UNIPAC OPTOELECTRONICS CORPORATION

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TENTATIVE

UR038Q01 REFLECTIVE COLOR TFT-LCD MODULE SPECIFICATION

MODEL NAME: UR038Q01

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Record of Revision

Version		Page	Content
1	28/Dec./2000		First draft.

Contents:

A. General specifications

NO.	Item	Specification	Remark
1	Driving method	Active matrix TFT	
2	Display mode	Reflective type	
3	Display resolution(pixel)	240(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)×96.8(H)×5(D)	Note 1
13	Bezel opening	60.3(W) × 80.0 (H) (mm)	
14	Weight(g)	70±10	

Note 1: Refer to Fig. 1.

B. Electrical specifications

1.Pin assignment

(1).TFT-LCD panel Input/Output signal interface

No	Pin name	I/O	Description	Remark
1	Vcom	-	Common electrode	
2	STHL	I/O	Start pulse	
3	LR	I	Left/Right control	Note.1
4	PS	I	Power saving input	
5	DUMMY	-		Connect to " GND"
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 voltage input	
15	Vref9	I	Gamma voltage input	Reservation for gamma voltage setting
16	Vref8	I	Gamma voltage input	
17	Vref7	I	Gamma voltage input	Reservation for gamma voltage setting
18	Vref6	I	Gamma voltage input	Reservation for gamma voltage setting
19	Vref5	I	Gamma voltage input	
20	Vref4	I	Gamma voltage input	Reservation for gamma voltage setting
21	Vref3	I	Gamma voltage input	Reservation for gamma voltage setting
22	Vref2	I	Gamma voltage input	
23	Vref1	I	Gamma voltage input	Reservation for gamma voltage setting
24	Vref0	I	Gamma voltage input	
25	AV_{DD}	-	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	-		Connect to " GND"
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	
40	R0	I	Red data(LSB)	

No	Pin name	I/O	Description	Remark
41	DUMMY	-		Connect to " GND"
42	STHR	I/O	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_{EE}	I	Vgl power	
50	V_{GG}	I	Vgh power	
51	V_{DD}	I	Digital power	
52	V_{SS} (GND)	I	Digital ground	
53	STVU	I/O	Start pulse	
54	STVD	I/O	Start pulse	
55	FG	I	Vertical clock input	
56	UD	I	UP/DOWN control	Note 2
57	XDON	I		
58	XDOFF	I	Output enable	
59	GND	-		
60	DUMMY	-		Connect to " GND"

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

Pin No.	Symbol	I/O	Description	Remark
L1	VL1	I	Power supply for fluorescent tube(high voltage)	
L2	VL2	I	Power supply for fluorescent tube(low voltage)	Note 1

Note 1: L2 terminal should be connected to either GND voltage terminal of DC/AC inverter.

(3) Touch panel driving section

Pin No.	Symbol	I/O	Description	Remark
T1	Y1	-	Lower electrode Y(12 o'clock side)	
T2	X2	-	Upper electrode X(right side)	
T3	Y2	-	Lower electrode Y(6 o'clock side)	
T4	X1	-	Lower electrode X(left 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		0	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, XDOFF, LR, CLK, STVR, STVL, UD, V_CK.

3. Electrical characteristics

a. Typical operating conditions

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Power supply	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}	-10.5	-10	-9.5	V	
VCOM	V_{CAC}	(4.0)	(4.4)	(4.8)	Vp-p	
	V_{CDC}		(0.4)		V	
Reference voltage	Vref0 ~ Vref4	AVss +0.1		AV_{DD} -0.1	V	AV_{DD}≧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 same phase and amplitude with common electrode driving signal(VCOM).
Note 2: The brightness of LCD panel can be changed by adjusting the AC component of VCOM.
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}= -10V	-	(-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}=(4.4V)		TBD		mA	

c. Front light driving conditions

Parameter	Symbol	Min	Typ	Max	Units	Remarl
Lamp voltage	V_L	-	(335)	-	Vrms	
Lamp current	I_L	-	(1.4)	-	mArms	
Frequency	F_L	50	60	100	KHz	
Kick-off voltage	V_S	-	-	(1000)	Vrms	T=25℃
		-	-	TBD	Vrms	T=0℃
Power consumption	W_L	-	0.5	1	W	Note 1
Minimum ambient light for starting	L	2	-	-	Cd/m^2	
Lamp life time	LL	10,000	-	-	hour	

Note 1: T= 25℃, I_L =1.4mA

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=1.4mA) to be decrease to the 50% of the initial value.

Note 5: connector(backlight): JST BHSR-02VS-1
Mating connector: FH16-60S-0.3HW(HRS/60 Pin)

4. AC Timing

a. Timing conditions

Parameter		Symbol	Min	Typ	Max	Unit	Remark
Horizon-tal timing	Clock frequency	Fclk	-	5.58	(7.5)	MHz	
	Rising time of clock	Tr	-	-	20	ns	
	Falling time of clock	Tf	-	-	20	ns	
	Pulse width(high level)	Tcw	67	-	-	ns	
	Pulse width(low level)	Tcw	67	-	-	ns	
	Frequency of start pulse	Fst	(19.8)	21.12	23	KHz	
	Set up time of start pulse	Tsu	4	90	-	ns	
	Hold time of start pulse	Thd	4	90	-	ns	
	Pulse width of start pulse	Tstw	-	-	1	Tcph	
Set up time of data		Tdsu	12	90		ns	
Hold time of data		Tdhd	12	90		ns	
Vertical timing	Clock frequency	Fvck	(19.8)	21.12	23	KHz	
	Pulse width of clock	Twck	350	-	-	ns	
	Rising time of clock	Trck	-	-	100	ns	
	Falling time of clock	Tfck	-	-	100	ns	
	Frequency of start pulse	Tvst	-	60	-	Hz	
	Set up 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	

b. Timing diagram

Please refer to the attached drawings, from Fig.2 to Fig.6.

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 (Note 1, Note 2)

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} =1.4mArms

FL Driving frequency : f_{FL} = 60kHz

FL Inverter : To be defined

The measuring method is shown in 2. 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 (screen illuminant < 2-lx)

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

a. Not driving the front light condition

Item		Symbol	Conditions	Specifications			Unit	Note
				Min.	Typ.	Max.		
Contrast Ratio		CR_{AVE}	θ=0°, ϕ=0° Viewing normal angle	10	15		-	Note 2
Response Time		t_{ON}		-		30	ms	Note 3
		t_{OFF}		-		30	ms	
White chromaticity		W_{XOFF}		0.29	0.32	0.34	CIE	
		W_{YOFF}		0.31	0.34	0.36	CIE	
Viewing angle	Horizontal	θ_H	CR > 2	-	100	-	Degree	Note 1
	Vertical	θ_V		-	80	-		
Reflection ratio		R		22	26		%	Note 7

b. Driving the front light condition

Item	Symbol	Conditions	Specifications			Unit	Note
			Min.	Typ.	Max.		
Contrast Ratio	CR_{AVE}	θ=0°, ϕ=0° Viewing normal angle	4	5	-	-	Note 7
White chromaticity	W_{XON}		0.266	0.293	0.319	CIE	
	W_{YON}		0.285	0.310	0.335	CIE	
Luminance	Y_L		16	22		Cd/m^2	
White uniformity	δ_W		-	1.3	1.6	-	

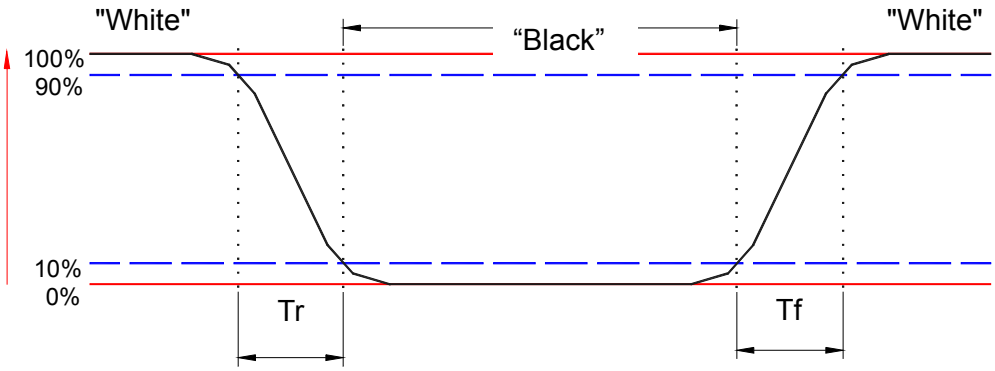
Note 1: Ambient temperature = 25℃.

Note 2: To be measured in dark room after backlight warm up 30 minutes.

Note 3: To be measured with a viewing cone of 1°by Topcon luminance meter BM-5A.

Note 4: Definition of response time:

The output signals of BM-7 are measured when the input signals are changed from “Black” to “White” (falling time) and 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 5. Definition of contrast ratio:

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L63 / L0

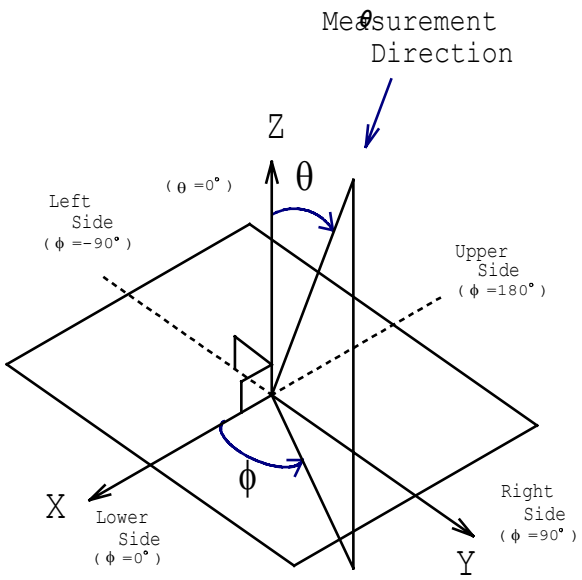
L63: Luminance on the white raster (gray scale level L63)

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

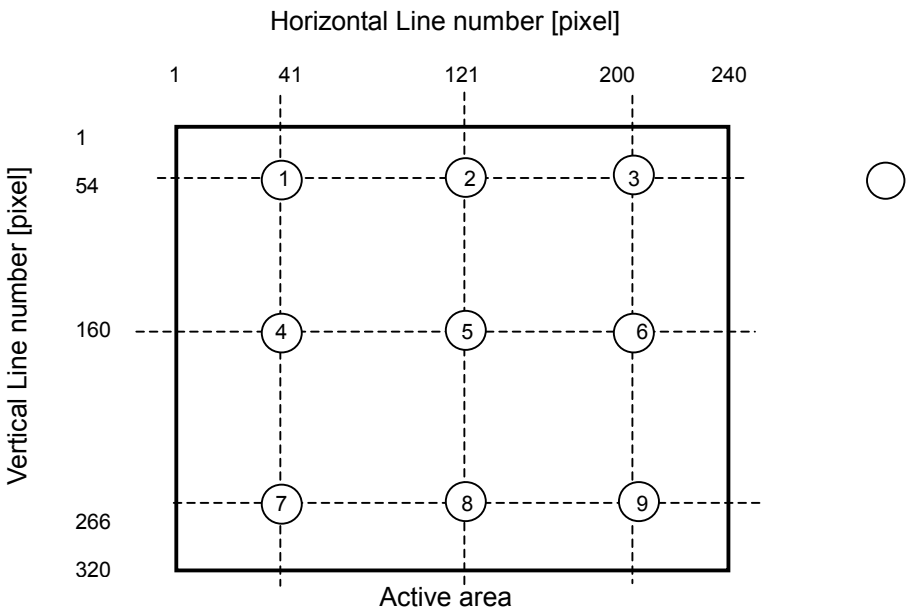
$$CR_{AVE} = (CR\ (1)+CR\ (3)+CR\ (5)+CR\ (7)+CR\ (9))/\ 5$$

CR (X) is corresponded to the Contrast Ratio of a point of X

Note 6: Definition of viewing angle:



Note 7: Definition of the 9 points (from 1 to 9) on panel, refer to figure as below



Note 8: Definition of brightness: To average the luminance of center 5 points (1, 3, 5, 7, 9)

Average Luminance of White $Y_{L,AVE}$

$$Y_{L,AVE} = (Y_{L1} + Y_{L3} + Y_{L5} + Y_{L7} + Y_{L9}) / 5$$

Y_{LX} is corresponded to the Luminance of a point of X

Note 9: Driving conditions for CCFL : I_L=1.4 mA, 60KHz Frequency

Note 10: Definition of white uniformity:

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

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℃, 95%RH, 240 Hrs(no condensation of dew)
4	High temperature operating test	Ta= 50℃, 240 Hrs
5	Low temperature operating test	Ta= 0℃, 240 Hrs
6	Heat shock test	Ta= -25℃(1H) ~ 70℃(1H) /5cycle
7	Vibration test	Frequency: 10Hz ~ 55Hz Stroke: 1.5mm Sweep: 10Hz ~ 55Hz X,Y,Z 2hours for each direction(total 6hours)
8	Shock test	10G, 6ms ±X, ±Y, ±Z 3 times for each direction
9	Electro static discharge test	±200V, 200pF(0Ω), 1 time for each terminal
10	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 :

To be defined

NOTES :
1. The bending radius of FPC should be larger than 0.6.
2. Unit:mm.
3. Values with ( ) are estimated , not the final spec.
4. FPC Connector:FH16-60S-0.3SHW (HRS).
5. BLU Connector:BHSR-02VS-1 (JST).

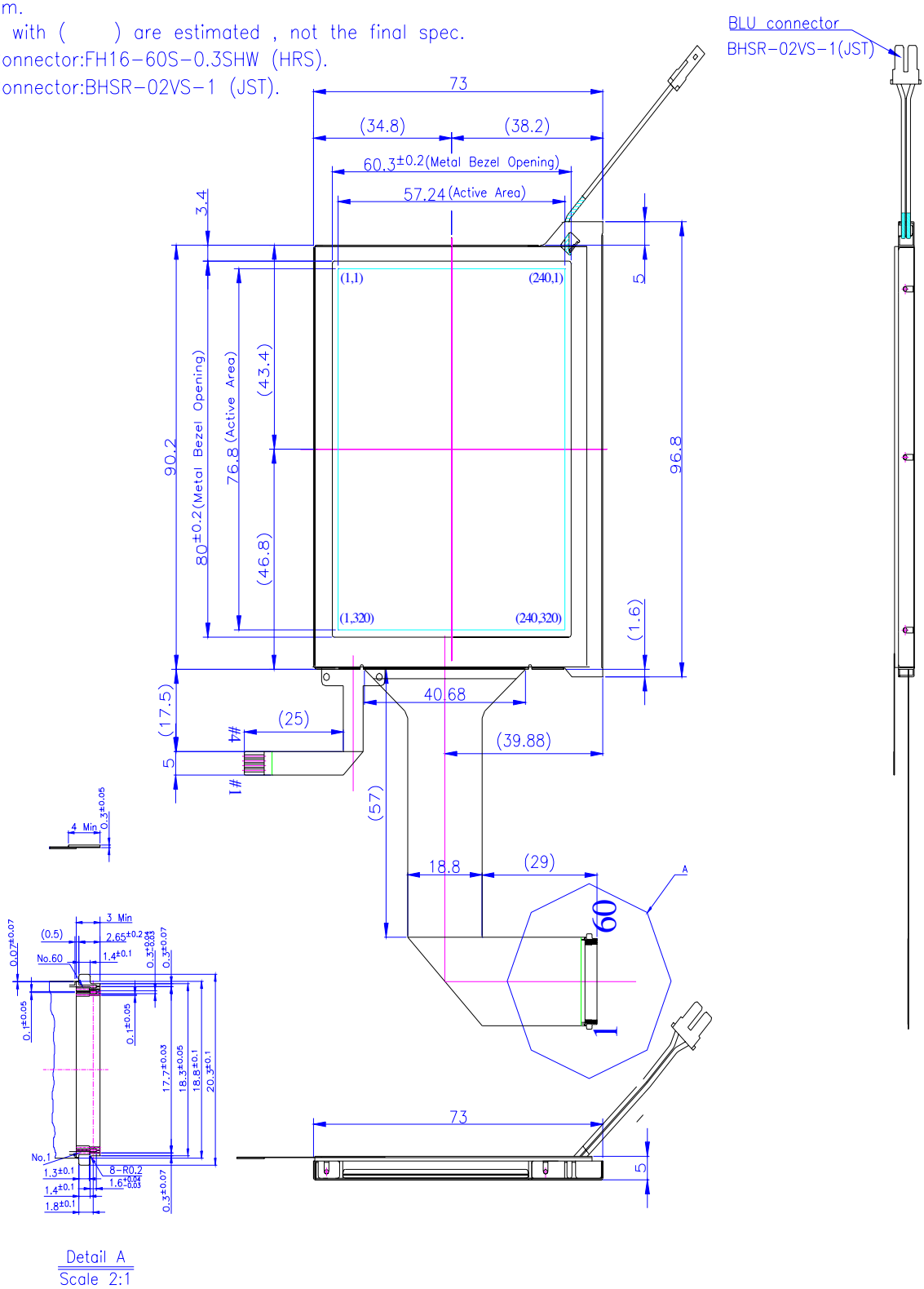


Fig.1-(a) LCM outline dimensions(Front side)

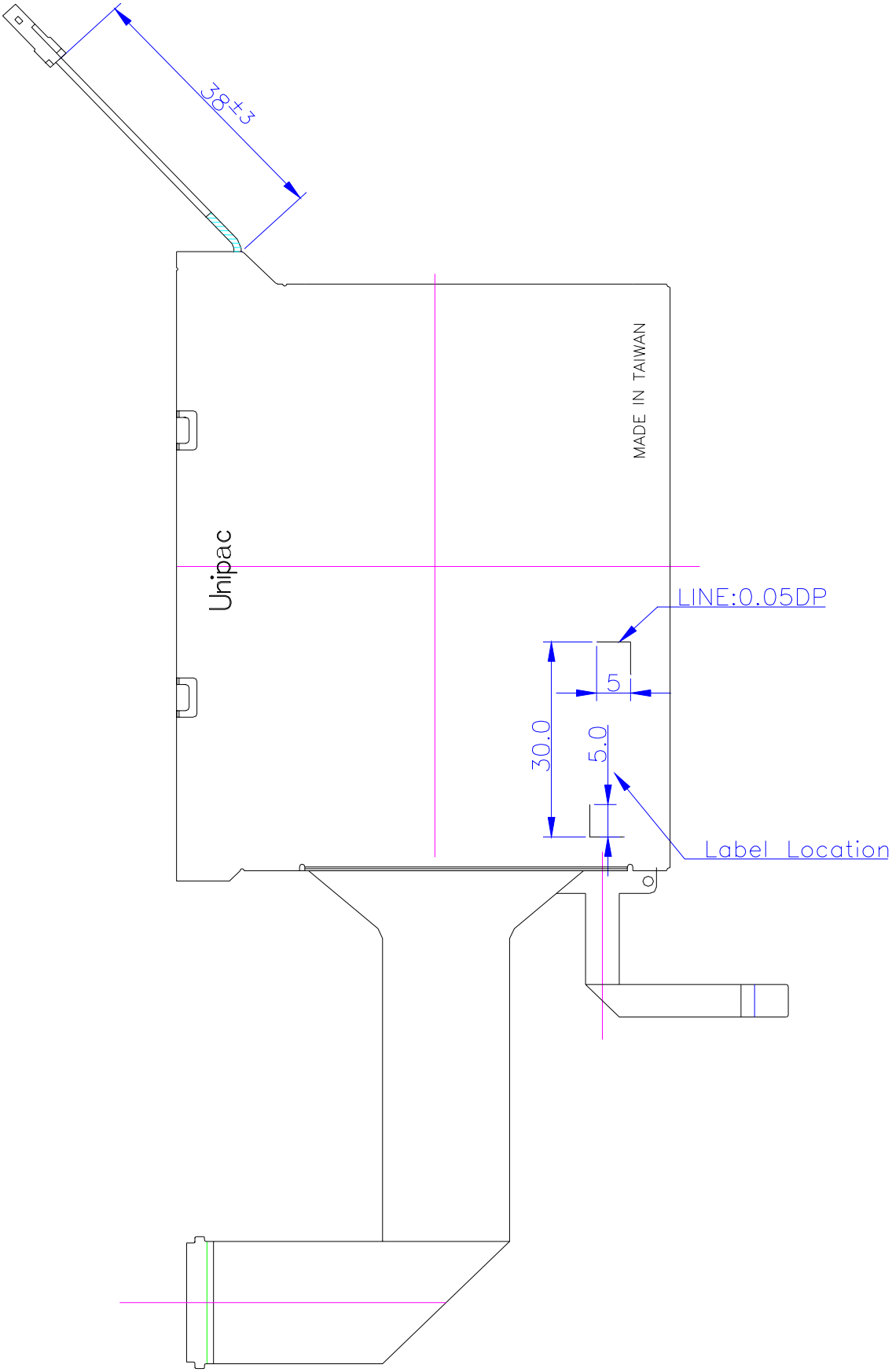


Fig.1-(b) LCM outline dimensions(Back side)

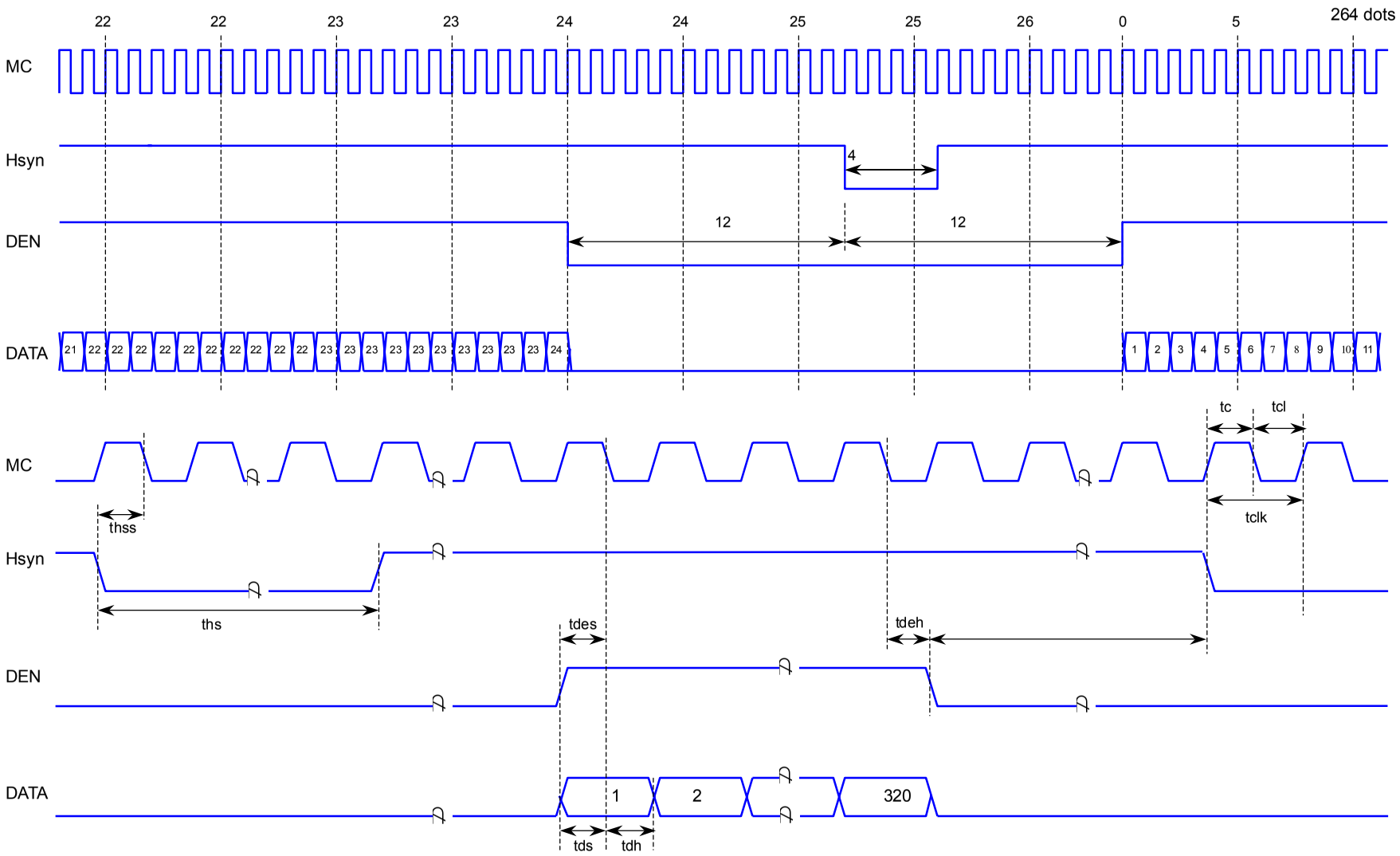


Fig.2 Horizontal input signal

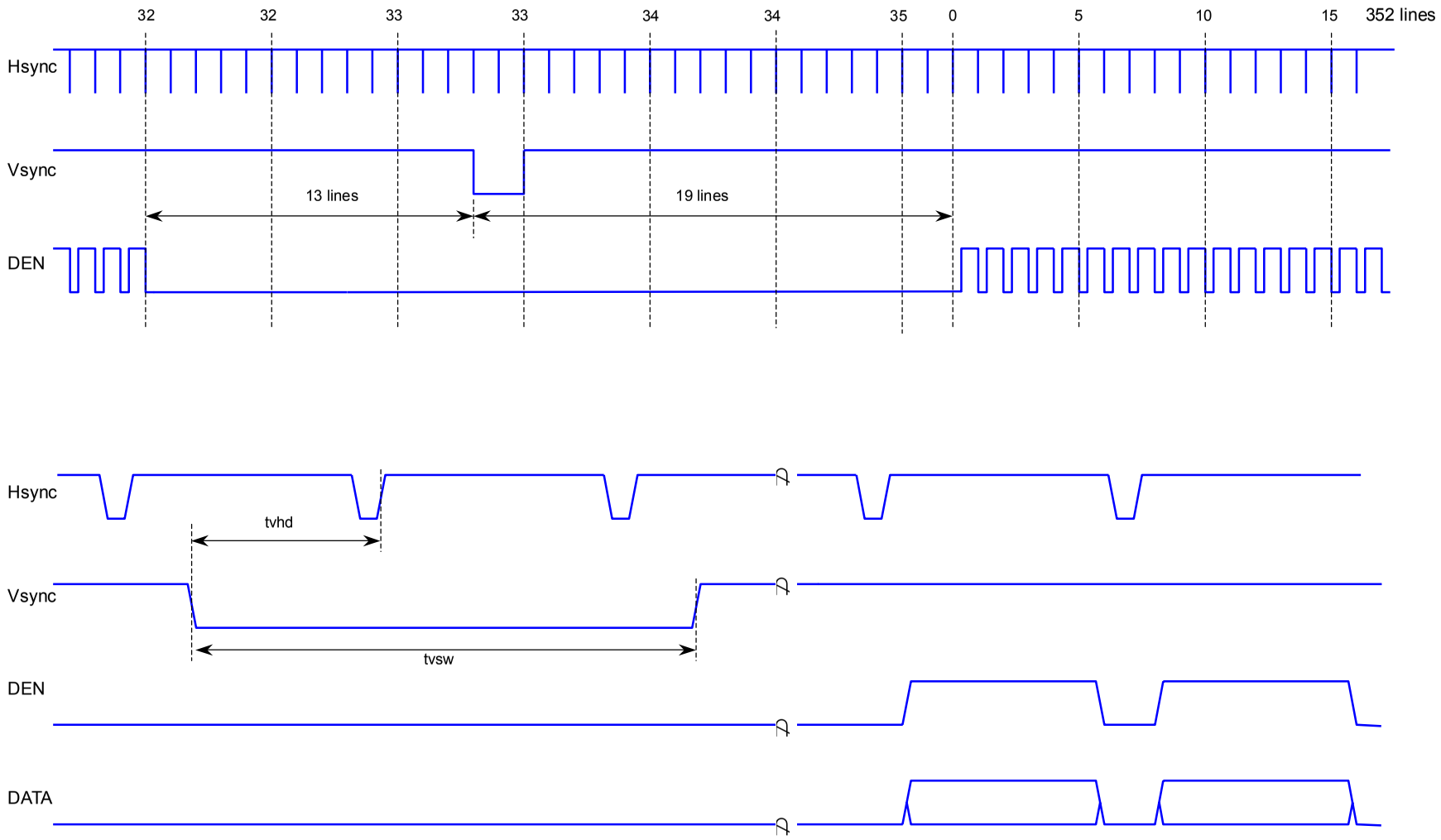


Fig.3 Vertical input timing chart

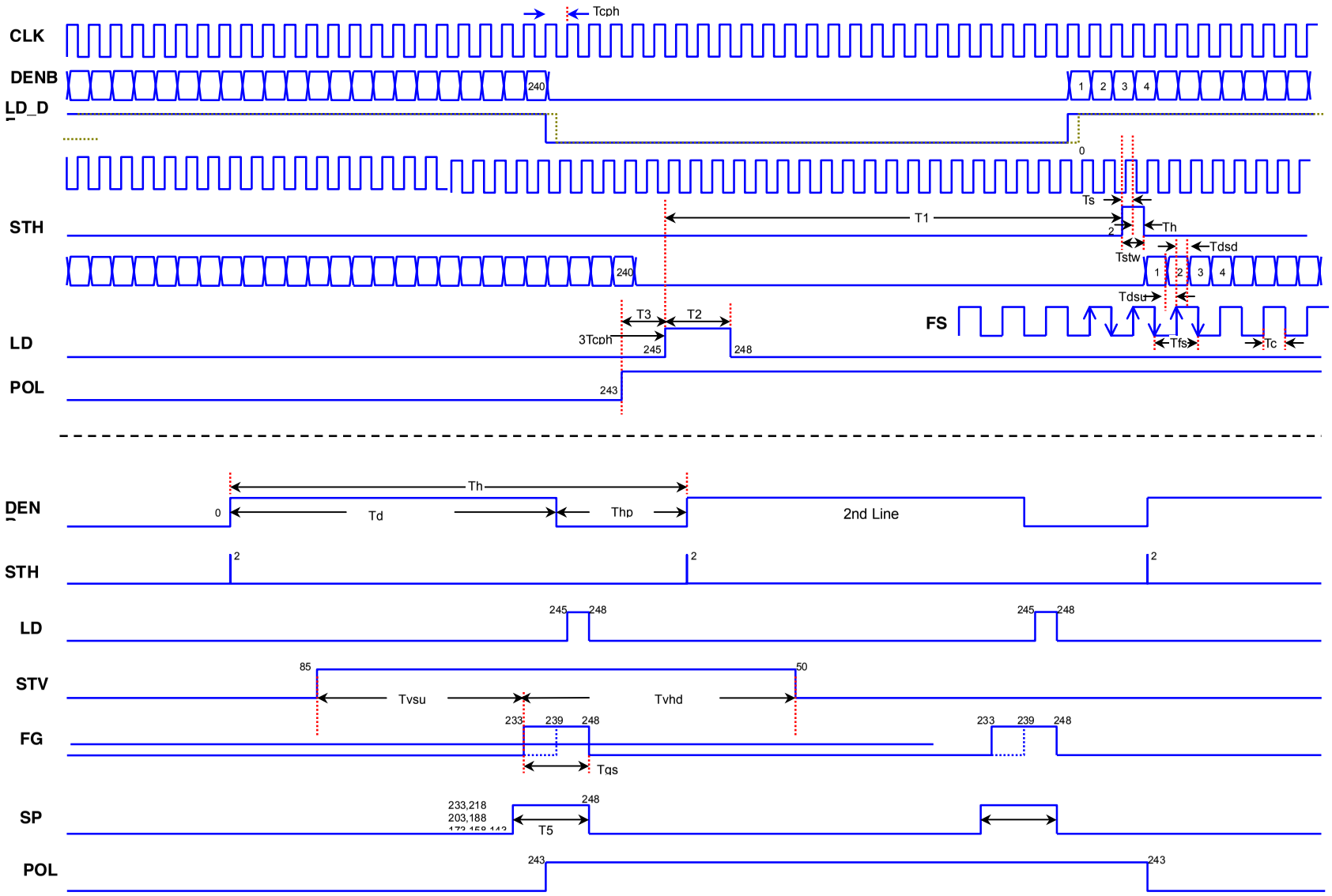


Fig.4-(a) Output Timing Chart

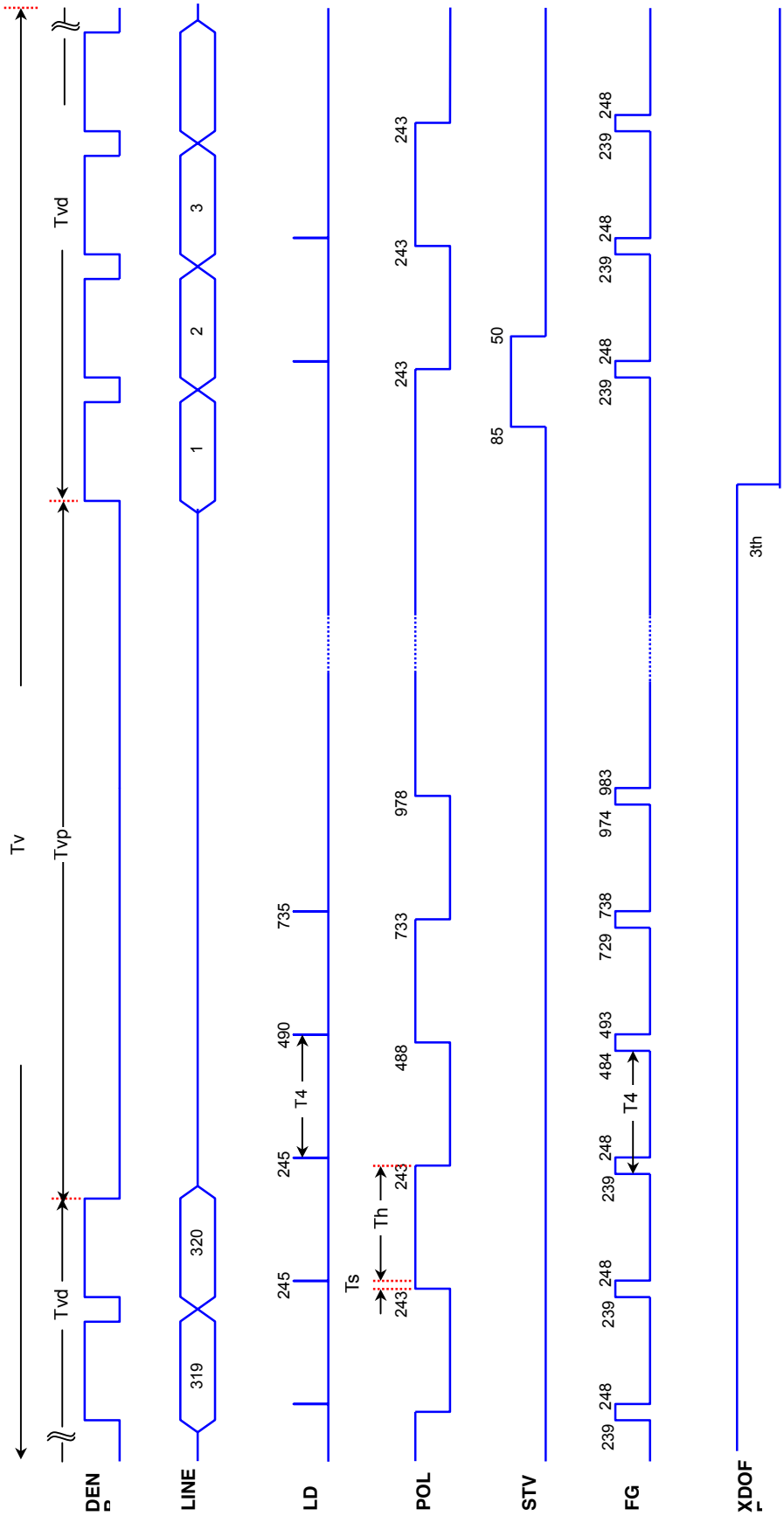


Fig.4-(b) Output Timing Chart