FTDI Chip

VM810C Datasheet

Embedded Video Engine Credit Card Board

General Purpose Multi Media Controller

1 Introduction

The VM810C is a development module for FTDI's FT810, which is used to develop and demonstrate the functionality of the FT810 Embedded Video Engine, EVE. This module behaves as an SPI slave, and requires a SPI Master for proper micro-controller interfacing and system integration.

VM810C modules support 5.0" LCD panel size options. Users can also connect to different LCD screens as long as they meet the FT810 technical specification and fit the VM810C LCD connector.

- VM810C50A-D, 3.3/5V micro-controller adaptor card with 5.0" LCD

- VM810C50A-N, 3.3/5V micro-controller adaptor card, with 4.3/5.0" LCD connector but no display

1.1 Features

The VM810C utilises the FTDI FT810 Embedded Video Engine. Graphic, audio and touch features of the FT810 can be accessed with the VM810C. For a full list of the FT810's features please see the FT810 datasheet.
The VM810C has the following features:

- Ready to use LCD module

- Options with or without 5" 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 VM810C using SPI host connector, or via USB Micro-B port, or via a 2.0mm JST connector

- 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
VM810C50A-N	**Credit Card Size VM810C module, supports 3.3/5v MCU Adapter Board, with FPC/FFC 40 LCD connector. No display is provided.**
VM810C50A-D	**Credit Card Size VM810C module, supports 3.3/5v MCU Adapter Board, with FPC/FFC 40 LCD connector. Includes 5 inch 800x480 TFT LCD display with resistive touch panel.**
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

Table of Contents

3 Hardware Description

Please refer to section **0** for connector settings. Some VM810C jumpers must be set to work properly with your system.

3.1 VM810C board
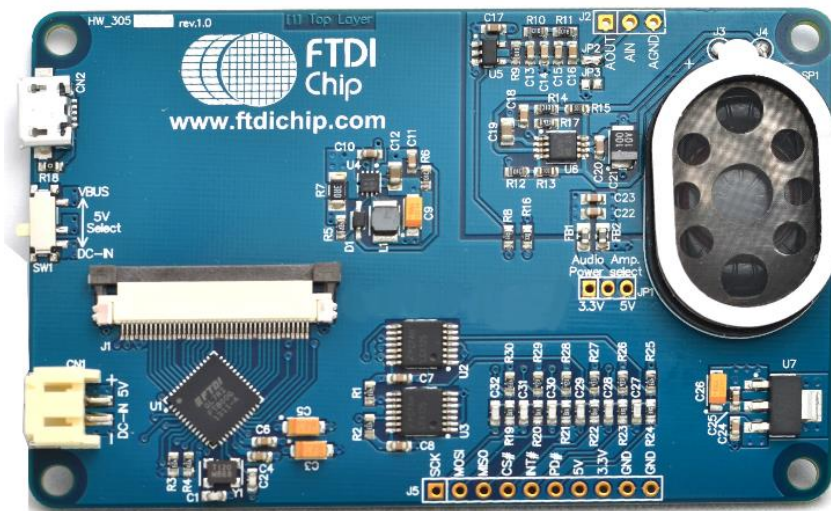
Figure 3-1 – VM810C board top view

The VM810C 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 main functions of the VM810C 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

- WVGA(800x480) TFT LCD touch screen panel (for the VM810C50A-D module)

- LCD backlight driver. On board back light driver has over voltage protection (OVP) of 34V, and drive current 60mA.

- 5V tolerant buffers between the SPI master interface and the Slave interface of the FT810

  - o SPI timing requirements can be referenced in the FT810 datasheet. The on board level converter buffers introduce additional delay. The actual maximum SPI clock frequency depends on the host system timing and connection cable length to the VM810C.

- 3 stage audio filter and power amplifier

- 8Ω speaker

- Audio line out option

3.2 Physical Descriptions

3.2.1 PCB layout

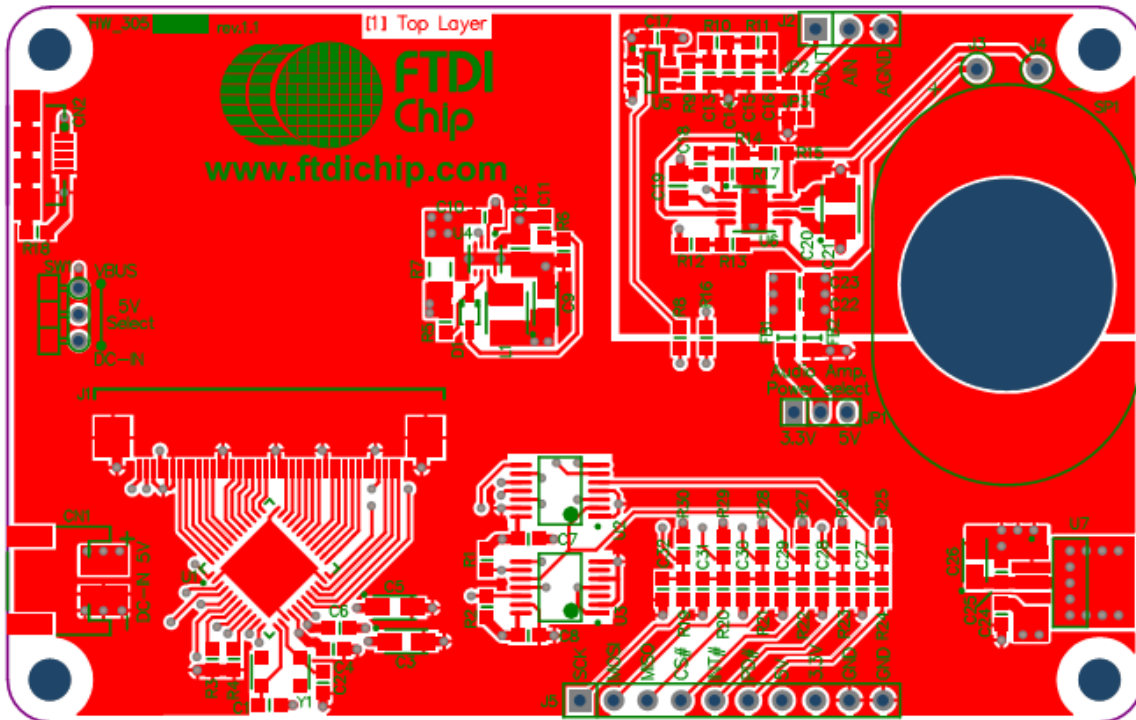The VM810C is an 85.6mm x 54.1mm, four-layer printed circuit board. Board thickness is approximately 1.6mm.

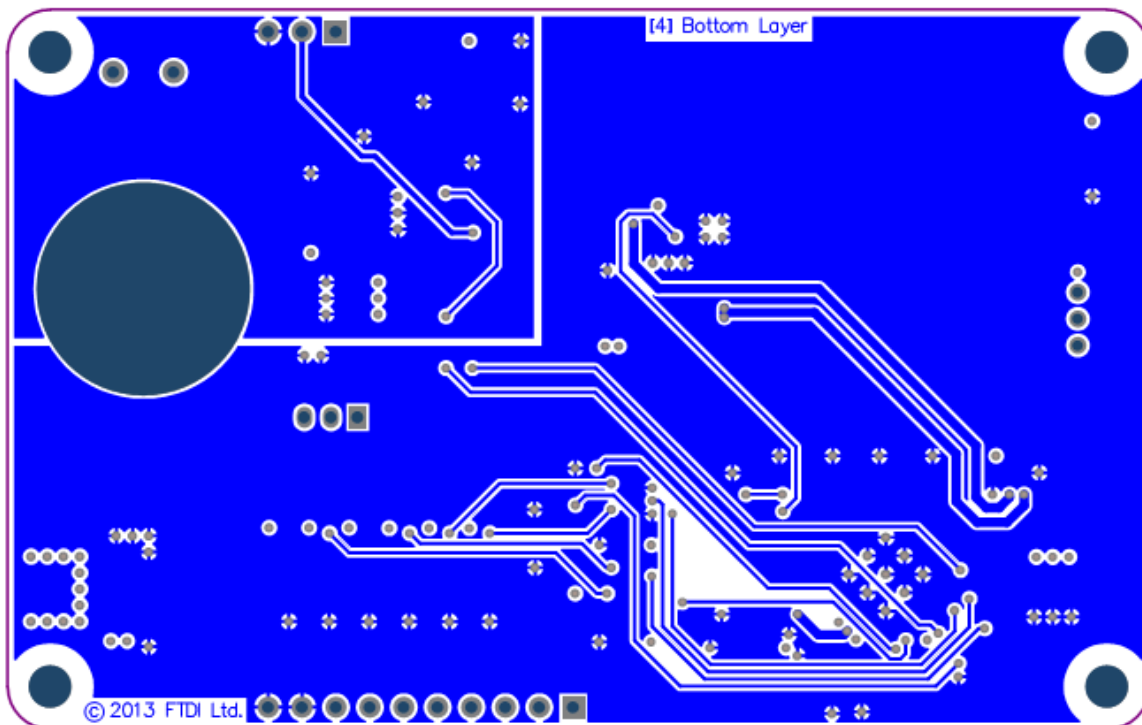**Figure 3-2 – VM810C board top layer**

Figure 3-3 – VM810C board bottom layer

3.2.2 VM810C Connectors

Connectors and jumpers are described in the following sections.

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

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

Pin No.	Name	Type	Description
1	VCC	P	5V power supply
2	GND	P	Ground

Table 3-1 – 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 3-2 – CN2 Pinout

- **J1- LCD Flex Cable connector**

This connector is the interface between the FT810 IC and the LCD Module.

Signal	Pin No	Description
LED K	1	LED-
LED A	2	LED+
DISP	31	LCD Display Enable
HSYNC	32	LCD Horizontal Sync
VSYNC	33	LCD Vertical Sync
DCLK	30	LCD Pixel Clock
DE	34	LCD Data Enable
R2	7	Bit 2 of Red RGB signals
R3	8	Bit 3 of Red RGB signals
R4	9	Bit 4 of Red RGB signals
R5	10	Bit 5 of Red RGB signals
R6	11	Bit 6 of Red RGB signals
R7	12	Bit 7 of Red RGB signals
G2	15	Bit 2 of Green RGB signals
G3	16	Bit 3 of Green RGB signals

Signal	Pin No	Description
G4	17	Bit 4 of Green RGB signals
G5	18	Bit 5 of Green RGB signals
G6	19	Bit 6 of Green RGB signals
G7	20	Bit 7 of Green RGB signals
B2	23	Bit 2 of Blue RGB signals
B3	24	Bit 3 of Blue RGB signals
B4	25	Bit 4 of Blue RGB signals
B5	26	Bit 5 of Blue RGB signals
B6	27	Bit 6 of Blue RGB signals
B7	28	Bit 7 of Blue RGB signals
XP	37	touch panel X right
YM	38	touch panel Y down
XM	39	touch panel X left
YP	40	touch panel Y up
3V3	4	3V3 Power
GND	3,5,6,13,14,21,22,29,36	Ground
NC	35	No connect

Table 3-3 – 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	Name	Description
1	Audio line out	Use pin 1 and 3 for FT810 audio line out to external speaker
2	Audio line in	Short pin1 and 2 to loopback FT810 audio into the on-board power amplifier
3	Audio GND	Audio GND

Table 3-4 – 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 is also power and ground pins on this interface. Note J5 is not soldered on the VM810C board by default.

Pin No.	Name	Type	Description
1	SCLK	I	SPI Clock input

Pin No.	Name	Type	Description
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 3-5 – 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 (default, recommended)
2-3	5V selected

Table 3-6 – 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. Do not fit this solder connection.

- **SW1 – Power source select**

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

Table 3-7 – JP1 Pin options

4 Board Schematics
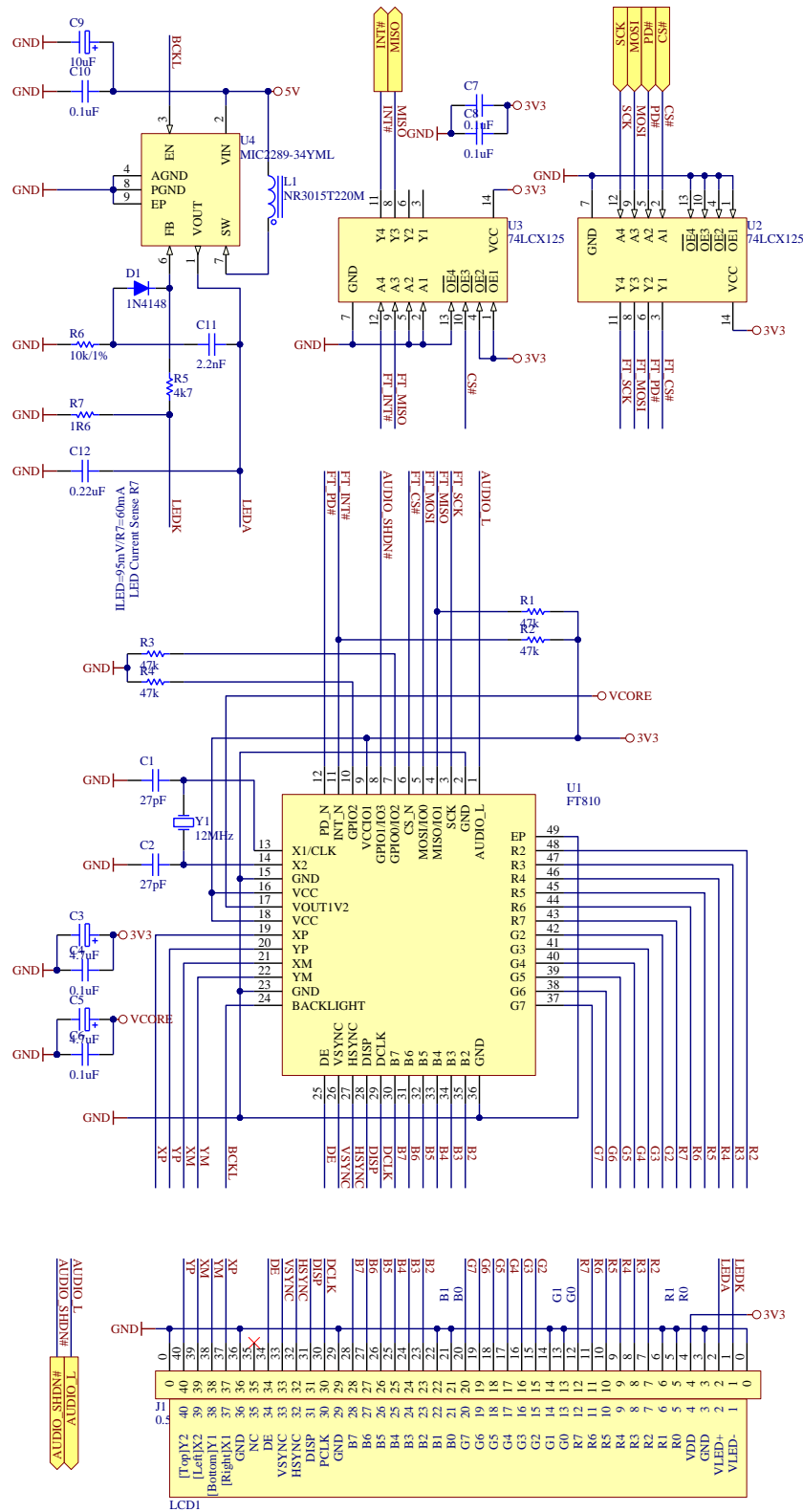
Figure 4-1 - FT810 and LCD circuit
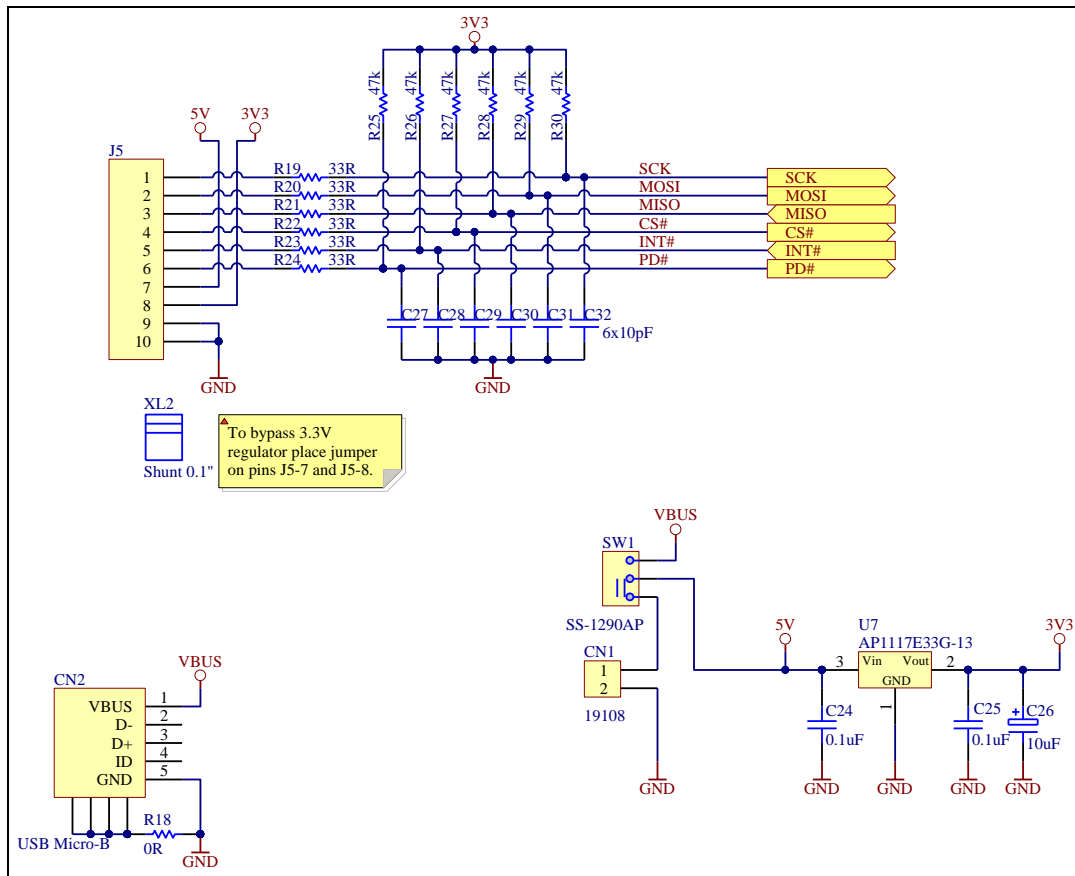
Figure 4-2 – SPI Interface Circuit

VM810C EVE2 CREDIT CARD MODULE
Version 1.1
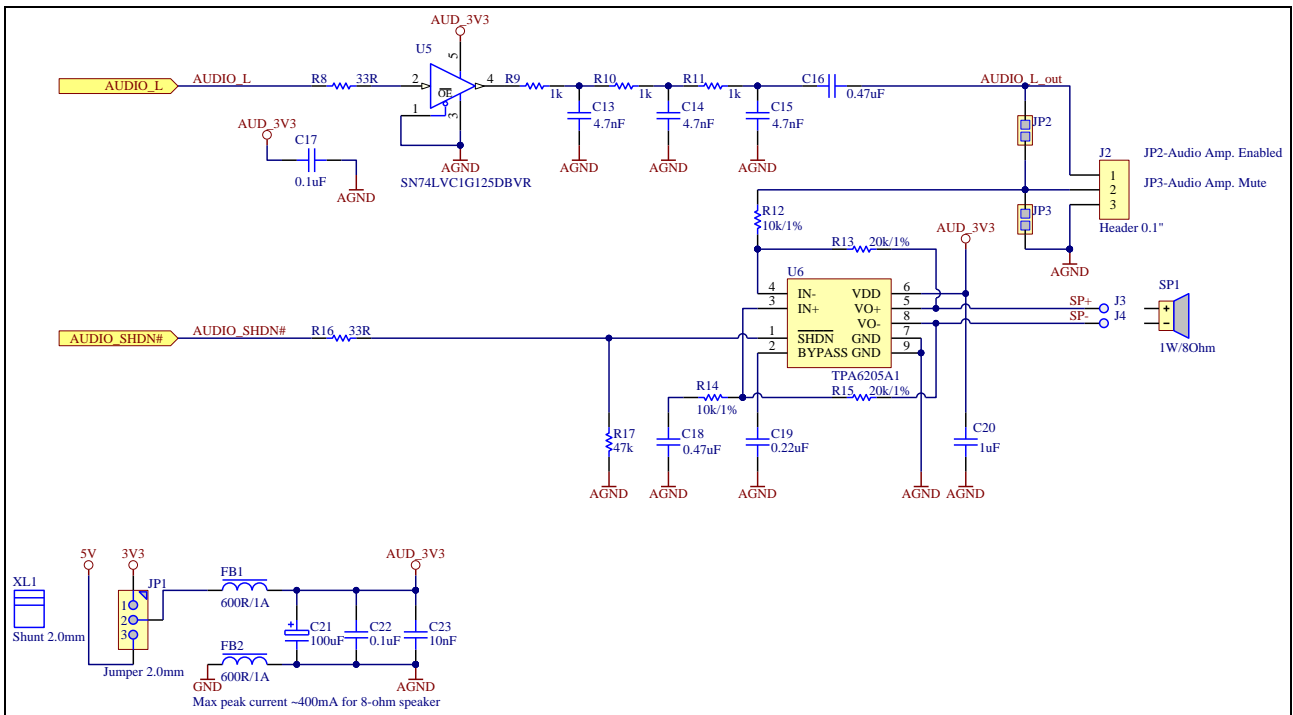Document No.: FT_001225 Clearance No.: FTDI#464

Figure 4-3 – Audio Circuit

5 Hardware Setup Guide

5.1 Power Configuration

There are 3 methods of powering the VM810C board.

1) USB Power(5V) - Connect USB power through micro-USB cable to CN2

2) DC IN(5V) - Connect 5V to CN1

3) J5 Power(5V) - Connect 5V to J5 pin 7

The following table summarise how to power the VM810C board using the various methods.

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

Table 5-1 – Board power configuration

5.2 Backlight LED current Configuration

The VM810C module has backlight LED driver circuit on-board. The driver takes 5V as input power source, and regulator the output voltage so that the total output current drawn by the backlight LED chain is 60mA. This works fine with the 5" WVGA LCD provided with the VM810C50-D module (18 white LED organized at 3 sets of 6 series LED).

If the user selects their own LCD panel to use with the VM810C board, the backlight LED current may need to be re-configured to suite the LCD panel. By replacing the resistor R7 on VM810C PCB the backlight LED current can be changed. The value of R7 is determined by following formula:

R7 = 95mV / I_{LED}

5.3 MPSSE Setup

To give a quick start with the VM810C development board, a Windows based Sample Application and demo applications are provided for users to experiment and experience the FT810 in the VM810C 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 SPI interface. Sample code is available for driving the FT810 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 VM810C modules directly. Detailed information of VA800A-SPI can be found at:

http://www.ftdichip.com/Support/Documents/DataSheets/Modules/DS_VA800A-SPI_MPSSE_Module.pdf.

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. If the 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 which requires an additional 5V power source to connect to CN2 or CN1. Refer to table 5-1 for board power configuration.

Figure 5-1 – VM810C 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 VM810C board

- Connect VA800A-SPI to the VM810C module in the correct orientation (pin1 to pin1 aligned).

- 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 VM810C 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 VM810C board

- Connect MPSSE leads to VM810C board's J5(SPI interface) in accordance with Table 5-2

- Plug MPSSE cable to PC USB host port

Software Setup

- Download PC based MPSSE software libraries. 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 the PC

- For more information on utilizing the VM810C development system with the MPSSE cable and Sample Application, refer to AN_245. Note the procedure is the same as for previous generation VM800C modules.

Further documentation associated with the VM810C development system and design flow can be found at following link: http://www.ftdichip.com/Products/Modules/VM810C.html

The FT81x Programming Guide describes the programming code and formats used by the FT810. 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

6 Mechanical Dimensions
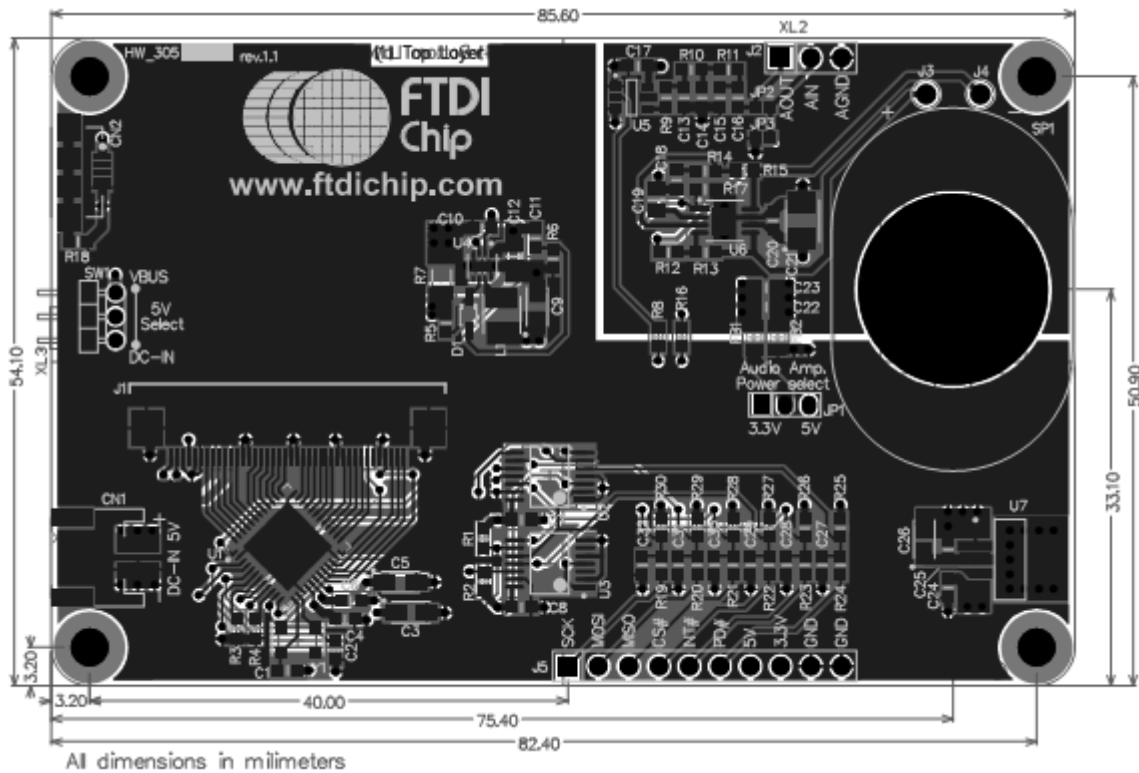
Figure 6-1 – PCB mechanical dimensions
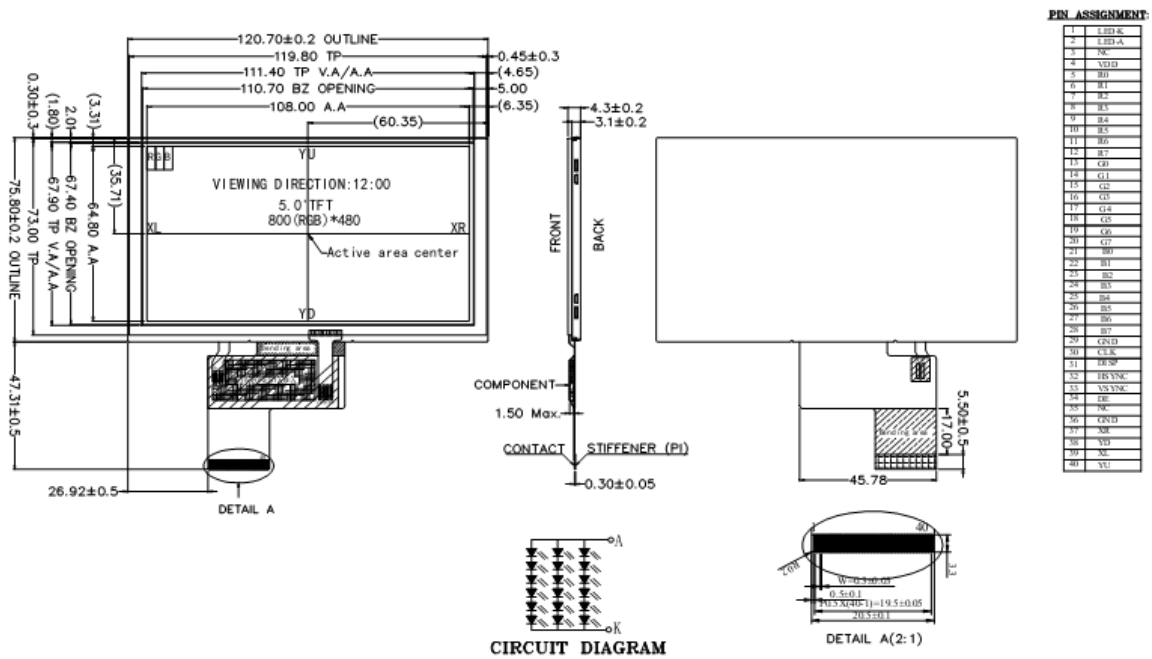
Figure 6-2 – 5" WVGA LCD dimensions

7 Specifications

7.1 Optical Specification

Item	Symbol		Condition	Min.	Typ.	Max.	Unit	Note
Brightness (With TP)	Bp		$\theta=0°$ $\Phi=0°$		400	-	Cd/m^2	1
Uniformity	$\triangle$Bp			75	-	-	%	1,2
Viewing Angle	3:00		Cr≥10	-	60	-	Deg	3
	6:00			-	45	-		
	9:00			-	60	-		
	12:00			-	60	-		
Contrast Ratio	Cr		$\theta=0°$ $\Phi=0°$	300	500		-	4
Response Time	T$_r$			-	10	-	ms	5
	T$_f$			-	10	-	ms	
Color of CIE Coordinate	W	x	$\theta=0°$ $\Phi=0°$		0.28		-	1,6
		y			0.33		-	
	R	x			0.51		-	
		y			0.34		-	
	G	x			0.31		-	
		y			0.56		-	
	B	x			0.15		-	
		y			0.14		-	
NTSC Ratio	S			50	60	-	%	

Note: The parameter is slightly changed by temperature, driving voltage and materiel

Note 1: The data are measured after LEDs are turned on for 5 minutes. LCM displays full white. The brightness is the average value of 9 measured spots. Measurement equipment PR-705 (Φ8mm)

Measuring condition:
- Measuring surroundings: Dark room.
- Measuring temperature: Ta=25℃.
- Adjust operating voltage to get optimum contrast at the center of the display.

Measured value at the center point of LCD panel after more than 5 minutes while backlight turning on.

Table 7-1 – 5" TFT Optical Specification

8 Contact Information

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http://ftdichip.com

Distributor and Sales Representatives

Please visit the Sales Network page of the FTDI Web site for the contact details of our distributor(s) and sales representative(s) in your country.

Appendix A – References

Document References

For module documentations, please refer to URL below:

http://www.ftdichip.com/Products/Modules/VM810C.html

FT810 datasheet: DS_FT81x

FT810 software programming guide: FT81x_Programmer_Guide

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

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

Acronyms and Abbreviations

Terms	Description
EVE	Embedded Video Engine
IC	Integrated Circuit
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MPSSE	Multi Purpose Synchronous Serial Engine
OVP	Over Voltage Protection
PC	Personal Computer
SPI	Serial Peripheral Interface
TFT	Thin Film Transistor
USB	Universal Serial Bus
WVGA	Wide Video Graphics Array

Appendix B - List of Figures and Tables

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Appendix C – Revision History

Document Title: VM810C EVE2 Credit Card Module

Document Reference No.:   FT_001225

Clearance No.:   FTDI#464

Product Page: http://www.ftdichip.com/eve.htm

Document Feedback: Send Feedback

Revision	Changes	Date
1.1	Initial Datasheet Released	2015-09-29