THine Solutions

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
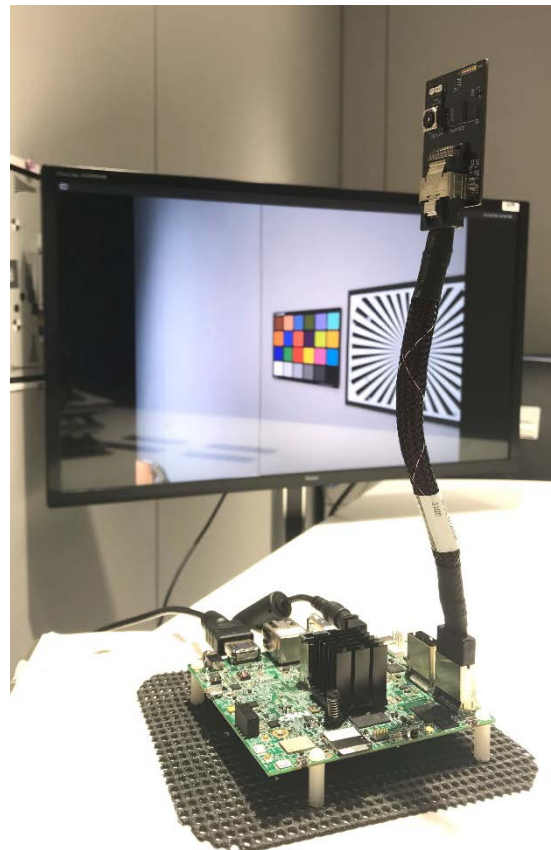- ✓ Compatible with NXP EVK for i.MX 8M Family

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

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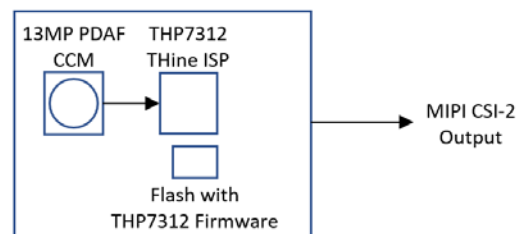
1. System requirement

Item	Specification
Hardware Requirements	• 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

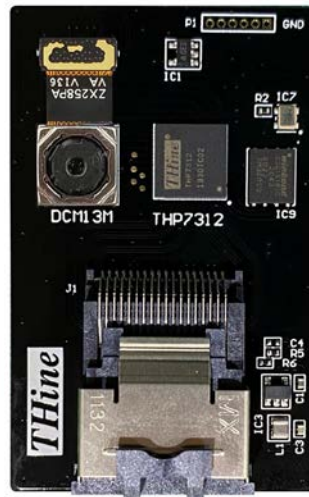| Item	Description
Linux Camera Board	PCB with 13M pixel Camera module, THP7312-P
Cable for Connection with an i.MX 8M Family EVKs	23cm Mini-SAS semi rigid cable (MOLEX 0795762107)

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 ℃

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

THine Solutions, Inc. (TSI), headquartered in Santa Clara, CA. is a subsidiary of THine Electronics, Inc., a Japanese company headquartered in Tokyo, Japan. TSI is responsible for design and manufacturing of THS Series Kit Solutions as well as for sales and marketing of THine IC products in the Americas, EMEA, and India territories. TSI offers products, tools, and technical assistance targeting image generation, image processing and image transmission applications supporting various Operating Systems including Windows®, macOS®, Android™, and Linux®, and various platforms including Raspberry Pi, Jetson, and i.MX 8M families. TSI's Kits and tools support customer needs from proof-of-concept evaluation to production. THine's IC products include standalone ISPs, V-by-One® HS SerDes ICs, and LVDS SerDes ICs. End product markets we serve include medical scopes, AR/VR systems, barcode scanners, vision assistive glasses, multifunction printers, drones, surveillance cameras, biometric devices, body cams, USB webcams, surgical microscopes, high-resolution displays, and automotive infotainment systems. TSI supports fulfilment directly and through our distribution partners including Digi-Key, Arrow Asia, and Avnet. For more information, visit www.thinesolutions.com.