PRODUCT SPECIFICATION

128*64 DOTS LCD MODULE
MODEL: G1206ZDTRNFG-B2 Ver:1.2

< ◇> Preliminary Specification

< ◆> Finally Specification

CUSTOMER'S APPROVAL	
CUSTOMER :	
SIGNATURE:	DATE:

APPROVED BY	PM REVIEWED	PD REVIEWED	PREPARED BY

Revision Status

Version	Revise Date	Page	Content	Modified By
Ver 1.0	2016-02-01		First Issued	
Ver 1.1	2018-02-11		Modify Sample NO.,Polarizer mode & IDD	
Ver 1.2	2018-03-19		Add Initialization Program	

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1. Technology Description

BCD (Bi-stable Cholesteric Display) is a sunlight readable reflective LCD with extremely low power consumption characteristics. Due to the non-volatile memory feature of the technology, zero power is required to retain the image of the display. Energy is only required to change the displayed image. No backlighting is required, only ambient lighting from the surrounding is required. Readability when under direct sunlight is excellent and good contrast from viewing at very wide angles are possible.

2. Typical Applications

This module is intended for general purpose graphic and character display applications. Suggested uses include instrumentation, remote control, electronic product or price label, point of sale display, general purpose indoor or outdoor signage and information display.

3. General Description

The features of LCD are as follows

* Passive matrix bistable cholesteric LCD graphic module
* Color : Black & Yellow
* Display mode :VA
* Driver/Controller IC :SSD1603
* Interface Input Data : 4-wires Serial Interface
* Driving scheme : Special BCD driving scheme
* Driving Method : 1/64 Duty,static
* Viewing Direction : Full Viewing
* Backlight : Without
* Polarizer mode : Without polarizer

Yellow character with Black background

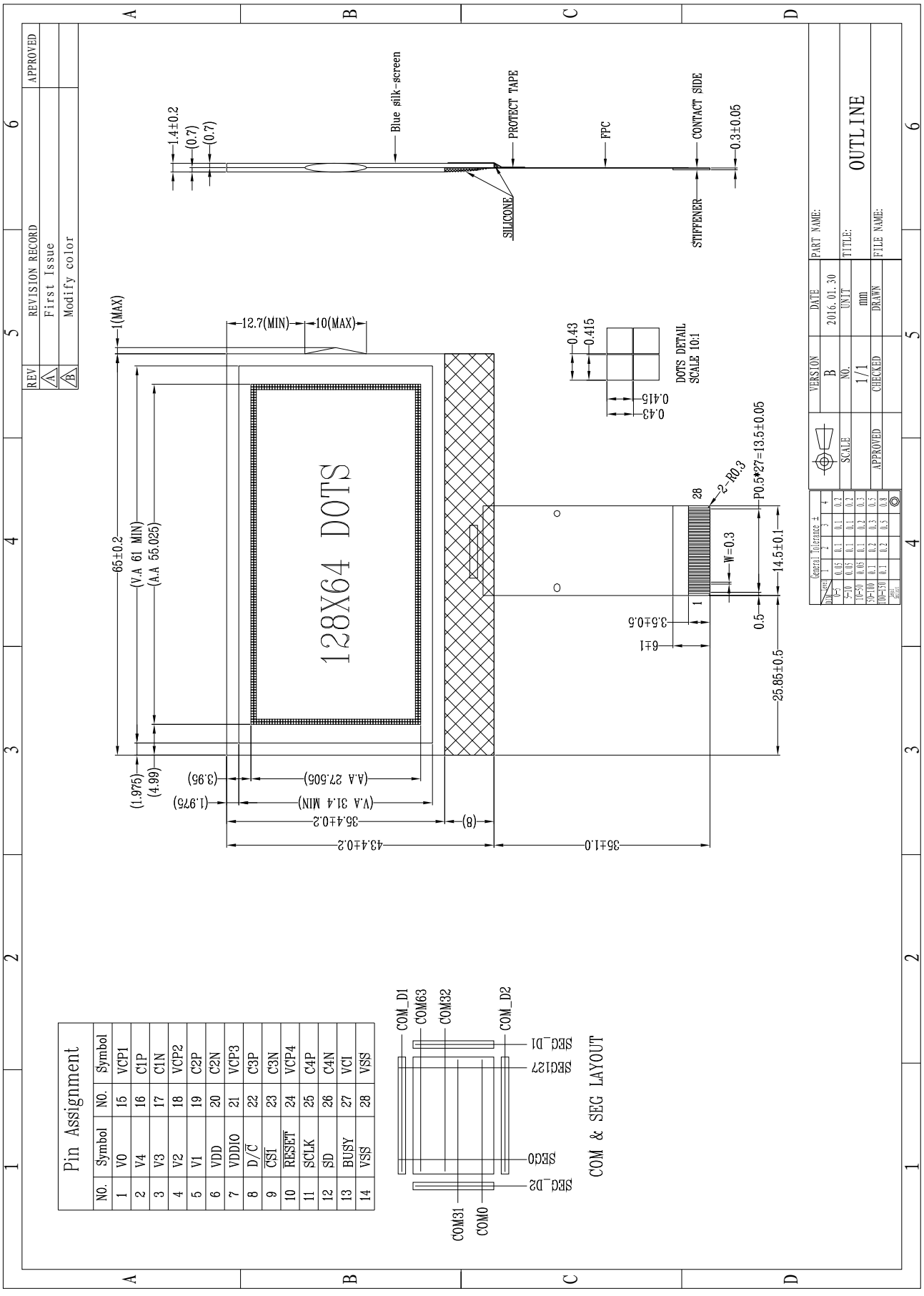
*Sample NO. : -

4. Mechanical Specifications

The mechanical detail is shown in Fig. 1 and summarized in Table 1 below.

Table 1

Item	Specification	Unit
Module Size	65(W) x 43.4(H) x 1.4(D)	mm
Viewing Area	61 MIN(W) x31.4 MIN(H)	mm
Active Area	55.025(W) x 27.505(H)	mm
Number of Dots	128 X64 Dots	-
Dot Size	0.415(W) x 0.415(H)	mm
Dot pitch	0.43(W) x 0.43(H)	mm



Pin Assignment

NO.	Symbol	NO.	Symbol
1	V0	15	VCP1
2	V4	16	C1P
3	V3	17	C1N
4	V2	18	VCP2
5	V1	19	C2P
6	VDD	20	C2N
7	VDDIO	21	VCP3
8	D/$\overline{C}$	22	C3P
9	$\overline{CS}$	23	C3N
10	$\overline{RESET}$	24	VCP4
11	SCLK	25	C4P
12	SD	26	C4N
13	BUSY	27	VCI
14	VSS	28	VSS

Figure 1: Module Specification

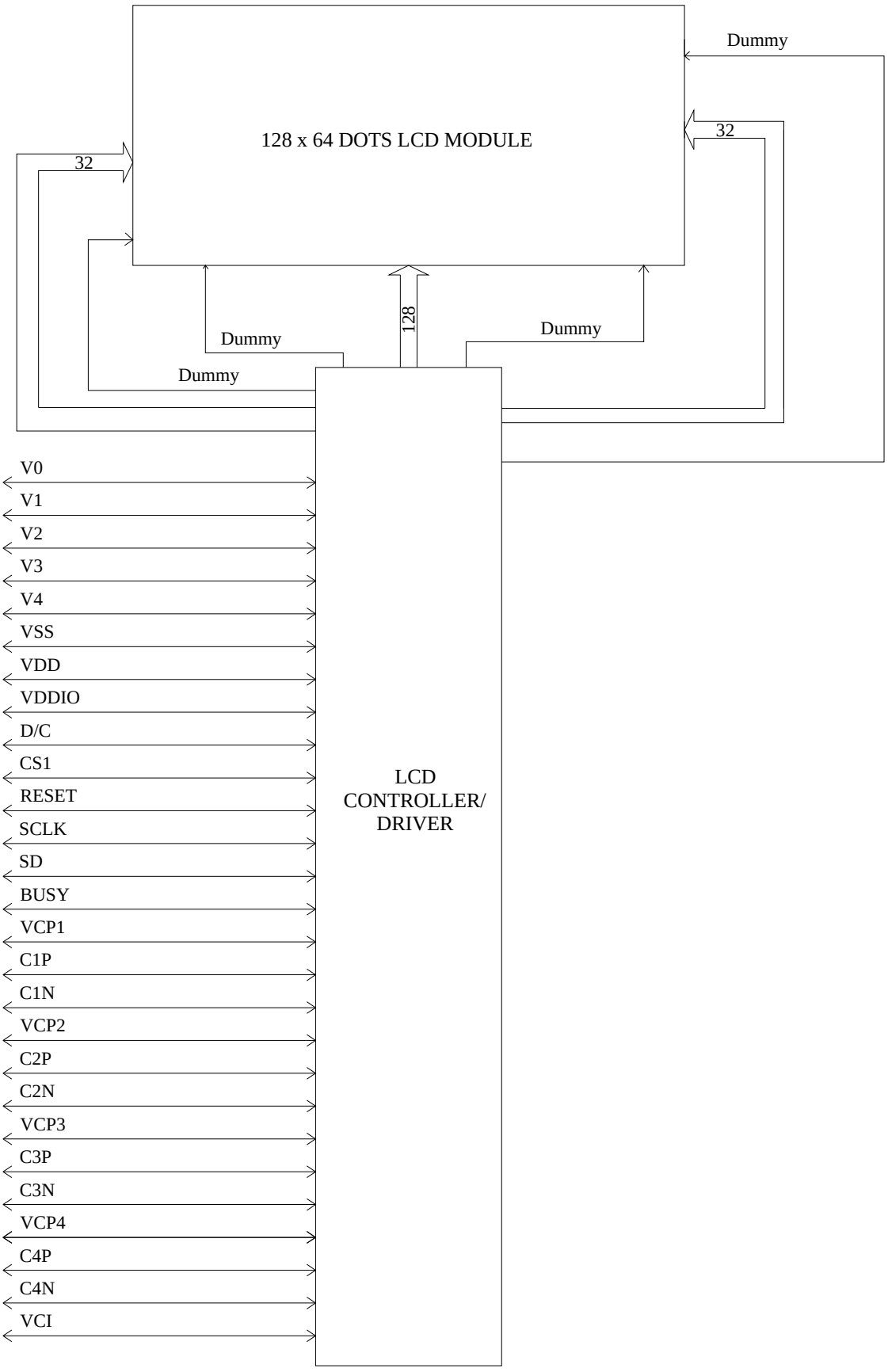


Figure 2: Block Diagram

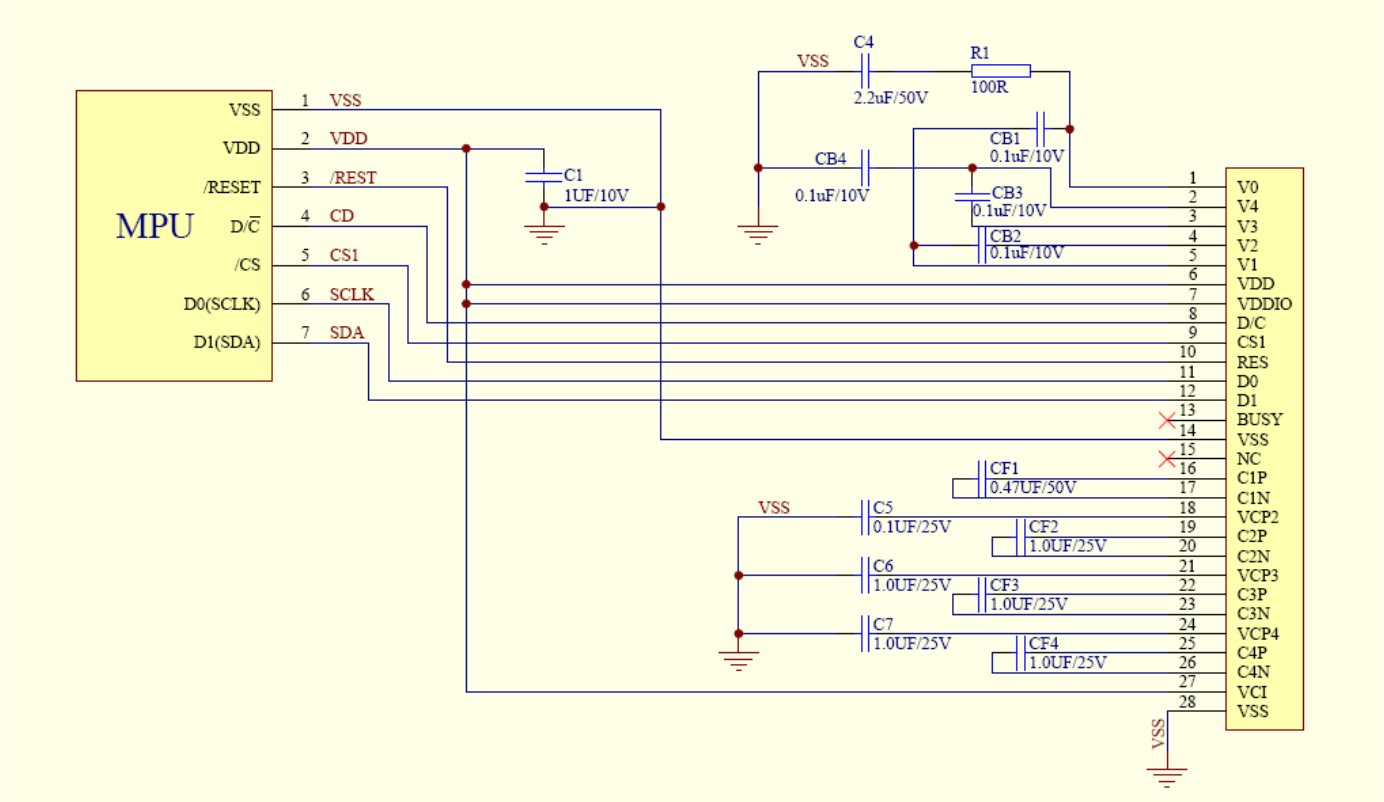


Figure 3: Circuit Diagram

5. Interface Signals

Table 2

PIN NO.	SYMBOL	FUNCIONS
1	V0	It is the high voltage power input pin and panel driving voltage. It should be connected to VCP1.
2	V4	Panel driving voltage. If bias divider is enabled with the presence of V0. The voltage is equal to 1/N * V0, where N is equal to the Bias ratio Setting.
3	V3	Panel driving voltage. If bias divider is enabled with the presence of V0. The voltage is equal to 2/N * V0, where N is equal to the Bias ratio Setting.
4	V2	Panel driving voltage. If bias divider is enabled with the presence of V0. The voltage is equal to (N-2)/N * V0, where N is equal to the Bias ratio Setting.
5	V1	Panel driving voltage. If bias divider is enabled with the presence of V0. The voltage is equal to (N-1)/N * V0, where N is equal to the Bias ratio Setting.
6	VDD	This pin is the system power supply pin of the logic block.
7	VDDIO	Power supply for interface logic level. It should be match with the MCU interface voltage level. It must always be equal or lower than VDD.
8	D/C	This pin is Data/Command control pin. A high at D/C indicates data input while a low at D/C indicates command input.
9	CS1	These pins are the chip select inputs for communication between MCU. To select the chip CS1# must be low and CS2 must set high. For serial mode, it is needed to select the chip which CS1# must be low and CS2 must set high.
10	RESET	This pin is the reset signal input. Initialization of the chip is started once this pin is pulled low. Minimum pulse width for reset sequence is 20us.
11	SCLK	In serial interface mode, D1 is the serial data input (SDIN), D0 is the serial clock input, (SCLK).
12	SD	
13	BUSY	A high level indicates busy status (output driving waveform) of the driver.
14	VSS	Ground.
15	VCP1	DC/DC output voltage. Connect with a capacitor to VSSC. It should be connected to V0.
16	C1P	DC/DC flying capacitor terminal. Connect a capacitor between C1N and C1P.
17	C1N	
18	VCP2	DC/DC intermediate output voltage. Connect with a capacitor to VSSC. If using external mode with HV buffer enabled, it should be connected to V0.
19	C2P	DC/DC flying capacitor terminal. Connect a capacitor between C2N and C2P.
20	C2N	
21	VCP3	DC/DC intermediate output voltage. Connect with a capacitor to VSSC.
22	C3P	DC/DC flying capacitor terminal. Connect a capacitor between C3N and C3P.
23	C3N	
24	VCP4	DC/DC intermediate output voltage. Connect with a capacitor to VSSC.
25	C4P	DC/DC flying capacitor terminal. Connect a capacitor between C4N and C4P.
26	C4N	
27	VCI	Power supply for DC-DC converter and analog part of the chip. It should be connected to VDD.
28	VSS	Ground.

6. Absolute Maximum Ratings

6.1 Electrical Maximum Ratings-For IC Only

Table3

Parameter	Symbol	Conditions	Min.	Max.	Unit
Supply Voltage	V_{DD}	TA=+25℃, Referenced to V_{SS} = 0V	-0.3	+3.6	V
	V_{DDIO}		-0.3	Min(VDD+0.5,+3.6)	V
	V_0		-0.3	+38	V
	V_{CI}		-0.3	+3.6	V
Input Voltage	V_{in}		V_{ss} - 0.3	V_{DDIO} + 0.3	V

Note1: TA = +25℃.

Note2: The maximum applicable voltage on any pin with respect to VSS (0V).

Note3: The modules may be destroyed if they are used beyond the absolute maximum ratings.

6.2 Environmental Condition

Table4

Item	Operating temperature (Topr)		Storage temperature (Tstg)		Remark
	Min.	Max.	Min.	Max.	
Ambient temperature	-20◦C	+70◦C	-30◦C	+80◦C	Dry
Humidity	90% max. RH for Ta ≤ 40°C < 50% RH for 40°C < Ta ≤ Maximum operating temperature				No condensation
Packing vibration(GB/T5170.14-2009)	Frequency range:10Hz~50Hz Acceleration of gravity:5G X,Y,Z 30 min for each direction.				3 directions

Note : Product cannot sustain at extreme storage conditions for long time.

7. Electrical Specifications

7.1 Typical Electrical Characteristics

At Ta = 25 ˚C, VDD = +3.0V± 5%, VSS=0V.

Table5

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply voltage (System)	VDD-VSS		2.7	3.0	3.5	V
	VCI-VSS		VDD	-	3.5	V
	VLCD		-	26	-	V
Input signal voltage low	V_{IL}		0	-	$0.2V_{DDIO}$	V
Input signal voltage high	V_{IH}		$0.8V_{DDIO}$	-	V_{DDIO}	V
Supply current	IDD	VDD=3.0V	-	0.5	-	mA
	ICI	VCI=3.0V	-	0.9	2.0	mA

* Internally Generated

7.2 TIMING Specifications

At Ta = +25 ˚C, VDD = VCI = VDDIO = +3.0V ± 5%

Table 6

Symbol	Parameter	Min	Typ	Max	Unit
t_{cycle}	Clock Cycle Time	60	-	-	ns
t_{AS}	Address Setup Time	10	-	-	ns
t_{AH}	Address Hold Time	20	-	-	ns
t_{DSW}	Write Data Setup Time	30	-	-	ns
t_{DHW}	Write Data Hold Time	30	-	-	ns
T_{CLKL}	Clock Low Time	30	-	-	ns
T_{CLKH}	Clock High Time	30	-	-	ns
t_{CSS}	Chip Select Setup Time (for D7 input)	30	- -	- -	ns
t_{CSH}	Chip Select Hold Time (for D0 input)	30	- -	- -	ns
t_R	Rise Time	-	-	10	ns
t_F	Fall Time	-	-	10	ns

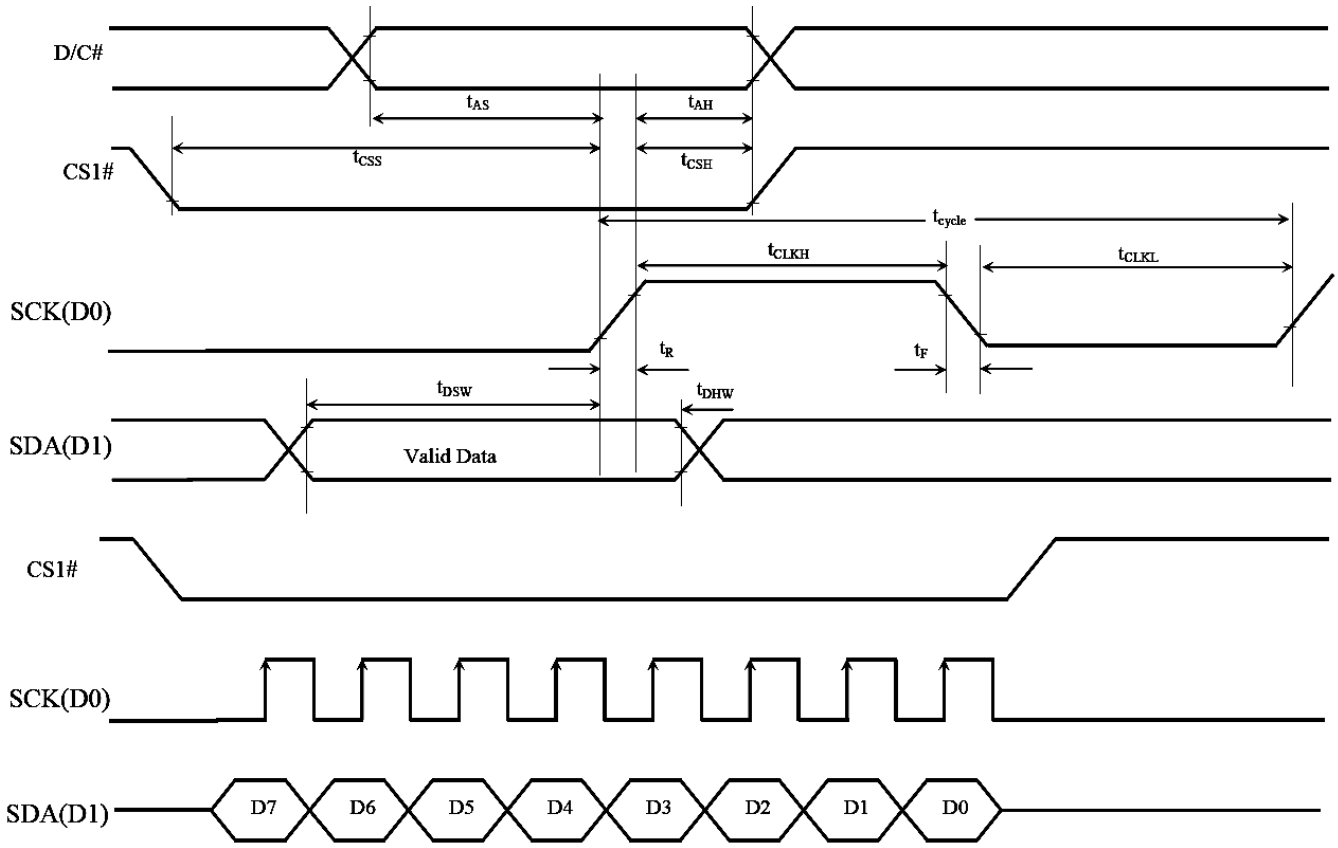


Figure 4:Timing characteristic of 4-wires Serial Interface

7.3 Temperature Compensation

Table 7: TC Table

Temperature, T(℃)	View Area Clear Duration (ms)	View Area Idle Duration (ms)	Active Area Clear Duration (ms)	Active Area Idle Duration (ms)	Drive Duration (ms)
50≤T<70	6	12	100	12	6
10≤T<50	18	12	100	12	18
0≤T<10	35	12	150	12	35
-5≤T<0	50	12	200	12	50
-10≤T<-5	80	12	250	12	80
-15≤T<-10	150	12	350	12	150
-20≤T<-15	350	12	700	12	350

Notes: For details, please reference to BCD application notes.

8.Example Initialization Program

```
void com_out(unsigned char ComDat)
{
        unsigned char mask;
        LCD_CS1=0;          //CS1=LOW:chip select
        LCD_DC =0;          //D/C=LOW :COMMAND CONTROL  INPUT
    for(mask=0x80;mask!=0;mask>>=1)
        {
            if(ComDat&mask)
            {
                LCD_SDA=1;   //DATA INPUT
            }
            else
            {
                LCD_SDA=0;  //DATA INPUT
            }
            LCD_SCL=0;    //CLOCK INPUT
            _nop_();
            _nop_();
            LCD_SCL=1;    //CLOCK INPUT
            _nop_();
            _nop_();
        }
        LCD_CS1=1;    //CS1=HIGH:chip not select

}
/*****************************************************************/
void data_out(unsigned char ComDat)
{
        unsigned char mask;
        LCD_CS1=0;   //CS1=LOW:chip select
        LCD_DC =1;     //D/C=LOW :DATA CONTROL INPUT
    for(mask=0x80;mask!=0;mask>>=1)
        {
            if(ComDat&mask)
            {
                LCD_SDA=1;  //DATA INPUT
            }
            else
            {
                LCD_SDA=0;  //DATA INPUT
            }
            LCD_SCL=0; //CLOCK INPUT
            _nop_();
            _nop_();
            LCD_SCL=1; //CLOCK INPUT
            _nop_();
            _nop_();
        }
        LCD_CS1=1;   //CS1=HIGH:chip not select
}
void reset(void)
    {
      LCD_RES= 0;
            Delay_ms(100);
      LCD_RES=1;
            Delay_ms (100);
    }
void Repeat_set (unsigned char repeat_times1, unsigned char repeat_times2, unsigned char repeat_times3)
{
   com_out (0x93);              //VA clear repeat times
   com_out (repeat_times1);
   com_out (0x94);              //VA idle repeat times
   com_out (repeat_times1);
   com_out (0x95);              //AA clear repeat times
   com_out (repeat_times2);
   com_out (0x96);              //AA idle repeat times
   com_out (repeat_times2);
   com_out (0x97);              //Driving repeat times
   com_out (repeat_times3);
}
```

```
void init_lcd()
{
com_out(0xA9); //Analog control auto  ON/OFF
com_out(0x00);       //OFF
com_out(0xA3);  //SET analog control
com_out(0x1A);         // *Enable band gap + other analog control
com_out(0xF6); // *Enable Oscillator
com_out(0x40);         //set display start line
 com_out(0xe9);     // set  bias resistor ladder
com_out(0x84);     // Enable bias ladder
com_out(0x2f);         //set power control register

 com_out(0x80);    // Set thecontrol scheme
com_out(0x00);     //
com_out(0x0a);      // Set VA clear hold time
com_out(0x0A);         // Set VA idle hold time
com_out(0x15);     // Set AA clear hold time
com_out(0x0C);     // Set AA idle hold time
com_out(0x0F);     // Set driving using time
com_out(0x50);     // Set clear voltage
com_out(0x48);     // Set drive voltage

com_out(0xa8);  // Set Multiplex
Ratio
com_out(0x40);     // Set duty = 1/64
com_out(0xa2);    //set LCD bias
com_out(0x02);     // Set bias = 1/9
com_out(0xa6);       //set normal /reverse display:x0=0 normal
com_out(0x32);  //set driving scheme
com_out(0x20);     // Set scheme A
com_out(0xa0);   //set segment remap
com_out(0xc8);   //set com output scan direction

com_out(0x00); //set higher column address
com_out(0x10);   //set lower column address
Repeat_set (0,0,0);
com_out(0x31); //driving update
}
void Write_BMP(unsigned char arr[])
    {
        unsigned char *spr,page,col;
                spr = arr;
            for(page=0;page<8;page++)
              {
                 com_out(0xb0+page); //set page address
                 com_out(0x10); //set higher column address
                com_out(0x00);   //set lower column address
               for(col=0;col<128;col++)
                  {
                                data_out(*spr++);
                  }
                  data_out(0x00);
                  data_out(0x00);
                  data_out(0x00);
                  data_out(0x00);

               }
    com_out(0x32);
   com_out(0x20);
    Repeat_set (1,0,0);
    com_out(0x31);
   Delay_US(100);
    Repeat_set (0,1, 0);
    com_out(0x31); Delay_US(100);
    com_out(0x32);
    com_out(0x20);
   Repeat_set (0,0, 1);
    com_out(0x31);
       }
```

```
void main(void)
        {
reset();
  while(1)
          {
    init_lcd();
     Write_BMP(demo);
}
}

char code demo[]={
0XFF,0XFF,0XFF,0XFF,0XFF,0XFF,0XFF,0XFF,0XFF,0XFF,0XFF,0XFF,0XFF,0XFF,0XFF,0XFF,
0XFF,0X1F,0X0F,0XEF,0XEF,0XCF,0XDF,0XFF,0XFF,0X1F,0X1F,0X7F,0XFF,0XFF,0X7F,0X7F,
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0XFF,0XFF,0XFF,0XFF,0X03,0XFD,0X0E,0XF6,0XF6,0XF6,0X0E,0XFE,0XFE,0X06,0XDE,0XBE,
0X06,0XFE,0XFE,0X02,0XFE,0X0E,0XF6,0XF6,0XF6,0X0E,0XFE,0X06,0XD6,0XD6,0XFE,0X06,
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0XD6,0XD6,0XD6,0XF6,0XF6,0X06,0XF6,0XF6,0XFD,0X03,0XFF,0XFF,0XFF,0XFF,0XFF,0XFF,
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0XF6,0XF7,0XF7,0XF4,0XF7,0XF7,0XF6,0XF6,0XF6,0XF7,0XF7,0XF6,0XF7,0XF7,0XF7,0XF6,
0XF7,0XF7,0XFB,0XFC,0XFF,0XFF,0XFC,0XFB,0XF7,0XF7,0XF6,0XF7,0XF7,0XF7,0XF6,0XF7,
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0XFC,0XFB,0XF7,0XF7,0XF6,0XF7,0XF7,0XF7,0XF6,0XF6,0XF6,0XF6,0XF7,0XF6,0XF7,0XF6,
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0XF6,0XF6,0XF6,0XF7,0XF7,0XF6,0XF7,0XF7,0XFB,0XFC,0XFF,0XFF,0XFF,0XFF,0XFF,0XFF,
};
```

9. Optical Characteristics at 25℃

Table 8

Item	Symbol	Value			Unit	Condition	
		Min.	Typ.	Max.			
Image refresh time	-	-	1.8	-	S	VDD=3.0V, VLCD =24V, @25 ℃	
Contrast ratio	CR	-	6	-	-	-	
Optimum viewing area Cr ⩾ 2	θ1(6 o'clock)	-	80	-	DEG	ϕ = 0°	Vop= Optimum voltage
	θ2(12 o'clock)	-	80	-			
	ϕ1(3 o'clock)	-	80	-		ϕ = 0°	
	ϕ2(9 o'clock)	-	80	-			

9.1 Optical Characteristics Definition

9.1.1 Viewing Angle

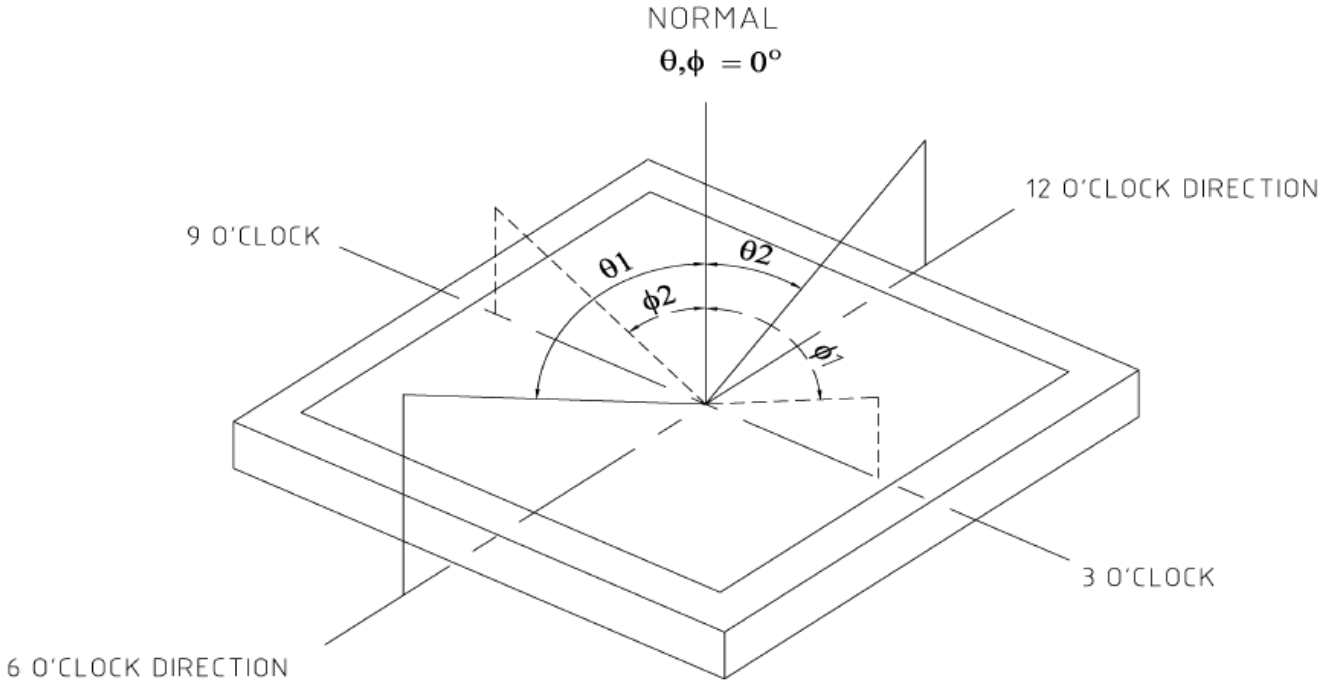


Figure 5

9.1.2 Contrast Ratio

B1 = pixel luminance at stable dark state

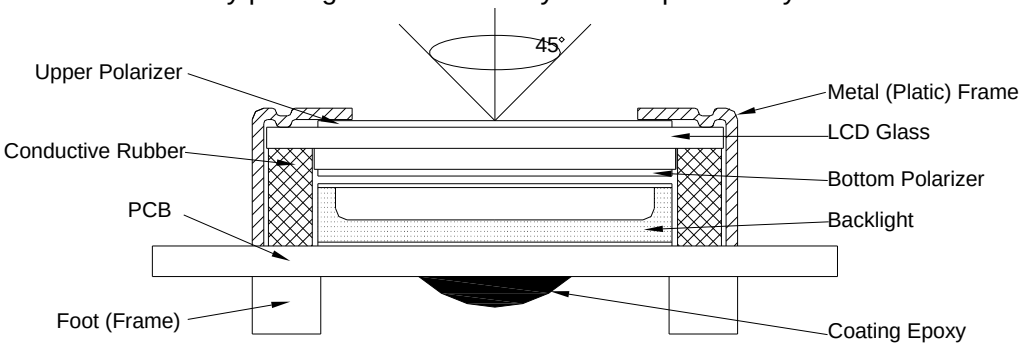
B2 = pixel luminance at stable bright state

Contrast Ratio = B2/B1

10. QUALITY SPECIFICATIONS

10-1. LCM Appearance and Electric inspection Condition

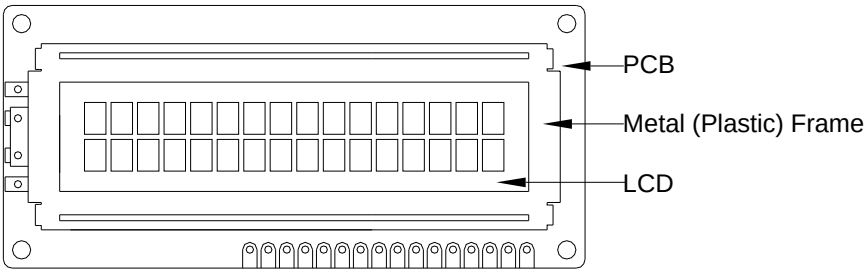
1. Inspection will be done by placing LCM 30cm away from inspector's eyeballs under normal illumination.



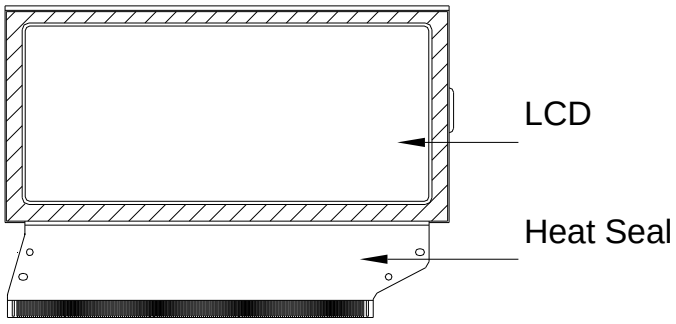
2. View Angle: with in 45°around perpendicular line.

10-2. Definition

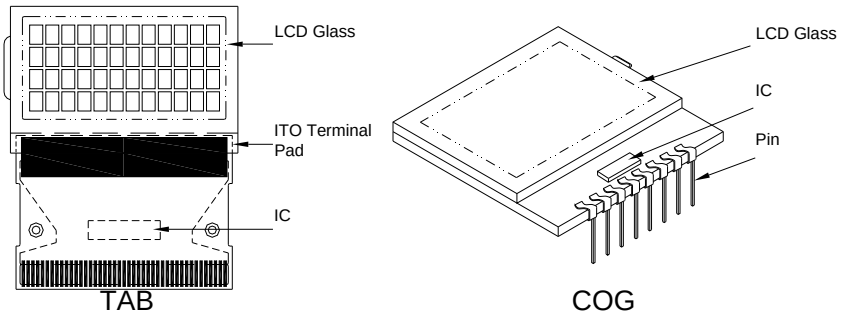
1. COB



2. Heat Seal



3. TAB and COG



10-3. Sampling Plan and Acceptance

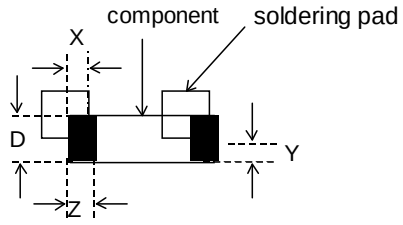
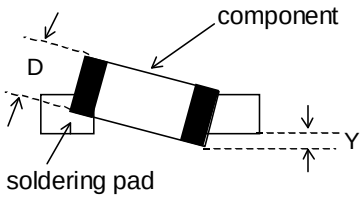
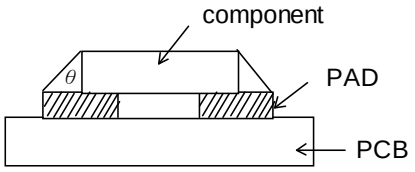
1. Sampling Plan
   MIL - STD - 105E (‖) ordinary single inspection is used.
2. Acceptance
   Major defect: AQL = 0.65%
   Minor defect: AQL = 1.5%

7-4. Criteria

1. COB

Defect	Inspection Item	Inspection Standards	
Major	PCB copper flakes peeling off	Any copper flake in viewing Area should be greater than 1.0mm^2	Reject
Major	Height of coating epoxy	Exceed the dimension of drawing	Reject
Major	Void or hole of coating epoxy	Expose bonding wire or IC	Reject
Major	PCB cutting defect	Exceed the dimension of drawing	Reject

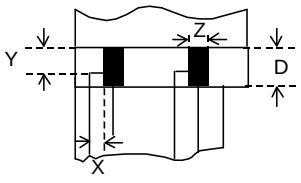
2. SMT

Defect	Inspection Item	Inspection Standards	
Minor	Component marking not readable		Reject
Minor	Component height	Exceed the dimension Of drawing	Reject
Major	Component solder defect (missing , extra, wrong component or wrong orientation		Reject
Minor	Component position shift 	X < 3/4Z Y > 1/3D	Reject Reject
Minor	Component tilt 	Y > 1/3D	Reject
Minor	Insufficient solder 	$\theta \leq 20^\circ$	Reject

3. Metal (Plastic) Frame

Defect	Inspection Item	Inspection Standards		
Major	Crack / breakage	Anywhere		Reject
Minor	Frame Scratch	W	L	Acceptable of Scratch
		w<0.1mm	Any	Ignore
		0.1≤w<0.2mm	L≤5.0mm	2
		0.2≤w<0.3mm	L≤3.0mm	1
		w≥0.3mm	Any	0
		Note : 1. Above criteria applicable to scratch lines with distance greater than 5mm. 2. Scratch on the back side of frame (not visible) can be ignored .		
Minor	Frame Dent , Prick $\Phi = \frac{L+W}{2}$			Acceptable of Dents / Pricks
		$\Phi \leq 1.0$mm		2
		$1.0 < \Phi \leq 1.5$mm		1
		$1.5\text{mm} < \Phi$		0
		Note : 1. Above criteria applicable to any two dents / pricks with distance greater than 5mm 2. Dent / prick on the back side of frame (not visible) can be ignored		
Minor	Frame Deformation	Exceed the dimension of drawing		
Minor	Metal Frame Oxidation	Any rust		

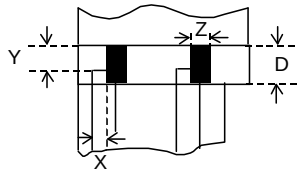
4. Flexible Film Connector (FFC)

Defect	Inspection Item	Inspection Standards	
Minor	Tilted soldering	Within the angle +5°	Acceptable
Minor	Uneven solder joint /bump		Reject
Minor	Hole $\Phi = \frac{L+W}{2}$	Expose the conductive line	Reject
		Φ > 1.0mm	Reject
Minor	Position shift 	Y > 1/3D	Reject
		X > 1/2Z	Reject

5.Screw

Defect	Inspection Item	Inspection Standards	
Major	Screw missing/loosen		Reject
Minor	Screw oxidation	Any rust	Reject
Minor	Screw deformation	Difficult to accept screw driver	Reject

6. Heatseal 、TCP 、FPC

Defect	Inspection Item	Inspection Standards	
Major	Scratch expose conductive layer		Reject
Minor	HS Hole $\Phi = \frac{L+W}{2}$	Φ> 0.5mm	Reject
Major	Adhesion strength	Less than the specification	Reject
Minor	Position shift 	Y > 1/3D	Reject
		X > 1/2Z	Reject
Major	Conductive line break		Reject

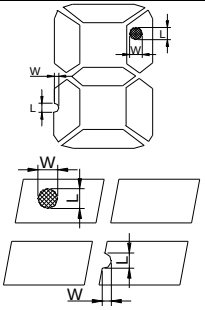
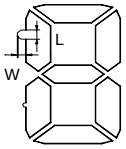
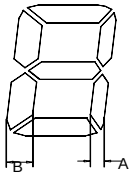
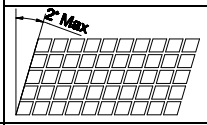
7. LED Backing Protective Film and Others

Defect	Inspection Item	Inspection Standards	
Minor	LED dirty, prick	Acceptable number of units	
		$\Phi \leq$0.10mm	Ignore
		0.10< $\Phi \leq$0.15mm	2
		0.15< $\Phi \leq$0.2mm	1
		Φ>0.2mm	0
		The distance between any two spots should be $\geq$5mm Any spot/dot/void outside of viewing area is acceptable	
Minor	Protective film tilt	Not fully cover LCD	Reject
Major	COG coating	Not fully cover ITO circuit	Reject

8. Electric Inspection

Defect	Inspection Item	Inspection Standards	
Major	Short		Reject
Major	Open		Reject

9. Inspection Specification of LCD

<table>
<tr><th>Defect</th><th colspan="2">Inspect Item</th><th colspan="5">Inspection Standards</th></tr>
<tr><td rowspan="4">Minor</td><td rowspan="4">Linear Defect</td><td rowspan="4">∗ Glass Scratch
∗ Polarizer Scratch
∗ Fiber and Linear material</td><td>W</td><td colspan="2">W≤0.03</td><td colspan="2">0.03<W≤0.05</td><td>W>0.05</td></tr>
<tr><td>L</td><td colspan="2">L<5</td><td colspan="2">L<3</td><td>Any</td></tr>
<tr><td>ACC. NO.</td><td colspan="2">1</td><td colspan="2">1</td><td>Reject</td></tr>
<tr><td>Note</td><td colspan="5">L is the length and W is the width of the defect</td></tr>
<tr><td rowspan="3">Minor</td><td rowspan="3">Black Spot and Polarizer Pricked</td><td rowspan="3">∗ Foreign material between glass and polarizer or glass and glass
∗ Polarizer hole or protuberance by external force</td><td>Φ</td><td>Φ≤0.1</td><td>0.1<Φ≤0.15</td><td>0.15<Φ≤0.2</td><td>Φ>0.2</td></tr>
<tr><td>ACC. NO.</td><td>3EA / 100mm^2</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Note</td><td colspan="4">Φ is the average diameter of the defect.
Distance between two defects > 10mm.</td></tr>
<tr><td rowspan="3">Minor</td><td rowspan="3">White Spot and Bubble in polarizer</td><td rowspan="3">∗ Unobvious transparant foreign material between glass and glass or glass and polarizer
∗ Air protuberance between polarizer and glass</td><td>Φ</td><td colspan="2">Φ≤0.3</td><td>0.3<Φ≤0.5</td><td>0.5<Φ</td></tr>
<tr><td>ACC. NO.</td><td colspan="2">3EA / 100mm^2</td><td>1</td><td>0</td></tr>
<tr><td>Note</td><td colspan="4">Φ is the average diameter of the defect.
Distance between two defects > 10mm.</td></tr>
<tr><td rowspan="3">Minor</td><td rowspan="3">Segment Defect</td><td rowspan="3">  </td><td>Φ</td><td>Φ≤0.10</td><td>0.10<Φ≤0.20</td><td>0.20<Φ≤0.25</td><td>Φ>0.25</td></tr>
<tr><td>ACC. NO.</td><td>3EA / 100mm^2</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Note</td><td colspan="3">W is more than 1/2 segment width</td><td>Reject</td></tr>
<tr><td rowspan="3">Minor</td><td rowspan="3">Protuberant Segment</td><td rowspan="3"> 
Φ = (L + W) / 2</td><td>Φ</td><td>Φ≤0.10</td><td>0.10<Φ≤0.20</td><td>0.20<Φ≤0.25</td><td>Φ>0.25</td></tr>
<tr><td>W</td><td>Glue</td><td>W≤1/2 Seg
W≤0.2</td><td>W≤1/2 Seg
W≤0.2</td><td>Ignore</td></tr>
<tr><td>ACC. NO.</td><td>3EA / 100mm^2</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td rowspan="4">Minor</td><td rowspan="4">Assembly Mis-alignment</td><td rowspan="2">  </td><td colspan="5">1. Segment</td></tr>
<tr><td>B</td><td>B≤0.4mm</td><td>0.4<B≤1.0mm</td><td>B>1.0mm</td></tr>
<tr><td>B-A</td><td>B-A<1/2B</td><td>B-A<0.2</td><td>B-A<0.25</td></tr>
<tr><td>Judge</td><td>Acceptable</td><td>Acceptable</td><td>Acceptable</td></tr>
<tr><td rowspan="2">  </td><td colspan="5">2. Dot Matrix</td></tr>
<tr><td colspan="4">Deformation>2°</td><td>Reject</td></tr>
<tr><td>Minor</td><td>Stain on LCD Panel Surface</td><td></td><td colspan="5">Accept when stains can be wiped lightly with a soft cloth or a similar one. Otherwise, judged according to the above items: “Black spot” and “White Spot”</td></tr>
</table>

11. HANDLING PRECAUTION

(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
- Trichloro trifloro thane

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 resumes normal condition after turning off once.
- A slight 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 reequired.

(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.

(8) Other

- After the product shipped, any product quality issues must be feedback within three months, otherwise, we will not be responsible for the subsequent or consequential events.