

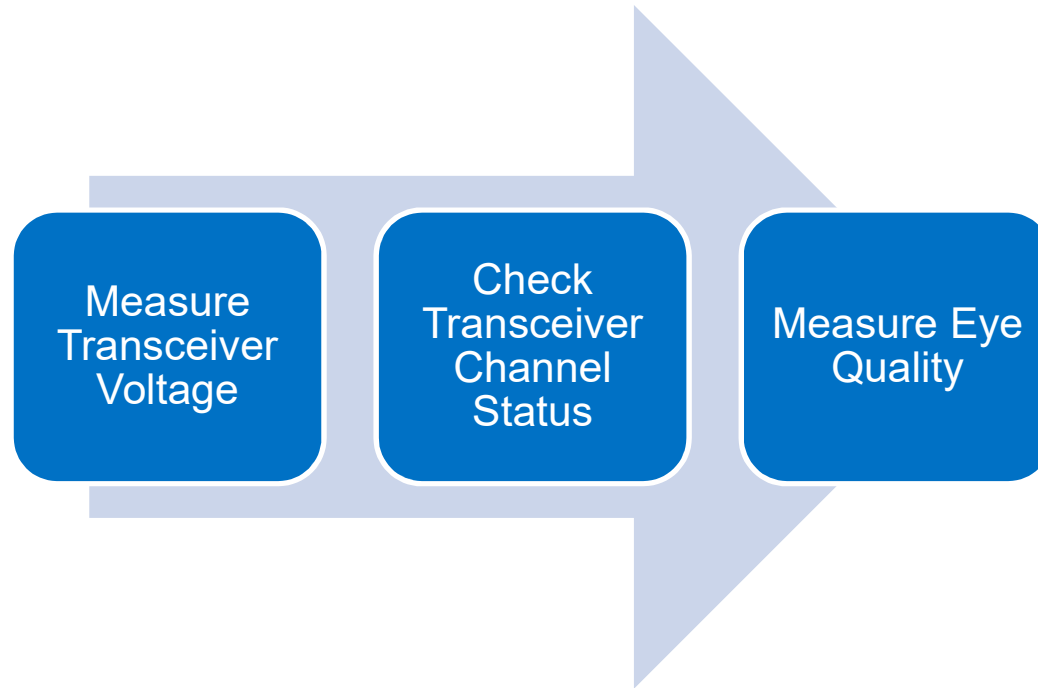


**INTEL® STRATIX® 10 DEVICE
L-TILE/H-TILE TRANSCEIVER DEBUG TOOL**

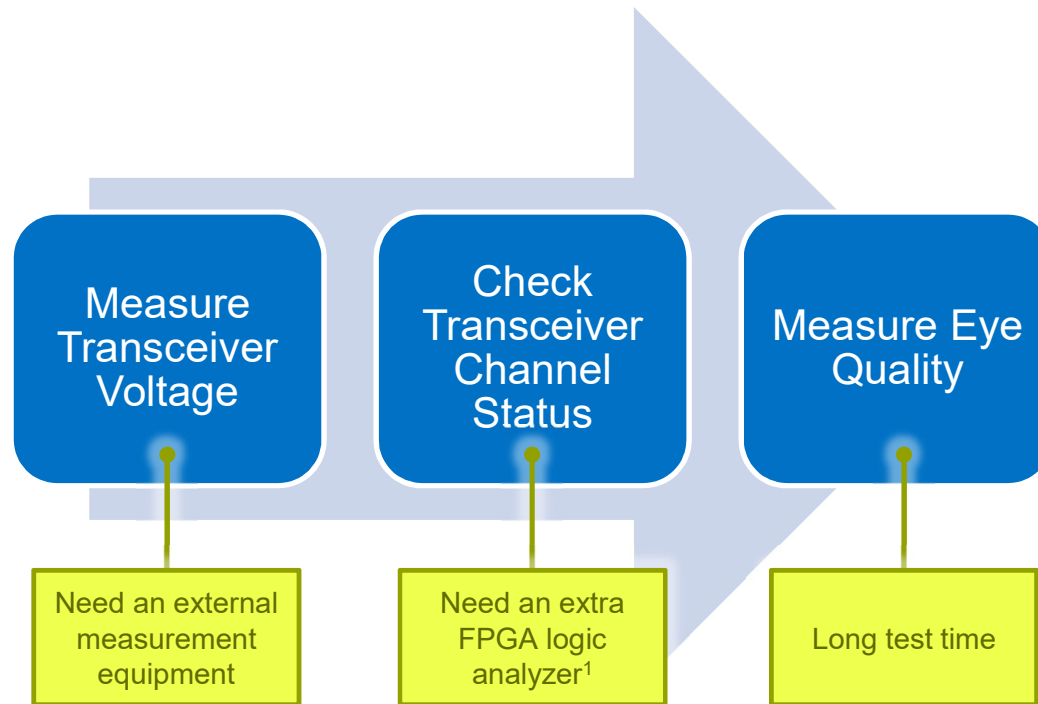
Agenda

- Challenges with the current transceiver debug process
- Why do we need a transceiver debug tool?
- Components and features of the Transceiver Debug Tool
- Steps to run the Transceiver Debug Tool

Challenges with the Current Transceiver Debug Process



Challenges with the Current Transceiver Debug Process



¹ For example, a Signal Tap logic analyzer

Why Do We Need a Transceiver Debug Tool?



Fast
Results



Fully
Automated



Design or Protocol
Agnostic

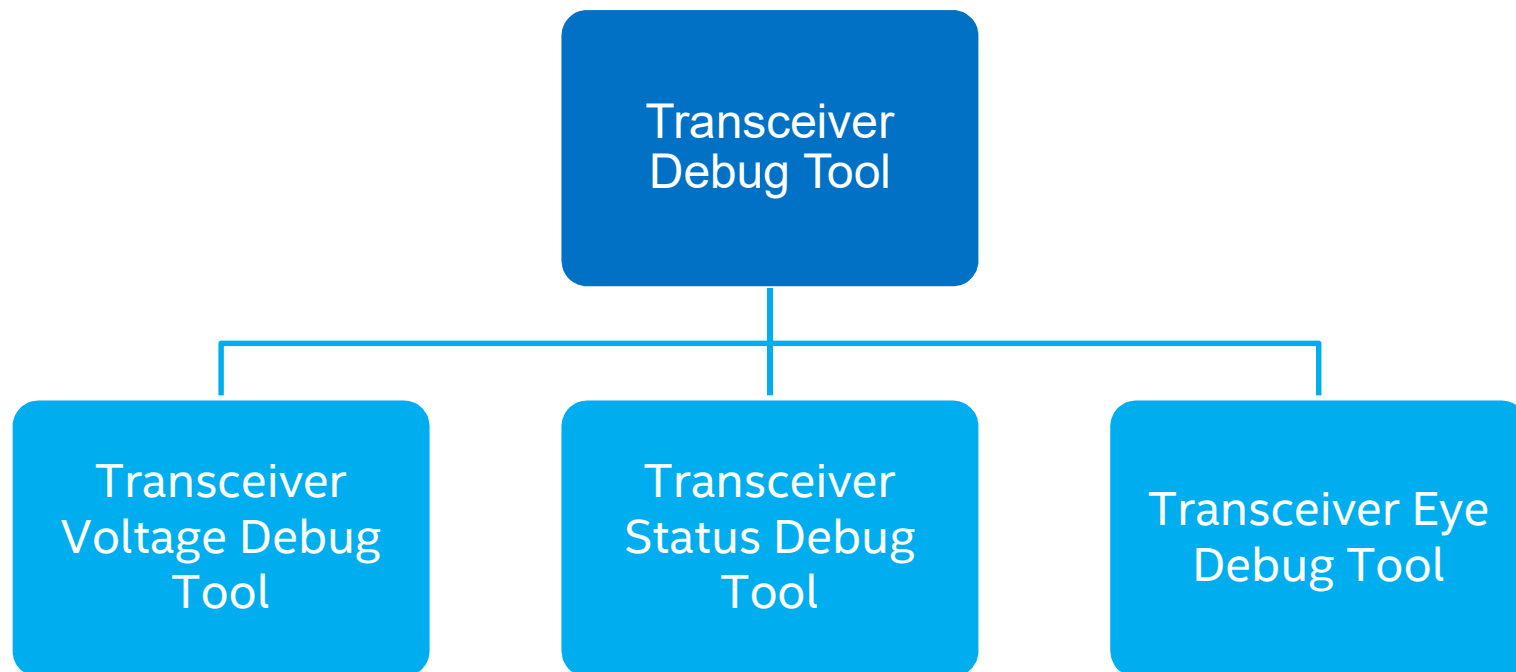


Push-Button
Results



No Effect on
Data Traffic

Components and Features of the Transceiver Debug Tool



Components and Features of the Transceiver Debug Tool

Transceiver Voltage Debug Tool

- Measure VCCER at the data sampling node
- Measure VCCET at the transmitter node

Transceiver Status Debug Tool

- Show the following channel status:
 - Locked to data and locked to ref
 - Calibration, Avalon® Memory Mapped (Avalon-MM) busy, and serial loopback
- Check the cable polarity swap

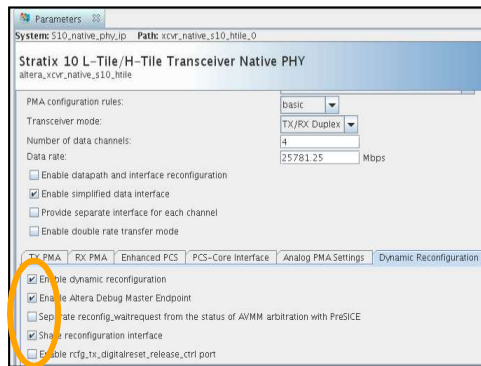
Transceiver Eye Debug Tool

- Measure the height or width of the eye at clock data recovery (CDR) sampling point

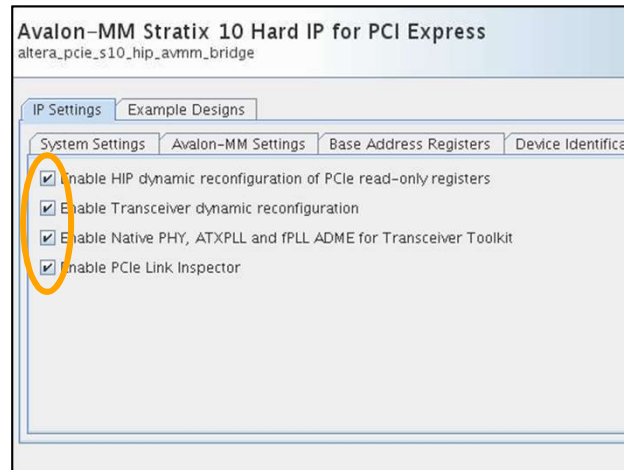
Four Steps to Run the Transceiver Debug Tool

Step 1: Enable the Altera® Debug Master Endpoint (ADME) and compile the design

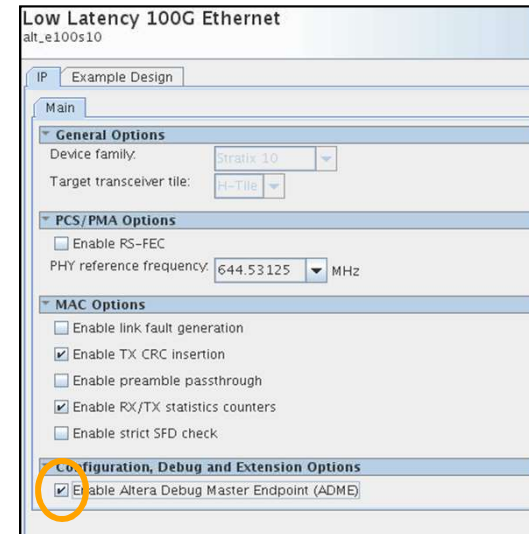
Native PHY Intellectual Property (IP)



PCIe* IP

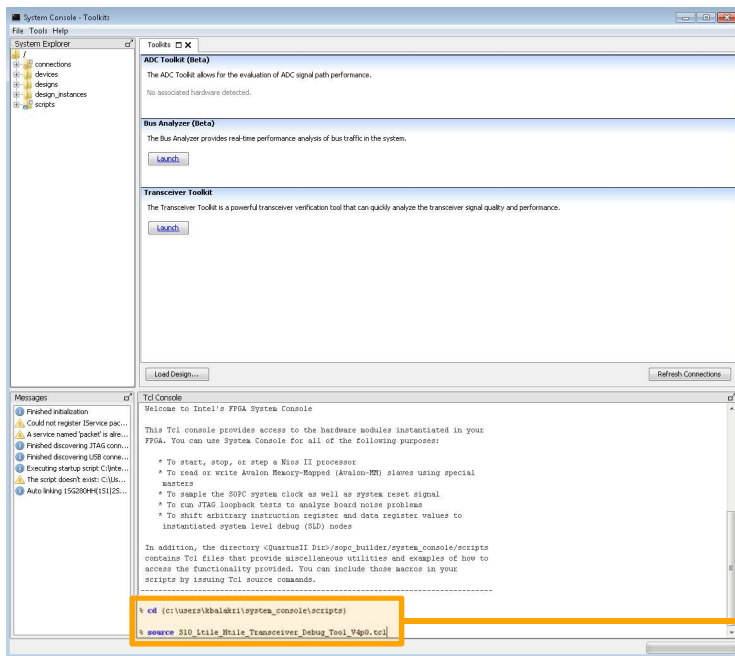


Ethernet IP



Four Steps to Run the Transceiver Debug Tool

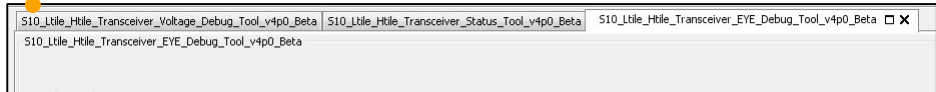
- Step 2: Program the device.
- Step 3: Load the design in the system console.
- Step 4: Use "cd" to change the directory where you have saved the tools script file and source "S10_Ltile_Htile_Transceiver_Debug_Tool_V4p0.tcl"



```
% cd {c:\users\kbalakri\system_console\scripts}
% source S10_Ltile_Htile_Transceiver_Debug_Tool_V4p0.tcl

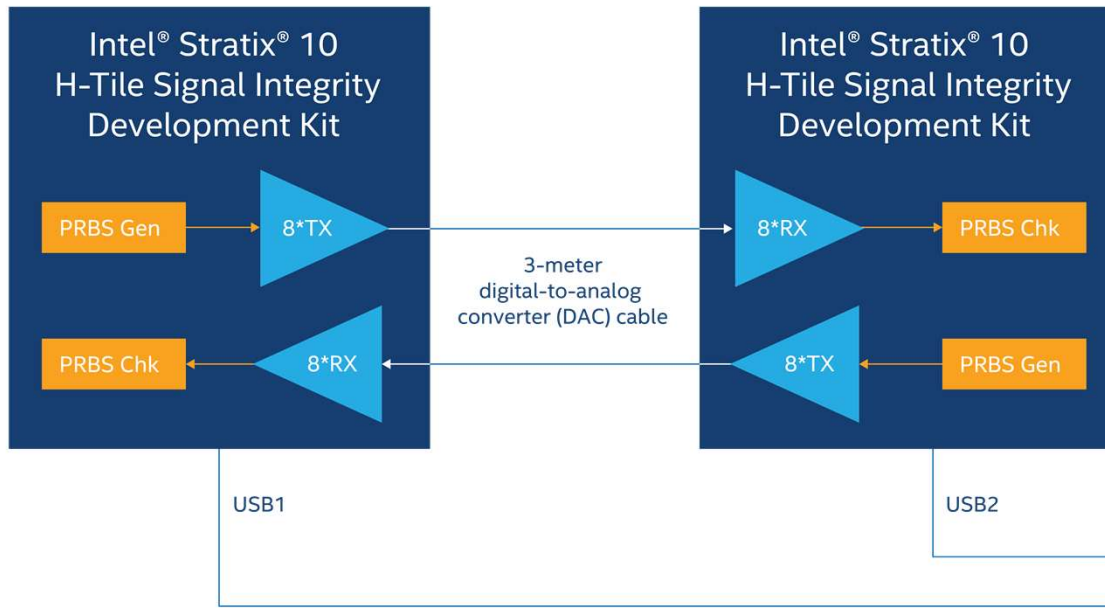
*****
S10_Ltile_Htile_Transceiver_Voltage_Debug_Tool_v4p0 Load Start      - Current time- 14hr_44min_11sec
altera_xcvr_native_s10_htile.slave
altera_xcvr_native_s10_htile.slave
S10_Ltile_Htile_Transceiver_Voltage_Debug_Tool_v4p0 Load Stop      - Current time- 14hr_44min_12sec
*****
S10_Ltile_Htile_Transceiver_Status_Debug_Tool_v4p0 Load Start      - Current time- 14hr_44min_12sec
S10_Ltile_Htile_Transceiver_Status_Debug_Tool_v4p0 Load Stop      - Current time- 14hr_44min_12sec
*****
S10_Ltile_Htile_Transceiver_Eye_Debug_Tool_v4p0 Load Start        - Current time- 14hr_44min_12sec
S10_Ltile_Htile_Transceiver_EYE_Debug_Tool_v4p0 Load Stop        - Current time- 14hr_44min_12sec
*****
Tools Loaded
Click "Tools" dropdown on the top left corner of System Console, Select the debug tool
*****
```

User will observe these tabs in the system console



Note: Refer to the backup slides for steps on how to program the device and load the sof file.

An Example of a Test Setup



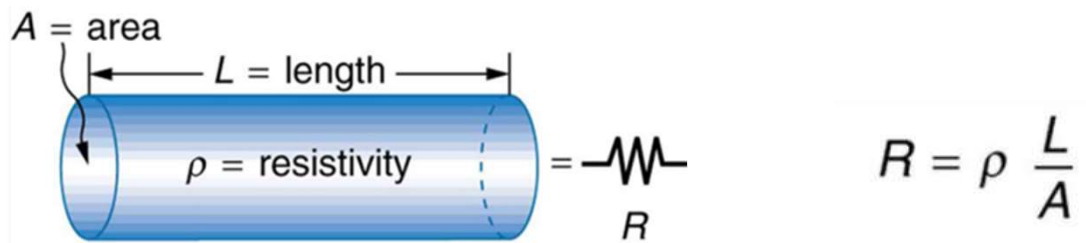
Number of Channels	4
Data Rate	28 Gbps
Connector	QSFP+
Cable Length	3 meters
Design	Physical medium attachment (PMA) Direct
RX Adaptation	Adaptive CTLE, VGA, All tap DFE



TRANSCEIVER VOLTAGE TOOL

PCB Trace Properties

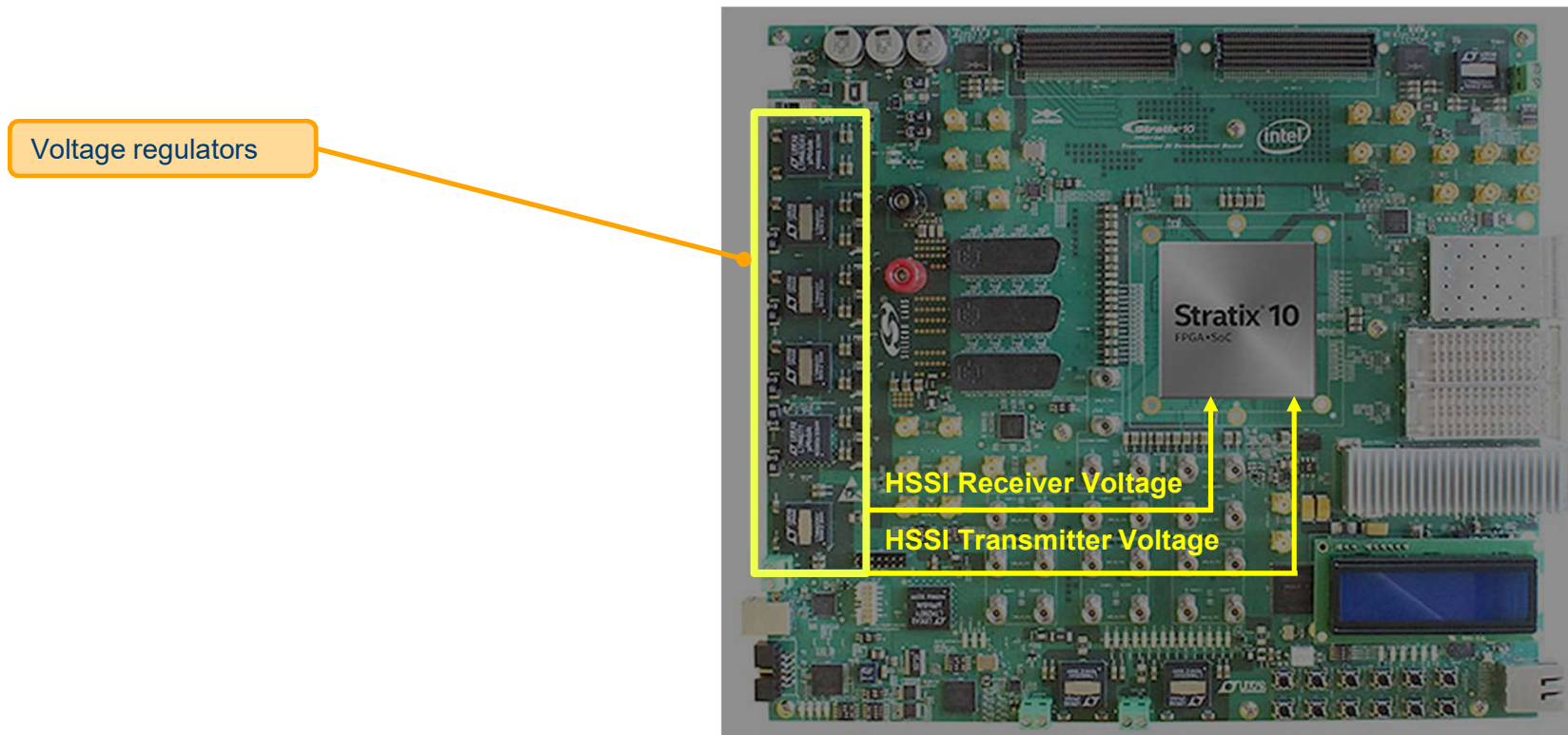
PCB trace resistance can be calculated as



$$R = \rho \frac{L}{A}$$

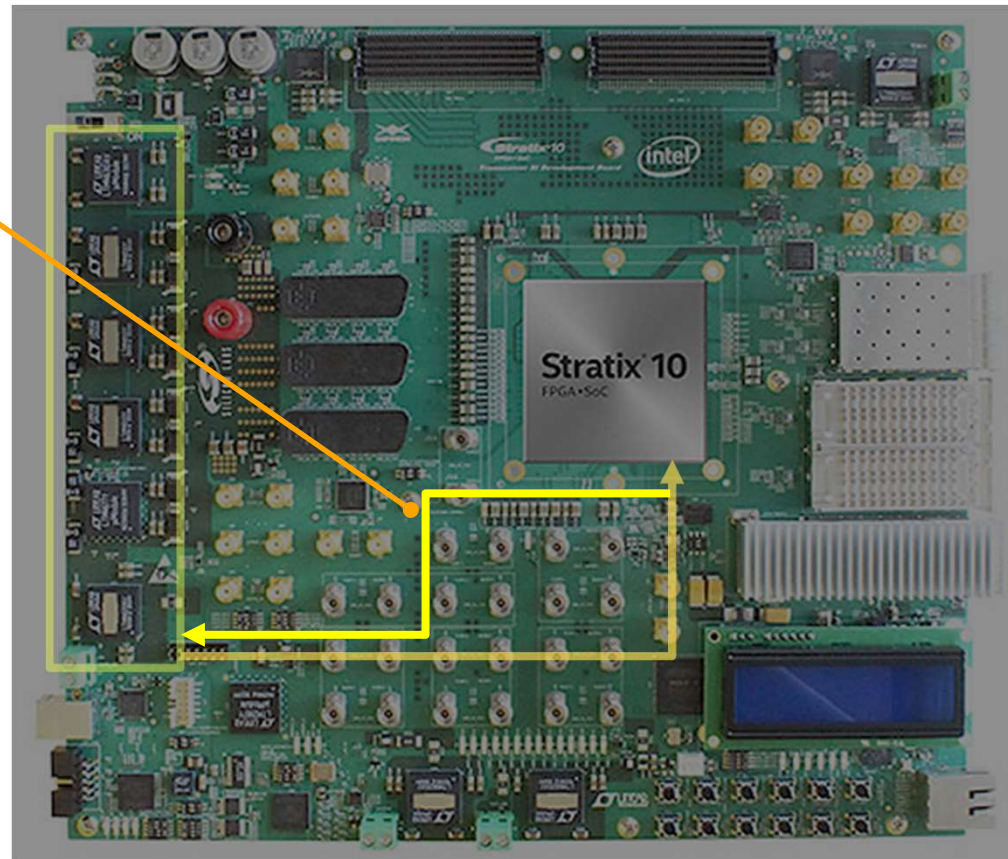


Intel® Stratix® 10 Signal Integrity (SI) Development Kit



Sense Trace

Sense trace measures the voltage nearest to the device

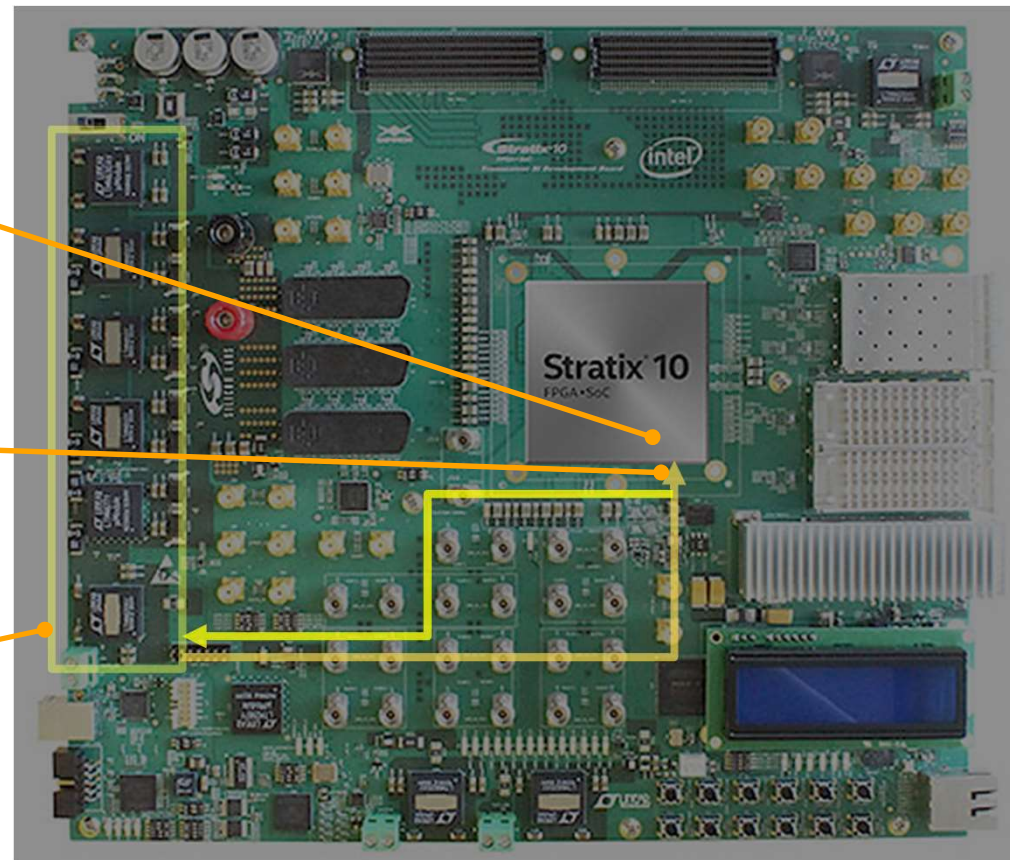


Problem Statement

Sense trace does not sense the package IR drop

Voltage drop from sense point to device is not measured

Need an external analog-to-digital (ADC) to convert the sensed voltage

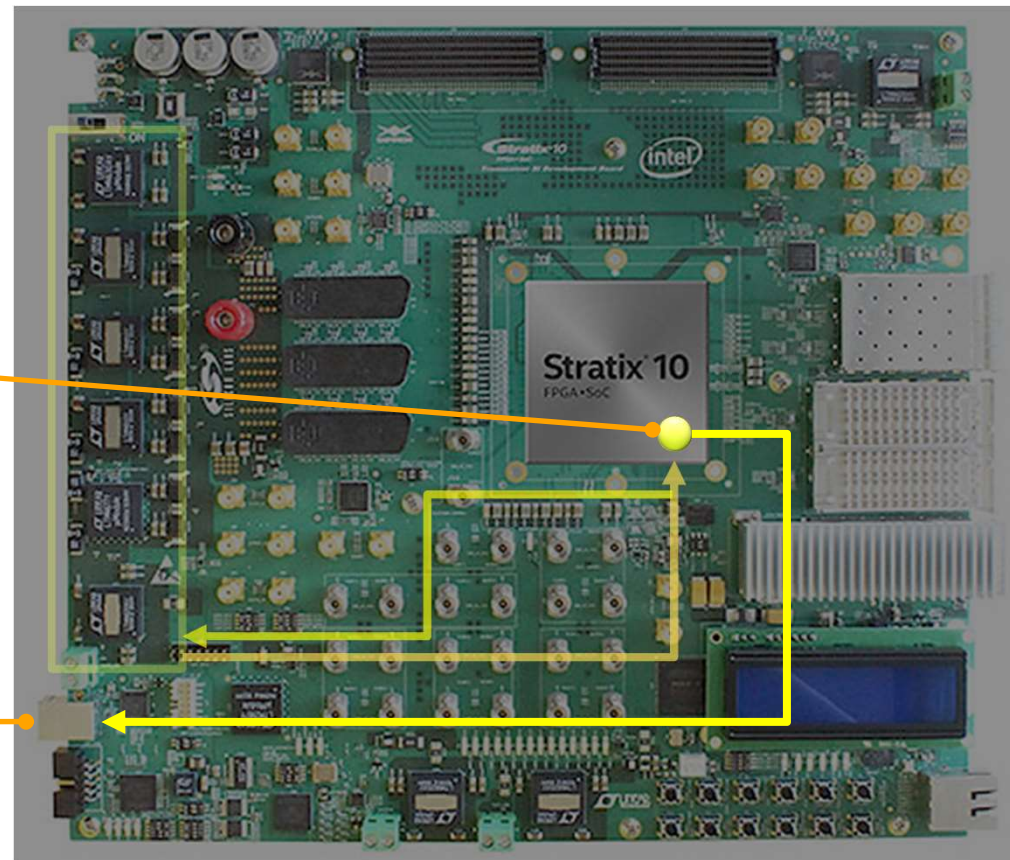


Solution

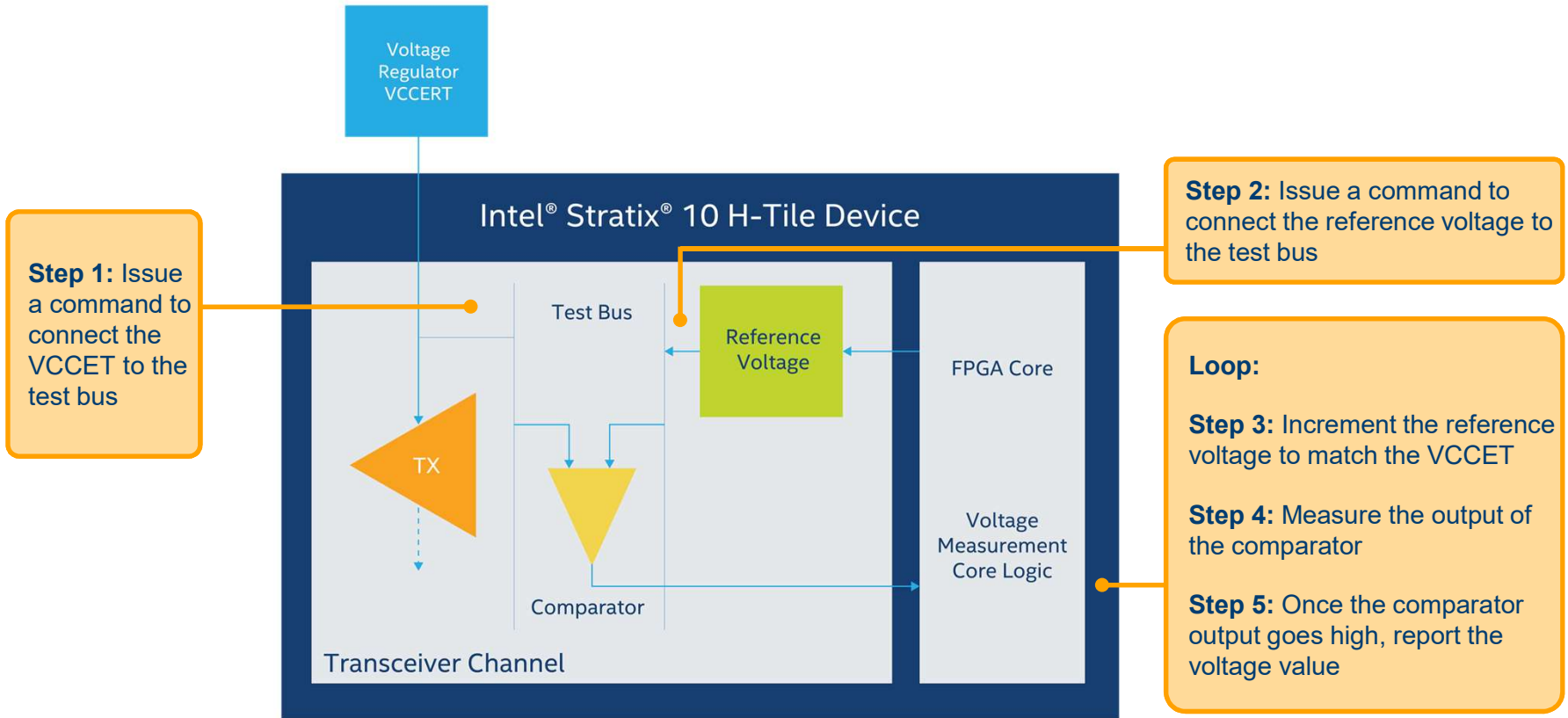
Intel® Stratix® 10
L-Tile/H-Tile Transceiver
Voltage Debug Tool

Measure the voltage internally

Measured voltage value
accessed via the JTAG or
System Console



Intel® Stratix® 10 L-Tile/H-Tile Transceiver Voltage Debug Tool Algorithm



Intel® Stratix® 10 Device L-Tile/H-Tile Transceiver Voltage Tool

S10_Ltile_Htile_Transceiver_Voltage_Debug_Tool_v4p0_Beta

Comments

```

*****
Tool_y4p0 based on Q17.1.2
To use this tool ADME should be Enabled
Datarate < 17.4Gbps - VCCET/VCCER - Min 1.0V || Typ 1.03V || Max 1.06V
Datarate > 17.4Gbps - VCCET/VCCER - Min 1.1V || Typ 1.12V || Max 1.14V
Accuracy : +-18mV
*****
    
```

Measurement Type

continuous update Disabled/check to Enable
 Stop the current measurement

Phy + Channel

devices_15G280HH(151|251|351)..@2#USB-1#Stratix_10H_SI_Dev_Kit||e100_1|ex_100g_inst|ex_100g_inst|xcvr|caui4_xcvr_644|alt_xcvr_native_optional_rcfg_logic

continuous update Disabled/check to Enable
 Stop the current measurement

	Ch0	Ch1	Ch2	Ch3	Status
VCCER	1.11578V	1.11578V	1.11578V	1.11578V	Done
VCCET	1.13380V	1.13380V	1.13380V	1.13380V	Done

devices_15G280HH(151|251|351)..@2#USB-1#Stratix_10H_SI_Dev_Kit||e100_2|ex_100g_inst|ex_100g_inst|xcvr|caui4_xcvr_644|alt_xcvr_native_optional_rcfg_logic

continuous update Disabled/check to Enable
 Stop the current measurement

	Ch0	Ch1	Ch2	Ch3	Status
VCCER	1.11578V	1.11578V	1.11578V	1.11578V	Done
VCCET	1.13380V	1.13380V	1.13380V	1.13380V	Done

Intel® Stratix® 10 Device L-Tile/H-Tile Transceiver Voltage Tool

S10_Ltile_Htile_Transceiver_Voltage_Debug_Tool_v4p0_Beta

Comments

```

*****
Tool_v4p0 based on Q17.1.2
To use this tool ADME should be Enabled
Datarate < 17.4Gbps - VCCET/VCCER - Min 1.0V || Typ 1.03V || Max 1.06V
Datarate > 17.4Gbps - VCCET/VCCER - Min 1.1V || Typ 1.12V || Max 1.14V
Accuracy : +/-18mV
*****
    
```

Measurement Type

continuous update Disabled/check to Enable Stop the current measurement

Phy + Channel

devices_15G280HH(151|251|351)|..@2#USB-1#Stratix_10H_SI_Dev_Kit||e100_1|ex_100g_inst|ex_100g_inst|xcvr|caui4_xcvr_644|alt_xcvr_native_optional_rcfg_logic

continuous update Disabled/check to Enable Stop the current measurement

	Ch0	Ch1	Ch2	Ch3	Status
VCCER	1.11578V	1.11578V	1.11578V	1.11578V	Done
VCCET	1.13380V	1.13380V	1.13380V	1.13380V	Done

e100_1|ex_100g_inst|ex_100g_inst|xcvr|caui4_xcvr_644|alt_xcvr_native_optional_rcfg_logic

devices_15G280HH(151|251|351)|..@2#USB-1#Stratix_10H_SI_Dev_Kit||e100_2|ex_100g_inst|ex_100g_inst|xcvr|caui4_xcvr_644|alt_xcvr_native_optional_rcfg_logic

continuous update Disabled/check to Enable Stop the current measurement

	Ch0	Ch1	Ch2	Ch3	Status
VCCER	1.11578V	1.11578V	1.11578V	1.11578V	Done
VCCET	1.13380V	1.13380V	1.13380V	1.13380V	Done

Tool automatically finds all the PHY instance

Tool automatically finds all the channels in the instantiated PHY instance

Tool automatically finds all connected cables (USB1 or USB2)

Intel® Stratix® 10 Device L-Tile/H-Tile Transceiver Voltage Tool

S10_Ltile_Htile_Transceiver_Voltage_Debug_Tool_v4p0_Beta

Comments

```

*****
Tool_v4p0 based on Q17.1.2
To use this tool ADME should be Enabled
Datarate < 17.4Gbps - VCCET/VCCER - Min 1.0V || Typ 1.03V || Max 1.06V
Datarate > 17.4Gbps - VCCET/VCCER - Min 1.1V || Typ 1.12V || Max 1.14V
Accuracy : +-18mV
*****
    
```

Measurement Type

continuous update Disabled/check to Enable
 Stop the current measurement

Phy + Channel

continuous update Disabled/check to Enable
 Stop the current measurement

e100_1|ex_100g_inst|ex_100g_inst|xcvr|caui4_xcvr_644|alt_xcvr_native_optional_rcfg_logic

	Ch0	Ch1	Ch2	Ch3	Status
VCCER	1.11578V	1.11578V	1.11578V	1.11578V	Done
VCCET	1.13380V	1.13380V	1.13380V	1.13380V	Done

continuous update Disabled/check to Enable
 Stop the current measurement

e100_2|ex_100g_inst|ex_100g_inst|xcvr|caui4_xcvr_644|alt_xcvr_native_optional_rcfg_logic

	Ch0	Ch1	Ch2	Ch3	Status
VCCER	1.11578V	1.11578V	1.11578V	1.11578V	Done
VCCET	1.13380V	1.13380V	1.13380V	1.13380V	Done

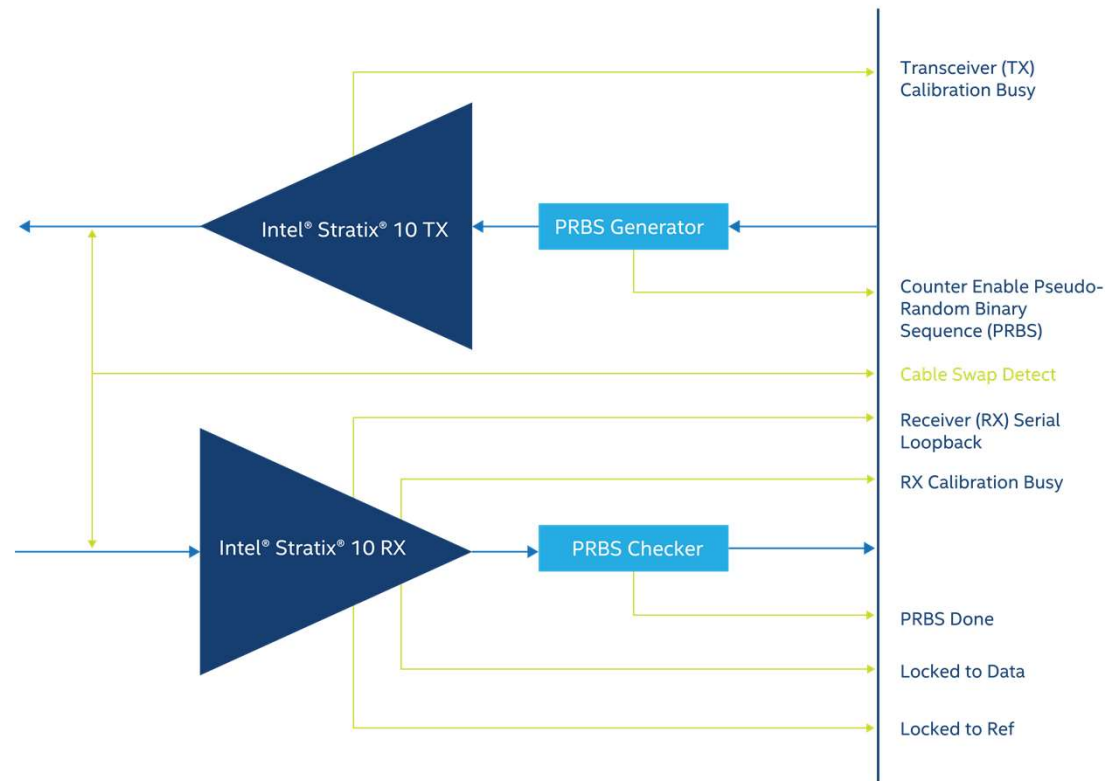
Measure the voltage once

Continuously measure the voltage

Stop the current measurement

TRANSCEIVER STATUS TOOL

Intel® Stratix® 10 Device Status Signal



Intel® Stratix® 10 Device L-Tile/H-Tile Transceiver Status Tool

S10_Ltile_Htile_Transceiver_Status_Tool_v4p0_Beta

Comments

.....
 Tool_v4p0 based on Q17.1.2
 1.To use this tool ADME should be Enabled
 2.Uncheck checkbox to enable Cable P/N Swap test

Measurement Type

continuous update Disabled/check to Enable

PHY + Channel

devices_15G280H{(151|251|351)}..@2#USB-1#Stratix_10H_SI_Dev_KIR|e100_1|ex_100q_inst|ex_100q_inst|xcvr|caui#_xcvr_644|alt_xcvr_native_optional_cfg_logic

Description	Disable	Ch0	Ch1	Ch2	Ch3	click_for_help
rx_is_lockedtodata {Red:NoLock, Green:LockHigh,}	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="button" value="rx_is_lockedtodata_help"/>
rx_is_lockedtoref {Red:NoLock, Green:LockHigh, Dark_green: Don't Care, Since Lock_to_data is high}	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="button" value="rx_is_lockedtoref_help"/>
tx_cal_busy {Red:Cal_on, Dark_Green:Cal_done}	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="button" value="tx_cal_busy_help"/>
rx_cal_busy {Red:Cal_on, Dark_Green:Cal_done}	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="button" value="rx_cal_busy_help"/>
avmm_busy {Red:Avmm_Busy, Dark_Green:Avmm_not_Busy}	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="button" value="avmm_busy_help"/>
rx_serialpbken {Green:Loopback_on, Dark_green:Loopback_off}	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="button" value="rx_serialpbken_help"/>
prbs_counter_en {Green:PRBS_enabled, Dark_red:PRBS_Disabled}	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="button" value="prbs_counter_en_help"/>
prbs_done {Green:PRBS_patt_found, Red:PRBS_patt_not_found}	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="button" value="prbs_done_help"/>
cable_P_N_swap {Green:No_need_to_swap_polarity,Red:Need_to_swap_polarity, Dark_green:Disable/No Data Lock} <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="button" value="cable_P_N_swap_help"/>

devices_15G280H{(151|251|351)}..@2#USB-1#Stratix_10H_SI_Dev_KIR|e100_2|ex_100q_inst|ex_100q_inst|xcvr|caui#_xcvr_644|alt_xcvr_native_optional_cfg_logic

Description	Disable	Ch0	Ch1	Ch2	Ch3	click_for_help
rx_is_lockedtodata {Red:NoLock, Green:LockHigh,}	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="button" value="rx_is_lockedtodata_help"/>
rx_is_lockedtoref {Red:NoLock, Green:LockHigh, Dark_green: Don't Care, Since Lock_to_data is high}	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="button" value="rx_is_lockedtoref_help"/>
tx_cal_busy {Red:Cal_on, Dark_Green:Cal_done}	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="button" value="tx_cal_busy_help"/>
rx_cal_busy {Red:Cal_on, Dark_Green:Cal_done}	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="button" value="rx_cal_busy_help"/>
avmm_busy {Red:Avmm_Busy, Dark_Green:Avmm_not_Busy}	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="button" value="avmm_busy_help"/>
rx_serialpbken {Green:Loopback_on, Dark_green:Loopback_off}	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="button" value="rx_serialpbken_help"/>
prbs_counter_en {Green:PRBS_enabled, Dark_red:PRBS_Disabled}	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="button" value="prbs_counter_en_help"/>
prbs_done {Green:PRBS_patt_found, Red:PRBS_patt_not_found}	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="button" value="prbs_done_help"/>
cable_P_N_swap {Green:No_need_to_swap_polarity,Red:Need_to_swap_polarity, Dark_green:Disable/No Data Lock} <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="button" value="cable_P_N_swap_help"/>

Intel® Stratix® 10 Device L-Tile/H-Tile Transceiver Status Tool

S10_Ltile_Htile_Transceiver_Status_Tool_v4p0_Beta

Comments

Tool_v4p0 based on Q17.1.2
 1.To use this tool ADME should be Enabled
 2.Uncheck checkbox to enable Cable P/N Swap test

Measurement Type
 continuous update Disabled/check to Enable

PHY + Channel

devices_15G280H(151|251|351)|..@2#USB-1#Stratix_10H_SI_Dev_KR||e100_1|ex_100q_inst|ex_100q_inst|xcvr|caui#xcvr_644|alt_xcvr_native_optional_rcfg_logic

Description	Disable	Ch0	Ch1	Ch2	Ch3	click_for_help
rx_is_lockedtodata {Red:NoLock, Green:LockHigh,}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="button" value="rx_is_lockedtodata_help"/>
rx_is_lockedtoref {Red:NoLock, Green:LockHigh, Dark_green: Don't Care, Since Lock_to_data is high}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="button" value="rx_is_lockedtoref_help"/>
tx_cal_busy {Red:Cal_on, Dark_Green:Cal_done}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="button" value="tx_cal_busy_help"/>
rx_cal_busy {Red:Cal_on, Dark_Green:Cal_done}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="button" value="rx_cal_busy_help"/>
avmm_busy {Red:Avmm_Busy, Dark_Green:Avmm_not_Busy}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="button" value="avmm_busy_help"/>
rx_serialpbken {Green:Loopback_on, Dark_green:Loopback_off}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="button" value="rx_serialpbken_help"/>
prbs_counter_en {Green:PRBS_enabled, Dark_green:PRBS_Disabled}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="button" value="prbs_counter_en_help"/>
prbs_done {Green:PRBS_patt_found, Red:PRBS_patt_not_found}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="button" value="prbs_done_help"/>
cable_P_N_swap {Green:No_need_to_swap_polarity,Red:Need_to_swap_polarity, Dark_green:Disable/No Data Lock} <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="button" value="cable_P_N_swap_help"/>

devices_15G280H(151|251|351)|..@2#USB-1#Stratix_10H_SI_Dev_KR||e100_2|ex_100q_inst|ex_100q_inst|xcvr|caui#xcvr_644|alt_xcvr_native_optional_rcfg_logic

Description	Disable	Ch0	Ch1	Ch2	Ch3	click_for_help
rx_is_lockedtodata {Red:NoLock, Green:LockHigh,}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="button" value="rx_is_lockedtodata_help"/>
rx_is_lockedtoref {Red:NoLock, Green:LockHigh, Dark_green: Don't Care, Since Lock_to_data is high}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="button" value="rx_is_lockedtoref_help"/>
tx_cal_busy {Red:Cal_on, Dark_Green:Cal_done}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="button" value="tx_cal_busy_help"/>
rx_cal_busy {Red:Cal_on, Dark_Green:Cal_done}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="button" value="rx_cal_busy_help"/>
avmm_busy {Red:Avmm_Busy, Dark_Green:Avmm_not_Busy}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="button" value="avmm_busy_help"/>
rx_serialpbken {Green:Loopback_on, Dark_green:Loopback_off}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="button" value="rx_serialpbken_help"/>
prbs_counter_en {Green:PRBS_enabled, Dark_green:PRBS_Disabled}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="button" value="prbs_counter_en_help"/>
prbs_done {Green:PRBS_patt_found, Red:PRBS_patt_not_found}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="button" value="prbs_done_help"/>
cable_P_N_swap {Green:No_need_to_swap_polarity,Red:Need_to_swap_polarity, Dark_green:Disable/No Data Lock} <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="button" value="cable_P_N_swap_help"/>

Tool automatically finds the Native PHY instantiated

Tool automatically finds the number of channels instantiated

Click on the button to view debug help

```

step1:QDR PRB deviation limit violation
  Ensure the maximum PRB difference limit between TX and RX is the link is within device specification
  check QDR PRB setting in RX DMA tab under Section REF 13
  Set QDR to manual 170 mode, assume rx_ribsout frequency

Step2: Increasing data
  Enable internal serial loopback. If QDR locks to data (in its lockdata asserted),
  the same could be from the incoming data or not optimized link tuning
  Check incoming data does not violate run length specification of the device
  adequate eye opening (if possible, probe the eye diagram at device RX pin
  Perform link tuning to optimize RX buffer making settings
  A reset to RX channel is required under following conditions:
  RX cable is unplugged and re-plugged
  long period of idle on the link
  increasing data path switched from external to internal loopback, and vice versa
    
```

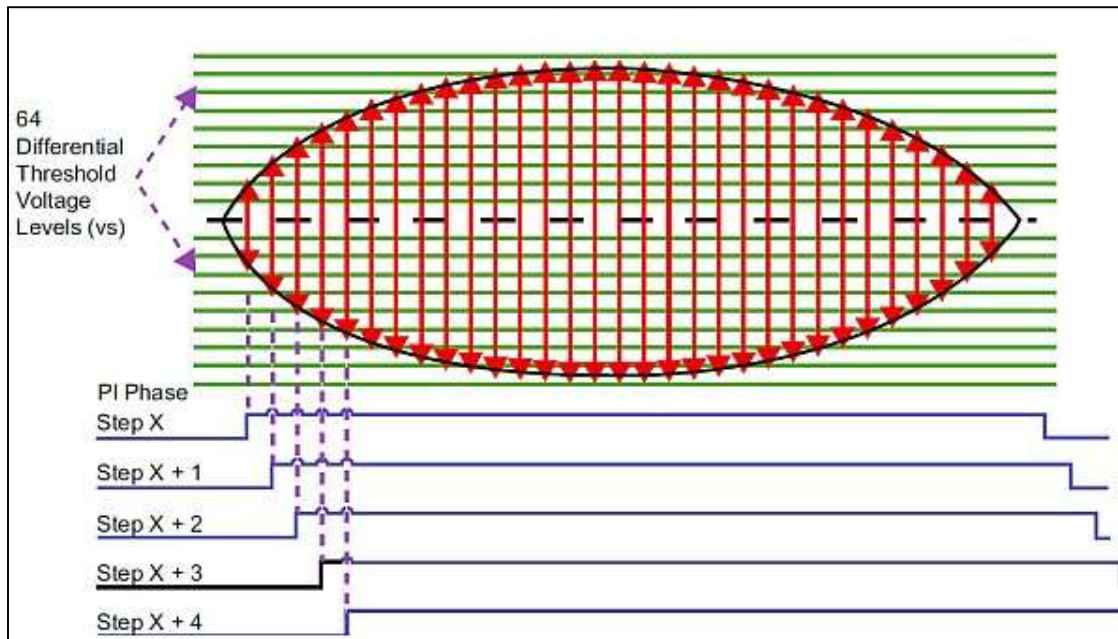
Uncheck the box to detect part number cable swap

TRANSCEIVER EYE DEBUG TOOL

Intel® Stratix® 10 Device Eye Viewer (On-Die Instrumentation (ODI))

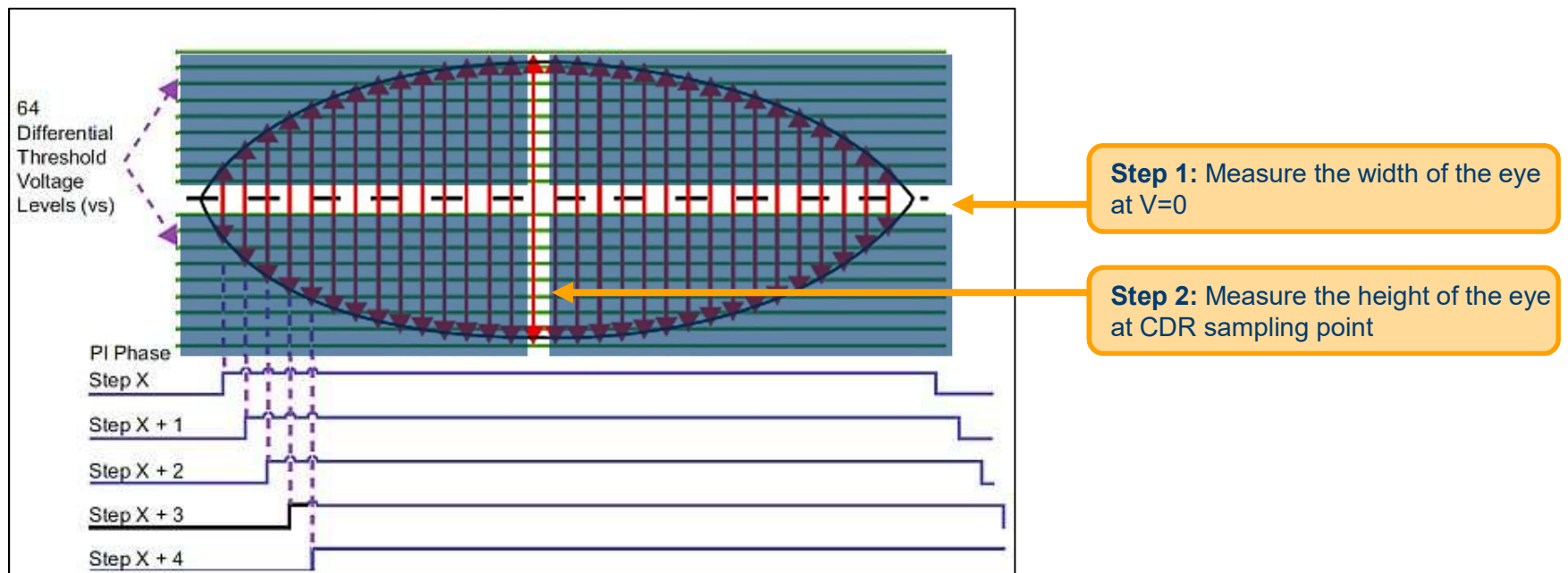
- Provides on-chip eye monitoring capabilities
- Helps to optimize link equalization parameters during board bring-up
- Supports in-system link diagnostics and equalization margin testing

Existing Intel® Stratix® 10 Transceiver Toolkit Eye Viewer Algorithm



- Loop 1: Increment the vertical threshold voltage
- Loop 2: Sweep the ODI clock across for different clock phase
- Measure the error count
- Loop end
- Plot the 2-D eye diagram

Intel® Stratix® 10 Device L-Tile/H-Tile Transceiver Eye Debug Tool Algorithm



Transceiver L-Tile/H-Tile Eye Debug Tool

S10_LTile_HTile_Transceiver_EYE_Debug_Tool_v4p0_Beta

Comments

.....
 Tool_v4p0 based on Q17.1.2
 To use this tool ADME should be Enabled
 This tool measure the Eye Height and Width at the CDR Sampling Point
 Change the Vertical and Horizontal sweep step size to decrease the measurement time
 Increasing the Step size will decrease the accuracy

 Logfile in the following Location --> log/Eye_measurement_057Julian_13hr_45min_59sec_sj-cabest02-24.csv

Measurement Type

Continuous Measure Eye Disabled(check to Enable) Stop the current measurement

Phy instance + Channel

devices_15G280H#[151|251|351]...@2#USB-1#Stratix_10H_SL_Dev_KIR|[S10_4chan_25g_inst1|S10_native_phy_ip|xcvr_native_s10_htile_0|alt_xcvr_native_optional_rcfg_logic

continuous update Disabled(check to Enable) Stop the current measurement

S10_4chan_25g_inst1|S10_native_phy_ip|xcvr_native_s10_htile_0|alt_xcvr_native_optional_rcfg_logic

enable	chan_en	sripbk	Horiz_step	Vert_step	PRBS	Eye_W/H_1e6	Eye_W/H_1e7	Eye_W/H_1e8	Eye_W/H_1e9	Eye_W/H_1e10	Eye_W/H_1e11	Eye_W/H_1e12	Status	VOD	Post	Pre	acpain	dcgain	VGA	DFE	Test_Time
<input type="button" value="enable"/>	0	2	2	2	PRBS31	36/40	32/40	32/40	28/40	--	--	--	Done	31	0	0	8	28	22	54,3,3,5,6,2,3,3,3,1,1,1,1,1,1	19 sec
<input type="button" value="enable"/>	0	2	2	2	PRBS31	42/44	38/44	34/36	34/32	--	--	--	Done	31	0	0	8	29	23	53,3,3,5,4,3,2,3,2,2,1,1,0,2	18 sec
<input type="button" value="enable"/>	0	2	2	2	PRBS31	40/48	34/48	34/44	32/40	--	--	--	Done	31	0	0	8	29	22	52,1,2,3,4,4,2,3,2,1,2,2,1,1,1	18 sec
<input type="button" value="enable"/>	0	2	2	2	PRBS31	40/56	36/52	34/44	34/44	--	--	--	Done	31	0	0	8	29	21	51,1,2,4,4,2,4,2,1,1,1,2,1,0,0	16 sec

devices_15G280H#[151|251|351]...@2#USB-1#Stratix_10H_SL_Dev_KIR|[S10_4chan_25g_inst2|S10_native_phy_ip|xcvr_native_s10_htile_0|alt_xcvr_native_optional_rcfg_logic

continuous update Disabled(check to Enable) Stop the current measurement

S10_4chan_25g_inst2|S10_native_phy_ip|xcvr_native_s10_htile_0|alt_xcvr_native_optional_rcfg_logic

enable	chan_en	sripbk	Horiz_step	Vert_step	PRBS	Eye_W/H_1e6	Eye_W/H_1e7	Eye_W/H_1e8	Eye_W/H_1e9	Eye_W/H_1e10	Eye_W/H_1e11	Eye_W/H_1e12	Status	VOD	Post	Pre	acpain	dcgain	VGA	DFE	Test_Time
<input type="button" value="enable"/>	0	2	2	2	PRBS31	38/40	--	32/40	30/40	--	--	--	Done	31	0	0	8	29	19	46,0,2,5,3,2,2,3,3,1,1,1,1,1,0	17 sec
<input type="button" value="enable"/>	0	2	2	2	PRBS31	38/40	--	32/40	30/40	--	--	--	Done	31	0	0	8	28	22	57,3,3,4,6,3,3,3,2,1,1,2,1,1,1	16 sec
<input type="button" value="enable"/>	0	2	2	2	PRBS31	42/40	--	36/40	34/40	--	--	--	Done	31	0	0	8	28	20	55,3,3,6,4,3,3,3,2,1,2,1,1,1,1	17 sec
<input type="button" value="enable"/>	0	2	2	2	PRBS31	38/52	--	34/52	32/52	--	--	--	Done	31	0	0	8	28	20	53,2,3,3,5,3,3,2,2,3,2,1,1,1,1	17 sec

Transceiver L-Tile/H-Tile Eye Debug Tool

S10_tile_Htile_Transceiver_EYE_Debug_Tool_v4p0_Beta

Comments

Tool_v4p0 based on Q17.1.2
 To use this tool ADME should be Enabled
 This tool measure the Eye Height and Width at the CDR Sampling Point
 Change the Vertical and Horizontal sweep step size to decrease the measurement time
 Increasing the Step size will decrease the accuracy
 LogFile in the following Location --> log/Eye_measurement_057Julian_13hr_45min_59sec_sj-catest02-24.csv

Measurement Type

Continuous Measure Eye Disabled(check to Enable) Stop the current measurement

Phy instance + Channel

devices_15G280H#(151|251|351)...@2#USB-1#Stratix_10H_SL_Dev_KIR||S10_4chan_25g_inst1|S10_native_phy_ip|xcvr_native_s10_htile_0|alt_xcvr_native_optional_rcfg_logic

continuous update Disabled(check to Enable) Stop the current measurement

S10_4chan_25g_inst1|S10_native_phy_ip|xcvr_native_s10_htile_0|alt_xcvr_native_optional_rcfg_logic

channel	chan_en	srpbk	Horiz_step	Vert_step	PRBS	Eye_W/H_1e6	Eye_W/H_1e7	Eye_W/H_1e8	Eye_W/H_1e9	Eye_W/H_1e10	Eye_W/H_1e11	Eye_W/H_1e12	Status	VOD	Post	Pre	acpain	dcgain	VGA	DFE	Test_Time
Chan0	enable	0	2	2	PRBS31	36/40	32/40	32/40	28/40	--	--	--	Done	31	0	0	8	28	22	54,3,3,5,6,2,3,3,1,1,1,1,1,1	19 sec
Chan1	enable	0	2	2	PRBS31	42/44	38/44	34/36	34/32	--	--	--	Done	31	0	0	8	29	23	53,3,3,5,4,3,2,3,2,2,1,1,1,1	18 sec
Chan2	enable	0	2	2	PRBS31	40/48	34/48	34/44	32/40	--	--	--	Done	31	0	0	8	29	22	52,1,2,3,4,4,2,3,2,1,2,2,1,1,1	18 sec
Chan3	enable	0	2	2	PRBS31	40/56	36/52	34/44	34/44	--	--	--	Done	31	0	0	8	29	21	51,1,2,4,4,2,4,2,1,1,1,2,1,1,1	16 sec

devices_15G280H#(151|251|351)...@2#USB-1#Stratix_10H_SL_Dev_KIR||S10_4chan_25g_inst2|S10_native_phy_ip|xcvr_native_s10_htile_0|alt_xcvr_native_optional_rcfg_logic

continuous update Disabled(check to Enable) Stop the current measurement

S10_4chan_25g_inst2|S10_native_phy_ip|xcvr_native_s10_htile_0|alt_xcvr_native_optional_rcfg_logic

channel	chan_en	srpbk	Horiz_step	Vert_step	PRBS	Eye_W/H_1e6	Eye_W/H_1e7	Eye_W/H_1e8	Eye_W/H_1e9	Eye_W/H_1e10	Eye_W/H_1e11	Eye_W/H_1e12	Status	VOD	Post	Pre	acpain	dcgain	VGA	DFE	Test_Time
Chan0	enable	0	2	2	PRBS31	--	32/40	30/40	--	--	--	--	Done	31	0	0	8	29	19	46,0,2,5,3,2,2,3,3,1,1,1,1,1,0	17 sec
Chan1	enable	0	2	2	PRBS31	38/40	--	32/40	30/40	--	--	--	Done	31	0	0	8	28	22	57,3,3,4,6,3,3,3,2,1,1,2,1,1,1	16 sec
Chan2	enable	0	2	2	PRBS31	42/40	--	36/40	34/40	--	--	--	Done	31	0	0	8	28	20	55,3,3,6,4,3,3,3,2,1,2,1,1,1,1	17 sec
Chan3	enable	0	2	2	PRBS31	38/52	--	34/52	32/52	--	--	--	Done	31	0	0	8	28	20	53,2,3,3,5,3,3,2,2,3,2,1,1,1,1	17 sec

Short Measurement Time

Transceiver L-Tile/H-Tile Eye Debug Tool

S10_Htile_Transceiver_EYE_Debug_Tool_v4p0_Beta

Comments

Tool_v4p0 based on Q17.1.2
 To use this tool ADME should be Enabled
 This tool measure the Eye Height and Width at the CDR Sampling Point
 Change the Vertical and Horizontal sweep step size to decrease the measurement time
 Increasing the Step size will decrease the accuracy
 LogFile in the following Location --> log/Eye_measurement_057Julian_13hr_45min_59sec_sj-cabest02-24.csv

Measurement Type

Continuous Measure Eye Disabled(check to Enable) Stop the current measurement

Phy Instance + Channel

devices_15G280H#([151|251|351])...@2#USB-1#Stratix_10H_SL_Dev_KIR|[S10_4chan_25g_inst1|S10_native_phy_ip|xcvr_native_s10_htile_0|alt_xcvr_native_optional_rcfg_logic

continuous update Disabled(check to Enable) Stop the current measurement

S10_4chan_25g_inst1|S10_native_phy_ip|xcvr_native_s10_htile_0|alt_xcvr_native_optional_rcfg_logic

channel	chan_en	srpbk	Horiz_step	Vert_step	PRBS	Eye_W/H_1e6	Eye_W/H_1e7	Eye_W/H_1e8	Eye_W/H_1e9	Eye_W/H_1e10	Eye_W/H_1e11	Eye_W/H_1e12	Status	VOD	Post	Pre	acpain	dogain	VGA	DFE	Test_Time
Chan0	enable	0	2	2	PRBS31	36/40	32/40	32/40	28/40	--	--	--	Done	31	0	0	8	28	22	54,3,3,5,6,2,3,3,3,1,1,1,1,1,1	19 sec
Chan1	enable	0	2	2	PRBS31	42/44	38/44	34/36	34/32	--	--	--	Done	31	0	0	8	29	23	53,3,3,3,5,4,3,2,3,2,2,1,1,0,2	18 sec
Chan2	enable	0	2	2	PRBS31	40/48	34/48	34/44	32/40	--	--	--	Done	31	0	0	8	29	22	52,1,2,3,4,4,2,3,2,1,2,2,1,1,1	18 sec
Chan3	enable	0	2	2	PRBS31	40/56	36/52	34/44	34/44	--	--	--	Done	31	0	0	8	29	21	51,1,2,4,4,2,4,2,1,1,1,2,1,0,0	16 sec

devices_15G280H#([151|251|351])...@2#USB-1#Stratix_10H_SL_Dev_KIR|[S10_4chan_25g_inst2|S10_native_phy_ip|xcvr_native_s10_htile_0|alt_xcvr_native_optional_rcfg_logic

continuous update Disabled(check to Enable) Stop the current measurement

S10_4chan_25g_inst2|S10_native_phy_ip|xcvr_native_s10_htile_0|alt_xcvr_native_optional_rcfg_logic

channel	chan_en	srpbk	Horiz_step	Vert_step	PRBS	Eye_W/H_1e6	Eye_W/H_1e7	Eye_W/H_1e8	Eye_W/H_1e9	Eye_W/H_1e10	Eye_W/H_1e11	Eye_W/H_1e12	Status	VOD	Post	Pre	acpain	dogain	VGA	DFE	Test_Time
Chan0	enable	0	2	2	PRBS31	38/40	--	32/40	30/40	--	--	--	Done	31	0	0	8	29	19	46,0,2,5,3,2,2,3,3,1,1,1,1,1,0	17 sec
Chan1	enable	0	2	2	PRBS31	38/40	--	32/40	30/40	--	--	--	Done	31	0	0	8	28	22	57,3,3,4,6,3,3,3,2,1,1,2,1,1,1	16 sec
Chan2	enable	0	2	2	PRBS31	42/40	--	36/40	34/40	--	--	--	Done	31	0	0	8	28	20	55,3,3,6,4,3,3,3,2,1,2,1,1,1,1	17 sec
Chan3	enable	0	2	2	PRBS31	38/52	--	34/52	32/52	--	--	--	Done	31	0	0	8	28	20	53,2,3,3,5,3,3,2,3,2,1,1,1,1,1	17 sec

- Measure the width of the eye at vertical ref of 0 volt
- Measure the height of the eye at the horizontal step where CDR is sampling at different bit error rate (BER)

Transceiver L-Tile/H-Tile Eye Debug Tool

S10_Ltile_Htile_Transceiver_EYE_Debug_Tool_v4p0_Beta

Comments

Tool_v4p0 based on Q17.1.2
 To use this tool DFE should be Enabled
 This tool measures the Eye Height and Width at the CD0 Sampling Point
 Change the Vertical and Horizontal sweep step size to decrease the measurement time
 Increasing the sweep size will decrease the accuracy
 Logfile in the following Location --> log/Eye_measurement_057Julian_13hr_45min_59sec_sj-cabest02-24.csv

Measurement Type

Continuous Measure Eye Disabled(check to Enable) Stop the current measurement

Phy Instance + Channel

devices_15G280H((151|251|351)...@2#USB-1#Stratix_10H_SL_Dev_KIR|S10_4chan_25g_inst1|S10_native_phy_ip|xcvr_native_s10_htile_0|alt_xcvr_native_optional_rcfg_logic

continuous update Disabled(check to Enable) Stop the current measurement

S10_4chan_25g_inst1|S10_native_phy_ip|xcvr_native_s10_htile_0|alt_xcvr_native_optional_rcfg_logic

channel	chan_en	srpbk	Horiz_step	Vert_step	PRBS	Eye_W/H_1e6	Eye_W/H_1e7	Eye_W/H_1e8	Eye_W/H_1e9	Eye_W/H_1e10	Eye_W/H_1e11	Eye_W/H_1e12	Status	VOD	Post	Pre	acpain	dcgain	VGA	DFE	Test_Time
Chan0	enable	0	2	2	PRBS31	36/40	32/40	32/40	28/40	--	--	--	Done	31	0	0	8	28	22	54,3,3,5,6,2,3,3,3,1,1,1,1,1,1	19 sec
Chan1	enable	0	2	2	PRBS31	42/44	38/44	34/36	34/32	--	--	--	Done	31	0	0	8	29	23	53,3,3,5,5,4,3,2,3,2,2,1,1,0,2	18 sec
Chan2	enable	0	2	2	PRBS31	40/48	34/48	34/44	32/40	--	--	--	Done	31	0	0	8	29	22	52,1,2,3,4,4,2,3,2,1,2,2,1,1,1	18 sec
Chan3	enable	0	2	2	PRBS31	40/56	36/52	34/44	34/44	--	--	--	Done	31	0	0	8	29	21	51,1,2,4,4,2,4,2,1,1,1,2,1,0,0	16 sec

devices_15G280H((151|251|351)...@2#USB-1#Stratix_10H_SL_Dev_KIR|S10_4chan_25g_inst2|S10_native_phy_ip|xcvr_native_s10_htile_0|alt_xcvr_native_optional_rcfg_logic

continuous update Disabled(check to Enable) Stop the current measurement

S10_4chan_25g_inst2|S10_native_phy_ip|xcvr_native_s10_htile_0|alt_xcvr_native_optional_rcfg_logic

channel	chan_en	srpbk	Horiz_step	Vert_step	PRBS	Eye_W/H_1e6	Eye_W/H_1e7	Eye_W/H_1e8	Eye_W/H_1e9	Eye_W/H_1e10	Eye_W/H_1e11	Eye_W/H_1e12	Status	VOD	Post	Pre	acpain	dcgain	VGA	DFE	Test_Time
Chan0	enable	0	2	2	PRBS31	--	32/40	30/40	--	--	--	--	Done	31	0	0	8	29	19	46,0,2,5,3,2,2,3,3,1,1,1,1,1,0	17 sec
Chan1	enable	0	2	2	PRBS31	38/40	--	32/40	30/40	--	--	--	Done	31	0	0	8	28	22	57,3,3,4,6,3,3,3,2,1,1,2,1,1,1	16 sec
Chan2	enable	0	2	2	PRBS31	42/40	--	36/40	34/40	--	--	--	Done	31	0	0	8	28	20	55,3,3,6,4,3,3,3,2,1,2,1,1,1,1	17 sec
Chan3	enable	0	2	2	PRBS31	38/52	--	34/52	32/52	--	--	--	Done	31	0	0	8	28	20	53,2,3,3,5,3,3,2,3,2,1,1,1,1,1	17 sec

- Click to measure and log the eye once
- Continuously measure and log the eye
- Stop the current measurement

Transceiver L-Tile/H-Tile Eye Debug Tool

S10_Ltile_Htile_Transceiver_EYE_Debug_Tool_v4p0_Beta

Comments

Tool_v4p0 based on Q17.1.2
 To use this tool ADME should be Enabled
 This tool measure the Eye Height and Width at the CDR Sampling Point
 Change the Vertical and Horizontal sweep step size to decrease the measurement time
 Increasing the Step size will decrease the accuracy
 Logfile in the following Location --> log/Eye_measurement_057Julian_13hr_45min_59sec_sj-catest02-24.csv

Measurement Type
 Measure Eye Once Continuous Measure Eye Disabled(check to Enable) Stop the current measurement

Phy instance + Channel

devices_15G280H(151|251|351)...@2#USB-1#Stratix_10H_ST1Dev_KIR||S10_4chan_25g_inst1|S10_native_phy_ip|xcvr_native_s10_htile_0|alt_xcvr_native_optional_rcfg_logic

continuous update Disabled(check to Enable) Stop the current measurement

S10_4chan_25g_inst1|S10_native_phy_ip|xcvr_native_s10_htile_0|alt_xcvr_native_optional_rcfg_logic

channel	chan_en	srpbk	Hor_step	Vert_step	PRBS	Eye_W/H_1e6	Eye_W/H_1e7	Eye_W/H_1e8	Eye_W/H_1e9	Eye_W/H_1e10	Eye_W/H_1e11	Eye_W/H_1e12	Status	VOD	Post	Pre	acpain	dogain	VGA	DFE	Test_Time
Chan0	enable	0	2	2	PRBS31	36/40	32/40	28/40	--	--	--	--	Done	31	0	0	8	28	22	54,3,3,5,6,2,3,3,1,1,1,1,1,1	19 sec
Chan1	enable	0	2	2	PRBS31	42/44	38/44	34/36	34/32	--	--	--	Done	31	0	0	8	29	23	53,3,3,5,4,3,2,3,2,1,1,0,2	18 sec
Chan2	enable	0	2	2	PRBS31	40/48	34/48	34/44	32/40	--	--	--	Done	31	0	0	8	29	22	52,1,2,3,4,4,2,3,2,1,2,2,1,1	18 sec
Chan3	enable	0	2	2	PRBS31	40/56	36/52	34/44	34/44	--	--	--	Done	31	0	0	8	29	21	51,1,2,4,4,2,4,2,1,1,1,2,1,0,0	16 sec

devices_15G280H(151|251|351)...@2#USB-1#Stratix_10H_ST1Dev_KIR||S10_4chan_25g_inst2|S10_native_phy_ip|xcvr_native_s10_htile_0|alt_xcvr_native_optional_rcfg_logic

continuous update Disabled(check to Enable) Stop the current measurement

S10_4chan_25g_inst2|S10_native_phy_ip|xcvr_native_s10_htile_0|alt_xcvr_native_optional_rcfg_logic

channel	chan_en	srpbk	Hor_step	Vert_step	PRBS	Eye_W/H_1e6	Eye_W/H_1e7	Eye_W/H_1e8	Eye_W/H_1e9	Eye_W/H_1e10	Eye_W/H_1e11	Eye_W/H_1e12	Status	VOD	Post	Pre	acpain	dogain	VGA	DFE	Test_Time
Chan0	enable	0	2	2	PRBS31	38/40	--	32/40	30/40	--	--	--	Done	31	0	0	8	29	19	46,0,2,5,3,2,2,3,3,1,1,1,1,1,0	17 sec
Chan1	enable	0	2	2	PRBS31	38/40	--	32/40	30/40	--	--	--	Done	31	0	0	8	28	22	57,3,3,4,6,3,3,3,2,1,1,2,1,1,1	16 sec
Chan2	enable	0	2	2	PRBS31	42/40	--	36/40	34/40	--	--	--	Done	31	0	0	8	28	20	55,3,3,6,4,3,3,3,2,1,2,1,1,1	17 sec
Chan3	enable	0	2	2	PRBS31	38/52	--	34/52	32/52	--	--	--	Done	31	0	0	8	28	20	53,2,3,3,5,3,3,2,3,2,1,1,1,1	17 sec

Enable or disable the measurement

Choose the horizontal step size

Choose the vertical step size

Choose PRBS or user traffic

Apply global values

Download the Transceiver Debug Tool



S10_Ltile_Htile_Transceiver_Debug_Tool_V4p0.tcl

Summary

- Needs the least user intervention
- The only way to measure internal high-speed serial interface (HSSI) voltages
- Eye debug tools are 5X faster than Transceiver Toolkit eye plots[†]
- The only tool that can measure eye height and width while running a protocol

BACKUP

Step 1: Program the Device and Open System Console

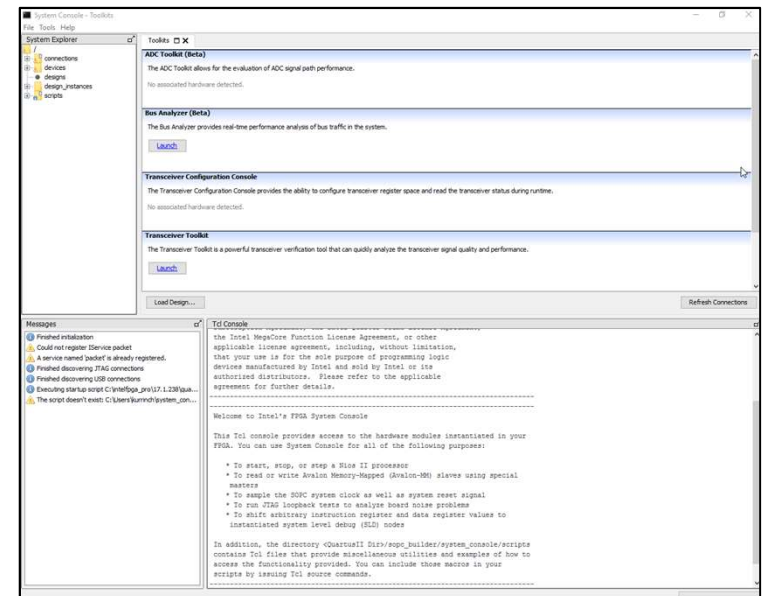
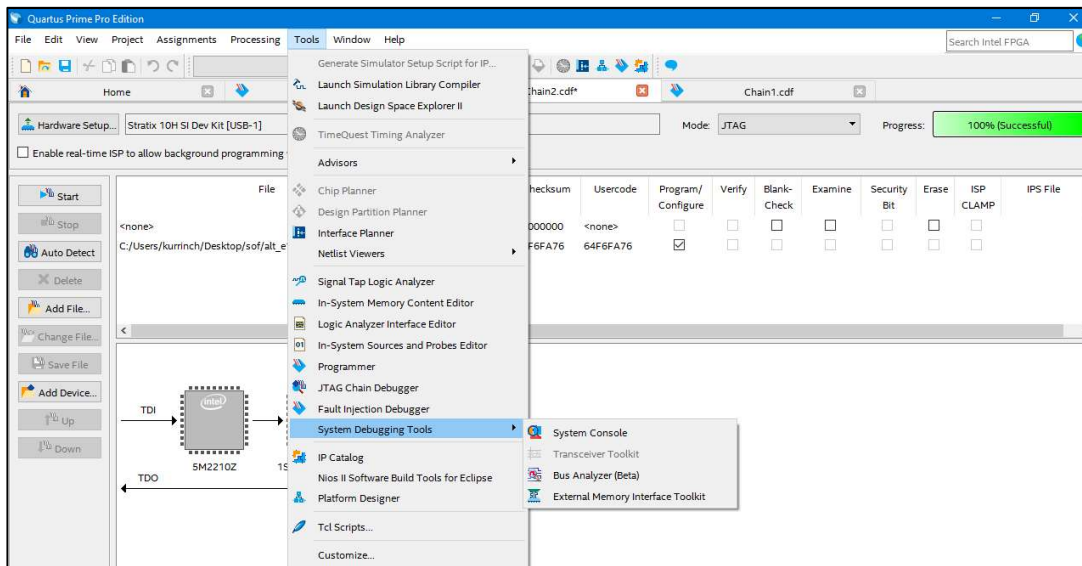
The screenshot shows the Quartus Prime Pro Edition interface. The top menu bar includes File, Edit, View, Project, Assignments, Processing, Tools, Window, and Help. The toolbar contains various icons for file operations and programming. The hardware setup is configured for a Stratix 10H SI Dev Kit [USB-1] in JTAG mode. The progress bar indicates 100% (Successful).

Below the progress bar, there is a table of files to be programmed:

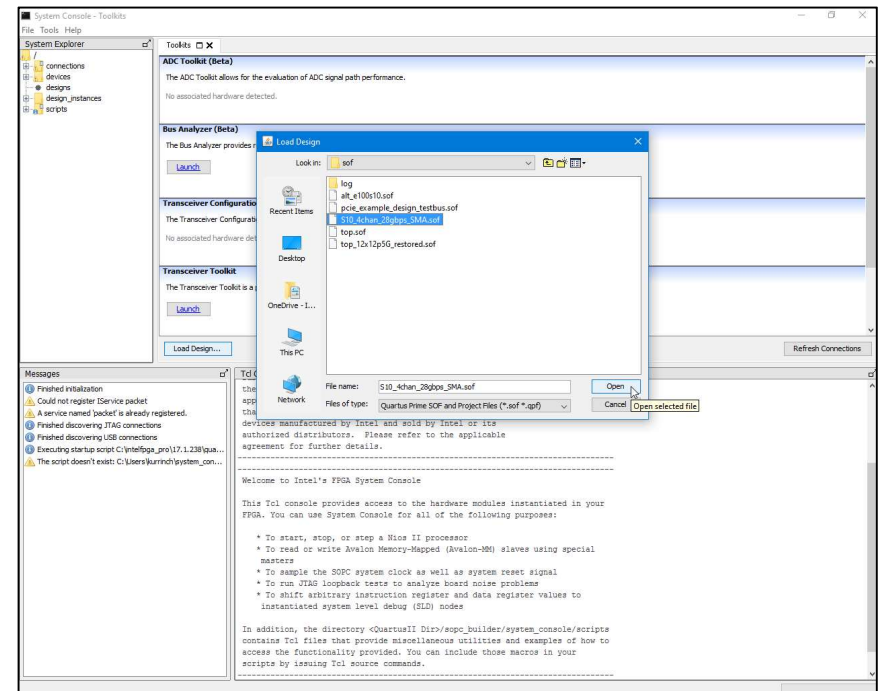
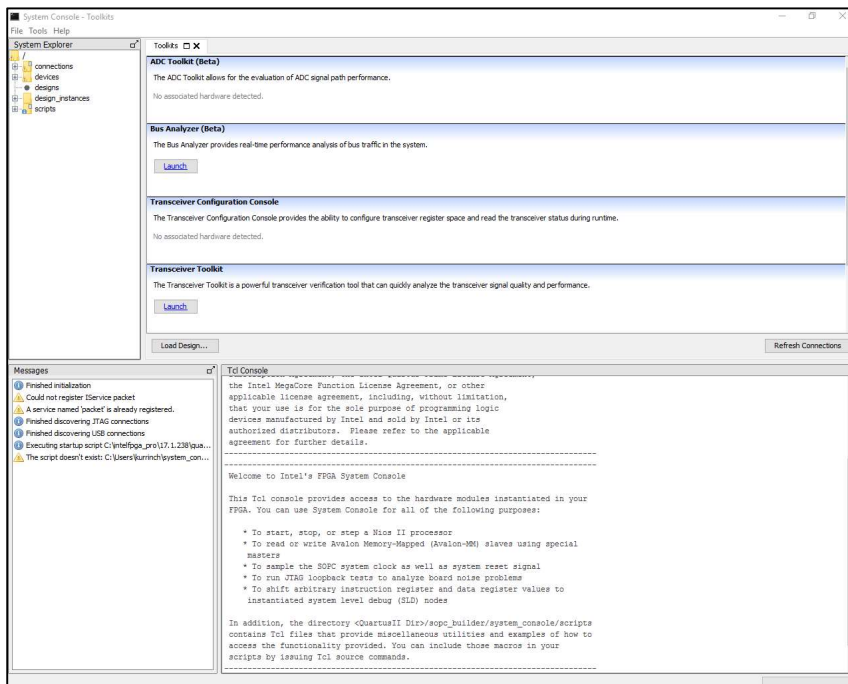
File	Device	Checksum	Usercode	Program/Configure	Verify	Blank-Check	Examine	Security Bit	Erase	ISP CLAMP	IPS File
<none>	5M2210Z	00000000	<none>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
C:/Users/kurrinch/Desktop/sof/alt_e100s10.sof	1sg280hu1f50e2v...	64F6FA76	64F6FA76	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

At the bottom of the interface, a diagram shows two Intel FPGAs connected in a chain. The first device is labeled 5M2210Z and the second is 1SG280HU1F50S1. Arrows indicate the JTAG connection: TDI (Test Data In) enters the first device, and TDO (Test Data Out) exits the second device.

Step 2: Load the SOF File in the System Console



Step 3: Load the SOF File in the System Console



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