

## FMC-MULTI-CAM4 Getting Started

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## Introduction

The Avnet Multi-Camera FMC module supports up to four (4) high definition camera modules using MAXIM Integrated's GMSL (Gigabit Multimedia Serial Link) technology.

GMSL is widely used in the automotive industry for in-vehicle high speed communication of video streams. Making use of low-cost coax cable up to 15 meters in length, GMSL meets the most stringent electromagnetic compatibility (EMC) requirements of the automotive industry.

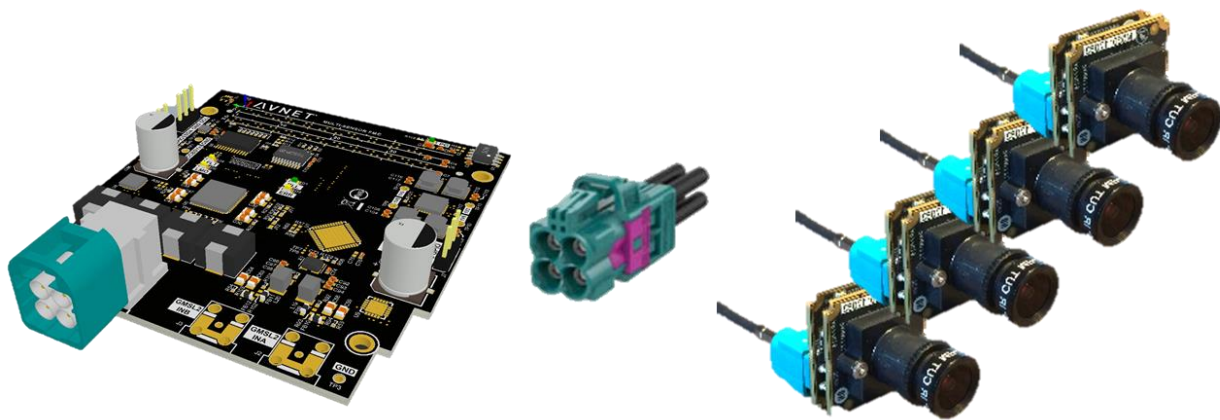
The provided linux-based reference designs support the ON Semiconductor MARS (Modular Automotive Reference System) based camera modules, including the MAXIM Integrated MAX96705 GMSL Serializer board and the ON Semiconductor AR0231AT image sensor board.

The AR0231AT image sensor is an automotive-grade image sensor which uses the latest 3.0 micron Back Side Illuminated (BSI) pixel with ON Semiconductor's DR-Pix™ technology, which offers dual conversion gain for improved performance under all lighting conditions. It includes LED Flicker Mitigation (LFM), and achieves 120dB of High-Dynamic Range with 4-exposure HDR.

The Multi-Camera FMC Module is available in two options:

- FMC module only (without any cable or cameras)
- Quad AR0231AT Camera FMC bundle (including cable and four cameras)

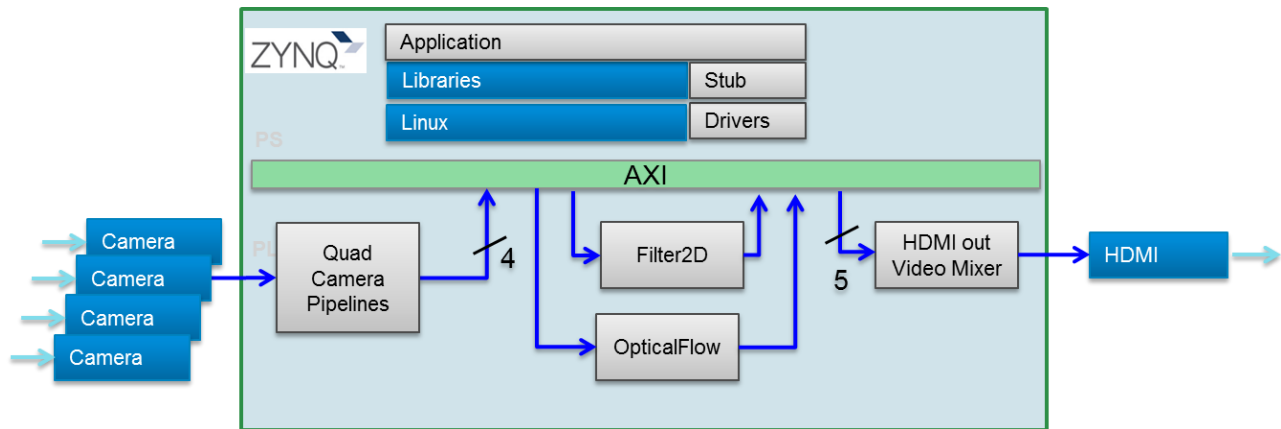
The Quad AR0231AT Camera FMC Bundle includes the Multi-Camera FMC module, a cable assembly, as well as four AR0231AT camera modules with GMSL serialization.



The Quad AR0231AT Camera FMC Bundle is meant to be used with Xilinx Zynq-UltraScale+ FMC carriers, including the ZCU102, the ZCU104, as well as the Avnet UltraZed EV SOM + Carrier. The Quad Camera FMC Bundle is fully integrated to the Xilinx reVISION stack, including SDSoc platforms and design examples.

## Overview

The Getting Started design is illustrated in the following simplified block diagram.



The Getting Started design consists of the following components:

- video sources
  - Quad camera capture pipelines
- computer vision accelerators implemented as memory-to-memory (m2m) pipelines
  - Filter 2D
  - Optical Flow
- video sinks
  - HDMI display pipeline

For more details on this design, including instructions on how to re-build the design, please refer to the “**FMC-MULTI-CAM4 reVISION 2018.2 Tutorial**”, available on-line.

## Hardware Setup

The following sections describe the software and hardware requirements for this tutorial.

### Software

The software required to build, and execute the reference design is:

- Linux or Windows host machine
- Terminal Emulator (HyperTerminal or TeraTerm)

### Hardware

The hardware required to build, and execute the reference design is:

- One of the following supported FMC carriers:
  - ZCU102
  - ZCU104
- Quad AR0231AT Camera FMC Bundle, including:
  - AES-FMC-MULTICAM4-G FMC module
  - Quad-HFM to 4x FAKRA Cable Assembly
  - 4 camera modules. Each composed of:
    - MAX96705 Serializer Kit (MARS1-MAX96705-GEVK)
    - AR0231AT Image Sensor Board (MARS1-AR0231AT7-GEVB)
- Monitor with HDMI input supporting one of the following resolutions:
  - 3840x2160 **or**
  - 1920x1080

## Extracting the design files

In this section, the archive containing the pre-built examples will be extracted to your computer.

1. Download the following archive:
  - Getting Started Design  
**FMC\_MULTICAM4\_Getting\_Started\_2018\_2\_02.zip**  
<https://avnet.egnyte.com/dl/Qt2cF9umB>
2. Extract the archive to your computer
  - a. For Linux, use the unzip utility.
  - b. For Windows, use the 7zip utility  
If you need 7zip, get it here  
[7zip](#)

## Running the Getting Started design

Setup the ZCU102 or ZCU104 hardware as follows:

1. Connect the FMC-MULTICAM4 FMC module to the FMC connector (J5 for HPC0 FMC on ZCU102, J5 for LPC FMC on ZCU104)
2. Attach the four AR0231AT camera modules to their respective MAX96705 Serializer modules, and connect to the FMC-MULTICAM4 FMC module with the cable assembly
3. Connect the power supply to the 12V connector (J52 on ZCU102, J52 on ZCU104)
4. Connect the HDMI display with an HDMI cable to the top connector of dual HDMI connector (P7 on ZCU102, P7 on ZCU104)
5. Connect a micro-USB cable to the USB-UART connector (J83 on ZCU102, J164 on ZCU104)  
Use the following settings for your terminal emulator:
  - Baud Rate: 115200
  - Data: 8 bit
  - Parity: None
  - Stop: 1 bit
  - Flow Control: None
6. Insert SD card (FAT formatted) with pre-built image copied from one of the following directories:
  - ZCU102 : sd\_card/zcu102\_rv\_mc4\_filter2d\_optflow
  - ZCU104 : sd\_card/zcu104\_rv\_mc4\_filter2d\_optflow
7. Set boot mode to SD card
  - ZCU102 : SW6[4:1]: **off,off,off, on**
  - ZCU104 : SW6[4:1]: **off,off,off, on**
8. Turn on the power switch (SW1 on ZCU102, SW1 on ZCU104)

Once linux has finished booting, you should see the linux prompt on the serial console:

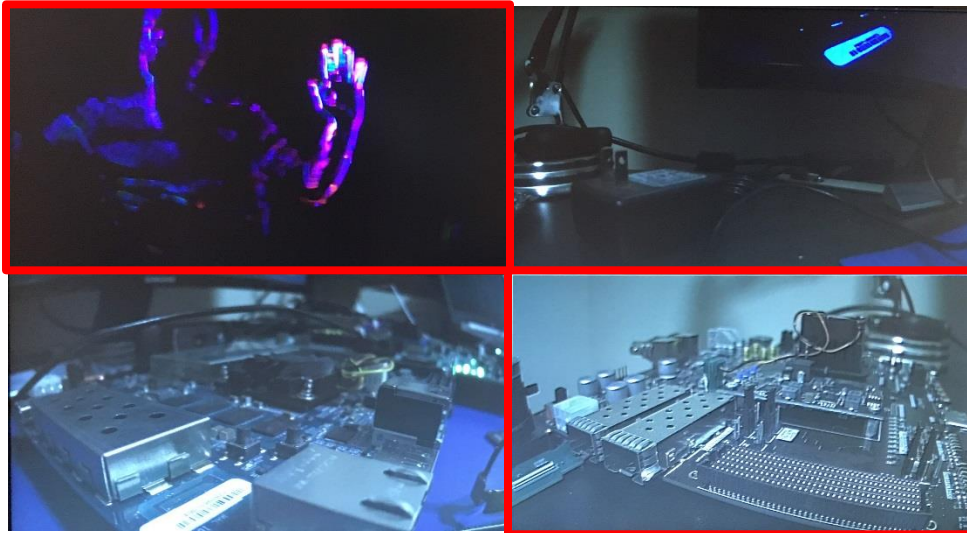
```
...  
Setting console loglevel to 0 ...  
root@xilinx:~# cd /media/card  
root@xilinx:/media/card# ./gstfilter2d_optflow.sh
```

9. Change the active directory to the sd card with the following command : **cd /media/card**
10. Execute the design with the following command : **./gstfilter2d\_optflow.sh**

You should observe the live captures from the four cameras on the 4K monitor.

- the top-left quadrant is running the “Optical Flow” accelerator, indicating movement in the scene
- the bottom-right quadrant is running the “Filter 2D” accelerator, enhancing the edges in the scene
- the other two quadrants are running a passthrough

Optical Flow



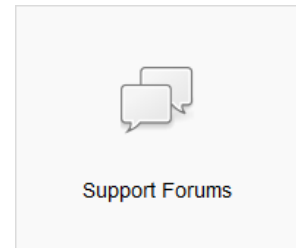
Filter 2D

For more details on this design, including instructions on how to modify the gstreamer pipelines and how to re-build the design, please refer to the “**FMC-MULTI-CAM4 reVISION 2018.2 Tutorial**”, available on-line.

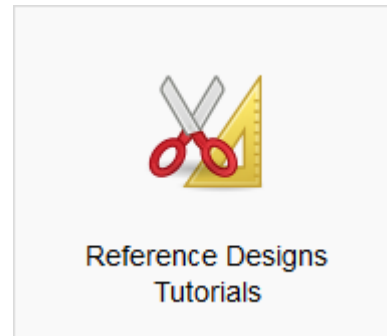
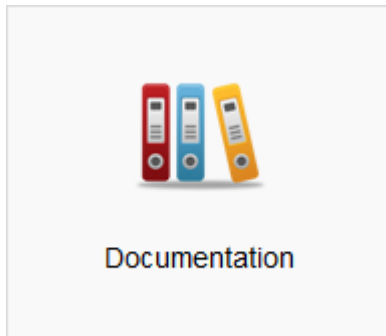
## Appendix I: Getting Support

### Avnet Support

- Technical support is offered online through the [ultrazed.org](http://ultrazed.org) website support forums. Avnet dev kit users are encouraged to participate in the forums and offer help to others when possible.  
<http://ultrazed.org/forums/zed-english-forum>  
<http://ultrazed.org/forums/software-application-development>



- For questions regarding the community website, please direct questions to the ultrazed.org Web Master ([webmaster@ultrazed.org](mailto:webmaster@ultrazed.org)).
- To access the most current collateral for the Avnet dev kits, visit the community support page ([www.ultrazed.org/content/support](http://www.ultrazed.org/content/support)) and click one of the icons shown below:



## Xilinx Support

For questions regarding products within the Product Entitlement Account, send an email message to the Customer Service Representative in your region:

- Canada, USA and South America - [isscs\\_cases@xilinx.com](mailto:isscs_cases@xilinx.com)
- Europe, Middle East, and Africa - [eucases@xilinx.com](mailto:eucases@xilinx.com)
- Asia Pacific including Japan - [apaccase@xilinx.com](mailto:apaccase@xilinx.com)

For technical support, including the installation and use of the product license file, contact Xilinx Online Technical Support at [www.xilinx.com/support](http://www.xilinx.com/support). The following assistance resources are also available on the website:

- Software, IP and documentation updates
- Access to technical support Web tools
- Searchable answer database with over 4,000 solutions
- User forums



## Revision History

Date	Version	Revision
27 Aug 2018	2018.2.01	Initial Release
04 Sep 2018	2018.2.02	Change instructions with separate download link.