

S5U13781R00C100 Demonstration Manual

for STM32 VL-Discovery and SHENZHEN TOPWAY LMT035KDH03 Panel

Document Number: X94A-G-007-01.2

Evaluation board/kit and Development tool important notice

- 1. This evaluation board/kit or development tool is designed for use for engineering evaluation, demonstration, or development purposes only. Do not use it for other purposes. It is not intended to meet the requirements of design for finished products.
- 2. This evaluation board/kit or development tool is intended for use by an electronics engineer and is not a consumer product. The user should use it properly and in a safe manner. Seiko Epson does not assume any responsibility or liability of any kind of damage and/or fire caused by the use of it. The user should cease to use it when any abnormal issue occurs even during proper and safe use.
- 3. The part used for this evaluation board/kit or development tool may be changed without any notice.

NOTICE

No part of this material may be reproduced or duplicated in any form or by any means without the written permission of Seiko Epson. Seiko Epson reserves the right to make changes to this material without notice. Seiko Epson does not assume any liability of any kind arising out of any inaccuracies contained in this material or due to its application or use in any product or circuit and, further, there is no representation that this material is applicable to products requiring high level reliability, such as, medical products. Moreover, no license to any intellectual property rights is granted by implication or otherwise, and there is no representation or warranty that anything made in accordance with this material will be free from any patent or copyright infringement of a third party. When exporting the products or technology described in this material, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. You are requested not to use, to resell, to export and/or to otherwise dispose of the products (and any technical information furnished, if any) for the development and/or manufacture of weapon of mass destruction or for other military purposes.

All brands or product names mentioned herein are trademarks and/or registered trademarks of their respective companies.

©SEIKO EPSON CORPORATION 2007-2018. All rights reserved.

Table of Contents

1	Intr	oduction	5
	1.1	General Description	5
	1.2	Terminology	5
	1.3	Required Materials for Demonstration System	6
2	Pre	paration of Demo	8
	2.1	Instruction for Tool Download and Install	8
	2.2	Instruction for Demo Sample Software Download	9
	2.3	Unzip Downloaded Files	10
3	Exp	Planation of the Demo using STM32 VL-Discovery	13
	3.1	Summary	13
	3.2	Write Image Data into Flash Memory	14
	3.2.	1 S5U13781R00C100 Connection with UM232H	14
	3.2.	2 Procedure for Writing Image Data into Flash Memory	15
	3.3	Write Demo Sample Software into STM32 VL-Discovery	18
	3.4	Connect the S5U13781R00C100 with the STM32 VL-Discovery	21
	3.5	Connect the S5U13781R00C100 with LCD Panel	22
	3.6	Running Demo	24
4	Exp	Planation of the Demo using PC	26
	4.1	Connection with USB Serial Conversion Board: UM232H (Control S1D13781 via SPI)	27
	4.2	Connection with LCD panel	28
	4.3	Displaying an Image on LCD	28
5	Cha	ange Record	32
6	Sal	es and Technical Support	33

1 Introduction

1.1 General Description

This manual describes following two types of demonstration system using S5U13781R00C100 reference board.

(1) Demonstration system consisting of a microcontroller evaluation board and an LCD panel.

(2) Demonstration system consisting of a personal computer and an LCD panel.

By the instruction of this manual, you can realize above two types of demonstration system easily.

For detailed specification of the S5U13781R00C100 reference board, please refer to the "S5U13781R00C100 Reference Board User Manual".

This user manual is updated as appropriate. Please check the Seiko Epson Website at <u>http://www.epson.jp/device/semicon_e/product/lcd_controllers/reference_design/index.htm</u> for the latest revision of this document before beginning any development.

We appreciate your comments on our documentation. Please contact us via email at vdc-documentation@ea.epson.com.

1.2 Terminology

SPI: Serial Peripheral InterfaceLUT: Look Up Tableppm format: portable pixmap formatbpp: bits per pixelURL: Uniform Resource LocatorPIP: Picture In PictureLED: Light Emitting Diode

1.3 Required Materials for Demonstration System

Hardware

Following parts are required to establish demonstration system.

- 1. S5U13781R00C100 (LCDC reference board from Epson)
- 2. LMT035KDH03
 - (3.5 inch, 320x240 dot, 24-bit full color TFT LCD panel from Shenzhen TOPWAY)
- 3. UM232H (USB-Serial conversion board from FTDI)
- 4. AC power supply (e.g. General purpose DC5V2A output, 100V 240V input, inner diameter 2.1mm)
- 5. AC power supply (e.g. General purpose DC3.3V2A output, 100V 240V input, inner diameter 2.1mm)
- 6. DC jack (e.g. General purpose inner diameter 2.1mm)
- 7. Pin header (e.g. General purpose 2x25 2.54mm pitch)
- 8. Jumper pin (e.g. General purpose 2.54mm pitch)
- 9. USB cable A female mini B male (General purpose A-miniB)
- 10. Personal computer

For programming of STM32 VL-Discovery and UM232H control.

Required software is available on the internet.

Demonstrations explained in this manual are confirmed operating on a personal computer configured as follows.

OS: Microsoft Windows XP Professional Version 2002 Service Pack 3

CPU: Intel(R) Core(TM)2 CPU U7600 @1.2GHz

On board memory: 1GB

Capacity of hard disk: 37GB capacity of C: drive. (Disk space required for the software tools is less than 5GB.)

Software (Demo)

Sample software package (includes image data for demo and configuration information for LCD) is available on the Epson web site.

Software (Development Tool)

Following tools are required.

- 1. IAR Embedded Workbench for ARM, v. 6.30, 32K Kickstart Edition from IAR systems
- 2. STM32F10x standard peripheral library from ST Microelectronics
- 3. Visual C++ 2010 Express from Microsoft
- 4. Driver and MPSSE-SPI library for UM232H from FTDI

These tools are available without charge on web site of each vendor.

2 Preparation of Demo

For preparation of demo, this section describes the tool set up and data package.

2.1 Instruction for Tool Download and Install

1. IAR Embedded Workbench for ARM, v. 6.309, 32K Kickstart Edition from IAR systems

Download from the following URL and install according to the introduction provided from the company.

EWARM 32K size limited version for evaluation (KS version) Ver 6.309. File size: 782MB. http://ftp.iarsys.co.jp/~download/KH_forSE_EWARMKS6.30_P/EWARM-KS-CD-6309.exe

Note:

Install the IAR Embedded Workbench and Driver (ST-Link) in the ARM Kickstart installer window.

2. ST Microelectronics STM32F10x standard peripheral library

The standard peripheral library is available from the following URL. <<u>http://www.st.com/internet/com/SOFTWARE_RESOURCES/SW_COMPONENT/FIRMWARE/stm32f</u> 10x_stdperiph_lib.zip>

3. Microsoft[™] Visual C++ 2010 Express from Microsoft.

Download Microsoft[™] Visual C++ 2010 Express from the following URL and install according to the introduction provided by Microsoft. http://www.microsoft.com/visualstudio/en-us/products/2010-editions/visual-cpp-express/

4. Driver and MPSSE-SPI library for UM232H from FTDI

Download the Driver and MPSSE-SPI library from the following URLs.

Driver for UM232H http://www.ftdichip.com/Drivers/D2XX.htm

D2XX driver for Windows can be downloaded from the following URL (located on the above web page). http://www.ftdichip.com/Drivers/CDM/CDM20814 WHQL Certified.zip

MPSSE-SPI library http://www.ftdichip.com/Support/SoftwareExamples/MPSSE/LibMPSSE-SPI.htm

The MPSSE-SPI library (file name: libMPSSE-SPI.zip) can be downloaded from the following URL (located on the above web page). http://www.ftdichip.com/Support/SoftwareExamples/MPSSE/LibMPSSE-SPI/libMPSSE-SPI.zip

2.2 Instruction for Demo Sample Software Download

The LCDC reference sample software package "epson_lcdc_demo_qvga1_rev1.zip" is downloadable from the <u>EPSON LCDC reference Web site</u>.

Verify that the files described in Table 2-1, LMT035KDH03 Download File, are in the downloaded file.

Table 2-1 LMT035KDH03 Download File

For LMT035KDH03 (3.5 inch 320x240 dot 24-bit full color TFT panel from Shenzhen TOPWAY)

Download File	Contents
demo_stm32vl_qvga1.zip	Firmware project file for STM32VL-Discovery Target tool: EWARM
flash_qvga1.zip	Project file for data writing to M25P16 (SPI flash ROM) Target tool: Visual C++ 2010 Express
demo_um232h_qvga1.zip	Project file for UM232H demo Target tool: Visual C++ 2010 Express

2.3 Unzip Downloaded Files

(1) Preparation for display demo using STM32 VL-Discovery

- 1. Make the project folder "demo_stm32vl_qvga" and place the file "stm32f10x_stdperiph_lib.zip" into this folder.
- 2. Unzip the file "stm32f10x_stdperiph_lib.zip". The folder "STM32F10x_StdPeriph_Lib_Vx.x.x" will be created.
- 3. Unzip the file "demo_stm32vl_qvga1.zip" described in the Table 2-1, *LMT035KDH03 Download File*. The folder "S1D13781" and "STM32F10x_s1d13781_Demo" will be created.
- Move folder "S1D13781" to the following folder.
 "\demo_stm32vl_qvga\STM32F10x_StdPeriph_Lib_Vx.x.xLibraries"
- 5. Move folder "STM32F10x_s1d13781_Demo" to the following folder. "\demo_stm32vl_qvga\STM32F10x_StdPeriph_Lib_Vx.x.x\Project" *Vx.x.x shows version number.

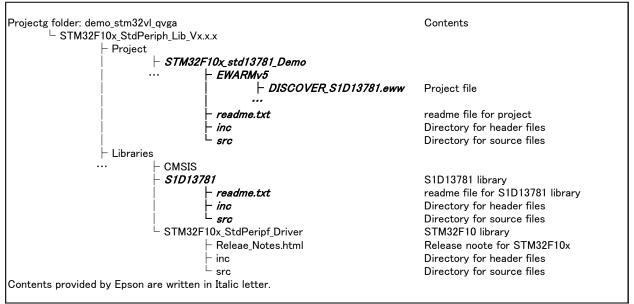


Figure 2-1 Structure of the Project Folder (STM32)

(2) Preparation for writing data into flash memory

- 1. Unzip the file "flash_qvga1.zip" described in the Table 2-1, *LMT035KDH03 Download File*. The project folder "flash_qvga" is created.
- 2. Unzip the MPSSE-SPI library "libMPSSE-SPI.zip" downloaded in Section 2.1, Instruction for Tool Download and Install. The folder "libMPSSE-SPI" will be created.
- 3. Double click the "b.bat" icon in the folder "\libMPSSE-SPI\Release-SPI\samples".

A command window is opened. Type "3" to select "SPI-Static".

Copy following three files from the folder "\libMPSSE-SPI\Release-SPI\samples\SPI" into the project folder: "flash_qvga".

ftd2xx.h libMPSSE.a libMPSSE_spi.h

This completes embedding the MPSSE-SPI library into the M25P16 write project folder: "flash_qvga".

Project folder: flash_qvga	Contents
<i>⊢ ReadMe.txt</i>	
EPSON_LCDC_REF.sln	Solution file
- ***.cpp	Source file
- ***.h	Header file
⊢ libMPSSE.a	MPSSE library from FTDI
├ libMPSSE.h	MPSSE header file from FTDI
⊢ ftd2xx.h	D2XX header file from FTDI
⊢ pix	Directory for demo image data
··· - image*_480x272.ppm	Demo image data for PSP panel (in PPM format)
•••	
<i>⊢ image*_320x240.ppm</i>	Demo image data for QVGA panel (in PPM format)

Figure 2-2 Structure of The Project Folder (Flash)

(3) Preparation for display demo using PC

- 1. Unzip the file "demo_un232h_qvga1.zip" described in Table 2-1, *LMT035KDH03 Download File*. The Project folder "demo_um232h_qvga" is created.
- 2. Unzip the MPSSE-SPI library "libMPSSE-SPI.zip" downloaded in Section 2.1, Instruction for Tool Download and Install. Then the folder "libMPSSE-SPI" will be created.
- 3. Double click the "b.bat" icon in the folder "\libMPSSE-SPI\Release-SPI\samples".

A command window is opened. Then type "3" to select "SPI-Static".

Copy following three files from the folder "\libMPSSE-SPI\Release-SPI\samples\SPI" into the project folder: "demo_um232h_qvga".

ftd2xx.h libMPSSE.a libMPSSE_spi.h

This completes embedding MPSSE-SPI library into the UM232H demo project folder: "demo_um232h_qvga".

Project folder: demo um232h gvga Contents ReadMe.txt - EPSON_LCDC_REF.sln Solution file - ***.cpp Source file - ***.h Header file - libMPSSE.a MPSSE library from FTDI - libMPSSE.h MPSSE header file from FTDI – ftd2xx.h D2XX header file from FTDI Directory for demo image data |- pix Demo image data for PSP panel (in PPM format) image*_480x272.ppm Demo image data for QVGA panel (in PPM format) image*_320x240.ppm Contents provided by Epson are written in Italic letter.

Figure 2-3 Structure of the project folder (UM232H)

3 Explanation of the Demo using STM32 VL-Discovery

This section describes about the contents and instruction for display demo using STM32 VL-Discovery.

3.1 Summary

The STM32VL-Discovery is the evaluation board for ARM Cortex-M3 on board STM32F100xx microcontroller from ST Microelectronics (hereafter STM). This board is reasonably priced and includes an ICE feature, making it suitable for this evaluation.

The demo displays a still image on an LCD panel. Hardware consists of following items.

LCD controller: S5U13781R00C100 reference board

Microcontroller: STM32VL-Discovery

LCD panel:

LMT035KDH03 from Shenzhen TOPWAY (3.5 inch, 320x240 dots, 24 bit full color TFT panel)

Display image data on PC will be written into the 16Mbit SPI NOR Flash standard memory (M25P16) on the S5U13781R00C100 reference board by using UM232H*.

* The UM232H Single Channel USB Hi-Speed FT232H Development Module is a one chip USB-serial conversion IC from Future Technology Devices International. This board is reasonably priced, making it suitable for this evaluation.

The firmware for the STM32 VL-Discovery is written using "IAR Embedded Workbench for ARM, 6.30, 32K Kickstart Edition" from IAR systems.

3.2 Write Image Data into Flash Memory

3.2.1 S5U13781R00C100 Connection with UM232H

A connection example for the S5U13781R00C100 reference board and the UM232H via SPI for writing image data into the M25P16 is described in Figure 3-1, *Connection with UM232H (via SPI)*.

If noise on the SPI signal causes problems, place a resistor of several hundred ohms between the S5U13781R00C100 and STM 32 VL-Discovery SPI port for the purpose of noise damping.

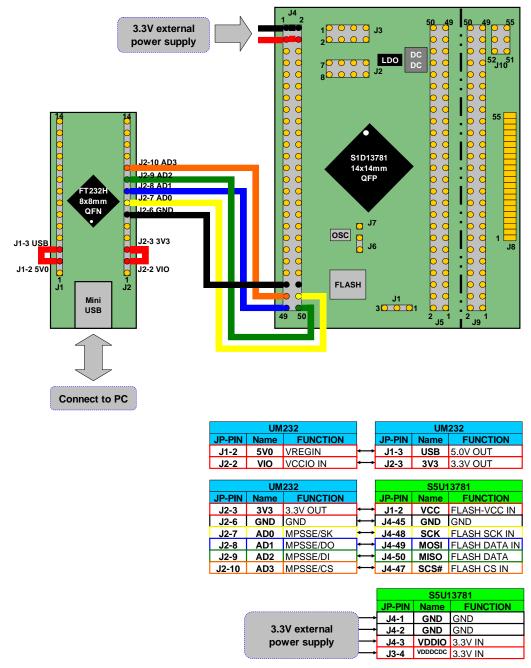


Figure 3-1 Connection with UM232H (via SPI)

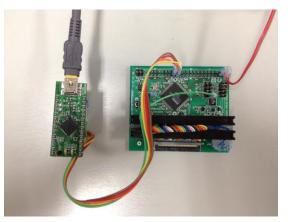
3.2.2 Procedure for Writing Image Data into Flash Memory

This section describes the image data writing procedure to the M25P16 (SPI flash ROM) for the demo using the LMT035KDH03(3.5 inch 320x240 dot 24bit full color TFT panel from Shenzhen TOPWAY).

To start, connect the S5U13781R00C100 reference board to the UM232H via SPI, and connect the UM232H to the PC via USB.

See Section 3.2.1, Connection with UM232H (Control S1D13781 via SPI), for connection information.

Unzip and apply the UM232H driver prepared in Section 2.1, Instruction for tool download and install.

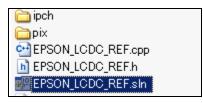


Note: the S5U13781R00C100 requires an external power supply.

↓

Launch the project file for Visual C++ 2010 Express.

Double click the "EPSON_LCDC_REF.sln" icon in the project folder for writing M25P16: "flash_qvga" which is prepared at 2-3-(2): "Preparation for writing data into flash memory".



↓

Proceed with writing data to the M25P16.

😫 EPSON_LCDC_REF - Microsoft Visual C++ 2010 Express <u>File Edit View Project Build Debug Tools Window H</u>elp i 🛅 - 🛅 - 📂 🚽 🕔 🔺 🔖 <u>W</u>indows ▶ n32 : 🗊 🐁 🏊 🗤 | 諱曰 諱曰 📃 🔁 🕨 🧕 Start Debugging F5 EPSON_LCDC_REFh × ftd2xx Ctrl+F5 (Global Scope) Exceptions... Ctrl+Alt+E #define TEST_M25P StepInto #define TEST_LCDC □ Step Over F11 [⊒ Step <u>O</u>ver F10 └ □/*-----F9 Toggle Breakpoint Select Mode (TEST New <u>B</u>reakpoint //#define TEST_MODE Delete All Breakpoints Ctrl+Shift+F9 Clear <u>A</u>ll DataTips Select LCD Panel Export DataTips ... Import DataTips ... Options and Settings... //#define LCD_PANEL_____Options and Su //#define LCD PANEL LMT035DNAFWU 1 //qvga #define LCD_PANEL_LMT035KDH03 //qvga new Select BPP (LCDC_BPP_24 or LCDC_BPP_16 or LCDC_BPP_08) #define LCDC_BPP LCDC_BPP_24

Select "Debug" from the menu \rightarrow "Start Debugging" from the sub menu.

Here, if the window opens which asks "This project is changed. Will you build?", select "Yes".

 \downarrow

A command window is opened and the data write starts.

EPSON_LCDC_REFh ×					
(Global Scope) 🔤 🕻	¥Documents and Settin	ngs¥0086114¥デスクト	ップ¥Release_dir¥demo_um	232h_qvga¥Deb	- 🗆 X
#define TE M25P	Page Programed	64c00h			-
tdefine TE M25P	Page Programed	64d00h			
M25P	Page Programed	64e00h			
	Page Programed	64f00h			
Select M M25P	Page Programed	65000h			
#define TE M25P	Page Programed	65100h			
	Page Programed	65200h			
	Page Programed	65300h			
Select L M25P	Page Programed	65400h			
M25P	Page Programed	65500h			
M25P	Page Programed	65600h			
//#define M25P	Page Programed	65700h			
//#define M25P	Page Programed	65800h			_
#define L(M25P	Page Programed	65900h			
M25P	Page Programed	65a00h			
	Page Programed	65b00h			
T M25P	Page Programed	65c00h			
	Page Programed	65d00h			
M25P	Page Programed	65e00h			
	Page Programed	65f00h			
	Page Programed	66000h			
	Page Programed	66100h			
	Page Programed	66200h			
M25P	Page Programed	66300h			

*It may take several minutes (up to 10) to write the Epson logo image and the four photo images. Once writing completes, the command window will be closed automatically.

- 🌁 Dump_m25p

Supplemental information

The Epson logo image and four photograph images data are on the PC and have a color depth of 24bpp.

The stored folder is "flash_qvga\pix".

🚺 image_pip_320x240.ppm
🛅 image2_320x240.ppm
🛅 image2_480x272.ppm
置 image1_480x272.ppm
置 image1_320x240.ppm
置 image3_480x272.ppm
置 image3_320x240.ppm
📰 image4_480x272.ppm
🗾 image4_320x240.ppm
🖹 image_pip_480x272.ppm

The software writes each image to the M25P16 in the format used for the demo.

Epson logo (PIP window): Written as 16bpp image data Four photo images (Main window): Written as 24bpp image data

3.3 Write Demo Sample Software into STM32 VL-Discovery

Connect the STM32 VL-Discovery to the PC via USB.



 \downarrow

Launch the project file for IAR Embedded Workbench.

Double click "DISCOVER_S1D13781.eww" located in the project folder: "\demo_stm32vl_qvga\STM32F10x_StdPeriph_Lib_V3.5.0\Project".

DISCOVER_S1D13781
🚞 settings
🔂 DISCOVER_S1D13781.dep
🔂 DISCOVER_S1D13781.ewd
🗟 DISCOVER_S1D13781.ewp
DISCOVER_S1D13781.eww
stm32f100_flash.icf
-

Here, if the window opens which states "Can not open this file", then launch "IAR Embedded Workbench" from the Windows start menu.

 \downarrow

EWARM is launched and project file is opened.

1 🖬 🖬 🞒 🐰 12 🖻 💼 🗠 🗠 🗌	- 4 >	🐂 🚾 🔤 🐵 📣 🐏 📫 📽 🕺 🥭 🕭 🕭
orkspace	×	SID13781.h s1d13781_constants.h stm32f10x_spi.c s1d13781_display.c main.c
DISCOVER_S1D13781	•	sFLASH ReadBuffer(Rx Buffer, ImageFlashAddr, BufferSize);
Files	80 🗠 🔺	seBurstUriteMemory16(PipAddress, (const uint16_t*) Rx_Buffer, 2
DISCOVER_S1D13781 - DISCOVER_S1D13781	~	
		ImageFlashAddr += PipStride; PipAddress += PipStride;
🛏 🖻 system_stm32f10x.c		FipMulless += FipAcride,
—Ģ⊇DOĊ		3
E readme.txt		· · · · · · · · · · · · · · · · · · ·
- 🛱 🗀 EWARM/5		
🛏 🔂 startup_stm32f10x_md_v1.s		/*
		Load LUT2 data
- P inc		2012/2/23 by iifbu group
S1D13781.h		for epson logo color with Sbpp+LUT2
s1d13781_constants.h		
s1d13781_datatype.h		#define LUT2_Address 0x60400
s1d13781_display.h		<pre>for (uint16 t i = 0; i < 0x400; i+=4) {</pre>
s1d13761_hcl.h		if (i < 0x100) {
sidi 3761_pip.n		seWriteReg16 (LUT2 Address +1, (UInt16) (0) (UInt16) ((0) <<
		seWriteReg16(LUT2_Address +i+2, (UInt16)(0));
		<pre>} else if (i > 0x100*3) {</pre>
		seWriteReg16(LUT2_Address +i, (UInt16)(i/4) (UInt16)((i,
-@ s1d13781_pip.c		seUriteReg16(LUT2_Address +1+2, (UInt16)(1/4));
- C StdPeriph_Driver		} else (
Here in the second seco		<pre>seUriteReg16(LUT2_Address +i, (UInt16)(i/4) (UInt16)((i, seUriteReg16(LUT2_Address +i+2, (UInt16)(i/32));</pre>
H stm 32f1 0x_exti.c		Seorreekegro(Lorz_Address +1+2, (oincro)(1/32));
B stm32f10x apio.c		, ,
E stm32f10x_pwr.c		· · ·
	-	while (1)
DISCOVER_S1D13781		16 I
Log		
4		

Build the project file.

Select "Project" from the menu \rightarrow "Rebuild All" from the sub menu.

Vertication of the second seco	D13781 - IAR Embedded W <u>Project</u> Tools Window <u>H</u> Add Eiles Add Group Import File List Edit Configurations	forkbench IDE slp	× < > ×	> > > > > > > > > > > > > > > > > > >
Files	Remoye Create <u>N</u> ew Project Add <u>Existing Project</u> Options	Alt+F7		Se II P: }
EVARN	Version Control System Make Compile Rebuild All Clean Batch build	F7 Ctrl+F7 F8		/* Load 20 fd
h s10 	Stop Build Download and Debug Debug without Downloading Make & Restart Debugger	Ctrl+Break Ctrl+D Ctrl+R		#define L for (i
└── î s1ı └─ □ ○ src └── î s1ı └── î s1ı └── î s1ı	Restart Debugger Download Open Device File	Ctrl+Shift+R		}
H StdPerip H		Ļ		,

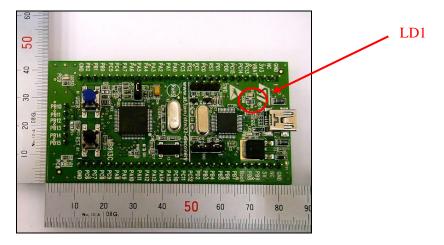
Download the code to the STM32 VL-Discovery and write it into Flash.

Select "Project" from the menu \rightarrow "Download" from the sub menu \rightarrow "Download active application"

泽	DISCOV	/ER_S1	D13781	- IAR I	Embedded	Workbench I	DE				
Eile	e <u>E</u> dit	⊻iew	<u>P</u> roject	<u>T</u> ools	<u>W</u> indow	<u>H</u> elp					
	l 😅 🖡	3 🕼	Add <u>F</u> Add <u>G</u>	roup				•	> ×] 🗈 🗫 🐗 🌬
	SCOVER	C1D12		File Lis			- F			SID13/81.	h s1d13781_constan
li-		_31013		onfigura	tions			0			sFLASH_ReadBu seBurstWriteM
	iles		Remo	<u>/</u> e			- E	82	<u>≊</u> ; ▲		Seburstwritten
	⑦ DIS -曰 🗀 C - 山 同			e <u>N</u> ew P xisting f				· ·			ImageFlashAdd PipAddress +=
II i	-0 🗋 C		Option	IS		Alt+F7				}	
		readr WARN	Versio	n Contr	ol System		•			,	
III.	L 6	startu	<u>M</u> ake			F7				V*	÷
F		1D137	<u>C</u> omp Re <u>b</u> ui Clean			Ctrl+F7					Load LUT2 data 2012/2/23 by
H		- \Lambda S1 - \Lambda s1)	Detels	build		F8				±/	for epson log
E		- 🔓 s1) - 🔓 s1)	Stop B	Build		Ctrl+Break				#defin	e LUT2_Address
H	ΤĒ	- 🖪 si - 🔓 si		oad and	Debug Downloadi	Ctrl+D				fo	r (uintl6_t i
		- 🔓 s1)	Make		rt Debugge						<pre>if (i < 0x100 seWriteRe</pre>
H		- <u> h</u> s1ı		rt Debue		Ctrl+Shift+F	2				seWfiteRe
		src	Do <u>w</u> nl	oad			- 1	<u>D</u> ownload a		lication	} else if (i
H		0 🚺 s1 0 🚺 s1	-	Device I	File		•	Download 1			seWriteRe
H			13781_				— <u> </u>	<u>E</u> rase mem	iory		seWriteRe
Ht.			h_Drive								} else {
Hł.		misc.									seWriteRe seWriteRe
III.			- f10x_ex	ti.c)
It		stm 32	:f10x_gp	io.c						}	,
III î			410							· · ·	

 \downarrow

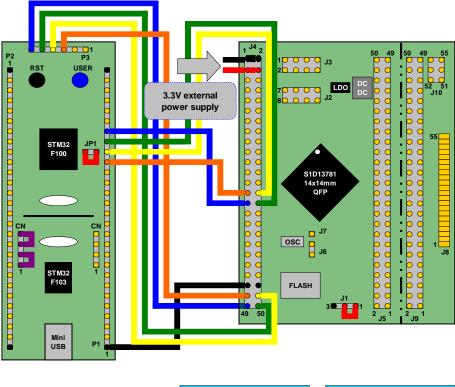
The red LED (LD1) blinks and the code will be written.



3.4 Connect the S5U13781R00C100 with the STM32 VL-Discovery

A connection example for the S5U13781R00C100 reference board and the STM32 VL-Discovery via SPI is shown in Figure 3-2, *Connection Example for STM32VL-Discovery (via SPI)*.

If noise on the SPI signal causes problems, place a resistor of several hundred ohms between the S5U13781R00C100 and STM 32 VL-Discovery SPI port for the purpose of noise damping.



	STM3	2VLD		STM32VLD					
JP-PIN	Name	FUNCTION		JP-PIN	Name	FUNCTION			
JP1-1	IDD	IDD	↔	JP1-2	IDD	IDD			
CN3-1	SWD	SWD	↔	CN3-2	SWD	SWD			
CN3-3	SWD	SWD	↔	CN3-4	SWD	SWD			
	O E L M	12704		CEL14.2704					

	5501	3781			5501	3781
JP-PIN	Name	FUNCTION		JP-PIN	Name	FUNCTION
J1-1	VDDIO	VDDIO	↔	J1-2	VCC	FLASH-VCC IN

	STM	32VLD		S5U13781				
JP-PIN	Name	FUNCTION		JP-PIN	Name	FUNCTION		
P1-1	GND	GND]⊷	J4-45	GND	GND		
P1-19	PA4	SPI1_NSS	↔	J4-27	SCS#	SPI CS IN		
P1-20	PA5	SPI1_SCK	┥	J4-28	SCK	SPI SCK IN		
P1-21	PA6	SPI1_MISO	}	J4-30	MISO	SPI DATA OUT		
P1-22	PA7	SPI1_MOSI	⊶	J4-29	MOSI	SPI DATA IN		
P3-3	PB12	SPI2_NSS	⊶	J4-47	SCS#	FLASH CS IN		
P3-4	PB13	SPI2_SCK	→	J4-48	SCK	FLASH SCK IN		
P3-5	PB14	SPI2_MISO]⊷	J4-50	MISO	FLASH DATA		
P3-6	PB15	SPI2_MOSI	↔	J4-49	MOSI	FLASH DATA IN		
				S5U13781				
				JP-PIN	Name	FUNCTION		
(\rightarrow	J4-1	GND	GND		
	2 3	W ovtornal						

		55013781		
	JP-PIN	Name	FUNCTION	
·	+ J4-1	GND	GND	
3.3V external	+ J4-2	GND	GND	
power supply	→ J4-3		3.3V IN	
	+ J3-4	VDDDCDC	3.3V IN	
		-		

Figure 3-2 Connection Example for STM32VL-Discovery (via SPI)

3.5 Connect the S5U13781R00C100 with LCD Panel

This section describes the TFT panel connection to the S5U13781R00C100 reference board using the LMT035KDH03.

The LMT035KDH03 is a 3.5 inch, 320x240 dot, 24-bit full color TFT LCD panel from Shenzhen TOPWAY.

A connection example between the S5U13781R00C100 reference board and the LMT035KDH03 is shown in Figure 3-3, *LMT035KDH03 Connection Example*.

Table 3-1, *T-55343GD035JU-LW-ADN Connection Example (1 of 2)*, and Table 3-2, *LMT035KDH03 Connection Example (2 of 2)*, show detailed connection information for each signal.

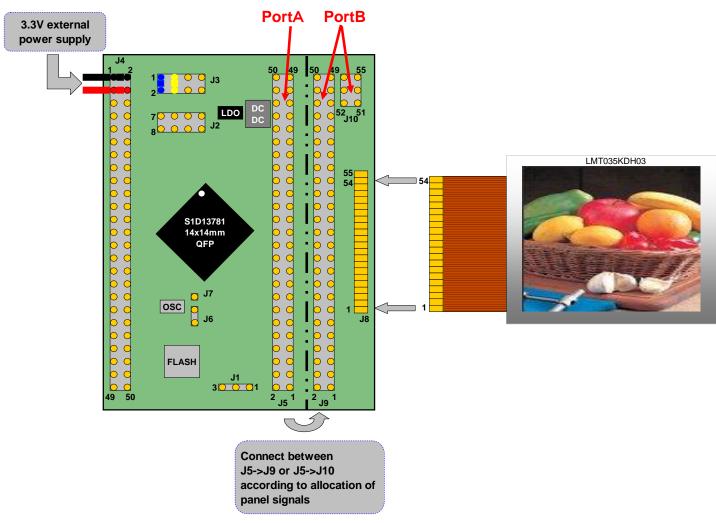


Figure 3-3 LMT035KDH03 Connection Example

S5U13781F	R00C100 ref	erenc	e board	LMT035KDH03	TFT panel
Pin name	PortA	\rightarrow	PortB	Pin name	Pin number
GND	J5-1	\rightarrow	J10-53	GND	53
DE	J5-5	\rightarrow	J10-52	DEN	52
PCLK	J5-6	\rightarrow	J9-38	DCLK	38
GND	J5-7	\rightarrow	J10-54	GND	54
PDT0	J5-9	\rightarrow	J9-12	B0	12
PDT1	J5-10	\rightarrow	J9-13	B1	13
PDT2	J5-11	\rightarrow	J9-14	B2	14
PDT3	J5-12	\rightarrow	J9-15	B3	15
PDT4	J5-13	\rightarrow	J9-16	B4	16
PDT5	J5-14	\rightarrow	J9-17	B5	17
PDT6	J5-15	\rightarrow	J9-18	B6	18
PDT7	J5-16	\rightarrow	J9-19	B7	19
PDT8	J5-17	\rightarrow	J9-20	G0	20
PDT9	J5-18	\rightarrow	J9-21	G1	21
PDT10	J5-19	\rightarrow	J9-22	G2	22
PDT11	J5-20	\rightarrow	J9-23	G3	23
PDT12	J5-21	\rightarrow	J9-24	G4	24
PDT13	J5-22	\rightarrow	J9-25	G5	25
PDT14	J5-23	\rightarrow	J9-26	G6	26
PDT15	J5-24	\rightarrow	J9-27	G7	27
PDT16	J5-25	\rightarrow	J9-28	R0	28
PDT17	J5-26	\rightarrow	J9-29	R1	29
PDT18	J5-27	\rightarrow	J9-30	R2	30
PDT19	J5-28	\rightarrow	J9-31	R3	31
PDT20	J5-29	\rightarrow	J9-32	R4	32
PDT21	J5-30	\rightarrow	J9-33	R5	33
PDT22	J5-31	\rightarrow	J9-34	R6	34
PDT23	J5-32	\rightarrow	J9-35	R7	35
VDDIO	J5-39	\rightarrow	J9-41, J9-42	VDD	41,42
LED+	J5-46	\rightarrow	J9−3, J9−4	LED_ANODE	3,4
LED-	J5-48	\rightarrow	J9-1, J9-2	LED_CATHODE	1,2
GND	J5-50	\rightarrow	J10-53	GND	53
HS	J5-4	\rightarrow	J9-36	HSYNC	36
VS	J5-3	\rightarrow	J9-37	VSYNC	37
VDDIO	J5-39	\rightarrow	J9-8	/RST	8

 Table 3-1 LMT035KDH03 Connection Example (1 of 2)
 Image: Connection Example (1 of 2)

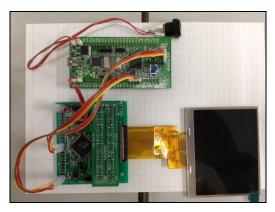
Table 3-2 LMT035KDH03 Connection Example (2 of 2)

S5U13781R00C100 reference board	Description
Connect J3-1 and J3-2	Set DC-DC converter enable
Connect J3-3 and J3-4	Set DC-DC converter output current = 20mA
Connect GND of power source to J4-1and J4-2	Connect power source GND
Connect 3.3V of power source to J4-3 and J4-4	Connect power source 3.3V to VDDIO and VDDDCDC

3.6 Running Demo

Connect the S5U13781R00C100 with the STM32VL-Discovery and LMT035KDH03

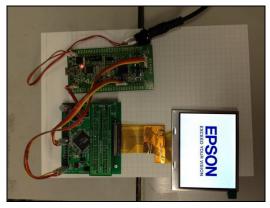
Refer to Section 3.4, Connect the S5U13781R00C100 with the STM32 VL-Discovery, and Section 3.5, Connect the S5U13781R00C100 with LCD Panel, for further information.



Connection image

Power ON starts the demo

Supplying power to the STM32 VL-Discovery (from USB or 5V external power supply) and to the S5U13781R00C100 (from 3.3V external power supply) starts the demo automatically.



Connection image

The demo proceeds as shown in figure 3-4, Demo Flow Diagram.

The Epson logo (PIP window) and photo image (Main window) will alternately be changed. The Epson logo will be overlaid on the photo image and repeats fade-in and fade-out.

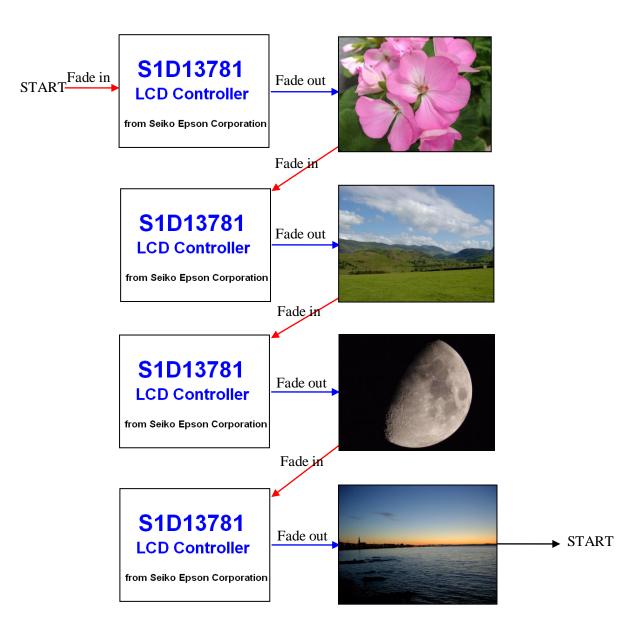


Figure 3-4 Demo Flow Diagram

Here, the display image data of the Epson logo is in 16bpp and the photo image is 24bpp.

Using the above data formats enables S1D13781 to process display with its built-in 384kbytes SRAM.

4 Explanation of the Demo using PC

This section describes display demo using the UM232H USB-SPI conversion board connected to PC. Hardware configuration for the demo is shown in the following figure.

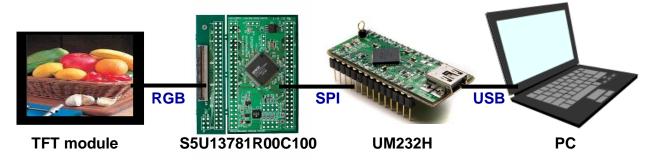


Figure 4-1 Constitution of Display Demo using a PC

For this demo, the display system consists of the following hardware.

PC

LCD controller: S5U13781R00C100 reference board USB-SPI conversion board: UM232H LMT035KDH03 from Shenzhen TOPWAY

(3.5 inch, 320x240 dots, 24 bit full color TFT panel)

The demo is as follows.

- 1. Color gradation bar display demo using the S1D13781 2D BitBLT feature
- 2. Still image display

In this demo, a PPM format image stored in a PC will be used as the demo still image.

The sample project provided on the EPSON web site is verified in its compilation and operation with Microsoft Visual C++ 2010 Express compiled.

4.1 Connection with USB Serial Conversion Board: UM232H (Control S1D13781 via SPI)

A connection example to control the S1D13781 by connecting the S5U13781R00C100 reference board and the UM232H via SPI is described in Figure 4-2, *Connecting the UM232H to S1D13781 via SPI*.

If noise on the SPI signal causes problems, place a resistor of several hundred ohms between the S5U13781R00C100 and STM 32 VL-Discovery SPI port for the purpose of noise damping.

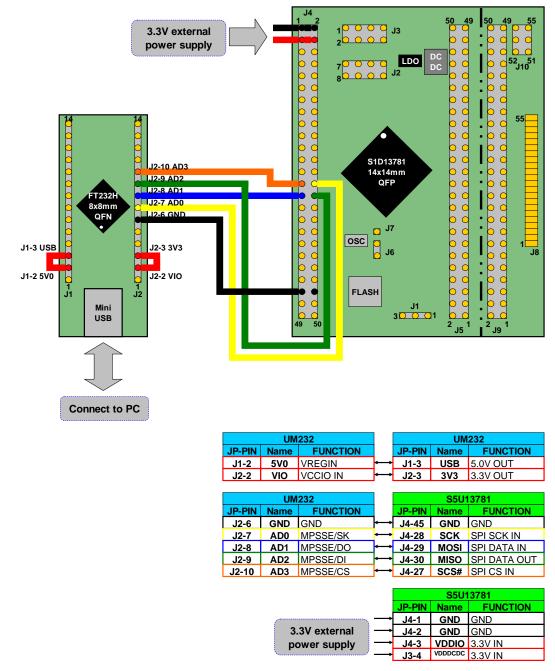


Figure 4-2 Connecting the UM232H to S1D13781 via SPI

4.2 Connection with LCD panel

See Section 3.5, Connect the S5U13781R00C100 with LCD panel, for further information.

4.3 Displaying an Image on LCD

Displaying an still image using LMT035KDH03 (3.5 inch 320x240 dot 24bit full color TFT panel from Shenzhen TOPWAY)

Connect the S5U13781R00C100 reference board and the UM232H via SPI and connect the UM232H to PC via USB.

See Section 4.1, Connection with UM232H (Control S1D13781 via SPI), for connection information.

Unzip and apply the UM232H driver prepared in Section 2.1, Instruction for Tool Download and Install.

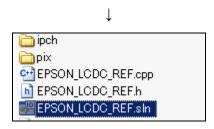


Connection image

↓

Launch project file for Visual C++ 2010 Express.

Double click the "EPSON_LCDC_REF.sln" icon in the UM232H demo project folder: "demo_um232h_qvga" prepared at 2-3-(3): "Preparation for display demo using PC".



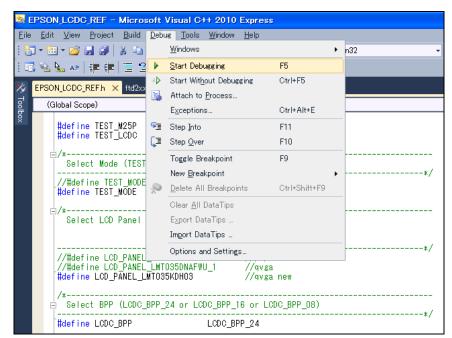
 \downarrow

- 2 🛛 - Mic le <u>E</u>dit <u>V</u>iew <u>P</u>roject <u>B</u>uild <u>D</u>ebug <u>T</u>ools <u>W</u>indow <u>H</u>elp 🔁 = 🖽 = 🚅 😹 🎉 | 🕉 🛍 😤 | 🕫 - 🝽 - | 🔜 🕾 🖄 🌫 🛃 🚆 - 💭 - 🖳 | 🕨 Debug - Win32 - 🖄 Dump_m25p 3 월 💁 🖉 建 🗄 🚊 일 💷 🖓 🤪 🖓 😓 🥋 🚽 EPSON_LCDC_REFh × ftd2xxh olution Explorer (Global Scope) #define TEST_M25P
#define TEST_LCDC true false //#define TEST_MODE #define TEST_MODE TEST_M25P TEST_LODC //#define LCD_PANEL_ATM0430D5 //#define LCD_PANEL_LMT035DNAFVU_1 #define LCD_PANEL_LWT035KDH03 //psp //qvga //qvga new /*-----Select BPP (LCDC_BPP_24 or LCDC_BPP_16 or LCDC_BPP_08) 🔁 Solution Explorer - 🌺 Class Vie #define LCDC BPP LCDC_BPP_24 - 3 21 voupur nom Lecus - 👔 🔅 🔍 🛒 🗃 program '[3120] EPSON_LCOC_REF.exe: Native' has exited with code 0 (0x0).

The Visual C++ 2010 Express window is opened.

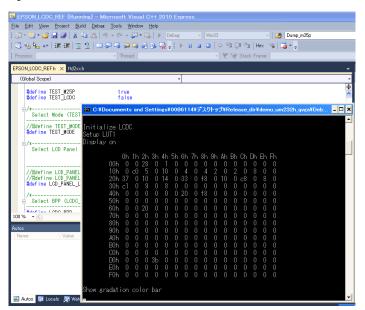


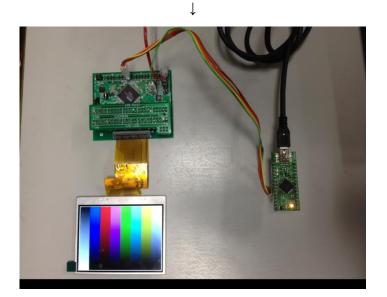
Start the demo by selecting "Debug" from the menu \rightarrow "Start Debugging" from the sub menu



Here, if the window opens which asks "This project is changed. Will you build?", select "Yes".

A command window is opened and the data write starts.

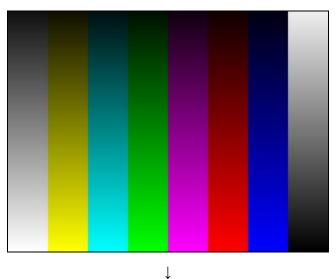




Connection image

This demo displays the image on the LCD in the following order.

(1) Color gradation bar image using 2D BitBLT feature



(2) Displays the image "image1_320x240.ppm" located in the folder "demo_um232h_qvga\pix".



↓

Return to (1)

5 Change Record

X94A-G-007-01 Revision 1.2 - Issued: April 9, 2018

• Maintenance update to fix contacts/addresses and minor formatting

X94A-G-007-01 Revision 1.1 - Issued: January 15, 2013

- Section 2.1 Instruction for Tool Download and Install changes URL to item 1, IAR Embedded Workbench for ARM .
- Section 3.2 Write Image Data into Flash Memory changes figure 3-1. Connection with UM232H (via SPI)
- Section 3.6 Running demo changes photos of figure 3-4. Demo flow diagram.
- Section 4.3 Displaying an Image on LCD changes photo of Demo flow diagram.

X94A-G-007-01 Revision 1.0 - Issued: April 11, 2012

• Re-format and edit document

6 Sales and Technical Support

For more information on Epson Display Controllers, visit the Epson Global website.

https://global.epson.com/products_and_drivers/semicon/products/display_controllers/

For Sales and Technical Support, contact the Epson representative for your region.

https://global.epson.com/products_and_drivers/semicon/information/support.html

