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	Business Solutions Promotion GROUP SHARP CORPORATION	APPLICABLE GROUP Business Solutions Promotion Group
	TECHNICAL LITERATURE	

DEVICE SPECIFICATION

TFT-LCD Module

Designed for **PN-V601**

Draft, on Dec.3rd

RECORDS OF REVISION

SPEC No.	DATE	REVISED No.	SUMMARY		NOTE
			PAGE		

1. Application

This specification applies to the color 60.0” TFT-LCD module designed for SHARP PN-V601.

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2. Overview

This module is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver ICs, control circuit, power supply circuit, and LED back light system etc. Graphics and texts can be displayed on a 1366×RGB×768 dots panel with about 16.77 million colors by using 8bit LVDS (Low Voltage Differential Signaling) to interface and +12V of DC supply voltages.

And in order to improve the response time of LCD, this module applies the Over Shoot driving (O/S driving) technology for the control circuit. In the O/S driving technology, signals are being applied to the Liquid Crystal according to a pre-fixed process as an image signal of the present frame when a difference is found between image signal of the previous frame and that of the current frame after comparing them.

With this technology, image signals can be set so that liquid crystal response completes within one frame. As a result, motion blur reduces and clearer display performance can be realized.

3. Mechanical Specifications

Parameter	Specifications	Unit
Display size	152.439(Diagonal)	cm
	60.0 (Diagonal)	inch
Active area	1328.7765 (H)×747.072 (V)	mm
Pixel format	1366 (H)×768 (V) (1 pixel＝R+G+B dots)	pixel
Pixel pitch	0.97275 (H)×0.97275 (V)	mm
Pixel configuration	R, G, B vertical stripe	
Display mode	Normally black	
Unit outline dimensions (*1)	1335.9(W)×754.2(H)×104.2(D)	mm
Mass	27.6±1.0	kg
Surface treatment	LR coating Hard coating: 2H and more	

4. Input Terminals

4-1. TFT-LCD panel driving

CN1 (Interface signals)

Using connectors : FX16S-41S-0.5SH (HIROSE)

Mating connectors : FX16M1-41P-HC (HIROSE)

Pin No.	Symbol	Function	Remark
1	Reserved	-	Must be OPEN
2	Reserved	-	Must be OPEN
3	Reserved	-	Must be OPEN
4	Reserved	-	Must be OPEN
5	GND	GND	
6	GND	GND	
7	GND	GND	
8	GND	GND	
9	LVDS_SEL	Select LVDS data order [Note 1]	Pull Up : (+3.3V)
10	Reserved	-	Must be OPEN
11	GND	GND	
12	RX0-	LVDS CH0 differential data input(-)	
13	RX0+	LVDS CH0 differential data input(+)	
14	GND	GND	
15	RX1-	LVDS CH1 differential data input(-)	
16	RX1+	LVDS CH1 differential data input(+)	
17	GND	GND	
18	RX2-	LVDS CH2 differential data input(-)	
19	RX2+	LVDS CH2 differential data input(+)	
20	GND	GND	
21	RXCLK-	LVDS Clock input(-)	
22	RXCLK+	LVDS Clock input(+)	
23	GND	GND	
24	RX3-	LVDS CH3 differential data input(-)	
25	RX3+	LVDS CH3 differential data input(+)	
26	GND	GND	
27	Reserved	-	Must be OPEN
28	Reserved	-	Must be OPEN
29	GND	GND	
30	Reserved	-	Must be OPEN
31	Reserved	-	Must be OPEN
32	U/D	NC	OPEN
33	GND	GND	
34	GND	GND	
35	GND	GND	
36	GND	GND	
37	GND	GND	
38	Reserved	-	Must be OPEN
39	Reserved	-	Must be OPEN
40	Reserved	-	Must be OPEN
41	Reserved	-	Must be OPEN

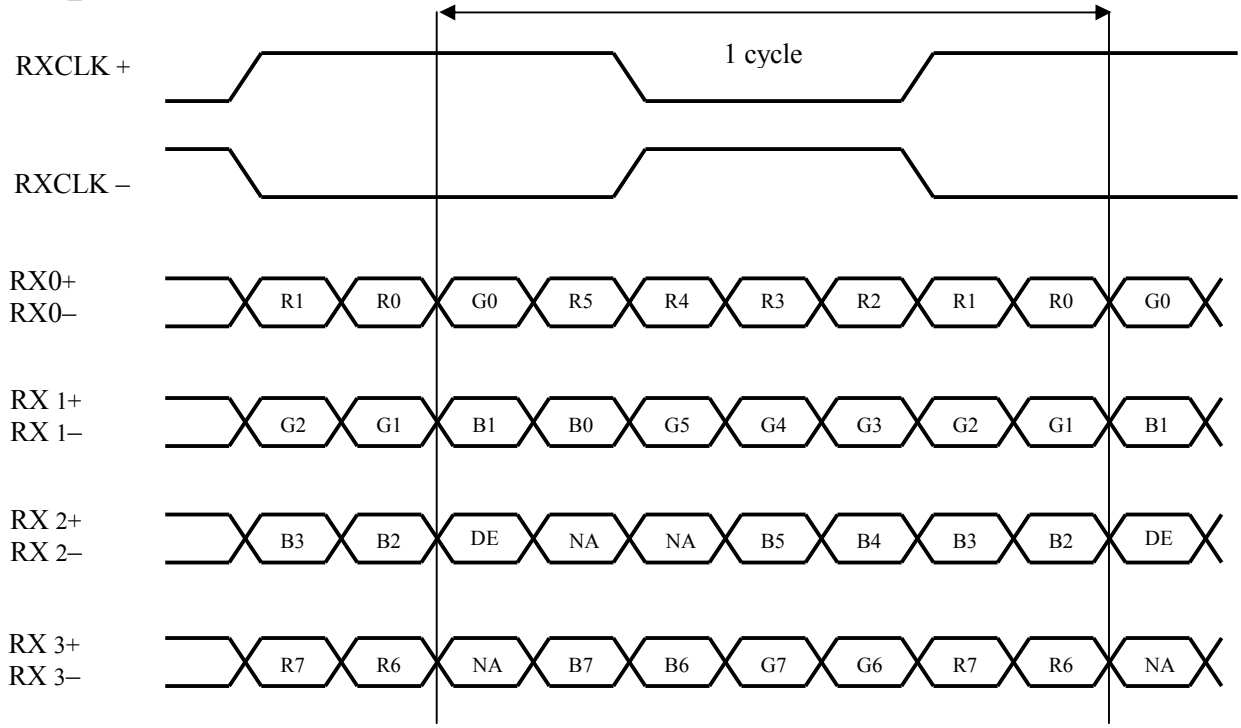
[Note 1] LVDS Data order

LVDS_SEL		
Data	L(GND) [VESA]	H(3.3V) or Open [JEIDA]
TA0	R0(LSB)	R2
TA1	R1	R3
TA2	R2	R4
TA3	R3	R5
TA4	R4	R6
TA5	R5	R7(MSB)
TA6	G0(LSB)	G2
TB0	G1	G3
TB1	G2	G4
TB2	G3	G5
TB3	G4	G6
TB4	G5	G7(MSB)
TB5	B0(LSB)	B2
TB6	B1	B3
TC0	B2	B4
TC1	B3	B5
TC2	B4	B6
TC3	B5	B7(MSB)
TC4	NA	NA
TC5	NA	NA
TC6	DE(*)	DE(*)
TD0	R6	R0
TD1	R7	R1
TD2	G6	G0
TD3	G7	G1
TD4	B6	B0
TD5	B7	B1
TD6	NA	NA

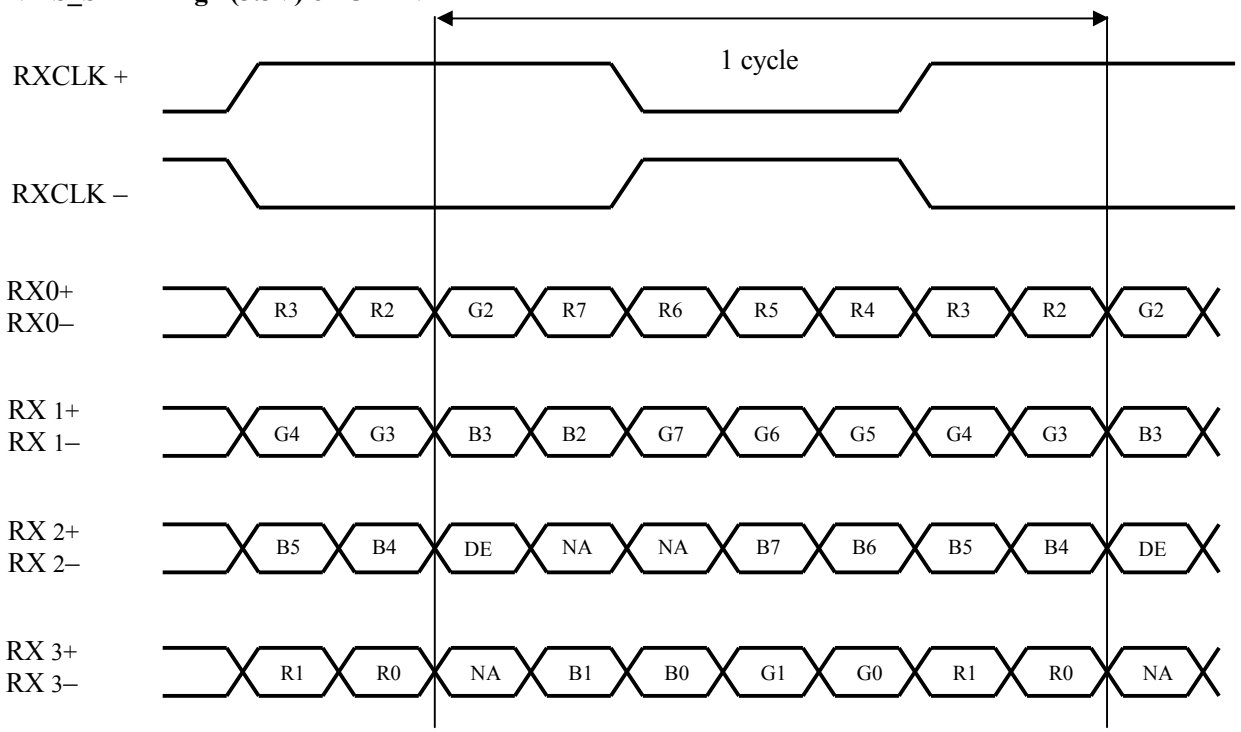
NA: Not Available

(*)Since the display position is prescribed by the rise of DE(Display Enable)signal, please do not fix DE signal during operation at ”High”.

LVDS_SEL = Low (GND)



LVDS_SEL = High (3.3V) or OPEN



DE: Display Enable, NA: Not Available (Fixed Low)

CN2 (+12V DC power supply)

Using connectors : SM05B-PASS (JST)

Mating connectors : PAP-05V-S (JST)

Pin No.	Symbol	Function	Remark
1	VCC	+12V Power Supply	
2	VCC	+12V Power Supply	
3	GND	GND	
4	GND	GND	
5	NC		

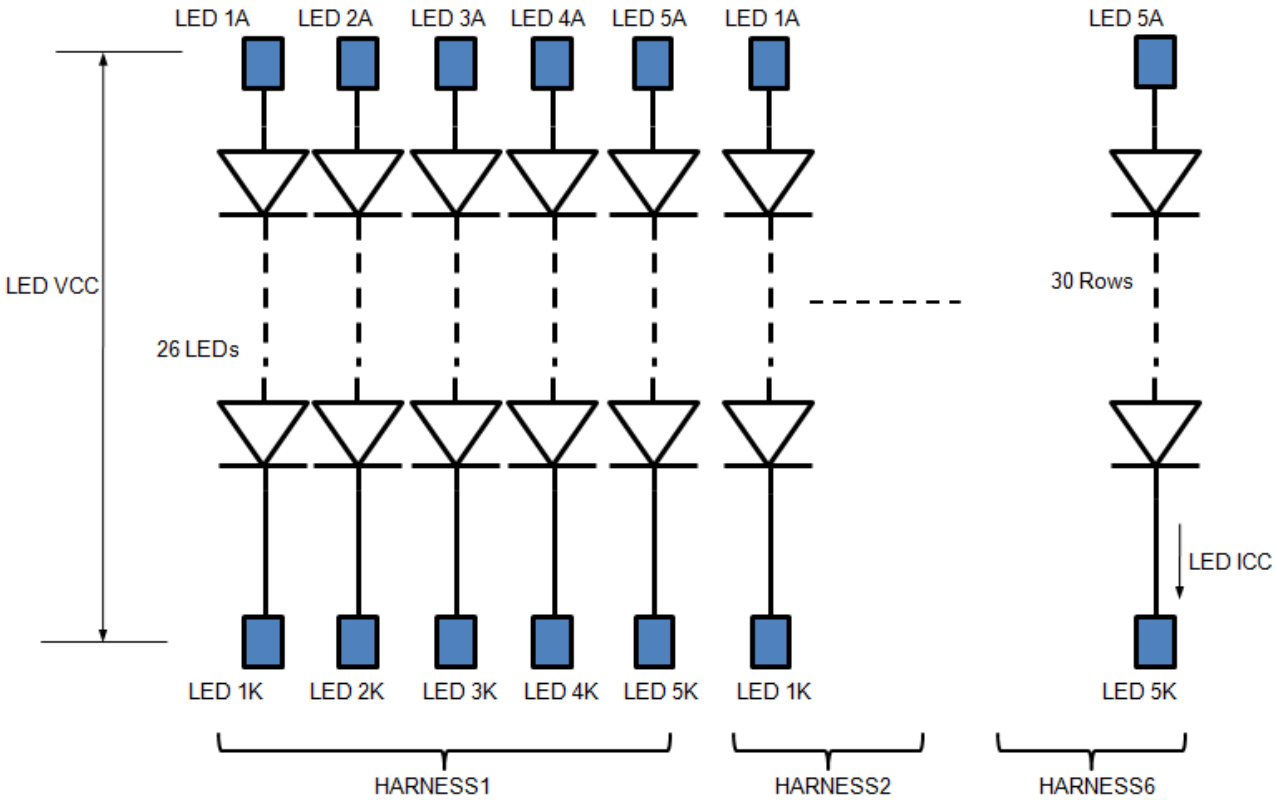
LED HARNESS1 - 6 (LED Power supply)

Using connectors : 51284-1000 or 51284-1001 (MOLEX)

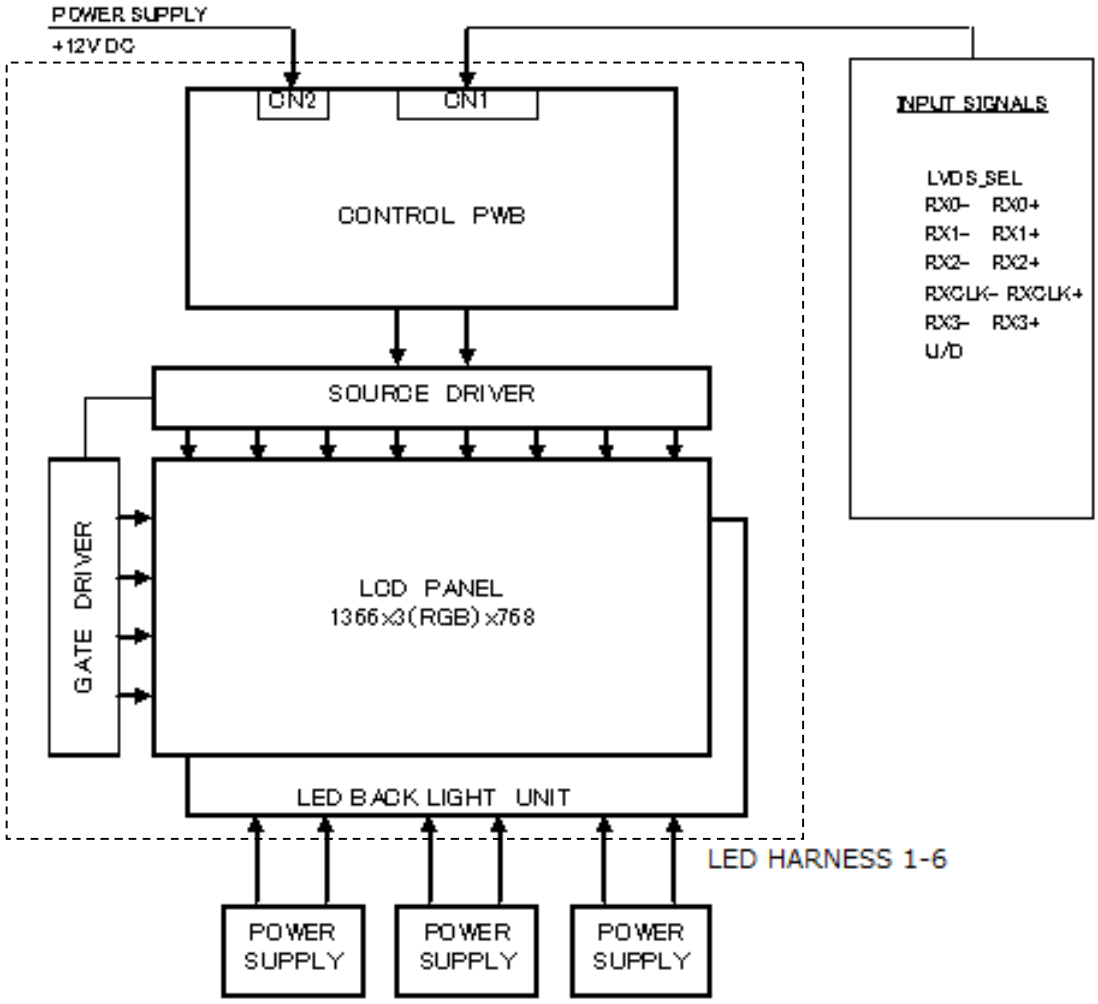
Mating connectors : 55883-1090 or 55883-1091 (MOLEX)

Pin No.	Symbol	Function	Remark
1	LED 1A	LED Anode1	
2	LED 2A	LED Anode2	
3	LED 3A	LED Anode3	
4	LED 4A	LED Anode4	
5	LED 5A	LED Anode5	
6	LED 1K	LED Cathode1	
7	LED 2K	LED Cathode2	
8	LED 3K	LED Cathode3	
9	LED 4K	LED Cathode4	
10	LED 5K	LED Cathode5	

LED BACK LIGHT Diagram



4-2. Interface block diagram



4.3. The back light system characteristics

The back light system is direct type with 780 LEDs.

The characteristics of the LED are shown in the following table.

Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
Life time	T_L	—	(37000)	—	Hour	[NOTE]

[NOTE]

・LED life time is defined as the time when brightness become 70% of the original value in the continuous Operation under the condition of Ta=25℃

5. Absolute Maximum Rating

Parameter	Symbol	Condition	Ratings	Unit	Remark
Input Voltage (for Control)	V_I	Ta=25℃	-0.3 ～ 3.6	V	[NOTE1]
12V supply voltage (for Control)	VCC	Ta=25℃	0 ～ 14	V	
Forward current (for LED)	I_F	Ta=25℃	80	mA	Tc≦74.1℃
Reverse voltage (for LED)	V_R	Ta=25℃	5	V	Each LED 1 piece
Storage temperature	T_{stg}		-25 ～ (+60)	℃	
Operation temperature	T_{opa}		0 ～ (+50)	℃	[NOTE2]4

[NOTE1] LVDS_SEL, HZ_SEL

[NOTE2] Humidity 95% RH Max (Ta≦40℃)
Maximum wet-bulb temperature at 39℃ or less.(Ta＞40℃)
No condensation.

6. Electrical Characteristics

6.1 Control driving

Parameter		Symbol	Min.	Typ.	Max	Unit	Remark
+12V supply voltage	Supply voltage	VCC	11.4	12.0	12.6	V	
	Current dissipation	ICC		(1)		A	
Permissible input ripple voltage		V_{RP}	—	—	100	mV	
Differential input threshold voltage	High	V_{TH}	1.3	—	1.8	V	[NOTE3]
	Low	V_{TL}	0.6	—	1.1	V	
Differential input leak current		I_{Iz}	-10		+10	μA	
Input Low voltage		V_{IL}	—	—	1.0	V	[NOTE1,2]
Input High voltage		V_{IH}	2.5	—	3.3	V	
Input leak current (Low)		I_{IL1}	—	—	400	μA	V_I=0V [NOTE1]
		I_{IL2}	—	—	900	μA	V_I=0V [NOTE2]
Input leak current (High)		I_{IH1}	—	—	TBD	μA	V_I=3.3V [NOTE1]
		I_{IH2}	—	—	TBD	μA	V_I=3.3V [NOTE2]
Terminal resistor		R_T	—	100	—	Ω	

[NOTE1] LVDS_SEL(10kΩpull-up)

[NOTE2] HZ_SEL(4.7kΩpull-up)

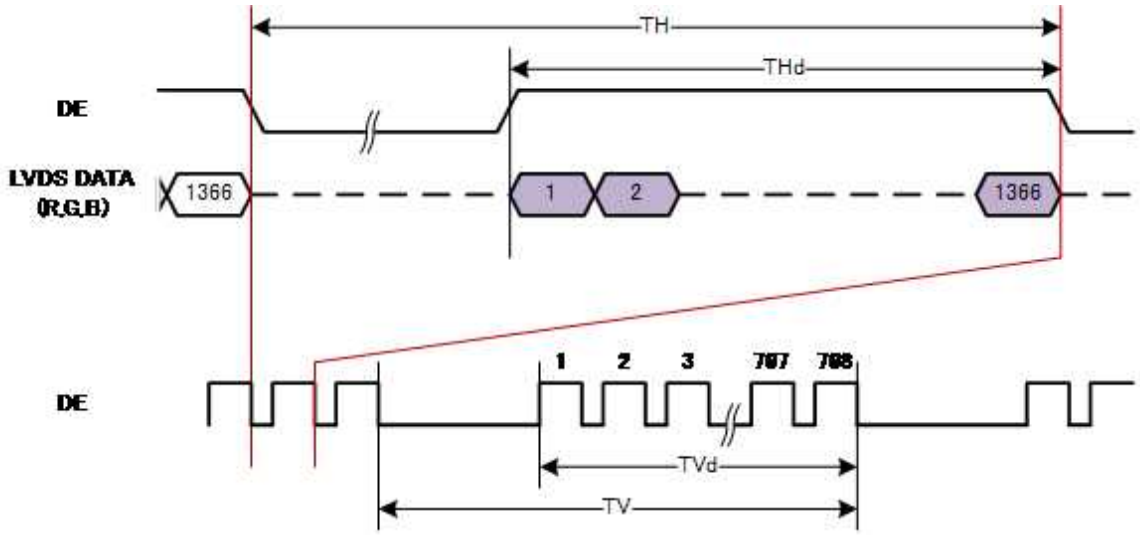
[NOTE3] RXCLK±、RX0±、RX1±、RX2±、RX3±

6.2 LED driving

Parameter	Symbol	Min.	Typ.	Max	Unit	Remark
Input voltage	LED VCC		(252.2)		V	LED ICC=45mA [NOTE]
	LED ICC		(45)	60	mA	Each pin of LED HARNESS1 - 6

[NOTE] Measurement after 100ms has passed since power supply was turned on.

6.3 Timing characteristics of input signals



Parameter		Symbol	Min.	Typ.	Max.	単位	備考
Clock	Frequency	1/Tc		83		MHz	
Data Enable	Horizontal period	TH		1696		clock	
				20.43		μ sec	
	Horizontal period (High)	THd	—	1366	—	clock	
	Vertical period	TV		806		line	
	Vertical period (High)	TVd	—	768	—	line	

7. Optical characteristics

Ta=25℃, VCC=12.0V, LED ICC=45mA, LED VCC PWM Burst= 99.97% , Timing :60Hz (typ.value)

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Contrast ratio		CRn	θ =0°		2400		—	[NOTE2,4]
Luminance of white		x	θ =0°		0.292			[NOTE4]
		y			0.307			
Luminance of red		x			0.656			
		y			0.337			
Luminance of green		x			0.306			
		y			0.641			
Luminance of blue		x			0.152			
		y			0.065			
Viewing angle range	Horizontal	θ_{21}, θ_{22}	CR>10		88		deg	[NOTE1,4]
	Vertical	θ_{11}, θ_{12}			88		deg	
Luminance		Y_L	White θ =0°		(750)		cd/m^2	
Luminance uniformity		δ w			(1.25)			[NOTE6]
Response time		τ	θ =0°		6		ms	[NOTE3,4,5]

Measurement condition : Set the PWM Burst of LED VCC to maximum
The measurement shall be executed 60 minutes after lighting at rating.

[Note]The optical characteristics are measured using the following equipment.

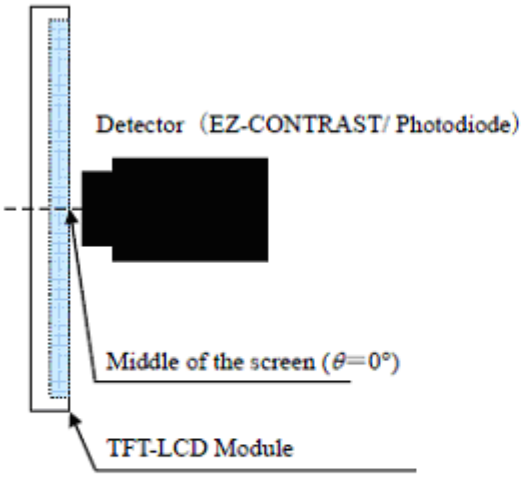


Fig.4-1 Measurement of viewing angle range and Response time.
Viewing angle range: EZ-CONTRAST
Response time: Photodiode

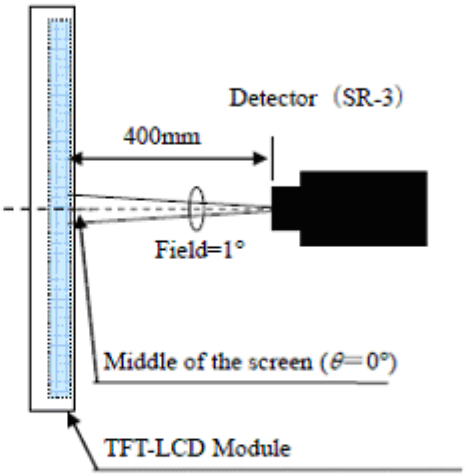
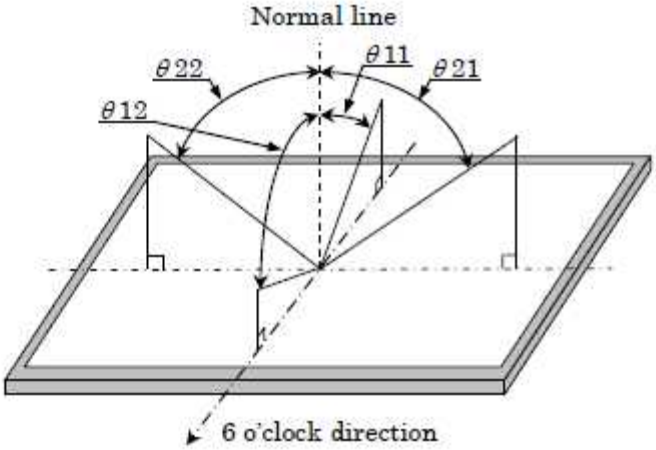


Fig.4-2 Measurement of Contrast, Luminance, Chromaticity.

[Note 1]Definitions of viewing angle range :



[Note 2]Definition of contrast ratio :

The contrast ratio is defined as the following.

$$\text{Contrast Ratio} = \frac{\text{Luminance (brightness) with all pixels white}}{\text{Luminance (brightness) with all pixels black}}$$

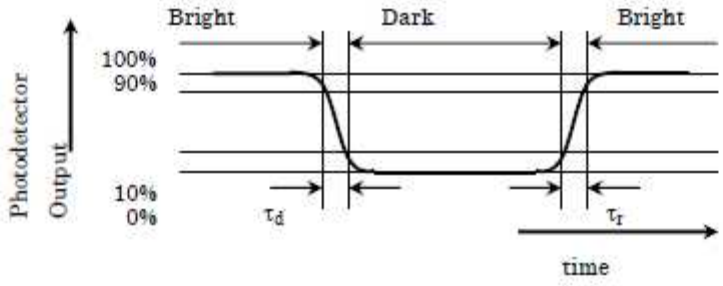
[Note 3]Definition of response time

The response time (τ_d and τ_r) is defined as the following figure and shall be measured by switching the input signal for "any level of gray (0%, 25%, 50%, 75% and 100%)" and "any level of gray (0%, 25%, 50%, 75% and 100%)".

	0%	25%	50%	75%	100%
0%		tr:0%-25%	tr:0%-50%	tr:0%-75%	tr:0%-100%
25%	td: 25%-0%		tr: 25%-50%	tr25%-75%	tr: 25%-100%
50%	td: 50%-0%	td: 50%-25%		tr: 50%-75%	tr: 50%-100%
75%	td: 75%-0%	td: 75%-25%	td: 75%-50%		tr: 75%-100%
100%	td: 100%-0%	td: 100%-25%	td: 100%-50%	td:100%-75%	

t*:x-y...response time from level of gray(x) to level of gray(y)

$\tau_r = \Sigma(tr:x\text{-}y)/10$, $\tau_d = \Sigma(td:x\text{-}y)/10$



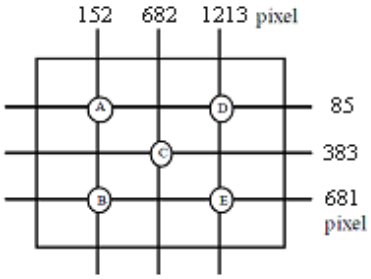
[Note 4]This shall be measured at center of the screen.

[Note 5] This value is valid when O/S driving is used at typical input time value.

[Note 6]Definition of white uniformity ;

White uniformity is defined as the following with five measurements. (A~E)

$$\delta w = \frac{\text{Maximum luminance of five points (brightness)}}{\text{Minimum luminance of five points (brightness)}}$$



8. Outline dimensions