Charge Module S Datasheet

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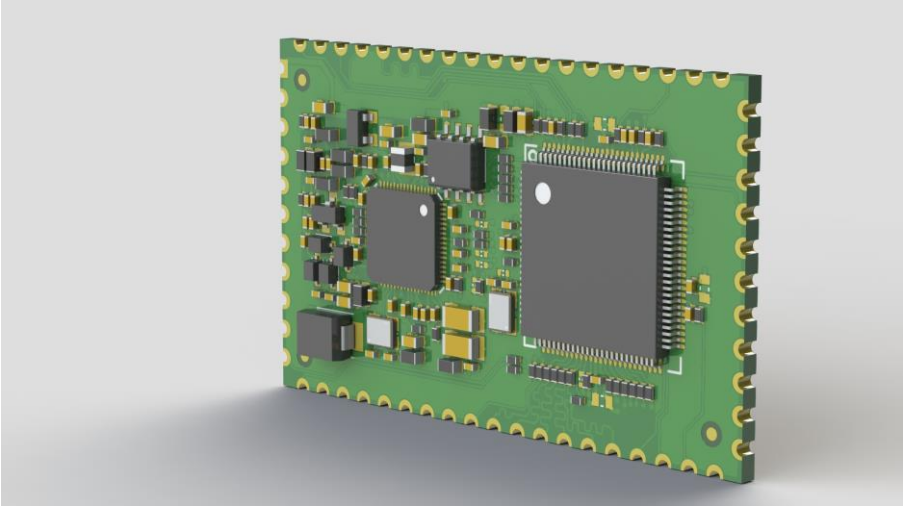

1 Revisions

Revision	Release Date	Changes
1	11 September 2019	initial release
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
3	21 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
4	17 June 2021	• Added UDS feature • Removed DIN only from order code compilation • Added Pin 1 marking at mechanical dimensions • Updated Module marking
5	23.Nov.2022	• changed min. DC supply voltage to 3.13V • updated table Module Pinout • added figure for Module dimensions • updated company contact • move reverence HW to user guide • add storage temperature • add packaging information
6	03.Mar.2023	• updated table module pinout • updated table absolute maximum ratings • add crypto chip chapter
7	23.May.2023	• add order codes for V2.x • add reel packaging to order code
8	19.Jul.2023	• updated table Module Pinout • updated comments for table Module Pinout • add reel information • add MSL level
9	11.April.2024	• added Startup & SLAC time • removed tray package variant • added information for bow & twist percentage

		• removed ADC functionality from customer GPIO
10	01.Oct.2024	• corrected startup time

Table 1 Revision Table

2 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.

3 Key Features

- Dual mode ISO 15118-2 / DIN 70121 SW Stack (DC)
- IEC61851
- Ready for ISO 15118 (AC)
- Ready for Plug and Charge
- Ready for Bidirectional charging
- Ready for TLS 1.2/1.3
- Automotive ready
- UDS support for diagnostics and configuration

4 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
Startup time	max. 400ms
powerOn to SLAC time	max. 3.4s

Table 2 Operational Parameter

5 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

6 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.

7 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.

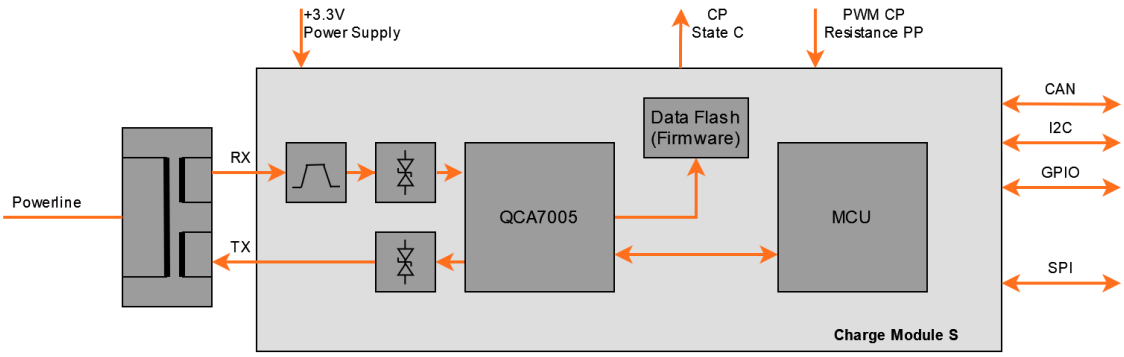

Figure 1 Block diagram

8 Electrical Characteristics

8.1 Absolute 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
T_{STORE}	Storage temperature	-40	+85	°C
R_{AH}	Relative air humidity (not condensing)	10	90	%

Table 3 Maximum ratings

8.2 Recommended operating conditions

Symbol	Supply Parameter	Min	Typ	Max	Unit
V_{DD}	DC supply voltage	3.13	3.3	3.46	V
I_{DD}	Current for VDD	-	-	350	mA
I_{GPIO}	GPIO current	-	3.5	14	mA

Table 4 Supply parameter

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

Table 5 GreenPHY powerline communication parameter

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

Table 6 Digital input parameter

Digital output parameter	Min	Typ	Max	Unit
Output voltage	-	2.5	3.3	V

Output current	-	3.5	14	mA

Table 7 Digital output parameter

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	DIR[1]	IN	Reserved, connect to GND
8	GND	SUPPLY	Ground connection
9	GND	SUPPLY	Ground connection
10	GND	SUPPLY	Ground connection
11	RSVD_01		Reserved
12	RSVD_02		Reserved
13	RSVD_03		Reserved
14	RSVD_04		Reserved
15	RSVD_05		Reserved
16	RSVD_06		Reserved
17	RSVD_07		Reserved
18	RSVD_08		Reserved
19	RSVD_09		Reserved
20	RSVD_10		Reserved
21	RSVD_11		Reserved
22	RSVD_12		Reserved
23	RSVD_13		Reserved
24	RSVD_14		Reserved
25	RSVD_15		Reserved
26	RSVD_16		Reserved
27	CAN_RX	IN	CAN RX channel
28	CAN_TX	OUT	CAN TX channel
29	PP_value[2]	ADC	Proximity pilot ADC signal, RC low pass filter present on PCB (f_c = 160 kHz)
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_L[5]	IN	SPI Chip select (master→slave), Low active
34	IRQ_O	OUT	SPI interrupt (slave→master)
35	I2C_SCL	OUT	Reserved
36	I2C_SDA	IN/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	ADC_1[2]	ADC	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[2]	ADC	Reserved
44	CP_Neg_Peak_det[2]	ADC	Reserved
45	GPIO_1	IN/OUT	Customer can configure it as GPIO
46	GPIO_2	IN/OUT	Customer can configure it as GPIO
47	GPIO_3	IN/OUT	Customer GPIO
48	GPIO_4	IN/OUT	Customer GPIO
49	GPIO_5	IN/OUT	Customer GPIO

50	GPIO_6	IN/OUT	Customer 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_L[3]	IN	Reset input pin, Low active
60	JTAG_TMS	IN/OUT	Test mode selection

Table 8 Module Pinout

[1] Connect directly to GND for normal operation.

[2] If ADC is not used, connect to GND with 10 kOhms series resistor.

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

[4] Unused digital pins can be left floating. It is recommended to connect the unused pins to GND with 10 kOhms series resistor.

[5] When configured, can be used to disable all outgoing CAN-communication (except diagnostic), when pulled high

9 Module Dimensions

Figure 2 shows the physical dimensions of the module. Pin 1 is a rectangular shaped pad on the top side of the Module.

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

Bow & Twist is max. 0.5% for the module.

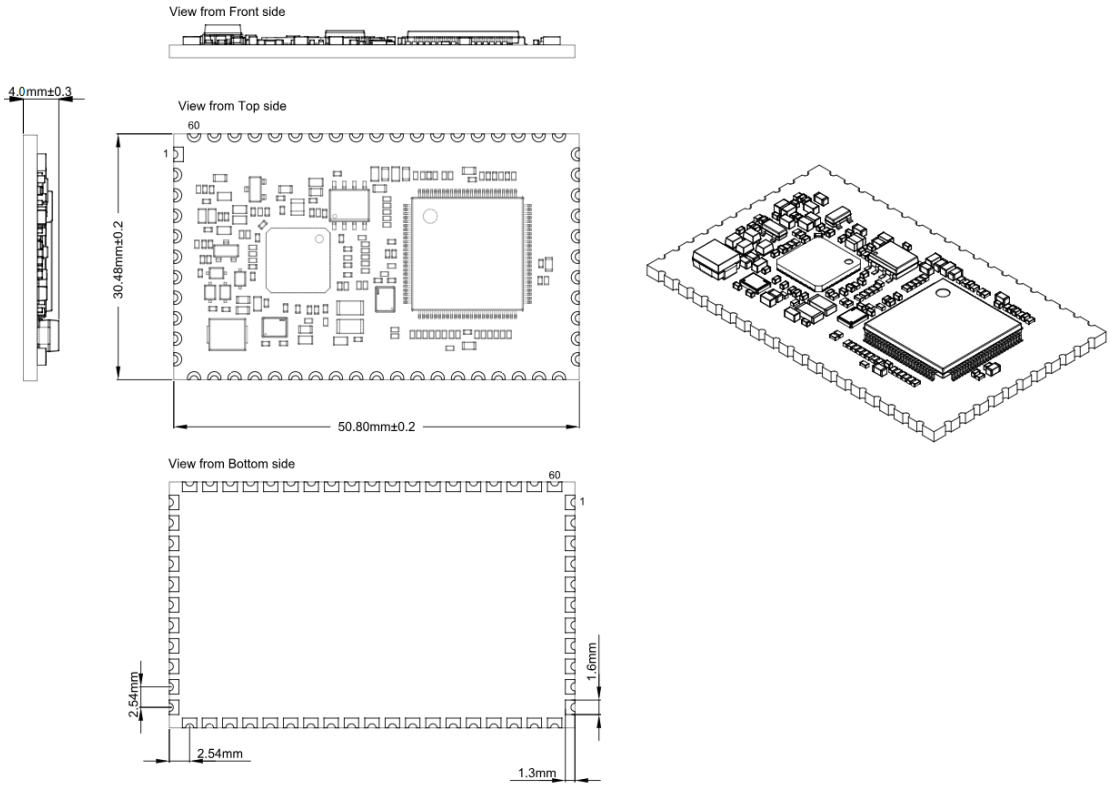

Figure 2 Charge Module S dimensions

10 Footprint Dimensions

The recommended footprint for the Charge Module S module can be seen in Figure 3. The module outline shows the ideal measures, tolerance is not included.

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

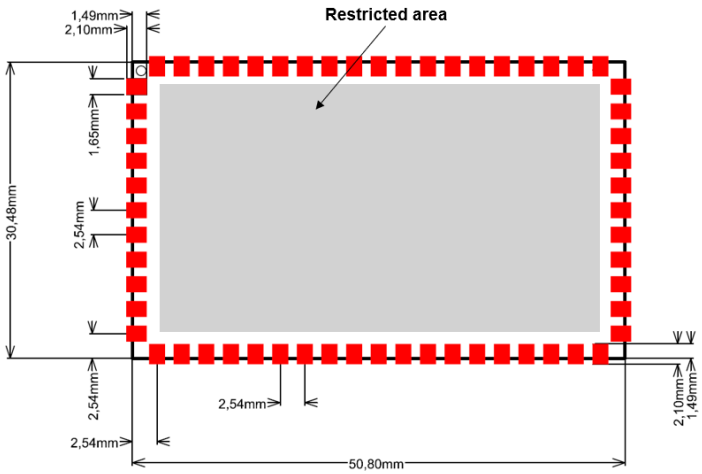

Figure 3 Charge Module S footprint

11 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

12 Cryptochip for Encryption and Cyber Security

To enable a TLS functionality in future firmware releases, the crypto chip SE050C1HQ1/Z01SCZ from NXP has to be connected to the I2C interface of the module. The TLS encryption is a mandatory requirement for the ISO15118-20 protocol and optional for ISO15118-2. A reference schematic can be found in NXP's technical documentation of the crypto chip.

13 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*							

* under development

14 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	Availability	Comment
I2CMS-DMBC-01-00-00-R	Dual	Type 2	by Customer	CAN	standard	SW V1.0.2
I2CMS-DMNC-01-00-00-R	Dual	Type 2	Native GPIO	CAN	standard	SW V1.0.2
I2CMS-DMBC-01-01-00-R	Dual	Type 2	by Customer	CAN	standard	SW V2.x
I2CMS-DMNC-01-01-00-R	Dual	Type 2	Native GPIO	CAN	standard	SW V2.x

15 Packaging

15.1 Reel

Material: Polystyrene

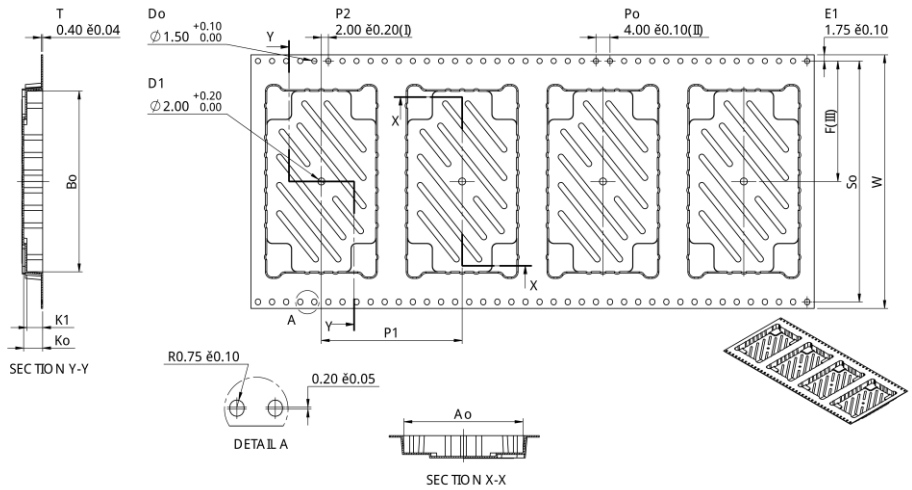

Figure 4 Tape and Reel Technical Drawing

Ao	31.00	+/- 0.15
Bo	51.30	+/- 0.15
Ko	5.40	+/- 0.15
K1	4.50	+/- 0.15
F	34.20	+/- 0.30
P1	40.00	+/- 0.15
So	68.40	+/- 0.20
W	72.00	+/- 0.30

Table 9 Tape and Reel Technical Drawing Dimensions

All dimensions in millimeters unless otherwise stated.

(I)	Measured from centreline of sprocket hole to centreline of pocket.
(II)	Cumulative tolerance of 10 sprocket holes is +/- 0.20 .
(III)	Measured from centreline of sprocket hole to centreline of pocket.
(IV)	Other material available.

(V)	Dimension with () is used for design reference purpose. No measurement required.

16 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.

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

17 Contact

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