

TLK10002 Dual-Channel, 10-Gbps, Multi-Rate Transceiver EVM Graphical User Interface

This user's guide describes the usage and construction of the TLK10002 evaluation module (EVM) graphical user interface. This document provides a basic overview of the different portions of the program.

	Contents	
1	Introduction	. 2
2	High-Level Operation of the GUI	. 3
3	Low-Level Operation of the GUI	16
4	BER and Latency Tests	18
5	High-Speed Link Optimizer Tests	20

List of Figures

TLK10002 GUI Screen	2
TLK10002EVM GUI Read Me First Window	3
TLK10002EVM GUI High-Level Device Configuration Window	4
TLK10002EVM GUI High-Level Device Configuration Review Updates Window	5
TLK10002EVM GUI High-Level Device INAP/N Configuration	6
TLK10002EVM GUI High-Level Device OUTAP/N Configuration	7
TLK10002EVM GUI High-Level Device HSTXAP/N Configuration	8
TLK10002EVM GUI High-Level Device HSRXAP/N Configuration	9
TLK10002EVM GUI High-Level Device Clock and Rate Configuration	10
TLK10002EVM GUI High-Level Device Lane Alignment Configuration	11
TLK10002EVM GUI High-Level Device LOS of Signal Output Configuration	12
TLK10002EVM GUI High-Level Device Channel Operation and Test Pattern Configuration	13
TLK10002EVM GUI High-Level Device LOSA Status Window	14
TLK10002EVM GUI High-Level Device Executed Commands Status Window	15
TLK10002EVM GUI Low-Level Register Configuration Window	16
TLK10002EVM GUI Low-Level Configuration Through Macros	17
TLK10002EVM GUI BER Tab	18
	19
TLK10002EVM GUI High-Speed Link Optimizer Tab	20
	TLK10002EVM GUI High-Level Device LOSA Status Window TLK10002EVM GUI High-Level Device Executed Commands Status Window TLK10002EVM GUI Low-Level Register Configuration Window TLK10002EVM GUI Low-Level Configuration Through Macros TLK10002EVM GUI BER Tab



Introduction

1 Introduction

Read Me First	TLK10002 [Device Configuration	Low Level Register Configuration	BER & Latency Test	HS Link Optimize
CHANNEL A	CHANNEL B	LOSA Status	LOSB Status	External Control Pin Software Control ()	Board Settings Power Down Mode (
	Channel A C	onfiguration		LOW/HIGH PDTRXA_N PDTRXB_N	Main Reset
INA P/N Select Lane	LANE 0	rializer Mode A 4 to 1	HSTXAP/N	REFCLKA_SEL	Reset TLK1000 DATAPATH
OUTA P/N Select Lane	LANE 0 LANE 1 LANE 2 LANE 3	De-Serializer Mode A	HSRXAP/N	1C_MODE_SEL 1C_ALK_SEL 12C Status 12C_JC_PLL_LOCK 12C_LS_CK_OUT_B	Reset JC_PLL Load Config Save config
Lane Alignm	ent LOS Output	FL Clock Rate	Test Pattern	12C_LS_OK_OUT_A	Load Script

Figure 1. TLK10002 GUI Screen

WARNING

This equipment is intended for use in a laboratory test environment only. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to subpart J of part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user at own expense will be required to take whatever measures may be required to correct this interference.

The Texas Instruments (TI) TLK10002 SERDES evaluation module (EVM) boards are controlled and configured using a custom-developed graphical user interface (GUI).

High-level and low-level manipulation of the registers is possible through this GUI as well as a variety of built-in test modes.

The High-Speed Transmit and Receive portions can sweep through a nested loop of parameter combinations and both visually and empirically report the results to save time in determining the optimal combination of settings.



2 High-Level Operation of the GUI

TEXAS INSTRUMENTS TLK10002 EVM						
Read Me First	TLK10002 Device Configuration	Low Level Register Configuration	BER & Latency Test	HS Link Optimizer		
1. High Level Test: Uses 2. Low Level Test: Direc 3. Each configuration at Any changes in Low leve 4. Macro Macro is a feature that Whenever there is a rea The recorded steps are i The recorded macro scri The Macro also provides 5. BER Test, Latency tee when the High Speed T	the high level functions to configure the de thy control the registers of the device during the <i>High Level Test</i> is recored to Mid level et all be reflected in High Level test immedi is included to record the flow of low level f d or write operation that is executed (Macr displayed in the list box. pt is saved as 4".txt fle, which can later be user with options to wait at particular step st and HS Link Optimizer are used to test th	g the test. register values and through script it can be u ately unctions. o in record mode) it gets recorded.	updated to Low level test. ecuting an particular step. vide optimal performance.			
Simulate Communication						

Figure 2. TLK10002EVM GUI Read Me First Window

When the GUI starts, the indicator at the bottom right corner of the window is red and displays *Working* while the GUI establishes communication with the USB port of the EVM and sets the default configurations required for proper operation of both the board and the GUI.



High-Level Operation of the GUI

TLK10002 GUI TEXAS INSTRUMENTS **TLK10002 EVM** Read Me First TLK10002 Device Configu Low Level Register Configuration HS Link Optimizer **BER & Latency Test** External Control Pin CHANNEL A CHANNEL B LOSA Status LOSB Status Board Settings Software Control () Power Down Mode 120 LOW/HIGH Channel A Configuration PDTRXA N 0 Ŧ Main Reset 0 PDTRXB_N Reset TLK10002 ŧ PRESEN 5 LANE O INA P/N Select Lane REFCLKA_SEL 0 LANE 1 Lane 0 Serializer Mode A Reset TLK10002 DATAPATH 0 REFCLKB SEL LANE 2 4 to 1 0 LS_OK_IN_A Reset TLK10002 TXFIFO LANE 3 HSTXAP/N INAP/N 0 LS_OK_IN_B () Reset TLK10002 RXFIFO JC_POWERDOWN Ŧ 0 JC REF SEL 0 LANE O JC_MODE_SEL Reset JC PLL OUTA P/N Select Lane LANE 1 De-Serializer Mode A JC_AUX_SEL 0 Lane 0 1 to 4 LANE 2 Load Config OUTAP/N LANE 3 HSRXAP/N I2C Status I2C_JC_PLL_LOCK 0 Save config I2C_LS_OK_OUT_B . I2C_LS_OK_OUT_A Load Script 0 Lane Alignment LOS Output FL Clock Rate Test Pattern I2C PRBS PASS . X Discard Updates I2C LOSB 0 I2C_LOSA o Review Updates Apply Channel A Settings to Channel B Device Configured 🕘 Require Update? 🧲 Refresh Apply Updates Build date - 12/18/2010 12/28/2010 1:19:42 AM Version: 1.0



Configuration of the external control pins of the TLK10002 device through the GUI is performed by setting the toggle switch located in the central portion of the GUI, where it is grouped under the title External Control Pin. A TCA6424 I2C-to-GPIO device on the board is configured to control the high/low settings of the device pins from USB data sent to the board from the GUI. It is possible to disable the software control and rely on manual settings of these signals. Monitoring external status pins is also possible through this method.

In order to keep the GUI and the device settings on the board synchronized, all reset signals must be initiated from the GUI through the various buttons. If the Reset button on the board itself is pressed, the GUI does not realize that the registers were reset and continues to display the previous register values.

Configuration of the TLK10002 register settings is accomplished from the high level Device Configuration tab of the GUI. All of the settings of the TLK10002 can be modified from various portions of this tab, which are broken out and grouped into individual windows according to their functions.

When the settings of the GUI do not match the actual register settings of the EVM device, the Require Update? light glows red, indicating that some setting has changed in the GUI memory and needs to be sent to the device. When the device settings match the GUI's memory, the Device Configured light glows green, indicating that the board is configured as displayed in the GUI.

To change the various register settings in the GUI memory to a new value, find the particular parameter field in the various windows, select the new value, and click the Save button. Failing to click the Save button causes in the change to be discarded and the current value of the register to be maintained.

elect Values to Display					
TLK10002 ChannelA					🗶 EXIT
	d-Level Register \	Values(Con	figuration (lakre)	
Name	Current Value	New Value	Protocol	Register Name	Indicator
ChannelA_REFCLK_ SEL	0	0	MDIO	CHANNEL_CONTROL_1	
ChannelA_CLKOUT_SEL	0	0	MDIO	CHANNEL_CONTROL_1	
ChannelA_CLKOUT_DIV	0	0	MDIO	CHANNEL_CONTROL_1	
ChannelA_TX_MUX_SEL	1	1	MDIO	CHANNEL_CONTROL_1	
ChannelA_RX_DEMUX_SEL	1	1	MDIO	CHANNEL_CONTROL_1	
ChannelA_HS_CH_SYNC_HYSTERESIS	0	0	MDIO	CHANNEL_CONTROL_1	
ChannelA_TX_MODE_SEL	0	0	MDIO	CHANNEL_CONTROL_1	
ChannelA_RX_MODE_SEL	0	0	MDIO	CHANNEL_CONTROL_1	
ChannelA_POWERDOWN	0	0	MDIO	CHANNEL_CONTROL_1	
ChannelA_HS_PLL_MULT	1101	1101	MDIO	HS_SERDES_CONTROL_1	
ChannelA_HS_ENPLL CFGPLL	1	1	MDIO	HS_SERDES_CONTROL_1	
ChannelA_HS_VRANGE	0	0	MDIO	HS_SERDES_CONTROL_1	
ChannelA_HS_LOOP_BANDWIDTH	1	1	MDIO	HS_SERDES_CONTROL_1	
ChannelA_HS_RATE_RX	0	0	MDIO	HS_SERDES_CONTROL_2	
ChannelA_HS_ENRX	1	1	MDIO	HS_SERDES_CONTROL_2	
ChannelA_HS_ENUNSD	0	0	MDIO	HS_SERDES_CONTROL_2	
ChannelA_HS_AZCAL	0	0	MDIO	HS_SERDES_CONTROL_2	
ChannelA_HS_AGCCTRL	1	1	MDIO	HS_SERDES_CONTROL_2	
ChannelA_HS_RATE_TX	0	0	MDIO	HS_SERDES_CONTROL_2	
ChannelA_HS_ENTX	1	1	MDIO	HS_SERDES_CONTROL_2	
ChannelA_HS_SWING	1010	1010	MDIO	HS_SERDES_CONTROL_2	
ChannelA_HS_TWCRF	0	0	MDIO	HS_SERDES_CONTROL_3	
ChannelA_HS_H1CDRMODE	0	0	MDIO	HS_SERDES_CONTROL_3	
ChannelA_HS_EQHLD	0	0	MDIO	HS_SERDES_CONTROL_3	
ChannelA_HS_EQLIM	0	0	MDIO	HS_SERDES_CONTROL_3	
ChannelA_HS_CDRTHR	0	0	MDIO	HS_SERDES_CONTROL_3	
ChannelA_HS_CDRFMULT	10	10	MDIO	HS_SERDES_CONTROL_3	
ChannelA_HS_EQPRE	11	11	MDIO	HS_SERDES_CONTROL_3	
ChannelA HS ENTRACK	1	1	MDIO	HS SERDES CONTROL 3	~

Figure 4. TLK10002EVM GUI High-Level Device Configuration Review Updates Window

When register values change in memory and the *Require Update*? light glows red, the changed values can be reviewed prior to applying the changed values to the TLK10002 device. This is accomplished by clicking the Review Updates button on the bottom right portion of the GUI window. All the registers that are selectable are tracked by the GUI in a mid-level array that stores the current and new value for the register. When even one new value field changes, the *Require Update*? light glows red.

The new values can also be discarded with the click of the Discard Updates button.



High-Level Operation of the GUI

TLK10002 GUI V TEXAS INSTRUMENT **TLK10002 EVM** Read Me Firs TLK10002 Device Configuration Low Level Register Configuration BER & Latency Test HS Link Optimizer External Control Pin CHANNEL A LOSA Status CHANNEL B LOSB Status Board Settings Software Control () Power Down Mode 120 LOW/HIGH INA PIN Lane Configuration 0 PDTRXA N L. Main Reset 0 PDTRXB_N Reset TLK10002 PRBSEN 5 Device REFCLKA SEL 0 P/N Polarity Reset TLK10002 DATAPATH Enable 📀 0 Norma × REFCLKB SEL LS_OK_IN_A Reset TLK10002 TXFIFO EQ Control LS_OK_IN_B 0 Enable LOS 💿 0000 ~ JC POWERDOWN Reset TLK10002 RXFIFO JC_REF_SEL 0 CDR Control Enable Test Module 000 v JC_MODE_SEL 0 Reset JC_PLL 0 JC AUX SEL Load Config **I2C Status** I2C JC PLL LOCK 0 Save config I2C_LS_OK_OUT_B . Rate Full Rate Save Back I2C_LS_OK_OUT_A Load Script ۲ I2C_PRBS_PASS . 💢 Discard Updates I2C LOSB . I2C_LOSA 0 60' Review Updates Apply Channel A Settings to Channel B Device Configured 😑 Require Update? 🧉 Refresh Apply Updates Build date - 12/18/2010 12/28/2010 1:24:12 AM Version : 1.0 READ

Figure 5. TLK10002EVM GUI High-Level Device INAP/N Configuration

Selecting the INA0P/N button on the left portion of the Channel A Configuration window opens the INA0P/N parameters. If changes need to be made to any of these parameters, select the new values, and click the Save button. To navigate away from the window and return to the Channel A Configuration window, click the Back button. If changes have been made and not saved, the message box is displayed to inform the user that changes will be discarded if not saved.



High-Level Operation of the GUI

EXAS INSTRUMENTS			TLK10002 EV	141	
Read Me First	TLK10002 Dev	ice Configuration	Low Level Register Configuration	on BER & Latency Test	HS Link Optimizer
CHANNEL A	CHANNEL B	LOSA Status	LOSB Status	External Control Pin Software Control ()	Board Settings Power Down Mode
	OUTA PIN Lan	e Configuration		LOW/HIGH PDTRXA_N PDTRXB_N PRBSEN	Main Reset Main Reset Reset TLK10002 Device
	Enable 🛞	P/N Polarity Normal	×	REFCLKA_SEL REFCLKB_SEL LS_OK_IN_A	Reset TLK10002 DATAPATH
	Enable Test Mode 🔿	De-emphasis dB 0	¥	L5_OK_IN_B	Reset TLK10002 TXFIFO
	Offset Compensation 🔿	Swing mVdfpp 1015	×	JC_REF_SEL	Reset JC_PLL
				I2C Status	Load Config
Rate:	Full Rate	Save	Back	I2C_L5_OK_OUT_B	Save config
				I2C_PRBS_PASS	Discard Updates
oply Channel A ettings to Channel B)	Device Configure	d 😑 Require Update? 🌑	Refresh	🔗 🗸 Review Updates

Figure 6. TLK10002EVM GUI High-Level Device OUTAP/N Configuration

Selecting the OUTA0P/N button on the left portion of the Channel A Configuration window opens the OUTA0P/N parameters. If changes need to be made to any of these parameters, simply select the new values and click the Save button. To navigate away from the window and return to the Channel A Configuration Window, click the Back button. If changes have been made and not saved, the message box is displayed to inform the user that changes will be discarded if not saved.



High-Level Operation of the GUI

TEXAS INSTRUMENTS			TLK10002 EV	1	
Read Me First	TLK10002	Device Configuration	Low Level Register Configuration	BER & Latency Test	HS Link Optimizer
CHANNEL A	CHANNEL B	LOSA Status	LOSB Status	External Control Pin Software Control () I2C LOW/HIGH PDTRXA_N	Board Settings Power Down Mode
Adiacent F	Pre/Post r Fields	0	alarity Normal V InVidpp 1000 V Curse Reduction Factor % 0 V	PRESEN	Reset TLK10002 Device Device Device Reset TLK10002 DATAPATH Reset TLK10002 TXFIPO Reset TLK10002 RXFIPO Reset JC_PLL
Rate:	Full Rate	Save	Back	12C Status 12c_jc_PLLLOCK 12c_js_OK_OUT_B 12c_js_OK_OUT_A 12c_pR85_PA55 12c_loSB 12c_loSA	Load Config Save config Load Script Load Script Discard Updates
pply Channel A ettings to Channel B		Device Configure	ed 🔵 Require Update? 🔘	Refresh	Apply Updates

Figure 7. TLK10002EVM GUI High-Level Device HSTXAP/N Configuration

Selecting the HSTXAP/N button on the right portion of the Channel A Configuration window opens the HSTXAP/N parameters. If changes need to be made to any of these parameters, select the new values, and click the Save button. To navigate away from the window and return to the Channel A Configuration window, click the Back button. If changes have been made and not saved, the message box is displayed to inform the user that changes will be discarded if not saved.



High-Level Operation of the GUI

Read Me First	TLK10002 D	evice Configuration	Low Level Register Configuration	n BER & Latency Test	H5 Link Optimize
CHANNEL A	CHANNEL B HSRXAPIN Enable)	LOSA Status I Configuration Enable ENTR	LOSB Status	External Control Pin Software Control (* 12C LOW/MGH PDTRXA_N (* PDTRXB_N (* PRBSEN (*)	Board Settings Power Down Mode (Main Reset Reset TL(100) Device
Enable Enable Enable ENTRACK ENTRACK			REFCLKA_SEL REFCLKA_SEL LS_OK_JN_A LS_OK_JN_B JC_POWERDOWN JC_REF_SEL JC_MODE_SEL JC_AUX_SEL IZC Status IZC Status IZC_JC_PUL_LOCK Sa		
Channel A gs to Channel B	Full Rate	Save	Back	12C_LS_OK_OUT_B 12C_LS_OK_OUT_A 12C_PR85_PASS 12C_LOSB 12C_LOSA Refresh	Load Script

Figure 8. TLK10002EVM GUI High-Level Device HSRXAP/N Configuration

Selecting the HSRXAP/N button on the right portion of the Channel A Configuration window open the HSRXAP/N parameters. If changes need to be made to any of these parameters, select the new values, and click the Save button. To navigate away from the window and return to the Channel A Configuration window, click the Back button. If changes have been made and not saved, and message box is displayed to inform the user that changes will be discarded if not saved.



High-Level Operation of the GUI

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Read Me First	TLK10002 De	vice Configuration	Low Level Register Configuration	BER & Latency Test	HS Link Optimize
CHANNEL A	CHANNEL B Glock And Rat	LOSA Status	LOSB Status	External Control Pin Software Control () 12C LOW/HIGH PDTRXA N	Board Settings Power Down Mode (Main Reset
122.88 9830.4 REFC Others Output Clock Source 0 Serial Data Rate(Mbps) Output Clock Source 0 Reference clock Preg MHz Output Clock Divide HS HS HS HS HS Output Clock Divide HS HS Output Clock HS HS Normal VE Enable HS PL US Channel A HSRX Re Output Clock HS HS Reference Clock Quality VE Normal VE LS Enable HS PL US Churd M to Manage Description VE		HS PLL Multipler LS PLL Multiplier HS Rate	_0 vered Byte Clock	POTRXB_N PRBSEN REFCLKA_SEL REFCLKB_SEL LS_OK_JN_A LS_OK_JN_B XC_POWERDOWN XC_REF_SEL XC_MODE_SEL XC_AUX_SEL IZC_JS_OK_OUT_A IZC_LS_OK_OUT_A IZC_LS_OK_OUT_A IZC_PABS_PASS IZC_LOSA IZC_LOSA	Main Keset Reset TLK10000 Device Reset TLK10000 DATAPATH Reset TLK10000 Reset TLK10000 Reset TLK10000 Reset JC_PLL Load Config Load Script X Discard Updates
y Channel A		Device Configured	l 🥥 Require Update? 🌑	Refresh	Apply Update

Figure 9. TLK10002EVM GUI High-Level Device Clock and Rate Configuration

Selecting the Clock Rate button on the bottom portion of the Channel A Configuration window opens the Clock and Rate parameters. The GUI is designed for easy evaluation of the supported CPRI and OBSAI standard frequencies as listed in the TLK10002 data sheet. By selecting the high-speed, serial-data rate, the reference clock frequency, the reference clock source for the lane, and the output clock source and divider values, all the various register settings are properly configured and stored into memory to await a device update. If changes need to be made to any of these parameters, select the new values, and click the Save button. To navigate away from the window and return to the Channel A Configuration window, click the Back button. If changes have been made and not saved, the message box is displayed to inform the user that changes will be discarded if not saved.

If other frequencies need to be tested, manual setting of the various clock and rate parameter register settings must be performed.



High-Level Operation of the GUI

CHANNEL A CHANNEL E	10002 Device Configuration	Low Level Register Configuration	BER & Latency Test	HS Link Optimize
CHANNEL A CHANNEL B				
	LOSA Status	LOSB Status	External Control Pin Software Control 🕥	Board Settings Power Down Mode (
Reflected Lane Status Lane 0 Slave Channel Sync Hysteresis Ethernet Standards Min Align Character Distance in Sl 24 8b/10b Error Rate Checking Three Unk OK if < 1 error		I Sync Status atus k Status primert In Lane Master primert In	IZC LOW/HIGH POTRXB_N POTRXB_N PRBSEN REFCLKA_SEL I.S_OK_JN_A I.S_OK_JN_B J.C_POWERDOWN J.C_REF_SEL J.C_MODE_SEL J.C_AUX_SEL	Main Reset Main Reset Main Reset Reset TLK1000 Device Reset TLK1000 TXFIFO Reset TLK1000 RXFIFO RXFIFO RESET TLK1000 RXFIFO
8b/10b Error Rate Checking Time		Back	12C Status 12c_JC_PLL_LOCK 12c_JS_OK_OUT_B 12c_JS_OK_OUT_A 12c_PR85_PASS 12c_LOSB 12c_LOSA	Load Config

Figure 10. TLK10002EVM GUI High-Level Device Lane Alignment Configuration

Selecting the Lane Alignment button on the bottom portion of the Channel A Configuration window opens the Lane Alignment parameters. If changes need to be made to any of these parameters, select the new values and click the Save button. To navigate away from the window and return to the Channel A Configuration window, click the Back button. If changes have been made and not saved, the message box is displayed to inform the user that changes will be discarded if not saved.



High-Level Operation of the GUI

Texas Instruments			TLK10002 EVN	1	
Read Me First	TLK10002 Dev	ice Configuration	Low Level Register Configuration	BER & Latency Test	HS Link Optimizer
CHANNEL A	CHANNEL B LOS Confi Denable H5_LOS_MASK Confide H5_COS_MASK Confide H5_COS_MASK Confide H5_COS Confide H5_COS Confide H5_LOS Confide H5_LOS	LOSA Status	CK KC(LANE 3) KC(LANE 2) KC(LANE 1) KC(LANE 0) D_CCOE(LANE 3) D_CCOE(LANE 3) D_CCOE(LANE 3) D_CCOE(LANE 3) D_CCOE(LANE 0) NE 3) NE 2) NE 1) NE 0)	External Control OPin Software Control © IZC POTRXA,N POTRXA,N POTRXB,N PRSEN REPCLKA,SEL SC,JN,A REPCLKB,SEL SC,JN,A IS,OK,JN,A IS,	Board Settings Power Down Mode Power Down Mode Main Reset Reset TK10002 Device Device Device Device Reset TK10002 TKFIFO Reset TK10002 TKFIFO Reset TK10002 RESET TK1002 RESET TK100
Apply Channel A	j	Device Configure	d 🔴 Require Update? 🔵	Refresh	හින් Review Updates

Figure 11. TLK10002EVM GUI High-Level Device LOS of Signal Output Configuration

Selecting the LOS Output button on the bottom portion of the Channel A Configuration window opens the LOS Output parameters. If changes need to be made to any of these parameters, select the new values, and click the Save button. To navigate away from the window and return to the Channel A Configuration window, click the Back button. If changes have been made and not saved, the message box is displayed to inform the user that changes will be discarded if not saved.



High-Level Operation of the GUI

Read Me First	TEKTOOOZ	Device Configuration	Low Level Register Configuration	BER & Latency Test	HS Link Optimizer
CHANNEL A	CHANNEL B	LOSA Status n Mode And Test Pattern	LOSB Status	External Control Pin Software Control () 12C LOW/HIGH	Board Settings Power Down Mode
Operation Mode Transceiver OEnable H5 Test Pattern Val DEnable H5 Test Pattern Val H5 Test Pattern Val DEnable L5 Test Pattern Val L5 Test Pattern Val DEnable L5 Test Pattern Val DEna		Validation Seneration	PDTRXA_N PDTRXB_N PRBSEN REFCLKB_SEL LS_OK_JN_A LS_OK_JN_B XC_POWERDOWN XC_REF_SEL XC_ALIX_SEL	Main Reset Keset TLK1000 Keset TLK	
		Save	Back	I2C_JC_PUL_LOCK I2C_JS_OK_OUT_B I2C_LS_OK_OUT_A I2C_LS_OK_OUT_A I2C_PRBS_PASS I2C_LOSB I2C_LOSA	Load Config

Figure 12. TLK10002EVM GUI High-Level Device Channel Operation and Test Pattern Configuration

Selecting the Test Pattern button on the bottom portion of the Channel A Configuration window opens the test pattern parameters. If changes need to be made to any of these parameters, select the new values, and click the Save button. To navigate away from the window and return to the Channel A Configuration window, click the Back button. If changes have been made and not saved, the message box is displayed to inform the user that changes will be discarded if not saved.



High-Level Operation of the GUI

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Read Me First TLK10002		Device Configuration	Low Level Register Configuration	BER & Latency Test	HS Link Optimize
CHANNEL A	CHANNEL B	LOSA Status Channel A Lane		External Control Pin Software Control () I2C LOW/HIGH PDTRXA N	Board Settings Power Down Mode (Main Reset
HS_LOS HS_AZ_L HS_AGC. HS_CHAI HS_CHAI HS_DECC TX_FIFO. TX_FIFO.	E_STATUS XONE LOCKED INEL_SYNC DE_INVALID DE_INVALID LUNDERFLOW QVERFLOW	LAS_LN_ALIGN_ LAS_LN_ALIGN_ LAS_LN_ALIGN_ LAM_ALIGN_SEC LS_LOS LAM_INVALID_E LAS_LNYALID_D LAS_LNYALID_D T LAS_CH_SYNC_5 LAS_LNYALID_D T LAS_LNYALIGN I5 LAS_LNYALIGN	STATE[2:0] ST NCODE TATUS ECODE TATE[2:0] STATE[3:0]	POTRXB_N	Reset TLK100 Device Reset TLK100 Device Reset TLK100 TAFIFO Reset TLK100 RAFIFO
	к .оск	15 LAS_LNI_ALIGN		I2C_Status I2C_JC_PLL_LOCK I2C_LS_OK_OUT_B I2C_LS_OK_OUT_A I2C_PR85_PASS I2C_LOSB	 Load Config Save config Load Script Discard Update
y Channel A		Device Configure	d 🔵 Require Update? 🌑	I2C_LOSA	🔗 🗹 Review Update

Figure 13. TLK10002EVM GUI High-Level Device LOSA Status Window

Selecting the LOSA Status tab on the top portion of the Channel A Configuration window opens the LOSA Status parameters. The values of the various status registers are read when this window is selected and can be refreshed by clicking the Refresh button at the bottom of the window.

STATUS WINDO	V		
Command	Status	Value	1
MDIO WRITE (B,LS_SERDES_CONTROL_1)	Success	1115	
MDIO WRITE (B,LN3_LS_SERDES_CONTROL_2)	Success	DC04	
MDIO WRITE (B,LN2_LS_SERDES_CONTROL_2)	Success	DC04	
MDIO WRITE (B,LN1_LS_SERDES_CONTROL_2)	Success	DC04	
MDIO WRITE (B,LN0_LS_SERDES_CONTROL_2)	Success	DC04	
MDIO WRITE (B,LN3_L5_SERDES_CONTROL_3)	Success	0001	
MDIO WRITE (B,LN2_L5_SERDES_CONTROL_3)	Success	0001	
MDIO WRITE (B,LN1_LS_SERDES_CONTROL_3)	Success	0001	
MDIO WRITE (B,LN0_LS_SERDES_CONTROL_3)	Success	0001	
MDIO WRITE (B,HS_OVERLAY_CONTROL)	Success	0900	
MDIO WRITE (B,LS_OVERLAY_CONTROL)	Success	4000	
MDIO WRITE (B,LOOPBACK_TP_CONTROL)	Success	0700	-
MDIO WRITE (B,LAS_CONFIG_CONTROL)	Success	03F0	
MDIO WRITE (B,LAS_BER_TIMER_CONTROL)	Success	FFFF	
WAIT(100)	Success		
MDIO WRITE IMM (0E,0008,0)	Success	0008	
MDIO WRITE IMM (0E,0008,1)	Success	0008	
WAIT(10)	Success		
MDIO READ (A, CHANNEL_STATUS_1)	Success	FFFF	
MDIO READ (A, HS_ERROR_COUNTER)	Success	FFFF	
MDIO READ (A,LS_LN0_ERROR_COUNTER)	Success	FFFF	
MDIO READ (A,LS_LN1_ERROR_COUNTER)	Success	FFFF	
MDIO READ (A,LS_LN2_ERROR_COUNTER)	Success	FFFF	
MDIO READ (A,LS_LN3_ERROR_COUNTER)	Success	FFFF	
MDIO READ (B,CHANNEL_STATUS_1)	Success	FFFF	
MDIO READ (B,HS_ERROR_COUNTER)	Success	FFFF	
MDIO READ (B,LS_LN0_ERROR_COUNTER)	Success	FFFF	
MDIO READ (B,LS_LN1_ERROR_COUNTER)	Success	FFFF	
MDIO READ (B,LS_LN2_ERROR_COUNTER)	Success	FFFF	
MDIO READ (B,LS_LN3_ERROR_COUNTER)	Success	FFFF	
<u><</u>	2		>
Executed Script	Abort	Save Rep	oort

Figure 14. TLK10002EVM GUI High-Level Device Executed Commands Status Window

When all the settings have been selected and the user is ready to apply the updated values to the TLK10002 device, clicking the Apply Updates button on the bottom right portion of the GUI window causes the GUI to write all of the TLK10002 registers per a text file based script. This script can be changed and loaded by clicking the Load Script button and navigating to the desired file. To set that file as the default file, right-clicking the Load Script button after selecting the desired file and selecting the Set Default option causes the replacement of the default script file with the selected file. While the script is executing, a status window is displayed showing each transaction and the register value that is being written or read from the device. This status can be saved off to a text file if desired.



3 Low-Level Operation of the GUI

The TLK10002 device registers and settings can be controlled manually through a low-level register Read/Write portion of the GUI.

Read Me First		TLK	10002	Devic	e Config	uration		Low Level Register Configuration BER & Latency Test		HS Link Optimizer				
gister Map ock / Register Name I TLK10002_Global	Address	Default	1	Size	LW*	LR*	^	Write Data Registr	r Data	Transfer Read to Write	Macro Start/Rec	Stop	Delete	Macro Hel
GLOBAL_CONTROL_1 LATENCY_MEASURE_CONTROL LATENCY_COUNTER_2 LATENCY_COUNTER_1	0×0 0×16 0×17 0×18	0x600 0x7F00 0x0 0x0	R/W R/W R R	16 16 16 16	600 7F00 0	600 7F00 0 0		Read Data 1 [× 8800 2		WCRF[4:0][0] WCRF[4:0][1] WCRF[4:0][2]	Loop Wait	0 🗘	End Loop Save	Clear Save As
TI_RESERVED_CONTROL_1 TI_RESERVED_CONTROL_2 TI_RESERVED_STATUS_1	0x19 0x1A 0x1B	0x0 0x0 0x0	R/₩ R/₩ R/₩	16 16 16	0 0	0 0		Read Register 4	HS_T	WCRF[4:0][3] WCRF[4:0][4] 1CDRMODE[5]	Comment	Message Run Se	Pause	Toggle #
TI_RESERVED_CONTROL_3 TI_RESERVED_CONTROL_4 TI_RESERVED_CONTROL_5	0×1C 0×1E 0×1F	0x3000 0x0 0x0	R/W R/W R/W	16 16 16	3000 0 0	3000 0 0		Current Address 6 [× 4 7]	HS_EC	QHLD[6]		ned Macro Files	ACCCCG	Hoore
TLK10002_ChannelA CHANNEL_CONTROL_1 HS_SERDES_CONTROL_1 HS_SERDES_CONTROL_2 HS_SERDES_CONTROL_3	0x1 0x2 0x3 0x4	0×300 0×811D 0×A444 0×8800	R/W R/W R/W	16 16 16 16	300 811D A444 6800	300 811D A444 B800		9 (× 0 10 10 11 11 12 12 12 12 12 12 12 12 12 12 12		DRTHR[1:0][9] DRFMULT[1:0][10] DRFMULT[1:0][11] QPRE[2:0][12]	Open Macro Fi	le Path		×
H5_SERDES_CONTROL_4 L5_SERDES_CONTROL_1 LN3_L5_SERDES_CONTROL_3 LN3_L5_SERDES_CONTROL_3 LN2_L5_SERDES_CONTROL_3 LN2_L5_SERDES_CONTROL_3 LN1_L5_SERDES_CONTROL_3 LN1_L5_SERDES_CONTROL_3 LN0_L5_SERDES_CONTROL_3 LN0_L5_SERDES_CONTROL_3 LN0_L5_SERDES_CONTROL_3 L5_OVERLAY_CONTROL L5_OVERLAY_CONTROL L0OPBACK_TP_CONTROL LAS_SERDES_CONTROL_3 LAS_SERDES_CONTROL_3 LAS_SERDES_CONTROL LAS_SERDES_CONTROL LAS_SERDES_CONTROL LAS_SERDES_CONTROL LAS_SERDES_CONTROL LS_UND_BROR_COUNTER L5_LN0_BEROR_COUNTER L5_LN2_SEROR_COUNTER L5_LN2_SEROR_COUNTER L5_LN2_SEROR_COUNTER L5_LN2_SEROR_COUNTER L5_LN2_SEROR_COUNTER L5_LN2_SEROR_COUNTER L5_LN2_SEROR_COUNTER L5_LN2_SEROR_COUNTER L5_LN2_SEROR_COUNTER L5_LN2_SEROR_COUNTER L5_LN2_SEROR_COUNTER	0x5 0x7 0x7 0x8 0x7 0x8 0x7 0x8 0x7 0x8 0x7 0x8 0x7 0x8 0x9 0x8 0x2 0x8 0x2 0x0 0x0 0x10 0x11 0x12 0x14 0x14 0x15	0x2000 0x1115 0xDC04 0x1 0xDC04 0x1 0xDC04 0x1 0xDC04 0x1 0x900 0x4000 0x4000 0x700 0x3F0 0x3FFFD 0x0 0xFFFD 0xFFFD 0xFFFD 0xFFFD 0xFFFD	R/WWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWW	16 16 16 16 16 16 16 16 16 16	2000 11115 DC04 1 DC04 1 DC04 1 DC04 1 DC04 1 B00 700 3F0 FFFF 8 8 0 FFFFD FFFFD FFFFD FFFFD FFFFD FFFFD FFFFD	2000 1115 DC04 1 DC04 1 DC04 1 DC04 1 DC04 1 DC04 1 DC04 1 DC04 1 0 FFFF FFFF FFFF FFFF FFFF FFFF FFF	×	HS ENITRACK(15:15)	HS_E	9PRE[2:0][14] 9PRE[2:0][14] VTRACK[15]	Macro Listing			

Figure 15. TLK10002EVM GUI Low-Level Register Configuration Window

Selecting the Low Level Register Configuration tab of the GUI brings up a complete register list for all the devices on the EVM. Selecting one of these registers loads the Register Description and Register Data fields with the proper values and display the current value. The bits can be set by clicking in the check boxes next to the bit's name or typing the full hexadecimal value for the register directly into the Write Data field. Clicking the Write Register button writes the register of the device. Reading the register is done by clicking the Read Data button. After a read or write operation, the LW (Last Written) or LR (Last Read) fields in the register list are updated for future reference.

The GUI's Mid Level Array synchronizes the high-level control indicator values so navigation between the high-level and the low-level portions of the GUI is possible.



		 10002	Devic	e Configu	uration	 Low Level Register Configuration BER & Latency Test	HS Link Optimizer		
TUCIODO2_GIÓBAI GLOBAL_CONTROL_1 LATENCY_MEASUBE_CONTROL_1 LATENCY_CONTREL_1 LATENCY_CONTREL_3 LATENCY_CONTREL_1 TL_RESERVED_CONTROL_3 TL_RESERVED_CONTROL_4 TL_RESERVED_CONTROL_4 TL_RESERVED_CONTROL_4 TL_RESERVED_CONTROL_5 TLATENCE_CONTROL_1 HS_SERVED_CONTROL_1 HS_SERVED_CONTROL_3 HS_SERVES_SERVES_CONTROL_3 HS_SERVES_SERVES_CONTROL_3 HS_SERVES_SERVES_CONTROL_3 HS_SERVES_SERVES_CONTROL_3 HS_SERVES_SERVES_CONTROL_3 HS_SERVES_SERVES_CONTROL_3 HS_SERVES_SERVES_CONTROL_3 HS_SERVES_SERVES_CONTROL_3 HS_SERVES_SERVES_CONTROL_3 HS_SERVES_SERVES_SERVES HS_SERVES_SERVES_SERVES_CONTROL_3 HS_SERVES_SERVES_SERVES_SERVES_SERVES HS_SERVES_SER	Address 0x0 0x16 0x17 0x18 0x18 0x18 0x18 0x18 0x16 0x1 0x2 0x3 0x5 0x7 0x3 0x5 0x7 0x3 0x5 0x7 0x7 0x8 0x7 0x8 0x7 0x8 0x7 0x8 0x7 0x8 0x7 0x8 0x7 0x8 0x7 0x8 0x7 0x7 0x8 0x7 0x7 0x8 0x7 0x7 0x8 0x7 0x7 0x8 0x7 0x7 0x7 0x7 0x7 0x7 0x7 0x7 0x7 0x7	Mode R/W R/W R R R/W R/W R/W R/W R/W R/W R/W R/W R/W		LW* 600 600 77500 0 0 0 0 0 3000 0 3000 0 3000 0 1115 DC04 1 PFFD FFFD FFFF FFFD	IR* IR* 600 7600 0 0 0 0 0 0 0 3000 811D 0 3001 811D 1 DCO4 1 DCO4 1 DCO4 1 DCO4 1 DCO4 1 DCO4 1 PFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF	Current Address Register Data Transfer Read to Write Write Data V HS_TWCRF[4:0][0] Read Data V HS_TWCRF[4:0][1] Read Data V HS_TWCRF[4:0][1] Read Register V HS_TWCRF[4:0][1] Read Register V HS_TWCRF[4:0][1] Current Address V HS_TWCRF[4:0][2] V HS_TWCRF[4:0][1] V V HS_CPRFILe[1:0][8] V V HS_CPRFILe[1:0][9] V V HS_CPRFILe[1:0][9] V HS_CPRFILE[1:0][9] V HS_CPRFILE[1:0][9] V HS_CPRFILE[1:0][9] V V HS_CPRFILE[1:0][1] V V	Run Recently Opened I Open Macro File P Macro Listing register_write M register_read MC register_write M	Stop Delete Macro Hei Image: Constraint of the state of the stat	

Figure 16. TLK10002EVM GUI Low-Level Configuration Through Macros

Low-level operations can be recorded, saved, and loaded for future use and convenience. To record a macro of register read and write transactions, first click the Start Record button, perform your sequence of register read/writes, and when finished, click the Stop button. Loops can be added by first selecting the number of loops desired and then clicking the Loop button. The end of the loop is set by clicking the End Loop button. Wait statements can be included by first selecting the length of the wait time in milliseconds and then clicking wait.

To save a macro, click the Save or Save as button, and select a filename and path to store the file.

To run a current or recalled macro, load the macro and click the Run button.



BER and Latency Tests

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4 BER and Latency Tests

Once the TLK10002 device registers and settings are applied to the device, switching over to the BER and Latency tab of the GUI can provide some basic lane testing and BER optimization tests.

Read Me First	TLK10002 Device Configuration	Low Level Register Configu	ration BER & Late	ency Test	H5 Link Optimizer
		Latency T	est		
		BER Test			
ransmitter Configuration HSTXAP/N	Receiver Configuration HSRXAP/N		PRBS_PASS Pin Selection ChannelA HS Serde	es Side 🗸	HS Test Pattern Selection PRBS 2^31-1
HSTX P/N Test Configuratio		Test Configuration			LS Test Pattern Selection PRBS 2^31-1
Enable Polarity Normal	Enable 🖲	Polarity Normal	CHANNEL A	Current Count	Cumulative count
Swing mVdfpp			HS Error Counter	0	
	1000 EQ Precursor	-	LS Lane 0 Error Counter	0	0
110 1430	1/9	13/9	LS Lane1 Error Counter	0	0
Pre Cursor Tap Weight %		13/9	LS Lane 2 Error Counter	0	0
	0 Adaptive GainC	entrel	LS Lane 3 Error Counter	0	0
-17.5 17.5		ange while Lock	CHANNEL B		
Adjacent Post Cursor1 Tap Wieght %	0		HS Error Counter	0	0
-37.5 +37.5	ADC Track Mod	le(ENTRACK)	LS Lane 0 Error Counter	0	0
	T	rack Mode 🔽	LS Lane1 Error Counter	0	0
Adjacent Post Cursor2 Tap Weight %			LS Lane 2 Error Counter	0	0
-17.5 17.5	0		LS Lane 3 Error Counter	0	0
			SINGLE READ	AL	ITO READ
			Read Counter	RUN TEST	STOP Reset Cumulativ

Figure 17. TLK10002EVM GUI BER Tab

The TLK10002 device test patterns can be selected and changed from this window, and the individual parameters for the various TX/RX and IN/OUT lanes can be selected and changed in real time allowing the effect of those changes to be displayed in the error count.

The TX and IN channel parameters can be switched between and modified on the left portion of the screen, the RX and OUT channel parameters can be switched between and modified in the middle portion of the screen, and the Error Count for the lanes can be seen on the right portion of the screen.

Clicking the Read Counter button reads the error counters once.

Clicking the Run Test button causes the error counters to be continually read in a loop and a cumulative total to be displayed. The cumulative totals can be cleared by clicking the Reset Cumulative button. Clicking the Stop button stops the test.

TEXAS INSTRUMENTS

BER and Latency Tests

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Texas Instruments		TLK10002 EVM		
Read Me First	TLK10002 Device Configuration	Low Level Register Configuration	BER & Latency Test	HS Link Optimizer
Test		Latency Test		
		Latency Measurement Testing		
	OEnable	Wait and Read La	stency (In sec) 10	
	Channel Selection A Start Location Low Speed Input	Start Comma Loc	ation 0	
	Stop Location Low Speed Output Clock Select	Stop Comma Loca	ation 0	
	CPRI/OBSAI Clock Clock Divider	Latency Count 0000 00000	00000000000	
		Measureme	nt Ready 🔘	
	Configure	Read	Counter	
	Process Completed)	

Figure 18. TLK10002EVM GUI Latency Tab

The internal latency counter of the TLK10002 can be set up and tested using the Latency tab of the GUI. Select the desired settings for the test on the left side of the screen, and click the Configure button. Then click the Read Counter button. If the Measurement Ready light does not glow green, the Measurement Ready bit of the register is a 0 indicating the measurement is either not ready or was not successful.



5 High-Speed Link Optimizer Tests

Once the TLK10002 device registers and settings are applied to the device, switching over to the High Speed Link Optimizer tab of the GUI can provide some thorough lane testing and BER optimization tests.

Read Me First	TLK10002 D	evice Configu	ation	Low Level Register Configuration				BER & Latency Test	H5 Link Optimizer	
Sweep 1 Setup	eep 1 Setup Sweep 2 Setup		Sweep 1 Te	est result		Sweep 2 Test Result				
Transmitter , Recein ChannelA , Cl		Test Pattern	n Selection RBS 2^31-1	Y	Nun	ber of Parameters to 2	Sweep	Other Arguments		
Sweeping I Parameter:		Start	Stop	Step	Non	Linear Steps(, separa	ted)			
Channe	A_HS_SWING 🔽	110 💌	1420	✓ 1	\$					
Channe	A_HS_EQPRE	1/9 💌	13/9	✓ 1	\$			Script Path	<u> </u>	
Global_G	LOBAL_RESET	Default 💌	Default	v 0					HPA\ICP\CIF\Projects\	
Global_C	ILOBAL_RESET	Default 🗸	Default	v 0	0				Time Per Parameter abination (Seconds)	
Global_G	LOBAL_RESET	Default 💌	Default	v 0	\$					
Global_C	ILOBAL_RESET	Default 🗸	Default	v 0	0					
			onfigure Swee Combination	Р				Run Sweep	Create Report Abort Sweep	

Figure 19. TLK10002EVM GUI High-Speed Link Optimizer Tab

Sweeps can be run on the various TLK10002 register settings if the TX and RX of the high-speed channels are looped back on themselves or between channels. To run a sweep, select the TX/RX mode, the data pattern, and the number of parameters to be swept along the top portion of the window. Then select the various parameters to be swept as well as their start and stop values and step size. A step size of one steps every value, a step size of 2 sweeps every other value, etc.

Then click the Configure Sweep Combination button, and if desired, de-select additional parameters that are not to be included in the sweep. Save these combinations and then setup the other sweep, if desired.

Just like the High Level General Device Configuration portion of the GUI, the Link Optimizer is run off a text-based script for flexibility and easy revisions. To load a script other than the default script, navigate to the desired script, and then right click the script path and set it as the default file.

Enter the desired test time for the each parameter combination, and click Run Test. The GUI sets the new values for the swept parameters in its mid-level register array, apply the updates to the device based on the script, which includes reading the error counters. After the desired amount of test time, the error counters are re-read and the results are processed before the sequence is repeated for the remaining combinations.

In the Test Results windows, a grid appears with individual squares representing the parameter combinations. Clicking on the squares displays the parameter values and the associated error count for that combination at the bottom of the window. If no errors occur, the square is green. If errors occur but the counter is not maximized, the square is yellow. If the error counter was maximized, the square is red indicating that is not a good combination.

The results can also be saved to a CSV file at the end of the testing.

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