SPECIFICATIONS FOR LCD MODULE

CUSTOMER	
MODEL	**SCT035001-V11**
CUSTOMER APPROVED	

APPROVED BY	CHECKED BY	ORGANIZED BY
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RECORDS OF REVISIONS

Version	Content	Date
A0	First Issue	2020-09-22

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1. General Description

This Module SCT035001-V11 is TFT Liquid Crystal Display Module. This specification covers the delivery requirements for the liquid crystal display module delivered by quality to Customer.

1.1. Mechanical & Display Specifications

Item	Standard value	Unit
LCD Size	3.5	inch
Dot Matrix	320(RGB) ×240	pixel
Module Size	76.20 ×63.20 ×3.21	mm
Active Area	70.08 ×52.56	mm
Dot Pitch	0.219 ×0.219	mm
Pixel Configuration	R.G.B. Stripe	-
Color depth	16.7M	-
Display Mode	Normally white, Transmissive	-
Technology Type	a-Si	-
Viewing Direction	12 O'clock	-
Gray Scale Inversion Direction	6 O'clock	-
Driver IC	HX8238D or Compatible	-
Interface	Digital 24-bit RGB/ SERIAL RGB/CCIR656/CCIR601	-
LED Numbers	9 LEDs	-
Weight	TBD	g

1.2. Interface Pin

Pin No.	Symbol	Type	Description
1	LEDK	P	LED driving cathode
2	LEDK	P	LED driving cathode
3	LEDA	P	LED driving anode
4	LEDA	P	LED driving anode
5	NC	-	No connection
6	NC	-	No connection
7	NC	-	No connection
8	RESET	I	Hardware reset
9	SPENB	I	SPI interface data enable
10	SPCLK	I	SPI interface data clock
11	SPDAT	I	SPI interface data
12-19	B0 – B7	I	Blue data bit0 – bit7
20-27	G0 – G7	I	Green data bit0 – bit7
28-35	R0 – R7	I	Red data bit0 – bit7 / DX0 – DX7
36	HSYNC	I	Horizontal sync input
37	VSYNC	I	Vertical sync input
38	DCLK	I	Dot data clock input
39	NC	-	No connection
40	NC	-	No connection
41	VCC	P	Power supply for system
42	VCC	P	Power supply for system
43	NC	-	No connection
44	NC	-	No connection
45	NC	-	No connection
46	NC	-	No connection
47	NC	-	No connection
48	IF2	I	Control the input data format / floating
49	IF1	I	Control the input data format
50	IF0	I	Control the input data format
51	NC	-	No connection
52	DE	I	Data enable input
53	GND	P	Ground
54	GND	P	Ground

Note:

1. TYPE definition: I-----Input O---Output P----Power/Ground
2. The mode control (IF2) not use, it can't control CCIR601 interface, if not use CCIR601, it can be floating.
3. For digital RGB input data format, both SYNC mode and DE+SYNC mode are supported. If DE signal is fixed low, SYNC mode is used. Otherwise, DE+SYNC mode is used. Suggest used SYNC mode!!
4. SPENB, SPCLK, SPDAT usually pull high.
5. IF select serial RGB or CCIR601/656 input mode is selected, only DX0-DX7 used, and the other short to GND, Only selected serial RGB、CCIR601/656 interface, DX BUS will enable, Digital input mode DX0 is LSB and DX7 is MSB.
6. Control the input data format:

IF2-0: Define the input interface mode.

IF2	IF1	IF0	Format	Operating Frequency
0	0	0	Parallel-RGB data format (only support stripe type color filter)	6.5MHz
0	0	1	Serial-RGB data format	19.5MHz
0	1	0	CCIR 656 data format (640RGB)	24.54MHz
0	1	1	CCIR 656 data format (720RGB)	27MHz
1	0	0	YUV mode A data format (Cr-Y-Cb-Y)	24.54MHz
1	0	1	YUV mode A data format (Cr-Y-Cb-Y)	27MHz
1	1	0	YUV mode B data format (Cb-Y-Cr-Y)	27MHz
1	1	1	YUV mode B data format (Cb-Y-Cr-Y)	24.54MHz

Input format	DOTCLK Freq (MHz)	Display Data	Active Area (DOTCLK)
YUV mode	24.54	640	1280
	27	720	1440

Mode	D[23:16]	D[15:8]	D[7:0]	IHS	IVS	DEN
ITU-R BT 656	D[23:16]	GND	GND	NC	NC	NC
ITU-R BT 601	D[23:16]	GND	GND	IHS	IVS	NC
8 bit RGB	D[23:16]	GND	GND	IHS	IVS	NC for HV Mode
						DEN for DEN Mode
24 bit RGB	R[7:0]	G[7:0]	B[7:0]	IHS	IVS	NC for HV Mode
						DEN for DEN Mode

2. Electrical Characteristics

2.1. Absolute Maximum Rating

Item	Symbol	Min.	Max.	Unit	Remark
Power Supply	VCC	-0.3	4.6	V	
Input Signal Voltage	V_{IN}	-0.3	VCC+0.3	V	Note 1
Operating Temperature	T_{OPR}	-20	+70	℃	Ambient
Storage Temperature	T_{STG}	-30	+80	℃	Ambient

Note1: VIN represent IO

2.2. DC Electrical Characteristics

2.2.1. Driving TFT LCD Panel

GND=0V, Ta=25℃

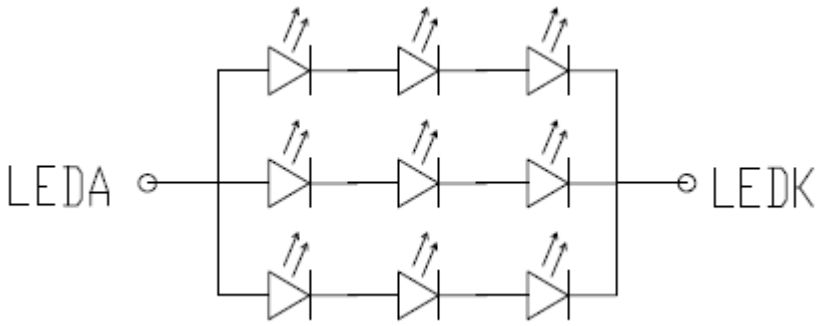
Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Operating Voltage	VCC	3.0	3.3	3.6	V	
Logic High level input voltage	V_{IH}	0.8VCC	-	VCC	V	
Logic Low level input voltage	V_{IL}	0	-	0.2VCC	V	
Logic High level output voltage	V_{OH}	0.8VCC	-	VCC	V	I_{OH}=-1.0mA
Logic Low level output voltage	V_{OL}	0	-	0.1VCC	V	I_{OL}=1.0mA
Power Consumption	I_{CC}	-	TBD	-	mA	

2.2.2. Driving Backlight

Ta=25℃

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Forward Current	I_F	-	60	60	mA	Note1
Forward Current Voltage	V_F	8.25	-	10.5	V	
Operating Life Time	-	10000			hrs	

Note 1: The figure below shows the connection of backlight LED.



Note 2: One LED: I_F =20mA.

2.3. AC Electrical Characteristics

2.3.1. Pixel Timing

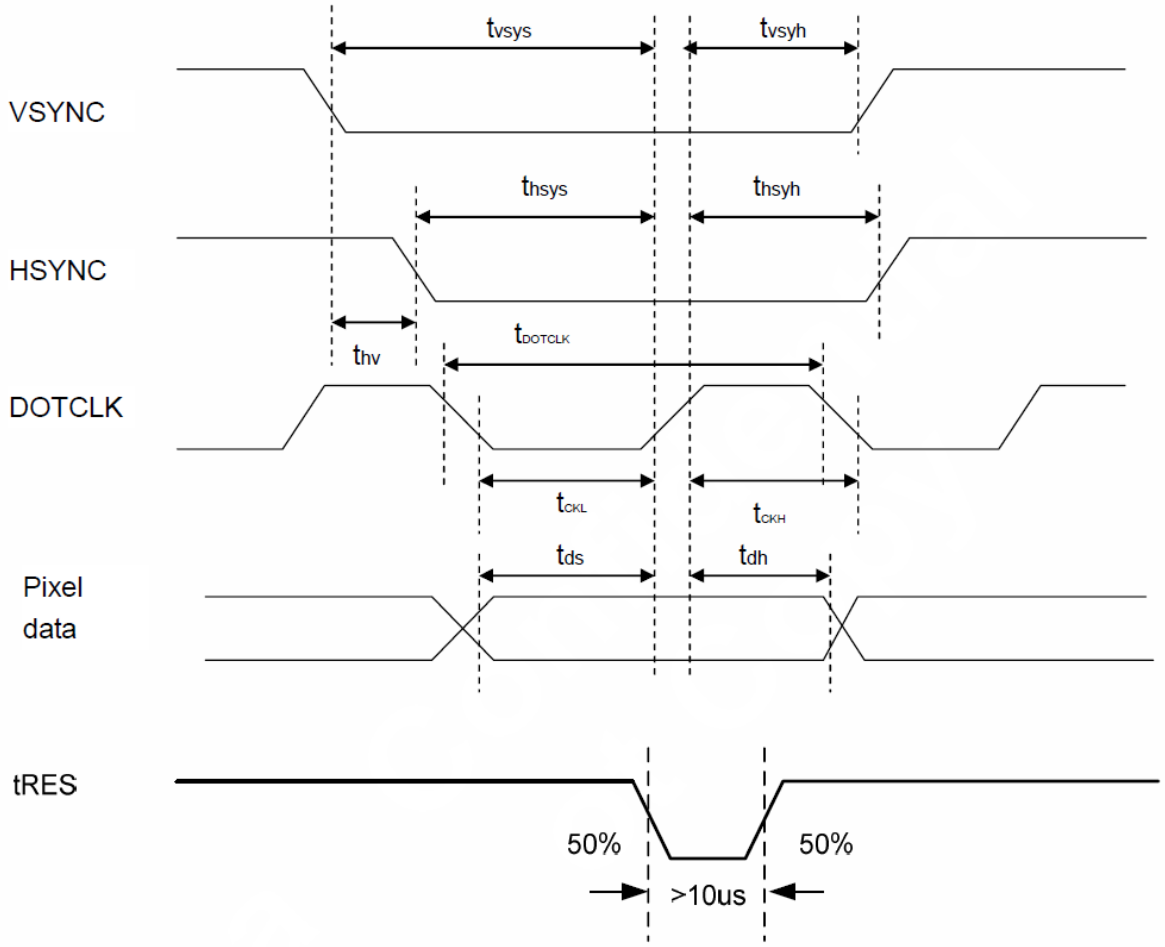
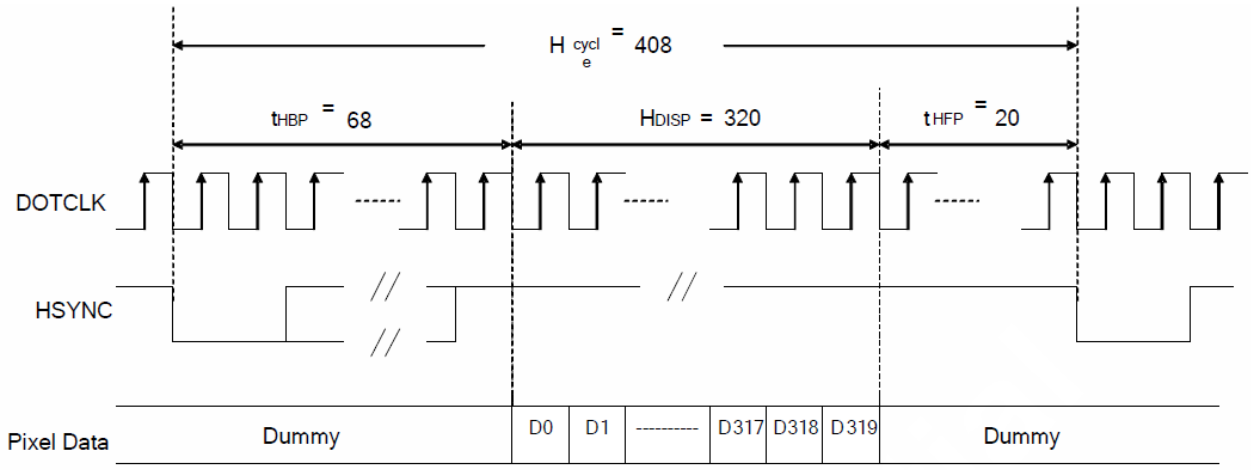


Figure 12. 1 Pixel Timing

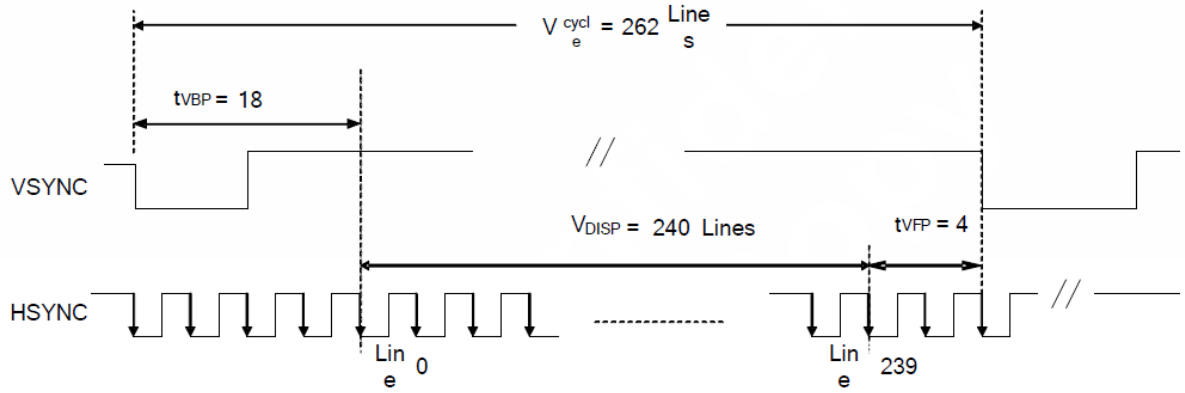
Characteristics	Symbol	Min.		Typ.		Max.		Unit
		24 bit	8 bit	24 bit	8 bit	24 bit	8 bit	
DOTCLK Frequency	fDOTCLK	-	-	6.5	19.5	10	30	MHz
DOTCLK Period	tDOTCLK	100	33.3	154	51.3	-	-	ns
Vertical Sync Setup Time	tvsys	20	10	-	-	-	-	ns
Vertical Sync Hold Time	tvsyh	20	10	-	-	-	-	ns
Horizontal Sync Setup Time	thsys	20	10	-	-	-	-	ns
Horizontal Sync Hold Time	thsyh	20	10	-	-	-	-	ns
Phase difference of Sync Signal Falling Edge	thv	1		-		240		tDOTCLK
DOTCLK Low Period	tCKL	50	15	-	-	-	-	ns
DOTCLK High Period	tCKH	50	15	-	-	-	-	ns
Data Setup Time	tds	12	10	-	-	-	-	ns
Data hold Time	tdh	12	10	-	-	-	-	ns
Reset pulse width	tRES	10		-		-		µs

Note: External clock source must be provided to DOTCLK pin of HX8238-D. The driver will not operate if absent of the clocking signal.

2.3.2. RGB interface Data Transaction Timing



(a) Horizontal Data Transaction Timing



(b) Vertical Data Transaction Timing

Figure 12. 2 Data Transaction Timing in Parallel RGB (24 bit) Interface (SYNC Mode)

Characteristics		Symbol	Min.		Typ.		Max.		Unit
			24 bit	8 bit	24 bit	8 bit	24 bit	8 bit	
DOTCLK Frequency		fDOTCLK	-	-	6.5	19.5	10	30	MHz
DOTCLK Period		tDOTCLK	100	33.3	154	51.3	-	-	ns
Horizontal Frequency (Line)		fH	-		14.9		22.35		KHz
Vertical Frequency (Refresh)		fV	-		60		90		Hz
Horizontal Back Porch		tHBP	-	-	68	204	-	-	tDOTCLK
Horizontal Front Porch		tHFP	-	-	20	60	-	-	tDOTCLK
Horizontal Data Start Point		tHBP	-	-	68	204	-	-	tDOTCLK
Horizontal Blanking Period		tHBP + tHFP	-	-	88	264	-	-	tDOTCLK
Horizontal Display Area		HDISP	-	-	320	960	-	-	tDOTCLK
Horizontal Cycle		Hcycle	-	-	408	1224	450	1350	tDOTCLK
Vertical Back Porch		tVBP	-		18		-		Lines
Vertical Front Porch		tVFP	-		4		-		Lines
Vertical Data Start Point		tVBP	-		18		-		Lines
Vertical Blanking Period		tVBP + tVFP	-		22		-		Lines
Vertical Display Area	NTSC	VDISP	-		240		-		Lines
	PAL				280(PALM=0)				
	PAL				288(PALM=1)				
Vertical Cycle	NTSC	Vcycle	-		262		350		Lines
	PAL				313				

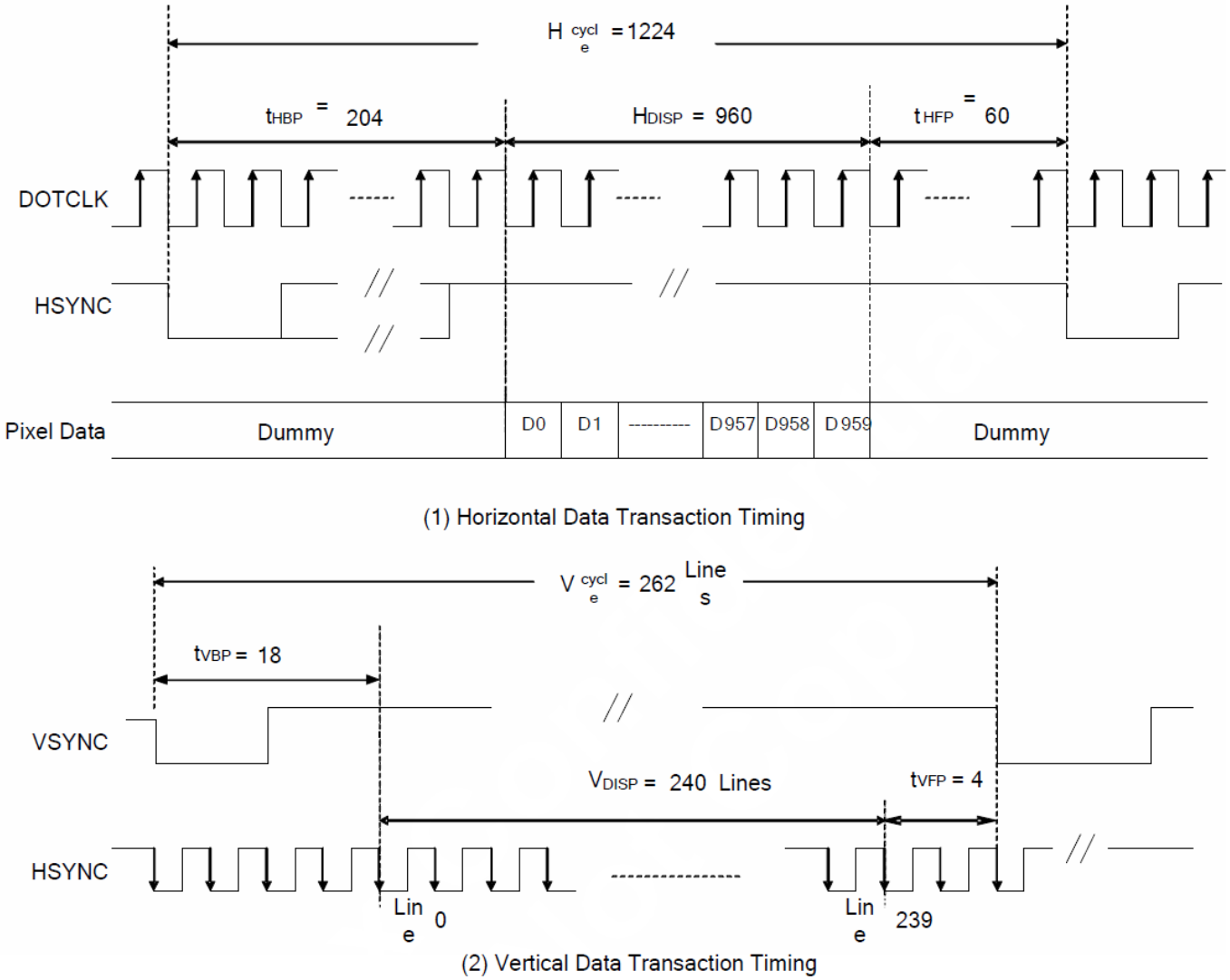


Figure 12. 3 Data Transaction Timing in Serial RGB (8 bit) Interface (SYNC Mode)

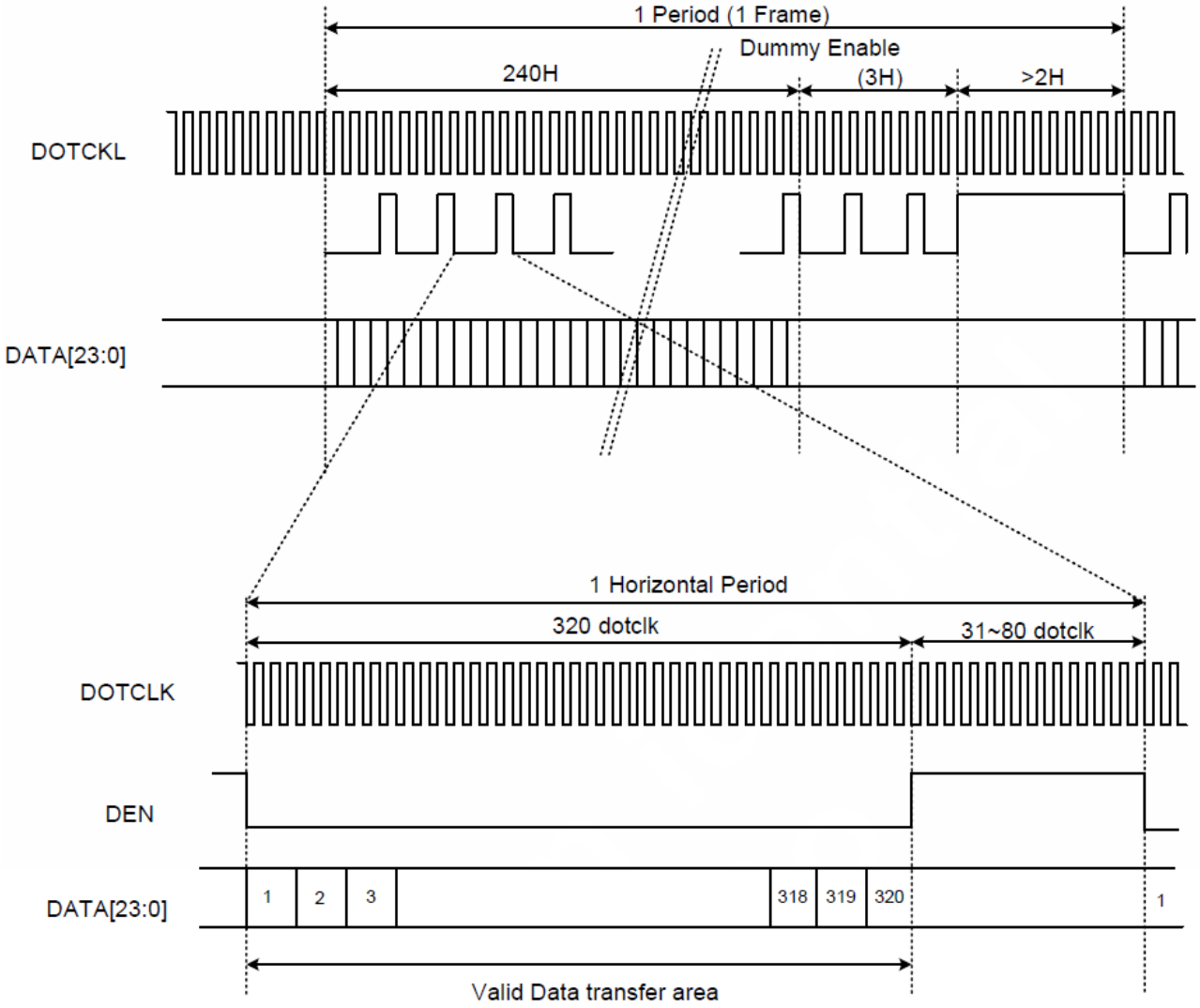
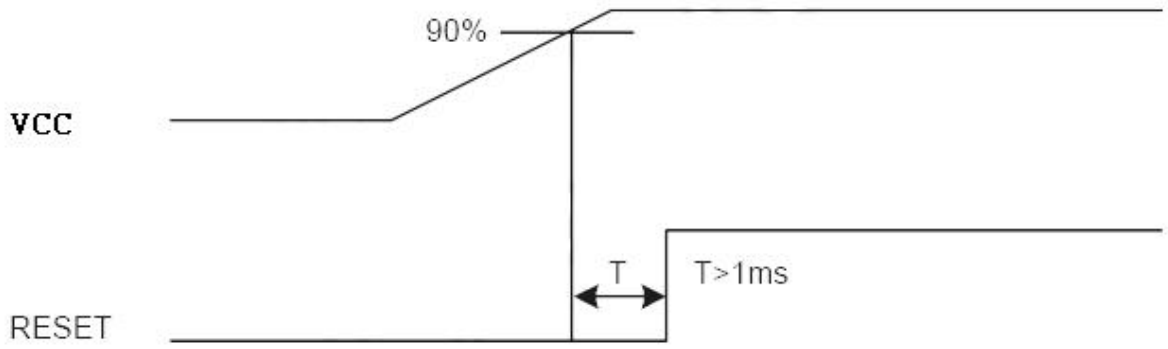


Figure 12. 4 Signal Timing in DE Mode

2.3.3. Reset Timing

The RESET input must be held at least 1ms after power is stable.



Reset timing

3. Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle		θT	CR≥10		50	-	degree	Note5
		θB			55	-		
		θL			60	-		
		θR			60	-		
Contrast Ratio		CR	θ=0 ° optimal	-	300	-	-	Note3
Response Time		T_R	Ta=25℃	-	15	30	ms	Note2
		T_F		-	35	50		
Color Chromaticity	White	x	θ=0°	-0.05	0.312	+0.05	-	Note6
		y			0.349			
	Red	x			0.639			
		y			0.344			
	Green	x			0.294			
		y			0.587			
	Blue	x			0.132			
		y			0.136			
Uniformity		U	θ=0°	70	80	-	%	Note7
Luminance		L	I_F=Typ.	900	1000	-	cd/m^2	Note8

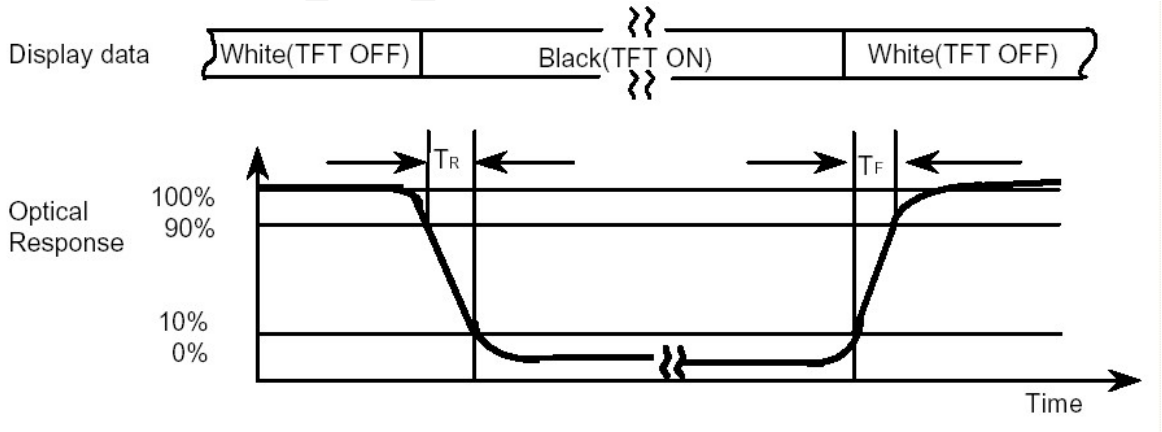
Note:

1. Test equipment setup

After stabilizing and leaving the panel alone at a given temperature for 30 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7 with a viewing angle of 1 °at a distance of 50cm and normal direction.

2. Definition of response time: T_R and T_F

The figure below is the output signal of the photo detector.

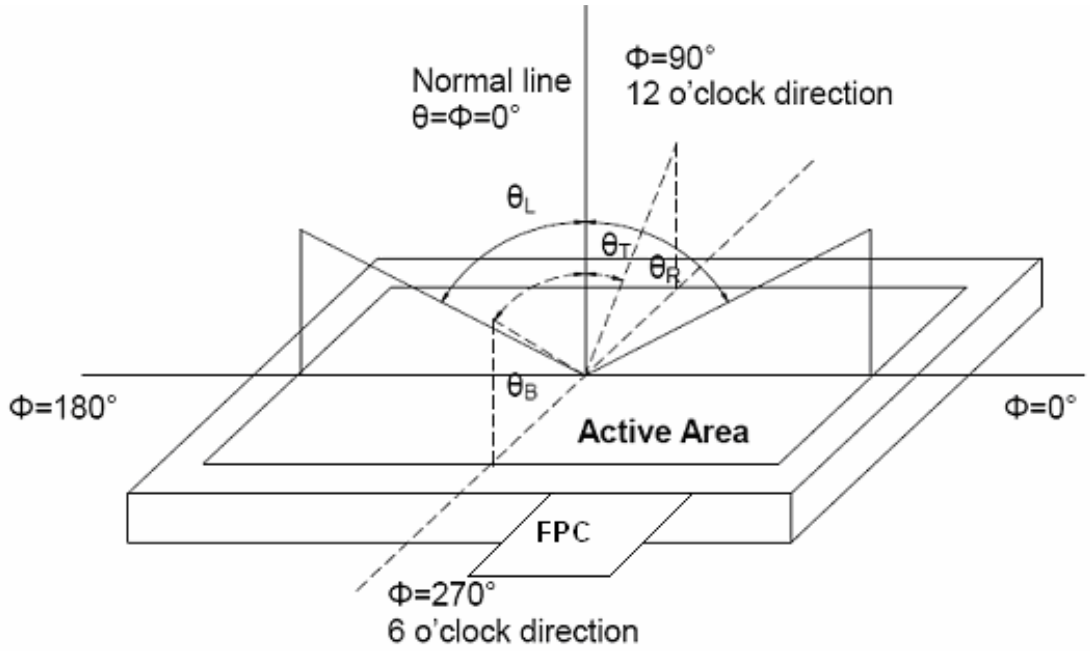


3.Definition of contrast ratio

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

4.The 100% transmission is defined as the transmission of LCD panel when all the input terminals of module are electrically opened.

5. Definition of viewing angle:



6. Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

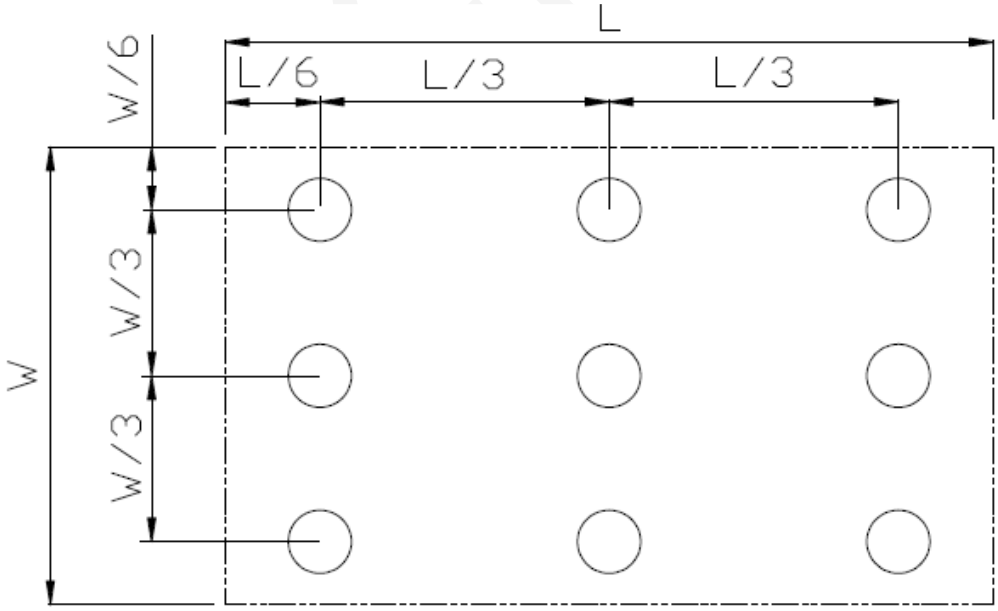
7. Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig.). Every measuring point is placed at the center of each measuring area.

Luminance Uniformity(U) = L_{MIN} / L_{MAX}

L-------Active area length

W----- Active area width



L_{MAX}: The measured maximum luminance of all measurement position.

L_{MIN}: The measured minimum luminance of all measurement position.

8. Definition of Luminance:

Measure the luminance of white state at center point.

4. Reliability

4.1. Reliability Condition

No.	Item	Condition	Remark
1	High temperature Operating	70℃, 240hrs	Finish product (With polarizer)
2	Low temperature Operating	-20℃, 240hrs	Finish product (With polarizer)
3	High temperature Storage	80℃, 240hrs	Finish product (With polarizer)
4	Low temperature Storage	-30℃, 240hrs	Finish product (With polarizer)
5	High temperature & Humidity Storage	80℃, 90%RH, 240hrs	Finish product (With polarizer)
6	Thermal Shock Storage (No operation)	-30℃, 30min. <=> 80℃,30min. 100 Cycles	Finish product (With polarizer)
7	ESD Test	Voltage: +8KV R:330Ω, C:150pF Air discharge, 10 times	Finish product (With polarizer)
8	Vibration Test	0.015G*G/Hz from 5-200HZ, -6dB/Octave from 200-500HZ 2 hours for each direction of X. Y. Z. (6 hours for total)	Finish product (With polarizer)
9	Drop Test	Packed, 60cm free fall 1 corner, 3 edges, 6 surfaces	Finish product (With polarizer)

*One single product test for only one item.

* Judgment after test: keep in room temperature for more than 2 hours.

- Current consumption < 2 times of initial value
- Contrast > 1/2 initial value
- Function: work normally

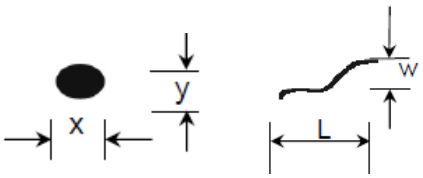
4.2. Inspection plan

Class	Item	Judgment	Class
Packing & Indicate	1.Outside and inside package	"Model no.", "lot no." and" quantity" should indicate on the package.	Minor
	2.Model mixed and quantity	Other model mixed ..... rejected. Quantity short or over ..... rejected.	Critical
	3.Product indication	"Model no." should indicate on the product	Major
Assembly	4.Dimension,LCD glass scratch and scribe defect	According to specification or drawing	Major
Appearance	5.Viewing area	Polarizer edge or LCD's sealing line is visible in the viewing area ..... rejected	Minor
	6.Blemish,black spot, white spot in the LCD and LCD glass cracks	According to standard of visual inspection (inside viewing area)	Minor
	7.Blemish,black spot White spot and scratch on the polarizer	According to standard of visual inspection (inside viewing area)	Minor
	8.Bubble in polarizer	According to standard of visual inspection (inside viewing area)	Minor
	9.LCD's rainbow color	Strong deviation color (or Newton ring) of LCD ..... rejected. Or according to limited sample (if needed, and inside viewing area)	Minor
	10.FPC	Burned area or wrong part number is on FPC. The symbol, character, and mark of FPC are unidentifiable. The stripped solder mask, A>1.0mm. 0.3mm < stripped solder mask or visible circuit, A<1.0mm,and the number is ≧4 pieces. Particle between circuits in solder mask. Circuit is peeled off or cracked. Any circuit risen or exposed. 0.2mm< Area of solder ball, A is ≦0.4mm,the number of solder ball is ≧3 pieces. The magnitude of solder ball, A is > 0.4mm.	Minor
Electrical	11.Electrical and optical characteristics (contrast, VOP, chromaticity etc.)	According to standard of visual inspection (inside viewing area)	Critical
	12.Missing pattern	Missing dot, line, character ..... rejected	Critical
	13.Short circuit, wrong pattern display	Non display, wrong pattern display, current consumption out of specification ..... rejected	Critical
	14.Pin hole, pattern deformity	According to standard of visual inspection	Minor
	15.Black spot, white spot, black line, white line, slant line, background uneven, color uneven	Strong deviation color ..... rejected Or according to limited sample full off screen (all black) ..... disregards	Minor
	16.Stick image (retention image)	Fixed test picture within two hours ..... rejected	Minor

4.3. Standard of visual inspection

<table>
<tr><th>Class</th><th>Item</th><th>Judgment</th></tr>
<tr><td>Minor</td><td>Blemish, black spot, white spot in the LCD.

Blemish, black spot, white spot and scratch on the polarizer.

Round type Line type</td><td>(A) Round type Unit: mm
<table>
<tr><th>Diameter (mm)</th><th>Acceptable Quantity</th></tr>
<tr><td>0.25 < A</td><td>0</td></tr>
</table>
Note: A = (x + y)/2 (mm)

(B) Line type Unit: mm
<table>
<tr><th>Length</th><th>Width</th><th>Acceptable Quantity</th></tr>
<tr><td>-</td><td>W≦0.03</td><td>Acceptable</td></tr>
<tr><td>L<5</td><td>0.03<W≦0.07</td><td>3</td></tr>
<tr><td>L<5</td><td>0.03<W≦0.07</td><td>1</td></tr>
<tr><td>-</td><td>0.07<W</td><td>Follow round type</td></tr>
</table></td></tr>
<tr><td>Minor</td><td>Bubble in polarizer</td><td>Unit: mm
<table>
<tr><th>Diameter (mm)</th><th>Acceptable Quantity</th></tr>
<tr><td>A < 0.3</td><td>Acceptable</td></tr>
<tr><td>0.3 < A < 0.5</td><td>1</td></tr>
<tr><td>0.5 < A</td><td>0</td></tr>
</table></td></tr>
<tr><td>Minor</td><td>Pin hole, Pattern deformity</td><td>Unit: mm
<table>
<tr><th>Diameter (mm)</th><th>Acceptable Quantity</th></tr>
<tr><td>0.4 < A</td><td>0</td></tr>
</table></td></tr>
</table>

5. Precautions

5.1. Handling Precautions

(1) Protect the panel from static, it may cause damage to the CMOS Gate Array IC.

(2) Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

(3) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.

(4) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane. Don't use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.

(5) Pins of I/F connector shall not be touched directly with bare hands.

(6) Refrain from strong mechanical shock and / or any force to the panel. In addition to damage, this may cause improper operation or damage to the panel.

(7) Note that polarizers are very fragile and could be easily damaged. Do not press or scratch the surface harder than a B pencil lead.

(8) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, staining and discoloration may occur.

(9) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

5.2. Storage Precautions

(1) Do not leave the panel in high temperature, and high humidity for a long time. It is highly recommended to store the panel with temperature from 0 to 35℃ and relative humidity of less than 70%.

(2) The panel shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during the store.

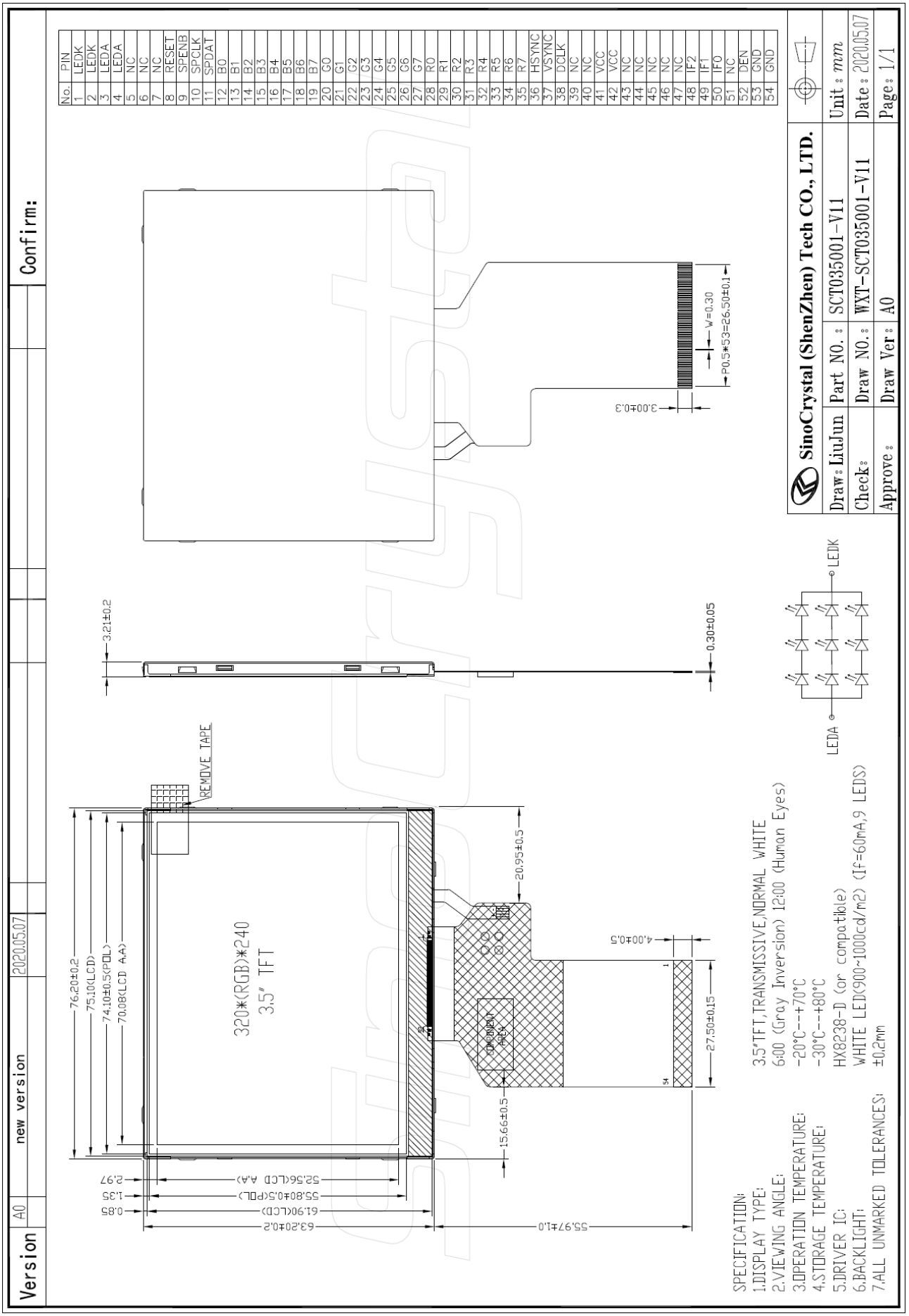
5.3. Operation Precautions

(1) The LCD shall be operated within the limits specified. Operation at values outside of these limits may shorten life, and/or harm display images.

(2) Do not exceed the absolute maximum rating value. (the supply voltage variation, Input voltage variation in part contents and environmental temperature and so on). Otherwise the panel may be damaged.

(3) If the panel displays the same pattern continuously for a long period of time, it can be the situation when the image" Sticks" to the screen.

6. Outline Dimension



7. Packing Information

7.1. Packing Quantity

TBD.

7.2. Flowing chart

TBD.