Application Note

AN_245

VM800C/B Sample Application PC Introduction

Version 1.1

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This application note is provided to introduce the setup of an Sample application running on a Windows PC with a VM800B or VM800C development system. The objective of the Sample Application is to enable users to become familiar with the usage of the FT8XX, the design flow, and display list language used to design the desired user interface or visual effect.

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1 Introduction

FT8XX combines display, audio and touch functionality into one single chip, powered by Bridgetek's advanced EVE (Embedded Video Engine) technology. The FT8XX device interfaces with a system MCU via an SPI interface. To help customers easily utilize the functionality of the FT8XX in a project, a Sample Application is provided here for tutorial purposes.

The Sample Application has been written for usage in conjunction with the BRIDGETEK USB to SPI bridge cable that incorporates the FT232H. This cable operates in MPSSE mode (Multi-Protocol Synchronous Serial Engine) to enable the code to be executed from a PC and bridged over USB to provide stimulus to the VM800B and VM800C development systems for fast and easy testing.
Users can read the source code of the Sample Application first, and then run the code to observe the effects. Editing the code is also encouraged to help learn the features of the FT8XX.

Note that although the basic project compiles for the Windows PC with the MPSSE cable, most of the code could be re-used in different microcontroller design environments. All that the FT8XX requires is a host microcontroller device with an SPI master interface and the transportation layer of Sample Application adapted for the specific device.

Further information regarding the FT8XX programming language or pseudo code can be found in the FT8XX Series Programmer Guide. This document introduces how to set up and use the Sample Application with the BRIDGETEK VM800B/C development kits and a Windows PC.

For VM800B or VM800C development board details, please refer to the datasheets for VM800B or VM800C modules from BRIDGETEK.

NOTE: Any source code is provided on an "as is" basis, and is neither guaranteed nor supported.

1.1 Audience

This document assumes the audience have read the datasheet and Programmer Guide of the FT8XX. In addition, familiarity of the C/C++programming language is necessary to understand the Sample Application source code.

1.2 Scope

The Sample Application mentioned in this document runs on a Windows PC, through Microsoft Visual Studio C++ software. It is comprised of the source code as well as project files.

2 Overview

2.1 Hardware Setup Block Diagram

The diagram below illustrates the overall hardware setup.

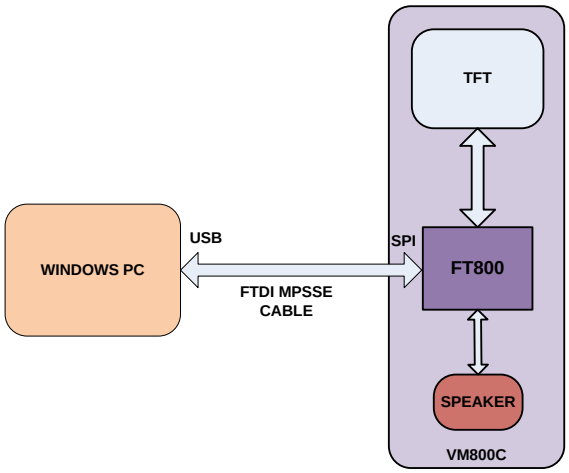

Figure 1 - Example Block Diagram of Setup for VM800C Board with Windows PC

The VM800B and VM800C units require minimal hardware configuration. The FT8XX IC, the TFT display and the speaker are all included in the module assembly. The MPSSE cable provides the USB to SPI Bridge.

2.2 Application flow

The diagram below gives the basic flow to configure the FT8XX in an application.

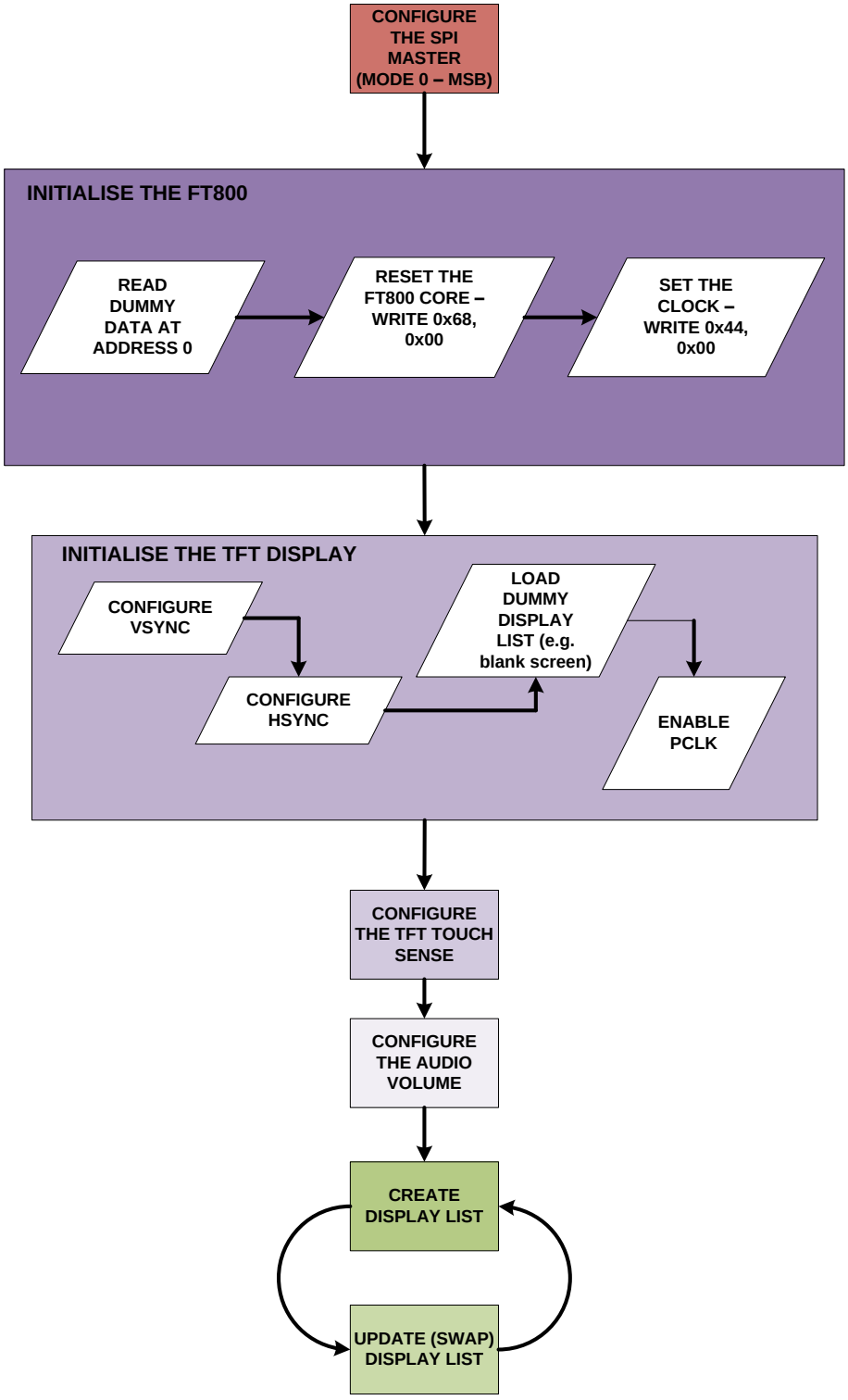

Figure 2 - Application Flow

2.3 Architecture

The Sample Application is designed to easily port to various platforms with SPI host functionality. To achieve this, the Sample Application introduces one HAL (hardware abstraction layer) to make the Sample Application code generic for different platforms.

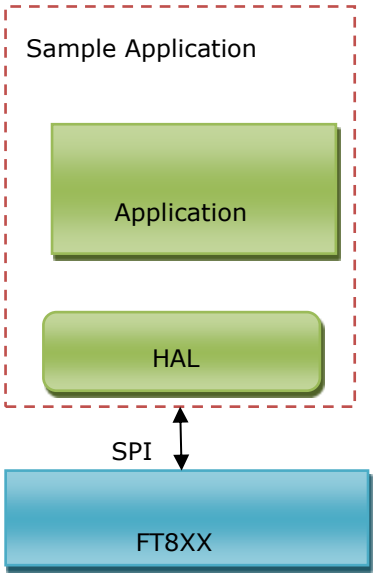

Figure 3 - Architecture Diagram

2.4 Hardware Requirements

- VM800B or VM800C development kit.

  Note that this kit comes with an option for 3 different size displays, 3.5”, 4.3”, or 5.0”(VM800B35A-D, VM800C35A-D, VM800B43A-D, VM800C43A-D, VM800B50A-D, or VM800C50A-D, respectively).
- Microsoft Windows based PC working as a host. Windows XP onwards is preferred.
- MPSSE cable (3.3V). BRIDGETEK USB interface to SPI converter.
- One USB A to MicroB cable to provide power to the VM800B/C board. Optional if a battery or other power source is provided for the VM800B or VM800C development board.

2.5 Software Requirements

- D2XX driver for the MPSSE cable. Please download and install on the PC.
- Microsoft Visual C++. The IDE(Integrated Development Environment) used to create the Sample Application. It is required by users to build and run the Sample Application. Note: The express version of the tool is a free download from Microsoft.
- FT8XX Sample Application release package.

2.5.1 Software package introduction

2.5.1.1 Folder Introduction

- Folder "Src" includes the .C source files of the Sample Application.
- Folder "Bin" includes the binary and library files used by the Sample Application
- Folder "Hdr" includes the .h files which define the macros, data structures and function prototypes for the source .C files.
- Folder "Test" includes the resources files, such as bitmaps and sound tracks used in the application.
- Folder "Project" includes the MSVC project and solution file.
- Folder "Docs" includes the folder "MSVC_Win32" which contains this document.

2.5.1.2 Dependency

- FT8XX Sample Application depends on the BRIDGETEK D2XX driver to communicate with FT8XX through the MPSSE cable.
- FT8XX Sample Application is one console application with a GUI interface at the Windows PC side.
- FT8XX Sample Application is linked with the BRIDGETEK libMPSSE-SPI library, Please see http://www.ftdichip.com/Support/SoftwareExamples/MPSSE/LibMPSSE-SPI.htm for details.

3 Setup

3.1 Hardware Connection

The picture below shows the connection on the VM800C board.

Two USB ports will be used on the windows PC:

One USB cable connecting via the MicroB connector is used to supply power (5V/100mA) from the PC to the device.

One MPSSE cable is needed to connect the PC with the FT8XX SPI interface.

Figure 4 - Module Connections

Signals from the MPSSE cable to the VM800C board are colour coded as shown below.

Figure 5 – MPSSE Cable Connection

MPSSE Cable Signal Name	Colour
SCK	ORANGE
MOSI	YELLOW
MISO	GREEN
CS#	BROWN
INT#	PURPLE
PD#	BLUE
GND	BLACK

Table 1 - MPSSE Cable Signal Colour Mapping

3.2 Source Code Build

Open the file "Project\Msvc_win32\SampleApp\ SampleApp.sln" with Microsoft Visual C++ and the following screen should appear:

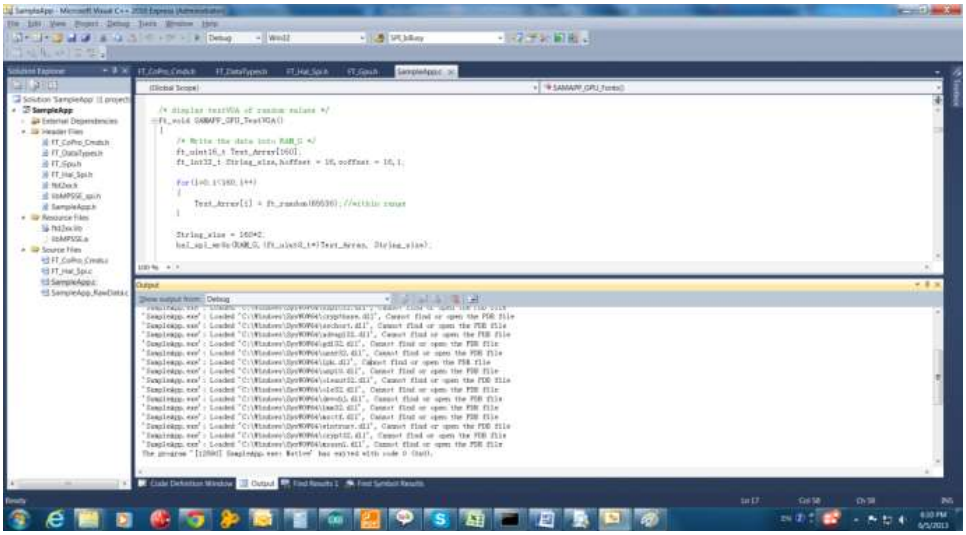

Figure 6 – Visual Studio Project Page

3.2.1 Determine the Screen Size

For 3.5 inch display panels, ensure the compilation macro switch "#define SAMAPP_DISPLAY_QVGA" in "Hdr\Platform.h" is defined. This macro enables the FT8XX to support 3.5 inches panels with a resolution of 320x240 pixels.

For 4.3 or 5 inch display panels, please ensure the macro above is undefined within the Sample Application project. This will ensure the correct display resolution is selected to match the 4.3 or 5 inch display panels with a resolution of 480x272 pixels.

After correctly setting the definition, re-build the project.

Display panels other than those stated above are not supported at this time by the Sample Application.

3.2.2 Determine the Group of Functions to Build and Run

All the functions are grouped into 5 categories, which are compiled and built under the following compiler switches in the file "Project\Hdr\Platform.h "

```
#define SAMAPP_ENABLE_APIS_SET0
#define SAMAPP_ENABLE_APIS_SET1
#define SAMAPP_ENABLE_APIS_SET2
#define SAMAPP_ENABLE_APIS_SET3
#define SAMAPP_ENABLE_APIS_SET4
#define SAMAPP_ENABLE_APIS_SET5
```

Users can define all 5 macros to be enabled at the same time or undefined sections to focus on a certain feature.

Note the categories mentioned here are not the same as the groups mentioned in Major Function Groups in the Sample Application. The groups here are defined for the purpose of running on the Windows PC.

3.2.3 Experimenting with the Sample Application Project

Place the break point at the line you would like to study before you run the Sample Application. This allows functions to be tested and executed one by one, thus simplifying debugging and observing the functionality of each different function call. A key item to note is that the actual display is not updated until the display list swap is executed.

Figure 7 - Visual Studio Project Page

3.2.4 Source File Brief

"SampleApp.c" under "src\" is the main source file for the Sample Application. The "Main" entry function is inside. It defines all the sample functions. Breakpoints can be set in this file for each of the functions for further study.

The functions in "SampleApp.c" are mostly in the form of "SAMAPP_GPU_xxx" and "SAMAPP_CoPro_xxx".

"Gpu_Hal.c" under folder "src" defines the transportation layer functions, which provide one SPI abstraction layer to access the FT8XX. Editing this file allows to port the application to alternative MCU's and compilers with minimum effort. It is more specific to the SPI master interface than the FT8XX.

"CoPro_Cmds.c" defines the APIs of the FT8XX coprocessor engine commands. This file is structured to be generic and could be ported to other projects for other target MCU's.

"GPU.h" defines the FT8XX specific interface, including the instructions and parameters, register names and memory maps. This file relates directly to the FT8XX Programmers Guide and is independent from any MCU.

"SampleApp_RawData.c" defines the bitmap and jpeg data used in the Sample Application.

3.2.5 Project File Brief

"SampleApp.sln" is the solution file used by Microsoft Visual C++ IDE (Integrated Development Environment). It will invoke other project files to restore the building environment on your PC. You can open it after Microsoft Visual C++ is installed on your windows PC.

3.2.6 Major Function Groups in the Sample Application

The major functions in the Sample Application can be classified into the following groups according to the functionality and design purpose.

3.2.6.1 Primitives Group

The functions in this group are designed to demonstrate the usage of FT8XX primitives.

An FT8XX primitive is the basic drawing command for geometric shapes, for example, points, lines etc. More information on the primitives can be found in the FT8XX Programmers Guide.

All the functions are in the form of "SAMAPP_GPU_xxx". Here is the list:

```
/*draw circles*/
SAMAPP_GPU_Points();
/*draw a triangle*/
SAMAPP_Gpu_Polygon();
/*draw lines*/
SAMAPP_GPU_Lines();
/*draw rectangles*/
SAMAPP_GPU_Rectangles();
/*draw bitmaps*/
SAMAPP_GPU_Bitmap();
/*draw palette format bitmap*/
SAMAPP_GPU_Bitmap_Palette()
/*draw palette format bitmap as background*/
SAMAPP_GPU_Bitmap_Palette()
/*draws chars with different fonts*/
SAMAPP_GPU_Fonts();
SAMAPP_GPU_Text8x8();
SAMAPP_GPU_TextVGA();
/*draws a bargraph*/
SAMAPP_GPU_Bargraph();
SAMAPP_GPU_LineStrips();
SAMAPP_GPU_EdgeStrips();
/*example of cutting away an active area on the display*/
SAMAPP_GPU_Scissor();
/*Font and Points Primitives combination*/
SAMAPP_GPU_String();
/*Call and Return Primitives combination*/
SAMAPP_GPU_StreetMap();
/*Additive blending of fonts*/
SAMAPP_GPU_AdditiveBlendText();
```

```
/*Usage of Macro*/
SAMAPP_GPU_MacroUsage();
/*Additive blending of points*/
SAMAPP_GPU_AdditiveBlendPoints();
```

3.2.6.2 Widgets Group

The functions in this group are designed to demonstrate the FT8XX graphic engine widgets, which are visual components that have been created to reduce the effort of GUI programmers.

A widget will create a complex object with one command as opposed to many. For example, the clock widget provides a large circle for the face, twelve circles for each number and 3 lines for each clock hand. If this image was created without the widget the programmers would need to draw 13 circles and 3 hands in separate primitive commands.

There are 14 in-built widgets and their sample functions are in the form of "SAMAPP_CoPro_Widget_xxx" as below:

```
SAMAPP_CoPro_Widget_Logo();
SAMAPP_CoPro_Widget_Text();
SAMAPP_CoPro_Widget_Number();
SAMAPP_CoPro_Widget_Button();
SAMAPP_CoPro_Widget_Clock();
SAMAPP_CoPro_Widget_Guage();
SAMAPP_CoPro_Widget_Gradient();
SAMAPP_CoPro_Widget_Keys();
SAMAPP_CoPro_Widget_Progressbar();
SAMAPP_CoPro_Widget_Scroll();
SAMAPP_CoPro_Widget_Slider();
SAMAPP_CoPro_Widget_Dial();
SAMAPP_CoPro_Widget_Toggle();
SAMAPP_CoPro_Widget_Spinner();
```

The following functions are designed to demonstrate additional FT8XX commands, which are frequently used by programmers to simplify a project. They are in the form of "SAMAPP_CoPro_xxx".

```
/*Screen calibrate example*/
SAMAPP_CoPro_Calibrate();
SAMAPP_CoPro_Screensaver();
/*Matrix example for Bitmap manipulation*/
SAMAPP_CoPro_Matrix();
/*Appending block of memory to the current display list*/
SAMAPP_CoPro_AppendCmds();
/*Decompress functionality example*/
SAMAPP_CoPro_Inflate();
/*JPEG decoding functionality example*/
SAMAPP_CoPro_Loadimage();
/*Customer Font example*/
SAMAPP_CoPro_Setfont();
/*Customer Font used in widget example : Chinese Font*/
SAMAPP_ChineseFont();
/*Track usage example for touch*/
SAMAPP_CoPro_Track();
/*Screenshot example*/
SAMAPP_CoPro_Snapshot();
/*Sketch example*/
SAMAPP_CoPro_Sketch();
```

3.2.6.3 Audio & Touch Group

The APIs in this group demonstrate how to utilize the audio and touch functionality of the FT8XX.

```
/* Audio playback API */
o   SAMAPP_Aud_Music_Player();
 /* Audio Playback sample function in streaming way*/
o   SAMAPP_Aud_Music_Player_Streaming();
/*FT800 Built-In Sound sample function*/
o   SAMAPP_Sound()

/*FT800 Touch and Tag usage sample function*/
o   SAMAPP_Touch()
  /* FT800 Track coprocessor engine command usage sample */
o   SAMAPP_CoPro_Track()
/*FT800 keys widget and touch tag usage example*/
o   SAMAPP_CoPro_Widget_Keys_Interactive()
```

3.2.6.4 Host Command Group

The APIs in this group demonstrate the power management feature of the FT8XX.

```
  /*Toggle the PD_N pin of FT800 for power cycle*/
o   Gpu_Hal_Powercycle ()
  /*
FT800 Host Command Function: users can send the respective host commands to
achieve clock source selection, power mode switch, frequency selection as
well as core reset.
   */
o   Gpu_HostCommand()
/*
This API defines 6 scenarios of power mode switch, implemented by calling
functions above.
*/
o   SAMAPP_PowerMode()
```

4 Helpful Hints

- Users are strongly encouraged to read the datasheets of the VM800B and VM800C development systems before reading this document and starting to use the Sample Application.
- Before running the FT8XX Sample Application, please make sure the MPSSE cable is connected with VM800B or VM800C board and the proper driver is loaded.
- If encountering issues while running the FT8XX Sample Application, please check the USB port status in the device manager of the Windows PC and make sure there are no other USB ports in use with the D2XX driver.
- The use of "debug" mode will allow individual sections of the Sample Application to be executed through the placement of breakpoints.
- Note that a calibration procedure (e.g. SAMAPP_CoPro_Calibrate()) is required if experimenting with the touch screen feature.

5 Contact Information

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Distributor and Sales Representatives

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

Appendix A– References

Document References

- AN_391 EVE Platform Guide
- VM800C Datasheet
- VM800B Datasheet
- FTDI MPSSE for SPI application note
- FT8XX Series Programmer Guide
- FT8XX Embedded Video Engine Datasheet
- Sample Application

Acronyms and Abbreviations

Terms	Description
EVE	Embedded Video Engine
IDE	Integrated Development Environment
MPSSE	FTDI Multi-Protocol Synchronous Serial Engine
MSVC	Microsoft Visual Studio C++ 2010
SPI	Serial Peripheral Interface
UI	User Interface
USB	Universal Serial Bus
VM800B/C	VM800B or VM800C board

Appendix B – List of Tables & Figures

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Appendix C– Revision History

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1.0	Initial release	2013-03-28
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