TIDA-00882 – USB Type-C™ HDD with USB Power Delivery Reference Design

BERTScope USB 3.0 Receiver Test

RECEIVER TEST RESULTS

11/12/2015 08:51:18

Identification

Name: 10970066_Texas
Creator: Tek Lab
Description:
Comment:
Passed: Passed (8)
Date/Time: 11/12/2015 08:47:55
DUT Type: Device

Test Calibrations

EYE: 20151109
DPP: 20151109
DPP S/N: B010549
BSC S/N: 281047
CR S/N: B172091

Test Signals

PG: Rate 4.987, RJ 20.7%, Delay 1717.0 pS
SSC: 5000 PPM, 33 KHZ
DPP: Ampl 595 mV, Taps [0.00 -3.97 -3.97 -3.97]
ED: Rate 5.000, Sync UserGrabNGo
CR: BW 11.00 MHz, Peaking 2.09 dB, Lock Range 30.00 MHz
PG Pattern: USB3_A_CP0wSKP_B_Keep.ram
Det Pattern: USB3_CP0.ram

Jitter Tolerance Configuration

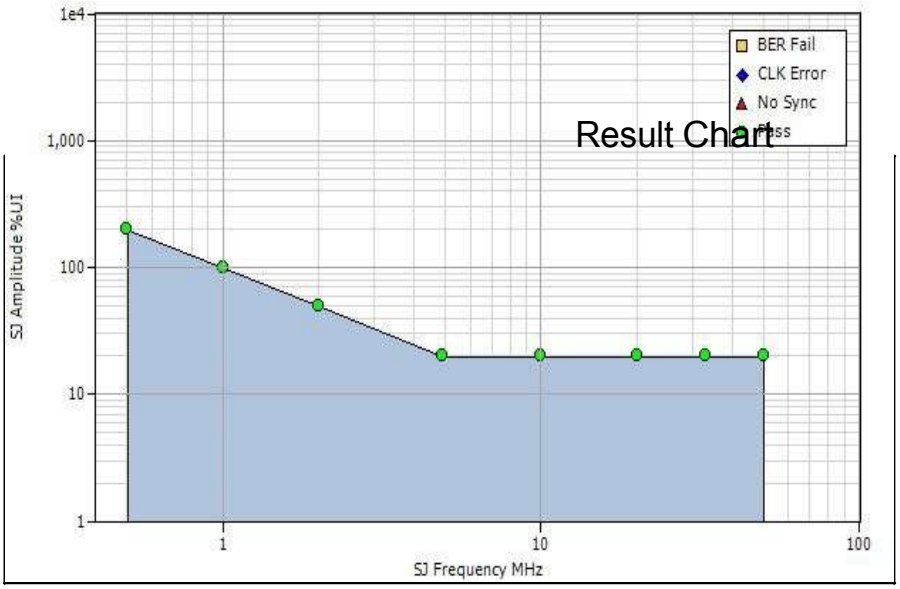
Test Mode: Compliance
Test Bits: 3.00e010
Margin: 0.00%
Max Errors: 1

Stressed Eye

Deemphasis: 3.00 dB (3.00 dB)
RJ: 2.42 pS (2.25 pS)

Eye Height: 180.00 mV (180.81 mV)

(values in parenthesis are calibration verification measurements)



Jitter Tolerance Summary

MHZ	Test	Template	Bits	Errors	BER	Status	Margin	Cal Target	Cal Meas
0.50	200.00%	200.00%	3.00e010	0	0.00e000	Passed	0.00%	400.00 pS	388.12 pS
1.00	100.00%	100.00%	3.00e010	0	0.00e000	Passed	0.00%	200.00 pS	192.02 pS
2.00	50.00%	50.00%	3.00e010	0	0.00e000	Passed	0.00%	100.00 pS	95.41 pS
4.90	20.00%	20.00%	3.00e010	0	0.00e000	Passed	0.00%	40.00 pS	37.73 pS
10.00	20.00%	20.00%	3.00e010	0	0.00e000	Passed	0.00%	40.00 pS	37.11 pS
20.00	20.00%	20.00%	3.00e010	0	0.00e000	Passed	0.00%	40.00 pS	39.01 pS
33.00	20.00%	20.00%	3.00e010	0	0.00e000	Passed	0.00%	40.00 pS	37.79 pS
50.00	20.00%	20.00%	3.00e010	0	0.00e000	Passed	0.00%	40.00 pS	38.96 pS

TekExpress USB 3.1 Report

Test Report

Execution and Setup Information			
DUT ID	10970066	Suite	Device
Date/Time	2015-11-12 08:58:12	Scope Model	MSO73304DX
Connector Type	Standard	Scope Serial Numer	B260121
Test Point	Compliance (TP1) – Far End	Scope F/W Version	7.5.0 Build 1
DPOJET Version	"7.1.2.38"	SPC Factory:S/W Calibration	PASS;PASS
SigTest Version	3_2_8	TekExpress Version	USB:6.0.6.6 Framework:3.0.1.88
Total Execution Time	3 Minutes 20 Seconds		
Toggle Tool	Do not use		
Acquisition Mode	Live		
Over All Test Result	Pass		
DUT COMMENT:	General Comment – USB3.1 DUT		

UI-Unit Interval							
Measurement Details	Generation	Method	Measured Value	Test Result	Margin	Low Limit	High Limit
UI–Unit Interval	Gen 1	DPOJET	200.486 ps	Pass	546.169 fs & 573.831 fs	199.94 ps	201.06 ps
UI-Unit Interval	Gen 1	USB-IF	200.476 ps	Pass	536.000 fs & 584.000 fs	199.94 ps	201.06 ps
COMMENTS							

VTx-Diff-PP-Differential PP Tx voltage swing							
Measurement Details	Generation	Method	Measured Value	Test Result	Margin	Low Limit	High Limit
VTx-Diff-PP-Differential PP Tx voltage swing	Gen 1	DPOJET	298.025 mV	Pass	198.025 mV & 901.975 mV	100.0 mV	1.2 V
COMMENTS							

TCDR_Slew_Max-Maximum Slew Rate							
Measurement Details	Generation	Method	Measured Value	Test Result	Margin	Low Limit	High Limit
TCDR_Slew_Max-Maximum Slew Rate	Gen 1	DPOJET	5.147 ms/s	Pass	4.853 ms/s	N.A	10.0 ms/s
COMMENTS							

Rj-Tx random jitter-Dual Dirac							
Measurement Details	Generation	Method	Measured Value	Test Result	Margin	Low Limit	High Limit
Rj-Tx random jitter-Dual Dirac	Gen 1	DPOJET	1.236 ps	Pass	2.034 ps	N.A	3.27 ps
Rj-Tx random jitter-Dual Dirac	Gen 1	USB-IF	1.671 ps	Pass	1.599 ps	N.A	3.27 ps
COMMENTS							

Mask Hits							
Measurement Details	Generation	Method	Measured Value	Test Result	Margin	Low Limit	High Limit
Mask Hits	Gen 1	DPOJET	0.000	Pass	0.000	N.A	0
Mask Hits	Gen 1	USB-IF	0.000	Pass	0.000	N.A	0
COMMENTS							

TSSC-Freq-Dev-Max							
Measurement Details	Generation	Method	Measured Value	Test Result	Margin	Low Limit	High Limit
TSSC-Freq-Dev-Max (Max)	Gen 1	DPOJET	-4.989 kppm (Max)	Pass	310.853 ppm & 1.289 kppm	-5.3 kppm	-3.7 kppm
TSSC-Freq-Dev-Max (Min)	Gen 1	DPOJET	-5.020 kppm (Min)	Pass	279.867 ppm & 1.320 kppm	-5.3 kppm	-3.7 kppm
COMMENTS							

TSSC-Freq-Dev-Min							
Measurement Details	Generation	Method	Measured Value	Test Result	Margin	Low Limit	High Limit
TSSC-Freq-Dev-Min (Max)	Gen 1	DPOJET	106.952 ppm (Max)	Pass	406.952 ppm & 193.048 ppm	-300.0 ppm	300.0 ppm
TSSC-Freq-Dev-Min (Min)	Gen 1	DPOJET	65.191 ppm (Min)	Pass	365.191 ppm & 234.809 ppm	-300.0 ppm	300.0 ppm
COMMENTS							

TSSC-Mod-Rate – SSC Modulation rate							
Measurement Details	Generation	Method	Measured Value	Test Result	Margin	Low Limit	High Limit
TSSC-Mod-Rate – SSC Modulation rate	Gen 1	DPOJET	31.242 kHz	Pass	1.242 kHz & 1.758 kHz	30.0 kHz	33.0 kHz
COMMENTS							

TSSC-USB Profile							
Measurement Details	Generation	Method	Measured Value	Test Result	Margin	Low Limit	High Limit
TSSC–USB Profile	Gen 1	DPOJET	200.504 ps	Pass	200.504 ps	0 s	N.A
COMMENTS							

TJ-Tx total jitter-Dual Dirac at 10E-12 BER							
Measurement Details	Generation	Method	Measured Value	Test Result	Margin	Low Limit	High Limit
TJ-Tx total jitter–Dual Dirac at 10E-12 BER	Gen 1	DPOJET	34.829 ps	Pass	97.171 ps	N.A	132.0 ps
TJ-Tx total jitter–Dual Dirac at 10E-12 BER	Gen 1	USB-IF	51.264 ps	Pass	80.736 ps	N.A	132.0 ps
COMMENTS							

DJ-Tx deterministic Jitter-Dual Dirac							
Measurement Details	Generation	Method	Measured Value	Test Result	Margin	Low Limit	High Limit
DJ-Tx deterministic Jitter–Dual Dirac	Gen 1	DPOJET	17.279 ps	Pass	68.721 ps	N.A	86.0 ps
DJ-Tx deterministic Jitter–Dual Dirac	Gen 1	USB-IF	27.763 ps	Pass	58.237 ps	N.A	86.0 ps
COMMENTS							

Eye Height – Transmitter Eye Mask							
Measurement Details	Generation	Method	Measured Value	Test Result	Margin	Low Limit	High Limit
Eye Height – Transmitter Eye Mask	Gen 1	DPOJET	175.859 mV	Pass	75.859 mV & 1.024 V	100.0 mV	1.2 V
Eye Height – Transmitter Eye Mask	Gen 1	USB-IF	174.802 mV	Pass	74.802 mV & 1.025 V	100.0 mV	1.2 V

COMMENTS	

Width@BER							
Measurement Details	Generation	Method	Measured Value	Test Result	Margin	Low Limit	High Limit
Width@BER	Gen 1	DPOJET	124.034 ps	Pass	56.034 ps	68.0 ps	N.A
Width@BER	Gen 1	USB-IF	148.736 ps	Pass	80.736 ps	68.0 ps	N.A
COMMENTS							

LFPS Duty Cycle							
Measurement Details	Generation	Method	Measured Value	Test Result	Margin	Low Limit	High Limit
LFPS Duty Cycle (Max)	Gen 1	DPOJET	49.893 % (Max)	Pass	9.893 % & 10.107 %	40.0 %	60.0 %
LFPS Duty Cycle (Min)	Gen 1	DPOJET	49.443 % (Min)	Pass	9.443 % & 10.557 %	40.0 %	60.0 %
LFPS Duty Cycle (Max)	Gen 1	USB-IF	50.145 % (Max)	Pass	10.145 % & 9.855 %	40.0 %	60.0 %
LFPS Duty Cycle (Min)	Gen 1	USB-IF	49.660 % (Min)	Pass	9.660 % & 10.340 %	40.0 %	60.0 %
COMMENTS							

LFPS Fall Time							
Measurement Details	Generation	Method	Measured Value	Test Result	Margin	Low Limit	High Limit
LFPS Fall Time	Gen 1	DPOJET	207.304 ps	Pass	3.793 ns	N.A	4.0 ns
LFPS Fall Time	Gen 1	USB-IF	221.241 ps	Pass	3.779 ns	N.A	4.0 ns
COMMENTS							

LFPS Rise Time							
Measurement Details	Generation	Method	Measured Value	Test Result	Margin	Low Limit	High Limit
LFPS Rise Time	Gen 1	DPOJET	211.719 ps	Pass	3.788 ns	N.A	4.0 ns
LFPS Rise Time	Gen 1	USB-IF	228.837 ps	Pass	3.771 ns	N.A	4.0 ns
COMMENTS							

LFPS TPeriod							
Measurement Details	Generation	Method	Measured Value	Test Result	Margin	Low Limit	High Limit
LFPS TPeriod (Max)	Gen 1	DPOJET	33.605 ns (Max)	Pass	13.605 ns & 66.395 ns	20.0 ns	100.0 ns
LFPS TPeriod (Min)	Gen 1	DPOJET	33.393 ns (Min)	Pass	13.393 ns & 66.607 ns	20.0 ns	100.0 ns
LFPS TPeriod (Max)	Gen 1	USB-IF	33.606 ns (Max)	Pass	13.606 ns & 66.394 ns	20.0 ns	100.0 ns
LFPS TPeriod (Min)	Gen 1	USB-IF	33.404 ns (Min)	Pass	13.404 ns & 66.596 ns	20.0 ns	100.0 ns
COMMENTS							

LFPS Vcm-AC							
Measurement Details	Generation	Method	Measured Value	Test Result	Margin	Low Limit	High Limit
LFPS Vcm-AC	Gen 1	DPOJET	67.969 mV	Pass	32.031 mV	N.A	100.0 mV
LFPS Vcm-AC	Gen 1	USB-IF	72.000 mV	Pass	28.000 mV	N.A	100.0 mV
COMMENTS							

LFPS Vtx-DIFF-PP							
Measurement Details	Generation	Method	Measured Value	Test Result	Margin	Low Limit	High Limit
LFPS Vtx-DIFF-PP (Max)	Gen 1	DPOJET	1.160 V (Max)	Pass	360.000 mV & 40.000 mV	800.0 mV	1.2 V
LFPS Vtx-DIFF-PP					276.000 mV &		

(Min)	Gen 1	DPOJET	1.076 V (Min)	Pass	124.000 mV	800.0 mV	1.2 V
LFPS Vtx-DIFF-PP (Max)	Gen 1	USB-IF	1.156 V (Max)	Pass	356.000 mV & 44.000 mV	800.0 mV	1.2 V
LFPS Vtx-DIFF-PP (Min)	Gen 1	USB-IF	1.076 V (Min)	Pass	276.000 mV & 124.000 mV	800.0 mV	1.2 V
COMMENTS							

LFPS TBurst							
Measurement Details	Generation	Method	Measured Value	Test Result	Margin	Low Limit	High Limit
LFPS TBurst (Max)	Gen 1	DPOJET	997.999 ns (Max)	Pass	397.999 ns & 402.001 ns	600.0 ns	1.4 us
LFPS TBurst (Min)	Gen 1	DPOJET	971.423 ns (Min)	Pass	371.423 ns & 428.577 ns	600.0 ns	1.4 us
LFPS TBurst (Max)	Gen 1	USB-IF	1.055 us (Max)	Pass	455.000 ns & 345.000 ns	600.0 ns	1.4 us
LFPS TBurst (Min)	Gen 1	USB-IF	1.051 us (Min)	Pass	451.120 ns & 348.880 ns	600.0 ns	1.4 us
COMMENTS							

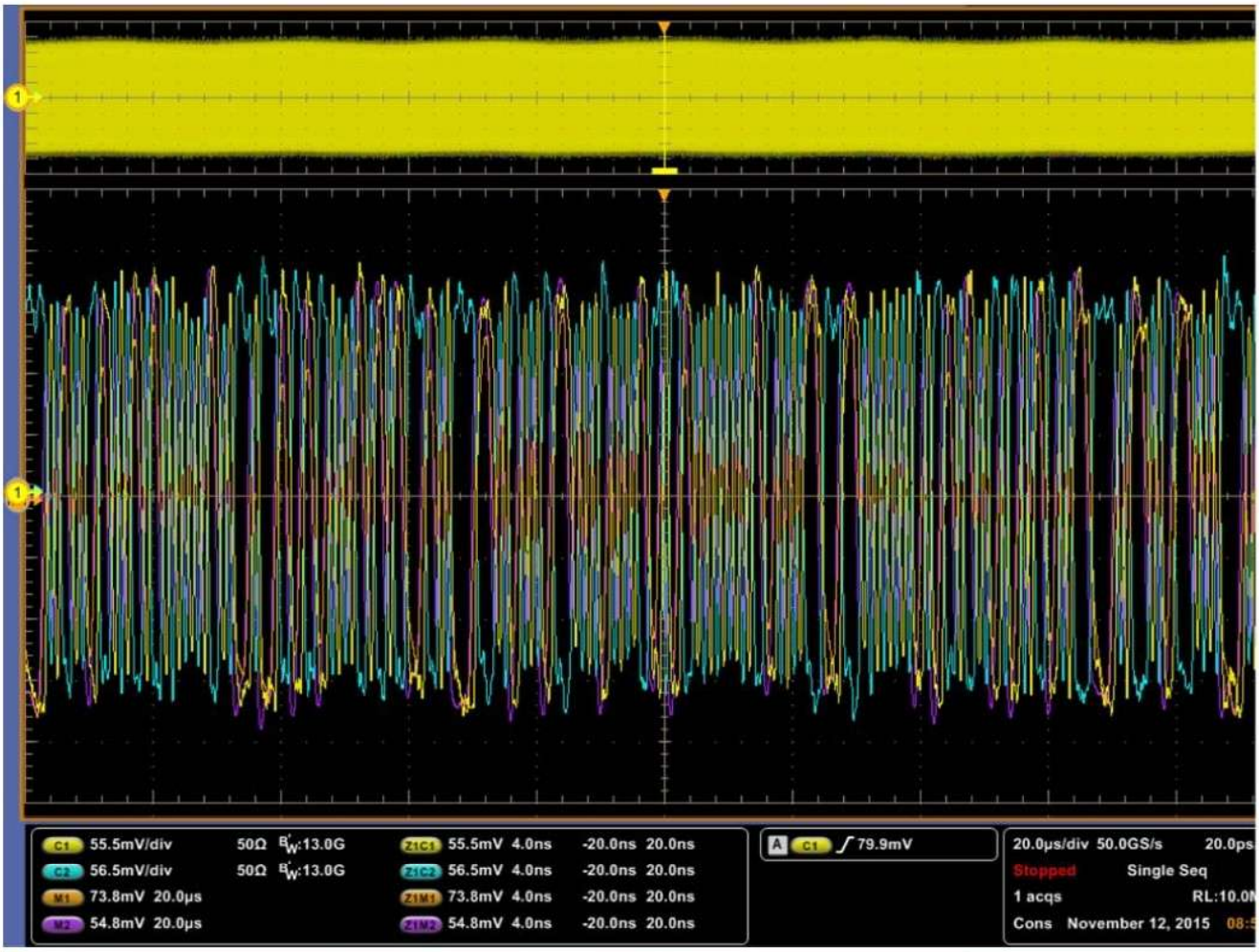
LFPS TRepeat							
Measurement Details	Generation	Method	Measured Value	Test Result	Margin	Low Limit	High Limit
LFPS TRepeat (Max)	Gen 1	DPOJET	10.040 us (Max)	Pass	4.040 us & 3.960 us	6.0 us	14.0 us
LFPS TRepeat (Min)	Gen 1	DPOJET	9.627 us (Min)	Pass	3.627 us & 4.373 us	6.0 us	14.0 us
LFPS TRepeat (Max)	Gen 1	USB-IF	10.035 us (Max)	Pass	4.035 us & 3.965 us	6.0 us	14.0 us
LFPS TRepeat (Min)	Gen 1	USB-IF	9.630 us (Min)	Pass	3.630 us & 4.370 us	6.0 us	14.0 us
COMMENTS							

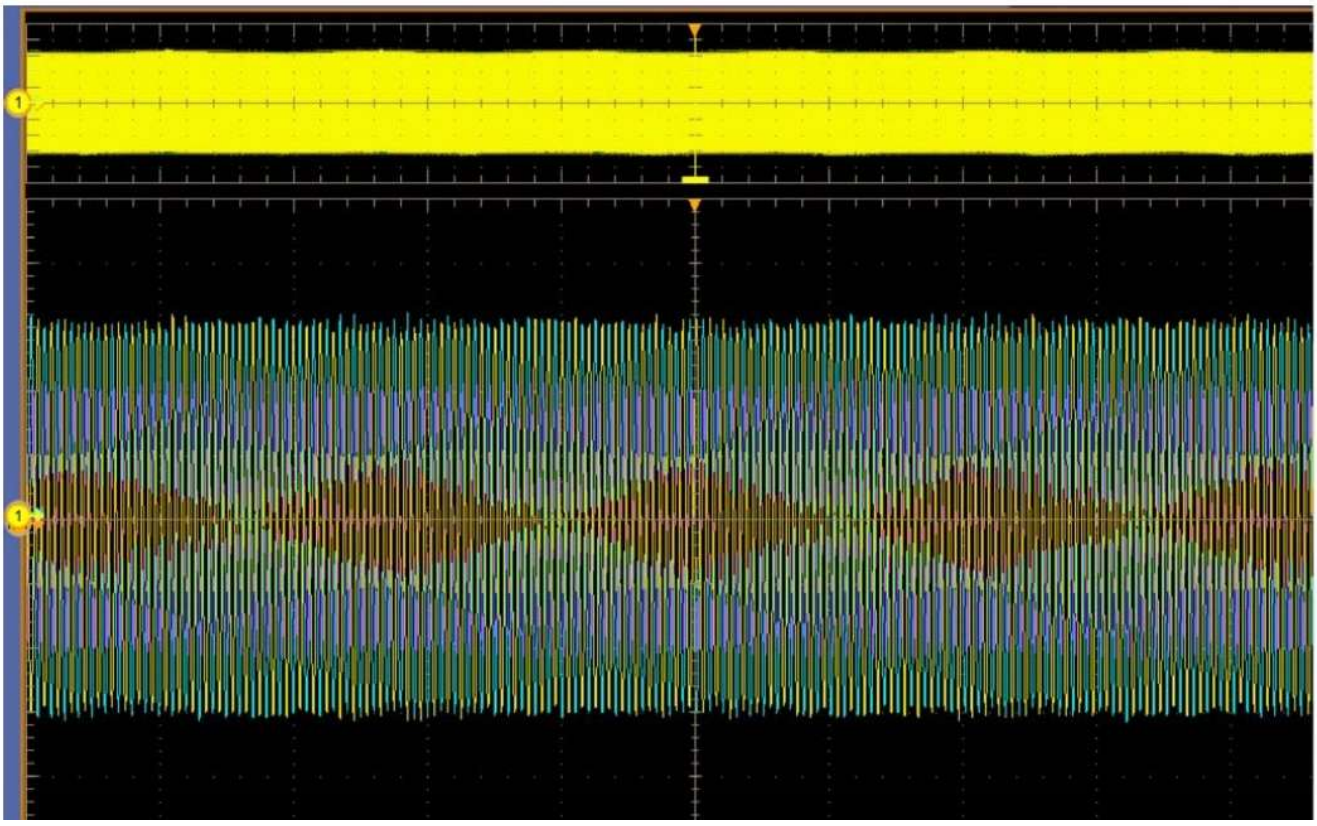
Rj(CP0)							
Measurement Details	Generation	Method	Measured Value	Test Result	Margin	Low Limit	High Limit
Rj(CP0)	Gen 1	DPOJET	4.197 ps	–	N.A	N.A	N.A
COMMENTS							

TJ(CP0)							
Measurement Details	Generation	Method	Measured Value	Test Result	Margin	Low Limit	High Limit
TJ(CP0)	Gen 1	DPOJET	76.879 ps	–	N.A	N.A	N.A
COMMENTS							

Back to Setup Information

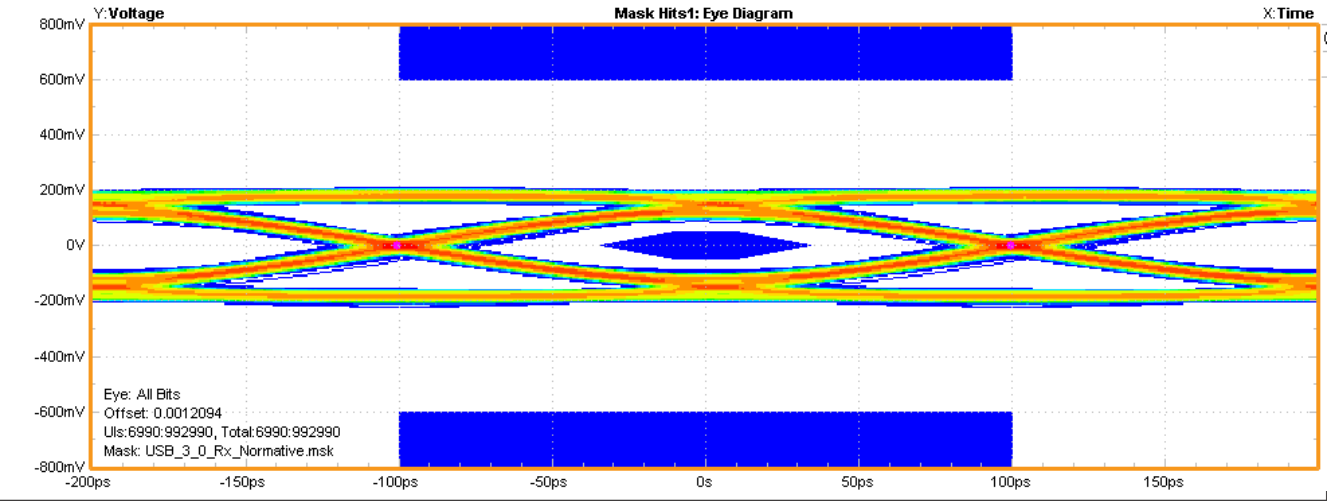
UI-Unit Interval
CP0 waveform CP1 waveform


C1 55.5mV/div 50Ω BW:13.0G
C2 56.5mV/div 50Ω BW:13.0G
M1 73.8mV 20.0µs
M2 54.8mV 20.0µs
Z1C1 55.5mV 4.0ns -20.0ns 20.0ns
Z1C2 56.5mV 4.0ns -20.0ns 20.0ns
Z1M1 73.8mV 4.0ns -20.0ns 20.0ns
Z1M2 54.8mV 4.0ns -20.0ns 20.0ns
A C1 79.9mV
20.0µs/div 50.0GS/s 20.0ps
Stopped Single Seq
1 acqs RL:10.0M
Cons November 12, 2015



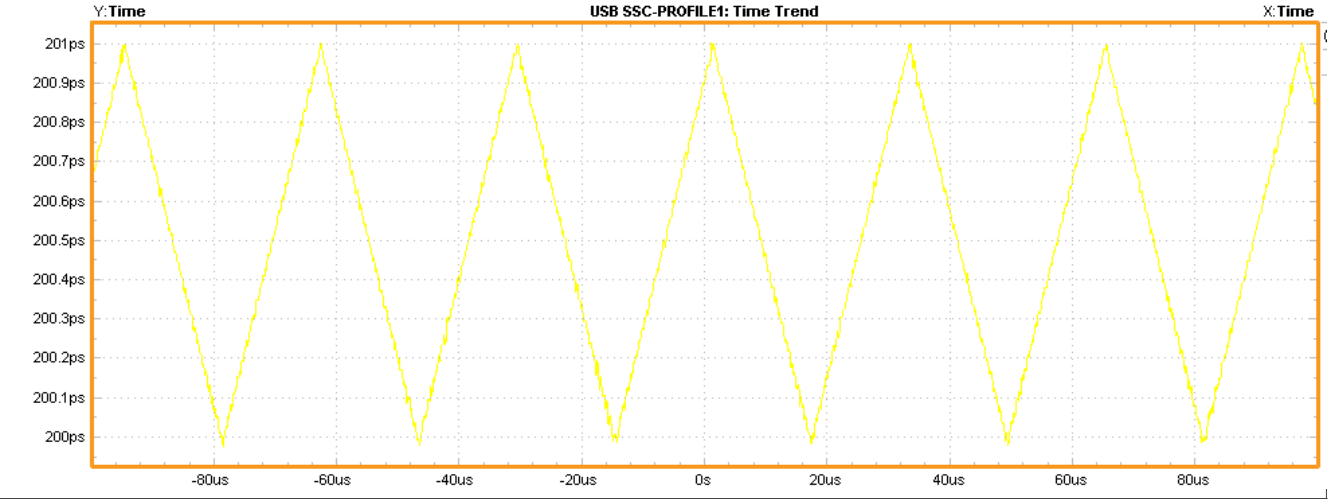
Mask Hits

Mask Hits



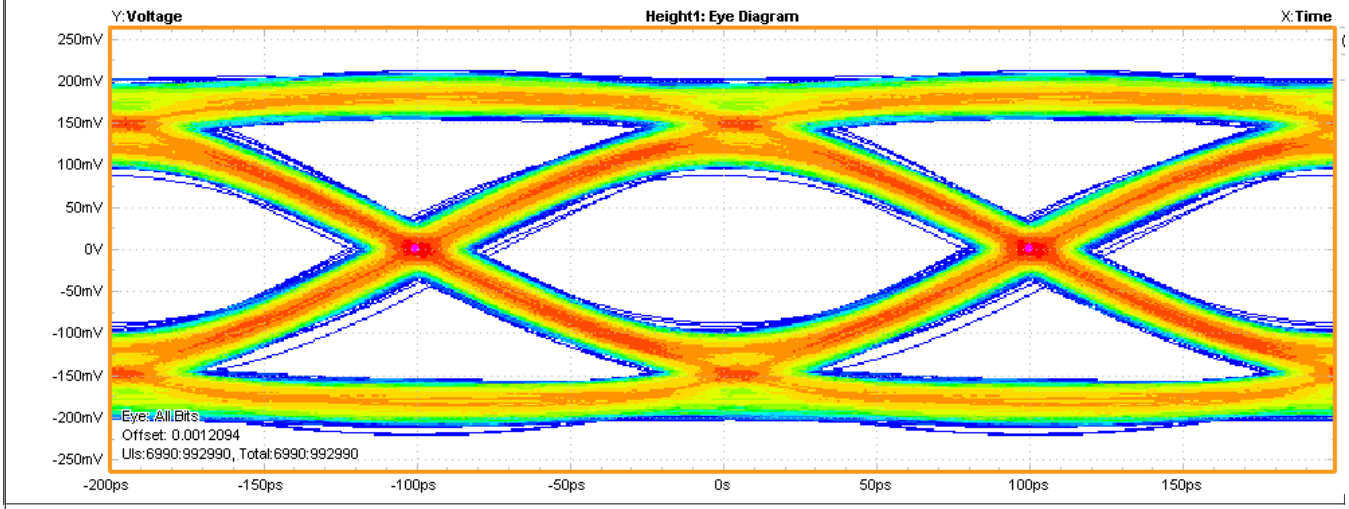
TSSC-USB Profile

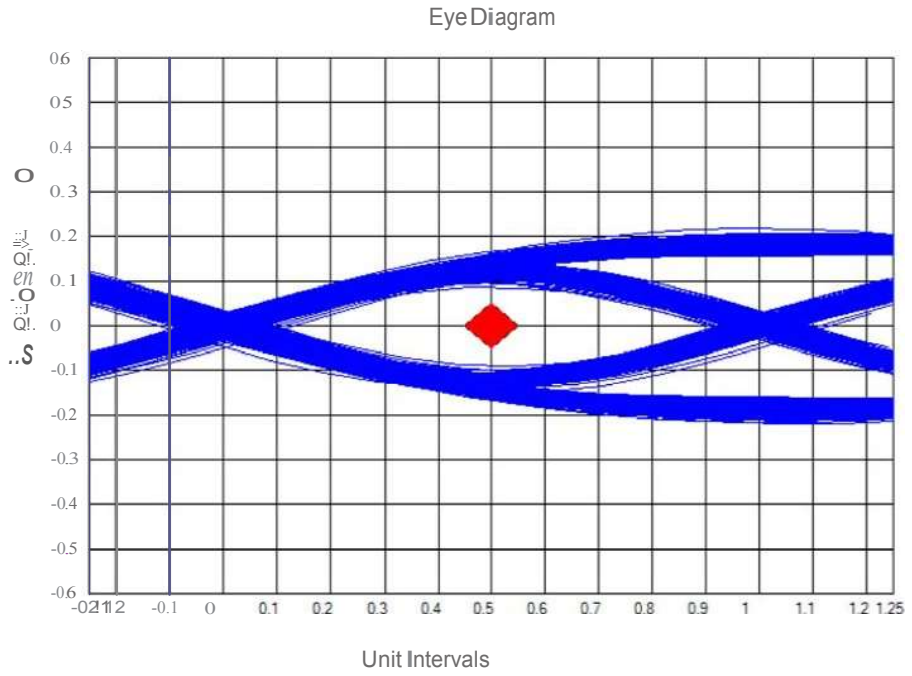
TSSC-USB Profile

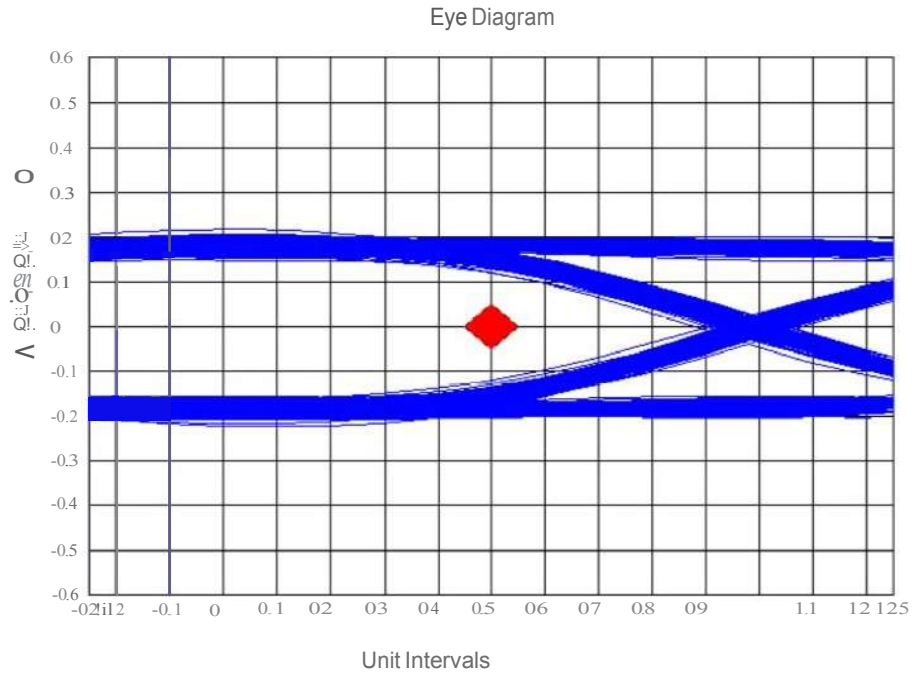


Eye Height – Transmitter Eye Mask

Eye Height – Transmitter Eye Mask

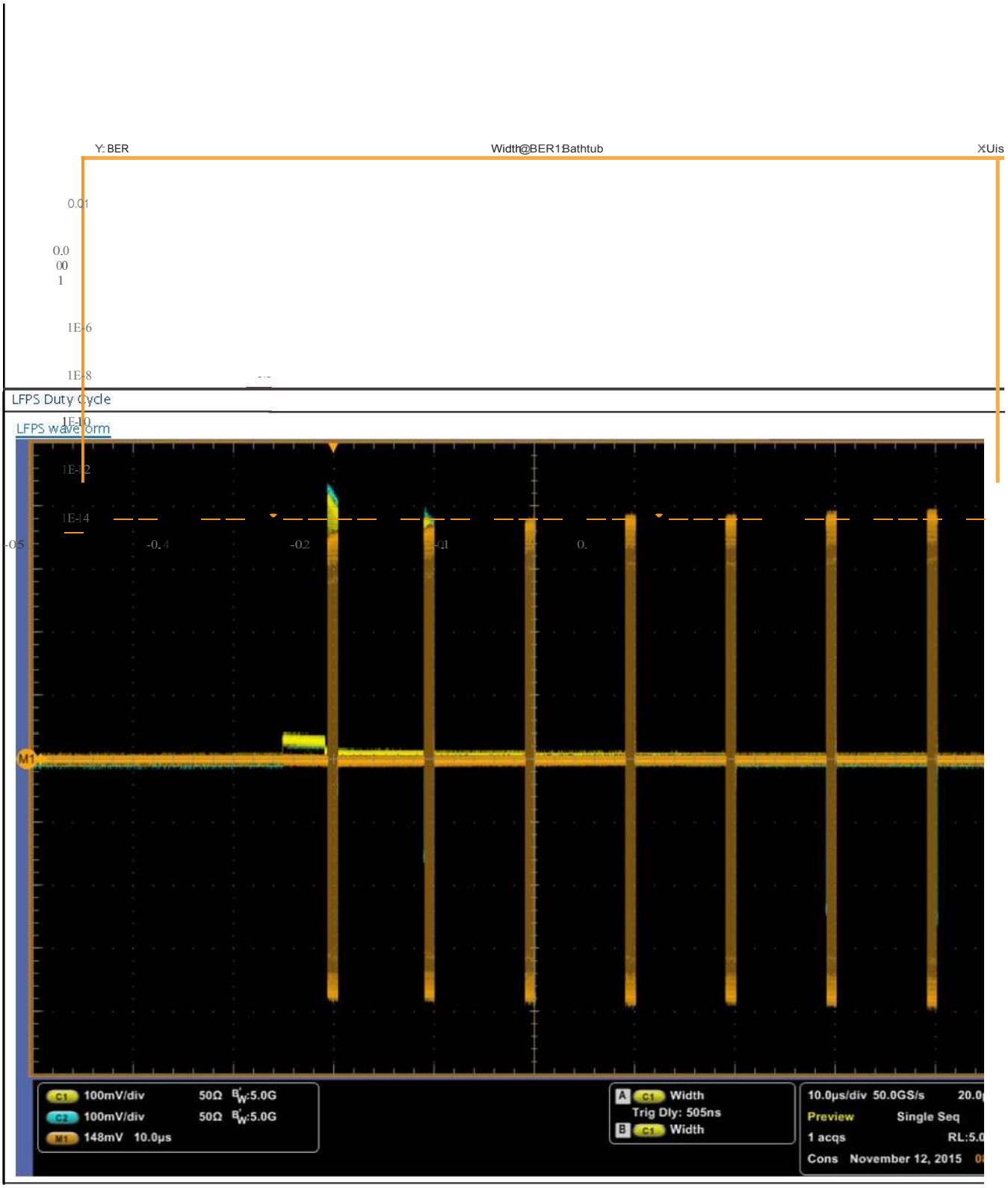






WIdth@BER

Width@BER


Y: BER
Width@BER1Bathtub
X:Uis
0.01
0.0
00
1
1E-6
1E-8
LFPS Duty Cycle
LFPS waveform
1E-12
1E-14
-0.5
-0.4
-0.2
-0.1
0.
M1
C1 100mV/div 50Ω BW:5.0G
C2 100mV/div 50Ω BW:5.0G
M1 148mV 10.0µs
A C1 Width
Trig Dly: 505ns
B C1 Width
10.0µs/div 50.0GS/s
Preview Single Seq
1 acqs
Cons November 12, 2015

IMPORTANT NOTICE FOR TI REFERENCE DESIGNS

Texas Instruments Incorporated ("TI") reference designs are solely intended to assist designers (“Buyers”) who are developing systems that incorporate TI semiconductor products (also referred to herein as “components”). Buyer understands and agrees that Buyer remains responsible for using its independent analysis, evaluation and judgment in designing Buyer’s systems and products.

TI reference designs have been created using standard laboratory conditions and engineering practices. **TI has not conducted any testing other than that specifically described in the published documentation for a particular reference design.** TI may make corrections, enhancements, improvements and other changes to its reference designs.

Buyers are authorized to use TI reference designs with the TI component(s) identified in each particular reference design and to modify the reference design in the development of their end products. HOWEVER, NO OTHER LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE TO ANY OTHER TI INTELLECTUAL PROPERTY RIGHT, AND NO LICENSE TO ANY THIRD PARTY TECHNOLOGY OR INTELLECTUAL PROPERTY RIGHT, IS GRANTED HEREIN, including but not limited to any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services, or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

TI REFERENCE DESIGNS ARE PROVIDED "AS IS". TI MAKES NO WARRANTIES OR REPRESENTATIONS WITH REGARD TO THE REFERENCE DESIGNS OR USE OF THE REFERENCE DESIGNS, EXPRESS, IMPLIED OR STATUTORY, INCLUDING ACCURACY OR COMPLETENESS. TI DISCLAIMS ANY WARRANTY OF TITLE AND ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, QUIET ENJOYMENT, QUIET POSSESSION, AND NON-INFRINGEMENT OF ANY THIRD PARTY INTELLECTUAL PROPERTY RIGHTS WITH REGARD TO TI REFERENCE DESIGNS OR USE THEREOF. TI SHALL NOT BE LIABLE FOR AND SHALL NOT DEFEND OR INDEMNIFY BUYERS AGAINST ANY THIRD PARTY INFRINGEMENT CLAIM THAT RELATES TO OR IS BASED ON A COMBINATION OF COMPONENTS PROVIDED IN A TI REFERENCE DESIGN. IN NO EVENT SHALL TI BE LIABLE FOR ANY ACTUAL, SPECIAL, INCIDENTAL, CONSEQUENTIAL OR INDIRECT DAMAGES, HOWEVER CAUSED, ON ANY THEORY OF LIABILITY AND WHETHER OR NOT TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, ARISING IN ANY WAY OUT OF TI REFERENCE DESIGNS OR BUYER’S USE OF TI REFERENCE DESIGNS.

TI reserves the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products are sold subject to TI’s terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI’s terms and conditions of sale of semiconductor products. Testing and other quality control techniques for TI components are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers’ products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers’ products and applications, Buyers should provide adequate design and operating safeguards.

Reproduction of significant portions of TI information in TI data books, data sheets or reference designs is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards that anticipate dangerous failures, monitor failures and their consequences, lessen the likelihood of dangerous failures and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in Buyer’s safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI’s goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed an agreement specifically governing such use.

Only those TI components that TI has specifically designated as military grade or “enhanced plastic” are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components that have ***not*** been so designated is solely at Buyer's risk, and Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265