# PCB Design for CMOS Image Sensor

**Introduction About The Sensor:**
The CM06M is a CMOS monochrome image sensor designed for intra-oral dental X-Ray photography applications, with very low dark current and a linear dynamic range of over 12 true bits at room temperature. Using an LVDS output amplifier an image can be read out with 5M pixels per second.

The sensor does not have physical pins for connection to external controllers or FPGAs; instead, it has pads on the bottom. Therefore, I designed a PCB to mount the sensor and provide external control.

**Design Overview**
**Purpose:** The PCB was designed to support the high-speed differential signals essential for data acquisition while maintaining an I2C interface for low-speed configuration purposes, ensuring smooth communication between the image sensor and the controlling microcontroller.

**Signal Design High-Speed Differential Signals:**
These signals are used to transmit data between the image sensor and the external processing system, ensuring high data integrity and minimizing signal degradation over long distances. The PCB design employs differential pairs to handle the high-frequency data signals, ensuring low noise and interference.

A single-channel LVDS (Low Voltage Differential Signaling) buffer from Texas Instruments. It accepts LVDS (and compatible LVPECL) input and provides LVDS output

DS90LV001TLD_NOPB

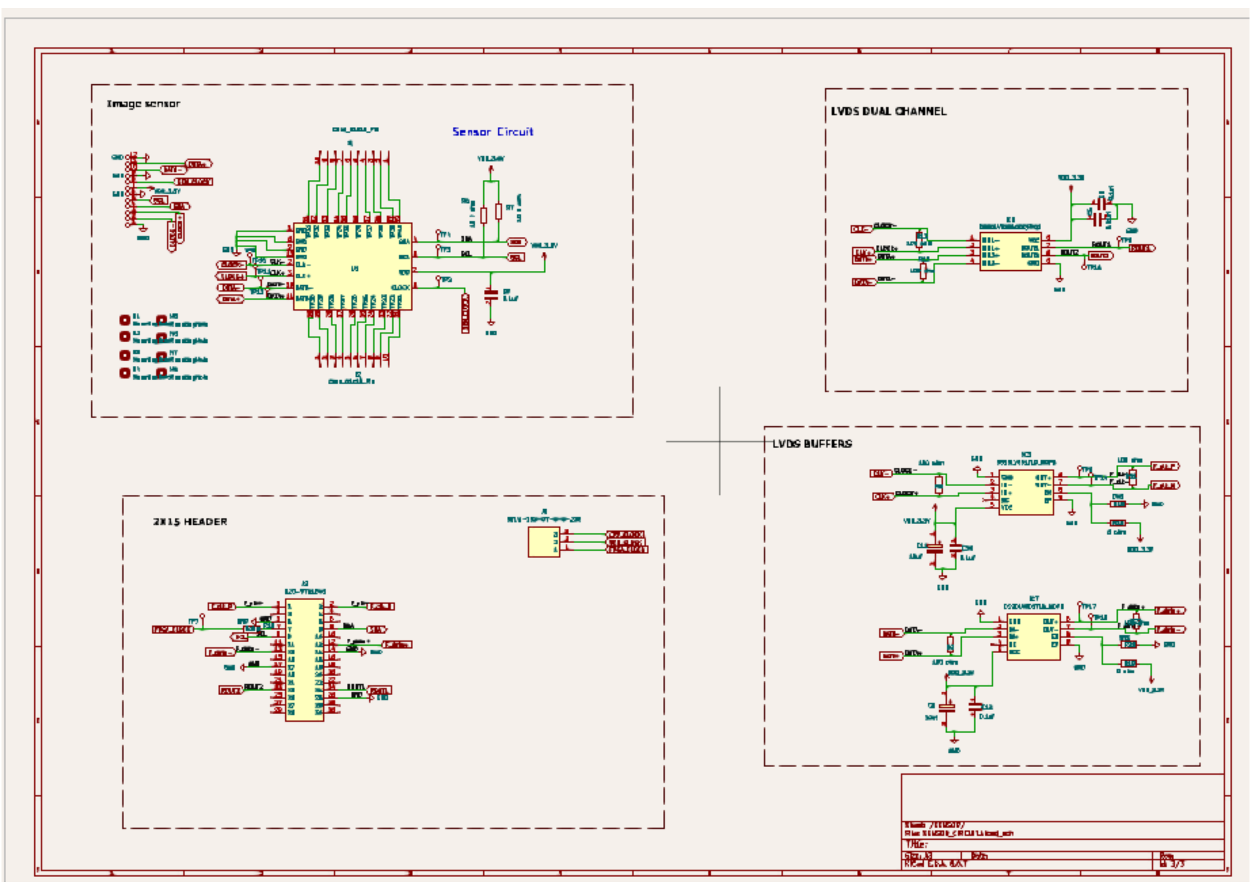
**Voltage Regulator – MIC37303YME-TR:**
This device is a high-current, low-dropout (LDO) regulator from Microchip Technology. It can supply up to 3 A of output current with an adjustable output voltage range from 1.24 V to 5.5 V. The regulator ensures stable and reliable power delivery for high-performance devices such as image sensors, FPGAs, and processors. With its low dropout voltage, integrated protection features (over-current, over-temperature, and reverse current), and logic-controlled enable pin, it provides efficient power regulation while maintaining system safety and flexibility.

**Crystal Oscillator – XLH736005.000000I:**
This is a 5 MHz fixed-frequency crystal oscillator (XO) by Renesas Electronics (formerly IDT). It delivers a HCMOS output with a frequency stability of ±20 ppm, and operates at a 3.3 V supply voltage. Encased in a compact SMD package (≈7 × 5 mm), it provides precise timing with low phase jitter, ensuring reliable clock generation for digital systems.

**Schmitt-Trigger Inverter – 74LVC1G14GV,125:**
This is a single-channel Schmitt-trigger inverter (logic gate) from Nexperia. It features Schmitt-trigger inputs to clean up slowly changing or noisy signals by introducing hysteresis before inversion. The IC operates across a broad supply voltage range and supports mixed-voltage interfacing, making it ideal for robust digital signal conditioning.

**LVDS Dual Receiver – DS90LV028AQDQFRQ1:**
This is a dual-channel Low-Voltage Differential Signaling (LVDS) line receiver from Texas Instruments, AEC-Q100 qualified for automotive use. It's designed for low-power, high-speed data reception over differential links, converting LVDS inputs into 3.3 V CMOS outputs.

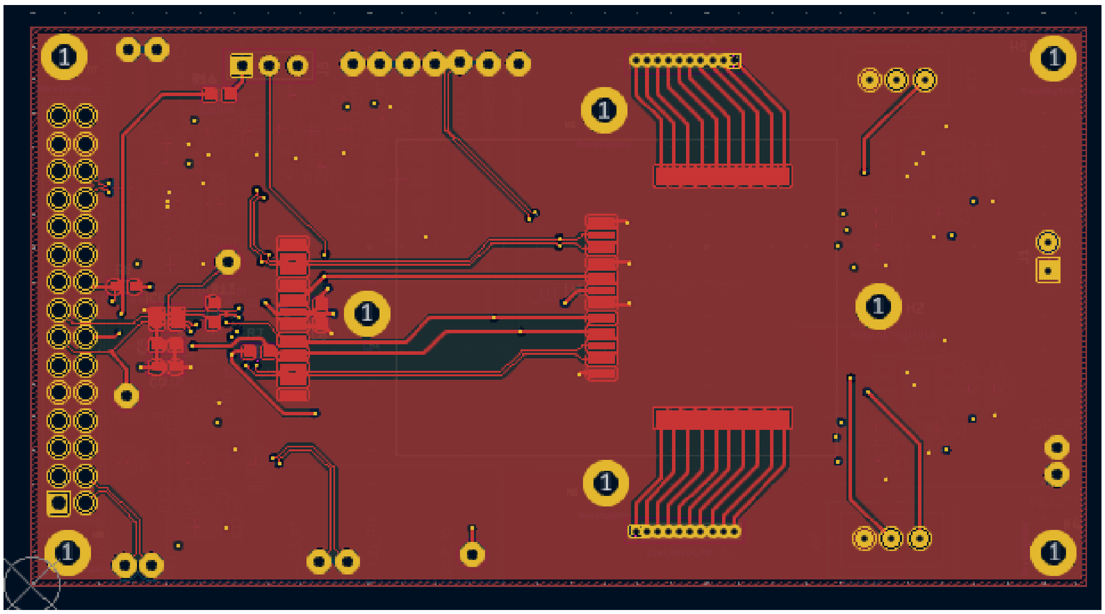
**Schematic:**

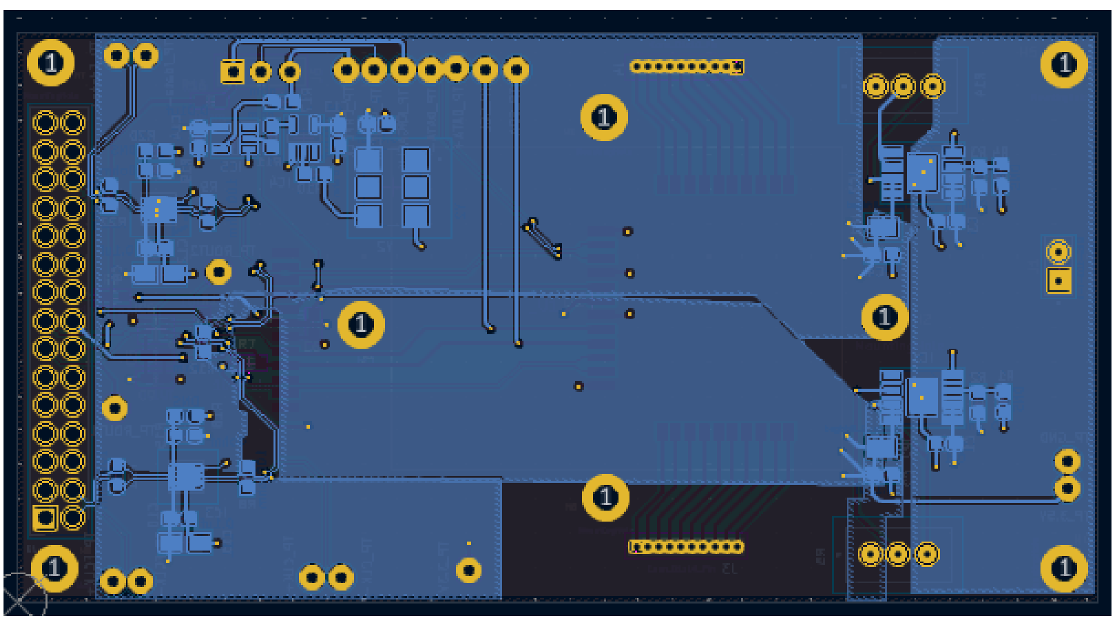



This is the schematic of the pcb you can find the  full and clear design links attached below.

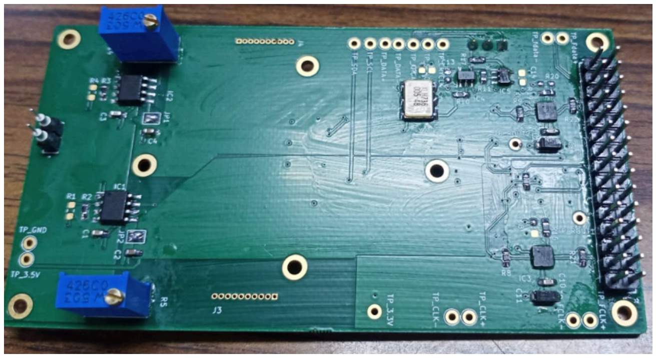
**PCB Layout:**

The following figures show the top and bottom layer views of the PCB after completing the final routing stage. The design is implemented as a 4-layer PCB, with dedicated planes for power and ground to ensure signal integrity, controlled impedance for high-speed differential pairs, and reduced noise coupling. The top and bottom layers primarily handle component placement and signal routing, while the internal layers provide stable reference planes and distribute power efficiently.





**Post-Fabrication Assembly and Testing:**
After the PCB was fabricated, the board arrived and I performed basic **soldering**, which I had learned prior to this stage. Once all components were placed on the board, I carried out a continuity check to ensure all connections were correct. After verifying the continuity, I powered the board to test the power rails and confirmed proper voltage levels. Finally, I proceeded with testing the remaining signal paths to ensure full functionality of the board.



**Testing:** After the PCB was fabricated, thorough testing was conducted to verify the high-speed differential signals and I2C communication. The image sensor was programmed via I2C to confirm correct register writes and sensor configuration. High-speed probes were used to analyze the differential signals.

**Conclusion** The PCB design successfully integrates high-speed differential signals for data transfer and an I2C interface for sensor configuration. With careful consideration of signal integrity, routing, and component selection, the design meets the performance requirements for the CMOS image sensor's functionality.

**Github:** [https://github.com/sonikachepena/PCB_Design-for-CMOS-Image-Sensor](https://github.com/sonikachepena/PCB_Design-for-CMOS-Image-Sensor)

Thank you,
Sonika chepena.