APATL0000249

IPS Alpha Technology, Ltd.

Date : Jan.23, 2008

For Messrs. TOSHIBA CORPORATION
Digital Media Network Company

CUSTOMER'S ACCEPTANCE SPECIFICATIONS

AX094F002G

TOSHIBA Part No. : V33A00014300

CONTENTS

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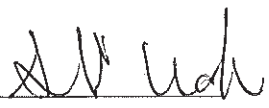
Accepted by : _____

Proposed by : 

Date: _____

RECORD OF REVISION

Date	The upper section : Previous revision The lower section : New revision		Summary
	Sheet No.	Page	
Nov.01, 2007	-	-	The substitution of transformer core material is added. Current : 3H manufactured by Nippon Ceramic Additional : PC95 manufactured by TDK
	-	-	
	IPS4PS-2604-AX094F002G-1		1.1 Environmental Absolute Maximum Ratings Changed: Vibration(Z) Max: 14.7 (1.5G) → Max: 4.9 (0.5G) Added: Box Vibration
	IPS4PS-2604-AX094F002G-2		
Dec.03, 2007	IPS4PS 2611-AX094F002G-2	11-2/2	Add record of revision described on the label. ・Add substitution of Tcon pcb assembly maker. ・New source-drain pcb assembly and change contact with upper frame.
	IPS4PS 2611-AX094F002G-3	11-2/2	
Jan.23, 2008	IPS4PS 2611-AX094F002G-3	11-2/2	Add record of revision described on the label. (Add Rev.E,F)
	IPS4PS 2611-AX094F002G-4	11-2/2	

DESCRIPTION

The following specifications are applied to the following TFT module.
Note : Inverter for back light unit is built in this module.

Product Name : AX094F002G

General Specifications

Effective Display Area	: (H)819.36(V)460.89	(mm)
Number of Pixels	: (H)1,920×(V)1,080	(pixels)
Pixel Pitch	: (H)0.42675×(V)0.42675	(mm)
Color Pixel Arrangement	: R+G+B Vertical Stripe	
Display Mode	: Transmissive Mode Normally Black Mode	
Top Polarizer Type	: Anti-Glare	
Number of Colors	: 16,777,216	(colors)
Viewing Angle Range	: Super Wide Version (Horizontal & Vertical : 178°, CR≧10)	
Input Signal	: 2-channel LVDS (LVDS:Low Voltage Differential Signaling)	
Back Light	: 20 pcs. of EEFL (Inverter with power supply circuit)	
External Dimensions	: (H)877 x (V)516.8 x (t)81.4	(mm)
Weight	: Typ 9,500	(g)

1. ABSOLUTE MAXIMUM RATINGS

1.1 Environmental Absolute Maximum Ratings

ITEM		Operating		Storage		Unit	Note
		Min.	Max.	Min.	Max.		
Temperature		0	65	-20	60	℃	1),5)
Humidity		2)		2)		%RH	1)
Vibration	X,Y	-	4.9(0.5G)	-	14.7(1.5G)	m/s^2	3)
	Z				4.9(0.5G)		
Box Vibration		-		-	14.7(1.5G)	m/s^2	6)
Shock		-	29.4(3G)	-	294(30G)	m/s^2	4)
Corrosive Gas		Not Acceptable		Not Acceptable		-	
Illumination at LCD Surface		-	50,000	-	50,000	1x	

Note 1) Temperature and Humidity should be applied to the glass surface of a Super-TFT module, not to the system installed with a module.
The temperature at the center of rear surface should be less than 70℃ on the condition of operating.
The brightness of a EEFL tends to drop at low temperature. Besides, the life-time becomes shorter at low temperature.

2) Ta≦40 ℃ · · · · · · Relative humidity should be less than 90%RH max. Dew is prohibited.
Ta＞40 ℃ · · · · · · Relative humidity should be lower than the moisture of the 90%RH at 40℃.

3) Frequency of the vibration is between 15Hz and 100Hz. (Remove the resonance point)

4) Pulse width of the shock is 10 ms. All mounting holes shall be fixed. (Rear mountng holes)

5) Long operation under low temperature may cause some portion of display area to be reddish for several minutes after turning on the product.
However, it does not affect the characteristics and reliability of the product.

6) Frequency of the box vibration is between 7Hz and 30Hz with packing specification.
However, it does not affect the characteristics and reliability of the product.

1.2 Electrical Absolute Maximum Ratings

(1)TFT Module Vss = 0 V

ITEM	SYMBOL	Min.	Max.	Unit	Note
Power Supply Voltage	VDD	0	13.2	V	
Input Voltage for logic	VI	0	3.6	V	1)
Electrostatic Durability	VESD0	±100		V	2),3)
	VESD1	±8		kV	2),4)

Note 1)It is applied to pixel data signal and clock signal.
2)Discharge Coefficient：200pF-250Ω, Environmental：25℃-70%RH
3)It is applied to I/F connector pins.
4)It is applied to the surface of a metallic bezel and a LCD panel.

(2) Back-light Inverter Vss = 0 V

ITEM	SYMBOL	Min.	Max.	Unit	Note
Input Voltage	Vin	85	270	V	
ON/OFF Control Input Voltage	ON/OFF	0	7.0	V	
Brightness Control Voltage	BRT	0	7.0	V	
Error Signal Control	ERR	0	7.0	V	

2. INITIAL OPTICAL CHARACTERISTICS

The following optical characteristics are measured under stable conditions. It takes about 30 minutes to reach stable conditions. The measuring point is the center of display area unless otherwise noted.

The optical characteristics should be measured in a dark room or equivalent state.

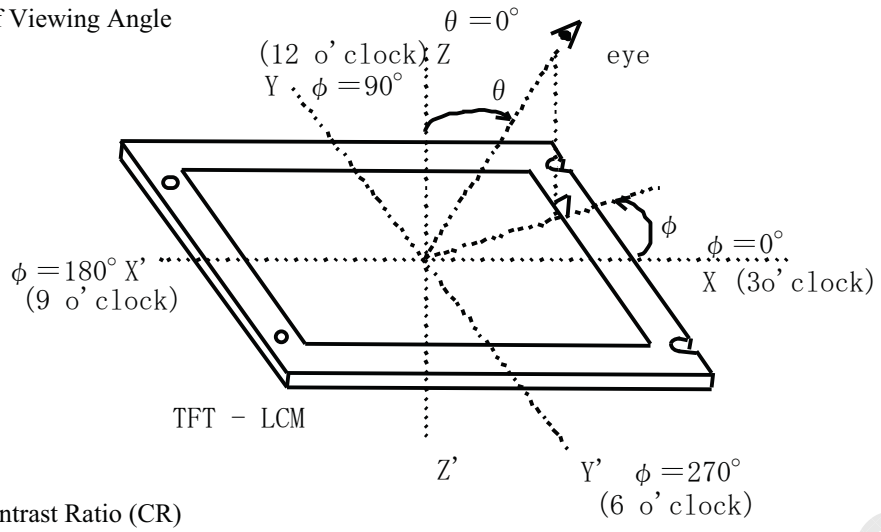
Measuring equipment：CS-1000A or equivalent (Except MPRT)

MPRT-1000 (MPRT)

Ambient Temperature =25℃, VDD=12.0V, f V=60Hz, VBL=100Vac, BRT=3.3V

ITEM		SYMBOL	CONDITION	Min.	Typ.	Max.	UNIT	NOTE
Contrast Ratio		C R		600	900	-	-	2)
Response Time	Rise	ton		-	8	20	ms	3)
	Fall	toff		-	6	20	ms	3)
Brightness of white		Bwh		400	500	-	cd/m^2	
Brightness uniformity		Buni		-	-	30	%	4)
Color Chromaticity (CIE)	Red	χ	θ =0° 1)	0.62	0.65	0.68	-	【Gray scale =255】
		y		0.30	0.33	0.36		
	Green	χ		0.27	0.30	0.33		
		y		0.59	0.62	0.65		
	Blue	χ		0.12	0.15	0.18		
		y		0.04	0.065	0.10		
	White	χ		0.243	0.273	0.303		
		y		0.245	0.275	0.305		
Variation of Color Position (CIE)	Red	$\Delta\chi$	θ =+50° ϕ =0°, 90° 180°, 270° 1)	-	-	0.04	-	5) 【Gray scale =255】
		Δ y		-	-	0.04		
	Green	$\Delta\chi$		-	-	0.04		
		Δ y		-	-	0.04		
	Blue	$\Delta\chi$		-	-	0.04		
		Δ y		-	-	0.04		
	White	$\Delta\chi$		-	-	0.04		
		Δ y		-	-	0.04		
Contrast Ratio at 89°		CR89	ϕ =0°, 90° 180°, 270° 1)	10	-	-	-	Estimated value
Gray scale		L255	θ =0° 1)	-	100%	-	-	
		L239		-	87%	-		
		L223		-	74%	-		
		L207		-	63%	-		
		L191		-	53%	-		
		L175		-	44%	-		
		L159		-	35%	-		
		L143		-	28%	-		
		L127		-	22%	-		
		L111		-	16%	-		
		L95		-	11%	-		
		L79		-	7.6%	-		
		L63		-	4.6%	-		
		L47		-	2.4%	-		
		L31		-	0.97%	-		
		L15		-	0.34%	-		
		L0		-	0.12%	-		
MPRT		MPRT		-	15	-	ms	

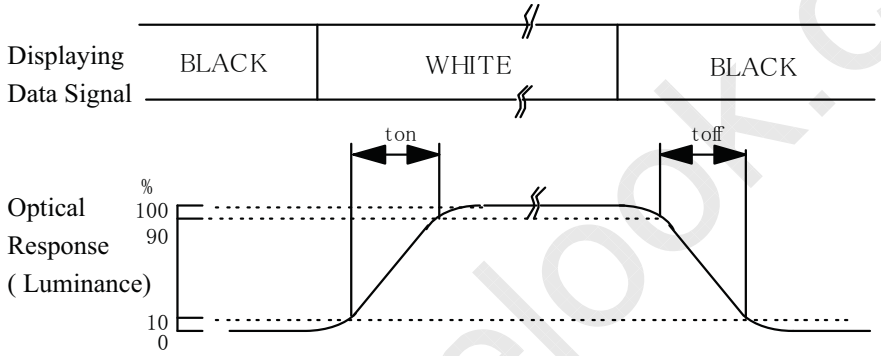
Note 1) Definition of Viewing Angle



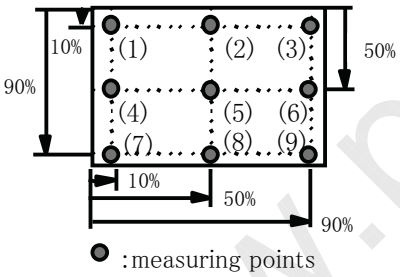
2) Definition of Contrast Ratio (CR)

$$CR = \frac{\text{(Luminance at displaying WHITE)}}{\text{(Luminance at displaying BLACK)}}$$

3) Definition of Response Time



4) Definition of Brightness Uniformit Display pattern is white (255 level) . The brightness uniformity is defined as the following equation. Brightness at each point is measured, and average, maximum and minimum brightness is calculated.



$$Buni = \frac{\left| \text{Bmax or Bmin} - \text{Bave} \right|}{\text{Bave}} \times 100$$

where, Bmax = Maximum brightness

Bmin = Minimum brightness

$$Bave = \text{Average brightness} = \frac{\sum_{k=1}^{9} (B(k))}{9}$$

5) Variation of color position on CIE is defined as difference between colors at θ =0°and at θ =50°& φ =0°90°180°270°.

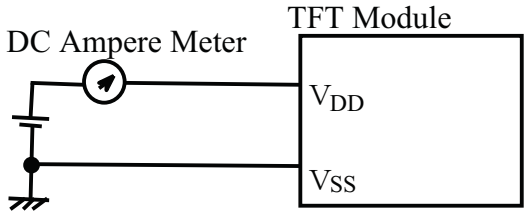
3. ELECTRICAL CHARACTERISTICS

3.1 TFT-LCD Module

Ta=25℃、Vss=0V

ITEM		SYSTEM	Min.	Typ	Max	単位	備考
Power supply Voltage		V_{DD}	11.4	12.0	12.6	V	
Power supply Current		I_{DD}	-	0.9	1.25	A	1), 2)
Ripple voltage of power Supply		V_{DDR}	-	-	0.15	V	
LVDS select	High	LVDSSEL	2.2	2.5	3.6	V	
	Low		0	0	0.6	V	

Note 1) fV=60.0Hz, fCLK=66MHz, VDD=12.0V, and display pattern is white.



2) Current fuse is built in a module. Current capacity of power supply for VDD should be larger than 4A, so that the fuse can be opened at the trouble of electrical circuit of module.

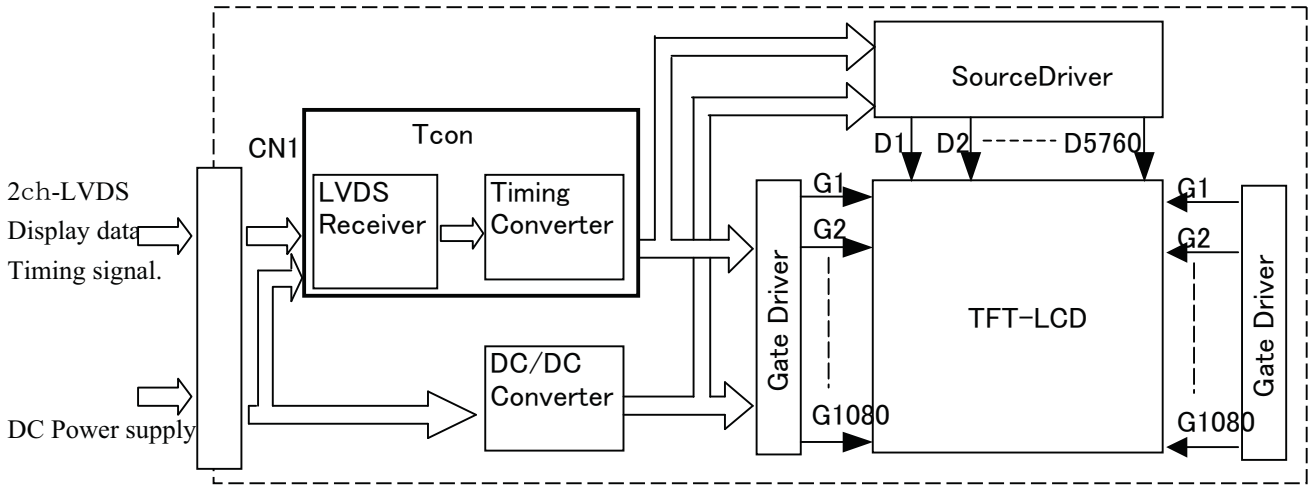
3.2 Back Light

ITEM		Symbol	Min.	Typ.	Max.	Unit	Notes	
Input Voltage		VBL	85	100/120 220/240	270	V		
Input Voltage Freaquency		Vin_frq	47	50/60	63	Hz		
Input Power		PBL	-	-	160	W	3)	BRT=3.3V, Ta=25℃
			-	140	-		4)	
ON/OFF Control Input Voltage	ON	ON/OFF	3.1	-	7	V		
	OFF		0.0	-	0.4	V		
Brigthness Control Input Voltage	Min. Brightness	BRT	0.0	-	-	V		
	Max. Brightness		2.7	-	3.1	V		
PWM Duty	Min. Brightness	on-Duty	-	20	-	%		
Output Frequency		f	54.5	55.5	56.5	kHz		
Error Signal Control	Normal	ERR	2.9	3.1	3.3	V		
	Abnormal		-	0.0	0.1	V		
Average Lamp Life Time		-	60,000	-	-	hours	5)	

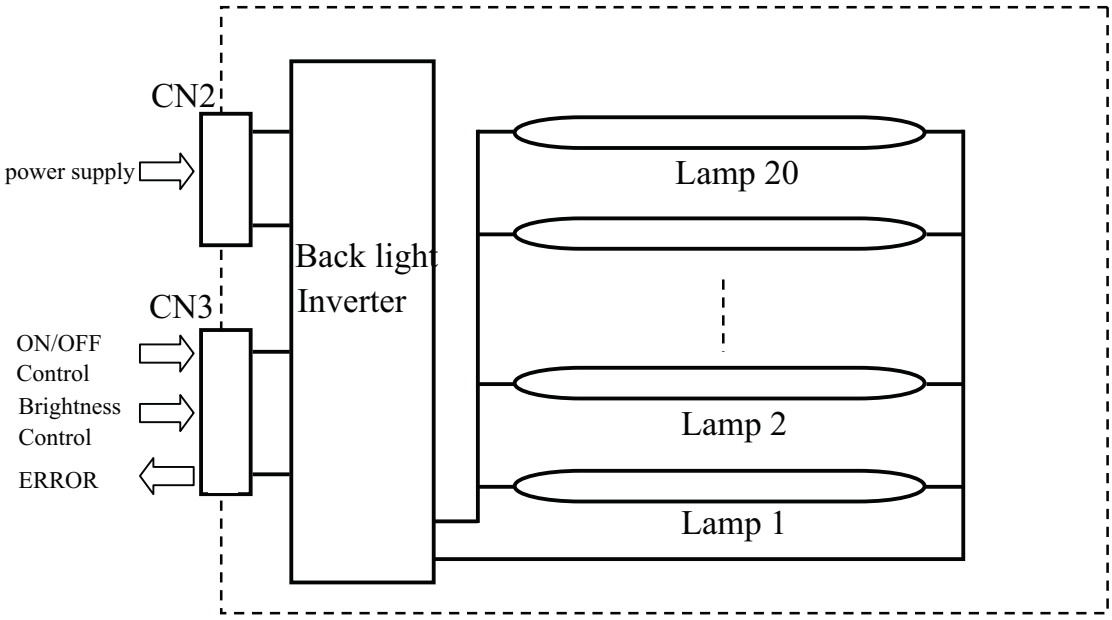
Note 3) Warm up period (1 hour after back light is turnd on.)
4) Stable period (Average of 1min after warm up period)
5) Life time of a lamp is defined as the time at which brightness of the lamp is 50% compared to that of initial value at that typical lamp current on condition of continuous operating at 25 ± 2℃.

4. BLOCK DIAGRAM

(1) Super-TFT Module



(2) Back light unit



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5. INTERFACE PIN ASSIGNMENT

5. 1 TFT-LCD MODULE

CN1:JAE FI-R51S-HF

(Matching connector : JAE FI-R51-HL)

PIN No.	SYMBOL	Description	Note
1	VSS	GND(0V)	2)
2	IC	Internally Connected , Keep Open	
3	IC		
4	IC		
5	IC		
6	IC		
7	LVDSSEL	Select LVDS Data Format	
8	IC	Internally Connected, Keep Open	
9	IC		
10	IC		
11	VSS	GND(0V)	2)
12	RxA0-	ODD Pixel Data	3)
13	RxA0+		
14	RxA1-	ODD Pixel Data	3)
15	RxA1+		
16	RxA2-	ODD Pixel Data	3)
17	RxA2+		
18	VSS	GND(0V)	2)
19	CLKA-	ODD Pixel Clock	3)
20	CLKA+		
21	VSS	GND(0V)	2)
22	RxA3-	ODD Pixel Data	3)
23	RxA3+		
24	IC	Internally Connected, Keep Open	
25	IC		
26	VSS	GND(0V)	2)
27	VSS		

PIN No.	SYMBOL	Description	Note
28	RxB0-	EVEN Pixel Data	3)
29	RxB0+		
30	RxB1-	EVEN Pixel Data	3)
31	RxB1+		
32	RxB2-	EVEN Pixel Data	3)
33	RxB2+		
34	VSS	GND(0V)	2)
35	CLKB-	EVEN Pixel Clock	3)
36	CLKB+		
37	VSS	GND(0V)	2)
38	RxB3-	EVEN Pixel Data	3)
39	RxB3+		
40	IC	Internally Connected, Keep Open	
41	IC		
42	VSS	GND(0V)	2)
43	VSS		
44	VSS		
45	VSS		
46	VSS		
47	NC	No Connection	
48	VDD	Power Supply (typ.+12V)	1)
49	VDD		
50	VDD		
51	VDD		

Notes 1) All VDD pins shall be connected to +12.0V(Typ.).

2) All VSS pins shall be grounded. Metal bezel is internally connected to VSS.

3) Rx n+ and Rx n- (n=0,1,2,3) should be wired by twist-pairs or side-by-side FPC patterns, respectively.

5. 2 BACK-LIGHT UNIT

CN2:JST B3P4-VH

(Matching connecor : JST PHR-3)

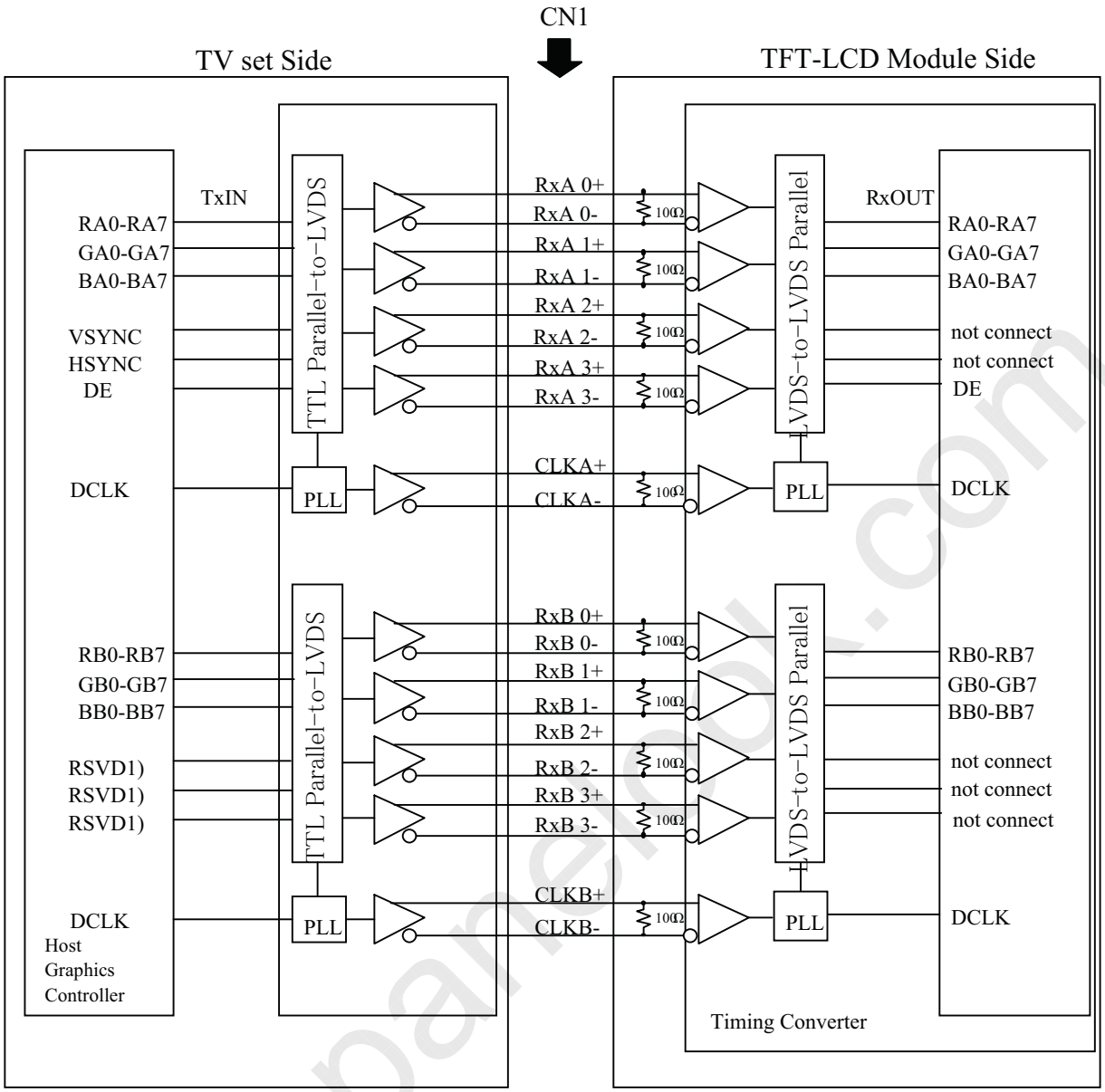
Pin No.	SYMBOL	Description	Note
1	Vac	Vac	
2	Vac	Vac	
3	IC	Internally connected, Keep open	
4	Vac	Vac	

CN3:JST B14B-PH

(Matching connecor : JST PHR-14)

Pin No.	SYMBOL	Description	Note
1	NC	NC	
2	ON/OFF	High : Lamp ON, Low : Lamp OFF	
3	BRT	Brightness Control	
4	ERR	Error Signal Control	
5	NC	NC	
6	S-GND	GND(0V)	
7	NC	NC	
8	NC		
9	NC		
10	NC		
11	NC		
12	NC		
13	NC		
14	NC		

5.3 BLOCK DIAGRAM OF INTERFACE



RA0～RA7, RB0～RB7 : Pixel R Data (7; MSB, 0; LSB)
GA0～GA7, RB0～RB7 : Pixel G Data (7; MSB, 0; LSB)
BA0～BA7, BB0～BB7 : Pixel B Data (7; MSB, 0; LSB)
DE : Data Enable

Notes 1) The system must have the transmitter to drive the module.
2) LVDS cable impedance shall be 50 ohms per signal line or about 100 ohms per twist-pair line when it is used differentially.

5.4 LVDS INTERFACE

The 7st LVDSSEL signal of the connector pin specification is "L". 【LVDSSEL = L】

	SIGNAL	TRANSMITTER THC63LVDM83A		INTERFACE CONNECTOR		RECEIVER		TFT CONTROL
		PIN	INPUT	TV Set	TFT-LCD	PIN	OUTPUT	INPUT
24bit	RA0/RB0	51	Tx IN0	TA OUT0+	RxA/B 0+	27	Rx OUT0	RA0/RB0
	RA1/RB1	52	Tx IN1			29	Rx OUT1	RA1/RB1
	RA2/RB2	54	Tx IN2			30	Rx OUT2	RA2/RB2
	RA3/RB3	55	Tx IN3			32	Rx OUT3	RA3/RB3
	RA4/RB4	56	Tx IN4			33	Rx OUT4	RA4/RB4
	RA5/RB5	3	Tx IN6	TA OUT0-	RxA/B 0-	35	Rx OUT6	RA5/RB5
	GA0/GB0	4	Tx IN7			37	Rx OUT7	GA0/GB0
	GA1/GB1	6	Tx IN8	TA OUT1+	RxA/B 1+	38	Rx OUT8	GA1/GB1
	GA2/GB2	7	Tx IN9			39	Rx OUT9	GA2/GB2
	GA3/GB3	11	Tx IN12			43	Rx OUT12	RA3/RB3
	GA4/GB4	12	Tx IN13			45	Rx OUT13	RA4/RB4
	GA5/GB5	14	Tx IN14			46	Rx OUT14	RA5/RB5
	BA0/BB0	15	Tx IN15	TA OUT1-	RxA/B 1-	47	Rx OUT15	RA0/RB0
	BA1/BB1	19	Tx IN18			51	Rx OUT18	RA1/RB1
	BA2/BB2	20	Tx IN19	TA OUT2+	RxA/B 2+	53	Rx OUT19	RA2/RB2
	BA3/BB3	22	Tx IN20			54	Rx OUT20	RA3/RB3
	BA4/BB4	23	Tx IN21			55	Rx OUT21	RA4/RB4
	BA5/BB5	24	Tx IN22			1	Rx OUT22	RA5/RB5
	HSYNC/RSVD1)	27	Tx IN24			3	Rx OUT24	not connect
	VSYNC/RSVD1)	28	Tx IN25	TA OUT2-	RxA/B 2-	5	Rx OUT25	not connect
	DE/RSVD1)	30	Tx IN26			6	Rx OUT26	DE/not connect
	RA6/RB6	50	Tx IN27	TA OUT3+	RxA/B 3+	7	Rx OUT27	RA6/RB6
	RA7/RB7	2	Tx IN5			34	Rx OUT5	RA7/RB7
	GA6/GB6	8	Tx IN10			41	Rx OUT10	GA6/GB6
	GA7/GB7	10	Tx IN11			42	Rx OUT11	GA7/GB7
	BA6/BB6	16	Tx IN16			49	Rx OUT16	BA6/BB6
	BA7/BB7	18	Tx IN17	TA OUT3-	RxA/B 3-	50	Rx OUT17	BA7/BB7
	RSVD 1)	25	Tx IN23			2	Rx OUT23	RSVD 1)
	DCLK	31	TxCLK IN	TxCLK OUT+	RxA/BCLK IN+	26	RxCLK OUT	DCLK
				TxCLK OUT-	RxA/BCLK IN-			

RA0～RA7, RB0～RB7 :Pixel R Data (7;MSB, 0;LSB)
GA0～GA7, GB0～GB7 :Pixel G Data (7;MSB, 0;LSB)
BA0～BA7, BB0～BB7 :Pixel B Data (7;MSB, 0;LSB)
DE :Data Enable

Notes 1)RSVD(reserved)pins on the transmitter shall be tied to"H"or"L".

5.4 LVDS INTERFACE

The 7st LVDSSEL signal of the connector pin specification is "H". 【LVDSSEL = H】

	SIGNAL	TRANSMITTER THC63LVDM83A		INTERFACE CONNECTOR		RECEIVER		TFT CONTROL
		PIN	INPUT	TV Set	TFT-LCD	PIN	OUTPUT	INPUT
	RA2/RB2	51	Tx IN0			27	Rx OUT0	RA2/RB2
	RA3/RB3	52	Tx IN1			29	Rx OUT1	RA3/RB3
	RA4/RB4	54	Tx IN2	TA OUT0+	RxA/B 0+	30	Rx OUT2	RA4/RB4
	RA5/RB5	55	Tx IN3			32	Rx OUT3	RA5/RB5
	RA6/RB6	56	Tx IN4			33	Rx OUT4	RA6/RB6
	RA7/RB7	3	Tx IN6	TA OUT0-	RxA/B 0-	35	Rx OUT6	RA7/RB7
	GA2/GB2	4	Tx IN7			37	Rx OUT7	GA2/GB2
	GA3/GB3	6	Tx IN8			38	Rx OUT8	GA3/GB3
	GA4/GB4	7	Tx IN9			39	Rx OUT9	GA4/GB4
	GA5/GB5	11	Tx IN12	TA OUT1+	Rx A/B1+	43	Rx OUT12	GA5/GB5
	GA6/GB6	12	Tx IN13			45	Rx OUT13	GA6/GB6
	GA7/GB7	14	Tx IN14			46	Rx OUT14	GA7/GB7
	BA2/BB2	15	Tx IN15	TA OUT1-	RxA/B 1-	47	Rx OUT15	BA2/BB2
24bit	BA3/BB3	19	Tx IN18			51	Rx OUT18	BA3/BB3
	BA4/BB4	20	Tx IN19			53	Rx OUT19	BA4/BB4
	BA5/BB5	22	Tx IN20			54	Rx OUT20	BA5/BB5
	BA6/BB6	23	Tx IN21	TA OUT2+	Rx A/B2+	55	Rx OUT21	BA6/BB6
	BA7/BB7	24	Tx IN22			1	Rx OUT22	BA7/BB7
	HSYNC/RSVD1)	27	Tx IN24			3	Rx OUT24	HSYNC/RSVD1)
	VSYNC/RSVD1)	28	Tx IN25	TA OUT2-	Rx A/B2-	5	Rx OUT25	VSYNC/RSVD1)
	DE/RSVD1)	30	Tx IN26			6	Rx OUT26	DE/RSVD1)
	RA0/RB0	50	Tx IN27			7	Rx OUT27	RA0/RB0
	RA1/RB1	2	Tx IN5			34	Rx OUT5	RA1/RB1
	GA0/GB0	8	Tx IN10	TA OUT3+	RxA/B 3+	41	Rx OUT10	GA0/GB0
	GA1/GB1	10	Tx IN11			42	Rx OUT11	GA1/GB1
	BA0/BB0	16	Tx IN16			49	Rx OUT16	BA0/BB0
	BA1/BB1	18	Tx IN17	TA OUT3-	Rx A/B3-	50	Rx OUT17	BA1/BB1
	RSVD 1)	25	Tx IN23			2	Rx OUT23	RSVD 1)
	DCLK	31	TxCLK IN	TxCLK OUT+	RxCLKA/B IN+	26	RxCLK OUT	DCLK
				TxCLK OUT-	RxCLKA/B IN-			

RA0～RA7, RB0～RB7 :Pixel R Data (7;MSB, 0;LSB)
GA0～GA7, GB0～GB7 :Pixel G Data (7;MSB, 0;LSB)
BA0～BA7, BB0～BB7 :Pixel B Data (7;MSB, 0;LSB)
DE :Data Enable

Notes 1)RSVD(reserved)pins on the transmitter shall be tied to"H"or"L".

5.5 CORRESPONDENCE BETWEEN INPUT DATA AND DISPLAY IMAGE

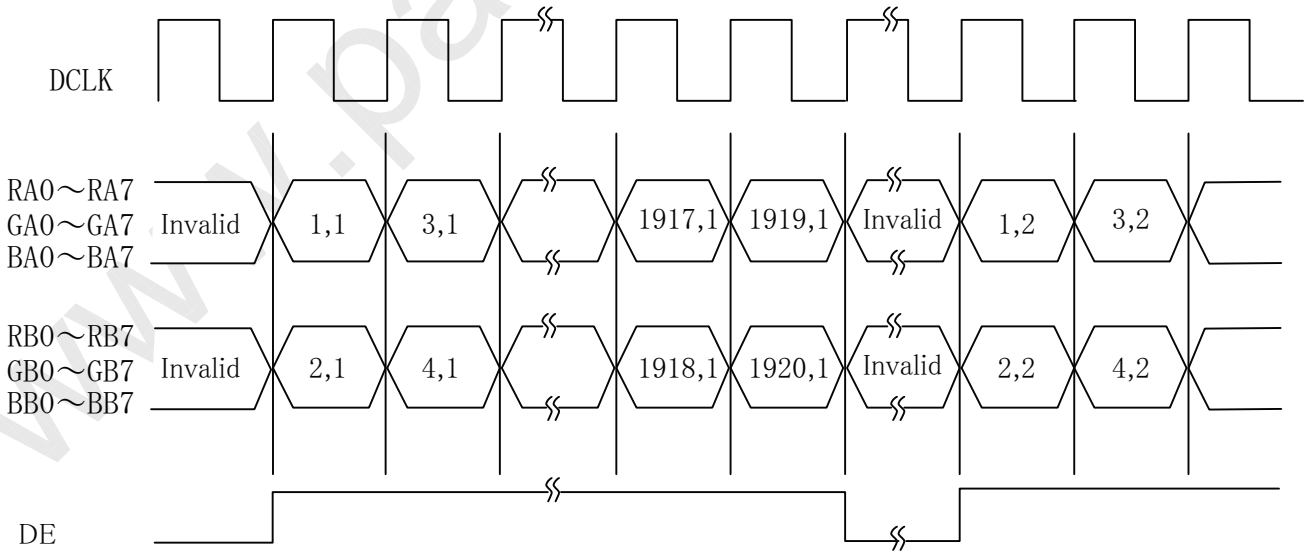
Display data of adjacent one pixel is latched during one cycle of DCLK.

	(1,1)			(1,2)	
RA	GA	BA	RB	GB	BB

odd pixel : RA0～RA7 :R data
GA0～GA7 :G data
BA0～BA7 :B data

Even pixel: RB0～RB7 :R data
GB0～GB7 :G data
BB0～BB7 :B data

1, 1	1, 2	1, 3	----------	1, 1920
2, 1	2, 2	2, 3	----------	2, 1920
3, 1	3, 2	3, 3	----------	3, 1920
⋮	⋮	⋮		⋮
1080, 1	1080, 2	1080, 3	----------	1080, 1920



5.6 RELATIONSHIP BETWEEN DISPLAY COLORS AND INPUT SIGNALS

Color		Input	Red Data								Green Data								Blue Data							
			R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
			MSB							LSB	MSB							LSB	MSB							LSB
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		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 (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		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
		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		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
		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

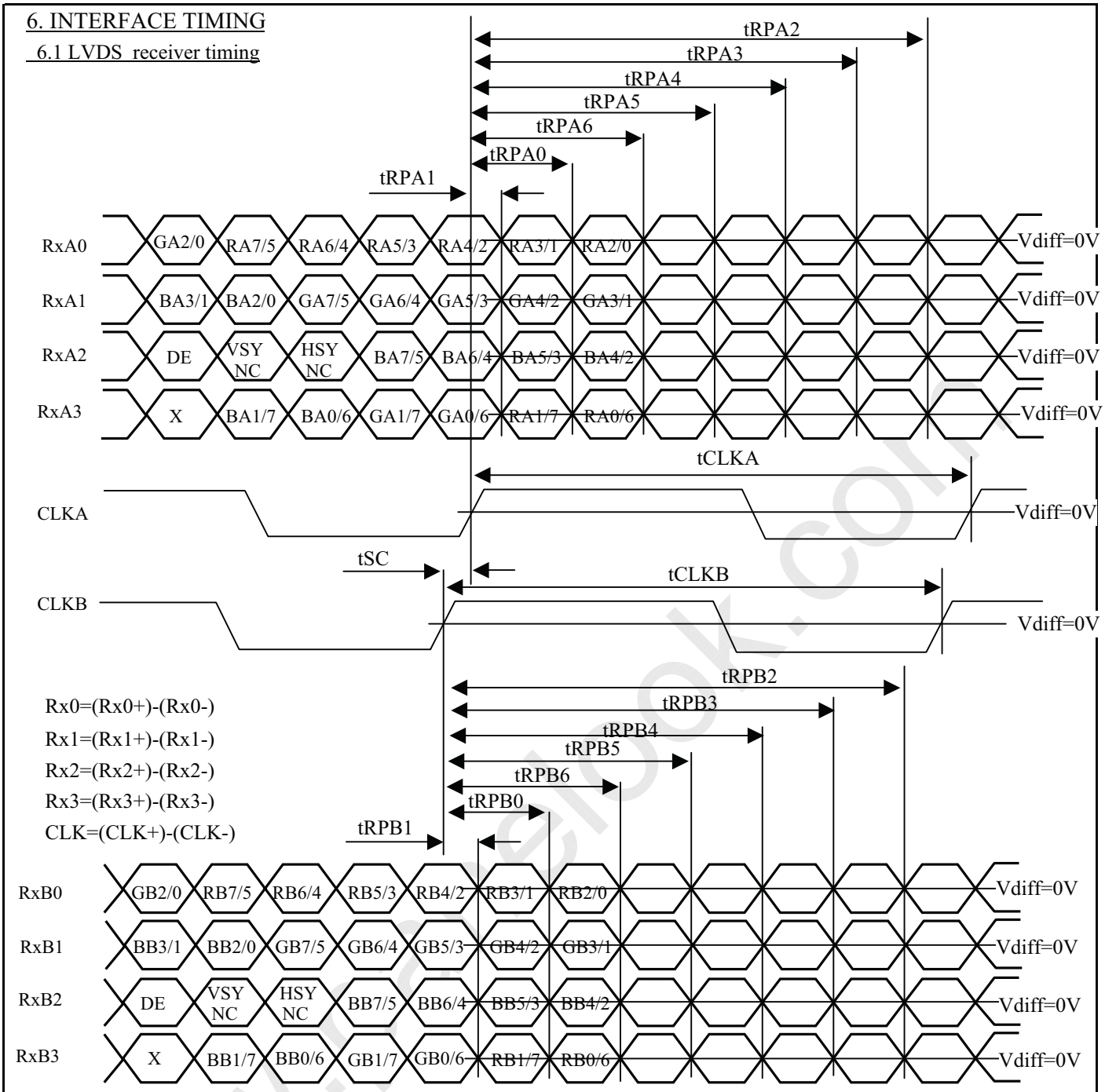
Notes 1) Definition of gray scale:

Color(n) ・・・・Number in parenthesis indicates gray scale level. Larger n corresponds to brighter level.

2) Data: 1:High, 0:Low

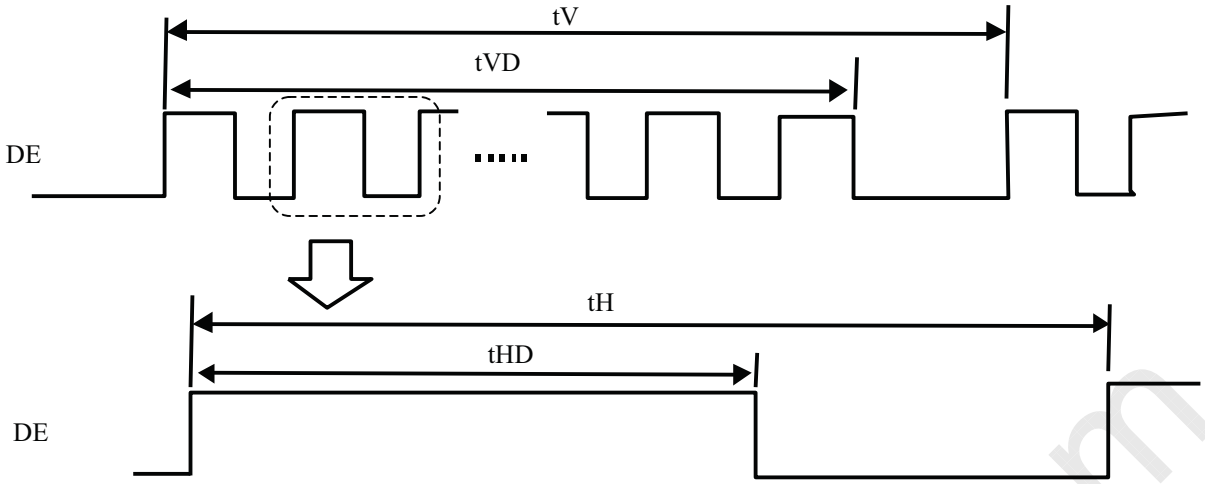
6. INTERFACE TIMING

6.1 LVDS receiver timing



Item		Symbol	Min	Typ	Max	Unit	Note
CLK	Frequency	DCLK	65	66	67.5	MHz	=1/tclk
	CLK Skew	tSC	-4.0	0	4.0	ns	
	0 data position	tRP0	1/7tCLK - 0.4	1/7tCLK	1/7tCLK +0.4	ns	
	1st data position	tRP1	-0.4	0	+0.4		
Rx*0	2nd data position	tRP2	6/7tCLK -0.4	6/7tCLK	6/7tCLK +0.4		
Rx*1	3rd data position	tRP3	5/7tCLK -0.4	5/7tCLK	5/7tCLK + 0.4		
Rx*2	4th data position	tRP4	4/7tCLK - 0.4	4/7tCLK	4/7tCLK +0.4		
Rx*3	5th data position	tRP5	3/7tCLK - 0.4	3/7tCLK	3/7tCLK + 0.4		
	6th data position	tRP6	2/7tCLK - 0.4	2/7tCLK	2/7tCLK + 0.4		

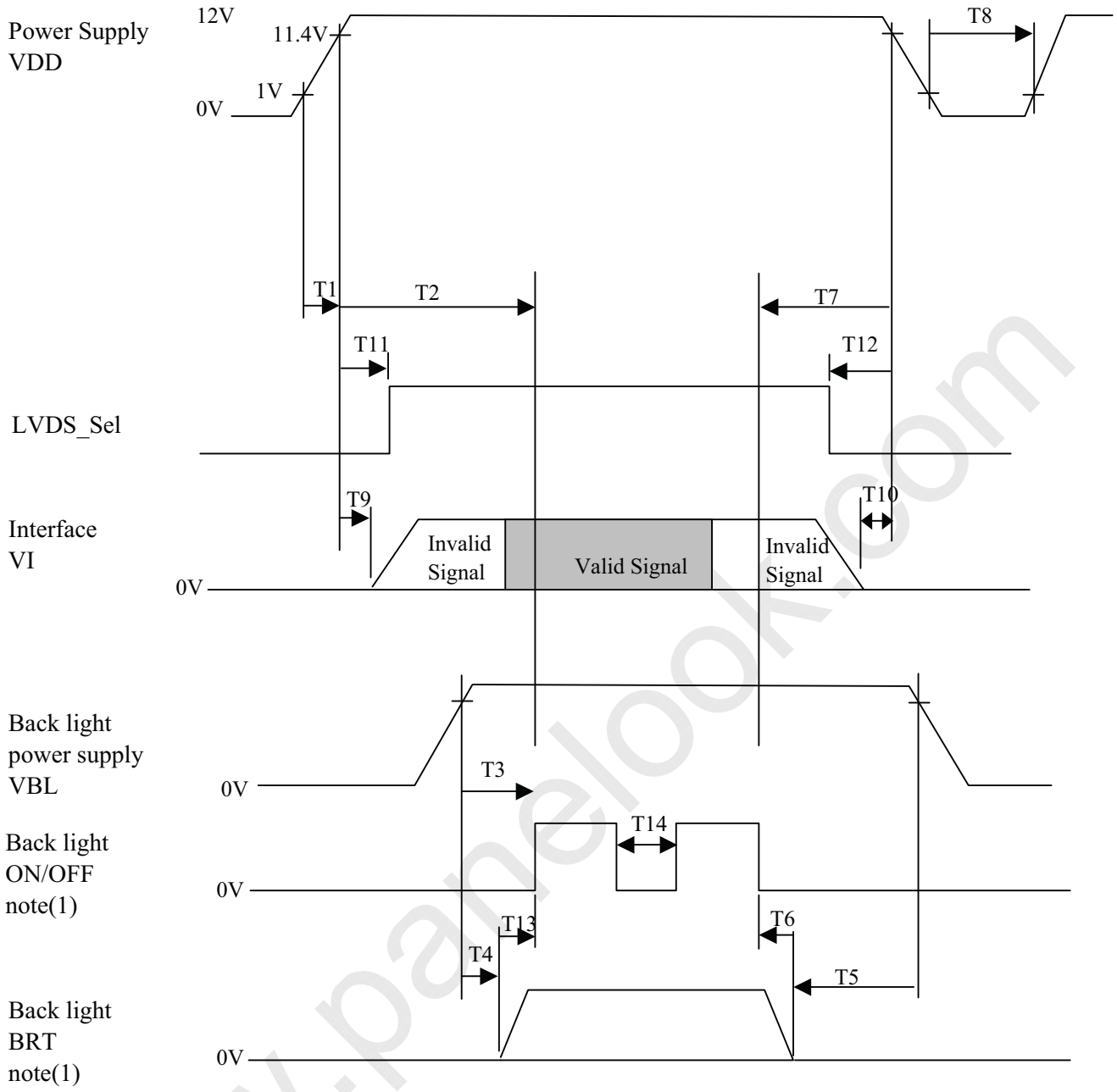
6.2 SYNCRONIZATION SIGNAL TIMING



Item		Symbol	Min	Typ	Max	Unit	Note
DE	Horizontal Frequency	fH	63	66	68	kHz	
	Horizontal Period	tH	990	1000	1035	tCLK	
	Horizontal Valid	tHD		960		tCLK	
	Vertical Frequency	fV	48	60	62	Hz	
	Vertical Period	tV	1090	1100	1350	tH	
	Vertical Valid	tVD		1080		tH	

2pxl/clk

6.3 TIMING BETWEEN INTERFACE SIGNALS POWER SUPPLY

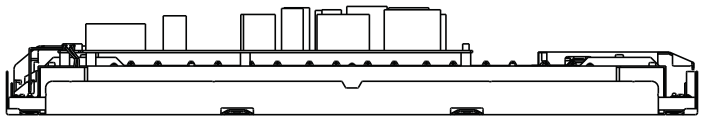


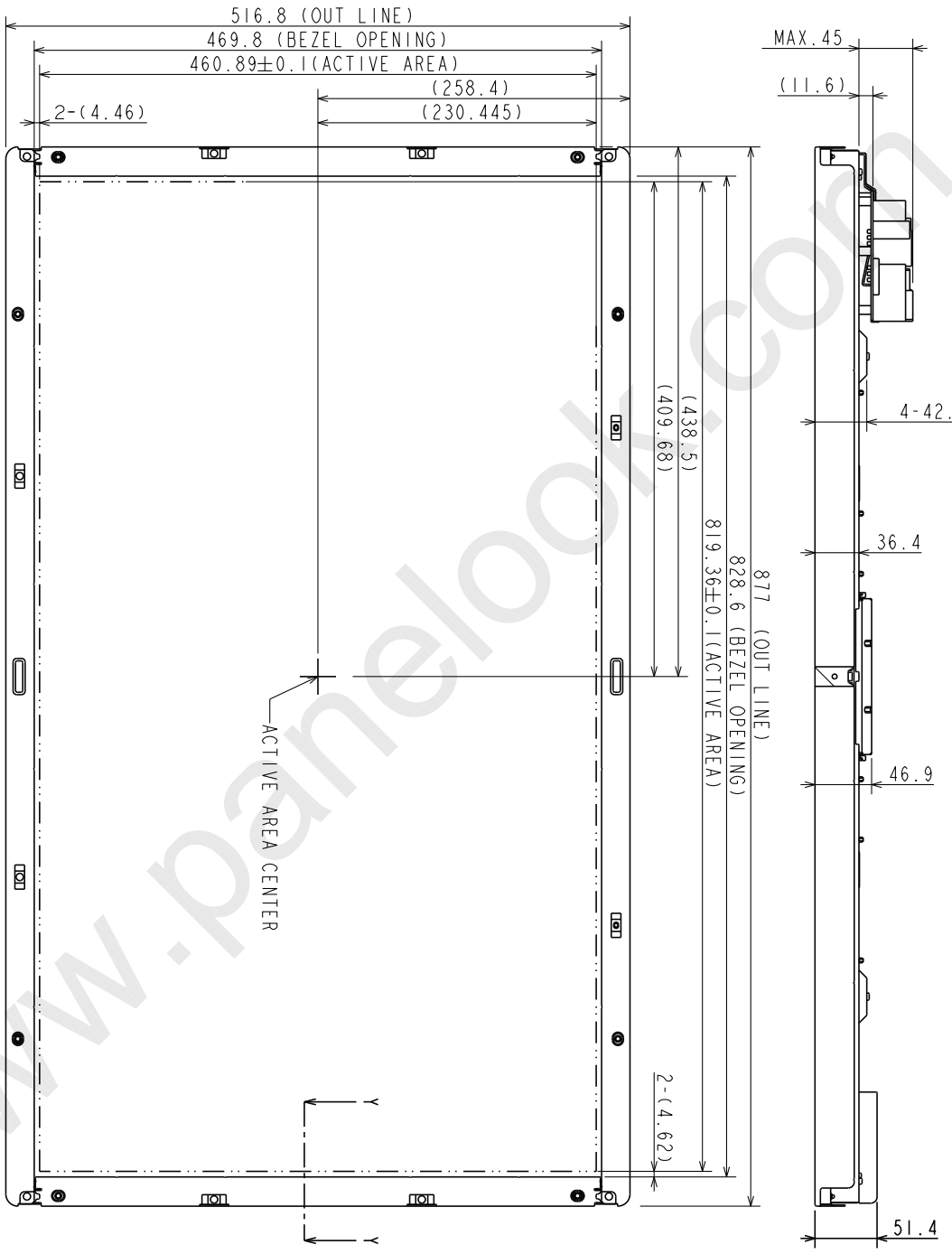
0 ≦ T1 ≦ 10	T5,T6 : Not specfied	10 ≦ T9	0.1 < T13
350 ≦ T2	0 ≦ T7	0 ≦ T10	100 < T14
1200 < T3	350 ≦ T8	10 ≦ T11 ≦T2-150	
0 ≦ T4		0 ≦ T12	

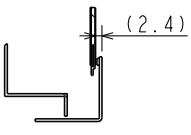
Unit : ms

7. DIMENSIONAL OUT LINE

(1) FRONT VIEW







SECTION Y-Y

Note 1) The dimension in a parenthesis is a reference value.
2) Unspecified tolerance to be ±1.0

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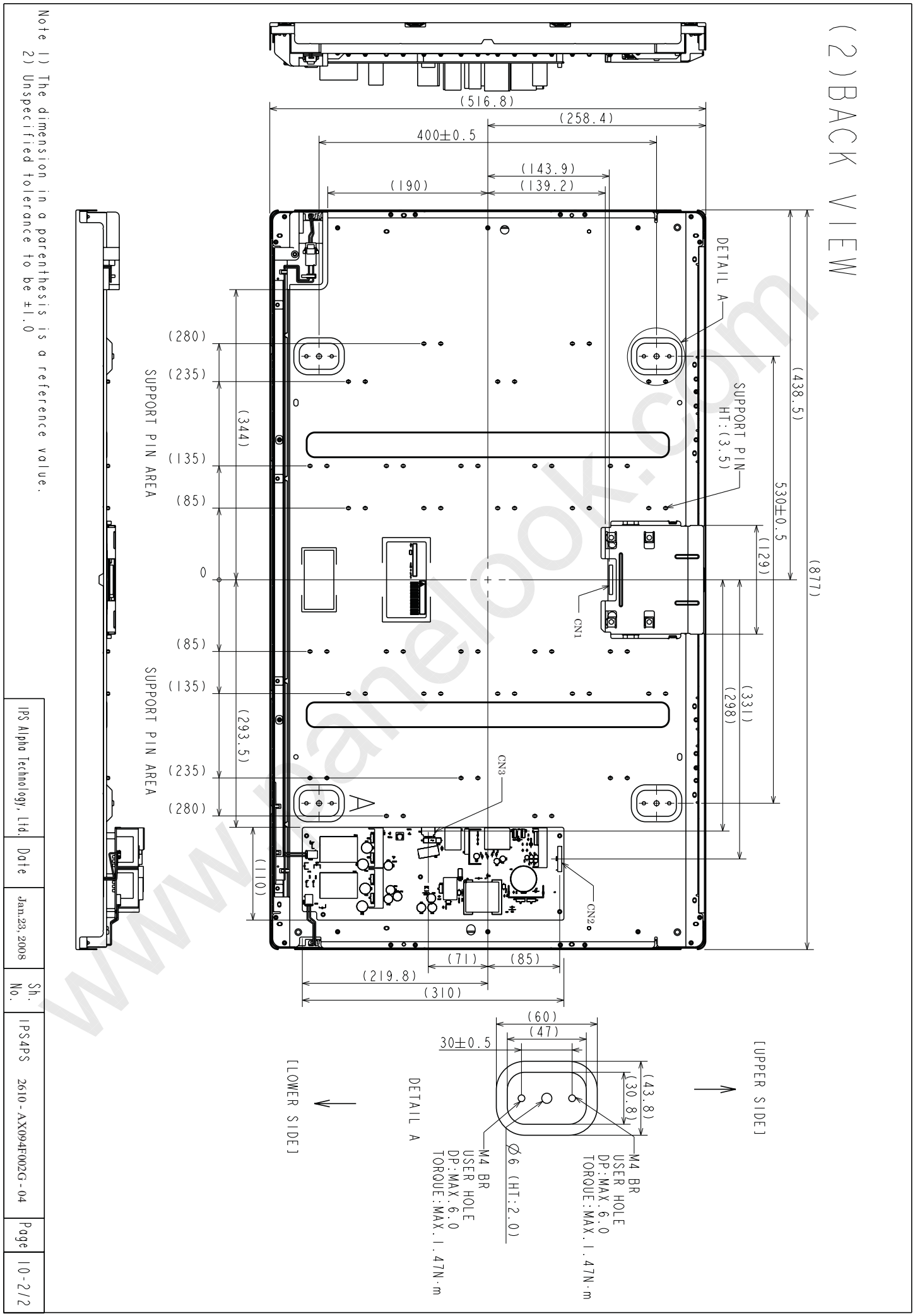

Note 1) The dimension in a parenthesis is a reference value.
2) Unspecified tolerance to be ±1.0

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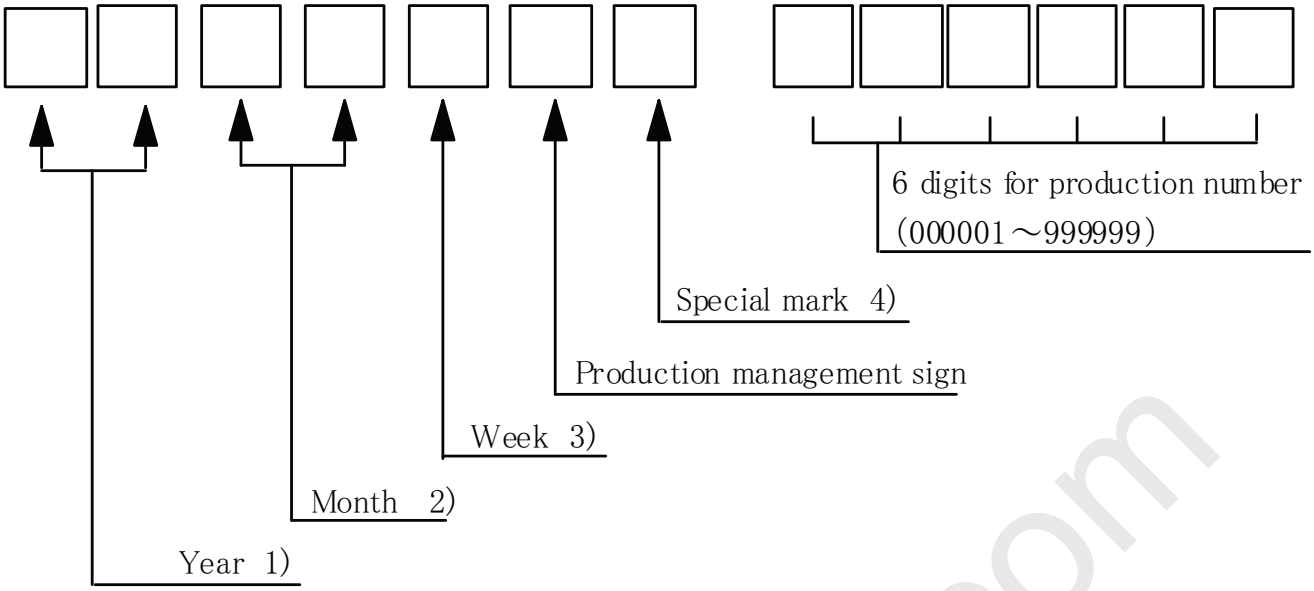
8. DESIGNATION OF LOT MARK

8.1 LOT MARK



Notes

1)

Year	Mark
2006	06
2007	07
2008	08

2)

Month	Mark	Month	Mark
1	01	7	07
2	02	8	08
3	03	9	09
4	04	10	10
5	05	11	11
6	06	12	12

3)

Week(Day)	Mark
1～7	1
8～14	2
15～21	3
22～28	4
29～31	5

4) It is the mark that was opened up by production person to take correspondence with production number.

8.2 Revision (REV.) control

REV. is the column for manufacturing convenience. A-Z except I and O may be written on this column.

8.3 Location of lot mark

Lot mark is printed on a label. The label is on the metallic bezel as shown in 7. External Dimensional. The style of character will be changed without notice.

8.4 Record of revision descrived on the label

Revision	Specification
A	Initial, The color filter supplier : A
B	Initial, The color filter supplier : B
C	The color filter supplier : A, Drain-source pcb assembly and contact with upper frame is changed.
D	The color filter supplier : B, Drain-source pcb assembly and contact with upper frame is changed.
E	Lamp is changed based on Rev.C.
F	Lamp is changed based on Rev.D.

9. COSMETIC SPECIFICATIONS

9.1 Condition for cosmetic inspection

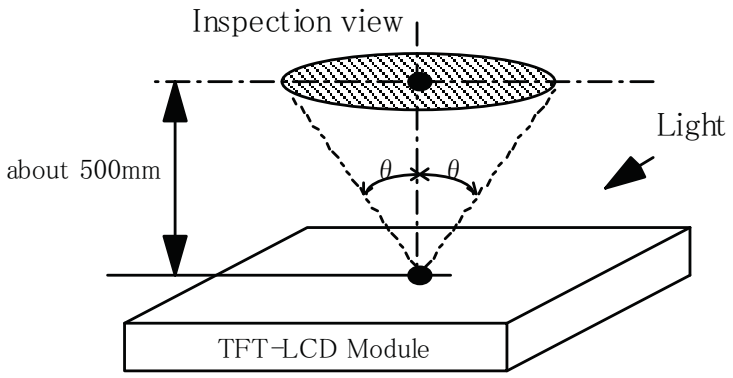
(1) Viewing zone

a) The figure shows the correspondence between eyes (of inspector) and TFT-LCD module.

$\theta \leqq 45^{\circ}$: when non-operating inspection

$\theta \leqq 5^{\circ}$: when operating inspection

b) Inspection should be executed only from front side and only A-zone.
Cosmetic of B-zone and C-zone are ignore.
(refer to 9.2 Definition of zone)



(2) Environmental

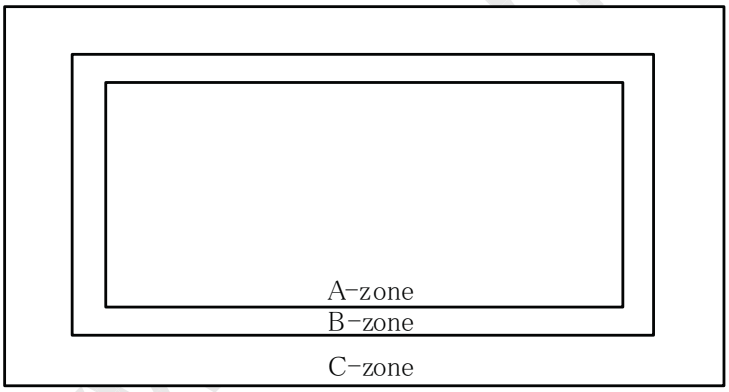
a) Temperature : 25 degrees

b) Ambient light : about 700 lx and non-directive when operating inspection.
: about 1000 lx and non-directive when non-operating inspection.

c) Back-light : when non-operating inspection, back-light should be off .

9.2 Definition of zone

- A-zone : Display area (pixel area)
- B-zone : Area between A-zone and C-zone
- C-zone : Metallic bezel area



9.3 COSMETIC SPECIFICATIONS

When displaying conditions are not stable (ex. at turn on or off), the following specifications are not applied.

	No	ITEM			Max. acceptable number A-zone	Unit	Note
Operating inspection	1	Dot defect	Sparkle mode	1-dot	0	pcs	1), 3)
				2-dots	0	Units	
				3-dots	0		
				Density	0	pcs/ ϕ 20mm	4)
				Total	0	pcs	
			Partial Sparkle mode	1-dot	4	pcs	1), 3)
				2-dots	0	Units	
				3-dots	0		
				Density	1	pcs/ ϕ 20mm	4)
				Total	4	pcs	
			Black mode	1-dot	5	pcs	2), 3), 4)
				2-dots	1	Units	
				3-dots	0		
				Density	3	pcs/ ϕ 20mm	4), 5)
				Total	5	pcs	
	2	Line defect			Serious one is not allowed	-	-
	3	Uneven brightness					
	4	Stain inclusion (Line shape, W : width (mm), L : length (mm))	W≦0.01	L : Ignore	Ignore	pcs	6)
			0.01＜W＜0.08	L＜3.0	3		
				3.0≦L	0		
			0.08≦W	-	(See dot shape)		
			Total		3		
	5	Stain inclusion (Dot shape, D : ave. dia (mm))	D≦0.22		Ignore	pcs	6)
			0.22＜D≦0.5		3		
			0.5＜D		0		
	6	Scratch on polarizer (Line shape, W : width (mm), L : length (mm))	W≦0.01	L : Ignore	Ignore	pcs	7)
			0.01＜W≦0.08	L＜10	4		
				10≦L	0		
			0.08＜W	-	0		
	7	Scratch on polarizer Dot shape and Bubbles, Peeling in polarizer (D : ave. dia (mm))	D＜0.1		Ignore	pcs	7)
			0.1≦D≦0.5		4		
			0.5＜D		0		
			Total		4		
	8	Wrinkles on polarizer			Serious one is not allowed.	-	-

Note

1) Definition of dot defect (Sparcle mode)

Bdot : Brightness of the dot at displaying black raster

	Ignore	Partial Sparcle mode	Sparcle mode
Red dot	Bdot≦7.8%	7.8%＜Bdot≦24.3%	24.3%＜Bdot
Green dot	Bdot≦4.1%	4.1%＜Bdot≦24.3%	24.3%＜Bdot
Blue dot	Bdot≦18.0%	18.0%＜Bdot≦24.3%	24.3%＜Bdot

2) Definition of dot defect (Black mode)

Brightness of the dot is less than 70% of L255 brightness.

3) 1 dot : defect dot is isolated, not attached to other defect dot.
N dots : N defect dots are consecutive. (N means the number of defects dots)

4) Density : number of defect dots inside ϕ 20mm

5) Distance between defects shall be longer than 5mm.

6) Those stains which can be wiped out easily are acceptable.

7) Not applied to B-zone.

10. PRECAUTION

Please pay attention to the followings when a TFT module with a back-light unit is used, handled and mounted.

10.1 Precaution to handling and mounting

(1) Applying strong force to a part of the module may cause partial deformation of frame or mold, and cause damage to the display.

(2) The module should gently and firmly be held by both hands. Never hold by just one hand in order to avoid any internal damage. Never drop or hit the module.

(3) The module should be installed with mounting holes of a module.

(4) Uneven force such as twisted stress should not be applied to a module when a module is mounted on the cover case. The cover case must have sufficient strength so that external force can not be transmitted directly to a module.

(5) It is recommended to leave a space between a module and a holding board of a module so that partial force is not applied to a module.

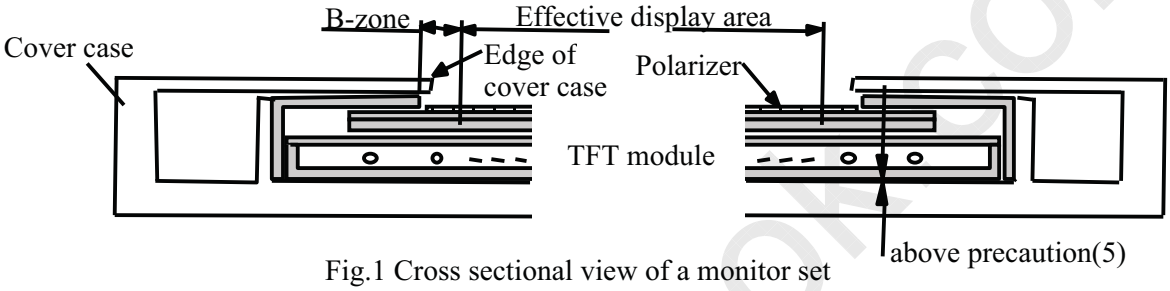


Fig.1 Cross sectional view of a monitor set

(6) The edge of a cover case should be located inside more than 1mm from the edge of a module front frame.

(7) A transparent protective plate should be added on the display area of a module in order to protect a polarizer and TFT cell. The transparent protective plate should have sufficient strength so that the plate can not touch a module by external force.

(8) Materials included acetic acid and choline should not be used for a cover case as well as other parts and boards near a module. Acetic acid attacks a polarizer. Choline attacks electric circuits due to electro-chemical reaction.

(9) The polarizer on a TFT cell should carefully be handled due to its softness, and should not be touched, pushed or rubbed with glass, tweezers or anything harder than HB pencil lead. The surface of a polarizer should not be touched and rubbed with bare hand, greasy clothes or dusty clothes.

(10) The surface of a polarizer should be gently wiped with absorbent cotton, chamois or other soft materials slightly contained petroleum benzene when the surface becomes dirty. Normal-hexane as cleaning chemicals is recommended in order to clean adhesives which fix front/rear polarizers on a TFT cell. Other cleaning chemicals such as acetone, toluen and alcohol should not be used to clean adhesives because they cause chemical damage to a polarizer.

(11) Saliva or water drops should be immediately wiped off. Otherwise, the portion of a polarizer may be deformed and its color may be faded.

(12) The module should not be opened or modified. It may cause not to operate properly.

(13) Metallic bezel of a module should not be handled with bare hand or dirty gloves. Otherwise, color of a metallic frame may become dirty during its storage. It is recommended to use clean soft gloves and clean finger stalls when a module is handled at incoming inspection process and production (assembly) process.

(14) Lamp(EEFL) cables should not be pulled and held.

10.2 Precaution to operation

(1) The ambient temperature near the operated module should be satisfied with the absolute maximum ratings. Unless it meets the specifications, sufficient cooling system should be adopted to system.

(2) The spike noise causes the mis-operation of a module. The level of spike noise should be as follows:
-200mV<=over- and under- shoot of VDD<= +200mV
VDD including over- and under- shoot should be satisfied with the absolute maximum ratings.

(3) Optical response time, luminance and chromaticity depend on the temperature of a TFT module. Response time and saturation time of EEFL luminance become longer at lower temperature operation.

(4) Sudden temperature change may cause dew on and/or in the a module. Dew males damage to a polarizer and/or electrical contacting portion. Dew causes fading of displayed quality.

(5) Fixed patterns displayed on a module for a long time may cause after-image. It will be recovered soon.

(6) A module has high frequency circuits. Sufficient suppression to electromagnetic interference should be done by system manufacturers. Grounding and shielding methods may be effective to minimize the interference.

(7) Noise may be heard when a back-light is operated. If necessary, sufficient suppression should be done by system manufacturers.

(8) The module should not be connected or removed while a main system works.

(9) Inserting or pulling I/F connectors causes any trouble when power supply and signal dates are on-state.I/F connectors should be inserted and pulled after power supply and signal dates are turned off.

10.3 Electrostatic discharge control

(1) Since a module consists of a TFT cell and electronic circuits with CMOS-ICs, which are very weak to electrostatic discharge, persons who are handling a module should be grounded through adequate methods such as a list band. I/F connector pins should not be touched directly with bare hands.

(2) Protection film for a polarizer on a module should be slowly peeled off so that the electrostatic charge can be minimized.

10.4 Precaution to strong light exposure

(1) A module should not be exposed under strong light. Otherwise, characteristics of a polarizer and color filter in a module may be degraded.

10.5 Precaution to storage

When modules for replacement are stored for a long time, following precautions should be taken care of:

(1) Modules should be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during storage. Modules should be stored at 0 to 35−C at normal humidity (60%RH or less).

(2) The surface of polarizers should not come in contact with any other object. It is recommended that modules should be stored in the Hitachi's shipping box.

10.6 Precaution to handling protection film

(1) The protection film for polarizers should be pealed off slowly and carefully by persons who are electrically grounded with adequate methods such as a list band. Besides, ionized air should be blown over during peeling action. Dusts on a polarizer should be blown off by an ionized nitrogen gun and so on.

(2) The protection film should be peeling off without rubbing it to the polarizer. Because, if the film is rubbed together with the polarizer, since the film is attached to the polarizer with a small amount of adhesive, the adhesive may remain on a polarizer.

(3) The module with protection film should be stored on the conditions explained in 10.5 (1). However, in case that the storage time is too long, adhesive may remain on a polarizer even after a protection film is peeled off. Besides, in case that a module is stored at higher temperature and/or higher humidity, adhesive may remain on a polarizer. The remained adhesive may cause non-uniformity of display image.

(4) The adhesive can be removed easily with Normal-Hexane. The remained adhesive or its vestige on the polarizer should be wiped off with absorbent cotton or other soft materials such as chamois slightly contained Normal-Hexane.

10.7 Safety

(1) Since a TFT cell and lamps are made of glass, handling to the broken module should be taken care sufficiently in order not to be injured. Hands touched liquid crystal from a broken cell should be washed sufficiently.

(2) The module should not be taken apart during operation so that back-light drives by high voltage.

10.8 Environmental protection

(1) The TFT module contains cold cathode fluorescent lamps. Please follow local ordinance or regulations for its disposal.

(2) Flexible printed circuits and printed circuits board used in a module contain small amount of lead. Please follow local ordinance or regulations for its disposal.

10.9 Use restrictions and limitations

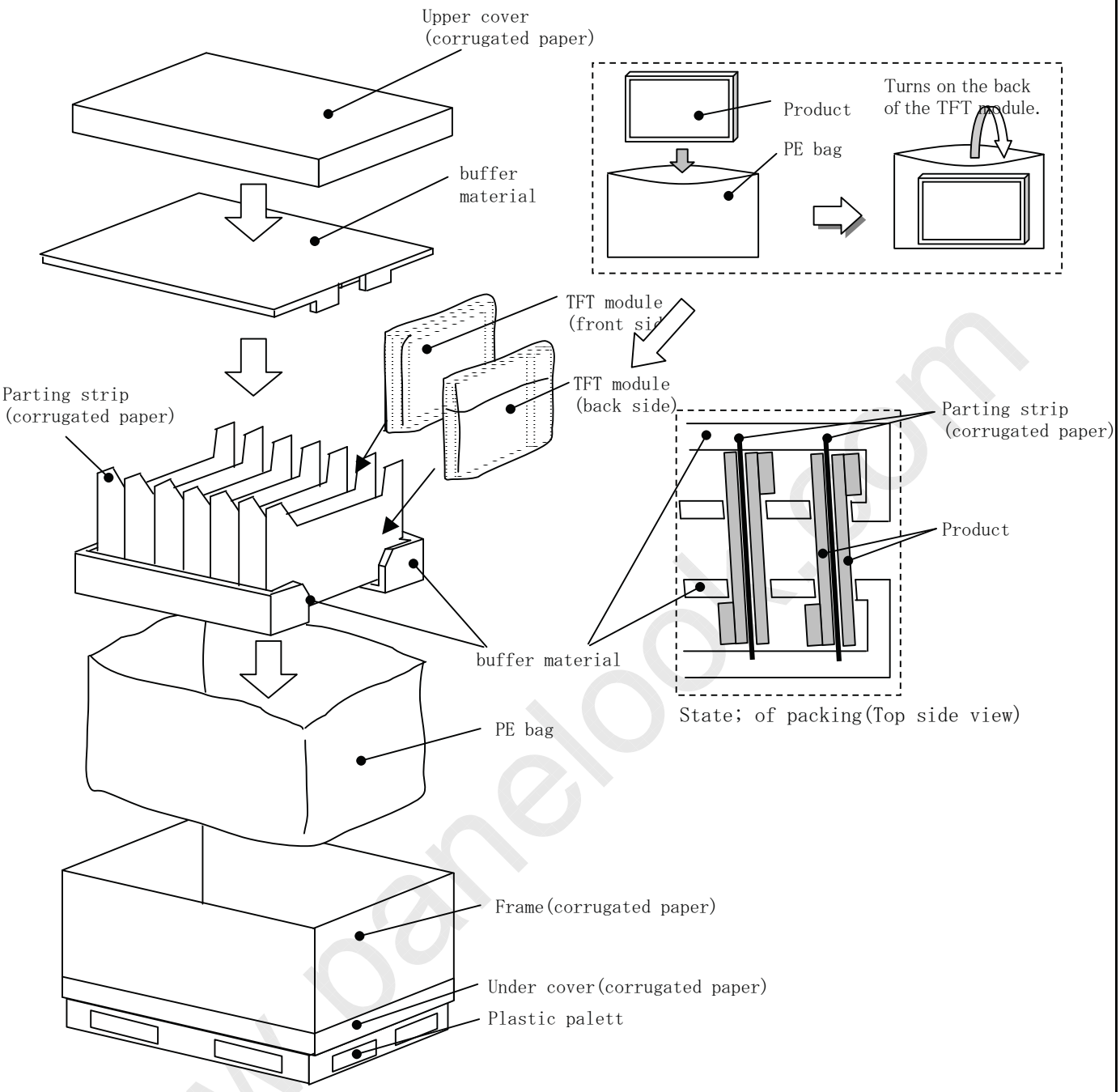
(1) This product is not authorized for use in life support devices or systems, military applications or other applications which pose a significant risk of personal injury.

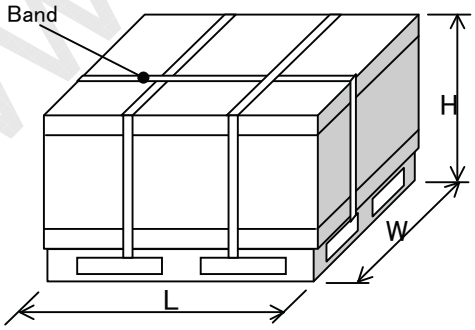
(2) In no event shall Hitachi, Ltd., be liable for any incidental, indirect or consequential damages in connection with the installation or use of this product, even if informed of the possibility thereof in advance. These limitations apply to all causes of action in the aggregate, including without limitation breach of contact, breach of warranty, negligence, strict liability, misrepresentation and other torts.

10.10 Others

(1) Electrical components which may not affect electrical performance are subjective to change without notice because of their availability.

11.Packing



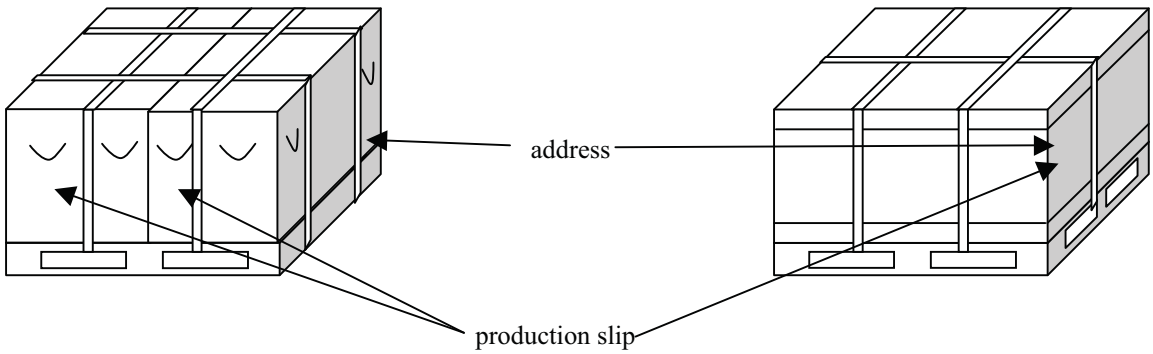


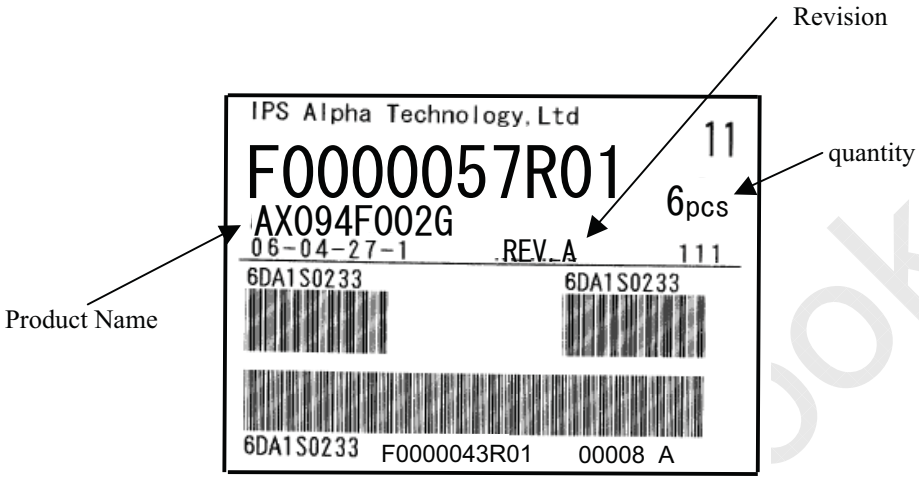
(14 products/pallet)

Size : 1220(L) x 1000(W) x 720(H)

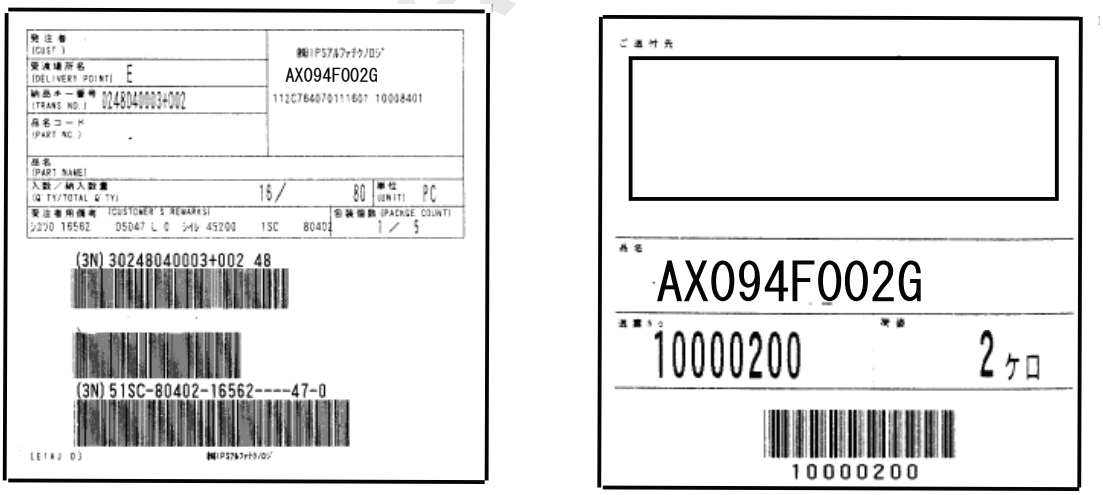
Weight : 154kg(Typ.)

IPS Alpha Technology, Ltd.	Date	Jan. 23, 2008	Sheet No.	IPS4PS 2614 -AX094F002G-4	Page	14-1/2





production slip (ex.) label size (102 × 70)



Address label
label size (100 × 100)

12. RELIABILITY TEST

The following reliability test is confirmed by IPS Alpha Technology, Ltd.

No.	ITEM	condition	Quantity	Period	
				determination	end
1	Low Temperature / operating	Ta = 0℃	2	500h	500h
2	High Temperature / operating	Ta = 45℃	2	500h	500h
4	High Temperature High Humidity / operating	40℃95%RH	2	500h	500h
5	Low Temperature / storage	Ta = -30℃	2	240h	500h
6	High Temperature / storage	Ta = 70℃	2	240h	500h
7	Thermal Shock	-35℃/85℃ 30min/30min	2	100cy	100cy
8	Vibration	f=15-100Hz, 14.7m/s^2 xyz / 1hr each direction	2	-	-
9	Shock	294m/s^2, 10ms xyz / 3times each direction	2	-	-
10	ESD1	250Ω/200pF I/F connector pin	2	±100V	±100V
11	ESD2	250Ω/200pF TFT module	2	±8kV	±15kV

Result Evaluation

Display function should be kept.