

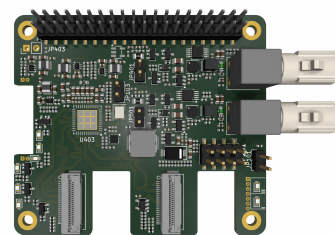
GMSL2 Camera HAT for Raspberry Pi

Brechel Electronic

Industrial Interface Solutions

Designed by Philipp Brechel (Germany)

www.be-iis.eu | www.github.com/be-iis



Document ID: BE-IIS-GMSL2-2CAM_RevA_Datasheet

Revision: Rev. A

Date: June 30, 2026

Document Status: in development

Product Status: In development

GMSL2 enables high-speed camera links over a single automotive cable, allowing image sensors to be placed remotely from the processing unit.

This HAT enables the connection of two GMSL2 camera to a Raspberry Pi using a dedicated GMSL2 deserializer and CSI-2 video output.

Key Features

- Dual GMSL2 camera input
- MAX96716 GMSL2 deserializer
- Raspberry Pi CSI interface compatible
- Single and Dual HAT Operation
- Multiple Camera Power Supply Voltages
- PoC Filter and Protection
- Rosenberger FAKRA connector
- RoHS compliant
- Quality component suppliers

Product Description

The HAT connects to CSI port 1 and 2 of the Raspberry Pi, or compatible CSI-2 interface of another single-board computer.

Configuration and control are handled via the I2C interface on the 40-pin header.

Applications

- GMSL2 camera evaluation
- Automotive camera prototyping
- Industrial vision evaluation
- Raspberry Pi based video capture
- Sensor and imager bring-up
- Education and laboratory use
- Stereo Camera Evaluation

Contents

1	Introduction	3
1.1	General	3
1.2	Raspberry Pi Compatibility	3
1.3	HAT Compatibility Level	4
2	Hardware Configuration	5
2.1	Main Features	5
2.2	Power Supply	7
2.2.1	Main Power Supply	7
2.3	Power Supply	7
2.3.1	Main Power Supply	7
2.3.2	Supplementary Power Supplies	7
2.3.3	Camera Power Supply	7
2.3.4	Camera Power Supply Monitoring	8
2.4	GMSL2	8
2.4.1	MAX96714 Deserializer	8
2.4.2	CFG0 Configuration	8
2.4.3	CFG1 Configuration	8
2.4.4	Reset	8
2.4.5	MIPI CSI-2 Interface	9
2.4.6	I2C Interface	9
2.5	Connectors	9
2.5.1	FAKRA Connector	9
2.5.2	Power Connector	9
2.5.3	40-Pin Header	9
2.6	Device Identification	9
2.7	Housing and Outline	10
3	References	10
4	Revision History	10
	Company Information	11

1 Introduction

1.1 General

The BE-IIS-GMSL2-1CAM is a Raspberry Pi HAT compliant camera interface board for connecting two GMSL2 camera to a Raspberry Pi or to another compatible single-board computer.

GMSL2 enables high-speed camera links over a single automotive cable, allowing image sensors to be placed remotely from the processing unit. This makes the board suitable for evaluation, prototyping, industrial vision systems, and test setups where camera placement and processing hardware must be physically separated.

The board integrates a dedicated GMSL2 deserializer [1] and provides up to two CSI-2 video outputs for the host system. The CSI-2 interface can be connected to CSI port 1 and CSI port 2 of the Raspberry Pi, or to a compatible CSI-2 input of another single-board computer.

The camera-side power supply is routed through a Power-over-Coax filter and protection circuit. Multiple camera supply voltage options are supported, allowing the board to be adapted to different GMSL2 camera modules.

Configuration and control are handled via the I2C interface on the CSI-Connector. The I2C connection provides access to the deserializer and, depending on the connected camera system, to the remote serializer and image sensor configuration path. The 40-Pin header is just used for +5V Supply.

The BE-IIS-GMSL2-2CAM is intended for GMSL2 camera evaluation, rapid prototyping, software bring-up, industrial vision testing, and Raspberry Pi or SBC based camera development. ““tex

1.2 Raspberry Pi Compatibility

The board follows the Raspberry Pi HAT+ mechanical and electrical interface concept. Compatibility depends on the selected Raspberry Pi model, operating system architecture, enabled interfaces, and the installed BE-IIS software configuration.

Model	32-bit	64-bit
Raspberry Pi 2	×	×
Raspberry Pi 3	×	×
Raspberry Pi 4	×	×
Raspberry Pi 5	✓	✓
Raspberry Pi Zero	×	×
Raspberry Pi Zero 2 W	×	×

Table 1: Raspberry Pi compatibility

Note: Compatibility depends on the installed operating system, kernel version and enabled interfaces.““

1.3 HAT Compatibility Level

Table 2 describes the HAT compatibility level of the board.

Level	Description	Support	Configuration
HAT	The board can be used as a standard Raspberry Pi HAT.	✓	Standard Raspberry Pi HAT form factor
HAT+	The board supports the Raspberry Pi HAT+ auto-detection mechanism.	✗	HAT+ EEPROM populated; connected to the I2C interface of the CSI connector
HAT++	The board supports detection and stackable operation according to the BE-IIS HAT++ specification.	✗	HAT++ stack detection is not implemented; the board is designed to operate alongside HAT++ boards

Table 2: HAT compatibility level

2 Hardware Configuration

2.1 Main Features

The BE-IIS-GMSL2-2CAM enables the connection of two GMSL2 camera to a Raspberry Pi or compatible single-board computer.

It allows remote camera placement by separating the image sensor from the processing unit while using a single automotive cable for the high-speed camera link.

The board integrates a dedicated GMSL2 deserializer and converts the incoming camera links to up to two CSI-2 video interface for the host system. The CSI-2 output can be connected to CSI port 1 and CSI port 2 of the Raspberry Pi, or to a compatible CSI-2 input of another SBC.

Power is supplied either through the 40-pin Raspberry Pi header.

Configuration and control are performed via the I2C interface provided on the CSI-2 connector.

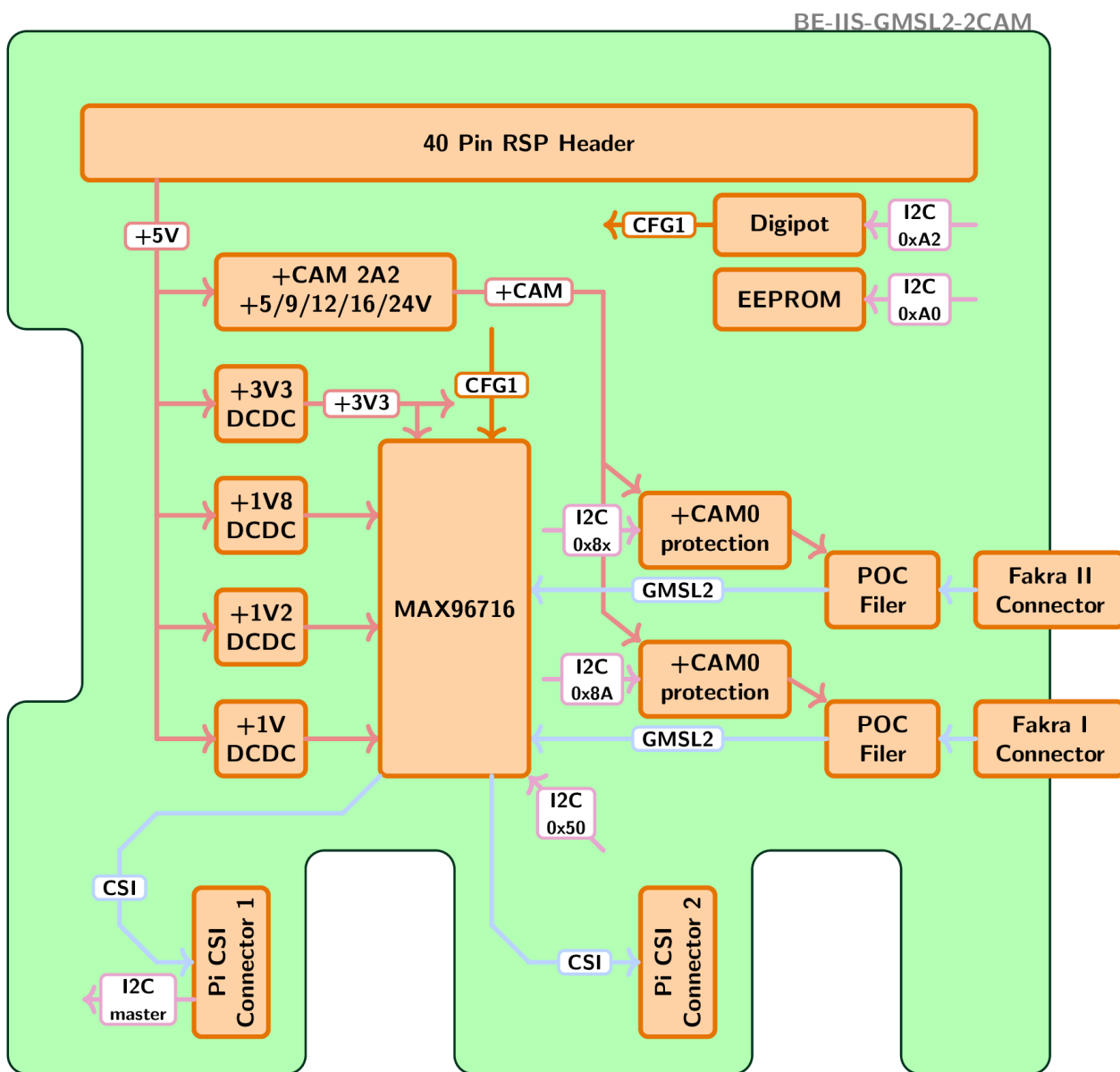


Figure 1: BE-IIS-GMSL2-1CAM block diagram

GMSL2 Deserializer

- Supplier: Analog Devices
- MAX96716 high-speed link deserializer with dual GMSL input
- CFG0: fixed to I2C target address 0x50
- CFG1: configured by digital potentiometer
- 25MHz crystal

I2C Interface

- I2C interface provided by the CSI connector
- Hardware detection by EEPROM
- Hardware configuration by digipot
- Monitoring by voltage and current monitor

PoC: Power over Coax

- Integrated PoC filter
- Supports currents up to 1,A
- Supports input voltages from 5,V to 24,V

Camera Power Supply

- Supports currents up to 1,A
- Default output voltage: 5.5,V
- Selectable by jumper: 9,V, 12,V, 16,V, or 24,V

Monitoring

- Optional configuration by jumper setting
- Defined voltage and current monitoring ranges
- Power-off in case of overvoltage or overcurrent

Configuration

- Digital configuration by digital potentiometer
- Supports volatile and persistent configuration options

2.2 Power Supply

2.2.1 Main Power Supply

2.3 Power Supply

2.3.1 Main Power Supply

The main power supply of the HAT is designed for a nominal input voltage of 5,V. The estimated power consumption of a dual deserializer configuration is based on the following assumptions:

- Dual GMSL2 deserializer: approx. 2.2,W
- Two connected cameras: approx. 2,W each

For design margin, the HAT power input is specified for 5,V / 1.5,A minimum. A higher current capability is recommended if additional peripherals, losses, or future design variants have to be supported.

2.3.2 Supplementary Power Supplies

The board provides dedicated DC/DC converters for the supplementary power supplies. These converters are enabled when the 3.3,V supply on the CSI flex cable is active.

The following supply rails are provided:

- 1.0,V / 1,A: core supply for the GMSL2 deserializer
- 1.2,V / 1,A: supply rail for the GMSL2 deserializer
- 1.8,V / 1,A: supply rail for the GMSL2 deserializer
- 3.3,V / 1,A: I/O voltage supply

2.3.3 Camera Power Supply

The BE-IIS-GMSL2-2CAM provides a dedicated DC/DC boost converter for the camera power supply. The default camera supply voltage is 5.5,V. Additional output voltages can be selected by jumper configuration.

- 5.5,V: default configuration
- 9.5,V: Jumper 1
- 12.5,V: Jumper 2
- 16.5,V: Jumper 3
- 24,V: Jumper 4

Never apply more than one Jumper!

The maximum output current is 2.2,A.

The jumper reference designator is JP201.

The boost converter is enabled by pin 17 of the CSI connector. By default, the camera power supply is disabled.

2.3.4 Camera Power Supply Monitoring

An INA226 [2] monitors the camera supply voltage and current.

The voltage and current limits can be configured by software, for example by using a Device Tree overlay entry. If one of the configured limits is exceeded, the alert pin is asserted. The alert pin can be monitored by Linux.

If jumper JP401 is fitted, the alert signal also controls a high-side switch and disconnects the camera power supply in case of an overvoltage or overcurrent condition.

Depending on the selected operating mode, the camera power supply either remains disabled after a fault condition or is automatically enabled again after the hardware filter has discharged. The typical recovery time is approximately 1,s.

2.4 GMSL2

2.4.1 MAX96714 Deserializer

The GMSL2 deserializer is implemented with a MAX96716 device.

- Reference designator: U103
- Type: MAX96714

2.4.2 CFG0 Configuration

CFG0 is pulled to GND by a 10 k Ω resistor to force I2C mode and set the I2C target address to 0x50.

As an assembly option, a digital potentiometer can be used to adjust the CFG0 level flexibly and volatile.

- Reference designator: U106
- Type: TPL0102
- Channel 0: CFG0

2.4.3 CFG1 Configuration

CFG1 can be configured by a digital potentiometer to adjust the CFG1 level flexibly and volatile.

- Reference designator: U106
- Type: TPL0102
- Channel 1: CFG1

2.4.4 Reset

The reset signal is controlled by a hardware filter and pin 18 of the CSI connector.

If pin 18 is left open, the reset signal is generated by the onboard RC filter.

2.4.5 MIPI CSI-2 Interface

The MIPI CSI-2 output of the deserializer is connected to the CSI port of the Raspberry Pi or compatible SBC.

The pinout follows the Raspberry Pi 5 CSI connector specification.

2.4.6 I2C Interface

The I2C interface is connected to MFP3 as SDA and MFP4 as SCL.

As an assembly option, the pass-through I2C connection can be populated to provide access to the remote serializer and camera-side devices.

The I2C bus is pulled up with 3.3 k Ω resistors.

2.5 Connectors

2.5.1 FAKRA Connector

The GMSL2 camera link uses a FAKRA connector.

- Supplier: Rosenberger
- MPN: 59S22B-40MT5-Z
- Coding: uncoded / blue

2.5.2 Power Connector

The external power input uses a 3-pin terminal block with 3.5,mm pitch.

- Supplier: Phoenix Contact, Würth Elektronik, or compatible
- Pitch: 3.5,mm
- Example MPN: PT 1,5/3-3,5-H
- Coding: no coding

2.5.3 40-Pin Header

The 40-pin header follows the Raspberry Pi header specification.

Only the power pins are used by the BE-IIS-GMSL2-2CAM.

- Used: 5,V
- Used: GND
- Remaining pins: not connected

2.6 Device Identification

The EEPROM is connected to the I2C bus of the CSI connector.

The board does not support the standard Raspberry Pi HAT+ auto-detection mechanism, because the EEPROM is not connected to the HAT ID EEPROM interface of the 40-pin header.

Instead, device identification can be performed by probing the EEPROM on the CSI I2C bus. If the EEPROM is detected, the corresponding overlay can be applied by software. After a reboot, the overlay becomes active.

- EEPROM I2C address: 0x50
- 8-bit EEPROM address notation: 0xA0

2.7 Housing and Outline

The BE-IIS-GMSL2-1CAM is mechanically compliant with the Raspberry Pi HAT specification [7].

The board can be used as a standard HAT by plugging it onto the 40-pin header of a Raspberry Pi 5 or compatible SBC.

If the HAT and the Raspberry Pi or SBC are powered independently, the 40-pin header connection is not required. This allows flexible mechanical arrangements, such as placing the boards next to each other or mounting the Raspberry Pi above the HAT.

For operation, the BE-IIS-GMSL2-1CAM only requires a connection to a compatible CSI-2 port of the host system.

3 References

1. Analog Devices MAX96716 Datasheet
2. TI INA226 Datasheet
3. BE-IIS Installer (Software and Setup Tools)
4. Raspberry Pi HAT+ Specification
5. Schematic, PCB-Viewer, BOM, 3D-Model
6. Power over Dataline extension board
7. Raspberry Pi HAT+ Specification

4 Revision History

Revision	Date	Description
A.00	2026-06-28	Initial draft

Company Information

Manufacturer

BE-IIS welcomes technical feedback, suggestions and improvement ideas. Business inquiries, cooperation requests and distribution opportunities are welcome.

Name	Philipp Brechel
Company	Brechel Electronic
Business	Industrial Interface Systems
Address	Hindenburgstraße 100/1 73207 Plochingen, Germany

Contact

Email	contact@be-iis.eu
Web	www.be-iis.eu
GitHub	github.com/be-iis
LinkedIn	linkedin.com/in/brechel
Digikey	https://www.digikey.de/de/supplier-centers/industrial-interface-solutions
Languages	German and English
