



PRODUCT SPECIFICATION

MODEL: WD090HHM30AC-Q4

<◇>PRELIMINARY SPECIFICATION

<◆>APPROVAL SPECIFICATION

CUSTOMER APPROVED	DESIGNED	CHECKED	APPROVED

SUPPLIER APPROVED	DESIGNED	CHECKED	APPROVED

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REVISION STATUS

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Contents	Page
1.0. General Specification	4
2.0. Absolute Maximum Ratings	5
3.0. Optical characteristics	6
4.0. Block diagram	10
5.0. Interface pin connection	12
6.0. Electrical characteristics	14
7.0. Reliability test items	19
8.0. Outline dimension	20
9.0. Bom List	21
10.0. Lot mark	22
11.0. Package specification	23
12.0. General Precaution	24



1.0 GENERAL DESCRIPTION

1.1 Introduction

The model **WD090HHM30AC-Q4** is a color active matrix thin film transistor (TFT) liquid crystal display without plagiarizer. This model is composed of amorphous silicon TFT as a switching device. This TFT LCD has a 9.0-inch wide (16:9) diagonally measured active display area with WVGA (1280 horizontal by 720 vertical pixel) resolution. Each pixel is divided into Red, Green, Blue dots which are arranged in vertical stripes.

1.2 Features

- 9.0 inch configuration.
- 16.7M color by 8 bit R.G.B. signal input
- RoHS/Halogen Free Compliance

1.3 Applications

- Mobile NB
- Digital Photo frame
- Display terminal for AV application

1.4 General information

Item	Specification	Unit
Screen Size	9 inches	Diagonal
Number of Pixel	1280RGB (H) ×720(V)	Pixels
Display area	198.912(H) x 111.888(V)	mm
Outline Dimension	210.7 x 126.5 x 5.1(Typ)	mm
Display mode	Normally Black	--
Pixel arrangement	RGB Vertical stripe	--
Pixel pitch	0.1554(H) ×0.1554(V)	mm
Back-light	LED Side-light type	--
Surface treatment	Anti - glare	--
Interface	MIPI	



1.5 Mechanical Information

Item		Min.	Typ.	Max.	Unit
Module Size	Horizontal (H)	210.5	210.7	210.9	mm
	Vertical (V)	126.3	126.5	126.7	mm
	Depth (D)	4.9	5.1	5.3	mm
Weight		--		240	g

2.0 ABSOLUTE MAXIMUM RATINGS

2.1 Electrical Absolute Rating

2.1.1 TFT LCD Module

Item	Symbol	Min	Max	Unit	Note
Power supply voltage	VDD	3.0	3.6	V	GND=0
	AVDD	4.5	6	V	AGND=0
	AVEE	-6	-4.5	V	AGND=0

Note:

1. Stresses above those listed under "Absolute Maximum Rating" may cause permanent damage to the device. These are stress ratings only. Functional operation of this device at indicated in the operational sections(6.1) of this specification.

2. $T_a=25\pm 2^{\circ}\text{C}$

2.2 Environment Absolute Rating

Item	Symbol	Min.	Max.	Unit	Note
Storage temperature	T_{STG}	-30	80	$^{\circ}\text{C}$	
Operating temperature	T_{OPR}	-20	70	$^{\circ}\text{C}$	

Note: If users use the product out off the environmental operation range(temperature and humidity), it will have visual quality concerns.



3.0 OPTICAL CHARACTERISTICS

3.1 Optical specification

Item		Symbol	Condition	Min	Type	Max	Unit	Note
White luminance (Center)		YL	Θ=0 Normal Viewing Angle	400	450	TBD	nits	(1)(4)(6)
Response time		T _r + T _f		--	35		msec	(1)(3)
Contrast ratio		CR		900	1200	--	--	(1)(2)
Color Chromaticity (CIE 1931)	white	W _x			0.303			(1)(4)
		W _y		0.323				
Viewing Angle	Hor.	Θ _L	CR≥10	75	85	--		(1)(4)
		Θ _R		75	85	--		
	Ver.	Θ _U		75	85	--		
		Θ _D		75	85	--		
Brightness		B _{UNI}	Θ=0	70	80	--	%	(5)
Color gamut (NTSC)		S		69	72	--	%	C-light
Optima View Direction		ALL VIEW						

1), 客户签样亮度 $\pm 10\%$ = 大货亮度, 小于10%视为不良。

2), 大货同一批色调一致的情况下(目视同为冷色或暖色)与客户签样相比, X色坐标相差 ± 0.015 , Y色坐标相差 ± 0.02 以内视为正常OK品。

3.2 Measuring Condition

- Measuring surrounding: dark room
- LED current IL: 180mA
- Ambient temperature: $25 \pm 2^\circ\text{C}$
- 30min. warm-up time

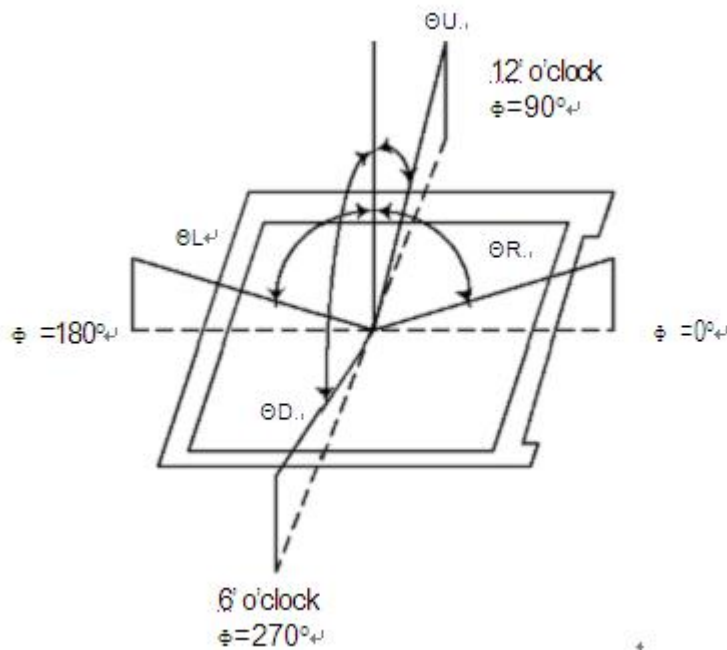
3.3 Measuring Equipment

- BM-7 optical characteristics.
- Measuring spot size: 20 ~ 21mm



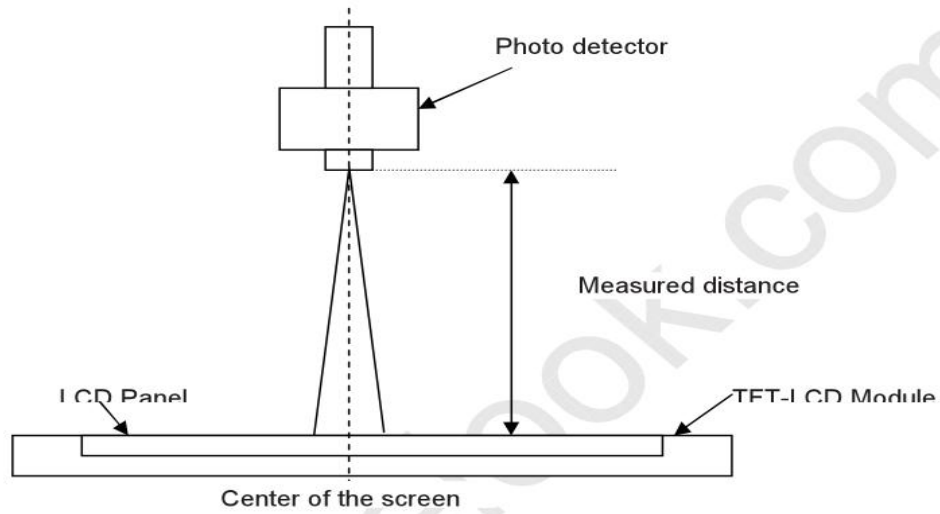
Note (1) Definition of Viewing angle range:

Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see FIGURE 1).

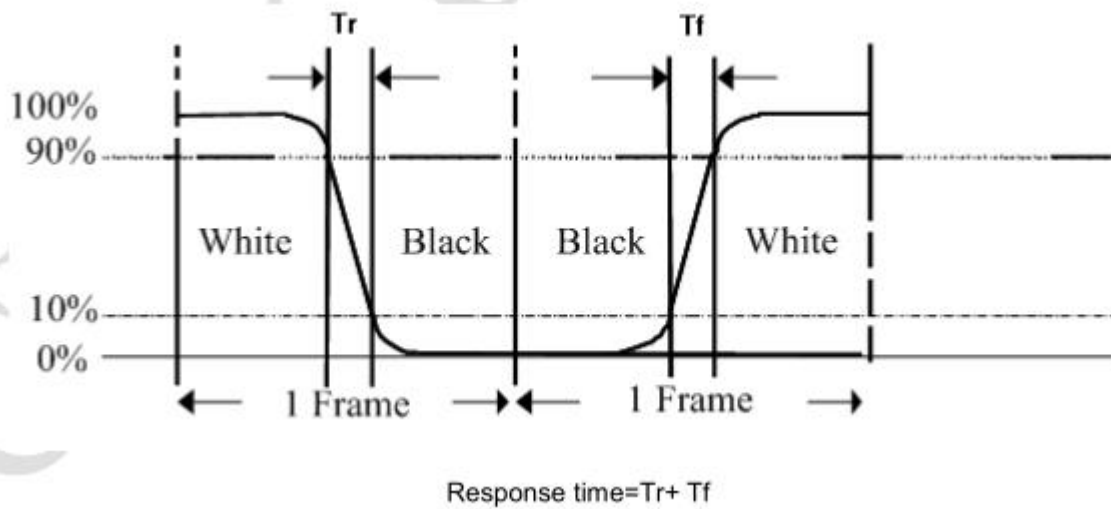


Note (2) Definition of Contrast Ratio(CR): Measured at the center point of panel

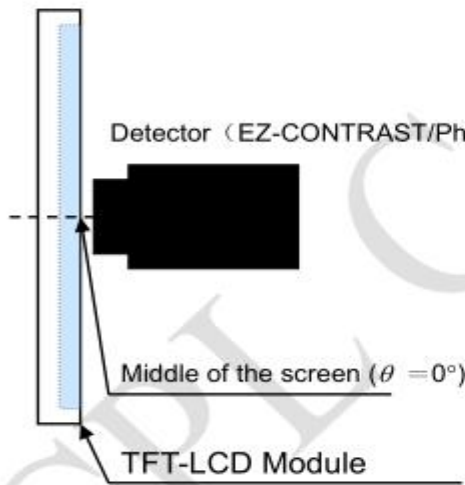
$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$



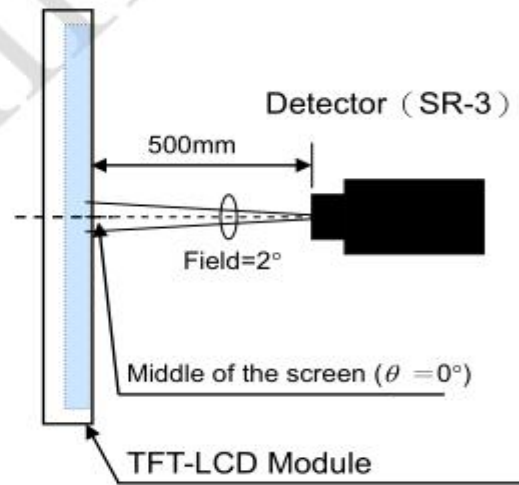
Note (3) Definition of Response Time: Sum of T_R and T_F



Note (4) Definition of optical measurement setup

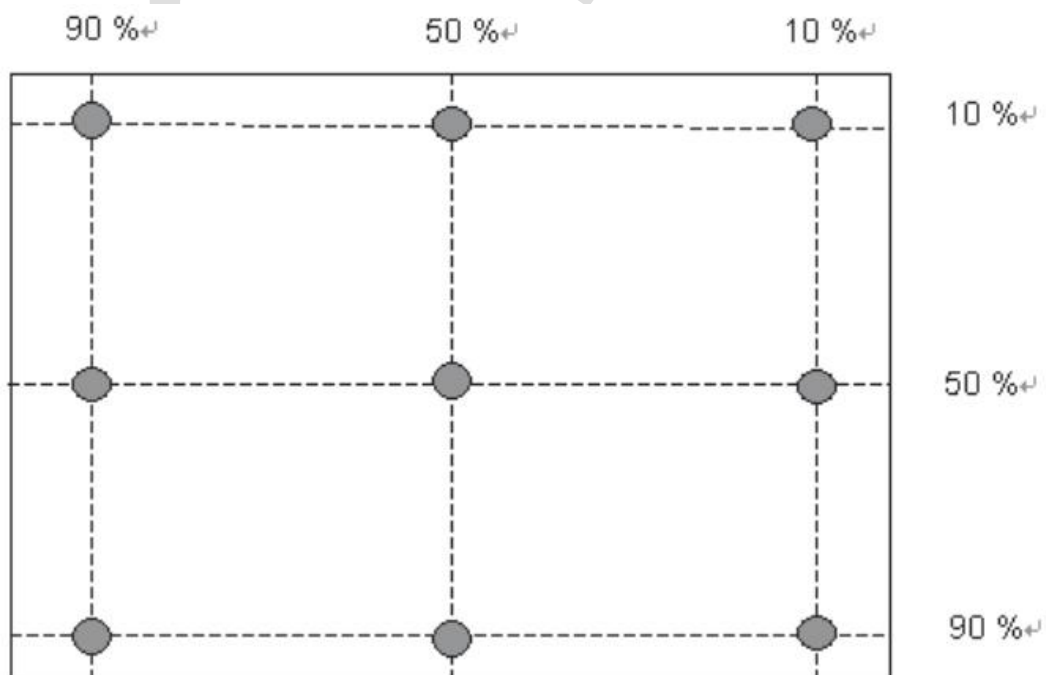


Measurement of viewing angle range, Response time.



Measurement of Contrast, Luminance, Chromaticity.

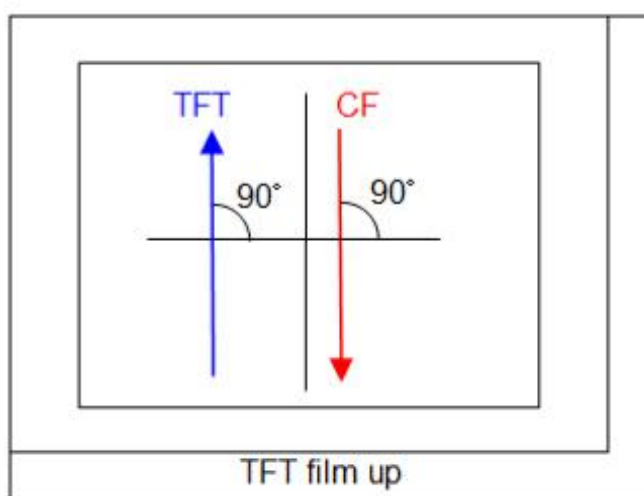
Note (5) Definition of brightness uniformity





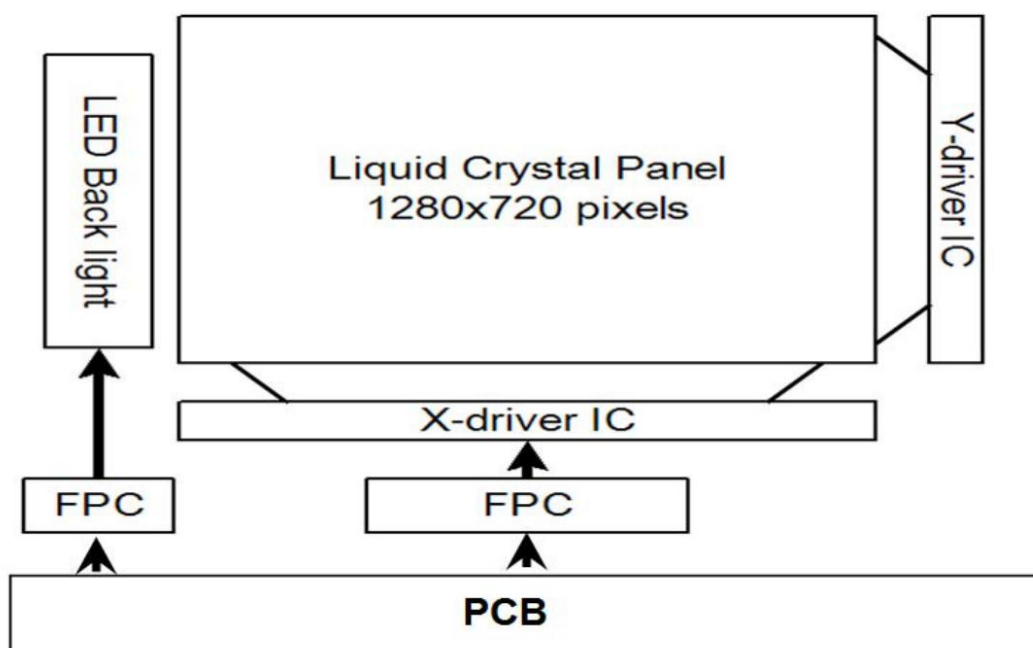
$$\text{Luminance uniformity} = \frac{(\text{Min Luminance of 9 points})}{(\text{Max Luminance of 9 points})} \times 100 \%$$

Note (6) Rubbing Direction (The different Rubbing Direction will cause the different optima view direction.



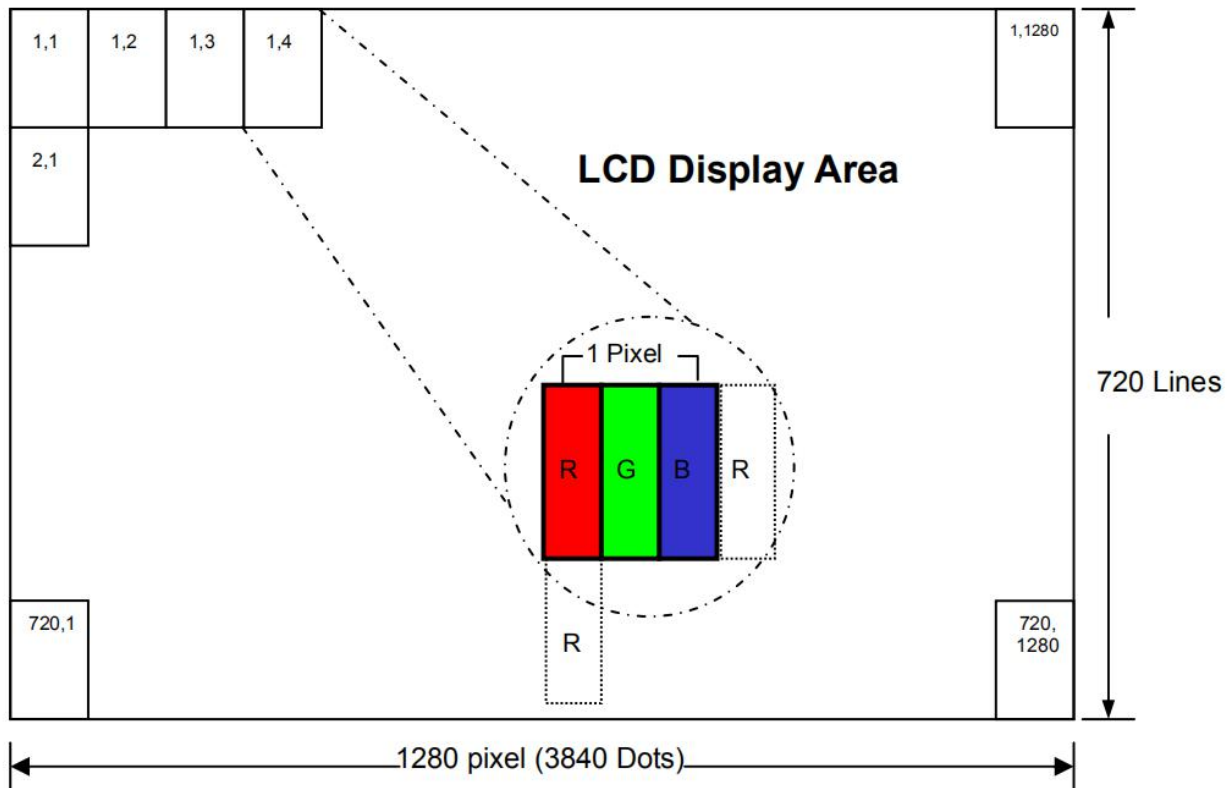
4.0 BLOCK DIAGRAM

4.1 TFT LCD Module





4.2 Pixel Format

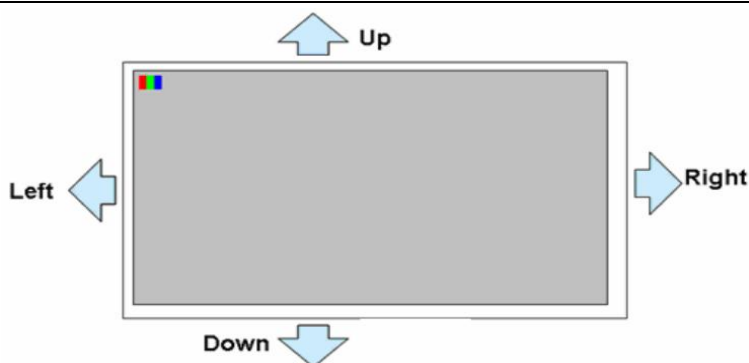




5.0 INTERFACE PIN CONNECTION

5.1 TFT LCD Module: FPC UP Connector, (FH28-60S-0.5H (HIROSE), 60pin,pitch = 0.5mm)

Pin No.	Symbol	Function	Remark
1	VCOM	No connection	
2	VDD	Digital Power	
3	VDD	Digital Power	
4	NC	No connection	
5	RESET	Global reset pin.	
6	STBYB	Standby mode, Normally pulled high STBYB = "1", normal operation STBYB = "0", timing controller, source driver will turn off, all output are High-Z	
7	GND	Power ground	
8	MIPI_D0-	Negative mipi differential data inputs	
9	MIPI_D0+	Positive mipi differential data inputs	
10	GND	Power ground	
11	MIPI_D1-	Negative mipi differential data inputs	
12	MIPI_D1+	Positive mipi differential data inputs	
13	GND	Power ground	
14	MIPI_CLK-	Negative mipi differential data inputs	
15	MIPI_CLK+	Positive mipi differential data inputs	
16	GND	Power ground	
17	MIPI_D2-	Negative mipi differential data inputs	
18	MIPI_D2+	Negative mipi differential data inputs	
19	GND	Power ground	
20	MIPI_D3-	Negative mipi differential data inputs	
21	MIPI_D3+	Negative mipi differential data inputs	
22	LED-	No connection	
23	LED-	No connection	
24	AVDD	Power for analog circuit	
25	NC	No connection	
26	VGL	Gate OFF voltage	
27	NC	No connection	
28	VGH	Gate OFF voltage	
29	LED+	No connection	
30	LED+	No connection	



5.2 Back-Light Unit

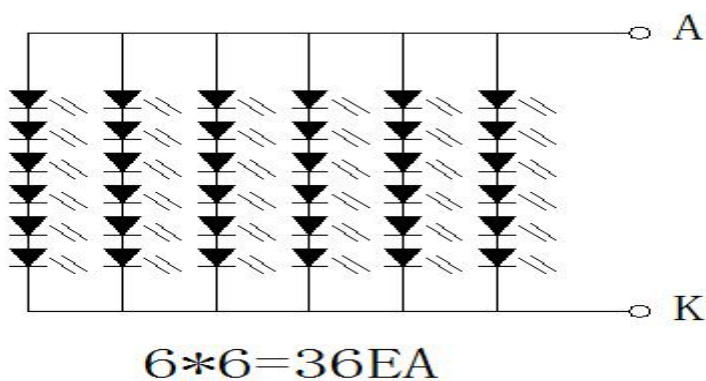
The backlight system is an edge-lighting type with $6C * 7P=42$ LED.

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

Item	Symbol	Min	Typ	Max	Unit	Note
LED current	IL	160	180	200	mA	
LED voltage	VL	18.0	19.2	21.0	V	
Operating LED life time	Hr	20000	25000	--	Hour	(1)

Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition: $T_a=25\pm3\text{ }^{\circ}\text{C}$, typical IL value indicated in the above table and the $f_L=50\text{k}$ Hz until the brightness becomes less than 50%.

线路原理图:



6.1 TFT LCD Module

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Digital Power Supply Voltage For LCD	DVDD	3.0	3.3	3.6	V	
Gate On Power Supply Voltage	VGH	18	18.5	20	V	
Gate Off Power Supply Voltage	VGL	-12	-11.5	-11	V	
Data (RGB signal) Voltage	Vsig	0.2	--	11.9		
Operation frequency	FCLK	--	--	200	KHZ	

Note 1: Please adjust VCOM to make the flicker level be minimum. Typ VCOM 电压值
只做参考，具体以实际效果为准（根据FLICKER 状态可调整）

Note (2): Be sure to apply the power Voltage as the power sequence spec.

Note (3): GND=0V

6.2 TFT LCD Module

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Supply Voltage	VDD	3	3.3	3.6	V	Note (1)
	V _{IH}	0.7VDD		VDD	V	Note (2)
	V _{IL}	GND		0.3VDD	V	Note (2)
Current of power supply	IDD		320		mA	VDD=3.3V

Note :

(1) : VDD setting should match the signals output voltage of customer's system board.

(2) : RESET,STBYB,SELB(DINT),L/R,U/D

6.3 AC Characteristics

6.3.1 MIPI AC characteristics

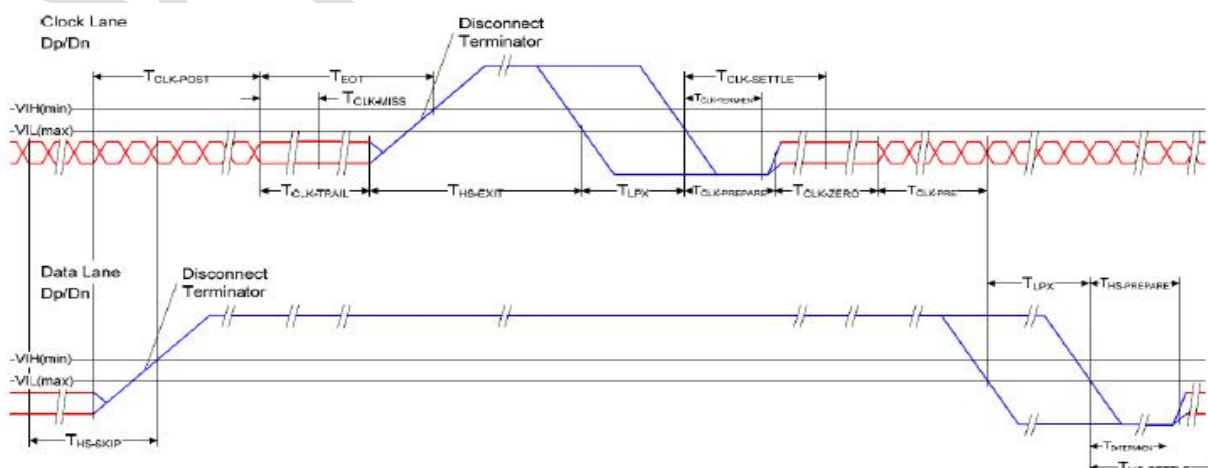
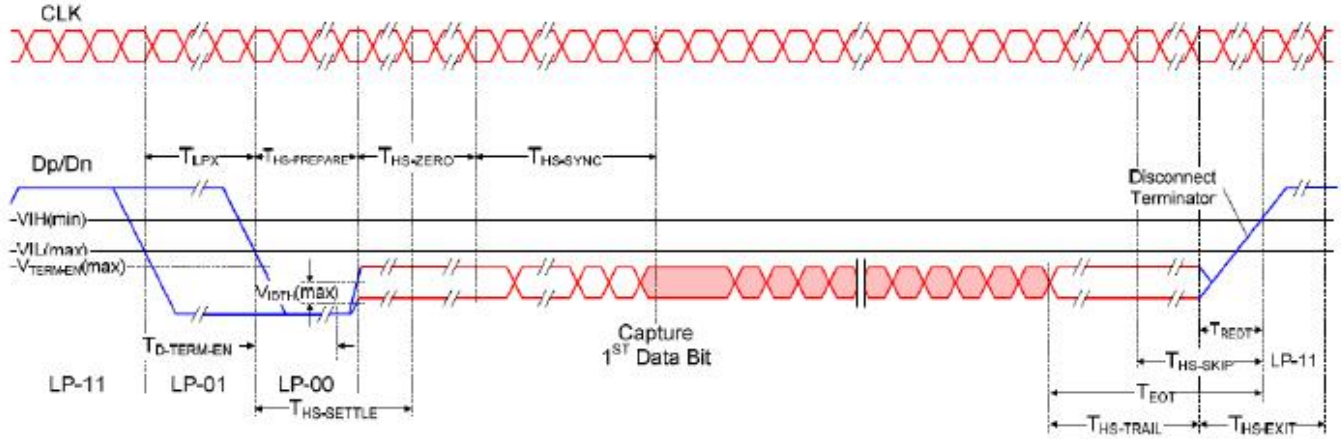




Figure 13.1: Switching the clock lane between clock transmission and low-power mode

6.3.2 Timing

of



-speed data transmission in bursts

6.3.3 MIPI data-clock timing specification



Parameter	Descript	Spec.			Unit
		Min.	Typ.	Max.	
T _{REOT}	30%-85% rise time and fall time	-	-	35	ns
T _{CLK-MISS}	Timeout for receiver to detect absence of Clock transitions and disable the Clock Lane HS-RX.	-	-	60	ns
T _{CLK-POST} *1	Time that the transmitter continues to send HS clock after the last associated Data Lane has transitioned to LP Mode. Interval is defined as the period from the end of T _{HS-TRAIL} to the beginning of T _{CLK-TRAIL} .	60 ns + 52*UI (For DCS)	-	-	ns
T _{CLK-PRE}	Time that the HS clock shall be driven by the transmitter prior to any associated Data Lane beginning the transition from LP to HS mode.	8	-	-	ns
T _{CLK-SETTLE}	Time interval during which the HS receiver shall ignore any Clock Lane HS transitions, starting from the beginning of T _{CLK-PRE} .	95	-	300	ns
T _{CLK-TERM-EN}	Time for the Clock Lane receiver to enable the HS line termination, starting from the time point when Dn crosses V _{IL,MAX} .	Time for Dn to reach V _{TERM-EN}	-	38	ns
T _{HS-SETTLE}	Time interval during which the HS receiver shall ignore any Data Lane HS transitions, starting from the beginning of T _{HS-PREPARE} .	85 ns + 6*UI	-	145 ns + 10*UI	ns
T _{EOT}	Time from start of T _{HS-TRAIL} or T _{CLK-TRAIL} period to start of LP-11 state	-	-	105ns+48*UI	-
T _{HS-EXIT} ⁽¹⁾	time to drive LP-11 after HS burst	100	-	-	ns
T _{HS-PREPARE}	Time to drive LP-00 to prepare for HS transmission	40ns + 4*UI	-	85ns+6*UI	ns
T _{HS-PREPARE} + T _{HS-ZERO}	T _{HS-PREPARE} + Time to drive HS-0 before the Sync sequence	145ns + 10*UI	-	-	ns
T _{HS-SKIP}	Time-out at RX to ignore transition period of EoT	40	-	55ns+4*UI	ns
T _{HS-TRAIL}	Time to drive flipped differential state after last payload data bit of a HS transmission burst	60 + 4*UI	-	-	ns
T _{LPX}	Length of any Low-Power state period	50	-	-	ns
Ratio T _{LPX}	Ratio of T _{LPX(MASTER)} /T _{LPS(SLAVE)} between Master and Slave side	2/3	-	3/2	-
T _{TA-GET}	Time to drive LP-00 by new TX	5*T _{LPX}			ns
T _{TA-GO}	Time to drive LP-00 after Turnaround Request	4*T _{LPX}			ns
T _{TA-SURE}	Time-out before new TX side starts driving	T _{LPX}	-	2*T _{LPX}	ns

Note: (1) For image transmission:

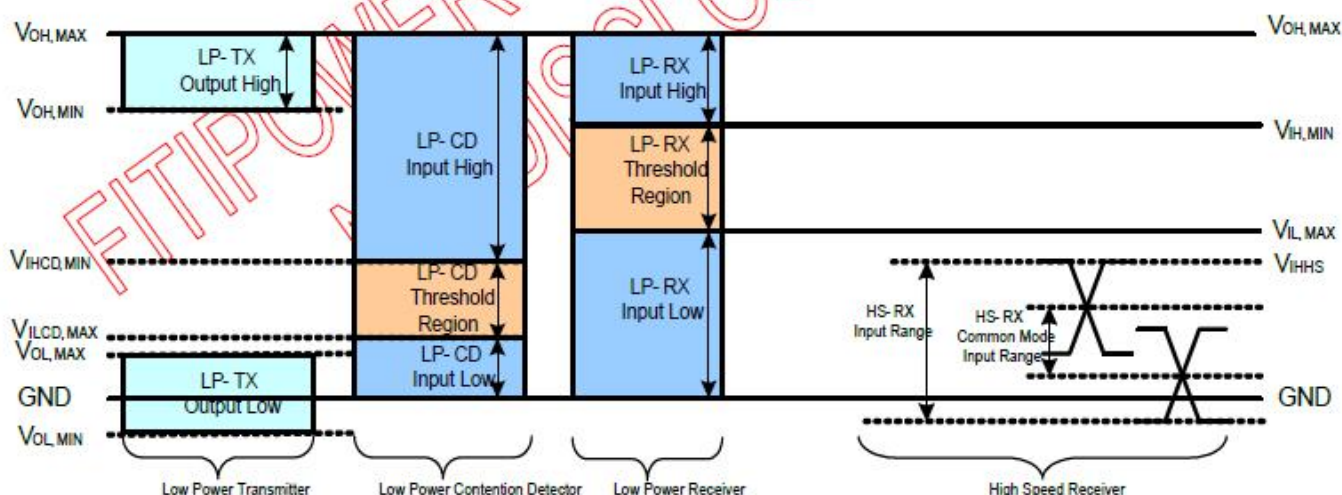
T_{CLK-POST} min value =164 when MIPI max frequency per lane = 0.53Gbps.

T_{CLK-POST} min value =112 when MIPI max frequency per lane = 1Gbps



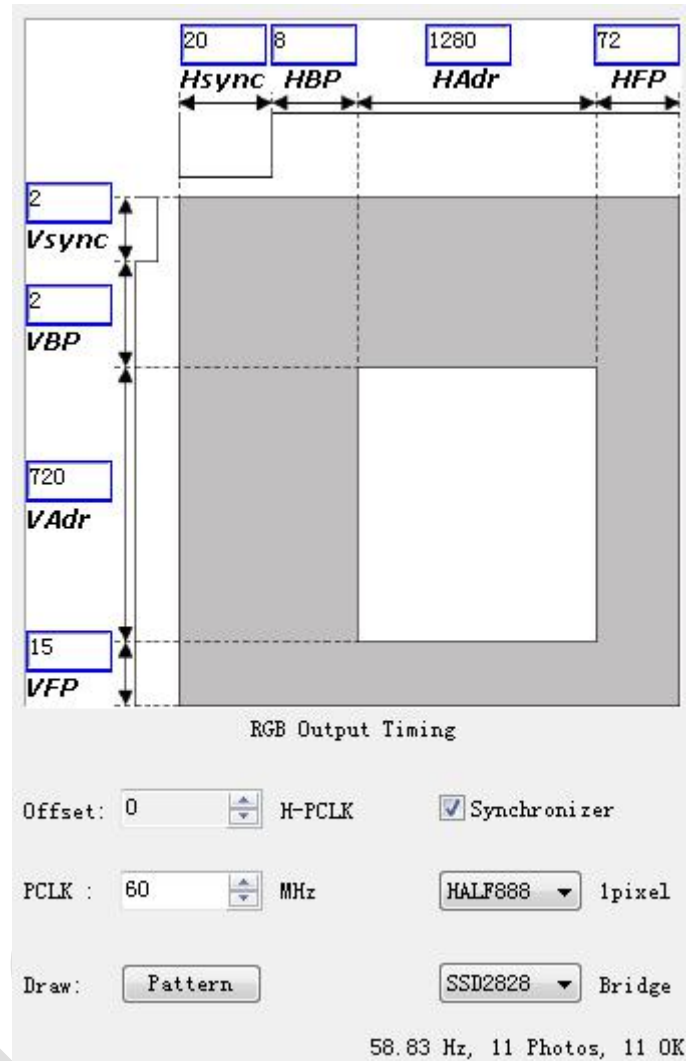
6.4 MIPI DC electrical characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit
MIPI Characteristics for High Speed Receiver					
Single-ended input low voltage	V_{ILHS}	-40	-	-	mV
Single-ended input high voltage	V_{IHHS}	-	-	460	mV
Common-mode voltage	V_{CMRXDC}	70	-	330	mV
Differential input impedance	Z_{ID}	80	100	125	ohm
HS transmit differential voltage($V_{OD}=V_{DP}-V_{DN}$)	$ V_{OD} $	-	200	250	mV
MIPI Characteristics for Low Power Mode					
Pad signal voltage range	V_I	-50	-	1350	mV
Logic 0 input threshold	V_{IL}	0	-	550	mV
Logic 1 input threshold	V_{IH}	1000	-	1350	mV
Output low level	V_{OL}	-50	-	50	mV
Output high level	V_{OH}	1.1	1.2	1.3	V
MIPI Digital Operating Current	$I_{VDDMIPI}$	-	15	20	mA
MIPI Digital Stand-by Current	I_{STMPI}	-	-	250	uA





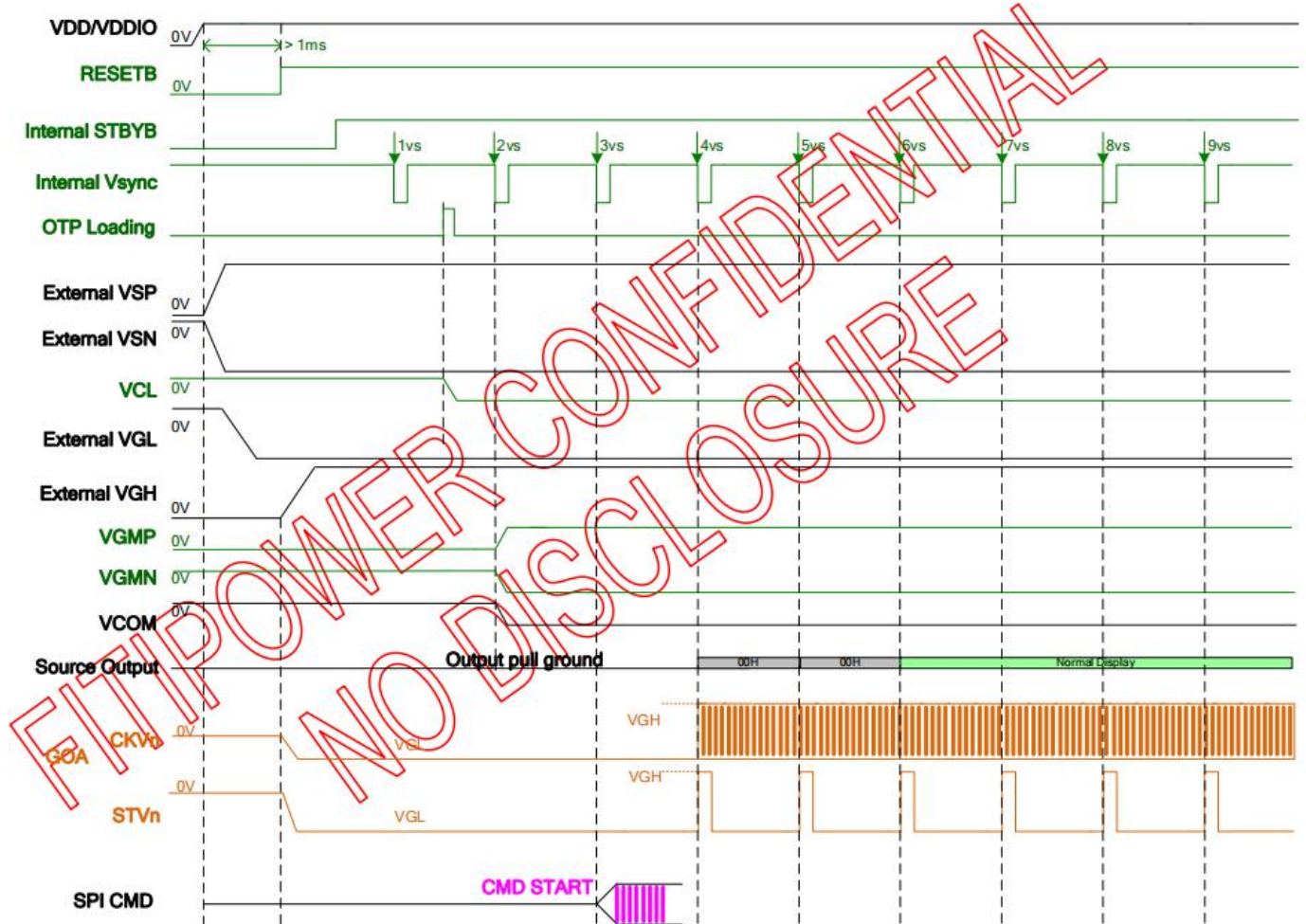
6.5 Interface Timing





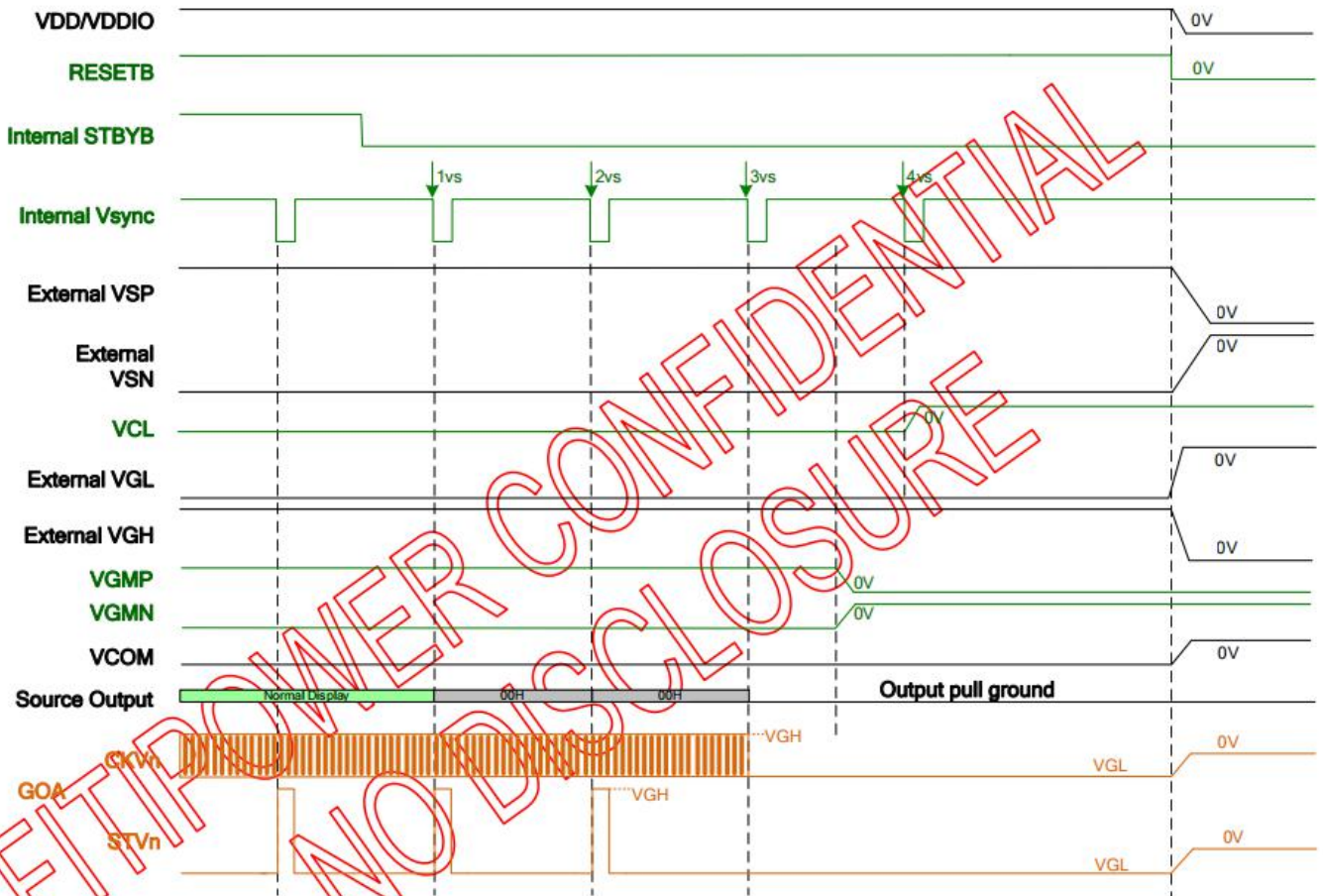
6.6 Power On/Off Sequence

6.6.1 Power on sequence





6.6.2 Power off
sequence





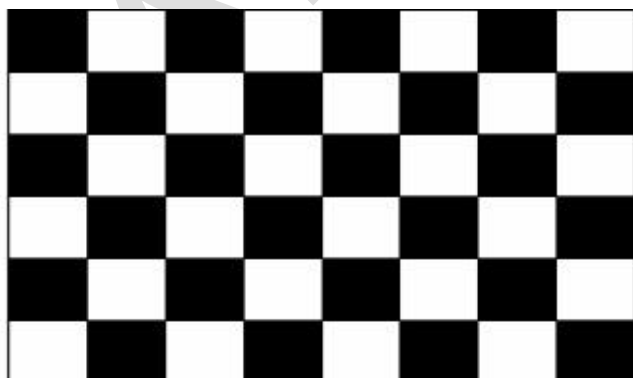
7.0 RELIABILITY TEST ITEMS

No.	Test Item	Conditions	Note
1	High Temperature Storage	Ta=+80℃, 24hrs	
2	Low Temperature Storage	Ta=-30℃, 24hrs	
3	High Temperature Operation	Ta=+70℃, 24hrs	
4	Low Temperature Operation	Ta=-20℃, 24hrs	
5	High Temperature and High Humidity(operation)	Ta=+60℃, 80%RH 24hrs	
6	Thermal cycling Test	-20℃/30 min ~ +70℃/30 min for a total 10cycles, Start with cold temperature and end with high temperature.	
7	Vibration Test (Non-operation)	<ul style="list-style-type: none">● Frequency range:8~33.3Hz● Stoke: 1.3 mm● Vibration: sinusoidal wave, perpendicular axis(both x, z axis: 2hrs ,y axis: 4hrs).● Sweep: 2.9G,33.3 Hz -400 Hz● Cycle time: 15 min	
8	Shock Test (Non-operation)	<ul style="list-style-type: none">● Shock level: 980m/s 2 (equal to 100G).● Waveform: half sinusoidal wave,6ms.● Number of shocks: ±X,±Y,±Z axes for a total of six shock inputs.	
9	ESD Test	150pF, 330Ω, ±8kV&±15kV air& contact test	1
		200pF, 0Ω, ±200V contact test	2

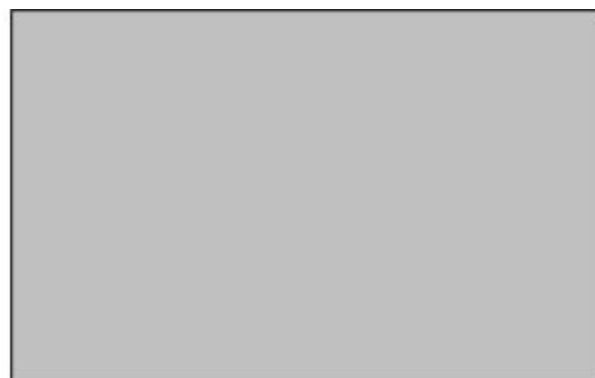
Note 1: LCD glass and metal bezel

Note 2: IF connector pins

Note 3: Operation with test pattern sustained for 4hrs, then change to gray pattern immediately.

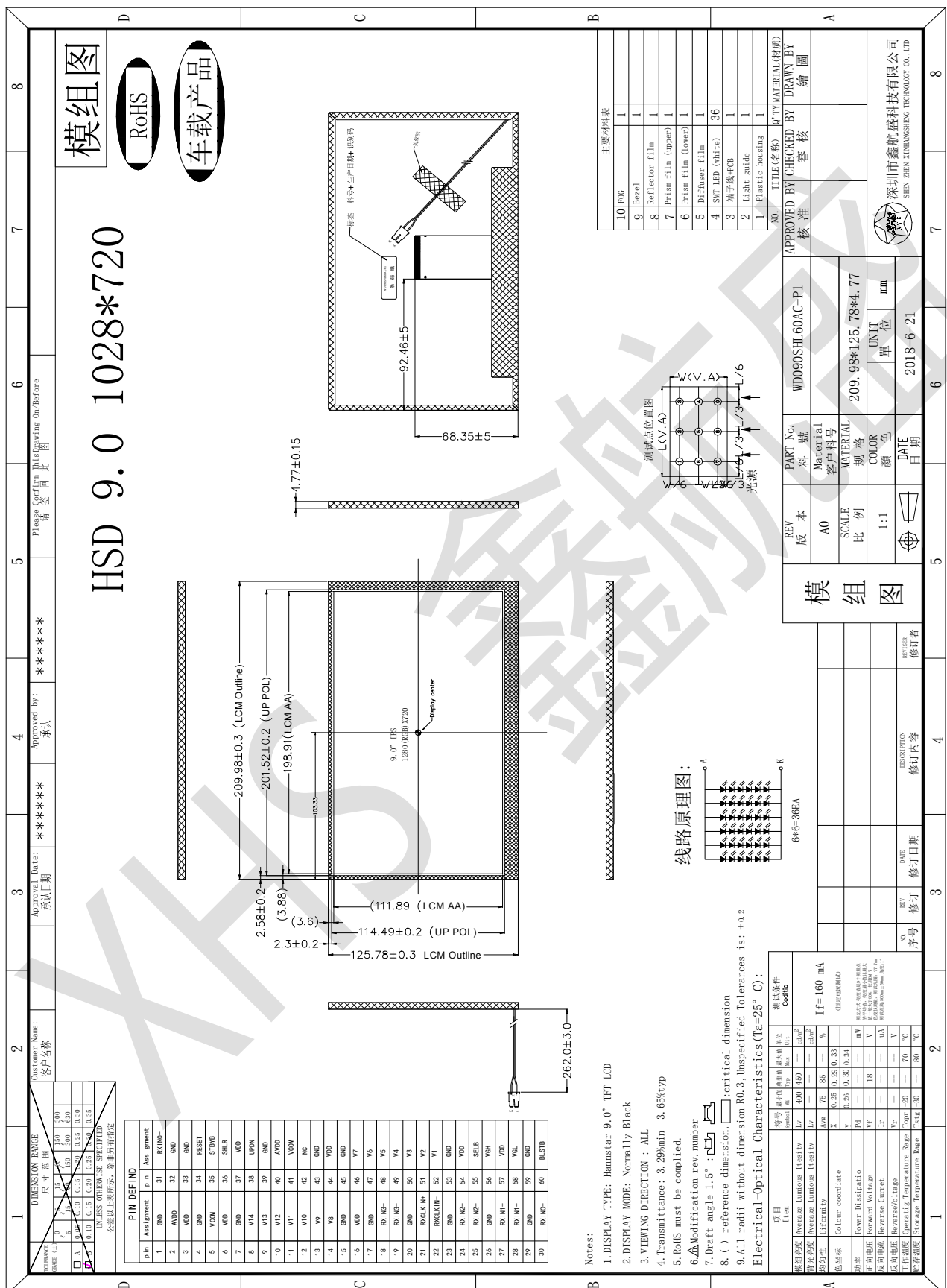


(a) Test Pattern (chess board Pattern)



(b) Gray Pattern

8.0 OUTLINE DIMENSION





9.0 LOT MARK

9.1 Location of Lot Mark

- (1) Location: The label is attached to the backside of the LCD module.
- (2) Detail of the Mark: as attached below.
- (3) This is subject to change without prior notice.

-----T.B.D

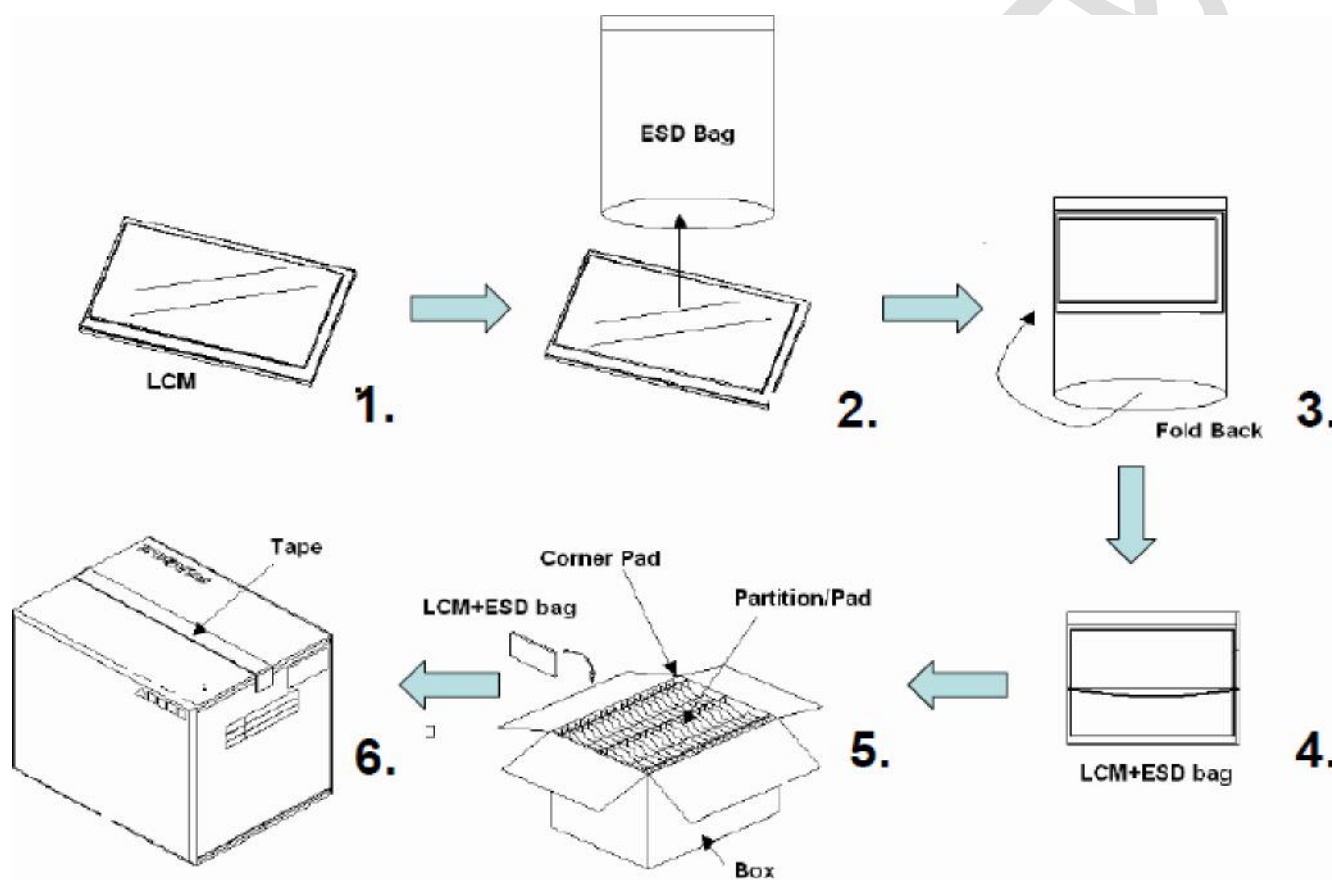


10.0 PACKAGE SPECIFICATION

10.1 Packing form

LCM Model	LCM Qty. in the box	Inner Box Size (mm)	Note
WD090HHM60AC-Q4	50 pcs/box	383±5 x 373±5 x 275±5	

10.2 Packing assembly drawings



Items	Material	Notice
Box	Corrugated Paper Board	AB Flute
Partition/Pad	Corrugated Paper Board	B Flute
Corner Pad	Corrugated Paper Board	AB Flute
ESD bag	PE	



11.0 GENERAL PRECAUTION

11.1 Use Restriction

This product is not authorized for use in life supporting systems, aircraft navigation control systems, military systems and any other application where performance failure could be life-threatening or otherwise catastrophic.

11.2 Assembly Precaution

- 11.2.1 Please use the mounting hole on the module side in installing and do not bending or wrenching LCD in assembling. And please do not drop, bend or twist LCD module in handling.
- 11.2.2. Please design display housing in accordance with the following guide lines.
 - 11.2.2.1 Housing case must be destined carefully so as not to put stresses on LCD all sides and not to wrench module. The stresses may cause non-uniformity even if there is no non-uniformity statically.
 - 11.2.2.2 Keep sufficient clearance between LCD module back surface and housing when the LCD module is mounted. The clearance in the design is recommended taking into account the tolerance of LCD module thickness and mounting structure height on the housing.
- 11.2.3 Please do not push or scratch LCD panel surface with any-thing hard. And do not soil LCD panel surface by touching with bare hands.(Polarizer film, surface of LCD panel is easy to be flawed.)
- 11.2.4 Please do not press any parts on the rear side such as source IC, gate IC, and FPC during handling LCD module, If pressing rear part is unavoidable, handle the LCD module with care not to damage them.
- 11.2.5 Please wipe out LCD panel surface with absorbent cotton or soft cloth in case of it being soiled.
- 11.2.6 Please wipe out drops of adhesives like saliva and water on LCD panel surface immediately. They might damage to cause panel surface variation and color change.
- 11.2.7 Please do not take a LCD module to pieces and reconstruct it. Resolving and reconstructing modules may cause them not to work well.

11.3 Disassembling or Modification

Do not disassemble or modify the module. It may damage sensitive parts inside LCD module, and may cause scratches or dust on the display. Century does not warrant the module, if customers disassemble or modify the module.

11.4 Breakage of LCD Panel

- 11.4.1.If LCD panel is broken and liquid crystal spills out, do not ingest or inhale liquid crystal, and do not contact liquid crystal with skin.
- 11.4.2. If liquid crystal contacts mouth or eyes, rinse out with water immediately.
- 11.4.3. If liquid crystal contacts skin or cloths, wash it off immediately with alcohol and rinse thoroughly with water.
- 11.4.4. Handle carefully with chips of glass that may cause injury, when the glass is broken.



11.5 Absolute Maximum Ratings and Power Protection Circuit

- 11.5.1. Do not exceed the absolute maximum rating values, such as the supply voltage variation, input voltage variation, variation in parts' parameters, environmental temperature, etc., otherwise LCD module may be damaged.
- 11.5.2. Please do not leave LCD module in the environment of high humidity and high temperature for a long time.
- 11.5.3. It's recommended to employ protection circuit for power supply.

11.6 Operation

- 11.6.1 Do not touch, push or rub the polarizer with anything harder than HB pencil lead.
- 11.6.2 Use fingerstalls of soft gloves in order to keep clean display quality, when persons handle the LCD module for incoming inspection or assembly.
- 11.6.3 When the surface is dusty, please wipe gently with absorbent cotton or other soft material.
- 11.6.4 Wipe off saliva or water drops as soon as possible. If saliva or water drops contact with polarizer for a long time, they may causes deformation or color fading.
- 11.6.5 When cleaning the adhesives, please use absorbent cotton wetted with a little petroleum benzine or other adequate solvent.

11.7 Static Electricity

- 11.7.1 Protection film must remove very slowly from the surface of LCD module to prevent from electrostatic occurrence.
- 11.7.2. Because LCD module use CMOS-IC on circuit board and TFT-LCD panel, it is very weak to electrostatic discharge. Please be careful with electrostatic discharge.
- 11.7.3 Persons who handle the module should be grounded through adequate methods.

11.8 Disposal

When disposing LCD module, obey the local environmental regulations.

11.9 Others

- 11.9.1 A strong incident light into LCD panel might cause display characteristics' changing inferior because of Polarizer film, color filter, and other materials becoming inferior. Please do not expose LCD module direct sunlight Land Strong UV rays.
- 11.9.2 Please pay attention to a panel side of LCD module not to contact with other materials in pressing it alone.
- 11.9.3 For the packaging box, please pay attention to the followings:
 - 11.9.3.1 Packaging box and inner case for LCD are designed to protect the LCDs from the damage or scratching during transportation. Please do not open except picking LCDs up from the box.
 - 11.9.3.2 Please do not pile them up more than 6 boxes(They are not designed so) And please do not turn over.
 - 11.9.3.3 Please handle packaging box with care not to give them sudden shock and vibrations. And also please do not throw them up.
 - 11.9.3.4 Packing box and inner case for LCDs are made of cardboard, So please pay attention not to get them wet(Such like keeping them in high humidity or wet place can occur getting them wet.)