



CTD452 User Guide

Referenced Devices

CT452 – XtremeSense® TMR IC
CTD452 – Evaluation Board

Introduction

This user guide describes the operation and use of the CTD452 demo board as an engineering tool for evaluating the CT452 IC performance in contactless current sensing applications.

The CT452 is a differential magnetic field sensor IC that detects a current induced magnetic flux and outputs a voltage proportional to the AC or DC current flow. The CT452 integrates two patented XtremeSense® TMR flux sense elements configured for common field rejection, high bandwidth, high current accuracy, and immune to external magnetic field noise. It achieves a total output error of less than $\pm 0.7\%$ FS (typ) with a total lifetime drift of $\pm 1.0\%$ FS (typ).

The CTD452 is a 4-layer (3 oz copper) PCB designed to test two types of contactless current sensing methods: with a PCB trace for $<75 A_{PK}$ current or with a busbar for $300 A_{NOMINAL}$ current. Both the PCB current carrying trace and the supplied copper busbar have three (3) slits for current steering and generating a differential magnetic field.

Features

- Total Error: $\pm 0.7\%$ FS (Typ.)
- Available Field Ranges:
 - +6 mT
 - ± 6 mT
 - +12 mT
 - ± 12 mT
 - +24 mT
 - ± 24 mT
- Built-in Galvanic Isolation
- Low Noise Performance
- 1 MHz Operating Bandwidth
- ~300 ns Signal Response
- Immunity to Common Mode Fields

General Description

The CTD452 demo board shown in Figure 1 features:

- 1x CT452 current sense IC
- 1x 4-layer 3oz copper PCB
- 1x 100 pF SMD capacitor (optional)
- 1x 1 μ F SMD capacitor
- 1x 5 pF SMD capacitor
- Six pin male header for biasing and measurements
- 2x Metal screw connectors
- 2 Sets of nylon screws and nuts
- 1x Custom slitted busbar

The CTD452 is enabled by applying a 5.0V bias between the V_{CC} and GND pins. The voltage corresponding to the detected flux is available on the Out pin. The V_{REF} pin provides a voltage that is half of V_{CC} while the FLTB pin provides an active low signal for an over-field or under-voltage condition. The FILT pin has a capacitor C3 to improve noise performance. Figure 2 shows the schematic and table for C3 value options. Please review the CT452 datasheet for more detailed electrical and performance specifications.

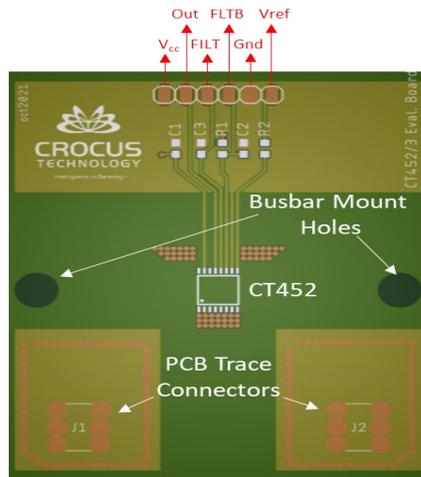


FIGURE 1 CTD452 DEMO BOARD

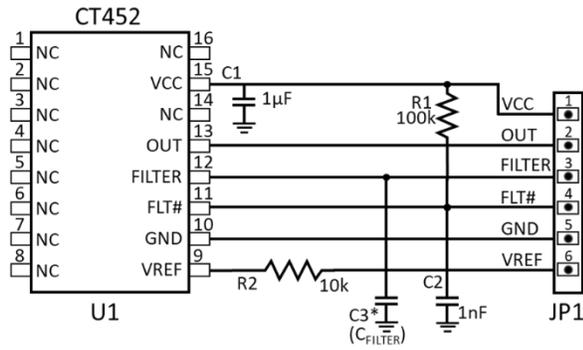


Table 1. Capacitor C3 Options for FILTER pin

Cut-off Frequency	*C _{FILTER} (pF)	Capacitor Part Number
100 kHz	91	GRM0225C1C910JA02
250 kHz	33	GRM0225C1C330JA02
500 kHz	16	GRM0225C1C160JA03
1.0 MHz	5	GRM0225C1C5R0CA03

FIGURE 2 CTD452 DEMO BOARD SCHEMATIC

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

In this configuration, the busbar is removed so current is measured by placing the CTD452 in-line between the supply voltage and the load as shown in Figure 3. For DC currents the supply voltage must be connected to the 'Current IN' terminal (Red) and the load is connected to the 'Current OUT' (Black) terminal resulting in a current flow through the PCB trace underneath the CT452 IC. The top layer of the EVB has the CT452 IC as well as the signal traces routed to

the 6-pin header. The remaining 3 layers of the PCB are used to carry the in-line current. The maximum current passed through the EVB is limited by the thermal capability of the PCB layers.

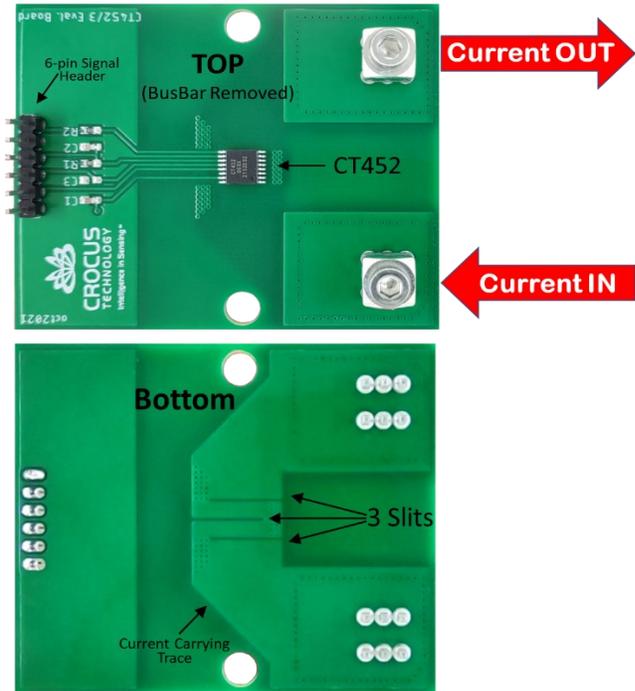


FIGURE 3 CTD452 PCB CURRENT SENSING

Busbar Current Sensing (300 A_{NOMINAL})

As shown in Figure 4, the custom slitted busbar is placed over the CT452 for measuring currents in the range of 70~300A. It can carry a steady state current of 300A with a peak current of ~900A. When installing the busbar, make sure the slit orientation is opposite to the bottom PCB trace's slit orientation (this is due to the inversion of the magnetic flux). Take care in handling the busbar and do not over-tighten the nylon screws as this could bend the busbar. Do not use the PCB's Red and Black terminals, they must be left floating when using the busbar. Also note the DC current flow direction shown in Figure 4.

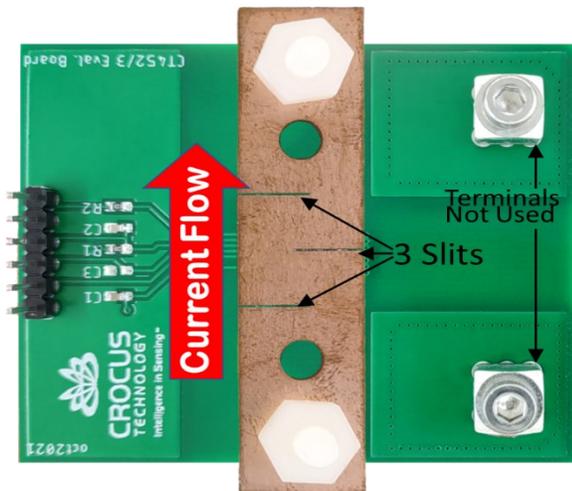


FIGURE 4. CTD452 WITH BUSBAR

CT452 Sensor Alignment

The CT452 has two integrated TMR sensors for high common mode field rejection (CMFR) capability. Their position in the IC is one of the parameters which dictates the dimensions of the three slits on the current carrying PCB trace and busbar. The position of the current carrying conductor, (whether on top or bottom of the CT452) will dictate the slit orientation since magnetic field orientation will be affected. Figure 5 shows the TMR sensor position dimensions within the CT452.

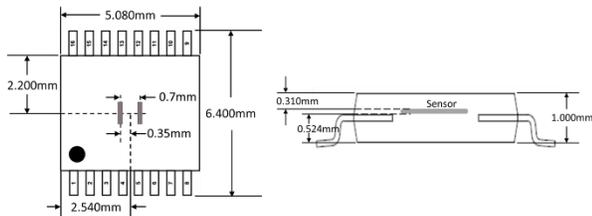


FIGURE 5 DUAL TMR SENSOR POSITION

PCB and Busbar Slit Design

Please contact Crocus for custom 3-slit design guidance.

CTD452 Ordering Table

TABLE 1: CTD452 PART NUMBERS

Ordering Part Number	Field Range
CTD452-06U	+6 mT
CTD452-06B	±6 mT
CTD452-12U	+12 mT
CTD452-12B	±12 mT
CTD452-24U	+24 mT
CTD452-20B	±24 mT

Conversion of Field mT to mV/A

Please contact Crocus for guidance on busbar design and placement since this affects the magnetic field (mT) generation and how the CT452 converts this to a sensitivity (mV/A) for current level detection.

Conclusion

The CTD452 is a tool for evaluating the magnetic flux sense capabilities of the CT452 Crocus TMR sensor. This user guide provides a description of the demo board and how to use it for measuring contactless currents.

Contact

For samples, questions or design guidance:
support@crocus-technology.com