LCM Test Tool User Guide

Document Information

abstract	The LCM Test Tool is the convenient tool to light on the LCM rapidly. It can export the dedicated text file to integrate with the same driver for different LCM, respectively. This document instructs the user how to use the tool smoothly.
Apply to	N9H2x Series

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1 Overview

1.1 USB Booting in Recovery Mode

The N329/N9H2X series has two boot flows – one is the Normal Mode and the other is Recovery Mode. To use LCM Test Tool from USB booting, the N9H2X device should be set to the Recovery Mode. During USB booting, the N9Hxx related firmware for LCM Test Tool will be loaded to DRAM from USB. The main purpose of firmware is to decode the USB vendor command for LCM initial settings.

1.2 LCM Test Tool Introduction

The LCM Test Tool is a convenient tool to check whether the LCM related initial settings to be well or not. The settings have been passed to the DRAM by USB and verified rapidly by the corresponding firmware. After getting the exact image displayed on the LCM, these settings can be exported and saved as a text file. The LCM driver can take advantage of the file contents to light on the LCM successfully. In the VPOST sample code, it provides an example to instruct how to use the file exactly.

Here some files within the LCM Test Tool folder have been described below.

- [LCM Test Tool Version History – ChangeLog.txt]

  All LCM Test Tool and firmware change history are listed in this file.

- [LCM Test Tool program – LCMTest.exe]

  The PC-based tool execution file.

- [LCM Test Tool Configuration for Boot Code Header – LCMTest.ini]

  The IBR program supports some user-defined items in boot code header, including boot code executing address, DRAM clock skew settings, register writing function, and delay function. After confirming the flash content is for booting, the IBR will do corresponding operation according to the boot code header information.

- [N9H2x_musb.bin]

  The LCM Test Tool can load the firmware (N9H20_musb.bin or N9H26_musb.bin) from PC to N9H2X series by USB boot. After booting, it can be executed in N9H2x device.

- [default setting – Option.ini]

  This file stores the default settings for the tool.

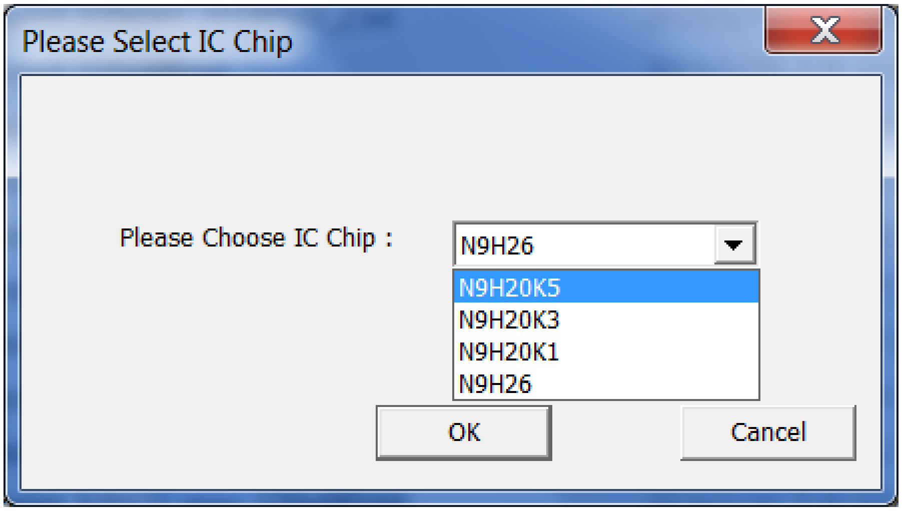
- [LCM register settings – Register.ini]

  The file stores the default settings for LCM internal regsiter.

2 Function Description

2.1 Starting to Use LCM Test Tool

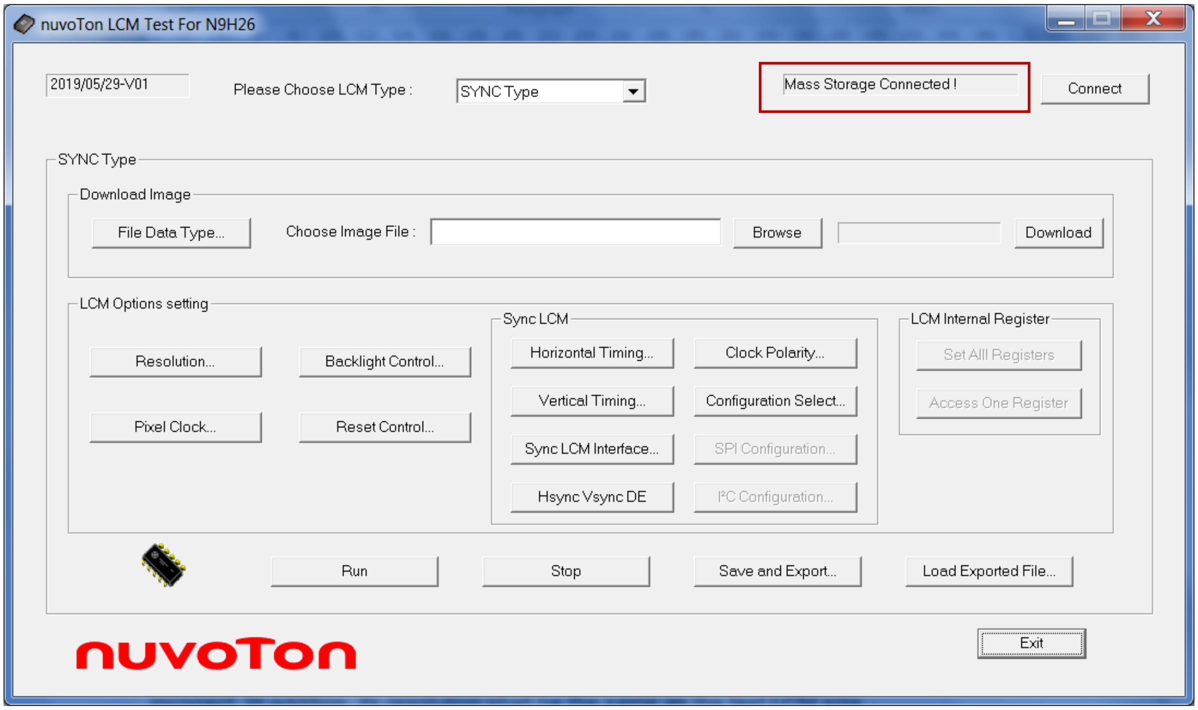
When to begin opening the tool, the connected device must be selected first. The available devices consist of N9H20K5, N9H20K3, N9H20K1 and N9H26.



Please Select IC Chip

Please Choose IC Chip : N9H26

After the device selected from the dialog, the tool will try to connect the target board automatically. Before to do other selection, please make sure the board being connected.



nuvoTon LCM Test For N9H26

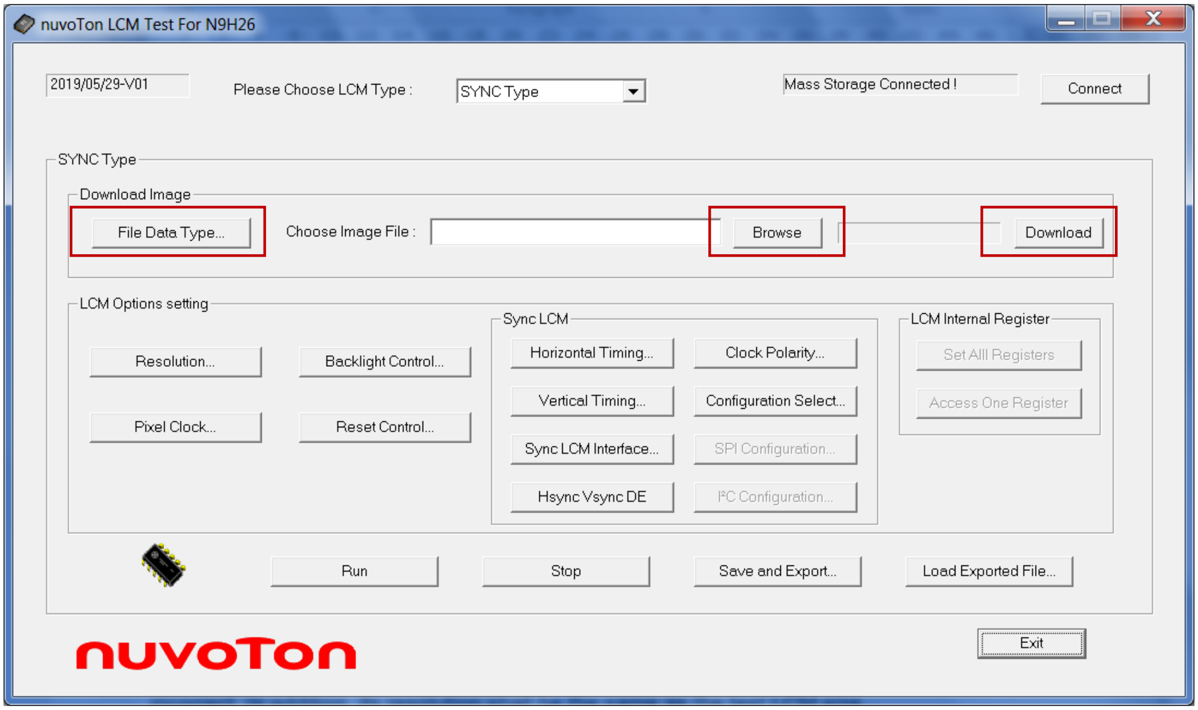
2019/05/29-V01

Please Choose LCM Type : SYNC Type

Mass Storage Connected !

2.2 Download Image

The tool supports the raw data image file and its data type shall be given at the same time. If the selected data type is different from the image contents, the displayed image will be incorrect. In addition, its resolution shall be the same as the test LCM size.



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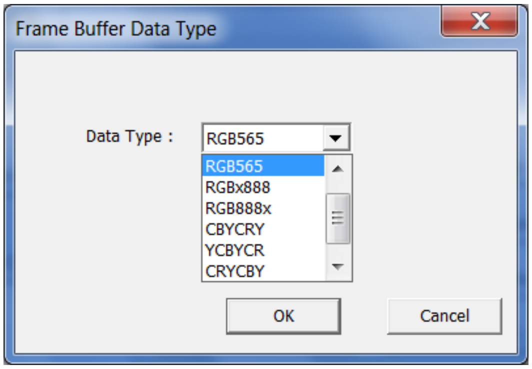
Please Choose LCM Type : SYNC Type

Mass Storage Connected !

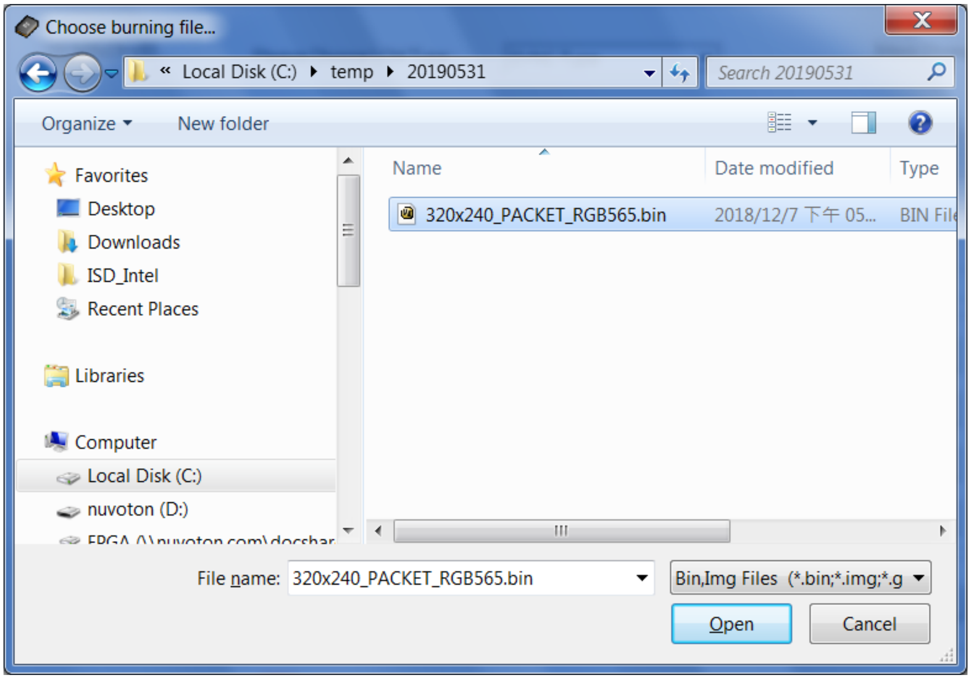
Before to download the test image, the file data type shall be selected from its dialog.



Frame Buffer Data Type

Data Type : RGB565

Then the image fle can be browsed and selected from the disk. Specifically, the image file must be a raw one with binary format.



Choose burning file...

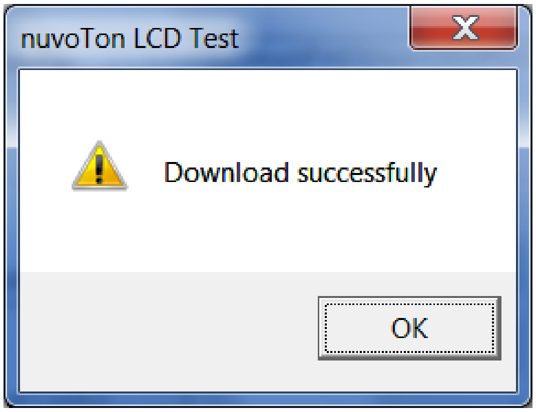
Local Disk (C:) ▸ temp ▸ 20190531

Name	Date modified	Type
320x240_PACKET_RGB565.bin	2018/12/7 下午 05...	BIN File

File name: 320x240_PACKET_RGB565.bin

Bin,Img Files (*.bin;*.img;*.g

After the file being selected, click the button “Download” and then get the information of “Downloaded successfully”



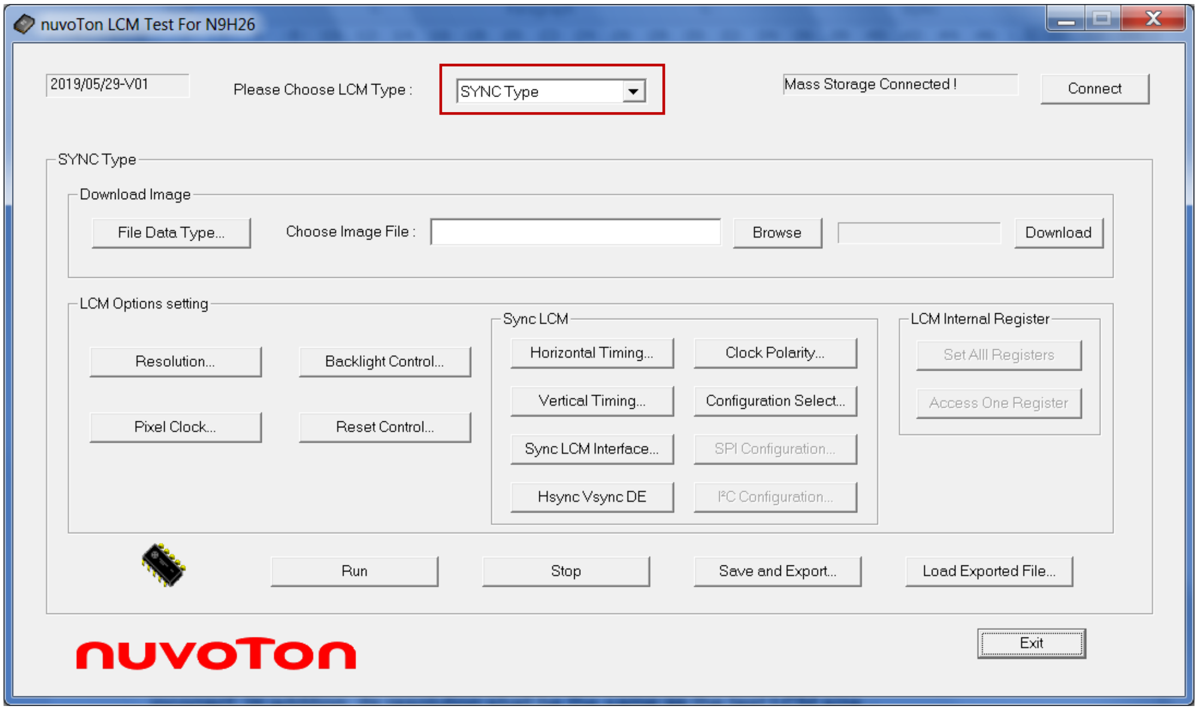
nuvoTon LCD Test

Download successfully

2.3 LCM Option Setting

Several options listed below must be set for both the sync and MPU LCM.

- [Set LCM Type]

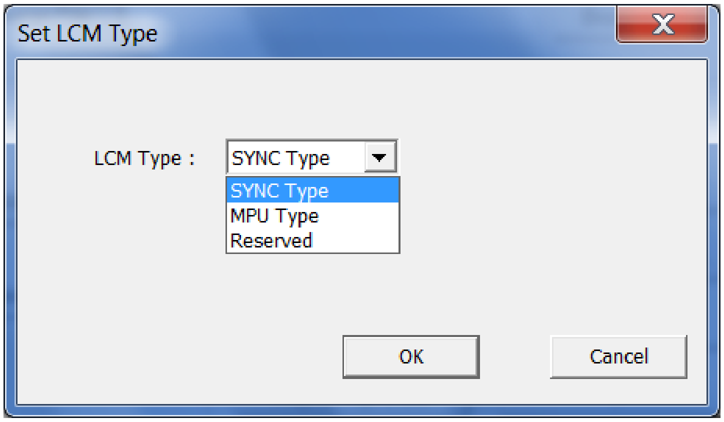


2019/05/29-V01

Please Choose LCM Type : SYNC Type

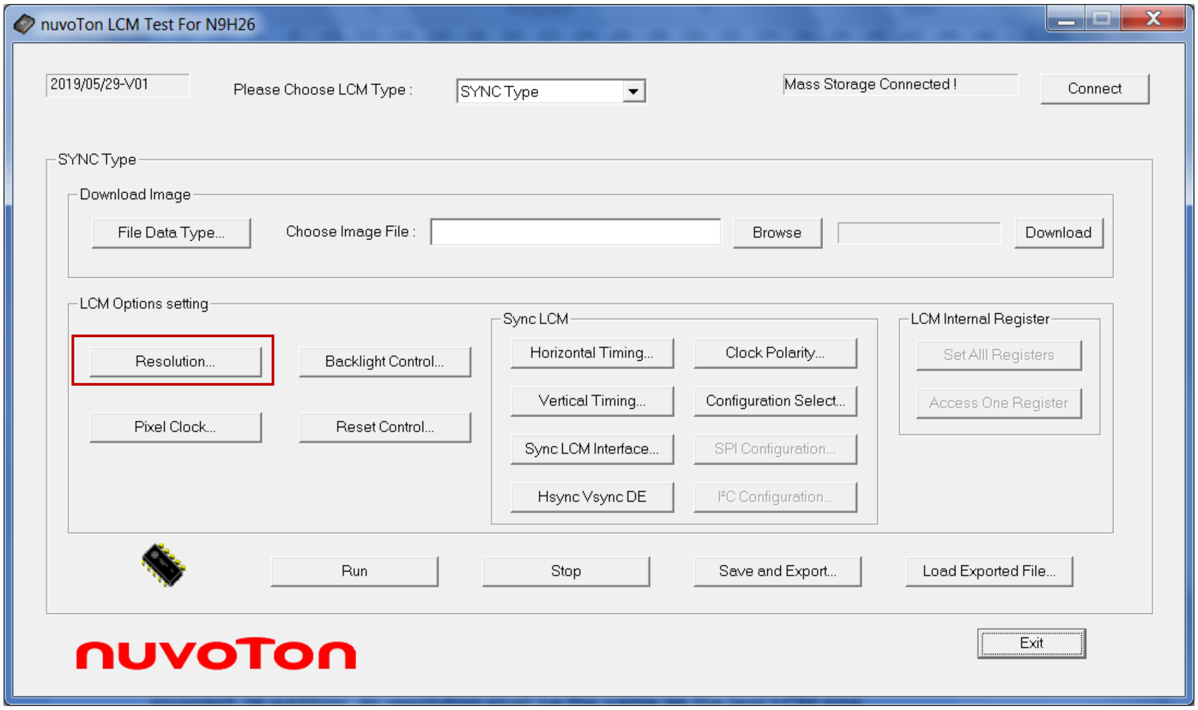
Mass Storage Connected !

Two knids of LCM type can be selected, including “SYNC Type” and “MPU Type”.From the dialog, please select the LCM type.



LCM Type : SYNC Type

- [LCM Resolution]



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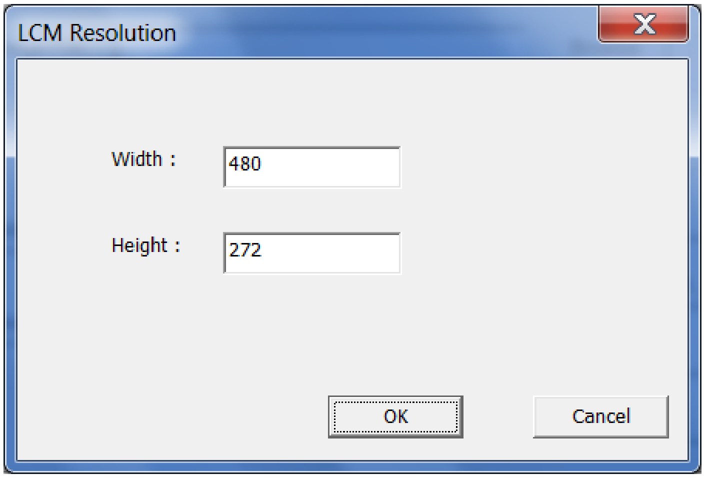
Please Choose LCM Type : SYNC Type

Mass Storage Connected !

The resolution must be given to match with the tested LCM. The exact settings are given in the “LCM Resolution” window.

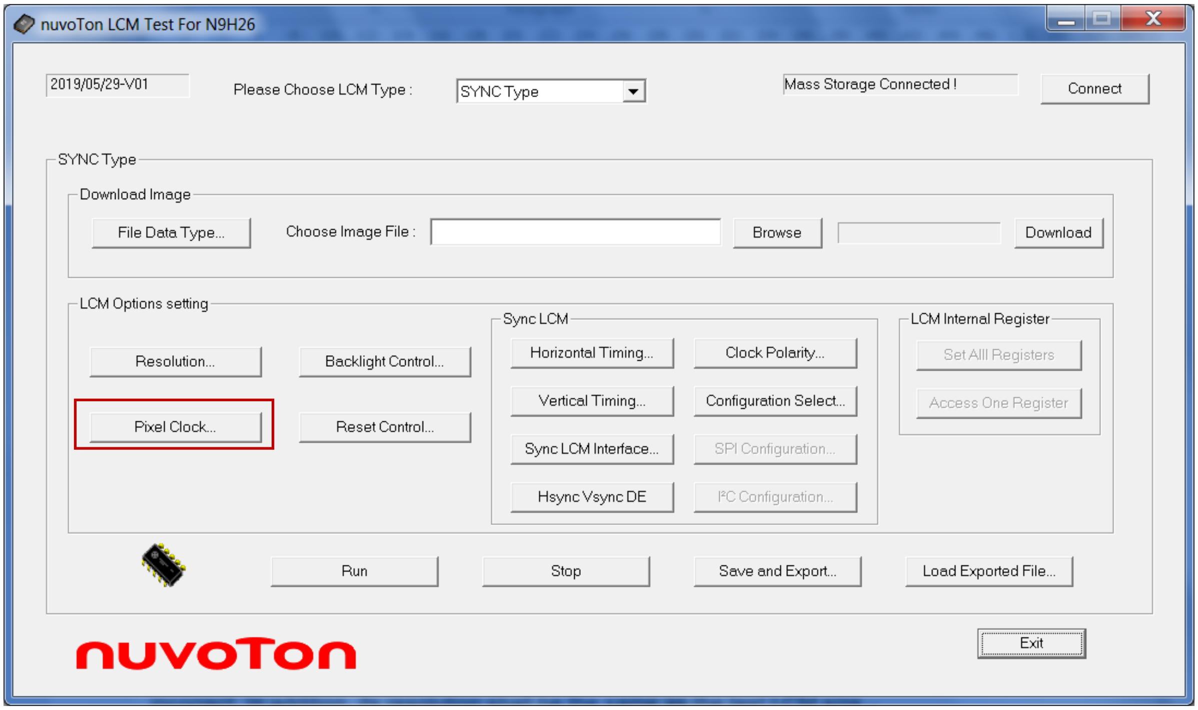


LCM Resolution

Width : 480

Height : 272

- [Pixel Clock Frequency]



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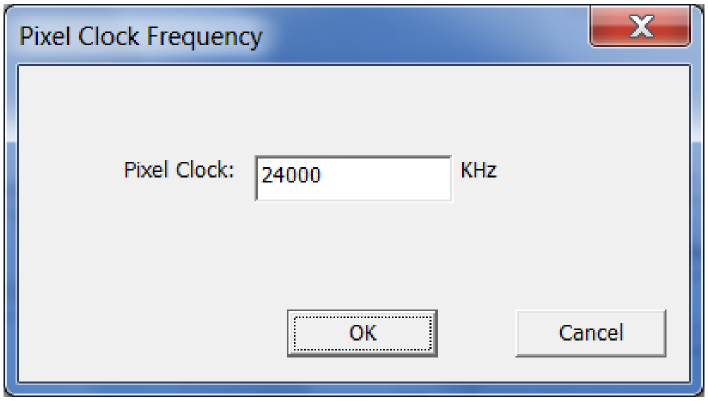
Please Choose LCM Type : SYNC Type

Mass Storage Connected !

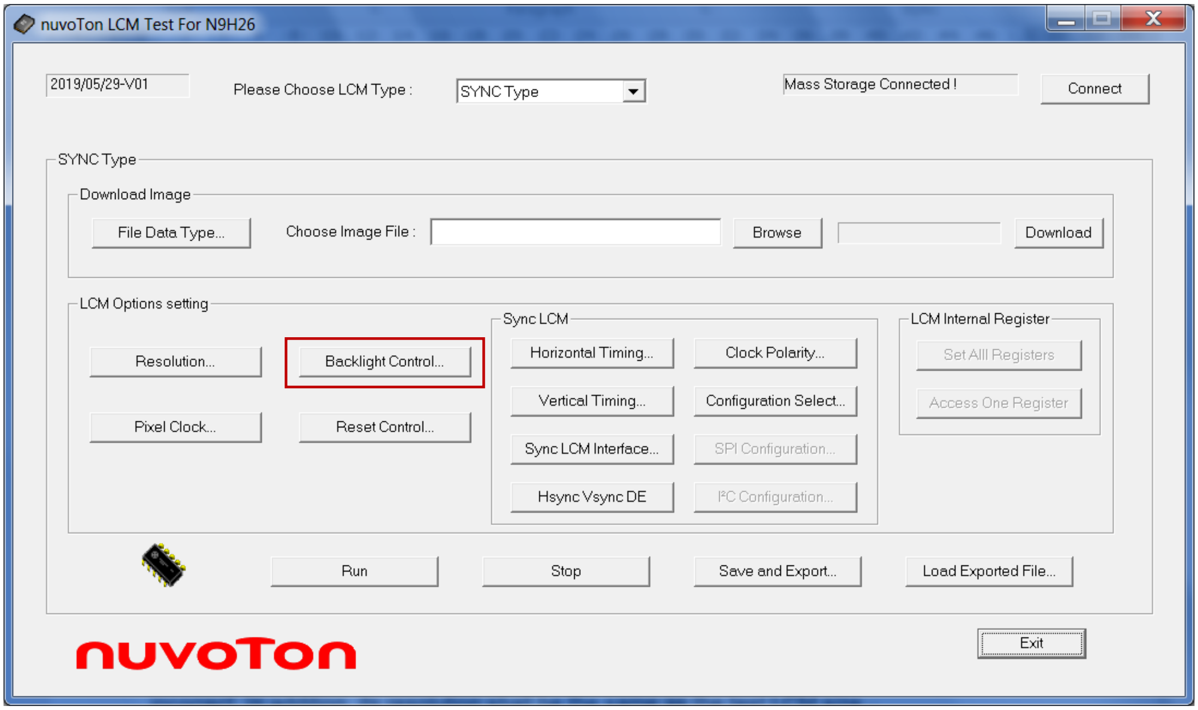
Set the pixel clock in the “Pixel Clock” window and its clock base is KHz.



Pixel Clock Frequency

Pixel Clock: 24000 KHz

- [Backlight Control]



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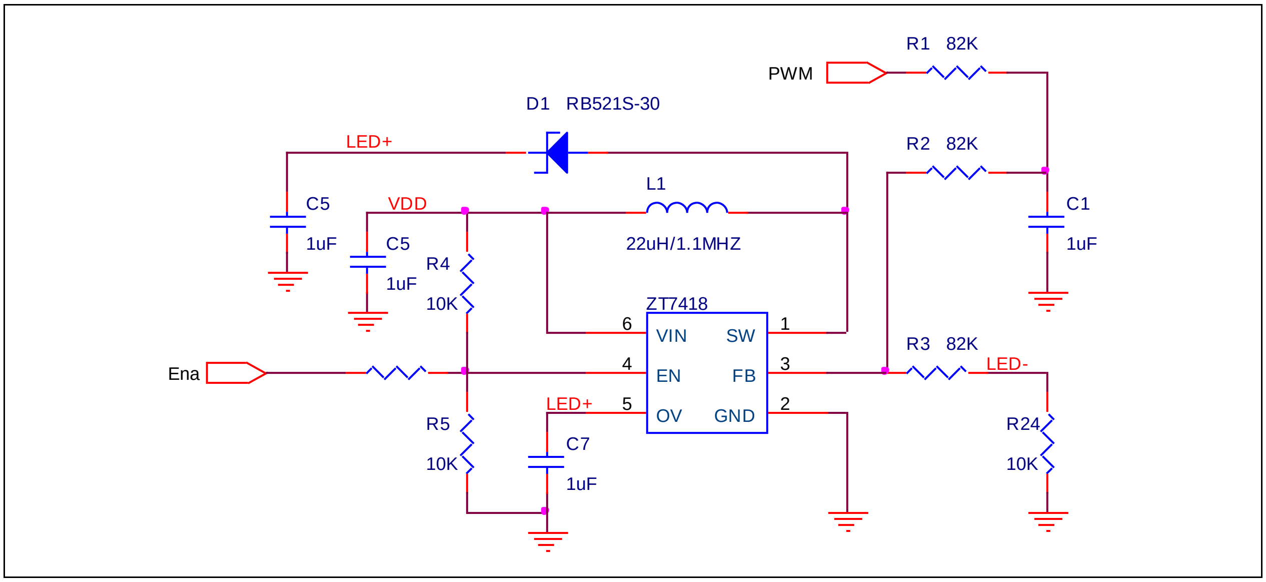
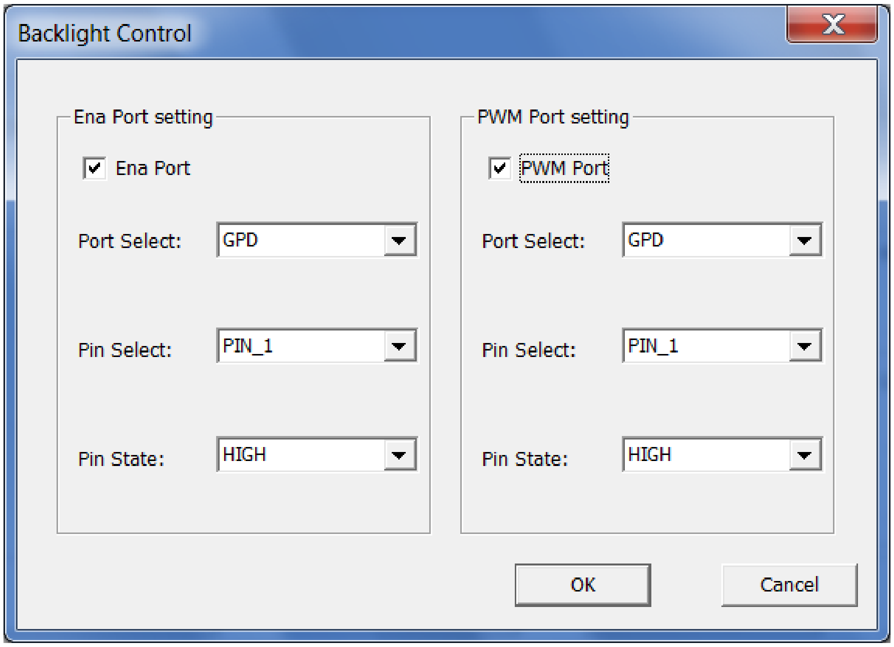
Please Choose LCM Type : SYNC Type

Mass Storage Connected !

In the backlight control circuit, sometimes it needs “Ena” or “PWM” or both control signals. For example, the following application circuit for ZT7418 LED driver needs to set “Ena” and “FB” ports for backlight control.



The user can use this option to control “Ena” and “PWM” ports properly.



Backlight Control

Ena Port setting

☑ Ena Port

Port Select: GPD

Pin Select: PIN_1

Pin State: HIGH

PWM Port setting

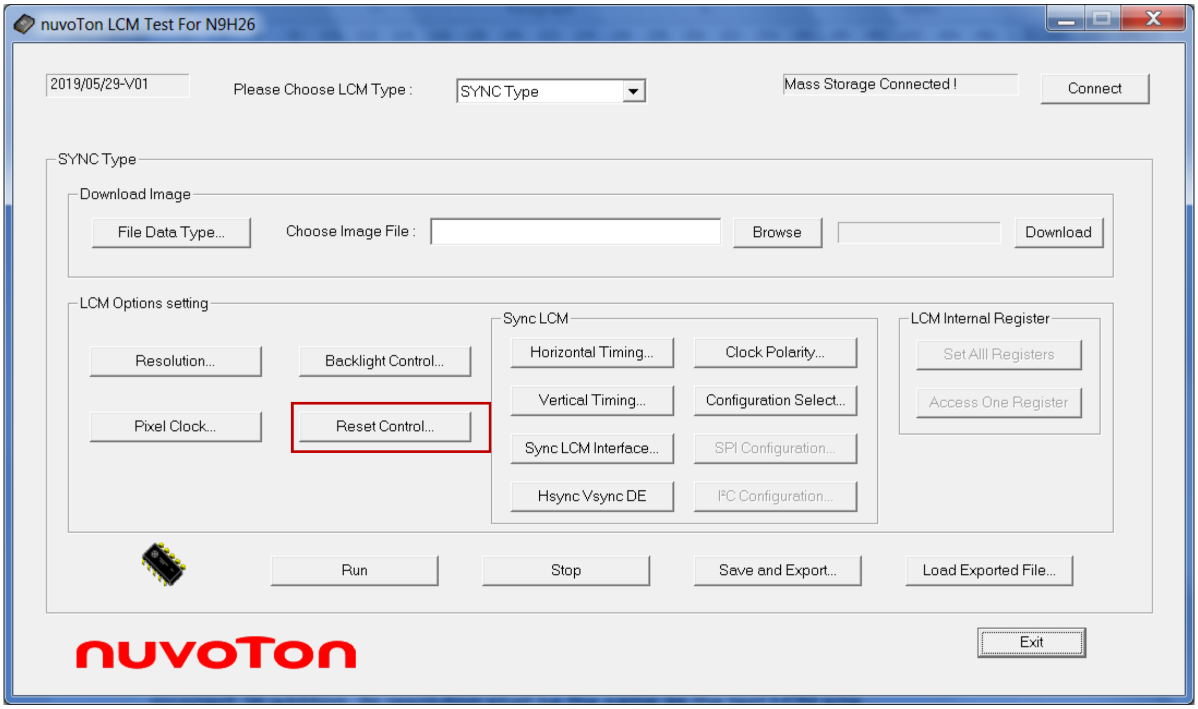
☑ PWM Port

Port Select: GPD

Pin Select: PIN_1

Pin State: HIGH

- [Reset Control]



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Please Choose LCM Type : SYNC Type

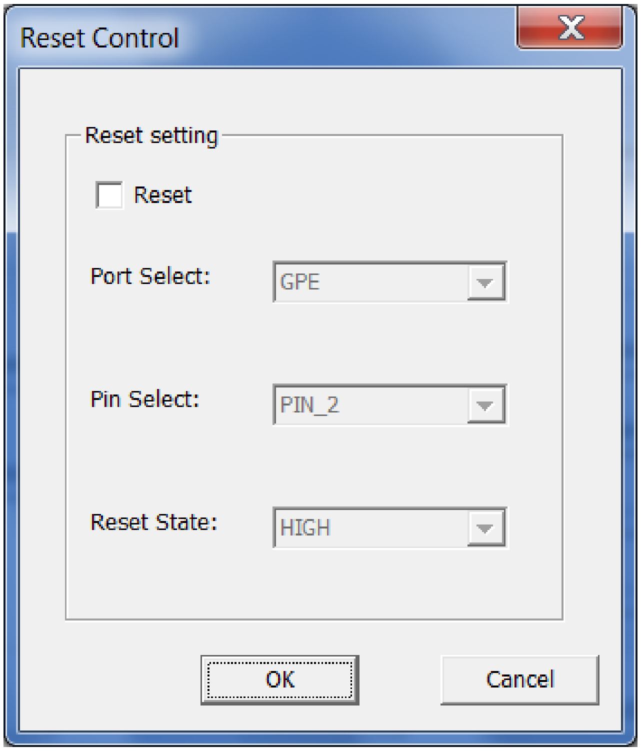
Mass Storage Connected !

SYNC Type

Download Image

Choose Image File :

This tool also provides the LCM reset control option. If the LCM reset pin is connected to the board reset directly, this option can be neglected and not selected.



Reset Control

Reset setting

□ Reset

Port Select: GPE

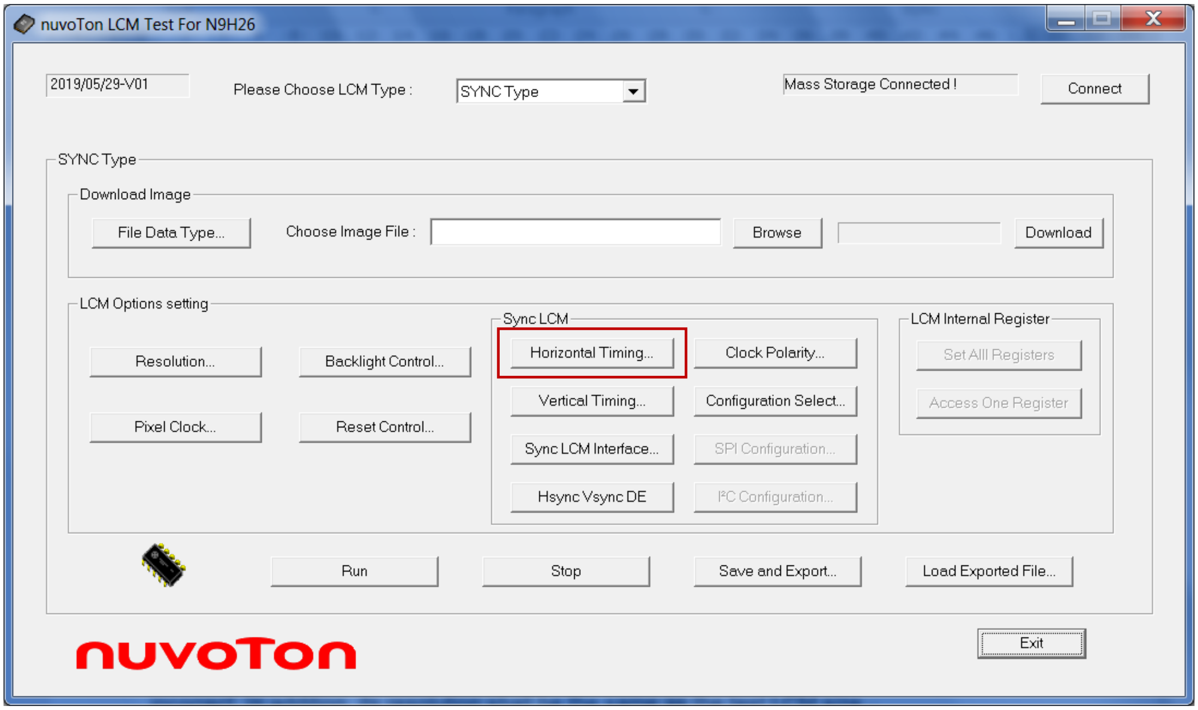
Pin Select: PIN_2

Reset State: HIGH

2.4 Sync LCM Option

Several options are dedicated to the sync type LCM and listed below.

- [Horizontal Timing]



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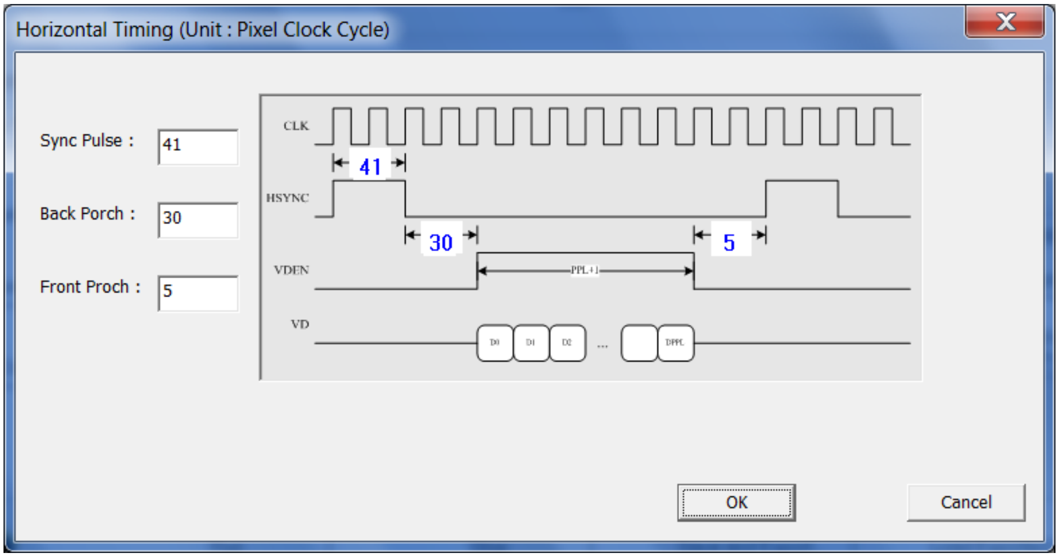
Please Choose LCM Type : SYNC Type

Mass Storage Connected !

Choose Image File :

For the horizontal timing, this tool provides three settings with the times of pixel clock cycles, including

- HSPW: horizontal sync pulse width
- HBPD: horizontal back porch duration
- HFPD: horizontal from porch duration



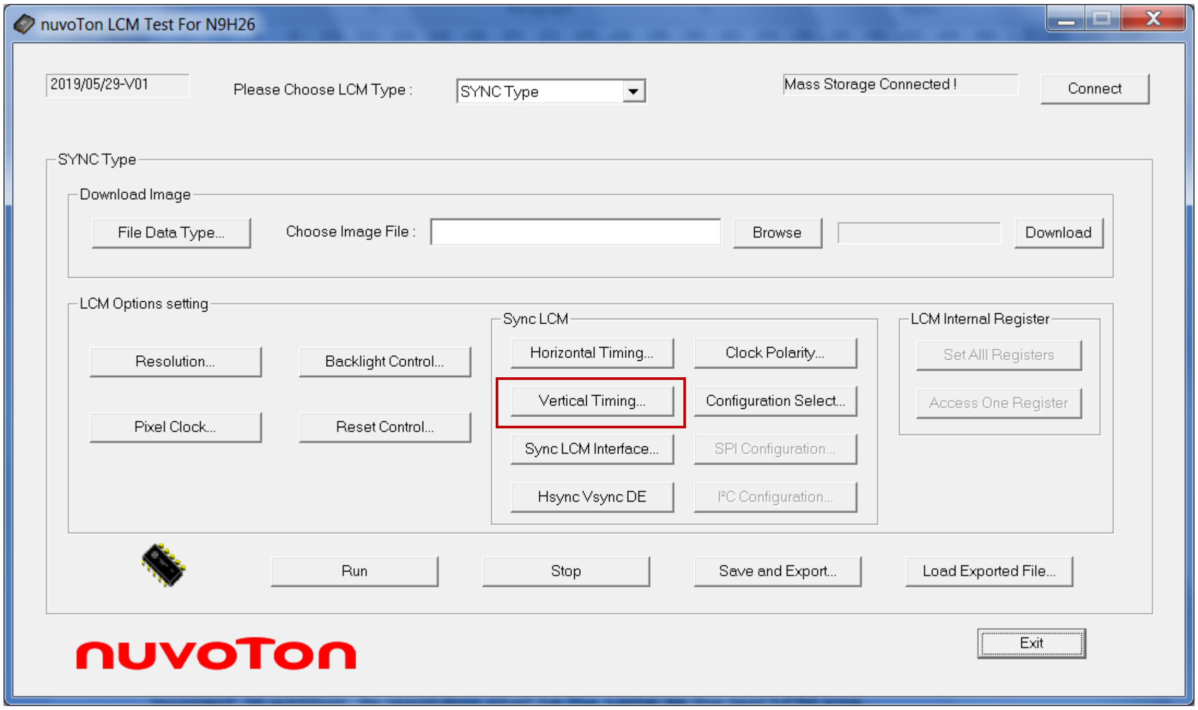
Horizontal Timing (Unit : Pixel Clock Cycle)

Sync Pulse : 41

Back Porch : 30

Front Proch : 5

- [Vertical Timing]



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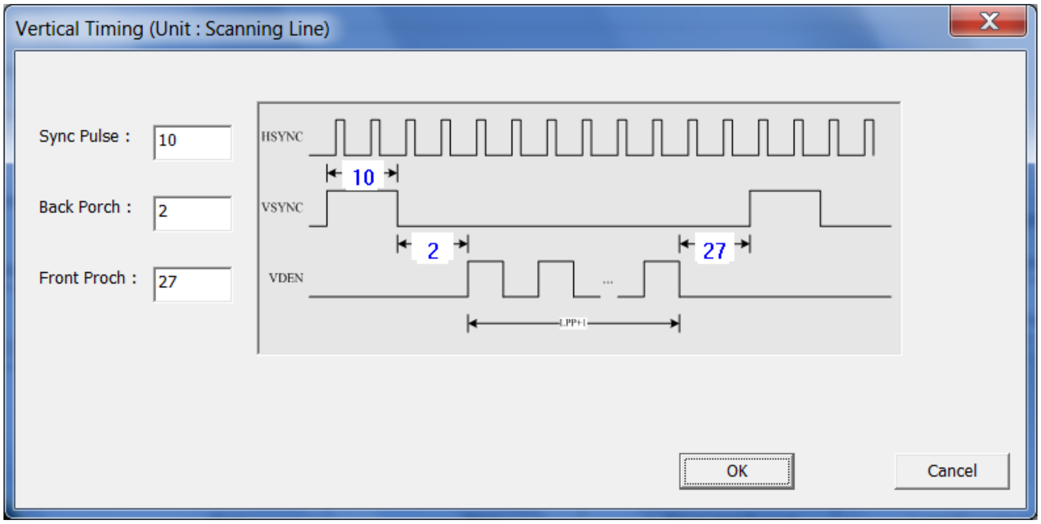
Please Choose LCM Type : SYNC Type

Mass Storage Connected !

For the vertical timing, this tool provides three settings with the times of scanning lines, including

- ➢ VSPW: vertical sync pulse width
- ➢ VBPD: vertical back porch duration
- ➢ VFPD: vertical from porch duration



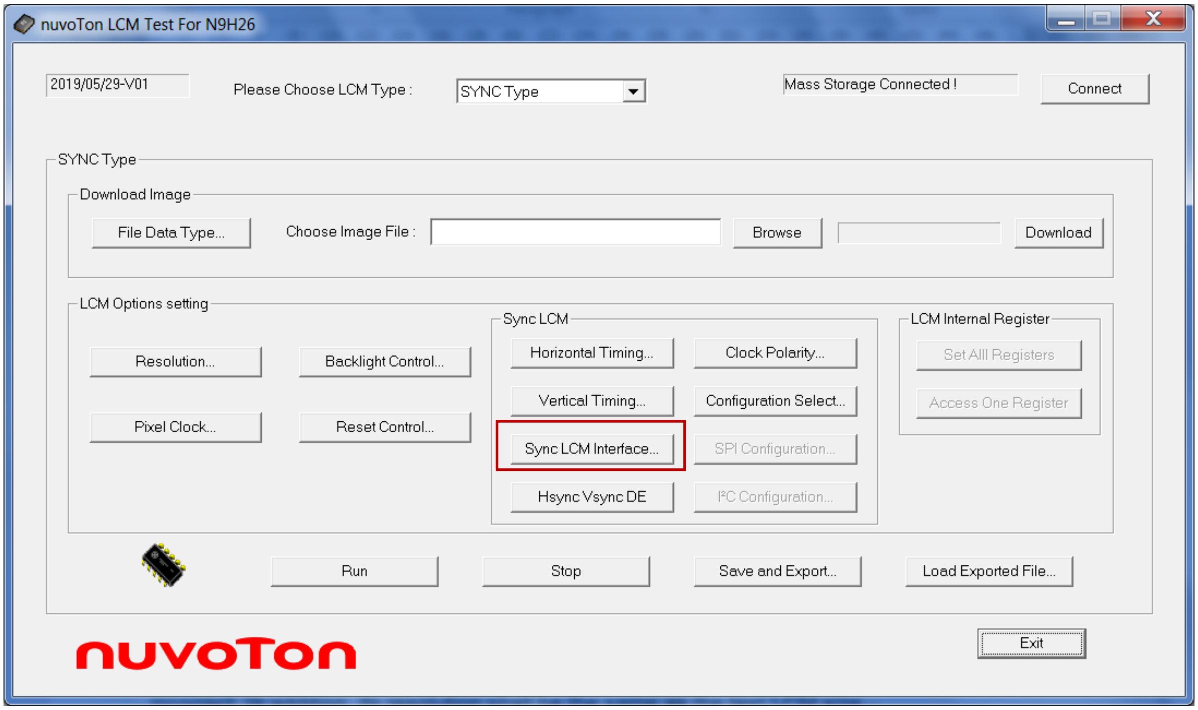
Vertical Timing (Unit : Scanning Line)

Sync Pulse : 10

Back Porch : 2

Front Proch : 27

- [Sync LCM Interface]



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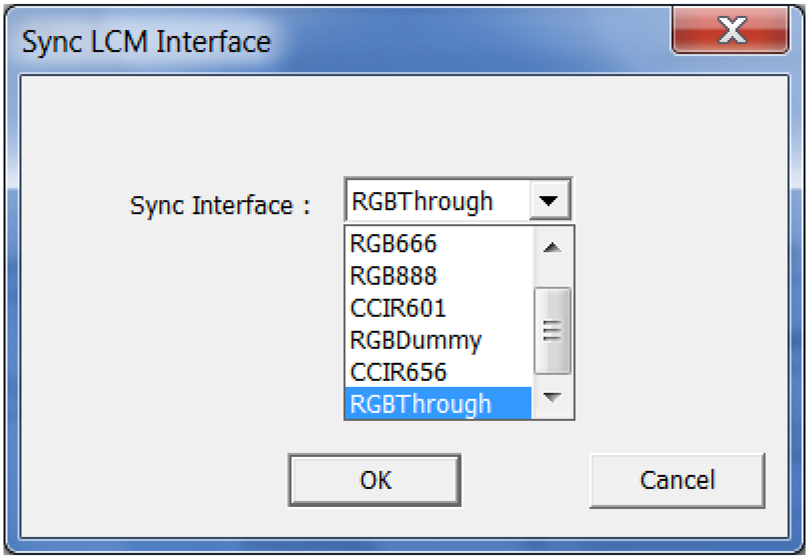
Please Choose LCM Type : SYNC Type

Mass Storage Connected !

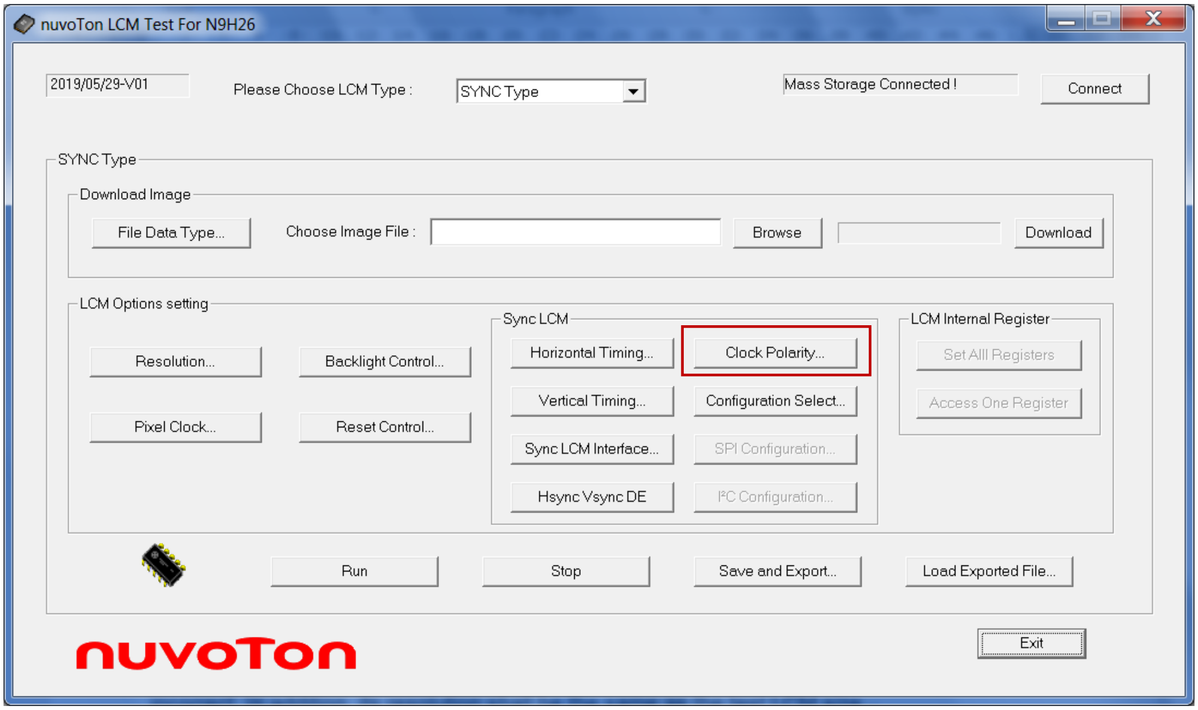
In the sync type LCM, it may use the different interfaces to receive image data, including RGB565, RGB888, CCIR656, CCIR601 and so on. This tool can support most interfaces for the sync type LCM.



Sync LCM Interface

Sync Interface : RGBThrough

- [Clock Polarity]

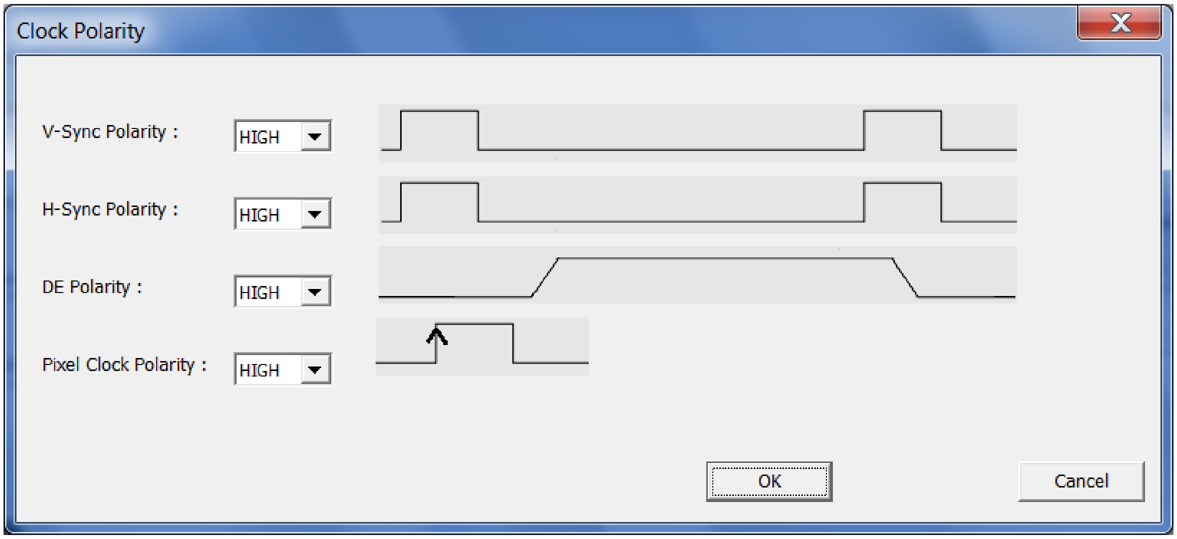


2019/05/29-V01

Please Choose LCM Type : SYNC Type

Mass Storage Connected !

As for several sync clocks, this tool also provide the polarity settings.



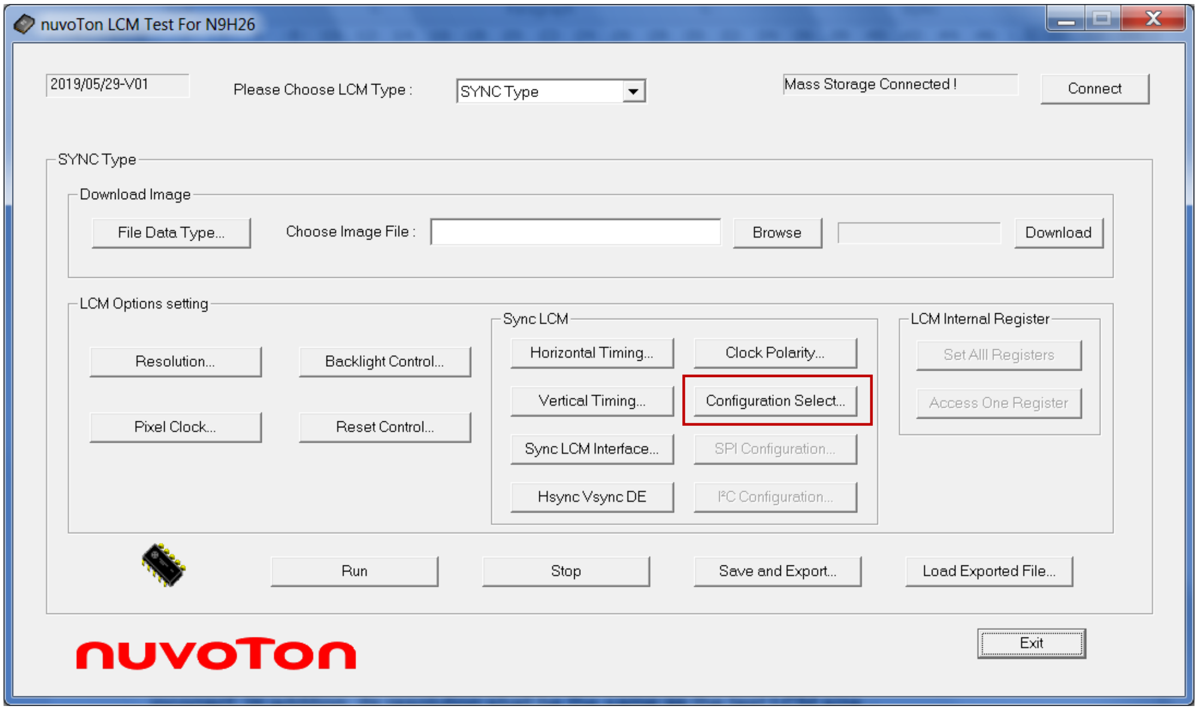
V-Sync Polarity : HIGH

H-Sync Polarity : HIGH

DE Polarity : HIGH

Pixel Clock Polarity : HIGH

- [Configure Interface]



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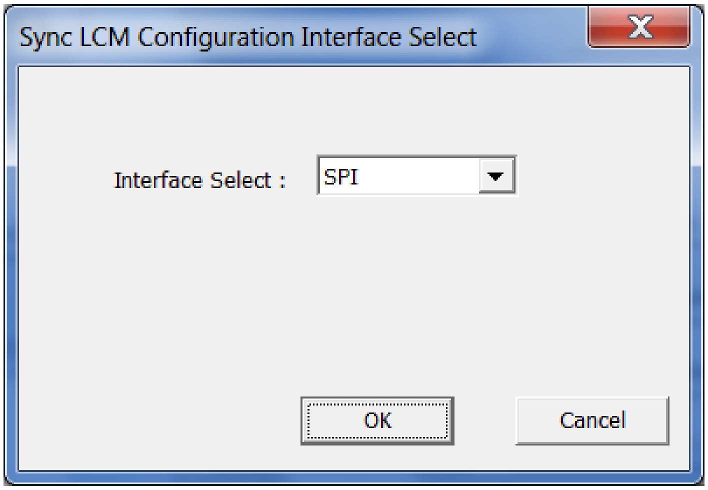
Please Choose LCM Type : SYNC Type

Mass Storage Connected !

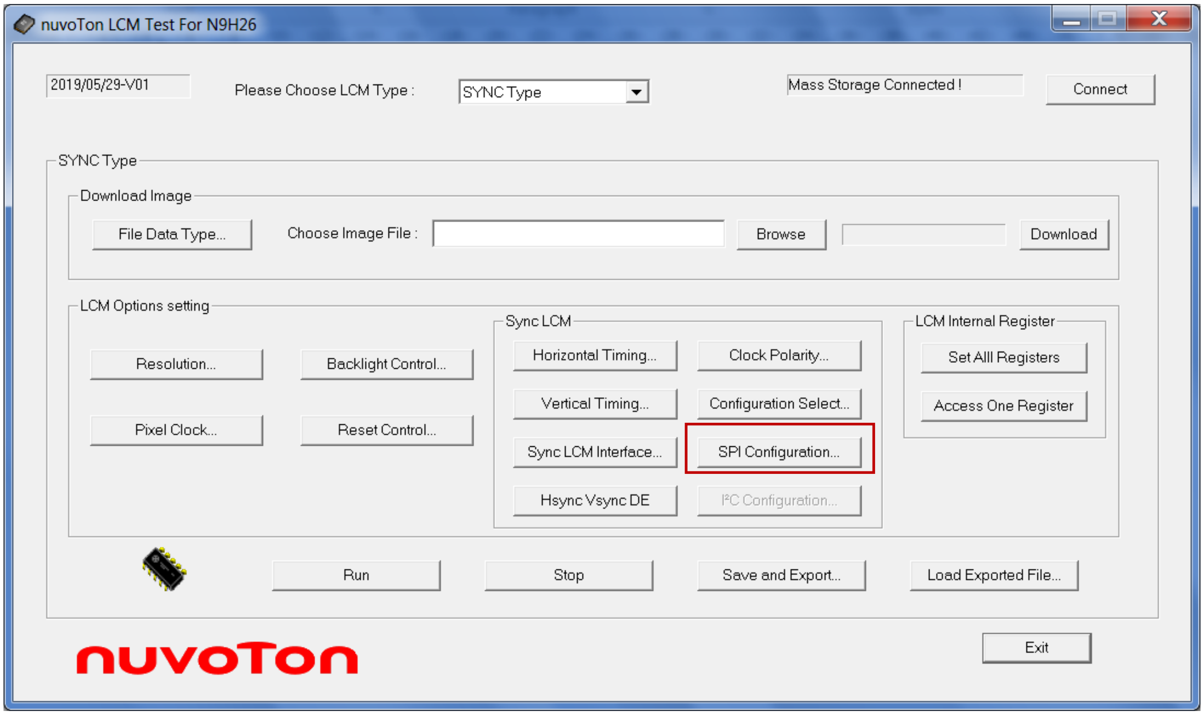
In some LCMs, their internal registers must be configured in advance and usually the selected interface is the SPI interface. Therefore, this tool provides the SPI interface for LCM register configuration.



Sync LCM Configuration Interface Select

Interface Select : SPI

- [SPI Configuration]

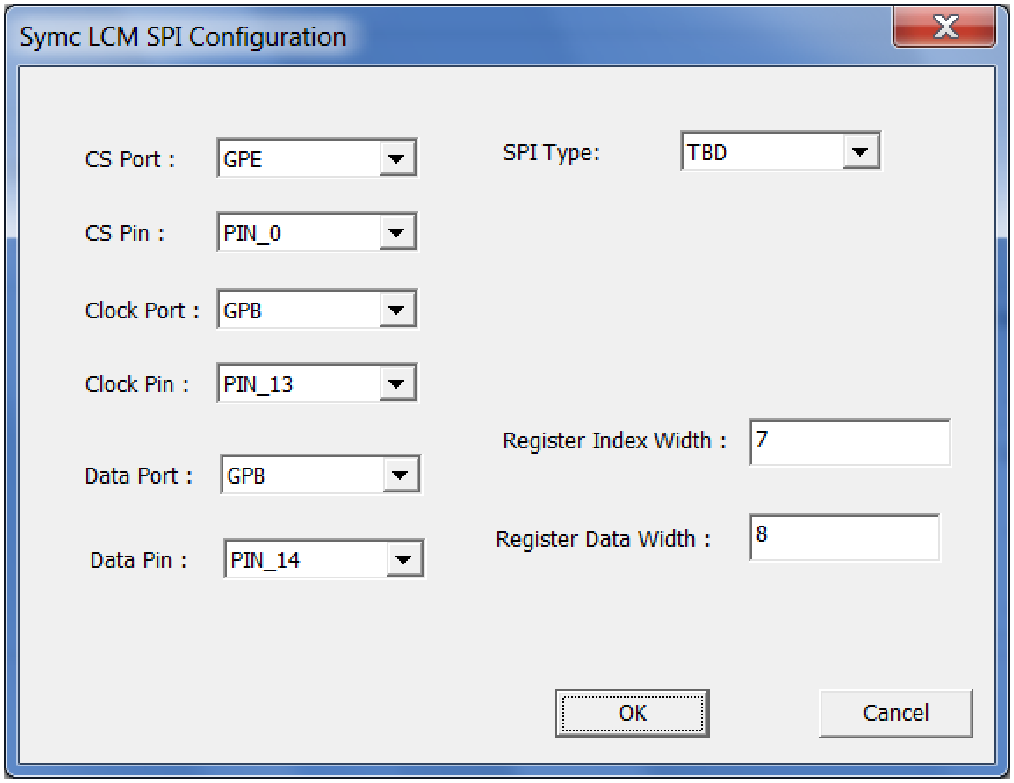


2019/05/29-V01

Please Choose LCM Type : SYNC Type

Mass Storage Connected !

If the SPI interface is selected in “Configure Interface”, we can set the SPI port, register index and data width.



CS Port : GPE

SPI Type: TBD

CS Pin : PIN_0

Clock Port : GPB

Clock Pin : PIN_13

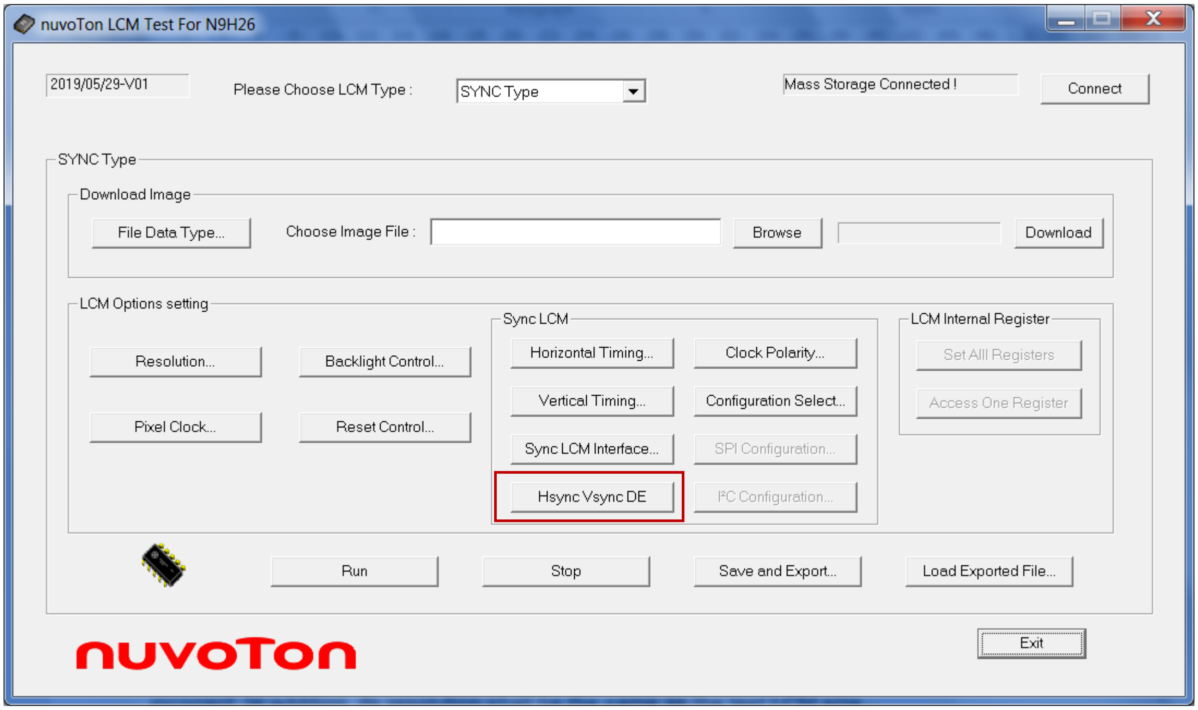
Register Index Width : 7

Data Port : GPB

Register Data Width : 8

Data Pin : PIN_14

- [Hsync Vsync DE Mode]



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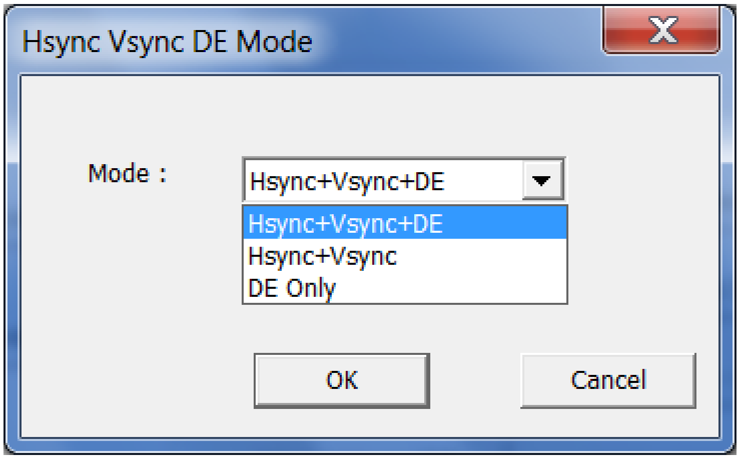
Please Choose LCM Type : SYNC Type

Mass Storage Connected !

In the different sync type LCMs, they may need different sync signals, for example, “Hsync+Vsync+DE” or “Hsync+Vsync” or “DE_only”. This tool provides the option to be selected.



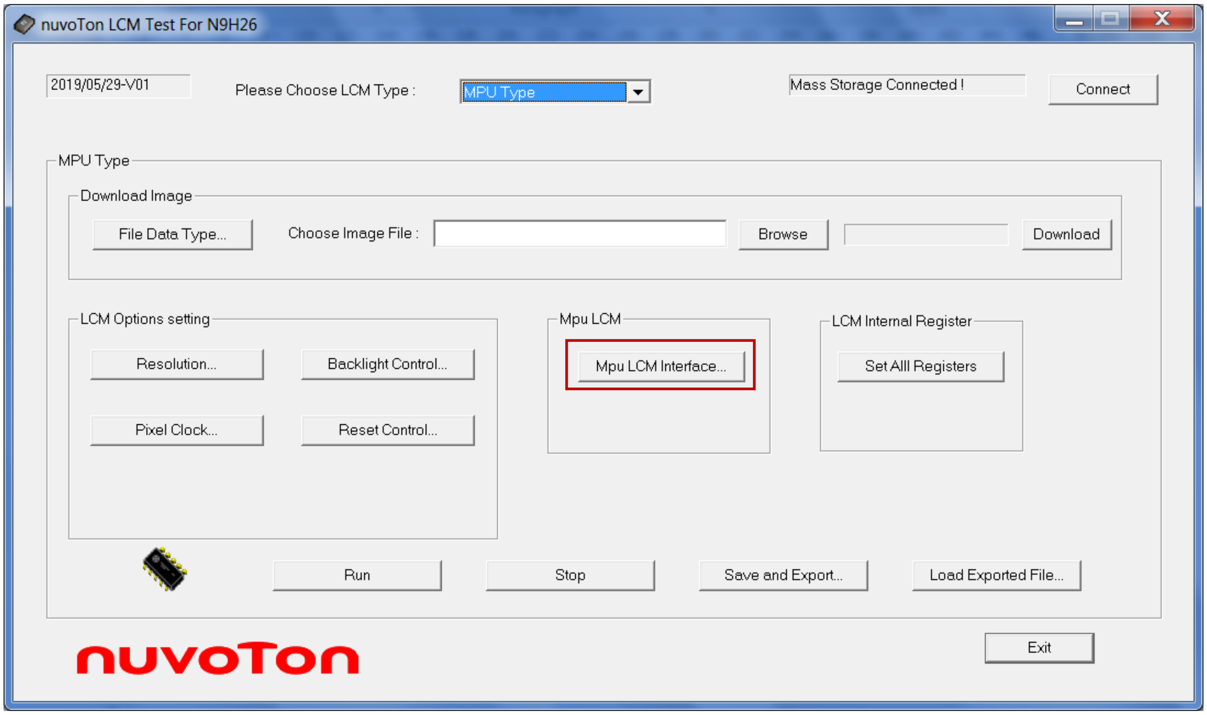
Hsync Vsync DE Mode

Mode : Hsync+Vsync+DE

2.5 MPU LCM Option

In MPU LCM, both the MPU interface and internal reigisters must be given. The interface is introdiced in this section. As for how to set the internal registers, it will be decribed in the next section.

- [MPU LCM Interface]



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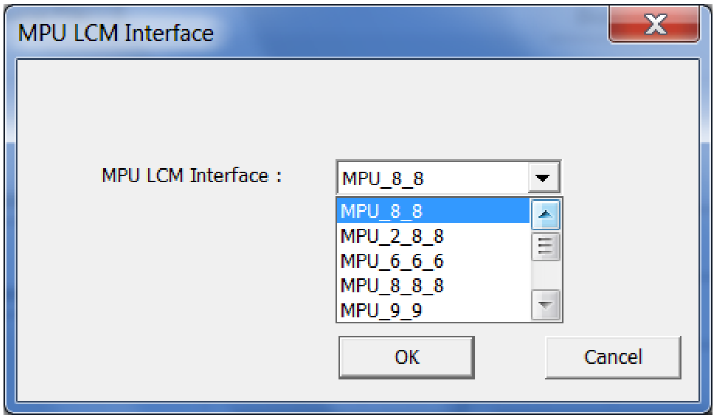
Please Choose LCM Type : MPU Type

Mass Storage Connected !

This tool provides several MPU interfaces for selection.



MPU LCM Interface

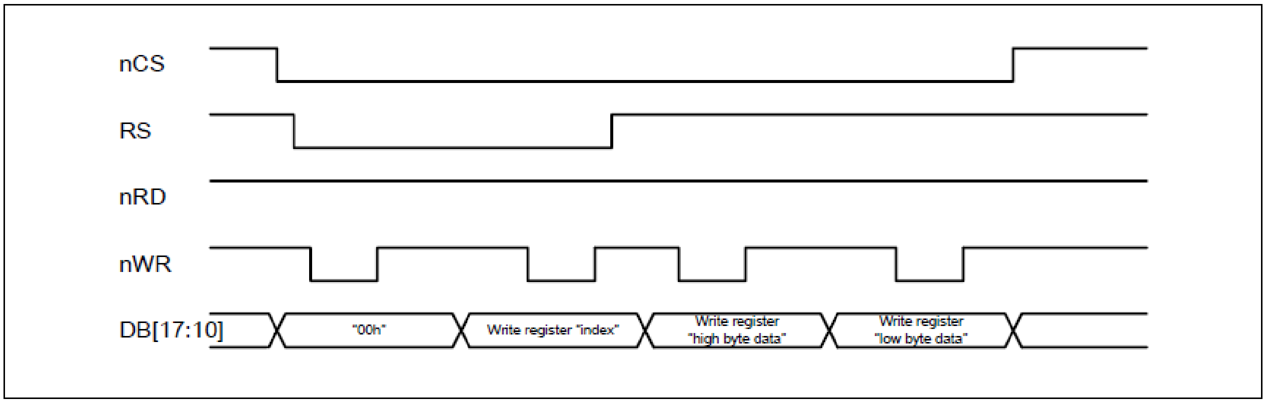
MPU LCM Interface : MPU_8_8

In different MPU LCM interfaces, mainly they are diferent from the data bus width and read/write cycle numbers in each LCM register/graphic memory access. Here the table lists the data bus width and cycle number for different interfaces, respectively.

	memory cell	bus width	1st transfer	2nd transfer	3rd transfer
MPU_8_8	16-bit	8-bit	8	8	x
MPU_2_8_8	18-bit	8-bit	2	8	8
MPU_6_6_6	18-bit	6-bit	6	6	6
MPU_8_8_8	24-bit	8-bit	8	8	8
MPU_9_9	18-bit	9-bit	9	9	x
MPU_8_8	16-bit	8-bit	8	8	x
MPU_16_2	18-bit	16-bit	16	2	x
MPU_2_16	18-bit	16-bit	2	16	x
MPU_16_8	24-bit	16-bit	16	8	x
MPU_8_16	24-bit	16-bit	8	16	x
MPU_18	18-bit	18-bit	18	x	x
MPU_24	24-bit	24-bit	24	x	x

x: means data not being sent at the time.

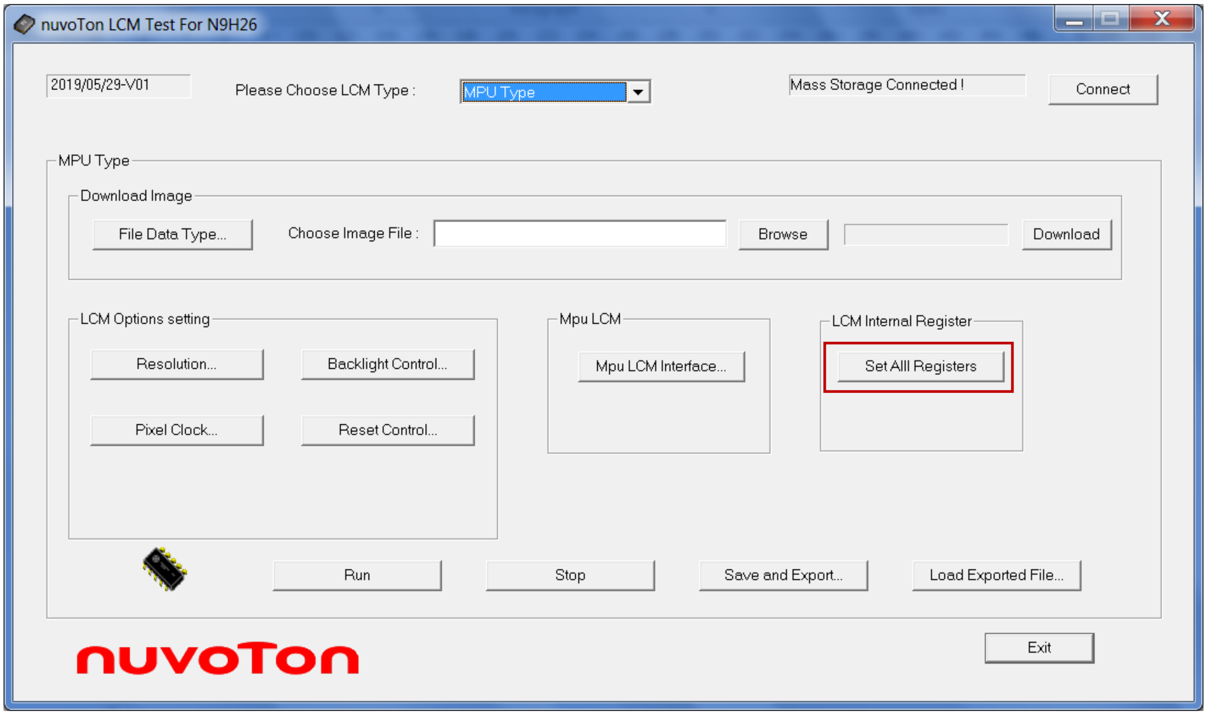
To interpret the table in more details, let we use the MPU_8_8 interface as an example. In MPU_8_8, from the table, we can know that each 16-bit memory access needs two times of 8-bit data transfer and its data bus is 8-bit width. Referring from ILI9325 LCD driver datasheet, Its AC timing waveform is given below.


nCS
RS
nRD
nWR
DB[17:10]
"00h"
Write register "index"
Write register "high byte data"
Write register "low byte data"

From the above waveform, it is easy to find total two times 8-bit WR cycles to finish 16-bit register access.

2.6 Set LCM Internal Registers

- [Set All Registers]



All MPU and some sync type LCMs need to configure internal registers. The tool can load the register setting file and its filename is register.ini. In register.ini, it is constructed by the register pair, {register index, register data}, that is, the first word is the register index and the sceond word is the register data, and so forth. The default regsiter.ini is for ILI9325 LCM.

Some specical cases for only to send register index or register data or add delay cycle between two reigster pairs, this tool provides the following methods to meet different requirements.

1. only send reigster index but not regsiter data

   In the register pair, the regsiter data is given by 0xFFCD, that is, {registe index, 0xFFCD}

2. only send reigster data but not regsiter index

   In the register pair, the regsiter index is given by 0xFFCC, that is, {0xFFCC, register data}

3. add delay cycle

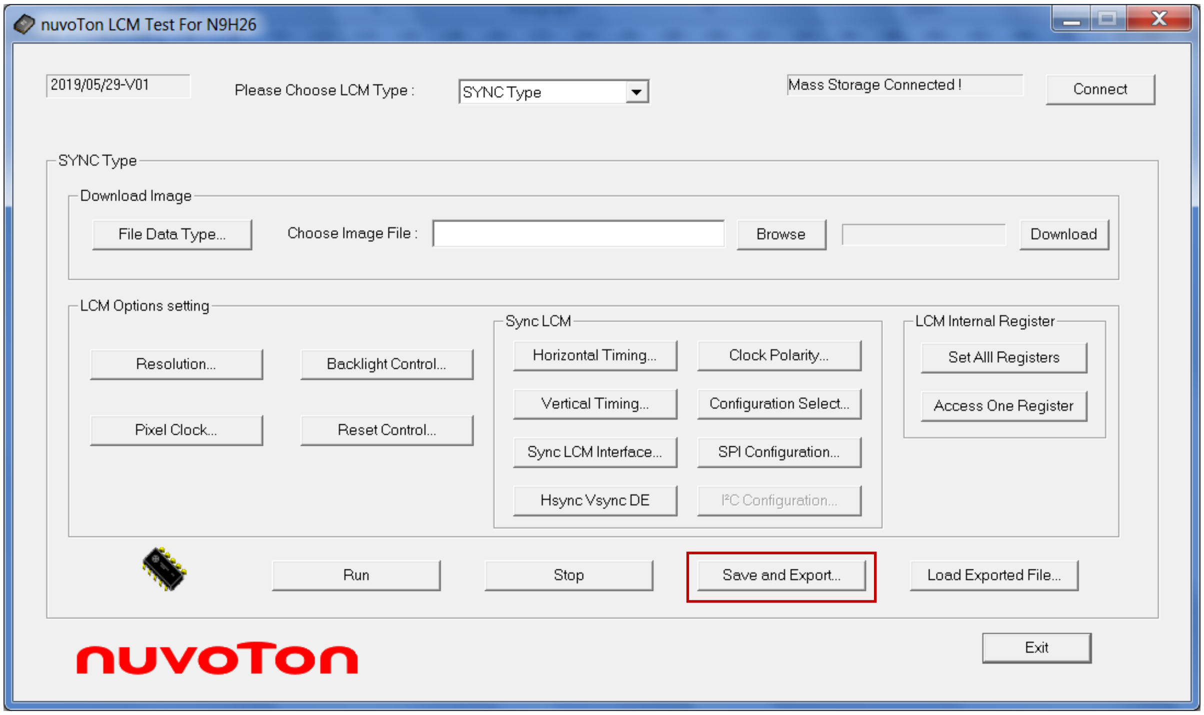
In the register pair, the regsiter index is given by 0xFFDD and the register data is the delay cycle. The delay cycle base is 10 mS.

Here is an example for the setting file.

```
lcm_reg[] = {
/* {RegIndex, RegData} */
    {0x00CF, 0x0000},
    {0x002C, 0xFFCD},    // 0xFFCD: register data need not send
    {0xFFCC, 0x00C1},    // 0xFFCC: register index need not send
    {0x00ED, 0x0064},
    {0xFFDD, 0x0012},    // 0xFFDD: 10 mS delay cycle base; total delay 180 mS
};
```

2.7 Save and Export Setting File

- [Save and Export]



nuvoTon LCM Test For N9H26

2019/05/29-V01

Please Choose LCM Type : SYNC Type

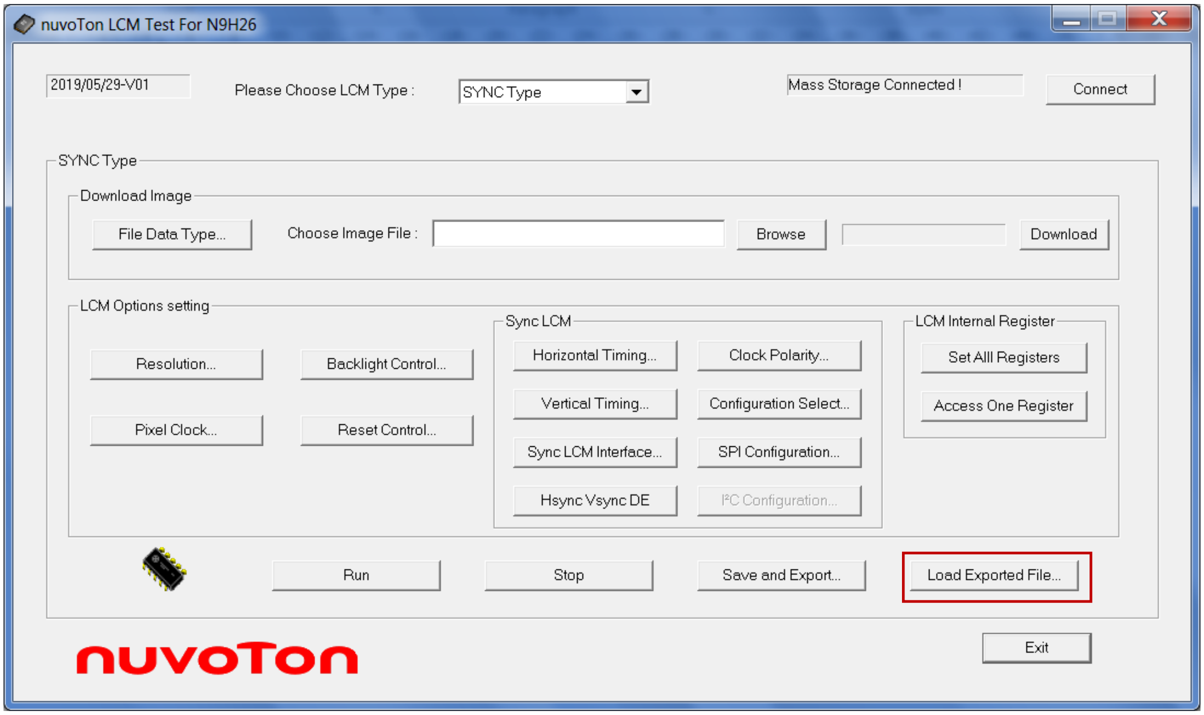
Mass Storage Connected !

Choose Image File :

All tool settings can be exported and saved as a setting file, and it can be integrated with the LCM driver to light on the dedicated LCM. In general, the different LCMs shall have the different setting files. Based on the different setting files, we can use them to integrate with the same LCM driver for different LCMs, respectively.

2.8 Load Exported File

- [Load Exported File]



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Please Choose LCM Type : SYNC Type

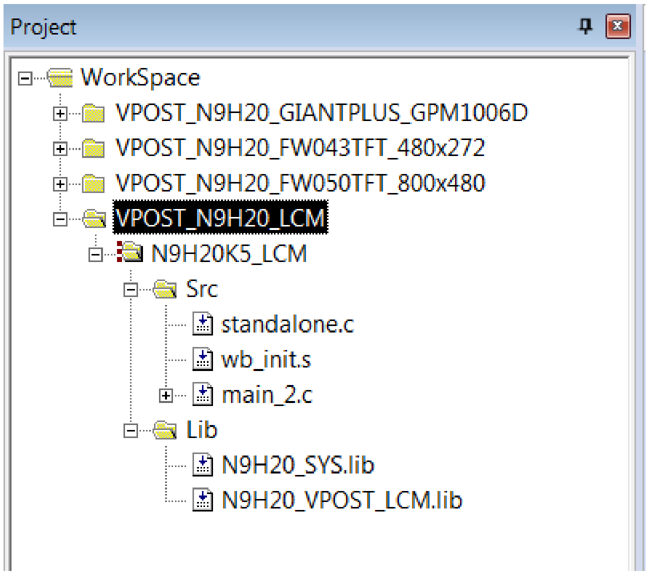
Mass Storage Connected !

Choose Image File :

For different LCM, the different setting files also can be loaded in this tool, respectively.

3 Application Example

In VPOST sample code, it provides an example project “VPOST_N9H20_LCM” to instruct the user how to integrate with the setting file.



Project

```
WorkSpace
    VPOST_N9H20_GIANTPLUS_GPM1006D
    VPOST_N9H20_FW043TFT_480x272
    VPOST_N9H20_FW050TFT_800x480
    VPOST_N9H20_LCM
        N9H20K5_LCM
            Src
                standalone.c
                wb_init.s
                main_2.c
            Lib
                N9H20_SYS.lib
                N9H20_VPOST_LCM.lib
```

As for how to combine with the setting file, the procedure is listed below.

1. Use the tool to light on the target LCM.
2. After lighting on the LCM successfully, export the setting file and save it to the desired filename. For example, it is named as “export_GPM1006D_320x240.txt”.
3. In the application prorgam, please include the above file in an array. In main-2.c case, the arary name is Lcm_Initdata[]”.
4. Preapre another image raw data file and include it in another array in the application program. In main-2.c case, the arary name is “Vpost_Frame[]”.
5. Link wih LCM driver library N9H2x_VPOST_LCM.lib in the project file. For N9H20 or N9H26 device, N9H20_VPOST_LCM.lib or N9H26_VPOST_LCM.lib shall be linked, respectively.
6. Add N9HxxLCMInit() statement in the application program for LCM initialization. In main-2.c case, the N9HxxLCMInit((UINT32*)Vpost_Frame, (UINT8*)Lcm_InitData) statement is added in the main() function.

The sample code for LCM initialization is listed below and can also be found in main-2.c in N9H2x BSP.

```
__align(32) UINT8 Lcm_InitData[] = {
#ifdef __LCD_320x240__
```

```
    #include "export_GPM1006D_320x240.txt"       // exported file
#endif
}
__align(32) UINT8 Vpost_Frame[] = {
#ifdef __LCD_320x240__
    #include "roof_320x240_rgb565.dat"  // image data
#endif
}
int main(void) {
        /* initialize LCM and display the image */
        N9HxxLCMInit((UINT32*)Vpost_Frame, (UINT8*)Lcm_InitData);
}
```

4 Revision History

Date	Revision	Description
2019.05.13	1.00	Initially issued.
2019.05.31	1.01	Add N9H26 supported.

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