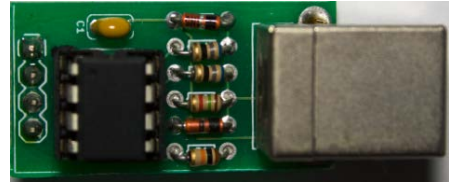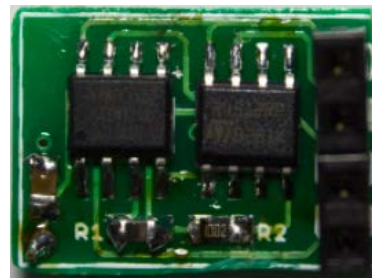# insideGadgets
ATtiny25 Tiny Temperature Logger (A25TTL) v2.0 Kit

A tiny temperature logger with minimal parts using the ATtiny13A/25 and a 512Kbit I2C EEPROM powered by a 3V CR1220 coin cell. Data logged can be extracted to a computer by using the A25TTL Reader module with a USB cable.

The A25TTL uses V-USB: http://www.obdev.at/vusb/

Features

- Compact design with temperature logging and USB transfer on separate PCBs. You can have multiple A25TTLs and only need a single A25TTL Reader.
- Low power consumption, at least 6 months battery life using 1 minute logging
- Measure temperature from -40C to 125C
- Uses an external 512Kbit I2C EEPROM which allows for 32,768 readings (2 byte values)
- Programmable logging delay time ranging from 1 second to 1 year in 1 second increments
- Easily transfer the logged data to your PC via USB using the A25TTL Reader which plugs into the A25TTL

Note: No information on time is recorded when logging.

Specifications

PCB Board: 17mm x 12mm (Logger), 31mm x 16mm (Reader)
Voltage: 1.8V to 5.5V
Current used when sleeping: 4uA
Current used when logging - thermistor on and write to EEPROM: 5mA (max), 3mA (average) for 28ms
Resolution of temperature (2 bytes): 0.16C (rounded up or down in 0.2C increments)
Accuracy of thermistor: within 1% -/+
Accuracy of timer: within 10% -/+
Operating temperature: -40C to 125C (Most CR1220 batteries only support -40C to 70C)
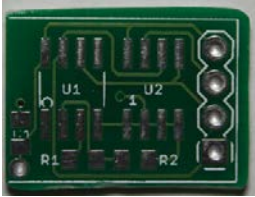
Kit Contents

To assemble the kit you will require a soldering iron and solder.
To use the kit you will require a 3V CR1220 coin cell.
To extract the data you will require the A25TTL Reader and a USB type A to B cable (commonly used for connecting printers).

ATtiny25 Tiny Temperature Logger

Picture	Name	Description	Qty
	PCB	A25TTL v1.0 PCB (works with v1.0, v1.1 and v2.0 firmware)	1
	U1	ATtiny13A 10MHz SOIC – ATTINY13A-SSH (Pre-programmed) or ATtiny25V 10MHz SOIC - ATTINY25V-10SSU (Pre-programmed)	1
	U2	STMicro 512Kbit I2C EEPROM - M24512-RMN6P or OnSemi 512Kbit I2C EEPROM - CAT24C512	1
	R1	Murata 10K 1% NTC Thermistor SMD 0603 - NCP18XH103F03RB	1
	R2	10K 1% Resistor SMD 0805	1
	C1	0.1uF Capacitor SMD 0805	1
	FEMALEHEADER	2 pin female header	2
	BATHOLDPIN	Coin cell battery pin	1

ATtiny25 Tiny Temperature Logger Reader

Picture	Name	Description	Qty
	PCB	A25TTL Reader v1.0 PCB	1
	U1	ATtiny85 20MHz DIP8 - ATTINY85-20PU (Pre-programmed)	1
	R1	10K Resistor 1/8W (Brown, black, orange, gold)	1
	R2	1.5K Resistor 1/8W (Brown, green, red, gold)	1
	R3, R4	68R Resistor 1/8W (Blue, gray, black, gold)	2
	D1, D2	Zener Diode 3.6V 1/2W DO-35 - 1N5227B	2
	C1	0.1uF Capacitor	1
	ICSOCKET	8 pin IC socket	1
	USB	USB Type B Receptacle	1
	MALEHEADER	4 pin male header	1

1. Step by Step Instructions

ATtiny25 Tiny Temperature Logger

1. Apply a tiny bit of solder to one pad on U1.
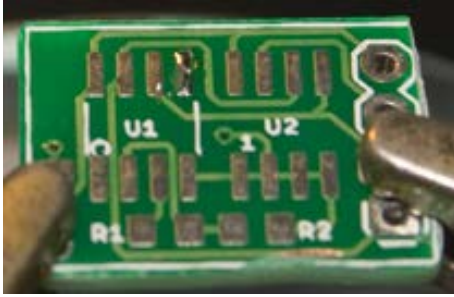
2. Position and hold the ATtiny25V (U1) in place using tweezers and solder the pin you previously applied a bit of solder to. Notice pin 1 is on the bottom left.

3. Solder the other pins.
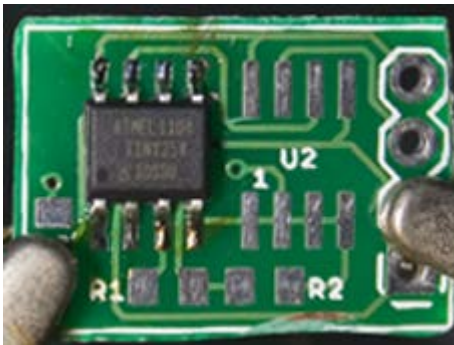
4. Apply the same technique to the EEPROM (U2). Notice pin 1 is on the bottom left.
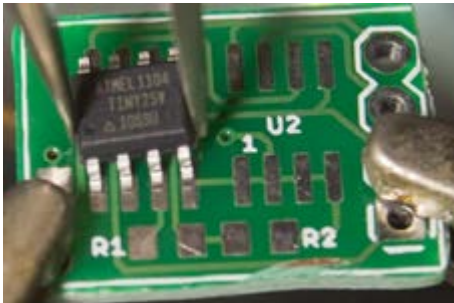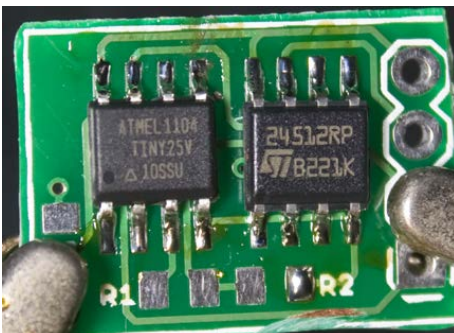
5. Apply a little bit of solder to one pad of R1 and R2.
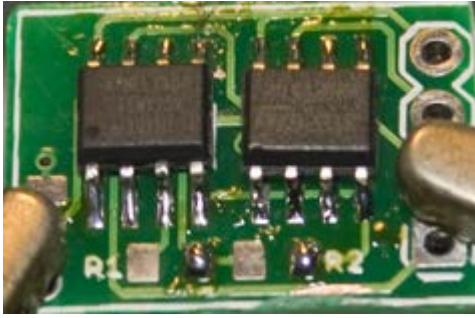
6. Position and hold the 10K thermistor (R1) in place using tweezers and solder the pin you previously applied a bit of solder to, and then apply solder to the other pin. Compared to the capacitor, the thermistor is slightly bigger.
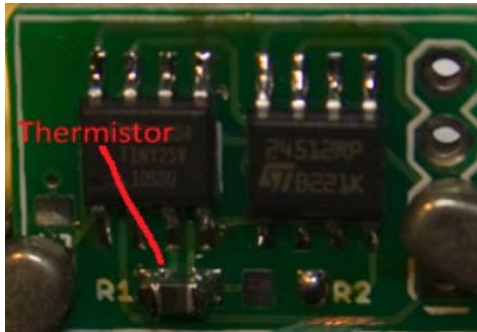
7. Install the 10K resistor (R2).

8. Install the 0.1uF capacitor (C1).

9. Install the two 2 pin female headers.
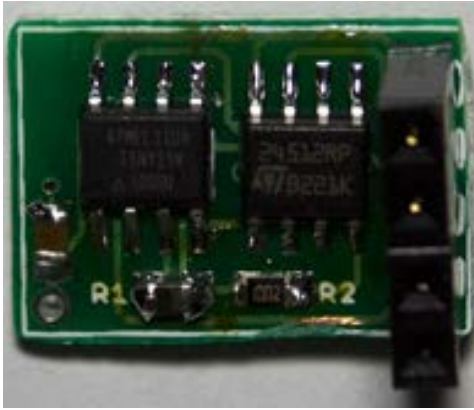
10. Apply solder to the pad on the bottom of the PCB which is where the battery will go.
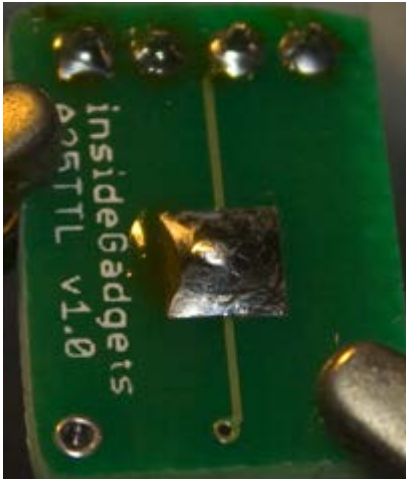
11. Reinforce the battery holder pin by applying solder to the area near the pin on both sides. We need to reinforce the pin otherwise it may break off.
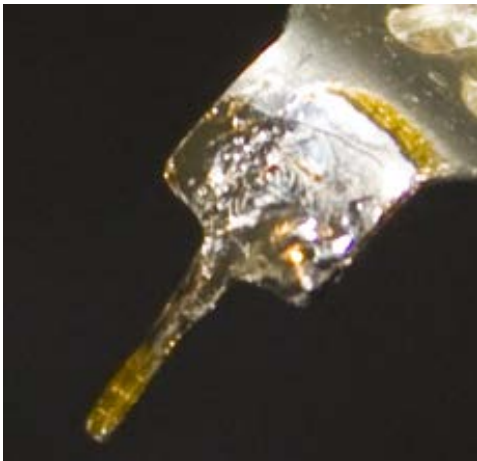
12. Install the battery holder pin and solder both sides. You can use sticky tape to hold it in place.
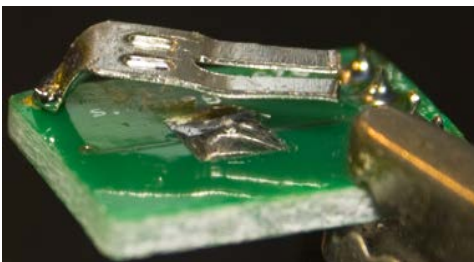
ATtiny25 Tiny Temperature Logger Reader

1. Install the 3 resistors (R1, R2, R3) and the 2 diodes (D1, D2). You can use sticky tape to hold down the components.
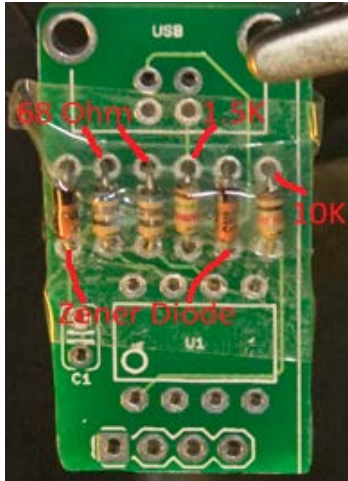
2. Install the capacitor (C1).

3. Install the 8 pin socket.

4. Install the 4 pin male header on the bottom.

5. Install the USB socket.

6. Insert the ATtiny85 to the 8 pin socket. Notice pin 1 is on the bottom left.

2. Programming the ATtiny25/85 (optional)

This step is only necessary if you wish to update the firmware on the ATtiny13A/25/85 or if you have replaced either chip. You will require a programmer such as the USBtinyISP and your programmer will need to be supported by the software called AVRDUDE.

To program the ATtiny and fuse bits we use the AVRDUDE software:
http://savannah.nongnu.org/projects/avrdude/

ATtiny13A or 25 Tiny Temperature Logger
Upload the \A25TTL_v2.0\main.hex file to the ATtiny13A / 25 by running the following command:
avrdude –p ATtiny13 –c usbtiny –U flash:w:main.hex

ATtiny25 Tiny Temperature Logger Reader
1. Change the fuse bits so the ATtiny85 uses 16MHz PLL and divide clock by 8 by running the following command:
avrdude -p ATtiny85 -c usbtiny -U lfuse:w:0x61:m -U hfuse:w:0xdf:m -U efuse:w:0xff:m

2. Upload the \A25TTL_Reader_v1.0\main.hex file to the ATtiny85 by running the following command:
avrdude –p ATtiny85 –c usbtiny –U flash:w:main.hex

3. How to Use

Installing the USB driver when plugging in the A25TTL Reader
1. When plugging in the A25TTL Reader, it will appear as an unknown device.
2. Choose to "Install from a list or specific location".
3. Select the \USB_Driver folder as the driver location.
4. When you are prompted for the "libusb0.sys" file, select either the \USB_Driver\x86 or USB_Driver\amd64 folder based if your operating system is 32bit or 64bit.

Configure the logging time interval
1. Remove the battery from the A25TTL Logger
2. Connect the A25TTL to the Reader as shown below.
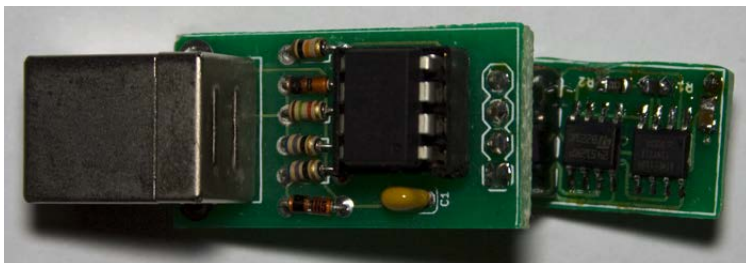
3. Plug the USB cable into the A25TTL Reader.
4. Run the a25ttl_program_delay.exe program found in the \A25TTL_v1.0\a25ttl_programs folder. You will be prompted to enter in the day, hour, minute and second to delay for.
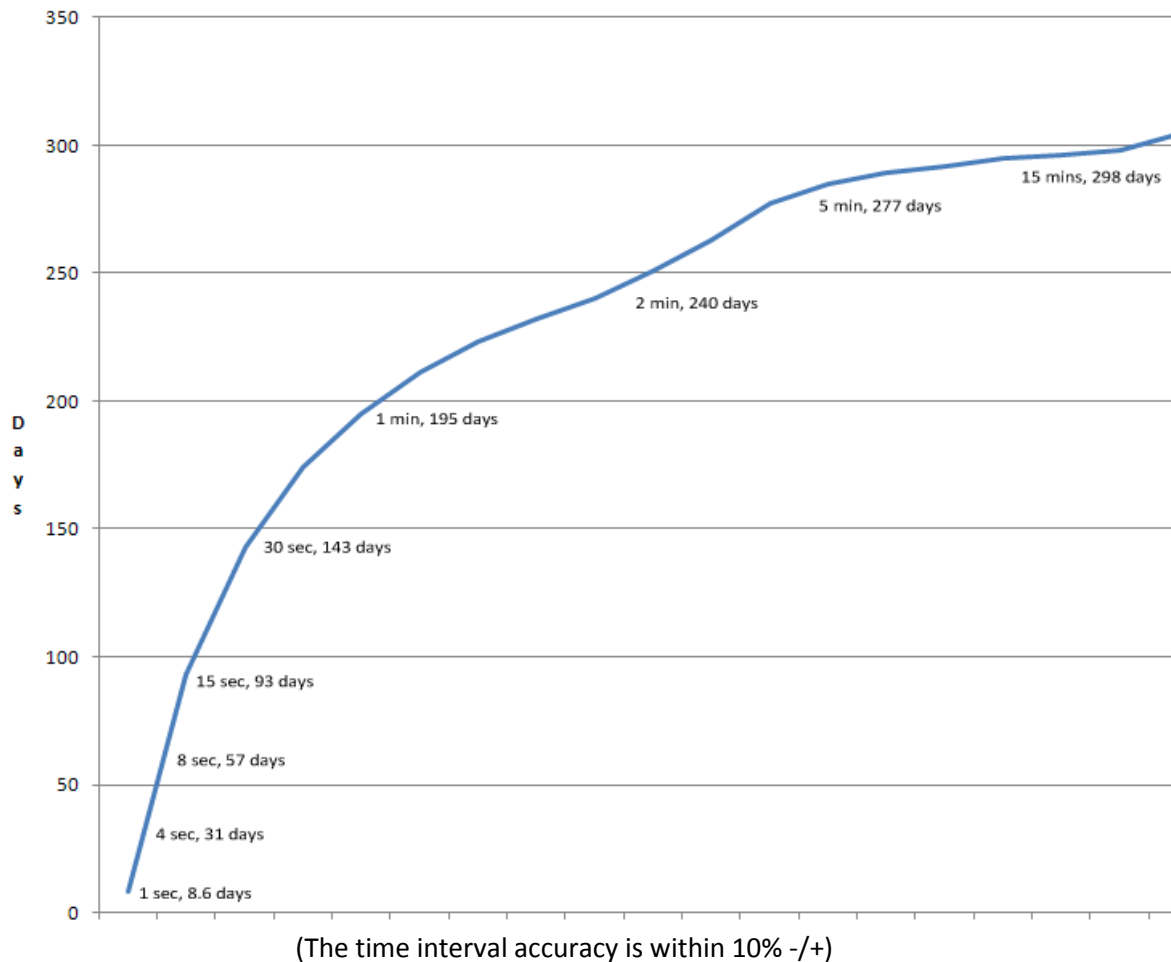
```
ATtiny25 Tiny Temperature Logger: Delay Time Programmer v1.0
Used to change the delay time in-between each recording.
The delay time is set in days, hours, minutes and seconds.

Please enter in the days: 0
Please enter in the hours: 0
Please enter in the minutes: 0
Please enter in the seconds: 4

Programming delay time as 4 seconds...
Completed
```
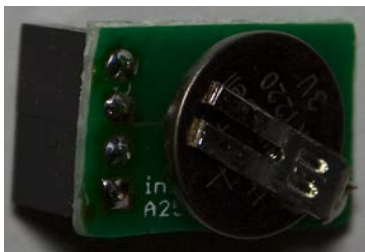
Below are the estimated days that the A25TTL will last depending on the delay time you select.

15 mins, 298 days
5 min, 277 days
2 min, 240 days
1 min, 195 days
30 sec, 143 days
15 sec, 93 days
8 sec, 57 days
4 sec, 31 days
1 sec, 8.6 days
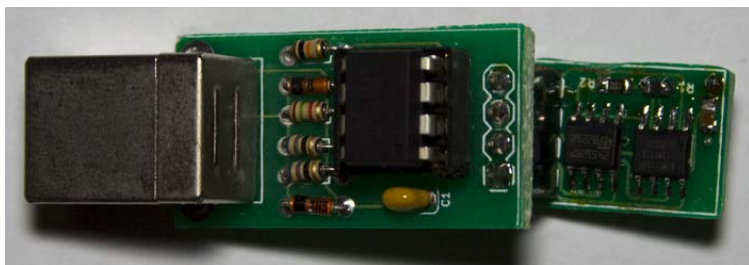
(The time interval accuracy is within 10% -/+)

Start Logging

To start logging, insert the 3V CR1220 battery in the A25TTL.

Transfer data logged to your PC

1. Remove the battery from the A25TTL Logger
2. Connect the A25TTL to the Reader as shown below.

3. Plug the USB cable into the A25TTL Reader.

4. Run the a25ttl_transfer.exe program found in the A25TTL_v1.0\a25ttl_programs folder. A file with the data logged will be created with the following name: <year>-<month>-<day>_<hour>-<minute>-<second>.txt.

5. Remove the A25TTL Reader from the Logger and repeat if you have multiple A25TTL.

Note: There may be a chance when you remove the battery when it's logging that when you transfer the data, there may be a point where your previous logged data is displayed at the end (you may see a sudden change of results). This is because the byte that indicates the end of your current logged session wasn't written properly.

Revision History

V2.0 Rev.2 – 1/09/2015

- Update A25TTL_Reader program to correct program delay bug

V2.0 Rev.1 – 10/10/2014

- Reduced code size to fit on an ATtiny13A
- Moved reader temperature conversion function to the a25ttl_transfer.exe program so now you can modify it easily without reprogramming the ATtiny

V1.1 Rev.1 – 1/10/2014

- Updated logger to work with any I2C EEPROM
- Updated reader temperature conversion function to use Beta parameters in order to use a new 1% thermistor
- Updated reader to allow for hot plugging in loggers

V1.0 Rev. 1 – 20/03/2013

- Initial Revision