



Low Current Sensing Applications

Introduction

Crocus Technology is extending its current sensing product portfolio to include a high bandwidth, low current sensor up to $\pm 15 A_{PK}$. Based on its patented TMR technology, the CT110 features superior linearity and over temperature performance with the capability of sensing current as low as 10 mA to enable a high dynamic range.

The CT110 is a 6-pin device that features a linear ratiometric analog output in addition to a digital active low over-current protection output that is triggered in under 0.5 μs .

It is a factory trimmed device that guarantees the sensor gain and the over-current protection threshold.

Operating Principle

The CT110 is an isolated device that measures the magnetic field generated by the current flowing inside the package.

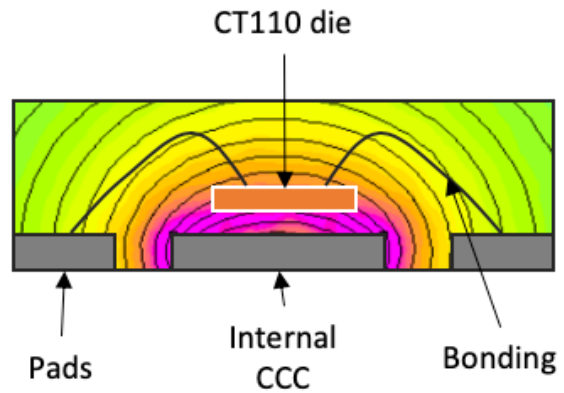


Figure 2: Cross-section of the CT110 package showing the internal magnetic field.

The CT110 sensor is based on a monolithic die that includes a highly linear 1D TMR sensor configured in a full-bridge layout, and an integrated circuit for amplification, gain, and over-current protection threshold trimming.

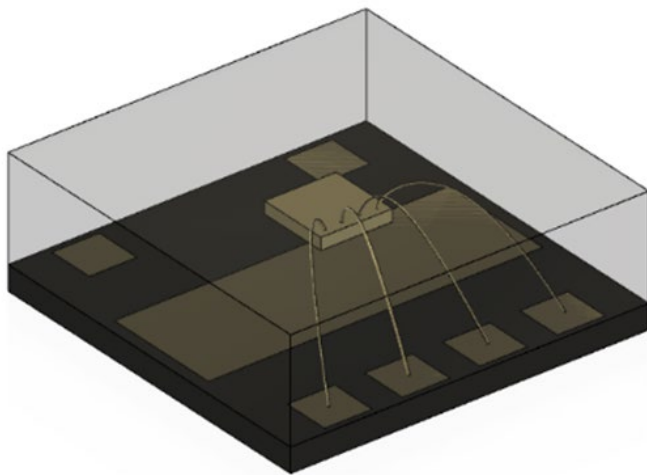


Figure 1: CT110 packaging showing the die, pads and current carrying conductor.

The galvanic separation between the die and the current carrying conductor allows the sensor to perform isolated current measurements.

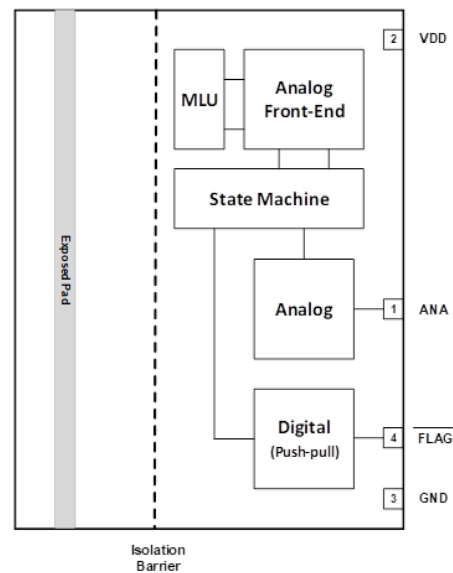


Figure 3: CT110 block diagram.

The CT110 is factory trimmed and cannot be re-programmed on the application side.



Reference Design

The CT110 measures bi-directional current, hence the ANA output pin is trimmed to be equal to half of V_{DD} when the current is null and varies towards V_{DD} or GND depending on the direction of the current. The sensor does not require any additional circuitry and can be connected directly to an ADC or comparator.

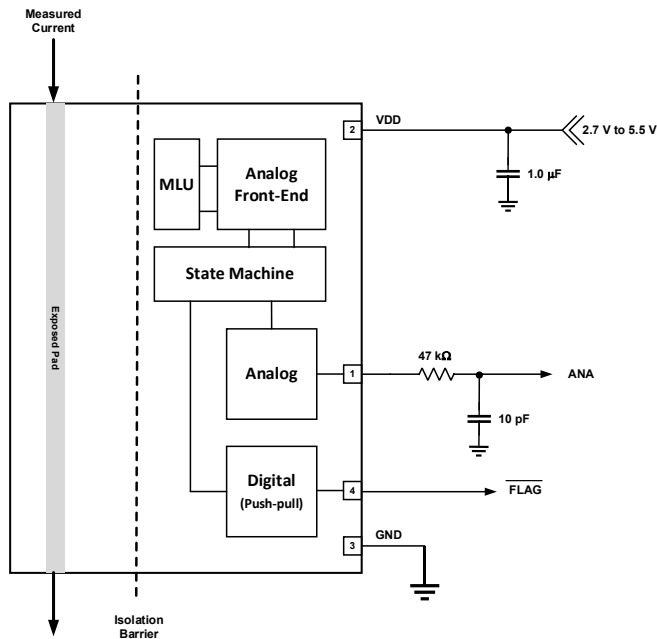


Figure 4: CT110 application block diagram.

Below is a recommended circuit featuring the CT110 along with a decoupling capacitor $C1 = 1.0 \mu F$. An RC filter may be connected to the ANA pin to lower noise.

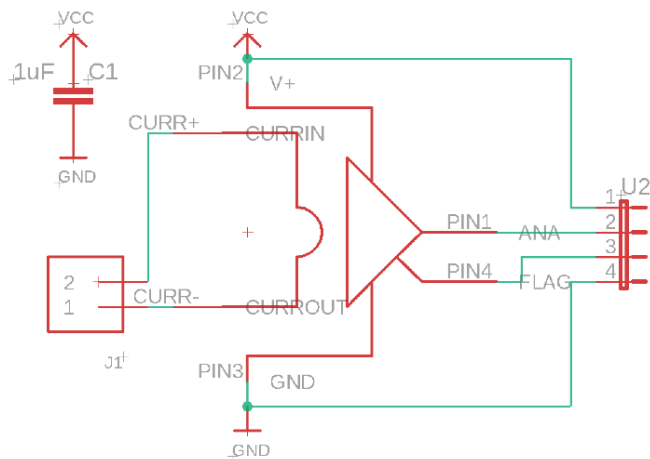


Figure 5: CT110 application schematic diagram.

The graphic in Figure 6 shows the top layer for the printed circuit board (PCB) layout for the EVB111, the evaluation board for CT110.

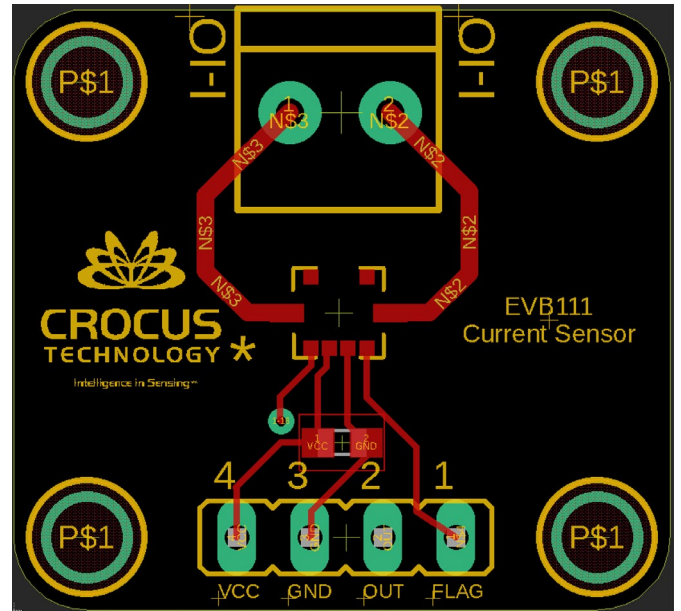


Figure 6: Typical GDS layout of the top layer for the CT110 evaluation board, EVB111.

In Figure 7, this is the PCB layout for the bottom or ground layer of EVB111.

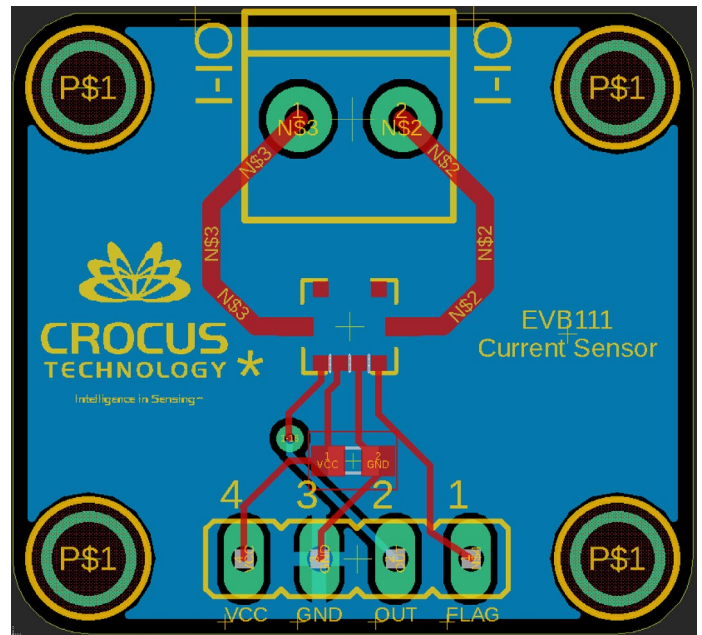


Figure 7: Typical GDS layout of the ground layer for the CT110 evaluation board.



Results

The figure below shows the typical ANA voltage output of the CT110 for the 5.0 A variant. The device was powered using a 5.0 V supply. The typical full-scale linearity and total output errors are $\pm 0.1\%$ and $\pm 0.5\%$ respectively.

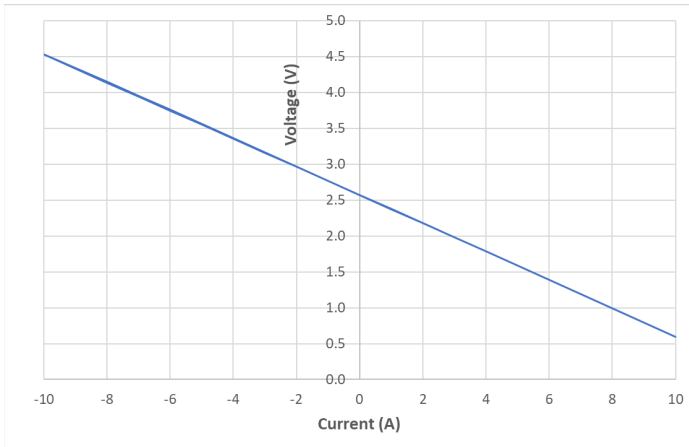


Figure 8: Typical ANA voltage output at $V_{DD} = 5\text{ V}$.

The $\overline{\text{FLAG}}$ pin is a push-pull digital output active low. This pin will output a low signal when the current measured exceeds 110% of the nominal current.

Summary

The CT110 is a new TMR sensor from Crocus Technology that is optimized towards low current applications. It is factory programmed and offers a small footprint, cost effective, isolated current sensing solution.