

CSD17381F4 30 V N-Channel FemtoFET™ MOSFET

1 Features

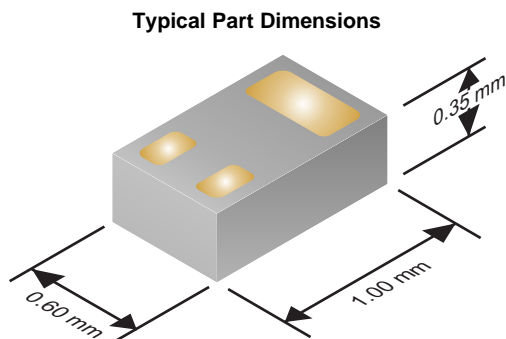
- Ultra-Low On-Resistance
- Ultra-Low Q_g and Q_{gd}
- Low Threshold Voltage
- Ultra-Small Footprint (0402 Case Size)
 - 1.0 mm x 0.6 mm
- Ultra-Low Profile
 - 0.35 mm Height
- Integrated ESD Protection Diode
 - Rated >4 kV HBM
 - Rated >2 kV CDM
- Lead and Halogen Free
- RoHS Compliant

2 Applications

- Optimized for Load Switch Applications
- Optimized for General Purpose Switching Applications
- Single-Cell Battery Applications
- Handheld and Mobile Applications

3 Description

This 90 m Ω , 30 V 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.



Product Summary

$T_A = 25^\circ\text{C}$		TYPICAL VALUE		UNIT
V_{DS}	Drain-to-Source Voltage	30		V
Q_g	Gate Charge Total (4.5 V)	1040		pC
Q_{gd}	Gate Charge Gate-to-Drain	133		pC
$R_{DS(on)}$	Drain-to-Source On-Resistance	$V_{GS} = 1.8\text{ V}$	160	m Ω
		$V_{GS} = 2.5\text{ V}$	110	m Ω
		$V_{GS} = 4.5\text{ V}$	90	m Ω
$V_{GS(th)}$	Threshold Voltage	0.85		V

Ordering Information⁽¹⁾

Device	Qty	Media	Package	Ship
CSD17381F4	3000	7-Inch Reel	Femto (0402) 1.0 mm x 0.6 mm SMD Lead Less	Tape and Reel
CSD17381F4T	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	30	V
V_{GS}	Gate-to-Source Voltage	12	V
I_D	Continuous Drain Current, $T_A = 25^\circ\text{C}^{(1)}$	3.1	A
I_{DM}	Pulsed Drain Current, $T_A = 25^\circ\text{C}^{(2)}$	10	A
I_G	Continuous Gate Clamp Current	35	mA
	Pulsed Gate Clamp Current ⁽²⁾	350	
P_D	Power Dissipation ⁽¹⁾	500	mW
ESD Rating	Human Body Model (HBM)	4	kV
	Charged Device Model (CDM)	2	kV
T_J , T_{sig}	Operating Junction and Storage Temperature Range	-55 to 150	$^\circ\text{C}$
E_{AS}	Avalanche Energy, single pulse $I_D = 7.4\text{ A}$, $L = 0.1\text{ mH}$, $R_G = 25\ \Omega$	2.7	mJ

(1) Typical $R_{\theta JA} = 90^\circ\text{C/W}$ on 1 inch² (6.45 cm²), 2 oz. (0.071 mm thick) Cu pad on a 0.06 inch (1.52 mm) thick FR4 PCB.

(2) Pulse duration $\leq 300\ \mu\text{s}$, duty cycle $\leq 2\%$

Top View

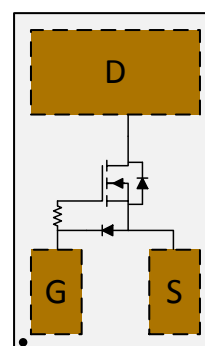


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4 Revision History

Changes from Revision C (January 2014) to Revision D Page

- Corrected timing V_{DS} to read 15 V

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Changes from Revision B (November 2013) to Revision C Page

- Added I_G parameter
- Lowered I_{DSS} limit
- Lowered I_{GSS} limit

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Changes from Revision A (July 2013) to Revision B Page

- Deleted jumbo reel info
- Added short reel info

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Changes from Original (April 2013) to Revision A Page

- Added ESD info to Features
- Included jumbo reel ordering information
- Added ESD rating info to Absolute Maximum Ratings table
- Added circuit schematic to pinout view

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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	$V_{GS} = 0\text{ V}, I_{DS} = 250\ \mu\text{A}$	30			V
I_{DSS}	Drain-to-Source Leakage Current	$V_{GS} = 0\text{ V}, V_{DS} = 24\text{ V}$			100	nA
I_{GSS}	Gate-to-Source Leakage Current	$V_{DS} = 0\text{ V}, V_{GS} = 10\text{ V}$			50	nA
$V_{GS(th)}$	Gate-to-Source Threshold Voltage	$V_{DS} = V_{GS}, I_{DS} = 250\ \mu\text{A}$	0.65	0.85	1.10	V
$R_{DS(on)}$	Drain-to-Source On-Resistance	$V_{GS} = 1.8\text{ V}, I_{DS} = 0.5\text{ A}$		160	250	m Ω
		$V_{GS} = 2.5\text{ V}, I_{DS} = 0.5\text{ A}$		110	143	m Ω
		$V_{GS} = 4.5\text{ V}, I_{DS} = 0.5\text{ A}$		90	117	m Ω
		$V_{GS} = 8\text{ V}, I_{DS} = 0.5\text{ A}$		84	109	m Ω
g_{fs}	Transconductance	$V_{DS} = 15\text{ V}, I_{DS} = 0.5\text{ A}$		4.8		S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	$V_{GS} = 0\text{ V}, V_{DS} = 15\text{ V},$ $f = 1\text{ MHz}$		150	195	pF
C_{oss}	Output Capacitance			44	57	pF
C_{rss}	Reverse Transfer Capacitance			2.2	2.9	pF
R_G	Series Gate Resistance			23		Ω
Q_g	Gate Charge Total (4.5 V)	$V_{DS} = 15\text{ V}, I_{DS} = 0.5\text{ A}$		1040	1350	pC
Q_{gd}	Gate Charge Gate-to-Drain			133		pC
Q_{gs}	Gate Charge Gate-to-Source			226		pC
$Q_{g(th)}$	Gate Charge at V_{th}			150		pC
Q_{oss}	Output Charge		$V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V}$		1110	
$t_{d(on)}$	Turn On Delay Time			3.4		ns
t_r	Rise Time	$V_{DS} = 15\text{ V}, V_{GS} = 4.5\text{ V},$ $I_{DS} = 0.5\text{ A}, R_G = 2\ \Omega$		1.4		ns
$t_{d(off)}$	Turn Off Delay Time			10.8		ns
t_f	Fall Time			3.6		ns
DIODE CHARACTERISTICS						
V_{SD}	Diode Forward Voltage	$I_{SD} = 0.5\text{ A}, V_{GS} = 0\text{ V}$		0.73	0.9	V
Q_{rr}	Reverse Recovery Charge	$V_{DS} = 15\text{ V}, I_F = 0.5\text{ A}, di/dt = 300\text{ A}/\mu\text{s}$		1500		pC
t_{rr}	Reverse Recovery Time			5.6		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⁾	250	

(1) Device mounted on FR4 material with 1 inch² (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)

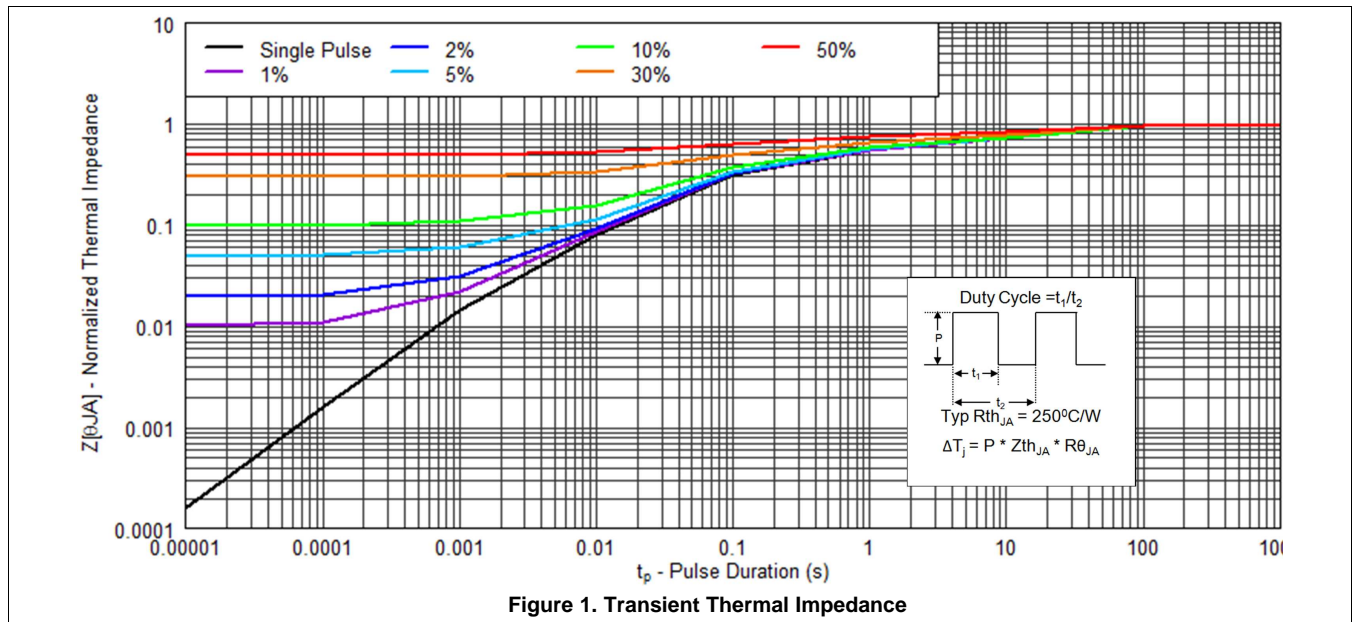


Figure 1. Transient Thermal Impedance

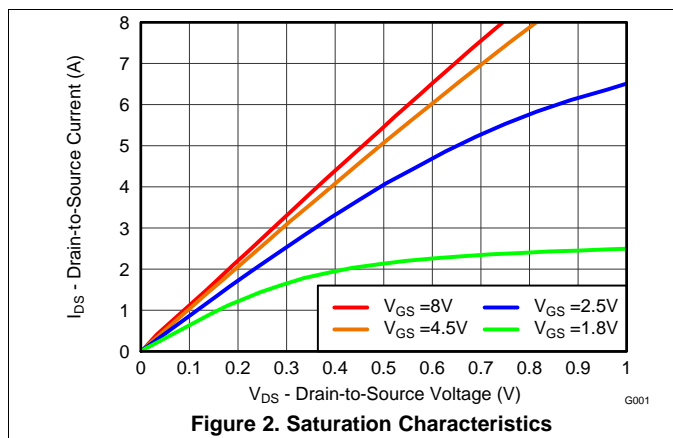


Figure 2. Saturation Characteristics

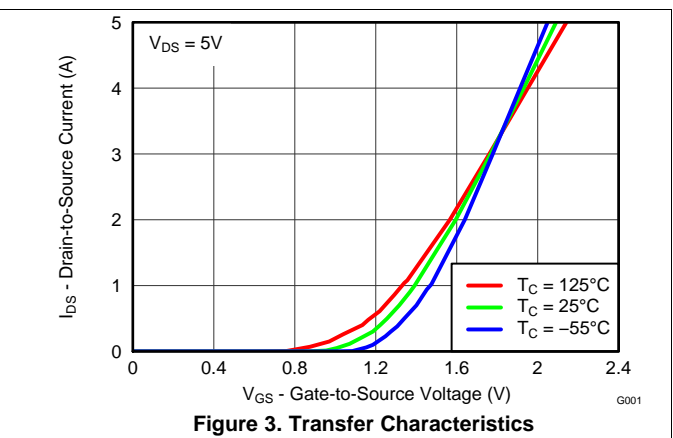
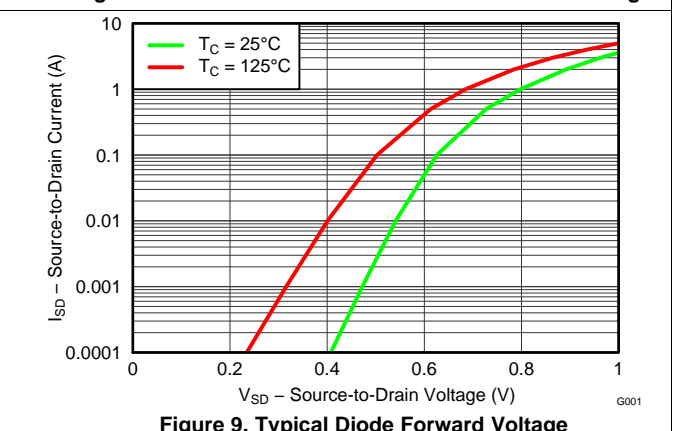
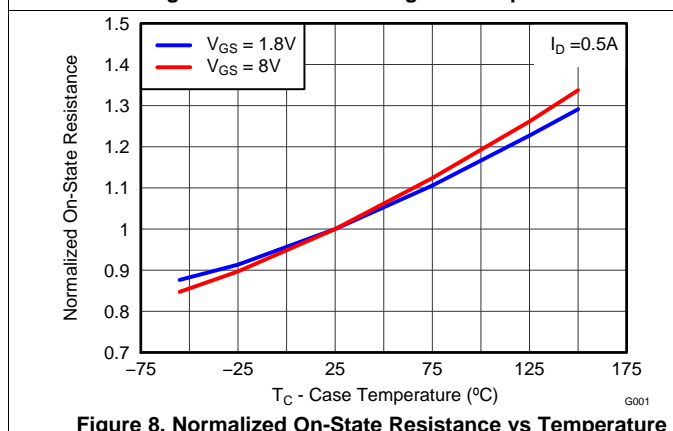
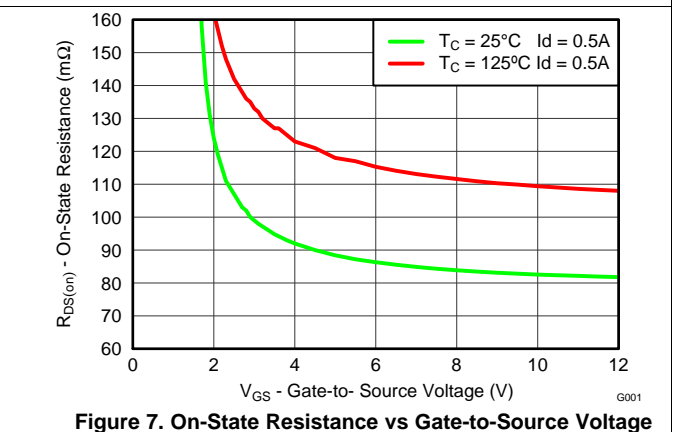
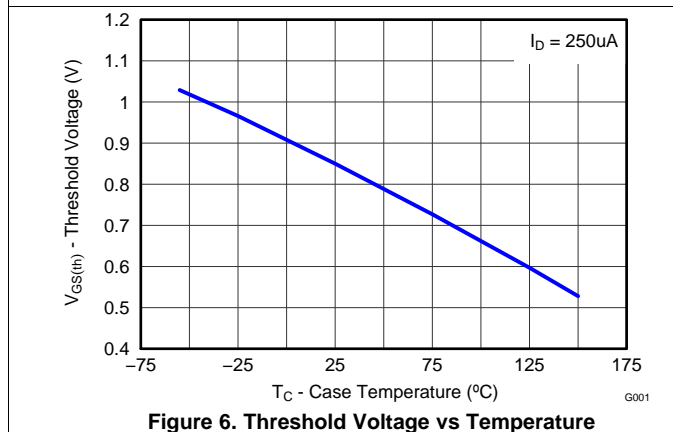
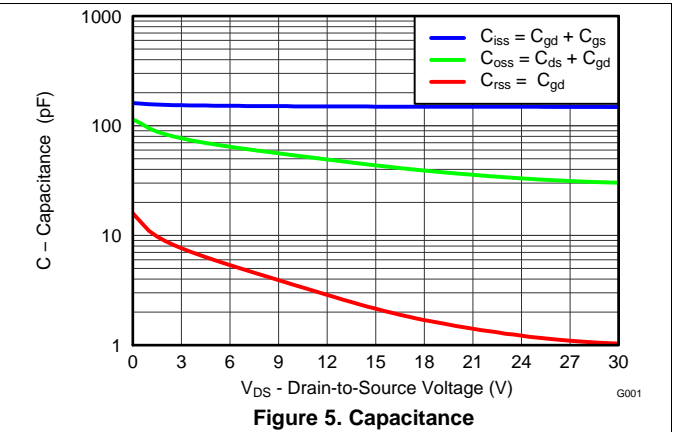
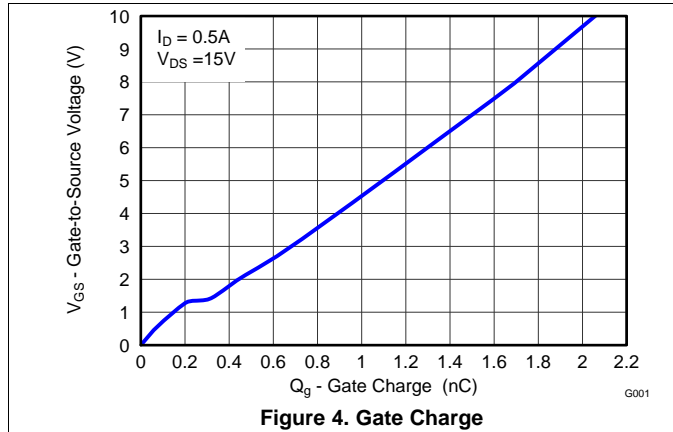


Figure 3. Transfer Characteristics

Typical MOSFET Characteristics (continued)

(T_A = 25°C unless otherwise stated)



Typical MOSFET Characteristics (continued)

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

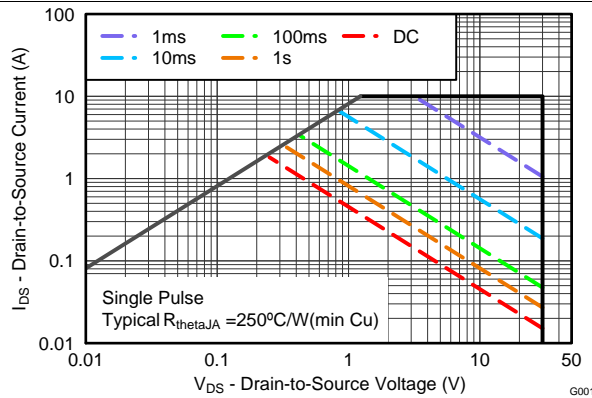


Figure 10. Maximum Safe Operating Area

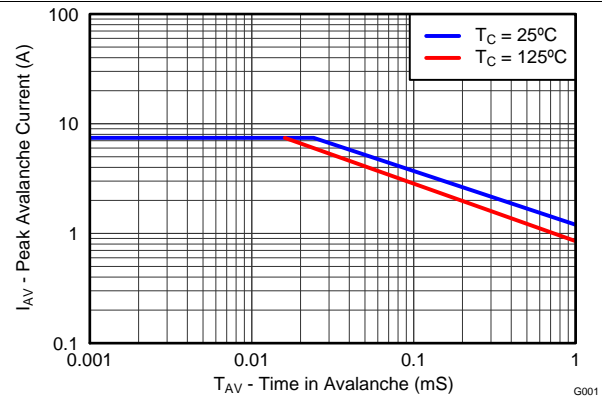


Figure 11. Single Pulse Unclamped Inductive Switching

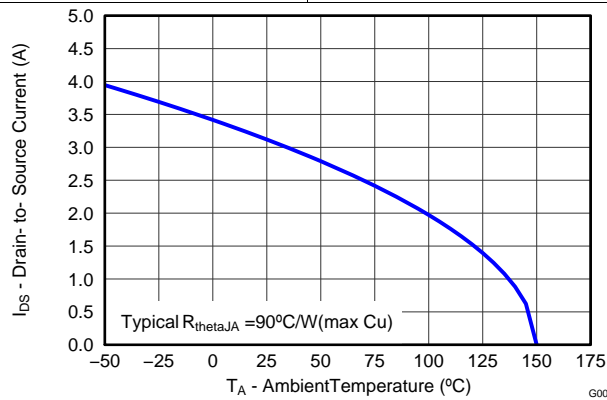


Figure 12. Maximum Drain Current vs Temperature

6 Device and Documentation Support

6.1 Trademarks

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

6.2 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.

6.3 Glossary

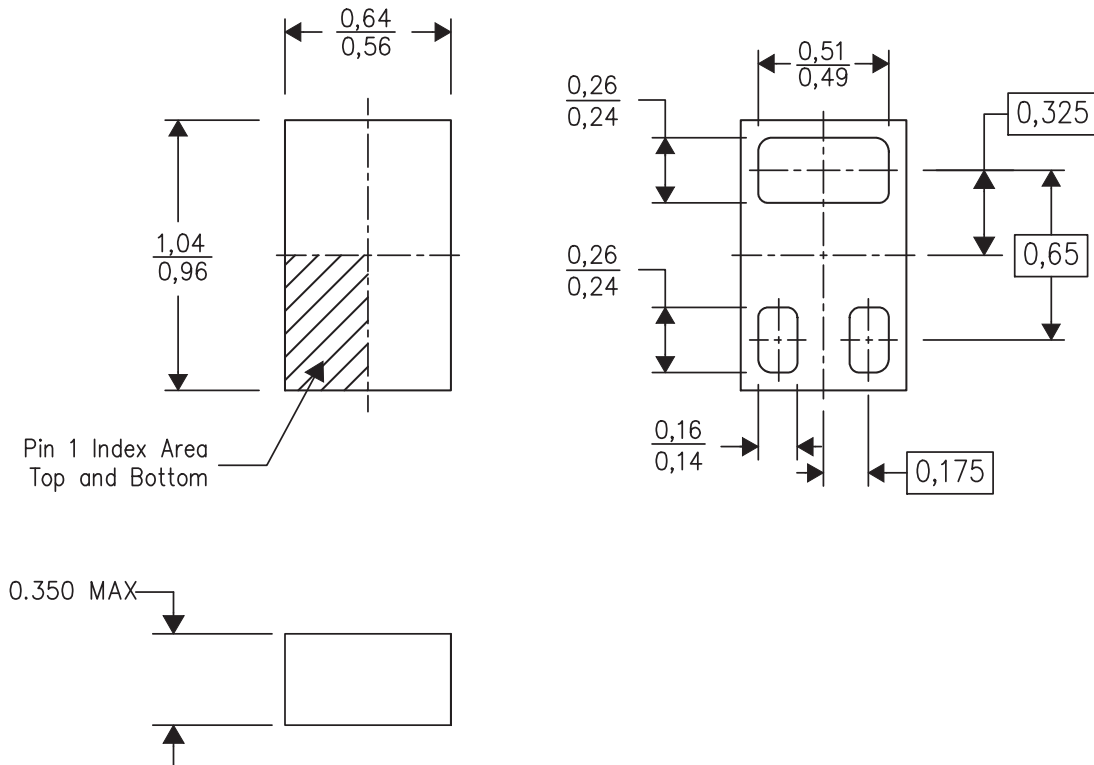
[SLYZ022](#) — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

7 Mechanical Data

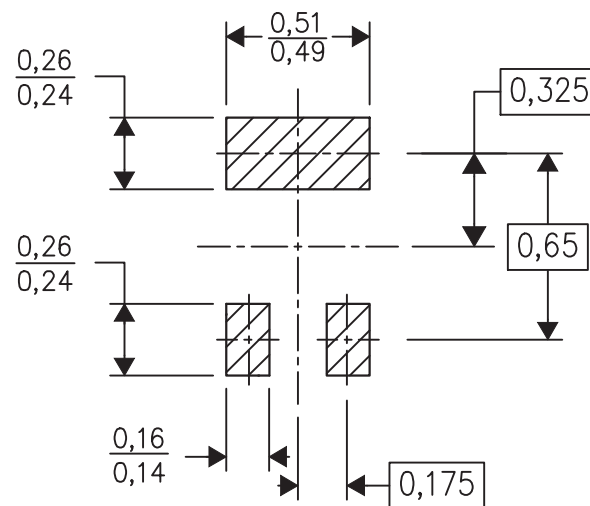
The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

7.1 Mechanical Dimensions



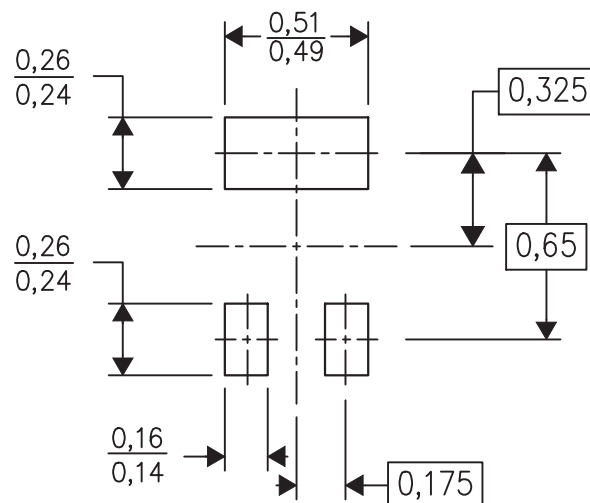
- (1) All linear dimensions are in millimeters (dimensions and tolerancing per AME T14.5M-1994).
- (2) This drawing is subject to change without notice.
- (3) This package is a PB-free solder land design.

7.2 Recommended Minimum PCB Layout



(1) All dimensions are in millimeters.

7.3 Recommended Stencil Pattern



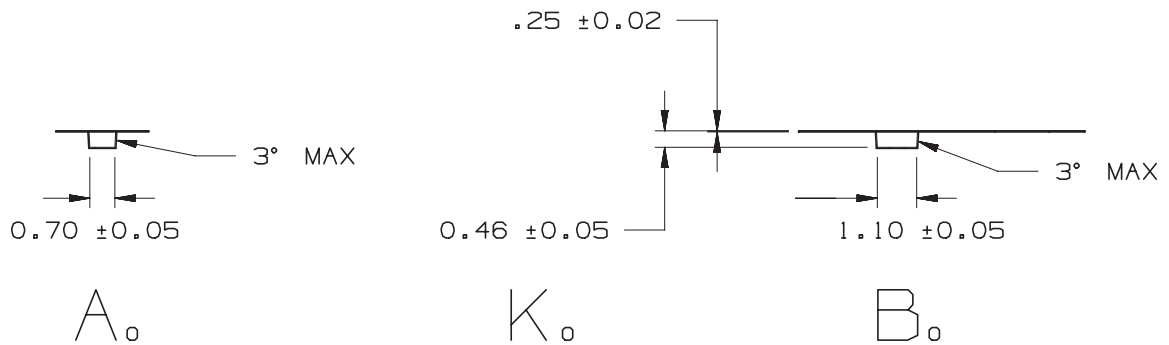
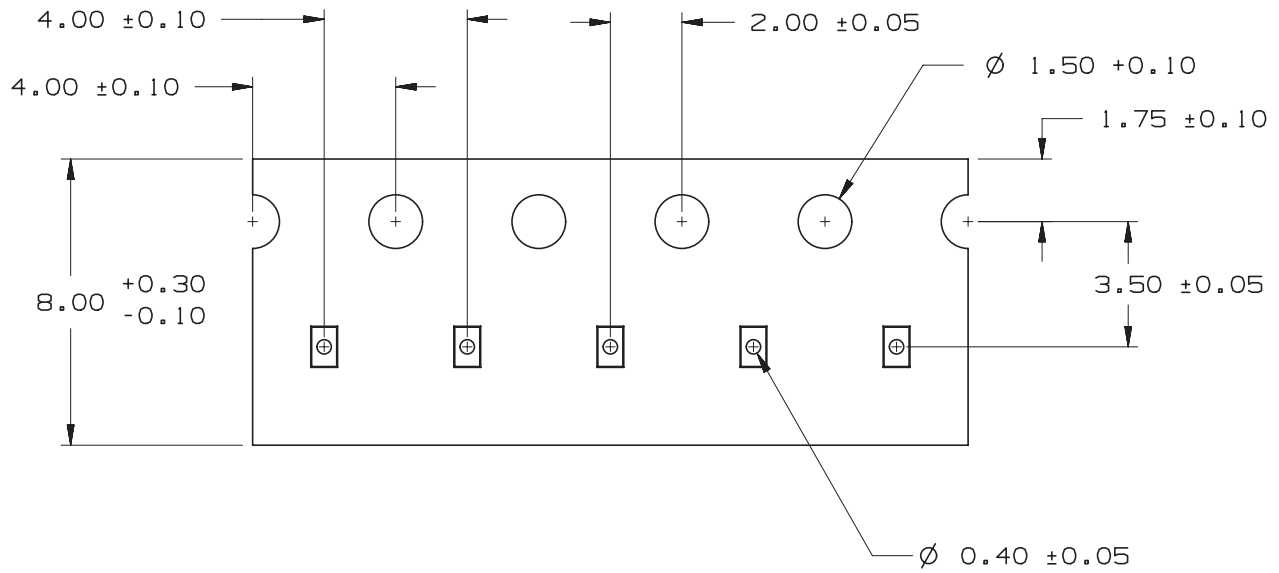
(1) All dimensions are in millimeters.

CSD17381F4

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7.4 CSD17381F4 Embossed Carrier Tape Dimensions



- (1) Pin 1 is oriented in the top-right quadrant of the tape enclosure (quadrant 2), closest to the carrier tape sprocket holes.

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
CSD17381F4	PICOST AR	YJC	3	3000	178.0	8.4	0.7	1.1	0.46	4.0	8.0	Q2
CSD17381F4	PICOST AR	YJC	3	3000	180.0	8.4	0.7	1.1	0.46	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)
CSD17381F4	PICOSTAR	YJC	3	3000	220.0	220.0	35.0
CSD17381F4	PICOSTAR	YJC	3	3000	182.0	182.0	17.0

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