UM10572

PCA9955 demonstration board OM13330

Rev. 1 — 7 June 2012 **User manual**

Document information

Info	Content
Keywords	Fm+ I2C-bus, PCA9955, RGB and white LEDs, 16-channel × 8-bit PWMs
Abstract	The OM13330 is an add-on to 9-pin connector of the NXP I2C demo board 2005-1 or Fm+ I^2C-bus development board. This daughter board makes it easy to test and design with the PCA9955, a 16-channel Fast-mode Plus (Fm+) 57 mA constant current and outputs allow up to 40 V for LED supply. These boards, along with the Win-I2CUSB Lite GUI (PC based), provide an easy to use evaluation platform.

Revision history

Rev	Date	Description
v.1	20120607	user manual; initial release

Contact information

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1. Introduction

The PCA9955 evaluation board features LEDs for color mixing, blinking and dimming demonstrations. A graphical interface allows the easy exploration of the different functions of the driver. The board can be connected in series with other I^{2}C-bus demo boards to create an evaluation system.

The IC communicates to the host via the industry standard I^{2}C-bus/SMBus port. The evaluation software runs under Microsoft Windows PC platform.

2. Features

- A complete evaluation platform for the PCA9955 16-channel Fm+ I^{2}C-bus constant current LED driver
- Easy to use GUI-based software demonstrates the capabilities of the PCA9955
- On-board RGB and White LEDs for visual experience
- Convenient test points for easy scope measurements and signal access
- USB interface to the host PC
- No external power supply required

3. Getting started

3.1 Assumptions

Familiarity with the I^{2}C-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 60 processor (or equivalent), 8 MB RAM, 10 MB of hard drive space
- One USB port (either 2.0 or 1.1 compatible)
- Windows 98SE, ME, 2000, XP, or Vista
- I2C demonstration board 2005-1 (OM6275) or WIN-I2CUSB board (from www.nxp.com/redirect/demoboard.com)

3.4 Power requirements

The NXP demonstration board I2C 2005-1 and OM13330 hardware obtain power from the PC USB port. Take care to not exceed the USB port current capabilities.

4. Installation

4.1 I2C demo board 2005-1 and WIN-I2CUSB Lite software

The OM13330 is a daughter card to the OM6275 I2C demo board 2005-1. You can download the WIN-I2CUSB Lite Software, the OM6275 user manual UM10206, and find ordering information at the NXP web site ics.nxp.com/support/boards/i2c20051/.

The Win-I2CUSB Lite software from The Boardshop runs on Windows 98SE, ME, 2000, and XP, and is compatible with any PC hardware having a minimum of a Pentium processor and a USB port. The software allows the user to select one of the I^2C-bus devices on the board from a menu and also provides a Universal mode (I2C Expert mode) to allow users to create their own I^2C-bus commands with the same I^2C-bus devices.

4.2 OM13330 connection to I2C demo board 2005-1

The I2C demo board 2005-1 should be disconnected from your PC before mounting the OM13330 board on to it. The OM13330 board has a 9-pin female connector (J4) that connects to the JP1 male connector on the I2C demo board 2005-1 as shown in Figure 1.

With both boards facing you, with USB connector on the right-hand side as shown in the Figure 1, connect the OM13330 board to the I2C demo board 2005-1 before connecting the USB cable. Once the board is connected, connect the USB cable and start the WIN-I2CUSB Lite software. You are now ready to evaluate the PCA9955.

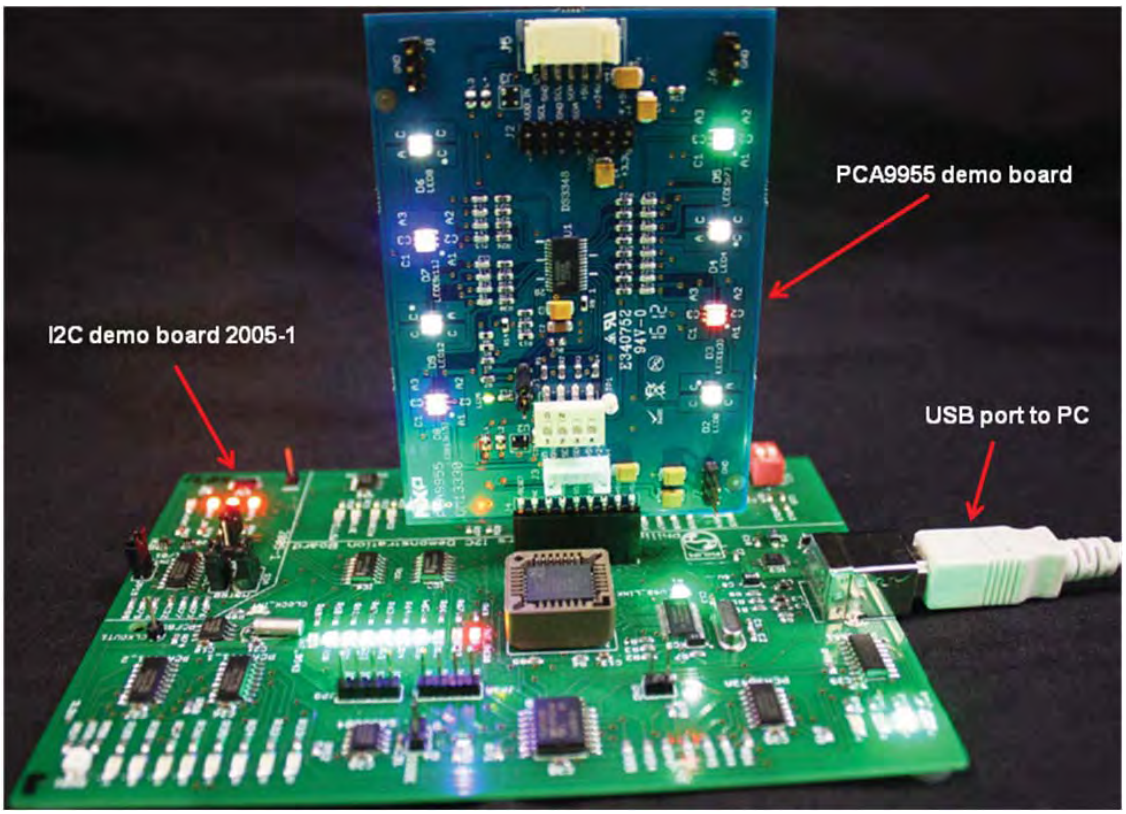

Fig 1. PCA9955 demo board (OM13330) mounting to the I2C demo board 2005-1 (OM6275)

4.3 OM13330 connection to Win-I2CUSB hardware adapter board

The Win-I2CUSB board should be disconnected from your PC before connecting the OM13330 board on to it. The OM13330 board has a 14-pin male connector (J2) that connects to the 14-pin male connector (J1) on the Win-I2CUSB board as shown in Figure 2.

Connect the OM13330 board to the Win-I2CUSB board before connecting the USB cable. Once the board is connected, connect the USB cable and start the WIN-I2CUSB Lite software. You are now ready to evaluate the PCA9955.

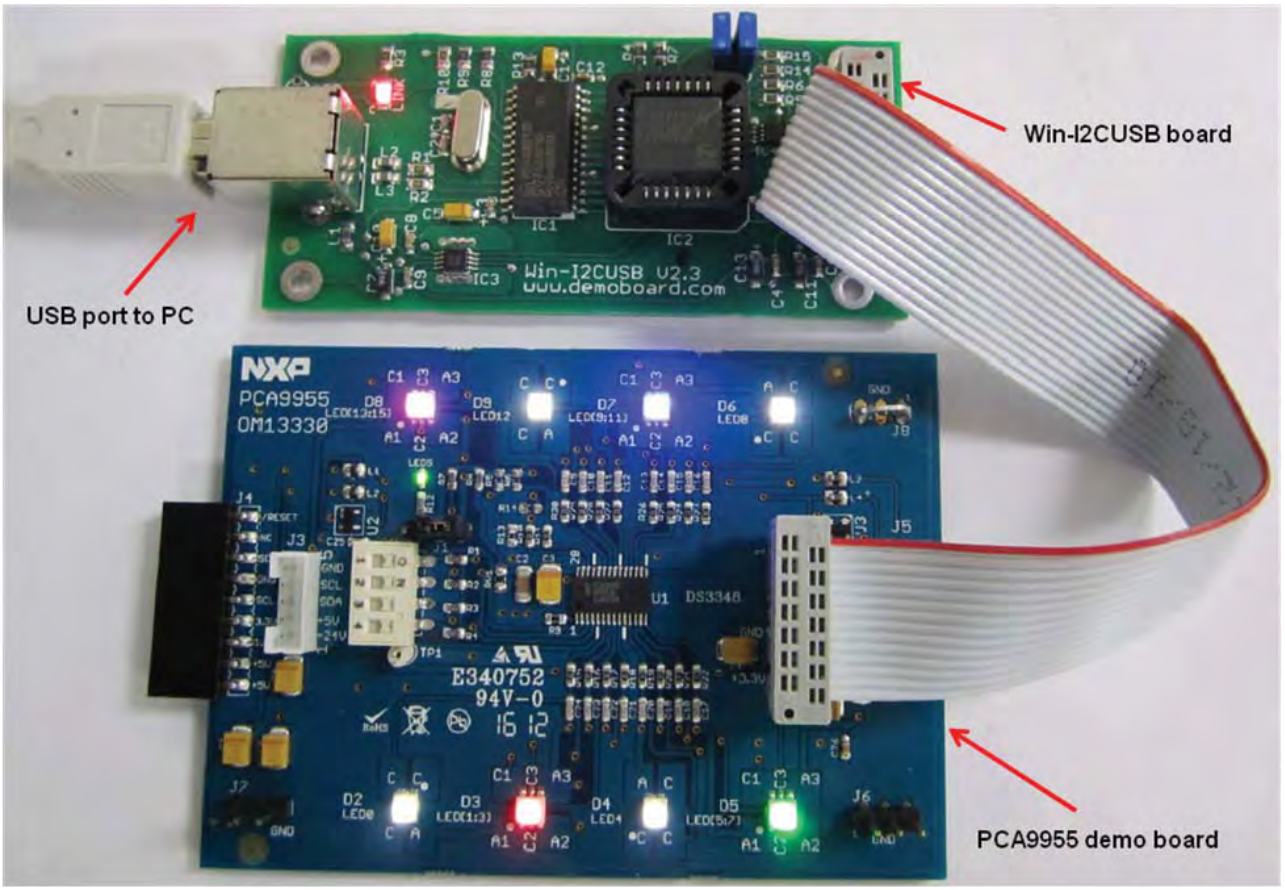

Fig 2. PCA9955 demo board (OM13330) connecting to the Win-I2CUSB board

5. Hardware description

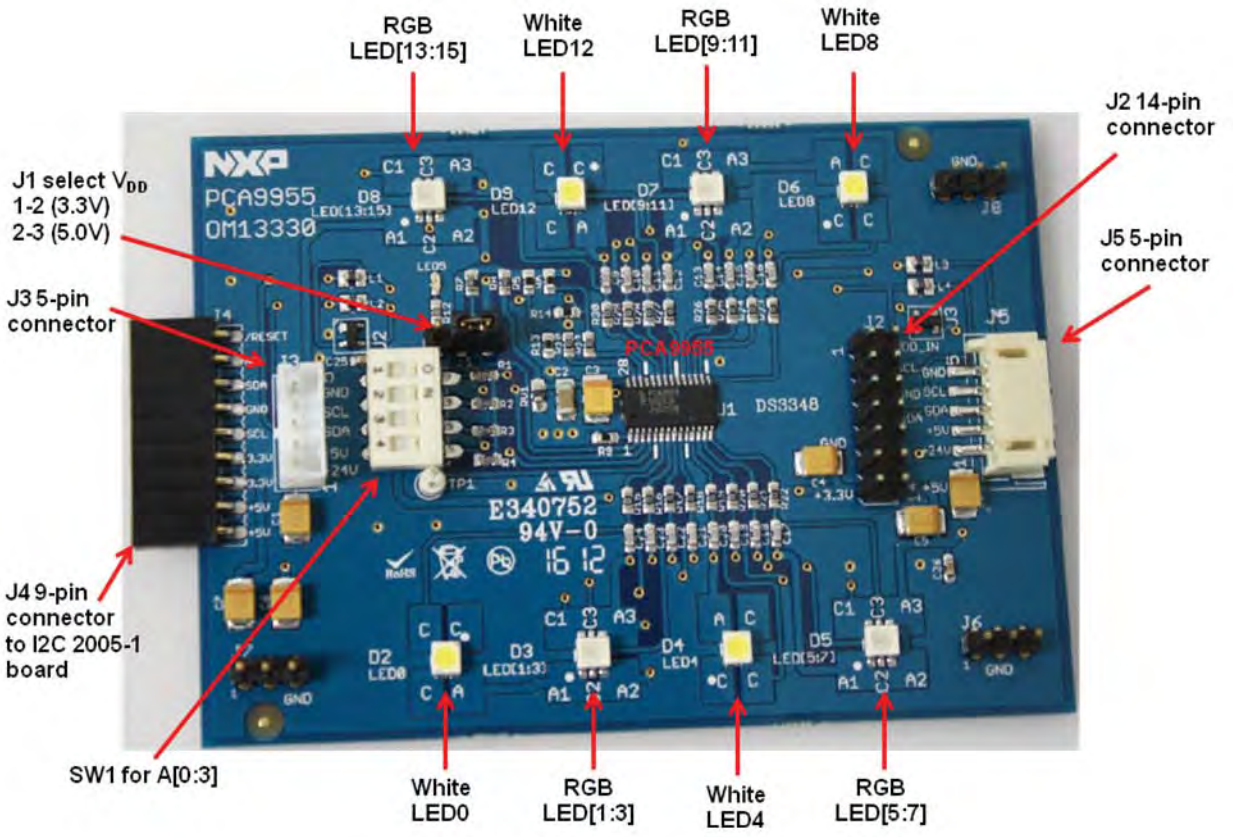

Fig 3. PCA9955 demo board (OM13330)

Figure 3 shows the following items on the hardware:

- J4 (9-pin) is for connection to JP1 on I2C demo board 2005-1.
- J3 and J5 (5-pin) are for connection to PCA9665/PCU9669 mini boards and cascade the second PCA9955 demo board.
- J1 selects V_{DD} power for PCA9955, connected 1-2 for V_{DD} = 3.3 V and connected 2-3 for V_{DD} = 5 V.
- SW1 4-position DIP switch to select I^2C-bus address A[0:3] = SW1[1:4] for this device (default is 0xC0, all switches are ON position).
- J2 (14-pin) is for connection to J1 on Win-I2CUSB board.
- 4-channel to drive four White LEDs (D2, D4, D6, D9) and 12-channel to drive four RGB LEDs (D3, D5, D7, D8).
- J6, J7 and J8 are GND pins for probing use.

6. Schematic

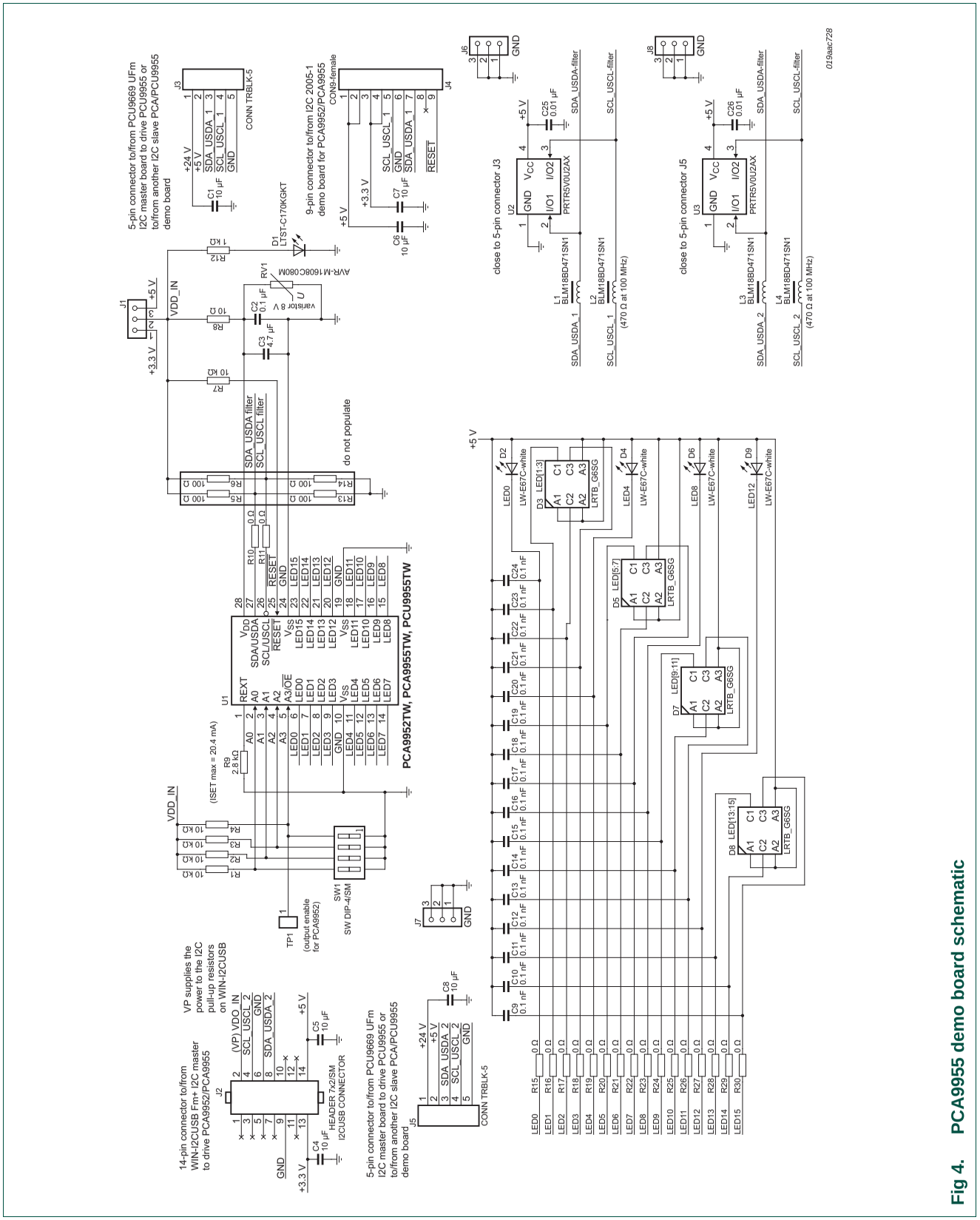

Fig 4. PCA9955 demo board schematic

7. OM13330 demonstration board main components

Table 1. OM13330 demo board main components

Device	Description	Address/LED output	Location
PCA9955TW	16-channel Fm+ I2C-bus 57 mA constant current LED driver	0xC0 for I2C demo board 2005-1 interface	U1
LW-E67C	White LED	LED0, LED4, LED8, LED12	D2, D4, D6, D9
LRTB_G6SG	RGB LED	LED1, LED2, LED3	D3
LRTB_G6SG	RGB LED	LED5, LED6, LED7	D5
LRTB_G6SG	RGB LED	LED9, LED10, LED11	D7
LRTB_G6SG	RGB LED	LED13, LED14, LED15	D8
LTST-C170KGKT	Green LED for PCA9955 power supply either 3.3 V or 5 V indicator	-	D1

8. PCA9955 evaluation steps

The PCA9955 functions are controlled by WIN-I2CUSB Lite GUI. Refer to the PCA9955 data sheet for additional information on the registers and functionality.

Connect the hardware as described in Section 4. The PCA9955 demo board address is set to 0xC0 on SW1 as A[0:3] = SW1[1:4] = 0000 (0 → ON, 1 → OFF). When you have correctly installed the software and the demonstration board hardware is connected and recognized by the computer, start the Win-I2CUSB Lite software. As shown in Figure 5, when the demonstration board hardware is correctly connected to the USB port and the computer recognizes it, the message ‘Hardware Detected’ is displayed on the bottom of the window.

Switched 3.3 V and 5.0 V power supplies are controlled through the ‘Options’ menu or by double-clicking the 3.3 V or 5.0 V symbols on the bottom of the window. Power supplies are disabled by default, and must be enabled before using the I^2C-bus devices on the board. I^2C-bus frequency is controlled through the ‘Options’ menu or by double-clicking on the frequency symbol on the bottom of the window.

8.1 Color mixing and dimming LEDs

1. From the ‘Device’ drop-down menus, select ‘LED Blinkers and Dimmers’, and from the subsequent drop-down menu select ‘PCA9955 16-channel Constant Current LED Driver’ as shown in Figure 5.
2. Check the ‘Auto Write On’ box (lower left), uncheck the ‘Low power mode (oscillator off)’ box to enable the device to ‘Normal mode’ (upper left).
3. The device configuration screen is displayed by clicking the following options:
   - ‘PWM 0 to 7’ individual brightness control for LED0 to LED7 as shown in Figure 6.
   - ‘PWM 8 to 15’ individual brightness control for LED8 to LED15 as shown in Figure 7.
   - ‘LEDOUT’ LED driver output state for LED0 to LED15 as shown in Figure 8.
   - ‘Output Gain’ LED output current setting for LED0 to LED15 as shown in Figure 9.

– ‘Other’ GRPPWM is group PWM for global brightness control, GRPFREQ is group frequency for global blinking control when group control = blinking in Mode 2 register, PWMALL is brightness control for all LED outputs, OFFSET is control LED output delay offset, IREFALL is control output current for all LEDs as shown in Figure 10.

4. Click the ‘LEDOUT’ configuration screen and select ‘PWMn & GRPPWM’ for LED[1:3] (see Figure 8).
5. Click the ‘Output Gain’ configuration screen and adjust the IREF[1:3] = 0x30 for LED[1:3] output current at 3.8 mA = 48 × 80 µA (see Figure 9).
6. Click the ‘PWM 0 to 7’ configuration screen and move the PWM1 (red) PWM2 (green) PMW3 (blue) bars for color mixing (see Figure 6).
7. Once you set a color on D3 RGB LED with the PWM[1:3] values, click the ‘Other’ configuration screen and move the GRPPWM bar for dimming effect (see Figure 10).

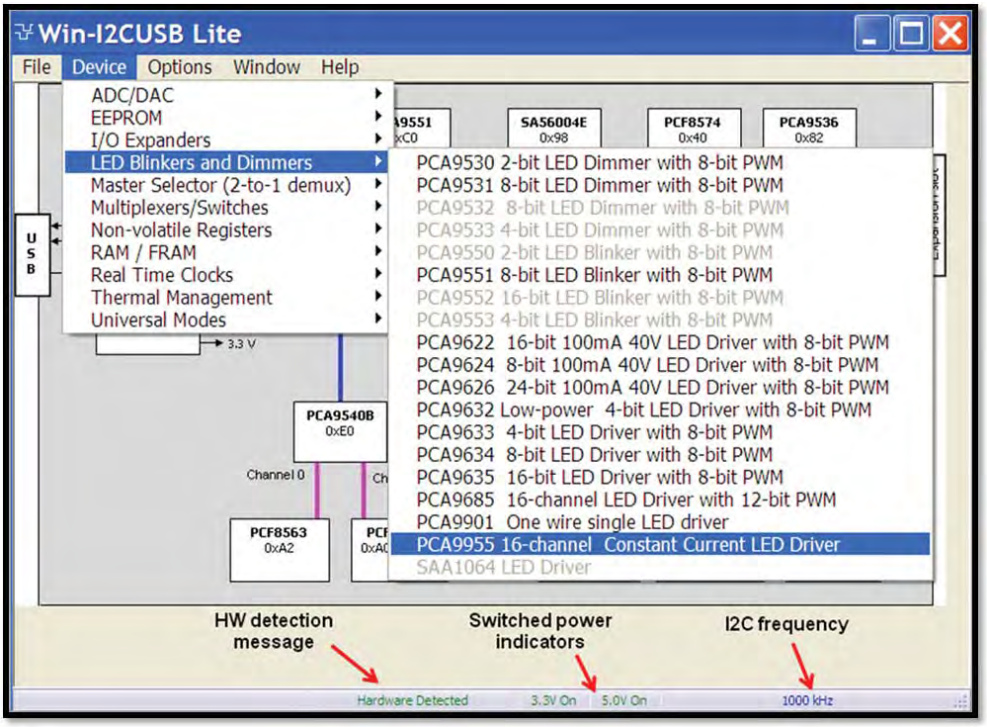

Fig 5. Drop-down menu selections

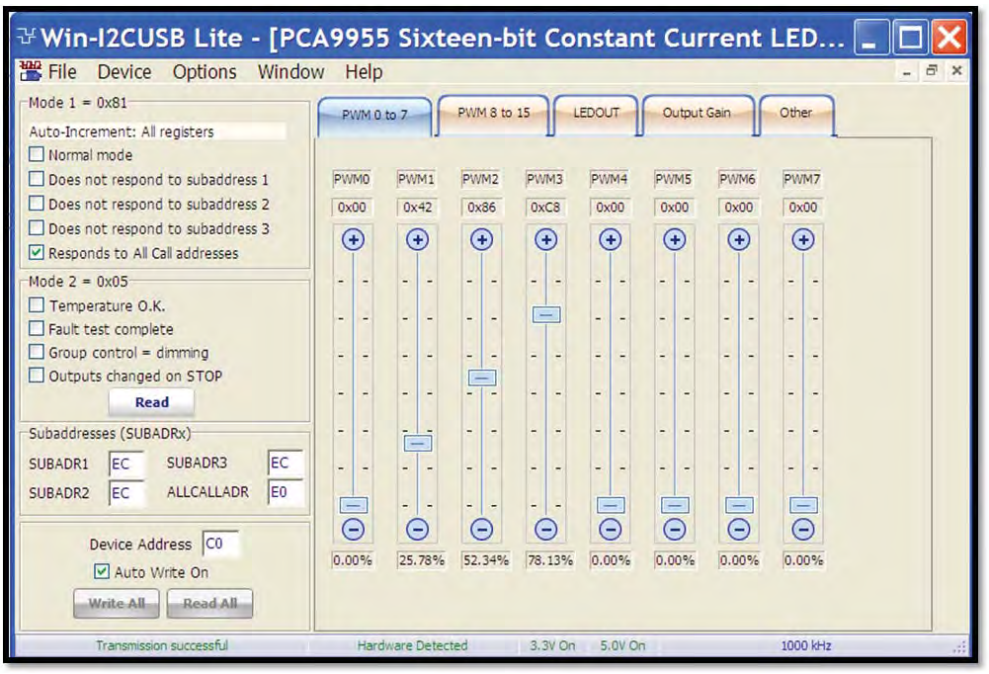

Fig 6. Device configuration screen for PWM[0:7]

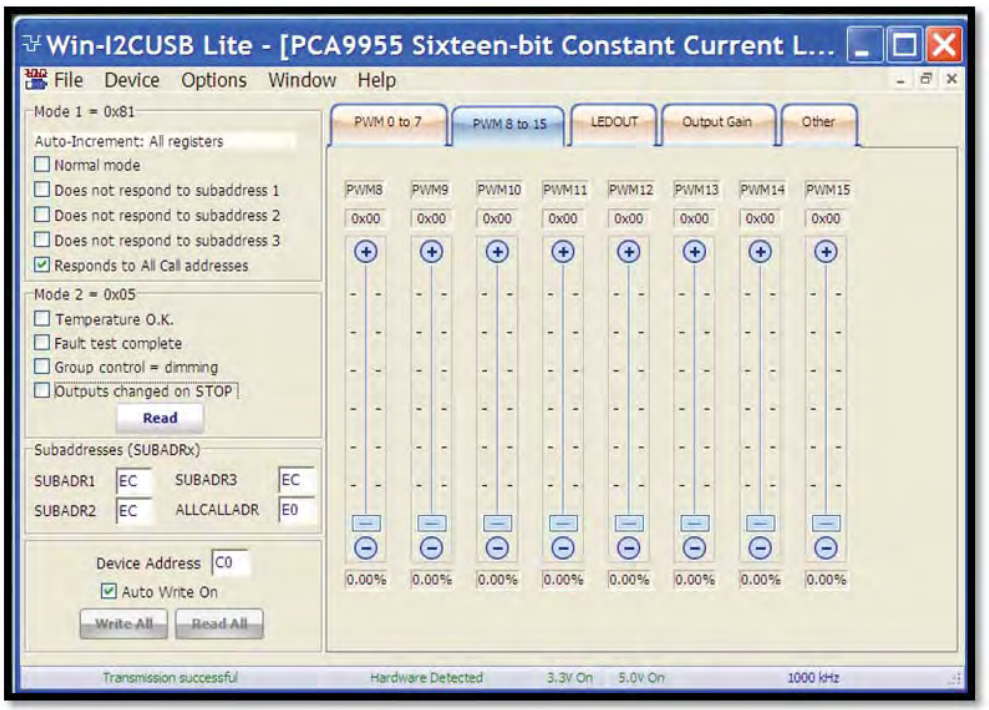

Fig 7. Device configuration screen for PWM[8:15]

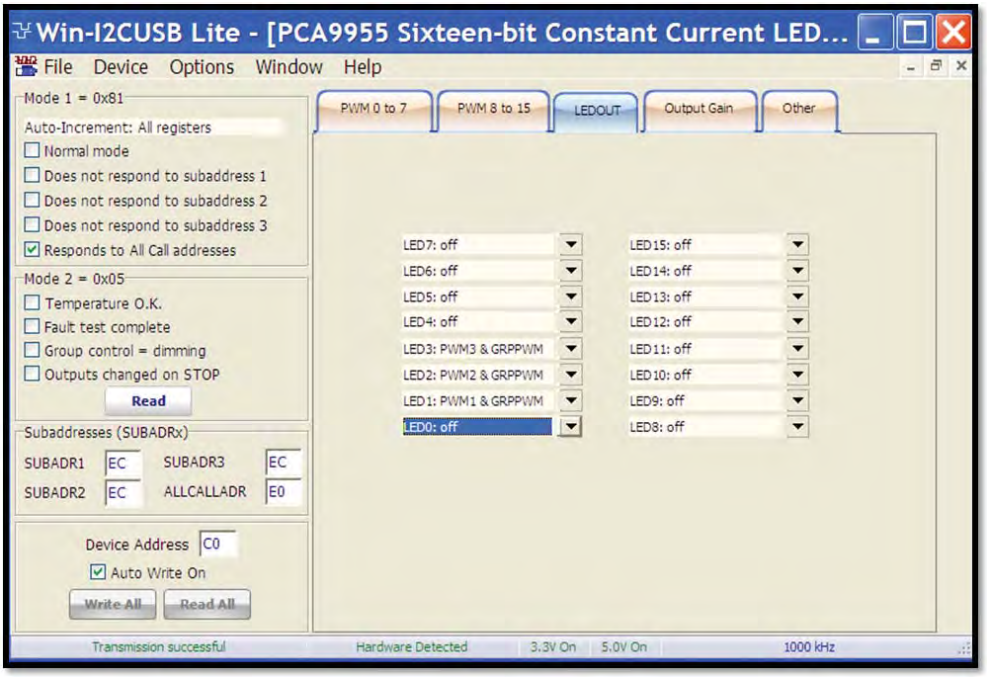

Fig 8. Device configuration screen for LEDOUT

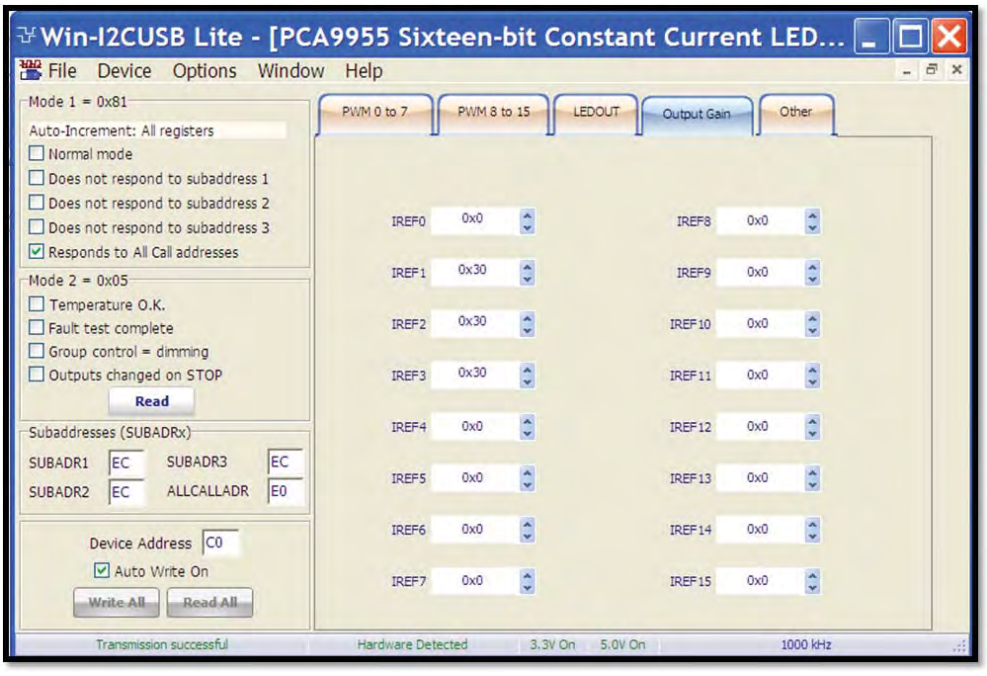

Fig 9. Device configuration screen for LED output current setting

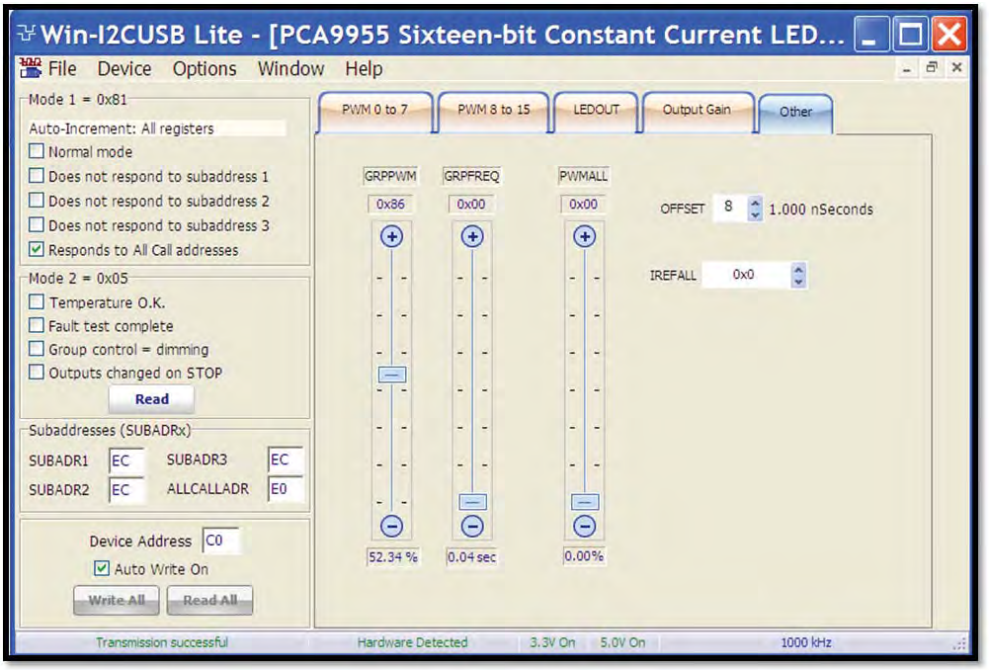

Fig 10. Device configuration screen for 'Other' (Group and All registers)

8.2 Color mixing and blinking LEDs

To set up a blinking demo, repeat step 1 through step 7 as in Section 8.1, then do the following:

1. In the Mode 2 (= 0x25) selection window (middle left), check the 'Group control = dimming' box to change the mode to 'Group control = blinking'.
2. To set a blink cycle, click the 'Other' configuration screen and move the GRPFREQ bar to select blinking frequency as well as the GRPPWM bar to select the duty cycle (see Figure 11).
3. For example, set the GRPPWM to 0x52 (32 % duty cycle) and the GRPFREQ to 0x0B (0.5 second) for a one-third duty cycle and blink every half second on D3 RGB LED.
4. Change the PWM[1:3] values, GRPPWM and GRPFREQ values to create different blink patterns and colors.

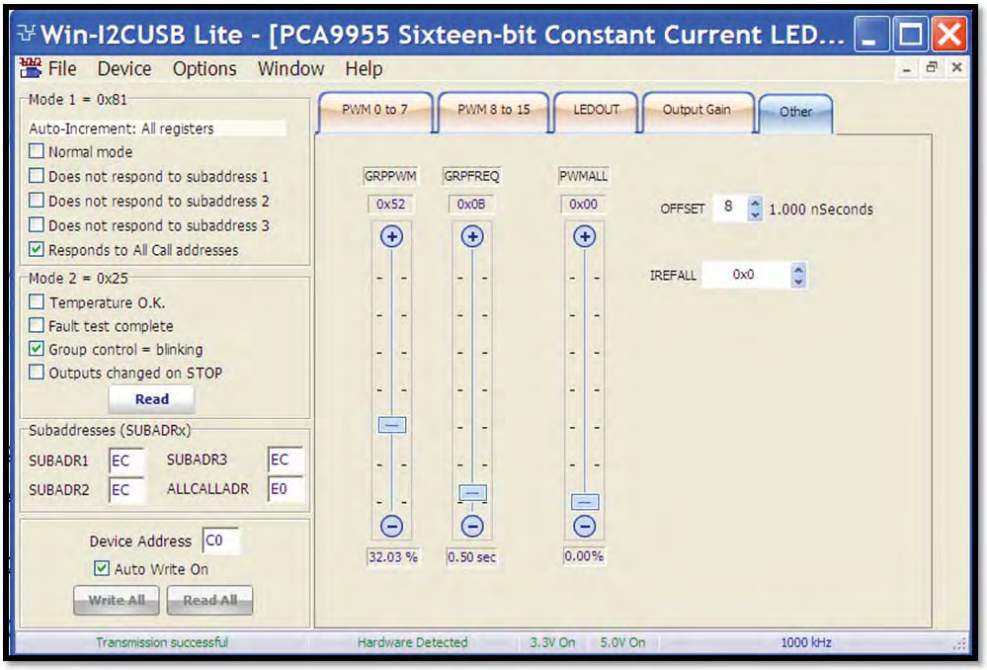

Fig 11. Example of short blink every half second

9. Support

For support, send an E-mail to: **i2c.support@nxp.com**

10. Abbreviations

Table 2. Abbreviations

Acronym	Description
ESD	ElectroStatic Discharge
GUI	Graphical User Interface
I^2C-bus	Inter-Integrated Circuit bus
IC	Integrated Circuit
LED	Light-Emitting Diode
PC	Personal Computer
PWM	Pulse Width Modulator
RAM	Random Access Memory
RGB	Red/Green/Blue
RGBA	Red/Green/Blue/Amber
SMBus	System Management Bus
USB	Universal Serial Bus

11. References

[1] **PCA9955, 16-channel Fm+ I^2C-bus 57 mA constant current LED driver —** Product data sheet; NXP Semiconductors; www.nxp.com/documents/data_sheet/PCA9952_PCA9955.pdf

[2] **UM10206, "I2C Demonstration Board 2005-1 Quick Start Guide" —** NXP Semiconductors; www.nxp.com/documents/user_manual/UM10206.pdf

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