



SPECIFICATION FOR TFT LCD MODULE

CUSTOMER : _____

CUSTOMER MODULE : _____

HL MODEL : HG101WQ003

Preliminary Specification

Final Specification

Customer Confirmation column:

Approved by : _____ Dept. : _____ Data : _____

Please return one of the copies of the specification with your signature to us within two weeks after you receive this document. If it is not returned, we will assume that you agree to the entire contents of this specification document.

Designed by	Checked by	Approved by



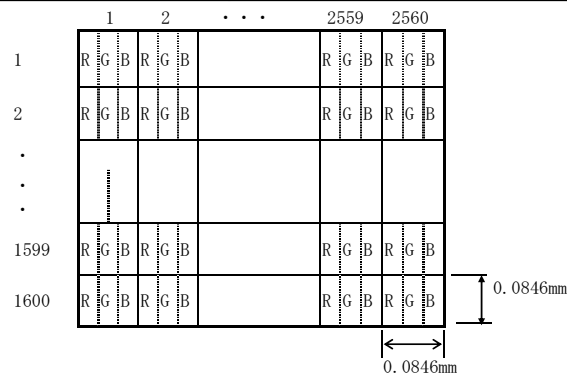
1. BASIC SPECIFICATIONS

1.1 STRUCTURES

HG101WQ003 is 10.1" color TFT -LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel , driver ICs ,control circuit, Utilizes a panel with a 16:10 aspect ratio. The 10.1"screen produces a high resolution image that is composed of 2560x1600 pixel elements in a stripe arrangement.

General specifications are summarized in the following table:

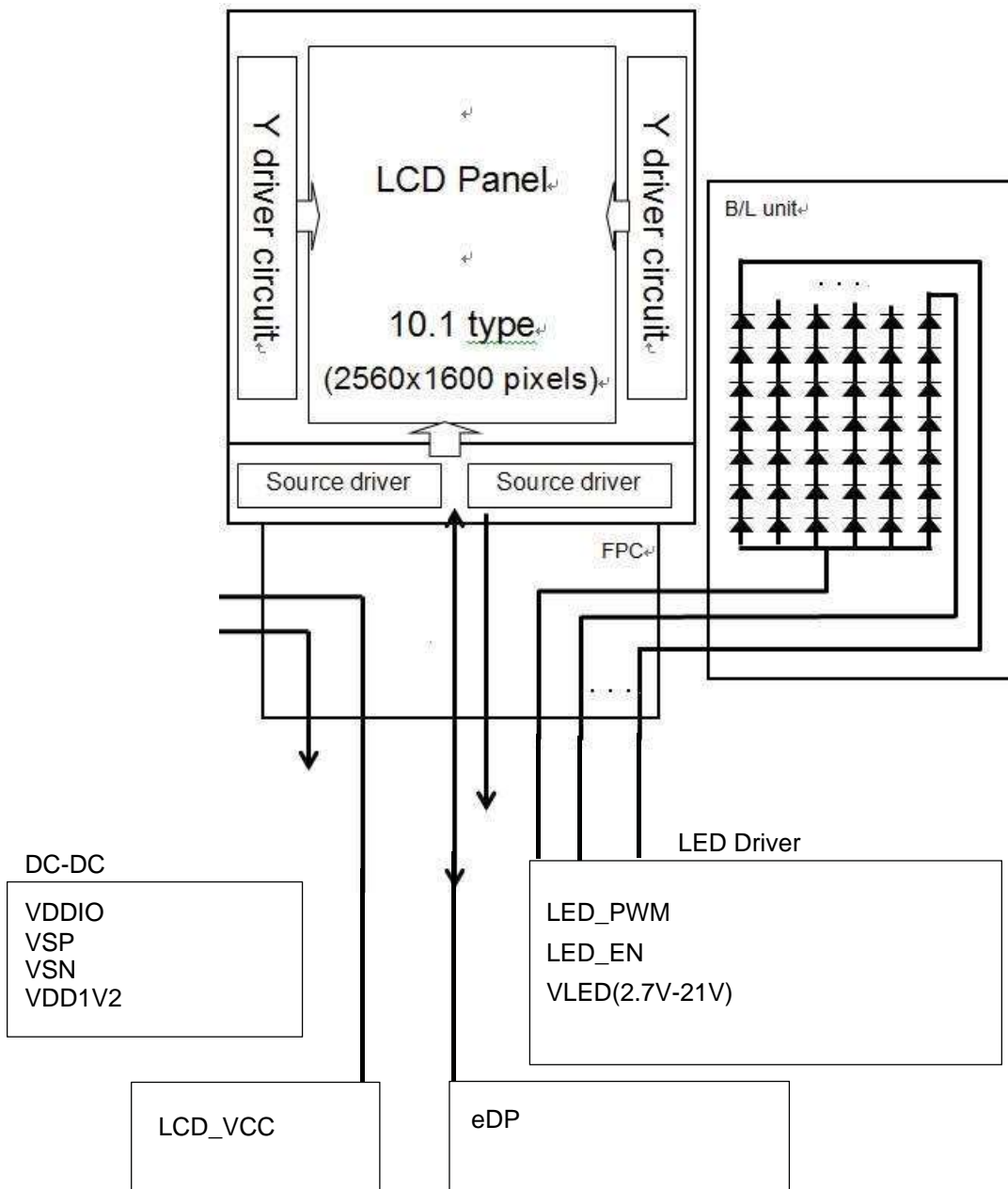
		Spec
General	LCD type	IPS
	Diagonal size	10.1" Landscape
	Resolution	WQXGA (2560xRGBx1600)
	Active area	216.576 mm(H) x 135.36 mm(V)
	Pixel Pitch	28.2 um(H) x 84.6um(V)
	PPI	300
	Panel Type	LTPS
Interface	Interface	2lane eDP 1.3
Optical	Luminance	Typ.400 cd/m2 @20mA
	Color gamut	Typ. 77.1% (NTSC) 108.8% (sRGB)
	Contrast	Typ.1000:1
	Number of colors	16M (24bit)
	Viewing angle	L/R/T/B > 80 @CR>10
Back Light	Number of LEDs	42
	LED current	20mA
LCD Panel	Glass size	220.58 mm(H) x 143.76 mm(V) x 0.36mm
	Glass border(L/R/T/B)	2.0/2.0/2.0/6.4
	Glass Thickness	0.36mm(0.18+0.18)
Module	Module structure	LCD panel + FPC + BL
	Module border (L/R/T/B)	2.502 / 2.502 / 2.5 / 6.9
	Module dimensions	221.85 mm(H) x 145.15 mm(V) x 2.0 mm(D) ※ w/o FPC & CG



The LCD Products listed on this document are not suitable for use of aerospace equipments, submarine cables, nuclear reactor control systems and life support systems. If customers intend to use these LCD products for above applications or not listed in "Standard" as follows, please contact our sales people in advance.



1.2 BLOCK DIAGRAM





1.3 INTERFACE PINS

CONNECTOR (L72E30-HD2100T)

PIN	SYMBOL	FUNCTION
1	NC	NC
2	GND	GROUND
3	Lane1_N	Complement Signal Link Lane 1
4	Lane1_P	True Signal Link Lane 1
5	GND	GROUND
6	Lane0_N	Complement Signal Link Lane 0
7	Lane0_P	True Signal Link Lane 0
8	GND	GROUND
9	AUX_CH_P	True Signal Auxiliary Channel
10	AUX_CH_N	Complement Signal Auxiliary Channel
11	GND	GROUND
12	LCD_VCC	LCD logic and driver power
13	LCD_VCC	LCD logic and driver power
14	NC	NC
15	GND	GROUND
16	GND	GROUND
17	HPD	HPD signal pin
18	GND	GROUND
19	GND	GROUND
20	GND	GROUND
21	GND	GROUND
22	BL_ENABLE	Backlight On/Off(Optional)
23	BL_PWM_DIm	System PWM signal input for dimming
24	NC	NC
25	NC	NC
26	BL_PWR	Backlight power
27	BL_PWR	Backlight power
28	BL_PWR	Backlight power
29	BL_PWR	Backlight power
30	NC	NC



2. FUNCTIONS

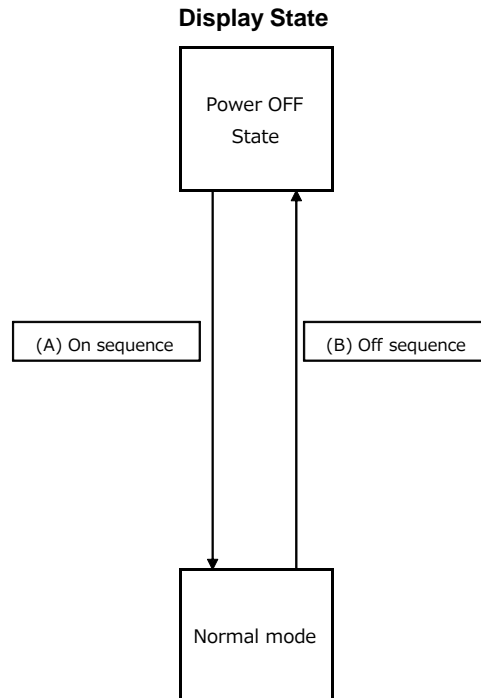
The use of 10.1" WQXGA LCD basically conforms to specifications of LCD driver IC (Renesas SP).

It explains typical function in this manual.

2.1 OVERVIEW

The basic operation mode of this LCD module is illustrated below.

When changing from one mode to another, make sure to follow the sequence indicated in the figure.



2.2 INTERFACE

2Lane eDP to MIPI Video mode 4 Data Lanes and 2 clock lane with 2ports

HS(High Speed) Transmission (Unidirectional)

LP(Low Power) Transmission (Bidirectional)

Diagnostic function - checksum and ECC error monitoring

Functionality supported by Escape mode

Clock Lane supports ULPS

Packet - Based Protocol



3. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Ratings	Unit	Remarks
power supply voltage	LCD_VCC	-0.3~4.6	V	LCD_VCC-GND
LED Enable Input	VLED_EN	-0.3~6.5	V	VLED_EN-GND
PWM EN demming range	FPWM	200~200K	Hz	IOVCC-GND
operating temperature range (environmental)	TOP	0 to 50	°C	no dew condition
storage temperature range (environmental)	TST	-20 to 60	°C	no dew condition

Stress beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device.



4. ELECTRICAL SPECIFICATIONS

4.1 DC SPECIFICATIONS

4.1.1 DC specifications of general pins

GND = 0V, Ambient temperature = 25°C

Parameter	Symbol	Condition	Ratings			Unit	Pins
			Min.	Typ.	Max.		
Power supply voltage	LCD_VCC		3.2	3.3	3.4	V	
Low-level input voltage	VIL		0	-	0.3 x IOVCC	V	
High-level input voltage	VIH		0.7 x IOVCC	-	IOVCC	V	
Low-level output voltage	VOL	IOUT=+1mA	0.0	-	0.2 x IOVCC	V	
High-level output voltage	VOH	IOUT=-1mA	0.8 x IOVCC	-	IOVCC	V	
Power supply current(DC-DC)	IVCC		-	480	-	mA	LCD_VCC

*1: Rated values indicate operating range of electrical functions.

*2: When it is the power supply voltage Typ.

*3: Display image is "White raster Display shown in describes..

<White raster Display>



ELECTRICAL CHARACTERISTICS

Ta=25°C

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
LED Total Input Voltage	VLED	2.7	12	21	V	
LED Total Input Current	IBL+	-	120	-	mA	
LED Enable Input	VLED_EN	2.5	-	5.5	V	
Duty cycle range	PWM	-	-	50K	Hz	



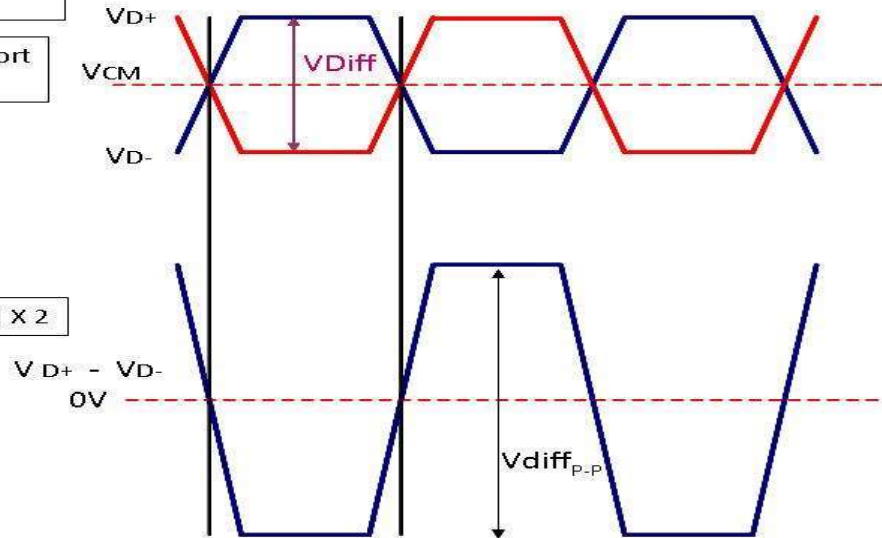
4.2 Signal Electrical Characteristics

4.2.1 Display Port main link signal:

Differential pair VD+, VD-
Which is one Display port
Main link

VCM of Display port
Main link

$$V_{diff_{p-p}} = [(VD+) - (VD-)] \times 2$$

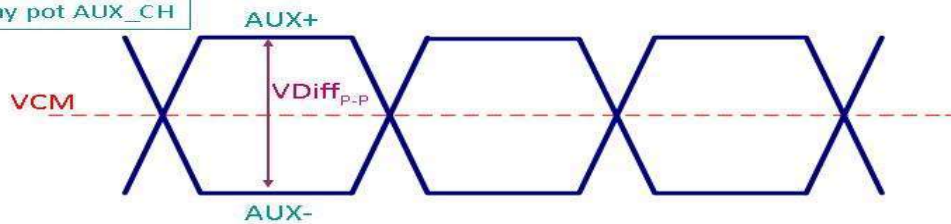


Display port main link					
		Min	Typ	Max	unit
VCM	RX input DC Common Mode Voltage		0		V
VDiff _{p-p}	Peak-to-peak Voltage at a receiving Device	100		1320	mV

Fallow as VESA display port standard V1.1a

4.2.2 Display Port AUX_CH signal:

Differential AUX+, AUX-
Which is Display pot AUX_CH



Display port AUX_CH					
		Min	Typ	Max	unit
VCM	AUX DC Common Mode Voltage		0		V
VDiff _{p-p}	AUX Peak-to-peak Voltage at a receiving Device	0.4	0.6	0.8	V

Fallow as VESA display port standard V1.1a.

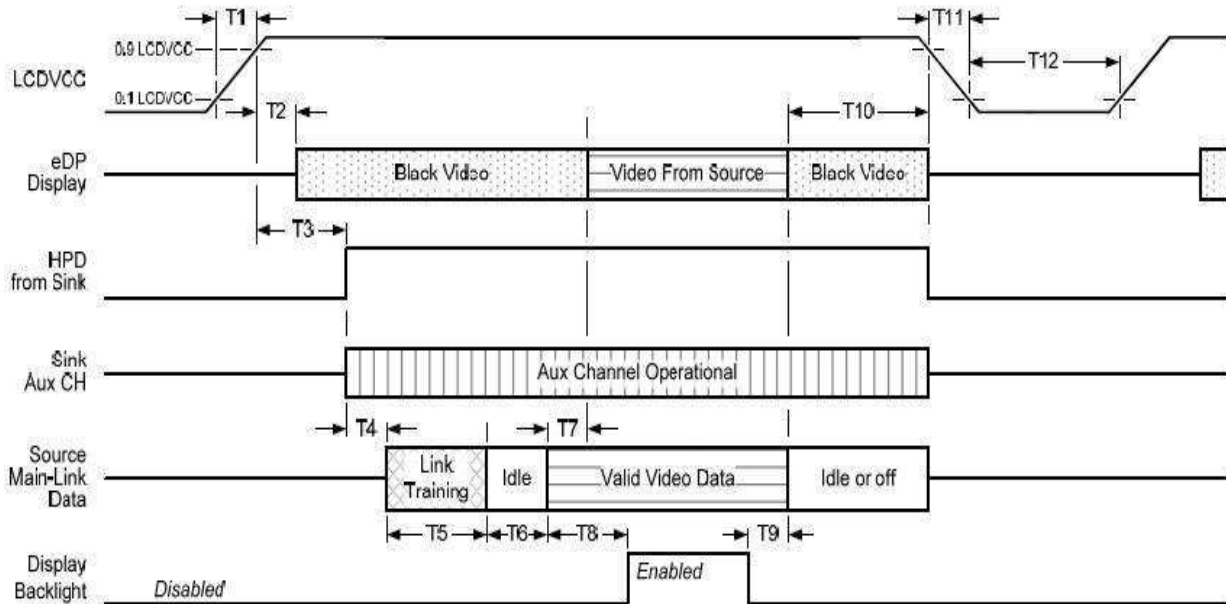
4.2.2 Display Port VHPD signal:

Display port VHPD					
		Min	Typ	Max	unit
VHPD	HPD Voltage	2.25		3.6	V



4.3 RECOMMENDED SEQUENCE

4.3.1 Display Port panel power sequence:

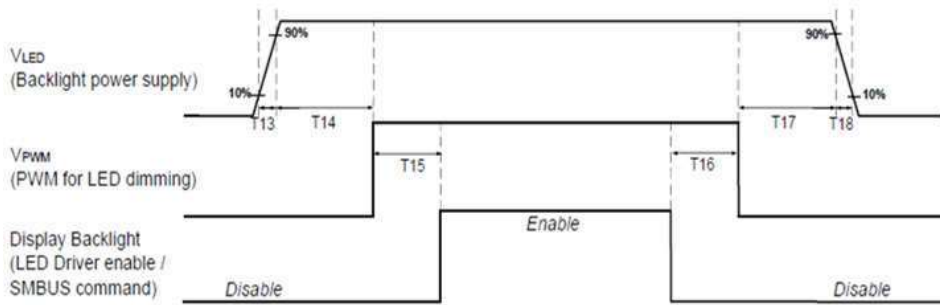


4.3.2 Display Port panel power sequence timing parameter:

Timing parameter	Description	Reqd. by	Limits			Notes
			Min.	Typ.	Max.	
T1	power rail rise time, 10% to 90%	source	0.5ms		10ms	
T2	delay from LCDVDD to black video generation	sink	0ms		200ms	prevents display noise until valid video data is received from the source
T3	delay from LCDVDD to HPD high	sink	122ms		200ms	sink AUX_CH must be operational upon HPD high.
T4	delay from HPD high to link training initialization	source				allows for source to read link capability and initialize.
T5	link training duration	source				dependant on source link to read training protocol.
T6	link idle	source				Min accounts for required BS-Idle pattern. Max allows for source frame synchronization.
T7	delay from valid video data from source to video on display	sink	0ms		50ms	max allows sink validate video data and timing.
T8	delay from valid video data from source to backlight enable	source				source must assure display video is stable.
T9	delay from backlight disable to end of valid video data	source				source must assure backlight is no longer illuminated.
T10	delay from end of valid video data from source to power off	source	0ms		500ms	
T11	power rail fall time, 90% to 10%	source			10ms	
T12	power off time	source	500ms			

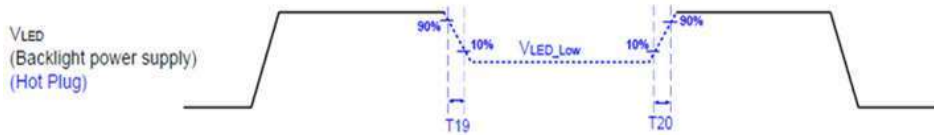


4.3.3 Display Port panel power sequence timing parameter:



	Min (ms)	Max (ms)
T13	0.5	10
T14	10	-
T15	10	-
T16	10	-
T17	10	-
T18	0.5	10
T19	1*	-
T20	1*	-

Note: When the adapter is hot plugged, the backlight power supply sequence is shown as below.



Seamless change: $T19/T20 = 5 \times T_{PWM}^*$
 $*T_{PWM} = 1/PWM \text{ Frequency}$

4.3.4 Timing Chart

Basically, interface timings should match the 2560x1600 /60Hz manufacturing guide line timing.

Parameter	Symbol	Min.	Typ.	Max.	Unit	
Frame Rate	---	--	60	---	Hz	
Clock frequency	$1/T_{Clock}$	259.7	269.0	315.3	MHz	
Vertical Section	Period	T_V	1640	1646	1800	T_{Line}
	Active	T_{VD}	1600			
	Blanking	T_{VB}	40	46	200	
Horizontal Section	Period	T_H	2640	2720	2920	T_{Clock}
	Active	T_{HD}	2560			
	Blanking	T_{HB}	80	160	200	

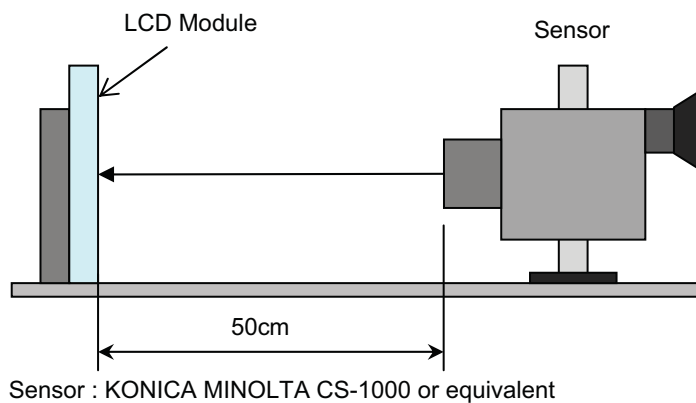
Note1 : DE mode only



5. OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Notes	
Brightness	B	$\varphi=0^\circ, \theta=0^\circ$	350	(400)	-	Cd/m ²	(1),(2)	
Viewing Angle on axis	$\varphi=0$	θ	CR>10	(80)	-	-	degree	(3),(4)
	$\varphi=90$							
	$\varphi=180$							
	$\varphi=270$							
Contrast Ratio	CR	$\varphi=0^\circ, \theta=0^\circ$	-	(1200)	-	-	(5)	
Color Gamut CIE 1931 (Primary Color)	Red	x	$\varphi=0^\circ, \theta=0^\circ$	-	0.6379	-	-	-
		y		-	0.3393	-		
	Green	x		-	0.3179	-		
		y		-	0.647	-		
	Blue	x		-	0.1502	-		
		y		-	0.0461	-		
	White	x		-	0.2911	-		
		y		-	0.3082	-		
NTSC Ratio (CIE1931)	-	$\varphi=0^\circ, \theta=0^\circ$	-	(77)	-	-		
Gamma Curve	-	$\varphi=0^\circ, \theta=0^\circ$	-	(2.2)	-	-		
Cross Talk	CT	-	-	-	(4)	%	(6)	

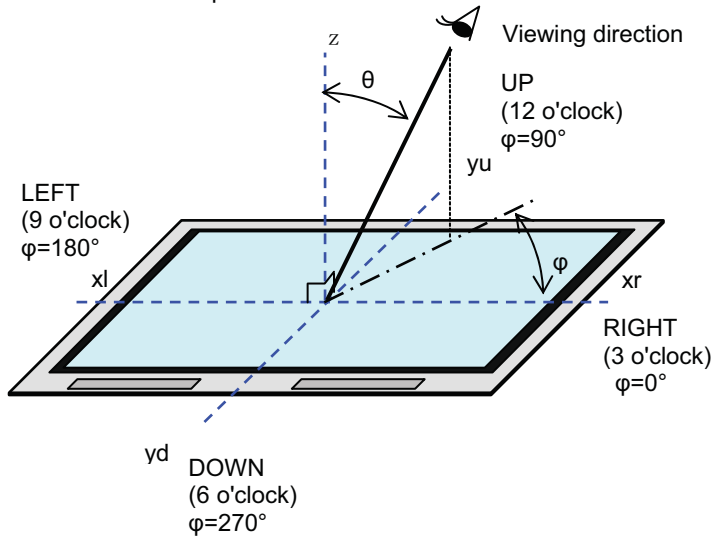
Notes (1) Definition of Brightness "B". At the Center of Active Area.



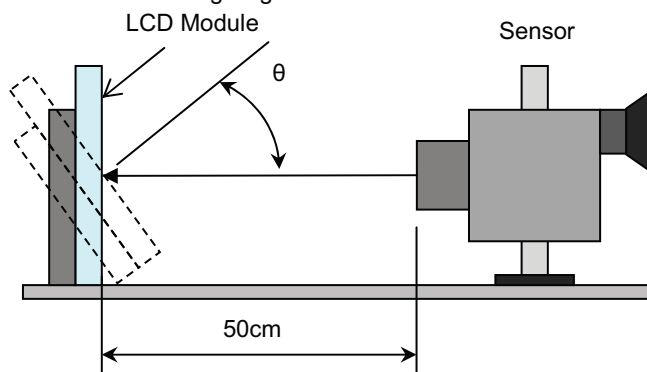
(2) Display image for measurement : All White



(3) Definition of θ and φ



(4) Definition of Viewing Angle θ



Sensor : TOPCON's BM-5A or equivalent

(5) Definition of Contrast "CR"

CR = (Brightness when displaying White raster) / (Brightness when displaying Black raster)

(6) Definition of Cross Talk "CT"

CT = {(Brightness [Cross-talk pattern]) - (Brightness [127Gray])} / (Brightness [127Gray]) x 100(%)

Measurement pattern :

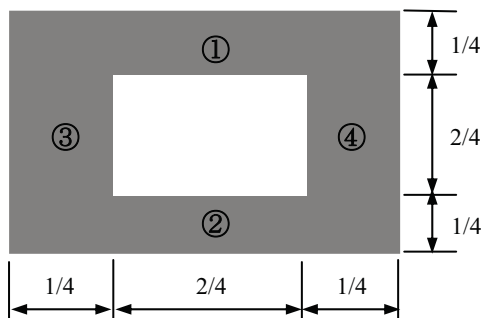
Cross talk pattern 1 : White box

Cross talk pattern 2 : Black box

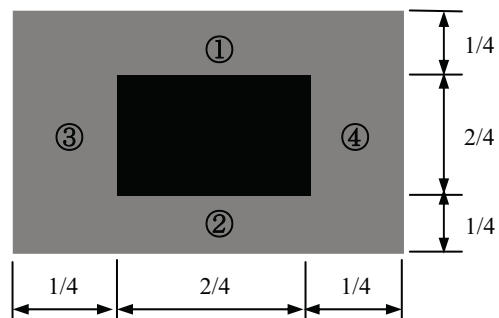
Measurement Point :

Vertical Crosstalk : ① and ②

Horizontal Crosstalk : ③ and ④



Cross talk pattern 1 : White box



Cross talk pattern 2 : Black box



6. DIMENSIONAL OUTLINE

