STONE

Intelligent TFT-LCD Module

Model
STWI070WT-01

Equipment Manual

Contents

Preface

This equipment manual is part of our Intelligent TFT-LCD Module documentation. It provides the information in regards of operation, installation, configuration, function, system as well as its technical design and working principle.

Organization of the manual

The STWI070WT-01 equipment manual is organized into the following chapters:

Chapter	Contents
1	Overview of features and functional scope of the STWI070WT-01
2-3	Technical Parameters, Interface Description
4-5	Accessories, Physical Dimensions
6-8	Electrical Components, Naming Rule, International Certification
Appendix	ESD Guidelines, Glossary

Customer Online Services

Customer Support offers comprehensive additional information of Intelligent
Products through its Online services as follows:
- Official website: http://www.stoneitech.com/
                      http://www.stone-hmi.com
- Official forum: https://forum.stoneitech.com/
- Telephone: 0086-10-84351669

Other support

In need of technical queries, please contact STONE representatives in the subsidiaries and branches responsible for your area.

Trademarks

STONE registered trademarks are as below:

- STONE

- STONE TECH

- Intelligent HMI

- Intelligent TFT - LCD Module

Abbreviations

The abbreviation table in this equipment manual is as below:

LED	Light Emitting Diode
CPU	Central Processing Unit
ESD	Electrostatic Sensitive Device
HMI	Human Machine Interface
IF	Interface
LCD	Liquid Crystal Display
UART	Universal Asynchronous Receiver/Transmitter
COM	Commercial
DIN	Data Input
DOUT	Data Output
VIN	Voltage Input
GND	Ground
TP	Touch Panel

A list of all the technical terms together with their explanations is provided in the glossary at the end of this manual.

1 Introduction

This chapter contains general information of:

- Brief Introduction

- Warranty

- Product Characteristics

- Application Area

- Working principle

- Operation Processing

- Software Operation
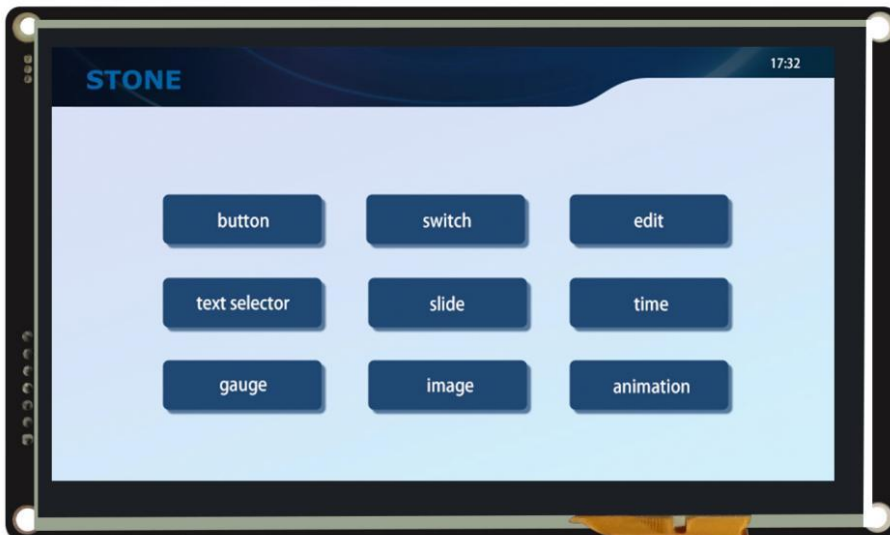
1.1 Brief Introduction

The STWI070WT-01 has been conceived as **TFT monitor** & **Touch controller.** It includes processor, control program, driver, flash memory, RS232 / RS422 / RS485 / TTL / LAN port, Wi-Fi / Bluetooth, touch screen, power supply etc., so it is a whole display system based on the powerful & easy operating system, **which can be controlled by Any MCU.**

The STWI070WT-01 can be used to perform all basic functions, such as text display, image display, curve display as well as touch function, Video & Audio function etc. The User Interface can be more abundant and various. And the flash memory can store your data, configuration files, image file, font file, video file and audio file etc.

1.2 Warranty

All products purchased from our company are guaranteed to keep in good repair for **3 years**. If quality problems (except human error) happen in guarantee period, our company will maintain for free to replace the broken one unconditionally.

1.3 Product Characteristics

- With Cortex A8 CPU & Driving device
- Controlled by any MCU
- Display Picture / Text / Curve / Video
- 262K (18bit) colour TFT display
- With / without Touch Screen
- RS232 / RS422 / RS485 / TTL UART Interface & USB port
- Ethernet port / WI-FI / Bluetooth optional
- Wide voltage range
- Easy to use! Powerful function! Saving Much Development cost and time!

1.4 Application Area

Widely used in various industrial field
- Medical & Beauty Equipment
- Engineering Machinery and Vehicle Equipment
- Electronic Instrument
- Industrial Control System
- Electric Power Industry
- Civil Electronic Equipment
- Automation Equipment
- Traffic
- New energy project
- IOT applications
Etc.

1.5 Working Principle

The Intelligent TFT-LCD Module communicates with the Customer's
MCU / CPU / FPGA / PLC via Commands (JSON command and HEX Code), and then
the MCU would control its connected equipment to work according to the received
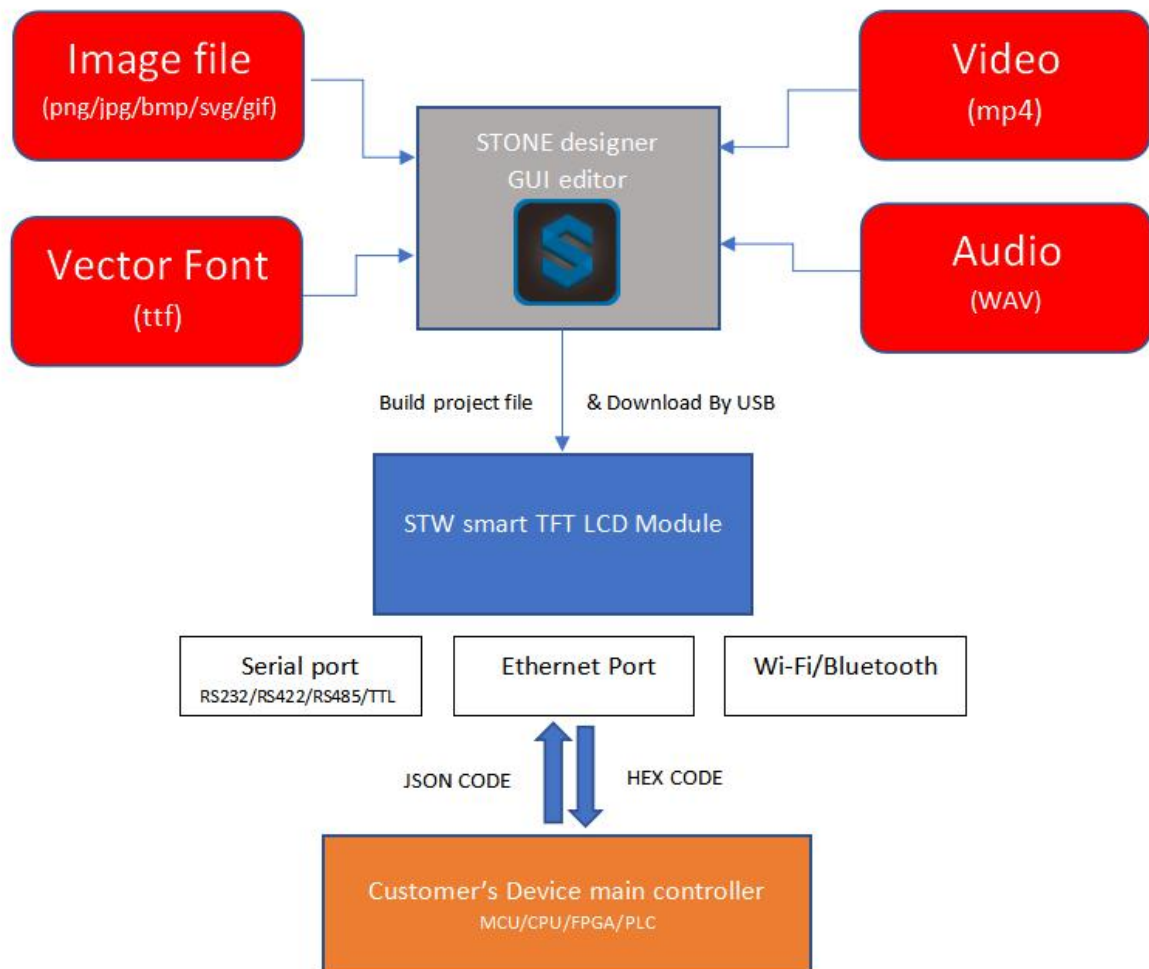commands.

Figure 1.3-1 Configuration and process control phase

1.6 Operation Processing

Only **3 steps** to use our TFT-LCD Module:

1. Build a GUI project by STONE designer GUI editor with png/jpg/bmp/svg/gif image files.

2. Connect with customer's MCU through RS232,RS422,RS485,TTL directly. Plug and play.

3. Write a simple program for MCU to control the TFT-LCD Module via Command Set.

   (JSON code to TFT-LCD Module and HEX Code to Customer's MCU).

That's all.

The communication protocol (customized command set) is built with 2 parts:

    1.   Initiative command (MCU→TFT-LCD Module)

    Frame head: ST<
    Command content: { json }
    Frame end: >ET

    For example:
    ST<{"cmd_code":"open_win","widget":"label_value"}>ET
    ST<{"cmd_code":"set_value","widget":"label_value","value":100}>ET

Important: The text content should be with the quotes(""), including widgets' name but the value content shouldn't be with the quotes, such as value or true/false states.

    2.   Passive command (TFT-LCD Module→MCU)

    Basic command format:
    Frame head + CMD + LEN + DATA + Frame tail + CRC16
    Example: ST<   0x1068   0x0004   0x01 0x02 0x03 0x04   >ET   CRC16

The TFT LCD module serial port command frame is composed of 5 data blocks, shown as the table 1-1.6. All serial port commands or data are represented with hex format. The data transfer in MSB manner. E.g. for 0x1234, first send 0x12 and then send 0x34.

Table 1-1.6 Command Frame

Definition	Frame header	Command	length	Data	Frame tail	CRC check code
Length (byte)	3	2	2	N	3	2
Description	Could be customized	Specific command function, default setting	The bytes number of Data	-	Could be customized	Default setting
Example	ST<	0x1068	0x0004	0x01, 0x02, 0x03, 0x04	>ET	CRC16

More information, please refer to the document of Development Guide.

1.7 Software Operation

We will offer simple "Stone Desinger GUI editor" to help you to design the new project file for Intelligent TFT-LCD Module on Windows system PC or MacOS PC, or it also can Design on website version directly.
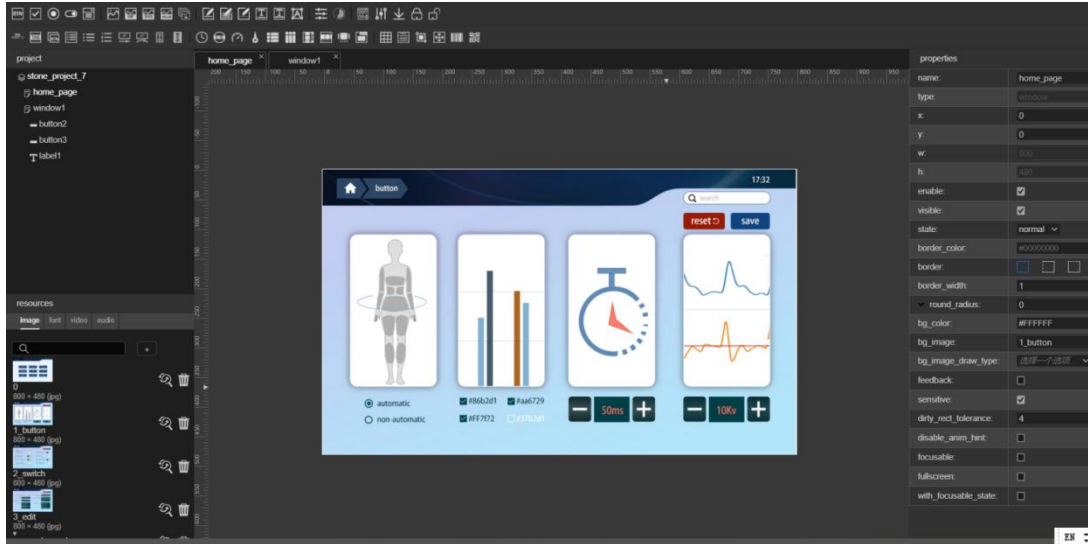
2 Technical Parameters

This chapter contains technical data on:

- **Physical Parameters:**
  Physical Parameters
  Display

- **Hardware Parameters:**
  Processor
  Memory
  Interface
  Power Supply

- **Storage & Test**
  Electrical Characteristics
  Ambient Conditions
  Noise Immunity
  Radio Interference

- **Support Device**
  Support Device

Physical Parameter

Size	7 inch
Resolution	800×RGB×480
Pixel Spacing	0.0642(W) × 0.1790(H) mm
Color	262,144 colors (18 bit)
Viewing Area	154.08(W) × 85.92(H) mm
Display Dimension	186.4mmx105.5mm
Overall Dimension	186.4mmx105.5mmx17.4mm (Standard type) 186.4mmx105.5mmx23.8mm (with Ethernet port)
Net Weight	300g

Display

Backlight Type	LED
Brightness	300cd/m2 (Brightness can be adjustable in 100 levels)
Contrast	500:1
Backlight life	300,000 hours
Viewing Angle	70°/70°/50°/70°(L/R/U/D)
TFT Panel	A Class Industry Panel
Touch Screen	4 Wire Resistance Touch /Capacitive Touch / Without Touch Screen
Screen Mode：	Digital

Processor

CPU	Cortex A8
Refresh Rate	1G Hz
Max Frame rate	60 FPS

Memory

Flash Memory	Standard 256MB, Extension 1GB or 2GB
Memory Amount for Image	According to the capability of the image, Suggest "PNG, BMP, JPG, SVG, GIF" format.

Interface

Serial Interface	RS232 / RS422 / RS485 / TTL level
Ethernet interface	10M/100M (Optional)
Wireless interface	Wi-Fi / Bluetooth (Optional)
Project file downloading	USB2.0 port or U storage Disk

Power Supply

Rated voltage	+12V DC or +5V DC
Permissible voltage range	+7V DC...+28V DC or +5V DC
Max. permissible transients	+28V
Time between two transients	50 sec minimum
Internal Fuse	2A self-recovery fuse
Power consumption	3.0 W

Electrical Characteristics

Parameter	Condition	Min	Type	Max
Supply Current	VIN=12V (Max brightness)		220mA	
	VIN=12V (close brightness)		120mA	
Baud Rate			115200 bps	
Signal				

Ambient Conditions	
Max. permissible ambient temperature	
Operation	-20℃～ +70℃
Storage	-30℃～ +80℃
Relative humidity	
Operation	55℃,85%
Storage	60℃,90%
Shock loading	
Operation	15 g/11 msec
Storage	25 g/6 msec
Vibration	
Operation	0.035 mm (10 - 58 Hz)/ 1 g (58 - 500 Hz)
Storage	3.5 mm (5 - 8,5 Hz)/ 1 g (8.5 - 500 Hz)
Barometric pressure	
Operation	706 to 1030 hPa
Storage	581 to 1030 hPa

Noise Immunity	
Static discharge (contact discharge/air discharge)	EN 61000-4-2 6 kV/8 kV

RF irradiation	EN 61000-4-3
	  10 V/m, 80% AM
	  1 kHz

Pulse modulation	ENV 50204
	  900 MHz $\pm$5 MHz
	  10 V/meff., 50% ED, 200 Hz

RF conduction	EN 61000-4-6
	  150 kHz - 80 MHz
	  10 V, 80% AM, 1 kHz

Burst interference	EN 61000-4-4
Supply lines	2kV
Process data lines	2kV
Signal lines	1kV

Radio Interference	
Radio interference level complying to EN 55011	Class A

Support Device	14
UART Port	Support RS232 / RS422 / RS485 / TTL
Network Port	Support Ethernet Port / Wi-Fi / Bluetooth
Flash Memory	Support Standard 256MB, Extend 1GB or 2GB
Buzzer	Support
RTC	Support
USB port	Support Online Download By USB Cable
U Storage Disk Interface	Support. Offline Download or Copy User Data
Touch Screen	4 Wire Resistance / Capacitive
Vector Font	Standard TTF Format
Image	Support PNG/JPG/BMP/SVG/GIF Format
Audio Interface	Support WAV format The length of single audio file is not limited, theoretically up to 4096 audio files, speaker power is 8 ohms 2 watts or 4 ohms 3 watts
Command Set	Unified Simplified Command Sets
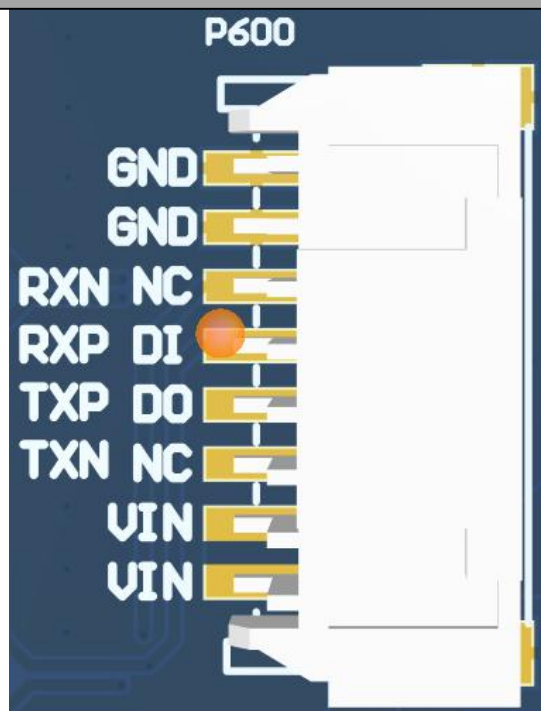
3 Interface Description

This chapter contains the description of the interfaces:

- VVC
- NC
- DOUT
- DIN
- GND

Please notify the interface type before ordering. RS232/ RS422/ RS485/ TTL Interface.

Communication Interface Definition：				
	Pin Name	**Pin NO.**	**Pin Type**	**Interpret**
	GND	1,2	P	Power Ground
	DIN	4	I	Data Input
	DOUT	5,	O	Data Output
	NC	3,6		None
	VCC	7,8	P	Power Supply Input

I: Input   O: Output   P: Power

Note A: 1. Adopting the 8 Pin 2mm spacing socket. Model Code: A2006WF-08A.

2. Direction of the signal was defined with TFT-LCD Module;

   "I" refers to the signal from the user's MCU transmitted to the TFT-LCD Module.

3. Pins with the same definition are connected together in the module inside.

4. RS232, RS422, RS485, TTL port can be default which need to point out in the order.

Note B: The selection of Baud rate for the serial interface：

Baud rate （bps）	1200	2400	4800	9600	19200	38600	57600	115200

4 Accessories

This chapter contains the accessories:

- Double 8-pin Connect Cable
- 8-pin Socket
- Type A USB Cable
- Converter: USB ⇌ RS232 / RS422 / RS485 / TTL
- Metal Bezel (optional)
- IP65 Plastic Box (optional)

Accessory Name	Model	Note	Picture
Double 8-pinCable	L8	Optional： 10cm/20cm/35cm/65cm	
8-pin Socket	S8	SMD-8 2.0mm with Lock	
Type A USB Cable	LU	Double USB Port Cable Online Downloading	
Converter	UR2.0 UR4.0 UR1.0	USB to RS232 USB to RS422 / RS485 USB to TTL	
U Storage Disk		Offline USB Batch Downloading Function	

Accessory Name	Model	Note	Picture
IP65 Plastic Box (optional)	PB-043 PB-050 PB-056 PB-070 PB-080 PB-104	For: 4.3", 5", 5.6", 7", 8",10.4"	
Metal Bezel (optional)	MB-035 MB-043 MB-050 MB-056 MB-070 MB-080 MB-101 MB-104	For: 3.5", 4.3", 5", 5.6", 7", 8",10.1",10.4"	

5 Physical Dimensions

This chapter contains the information of Physical Dimensions.
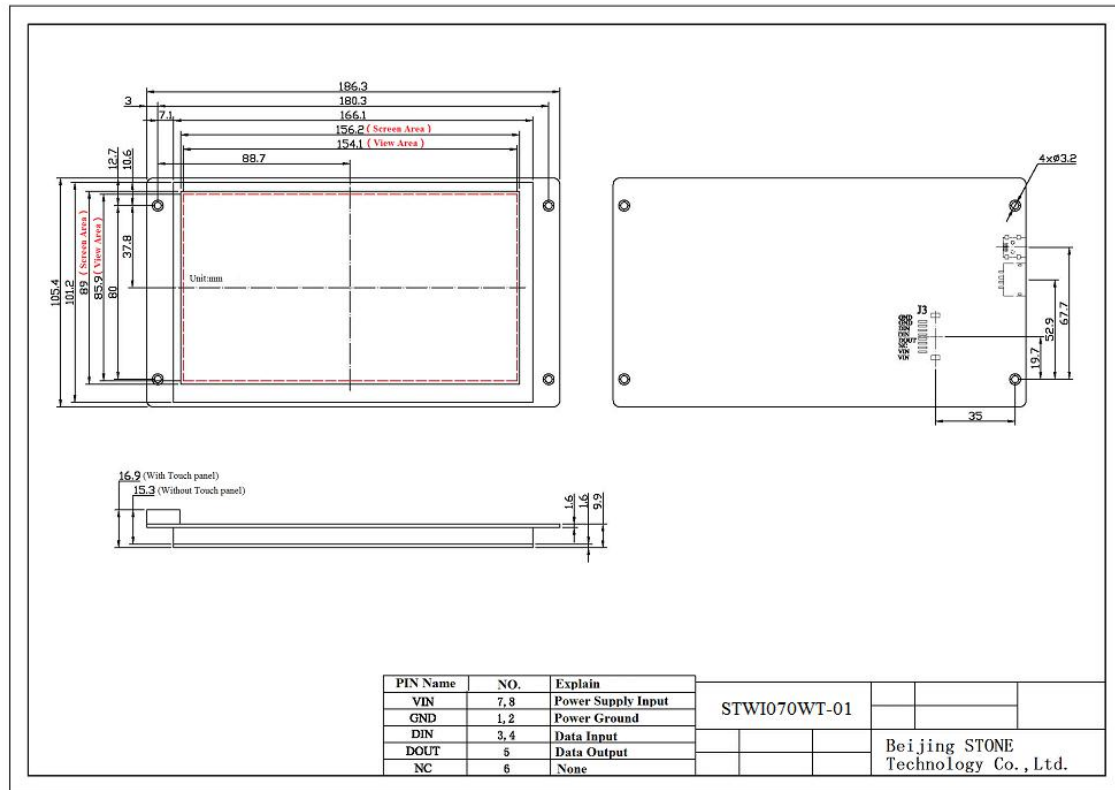
Figure 5-1   STWI070WT-01 dimension

6 Electrical Components

This chapter contains the brands of the components:

- TFT Panel
- Touch Screen
- CPU
- LCD Controller
- Flash memory
- Connecter
- Capacitance
- IC

Electrical Components

Components	Supplier
TFT Panel	INNOLUX INNOLUX CORPORATION AUO CHIMEI 奇美實業 SHARP 夏 普
CPU	TEXAS INSTRUMENTS ST nuvoTon
LCD Controller	ALTERA
Touch Screen	FUJITSU AMT
Flash Memory	TOSHIBA winbond
Connector	molex one company › a world of innov Tyco Electronics OMRON
Capacitance	SAMSUNG TDK muRata INNOVATOR IN ELECTRONICS UniOhm
IC	SAMSUNG ISSI LINEAR TECHNOLOGY TEXAS INSTRUMENTS nuvoTon

7 Naming Rule

This chapter contains the naming rule:

As sample STWI070WT-01N

Code	Explain
ST	Company Code
W	The third version product
I	I=Industrial Type ; A=Advanced Type；C=Civil Type
070	TFT Panel Dimension: 7 inch
W	W=Wide Voltage (+7V to +28V)　　L=Low Voltage (+5V)
T	T=With Resistive Touch Screen N=Without Touch Screen C=With Capacitive Touch Screen
0	0=RS232　　4=RS422/RS485　　1=TTL Level
1	Hardware Code
N	N=Ethernet　　W=Wi-Fi/Bluetooth

8 International Certification

This chapter contains the certification we passed:
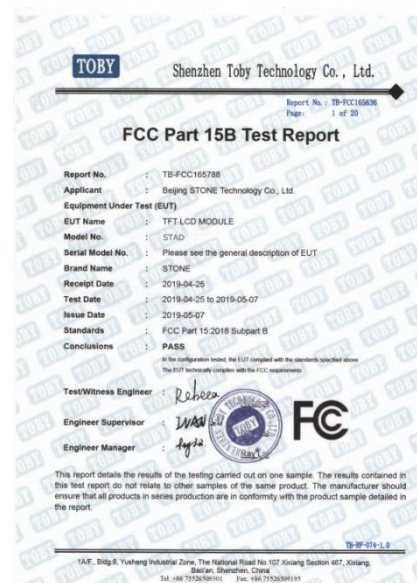
- CE Certificate
- ROHS Certificate
- FCC Certificate
- ISO9001:2008 Quality System

CE Certificate

FCC Certificate

RoHS Certificate

ISO9001:2008

APPENDIX

ESD Guidelines

What does ESD mean?

Virtually all present-day modules incorporate highly integrated MOS devices or components. For technological reasons, these electronic components are very sensitive to overvoltages and consequently therefore to electrostatic discharge:

These devices are referred to in German as Elektrostatisch Gefährdeten Bauelemente/ Baugruppen: ºEGBº

The more frequent international name is:

ºESDº (E lectrostatic Sensitive Device)

The following symbol on plates on cabinets, mounting racks or packages draws attention to the use of electrostatic sensitive devices and thus to the contact sensitivity of the assemblies concerned:
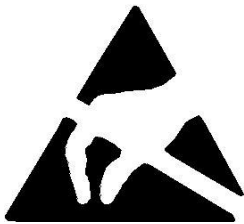
ESDs may be destroyed by voltages and energies well below the perception threshold of persons. Voltages of this kind occur as soon as a device or an assembly is touched by a person who is not electrostatically discharged . Devices exposed to such overvoltages cannot immediately be detected as defective in the majority of cases since faulty behavior may occur only after a long period of operation.

Precautions against electrostatic discharge

Most plastics are capable of carrying high charges and it is therefore imperative that they be kept away from sensitive components.

When handling electrostatic sensitive devices, make sure that persons, workplaces and packages are properly grounded.

Handling ESD assemblies

A general rule is that assemblies should be touched only when this cannot be avoided owing to the work that has to performed on them. Under no circumstances should you handle printed-circuit boards by touching device pins or circuitry.

You should touch devices only if

● you are grounded by permanently wearing an ESD wrist strap or

● you are wearing ESD shoes or ESD shoe-grounding protection straps in conjunction with an ESD floor.

Before you touch an electronic assembly, your body must be discharged. The simplest way of doing this is to touch a conductive, grounded object immediately beforehand ± for example, bare metal parts of a cabinet, water pipe etc.

Assemblies should not be brought into contact with charge-susceptible and highly insulating materials such as plastic films, insulating table tops and items of clothing etc. containing synthetic fibers.

Assemblies should be deposited only on conductive surfaces (tables with an ESD coating, conductive ESD cellular material, ESD bags, ESD shipping containers).

Do not place assemblies near visual display units, monitors or television sets (minimum distance to screen > 10 cm).

Measuring and modifying ESD assemblies

Perform measurements on ESD assemblies only when

● the measuring instrument is grounded ± for example, by means of a protective conductor ± or

● the measuring head has been briefly discharged before measurements are made with a potential-free measuring instrument ± for example, by touching a bare metal control cabinet.

When soldering, use only grounded soldering irons.

Shipping ESD assemblies

Always store and ship assemblies and devices in conductive packing ± for example, metallized plastic boxes and tin cans.

If packing is not conductive, assemblies must be conductively wrapped before they are packed. You can use, for example, conductive foam rubber, ESD bags, domestic aluminum foil or paper (never use plastic bags or foils).

With assemblies containing fitted batteries, make sure that the conductive packing does not come into contact with or short-circuit battery connectors. If necessary, cover the connectors beforehand with insulating tape or insulating material.

Glossary

⬦B⬦

Baud rate

Rate of speed at which data is downloaded. Baud rate is specified in Bit/s.

Boot

A loading process which downloads the operating system in the working memory of the operating unit.

⬦C⬦

Command Set

Hex Code, the MCU can control the TFT Module via the command set.

Configuration file

It can be created by the softwares.

⬦D⬦

Download

Download the image, configuration files and data through mini USB port or USB port.

Download mode

Through mini USB port or USB port.

F

Flash memory

Programmable memory which can be electrically deleted and written to again segment-by-segment.

H

Half Brightness Life

The period of time after which the brightness tube only achieves 50% of the original value.

I

Input field

Enables the user to enter values which are subsequently sent to the **MCU**.

M

MCU

Micro Control Unit, it is widely used in the industrial control.

N

Normal operation

Operating unit operating mode in which messages are displayed and screens can be operated.

◇**O**◇

Output field

Displays current values from the **MCU** on the operating unit.

◇**P**◇

Process screen

The display of process values and process progress on the operating unit in the form of screens, which may contain graphics, texts and values.

◇**R**◇

RS485

Standard interface for serial data transfer at a very high transmission rate.

◇**S**◇

Screen

A screen displays all the logically related process data on the operating unit, whereby the individual values can be modified.

◇**T**◇

Touch panel

This is an operating unit without a keyboard. The touch panel (abbreviated to TP) is operated via the contact-sensitive screen elements.