Approval

TO :

DATE :

SAMSUNG TFT-LCD

MODEL NO. : LTM121SI-T01

APPROVED BY :

Any Modification of Spec is not allowed without SEC's permission.

Approved by :

PREPARED BY : AMLCD Technical Customer Service Team

SAMSUNG ELECTRONICS CO., LTD.

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Revision History

Date	Rev.No.	Page	Summary
Oct. 17 2001	000	All	Approval specification of LTM121SI-T01 model is issued first.

GENERAL DESCRIPTION

DESCRIPTION

LTM121SI-T01 is a color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFTs as switching devices. this model is composed of a TFT LCD panel, a driving circuit and a backlight system. The resolution of a 12.1" contains 800 x 600 pixels and can display up to 262,144 colors. 6 o'clock direction is the optimum viewing angle.

FEATURES

- Thin and Light weight
- High contrast ratio, High aperture structure.
- High-speed response
- SVGA (800 x600 pixels) resolution
- Low power consumption
- Dual CCFLs(Cold Cathode Fluorescent Lamp)
- DE (Data enable) mode.
- 3.3V Power Supply

APPLICATIONS

- Notebook PC and desktop monitors
- Display terminals for AV application products
- Monitors for Industrial machine and P.O.S.

General Information

ITEM	SPECIFICATION	UNIT	NOTE
Display area	246.0(H) x 184.5(V) (12.1"diagonal)	mm	
Driver element	a-si TFT active matrix		
Display colors	262,144		
Number of pixel	800 x 600	pixel	
Pixel arrangement	RGB vertical stripe		
Pixel pitch	0.3075 (H) x 0.3075 (V) (TYP.)	mm	
Display Mode	Normally white		
Surface treatment	Haze 25, Hard-Coating (3H)		

Mechanical Information

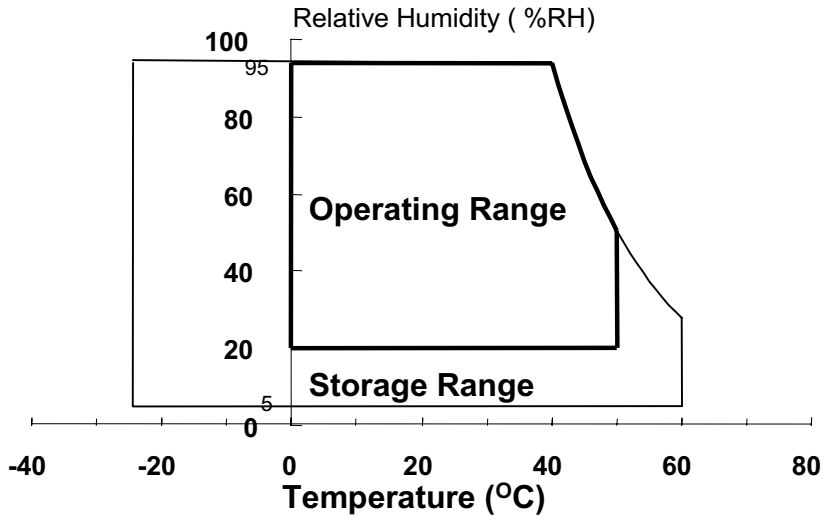
ITEM		MIN.	TYP.	MAX.	NOTE
Module size	Horizontal (H)	274.5	275.0	275.5	mm
	Vertical (V)	205.0	205.5	206.0	mm
	Depth (D)	9.2	10.2	10.7	mm
Weight		-	650	680	g

1. ABSOLUTE MAXIMUM RATINGS

1.1 ABSOLUTE RATINGS OF ENVIRONMENT

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Storage temperate	T_{STG}	-25	60	˚C	(1)
Operating temperate (Temperature of glass surface)	T_{OPR}	0	50	˚C	(1)
Shock (nonoperating)	Snop	-	50	G	(2),(4)
Vibration (nonoperating)	Vnop	-	1.5	G	(3),(4)

Note (1) Temperature and relative humidity range are shown in the figure below.
95 % RH Max. (40 ˚C ≥ Ta)
Maximum wet - bulb temperature at 39 ^{O}C or less. (Ta > 40 ˚C) No condensation.
(2) 11 ms, half sine wave, one time per ±X, ±Y, ±Z.
(3) 10 -300 Hz, Sweep rate 10 min, 30 min per X,Y,Z.
(4) In testing Vibration and Shock, the fixture which holds the module to be tested has to be hard and rigid enough so that the module would neither be twisted nor bent by the fixture.



1.2 ELECTRICAL ABSOLUTE RATINGS

(1) TFT LCD MODULE

(GND= 0 V, V_{DD}=3.3V)

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Power Supply Voltage	V_{DD}	GND-0.3	3.6	V	(1)

NOTE (1) Within Ta (25 ± 2 ˚C)

(2) BACK-LIGHT UNIT

Ta = 25 ± 2 ˚C

ITEM	SYMBOL	MIN.	MAX.	UNIT.	NOTE
Lamp current	I_L	2.0	7.0	mA_{rms}	(1)
Lamp frequency	F_L	40	80	KHz	(1)

NOTE (1) Permanent damage to the device may occur if maximum values are exceeded. Functional operation should be restricted to the conditions described under Normal Operating Conditions.

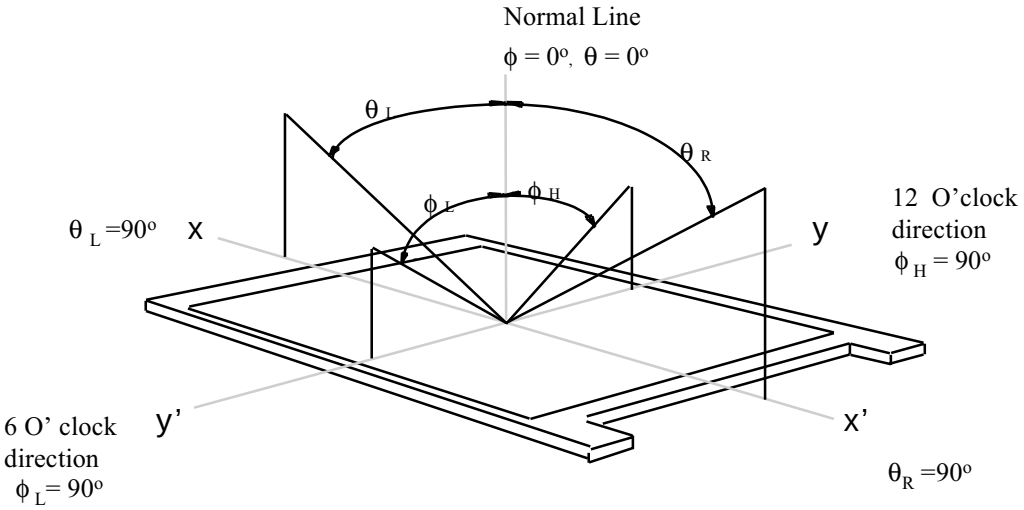
2. OPTICAL CHARACTERISTICS

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note (5).
Measuring equipment : TOPCON BM-5A

* Ta = 25± 2ºC , V_{DD}=3.3V, fv= 60Hz, f_{DCLK}=40MHz, I_L = 6.0mA

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	
Contrast Ratio		CR		200	300	-		(2),(5)
Response Time at 25 ºC	Rise	T_R		-	5	10	msec	(3)
	Fall	T_F		-	20	30		
Average Luminance of White (5 Points)		$Y_{L,AVE}$	ϕ = 0 θ = 0	250	300	-	cd/m^2	6.0mA (4)
Color Chromaticity (CIE)	Red	R_x		0.560	0.590	0.620		(1),(5)
		R_y		0.325	0.355	0.385		
	Green	G_x	Viewing Normal Angle	0.270	0.300	0.330		
		G_y		0.515	0.535	0.565		
	Blue	B_x		0.125	0.155	0.185		
		B_y		0.110	0.140	0.170		
	White	W_x		0.280	0.310	0.340		
		W_y		0.310	0.340	0.370		
Viewing Angle	Hor.	θ_L	CR≥ 10	50	60	-	Degrees	
		θ_R		50	60	-		
	Ver.	ϕ_H		40	45	-		
		ϕ_L		50	55	-		
13 Points White Variation		δ_W				2.0		(6)

Note (1) Definition of Viewing Angle : Viewing angle range (10 ≤ CR)



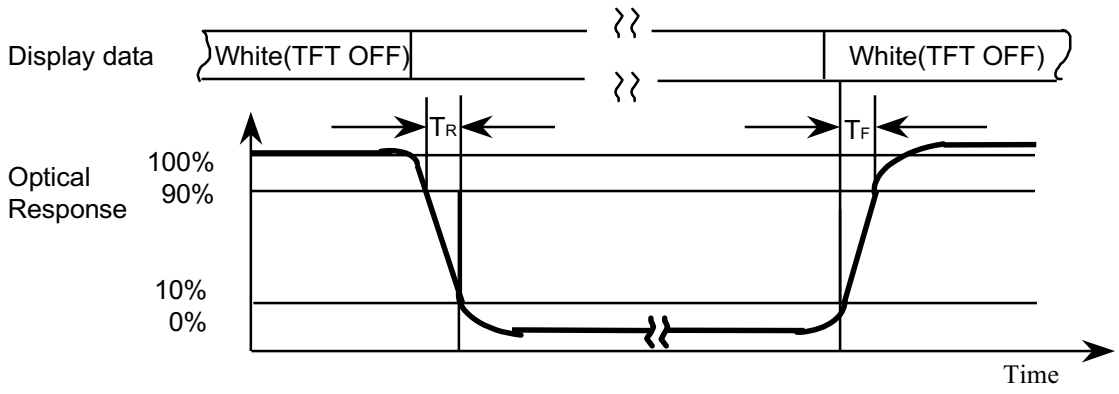
Note (2) Definition of Contrast Ratio (CR) : Ratio of gray max (Gmax) ,gray min (Gmin)

at 5 points(4, 5, 7, 9, 10)

$$CR = \frac{CR1 + CR2 + CR3 + CR4 + CR5}{5}$$

POINTS : ④ , **⑤** , ⑦ , ⑨ , ⑩ at FIGURE OF NOTE (6)

Note (3) Definition of Response time :



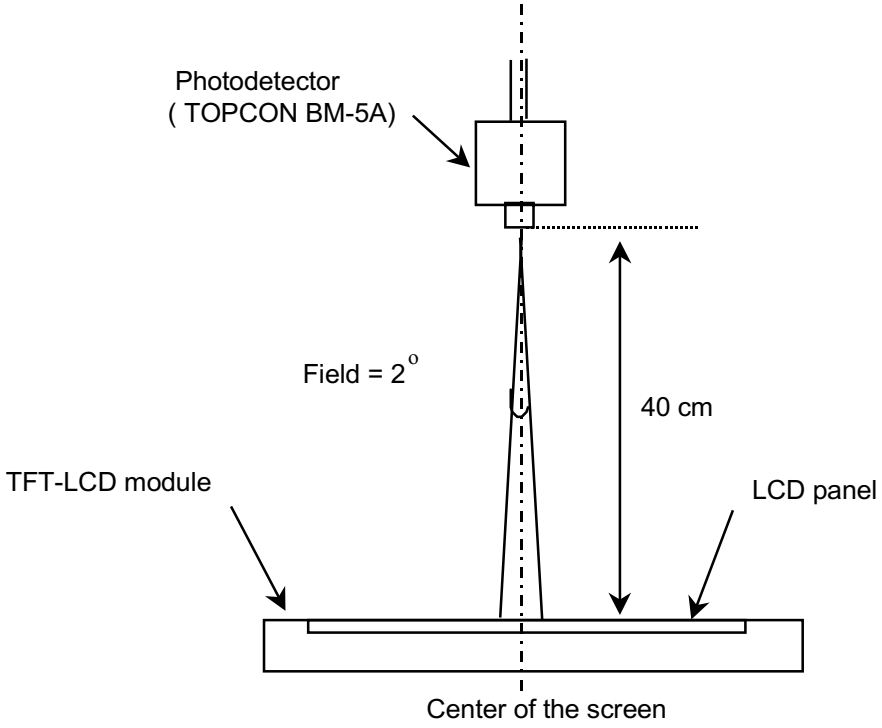
Note(4) Definition of Average Luminance of White : measure the luminance of white at 5 points.

Average Luminance of White ($Y_{L,AVE}$)

$$Y_{L,AVE} = \frac{Y_{L4} + Y_{L5} + Y_{L7} + Y_{L9} + Y_{L10}}{5}$$

POINTS : ④ , **⑤** , ⑦ , ⑨ , ⑩ at FIGURE OF NOTE (6)

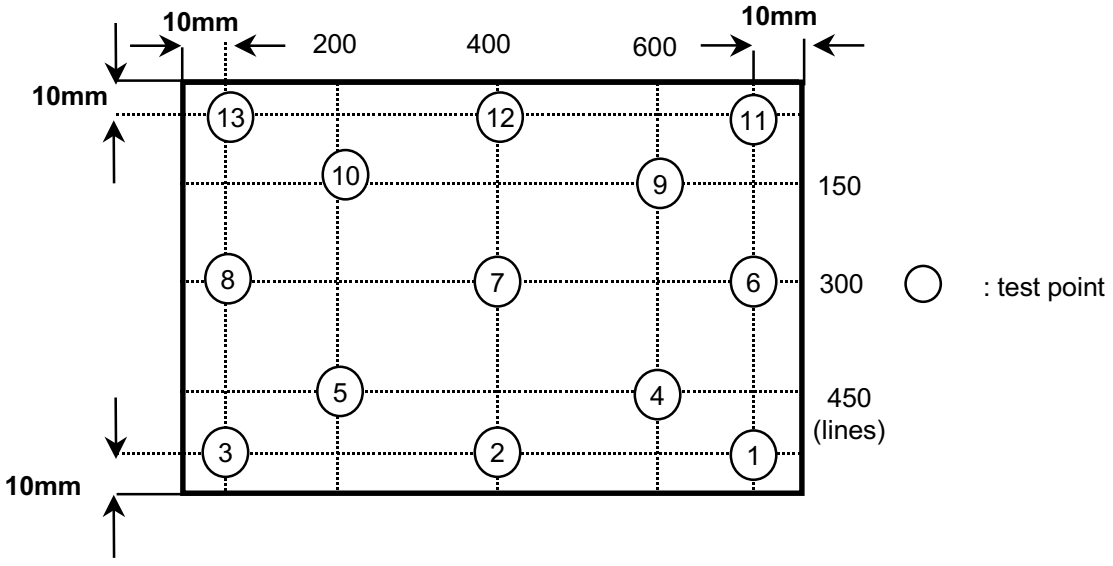
Note (5) Measurement should be executed in a stable, windless, and dark room after lighting the back-light for 30 min to stabilize at a given temperature. This should be measured in the center of screen.
Lamp current : 6.0mA , Environment condition : Ta = 25 ± 2 ˚C



Optical characteristics measurement setup

Note(6) Definition of 13-point white variation (δ_W)

$$\delta_W = \frac{\text{Maximum luminance of 13 points}}{\text{Minimum luminance of 13 points}}$$



3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

Ta=25°C ±2 °C

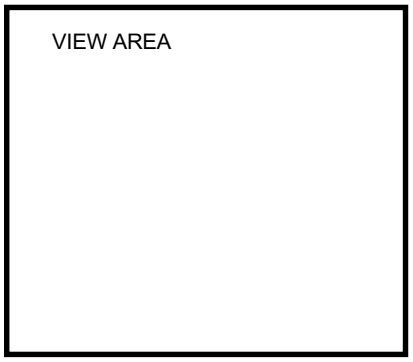
ITEM		SYMBOL	MIN	TYP	MAX	UNIT	NOTE
Voltage of Power Supply		V_{DD}	3.0	3.3	3.6	V	
Input Voltage for Logic Signals	High	Vih	0.7Vdd	-	-	V	(1)
	Low	Vil	-	-	0.3Vdd	V	(1)
Vsync Frequency		f_V	-	60	-	Hz	
Hsync Frequency		f_H	-	37.879	-	kHz	
Main Frequency		f_{DCLK}	38	40	42	MHz	
Rush Current		I_{RUSH}	-	-	1.5	A	(4)
Current of Power Supply	White	I_{DD}	-	290	-	mA	(2)(3) ***a**
	Mosaic		-	320	-	mA	(2)(3) ***b**
	V.Stripe		-	350	450	mA	(2)(3) ***c**

Note (1) Display data pins and timing signal pins should be connected.(GND=0V)

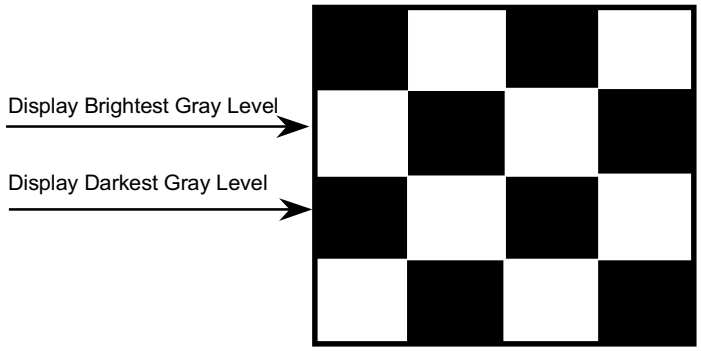
(2) f_V= 60Hz, f_{DCLK} = 40MHz, V_{DD} =3.3V, DC Current.

(3) Power dissipation pattern.

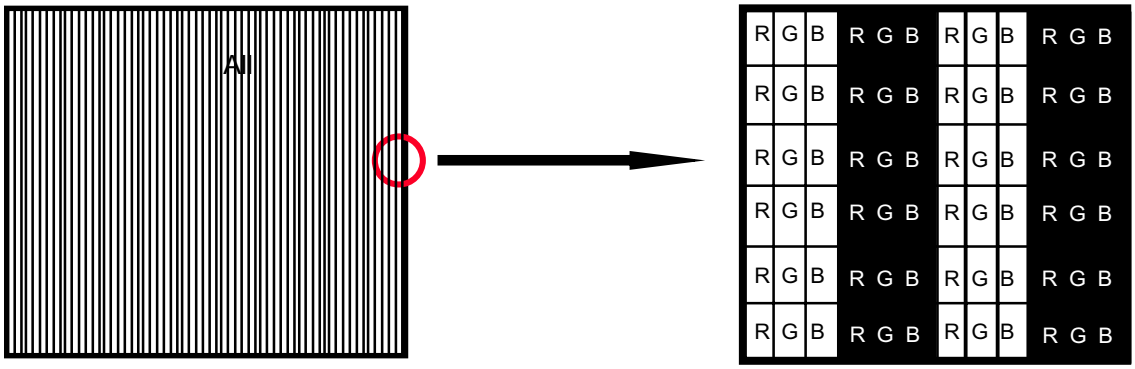
*a) White Pattern



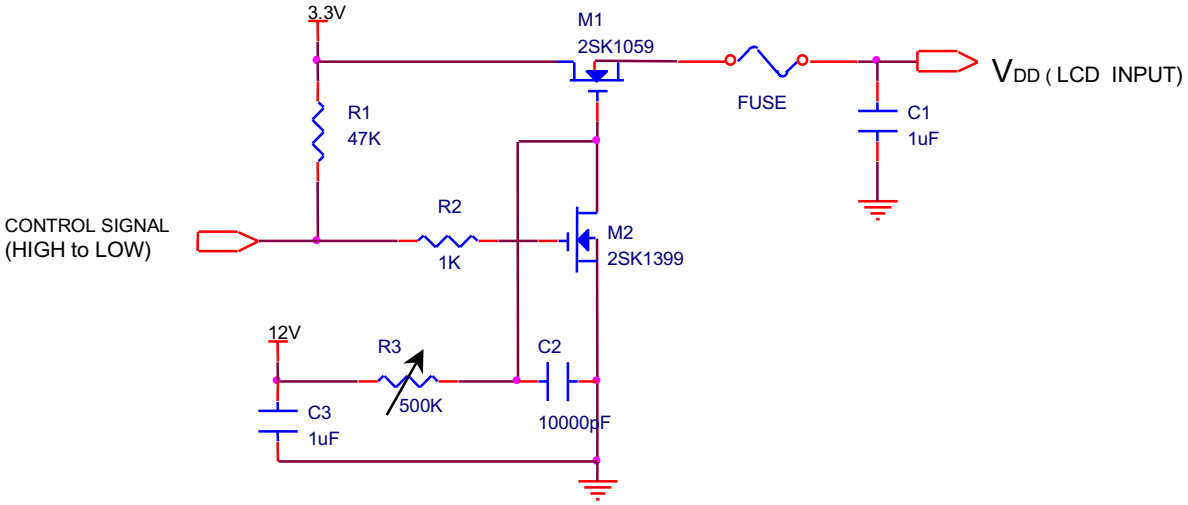
*b)Mosaic Pattern



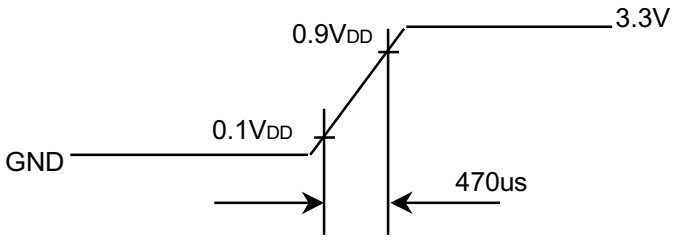
*c) V.Stripe



(4) Rush current measurement condition



VDD rising time is 470us



3.2 BACK-LIGHT UNIT

The backlight system is an edge - lighting type with 2 single CCFLs(Cold Cathode Fluorescent Tube).
The characteristics of a single lamp are shown in the following tables.

INVERTER : SEC 130

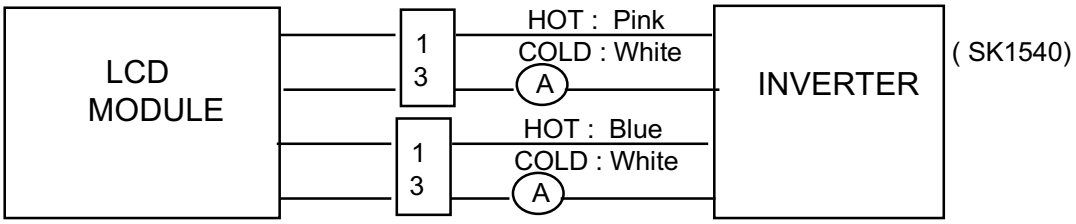
Ta=25°C±2 °C

ITEM	SYMB	MIN	TYP	MAX	UNIT	NOTE
Lamp Current	I_L	2.0	6.0	7.0	mArms	(1)
Lamp Voltage	V_L	-	500	-	Vrms	I_L=6.0mA
Frequency	f_L	40	60	80	KHz	(2)
Power Consumption	P_L	-	6.0	-	W	(3), I_L=6.0mA
Operating Life Time	Hr	50,000		-	Hour	(4)
Startup Voltage	V_S	-	-	1236 (25 °C) 1740 (0 °C)	Vrms	(5)

Note) The inverter must have a symmetric output voltage waveform and be designed on the basis of the modularized lamp.

The performance of the backlight, for example life time or brightness, is much influenced by the characteristics of the DC-AC inverter for the lamp. So all the parameters of an inverter should be carefully designed so as not to produce too much leakage current from high-voltage output of the inverter.
When you design or order the inverter, please make sure that a poor lighting caused by the mismatch of the backlight and the inverter(miss lighting, flicker, etc.) will never occur. When you confirm it, the module should be operated in the same condition as it is installed in your instrument.

Note (1) Lamp current is measured with a high frequency current meter as shown below.

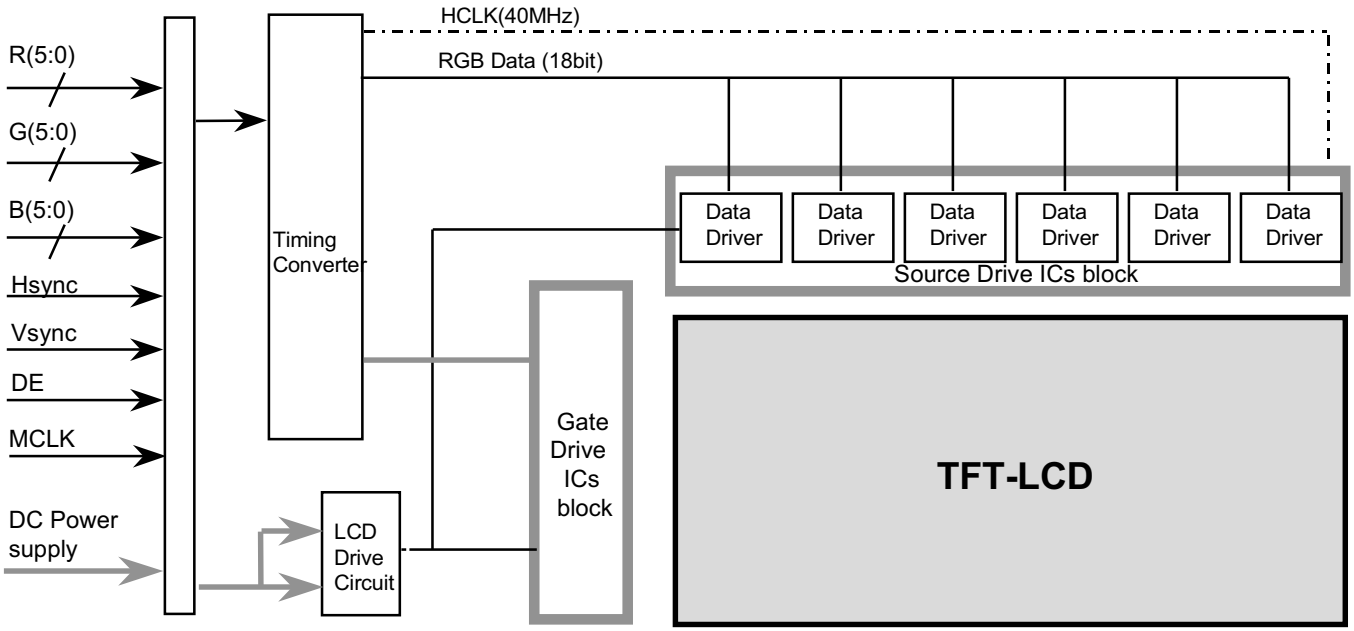


No 3 Pin is V_{LOW}.
Switching Frequency : 40 ~ 80 KHz

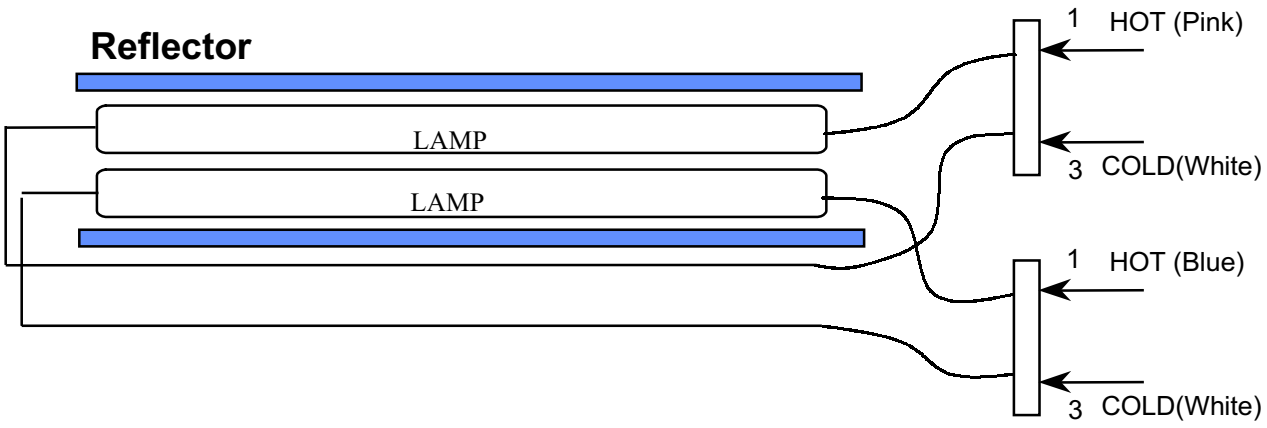
(2) Lamp frequency may produce interference with horizontal synchronous frequency and this may cause line flow on the display. Therefore lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible in order to avoid interference.
(3) refer to $I_L \times V_L \times 2$ (2 lamps) to calculate.
(4) 50,000 Hr can be defined as the lifetime of a lamp which continues to operate under the condition Ta = 25 °C ± 2 °C and I_L = 6 mArms until one of the following events occur.
1. When the brightness becomes 50% or lower than it's original.
2. When the Effective ignition length becomes 80% or lower than it's original value.
(Effective ignition length is defined as an area that has over 70% brightness of one at the center point.)
(5) The voltage above this value should be applied to the lamp for more than 1 second to startup Otherwise the lamp may not be turned on.

4. BLOCK DIAGRAM

4.1 TFT LCD Module



4.2 BACK-LIGHT UNIT



Note) The output of the inverter may change according to the material of the reflector.

5. INPUT TERMINAL PIN ASSIGNMENT

5.1. Input Signal & Power Connector : Hirose DF9B-41P-1V

Pin NO.	Symbol	Function	Polarity	Remark
1	GND	Power Ground	-	-
2	DCLK	Data Clock	-	(1)
3	GND	Power Ground	-	-
4	HSYNC	Horizontal Sync Signal	Negative	-
5	VSYNC	Vertical Sync Signal	Negative	-
6	GND	Power Ground	-	-
7	GND	Power Ground	-	-
8	GND	Power Ground	-	-
9	R0	Red Data [LSB]	Positive	(2)
10	R1	Red Data	Positive	
11	R2	Red Data	Positive	
12	GND	Power Ground	-	-
13	R3	Red Data	Positive	(2)
14	R4	Red Data	Positive	
15	R5	Red Data [MSB]	Positive	
16	GND	Power Ground	-	-
17	GND	Power Ground	-	-
18	GND	Power Ground	-	-
19	G0	Green Data [LSB]	Positive	(2)
20	G1	Green Data	Positive	
21	G2	Green Data	Positive	
22	GND	Power Ground	-	-
23	G3	Green Data	Positive	(2)
24	G4	Green Data	Positive	
25	G5	Green Data [MSB]	Positive	
26	GND	Power Ground	-	-
27	GND	Power Ground	-	-
28	GND	Power Ground	-	-
29	B0	Blue Data	Positive	(2)
30	B1	Blue Data	Positive	
31	B2	Blue Data	Positive	
32	GND	Power Ground	-	-
33	B3	Blue Data	Positive	(2)
34	B4	Blue Data	Positive	
35	B5	Blue Data [MSB]	Positive	
36	GND	Power Ground	-	-
37	DE [DTMG]	Data Enable [Display Timing]	Positive	-
38	N.C.	No Connection	-	Open
39	VDD	Power Supply [+3.3V]	-	-
40	VDD	Power Supply [+3.3V]	-	-
41	N.C.	No Connection	-	Open

Remark : (1) Display Data is sampled at the negative edge of Data Clock.
(2) Data level 0 means no color (Black).

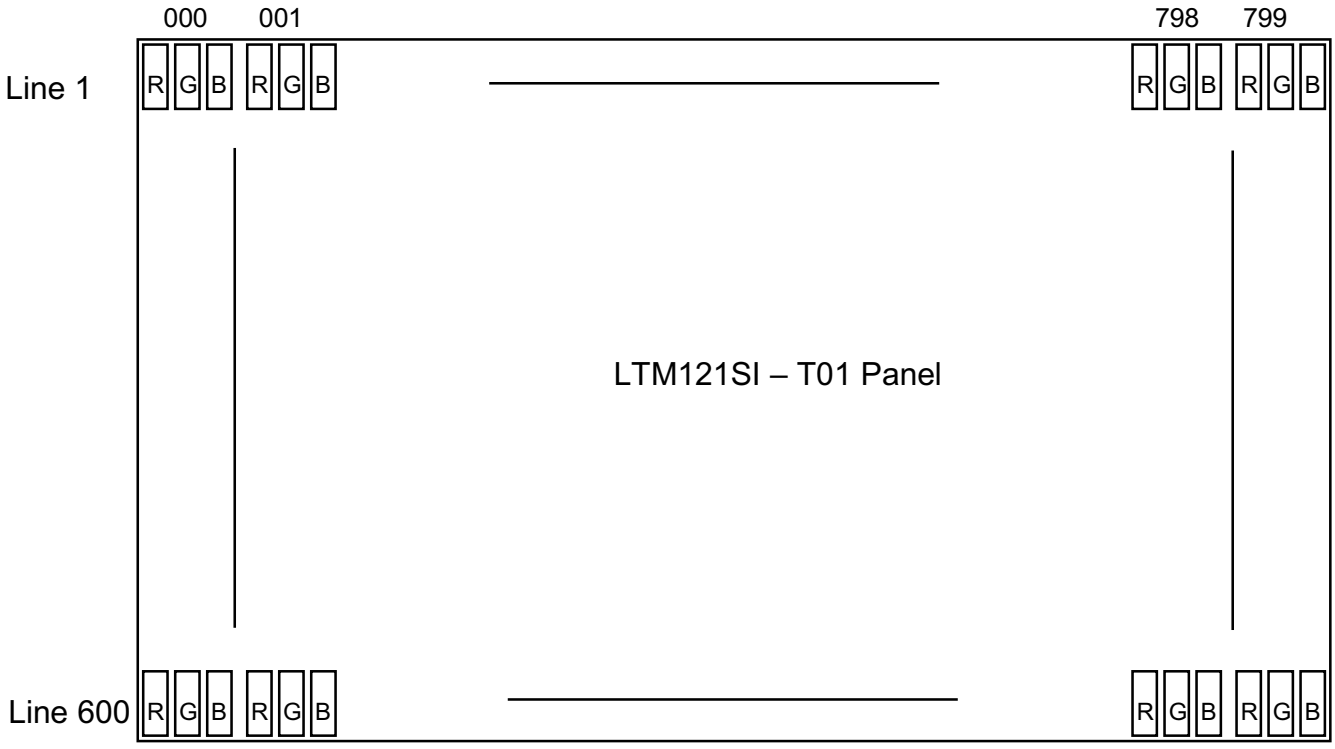
5.2 BACK LIGHT UNIT

Connector : JST BHR-03VS-01

Pin NO.	Symbol	Color	Function
1	HOT	PINK	High Voltage
3	COLD	WHITE	Low Voltage

Pin NO.	Symbol	Color	Function
1	HOT	BLUE	High Voltage
3	COLD	WHITE	Low Voltage

5.3 PIXEL FORMAT



5.4 Input Signals, Basic Display Colors and Gray Scale of Each Color

COLOR	DISPLAY	DATA SIGNAL																		GRAY SCALE LEVEL
		RED						GREEN						BLUE						
		R0	R1	R2	R3	R4	R5	G0	G1	G2	G3	G4	G5	B0	B1	B2	B3	B4	B5	
COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	-
	GREEN	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	-
	CYAN	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	-
	RED	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	-
	MAGENTA	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1	-
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	-
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-
GRAY SCALE OF **RED**	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R0
	DARK ↑	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1
		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R3~R60
	↓ LIGHT	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
		1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	R61
		0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	R62
	RED	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	R63
GRAY SCALE OF **GREEN**	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G0
	DARK ↑	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	G1
		0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	G2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	G3~G60
	↓ LIGHT	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
		0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0	G61
		0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	G62
	GREEN	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	G63
GRAY SCALE OF **BLUE**	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	B0
	DARK ↑	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	B1
		0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	B2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B3~B60
	↓ LIGHT	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
		0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	B61
		0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	B62
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	B63

Note 1) Definition of gray :
Rn: Red gray, Gn: Green gray, Bn: Blue gray (n=gray level)
Note 2)Input signal: 0 =Low level voltage, 1=High level voltage

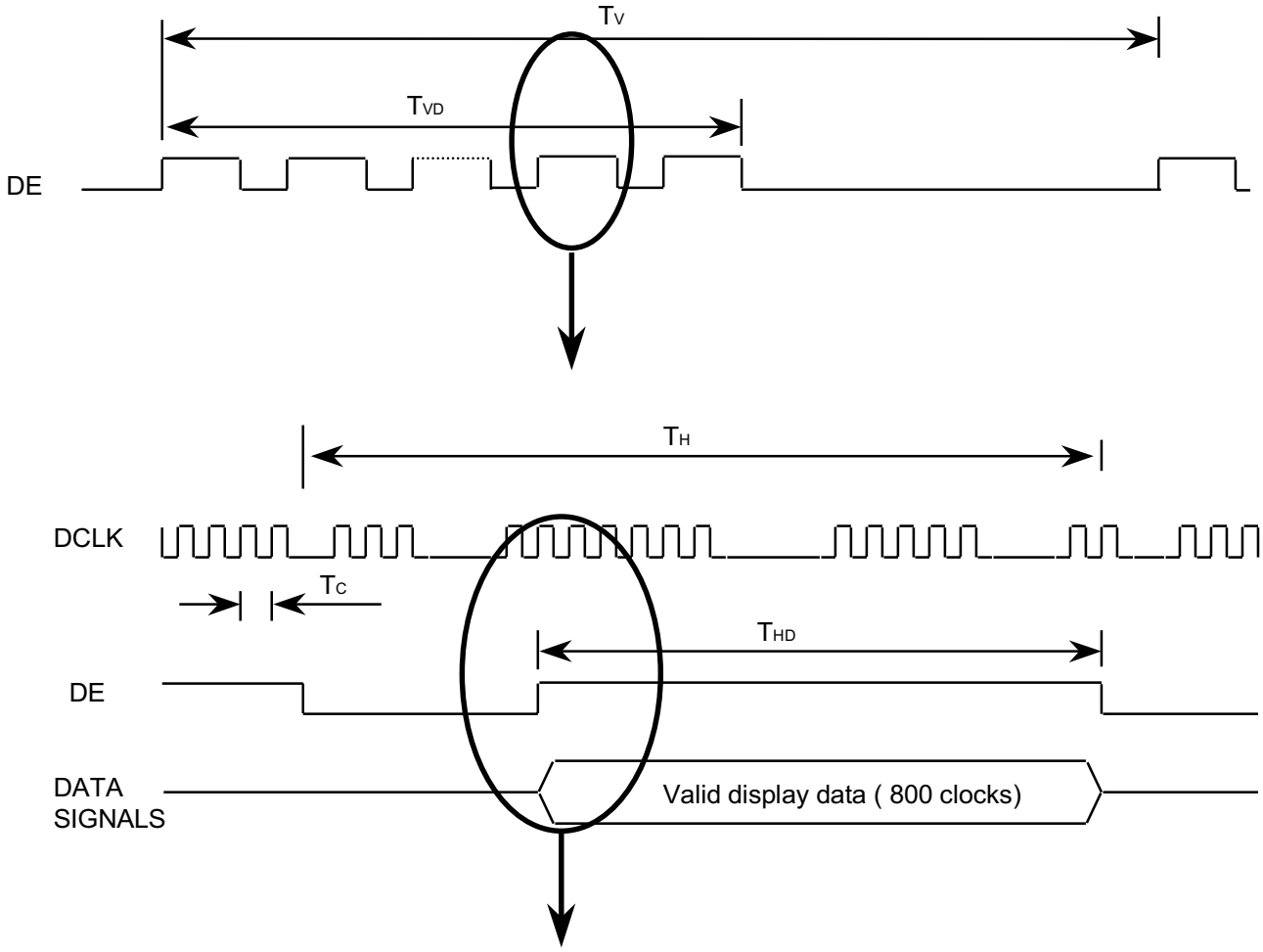
6. INTERFACE TIMING

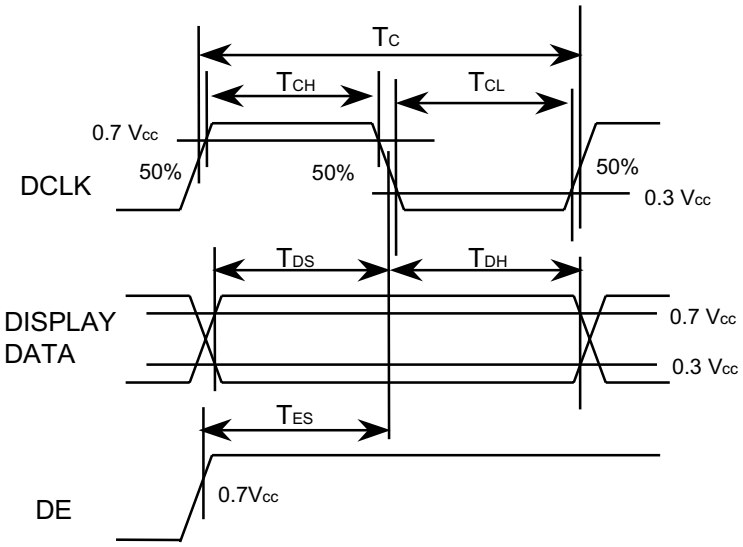
6.1 Timing Parameters (DE mode)

Signal	Item	Symbol	MIN	TYP	MAX	Unit	Note
Clock	Frequency	1/Tc	38.0	40.0	42.0	MHz	
	High Time	Tch	10	-	-	nsec	
	Low Time	Tcl	10	-	-	nsec	
Data	Setup Time	Tds	2	-	-	nsec	
	Hold Time	Tdh	0	-	-	nsec	
Data Enable	Setup Time	Tes	5	-	-	nsec	(1)
One Line Scanning Time	Cycle	Th	1024	1056	1056	clocks	
Frame Frequency	Cycle	Tv	620	628	664	lines	
Vertical Active Display Term	Display Period	Tvd	600	600	600	lines	
Horizontal Active Display Term	Display Period	Thd	800	800	800	clocks	

Note (1) The duration of DE [DTMG] signal must be longer than 1 clock period at every horizontal sync. period

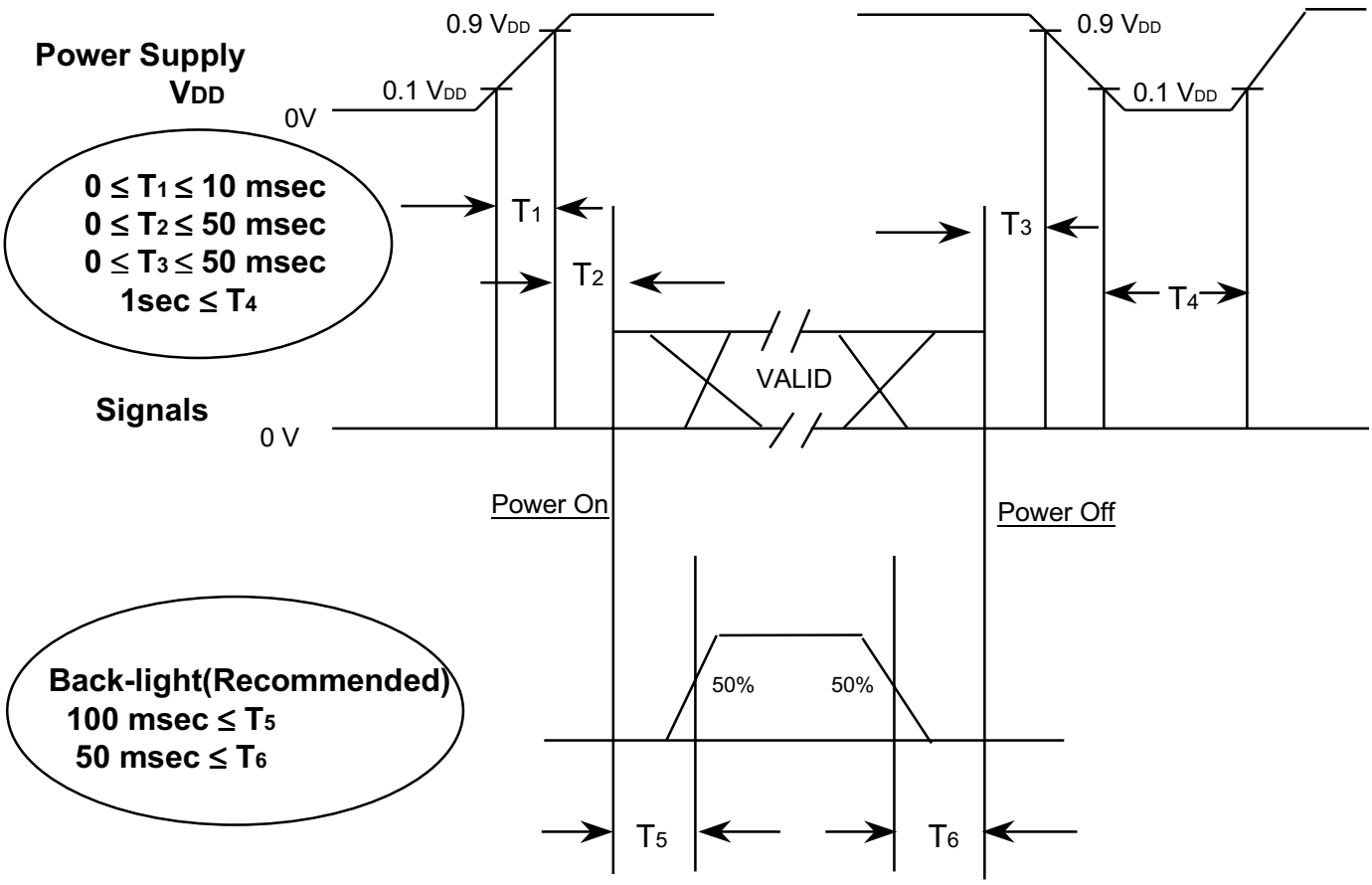
6.2 Timing diagrams of interface signal





6.3. Power ON/OFF Sequence

: To prevent a latch-up or DC operation of the LCD module, the power on/off sequence shall be as shown below.



Power ON/OFF Sequence

NOTE.

(1) The supply voltage applied to the module input should be the same as wit V_{DD}.

(2) Apply the lamp voltage within the LCD operation range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight does, the display may momentarily become white.

(3) In case of V_{DD} = off level, please keep the level of input signals on the low or a high impedance.

(4) T4 should be measured after the module has been fully discharged between power off and on period.

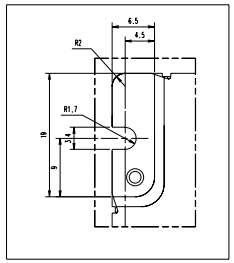
(5) Interface signal should not be kept at high impedance when the power is on.

7. Mechanical Outline Dimension

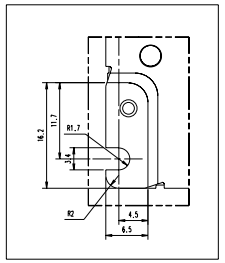
[Refer to the Next Page]

FILE NO.

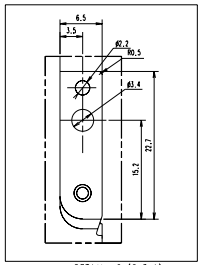
NO	PART NAME	CODE NO	SPECIFICATION	Q'TY	WEIGHT FINISH	WEIGHT MATERIAL	UNFOLDED DIM OF MATERIAL	REMARK



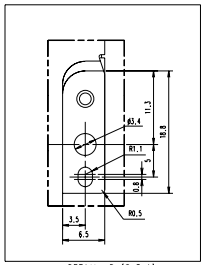
DETAIL "A"(S:3/1)



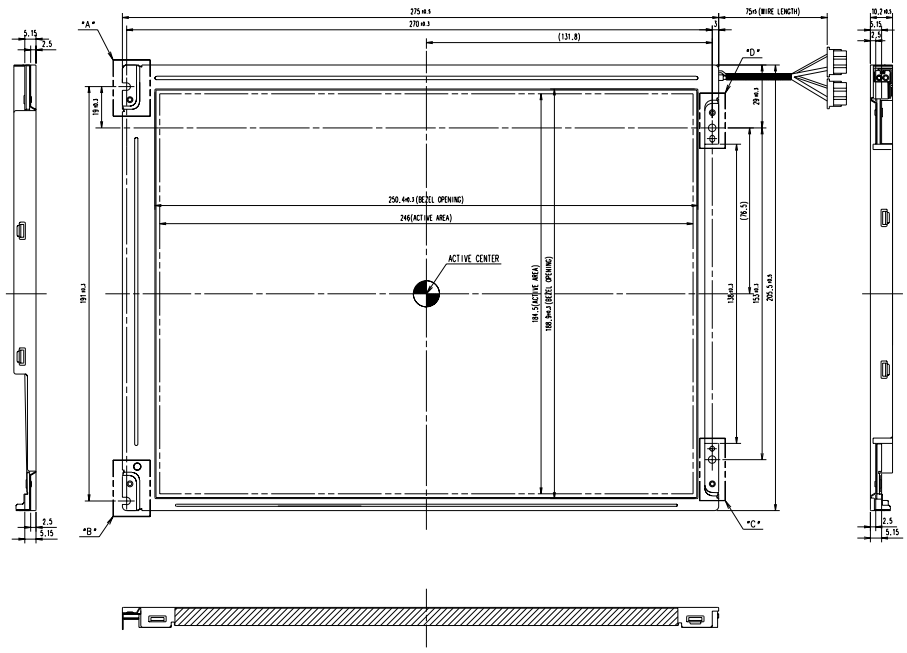
DETAIL "B"(S:3/1)

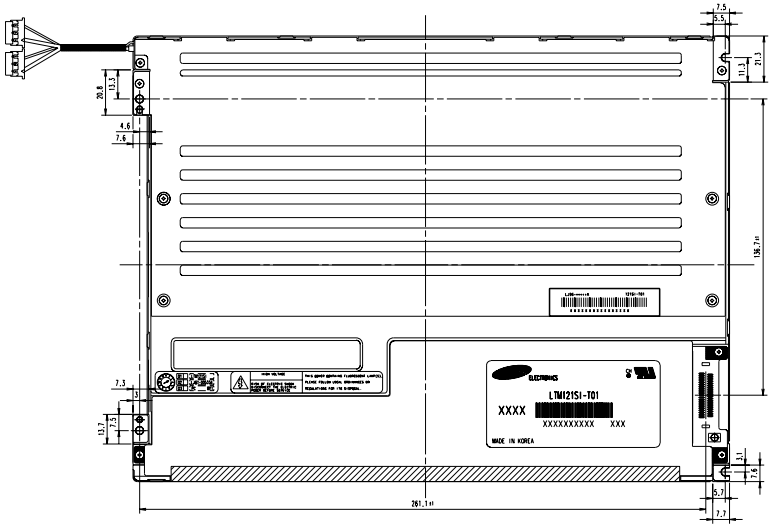


DETAIL "C"(S:3/1)



DETAIL "D"(S:3/1)





* NOTE
1. CONNECTOR SPECIFICATION
   - MAKER : HIROSE OR COMPATIBLE
   - PART NO: DF9B-41P-1V (1K/RL)
2. CCFT LAMP CONN. SPECIFICATION
   - MAKER : JST
   - PART NO: BHR-03VS-01 (2 EA)

REVISION

GENERAL TOLERANCE			
STEP	LEVEL 1	LEVEL 2	LEVEL 3
0 < X ≤ 4	±0.05	±0.1	±0.2
4 < X ≤ 16	±0.08	±0.15	±0.3
16 < X ≤ 64	±0.12	±0.25	±0.5
64 < X ≤ 256	±0.25	±0.4	±0.8

REV	DATE	DESCRIPTION OF REVISION	REASON	CHG'D BY

UNIT	mm	DRA'N BY	DES'D BY	CHK'D BY	APP'D BY
SCALE	✓	T J KIM	T J KIM	S H LEE	Y B CHU
TOLERANCE		'01.03.22	'01.03.22	'01.03.22	'01.03.23
					SPEC. NO

SAMSUNG ELECTRONICS

MODEL NAME	LTM121SI-T01		
PART/SHEET NAME	OUTLINE DIMENSION	SHEET	1/1
CODE NO.		VER.	00

8. RELIABILITY TEST

Test Items	Conditions	Time / Cycle	Sample
HTOL*	50°C, Dynamic	500 hrs	12
LTOL*	0 °C, Dynamic	500 hrs	5
THB*	40°C / 90%, Dynamic	500 hrs	5
HTS****	70°C, No Bias	250 hrs	5
LTS****	-30°C, No Bias	250 hrs	5
Thermal Shock (Non-operating)	-20 ~ 60°C, No bias, Ramp-up & down : 1 min., Soak time : 30min.	100 Cyc.	5
Temperature Characteristics & Power on/off	Storage : 0°C, 30min., 10 times (power on/off) Ramp up : 0°~ 25°C, 30 min Storage : 25°C, 30 min., 10 times (power on/off) Ramp up : 20~ 50°C, 30 min. Storage : 50°C, 30 min., 10 times (power on/off) Ramp up : 50~ 0°C, 30 min.	10Cyc.	10
Shock (Non-operating)	50 G, 11 msec, Sine wave, ± x/y/z axis	one time/axis	3
Vibration (Non-operating)	1.5G, 10 ~ 300 ~ 10 Hz, x/y/z axis, sweep rate : 10 min.	30 min/axis	3
ESD (Non-operating)	Contact : 150pF, 330 ohm Air : 150pF, 330 ohm	± 10KV ± 20KV	3 3
Box Vibration	1.1G, 5 ~ 100Hz, 1hour / y axis(up/down), sweep rate : 5min		10
Box Drop	Height : 66cm		10

[Result Evaluation Criteria]

Under the display quality test conditions with normal operation state, these shall be no change which may affect practical display function.

* HTOL/ LTOL : High/Low Temperature Operating Life, ** THB : Temperature Humidity Bias
**** HTS/LTS : High/Low Temperature Storage

9. Packing

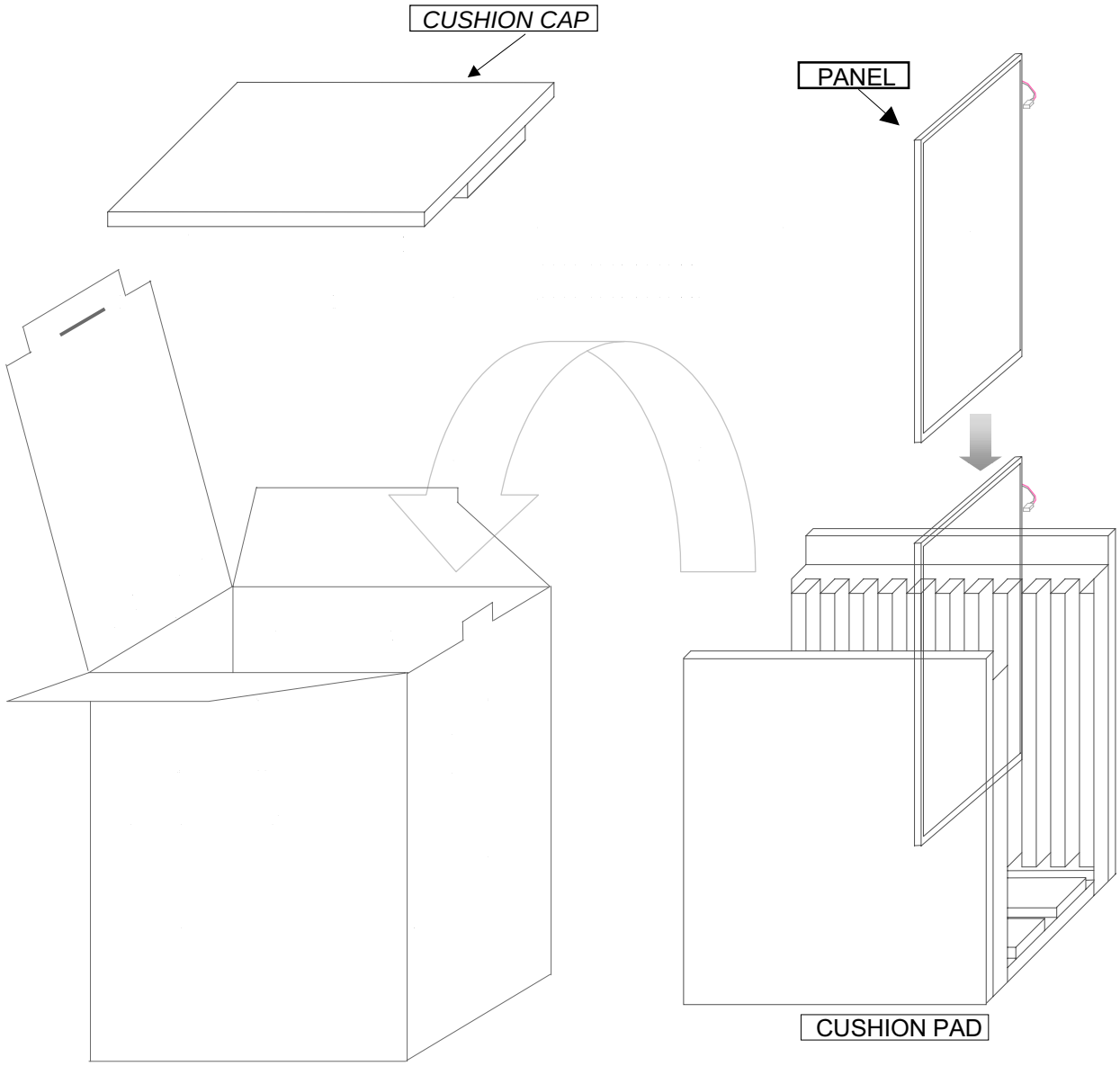
9.1 Packing

CARTON(Internal Package)

(1)Packing Form

Corrugated fiberboard box and corrugated cardboard as shock absorber

(2)Packing Method



Note (1)Total : Approx. 8.5Kg

(2)Acceptance number of piling : 10 sets

(3)Carton size : 267(W) X 228(D) X 340(H)

(4)Max accumulation quality : 5cartons

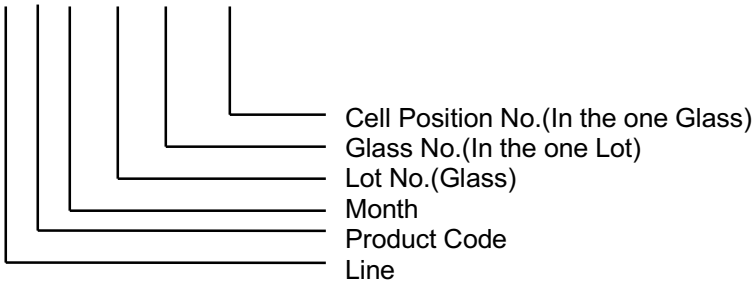
(3)Packing Material

NO.	Parts name	Quantity
1.	Static electric protective sack	10
2.	Packing case(inner box) included shock absorber	1 set
3.	Pictorial marking	2 pics
4.	Silica gel(50g X 2)	2
5.	Carton	1 set

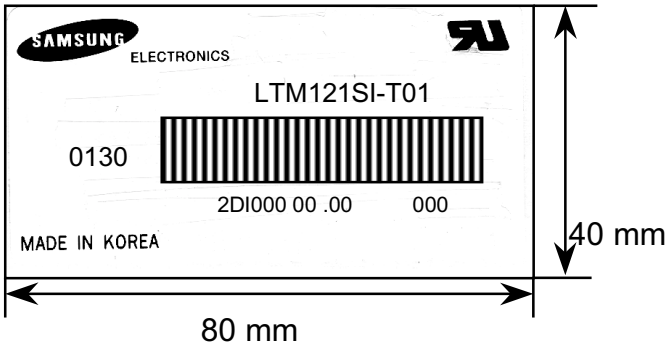
10. MARKINGS & OTHERS

A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

(1)Parts number : LTM121SI – T01
(2)Revision : One letter
(3)Control code : One letter
(4)Lot number : 2D I XXX XX XX

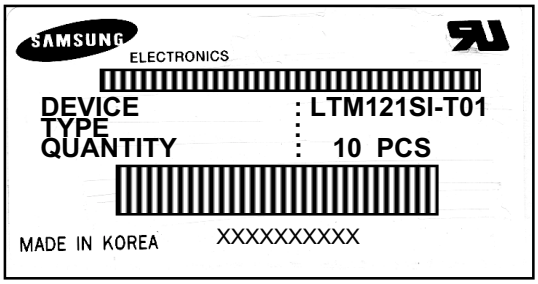


(5) Nameplate Indication



LTM... : Parts name
2DI… : Lot number
0130 : Inspected work week

(6) Packing box attach



11. GENERAL PRECAUTIONS

11.1 Handling

(a) When the module is assembled, it should be attached to the system firmly using every mounting hole. Be careful not to twist and bend the module.

(b) Refrain from strong mechanical shock and / or any force to the module. In addition to damage, this may cause improper operation or damage to the module and CCFT back-light.

(c) Note that polarizers are very fragile and could be damaged easily. Do neither press nor scratch the surface harder than a HB pencil lead.

(d) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, staining and discoloration may occur.

(e) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

(f) The desirable cleaners are water, IPA(Isopropyl Alcohol) or Hexane.
Do not use Ketone type materials(ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might cause permanent damage to the polarizer due to chemical reaction.

(g) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth . In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.

(h) Protect the module from static which may cause damage to the C-MOS Gate Array IC.

(i) Use finger-stalls with soft gloves in order to keep display clean during incoming inspection and assembly process.

(j) Do not disassemble the module.

(k) Do neither pull nor fold the lamp wire.

(l) Do not adjust the variable resistor which locates on the back side.

(m) Pins of I/F connector should not be touched directly with bare hands.

10.2 Storage

(a) Do not leave the module in high temperature, and high humidity for a long time. It is high recommended to store the module with temperature from 0 to 35 °C and relative humidity of less than 70%.

(b) Do not store the TFT-LCD module in direct sunlight.

(c) The module should be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during the store.

10.3 Operation

(a) Do neither connect nor disconnect the module in the " Power On" condition.

(b) Power supply should always be turned on/off by following item 6.3 " Power on/off sequence ".

(c) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference should be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.

(d) A cable between the backlight connector and its inverter power supply should be a minimized length and be connected directly . A longer cable between the backlight and the inverter may cause lower luminance of lamp(CCFT) and require higher startup voltage(Vs).

10.4 Others

(a) Ultra-violet ray filter is necessary for outdoor operation.

(b) Avoid condensation of water. It may result in improper operation or disconnection of electrode.

(c) Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature and so on) Otherwise the module may be damaged.

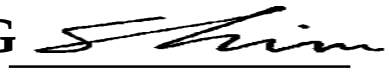
(d) If the module displays the same pattern continuously for a long time, it can bring about the situation that the image "sticks" to the screen.

(e) Because this module has its circuitry PCB on the rear side, it should be handled carefully in order not to be stressed.

Cosmetic Outgoing Inspection Specification

(LTM121SI SVGA TFT - LCD)

Customer _____

SAMSUNG 

J.S.Shim
Sr. Manager, LCD CS Group

LCD CS Group

AMLCD Division

Address : San 24 Nongseo-Lee, Kihung-Eup, Yongin Si, Kyungki-Do, Korea
Tel. 82-2-760-7838 Fax. 82-2-760-7369

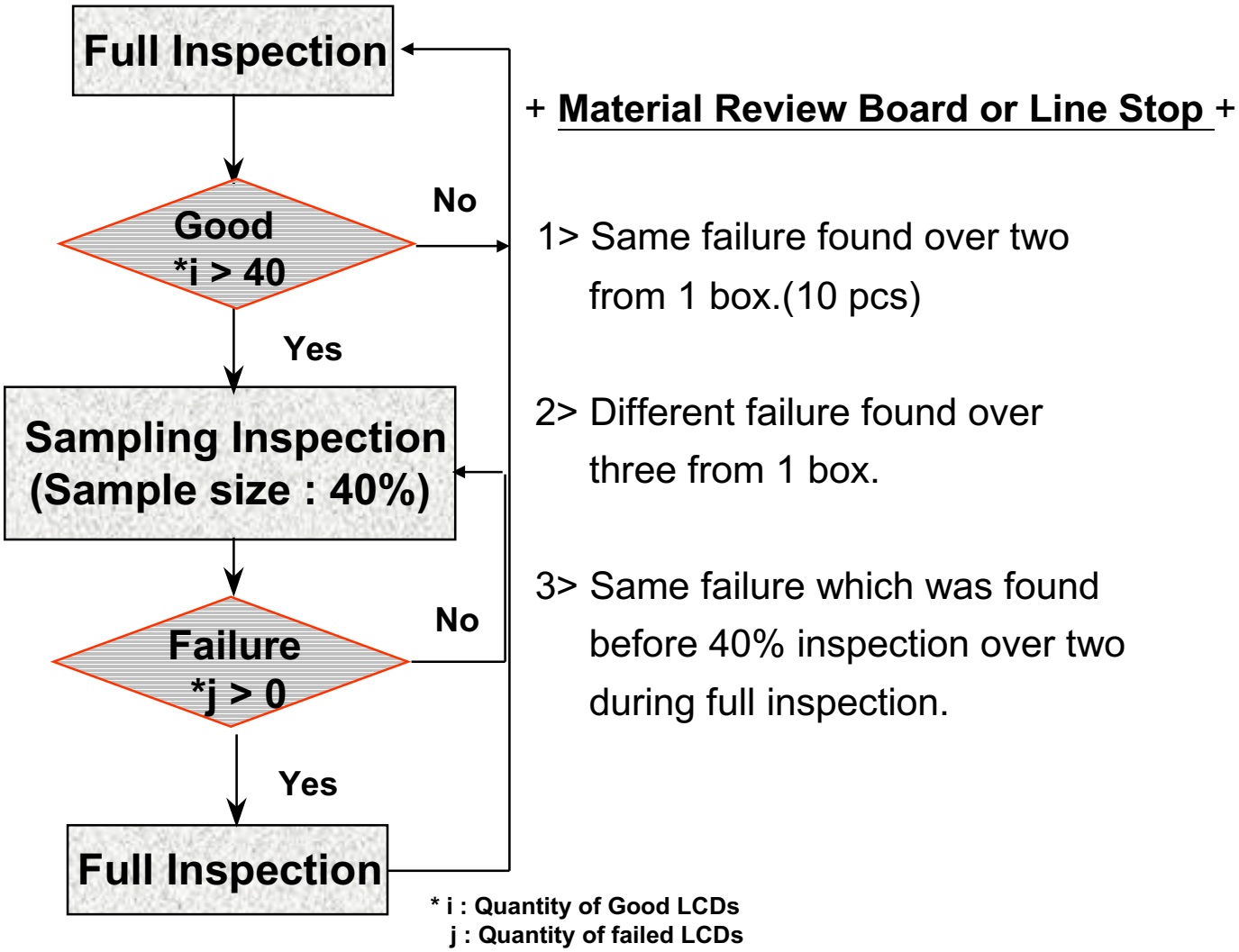
1. Outgoing Inspection

1.1 Outgoing Inspection Plan

1.1-1 Sampling Plan

+ Sample size : 40 %

1.1-2 Flow Chart



+ **Material Review Board or Line Stop** +

1> Same failure found over two from 1 box.(10 pcs)

2> Different failure found over three from 1 box.

3> Same failure which was found before 40% inspection over two during full inspection.

*** i : Quantity of Good LCDs**
j : Quantity of failed LCDs

1.2 Outgoing Inspection Criteria

1.2.1 Inspection Introduction

1.2.1.1 Conditions

viewing distance	30 ~ 50 cm
ambient illumination	300 ~ 700 Lux (nominal 500 Lux)
ambient temperature	25 + - 3 'C
viewing angle	The surface of the module and the inspector's line of view shall be at 90 degrees.
display pattern (SEC's test program)	12.1" SVGA - SLT

1.2.1.2 Defect Modes

dark / bright spots

points on the display which appear dark / bright and remain unchanged in size

dark / bright lines

lines on the display which appear dark / bright and remain unchanged in size

polarizer scratch

when the unit is lit a light, line is seen across a darker background; line does not vary in size

polarizer dent

when the unit is lit a light, light(white) spots appear against a darker background, and do not vary in size

bright/dark dot

a sub-pixel (R, G, B dot) stuck off / on

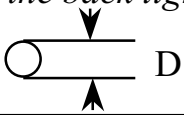
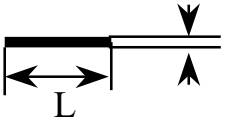
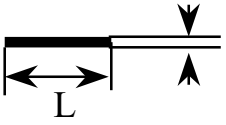
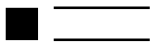
1.2.2 Mechanical Inspection

Chassis Gap	max. 0.7mm
Silicone Gasket (Glue)	silicone material shall not be exposed beyond the metal frame edge into the view area
Light Leakage	there shall be no visible light around the edges of the screen.

**** If there is none identified criteria in this specification, Samsung will refer production specification that Customer and Samsung agreed.***

**** If there is mechanical dimension issue which has no designated tolerance, Samsung will apply natural tolerance.***

1.2.3 Visual Inspection

Defect Type	Count (mm)	Reject (mm)
*Dark / bright spot *1 (foreign circular matter on the back light)* 	0.1 < D <= 0.8 N <= 4	D > 0.8
Bright line (light lint), or dark line (dark lint / hair) 	0.01 < W <= 0.08 0.3 < L <= 1.0 N <= 4	W > 0.08 L > 1.0
Polarizer scratch 	0.01 < W <= 0.1 0.3 < L <= 5.0 N <= 3	W > 0.1 L > 5.0
Polarizer dent/bubble 	D <= 0.5 N <= 6	D > 0.5
Maximum allowable number of defects	N <= 7	N > 7

[D : diameter, W : width, L : length, N : count]

**1. Translucent edge is ignored in measuring the diameter of spot.*

1.2.4. Electrical Inspection

Defect Type	Accept	Reject
Bright dot, ***(Fig. 1)***		
Random	N <= 4	N > 4
two adjacent	N <= 1	N > 1
Dark dot , ***(Fig. 2)***		
random	N <= 6	N > 6
two adjacent	N <= 2	N > 2
three adjacent	N <= 1	N > 1
four or more adjacent	not allowed	
Maximum allowable number of dot defect	N <= 8	N > 8
Minimum distance between defects, ***(Fig.3)***		
bright dot - to - bright dot	L => 15mm	L < 15mm
dark dot - to - dark dot	L => 5mm	L < 5mm

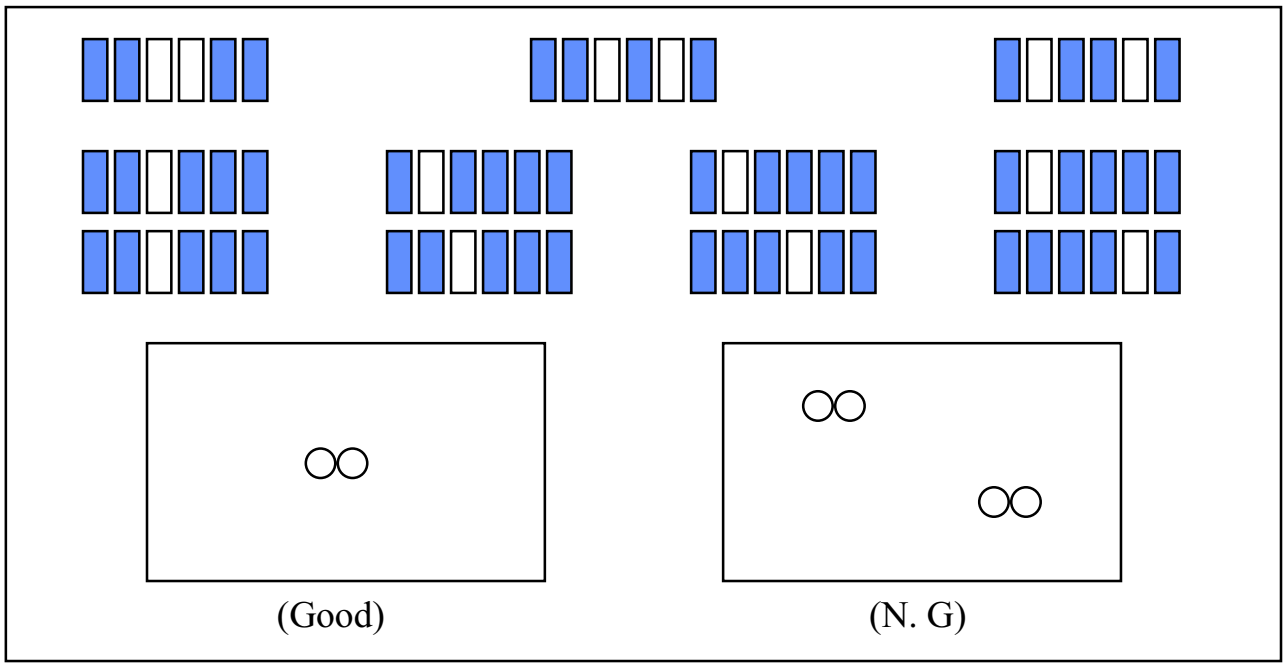
[L : length, N : count]

Off dot count method add all dot defects in individual patterns (R, G, B, Black and White). A dot defect appeared repeatedly is counted as one (1) dot defect.

Adjacent dot count Samsung uses standard pattern -- R, G, B, Black and White.

Fig. 1. Bright dot defect description

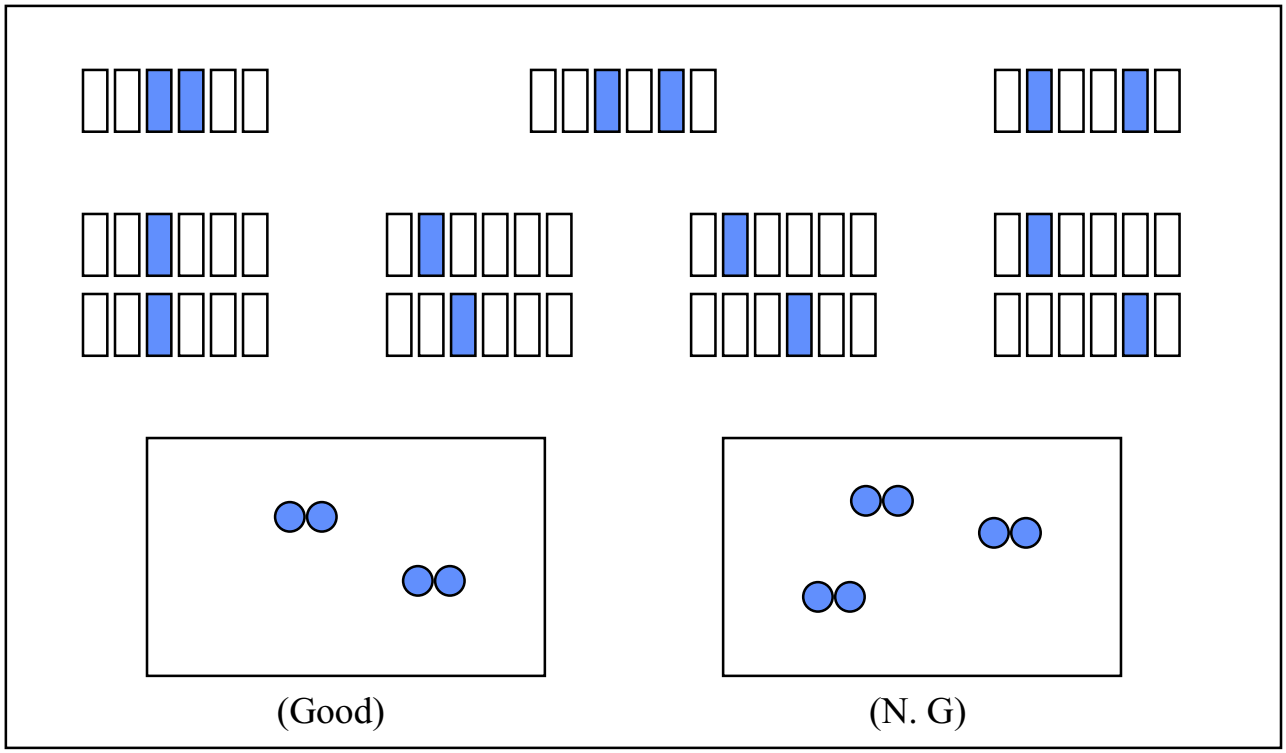
【two adjacent】



* adjacent two dots in horizontal direction will be considered as one dot

Fig. 2. Dark dot defect description

【two adjacent】



* adjacent two dots in horizontal direction will be considered as one dot

【three adjacent】

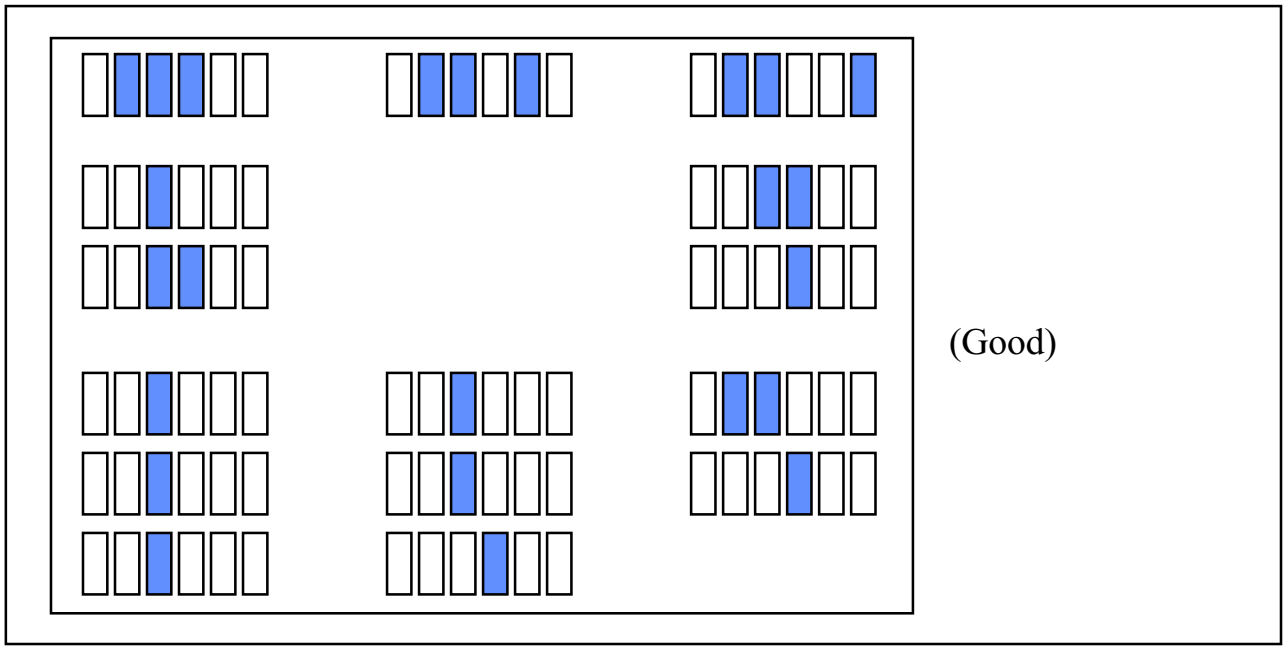
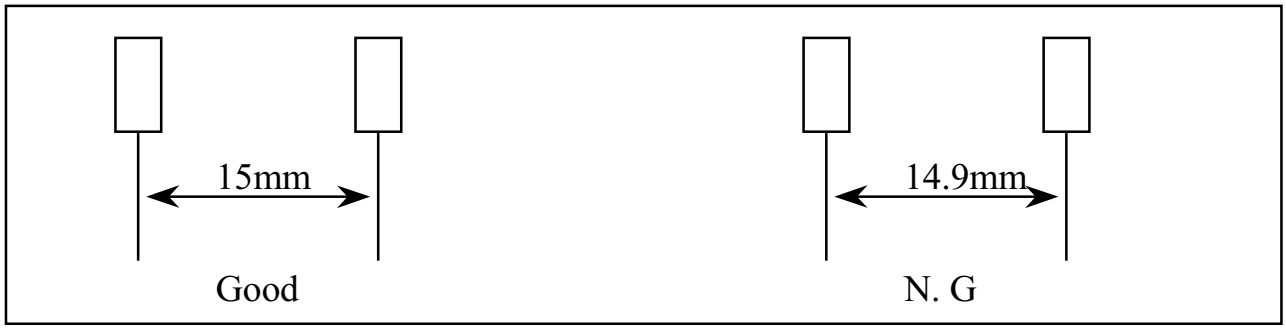
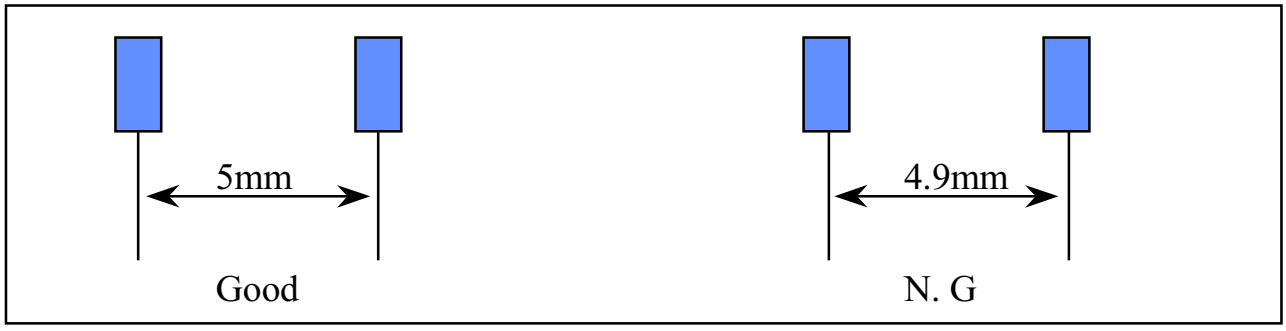


Fig. 3. Minimum distance between dot defects

【bright dot - to - bright dot】



【dark dot - to - dark dot】



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