

**SPECIFICATION
OF
LCD MODULE
MODULE NO.: HT020SQV003NS**

Customer Approval:

☐ **Accept**

☐ **Reject**

TECHNOLOGY LIMITED	SIGNATURE	DATE
PREPARED BY		
CHECKED BY		
APPROVED BY		

SPEC TITLE

DOCUMENT CONTROL SPECIFICATION

DATE : 2019-05-22

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1. GENERAL DESCRIPTION:

Display & LCD Type: 240* (RGB) *320,TFT-Panel

Viewing Direction: ALL

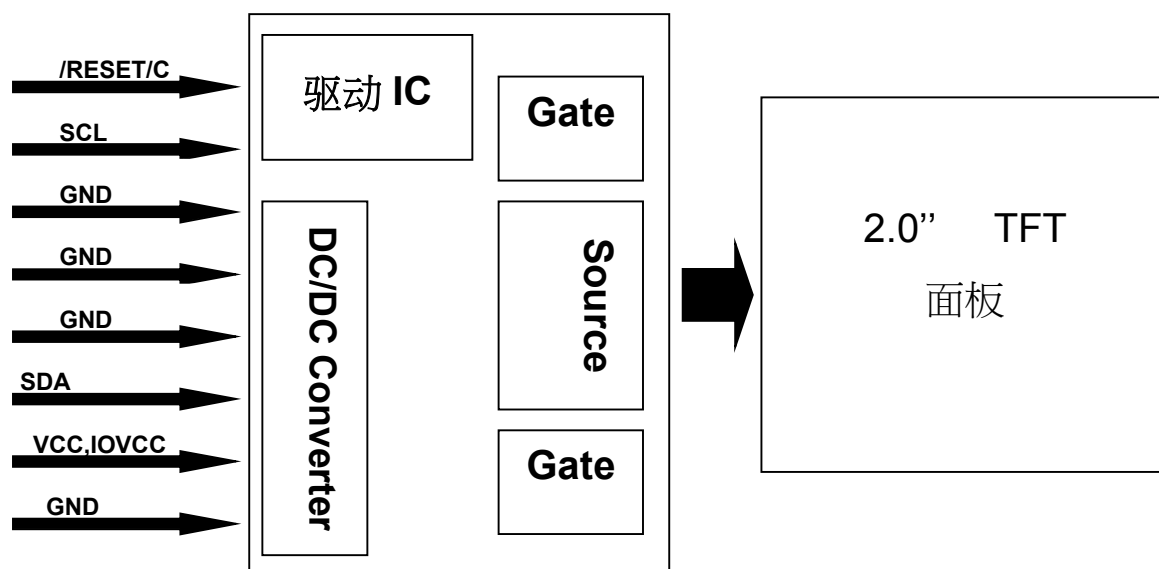
Backlight Type: White LED

2. MECHANICAL SPECIFICATIONS:

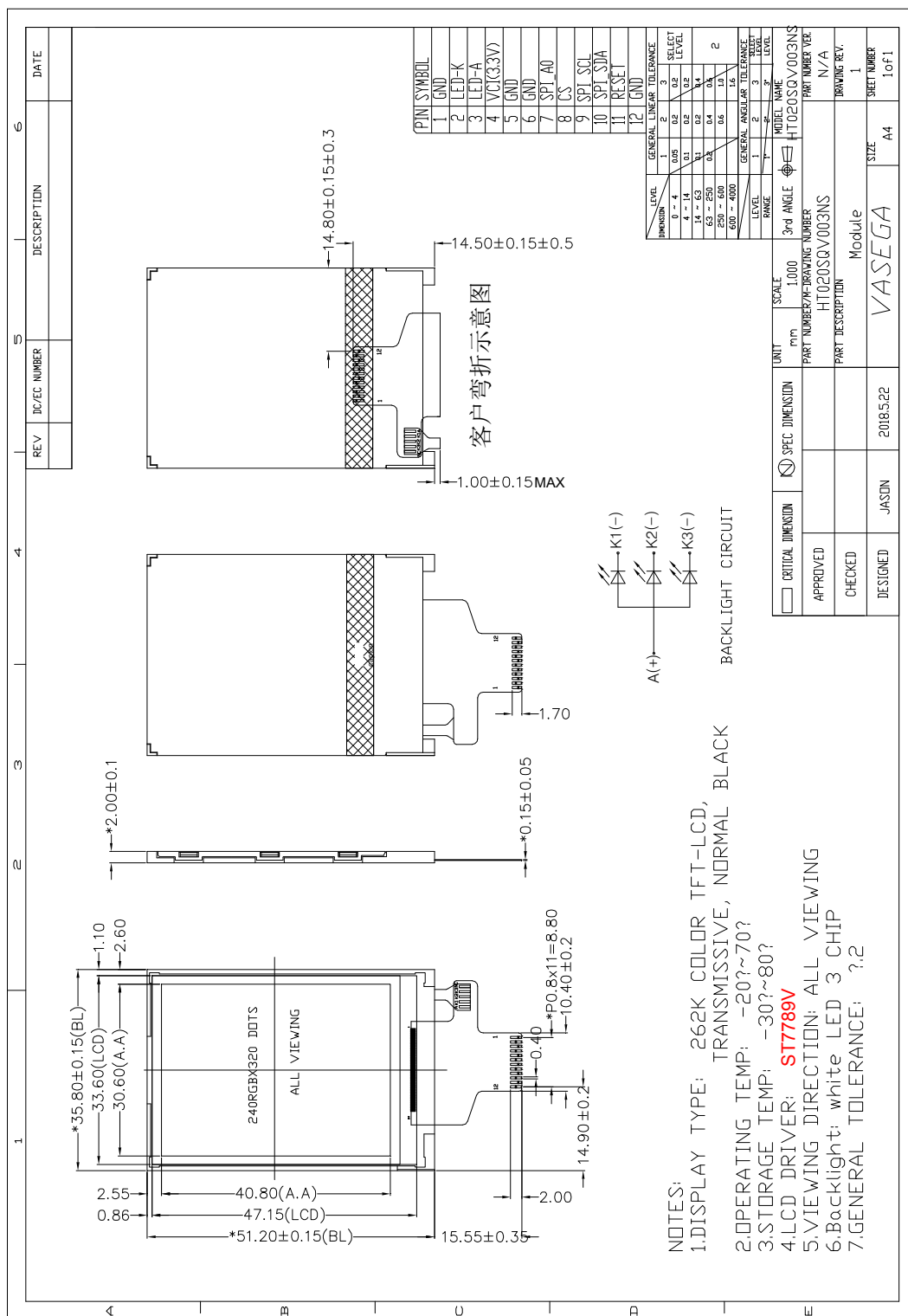
ITEM	SPECIFICATION	UNIT
DISPLAY SIZE	2.0	inch
OUTLINE DIMENSIONS	35.8*51.2*2.0	mm
DRIVER IC	ST7789V	-
INTERFACE TYPE	4-Wire SPI	-

*See attached drawing for details.

3. BLOCK DIAGRAM:



4. DIMENSIONAL OUTLINE:



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5. PIN DESCRIPTION:

NO.	PIN NAME	I/O	Description
1	GND	I	System Ground .
2	LED-K	O	LED Cathode.
3	LED+A	I	LED Anode.
4	VCI3.3V	I	Power Supply 3.3V Voltage.
5	GND	I	System Ground .
6	GND	I	System Ground .
7	SPI_A0	I	Register select signal. - Display data/command selection pin in 4-line serial interface.
8	CS	I	Input pin for chip selection signal. -Chip selection pin Low enable. High disable.
9	SPI_SCL	I	-This pin is used to be serial interface clock. Display Clock input signal
10	SPI_SDA	I	SPI interface input pin. -The data is latched on the rising edge of the SCL signal. Display Data input signal
11	RESET	I	LCM Reset input signal. -This signal will reset the device and it must be applied to properly initialize the chip. -Signal is active low.
12	GND	I	System Ground

Note:

-

6. MAXIMUM ABSOLTE LIMIT:

Item	Symbol	Value	Unit
Power supply voltage for logic	V_{DD}	2.8~3.3	V
Input voltage	V_{in}	$V_{DD}+0.3$	V
Operating temperature	T_{opr}	-20 to 70	°C
Storage temperature	T_{stg}	-30 to 80	°C

Note: Note1: Absolute maximum rating is the limit value beyond which the IC maybe broken.

They do not assure operations.

Note2: Background color changes slightly depending on ambient temperature. This Phenomenon is reversible.

$T_a \leq 70^{\circ}\text{C}$: 75%RH max

$T_a > 70^{\circ}\text{C}$: absolute humidity must be lower than the humidity of 75%RH at 70°C

Note3: T_a at -30°C will be <48hrs, at 80°C will be <120hrs

7.ELECTRICAL CHARACTERISTICS

7-1 DC Characteristics ($V_{DD}=2.8\text{V}, T_a=25^{\circ}\text{C}$)

Item	Symbol	Min	Type	Max	Unit	Test condition
Operating voltage	V_{DD}	2.6	3.3	3.5	V	-
Supply current	I_{DD}	-	-	5	mA	$V_{DD}=2.8\text{V}, T_a=25^{\circ}\text{C}$
Input voltage	V_{IH}	0.8VDD	-	VDD	V	-
	V_{IL}	0	-	0.2VDD	V	
Input leakage current	I_{IL}	-1.0	-	1.0	μA	$V_{IN}=V_{DD}$ or V_{SS}

Note: Voltage greater than above may damage the module.

All voltages are specified relative to $V_{SS}=0\text{V}$.

7-2 Backlight Electrical-optical Characteristics

1. Stander Lamp Styles (Edge Lighting Type):

The LED chips are distributed over the edge light area of the illumination unit, which gives the less power consumption:

2. The Main Advantages of the LED Backlight are as following:

2.1 The brightness of the backlight can simply be adjusted by a resistor or a potentiometer.

3. Data About LED Backlight:

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Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition	Note
Supply Voltage	Vf	3.0	3.2	3.4	V	If=45 mA	-
Supply Current	If	-	45	-	mA	-	-
Reverse Voltage	Vr	-	-	5	V	-	
Power dissipation	Pd	-	288	-	mW	-	
Luminous Intensity for LCM	-	100	-	-	Cd/m ²	If=45mA	-
Uniformity for LCM	-	80	-	-	%	If=45 mA	-
Backlight Color	White						

NOTE:

1. Uniformity = Min/Max * 100%
2. LED life time defined as follows:
The final brightness is at 70% of original brightness;
Measured Method: (X*Y: Light Area);

8. AC CHARACTERISTICS ($V_{DD}=2.8V$, $T_A=25^{\circ}C$)

8.1. Interface : System Bus Read/Write Characteristics.

7.4.3 Serial Interface Characteristics (4-line serial):

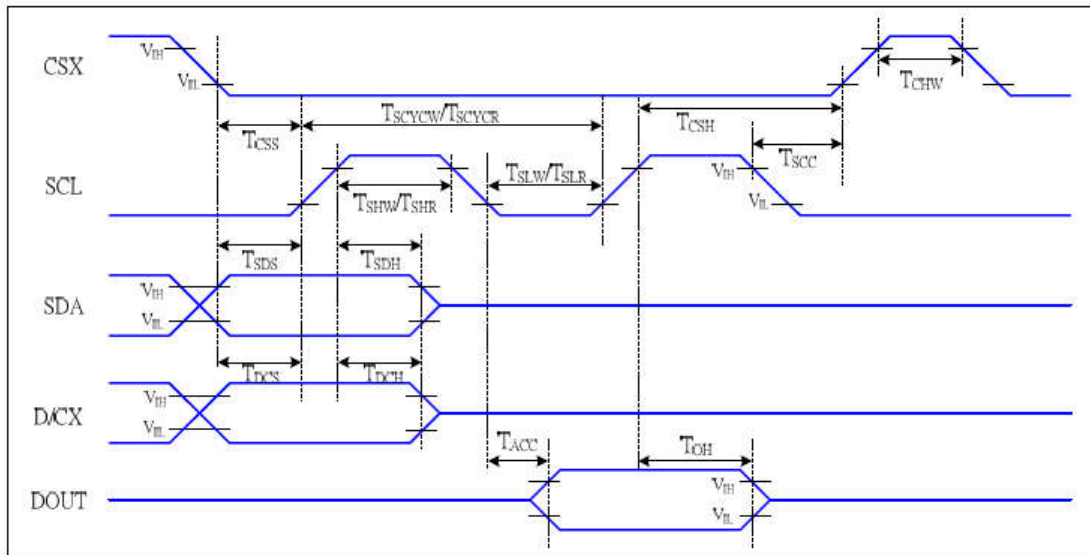


Figure 5 4-line serial Interface Timing Characteristics

$V_{DDI}=1.65$ to $3.3V$, $V_{DD}=2.4$ to $3.3V$, $AGND=DGND=0V$, $T_a=-30$ to $70^{\circ}C$

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	T_{CSS}	Chip select setup time (write)	15		ns	
	T_{CSH}	Chip select hold time (write)	15		ns	
	T_{CSS}	Chip select setup time (read)	60		ns	
	T_{SCC}	Chip select hold time (read)	65		ns	
	T_{CHW}	Chip select "H" pulse width	40		ns	
SCL	T_{SCYCW}	Serial clock cycle (Write)	66		ns	-write command & data ram
	T_{SHW}	SCL "H" pulse width (Write)	15		ns	
	T_{SLW}	SCL "L" pulse width (Write)	15		ns	
	T_{SCYCR}	Serial clock cycle (Read)	150		ns	-read command & data ram
	T_{SHR}	SCL "H" pulse width (Read)	60		ns	
	T_{SLR}	SCL "L" pulse width (Read)	60		ns	
D/CX	T_{DCS}	D/CX setup time	10		ns	
	T_{DCH}	D/CX hold time	10		ns	
SDA (DIN)	T_{SDS}	Data setup time	10		ns	
	T_{SDH}	Data hold time	10		ns	
DOUT	T_{ACC}	Access time	10	50	ns	For maximum $CL=30pF$
	T_{OH}	Output disable time	15	50	ns	For minimum $CL=8pF$

Table 6 4-line serial Interface Characteristics

Note : The rising time and falling time (T_r , T_f) of input signal are specified at 15 ns or less. Logic high and low levels are specified as

8.2 Drive LCM Initial:

/******

* Function Name : SPI Send data

* Description : SPI Send 8 bit data

* Input : byte

* Output : None

* Return : None

*****/

void LCD_WriteByteSPI(unsigned char byte)

{

SPI_SDA = (byte >> 7); SPI_SCL_CLR; SPI_SCL_SET;
SPI_SDA = (byte >> 6); SPI_SCL_CLR; SPI_SCL_SET;
SPI_SDA = (byte >> 5); SPI_SCL_CLR; SPI_SCL_SET;
SPI_SDA = (byte >> 4); SPI_SCL_CLR; SPI_SCL_SET;
SPI_SDA = (byte >> 3); SPI_SCL_CLR; SPI_SCL_SET;
SPI_SDA = (byte >> 2); SPI_SCL_CLR; SPI_SCL_SET;
SPI_SDA = (byte >> 1); SPI_SCL_CLR; SPI_SCL_SET;
SPI_SDA = (byte >> 0); SPI_SCL_CLR; SPI_SCL_SET;

}

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/******4W-SPI******/

void SPI4W_WriteRegIndex(u16 Index)

{

LCD_CS_CLR;

SPI_A0_CLR;

SPI_SCL_CLR;

SPI_SDA =0;

//////////

SPI_SDA = (Index >> 7); SPI_SCL_CLR; SPI_SCL_SET;

SPI_SDA = (Index >> 6); SPI_SCL_CLR; SPI_SCL_SET;

SPI_SDA = (Index >> 5); SPI_SCL_CLR; SPI_SCL_SET;

SPI_SDA = (Index >> 4); SPI_SCL_CLR; SPI_SCL_SET;

SPI_SDA = (Index >> 3); SPI_SCL_CLR; SPI_SCL_SET;

SPI_SDA = (Index >> 2); SPI_SCL_CLR; SPI_SCL_SET;

SPI_SDA = (Index >> 1); SPI_SCL_CLR; SPI_SCL_SET;

SPI_SDA = (Index >> 0); SPI_SCL_CLR; SPI_SCL_SET;

LCD_CS_SET;

}

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```
void SPI4W_WriteData(u16 dat)
{
    LCD_CS_CLR;
    SPI_A0_SET;

    SPI_SCL_CLR;
    SPI_SDA=0;
    //////////////////////////////////
    SPI_SDA = (dat >> 7);  SPI_SCL_CLR; SPI_SCL_SET;
    SPI_SDA = (dat >> 6);  SPI_SCL_CLR; SPI_SCL_SET;
    SPI_SDA = (dat >> 5);  SPI_SCL_CLR; SPI_SCL_SET;
    SPI_SDA = (dat >> 4);  SPI_SCL_CLR; SPI_SCL_SET;
    SPI_SDA = (dat >> 3);  SPI_SCL_CLR; SPI_SCL_SET;
    SPI_SDA = (dat >> 2);  SPI_SCL_CLR; SPI_SCL_SET;
    SPI_SDA = (dat >> 1);  SPI_SCL_CLR; SPI_SCL_SET;
    SPI_SDA = (dat >> 0);  SPI_SCL_CLR; SPI_SCL_SET;

    LCD_CS_SET;

}
```

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```
void SPI4W_WriteDisplayData(u16 dat)
```

```
{
```

```
    LCD_CS_CLR;
```

```
    SPI_A0_SET;
```

```
    SPI_SDA=1;
```

```
    SPI_SCL_CLR;
```

```
//////////
```

```
    SPI_SDA = (dat >> 15);    SPI_SCL_CLR; SPI_SCL_SET;
```

```
    SPI_SDA = (dat >> 14);    SPI_SCL_CLR; SPI_SCL_SET;
```

```
    SPI_SDA = (dat >> 13);    SPI_SCL_CLR; SPI_SCL_SET;
```

```
    SPI_SDA = (dat >> 12);    SPI_SCL_CLR; SPI_SCL_SET;
```

```
    SPI_SDA = (dat >> 11);    SPI_SCL_CLR; SPI_SCL_SET;
```

```
    SPI_SDA = (dat >> 10);    SPI_SCL_CLR; SPI_SCL_SET;
```

```
    SPI_SDA = (dat >> 9);     SPI_SCL_CLR; SPI_SCL_SET;
```

```
    SPI_SDA = (dat >> 8);     SPI_SCL_CLR; SPI_SCL_SET;
```

```
    SPI_SDA = (dat >> 7);     SPI_SCL_CLR; SPI_SCL_SET;
```

```
    SPI_SDA = (dat >> 6);     SPI_SCL_CLR; SPI_SCL_SET;
```

```
    SPI_SDA = (dat >> 5);     SPI_SCL_CLR; SPI_SCL_SET;
```

```
    SPI_SDA = (dat >> 4);     SPI_SCL_CLR; SPI_SCL_SET;
```

```
    SPI_SDA = (dat >> 3);     SPI_SCL_CLR; SPI_SCL_SET;
```

```
    SPI_SDA = (dat >> 2);     SPI_SCL_CLR; SPI_SCL_SET;
```

```
    SPI_SDA = (dat >> 1);     SPI_SCL_CLR; SPI_SCL_SET;
```

```
    SPI_SDA = (dat >> 0);     SPI_SCL_CLR; SPI_SCL_SET;
```

```
    LCD_CS_SET;
```

```
}
```

```
/******4W-SPI END *****/
```

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/*

*/

* Function Name : LCD_WR_REG
* Description : Write regval to REG
* Input : regval
* Output : None
* Return : None

*/

void LCD_WR_8REG(u16 regval) //8BIT REG

{

SPI4W_WriteRegIndex(regval);

}

/*

*/

* Function Name : LCD_WR_DATA
* Description : 写 LCD 数据函数,data:要写入的值
* Input : data
* Output : None
* Return : None

*/

void LCD_WR_8DATA(u16 data) //初始化时对应: 8BIT DATA

{

//LCD->LCD_RAM=data;

SPI4W_WriteData(data);

}

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/*
* Function Name : LCD_Reset
* Description : 对 L C D 进行复位操作
* Input : None
* Output : None
* Return : None
***/

```
void LCD_RESET(void)
{
    GPIO_SetBits(GPIOD, GPIO_Pin_13 );
    delay_ms(130);
    GPIO_ResetBits(GPIOD, GPIO_Pin_13);
    delay_ms(150);
    GPIO_SetBits(GPIOD, GPIO_Pin_13 );
    delay_ms(130);
}
```

/*
* Function Name : LCD_WriteRAM
* Description : LCD 写 GRAM 寄存器函数
* Input : RGB_Code:颜色值
* Output : None
* Return : None
***/

```
void LCD_WriteRAM(u16 RGB_Code)
{
// LCD->LCD_RAM = RGB_Code;//写十六位 GRAM
    SPI4W_WriteDisplayData(RGB_Code);
}
```

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////////void LCD_Init(void)////////

void ST7789S_HSD20IPS_Initial(void)

{

delay_ms(120); //ms

LCD_WR_8REG(0x11); //Sleep out

delay_ms(120); //Delay 120ms

LCD_WR_8REG(0x36);

LCD_WR_8DATA(0x00);

LCD_WR_8REG(0x3A);

LCD_WR_8DATA(0x55);

LCD_WR_8REG(0x21);

LCD_WR_8REG(0xB2);

LCD_WR_8DATA(0x05);

LCD_WR_8DATA(0x05);

LCD_WR_8DATA(0x00);

LCD_WR_8DATA(0x33);

LCD_WR_8DATA(0x33);

LCD_WR_8REG(0xB7);

LCD_WR_8DATA(0x75);

LCD_WR_8REG(0xBB);

LCD_WR_8DATA(0x22);

LCD_WR_8REG(0xC0);

LCD_WR_8DATA(0x2C);

LCD_WR_8REG(0xC2);

LCD_WR_8DATA(0x01);

LCD_WR_8REG(0xC3);

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LCD_WR_8DATA(0x13);

LCD_WR_8REG(0xC4);
LCD_WR_8DATA(0x20);

LCD_WR_8REG(0xC6);
LCD_WR_8DATA(0x11);

LCD_WR_8REG(0xD0);
LCD_WR_8DATA(0xA4);
LCD_WR_8DATA(0xA1);

LCD_WR_8REG(0xD6);
LCD_WR_8DATA(0xA1);

LCD_WR_8REG(0xE0);
LCD_WR_8DATA(0xD0);
LCD_WR_8DATA(0x05);
LCD_WR_8DATA(0x0A);
LCD_WR_8DATA(0x09);
LCD_WR_8DATA(0x08);
LCD_WR_8DATA(0x05);
LCD_WR_8DATA(0x2E);
LCD_WR_8DATA(0x44);
LCD_WR_8DATA(0x45);
LCD_WR_8DATA(0x0F);
LCD_WR_8DATA(0x17);
LCD_WR_8DATA(0x16);
LCD_WR_8DATA(0x2B);
LCD_WR_8DATA(0x33);

LCD_WR_8REG(0xE1);
LCD_WR_8DATA(0xD0);
LCD_WR_8DATA(0x05);
LCD_WR_8DATA(0x0A);
LCD_WR_8DATA(0x09);
LCD_WR_8DATA(0x08);
LCD_WR_8DATA(0x05);

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LCD_WR_8DATA(0x2E);
LCD_WR_8DATA(0x43);
LCD_WR_8DATA(0x45);
LCD_WR_8DATA(0x0F);
LCD_WR_8DATA(0x16);
LCD_WR_8DATA(0x16);
LCD_WR_8DATA(0x2B);
LCD_WR_8DATA(0x33);

LCD_WR_8REG(0x29); //Display on

}

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9. OPTICAL CHARACTERISTICS:

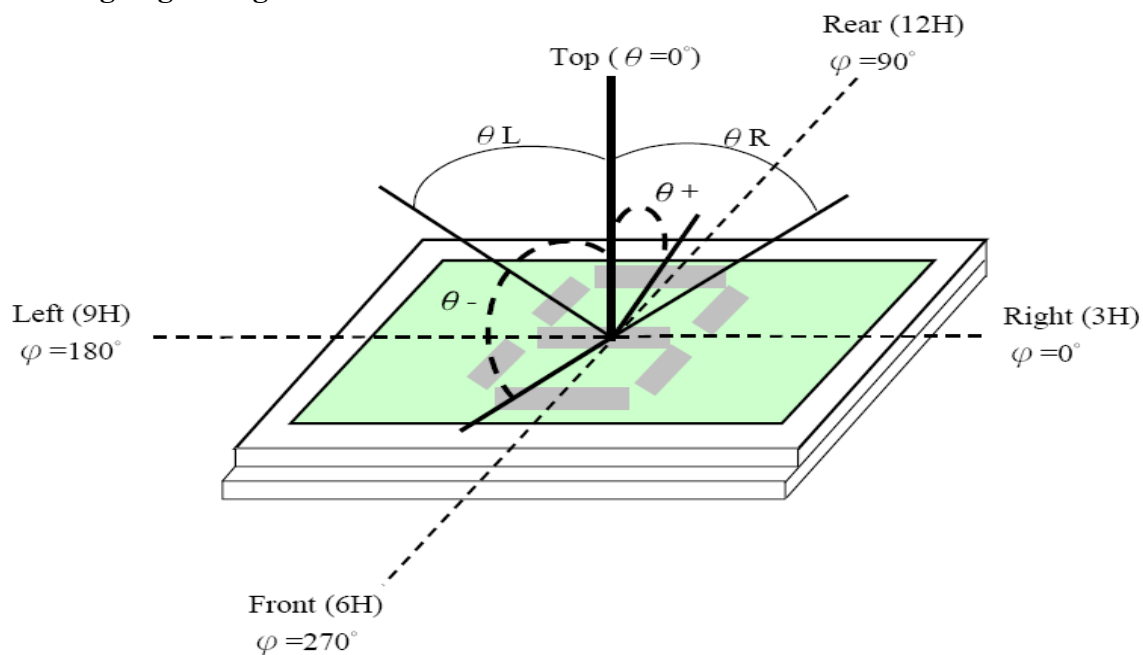
No.	ITEM		Symbol	Conditions	Specification			Unit	Note
					Min	Typ	Max		
1	Response Time		Tr+Tf	25℃	-	15	-	Ms	(1)(2)
2	Transmittance (With PL)		T(%)	-	-	7.1	-	-	-
3	Contrast Rate		Cr	$\theta=0$, Normal viewing angle	-	250	-	-	(1)(3)
4	Viewing Angle	Hor.	θR	CR>10	-	-	-	Deg	-
			θL		-	-	-		
		Ver.	$\theta +$		-	-	-		
			$\theta -$		-	-	-		

Measure Conditions:

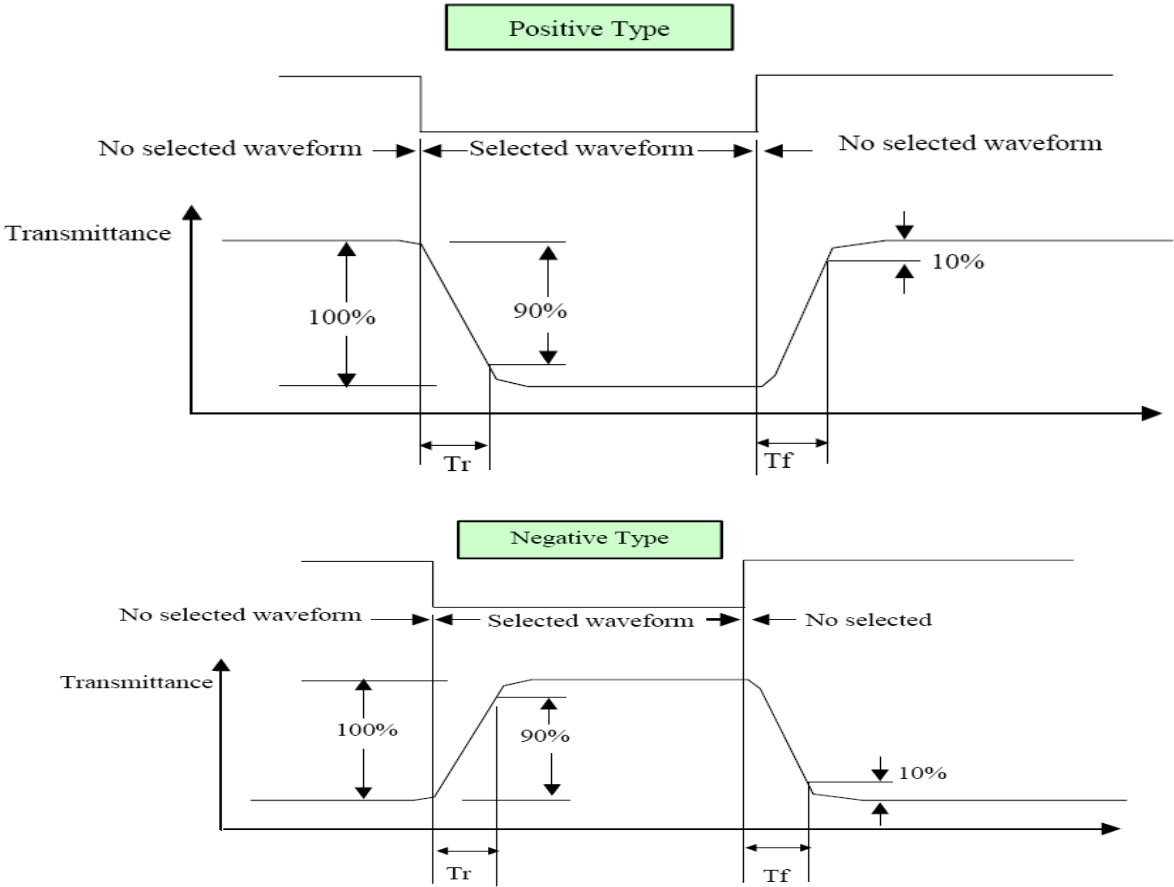
1. Measure surrounding : dark room;
2. Ambient temperature: 25±2℃;
3. 30min.warm-up time.

Note Definition:

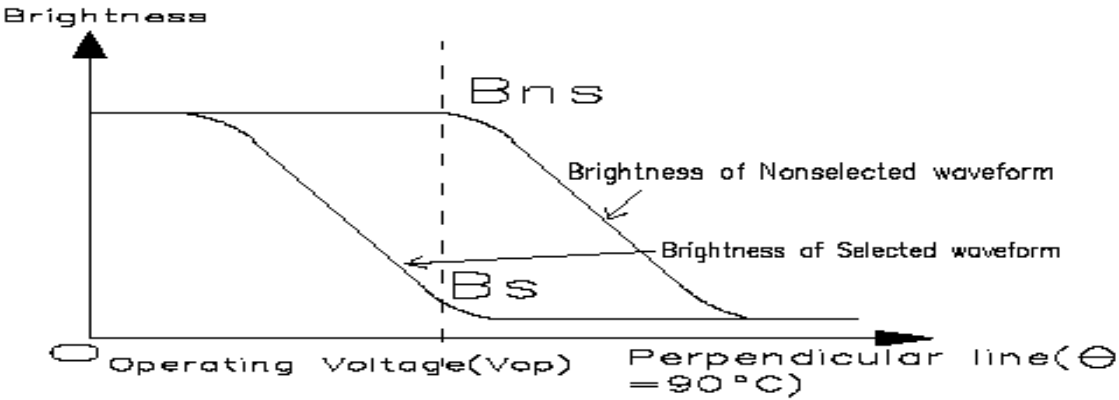
Note(1)Viewing angle range:



Note (2)Response Time:



Note(3)Contrast Ratio Definition:



Luminance with all pixel white

Contrast Ratio (Cr)=

Luminance with all pixel black

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10.PACKAGE.

TBD

11. STANDARD SPECIFICATION FOR RELIABILITY:

Item	Condition	Time (hrs)	Assessment
High temp. Storage	80°C	120	No abnormalities in functions and appearance
High temp. Operating	70°C	120	
Low temp. Storage	-30°C	120	
Low temp. Operating	-20°C	120	
Humidity	40°C/ 90%RH	120	
Thermal Shock Temp. Cycle	-20°C ← 25°C → 70°C (0.5 hour ← 5 min → 0.5 hour)	10cycles	

Functions, performance, appearance, etc. shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature (25±10°C), normal humidity (45±20% RH), and in area not exposed to direct sun light. (Life time of backlight, please refer to Data about backlight.)

Testing Conditions and Inspection Criteria:

For the final test the testing sample must be stored at room temperature for 24 hours, after the tests listed in up Table, Standard specifications for Reliability have been executed in order to ensure stability.

Item	Test Model	In section Criteria
Current Consumption	Refer To Specification	The current consumption should conform to the product specification.
Contrast	Refer To Specification	After the tests have been executed, the contrast must be larger than half of its initial value prior to the tests.
Appearance	Visual inspection	Defect free.

12.SPECIFICATION OF QUALITY ASSURANCE:

12.1 Purpose

This standard for Quality Assurance should affirm the quality of LCD Module products to supply to purchaser .

12.2 Standard for Quality Test

a. Inspection:

Before delivering, the supplier should take the following tests, and affirm the quality of product.

b. Electro-Optical Characteristics:

According to the individual specification to test the product.

c. Test of Appearance Characteristics:

According to the individual specification to test the product.

d. Test of Reliability Characteristics:

According to the definition of reliability on the specification for testing products.

e. Delivery Test:

Before delivering, the supplier should take the delivery test.

(i) Test method: According to MIL-STD105E.General Inspection Level II take a single time.

(ii) The defects classify of AQL as following:

Major defect: AQL = 0.65

Minor defect: AQL = 2.5

Total defects: AQL = 2.5

12-3. Nonconforming Analysis & Deal With Manners

a. Nonconforming Analysis:

(i) Purchaser should supply the detail data of non- conforming sample and the non- conforming.

(ii) After accepting the detail data from purchaser, the analysis of nonconforming should be finished in two weeks.

(iii) If supplier can not finish analysis on time, must announce purchaser before two weeks.

b. Disposition of nonconforming:

(i) If find any product defect of supplier during assembly time, supplier must change the good product for every defect after recognition.

(ii) Both supplier and customer should analyze the reason and discuss the disposition of nonconforming when the reason of nonconforming is not sure.

12-4. Agreement items

Both sides should discuss together when the following problems happen.

a. There is any problem of standard of quality assurance, and both sides think that it must be modified.

b. There is any argument item which does not record in the standard of quality assurance.

c. Any other special problem.

12-5 Standard of The Product Appearance Test

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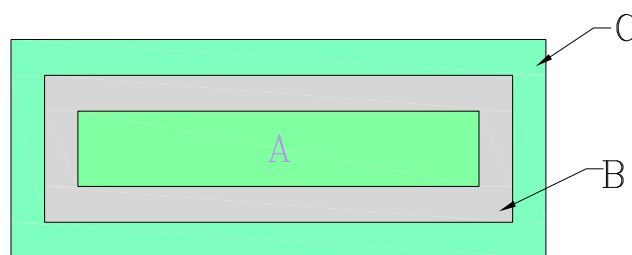
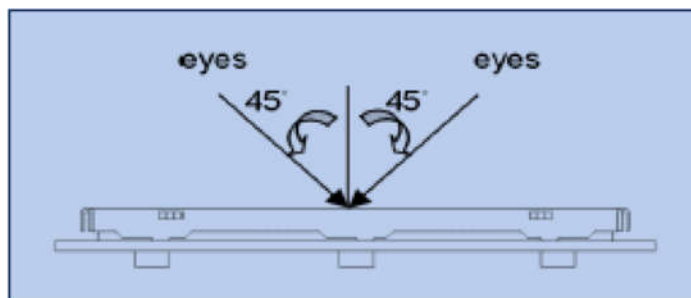
a. Manner of appearance test: This specification should be applied for both light on and off situation.

(i) The test must be under 20W × 2 or 40W fluorescent light, and the distance of view must be at 30±5cm.

(ii) When test the model of transmissive product must add the reflective plate.

(iii) The test direction is base on about around 10° of vertical line (Left graph)

(iiii) Temperature: 25±5℃ Humidity: 65±10%RH



(iv) Definition of area (Right graph)

A. Area: Viewing area. B. Area: Out of viewing area.(Outside viewing area)

b. Basic principle:

(i) It will accord to the AQL when the standard can not be described.

(ii) The sample of the lowest acceptable quality level must be discussed by both supplier and customer when any dispute happened.

(iii) Must add new item on time when it is necessary.

c. Standard of inspection: (Unit: mm)

Allowable limits defined in follow Dot defect Table should be met for each white, black , R, G, B raster. The limits apply to the entire area. Missing white in 60% or more of typical (one color, R or G or B) pixel aperture is defined as a bright defect, less than 60% is acceptable .Black spot in 60% or more of typical pixel aperture is defined as a dark defect, less than 60% is acceptable.

Dot defect table:

Item		White dot defect	Black dot defect	Total
1	Defect counts	3	3	3
2	Combined defect Counts	No combined dot defect allowed. Two Single dot defect that within 5mm during each dot defect should becounated as combined dot defect.		

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12-6 Inspection specification

AQL inspection standard

Sampling method: MIL-STD-105E, Level II, single sampling

Classify	Item		Note	AQL
Major	Display state	Short or open circuit	1	0.65
		Contrast defect (dim, ghost)		
		LC leakage		
		Flickering		
		No display		
		Wrong viewing direction	2	
		Wrong Back-light	7	
	Non-display	Flat cable or pin reverse	9	
		Wrong or missing component	10	
Minor	Display state	Background color deviation	2	2.5
		Black spot and dust	3	
		Line defect	4	
		Scratch		
		Rainbow	5	
		Pin hole	6	
	Polarizer	Bubble and foreign material	3	
		Scratch	4	
	PCB,FPC	Scratch	4	
	Soldering	Poor connection	8	
	Wire	Poor connection	9	
	LCD	CHIP OUT	11	

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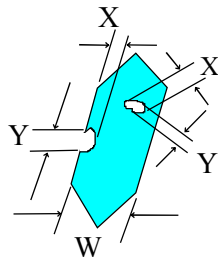
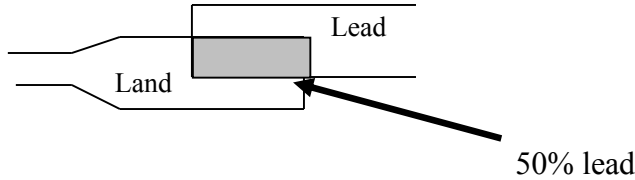
Note on defect classification:

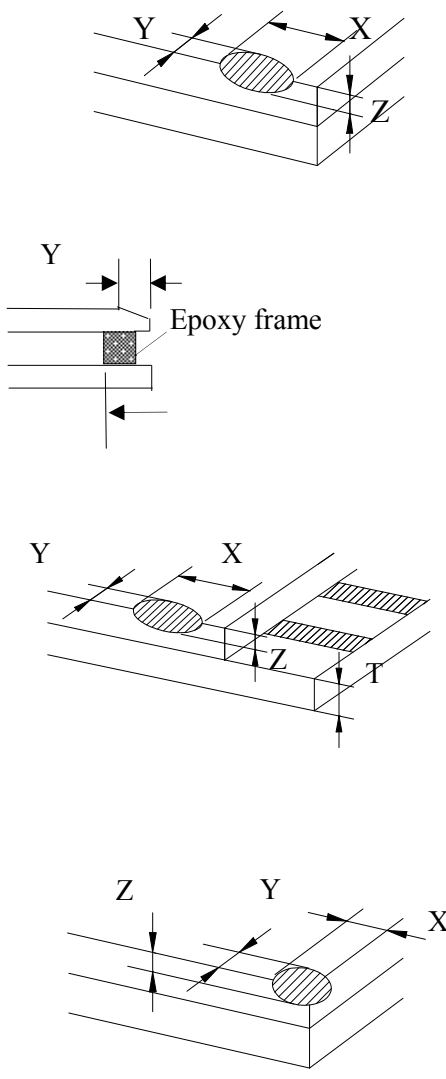
No.	Item	Criterion																	
1	Short or open circuit	Not allow																	
	LC leakage																		
	Flickering																		
	No display																		
	Wrong viewing direction																		
	Wrong Back-light																		
2	Contrast defect	Refer to approval sample																	
	Background color deviation																		
3	Point defect, Black spot, dust (incl. Polarizer) ex.: dirt under polarizer, Pinhole of reflector ,glass scratch, dirt under glass,scratch on polarizer $\phi = (X+Y)/2$	<table><tr><td>Point Size</td><td>Acceptable Qty.</td></tr><tr><td>$\phi \leq 0.10$</td><td>Disregard</td></tr><tr><td>$0.10 < \phi \leq 0.20$</td><td>3</td></tr><tr><td>$0.20 < \phi \leq 0.25$</td><td>2</td></tr><tr><td>$0.25 < \phi \leq 0.30$</td><td>1</td></tr><tr><td>$\phi > 0.30$</td><td>0</td></tr></table> <p>Unit: mm</p>	Point Size	Acceptable Qty.	$\phi \leq 0.10$	Disregard	$0.10 < \phi \leq 0.20$	3	$0.20 < \phi \leq 0.25$	2	$0.25 < \phi \leq 0.30$	1	$\phi > 0.30$	0					
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4	Line defect	<table><tr><td>Line L</td><td>Line W</td><td>Acceptable Qty.</td></tr><tr><td>---</td><td>$0.015 \geq W$</td><td>Disregard</td></tr><tr><td>$3.0 \geq L$</td><td>$0.03 \geq W$</td><td rowspan="2">2</td></tr><tr><td>$2.0 \geq L$</td><td>$0.05 \geq W$</td></tr><tr><td>$1.0 \geq L$</td><td>$0.1 > W$</td><td>1</td></tr><tr><td>---</td><td>$0.05 < W$</td><td>Applied as point defect</td></tr></table> <p>Unit: mm</p>	Line L	Line W	Acceptable Qty.	---	$0.015 \geq W$	Disregard	$3.0 \geq L$	$0.03 \geq W$	2	$2.0 \geq L$	$0.05 \geq W$	$1.0 \geq L$	$0.1 > W$	1	---	$0.05 < W$	Applied as point defect
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$1.0 \geq L$	$0.1 > W$	1																	
---	$0.05 < W$	Applied as point defect																	
5	Rainbow	Not more than two color changes across the viewing area																	
No.	Item	Criterion																	

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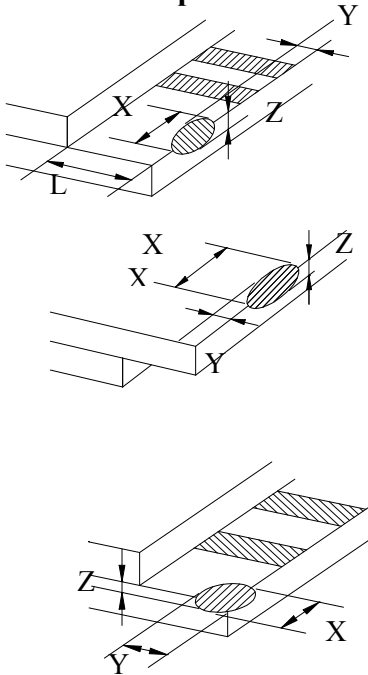
6	<p>Segment pattern W = Segment width $\phi = (X+Y)/2$</p>	<p>(1) Pin hole $\phi < 0.15\text{mm}$ is acceptable.</p> <div>  <table border="1" data-bbox="967 450 1430 642"> <tr> <th>Point Size</th> <th>Acceptable Qty</th> </tr> <tr> <td>$\phi \leq 1/4W$</td> <td>Disregard</td> </tr> <tr> <td>$1/4W < \phi \leq 1/2W$</td> <td>1</td> </tr> <tr> <td>$\phi > 1/2W$</td> <td>0</td> </tr> </table> <p>Unit: mm</p> </div>	Point Size	Acceptable Qty	$\phi \leq 1/4W$	Disregard	$1/4W < \phi \leq 1/2W$	1	$\phi > 1/2W$	0
Point Size	Acceptable Qty									
$\phi \leq 1/4W$	Disregard									
$1/4W < \phi \leq 1/2W$	1									
$\phi > 1/2W$	0									
7	Back-light	<p>(1) The color of backlight should correspond its specification. (2) Not allow flickering</p>								
8	Soldering	<p>(1) Not allow heavy dirty and solder ball on PCB or FPC. (The size of dirty refer to point and dust defect) (2) Over 50% of lead should be soldered on Land.</p> <div>  </div>								
9	Wire	<p>(1) Copper wire should not be rusted (2) Not allow crack on copper wire connection. (3) Not allow reversing the position of the flat cable. (4) Not allow exposed copper wire inside the flat cable.</p>								
10	PCB,FPC	<p>(1) Not allow screw rust or damage. (2) Not allow missing or wrong putting of component.</p>								

11	LCD	<div>2.1.1 chip on the surface</div>  <p>Note: A:LCD Length</p> <table border="1"> <thead> <tr> <th>X</th><th>Y</th><th>Z</th></tr> </thead> <tbody> <tr> <td>>1/8A</td><td>≤0.3mm</td><td>≤1/2T</td></tr> <tr> <td rowspan="2">≤1/8A</td><td>Not enter into epoxy frame</td><td>≤T</td></tr> <tr> <td>Not enter into the inner edge of epoxy</td><td>≤1/2T</td></tr> </tbody> </table>	X	Y	Z	>1/8A	≤0.3mm	≤1/2T	≤1/8A	Not enter into epoxy frame	≤T	Not enter into the inner edge of epoxy	≤1/2T
X	Y	Z											
>1/8A	≤0.3mm	≤1/2T											
≤1/8A	Not enter into epoxy frame	≤T											
	Not enter into the inner edge of epoxy	≤1/2T											

11

LCD

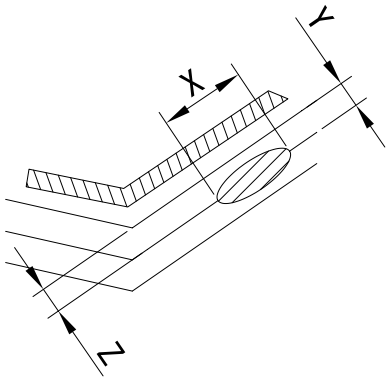
2.1.2chip on the terminal



X	Y	Z
>1/8A	≤0.3mm	≤1/2T
≤1/8A	≤1/2L	≤T
≤1/8A&≤1mm	≤L	≤T
≤1/8A&≤2mm	≤L	≤1/2T

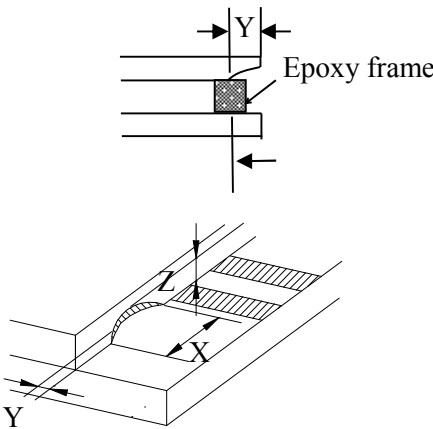
Note: A:LCD Length.
the distance between crack and contact pad must be greater than the width of 1st contact pad.

2.1.3chip out on between side



11

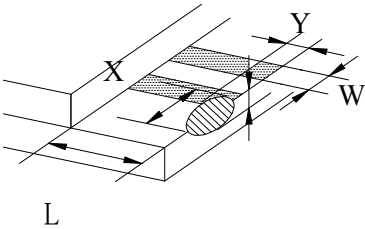
LCD



X	Y	Z
$\leq 1/8A$	Not enter into epoxy frame	$Z \leq 2T$
	Not enter into 1/2 epoxy frame	$Z \leq 1/2T$

Note: A : LCD Length

2.1.4 including corner chip and side chip



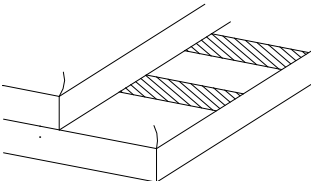
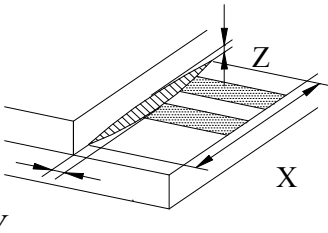
Note: A:LCD Length

X	Y	Z
$>1/8A$	$\leq 1/6L$	$\leq 1/2T$
$\leq 1/8A$	$\leq 1/3L$	
$\leq 1/4W$	$\leq 2/3L$	

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11	LCD	<p>2.2 Chip out</p>  <ol style="list-style-type: none"> 1) Chip out is that crackles extend to inner edge. 2) Crackles round epoxy frame will be rejected. 3) Chip out on the terminal will be rejected: $Z=T$ length $>1\text{mm}$ or $Z<T$ length $>2\text{mm}$ 4) The chip out at ITO will be rejected. <p>2.3 Poor cutting</p>  <table border="1" data-bbox="676 1032 1155 1279"> <thead> <tr> <th>X</th><th>Y</th><th>Z</th></tr> </thead> <tbody> <tr> <td>$>1/8$ A</td><td>≤ 0.3</td><td>$\leq 1/2T$</td></tr> <tr> <td>$\leq 1/8$ A</td><td>According to drawing</td><td>$1/2T \leq Z \leq T$</td></tr> </tbody> </table> <p style="text-align: right;">Note : A:</p> <p>LCD Length.</p>	X	Y	Z	$>1/8$ A	≤ 0.3	$\leq 1/2T$	$\leq 1/8$ A	According to drawing	$1/2T \leq Z \leq T$
X	Y	Z									
$>1/8$ A	≤ 0.3	$\leq 1/2T$									
$\leq 1/8$ A	According to drawing	$1/2T \leq Z \leq T$									
12	SMT	<p>According to the <Acceptable of electronic assemblies> IPC-A-610C class 2 stander. Component missing or function defect are Major defect ,the others are Minor defect.</p>									

Any one out of the specification will be rejected.

13. GENERAL PRECAUTIONS

(1) Mounting Method

The panel of the LCD Module consists of two thin glass plates with polarizers which easily get damaged since the Module is fixed by utilizing fitting holes in the printed circuit board. Extreme care should be taken when handling the LCD Modules.

(2) Caution of LCD handling & cleaning

When cleaning the display surface, use soft cloth with solvent (recommended below) and wipe lightly.

- Isopropyl alcohol
- Ethyl alcohol
- Trichlorotrifluoroethane

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface. Do not use the following solvent:

- Water
- Ketone
- Aromatics

(3) Caution against static charge

The LCD Module use C-MOS LSI drivers, so we recommend that you connect any unused input terminal to VDD or VSS, do not input any signals before power is turned on. And ground your body, Work/assembly table. And assembly equipment to protect against static electricity.

(4) Packaging

Modules use LCD elements, and must be treated as such. Avoid intense shock and falls from a height.

- To prevent modules from degradation. Do not operate or store them exposed directly to sunshine or high temperature/humidity.

(5) Caution for operation

- It is indispensable to drive LCD's within the specified voltage limit since the higher voltage than the limit shorten LCD life. An electrochemical reaction due to direct current causes LCD deterioration, Avoid the use of direct current drive.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them.

However those phenomena do not mean malfunction or out of order with LCD's which will come back in the specified operating temperature range.

- If the display area is pushed hard during operation, some font will be abnormally displayed but it

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resumes normal condition after turning off once.

- As light dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.

Usage under the relative condition of 40°C, 50%RH or less is required.

(6) Storage

In the case of storing for a long period of time (for instance, for years) for the purpose or replacement use, The following ways are recommended.

- Storage in a polyethylene bag with sealed so as not to enter fresh air outside in it, And with no desiccant.

- Placing in a dark place where neither exposure to direct sunlight nor light is.

Keeping temperature in the specified storage temperature range.

- Storing with no touch on polarizer surface by the anything else. (It is recommended to store them as they have been contained in the inner container at the time of delivery)

(7) Safety

- It is recommendable to crash damaged or unnecessary LCD into pieces and wash off liquid crystal by using solvents such as acetone and ethanol which should be burned up later.

- When any liquid crystal leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water.

- END -