

**SPECIFICATION
FOR
TFT MODULE**

MODULE No. : TFT104A101A

CUSTOMER APPROVAL:

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	SIGNATURE	DATE
PREPARED BY		2018-04-04
CHECKED BY		2018-04-04
APPROVED BY		2018-04-04

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.

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1. GENERAL INFORMATION

No.	Item	Contents	Unit
1	LCD size	10.4 inch (Diagonal)	/
2	LCD type	TN/Normally white/Transmissive	/
3	Viewing direction(eye)	12 O'clock	/
4	Gray scale inversion direction	6 O'clock	/
5	Resolution(H*V)	800 *600 Pixels	/
6	Module size (L*W*H)	236.00*176.90*5.60	mm
7	Active area (L*W)	211.20*158.40	mm
8	Pixel pitch (L*W)	0.264*0.264	mm
9	Interface type	LVDS interface	/
10	Module power consumption	TBD	W
11	Back light type	LED	/
12	Driver IC	-	/
13	Weight	TBD	g

2. ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min.	Max.	Unit
Power supply input voltage(TFT Module)	VDD	3.0	3.6	V
Backlight current (normal temp.)	ILED	-	30	mA
Operation temperature	Top	-20	+70	°C
Storage temperature	Tst	-30	+80	°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 input voltage(LCM)	VDD	2.7	3.3	3.6	V	
Power supply current	IVDD	-	480	-	mA	
LVDS Differential input high Threshold voltage	RxVTH	-	-	+100	mV	RXVC M=1.2 V
LVDS Differential input low Threshold voltage	RxVTL	-100	-	-	mV	
LVDS Differential input common mode voltage	RxVCM	0.7	1.2	1.6	V	
LVDS Differential voltage	VID	200	-	600	mV	

4. BACKLIGHT CHARACTERISTICS

(at Ta=25°C,RH=60%)

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED Forward Voltage	VF	2.9	-	3.4	V	
LED Forward Current	IF	-	20	-	mA	Vi=12v Duty 100%
LED power consumption	Pled	-	3.0	3.6	W	Vi=12vm Duty 100%
LED Power Consumption	PLED	-	2.448	-	W	
Back-light Power Supply Voltage	HVDD	-	-	20.7	V	
Back-light Power Supply Current	IHVDD	-	120	-	mA	6 parallel * 6 string
LED Life-Time	-	-	30000	-	Hrs	

Note1: Calculator Value for reference ILED×VLED×LED Quantity = PLED.

Note2: The LED Life-time define as the estimated time to 50% degradation of initial luminous.

6. ELECTRO-OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark	Note
Response time	Tr+ Tf	-	-	30	-	ms	FIG.1	Note 4
Contrast ratio	Cr		600	800	-	-	FIG.2	Note 1
Surface luminance	Lv	$\theta=0^\circ$	450	500	-	cd/m ²	FIG.2	Note 2
Luminance uniformity	Yu	$\theta=0^\circ$	70	80	-	%	FIG.2	Note 3
NTSC	-	$\theta=0^\circ$	-	50	-	%	FIG.2	Note 5
Viewing angle	θ	$\phi=90^\circ$	60	70	-	deg	FIG.3	Note 6
		$\phi=270^\circ$	50	60	-	deg	FIG.3	
		$\phi=0^\circ$	60	70	-	deg	FIG.3	
		$\phi=180^\circ$	60	70	-	deg	FIG.3	
CIE (x,y) chromaticity	Red x	$\theta=0^\circ$ $\phi=0^\circ$ Ta=25°C	Typ -0.03	0.609	Typ +0.03	-	FIG.2 CIE1931	Note 5
	Red y			0.335		-		
	Green x			0.329		-		
	Green y			0.555		-		
	Blue x			0.148		-		
	Blue y			0.102		-		
	White x			0.299		-		
	White y			0.339		-		

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.

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

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 (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (TOFF) 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

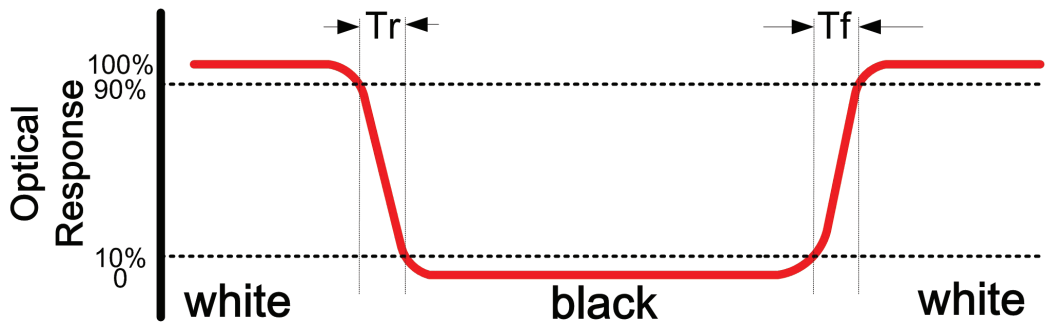


FIG.2. Measuring method for contrast ratio, surface luminance, luminance uniformity, CIE (x,y) chromaticity

Size : $S \leq 5''$ (see Figure a)
 A : 5 mm B : 5 mm
 H,V : Active area
 Light spot size $\varnothing = 5\text{mm}$ (BM-5) or $\varnothing = 7.7\text{mm}$ (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).

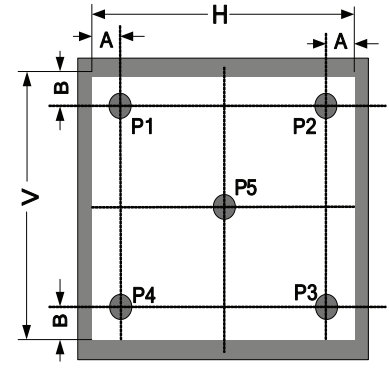


Figure a

Size : $5'' < S \leq 12.3''$ (see Figure b)
 H,V : Active area
 Light spot size $\varnothing = 5\text{mm}$ (BM-5) or $\varnothing = 7.7\text{mm}$ (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).

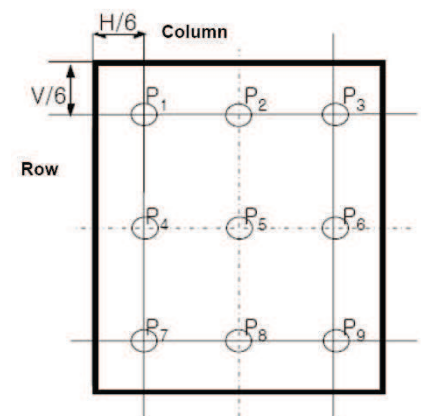


Figure b

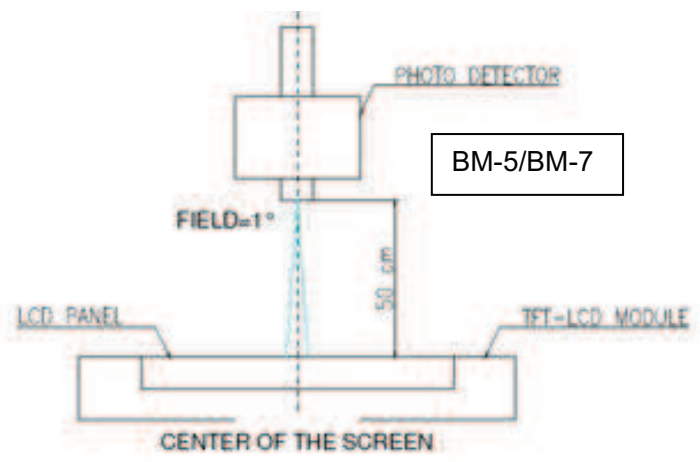
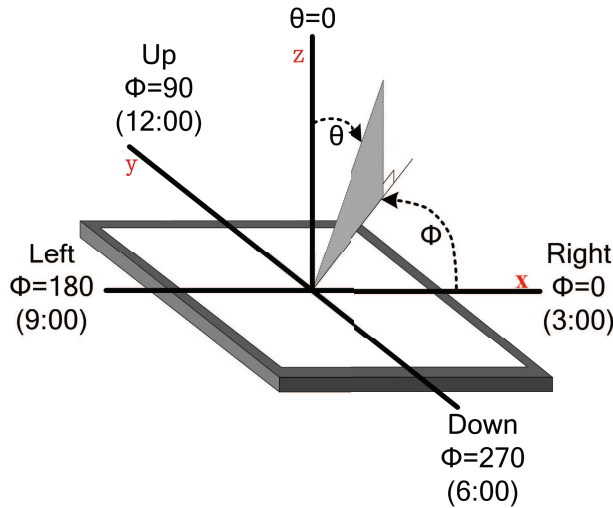


Figure c

FIG.3. The definition of viewing angle



7. INTERFACE DESCRIPTION

TFT Module Interface description

Interface No.	Name	I/O or connect to	Description
1	VDD	P	Power Supply
2	VDD	P	Power Supply
3	GND	P	Ground
4	GND	P	Ground
5	IN0-	I	Differential Data Input, CH0 (Negative)
6	IN0+	I	Differential Data Input, CH0 (Positive)
7	GND	P	Ground
8	IN1-	I	Differential Data Input, CH1 (Negative)
9	IN1+	I	Differential Data Input , CH1 (Positive)
10	GND	P	Ground
11	IN2-	I	Differential Data Input , CH2 (Negative)
12	IN2+	I	Differential Data Input , CH2 (Positive)
13	GND	P	Ground
14	CLK-	I	Differential Clock Input (Negative)
15	CLK+	I	Differential Clock Input (Positive)
16	GND	P	Ground
17	IN3-	I	Differential Data Input, CH3 (Negative)
18	IN3+	I	Differential Data Input, CH3 (Positive)
19	GND	P	Ground
20	SEL68	I	LVDS 6/8 bit select function control, Low or NC 6 bit Input Mode High 8bit Input Mode

8. AC CHARACTERISTICS

DE MODE

Parameter	Symbol	Min	Typ	Max	Unit
DCLK Frequency	fclk	32.6	39.6	62.4	MHz
Horizontal Display Area	thd		800		DCLK
HSD Period	th	900	1056	1300	DCLK
HSD Blanking	thb + thfp	90	200	500	DCLK
Vertical Display Area	tvd		600		TH
VSD Period	tv	610	630	800	TH
VSD Blanking	tvbp + tvfp	10	30	200	TH

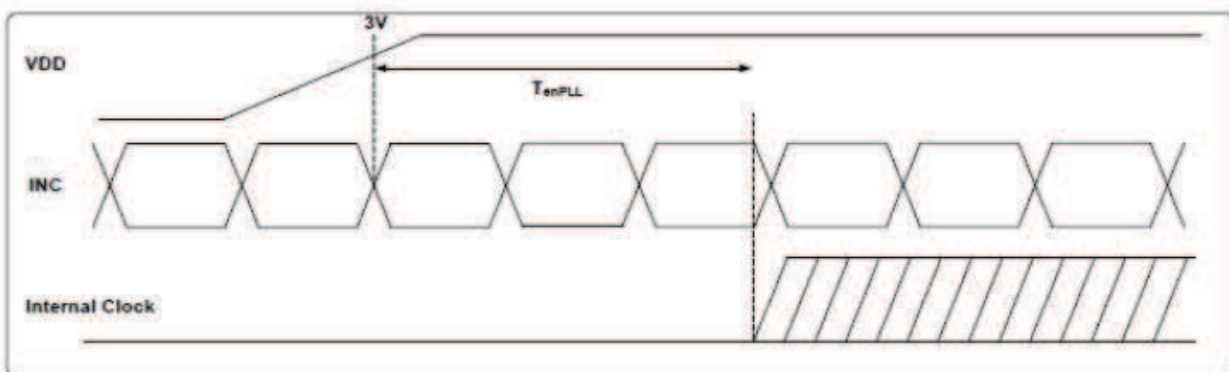
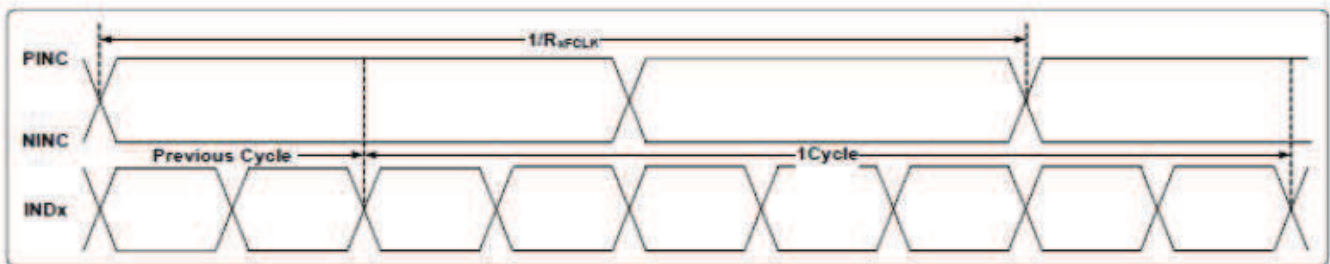
DE mode (800 x 600)

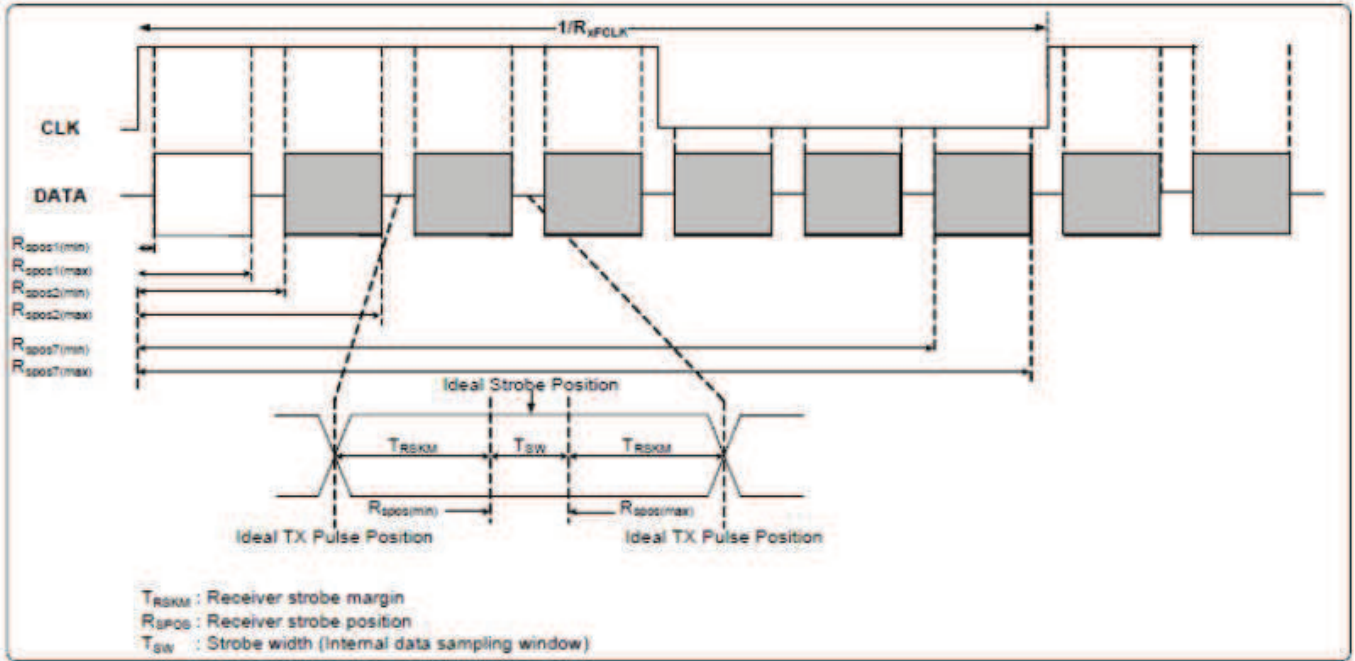
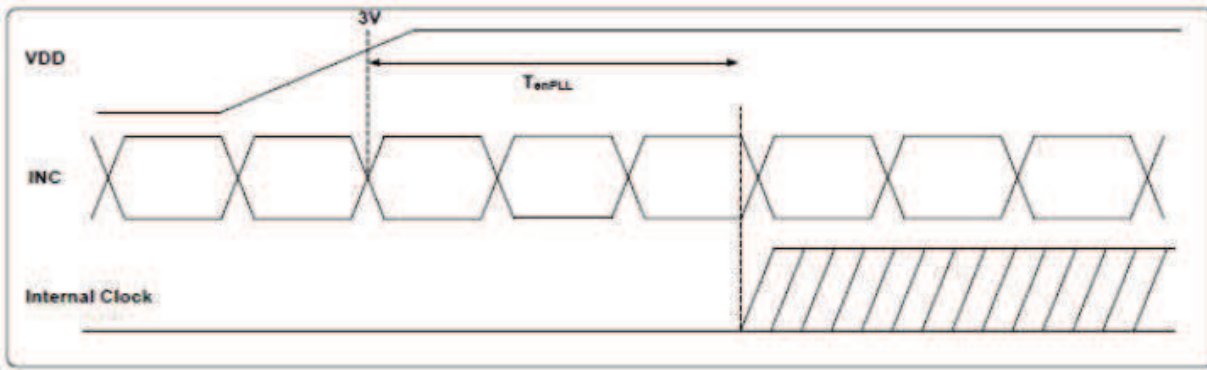
LVDS RX INTERFACE TIMING PARAMETER

The specification of the LVDS Rx interface timing parameter is shown below.

Parameter	Symbol	Min	Typ	Max	Unit	Condition
Clock frequency	RXFCLK	20	-	85	MHz	-
Input data skew margin	TRSKM	-600	-	+600	pS	VID = 200mV RXVCM = 1.2V RXFCLK = 65MHz
Clock high time	TLVCH	-	$4/(7 * \text{RXFCLK})$	-	ns	-
Clock low time	TLVCL	-	$3/(7 * \text{RXFCLK})$	-	ns	-
PLL wake-up time	TemPLL	-	-	150	µs	-

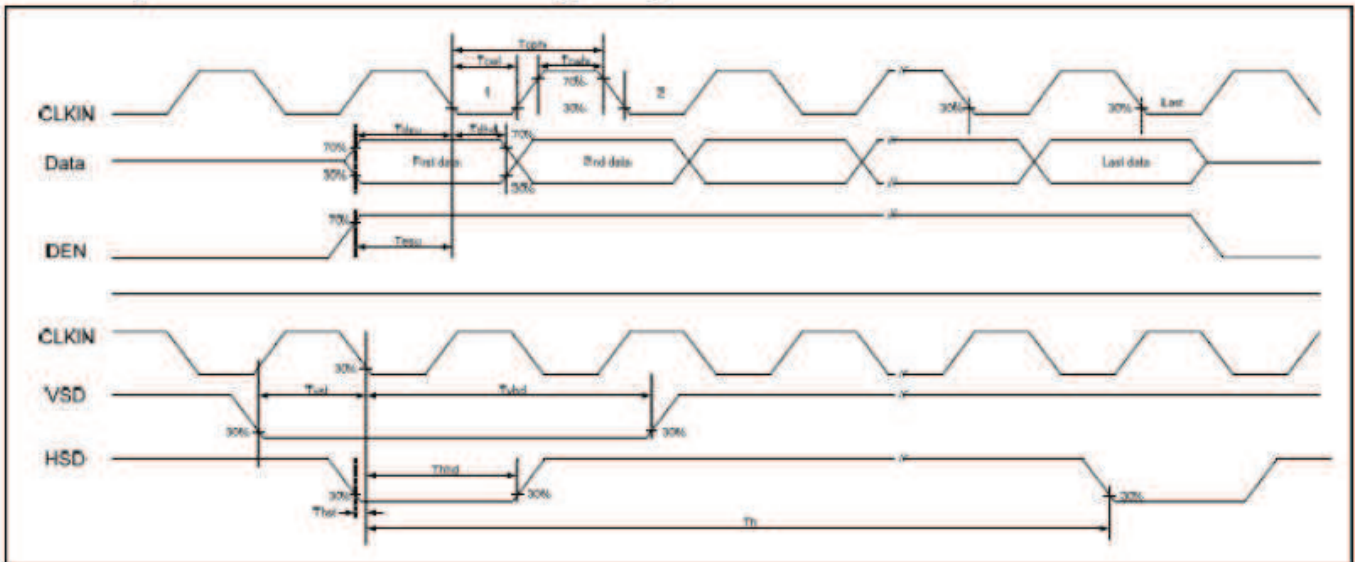
LVDS mode AD electrical characteristics

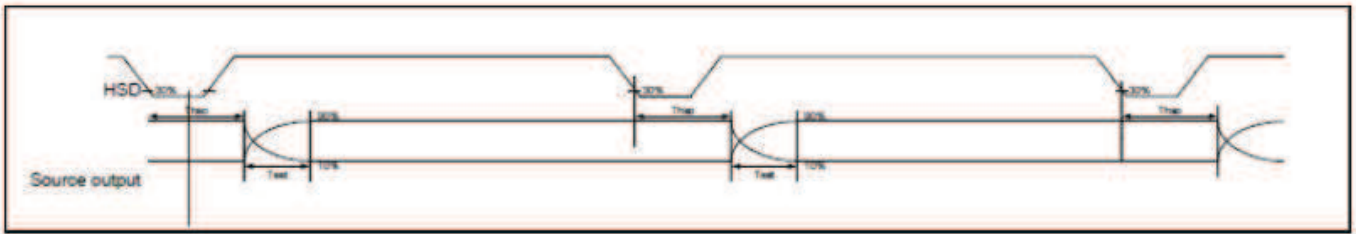




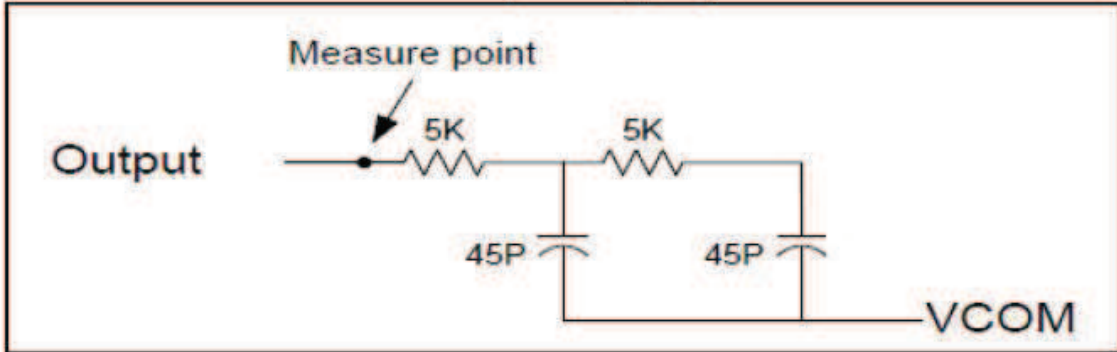
SIGNAL TIMING WAVEFORMS OF INTERFACE SIGNAL

a. Input Clock and Data Timing Diagram



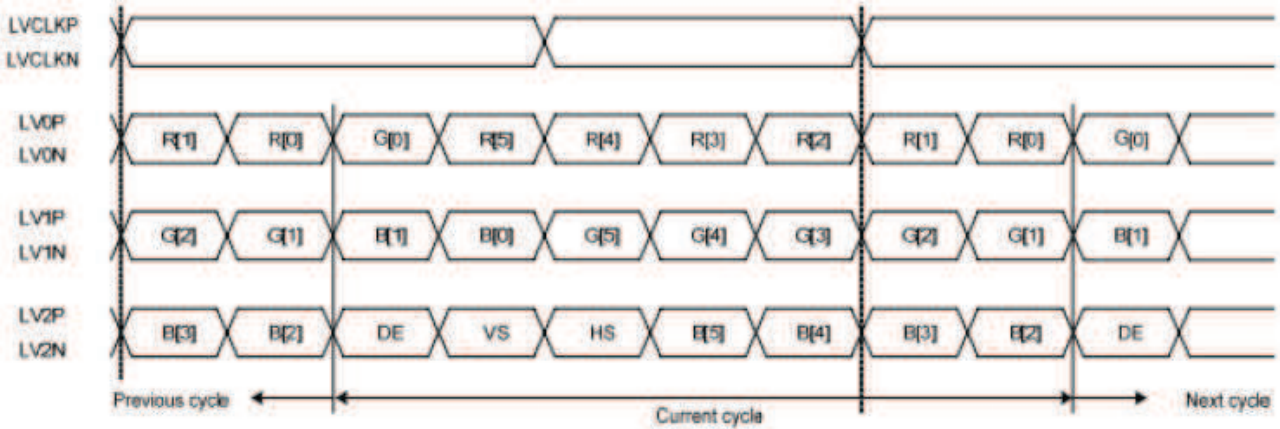


Source output timing diagram

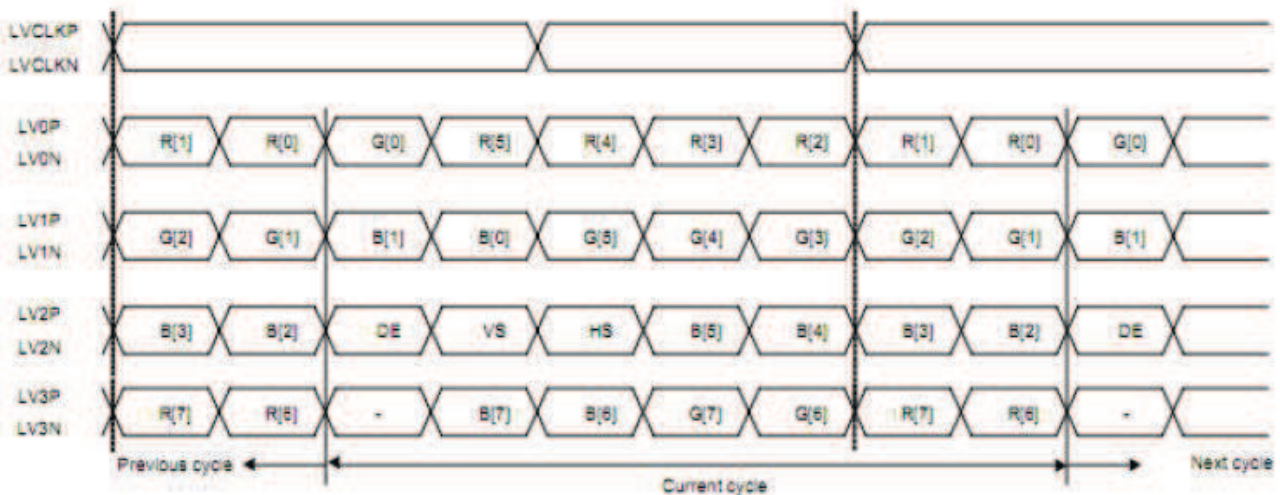


Output load condition

LVDS INPUT SIGNAL

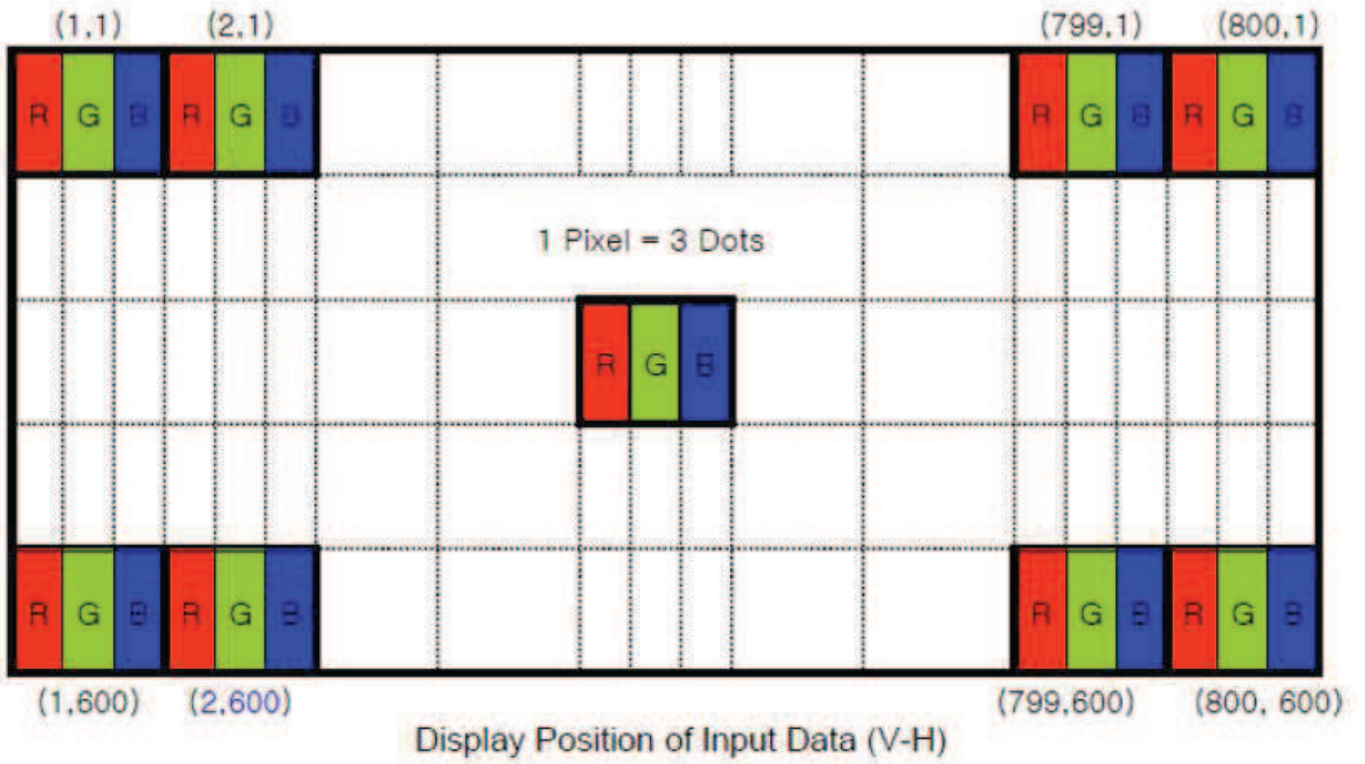


6-bit LVDS input data mapping

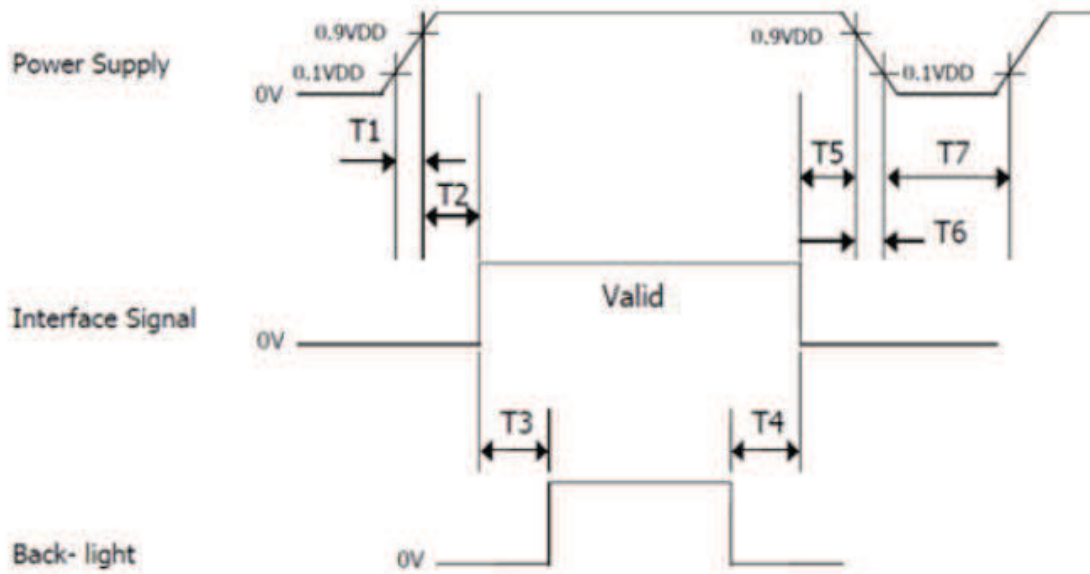


8-bit LVDS input data mapping

DATE INPUT FORMAT



9. POWER SEQUENCE



Parameter	Values			Units
	Min	Typ	Max	
T1	0.5	-	10	ms
T2	0	-	50	ms
T3	200	-	-	ms
T4	200	-	-	ms
T5	0.5	-	50	ms
T6	0	-	10	ms
T7	500	-	-	ms

10. RELIABILITY TEST CONDITIONS

No.	Test item	Test condition	Inspection after test	
10.1	High temperature storage test	+80°C/240 hours	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-d isplay,missing lines, Short lines,ITO corrosion; 3.Visual defect : Air bubble in the LCD,Seal leak,Glass crack.	
10.2	Low temperature storage test	-30°C/240 hours		
10.3	High temperature operating test	+70°C/120 hours		
10.4	Low temperature operating test	-20°C/120 hours		
10.5	Temperature cycle storage test	-30°C ~ 25°C ~ +80°C/10cycles (30min.) (10min.) (30min.)		
10.6	High temperature high humidity test	+50°C*90% RH/120 hours		
10.7	Vibration test	Frequency : 250 r/min Amplitude : 1 inch Time: 45min		
10.8	Drop test	Drop direction: 1 corner/3 edges/6 sides 10 time		
		Packing weight(kg)		Drop height(cm)
		<11		80±1.6
		11 ≧ G < 21	60±1.2	
		21 ≧ G < 31	50±1.0	
		31 ≧ G < 40	40±0.8	
10.9	ESD test	Air discharge: ±8KV, 10time Contact discharge: ±4KV, 10time		

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 polarizers which easily be damaged. And since the module is 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 happens 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 uses C-MOS LSI drivers, so we recommend 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 employs 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 than the limit causes 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 than the operating temperature range and on the other hand at higher temperature LCD's show 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 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.