REFERENCE DESIGN GUIDE

SV4E-SLVSEC

16-Lane, 6.5 Gbps SLVS-EC Protocol Analyzer

E SERIES

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INTROSPECT.CA

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Introduction

OVERVIEW

The **SV4E-SLVSEC 16-Lane, 6.5 Gbps Protocol Analyzer** is a highly integrated packet and protocol analyzer that enables the development, debugging, and testing of image sensor and camera systems based on the Scalable Low Voltage Signaling Embedded Clock (SLVS-EC) Version 2.0 protocol. This document provides the information required to interface the SV4E to an image sensor device under test. Each of the SV4E ports is described in detail, including physical connectors, pinouts, and cabling considerations. Device dimensions for creating test fixtures are also provided.

Ports and Connectors

PHYSICAL CONNECTIONS

For benchtop applications, the SV4E is enclosed in external casing as shown in Figure 1. All of the SV4E ports and connectors are accessible on the left and right sides of the module, as shown in Figure 1(a) and (b).

Figure 1: SV4E ports and connectors: (a) USB and power (b) High and low speed connectors.

For ATE applications where the external casing of the SV4E may not be required, ports may be directly accessed at the circuit board level. The top view of the SV4E and port reference designators are shown in Figure 2. The following sections provide design details and pinout information for each of the ports.

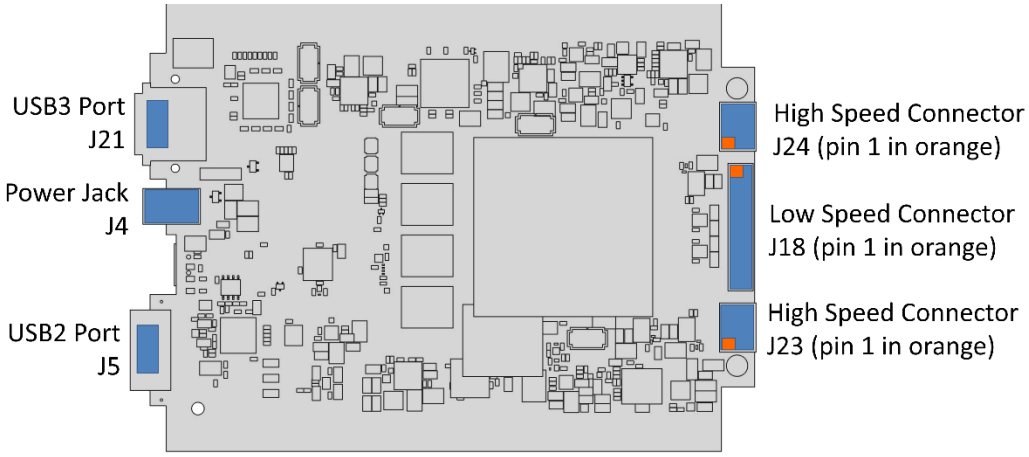


Figure 2: SV4E-SLVSEC top view, with ports locations and reference designators (for ATE applications only).

HIGH SPEED CONNECTORS (J23 AND J24)

The SV4E has two 26 pin high speed connectors for SLVS-EC inputs. These connectors provide 16 lanes of SLVS-EC data at a maximum bandwidth of 6.5 Gbps. The two board connectors (J23 and J24) have the following manufacturer's part number:

J23 and J24 connectors: **Samtec Accelerate ARF6–08–L–D–A**

https://www.samtec.com/products/arf6

and are designed to mate with the following cable type:

Cable: **Samtec Accelerate ARC6-08**

https://www.samtec.com/products/arc6

The pinout for the high speed signals are given in Table 1 and Table 2.

TABLE 1: J23 HIGH SPEED SIGNAL PINOUT

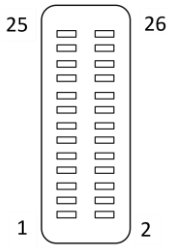
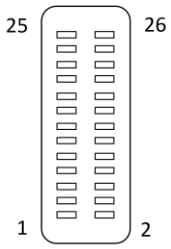
FOOTPRINT	PINS	SIGNAL NAME	DESCRIPTION	PINS	SIGNAL NAME	DESCRIPTION
ARF6-08-L-D-A SV4E top view (Refer to Figure 2 for orientation) 	1	GND	Ground	2	GND	Ground
	3	RX_0_P	RX Lane 0 Positive	4	RX_1_P	RX Lane 1 Positive
	5	RX_0_N	RX Lane 0 Negative	6	RX_1_N	RX Lane 1 Negative
	7	GND	Ground	8	GND	Ground
	9	RX_2_P	RX Lane 2 Positive	10	RX_3_P	RX Lane 3 Positive
	11	RX_2_N	RX Lane 2 Negative	12	RX_3_N	RX Lane 3 Negative
	13	GND	Ground	14	GND	Ground
	15	RX_4_P	RX Lane 4 Positive	16	RX_5_P	RX Lane 5 Positive
	17	RX_4_N	RX Lane 4 Negative	18	RX_5_N	RX Lane 5 Negative
	19	GND	Ground	20	GND	Ground
	21	RX_6_P	RX Lane 6 Positive	22	RX_7_P	RX Lane 7 Positive
	23	RX_6_N	RX Lane 6 Negative	24	RX_7_N	RX Lane 7 Negative
	25	GND	Ground	26	GND	Ground

TABLE 2: J24 HIGH SPEED SIGNAL PINOUT

FOOTPRINT	PINS	SIGNAL NAME	DESCRIPTION	PINS	SIGNAL NAME	DESCRIPTION
ARF6-08-L-D-A SV4E top view (Refer to Figure 2 for orientation) 	1	GND	Ground	2	GND	Ground
	3	RX_8_P	RX Lane 8 Positive	4	RX_9_P	RX Lane 9 Positive
	5	RX_8_N	RX Lane 8 Negative	6	RX_9_N	RX Lane 9 Negative
	7	GND	Ground	8	GND	Ground
	9	RX_10_P	RX Lane 10 Positive	10	RX_11_P	RX Lane 11 Positive
	11	RX_10_N	RX Lane 10 Negative	12	RX_11_N	RX Lane 11 Negative
	13	GND	Ground	14	GND	Ground
	15	RX_12_P	RX Lane 12 Positive	16	RX_13_P	RX Lane 13 Positive
	17	RX_12_N	RX Lane 12 Negative	18	RX_13_N	RX Lane 13 Negative
	19	GND	Ground	20	GND	Ground
	21	RX_14_P	RX Lane 14 Positive	22	RX_15_P	RX Lane 15 Positive
	23	RX_14_N	RX Lane 14 Negative	24	RX_15_N	RX Lane 15 Negative
	25	GND	Ground	26	GND	Ground

Please check the Samtec website listed previously for information on cable lengths and wiring options. The Introspect recommended part number is "ARC6-08-XX.X-LU-LU-3-1", where XX.X indicates the desired cable length.

IMPORTANT NOTE

All ARC6 cables currently offered by Samtec perform a **signal remapping** which must be accounted for in the load board design. The **"-3"** option listed in the recommended part number above maps pin 1 from one end of the cable to pin (N-1) on the other end of the cable. Please consult the Samtec ARC6 Accelerate catalogue for full design details.

LOW SPEED CONNECTOR (J18)

The SV4E has one 40 pin low speed connector, which provides 16 general purpose I/Os (GPIO) and 6 programmable power supplies. Each is described briefly below.

GPIO pins are provided for communications with DUTs, external devices, or other automated test equipment. The first five GPIOs on the SV4E are reserved, while the remaining 11 GPIOs are user-defined and may operate as either input or output. All pins operate at 1.8 V LVCMOS voltage levels. The pinout and descriptions for the 16 GPIO pins are given in Table 3 and Table 4.

Six programmable power supplies are provided for powering a DUT or for powering other external devices. The programmable range of these supplies is from 1.0V to 5.0V, in steps of 1 mV, with a maximum output current of 3.0 A for each supply. Both voltage programming and current monitoring are provided through the Pinetree software interface, and each supply may be programmed independently. The pinout for the programmable power supply pins is given in Table 3 later in this document.

The low speed board connector (J18) has the following manufacturer's part number:

J18 connector: **Samtec Tiger Eye TFM-120-02-L-D-WT**

https://www.samtec.com/products/tfm-120-02-l-d-wt

and is designed to mate with the following cable type:

Cable: **Samtec Tiger Eye SFSD-20-28-G**

https://www.samtec.com/products/sfsd

Please check the Samtec website listed above for information on cable lengths and cable wiring options. The Introspect recommended cable part number is "SFSD-20-28-G-XX.XX-DR-NDX", where XX.X indicates the desired cable length.

IMPORTANT NOTE 1

Several of the SFSD cable options offered by Samtec perform a signal remapping which must be accounted for in the load board design. Samtec part numbers with an "End 2 Option" of "**-NDX"**, as listed in the recommended part number above, do not require a signal remapping and for this reason the -NDX option is recommended. Please consult the Samtec Tiger Eye catalogue for additional information on pin mapping.

IMPORTANT NOTE 2

The SV4E low speed connector J18 includes side **retention latches** which provide extra connection stability. The retention latch is specified in the "End Option" of **-DR** as in the recommended cable part number.

The pinout for the low speed connector (J18) is given in Table 3, with additional information about the GPIO usage and descriptions provided Table 4.

TABLE 3: J24 LOW SPEED SIGNAL PINOUT

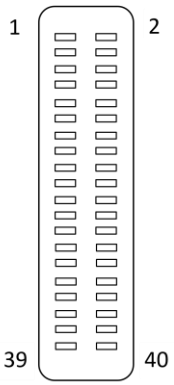
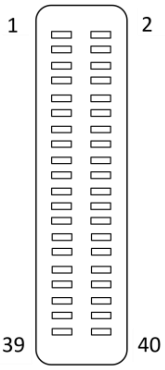
FOOTPRINT	PINS	SIGNAL NAME	DESCRIPTION	PINS	SIGNAL NAME	DESCRIPTION
TFM-120-02-L-D-WT SV4E top view (Refer to Figure 2 for orientation) 	1	GPIO_0	Refer to Table 4	2	GPIO_8	GPIO Pin 8
	3	GPIO_1	Refer to Table 4	4	GPIO_9	GPIO Pin 9
	5	GND	Ground	6	GND	Ground
	7	GPIO_2	Refer to Table 4	8	GPIO_10	GPIO Pin 10
	9	GPIO_3	Refer to Table 4	10	GPIO_11	GPIO Pin 11
	11	GND	Ground	12	GND	Ground
	13	GPIO_4	Refer to Table 4	14	GPIO_12	GPIO Pin 12
	15	GPIO_5	GPIO Pin 5	16	GPIO_13	GPIO Pin 13
	17	GND	Ground	18	GND	Ground
	19	GPIO_6	GPIO Pin 6	20	GPIO_14	GPIO Pin 14
	21	GPIO_7	GPIO Pin 7	22	GPIO_15	GPIO Pin 15
	23	GND	Ground	24	GND	Ground
	25	PV1_OUT	Programmable Voltage Supply 1	26	PV6_OUT	Programmable Voltage Supply # 6
	27	PV1_OUT	Programmable Voltage Supply # 1	28	PV6_OUT	Programmable Voltage Supply # 6
	29	GND	Ground	30	GND	Ground
	31	PV2_OUT	Programmable Voltage Supply # 2	32	PV5_OUT	Programmable Voltage Supply # 5
	33	PV2_OUT	Programmable Voltage Supply # 2	34	PV5_OUT	Programmable Voltage Supply # 5
	35	GND	Ground	36	GND	RX Lane 15 Positive
	37	PV3_OUT	Programmable Voltage Supply # 3	38	PV4_OUT	Programmable Voltage Supply # 4
	39	PV3_OUT	Programmable Voltage Supply # 3	40	PV4_OUT	Programmable Voltage Supply # 4

TABLE 4: SV4E GPIO ADDITIONAL PIN DESCRIPTIONS

FOOTPRINT	PINS	NAME	STATUS	I/O	DESCRIPTION
TFM-120-02-L-D-WT SV4E top view (Refer to Figure 2 for orientation) 	1	RESET_N	Reserved	I	SV4E reset pin, active low ("0" = reset, "1" = not in reset)
	3	USER I2C SCL	Reserved	O	General purpose I2C bus (SV4E is master)
	7	USER I2C SDA	Reserved	I/O	General purpose I2C bus (SV4E is master)
	9	FRAME_START/END	Reserved	O	Asserted to "1" on frame start Deasserted to "0" on frame end
	13	LINE_START/END	Reserved	O	Asserted to "1" on line start Deasserted to "0" on line end
	15	GPIO_5	User Configurable	I/O	Input or output
	19	GPIO_6	User Configurable	I/O	Input or output
	21	GPIO_7	User Configurable	I/O	Input or output
	2	GPIO_8	User Configurable	I/O	Input or output
	4	GPIO_9	User Configurable	I/O	Input or output
	8	GPIO_10	User Configurable	I/O	Input or output
	10	GPIO_11	User Configurable	I/O	Input or output
	14	GPIO_12	User Configurable	I/O	Input or output
	16	GPIO_13	User Configurable	I/O	Input or output
	20	GPIO_14	User Configurable	I/O	Input or output
	22	GPIO_15	User Configurable	I/O	Input or output

USB2 AND USB3 PORTS (J5 AND J21)

The SV4E has two USB ports for connection to a PC, shown previously in Figure 1 and Figure 2.

The USB2 port (J5) is a **USB2.0 mini B jack**, and the compatible USB 2.0 cable is provided with the SV4E module. The USB 2.0 connection is used for two purposes. It serves as the primary communication between the SV4E module and Pinetree during test execution, and it is also used for providing firmware updates for the SV4E module. Both functions are handled by the Pinetree software on the user PC.

The USB3 port (J21) is a **USB3.0 micro B jack**, and the compatible USB 3.0 cable is provided with the SV4E module. This USB connection is used for transferring large blocks of received image data from SV4E module to the PC. The typical transfer rate for image data is 350 MBytes/sec. Data transfer is handled automatically by Introspect software on the user PC.

POWER JACK (J4)

The SV4E receives power from a 12 V, 5.0 A adapter connected directly to the J4 power jack. The power jack is a barrel connector, and the required power supply adapter is provided with the module. The adapter is manufactured by CUI Inc, with part number **CUI SDI65-12-UC-P5.**

SV4E Device Dimensions

For bench applications, the SV4E is enclosed in a case, with dimensions of 6.3 inches (L) by 4.3 inches (W) by 1.3 inches (H).

For ATE applications where the external casing of the SV4E may not be required, please refer to Figure 3 on the following page. Note that the three holes shown may be used for mounting the SV4E to a test fixture.

Figure 4 shows the vertical profile of the SV4E, as viewed from the right side of the board (the high and low speed connector side). The high speed and low speed cable launch require additional vertical clearance above the module. A minimum clearance of 1.75 inches above the SV4E circuit board is recommended above both the high and low speed cable connections.

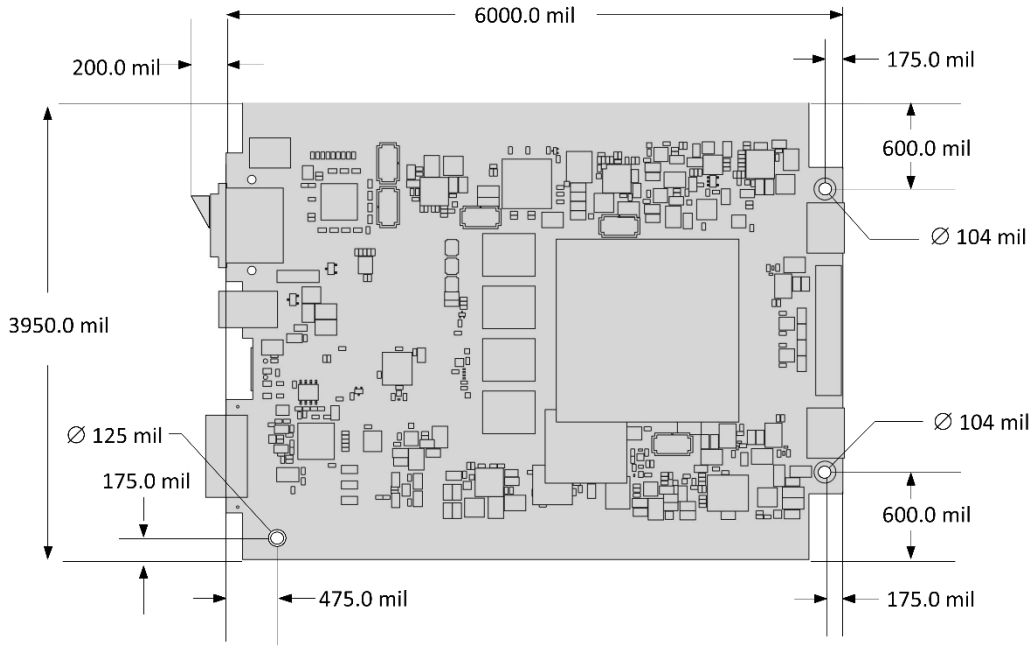


Figure 3: SV4E-SLVSEC ports locations and reference designators (for ATE applications only).

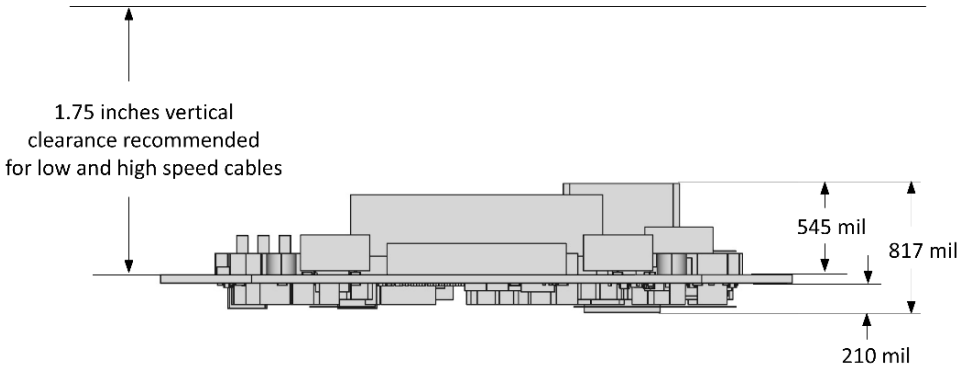


Figure 4: SV4E-SLVSEC ports locations and reference designators (for ATE applications only).

REVISION NUMBER	HISTORY	DATE
1.0	Document release	January 25, 2021
1.1	Removed Appendix with specifications. All updated specifications are now found in SV4E-SLVSEC datasheet.	August 9, 2021
1.2	Updated the GPIO voltage specification to 1.8V LVCMOS	June 14, 2024

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