

# Future Technology Devices International

## Datasheet

### FT51A-EVM Development Module



*FT51A-EVM is an FT51A development module with the following features: display, heart-rate monitor, temperature sensor and force sensitive resistor.*

## 1 Introduction

The FT51A-EVM is a development module for FTDI's FT51AQ, one of the devices from FTDI's range of 8-bit microcontrollers with USB interface bridging features integrated. FT51A is a MCU which includes the following features: USB client and USB hub interfaces, 8051 core, 8-bit ADC, UART, SPI, I<sup>2</sup>C, 245 FIFO and PWM.

The FT51A-EVM demonstrates the FT51A series I<sup>2</sup>C and SPI interfaces, the ADC input, PWM and GPIO features. It contains a 28 pin header which allows easy access to all the FT51AQ's IO pins, as well as the debug and reset pins. This module also comes preloaded with the FT51A-EVM firmware that allows users to use all the features of the module without developing firmware.

### 1.1 Features

The FT51A-EVM is fitted with a FT51AQ; many of the features of the FT51A series can be utilized with this module. For a full list of the FT51A series features please see the FT51A datasheet which can be found by clicking [here](#).

In addition to the features listed in the FT51A datasheet, the FT51A-EVM has the following features:

- 20 X 2 characters, LCD display, with I<sup>2</sup>C interface and RGB backlight.
- Heart-Rate Monitor with filtered and amplified analogue output
- Force sensitive resistor
- SPI temperature sensor
- Push buttons controls and LED indicator
- Interface footprints to allow for communication with FTDI's FT8xx modules and TTL-232R cables
- Upstream and downstream USB ports which allows for direct connection cascading.
- Debugger interface header used for debugging and programming the FT51AQ. Designer for operation with FTPD-1. See [FTPD-1 datasheet](#) for details about this module.
- Onboard jumper for configuring the module to be in self powered or USB powered.

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## 2 Driver Support

Driver support for the FT51A USB Device Firmware Updater (DFU) is available as part of the FT51A SDK and is available for the following OS:

- Windows 10 32,64-bit
- Windows 8.1 32,64-bit
- Windows 8 32,64-bit
- Windows 7 32,64-bit

The DFU driver files can be found at the following PC location once the FT51A SDK has been installed:

C:\Users\*Username*\Documents\FTDI\FT51A\_SDK\*version*\drivers

NOTE: "username" will be different for each user that logs into a PC.

### 3 Ordering Information

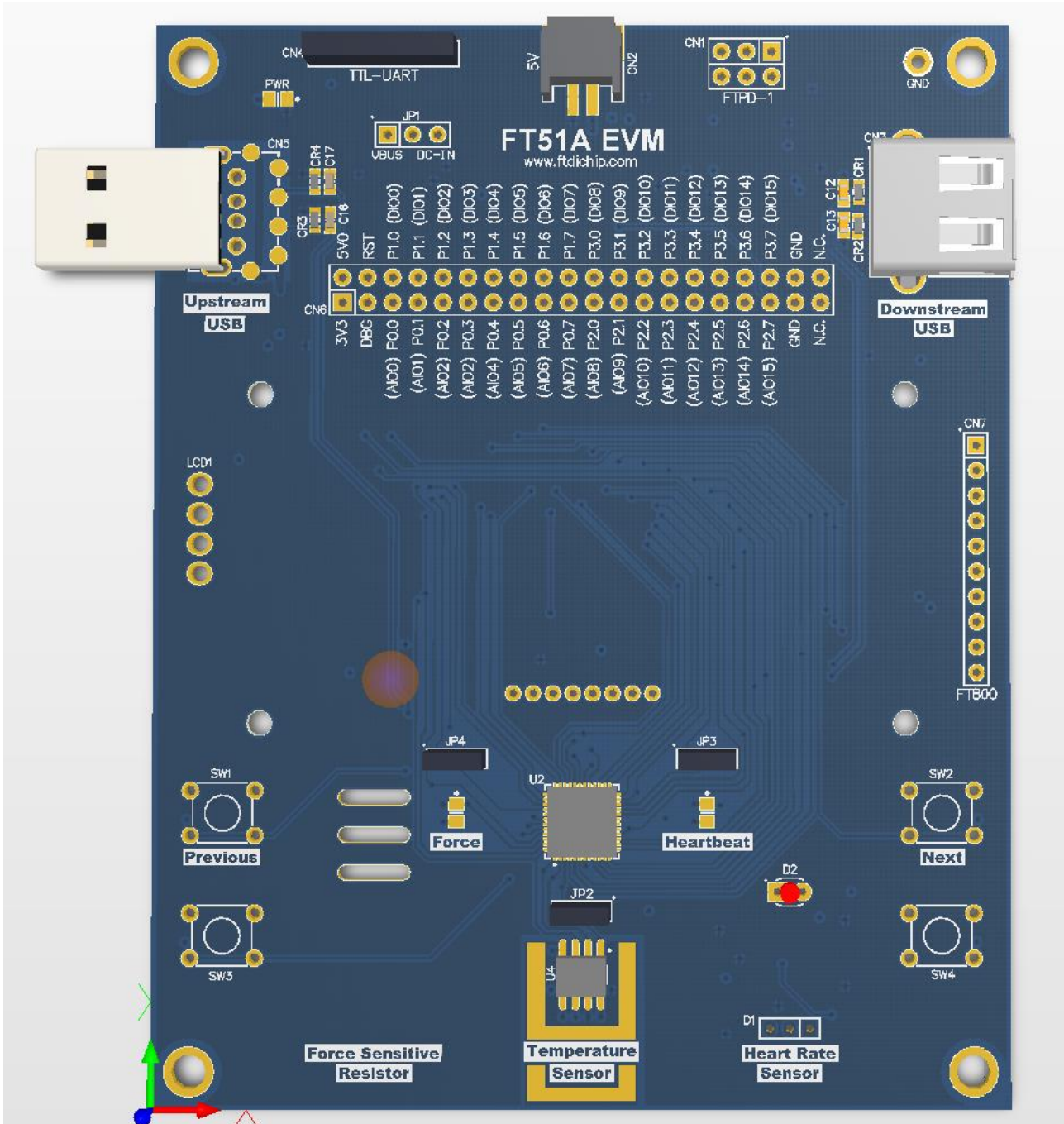
| Module Code | Utilised IC Code | Description               |
|-------------|------------------|---------------------------|
| UMFT51A-EVM | FT51AQ           | FT51A evaluation platform |

Other modules in the FT51A range:

| Module Code | Utilised IC Code | Description                |
|-------------|------------------|----------------------------|
| UMFT51AA-01 | FT51AQ           | 8051 compatibility module. |

## 4 FT51A-EVM Signals and Configurations

### 4.1 FT51A-EVM Pin Out



**Figure 4.1 – Module Pin Out**

Figure 4.1 illustrates the signals available on the header pins.

## 4.2 Connector Descriptions

| Pin No.         | Name   | Type          | Description                                       |
|-----------------|--------|---------------|---|
| CN1-1 and CN1-4 | NC     | Not Connected | Floating pin.                                     |
| CN1-2           | VCC5V  | Power         | 5 volt power input. (Protected by zenor diode.)   |
| CN1-3           | RESET# | Signal        | Active low reset                                  |
| CN1-5           | DBG    | Signal        | Debugger data line, single line half-duplex UART. |
| CN1-6           | GND    | Ground        | 0 volt ground.                                    |

**Table 4.1 – Debugger Port Pin Out Description**

| Pin No. | Name | Type   | Description         |
|---------|------|--------|---------------------|
| CN2-1   | VCC  | Power  | 5 volt power input. |
| CN2-2   | GND  | Ground | 0 volt ground.      |

**Table 4.2 – Power Port Pin Out Description**

| Pin No. | Name | Type   | Description                     |
|---------|------|--------|---------------------------------|
| CN3-1   | VBUS | Power  | 5 volt power output.            |
| CN3-2   | DM   | Signal | USB Data - to downstream device |
| CN3-3   | DP   | Signal | USB Data + to downstream device |
| CN3-4   | GND  | Ground | 0 volt ground.                  |

**Table 4.3 – Downstream USB Port Pin Out Description**

| Pin No. | Name      | Type   | Description                            |
|---------|-----------|--------|--|
| CN4-1   | GND       | Ground | 0 volt ground.                         |
| CN4-2   | UART_RTS# | Signal | UART Ready to Send output. Active low. |
| CN4-3   | NC        | NC     | No Connect                             |
| CN4-4   | UART_RX   | Signal | UART RX Data input.                    |
| CN4-5   | UART_TX   | Signal | UART TX Data output.                   |
| CN4-6   | UART_CTS# | Signal | UART Clear to Send input. Active low.  |

**Table 4.4 – UART Port Pin Out Description**

Note: CN4 is not fitted by default.

| Pin No. | Name | Type   | Description  |
|---------|------|--------|--|
| CN5-1   | VBUS | Power  | 5 volt power input. To enable bus power mode close JP1 |
| CN5-2   | DM   | Signal | USB Data - from upstream device                        |
| CN5-3   | DP   | Signal | USB Data + from upstream device                        |
| CN5-4   | GND  | Ground | 0 volt ground.   |

**Table 4.5 – Upstream USB Port Pin Out Description**

| Pin No. | Name     | Type                   | Description  |
|---------|----------|------------------------|--|
| CN6-1   | VCC3V3   | Power                  | 3.3 volt power output  |
| CN6-2   | VCC5V    | Power                  | 5 volt power output  |
| CN6-3   | DBG      | Signal<br>Input/Output | Debugger interface pin, bi-directional, open-drain output with on-board pull-up resistor   |
| CN6-4   | RST      | Signal Input           | FT51A reset pin, active high   |
| CN6-5   | AIO0     | I/O Signals            | JP4 1-2 short: Unused analog IO pin<br>JP4 2-3 short: No connection                        |
| CN6-6   | SW1      | Signal Input           | (DIO0) Active low when SW1 pressed.  |
| CN6-7   | AIO1     | I/O Signals            | Unused analog IO pin   |
| CN6-8   | FSR_LED  | Signal Output          | (DIO1) Drive the LED indicating FSR pressure.  |
| CN6-9   | AIO2     | I/O Signals            | Unused analog IO pin   |
| CN6-10  | DIO2     | Signal Output          | When connecting the FT51A-EVM to a FTDI FT800, DIO2 can be used as the SPI master CS# net. |
| CN6-11  | AIO3     | I/O Signals            | Unused analog IO pin   |
| CN6-12  | SPI MOSI | Signal output          | (DIO3) Master Out, Slave In SPI signal   |
| CN6-13  | AIO4     | I/O Signals            | Unused analog IO pin   |
| CN6-14  | SPI MISO | Signal input           | (DIO4) Master In, Slave Out SPI signal   |
| CN6-15  | AIO5     | I/O Signals            | Unused analog IO pin   |
| CN6-16  | SPI SCLK | Signal output          | (DIO5) SPI clock output  |
| CN6-17  | AIO6     | I/O Signals            | Unused analog IO pin   |
| CN6-18  | DIO6     | Signal Output          | Can be used as SPI CS# to temperature sensor,  |

| Pin No.        | Name          | Type          | Description  |
|----------------|---------------|---------------|--|
|                |               |               | can be over written by jumper JP2.   |
| CN6-19         | SW3           | Signal Input  | (AIO7) Active low when SW3 pressed.  |
| CN6-20         | SW2           | Signal Input  | (DIO7) Active low when SW2 pressed.  |
| CN6-21         | SW4           | Signal Input  | (AIO8) Active low when SW4 pressed.  |
| CN6-22         | LCD_RST#      | Signal Output | (DIO8) Controls the reset feature of the LCD module  |
| CN6-23         | AIO9          | I/O Signals   | Unused analog IO pin   |
| CN6-24         | DIO9          | Signal I/O    | Unused digital IO.   |
| CN6-25         | AIO10         | I/O Signals   | JP3 1-2 short: Unused analog IO pin<br>JP3 2-3 short: No connection                        |
| CN6-26         | UART RTS#     | Output signal | (DIO10) UART Ready To Send signal. Active low.   |
| CN6-27         | HB_LED        | Signal Output | (AIO11) Used to drive the on board heartbeat indicator LED                                 |
| CN6-28         | UART RX       | Signal Input  | (DIO11) UART data receive signal   |
| CN6-29         | LCD_PWM ( R ) | Signal Output | (AIO12) control the LCD backlight red signal   |
| CN6-30         | UART CTS#     | Signal Input  | (DIO12) UART clear to send signal input. Active low.                                       |
| CN6-31         | LCD_PWM (G)   | Signal Output | (AIO13) control the LCD backlight green signal   |
| CN6-32         | I2C_SCL       | Signal Output | (DIO13) I <sup>2</sup> C clock output. Used to communicate with the LCD display            |
| CN6-33         | LCD_PWM (B)   | Signal Output | (AIO14) control the LCD backlight blue signal  |
| CN6-34         | I2C_SDA       | Signal IO     | (DIO14) Bidirectional I <sup>2</sup> C data line. Used to communicate with the LCD display |
| CN6-35         | VBUS_PWR      | Signal Input  | (AIO15) Indicates if power is present on USB bus   |
| CN6-36         | UART TX       | Signal        | (DIO15) UART TX signal output. Active low.   |
| CN6-37, CN6-38 | GND           | Ground        | 0V Ground  |
| CN6-39, CN6-40 | NC            | -             | No connection  |

**Table 4.6 – Module IO Pin Out Description**

Note: The term “Unused” means the IO pin is not used by the on-board electronics. These IOs are free to be used by user’s add-on circuit.



| Pin No. | Name     | Type   | Description                                  |
|---------|----------|--------|--|
| CN7-1   | SPI_SCLK | Signal | SPI CLK output                               |
| CN7-2   | SPI_MOSI | Signal | SPI Master Output Slave Input. Output signal |
| CN7-3   | SPI_MISO | Signal | SPI Master Input Slave Output. Input signal  |
| CN7-4   | CS#      | Signal | Active low EVE chip select signal output     |
| CN7-5   | INT#     | Signal | Active low EVE interrupt signal input        |
| CN7-6   | PD#      | Signal | Active low EVE power down signal output      |
| CN7-7   | 5V       | Power  | 5V power output                              |
| CN7-8   | NC       | -      | No connection                                |
| CN7-9   | GND      | GND    | Ground 0 volts.                              |
| CN7-10  | GND      | GND    | Ground 0 volts.                              |

**Table 4.7 – EVE/SPI Pin Out Description**

Note: CN7 is not fitted by default.

### 4.3 I/O Pin Feature Options

The following features can be configured using the FT51A's multiplexer to bring signal to the available pins.

| FT51A IO Signal Option  | Available On Pin    | Description  |
|-------------------------|---------------------|--|
| GPIO                    | DIO0-15 and AIO0-15 | General purpose IO   |
| ADC                     | AIO0-15             | 8-bit analog to digital converter  |
| UART                    | DIO0-15             | UART interface. Data rates up to 3 Mbaud.                                  |
| SPI Master              | DIO0-15             | SPI master interface. Clock frequency up to 24MHz                          |
| SPI Slave               | DIO0-15             | SPI slave interface  |
| 245 FIFO                | DIO0-15             | 8 bit parallel data interface with handshake. Data rates up to 7MB/s.      |
| I <sup>2</sup> C Master | DIO0-15             | I <sup>2</sup> C master interface. Data rates up to 3.4Mb/s                |
| I <sup>2</sup> C Slave  | DIO0-15             | I <sup>2</sup> C slave interface   |
| PWM                     | DIO0-15 and AIO0-15 | Pulse Width Modulation output.   |
| BCD Detect              | DIO0-15 and AIO0-15 | Indicates a dedicated charger port has been detected on upstream USB port. |

**Table 4.8 – I/O Signal Options**

## 5 Module Configurations

### 5.1 Jumper Configuration Options

| Solder Link No. | Setting | Status      | Description  |
|-----------------|---------|-------------|--|
| JP1             | 2-3     | Non-Default | Self-Powered mode. This setting removes the connection between VBUS and VCC5V. For self-powered operation 5V power is received from CN2-1.   |
| JP1             | 1-2     | Default     | Bus-Powered mode. This setting creates a connection between VBUS and VCC5V. For bus-powered operations 5V power will be outputted from CN2-1 when the module is connected to an upstream USB port. |

**Table 5.1 – Jumper JP1 Modes**

| Solder Link No. | Setting | Status      | Description  |
|-----------------|---------|-------------|--|
| JP2             | 1-2     | Non-Default | Disable the temperature sensor's SPI outputs.                      |
| JP2             | 2-3     | Default     | Allow the FT51A to control the CS# line of the temperature sensor. |

**Table 5.2 – Jumper JP2 Modes**

| Solder Link No. | Setting | Status      | Description  |
|-----------------|---------|-------------|--|
| JP3             | 1-2     | Non-Default | Disable the heart rate monitor.                          |
| JP3             | 2-3     | Default     | Allow the FT51A to monitor the heart rate sensor output. |

**Table 5.3 – Jumper JP3 Modes**

| Solder Link No. | Setting | Status      | Description  |
|-----------------|---------|-------------|--|
| JP4             | 1-2     | Non-Default | Disable the force sensitive resistor.                    |
| JP4             | 2-3     | Default     | Allow the FT51A to monitor the force sensitive resistor. |

**Table 5.4 – Jumper JP4 Modes**

## **6 Using Preloaded Firmware**

The preloaded firmware of the FT51A\_EVM evaluation module will display sensor data on the LCD panel. The data which is displayed is from the temperature sensor (U4).

This firmware may be replaced either via the debugger / programmer module FTPD-1 using supplied code from FTDI or with the users own application.

Alternatively as the default firmware includes DFU (Device Firmware Update) on the upstream USB port the firmware may be reprogrammed over USB using the DFU.

## 7 Programming Firmware to the MTP Memory

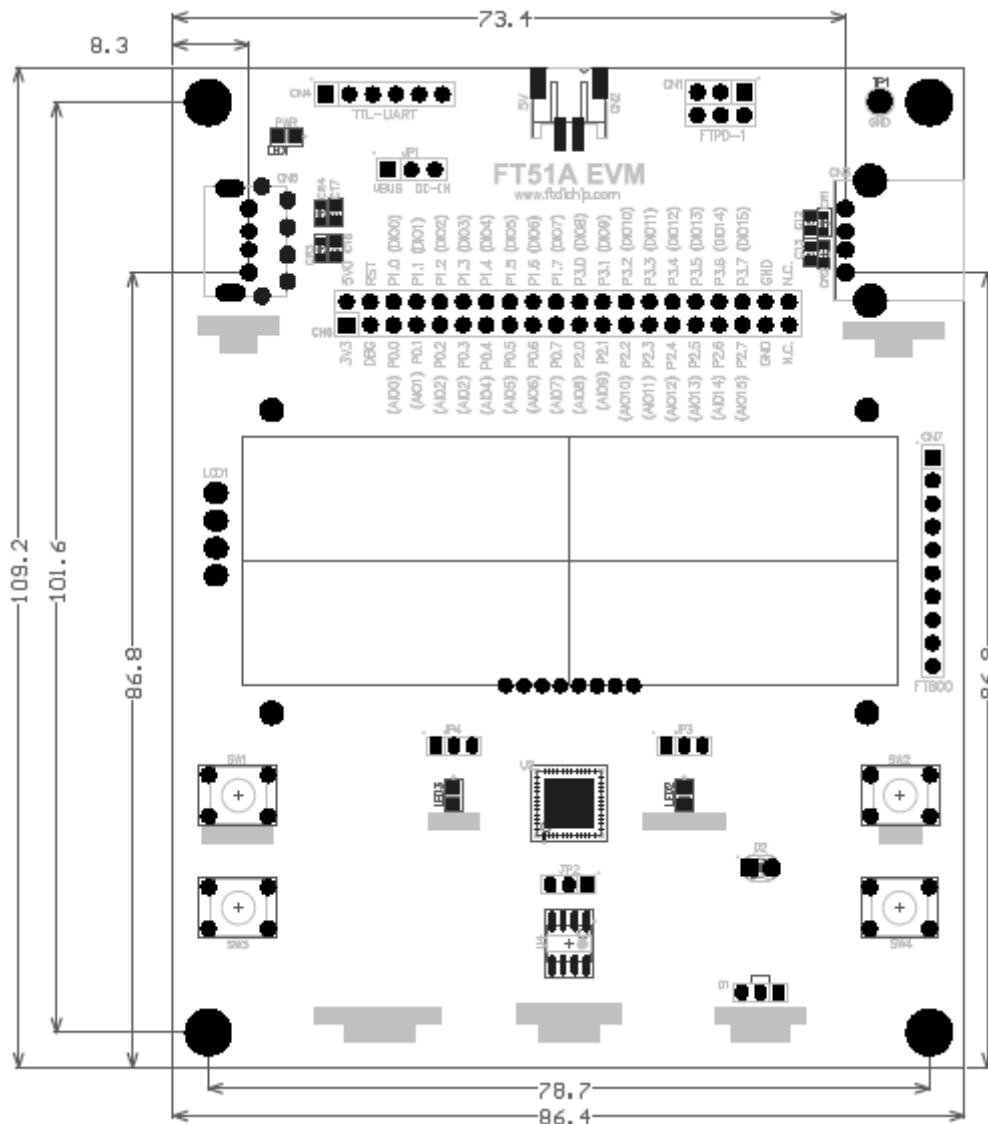
The FT51AQ of the FT51A-EVM is programmed with the FT51A-EVM firmware which allows users to interface with the temperature sensor.

For users wishing to apply their own code or other supplied examples, the FT51AQ can be programmed using the FTPD-1 or over USB using DFU. Connector CN-1 is used as a dedicated port that interfaces with the FTPD-1.

A list of available examples (at time of writing) is shown below and source code can be found in 'C:\Users\Username\Documents\FTDI\FT51A\_SDK\version\examples' after installing the FT51A SDK:

- AN\_344\_FT51A\_DFU\_Sample
- AN\_345 FT51A Keyboard Sample
- AN\_346 FT51A Mouse Sample
- AN\_347 FT51A Test and Measurement Sample
- AN\_348 FT51A FT800 Sensors Sample
- AN\_349 FT51A FT800 Spaced Invaders Sample
- AN\_351 FT51A Compatibility Module
- AN\_354 FT51A Standalone Demo Application

## 8 Module Dimensions

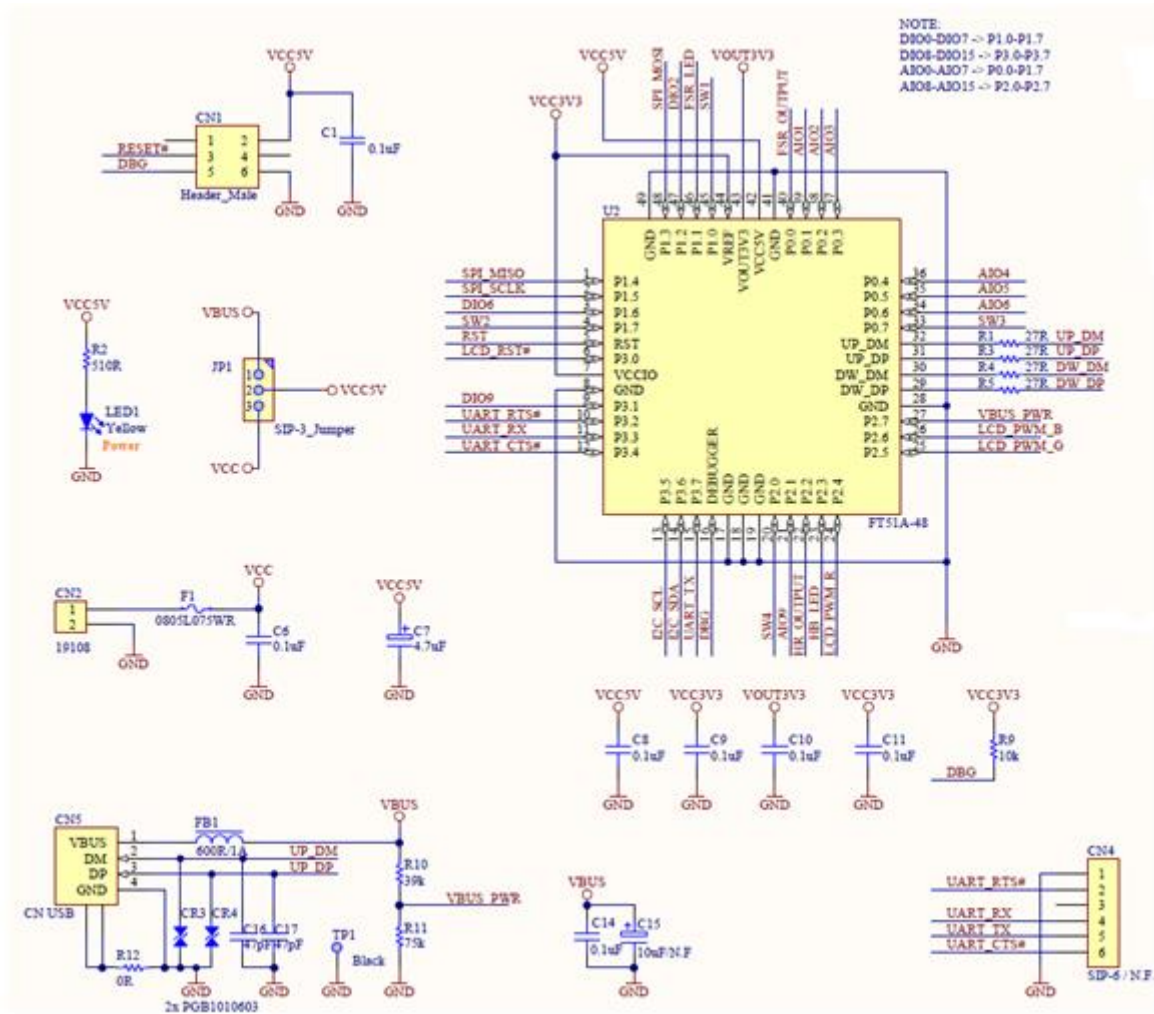


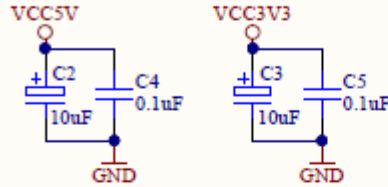
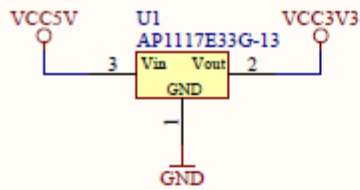
**Figure 8.1 – FT51A-EVM Module Dimensions**

All dimensions are given in millimetres. The height of the assembled module (including the rubber standing) is 15mm.

The FT51A-EVM module exclusively uses lead free components, and is fully compliant with European Union directive 2002/95/EC.

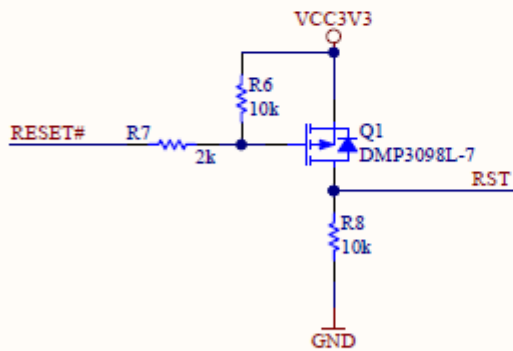
### 9 UMFT51AA Module Circuit Schematic



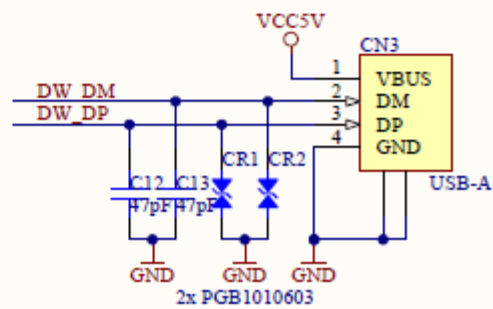


|           |           |
|-----------|-----------|
| VBUS PWR  | VBUS PWR  |
| UART_TX   | UART_TX   |
| UART_RTS# | UART_RTS# |
| UART_RX   | UART_RX   |
| UART_CTS# | UART_CTS# |

|            |            |
|------------|------------|
| FSR_OUTPUT | FSR_OUTPUT |
| HR_OUTPUT  | HR_OUTPUT  |
| SPI_SCLK   | SPI_SCLK   |
| SPI_MISO   | SPI_MISO   |
| SPI_MOSI   | SPI_MOSI   |
| SPI_CS#    | SPI_CS#    |
| LCD_RST#   | LCD_RST#   |
| I2C_SCL    | I2C_SCL    |
| I2C_SDA    | I2C_SDA    |
| LCD_PWM_R  | LCD_PWM_R  |
| LCD_PWM_G  | LCD_PWM_G  |
| LCD_PWM_B  | LCD_PWM_B  |
| SW1        | SW1        |
| SW2        | SW2        |
| FSR_LED    | FSR_LED    |
| HB_LED     | HB_LED     |

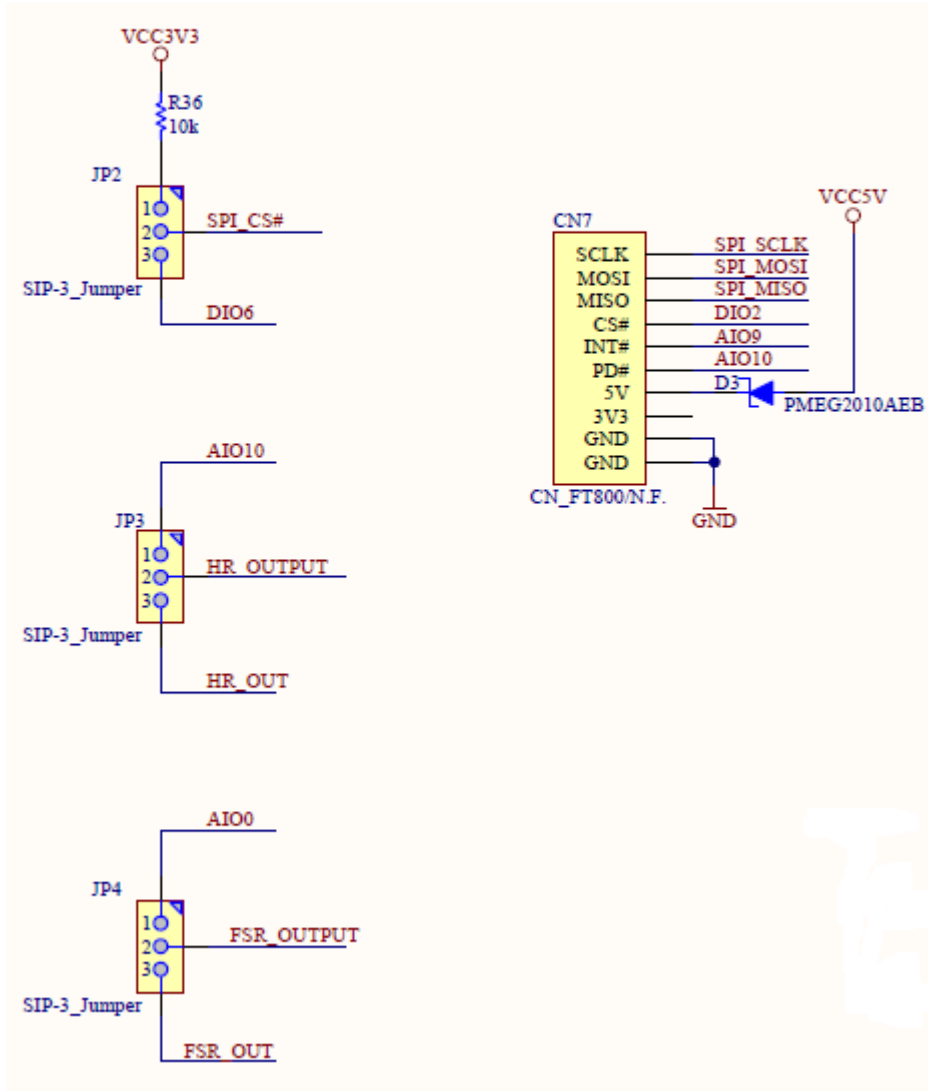


|      |      |
|------|------|
| RST  | RST  |
| DIO2 | DIO2 |
| DIO6 | DIO6 |
| DIO9 | DIO9 |
| AIO1 | AIO1 |
| AIO2 | AIO2 |
| AIO3 | AIO3 |
| AIO4 | AIO4 |
| AIO5 | AIO5 |
| AIO6 | AIO6 |
| SW3  | SW3  |
| SW4  | SW4  |
| AIO9 | AIO9 |
| DBG  | DBG  |









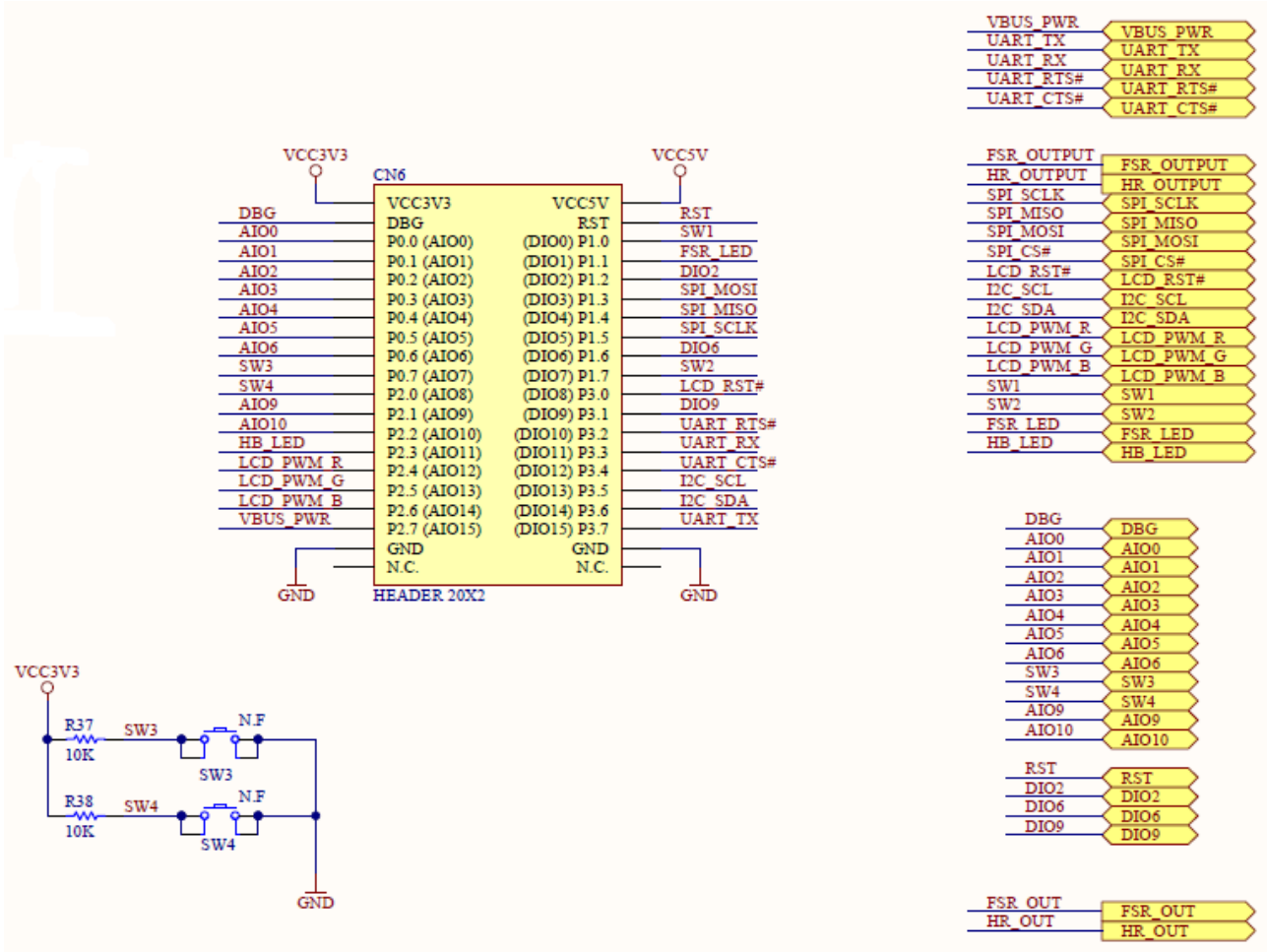


Figure 9.1 – Module Circuit Schematic

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## Appendix A – References

### Document References

[DS\\_FT51A](#) – FT51A datasheet

[DS\\_FTPD-1](#) – FT51A programmer module

[AN\\_289](#) – FT51A Programming Guide

### Acronyms and Abbreviations

| Terms            | Description                |
|------------------|----------------------------|
| DFU              | Device Firmware Update     |
| EVE              | Embedded Video Engine      |
| I <sup>2</sup> C | Inter integrated Circuit   |
| LCD              | Liquid Crystal Display     |
| LED              | Light Emitting Diode       |
| MCU              | Micro Controller Unit      |
| MTP              | Multiple Time Programmable |
| USB              | Universal Serial Bus       |

## **Appendix B – List of Figures and Tables**

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## Appendix C – Revision History

Document Title: FT51A-EVM Development Module Datasheet  
Document Reference No.: BRT\_000028  
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Product Page: <http://brtchip.com/product>  
Document Feedback: [Send Feedback](#)

| Revision    | Changes  | Date       |
|-------------|--|------------|
| Version 1.0 | Initial Release  | 2015-11-18 |
| Version 1.1 | Dual branding to reflect the migration of the product to the Bridgetek name – logo changed, copyright changed, contact information changed | 2016-09-19 |