

WEBENCH® Capacitive Sensing Designer

Design inductive sensing circuits

Agenda

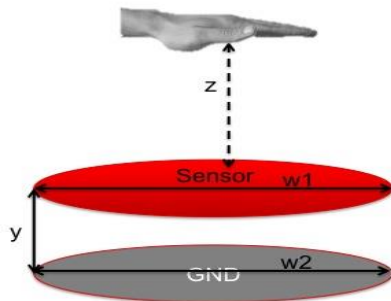
- Overview and selected Applications of FDC products
- Overview of WEBENCH Capacitive Sensing Designer (FDC) Tool
- Step by Step Walk-through
- Live Demo
- Q&A

FDC Products - Overview

- Concept
 - Uses Electric Field between the sensor plate and human body to determine presence of human hand.
 - Contactless.
- Selected Applications
 - Proximity sensing and gesture recognition, Liquid level sensing, collision avoidance, Rain and snow sensing etc.
- Advantages
 - Extremely high noise resolution (60X better than any existing solution)
 - EMI resistant architecture
 - High resolution (upto 28 bits)
 - Lower system cost (cheap sensor, just any conductor)

WEBENCH FDC Designer - Overview

- Focus on “gesture recognition”



- Calculates all combinations of sensor configuration (W_1 , W_2 and Y) and IC that satisfy user's sensing distance requirement.
- Calculates sensing distance for user's sensor configuration.

WEBENCH FDC Designer - Step By Step Walk Through

Launching FDC Designer

Go to ti.com and select Sensors on WEBENCH panel

The screenshot shows the Texas Instruments WEBENCH Designer interface. The browser address bar displays the URL: http://www.ti.com/lids/ti/analog/webench/overview.page?DCMP=sva_web_webdesigncntr_en&HQ=sva-web-webdesigncntr-variety-lp-en. The page header includes the Texas Instruments logo, a search bar, and navigation tabs for Products, Applications & My Designs. The main content area is titled "WEBENCH® Designer" and features a grid of tool categories: Power, FPGA/μP, LED, Clocks, Filters, Sensors, Interface, and Reference. The "Sensors" category is selected, leading to a "Select a Sensor Tool:" dropdown menu with "Capacitive Sensing" chosen. Below this, a diagram illustrates a hand hovering over a sensor (w1) above a ground plane (w2), with a vertical distance z. To the right of the diagram are input fields for sensor dimensions: Max W1 (2 cm), Min W2 (100 cm), Max Y (100 cm), and Z (10 cm). A "Powered by:" section has radio buttons for Battery and Plug-in (selected). A red "Start Design" button is at the bottom. The left sidebar lists design tools like Power Designer, WebTHERM™ Simulation, and LED Designer. The right sidebar shows "My technical documents" and "Clock Architect" information.

Step 1 – Sensor Solutions From User Input

webench.ti.com/webench5/fdc/

WEBENCH Designer for Proximity Sensing Applications (BETA)

My Designs/Projects

New Assistant

User Inputs

Requirements and Conceptual Diagram

I know my sensing distance

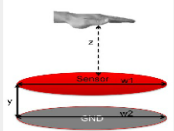
Max diameter of sensor (Max W1) (cm)

Min diameter of ground plate (Min W2) (cm)

Max Distance between sensor and ground (Max Y) (cm)

Target proximity distance sensing (Z) (cm)

Recalculate Powered by ? Battery Plug-in



Filter Results

W1 (cm) to

Channels to

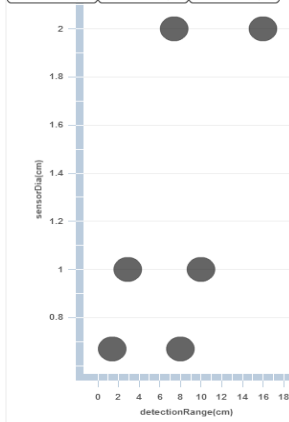
Z (cm) to

Resolution (bits) to

Filter Results

Advanced Charting

X Axis: detection1 | Y Axis: sensorDis | Bubble Size: sensorGn



Solutions: (12 found)

Part	Create	# of Channels	Resolution (Bits)	Nominal Supply voltage (V)	Proximity sensing distance - Z (cm)	Sensor diameter - W1 (cm)	Ground sensor size - W2 (cm)	Distance to sensor - Y (cm)
FDC2242	Create Design	2	28	3.3	8	0.67	100	100
FDC2242	Create Design	2	28	3.3	10	1	100	100
FDC2242	Create Design	2	28	3.3	16	2	100	100
FDC2112	Create Design	2	12	3.3	1.4	0.67	100	100
FDC2112	Create Design	2	12	3.3	2.9	1	100	100
FDC2112	Create Design	2	12	3.3	7.4	2	100	100

Results

Step 2 – Select Solution Based On Trade-Offs

webench.ti.com/webench5/fdc/#

WEBENCH Designer for Proximity Sensing Applications (BETA)

My Designs/Projects

Back New BOM Charts Schematic Op Vals Assistant

Charts

Detection Range vs Sensor Diameter

Click here to view Chart

Schematic

FDC2212

Operating Values

Name	Value	Description
Detection Range (cm)	10	Proximity sensing distance of the sensor configuration
Sensor Diameter (cm)	1	Diameter of sensor plate
Ground Diameter (cm)	100	Diameter of ground plate
Input Voltage (V)	3.3	Input voltage for the IC
Number of Channels	2	Number of channels IC can support
Resolution Bits	28	Resolution of the IC in bits
Ground sensor gap (cm)	100	Distance between ground and sensor (cm)

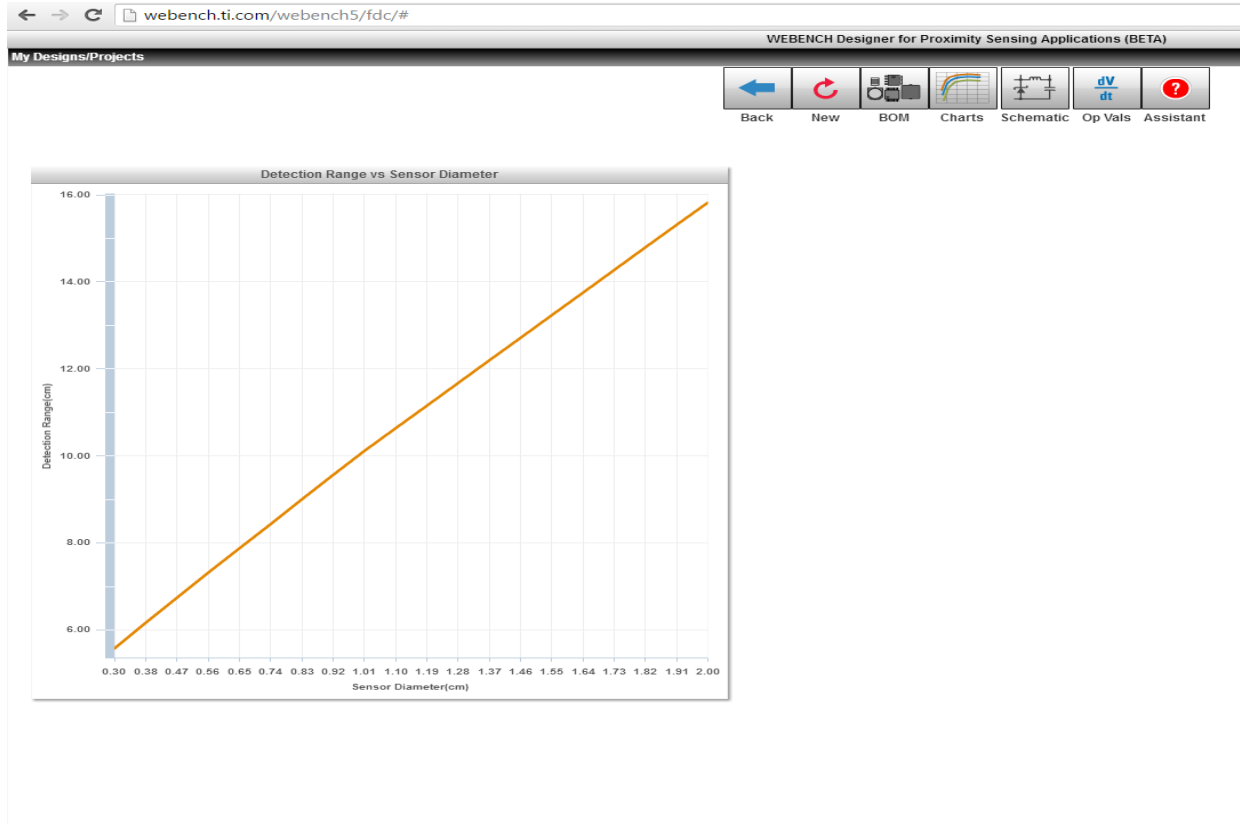
Bill of Materials

Part	Manufacturer	Part Number	Quantity	Price	Attributes	Footprint
Sensor		Capacitor plat...	1	NA		NA
IC	Texas Instruments	FDC22...	1	\$4.75		36.0

Detailed Op Vals

Detailed BOM

Step 3 – Analyze performance from charts



Example: Cap Sensing Designer

Design Problem:	Goal:
<p>A movement detection system needs a sensor. The target sensing distance is 25 cm. Due to size restrictions of the detector, the maximum sensor diameter could be 20 cm and the maximum distance between the sensor and ground could be 1 cm. Assume ground diameter to be 20 cm.</p> <p>Assume a 2 channel device is sufficient and the system is powered by plug in.</p>	<p>Use FDC Designer to calculate smallest possible sensor required and the FDC IC that can achieve user requirements.</p>

Cap Sensing Designer Example

I know my sensing distance

Sensor diameter: 9.4cm

My Designs/Projects

WEBENCH Designer for Proximity Sensing Applications

New Assistant

Requirements and Conceptual Diagram

I know my sensing distance

Max diameter of sensor (Max W1) 20 (cm)

Min diameter of ground plate (Min W2) 20 (cm)

Max Distance between sensor and ground (Max Y) 1 (cm)

Target proximity distance sensing (Z) 25 (cm)

Recalculate Powered by Battery Plug-in

Filter Results

W1 9 20 (cm)

Channels 2 4

Z 25 61 (cm)

Resolution 12 28 (bits)

Advanced Charting

X Axis: detection1 Y Axis: sensorDik Bubble Size: sensorGn

Solutions: (20 found)

Part	Create	# of Channels	Resolution (Bits)	Nominal Supply voltage (V)	Proximity sensing distance - Z (cm)	Sensor diameter - W1 (cm)	Ground sensor size - W2 (cm)	Distance sensor - Y (cm)
FDC2212	Create Design	2	28	3.3	26	9.4	20	1
FDC2212	Create Design	2	28	3.3	27	10	20	1
FDC2212	Create Design	2	28	3.3	34	12	20	1

Video Demo

WEBENCH[®] Capacitive Sensing Designer

Design tool for applications requiring proximity sensing, gesture recognition, liquid-level sensing

Shrikrishna Srinivasan,
Software Engineer

