UM11196

PCA9957 Evaluation board OMPCA9957LEDEV

Rev. 1.0 — 27 April 2020 User manual

Document information

Information	Content
Keywords	SPI-bus, PCA9957, RGB and White LEDs, 24-channel x 8-bit PWMs
Abstract	The OMPCA9957LEDEV eval board allows test and design for the PCA9957, which is a 24-channel SPI 4-wire bus 32 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 history

Rev	Date	Description
v.1.0	20200427	Initial version

1 Introduction

The PCA9957 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 demo-boards 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.

2 Features

- A complete evaluation platform for the PCA9957 24-channel SPI-bus 35 mA/5.5V constant current LED driver
- Easy to use GUI based software demonstrates the capabilities of the PCA9957.
- 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 PCA9957 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 (from www.nxp.com)

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 OMPCA9957LEDEV EV board and OM13089 MCU board connection

OMPCA9957LEDEV evaluation board is connected to the OM13089 MCU board using two connectors (J1 & J2 on OMPCA9957LEDEV board and J1 & J8 on OM13089 board).

The OM13089 MCU board communicates with PCA9957 demo GUI through PC USB port and uses SPI bus to communicate to PCA9957.

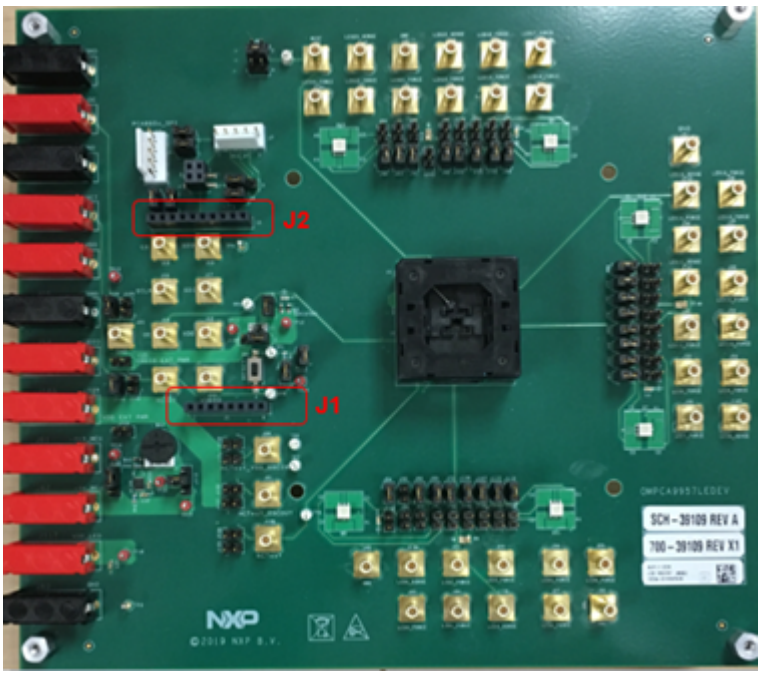


Figure 1. OMPCA9957LEDEV evaluation board

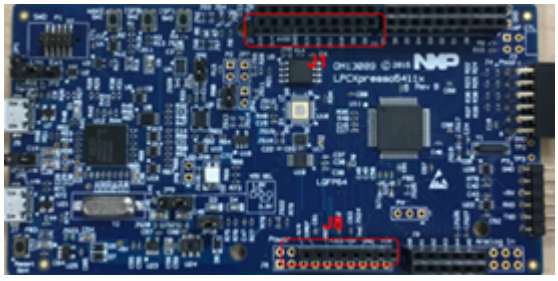
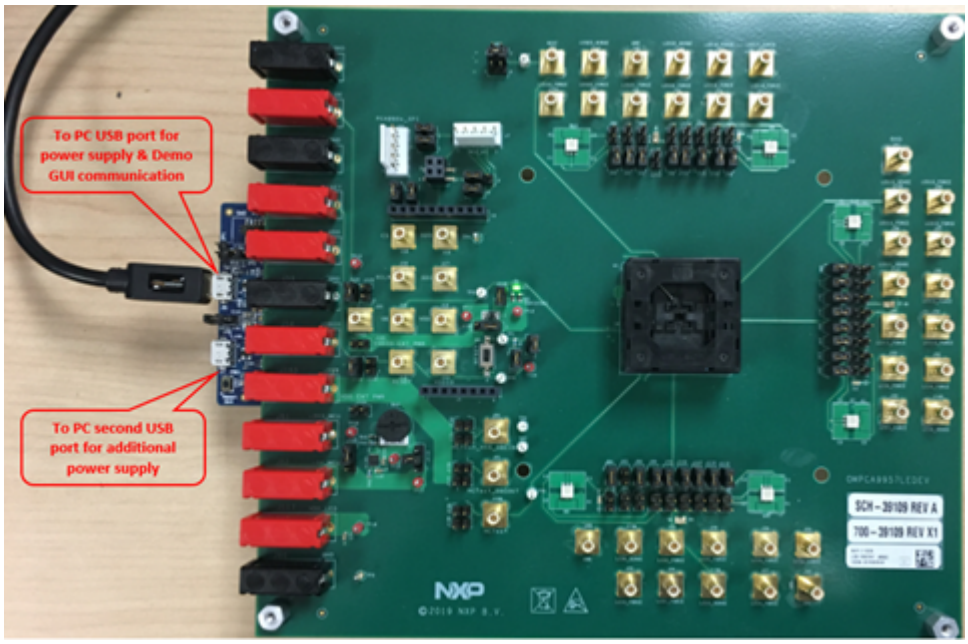


Figure 2. OM13089 MCU board



- Use J5 (USB Micro-B connector) on OM13089 for power supply and GUI communication port.
- Use J7 (USB Micro-B connector) on OM13089 for additional power supply

Figure 3. OMPCA9957LEDEV evaluation board connecting to the OM13089 MCU board

5 Hardware description

- J1 and J2 are connected to the PM13089 MCU board.
- J123 selects PCA9957 VDD power supply.
- J120 selects PCA9957 VDDIO power supply.
- J113 selects LED power supply.

Table 1. OMPCA9957LEDEV EV board main components

Device	Description	Location
PCA9957	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	3-4	REXT = 2 kohm, Iref = 125 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

Jumper	Default setting	Comment
J2	N/A	SPI bus interface to the OM13089 MCU board
J3, J4	N/A	For OMPCA9957LEDEV 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

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

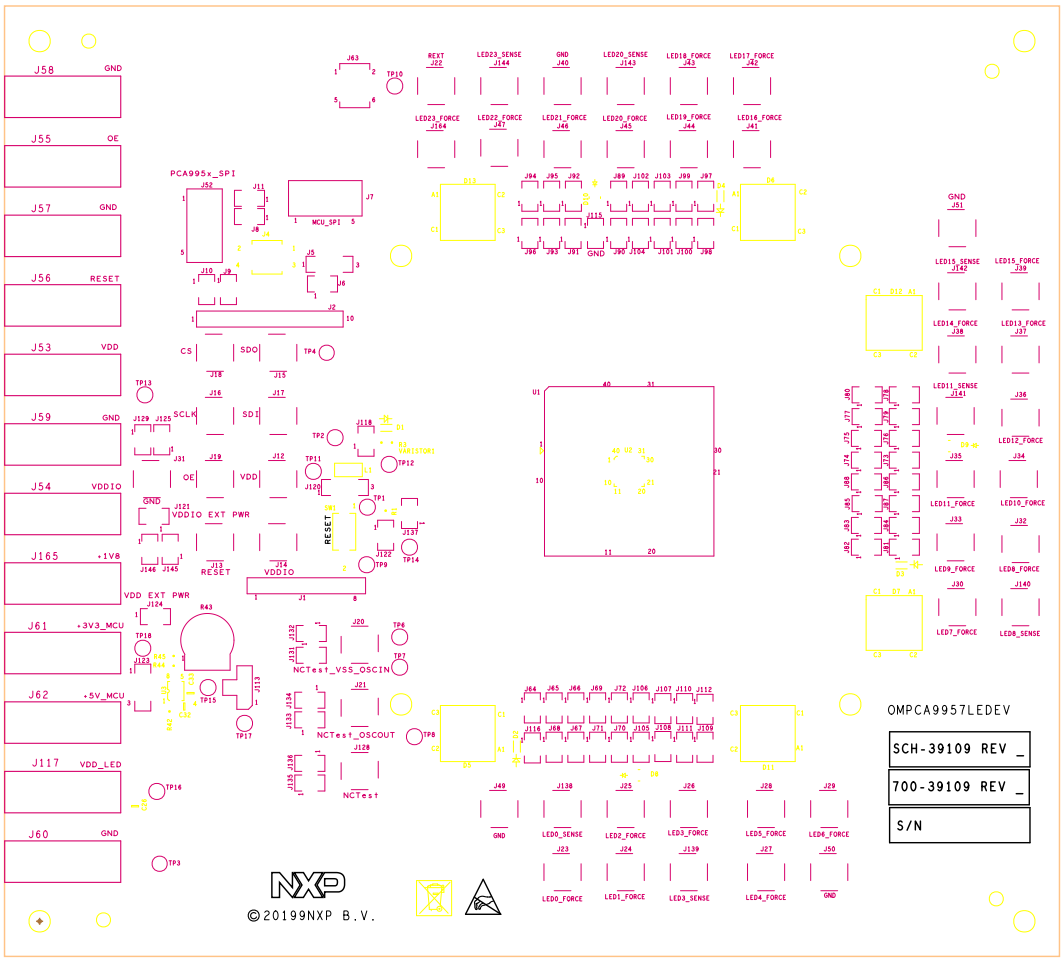


Figure 4. Jumpers and test points location

6 Schematic

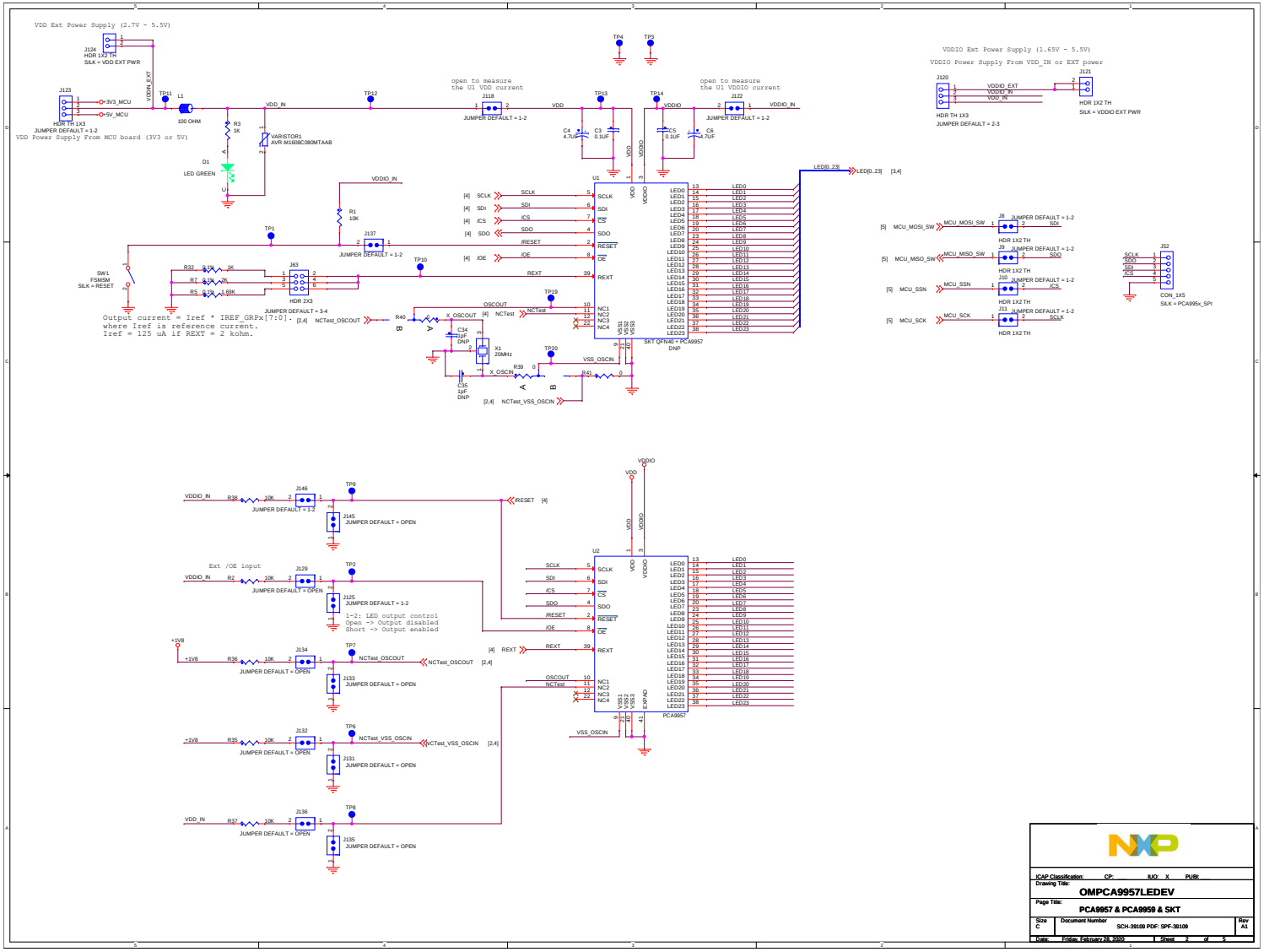


Figure 5. PCA9957 schematic

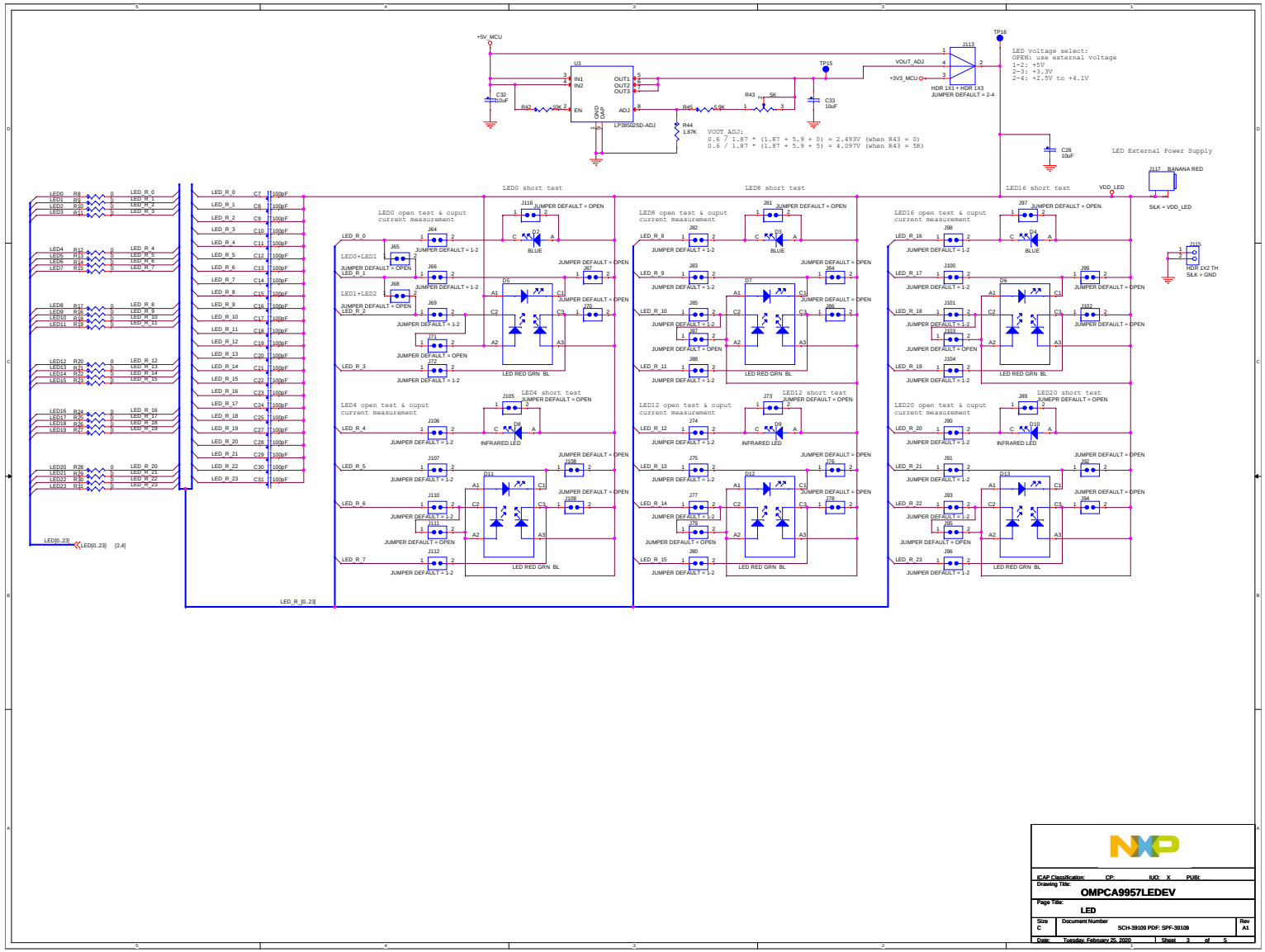


Figure 6. LED portion schematic

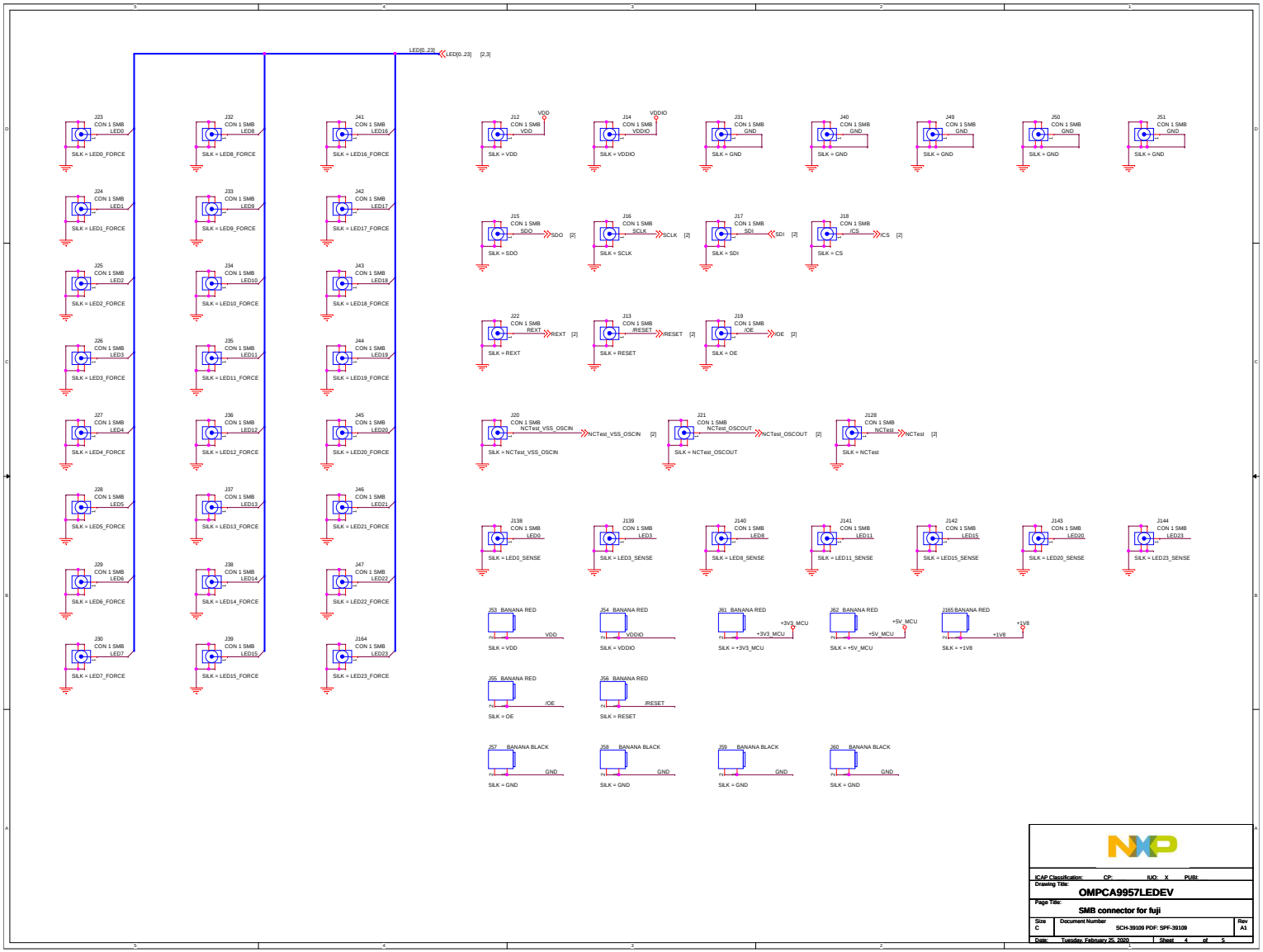
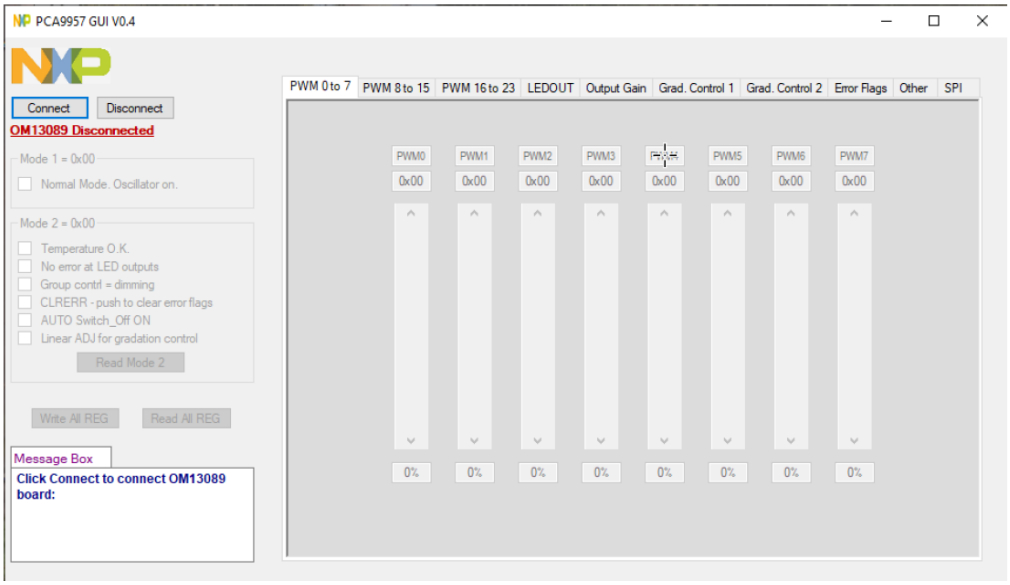


Figure 7. SMB and banana connector portion schematic

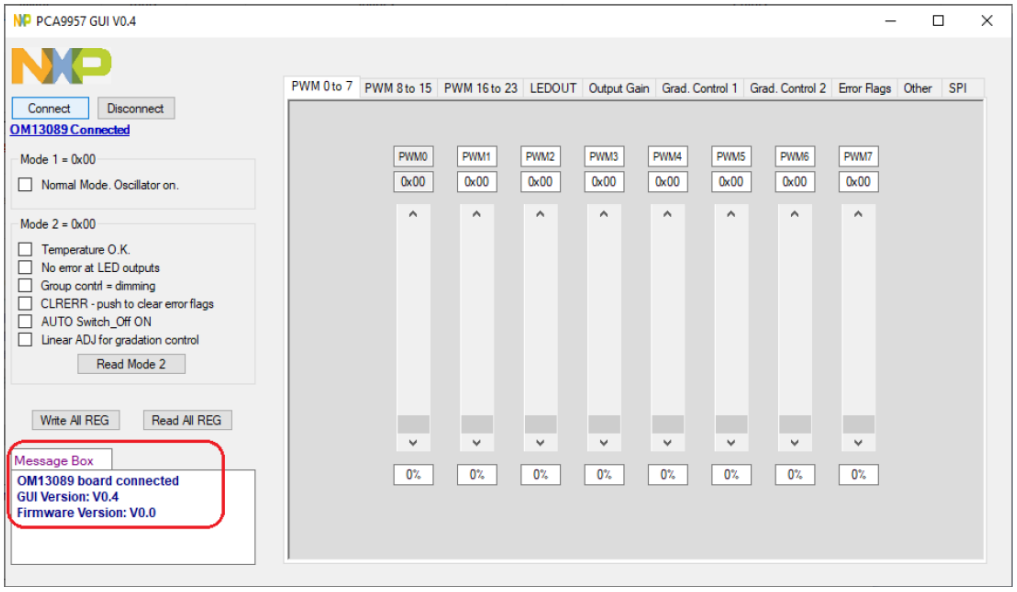
7 PCA9957 Demo GUI

7.1 Run PCA9957 GUI V0.1.exe on Windows 7, 8, or 10 PC

1. Click “Connect” button to connect OM13089 board

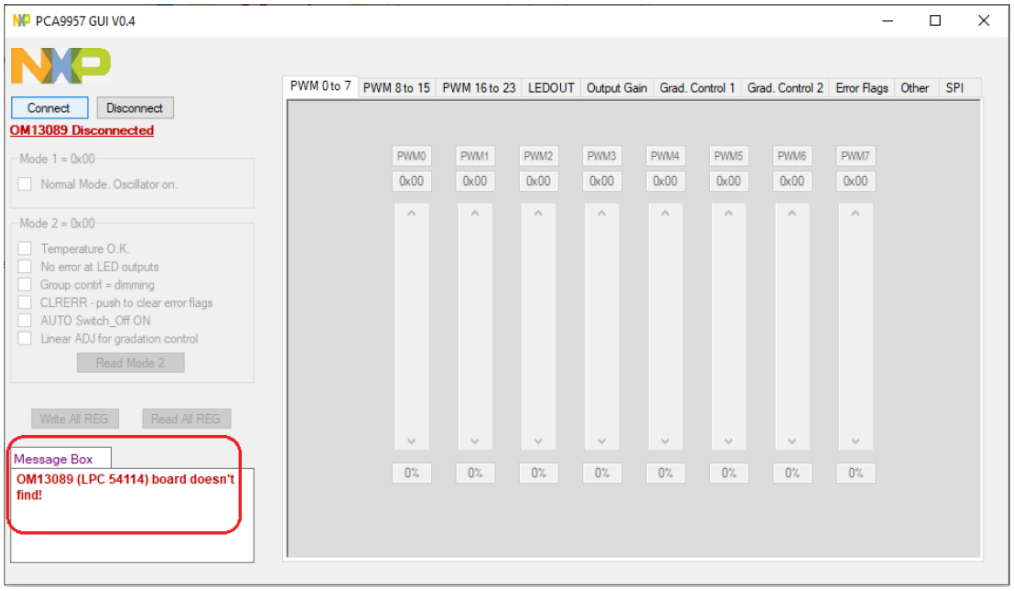


2. If OM13089 board is detected
   a. It shows “OM13089 board connected” in Message Box
   b. It shows GUI version number as well as reads out firmware version number in the OM13089 board

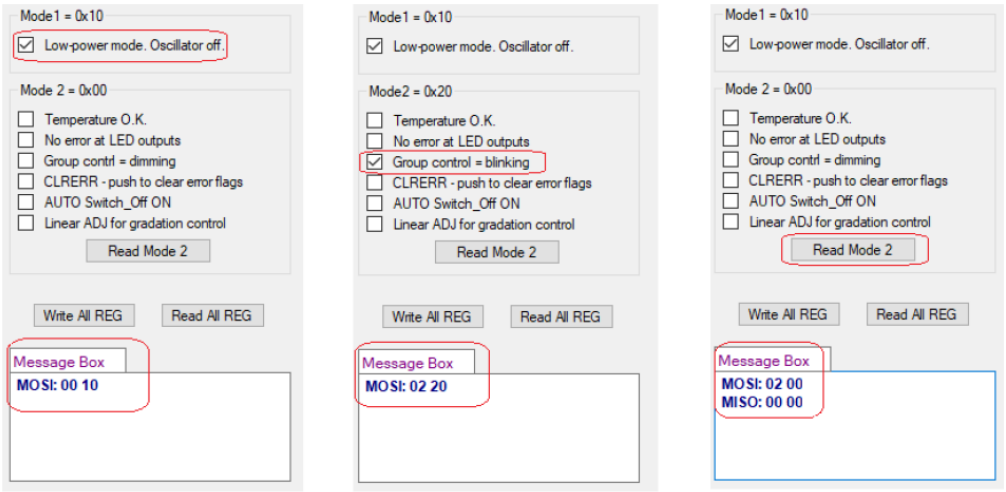


3. If OM13089 board is not detected

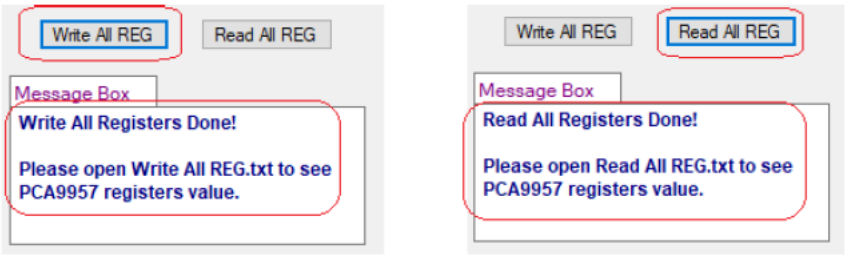
a. It shows “OM13089 (LPC 54114) board doesn't find!” in Message Box.
b. Please check whether USB cable is connected to right USB port (J5) on OM13089 board



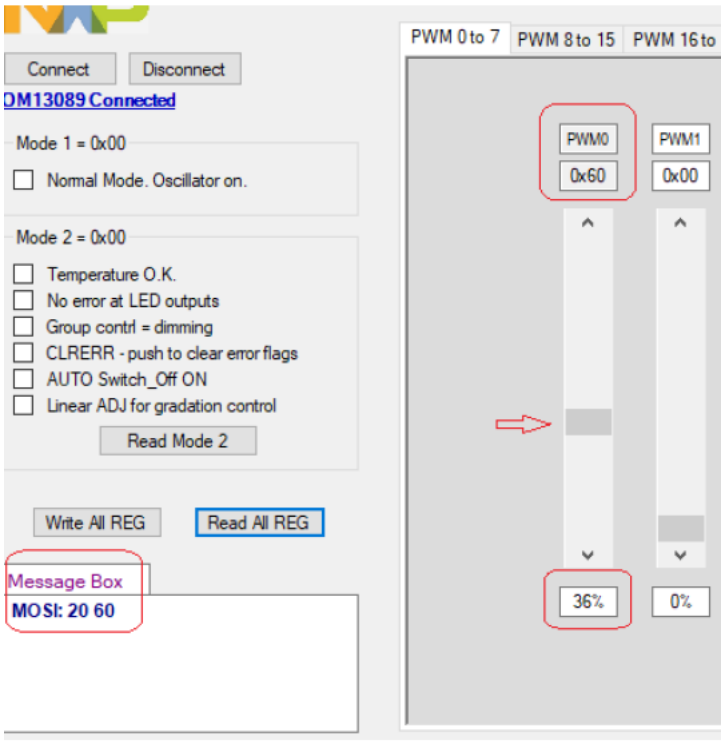
4. Use Mode1 & 2 command interface to read/write Mode1 & 2 register
   a. It shows MOSI and MISO value in Message Box



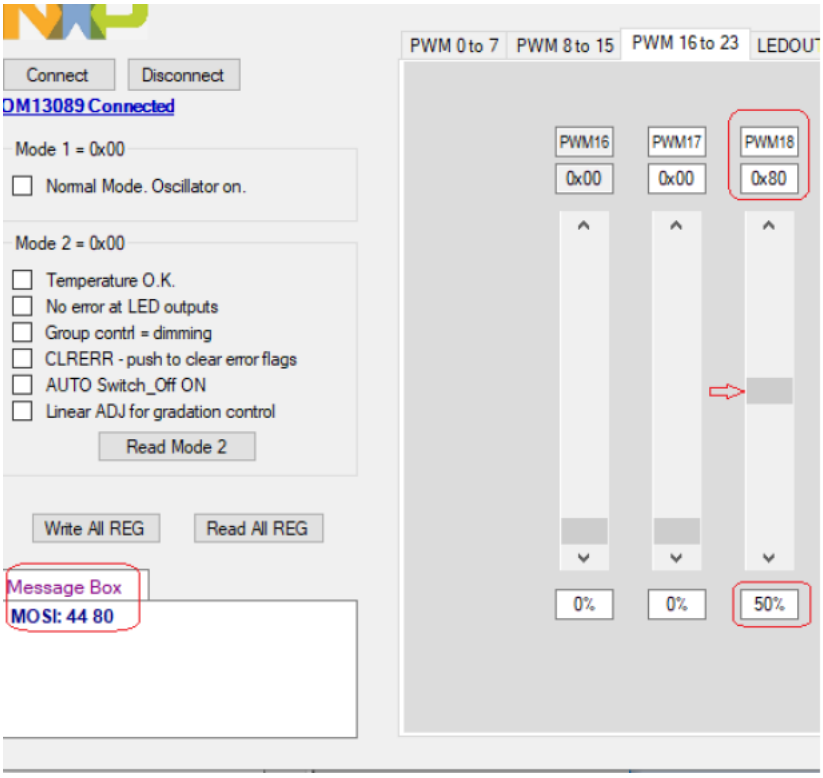
5. “Write All REG” and “Read All REG” buttons
   a. Use “Write All REG” button to write in all register value into PCA9957
   b. Use “Read All REG” button to read our all register value from PCA9957



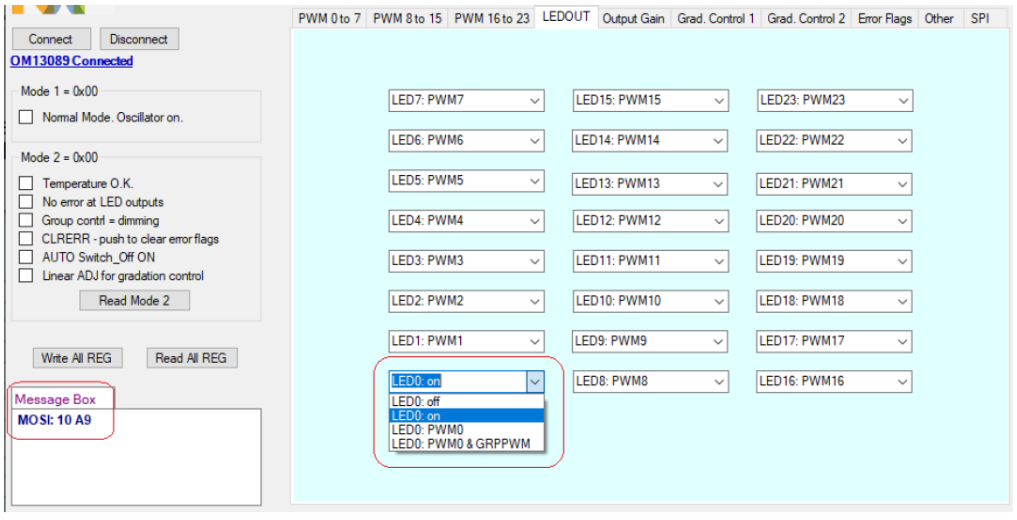
6. Use “PWM 0 to 7” page to adjust PWM0 – PWM7 setting
   a. Use PWM0 – PWM7 scroll bar to adjust PWM value



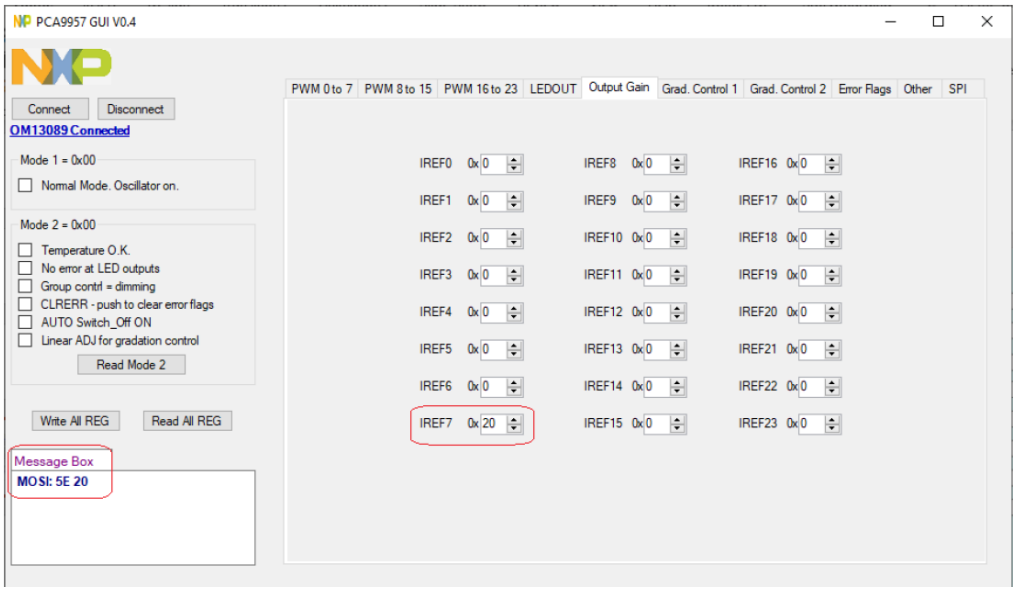
7. Use “PWM 16 to 23” page to adjust PWM16 – PWM23 setting
   a. Use PWM16 – PWM23 scroll bar to adjust PWM value



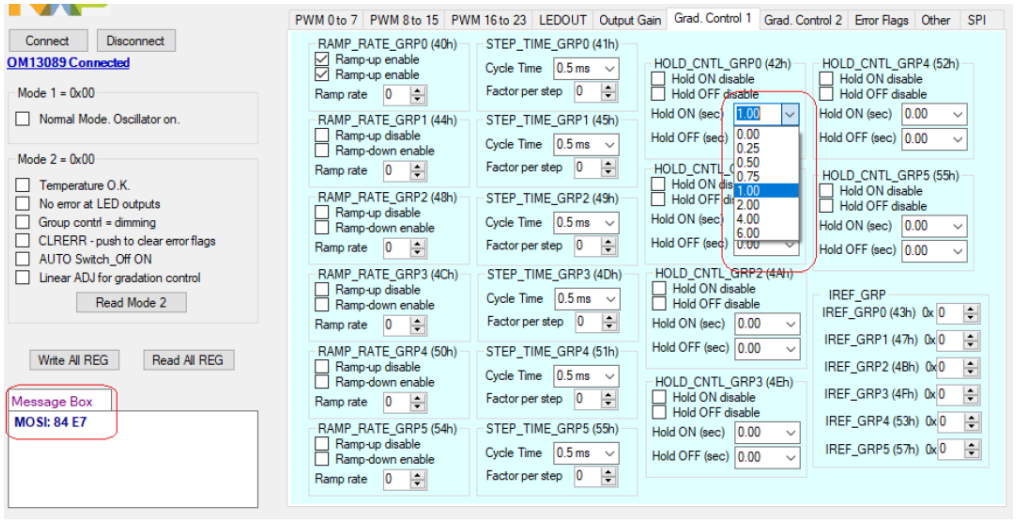
8. Use “LEDOUT” page to select LED0 - 23 output state control
   a. Use LED0 control box to select LED0 output pin to ON state



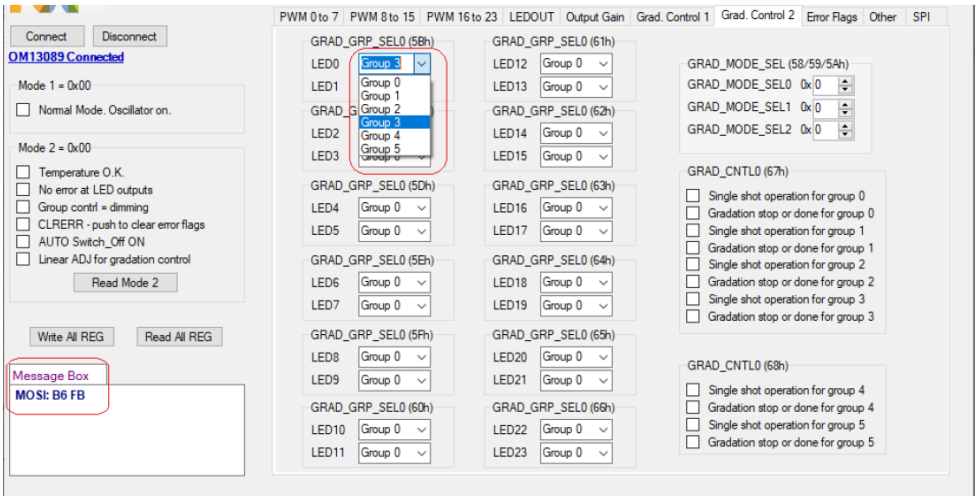
9. Use “Output Gain” page to set select LED0 - 23 output current setting
   a. Use IREF7 Numeric up/down box to set LED7 output current setting to 0x20



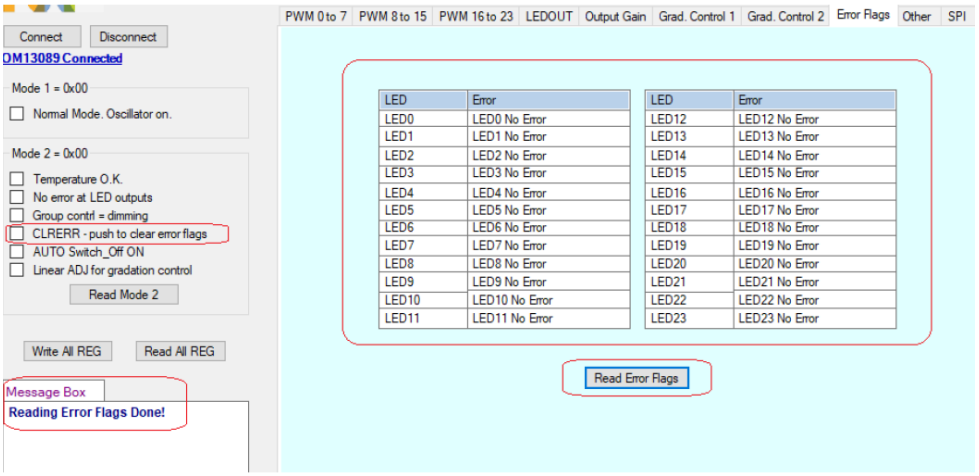
10. Use “Grad. Control 1” page to select settings for group 0 – 5
    a. Ramp enable and rate control, step time control, hold ON/OFF time control and output gain control for group 0-5 settings



11. Use “Grad. Control 2” page to select below settings
    a. Gradation mode and gradation group select for channel 0 to channel 23, gradation control for group 0 to group 5 settings

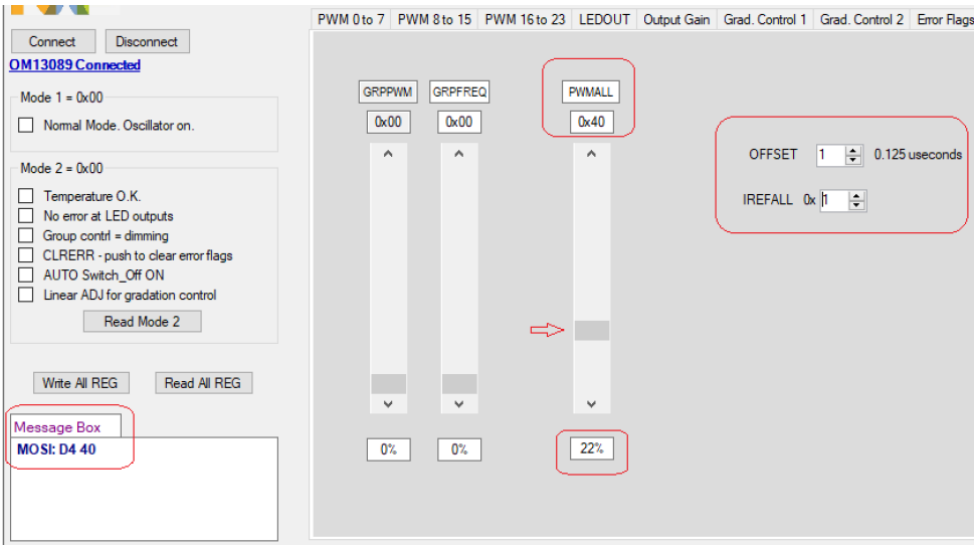


12. Use “Error Flags” page to read out error status for LEDs output
    a. Click on “Read Error Flags” button to read out error status for LED0-23 output
    b. Click on “CLRERR” button to clear error flags.

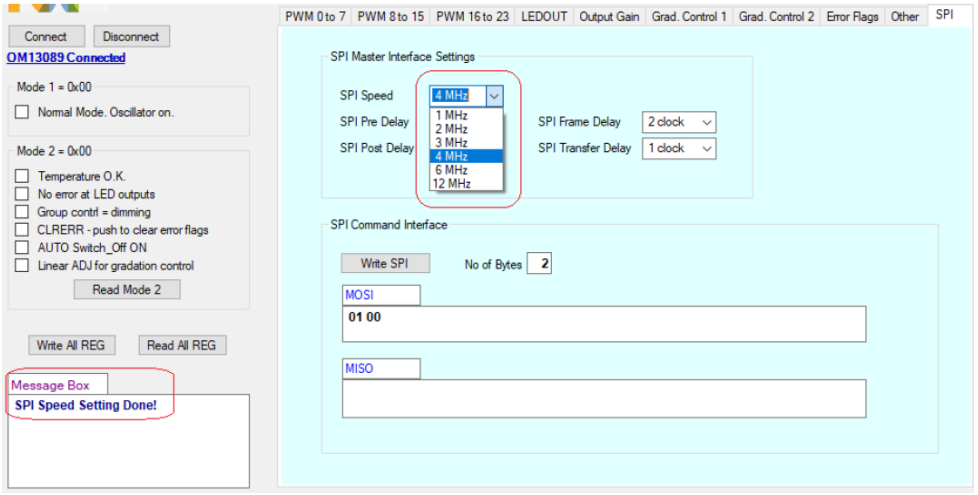


LED	Error	LED	Error
LED0	LED0 No Error	LED12	LED12 No Error
LED1	LED1 No Error	LED13	LED13 No Error
LED2	LED2 No Error	LED14	LED14 No Error
LED3	LED3 No Error	LED15	LED15 No Error
LED4	LED4 No Error	LED16	LED16 No Error
LED5	LED5 No Error	LED17	LED17 No Error
LED6	LED6 No Error	LED18	LED18 No Error
LED7	LED7 No Error	LED19	LED19 No Error
LED8	LED8 No Error	LED20	LED20 No Error
LED9	LED9 No Error	LED21	LED21 No Error
LED10	LED10 No Error	LED22	LED22 No Error
LED11	LED11 No Error	LED23	LED23 No Error

13. Use “Other” page to select below settings
    a. Group duty cycle control, group frequency, Offset/delay on LEDn outputs, brightness control for all LEDn, and output gain control for all registers IREF0 to IREF23 settings



14. Use “SPI” page select SPI interface related settings
    a. SPI speed, Pre-Delay, Post-Delay, Frame Delay, Transfer Delay and command interface



8 Abbreviations

Table 7. Abbreviations

Acronym	Description
ESD	Electro Static Discharge
GUI	Graphical User Interface
I^2C-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

9 References

[1] **PCA9957** — 24-channel SPI serial bus 32 mA / 5.5V constant current LED driver; Product data sheet; NXP Semiconductors

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