HB2200

Innovative IEEE 802.15.4/ZigBee compatible SoC
for massive IoT networking

Evaluation Board (EVB2200)

User Guide

AN-HB2200

Version 1.2

Revision History

Revision No.	Date	Description	
1.0	Dec. 11, 2019	• Initial release	
1.1	Apr. 22, 2020	• Minor revision	
1.2	Oct. 14, 2020	• Minor revision	

Table of Contents

1. Overview

1.1. Description

HB2200 is an innovative SoC that can provide secure self-construction of low-power large-scale IoT networks even in very harsh operating environments, while providing full backward compatibility with IEEE 802.15.4/ZigBee. It can be applied to most of IoT service environments in a plug-and-play mode, where conventional low-power IoT connectivity technologies (e.g., ZigBee, Bluetooth, BLE and Z-Wave) cannot. HB2200 development kit (DK2200), comprising evaluation board (EVB2200) and application software tools, enables the development of versatile IoT systems quick and easy. This document is a user guide for EVB2200.

1.2. Features

- GPIO pin header compatible with Raspberry Pi 3
- Serial wire debug (SWD) pin header for J-Link programming/debugging
- On-board 2.4 GHz chip antenna and SMA connector
- 10V pulse width modulation (PWM) output (e.g., applications to smart lighting)
- Multiple power sources: An adapter, Micro-USB and PWM connector with a voltage range of 4.5V ~ 18V
- Reset/wakeup interrupt/user buttons and LEDs

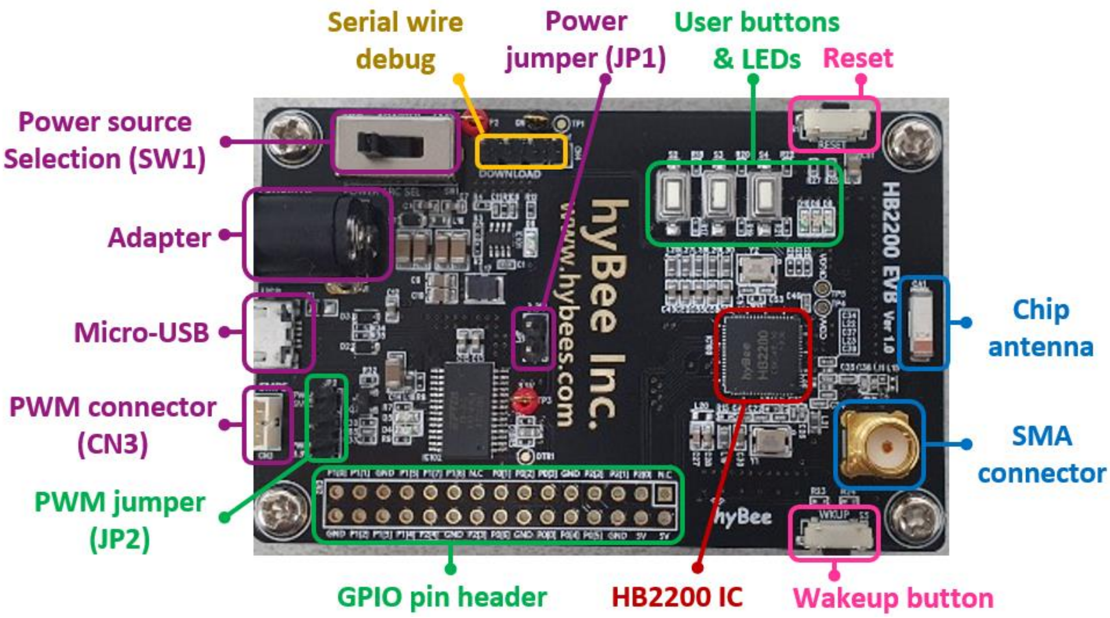


Figure 1-1. Front view of EVB2200

Table 1-1. Component name

Function	Name on the board	Function	Name on the board
Power source selection	**SW1**	Reset button	**S1**
Adapter	**J1**	Wakeup button	**S5**
Micro-USB	**USB**	GPIO pin header	**CN2**
PWM output	**CN3**	User buttons	**S2, S3, S4**
Power jumper	**JP1**	User LEDs	**D8, D9, D10**
PWM jumper	**JP2**	Chip antenna	**CA1**
HB2200 IC	**IC100**	SMA connector	**ANT1**
Serial wire debug	**CN4**		

2. Power supply

2.1. Input power modes

EVB2200 can be powered by one of three power sources; Micro-USB, adapter J1 or PWM connector CN3, shown in Figure 1-1. A user can select the input power source by using switch SW1 shown in Figure 1-1. It is required to keep the power jumper JP1 in connection, as shown in Figure 2-1.

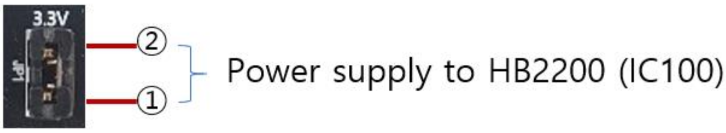


Figure 2-1. Power jumper JP1

2.2. Power sources

1. USB

The power for EVB2200 can be supplied through the Micro-USB connector shown in Figure 1-1**,** which is connected to a USB host device (e.g., personal computer (PC) or USB hub). Since the Micro-USB connector can be used as a UART port, it may be required to install a USB UART driver in an external PC.

2. External power supply

The power for EVB2200 can be supplied through adaptor J1 which is connected to an external power supply module.

3. PWM connector power

A PWM connector CN3 is provided to support IoT applications (e.g., smart LED lighting that may use PWM signal for dimming control). The power for EVB2200 can be supplied through connector CN3 which is connected to an external switching-mode power supply (SMPS) generating DC power in a voltage range of 4.5V ~ 21V.

The pin description for PWM connector CN3 and jumper JP2 is summarized in Figure 2-2, where the voltage level of the PWM signal can be controlled by jumper JP2. If pin3 and pin2 of JP2 are connected, the voltage level of the PWM signal is the same as that of the power source. For example, when a voltage level from the SMPS (i.e., pin1 of CN3) is 10V, the voltage level of the PWM signal (i.e., pin3 of CN3) is also 10V. If pin1 and pin2 of JP2 are connected, the output level of the PWM signal (i.e., pin3 of CN3) is fixed to a voltage level of 3.3V.

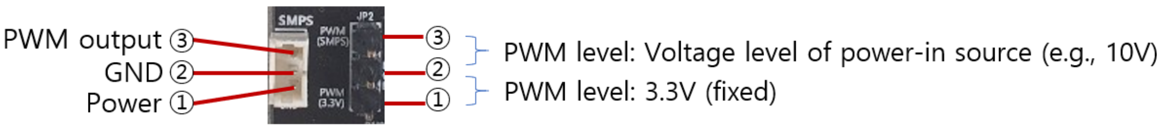


Figure 2-2. Control of PWM voltage level by jumper JP2

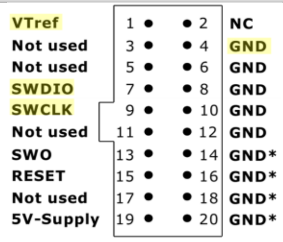
3. UART

The USB UART can support UART functions for EVB2200 operation. The USB UART can be connected to an external PC, equipped with USB driver software, through a USB cable. The download link for the USB UART driver is: https://www.ftdichip.com/Drivers/VCP.htm

4. Serial wire debug (SWD)

SEGGER J-Link is used as a basic debugger toolbox of EVB2200. The debugger port CN4 is a 4-pin male header with a pitch space of 2.54mm. Table 4-1 describes the definition of debugger port CN4.

Table 4-1. Pin name of the debugger port

SWD signal name	Pin no. in standard J-Link	J-Link pin map
VTref	1	
GND	4	
SWDIO	7	
SWCLK	9	

5. Buttons and LEDs

Five buttons and three LEDs are installed to support the management of EVB2200 operation.

- Reset button S1

  Button S1 can be used to reset the EVB2200 operation.

- Wake-up button S5

  Button S5 is connected to WKUP pin of HB2200 SoC. Binary files can be downloaded to HB2200 SoC in the in-system programming (ISP) mode. The ISP mode can be initiated by pressing the RESET button while pressing the WKUP button, as illustrated in Figure 5-1.

- User buttons S2, S3 and S4

  Buttons S2, S3 and S4, connected to P0[0], P0[1] and P1[3], respectively, are provided to support software development of IoT applications by users. Note that when the button is pressed, the GPIO is set to a low/0 status and vice versa.

- LEDs

  Three LEDs, D8, D9 and D10, are installed to display the status of EVB2200 operation, and they are connected to the GPIO as summarized in Table 5-2. Note that when the GPIO is set to a low/0 status, the LED is on and vice versa.

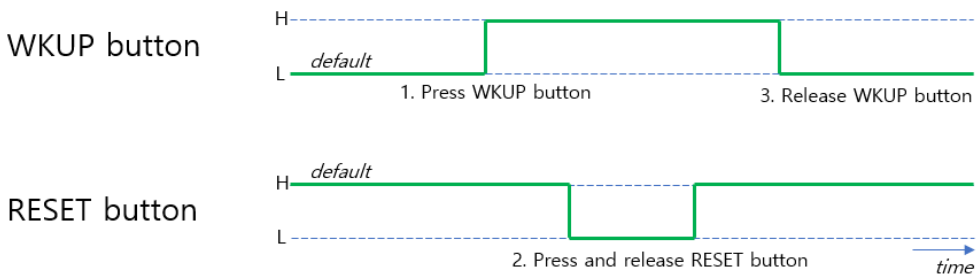


Figure 5-1. Operation mode change to the ISP mode

Table 5-1. GPIO connection of user buttons

Button	GPIO connection
S2	P0[0]
S3	P0[1]
S4	P1[3]

Table 5-2. GPIO connection of LEDs

LED	Color	GPIO connection
D8	Blue	P1[2]
D9	Green	P1[1]
D10	Red	P1[0]

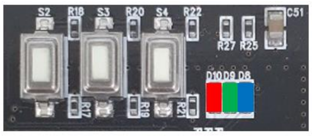


Figure 5-2. User buttons and LEDs

6. RF

EVB2200 can operate using one of two types of antennas; chip antenna or SMA connector

6.1. Chip antenna

A chip antenna, ACX AT7020, is installed in EVB2200 as the basic configuration. It can be used in most of application environments, unless special high transmit power is required.

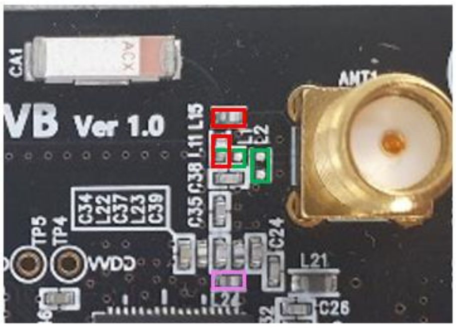
6.2. SMA connector

EVB2200 provides an SMA connector for the use of an external antenna in lieu of the chip antenna. In this case, it may be required to change the magnitude of **L24** to 6.2nH, remove **L11** and **L15**, and mount **L1** and **L2**. The reference magnitude of components is summarized in Figure 7-1.

7. GPIO pin header

Each GPIO pin in the GPIO pin header CN2 can be used according to user's requirements. For ease of application software development, the pin configuration of GPIO pin header is compatible to that of Raspberry Pi 3, as shown in Figure 7-2. When EVB2200 is combined with a Raspberry Pi 3 module, it can be powered through pin2 and pin4 (i.e., no other power source is required for EVB2200). UART, SPI and I2C can be used for communication between EVB2200 and Raspberry Pi 3 module. Refer to

Table 7-1 for the description of the pin distribution.



	L1	L2	L24	L11	L15
INT-CHIP	DNP	DNP	4.3nH	4.3nH	4.7nH
EXT-SMA	4.3nH	4.7nH	6.2nH	DNP	DNP

*component size: 1005

Figure 7-1. Chip antenna and SMA connector in EVB2200

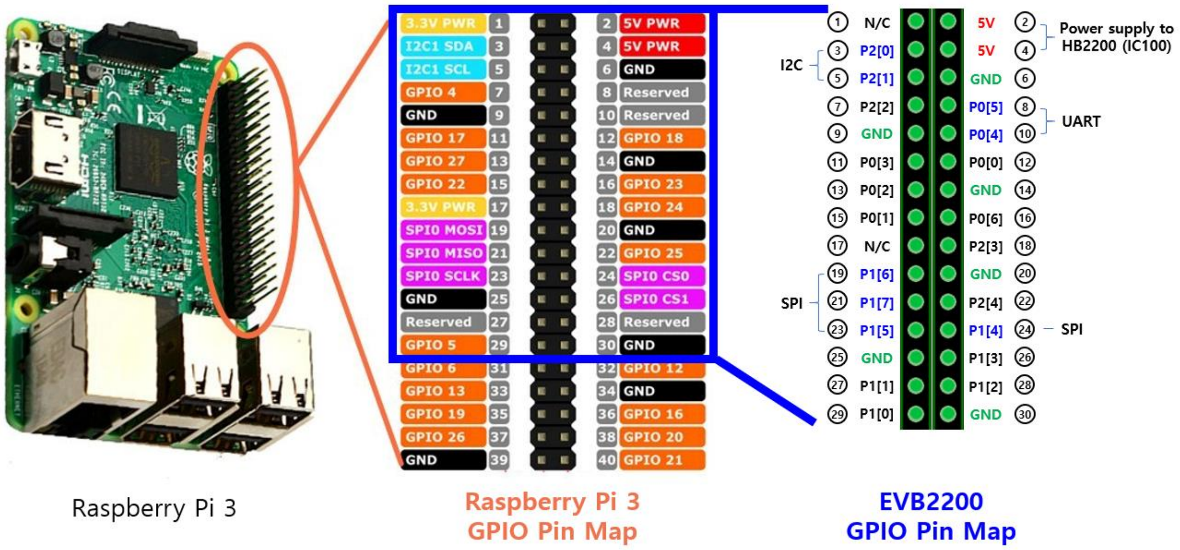
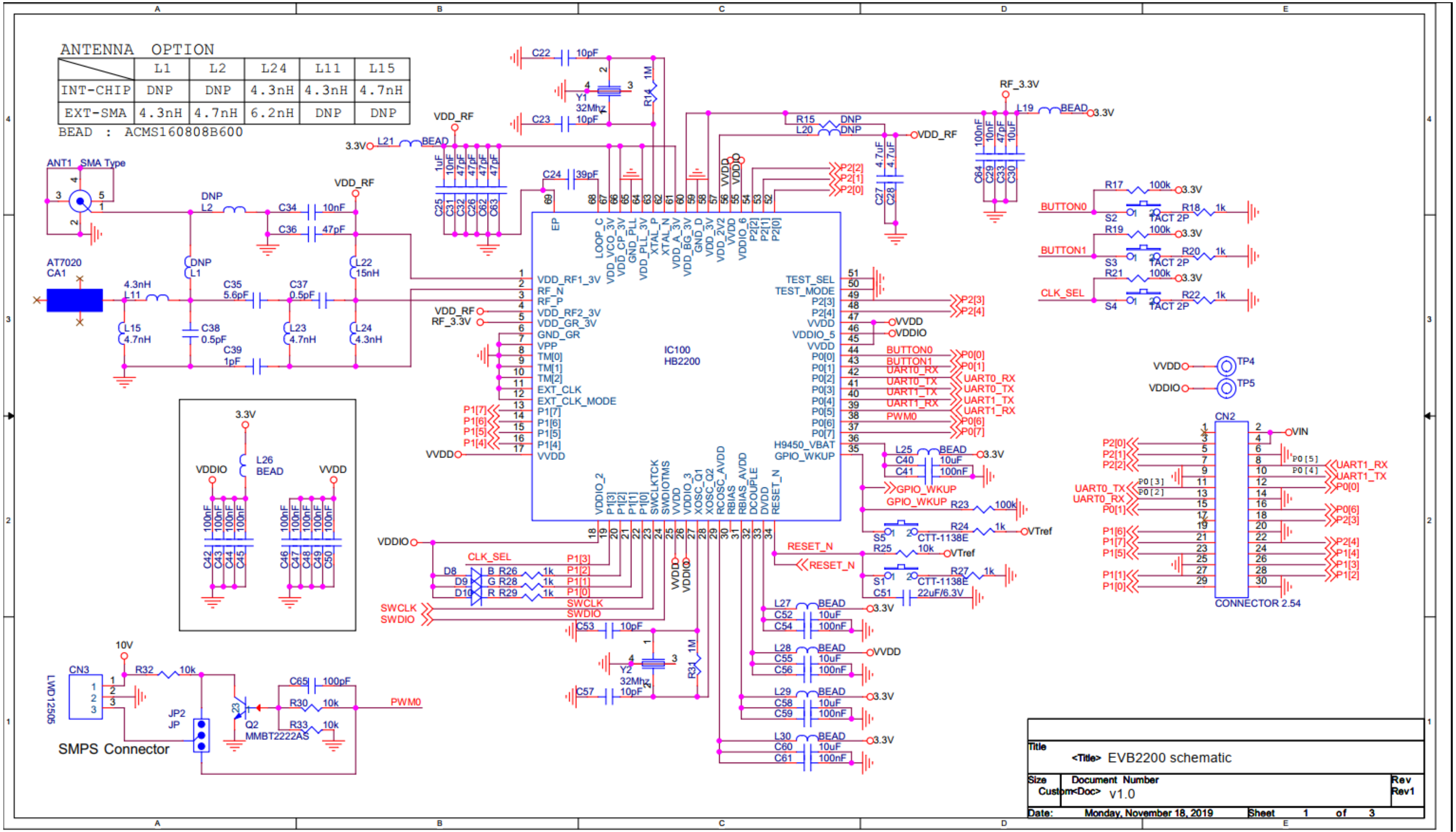


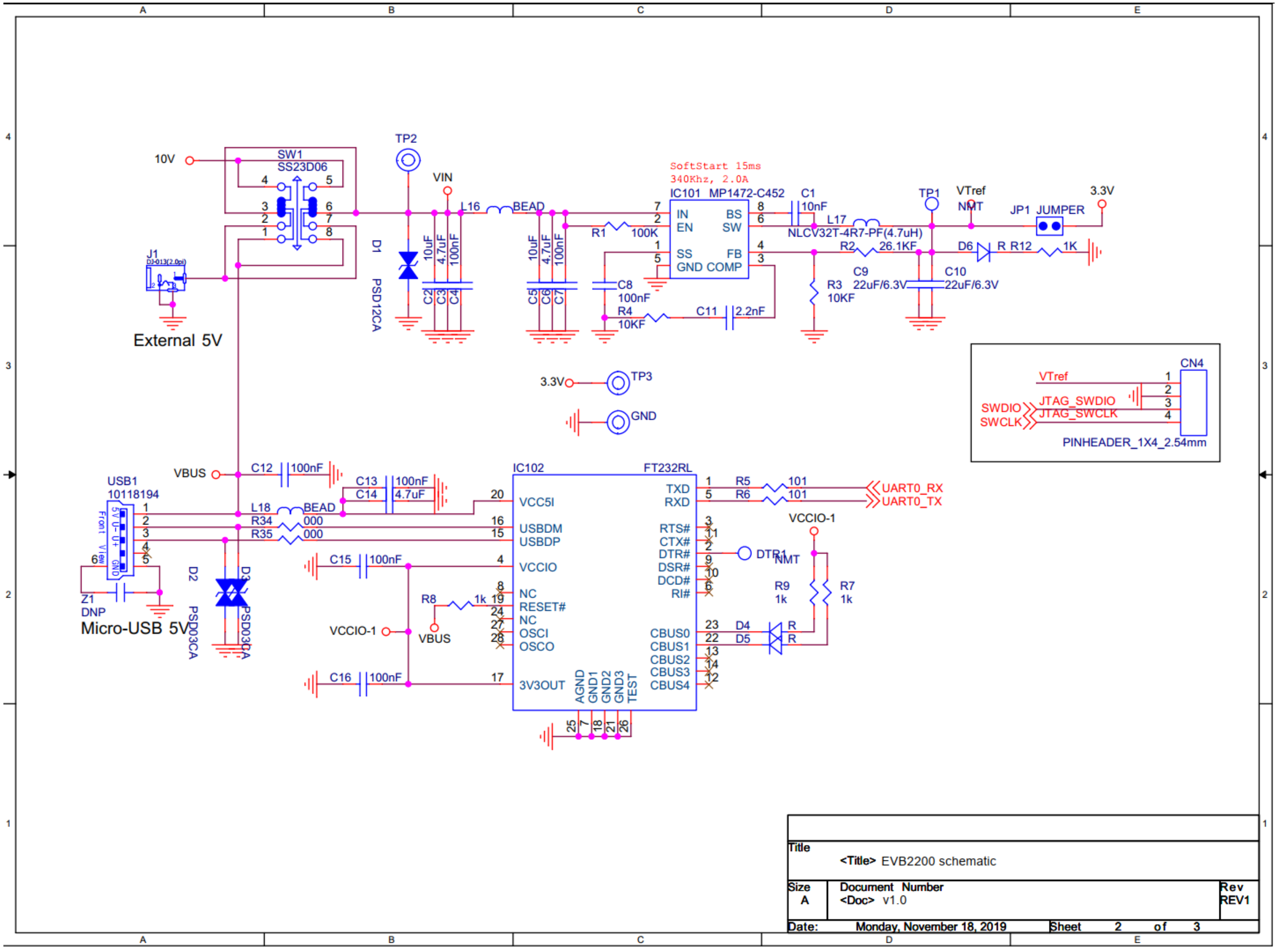
Figure 7-2. Pin configuration for connection with Raspberry Pi 3 module

Table 7-1. Pin description for connection with a Raspberry Pi 3 module

EVB2200		Raspberry Pi 3		Description
Pin no.	**Pin name**	**Pin no.**	**Pin name**	
1	N/C	1	3.3V PWR	Not used
2	5V	2	5V PWR	**Power-in**
3	P2[0]	3	I2C1_SDA	I2C
4	5V	4	5V PWR	**Power-in**
5	P2[1]	5	I2C1_SCL	I2C
6	GND	6	GND	Ground
7	P2[2]	7	GPIO 4	GPIO
8	P0[5]	8	Reserved	UART
9	GND	9	GND	Ground
10	P0[4]	10	Reserved	UART
11	P0[3]	11	GPIO 17	GPIO
12	P0[0]	12	GPIO 18	GPIO
13	P0[2]	13	GPIO 27	GPIO
14	GND	14	GND	Ground
15	P0[1]	15	GPIO 22	GPIO
16	P0[6]	16	GPIO 23	GPIO
17	N/C	17	3.3V PWR	Not used
18	P2[3]	18	GPIO 24	GPIO
19	P1[6]	19	SPI0_MOSI	SPI
20	GND	20	GND	Ground
21	P1[7]	21	SPI0_MISO	SPI
22	P2[4]	22	GPIO 25	GPIO
23	P1[5]	23	SPI0_SCLK	SPI
24	P1[4]	24	SPI0_CS0	SPI
25	GND	25	GND	Ground
26	P1[3]	26	SPI0_CS1	GPIO
27	P1[1]	27	Reserved	Not used
28	P1[2]	28	Reserved	Not used
29	P1[0]	29	GPIO 5	GPIO
30	GND	30	GND	Ground

8. EVB2200 circuit schematic diagram




10V
SW1
SS23D06
TP2
VIN
L16
BEAD
SoftStart 15ms
340Khz, 2.0A
IC101 MP1472-C452
C1
10nF
L17
NLCV32T-4R7-PF(4.7uH)
TP1
VTref
NMT
JP1 JUMPER
3.3V
R2 26.1KF
D6
R R12 1K
C9 22uF/6.3V
C10 22uF/6.3V
R3 10KF
R1 100K
C8 100nF
R4 10KF
C11 2.2nF
D1 PSD12CA
J1
External 5V
3.3V TP3
GND
CN4
VTref
SWDIO JTAG_SWDIO
SWCLK JTAG_SWCLK
PINHEADER_1X4_2.54mm
VBUS
C12 100nF
C13 100nF
C14 4.7uF
USB1
10118194
L18 BEAD
R34 000
R35 000
Z1
DNP
Micro-USB 5V
D2 PSD03CA
D3 PSD03CA
C15 100nF
C16 100nF
R8 1k
VCCIO-1
VBUS
IC102 FT232RL
VCC5I
USBDM
USBDP
VCCIO
NC
RESET#
NC
OSCI
OSCO
3V3OUT
AGND GND1 GND2 GND3 TEST
TXD
RXD
RTS#
CTX#
DTR#
DSR#
DCD#
RI#
CBUS0
CBUS1
CBUS2
CBUS3
CBUS4
R5 101
R6 101
UART0_RX
UART0_TX
VCCIO-1
DTR1
NMT
R9 1k
R7 1k
D4 R
D5 R
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IC100 : HB2200

Pin	Symbol	Bypass Cap.1	Bypass Cap.2	Component
1	VDD_RF1_3V	47pF	10nF	C36,C34
4	VDD_RF2_3V	47pF		C63
5	VDD_GR_3V	100nF		C64
57	VDD_2V2	4.7uF	4.7uF	C27,C28
58	VDD_3V	10uF		C30
60	VDD_BG_3V	47pF	10nF	C33,C29
61	VDD_A_3V	47pF		C26
64	VDD_PLL_3V	47pF		C32
66	VDD_CP	10nF		C31
67	VDD_VCO	1uF		C25

*Note: The path length between the bypass capacitors to each pin should be made as short as possible.

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