Product Specification

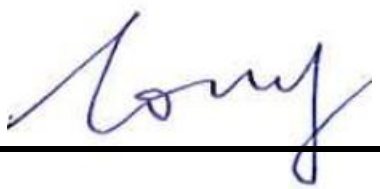
E116HVZ-501

☐ **Preliminary Specifications**

■ **Final Specifications**

Module	11.6 Inch Color TFT-LCD
Model Name	**E116HVZ-501** (VVX11FG009)
Document Version	Rev.01

Coutomer _____ Approved by Date _____ _____
Notice : This Specification is subject to change without notice.

Approved By	Prepared By
	

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For

CUSTOMER'S ACCEPTANCE SPECIFICATIONS

VVX11F009G00

CONTENTS

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Accepted by	Proposed by
Date:	森下 俊輔

RECORD OF REVISION

Date	The upper section : Previous revision The lower section : New revision Sheet No.	Page	Summary
Mar.5,2013	IPS4PS 2604 VVX11F009G00-1 IPS4PS 2604 VVX11F009G00-2	4-2/2	Delete input voltage for logic of absolute maximum ratings. Add input voltage for LED PWM and LED enable of absolute maximum ratings.
	IPS4PS 2605 VVX11F009G00-1 IPS4PS 2605 VVX11F009G00-2	5-1/2	Change green color chromaticity. Green-y (Typ.) : 0.595 → 0.612
	IPS4PS 2606 VVX11F009G00-1 IPS4PS 2606 VVX11F009G00-2	6-1/1	Delete input voltage for logic of electrical characteristics.
	IPS4PS 2609 VVX11F009G00-1 IPS4PS 2609 VVX11F009G00-2	9-1/5	Change eDP receiver characteristics value for machng VESA eDP standard. (1) Delete maximum value of VDIFFp-p. (2) Delete typical value of UI.
	IPS4PS 2609 VVX11F009G00-1 IPS4PS 2609 VVX11F009G00-2	9-3/5	Change syncronization signal timing to be clear the defference between frame rate 60Hz and 40Hz operation. (1) Add frame rate 40Hz specification.
	IPS4PS 2612 VVX11F009G00-1 IPS4PS 2612 VVX11F009G00-2	12-1/3	Add special inspection condition. Change ambient light condition for non-operating inspection.
	IPS4PS 2612 VVX11F009G00-1 IPS4PS 2612 VVX11F009G00-2	12-2/3	Add inspection criteria. (1) Polarizer scratches on B-zone. (2) Fixed tape overlap with polarizer. (3) Wrinkles on fixed tape.
	IPS4PS 2615 VVX11F009G00-1 IPS4PS 2615 VVX11F009G00-2	15-1/1	(1) Change high temperature and high humidity operation reliability test condition. (40℃ 95%RH → 45℃ 90%RH) (2) Change high temperature and high humidity operation reliability test end period. (500h → 48h)
Mar.6,2013	IPS4PS 2604 VVX11F009G00-2 IPS4PS 2604 VVX11F009G00-3	4-2/2	Change electrical absolute maximum ratings of logic signals input voltage (LED_EN, LED_PWM). Max : 2.0 → 3.6V
Mar.8,2013	IPS4PS 2612 VVX11F009G00-3 IPS4PS 2612 VVX11F009G00-4	12-1/3	Change target for cosmetic inspection of partial non-uniformity.

RECORD OF REVISION

Date	The upper section : Previous revision The lower section : New revision Sheet No.	Page	Summary
Mar.14,2013	IPS4PS 2612 VVX11F009G00-4 IPS4PS 2612 VVX11F009G00-5	12-1/3	Change environmental ambient light of non-operating inspection. (1000～1300 lx → 300～800 lx)
Jun.19,2013	IPS4PS 2611 VVX11F009G00-5 IPS4PS 2611 VVX11F009G00-6	11-1/1	Add revision "B" for Von terminal failure countermeasure FPC position adding. Add revision "C" for appliing the countermeasure for PaulSmith issue. Add customer parts number on product label for revision "A" and "B". Add country of origin on product label for revision "C".
	IPS4PS 2612 VVX11F009G00-5 IPS4PS 2612 VVX11F009G00-6	12-2/3, 3/3	Add inspection criteria. Bump on polariser. Add inspection notice 12) for limit sample judgement for 0.6<D≦0.8 size bump on polarizer.

DESCRIPTION

The following specifications are applied to the following IPS-Pro-TFT LCD module.

Product Name : VVX11F009G00

General Specifications

Effective display area	: (H) 256.896 × (V) 144.504	(mm)
Number of pixels	: (H) 1,920 × (V) 1,080	(pixels)
Pixel pitch	: (H) 0.1338 × (V) 0.1338	(mm)
Pixel density	: 190	(ppi)
Color pixel arrangement	: R+G+B vertical stripe	
Display mode	: Transmissive mode Normally black mode	
Top polarizer type	: Semi-Glare	
Number of colors	: 16,777,216	(colors)
Input signal	: eDP (Ver 1.3) 2Lane with PSR and ASSR function	
Backlight	: 35 pieces of LED (LED : Light-emitting diode)	
External dimensions	: Typ. (H) 268.896 × (V) 166.564 × (T) 2.282	(mm)
Weight	: Typ. 132	(g)

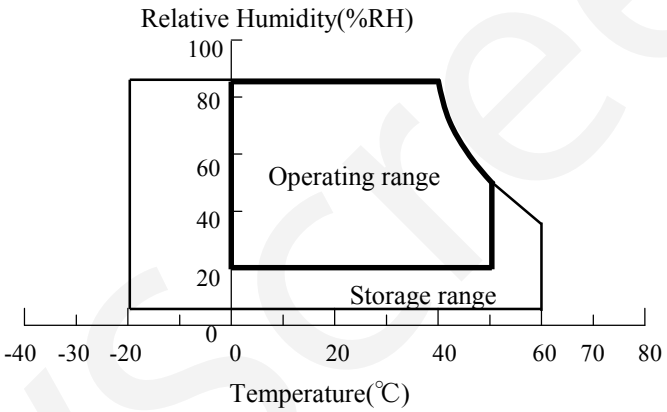
1. ABSOLUTE MAXIMUM RATINGS

1. 1 Environmental Absolute Maximum Ratings

ITEM	Operating		Storage		UNIT	NOTE
	Min.	Max.	Min.	Max.		
Temperature	0	50	-20	60	℃	1),3)
Humidity	2)		2)		%RH	1),4)
Vibration	-	5)	-	6)	Grms	7)
Shock	-	1176(120G)	-	2058(210G)	m/s^2	8),9)
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 IPS-Pro TFT LCD module, not to the system installed with a module.

2) Ta≦40 ℃ · · · · · · Relative humidity should be less than 85 %RH max. Dew is prohibited.
Ta＞40 ℃ · · · · · · Relative humidity should be lower than the moisture of the 85 %RH at 40 ℃.



3) The temperature of LCD front surface would be 65 ℃ in operating, it may affect the optical characteristics however it does not damage the function of the module.

4) The humidity of LCD front surface would be less than 20％RH in storage, it may affect the optical characteristics, however it does not damage the function of the module.

5) Random 1.1Grms: 5-50Hz $0.024G^2/Hz$, 50-100Hz -36dB/oct

6) Random 2.3Grms: 5-50Hz $0.11G^2/Hz$, 50-100Hz -36dB/oct

7) Direction : ±X, ±Y, ±Z (One time each direction) 20min, total 60min.

8) Direction : ±X, ±Y, ±Z (One time each direction)

9) Pulse width of the shock is 3 ms.

1. 2 Electrical Absolute Maximum Ratings

(1)TFT-LCD module

VSS = 0 V

ITEM	SYMBOL	Min.	Max.	UNIT	NOTE
Power Supply Voltage	VDD	-0.3	6.5	V	
Input Voltage for LED driver	V_{LED}	-0.3	25.0	V	
Logic signals input voltage	LED_EN	-0.3	3.6	V	
	LED_PWM	-0.3	3.6	V	
Electrostatic Durability	VESD0	±15		kV	1),2)
	VESD1	±250		V	3),4)

Note 1) Constant discharge: 150pF-330Ω, Environment: 15-35℃/30-60%RH, Aerial discharge
2) It is applied to the surface of a metallic bezel and a LCD panel. Operating
3) Constant discharge: 200pF-0Ω (GRD=0V), Environment: 15-35℃/30-60%RH, Contact Discharge.
4) It is applied to the I/F conect pin. Non-perating

2. INITIAL OPTICAL CHARACTERISTICS

The following optical characteristics are measured under stable conditions. It takes about 10 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.

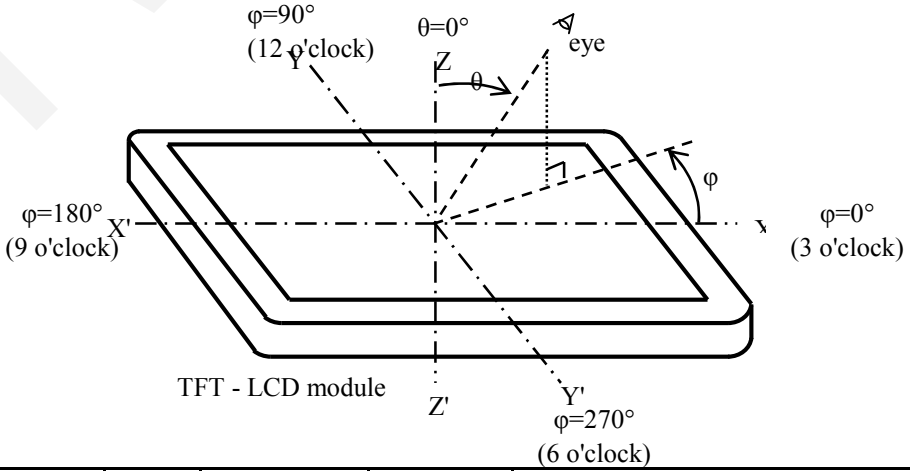
Measuring equipment : CS-1000A, or equivalent

Ambient Temperature =25 ℃ , VDD=3.3 V , VLED=+4.5～+11.5V , fV=60 Hz ,

If = 20.0mA/string (On-duty=100%)

ITEM		SYMBOL	CONDITION	Min.	Typ.	Max.	UNIT	NOTE
Contrast ratio		CR	θ= 0 ° 1)	600	1000	-	-	2)
Response time		Tr + Tf		-	26	35	ms	3)
Brightness of white		Bwh		450	570	-	cd/m^2	-
Brightness uniformity		Buni		65	-	-	%	4)
Color chromaticity (CIE)	Red	x		0.620	0.650	0.680	-	【Gray scale =255】
		y		0.295	0.325	0.355		
	Green	x		0.295	0.325	0.355		
		y		0.582	0.612	0.642		
	Blue	x		0.115	0.145	0.175		
		y		0.015	0.045	0.075		
	White	x		0.283	0.313	0.343		
		y		0.299	0.329	0.359		
Contrast ratio at 85 °		CR85	φ=0°, 90° ,180°,270° 5)	10	-	-	-	Estimated value
Half brightness Angle		Bhalf	UP	-	12	-	degree	1) (Bwhmax / 2)
			Down	-	15	-		
			Left/Right	-	46	-		
NTSC		-	θ=0°	-	72	-	%	-
Gamma		-	θ=0°	-	2.2	-	-	-
Image sticking		-	Checker pattern	Not recognized			-	6)
Cross talk		-	θ=0°	Not recognized			-	7)

Note 1) Definition of viewing angle



Note 2) Definition of contrast ratio (CR)

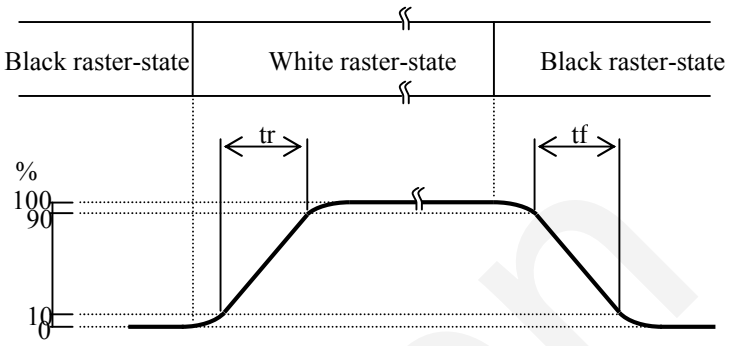
$$CR = \frac{B_{WH}}{B_{BL}}$$

B_{WH} : Brightness at white raster-state

B_{BL} : Brightness at black raster-state

3) Definition of response time

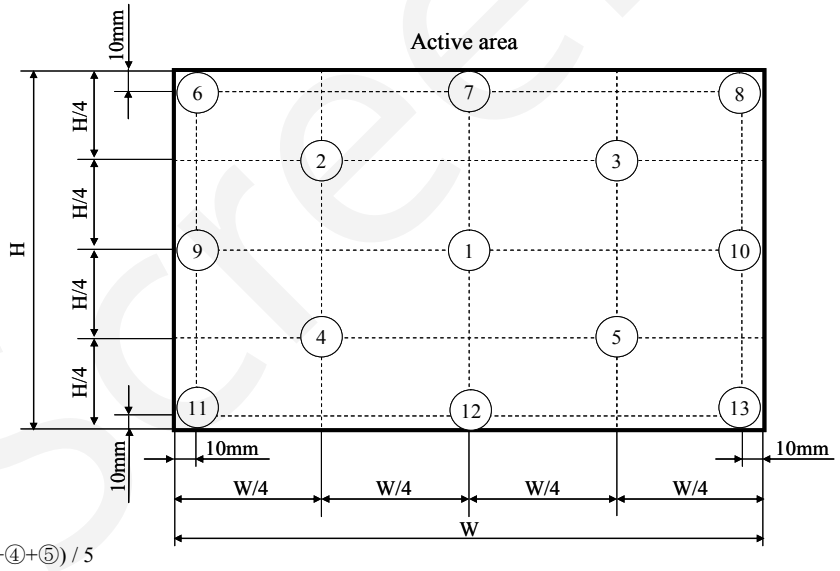
Displaying data signal



tr ＝ Start-up time

tf ＝ Falling time

4) Definition of response time



①-⑬ : Measurement points

Brightness (5 point) : (①+②+③+④+⑤) / 5

Buni (13 points) : Min(①-⑬) / Max(①-⑬)×100%

5) Contrast ratio at 85 °

Evaluetion conditions are on horizontal & vertical axis

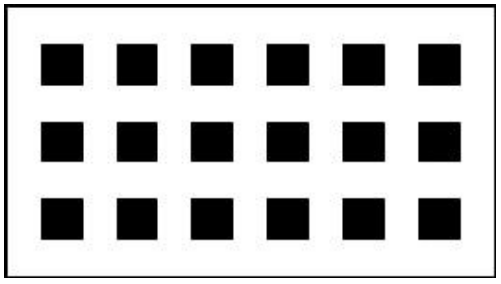
6) Aging :

4h aging with checker pattern at room temperature.

Check :

After aging, turn on gray raster (127/255 level) pattern

It must not recognize within 5 seconds when hold 13% ND filter to the display side.



Display patern for image sticking

7) It must not recognize within 5 seconds when hold 13% ND filter to the display side.

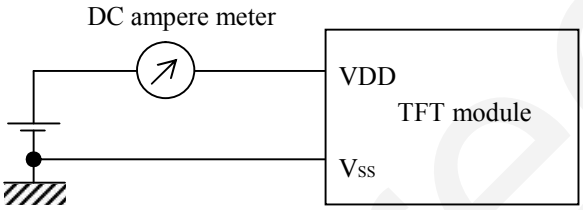
3. ELECTRICAL CHARACTERISTICS

3. 1 TFT-LCD module

Ta = 25 ℃ , V_{SS} = 0 V

ITEM		SYMBOL	Min.	Typ.	Max.	UNIT	NOTE
Power supply voltage		V_{DD}	3.0	3.3	3.6	V	
Power supply current		I_{DD}	-	220	700	mA	1)
Ripple voltage of power supply		V_{DDR}	-	-	150	mV	
Input voltage for LED driver		V_{LED}	4.5	-	11.5	V	
Logic signals input voltage	High	VIH	1.5	-	-	V	LED_EN LED_PWM
	Low	VIL	-	-	0.8	V	

Note 1) fV=60.0Hz, VDD=3.3V
Typ. : display pattern is white raster.
Max. : display pattern is pixel checker. (white and black)



3. 2 Backlight unit

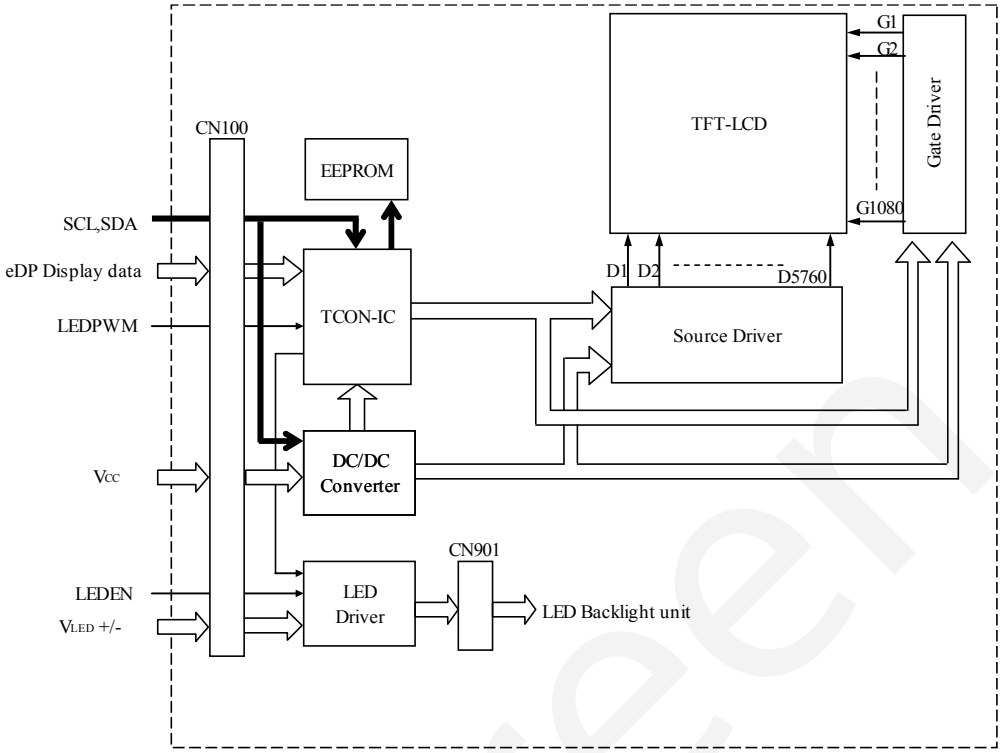
ITEM		SYMBOL	Min.	Typ.	Max.	UNIT	NOTE
Power Consumption		Pbl	-	2.3	2.6	W	1)
PWM	Duty	PD	1	-	100	%	
	Frequency	PF	100	300	5k	Hz	
LED Life time		-	10,000	-	-	h	2)

One Backlight Unit : 1 LED Array
One LED Array : 5 LED String
One LED String : 7 LED package

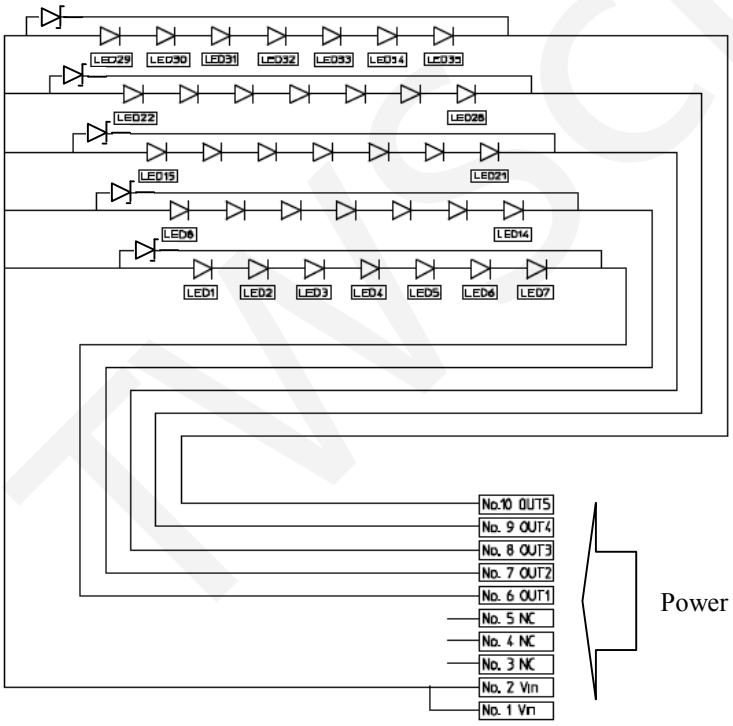
Note 1) PWM on-duty=100%
2) Life time of a LED is defined as follows. The life is determined as the time at which brightness of the LED is 50 % compared to that of initial value at that typical forward current on condition of continuous operating at 25 ± 2 ℃.

4. BLOCK DIAGRAM

4. 1 TFT-LCD module



4. 2 Backlight unit



PIN Assignment		
PIN No.	Symbol	Function
10	OUT5	LED current sense for string 5
9	OUT4	LED current sense for string 4
8	OUT3	LED current sense for string 3
7	OUT2	LED current sense for string 2
6	OUT1	LED current sense for string 1
5	NC	Not Connect
4	NC	Not Connect
3	NC	Not Connect
2	Vin	Input voltage power supply
1	Vin	Input voltage power supply

Note 1)　Conector: FH19C-10S-0.5SH

5. INTERFACE PIN ASSIGNMENT

5. 1 Pin alignment

CN100:JAE (HD2S030HA1)

PIN No.	SYMBOL	DESCRIPTION	Note
1	WP	EEPROM Write Protect	5)
2	H_GND	High Speed Ground (0V)	2)
3	Lane1_N	Complement Signal Link Lane 1	
4	Lane1_P	True Signal Link Lane 1	
5	H_GND	High Speed Ground (0V)	2)
6	Lane0_N	Complement Signal Link Lane 0	
7	Lane0_P	True Signal Link Lane 0	
8	H_GND	High Speed Ground (0V)	2)
9	AUX_CH_P	True Signal Aux Channel	
10	AUX_CH_N	Complemnt Signal Aux Channel	
11	H_GND	High Speed Ground (0V)	2)
12	V_{CC}	Power supply for LCD	1)
13	V_{CC}		
14	BIST	Keep open or connect to GND	
15	GND	GND(0V)	2)

PIN No.	SYMBOL	DESCRIPTION	Note
16	GND	GND(0V)	2)
17	HPD	Hot plug detection signal pin	
18	V_{LED}-	GND(0V)	2)
19	V_{LED}-		
20	V_{LED}-		
21	V_{LED}-		
22	LED_EN	LED enable	4)
23	LED_PWM	PWM signal input	
24	SDA	I2C-bus Data	
25	SCL	I2C-bus Clock	
26	V_{LED}+	Power supply for LED	3)
27	V_{LED}+		
28	V_{LED}+		
29	V_{LED}+		
30	GND	GND(0V)	2)

Notes 1) All V_{CC} pins should be connected to +3.3V(typ).

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

3) All V_{LED}+ pins should be connected to (+4.5～+11.5V).

4) H:LED ON L:LED OFF

5) H or open : Write protect　L : Write enable

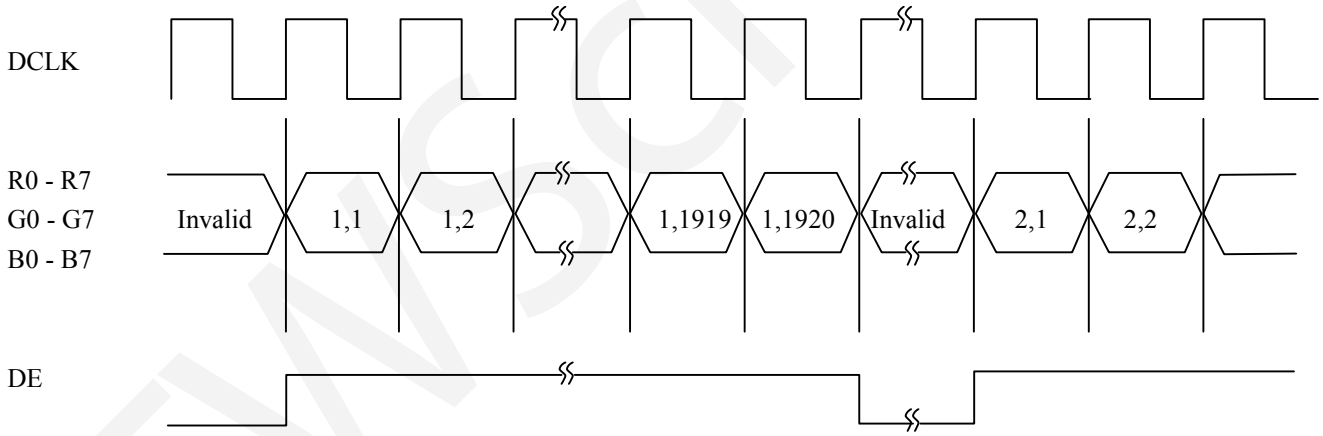
5. 2 Correspondence between input data and display image

Display data of adjacent two pixel is latched during four cycle of DCLK.

R (1,1)	G (1,1)	B (1,1)

Pixel : R0 - R7 : R (x,y)
G0 - G7 : G (x,y)
B0 - B7 : B (x,y)

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. 3 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
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	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
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	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	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
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	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

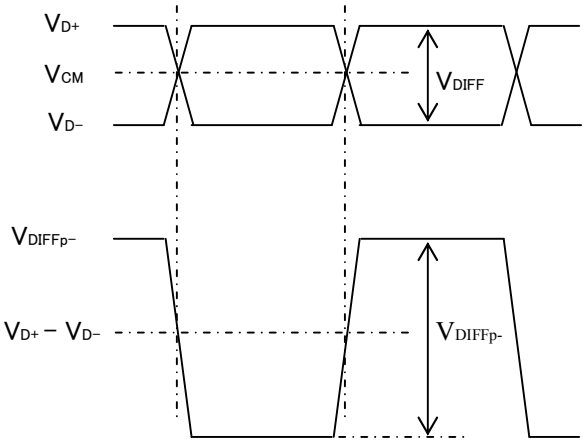
Note 1) Definition of gray scale :
Color(n)・・・・Number in parenthesis indicates gray scale level.
Larger n corresponds to brighter level.

2) Data : 1 : High, 0 : Low

6. INTERFACE TIMING

6. 1 eDP receiver characteristics

(1) DisplayPort Main Link Receiver Characteristics



Symbol	Description	Min.	Typ.	Max.	Unit	Comments
VDIFFp-p	Differential peak-to-peak input voltage	120	-	1200	mV	
VCM	DC common mode voltage	0	-	2.0	V	
RTERM	Differential termination resistance	-	100	-	Ω	
ISHORT	Short circuit current limit	-	-	50	mA	
LSKEW	Lane Intra-pair skew	-	-	100	ps	

(2) DisplayPort AUX Channel Characteristics

Symbol	Description	Min.	Typ.	Max.	Unit	Comments
UI	AUX Unit interval	0.4	0.5	0.6	us	
VAUX_DIFFp-p	AUX Differential peak-to-peak input voltage	0.32	-	1.32	V	
VAUX_CM	AUX DC common mode voltage	0	-	2.0	V	
RAUX_TERM	AUX CH termination resistance	-	100	-	Ω	
IAUX_SHORT	AUX Short circuit current limit	-	-	90	mA	
CAUX	AUX AC coupling capacitor	75	100	200	nF	

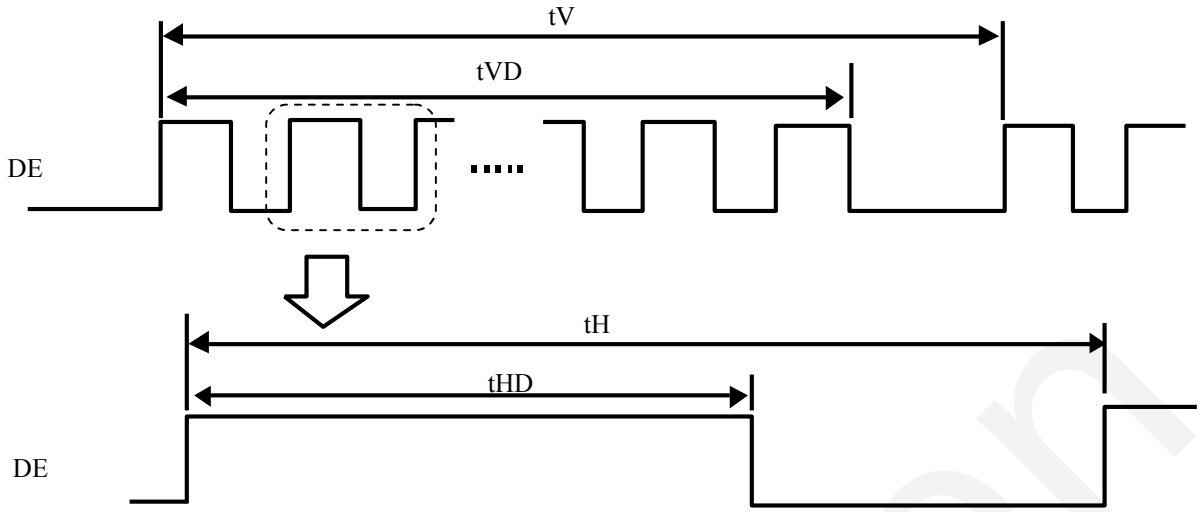
6. 2 eDP 2lane 8bit input data mapping

Lane0	Lane1
R1-7:0	R2-7:0
G1-7:0	G2-7:0
B1-7:0	B2-7:0
R3-7:0	R4-7:0
G3-7:0	G4-7:0
B3-7:0	B4-7:0
R5-7:0	R6-7:0
G5-7:0	G6-7:0
B5-7:0	B6-7:0

6. 3 HPD characteristics

Parameter	Min.	Typ.	Max.	Unit	Comments
HPD Voltage	2.25	2.5	2.75	V	HPD signal to be driven by the Sink Device
Hot Plug Detection Threshold	2.0	-	-	V	HPD signal to be detected by the Source Device
Hot Unplug Detection Threshold	-	-	0.8	V	

6. 4 SYNCRONIZATION SIGNAL TIMING



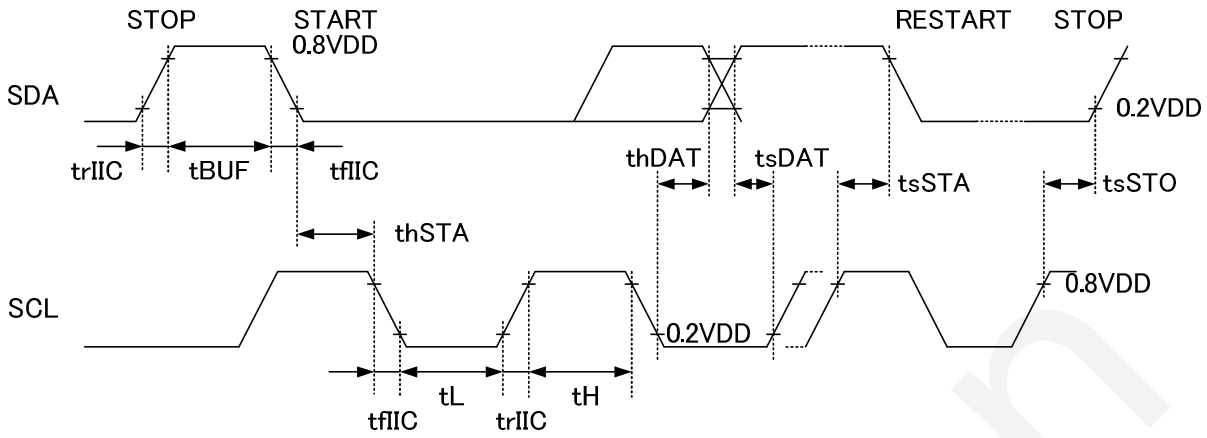
Frame rate 60Hz

ITEM		SYMBOL	Min.	Typ.	Max.	UNIT	NOTE
DE	Vertical Period	tV	1092	1093	1094	tH	
	Vertical Valid	tVD		1080		tH	
	Horizontal Period	tH	2040	2264	2265	tCLK	
	Horizontal Valid	tHD		1920		tCLK	

Frame rate 40Hz (Internal operation condition)

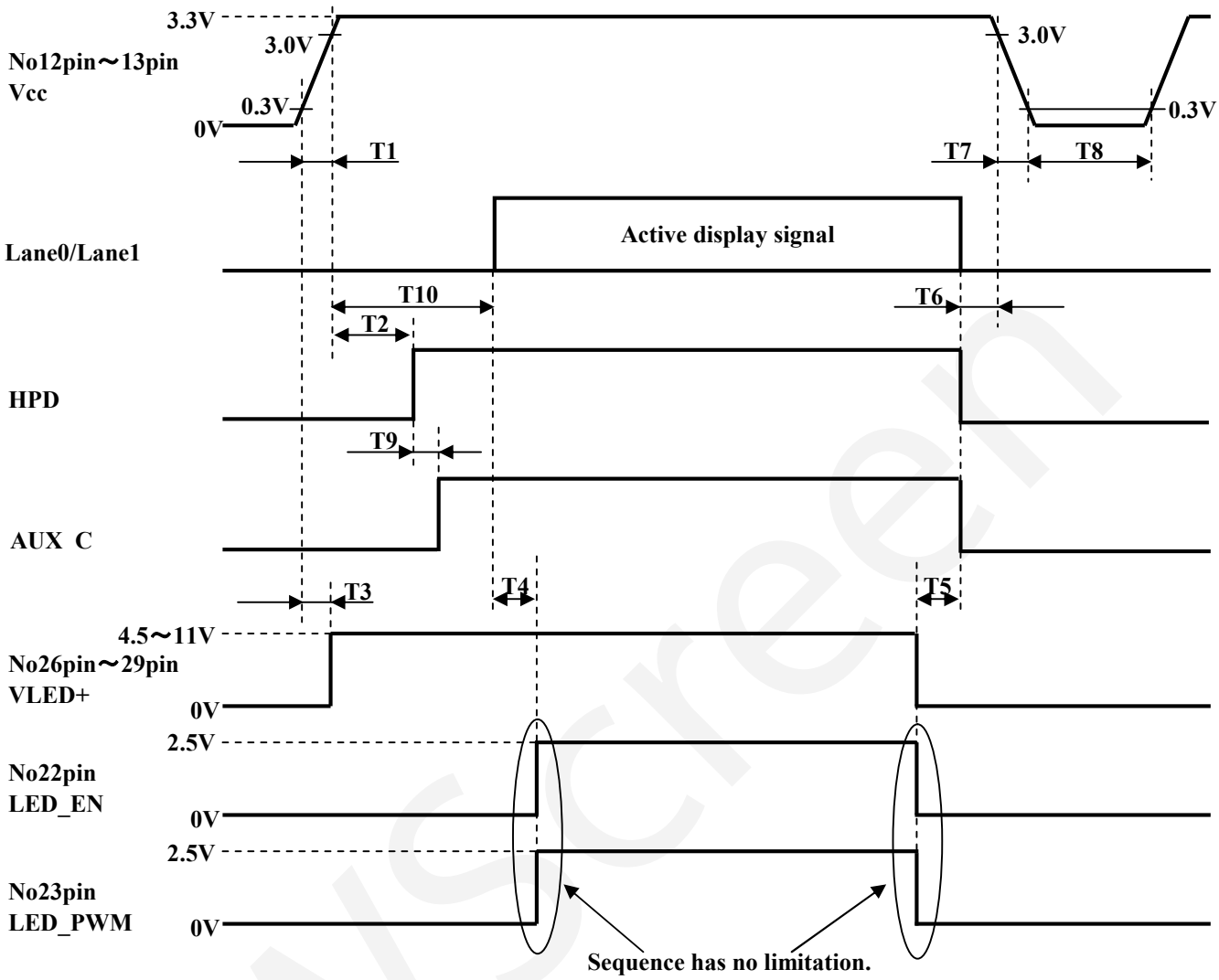
ITEM		SYMBOL	Min.	Typ.	Max.	UNIT	NOTE
DE	Vertical Period	tV	1638	1640	1641	tH	
	Vertical Valid	tVD		1080		tH	
	Horizontal Period	tH	2040	2264	2265	tCLK	
	Horizontal Valid	tHD		1920		tCLK	

6. 5 I2C timing



Parameter	Symbol	Conditions	Rating			Unit
			MIN	TYP	MAX	
SCL Clock Frequency	fscl	See. Upper Fig.	1	-	100	kHz
STOP START Interval	tBUF		4.7	-	-	µs
START HOLD Time	thSTA		4.0	-	-	µs
RESTART SETUP Time	tsSTA		4.7	-	-	µs
STOP SETUP Time	tsSTO		4.7	-	-	µs
Rize Time	trIIC		-	-	1.0	µs
Fall Time	tfIIC		-	-	0.3	µs
Clock Low Time	tL		4.7	-	-	µs
Clock High Time	tH		4.0	-	-	µs
Data Setup Time	tsDAT		0.2	-	-	µs
Data Hold Time	thDAT	-	0.2	-	-	µs

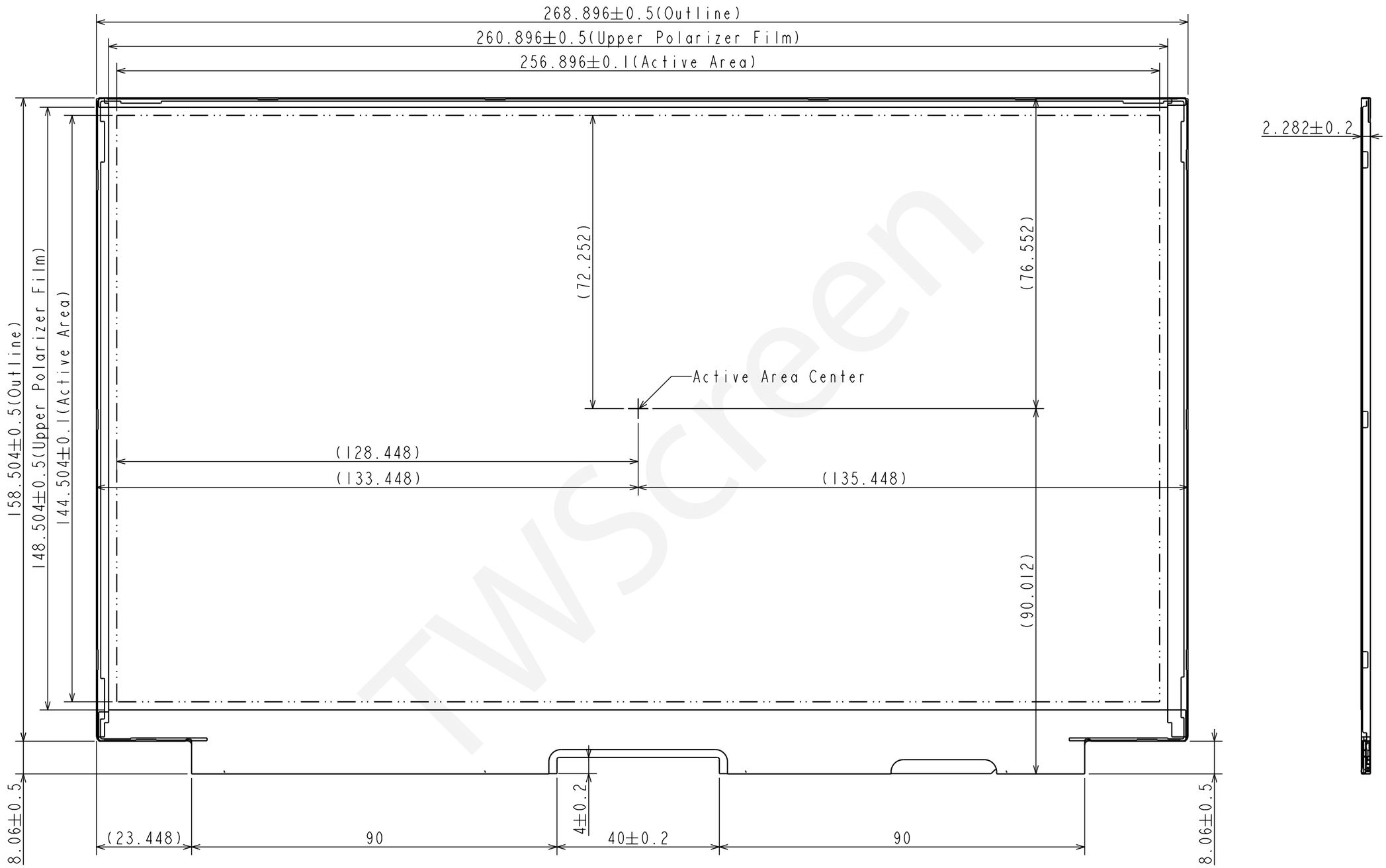
6. 6 Timing between interface signals and power supply



SYMBOL	Min.	Typ.	Max.	UNIT	Note
T1	0.5	-	10	ms	
T2	-	160	180	ms	
T3	0	-	-	ms	
T4	0	-	-	ms	
T5	0	-	-	ms	
T6	0	-	-	ms	
T7	-	-	10	ms	
T8	500	-	-	ms	
T9	0	-	-	ms	
T10	260	-	-	ms	

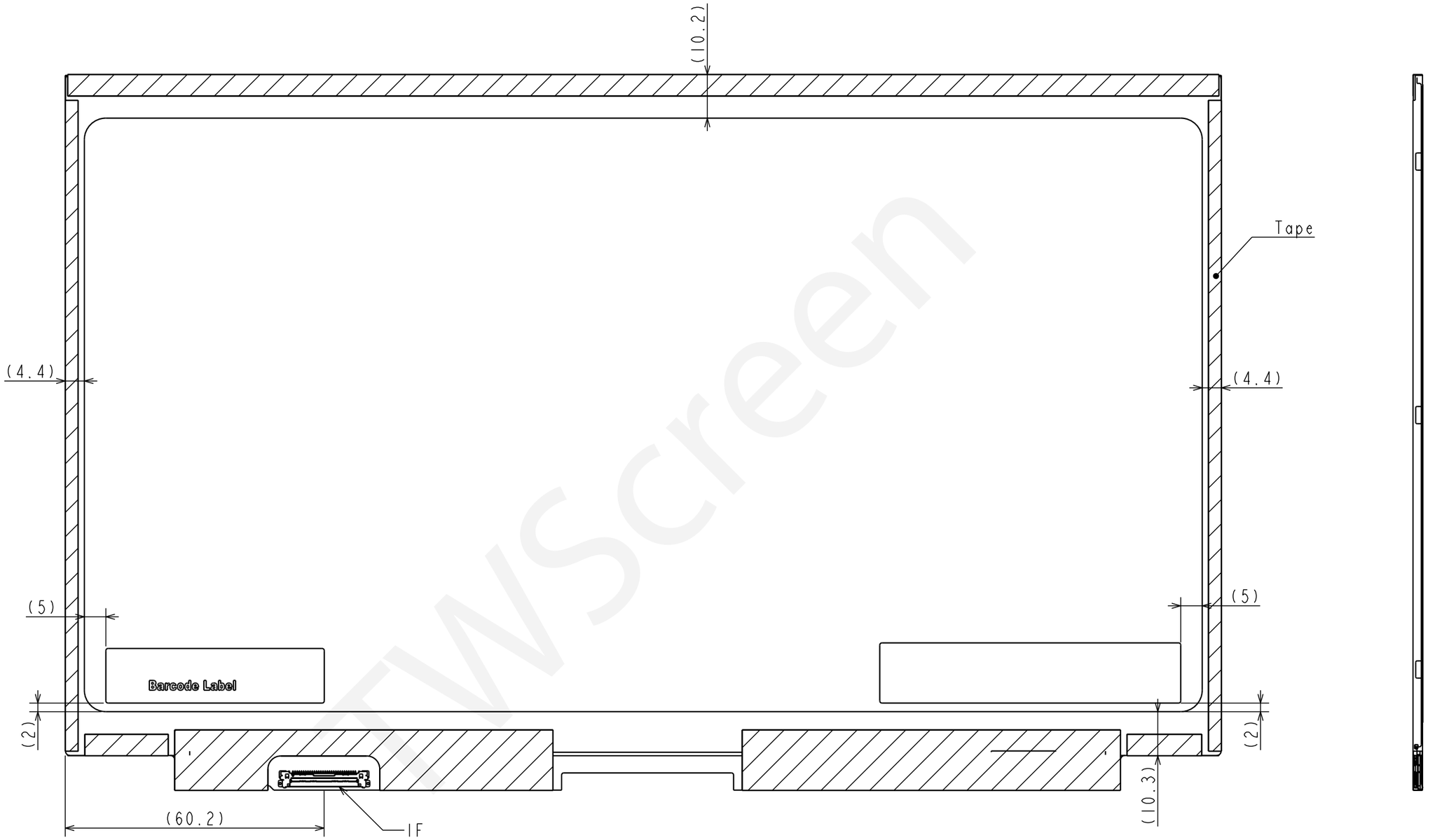
7. DIMENSIONAL OUTLINE

(1)FRONT VIEW



Note 1) The dimension in a parenthesis is a reference value.
2) Dimensional tolerance to be ±0.8 mm unless otherwise specified.

(2)BACK VIEW



Note 1) The dimension in a parenthesis is a reference value.
2) Dimensional tolerance to be ±0.8 mm unless otherwise specified.

Panasonic Liquid Crystal Display Co., Ltd.	Date	Jun.19,2013	Sh. No.	IPS4PS 2610 VVX11F009G00-6	Page	10-2/2

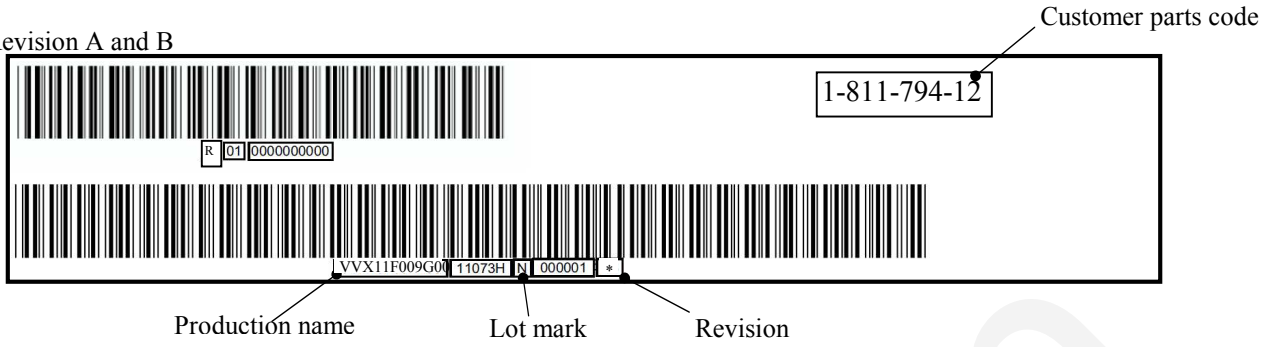
8. LABEL FORMAT

8.1 Label

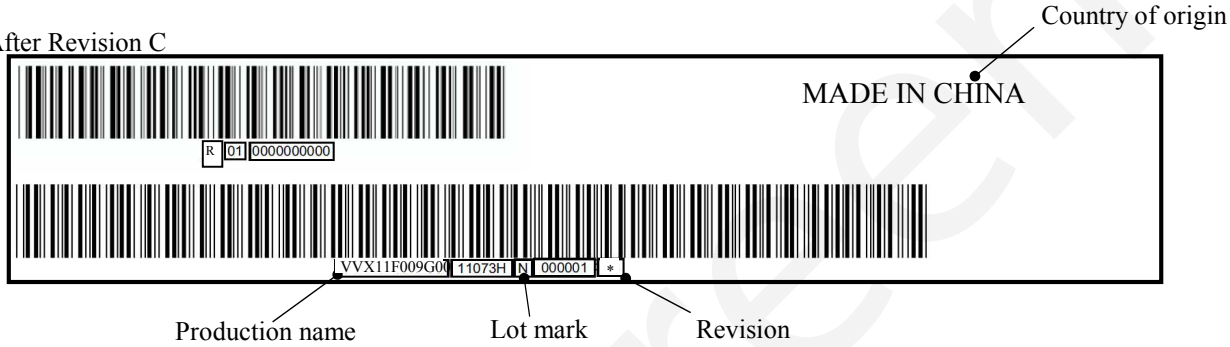
The label is on the metallic bezel as shown in 7. External Dimensional.

The style of character will be changed without notice.

Revision A and B



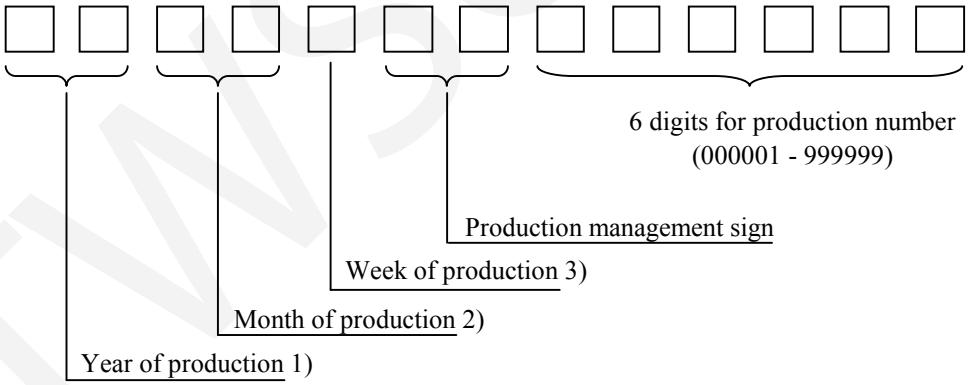
After Revision C



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 Lot mark



Notes 1)

Mark	Year
13	2013
14	2014
15	2015

2)

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

3)

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

8.4 Record of revision described on the label

Rev.A: initial

Rev.B: Von terminal failure countermeasure FPC position added

Rev.C: Applied the countermeasure for PaulSmith issue

9. COSMETIC SPECIFICATIONS

9.1 Condition for cosmetic inspection

(1) Viewing zone

a) Fig.9.1 shows the correspondence between eyes (of inspector) and LCD module.
θ≦10° : when non-operating inspection
and when operating inspection

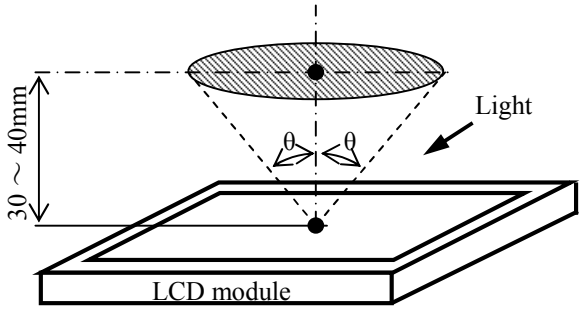


Fig. 9.1 Inspection view

・Special condition

1) Viewing distance is close for inspection of adjacent dots and distance between defect dots.
2) Partial non-uniformity from oblique angle especially optical chiecking (light leakage, white spot and etc.) should be inspected as Fig. 9.2.
3) Image-sticking shoulc be inspected from view angle θ=40deg.

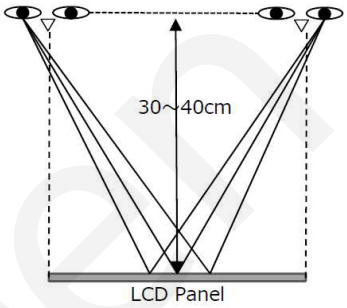


Fig. 9.2 Inspection condition for parcial non-uniformity

b) Inspection should be executed only from front side and only A-zone.
Cosmetic of B-zone and C-zone are ignore.
(refer to Fig. 9.3 Definition of zone)

(2) Environmental

a) Temperature : 25 degrees
b) Ambient light : 300 ～ 500 lx and non-directive when operating inspection.
300 ～ 800 lx and non-directive when non-operating inspection.
c) Backlight : when non-operating inspection, backlight 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 : Fixed tape area

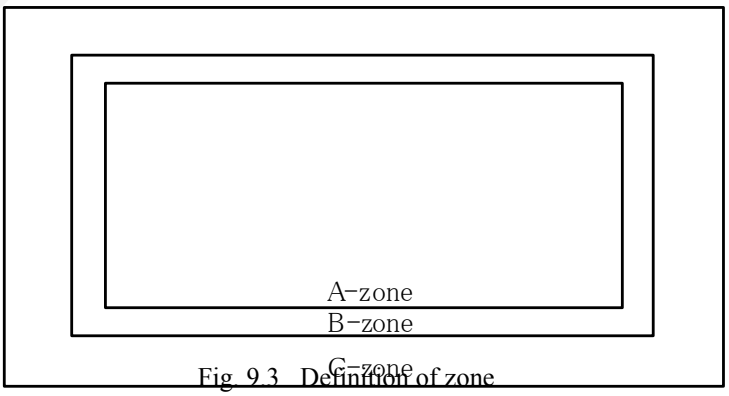


Fig. 9.3 Definition of zone

9.3 Cosmetic specifications

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

Inspection condition	Zone	No	ITEM			Max. acceptable number	Unit	Note
Operating inspection	A	1	Dot defect	Bright dot	Random	1 (Green=0)	pcs	1),2),4)
					2-dots	0	Units	1),5),10)
					3-dots	0		
					Density	0	pcs/φ15mm	1),6)
					Total	1	pcs	
				Dark dot	Random	5	pcs	3),4)
					2-dots	1 (Vertical=0)	Units	3),5),10)
					3-dots	0		
					Density	0	pcs/φ15mm	3),6)
					Total	5	pcs	
				Total		5	pcs	
		2	Foreign Black/White/Bright spot (D : ave. dia (mm))	D≦0.15		Ignore	pcs	7),8)
				0.15<D≦0.4		3		
				D>0.4		0		
		3	Foreign Black/White/Bright line (W: Width (mm) L: Length (mm))	W≦0.05		Ignore	pcs	7),8)
				0.05<W≦0.1	L≦0.5	Ignore		
					0.5<L≦2.0	4		
					L>2.0	0		
				W>0.1		0		
Non operating inspection		4	Defect on polarizer (D : ave. dia (mm))	Dent Air bubble Peeling	D≦0.15	Ignore	pcs	7)
					0.15<D≦0.4	3		
					D>0.4	0		
				Bump	D≦0.15	Ignore	pcs	7),12)
					0.15<D≦0.6	3		
					0.6<D≦0.8	3		
					D>0.8	0		
				Total		3	pcs	
		5	Polarizer scratches (W: Width (mm) L: Length (mm))	W≦0.05		Ignore	pcs	7)
				0.05<W≦0.1	L≦0.5	Ignore		
					0.5<L≦10.0	4		
					L>10.0	0		
				W>0.1		0		
		6	Wrinkles on polarizer			Serious one is not allowed.	-	-
		7	Polarizer Undulation			Not Allowed if it is noticeable.	-	-
		8	Lack of polarizer adhesive (W: Width (mm) L: Length (mm))	W≦0.5	L≦9	Ignore	pcs	-
				W＞0.5	L＞9	0		
	B	9	Polarizer scratches			Serious one is not allowed.	-	-
		10	Fixed tape overlap with polarizer			Not Allowed.	-	-
	C	11	Wrinkles on fixed tape			Serious one is not allowed.	-	-

Note 1) Bright dot : Count the dot that it is brighter than the judgment pattern of bright dot.
(Jadgement gray level is Red : 51, Green : 51, Blue : 102)

2) Bright green dot defect is not allowed.

3) Dark dot : Count the dot that it is brightness less than 70% at white. (visible to eye)

4) 1 dot : Defect dot is isolated, not attached to other defect dot.

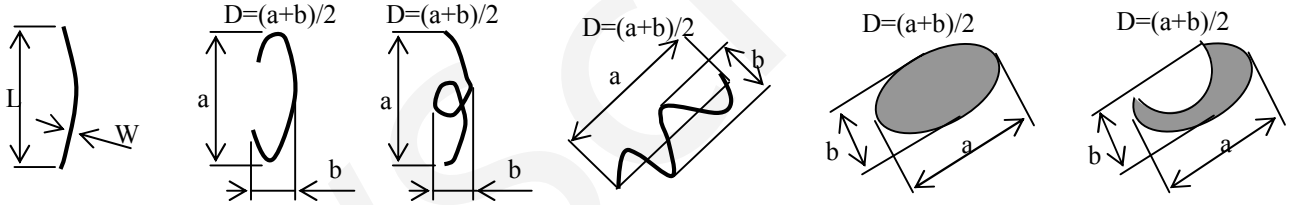
5) N-dots : N defect dots are consecutive. (N means the number of defects dots)

6) Density : Number of defect dots inside φ15mm

7) Those foreign materials and stains which can be wiped out easily are acceptable.

8) The defect which due to the foreign material or stain shall be seen from the front side of the display.
The defect which due to the air bubble is judged at the place where it is seen the maximum brightness by seeing from many angles.

9) Diameter of foreign material is the maximum diameter.
Dimensional definition of scratch and foreign material is as follows.



10) Definition of the linked dot defect : 2-dot defect is counted as "2-dot defect: 1 set" when 1 out of 6 dots except for the vertical direction against nearby dot defect is a dot defect.
Dot defects in the vertical direction against nearby dot defect are not allowed.
※ If there is a defect in any of the location of the "△" against "×" in the right figure below, it is defined as the linked dot defect.

R	G	B	R △	G	B △	R	G	B
R	G	B	R △	G ×	B △	R	G	B
R	G	B	R △	G	B △	R	G	B

11) Sample for judgment of defect visibility (Limit Sample) shall be agreed if necessary.
The other defect items shall be added if necessary.

12) The bump which size is as 0.6<D≦0.8 should be judged by the limit sample.

10. PRECAUTION

Please pay attention to the followings when a TFT module with a backlight 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) 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.

(4) 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.

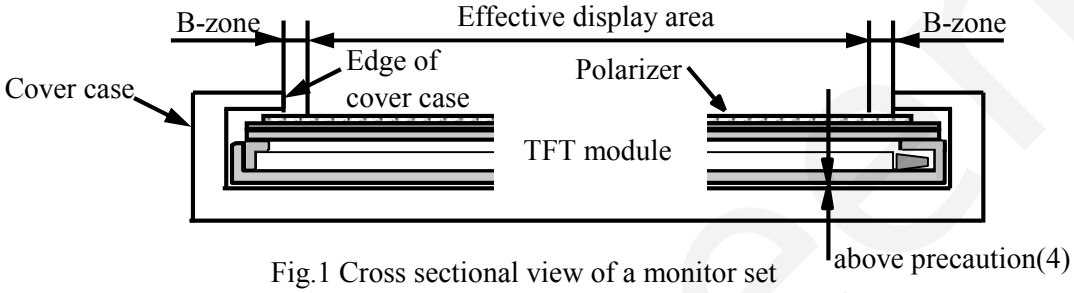


Fig.1 Cross sectional view of a monitor set

(5) The edge of a cover case should be located inside more than 1mm from the edge of a polarizer edge.

(6) 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.

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

(8) 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.

(9) 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 or Isopropyl alcohol 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.

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

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

(12) A module should not be handled with bare hand or dirty gloves. Otherwise, color of a module fixed sheet and metal 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.

(13) Printed circuits board part should not be held and touched. It may cause not to operate properly.

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:

-100mV ≦ over- and under- shoot of VDD ≦ +100mV

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.

(4) Sudden temperature change may cause dew on and/or in the a module. Dew makes 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 backlight 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 data are on-state. I/F connectors should be inserted and pulled after power supply and signal data 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℃ 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 Panasonic Liquid Crystal Display's shipping box.

10.6 Precaution to handling protection film

(1) The protection film for polarizers should be peeled 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 or Isopropyl alcohol. 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 or Isopropyl alcohol.

10.7 Safety

(1) Since a TFT cell is 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 backlight drives by high voltage.

10.8 Environmental protection

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 Panasonic Liquid Crystal Display Co.,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.

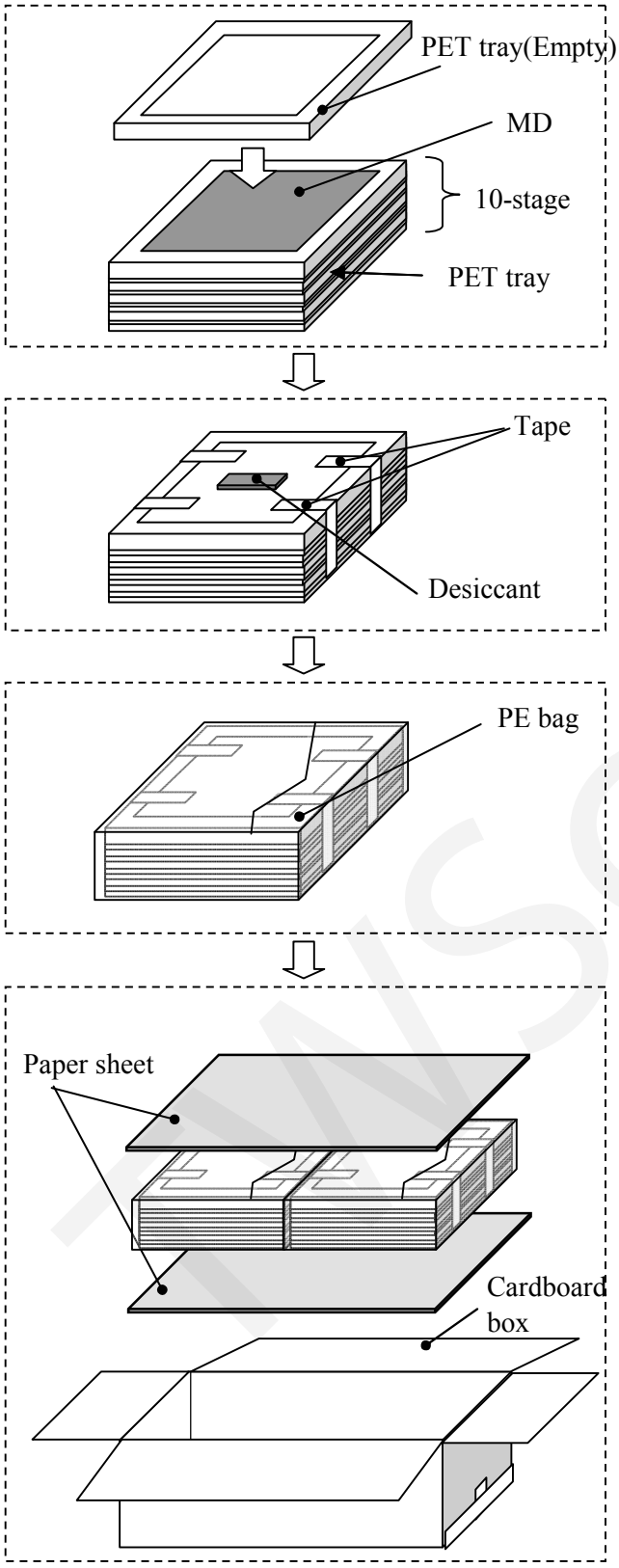
10.10 Others

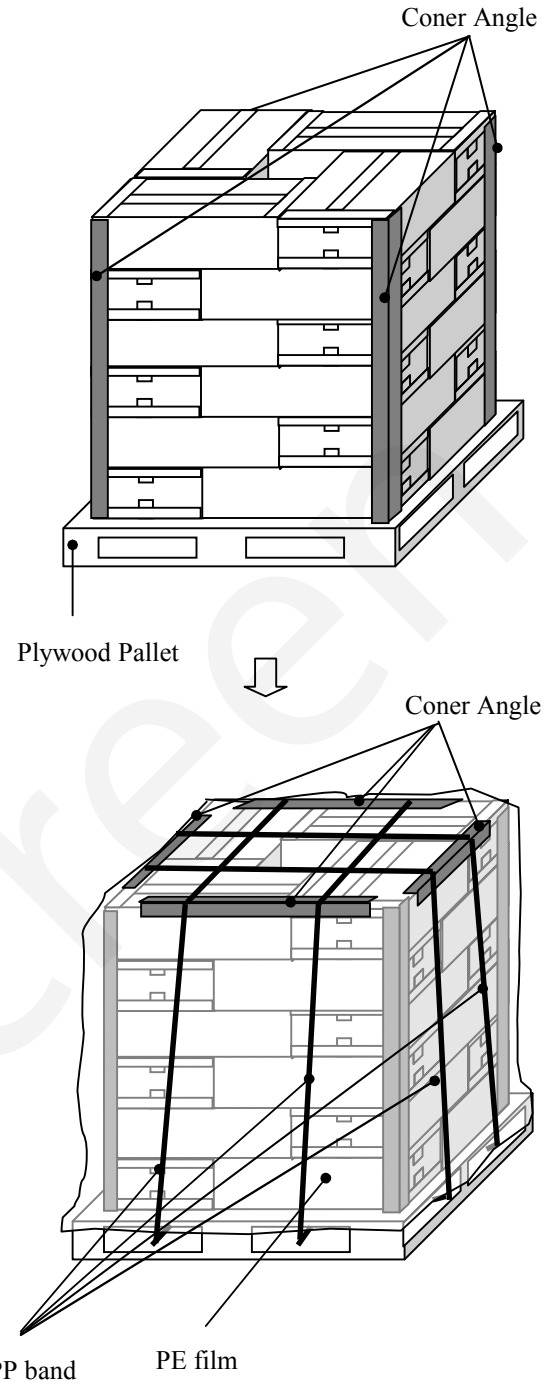
Electrical components which may not affect electrical performance are subjective to change without notice because of their availability.

11. PACKING

11.1 Precaution to handling and mounting

1) Standard packing specification

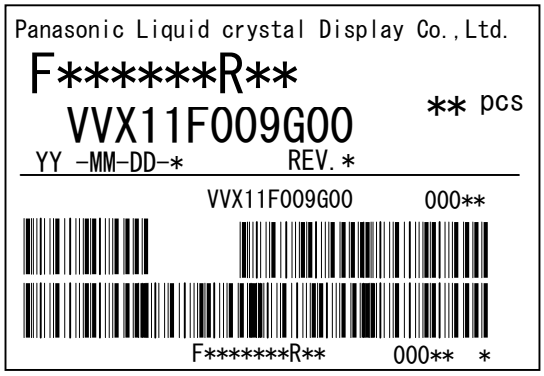




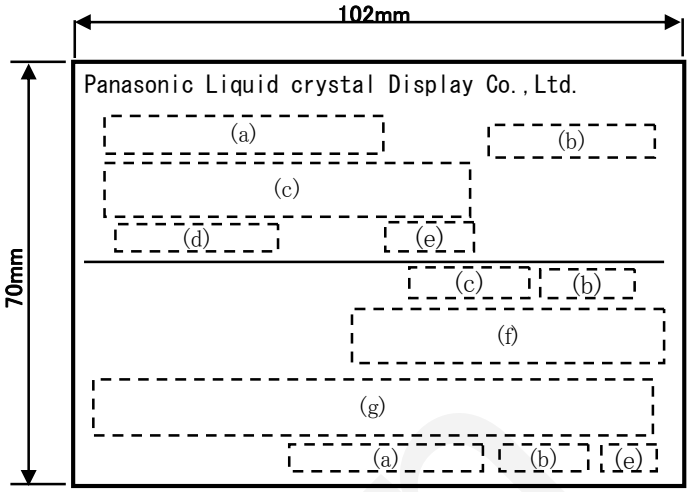
Package information

ITEMS	Box	Pallet
Size [mm]	530 × 375 × 175	1100 × 1100 × 1300
Product quantity [Pieces]	20	480
Weight [kg]	5.6	160

11.2 Label sample of packing box



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



Code	Contents of Printing
(a)	PLD internal code.
(b)	Quantity of the product (pcs)
(c)	This shows product name.
(d)	Lot of registration
(e)	Revision
(f)	Bar codes correspond to (c), (b).
(g)	Bar codes correspond to (a), (b), (e).

12. Reliability test

No.	Item	condition	Quantity	Period		Note
				determination	end	
1	Low Temperature / Operating	Ta=0℃	3	48h	500h	
2	High Temperature / Operating	Ta=50℃	3	48h	500h	
3	High Temperature High Humidity / Operating	45℃ 90%RH	3	48h	48h	
4	Low Temperature / Strage	Ta=-30℃	3	48h	500h	
5	High Temperature / Strage	Ta=70℃	3	48h	500h	
6	High Temperature High Humidity / Strage	60℃ 93%RH	3	48h	500h	
7	Heat shock	-30/70℃ 2h / 2h	3	12cy.	200cy	1)
8	Vabration / operationg	Random, 1.1 Grms (X, Y, Z)	3	20 minutes for each direction	-	2)
9	Vabration / non-operationg	Random, 2.3 Grms (X, Y, Z)	3	20 minutes for each direction	-	3)
10	Shock / operationg	Half sine wave, 120G, 3ms (±X, ±Y, ±Z)	3	1 shock for each direction	-	
11	Shock / non-operationg	Half sine wave, 210G, 3ms (±X, ±Y, ±Z)	3	1 shock for each direction	-	
12	Altitude / Operating	700hPa (3000m)	3	48h	-	
13	Altitude / Storage	260hPa (10000m)	3	48h	-	

Note 1) Temperature slope: More than 10℃ / min.

2) 5-50Hz $0.024G^2$/Hz, 50-100Hz -36dB/oct

3) 5-50Hz $0.11G^2$/Hz, 50-100Hz -36dB/oct

Result Evaluation

Display function should be kept.