

12-V , N-Channel NexFET™ Power MOSFETs

Check for Samples: [CSD13381F4](#)

FEATURES

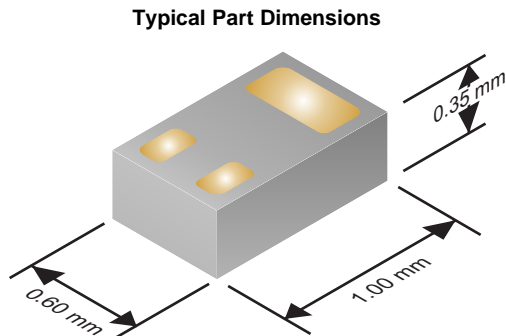
- **Low On Resistance**
- **Low Q_g and Q_{gd}**
- **Low Threshold Voltage**
- **Ultra Small Footprint (0402 Case Size)**
 - 1.0 mm x 0.6 mm
- **Ultra Low Profile**
 - 0.35 mm Height
- **Integrated ESD Protection Diode**
 - Rated > 4kV HBM
 - Rated > 2kV CDM
- **Pb and Halogen Free**
- **RoHS Compliant**

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
		$V_{GS} = 2.5V$	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		

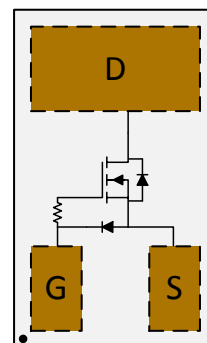
ABSOLUTE MAXIMUM RATINGS

$T_A = 25^\circ\text{C}$ 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, $T_A = 25^\circ\text{C}^{(1)}$	2.1	A
I_{DM}	Pulsed Drain Current, $T_A = 25^\circ\text{C}^{(2)}$	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	$^\circ\text{C}$
E_{AS}	Avalanche Energy, single pulse $I_D = 7.4A$, $L = 0.1mH$, $R_G = 25\Omega$	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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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

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Static Characteristics						
BV_{DSS}	Drain to Source Voltage	$V_{GS} = 0V, I_{DS} = 250\mu A$	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	$V_{DS} = V_{GS}, I_{DS} = 250\mu A$	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	m Ω
		$V_{GS} = 2.5V, I_{DS} = 0.5A$		170	225	m Ω
		$V_{GS} = 4.5V, I_{DS} = 0.5A$		140	180	m Ω
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 V_{th}			155		pC
Q_{oss}	Output Charge	$V_{DS} = 6V, V_{GS} = 0V$		1120		pC
$t_{d(on)}$	Turn On Delay Time	$V_{DS} = 0V, V_{GS} = 4.5V,$ $I_{DS} = 0.5A, R_G = 2\Omega$		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	$V_{DS} = 6V, I_F = 0.5A, di/dt = 300A/\mu s$		1550		pC
t_{rr}	Reverse Recovery Time			6		ns

THERMAL CHARACTERISTICS

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

PARAMETER		Typical Values	UNIT
$R_{\theta JA}$	Thermal Resistance Junction to Ambient ⁽¹⁾	90	$^\circ\text{C/W}$
	Thermal Resistance Junction to Ambient ⁽²⁾	250	$^\circ\text{C/W}$

(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.

TYPICAL MOSFET CHARACTERISTICS

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

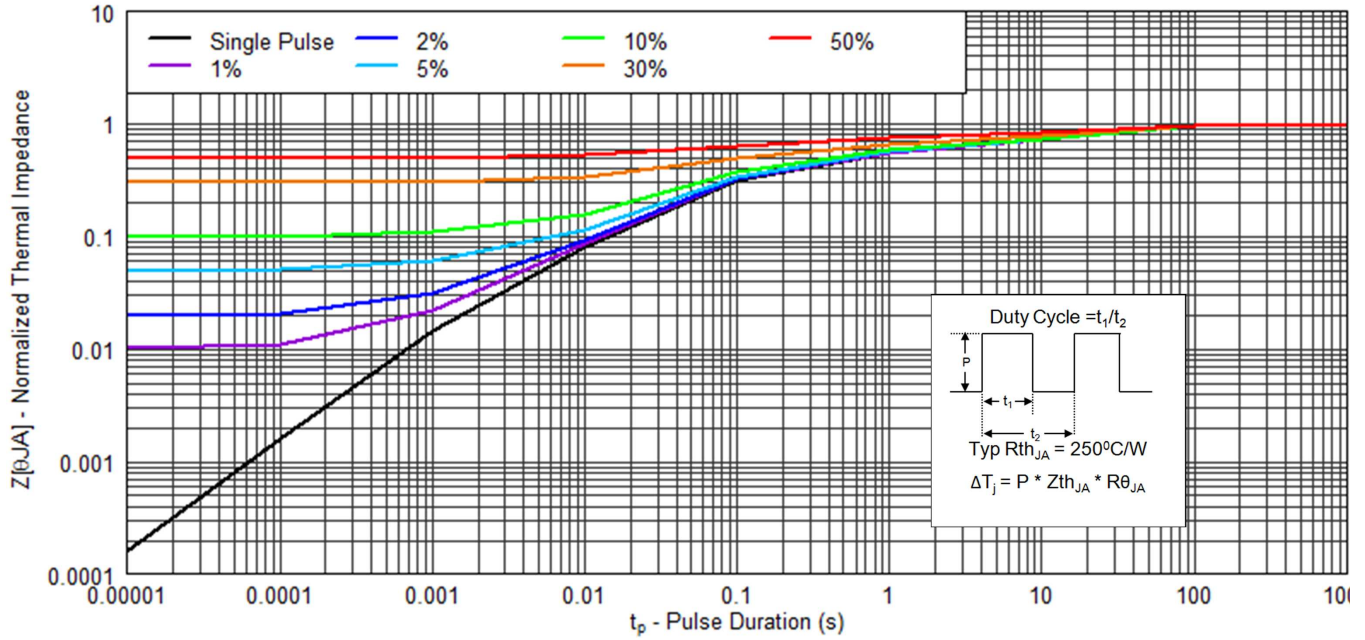


Figure 1. Transient Thermal Impedance

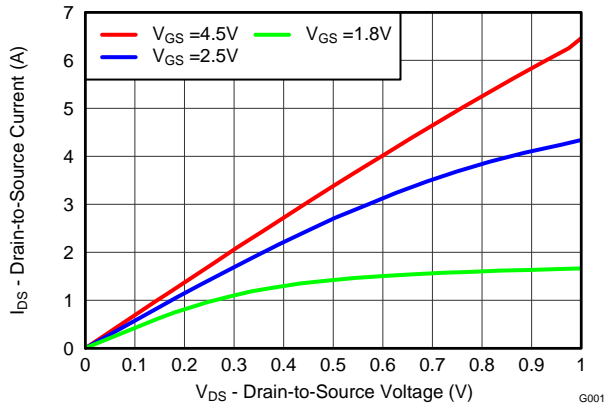


Figure 2. Saturation Characteristics

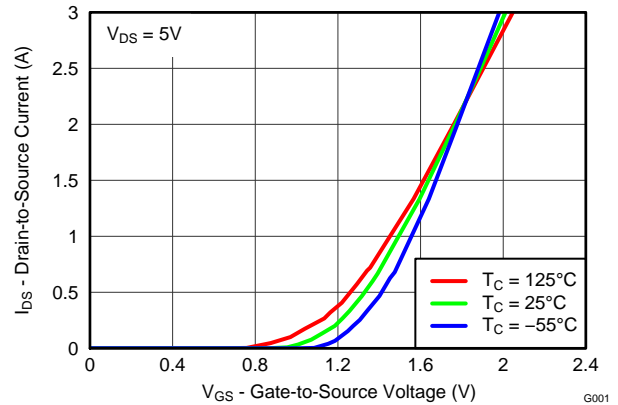


Figure 3. Transfer Characteristics

TYPICAL MOSFET CHARACTERISTICS (continued)

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

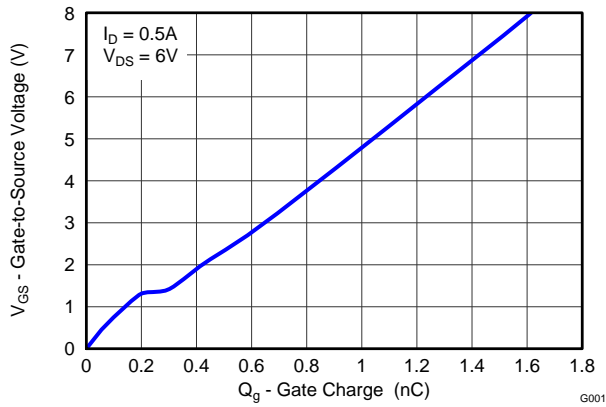


Figure 4. Gate Charge

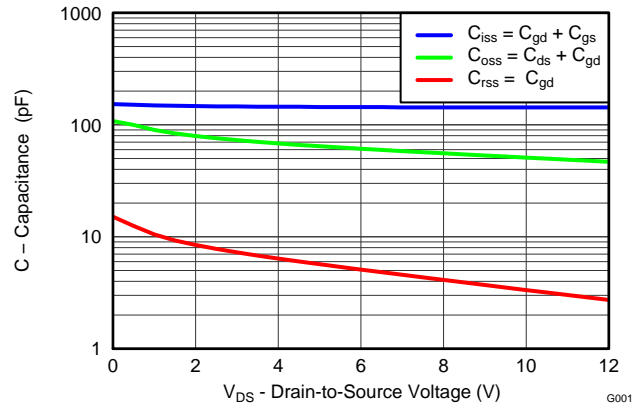


Figure 5. Capacitance

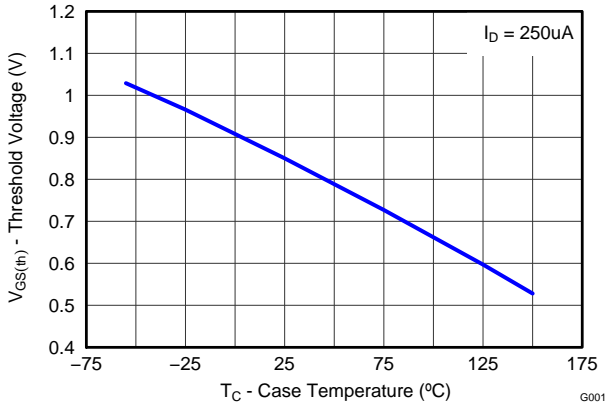


Figure 6. Threshold Voltage vs. Temperature

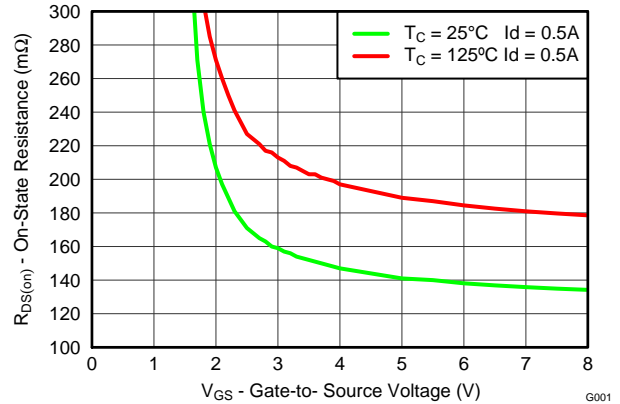


Figure 7. On-State Resistance vs. Gate-to-Source Voltage

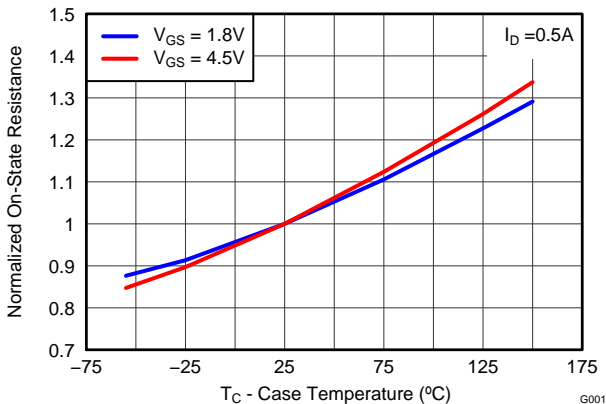


Figure 8. Normalized On-State Resistance vs. Temperature

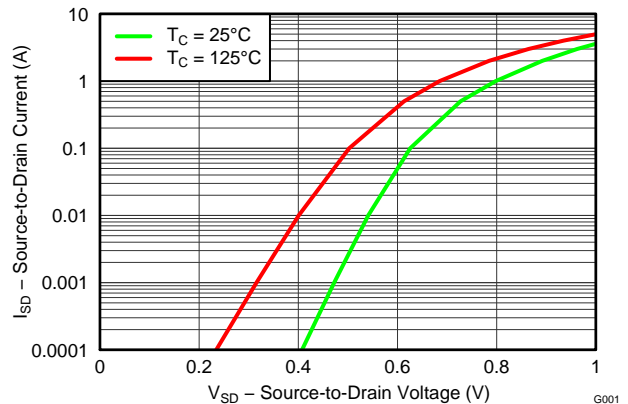


Figure 9. Typical Diode Forward Voltage

TYPICAL MOSFET CHARACTERISTICS (continued)

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

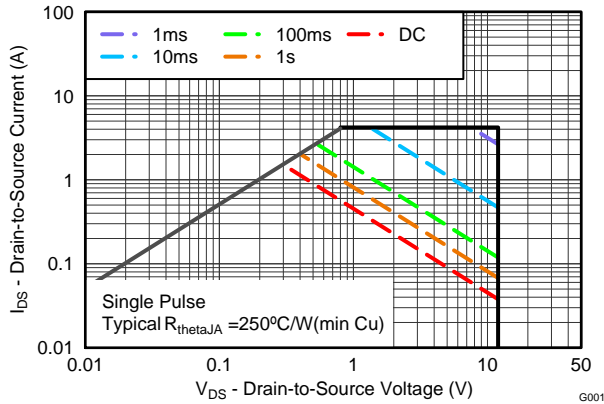


Figure 10. Maximum Safe Operating Area

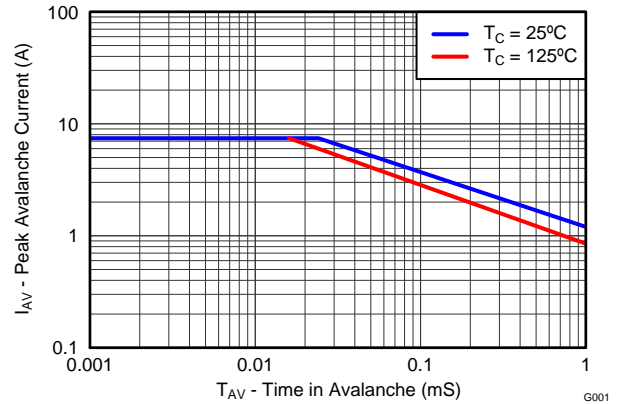


Figure 11. Single Pulse Unclamped Inductive Switching

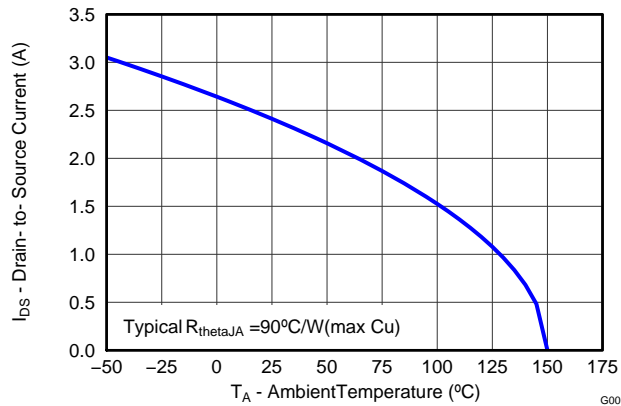
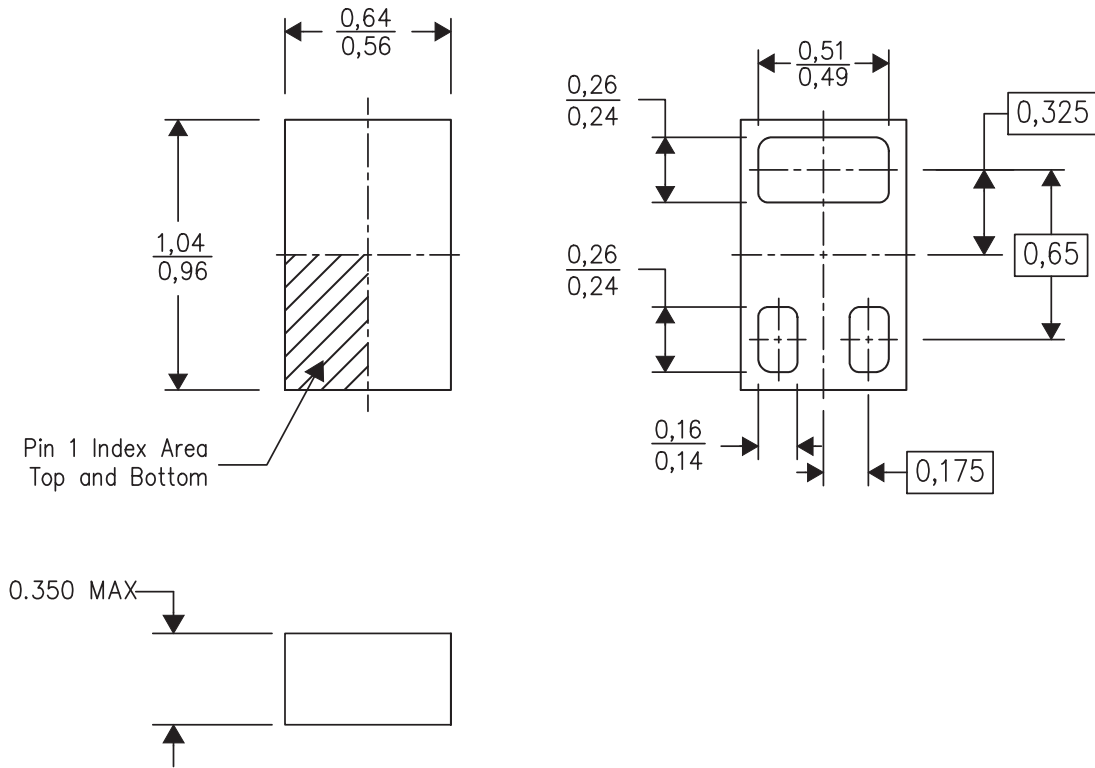


Figure 12. Maximum Drain Current vs. Temperature

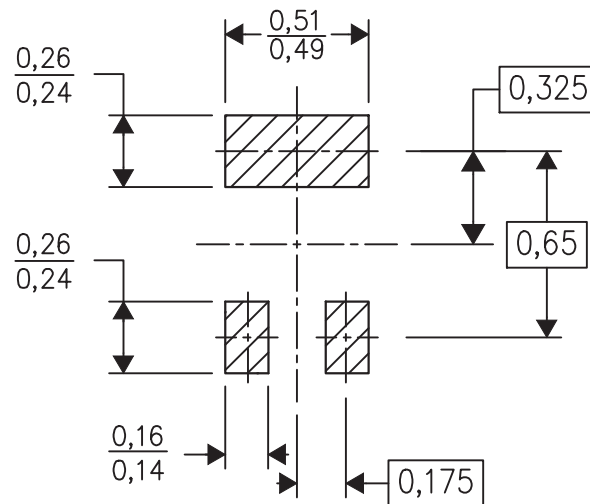
MECHANICAL DATA

0402 Mechanical Dimensions



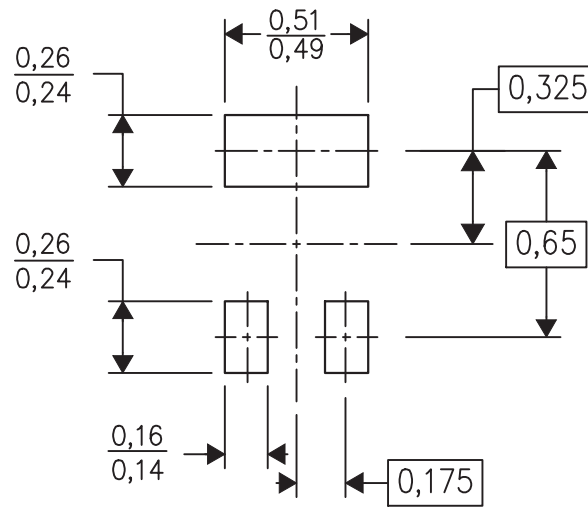
- (1) All linear dimensions are in millimeters (dimensions and tolerancing per AME T14.5M-1994)
- (2) This drawing is subject to change without notice
- (3) This package is a PB-Free solder land design

Recommended Minimum PCB Layout



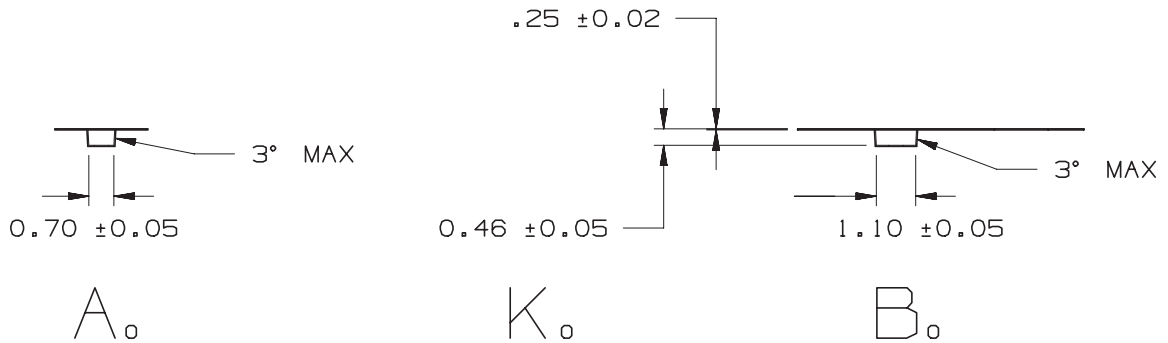
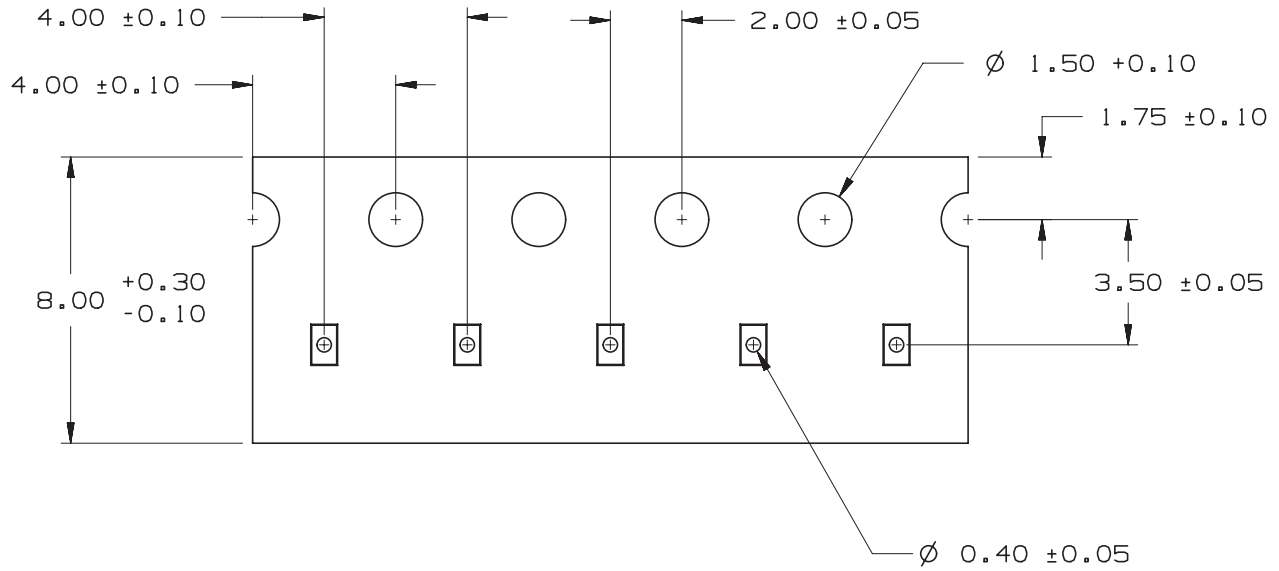
- (1) All dimensions are in millimeters.

Recommended Stencil Pattern



(1) All dimensions are in millimeters.

CSD13381F4 Embossed Carrier Tape Dimensions



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

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