in-tech smart charging GmbH

June 17, 2021

Charge Module S

Preliminary Datasheet

Introduction

Charge Module S add DIN 70121 and ISO 15118 functionality to the EV side. It provides all core functionalities to enable Onboard-Chargers or Battery Packs the High-Level Communication with a CCS Charging Station.

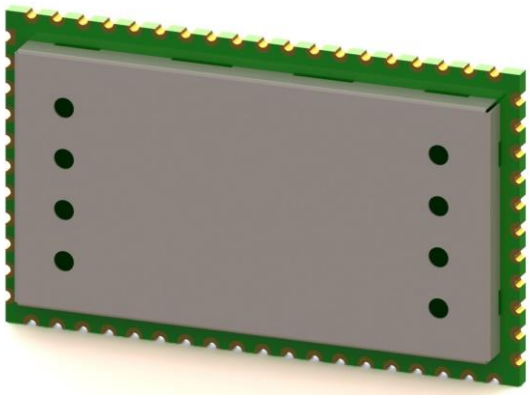
The Module is equipped with a QCA7005 and a powerful Cortex M4 running a state-of-the-art Real Time Operating System with our complete SW-Stack included.

Key Features

- Dual mode ISO 15118/DIN 70121 SW-Stack (DC)
- IEC61851 and ISO 15118 (AC)
- Ready for Plug and Charge
- Ready for bidirectional charging
- TLS 1.2
- SPI-Interface
- CAN-Interface
- Automotive ready
- UDS support for diagnostics and configuration

Operational

Parameter	Value
Weight	< 10 g
Temperature range	-40 °C - 85 °C
RoHS / reach	This product is manufactured RoHS / reach compliant.
Power supply	3.3 V
Power consumption	Max. 350 mA
Outline dimension	50.8 mm x 30.48 mm



Applications

- Generic Charge Communication Controller for Electric Vehicles
- Integration into an AC Onboard-Charger to enable Fast DC charging
- Integration into an AC Onboard-Charger to enable smart ISO 15118 AC charging
- Integration into a BMS, to enable "native" DC charging

Interfaces

Charge Module S has a CAN-Interface for the customers application.

- **CAN bus**
  CAN is implemented in Charge Module S with baud rate running at default 500 Kbit/s. Messages are supporting extended IDs. A DBC-File is available on request.
- **SPI**
  It is not yet implemented. If you are interested, please get in touch with us.
- **Ethernet**
  It is not yet implemented. If you are interested, please get in touch with us.

Contents

1 Module Overview

The block diagram in *Figure 1* the module components in the gray box as well as the connections and external components that you need additionally.

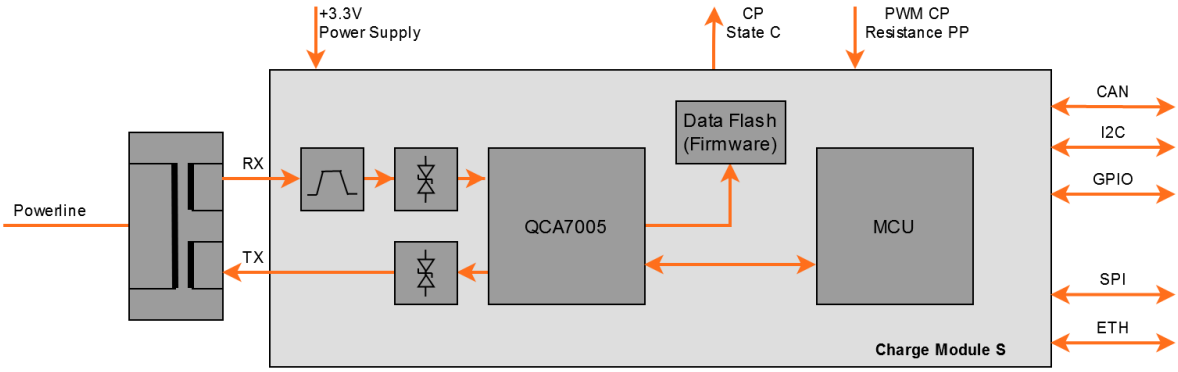


Figure 1 Block diagram

2 Electrical Characteristics

2.1 Absolut maximum ratings

Symbol	Maximum parameter	Min	Max	Unit
V_{DD}	Digital supply voltage	-0.3	3.46	V
V_{DIO}	Digital input voltage	-0.3	3.6	V
V_{PP}	Proximity pilot voltage	-0.3	+3.3	V
T_{STORE}	Storage temperature	-	-	°C
R_{AH}	Relative air humidity (not condensing)	10	90	%

2.2 Recommended operating conditions

2.2.1 Supply parameter

Symbol	Supply parameter	Min	Typ	Max	Unit
V_{DD}	DC supply voltage	2.7	3.3	3.46	V
I_{DD}	Current for V_{DD}	-	-	350	mA
I_{GPIO}	GPIO current	-	3.5	14	mA

2.2.2 GreenPHY powerline communication parameter

PLC on control pilot parameter	Min	Typ	Max	Unit
Reach	-	-	300	m
Data rate	-	-	10	Mbit/s

2.2.3 Digital input parameter

Digital input parameter	Min	Typ	Max	Unit
Input voltage	-	-	3.6	V

2.2.4 Digital output parameter

Digital output parameter	Min	Typ	Max	Unit
Output voltage	-	2.5	3.3	V
Output current	-	3.5	14	mA

3 Module Pinout

Pin	Name	Direction	Description
1	V_{DD}	SUPPLY	Supply voltage for the module
2	GND	SUPPLY	Ground connection
3	RXIN_N	IN	Powerline receiver input negative
4	RXIN_P	IN	Powerline receiver input positive
5	TXOUT_N	OUT	Powerline transmitter output negative
6	TXOUT_P	OUT	Powerline transmitter output positive
7	ZC_IN	IN	Zero cross detection input
8	GND	SUPPLY	Ground connection
9	GND	SUPPLY	Ground connection
10	GND	SUPPLY	Ground connection
11	MII_RMII_MDC	OUT	Reserved
12	MII_RMII_MDIO	IN/OUT	Reserved
13	MII_RX_CLK	IN	Reserved
14	MII_RMII_RXD0	IN	Reserved
15	MII_RMII_RXD1	IN	Reserved
16	MII_RXD2	IN	Reserved
17	MII_RXD3	IN	Reserved
18	MII_RMII_RX_DV	IN	Reserved
19	MII_RMII_RX_ER	IN	Reserved
20	MII_TX_ER	OUT	Reserved
21	MII_RMII_TXD0	OUT	Reserved
22	MII_RMII_TXD1	OUT	Reserved
23	MII_TXD2	OUT	Reserved
24	MII_TXD3	OUT	Reserved
25	MII_RMII_TX_EN	OUT	Reserved
26	MII_RMII_TX_CLK	OUT	Reserved
27	CAN_RX	IN	CAN RX channel
28	CAN_TX	OUT	CAN TX channel
29	PP_value	IN	Proximity pilot ADC signal
30	SPI_CLK	IN	SPI clock (master→slave)
31	SPI_DI	IN	SPI data MOSI (master→slave)
32	SPI_DO	OUT	SPI data MISO (slave→master)
33	SPI_CS	IN	SPI chip select (master→slave)
34	IRQ_O	OUT	SPI interrupt (slave→master)
35	I2C_SCL	OUT	Reserved
36	I2C_SDA	OUT	Reserved
37	EV_CP_Edge	IN	Control pilot edge detector (PWM-duty cycle detection)
38	CP_State_C	OUT	Output pin to switch state (B↔C)
39	EV_CP_Bufferd	IN	Reserved
40	CP_RST_Neg	OUT	Reserved
41	CP_RST_Pos	OUT	Reserved
42	CP_PWM_out	OUT	Reserved for PWM generation
43	CP_Pos_Peak_det	IN	Reserved
44	CP_Neg_Peak_det	IN	Reserved
45	GPIO_1	IN/OUT	Reserved GPIO
46	GPIO_2	IN/OUT	Reserved GPIO
47	GPIO_3	IN/OUT	Reserved GPIO

Pin	Name	Direction	Description
48	GPIO_4	IN/OUT	Reserved GPIO
49	GPIO_5	IN/OUT	Reserved GPIO
50	GPIO_6	IN/OUT	Reserved GPIO
51	Trace_CLK_OUT	OUT	Trace clock out
52	Trace_D3	OUT	Trace data out 3
53	Trace_D2	OUT	Trace data out 2
54	Trace_D1	OUT	Trace data out 1
55	Trace_D0	OUT	Trace data out 0
56	JTAG_TDO	OUT	Test data output
57	JTAG_TDI	IN	Test data input
58	JTAG_TCLK	IN	Test clock
59	RESET*	IN	Reset input pin
60	JTAG_TMS	IN/OUT	Test mode selection

*The RESET pin is driven low by the MCU for at least 128 bus clock cycles and until flash memory initialization has completed.

4 Mechanical Dimensions

Figure 2 shows the recommended footprint for the Charge Module S module. The module outline shows the ideal measures, tolerance is not included.

All dimensions are in mm. The pads are all of the same size and the distances between the pads are equal, if not otherwise specified in the drawing.

The area between the pads should kept free of copper on the base PCB.

Pin 1 is a rectangular shaped pin on the top side of the Module.

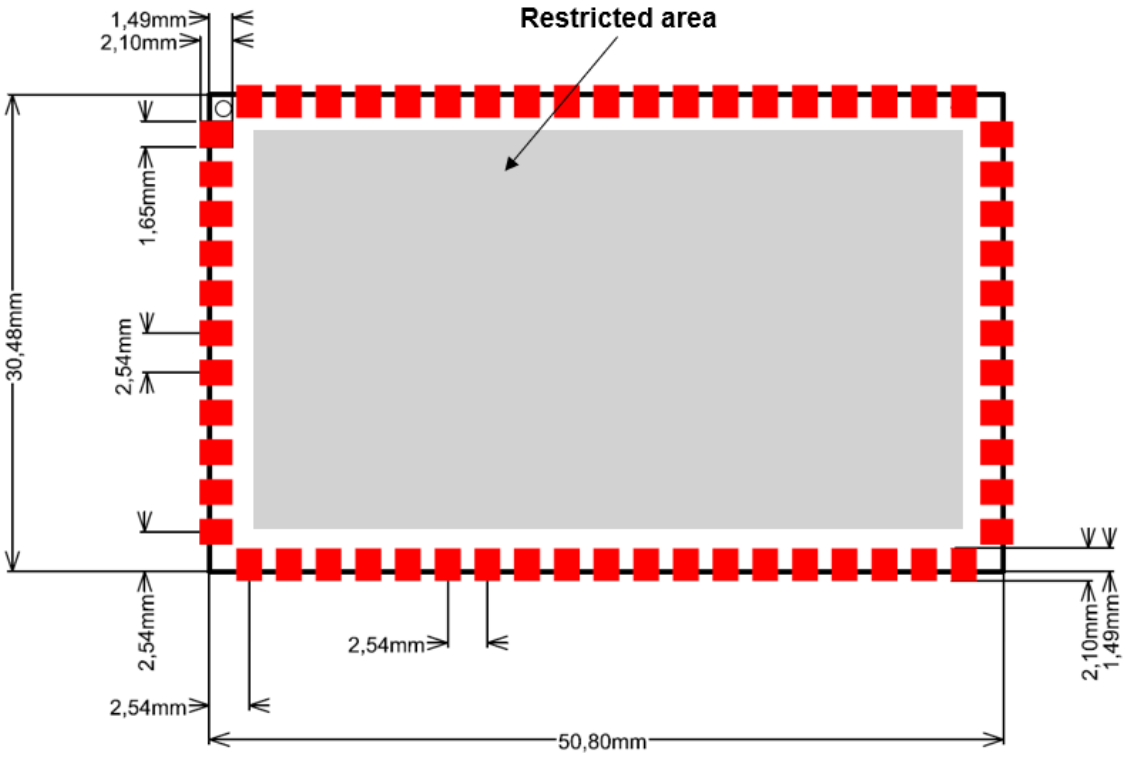


Figure 2 Recommended Footprint

5 Reference Schematics

A possible implementation of the coupling circuit is shown in *Figure 3* for coupling to automotive applications. This schematic is freely based on the QCA7000 / QCA7005 Add-In reference schematic by Qualcomm Atheros. If you are not sure if the signals will couple to other lines where PLC communication is used, you should connect the zero-cross detector to your mains port. For use in electric vehicles (PEV) the signal ZC IN needs to be connected to GND.

in-tech smart charging GmbH provides you with all non-standard parts you will need to implement this design into your own application.

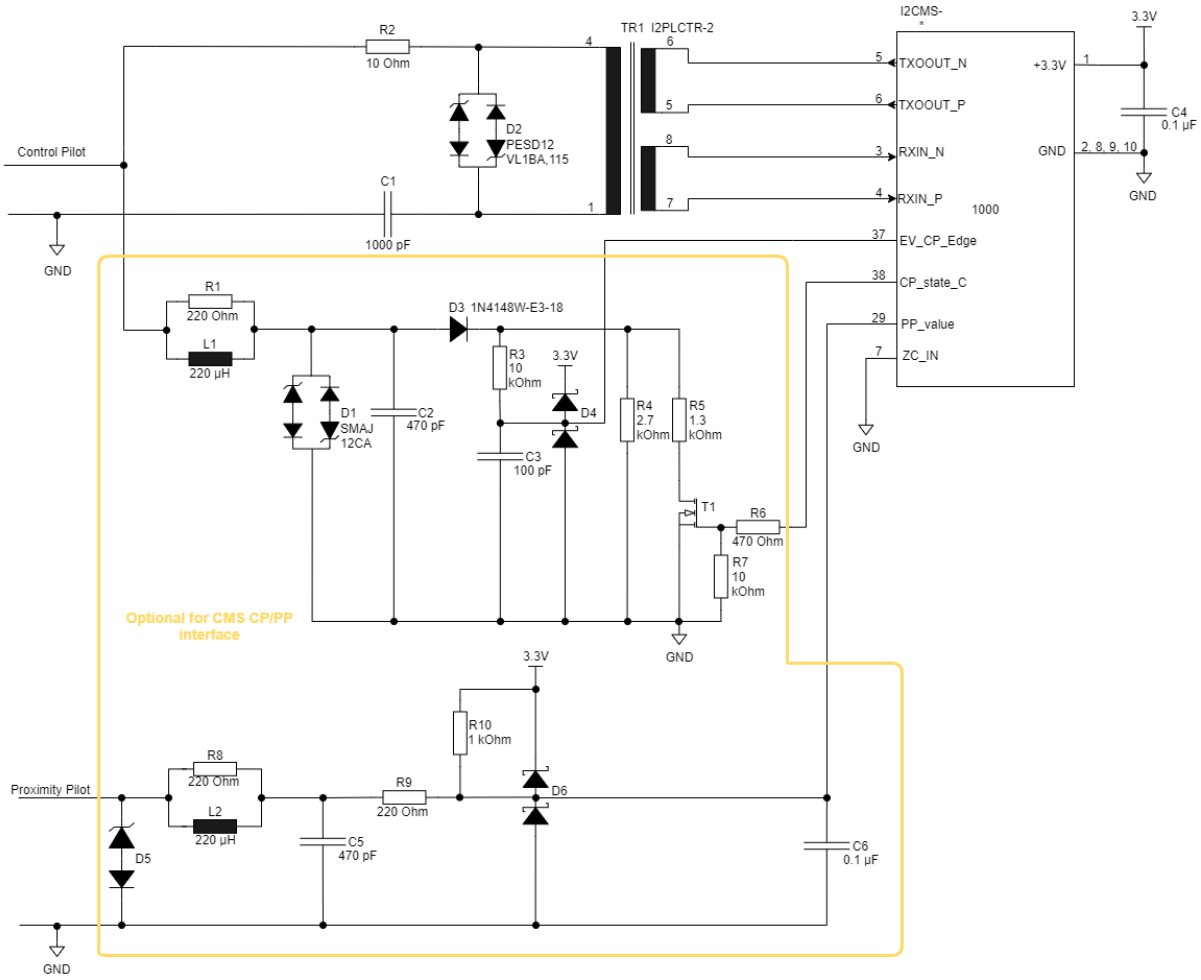


Figure 3 Reference Schematic

6 Module Marking

Each Module is marked with a label containing the following data:

- Data Matrix Code with following Information (space separated Values):
  - Order Code
  - MAC Address QCA7005
  - MAC Address Host
  - Serial Number

7 Order Code Compilation

Product Family Code	SW Stack Variant	Plug Type	61851 Interface Type	Customer Interface	HW Version	SW Version	Customize Variant	Packaging
I2CMS-	**D: Dual (ISO and DIN)**	**M: Type 2**	**B: By customer**	**C: CAN**	**-01 (C-Sample)**	**-00 (dev)**	**-00 (none)**	-T: Tray
	P: ISO 15118 PnC*	**J: Type 1**	**N: Native GPIO**	S: SPI*				-R: Reel
	V: ISO 15118 V2G*		P: PP by customer*	E: Ethernet*				
			C: CP by customer*					

* Under development

8 Order Information

The following table provides an overview of the available Charge Module S variants.

Order Code	SW Stack	Plug Type	IEC 61851 Interface	Customer Interface	Packaging	Availability
I2CMS-DMBC-00-00-00-T	Dual	Type 2	By Customer	CAN	Tray	Standard
I2CMS-DMNC-00-00-00-T	Dual	Type 2	Native GPIO	CAN	Tray	Standard

9 Handling

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

- Process the modules according to IPC/JEDEC J–STD-020 and J-STD-033 guidelines.
- Limit repeated reflow processes to maximum 2.

Detailed information will be added later.

10 Revisions

Revision	Release Date	Changes
4	17 June 2021	• Added UDS protocol feature • Removed DIN only from order code compilation • Added Pin 1 marking at mechanical dimensions • Updated Module marking
3	23 March 2021	• Updated Charge Module S 3D figure • Updated Figure 2 in Chapter 4 Mechanical Dimensions • Updated Figure 3 in Chapter 5 Reference Schematics • Reworked descriptions to meet the actual design
2	20 Mai 2020	• Changed module pinout for Ethernet (MII RMII), Trace, CP, GPIOs • Rename GPIOs and reduce number of GPIOs, • Rename Pin34 from SPI Interrupt to IRQ O • Add reference circuits for Control Pilot and Proximity Pilot
1	11 September 2019	Initial release

11 Contact

in-tech smart charging GmbH
Friedrich-List-Platz 2
04103 Leipzig
Germany
Website: https://in-tech-smartcharging.com

12 Disclaimer

Tbd.