12-V , N-Channel NexFET™ Power MOSFETs

Check for Samples: **CSD13381F4**

FEATURES

- **Low On Resistance**
- **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 > 4kV HBM**
  - **Rated > 2kV CDM**
- **Pb and Halogen Free**
- **RoHS Compliant**

APPLICATIONS

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

DESCRIPTION

The FemtoFET™ MOSFET technology has been 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.
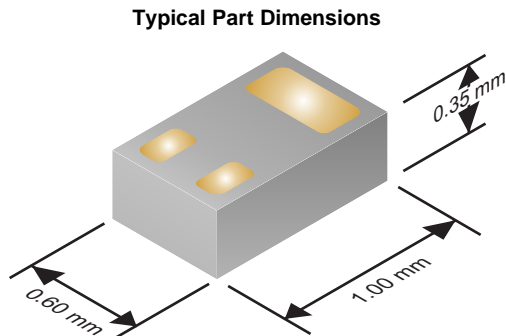
PRODUCT SUMMARY

V_{DS}	Drain to Source Voltage	12		V
Q_g	Gate Charge Total (4.5V)	1060		pC
Q_{gd}	Gate Charge Gate to Drain	140		pC
$R_{DS(on)}$	Drain to Source On Resistance	V_{GS} = 1.8V	310	mΩ
		V_{GS} = 2.5V	170	
		V_{GS} = 4.5V	140	
$V_{GS(th)}$	Threshold Voltage	0.85		V

ORDERING INFORMATION

Device	Qty	Media	Package	Ship
CSD13381F4	3,000	7-Inch Reel	Femto(0402) 1.0mm x 0.6mm SMD Lead Less	Tape and Reel
CSD13381F4R	18,000	13-Inch Reel		

ABSOLUTE MAXIMUM RATINGS

T_A = 25°C unless otherwise stated		VALUE	UNIT
V_{DS}	Drain to Source Voltage	12	V
V_{GS}	Gate to Source Voltage	8	V
I_D	Continuous Drain Current, T_A = 25°C[1]	2.1	A
I_{DM}	Pulsed Drain Current, T_A = 25°C[2]	7	A
P_D	Power Dissipation[1]	500	mW
ESD Rating	Human Body Model (HBM)	4	kV
	Charged Device Model (CDM)	2	kV
T_J, T_{STG}	Operating Junction and Storage Temperature Range	−55 to 150	°C
E_{AS}	Avalanche Energy, single pulse I_D = 7.4A, L = 0.1mH, R_G = 25Ω	2.7	mJ

(1) Typical $R_{θJA}$ = 90°C/W on 1-inch^2 (6.45-cm^2), 2-oz. (0.071-mm thick) Cu pad on a 0.06-inch (1.52-mm) thick FR4 PCB.

(2) Pulse duration ≤300µs, duty cycle ≤2%
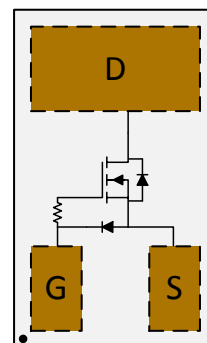
Typical Part Dimensions

Top View

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of the Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

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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.

ELECTRICAL CHARACTERISTICS

(T_A = 25°C unless otherwise stated)

	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Static Characteristics						
BV_{DSS}	Drain to Source Voltage	V_{GS} = 0V, I_{DS} = 250µA	12			V
I_{DSS}	Drain to Source Leakage Current	V_{GS} = 0V, V_{DS} = 9.6V			1	µA
I_{GSS}	Gate to Source Leakage Current	V_{DS} = 0V, V_{GS} = 4V			100	nA
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{DS} = V_{GS}, I_{DS} = 250µA	0.65	0.85	1.10	V
$R_{DS(on)}$	Drain to Source On Resistance	V_{GS} = 1.8V, I_{DS} =0.5A		310	400	mΩ
		V_{GS} = 2.5V, I_{DS} =0.5A		170	225	mΩ
		V_{GS} = 4.5V, I_{DS} = 0.5A		140	180	mΩ
g_{fs}	Transconductance	V_{DS} = 6V, I_{DS} = 0.5A		3.2		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{GS} = 0V, V_{DS} = 6V, f = 1MHz		155	200	pF
C_{oss}	Output Capacitance			47	62	pF
C_{rss}	Reverse Transfer Capacitance			2.5	3.3	pF
R_G	Series Gate Resistance			23		Ω
Q_g	Gate Charge Total (4.5V)	V_{DS} = 6V, I_{DS} = 0.5A		1060	1400	pC
Q_{gd}	Gate Charge Gate to Drain			140		pC
Q_{gs}	Gate Charge Gate to Source			230		pC
$Q_{g(th)}$	Gate Charge at Vth			155		pC
Q_{oss}	Output Charge	V_{DS} = 6V, V_{GS} = 0V		1120		pC
$t_{d(on)}$	Turn On Delay Time	V_{DS} = 0V, V_{GS} = 4.5V, I_{DS} = 0.5A, R_G = 2Ω		3.7		ns
t_r	Rise Time			1.5		ns
$t_{d(off)}$	Turn Off Delay Time			11.0		ns
t_f	Fall Time			3.8		ns
Diode Characteristics						
V_{SD}	Diode Forward Voltage	I_{SD} = 0.5A, V_{GS} = 0V		0.73	0.9	V
Q_{rr}	Reverse Recovery Charge	V_{DS}= 6V, I_F = 0.5A, di/dt = 300A/µs		1550		pC
t_{rr}	Reverse Recovery Time			6		ns

THERMAL CHARACTERISTICS

(T_A = 25°C unless otherwise stated)

	PARAMETER	Typical Values	UNIT
$R_{\theta JA}$	Thermal Resistance Junction to Ambient[1]	90	°C/W
	Thermal Resistance Junction to Ambient[2]	250	°C/W

(1)   Device mounted on FR4 material with 1-inch^2 (6.45-cm^2), 2-oz. (0.071-mm thick) Cu.
(2)   Device mounted on FR4 material with minimum Cu mounting area.

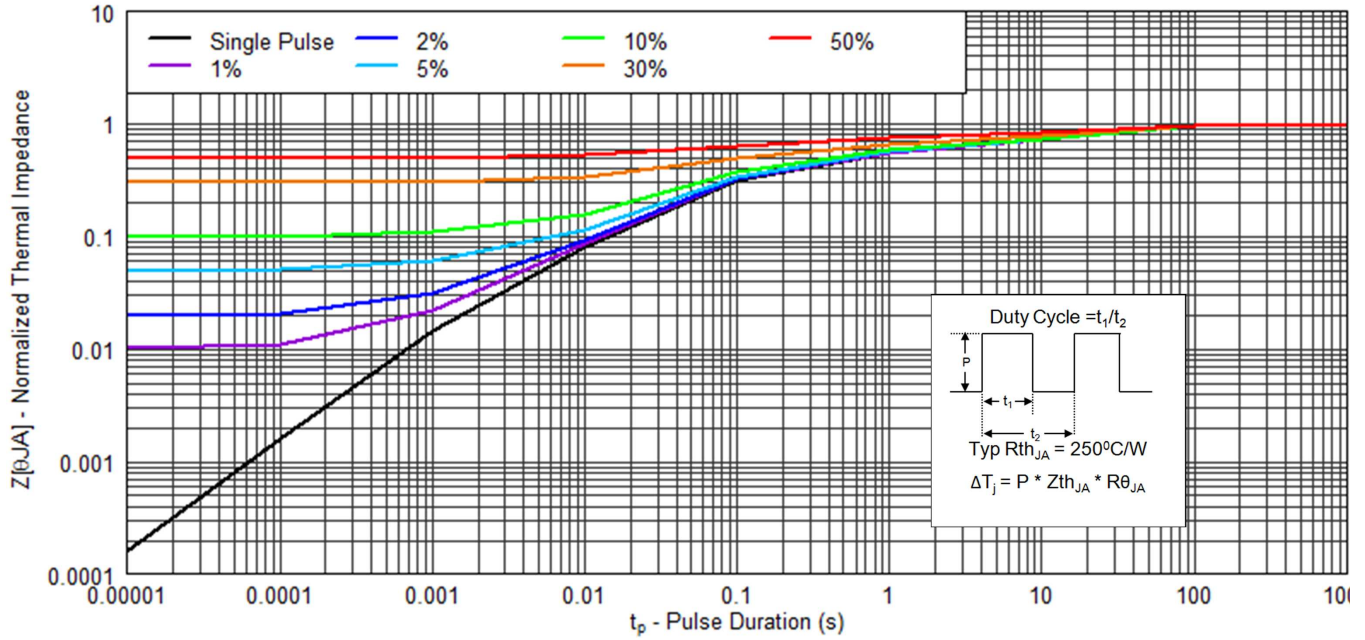## TYPICAL MOSFET CHARACTERISTICS

(T_A = 25°C unless otherwise stated)
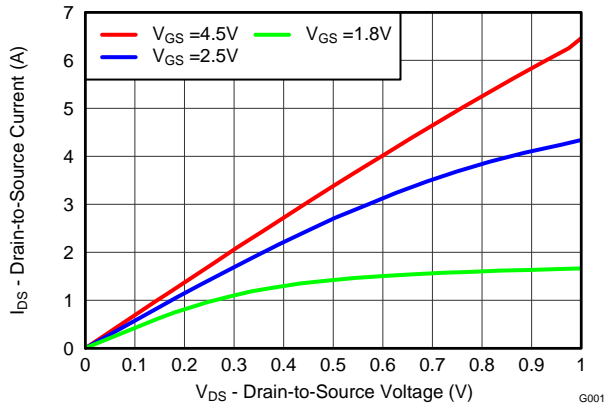

Figure 1. Transient Thermal Impedance

Figure 2. Saturation Characteristics
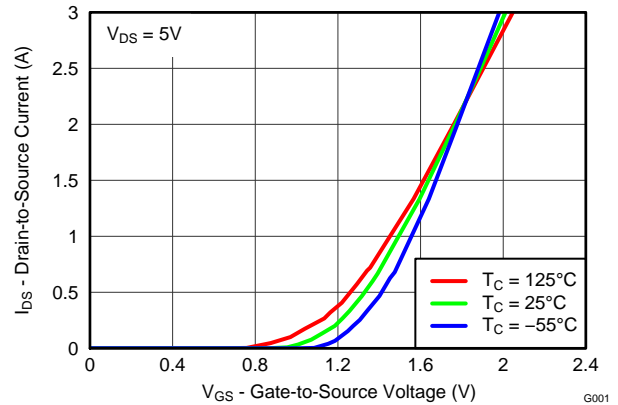

Figure 3. Transfer Characteristics

TYPICAL MOSFET CHARACTERISTICS (continued)
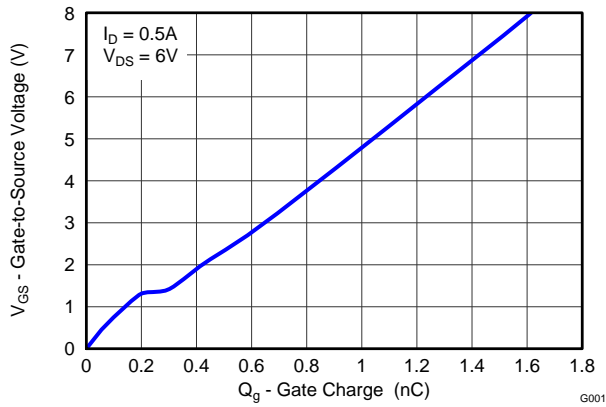
(T_A = 25°C unless otherwise stated)
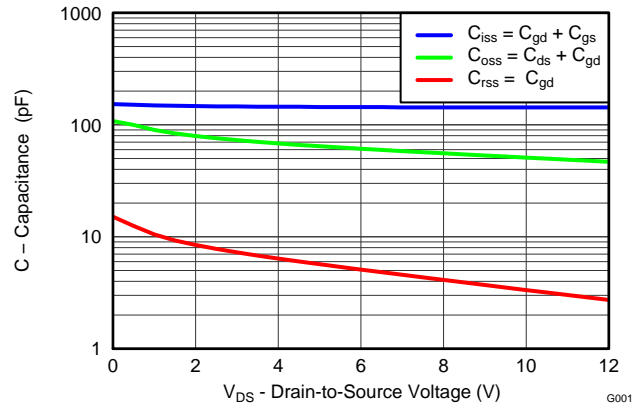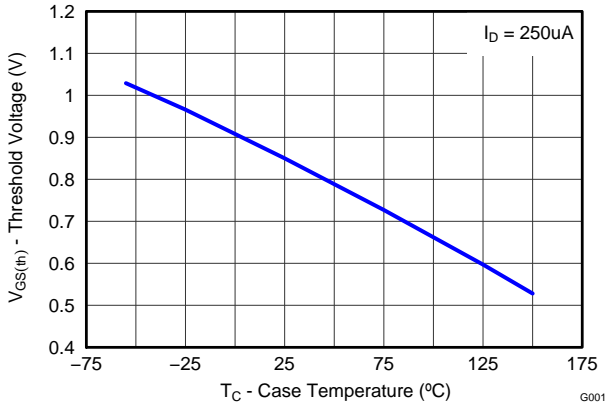

Figure 4. Gate Charge

Figure 5. Capacitance

Figure 6. Threshold Voltage vs. Temperature
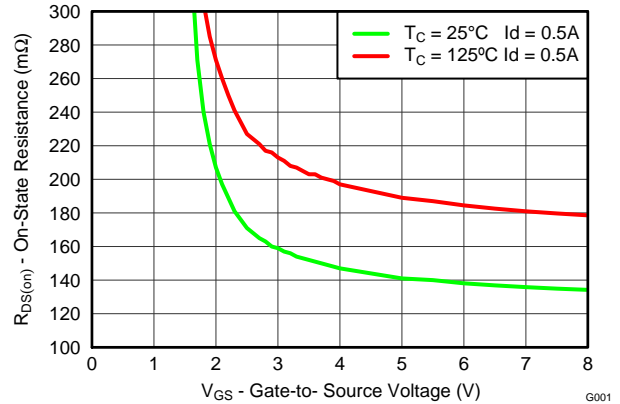
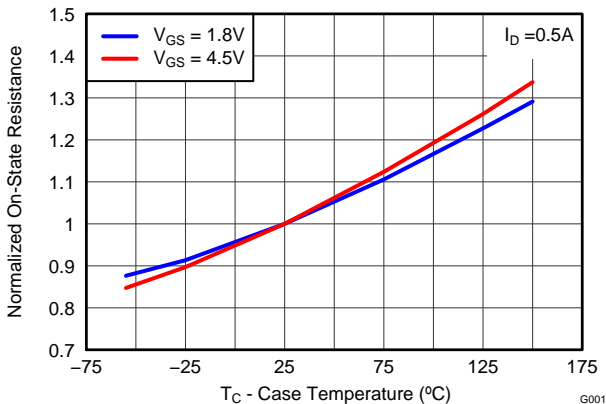
Figure 7. On-State Resistance vs. Gate-to-Source Voltage

Figure 8. Normalized On-State Resistance vs. Temperature
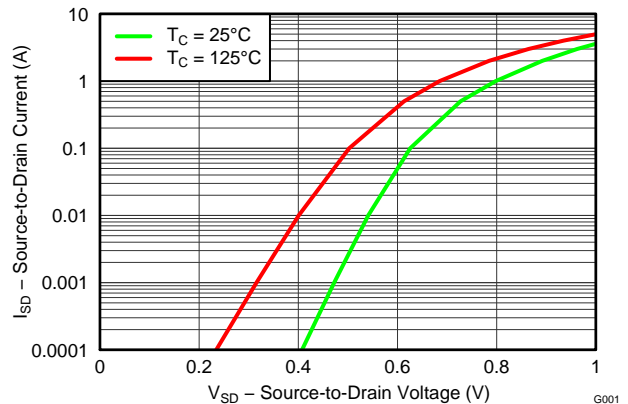
Figure 9. Typical Diode Forward Voltage

TYPICAL MOSFET CHARACTERISTICS (continued)

(T_A = 25°C unless otherwise stated)
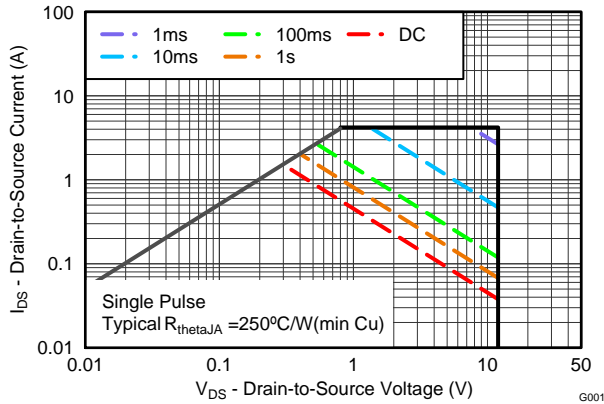
Figure 10. Maximum Safe Operating Area
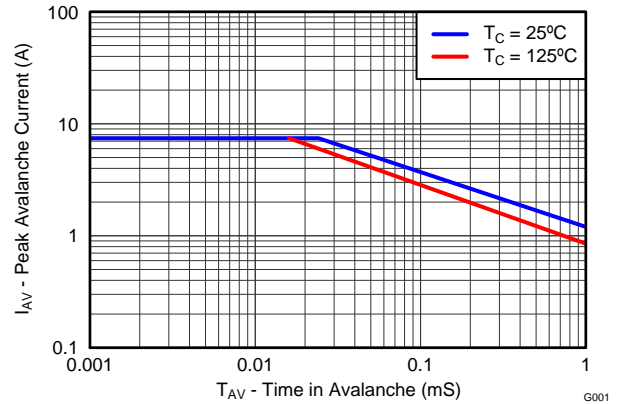
Figure 11. Single Pulse Unclamped Inductive Switching
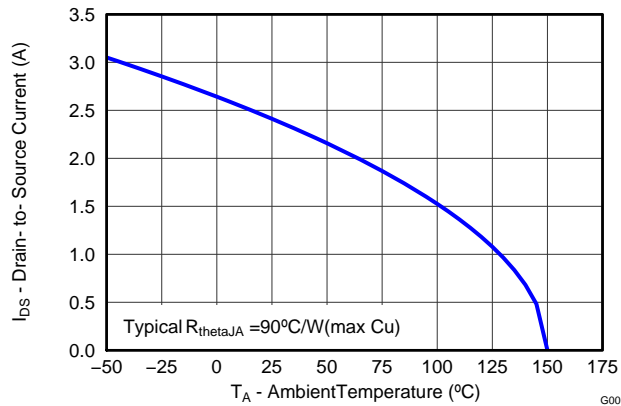
Figure 12. Maximum Drain Current vs. Temperature

Product Folder Links: *CSD13381F4*

MECHANICAL DATA

0402 Mechanical Dimensions

Pin 1 Index Area
Top and Bottom
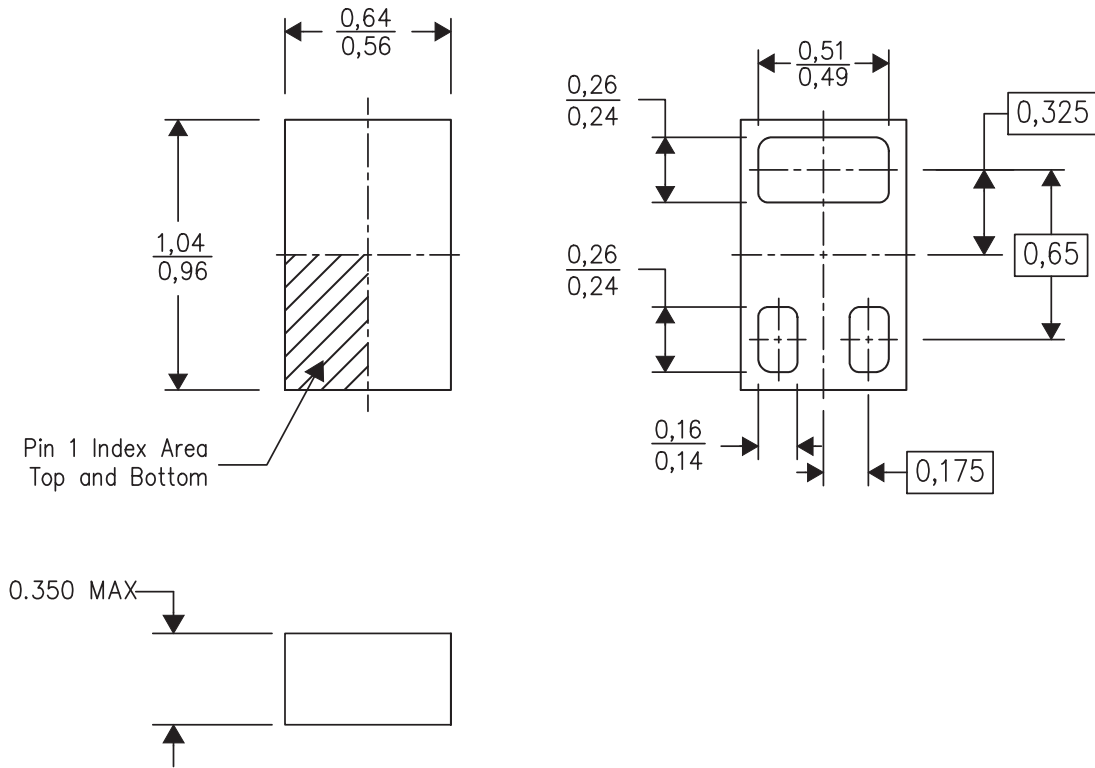
(1) All linear dimensions are in millimeters (dimensions and tolerancing per AME T14.5M-1994)

(2) This drawing is subject to change without notice

(3) This package is a PB-Free solder land design

Recommended Minimum PCB Layout

(1) All dimensions are in millimeters.

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Product Folder Links: *CSD13381F4*
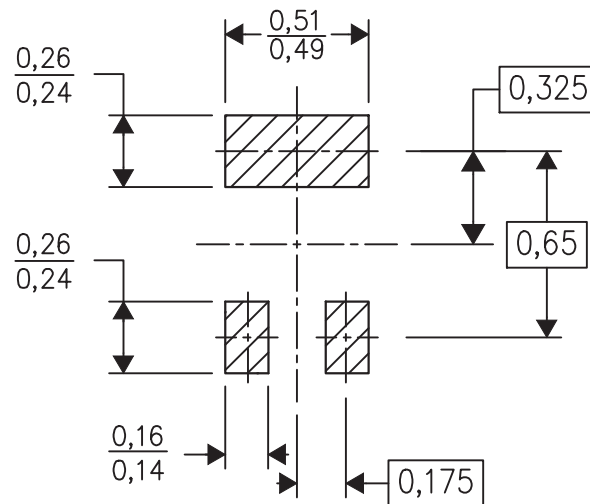
Recommended Stencil Pattern
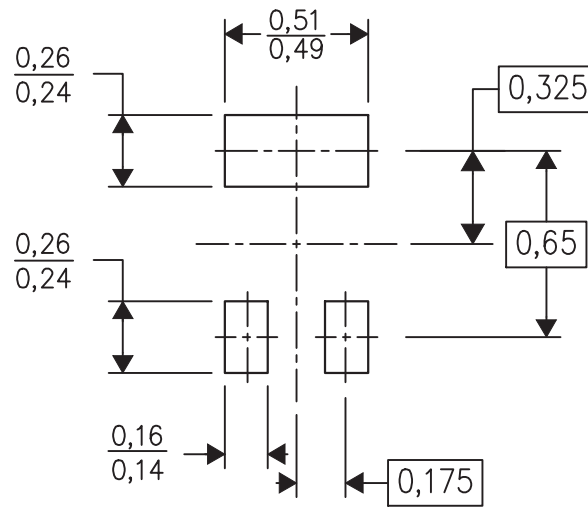
(1)   All dimensions are in millimeters.

CSD13381F4 Embossed Carrier Tape Dimensions

4.00 ±0.10
4.00 ±0.10
2.00 ±0.05
∅ 1.50 +0.10
1.75 ±0.10
8.00 +0.30 -0.10
3.50 ±0.05
∅ 0.40 ±0.05

.25 ±0.02

3° MAX
0.70 ±0.05
A_o

0.46 ±0.05
K_o

3° MAX
1.10 ±0.05
B_o
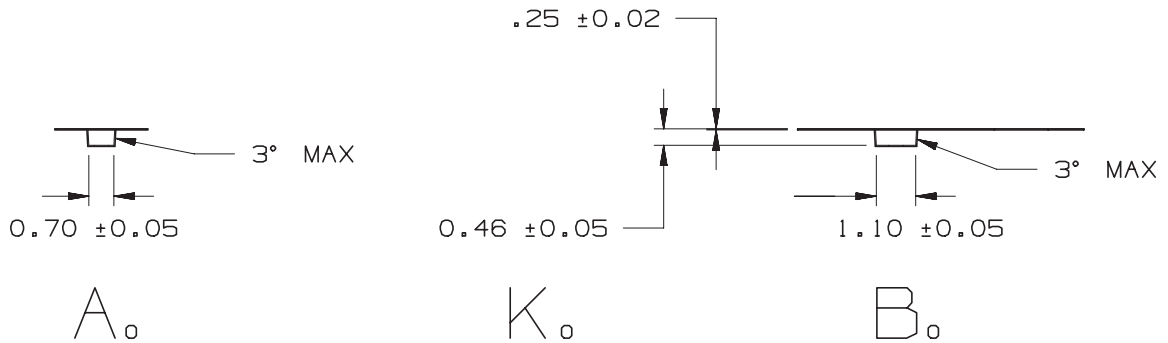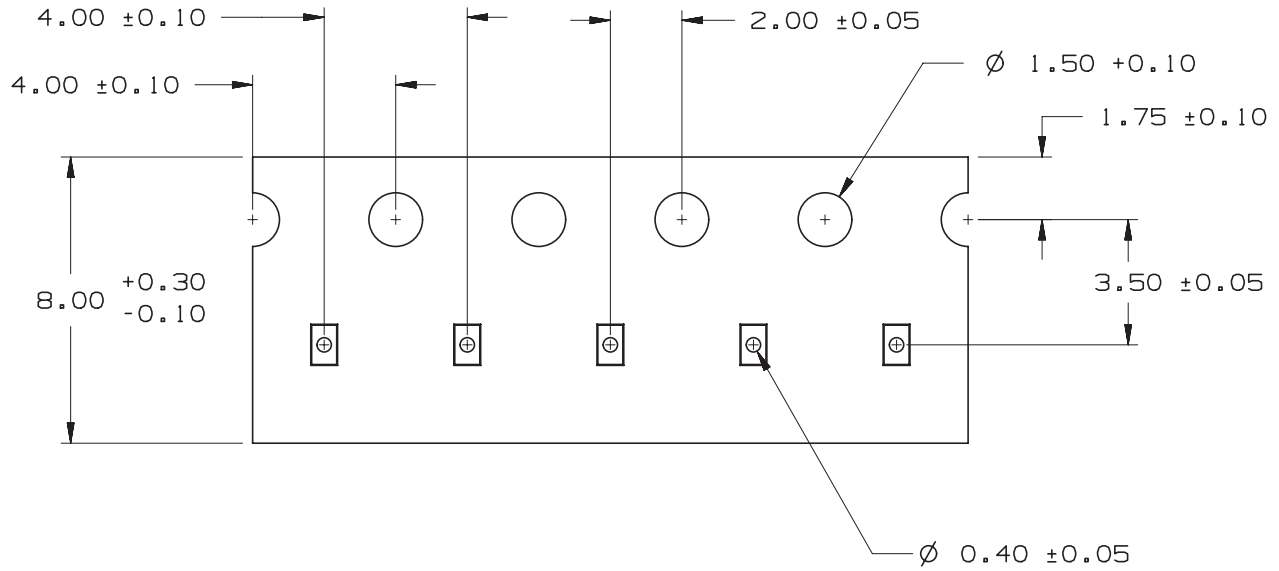
(1)   Pin 1 will be oriented in the top right quadrant of the tape enclosure (Quadrant 2), closest to the carrier tape sprocket holes.

IMPORTANT NOTICE

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