DESCRIPTION

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

Product Name : VVX09F035M10

General Specifications

Effective display area	: (H)191.52 × (V)119.70	(mm)
Number of pixels	: (H) 1,920 × (V) 1,200	(pixels)
Pixel pitch	: (H) 0.09975 × (V) 0.09975	(mm)
Color pixel arrangement	: R+G+B vertical stripe	
Display mode	: Transmissive mode Normally black mode	
Top polarizer type	: Hard Coat (w/ Retardation Film)	
Number of colors	: 16,194,277 (6bits/color with Dithering)	(colors)
Input signal	: eDP 2 Lanes	
Backlight	: 35 pieces of LED	
External dimensions	: Typ. (H) 203.5 × (V) 135.9 × (t) 2.91 (PCB side 4.8 max.)	(mm)
Weight	: 130 max.	(g)

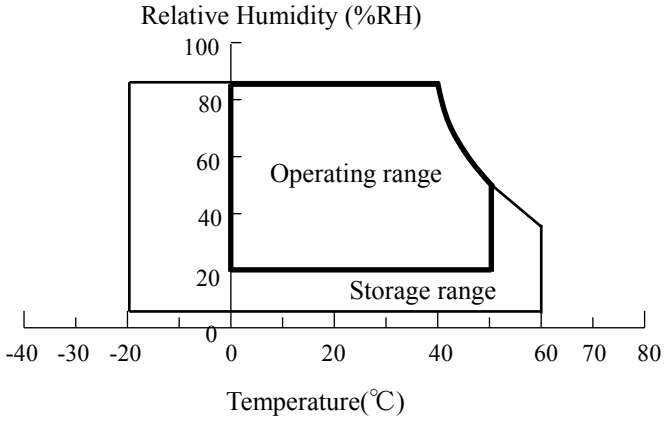
1. ABSOLUTE MAXIMUM RATINGS

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)
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 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) Sine vibration (Non-OP) 3.5 G Zero-to peak, 30min One sweep, 10 to 500 Hz, all 3 axes (X, Y, Z) .

5) Shock (Non-OP) Half sine 30.6 G, duration time 18 ms. Velocity change :3.4 m/s

1. 2 Electrical Absolute Maximum Ratings

(1)TFT-LCD module

ITEM	SYMBOL		Min.	
Power Supply Voltage	VCC		-0.3	
Input Voltage for logic	VI		-0.3	

Note 1) It is applied to PWMI

Co., Ltd.			

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 ℃ , f v=60 Hz ,

If=17.5mA (on duty 100%)

ITEM		SYMBOL	CONDITION	Min.	Typ.	Max.	UNIT	NOTE
Contrast ratio		CR	θ = 0 ° 1)	640	800	-	-	1),2)
Response time (Rise + Fall)		Tr + Tf	θ = 0 ° 1)	-	-	30	ms	1),3)
Brightness of white		Bwh		310	350	-	cd/m^2	1)
Brightness uniformity		Buni(9points)		-	1.4	1.6	-	1),4)
Color chromaticity (CIE)	Red	x		0.590	0.620	0.650	-	1) 【Gray scale =255】
		y		0.310	0.340	0.370		
	Green	x		0.290	0.320	0.350		
		y		0.530	0.560	0.590		
	Blue	x		0.120	0.150	0.180		
		y		0.080	0.110	0.140		
	White	x		0.283	0.313	0.343		
		y		0.299	0.329	0.359		
View Angle (Contrast ratio)	Right	–	θ=80 °, ϕ =0°	80	-	-	-	1)
	Left	–	θ=80 °, ϕ =180°	80	-	-		
	Top	–	θ=80 °, ϕ =90°	80	-	-		
	Bottom	–	θ=80 °, ϕ =270°	80	-	-		
NTSC		–	θ = 0 ° 1)	45	50	-	%	1)
W,R,G,B Gamma		–	θ = 0 °	1.9	2.2	2.5	-	1)
Flicker		-	θ= 0 ° Full Luminance	-	-	-20	dB	1) Equipment : Brotess-MSE
Cross talk		–	θ= 0 °	–	–	2	%	5)
Image sticking		–	Mosaic pattern	–	–	15	min	6)

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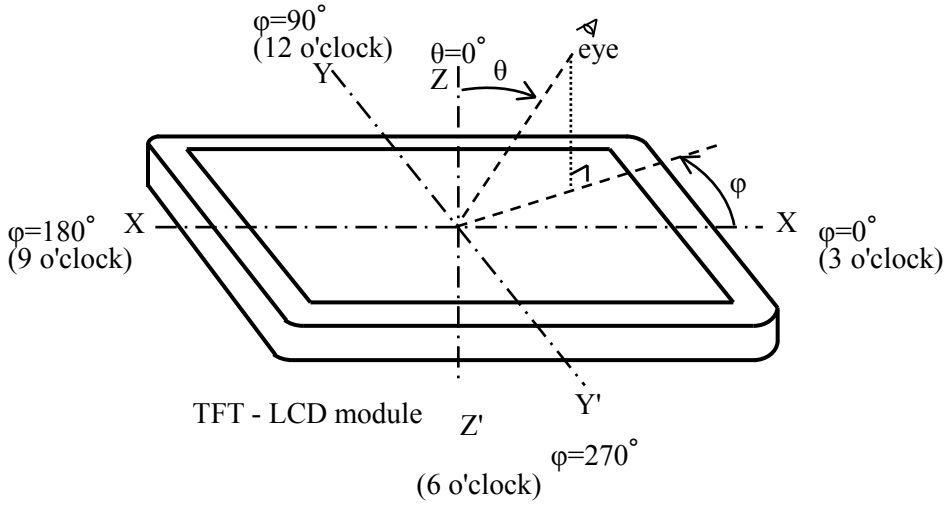
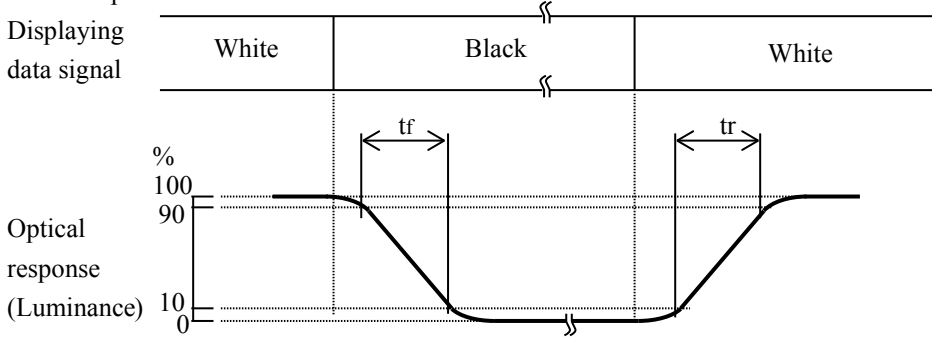
Note 1) Definition of viewing angle



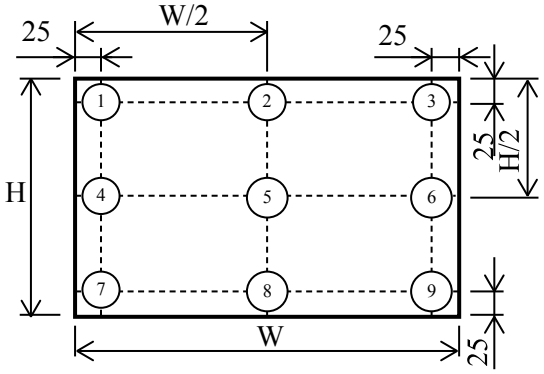
2) Definition of contrast ratio (CR)

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

3) Definition of response time



4) Definition of Uniformity



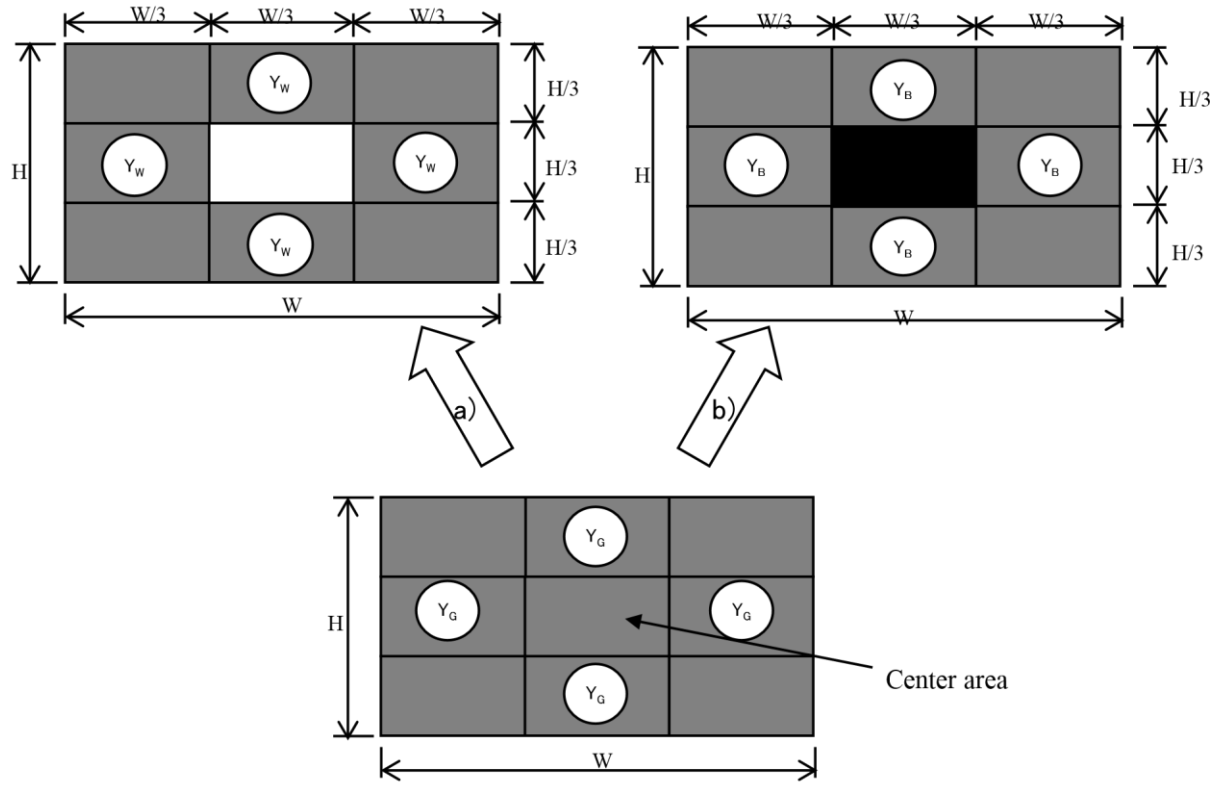
Unit : mm

①～⑨ : measuring points

Buni (9 Points) = max(①～⑨)/min(①～⑨)

3

Note 5) 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

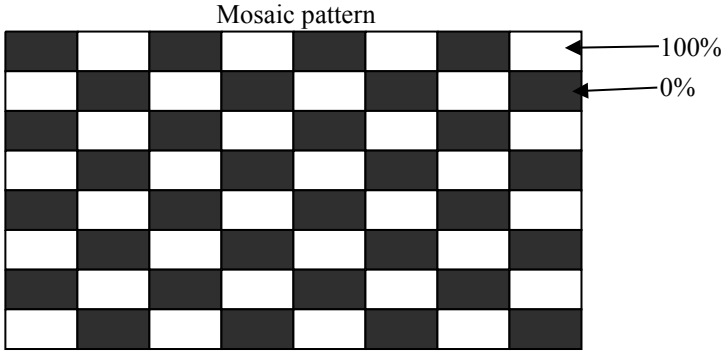
$$CT = \frac{|Y_B(X_{127}) - Y_G(X_{127})|}{Y_G(X_{127})} \times 100\%$$

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

6) Image sticking

Condition : Show Mosaic pattern for 30min and image sticking shall be invisible in 15min after switching to 50% gray pattern.

Mosaic pattern



3. ELECTRICAL CHARACTERISTICS

3. 1 TFT-LCD module

Ta = 25 ℃ , V_{SS} = 0 V

ITEM		SYMBOL	Min.	Typ.	Max.	UNIT	NOTE
Power supply voltage		VCC	3.0	3.3	3.6	V	
Power supply current		Icc	-	0.227	0.258	A	at white pattern
Power Consumption		Pcc	-	0.750	0.850	W	at white pattern
Logic signals input voltage	High	VIH	1.6	-	-	V	PWMI
	Low	VIL	-	-	0.7	V	
Logic signal output voltage	High	VOH	1.8	-	-	V	PWMO
	Low	VOL	-	-	0.4	V	

3. 2 Backlight unit

ITEM	SYMBOL	Min.	Typ.	Max.	UNIT	NOTE
LED forward Current	I_f	-	17.5	20.0	mA	1)
LED forward Voltage	Vbl	-	19.6	21.0	V	
Power Consumption	Pbl	-	1.72	2.10	W	

Note 1) This characteristics should be applied putting on the LED about 60 minutes later with ambient temperature.
(Ta = 25 ℃ ± 2 ℃)

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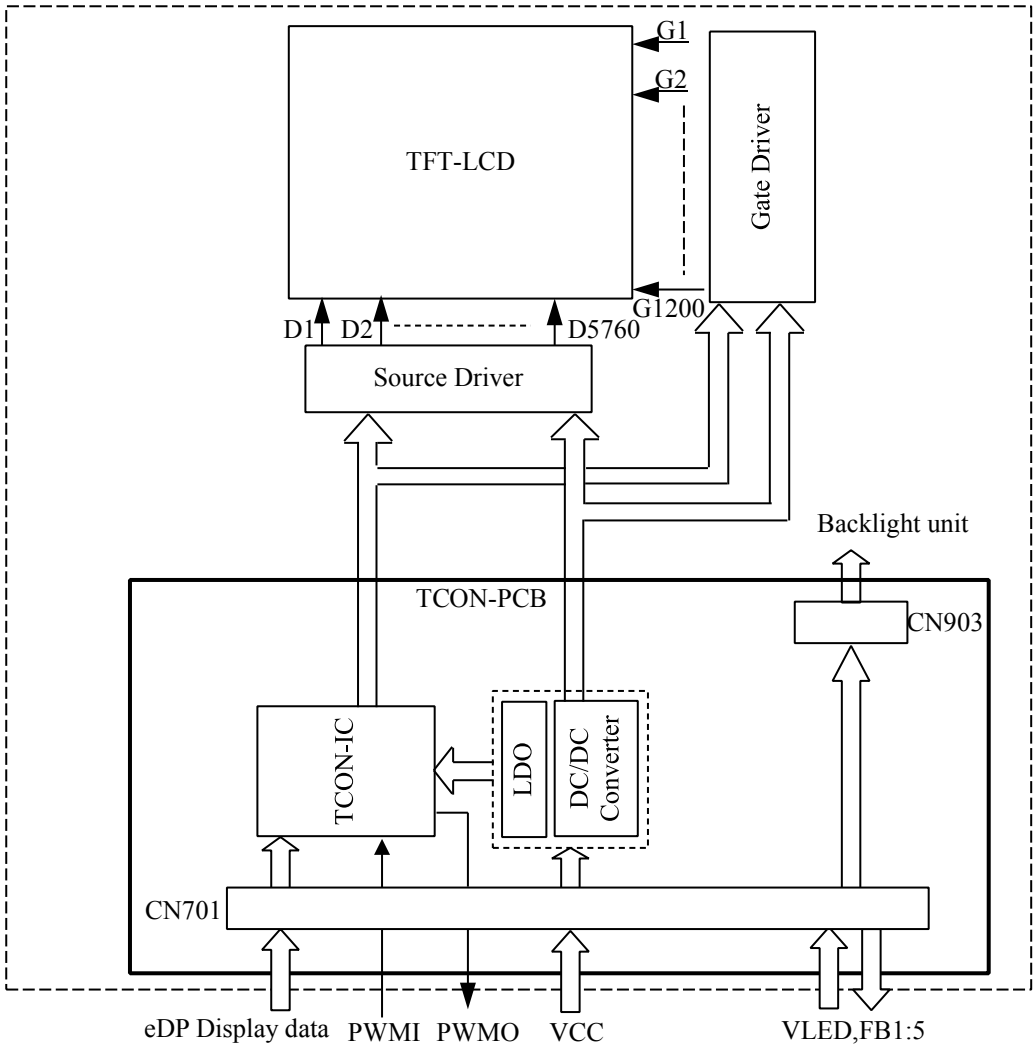
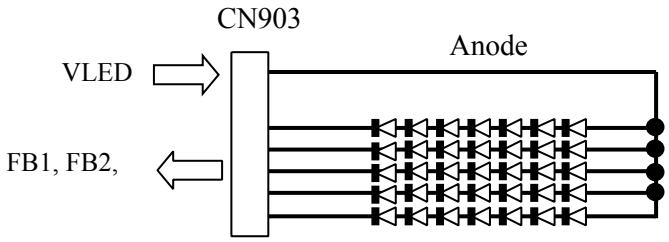
4. BLOCK DIAGRAM

4. 1 TFT-LCD module



4. 2 Backlight unit



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5. INTERFACE PIN ASSIGNMENT

5. 1 TFT-LCD module

CN701:DAI-ICHI SEIKO(20455-030E-02)

PIN No.	SYMBOL	DESCRIPTION	Note
1	WP	Keep open	
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	VCC	Power supply for LCD	1)
13	VCC		
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	PWMI	PWM signal input	
19	PWMO	PWM signal output	
20	SDA	Keep open	
21	SCL	Keep open	
22	NC	Keep open	
23	FB5	LED string 5 cathode	3)
24	FB4	LED string 4 cathode	
25	FB3	LED string 3 cathode	
26	FB2	LED string 2 cathode	
27	FB1	LED string 1 cathode	
28	NC	Keep open	
29	VLED	BL LED drive voltage	2)
30	VLED		

Notes 1) All Vc

All GND pins shall be grounded. Metal bezel is internally connected to GND. 3)
All VLED pins shall be connected to LED drive voltage

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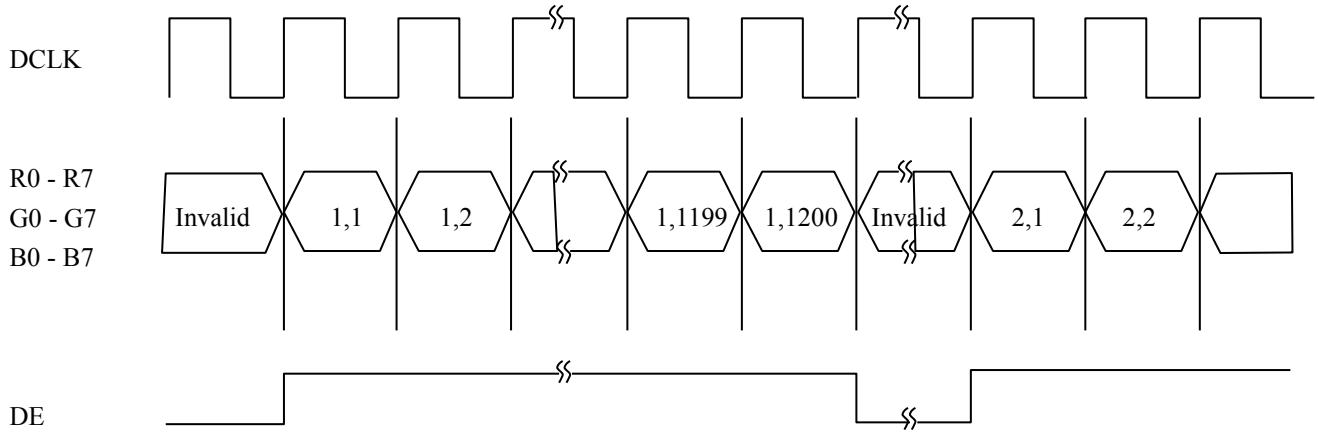
5. 2 Correspondence between input data and display image

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

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
⋮	⋮	⋮		⋮
1200 , 1	1200 , 2	1200 , 3		1200 , 1920



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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
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	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

Note 1) Definition of gray scale :

Color (n) ・・・ Number in parenthesis indicates gray scale level.

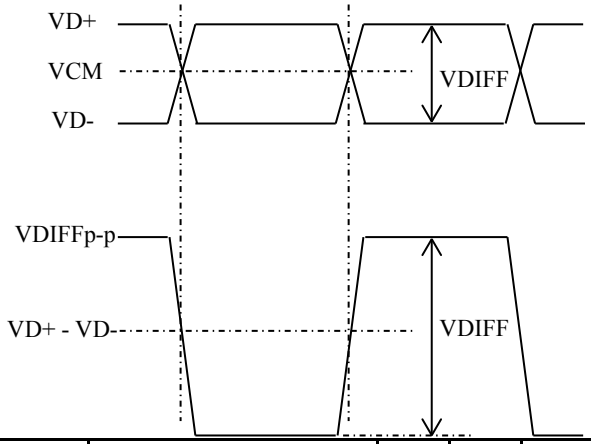
Larger n corresponds to brighter level.

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	-	-	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) Display Port 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	-	1.36	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	75	-	200	nF	

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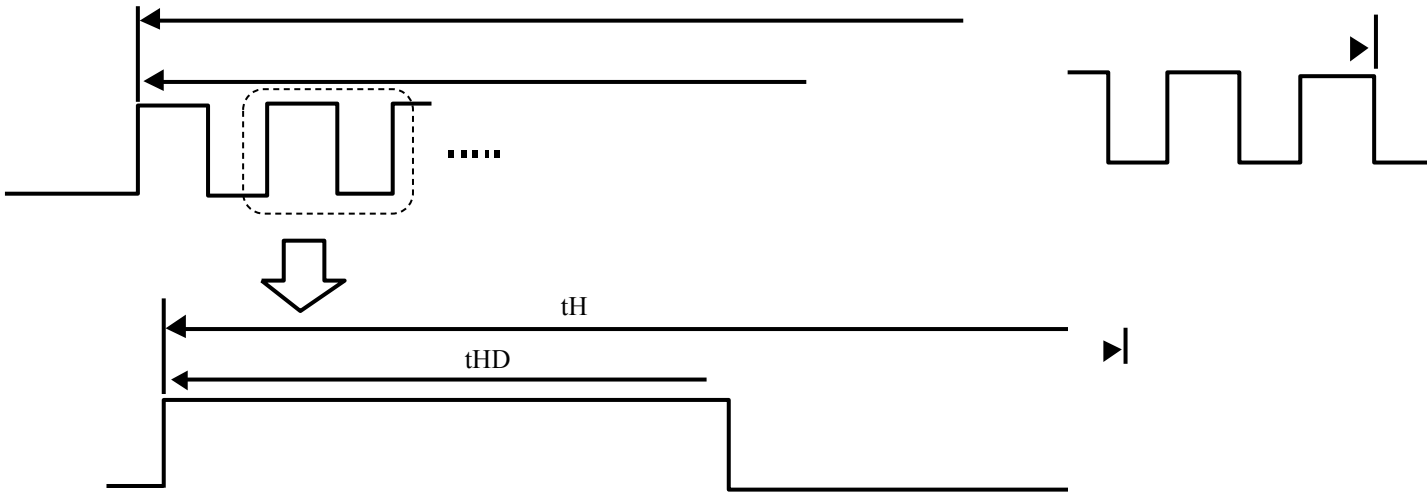
6. 2 eDP 2lane 8bit input data mapping

Lane0	Lane1
R0-7:0	R1-7:0
G0-7:0	G1-7:0
B0-7:0	B1-7:0
R2-7:0	R3-7:0
G2-7:0	G3-7:0
B2-7:0	B3-7:0
R4-7:0	R5-7:0
G4-7:0	G5-7:0
B4-7:0	B5-7:0

6. 3 HPD characteristics

Parameter	Min.	Typ.	Max.	Unit	Comments
HPD Voltage	2.25	-	3.6	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	



ITEM		SYMBOL	Min.	Typ.	Max.	UNIT
DE	Vertical Frequency	fV	(58)	(60)		
	Vertical Period	tV	(1208)	(123		
	Vertical Valid	tVD		1200		
	Horizontal Frequency	fH	(70)	(74)		
	Horizontal Period	tH	(1990)	(208		
	Horizontal Valid	tHD		1920		

NOTE
(62)Hz
)(1600)tH
tH
(78)kHz
))(3072)tCLK tCLK

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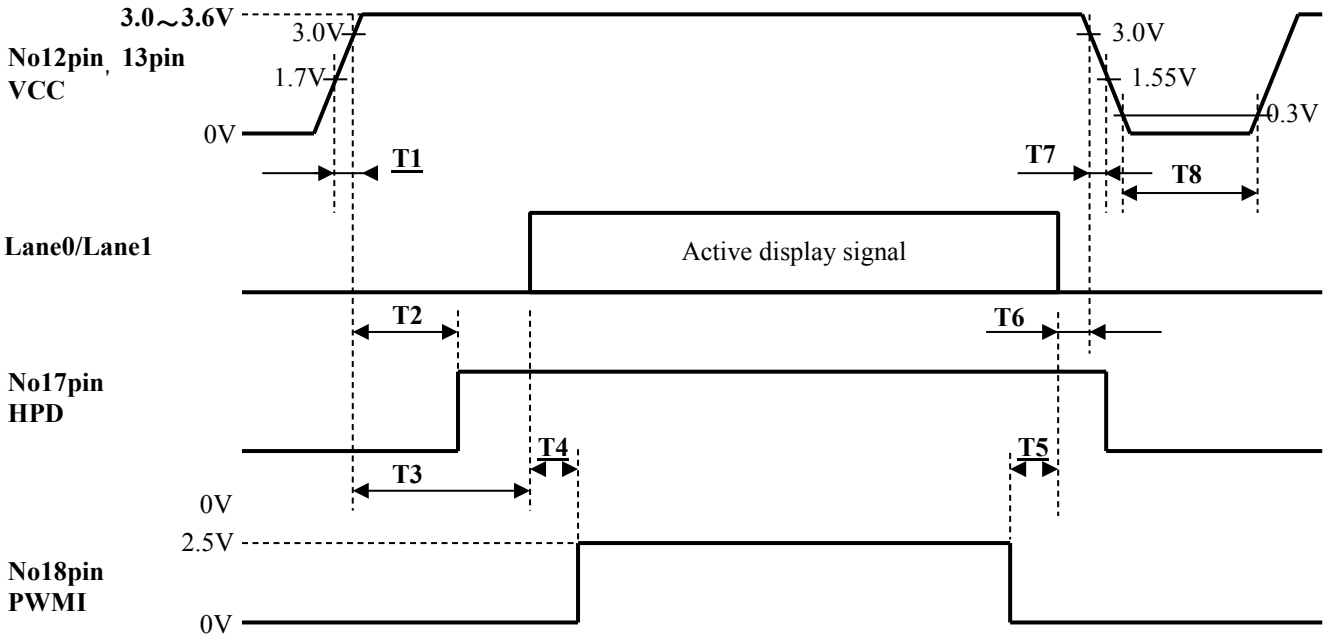
6.5 Timing between interface signals and power supply



SYMBOL	Min.	Typ.	Max.	UNIT	Note
T1	0	-	218	ms	
T2	-	-	100	ms	
T3	200	-	-	ms	
T4	34	-	-	ms	
T5	34	-	-	ms	
T6	34	-	-	ms	
T7	0	-	55	ms	
T8	500	-	-	ms	

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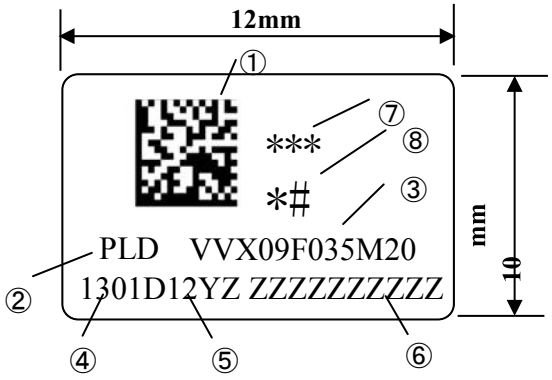
7. LABEL FORMAT

7.1 Label

The label is on the metallic bezel as shown in 12. External Dimensional.

The style of character will be changed without notice.



Thickness : 0.05mm

① Contents of ②～⑥ are indicated by bar codes.【Express by the data matrix】

② PLD

③ Production name : VVX09F035M20 ④ Please refer to 7.2.

⑤ Please refer to 7.2.

⑥,⑦,⑧ A cord for production of PLD inside management.

2) 01 , The 1st week of year
02 , The 2nd week of year
03 , The 3rd week of year
04 , The 4th week of year 05 , The 5th week of year 06 , The 6th week of year
.....
52 , The 52th week of year

Mark	Year
13	2013
14	2014
15	2015

7.2 Lot mark

□□ □□ □ □□□□

4 digits for serial number (0001 - ZZZZ) witout I and U and U and V.

Production management sign

Month and week of production 2)

Year of production 1)

1)

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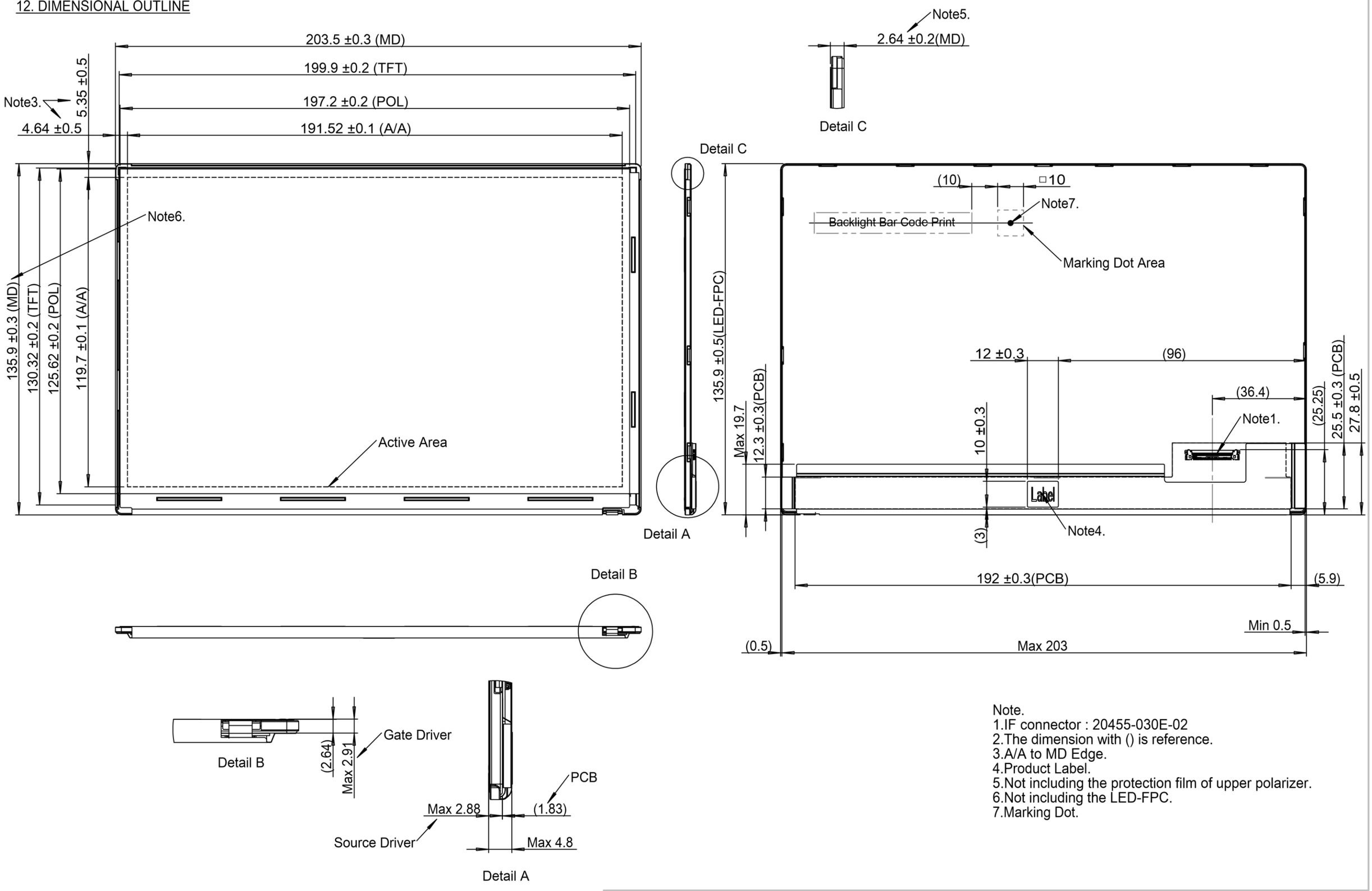
12. DIMENSIONAL OUTLINE



Note.
1.IF connector : 20455-030E-02
2.The dimension with () is reference.
3.A/A to MD Edge.
4.Product Label.
5.Not including the protection film of upper polarizer.
6.Not including the LED-FPC.
7.Marking Dot.