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Product Specification

SPECIFICATION FOR APPROVAL

- () Preliminary Specification
- () Final Specification

Title	30" WQXGA TFT LCD
-------	--------------------------

BUYER	General
MODEL	

SUPPLIER	LG.Philips LCD CO., Ltd.
*MODEL	LM300WQ5
SUFFIX	STA2

*When you obtain standard approval, please use the above model name without suffix

SIGNATURE	DATE
/	_____
/	_____
/	_____

Please return 1 copy for your confirmation with your signature and comments.

APPROVED BY	DATE
S.G.Hong / G.Manager	_____
REVIEWED BY	
D.Y.Kim / Manager	_____
PREPARED BY	
S.R.Yoo / Engineer	_____

**Product Engineering Dept.
LG. Philips LCD Co., Ltd**

Product Specification

RECORD OF REVISIONS

Revision No	Date	Page	Description
Ver. 0.0	FEB 7, 2007		First Draft. (Preliminary Specifications)
Ver. 0.1	MAR 29, 2007		TBD Update
Ver. 0.2	MAY 3, 2007	4, 17	Change Luminance Spec. (400nit→370nit)
		25	Update Mechanic Drawing (Cover Shield)
		27	Update Packing Form (Box Size)
		4, 8	Update miswritten words
Ver. 0.3	MAY 7, 2007	9	Change Pin1,2 description (I2C → Reserved)
Ver. 0.4	MAY 15, 2007		Standardize internally
		12	Add pixel frequency (Typ 268.5□)
		15	Remove T6
		25	Change spec 1. bandwidth10~500 → 100~300 2. Duration 10 → 30min 3. Shock level 100 → 120G
Ver. 0.5	MAY 28, 2007	15	Change timing of signal sequence (waveform)
Ver. 0.6	JUN 26, 2007	8	Update Pin Configuration of 30Pin CNT
		9	Change 20Pin Power CNT
		13	Add Single Mode Timing
		16	Update Power Sequence (T10)
		24, 25	Update a Mechanic Drawing
Ver. 0.7	AUG 14, 2007	9	Change Pin Configuration of 20pin CNT
Ver 0.8	OCT 10.2007	16	Update Power Sequence(T5)
Ver 0.9	OCT 15.2007	16,17	Update Power Sequence(T6) : 16 Page Update Power Sequence(T1) : 17 Page
Ver.1.0	NOV 2.2007	4, 6	Update Electrical Characteristic (Input Current & Power Consumption)
		7	Update Inverter Electrical Characteristic (Input Current & Power)
		17	Change Spec 1. Luminance Uniformity (Min.75% → Typ.75%) 2. Color Coordinates
		24, 25	Update a Mechanic Drawing

Product Specification

1. General Description

The LM300WQ5 LCD is a Color Active Matrix Liquid Crystal Display with an integral Cold Cathode Fluorescent Lamp(CCFL) back light system. The matrix employs a-Si Thin Film Transistor as the active element. It is a transmissive type display operating in the normally black mode. This TFT-LCD has a 30.0 inch diagonally measured active display area with WQXGA resolution(2560 vertical by 1600 horizontal pixel array). Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes. Gray scale or the luminance of the sub-pixel color is determined with a 8-bit gray scale signal for each dot, thus, presenting a palette of more than 16,777,216 colors.

The LM300WQ5 has been designed to apply the Dual TMDSTTM(Transition Minimized differential Signaling) as the interface method to enables a simple and low-cost implementation in both the host and monitor.

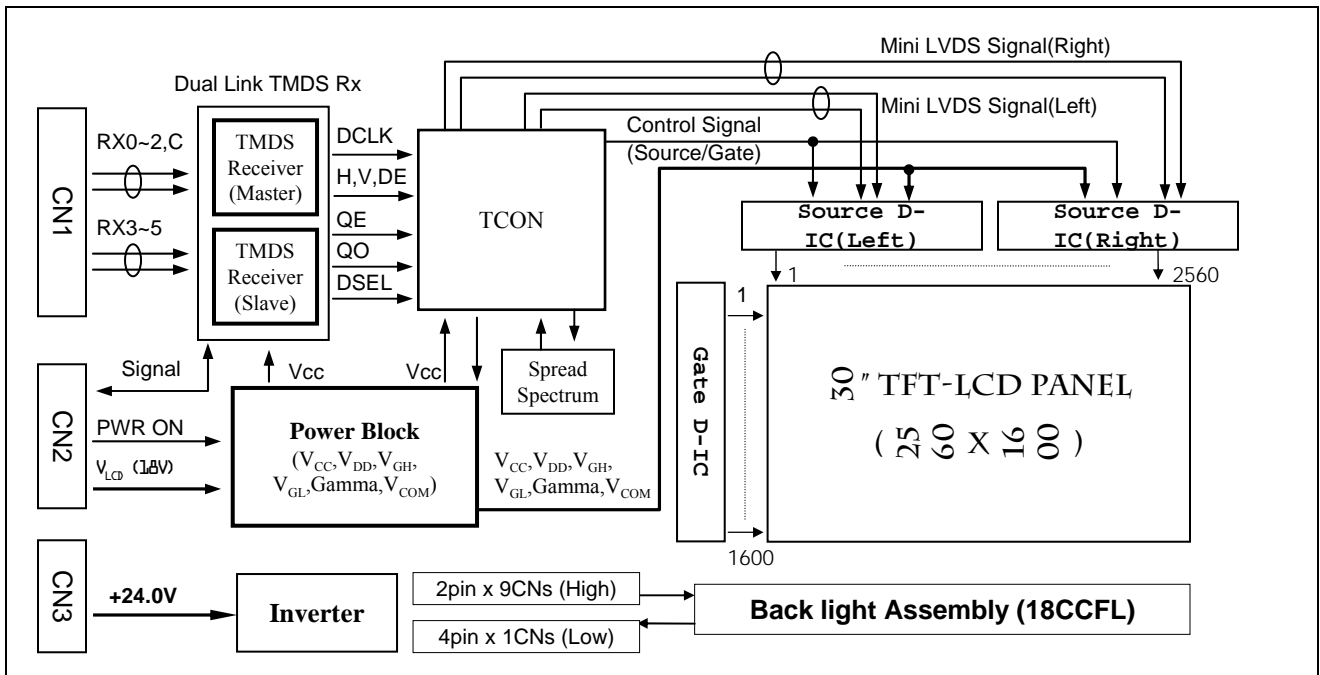


Figure 1. Block diagram

General Features

Active screen size	30.0 inches (756.228mm) diagonal
Outline Dimension	677.30(H) x 436.80(V) x 42.30(D) mm(Typ.)
Pixel Pitch	0.2505 mm x 0.2505 mm
Pixel Format	2560 horizontal By 1600 vertical Pixels. RGB stripe arrangement
Color Depth	8-bit, 16,777,216 color
Luminance, White	370 cd/m ² (1 point Center)
Viewing Angle(CR>10)	Viewing Angle Free(R/L 178(Typ.), U/D 178(Typ.))
Power Consumption	Total 123.00 Watt(Typ.), (15.00 Watt @V _{LCD} , 108W @370cd/)
Weight	5100 g (Typ.)
Display Operating Mode	Transmissive mode, normally Black
Surface Treatments	Hard coating (3H), Anti-glare treatment of the front polarizer

Product Specification

3. Electrical Specifications

3-1. Electrical Characteristics

It requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The second input power for the CCFL, is typically generated by an inverter. The inverter is an external unit to the LCDs.

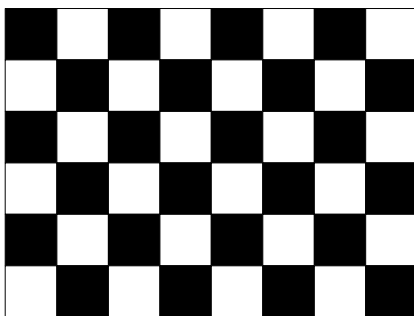
Table 2. Electrical Characteristics

Parameter	Symbol	Values			Unit	Notes
		Min	Typ	Max		
MODULE :						
Power Supply Input Voltage	V _{LCD}	17.0	18.0	19.0	V _{dc}	
Permissible Power Input Ripple	V _{dRF}			400	mV _{p-p}	
Power Supply Input Current	I _{LCD}	700	830	960	□	1
		-	1080	1500	□	2
Power Consumption	P _{LCD}	-	15.0	17.3	Watt	1
Rush current	I _{RUSH}	-	-	4	A	3

Note :

1. The specified current and power consumption are under the V_{LCD}=18.0V, 25 ± 2°C, f_v=60Hz condition whereas mosaic pattern(8 x 6) is displayed and f_v is the frame frequency.
2. The current is specified at the maximum current pattern.
3. The duration of rush current is about 2ms and rising time of power Input is 1ms(min.).

White : 255Gray
Black : 0Gray



Mosaic Pattern(8 x 6)

Maximum current pattern



White Pattern

[Figure 3] Mosaic pattern : for power consumption measurement

Product Specification

Table 3. INVERTER Electrical Characteristics

Parameter	Symbol	Condition	Values			Unit	Notes
			Min.	Typ.	Max.		
Inverter :							
Input Voltage	V_{BL}		21.6	24.0	26.4	V	1
Input Current	I_{BL}	$V_{BR} = 3.3V$		4.5	5.4	A	2
Input Power	PBL	$V_{BR} = 3.3V$		108	130	Watt	2
B/L on/off control	VON/OFF	Lamp ON = High	2.0	-	5.0	V	
		Lamp OFF =Low	0.0	-	0.8	V	
Brightness Adj	VBR		0	-	3.3	V	
LAMP :							
Life time			40,000			Hrs	3

Notes :

1. The input voltage ripple is limited below 400mVp-p.
2. The specified current and power consumption are under the typical supply Input voltage, 24V.
3. The life is determined as the time at which luminance of the lamp is 50% compared to that of initial value at the typical lamp current on condition of continuous operating at $25 \pm 2^{\circ}C$.
4. Electrical characteristics are determined after the unit has been 'ON' and stable for approximately 30min in a dark environment at $25^{\circ}C \pm 2^{\circ}C$.

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3-2. Interface Connections

This LCD employs three kinds of interface connections. A 30-pin connector is used for TMDS signals from the host computer. A 20-pin connector is used for LCD module power and LCM controls signal from external monitor control circuits. And 14-pin connector is used for the inverter for backlight system.

3-2-1. Signal Interface

The Dual TMDS signal interface connector is KDF71G-30S-1H(manufactured by Hirose) or FI-XL30SSL-HF(manufactured by JAE) or equivalent.

The pin configuration for the 30 pin connector is shown in the table below.

Table 4. 30Pin Connector pin configuration(For Dual Link TMDS)

Pin No.	Symbol	Description	Pin No.	Symbol	Description
1	NC	NC	16	RxC-	TMDS negative differential output(Channel C for 3,4,5ch)
2	NC	NC	17	SHLD2	Shield for TMDS Channel 2
3	NC	NC	18	Rx2+	TMDS positive differential output(Channel 2)
4	NC	NC	19	Rx2-	TMDS negative differential output(Channel 2)
5	SHLD5	Shield for TMDS Channel 5	20	SHLD1	Shield for TMDS Channel 1
6	Rx5+	TMDS positive differential output(Channel 5)	21	Rx1+	TMDS positive differential output(Channel 1)
7	Rx5-	TMDS negative differential output(Channel 5)	22	Rx1-	TMDS negative differential output(Channel 1)
8	SHLD4	Shield for TMDS Channel 4	23	SHLD0	Shield for TMDS Channel 0
9	Rx4+	TMDS positive differential output(Channel 4)	24	Rx0+	TMDS positive differential output(Channel 0)
10	Rx4-	TMDS negative differential output(Channel 4)	25	Rx0-	TMDS negative differential output(Channel 0)
11	SHLD3	Shield for TMDS Channel 3	26	SHLDC1	Shield for TMDS Channel C
12	Rx3+	TMDS positive differential output(Channel 3)	27	RxC+	TMDS positive differential output(Channel C for 0,1,2 ch)
13	Rx3-	TMDS negative differential output(Channel 3)	28	RxC-	TMDS negative differential output(Channel C for 0,1,2ch)
14	SHLDC2	Shield for TMDS Channel C	29	NC	NC
15	RxC+	TMDS positive differential output(Channel C for 3,4,5 ch)	30	NC	NC

Notes : 1. Interface Chips

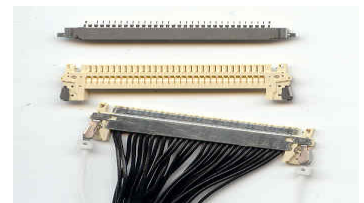
: Si17189 x 1ea (Dual TMDS Receiver ,Silicon Image)

2. Connector

2.1 Connector(Receptacle) : KDF71G-30S-1H(Hirose) or FI-XL30SSL-HF(JAE) or Equivalent.

2.2 Mating Connector(Plug) : FI-X30H and FI-X30HL or its equivalent.

3. 28,29 pins are only used in LCM manufacture.



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3-2-2. Power Connector

The power connector is FI-XL20S-HF or equivalent.

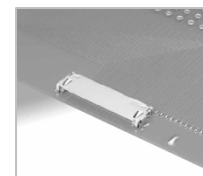
The pin configuration for the 20 pin connector is shown in the table below.

Table 5. 20Pin Connector pin configuration (Power Connector CN1)

Pin	Symbol	Description	Notes
1	NC	Reserved for I2C data	
2	NC	Reserved for I2C clock	
3	PWR_ON	LCM On signal input	In (3.3V TTL)
4	GND	ground	
5	GND	ground	
6	VLCD	18V	
7	VLCD	18V	
8	VLCD	18V	
9	GND	ground	
10	GND	ground	
11	HDCP_SCL	HDCP_I2C_Clock	In / out(5V TTL)
12	HDCP_SDA	HDCP_I2C_Data	In / out(5V TTL)
13	AGP	Auto pattern generation (NC/GND – no signal black)	High : AGP, Low :black
14	HS_OUT	Hsync output to scaler	out(3.3V TTL)
15	VS_OUT	Vsync output to scaler	out(3.3V TTL)
16	V_IC	5V logic voltage input for I2C	
17	NC	Reserved ODC on/off control (NC/HIGH – ODC ON)	
18	A_BR	Analog Vbr output for Inverter dimming	0~3.3V DC
19	NC	Reserved Data stretch on/off control (NC/GND-off)	
20	GND	ground	

Notes : 1. Connector

- 1) Connector(Receptacle) : DF19G-20P-1H or Equivalent.
- 2) Mating Connector(Plug) : DF19G-20S-1C or Equivalent.



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3-3. Signal Timing Specifications

This is the signal timing required at the input of the TMD5 Transmitter. All of the interface signal timing should be satisfied with the following specifications for it's proper operation.

Table 7. TIMING TABLE 1 (Dual mode: 2560x1600)

PS ON : High

ITEM		SYMBOL	Min	Typ	Max	Unit	Note
DCLK	Period	t_{CLK}	7.45	7.45	7.45	ns	Pixel Frequency : Typ 268.5□
	Frequency	f_{CLK}	(133.25)	134.25	(135.25)	MHz	
Hsync	Width-Total	t_{HT}	2720	2720	2720	t_{CLK}	
	Period	t_{HP}	10.13	10.13	10.13	us	
	Frequency	f_H	98.71	98.71	98.71	KHz	
	Width	t_{WH}	32	32	32	t_{CLK}	
Vsync	Width-Total	t_{VT}	1646	1646	1646	t_{HP}	
	Period	t_{VP}	16.68	16.68	16.68		
	Frequency	f_V	59.97	59.97	59.97	Hz	
	Width	t_{WV}	6	6	6	t_{HP}	
Data Enable	Horizontal Valid	t_{HV}	2560	2560	2560	t_{CLK}	
	Horizontal Back Porch	t_{HBP}	80	80	80		
	Horizontal Front Porch	t_{HFP}	48	48	48		
	Horizontal Blank	-	160	160	160		$t_{WH} + t_{HBP} + t_{HFP}$
	Vertical Valid	t_{VV}	1600	1600	1600	t_{HP}	
	Vertical Back Porch	t_{VBP}	38	38	38		
	Vertical Front Porch	t_{VFP}	2	2	2		
	Vertical Blank	-	46	46	46		

Note: Hsync period and Hsync width-active should be even number times of t_{CLK} . If the value is odd number times of t_{CLK} , display control signal can be asynchronous. In order to operate this LCM a Hsync, Vsyn, and DE(data enable) signals should be used.

1. : The performance of the electro-optical characteristics may be influenced by variance of the vertical refresh rates.
2. Vsync and Hsync should be keep the above specification.
3. Hsync Period, Hsync Width, and Horizontal Back Porch should be any times of of character number(8).
4. The polarity of Hsync, Vsync is not restricted.

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Table 8. TIMING TABLE 2 (Single mode: 1280x800)

PS ON : Low

ITEM		SYMBOL	Min	Typ	Max	Unit	Note
DCLK	Period	t_{CLK}	14.08	14.08	14.08	ns	
	Frequency	f_{CLK}	(70.00)	71.00	(72.00)	MHz	Single
Hsync	Width-Total	t_{HP}	1440	1440	1440	t_{CLK}	
	Period	t_{HP}	20.28	20.28	20.28	us	
	Frequency	f_H	49.31	49.31	49.31	KHz	
	Width	t_{WH}	32	32	32	t_{CLK}	
Vsync	Width-Total	t_{VT}	823	823	823	t_{HP}	
	Period	t_{VP}	16.69	16.69	16.69	ms	
	Frequency	f_V	59.91	59.91	59.91	Hz	
	Width	t_{WV}	6	6	6	t_{HP}	
Data Enable	Horizontal Valid	t_{HV}	1280	1280	1280	t_{CLK}	
	Horizontal Back Porch	t_{HBP}	80	80	80		
	Horizontal Front Porch	t_{HFP}	48	48	48		
	Horizontal Blank	-	160	160	160		$t_{WH} + t_{HBP} + t_{HFP}$
	Vertical Valid	t_{VV}	800	800	800	t_{HP}	
	Vertical Back Porch	t_{VBP}	15	15	15		
	Vertical Front Porch	t_{VFP}	2	2	2		
	Vertical Blank	-	23	23	23		

Notes :

Hsync period and Hsync width-active should be even number times of t_{CLK} . If the value is odd number times of t_{CLK} , display control signal can be asynchronous. In order to operate this LCM a Hsync., Vsync and DE(data enable) signals should be used.

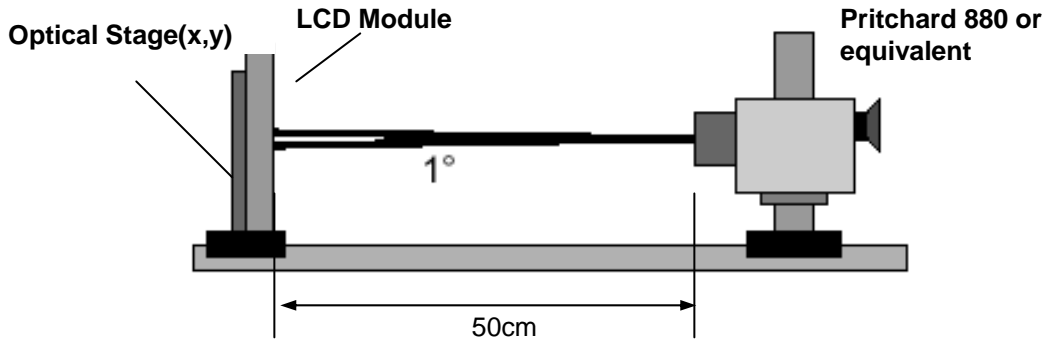
1. The performance of the electro-optical characteristics are may be influenced by variance of the vertical refresh rates.
2. Vsync, Hsync should be keep the above specification.
3. Hsync Period should be a double number of character (8).
4. The polarity of Hsync, Vsync is not restricted.

Product Specification

4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 30 minutes in a dark environment at 25 °C. The values specified are measured at an approximate distance 50cm from the LCD surface at a viewing angle of Φ and θ equal to 0 °.

Figure. 5 presents additional information concerning the measurement equipment and method.



[Figure 5] Optical characteristic measurement equipment and method

Table 12. Optical characteristics ($T_a=25\pm 2^\circ\text{C}$, $V_{\text{LCD}}=18\text{V}$, $f_v=60\text{Hz}$, $\text{CLK}=134.25\text{MHz}$, $I_{\text{OUT}}=5.5\text{mA}$)

Parameter	Symbol	Values			Units	Notes	
		Min	Typ	Max			
Contrast Ratio	CR	(700)	1000			1	
Surface Luminance, white	L_{WH}	(300)	(370)		cd/m ²	2	
Luminance Variation	δ_{WHITE}	70	75	-	%	3	
Luminance Uniformity (angular dependant)		-	-	1.7	TCO '99		
Response Time	Rise Time	T_{rR}	-	6	12	ms	4
	Decay Time	T_{rD}	-	6	12	ms	4
	Gray To Gray	$T_{\text{GTG_AVR}}$	-	5	-	ms	5
		$T_{\text{GTG_MAX}}$	-	17	-	ms	5
Color Coordinates [CIE1931]	RED	R_x		(0.678)			
		R_y		(0.309)			
	GREEN	G_x		(0.210)			
		G_y	Typ -0.03	(0.692)	Typ +0.03		
	BLUE	B_x		(0.146)			
		B_y		(0.055)			
	WHITE	W_x		(0.313)			
	W_y		(0.329)				
Color shift	Horizontal	$\theta_{\text{CST_H}}$	-	176	-	degree	6
	Vertical	$\theta_{\text{CST_V}}$	-	176	-		
Viewing Angle (CR>10)							
general	Horizontal	θ_{H}	170	178	-	degree	7
	Vertical	θ_{V}	170	178	-		
Effective	Horizontal	$\theta_{\text{GMA_H}}$	-	176	-	degree	8
	Vertical	$\theta_{\text{GMA_V}}$	-	176	-		
Gray Scale				2.2		9	

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6. **Color shift** is the angle at which the color difference is lower than 0.04.

- Color difference($\Delta u'v'$)

$$u' = \frac{4x}{-2x + 12y + 3}$$

$$v' = \frac{9y}{-2x + 12y + 3}$$

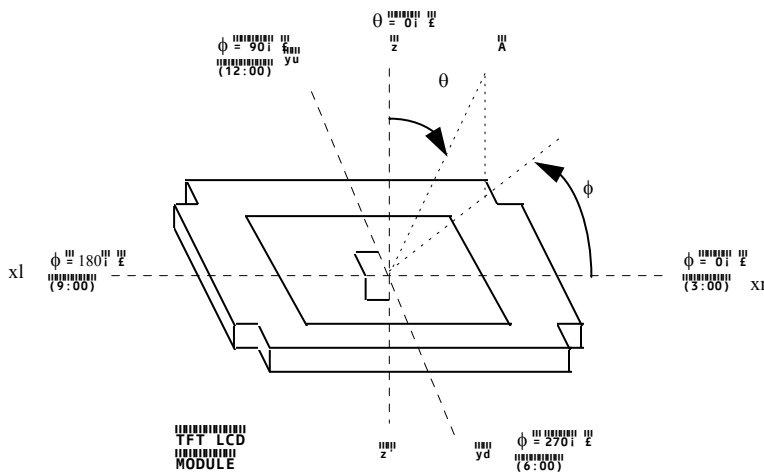
$$\Delta u'v' = \sqrt{(u'_1 - u'_2)^2 + (v'_1 - v'_2)^2}$$

u'_1, v'_1 : $u'v'$ value at viewing angle direction

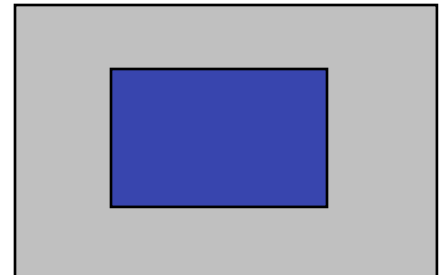
u'_2, v'_2 : $u'v'$ value at front($\theta=0$)

- Pattern size : 25% Box size

- Viewing angle direction of color shift : Horizontal, Vertical



25% Box size



Viewing angle direction

Average RGB values in Bruce RGB for Macbeth Chart

	Dark skin	Light skin	Blue sky	Foliage	Blue flower	Bluish green
R	98	206	85	77	129	114
G	56	142	112	102	118	199
B	45	123	161	46	185	178
	Orange	Purplish blue	Moderate red	Purple	Yellow green	Orange yellow
R	219	56	211	76	160	230
G	104	69	67	39	193	162
B	24	174	87	86	58	29
	Blue	Green	Red	Yellow	Magenta	cyan
R	26	72	197	241	207	35
G	32	148	27	212	62	126
B	145	65	37	36	151	172
	White	Neutral 8	Neutral 6.5	Neutral 5	Neutral 3.5	black
R	240	206	155	110	63	22
G	240	206	155	110	63	22
B	240	206	155	110	63	22

5. Mechanical Characteristics

The contents provide general mechanical characteristics. In addition the figures in the next page are detailed mechanical drawing of the LCD.

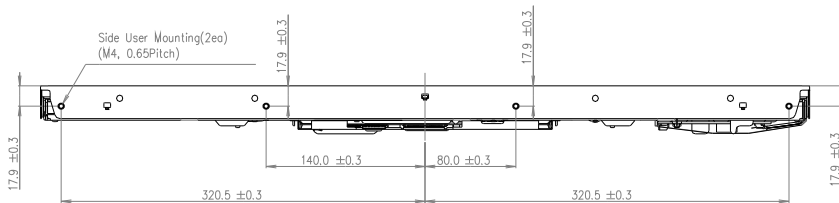
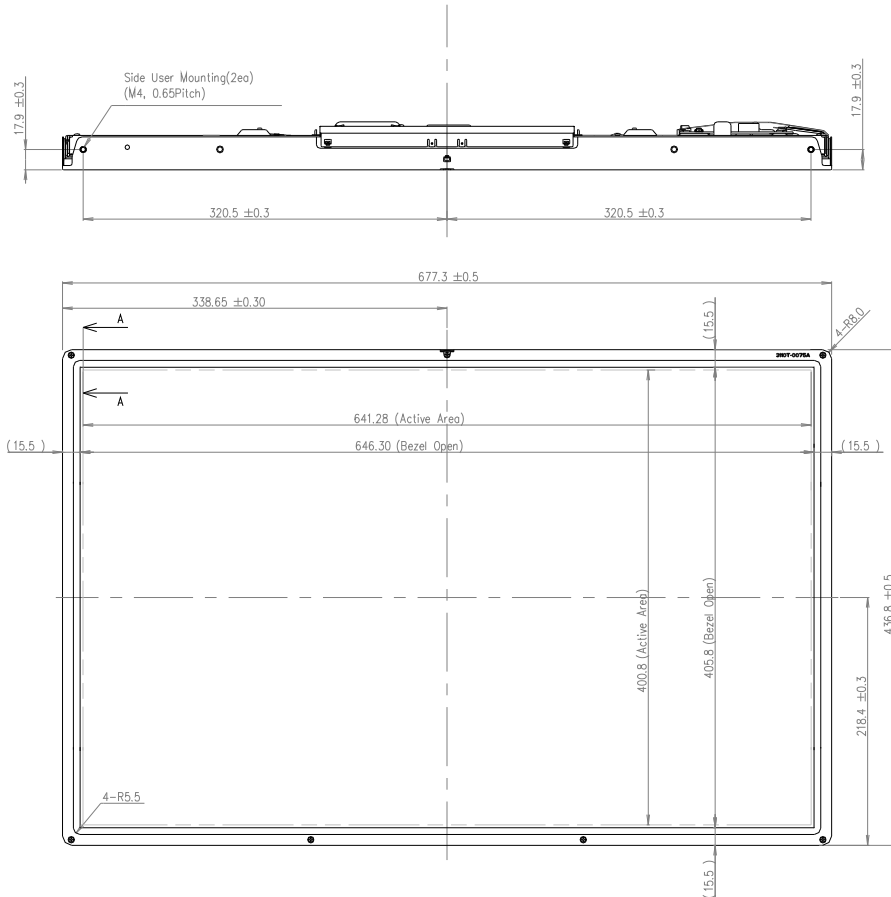
Table 14. Mechanical characteristics

Outline Dimension	Horizontal	677.30 mm
	Vertical	436.80 mm
	Depth	42.30 mm
Bezel Area	Horizontal	646.30 mm
	Vertical	405.80 mm
Active Display Area	Horizontal	641.28 mm
	Vertical	400.8 mm
Weight	5100g (Typ.), 5400g (Max.)	
Surface Treatment	Hard coating(3H) Anti-glare(13%) treatment of the front polarizer	

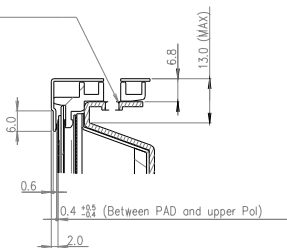
Notes : Please refer to a mechanic drawing in terms of tolerance at the next page.

Product Specification

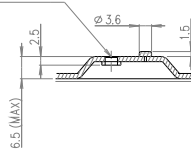
<FRONT VIEW>



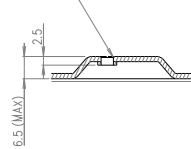
M4 Machine Screw(0.65Pitch)
(Torque 2.5kgf~3.5kgf)



M4 Machine Screw(0.65Pitch)
(Torque 2.5kgf~3.5kgf)

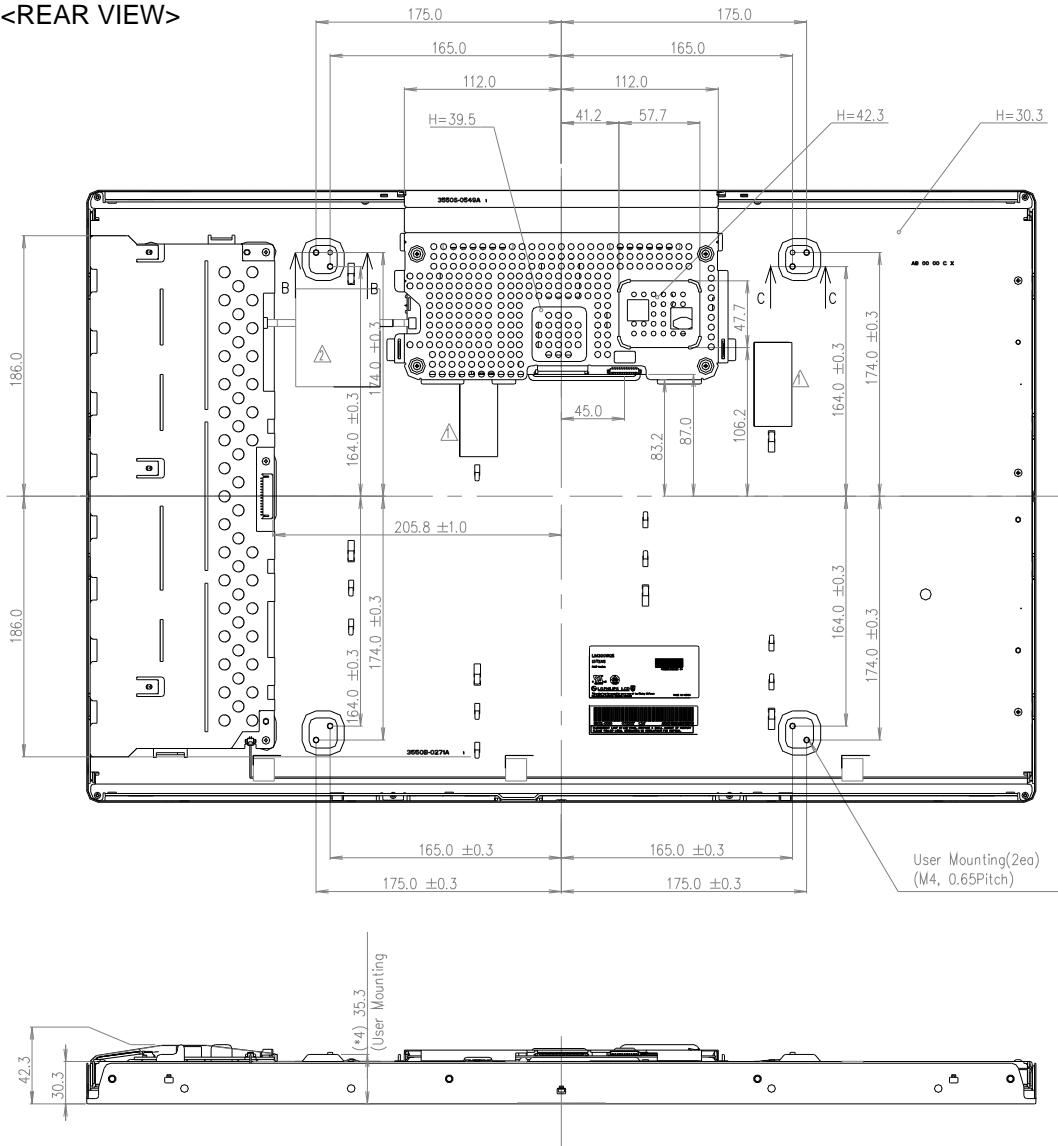


M4 Machine Screw(0.65Pitch)
(Torque 2.5kgf~3.5kgf)



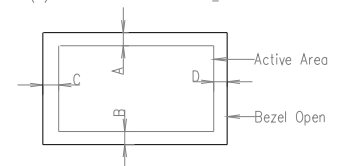
Product Specification

<REAR VIEW>



Notes

1. Unspecified tolerances are to be $\pm 0.5\text{mm}$.
2. Both backlight wires and contraction tubes are excluded from outline dimensions.
3. Tilt and partial disposition tolerance of display area are as following.
 - (1) Y-direction : IA-BI $< \pm 1.4\text{mm}$
 - (2) X-direction : IA-BI $< \pm 1.4\text{mm}$



4. User Connector Specification : KDF71G-30S-1H
5. Power Connector Specification : DF19G-20P-1H

Product Specification

6. Reliability

Environment test condition

No	Test Item	Condition
1	High temperature storage test	Ta= 60°C 240h
2	Low temperature storage test	Ta= -20°C 240h
3	High temperature operation test	Ta= 50°C 50%RH 240h
4	Low temperature operation test	Ta= 0°C 240h
5	Vibration test (non-operating)	Wave form : random Vibration level : 1.0G RMS Bandwidth : 10-300Hz Duration : X,Y,Z, 30 min One time each direction
6	Shock test (non-operating)	Shock level : 120G Waveform : half sine wave, 2ms Direction : ±X, ±Y, ±Z One time each direction
7	Altitude operating storage / shipment	0 - 10,000 feet(3048m) 0 - 40,000 feet(12,192m)

7. International Standards

7-1. Safety

- a) UL 60950-1:2003, First Edition, Underwriters Laboratories, Inc., Standard for Safety of Information Technology Equipment.
- b) CAN/CSA C22.2, No. 60950-1-03 1st Ed. April 1, 2003, Canadian Standards Association, Standard for Safety of Information Technology Equipment.
- c) EN 60950-1:2001, First Edition, European Committee for Electrotechnical Standardization(CENELEC) European Standard for Safety of Information Technology Equipment.

7-2. EMC

- a) ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electrical Equipment in the Range of 9kHz to 40GHz." American National Standards Institute(ANSI), 1992
- b) C.I.S.P.R. "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." International Special Committee on Radio Interference.
- c) EN 55022 "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." European Committee for Electrotechnical Standardization.(CENELEC), 1998 (Including A1: 2000)

Product Specification

8. Packing

8-1. Designation of Lot Mark

a) Lot Mark

A	B	C	D	E	F	G	H	I	J	K	L	M
---	---	---	---	---	---	---	---	---	---	---	---	---

A,B,C : SIZE(INCH)
E : MONTH

D : YEAR
F ~ M : SERIAL NO.

Note

1. YEAR

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Mark	1	2	3	4	5	6	7	8	9	0

2. MONTH

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mark	1	2	3	4	5	6	7	8	9	A	B	C

b) Location of Lot Mark

Serial No. is printed on the label. The label is attached to the backside of the LCD module.
This is subject to change without prior notice.

8-2. Packing Form

- a) Package quantity in one box : 5 pcs
- b) Box size : 756mm X 343mm X 515mm.

9. Precautions

Please pay attention to the following when you use this TFT LCD module.

9-1. Mounting Precautions

- (1) You must mount a module using holes (refer 26~27 page)
- (2) You should consider the mounting structure so that uneven force(ex. twisted stress) is not applied to the module.
And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- (3) Please attach a transparent protective plate to the surface in order to protect the polarizer.
Transparent protective plate should have sufficient strength in order to the resist external force.
- (4) You should adopt radiation structure to satisfy the temperature specification.
- (5) Acetic acid type and chlorine type materials for the cover case are not describe because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- (6) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.
Do not touch the surface of polarizer for bare hand or greasy cloth.(Some cosmetics are determined to the polarizer.)
- (7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
- (8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (9) Do not open the case because inside circuits do not have sufficient strength.

9-2. Operating Precautions

- (1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage :
 $V = \pm 200\text{mV}$ (Over and under shoot voltage)
- (2) Response time depends on the temperature.(In lower temperature, it becomes longer.)
- (3) Brightness depends on the temperature. (In lower temperature, it becomes lower.)
And in lower temperature, response time(required time that brightness is stable after turned on) becomes longer.
- (4) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- (5) When fixed patterns are displayed for a long time, remnant image is likely to occur.
- (6) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.
- (7) Please do not give any mechanical and/or acoustical impact to LCM. Otherwise, LCM can not be operated its full characteristics perfectly.
- (8) A screw which is fastened up the steels should be a machine screw (if not, it causes metal foreign material and deal LCM a fatal blow)
- (9) Please do not set LCD on its edge.

9-3. Electrostatic Discharge Control

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

9-4. Precautions for Strong Light Exposure

Strong light exposure causes degradation of polarizer and color filter.

9-5. Storage

When storing modules as spares for a long time, the following precautions are necessary.

- (1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
- (2) The polarizer surface should not come in contact with any other object.
It is recommended that they be stored in the container in which they were shipped.

9-6. Handling Precautions for Protection Film

- (1) The protection film is attached to the bezel with a small masking tape.
When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
- (2) When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the Bezel after the protection film is peeled off.
- (3) You can remove the glue easily. When the glue remains on the Bezel or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.