AU Optronics Corp.

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Product Specification

3.8″ COLOR TFT-LCD MODULE

MODEL NAME: H038QR03 Ver.0 (UR038Q03)

(◆) Preliminary Specification
( ) Final Specification

Note: The content of this specification is subject to change.

Record of Revision

Version	Revise Date	Page	Content
1	30/July/2001		First draft.
2	2/Aug./2001	3	**Display resolution 240 (H) * 3 * 320(V)**
3	29/Aug./2001	5	**Pin49:V_{GG}(0 r g . V_{EE}); Pin50:V_{EE}(0 r g . V_{GG});**

Contents:

Appendix:

A. General specifications

NO.	Item	Specification	Remark
1	Driving method	Active matrix TFT	
2	Display mode	Reflective type	
3	Display resolution(pixel)	240*3 (H)×320(V)	
4	Active area(mm)	57.24(H)×76.8(V)	
5	Screen size(inch)	3.8(Diagonal)	
6	Pixel pitch(mm)	0.24(H)×0.24(V)	
7	Pixel configuration	R. G. B. Vertical stripe	
8	Display color	262144 (colors)	
9	Surface treatment(Touch panel)	(Hard coating 3H)	
10	Interface	18 bits R, G, B digital input	
11	Front light	Single cold-cathode fluorescent lamp for side lighting	
12	Overall dimension(mm)	73.0(W)×94.5(H)×5.0(D)	Note 1
13	Bezel opening	60.3(W) × 80.0 (H) (mm)	
14	Weight(g)	55±5	

Note 1: Refer to Fig. 1.

B. Electrical specifications

1.Pin assignment

(1).TFT-LCD panel Input/Output signal interface (Mating connector : FH16-60S-0.3SHW)

No	Pin name	I/O	Description	Remark
1	Vcom	-	Common electrode	
2	STHL	I/O	Horizontal Start pulse	
3	LR	I	Left/Right control	Note.1
4	SP	I	Power saving adjust pin	
5	(DUMMY1)	-		
6	B5	I	Blue data (MSB)	
7	B4	I	Blue data	
8	B3	I	Blue data	
9	B2	I	Blue data	
10	B1	I	Blue data	
11	B0	I	Blue data(LSB)	
12	LD	I	Data load	
13	AV_{SS} (GND)	-	Analog ground	
14	Vref10	I	Gamma input voltage	
15	Vref9	I	Gamma input voltage	
16	Vref8	I	Gamma input voltage	
17	Vref7	I	Gamma input voltage	
18	Vref6	I	Gamma input voltage	
19	Vref5	I	Gamma input voltage	
20	Vref4	I	Gamma input voltage	
21	Vref3	I	Gamma input voltage	
22	Vref2	I	Gamma input voltage	
23	Vref1	I	Gamma input voltage	
24	Vref0	I	Gamma input voltage	
25	AV_{DD}	I	Analog power	
26	INV	I	Data inversion control	
27	FS	I	Horizontal clock input	
28	G5	I	Green data(MSB)	
29	G4	I	Green data	
30	G3	I	Green data	
31	G2	I	Green data	
32	G1	I	Green data	
33	G0	I	Green data(LSB)	
34	DUMMY	-		
35	R5	I	Red data(MSB)	
36	R4	I	Red data	
37	R3	I	Red data	
38	R2	I	Red data	
39	R1	I	Red data	

No	Pin name	I/O	Description	Remark
40	R0	I	Red data(LSB)	
41	DUMMY	-		
42	STHR	I/O-	Horizontal Start pulse	
43	DV_{SS}(GND)	-	Digital ground	
44	DV_{CC}	-	Digital power	
45	AV_{DD}	-	Analog power	
46	AV_{SS}(GND)	-	Analog ground	
47	Vcom	-	Common electrode	
48	Vcom	-	Common electrode	
49	V_{GG}	I	Vgh power	
50	V_{EE}	I	Vgl power	
51	DVcc	I	Digital power	
52	DV_{SS}(GND)	I	Digital ground	
53	STVU	I/O	Vertical Start pulse	
54	STVD	I/O	Vertical Start pulse	
55	FG	I	Vertical clock input	
56	UD	I	UP/DOWN control	Note 2
57	XDON	I	Gate Output enable pin	H:Gate driver Output enable
58	XDOFF	I	Gate Output disable pin	H:Gate driver Output disable
59	GND	-		
60	DUMMY	-		

Note 1. Selection for horizontal scanning direction

LR	STHL	STHR	Scanning direction(pixel configuration)
High	Output	Input	Normal scanning (1, Y) → (240,Y)
Low	Input	Output	Reverse scanning (240, Y) → (1, Y)

Note 2. Selection for vertical scanning direction

UD	STVU	STVD	Scanning direction(Pixel configuration)
High	Output	Input	Normal scanning (X, 1) ↓ (X,320)
Low	Input	Output	Reverse scanning(X,320) ↓ (X, 1)

(2) Front light driving section(Connector : JST / BHSR-02VS-1)

Pin No.	Symbol	I/O	Description	Remark
L1	VL1	I	Power supply for fluorescent tube(high voltage)	Pink color wire
L2	VL2	I	Power supply for fluorescent tube(low voltage)	White color wire

Touch panel driving section

Pin No.	Symbol	I/O	Description	Remark
T1	YU	-	Electrode Y(12 o' clock side)	
T2	XL	-	Electrode X(left side)	
T3	YL	-	Electrode Y(6 o' clock side)	
T4	XR	-	Electrode X(right side)	

2. Absolute maximum ratings

Item	Symbol	Condition	Min.	Max.	Unit	Remark
Power voltage	DV_{CC}	GND=0	-0.3	5.5	V	
	AV_{DD}	AV_{SS}=0	-0.3	5.5	V	
	V_{GH}	GND=0	-0.3	18	V	
	$V_{EE}(V_{GL})$		-15	0.3	V	
	$V_{GH}-V_{GL}$		-	36	V	
Input signal voltage	V_i		-0.3	AV_{DD}+0.3	V	Note 1
	V_I		-0.3	DV_{DD}+0.3	V	Note 2
	VCOM		-2.9	5.2	V	
Operating temperature	Topa		-10	50	℃	Ambient temperature
Storage temperature	Tstg		-25	70	℃	Ambient temperature

Note 1: Vrefn (n=0,~4).

Note 2: Rn, Gn, Bn(n=0 ~5), STHL, STHR, XDON,XDOFF, LR, CLK, STVR, STVL, UD, INV,PS,FG

3. Electrical characteristics

a. Typical operating conditions

Item		Symbol	Min.	Typ.	Max.	Unit	Remark
Power supply (Note 3)		DV_{CC}	2.5	3.3	3.6	V	
		AV_{DD}	3.1	3.3	3.6	V	
		V_{GH}	14.3	15	15.7	V	
		V_{GL}	-12.5	-12	-11.5	V	
VCOM		V_{CAC}		4.8		Vp-p	Note 1
		V_{CDC}	0.4	0.7	1.0	V	Note 2
Reference voltage		Vref0 ~ Vref10	AVss +0.1		AV_{DD} -0.1	V	AV_{DD}≧Vref10≧Vref9≧ Vref8≧Vref7≧Vref6≧ Vref5≧Vref4≧Vref3≧ Vref2≧Vref1≧Vref0≧ AVss
Input Signal voltage	H Level	V_{IH}	0.8DVcc			V	
	L Level	V_{IL}			0.2DVcc	V	

Note 1: The brightness of LCD panel can be changed by adjusting the AC component of VCOM.

Note 2: V_{CDC} could be adjusted so as to minimize vertical straight line, flicker and maximum contrast on each module.

Note 3: Be sure to apply GND, DV_{CC}, V_{GL} to the LCD first, and then apply V_{GH}.

b. Current consumption (GND=AVss=0V)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Current for driver	I_{GH}	V_{GH}=15V	-	(80)		μA	
	I_{GL}	V_{GL}= -12V	-	(-0.2)		mA	
	I_{CC}	DV_{CC}=3.3V	-	(1.3)		mA	
	I_{DD}	AV_{DD}=3.3V	-	(3.2)		mA	
Current of Vcom	I_{Vcom}	V_{CAC}= 4.8V		0.5		mA	

c. Front light driving conditions

Parameter	Symbol	Min	Typ	Max	Units	Remark
Lamp voltage	V_L	260	290	320	Vrms	
Lamp current	I_L	-	(1.75)	-	mArms	
Frequency	F_L	40	50	60	KHz	Note 3
Power consumption	W_L	-	0.5	1	W	Note 1
Starting Voltage(T= 0℃)	VL			(650)		
Starting Voltage(T= 25℃)	VL			(450)		
Minimum ambient light for starting	L	2	-	-	cd/m^2	
Lamp life time	L_L	10,000	-	-	hour	Note 4

Note 1: T= 25℃, I_L =1.75mArms, V=290Vrms

Note 2: Inverter should be designed with the characteristic of lamp. When you are designing the inverter, the output voltage of the inverter should comply with the following conditions.

(1). The area under the positive and negative cycles of the waveform of the lamp current and lamp voltage should be area symmetric(the symmetric ratio should be larger than 90%).

(2). There should not be any spikes in the waveform.

(3). The waveform should be sine wave as possible.

(4). Lamp current should not exceed the maximum value within the operating Temperature (It is prohibited to over the maximum lamp current even if operated in The non-guaranteed temperature). When lamp current over the maximum value for a long time, it may cause fire. Therefore, it is recommend that the inverter should have the current limited circuit.

Note 3: Lamp frequency may produce interference with horizontal synchronous frequency And this may cause line flow on the display. Therefore lamp frequency shall be Detached from the horizontal synchronous frequency and its harmonics as far as possible in order to avoid interference.

Note 4: Brightness (I_L=2.0 mA) to be decrease to the 50% of the initial value.

4. AC Timing

a. Timing conditions

Parameter		Symbol	Min	Typ	Max	Unit	Remark
Horizontal Timing	Clock frequency	Fclk	-	5.58	7.5	MHz	
	Clock width	Tcw	67	-	-	ns	
	Setup time of start pulse	Tsu	20	90		ns	
	Hold time of start pulse	Thd	20	90	-	ns	
	Set up time of data	Tdsu	20	90	-	ns	
	Hold time of data	Tdhd	20	90	-	ns	
	Propogation delay of STH	Tphl	10	-	30	ns	
	Frequency of start pulse	Fst	19.8	21.12	23	KHz	
	Pulse width of start pulse	Tstw	-	1	-	Tcph	
	Time that last data to LD	Tld	-	-	1	Tcph	
	Pulse width of LD	Twld	2	-	-	Tcph	
	LD signal DIO setup time	Tlds	2	-	-	Tcph	
	Pulse width of SP	Twsp	0			Tcph	
	Setup time that POL to LD	Tspl	-	2	-	Tcph	
	Hold time that POL to LD	Thpl	-	245	-	Tcph	
Vertical Timing	Clock frequency	Fvck	19.8	21.12	23	KHz	
	Pulse width of clock	T_{PWCLK}	500	-	-	ns	
	Rising time of clock	Trck	-	-	100	ns	
	Falling time of clock	Tfck	-	-	100	ns	
	Frequency of start pulse	Tvst	-	60	-	Hz	
	Setup time of start pulse	Tvsu	50	100	-	ns	
	Hold time of start pulse	Tvhd	350	-	-	ns	
	Rising time of start pulse	Trvst	-	-	100	ns	
	Falling time of start pulse	Tfvst	-	-	100	ns	
	Pulse width of GS	Tgs	9	15	-	Tcph	
	Period of FG cycle	T4	-	245	-	Tcph	

b. Timing diagram

Please refer to the attached drawings, from Fig.2 to Fig.4.

c. Display position

D(1,1)	D(2,1)	…..	D(X,1)	…..	D(239,1)	D(240,1)
D(2,1)	D(2,2)	…..	D(X,2)	…..	D(239,2)	D(240,2)
⋮		…..	⋮	…..	⋮	⋮
D(1,Y)	D(2,Y)	…..	D(X,Y)	…..	D(239,Y)	D(240,Y)

⋮		…..	⋮	…..	⋮	⋮
D(1,319)	D(2,319)	…..	D(X,319)	…..	D(239,319)	D(240,319)
D(1,320)	D(2,320)	…..	D(X,320)	…..	D(239,320)	D(240,320)

d. Display color v.s. input data signals

Display colors		Data signal (0 : Low level, 1: High level)																	
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red grayscale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Dark	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑ ↓																		
	bright																		
		1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
		1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Green grayscale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Dark	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	↑ ↓																		
	bright																		
		0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
		0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Blue grayscale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	↑ ↓																		
	bright																		
		0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
		0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Note : Each basic color can be displayed in 64 gray scales using the 6 bit data signals. By combining the 18-bit data signals(R, G, B), the 262, 144 colors can be achieved on the display.

C. Optical specifications

1. Test conditions

Ambient temperature : T_a 25±2°C
Ambient humidity : H_a 65±20%RH
Supply voltage : V_{DD} 3.3V
Input signal : According to typical value in "Electrical characteristics"
FL Input current : I_{FL} =1.75mArms
FL Driving frequency : f_{FL} = 50kHz
FL Inverter : (Harison / HIU-757)
Measurement point : One point on the center of panel otherwise specified

The measuring method and systems are shown in 2 and 3. All of characteristics listed are measured under the condition using the Unipac test inverter and photometer. The following items are measured under stable conditions. The optical characteristics should be measured in a dark room (ambient light < 2 lux)

2. Optical specifications (With touch panel, front light and LCD panel)

a. Not driving the front light condition (Note 2)

Item		Symbol	Conditions	Specifications			Unit	Remark
				Min.	Typ.	Max.		
Contrast Ratio		CR_{AVE}	θ=0°, ϕ=0° Viewing normal angle	(10)	(16)		-	System 1 Note 4
Response Time		tr		-	(15)	20	ms	System 3 Note 3
		tf		-	(25)	30	ms	
White chromaticity		W_{XOFF}		-	(0.32)	-	CIE	System 2
		W_{YOFF}		-	(0.34)	-	CIE	
Viewing angle	Horizontal	θ_H	CR > 2	-	(100)	-	Degree	System 1
	Vertical	θ_V		-	(90)	-		
Reflection ratio		R		-	(20)		%	System 1 Note 4

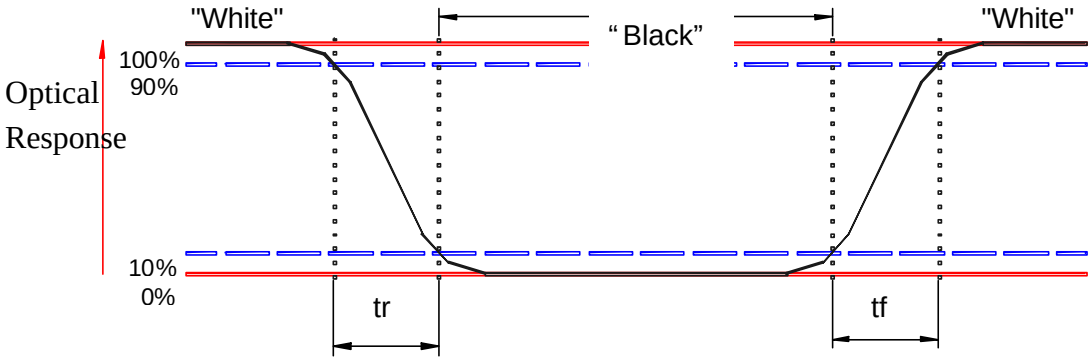
b. Driving the front light condition (Note 1,2,7)

Item	Symbol	Conditions	Specifications			Unit	Note
			Min.	Typ.	Max.		
Contrast Ratio	CR_{AVE}	θ=0°, ϕ=0° Viewing normal angle	(8)	(9)	-	-	System 1 Note 4
White chromaticity	W_{XON}		-	(0.31)	-	CIE	System 2
	W_{YON}		-	(0.32)	-	CIE	
Luminance	Y_L		(22)	(30)	-	cd/m^2	System 4
White uniformity	δ_W		-	(1.4)	1.6	-	System 4, Note 6,8

Note 1: To be measured in dark room after lighting the frontlight for 30 minutes.
Note 2: To be measured with a field angle of 1 ° by Topcon luminance meter BM-7.

Note 3: Definition of response time:

The output signals of BM-7 are measured when the input signals are changed from “Black” to “White” (falling time) then from “White” to “Black” (rising time), respectively. The response time means the interval between the 10% and 90% of amplitudes. Refer to figure as below.



Note 4. Definition of contrast ratio:

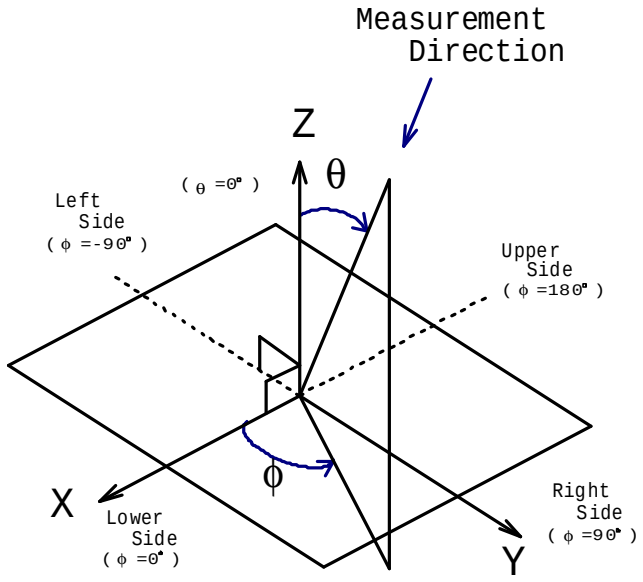
The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L63 / L0

L63: Luminance on the white raster (gray scale level L63)

L 0: Luminance on the black raster (gray scale level L0)

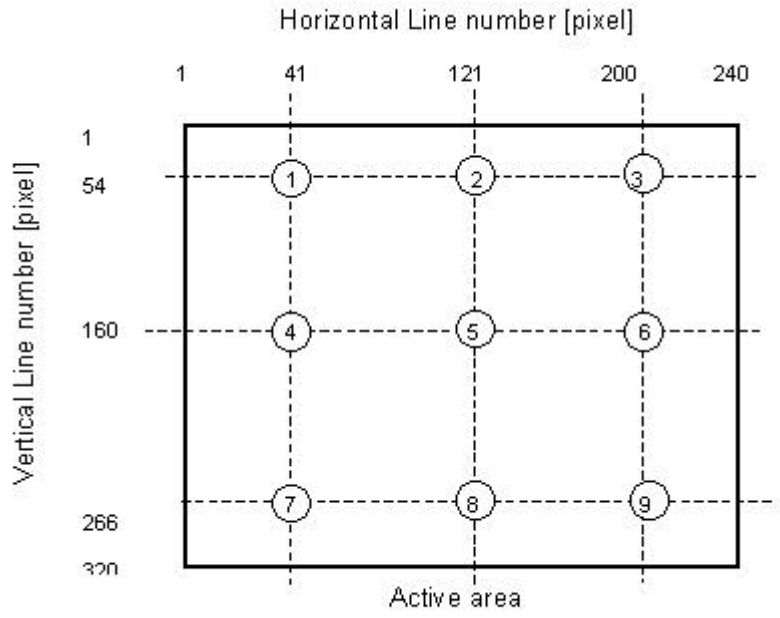
Note 5: Definition of viewing angle:



Note 6: Definition of white uniformity:

$$\delta w = \frac{\text{Maximum Luminance of nine points (brightness)}}{\text{Minimum Luminance of nine points (brightness)}}$$

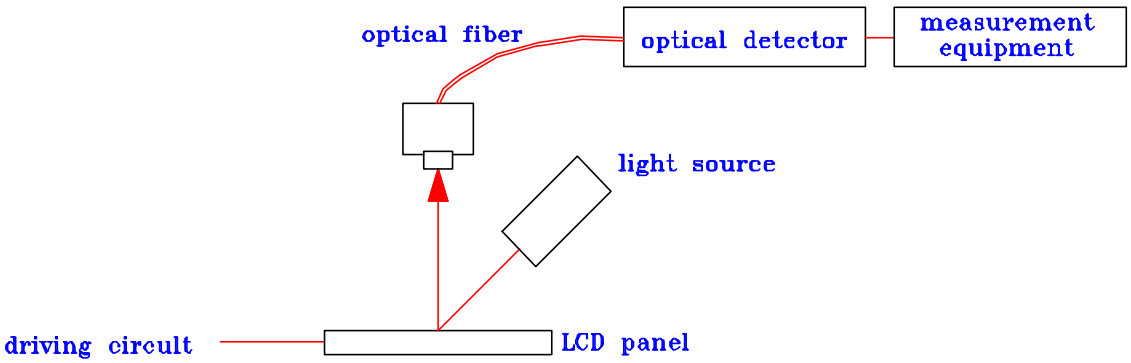
Definition of the 9 points (from 1 to 9) on panel, refer to figure as below



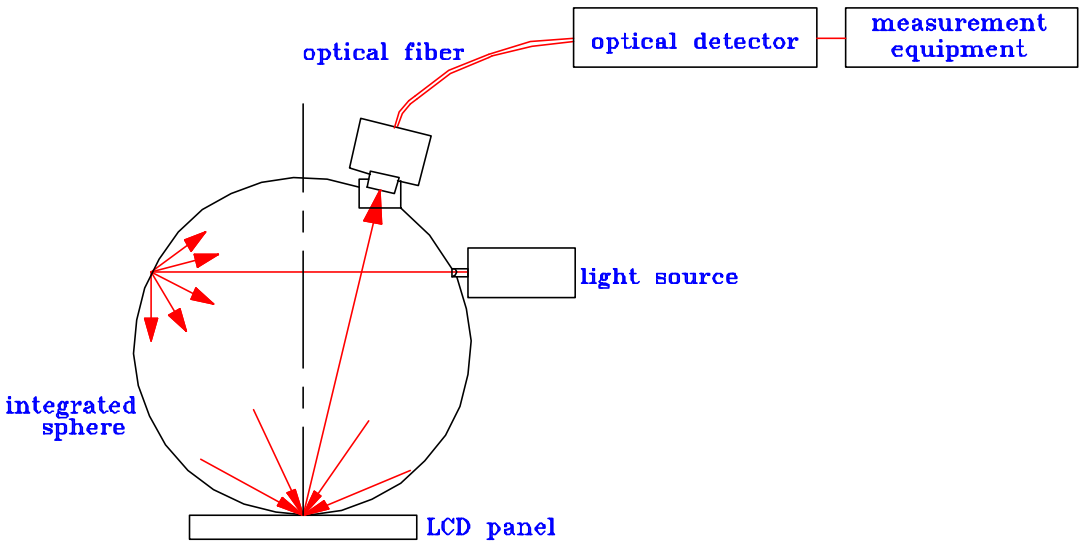
Note 7: Driving conditions for CCFL : I_L= 1.75 mA, 50KHz Frequency

3.Measurement system:

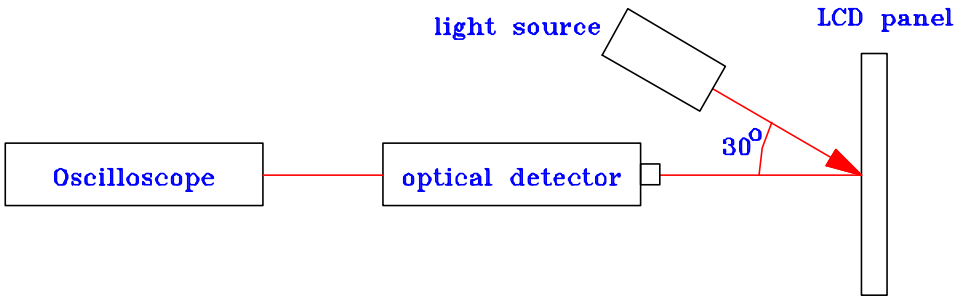
a. System 1



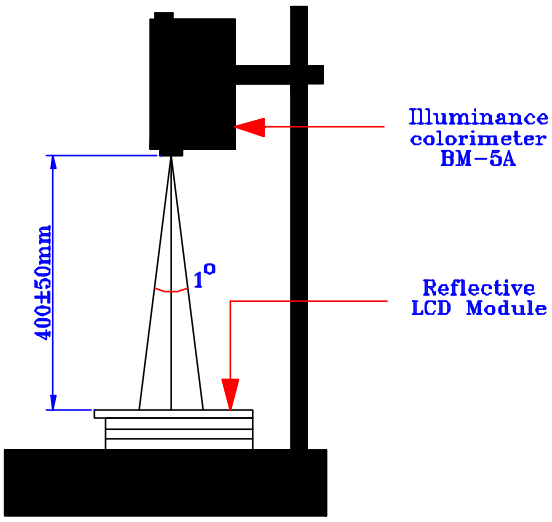
b. System 2



c. System 3



d. System 4



(a) The apparatus for Luminance measurement

D. Reliability test items (Note 1)

No.	Test items	Test conditions
1	High temperature storage test	Ta= 70℃, 240 Hrs
2	Low temperature storage test	Ta= -25℃, 240 Hrs
3	High temperature and high humidity operating test	Ta= 40℃, 90%RH, 240 Hrs(no condensation of dew)
4	High temperature operating test	Ta= 50℃, 240 Hrs
5	Low temperature operating test	Ta= -10℃, 240 Hrs
6	Heat shock test	Ta= -25℃(1H) ~ 70℃(1H) /5cycle
7	Altitude storage test	Height = 0 ~ 40000 feet,48hr
8	Altitude operating test	Height = 0 ~ 15000 feet,48hr
9	Vibration test	Frequency: 10Hz ~ 55Hz Stroke: 1.5mm Sweep: 10Hz ~ 55Hz X,Y,Z 2hours for each direction(total 6hours)
10	Shock test	100G, 6ms ±X,±Y,±Z 3 times for each direction
11	Electro static discharge test	±200V, 200pF(0Ω), 1 time for each terminal
12	Electro static discharge test(Air)	Discharge = ±8 KV Contact = ±4 KV (10times/1point,1times/1sec)
13	Point activation test(touch panel) ℃	Hit it 1,000,000 times with silicon rubber of R8 H60 Hitting force: 250g Hitting speed: 3 times per second

Note 1: Evaluation should be tested after storage at room temperature for one hour.

Note 2: There should be no change which might affect the practical display function when the display quality test is conducted under normal operating condition.

Note 3: Judgement: 1. Function OK

2. No serious image quality degradation

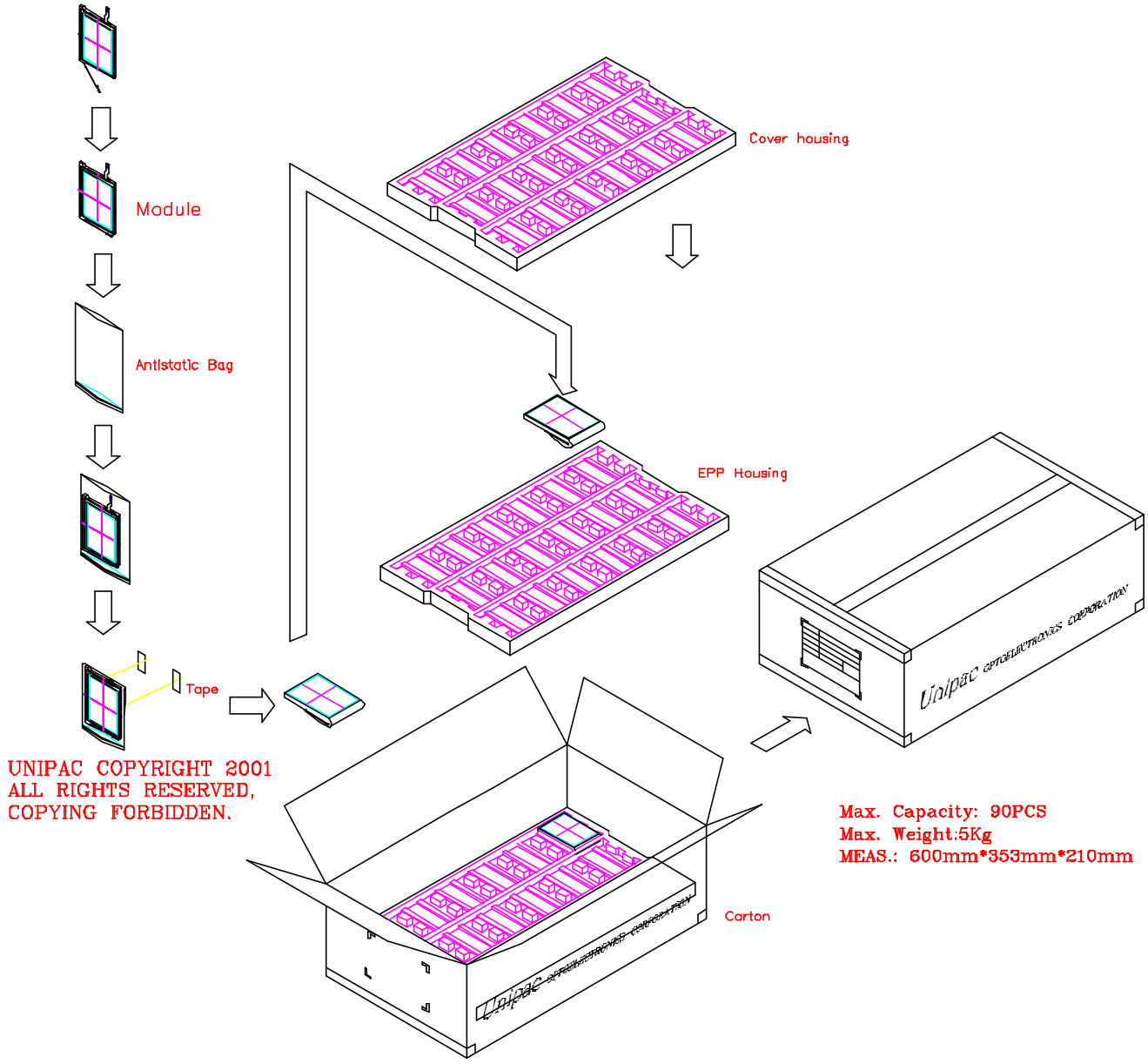
E. Display quality

The display quality of the color TFT-LCD module should be in compliance with the Unipac' s OQC inspection standard.

F. Handling precaution

The Handling of the TFT-LCD should be in compliance with the Unipac' s handling principle standard.

G. Packing form :



NOTES :
1. The bending radius of FPC should be larger than 0.6.
2. General Tolerance:±0.3 .
3. Values with ( ) are estimated , not the final spec.
4. FPC Connector:FH16-60S-0.3SHW (HRS).
5. FLU Connector:BHSR-02VS-1 (JST).
6. FPC of TOUCH PANEL total lengthen :30mm .
7. TOUCH PANEL FOR NISSHA REV.
8. Weight: 55±5 g
9. Unit:mm.

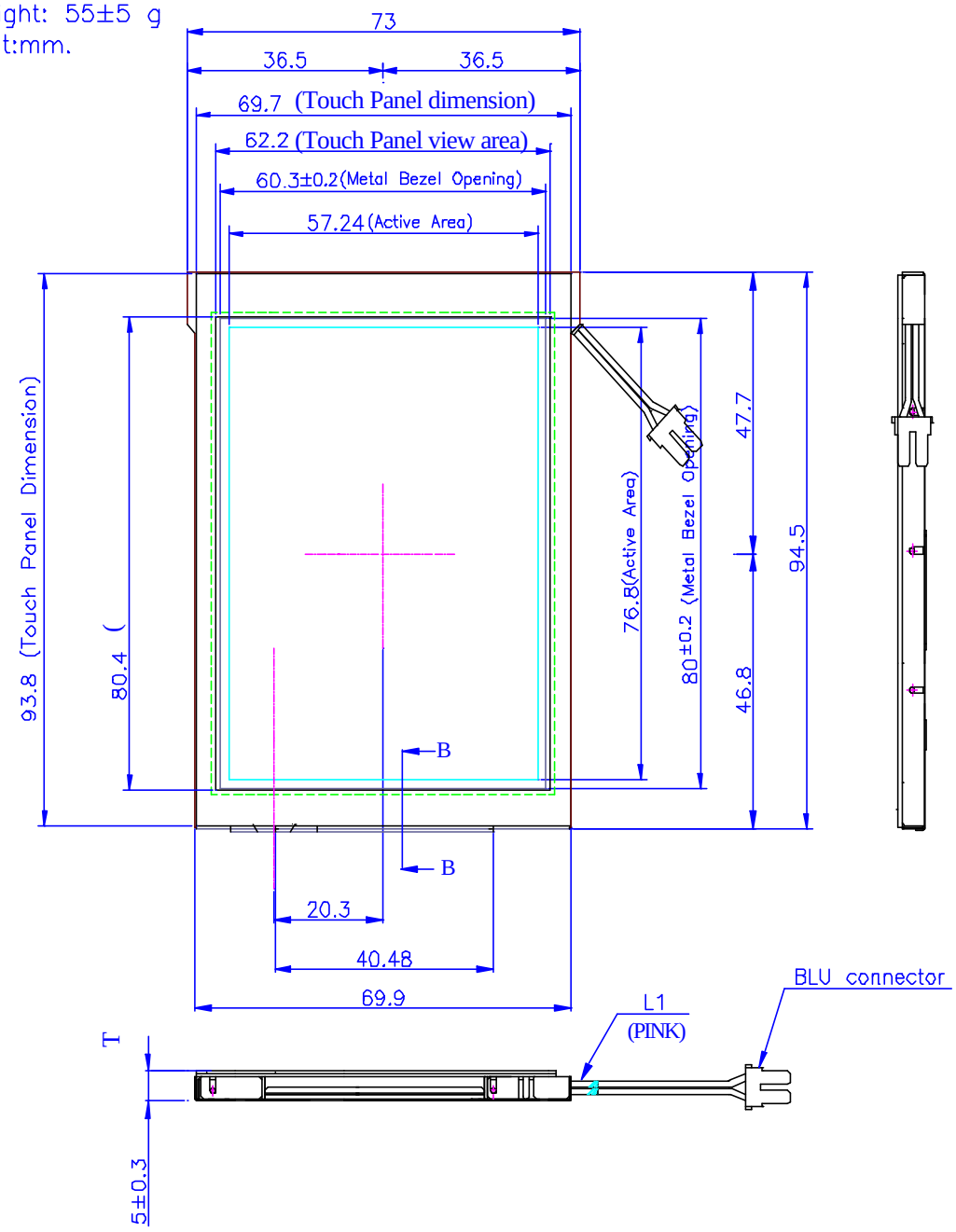


Fig.1-(a) LCM outline dimensions(Front side)

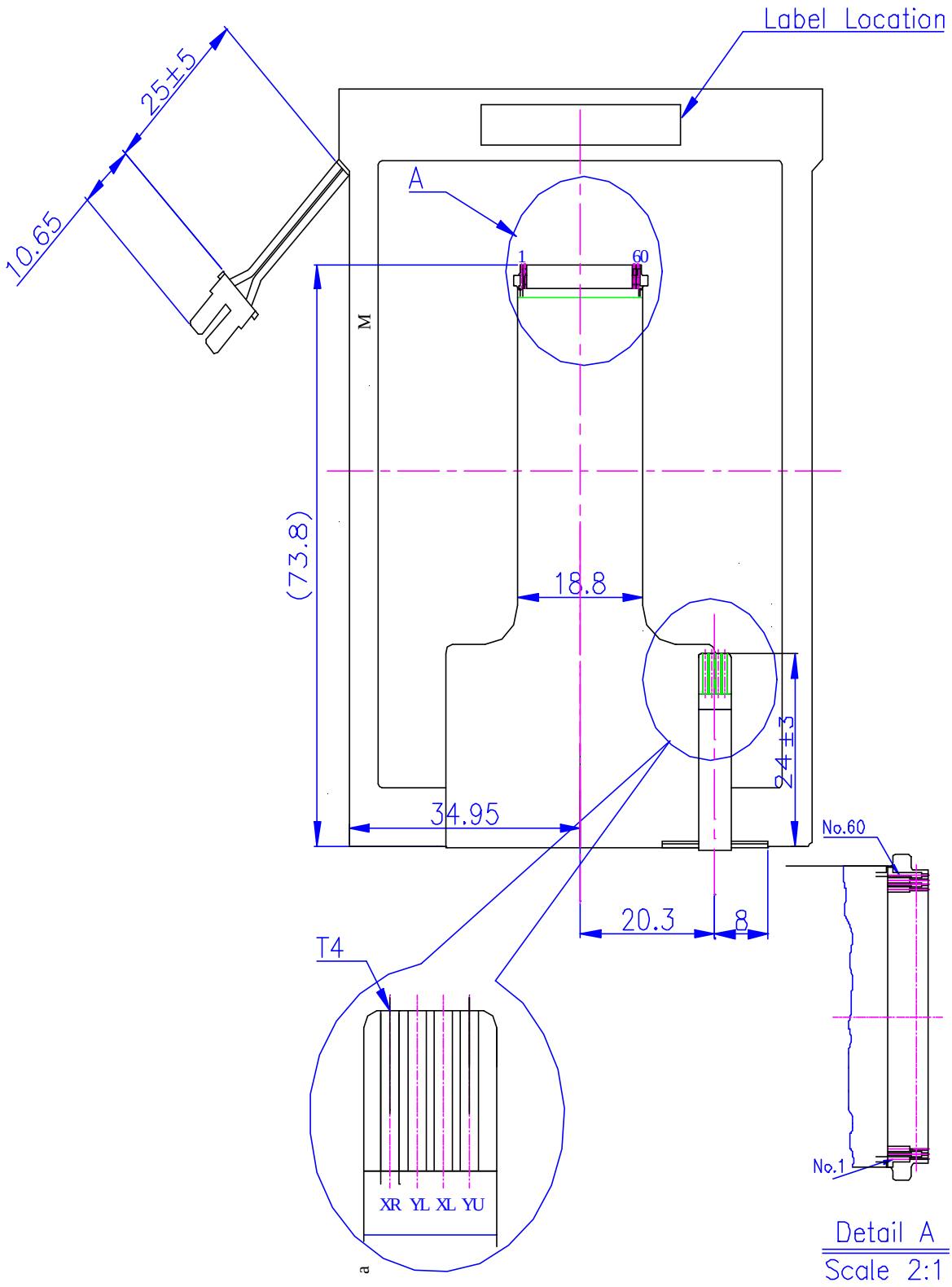
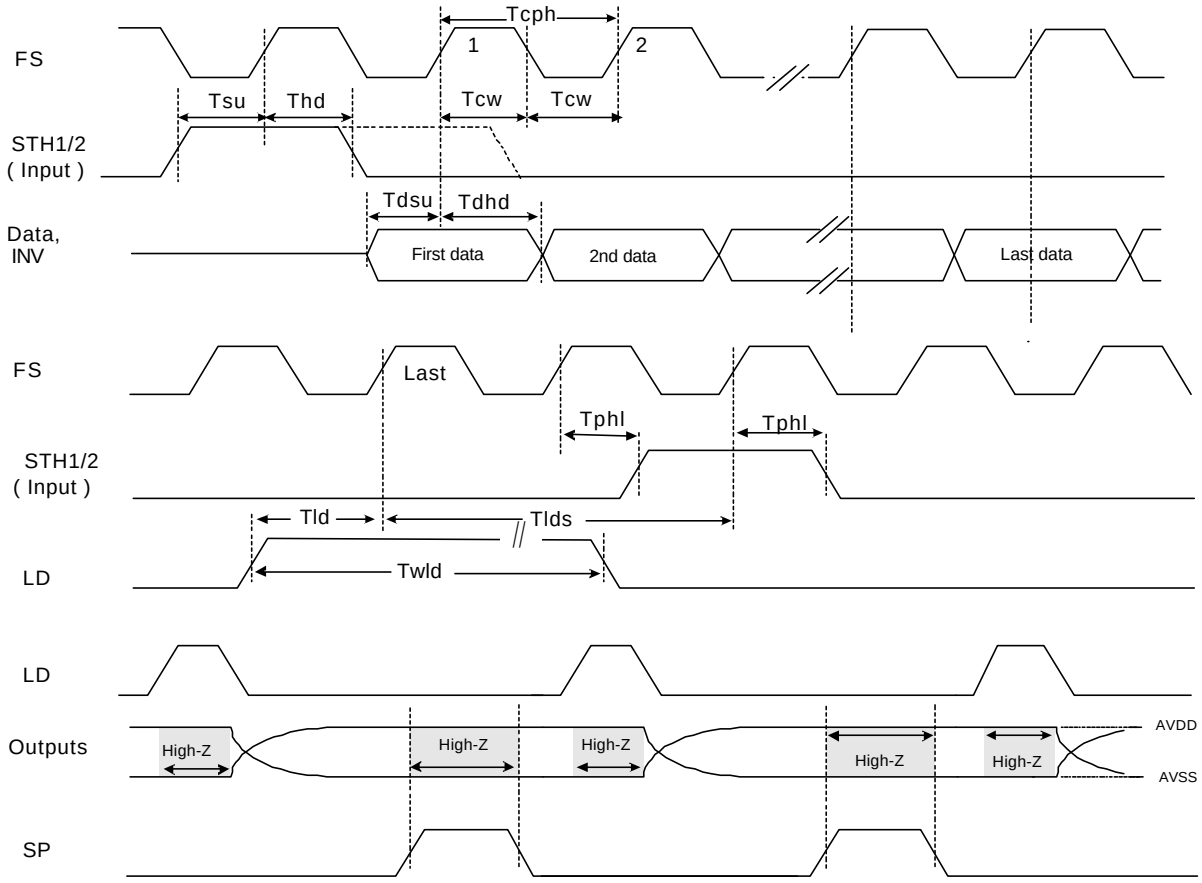


Fig.1-(b) LCM outline dimensions(Back side)

AC Characteristics



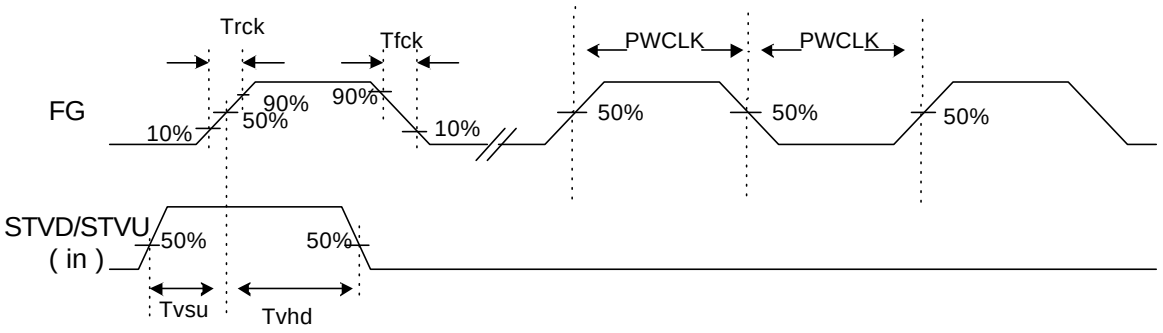


Fig.2Timing Diagram(I)

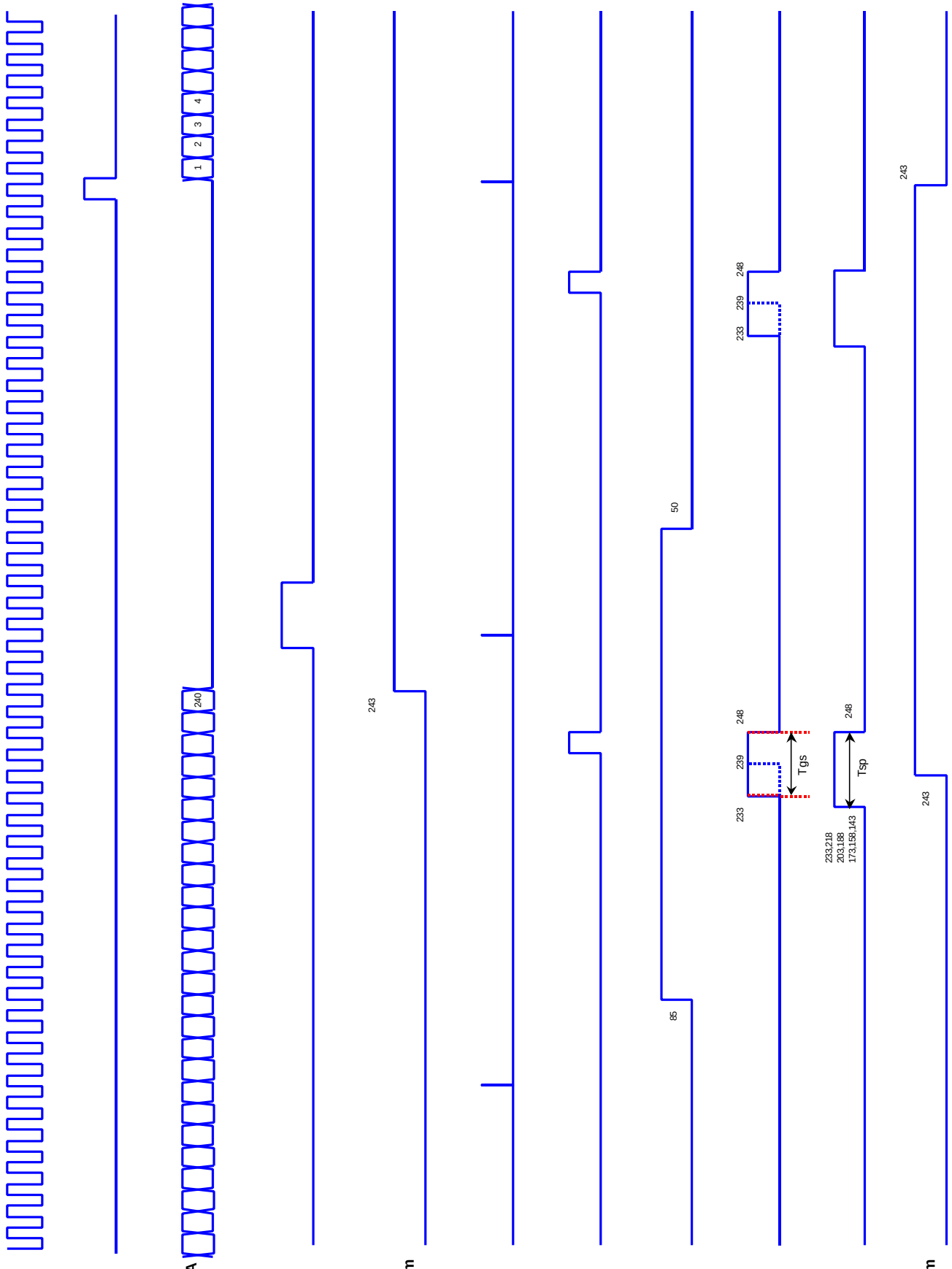


Fig.3 Timing Diagram(II)

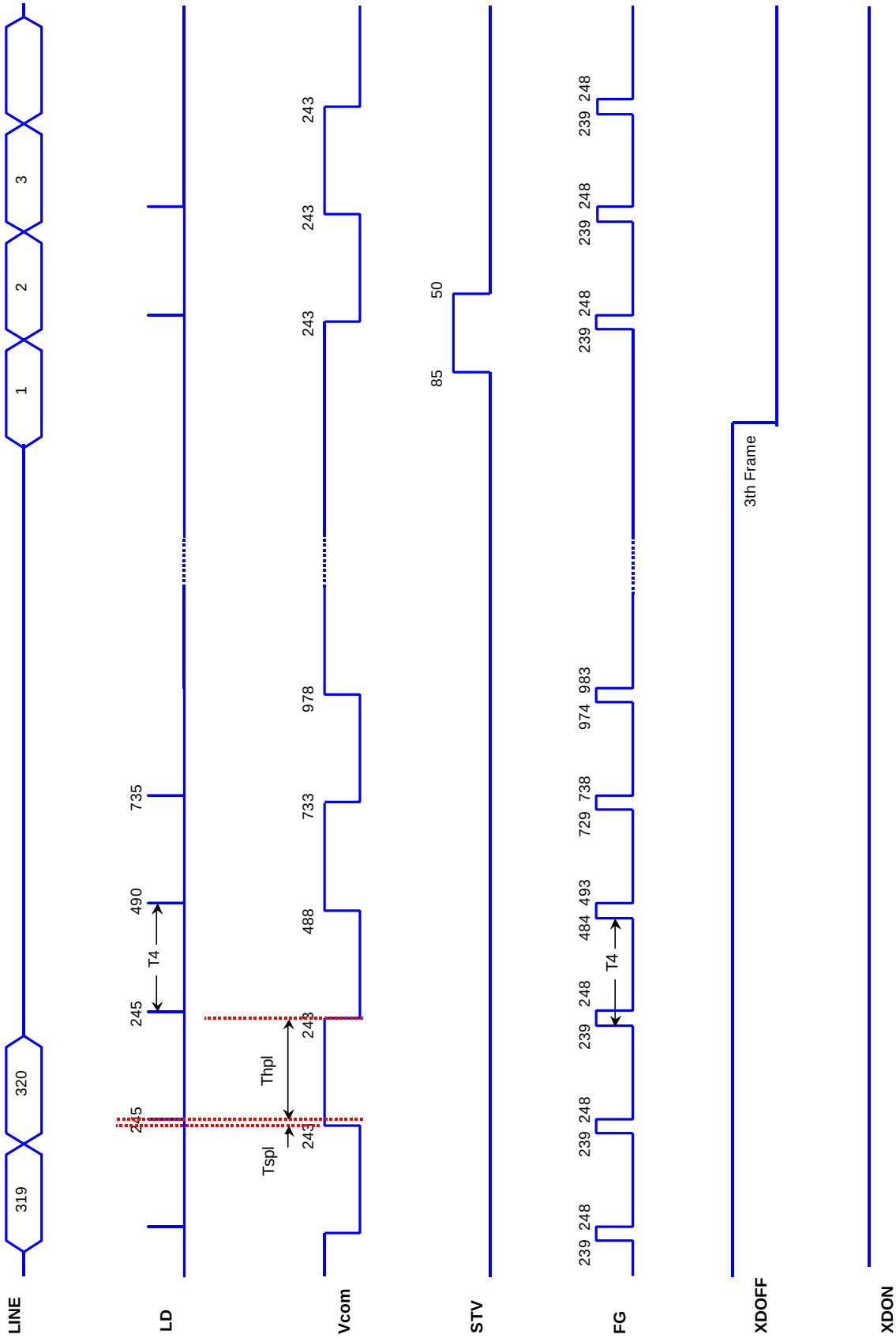


Fig.4 Timing Diagram(III)