

SM21xx User's Manual

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Revision History:

#	Version	Author	Created / modified on	Details of the changes made
1	0.1	PDD	9 October 2009	Created initial draft.
2	1.0	PVR	12 October 2009	Replaced pictures, made minor aesthetic changes.

LIST OF ABBREVIATIONS

SPJETPL **SPJ Embedded Technologies Pvt. Ltd.**
DB **Daughter Board**

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1 Introduction

This is user's manual for SM21xx series Modules from SPJ Embedded Technologies. The module offers a quick way to use LPC microcontrollers for any application. This module supports LPC2138 and LPC2148 from ARM7 family by NXP. Hence, this is a combined User's Manual for all above microcontrollers.

CAUTION: These modules contain components that are sensitive to Electrostatic Discharge (ESD). The module must be handled carefully, so as not to subject it to ESD. As far as possible, do not touch any conducting part on the module – including any component or connector pins – as this may damage parts of the module permanently. If you must touch any of the parts, make sure to discharge yourself to earth. Parts damaged due to ESD are not covered by the limited warranty.

2 Module Specifications:

2.1 Hardware specifications:

- Supported microcontrollers: LPC2138 and LPC2148.
- All these microcontrollers are ARM7TDMI architecture.
- On-chip 512KB ISP flash, 32KB SRAM for SM2138 and 32+8KB for SM2148. This is enough for many applications like Instrumentation, PID loop controllers and Data acquisition etc.
- Supply voltage required: 5VDC (minimum 4.75V, maximum 5.25V). The microcontroller chip itself operates on 3.3V, but the module includes a small voltage regulator that produces 3.3V from 5V.
- Power consumption: 65 mA @ 5VDC (Crystal Oscillator= 12MHz, CPU speed = 48MHz Peripheral speed = 48MHz).
- Module includes crystal for main clock. Default operating speed is 12MHz; can be boosted up to 60MHz using on-chip PLL.
- Module includes power-on reset circuit as well as push-button for manual reset.
- All port pins (up to 45 for SM2148 and up to 47 for SM2138 GPIO including JTAG) pins available on connector.
- All digital I/O pins are 5V tolerant.
- RS232 (3 wire) on separate connector, useful for In-System-Programming or any other purpose. Separate 2-pin berg is included for selecting ISP Program mode.
- Other interfaces: Two I2C configurable as Master or Slave; Two SPI master or slave; Two UARTs one with full modem support.
- Module includes I2C compatible 64KB EEPROM (AT24C512) for non-volatile data storage.
- Also includes crystal (32.768KHz) for on chip RTC. Battery for RTC backup maybe connected externally. Module connector has pins for connecting external battery (3VDC only).
- Analog Inputs: Two ADCs, up to 16 ADC channels (8 channels per ADC), 10 bit resolution, with conversion time as low as 2.44uS per channel. On board 3.3V is connected to VREF pin.
- Analog outputs: One DAC output, 10-bit resolution.
- Compact footprint, 35 mm X 45 mm. Module has 2 through-hole connectors (2 mm pitch dual row male pins), each with 38 pins (2 rows of 19 pins).
- Operating Temperature Range: By default 0°C to +70°C, Extended temperature range on request.

2.2 Support:

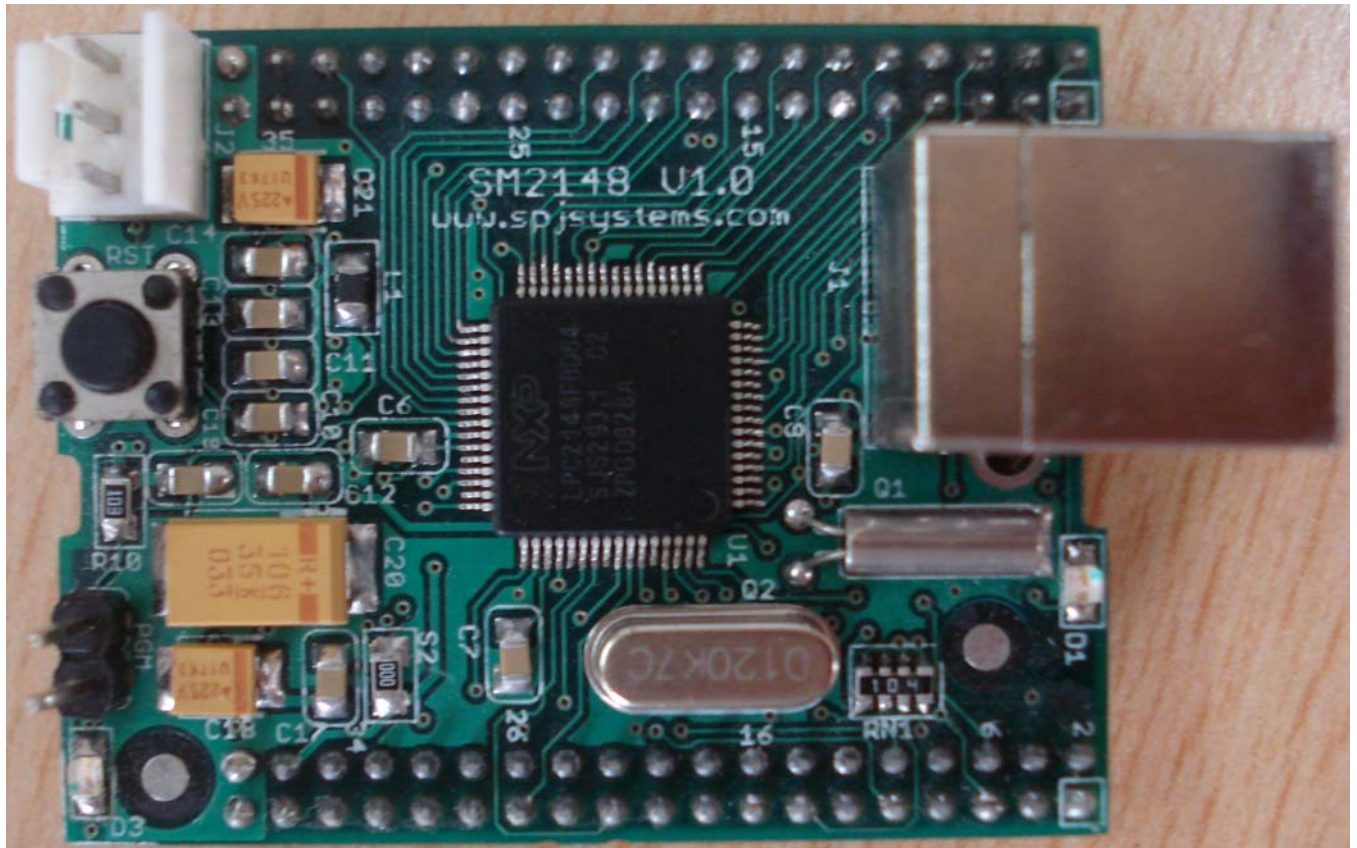
- EAGLE libraries available, so module can be used as a component in your EAGLE schematic and PCB. Similar libraries will be soon made available for other CAD packages.
- Sample programs of many useful functions available.

2.3 Optional accessories:

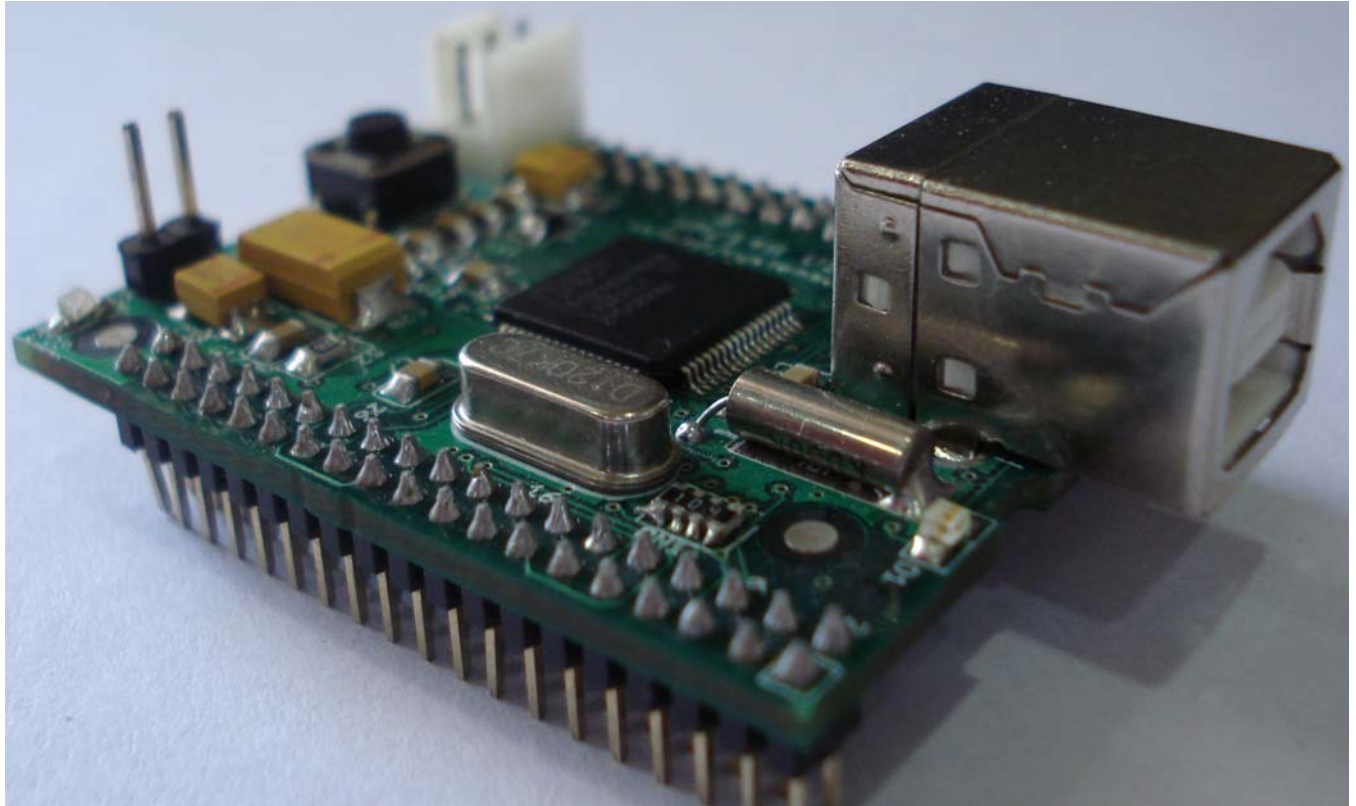
- Serial Cable: This is a small cable with 3 pin connector on one side – compatible with the module; and DB9 female connector on the other side – compatible with a computer's COM port. This is very useful for programming the module, with the help of programming software running on computer. Flash programming software utility is available from NXP web-site. We recommend to use FlashMagic as a flash programming tool.
- SM-BaseBoard: Has sockets compatible with the SM21xx modules. The BaseBoard provides some prototyping area as well as connectors in more standard format – for example DB9 for RS232.

3 Module photos:

3.1 As seen from top:



3.2 3D view:



4 Connectors and Switches:

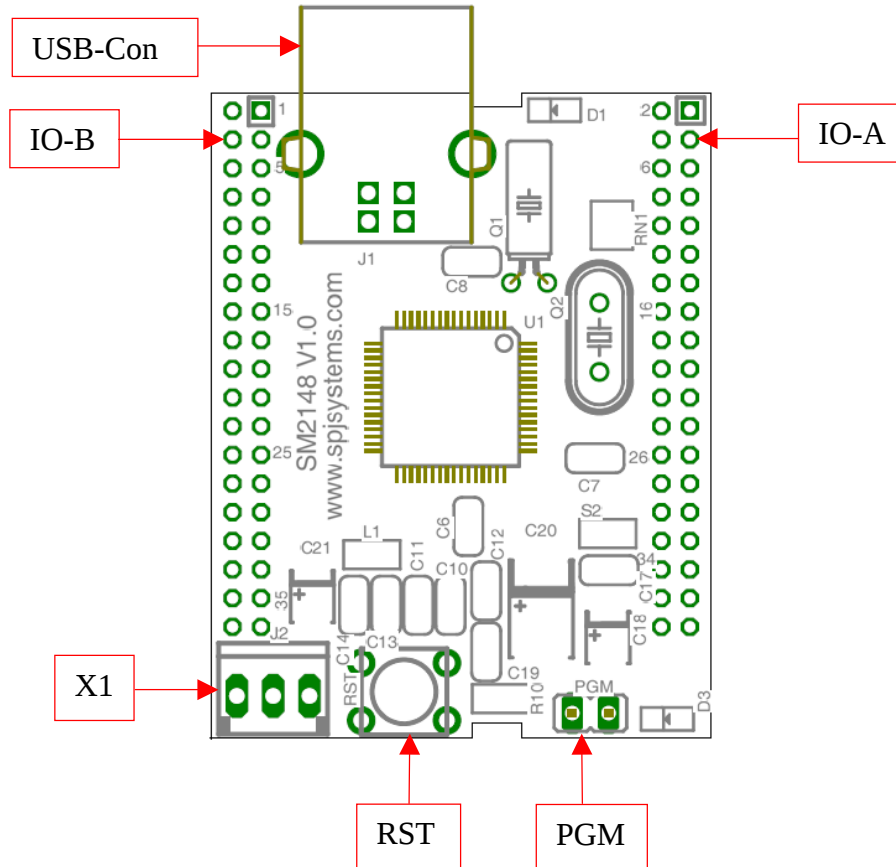


Figure1: Component locations on SM2138 and SM2148 modules.

4.1 Connector description:

Locations of various connectors are shown in Figure 1 and Figure 2.

4.1.1 IO-A

It is a 19 x 2 male header, with it's pins protruding down from the bottom of module. Many pins have same meaning across both modules, but some have different meaning, as shown below:

Pin #	SM2138 signal	SM2148 signal
1	+5V	+5V
2	+VBAT	+VBAT
3	+3V3	+3V3
4	AVDD	AVDD
5	RS232-RXD	RS232-RXD
6	RS232-TXD	RS232-TXD
7	NC	NC
8	NC	NC
9	P1.26/RTCK	P1.26/RTCK
10	P1.31/NTRST	P1.31/NTRST
11	NRST	NRST
12	P1.27/TDO	P1.27/TDO
13	P1.29/TCK	P1.29/TCK
14	P1.28/TDI	P1.28/TDI
15	P1.30/TMS	P1.30/TMS
16	NC	NC
17	NC	NC
18	NC	NC
19	P0.17	P0.17
20	P0.18	P0.18
21	P0.19	P0.19
22	P0.20	P0.20
23	P0.21	P0.21
24	P0.22	P0.22
25	P0.23	P0.23
26	P0.25	P0.25
27	NC	NC
28	NC	NC
29	NC	NC
30	NC	NC
31	NC	NC
32	NC	NC
33	NC	NC
34	NC	NC
35	AGND	AGND
36	AGND	AGND
37	DGND	DGND
38	DGND	DGND

4.1.2 IO-B

It is a 19 x 2 male header, with it's pins protruding down from the bottom of module. Many pins have same meaning across all 4 modules, but some have different meaning, as shown below:

Pin #	SM2138 signal	SM2148 signal
1	P1.16	P1.16
2	P1.17	P1.17
3	P1.18	P1.18
4	P1.19	P1.19
5	P0.28	P0.28
6	P0.29	P0.29
7	P0.30	P0.30
8	P0.31	P0.31
9	P0.0	P0.0
10	P0.1	P0.1
11	P0.2	P0.2
12	P0.3	P0.3
13	P0.4	P0.4
14	P0.5	P0.5
15	P0.6	P0.6
16	P0.7	P0.7
17	P0.8	P0.8
18	P0.9	P0.9
19	P0.10	P0.10
20	P0.11	P0.11
21	P0.12	P0.12
22	P0.13	P0.13
23	P0.14	P0.14
24	NC	NC
25	P0.26	D+
26	P0.27	D-
27	NC	NC
28	NC	NC
29	P0.15	P0.15
30	P0.16	P0.16
31	P1.25	P1.25
32	P1.24	P1.24
33	P1.23	P1.23
34	P1.22	P1.22
35	P1.21	P1.21
36	P1.20	P1.20
37	DGND	DGND
38	DGND	DGND

CAUTION: All signals on IO-A and IO-B connectors are directly pins of ADuC702x processor and **NOT** all the pins are **5V tolerant**. Users must take care that voltage on these pins shall never exceed 3.3V or Vref or 5V (as the case maybe for individual pin), as it may cause permanent damage to the module.

4.1.3 X1:

It is a 3 pin connector which has RS-232 signals.

Pin #	Signal
1	RS232-TXD
2	RS232-RXD
3	DGND

4.2 Switches description:

4.2.1 RST

This is a push-button for “user reset”. Pressing this switch momentarily will apply a reset pulse to the RST pin of LPC21XX.

4.2.2 PGM

This is a two-pin berg connector to enable “In System Programming”. Refer to next section for usage of this connector as a programming switch.

5 Downloading user program into module and running it:

The LPC21xx micro-controllers include on-chip flash for storing user program and non-volatile data. LPC2148 and LPC2138 have 512KBytes flash. This flash is In-System-Programmable (ISP). Therefore it is possible to download user program into on-chip flash of LPC2148/LPC2138, through serial port connected to PC.

For doing so place jumper in berg strip shown as "PGM". (For more details about PGM jumper please refer to "Connectors and Switches" section above). This section describes how to use the software Flash Magic to download program into on-board microcontroller.

5.1 Download program using Flash Magic into SM21xx

Install FlashMagic. Run the FlashMagic from start menu.

In Flash Magic go to Options -> Advanced Options-> Hardware Config. Disable "Use DTR and RTS to control RST and PSEN". Click on OK.

1. Connect the serial cable (supplied with the board) from SM21XX board to any com port of PC.
2. Place jumper in PGM connector. Switch ON power to the SM21xx.
3. Do proper settings in Flash Magic (COM Port: COM1 (if other choose it), Baud Rate: 38400, Device: LPC2148, Interface: None (ISP), Enable "Erase blocks used by Hex File", Browse the file which you want to download) and click on Start button.
4. Flash Magic will download the program. Wait till download finishes.

5.2 Running user program from flash

1. After downloading the program remove the jumper PGM.
2. Either press reset button or switch OFF the board and again switch ON. You can see output according to the program.

Note: Flash Magic can be used to download the program into other Philips Microcontrollers also. See the list in Flash Magic itself.

6 Using SM21xx Module in your hardware:

6.1 If you use EAGLE for schematic capture and PCB design:

We provide an EAGLE library, which contains these modules as if they were components. Name of this library is SM702x.lbr. It can be downloaded from our web-site. It has 2 components named SM2138 to SM2148. Each component has appropriate symbol. Footprint (package) for all these components is same.

To integrate this module in your hardware, simply create a schematic in EAGLE and add one of the 2 modules into it. It's footprint will automatically appear in corresponding PCB. You may complete PCB design as usual. When PCB is fabricated, you may solder 2 mm pitch female sockets (dual row 19X2 pins each) on it and then simply plug-in the module into the female sockets.

6.2 If you use some other software:

See below mechanical drawing of the module. Note that it is same for all 4 modules. However, pin connections (of IO-A and IO-B connectors) maybe different for different modules, as described above. You may design your PCB according to this mechanical drawing and the pin connections described above.

