PLC-Stamp micro

I2SE GmbH

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Revisions

Revision	Release Date	Changes
3	April 08, 2015	added information about UART and SPI interface, added MSL information
2	April 16, 2014	added information about the usage of the GPIO and SERIAL signals of the module
1	November 08, 2013	initial release

Contents

1 Abstract

The PLC (PowerLine Communication) module gives your application access to powerline communication based on the HomePlug® Green PHY™ Chip QCA7000. You can realize point-to-point and multi-point connections depending on your application. The data will be transmitted as Ethernet packets over the power line. This gives you the opportunity to use TCP/IP or whatever network protocols you wish to use.

The galvanic isolation from the power line as well as the power supply is left to you so that you can design it right for you application.

The QCA7000 from Qualcomm Atheros guarantees the compatibility with many other commercial powerline devices.

Parameter	Value
Power supply	3.3 V
Power consumption	0.5 W
Data rate	max. 10 MBit/s
Reach	maximal 300 m over the Powerline
Temperature range (IT)	-40 °C - +85 °C
Outline dimension	20 mm x 20 mm x 7 mm
Weight	4 g (preliminary)
RoHS	PLC-Stamp micro is manufactured RoHS compliant

2 Applications

- interconnection of household appliances to the Smart Grid
- connecting smart meters to Smart Meter Gateways and/or LAN/WAN/Wifi
- connecting sensors
- connecting photovoltaics
- connecting heating and air conditioning
- coupling of machines and measurement devices
- forwarding of digital Signals (remote I/O)
- coupling of RF-cells for home automation

3 Interfaces

Powerline: 230 V AC, 110 V AC, DC, dead-wire 2-wire-connections
Serial interfaces: UART or SPI

3.1 GPIO

3.1.1 Power On Configuration

The QCA7000 has four GPIO which are read at boot time to get the desired configuration. The 1 shows how to configure the QCA7000 on boot time.

GPIO #	pull up	pull down	Function
0	X		boot source = flash
0		X	boot source = host
1	X		not used
1		X	boot host = SPI slave
2	X		SPI slave mode = burst
2		X	SPI slave mode = legacy
3	X		not used
3		X	not used

Table 1: QCA7000 boot strap options

3.1.2 General Purpose I/O Functions

The QCA7000 GPIOs can also be used as GPIO on QCA7000 runtime. They can be either used as input or output to display various states or trigger some actions. It is not possible to use these pins for external purposes like switching relays etc.

The GPIO can be configured to display one or more of the following signals:

- Powerline link status
- Powerline TX
- Powerline RX
- SPI TX
- SPI RX
- Pushbutton Simple Connect Status

There are several input functions for the GPIO available:

- Pushbutton Simple Connect
- network membership key (NMK) randomization
- reset to factory default

Please refer to the QCA7000 datasheet about more information for those interfaces.

3.2 UART / SPI

The signals SERIAL_0 through SERIAL_4 are the SPI or UART signals. In 2 the UART and SPI function for each signal is described.

Signal Name	SPI function	UART function
SERIAL_0	Interrupt	
SERIAL_1	CLK	RTS
SERIAL_2	CS	CTS
SERIAL_3	MISO	TXD
SERIAL_4	MOSI	RXD

Table 2: QCA7000 UART/SPI signals

Please note that selecting between SPI and UART mode is done via different firmware of the QCA7000. In bootloader mode it always starts in SPI mode which enables you to upload new firmware.
Please refer to the QCA7000 datasheet about more information for those interfaces.

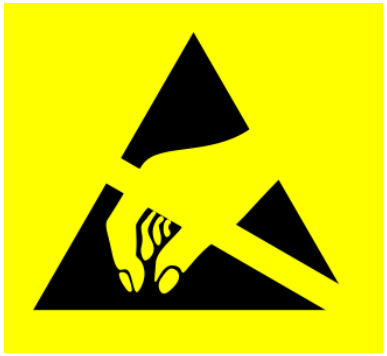
3.2.1 UART

The UART supports frequencies up to 115,200 baud and has four signal pins: TX, RX, RTS and CTS.

3.2.2 SPI

The QCA7000 uses SPI in Mode 3: CPOL=1, CPHA=1.
The SPI should be used in burst mode, meaning that the chip select is held low during a complete SPI message.
The SPI CLK period should not be less than 83.3 ns.

4 Handling



This electronic component is sensitive to electrostatic discharge (ESD).

The module contains components with **moisture sensitivity level (MSL) 3**. Please handle them accordingly.

5 Module overview

The block diagram in figure 1 shows the components on the module in the grey box as well as the connections and external components that you need additionally.

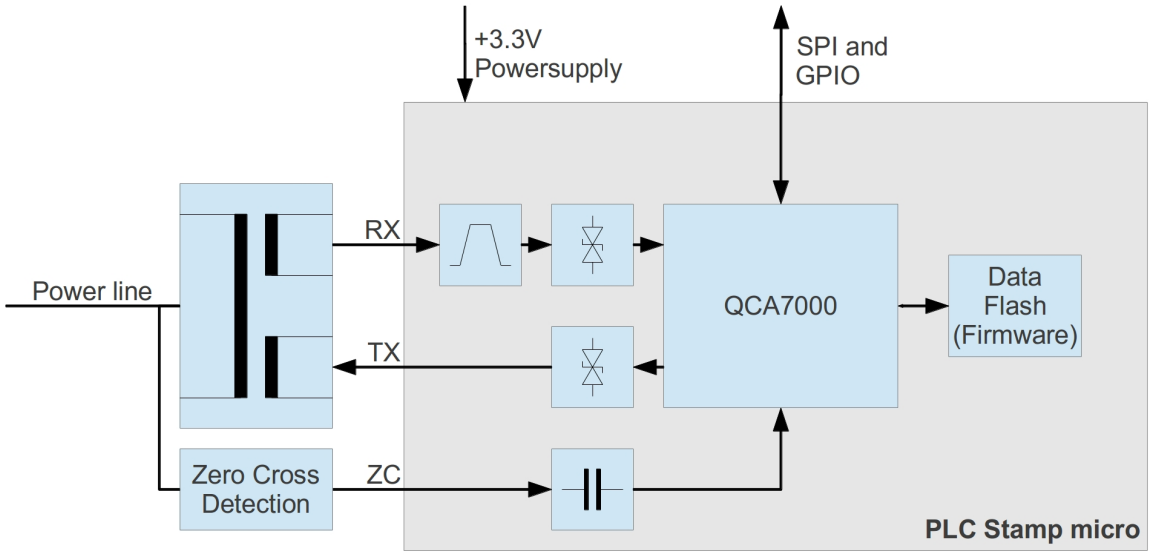


Figure 1: Block diagram of PLC Stamp micro

On the top side in figure 2 of the module you can locate the main chip which is the QCA7000. The data flash (optional, see order options) which stores the firmware is located on the bottom side of the module, which you can see in figure 3.

6 Getting started

An easy way to put PLC-Stamp micro into operation is to use it with the evaluation kit that is offered by I2SE. Please contact your distributor about it.
For your own design please have a look at the reference design. I2SE provides you with all non standard parts that you will need to put that design into your own application. See section ”Available Accessories” for further references to these parts.

7 Firmware and MAC addresses

Depending on how you order these modules they come with or without firmware and parameter information block (PIB) programmed. The PIB contains the MAC addresses of the module. If you order the module without firmware that you will have to flash it yourself. Please refer to the QCA7000 documentation for the flash procedure. Additionally I2SE provides you with Application notes about the firmware provisioning process. Nevertheless you will need direct access to the QCA7000 firmware and PIB files from Qualcomm Atheros. I2SE will not provide these files.

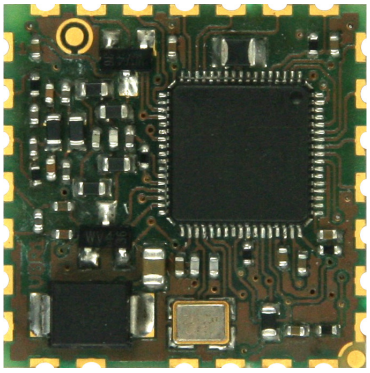


Figure 2: Top View of PLC Stamp micro

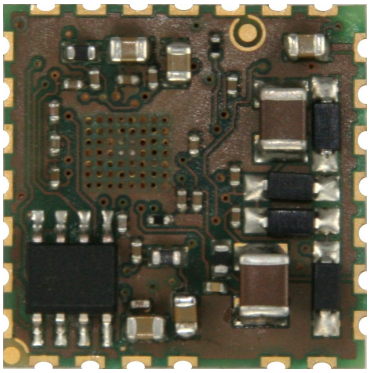


Figure 3: Bottom View of PLC Stamp micro

8 Module pinout

PIN	Direction	Name	Description
1	SUPPLY	VDD	Supply Voltage for the Module
2	IN	RX_N	Powerline receiver input negative
3	IN	RX_P	Powerline receiver input positive
4	OUT	TX_N	Powerline transmitter output negative
5	OUT	TX_P	Powerline transmitter output positive
6	IN	ZC_IN	Zerocross detection input
7	SUPPLY	GND	Ground connection
8	SUPPLY	GND	Ground connection
9	SUPPLY	GND	Ground connection
10			not present (mechanical coding)
11	SUPPLY	GND	Ground connection
12	SUPPLY	GND	Ground connection
13	SUPPLY	GND	Ground connection
14	SUPPLY	GND	Ground connection
15	SUPPLY	GND	Ground connection
16	SUPPLY	GND	Ground connection
17	SUPPLY	GND	Ground connection
18	IN/OUT	GPIO_0	GPIO 0 of the QCA7000
19	IN/OUT	GPIO_1	GPIO 1 of the QCA7000
20	IN/OUT	GPIO_2	GPIO 2 of the QCA7000
21	IN/OUT	GPIO_3	GPIO 3 of the QCA7000
22	IN	RESET_L	Reset (low active)
23	IN/OUT	SERIAL_4	Serial_4 of the QCA7000
24	IN/OUT	SERIAL_3	Serial_3 of the QCA7000
25	IN/OUT	SERIAL_2	Serial_2 of the QCA7000
26	IN/OUT	SERIAL_1	Serial_1 of the QCA7000
27	IN/OUT	SERIAL_0	Serial_0 of the QCA7000
28	SUPPLY	GND	Ground connection

9 Technical Data

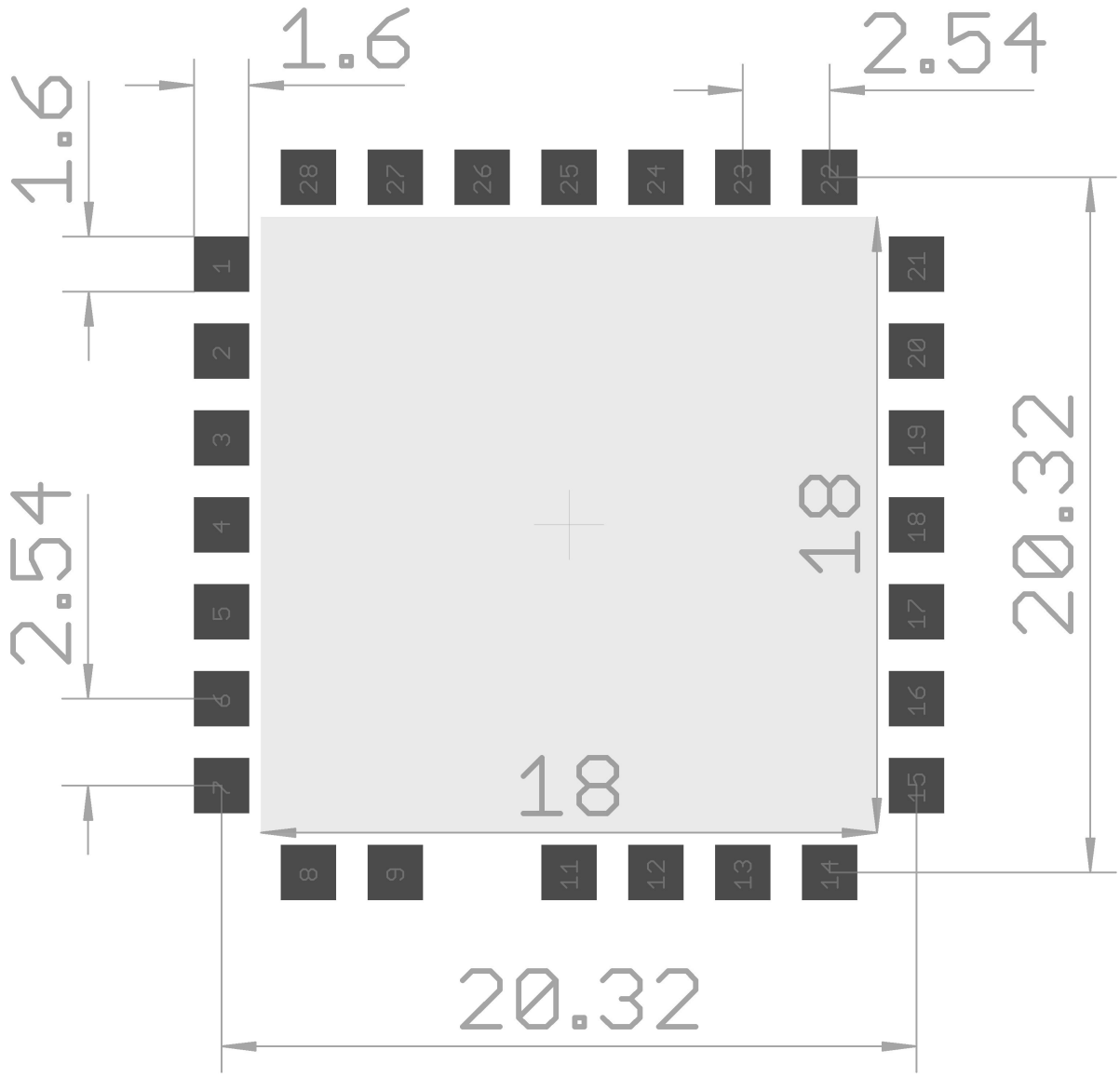
9.1 Absolute Maximum Ratings

SYMBOL	PARAMETER	Min.	Max.	UNIT
VDD	Digtal supply voltage	-0.3	3.46	V
VDIO	Digtal input voltage	-0.3	3.63	V
TSTORE	Storage temperature	-40	150	℃
RAH	Relative air humidity (not condensing)	10	90	%

9.2 Operating conditions

SYMBOL	PARAMETER	Min.	Typ.	Max.	UNIT
VDD	Digtal supply voltage	3.13	3.3	3.46	V
TCASE	Top of case temperature (see order information)	-40	-	85	℃

9.3 Recommended Footprint



10 Order Information

The following table gives you an overview about the available variants of PLC Stamp micro. The column identification gives you a guideline to identify each variant.
Please note that flashed firmware is always costumer specific. Contact your distributor before ordering a part with included firmware.

10.1 Available accessories

I2SE provides you with tested powerline transformers. These are part of the reference designs. Please see further documentation for a full specification of these transformers.

Version	Order Code
1:4:5 for mains power line coupling	I2PLCTR-1
1:1:1 for Electric Vehicle and Electric Vehicle Supply Equipment	I2PLCTR-2

Order code	Firmware flashed	Temperature Range / ℃	flash included	availability	identification
I2PLCSMC-FNI	no	-40 - 85	yes	standard	QCA7000 laser marked with: QCA7000-AL3B, flash populated
I2PLCSMC-FFI	yes	-40 - 85	yes	on request	QCA7000 has a customer specific label with temperature range and MAC address written to it
I2PLCSMC-NNI	no	-40 - 85	no	on request	QCA7000 laser marked with: QCA7000-AL3B, no flash populated
I2PLCSMC-FNC	no	0 - 70	yes	on request	QCA7000 laser marked with: QCA7000-AL3C, flash populated
I2PLCSMC-FFC	yes	0 - 70	yes	on request	QCA7000 has a customer specific label with temperature range and MAC address written to it
I2PLCSMC-NNC	no	0 - 70	no	on request	QCA7000 laser marked with: QCA7000-AL3C, no flash populated

Table 3: PLC Stamp Micro Order Codes

Product Code	Flash Chip populated	Firmware Flashed	Temperature Range
I2PLCSMC-	F: populated N: not populated	F: flashed N: not flashed	I: Industrial (-40 - +85 ℃) C: Consumer Temperature Range (0 - 75 ℃)

Table 4: PLC Stamp Micro Order Code construction

11 How to reach us

Home Page: http://www.i2se.com
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