Panasonic Liquid Crystal Display Co.,Ltd.

Aug.20,2013

TECHNICAL DATA

VVX16T028J00

15.5"WQHD＋

CONTENTS

Please return 1 copy with your signature on this page for approval.

Accepted by: _____ Proposed by: _____

Date: _____

RECORD OF REVISION

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DESCRIPTION

The following specifications are applied to the following TFT LCD module.

Product Name : VVX16T028J00

General Specifications

Effective display area	: (H) 343.87×(V) 193.43	(mm)
Number of pixels	: (H) 2,880×(V) 1,620	(pixels)
Pixel pitch	: (H) 0.1194 × (V) 0.1194	(mm)
Color pixel arrangement	: R+G+B vertical stripe	
Display mode	: Transmissive mode Normally black mode	
Top polarizer type	: AG Coat (w/o Retardation Film)	
Number of colors	:16,777,216	(colors)
Input signal	: eDP 4Lanes	
Backlight	: 80 pieces of LED	
External dimensions	: Typ. (H) 359.5 × (V) 217.43 × (t) 3.0	(mm)
Weight	: Typ. 350	(g)

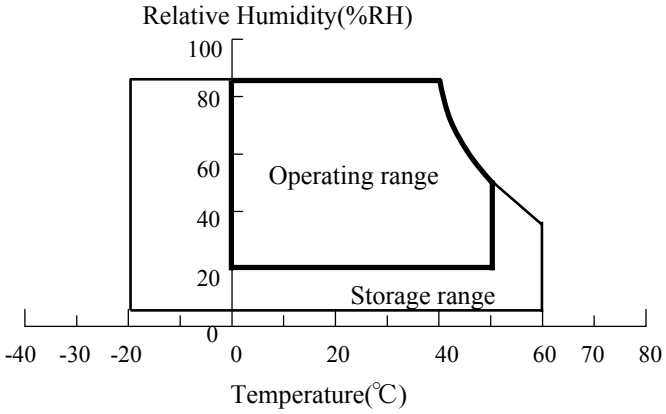
1. ABSOLUTE MAXIMUM RATINGS

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	-	-	4)		m/s^2	
Shock	-	-	5)		m/s^2	
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) Sine vibration (Non-OP) 1.0 G Zero-to peak,
1hr One sweep, 5 to 500 Hz, all 3 axes (X, Y, Z) .

6) Shock (Non-OP) Half sine 200 G, duration time 2 ms. 6axis(+-x,+-y,+-z)
One time each axcis.

1. 2 Electrical Absolute Maximum Ratings

(1)TFT-LCD module V_{SS} = 0 V

ITEM	SYMBOL	Min.	Max.	UNIT	NOTE
Power Supply Voltage	LCD_VCC	0	5.0	V	
Input Voltage for logic	V_I	-0.3	3.6	V	1)
LED Power Supply Voltage	BL_PWR	-0.3	25	V	
Electrostatic Durability	V_{ESD0}	+ / - 6 kV		kV	2)4)
	V_{ESD1}	+ / - 8 kV		kV	3)5)

Note 1) It is applied to LEDEN, LEDPWMI.

2) Contact discharge , 150pF/330 ohms

3) Air discharge , 150pF/ 330 ohms

4) Criteria : The loss of a temporary function and performance which need an operator's intervention or the reboot of a system.

5) Criteria : Temporary degradation and the loss of a function and performance in which self-recovery is possible, are allowed.

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.

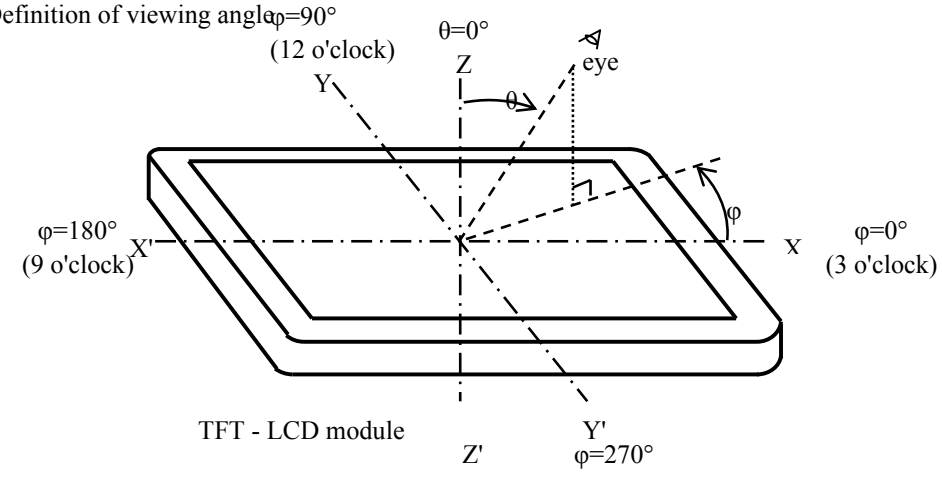
Measuring equipment : CS-1000A, or equivalent

Ambient Temperature =25 ℃ , LCD_VCC=3.3V , VLED=6.0～8.4V , f v=60 Hz ,

If=20mA (on duty 100%)

ITEM		SYMBOL	CONDITION	Min.	Typ.	Max.	UNIT	NOTE
Contrast ratio		CR	θ = 0 ° 1)	600	1000	-	-	1),2)
Response time (Rise + Fall)		Tr + Tf	θ = 0 ° 1)	-	21	30	ms	1),3)
Brightness of white		Bwh		280	350	-	cd/m^2	1),4)
Brightness uniformity		Buni(5points)		-	-	1.33	-	1),5)-a)
		Buni(13points)		-	-	1.67		1),5)-b)
Color chromaticity (CIE)	Red	x	θ = 0 ° 1)	0.622	0.652	0.682	-	1) 【Gray scale =255】
		y		0.299	0.329	0.359		
	Green	x		0.294	0.324	0.354		
		y		0.570	0.600	0.630		
	Blue	x		0.120	0.150	0.180		
		y		0.015	0.045	0.075		
	White	x		0.283	0.313	0.343		
		y		0.299	0.329	0.359		
View Angle	Right	−	θ=80 °, ϕ =0°	10	-	-	-	1)
	Left	−	θ=80 °, ϕ =180°	10	-	-		
	Top	−	θ=80 °, ϕ =90°	10	-	-		
	Bottom	−	θ=80 °, ϕ =270°	10	-	-		
NTSC		−	θ = 0 ° 1)	−	72	-	%	1)
W,R,G,B Gamma		−	θ = 0 °	-	2.2	-	-	1)
Cross talk		−	θ= 0 °	−	−	5	%	1),6)
Leakage light		−	θ= 45 °	No Light leakage			-	7)

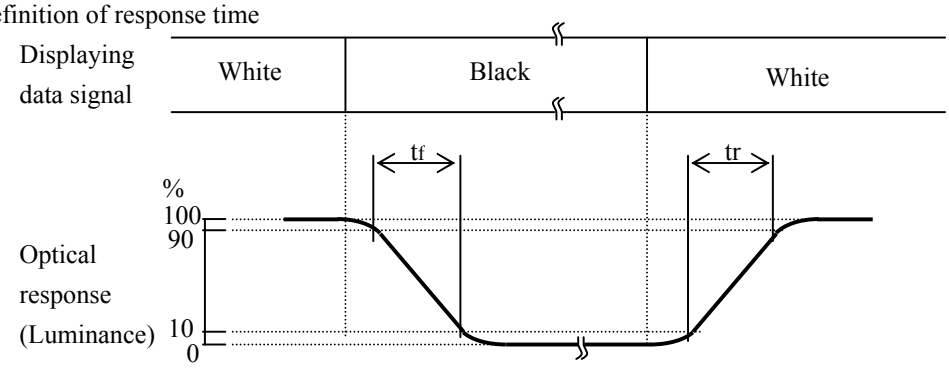
Note 1) Definition of viewing angle



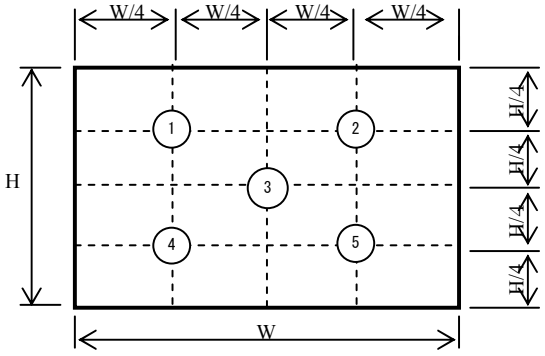
2) Definition of contrast ratio (CR)

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

3) Definition of response time



4) Definition of Brightness

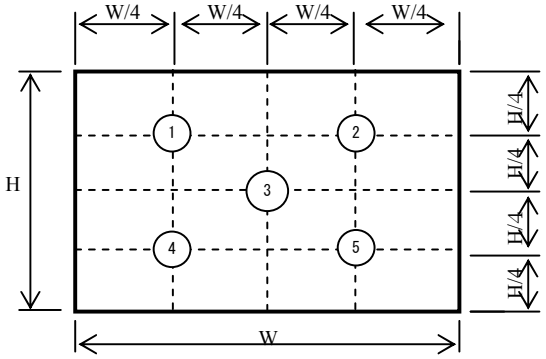


①～⑤: measuring points

Bwh = (①+②+③+④+⑤)/5

5) Definition of Uniformity

a) 5 Points

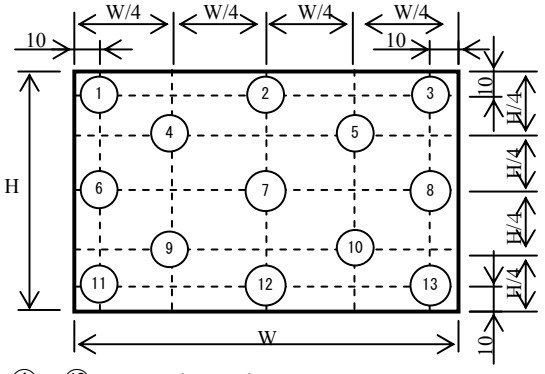


①～⑤: measuring points

Buni (5 Points) = max(①～⑤)/min(①～⑤)

b) 13 Points

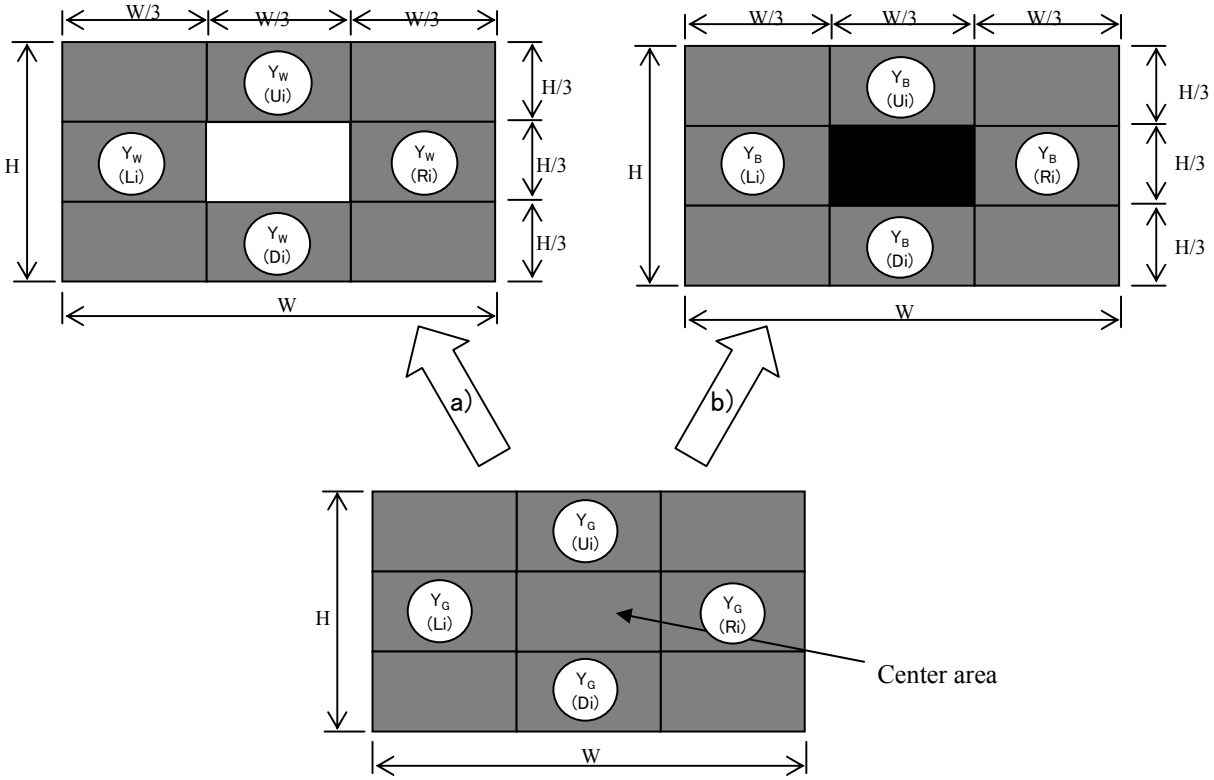
Unit : mm



①～⑬: measuring points

Buni (13 Points) = max(①～⑬)/min(①～⑬)

Note 6) Definition of Cross talk



a) Center area : White

$$CT = \frac{|Y_W(X_{127}) - Y_G(X_{127})|}{Y_G(X_{127})} \times 100\%$$

b) Center area : Black

$$CT = \frac{|Y_B(X_{127}) - Y_G(X_{127})|}{Y_G(X_{127})} \times 100\%$$

Note: x=U,D,L and R, X_{127} = Gray scale 127

Note 7)

Use ND filter(6%). The position of ND filter is on TFT-LCD module.

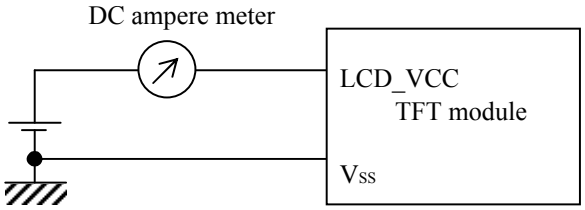
3. ELECTRICAL CHARACTERISTICS

3. 1 TFT-LCD module

Ta = 25℃ , V_{SS} = 0 V

ITEM		SYMBOL	Min.	Typ.	Max.	UNIT	NOTE
Power supply voltage		LCD_VCC	3.0	3.3	3.6	V	
Power supply current		Icc	-	0.4	1.4	A	1)
Ripple voltage of power supply		V_{CCR}	-	-	(100)	mV	
Logic signals input voltage	High	VIH	1.62	-	3.3	V	BL_ENABLE, BL_PWM_DIM
	Low	VIL	0	-	0.65	V	
I2C BUS input voltage	High	VIH2	1.62	1.8	1.98	V	SCL, SDA
	Low	VIL2	0	-	0.8	V	

Note 1) Typ. : display pattern is white raster.
Max. : display pattern is horizontal stripe. (white and black)



3. 2 Backlight unit

Ta=25℃

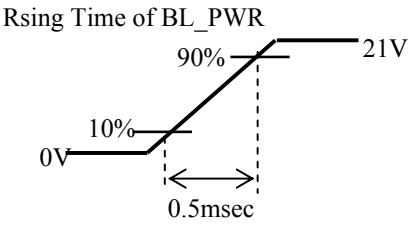
ITEM		SYMBOL	Min.	Typ.	Max.	UNIT	NOTE
Power supply voltage		BL_PWR	6.0	-	21	V	
Power inrush current		I_BL_P	-	-	2	A	1)
Power Consumption		Pbl	-	5.3	5.8	W	2)
PWM	Duty	PD	0	-	100	%	
	Frequency	PF	0.1	-	5	kHz	3)
LED Life time		-	12,000	-	-	h	4)

Note

1)Mesure Condition

Power Supply:Kikusui PBZ40-10

Rsing Time of BL_PWR : refer to the right figure.



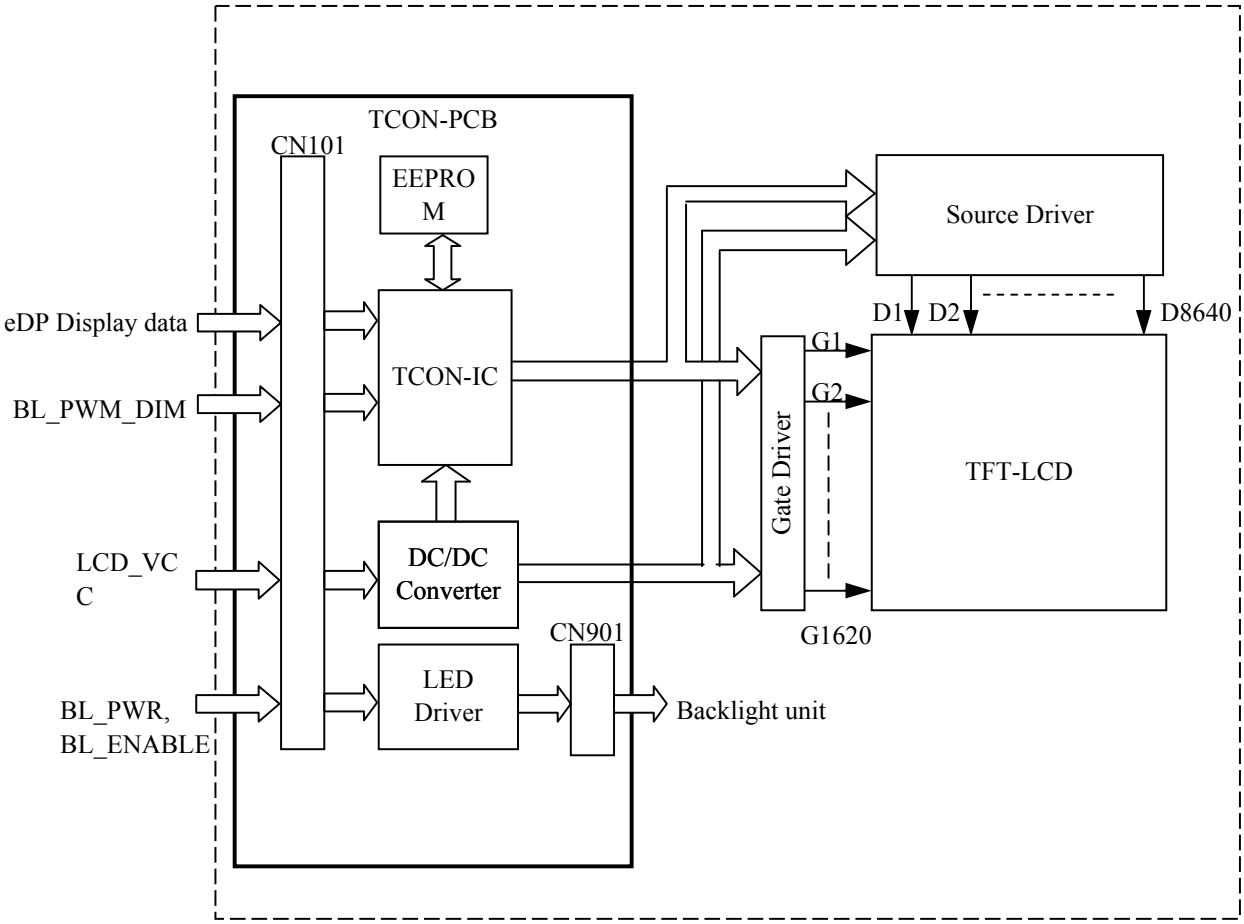
2) This characteristics should be applied putting on the LED about 60 minutes later with ambient temperature. (Ta = 25 ℃ ± 2 ℃)

3) Duty（Min） is 1%

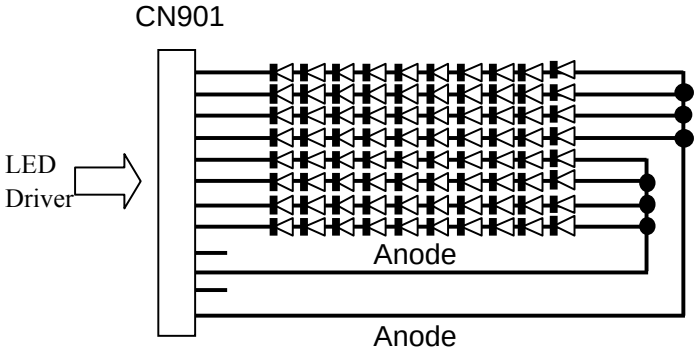
4) Life time of a LED is defined as follows.
The life is determined as the time at which brightness of the LED is 50 % compared to that of initial value at that typical forward current on condition of continuous operating at 25 ± 2 ℃.

4. BLOCK DIAGRAM

4. 1 TFT-LCD module



4. 2 Backlight unit



5. INTERFACE PIN ASSIGNMENT

5. 1 TFT-LCD module

CN101:JAE (HD1S040HA1R6000)

PIN No.	SYMBOL	DESCRIPTION	Note
1	WP	EEPROM Write Protect	1
2	H_GND	High Speed Ground(0V)	
3	eDP_Rx_3N	Complement Signal Link Lane 3	
4	eDP_Rx_3P	True Signal Link Lane 3	
5	H_GND	High Speed Ground(0V)	
6	eDP_Rx_2N	Complement Signal Link Lane 2	
7	eDP_Rx_2P	True Signal Link Lane 2	
8	H_GND	High Speed Ground(0V)	
9	eDP_Rx_1N	Complement Signal Link Lane 1	
10	eDP_Rx_1P	True Signal Link Lane 1	
11	H_GND	High Speed Ground	
12	eDP_Rx_0N	Complement Signal Link Lane 0	
13	eDP_Rx_0P	True Signal Link Lane 0	
14	H_GND	High Speed Ground	
15	eDP_AUX_CH_P	True Signal Aux Channel	
16	eDP_AUX_CH_N	Complement Signal Aux Channel	
17	H_GND	High Speed Ground(0V)	
18	LCD_VCC	LCD logic and driver power	
19	LCD_VCC	LCD logic and driver power	
20	LCD_VCC	LCD logic and driver power	

PIN No.	SYMBOL	DESCRIPTION	Note
21	LCD_VCC	LCD logic and driver power	
22	TEST	LCD Test port	2
23	LCD_GND	LCD logic and driver ground(0V)	
24	LCD_GND	LCD logic and driver ground(0V)	
25	LCD_GND	LCD logic and driver ground(0V)	
26	LCD_GND	LCD logic and driver ground(0V)	
27	eDP_HPD	HPD signal pin	
28	BL_GND	Backlight ground(0V)	
29	BL_GND	Backlight ground(0V)	
30	BL_GND	Backlight ground(0V)	
31	BL_GND	Backlight ground(0V)	
32	BL_ENABLE	Backlight enable	3
33	BL_PWM_DIM	System PWM signal input	4
34	SDA	I2C-bus Data	5
35	SCL	I2C-bus Clock	
36	BL_PWR	Backlight power	
37	BL_PWR	Backlight power	
38	BL_PWR	Backlight power	
39	BL_PWR	Backlight power	
40	HSYNC	HSYNC output from Tcon	

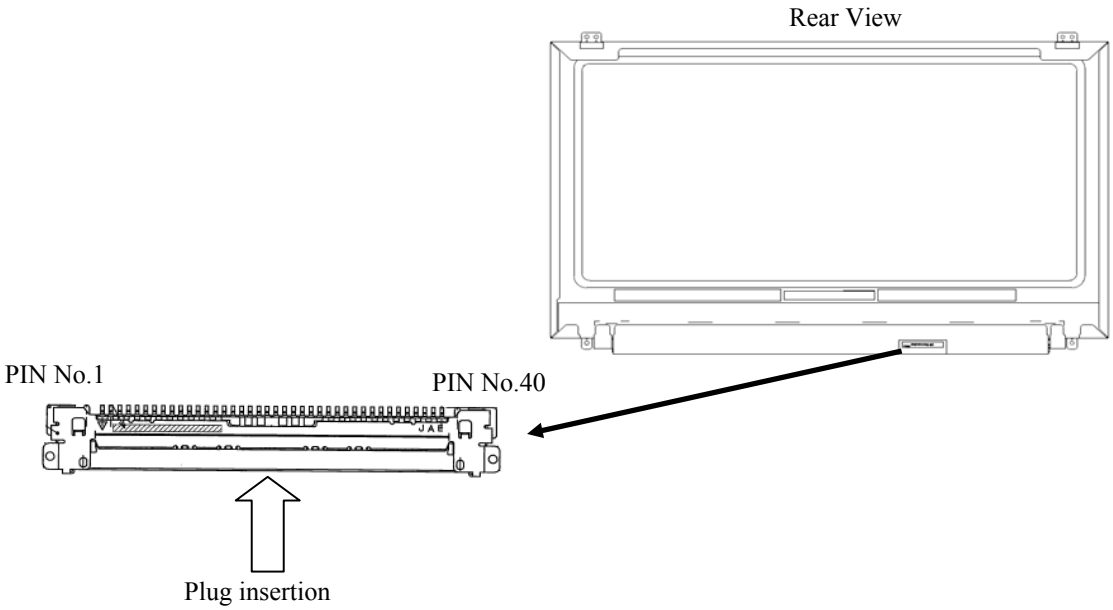
Notes 1) Keep open. Internal state = H (Write Protect)

2) Keep open or connect GND. Internal state = L (Di

3) L(Default) = Backlignt Disable, H = Backlight Enable

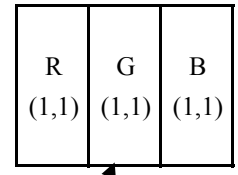
4) Internal state = L (Backlight is turned off)

5) The following I2C device and slave address are used in this product.
Please do not use them to other I2C devices.
A0(hex), C0(hex)



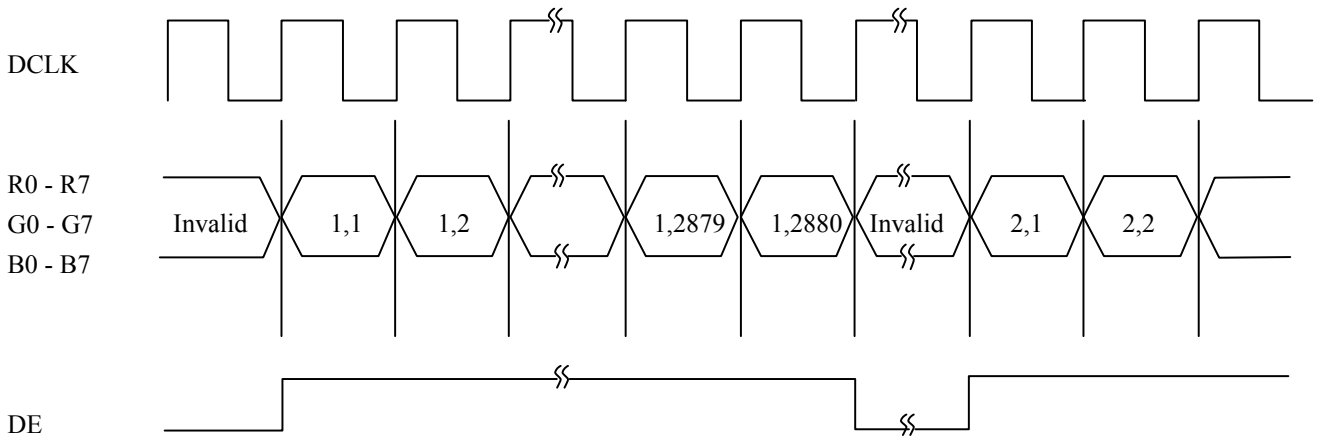
5. 2 Correspondence between input data and display image

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



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

1 , 1	1 , 2	1 , 3	- -	1 , 2880
2 , 1	2 , 2	2 , 3	- -	2 , 2880
3 , 1	3 , 2	3 , 3	- -	3 , 2880
⋮	⋮	⋮		⋮
1620 , 1	1620 , 2	1620 , 3		1620 , 2880



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	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.

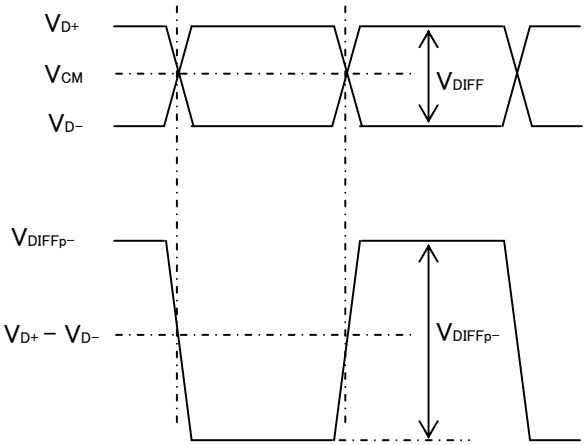
Larger n corresponds to brighter level.

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
$V_{DIFFp-p}$	Differential peak-to-peak input voltage	120		1200	mV	
V_{CM}	DC common mode voltage	0		2.0	V	
R_{TERM}	Differential termination resistance		100		Ω	
I_{SHORT}	Short circuit current limit			50	mA	
L_{SKEW}	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	
$V_{AUX\_DIFFp-p}$	AUX Differential peak-to-peak input voltage	0.32		1.32	V	
V_{AUX_CM}	AUX DC common mode voltage	0		2.0	V	
R_{AUX_TERM}	AUX CH termination resistance		100		Ω	
I_{AUX_SHORT}	AUX Short circuit current limit			90	mA	
C_{AUX}	AUX AC coupling capacitor		100		nF	

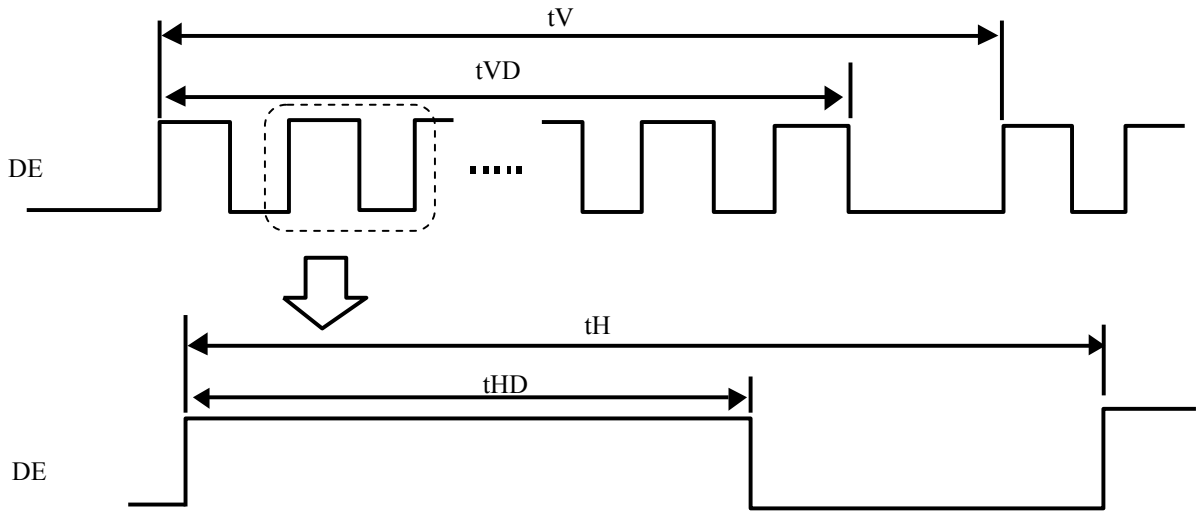
6. 2 eDP 4lane 8bit input data mapping

Lane0	Lane1	Lane2	Lane3
R1-7:0	R2-7:0	R3-7:0	R4-7:0
G1-7:0	G2-7:0	G3-7:0	G4-7:0
B1-7:0	B2-7:0	B3-7:0	B4-7:0
R5-7:0	R6-7:0	R7-7:0	R8-7:0
G5-7:0	G6-7:0	G7-7:0	G8-7:0
B5-7:0	B6-7:0	B7-7:0	B8-7:0
R9-7:0	R10-7:0	R11-7:0	R12-7:0
G9-7:0	G10-7:0	G11-7:0	G12-7:0
B9-7:0	B10-7:0	B11-7:0	B12-7:0

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



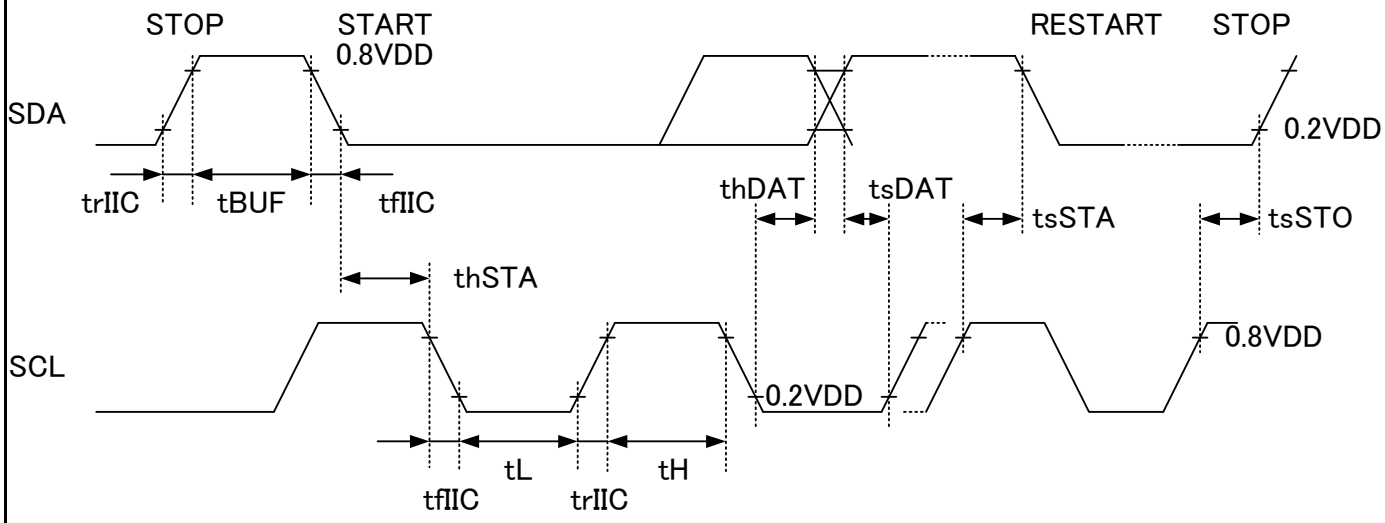
(60Hz)

ITEM		SYMBOL	Min.	Typ.	Max.	UNIT	NOTE
DE	Vertical Frequency	fV	49	60	61	Hz	
	Vertical Period	tV	1634	1639	1985	tH	
	Vertical Valid	tVD		1620		tH	
	Horizontal Frequency	fH	96	98	100	kHz	
	Horizontal Period	tH	3024	3076	3152	tCLK	
	Horizontal Valid	tHD		2880		tCLK	

(50Hz)

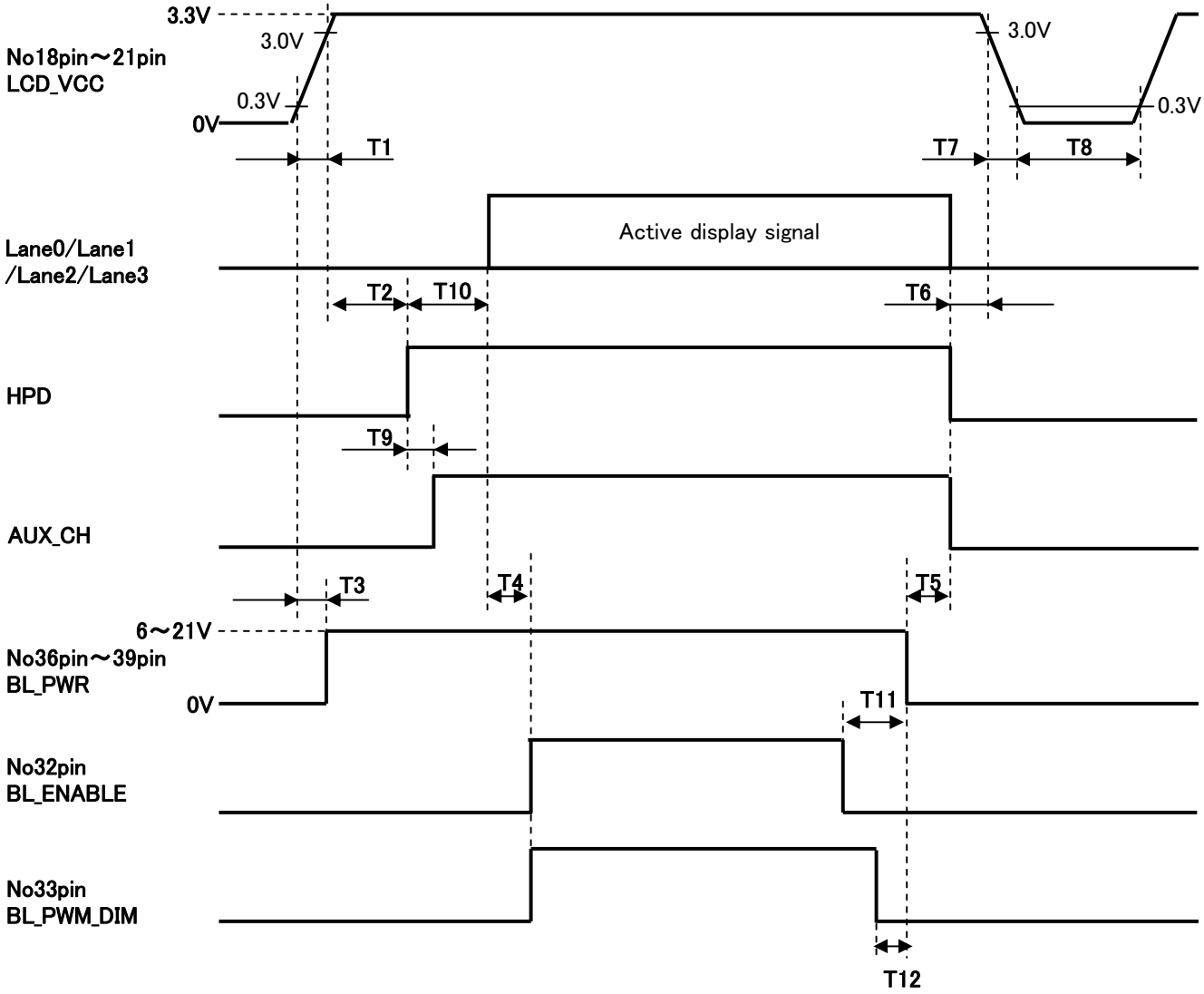
ITEM		SYMBOL	Min.	Typ.	Max.	UNIT	NOTE
DE	Vertical Frequency	fV	49	50	61	Hz	
	Vertical Period	tV	1634	1967	1985	tH	
	Vertical Valid	tVD		1620		tH	
	Horizontal Frequency	fH	96	98	100	kHz	
	Horizontal Period	tH	3024	3076	3152	tCLK	
	Horizontal Valid	tHD		2880		tCLK	

6.5 I2C timing



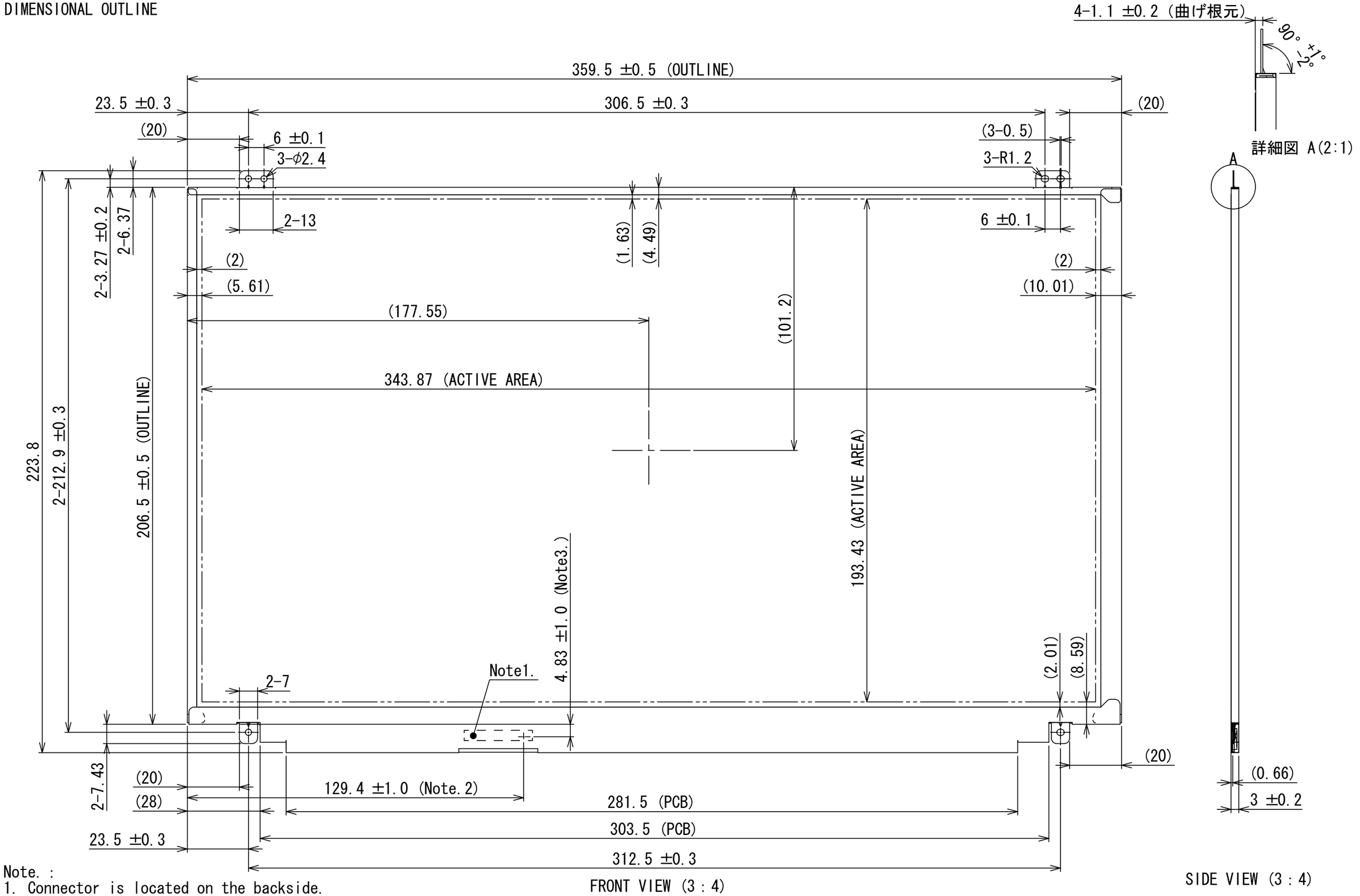
Parameter	Symbol	Conditions	Rating			Unit
			MIN	TYP	MAX	
SCL Clock Frequency	fscl	See. Upper Fig.	1	-	100	kHz
STOP START Interval	tBUF		4.7	-	-	μs
START HOLD Time	thSTA		4.0	-	-	μs
RESTART SETUP Time	tsSTA		4.7	-	-	μs
STOP SETUP Time	tsSTO		4.7	-	-	μs
Rize Time	trIIC		-	-	1.0	μs
Fall Time	tfIIC		-	-	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	–	–	200	ms	
T3	0	–	–	ms	
T4	50	–	–	ms	
T5	50	–	–	ms	
T6	0	–	500	ms	
T7	–	–	10	ms	
T8	500	–	–	ms	
T9	0	–	–	ms	
T10	10	–	–	ms	
T11	0	–	–	ms	
T12	0	–	–	ms	

DIMENSIONAL OUTLINE

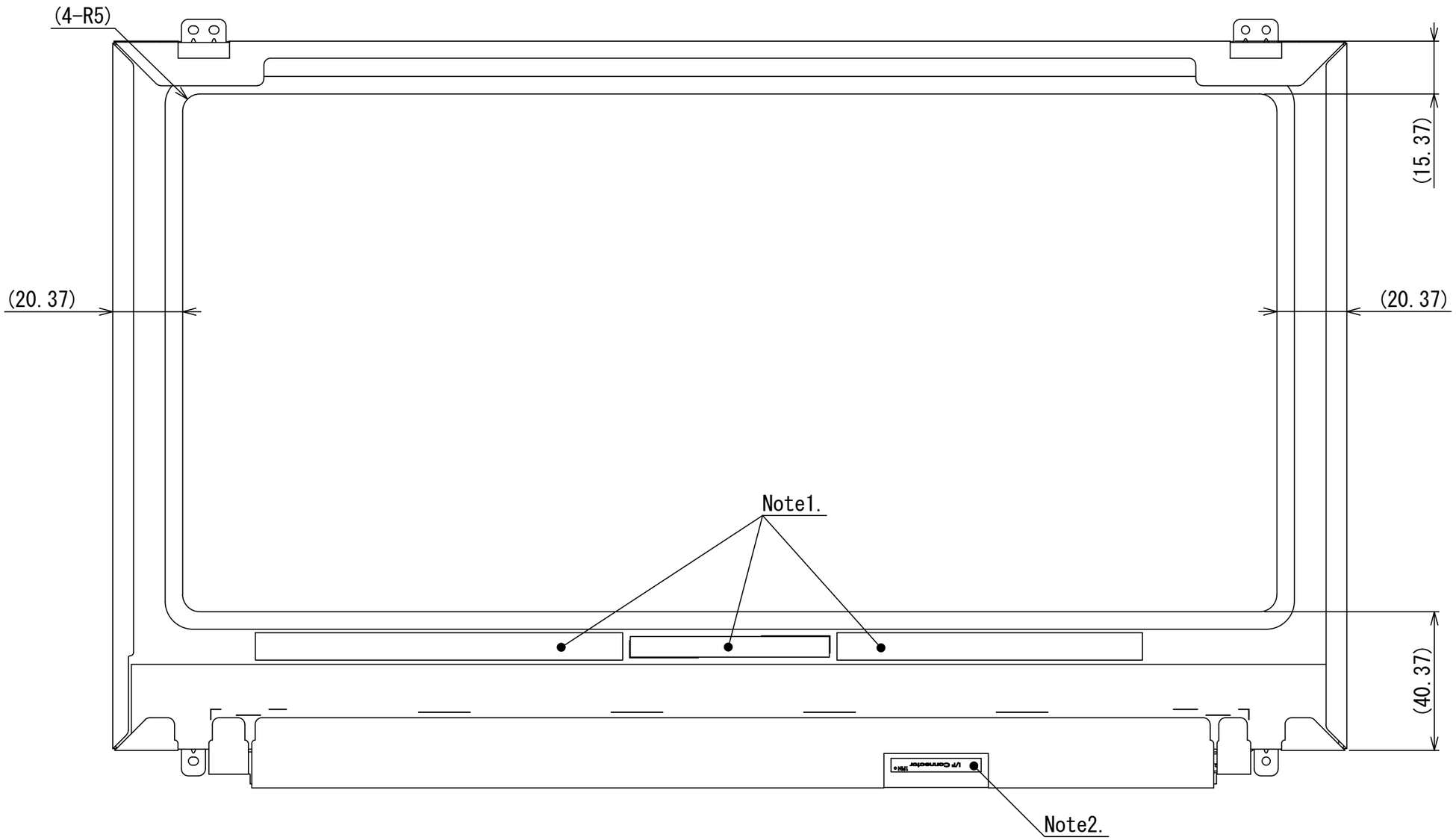


FRONT VIEW (3 : 4)

SIDE VIEW (3 : 4)

Note. :
1. Connector is located on the backside.
2. Dimension means the center of #1 pin to the outline of module.
3. Dimension means the fitting part of connector to the outline of module.

Panasonic Liquid Crystal Display Co., Ltd	Date	Aug. 9. 2013	Sheet No.	IPS4PS2610 VVX16T028J00 -1	Page	10-1/2



REAR VIEW (3 : 4)

Note. :
1. These are the labels.
2. Connector is JAE HD1S040HAR6000.

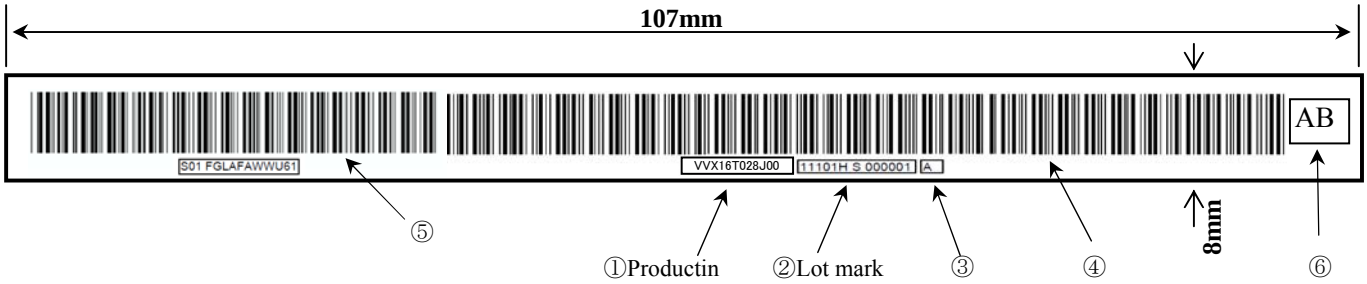
Panasonic Liquid Crystal Display Co., Ltd	Date	Aug. 9. 2013	Sheet No.	IPS4PS2610 VVX16T028J00 -1	Page	10-2/2	

8. LABEL FORMAT

8.1 Module Label

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

The style of character will be changed without notice.



① VVX16T028J00

② Please refer to 8.3.

③ Please refer to 8.2.

④ Contents of ①～③ are indicated by bar codes.【Express by the code 39.】

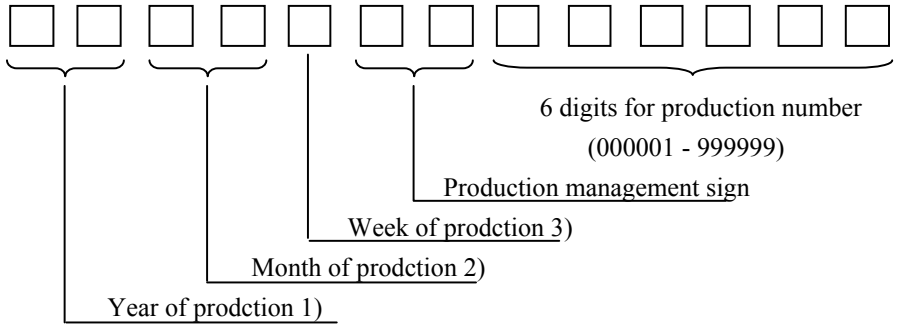
⑤ A cord for production of PLD inside management.

⑥ PLD internal code.

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



1)

Mark	Year
11	2011
12	2012
13	2013

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

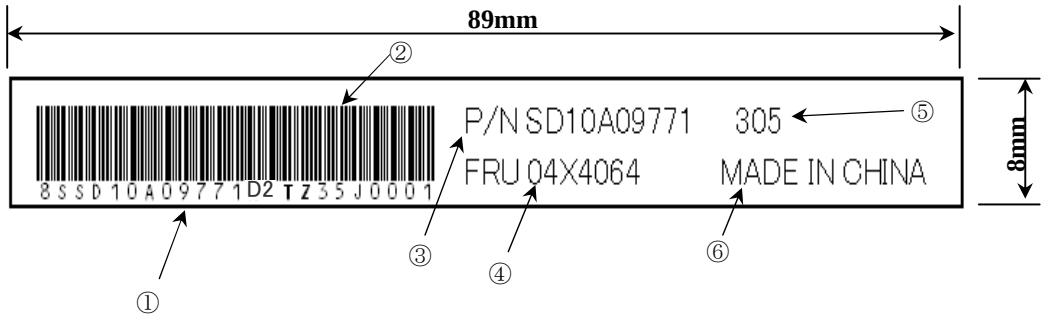
3)

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

8.4 Lavel of Customer

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

The style of character will be changed without notice.



① Code of costermer (Please refer to 8.5.)

② Contents of ① are indicated by bar codes.【Express by the code 39.】

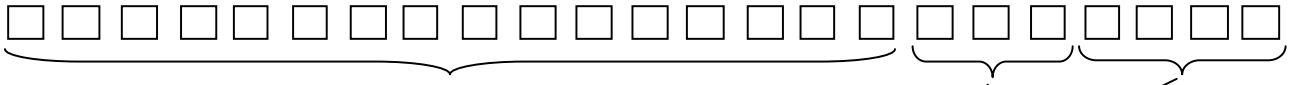
③ 10 digits for production number

④ Fix code of costermer

⑤ Year and Month of prodction (Please refer to 8.6.)

⑥ Origin

8.5 Code of costermer

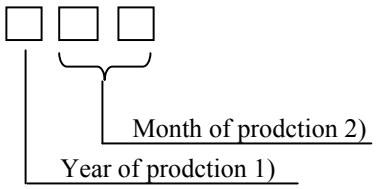


Fix code of costermer

4 digits for production number
(0001 - 9999)

Year and Month and Day of production
(Please refer to 8.6.-1),3),4))

8.6 Year and Month of production



1)

Mark	Year
3	2013
4	2014
5	2015

3)

Mark	Month
1～9	1～9
10	A
11	B
12	C

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

4)

Mark	Day	Mark	Day	Mark	Day
01	1	11	B	21	M
02	2	12	C	22	N
03	3	13	D	23	P
04	4	14	E	24	R
05	5	15	F	25	S
06	6	16	G	26	T
07	7	17	H	27	V
08	8	18	J	28	W
09	9	19	K	29	X
10	A	20	L	30	Y
				31	Z

9. COSMETIC SPECIFICATIONS

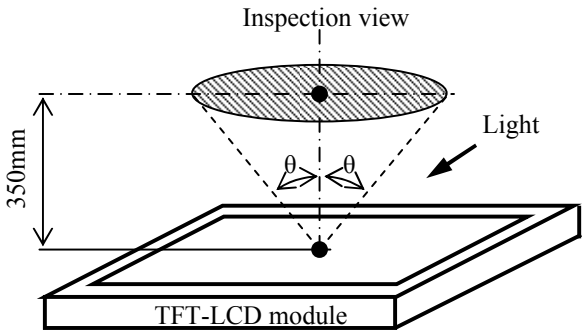
9.1 Condition for cosmetic inspection

(1) Viewing zone

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

θ≦45° : when non-operating inspection

θ≦45° : when operating inspection



b) Inspection should be executed only from front side and only display area(Azone).
Cosmetic of B-zone and C-zone are ignore.
Tarnish of Fixed tape which may not affect electrical performance are ignore.
(refer to 9.2 Definition of zone)

(2) Environmental

a) Temperature : 25 degrees

b) Ambient light : about 300-500 lx and non-directive when operating inspection.
: about 1000-1300 lx and non-directive when non-operating inspection.

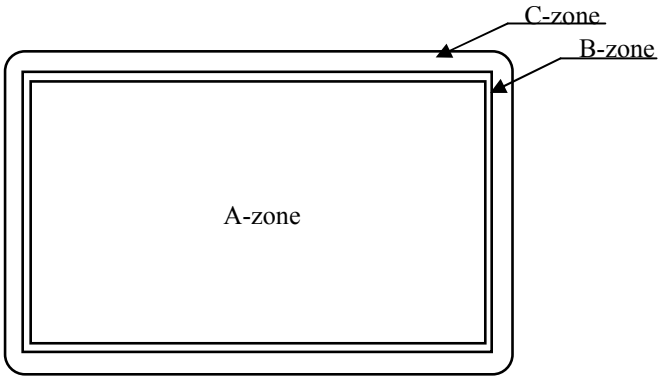
c) Backlight : when non-operating inspection, backlight should be off .

9.2 Definition of zone

・A-zone : Display area (pixel area)

・B-zone : Area between C-zone and display area

・C-zone : Fixed tape 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	Unit	Note
1	Dot defect	Bright Dot of G	1-dot	0	pcs	1),3)
		Bright Dot of R	1-dot	2	pcs	1),2),5)
			2-dots	0		
		Bright Dot of B	1-dot	2	pcs	1),4),5)
			2-dots	0		
		total		2	pcs	-
2	Black Dot defect	1-dot		5	pcs	1),6),7)
		2-dots		0		
		Density		0		
	total			5	pcs	-
3	Line defect			Serious one is not allowed	-	-
4	Uneven brightness					
5	Stain inclusion (Line shape, W : width (mm), L : length (mm))	W≦0.02	L:Ignore	Ignore	pcs	7),8)
		0.02＜W≦0.1	L≦3.0	3		
			3.0＜L	0		
		W＞0.1	—	(See dot shape)		
6	Scratch on polarizer (Line shape, W : width (mm), L : length (mm))	W≦0.02	L:Ignore	Ignore	pcs	7),9)
		0.02＜W≦0.1	L≦3.0	3		
			3.0＜L	0		
		W＞0.1	—	(See dot shape)		
7	・Stain inclusion (Dot shape, D : ave. dia (mm))	D≦0.2		Ignore		8),9)
		0.2＜D≦0.4		3		
		0.4＜D		0		
8	・Scratch onpolarizer (Dot shape, D : ave. dia (mm)) ・Bubbles, peeling in polarizer (D : ave. dia (mm))	D≦0.2		Ignore		
		0.2＜D≦0.4		3		
		0.4＜D		0		
9	Wrinkles on polarizer			Serious one is not allowed.	-	-

Note

1) Dot defect : defect area > 1/2 dot.
2) Bright Dot of Red: 160 < brightness *Total : 256 stair
3) Bright Dot of Green : 96 < brightness *Total : 256 stair
4) Bright Dot of Blue: 200 < brightness *Total : 256 stair
5) Number of defect dots inside φ15mm (There is the distance between defects more than 15mm.)
6) Black of dot is less than 70% at white. (visible to eye)
7) Number of defect dots inside φ5mm (There is the distance between defects more than 5mm.)
8) Those stains which can be wiped out easily are acceptable.
9) Polarizer area inside of B-zone is not applied.
10) No major (serious) defects when viewed in gray scale mode.

9.4 Mura inspection

1)Ambient light: 80 lux

2)Use ND filter(6%). The position of ND filter is on TFT-LCD module.

3)View Distance: 350mm

4)Checking angle: $\theta \leqq 45^{\circ}$

5)Checking time: 3sec

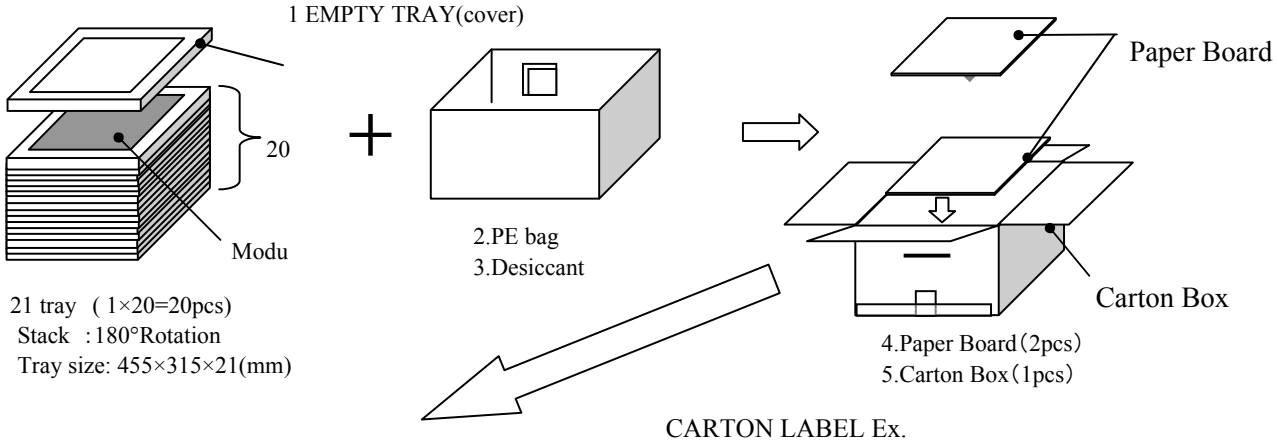
6) Display pattern

Band mura Gray(127/256 stair)

Curtain mura：Full Black(0/256 stair)

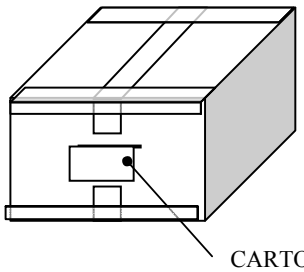
10. PACKING

10.1 Outer Carton package



1. 21 tray (1×20=20pcs)
   Stack :180°Rotation
   Tray size: 455×315×21(mm)

4.Paper Board（2pcs）
5.Carton Box（1pcs）



5.Carton Box（1pcs）
6.CARTON LABEL

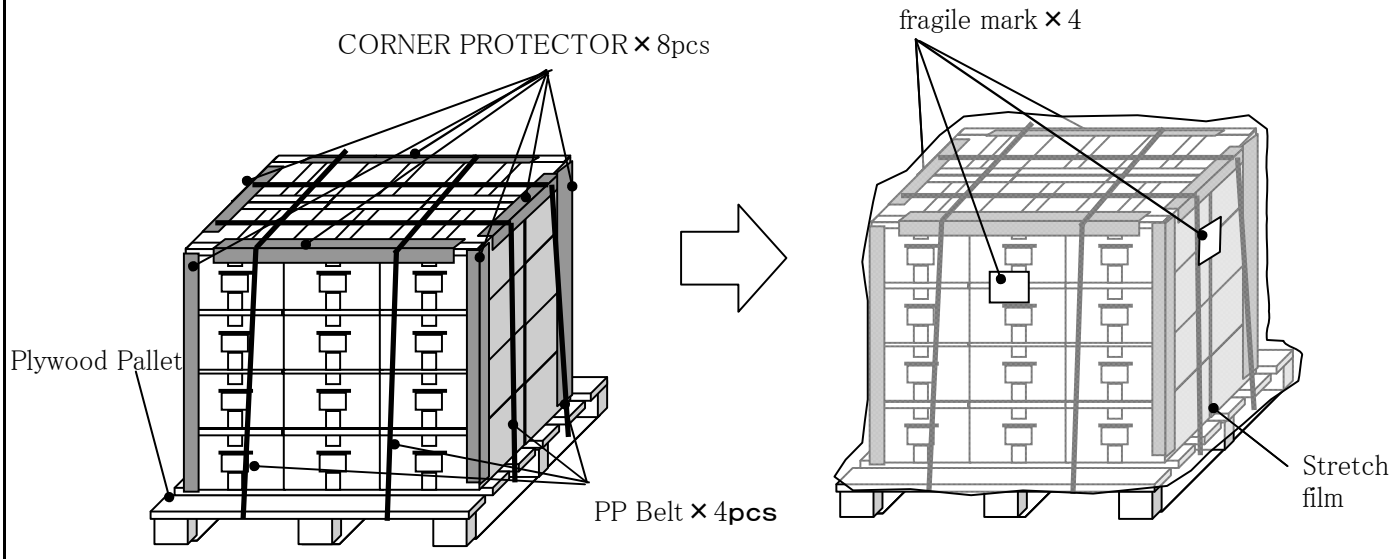
CARTON LABEL Ex.

10.2 Pallet Package

①Pile up Carton box 24 on pallet (3×2×4) .

②Attach the cardboard to the 4 corners of the side. Wrap the stretch film around pallet.
Attach 4 pieces of card board to the top of pallet. Fix to the pallet in the band.

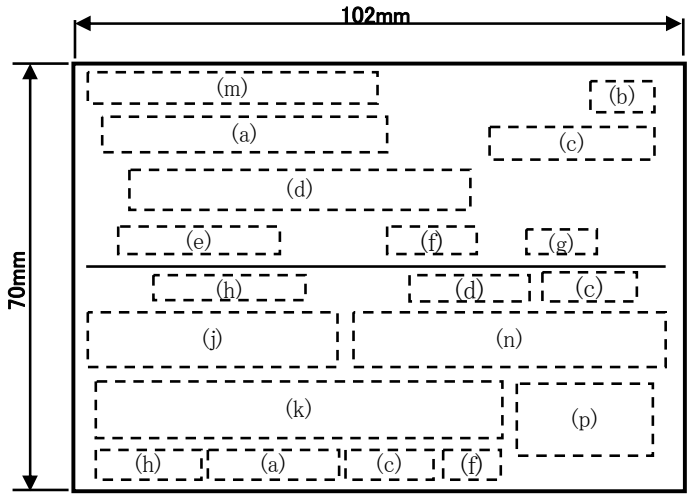
③Stick fragile marks×4 on stretch film. (The height to stick is the 2nd box from a top.)



Packing size: 110 x 110 x 148 (cm)
Package weight: 120 (kg)
Capacity: 480 (pcs)

※Pile up inner box on the center of pallet.
※Wrap stretch film uniformity.
※Must not twist packing strap.

10.3 Package Label



Code	Contents of Printing
(a)	PLD internal code.
(b)	The place of issuing label.
(c)	Quantity of the product (pcs)
(d)	This shows product name.(VVX16T028J00)
(e)	Lot of registration
(f)	Revision (Rev.)
(g)	PLD internal code.
(h)	Serial No. of identification tag Serial No. is defined as follows. 1 7 11 B 0001 Serial No. (0001～9999 and A000~Z9999) must be continuous. Do not reset. Date (Refer to the table 1.) The production base refers to Note (1) Base Code mentioned above. Month (Refer to the table 2.) Year (Last 1digit of AD)
(j)	Bar code corresponds to (h).
(k)	Bar codes correspond to (h), (a),(c) and (f).
(m)	PLD company name.
(n)	Bar codes correspond to (d), (c).
(p)	Custermer internal code. P/N 0C00341 1ZN7X

Table 1 Date ※Do not use I.O.

Date	1	2	3	4	5	6	7	8	9	10	11	12
Code	1	2	3	4	5	6	7	8	9	A	B	C
Date	13	14	15	16	17	18	19	20	21	22	23	24
Code	D	E	F	G	H	J	K	L	M	N	P	Q
Date	25	26	27	28	29	30	31					
Code	R	S	T	U	V	W	X					

Table 2 Month ※Do not use I.O.

Month	1	2	3	4	5	6	7	8	9	10	11	12
Code	A	B	C	D	E	F	G	H	J	K	L	M

11. PRECAUTION

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

11.1 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.

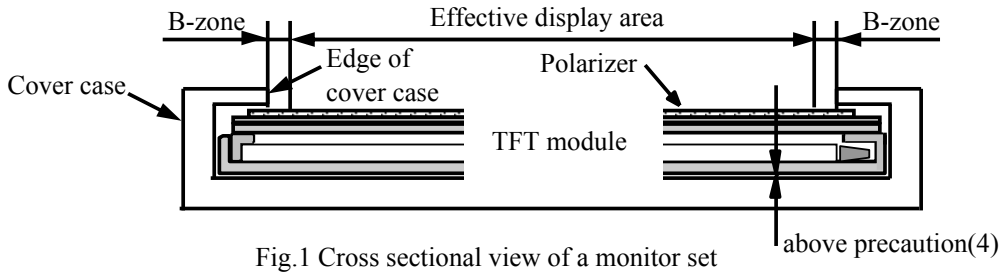


Fig.1 Cross sectional view of a monitor set

(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.

11.3 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.

11.4 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.

11.5 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.

11.6 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.

11.7 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.

11.8 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.

11.9 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.

11.10 Others

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

APPENDIX A EDID(1)

Address (Dec)	Address (Hex)	Field Name and Comments	Value (Hex)		Value (Binary)	Value (Binary)
0	00	Header	0	0	0 0 0 0 0 0 0 0	Header
1	01		F	F	1 1 1 1 1 1 1 1	
2	02		F	F	1 1 1 1 1 1 1 1	
3	03		F	F	1 1 1 1 1 1 1 1	
4	04		F	F	1 1 1 1 1 1 1 1	
5	05		F	F	1 1 1 1 1 1 1 1	
6	06		F	F	1 1 1 1 1 1 1 1	
7	07		0	0	0 0 0 0 0 0 0 0	
8	08	ID Manufacture Name "Panasonic(MEI)"	3	4	0 0 1 1 0 1 0 0	Vendor Product ID Serial No
9	09		A	9	1 0 1 0 1 0 0 1	
10	0A	ID Product Code	A	2	1 0 1 0 0 0 1 0	
11	0B		9	6	1 0 0 1 0 1 1 0	
12	0C	ID Serial Number	0	0	0 0 0 0 0 0 0 0	
13	0D		0	0	0 0 0 0 0 0 0 0	
14	0E		0	0	0 0 0 0 0 0 0 0	
15	0F		0	0	0 0 0 0 0 0 0 0	
16	10	Week of Manufacture (Week not use,)	F	F	1 1 1 1 1 1 1 1	Week & Year
17	11	Model Year	1	7	0 0 0 1 0 1 1 1	
18	12	EDID Structure Version Numver = 01h	0	1	0 0 0 0 0 0 0 1	EDID
19	13	EDID Structure Revisio Numver = 04h	0	4	0 0 0 0 0 1 0 0	
20	14	Video Input Definision = Digital 8bit depth	A	0	1 0 1 0 0 0 0 0	Display Parameter
21	15	Horizontal Screen Sieze or Aspect Ratio	2	2	0 0 1 0 0 0 1 0	
22	16	Vertical Screen Size or Aspect Ration	1	3	0 0 0 1 0 0 1 1	
23	17	Display Transfer Characteristic(Gamma)	7	8	0 1 1 1 1 0 0 0	
24	18	Feature Support	0	2	0 0 0 0 0 0 1 0	
25	19	Red/Green Low Order Bits	1	2	0 0 0 1 0 0 1 0	Color Characteristic
26	1A	Blue/White Low Order Bits	A	1	1 0 1 0 0 0 0 1	
27	1B	Red-x : High Order Bits	A	7	1 0 1 0 0 1 1 1	
28	1C	Red-y : High Order Bits	5	4	0 1 0 1 0 1 0 0	
29	1D	Green-X : Hight Order Bits	5	3	0 1 0 1 0 0 1 1	
30	1E	Green-Y : Hight Order Bits	9	9	1 0 0 1 1 0 0 1	
31	1F	Blue-x : Hight Order Bits	2	6	0 0 1 0 0 1 1 0	
32	20	Blue-y : Hight Order Bits	0	B	0 0 0 0 1 0 1 1	
33	21	White-x : Htight Order Bits	5	0	0 1 0 1 0 0 0 0	
34	22	White-y : Hight Order Bits	5	4	0 1 0 1 0 1 0 0	
35	23	Established Timing Ⅰ	0	0	0 0 0 0 0 0 0 0	Established Timings
36	24	Established Timing Ⅱ	0	0	0 0 0 0 0 0 0 0	
37	25	Manufacture's Resevrved Timings	0	0	0 0 0 0 0 0 0 0	
38	26	Standard Timing Identification 1 was not used	0	1	0 0 0 0 0 0 0 1	Standard Timing
39	27	Standard Timing Identification 1 was not used	0	1	0 0 0 0 0 0 0 1	
40	28	Standard Timing Identification 2 was not used	0	1	0 0 0 0 0 0 0 1	
41	29	Standard Timing Identification 2 was not used	0	1	0 0 0 0 0 0 0 1	
42	2A	Standard Timing Identification 3 was not used	0	1	0 0 0 0 0 0 0 1	
43	2B	Standard Timing Identification 3 was not used	0	1	0 0 0 0 0 0 0 1	
44	2C	Standard Timing Identification 4 was not used	0	1	0 0 0 0 0 0 0 1	
45	2D	Standard Timing Identification 4 was not used	0	1	0 0 0 0 0 0 0 1	

APPENDIX A EDID(2)

Address (Dec)	Address (Hex)	Field Name and Comments	Value (Hex)	Value (Binary)	Value (Binary)
46	2E	Standard Timing Identification 5 was not used	01	00000001	Standard Timing
47	2F	Standard Timing Identification 5 was not used	01	00000001	
48	30	Standard Timing Identification 6 was not used	01	00000001	
49	31	Standard Timing Identification 6 was not used	01	00000001	
50	32	Standard Timing Identification 7 was not used	01	00000001	
51	33	Standard Timing Identification 7 was not used	01	00000001	
52	34	Standard Timing Identification 8 was not used	01	00000001	
53	35	Standard Timing Identification 8 was not used	01	00000001	
54	36	Preferred Timing Mode1	2A	00101010	Preferred Timing Mode
55	37	60Hz Timing	76	01110110	
56	38	Horizontal Addressable Video [pixel]	40	01000000	
57	39	Horizontal Blanking [pixel]	C4	11000100	
58	3A		B0	10110000	
59	3B	Vertical Addressable Video [line]	54	01010100	
60	3C	Vertical Blanking [line]	14	00010100	
61	3D		60	01100000	
62	3E	Horizontal Front Porch [pixel]	2C	00101100	
63	3F	Horizontal Sync Pulse Width [pixel]	04	00000100	
64	40	Vertical Front Porch [line] /Vertical Sync Pulse [line]	91	10010001	
65	41		00	00000000	
66	42	Horizontal Addressable Video Image Size [mm]	58	01011000	
67	43	Vertical Addressable Video Image Size [mm]	C1	11000001	
68	44		10	00010000	
69	45	Right Horizontal Border	00	00000000	
70	46	Top Vertical Border	00	00000000	
71	47	Signal Type (Non-Inter, Nor Stereo, Digital Sync)	1E	00011110	
72	48	Preferred Timing Mode2 (Detailed Timing #2)	2A	00101010	2nd Detailed Timing Descriptor or the 1st Display Descriptor
73	49	50Hz Timing	76	01110110	
74	4A	Horizontal Addressable Video [pixel]	40	01000000	
75	4B	Horizontal Blanking [pixel]	C4	11000100	
76	4C		B0	10110000	
77	4D	Vertical Addressable Video [line]	54	01010100	
78	4E	Vertical Blanking [line]	5B	01011011	
79	4F		61	01100001	
80	50	Horizontal Front Porch [pixel]	2C	00101100	
81	51	Horizontal Sync Pulse Width [pixel]	04	00000100	
82	52	Vertical Front Porch [line] /Vertical Sync Pulse [line]	91	10010001	
83	53		00	00000000	
84	54	Horizontal Addressable Video Image Size [mm]	58	01011000	
85	55	Vertical Addressable Video Image Size [mm]	C1	11000001	
86	56		10	00010000	
87	57	Right Horizontal Border	00	00000000	
88	58	Top Vertical Border	00	00000000	
89	59	Signal Type (Non-Inter, Nor Stereo, Digital Sync)	1E	00011110	

APPENDIX A EDID(3)

Address (Dec)	Address (Hex)	Field Name and Comments	Value (Hex)	Value (Binary)	Value (Binary)
90	5A	(Detailed Timing #3)	0 0	0 0 0 0 0 0 0 0	3rd Detailed Timing Descriptor or the 2nd Display Descriptor
91	5B	Flag	0 0	0 0 0 0 0 0 0 0	
92	5C	Flag	0 0	0 0 0 0 0 0 0 0	
93	5D	Display Range Limits	F D	1 1 1 1 1 1 0 1	
94	5E	Offset	0 0	0 0 0 0 0 0 0 0	
95	5F	Minimum Vertical Rate [Hz]	3 1	0 0 1 1 0 0 0 1	
96	60	Maximum Vertical Rate [Hz]	3 D	0 0 1 1 1 1 0 1	
97	61	Minimum Horizontal Rate [kHz]	6 0	0 1 1 0 0 0 0 0	
98	62	Maximum Horizontal Rate [kHz]	6 4	0 1 1 0 0 1 0 0	
99	63	Maximum Pixel Clock [MHz] ÷ 10	1 E	0 0 0 1 1 1 1 0	
100	64	Video Timing Support Flags Range Limit only	0 1	0 0 0 0 0 0 0 1	
101	65	Line Feed	0 A	0 0 0 0 1 0 1 0	
102	66	Blank	2 0	0 0 1 0 0 0 0 0	
103	67	Blank	2 0	0 0 1 0 0 0 0 0	
104	68	Blank	2 0	0 0 1 0 0 0 0 0	
105	69	Blank	2 0	0 0 1 0 0 0 0 0	
106	6A	Blank	2 0	0 0 1 0 0 0 0 0	
107	6B	Blank	2 0	0 0 1 0 0 0 0 0	
108	6C	(Detailed Timing #4)	0 0	0 0 0 0 0 0 0 0	4th Detailed Timing Descriptor or the 3rd Display Descriptor
109	6D	Flag	0 0	0 0 0 0 0 0 0 0	
110	6E	Flag	0 0	0 0 0 0 0 0 0 0	
111	6F	Display Product Name	F E	1 1 1 1 1 1 1 0	
112	70	Flag	0 0	0 0 0 0 0 0 0 0	
113	71	1st character	5 6	0 1 0 1 0 1 1 0	
114	72	2nd character	5 6	0 1 0 1 0 1 1 0	
115	73	3rd character	5 8	0 1 0 1 1 0 0 0	
116	74	4th character	3 1	0 0 1 1 0 0 0 1	
117	75	5th character	3 6	0 0 1 1 0 1 1 0	
118	76	6th character	5 4	0 1 0 1 0 1 0 0	
119	77	7th character	3 0	0 0 1 1 0 0 0 0	
120	78	8th character	3 2	0 0 1 1 0 0 1 0	
121	79	9th character	3 8	0 0 1 1 1 0 0 0	
122	7A	10th character	4 A	0 1 0 0 1 0 1 0	
123	7B	11th character	3 0	0 0 1 1 0 0 0 0	
124	7C	12th character	3 0	0 0 1 1 0 0 0 0	
125	7D	Terminator	0 A	0 0 0 0 1 0 1 0	
126	7E	Extension flag = 00	0 0	0 0 0 0 0 0 0 0	Extension Flag
127	7F	Check Sum	5 5	0 1 0 1 0 1 0 1	Check SUM