

TIDA-060039 - designing the push-button sensors

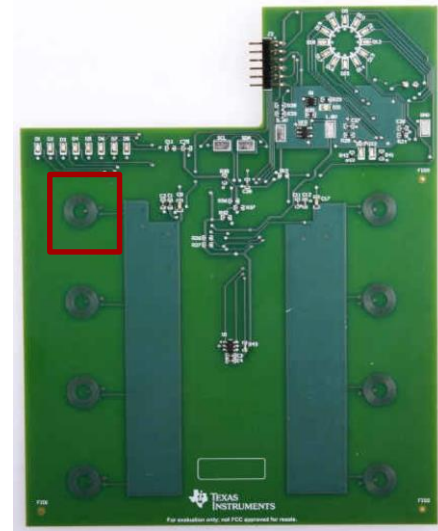
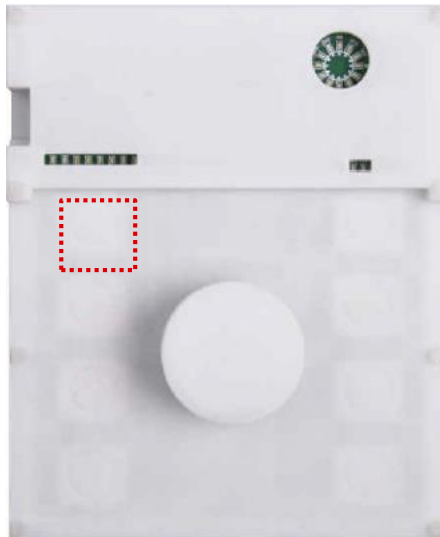
TI Precision Labs – TIDA-060039

Presented by John Miller

Prepared by John Miller

TIDA-060039 design overview

- TIDA-060039 supports:
 - A dial actuator implemented with TMAG5273, a 3-axis linear Hall sensor.
 - Eight push-buttons implemented with PC board coils and two LDC3114's, a four-channel inductive sensor interface.



Inductive Sensing Design Calculator Tool available for download at <https://www.ti.com/lit/zip/slyc137>.

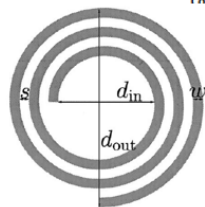
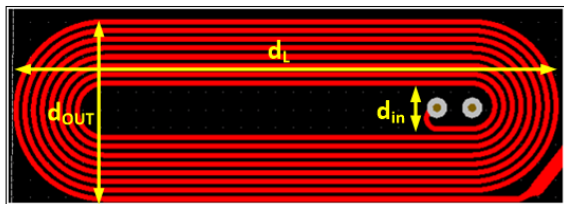
Step 1 – Open the tool (LDC_Tools-ext51.xlsx) & enter coil parameters

TI LDC InductanceCalculator

Estimator tool for racetrack spiral coils. This tool is provided without warranty or support. User assumes all liability.

[Take a look at this blog post for additional information](#)

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Enter only in Yellow Fields (pull-down for mm or mil)
Results in Orange Fields

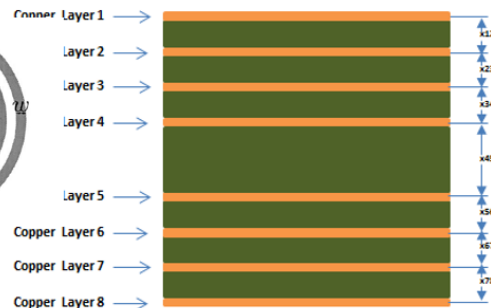


←Double-Click For Instructions

LC Sensor calculations			
LDC Device		LDC3114	
Operating temperature	T	25 °C	Enter operating temperature
Sensor capacitance	C	390.0 pF	Select LC tank capacitance
Layers	M	2 Layers	Number of layers on PCB board (1≤M≤8)
Turns (per layer)	N	10 Turns	Number of turns per layer
Outer diameter of the inductor	d _{OUT}	9.00 mm	Outer Diameter of the spiral inductor
Sensor Shape		Circular	
Long side of inductor	d _L	20.00 mm	
spacing between traces	S	4.000 mil	Space between traces (mm or mil)
width of trace	w	4.000 mil	Width of the trace (mm or mil)
PCB thickness between 1st layer and 2nd layer	h12	8.000 mil	Space between layer 1 and 2 (mm or mil)
PCB thickness between 2nd layer and 2nd layer	h22	20.000 mil	Space between layer 2 and 2 (mm or mil)

Ver 0

Layer Stackup



Step 2 – Enter the target distance & capacitance

LC Sensor calculations				
LDC Device		LDC3114		
Operating temperature	T	25	°C	Enter operating temperature
Sensor capacitance	C	390.0	pF	Select LC tank capacitance
Self resonant frequency (estimated)	SRF	62.831	MHz	SRF should be $>1.25 \cdot f_{\text{sensor}}$
Target Distance	D	5.000	mm	For aluminum target of at least 5 skin depths
Sensor Inductance from Target Interaction	L'	1.594	μH	
Sensor Frequency with Target Interaction	f_{RES}'	6.351	MHz	
Rp with Target Interaction	R_p'	1.93	k Ω	
Q Factor with target	Q'	30.2		Sensor Q too high

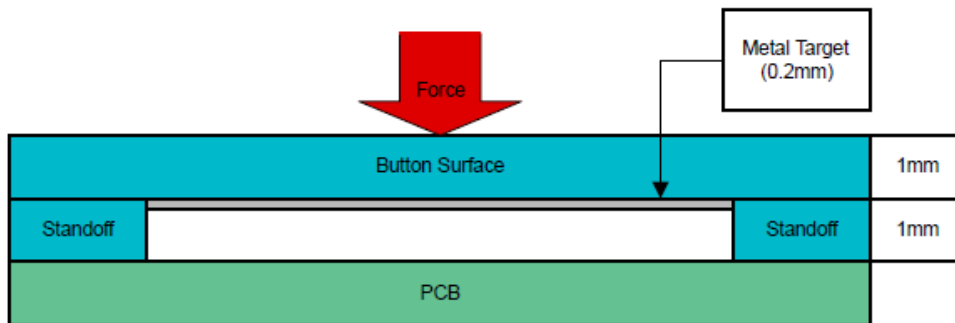


Figure 2-3. Inductive Touch Button Stackup

To find more inductive sensing resources, visit our [E2E Inductive Sensing FAQ page](#) or our [Inductive Sensing blogs](#).

To find online training material, watch our [Inductive Sensing technology overview](#) or our [LDC calculator tool overview](#).