

8. ELECTRICAL CHARACTERISTICS

8.1 LCM ELECTRICAL CHARACTERISTICS

Ta=25°C

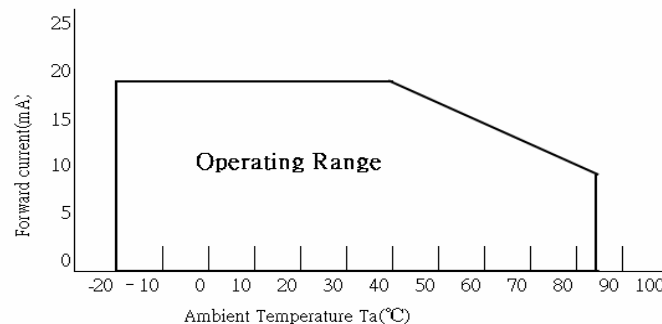
ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT
Power Voltage	VCC-VSS=3.3V	3.0	3.3	3.6	V
	ICC	-	18	25	mA
Input High Voltage	V _{IH}	0.7*VCC	-	VCC	V
Input Low Voltage	V _{IL}	0	-	0.3*VCC	V

8.2 LED BACKLIGHT ELECTRICAL CHARACTERISTICS

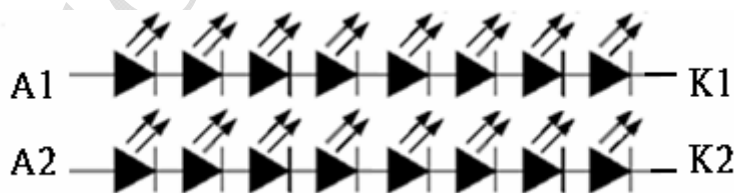
ITEM		SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Forward Voltage (A1-K1、A2-K2)	-20°C	V _f	-	-	26.42	V	-
	25°C		-	23.92	-	V	-
	75°C		21.62	-	-	V	-
Forward Current	25°C/75°C	IA1(A1-K1)	-	13	-	mA	1
		IA2(A2-K2)	-	13	-		
Number of LED		-	-	16	-	EA	2

Note: Forward Voltage for reference voltage, forward current for main drive current.

Note 1: Single LED Operating Curve



Note 2: LED Number



8.3 TFT common electrode voltage

Item	Symbol	Specification			Unit
		Min	Typ	Max	
TFT common electrode voltage	VcomH	Ta=25°C	-	4.2	V
		Ta=60°C	-	-	
	VcomL	Ta=25°C	-	-1.4	
		Ta=60°C	-	-	

* VcomH and VcomL are the reference voltages.

* Vcom voltage may make the adjustment by the adjustable resistor.

* The product picture will use the adjustable resistor to adjust to the suitable picture.

[HY-LINE Computer Components / www.hy-line.de/computer](http://www.hy-line.de/computer)

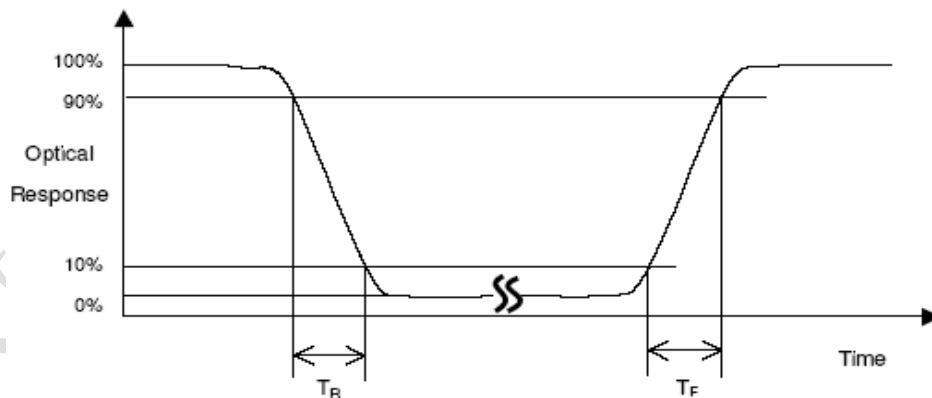
9.OPTICAL CHARACTERISTICS

9.1 OPTICAL CHARACTERISTICS OF LCM PANEL

Ta=25°C

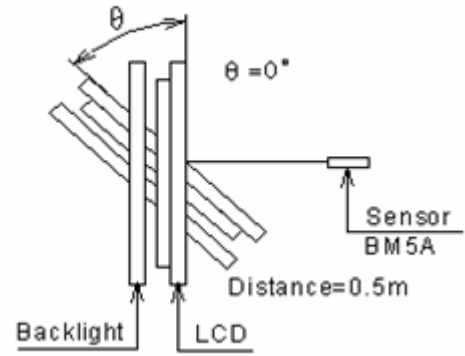
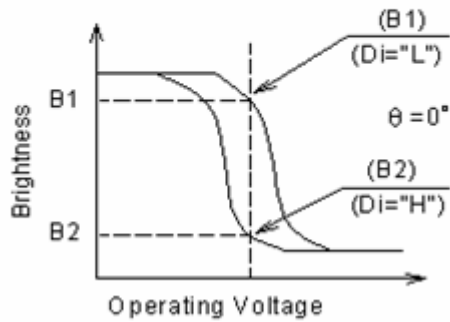
Item	Symbol	Conditions	Specifications			Unit	
			Min	Typ	Max		
Contrast ratio	CR	Viewing normal angle $\Theta X = \Theta Y = 0^\circ$	150	250	-	-	
Response time	TR		-	15	20	ms	
	TF		-	35	50	ms	
Chromaticity	Red		X _R	0.57	0.6	0.63	-
			Y _R	0.33	0.36	0.39	-
	Green		X _G	0.31	0.34	0.37	-
			Y _G	0.54	0.57	0.6	-
	Blue		X _B	0.11	0.14	0.17	-
			Y _B	0.08	0.11	0.14	-
	White		X _W	0.29	0.32	0.35	-
		Y _W	0.30	0.33	0.36	-	
Viewing angle	$\Theta X+$	CR ≥ 10	45	55	-	Deg.	
	$\Theta X-$		45	55	-	Deg.	
	$\Theta Y+$		10	15	-	Deg.	
	$\Theta Y-$		45	55	-	Deg.	

Note (1) Definition of Response Time (TR,TF) :



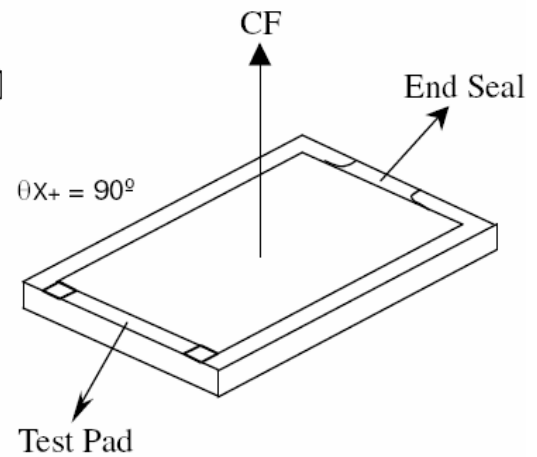
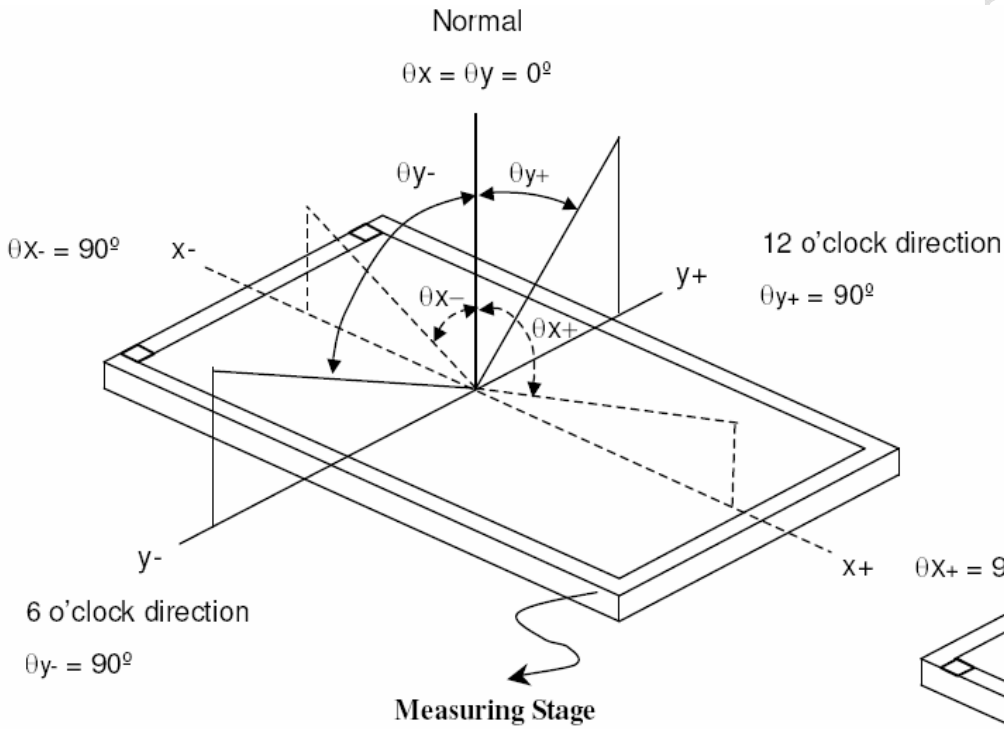
Note (2) Definition of Contrast Ratio "CR":

$$CR_{\pm} = \frac{\text{Brightness on non-selected dot (B1)}}{\text{Brightness on selected dot (B2)}}$$

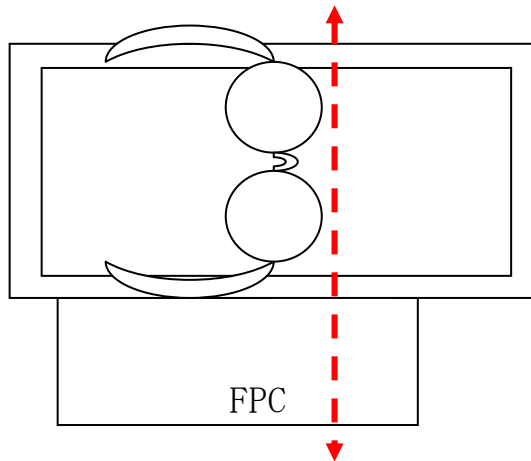


Note (3) Definition of Viewing Angle

* 6 O'clock Gray Scale Inversion Direction



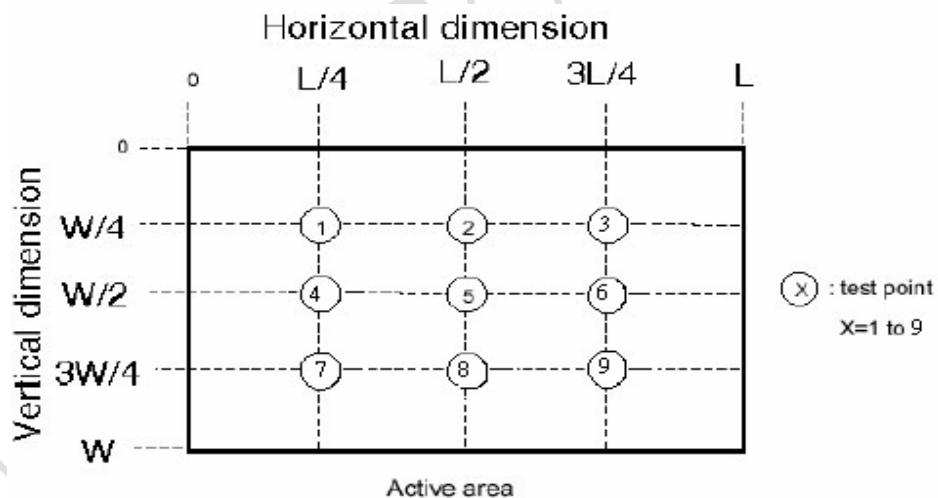
* The sunglasses become 90°, display picture changes black



9.2 Optical Characteristics of Backlight

I T E M		MIN.	TYP.	MAX.	UNIT	Remark
Luminance for LCM	Ta=25°C IA1=IA2=13mA	700	750	-	cd/m ²	Note 1,2
	Ta=75°C IA1=IA2=13mA	600	650	-	cd/m ²	
Luminance Uniformity		75	80	-	%	Note 1,3

Note (1) Measurement of the following 9 points on the display.



Note (2) The Brightness should be the average Brightness of point ① ~ ⑨ .

Note (3) Definition of the luminance uniformity .

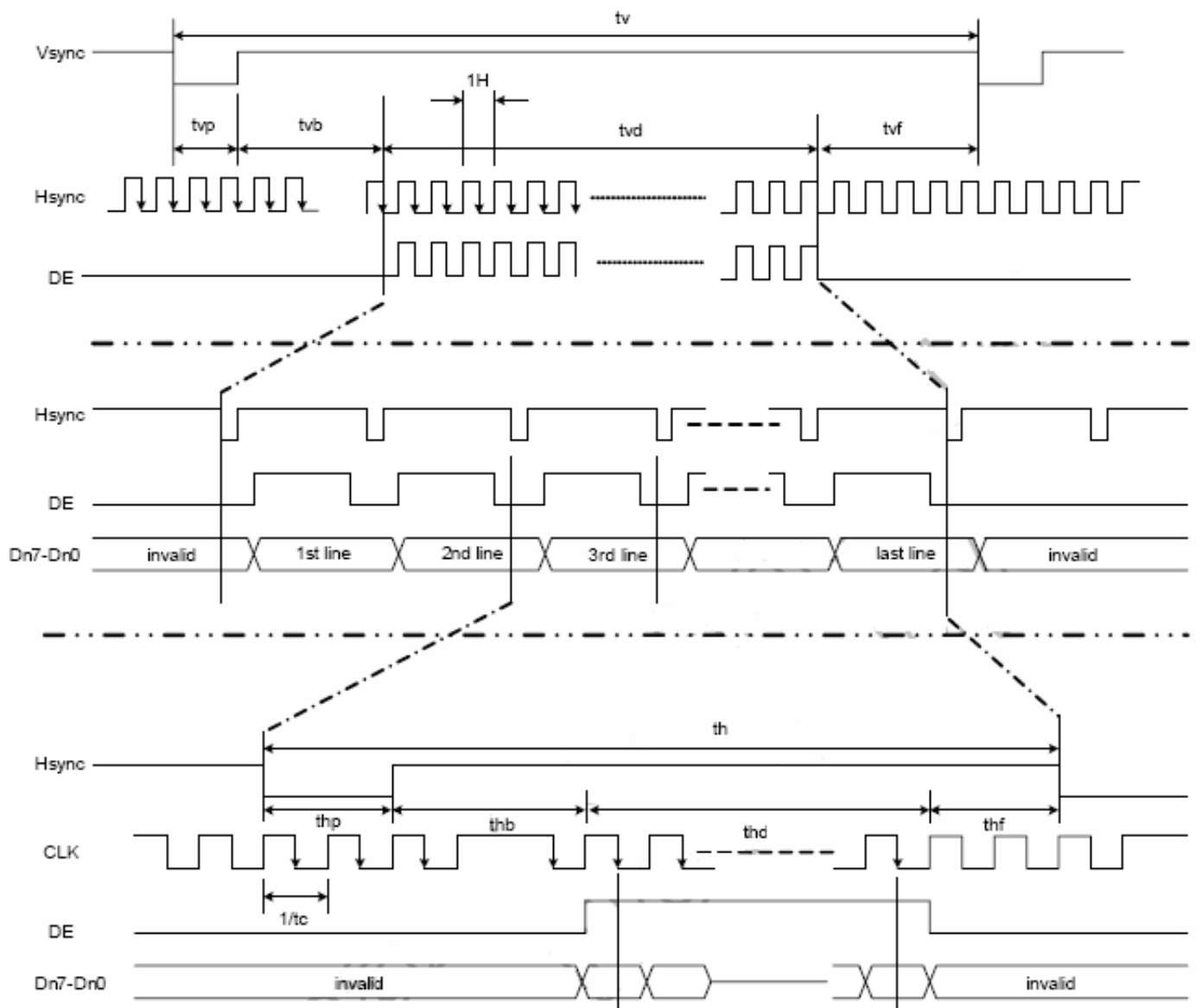
$$\left[1 - \frac{\text{MAX Luminance} - \text{Average Luminance}}{\text{Average Luminance}} \right] \times 100\% > 80\%$$

10. AC CHARACTERISTICS

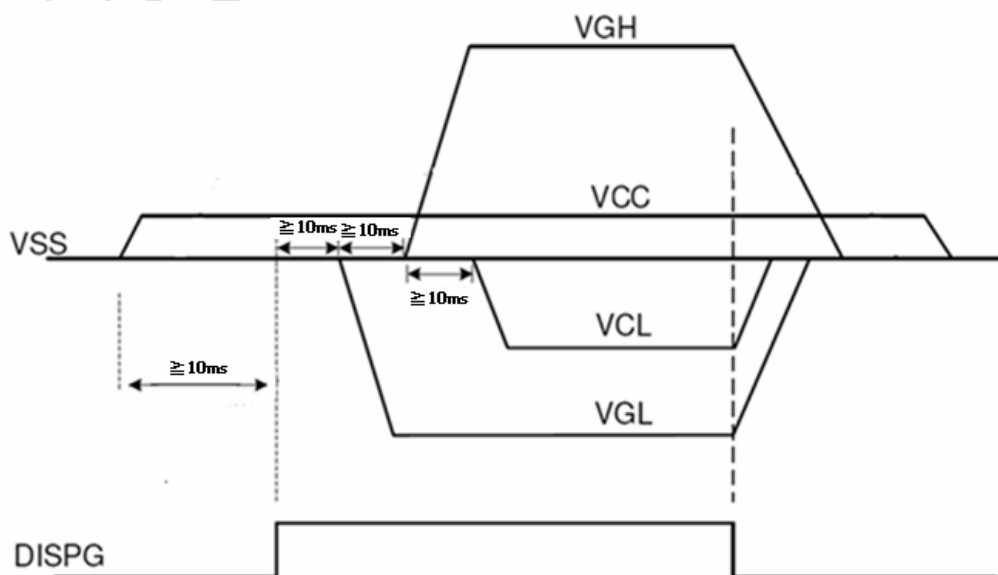
10.1 Timing Requirement

Ta = 25°C

Parameter	Symbol	Min	Typ	Max	Unit
Clock cycle	fclk	9	-	15	MHz
Hsync cycle	1/th	17.14	-	24.7	KHz
Vsync cycle	1/tv	59.94	-	86.7	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	-	41	CLK
Horizontal back porch	thb	2	-	41	CLK
Vertical Signal					
Vertical cycle	tv	285	286	399	H
Vertical display period	tvd	272	272	272	H
Vertical front porch	tvf	1	2	227	H
Vertical pulse width	tvp	1	-	11	H
Vertical back porch	tvb	1	-	11	H



10.2 Power ON/OFF sequence



11. LCM INSPECTION

11.1 QUALITY LEVEL

INSPECTION PLAN:

SAMPLING LEVEL : II, normal inspection, single sampling inspection

Sampling Plan		MIL-STD-105E
		Normal Inspection, Single Sampling
		Level II
AQL	Major Defect	0.4%
	Minor Defect	1.0%

11.2 ENVIRONMENT CONDITIONS:

Ambient Temperature		20+5 °C.
Ambient Humidity		50±10%RH
Ambient Illumination	Inspection	300~700 Lux

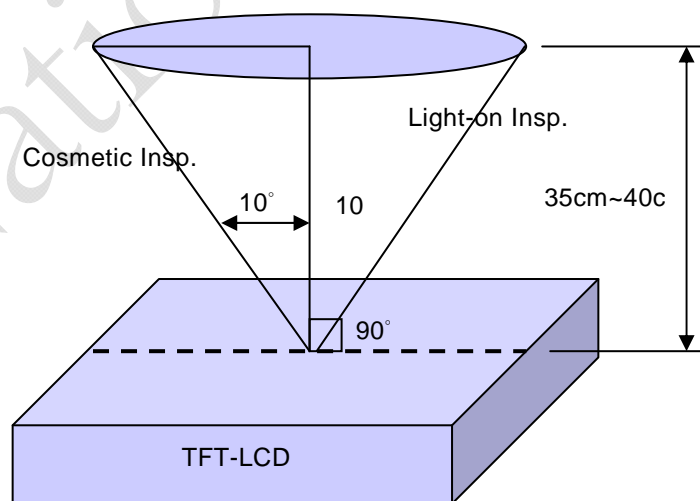
11.3 INSPECTION CONDITION

(1) Inspection Distance: 35 cm±5cm

(2) View Angle:

Light-on Inspection Angle : ±10°

Cosmetic Inspection Angle : ±10°



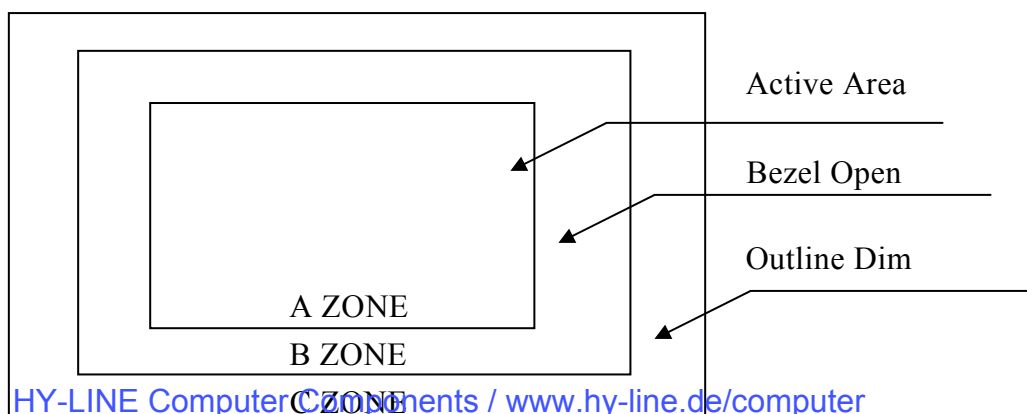
11.4 DEFINITION OF EACH ZONE

A zone : Active Area

B zone : Bezel Open

C zone : Outline Dim

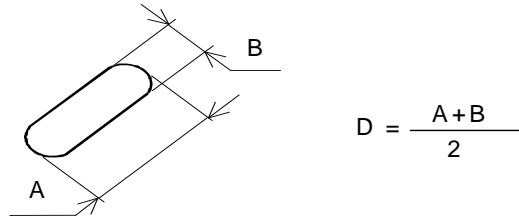
No.	ITEM	CRITERIA		Zone	
1	Point Defect	Bright dot	Random	3	A
			2 dots adjacent	1	
		Dark dot	Random	4	
			2 dots adjacent	1	
		Total Dot Defect	6		
Distance	Minimum Distance Between Bright to Bright dots/Dark to Dark dots	$L \geq 5\text{mm}$			
2	Bubbles in polarizer	Average diameter D(mm)	Maximum number acceptable	A , B	
		$D \leq 0.3$	Ignore		
		$0.3 < D \leq 0.7$	$N \leq 2$		
		$0.7 < D$	Not allowed		
	Bubbles in AR Film	$D \leq 0.6$	$N \leq 2$		
3	Foreign Material in spot shape	Average diameter D(mm)	Maximum number acceptable	A	
		$D \leq 0.2\text{mm}$	Ignore		
		$0.2\text{mm} < D \leq 0.4\text{mm}$	$N \leq 3$		
		$D > 0.4\text{mm}$	Not allowed		
4	Foreign Material in line or spiral shape or Scratches	$W \leq 0.05 \text{ mm}$ and $L \leq 0.3$ mm	Ignore	A	
		$0.05 < W \leq 0.1 \text{ mm}$, $0.3 < L \leq 3.0 \text{ mm}$	$N \leq 4$		
		$W > 0.1\text{mm}$ or $L > 3.0\text{mm}$	Not allowed		
5	Bezel Deformation	Obvious deformation is not allowed		C	
6	Bezel Oxidation	Not allowed if it rusts continuously over 1 cm (It is out of warranty with rusted tin plate)			
7	Bezel Scratch	Non-feeling abrasion	Ignore		
		Has the feeling abrasion	$L \leq 20\text{mm}$, $W \leq 0.3 \text{ mm}$, $N \leq 7$		
8	Metal Squash Dent /Flange(Front Side)	$D(W) \leq 1 \text{ mm}$, $L \leq 3$, $N \leq 4$			



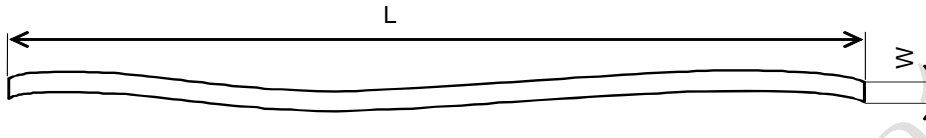
11.5 APPEARANCE SPECIFICATION

*) If a problem occurs in respect to any of these items , both parties (Customer and ONation) will discuss in more detail.

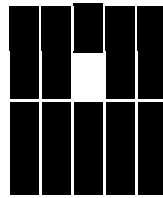
Note 1 : Definition of average diameter D



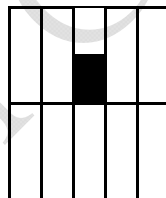
Note 2 : Definition of length L and width W



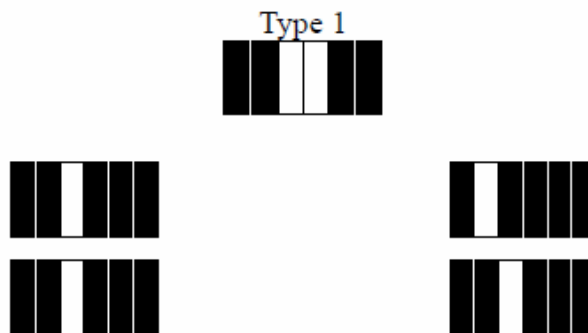
Note 3 : Bright dot defect description:



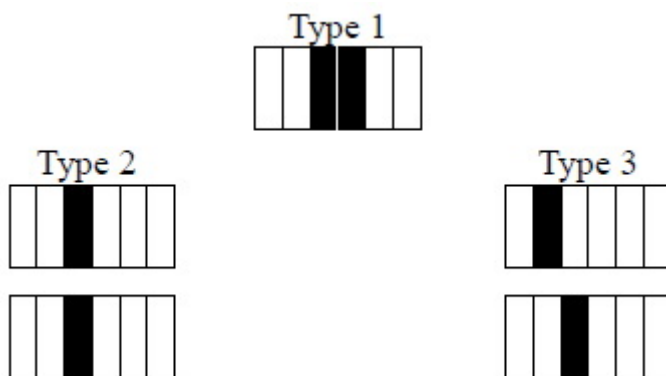
Note 4 : Dark dot defect description:



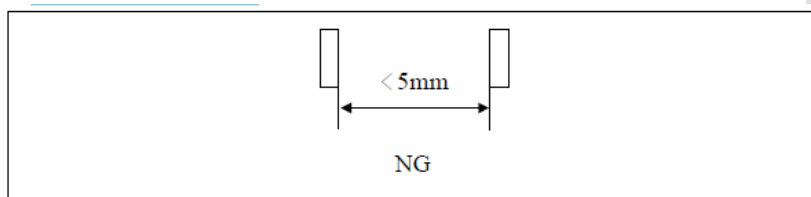
Note 5 : Bright dot defect description- Two adjacent.



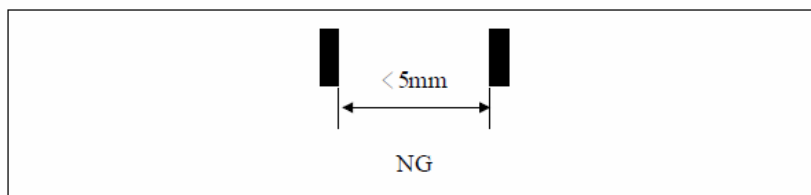
Note 6 : Dark dot defect description- Two adjacent.



Note 7 :Minimum distance between dot defects
Bright dot to bright dot.



Dark dot to dark dot



Note 8 : Every dot herein means sub-pixel(Each Red, Green, Blue Color).

Note 9 : Damaged less than half size of sub-pixel not counted as defect.

Note 10 : Extraneous substances which can be <6.5mm, such as fingerprint and particles are not considered as a defect.

Note11 : Defects on the Black Matrix (outside Active Area 0.3mm) are not considered as a defect.

12. RELIABILITY TEST

NO.	ITEM	CONDITIONS
1	High Temperature Storage	80°C *240HRS
2	Low Temperature Storage	-30°C *240HRS
3	High Temperature Humidity Operation	60°C /90%RH*240HRS
4	High Temperature Operation	75°C *240HRS
5	Low Temperature Operation	-20°C *240HRS
6	Temperature Cycle	-30°C ←→80°C *100CYCLE (30min) (5min) (30min)
7	Vibration test	10~55Hz, →1.5mmp-p Sweep time: 1min 2 hours for each direction of X,Y,Z
8	Shock test	100G action time 6 ms Direction: ±X, ±Y, ±Z 3 times of each direction
9	Atmospheric pressure test	115mbar*40HRS
10	Static electricity test	VS=800V,RS=1.5KΩ,CS=100pF*1time

1. Water condensation is not allowed for each test items.
2. Each test is done by new TFT-LCD module. Don't use the same TFT-LCD module repeatedly for reliability test.
3. The reliability test is performed only to examine the TFT-LCD module capability.
4. To inspect TFT-LCD module after reliability test, please store it at room temperature and room humidity for 24hours at least in advance.

13. PACKAGE INFORMATION

