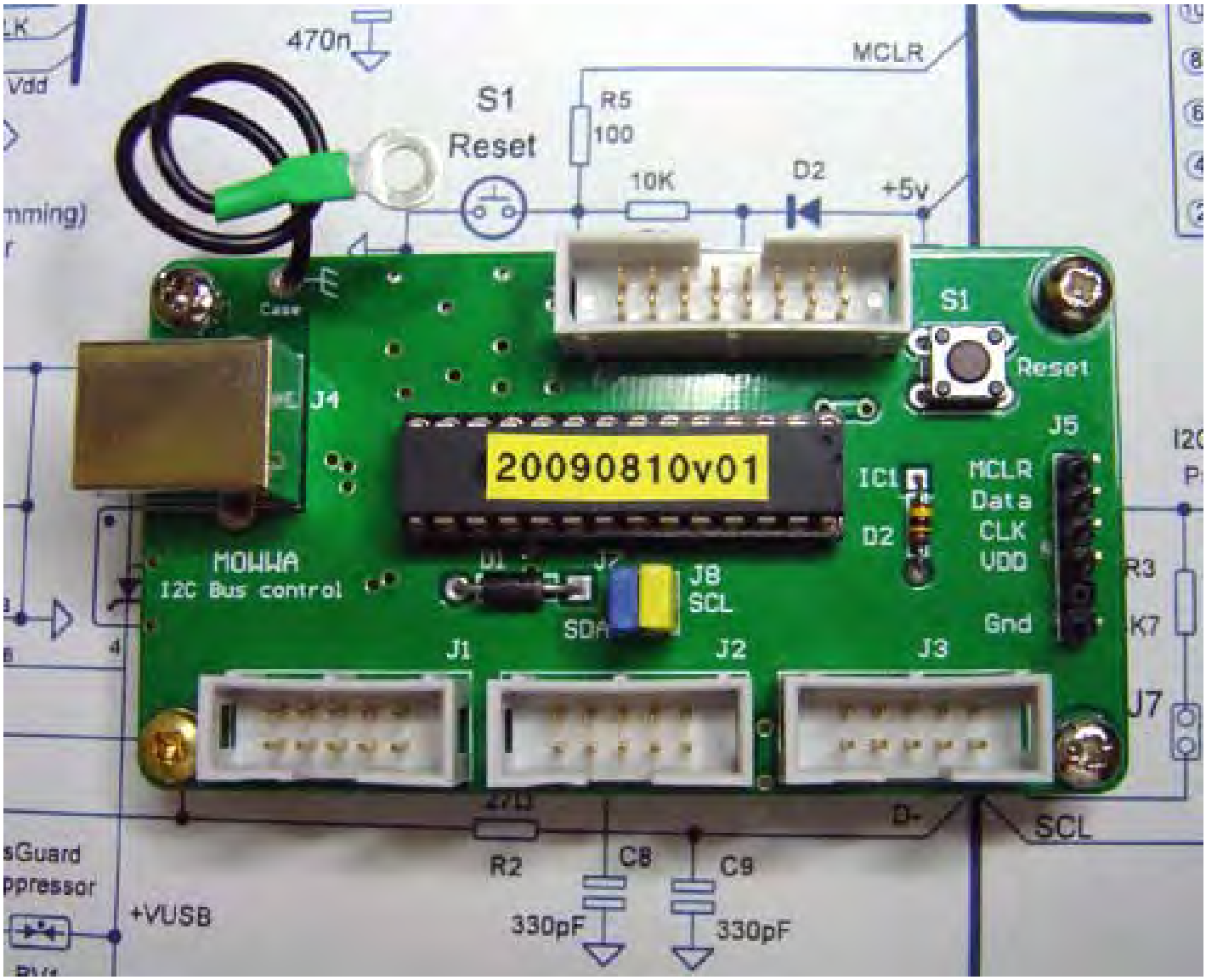
M0WWA



Front-End USB-I2C control module
Manual

version 01. September 2009

Preventing Electrostatic Discharge Damage

There is no climate or work location where the components of your Front-End USB-I2C control module are safe from Electrostatic Discharge (ESD) unless you take specific steps to prevent such damage.
Many of the components in your Front-End USB-I2C control module can be damaged by static discharges of only a few volts far too little for you to notice. It is those low-voltage but destructive discharges that easily happen anywhere and under virtually any environmental conditions.
ESD damage may not be apparent at first. The damaged components may not fail completely. Instead, the damage may result in below-normal performance for an extended period of time before you experience a total failure.

How ESD Damage Occurs

Whenever an object containing a static charge touches a circuit in your Front-End USB-I2C control module, current will rush into the circuit until the components reach the same voltage as the source of the static charge.
If the voltage or current that passes through a component in your Front-End USB-I2C control module during that brief period exceeds its normal operating specifications, it may be damaged or destroyed.

Preventing ESD Damage

ESD damage cannot occur if there is no voltage difference between the components in your Front-End USB-I2C control module and any object that touches them.
That is how anti-static packaging works. Anti-static bags allow the static charge to flow over their surface, so that any part of the bag that touches the components inside are all at the same potential at all times.
Anti-static foam keeps the leads of sensitive components at the same potential.
At your work bench, avoiding a dangerous voltage is achieved most easily by tying everything together and connecting them to a common mains safety ground. This includes your Front-End USB-I2C control module, individual board or other sensitive components as well as everything they may touch at the work table.
Inexpensive static dissipating work mats are readily-available that will steadily and safely drain off any charges built up on parts or circuit board placed on them.
They are supplied with a lead that connects the mat to the common workbench ground.
Also, metal cabinets on test equipment used on the bench should be tied togetherand connected to the common ground.
Most importantly, you must have a way of continuously draining off any static charges that occur on your body. Such charges are easy to create, even while sitting quietly at the work bench. Moving your feet on the floor, shifting position in your chair or even moving your arms so that clothing rubs against itself can all produce destructive static charges. You can discharge yourself by touching an unpainted metal ground, but that will last only until you move in a way that produces a new static charge. The safest technique is to wear a grounded wrist strap with a series 1-megohm resistor that continuously drains off any charges. Such wrist straps are readily available and inexpensive.

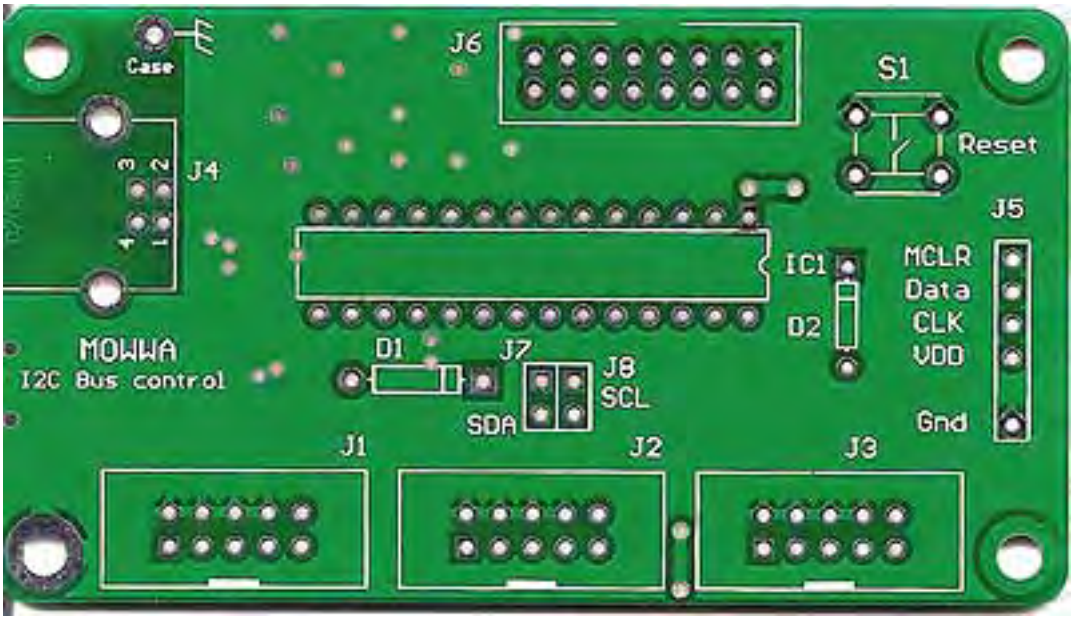
WARNING

DO NOT attach a ground directly to yourself without a current-limiting resistor as this poses a serious shock hazard.
A wrist strap must include a 1-megohm resistor to limit the current flow.
If you choose to touch an unpainted, metal ground to discharge yourself, do it only when you are not touching any live circuits with your other hand or any part of your body.
I strongly recommend you take the following anti-static precautions to avoid trouble:
- Leave ESD-sensitive parts in their anti-static packaging until you install them. The packaging may be a special plastic bag or the component's leads may be inserted in conductive foam. Parts which are especially ESD-sensitive are identified in the parts list and in the assembly procedures.
- Wear a conductive wrist strap with a series 1-megohm resistor. If you do not have a wrist strap, touch a ground briefly before touching any sensitive parts to discharge your body. Do this frequently while you are working. You can collect a destructive static charge on your body just sitting at the work bench. DO NOT attach a ground directly to yourself as this poses a serious shock hazard.
- Use a grounded anti-static mat on your work bench.
- Be sure the iron is ESD-safe with a grounded tip tied to the same common ground used by your mat or wrist strap.

Preparing for Assembly

Overview

The Front-End USB-I2C control module comprises one PCB assembly.
The figure shows the high-quality double-sided plated through hole bare PC board.



Tools Required

You will need the following tools to build the kit:
• Fine-tip temperature-controlled ESD-safe soldering station with grounded tip 370-430°C (700 to 800°F) lonf life type no greater than 1 mm. Use the temperature-controlled station.
• IC-grade, small-diameter solder wire no more that 0.7mm in diameter. Small diameter solder is important to avoid filling adjacent solder pads and creating solder bridges.
• DO NOT use acid-core solder wire or water-soluble flux solder.
• High quality Flux pen solder such as Electrolube.
• Flux residue remover.
• Fine tips tweezers.
• Small diagonal cutters. Flush-cutting type.
• Magnifying visor or magnifying glass with a hands-free stand.
• Desoldering tools and supplies are invaluable. Narrow solder wick or a good vacuum desoldering are recommended.
• Digital Multimeter (DMM)
The following tools are strongly recommended:
- ESD wrist strap.
- Static dissipating work mat.

Soldering and Desoldering

Use adequate ventilation when soldering; avoid inhaling smoke or fumes. Always wash your hands after handling solder, as lead residue is highly toxic.
When applying solder, use the minimum amount required to surround the component lead and make good contact with its printed-circuit pad. You don't need a "fillet" (build-up) of solder. This will avoid unwanted solder bridges.
The solder must flow onto both the component lead and its PC board pad. To ensure that both will be heated at the same time, the tip of the iron should contact both the component lead and the PC board pad before solder is applied.
Solder joints should be clean and shiny. If a joint appears dull or has fine cracks, it is probably cold.
Cold solder joints should be cleaned and re-soldered. First, use solder wick (desoldering braid) to remove the old solder. Then apply fresh solder. If you have many cold solder joints, it probably indicates that your soldering iron temperature is too low, or that the tip or solder itself is defective.
The Front-End USB-I2C control module uses ROHS compliance high-quality double-sided PC board.
Removing components can be difficult, since you must get all of the solder back out of the hole before a lead can be removed.
To do this, you'll need solder wick (desoldering braid) and/or a vacuum desoldering tool. It also takes some practice. A number of suggestions are provided below.
The best strategy for avoiding de-soldering is to place all components properly the first time. Double-check values and orientations, and avoid damaging parts via ESD.

When removing components:

- Don't pull a lead or pin out of a hole unless the solder has been removed or you are applying heat. Otherwise you can literally pull the plating out of the plated-through hole.
- Limit soldering iron contact to a few seconds at a time.
- Use small-size solder-wick. Use the wick on both the top and bottom padswhen possible. This helps get all of the solder out of the hole.
- If you use a vacuum desoldering tool (solder sucker), use a large unit. Small solder suckers are not very effective.
- The safest way to remove ICs and other components with more than 3 leads is to clip all of the pins at the body of the device first, then remove all of the pins individually. You may damage pads and traces by trying to remove such components intact.
- Invest in a PC board vice with a heavy base if possible. This makes parts removal easier because it frees up both hands.

Unpacking and Inventory

Preventing Electro-Static Discharge Damage

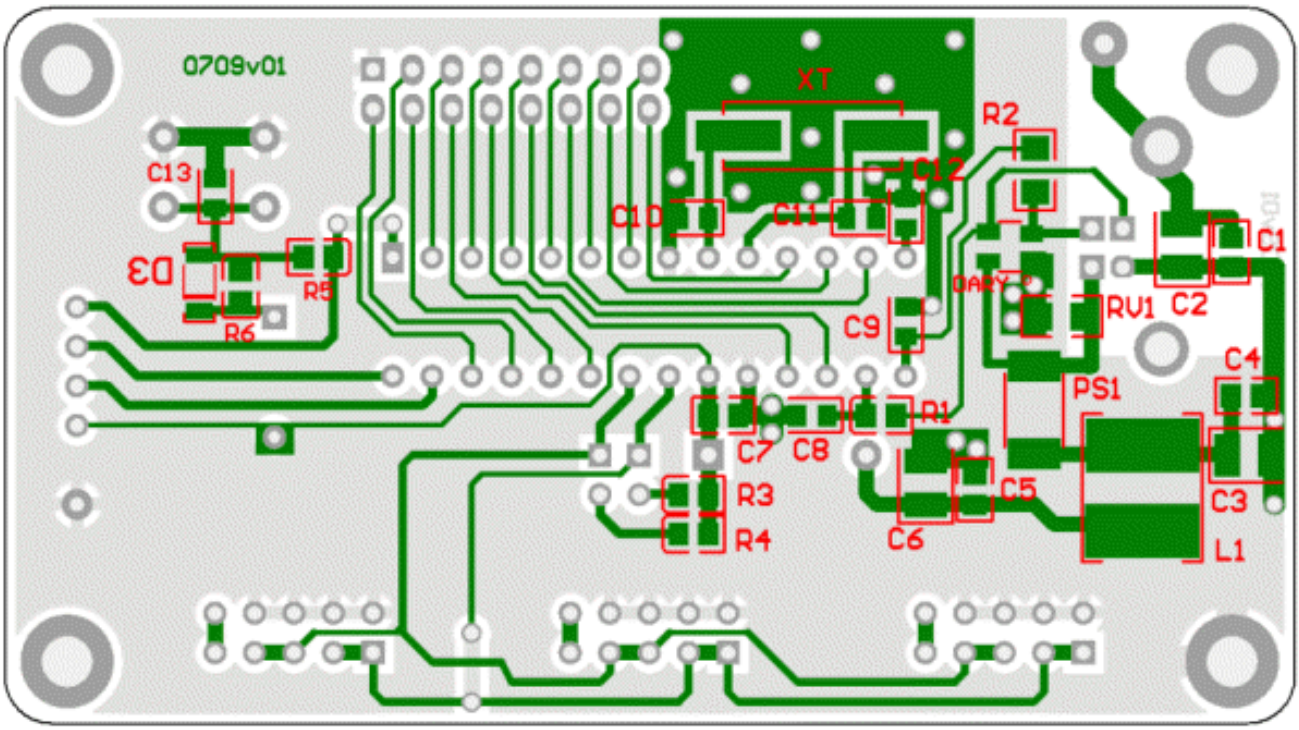
The PIC 18F2455 microcontroller used in the Front-End USB-I2C control module is sensitive to Electro-Static Discharge (ESD) damage.
ESD damage may not make the circuit fail completely. Sometimes the unit may continue to operate somewhat, creating a very difficult-to-find problem. We strongly recommend that you take the following precautions whenever handling the PC board when the microcontroller is installed.
The precautions are listed in their order of importance:
1. Leave the microcontroller in its anti-static packaging until you install it.
2. Wear a conductive wrist strap with a 1-megohm series resistor when handling the microcontroller or the board with it installed. If you do not have a wrist strap, frequently touch an unpainted ground while working. You can collect a destructive charge on your body just sitting at the work bench.
Do not attach a ground directly to yourself as this poses a serious shock hazard.
3. Use an ESD-safe soldering iron with a grounded tip.
4. Use a grounded anti-static mat on your work bench.
Before starting construction, do a complete inventory, comparing the parts in your kit with the parts list to familiarize yourself with all of the parts and to ensure the kit is complete.

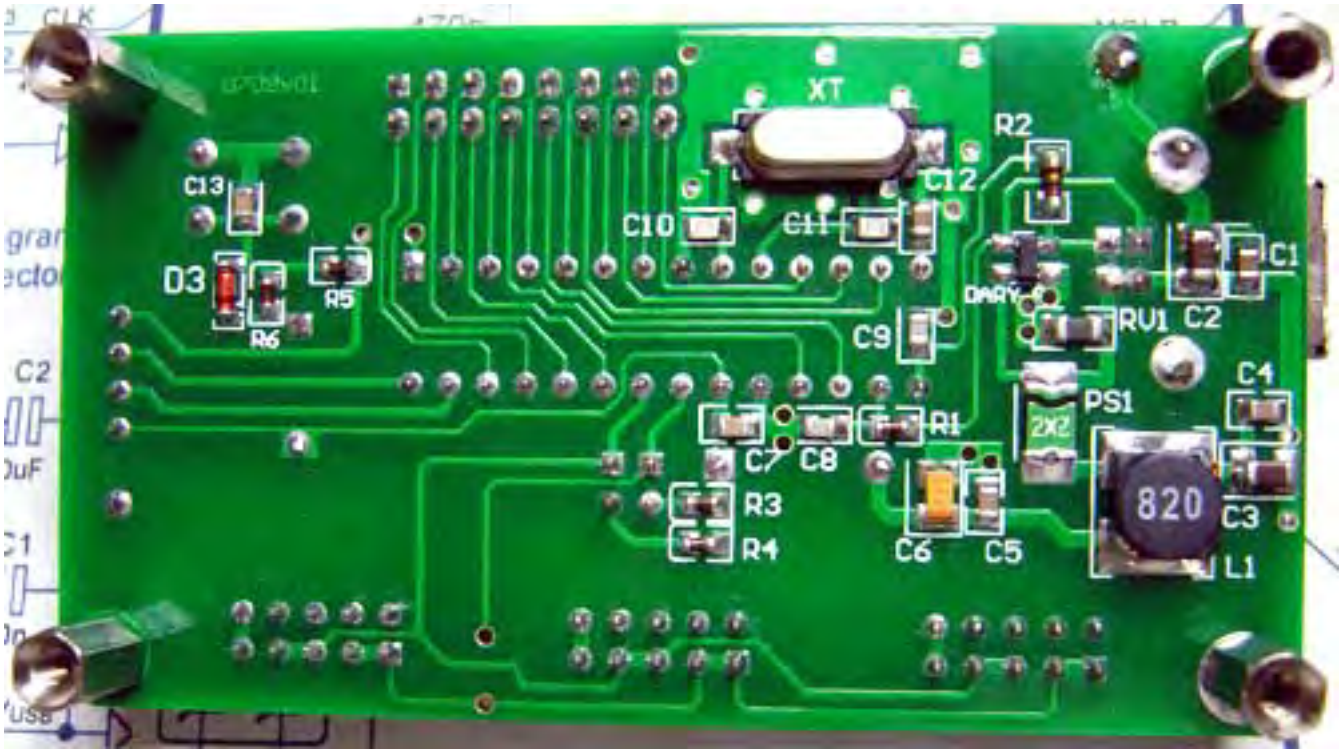
Front-End USB-I2C control module. Bill of materials.

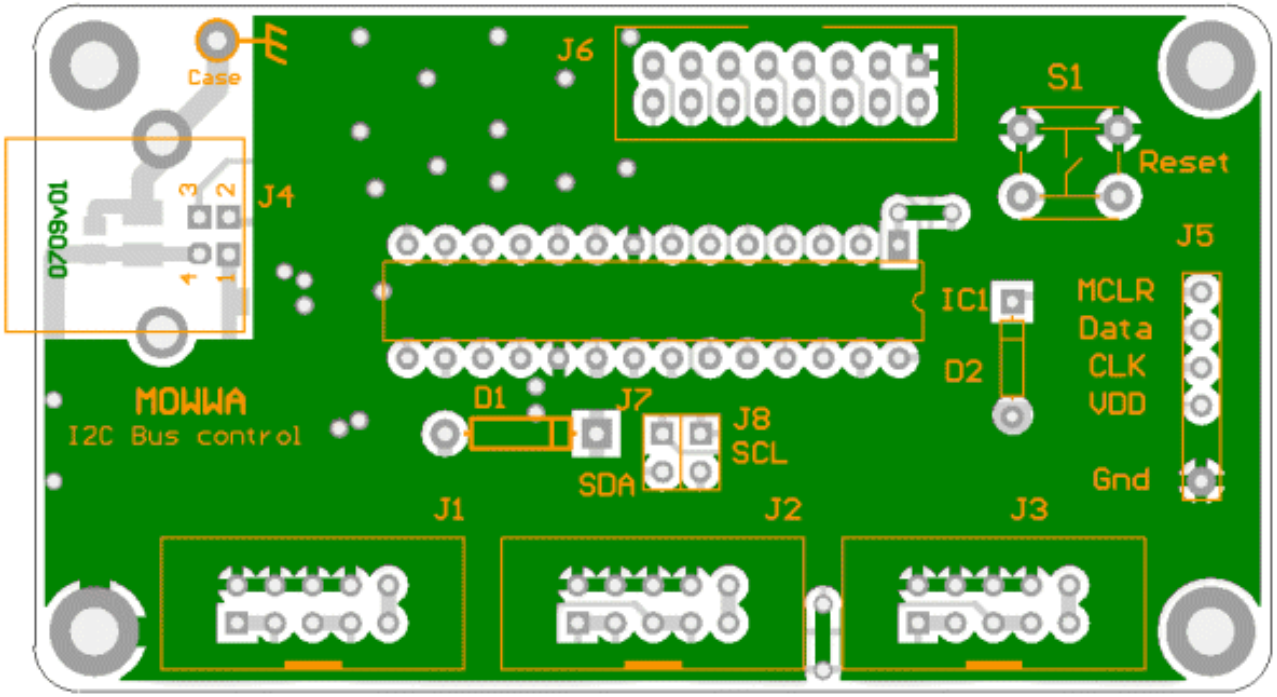
Type	Reference	Description	Quantity
SMD resistor	R1	270 Ohms 0805-1%	1
SMD resistor	R2	270 Ohms 1206-1%	1
SMD resistor	R3, R4	4K7 Ohms 0805-1%	2
SMD resistor	R5	100 Ohms 0805-1%	1
SMD resistor	R6	10K Ohms 0805-1%	1
Chip cap	C1	10n/50V 0805	1
Chip cap	C2, C3	10uF/16v 1206	2
Chip cap	C4,C5,C7,C13	100nF/50v 0805	4
Tantalum cap	C6	22uF/16V	1
Chip cap	C10,C11	27pF/50V 0805	2
Chip cap	C12	470n/50V 0805	1
IC	U1	PIC 18F2455 PDIP	1
Diode Array	Dary	SP0503	1
Diode	D1	1N5817 Schottky axial	1
Diode	D2	1N4148 axial	1
Diode SMD	D3	1N4148 MELF	1
SMD	RV1	5V6/1206 Transient Suppressor	1
SMD	PS1	Polyswitch/0.22 Amp	1
SMD	L1	SMD POWER INDUCTOR 82UH	1

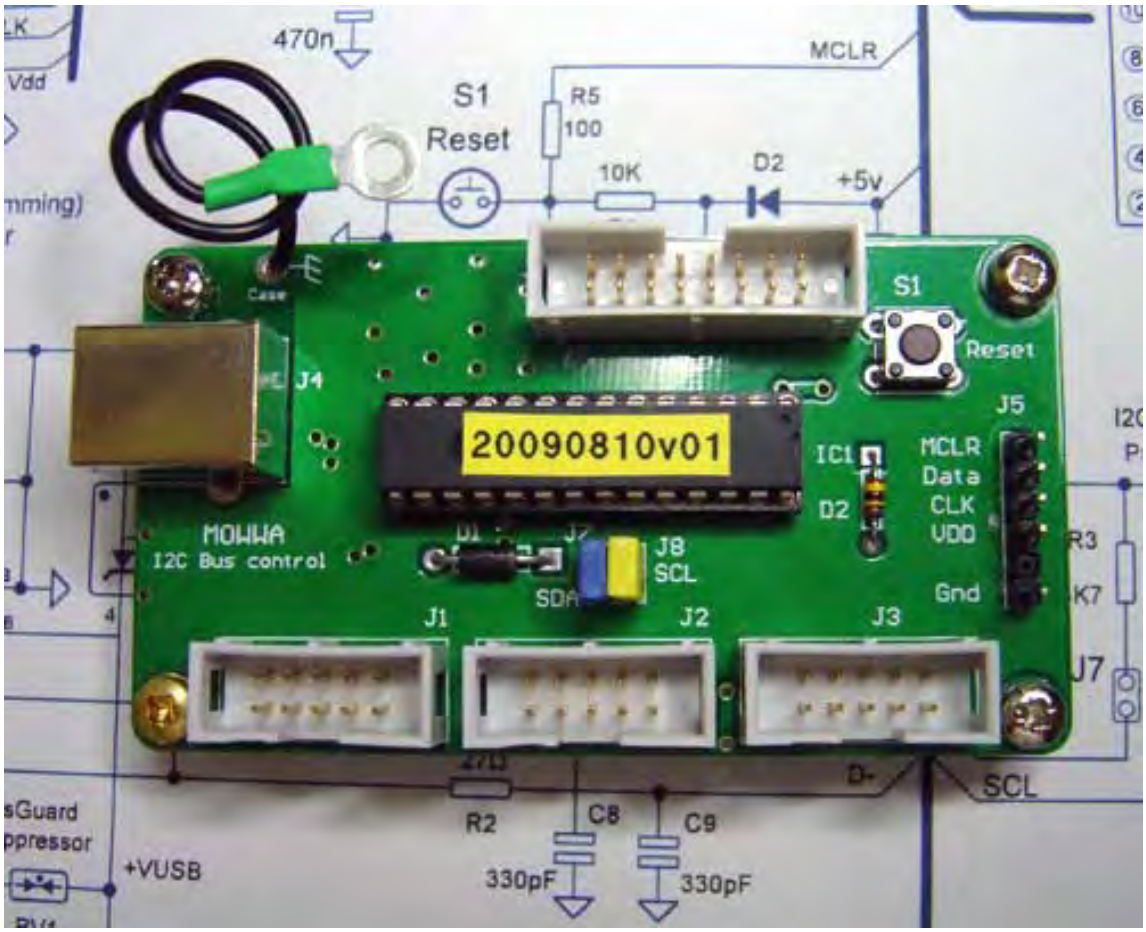
USB Adapter & Power Converter. Bill of materials.

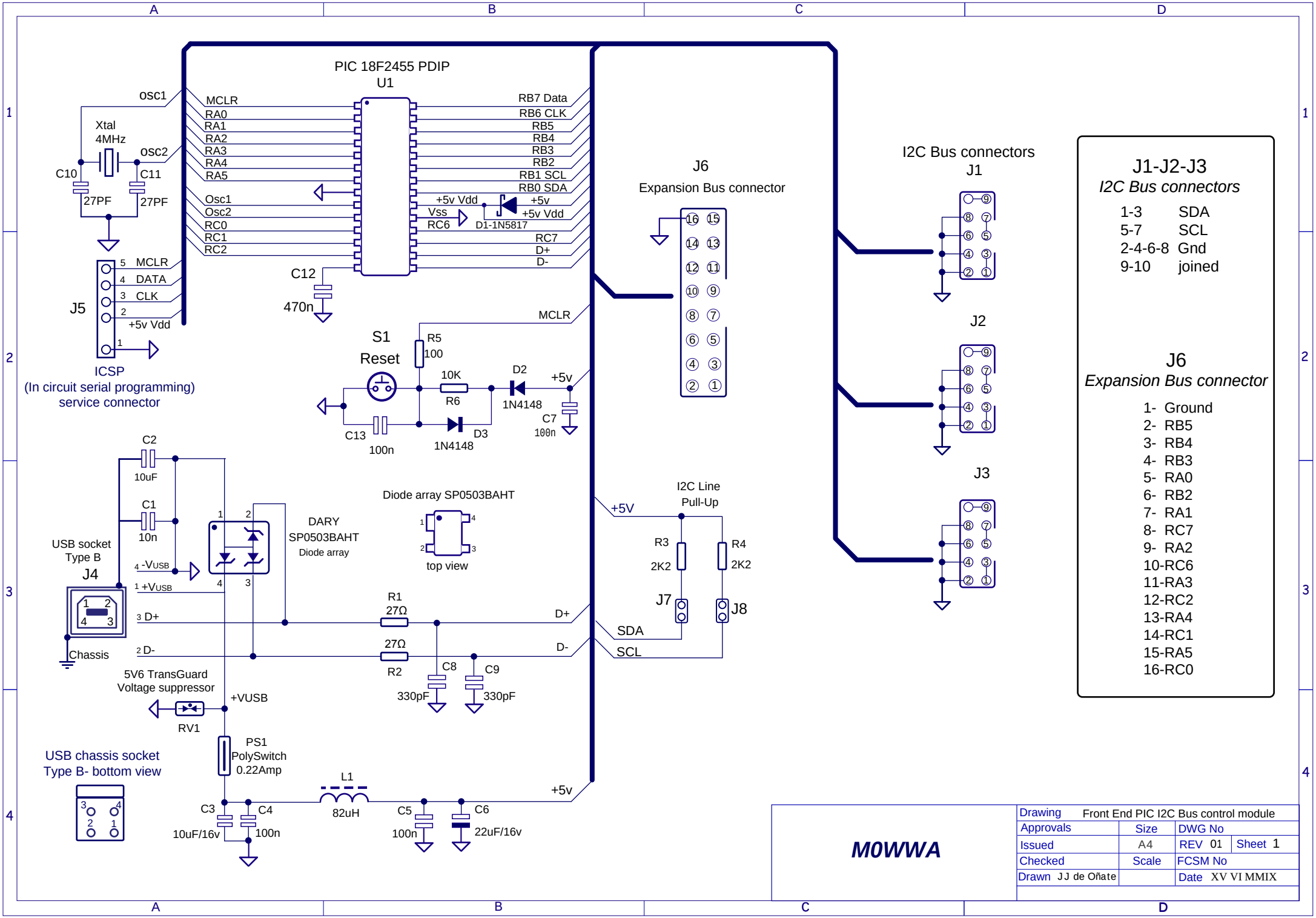
Type	Reference	Description	Quantity
SMD	XT	4MHz ACT HC49/US-SMX	1
Header	J1,J2,J3	IDC Headers 10 vias	3
Socket	J4	USB socket type B	1
Header	J5	Single row Header 4+1 pins	1
Header	J6	IDC Header 16 vias	1
Header	J7,J8	Double row Header 2+2 pins	1
Jumper		2.54mm Jumper link	1
Switch	S1	Tactile switch	1
Socket		28 pins PDIP IC socket	1
Spacers	Hex.	M3x8mm.	4
Screws		M3x6mm.	4
Washers		M3	4
Tag		Case cable tag	1
PCB		Bare PCB	1

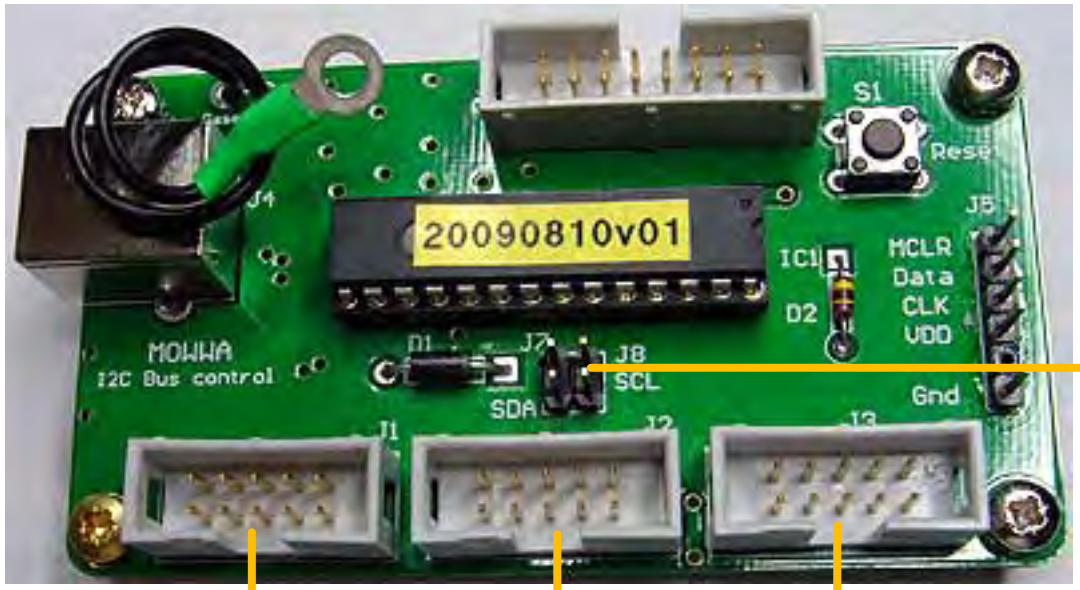

0709v01
XT
R2
C13
C12
C10
C11
C1
D3
R5
R6
C9
RV1
C2
C4
PS1
R1
C7
C8
C3
R3
C5
R4
C6
L1


XT
R2
C13
C12
C10
C11
C1
D3
R5
R6
C9
RV1
C2
C4
PS1
R1
C7
C8
R3
R4
C6
C5
820
C3
L1


Case
J6
S1
Reset
J4
J5
IC1
MCLR
Data
CLK
VDD
D2
D1
J7
J8
SCL
SDA
Gnd
MOWWA
I2C Bus control
J1
J2
J3


470n
MCLR
S1
Reset
R5
100
10K
D2
+5v
20090810v01
J4
J5
IC1
MCLR
Data
CLK
VDD
D2
MOWWA
I2C Bus control
J8
SCL
SDA
Gnd
J1
J2
J3
R2
C8
C9
330pF
330pF
+VUSB
SCL


PIC 18F2455 PDIP
U1
MCLR
RA0
RA1
RA2
RA3
RA4
RA5
Osc1
Osc2
RC0
RC1
RC2
RB7 Data
RB6 CLK
RB5
RB4
RB3
RB2
RB1 SCL
RB0 SDA
+5v Vdd
Vss
RC6
+5v
+5v Vdd
D1-1N5817
RC7
D+
D-
OSC1
OSC2
Xtal
4MHz
C10
C11
27PF
27PF
C12
470n
J5
5 MCLR
4 DATA
3 CLK
2 +5v Vdd
1
ICSP
(In circuit serial programming)
service connector
S1
Reset
R5
100
10K
R6
D2
1N4148
+5v
C7
100n
C13
100n
D3
1N4148
J6
Expansion Bus connector
16 15
14 13
12 11
10 9
8 7
6 5
4 3
2 1
I2C Bus connectors
J1
J2
J3
J1-J2-J3
I2C Bus connectors
1-3 SDA
5-7 SCL
2-4-6-8 Gnd
9-10 joined
J6
Expansion Bus connector
1- Ground
2- RB5
3- RB4
4- RB3
5- RA0
6- RB2
7- RA1
8- RC7
9- RA2
10-RC6
11-RA3
12-RC2
13-RA4
14-RC1
15-RA5
16-RC0
C2
10uF
C1
10n
USB socket
Type B
J4
4 -VUSB
1 +VUSB
3 D+
2 D-
Chassis
DARY
SP0503BAHT
Diode array
Diode array SP0503BAHT
top view
R1
27Ω
R2
27Ω
C8
330pF
C9
330pF
D+
D-
I2C Line
Pull-Up
+5V
R3
2K2
R4
2K2
J7
J8
SDA
SCL
5V6 TransGuard
Voltage suppressor
RV1
+VUSB
PS1
PolySwitch
0.22Amp
L1
82uH
C3
10uF/16v
C4
100n
C5
100n
C6
22uF/16v
+5v
USB chassis socket
Type B- bottom view
M0WWA
Drawing Front End PIC I2C Bus control module
Approvals
Issued
Checked
Drawn JJ de Oñate
Size
A4
Scale
DWG No
REV 01
Sheet 1
FCSM No
Date XV VI MMIX



Do not install SDA-SCL jumpers

I2C BUS line

I2C BUS line

I2C BUS line

I2C Slave
no pull-up resistors

I2C Slave
no pull-up resistors

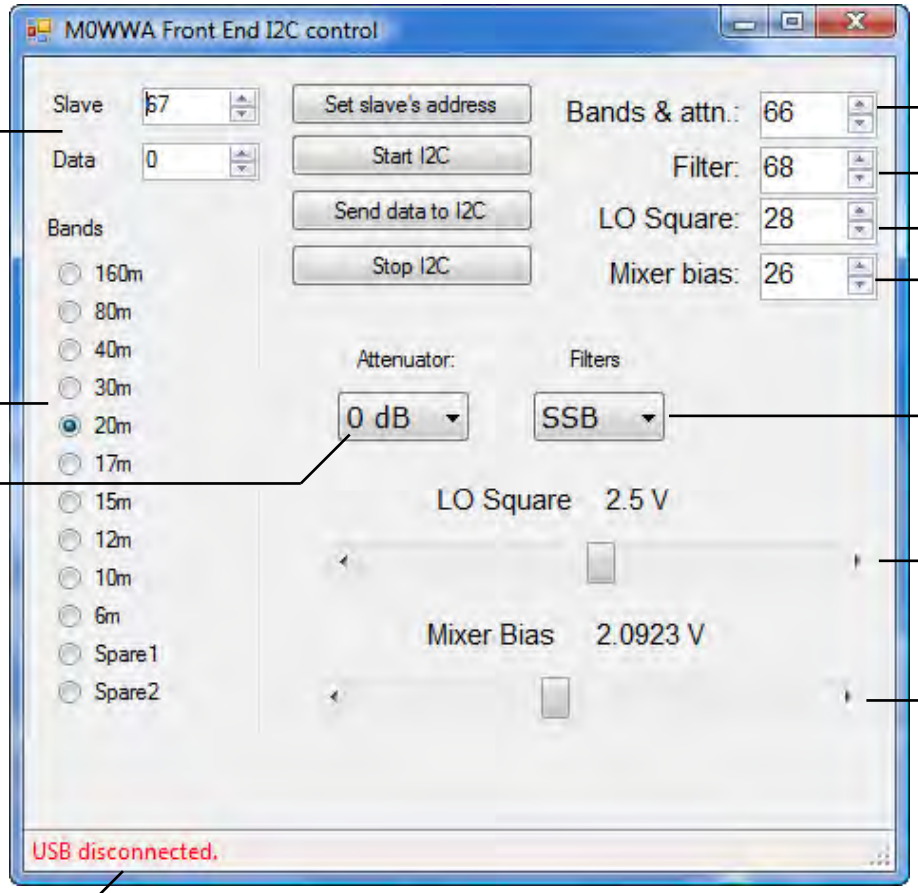
I2C Slave
no pull-up resistors

I2C Slave
no pull-up resistors

last slave on I2C Bus

pull-up resistor
connected to SDA and SCL lines

Connecting Slaves to the I2C Bus



I2C Manually
(for experimentation purposes)

I2C default addresses *

IC1 PCF8575 address

IC4002 PCF8574 address

IC3003 AD5321 address

IC3004 AD5321 address

BPF bank:

- Bands

- Attenuator

H-Mixer:

- Filters

- Squarer DAC

- Bias-point DAC

Status bar

Graphic User Interface controls on PC

* Addresses can be changed for your particular hardware configuration.
The program takes by default theese addresses. Changes are keep in memory.

Notes: