CTD453 User Guide

Referenced Devices

CT453
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Introduction

The CTD453 demo board showcases the advantages of contactless current sensing using the CT453 differential magnetic field sensor from Crocus Technology.

The CT453, based on Crocus Technology's XtremeSense® TMR technology, features a full-bridge configuration compromised of four (4) TMR elements with active CMOS circuitry that enables high bandwidth, high accuracy current measurements. It achieves a total output error of less than ±1.0% FS over voltage and temperature.

The CTD453 is a 4-layer PCB, equipped to perform contactless current sensing for 2 ranges: using PCB traces for <75 A_{PK} current and using a busbar for 300 $A_{NOMINAL}$ current.

Features

- Total Error: ±0.5% FS (Typ.)
- Available Field Ranges:
  - +6 mT
  - ±6 mT
  - +12 mT
  - ±12 mT
  - +24 mT
  - ±24 mT
- Inbuilt Galvanic Isolation
- Low Noise Performance
- VOUT – VREF Error: ±1.0% FS (Max.)
- High Bandwidth: 1 MHz
- Fast Response Time: ~300 ns
- Immunity to Common Mode Fields

General Description

The CTD453 demo board is shown below. It features:

- 2x Screw connectors
- 1x CT453 current sensor
- 1x 100 pF SMD capacitor (optional)
- 1x 1 µF SMD capacitor
- 1x 5 pF SMD capacitor
- Multiple male header connectors for biasing and measurements
- Nylon washers and custom busbar

The CTD453 shown in Figure 1, is powered by applying a 3.3 V bias voltage between the VCC and GND pins. The analog output voltage of the sensor is accessed through the Out pin. The VREF and FLTB pins on the PCB provide access to the VREF and $\overline{FLT}$ pins on the IC.

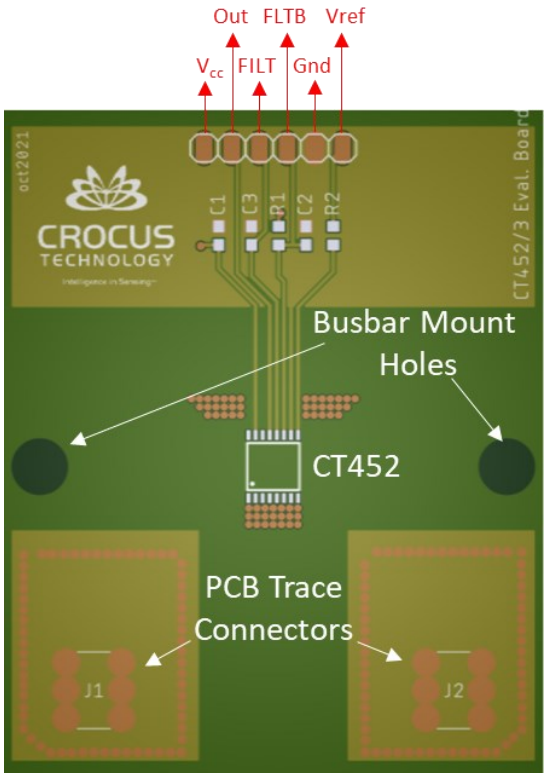

FIGURE 1 CTD453 DEMO BOARD

PCB Current Sensing (Steady State Current < 75A_{pk})

In this mode, the current is measured by passing it through the PCB traces using the screw connectors. The top layer of the EVB is used to place the CT453 IC and I/O traces needed to connect to the CT453.The remaining 3 layers of the PCB are used to carry the current being measured. The maximum current that can be passed through the EVB is guided by the thermal limitations of the PCB layers.

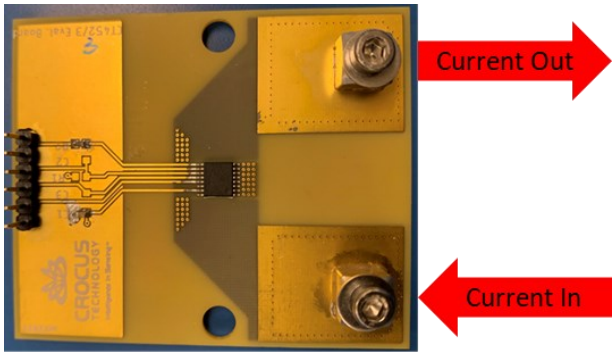

FIGURE 2 CTD453 PCB BASED CURRENT SENSING

Figure 2. illustrates the positive direction of current flow through the PCB. The analog output of the sensor and the <1% total error over full temperature range is showcased in Figure 3.

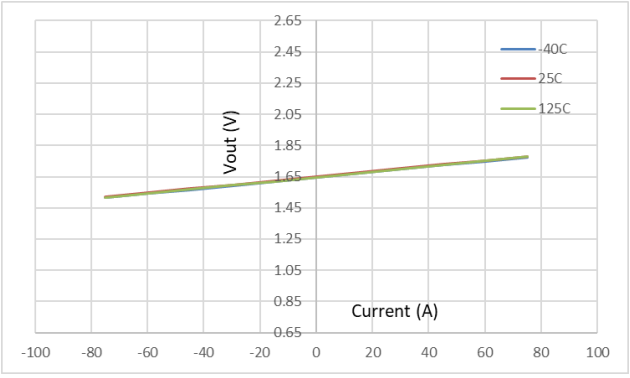

FIGURE 3. EXCELLENT LINEARITY AND TEMPERATURE PERFORMANCE FOR CTD453

In addition to excellent linearity and temperature performance, the CT453 also has extremely low noise. The input referred noise density is shown in Figure 4, and it can be observed that the noise spectrum has a very pronounced 1/f roll-off with a typical integrated noise less than 1 mV_{RMS} from DC to 100 kHz.

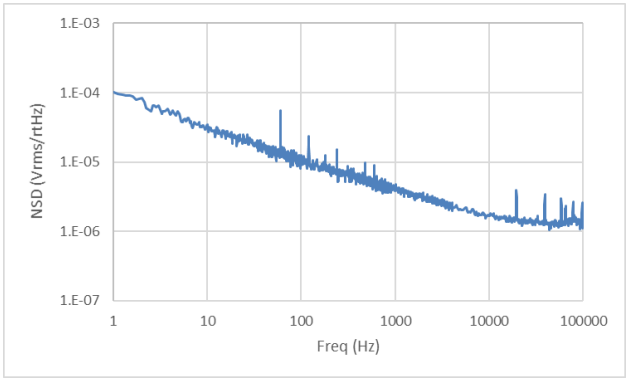

FIGURE 4. NOISE DENSITY OF THE CTD453

The intergated noise is an order of magnitude lower than the noise from any competing contactless sensor in the market.

Busbar Current Sensing

The busbar supplied with the CTD453 should be used to measure larger currents. The busbar is made of copper and three (3) slits are placed in the busbar to generate a differential magnetic field. The CTD453 in this configuration is illustrated in Figure 5.

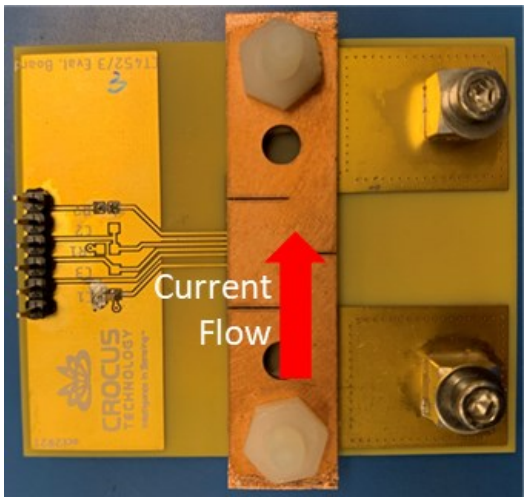

FIGURE 5. CTD453 WITH BUSBAR