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SHARP

DISPLAY DEVICE GROUP
SHARP CORPORATION
SPECIFICATIONS

TECHNICAL LITERATURE FOR

TFT-LCD module

MODEL No. LQ079L1SX01

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DEVELOPMENT DEPERTMENT 2
DISPLAY DEVICE DIVISION 2
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MODEL No.: LQ079L1SX01 Technical literature

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LCY-W13Z51	25,Jan.,2014			1st ISSUE Technical literature	

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[For handling and system design]

(1) Do not scratch the surface of the polarizer film as it is easily damaged.

(2) If the cleaning of the surface of the LCD panel is necessary, wipe it swiftly with cotton or other soft cloth. Do not use organic solvent as it damages polarizer.

(3) Water droplets on polarizer must be wiped off immediately as they may cause color changes, or other defects if remained for a long time.

(4) Since this LCD panel is made of glass, dropping the module or banging it against hard objects may cause cracks or fragmentation.

(5) Certain materials such as epoxy resin (amine's hardener) or silicone adhesive agent (de-alcohol or de-oxym) emits gas to which polarizer reacts (color change). Check carefully that gas from materials used in system housing or packaging do not hart polarizer.

(6) Liquid crystal material will freeze below specified storage temperature range and it will not get back to normal quality even after temperature comes back within specified temperature range. Liquid crystal material will become isotropic above specified temperature range and may not get back to normal quality. Keep the LCD module always within specified temperature range.

(7) Do not expose LCD module to the direct sunlight or to strong ultraviolet light for long time.

(8) If the LCD driver IC (COG) is exposed to light, normal operation may be impeded. It is necessary to design so that the light is shut off when the LCD module is mounted.

(9) Do not disassemble the LCD module as it may cause permanent damage.

(10) As this LCD module contains components sensitive to electrostatic discharge, be sure to follow the instructions in

below.

① Operators

Operators must wear anti-static wears to prevent electrostatic charge up to and discharge from human body.

② Equipment and containers

Process equipment such as conveyer, soldering iron, working bench and containers may possibly generate electrostatic charge up and discharge. Equipment must be grounded through 100Mohms resistance. Use ion blower.

③ Floor

Floor is an important part to leak static electricity which is generated from human body or equipment.
There is a possibility that the static electricity is charged to them without leakage in case of insulating floor, so the countermeasure(electrostatic earth:$1\times10^{8}\Omega$) should be made.

④Humidity

Proper humidity of working room may reduce the risk of electrostatic charge up and discharge. Humidity should be kept over 50% all the time.

⑤Transportation/storage

Storage materials must be anti-static to prevent causing electrostatic discharge.

⑥Others

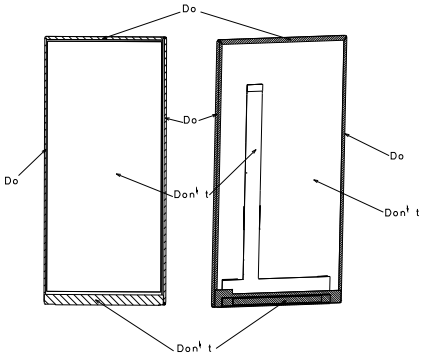
Protective film is attached on the surface of LCD panel to prevent scratches or other damages. When removing this protective film, remove it slowly under proper anti-ESD control such as ion blower.

(11) Hold LCD very carefully when placing LCD module into the system housing. Do not apply excessive stress or pressure to LCD module. Do not to use chloroprene rubber as it may affect on the reliability of the electrical interconnection.

(12) Do not hold or touch LCD panel to flex interconnection area as it may be damaged.

(13) As the binding material between LCD panel and flex connector mentioned in 12) contains an organic material, any type of organic solvents are not allowed to be used. Direct contact by fingers is also prohibited.

(14) When carrying the LCD module, place it on the tray to protect from mechanical damage. It is recommended to use the conductive trays to protect the CMOS components from electrostatic discharge. When holding the module, hold the Plastic Frame of LCD module so that the panel, COG and other electric parts are not damaged.



(15) Do not touch the COG's patterning area. Otherwise the circuit may be damaged.

(16) Do not touch LSI chips as it may cause a trouble in the inner lead connection.

(17) Place a protective cover on the LCD module to protect the glass panel from mechanical damages.

(18) LCD panel is susceptible to mechanical stress and even the slightest stress will cause a color change in background. So make sure the LCD panel is placed on flat plane without any continuous twisting, bending or pushing stress.

(19) Protective film is placed onto the surface of LCD panel when it is shipped from factory. Make sure to peel it off before assembling the LCD module into the system. Be very careful not to damage LCD module by electrostatic

discharge when peeling off this protective film. Ion blower and ground strap are recommended.

(20) Make sure the mechanical design of the system in which the LCD module will be assembled matches specified viewing angle of this LCD module.

(21) This LCD module does not contain nor use any ODS (1,1,1-Trichloroethane, CCL4) in all materials used, in all production processes.

[For operating LCD module]

(1) Do not operate or store the LCD module under outside of specified environmental conditions.
(2) At the shipment, adjust the contrast of each LCD module with electric volume. LCD contrast may vary from panel to panel depending on variation of LCD power voltage from system.
(3) As opt-electrical characteristics of LCD will be changed, dependent on the temperature, the confirmation of display quality and characteristics has to be done after temperature is set at 25 °C and it becomes stable.

[Precautions for Storage]

(1) Do not expose the LCD module to direct sunlight or strong ultraviolet light for long periods. Store in a dark place.
(2) The liquid crystal material will solidify if stored below the rated storage temperature and will become an isotropic liquid if stored above the rated storage temperature, and may not retain its original properties. Only store the module at normal temperature and humidity (25±5°C,60±10%RH) in order to avoid exposing the front polarizer to chronic humidity.
(3) Keeping Method
a. Don't keeping under the direct sunlight. b. Keeping in the carton under the dark place.

[Other Notice]

(1) Do not operate or store the LCD module under outside of specified environmental conditions.
(2) As electrical impedance of power supply lines (IOVCC/VSP/VSN-GND) are low when LCD module is working, place the de-coupling capacitor near by LCD module as close as possible.
(3) Reset signal must be sent after power on to initialize LSI. LSI does not function properly until initialize it by reset signal.
(4) Generally, at power on, in order not to apply DC charge directly to LCD panel, supply logic voltage first and initialize LSI logic function including polarity alternation. Then supply voltage for LCD bias. At power off, in order not to apply DC charge directly to LCD panel, execute Power OFF sequence and Discharge command.
(5) Don't touch to FPC surface, exposed IC chip, electric parts and other parts, to any electric, metallic materials.
(6) No bromide specific fire-retardant material is used in this module.
(7) Do not display still picture on the display over 2 hours as this will damage the liquid crystal.
(8) The connector used in this LCD module is the one Sharp have not ever used.
Therefore, please note that the quality of this connector concerned is out of Sharp's guarantee.

(9) Be sure to use a power supply with the safety protection circuit such as the fuse for excess voltage,excess current, electric discharge waveform and Latch-up occurring.

(10) Epoxy resin (amine series curing agent), silicone adhesive material (dealcoholization series and oxime series), tray forming agent (azo compound) etc, in the cabinet or the packing materials may induce abnormal display with polarizer film deterioration regardress of contact or noncontact to polarizer film.

Be sure to confirm the component of them.
(11) This module is designed for OCA TP bonding. If you are changing TP system, please contact us.

[Precautions for Discarding Liquid Crystal Modules]

COG: After removing the LSI from the liquid crystal panel, dispose of it in a similar way to circuit boards from electronic devices.
LCD panel: Dispose of as glass waste. This LCD module contains no harmful substances. The liquid crystal panel contains no dangerous or harmful substances. The liquid crystal panel only contains an extremely small amount of liquid crystal (approx.100mg) and therefore it will not leak even if the panel should break.
Its median lethal dose (LD50) is greater than 2,000 mg/kg and a mutagenetic (Aims test:negative) material is employed.
FPC: Dispose of as similar way to circuit board from electric device.

TFT-LCD MODULE

LQ079L1SX01

DEVICE SPECIFICATIONS

CONTENTS

1. Application

This data sheet is to introduce the specification of LQ079L1SX01 active matrix 16,777,216color LCD module.
Main color LCD module is controlled by Driver IC (Novatek NT35523).
If any problem occurs concerning the items not stated in this specification, it must be solved sincerely by both parties after deliberation.
As to basic specification of driver IC refer to the IC specification and handbook.

2. Construction and Outline

Construction: LCD panel, Driver (COG), FPC with electric components,
24 White LEDs lump, prism sheet, diffuser, light guide and reflector, plastic frame and metal frame to fix them mechanically.
Outline: See page 28
Connection: Board to board connector (HIROSE, BM14B(0.8)-50DP-0.4V(51))
There shall be no scratches, stains, chips, distortions and other external drawbacks that may affect the display function.

In order to realize thin module structure, double-sided adhesive tapes are used to fix LCD panels. As these tapes do not guarantee to permanently fix the panels, LCD panel may rise from the module when shipped from factory.
So please make sure to design the system to hold the edges of LCD panel by the soft material such as sponge when LCD module is assembled into the cabinet.

3. Mechanical Specification

Table 1

Parameter		Specifications	Unit
Outline dimensions (typ)		125.55 (W) × 170.95 (H) × 1.95 (D) *1	mm
Main LCD Panel	Active area	119.808 (W) × 159.744(H)	mm
	Display format	1536(W) × RGB × 2048(H)	-
	Dot pitch	0.026 (W) × 0.078 (H)	mm
	Base color	Normally Black	-
	Illumination mode	Transmissive	
Mass		TBD	g

*1 The above-mentioned table indicates module sizes without some projections and FPC.

4. Electrical Absolute Maximum Ratings

Table 2

Parameter	Symbol	Rated value	Unit	Remarks
Driver IC (Positive Analog) Power Supply Voltage	VSP	-0.3～+6.6	V	【Note4-1,3】
Driver IC (Negative Analog) Power Supply Voltage	VSN	+0.3～-6.6	V	【Note4-1,3】
Driver IC (Digital) Power Supply Voltage	IOVCC	-0.3～+5.5	V	【Note4-1,2】
LED Backlight Power Supply Current	ILED	0～+35	mA	Per line 6pcs serial*4parallel

【Note4-1】If used beyond the absolute maximum ratings, the LSI may be destroyed. It is strongly recommended to use the LSI within the limits of its electrical characteristics during normal operation. The reliability of LSI is not guaranteed if used in the conditions beyond the limits and it may lead to malfunction.

【Note4-2】Make sure (High) IOVCC≥ GND (Low).

【Note4-3】Make sure (High) VSP ≥ GND (Low), (Low) VSN≤GND (High).

5.Environment Conditions

Table 3

Item	Top		Tstg		Remark
	MIN.	MAX.	MIN.	MAX.	
Ambient temperature	-20 °C	+60°C	-30 °C	+70°C	【Note5-1】

【Note5-1】Humidity:90%RHMax.(at Ta≤40°C). Maximum wet-bulb temperature is less than 39°C (at Ta>40°C). Condensation of dew must be avoided.

As opt-electrical characteristics of LCD will be changed, dependent on the temperature, the confirmation of display quality and characteristics has to be done after temperature is set at 25 °C and it becomes stable. Be sure not to exceed the rated voltage, otherwise a malfunction may occur.

6. Electrical Specifications

(6-1) Power Supply Voltage Range

Table 4

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remarks
Driver IC(Positive Analog) Power Supply Voltage	VSP	5.5	5.6	5.7	V	【Note6-1】
Driver IC(Negative Analog) Power Supply Voltage	VSN	-5.5	-5.6	-5.7	V	【Note6-1】
Driver IC(Digital) Power Supply Voltage	IOVCC	1.7	1.8	1.9	V	【Note6-1】

(6-2) DC characteristics

Table 5 IOVCC=1.8V, VSP=5.6V, VSN=-5.6V

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remarks
Input voltage (Low)	V_{IL}	0	-	0.3*IOVCC	V	【Note6-2,3】
Input voltage (High)	V_{IH}	0.7*IOVCC	-	IOVCC	V	【Note6-2,3】
Input current (Low)	I_{IL}	-1	-	-	μA	【Note6-2,3】
Input current (High)	I_{IH}	-	-	1	μA	【Note6-2,3】
Output voltage (Low)	V_{oL}	0	-	0.2*IOVCC	V	【Note6-2,4】
Output voltage (High)	V_{oH}	0.8*IOVCC	-	IOVCC	V	【Note6-2,4】
Current consumption	I_{VSP}	-	TBD	TBD	mA	【Note6-5】
	I_{VSN}	-	TBD	TBD	mA	【Note6-5】
	I_{IOVCC}	-	TBD	TBD	mA	【Note6-5】
	I_{VSP}	-	TBD	TBD	mA	【Note6-6】
	I_{VSN}	-	TBD	TBD	mA	【Note6-6】
	I_{IOVCC}	-	TBD	TBD	mA	【Note6-6】

【Note6-1】Include Ripple Noise

【Note6-2】Applied overshoot

【Note6-3】Apply to terminal of RESET

【Note6-4】Apply to terminal of LCD-PWM,LCD-TE

【Note6-5】Measurement Conditions : Full screen white pattern, VSP/VSN=±5.60V,IOVCC=1.80V,60Hz Refresh

【Note6-6】Measurement Conditions : Deep standby mode

(6-3) MIPI DSI characteristics

<DC characteristics>

Table 6

Item		Symbol	Test condition	Min.	Typ.	Max.	Unit	Note
HS-RX	Differential input high threshold	VIDTH	IOVCC=1.7V～1.9V	-	-	70	mV	3
	Differential input low threshold	VIDTL	IOVCC=1.7V～1.9V	-70	-	-	mV	3
	Single-ended input low voltage	VILHS	IOVCC=1.7V～1.9V	-40	-	-	mV	
	Single-ended input high voltage	VIHHS	IOVCC=1.7V～1.9V	-	-	460	mV	
	Common-mode voltage HS receive mode	VCMRX(DC)	IOVCC=1.7V～1.9V	70	-	330	mV	1
	Differential input impedance	ZID	IOVCC=1.7V～1.9V	-	100	-	Ω	2
LP-RX	Logic 0 input voltage not in ULP State	VIL	IOVCC=1.7V～1.9V	0	-	550	mV	
	Logic 1 input voltage	VIH	IOVCC=1.7V～1.9V	880	-	1350	mV	
	I/O leakage current	ILEAK	IOVCC=1.7V～1.9V	-10	-	10	μA	
LP-TX	Thevenin output low level	VOL	IOVCC=1.7V～1.9V	-50	-	50	mV	
	Thevenin output high level	VOH	IOVCC=1.7V～1.9V	1.1	-	1.3	V	
	Output impedance of LP transmitter	ZOLP	IOVCC=1.7V～1.9V	TBD	-	-	Ω	2
CD-RX	Logic 0 contention threshold	VILCD	IOVCC=1.7V～1.9V	0	-	200	mV	
	Logic 1 contention threshold	VIHCD	IOVCC=1.7V～1.9V	450	-	1350	mV	

Notes: 1. VCMRX (DC) = (V_{DP}+V_{DN})/2

2. Excluding COG resistance (contact resistance and ITO wiring resistance). The values are tentative.

3. Minimum 110mV/-110mV HS differential swing is required for display data transfer.

<AC Characteristics>

High Speed Mode

Table 7

Signal	Symbol	Parameter	Min.	Typ.	Max.	Unit	Description
DSI-CLK+/-	$2xUI_{INST}$	Double UI instantaneous	2	-	5	ns	8 Lane(Note 5)
DSI-CLK+/-	UI_{INSTA} UI_{INSTB}	UI instantaneous halfs ($UI=UI_{INSTA}=UI_{INSTB}$)	1	-	2.5	ns	8 Lane(Note 5)
DSI-Dn+/-	t_{DS}	Data to clock setup time	0.15xUI	-	-	ps	
DSI-Dn+/-	t_{DH}	Data to clock hold time	0.15xUI	-	-	ps	
DSI-CLK+/-	t_{DRTCLK}	Differential rise time for clock	150	-	0.3xUI	ps	
DSI-Dn+/-	$t_{DRTDATA}$	Differential rise time for data	150	-	0.3xUI	ps	
DSI-CLK+/-	t_{DFTCLK}	Differential fall time for clock	150	-	0.3xUI	ps	
DSI-Dn+/-	$t_{DFTDATA}$	Differential fall time for data	150	-	0.3xUI	ps	

Notes: 4. Dn=D0(A/B)，D1(A/B)，D2(A/B) and D3(A/B).
5. Maximum total bit rate is 4Gbps for 24-bit data format.

Low Power Mode

Table 8

Signal	Symbol	Parameter	Min.	Typ.	Max.	Unit	Description
DSI-D0+/-	T_{LPXM}	Length of LP-00,LP-01,LP-10 or LP-11 periods MPU→Display Module	50	-	75	ns	Input
DSI-D0+/-	T_{LPXD}	Length of LP-00,LP-01,LP-10 or LP-11 periods Display Module →MPU	50	-	75	ns	Output
DSI-D0+/-	$T_{TA-SURED}$	Time-out before the MPU start driving	T_{LPXD}	-	$2xT_{LPXD}$	ns	Output
DSI-D0+/-	$T_{TA-GETD}$	Time to drive LP-00 by display module	$5x\ T_{LPXD}$	-	-	ns	Input
DSI-D0+/-	T_{TA-GOD}	Time to drive LP-00 after turnaround request -MPU	$4x\ T_{LPXD}$	-	-	ns	Output

Table 9 **MIPI DSI LP-RX/TX Clock and Data-Clock Specifications**

Signal	Symbol	Parameter	Min.	Typ.	Max.	Unit	Description
Low Power Mode to High Speed Mode Timing							
DSI-Dn+/-	T_{LPX}	Length of any low power state period	50	-	-	ns	Input
DSI-Dn+/-	$T_{HS-PREPARE}$	Time to drive LP-00 to prepare for HS transmission	40+4*UI	-	85+6*UI	ns	Input
DSI-Dn+/-	$T_{HS-TERM-EN}$	Time to enable data receiver line termination measured from when Dn crosses V_{ILMAX}	-	-	35+4*UI	ns	Input
High Speed Mode to Low Power Mode Timing							
DSI-Dn+/-	$T_{HS-SKIP}$	Time-out at display module to ignore transition period of EoT	40	-	55+4*UI	ns	Input
DSI-Dn+/-	$T_{HS-EXIT}$	Time to drive LP-11 after HS burst	100	-	-	ns	Input
DSI-Dn+/-	$T_{HS-TRAIL}$	Time to drive flipped differential state after last payload data bit of a HS transmission burst	60+4*UI	-	-	ns	Input
High Speed Mode to/from Low Power Mode Timing							
DSI-CLK+/-	$T_{CLK-POS}$	Time that the MPU shall continue sending HS clock after the last associated data lane has transition to LP mode	60+52*UI	-	-	ns	Input
DSI-CLK+/-	$T_{CLK-TRAIL}$	Time to drive HS differential state after last payload clock bit of a HS transmission burst	60	-	-	ns	Input
DSI-CLK+/-	$T_{HS-EXIT}$	Time to drive LP-11 after HS burst	100	-	-	ns	Input
DSI-CLK+/-	$T_{CLK-PREPARE}$	Time to drive LP-00 to prepare for HS transmission	38	-	95	ns	Input
DSI-CLK+/-	$T_{CLK-TERM-EN}$	Time-out at clock lane display module to enable HS transmission	-	-	38	ns	Input
DSI-CLK+/-	$T_{CLK-PREPARE}$ +$T_{CLK-ZERO}$	Minimum lead HS-0 drive period before starting clock	300	-	-	ns	Input
DSI-CLK+/-	$T_{CLK-PRE}$	Time that the HS clock shall be driven prior to any associated data lane beginning the transition from LP to HS mode	8*UI	-	-	ns	Input

Notes: 6. Dn=D0，D1，D2 and D3.

7. Two HS transmission can be sent with a break as short as $T_{HS-EXIT}$ from each other in continuous clock mode. In discontinuous mode, the break is longer which account $T_{CLK-POS}$, $T_{CLK-TRAIL}$ and $T_{HS-EXIT}$, before activity in clock and data lanes again.

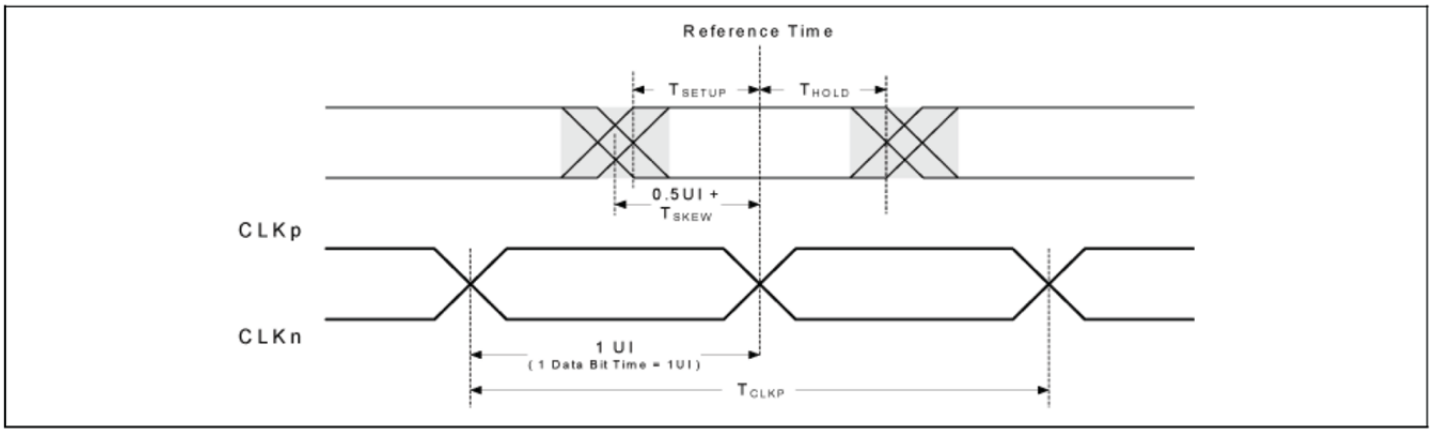


Fig.1 **Data to Clock Timing Definitions**

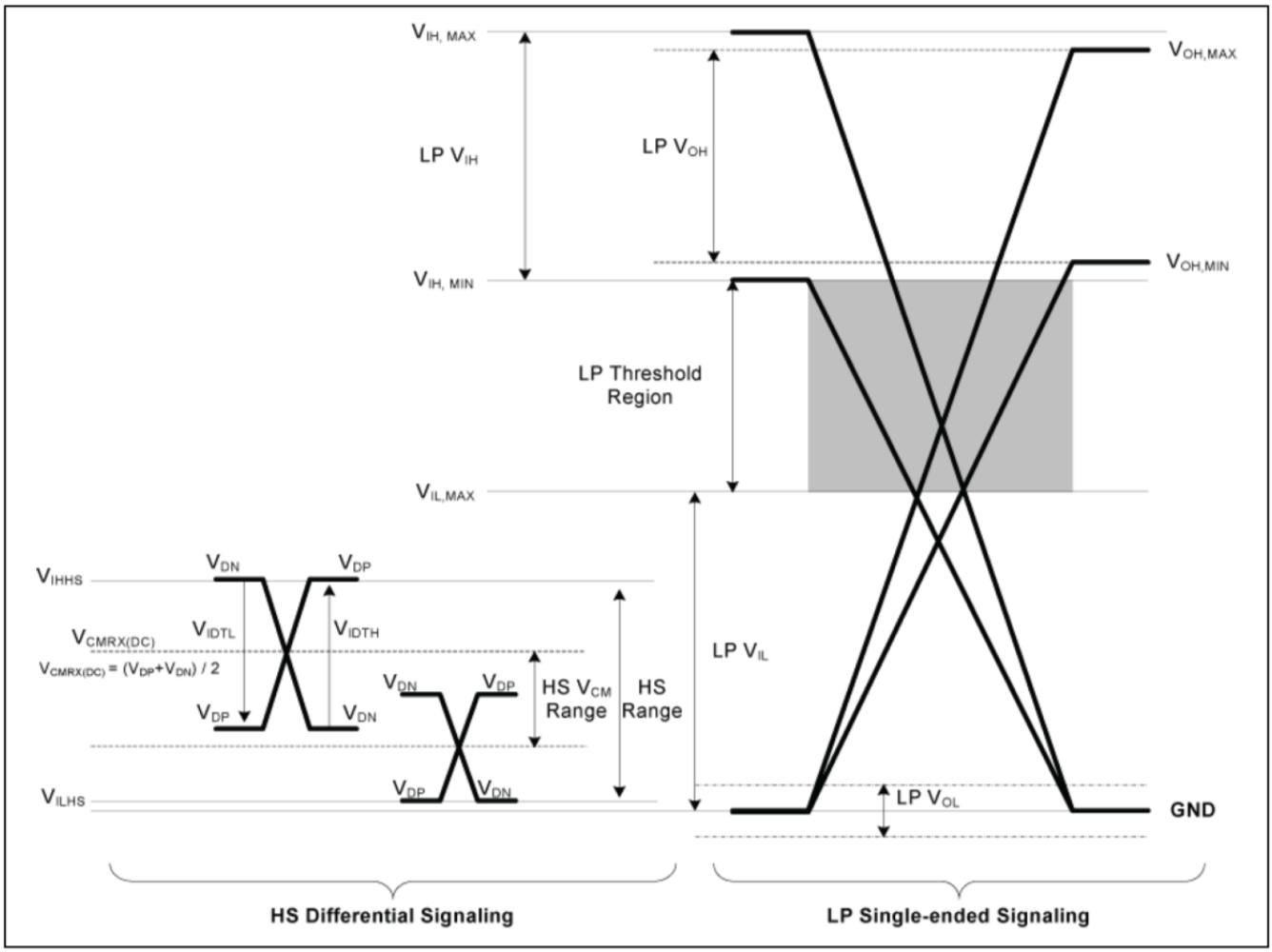


Fig.2 **DSI LP Mode**

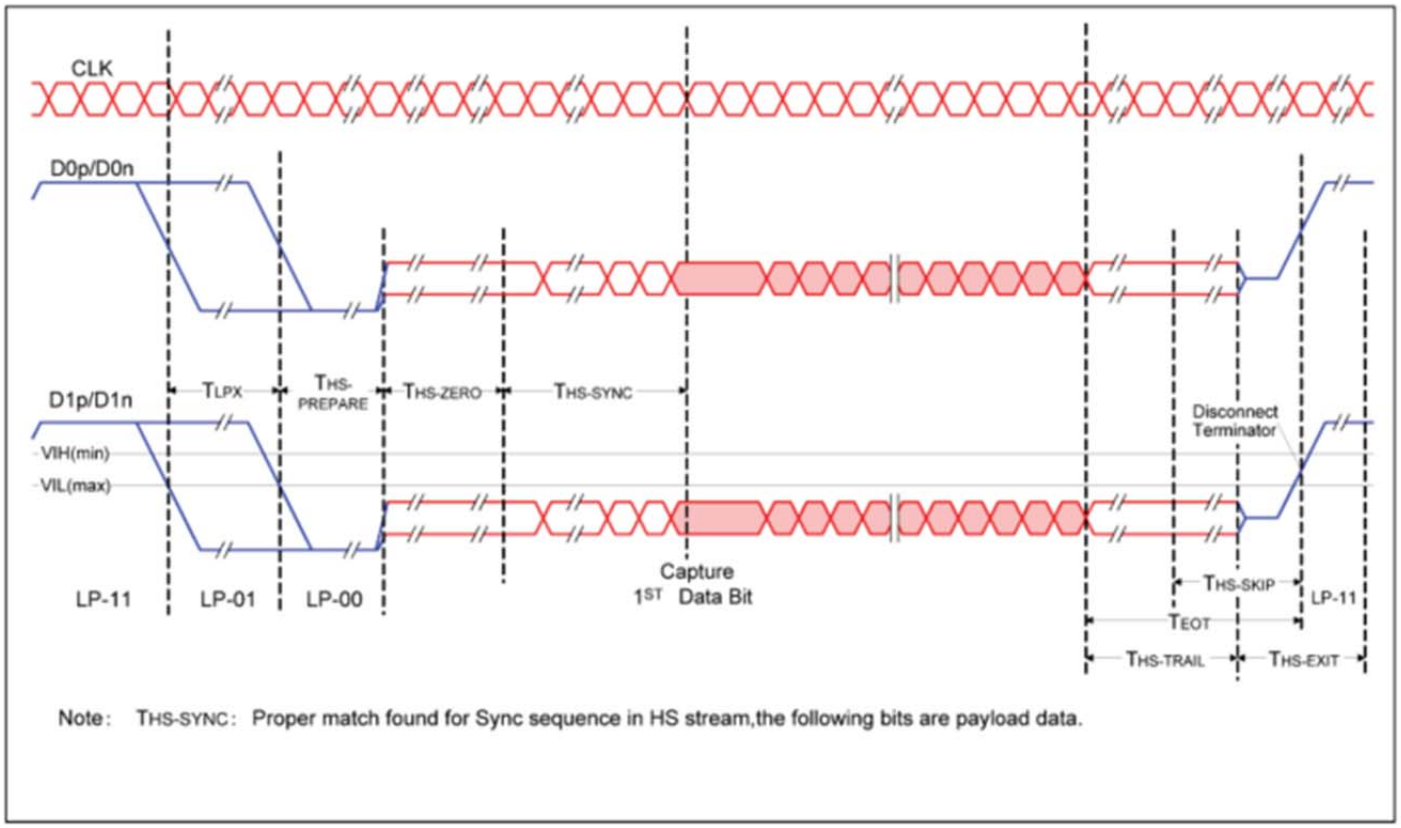


Fig.3 **HS Data Transmission in Bursts**

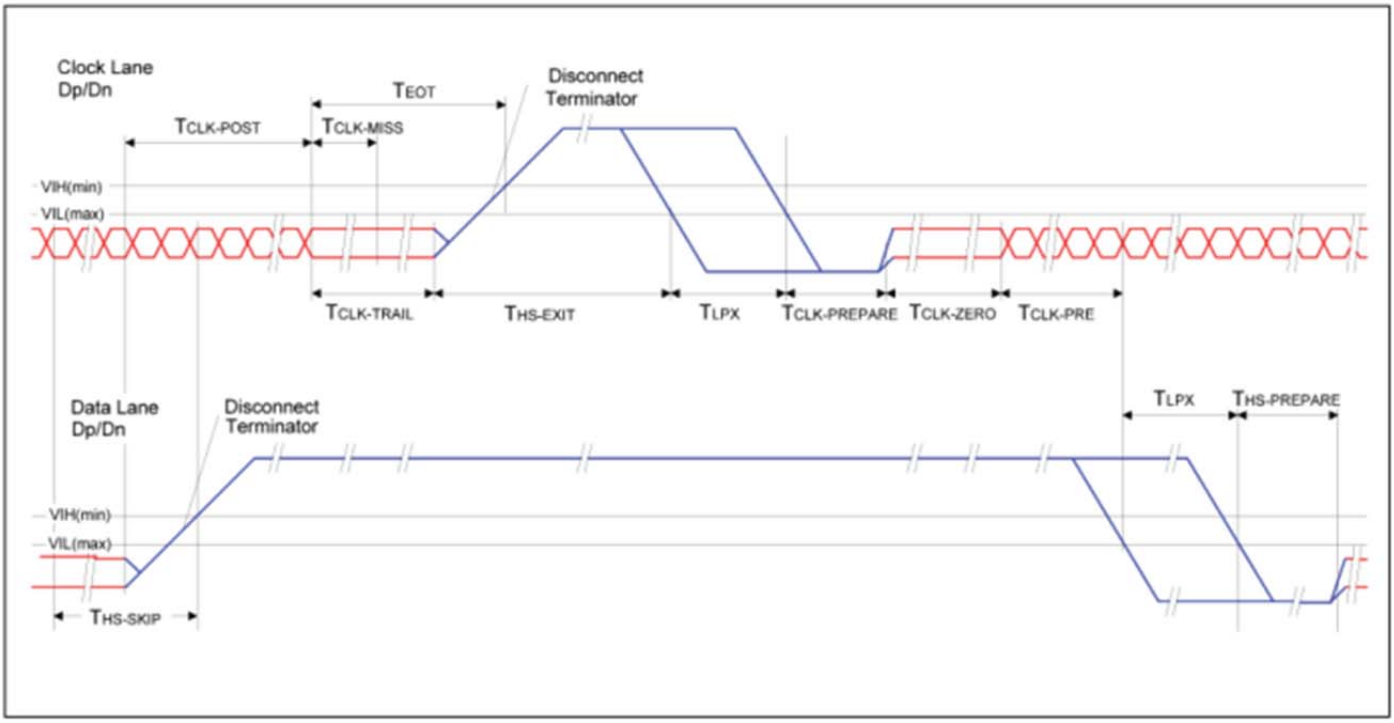


Fig.4 **Switching the Clock Lane between Clock Transmission and LP Mode**

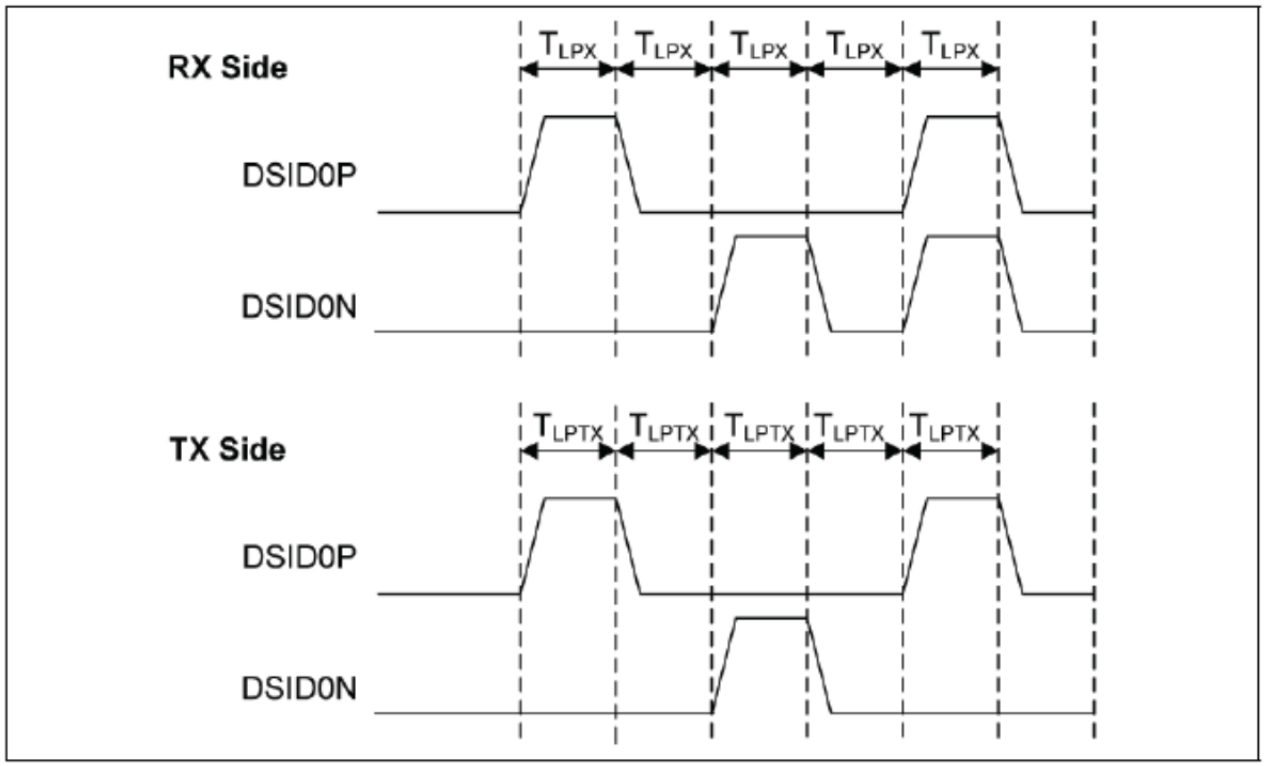


Fig.5 **DSI LP Mode(Rx/Tx)**

(6-4) LED backlight

At main panel the back light uses 24pcs white LEDs.

Table 10 Ta=25 °C

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Forward current	IILED-1	-	40	-	mA	LED Input1
	IILED-2	-	40	-	mA	LED Input2
LED-PWM Frequency	$f_{LED-PWM}$	-	25	-	KHz	LCD-PWM Output Frequency
LED-PWM Duty Ratio		10		100	%	LCD-PWM Output Duty Ratio

*Please consider Allowable Forward Current on used temperature

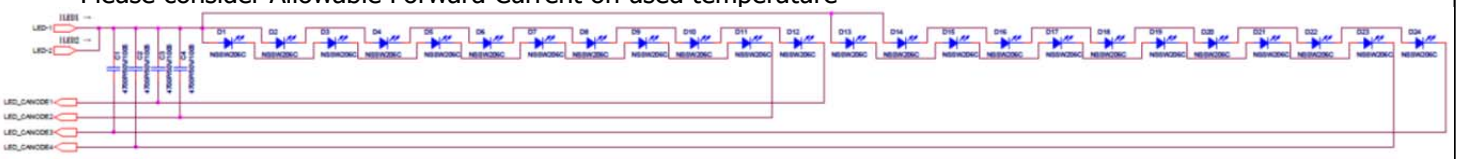


Fig.6 **Schematics drawing of backlight**

(6-5) Interface signals

Table 11

Pin No.	Symbol	I/O	Description	Remarks
1	LED-CATHODE4	-	LED back light power group4 negative	
2	GND	-	Ground	
3	LED-CATHODE3	-	LED back light power group3 negative	
4	DATAN3_B	I	MIPI data3 negative signal(Slave IC)	
5	LED-CATHODE2	-	LED back light power group2 negative	
6	DATAP3_B	I	MIPI data3 positive signal(Slave IC)	
7	LED-CATHODE1	-	LED back light power group1 negative	
8	GND	-	Ground	
9	NC	-	Not connect	
10	DATAN0_B	I	MIPI data0 negative signal(Slave IC)	
11	LED-1	-	LED back light power positive	
12	DATAP0_B	I	MIPI data0 positive signal(Slave IC)	
13	LED-2	-	LED back light power positive	
14	GND	-	Ground	
15	NC	-	Not connect	
16	CLKN_B	I	MIPI clock negative signal(Slave IC)	
17	IOVCC	I	Power supply to interface pins(logic)	
18	CLKP_B	I	MIPI clock positive signal(Slave IC)	
19	VSP	I	Power supply for analog(+5.6V)	
20	GND	-	Ground	
21	VSP	I	Power supply for analog(+5.6V)	
22	DATAN1_B	I	MIPI data1 negative signal(Slave IC)	
23	NC	-	Not connect	
24	DATAP1_B	I	MIPI data1 positive signal(Slave IC)	
25	VSN	I	Power supply for analog(-5.6V)	
26	GND	-	Ground	
27	VSN	I	Power supply for analog(-5.6V)	
28	DATAN2_B	I	MIPI data2 negative signal(Slave IC)	
29	GND	-	Ground	
30	DATAP2_B	I	MIPI data2 positive signal(Slave IC)	
31	RESET	I	Device reset signal	“L”Active
32	GND	-	Ground	
33	LCD-PWM	O	Backlight LED driver PWM	
34	DATAN3_A	I	MIPI data3 negative signal(Master IC)	
35	LCD_TE	O	Tearing signal output from driver IC	
36	DATAP3_A	I	MIPI data3 positive signal(Master IC)	
37	ID_DET	-	NC(floating setting in LCD module)	
38	GND	-	Ground	
39	GND	-	Ground	
40	DATAN0_A	I	MIPI data0 negative signal(Master IC)	
41	DATAP2_A	I	MIPI data2 positive signal(Master IC)	
42	DATAP0_A	I	MIPI data0 positive signal(Master IC)	
43	DATAN2_A	I	MIPI data2 negative signal(Master IC)	

44	GND	-	Ground	
45	GND	-	Ground	
46	CLKN_A	I	MIPI clock negative signal(Master IC)	
47	DATAP1_A	I	MIPI data1 positive signal(Master IC)	
48	CLKP_A	I	MIPI clock positive signal(Master IC)	
49	DATAN1_A	I	MIPI data1 negative signal(Master IC)	
50	GND	-	Ground	

Notes:The direction is named with respect to the display module, I = from host to LCM, O = from LCM to host.

Table 12 **Connector description**

Item	Description
Connector type	Board to Board
Pin amount	50
Manufacturer	Hirose
Part number	BM14B(0.8)-50DP-0.4V(51)

(6-6) General Timing Diagram

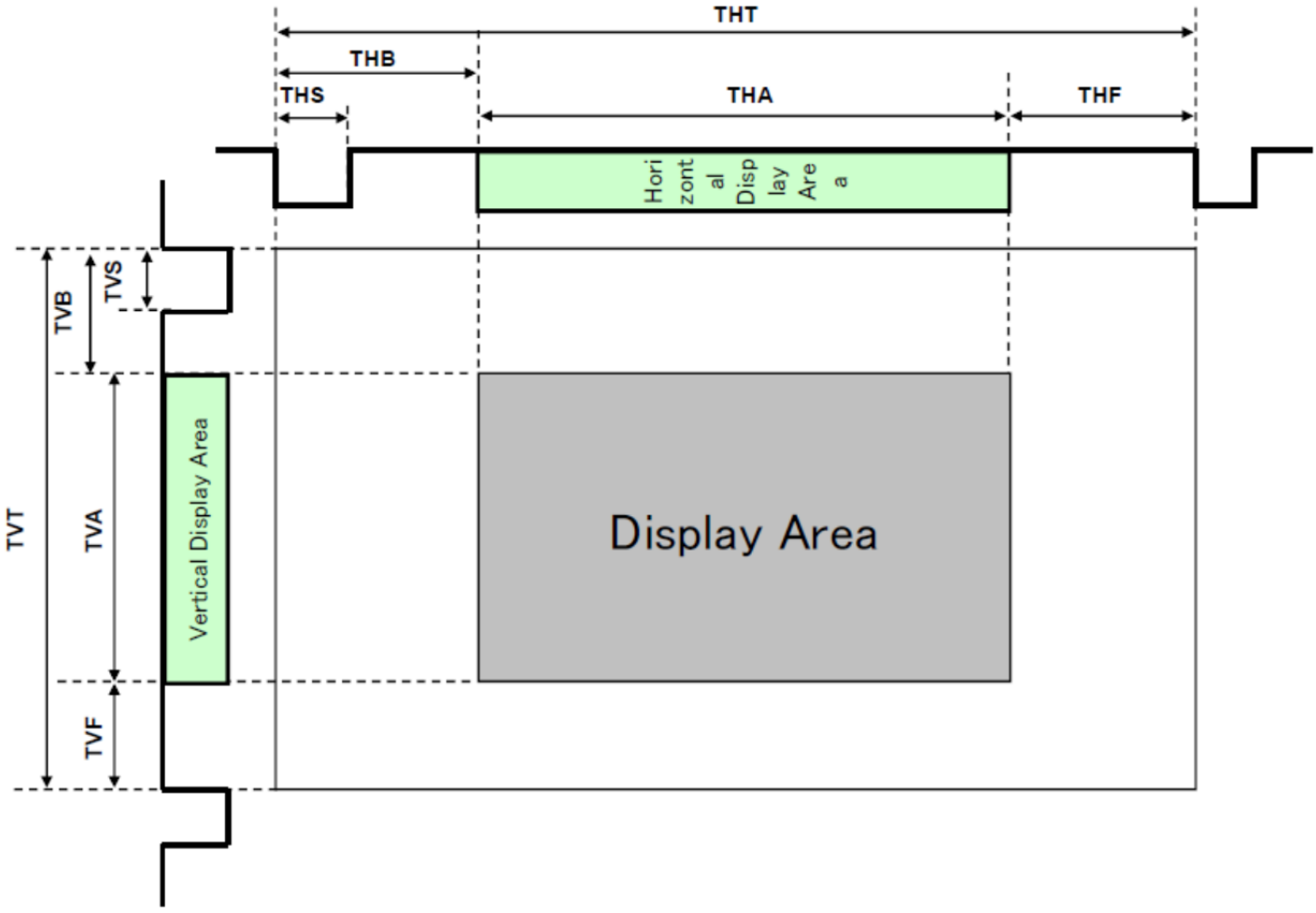


Fig.7

Table 13 Ta=25 °C

Item	Symbol	Min.	Typ.	Max.	Unit
Horizontal Frequency		-	124.32	-	kHz
Pixel Clock Frequency		-	118	-	MHz
Horizontal Total	THT	878	948	-	CK
Horizontal Synchronization	THS	1	24	-	CK
Horizontal Back Porch	THB	55	90	-	CK
Horizontal Address	THA	768	768	768	CK
Horizontal Front Porch	THF	55	90	-	CK
MIPI Port 1 & 2 Skew	SKEW	-THB	0	THF	A to B
Vertical Frequency		-	60	-	Hz
Vertical Total	TVT	2068	2072	-	THT
Vertical Synchronization	TVS	1	2	-	THT
Vertical Back Porch	TVB	8	10	-	THT
Vertical Address	TVA	2048	2048	2048	THT
Vertical Front Porch	TVF	12	14	-	THT
Mipi Clock Frequency		654	770	1000	Mbps

IOVCC＝1.8V,VSP=5.6V,VSN=-5.6V,GND=0V

(6-7) Reset Timing Characteristics

Table 14

Item	Symbol	Test condition	Min.	Max.	Unit
Reset low-level width1	tRW1	Power supply on	15	-	ms
Reset low-level width2	tRW2	Operation	10	-	us
Reset time (Sleep IN)	tRT1	-	-	20	ms
Reset time (Sleep OUT)	tRT2	-	-	120	ms
Noise reject width	tRESNR	-	-	5	us

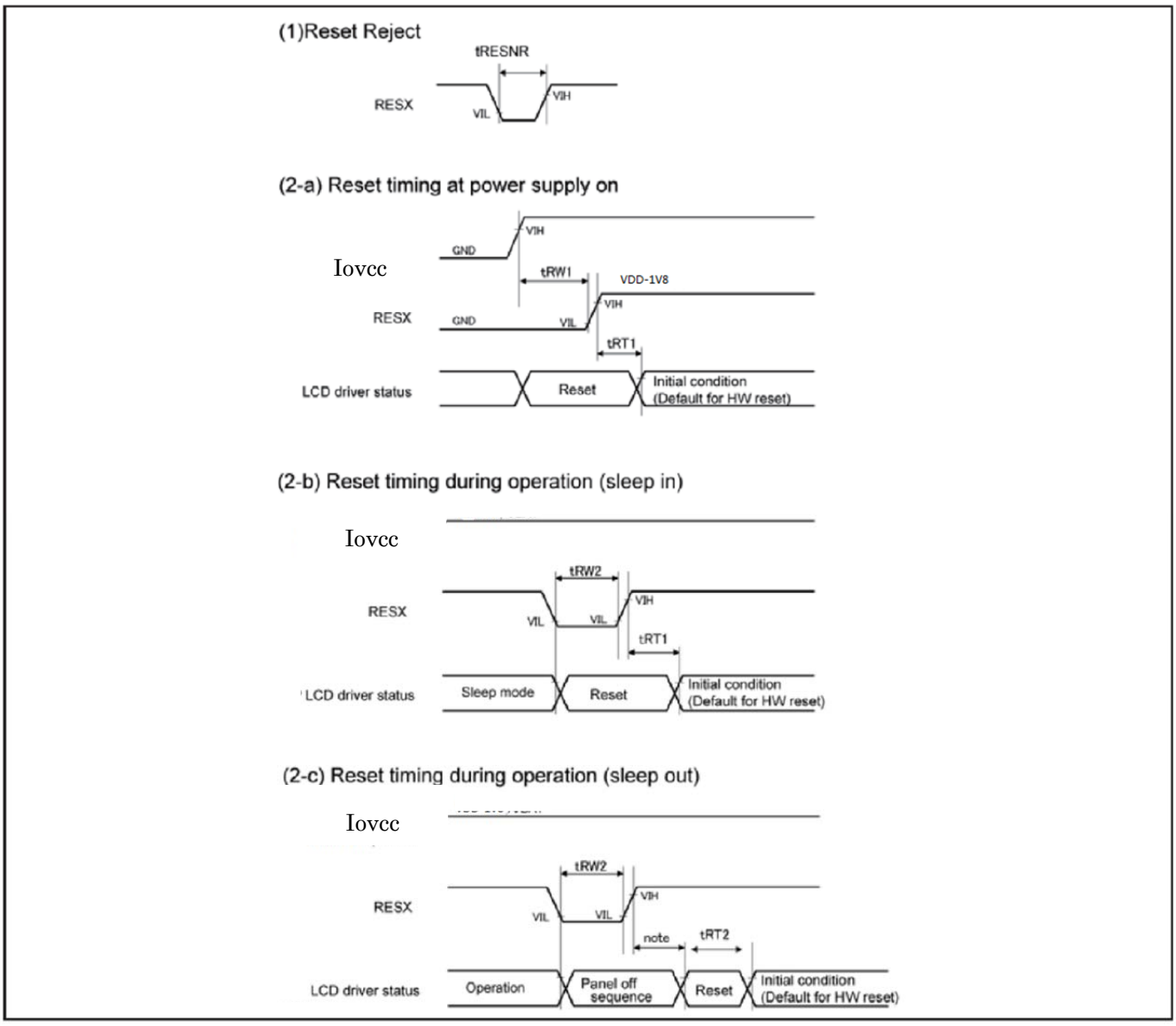


Fig.8 **Reset Timing Characteristics**

(6-8) Schematic of LCD module system

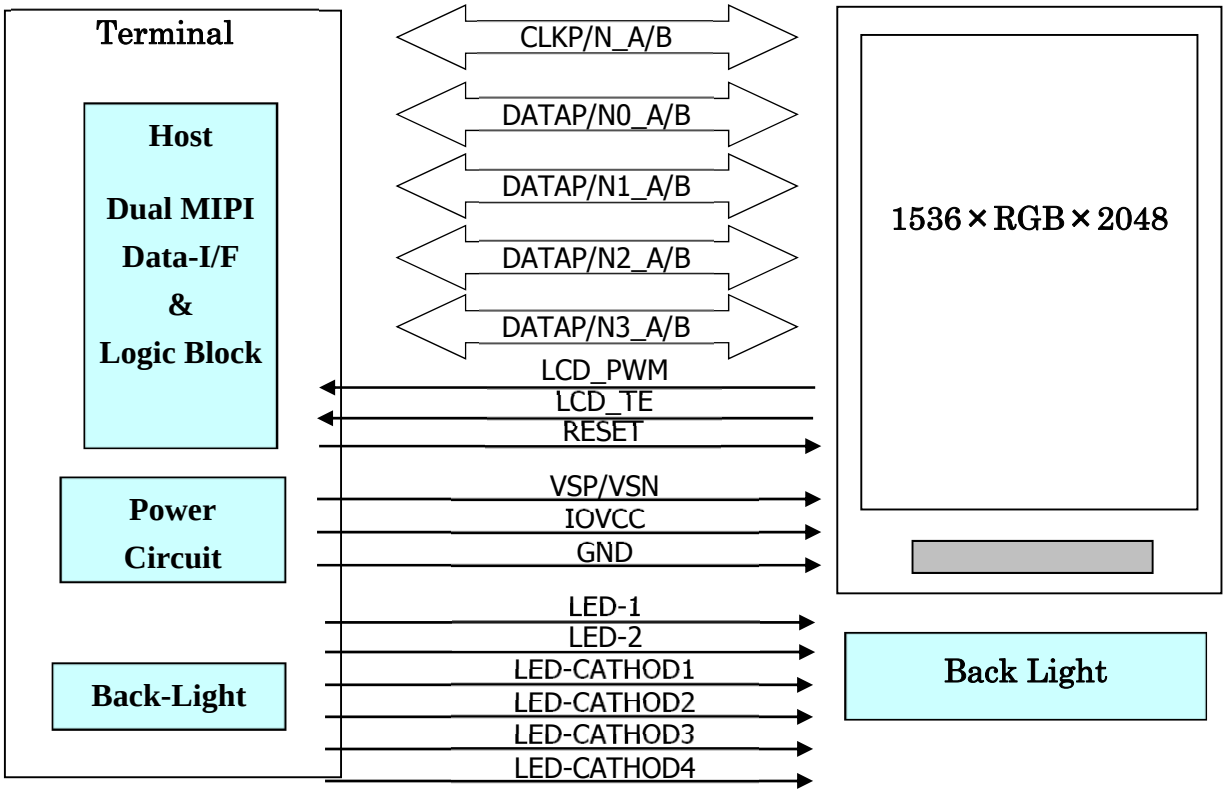


Fig.9 **Schematic of LCD module system**

7. Initial Sequence

Condition
I/F: MIPI DSI 8Lane,Video Mode (770)Mbps
Dots Size : 1536 x RGB x 2048
Power Supply:IOVCC=1.8V, VSP=5.6V, VSN=-5.6V
Color Mode:24bit
Frame frequency :TYP 60Hz

Table 15 **Power ON Sequence**

Power ON Sequence

ITEM	Command	Parameter	REMARK
Reset (Reset="L")			
IOVCC ON			IOVCC: Typ 1.8V
WAIT Min 10ms			
VSP ON			VSP: Typ 5.6V
WAIT Min 10ms			
VSN ON			VSN: Typ -5.6V
WAIT Min 20ms			
Reset release ("L"→"H")			
WAIT Min 10ms			
Reset set ("H"→" L")			
WAIT Min 10ms			
Reset release ("L"→"H")			
WAIT Min 30ms			
Initial code access			Table 16
DSI Vedio mode transfer start			
Sleep out	0x11	-	
WAIT MIN 6V (Frame)			
Write_display_brightness	0x51	0xFF	LED light:100%.
Write_content_adaptive_brightness_control	0x55	0x02	CABC OFF=00h CABC ON=02h
Write_control_display (BackLight On)	0x53	0x2C	LED(PWM) On
Display ON	0x29	-	
Wait Min 120ms			
Display pattern			Any pattern

Table 17 **Power OFF Sequence**

POWER OFF Sequence

ITEM	Command	Parameter	REMARK
Backlight OFF	0x53	00h	
Display OFF	0x28	-	-
Manufacturer command setting	0xF0	55h	LP mode:don't need HS mode:need
		AAh	
		52h	
		08h	
		01h	
	0xBE	00h	
		70h	
	0xBF	00h	
		70h	
Wait Min 100ms			
Sleep in	0x10	-	-
Wait Min 150ms			
DSI Vedio mode transfer stop			
Reset (Reset="L")			
Wait 10ms			
VSN OFF(GND)			
WAIT 10ms			
VSP OFF(GND)			
Wait 10ms			
IOVCC OFF(GND)			

Table 18 Deep standby In Sequence

Deep standby In Sequence (Normal->Deep standby In)

ITEM	Command	Parameter	REMARK
Backlight OFF	0x53	00h	
Display OFF	0x28	-	-
Wait Min 20ms			
Sleep IN	0X10	-	-
Wait Min 100ms			
Deep Standby IN	0X4F	0x01	-
DSI Vedio mode transfer stop			
VSN OFF(GND)			
Wait Min 10ms			
VSP OFF(GND)			
Wait Min 5ms			
Reset (Reset="L")			

Table 19 Deep standby Out Sequence

Deep standby Out Sequence (Deep standby In -> Normal)

ITEM	Command	Parameter	REMARK
Reset (Reset="L")			
WAIT Min 5ms			
VSP ON			
WAIT 150ms			
VSN ON			
WAIT 50ms			
Reset (Reset="L"⇒ "H")			
WAIT Min 30ms			

Initial code access			Table 16
WAIT Min 120ms			
Sleep out	0x11	-	-
Wait Min 100ms			
Write_display_brightness	0x51	0xFF	LED light:100%.
Write_content_adaptive_brightness_control	0x55	0x02	CABC OFF=00h CABC ON=02h
Write_control_display (BackLight On)	0x53	0x2C	LED(PWM) On
Display ON	0x29	-	
Wait Min 120ms			
Display pattern			Any pattern

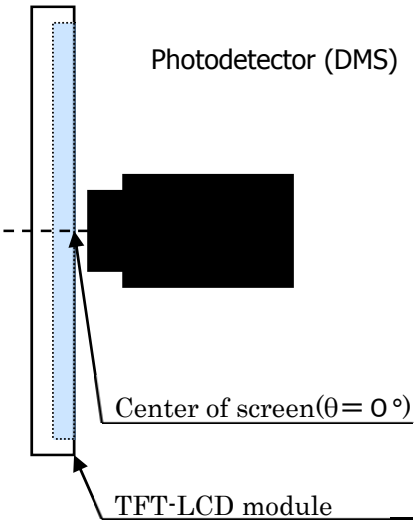
8. Optical Characteristics

Table 20 IOVCC=1.8 V, VSP=5.6V, VSP=-5.6V, ILED-1=40mA ,ILED-2=40mA, Ta = 25℃

Optical Characteristics

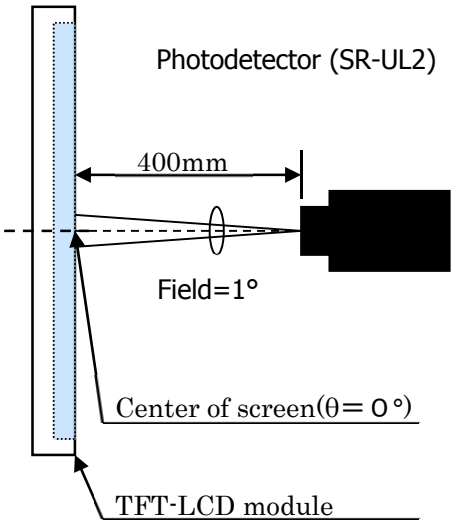
Parameter	symbol	condition	MIN	TYP	MAX	unit	Remark
Brightness	Br	θ=0°	(400)	(500)	-	cd/㎡	Note1
Contrast	Co	θ=0°	-	(1000)	-		Note1,3
Viewing Angle	Top	CR > 10	-	(85)	-	deg	Note2
	Bottom		-	(85)	-		
	Left		-	(85)	-		
	Right		-	(85)	-		
Response Time	(τr+td)	θ=0°	-	(35)	-	ms	Note1,4
White chromaticity	x	θ=0°	(0.29)	(0.31)	(0.34)		Note1
	y		(0.30)	(0.33)	(0.36)		
Red	x	θ=0°	-	T.B.D	-		Note1
	y		-	T.B.D	-		
Green	x	θ=0°	-	T.B.D	-		Note1
	y		-	T.B.D	-		
Blue	x	θ=0°	-	T.B.D	-		Note1
	y		-	T.B.D	-		
Uniformity	-	θ=0°	-	(80)	-	%	Note5
NTSC ratio	-	θ=0°	-	(70)	-	%	Note1
Flicker	F	θ=0°	-	-	10	%	Note6

Note 1) The optical characteristics measurements are operated under a stable luminescence (ILED-1 = 40mA, ILED-2 = 40mA) and a dark condition. (Refer to Fig.10-1 and Fig.10-2)



Viewing angle / Response time measurement method

Fig10-1 Photodetector(DMS)



Luminance / Contrast / Chromaticity measurement method

Fig10-2 Photodetector(SR-UL2)

Note 2) Definition of range of visual angle

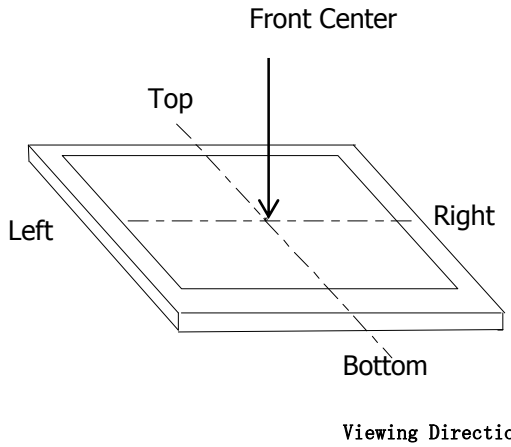


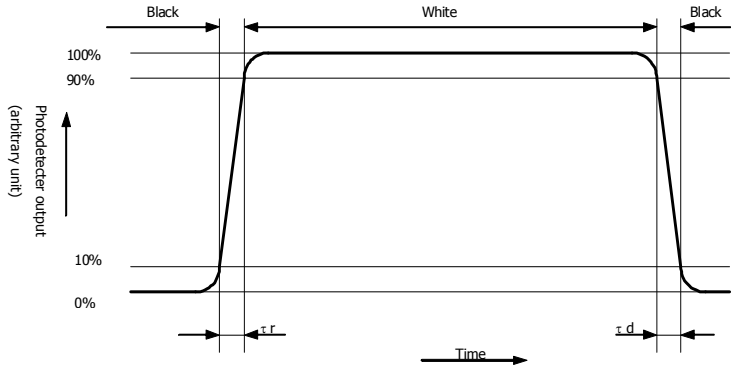
Fig.11 **Definition of viewing angle**

Note 3) Contrast ratio is defined as follows:

$$Co = \frac{Luminance(brightness)allpixcels"White"}{Luminance(brightness)allpixcels"Black"}$$

Note 4) Response time is defined as follows:

Fig.12 **Response time**



Note 5) Uniformity is defined as follows:

$$Uniformity = \frac{Minimum\ Luminance(brightness)\ in\ 9\ points}{Maximum\ Luminance(brightness)\ in\ 9\ points}$$

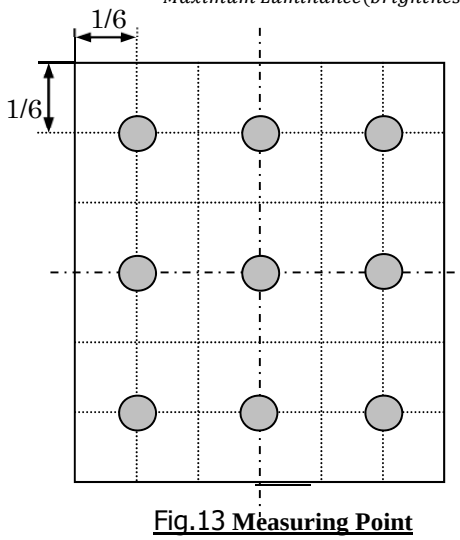


Fig.13 **Measuring Point**

【Note 6】Measuring systems: YOKOGAWA 3298_01 + 3298_11

·Temperature = 25℃(±3℃), Frame Frequency = 60Hz, LED back-light: ON, Environment brightness < 150 lx

·Measurement point is panel center.

·Measuring pattern Please refer to figure TBD.

9. Reliability

Table.21

No.	Test	Condition	Judgment criteria
1	Temperature Cycling	-30℃（30min）→70℃（30min） 20cycle	Per table in below
2	Humidity Storage	Ta=40℃ 95%RH 240h	Per table in below (no condensation)
3	High Temp. Storage	Ta= 70℃ 240h	Per table in below
4	Low Temp. Storage	Ta=-30℃ 240h	Per table in below
5	High Temp. Operation	Ta= 60℃ 240h	Per table in below
6	Low Temp. Operation	Ta=-20℃ 240h	Per table in below
7	ESD	Discharge resistance: 0 Ω Discharge capacitor: 200 pF Discharge voltage: ±200 V Max 1 time for each terminals ※ "GND" of display module is connected GND of test system ground.	Per table in below

INSPECTION	CRITERION(after test)
Appearance	No Crack on the FPC, on the LCD Panel
Alignment of LCD Panel	No Bubbles in the LCD Panel, No other Defects of Alignment in Active area
Electrical current	Within device specifications
Function / Display	No Broken Circuit, No Short Circuit or No Black line No Other Defects of Display

10. Packaging specifications and others

(10-1) Details of packaging

1) Packaging materials: Table.23
2) Packaging style : Fig.14,15

(10-2) Reliability

1) Vibration test

Table.22

Item	Test			
Frequency	5 Hz to 50 Hz (3 minutes cycle)			
Direction	Up-Down, Left-Right, Front-Back (3 directions)			
Period	Up-Down	Left-Right	Front-Back	Total
	60min	15min	15min	90min

The frequency should start at 5 Hz and vary continuously.

Total amplitude	20mm	0.2mm	20mm	0.2mm	
Frequency	5 Hz	50 Hz	5 Hz	50 Hz	(For 9.8m/s^2)

2) Drop test

Drop height: 750mm

Number of drop: 10 times (Drop sequence: 1 corner, 3 edges, 6 faces)

(10-3) Packaging quantities

40 modules per master carton

(10-4) Packaging weight

About: 4.8Kg

(10-5) Packaging outline dimensions

605mm×320mm×254mm(H)

(Packaging materials)

Table.23

	parts name	CRITERION(after test)
1	Master carton	Corrugate card board
2	Inside sleeve	Corrugate card board
3	Spacing piece A	Corrugate card board
4	Spacing piece B	Corrugate card board
5	Spacer	Corrugate card board
6	Protective bag	Polystyrene with anti-static treatment
7	OPP tape	Polypropylene
8	Bar code label	anti-static polystyrene

(10-6) RoHS

This TFT-LCD module is RoHS compliant products.

(10-7) Attention when abandoning it

Please abandon it according to regulations and the ordinance when this module.

(10-8) The country of origin of the TFT-LCD module

This LCD module manufacturing in CHINA (Wuxi Sharp Electronic Components Co., Ltd.)

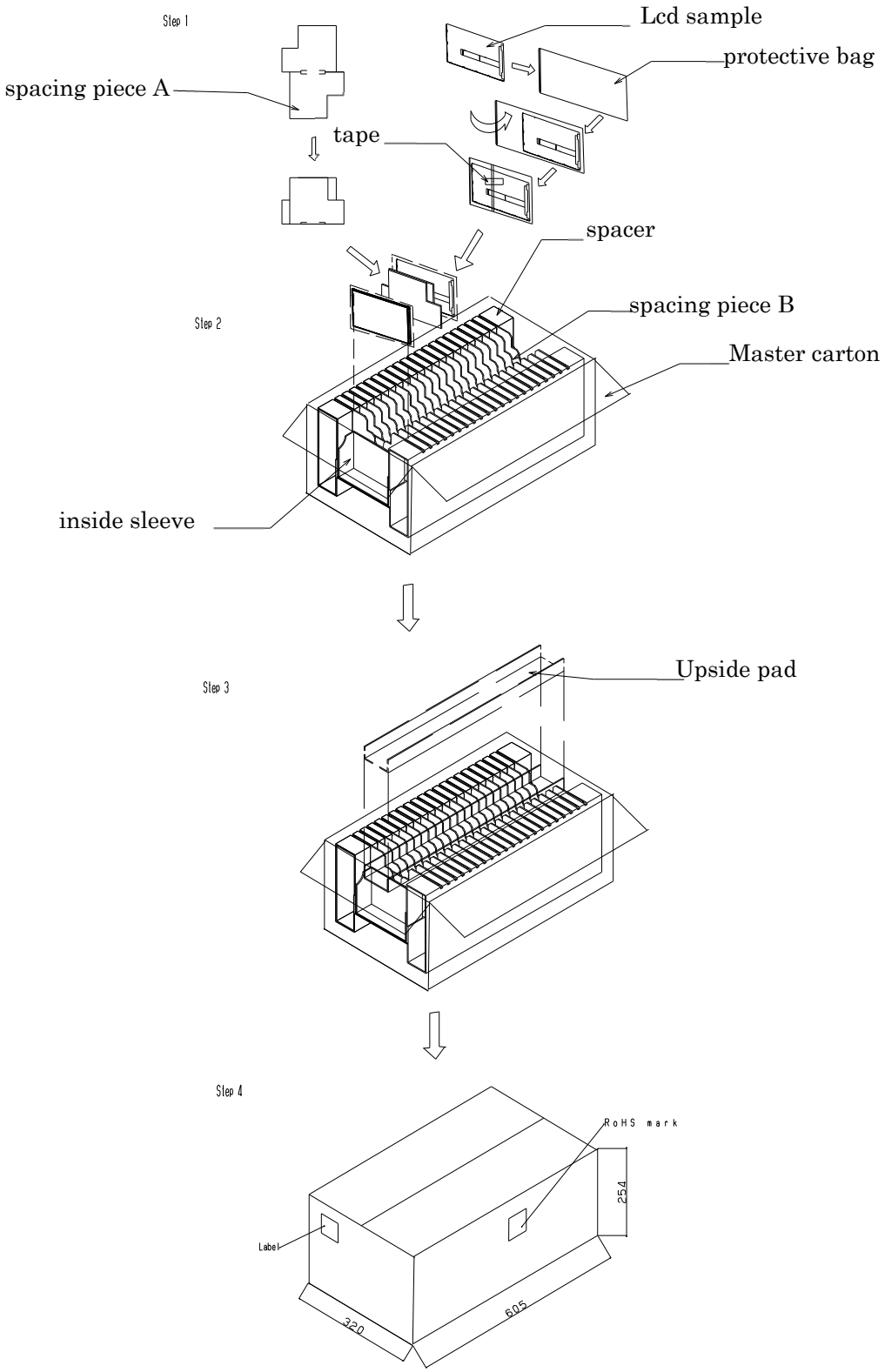


Fig.14 **Packaging style**

Bar code label

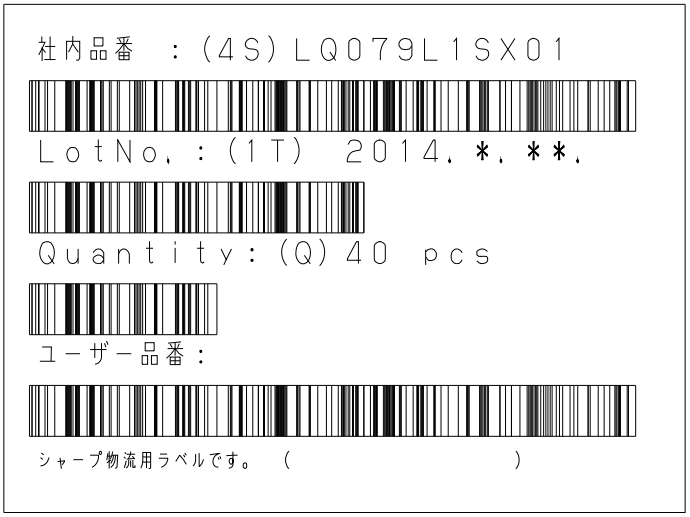


Fig.15 **Packaging style (Master carton for packaging)**

11. Indication of the Lot Number [ES1]

The lot number is shown on a label. Attached location is shown in Fig.16 (Outline Dimensions).

Indicated contents of the ink:

LQ079L1SX01␣LQ0DASA012␣490000001AW

① ② ③ ④ ⑤⑥ ⑦ ⑧ ⑨

① Model name.

②④ blanking.

③ 14/1/28 sample name.

⑤ production year.

ex. 2014 ⇒ 4

⑥ production month.

1: January
2: February
3: March
:
9: September
X: October
Y: November
Z: December

⑦ serial number.

0000001 ～ 9999999

⑧ Version number.

A,B,C

⑨ Factory management code.

12. Outline dimensions

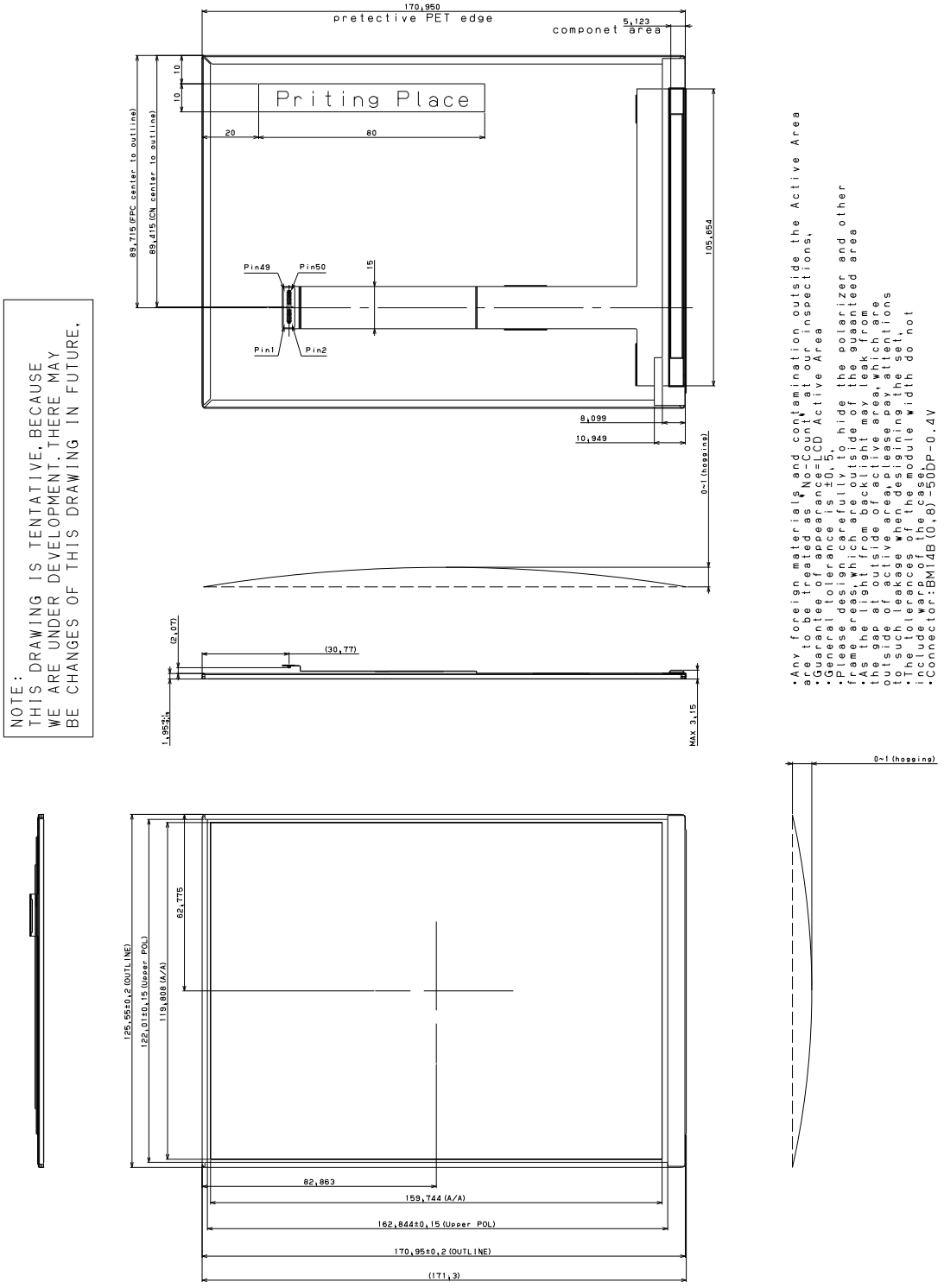


Fig. 16 **Outline dimensions**