WEBENCH® HELP TEXT

This document explains some of the use-cases and assumptions that are built into the WEBENECH® Inductive sensing designer tool.

Application use-case: Axial sensing

The tool generates coil solutions for axial sensing applications using the LDC, where a metal target moves either towards or away from the coil.

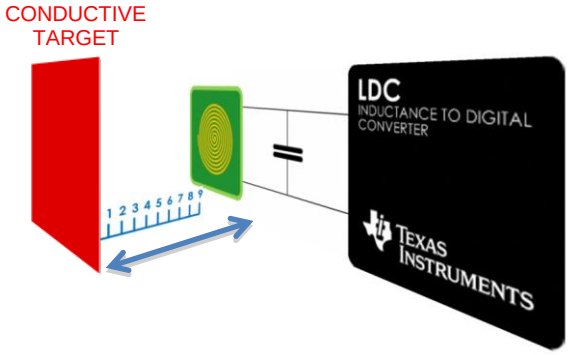

Figure 1: Conceptual axial sensing application with the LDC

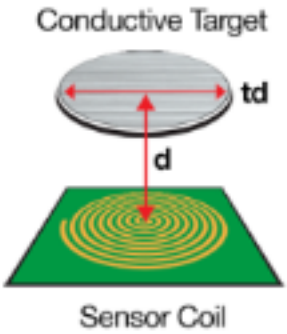

Figure 2: Webench image equivalent

The target in the vicinity of the LC tank disturbs its electro-magnetic field. This disturbance changes the eddy current losses in the target and also changes the overall inductance of the system. The change in eddy current losses can be observed as changes in the equivalent parallel resonant impedance of the LC tank (Rp) while the system inductance change can be observed as a shift in the resonant frequency of the tank.

Distance resolution calculation in WEBENCH®

The distance measurement resolution can be calculated using the LDC's Rp output or the L output. TI offers a family of LDC products providing several resolution and output options, and based on your application/system requirements, the WEBENCH® tool will help to determine which IC and output would be appropriate.

Device	L resolution (bits)	Rp resolution (bits)	# of channels	Nominal supply voltage (V)
LDC1000	24	16	1	5
LDC1041	24	8	1	5
LDC1051	-	8	1	5
LDC1312	12	-	2	3.3
LDC1314	12	-	4	3.3
LDC1612	28	-	2	3.3
LDC1614	28	-	4	3.3

Rules of thumb for choosing Rp vs. L-based measurements:

- Maximum sensing range
  - Rp has a larger distance range of measurement (distance between sensor and target)
- L typically has a shorter distance range of measurement
- Temperature dependence
  - Rp is dependent on temperature – if using Rp, temperature compensation will be required
  - L measurement is much more stable over temperature

For most applications other than metal type identification, the L measurement is the preferred approach.

Rules of thumb for overall system design:

- For accurate absolute distance sensing, the target should be within a distance of 50% of the coil diameter from the coil
- For simple metal presence detection, the target has to be within a distance of 1 coil diameter from the coil
- Target size should be comparable to coil size (or bigger)

Assumptions made in the tool:

- Modeling:
  - The coil and target shapes are both circular
  - Target thickness is larger than the skin depth for that material at the selected frequency
  - There are no other conductors or other ferrous materials in the vicinity of the coil
  - There are no EMI sources in the model
  - Operating temperature is set at 20°C

- Coil design:
  - 0.1mm (4mil) trace width and spacing
  - FR4 PCB 1.64mm (64.5mil) thick
  - 1oz copper (35.2µm, 1.4mil)
  - 2-layer PCB stack up: coil trace on top and bottom layers
  - 4-layer PCB stack up: coil trace on top, 2nd, 3rd and bottom layers, 0.127mm (5mil) spacing between top-and-2nd layers, and 3rd-and-bottom layers

- IC settings:
  - Highest resolution mode is chosen
  - Rp accuracy is assumed to be constant and equal to 0.1% over the full dynamic range. In reality, it will depend on the required measurement range

For additional information on optimal settings for the device, please refer to the corresponding datasheet (ti.com/ldc)