Product Specification				
SGD® DISPLAY THE WORLD	Model: GATJ17NNHA2E0	Rev. No.	Issued Date.	Page.
		B	2017/07/18	1 / 18

Thin-Film-Transistor LCD Module
Model: GATJ17NNHA2E0

Acceptance

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Revise Records

Rev.	Date	Contents	Written	Approved
A	2017/03/30	Preliminary Specification	Roy	Michael
B	2017/07/18	Update drawing	Roy	LF

Special Notes

Note1.	

Contents

1 General Description and Features 4
1.1 Features 4
1.2 LCD Module 4
2 Mechanical Information 4
3 Electrical Specifications 5
3.1 Absolute Max. Ratings 5
3.2 Electrical Absolute Rating 5
4 Electrical Characteristics 6
4.1 TFT-LCD Module 6
4.2 Backlight Unit 6
4.3 Parallel interface characteristics 7
5 Block Diagram 8
6 Input Terminal Pin Assignment 9
7 Optical Characteristics 10
8 Test 13
9 Dimensional outlines 14
10 Incoming Inspection Standards 15

1 General Description and Features

GATJ17NNHA2E0 is a TM (Transmissive) type color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT-LCD module, a driver circuit and a back-light unit. The resolution of a 1.77" contains 128RGB x 160 dots and can display up to 256K colors. The following table described the features of GATJ17NNHA2E0

1.1 Features

- Transmissive and back-light with 2 LEDs are available.
- TN (Twisted Nematic) mode.
- ROHS Compliance

1.2 LCD Module

Item	Specification	Unit
Screen Size	1.77 inches	Diagonal
Display Resolution	128RGB(H) x 160(V)	Dot
Active Area	28.03 (H) x 35.04 (V)	mm
Outline Dimension	34.7 (H) x 46.7 (V) x 2.5 (D)	mm
Display Mode	Normally white/Transmissive	--
Pixel Arrangement	RGB Vertical Stripe	--
Display Color	256K	--
Viewing Direction (Gray Inversion)	12 o'clock	--
Input Interface	8bit MCU interface	--

2 Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	34.5	34.7	34.9	mm	--
	Vertical (V)	46.5	46.7	46.9	mm	(1)
	Thickness (T)	2.4	2.5	2.6	mm	(1)
Weight		--	TBD	--	g	--

Note (1) Not include FPC.
Refer to the Dimensional Outlines for further information.

3 Electrical Specifications

3.1 Absolute Max. Ratings

3.1.1 Absolute Ratings of Environment

If the operating condition exceeds the following absolute maximum ratings, the TFT LCD module may be damaged permanently.

(Ta=25±2°C, V_{SS}=GND=0)

Item	Symbol	Min.	Max.	Unit	Note
Storage temperature	T_{STG}	-30	80	°C	(1)
Operating temperature	T_{OPR}	-20	70	°C	(1,2,3)

Note (1) 90 % RH Max. (40 °C ≥ Ta). Maximum wet-bulb temperature at 39 °C or less. (Ta > 40 °C) No condensation.

Note (2) In case of below 0°, the response time of liquid crystal (LC) becomes slower and the color of panel becomes darker than normal one. Level of retardation depends on temperature, because of LC's character

Note (3) Only operation is guarantied at operating temperature. Contrast, response time, another display quality are evaluated at +25°C.

3.2 Electrical Absolute Rating

3.2.1 TFT-LCD Module

(Ta=25±2°C, V_{SS}=GND=0)

Item	Symbol	Value		Unit	Condition
		Min.	Max.		
Supply voltage for logic	VDD	-0.3	3.3	V	
Input voltage for logic	Vin	-0.5	VDD+0.3	V	

3.2.2 Back-Light Unit

Item	Symbol	Min.	Max.	Unit	Note
Current of One LED	I_{LED}	--	30	mA	(1)

Note (1) Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded. Functional operation should be restricted to the conditions described under normal operating conditions.

4 Electrical Characteristics

4.1 TFT-LCD Module

(Ta=25±2°C)

Item		Symbol	Value			Unit	Condition
			Min.	Typ.	Max.		
Supply voltage for logic		VDD	2.6	2.8	3.3	V	
Input Voltage	H Level	VIH	0.8xVDD	-	VDD	V	
	L Level	VIL	-0.3	-	0.2x VDD	V	
Input leakage Current		I_{LKG}	-	TBD	TBD	mA	

4.2 Backlight Unit

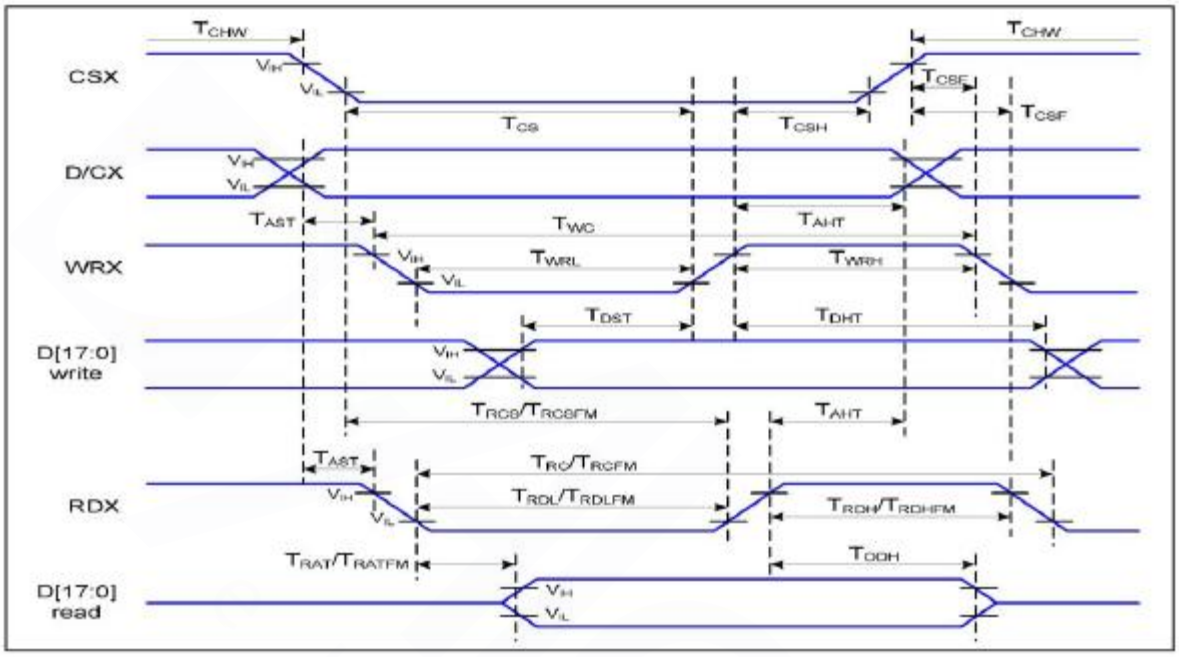
The back-light system is an edge-lighting type with white LED (Light Emitting Diode)s(Ta=25±2°C)

Item	Symbol	Value			Unit	Condition
		Min.	Typ.	Max.		
LED Voltage	V_L	6.0	6.4	6.8	V	
LED Current	I_f	-	20		mA	
LED life time	-	50000				

Note :(1) 2 LED serial.

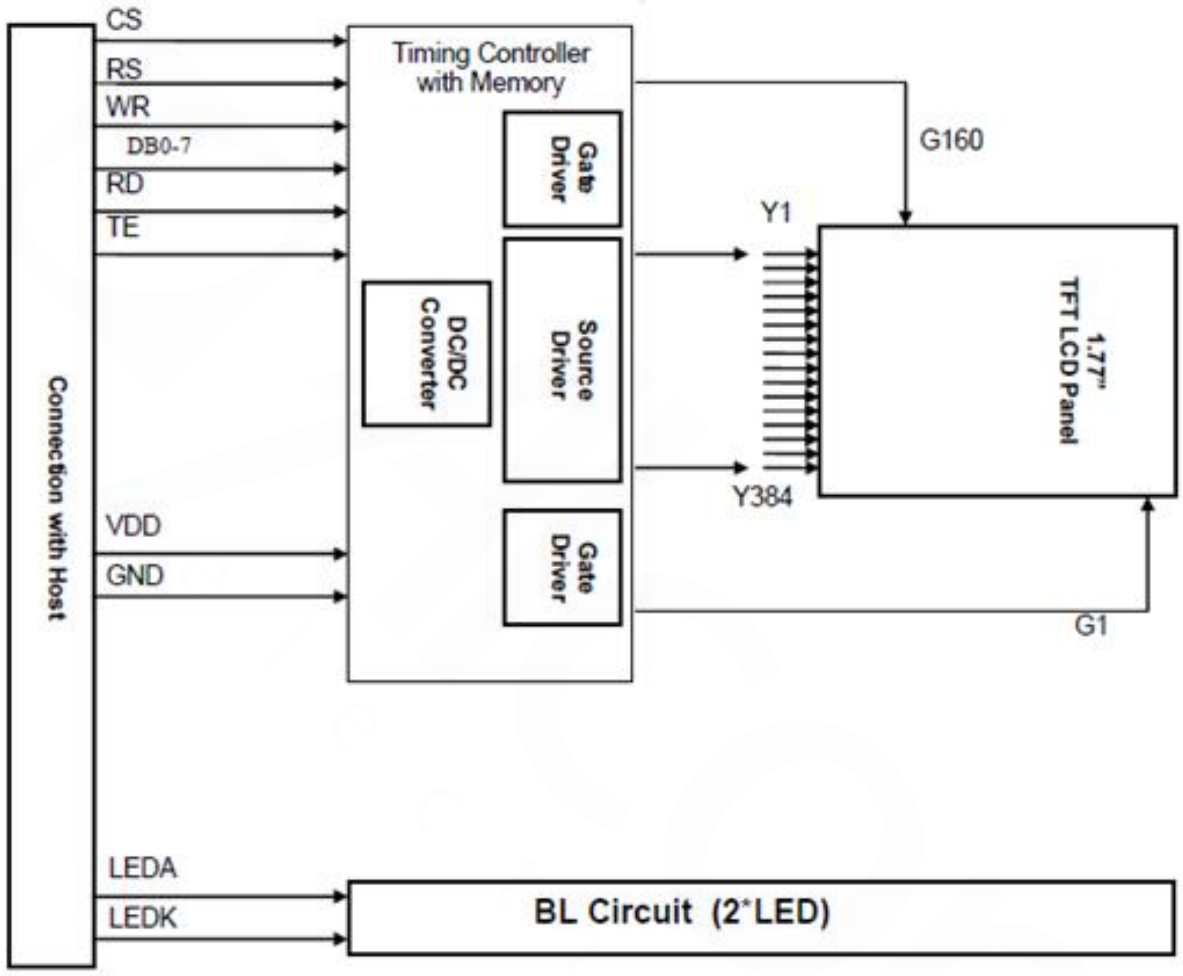
(

4.3 Parallel interface characteristics



Signal	Symbol	Parameter	Min	Max	Unit	Description
D/CX	TAST	Address setup time	0		ns	-
	TAHT	Address hold time (Write/Read)	10		ns	
CSX	TCHW	Chip select "H" pulse width	0		ns	-
	TCS	Chip select setup time (Write)	15		ns	
	TRCS	Chip select setup time (Read ID)	45		ns	
	TRCSFM	Chip select setup time (Read FM)	355		ns	
	TCSF	Chip select wait time (Write/Read)	10		ns	
	TCSH	Chip select hold time	10		ns	
WRX	TWC	Write cycle	66		ns	
	TWRH	Control pulse "H" duration	15		ns	
	TWRL	Control pulse "L" duration	15		ns	
RDX (ID)	TRC	Read cycle (ID)	160		ns	When read ID data
	TRDH	Control pulse "H" duration (ID)	90		ns	
	TRDL	Control pulse "L" duration (ID)	45		ns	
RDX (FM)	TRCFM	Read cycle (FM)	450		ns	When read from frame memory
	TRDHFM	Control pulse "H" duration (FM)	90		ns	
	TRDLFM	Control pulse "L" duration (FM)	355		ns	
D[17:0]	TDST	Data setup time	10		ns	For CL=30pF
	TDHT	Data hold time	10		ns	
	TRAT	Read access time (ID)		40	ns	
	TRATFM	Read access time (FM)		340	ns	
	TODH	Output disable time	20	80	ns	

5 Block Diagram



6 Input Terminal Pin Assignment

6.1 CN1 Pin Assignment

NO.	SYMBOL	Description
1	LED_K	LED Cathode
2	LED_A	LED Anode
3	GND	Ground
4	VDD	Power supply
5	TE	Tearing effective sync signal
6	NC	NC
7	/CS	Chip select
8	/RESET	RERSET
9	RS	Data or command select
10	/WR	Write data signal
11	/RD	Read data signal
12	DB7	Data bus
13	DB6	Data bus
14	DB5	Data bus
15	DB4	Data bus
16	DB3	Data bus
17	DB2	Data bus
18	DB1	Data bus
19	DB0	Data bus
20	GND	Ground

7 Optical Characteristics

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room
Measuring equipment: BM-7A

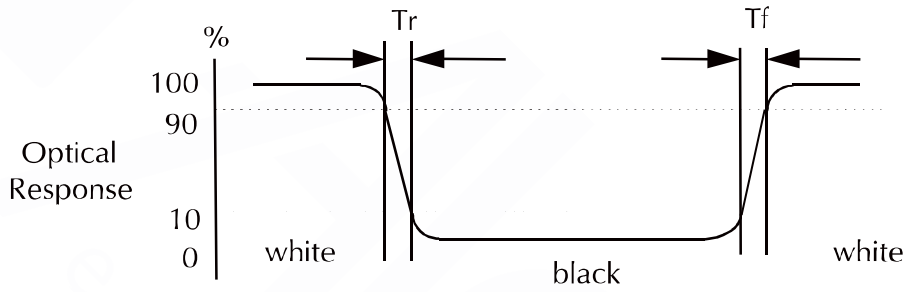
Item		Symbol	Condition	Min	Type	Max	Unit	Note
Brightness		B	--	--	320	--	cd/m^2	--
Response time		$T_{R+}T_F$	θ=0°	--	30	--	ms	--
Uniformity		Un	--	70	80	--	%	--
Contrast ratio		CR	At optimized viewing angle	--	500	--	--	--
Color Chromaticity	Red	R_X	θ=0° Normal Viewing Angle	--	0.633	--	--	--
		R_Y		--	0.329	--		
	Green	G_X		--	0.297	--	--	
		G_Y		--	0.577	--		
	Blue	B_X		--	0.133	--	--	
		B_Y		--	0.129	--		
	White	Wx		--	0.300	--	--	
		Wy		--	0.310	--		
Viewing Angle (6H)	Hor.	θ_R	CR≥10	40	45	--	Degree	--
		θ_L		40	45	--		
	Ver.	θ_U		40	45	--		
		θ_D		15	20	--		

a. Test equipment setup

After stabilizing and leaving the panel alone shall be warmed up for the stable operation of LCM, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-5A/BM-7(fast) with a viewing angle of 2° at a distance of 50cm and normal direction.

b. Definition of response time: Tr and Tf

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".

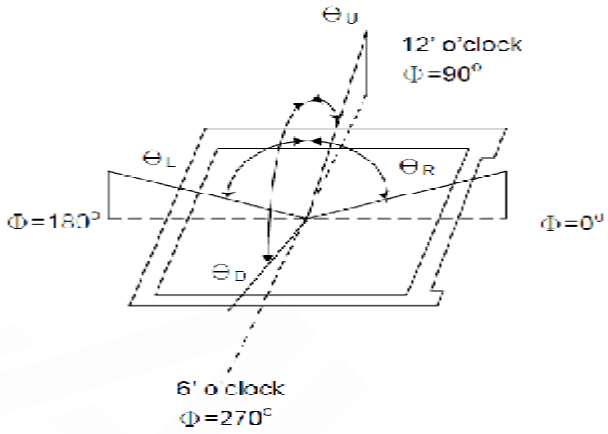


c. Definition of contrast ratio:

$$\text{Contrast Ratio (CR)} = \frac{\text{Brightness measured when LCD is at "white state"}}{\text{Brightness measured when LCD is at "black state"}}$$

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

e. View Angle



f. Definition of Luminance of White: Luminance of white at the center points

Light Source of Back-Light Unit	LED Type

g. Definition of White Uniformity

$$\text{White Uniformity} = \frac{\text{Min. luminance of white among 9-points}}{\text{Max. luminance of white among 9-points}} \times 100\%$$

8 Test

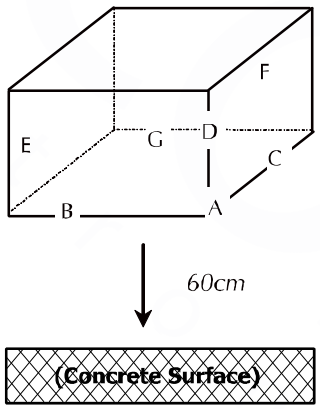
No change on display and in operation under the following test condition.

Condition: Unless otherwise specified, tests will be conducted under the following condition.

Temperature: 20±5°C.

Humidity: 65±5%RH.

Tests will be not conducted under functioning state.

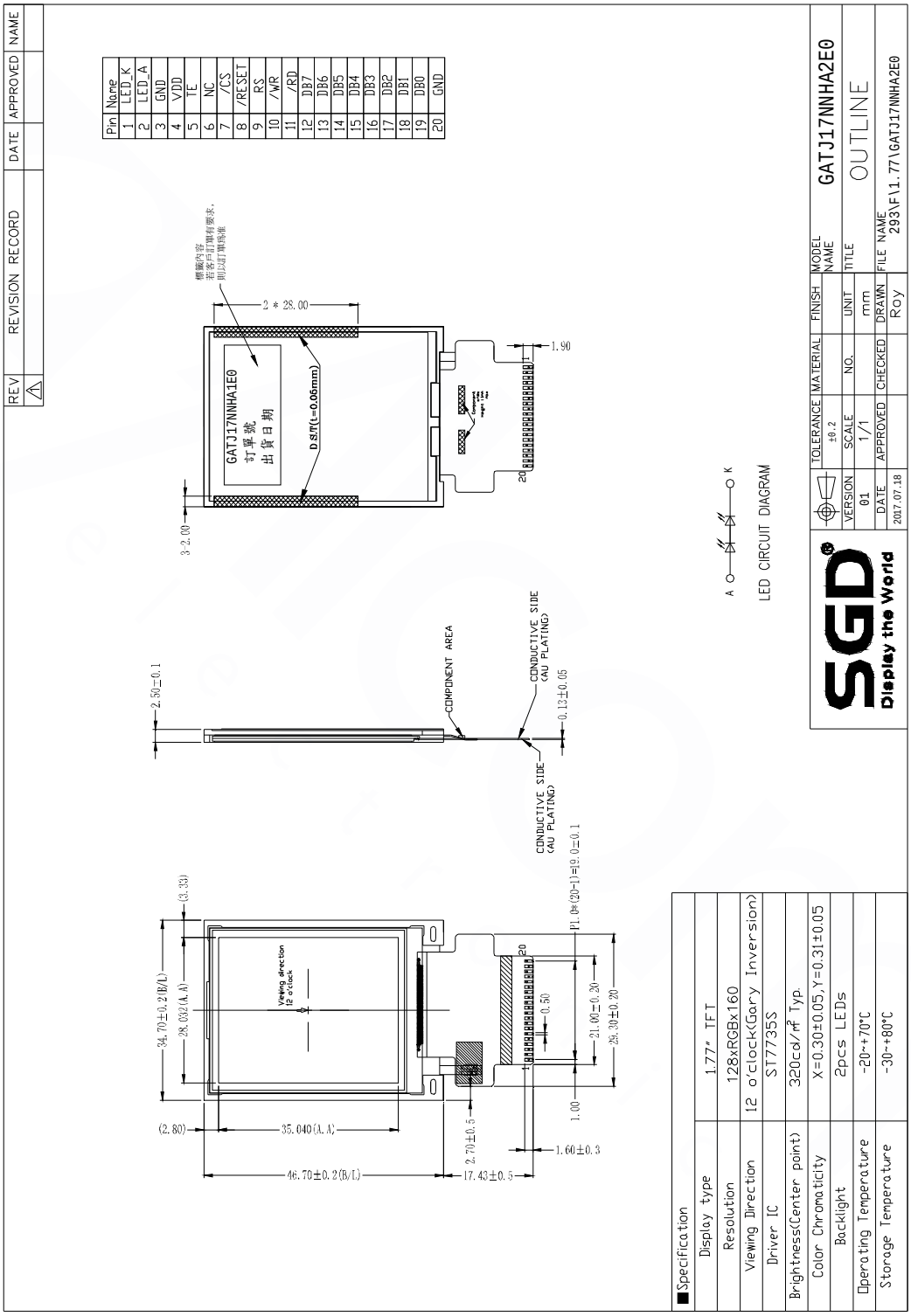
No.	Parameter	Condition	Notes
1	High Temperature Operating	70°C±2°C, 240hrs	
2	Low Temperature Operating	-20°C±2°C, 240hrs	1
3	High Temperature Storage	80°C±2°C, 240hrs.	2
4	Low Temperature Storage	-30°C±2°C, 240hrs.	1,2
5	Moisture storage	60°C±2°C, 90%,240hrs	1,2
6	Vibration Test	Packaging, Frequency : 10-55Hz Amplitude : 1.0mm, Each direction on X,Y axe 0.5 hours, circle 2 hours.	3
7	Drop Test	To be measured after dropping from 60cm high on the concrete surface in packing state.  *Dropping method corner dropping:* *A corner: Once edge dropping.* *B, C, D edge: Once face dropping.* *E, F, G face: Once.*	

Notes: 1. No dew condensation to be observed.

2. The function test shall be conducted after 4 hours storage at the normal temperature and humidity after removed from the test chamber.

3. Vibration test will be conducted to the product itself without putting I in a container.

9 Dimensional outlines



10 Incoming Inspection Standards

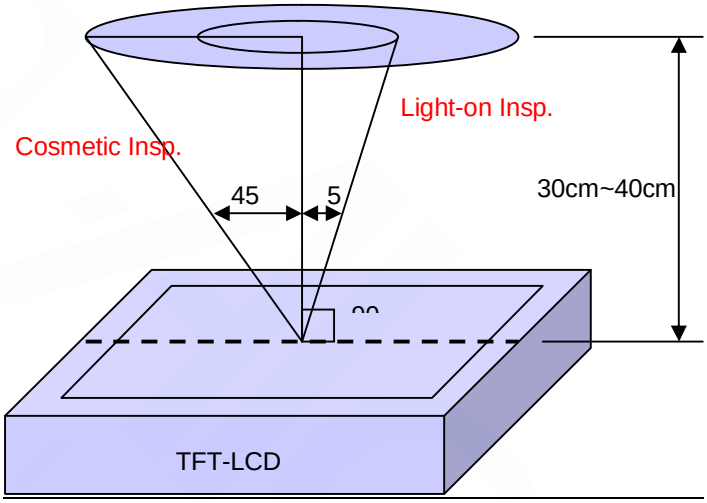
10.1 Inspection and Environment Conditions

10.1.1 Inspection Conditions:

(1)Inspection Distance: 35 cm±5cm

(2)View Angle : Light-on Inspection Angle：±5°

Cosmetic Inspection Angle：±45°



(perpendicular to LCD panel surface)

10.1.2 Environment Conditions:

Ambient Temperature		23℃±5℃
Ambient Humidity		55±10%RH
Ambient Illumination	Cosmetic Inspection	more than 600 Lux
	Functional Inspection	300~500 Lux

10.1.3 Sampling Conditions:

(1) Lot Size: Quantity of shipment lot per model

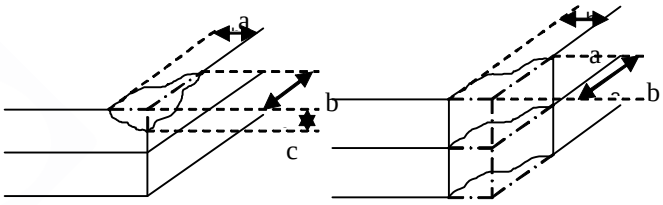
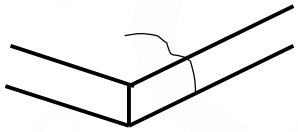
(2) Sampling Method:

Sampling Plan		MIL-STD-105E
		Normal Inspection, Single Sampling
		Level II
AQL	Major Defect	1.0%
	Minor Defect	1.5%

(3) The classification of Major(MA) and Minor(MI) defects is shown as 3. Inspection Criteria.

10.1.4 Inspection Criteria

10.1.4.1 Cosmetic Inspection(Panel):

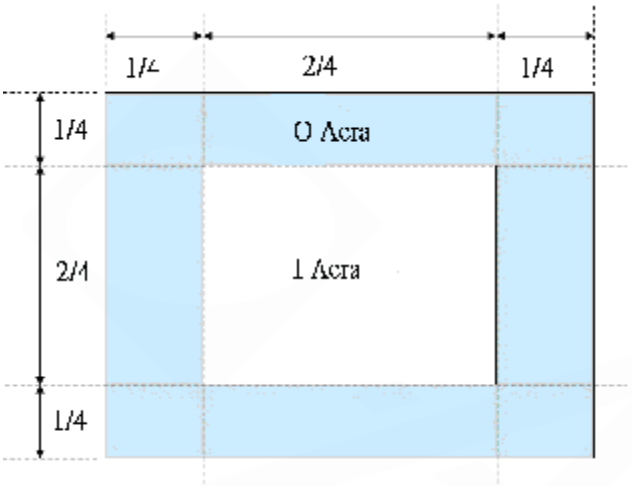
Item	Judgment Criteria	Classification
Chipping on Panel	 a≦3.0mm、b≦3.0mm、c≦t (Bottom glass thickness)	MA
Scratch on Panel *Note-2	W≦0.05mm or L< 5mm: Ignored 0.05mm<W≦0.1mm and L≦5mm: N≦5 W>0.1mm or L>5mm: Not allowed	MI
Bubble or Dent on Panel *Note-3	D≦0.2mm: Ignored 0.2mm<D≦0.3mm: N≦5 D>0.3mm: Not allowed	MI
Panel Crack	 Not Allowed crack	MA
Bezel Deformation	Obvious deformation is not allowed.	MI
Bezel Oxidation	Not allowed if it rusts continuously over 1 cm (It is out of warranty with rusted tin plate)	MI
Bezel Scratch	L≦20mm , W≦0.2 , N≦3	MI
Metal Squash Dent /Flange(Front Side)	D(W)≦1,L≦3,N≦3;	MI
B/L High Voltage Wire Denudation	Not allowed	MA
Polarizer flaw or leak out resin	Defect is defined as the active area.	MI

Outline Dimension	Must in Spec, refer to related product spec.	MI

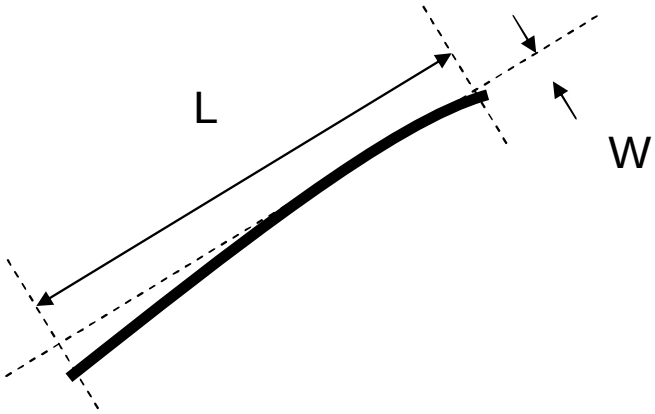
10.1.4.2 Functional Inspection:

Item	Judgment Criteria				Classification
	Area(Note1)		I	O	
Point Defect	Bright dot	Random	1		MI
		2 dots adjacent	0	0	
		3 dots adjacent or more	0	0	
	Dark dot	Random	2		
		2 dots adjacent	0		
		3 dots adjacent or more	0	0	
	Total Dot Defect		3		
	Distance	Distance between Bright and Bright dot	L≧5mm		
		Distance between Bright and Dark dot	L≧5mm		
		Distance between Dark dot	L≧5mm		
	(1) It is defined as Point Defect if defect area＞0.5dot (2) It is ignored if defect area≦0.5dot (3)Weak point defect will be defined as Bright Dot if it can be observed through ND filter 5%(Full Screen Black Inspection)				
Line Defect	Obvious vertical or horizontal line defect is not allowed.				MA
Mura	Not allowed if it can be observed through ND Filter 5 %				MI
Foreign Material in spot shape *Note-3	D≦0.2mm: Ignored 0.2mm<D≦0. 3mm: N≦3 D>0.3mm: Not allowed				MI
Foreign Material in line or spiral shape *Note-4	W≦0.05mm or L≦3mm: Ignored 0.05mm<W≦0.1mm and 1.0mm<L≦2mm: N≦4 W>0.1mm or L>5mm: Not allowed				MI
Display Function Abnormal	No Malfunction can be allowed				MA

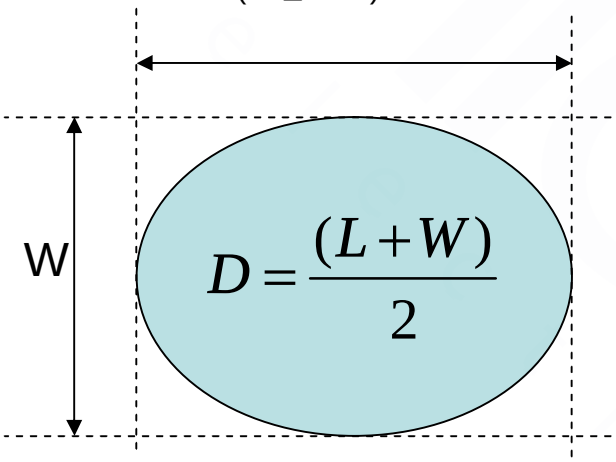
Note-1： I/O Area Definition



Note-2： Polarizer Scratch



Note-3：Spot Foreign Material
(W ≧L / 4)



Note-4：Line or Spiral Foreign Material
(W<L / 4)