User manual

Document information

Information	Content
Keywords	SPI-bus, PCA9959, RGB and White LEDs, 24-channel x 6-bit brightness, 64 grids for gradation control.
Abstract	The OMPCA9959LEDEV eval board allows test and design for the PCA9959, which is a 24-channel SPI 4-wire bus 63 mA/5.5V constant current LED driver. This eval board, along with the OM13089 MCU board, provides an easy to use evaluation platform.



Revision history

Revision histo	ory	
Rev	Date	Description
v.1.0	20200427	Initial version

1 Introduction

The PCA9959 evaluation board features LEDs for color mixing, blinking and dimming demonstrations. A graphical interface allows the user to easily explore the different functions of the driver. The board can be connected in series with other SPI-bus demoboards to create an evaluation system.

The IC communicates to the host via the industry standard SPI-bus port. The evaluation software runs under Microsoft Windows 7, 8, and 10 PC platform.

PCA9959 Evaluation board OMPCA9959LEDEV

2 Features

- A complete evaluation platform for the PCA9959 24-channel SPI-bus 63 mA/5.5V constant current LED driver
- Easy to use GUI based software demonstrates the capabilities of the PCA9959.
- On-board Infrared, blue and RGB LEDs for variable experiments
- · Convenient test points for easy scope measurements and signal access
- USB interface to the host PC
- Power supply from USB port (x2) or external power supply can be used to power PCA9959 evaluation board

3 Getting started

3.1 Assumptions

Familiarity with the SPI-bus is helpful but not required.

3.2 Static handling requirements

CAUTION



This device is sensitive to ElectroStatic Discharge (ESD). Therefore care should be taken during transport and handling. You must use a ground strap or touch the PC case or other grounded source before unpacking or handling the hardware.

3.3 Minimum system requirements

- PC Pentium processor (or equivalent)
- One USB port (either 3.0 or 2.0 or 1.1 compatible)
- Windows 7, 8, or 10
- OM13089 MCU board (<u>www.nxp.com</u>)

3.4 Power requirements

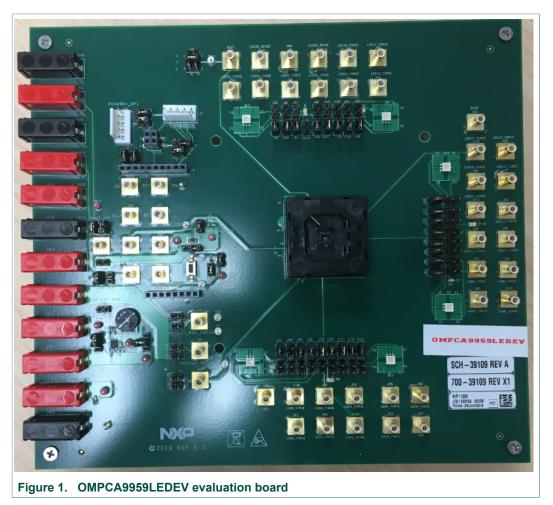
The OM13089 MCU board obtains power from the PC USB port, two USB parts can be connected to the OM13089 MCU board simultaneously. Please use external power supply option if exceeding the USB port current capabilities.

4 Hardware installation

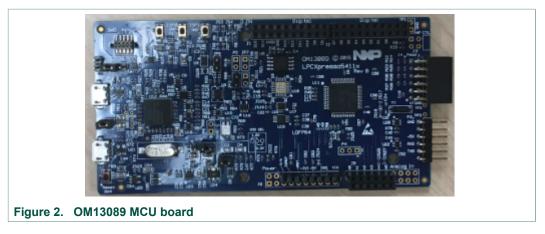
4.1 OMPCA9959LEDEV EV board and OM13089 MCU board connection

OMPCA9959LEDEV evaluation board is connected to the OM13089 MCU board using two connectors (J1 & J2 on OMPCA9959LEDEV board and J1 & J8 on OM13089 board).

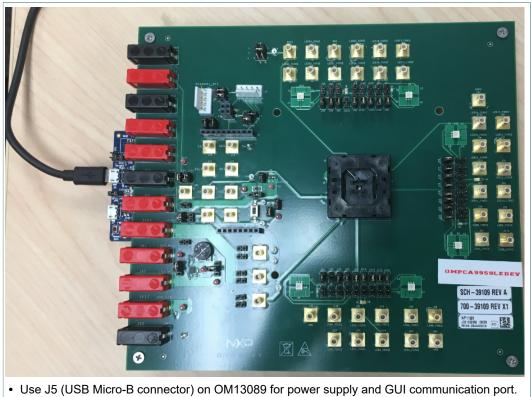
The OM13089 MCU board communicates with PCA9959 demo GUI through PC USB port and uses SPI bus to communicate to PCA9959.



PCA9959 Evaluation board OMPCA9959LEDEV



OMPCA9959LEDEV evaluation board connecting to the OM13089 MCU board



- Use J7 (USB Micro-B connector) on OM13089 for additional power supply
- Figure 3. OMPCA9959LEDEV evaluation board

5 Hardware description

- J1 and J2 are connected to the PM13089 MCU board.
- J123 selects PCA9959 VDD power supply.
- J120 selects PCA9959 VDDIO power supply.
- J113 selects LED power supply.

Table 1. OMPCA9959LEDEV EV board main components

Device	Description	Location
PCA9959	24-channel SPI-bus 32mA/5.5V constant current LED driver	U2
LP38502SD-ADJ	Adjustable output voltage LDO	U3
Green LED	Green LED for power supply indicator	D1
APT1608QBC/D	Blue LED	D2, D3, D4
SCM-013RT	Infrared LED	D8, D9, D10
LRTB GVSG	RGB LED	D5, D6, D7, D11, D12, D13

Table 2. Jumper settings for power supply

Jumper	Default setting	Comment
J123	1-2	1-2: Use +3V3 power supply for VDD 3-4: Use +5V power supply for VDD Open: Use external power supply from J124
J124	N/A	External power supply for VDD
J125	1-2	1-2: LED output enabled Open: LED disabled
J129	Open	1-2: LED output disabled Open: LED output enabled
J120	1-2	1-2: Use external power supply from J121 3-4: Use VDD_IN for VDDIO power supply
J121	N/A	External power supply for VDDIO
J118	1-2	1-2 : Not measuring VDD current Open: Use current meter to measure VDD current
J122	1-2	1-2 : Not measuring VDDIO current Open: Use current meter to measure VDDIO current
J137	1-2	1-2 : Use external POR circuit Open: Use internal POR circuit
J113	1-2	1-2: LED power supply from +5V_MCU 4-2: LED power supply from VOUT_ADJ 3-2: LED power supply from +3V3_MCU
J63	1-2	REXT = 1 kohm, Iref = 250 uA Output current = Iref * IREF_GRPx[7:0].

Table 3. Jumper settings Host interface

Jumper	Default setting	Comment
J1	N/A	Power supply from OM13089 MCU board

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Jumper	Default setting	Comment
J2	N/A	SPI bus interface to the OM13089 MCU board
J3, J4	N/A	For OMPCA9959LEDEV SPI daisy chain test
J5	1-2	MISO
J6	1-2	MOSI
J7	N/A	SPI bus test points
J8,J9,J10,J11	1-2	SPI bus
J52	N/A	SPI bus test points

Table 4. Jumper settings for LEDs

Jumper	Default setting	Comment
J64	1-2	D2 - Blue LED 1-2: Not measuring D2 current Open: Use current meter to measure D2 current
J116	Open	D2 - Blue LED 1-2: Bypass D2 LED Open: Use D2 LED
J82	1-2	D3 - Blue LED 1-2: Not measuring D3 current Open: Use current meter to measure D3 current
J81	Open	D3 - Blue LED 1-2: Bypass D3 LED Open: Use D3 LED
J98	1-2	D4 - Blue LED 1-2: Not measuring D4 current Open: Use current meter to measure D4 current
J97	Open	D4 - Blue LED 1-2: Bypass D4 LED Open: Use D4 LED
J66, J69, J72	1-2	D5 - RGB LED 1-2: Not measuring D5 current Open: Use current meter to measure D5 current
J67, J70, J71	Open	D5 - RGB LED 1-2: Bypass D5 LED Open: Use D5 LED
J100, J101, J104	1-2	D6 - RGB LED 1-2: Not measuring D6 current Open: Use current meter to measure D6 current
J99, J102, J103	Open	D6 - RGB LED 1-2: Bypass D6 LED Open: Use D6 LED
J83, J85, J88	1-2	D7 - RGB LED 1-2: Not measuring D7 current Open: Use current meter to measure D7 current
J84, J86, J87	Open	D7 - RGB LED 1-2: Bypass D7 LED Open: Use D7 LED
J106	1-2	D8 - Infrared LED 1-2: Not measuring D8 current Open: Use current meter to measure D8 current
J105	Open	D8 - Infrared LED 1-2: Bypass D8 LED Open: Use D8 LED
J74	1-2	D9 - Infrared LED 1-2: Not measuring D9 current Open: Use current meter to measure D9 current
J73	Open	D9 - Infrared LED 1-2: Bypass D9 LED Open: Use D9 LED
J90	1-2	D10 - Infrared LED 1-2: Not measuring D10 current Open: Use current meter to measure D10 current
J89	Open	D10 - Infrared LED 1-2: Bypass D10 LED Open: Use D10 LED
J107, J110, J112	1-2	D11 - RGB LED 1-2: Not measuring D11 current Open: Use current meter to measure D11 current
J108, J109, J111	Open	D11 - RGB LED 1-2: Bypass D11 LED Open: Use D11 LED

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Jumper	Default setting	Comment
J75, J77, J80	1-2	D12 - RGB LED 1-2: Not measuring D12 current Open: Use current meter to measure D12 current
J76, J78, J79	Open	D12 - RGB LED 1-2: Bypass D12 LED Open: Use D12 LED
J91, J93, J96	1-2	D13 - RGB LED 1-2: Not measuring D13 current Open: Use current meter to measure D13 current
J92, J94, J95	Open	D13 - RGB LED 1-2: Bypass D13 LED Open: Use D13 LED

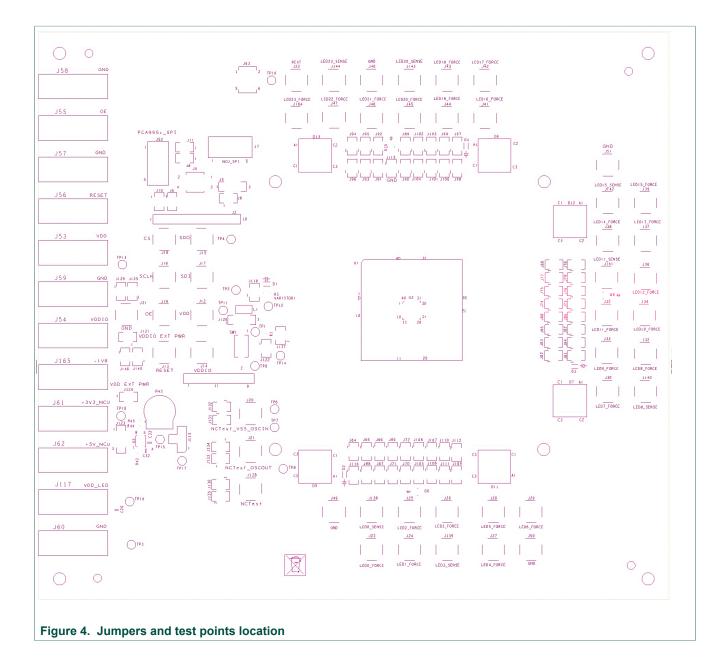
Table 5. Jumper settings for SMB connectors

Jumper	Default setting	Comment
J12	N/A	VDD SMB connector
J13	N/A	/RESET pin SMB connector
J14	N/A	VDDIO SMB connector
J15	N/A	SDO pin SMB connector
J16	N/A	SCLK pin SMB connector
J17	N/A	SDI pin SMB connector
J18	N/A	/CS pin SMB connector
J19	N/A	/OE pin SMB connector
J20	N/A	NCTest_VSS_OSCIN SMB connector
J21	N/A	NCTest_OSCOUT SMB connector
J22	N/A	REXT pin SMB connector
J23 - J30	N/A	LED 0 - 7 pin SMB connector
J31, J40, J49-J51	N/A	GND SMB connector
J32 - J39	N/A	LED 8 - 15 pin SMB connector
J41 - J47, J164	N/A	LED 16 - 23 pin SMB connector

Table 6. Jumper settings for banana connectors

Jumper	Default setting	Comment
J53	N/A	VDD banana connector
J54	N/A	VDDIO banana connector
J55	N/A	/OE pin banana connector
J56	N/A	/RESET pin banana connector
J57 - J60	N/A	GND banana connector
J61	N/A	3V3_MCU banana connector
J62	N/A	3V_MCU banana connector
J165	N/A	1V8 banana connector

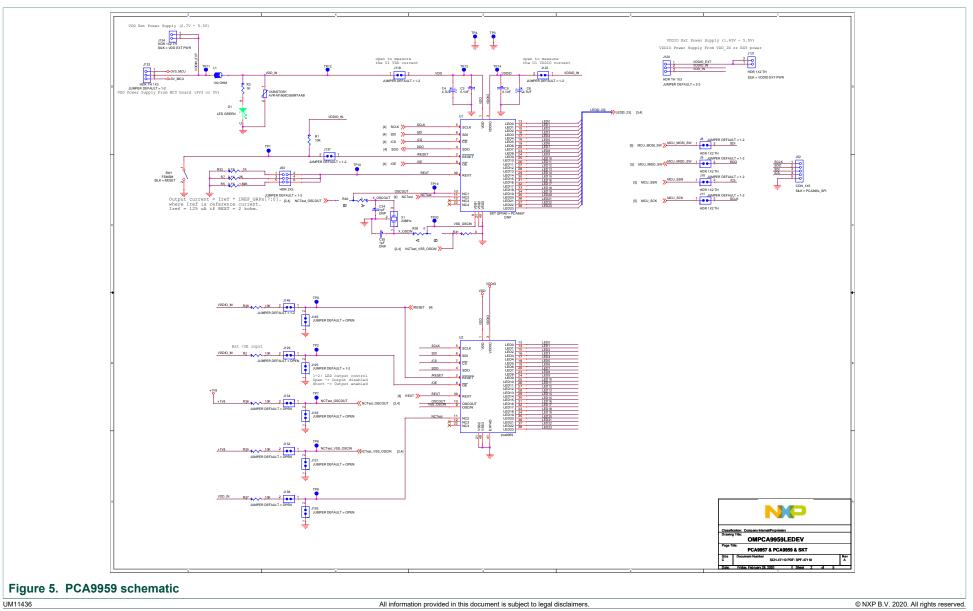
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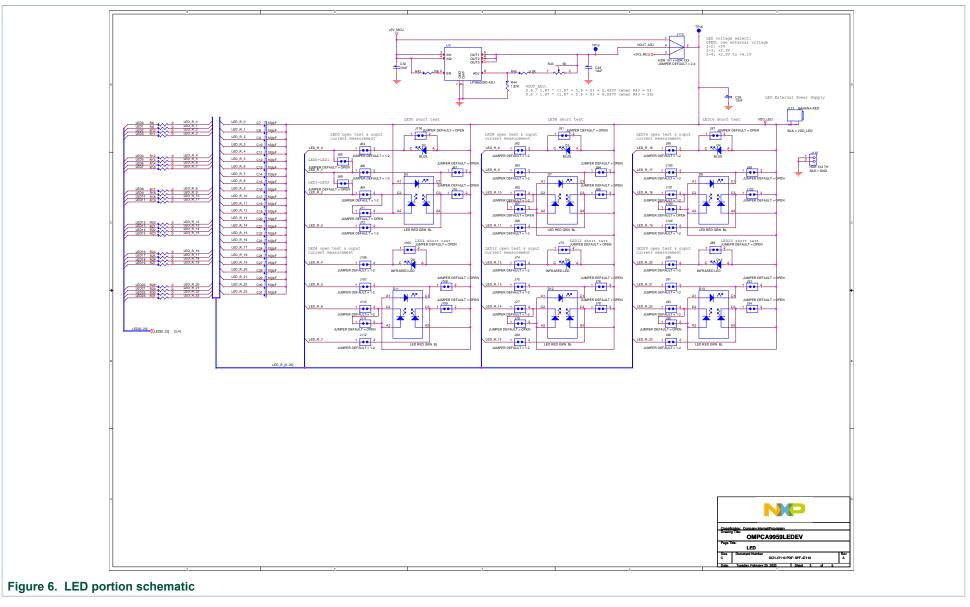


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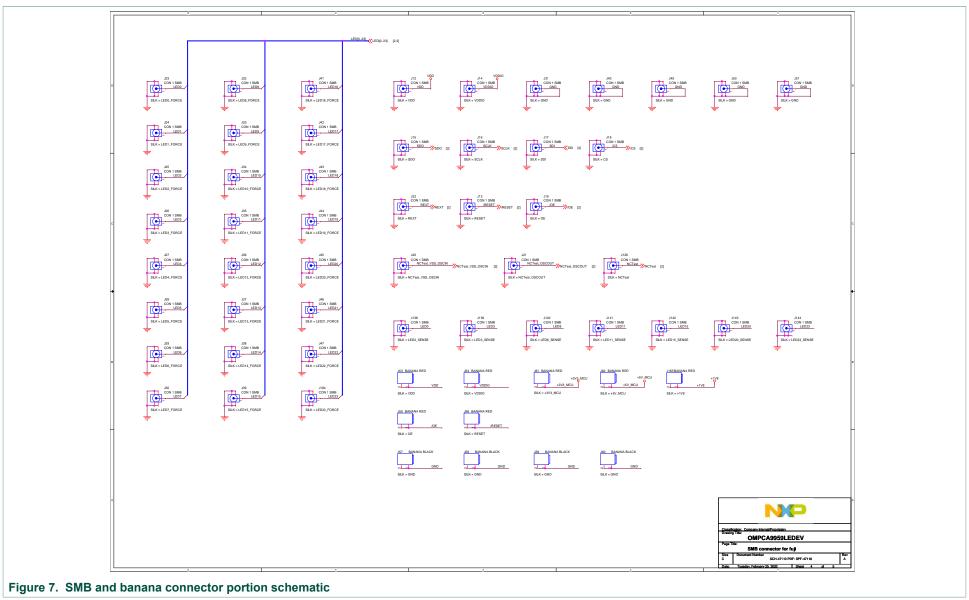
6 Schematic





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7 PCA9959 demo GUI

7.1 Run PCA9959 GUI V0.1.exe on Windows 7, 8, or 10 PC

1. Click "Connect" button to connect OM13089 board

PCA9959 GUI V0.2						- 🗆	
		_CFG CH12_CFG - CH23_CFG 8 - 15 GRID16 - 23 GRID24 - 3			GRID48 - 55 GRID56 - 63 E	ror Flags	
113089 Disconnected	GD0_G0	All LEDs in Group () is OFF	~	GD4_G0	All LEDs in Group () is OFF	~	
Mode 1 = 0x00	GD0_G1	All LEDs in Group 1 is OFF	~	GD4_G1	All LEDs in Group 1 is OFF	~	
Normal mode. Oscillator on.	GD0_G2	All LEDs in Group 2 is OFF	\sim	GD4_G2	All LEDs in Group 2 is OFF	\sim	
50nS delay offset btw ch x. x+1 Use ceralock resonator	GD0_G3	All LEDs in Group 3 is OFF	\sim	GD4_G3	All LEDs in Group 3 is OFF	~	
Mode 2 = 0x00	GD1_G0	All LEDs in Group () is OFF	\sim	GD5_G0	All LEDs in Group () is OFF	×	
Temperature O.K.	GD1_G1	All LEDs in Group 1 is OFF	~	GD5_G1	All LEDs in Group 1 is OFF	¥	
No error at LED outputs	GD1_G2	All LEDs in Group 2 is OFF	\sim	GD5_G2	All LEDs in Group 2 is OFF	~	
CLRERR - push to clear error flags	GD1_G3	All LEDs in Group 3 is OFF	\sim	GD5_G3	All LEDs in Group 3 is OFF	×	
AUTO Switch_Off_Dis ON	GD2_G0	All LEDs in Group 0 is OFF	~	GD6_G0	All LEDs in Group () is OFF	×	
No error at LED outputs No valid external clock presented CLRERR - push to clear error flags AUTO Switch_Olf_Dis ON Read Mode 2	GD2_G1	All LEDs in Group 1 is OFF	\sim	GD6_G1	All LEDe in Group 1 is OFF	~	
	GD2_G2	All LEDs in Group 2 is OFF	v	GD6_G2	All LEDs in Group 2 is OFF	v	
Read All REG	GD2_G3	All LEDs in Group 3 is OFF	\sim	GD6_G3	All LEDs in Group 3 is OFF	×	
Message Box	GD3_G0	All LEDs in Group 0 is OFF	\sim	GD7_G0	All LEDs in Group () is OFF	×	
Click Connect to connect OM13089	GD3_G1	All LEDs in Group 1 is OFF	~	GD7_G1	All LEDs in Group 1 is OFF	~	
board:	GD3_G2	All LEDs in Group 2 is OFF		GD7_G2	All LEDs in Group 2 is OFF		
	GD3_G3	All LEDs in Group 3 is OFF	\sim	GD7_G3	All LEDs in Group 3 is OFF	~	
	SID	EO			E CONTRACTOR OF CONTRACTOR OFO	PAGE 0	

2. If OM13089 board is detected

- a. It shows "OM13089 board connected" in Message Box
- b. It shows GUI version number as well as reads out firmware version number in the OM13089 board

PCA9959 GUI V0.2						-		
Connect Disconnect	CH0_CFG - CH11_CFG C GRID0 - 7 GRID8 - 15 C				GRID48 - 55 GRID56 - 63	Error Flags		
13089 Connected	GD0_G0 All LEDs	s in Group () is OFF	~	GD4_G0	All LEDs in Group () is OFF		×	
Mode 1 - 0x00	GD0_G1 AILED:	s in Group 1 is OFF	~	GD4_G1	All LEDs in Group 1 is OFF		~	
Normal mode. Oscillator on.	GD0_G2 AILED	a in Group 2 is OFF	~	GD4_G2	All LEDs in Group 2 is OFF		~	
Use ceralock resonator	GD0_G3 All LEDe	s in Group 3 is OFF	~	GD4_G3	All LEDs in Group 3 is OFF		~	
Mode 2 = 0x00	GD1_G0 AILED	s in Group () is OFF	~	GD5_G0	All LEDs in Group 0 is OFF		~	
Temperature 0.K	GD1_G1 AILED	s in Group 1 is OFF	~	GD5_G1	All LEDs in Group 1 is OFF		v	
No error at LED outputs	GD1_G2 AILED:	a in Group 2 is OFF	~	GD5_G2	All LEDs in Group 2 is OFF		~	
CLRERR - push to clear error flags	GD1_G3 AILED	a in Group 3 is OFF	~	GD5_G3	All LEDs in Group 3 is OFF		~	
Al 3089 Connected Mode 1 - 0x00 Hormal mode. Oscillator on. Strink delay offset bitw chix, x+1 Use cereliciti resonator Mode 2 = 0x00 Temperature 0 /K No error at LED oxtpits No valid oxtemul clock presented	GD2_G0 All LEDs	s in Group 0 is OFF	\sim	GD6_G0	All LEDs in Group () is OFF		\sim	
	GD2_G1 All LEDs	s in Group 1 is OFF	\sim	GD6_G1	All LEDs in Group 1 is OFF		V	
	GD2_G2 AII LED:	s in Group 2 is OFF	~	GD6_G2	All LEDs in Group 2 is OFF		×	
Read All REG	GD2_G3 AII LED	a in Group 3 is OFF	~	GD6_G3	All LEDs in Group 3 is OFF		~	
leepage Roy	GD3_G0 All LEDe	s in Group () is OFF	\sim	GD7_G0	All LEDs in Group () is OFF		\sim	
OM13089 board connected	GD3_G1 AILED	s in Group 1 is OFF	\sim	GD7_G1	All LEDs in Group 1 is OFF		\sim	
	GD3_G2 AII LED	s in Group 2 is OFF	~	GD7_G2	All LEDs in Group 2 is OFF		~	
	GD3_G3 AII LED:	s in Group 3 is OFF	~	GD7_G3	All LEDs in Group 3 is OFF		×	
	SIDE 0				Γ	PAGE		

- 3. If OM13089 board is not detected
 - a. It shows "OM13089 (LPC 54114) board doesn't find!" in Message Box.
 - b. Please check whether USB cable is connected to right USB port (J5) on OM13089 board

PCA9959 GUI V0.2						- 🗆	
VP	CH0 CFG-CH11	_CFG CH12_CFG - CH23_CFG G	arid/SIDE Control	I SPI			
Connect Disconnect	GRID0-7 GRID	8 - 15 GRID16 - 23 GRID24 - 31	GRID32 - 39	GRID40 - 47	GRID48 · 55 GRID56 · 63 Eno	r Flags	
13089 Disconnected	GD0_G0	All LEDs in Group () is OFF	~	GD4_G0	All LEDs in Group () is OFF	~	
Mode 1 = 0x00	GD0_G1	All LEDs in Group 1 is OFF	~	GD4_G1	All LEDs in Group 1 is OFF	~	
Normal mode. Oscillator on. 50nS delay offset btw.ch.x.x+1	GD0_G2	All LEDs in Group 2 is OFF	~	GD4_G2	All LEDs in Group 2 is OFF	~	
Use ceralock resonator	GD0_G3	All LEDs in Group 3 is OFF	\sim	GD4_G3	All LEDs in Group 3 is OFF	~	
Mode 2 = 0x00	GD1_G0	All LEDs in Group 0 is OFF	~	GD5_G0	All LEDs in Group 0 is OFF	~	
Temperature O.K.	GD1_G1	All LEDs in Group 1 is OFF	~	GD5_G1	All LEDs in Group 1 is OFF		
No error at LED outputs No valid external clock presented	GD1_G2	All LEDs in Group 2 is OFF	~	GD5_G2	All LEDs in Group 2 is OFF	\sim	
CLRERR - push to clear error flage	GD1_G3	All LEDs in Group 3 is OFF	\sim	GD5_G3	All LEDs in Group 3 is OFF	\sim	
AUTO Switch_Off_Dis ON	GD2_G0	All LEDs in Group 0 is OFF	~	GD6_G0	All LEDs in Group () is OFF	~	
Read Mode 2	GD2_G1	All LEDs in Group 1 is OFF	~	GD6_G1	All LEDs in Group 1 is OFF		
	GD2_G2	All LEDs in Group 2 is OFF	v	GD6_G2	All LEDs in Group 2 is OFF	V	
Read All REG	GD2_G3	All LEDs in Group 3 is OFF	~	GD6_G3	All LEDs in Group 3 is OFF	~	
Message Box	GD3_G0	All LEDs in Group () is OFF	~	GD7_G0	All LEDs in Group () is OFF	~	
OM13089 (LPC 54114) board doesn't	GD3_G1	All LEDs in Group 1 is OFF	~	GD7_G1	All LEDs in Group 1 is OFF	~	
find!	GD3_G2	All LEDs in Group 2 is OFF		GD7_G2	All LEDs in Group 2 is OFF		
	GD3_G3	All LEDs in Group 3 is OFF	\sim	GD7_G3	All LEDs in Group 3 is OFF	\sim	
	SID	EO			P	AGE 0	

4. Use Mode1 & 2 command interface to read/write Mode1 & 2 register a. It shows MOSI and MISO value in Message Box

Mode1 = 0x08
Normal Mode. Oscillator on
No delay offset
Use ceralock resonator
Mode2 = 0x20
Temperature O.K.
No error at LED outputs
External clock detected in correct range
CLRERR - push to clear error flags
AUTO Switch_Off_Dis ON
Read Mode 2
Read All REG
Message Box
MOSI: 00 08

- 5. "Write All REG" and "Read All REG" buttons
 - a. Use "Read All REG" button to read our all register value from PCA9959
 - b. Open "Read All REG.txt" to see all PCA9959 registers value

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Use "GRID0-7" to "GRID56-63" to adjust GRID0 – GRID63 setting
 a. Use GRID0 – GRID63 Combo Box to adjust GRIDx value

	010.050.0144.050.01			0.01		
Connect Disconnect	CH0_CFG CH11_CFG CH GRID0-7 GRID8-15 GF				GRID48 - 55	GRID56 - 63
OM13089 Connected	GD0_G0 LEDs in G	iroup () is driven by preset our	rent i	GD4_G0	All LEDs in Gro	up 0 is OFF
Node1 = 0xeb	GD0_G1 AI LEDs in G	n Group 0 is OFF iroup 0 is driven by preset our	rent1	GD4_G1	AI LEDs in Gro	up 1 is OFF
Normal Mode. Oscillator on No delay offeet	LEDa in G	roup 0 is driven by preset our roup 0 is driven by preset our	rent2	GD4_G2	AI LEDs in Gro	up 2 is OFF
Use ceralock resonator	GD0_G3 AI LEDe i	n Group 3 is OFF	~	GD4_G3	AI LEDs in Gro	up 3 is OFF
Node 2 - 0x00	GD1_G0 AI LEDs i	n Group O is OFF	~	GD5_G0	All LEDs in Gro	up O is OFF
Temperature O.K.	GD1_G1 AI LEDs i	Group 1 is OFF	~	GD5_G1	AI LEDs in Gro	up 1 is OFF
No error at LED outputs	GD1_G2 AI LEDs i	Group 2 is OFF	~	GD5_G2	AI LEDs in Gro	up 2 is OFF
No valid external clock presented CLRERR - push to clear error flags	GD1_G3 AI LEDe i	n Group 3 is OFF	~	GD5_G3	AI LEDs in Gro	up 3 is OFF
AUTO Switch_Off_Dis ON	GD2_G0 All LEDs i	n Group 0 is OFF	~	GD6_G0	All LEDs in Gro	up 0 is OFF
Read Mode 2	GD2_G1 AI LEDs I	n Group 1 is OFF	~	GD6_G1	All LEDs in Gro	up 1 is OFF
	GD2_G2 AI LEDs i	Group 2 is OFF	~	GD6_G2	AI LEDs in Gro	up 2 is OFF
Read AI REG	GD2_G3 AI LEDs i	n Group 3 is OFF	~	GD6_G3	AI LEDs in Gro	up 3 is OFF
Message Box	GD3_G0 AI LEDs i	n Group O is OFF	~	GD7_G0	All LEDs in Gro	up 0 is OFF
MOSI: 16 00	GD3_G1 AI LEDs I	n Group 1 is OFF	~	GD7_G1	All LEDs in Gro	up 1 is OFF
MOSI: 40 FD	GD3_G2 AI LEDs i	Group 2 is OFF	~	GD7_G2	AI LEDs in Gro	up 2 is OFF

- 7. Use "CH0_CFG-CH11_CFG" and "CH12_CFG-CH23" LED CHx output
 - a. Use CHx checkbox to enable or disable LED CHx output
 - b. Use CHx Group Combo Box to select LED CHx group.
 - c. Use CHx Current Setx to set chrrent set 1-3 for LED CHx.

	GRID0-7 GRID8-15 GRID16-23 GRID24-31 GRII
Connect Disconnect	CH0_CFG - CH11_CFG CH12_CFG - CH23_CFG Grid/SIC
OM13089 Connected	CH3_CFG1-4 (20-23h) CH3_CFG1-4 (2C-2Fh
Mode1 = 0xeb	CH0 Output Disable CH3 Output Disabl
Model = uxeb	CH0 Group Group CH3 Group Group
Normal Mode. Oscilator on	CH0 Current Se Group 0 CH3 Current Set 1 C
No delay offset	Group 1 CH0 Current Set Group 2 CH3 Current Set 2 C
Use ceralock resonator	Group 3
	CH0 Current Set 3 0 🚍 CH3 Current Set 3 0
Mode 2 - 0x00	
Temperature O.K.	CH1 CFG1-4 (24-27h) CH4 CFG1-4 (30-33h)
No error at LED outputs	CH1 Output Disable CH4 Output Disabl
No valid external clock presented	CH1 Group Group 0 V CH4 Group Group
CLRERR - push to clear error flags	CH1 Current Set 1 0 🚔 CH4 Current Set 1 0
AUTO Switch_Off_Dis ON	
	CH1 Current Set 2 0 🖨 CH4 Current Set 2 0
Read Mode 2	CH1 Current Set 3 0 🖨 CH4 Current Set 3 0
Boad ALBEG	CH2 CFG1-4 (28-28h) CH5 CFG1-4 (34-37h)
Read All REG	CH2 Output Disable CH5 Output Disable
	CH2 Group Group 0 V CH5 Group Group
Message Box	
MOSI: 16 80	CH2 Current Set 1 0 🚔 CH5 Current Set 1 0
MOSI: 40 F9	CH2 Current Set 2 0 🚔 CH5 Current Set 2 0
	CH2 Current Set 3 0 🛋 CH5 Current Set 3 0

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- 8. Use "Error Flags" page to read out error status for LEDs output
 - a. Click on "Read Error Flags" button to read out error status for LED0-23 output
 - b. Click on "CLRERR" button to clear error flags.

Model = Oxeb		Error	150	-	
Normal Mode. Oscillator on	LED		LED	Error	_
No delay offset	LED0	LEDO No Error	LED12	LED 12 No Error	_
Use ceralock resonator	LED1	LED1 No Error	LED13	LED 13 No Error	_
	LED2	LED2 No Error	LED14	LED14 No Error	
Mode 2 = 0x00	LED3	LED3 No Error	LED15	LED 15 No Error	
	LED4	LED4 No Error	LED16	LED 16 No Error	
Temperature O.K.	LED5	LED5 No Error	LED17	LED17 No Error	
No error at LED outputs	LED6	LED6 No Error	LED18	LED18 No Error	
No valid external clock presented	LED7	LED7 No Error	LED19	LED 19 No Error	
CLRERR - push to clear error flags	LED8	LED8 No Error	LED20	LED20 No Error	
AUTO Switch_Off_Dis ON	LED9	LED9 No Error	LED21	LED21 No Error	
Read Mode 2	LED10	LED10 No Error	LED22	LED22 No Error	
Neau mode 2	LED11	LED11 No Error	LED23	LED23 No Error	
Read AI REG		R	ead Error Flags		

- 9. Use "Grid/SID Control" page to select below settings
 - a. Time Step, Duration Counter, Gradation start/stop, One short/Recurrence mode and SIDE mode settings

	GRID0 - 7 GRID8 - 15 GRID16 - 23 GRID24 - 31 GRID32 - 39 GRI
Connect Disconnect	CH0_CFG · CH11_CFG CH12_CFG · CH23_CFG Grid/SIDE Control SP
OM13089 Connected	
OM13089 Connected Node1 = 0xeb Nomel Mode. Oscilator on No delay offset Use ceraicok reconstor Node 2 = 0x00 Temperature D.K. No error at LED outputs No valid external clock presented CLRERR - push to clear error flags AUTO Swtch_Off_Ds ON Read Mode 2 Read AI REG Message Box	Grid Duration Control Register (0Bh) Time Step (TSTEP) Duration Counter (DURCNT) Duration Counter TSTEP*(DURCNT+1) Gradation Control Register (09h) Gradation Control Register (09h) Gradation Stops. all LED return to Grid0 Precurence mode, all LED turn to Grid0 after Grid63 executed Side Control Register (0Ah) SIDE 0
MOSI: 12 FF	

- 10.Use "SPI" page to select SPI interface related settings
 - a. SPI speed, Pre-Delay, Post-Delay, Frame Delay, Transfer Delay and command interface

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Connect Disconnect OM13089 Connected	CH0_CFG - CH11_CFG CH12_CFG - CH23_CFG Grid/SIDE Control SPI
Node 1 - Queb Normal Mode. Oscilator on No delay offset Use cerelock resonator Mode 2 = 0x00	SPI Speed SPI Fre Delay SPI Pre Delay SPI Poet Delay SPI Poet Delay 1 MHz SPI Poet Delay 1 MHz G MHz 1 2 MHz 1
Temperature O.K. No error at LED outputs No valid external clock presented CLRERR - push to clear error flags AUTO Switch_Off_Dis ON Read Node 2	SPI Command Interface Write SPI No of Bytes NOSI 01 00
Read AI REG Message Box SPI Speed Setting Done!	MISO

8 Abbreviations

Table 7. Abbreviations	
Acronym	Description
ESD	Electro Static Discharge
GUI	Graphical User Interface
l ² C-bus	Inter-integrated Circuit bus
IC	Integrated Circuit
LED	Light Emitting Diode
MISO	Master In, Slave Out
MOSI	Master Out, Slave In
PC	Personal Computer
PWM	Pulse Width Modulator
RAM	Random Access Memory
RGB	Red/Green/Blue
RGBA	Red/Green/Blue/Amber
SPI	Serial Periphal Interface
USB	Universal Serial Bus

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9 References

- [1] PCA9959
- 24-channel SPI serial bus 32 mA / 5.5V constant current LED driver; Product data sheet; NXP Semiconductors

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