



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 ² C-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

For more information, please visit: <http://www.nxp.com>

For sales office addresses, please send an email to: salesaddresses@nxp.com

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 I²C-bus demo boards to create an evaluation system.

The IC communicates to the host via the industry standard I²C-bus/SMBus port. The evaluation software runs under Microsoft Windows PC platform.

2. Features

- A complete evaluation platform for the PCA9955 16-channel Fm+ I²C-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 I²C-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 I²C-bus devices on the board from a menu and also provides a Universal mode (I2C Expert mode) to allow users to create their own I²C-bus commands with the same I²C-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.

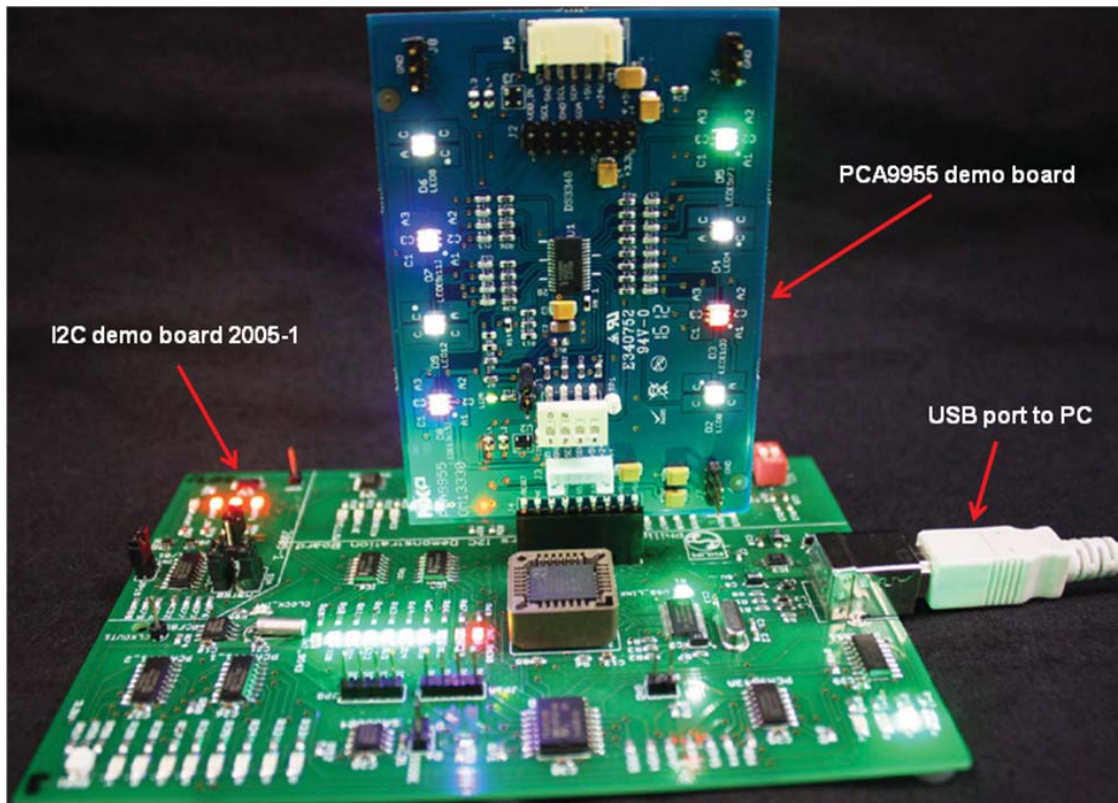


Fig 1. PCA9955 demo board (OM13330) mounting to the I2C demo board 2005-1 (OM6275)

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.

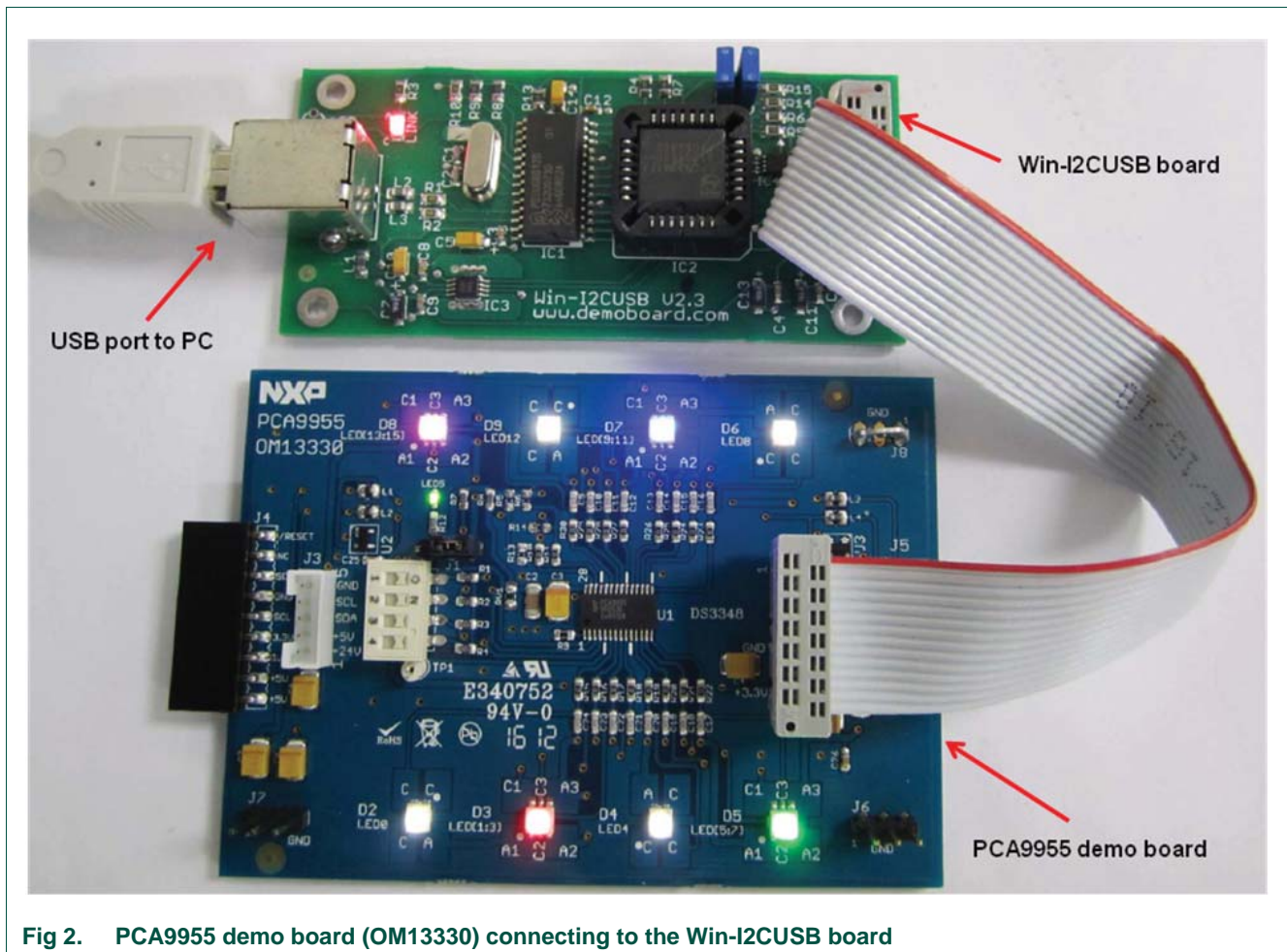


Fig 2. PCA9955 demo board (OM13330) connecting to the Win-I2CUSB board

5. Hardware description

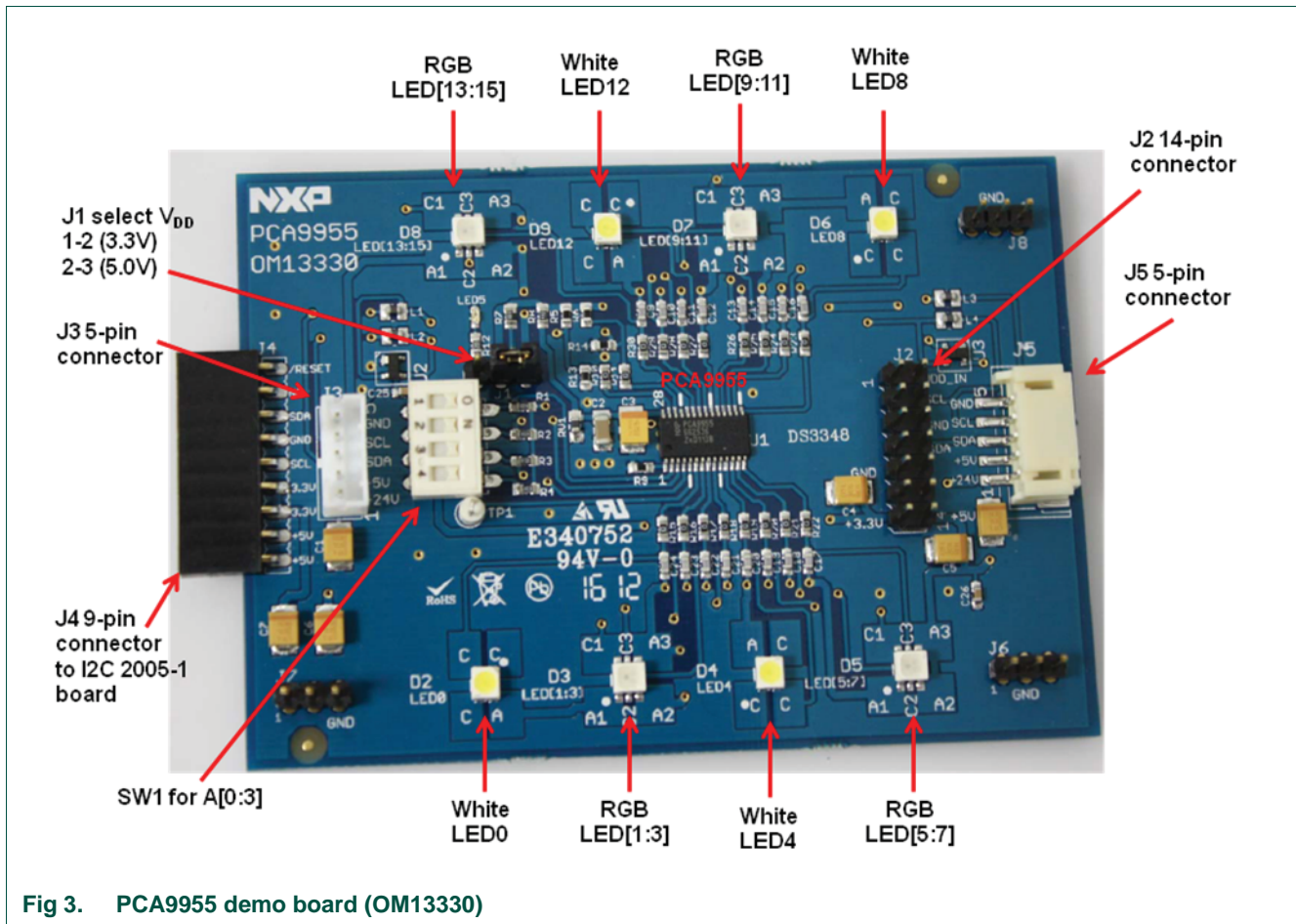


Fig 3. PCA9955 demo board (OM13330)

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 $V_{DD} = 3.3\text{ V}$ and connected 2-3 for $V_{DD} = 5\text{ V}$.
- SW1 4-position DIP switch to select I²C-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

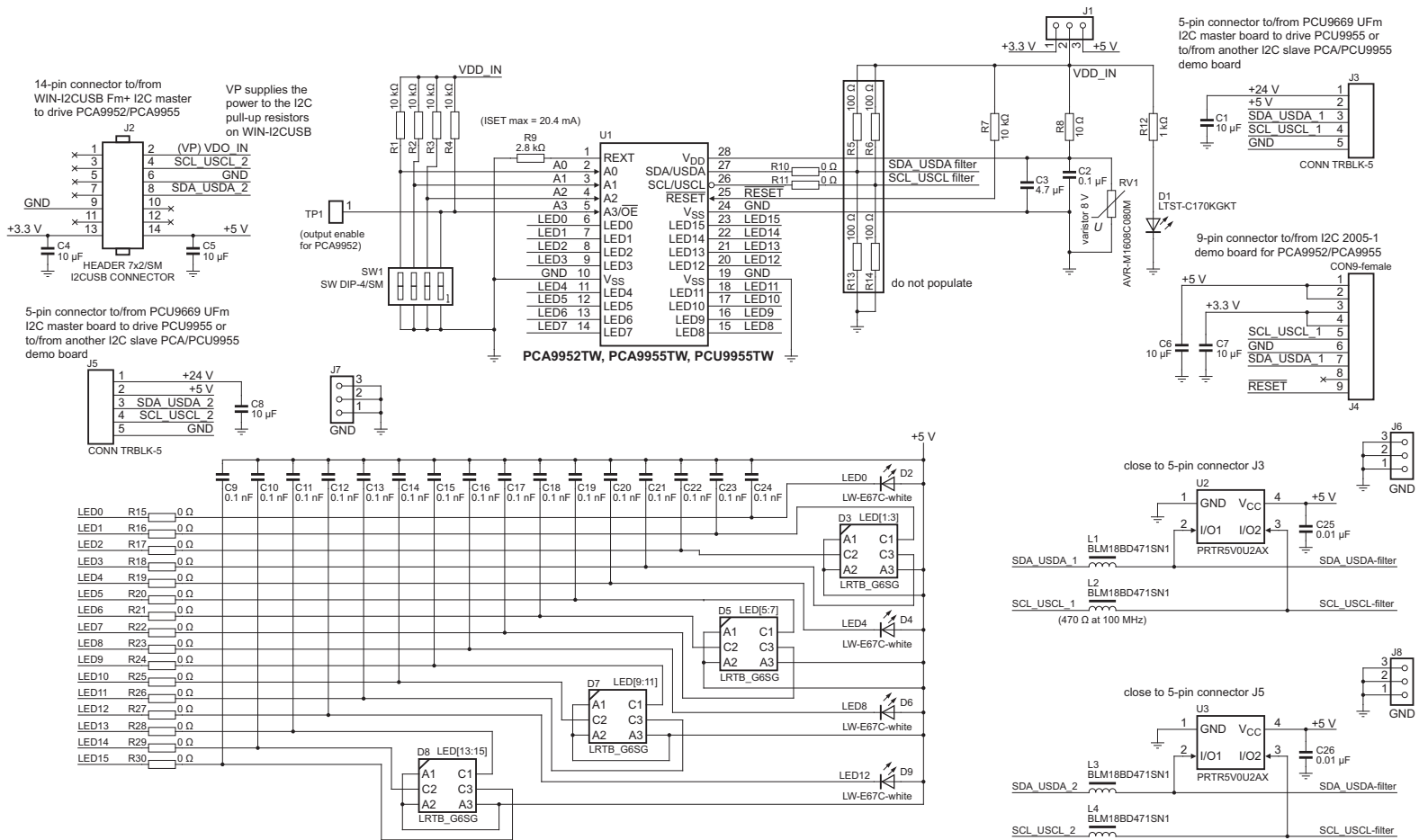


Fig 4. PCA9955 demo board schematic

019aac728

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 I²C-bus devices on the board. I²C-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

- 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](#).
- 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).
- 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) PWM3 (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](#)).

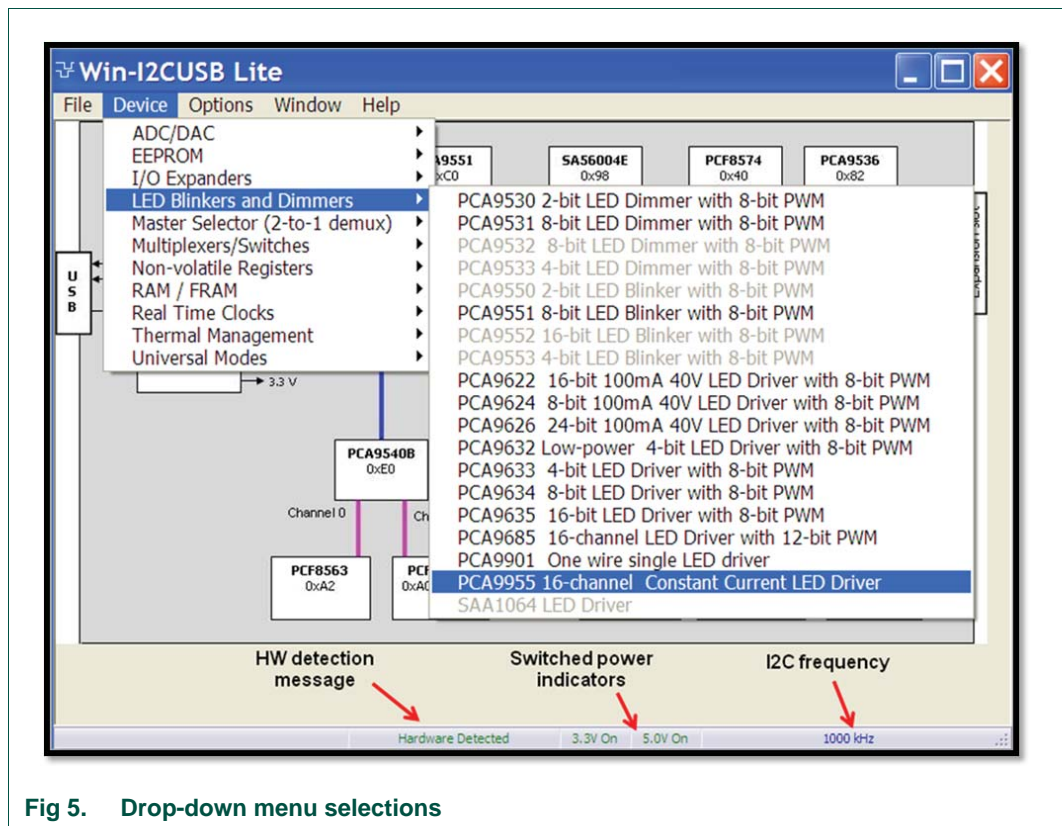


Fig 5. Drop-down menu selections

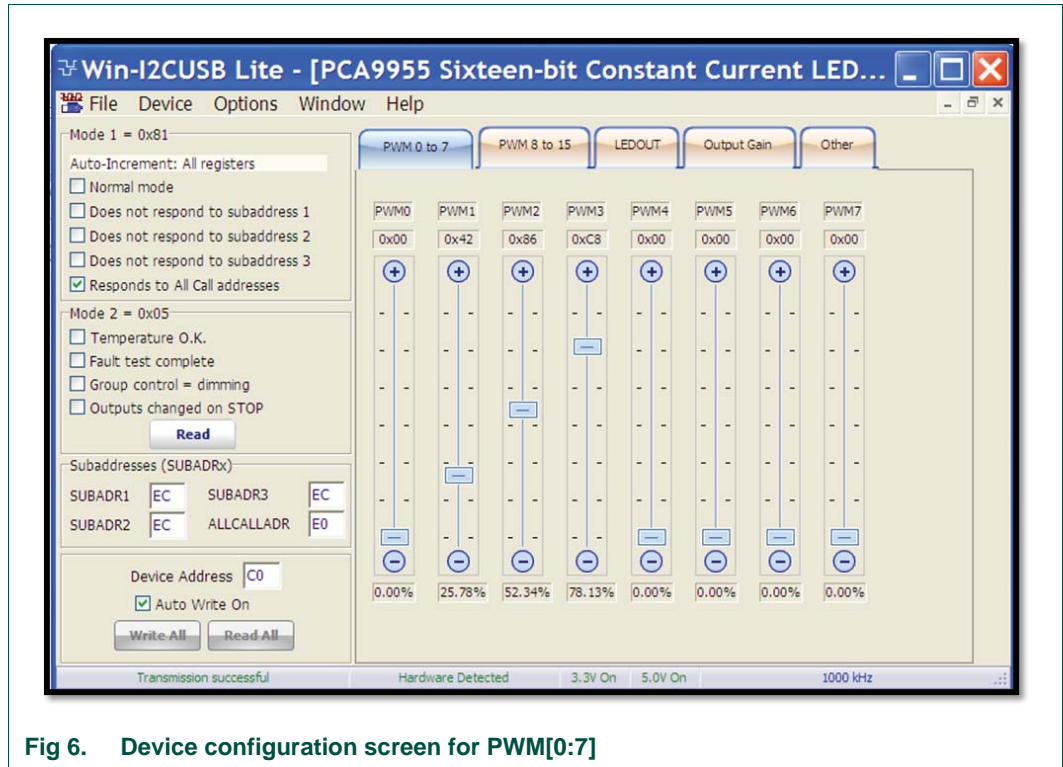


Fig 6. Device configuration screen for PWM[0:7]

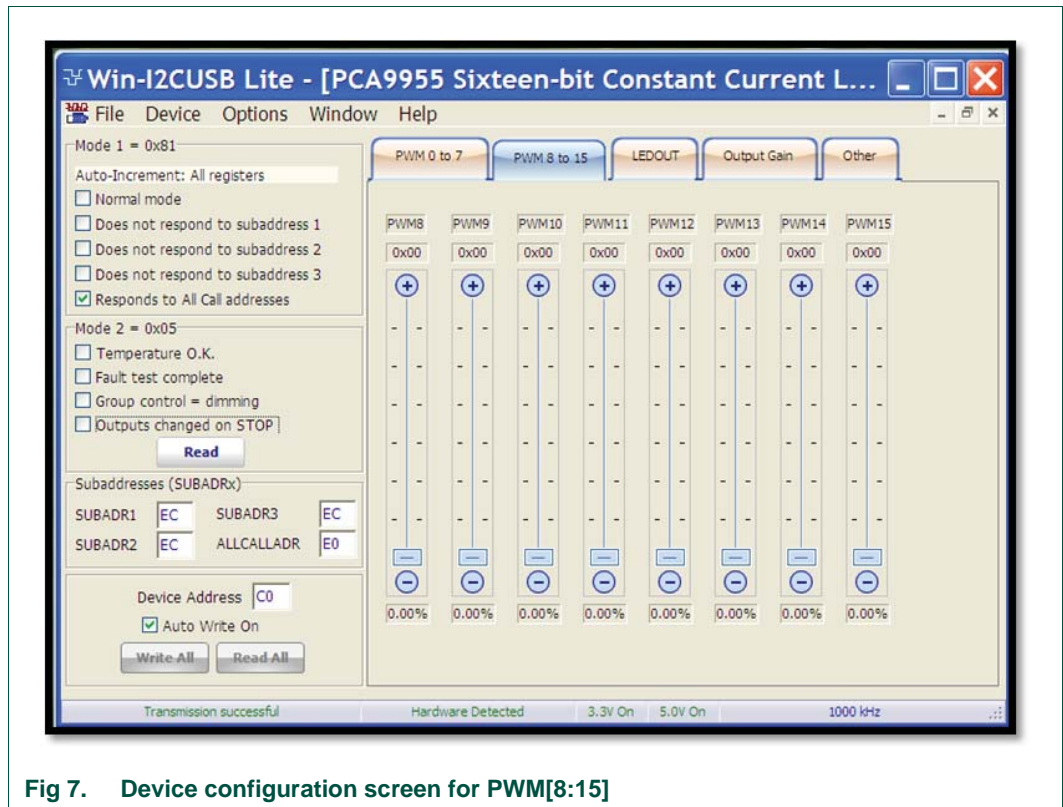


Fig 7. Device configuration screen for PWM[8:15]

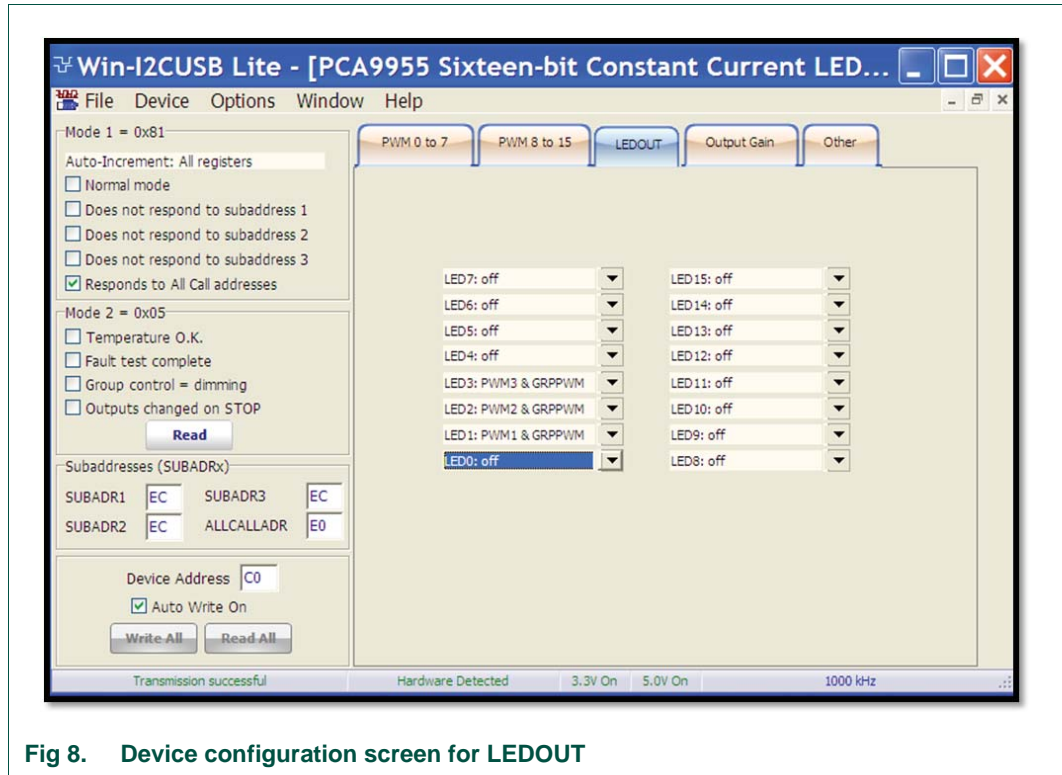


Fig 8. Device configuration screen for LEDOUT

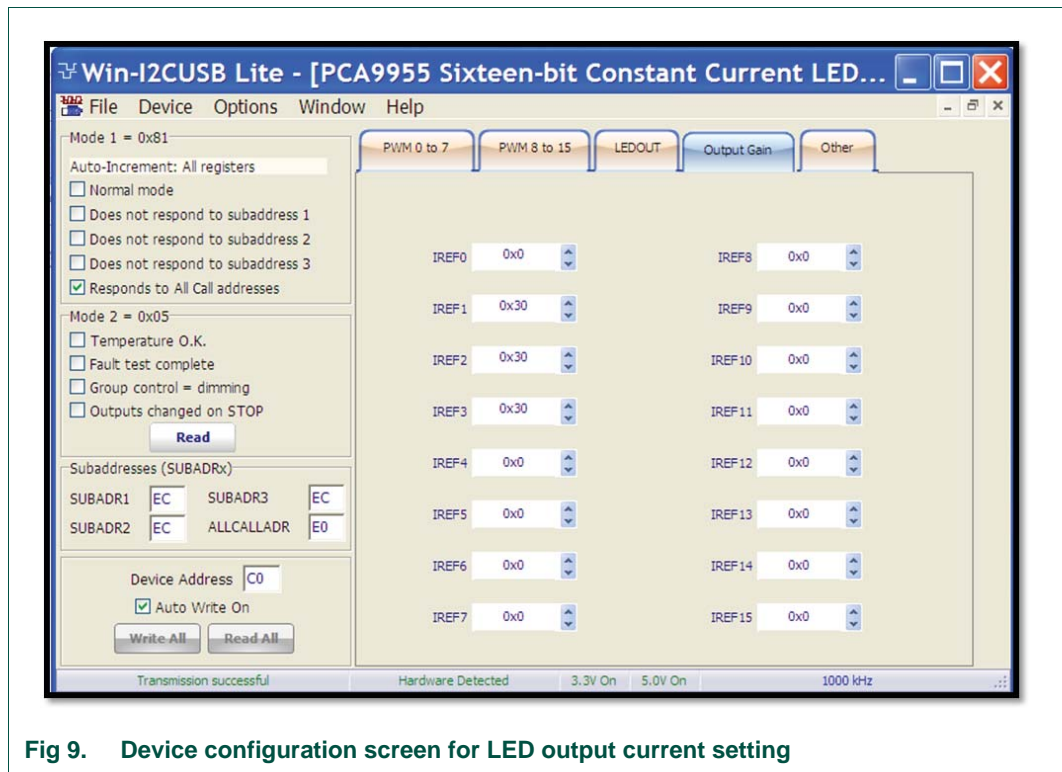


Fig 9. Device configuration screen for LED output current setting

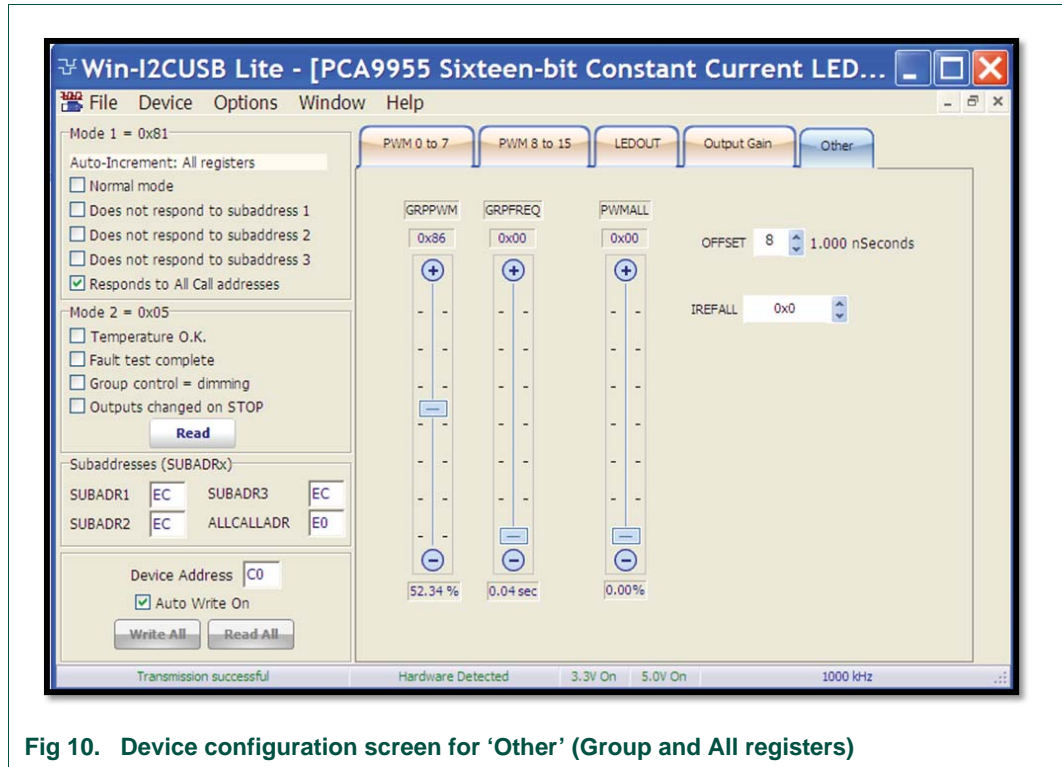


Fig 10. Device configuration screen for 'Other' (Group and All registers)

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.

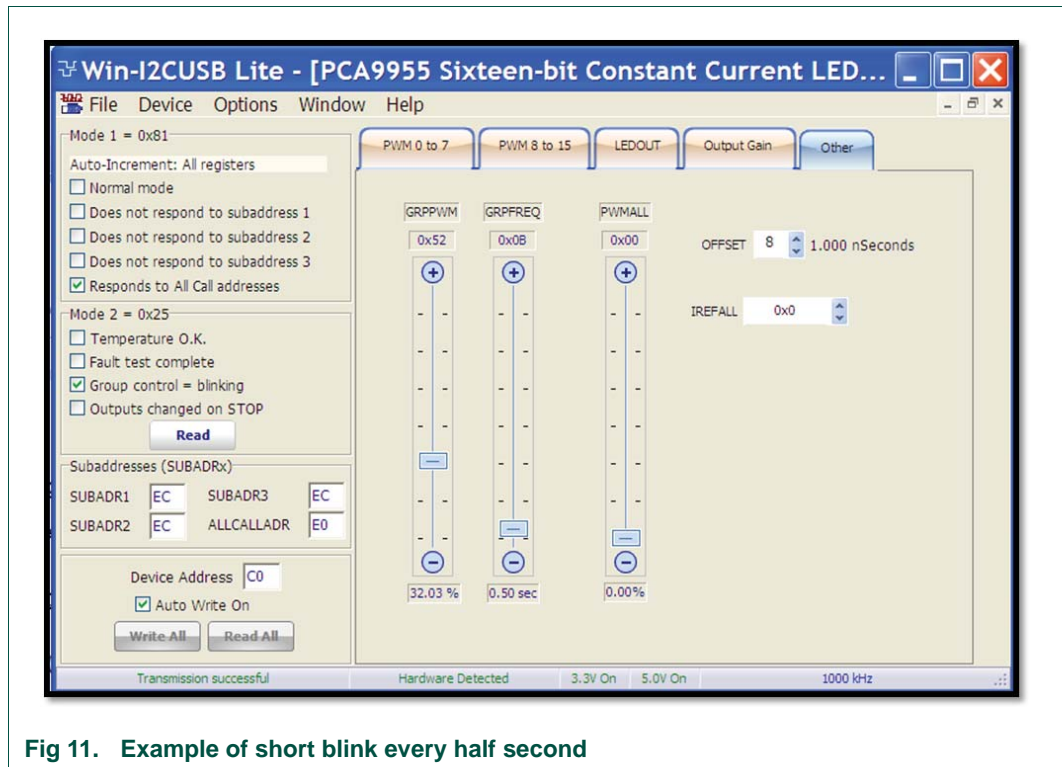


Fig 11. Example of short blink every half second

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 ² C-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+ I²C-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

12. Legal information

12.1 Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

12.2 Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. NXP Semiconductors takes no responsibility for the content in this document if provided by an information source outside of NXP Semiconductors.

In no event shall NXP Semiconductors be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, NXP Semiconductors' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the *Terms and conditions of commercial sale* of NXP Semiconductors.

Right to make changes — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — NXP Semiconductors products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors and its suppliers accept no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. NXP Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using NXP Semiconductors products, and NXP Semiconductors accepts no liability for any assistance with applications or customer product

design. It is customer's sole responsibility to determine whether the NXP Semiconductors product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

NXP Semiconductors does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using NXP Semiconductors products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). NXP does not accept any liability in this respect.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Evaluation products — This product is provided on an "as is" and "with all faults" basis for evaluation purposes only. NXP Semiconductors, its affiliates and their suppliers expressly disclaim all warranties, whether express, implied or statutory, including but not limited to the implied warranties of non-infringement, merchantability and fitness for a particular purpose. The entire risk as to the quality, or arising out of the use or performance, of this product remains with customer.

In no event shall NXP Semiconductors, its affiliates or their suppliers be liable to customer for any special, indirect, consequential, punitive or incidental damages (including without limitation damages for loss of business, business interruption, loss of use, loss of data or information, and the like) arising out of the use of or inability to use the product, whether or not based on tort (including negligence), strict liability, breach of contract, breach of warranty or any other theory, even if advised of the possibility of such damages.

Notwithstanding any damages that customer might incur for any reason whatsoever (including without limitation, all damages referenced above and all direct or general damages), the entire liability of NXP Semiconductors, its affiliates and their suppliers and customer's exclusive remedy for all of the foregoing shall be limited to actual damages incurred by customer based on reasonable reliance up to the greater of the amount actually paid by customer for the product or five dollars (US\$5.00). The foregoing limitations, exclusions and disclaimers shall apply to the maximum extent permitted by applicable law, even if any remedy fails of its essential purpose.

Translations — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

12.3 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

I²C-bus — logo is a trademark of NXP B.V.

13. Contents

1	Introduction	3
2	Features	3
3	Getting started	3
3.1	Assumptions	3
3.2	Static handling requirements	3
3.3	Minimum system requirements	3
3.4	Power requirements	3
4	Installation	4
4.1	I2C demo board 2005-1 and WIN-I2CUSB Lite software	4
4.2	OM13330 connection to I2C demo board 2005-1	4
4.3	OM13330 connection to Win-I2CUSB hardware adapter board	5
5	Hardware description	6
6	Schematic	7
7	OM13330 demonstration board main components	8
8	PCA9955 evaluation steps	8
8.1	Color mixing and dimming LEDs	8
8.2	Color mixing and blinking LEDs	13
9	Support	13
10	Abbreviations	14
11	References	14
12	Legal information	15
12.1	Definitions	15
12.2	Disclaimers	15
12.3	Trademarks	15
13	Contents	16

Please be aware that important notices concerning this document and the product(s) described herein, have been included in section 'Legal information'.

© NXP B.V. 2012.

All rights reserved.

For more information, please visit: <http://www.nxp.com>

For sales office addresses, please send an email to: salesaddresses@nxp.com

Date of release: 7 June 2012

Document identifier: UM10572

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[NXP:](#)

[OM13330](#)