Application Note

BRT_AN_012

FT9xx USBD HID Touch Panel

Version 1.1

Issue Date: 2017-10-31

This Application Note describes a virtual keyboard implemented with an FT9xx device and an FT8xx touch screen. The virtual keyboard behaves as a standard hardware keyboard when connected via USB to a host computer.

Bridgetek Pte Ltd (BRTChip)
178 Paya Lebar Road, #07-03, Singapore 409030
Tel: +65 6547 4827 Fax: +65 6841 6071
Web Site: http://www.brtchip.com

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1 Introduction

This Application Note describes a virtual keyboard implemented with an FT9xx device and an FT8xx touch screen. The virtual keyboard behaves as a standard hardware keyboard when connected via USB to a host computer.

The keyboard can be set to show different keyboard layouts for different regional variations.

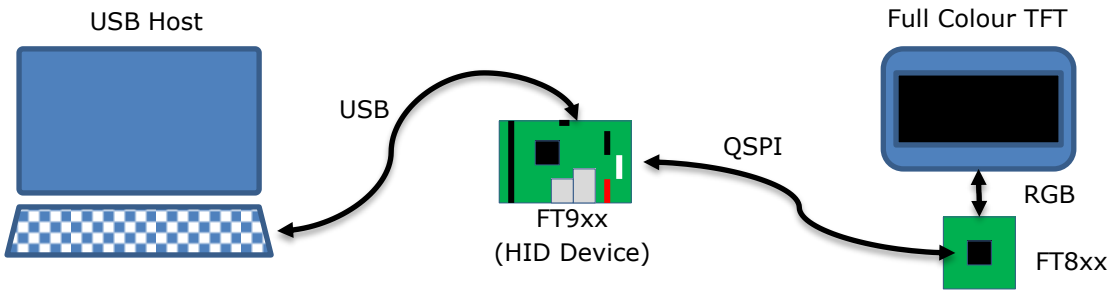

Figure 1 Block Diagram

The FT9xx presents a HID keyboard interface to the USB Host computer. The FT9xx provides a bridge to the QSPI connection to the FT8xx device. The FT8xx device controls the TFT display and the touchscreen interface on the display.

The document should be read in association with the example code provided in the references section.

1.1 Overview

This document describes the design and implementation of the FT9xx USBD HID Touch Panel code. The FT9xx USBD HID Touch Panel allows a user to:

- Implement a virtual keyboard on a touchscreen device.
- Connect the device to a host via USB.
- Interact with the host as if a hardware keyboard was connected.
- Modify the virtual keyboard for different international or regional layouts.

This document is intended to demonstrate the capabilities of the FT9xx family of microcontrollers by emulating USB devices and interfacing to FT8xx display ICs.

Third-party open source code is used to implement this application note:

- Printf – tinyprintf.

Links to resources for these libraries are in Appendix A – References.

1.2 Scope

The virtual keyboard implements a single USB device boot protocol keyboard with a report descriptor to match for a Windows PC. US, UK and standard German keyboard layouts are supported.

There is no specific support for Apple Mac keyboards although most Apple Mac functions can be performed with the keyboard emulated by this application note.

1.2.1 Features

The application note shows how to implement a USB HID device and interface with an FT8xx family display IC.

The USB device interface is used to send keyboard scancodes to the host and receive reports to change the status of the Caps Lock, Scroll Lock and Num Lock LEDs on the keyboard.

The FT8xx interface shows communication with the display IC co-processor, reading touch events and processing these to generate the keyboard scancodes. The display has several screens that can be selected with buttons to allow different layout or part of a keyboard to be displayed.

1.2.2 Possible Enhancements

This application note can be seen as a start for customisation or extension. Some example enhancements could be:

- Support for other country keyboard layouts.
- Add an Apple Mac layout.
- Tailor keyboard layout and function to a particular application. E.g. CAD or Point of Sale.
- Add a multimedia control interface.
- Implementing remote wakeup to allow the keyboard to wake the host.

2 Project Overview

The project files for the application are divided into the following folders.

Folder	Description
Source	Application source code and abstraction files.
Includes	Application specific header files.
Images	JPEG images for this application.
FontConvertor	EVE Font Convertor output files for this application.
EVE	EVE API libraries.
lib	Library files.
lib\tinyprintf	tinyprintf library.

Table 1 - Project Files Overview

2.1 Sources Folder

The main part of the application is found in the "Sources" folder. This is split into 3 main sections and has 3 source code files.

- The "main.c" file is generally responsible for the FT9xx setup and USB device code;
- The second file "keyboard.c" implements an interface between the USB device part and the FT8xx display;
- Lastly the "eve.c" file performs all FT8xx operations and is responsible for displaying the virtual keyboard and processing touches into scancodes as defined by the keyboard section.

The other 2 files in this folder are:

- "images.c" contains JPEG images encoded into C array declarations. These images are displayed by the FT8xx display.
- "fonts.c" which has the custom fonts used by this application encoded to be used by the FT8xx driven display.
- "crt0.S" a modified startup file (in FT9xx assembly language) to allow the application to write to a protected section of FlashROM on the device.

Files in these folders use the "Includes" folder for application specific header files.

2.2 EVE Folder

This folder holds the FT8xx API code which abstracts the FT8xx register and processing list writes into C functions. The API code is similar to the code used in other FT8xx example projects.

2.1 Images Folder

The FT8xx can display JPEG images. This folder contains the raw JPEG images which are encoded into the "images.c" file in the "Sources" folder.

The method for converting these to C code is as follows. Use the HexEdit utility to open the JPEG file, **Select All**, and then select **Edit -> Copy As... -> C** Source. The C code can be pasted into a source file to be used in the application.

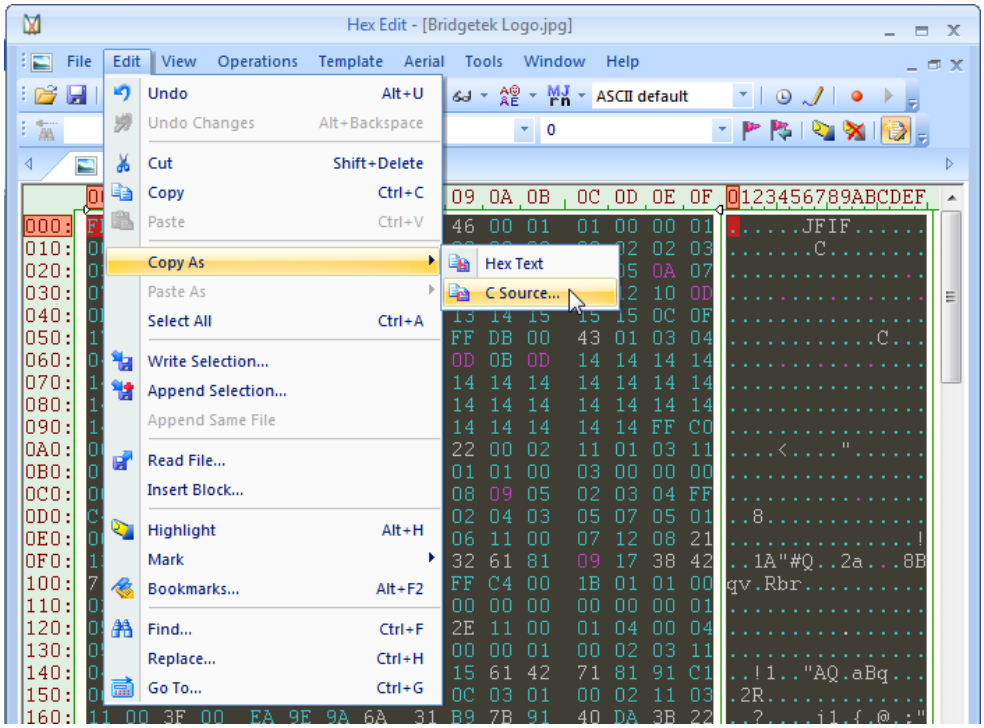

Figure 2 HexEdit Copy As C Source

If the code is declared as "**const uint8_t __flash__**" then it will reside in Program Memory and not be copied to RAM.

2.2 FontConvertor Folder

The FT8xx FNT_CVT utility (EVE Font Converter) is used to change a system TTF into a bitmap image which can be used by the FT8xx. The application uses the standard Arial font to make 2 font files: ASCII characters from 32 to 127 and several UETF-8 characters for key labels not available through normal ASCII.

The extended characters are used to provide arrow images for key labels and non-ASCII key labels for the standard German keyboard layout.

3 Using the Virutual Keyboard

3.1 Required Hardware

The application note is intended to be used on an ME812A-WH50R or ME813A-WH50C EVE development module with an MM900EV2A or MM900EV3A MCU module. The application note is written to work on an 800 by 600 display. Changes to the EVE module or FT9xx device can be made in the "FT_platform.h" file in the "Includes" folder of the source code.

The MM900EVxA module connects directly to the EVE development module with a set of pin headers. The QSPI interface on the FT9xx device is taken through the pin headers to the FT81x on the EVE module. The host PC connects via USB to the MM900EVxA module.

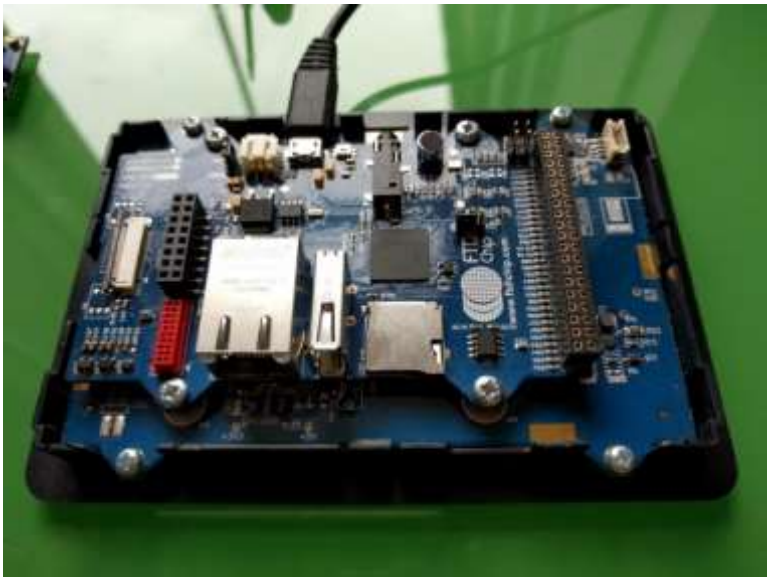

Figure 3 MM900EV2A and ME812A-WH50R module

3.2 Use of Application Note Software

The virtual keyboard will wait until it is connected to a host. The FT8xx display will indicate this with the Bridgetek logo and the caption "Waiting for host…".

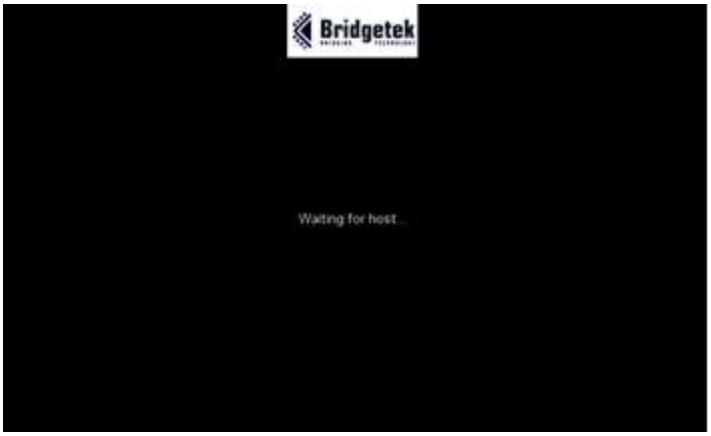

Figure 4 Waiting for Host Screen

Once the host is connected then it will display the virtual keyboard.

Figure 5 Virtual Keyboard Screen

The settings screen, is accessed from the "Setting" button allowing the choice of UK, US and German keyboard layouts. Pressing "Back" in the upper left hand corner will display an alphanumeric keyboard section of the virtual keyboard.

Pressing the "KeyPad" button will show the control and keypad area of a standard keyboard. To return to the main keyboard press the "KeyPad" button again.

Figure 6 KeyPad Screen

3.3 Keyboard Layouts

There are 3 different layouts for keys supported in this application. The US and UK layouts are QWERTY layouts where the key positions change slightly; the German layout is QWERTZ, however the layout is the same as the UK layout. For the German keyboard to work the host needs to have its keyboard locale set to German to allow the scan codes to match the key labels.

4 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@brtichip.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/

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

FT900/901/902/903 Datasheet

FT905/906/907/908 Datasheet

FT930/931/933 Datasheet

FT81x Datasheet

MM900EVxA datasheet

AN_324 FT9xx User Manual

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Acronyms and Abbreviations

Terms	Description
API	Application Programming Interface
ASCII	American Standard Code for Information Interchange
CAD	Computer Aided Design
EVE	Embedded Video Engine
HID	Human Interface Device (Keyboard, Mouse etc)
IC	Integrated Circuit
JPEG	Joint Photographic Experts Group
MCU	Microcontroller Unit
QSPI	Quad Serial Peripheral Interface
RAM	Random Access Memory
RGB	Red Green Blue (Color Model)
TTF	True Type Font
USBD	USB Device

Appendix B – List of Tables & Figures

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Appendix C– Revision History

Document Title: BRT_AN_012 FT9xx USBD HID Touch Panel
Document Reference No.: BRT_000120
Clearance No.: BRT#083
Product Page: http://brtchip.com/ft93x/ & http://brtchip.com/ft900/
Document Feedback: Send Feedback

Revision	Changes	Date
1.0	Initial version	2017-07-03
1.1	Fixed the Product Page broken link under Section Appendix C – Revision History	2017-10-31