SPECIFICATIONS

Product Name: LCD Module

Model Part Number: DSP-N1TFD-ATN

Revision: C Date: 2019-12-23

Prepared By:	Reviewed By:	Approved By:
SZX	HY	WS

Customer: _____

Custoer Approved Result: _____ □ OK □ NG _____

Custoer Confirmed Message: _____

_____

Approved By: _____ Date: _____

Contents

Record of History

The following table tracks the history of the changes made to this document.

Release Date	Rev.	Summary	Design
2018.1.24	A	Orign Released	SZX
2018.4.23	B	Renew outline& Display code	SZX
2018.11.24	C	Renew Response time	SZX

1. Technology Specifications

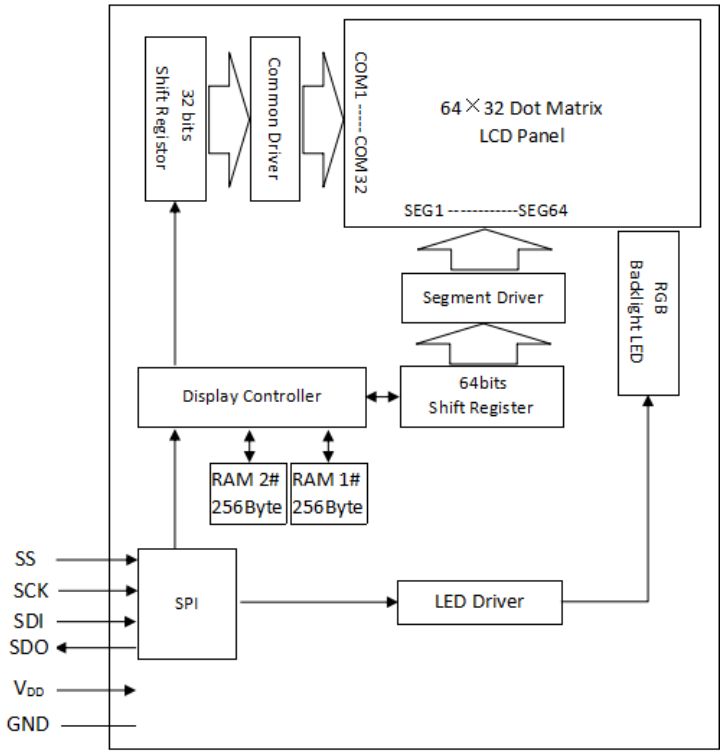
1.1 Features

S/N	ITEM	SPEC
1	Display Format	64×32 Dots
2	Display Mode	FSTN, Positive
3	Polarizer Mode	Transflective
4	Driving Method	1/32Duty, 1/5 Bias, Vop 5.7V
5	Viewing Direction	6 O'clock
6	Backlight	LED RGB
7	Interface	Serial Interface
8	Weight	——

1.2 Mechanical Specifications

Item	Description	Unit
Module Dimension	19(L) ×18(W) ×14.5(H)	mm
Viewing Area	14.9(L) ×12.3(W)	mm
Active Area	13.4(L)×9.74(W)	mm
Dot Size	0.19(L) ×0.285 (W)	mm
Dot Pitch	0.21(L) ×0.305(W)	mm

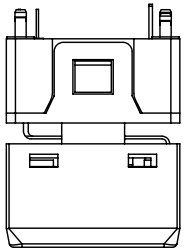
1.3 Block Diagram

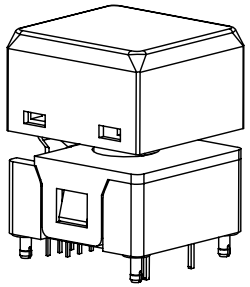


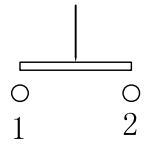
1.4 Interface Functions

Pin no.	SYMBOL	I/O	FUNCTION
1	GND	P	Ground(0V)
2	VDD	P	Power supply(+3.3V)
3	SDO	O	Data output line for SPI
4	SDI	I	Data input line for SPI
5	SCK	I	Clock line for SPI that synchronize command and data
6	SS	I	Chip select for SPI, Low active

DIMENSION	TOLERANCE
≤10	± 0.3
10~100	± 0.5
≥100	± 0.8



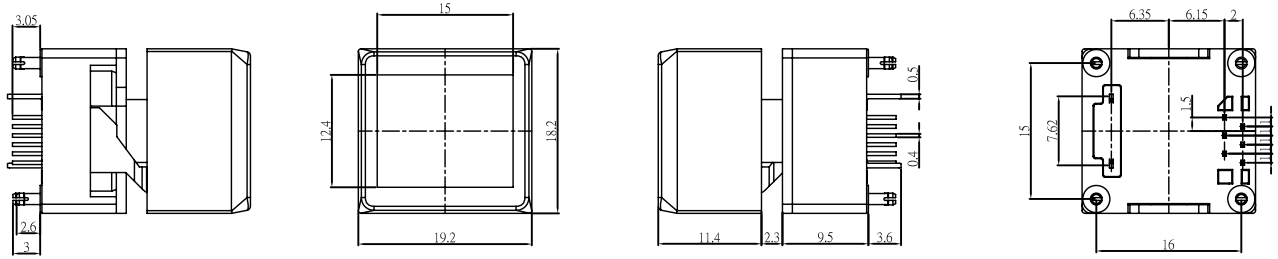


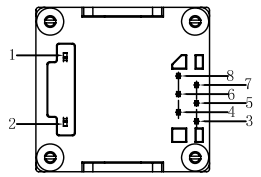


SW CIRCUIT

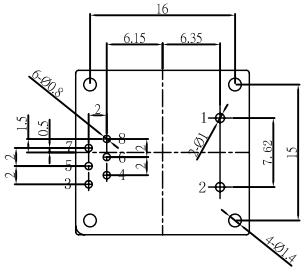
"RGB"

BACKLIGHT

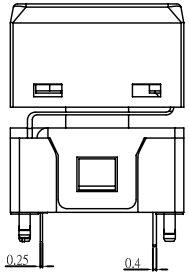




Terminal's VIEW



P.C.B. LAYOUT



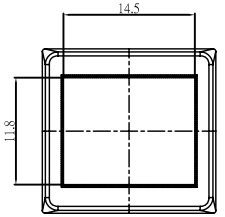
1. SWITCH(1->2) RATING : 12 V DC , 0.1A .
2. CONTACT RESISTANCE : 200 mΩ MAX .(Initial)
3. INSULATION RESISTANCE : 100 MΩ MIN(DC 250V) .
4. WITHSTAND VOLTAGE : AC 125 V / 1 MINUTE.
5. OPERATING TEMPERATURE : -25℃ ~ 70℃ .
6. OPERATING FORCE : 180±50 gf .
7. FULL TRAVEL : 1.8±0.3 .
8. LIFE CYCLE: 2,000,000 CYCLES .

*** 9. 64(horizontal)X32(vertical) Pixel FORMAT

10. PIN1~PIN8 MUST BE CHECK THE "DSP SERIES LCD SPEC"

PIN 1	SWITCH Terminal
PIN 2	SWITCH Terminal
PIN 3	GND[Gorund]
PIN 4	V_{DD}[Power]
PIN 5	SDO[Data Out]
PIN 6	SDI[Data In]
PIN 7	SCK[Serial Clock]
PIN 8	$\overline{SS}$[Slave Select]

Terminal's Configuration



VIEW Area

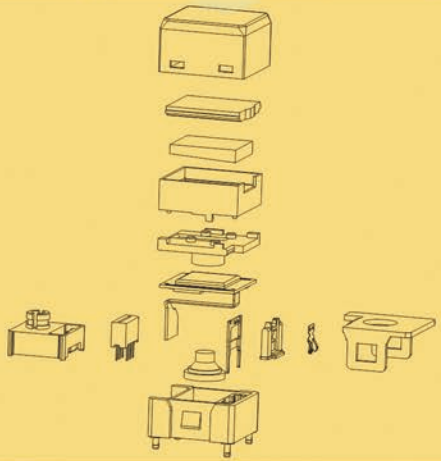
						UNIT	SCALE	ANGLE TER	VIEW	MODE	WWW.SZLAKEVIEW.COM ELECTRONICS CO., LTD
V0	2015/7/25	JOHNSON	ALEN	MIKE	ORIGINAL DESIGN	mm	1 : 1	± 3°		PUSH WITH LCD SWITCH	
VER	DATE	APPROVAL	CONFIRM	DESIGN	ENGINEERING RECORD DESCRIPTION	DSP-N1TFD-ATN					Tel: (86)755-29424722/29424733

Features:
Long electrical life cycles.
Choice of multiple colored caps.
Choice of painted colored caps.
Laser marking service.
Available for Push button with LCD display.

产品特色：
提供带触感型及无触感型两种选择
超高亮RGB背光源,耐久鲜明
LCD液晶屏，显示模式自定义
超长距离,高信耐接触,无杂讯

Applications
Studio equipment.
Audio/Video products.
Broadcast system.
Instrumentation.
Telecommunications...etc.

使用范围
音响、影像等录音室器材设备
广播系统、电信仪器设备。



DSP

General Specifications：（产品规格）

CONTACT RATING: 12 V DC,0.1A.
CONTACT RESISTANCE:200 mΩ MAX.(Initial).
INSULATION RESISTANCE: 100MΩ MIN (DC 250V).
WITHSTAND VOLTAGE: AC 125 V /1 MINUTE.
OPERATING TEMPERATURE: -25℃~70℃.
OPERATING FORCE: 180±50 gf.
FULL TRAVEL: 1.8±0.3mm .
LIFE CYCLE:2,000,000 CYCLES.
64(horizontal)X32(vertical) Pixel format.

Material：（产品材质）

Cover:Polycarbonate (PC)
Actuator:Polyoxymethylene (POM)
Base Frame:Polyamide (PA) +GF
Terminal:Brass with silver plating
Moving Contact:Phosphor Bronze with gold plating
Display: LCD

Terminal's Configuration

PIN 1	Switch Terminal	PIN 2	Switch Terminal
PIN 3	GND[Gorund]	PIN 4	VDD[Power]
PIN 5	SD0[Data 0ut]	PIN 6	SDI[Data In]
PIN 7	SCK[Serial Clock]	PIN 8	$\overline{SS}$[Slave Select]

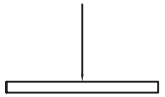
HOW TO ORDER

SERIES	OPERATION	POLE	TERMINAL	BACKLIGHT	DISPLAY	FRAME TYPE	CAP COLOR	PLATE COLOR
DSP	N	1	T	F	D	A	T	W
	N=NON-LOCK	1=1 POLE	T=TACTILE TYPE N=NON TACTILE X=NON OPERATION	R=RED G=GREEN B=BULUE Y=YELLOW W=WHITE F=FULL COLOR N=NONE	D=DISPLAY[LCD] L=DISPLAY[LED] O=DISPLAY[OLED] N=NONE	A=A TYPE B=B TYPE C=C TYPE D=D TYPE	T=TRANSPARENT R=RED G=GREEN B=BLUE Y=YELLOW S=SILVER N=NONE	W=WHITE R=RED G=GREEN B=BLUE Y=YELLOW N=NONE (LCD TYPE) F=FILM PLATE

CAP Symbol:Please refer to cap selection for all available symbols on cap surface,and any customization is welcomed

SCHEMATIC

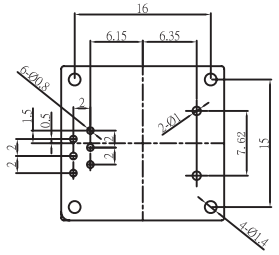
SWITCH



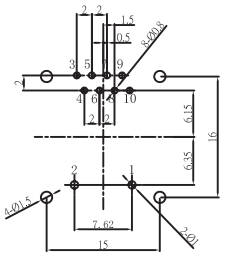
BACKLIGHT

"RGB"

P.C.B LAYOUT



"LCD"
"LED"



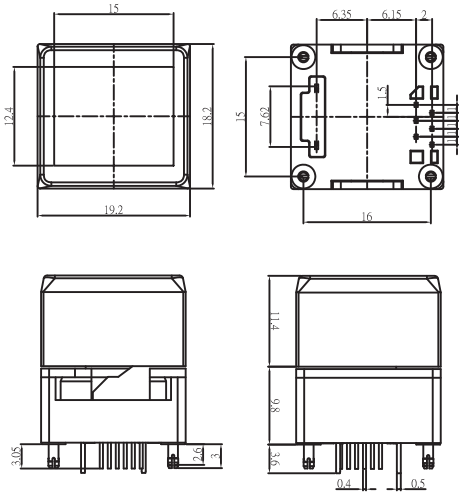
"OLED"

DISPLAY MODE

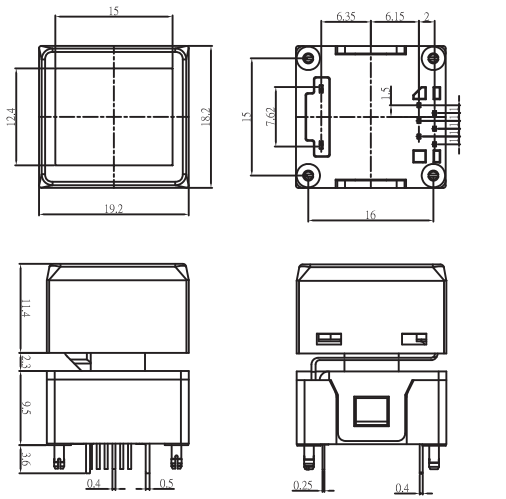
INTERFACE

"SPI"
"LCD"
"OLED"

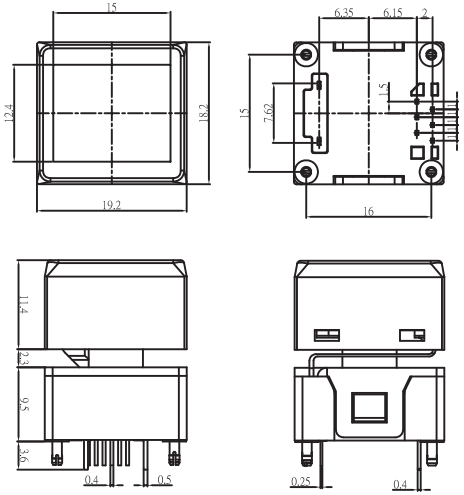
DSP-N1XFD-ATN



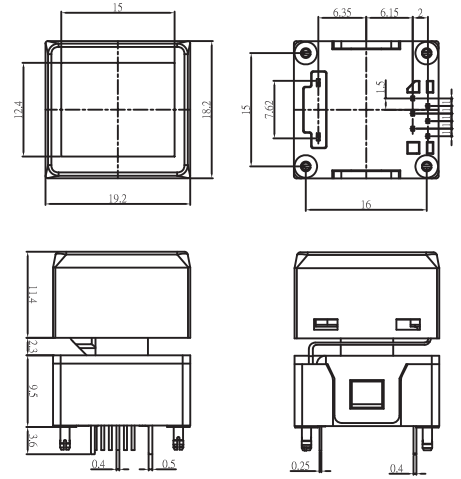
DSP-N1TFD-ATN



DSP-N1NFD-ATN

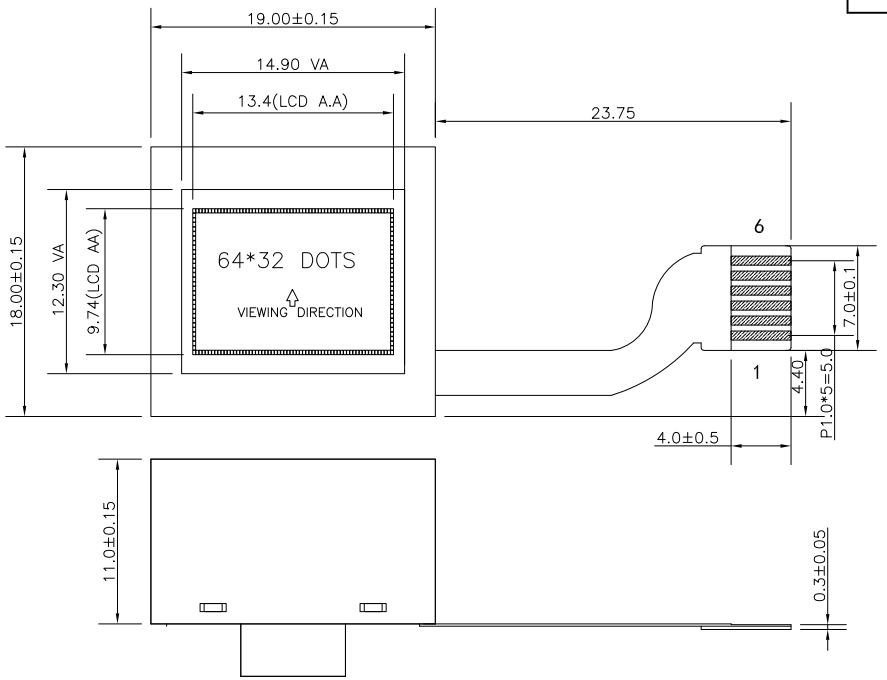


DSP-N1TFL-ATW

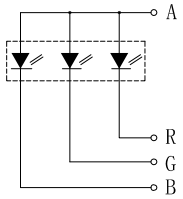


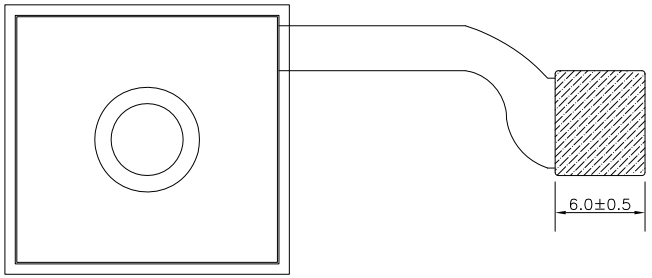
DIMENSION	TOLERANCE
≤10	± 0.3
10~100	± 0.5
≥100	± 0.8

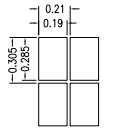
1	GND
2	VCC(3.3V)
3	SDO
4	SDI
5	SCK
6	SS



Circuit Diagram:1X1=1
Colour :RGB







dots details

NOTES:

1.Display Mode：FSTN POSITIVE / TRANSFLECTIVE
2.Viewing Direction： 6 O'Clock
3.Driving Method：1/32 DUTY,1/5 BIAS,VDD=3.3V,Vop=5.7V
4.Backlight：LED,Color-R/G/B,1 DIE
5.Operating Temp：-15°C--+50°C
6.Storage Temp：-20°C--+60°C
7.DRIVE IC:S1C17W36
8.UNMARK TOLERANCE IS :±0.2mm
9.( ) Reference dimension，* Important dimensions
10.RoHS

						UNIT	SCALE	ANGLE TER	VIEW	MODE	
V0	2015/7/25	JOHNSON	ALEN	MIKE	ORIGINAL DESIGN	mm	1 : 1	± 3°		TACT WITH LED SWITCH	WWW.SZLAKEVIEW.COM ELE TRONI S O., LTD
VER	DATE	APPROVAL	CONFIRM	DESIGN	ENGINEERING RECORD DESCRIPTION	DSP					Tel: (86)755-29424722/29424733

2、Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit
Supply Voltage (Logic)	VDD	-0.3	4.0	V
Input Voltage	Vin	-0.3	VDD +0.5	V
Input High Voltage	VIH	-0.3	VDD +0.5	V
Input Low Voltage	VIL	-0.3	VDD +0.5	V
Output High Current	IOH		-20	mA
Output Low Current	IOL		-20	mA
Supply Current for Backlight	If(Ta = 25℃)	--	60	mA
Reverse Voltage for Backlight	Vr(Ta = 25℃)	--	5	V
Operating Temperature	Topr	-15	50	℃
Storage Temperature	Tstg	-20	60	℃

3、Electrical Characteristics

3.1 DC Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage (Logic)	VDD		3.2	3.3	3.4	V
Supply Voltage (LCD Drive)	VLCD	Ta = 25℃	--	5.7	--	V
Frame Frequency	fFR	On-chip RC oscillator	--	64	--	HZ

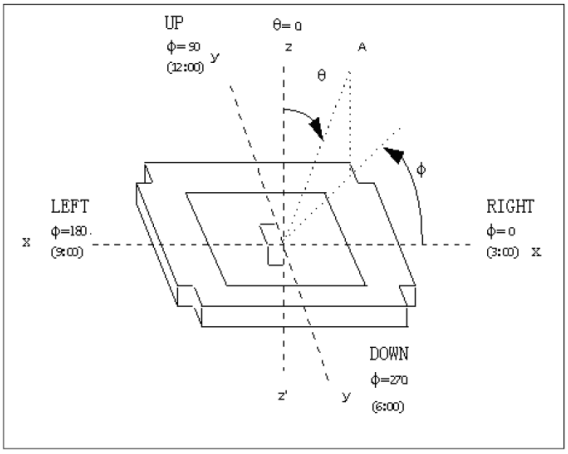
3.2 Optical Characteristics(Ta=25 ℃)

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Response time	Ton	25℃	--	30	70	ms
	Toff	25℃	--	50	110	ms
Contrast ration	CR	Θ=10 °, φ=270 °	--	3		-
Viewing Angle	θ	CR≥2		45		Deg φ=270 °
				20		Deg φ=90 °
				30		Deg φ=0 °
				30		Deg φ=180 °

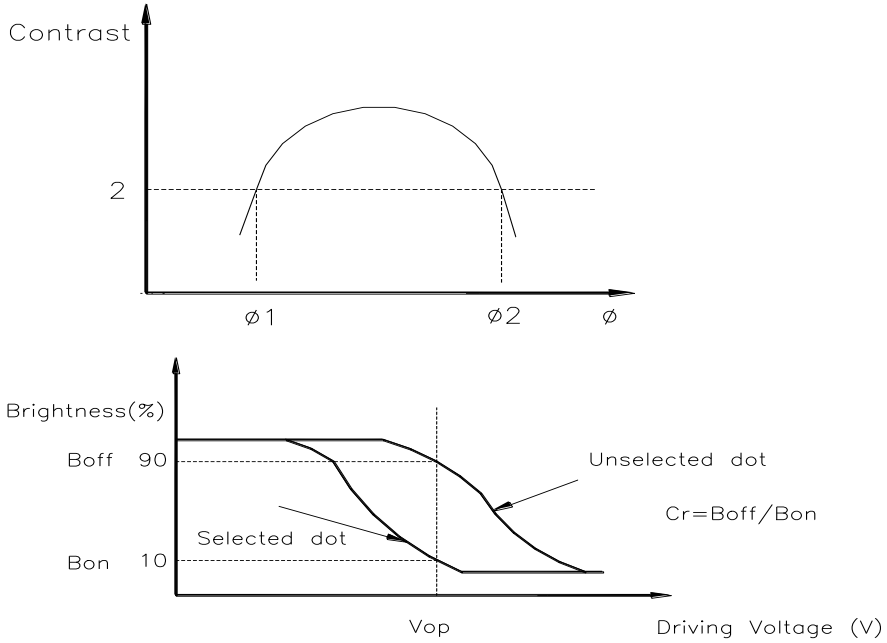
Panel only characteristics

NOTE1: Definition of Viewing Angle θ,ϕ

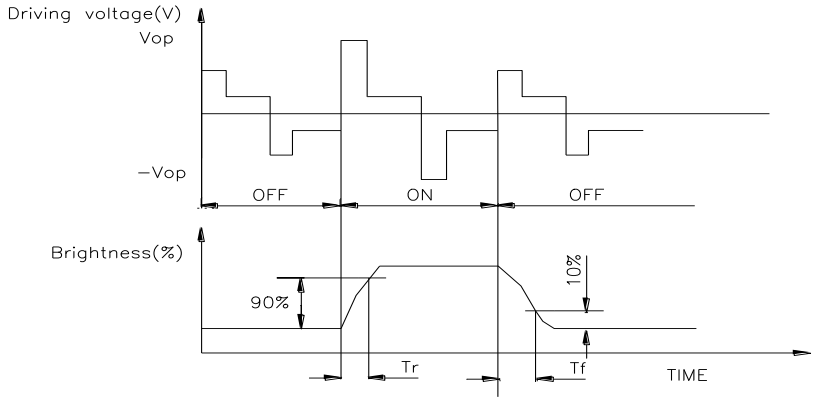
NOTE2: Definition of viewing Angle Range: Δϕ=|ϕ2-ϕ1|



NOTE3: Definition of Contrast



NOTE4: Definition of Response Time

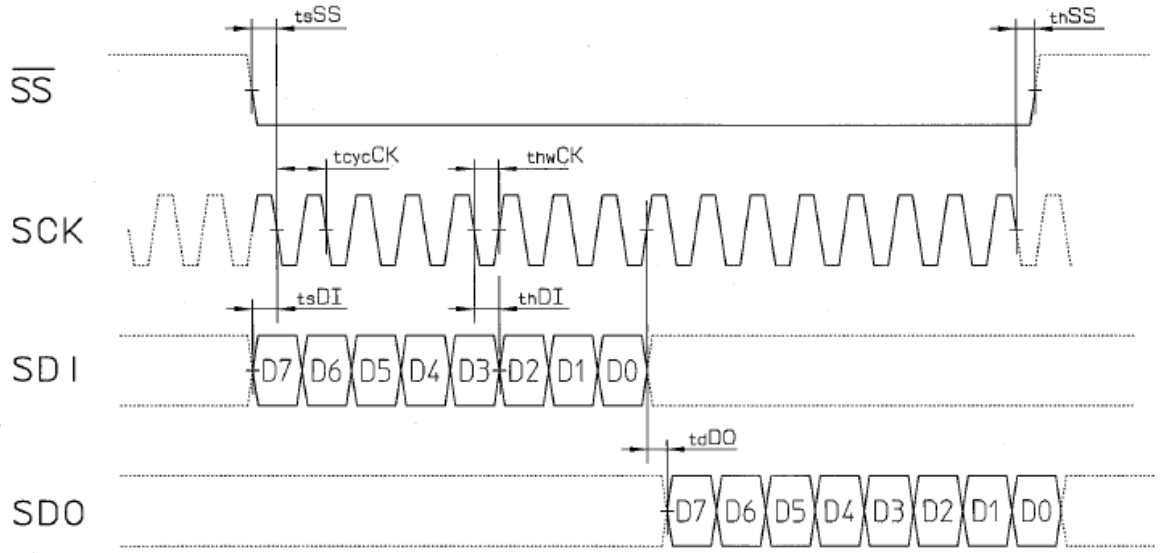


3.3 AC Characteristics

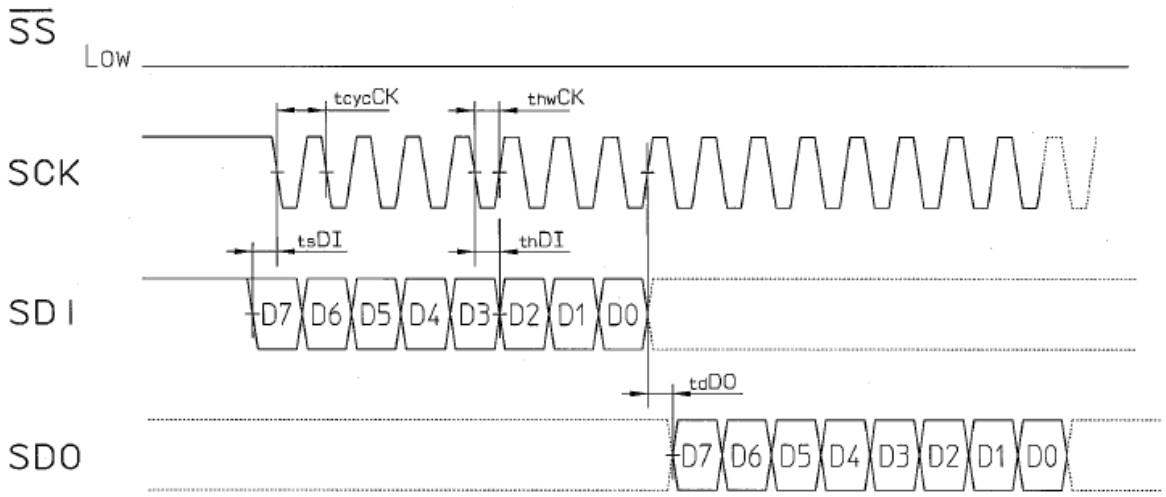
Characteristics of SPI(TA=-15 to +50℃，VDD=3.3V±2%)

Items	Symbols	min.	typ.	max.	Unit
SPI_$\overline{SS}$ Set Up Time	tsSS	10			ns
SPI_$\overline{SS}$ Hold Time	thSS	10			ns
SPI_CLK Cycle	tcyc CK			8	MHz
SPI_CLK Width	thw CK	10			ns
SPI_DI Set Up Time	tsDI	10			ns
SPI_DI Hold Time	thDI	10			ns
SPI_DO Delay Time	tdDO	10			ns

Timing chart of SPI(/SS using)



Timing chart of SPI(/SS low level fixed)



4、Commands and Data

4.1 Commands

4.1.1 Transferring display data/displaying on LCD: command(1Byte) + data(256Byte)
Others: command(1Byte) + data(1Byte)

4.1.2 Commands can be accepted only when all bits are coincided. Otherwise they are ignored.

4.1.3 Additional commands will not be received until the communication of commands(1Byte) and data(256 or 1Byte) will have been completed.

4.1.4 No limit time from the start to the end of data receipt.

4.1.5 No wait time required from the completion of data until the start of new command receipt, thus commands can be executed consecutively.

4.1.6 Irregular commands or data shall be ignored.

4.1.7 SS terminal needs to keep low signal during communication of the command and data. The command and data are initialized if the low signal disable during.

4.1.8 Initial status at power activation is LCD display off and LED off (brightness 1/20, color off).

4.1.9 The details of the commands are as follows:

Transferring display data/ displaying on LCD

Command		Data	Remarks
Hex	Binary		
(0x55)	01010101	256 Bytes(64×32=2048 bits)	Details of bitmap data shall be referred to below

LED color set

Command		Data	Remarks
Hex	Binary		
(0x40)	01000000	R R G G B B 1 1 2 bits × 3	For each of RGB: 00 = off 01 = 1/4 10 = 1/2 11 = full

LED brightness set

Command		Data	Remarks
Hex	Binary		
(0x41)	01000001	* * * 1 1 1 1 1 3 bits	For leading 3bits: 000 = 1/20 (dark) 001 = 1/10 010 = 1/7 011 = 1/5 100 = 1/3 101 = 1/2 110 = 2/3 111 = full (bright)

Reset (Returning to the initial status at power activation)

Command		Data	Remarks
Hex	Binary		
(0x5E)	01011110	00000011	Returning to the initial status at power activation

4.2 Display code(stm32f103c8 for example)

Main

```
int main(void)
{
   int i,j;
   SPI_FLASH_CS_LOW();//CS LOW,chip select;
   Delay( 15000 );//about 3ms(min 10ns)
   SPI_FLASH_Init(); //configure spi
   Delay( 15000 );

  SPI_FLASH_SendByte(0x40);//Backlight color set
  SPI_FLASH_SendByte(0xc3);//red


  SPI_FLASH_SendByte(0x40);// Backlight brightness set
  SPI_FLASH_SendByte(0x1f);// 1/20


  //LCD display
  for(i=0;i<256;i++) //64*32 dots ,256 bytes data
     {
        txbuf[i] = txbuf_OFF[i]; // write “OFF” to transfer buffer
      }
     SPI_FLASH_SendByte(0x55);
     for(j=0;j<256;j++)
     {
              SPI_FLASH_SendByte(txbuf[j]);   //write display data to spi
       }
     i=0;j=0;
   Delay( 10000000 );
}
```

void SPI_FLASH_Init(void)

```
{
  SPI_InitTypeDef   SPI_InitStructure;
  GPIO_InitTypeDef GPIO_InitStructure;
```

```
/* Enable SPI1 and GPIO clocks */
/*!< SPI_FLASH_SPI_CS_GPIO, SPI_FLASH_SPI_MOSI_GPIO,
   SPI_FLASH_SPI_MISO_GPIO, SPI_FLASH_SPI_DETECT_GPIO
       and SPI_FLASH_SPI_SCK_GPIO Periph clock enable */
RCC_APB2PeriphClockCmd(RCC_APB2Periph_GPIOA | RCC_APB2Periph_GPIOD, ENABLE);

/*!< SPI_FLASH_SPI Periph clock enable */
RCC_APB2PeriphClockCmd(RCC_APB2Periph_SPI1, ENABLE);

/*!< Configure SPI_FLASH_SPI pins: SCK */
GPIO_InitStructure.GPIO_Pin = GPIO_Pin_5;
GPIO_InitStructure.GPIO_Speed = GPIO_Speed_50MHz;
GPIO_InitStructure.GPIO_Mode = GPIO_Mode_AF_PP;
GPIO_Init(GPIOA, &GPIO_InitStructure);

/*!< Configure SPI_FLASH_SPI pins: MISO */
GPIO_InitStructure.GPIO_Pin = GPIO_Pin_6;
GPIO_Init(GPIOA, &GPIO_InitStructure);

/*!< Configure SPI_FLASH_SPI pins: MOSI */
GPIO_InitStructure.GPIO_Pin = GPIO_Pin_7;
GPIO_Init(GPIOA, &GPIO_InitStructure);

/*!< Configure SPI_FLASH_SPI_CS_PIN pin: SPI_FLASH Card CS pin */
GPIO_InitStructure.GPIO_Pin = GPIO_Pin_4;
GPIO_InitStructure.GPIO_Mode = GPIO_Mode_Out_PP;
GPIO_Init(GPIOA, &GPIO_InitStructure);

/* Select the FLASH: Chip Select low */
SPI_FLASH_CS_LOW();

/* SPI1 configuration */
SPI_InitStructure.SPI_Direction = SPI_Direction_2Lines_FullDuplex;// FullDuplex mode
SPI_InitStructure.SPI_Mode = SPI_Mode_Master;// Master mode
SPI_InitStructure.SPI_DataSize = SPI_DataSize_8b;// DataSize 8bits
SPI_InitStructure.SPI_CPOL = SPI_CPOL_High;// CPOL High
SPI_InitStructure.SPI_CPHA = SPI_CPHA_1Edge;//drop along data
SPI_InitStructure.SPI_NSS = SPI_NSS_Soft;// Soft cntrol
SPI_InitStructure.SPI_BaudRatePrescaler = SPI_BaudRatePrescaler_256;//frequency divide 256
SPI_InitStructure.SPI_FirstBit = SPI_FirstBit_MSB;// Firstbit MSB
SPI_InitStructure.SPI_CRCPolynomial = 7;//CRC check
SPI_Init(SPI1, &SPI_InitStructure);
```

```
  /* Enable SPI1   */
  SPI_Cmd(SPI1, ENABLE);
}
```

SPI FLASH SendByte

```
 u8 SPI_FLASH_SendByte(u8 byte)
 {
/* Loop while DR register in not emplty */
while (SPI_I2S_GetFlagStatus(SPI1, SPI_I2S_FLAG_TXE) == RESET);

/* Send byte through the SPI1 peripheral */
SPI_I2S_SendData(SPI1, byte);

/* Wait to receive a byte */
while (SPI_I2S_GetFlagStatus(SPI1, SPI_I2S_FLAG_RXNE) == RESET);

/* Return the byte read from the SPI bus */
return SPI_I2S_ReceiveData(SPI1);
}
```

void SPI_I2S_SendData(SPI_TypeDef* SPIx, uint16_t Data)

```
{
  /* Check the parameters */
  assert_param(IS_SPI_ALL_PERIPH(SPIx));

  /* Write in the DR register the data to be sent */
  SPIx->DR = Data;
}
```

uint16_t SPI_I2S_ReceiveData(SPI_TypeDef* SPIx)

```
{
  /* Check the parameters */
  assert_param(IS_SPI_ALL_PERIPH(SPIx));

  /* Return the data in the DR register */
  return SPIx->DR;
}
```

FlagStatus SPI_I2S_GetFlagStatus(SPI_TypeDef* SPIx, uint16_t SPI_I2S_FLAG)

```
{
  FlagStatus bitstatus = RESET;
  /* Check the parameters */
  assert_param(IS_SPI_ALL_PERIPH(SPIx));
```

```
  assert_param(IS_SPI_I2S_GET_FLAG(SPI_I2S_FLAG));
  /* Check the status of the specified SPI/I2S flag */
  if ((SPIx->SR & SPI_I2S_FLAG) != (uint16_t)RESET)
  {
    /* SPI_I2S_FLAG is set */
    bitstatus = SET;
  }
  else
  {
    /* SPI_I2S_FLAG is reset */
    bitstatus = RESET;
  }
  /* Return the SPI_I2S_FLAG status */
  return   bitstatus;
}
```

5、LED Backlight Characteristics(Ta = 25℃)

Item	Symbol	Min.	Typ.	Max.	Condition	Unit
Forward Voltage (red color)	Vf	1.7	2.0	2.6	If =15mA	V
Reverse Current (red color)	Ir			30	5.0V/LED	uA
Luminance (red color)	Lv	900	1200	--	If =15mA	cd/m2
Unlformlty (red color)	Avg	75			If =15mA	%
Color Coordinate (red color)	X	0.64		0.71	If =15mA	nm
	Y	0.29		0.33		

Item	Symbol	Min.	Typ.	Max.	Condition	Unit
Forward Voltage (green color)	Vf	2.65	3.4	3.6	If =15mA	V
Reverse Current (green color)	Ir			30	5.0V/LED	uA
Luminance (green color)	Lv	1800	2400	--	If =15mA	cd/m2
Unlformlty (green color)	Avg	75			If =15mA	%
Color Coordinate	X	0.13		0.25	If =15mA	nm

(green color)	Y	0.62		0.75		

Item	Symbol	Min.	Typ.	Max.	Condition	Unit
Forward Voltage (blue color)	Vf	2.7	3.0	3.6	If =15mA	V
Reverse Current (blue color)	Ir			30	5.0V/LED	uA
Luminance (blue color)	Lv	550	700	--	If =15mA	cd/m2
Unlformlty (blue color)	Avg	75			If =15mA	%
Color Coordinate (blue color)	X	0.11		0.16	If =15mA	nm
	Y	0.03		0.11		

6、Precautions For use of LCD Module

6.1 Handling Precautions

LCD modules are assembled and adjusted with a high degree of precision, do not applying excessive shocks to it or making any alterations or modifications to it, the following precautions should be taken when handing.

The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth. If the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

Do not apply excessive force on the surface of display or the adjoining areas of LCD module since this may cause the color tone to VA.

If the display surface of LCD module becomes contaminated, blow on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents.

·Isopropyl alcohol

·Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

·Water

·Ketone

·Aromatic Solvents

The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity, etc., exercise care to avoid touching the following sections when handling the module:

·Terminal electrode sections.

·Part of pattern wiring on TAB, etc.

6.2 Electro-Static Discharge Control

The IC mounted on the LCD is very susceptible to static electricity. To protect them from static electricity which your body and clothing collect, connect your body to the ground via a resistor of some 1MΩ so that electricity should discharge connect the resistor close to your body in the grounding line and protect yourself from electric shock hazard.

Module should be store in antistatic bag or other containers resistant to static after remove from its original package.

The LCD modules use CMOS LSI drivers, so customers are recommend that any unused input terminal would be connected to VDD or VSS, do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

In order to reduce the generation of static electricity, a relative humidity of 50-60% is recommended.

The LCD module is coated with a film to protect the display surface. Take care when peeling off this protective film since static electricity may be charged.

Tools required for assembly, such as soldering irons, must be properly grounded.

6.3 Design Precautions

The absolute maximum ratings represent the rated value beyond which LCD module can not exceed. When the LCD modules are used in excess of this rated value, their operating characteristics may be adversely affected.

To prevent the occurrence of erroneous operation caused by noise, attention must be paid to satisfy VIL, VIH specification values, including taking the precaution of using signal cables that are short.

The liquid crystal display exhibits temperature dependency characteristics. Since recognition of the display becomes difficult when the LCD is used outside its designated operating temperature range, be sure to use the LCD within this range. Also, keep in mind that the LCD driving voltage levels necessary for clear displays will VA according to temperature.

Sufficiently notice the mutual noise interference occurred by peripheral devices.

To cope with EMI, take measures basically on outputting side.

If DC is impressed on the liquid crystal display panel, display definition is rapidly deteriorated by the electrochemical reaction that occurs inside the liquid crystal display panel. To eliminate the opportunity of DC impressing, be sure to maintain the AC characteristics of the input signals sent to the LCD Module.

6.4 Soldering Precautions

Soldering should apply to I/O terminals only.

Soldering temperature is 320℃+(-)10℃.

Soldering time 3-4 seconds.

Eutectic solder (rosin flux filled) should be used.

Only properly grounded soldering iron should be used.

If soldering flux is used, be sure to remove any remaining flux after finishing the soldering operation and LCD surface should be covered during soldering to prevent any damage to flux spatters.

When remove the lead wires from the I/O terminals, use proper de-soldering methods, e.g. suction type de-soldering irons. Do not repeat wiring by soldering more than three times at the pads and plated though holes may be damaged.

6.5 Operational Precautions

Do not remove the panel or frame from the liquid crystal display module.

Power supplies should always be turned on before the independent input signal sources turned on, and input signals should be turned off before power supplies turned off.

The IC would break down if the driving voltage exceeds the limit. Make sure of electrical specifications, particularly the supply voltage.

It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage than the limit causes the shorter LCD life. The use of direct current drive should be avoided because an electrochemical reaction due to direct current causes LCD's undesirable deterioration.

Some font will be abnormally displayed when the display area is pushed hard during operation. But It resumes normal condition after turning off once.

The response of the display is slow when the ambient temperature is below the lower limit, and the display surface appears dark everywhere when the ambient temperature is above the upper limit, in any case, id does not mean failure. It operates properly in the normal operating temperature range.

The contrast of the liquid crystal display VAies with the viewing angle, ambient temperature, and driving voltage. Adjust the driving voltage for the best contrast by installing external VAiable switch.

If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.

Condensation on terminals can cause an electrochemical reaction disrupting the terminal circuit. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions. Therefore it must be used under the relative condition of 50% RH.

6.6 Storage Precautions

Take care to minimize corrosion of the electrodes. Water droplets or a current flow in a high humidity environment accelerates corrosion of the electrodes.

When storing the LCD module, avoid exposure to direct sunlight or to the light of fluorescent lamps. Keep the LCD module in sealed polyethylene bags designed to prevent static electricity charging under low temperature / normal humidity conditions (avoid high temperature / high humidity and low temperature below 0). The temperature range of 0℃~ -15℃ and at low humidity is recommended.

Whenever possible, the LCD module should be stored in the same conditions in which they were shipped from our company.

7. Quality Specification

7.1 Manner of test:

The test must be under 40W fluorescent light, and the distance of view must be at 30cm.

The test direction is based on around -10°- 30° of Vertical line.

7.2 Quality specification

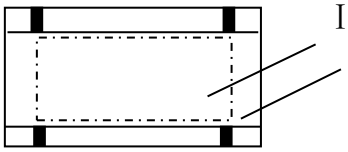
It shall be based on GB2828-87, Apply level II, Normal inspection by single sampling.

	IETM	CHECK LEVEL	AQL
MAJOR (MA)	LIQUID CRYSTAL LEAKAGE WRONG POLARIZER OUTSIDE DIMENSION SEGMENT MISSING SEGMENT SHORT	II	0.25
MINOR (MI)	1.BLACK SPOTS OR WHITE SPOTS. 2.FOREIGN SUBSTANCE, 3.WHITE SPOTS, 4.PINHOLE,SEGMENT 5.DEFORMATION SCRATCHS(GLASS & POLARIZER), 6.SEGMENT DEFECT, 7.AIR BUBBLES BETWEEN GLASS & POLARIZER, 8.COLOR VARIATION,GLASS CHIPS, 9.OTHER VISUAL DEFECTS.	II	1.0

7.3 Definition of area:

7.3.1 Ⅰ area: viewing area

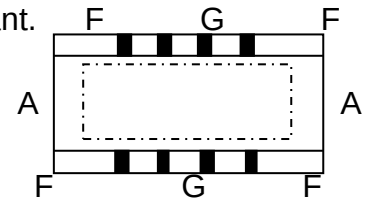
Ⅱ area: outside viewing area



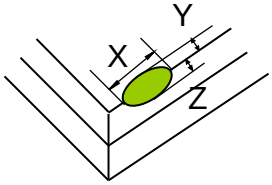
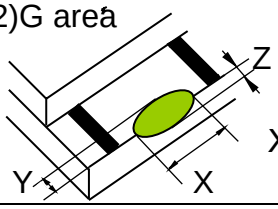
7.3.2 A area: The glass area outside sealant.

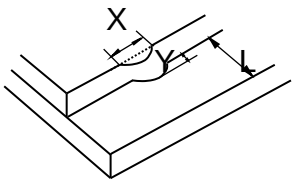
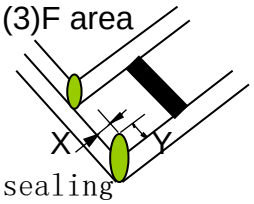
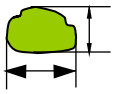
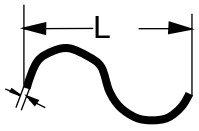
G area: Electrode pad area.

F area: Without electrode pad area.



7.4 Standard of appearance test: (unit: mm)

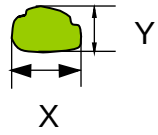
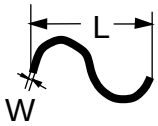
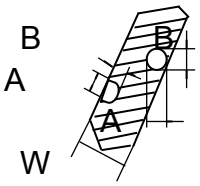
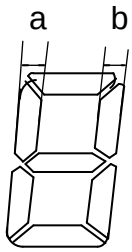
№	Items	Criterion	Checking manner
1	Substrate crack X: defect Length Y: defect Width Z: defect Depth T: glass Thickness N: defect QTY L:Connector Width	(1) A area  X≤3.0 Y：Don't allowed hurt sealing Z≥T/2 N≤3 X≤5.0 Y：Don't allowed hurt sealing Z≤T/2 N≤3 X≤1.0 Y≤0.5 Z≤T/3 No check (2)G area  X≤3.0 Y≤0.5 Z≤T/2 N≤2	checking with eyes

		 X≤total length Y≤1/4L N≤1 Over the drawing tolerance is not allowed (3)F area  X≤2.0 Y≤3 Z≤T N≤3 Don't allowed hurt	
2	Black spot white spot D=(X+Y)/2 Line	(1)  0.2<D≤0.25 N≤1 0.1<D≤0.2 N≤3 D≤0.1 No check (2)  L≤2.0 W≤0.03 N≤2 L≤1.0 W≤0.05 N≤1	Checking on the table with light and polarizer and checking with eyes directly.

№	Items	Criterion	Checking manner
3	Polarizer Bubble	D≤0.15 No check 0.15<D≤0.4 N≤2	Checking on the table with light and polarizer, and checking with eyes directly
4	Rainbow Color	Allow tiny rainbow Allow 5% color contrast or accord limitative sample	Checking on the table with light and polarizer, And checking with eyes directly
5	END Seal	1. Dimension accord design require 2. Inject depth（d）：1/5D≤d≤D （D：seal design depth）	Checking with eyes

6	Polarizer or pad appearance	No dirty	Checking with eyes

7.5 Standard of display test

№	Items	Criterion	Checking manner
1	Black spot white spot D=(X+Y)/2 Line	(1)  0.2<D≤0.25 N≤1 0.1<D≤0.2 N≤3 D≤0.1 No check (2)  L≤2.0 W≤0.03 N≤2 L≤1.0 W≤0.05 N≤1	Checking at the display state
2	Pin hole D=(A+B)/2 W: segment width	 W≤0.4 D≤0.20 And D≤1/2W N≤1 W>0.4 D≤0.25 And D≤1/3W N≤2 D≤0.05 No check	Checking at the display state
3	Different width of segment	 |a-b|<0.25 or |a-b|≤1/4W No check	Checking at the display state

8. Reliability

8.1 Standard Specification for Reliability of General-purpose LCM

Test Item	Test Condition	Note
High Temperature Operation	50 °C , 240hr	2
Low Temperature Operation	-15°C, 240hr	2
Humidity Operation	40°C,90%RH, 240hr	1,2
High Temperature Store	60°C,240hr.	2
Low Temperature Store	-20°C,240hr	2
thermal shock storage	-20 °C /60 °C,left for 1 hour each temperature, transition time 1 minutes,10 cycles	For module
Mechanical Shock	State 762mm, concrete floor,	For carton box

	1 corner,3edges,6faces, the 1st	
Mechanical Vibration	Vibration per minute: 200vibrations per minute The vibration direction: X,Y,Z direction total 1.5h	For module

Note 1: Condensation of water is not permitted on the module.

Note 2: The module should be inspected after 4 hour storage in normal conditions (15~35°C,45± 20%RH)

8.2 MTTF （Mean-Time-To-Fail）

The LCD is designed to meet the MTTF by 50,000 hours under normal room conditions (25℃, 45± 20%RH,without sun-shine)