

# BC-USB-Kit Manual

First Edition

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1. Overview

BC-USB-Kit is a USB-gadget development kit, which is equipped with a micro controller of Microchip Technology Inc, PIC24FJ128GB202 (hereafter PIC) as MCU (Micro Control Unit). To use IDE and other PIC development kits, which are provided by Microchip Technology Inc, you can develop and debug firmware for USB gadgets on BC-USB-Kit.

Besides the USB connector, BC-USB-Kit is equipped with an EEPROM, a humidity and temperature sensor, a programmable LED, and a programmable switch. To use these on-board sensors, LED, and switch, you can develop an original USB gadget easily. Moreover, since BC-USB-Kit has expansion terminals (pins) including PIO and I<sup>2</sup>C, you can easily attach external sensors and display units for expanding the functions.

2. Specification

Absolute Maximum Ratings

	Value	Memo
Power Supply Voltage	-0.3~20V	Use the power supply line on USB connector (From 1 to 4 terminal (pin))
I/O Terminal Voltage (1)	-0.3~3.6V	Exclude 5V tolerant terminals (pins) <sup>*1</sup>
I/O Terminal Voltage (2)	-0.3~5.5V	Apply only 5V tolerant terminals (pins) <sup>*1</sup>
Operating Temperature	0~ 80°C	No dew condensation

<sup>\*1</sup> For more information of 5V tolerant pins, please look at the section of "5. Pin Assignment."

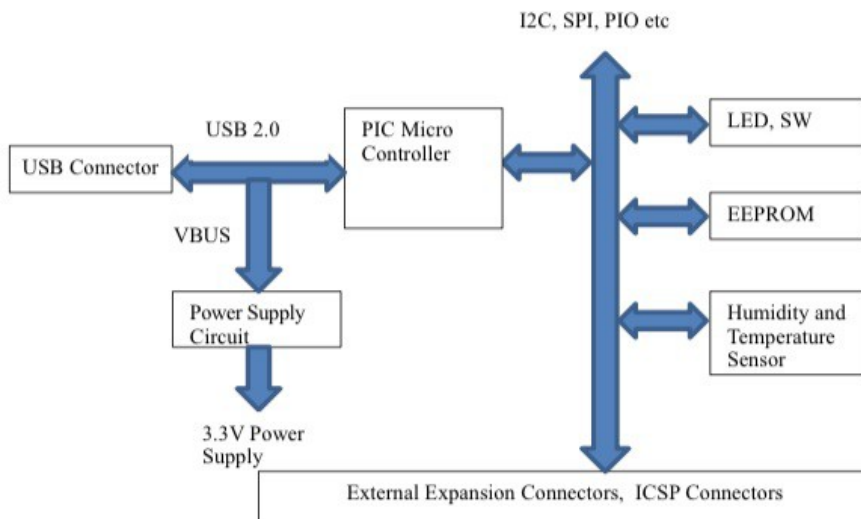
Absolute maximum ratings do not mean the operational limit of BC-USB-Kit. These are actual limits of hardware. If values of inputs exceed the values of these ranges, some part or whole of BC-USB-Kit function would be failed permanently. The failures do not always happen as the values of inputs surpass the ranges. However, please set the input values carefully, and do not exceed the ranges momentarily.

Operating Ratings

	Minimum	Standard	Maximum	Memo
Power supply voltage (VBUS)	4	5	5.5	V (BUS bus power supply voltage)
H level input voltage	2.3		3.6	V
L level input voltage	0		0.9	V
H level output voltage	2.8		3.3	V
L level output voltage	0		0.3	V

3. Simplified Block Diagram

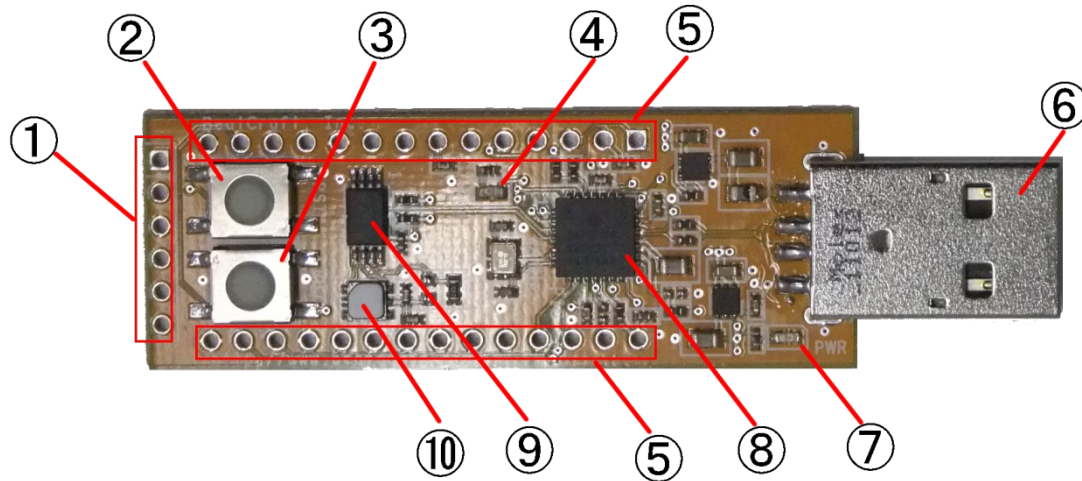
The simplified block diagram of BC-USB-Kit is shown below.



- ※ EEPROM and the humidity and temperature sensor is connected via I<sup>2</sup>C.
- ※ Because of Peripheral Pin Select (PPS), (re)mapping function of PIO, many devices can connect to the peripheral circuit, which is built into PIC.
- ※ The modes that this USB 2.0 supports are Low Speed and Full Speed.

#### 4. Names of Parts

The names of major parts of BC-USB-Kit



No.	Name	Ref	Memo
1	ICSP Connection Terminals	J2	Terminals that are connected to ICD3 and PICKit3
2	Reset Button	SW1	A switch for resetting PIC
3	User Programable Button	SW2	A user programable switch
4	User Programable LED	D1	A user programable LED
5	Expansion Terminals (Pins)	J1	To connect to other external devices for expansion J1 terminals are paired with the opposite side of pins
6	USBTypeA Connector (Male)	P1	A connector that connects to a USB port of PC
7	LED Power Indicator	D2	LED that indicates power supply (users are not accessible)
8	PIC Micro Controller	U1	PIC24FJ128GB202 micro controller
9	EEPROM	U2	1Mbits EEPROM via I2C access
10	Humidity & Temperature Sensor	U3	Humidity & temperature sensor via I2C access

- ※ LED power indicator (D2) eliminates as power is supplied
- ※ Reset Button (SW1) is connected to the reset of PIC. Once you push down the button, PIC is reset.
- ※ Number 1 to 6 terminals (pins) at J1 are paralleled to Number 1 to 6 terminals (pins) at J2. Please use only either pins at J1 or J2. (Never use both these pins of J1 and J2, simultaneously)
- ※ To use the terminals at J1 with a bread board, DIP-28P (a connection IC socket 28P) is required.

#### 5. Pin (Terminals) Assignment

BC-USB-Kit has a set of DIP-28 pin size connection terminals and a set of 6-pin pin-header size connection terminals.

DIP-28 pin (terminal) connector (J1)

#	Function/Name	Memo	
1	<i>MCLR</i>	Parallel to J2	
2	VIO	Parallel to J2	
3	GND	Parallel to J2	
4	PGED1	Parallel to J2	
5	PGEC1	Parallel to J2	
6	NC		
7	VIO		
8	SCL2	Exclusive to I2C (2ch)	
9	SDA2	Exclusive to I2C (2ch)	
10	GND		
11	TMS/RPB5/USBID/RB5		●
12	NC		
13	TDI/RPB7/CTED3/PMD5/INT0/RB7	(RB7)	●
14	GND		
15	GND		
16	TCK/RPB8/SCL1/CTED10/PMD4/RB8	( <i>UART-CTS</i> )	●
17	CVREFOUT/AN10/C3INB/RPB14/VBUSON/SCK1/CTED5/RB14	( <i>UART-RTS</i> )	
18	GND		
19	AN11/RPB13/CTPLS/PMRD/RB13	(UART-RX)	
20	AN9/C3INA/RPB15/SCK2/CTED6/PMCS1/RB15	(UART-TX)	
21	VIO		
22	GND		
23	PGED3/VREF+/CVREF+/AN0/C3INC/RPA0/CTED1/PMD7/RA0		
24	PGEC3/VREF-/CVREF-/AN1/RPA1/CTED2/PMD6/RA1		
25	SOSCI/RPB4/RB4		●
26	SOSCO/RPA4/T1CK/CTED9/PMA1/RA4		●
27	VIO		
28	VBUS		

This mark "●" indicates that it is a 5V tolerate terminal.

6-pin pin header connector

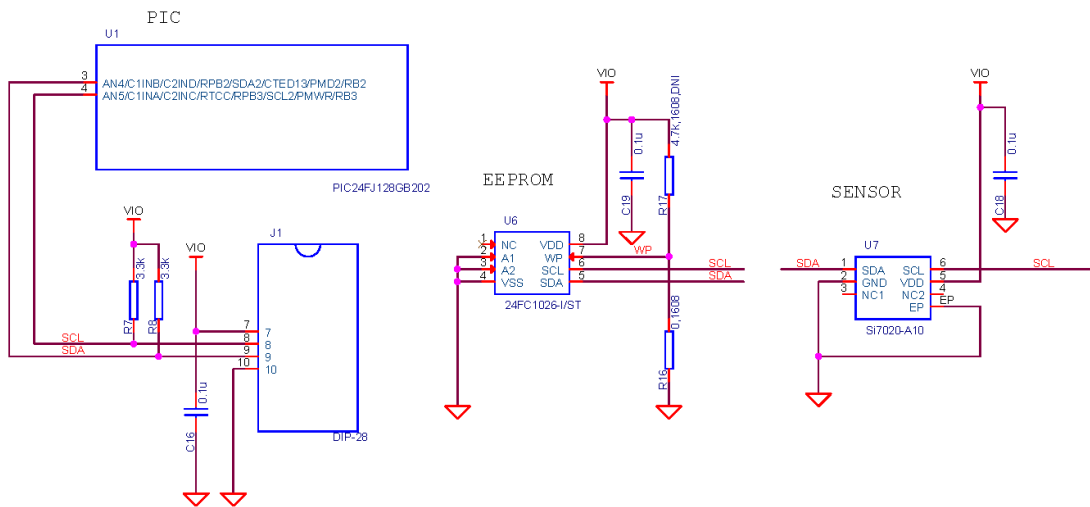
#	Name	Memo
1	<i>MCLR</i>	Parallel to J1
2	VIO	Parallel to J1
3	GND	Parallel to J1
4	PGED1	Parallel to J1
5	PGEC1	Parallel to J1
6	NC	

- ※ From the number 1 to number 6 pin header of DIP-28 pin connector (J1) is parallel to the number 1 to number 6 terminal at J2.  
When you use a programming tool such as PICKit 3 and MPLAB ICD3, please connect only one tool to either J1 expansion terminals (#1~#6) or J2 communication terminals (#1~#6). Never use both terminals with programming tools simultaneously.
- ※ VIO is the power supply line for the PIC micro controller and I/O signals. This power line is supplied DC 5V from the power supply line of USB bus (VBUS).
- ※ VBUS is the DC 5V line at the power supply line of USB bus.
- ※ Power of BC-USB-Kit is supplied from the USB bus, which is attached to the USB connector of BC-USB-Kit.
- ※ The functions of J1 are selected by Peripheral Pin Select (PPS), I/O pin mapping function of PIC24FJ. For more information, please read the manual and data sheet of PIC24FJ, which are available at the web site of Microchip Technology, Inc.





## 9. I<sup>2</sup>C

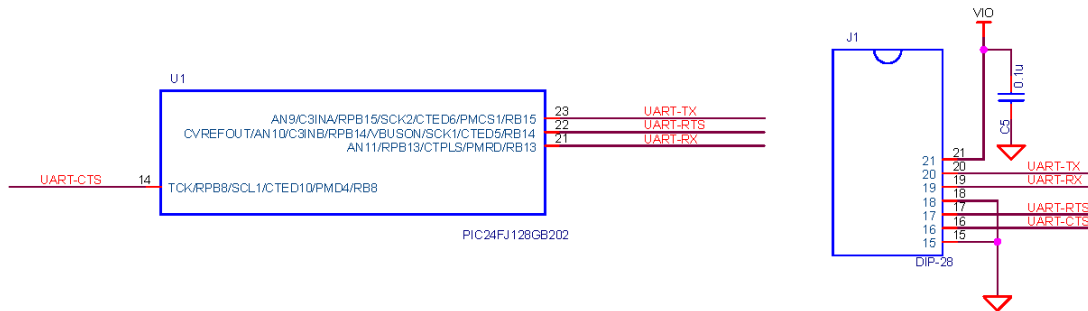


BC-USB-Kit is equipped with EEPROM and the humidity and temperature sensor on board, and these are connected to built-in I<sup>2</sup>C2 module inside PIC. Because of these connections, the terminals of I<sup>2</sup>C2 are reserved to I<sup>2</sup>C devices and cannot be used for other devices. The lines of SDA/SCL are pulled up by a 3.3k $\Omega$  on board resistor. To connect BC-USB-Kit to external devices, please use the listed four pin connectors at DIP-28. Since these pins are lined side by side, you can effortlessly access to the pins.

EEPROM is a 1Mbit serial ROM. Its I<sup>2</sup>C device addresses are fixed at 0x50 and 0x51. The I<sup>2</sup>C device address of the humidity and temperature sensor is fixed at 0x40. When you add I<sup>2</sup>C devices externally, please avoid these reserved I<sup>2</sup>C addresses.

Pin # at J1	Name	Memo
7	VIO	3.3V power supply
8	SCL	I <sup>2</sup> C clock
9	SDA	I <sup>2</sup> C data
10	GND	GND

## 10. UART



BC-USB-Kit uses UART at 3.3V -CMOS level. To use Peripheral Pin Select (PPS), I/O pin mapping function of PIC, the lines are allocated for devices. These terminals can be assigned for other functions if UART function and hardware flow are not specified at these terminals. To assign pins for UART, the mapping listed below is recommended. To use the mapping, you can access the pins, which are lined side by side. If you wish to use other pins, you can assign other pins to UART. To use UART1, please refer the configurations of resistors listed in the table below.

Pin# at J1	Name	Resistor	Value	Memo
15	GND	-		GND
16	$\overline{CTS}$	RPINR18<13:8>	8	
17	$\overline{RTS}$	RPOR7<5:0>	4	
18	GND	-		GND
19	$\overline{RX}$	RPINR18<5:0>	13	
20	$\overline{TX}$	RPOR7<13:8>	3	
21	VIO	-		3.3V

## 11. Analog Input

To use ADC, which is built inside the PIC micro controller, BC-USB-Kit can do AD conversion. The pins listed below are assigned for analog inputs of BC-USB-Kit.

Since the reference voltage terminals are assigned for other tasks, these are not available for BC-USB-Kit.

Pin# at J1	Name
19	AN7
20	AN9

## 12. Secondary Oscillator

BC-USB-Kit is not equipped with any secondary oscillator. To use a secondary oscillator, please input 32768Hz clock at the 26 pin.

## 13. Primary Oscillator

The 24MHz crystal oscillator is attached to OSCI/OSCO terminal. To use this on-board crystal oscillator for the USB function, please configure that 48MHz clock is provided for the USB module , which is built in the PIC micro controller.

- 4MHz clock will be needed after it passes PLL Prescaler PLLDIV<3:0>. Therefore,  $\div 6$  (PLLDIV<3:0> = 0101) is selected at PLL Presaler.
- The frequency of System Clock, which is output from PLL, depends on how to handle 32MHz at CPU Divier CPDIV<1:0>.



14. Reference

- PIC24FJ128GB204 FAMILY DataSheet  
Microchip Technology Inc.
- 16-bit MCU and DSC Programmer's Reference Manual  
Microchip Technology Inc.
- MPLAB® X IDE User Guide  
Microchip Technology Inc.
- Atmel AT24CM01 I2C-Compatible (2-wire) Serial EEPROM 1Mbit DATA SHEET  
Atmel
- Si7020-A10 I2C HUMIDITY AND TEMPERATURE SENSOR  
Silicon Laboratories

15. Appendix -Schematics and Layout drawing

Please look at the Japanese version of this document.