



USB4 Gen4 TVS Diode Electrical Test Report



Ref CTS: Revision 0.85
Report Version: Ver.1.2
17 July 2023

Customer ID	TDK Electronics Inc.
GRL Project Number	GER-TP-06122301
Part Number	SD0201SL-U LC103
Product description	TVS diode
Ports	1-differential
Test Board Type	SMA connector in both end
Scope of Testing	USB4 Gen4 TX TP2 Eye and Jitter Measurement perform on a reference board and with TVS board <ul style="list-style-type: none">• USB4 Gen4 TX TP2 Eye and Jitter
Overall Test Result	PASS

LEGAL DISCLAIMER:

1. This test report is subject to Granite River Labs Inc. Standard Terms & Conditions and does not guarantee the quality or functionality of the device tested, compliance with any specifications, or interoperability with other products. Customer is solely responsible for the quality, functionality, interoperability, and specification conformance of Customer's products.
2. This report is based on the information Customer has supplied to GRL and Customer's representation of the device tested. Test result is valid only to the original tested device model.

DUT Appearance

Pass-through Reference board Size: 0201	Test board: with TDK TVSD SD0201SL-ULC103 Size: 0201
 <p>A photograph of a green PCB pass-through reference board. It features four SMA connectors (two on the left, two on the right) and four silver test points. The board is labeled with 'TEST_JTEH1', 'TEST_JTEH2', 'Size: 0201', and 'Fixture Solution'.</p>	 <p>A photograph of a green PCB test board. It features four SMA connectors (two on the left, two on the right) and four silver test points. The board is labeled with 'TEST_JTEH1', 'TEST_JTEH2', 'Size: 0201', and 'Fixture Solution'.</p>

1. Project Summary

This TVS diode electrical test methodology is based on USB4™ Router Assembly Electrical Compliance Test Specification, Revision 0.85 for transmitter test point at TP2 as USB4 Ver 2.0 Gen4 compliance test specified for Transmitter Eye and Jitter Measurement.

2. Test Equipment

Make, Model	Description
Anritsu MP1900A	Signal Quality Analyzer
Keysight DSOV334A	33GHz Real Time Oscilloscope

3. Test Connection

This test is based on the following USB4 Ver2.0 Gen4 Tx Compliance Point TP2, which is the Reference measurement point located at the USB Type-C plug connected to the Router Assembly TX output. Used as a reference point for defining Router Assembly TX.

For the ESD/TVS already route to SMA connector, the TP2 is based on the output of the DUT as following Fig.2 USB4 2.0 test connection.

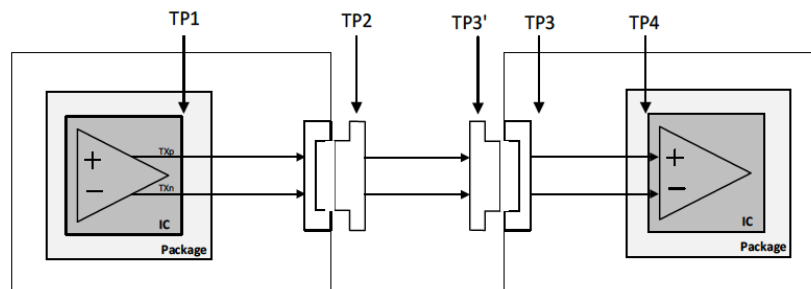


Fig.1 - USB4 2.0 TX Compliance Points Definition

For Transmitter Eye and Jitter Measurement

- 3.1. The pattern generator output to DUT through DC block and 40G phase match-paired cables.
- 3.2. The scope Channel 1 & Channel 3 connected to DUT.

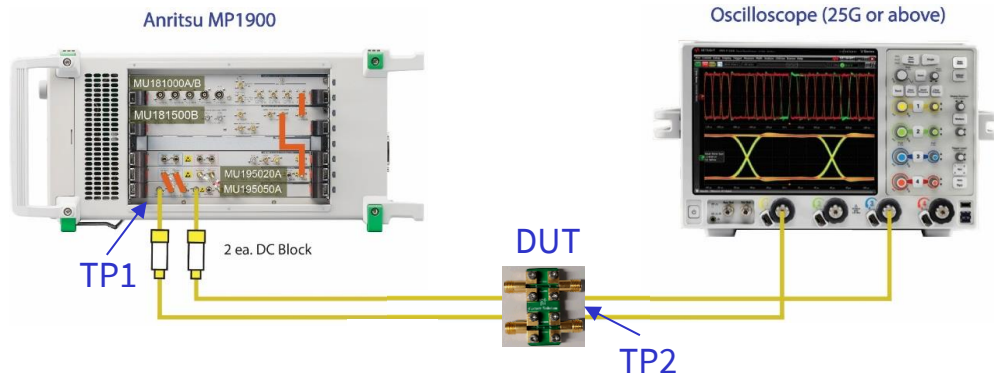


Fig.2 - USB4 2.0 Test Connection for TVS Tx Eye and Jitter Measurement at TP2

3.3. Setting Condition

- Pattern Generator Output Voltage: 570mV (Single-ended)
- SSC ON: 2800ppm @32KHz
- Symbol Rate = 25.6G Baud
- Pattern: PRTS7 (PAM3)
- Optimized Preset: Preset2, Calibrated with Test Board
- Transmitter Eye and Jitter Measurement Analysis with USB4 SigTest Ver. 0.86
- Test Point: Scope Capture at TP2

4. Test procedure

For Transmitter Eye and Jitter Measurement

- 4.1. Calibration: Connect the “Pass through board” between pattern generator and scope, follow USB4 2.0 Electrical CTS to do the TP2 Test to calibrate with symbol rate 25.6G Baud, PRTS7 (PAM3) pattern, to set the optimized V-SWING.
- 4.2. Measure the “Pass through board” Transmitter Eye and Jitter Measurement for TP2.
- 4.3. Replace the “Pass through board” with “TVS Populated board”.
- 4.4. Measure the “TVS Populated board” Transmitter Eye and Jitter Measurement for TP2.

Possible results and their meanings:

Result	Interpretation
PASS	The DUT Pass the test.
PASS with Comments	The DUT Pass the test however an additional explanation of the situation is included.
FAIL	The DUT Fail the test.
Warning	The DUT have behavior that is not recommended.
Not Applicable	The DUT does not support the technology required to perform this test.

USB4 2.0 Electrical Test Summary

Test ID	Test Items	Result		Comments
		Pass through	With TVS	
1.1	Gen4 Transmitter Eye and Jitter Measurement	PASS	PASS	

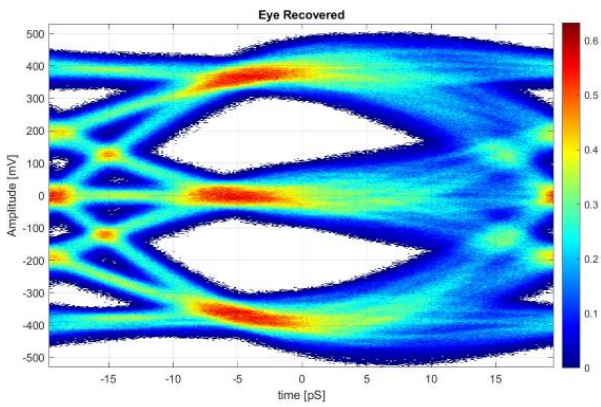
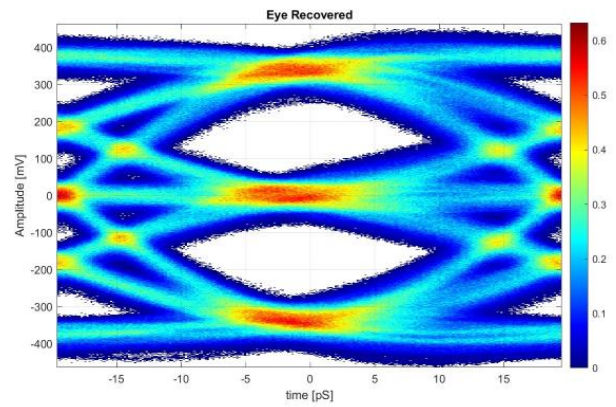
5. Electrical Test Result

5.1. Gen4 Transmitter Eye and Jitter Measurement subsets

TEST ID	Item	Unit	Status	Pass through	With TVS	Spec	Comments
5.1.1	UI	Ps	PASS	39.061	39.060	Min \geq 39.050ps	
5.1.2				39.061	39.060	Max \leq 39.074ps	
5.1.3	SSC_DOWN_SPREAD_RANGE	%	PASS	0.284	0.286	Min \geq 0.200%	
5.1.4				0.286	0.288	Max \leq 0.300%	
5.1.5	SSC_DOWN_SPREAD_RATE	KHz	PASS	31.987	31.986	Min \geq 30KHz	
5.1.6				32.010	32.014	Max \leq 33KHz	
5.1.7	SSC_PHASE_DEVIATION	KHz	PASS	11.035	11.057	Min \geq 2.5nspp Max \leq 15.5nspp	
5.1.8	SSC_SLEW_RATE	ppm/us	PASS	202.715	196.854	Max \leq 500ppm/ μ s	
5.1.9	UJ	UIpp	PASS	0.112	0.126	Max \leq 0.17UIpp	
5.1.10	UDJ	UIpp	PASS	0.039	0.039	Max \leq 0.075UIpp	
5.1.11	UDJ_LF	UIpp	PASS	0.008	0.008	Max \leq 0.03UIpp	
5.1.12	EVEN_ODD	UIpp	PASS	0.001	0.001	Max \leq 0.02UIpp	
5.1.13	V_SWING	mVp	PASS	416.82	423.11	Min \geq 390mVp Max \leq 500mVp	
5.1.14	TX_LEVELS_MISMATCH		PASS	0.999	0.999	Min \geq 0.975	
5.1.15	TX_SNR	dB	PASS	34.894	34.681	Min \geq 32.5dB	
5.1.16	TX_ISI_MARGIN	dB	PASS	12.927	11.649	Min \geq 11.5dB	
5.1.17	Eye Height	mV	NA	191.37	164.14	Informative	
5.1.18	Eye Width	ps	NA	15.585	14.668	Informative	

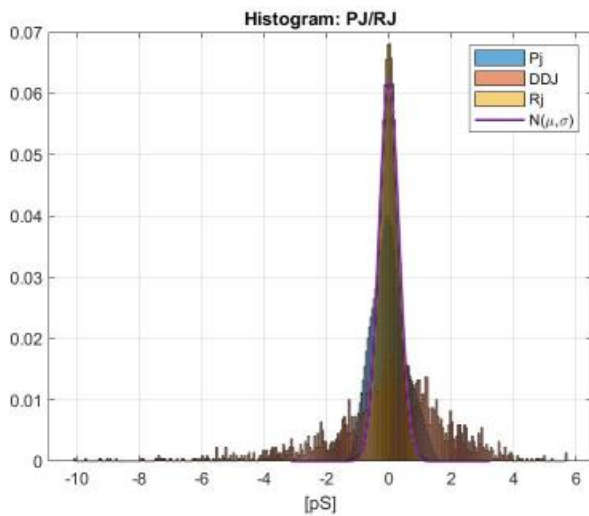
25.6G Baud Eye Diagram

25.6G Baud (Preset 2)

TP2_Pass through board

TP2_With TDK TVSD SD0201SL-ULC103


25.6G Baud Jitter Histogram

25.6G Baud (Preset 2)

TP2_Pass through board

TP2_With TDK TVSD SD0201SL-ULC103
