GTK UK LTD.

SPECIFICATION
FOR
TFT MODULE

MODULE No. :IPS102A101A

CUSTOMER APPROVAL:

	SIGNATURE	DATE
PREPARED BY	李军	2017-05-08
CHECKED BY	李军	2017-05-08
APPROVED BY	顶明明	2017-05-08

Notes :

1、Please contact GTK before assigning your product based on this module specification.

2、To improve the quality of product, and this product specification is subject to change without any notice.

REVISION RECORD

Rev No.	Rev date	Contents	Remarks
O	2017-05-08	First release	Preliminary

CONTENTS

1. GENERAL INFORMATION

No.	Item	Contents	Unit
1	LCD size	10.25 inch (Diagonal)	/
2	LCD type	IPS/Normally Black/Transmissive(Anti-glare)	/
3	Viewing direction(eye)	Free	/
4	Gray scale inversion direction	Free	/
5	Resolution(H*V)	1920 * 3(RGB) * 720 Pixels	/
6	Module size (L*W*H)	260.35(W) * 113.73(H) * 16.23(T)	mm
7	Active area (L*W)	243.648 * 91.368	mm
8	Pixel pitch (L*W)	0.1269 * 0.1269	mm
9	Interface type	LVDS interface	/
10	Module power consumption	TBD	W
11	Back light type	LED	/
12	Driver IC	HX8290-A-LT+HX8695-E-LT	/
13	Weight	TBD	g

2. ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min.	Max.	Unit
Power supply voltage for DCDC	VDDA	-0.3	3.96	V
Power supply voltage for Logic	VDD	-0.3	3.96	V
Single LED forward current	IF	-	150	mA
Operation temperature	Top	-30	+85	°C
Storage temperature	Tst	-40	+90	°C
Humidity	RH	-	90%(Max60 °C)	RH

3. ELECTRICAL CHARACTERISTICS

DC CHARACTERISTICS(at Ta=25°C)

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Power supply voltage for DCDC	VDDA	3.0	3.3	3.6	V	
Power supply voltage for Logic	VDD	3.0	3.3	3.6	V	
Power supply current for DCDC	I_{VDDA}	-	350	500	mA	Note1
Power supply current for Logic	I_{DD}	-	40	60	mA	Note1
Input voltage 'H' level	VIH	0.7VDD	-	VDD	V	
Input voltage 'L' level	VIL	GND	-	0.3VDD	V	
Differential input high Threshold voltage	RXVTH	-	-	+0.15	V	
Differential input low threshold voltage	RXVTL	-0.15	-	-	V	
Differential input common Mode voltage	RXVCM	1	1.2	1.7-| VID |/2	V	
LVDS input voltage	VINLV	0.7		1.7	V	
Differential input voltage	| VID |	0.15		0.6	V	
Differential input leakage Current	RVXliz	-10	-	+10	mA	

Note1 : All white pattern.

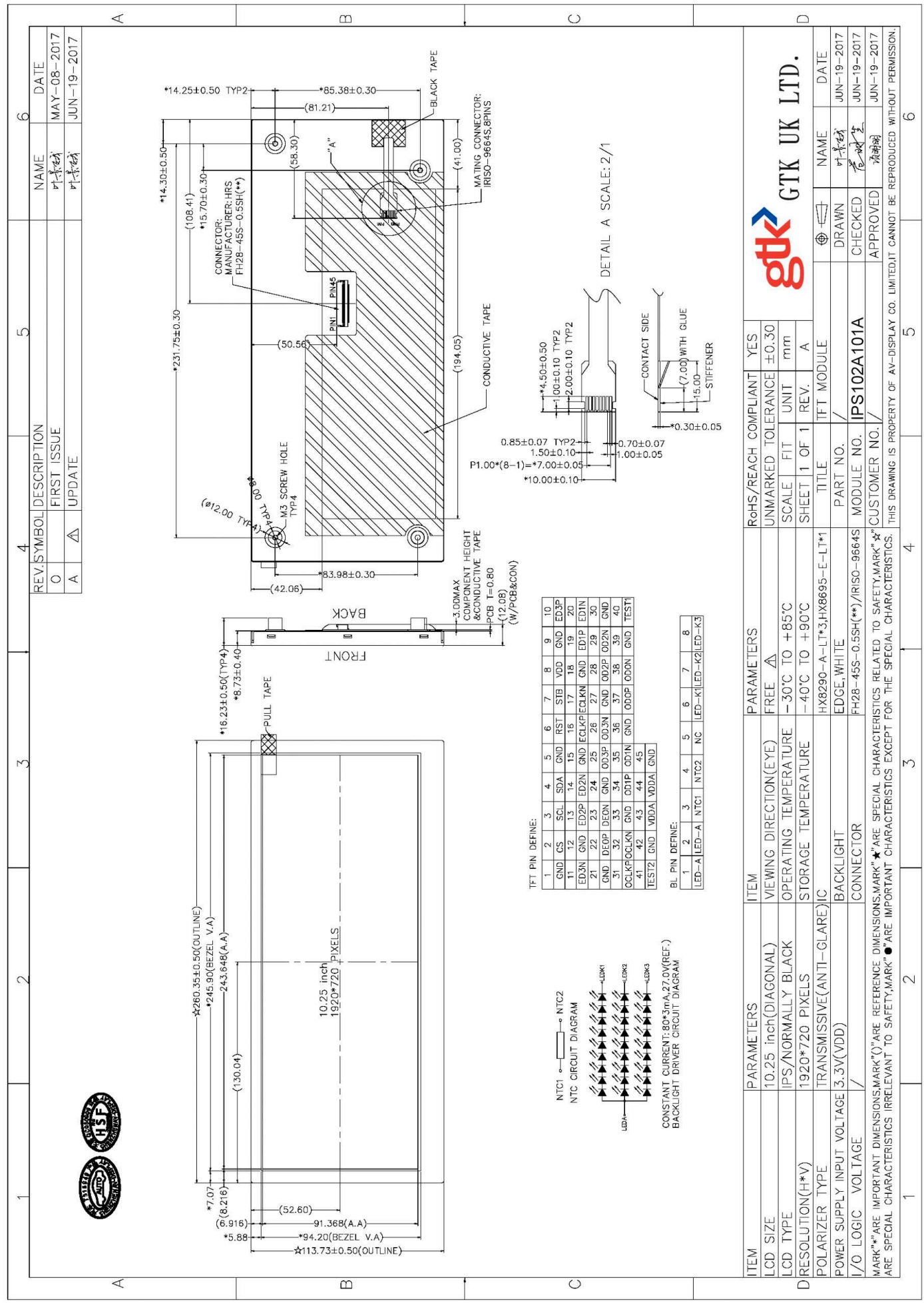
4. BACKLIGHT CHARACTERISTICS

(at Ta=25°C,RH=60%)

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Supply voltage of LED backlight	V LED	-	27	-	V	
Supply current of LED backlight	$I_{LED1/3}$	-	80	-	mA	Note1
Total Supply current of LED backlight	$I_{LEDTotal}$	-	240	-	mA	Note1
LED power consumption	PLED	-	6.48	-	W	Note2
Number of LED	-		27		PCS	
Connection mode	-	9 in series	3 in parallel		/	
LED life-time	-	30000	-	-	Hrs	Note3

Note1 : The LED driving condition is defined for each LED module.Total input current = 80 x 3= 240 mA
Note2 : Backlight power consumption is calculated by ILED (Total) x VLED
Note3 : The “LED Life Time” is defined as the time period when the brightness decrease to 50% of the initial value under continuous lighting at 25℃ (dry condition) with the recommended driving current.

5. EXTERNAL DIMENSIONS



6. ELECTRO-OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark	Note
Response time	Tr+ Tf	-	-	30	35	ms	FIG.1	Note 4
Contrast ratio	Cr		800	1000	-	-	FIG.2	Note 1
Surface luminance	Lv	θ=0°	600	-	-	cd/m^2	FIG.2	Note 2
Luminance uniformity	Yu	θ=0°	70	-	-	%	FIG.2	Note 3
NTSC	-	θ=0°	-	68	-	%	FIG.2	Note 5
Viewing angle	θ	∅=90°	70	80	-	deg	FIG.3	Note 6
		∅=270°	70	80	-	deg	FIG.3	
		∅=0°	70	80	-	deg	FIG.3	
		∅=180°	70	80	-	deg	FIG.3	
CIE (x,y) chromaticity	Red x	θ=0° ∅=0° Ta=25°C	Typ -0.04	0.656	Typ +0.04	-	FIG.2 CIE1931	Note 5
	Red y			0.327		-		
	Green x			0.288		-		
	Green y			0.590		-		
	Blue x			0.138		-		
	Blue y			0.111		-		
	White x			0.302		-		
	White y			0.329		-		

Note1.Definition of contrast ratio
Contrast ratio(Cr) is defined mathematically by the following formula.
For more information see FIG.2.

$$\text{Contrast ratio} = \frac{\text{Luminance measured when LCD on the “White” state}}{\text{Luminance measured when LCD on the “Black” state}}$$

Measured at the center area of the LCD

Note2.Definition of surface luminance
Surface luminance is the luminance with all pixels displaying white.
For more information see FIG.2.
Lv = Average Surface Luminance with all white pixels(P1,P2,P3, ...,Pn)

Note3.Definition of luminance uniformity
The luminance uniformity in surface luminance is determined by measuring luminance at each test position 1 through n, and then dividing the maximum luminance of n points luminance by minimum luminance of n points luminance.For more information see FIG.2.

$$Yu = \frac{\text{Minimum surface luminance with all white pixels (P1,P2,P3,.....,Pn)}}{\text{Maximum surface luminance with all white pixels (P1,P2,P3,.....,Pn)}}$$

Note4. Definition of response time
The response time is defined as the LCD optical switching time interval between “White” state and “Black”state.Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.
For additional information see FIG1.

Note5. Definition of color chromaticity (CIE1931)
CIE (x,y) chromaticity,The x,y value is determined by screen active area center position P5.For more information see FIG.2.

Note6. Definition of viewing angle
Viewing angle is the angle at which the contrast ratio is greater than 10. angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface.
For more information see FIG.3.
For viewing angle and response time testing, the testing data is base on Autronic-Melchers’s ConoScope or DMS series Instruments or compatible. For contrast ratio, Surface Luminance, Luminance uniformity and CIE,the testing data is base on TOPCON’s BM-5or BM-7 photo detector or compatible.

FIG.1. The definition of response Time

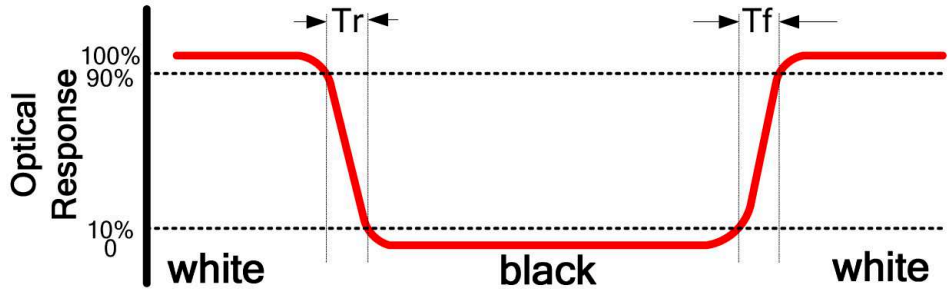


FIG.2. Measuring method for contrast ratio, surface luminance, luminance uniformity, CIE (x,y) chromaticity

Size : S≤5"(see Figure a)
A : 5 mm B : 5 mm
H,V : Active area
Light spot size ∅=5mm(BM-5) or ∅=7.7mm (BM-7)50cm distance or compatible distance from the LCD surface to detector lens.
test spot position : see Figure a.
measurement instrument : TOPCON's luminance meter BM-5 or BM-7 or compatible (see Figure c).

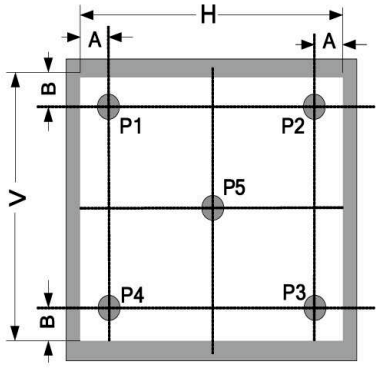


Figure a

Size : 5"＜S≤12.3"(see Figure b)
H,V : Active area
Light spot size ∅=5mm(BM-5) or ∅=7.7mm (BM-7)50cm distance or compatible distance from the LCD surface to detector lens.
test spot position : see Figure b.
measurement instrument : TOPCON's luminance meter BM-5 or BM-7 or compatible (see Figure c).

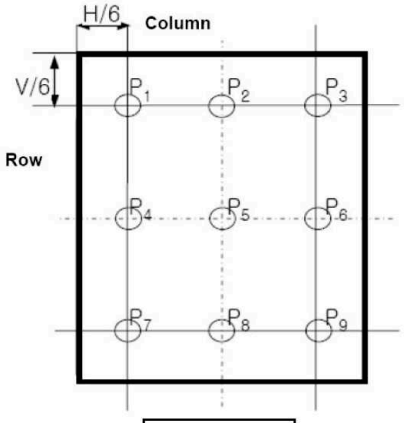


Figure b

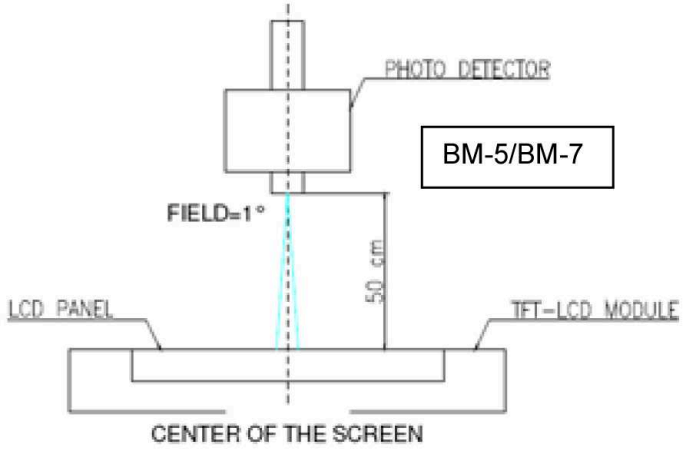
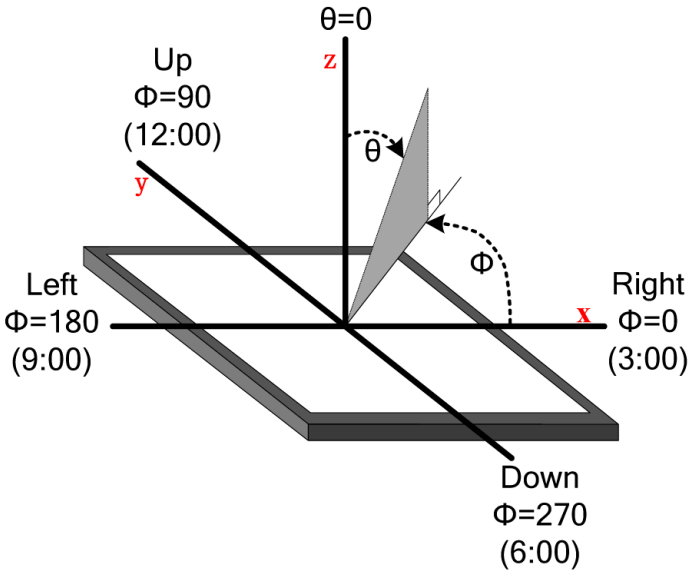


Figure c

FIG.3. The definition of viewing angle



7. INTERFACE DESCRIPTION

TFT Module Interface description

Interface No.	Name	I/O or connect to	Description
1	GND	P	Ground
2	CS	I	SPI chip select pin
3	SCL	I	SPI Clock pin
4	SDA	I/O	SPI Data pin
5	GND	P	Ground
6	RST	I	Reset Pin
7	STB	I	Standby Pin
8	VDD	P	Power pin for Logic
9	GND	P	Ground
10	ED3P	I	Even Data channel 3+
11	ED3N	I	Even Data channel 3-
12	GND	P	Ground
13	ED2P	I	Even Data channel 2+
14	ED2N	I	Even Data channel 2-
15	GND	P	Ground
16	ECLKP	I	Even Clock channel +
17	ECLKN	I	Even Clock channel -
18	GND	P	Ground
19	ED1P	I	Even Data channel 1+
20	ED1N	I	Even Data channel 1-
21	GND	P	Ground
22	ED0P	I	Even Data channel 0+
23	ED0N	I	Even Data channel 0-
24	GND	P	Ground
25	OD3P	I	Odd Data channel 3+
26	OD3N	I	Odd Data channel 3-
27	GND	P	Ground
28	OD2P	I	Odd Data channel 2+

29	OD2N	I	Odd Data channel 2-
30	GND	P	Ground
31	OCLKP	I	Odd Clock channel +
32	OCLKN	I	Odd Clock channel -
33	GND	P	Ground
34	OD1P	I	Odd Data channel 1+
35	OD1N	I	Odd Data channel 1-
36	GND	P	Ground
37	OD0P	I	Odd Data channel 0+
38	OD0N	I	Odd Data channel 0-
39	GND	P	Ground
40	TEST1	-	Test Pin
41	TEST2	-	Test Pin
42	GND	P	Ground
43	VDDA	P	Power for DC/DC
44	VDDA	P	Power for DC/DC
45	GND	P	Ground

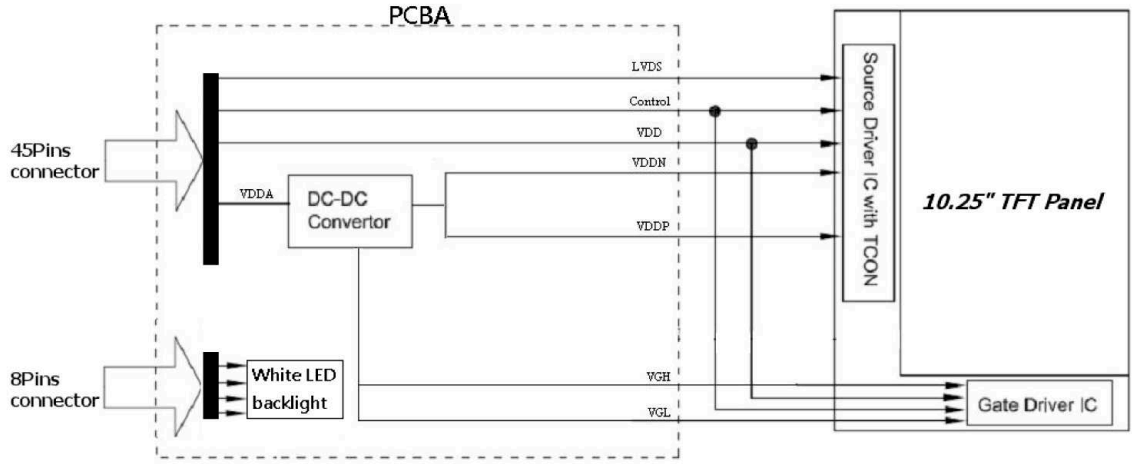
BL Interface description

Interface No.	Name	I/O or connect to	Description
1	LED-A	P	LED Anode
2	LED-A	P	LED Anode
3	NTC1	C	NTC thermistor terminal 1
4	NTC1	C	NTC thermistor terminal 2
5	NC	-	-
6	LED-K1	P	LED string 1 Cathode
7	LED-K2	P	LED string 2 Cathode
8	LED-K3	P	LED string 3 Cathode

NOTE: For I/O, “I” is Input, “O” is Output. “P” is for Power, and “C” is for passive.

8. AC CHARACTERISTICS

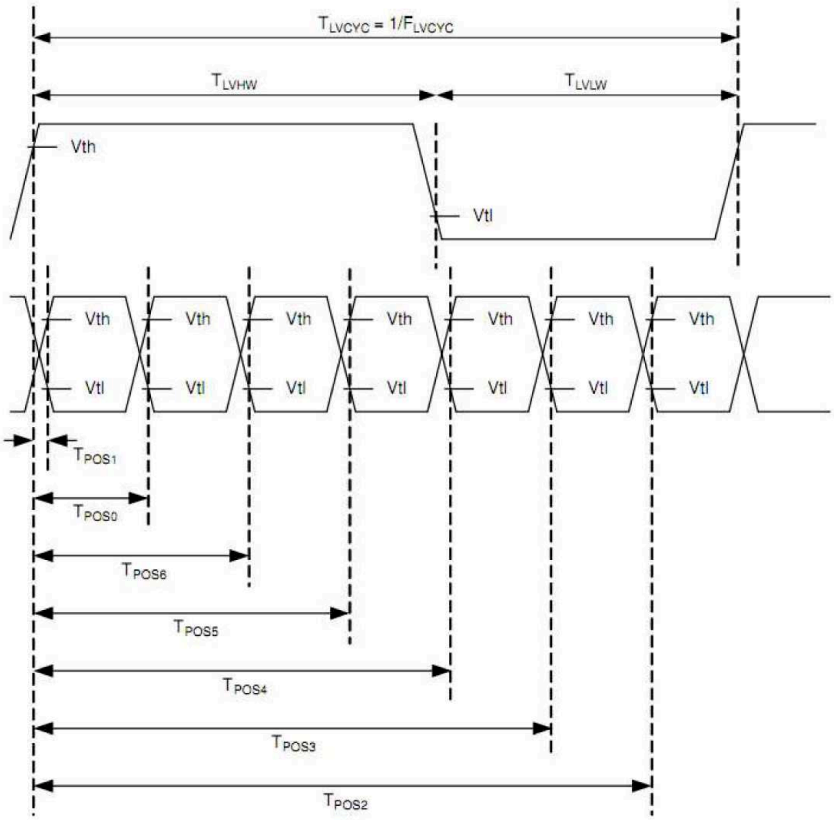
8.1 Block Diagram



8.2 LVDS AC electrical characteristics

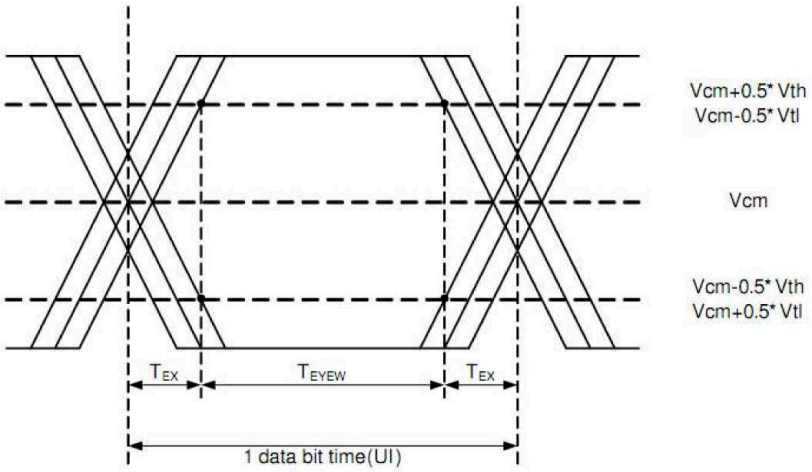
Parameter	Symbol	Min.	Typ.	Max.	Unit
Clock frequency	F_{LVCYC}	20	-	85	MHz
Clock period	T_{LVCYC}	11.76			ns
1 data bit time	UI		1/7		T_{LVCYC}
Clock high time	TLVCH		4		UI
Clock low time	TLVCL		3		UI
Position 1	T_{POS1}	-0.2	0	0.2	UI
Position 0	T_{POS0}	0.8	1	1.2	UI
Position 6	T_{POS6}	1.8	2	2.2	UI
Position 5	T_{POS5}	2.8	3	3.2	UI
Position 4	T_{POS4}	3.8	4	4.2	UI
Position 3	T_{POS3}	4.8	5	5.2	UI
Position 2	T_{POS2}	5.8	6	6.2	UI
Input eye width	T_{EYEW}	0.6			UI
Input eye border	T_{EX}			0.2	UI
LVDS wake up time	T_{ENLVDS}			150	ms

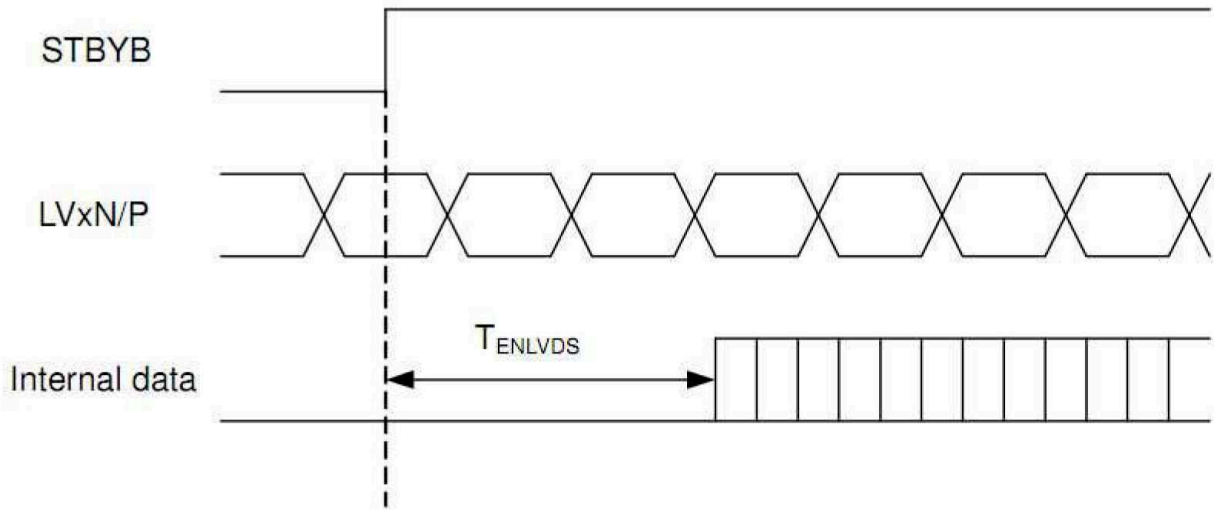
LVCLKP (R)-LVCLKN (R)



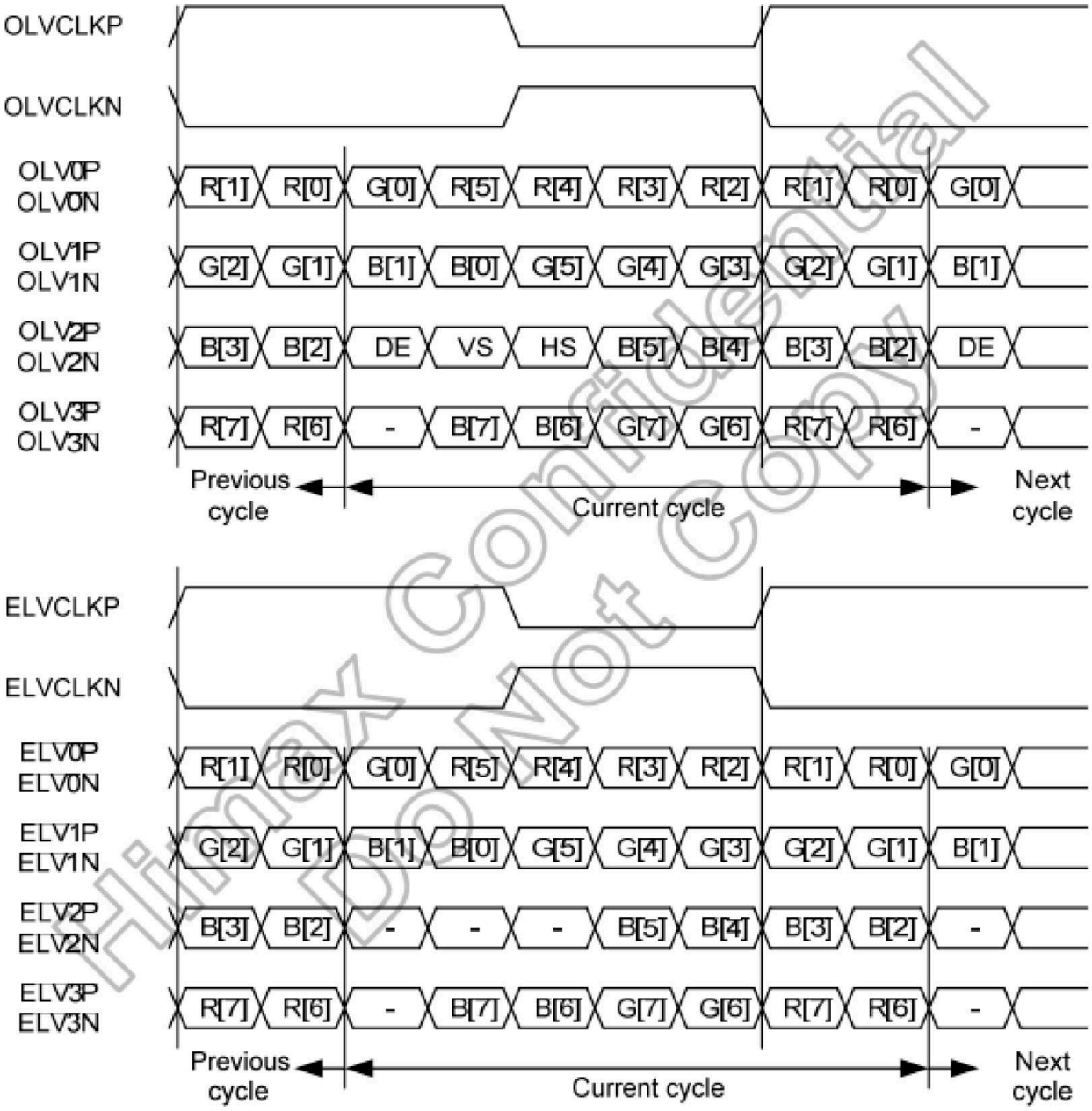
LVD [3:0]P(R)-
LVD [3:0]N(R)

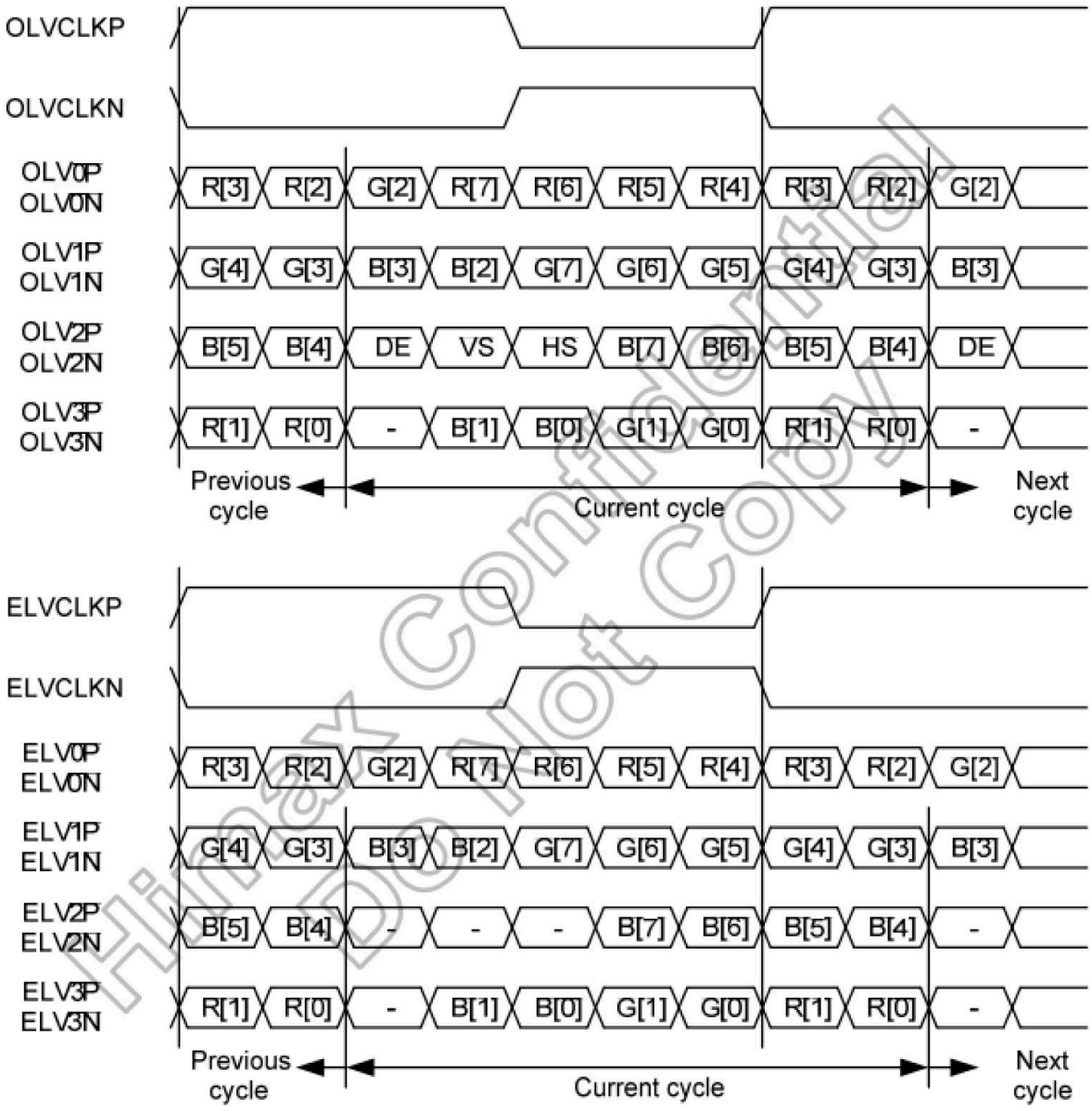
Single-ended:
LVD [3:0]P,
LVD [3:0]N





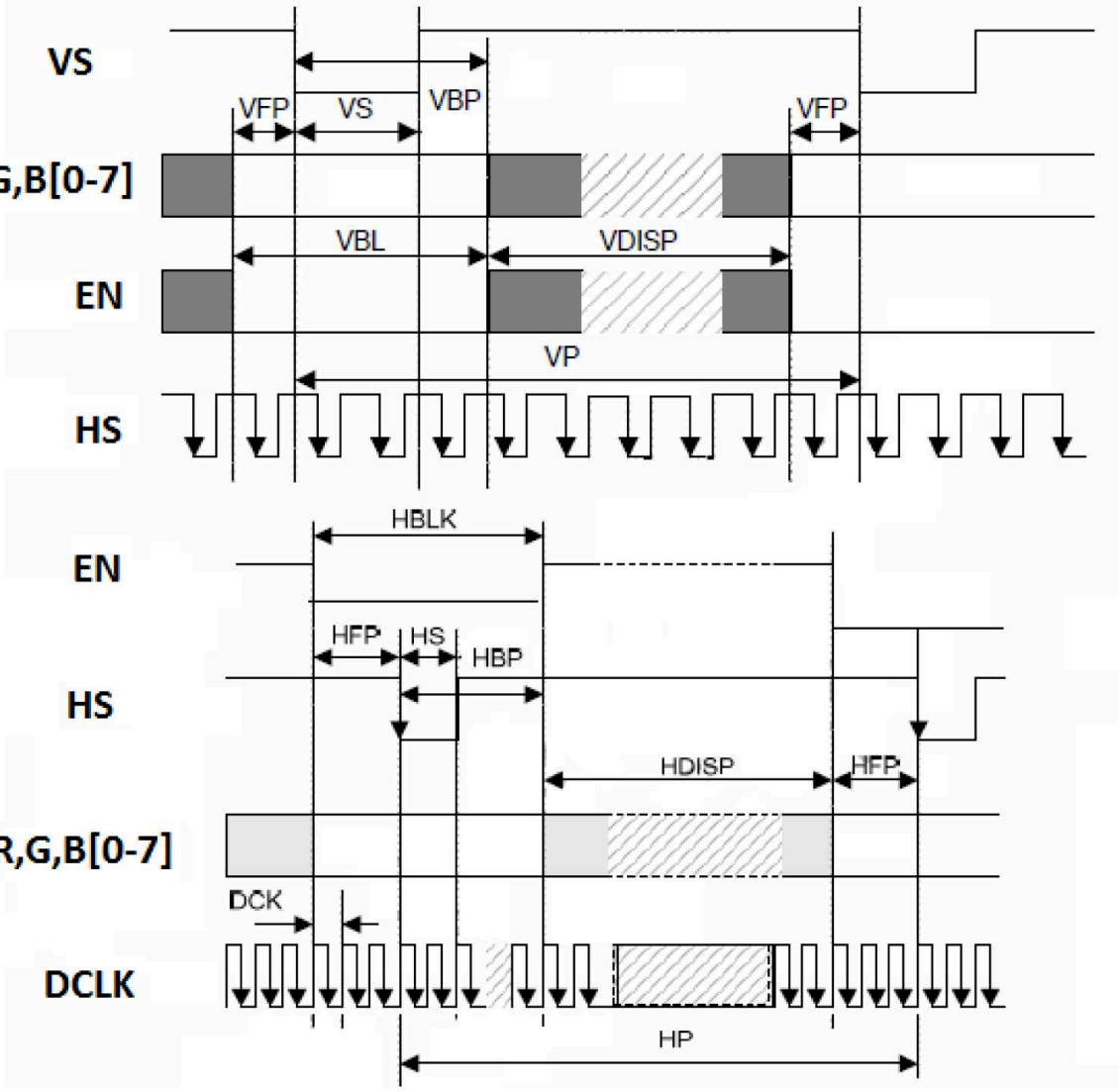
8.3 LVDS Input Format





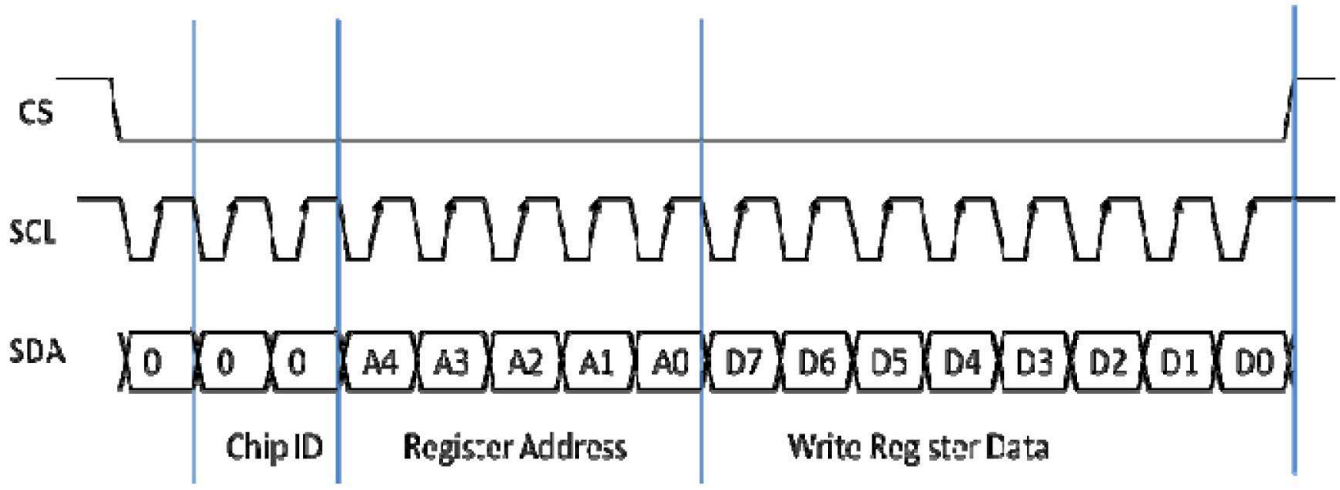
8.4 Video Signal Timing

Symbol	Parameter	Conditions	Related Pins	Min.	Typ.	Max.	Unit
VP	Vertical Total	-	VSYNC	727	733	740	Line
VS	VSYNC Low Pulse Width	-	VSYNC	1	3	20	Line
VBP	Vertical Back Porch	-	VSYNC	2	5	255	Line
VFP	Vertical Front Porch	-	VSYNC	5	8	260	Line
VDISP	Vertical Active Area	-	VSYNC, HSYNC	-	720	-	Line
HP	Horizontal Total		HSYNC	989	1002	1152	
HS	HSYNC Low Pulse Width	-	HSYNC	10	12	255	DCK
HBP	Horizontal Back Porch	-	HSYNC	5	16	255	DCK
HFP	Horizontal Front Porch	-	HSYNC	24	26	260	DCK
HDISP	Horizontal Active Area	-	HSYNC	-	960	-	DCK
F_{frame}	Frame Frequency	-	CLK	-	60	-	Hz
f_{CLK}	CLK frequency		CLK	43.1	44.1	51.1	MHz

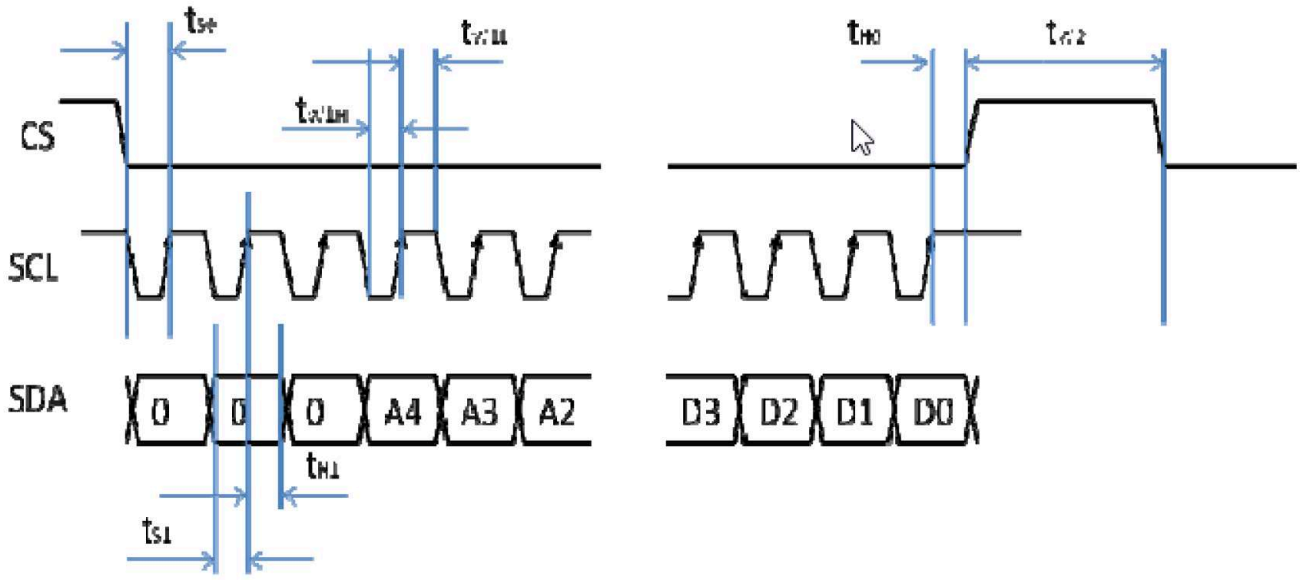


8.5 SPI interface (3 wires)

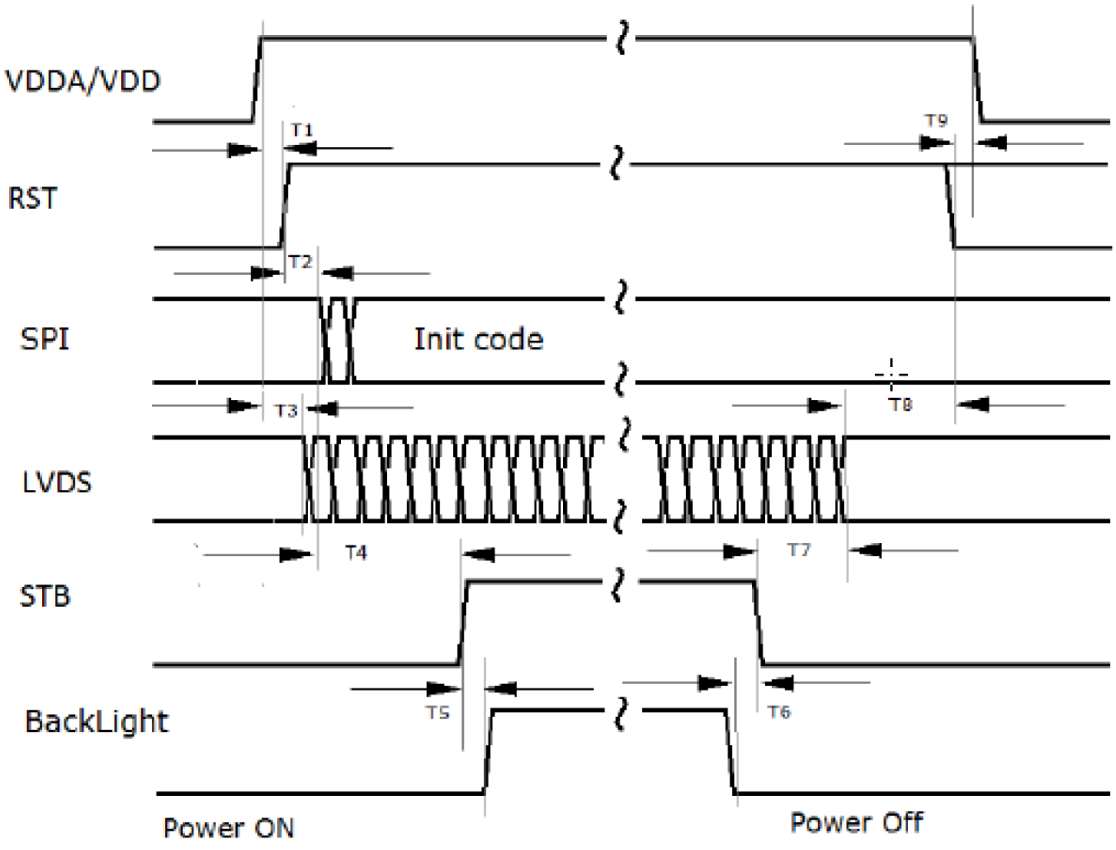
SPI interface is used to read and write the setting registers of the TFT module and read commands to control the TFT module. Refer to Appendix is for details of the registers setting.



Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Setup Time	t_{S0}	CS to SCL	60	-	-	ns
	t_{S1}	SDA to SCL	60	-	-	
Hold Time	t_{H0}	CS to SCL	60	-	-	ns
	t_{H1}	SDA to SCL	60	-	-	
Pulse Width	t_{WIL}	SCL Negative cycle	75	-	-	ns
	t_{WIH}	SCL Positive cycle	75	-	-	
	t_{W2}	CS	1	-	-	
Clock duty		SCL	40	50	60	%



9. POWER SEQUENCE



Symbol	Peremeter	Min.	Typ.	Max.	Unit	Remarks
T1	VDD Ready to RSET finish	10	-	-	ms	
T2	LVDS start to SPI Init.	3(TBC)	-	-	frame	
T3	VDD Ready to LVDS	T1	-	-	ms	
T4	SPI End to STB	0	-	-	ms	
T5	DISP Enable to Backlight On	7	-	-	frame	
T6	Backlight Off to STB Standby	0	-	-	ms	
T7	STB Standby to LVDS off	9	-	-	frame	
T8	LVDS off to Reset falling	0	-	-	ms	
T9	Reset falling to VDD off	0	-	-	ms	

10. RELIABILITY TEST CONDITIONS

<table>
<tr><th>No.</th><th>Test item</th><th colspan="2">Test condition</th><th>Inspection after test</th></tr>
<tr><td>10.1</td><td>High temperature storage test</td><td colspan="2">+90C/240 hours</td><td rowspan="12">Inspection after 2~4hours storage at room temperature, the sample shall be free from defects :
1.Current changing value before test and after test is 50% larger;
2. Function defect : Non-display,abnormal-display,missing lines, Short lines,ITO corrosion;
3.Visual defect : Air bubble in the LCD,Seal leak,Glass crack.</td></tr>
<tr><td>10.2</td><td>Low temperature storage test</td><td colspan="2">-40°C/240 hours</td></tr>
<tr><td>10.3</td><td>High temperature operating test</td><td colspan="2">+85°C/240 hours</td></tr>
<tr><td>10.4</td><td>Low temperature operating test</td><td colspan="2">-30°C/240 hours</td></tr>
<tr><td>10.5</td><td>Temperature cycle storage test</td><td colspan="2">-30°C ~ 25°C ~ +80°C/10cycles
(30min.) (10min.) (30min.)</td></tr>
<tr><td>10.6</td><td>High temperature high humidity test</td><td colspan="2">+60°C*90% RH/240 hours</td></tr>
<tr><td>10.7</td><td>Vibration test</td><td colspan="2">Frequency : 250 r/min
Amplitude : 1 inch
Time: 45min</td></tr>
<tr><td rowspan="5">10.8</td><td rowspan="5">Drop test</td><td colspan="2">Drop direction:
1 corner/3 edges/6 sides 10 time</td></tr>
<tr><td>Packing weight(kg)</td><td>Drop height(cm)</td></tr>
<tr><td>〈11</td><td>80±1.6</td></tr>
<tr><td>11≦G〈21</td><td>60±1.2</td></tr>
<tr><td>21≦G〈31</td><td>50±1.0</td></tr>
<tr><td>10.9</td><td>ESD test</td><td colspan="2">Air discharge: ±8KV, 10time
Contact discharge: ±6KV, 10time</td></tr>
</table>

Remark :
1.The test samples should be applied to only one test item.
2.Sample size for each test item is 3~5pcs.
3.For High temperature high humidity test, Pure water(Resistance>10MΩ) should be used.
4.In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.
5.B/L evaluation should be excepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence B/L has.
6.Failure judgment criterion: Basic specification, Electrical characteristic, Mechanical characteristic, Optical characteristic.

11. HANDLING PRECAUTIONS

11.1 Mounting method

The LCD module consists of two thin glass plates with polarizes which easily be damaged. And since the module in so constructed as to be fixed by utilizing fitting holes in the printed circuit board.
Extreme care should be needed when handling the LCD modules.

11.2 Caution of LCD handling and cleaning

When cleaning the display surface, Use soft cloth with solvent
[recommended below] and wipe lightly :
●.Isopropyl alcohol
●.Ethyl alcohol
Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.
Do not use the following solvent :
●.Water
●.Aromatics
Do not wipe ITO pad area with the dry or hard materials that will damage the ITO patterns
Do not use the following solvent on the pad or prevent it from being contaminated :
●.Soldering flux
●.Chlorine (Cl) , Sulfur (S)
If goods were sent without being silicon coated on the pad, ITO patterns could be damaged due to the corrosion as time goes on.
If ITO corrosion happen by miss-handling or using some materials such as Chlorine (Cl), Sulfur (S) from customer, Responsibility is on customer.

11.3 Caution against static charge

The LCD module use C-MOS LSI drivers, so we recommended that you :
Connect any unused input terminal to Vdd or Vss, do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

11.4 Packing

Module employ LCD elements and must be treated as such.
●.Avoid intense shock and falls from a height.
●.To prevent modules from degradation, do not operate or store them exposed direct to sunshine or high temperature/humidity.

11.5 Caution for operation

●.It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage then the limit cause the shorter LCD life.
●.An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.
●.Response time will be extremely delayed at lower temperature then the operating temperature range and on the other hand at higher temperature LCD's how dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, which will come back in the specified operation temperature.
●.If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
●.A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.
●.Usage under the maximum operating temperature, 50%Rh or less is required.
●.When fixed patterns are displayed for a long time,remnant image is likely to occur.

11.6 Storage

In the case of storing for a long period of time for instance, for years for the purpose or replacement use, the following ways are recommended.
●.Storing in an ambient temperature 10°C to 30°C, and in a relative humidity of 45% to 75%. Don't expose to sunlight or fluorescent light.
●.Storing in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it . And with no desiccant.
●.Placing in a dark place where neither exposure to direct sunlight nor light's keeping the storage temperature range.
●.Storing with no touch on polarizer surface by the anything else.
It is recommended to store them as they have been contained in the inner container at the time of delivery from us.

11.7 Safety

●.It is recommendable to crash damaged or unnecessary LCD's into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.

●.When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water.

12. PRECAUTION FOR USE

12.1 A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity. Judgment by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

12.2 On the following occasions, the handing of problem should be decided through discussion and agreement between responsible of the both parties.

●.When a question is arisen in this specification.

●.When a new problem is arisen which is not specified in this specifications.

●.When an inspection specifications change or operating condition change in customer is reported to GTK, and some problem is arisen in this specification due to the change.

●.When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.

13. PACKING SPECIFICATION

Please consult our technical department for detail information.