

Flinders & Hackerspace @ Tonsley Badge Build Instructions

Introduction

The heart of the FH@T Badge is a programmable IC from Microchip; the PIC32MX250F128D is a 32bit micro-controller. A micro-controller can be considered a miniature single chip computer. The PIC32MX250F128D has 32 kbytes of RAM and 128 kbytes of program memory and runs at 40MHz.

Key Features:

Arduino/Chipkit Library Compatibility

Microchip® PIC32MX250F128D microcontroller

- 40/50 MHz 32-bit MIPS
- 128K Flash
- 32K SRAM

16 Digital IO

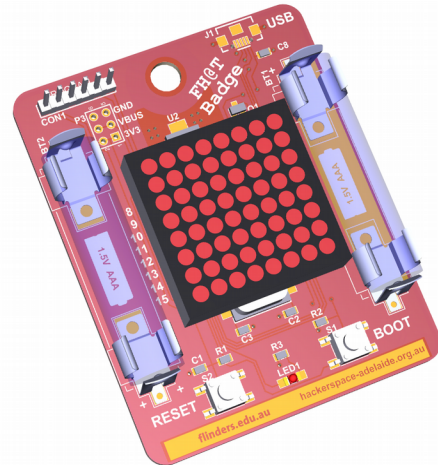
12 Analog Inputs

Battery or USB powered

64 LED Matrix

User push button

Programmed over USB



Thank you to Flinders University, Hackerspace Adelaide, Microchip and Element 14.

The FH@T Badge wouldn't be possible without the generous contributions of Flinders University, Hackerspace Adelaide, Microchip and Element 14. Please take a moment to explore their products, activities and services:

- Flinders University <http://flinders.edu.au/>
- Hackerspace Adelaide <http://hackerspace-adelaide.org.au/>
- Microchip <http://www.microchip.com/>
- Element 14 <http://au.element14.com/>

Safety

The following table identifies some of the risks and associated precautions involved in assembling the FH@T Badge.

RISK	Safe Operating Procedure (SOP)
Chemical absorption and ingestion	Always wash skin with soap and water after soldering. No eating or drinking in the lab.
	Enclosed footwear must be worn.
Trip Hazard	Ensure all bags are stored under desks.

Tools

Tweezers

Tweezers are used to position surface mount components prior to Reflow soldering and to hold surface mount components whilst hand soldering.



Vacuum Pick up tools

The hand-held SMD vacuum pick up tool is ideal for picking up and moving large or small electronic components weighing up to 50 g and having a flat surface.

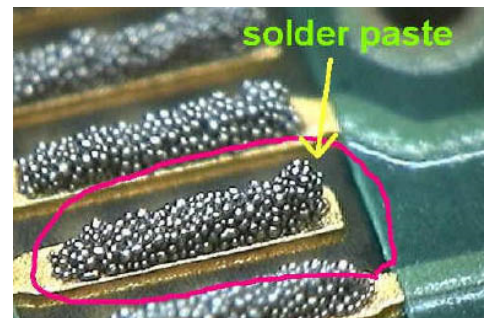


The Reflow Soldering Process

Reflow soldering is the most widely used method of soldering used within PCB assembly whether it is used for mass production or for prototype PCB assembly with surface mount components. The technology uses two main stages. First a solder paste is applied to the board, and then the board is heated to enable the solder to melt. This stage in itself has several steps that are needed to ensure that the board is heated and cooled correctly. Using reflow soldering technology it is possible to reliably solder surface mount components, and particularly those with very fine pitch leads. This makes it ideal for use with the components used in mass produced electronics products.

Solder Paste

Solder paste is a form of solder that is used in PCB assembly, especially when using reflow soldering techniques. The solder paste is a mixture of solder spheres and a specialised form of flux. This means that the solder is a form of paste that can be printed onto the surface of the PCB through a stencil or mask in the required amounts.



The paste is only applied to the areas that require soldering. While boards have solder resist layers added to them, it is necessary to only add solder paste to those areas where the solder is actually required. This is achieved by having a solder mask and solder paste printer. This only allows the solder paste to be added to those areas of the board where it is needed by way of a mask or board template.

Component Placement

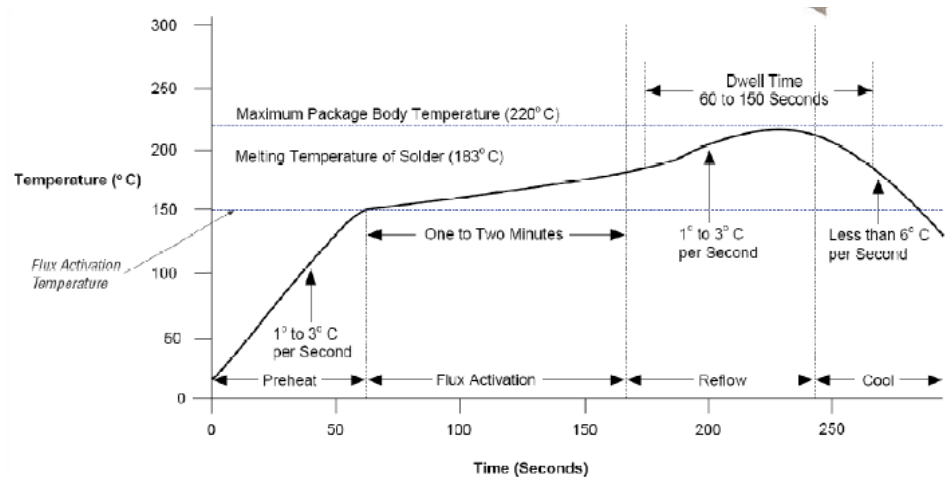
Normally an automatic pick and place machine is used because the numbers of components used these days and the accuracy required make manual placement non-viable. The components are held in place by the surface tension of the solder paste, and with all the components in place the PCB can be moved to the reflow soldering machine.



Reflow Process

The reflow process itself consists of a number of individual processes. These are required to ensure that the board is brought up to the correct temperature for reflow soldering without applying any unacceptable levels of thermal shock. Correctly profiling the temperature also ensures that the resulting solder joints are of the highest quality. The four stages normally used are as follows:

- Preheat
- Flux Activation
- Reflow
- Cool



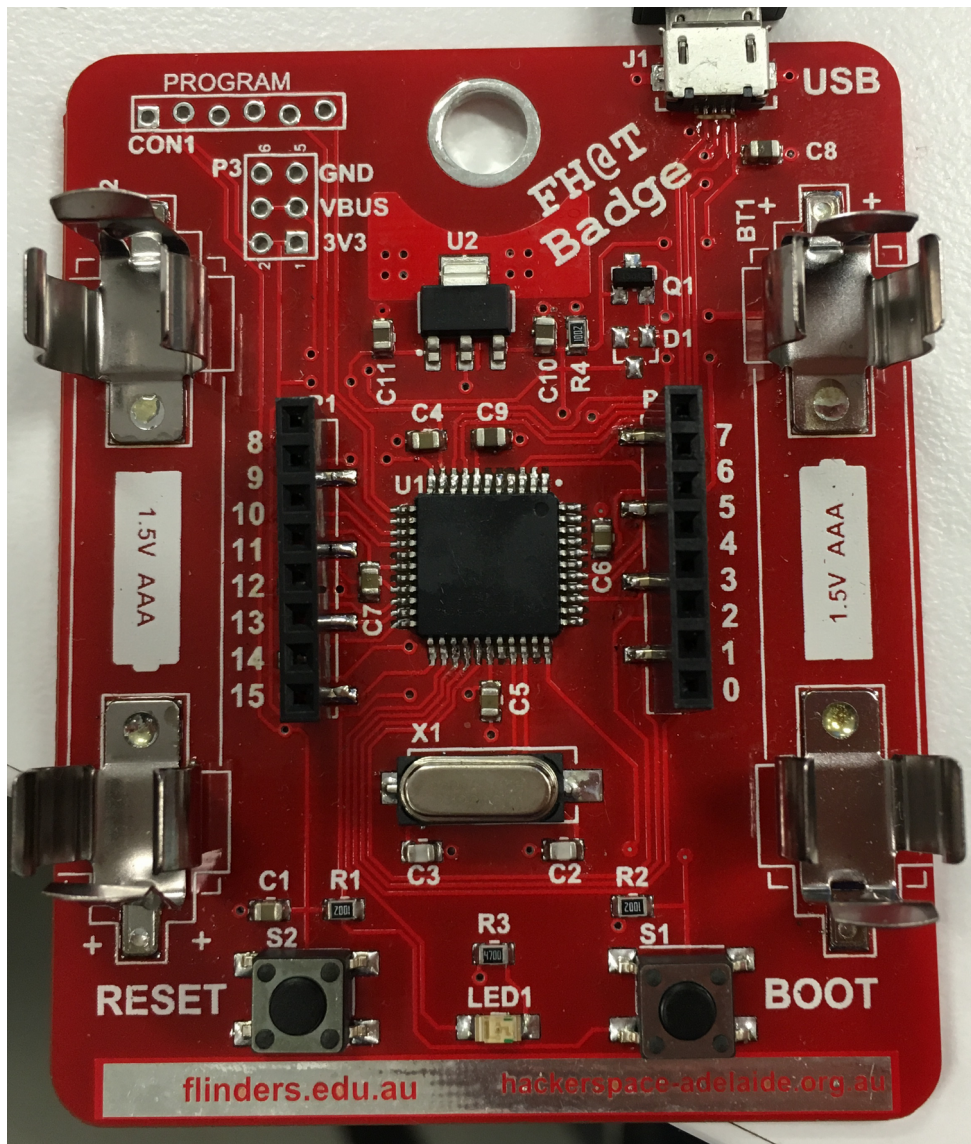
Reflow Solder Assembly Method

We will reflow solder the components. The first stage of assembly is to apply solder paste to the PCB. The paste has already been applied for you with a stencil. With the solder paste on the board the components can now be set in place.

Use a vacuum Pick up tool to place the Large IC U1. Then use tweezers to place the rest of the components on top of the solder paste. Do not press the components into the paste. Make sure that the components are placed flat, straight and even. Ensure that the components are placed in the correct position and polarised parts are place with the correct orientation.

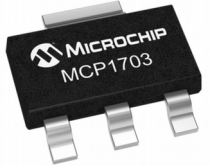
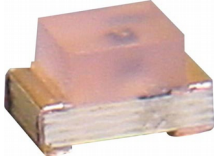
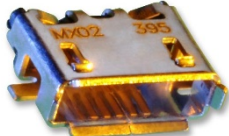
The components are held in place by the surface tension of the solder paste, and with all the components in place the PCB can be moved to the reflow soldering oven. When all the parts have been loaded the PCB will be reflow soldered in the oven.





Components

The following pictures will help you recognise the components. Place the components in the order below.

Designator	Description	Markings	Package	Image
U1	PIC32MX2501 28D		44-Pin TQFP Use Vacuum Pick up tool to place this component. Ensure that the round indent on top of the IC lines up with the round dots on the PCB.	
U2	RT9166A-33GG Voltage regulator IC		SOT-223	
R1, R2, R4	10k	1002	0805 Resistor	
R3	470R	4700		
C1, C4, C5, C6, C7	100nF	White Tape	0805 Capacitors	
C2, C3	27pF	Green Tape		
C8, C9, C10, C11	10uF	Clear (pk4)		
LED1	LED		1206 LED Green line marks the Cathode K ■ ■	
Q1	FDV304P P-Channel MOSFET Transistor		SOT 23	
X1	8MHz Crystal	8.000M	HC49SM	
J1	Micro USB Socket			

S1, S2	Tactile switch			
4 Battery Connectors	Keystone 55			
P1, P2	8 Way Surface Mount Headers			