introspect technology

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DATA SHEET

SV5C-eDP

Embedded DisplayPort Generator

C SERIES

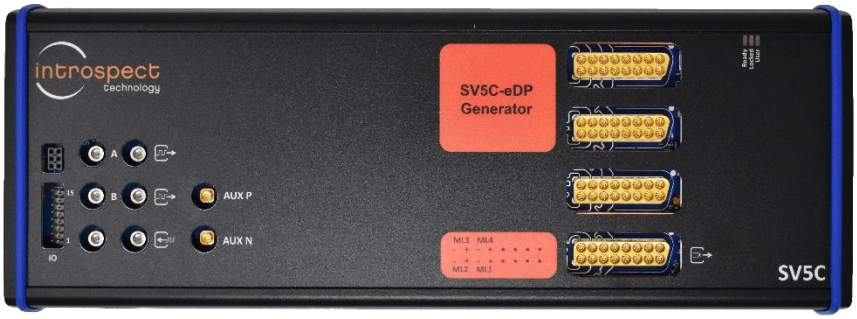

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Table of Contents

Introduction

OVERVIEW

The **SV5C-eDP Embedded DisplayPort Generator** is an ultra-portable, high-performance instrument capable of generating traffic for Embedded DisplayPort and DisplayPort applications at data rates of up to 12.5 Gbps. The SV5C-eDP Generator provides analog parameter controls that enable DisplayPort receiver stress-testing and allow for deep insights into voltage and timing sensitivities of DisplayPort sink devices. The instrument operates with Introspect Technology's award-winning software, Pinetree, which includes full pattern synthesis tools for generating test patterns and video frames for system-level test. Figure 1 below illustrates a typical application of the SV5C-eDP Generator in an Embedded DisplayPort system.

KEY FEATURES

- **Protocol**: supports Embedded DisplayPort up to v1.5 and DisplayPort up to v2.1 in HBR
- **Supported Data Rates:** up to 12.5 Gbps with a fully continuous range of data rates
- **Lane Count:** configurable from 1 to 4 lanes per port plus Auxiliary Channel
- **Analog Controls:** voltage amplitude and common mode voltage, each per lane
- **Signal Impairments:** jitter injection, sinusoidal voltage noise injection, per-wire timing skew
- **Pattern Generation:** full video frame generation with 2 GBytes of pattern memory

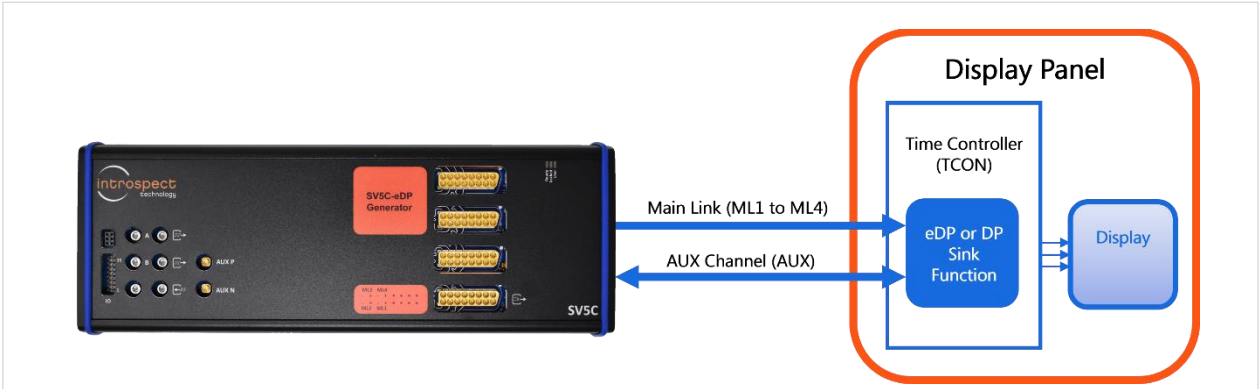


Figure 1: Typical application of the SV5C-eDP Generator connected to an Embedded DisplayPort System

PHYSICAL CONNECTIONS

The physical connections of the SV5C-eDP Generator are shown in Figure 2. The lanes (main link 1 to 4) are contained on a single MXP connector, as shown in the figure. The pin mapping for the Main Link, 6-pin GPIO and 16-pin GPIO are provided in Tables 1, 2, and 3, respectively.

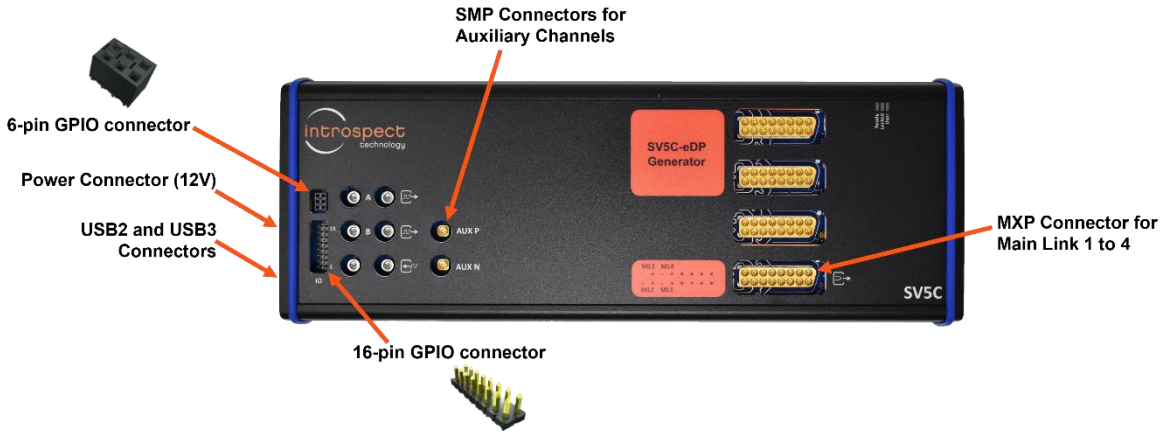


Figure 2: SV5C-eDP Generator physical connections

TABLE 1: MAIN LINK MXP CONNECTOR PINOUT

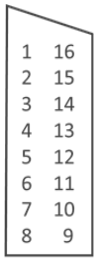
CONNECTOR	PIN	LANE
	12	Main Link 1P
	11	Main Link 1N
	10	Main Link 2P
	9	Main Link 2N
	7	Main Link 3P
	8	Main Link 3N
	5	Main Link 4P
	6	Main Link 4N

TABLE 2: 6-PIN GPIO CONNECTOR PINOUT

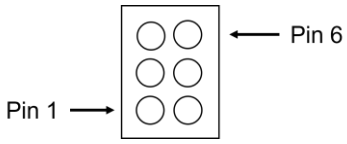
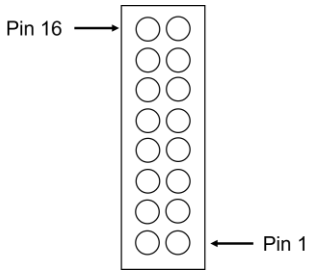
CONNECTOR	PIN	SIGNAL NAME	PIN	SIGNAL NAME
6-pin GPIO connector Samtec BCS-103-F-D-TE 	1	Ground	2	3V
	3	Ground	4	1.8V
	5	Ground	6	1.2V

TABLE 3: 16-PIN GPIO CONNECTOR PINOUT

CONNECTOR	PIN	FUNCTION	PIN	FUNCTION
16-pin GPIO connector Samtec MTLW-108-05-G-D-200  All User IO pins use 1.8V LVCMOS logic and have a weak internal pull-up.	1	HPD 1.2V Out	2	User IO 1
	3	HPD 3.3V Out / HPD From Programmable DAC In	4	User IO 2
	5	Ground	6	User IO 3
	7	Reserved	8	User IO 4
	9	Ground	10	User IO 5
	11	Reserved	12	User I2C SCL Controller
	13	Reserved	14	User I2C SDA Controller
	15	Reserved	16	HPD 1.8V Out / HPD 1.8V In

ORDERING INFORMATION

TABLE 4: ITEM NUMBERS FOR THE SV5C-EDP GENERATOR WITH RELATED PRODUCTS

PART NUMBER	NAME	KEY DIFFERENTIATORS
5740	SV5C-eDP Analyzer (includes Pinetree SW license)	High performance eDP protocol analyzer and eDP source tester
5741	SV5C-eDP Generator (includes Pinetree SW license)	High performance eDP protocol generator and eDP sink tester

Specifications

TABLE 5: GENERAL SPECIFICATIONS

PARAMETER	VALUE	UNITS	DSECRIPTION AND CONDITIONS
Application / Protocol			
Physical Layer Interface	eDP DP		Support for eDP up to version 1.5 Support for DP up to version 2.1 in HBR
Ports			
Number of Transmitter Lanes	5		Main Link 1, 2, 3, 4 Auxiliary Channel (bidirectional)
Number of GPIO pins	5		Programmable as external trigger input or flag output pins
Number of dedicated reference clock inputs	1		
Number of dedicated reference clock outputs	2		
PC connections for Pinetree Control	2		USB2 and USB3

Data Rates and Reference Clocks			
Minimum Data Rate	1562.6	Mbps	Per Lane
Maximum Data Rate	12.5	Gbps	Per Lane
Minimum External Input Clock	10	MHz	
Maximum External Input Clock	250	MHz	
Minimum External Output Clock	10	MHz	
Maximum External Output Clock	500	MHz	
Power Consumption			
DC Input Voltage	12	V	
Power Dissipation	100	W	

TABLE 6: EDP TRANSMITTER LANE CHARACTERISTICS

PARAMETER	VALUE	UNITS	DESCRIPTION AND CONDITIONS
HS Voltage Performance			
Minimum Output Voltage Swing	20	mV	Differential
Maximum Output Voltage Swing	850	mV	Differential
Voltage Swing Resolution	10	mV	Differential
Voltage Swing Accuracy	10% or 10 mV		The larger value of 10% or 10 mV
Minimum Common Mode Voltage	-20	mV	
Maximum Common Mode Voltage	750	mV	
Common Mode Voltage Resolution	1	mV	
Common Mode Voltage Accuracy	20% or 20 mV		The larger value of 20% or 20 mV
Swing and Common Mode Setting	Per Lane		
HS Timing Performance			
Rise and Fall Time	30	ps	Typical, fastest slew rate setting 20% to 80%
Slew Rate Range	13	V/ns	Difference between the fastest slew rate and the slowest slew rate

De-Emphasis Performance			
Pre-Tap 1 Range	+/- 150	mV	FIR taps defined as additive increments
Pre-Tap 1 Resolution	10	mV	
Post-Tap 1 Range	+/- 300	mV	
Post-Tap 1 Resolution	10	mV	
Post-Tap 2 Range	+/- 150	mV	
Post-Tap 2 Resolution	10	mV	
De-Emphasis Setting	Per Lane		
Transmitter Lane Output Coupling			
Output Differential Impedance	100	Ohm	
Differential Impedance Tolerance	+/- 10	Ohm	

TABLE 7: EDP TRANSMITTER SIGNAL IMPAIRMENT CHARACTERISTICS

PARAMETER	VALUE	UNITS	DESCRIPTION AND CONDITIONS
Noise Floor			
Random Jitter (RMS)	< 1.2	ps rms	
Deterministic Jitter Injection			
Minimum Sinusoidal Frequency	0.1	kHz	Per lane
Maximum Sinusoidal Frequency	50	MHz	Per lane
Frequency Resolution	0.1	kHz	
Maximum Sinusoidal Amplitude	16000	ps	Peak-Peak, tested to 1000 ps
Sinusoidal Amplitude Resolution	500	fs	
Sinusoidal Amplitude Accuracy	10% or 10 ps		The larger value of 10% or 10 ps
Voltage Noise Injection			
Maximum Amplitude of Common Mode Noise	40	mV	
Maximum Amplitude of Difference Mode Noise	80	mV	

Amplitude Resolution of Injected Noise	1	mV	
Maximum Frequency of Injected Noise	1	GHz	
Channel Skew Performance			
Coarse Skew Range: Programmable Skew	 +/- 20	 UI	Lane to lane Hardware is capable of larger skews
Coarse Skew Resolution: 1.62 Gbps, 2.7 Gbps 5.4 Gbps 8.1 Gbps	 0.25 0.5 1	 UI UI UI	Lane to lane
Fine Skew Range: Programmable Skew	 +/- 500	 ps	Wire to wire and lane to lane Hardware is capable of larger skews

TABLE 8: PATTERN HANDLING CHARACTERISTICS

PARAMETER	VALUE	UNITS	DESCRIPTION AND CONDITIONS
User-Programmable Pattern Memory			
Minimum Pattern Segment Size	8	Bits	
Maximum Pattern Segment Size	2	GBytes	
Total Memory Space for Transmitters	2	GBytes	
Pattern Sequencer			
Sequence Control	Yes		Loop infinite Loop-on-count (see count below) Play to end
Number of Sequencer Slots per Pattern Generator	16		Each pattern generator can string up to 16 different segments together, each with its own repeat count
Number of Entry Slots	1		Separate from above 16 segments
Number of Exit Slots	1		Separate from above 16 segments
Maximum Repeat Count Per Slot	65536		
Maximum Repeat Count for Outer Loop	65536		Outer loop can encompass any number of slots
Additional Pattern Characteristics			
Pattern Switching	Yes		Wait to end of segment, or immediate

TABLE 9: DISPLAYPORT FEATURES

PARAMETER	VALUE	DESCRIPTION AND CONDITIONS
Features		
Framing Modes	Standard Enhanced	
Supported Pixel Formats	RAW RGB YCbCr	RAW6, RAW8, RAW9, RAW10, RAW11, RAW12, RAW14, RAW16 RGB666, RGB888, RGB999, RGB101010, RGB111111, RGB121212, RGB161616 YCbCr422, YCbCr444 and Y-Only at: 6 bit, 8 bit, 9 bit, 10 bit, 11 bit, 12 bit and 16bit
Supported YCbCr Standard	YCbCr601 YCbCr709	
Display Stream Compression (DSC)	1.1, 1.2	
Data Scrambling	Yes	DP Seed, eDP Seed
Forward Error Correction (FEC)	Yes	
Advanced Link Power Management (ALPM)	AUX-wake AUX-less	
Adaptive-Sync (AS)		
Panel Self Refresh 1 & 2 (PSR)	Yes	
Panel Replay (PR)		
Audio	Yes	
Hot Plug Detect (HPD)	Yes	Standard Low voltage HPD

TABLE 10: PHYSICAL CHARACTERISTICS

PARAMETER	VALUE	UNITS	DESCRIPTION AND CONDITIONS
Dimensions			
Length	11, 280	in, mm	
Width	4.25, 108	in, mm	
Height	1.7, 43	in, mm	
Weight	2.5	lbs	
Physical Connections			
ML4 to ML1, Aux Channel	MXP		Huber & Suhner, 16 pin
6-pin GPIO			Samtec BCS-103-F-D-TE
16-pin GPIO			Samtec MTLW-108-05-G-D-200
Ref Clock In	SMP		SMP Differential Pair
Ref Clock Out	SMP		SMP Differential Pair
PC connection	USB2 USB3		USB2.0 mini B USB3.0 micro B
Power Switch / Connector			AC adapter provided 110/220 V, 50/60 Hz

REVISION NUMBER	HISTORY	DATE
1.0	Document Release	December 16, 2021
1.1	Updated the maximum output voltage swing specification	May 20, 2022
1.2	Updated the Molex Pinout and DP & eDP supported versions	May 24, 2023
1.3	Updated images of the SV5C-eDP Generator; physical connections & connector pin-out; DisplayPort Features in Table 9	November 20, 2023

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