深圳秦唐盛世科技有限公司

☐ Preliminary Specification
■ Final Specification

Customer Approve:

QC 品 质 : _____

R&D 研 发 : _____

Approved 批准: _____

产品型号(Description): QT090BHE50EW-90136

Compile by 编制	Quality/Engineer 品质/工程	Checked 审核	Approved 批准
刘宏乾			

地址（Address）：广东省深圳市宝安区西乡固戍红湾商务中心

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REVISION RECORD

REV NO	REV DATE	CONTENTS	REMARKS
V.0	2019-10-14	First Release	

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1.0 General description

1.1 Introduction

QT090BHE50EW-90136 is model a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT LCD panel, a driving circuit and a back light system. This TFT LCD has a 9.0(16:9) inch diagonally measured active display area with WSVGA (1024horizontal by 600 vertical pixel array) resolution. The TFT-LCD panel used for this module is adapted for a low reflection and higher color type.

1.2 Features

TTL Interface
Data enable signal mode
24-bit color depth,display 16.7M colors
Low driving voltage and low power consumption
ROHS Compliant

1.3 General information

Item	Specification	Unit	Remarks
Outline Dimension	210.7(H) x 126.5(V) x 5.0(body)	mm	Tolerance:±0.3mm
Display area	196.608(W) x114.15(H)	mm	
Number of Pixel	1024(H) x RGB x600(V)	pixels	
Pixel pitch	0.064(H) x 0.190(V)	mm	
Pixel arrangement	Pixels RGB stripe arrangement		
Display mode	Normally White		
Surface treatment	EWV Film		
Weight	TBD (Typ.)	gram	
Back-light	Single LED (Side-Light type)		

1.4 Mechanical Information

Item		Min.	Typ.	Max.	Unit
Module Size	Horizontal(H)	182.6	210.7	211.0	mm
	Vertical(V)	126.2	126.5	126.8	mm
	Depth(D)	5.2	5.5	5.7	mm

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2.0 ABSOLUTE MAXIMUM RATINGS

2.1 Electrical Absolute Rating

2.1.1 TFT LCD Module

Item	Specification	Unit
Outline Dimension	210.7(H) x 126.5(V) x 5.0(body)	mm
Display area	196.608(W) x114.15(H)	mm
Number of Pixel	1024(H) x RGB x600(V)	pixels
Pixel pitch	0.064(H) x 0.190(V)	mm
Pixel arrangement	Pixels RGB stripe arrangement	
Display mode	Normally White	
Surface treatment	EWV Film	
Weight	TBD (Typ.)	gram
Back-light	Single LED (Side-Light type)	

2.1.2 Back-Light Unit

Item	Symbol	Typ	MIN.	TYP.	MAX.	Unit	Note
Forward voltage	Vf	9.3	9.0	9.3	9.5	V	(1)(2)
Forward current	If	240	--	--	--	mA	(1)(2) (3)
Power Consumption	PBL	--	--	--	--	mW	

Note:

(1) Permanent damage may occur to the LCD module if beyond this specification. Functional operation should be restricted to the conditions described under normal operating conditions.

(2) Ta =25±2℃

(3) Test Condition: LED current 240 mA

3.0 OPTICAL CHARACTERISTICS

3.1 Optical Specifications

Item		Symbol	Temp	Condition	Min	Typ	Max	Unit	Remark
Viewing Angle range		Horizontal	θ	CR > 10	60	70	--	Deg	Note 1
		Vertical	θ		50	70	--	Deg	
Luminance Contrast ratio			CR	θ = 0°	--	500	--	--	Note 2
Brightness			YL		320	350	--	Cd/cm2	
Transmittance			T(%)	θ = 0°	--	5.18	--	%	Note 3
Color Gamut (C light)					--	60	--	%	
White chromaticity			Xw	Θ=0°	TYP. -0.03	0.229	TYP. +0.03		Note 4
			Yw			0.336			
Reproduction of color （C-light）		Red	Rx			0.635			
			Ry			0.322			
		Green	Gx			0.301			
			Gy			0.584			
		Blue	Bx			0.141			
			By			0.133			
Response Time (Rising + Falling)		Trt		Ta= 25°C θ = 0°	20	25	30	ms	Note 5

3.2 Measuring Condition

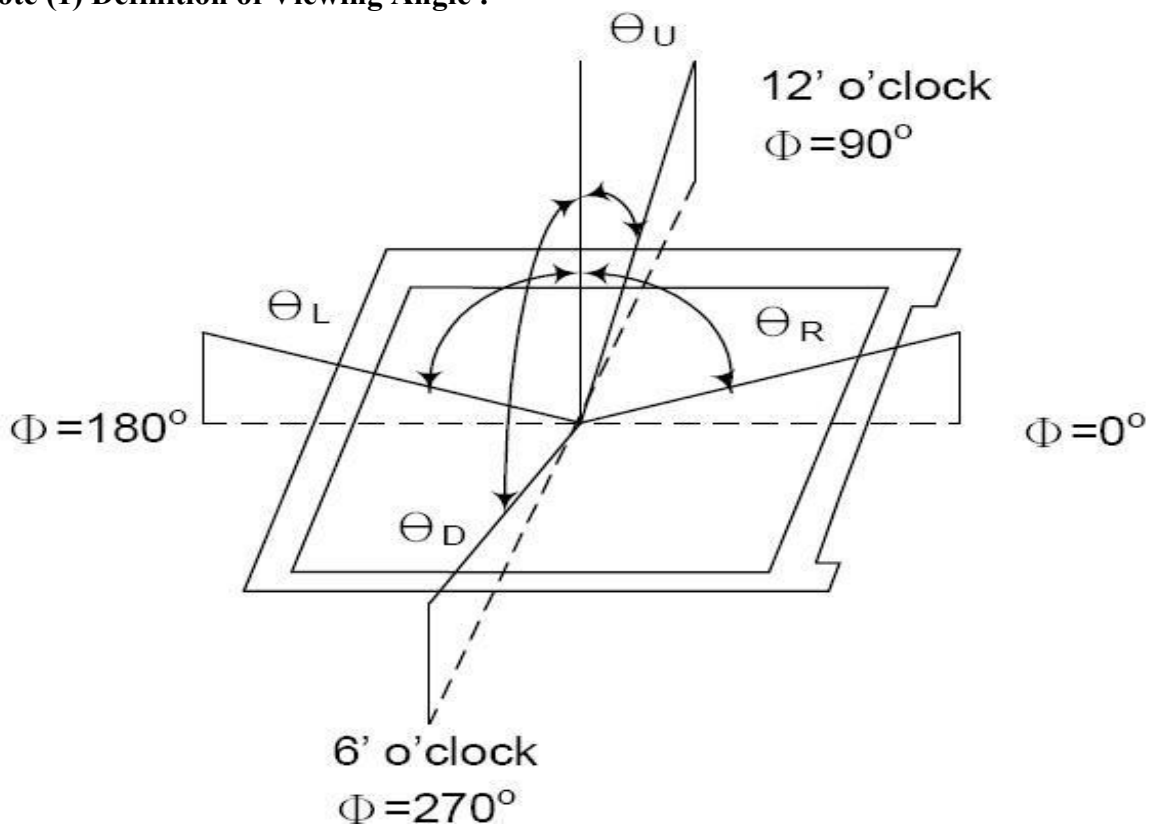
Measuring surrounding: dark room ,LED current IL : 240mA
Ambient temperature: 25±2℃
15min. warm-up time.

3.3 Measuring Equipment

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FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics. Measuring spot size: 20 ~ 21 mm

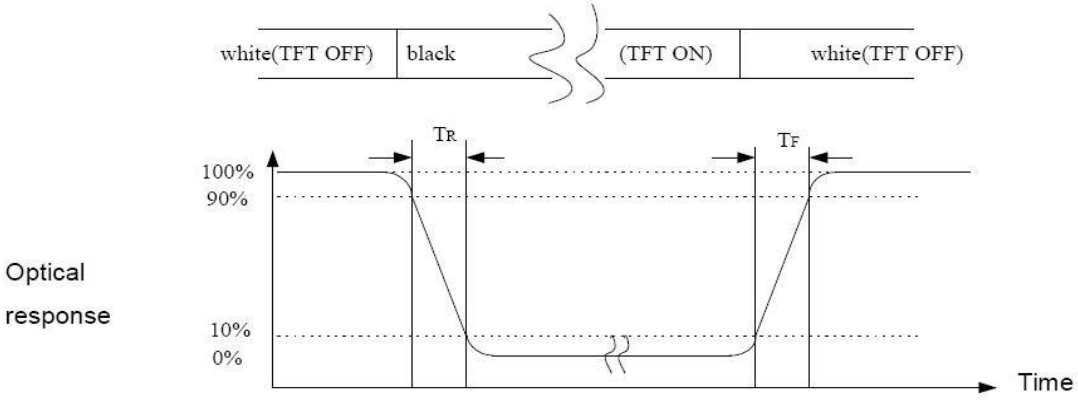
Note (1) Definition of Viewing Angle :



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

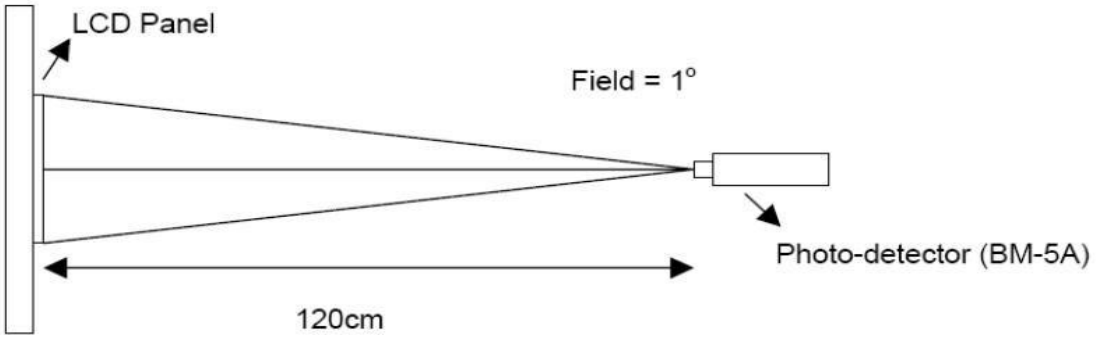
$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

Note (3) Definition of Response Time: Sum of TR and TF

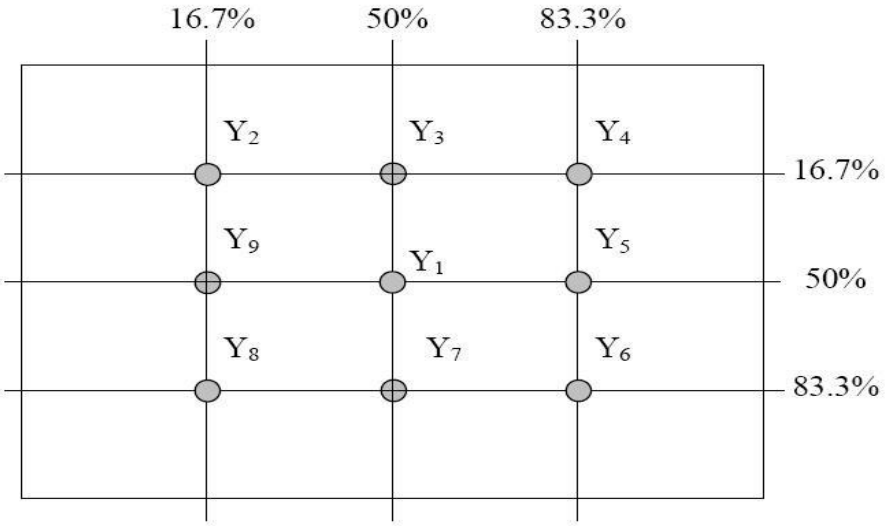


Note (4) Definition of optical measurement setup

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Note (5) Definition of brightness uniformity



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

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4.0 INTERFACE PIN CONNECTION

4.1 Signal of interface

Terminal No.	Symbol	IO	Functions
1--2	VLED+	P	Power for LED backlight (Anode)
3--4	VLED-	P	Power for LED backlight (Cathode)
5	GND	P	Analog Ground
6	VCOM	I	Common voltage
7	DVDD	P	Power for Digital Circuit
8	MODE	I	DE/SYNC mode select
9	DE	I	Data Input Enable
10	VS	I	Vertical Sync Input
11	HS	I	Horizontal Sync Input
12	B7	I	Blue data(MSB)
13	B6	I	Blue data
14	B5	I	Blue data
15	B4	I	Blue data
16	B3	I	Blue data
17	B2	I	Blue data
18	B1	I	Blue data
19	B0	I	Blue data(LSB)
20	G7	I	Green data(MSB)
21	G6	I	Green data
22	G5	I	Green data
23	G4	I	Green data
24	G3	I	Green data
25	G2	I	Green data
26	G1	I	Green data
27	G0	I	Green data (LSB)
28	R7	I	Red data(MSB)
29	R6	I	Red data
30	R5	I	Red data
31	R4	I	Red data
32	R3	I	Red data
33	R2	I	Red data
34	R1	I	Red data
35	R0	I	Red data(LSB)
36	GND	P	Power Ground
37	DCLK	I	Sample clock
38	GND	P	Power Ground
39	L/R	I	Left / right selection
40	U/D	I	Up/down selection
41	VGH	P	Gate ON Voltage
42	VGL	P	Gate OFF Voltage
43	AVDD	P	Power for Analog Circuit
44	RESET	I	Global reset pin.
45	NC	-	No connection
46	VCOM	I	Common Voltage

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47	DITHB	I	Dithering function
48	GND	P	Power Ground
49	NC	-	No connection
50	NC	-	No connection

5.0 Power On/Off Sequence

To prevent the device damage from latch up,the power on/off sequence shown Below must be followed.

Power on: VDD , GND→AVDD , AGND→V1-V14

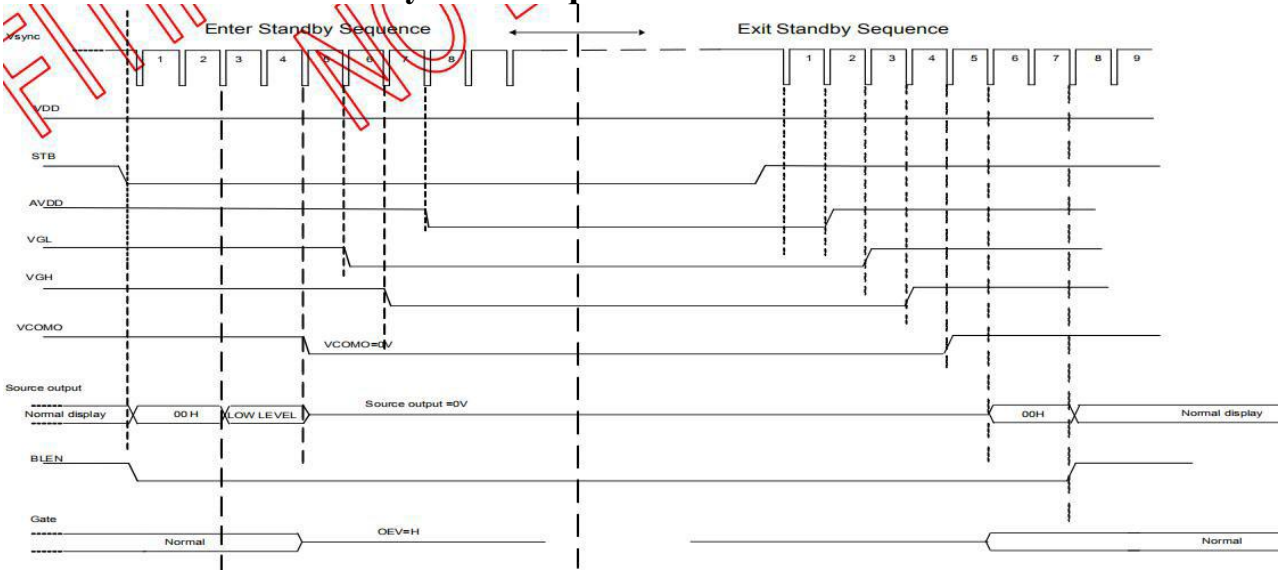
Power on: V1-V14→AVDD , AGND→VDD,GND

5.1 Power on/off control



● **power on/off timing sequence**

5.2 Enter and exit standby mode sequence



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6.0 ELECTRICAL CHARACTERISTICS

6.1 TFT LCD Module

Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage	VDD	3.0	3.3	3.6	V
	VGH	17.5	21	18.5	V
	VGL	-7.5	-7.0	-6.5	V
	AVDD	9.4	9.6	9.9	V
VCOM	VCOM	3.5	(3.8)	4.1	V

Note:

(1) VGH is TFT Gate operating voltage.

(2) VGL is TFT Gate operating voltage. The low voltage level of VGH signal must be fluctuates with same phase as Vcom.

6.2 Back-Light Unit

The backlight system is an edge-lighting type with 27LED.

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

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED current	IL	-	240	-	mA	(2)
LED Voltage	VL	-	9.3	-	V	
Operating LED life time	Hr	20000	-	-	Hour	(1)(2)

Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25±3 ° C, typical IL value indicated in the above table until the brightness becomes less than 50%.

Note (2) The "LED life time" is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and IL=240mA. The LED lifetime could be decreased if operating IL is larger than 240mA. The constant current driving method is suggested.

LED CIRCUIT DIAGRAM： 3 x 12 = 36 LED

K

A

6.3 DC Characteristics

6.3.1 Absolute Maximum Rating (GND=AGND=0V)

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Power supply voltage 1	Vdd	-0.5	-	+3.96	V
Power supply voltage 2	Avdd	-0.5	-	+13.50	V
Logic Output voltage	Vout	-0.5	-	+5.0	V
Input voltage	Vin	-0.5	-	AVDD+0.5	V
Operation temperature	TOPR	-20	-	+60	℃
Storage temperature	TSTG	-30	-	+70	℃

Note： (1) All of the Voltages listed above are with respective to GND=0V.

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(2) Device is subject to be damaged permanently if stresses belong those absolute maximum ratings listed above.

6.3.2 TTL mode DC electrical characteristics

(VDD=2.3~3.6V, AVDD=6.5~13.5V, GND=AGND=0V, TA=-25℃)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Low level input voltage	Vil	For the digital circuit	0	-	0.3×VDD	V
High level input voltage	Vih	For the digital circuit	0.7×VDD	-	VDD	V
Input leakage current	Ii	For the digital circuit	-	-	±1	μA
High level output voltage	Voh	Ioh= -400 μA	VDD-0.4	-	-	V
Low level output voltage	Vol	Iol= +400 μA	-	-	GND+0.4	V
Pull low/high resistor	Ri	For the digital input pin @ VDD=3.3V	200K	250K	300K	ohm
Digital Operation current	Idd	Fclk=65 MHz, FLD=50KHz, VDD=3.3V	-	15	25	mA
Digital Stand-by current	Ist1	Clock and all functions are stopped	-	10	50	μA
Analog Operating Current	Idda	No load, Fclk=65MHz, FLD=50KHz @ AVDD=10V,V1=8V, V14=0.4V	-	10	12	mA
Analog Stand-by current	Ist2	No load, Clock and all functions are Stopped	-	10	50	μA
Input level of V1 ~ V7	Vref1	Gamma correction voltage input	0.4*AVDD	-	AVDD-0.1	V
Input level of V8 ~ V14	Vref2	Gamma correction voltage input	0.1	-	0.6*AVDD	V
Output Voltage deviation	Vod1	Vo = AVSS+0.1V ~ AVSS+0.5V and Vo = AVDD-0.5V ~ AVDD-0.1V	-	±20	±35	mV
Output Voltage deviation	Vod2	Vo = AVSS+0.5V ~ AVDD-0.5V	-	±15	±20	mV
Output Voltage Offset between Chips	Voc	Vo = AVSS+0.5V ~ AVDD-0.5V	-	-	±20	mV
Dynamic Range of Output	Vdr	SO1 ~ SO1536	0.1	-	AVDD-0.1	V
Sinking Current of Outputs	IOLy	SO1 ~ SO1536; Vo=0.1V v.s 1.0V , AVDD=13.5V	80	-	-	uA
Driving Current of Outputs	IOHy	SO1 ~ SO1536; Vo=13.4V v.s 12.5V , AVDD=13.5V	80	-	-	uA
Resistance of Gamma Table	Rg	Rn: Internal gamma resistor	0.7*Rn	1.0*Rn	1.3*Rn	ohm

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- **TTL mode DC electrical characteristics**

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6.4 AC Characteristics

6.4.1 TTL mode AC electrical characteristics

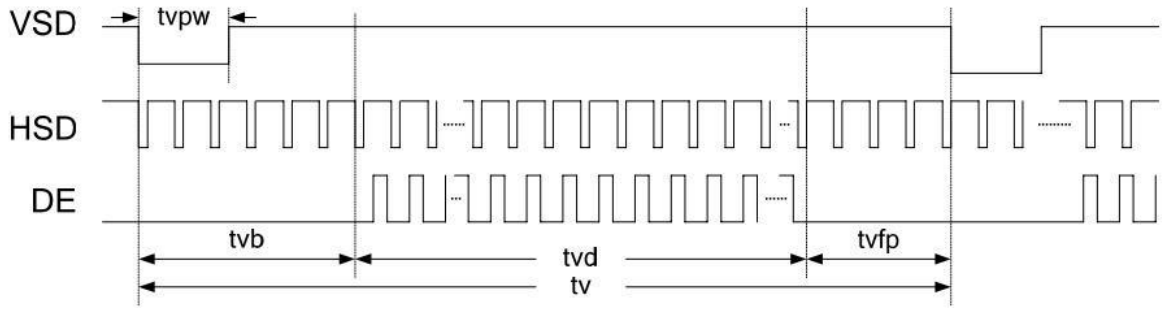
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
VDD Power On Slew rate	TPOR	From 0V to 90% VDD	1	-	20	ms
RST pulse width	TRST	DCLK = 65MHz	50	-	-	us
DCLK cycle time	Tcph	-	14	-	-	ns
DCLK pulse duty	Tcwh	-	40	50	60	%
VSD setup time	Tvst	-	5	-	-	ns
VSD hold time	Tvhd	-	5	-	-	ns
HSD setup time	Thst	-	5	-	-	ns
HSD hold time	Thhd	-	5	-	-	ns
Data set-up time	Tdsu	D0[7:0], D1[7:0], D2[7:0] to DCLK	5	-	-	ns
Data hold time	Tdhd	D0[7:0], D1[7:0], D2[7:0] to DCLK	5	-	-	ns
DE setup time	Tesu	-	5	-	-	ns
DE hold time	Tehd	-	5	-	-	ns
Output stable time	Tsst	Dual gate	-	-	3	us

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- TTL mode AC electrical characteristics

6.4.2 TTL mode data input format

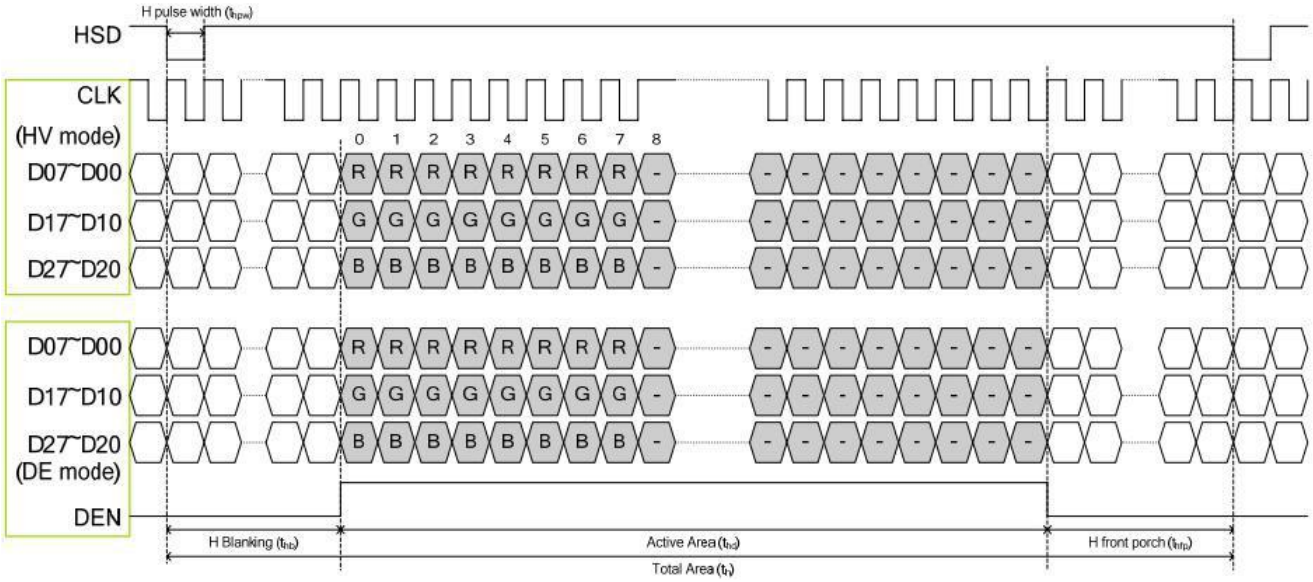
Vertical timing



- Vertical input timing diagram

Horizontal timing

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- Horizontal input timing diagram

6.4.3 Input timing table

➢ DE mode

Parameter	Symbol	Min.	Typ.	Max	Unit	Note
Horizontal Display Area	thd	-	1024	-	DCLK	
DCLK frequency	fclk	40.8	51.2	67.2	MHz	
HSD Period	th	1114	1344	1400	DCLK	
HSD Blanking	Thb+thfp	90	320	376	DCLK	
Vertical Display Area	tvd		600		T_H	
VSD Period	th	610	635	800	T_H	
VSD Blanking	Thb+thfp	10	35	200	T_H	

HV mode

Horizontal timing

Parameter	Symbol	Min.	Typ.	Max	Unit	Note
Horizontal Display Area	thd		1024		DCLK	
DCLK frequency	fclk	40.9	51.2	63	MHz	
HSD Period	th	1200	1344	1400	DCLK	
HS pulse width	thpw	1	-	140	DCLK	
HS Back Porch(Blanking)	thbp		160		DCLK	
HS Front Porch	thfp	16	160	216	DCLK	

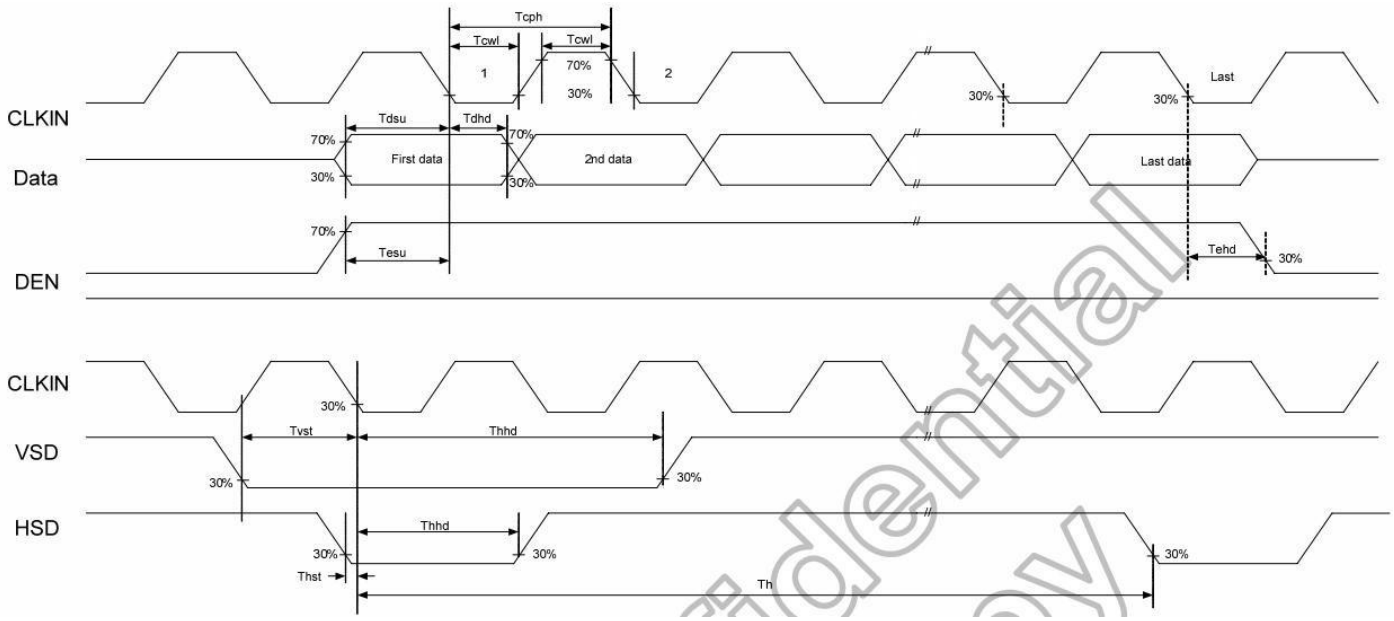
Vertical timing

Parameter	Symbol	Min.	Typ.	Max	Unit	Note
Vertical Display Area	tvd		600		T_H	
VS period time	tv	624	635	750	T_H	
VS pulse width	tvpw	1	-	20	T_H	
VS Back Porch(Blanking)	tvbp		23		T_H	
HS Front Porch	tvfp	1	12	127	T_H	

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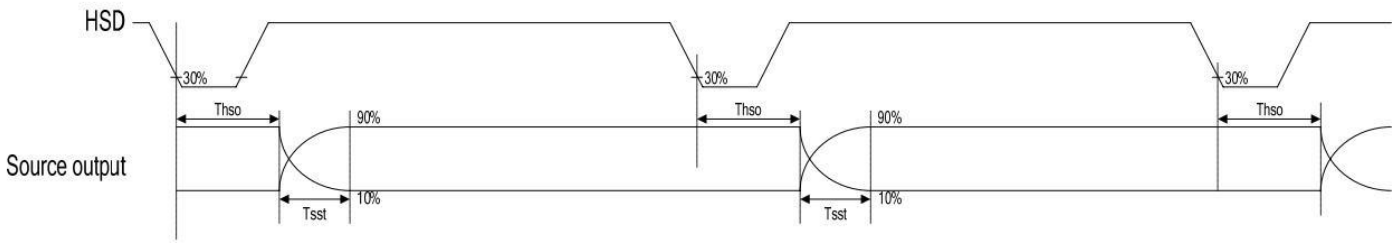
6.5 Timing Diagram of Interface Signal

6.5.1 Input clock and data timing waveform

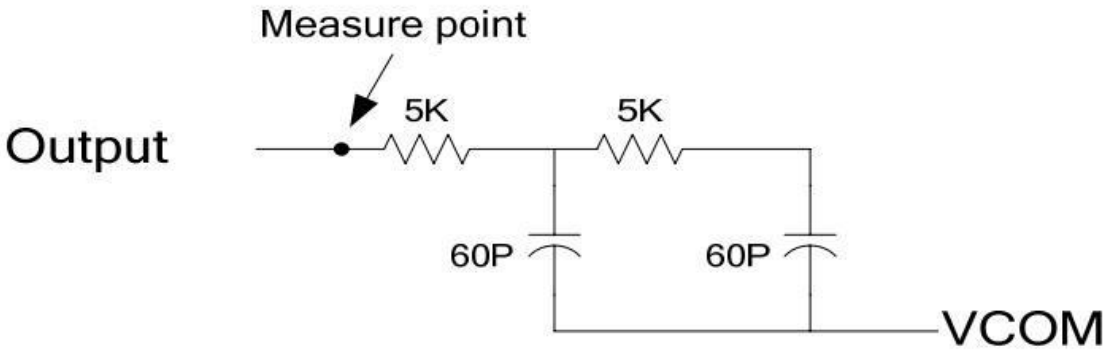


Input clock and data timing diagram

6.5.2 Source output timing diagram (cascade)



Source output timing diagram



Output load condition

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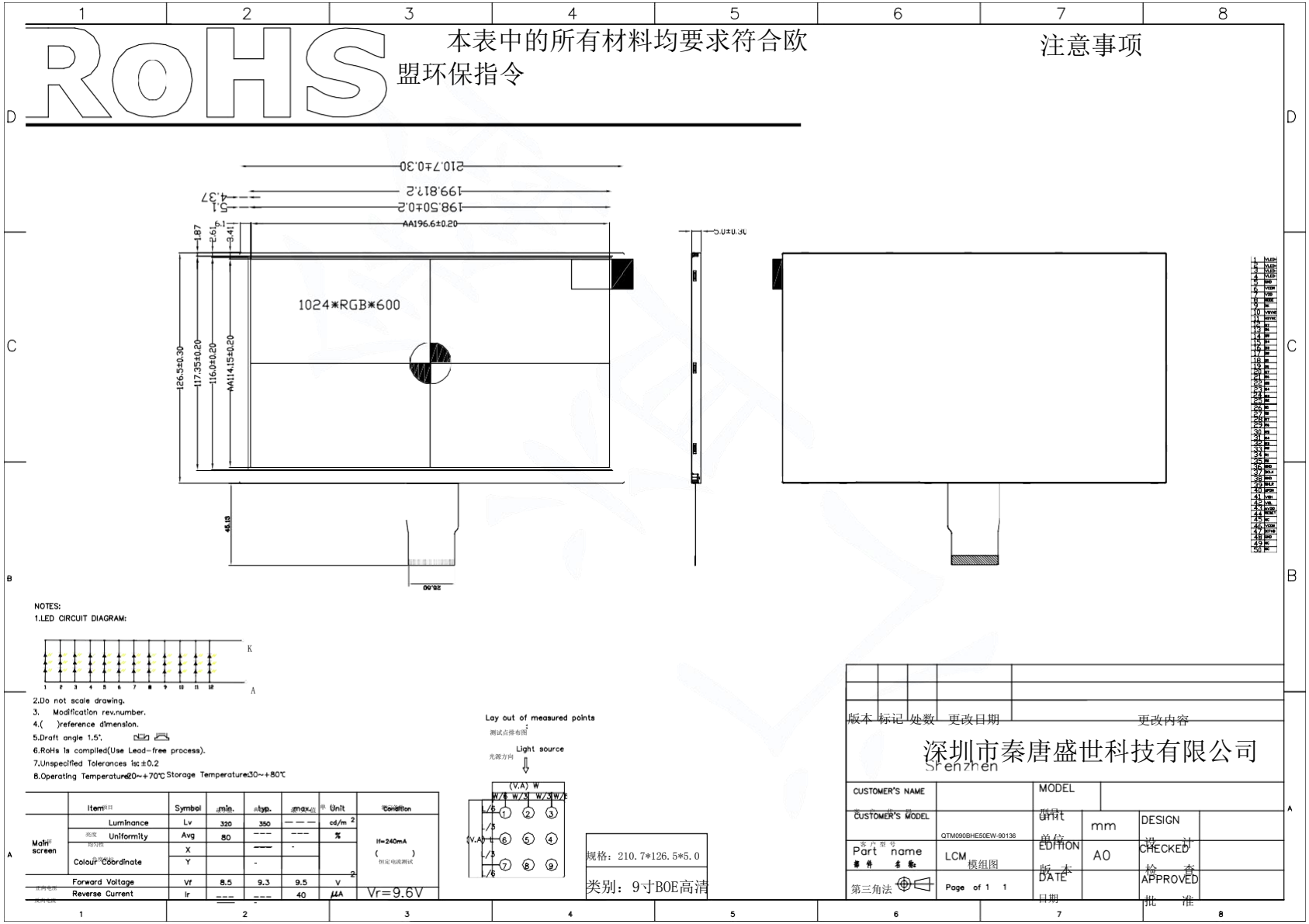
7.0 Reliability test items

Test Item	Test Conditions	Notes
High temperature Operation	Ta= +60℃, 120hrs	
Low temperature Operation	Ta= -20℃, 120hrs	
High Temperature Storage	Ta= +70℃, 120hrs	
Low Temperature Storage	Ta= -30℃, 120hrs	
Humidity Test	60℃ ,Humidity 80% ,96hrs	
Thermal Shock Test	-20℃,30min～+60℃,30min (30 cycle)	
Vibration Test(Packing)	Sine Wave 1.04G, 5~500Hz, XYZ 30min/each direction	
Static Electricity	Half-Sine, 100G, 6ms, ±XYZ, 3 cycle	

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8.0 OUTLINE DIMENSION



9.0 General precaution

9.1 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.

9.2 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. HYX does not warrant the module, if customers disassemble or modify the module.

9.3 Breakage of LCD Panel

8.3.1. 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.

8.3.2. If liquid crystal contacts mouth or eyes, rinse out with water immediately.

8.3.3. If liquid crystal contacts skin or cloths, wash it off immediately with alcohol and rinse thoroughly with water.

8.3.4. Handle carefully with chips of glass that may cause injury, when the glass is broken.

9.4 Electric Shock

8.4.1. Disconnect power supply before handling LCD module.

8.4.2. Do not pull or fold the LED cable.

8.4.3. Do not touch the parts inside LCD modules and the fluorescent LED's connector or cables in order to prevent electric shock.

9.5 Absolute Maximum Ratings and Power Protection Circuit

8.5.1. 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.

8.5.2. Please do not leave LCD module in the environment of high humidity and high temperature for a long time.

8.5.3. It's recommended to employ protection circuit for power supply.

9.6 Operation

8.6.1 Do not touch, push or rub the polarizer with anything harder than HB pencil lead.

8.6.2 Use fingerstalls of soft gloves in order to keep clean display quality, when persons handle the LCD module for incoming inspection or assembly.

8.6.3 When the surface is dusty, please wipe gently with absorbent cotton or other soft material.

8.6.4 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.

8.6.5 When cleaning the adhesives, please use absorbent cotton wetted with a little petroleum benzine or other adequate solvent.

9.7 Mechanism

Please mount LCD module by using mouting holes arranged in four corners tightly.

9.8 Static Electricity

8.8.1 Protection film must remove very slowly from the surface of LCD module to prevent from electrostatic occurrence.

8.8.2. 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. Persons who handle the module should be grounded through adequate methods.

9.9 Strong Light Exposure

The module shall not be exposed under strong light such as direct sunlight. Otherwise, display characteristics may be changed.

9.10 Disposal

When disposing LCD module, obey the local environmental regulations.

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