

THEIA-CAM Family Kit

THSCM101

Linux Camera for i.MX 8M Family with 13MP PDAF Sensor

General Description

THSCM101 is a Linux Camera Board with MIPI CSI-2 interface, incorporating Sony's 13M Pixel PDAF IMX258 sensor and THine's THP7312-P ISP. The PDAF sensor module is fully calibrated to perform fast and accurate auto focus. The ISP firmware is fully developed to support fine image quality.

THSCM101 can be embedded into final products as is or be used as a reference design with i.MX 8M Family EVKs. All functions and choices for resolution defined herein are configurable via V4L2 Control. THSCM101 design files and firmware as well as tools to customize the camera system and/or THP7312-P can be requested to THine Solutions, Inc.

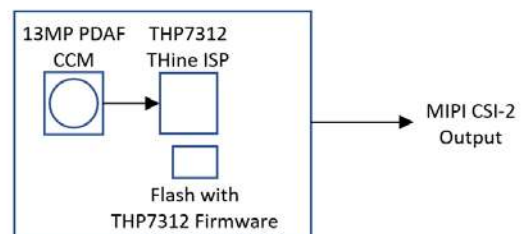
Features

- ✓ Multiple High-Resolution Choices
- ✓ PDAF (Phase Detection Auto Focus)
- ✓ V4L2 Linux camera processor driver available
- ✓ Fully fine-tuned image quality with ISP firmware available
- ✓ Compatible with NXP EVK for i.MX 8M Family

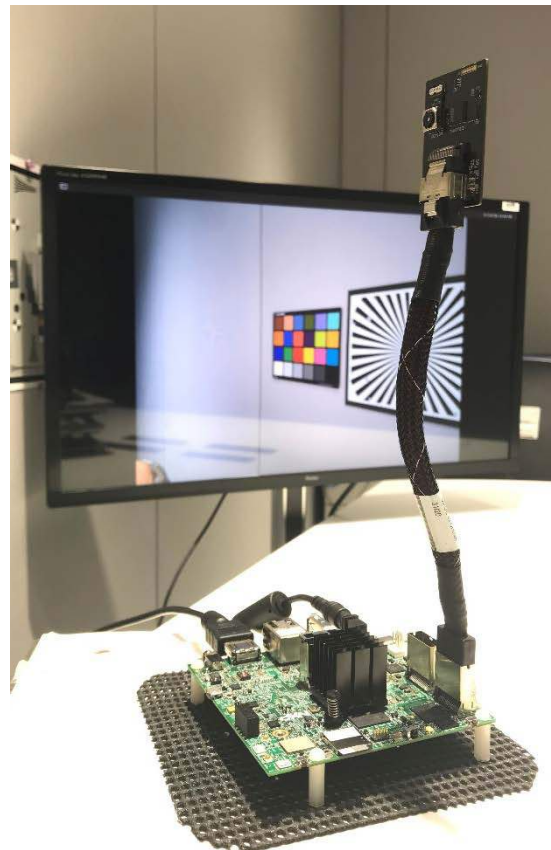
Applications

- Bodycams
- Barcode Scanner
- Surveillance cameras
- Robotics, Drone and AI cameras
- Smart glasses and AR/VR systems
- Document Scanners
- Medical Endoscopes
- Education and web conference cameras

Block Diagram



Use Case



1. System requirement

| Item | Specification |
|-----------------------|---|
| Hardware Requirements | <ul style="list-style-type: none"> ● NXP EVK: 8MMINILPD4-EVKB, 8MPLUSLPD4-EVK or MCIMX8M-EVKB ● SD card ● USB keyboard ● USB mouse ● HDMI monitor ● Standard HDMI cable |

Note: SD Card Software provided via <https://www.thinesolutions.com/linux-camera-for-imx8-with-13mp-pdaf-sensor>. (You can customize SD card image using the Linux source code. See Appendix “Camera function and image quality customization.”)

2. Contents of Kit

2.1 Contents in the box

| Item | Description |
|--|---|
| Linux Camera Board | PCB with 13M pixel Camera module, THP7312-P |
| Cable for Connection with an i.MX 8M Family EVKs | 23cm Mini-SAS semi rigid cable (MOLEX 0795762107) |

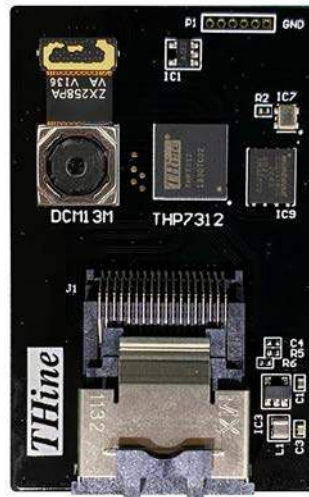


Figure 1 Linux Camera Board



Figure 2 Cable for Connection with an i.MX 8M Family EVK

2.2 Resources Available Online

| Item | Description |
|--------------------------------|---|
| Datasheet | This document |
| Start Guide | Brief document guiding how to set up initially |
| V4L2 Command Manual | How to use camera commands for THSCM101 |
| V4L2 Driver Integration Manual | How to integrate THSCM101 V4L2 source code into NXP BSP |

Note: Available at <https://www.thinesolutions.com/linux-camera-for-imx8-with-13mp-pdaf-sensor>

2.3 Resources Available Upon Request

| Item | Description |
|-----------------------------------|------------------------------------|
| SD Card Image of i.MX 8M Mini EVK | SD Card Image for i.MX 8M Mini EVK |
| SD Card Image of i.MX 8M Plus EVK | SD Card Image for i.MX 8M Plus EVK |
| SD Card Image of i.MX 8M EVK | SD Card Image for i.MX 8M EVK |
| V4L2 Driver Source Code | THSCM101 V4L2 driver source code |
| NXP BSP Patch | |

Note: Available Upon Request via <https://www.thinesolutions.com/support-request>

3. Specifications

3.1 Operating Condition

| Item | Description |
|-----------------------------|---|
| Power Supply | i.MX 8M Family EVK 3.3V and 1.8V power line |
| Power Consumption | 616mW, typical (1080p@30fps), 736mW, typical (3M@30fps), 951mW, typical (1080p@60fps) |
| Operating Temperature Range | -20 ~ 60 C |

3.2 Mechanical Specification for Camera Board

| Item | Value |
|-----------|--------|
| Width | 35 mm |
| Height | 55 mm |
| Thickness | 1.2 mm |
| Weight | 8.6 g |

3.3 Optical Specifications

| Item | Description |
|------------------------------|--|
| Image Sensor Pixel Size | 1.12 um x 1.12 um |
| Optical Size | 1/3.06" |
| Type of Shutter | Rolling Shutter |
| Auto Focus | PDAF, Contrast AF and Manual Focus available |
| Field of View (Diagonal) | 78.4° |
| Focal Ratio | 2.0 +/- 5% |
| Effective Focal Length (EFL) | 3.57 mm |
| TV Distortion | < 1.5% |
| Optical Distortion | < 2.0% |

3.4 Camera Functions

3.4.1 Output

| Item | Description |
|-----------|-------------------|
| Interface | MIPI CSI-2 4lanes |

3.4.2 Selectable Image Sizes and Frame Rates

| Item | Selectable Image sizes and frame rates |
|----------------------|--|
| V4L2 Driver Rev. 2.3 | 1080p@30fps, 1080p@60fps, 3M@30fps, 4K2K@30fps |

Note 1: Other resolutions including but not limited to 13MP@20fps are not available yet but firmware upgrades to support those are in development now. Contact THine Solutions for more information.

Note 2: Other NXP i.MX 8M Family EVKs not listed here may not be supported yet waiting for upgrades to be included. Contact THine Solutions for more information.

3.4.3 Auto Focus Mode

| Item | Description |
|--|---|
| One Shot Contrast AF | THSCM101 executes contrast-based AF once. |
| Continuous Contrast AF | THSCM101 executes contrast-based AF every time it detects scene change automatically. |
| One Shot Contrast and PDAF Hybrid AF | THSCM101 executes hybrid AF of PDAF and contrast-based AF once. |
| Continuous Contrast and PDAF Hybrid AF | THSCM101 executes hybrid AF of PDAF and contrast-based AF every time it detects scene change automatically. |

3.4.4 V4L2 Image Functions

| Item | Options |
|---|---|
| Sizes and Frame Rates | 1080p: 1920x1080(binning)@29.6fps, YUV422 1080p: 1920x1080(binning)@59.6fps, YUV422 3M pixel: 2048x1536(binning)@29.6fps, YUV422 4K2K: 3820x2160@29.6fps, YUV422 |
| Focus Mode | Auto or Manual |
| Auto Focus Method | Contrast or PDAF Hybrid |
| Focus Position | Infinity to 80mm |
| Brightness | 21 Steps |
| Contrast | 21 Steps |
| Saturation | 32 Steps |
| Sharpness | 32 Steps |
| Noise Reduction | Auto or Manual |
| Noise Reduction Level | 11 Steps |
| Auto Exposure Bias | 13 Steps from -6/3EV to +6/3EV |
| Power Line Frequency (Flicker Cancellation) | Disable, 50Hz or 60Hz |
| White Balance Mode | Auto or Manual |
| White Balance Manual | x1 to x7.97 for Red and Blue |
| Rotation | 0 or 180degrees |
| Low Light Exposure Mode | Exposure Time or Fixed Frame Rate |

Appendix

Camera Function and Image Quality Customization Options

| Item | Description |
|--|---|
| Embedded Linux for i.MX Applications Processors | You can customize your camera functions based on our V4L2 driver and the BSP of i.MX 8M families. Follow the instructions to build the SD card image in THSCM101 V4L2 Integration Manual.pdf. |
| THSCM101 V4L2 Driver Source Code for i.MX BSP | Contact THine Solutions, Inc. to obtain the source code for further customization. |
| Firmware Customization (*) | Camera Development Kit (CDK) by THine is GUI-based easy-to-use tool, available to customize THP7312-P firmware with the current camera implementation. Contact THine Solutions, Inc. for CDK License Agreement. You can implement your own camera function and image quality with CDK. |
| Camera Customization (*) | Camera Development Kit (CDK) by THine is GUI-based easy-to-use tool, available to customize THP7312-P firmware to support new camera implementation including change of image sensor and/or lens. Contact THine Solutions, Inc. for CDK License Agreement. You can implement your own camera function and image quality with CDK. |

(*) For Introduction to CDK, visit <https://www.thinesolutions.com/camera-development-kit-cdk> and <https://youtu.be/XPfAHk4xTXo>

Important Notice

1. The product specifications described in this document are subject to change without prior notice.
2. The circuit diagrams described in this document are examples of the application. THine Solutions, Inc. (“THine”) assumes no responsibility for any losses incurred by you or third parties from the use of these circuit diagrams.
3. Testing and other quality control techniques are used to this product to the extent THine deems necessary to support warranty for performance of this product. Except where mandated by applicable law or deemed necessary by THine based on the user’s request, testing of all functions and performance of the product is not necessarily performed.
4. This product is presumed to be used for general electric device, not for applications which require extremely high reliability/safety.

About THine Solutions

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