1. Pin Configuration

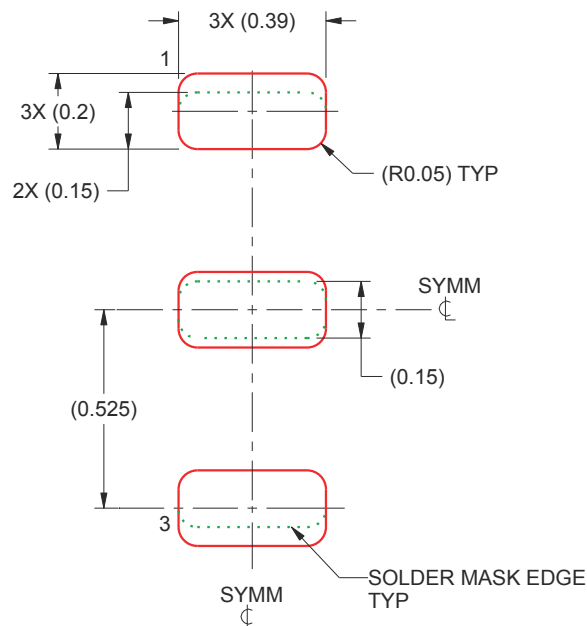
POSITION	DESIGNATION
Pin 1	Gate
Pin 2	Source
Pin 3	Drain

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.

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
CSD13385F5	Active	Production	PICOSTAR (YJK) 3	3000 LARGE T&R	Yes	NIAU	Level-1-260C-UNLIM	-55 to 150	4V
CSD13385F5.B	Active	Production	PICOSTAR (YJK) 3	3000 LARGE T&R	Yes	NIAU	Level-1-260C-UNLIM	-55 to 150	4V
CSD13385F5T	Active	Production	PICOSTAR (YJK) 3	250 SMALL T&R	Yes	NIAU	Level-1-260C-UNLIM	-55 to 150	4V
CSD13385F5T.B	Active	Production	PICOSTAR (YJK) 3	250 SMALL T&R	Yes	NIAU	Level-1-260C-UNLIM	-55 to 150	4V

⁽¹⁾ **Status:** For more details on status, see our [product life cycle](#).

⁽²⁾ **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

⁽³⁾ **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

⁽⁴⁾ **Lead finish/Ball material:** Parts 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.

⁽⁵⁾ **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

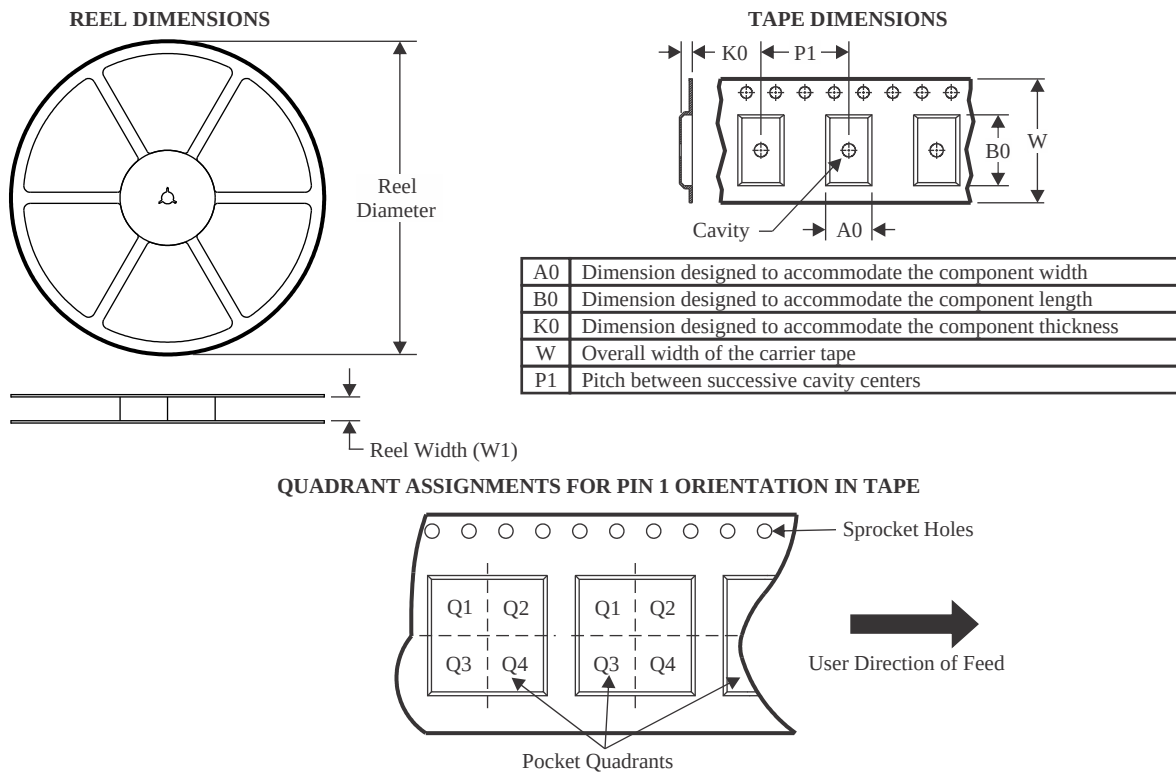
⁽⁶⁾ **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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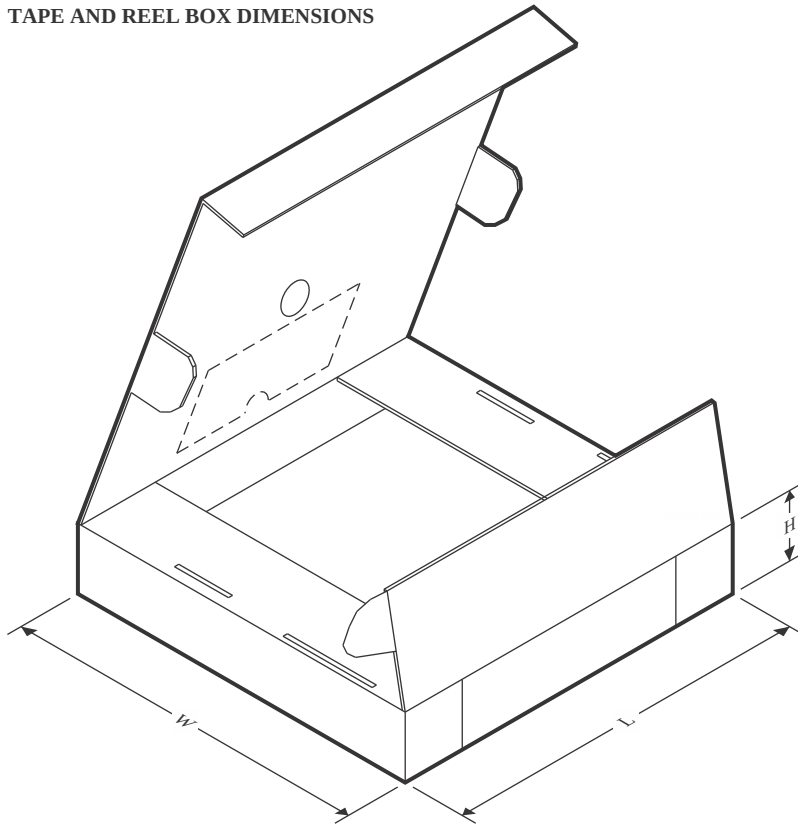
TAPE AND REEL INFORMATION



*All dimensions are nominal

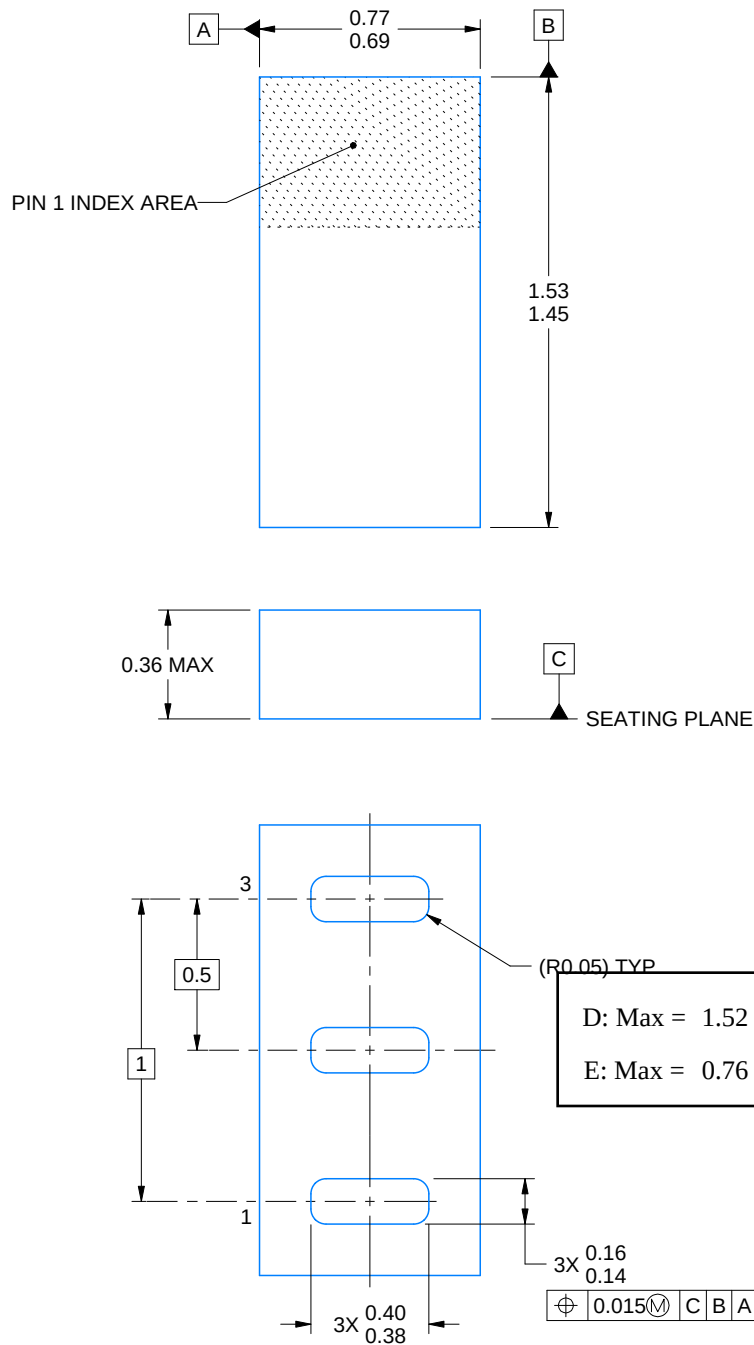
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
CSD13385F5	PICOSTAR	YJK	3	3000	180.0	8.4	0.92	1.68	0.42	4.0	8.0	Q1
CSD13385F5T	PICOSTAR	YJK	3	250	180.0	8.4	0.92	1.68	0.42	4.0	8.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CSD13385F5	PICOSTAR	YJK	3	3000	182.0	182.0	20.0
CSD13385F5T	PICOSTAR	YJK	3	250	182.0	182.0	20.0

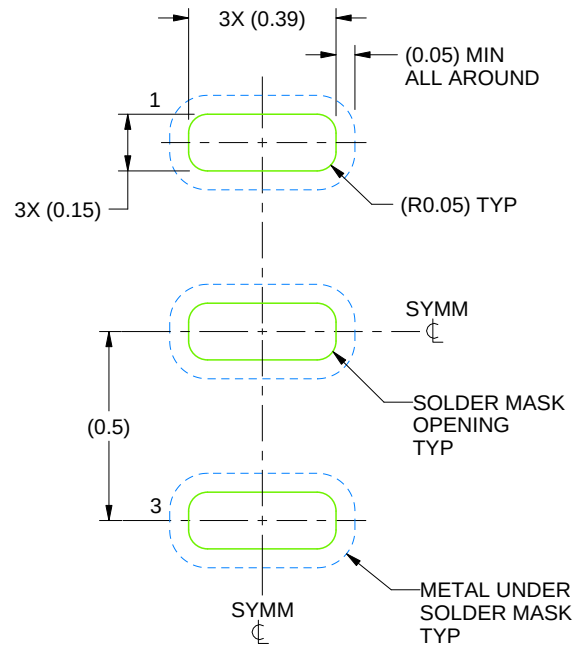


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NOTES:

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.

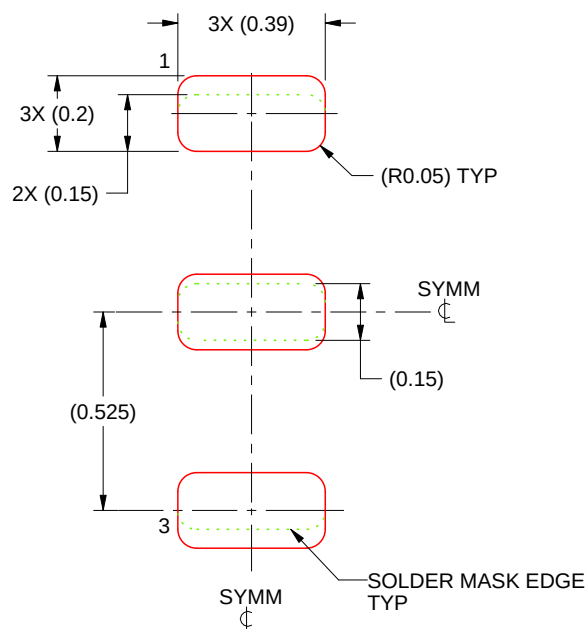


LAND PATTERN EXAMPLE
SOLDER MASK DEFINED
SCALE:50X

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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

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NOTES: (continued)

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

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