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# Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832 Email & Skype: info@chipsmall.com Web: www.chipsmall.com Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



USB-I<sup>2</sup>C-bus interface OM13518 with a GUI for the RTCs PCF85263 and PCF85363

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Abstract	User manual for the universal USB-I <sup>2</sup> C-bus interface dongle OM13518



#### USB-I<sup>2</sup>C-bus dongle OM13518 with a GUI

**Revision history** 

Rev	Date	Description
v.1	20140519	first revision

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## 1. Introduction

The OM13518 dongle is an easy to use interface handler between the USB of a PC and the I<sup>2</sup>C-bus. The software control via a Graphical User Interface (GUI) allows a fast start to communicate with different circuits.

- USB-2 is used for data and the 5 V power supply.
- Three I<sup>2</sup>C-bus ports are wired in parallel.
- Cables to connect up the I<sup>2</sup>C-bus are enclosed.

## 2. Key features

## 2.1 USB-I<sup>2</sup>C interface module

The OM13518 dongle is a ready to run module. It creates a virtual COM-port via an USB connection. It provides three  $I^2$ C-bus connections with 5 V option to power the application (max 450 mA).

Power consumption: module/total: <50 mA/max 500 mA

**I<sup>2</sup>C-bus clock frequency:** 245 Hz – 400 kHz

USB driver for Windows: Windows XP, Windows 7, Windows 8

Size: 50 mm × 40 mm × 15 mm

#### 2.2 Software

The software control via a GUI allows a fast start to communicate to the different circuits.

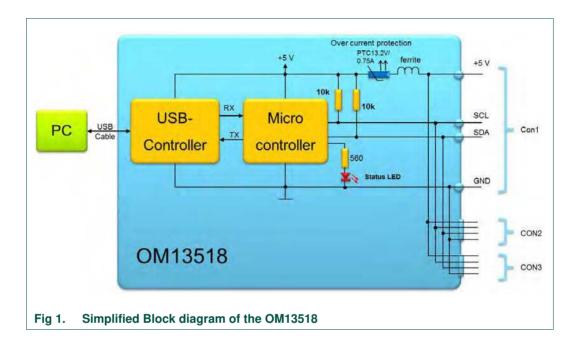
Aside from the detailed GUI pages for the Real-Time Clocks, a UNIVERSAL INTERFACE allows to communicate with any I<sup>2</sup>C-bus device by entering directly the hex codes. Example: s A2 28 p

Where s stands for the  $I^2C$  START and p for the  $I^2C$  STOP condition.

## 3. Dongle

#### 3.1 Circuit diagram

The dongle establishes the connection between the PC (USB port) and the  $I^2$ C-bus interface.



## 3.2 Interfacing I<sup>2</sup>C-bus peripherals

The  $l^2$ C-bus peripherals are connected directly with the  $l^2$ C-bus. The 3 connectors Con1, Con2, and Con3 are connected in parallel and carry the four signals as also imprinted on the package:

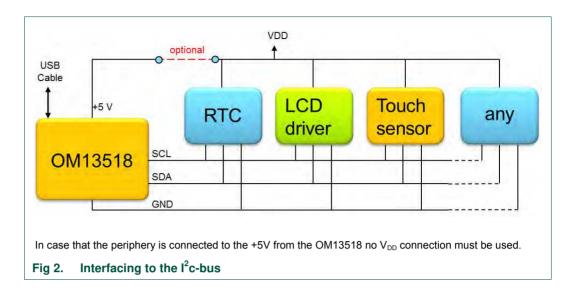
**+5 V:** Optional 5 V supply can be used. Total consumption of all 3 outputs must be kept below 450 mA.

SCL: Serial CLock line

SDA: Serial DAta line

GND: Ground

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There is no need for external pull-up resistors, since 10 k $\Omega$  pull-ups are already built in the OM13518 dongle.

#### Installation 4.

## 4.1 Hardware and driver installation

#### 4.1.1 The box contains:

- One dongle
- One USB cable
- Three I<sup>2</sup>C-bus cables:
  - One with female connector dedicated for NXP-RTC evaluation boards
  - Two cables for custom use via solder connection
  - The signal assignment is imprinted on the interface module \_



#### 4.1.2 Driver

First install the USB software driver before connecting the interface module.

- Unpack the file : cp210x\_vcp\_win\_xp\_s2k3\_vista\_7\_8\_v6\_6\_1.zip
- Install the driver in administrator mode

#### 4.1.3 Hardware

- Connect the USB cable with the dongle and with the PC and let the device to install. Connect the I<sup>2</sup>C-bus cable to your application; turn on the power in case an external one is needed.
- 2. The red LED will light up to indicate that the OM13518 successfully started up.
- 3. Now the system is ready for starting the GUI software

#### 4.2 GUI Installation

- 1. Unpack the file NXP\_USB-I2C-RTC\_GUI\_V02.zip. The latest version can be downloaded from the OM13518 home page.
- 2. Run the exe file: NXP\_USB-I2C-RTC\_GUI\_V02.exe
- 3. A start window will pop op
- 4. Choose the right com port in the drop down list
- 5. Press Connect: Status changes to Connected and turns green

Connection COM7	• Corvect	IPC Address:	OxA2	•
USB-12C Command	OM7 •	Disconnect	e, Alarms, Timestamps	Register Readba
Status, Firmwar	re, Y-Parameter	Direct Command		

## 5. Features of the Graphical User Interface (GUI)

The GUI can be used as a universal I<sup>2</sup>C-bus interface for controlling any peripheral circuit. Alternatively some specific windows are available e.g. for the Real-Time Clocks PCF85263 and PCF85363.

## 5.1 Universal I<sup>2</sup>C-bus interface

The Universal  $I^2C$  interface allows controlling any circuit by entering directly the  $I^2C$ -bus instructions. It is part of the Tab *USB-I2C Commands*.

Connection COM8	IPC Address: DxA2	NP
Dyvinder in MULE		RTC GUI V02
USB-I2C Commands Standard Registers Spec	al Registers   Time 6 Timestamps   Register Readback   R	AM 85363 only Demoboard
1 sa2 28 sa3 0A p	> Se	nd Congreand
		45
	2	
Save Configuration 4		
Read Contiguration 5	1	
	2	
Reset the dongle		
Reset dongle (Y-Parameters)		
Reset USB-PC		
Status, Firmware, Y-Parameter		
Received Data	Clear received Transmitted Data	Gear transmitted
00 00 00 00 00 00 00 00 00 08	s a2 28 s a3 0A p	

Procedure and details:

- 1. Universal I<sup>2</sup>C-bus interface control, type in the following format:
- Writing data, e.g.: s A2 28 04 p press Send Command (s = START, A2 = slave address, 28 04 = data, p = STOP)
- Reading data, e.g.: s A2 28 s A3 0A p: press Send Command setting address pointer, then reading 10 bytes (0Ah)
- 2. The sent data will be reflected in the field *Transmitted Data*.
- 3. The read data bytes are listed in the field *Received Data*.
- 4. Configuration can be saved on the PC (see section 5.2.1).
- Configuration can be reloaded to continue with the used presetting for further tasks (see section 5.2.1.2).

- 6. Tabs on the GUI of the RTCs: PCF85263, PCF85363, to follow
- 7. Hovering the mouse-pointer over a function button, tool tips will pop up for explanations.
- 8. Pressing ▼ will open the list of possible options to select from.

Time and Alarms	limestamps	
Time and Alarm R	egister Settings	
24	Howr Display Mode	1 second Resolution
TIME : AM	I/P Select 24 Hour Mode or 12 H	our Mode WDAY DA
Set Al		
Current		
ALARM1 : Enable	HR MN SC	
LIADIC		
Set		
		1 second R
		1 second 1 second 1/100 second VD/

#### 5.2 GUI pages for the RTC PCF85263 and PCF85363

The objective is to have a fast and straight forward control of all the functions of the RTC.

The principle for controlling is explained on the window *Time, Alarms, Timestamps* in Fig 7.

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Connection				13	2						
COM3		Dise	connect	) IR	C Address: DxA	2		•			
1	Connected)	to COM3								6	
SB-12C Comma	nds Stan	dard Regi	sters Spe	cial Regi	isters Time, Ala	ms, Timest	amps Re	gister Read		AM 85363 only	Demoboard
Time and Alarm	a second second										
Time and Ala	-				(				-		-
	24 Hour	• Dis	play Mode		1/100 second	Re:	solution	-	RTC	Mode	Watch Mode
	AM/PM	HOUR	MIN	SEC	1/100s	Inp	out fiel	ds	YEAR		
Set	AM 👻	14	09	03	00	08	15	03	14	EXECUTE	SET TIME
Current	-	14	09	17	95	SAT	13	MAR	2014	READ	START
ALARM1 :		-	and the lot	-		Ou	tput fi	elds			
Enable		HR	MN	SC SC			DY	MH		_	CLEAR A1F
Set										EXECUTE	STATUS A1F
Current				6.0	3				Ir	teractive	knobs
ALARM2 :		-	-								
Enable		HR	MN			E WE	Y				CLEAR A2F
Set										EXECUTE	STATUS A2F
Current										READ	ii
Alarms Enal	ble Registe	READ		1							
	-	<b>`</b>				-	- /	_	1		
aceived Data		Moni	tor Bu	s trar	nsmission	Trans	smitted Dat	а			Clear transmitted
0						A < 2					
0							00 000309 00 s A3 08	141306031	4p		
04 09 14 13 0	5 03 14					s A2 2	28 s A3 01 28 80 p				
						s A2 (	00 s A3 08				
15 09 14 13 0 15 09 14 13 0	6 03 14					= s A2 (	00 s A3 08 00 s A3 08	p			
16 09 14 13 0 17 09 14 13 0	6 03 14						00 s A3 08 00 s A3 08				
17 09 14 13 0	6 02 14					-					Subject

#### 5.2.1 Save and read back the configuration

#### 5.2.1.1 All the setting can be saved

- 1. Work with the GUI until you have the IC configured as desired.
- 2. Save the desired configuration to a file as follows: *USB-I2C-Commands* tab, *Save Configuration*, select a directory and name (see Fig 8).

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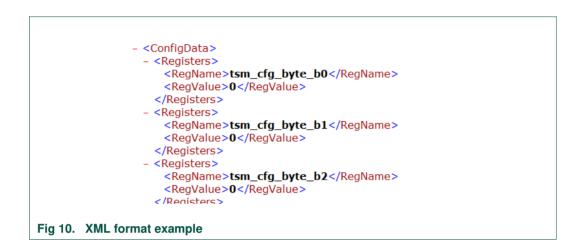
Connection COM8	IC Interest Dock 2	- N	
SB-I2C Commands Standard Registe	rs   Special Registers   Time, Alarms, T	imestampe   Register Readback   RAM 85363 only   Demobol	
-	GO . L + Computer + A	WS_System (C:) + LocalData + 12C_BUS_Platform + Project_	Time_control + + + Search Project
Save Configuration	Organize • New folder		
Read Configuration	2006 2007 2008 2009 2010 2011 2012 2012 2013 2014 2014 2014 2014 2014 2014 2014 2014	Name TCTRL_V_202 TCTRL_V_201	Type Size XML Document 161 XML Document 161
	File name: TCTRCV/20	BI	
	Save as type: XML Files		
	• Hide Folders	2	Save

3. If the GUI succeeds in writing the file, it will produce a pop-up window and then just press OK (see Fig 9).

	Save Configuration Read Configuration	File written successfully
Fig 9.	Reset the dongle Confirmation window	OK

#### File Format:

The file is written in standard XML format, which almost all Operating Systems can read (see Fig 10).



#### 5.2.1.2 Reload the settings

1. Read back a saved configuration file with *Read Configuration* (see Fig 11):

Connection COM8	PC PC Address: 0xA2	•	NP		
	Special Registers   Time, Alarma, Timestamps   Re	pister Readback   RAM 85363 only	RTC GUI V02		
	Organize + New folder			_	
	2005	* Name		Туре	Size
	👍 2006	TCTRLV	202	XML Elecoment	163
Save Configuration Read Configuration	2007 2008 2009	TCTRL V	201 /	XML Document	16)
	1 2010				
	2011	E:			
	2012	1.1			
	2014				
	2C_BUS_Platform				
	Project_Time_control				
	Uutlook				
	File name: TCTRL V_202	1		- 10	AL Files
	The nume Perine Perine	1			
					Open 🔻

2. If the GUI manages to read in the files successfully, it will produce a pop-up window and then just press OK (see Fig 12).

Connection COM8	Disconne     Disconne	IPC at IPC Addr	ress: DxA2	•		NM RTC GUI	V02
JSB-12C Commands	Standard Registers	Special Registers	Time, Alarms, Timestamps	Register Readback	RAM 85363 only	Demoboard	
Save	Configuration		File read successfully		Send Command		
Read	Configuration		ОК				
ig 12. Conf	irmation win	dow					

### 5.3 Examples

#### 5.3.1 Setting the clock and reading it

1. Perform a Software reset: *Reset* tab, function *SWR* (see Fig 13).

	USB-12C Commands	Standard Registers	Special Registers	Time, Alams, Timestamps	Register Readba
		Watch Dog Offset			
				Send So	ear Timescaler Coi oftware Reset Com ear Prescaler Com
Fig 13. Re	eset of the sof	tware			

- 2. Select menu Special Registers and press SWR.
- 3. Set the time and read back to verify that the clock is running (see Fig 7).
- A valid time and date can be entered in the Set row, then press EXECUTE
- The SET TIME programs the actual time based on your PC (see Fig 7 and Fig 14).
- *READ* reads the current time and date of the RTC (see Fig 7 and Fig 14).

• *START* will continuously read the time at about once every second (see Fig 7 and Fig 14).

There are options to change from *24 hour* to *12 hour* mode, activate the *1/100s* resolution and change the RTC from *RTC mode* (clock mode) to *stop watch mode* (see Fig 7 and Fig 14).

Time and Ala	24 Hour		splay Mod	e	1/100 secon	nd 🔻 Reso	lution		RTC	Mode 🔻	Watch Mode
TIME :	AM/PM	HOUR	MIN	SEC	1/100s	- WDAY	DAY	MONTH	YEAR	>	
Set	AM 🔻	15	48	00	00	02	15	04	14	EXECUTE	SET TIME
Current	-	15	57	06	11	TUE	15	APR	2014	READ	START

#### 5.3.2 Blinking the LED at the interrupt output with the help of the watchdog

Procedure and details:

1. Perform a Software reset: *Reset* tab, function *SWR* (see Fig 15).

Connection COM3   Disconnected to COM3	IPC Addr	ress: OxA2	•	
USB-I2C Commands Standard Registers	Special Registers	Time, Alarms, Timestamps	Register Readback	RAM 85363 onl
Resets Flags Watch Dog Offset				
Reset Settings : Register 0x CPR SWR I I I I I I I I I I I I I I I		Send So	ear Timescaler Comma ftware Reset Commar ear Prescaler Comman	d 0x2C
Fig 15. Software reset				

2. Enable INTA for interrupt mode (see Fig 16).

USB-I2C Con	nmands Stand	ard Registers	Special Registers	Time, Al	arms, Timesta	amps Regis	ster Readback	RAM 8	35363 on
Timestamp	OSC Settings	Battery Switc	h PIN Settings	Function	Interrupt A	Interrupt B	RAM Setting	STOP	
	PIN Settings : 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Register 0x27F	disabled	▼ IN1	TA 		> SET I B0 : INTAI B1 : INTAI B2 : TSPN B3 : TSPN B4 - TSIM	PM[0] PM[1] 1[0]	(PIN 9) (PIN 4)
Fig 16. Er	hable the IN	ITA for inte	errupt mode						

3. Enable INTA for Watchdog (pulse at each time countdown occurs) (see Fig 17).

ſ	USB-I2C Com	nmands Standa	ard Registers	Special Register	s Time, A	arms, Timesta	amps Regi	ster Readback	RAM 85363 on
	Timestamp	OSC Settings	Battery Switch	PIN Settings	Function	Interrupt A	Interrupt B	RAM Setting	STOP
		INTA Settings	: Register 0x29		0 1	}	SET BYT	E	
						ВО	: WDIEA	(WatchDog)	
						B1	: BSIEA	(Battery Switch)	)
Fi	g 17. Er	able the IN	TA for Wat	chdog					

- USB-I<sup>2</sup>C-bus dongle OM13518 with a GUI
- 4. Enable the watchdog for a repeat every 2 seconds for example (see Fig 18).

USB-I2C Commands Standard Registers Special Registers Tir	ime, Alarms, Timestamps	Register Readback	RAM 85363 only	Demoboard
Resets Flags Watch Dog Offset				
Watch Dog Settings : Register 0x2DH				
repeat         0         0         0         1         0         1 second           1         <	nd	- 0] (WatchDog Registe 1] 2] 3]		SET BYTE
 		(WatchDog Mode, sin	gle shot or continue	ous)
Fig 18. Enable the watchdog for a repe	at every 2 seco	onds		

5. Observe the LED flashing every 2 seconds!!!

#### 5.3.3 Interactive quartz frequency offset correction:

The quartz crystals come with a tolerance of typical  $\pm$  20 ppm. To correct the actual offset of the quartz in use, take the following steps:

- 1. Measure the frequency at CLKout pin, e.g. 32 768.51 Hz
- 2. Write the measured frequency in the entry field, it automatically calculates the offset and the needed correction value. 15.19 ppm or 7 correction pulses.
- 3. By activating *SET BYTE* the offset value is programmed in to the RTCs offset register.

**Note**: The offset calibration operates at the time counter level and will not result in any observable change in frequency.

USB-I2C Commands	1	the second second second second	Time, Alarms, Time	istamps Reg	ster Headback	RAM 85363 only	Demoboard
Resets Flags \	Vatch Dog Offset	E					
Offset Setting : R	egister 0x24H		Quartz L	oad Capacitar	ce		Correction Mode
msb	OFFSE	117.0] Isb	Constant of the second s	et in decimal	Offset in pp	m	Û
0	0 0 0		> 7		15.19	>	SET BYTE
Enter measured c	ystal frequency in i	(Hz) : 32768.51	> 3	0.517103 us		Period	nus :
					1 V		
	1	Difference to the ideal p	eriod in us : 0	.000475 us			
					V V		
	- 1	Difference to the ideal p	eriod in ppm :	5.563965 ppm			
			n	0	1 V		
	(	Offset Register value in	decimal : 7	correction pul	ses in normal m	ode	
	(	Offset Register value in	binary : 0	0000111			

#### 5.3.4 Dedicated drop down menus are integrated for e.g.:

- Register overview: reading all the values at once
- Back-up battery control
- Timestamp
- Watch dog
- RAM

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#### USB-I<sup>2</sup>C-bus dongle OM13518 with a GUI

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