深圳市拓普微科技开发有限公司
SHENZHEN TOPWAY TECHNOLOGY CO.,LTD.

LMT070DICFWD-NCN
LCD Module User Manual

Prepared by: **Yu** Date: 2019-01-08	Checked by: Date:	Approved by: Date:

| Rev.	Descriptions	Release Date
0.1	Preliminary release	2011-02-15
0.2	Revise DC char.; Add Parts, Packing and Reliability Test Sections	2011-06-14
0.3	Revise DC char.& Major Part List	2011-06-21
0.4	Refine 7.1 Timing Characteristics	2012-02-09
0.5	Add Outline Dwg	2015-07-31
0.6	Update Section 4	2019-01-08

Table of Content

1. Applications

This Module is designed for application which require high quality flat panel displays. It is also a good substitute for many outmoded CSTN module in the industrial application.

2. General Specification

Signal Interface :   Digital 18-bits RGB
Display Technology :   a-Si TFT active matrix
Display Mode :   Transmissive / Normal White
Screen Size(Diagonal) :   7.0"
Outline Dimension :   169.0 x 115.1x 8.6 (mm)
       (see attached drawing for details)
Active Area :   154.08 x 85.92 (mm)
Number of dots :   800 x 3 (RGB) x 480
Pixel Pitch :   0.0642 x 0.179 (mm)
Pixel Configuration :   RGB Stripe
Backlight :   LED
Surface Treatment :   Anti-Glare Treatment
Viewing Direction :   6 o'clock
Operating Temperature :   -20 ~ +70°C
Storage Temperature :   -30 ~ +80°C

3. Block Diagram
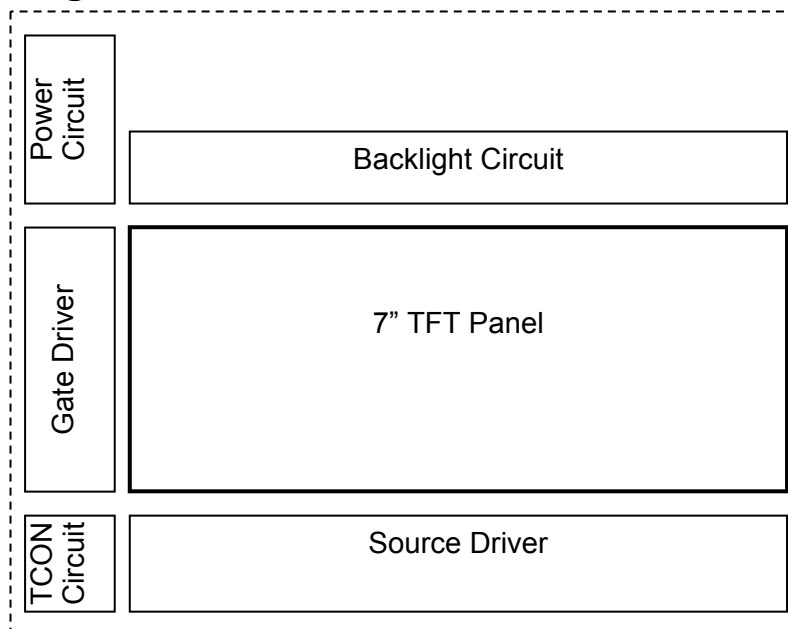
4. Terminal Function (Input Terminal)

Pin No.	Pin Name	I/O	Descriptions
1	GND	Power	Power Supply GND (0V)
2	GND		
3	ADJ	Input	LED driver enable control ADJ=Lo, BL off; ADJ=Hi, BL on
4	VLED	Power	Backlight Positive Power Supply (5V)
5	VLED		
6	VCC	Power	Positive Power Supply (3.3V)
7	VCC		
8	GND	Input	Power Supply GND (0V)
9	DE	Input	Data input enable
10	GND	Power	Power Supply GND (0V)
11	GND		
12	GND		
13	B5	Input	Blue Data
14	B4		
15	B3		
16	GND	Power	Power Supply GND (0V)
17	B2	Input	Blue Data
18	B1		
19	B0		
20	GND	Power	Power Supply GND (0V)
21	G5	Input	Green Data
22	G4		
23	G3		
24	GND	Power	Power Supply GND (0V)
25	G2	Input	Green Data
26	G1		
27	G0		
28	GND	Power	Power Supply GND (0V)
29	R5	Input	Red Data
30	R4		
31	R3		
32	GND	Power	Power Supply GND (0V)
33	R2	Input	Red Data
34	R1		
35	R0		
36	GND	Power	Power Supply GND (0V)
37	GND		
38	DCLK	Input	Data Clock
39	GND	Power	Power Supply GND (0V)
40	GND		

5. Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit	Condition
Power Supply voltage	V_{CC}	-0.3	5.0	V	
Backlight Supply voltage	V_{LED} –GND	-0.3	6.0	V	
Operating Temperature	T_{OP}	-20	70	°C	No Condensation
Storage Temperature	T_{ST}	-30	80	°C	No Condensation

Note:
*1. This rating applies to all parts of the module. And should not be exceeded.
*2. The operating temperature only guarantees operation of the circuit. The contrast, response speed,
 and the other specification related to electro-optical display quality is determined at the room temperature, T_{OP}=25℃
*3. Ambient temperature when the backlight is lit (reference value)
*4. Any Stresses exceeding the Absolute Maximum Ratings may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

6. Electrical Characteristics

6.1 DC Characteristics

Top=25℃, GND=0V

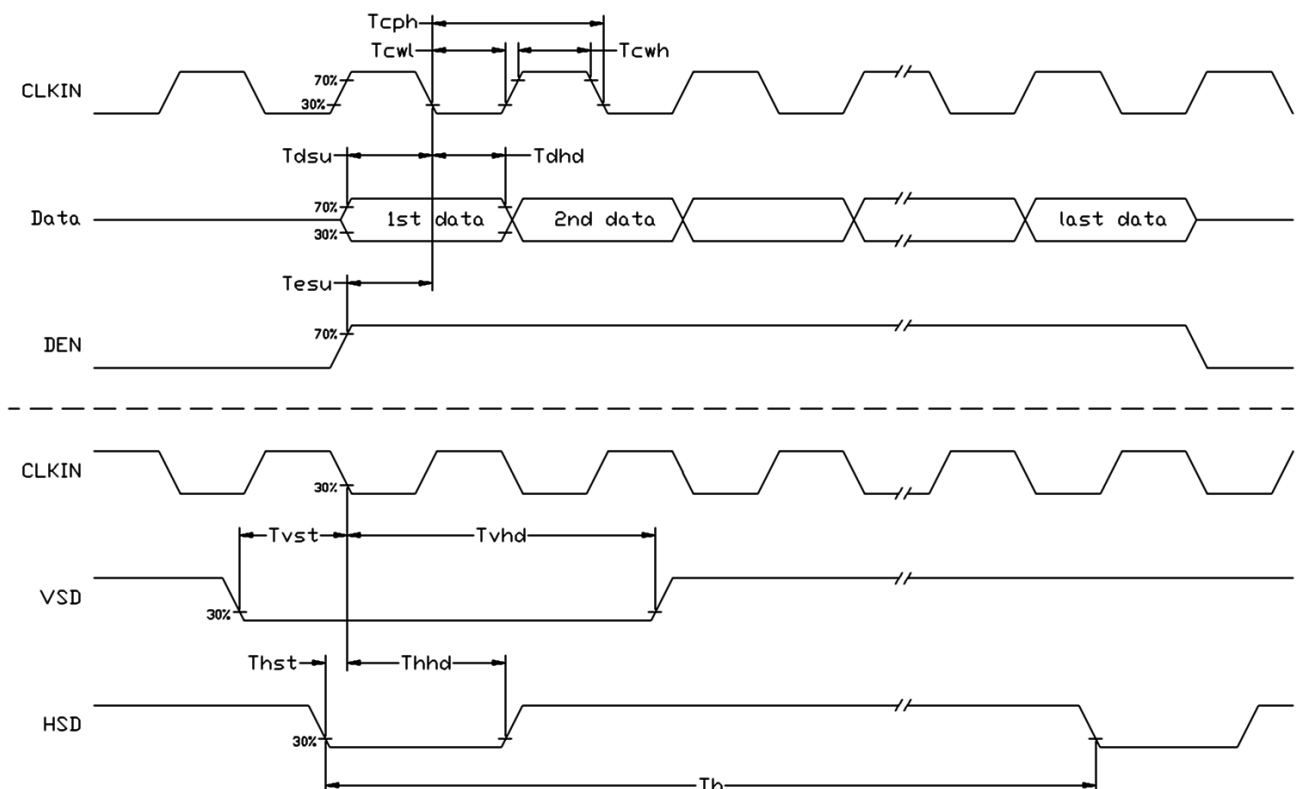| Items	Symbol	Min.	Typ.	Max.	Unit	Remark
Power Supply Voltage	V_{CC}	3.0	3.3	3.6	V	*2,*5
Backlight Supply Voltage	V_{LED}	4.5	5.0	5.5	V	*5
Input logic high voltage	V_{IH}	0.7 V_{CC}	-	V_{CC}	V	*2, *3
Input logic low voltage	V_{IL}	0	-	0.3 V_{CC}	V	*2, *3
Input ADJ high voltage	V_{ADJH}	3.0	-	5.5	V	
Input ADJ low voltage	V_{ADJL}	0	-	0.8	V	
Logic Supply (VCC)	I_{VCC}	-	25	100	mA	
Backlight Supply (VLED)	I_{VLED}	-	230	600	mA	*4, ADJ=Hi
Backlight Life Time	-	20,000	-	-	hr	*4

Note:
 *1. Never Apply logic signal before the VCC and VLED supply.
 *2. VCC setting should match the signals voltage
 *3. For Inputs: DCLK, DE, R0~R5, G0~G5, B0~B5
 *4. PWM signal (Freq=3000Hz (Typ.)) may applied to ADJ pin for backlight brightness control, where its life time could be extend by lower brightness.
 *5.Backlight Supply(VLED) and Power Supply (VCC) may provide individually.

7. AC Characteristics

7.1 Timing Characteristics

Item	Symbol	MIN.	TYP.	MAX.	Unit	Remark
HS setup time	Thst	8	-	-	ns	
HS hold time	Thhd	8	-	-	ns	
VS setup time	Tvst	8	-	-	ns	
VS hold time	Tvhd	8	-	-	ns	
Data setup time	Tdsu	8	-	-	ns	
Data hole time	Tdhd	8	-	-	ns	
DE setup time	Tesu	8	-	-	ns	
DV_{DD} Power On Slew rate	TPOR	-	-	20	ms	From 0 to 90% DV_{DD}
DCLK cycle time	Tcph	20	-	-	ns	
DCLK pulse duty	Tcwh	40	50	60	%	

7.2 Input Clock and Data Timing Diagram

7.3   Timing

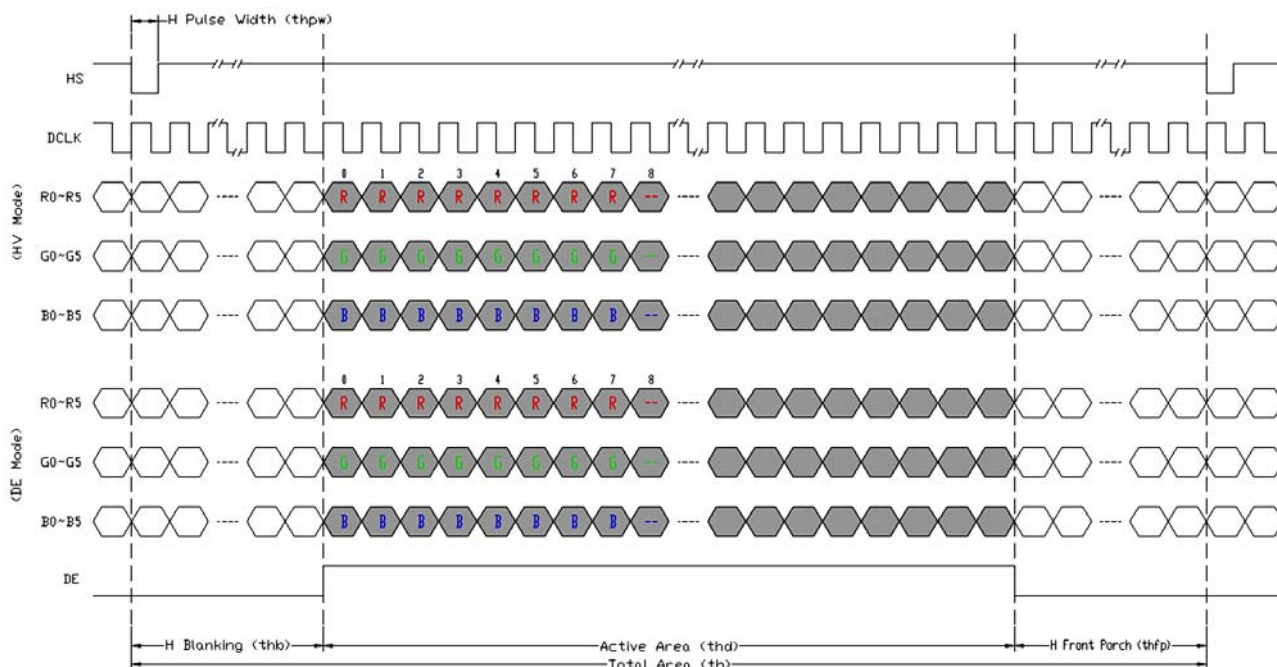| Item	Symbol	MIN.	TYP.	MAX.	Unit	Remark
Horizontal Display Area	thd	-	800	-	DCLK	
DCLK Frequency	fclk	26.4	33.3	46.8	MHz	
One Horizontal Line	th	862	1056	1200	DCLK	
HS pulse width	thpw	1	-	40	DCLK	
HS Blanking	thb	46	46	46	DCLK	
HS Front Porch	thfp	16	210	354	DCLK	
Vertical Display Area	tvd	-	480	-	TH	
VS period time	tv	510	525	650	TH	
VS pulse width	tvpw	1	-	20	TH	
VS Blanking	tvb	23	23	23	TH	
VS Front Porch	tvfp	7	22	147	TH	

7.4   Data Input Format

Figure 6-2-1 Horizontal input timing diagram.
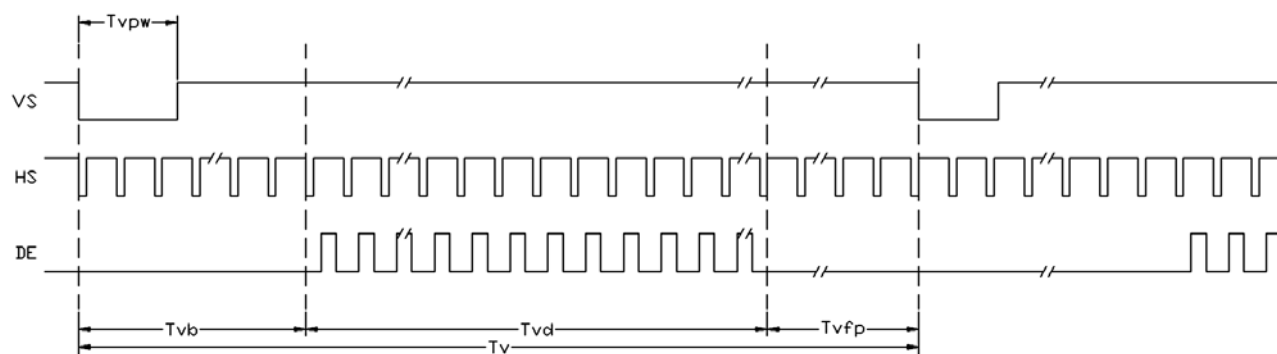
Figure 6-2-2 Vertical input timing diagram.

7.5 Optical Characteristics

| Item	Symbol	Condition	MIN.	TYP.	MAX.	UNIT	Note.
Viewing angle (CR≥10)	θ_L	9 o'clock	60	70	-	degree	*2
	θ_R	3 o'clock	60	70	-		
	θ_T	12 o'clock	40	50	-		
	θ_B	6 o'clock	60	70	-		
Response Time	T_f	Normal $\theta=0°$	-	10	20	msec	*3
	T_r		-	15	30	msec	
Contrast ratio	CR		400	500	-	-	*1
Color chromaticlty	W_X		0.26	0.31	0.26	-	
	W_Y		0.28	0.33	0.38	-	
Luminance	L		-	250	-	cd/m^2	*4
Luminance uniformity	Y_U		70	75	-	%	*4

Note:
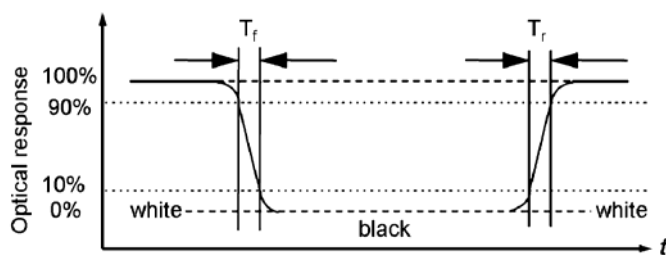*1. <u>Definition of Contrast Ratio</u>
The contrast ratio could be calculate by the following expression:
Contrast Ratio (CR) = Luminanc with all pixels white / Luminance with all pixels black
*2 <u>Definition of Viewing Angle</u>
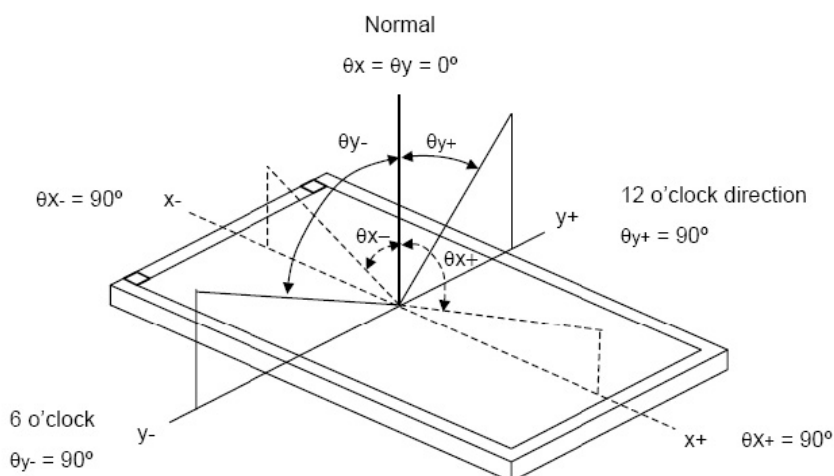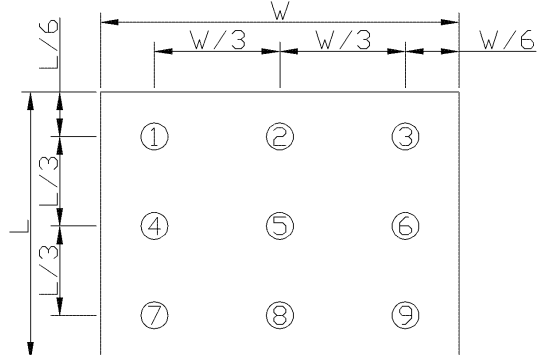

*3 <u>Definition of response time</u>

*4 <u>Definition of Luminance Uniformity</u>
Luminance uniformity (Lu)=
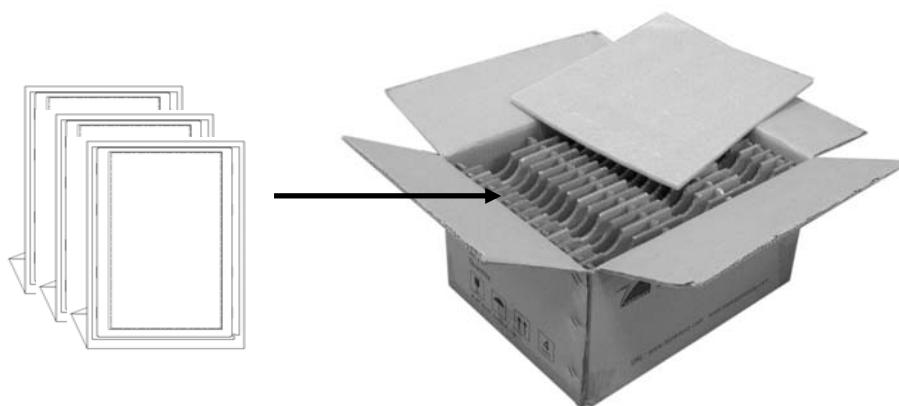Min. Luminance form pt1~pt9 / Max Luminance form Pt1~pt9

8. Parts

8.1 Major Part List

Item	Part No.	Supplier	Reference No.
TFT Panel	P18328010	Innolux	AT070TN90
Backlight Unit	P04303010		White LED side light
PCB Unit	P06400010		
Socket(K1)	P21311010	Xinfuer	0.5A-50PBS
Socket(K2)	P21312010	Xinfuer	0.5E-40PBX
Printed Circuit Board	P05390010	SHENZHEN SUN&LYNN CIRCUIT / MEI ZHOU BOMIN ELECTRONICS	

9. Packing

9.1 Inside of Packing

Packing-box partitions as <u>12x3</u> slot.
Each slot holds a LCD module with anti-static bag.
One Packing-box holds up-to <u>36</u> LCD modules

9.2 Outside of Packing-Box
A label on the side shows the content details

10. Precautions of using LCD Modules

Mounting
- Mounting must use holes arranged in four corners or four sides.
- The mounting structure so provide even force on to LCD module. Uneven force (ex. Twisted stress) should not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- It is suggested to attach a transparent protective plate to the surface in order to protect the polarizer. It should have sufficient strength in order to the resist external force.
- The housing should adopt radiation structure to satisfy the temperature specification.
- Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. Never rub with dust clothes with chemical treatment. Do not touch the surface of polarizer for bare hand or greasy cloth.(Some cosmetics deteriorate the polarizer.)
- When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzine. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
- Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer

Operating
- The spike noise causes the mis-operation of circuits. It should be within the ±200mV level (Over and under shoot voltage)
- Response time depends on the temperature.(In lower temperature, it becomes longer.)
- Brightness depends on the temperature. (In lower temperature, it becomes lower.) And in lower temperature, response time(required time that brightness is stable after turned on) becomes longer.
- Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- When fixed patterns are displayed for a long time, remnant image is likely to occur.
- Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference

Electrostatic Discharge Control
Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

Strong Light Exposure
Strong light exposure causes degradation of polarizer and color filter.

Storage
When storing modules as spares for a long time, the following precautions are necessary.
- Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
- The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.

Protection Film
- When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
- The protection film is attached to the polarizer with a small amount of glue. If some stress is applied to rub the protection film against the polarizer during the time you peel off the film, the glue is apt tore main on the polarizer. Please carefully peel off the protection film without rubbing it against the polarizer.
- When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the polarizer after the protection film is peeled off.
- You can remove the glue easily. When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.

Transportation
The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.

11. Reliability Test

Test Items	Testing Condition		Note
High Temperature Storage	Top = +80℃	240hrs	Note *1, Note *4
Low Temperature Storage	Top= -30℃	240hrs	Note *1, Note *4
High Temperature Operation	Tst = +70℃	96hrs	Note *2, Note *4
Low Temperature Operation	Tst = -20℃	96hrs	Note *2, Note *4
Operate at High Temperature and Humidity	+60℃,90%RH	96hrs	Note *4
Thermal Shock	-30℃/30 min ~ +80℃/30 min for a total 10 cycles, Start with cold temperature and end with high temperature.		Note *4
Electro Static Discharge	±2000V, Human Body Mode		

Note:
*1. Top = operating temperature of the product.
*2. Tst = storage temperature of the product.
*3. In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.
*4. Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

12. Appendix <Inspection items and criteria for appearance defect>

12.1 Bright/Dark Dots:

Defect Type	Specification	Major	Minor
Bright Dots	N≤ 2		●
Dark Dots	N≤ 3		●
Total Bright and Dark Dots	N≤ 4		●

Note: 1. **The definition of dot:** The size of a defective dot over 1/2 of whole dot is regarded as one defective dot.

2. **Bright dot:** Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

3. **Dark dot:** Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue pattern.

K1 Terminal		
No	Pin Name	
1	GND	
2	GND	
3	ADJ	
4	VLED	
5	VLED	
6	VCC	
7	VCC	
8	GND	
9	DE	
10	GND	
11	GND	
12	GND	
13	B5	
14	B4	
15	B3	
16	GND	
17	B2	
18	B1	
19	B0	
20	GND	
21	G5	
22	G4	
23	G3	
24	GND	
25	G2	
26	G1	
27	G0	
28	GND	
29	R5	
30	R4	
31	R3	
32	GND	
33	R2	
34	R1	
35	R0	
36	GND	
37	GND	
38	DCLK	
39	GND	
40	GND	

Note:
*1. LCD Display Type: TFT,Transmissive
*2. Pixel Arrangment: RGB-STRIPE
*3. Operating Voltage : 3.3V
*4. Backlight Supply :5.0V
*5. Backlight : LEDs
*6. Color Depth : 256K colors
*7. Operating Temperature : -20°C~70°C
*8. Storage Temperature : -30°C~80°C