DLC Display Co., Limited

德爾西顯示器有限公司

MODEL No:DLC0460ABM18RT-C-2

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Record of Revision

Date	Revision No.	Summary
2020-12-22	1.0	Rev 1.0 was issued

1. Scope

This data sheet is to introduce the specification of DLC0460ABM18RT-C-2 active matrix TFT module. It is composed of a color TFT-LCD panel, driver ICs, FPC, Capacitive touch panel and a backlight unit. The 4.6” display area contains 800(RGB) x 320 pixels.

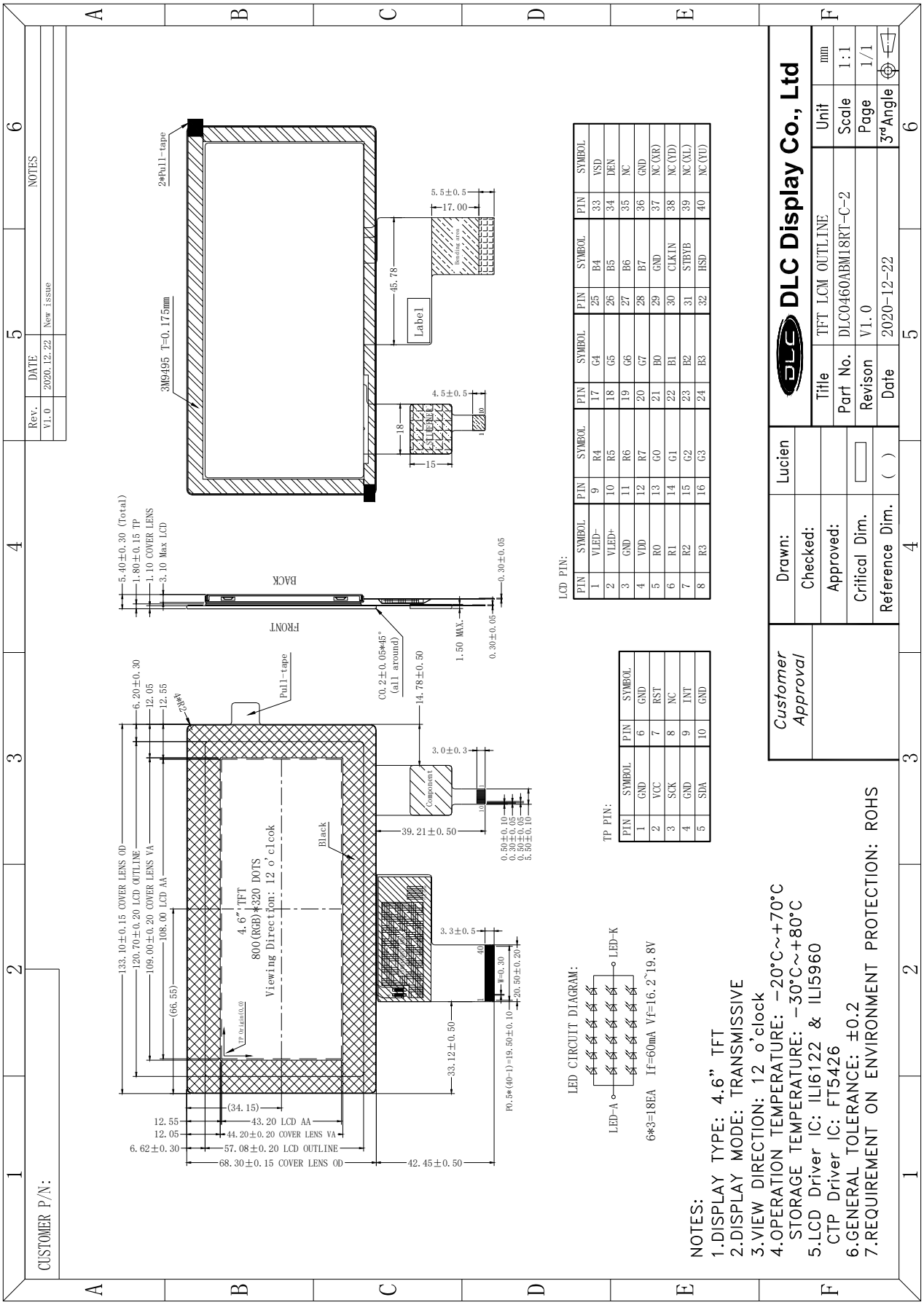
2. Application

Digital equipments which need color display, mobile phone, mobile navigator/video systems.

3. General Information

Item	Contents	Unit
Size	4.6	inch
Resolution	800(RGB) x 320	/
Interface	24-bit RGB interface	/
Technology type	a-Si TFT	/
Pixel pitch	0.135 x 0.135	mm
Pixel Configuration	R.G.B. Vertical Stripe	
Outline Dimension (W x H x D)	133.10 x 68.30 x 5.40	mm
Active Area	108.00 x 43.20	mm
Display Mode	TM with Normally White	/
Viewing Direction	12 o’clock	/
Backlight Type	LED	/
Driver IC for LCD	ILI6122 & ILI5960	/
Driver IC for CTP	FT5426	/
Weight	TBD	g

4. Outline Drawing



5. Interface signals

5.1 LCD PIN Definition

Pin	Symbol	Description	Remark
1	VLED-	LED backlight Cathode	
2	VLED+	LED backlight Anode	
3	GND	Ground	
4	VDD	Power supply	
5	R0	Red data signal	
6	R1	Red data signal	
7	R2	Red data signal	
8	R3	Red data signal	
9	R4	Red data signal	
10	R5	Red data signal	
11	R6	Red data signal	
12	R7	Red data signal	
13	G0	Green data signal	
14	G1	Green data signal	
15	G2	Green data signal	
16	G3	Green data signal	
17	G4	Green data signal	
18	G5	Green data signal	
19	G6	Green data signal	
20	G7	Green data signal	
21	B0	Blue data signal	
22	B1	Blue data signal	
23	B2	Blue data signal	
24	B3	Blue data signal	
25	B4	Blue data signal	
26	B5	Blue data signal	
27	B6	Blue data signal	
28	B7	Blue data signal	
29	GND	Ground	
30	CLKIN	Clock for input data. Data latched at rising edge of this signal	
31	STBYB	Display on/off	

32	HSD	Horizontal synchronizing signal	
33	VSD	Vertical synchronizing signal	
34	DEN	Input data enable control.	
35	NC	No connection	
36	GND	Ground	
37~40	NC	No connection	

5.2 CTP Interface Signals:

Pin	Symbol	Description	Remark
1	GND	Power Ground	
2	VCC	Power Supply	
3	SCK	Clock for the data input	
4	GND	Power Ground	
5	SDA	Data input	
6	GND	Power Ground	
7	RST	Reset pin	
8	NC	No connection	
9	INT	Interrupt output pin	
10	GND	Power Ground	

6. Absolute maximum Ratings

6.1. Electrical Absolute max. ratings

GND=0V,Ta = 25℃

Parameter	Symbol	MIN	MAX	Unit	Remark
Power Voltage	VDD	-0.5	5.0	V	

Notes:

1. If the module is above these absolute maximum ratings. It may become permanently damaged. Using the module within the following electrical characteristic conditions are also exceeded, the module will malfunction and cause poor reliability.
2. VDD >VSS must be maintained.

6.2. Environment Conditions

Item	Symbol	MIN	MAX	Unit	Remark
Operating Temperature	TOPR	-20	70	℃	
Storage Temperature	TSTG	-30	80	℃	

Notes:

1. The response time will become lower when operated at low temperature.
2. Background color changes slightly depending on ambient temperature.
   The phenomenon is reversible.
3. Ta<=40℃:85%RH MAX.
   Ta>=40℃:Absolute humidity must be lower than the humidity of 85%RH at 40℃.

7. Electrical Specifications

7.1 Electrical characteristics

GND=0V, Ta=25℃

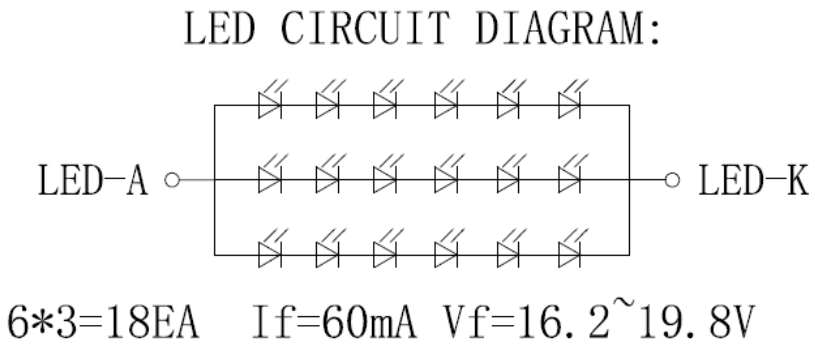
Item		Symbol	MIN	TYP	MAX	Unit	Remark
Power Supply Voltage		VDD	3.0	3.3	3.6	V	
Input Logic Voltage	"H"	VIL	0	--	0.3*VDD	V	
	"L"	VIH	0.7*VDD	--	VDD	V	

7.2 Backlight Characteristics

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Voltage	VF	16.2	18.0	19.8	V	Ta=25 ºC, IF=20mA/LED
Forward Current	IF	--	60	--	mA	Ta=25 ºC, IF=20mA/LED
LED Life Time(25 ºC)		--	30,000	--	Hr	

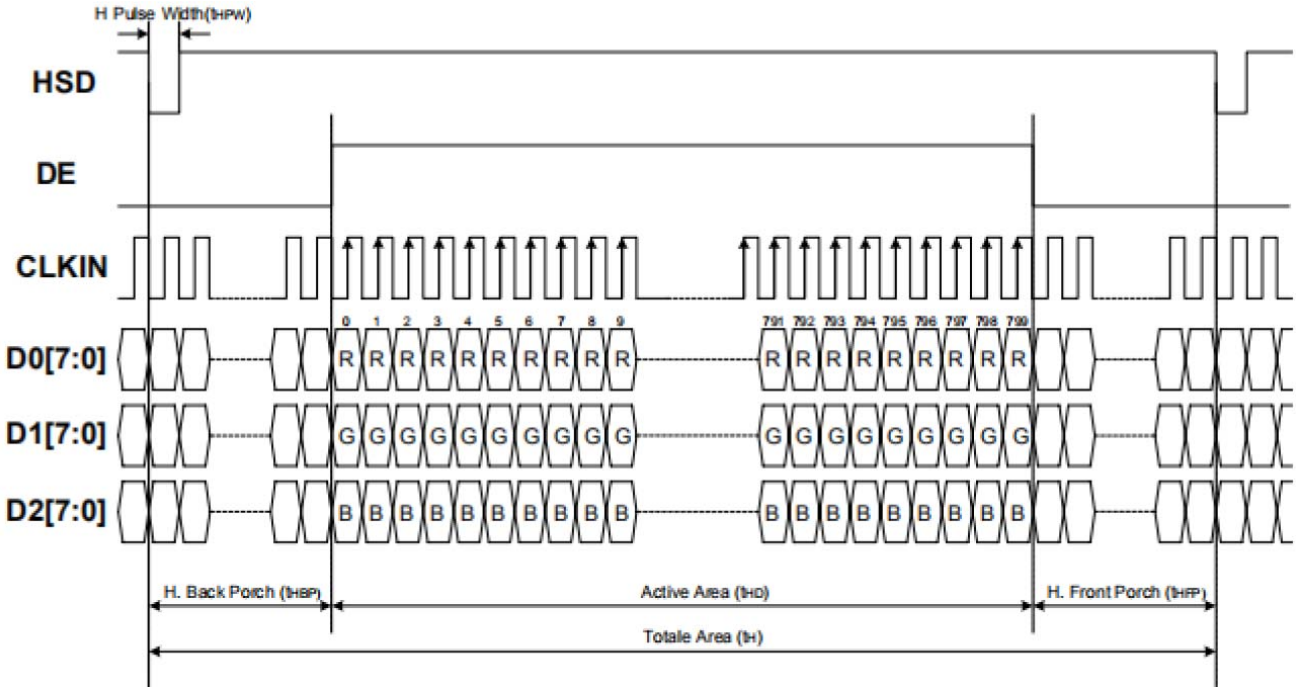
Notes:

1. LED life time defined as follows: The final brightness is at 50% of original brightness.
   (Required constant current supply IF =60mA and Environmental condition: 25℃±3℃, 60%±10%RH)
2. Backlighting circuit



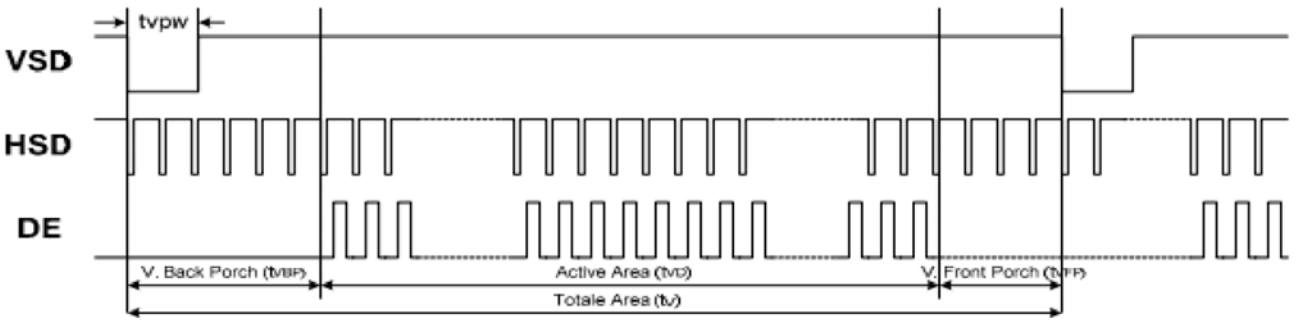
8. Command/AC Timing

8.1 AC Characteristics



Horizontal Input Timing

Parameter		Symbol	Value			Unit
			Min.	Typ.	Max.	
Horizontal display area		thd		800		DCLK
DCLK Frequency		fclk	--	33.3	50	MHz
1 Horizontal Line period		th	862	1056	1200	CLKIN
HSD Pulse width	Min	thpw		1		
	Typ			--		
	Max			40		
HSD Back Porch(Blanking)		thbp	46	46	46	
HSD Front Porch		thfp	16	210	354	



Vertical Input Timing

Parameter	Symbol	Value			Unit
		Min	Typ	Max	
Vertical display area	tvd		480		HSD
VSD period time	tv	510	525	650	HSD
VSD pulse width	tvpw	1	--	20	HSD
VSD Back Porch(Blanking)	tvbp	23	23	23	HSD
VSD Front Porch	tvfp	7	22	147	HSD

9. Optical Specification

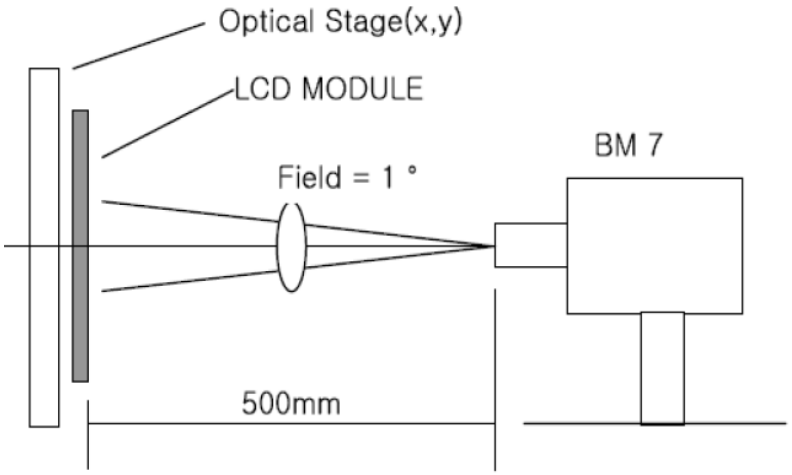
Ta=25℃

Item		Symbol	Condition	Min	Typ.	Max.	Unit	Remark
Contrast Ratio		CR	θ=0°	300	500	--		Note1 Note2
Response Time		Tr	25℃	--	10	20	ms	Note1 Note3
		Tf		--	10	20		
View Angles		ΘT	CR≧10	--	55	--	Degree	Note 4
		ΘB		--	65	--		
		ΘL		--	65	--		
		θR		--	65	--		
Chromaticity	White	x	Brightness is on	Typ-0.05	0.270	Typ+0.05		Note5, Note1
		y			0.330			
	Red	x			0.579			
		y			0.308			
	Green	x			0.316			
		y			0.553			
	Blue	x			0.139			
		y			0.129			
NTSC		S		--	49	--	%	Note5
Luminance		Lv		--	430	--		Note1, Note6
Uniformity		-	-	75	80		%	Note1, Note7

Note 1: Definition of optical measurement system.

Temperature = 25℃(±3℃)

LED back-light: ON, Environment brightness < 150 lx

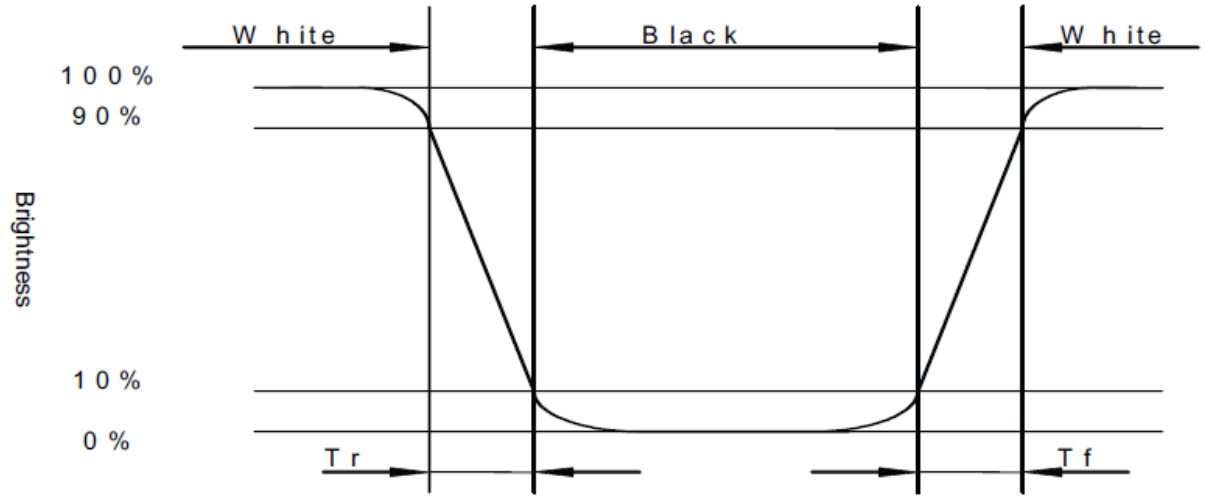


Note 2: Contrast ratio is defined as follow:

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

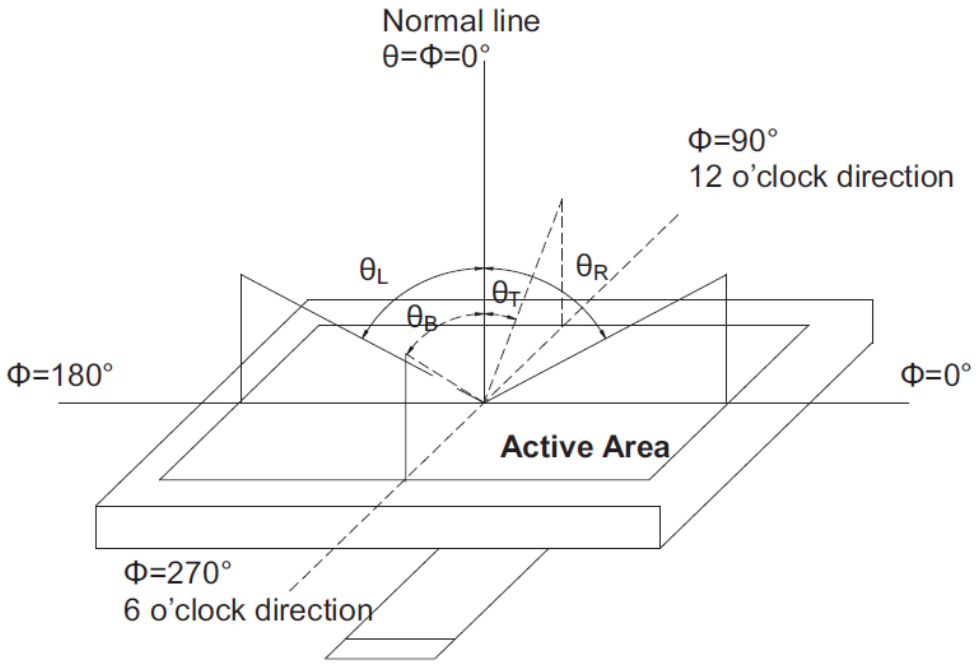
Note 3: Response time is defined as follow:

Response time is the time required for the display to transition from black to white (Rise Time, Tr) and from white to black(Decay Time, Tf).



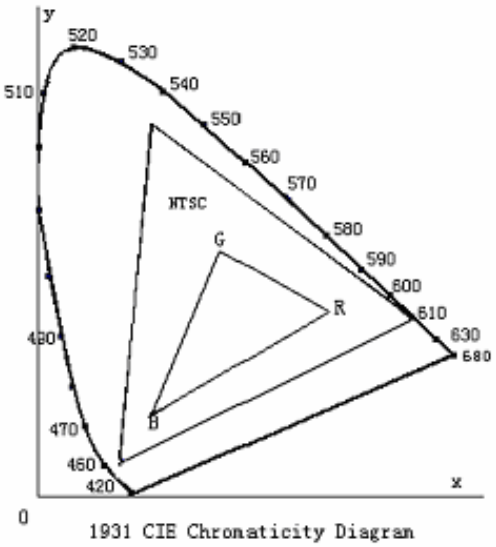
Note 4: Viewing angle range is defined as follow:

Viewing angle is measured at the center point of the LCD.



Note 5: Color chromaticity is defined as follow: (CIE1931)

Color coordinates measured at center point of LCD.



$$S = \frac{\text{area of RGB triangle}}{\text{area of NTSC triangle}} \times 100\%$$

Note 6: Luminance is defined as follow:

Luminance is defined as the brightness of all pixels "White" at the center of display area on optimum contrast.

Note 7: Luminance Uniformity is defined as follow:

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

$$\text{Uniformity (U)} = \frac{\text{Minimum Luminance(brightness) in 9 points}}{\text{Maximum Luminance(brightness) in 9 points}}$$

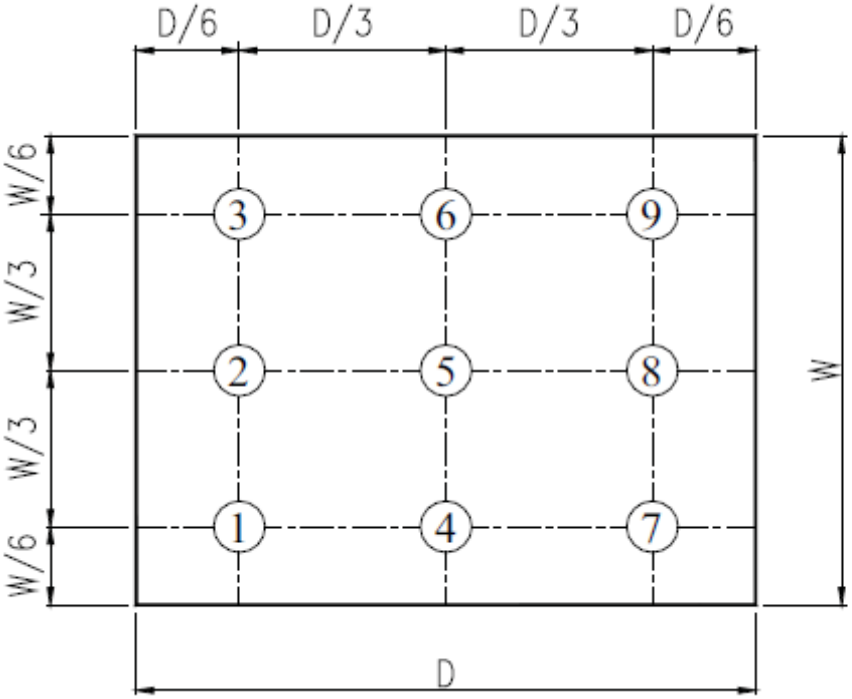


Fig. 2 Definition of uniformity

10. Environmental / Reliability Tests

No	Test Item	Condition	Judgment criteria
1	High Temp Operation	Ts=+70℃, 96hrs	Per table in below
2	Low Temp Operation	Ta=-20℃, 96hrs	Per table in below
3	High Temp Storage	Ta=+80℃, 96hrs	Per table in below
4	Low Temp Storage	Ta=-30℃, 96hrs	Per table in below
5	High Temperature & High Humidity Operation	Ta=+60℃,90%RH,96hours	Per table in below (polarizer discoloration is excluded)
6	Thermal Shock (Non-operation)	-20℃ 30 min~+70℃ 30 min, Change time:5min, 20 Cycles	Per table in below
7	ESD (Operation)	C=150pF, R=330Ω，5points/panel Air:±8KV, 5times; Contact:±4KV, 5 times;	Per table in below
8	Vibration (Non-operation)	Frequency range:10Hz~50Hz Acceleration of gravity:5G X,Y,Z 30 min for each direction	Per table in below
9	Shock (Non-operation)	Height:80 cm,1 corner, 3 edges, 6 surfaces.	Per table in below

INSPECTION	CRITERION(after test)
Appearance	No Crack on the FPC, on the LCD Panel
Alignment of LCD Panel	No Bubbles in the LCD Panel No other Defects of Alignment in Active area
Electrical current	Within device specifications
Function / Display	No Broken Circuit, No Short Circuit or No Black line No Other Defects of Display

11. Precautions for Use of LCD Modules

11.1 Safety

The liquid crystal in the LCD is poisonous. Do not put it in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and water.

11.2 Handling

A. The LCD and touch panel is made of plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.
B. Do not handle the product by holding the flexible pattern portion in order to assure the reliability
C. Transparency is an important factor for the touch panel. Please wear clear finger sacks, gloves and mask to protect the touch panel from finger print or stain and also hold the portion outside the view area when handling the touch panel.
D. Provide a space so that the panel does not come into contact with other components.
E. To protect the product from external force, put a covering lens (acrylic board or similar board) and keep an appropriate gap between them.
F. Transparent electrodes may be disconnected if the panel is used under environmental conditions where dew condensation occurs.
G. Property of semiconductor devices may be affected when they are exposed to light, possibly resulting in IC malfunctions.
H. To prevent such IC malfunctions, your design and mounting layout shall be done in the way that the IC is not exposed to light in actual use.

11.3 Static Electricity

A. Ground soldering iron tips, tools and testers when they are in operation.
B. Ground your body when handling the products.
C. Power on the LCD module before applying the voltage to the input terminals.
D. Do not apply voltage which exceeds the absolute maximum rating.
E. Store the products in an anti-electrostatic bag or container.

11.4Storage

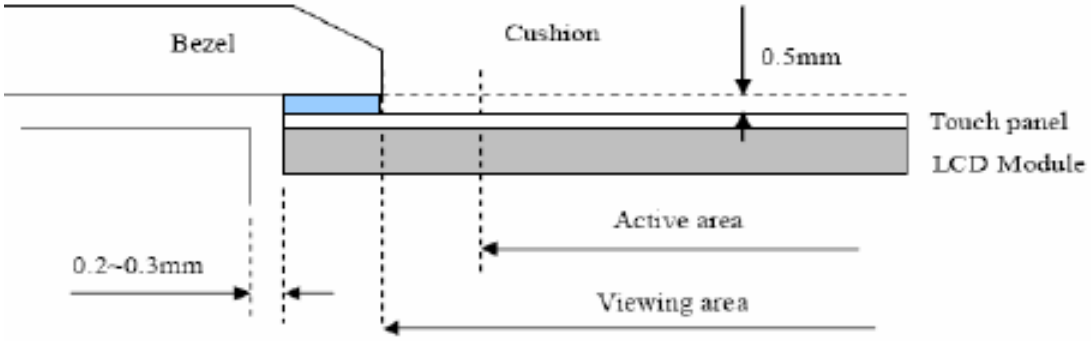
A. Store the products in a dark place at +25℃±10℃ with low humidity (40% RH to 60% RH). Don't expose to sunlight or fluorescent light.
B. Storage in a clean environment, free from dust, active gas, and solvent.

11.5 Cleaning

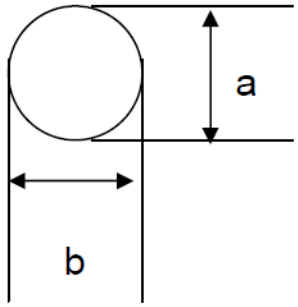
A. Do not wipe the touch panel with dry cloth, as it may cause scratch.
B. Wipe off the stain on the product by using soft cloth moistened with ethanol. Do not allow ethanol to get in between the upper film and the bottom glass. It may cause peeling issue or defective operation. Do not use any organic solvent or detergent other than ethanol.

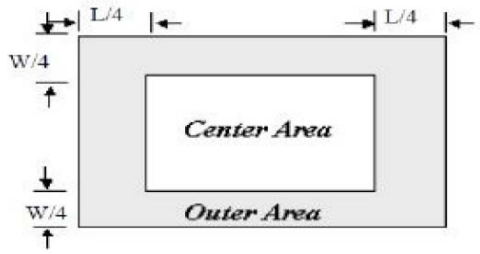
11.6 Cautions for installing and assembling

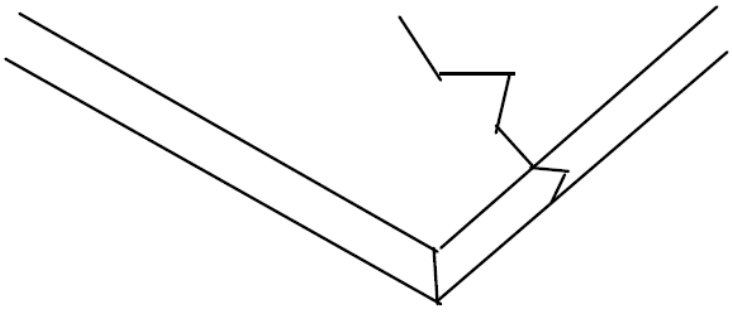
A. Bezel edge must be positioned in the area between the Active area and View area. The bezel may press the touch screen and cause activation if the edge touches the active area. A gap of approximately 0.5mm is needed between the bezel and the top electrode. It may cause unexpected activation if the gap is too narrow. There is a tolerance of 0.2 to 0.3mm for the outside dimensions of the touch panel and tail. A gap must be made to absorb the tolerance in the case and connector.
B. In order to make the display assembly stable and firm, DLC recommends to design some supporting at the display backside, especially for the display with tape-attached touch panel, such supporting is important and essential, or else, the display may drop-off from front after some period of time.
C. Do not display the fixed pattern for a long time because it may develop image sticking due to the LCD structure. If the screen is displayed with fixed pattern, use a screen saver.

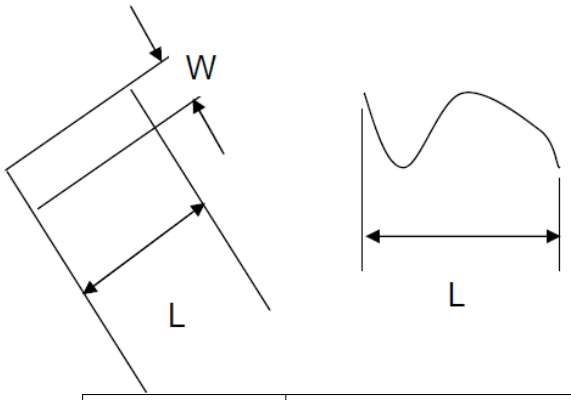


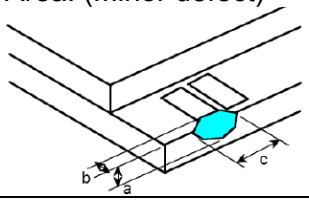
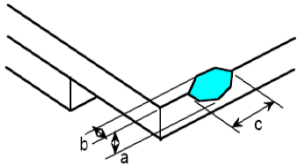
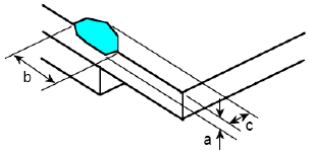
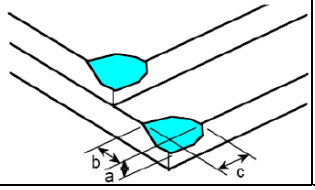
12. Inspection Specification

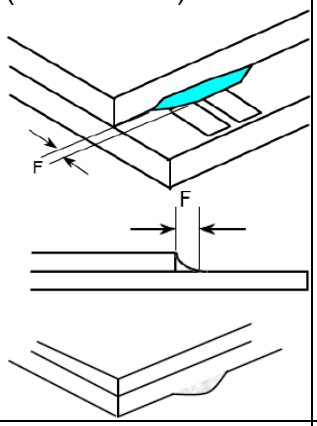
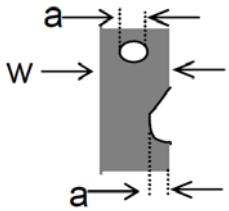
<table>
<tr><th>NO.</th><th>Item</th><th>Criteria (Unit: mm)</th></tr>
<tr><td>1</td><td>Black / White spot
Foreign material
(Round type)
Pinholes
Stain
Particles inside cell.
(Minor defect)</td><td>


<table>
<tr><th>Area / Size</th><th>Acc. Qty</th></tr>
<tr><td>φ≤0.20</td><td>Ignore</td></tr>
<tr><td>0.20<φ≤0.50</td><td>N≤3</td></tr>
<tr><td>0.50<φ</td><td>0</td></tr>
</table>
φ= (a + b) /2
Distance between 2 defects should more than 5mm apart.
</td></tr>
<tr><td>2</td><td>Electrical Defect
(Minor defect)</td><td>
<table>
<tr><td rowspan="2">Bright dot</td><td>Display Area</td><td>Total</td><td rowspan="3">Note1</td></tr>
<tr><td>N≤2</td><td>N≤2</td></tr>
<tr><td>Dark dot</td><td>N≤4</td><td>N≤4</td></tr>
<tr><td>Total dot</td><td>N≤4</td><td>N≤4</td><td></td></tr>
<tr><td>Mura</td><td colspan="2">Not visible through 5% ND filter.</td><td>Note 2</td></tr>
</table>
Remark:
1. Bright dot caused by scratch and foreign object accords to item 1.
</td></tr>
<tr><td>3</td><td>Inactive Area
(Minor defect)</td><td>
Line Criteria: L≦1mm, W≦0.1mm,
Dot Criteria: Please refer to Note 1,2&3
Note 1: Definition of Area


Note2:
<table>
<tr><th>Size</th><th>Inactive dot</th><th>Center</th><th>Outer</th><th>Total</th><th>Remark</th></tr>
<tr><td>All</td><td>Φ<0.2mm</td><td colspan="4">Is not counted</td></tr>
<tr><td><5”</td><td>0.2≤Φ≤0.3mm
L≤1mm,W≤0.1mm</td><td>N≤1</td><td>N≤2</td><td>N≤3</td><td></td></tr>
</table>
Note3: Inactive area D<0.2mm is not counted without appearance observation.
</td></tr>
<tr><td>4</td><td>Glass Crack
(Minor defect)</td><td>

Crack is potential to enlarge, any type is not allowed.
</td></tr>
</table>

<table>
<tr>
<td>5</td>
<td>Black and White line
Scratch
Foreign material
(Line type)
(Minor defect)</td>
<td>


<table>
<tr><th>Length</th><th>Width</th><th>Acc. Qty</th></tr>
<tr><td>/</td><td>W ≦ 0.1</td><td>Ignore</td></tr>
<tr><td>L ≦ 2.5</td><td>0.1 ＜ W ≦ 0.2</td><td>3</td></tr>
<tr><td>L＞2.5</td><td>0.2 ＜ W</td><td>0</td></tr>
<tr><td colspan="2">Total</td><td>3</td></tr>
</table>
Distance between 2 defects should more than 3mm apart. Scratches not viewable through the back of the display are acceptable.
</td>
</tr>
<tr>
<td>6</td>
<td>Glass Chipping Pad Area: (Minor defect)
  </td>
<td>
<table>
<tr><th>Length and Width</th><th>Acc. Qty</th></tr>
<tr><td>c > 3.0, b< 1.0</td><td>1</td></tr>
<tr><td>c< 3.0, b< 1.0</td><td>3</td></tr>
<tr><td colspan="2">a<Glass Thickness</td></tr>
</table>
</td>
</tr>
<tr>
<td>7</td>
<td>Glass Chipping Rear of Pad Area:
(Minor defect)
  </td>
<td>
<table>
<tr><th>Length and Width</th><th>Acc. Qty</th></tr>
<tr><td>c > 3.0, b< 1.0</td><td>1</td></tr>
<tr><td>c< 3.0, b< 1.0</td><td>2</td></tr>
<tr><td>c< 3.0, b< 0.5</td><td>4</td></tr>
<tr><td colspan="2">a<Glass Thickness</td></tr>
</table>
</td>
</tr>
<tr>
<td>8</td>
<td>Glass Chipping Except Pad Area:
(Minor defect)
  </td>
<td>
<table>
<tr><th>Length and Width</th><th>Acc. Qty</th></tr>
<tr><td>c > 3.0, b< 1.0</td><td>1</td></tr>
<tr><td>c< 3.0, b< 1.0</td><td>2</td></tr>
<tr><td>c< 3.0, b< 0.5</td><td>4</td></tr>
<tr><td colspan="2">a<Glass Thickness</td></tr>
</table>
</td>
</tr>
<tr>
<td>9</td>
<td>Glass Corner Chipping:
(Minor defect)
  </td>
<td>
<table>
<tr><th>Length and Width</th><th>Acc. Qty</th></tr>
<tr><td>c < 3.0, b< 3.0</td><td>Ignore</td></tr>
<tr><td colspan="2">a<Glass Thickness</td></tr>
</table>
</td>
</tr>
</table>

<table>
<tr><td>10</td><td>Glass Burr:
(Minor defect)
  </td><td><table><tr><th>Length</th><th>Acc. Qty</th></tr><tr><td>F < 1.0</td><td>Ignore</td></tr></table>Glass burr don’t affect assemble and module dimension.</td></tr>
<tr><td>11</td><td>FPC Defect:
(Minor defect)
  </td><td>11.1 Dent, pinhole width a<w/3.
(w: circuitry width.)
11.2 Open circuit is unacceptable.
11.3 No oxidation, contamination and distortion.</td></tr>
<tr><td>12</td><td>Bubble on Polarizer
(Minor defect)</td><td><table><tr><th>Diameter</th><th>Acc. Qty</th></tr><tr><td>φ≤0.30</td><td>Ignore</td></tr><tr><td>0.30 <φ≤0.50</td><td>N≤2</td></tr><tr><td>0.50 < φ</td><td>N=0</td></tr></table></td></tr>
<tr><td>13</td><td>Dent on Polarizer
(Minor defect)</td><td><table><tr><th>Diameter</th><th>Acc. Qty</th></tr><tr><td>φ≤0.25</td><td>Ignore</td></tr><tr><td>0.25 <φ≤0.50</td><td>N≤4</td></tr><tr><td>0.50 < φ</td><td>None</td></tr></table></td></tr>
<tr><td>14</td><td>Bezel</td><td>14.1 No rust, distortion on the Bezel.
14.2 No visible fingerprints, stains or other contamination.</td></tr>
<tr><td>15</td><td>Touch Panel</td><td>D: Diameter W: width L: length
15.1 Spot: D<0.25 is acceptable
0.25≦D≦0.4
2dots are acceptable and the distance between defects should more than 10 mm.
D>0.4 is unacceptable
15.2 Dent: D>0.40 is unacceptable
15.3 Scratch: W 0.03, L 10 is acceptable,
0.03<W 0.10, L 10 is acceptable
Distance between 2 defects should more than 10 mm.
W>0.10 is unacceptable.</td></tr>
<tr><td>16</td><td>PCB</td><td>16.1 No distortion or contamination on PCB terminals.
16.2 All components on PCB must same as documented on the BOM/component layout.
16.3 Follow IPC-A-600F.</td></tr>
<tr><td>17</td><td>Soldering</td><td>Follow IPC-A-610C standard</td></tr>
</table>

18	Follow IPC-A-610C standard	The below defects must be rejected. 18.1 Missing vertical / horizontal segment, 18.2 Abnormal Display. 18.3 No function or no display. 18.4 Current exceeds product specifications. 18.5 LCD viewing angle defect. 18.6 No Backlight. 18.7 Dark Backlight. 18.8 Touch Panel no function.

Remark: LCD Panel Broken shall be rejected. Defect out of LCD viewing area is acceptable.