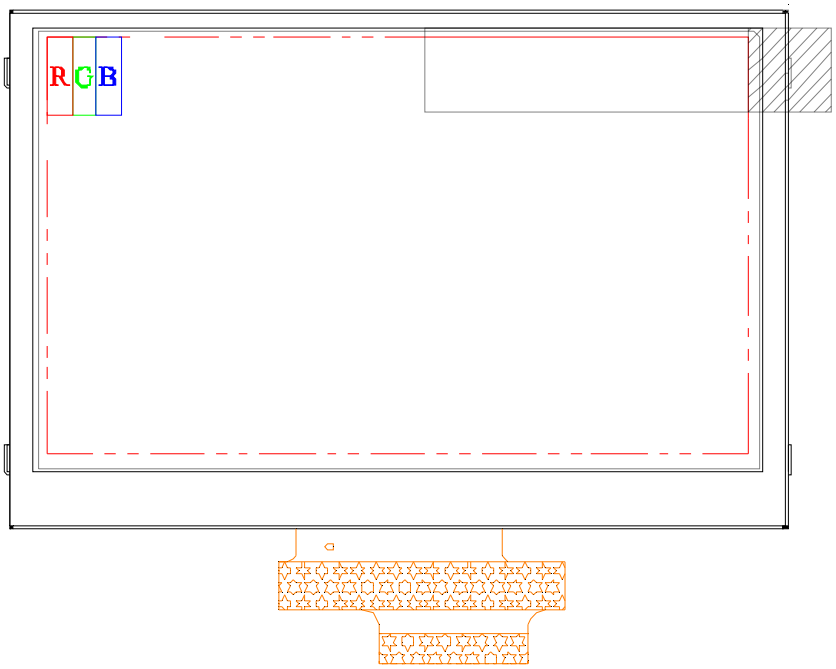
LXD
LIQUID CRYSTAL DISPLAYS
7300 ACC Blvd.
Raleigh, NC 27617
919-600-6440
800-786-8710

M7637A

480(RGB)X272 GRAPHIC TFT



Module Outline	105.5(H) x 67.2 (V) x 3.1T)
Active Area	95.04(H) x 53.856(V)
View Direction	12 O'clock
Polarizer Surface Treatment	Clear
Colors	16M
Operating Temperature	-20～70
Storage Temperature	-30～80

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RECORD OF REVISION

Rev	Date	Comment
1.0	09/APR/14’	Initial preliminary

3. FEATURE

- 64 gray level with 2 bit dithering function to realize 16M colors

4. GENERAL SPECIFICATIONS

Parameter	Specifications	Unit
Display resolution	480X R.G.B x 272	dot
Active area	95.04(W) x 53.856(H)	mm
Screen size	4.3(Diagonal)	inch
Dot pitch	0.066 (W) x 0.198(H)	mm
Color configuration	R.G.B. Stripe	
Overall dimension	105.5 (W) x 67.2(H) x 3.1(D)	mm
Weight	45	g
Surface treatment	Clear	
View Angle direction(Gray inversion)	6 o'clock	
Our components and processes are compliant to RoHS & REACH standard		

5. ELECTRICAL CHARACTERISTICS

5.1 Operation Conditions

GND=0V,Ta=25°C

Parameter	Symbol	MIN.	Typ.	MAX.	Unit	Remark
Power Supply voltage	V_{DD}	3.0	3.3	3.6	V	Note1
Power Supply Current	I_{DD}	--	17	20	mA	V_{DD} =3.3V
Ripple Voltage	V_{RPVDD}	--	--	100	mVp-p	
"H" level logical input voltage	V_{IH}	0.8VDD	--	VDD	V	
"L" level logical input voltage	V_{IL}	0	--	0.2VDD	V	
Operating temperature	Topa	-20	--	70	°C	Ambient temperature
Storage temperature	Tstg	-30	--	80	°C	Ambient temperature

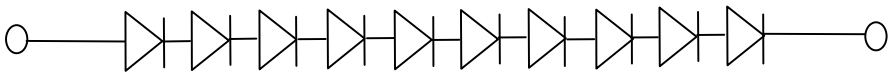
Note1:VDD Absolute Maximum Ratings -0.3V~+6V

5.2 Backlight driving for power conditions

Ta= 25 °C

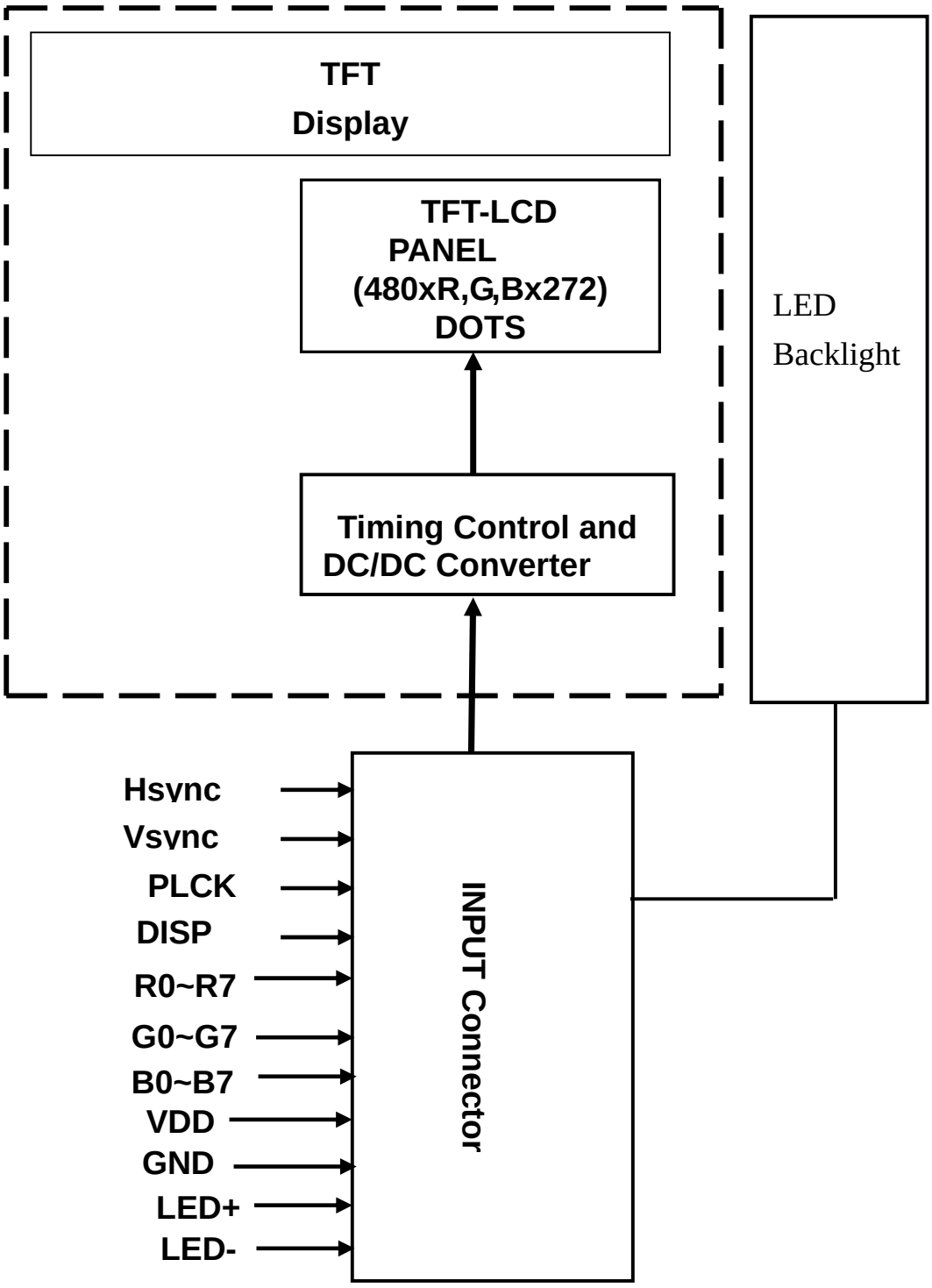
Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED current	I_L	--	20	--	mA	
VLED voltage	V_L	28	33	36	V	$I_{L=20}$ mA
LED life time		--	37000	--	Hours	Note 1

Note 1 under room temperature (25 °C, Humidity 30-60% RH,20mA)and IL=20mA.



Voltage：VLED=33V(Typ.)　　Current：20mA

6. BLOCK DIAGRAM



7. PIN CONNECTIONS

7.1 Input Pins Connection

Pin No	Symbol	Function	Remark
1	LED-	LED Power Source input terminal (Cathode side)	
2	LED+	LED Power Source input terminal (Anode side)	
3	GND	Ground	
4	GND	Ground	
5	VDD	Power Supply : +3.3V	
6	VDD	Power Supply : +3.3V	
7	R0	Digital data input. R0 is LSB and R7 is MSB	
8	R1		
9	R2		
10	R3		
11	R4		
12	R5		
13	R6		
14	R7		
15	GND	Ground	
16	G0	Digital data input. G0 is LSB and G7 is MSB	
17	G1		
18	G2		
19	G3		
20	G4		
21	G5		
22	G6		
23	G7		
24	GND	Ground	
25	B0	Digital data input. B0 is LSB and B7 is MSB	
26	B1		
27	B2		
28	B3		
29	B4		
30	B5		
31	B6		
32	B7		
33	GND	Ground	
34	PLCK	clock signal to sample each data	
35	GND	Ground	
36	DISP	Display ON/OFF Control ON=H(VDD), OFF=L(GND)	
37	Hsync	Horizontal synchronous signal	
38	GND	Ground	
39	Vsync	Vertical synchronous signal	
40	GND	Ground	

8. AC CHARACTERISTICS

8.1 Input Timing Requirement

(480RGBx272, Ta =25ºC, VDD=3.3V GND= 0V)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Clock cycle	$f_{CLK(1)}$	-	9	15	MHz
Hsync cycle	1/th	-	17.14	-	KHz
Vsync cycle	1/tv	-	59.94	-	Hz
Horizontal Signal					
Horizontal cycle	th	525	525	605	CLK
Horizontal display period	thd	480	480	480	CLK
Horizontal front porch	thf	2	2	82	CLK
Horizontal pulse width	$thp_{(2)}$	2	41	41	CLK
Horizontal back porch	$thb_{(2)}$	2	2	41	CLK
Vertical Signal					
Vertical cycle	tv	285	286	511	$H_{(1)}$
Vertical display period	tvd	272	272	272	$H_{(1)}$
Vertical front porch	tvf	1	2	227	$H_{(1)}$
Vertical pulse width	$tvp_{(2)}$	1	10	11	$H_{(1)}$
Vertical back porch	$tvb_{(2)}$	1	2	11	$H_{(1)}$

Note: (1) Unit: CLK=1/ f_{CLK} , H=th,
(2)It is necessary to keep tvp+tvb=12 and thp+thb=43 in sync mode.

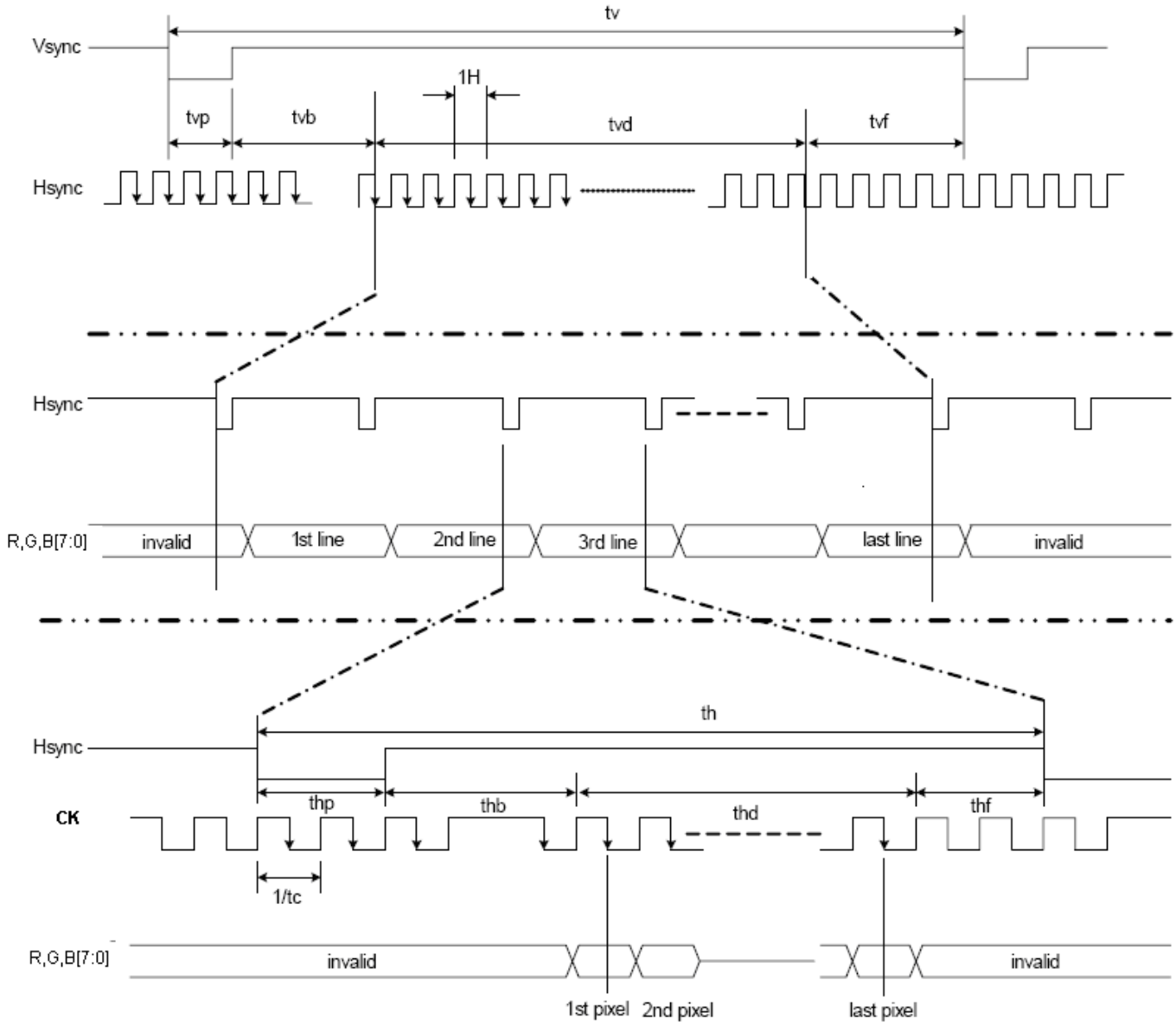


Fig 1. Parallel RGB input timing

8.2 Input Setup Timing Requirement

(Ta =25ºC, VDD=3.3V ,GND= 0V, tr (1)=tf (1)=2ns)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
DISP setup time	t_{diss}	10	-	-	ns
DISP hold time	t_{dish}	10	-	-	ns
Clock period	$PW_{CLK(2)}$	66.7	-	-	ns
Clock pulse high period	$PWH_{(2)}$	26.7	-	-	ns
Clock pulse low period	$PWL_{(2)}$	26.7	-	-	ns
Hsync setup time	t_{hs}	10	-	-	ns
Hsync hold time	t_{hh}	10	-	-	ns
Data setup time	t_{ds}	10	-	-	ns
Data hold time	t_{dh}	10	-	-	ns
Vsync setup time	t_{vhs}	10	-	-	ns
Vsync hold time	t_{vhh}	10	-	-	ns

Note: (1) tr, tf is defined 10% to 90% of signal amplitude.
(2) For parallel interface, maximum clock frequency is 15MHz.

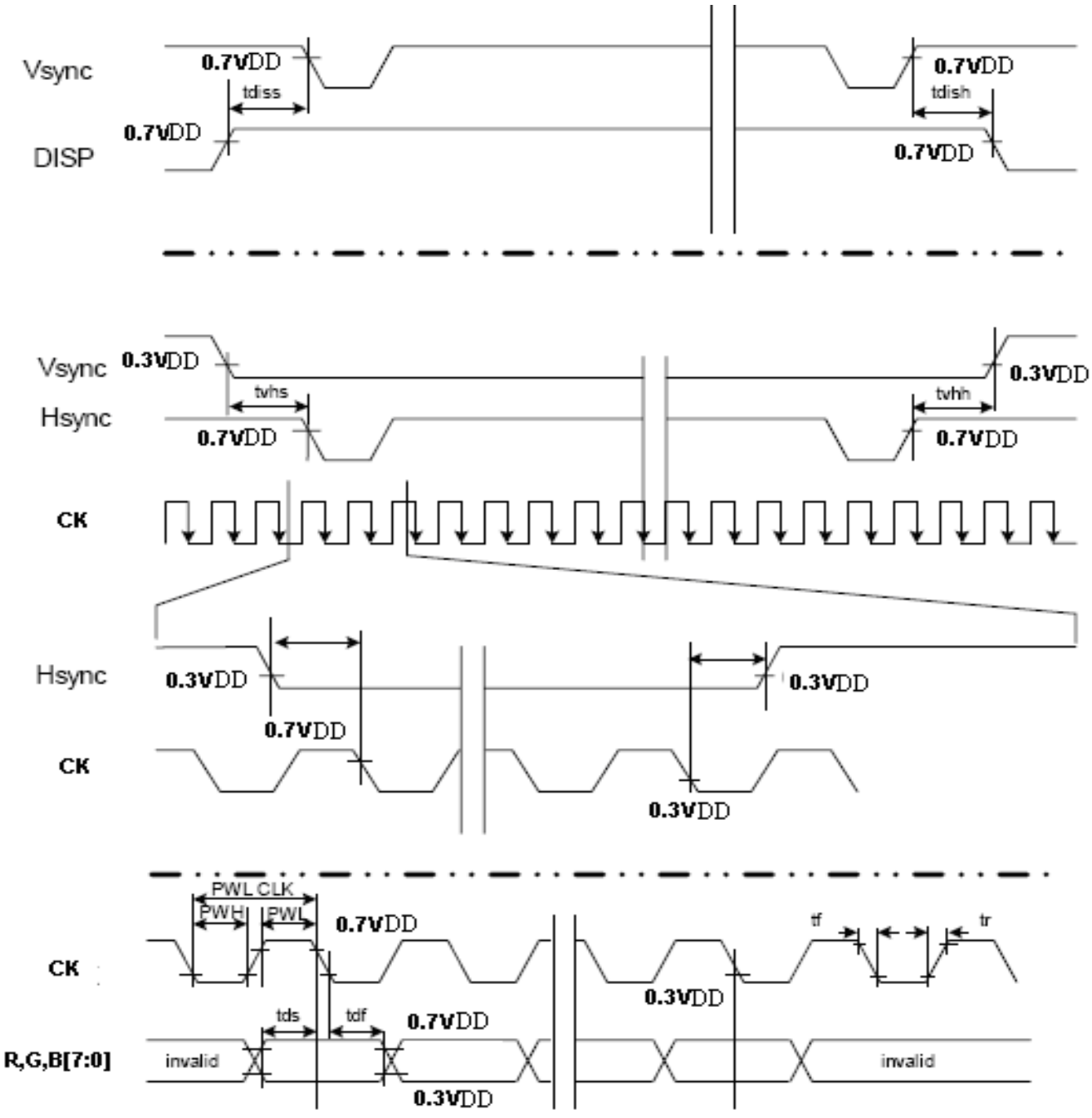


Fig 2. Input setup timing requirement

8.3 TCON Power ON/OFF Control

The TCON IC has a power ON/OFF sequence control function. When DISP pin is pulled "H", blank data is outputted for 10-frames first, from the falling edge of the following VSYNC signal. Similarly, when DISP is pulled "L", 10-frames of blank data will be outputted from the falling edge of the following VSYNC, too.

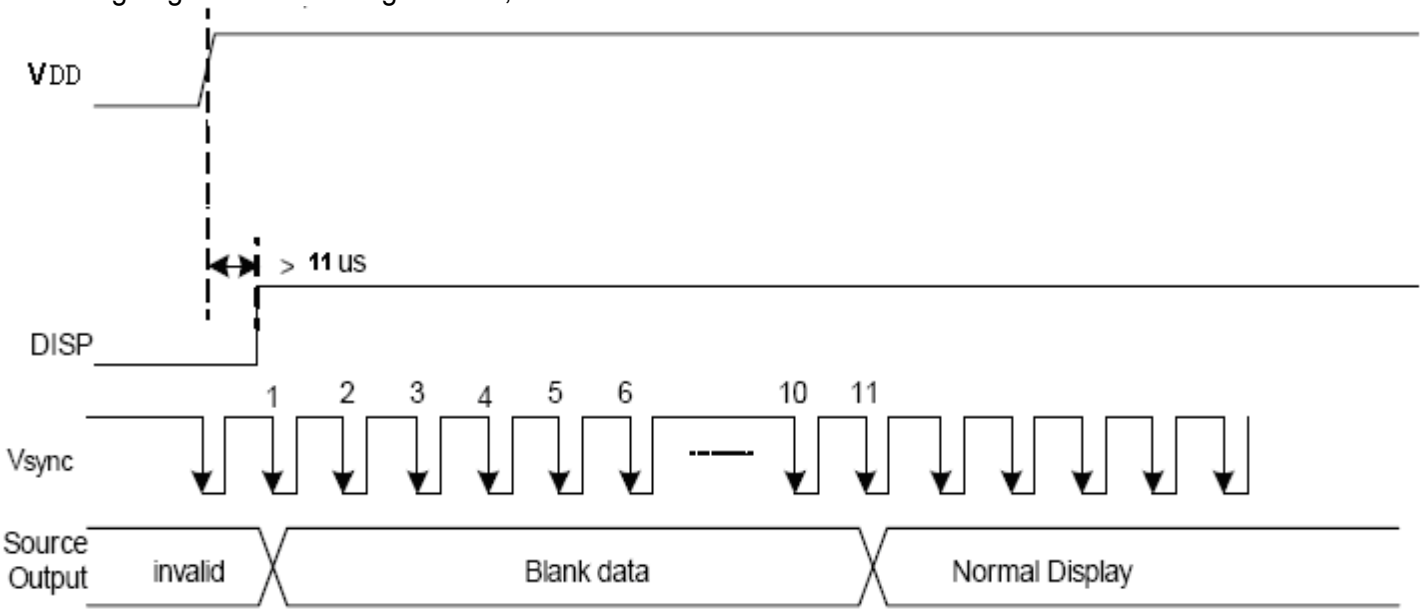


Fig 3. Power On Sequence

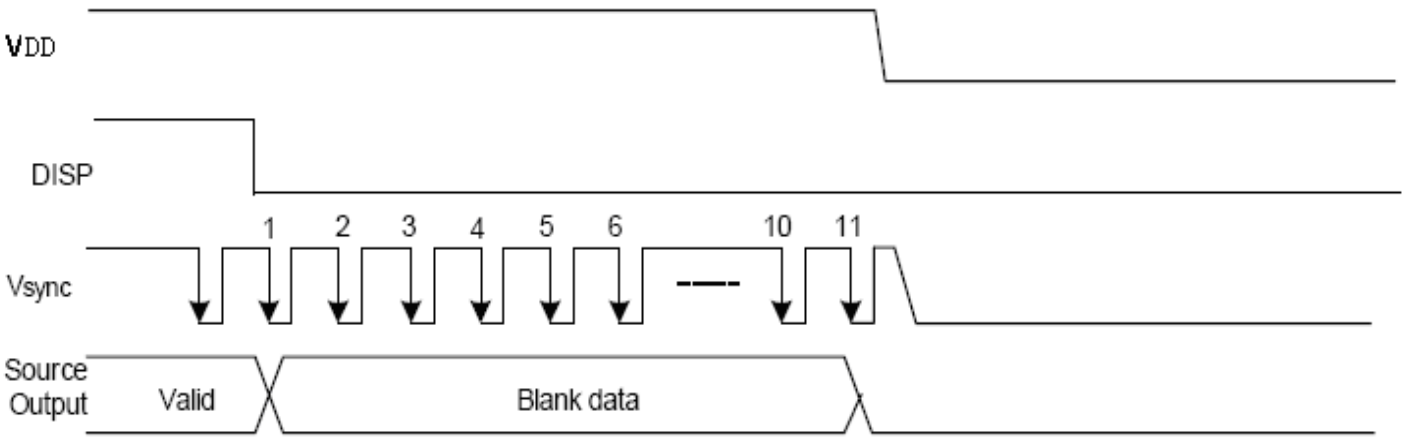
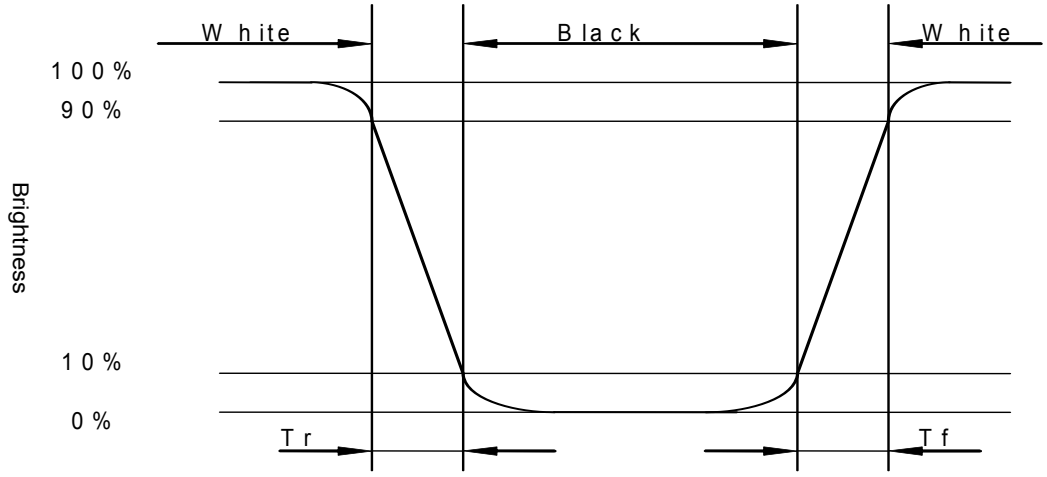


Fig 4. Power Off Sequence

9. Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response time	Rise	Tr	θ=0°	--	5	8	ms	Note 4
	Fall	Tf		--	15	20	ms	
Contrast ratio		CR	At optimized viewing angle	500	600	--		Note 5
Viewing angle	Top		CR≥10	40	50	--	Deg.	Note 6
	Bottom			60	70	--		
	Left			60	70	--		
	Right			60	70	-		
Luminance			θ=0°	570	720	--	cd/m^2	Note 7
Uniformity		B-uni		70	--		%	Note 8
White chromaticity		X	θ=0°	0.27	0.32	0.37		Note 7
		y		0.28	0.33	0.38		

Note 1: Ambient temperature =25°C. LED current I_L= 20 mA.
Note 2: To be measured in the dark room.
Note 3: To be measured on the center area of panel with a viewing cone of 1° by Topcon luminance meter BM-7A, after 2 minutes operation.
Note 4: Definition of response time:
The output signals of photo-detector are measured when the input signals are changed from “white” to “black”(rising time) and from “black” to “white”(falling time),respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as shown below.



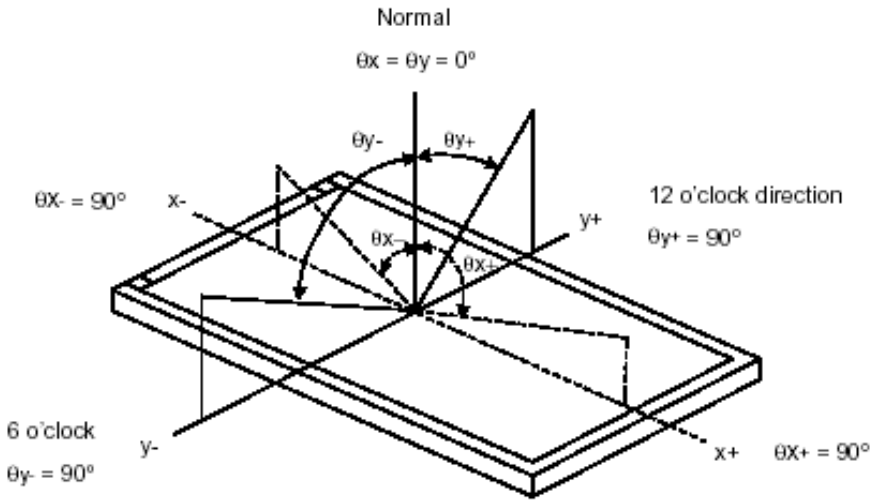
Note5: Definition of contrast ratio:

Contrast ratio is calculated with the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Photo-detector output when LCD is at “White” state}}{\text{Photo-detector output when LCD is at “Black” state}}$$

Note 6. Definition of viewing angle:

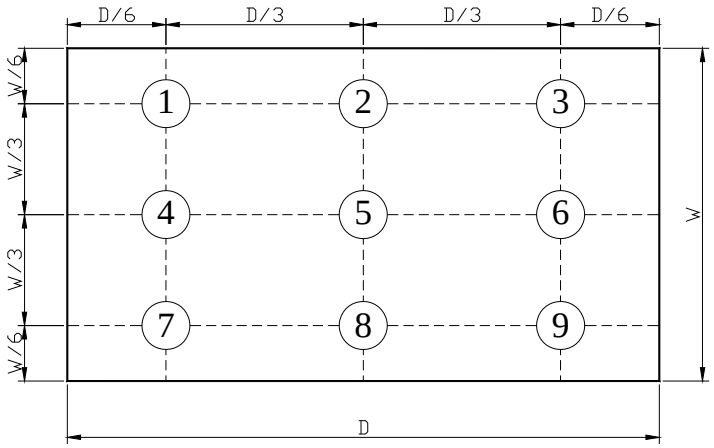
Refer to figure as below.



Note 7. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

Note 8: Definition of Brightness Uniformity (B-uni):

Luminance Measuring Points



$$\text{B-uni} = \frac{\text{Minimum luminance of 9 points}}{\text{Maximum luminance of 9points}}$$

10. QUALITY ASSURANCE

10.1 RA Test Condition

10.1.1 Temperature and Humidity(Ambient Temperature)

Temperature : 25 ± 5°C
Humidity : 65 ± 5%

10.1.2 Operation

Unless specified otherwise, test will be conducted under function state.

10.1.3 Container

Unless specified otherwise, vibration test will be conducted to the product itself without putting it in a container.

10.1.4 Test Frequency

In case of related to deterioration such as shock test. It will be conducted only once.

10.1.5 Test Method

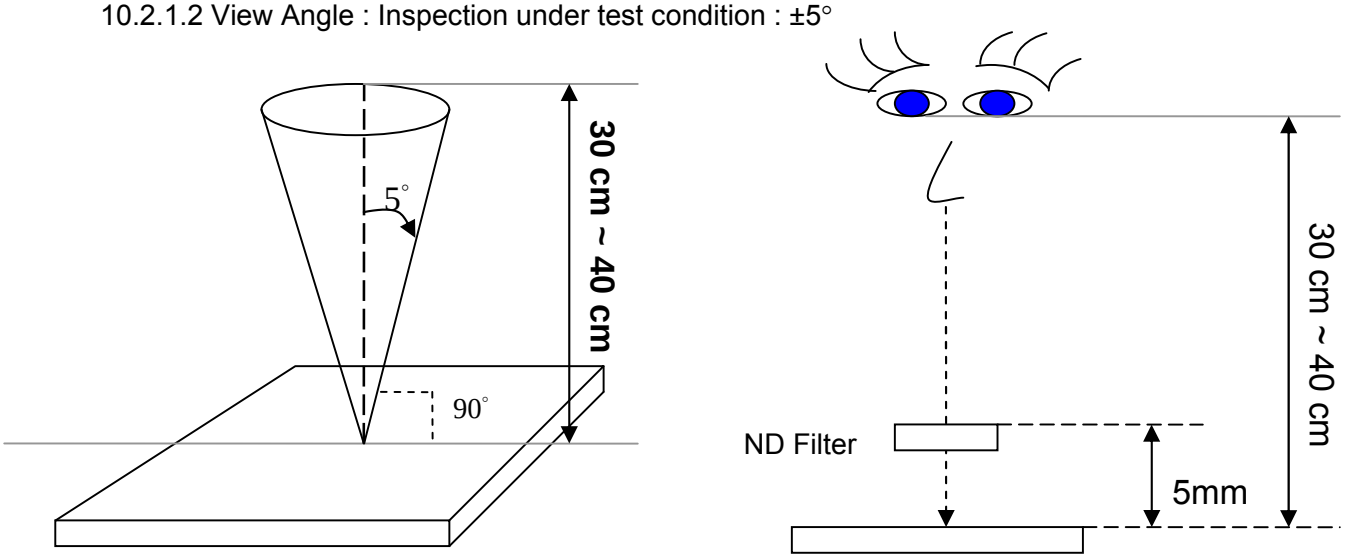
No.	Reliability Test Item & Level	Test Level	Remark
1	High Temperature Storage Test	T=80°C,240hrs	IEC68-2-2
2	Low Temperature Storage Test	T=-30°C,240hrs	IEC68-2-1
3	High Temperature Operation Test	T=70°C,240hrs	IEC68-2-2
4	Low Temperature Operation Test	T=-20°C,240hrs	IEC68-2-1
5	High Temperature and High Humidity Operation Test	T=60°C,90% RH,240hrs	IEC68-2-3
6	Thermal Cycling Test (No operation)	-30°C → +25°C → +80°C,200 Cycles 30 min 5min 30 min	IEC68-2-14
7	Vibration Test (No operation)	Frequency:0 ~ 55 Hz Amplitude:1.5 mm Sweep Time:11min Test Period:6 Cycles for each Direction of X,Y,Z	IEC68-2-6
8	Electrostatic Discharge Test (No operation)	150pF,330Ω Air:± 15KV;Contact: ± 8KV 10 times/point;4 points/panel face	IEC-61000-4-2

10.2 Inspection Judgment standard

10.2.1 Inspection conditions

10.2.1.1 Inspection Distance : 35 ± 5 cm

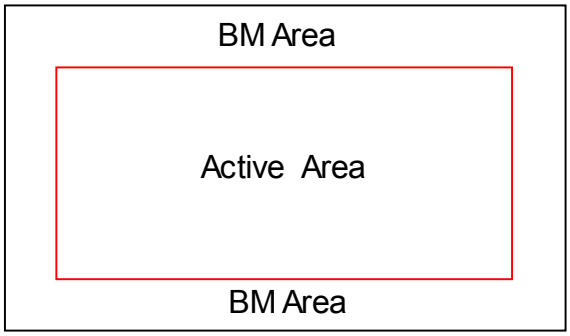
10.2.1.2 View Angle : Inspection under test condition : ±5°



10.2.1.3 Environment conditions :

Ambient Temperature :		25±5℃
Ambient Humidity :		65±5%
Ambient Illumination	Cosmetic Inspection	More than 600lux
	Functional Inspection	300 ~ 800lux

10.2.1.4 Definition of applicable Zones



10.3 Inspection Condition

<table>
<tr><th>No.</th><th>Parameter</th><th>Criteria</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Operating</td><td>Display function: No Display malfunction (Major)</td></tr>
<tr><td>Line Defect: No obvious Vertical and Horizontal line defect in bright, dark and colored. (Major) (Note:1)</td></tr>
<tr><td colspan="2"></td><td>Point Defect (Red, green, blue, dark): Active area ≤4dots (Minor)(Note:1)
<table>
<tr><th>Item</th><th>Acceptable number</th><th>Total</th><th>Class Of Defects</th><th>AQL Level</th></tr>
<tr><td>Bright</td><td>2</td><td rowspan="2">4</td><td rowspan="3">Minor</td><td rowspan="3">1.5</td></tr>
<tr><td>Dark</td><td>3</td></tr>
<tr><td>Adjacent Bright</td><td>1</td><td>1</td></tr>
<tr><td>Adjacent Dark</td><td>1</td><td>1</td></tr>
</table></td></tr>
<tr><td colspan="2"></td><td>Non-uniformity:
Visible through 2%ND filter white, R, G, B and gray 50%pattern. (Minor)</td></tr>
<tr><td colspan="2"></td><td>Foreign material in Black or White spots shape (W>1/4L) (Note: 5)
<table>
<tr><th>Dimension</th><th>Acceptable number</th><th>Class Of Defects</th><th>AQL Level</th></tr>
<tr><td>D ≤ 0.3</td><td>*</td><td rowspan="3">Minor</td><td rowspan="3">1.5</td></tr>
<tr><td>0.3 < D ≤0.5</td><td>3</td></tr>
<tr><td>D> 0.5</td><td>0</td></tr>
</table>
D = (Long + Short) / 2 ＊ : Disregard</td></tr>
<tr><td colspan="2"></td><td>Foreign Material in Line or spiral shape (W≤1/4L) (Note: 4)
<table>
<tr><th>Dimension</th><th>Acceptable number</th><th>Class Of Defects</th><th>AQL Level</th></tr>
<tr><td>W>0.1mm,L>5mm</td><td>0</td><td rowspan="3">Minor</td><td rowspan="3">1.5</td></tr>
<tr><td>L≦5mm,0.05mm<W≦0.1mm</td><td>3</td></tr>
<tr><td>L≦5mm,W<0.05mm</td><td>*</td></tr>
</table>
L : Length W : Width ＊ : Disregard</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">External Inspection (non-operating)</td><td>Dimension: Outline (Major)</td></tr>
<tr><td>Bezel appearance: uneven (Minor)</td></tr>
<tr><td>Scratch on the polarize: (Note:2)
<table>
<tr><th>Dimension</th><th>Acceptable number</th><th>Class Of Defects</th><th>AQL Level</th></tr>
<tr><td>W>0.1mm,L>5mm</td><td>0</td><td rowspan="3">Minor</td><td rowspan="3">1.5</td></tr>
<tr><td>L≦5mm,0.05mm<W≦0.1mm</td><td>3</td></tr>
<tr><td>L≦5mm,W<0.05mm</td><td>*</td></tr>
</table>
L : Length W : Width ＊ : Disregard</td></tr>
<tr><td>Dent and spots shape on the polarize (Note:2): (Note: 5)
<table>
<tr><th>Dimension</th><th>Acceptable number</th><th>Class Of Defects</th><th>AQL Level</th></tr>
<tr><td>D ≤ 0.3</td><td>*</td><td rowspan="3">Minor</td><td rowspan="3">1.5</td></tr>
<tr><td>0.3 < D ≤0.5</td><td>3</td></tr>
<tr><td>D> 0.5</td><td>0</td></tr>
</table>
D = (Long + Short) / 2 ＊ : Disregard</td></tr>
<tr><td>Polarizer flaw or leak out resin : Defect is defined as the active area.</td></tr>
</table>

Class of defects	**Major**	AQL 0.65%	**Definition** It is a defect that is likely to result in failure or to reduce materially the usability of the product for the intended function.
	Minor	AQL 1.5%	It is a defect that will not result in functioning problem with deviation classified.

Note:1.(a)Bright point defect is defined as point defect of R,G,B with area >1/2 dot respectively

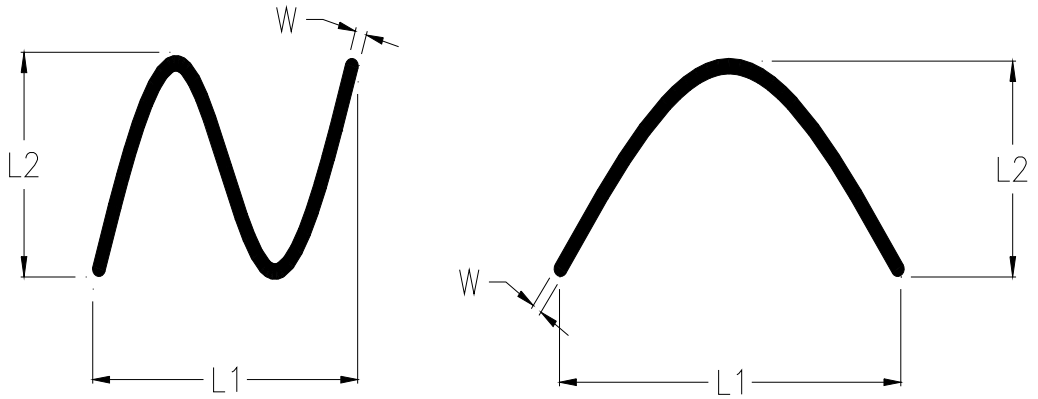
(b)Dark point defect is defined as visible in full white pattern.

(c)The point defect must under 2% ND Filter visible .

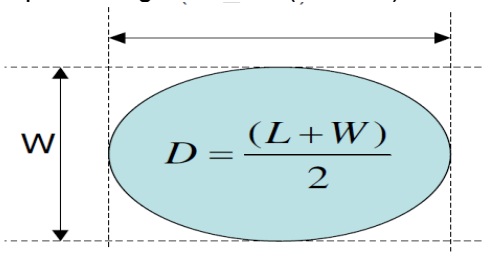
Note:2 The external inspection should be conducted at the distance 30± 5cm between the eyes of inspector and the panel .

Note:3 Luminance measurement for contrast ratio is at the distance 50± 5cm between the detective head and the panel with ambient illuminance less than 1 lux. Contrast ratio is obtained at optimum view angle.

Note:4 W-Width in mm , L-length of Max.(L1,L2) in mm.



Note:5 Spot Foreign Material (W≧L/4)

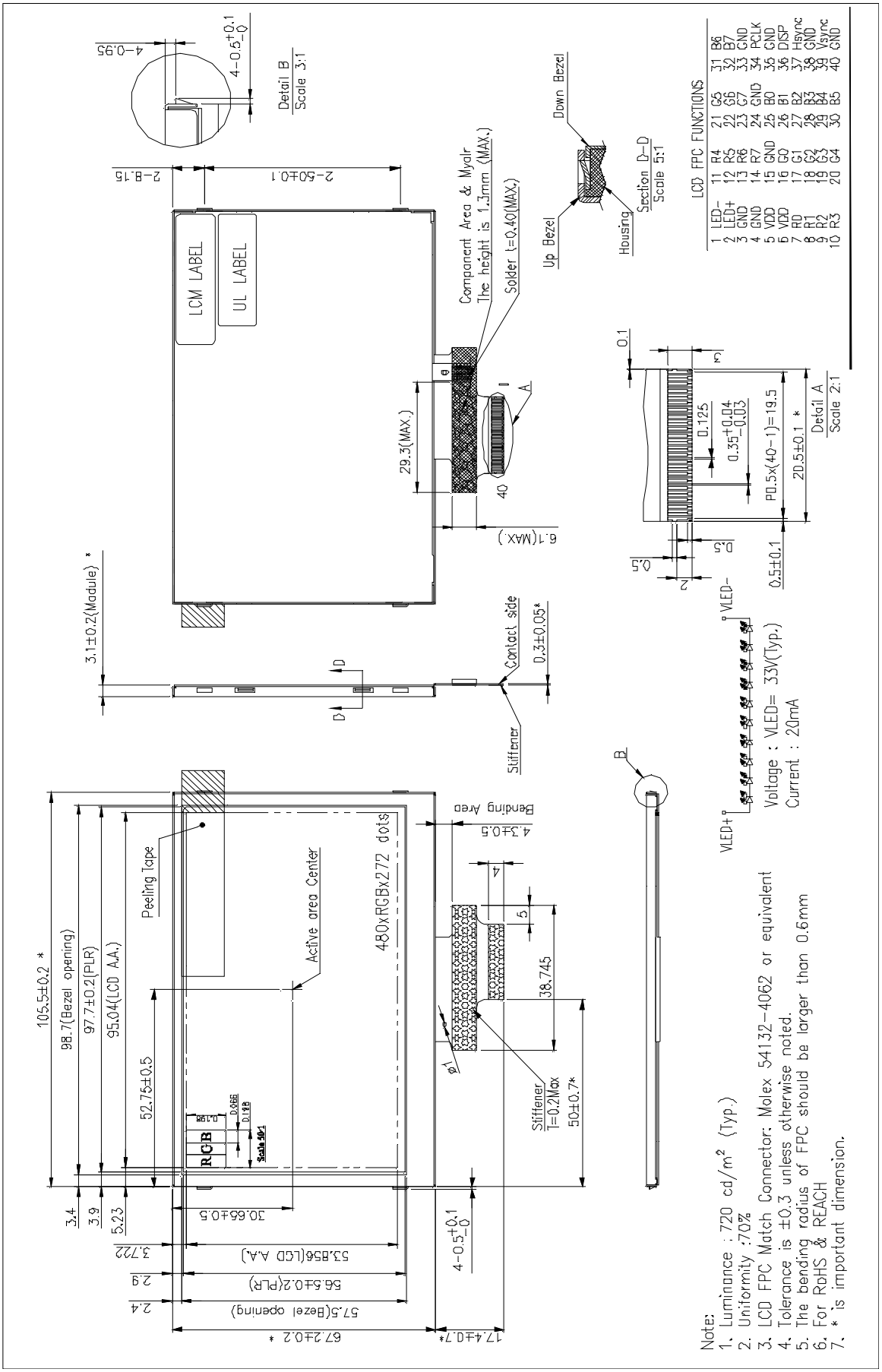


10.4 Sampling Condition

Unless otherwise agree in written, the sampling inspection shall be applied to the incoming inspection of customer.
Lot size: Quantity of shipment lot per model.
Sampling type: normal inspection, single sampling
Sampling table: MIL-STD-105E

Inspection level: Level II

13. OUTLINE DRAWING



Module Handling and Storage Precautions

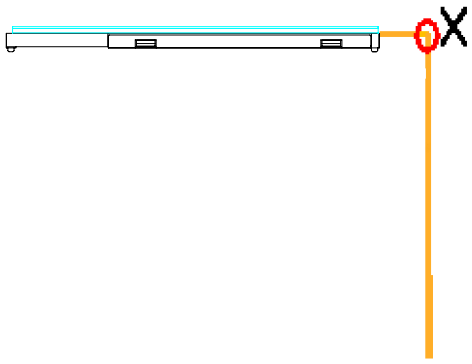
Storage

When long term storage of modules is required, it is necessary to follow some basic precautions

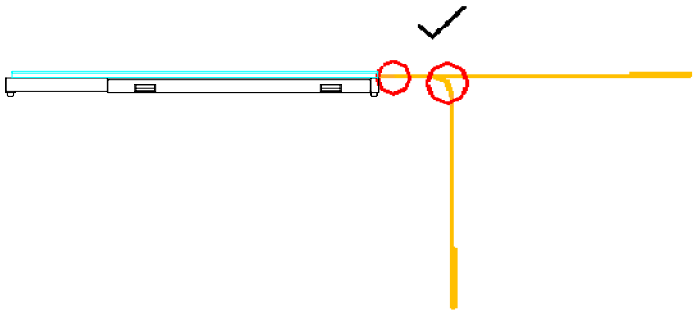
1. Store modules in the original factory packaging whenever possible. The sealed polyethylene antistatic bags or the antistatic trays are designed for long term storage.
2. Store the module sub-packs where they will not be subjected to high heat, sunlight, or high humidity conditions. Recommended storage temperatures should be kept between 0C to +40C, with relative humidity below 80%.
3. Desiccant should not be required if properly sealed and room temperature ambient temperatures are maintained.

Assembly handling precautions

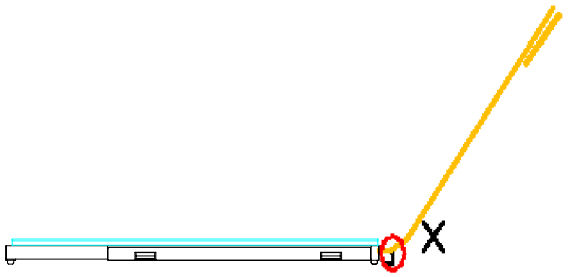
1. FPCs (Flexible Printed Circuits) can be damaged if improperly handled. Avoid sharp 90 degree bending or fold-over conditions which could damage or weaken the conductive traces.



2. The proper FPC bending direction for tight bends should be in the direction that puts the conductive traces on the inside radius of the bend. A rule of thumb is to limit the bend radius to not less than 10 times the FPC thickness. With an FPC of 0.2 mm nominal thickness, the bend radius should not be tighter than approximately 2 mm (4 mm diameter).



3. Avoid pulling up on the FPC in a pealing fashion from the glass bonding area.



4. Avoid stretching the FPC with a strong force, especially near the stiffener/contact end.
5. Proper ESD (Electro-Static Discharge) procedures must be followed. The IC can be damaged when subjected to high voltages.
6. Do not insert or remove the FPC connector from an energized socket.
7. The module is shipped with a protective release sheet on the front polarizer. It is advised to leave this protective film in place until the module is mounted in the final assembly to prevent scratches and fingerprints from marring the display surface.
8. Do not expose to high temperature and/or high humidity testing with the polarizer protective release sheet place.
9. It is possible to generate a static charge when removing this film. When mounted electrically in the circuit, this will not harm the device. However, the static charge may turn certain sections of the module on due to this static charge. This is normal and will dissipate shortly.
10. If cleaning is necessary, Isopropyl alcohol or Ethyl alcohol, either 100% or mixed 50%/50% with distilled water, may be used on a moist clean soft cloth. Do not use ketones and aromatic solvents which will damage the polarizer materials.
11. Do not attempt to disassemble the module.
12. Do not apply input signals to the module if the logic circuit power is off.
13. As with any glass product, use reasonable care when handling to avoid glass chips and cracks.
14. Do not apply excessive force to the IC or display surface.
15. Terminals labeled as NC (no connect) should not be connected to Vss or tied to any other connection.
16. COG Modules with Multiple-Time Programmable memory are sensitive to photon excitation and ESD. Under intense exposure to strong ambient light, MTP cells can lose its content before the specified memory retention time span.
    By design, the IC is expected to be mostly shielded in operation.

Module Usage

1. LXD Research and Display reserves the right to change material or processes or to make improvements that do not affect Fit, Form or Function without prior notice to our customer.

2. For module changes that affect Fit, Form or Function, LXD Research and Display will assign a new part number.