

FTDI Chip

VM800C Datasheet

Embedded Video Engine Credit Card Board



General Purpose Multi Media Controller

1 Introduction

The VM800C is a development module for FTDI's FT800, which is used to develop and demonstrate the functionality of the FT800 Embedded Video Engine, EVE. This module behaves as an SPI slave, and requires a SPI Master for proper micro-controller interfacing and system integration.

VM800C modules support 3 different LCD panel size options. Users can also connect to different LCD screens as long as they meet the FT800 technical specification and fit the VM800C LCD connector.

- VM800C35A-D, 3.3/5V micro-controller adaptor card with 3.5" LCD touch display
- VM800C43A-D, 3.3/5V micro-controller adaptor card with 4.3" LCD touch display
- VM800C50A-D, 3.3/5V micro-controller adaptor card with 5.0" LCD
- VMFT800C35A-N, 3.3/5V micro-controller adaptor card, with 3.5" LCD connector but no display
- VMFT800C43A-N, 3.3/5V micro-controller adaptor card, with 4.3/5.0" LCD connector but no display

1.1 Features

The VM800C utilises the FTDI FT800 Embedded Video Engine. Graphic, audio and touch features of the FT800 can be accessed with the VM800C. For a full list of the FT800's features please see the FT800 datasheet. The VM800C has the following features:

- Ready to use LCD module
- Part types with LCDs supporting resistive touch with pressure sensing.
- On board LCD backlight LED Driver
- Supports mono audio output
- On board audio power amplifier and micro speaker
- Flexible power supply. Powering the VM800C using either a 2.1mm power jack , SPI master connector or via USB Micro-B port
- 5 V tolerant buffers when used with a 5V SPI Master.

2 Ordering Information

Note that the kits below require a 5V/1A power supply. It is NOT provided in the development kit, but is offered as an optional accessory, as is the USB to SPI cable, with the following part types:

| Part No. | Description |
|----------------------|---|
| VM800C35A-N | Credit Card Size VM800C module, supports 3.3/5v MCU Adapter Board, with FPC/FFC 54 LCD connector. No display is provided. |
| VM800C43A-N | Credit Card Size VM800C module, supports 3.3/5v MCU Adapter Board, with FPC/FFC 40 LCD. No display is provided. |
| VM800C35A-D | Credit Card Size VM800C module, supports 3.3/5v MCU Adapter Board, with FPC/FFC 54 LCD connector, 3.5 inch TFT LCD display panel preinstalled. |
| VM800C43A-D | Credit Card Size VM800C module, supports 3.3/5v MCU Adapter Board, with FPC/FFC 40 LCD connector, 4.3 inch TFT LCD display panel preinstalled. |
| VM800C50A-D | Credit Card Size VM800C module, supports 3.3/5v MCU Adapter Board, with FPC/FFC 40 LCD connector, 5.0 inch TFT LCD display panel preinstalled. |
| VA-PSU-UK1 | Accessory - UK Model 5V/1A USB Power Supply (Mfr # JX-B0520C-1-B) |
| VA-PSU-US1 | Accessory - US Model 5V/1A USB Power Supply (Mfr # JX-B0520B-1-B) |
| VA-PSU-EU1 | Accessory - EU Model 5V/1A USB Power Supply (Mfr # JX-B0520A-1-B) |
| VA800A-SPI | Accessory - High Speed Micro USB to SPI adapter for BASIC boards based on FT232H MPSSE design |
| VA-FC-1M-BKW | Accessory - Flat USB A to Micro B Cable 1M- Black and White |
| VA-FC-1M-BLW | Accessory - Flat USB A to Micro B Cable 1M- Blue and White |
| VA-FC-STYLUS1 | Accessory - Resistive Touch Screen Pen Stylus |

Table 2-1 – Ordering information

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3 Hardware Description

Please refer to section 3.2.2 for connector settings. Some VM800C jumpers must be set to work properly with your system.

3.1 VM800C board

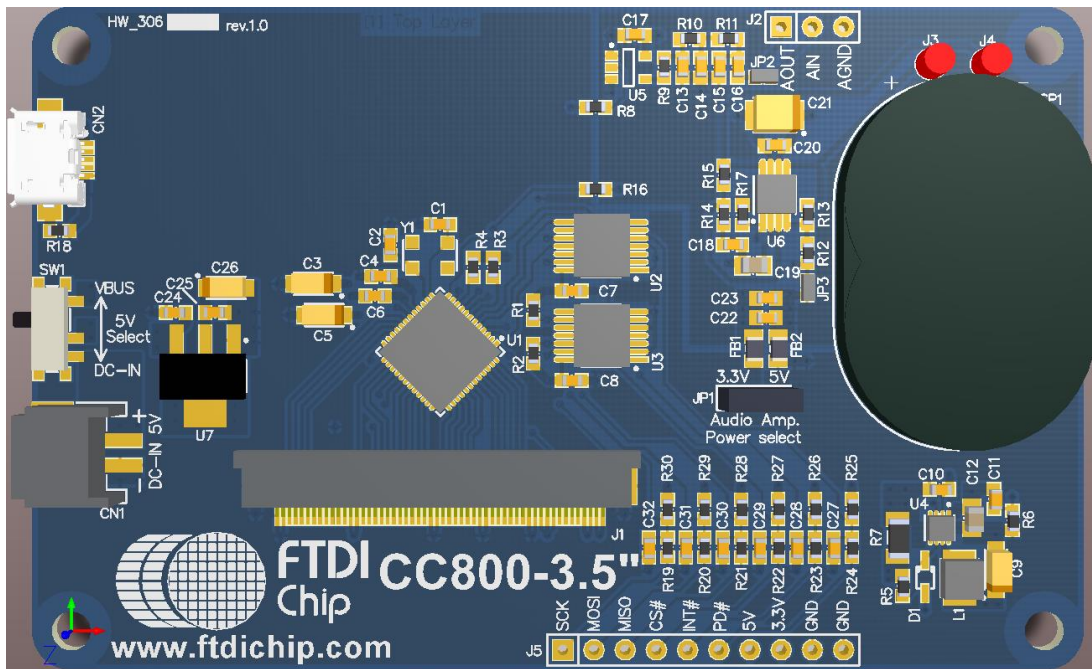


Figure 3-1 – VM800C board profile 3.5" display version

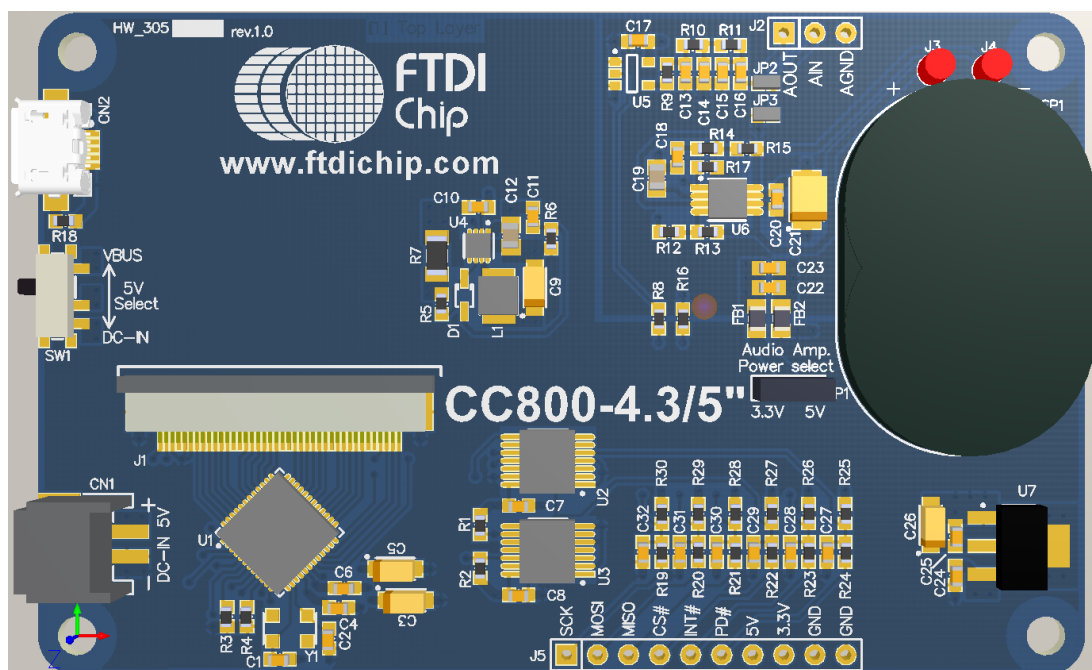


Figure 3-2 - VM800C board profile 4.3"/5" display version

The VM800C module is intended for direct use into existing applications that require a display. This module is suitable for interfacing with an external microcontroller that has a SPI Master channel.

The VM800C module PCB comes in 2 types, 3.5 inch as well as a 4.3/5 inch model. The difference between the 2 models is the flex cable receptacle of the LCD. The 3.5 inch LCD uses a 54 pin receptacle, whereas the 4.3/5 inch model uses a 40 pin receptacle.

The main functions of the VM800C are as follows:

- Micro USB, SPI connector or 2-pin connector for power supply
- 3.3V regulator : Takes 5V input and outputs 3.3V for on-board circuits
- LCD touch screen panel
- LCD backlight driver. On board back light driver has over voltage protection (OVP).

| Part No | OVP (v) | Backlight drive current (mA) |
|-------------|---------|------------------------------|
| VM800C35A-N | 34 | 20 |
| VM800C43A-N | 34 | 32 |
| VM800C35A-D | 24 | 20 |
| VM800C43A-D | 24 | 32 |
| VM800C50A-D | 24 | 32 |

Table 3-1 LED backlight drive OVP and current

- 5V tolerant buffers between the SPI master interface and the Slave interface of the FT800
 - SPI timing requirement can be referred to FT800 datasheet. The on board level convert buffers introduce additional delay. The actual maximum SPI clock frequency depends on the host system timing and connection cable length to VM800C.
- 3 stage audio filter and power amplifier
- 8Ω speaker
- Audio line out option

3.2 Physical Descriptions

3.2.1 PCB layout

The VM800C module is 85.6 x 54.1mm, four-layer printed circuit board. Board thickness is approximately 1.6mm.

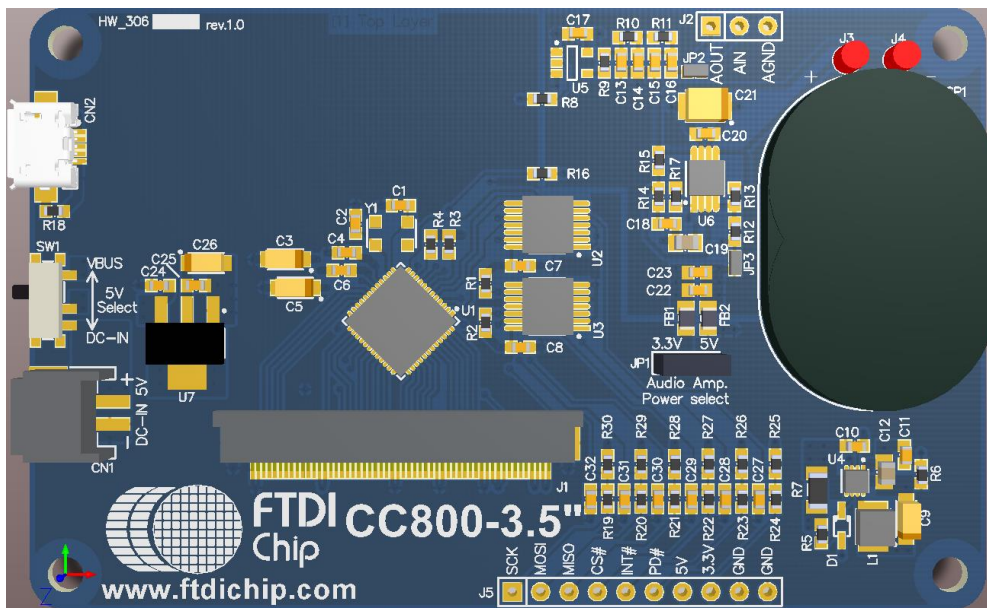


Figure 3-3 - VM800C module top view, 3.5 inch display version

3.2.2 VM800C Connectors

Connectors and jumpers are described in the following sections.

- **CN1- 2-pin power connector**

2 pin connector for 5V/3.3V power input to the board. Alternative to Micro USB connector.

| Pin No. | Name | Type | Description |
|---------|------|------|----------------------------|
| 1 | VCC | P | 5V or 3.3V DC power supply |
| 2 | GND | P | Ground |

Table 3-2 – CN1 Pinout

- **CN2- Micro USB Receptical**

This receptical is strictly for 5V input to power the board. There is no USB Functionality

| Pin No. | Name | Type | Description |
|---------|------|------|-----------------|
| 1 | VBUS | P | 5V power supply |
| 2 | NC | NA | No connection |
| 3 | NC | NA | No connection |
| 4 | NC | NA | No connection |
| 5 | GND | P | Ground |

Table 3-3 – CN2 Pinout

- **J1- LCD Flex Cable connector**

This connector is the interface between the FT800 IC and the LCD Module.

| Signal | Pin No (3.5") | Pin No (4.3/5.0") | Description |
|--------|------------------|----------------------|---|
| LED K | 1,2 | 1 | LED Cathode |
| LED A | 3,4 | 2 | LED Cathode |
| DISP | 8 | 31 | General purpose output pin for LCD Display Enable, push-pull output, 4/8mA sink/source current. Control by writing to Bit 7 of REG_GPIO register. |
| HSYNC | 36 | 32 | LCD Horizontal Sync, push-pull output, 4/8mA sink/source current. |
| VSYNC | 37 | 33 | LCD Vertical Sync, push-pull output, 4/8mA sink/source current. |
| DCLK | 38 | 30 | LCD Pixel Clock, push-pull output, 4/8mA sink/source current. |
| DE | 52 | 34 | LCD Data Enable, push-pull output, 4/8mA sink/source current. |
| R2 | 14 | 7 | Bit 2 of Red RGB signals, push-pull output, 4/8mA sink/source current. |
| R3 | 15 | 8 | Bit 3 of Red RGB signals, push-pull output, 4/8mA sink/source current. |
| R4 | 16 | 9 | Bit 4 of Red RGB signals, push-pull output, 4/8mA sink/source current. |
| R5 | 17 | 10 | Bit 5 of Red RGB signals, push-pull output, 4/8mA sink/source current. |
| R6 | 18 | 11 | Bit 6 of Red RGB signals, push-pull output, 4/8mA sink/source current. |
| R7 | 19 | 12 | Bit 7 of Red RGB signals, push-pull output, 4/8mA sink/source current. |
| G2 | 22 | 15 | Bit 2 of Green RGB signals, push-pull output, 4/8mA sink/source current |
| G3 | 23 | 16 | Bit 3 of Green RGB signals, push-pull output, 4/8mA sink/source current |
| G4 | 24 | 17 | Bit 4 of Green RGB signals, push-pull output, 4/8mA sink/source current |
| G5 | 25 | 18 | Bit 5 of Green RGB signals, push-pull output, 4/8mA sink/source current |

| Signal | Pin No (3.5") | Pin No (4.3/5.0") | Description |
|--------|----------------------------|-------------------------|---|
| G6 | 26 | 19 | Bit 6 of Green RGB signals, push-pull output, 4/8mA sink/source current |
| G7 | 27 | 20 | Bit 7 of Green RGB signals, push-pull output, 4/8mA sink/source current |
| B2 | 30 | 23 | Bit 2 of Blue RGB signals, push-pull output, 4/8mA sink/source current. |
| B3 | 31 | 24 | Bit 3 of Blue RGB signals, push-pull output, 4/8mA sink/source current. |
| B4 | 32 | 25 | Bit 4 of Blue RGB signals, push-pull output, 4/8mA sink/source current. |
| B5 | 33 | 26 | Bit 5 of Blue RGB signals, push-pull output, 4/8mA sink/source current. |
| B6 | 34 | 27 | Bit 6 of Blue RGB signals, push-pull output, 4/8mA sink/source current. |
| B7 | 35 | 28 | Bit 7 of Blue RGB signals, push-pull output, 4/8mA sink/source current. |
| XP | 48 | 37 | X +ve touch |
| YM | 49 | 38 | Y -ve touch |
| XM | 50 | 39 | X -ve touch |
| YP | 51 | 40 | Y +ve touch |
| 3V3 | 9,10,11,41,42 | 4 | 3V3 Power |
| GND | 12,13,20,21,28,29,53,54 | 3,5,6,13,14,21,22,29,36 | Ground |
| NC | 5,6,7,39,40,43,44,45,46,47 | 35 | No connect |

Table 3-4 – J1 Pinout

- **J2 - Selection between lineout or loop back into the power amplifier.**

Selection between audio lineout or loop back into the power amplifier. (Footprint only, JP2 next to J2 is connected by default for on board amplifier and on board mini speaker). If J2 is soldered and used for audio output selection, JP2 needs to be removed.

| Pin No. | Name |
|---------|--|
| 1 -2 | Audio amp enabled |
| 2-3 | Audio amp mute, Audio lineout on pin 1 |

Table 3-5 – J2 Pin Options

- **J3 – SP+**

Audio speaker +ve from the onboard amplifier.

- **J4 – SP-**

Audio speaker -ve from the onboard amplifier.

- **J5- SPI Interface**

This is the interface where the SPI control and data signals are routed. There are also power and ground pins on this interface. Note J5 is not soldered on the VM800C board by default.

| Pin No. | Name | Type | Description |
|---------|------|------|--|
| 1 | SCLK | I | SPI Clock input |
| 2 | MOSI | I | Master Out Slave in |
| 3 | MISO | O | Master In Slave out |
| 4 | CS# | I | Chip select , active low |
| 5 | INT# | OD | Host interrupt open drain output, active low. On board 47kΩ pull-up to 3.3V. |
| 6 | PD# | I | Active low power down input. |
| 7 | 5V | P | 5V power supply |
| 8 | 3.3V | P | 3.3V power supply |
| 9 | GND | P | Ground |
| 10 | GND | P | Ground |

Table 3-6 – J5 Pinout

- **JP1- Audio Amplifier Power Select**

This jumper provides the option to select the power supply voltage for the onboard power amplifier.

| Pin No. | Name |
|---------|--------------|
| 1-2 | 3V3 selected |
| 2-3 | 5V selected |

Table 3-7 – JP1 Pin options

*This needs to be configured before audio can be heard

- **JP2 – On board amplifier enable**

Solder connection fitted by default

- **JP3 - On board amplifier mute**

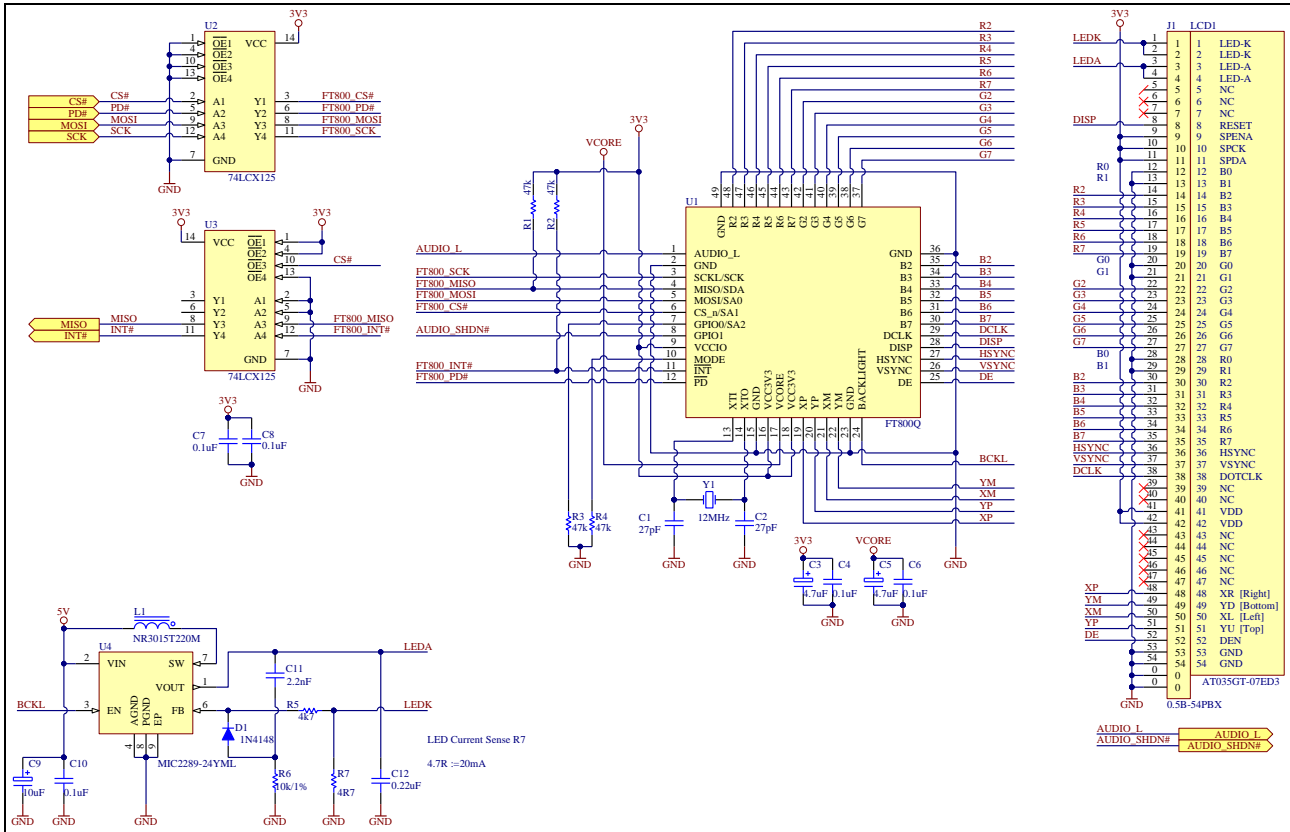
Solder connection not fitted by default

- **SW1 – Power source select**

| Pin No. | Name |
|---------|----------------|
| 1-2 | Power from CN1 |
| 2-3 | Power from CN2 |

Table 3-8 – JP1 Pin options

4 Board Schematics



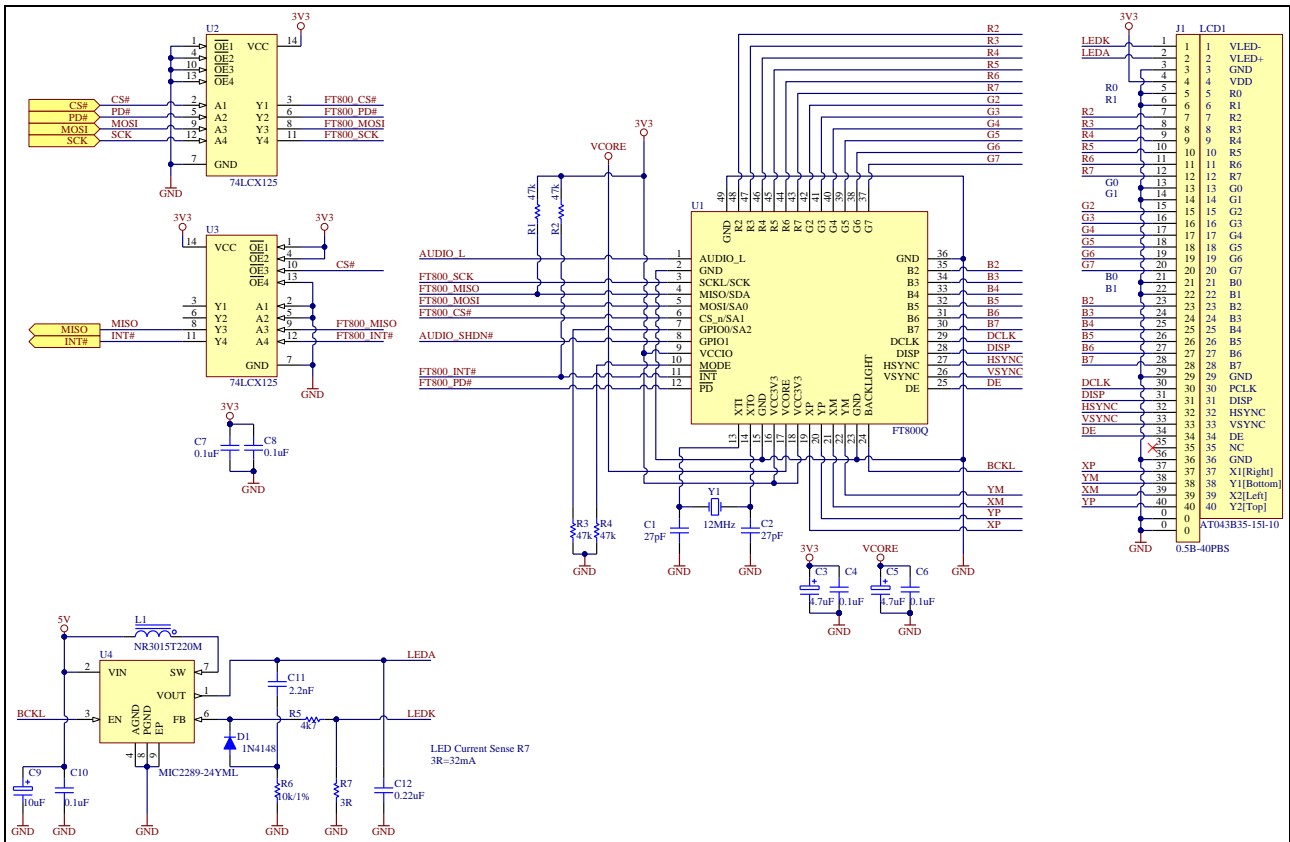


Figure 4-2 - VM800C43/VM800C50 (4.3"/5.0" Version)

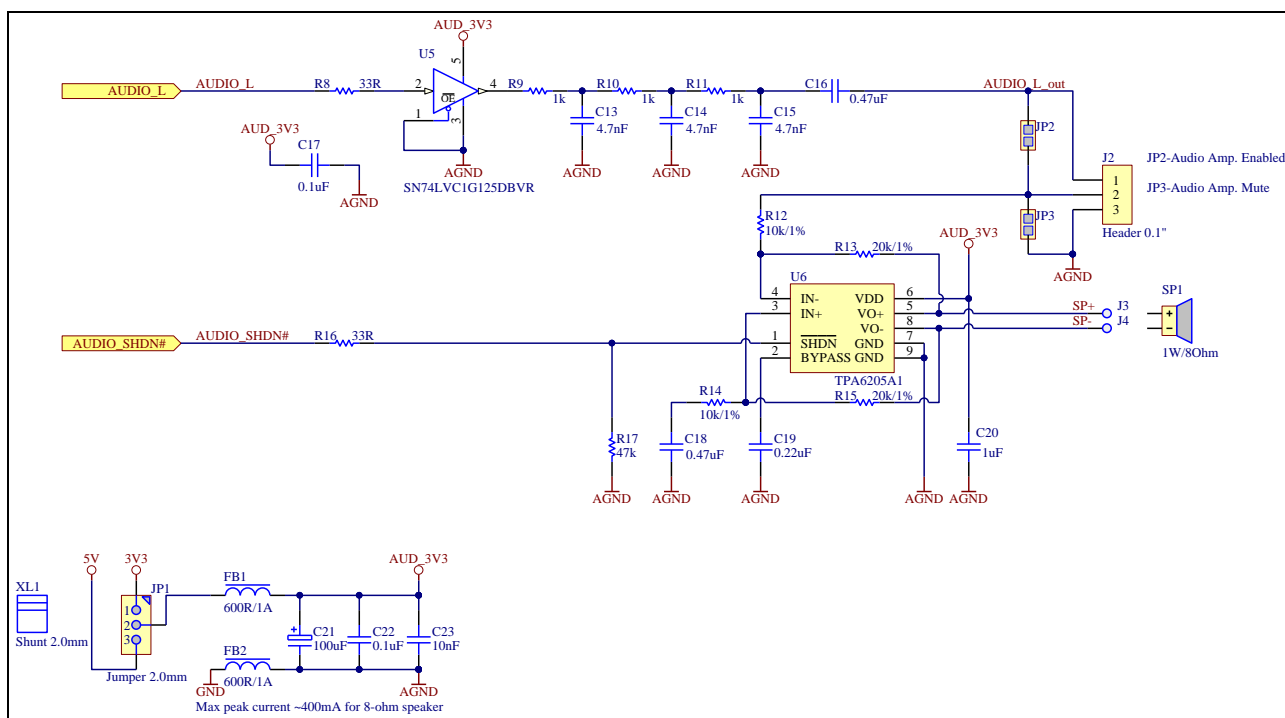


Figure 4-4 – VM800C Audio

5 Hardware Setup Guide

5.1 Power Configuration

There are 5 methods of powering the VM800C board.

- 1) USB Power(5V) - Connect USB power through micro-USB cable to CN2
- 2) DC IN(5V) - Connect 5V to CN1
- 3) DC IN(3.3V) - Connect 3.3V to CN1 and short J5 pin 7 and 8
- 4) J5 Power(5V) - Connect 5V to J5 pin 7
- 5) *J5 Power(3.3V) - Connect 3.3V to J5 pin 7 and 8

*Warning: Applying 5 V accidently in this mode may cause permanent damage to the VM800C module.

The following table summarise how to power the VM800C board using the various methods.

| Power Method | CN2 | CN1 | J5 Pin 7 | J5 Pin 8 | SW1 |
|-----------------|-----|------|----------|----------|---------------|
| USB Power | 5V | N/C | N/C | N/C | Short pin 2-3 |
| DC IN(5V) | N/C | 5V | N/C | N/C | Short pin 1-2 |
| DC IN(3.3V) | N/C | 3.3V | SHORT | | Short pin 1-2 |
| J5 Power(5V) | N/C | N/C | 5V | N/C | Any Position |
| J5 Power (3.3V) | N/C | N/C | 3.3V | | Any Position |

Table 5-1 Board power configuration

5.2 MPSSE Setup

To give a quick start with the VM800C development board, a Windows based Sample Application and demo applications are provided for users to experiment and experience the FT800 in the VM800C system. The following paragraphs provide a short description for development procedures.

MPSSE is a "multi purpose synchronous serial engine" interface available in some FTDI device (e.g. FT2232D, FT232H, FT2232H and FT4232H). This engine allows users to bridge from a USB port on a PC to an I²C or SPI interface. Sample code is available for driving the FT800 over this interface with a FT232H device that has been integrated into a cable. This device is available in the VA800A-SPI board, or C232HM-EDHSL-0(5V) cable or C232HM-DDHSL-0(3.3V) cable.

VA800A-SPI is a MPSSE module accessory which can connect to the VM800C modules directly. Detailed information of VA800A-SPI can be found at:

<http://www.ftdichip.com/VM800B.htm>.

More information about MPSSE cables may be found at:

http://www.ftdichip.com/Support/Documents/DataSheets/Cables/DS_C232HM_MPSSE_CABLE.pdf.

In this section it is assumed the 5V version of the MPSSE cable (FTDI part no C232HM-EDHSL-0) is used. In case a 3.3V version of the MPSSE cable (FTDI part no C232HM-DDHSL-0) is available, the setup is similar except for the power pin connection. Refer to table 5-1 for board power configuration.

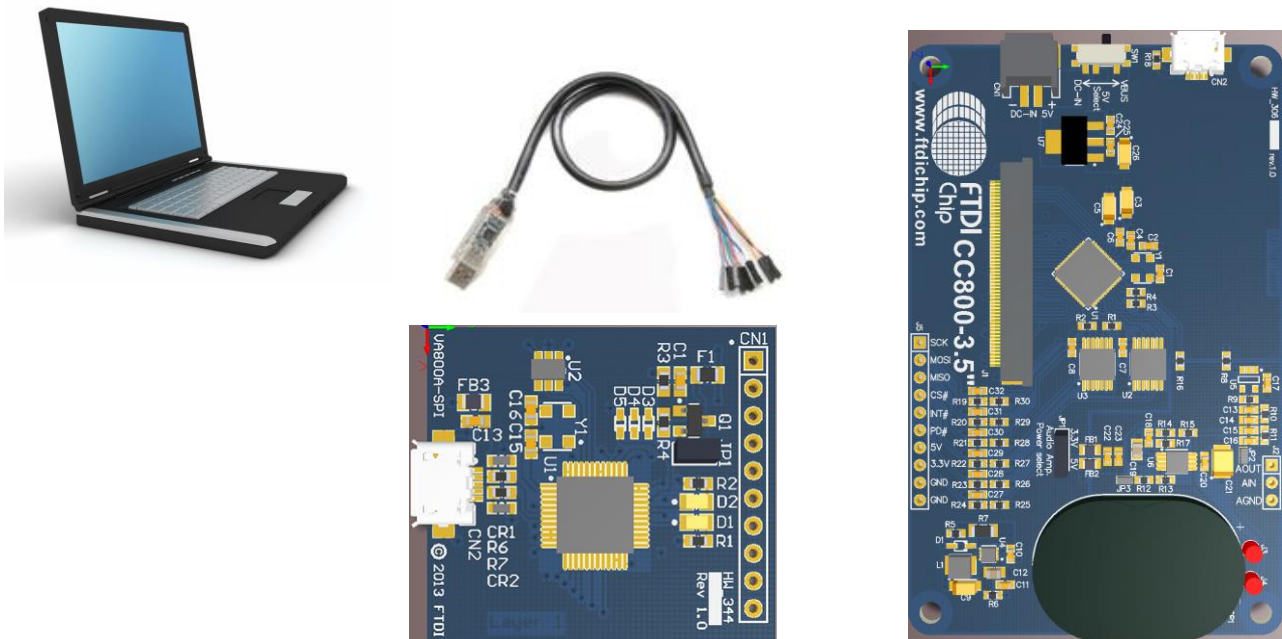


Figure 5-1 – VM800C connects to PC via VA800A-SPI or MPSSE cable.

Hardware Setup VA800A-SPI

- Solder a 10 position single row pin header to J5 footprint of the VM800C board
- Connect VA800A-SPI to the VM800C module in the correct orientation.
- Connect USB cable (e.g. FTDI accessory **VA-FC-1M-BKW** or **VA-FC-1M-BLW**) from the VA800A-SPI to the PC USB host port.
- VA800A-SPI will supply power to VM800C after MPSSE driver is properly loaded and the USB host completed USB device configuration.

Hardware Setup MPSSE Cable

- Solder a 10 position single row pin header to J5 footprint of the VM800C board
- Configure JP1 to either 3.3V or 5V
 - Power Audio Amp by 3.3V : JP1 pin1 and pin 2 close
 - Power Audio Amp by 5V : JP1 pin2 and pin 3 close (5V board supply must be provided)
- Connect MPSSE leads to VM800C board's J5(SPI interface) in accordance with Table 5-2
- Plug MPSSE cable to PC USB port

Software Setup

- Download PC Base MPSSE software. MPSSE cable and driver information can be found at <http://www.ftdichip.com/Products/Cables/USBMPSSE.htm>.
- Launch the Sample Application based on MPSSE from PC
- For more information on utilizing the VM800C development system with the MPSSE cable and Sample Application, refer to AN_245.

Further documentation associated with the VM800C development system and design flow can be found at following link: <http://www.ftdichip.com/VM800C.htm>

The FT800 Programming Guide describes the programming code and formats used by the FT800. The Sample Application is a well-formatted, and documented program that illustrates the Programming Guide, and provides numerous design examples and reference code demonstrations.

| J5 Pin number | J5 Signal | MPSSE pin number | MPSSE Signal | MPSSE Lead Color |
|---------------|-----------|------------------|--------------|------------------|
| 1 | SCK | 2 | SK | ORANGE |
| 2 | MOSI | 3 | DO | YELLOW |
| 3 | MISO | 4 | DI | GREEN |
| 4 | CS# | 5 | CS | BROWN |
| 5 | INT# | 7 | GPIOL1 | PURPLE |
| 6 | PD# | 9 | GPIOL3 | BLUE |
| 7 | 5V | 1 | VCC | RED |
| 8 | 3.3V | - | - | - |
| 9 | GND | 10 | GND | Black |
| 10 | GND | - | - | - |

Table 5-2 – MPSSE cable (C232HM-EDHSL-0) connection

5.3 Arduino® Setup

Sample codes and demo applications are provided to users who want to connect VM800C to a MCU. FTDI provides sample source code, Sample Application notes (AN_246) and a ready to run demo based on Arduino® platform. Further documentation associated with the VM800C development system and design flow can be found at <http://www.ftdichip.com/VM800C.htm>.

Applicaton note, AN_246, provides a reference guide for utilizing the VM800C development systems with the Sample Application software and Arduino Pro platform.

The FT800 Programming Guide describes the programming code and formats used by the FT800. The Sample Application is a well-formatted, and documented program that illustrates the Programming Guide, and provides numerous design examples and reference code demonstrations.

6 Specifications

6.1 Optical Specification

| Item | Symbol | Condition | Min | Typ. | Max. | Unit |
|----------------|------------|--------------------|-------|-------|-------|--------|
| View Angles | θT | $CR \geq 10$ | 30 | 40 | | Degree |
| | θB | | 50 | 60 | | |
| | θL | | 50 | 60 | | |
| | θR | | 50 | 60 | | |
| Contrast Ratio | CR | $\theta = 0^\circ$ | | 350 | | |
| Response Time | Ton | 25°C | | 25 | 40 | ms |
| | Toff | | | | | |
| Chromaticity | White | x | 0.260 | 0.310 | 0.360 | |
| | | y | 0.283 | 0.333 | 0.383 | |
| | RED | x | 0.574 | 0.624 | 0.674 | |
| | | y | 0.318 | 0.368 | 0.418 | |
| | GREEN | x | 0.300 | 0.350 | 0.400 | |
| | | y | 0.500 | 0.550 | 0.600 | |
| | BLUE | x | 0.093 | 0.143 | 0.193 | |
| | | y | 0.069 | 0.119 | 0.169 | |
| Uniformity | U | | 75 | 80 | | % |
| NTSC | | | | 50 | | % |
| Luminance | L | | | 500 | | cd/m2 |

Table 6-1 - 3.5" TFT Optical specification

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit | |
|-------------------------|-------------|------------------------------------|------------------------------------|-------|------|-------------------|---|
| Brightness | Bp | $\theta=0^\circ$ | 450 | 500 | - | Cd/m ² | |
| Uniformity | ΔBp | $\Phi=0^\circ$ | 70 | 80 | - | % | |
| Viewing Angle | 3:00 | $CR \geq 10$ | - | 65 | - | Deg | |
| | 6:00 | | - | 55 | - | | |
| | 9:00 | | - | 65 | - | | |
| | 12:00 | | - | 45 | - | | |
| Contrast Ratio | Cr | $\theta=0^\circ$ $\Phi=0^\circ$ | 200 | 250 | - | - | |
| Response Time | T_r | | - | 16 | - | ms | |
| | T_f | | - | 12 | - | ms | |
| Color of CIE Coordinate | W | x | $\theta=0^\circ$ $\Phi=0^\circ$ | 0.23 | 0.28 | 0.33 | - |
| | | y | | 0.28 | 0.33 | 0.38 | - |
| | R | x | | 0.46- | 0.51 | 0.56 | - |
| | | y | | 0.29 | 0.34 | 0.39 | - |
| | G | x | | 0.26 | 0.31 | 0.36 | - |
| | | y | | 0.51 | 0.56 | 0.61 | - |
| | B | x | | 0.10 | 0.15 | 0.20 | - |
| | | y | | 0.09 | 0.14 | 0.19 | - |
| NTSC Ratio | S | | 45 | 60 | - | % | |

Table 6-2 - 4.3" TFT Optical Specification

| Item | Symbol | Condition | Values | | | Unit |
|-----------------------------------|------------|---------------------------------|--------|------|------|-------------------|
| | | | Min. | Typ. | Max. | |
| Viewing angle ($CR \geq 10$) | θ_L | $\Phi=180^\circ$ (9 o'clock) | 60 | 70 | - | degree |
| | θ_R | $\Phi=0^\circ$ (3 o'clock) | 60 | 70 | - | |
| | θ_T | $\Phi=90^\circ$ (12 o'clock) | 40 | 50 | - | |
| | θ_B | $\Phi=270^\circ$ (6 o'clock) | 60 | 70 | - | |
| Response time | T_{ON} | Normal $\theta=\Phi=0^\circ$ | - | 10 | 20 | msec |
| | T_{OFF} | | - | 15 | 30 | msec |
| Contrast ratio | CR | | 400 | 500 | - | - |
| Color chromaticity | W_x | | 0.26 | 0.31 | 0.36 | - |
| | W_y | | 0.28 | 0.33 | 0.38 | - |
| Luminance | L | | 240 | 300 | - | cd/m ² |
| Luminance uniformity | Y_U | | 70 | 75 | - | % |

Table 6-3 - 5" TFT Optical Specification

7 Contact Information

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Web Site

<http://ftdichip.com>

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Appendix A - References

For module documentations, please refer to URL below:

www.ftdichip.com/VM800C.htm

FT800 datasheet: [DS_FT800_Embedded_Video_Engine](#)

FT800 software programming guide: [FT800_Programmer_Guide](#)

FT800 sample application notes:

[AN_245_VM800CB_SampleAPP_PC_Introduction](#)

[AN_246_VM800CB_SampleAPP_Arduino_Introduction](#)

C232HM-DDHSL-0 datasheet:

http://www.ftdichip.com/Support/Documents/DataSheets/Cables/DS_C232HM_MPSSE_CABLE.pdf

D2xx Programmers Guide:

[http://www.ftdichip.com/Support/Documents/ProgramGuides/D2XX_Programmer's_Guide\(FT_000071\).pdf](http://www.ftdichip.com/Support/Documents/ProgramGuides/D2XX_Programmer's_Guide(FT_000071).pdf)

AN_108: Command Processor for MPSSE and MCU Host Bus Emulation Modes

http://www.ftdichip.com/Support/Documents/AppNotes/AN_108_Command_Processor_for_MPSSE_and_MCU_Host_Bus_Emulation_Modes.pdf

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Appendix C – Revision History

Document Title: DS_VM800C
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Document Feedback: [Send Feedback](#)

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