深圳市一众显示科技有限公司

SHEN ZHEN TEAM SOURCE DISPLAY TECH. CO, LTD.

TFT-LCD Module Specification

Module NO.：TST121XA01DW

Version：V1.1

☐ APPROVAL FOR SPECIFICATION   ☐ APPROVAL FOR SAMPLE

For Customer's Acceptance：	
Approved by	**Comment**

Team Source Display：		
Presented by	**Reviewed by**	**Organized by**

Version No.	Date	Content	Remark
V1.1	2017-11-08	Initial Release	

Table Of Content

1. OVERVIEW

TST121XA02DW is 12.1" color TFT-LCD (Thin Film Tra nsistor Liquid Crystal Display) module composed of LCD panel, driver ICs, control circuit and backlight. By applying 8 bit digital data (6Bit+HFRC),1024×768, 16.7M-color images are displayed on the 12.1" diagonal screen.

General specifications are summarized in the following table:

ITEM	SPECIFICATION
Display Area(mm)	245.76 (W) ×184.32 (H) (12.1-inch diagonal)
Number of Pixels	1024(H) × 768(V)
Pixel Pitch(mm)	0.24(W) × 0.24(H)
Color Pixel Arrangement	RGB vertical strip
Display Mode	Normally white, TN
Number of Colors	16.7M(6bit+Hi-FRC)
Brightness(cd/m^2)	600 (typ.) (Center point)
Viewing Angle	140 /160(Typ.)
Surface Treatment	Anti-Glare, 3H
Optimum Viewing Direction	9 O'clock(Max. contrast ratio, Gray level inversion)
Power consumption(W)	8.74W (typ.)
Interface Connection	LVDS
Module Size(mm)	260.5 ×204 ×8.4 (typ.)
Module Weight(g)	524(typ.)
Backlight Unit	LED:(white-LED)

2. ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	MIN.	MAX.	UNIT	REMARK
Power Supply Voltage for LCD	VCC	-0.3	5	V	*1)
Logic Input Voltage	VI	-0.3	5	V	*1)
Backlight Power Supply Voltage	VLED	-0.3	20	V	*1)
Backlight ON-OFF Voltage	LED_EN	0	VLED +0.3	V	*1)
Backlight Dimming Control Input Voltage	LED_PWM	-0.3	6	V	*1)
Forward Current（per LED）	If	--	75	mA	*1)
Operation Temperature	Top	-30	80	℃	*1).*2).*3).*4).
Storage Temperature	Tstg	-40	85	℃	*1).*2).*3)

Note：

*1).Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

*2) The relative temperature and humidity range are as below sketch, 90%RH Max. (Ta≦40℃)

*3) The maximum wet bulb temperature ≦39℃(Ta＞40℃) and without dewing.

*4) If product in environment which over the definition of the relative temperature and humidity out of range too long, it will affect visual of LCD.
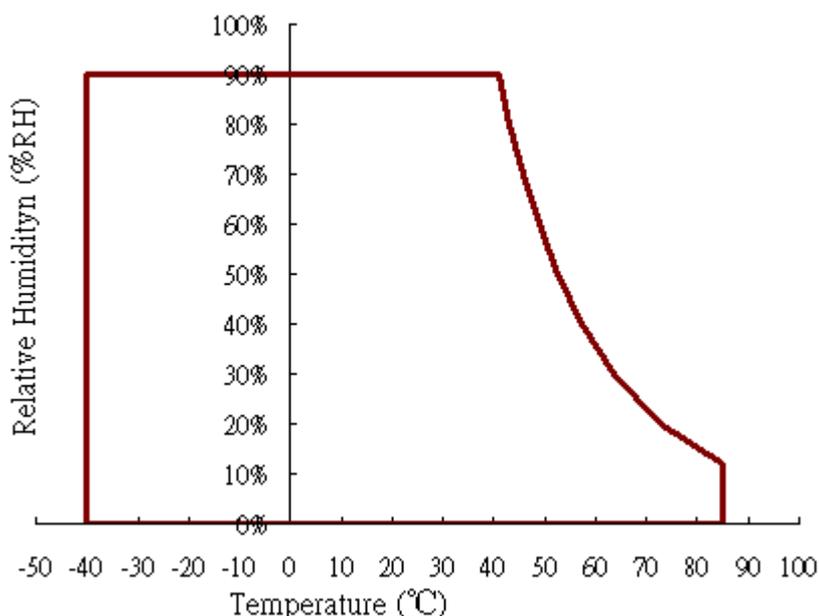
3. ELECTRICAL CHARACTERISTICS

(1).TFT-LCD

ITEM		SYMBOL	MIN	TYP	MAX	UNIT	NOTE
LCD Power Voltage		VCC	3.0	3.3	3.6	V	
LCD Power Current		IVCC	-	257	330	mA	*1)
LCD Rush Current		VCC_Irush			2	A	*3)
Logic Input Voltage (LVDS: IN+,IN-)	Common Voltage	VCM	$\dfrac{\lvert VID \rvert}{2}$	-	$2.4 - \dfrac{\lvert VID \rvert}{2}$	V	Logic Input Voltage (LVDS: IN+,IN-)
	Differential Input Voltage	$\lvert VID \rvert$	200	-	600	mV	*2)
	Threshold Voltage (HIGH)	VTH	-	-	100	mV	*2)
	Threshold Voltage (LOW)	VTL	-100	-	-	mV	
	1 Data time	UI	-	tclk*1/7	-	tclk	*4)
	LVDS clock to data skew	tskew	-	-	0.2	UI	
	input data eye width	teyew	0.6	-	-	UI	
Logic Input Voltage	VIH	0.7*VCC	-	VCC	V		Logic Input Voltage
	VIL	GND	-	0.3*VCC	V		
Power consumption		P		0.84	1.1	W	

【Note】

*1)TYP. specification：Gray-level test Pattern (TYP Freq. @3.3V)

　　MAX. specification：Black test Pattern (TYP Freq. @3.3V)
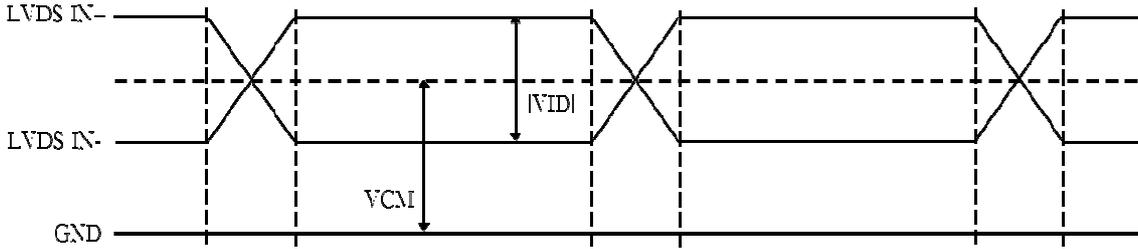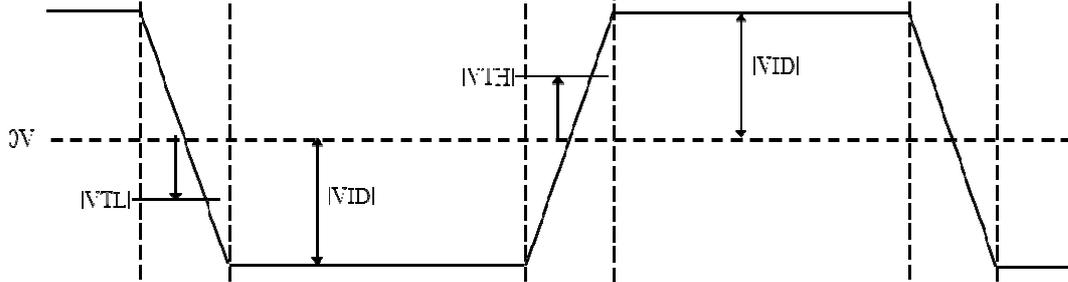
Gray-level Pattern   Black Pattern

*2) LVDS DC electrical characteristics

LVDS Single-End Signal

LVDS IN+

LVDS IN-

$|VID|$

VCM

GND

LVDS Differential Signal

$|VTH|$

$|VID|$

0V

$|VTL|$

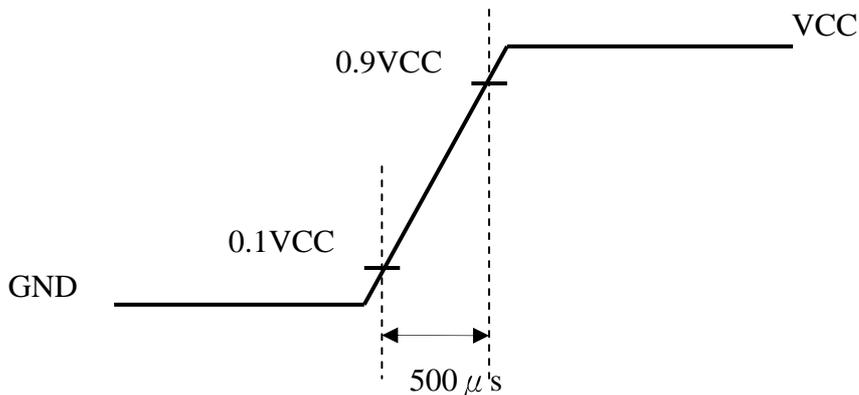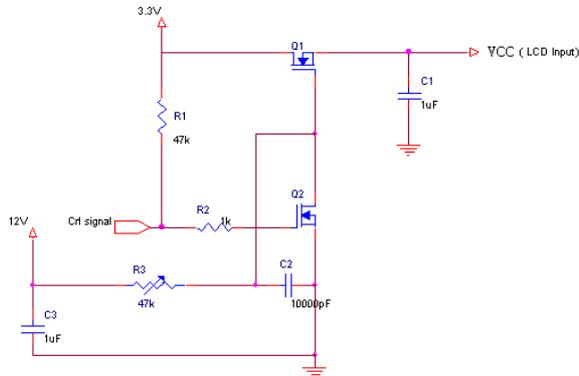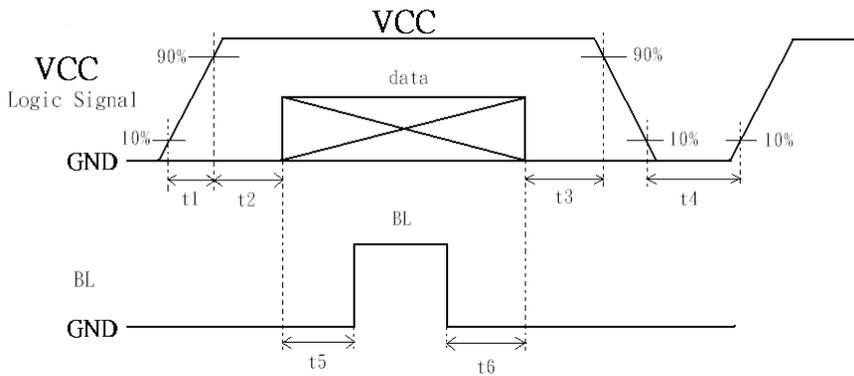$|VID|$

LVDS IN+ : Positive differential DATA & CLK Input

LVDS IN- : Negative differential DATA & CLK Input

*3) Irush measure condition

3.3V

Q1

VCC (LCD Input)

C1
1uF

R1
47k

Q2

12V

Crl signal

R2
1k

R3
47k

C2
10000pF

C3
1uF

VCC

0.9VCC

0.1VCC

GND

$500\,\mu's$

*4) Differential LVDS Data

(2).Converter Specification for Backlight   Ta=25℃

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
LED Driver Input Voltage	VLED	7	12	17	V	
LED Driver Input Current	IVLED		0.76	1.35	A	
Power Consumption (Backlight)	BLW		7.9	9.4	W	*2)
LED Forward voltage (single LED)	VF	2.8	--	3.4	V	IF=75mA Ta=25℃
Diming duty ratio	Adj	10		100	%	
Diming Frequence	fdim	190	200	22000	Hz	
Diming High level	Adj	2.1		5	V	
Diming Low level	Adj			0.8	V	
LED Enable High Level	EN	2.1		5		
LED Enable Low Level	EN			0.4		
LED Forward current (single LED)	IF	--	75	--	mA	Ta=25℃
LIFE TIME(Backlight)		50000	70000		hr	*1)

*1). Definition of the LED life time: Luminance (L) under 50% of the initial value. LED life time is restricted under normal condition, ambient temperature=25℃ and LED operation forward current=75mA.

*2).The maximum Power consumption and input current is measured by Vin=7V.

(3). Power and Signal sequence

0.50 ms≦t1 ≦10 ms   500 ms≦t4

0.01 ms＜t2 ≦50 ms   200 ms≦t5

0.01 ms＜t3 ≦50 ms   200 ms≦t6

Data includes RX1-~RX3-、RX1+~RX3+、RXC-、RXC+

4. INTERFACE PIN CONNECTION

1. CN1 (Data Signal and Power Supply)
   (1) Connector Part No.: STARCONN 076B20-0048RA-G4 or JAE FI-SEB20P-HFE or equivalent.
   (2)   User's connector Part No.: JAE FI-SE20ME or equivalent.

PIN #	SYMBOL	FUNCTION
1	RX3+	LVDS signal (+)--channel 3
2	RX3-	LVDS signal (-)--channel 3
3	NC	No connector
4	SEL68	LVDS 6/8 bit select function control, Low or NC =6 bit Input Mode High=8bit Input Mode
5	GND	Ground
6	RXC+	LVDS Clock Signal(+)
7	RXC-	LVDS Clock Signal(-)
8	GND	Ground
9	RX2+	LVDS signal (+)--channel 2
10	RX2-	LVDS signal (-)--channel 2
11	GND	Ground
12	RX1+	LVDS signal (+)--channel 1
13	RX1-	LVDS signal (-)--channel 1
14	GND	Ground
15	RX0+	LVDS signal (+)--channel 0
16	RX0-	LVDS signal (-)--channel 0
17	SHLR	Horizontal Reverse Scan Control, Low or NC =Normal Mode. High=Horizontal Reverse Scan
18	UPDN	Vertical Reverse Scan Control, Low or NC=Normal Mode, High=Vertical Reverse Scan
19	VCC	+3.3V Power
20	VCC	+3.3V Power

1) Please keep the NC Pin to float and don't connect it to GND or other signals.

2) GND Pin must connect to the ground, don't let it be a vacant pin.

2. CN2 (Backlight)
   (1) Connector Part No.: 91208-01001-H01 (ACES) or equivalent.
   (2) User's connector Part No.: 91209-01011 (ACES) or equivalent

PIN #	SYMBOL	FUNCTION	Remark
1	VLED	Converter input voltage	12V
2	VLED	Converter input voltage	12V
3	VLED	Converter input voltage	12V
4	NC	NO CONNECOTR	
5	VGND	GROUND	
6	VGND	GROUND	
7	VGND	GROUND	
8	VGND	GROUND	
9	EN	Enable pin	3.3V
10	Adj	Backlight Adjust	PWM Dimming (TYP. 200Hz, Hi: 3.3V DC ,Lo: 0V DC)

1) ADJ is brightness control pin , where pulse duty is proportional to luminance。
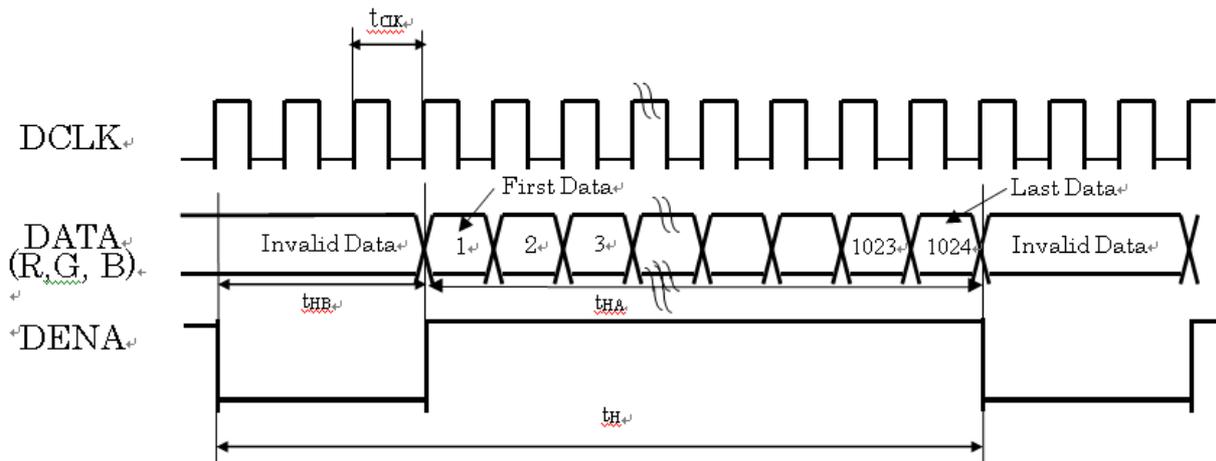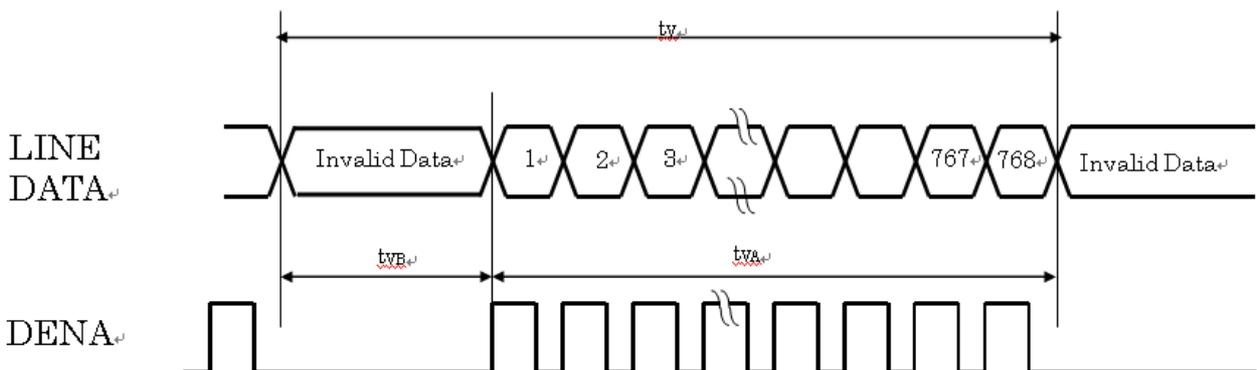
5. INTERFACE TIMING

(1) Timing Specifications

ITEM				SYMBOL	MIN.	TYP.	MAX.	UNIT
	DCLK		Frequency	f_{CLK}	57.5	64.9	74.4	MHz
				T_{CLK}	13.44	15.41	17.4	ns
LCD Timing	DENA	Horizontal	Horizontal total time	t_H	1240	1344	1464	t_{CLK}
			Horiaontal effective time	t_{HA}		1024		t_{CLK}
			Horizontal blank time	t_{HB}	216	320	440	t_{CLK}
		Vertical	Vertical total time	t_V	778	806	848	t_H
			Vertical effective time	t_{VA}		768		t_H
			Vertical blank time	t_{VB}	10	38	80	t_H
	Frame rate			Fv	50	60	65	Hz

(2) Timing Chart
a. Horizontal Timing

b. Vertical Timing

(3) LVDS DATA：Timing Chart

6 bit LVDS input(HSD="L")

IND0	R0	G0	R5	R4	R3	R2	R1	R0	G0	R5	R4
IND1	G1	B1	B0	G5	G4	G3	G2	G1	B1	B0	G5
IND2	B2	DE			B5	B4	B3	B2	DE		

8 bit LVL S input(HSD="H")

IND0	R0	G0	R5	R4	R3	R2	R1	R0	G0	R5	R4
IND1	G1	B1	B0	G5	G4	G3	G2	G1	B1	B0	G5
IND2	B2	DE			B5	B4	B3	B2	DE		
IND3	R6	-	B7	B6	G7	G6	R7	R6	-	B7	B6
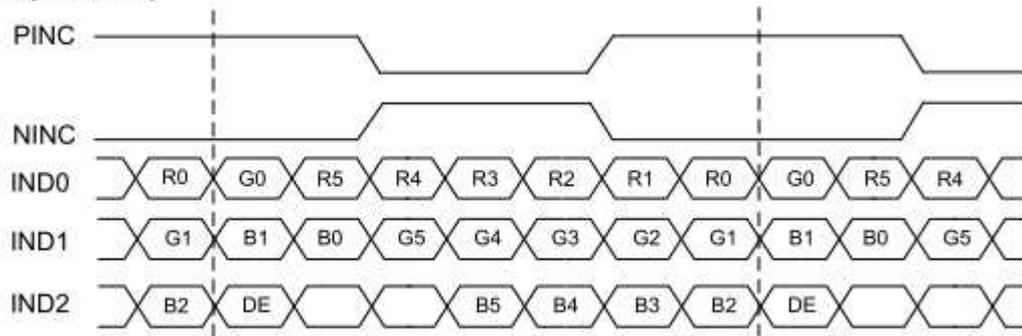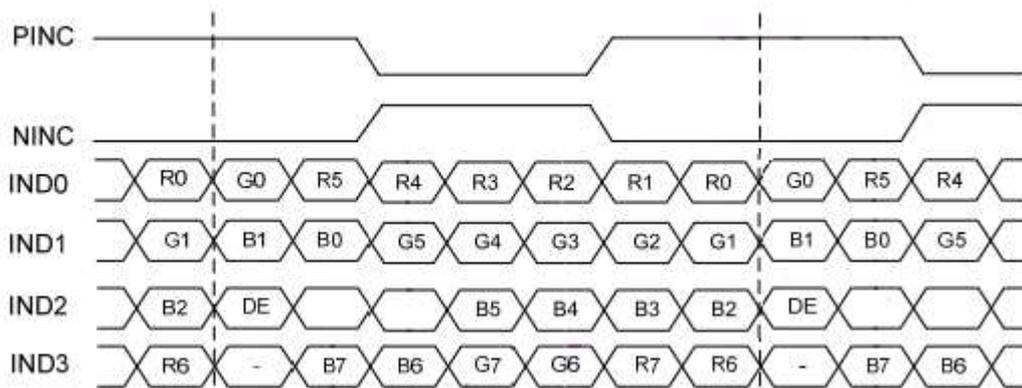
(4) Color Data Assignment

COLOR	INPUT DATA	R7 MSB	R6	R5	R4	R3	R2	R1	R0 LSB	G7 MSB	G6	G5	G4	G3	G2	G1	G0 LSB	B7 MSB	B6	B5	B4	B3	B2	B1	B0 LSB
					R DATA								G DATA								B DATA				
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	CYAN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	MAGENTA	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	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	1	1	1	1	1	1
RED	RED(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	GREEN(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	GREEN(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	GREEN(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	GREEN(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
BLUE	BLUE(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	BLUE(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	BLUE(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	BLUE(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

[Note]

1) Definition of gray scale:

Color (n): n indicates gray scale level; higher n means brighter level.

2) Data: 1-High, 0-Low.
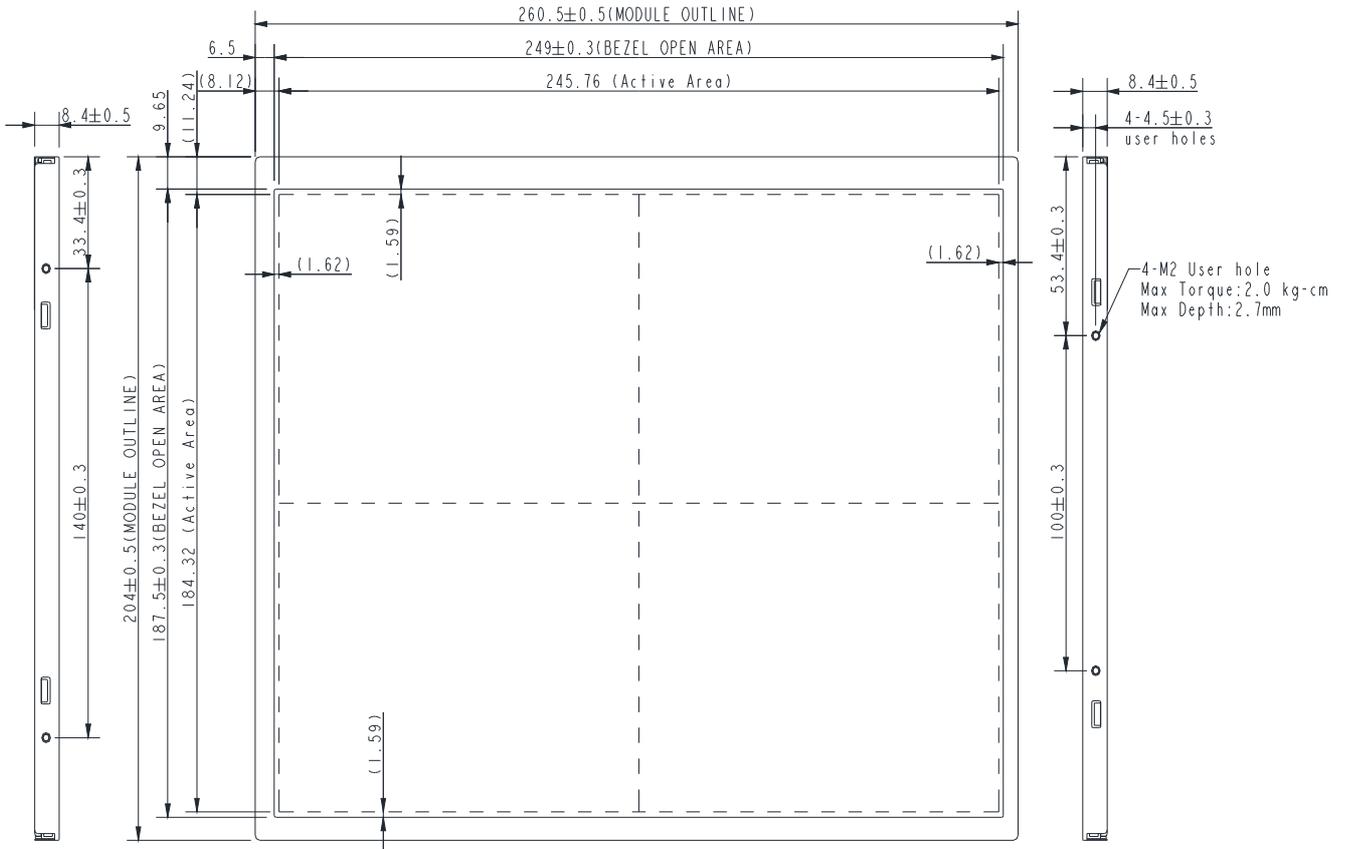
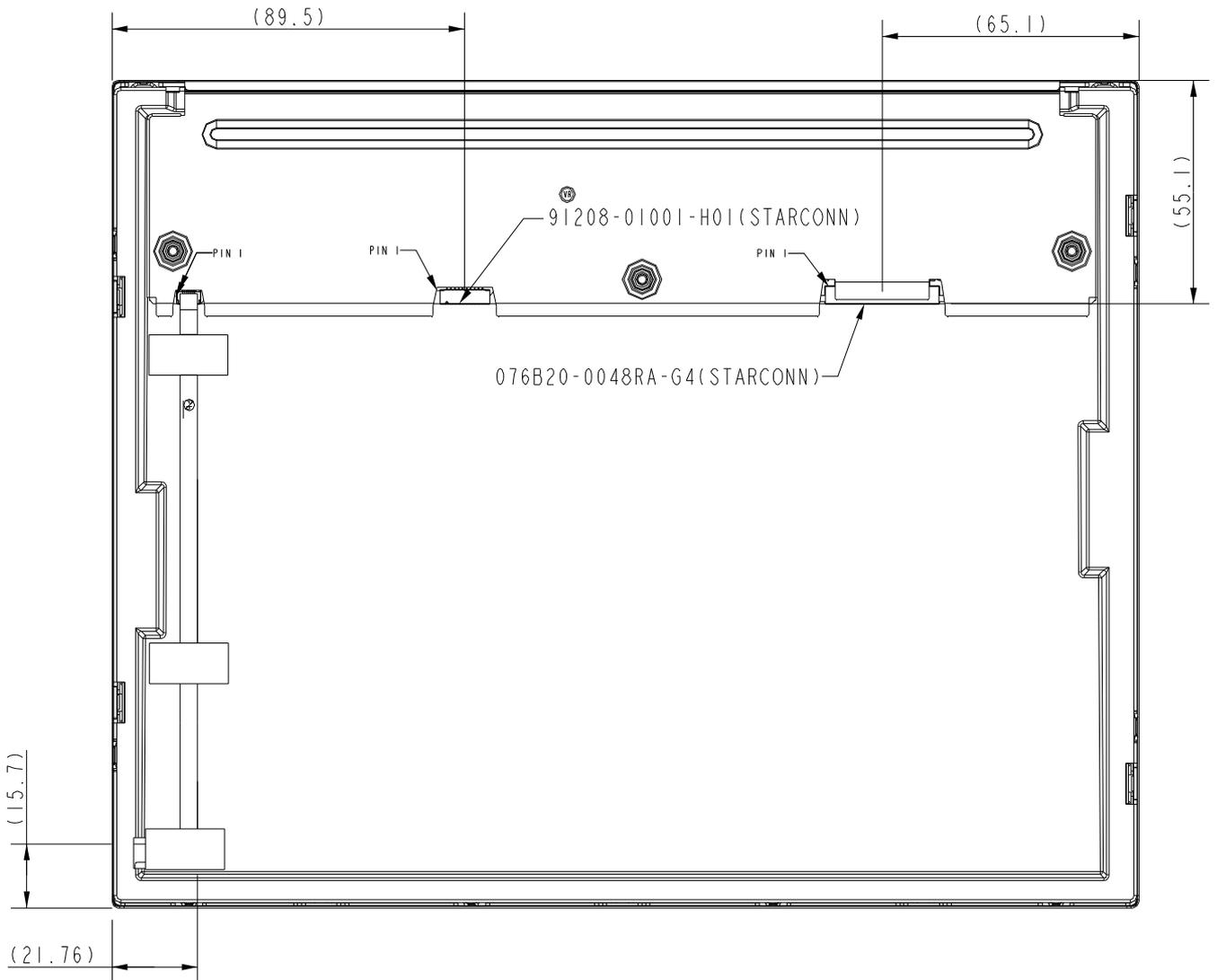3) This assignment is applied to both odd and even data.

6. BLOCK DIAGRAM

TFT- LCD Module

CN1 LCD
Connector

CN2 LED
Connector

Power Supply
Circuit

LED
Driver

Source Driver

Gate Driver

LCD Panel

1024*RGB*768

Light bar Unit
in Backlight
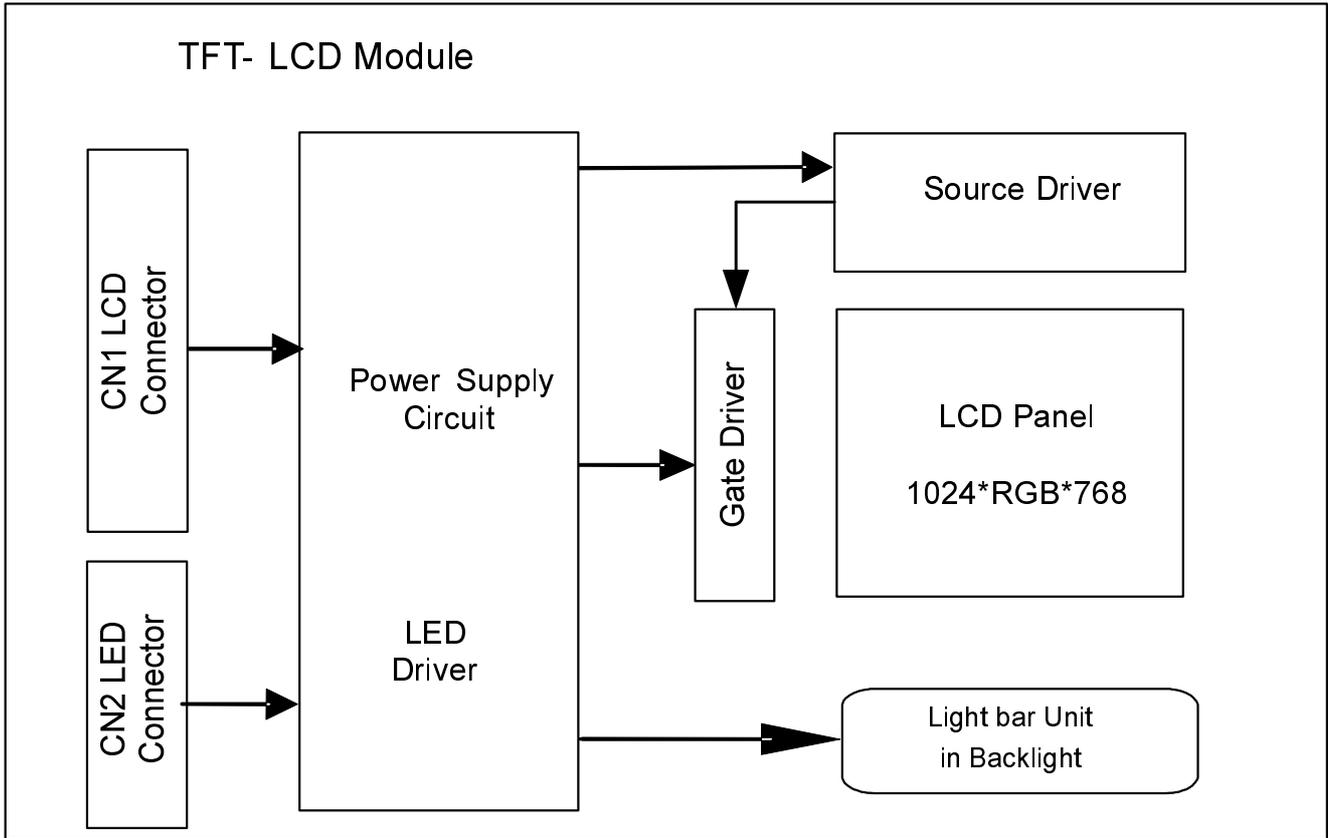
7. MECHANICAL SPECIFICATION

(1) Front side (Tolerance is ±0.5mm unless noted)   Unit: mm

(2) Rear side (Tolerance is ±0.5mm unless noted)   Unit: mm:

(89.5)   (65.1)

(55.1)

91208-01001-H01(STARCONN)

PIN 1   PIN 1   PIN 1

076B20-0048RA-G4(STARCONN)

(15.7)

(21.76)

8. OPTICAL CHARACTERISTICS

Ta=25℃，VCC=3.3

ITEM		SYMBOL	CONDITION	min	typ	max	UNIT	REMARK
Contrast Ratio		CR	θ＝ψ＝0°	500	700	--	--	*1) 2)
Luminance(CEN)		L	θ＝ψ＝0°	500	600	--	cd/m^2	*1) 3)
9P Uniformity		ΔL	θ＝ψ＝0°	75	80	--	%	*1) 3)
Response Time		Tr+Tf	θ＝ψ＝0°	-- --	16	--	ms	*5)
Crosstalk		CT	θ＝ψ＝0°	--	--	2	%	*6)
Viewing Angle	Horizontal	Left(ψ)	CR≧10	60	70	--	Deg.	*4)
		Right(ψ)		60	70			
	Vertical	Upper(θ)		70	80	--		
		Down(θ)		70	80			
Color Coordinates	White	X Y	θ＝ψ＝0°	0.263 0.279	0.313 0.329	0.363 0.379		*3)
	Red	X Y		0.594 0.305	0.634 0.345	0.674 0.385		
	Green	X Y		0.266 0.606	0.306 0.646	0.346 0.686		
	Blue	X Y		0.104 0.013	0.144 0.053	0.184 0.093		
Gamut		CG	θ＝ψ＝0°	65	70	--	--	CIE1931
Gamma		γ	VESA	2	2.2	2.4	--	*7)

[Note]

　　Definition of these measurement items is as follows:

1) Setup of Measurement Equipment

　The LCD module should be turn-on to a stable luminance level to be reached. The measurement should be executed after lighting Backlight for 10 minutes and in a dark room.
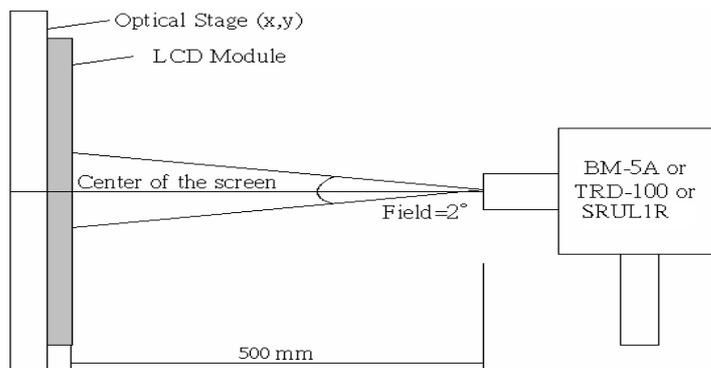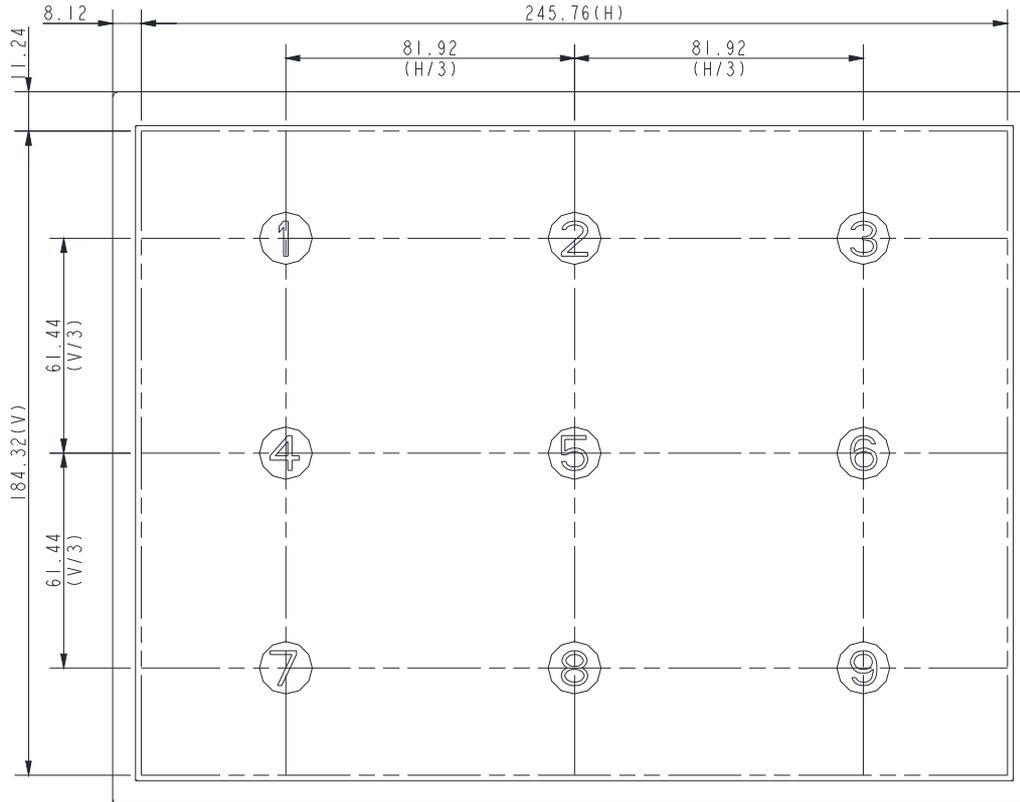
2).Definition of Contrast Ratio:

　CR=ON (White) Luminance/OFF (Black) Luminance

3).Definition of Luminance and Luminance uniformity:

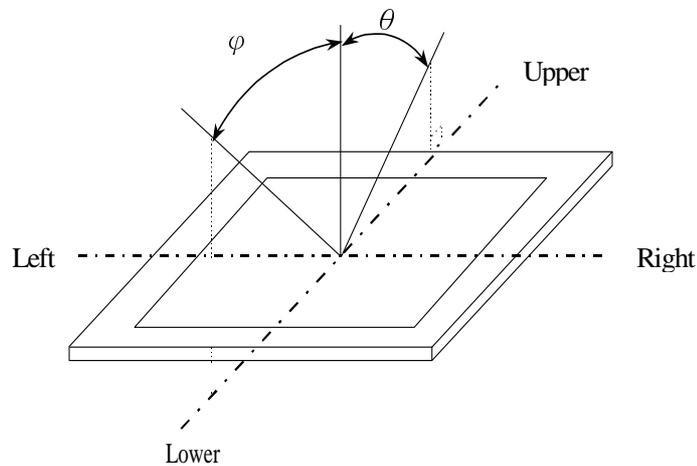　Center Luminance, &Color coordinate: measuring the luminance of the point no. 5

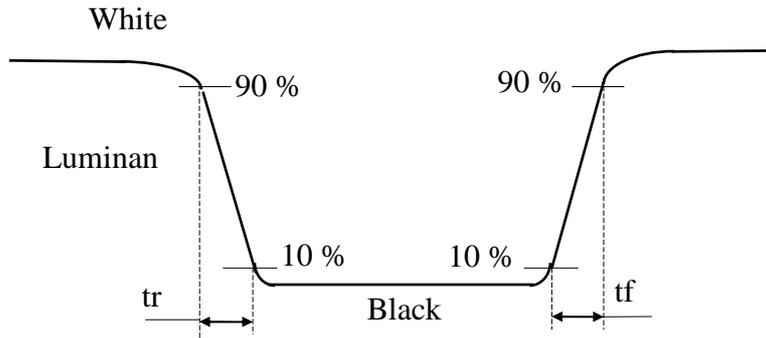　Average Luminance: measuring average luminance of points no.1-no.9

　Uniformity: ΔL= [L (Min)/L (Max)] ×100 %

4).Definition of Viewing Angle (θ,ψ):

5) Definition of Response Time:

White

90 %   90 %

Luminan

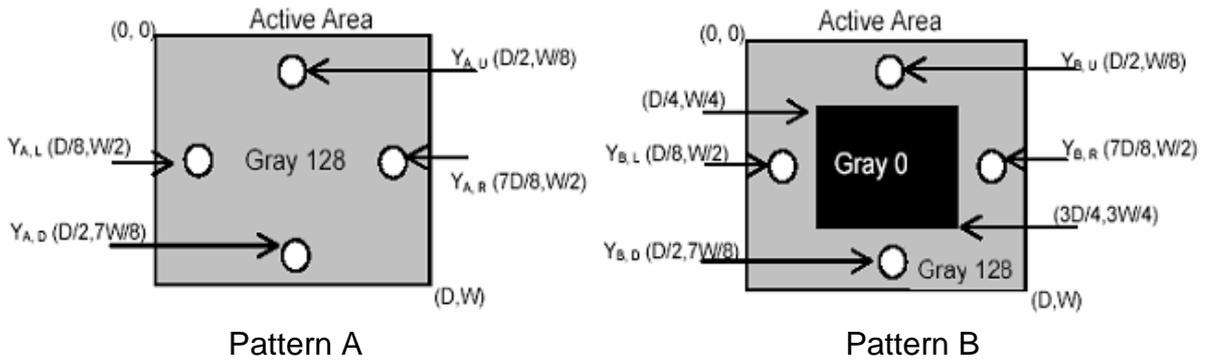10 %   10 %

tr   tf

Black

6) Definition of crosstalk:

$CT = |Y_B - Y_A| / Y_A \times 100\ (\%)$

Y_A: The luminance of measured position at pattern A

Y_B: The luminance of measured position at pattern B with Gray level 0

	Active Area	
(0, 0)		
	$Y_{A,U}$ (D/2,W/8)	
$Y_{A,L}$ (D/8,W/2)	Gray 128	
	$Y_{A,R}$ (7D/8,W/2)	
$Y_{A,D}$ (D/2,7W/8)		
	(D,W)	

Pattern A

	Active Area	
(0, 0)		
	$Y_{B,U}$ (D/2,W/8)	
(D/4,W/4)		
$Y_{B,L}$ (D/8,W/2)	Gray 0	$Y_{B,R}$ (7D/8,W/2)
		(3D/4,3W/4)
$Y_{B,D}$ (D/2,7W/8)	Gray 128	
	(D,W)	

Pattern B

7) Definition of Gamma (γ), follow VESA standard sampling every 16 gray level (0,16,32,.....224,240,255)

T %

$y = \gamma x - k$

Gray level (LOG)
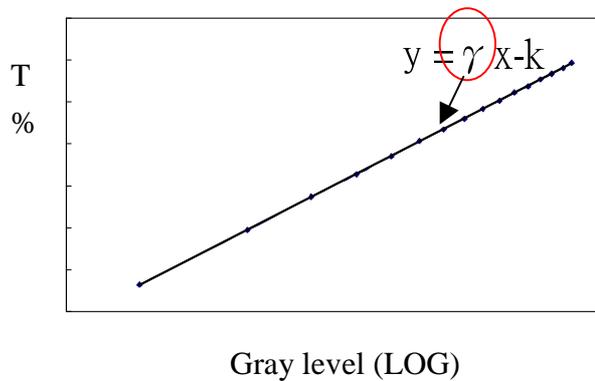
9. RELIABILITY TEST CONDITIONS

(1) Temperature and Humidity

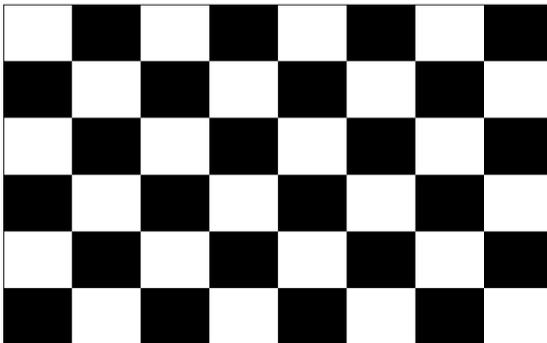| TEST ITEMS	CONDITIONS	NOTE
High Temperature High Humidity Operation	60℃; 90%RH; 240hrs	No condensation
High Temperature Operation	80℃; 240hrs	
High Temperature Storage	85℃; 240hrs	
Low Temperature Operation	-30℃; 240hrs	
Low Temperature Storage	-40℃; 240hrs	
Thermal Shock	-30℃(0.5hr) ~ 85℃(0.5hr); 200 Cycles	
Image Sticking	25℃,4hrs	*1)

[Note]

1) Image Sticking :

 Condition of image sticking test: 25℃

Operation with test pattern sustained for 4hrs, then change to gray pattern immediately.

After 5 min, the Mura must be disappeared completely.

(a) Test Pattern(Chess Board Pattern)   (b) judgment Pattern(128 Gray Pattern)

(2) Shock & Vibration

ITEMS	CONDITIONS
SHOCK (NON-OPERATION)	Shock level: 980m/s2(equal to 100G). Waveform: half sinusoidal wave, 2ms Number of shocks: one shock input in each direction of three mutually perpendicular axes for a total of six shock inputs
VIBRATION (NON-OPERATION)	Frequency range:8~33.3Hz Sweep:2.9G,33.3~400Hz Vibration： sinusoidal wave, perpendicular axis (both X,Z axis:2hrs ,Y axis:4hrs) Stoke:1.3mm Cycle time:15 min.

(3) ESD

POSITION	CONDITION(MDL turn off)
ESD (power off)	【MM Connector】200pF, 0，±200V ，contact mode for each pin
	1. 150 pF，330 Ω，±8K V/±15K V (Air mode)，±8K V (Contact mode)
	2. Air mode, test 25 times for each test point
	3. Contact mode, 25 times for each test point

(4) Judgment standard

The judgment of the above test should be made as follow:

Pass: Normal display image with no line defect.

Fail: No display image or line defects

10.WARRANTY

(1) The period is within 12 months since the date of shipping out under normal using
and storage conditions.

(2) The warranty will be avoided in case of defect induced by customer