



DATA SHEET

# SV4E-DPRXG

MIPI D-PHY Frame Grabber

E SERIES



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# Introduction

## OVERVIEW

The SV4E-DPRXG MIPI D-PHY Frame Grabber is a flexible solution for capturing and analyzing MIPI® Alliance CSI-2<sup>SM</sup> 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-DPRXG's unique analog front-end technology for the MIPI Alliance D-PHY<sup>SM</sup> physical layer means that users can achieve high-confidence sensor validation without worrying about physical attachment issues.

## KEY FEATURES

- **D-PHY Physical Layer:** monolithic receiver with integrated LP/HS signaling and support for data rates up to 3.5 Gbps
- **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 the award-winning Introspect ESP Software
- **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-DPRXG 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.

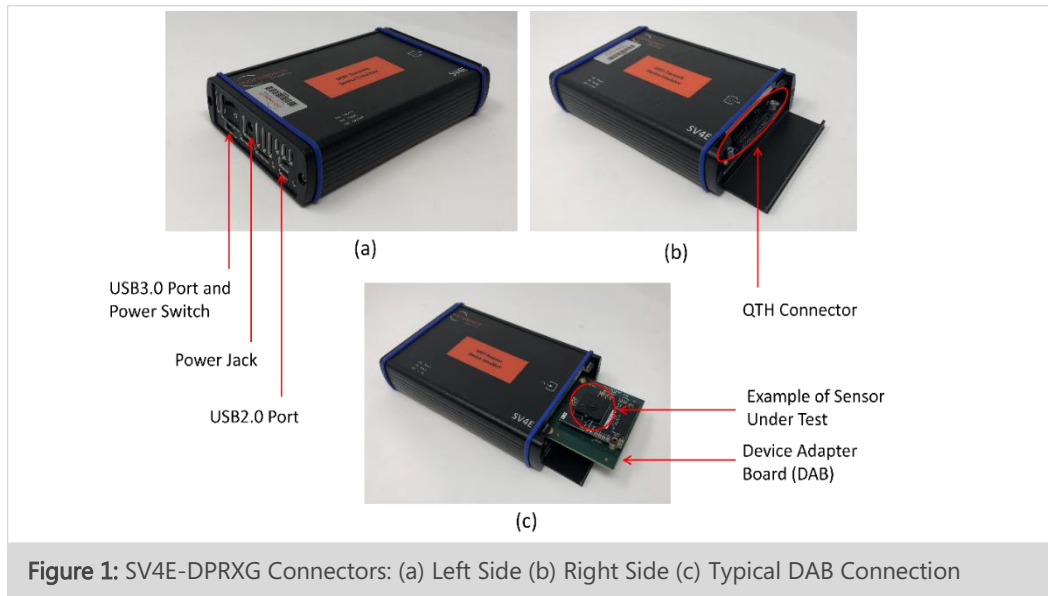


Figure 1: SV4E-DPRXG Connectors: (a) Left Side (b) Right Side (c) Typical DAB Connection

## QTH / QSH CONNECTOR

The SV4E-DPRXG has an 80 pin, high speed connector for all inputs and outputs, with part number Samtec QTH-040-01-L-D-DP-A.

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

This part is designed to mate to a high speed connector on the customer adapter board, using the following part number: Samtec QSH-040-01-L-D-DP-A

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

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

## ADDITIONAL DOCUMENTATION

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

- **EN-G046E-E-20085** SV4E-DPRX Device Adapter Board (DAB) Reference Design Guide Reference document for QTH / QSH pinout and general board design guidelines.

SV4E-DPRX 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-DPRXG

PART NUMBER	NAME	KEY DIFFERENTIATORS
5625	SV4E-DPRXG MIPI D-PHY Frame Grabber	Rapid capture of CSI-2 frames

## Specifications

TABLE 2: GENERAL SPECIFICATIONS

PARAMETER	VALUE	UNITS	DESCRIPTION AND CONDITIONS
<b>Application / Protocol</b>			
Physical Layer Interface	D-PHY		
MIPI Protocol	CSI-2 v1.3 CSI-2 v2.0		
LS/HS Handling	Automatic		
<b>Ports</b>			
Number of DPHY Receiver Lanes	4		4 data lanes plus 1 clock
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 Introspect ESP Software Control	2		USB2 and USB3
<b>Power Consumption</b>			
DC Input Voltage	12	V	
Maximum Current Draw	1.5	A	
<b>Data Rates / Frame Rates</b>			
Minimum Data Rate	80	Mbps	Per Lane
Maximum Data Rate	3.5	Gbps	Per Lane
Minimum LP Toggle Rate	0	MHz	
Maximum LP Toggle Rate	20	MHz	

TABLE 3: DPHY RECEIVER CHARACTERISTICS

PARAMETER	VALUE	UNITS	DESCRIPTION AND CONDITIONS
<b>Input Coupling</b>			
Input Impedance	50	ohm	HS transmission
	Hi-Z		LP transmission
<b>HS / LP Voltage</b>			
Minimum $ V_{OD} $	140	mV	Measured at SV4E module connector
Maximum $ V_{OD} $	300	mV	Measured at SV4E module connector
Minimum Programmable LP Threshold	0	mV	
Maximum Programmable LP Threshold	1200	mV	
<b>Timing</b>			
Minimum $T_{LPX}$	50 ns		
Minimum $T_{HS-PREPARE}$	40 ns + 4 UI		
Minimum $T_{HS-PREPARE} + T_{HS-ZERO}$	145 ns + 10 UI		
Minimum $T_{HS-TRAIL}$	Larger of: (60 ns + 4 UI) or 8 UI		
Minimum $T_{CLK-PREPARE}$	38 ns		
Minimum $T_{CLK-PREPARE} + T_{HS-ZERO}$	300 ns		
Minimum $T_{CLK-PRE}$	8 UI		
Minimum $T_{CLK-POST}$	60 ns + 52 UI		
Minimum $T_{CLK-TRAIL}$	60 ns		

TABLE 4: GPIO CHARACTERISTICS

PARAMETER	VALUE	UNITS	DESCRIPTION AND CONDITIONS
<b>Voltage</b>			
Voltage Level	2.5	V	All GPIOs operate at 2.5 V LVCMOS
V <sub>IL</sub> minimum	-0.3	V	
V <sub>IL</sub> maximum	0.7	V	
V <sub>IH</sub> minimum	1.7	V	
V <sub>IH</sub> maximum	3.3	V	
V <sub>OL</sub> maximum	0.4	V	
V <sub>OH</sub> minimum	2.0	V	

TABLE 5: I3C BUS SPECIFICATION

PARAMETER	VALUE	UNITS	DESCRIPTION AND CONDITIONS
<b>General Performance</b>			
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 on the following page.
Independent SDA Setup Timing	Yes		SDA setup can be set independently for I3C Open Drain, I3C Push Pull, and I2C operation.



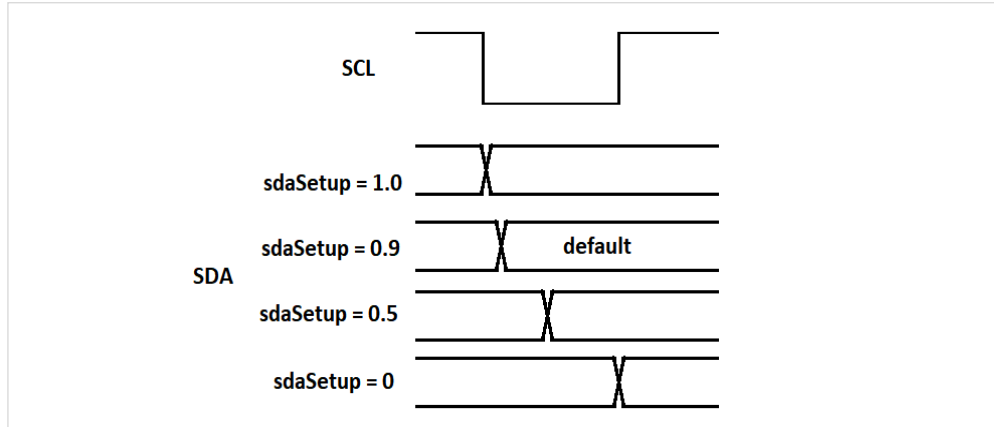


Figure 2: Timing diagram for SDA Setup Time

TABLE 6: PROGRAMMABLE POWER SUPPLY SPECIFICATION

PARAMETER	VALUE	UNITS	DESCRIPTION AND CONDITIONS
<b>General Performance</b>			
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
<b>Features</b>			
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.



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1.0	Document Release.	September 25, 2020

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