



ELECTRONICS

Preliminary

TO :

DATE : March. 13.2005

SAMSUNG TFT-LCD

MODEL NO.:LTP500WV-F01

NOTE :

Any Modification of Spec is not allowed without SEC's permission.

APPROVED BY :

S. C. OH

SAMSUNG ELECTRONICS CO., LTD.



Doc.No.

LTP500WV-F01

Rev.No

05-000-G-050313

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Revision History

Preliminary

Date	Rev.No.	Page	Summary
Jan.30.2005	000		Rev.000 was first issues.

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GENERAL DESCRIPTION

DESCRIPTION

LTP500WV-F01 is a color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching devices. This model is composed of a TFT LCD panel, a driver circuit and a back-light system. The resolution of a 5" Contains 800 x 480 pixels and can display up to 262,144 colors. 12 o'clock direction is the optimum viewing angle.

FEATURES

- High Brightness.
- High contrast ratio.
- 6Bits color depth.
- High resolution(800X480).
- Low power consumption.
- Back light with 12 LED(Light Emitting Diode).

APPLICATIONS

- Display terminals for PDA application products.
- Smart phone / Game machine / Camcorder / Hand held PC

GENERAL INFORMATION

ITEM	SPECIFICATION	UNIT	NOTE
Display area	109.2(H) x 65.52(V) (5" diagonal)	mm	
Driver element	a-Si TFT active matrix		
Display colors	262,144		
Number of pixel	800×RGB(H) x 480(V)	pixel	
Pixel arrangement	RGB vertical stripe		
Pixel pitch	0.1365(H) x 0.1365(V) (TYP.)	mm	
Display Mode	Normally white		
Viewing Direction	12:00	O'clock	

MECHANICAL INFORMATION

ITEM		MIN.	TYP.	MAX.	NOTE
Module size	Horizontal (H)	122.1	122.4	122.7	mm
	Vertical (V)	78.8	79.0	79.2	mm
	Depth (D)	3.45	3.75	4.08	mm
Weight		-	72.6	-	g

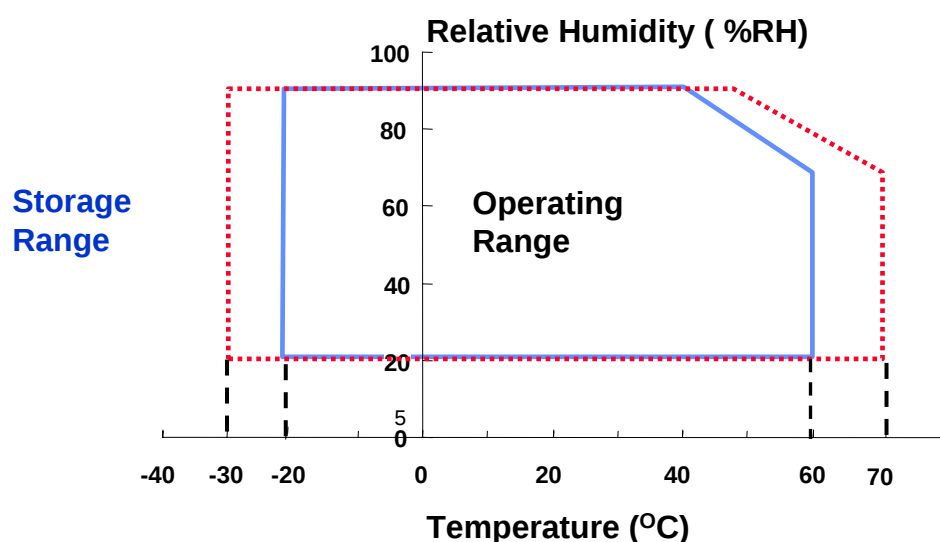
1. ABSOLUTE MAXIMUM RATINGS

1.1 ABSOLUTE RATINGS OF ENVIRONMENT

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Storage temperature	T_{STG}	-30	70	°C	(1)
Operating temperature (Temperature of glass surface)	T_{OPR}	-20	60	°C	(1)
Shock (non-operating)	S_{nop}	-	50	G	(2),(4)
Vibration (non-operating)	V_{nop}	-	1.0	G	(3),(4)

Note (1) 90%RH maximum humidity, 60 maximum wet-bulb temperature.

(2) When operated at a temperature lower than 0 , the LCD worked slowly and the screen slowed appearing dim images due to the characteristics id LC(Liquid Crystal).



1.2 ELECTRICAL ABSOLUTE RATINGS

(1) TFT LCD MODULE

 $T_a = 25 \pm 2^\circ\text{C}$, GND = 0V

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Supply Voltage	AVDD	-0.3	6.0	V	-
	VDD	-0.3	6.0	V	-
	Von	-0.3	35	V	-
	VCC - Voff	3.0	5.5	V	-
	Von - Voff	16.0	33	V	-
Input Voltage	V0 to V10	-0.3	AVDD + 0.3	V	-
	Other	-0.3	VDD + 0.3	V	-

(2) BACK-LIGHT UNIT

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

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
LED current	I_B	-	25	mA	(1)

NOTE (1) Permanent damage to the device may occur if maximum values are exceeded or reverse voltage loaded.
Functional operation should be restricted to the conditions described under Normal Operating Conditions.

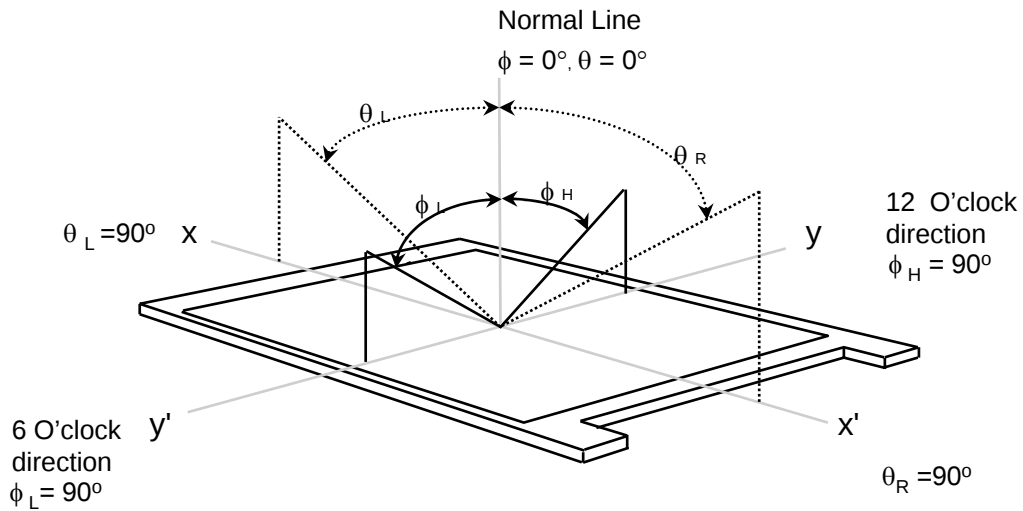
2. OPTICAL CHARACTERISTICS

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note (5).
Measuring equipment : TOPCON BM-5A,EZ-CONTRAST

* Ta = $25 \pm 2^{\circ}\text{C}$, fv= 75Hz, f_{DCLK}=32.64MHz, IL = 40mA

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Contrast Ratio (1 Points)		CR	$\phi = 0,$ $\theta = 0$ Normal Viewing Angle	150	250	-		(1), (2), (5)
Response Time at Ta	Rising	T _R		-	15	30	msec	(1), (3)
	Falling	T _F		-	20	45		
Luminance of White (center)		Y _L		-	180	-	cd/m ²	(1), (4)
Color Chromaticity (CIE)	Red	R _X		0.55	0.6	0.65		(1), (5)
		R _Y		0.31	0.36	0.41		
	Green	G _X		0.308	0.358	0.408		
		G _Y		0.502	0.552	0.602		
	Blue	B _X		0.101	0.151	0.201		
		B _Y		0.077	0.127	0.177		
	White	W _X		0.265	0.315	0.365		
		W _Y		0.285	0.335	0.385		
	Viewing Angle	Hor.	θ_L	CR ≥ 10	35	45	-	
θ_R			35		45	-		
Ver.		ϕ_H	25		30	-		
		ϕ_L	10		15	-		
5 Points White Variation		δ_L		-	-	1.45		(6) Ez-contrast

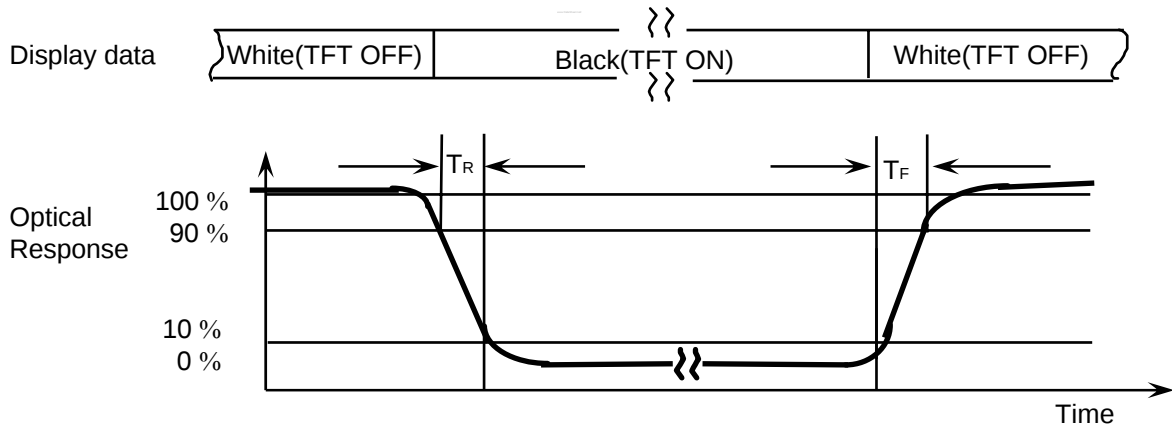
Note 1) Definition of Viewing Angle : Viewing angle range($10 \leq C/R$)



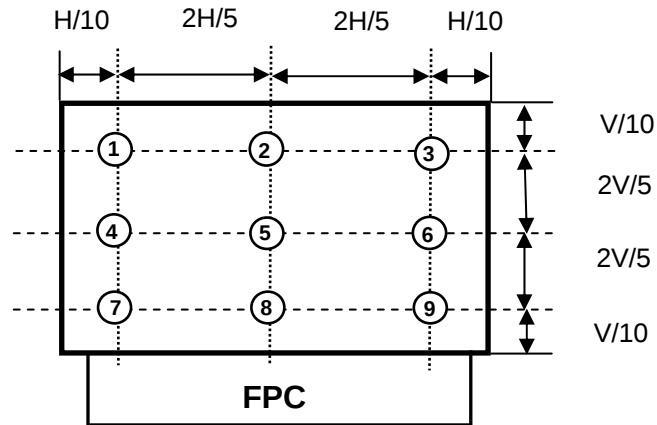
Note 2) Definition of Contrast Ratio (CR) : Ratio of gray max (Gmax) ,gray min (Gmin) at center point

$$CR = \frac{\text{gray max (Gmax)}}{\text{gray min (Gmin)}}$$

Note 3) Definition of Response time :



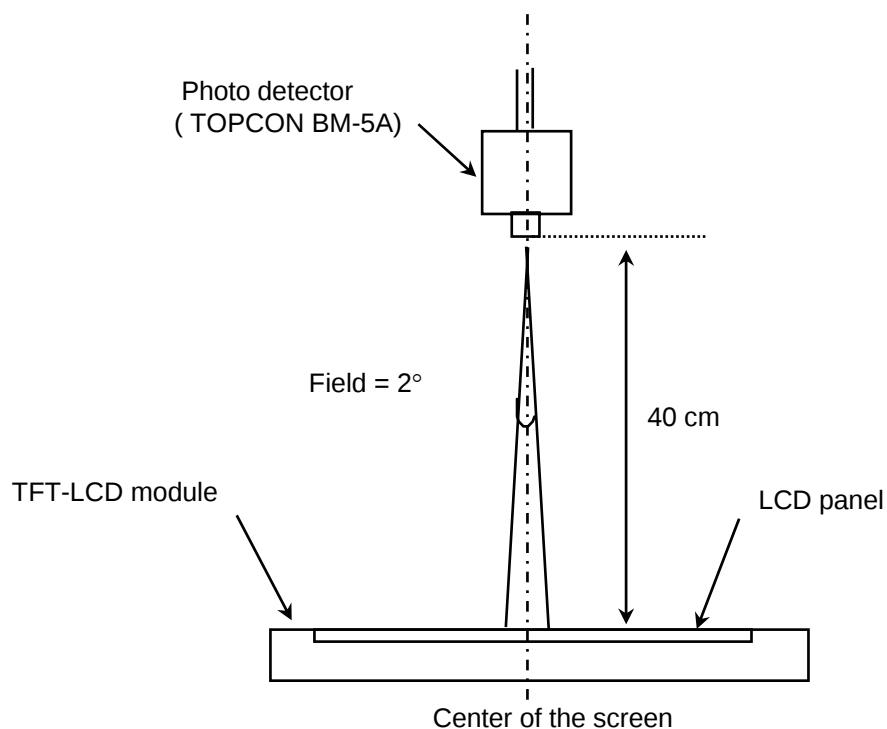
Note 4) Definition of Luminance of White : measure the luminance of white at center point(@)



Note 5) 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. This should be measured in the center of screen.

LED current : 18 mA

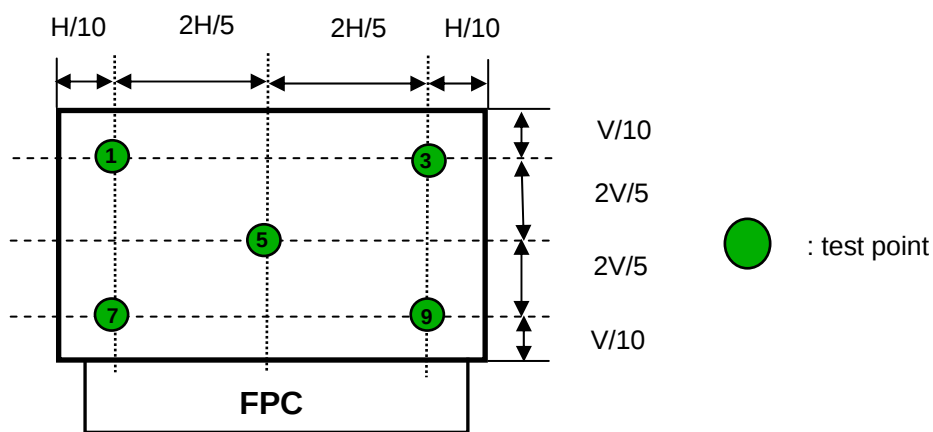
Environment condition : $T_a = 25 \pm 2 \text{ }^{\circ}\text{C}$



Optical characteristics measurement setup

Note 6) Definition of 5 points white variation (δ_L) [~]

$$\delta_L = \frac{\text{Maximum luminance of 5 points}}{\text{Minimum luminance of 5 points}}$$



3. ELECTRICAL CHARACTERISTICS

Preliminary

3.1 TFT LCD MODULE

Ta = 25 ± 2°C, GND = 0V

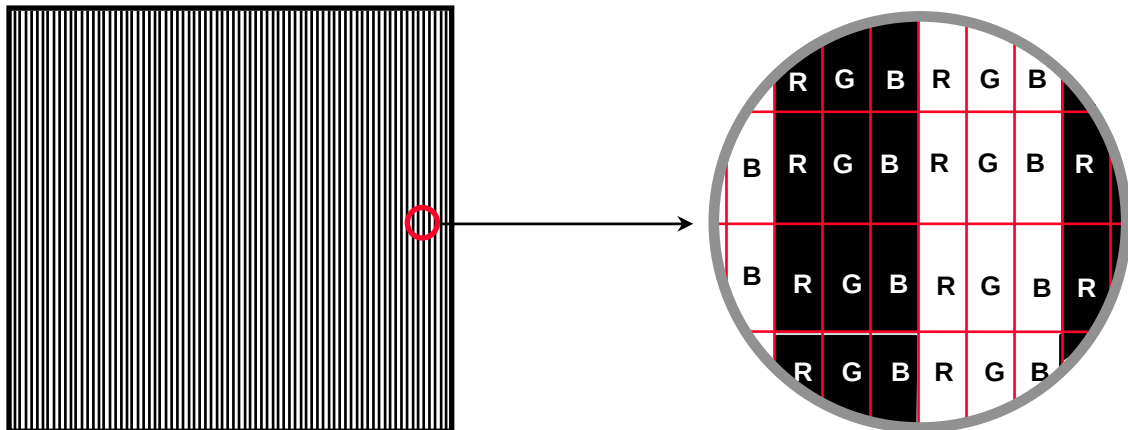
ITEM		SYMBOL	MIN	TYP	MAX	UNIT	NOTE
Input Level Shifters & Source Logic Input Voltage		VDD	2.5	3.3	3.6	V	-
Gate Logic Input Voltage		VCC	-9.0	-8.7	-8.4	V	-
Source Analog Input Voltage		AVDD	4.8	5.0	5.2	V	-
Gate On Voltage		Von	16.7	17.0	17.3	V	-
Gate Off Voltage		Voff	-12.3	-12.0	-11.7	V	-
Common Voltage		Vcom	-1.5	-	3.5	V	AC
Vsync Frequency		Fv	60	75	-	Hz	-
Hsync Frequency		f _H	-	29.4	100	KHz	-
Main Frequency		f _{DCLK}	-	32.24	40	MHz	(2)
Power Consumption	White		-	175	-	mW	(1),(3)
	Black		-	265	-	mW	-
	Vertical		-	295	300	mW	-

Note (1) f_v=75Hz, f_{DCLK} = 32.24MHZ, VDD = 3.3V , AVDD = 5.0V, VCC = -8.7V, Von = 17V, Voff = -12V
DC Current.

(2) 1 pixel /clock

(3) Power dissipation check pattern

*c) Vertical stripe pattern



3.2 BACKLIGHT UNIT

Preliminary

The back-light system is an edge - lighting type with The white LED(Light Emitting Diode)s.

Ta=25 ± 2°C

ITEM	SYMB	MIN	TYP	MAX	UNIT	NOTE
LEDs Current	IB	-	36	-	mA	(1)
Power Consumption	PBL	-	(800)	-	mW	(2)

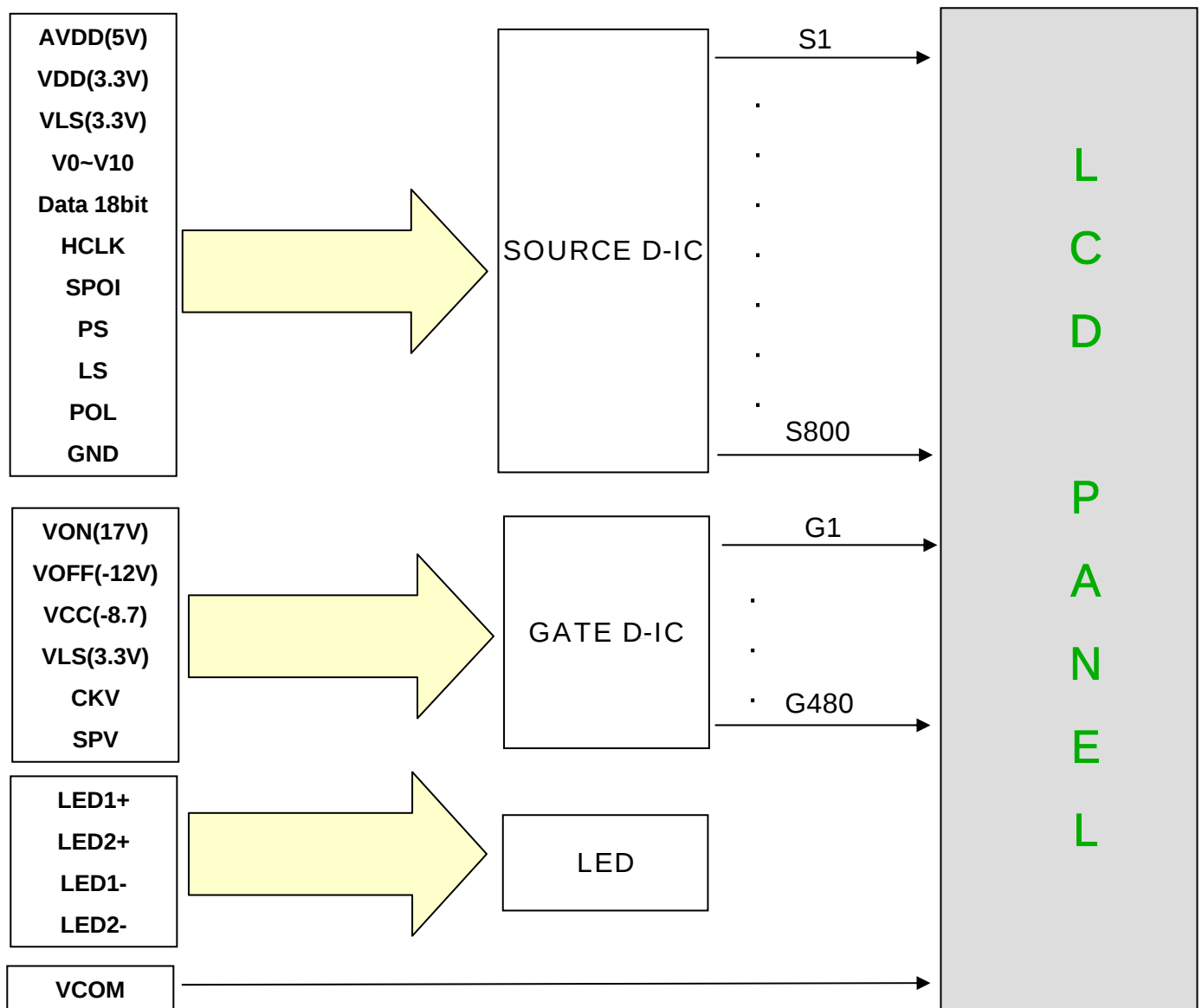
Note

(1) The LEDs parallel type.(Refer to 4.2)

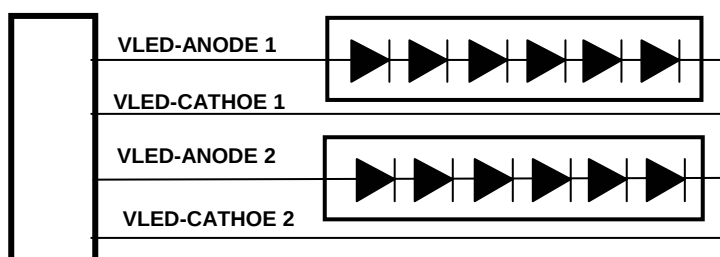
(2) Where $I_B = 36\text{mA}$, $V_B = P_{BL} / I_B$

4. BLOCK DIAGRAM

4.1 TFT-LCD module (Interface System Structure)



4.2 BACKLIGHT UNIT



4.3 Input Signal, Basic Display Colors and Gray Scale of Each Colors

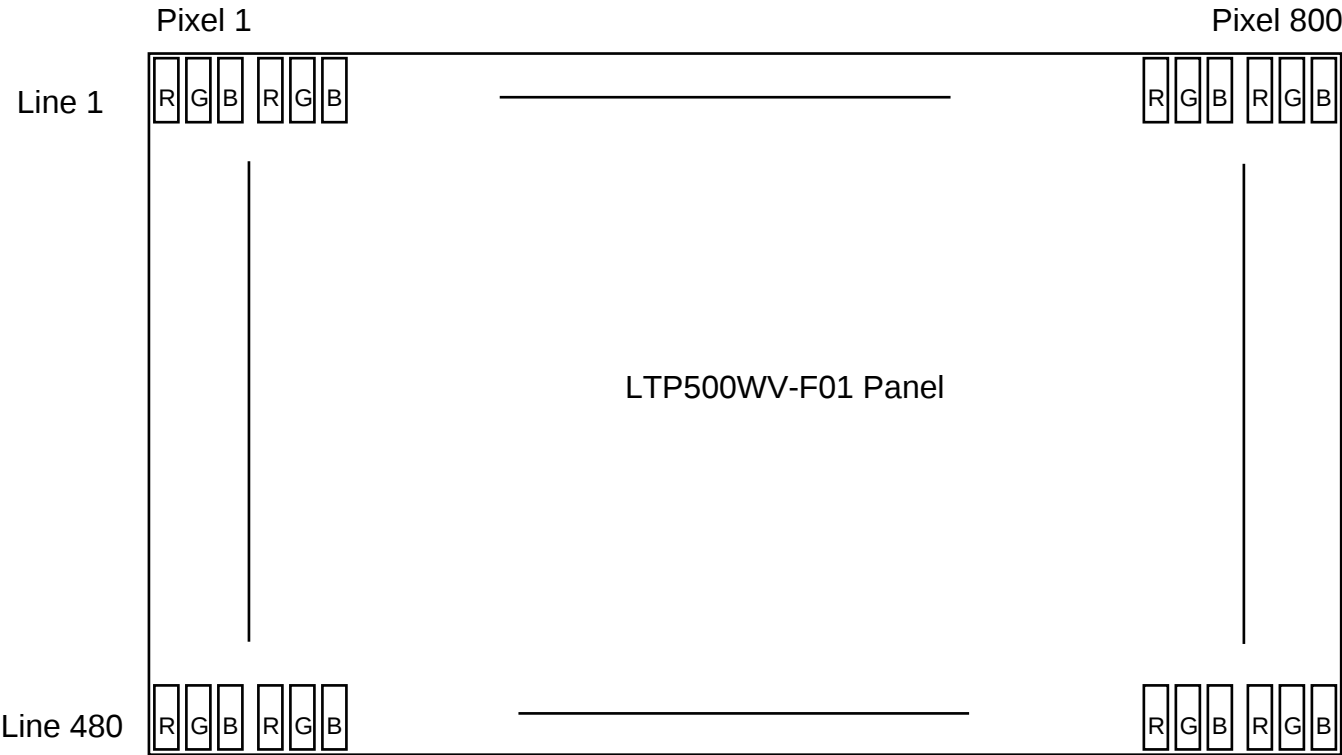
Color	Display	Data Signal																		Gray Scale Level
		Red						Green						Blue						
		R0 (LSB)	R1	R2	R3	R4	R5 (MSB)	G0 (LSB)	G1	G2	G3	G4	G5 (MSB)	B0 (LSB)	B1	B2	B3	B4	B5 (MSB)	
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	-
	Green	0	0	0	0	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	-
	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	-
	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	-
Gray Scale of Red	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R0
	Dark ↑ ↓ Light	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1
		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
		1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	R253
		1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	R254
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	R255
Gray Scale of Green	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G0
	Dark ↑ ↓ Light	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	G1
		0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	G2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
		0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0	G253
		0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	G254
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	G255
Gray Scale of Blue	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	B0
	Dark ↑ ↓ Light	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	B1
		0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	B2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
		0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	B253
		0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	B254
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	B255

NOTE.

- (1) Definition of Gray : Rn : Red Gray, Gn : Green Gray, Bn : Blue Gray (n = Gray level)
- (2) Input Signal : 0 = Low level voltage, 1 = High level voltage

4.4 PIXEL FORMAT

Preliminary



5. INPUT TERMINAL PIN ASSIGNMENT

Preliminary

MOLEX 55560-0601

No.	Symbol	Note	No.	Symbol	Note
1	LED1+	Back light LED(ANODE)	31	SPOI	Start pluse input/cascade output
2	LED1-	Back light LED(CATHODE)	32	GND	Ground
3	LED2+	Back light LED(ANODE)	33	V0	Gamma_Voltage_0
4	LED2-	Back light LED(CATHODE)	34	V1	Gamma_Voltage_1
5	GND	Ground	35	V2	Gamma_Voltage_2
6	GND	Ground	36	V3	Gamma_Voltage_3
7	CKV	Vertical clock	37	V4	Gamma_Voltage_4
8	VCOM	VCOM voltage	38	V5	Gamma_Voltage_5
9	SPV	Vetical start pluse	39	V6	Gamma_Voltage_6
10	VCOM	VCOM voltage	40	V7	Gamma_Voltage_7
11	GND	Ground	41	V8	Gamma_Voltage_8
12	VDD	3.3V	42	V9	Gamma_Voltage_9
13	VCC	-8.7V	43	V10	Gamma_Voltage_10
14	Voff	Gate off Voltage(-12V)	44	GND	Ground
15	GND	Ground	45	LS	Latch input
16	Von	Gate on Voltage(17V)	46	HCLK	Main clock
17	AVDD	5V	47	GND	Ground
18	PS	Input pin for power save	48	GND	Ground
19	R00	RED_DATA_0	49	VDD	3.3V
20	R01	RED_DATA_1	50	POL	Input data polarity exchange input
21	R02	RED_DATA_2	51	B00	BLUE_DATA_0
22	R03	RED_DATA_3	52	B01	BLUE_DATA_1
23	R04	RED_DATA_4	53	B02	BLUE_DATA_2
24	R05	RED_DATA_5	54	B03	BLUE_DATA_3
25	G00	GREEN_DATA_0	55	B04	BLUE_DATA_4
26	G01	GREEN_DATA_1	56	B05	BLUE_DATA_5
27	G02	GREEN_DATA_2	57	GND	Ground
28	G03	GREEN_DATA_3	58	VCOM	VCOM voltage
29	G04	GREEN_DATA_4	59	GND	Ground
30	G05	GREEN_DATA_5	60	VCOM	VCOM voltage

6. INTERFACE TIMING

6.1 Timing Parameters

(VDD = +3.0 to 3.6V, AVDD = +3.0 to 5.5V, Ta= -30 to +85)

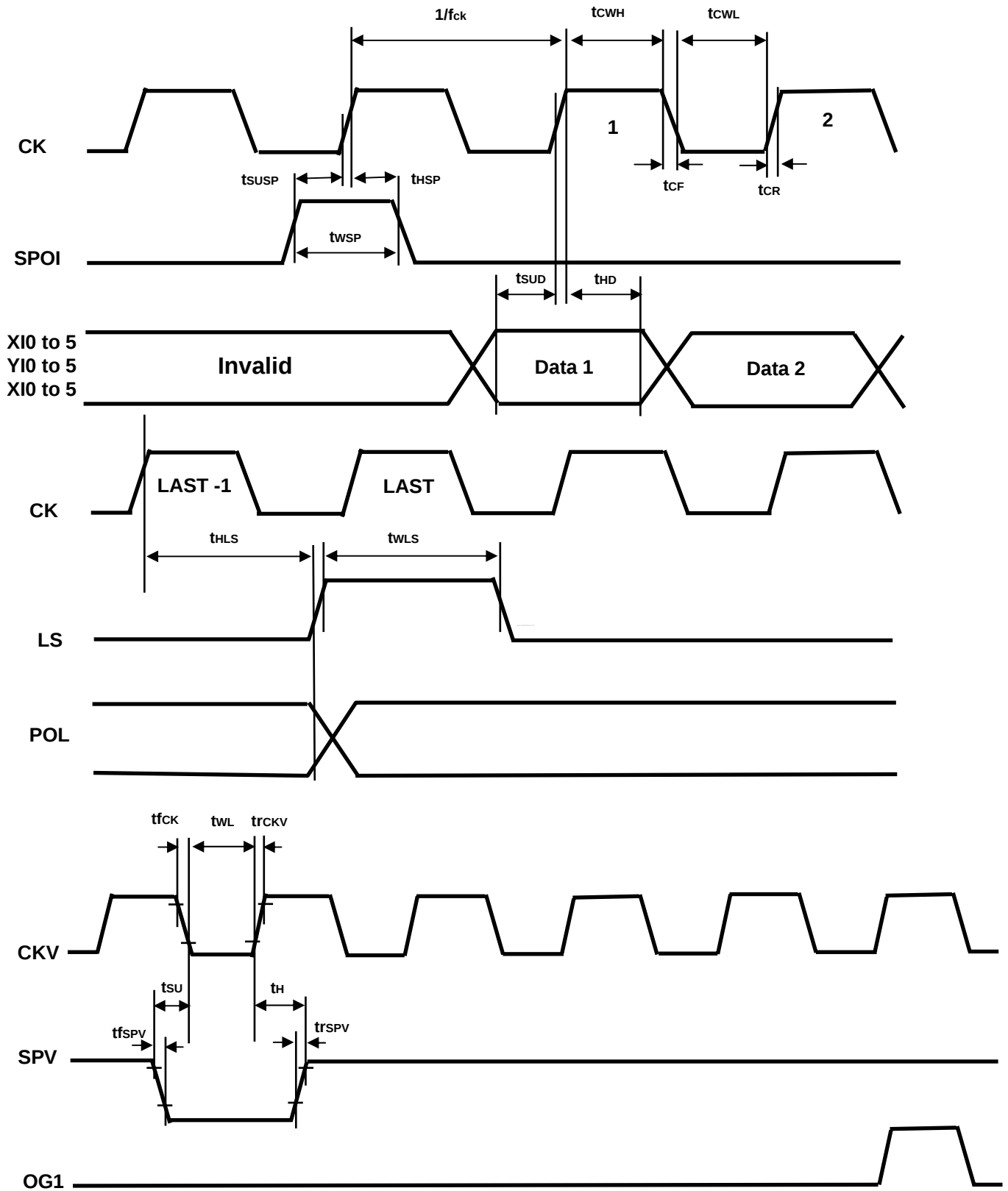
Application Pin	Parameter	Symbol	Measuring Condition	MIN	TYP	MAX	Unit.
CK	Clock frequency	f _{CK}			32.24	48	MHz
	“H” level pulse width	t _{CWH}		4			ns
	“L” level pulse width	t _{CWL}		4			ns
	Input rise time	t _{CR}	(Note 1)			4	ns
	Input fall time	t _{CF}	(Note 1)			4	ns
XI0 to ZI5	Data setup time	t _{SUD}		4			ns
	Data hold Time	t _{HD}		0			ns
SPOI	Start pulse setup time	t _{SUSP}		4			ns
	Start pulse hold time	t _{HSP}		0			ns
	Start pulse width	t _{WSP}	(Note 2)			1.5/f _{CK}	ns
	Start pulse output delay time	t _{DSP}				13	ns
LS	LS signal, SPI signal setup time	t _{LSSP}		18			ns
	LS signal, CK signal hold time	t _{HLS}		7			ns
	LS signal “H” level width	t _{WLS}		18			ns
CKV	Clock frequency	f _{CKV}				100	KHz
	Minimum “L” clock pulse width	t _{WL}		0.5			Us
	Clock rise time	t _{rckv}				100	ns
	Clock fall time	t _{fCKV}				100	ns
CKV, SPV	Data setup time	t _{SU}		100			ns
	Data hold time	t _H		300			ns
SPV	Pulse rise time	t _{rSPV}				100	ns
	Pulse fall time	t _{fSPV}				100	ns

NOTE(1) In the case of CK frequency is less than MAX, it is possible t_{CR} and t_{CF} are over MAX value. But please confirm that it has no problem, when it use this device.

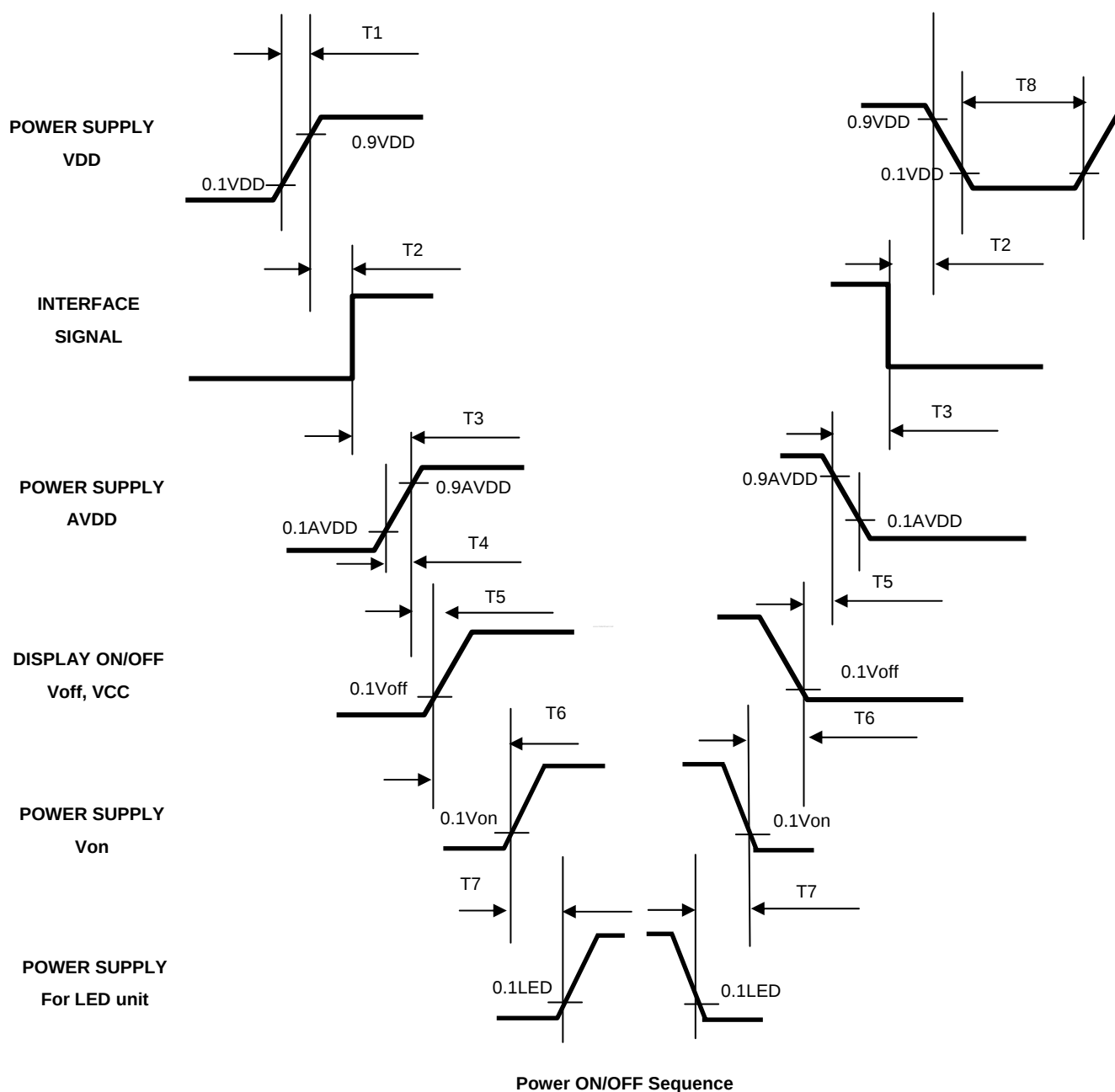
Example: f_{CK} = 8 MHz t_{CR}, t_{CF} = 25ns

NOTE(2) There is only one rising state of CK pulse within SPV pulse “H”.

6.2 Timing Diagram



6.3 Power ON/OFF Sequence



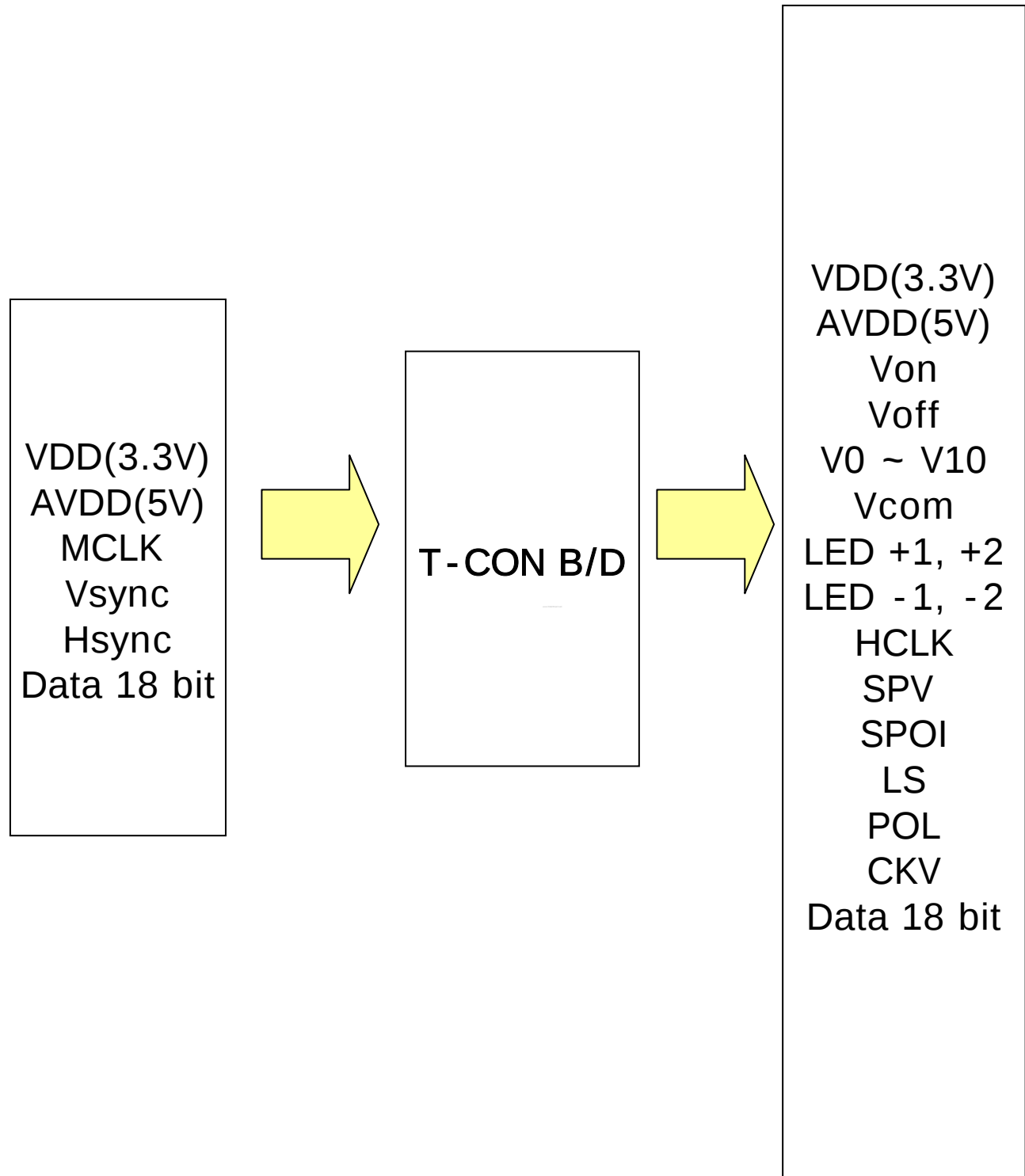
Symbol	Specification	Symbol	Specification
T1	$0 \leq T1 \leq 10 \text{ msec}$	T5	$0 \leq T5 \leq 30 \text{ msec}$
T2	$0 \leq T2 \leq 10 \text{ msec}$	T6	$0 \leq T6 \leq 10 \text{ msec}$
T3	$0 \leq T3 \leq 50 \text{ msec}$	T7	$100 \text{ msec} \leq T7$
T4	$0 \leq T4 \leq 10 \text{ msec}$		

NOTE.

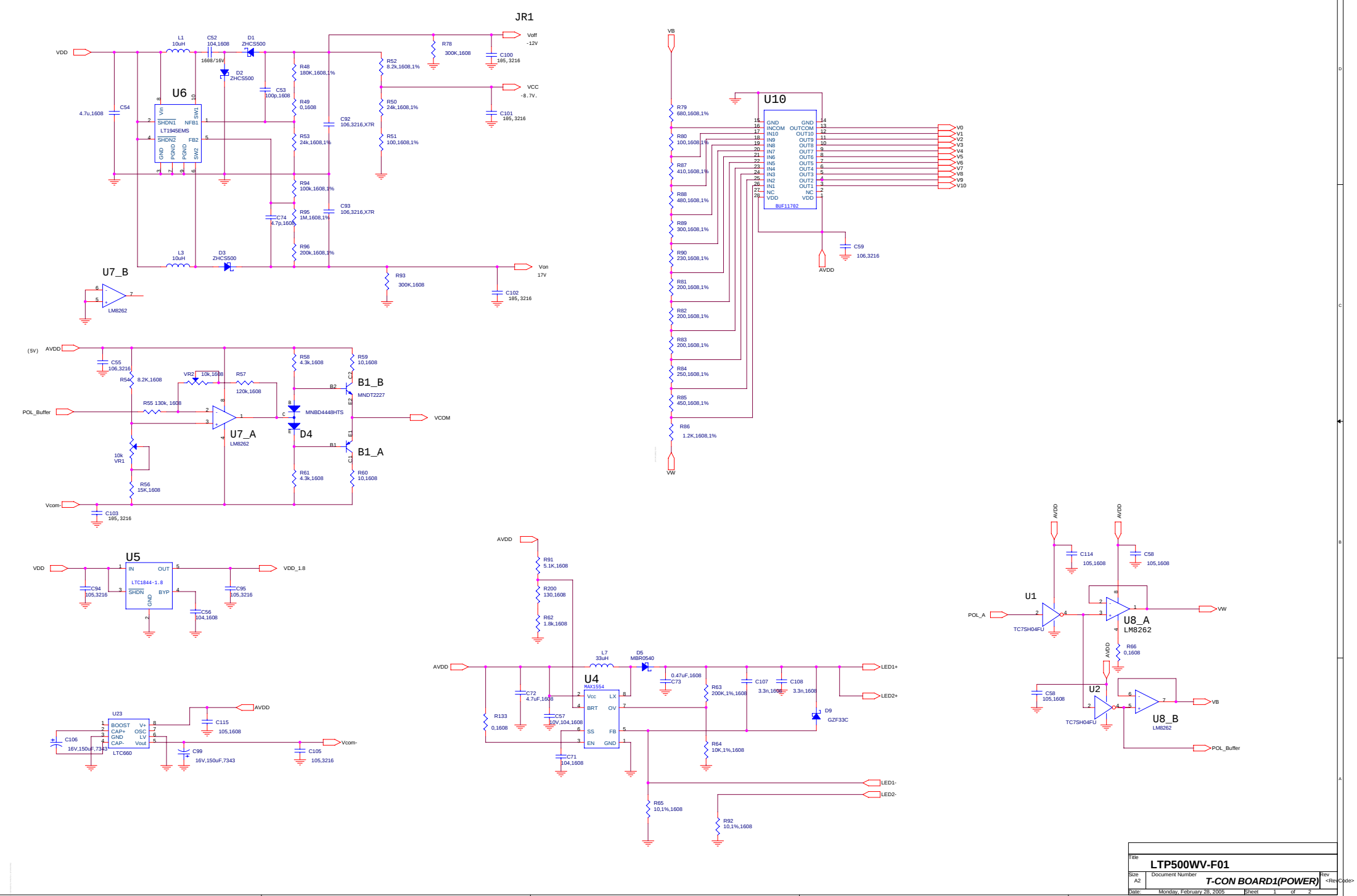
- (1) The supply voltage of the external system for the module input should be the same as the definition of AVDD and VDD.
- (2) Apply the LED voltage within the LCD operation range. When the Back-Light turns on before the LCD operation or the LCD turns off before the LEDs turns off, the display may momentarily become white.
- (3) In case of VDD = off level, please keep the level of input signals on the low or keep a high impedance.
- (4) Interface signal shall not be kept at high impedance when the power is on.

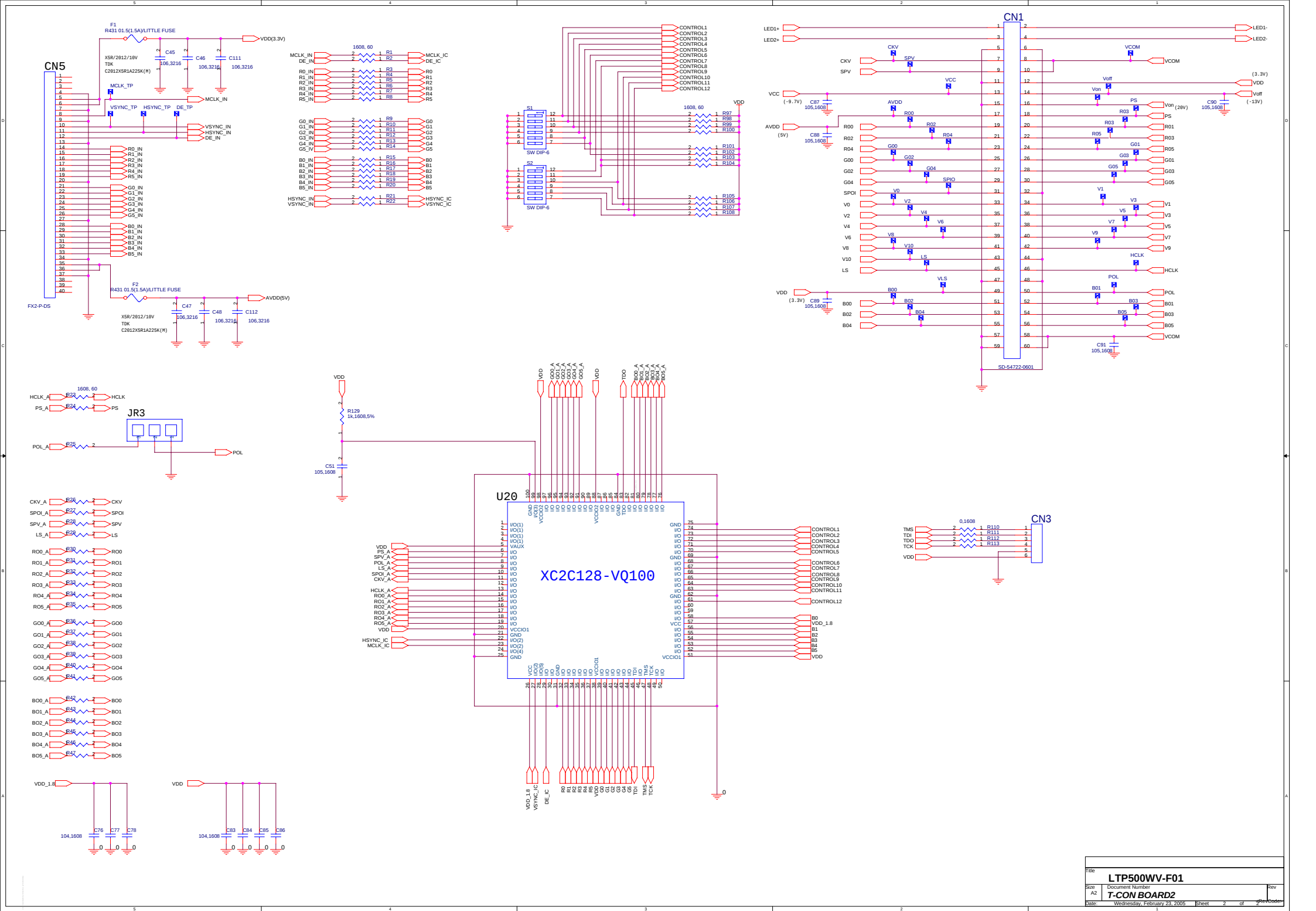
7. Operation Circuit

7.1 T-Con B/D



7.2 Reference Circuit



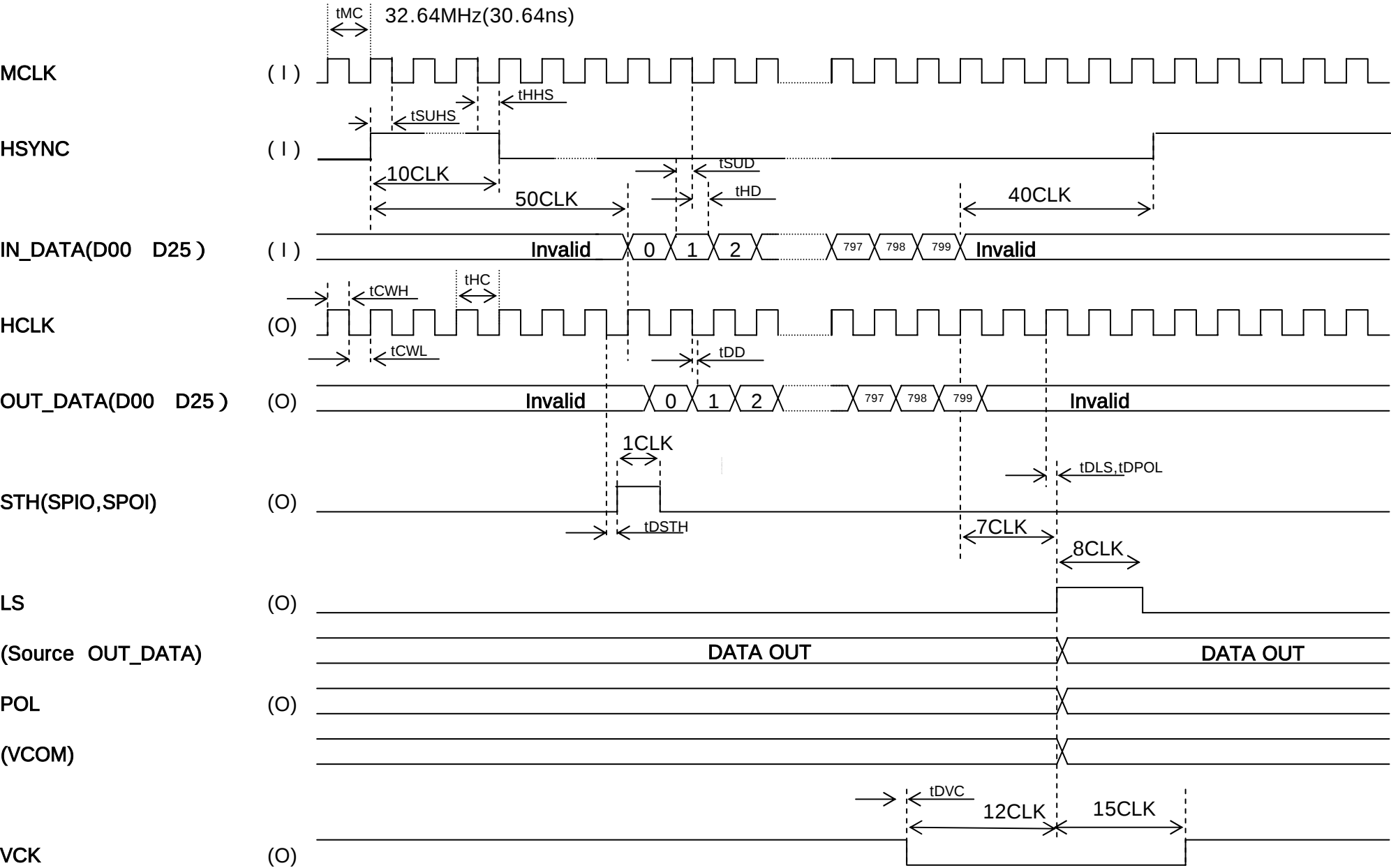


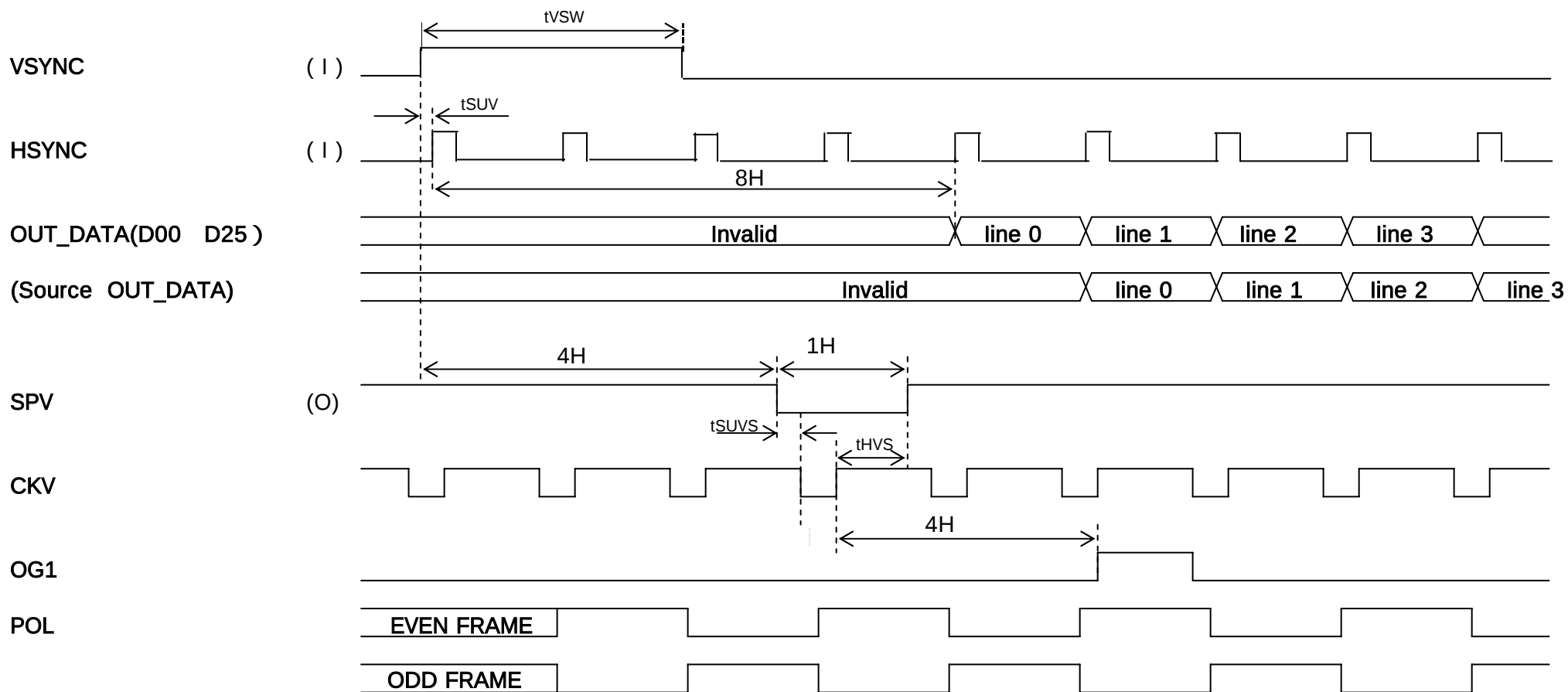
7.3 CPLD Pin MAP

Draft

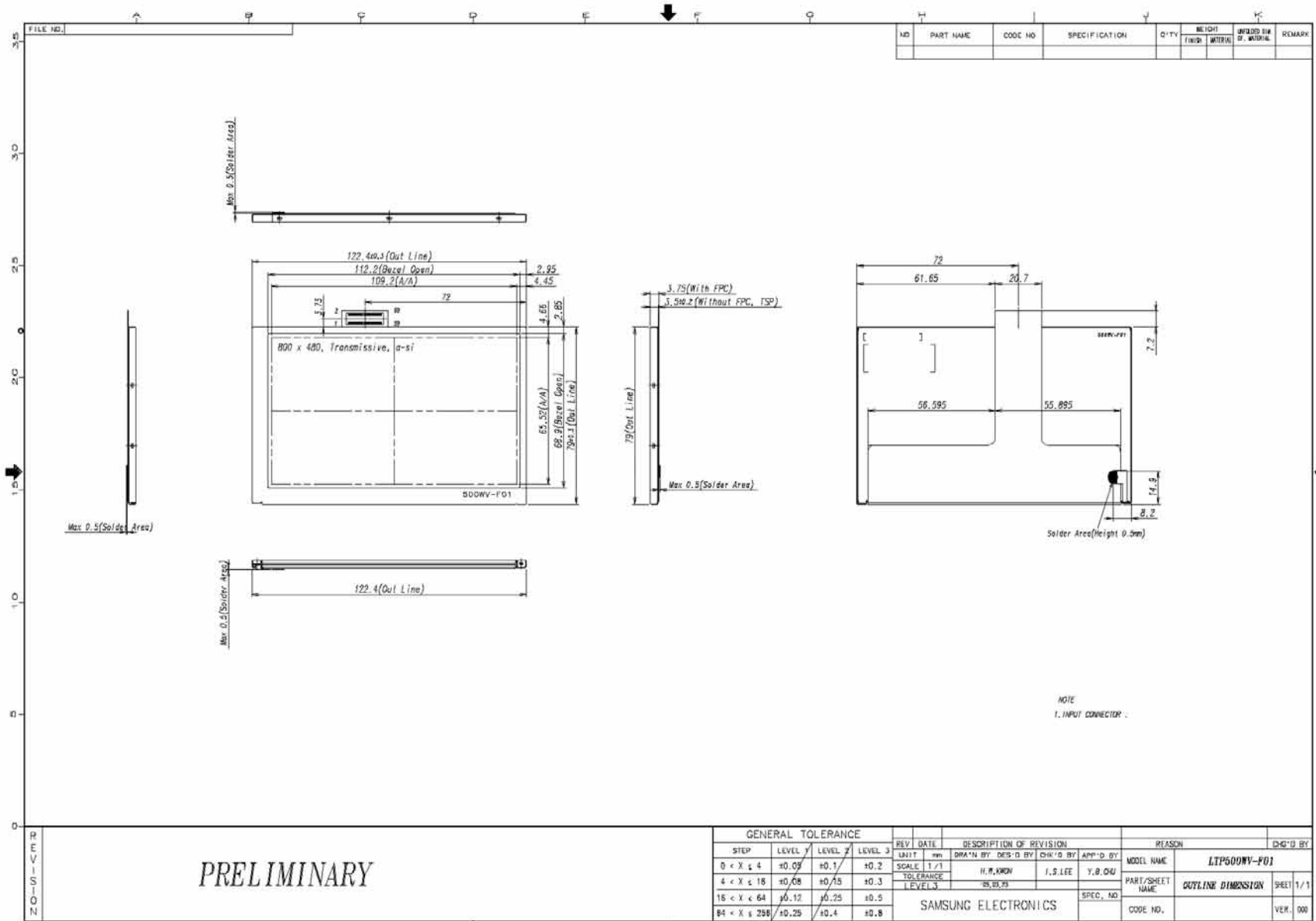
5	VAUX	3.3V	I	32	In_DATA_0	RED_0	I
7	PS	Input pin for power save	O	33	In_DATA_1	RED_1	I
8	SPV	Vertical scanning start pluse input	O	34	In_DATA_2	RED_2	I
9	POL	Input data polarity exchange input	O	35	In_DATA_3	RED_3	I
10	LS	Latch input	O	36	In_DATA_4	RED_4	I
11	SPIO/SPOI	Start pluse input/cascade output	O	37	In_DATA_5	RED_5	I
12	CKV	Vertical sync	O	39	In_DATA_6	GREEN_0	I
13	HCLK	Main clock	O	40	In_DATA_7	GREEN_1	I
20	VCCIO1	3.3V	I	41	In_DATA_8	GREEN_2	I
21	GND	GROUND	I	42	In_DATA_9	GREEN_3	I
22	Hsync	Horizontal sync	I	43	In_DATA_10	GREEN_4	I
23	MCLK	Main clock	I	44	In_DATA_11	GREEN_5	I
25	GND	GROUND	I	68	In_DATA_12	BLUE_0	I
26	VCC	1.8v	I	67	In_DATA_13	BLUE_1	I
27	Vsync	Vertical sync	I	66	In_DATA_14	BLUE_2	I
29	DE	Data enable	I	65	In_DATA_15	BLUE_3	I
31	GND	GROUND	I	64	In_DATA_16	BLUE_4	I
38	VCCIO1	3.3V	I	63	In_DATA_17	BLUE_5	I
51	VCCIO1	3.3V	I	14	Out_DATA_0	RED_0	O
57	VCC	1.8v	I	15	Out_DATA_1	RED_1	O
62	GND	GROUND	I	16	Out_DATA_2	RED_2	O
69	GND	GROUND	I	17	Out_DATA_3	RED_3	O
75	GND	GROUND	I	18	Out_DATA_4	RED_4	O
84	GND	GROUND	I	19	Out_DATA_5	RED_5	O
88	VCCIO2	3.3V	I	96	Out_DATA_6	GREEN_0	O
98	VCCIO2	3.3V	I	95	Out_DATA_7	GREEN_1	O
100	GND	GROUND	I	94	Out_DATA_8	GREEN_2	O
				93	Out_DATA_9	GREEN_3	O
				92	Out_DATA_10	GREEN_4	O
				91	Out_DATA_11	GREEN_5	O
				81	Out_DATA_12	BLUE_0	O
				80	Out_DATA_13	BLUE_1	O
				79	Out_DATA_14	BLUE_2	O
				78	Out_DATA_15	BLUE_3	O
				77	Out_DATA_16	BLUE_4	O
				76	Out_DATA_17	BLUE_5	O

7.4 Interface Timing of Signal

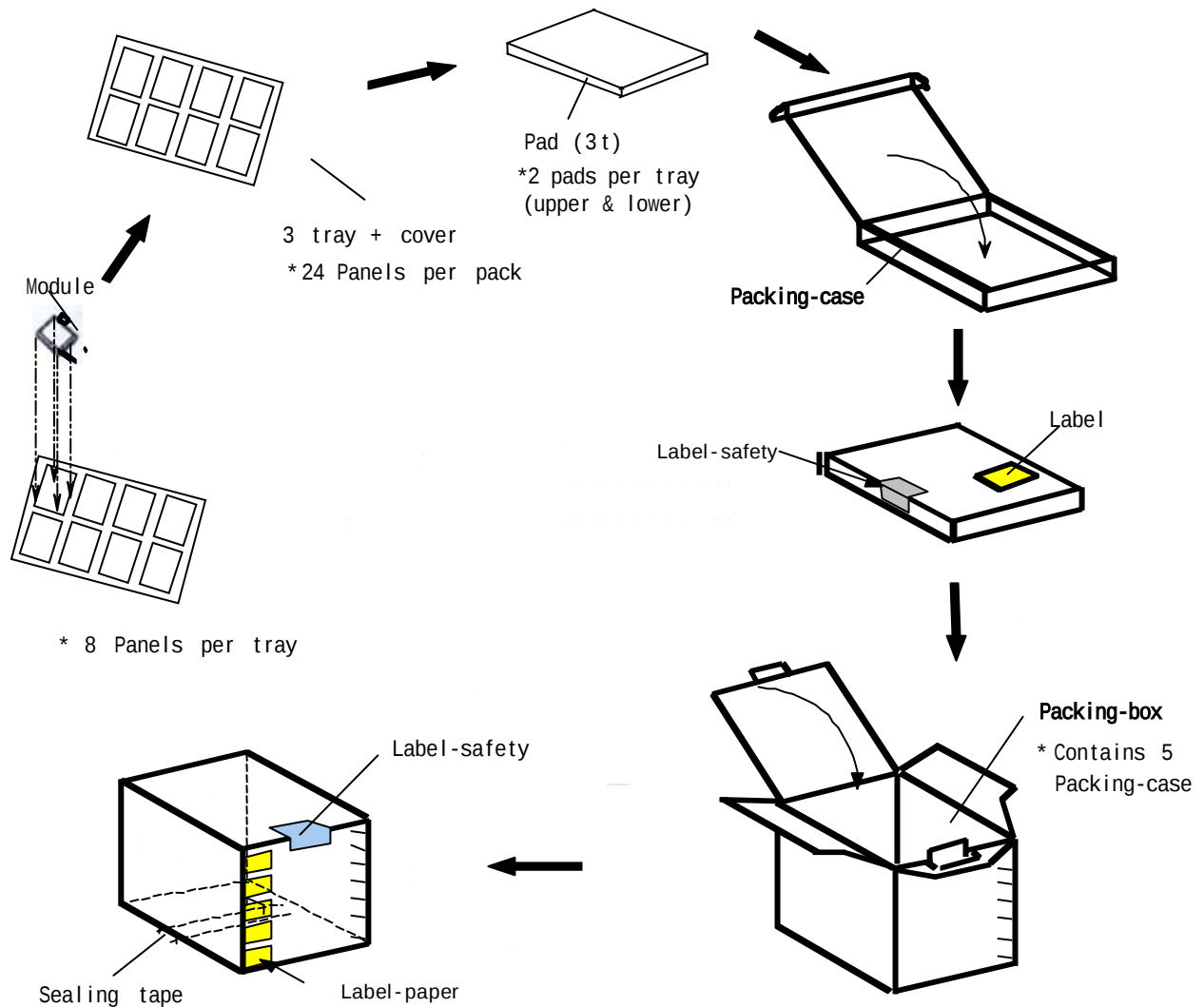




8. Outline Dimension



9. Packing



Note

- (1) Total : Case: Approx. 3.03 Kg
Box: Approx. 15.76 Kg
- (2) Size : Case: 490(W) x 342(D) x 58(H)
Box: 505(W) x 355(D) x 300(H)
- (3) Place the panels in the tray facing the direction shown in the figure.
- (4) Place 3 tray and cover(empty tray) and 2 pads inside the packing-case.
- (5) Place 5 packing-case inside the packing-box.(Affix the label)
- (6) Seal the packing-box. Affix the label-safety.

10. GENERAL PRECAUTIONS

Preliminary

1. Handling

- (a) When the module is assembled, It should be attached to the system firmly using every mounting holes. Be careful not to twist and bend the modules.
- (b) Refrain from strong mechanical shock and / or any force to the module. In addition to damage, this may cause improper operation or damage to the module and LED back-light.
- (c) Note that polarizers are very fragile and could be easily damaged. Do not press or scratch the surface harder than a HB pencil lead.
- (d) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, Staining and discoloration may occur.
- (e) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
- (f) The desirable cleaners are water, IPA(Isopropyl Alcohol) or Hexane.
Do not 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.
- (g) 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.
- (h) Protect the module from static , it may cause damage to the CMOS IC.
- (i) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (j) Do not disassemble the module.
- (k) Do not adjust the variable resistor which is located on the back side.
- (l) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (m) Pins of I/F connector shall not be touched directly with bare hands.

2. STORAGE

- (a) Do not leave the module in high temperature, and high humidity for a long time.
It is highly recommended to store the module with temperature from 0 to 35 °C and relative humidity of less than 70%.
- (b) Do not store the TFT-LCD module in direct sunlight.
- (c) The module shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during the store.

3. OPERATION

- (a) Do not connect, disconnect the module in the “Power On” condition.
- (b) Power supply should always be turned on/off by following item 6.2
“Power on/off sequence”.
- (c) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.

4. OTHERS

- (a) Ultra-violet ray filter is necessary for outdoor operation.
- (b) Avoid condensation of water. It may result in improper operation or disconnection of electrode.
- (c) Do not exceed the absolute maximum rating value. (the supply voltage variation, input voltage variation, variation in part contents and environmental temperature, so on)
Otherwise the module may be damaged.
- (d) If the module displays the same pattern continuously for a long period of time, it can be the situation when the image “sticks” to the screen.
- (e) This module has its circuitry FPC's on the rear side and should be handled carefully in order not to be stressed.