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DATA SHEET

SV4E-CPRXG

MIPI C-PHY Frame Grabber

E SERIES



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Introduction

OVERVIEW

The SV4E-CPRXG MIPI C-PHY Frame Grabber is a flexible solution for capturing and analyzing MIPI® Alliance CSI-2SM sensor data. It can be attached to any CSI-2 camera output or radar output, and it will automatically extract image data and provide for automated application development, calibration, and regression testing. The SV4E-CPRXG's unique analog front-end technology for the MIPI Alliance C-PHYSM physical layer means that users can achieve high-confidence sensor validation without worrying about physical attachment issues.

KEY FEATURES

- **C-PHY Physical Layer:** monolithic receiver with integrated LP/HS signaling and support for symbol rates up to 3.5 Gsps
- **CSI-2 Controller:** support for all CSI-2 data types and pixel formats, including RAW16 and RAW20
- **Virtual Channels:** automatic extraction of all virtual channels supported by the CSI-2 standard
- **I2C and I3C Master:** dual-mode I2C/I3C master for controlling sensors and providing true host-emulation capability
- **Diagnostics:** built-in frame-rate and CRC monitors

KEY BENEFITS

- **Self-Contained:** an all-in-one system reduces bench space and helps create very compact regression farms
- **Flexible:** live streaming mode helps with manual sensor setup, and bulk capture mode helps with automation
- **Automated:** leverages the full power of Python and Introspect's award-winning software, Pinetree
- **Future Proof:** high-performance receiver that is upgradable – within the same hardware – to include packet and protocol analysis

PHYSICAL CONNECTIONS

Photographs showing the ports and connectors on the SV4E-CPRXG are shown in Figure 1(a) and (b). The physical connection of a typical Device Adapter Board (DAB) is shown in Figure 1(c). The DAB provides the connection to the desired customer DUT.

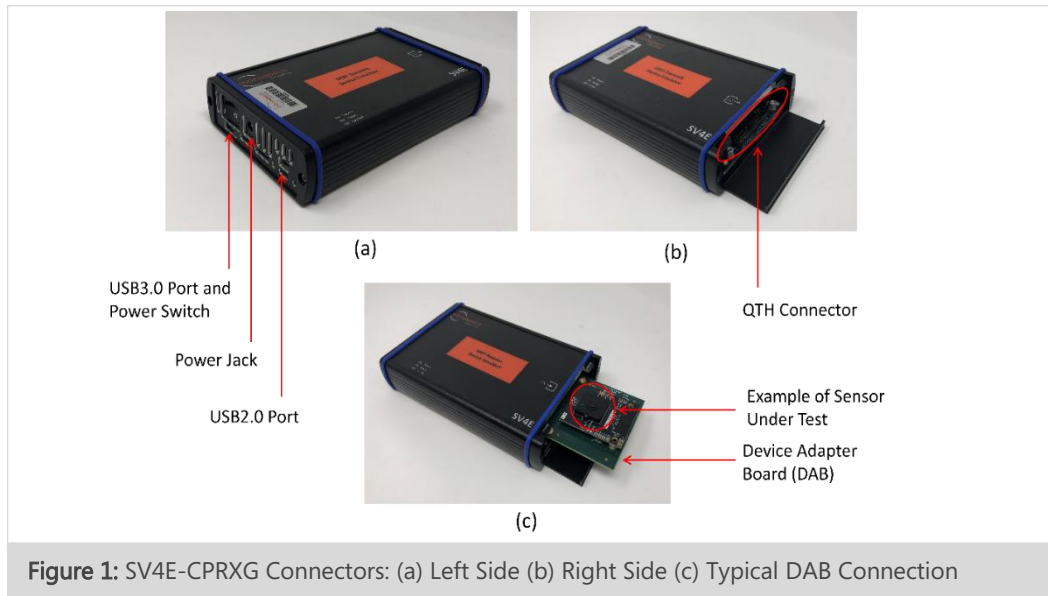


Figure 1: SV4E-CPRXG Connectors: (a) Left Side (b) Right Side (c) Typical DAB Connection

QTH / QSH CONNECTOR

The SV4E-DPRXG has a 120 pin, high-speed connector for all inputs and outputs, with part number Samtec QTH-060-01-L-D-A.

<https://www.samtec.com/products/qth>

This part is designed to mate to a high-speed connector on the customer adapter board, using the following part number: Samtec QSH-60-01-L-D-A.

<https://www.samtec.com/products/qsh>

For information on QTH signals and connections, please refer directly to the SV4E-CPRX Device Adapter Board Reference Design Guide, as listed in "Additional Documentation" on the following page.

ADDITIONAL DOCUMENTATION

SV4E-CPRX Device Adapter Board (DAB) Reference Design Guide

- **EN-G047E-E-22216** SV4E-CPRX Device Adapter Board (DAB) Reference Design Guide Reference document for QTH / QSH pinout and general board design guidelines.

SV4E-CPRX SMPM Adapter Board Device Reference Design Guide

- **EN-G049E-E-20086** SMPM Adapter Board Device Reference Design Guide Reference document for interfacing directly to an SV4E adapter board with SMPM connectors, recommended for C-PHY performance at 3.5 Gbps.

SV4E-CPRX DAB Design Files.zip

- Includes reference schematic, layout and CAD files for an example DAB. Please contact Introspect Technology

ORDERING INFORMATION

TABLE 1: ITEM NUMBERS FOR THE SV4E-CPRXG

PART NUMBER	NAME	KEY DIFFERENTIATORS
5624	SV4E-CPRXG MIPI C-PHY Frame Grabber	Rapid capture of CSI-2 frames

Specifications

TABLE 2: GENERAL SPECIFICATIONS

PARAMETER	VALUE	UNITS	DESCRIPTION AND CONDITIONS
Application / Protocol			
Physical Layer Interface	C-PHY		
MIPI Protocol	CSI-2 v1.3 CSI-2 v2.0		
LS/HS Handling	Automatic		
Ports			
Number of C-PHY Receiver Trios	3		
Number of GPIO pins	16		
Pre-Defined GPIO pins	5		SV4E RESET (input) I2C / I3C Bus (SCL, SDA, master only) FRAME_START (output) LINE_START (output)
User-Defined GPIO	11		Configurable, input or output, for use as triggers or flags
Programmable On-Board Power Supplies	6		
Connections to PC for Pinetree Control	2		USB2 and USB3
Power Consumption			
DC Input Voltage	12	V	
Maximum Current Draw	TBD	A	
Symbol Rates / Frame Rates			
Minimum Symbol Rate	39.0625	Mbps	Per Trio
Maximum Symbol Rate	3.525	Gbps	Per Trio
Minimum LP Toggle Rate	0	MHz	
Maximum LP Toggle Rate	20	MHz	

TABLE 3: C-PHY RECEIVER CHARACTERISTICS

PARAMETER	VALUE	UNITS	DESCRIPTION AND CONDITIONS
Input Coupling			
Input Impedance	50	ohm	HS transmission
	Hi-Z		LP transmission
HS / LP Voltage			
Minimum V _{OD} Weak	90	mV	Measured at SV4E module connector
Maximum V _{OD} Strong	300	mV	Measured at SV4E module connector
Minimum Programmable LP Threshold	0	mV	
Maximum Programmable LP Threshold	1200	mV	
Timing			
Minimum TLPX	50	ns	
Minimum T3-PREPARE	38	ns	
Minimum T3-PREBGIN	28	symbols	
Minimum T3-POST	7	symbols	

TABLE 4: GPIO CHARACTERISTICS

PARAMETER	VALUE	UNITS	DESCRIPTION AND CONDITIONS
Voltage			
Voltage Level	1.8	V	All GPIOs operate at 1.8 V LVCMOS
V _{IL} minimum	-0.3	V	
V _{IL} maximum	0.7	V	
V _{IH} minimum	1.5	V	
V _{IH} maximum	2.2	V	
V _{OL} maximum	0.4	V	
V _{OH} minimum	1.7	V	

TABLE 5: I3C BUS SPECIFICATION

PARAMETER	VALUE	UNITS	DESCRIPTION AND CONDITIONS
General Performance			
Voltage Level	2.5	V	
Maximum Open Drain Data Rate	4.0	MHz	
Maximum Push Pull Data Rate	12	MHz	
SDA Setup Time Range	1.0	UI	Specification for timing from SCL falling edge to the following SDA edge. See Figure 2 below.
Independent SDA Setup Timing	Yes		SDA setup can be set independently for I3C Open Drain, I3C Push Pull, and I2C operation.

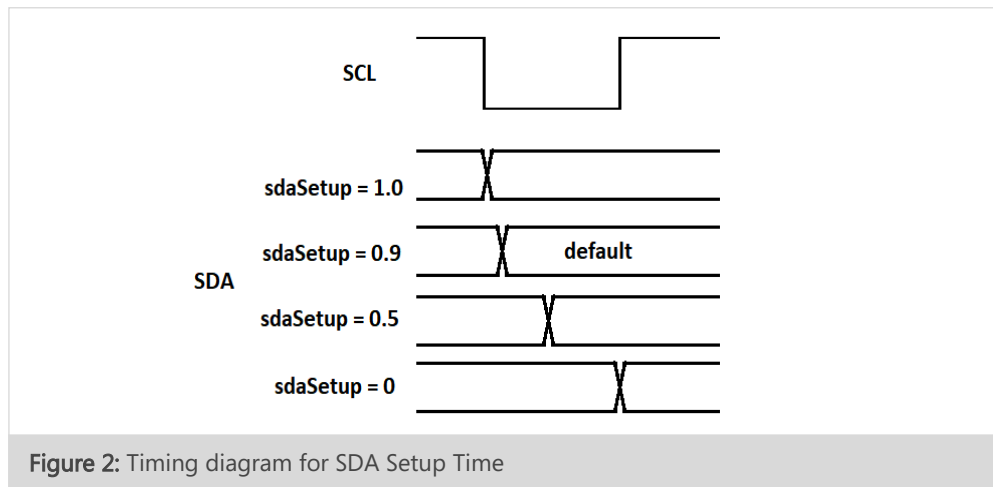


Figure 2: Timing diagram for SDA Setup Time

TABLE 6: PROGRAMMABLE POWER SUPPLY SPECIFICATION

PARAMETER	VALUE	UNITS	DESCRIPTION AND CONDITIONS
General Performance			
Number of Programmable Power Supplies	6		Each supply programmed independently.
Minimum Voltage	1000	mV	
Maximum Voltage	5000	mV	
Voltage Programming Resolution	1	mV	
Maximum Output Current	3.0	A	
Current Measurement Capability	Yes		Independent measurement provided on each programmable supply.
Minimum Current Measurement	50	mA	
Current Measurement Resolution	4	mA	

TABLE 7: PATTERN HANDLING CHARACTERISTICS

PARAMETER	VALUE	UNITS	DESCRIPTION AND CONDITIONS
Features			
Supported Formats	RAW, RGB, YUV		RAW6, RAW7, RAW8, RAW10, RAW12, RAW14, RAW16, RAW20, RGB444, RGB555, RGB565, RGB666, RGB888, YUV420, YUV422
Virtual Channel Support	Yes		
Packet Error Checking Support	Yes		CRC, ECC
Memory Depth	1	GByte	For received packet data
Streaming Support	Yes		Allows live streaming of captured image frames.
Bulk Capture Support	Yes		Allows capture of consecutive image frames.



Revision Number	History	Date
1.0	Document Release.	May 15, 2020
1.1	Updates to QSH/QTH connectors and GPIO voltage specifications	August 4, 2022
1.2	Updated QSH part number and references to Pinetree	August 28, 2023

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