Bridgetek Pte Ltd
MM932LC Development Module Datasheet

FT93x Family is a General Purpose 32-bit Microcontroller

1 Introduction

The MM932LC is a low cost development module for Bridgetek's 32-bit high performance FT93x Microcontroller family, which is used to develop and demonstrate the functionality of the FT932 Embedded Microcontroller.

This module is ideal for simple applications including USB capability products, embedded multimedia applications and other industrial control systems.

1.1 Features

For a full list of the FT93x features refer to the [FT93x datasheet](#). In addition, the MM932LC module has the following features:

- FT932Q 48-pin QFN package microcontroller.
- In built 16M Byte Eflash memory.
- A Micro-B USB connector for connecting to a USB host or providing a power supply over USB for the board.
- 2x8 pins 2.54mm pitch dual entry female header for SPI master to support LCD display modules.
- 2x5 pins 1.27mm pitch female Micro-MaTch connector for software download.
- 1x15 pins 2.54mm pitch female header support for external feature expansions.
- Hardware Reset button provided.
2 Ordering Information

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MM932LC</td>
<td>FT932 module, a 32-bit microcontroller with 128kB flash memory, 32kB data RAM and 128kB program memory embedded. USB2.0 Device, 16MB Eflash, several interface pin headers and connectors included.</td>
</tr>
</tbody>
</table>

*Table 2-1 – Ordering information*
3 Program Support

Example applications are provided for the MM932LC module by Bridgetek.
For other relevant documents and examples, please refer to the Bridgetek website.
Refer to BRT_AN_010_FT93x_User_Manual for system register information.
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4 Board Layout

The MM932LC development board is a 55 mm x 51 mm (Not including the 2 mounting holes) two-layer printed circuit board. The layout is as shown in Figure 4-1.

![MM932LC Board Layout](image)

**Figure 4-1 – MM932LC Board Layout**

Key Features:

1. Micro-MaTch connector
2. Dual-entry female header
3. 16M Byte Eflash memory
4. H/W Reset button
5. External I/O bus female pin header
6. FT932Q QFN48 Microcontroller
7. LDO regulator
8. USB Micro-B connector
9. Audio PWM output from FT8xx (assumes FT8xx based LCD plugged in).
4.1 Power Supply

The MM932LC development board is powered from a USB power supply source via the Micro-B USB CN3 port. A power jumper JP1 connects the USB power (VBUS_IN) to the input of an LDO regulator (VDD_5V).

A red LED (LED1) will illuminate after the +5V power supply is applied. This supply will also drive a fixed +3.3V LDO regulator which will provide power to all peripherals of the FT932 microcontroller.

![Power supply diagram](image)

**Figure 4-2 – Power supply**

4.2 Microcontroller

The FT932Q 48-pin QFN microcontroller (U1) provided on the board belongs to the 32-bit FT93x Microcontroller family from Bridgetek. For details of the FT932 Microcontroller, refer to the FT93x datasheet.

![FT932 Microcontroller](image)

**Figure 4-3 – FT932 Microcontroller**

There is one crystal used on the MM932LC development board. The 12MHz crystal (Y1) is the primary system clock frequency supplying the FT932Q IC.

The FT932Q IC on this board is operated from a single supply of +3.3V. The power output pins have decoupling capacitors as specified in the datasheet.
4.3 Flash Memory

The MM932LC module contains an on-board Winbond Serial Flash memory W25Q128FV (128M-bit/16Mbyte) with Dual/Quad SPI interface, which is ideal for code shadowing and storing voice, text and data.

Figure 4-4 – Flash Memory

Figure 4-5 – Flash Memory Interface
4.4 USB Connector

There is a USB connector provided on the MM932LC board. **CN3** is a Micro-B type USB2.0 connector which is used for connecting the module to a USB host. This is for power and data transfer.

![USB Connectors Interface](image)

**Figure 4-6 – USB Connectors Interface**

4.5 Programmer Interface

The programmer interface **CN5**, 2x5 pins 1.27mm pitch female Micro-Match header supports software application download, GDB debugging on the MM932LC development board with the UMFTPD2A module.

4.5.1 **CN5 – 10-pin Micro-Match Program Interface Signals**

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1~6</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
<td>P</td>
<td>Ground</td>
</tr>
<tr>
<td>8</td>
<td>DEBUG</td>
<td>I/O</td>
<td>FT90x One-Wire Interface</td>
</tr>
</tbody>
</table>
### Table 4-1 – CN5 Pinout

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>GDB_5V</td>
<td>P</td>
<td>External 5V power supply</td>
</tr>
<tr>
<td>10</td>
<td>RESETn</td>
<td>P</td>
<td>H/W Reset, active low</td>
</tr>
</tbody>
</table>

#### 4.6 SPI Master Interface

The FT932Q microcontroller has a SPI master interface that supports single, dual and quad SPI data transfer modes. There is a connector for supporting different FT8xx enabled LCD display modules as SPI slave devices.

- The **J1** dual-entry 2x8 pins 2.54mm pitch, female header is designed for FT80x and FT81x Embedded Video Engine (EVE) family LCD display modules. For example the **ME810A-HV35R module**, can connect directly to the MM932LC development board on the bottom side with a male pin header.
### J1 – 16-pin Dual Entry Header, SPI Master and Control Signals

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SPIM_SCK</td>
<td>O</td>
<td>SPI Master clock output</td>
</tr>
<tr>
<td>2</td>
<td>SPIM_SSn0</td>
<td>O</td>
<td>SPI Master chip select 0, active low</td>
</tr>
<tr>
<td>3</td>
<td>SPIM_MISO</td>
<td>I/O</td>
<td>SPI Master input, Slave output Data 1 for Quad SPI</td>
</tr>
<tr>
<td>4</td>
<td>SPIM_MOSI</td>
<td>I/O</td>
<td>SPI Master output, Slave input Data 0 for Quad SPI</td>
</tr>
<tr>
<td>5</td>
<td>SPIM_IO3</td>
<td>I/O</td>
<td>General I/O, data 3 for Quad SPI</td>
</tr>
<tr>
<td>6</td>
<td>SPIM_IO2</td>
<td>I/O</td>
<td>General I/O, data 2 for Quad SPI</td>
</tr>
<tr>
<td>7</td>
<td>DCX</td>
<td>O</td>
<td>Data / command selection pin for LCD controller</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Low: Command</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>High: Parameter</td>
</tr>
<tr>
<td>8</td>
<td>CS1#</td>
<td>O</td>
<td>SPI Master chip select 1, active low for LCD controller</td>
</tr>
<tr>
<td>9</td>
<td>VCCIO_3V3</td>
<td>P</td>
<td>+3.3V power supply</td>
</tr>
<tr>
<td>10</td>
<td>VDD_5V</td>
<td>P</td>
<td>+5V power supply</td>
</tr>
<tr>
<td>11</td>
<td>GND</td>
<td>P</td>
<td>Ground</td>
</tr>
<tr>
<td>12</td>
<td>GND</td>
<td>P</td>
<td>Ground</td>
</tr>
<tr>
<td>13</td>
<td>PWD#</td>
<td>O</td>
<td>FT8XX power down control, active low</td>
</tr>
<tr>
<td>14</td>
<td>INT#</td>
<td>I</td>
<td>Interrupt input from FT8XX, active low</td>
</tr>
<tr>
<td>15</td>
<td>AUD_LIN</td>
<td>I</td>
<td>Audio PWM output from FT8XX</td>
</tr>
<tr>
<td>16</td>
<td>DISP</td>
<td>O</td>
<td>LCD display enable</td>
</tr>
</tbody>
</table>

**Table 4-2 – J1 Pinout**
4.7 External I/O Bus

There are multiple interface signals provided on CN1 1x15 pins, 2.54mm pitch female header. External feature boards may connect via UART, PWM, ADC, DAC and I2C on these IO connectors.

Table 4-3 lists all features assigned for each pin.

### 4.7.1 CN1 – 15-pin Single Header, Multiple Interface Signals

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Function 1</th>
<th>Function 2</th>
<th>Function 3</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VDD_5V</td>
<td>-</td>
<td>-</td>
<td>+5.0V supply voltage, output.</td>
</tr>
<tr>
<td>2</td>
<td>VCCIO_3V3</td>
<td>-</td>
<td>-</td>
<td>+3.3V supply voltage, output.</td>
</tr>
<tr>
<td>3</td>
<td>ADC1</td>
<td>-</td>
<td>-</td>
<td>8-bit Analog-to-Digital converter 1, input.</td>
</tr>
<tr>
<td>4</td>
<td>ADC2</td>
<td>-</td>
<td>-</td>
<td>8-bit Analog-to-Digital converter 2, input.</td>
</tr>
<tr>
<td>5</td>
<td>ADC3</td>
<td>-</td>
<td>-</td>
<td>8-bit Analog-to-Digital converter 3, input.</td>
</tr>
</tbody>
</table>

Figure 4-8 – SPI Master Interface
<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Function 1</th>
<th>Function 2</th>
<th>Function 3</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6,9,12,15</td>
<td>GND</td>
<td>-</td>
<td>-</td>
<td>Ground.</td>
</tr>
<tr>
<td>7</td>
<td>DAC0</td>
<td>-</td>
<td>-</td>
<td>10-bit Digital-to-Analog converter 0, output.</td>
</tr>
<tr>
<td>8</td>
<td>DAC1</td>
<td>-</td>
<td>-</td>
<td>10-bit Digital-to-Analog converter 1, output.</td>
</tr>
<tr>
<td>10</td>
<td>I2CM_SDA</td>
<td>I2CS_SDA</td>
<td>GPIO13</td>
<td>I2C master data line input/output. I2C slave data line input/output. GPIO13 input/output.</td>
</tr>
<tr>
<td>11</td>
<td>I2CM_SCL</td>
<td>I2CS_SCL</td>
<td>GPIO12</td>
<td>I2C master serial clock input/output. I2C slave serial clock input/output. GPIO12 input/output.</td>
</tr>
<tr>
<td>13</td>
<td>UART0_RXD</td>
<td>PWM3</td>
<td>GPIO22</td>
<td>UART0 receiver input. PWM channel 3, output. GPIO22 input/output.</td>
</tr>
<tr>
<td>14</td>
<td>UART0_TXD</td>
<td>PWM2</td>
<td>GPIO23</td>
<td>UART0 transmitter output. PWM channel 2, output. GPIO23 input/output.</td>
</tr>
</tbody>
</table>

Table 4-3 – CN1 External I/O Bus
Figure 4-9 – External I/O Bus
5 Board Schematic

Figure 5-1 – MM932LC MCU and External I/O Bus
Figure 5-2 – MM932LC Interfaces and Connectors
6 Mechanical Dimensions

6.1 MM932LC PCB Dimensions

Figure 6-1 – MM932LC PCB Dimensions
7 Contact Information

Head Quarters – Singapore
Bridgetek Pte Ltd
178 Paya Lebar Road, #07-03
Singapore 409030
Tel: +65 6547 4827
Fax: +65 6841 6071

E-mail (Sales) sales.apac@brtchip.com
E-mail (Support) support.apac@brtchip.com

Branch Office – Taipei, Taiwan
Bridgetek Pte Ltd, Taiwan Branch
2 Floor, No. 516, Sec. 1, Nei Hu Road, Nei Hu District
Taipei 114
Taiwan, R.O.C.
Tel: +886 (2) 8797 5691
Fax: +886 (2) 8751 9737

E-mail (Sales) sales.apac@brtchip.com
E-mail (Support) support.apac@brtchip.com

Branch Office – Glasgow, United Kingdom
Bridgetek Pte Ltd.
Unit 1, 2 Seaward Place, Centurion Business Park
Glasgow G41 1HH
United Kingdom
Tel: +44 (0) 141 429 2777
Fax: +44 (0) 141 429 2758

E-mail (Sales) sales.emea@brtchip.com
E-mail (Support) support.emea@brtchip.com

Branch Office – Vietnam
Bridgetek VietNam Company Limited
Lutaco Tower Building, 5th Floor, 173A Nguyen Van Troi,
Ward 11, Phu Nhuan District,
Ho Chi Minh City, Vietnam
Tel: 08 38453222
Fax: 08 38455222

E-mail (Sales) sales.apac@brtchip.com
E-mail (Support) support.apac@brtchip.com

Web Site
http://brtchip.com/

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Appendix A - References

Document References

FT93X webpage: FT93x Webpage
FT93x datasheet: FT930/FT931/FT932/FT933 Datasheet
FT93x user manual: BRT_AN_010_FT93x_User_Manual
UMFTPD2A program module datasheet: DS_UMFTPD2A
ME810A-HV35R LCD display module document: DS_ME810A_HV35R

Acronyms and Abbreviations

<table>
<thead>
<tr>
<th>Terms</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>ADC</td>
<td>Analog-to-Digital Converter</td>
</tr>
<tr>
<td>DAC</td>
<td>Digital-to-Analog Converter</td>
</tr>
<tr>
<td>H/W</td>
<td>Hardware</td>
</tr>
<tr>
<td>I/O</td>
<td>Input/Output</td>
</tr>
<tr>
<td>I2C</td>
<td>Inter-Integrated Circuit</td>
</tr>
<tr>
<td>LCD</td>
<td>Liquid Crystal Display</td>
</tr>
<tr>
<td>LDO</td>
<td>Low Drop-Out</td>
</tr>
<tr>
<td>LED</td>
<td>Light-Emitting Diode</td>
</tr>
<tr>
<td>PWM</td>
<td>Pulse Width Modulation</td>
</tr>
<tr>
<td>QFN</td>
<td>Quad-Flat No-leads</td>
</tr>
<tr>
<td>RAM</td>
<td>Random Access Memory</td>
</tr>
<tr>
<td>SD</td>
<td>Secure Digital</td>
</tr>
<tr>
<td>SPI</td>
<td>Serial Peripheral Interface</td>
</tr>
<tr>
<td>UART</td>
<td>Universal Asynchronous Receiver/Transmitter</td>
</tr>
<tr>
<td>USB</td>
<td>Universal Serial Bus</td>
</tr>
</tbody>
</table>
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Appendix C – Revision History

<table>
<thead>
<tr>
<th>Revision</th>
<th>Changes</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version 1.0</td>
<td>Initial Release</td>
<td>2017-11-13</td>
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</table>