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SHARP

No.	**LCY-05049**
DATE	30 . Aug . 2005

TECHNICAL LITERATURE

FOR

TFT - LCD module

MODEL No. LQ070Y5DE01

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SHARP CORPORATION

MOBILE LIQUID CRYSTAL DISPLAY GROUP

MOBILE LCD DESIGHN CENTER

ENGINEERING DEPARTMENT 2

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・Automotive auxiliary information display

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1. Outline

This TFT-LCD module is an active matrix type LCD (Liquid Crystal Display) which displays 262,144 colors using an amorphous silicon TFT (Thin Film Transistor) and a panel with an aspect ratio of 17:9. Module outline is shown in Table 4-1.

2. Features

- The two-way viewing angle LCD technology enables to simultaneously display different information in right and left viewing directions.
- Adaptable to wide screens by using a panel of aspect ratio 17:9.
- The 7.0 screen produces a high resolution image that is composed of 384,000 pixels elements in a stripe arrangement.
- 262,144 colors can be displayed by 18-bit (6 bits x RGB) data signals.
- Adopted new wide viewing angle technology. (Optimal viewing angle: 6 o'clock direction)
- A picture with high contrast is realized by adopting an active matrix drive.
- Reduced reflection of outside light by adopting low-reflection black matrix.
- By COG packaging method, realized a slim, lightweight, and compact module.
- Image-inverted display in the vertical/ horizontal directions is possible. (When horizontal inversion is executed, the image is converted to the mirror symmetry image and the images viewing from right and left are exchanged.)

3. Structure and Module Outline

Module Outline Dimensions are shown in Diagram 1.

The module consists of a TFT-LCD panel, driver ICs, FPCs, the frame, a front shielding case and backlights.

(DC/ AC inverter circuits for driving the backlight are not incorporated in the module.)

4. Mechanical Specification

Table 4-1

Item	Specifications	Unit	Note
Screen Size	17.7 [7 inch] diagonal	cm	
Viewing Area	156.00 (horizontal) x 82.8 (vertical)	mm	
Dot Configuration	800 x RGB x 480	Dot	Note 4-1
Dot Pitch	0.065 (horizontal) x 0.1725 (vertical)	mm	
Pixel Matrix	RGB vertical stripe		
Display Mode	Normally White		
Outside Dimension	171.6(W) x 93.2(H) x 11.25(D)	mm	Note 4-2
Weight	Max. 280	g	

Note 4-1: The resolution at the eye point becomes 400 x RGB x 480 dots.
(Refer to Note 9-4 in "9. Optical Characteristics" section for the definition.)

Note 4-2: TYP value. Refer to Diagram 1: Module Outside Dimensions for the detailed dimension and the tolerance.
(except the backlight harnesses, FPCs and attachment bosses.)

5. Input Terminal Name and Function

5-1) TFT Liquid Crystal Panel Driving Parts

Table 5-1

Terminal	Symbol	Function	Note
1	V10	Gradation Voltage	
2	V9	Gradation Voltage	
3	V7	Gradation Voltage	
4	V5	Gradation Voltage	
5	V3	Gradation Voltage	
6	V0	Gradation Voltage	
7	VSHA	Source Driver Analog Supply Voltage	
8	SPR	Source Driver Starting Signal 1	Note 5-1
9	LBR	Horizontal Scanning Direction Switching Signal	Note 5-1
10	GND	GND	
11	CK	Source Driver Clock Signal	
12	N.C.	OPEN	
13	GND	GND	
14	LS	Source Driver Data Transmission Signal	
15	VSHD	Source Driver Digital Supply Voltage	
16	B5	BLUE Data Signal (MSB)	
17	B4	BLUE Data Signal	
18	B3	BLUE Data Signal	
19	B2	BLUE Data Signal	
20	B1	BLUE Data Signal	
21	B0	BLUE Data Signal (LSB)	
22	GND	GND	
23	G5	GREEN Data Signal (MSB)	
24	G4	GREEN Data Signal	
25	G3	GREEN Data Signal	
26	G2	GREEN Data Signal	
27	G1	GREEN Data Signal	
28	G0	GREEN Data Signal (LSB)	
29	GND	GND	
30	R5	RED Data Signal (MSB)	
31	R4	RED Data Signal	
32	R3	RED Data Signal	
33	R2	RED Data Signal	
34	R1	RED Data Signal	
35	R0	RED Data Signal (LSB)	
36	SPL	Source Driver Starting Signal 2	Note 5-1
37	CS	CS Electrode Driving Signal	
38	VCOM	Common Electrode Driving Signal	
39	VCOM	Common Electrode Driving Signal	
40	VDD	Gate Driver Supply Voltage Hi Level	
41	SPS	Gate Driver Starting Signal	
42	CLS	Gate Driver Clock Signal	
43	U/L	Vertical Scanning Direction Switching Signal	Note 5-1
44	MODE1	Output Mode Switching Signal 1	Note 5-2
45	MODE2	Output Mode Switching Signal 2	Note 5-2
46	VCC	Gate Driver Logic Supply Voltage Hi Level	
47	N.C.	OPEN	
48	VEE	Gate Driver Supply Voltage Lo Level	
49	N.C.	OPEN	
50	VSS	Gate Driver Logic Supply Voltage Lo Level	

Note 5-1: It controls vertical and horizontal scanning directions.

Table 5-2

Display Mode	U/L	LBR	SPL	SPR
Normal Display	Lo	Hi	Input	Output
Right and Left Inversion Display	Lo	Lo	Output	Input
Top and Bottom Inversion Display	Hi	Hi	Input	Output
Top and Bottom/ Right and Left Inversion Display	Hi	Lo	Output	Input

Note: Lo=GND, Hi=VSH

Note 5-2: Refer to the item 6-1 “Notice at Turning On the Power.”

The output mode of the gate driver is selected by setting MODE1 and MODE2.

Table 5-3:

MODE1	MODE2	Gate Driver Output Mode
Hi	Hi	Normal Mode
Lo	Hi	Do not use.
Hi	Lo	Interlaced 2 Pulse Mode
Lo	Lo	Fix All Outputs to VEE Level

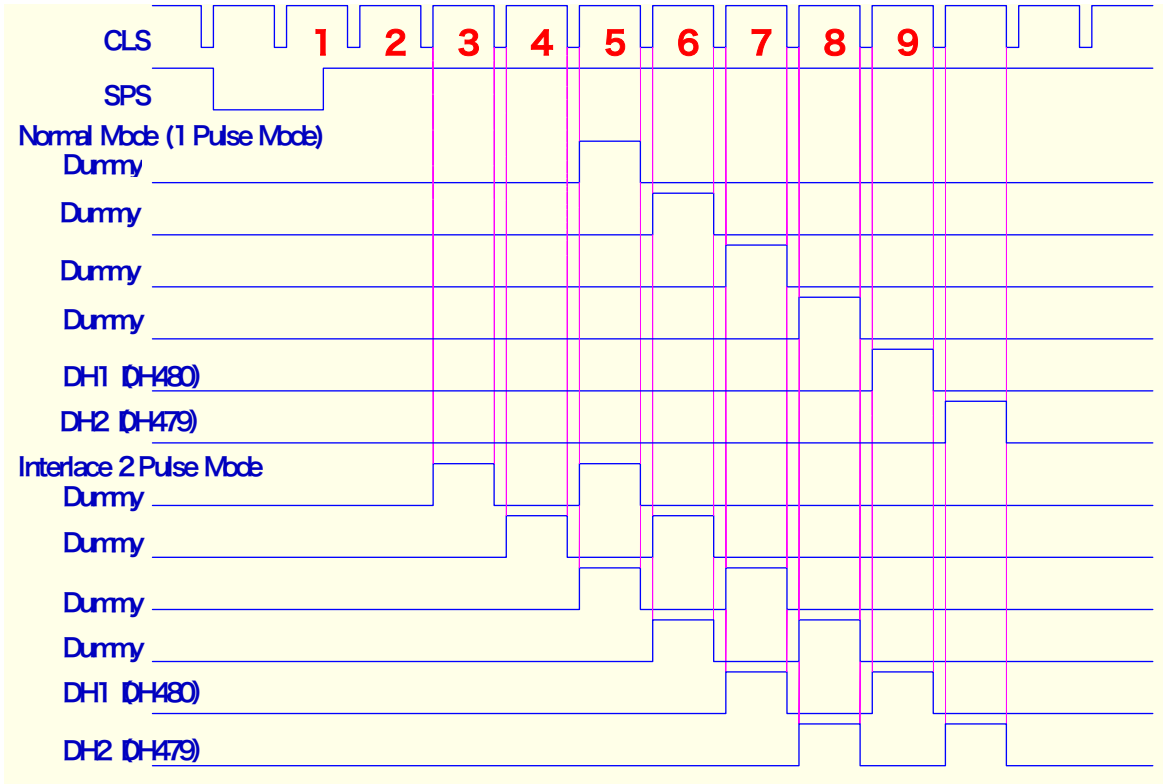


Diagram 5-1: Gate Output Timing

5-2) Backlight

Table 5-4

Terminal No.	Symbol	Function	Note
1	VL1	Lamp Input Terminal (Low Voltage Side)	
2	VL2	Lamp Input Terminal (High Voltage Side)	

6. Absolute Maximum Rating

Table 6-1 GND=0V

Item		Symbol	MIN.	MAX.	Unit	Note
Source Supply Voltage	Analog Power Supply	VSHA	－0.3	＋6.0	V	Ta=25°C
	Digital Power Supply	VSHD	－0.3	＋6.0	V	Ta=25°C
Gate Supply Voltage		VDD	－0.3	＋35.0	V	Ta=25°C
		VCC-VSS	－0.3	＋6.0	V	Ta=25°C
		VEE-VSS	－0.3	＋35.0	V	Ta=25°C
		VDD-VEE(VSS)	－0.3	＋35.0	V	Ta=25°C
Input Signal Voltage	Digital Signal	VID	－0.3	VSHD+0.3	V	Ta=25°C Note 6-1
	Analog Signal	VIA	－0.3	VSHA+0.3	V	Ta=25°C Note 6-2
Common Electrode Driving Signal		COM	－4	＋6	V	Ta=25°C
Storage Temperature		Tstg	－40	＋85	℃	Note 6-3,4
Operating Temperature (Panel Surface)		Topr1	－30	＋85	℃	Note 6-5,6
Operating Temperature (Ambient Temperature)		Topr2	－30	＋65	℃	Note 6-6

Note 6-1: SPL, SPR, R0～R5, G0～G5, B0～B5, LS, CK, LBR, MODE1, MODE2, R/L, SPS, CLS

Note 6-2: V0, V3, V5, V7, V9, V10

Note 6-3: Any parts of this module must not exceed these ratings.

Note 6-4: Maximum wet-bulb temperature is 57°C or less. There must be no condensation. Any condensation causes electric leak that causes this specification not to be satisfied.

Note 6-5: This operating temperature is only for guaranteeing the product operation.
Contrast, response speed and other display qualities are evaluated under Ta=+25°C.

Note 6-6: Ambient temperature when the backlight is lit. (Reference value)

7. Electrical Characteristics

7-1) TFT Liquid Crystal Panel Driving Parts

Table 7-1: Recommended Operating Condition GND=0V, Ta=+25°C

Item				Symbol	MIN.	TYP.	MAX.	Unit	Note
Source Supply Voltage	Analog Power Supply			VSHA	＋5.0	＋5.3	＋5.6	V	
	Digital Power Supply			VSHD	＋2.5	＋2.7	＋3.6	V	
Gate Supply Voltage	Power for Driving TFT	Hi		VDD	＋13.8	＋14.0	＋14.2	V	
		Lo	AC	VEE AC	－	COM AC	－	Vp-p	Note 7-1
			DC	VEE DC	－12.8	－13.0	－13.2	V	
	Power for Logic	Hi		VCC	VSS+VSHD-0.1	VSS+VSHD	VSS+VSHD+0.1	V	Note 7-2
		Lo		VSS	－18.0	－18.4	－18.8	V	
Reference Voltage				V0~V10	0	－	VSHA	V	Note 7-3
Source Input Voltage	Hi Input			V IHS	0.8xVSHD	－	VSHD	V	Note 7-6
	Lo Input			V ILS	GND	－	0.2xVSHD	V	
Source Input Current	Hi Input			I IHS1	－	－	10	μA	Note 7-4
	Hi Input			I IHS2	－	－	400	μA	Note 7-5
	Lo Input			I ILS	－	－	10	μA	Note 7-6
Gate Input Voltage	Hi Input			V IHG	0.8xVSHD	－	VSHD	V	Note 7-7
	Lo Input			V ILG	GND	－	0.2xVSHD	V	
Gate Input Current	Hi Input			I IHG	－	－	1.0	μA	
	Lo Input			I ILG	－	－	1.0	μA	
Signal for Driving Common Electrode (VCOM)			AC	COMAC	－	±3.6	±4.0	Vp-p	Note 7-8
			DC	COMDC1	＋0.5	－	＋2.5	V	
Signal for Driving CS Electrode (CS)			AC	COMAC	－	±3.6	±4.0	Vp-p	Note 7-1
			DC	COMDC2	－5.3	－5.5	－5.7	V	

Note: Precautions at Power-on

Follow the order below when turning on/ off the power.

Turning ON: VSHD, VSHA, VSS, VCC → Logic Signal, VEE → VDD → MODE1, MODE2

Turning OFF: VDD → VEE, Logic Signal (including MODE1,MODE2) → VSS, VCC, VSHA, VSHD

* Under the condition of VSS<VCC.

Input low voltage when turning on MODE1, MODE2 Signal Terminals and keep low voltage for 2 vertical synchronizing periods or more after VDD has completely risen. After that, keep either or both terminals at high voltage until turning off the power.

Note 7-1: Invert the polarity at the same amplitude and phase as VCOM.

Note 7-2: The range must be within 2.5V≤VCC-VSS≤3.6V.

Note 7-3: This is the reference power for gray scale. Switch this reference voltage every time the polarity of the signal for common electrode (VCOM) is changed. The phase of V0 (Black) Power is opposite of the phase of VCOM. The phase of V10 (White) is the same as that of VCOM.

Shift the center value (DC level) of each power amplitude to the positive direction according to the characteristics of liquid crystal as the center value moves toward white side like V3→V5→V7→V9→V10 when the center value of V0 (Black) is reference.

Adjust the amount of shifting to have no flicker in each gray-scale display after tuning the DC of VCOM signal for V0 gray-scale display.

Note 7-4: Applied to terminals R0～R5, G0～G5, B0～B5, SPR, SPL, CK, LS, LBR.

Note 7-5: Applied to PS terminal.

Note 7-6: Applied to terminals R0～R5, G0～G5, B0～B5, SPR, SPL, CK, LS, LBR, PS.

Note 7-7: Applied to terminals CLS, SPS, MODE1, MODE2, R/L.

Note 7-8: Switch the polarity of amplitude COMAC at the center value COMDC at every horizontal scan and every vertical scan. Adjust COMDC to minimize the flicker or maximize the contrast for every module.

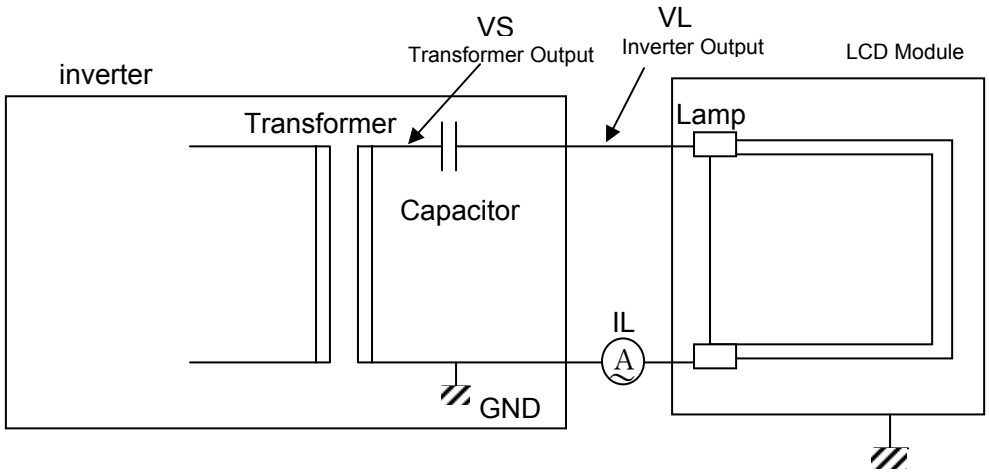
7-2) Backlight

Table 7-2

Item	Symbol	MIN.	TYP.	MAX.	Unit	Note
Lamp Voltage	VL	590	660	730	Vrms	Ta=+25°C, IL=6.0mArms/tube
Lamp Current	IL	5.5	6.0	6.5	mArms	Ta=25°C, Normal
	ILB	—	—	9.0	mArms	During boost (0°C or less, 5 minutes or less)
Lamp Power Consumption	W	—	7.92	—	W	Ta=+25°C, 2 lamps
Lighting Frequency	fL	30	—	100	kHz	
Kick-off Voltage	VS	—	—	1850	Vrms	Ta=+25°C
Trans Output [Vrms]		—	—	2075	Vrms	Ta=-30°C
Kick-off Voltage	VLS	—	—	1125	Vrms	Ta=+25°C
Inverter Output [Vrms]		—	—	1280	Vrms	Ta=-30°C

(NF power supply AS-114S, Lighting frequency 55KHz, Ballast capacity 18pF in the module state with its shield case connected to GND)

Cautions: The lighting start voltage is affected by wiring of connecting lead wires of the inverter and the backlight. Please confirm well by the set before moving into mass production.
The inverter must satisfy the table above, have symmetric positive and negative waves without spike waves and the waves must be sine wave.



7-3) Timing Characteristics of Input Signal

Input Signal Timing Waves are shown in Diagram 2-1 and 2-2.

Table 7-3: VSHA=+5.3V, VSHD=(+2.7V), GND=0V, Ta=25°C

Item		Symbol	MIN.	TYP.	MAX.	Unit	Applied Terminal
Source	Clock Frequency	fck	—	33.2	34.6	MHz	DCLK
	Clock Hi Level Pulse Width	Tcwh	12	—	—	ns	
	Clock Lo Level Pulse Width	Tcwl	13	—	—	ns	
	Clock Rise Time	Tcr	—	—	4	ns	
	Clock Fall Time	Tcf	—	—	4	ns	
	Start Pulse Frequency	fsp	—	31.5	31.8	kHz	SPL SPR Note 7-10
	Start Pulse Setup Time	Tsusp	4	—	—	ns	
	Start Pulse Hold Time	Thsp	0	—	—	ns	
	Start Pulse Width	Twsp	1/fck	1/fck	1.5/fck	ns	
	LS Signal Frequency	flp	—	fsp	—	kHz	LS
	LS Setup Time (CLS)	Tsulp	5.0	—	—	μs	
	LS Setup Time (SPL,SPR)	Tsulpsp	1/fck	—	—	ns	
	LS Hold Time (DCLK)	Thlpck	20	—	—	ns	
	LS Signal Hi Level Width	Twlp	1/fck	—	—	ns	
	Data Setup Time	Tsud	15	—	—	ns	R0~R5, G0~G5,
	Data Hold Time	Thd	10	—	—	ns	B0~B5
Gate	Clock Frequency	fcls	—	fsp	—	kHz	CLS
	Clock Pulse Width	Twl	5.5	—	(1/fcls)-53	μs	
	Clock Rise Time	Trcl	—	—	1/fck	ns	
	Clock Fall Time	Tfcl	—	—	1/fck	ns	
	Start Pulse Frequency	fsps	—	60	65	Hz	SPS
	Start Pulse Setup Time	Tsusps	100	—	—	ns	
	Start Pulse Hold Time	Thsps	300	—	—	ns	
	Start Pulse Rise Time	Trsps	—	—	100	ns	
	Start Pulse Fall Time	Tfsps	—	—	100	ns	
COM Signal Setup Time		Tsucom	3	—	—	μs	VCOM CS
COM Signal Hold Time		Thcom	0	—	—	μs	
COM Signal Rise Time		Trcom	—	—	2	μs	
COM Signal Fall Time		Tfcom	—	—	2	μs	
Gray-scale Signal Setup Time		Tsuv0	3	—	—	μs	V0, V3, V5, V7,
Gray-scale Signal Hold Time		Thv0	0	—	—	μs	V9, V10
Gray-scale Signal Rise Time		Trv0	—	—	2	μs	
Gray-scale Signal Fall Time		Tfv0	—	—	2	μs	

Note 7-10: There should be only one rise of DCLK in ‘Hi’ period (Twsp) of Start Pulse.

7-4) Current Consumption

Table 7-4 Ta=25°C

Item		Symbol	Voltage Condition	MIN.	TYP.	MAX.	Unit	Note
Source Current	Analog	ISHA	VSHA=+5.3V	－	40	95	mA	
	Digital	ISHD	VSHD=+2.7V	－	8.0	19	mA	
Gate Current	High	IDD	VDD=+14.0V	－	0.20	0.35	mA	
	Lo	IEE	VEE=-13.0+/-3.6V	－	－0.20	－0.35	mA	
	Logic Hi	ICC	VCC=-15.7V	－	0.05	0.10	mA	
	Logic Lo	ISS	VSS=-18.4V	－	－0.10	－0.20	mA	

* Measurement Condition

Display Pattern:

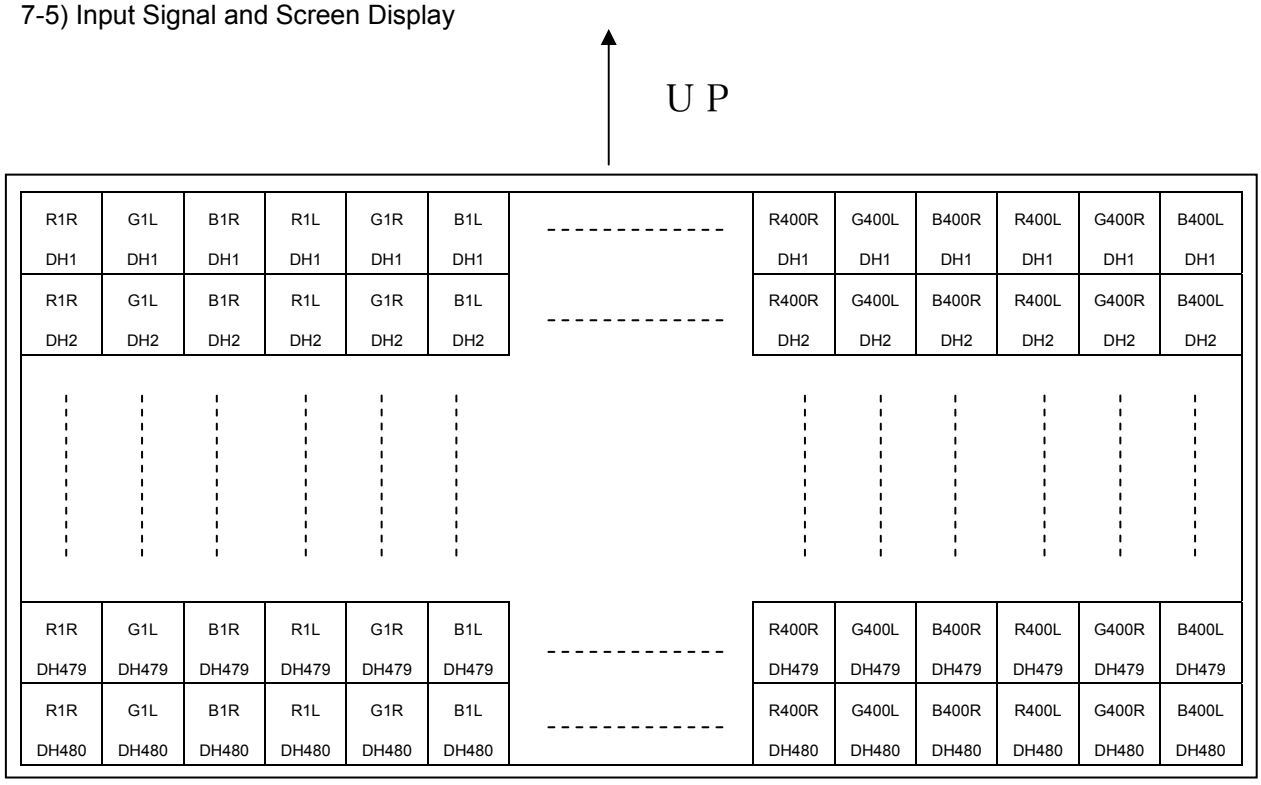
Vertical Stripe Pattern by displaying 21 gray scale (GS21) and 42 gray scale (GS42) alternately at every one pixel.

Driving Condition:

fck=33.2MHz, fsp=30.3kHz, fsps=60Hz Use purpose-built control IC “LZ9JG17.”

Normal Display

7-5) Input Signal and Screen Display



Data Display Position in the Screen [H, V]

8. Input Signal, Basic Display Color and Gray Scale of Each Color

Table 8-1

	Color Brightness Scale	Gray Scale	Data Signal																	
			R0	R1	R2	R3	R4	R5	G0	G1	G2	G3	G4	G5	B0	B1	B2	B3	B4	B5
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	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dark	GS2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	↓				↓						↓						↓		
	⇩	↓				↓						↓						↓		
	Bright	GS61	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	⇩	GS62	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red	GS63	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of Green	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	Dark	GS2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	⇧	↓				↓						↓						↓		
	⇩	↓				↓						↓						↓		
	Bright	GS61	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0
	⇩	GS62	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0
	Green	GS63	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale of Blue	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	Dark	GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	⇧	↓				↓						↓						↓		
	⇩	↓				↓						↓						↓		
	Bright	GS61	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1
	⇩	GS62	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
	Blue	GS63	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

0: Low Level Voltage 1: High Level Voltage

It displays 64 gray scales of each color by 6-bit data-signal input and 262,144-color display is possible by the combination of total 18 bits data.

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9. Optical Characteristics

Table 9-1 Ta=25°C

Item		Symbol	Condition	MIN.	TYP.	MAX.	Unit	Note
Viewing Angle Range	Horizon-tal	θ21, θ22	CR≥5 (During Single View)	60	65	—	° (degree)	Note 9-1
	Vertical	θ11		60	65	—	° (degree)	
		θ12		55	60	—	° (degree)	
Contrast Ratio		CRmax.	θ=0° (During Single View)	100	—	—		Note 9-2
Ratio of Crosstalk Components		XT(ep)	30°	—	3.0	5.0		Note 9-3.4
Observation Area		Φin	L=70cm ,XT≤10	—	20	23	° (degree)	Note 9-5
		Φout		46	50	—	° (degree)	
Response Speed	Rise	Tr	θ=0°	—	30	60	ms	Note 9-6
	Fall	τd		—	50	100	ms	
Panel Surface Brightness	Front	Y0	IL=6.0mArms (per one lamp) (without signal input)	150	220		cd/m^2	Note 9-7
	Two-way viewing Eye Point	Y30		210	320		cd/m^2	
Panel Surface Chromaticity		x	IL=6.0mArms (per one lamp)	0.265	0.315	0.365		Note 9-8
		y		0.295	0.345	0.395		

* Measurement should be made 30 minutes after lighting the lamp at the rating. The measurement of optical characteristics should be made using the measurement method of Diagram9-1, Diagram 9-2 and Diagram 9-3 below in a darkroom or in an equivalent situation.

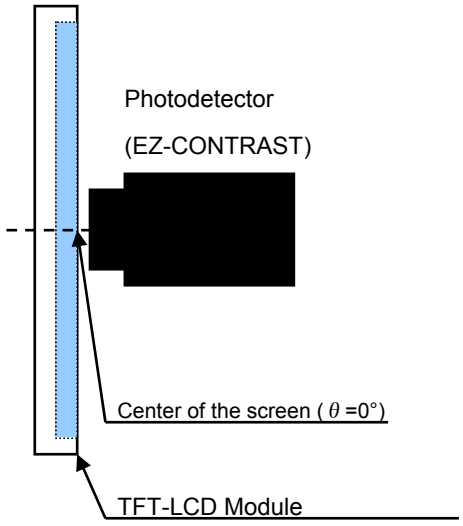


Diagram 9-1: Viewing Angle Range/ Contrast/ Response Speed／Ratio of Crosstalk Components／Observation Area Method

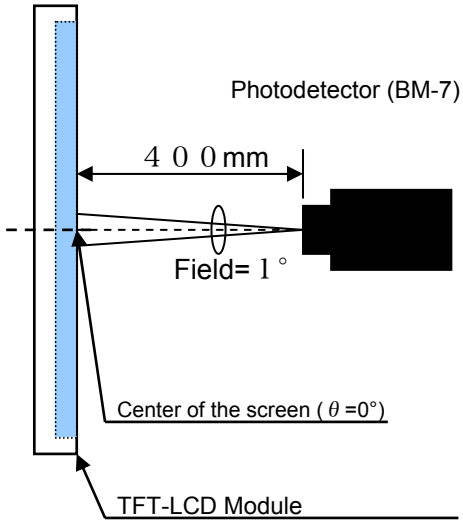
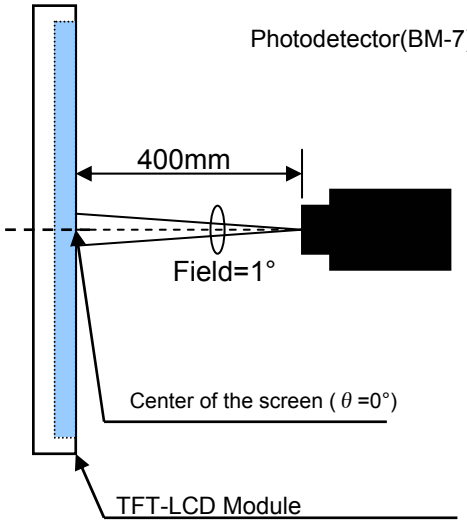
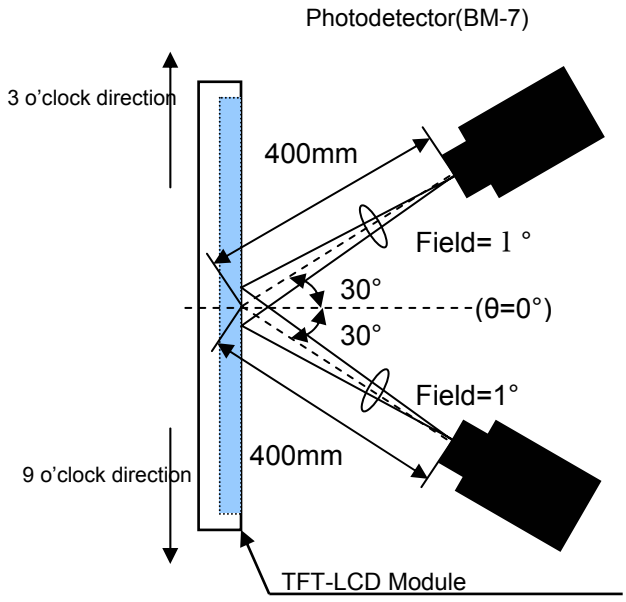


Diagram 9-2: Chromaticity Measurement Method



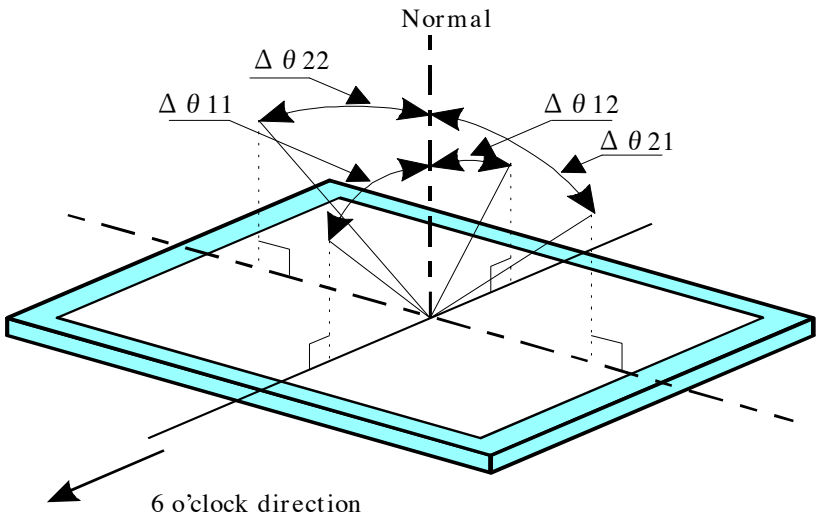
[Front Brightness]



[Two-way viewing Point Brightness]

Diagram 9-3: Brightness Measurement Method

Note 9-1: Definition of Viewing Angle Range

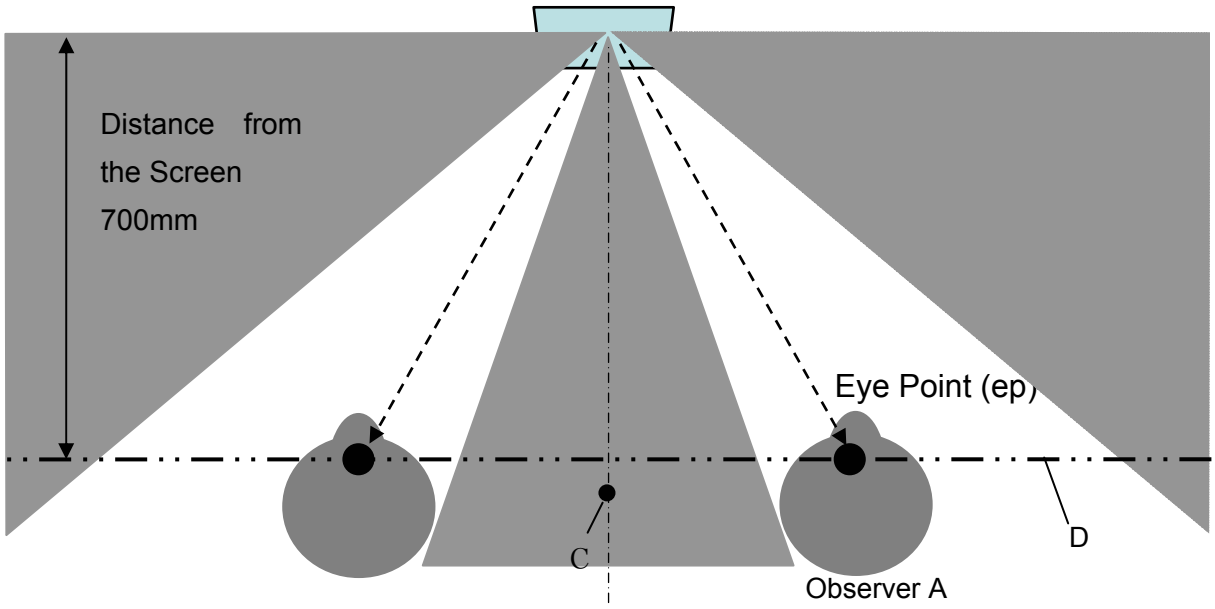


Note 9-2: Definition of Contrast Ratio

Defined by the formula below.

$$\text{Contrast Ratio(CR)} = \frac{\text{Screen Brightness of White (GS63)}}{\text{Screen Brightness of Black (GS0)}}$$

Note 9-3: Definition of Eye Point (Diagram viewed from above)

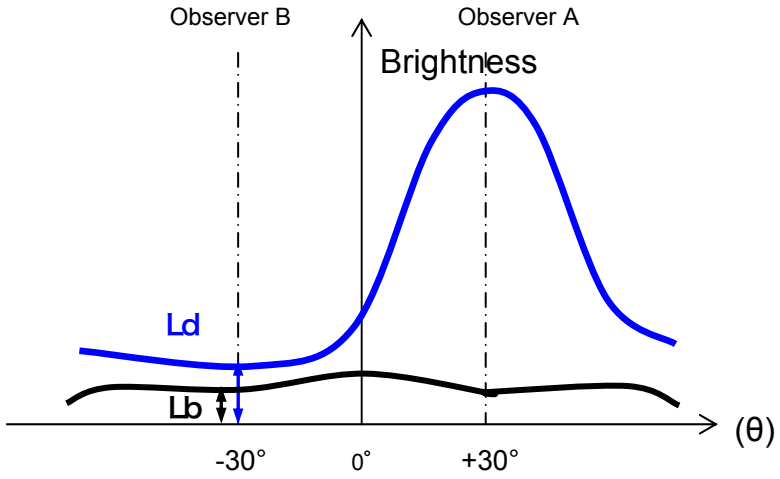


The eye point (Φep) is the point on the line which goes through the point C which is 700mm away from the center of the screen in the direction of normal and parallel with the screen (Line D), and where the center of the screen and the normal makes angle of 30°.

Note 9-4: Definition of Crosstalk Components Ratio (XTep)

The crosstalk components ratio (XTep) at the eye point is defined by the formula below using the brightness of the observer B's eye point when displaying all white to the observer A side and all black to the observer B side (Ld) and the brightness of the observer B's eye point when displaying all black to both the observer sides A and B (Lb). The measurement point is the center of the panel (2mmΦ).

$$\text{Crosstalk Components Ratio (XTep)} = \frac{Ld - Lb}{Lb}$$



○ Definition of XT(ep)

The crosstalk components ratio at the eye points (+30 degree, -30 degree,horizontally) is XTep.

○ Definition of XT(ea)

The area of +/- 5 degree(horizontally) from the eye point is defined as the eye area. The average crosstalk components ratio in the eye area is defined as XT(ea).

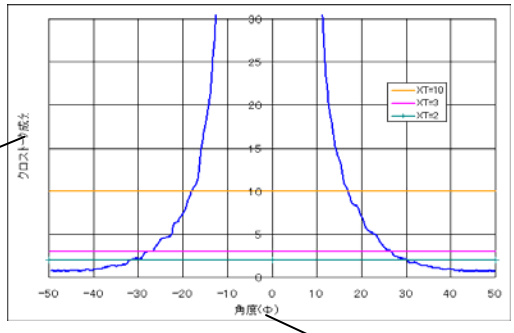
Note9-5: Definition of Observation Area

The observation area is defined by Φin and Φout, which indicate the angles from the eye point on the line D described in Note 9-3*. Φin is the angle on the side of the panel center from the eye point where the crosstalk components ratio is 8 or less. Φout is the angle outside the eye point where the crosstalk components ratio is 2 or less. (*Line D = 700mm away from the center of the screen in the direction of normal and parallel with the screen.)

Φin indicates the angle where the crosstalk components ratio becomes 8 when starting scanning from 0 degree direction, and Φout indicates the angle where the crosstalk components ratio becomes 2 when starting scanning from -80,80 degree direction.

○ Reference Data (The table below is reference data only and does not guarantee the specification.)

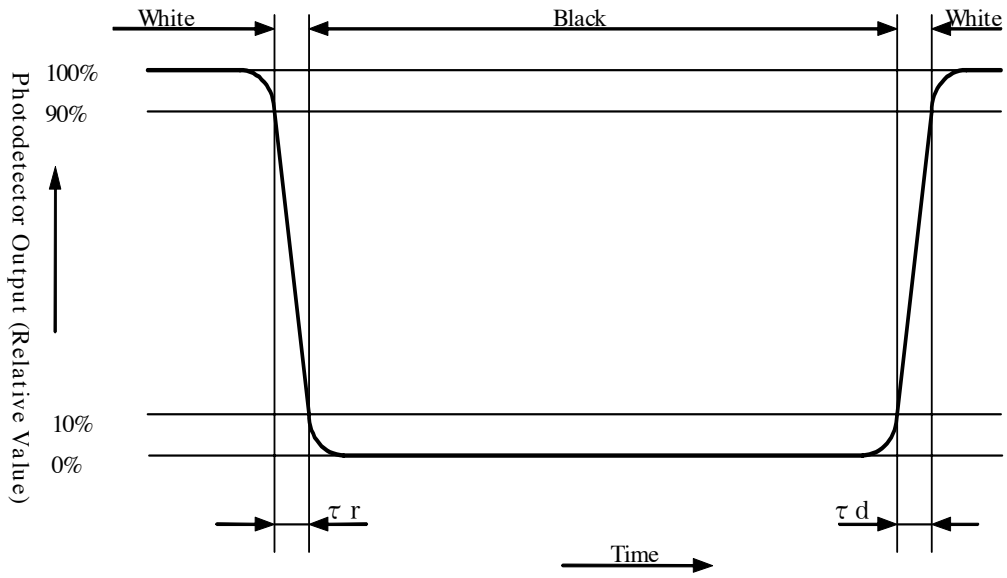
Crosstalk Components



[General tendency of the change to the angle (Φ) of the crosstalk components ratio] Angle (Φ)

Note9-6: Definition of Response Speed

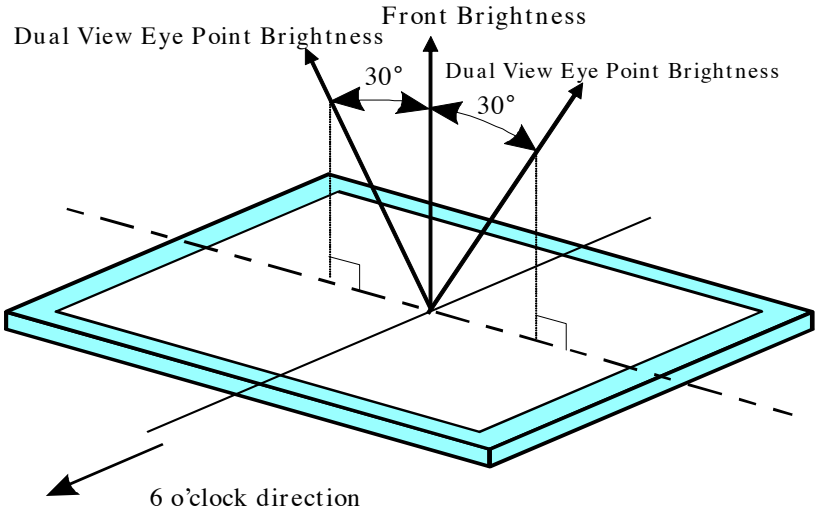
Input the signal which makes white or black state as the diagram below, and the time change of the photodetector output at that time is used to define it.



Note9-7: Definition of Panel Surface Brightness

The measurement value is taken after lighting at the center of the panel for 30 minutes at 1° measurement angle by TOPCON luminance meter BM-7. (Initial Characteristics)

Inverter Driving Frequency: 49kHz (Increased brightness by increased frequency is not included.)



Note 9-8: Panel Surface Chromaticity

The measurement value is taken after lighting at the center of the panel for 30 minutes at 1° measurement angle by TOPCON luminance meter BM-7. (Initial Characteristics)

Inverter Driving Frequency: 49kHz (Increased brightness by increased frequency is not included.)

10. Mechanical Function

10-1) Appearance: should have no serious defect. (Refer to Diagram 1: Module Outside Dimensions.)

10-2) Panel: Surface Compression Strength

Panel Fracture: The panel must not break at 19N pressure on the center applied by a smooth surface of 15mm diameter.

(Note) No matter how little its weight is, it may interfere with the function if any pressure is applied for a long time on the viewing area.

10-3) Input/ Output Connector Performance

A) Input/ Output Connector of the Liquid Crystal Panel Drive Component

(1) Applied Connector: FH12-50S-0.5SH (manufactured by HIROSE ELECTRIC CO., LTD.)

(2) FPC flexibility: Film Cover Layer Coat One-side-wired Part

No bending radius. The bending test should be conducted by bending 180° (should be bent once by hand) and should have no disconnection.

B) Input/ Output Connecter of Backlight Fluorescent Tube Drive Component (J.S.T. Mfg Co.,Ltd)

Terminal Name	Applied Connector and Housing	Compatible Connector (Plug)
CN1	BHR-04VS-1	SM04(4.0)-BHS-1-TB

11. Display Quality

Criteria for the color LCD module display quality are compliant with shipping inspection criteria.

TFT- LCD Module Reliability Test Condition

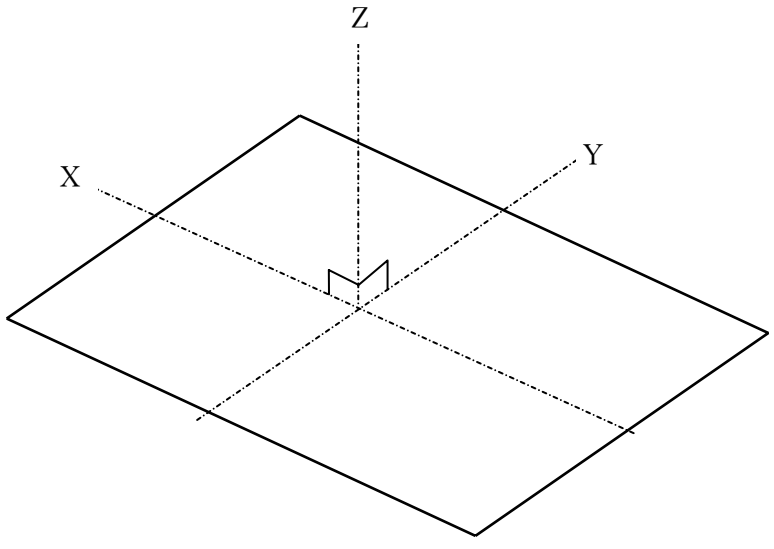
Table 11

Note) Temperature conditions comply with 6. Table 6-1: Operating Temperature Conditions.

No.	Test Item	Contents
1	High Temperature Storage	Leave in atmosphere of 85°C ambient temperature for 240h.
2	Low Temperature Storage	Leave in atmosphere of -40°C ambient temperature for 240h.
3	High Temperature & High Humidity Operation	Operate in atmosphere of 60°C ambient temperature and humidity 90% RH for 240h.
4	High Temperature Operation	Operate for 240h with the panel surface temperature 85°C.
5	Low Temperature Operation	Operate in atmosphere of -30°C ambient temperature for 240h.
6	Resistance to Electrostatic Pressure	+/-200V, 200pF (0Ω), once for each terminal
7	Shock Resistance	980m/s^2・6ms, +/-X; +/-Y; +/-Z 3 times each (JIS C0041, A-7 Condition C)
8	Vibration	Frequency Range: 8~33.3Hz Total Amplitude: 1.3mm Sweep Rate: 33.3Hz~400Hz Acceleration: 29.4m/s^2 (3G) Cycle: 15 minutes 2 hours each at X and Z directions, 4 hours at Y direction (Total 8 hours) [Note] (JIS D1601)
9	Thermal Shock	-30°C ~ +85°C/ 200 cycle (0.5h) (0.5h)

[Evaluation Method] There must be no change interfering actual use under the display quality inspection conditions in normal environment.

[Note] Definition of X, Y, Z directions is shown below.



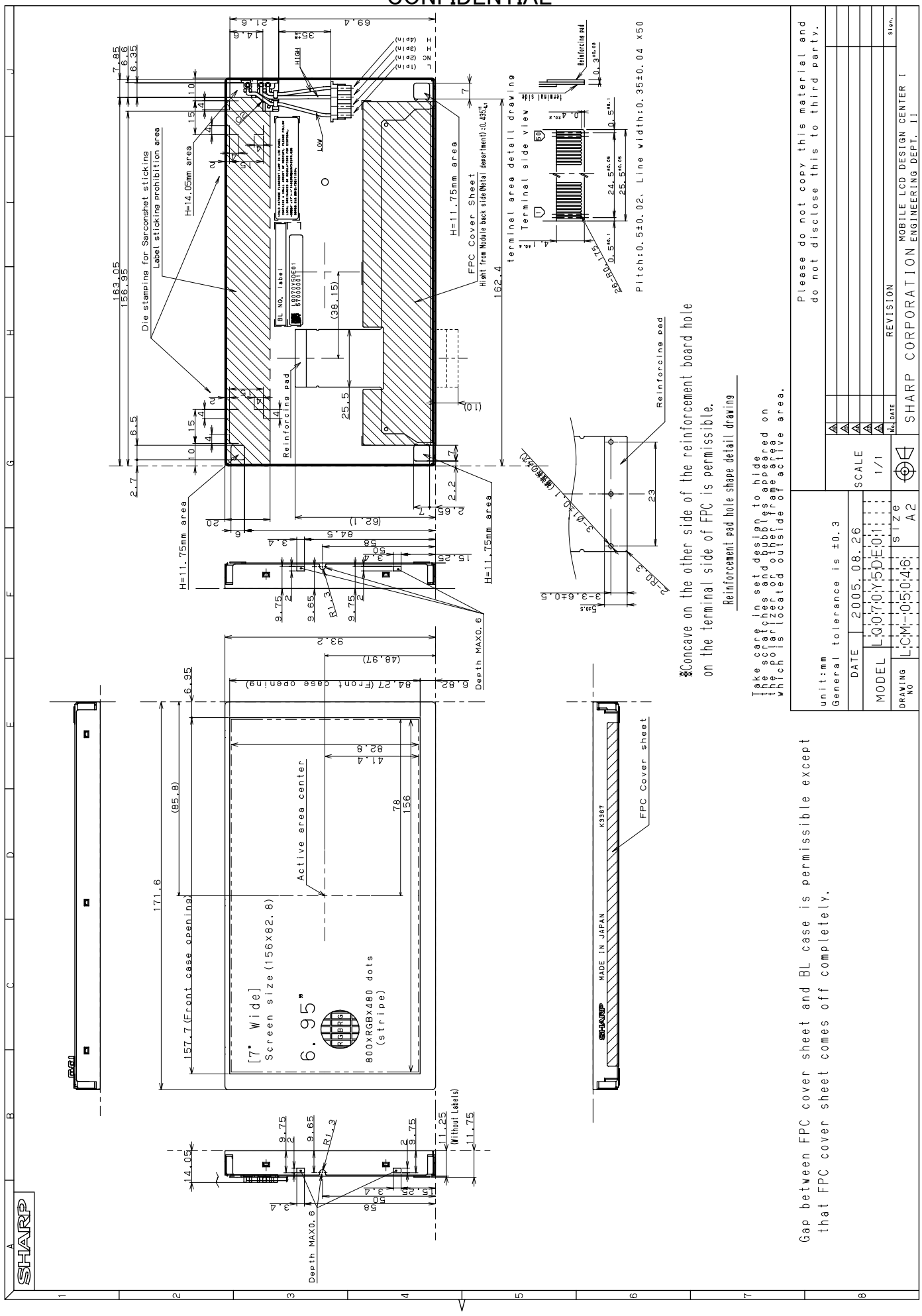


Fig.1 Outline Dimensions

LCY05049-19

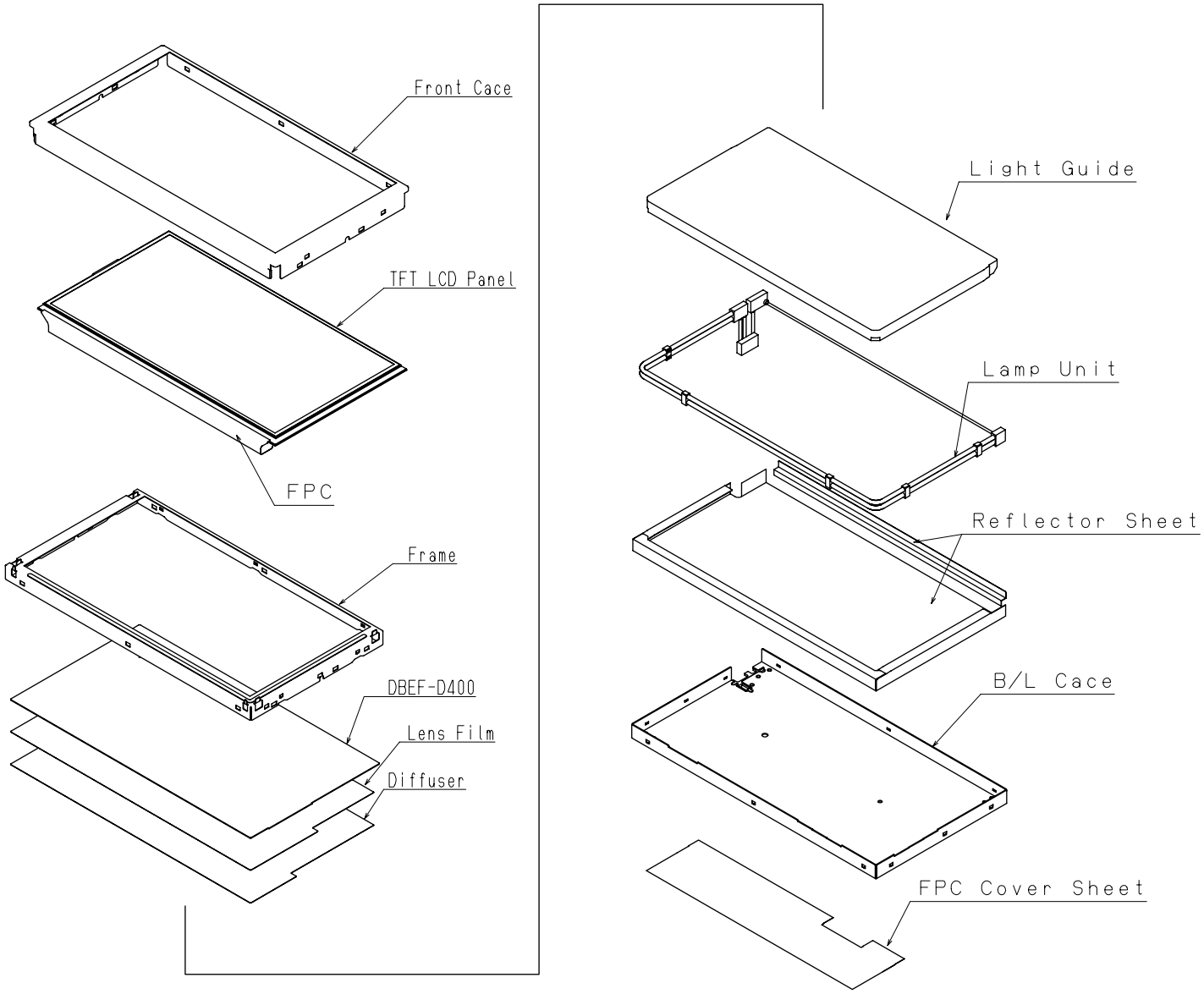


Fig.2 The construction of TFT-LCD module

LCY05049-20

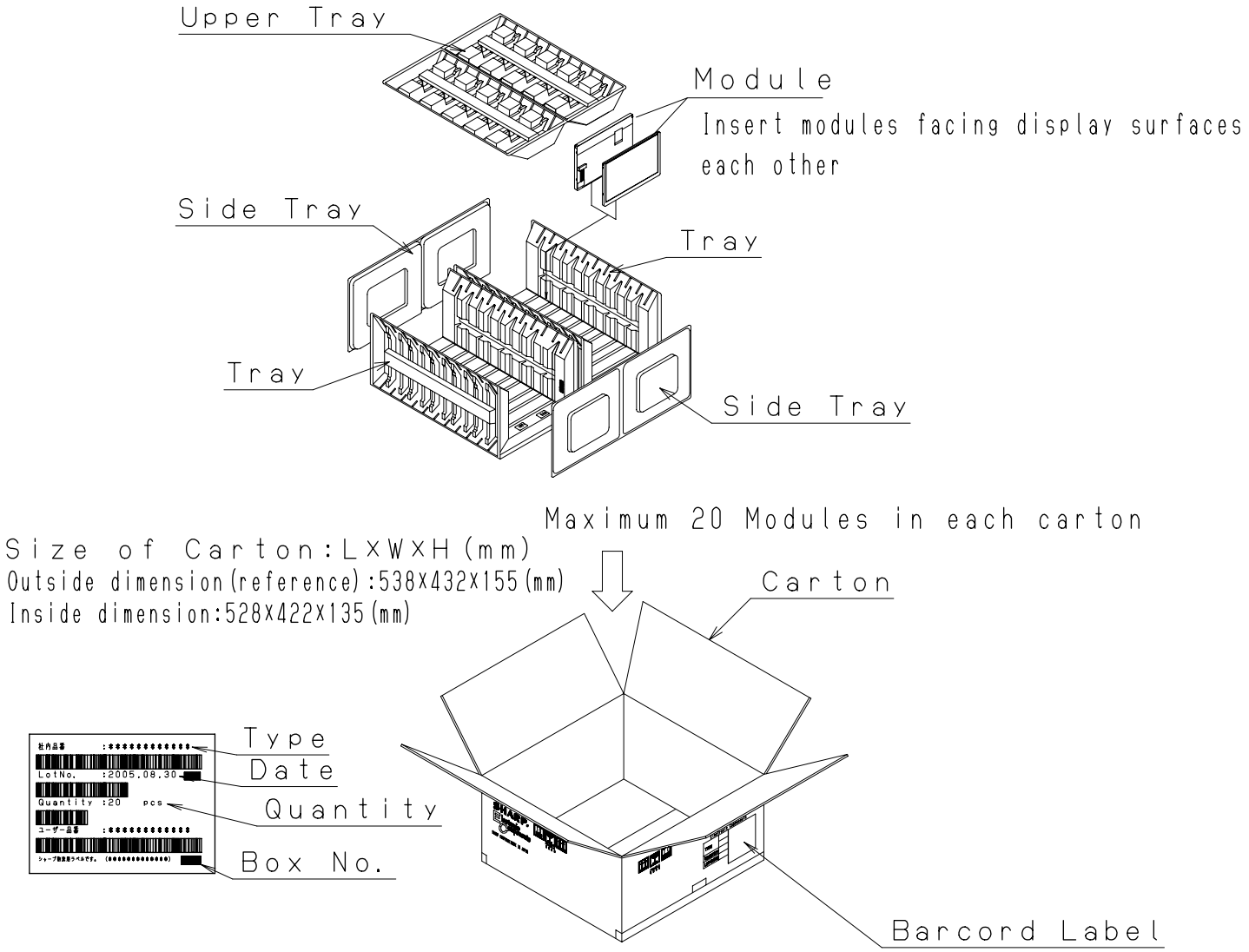


Fig. 3 Packing form

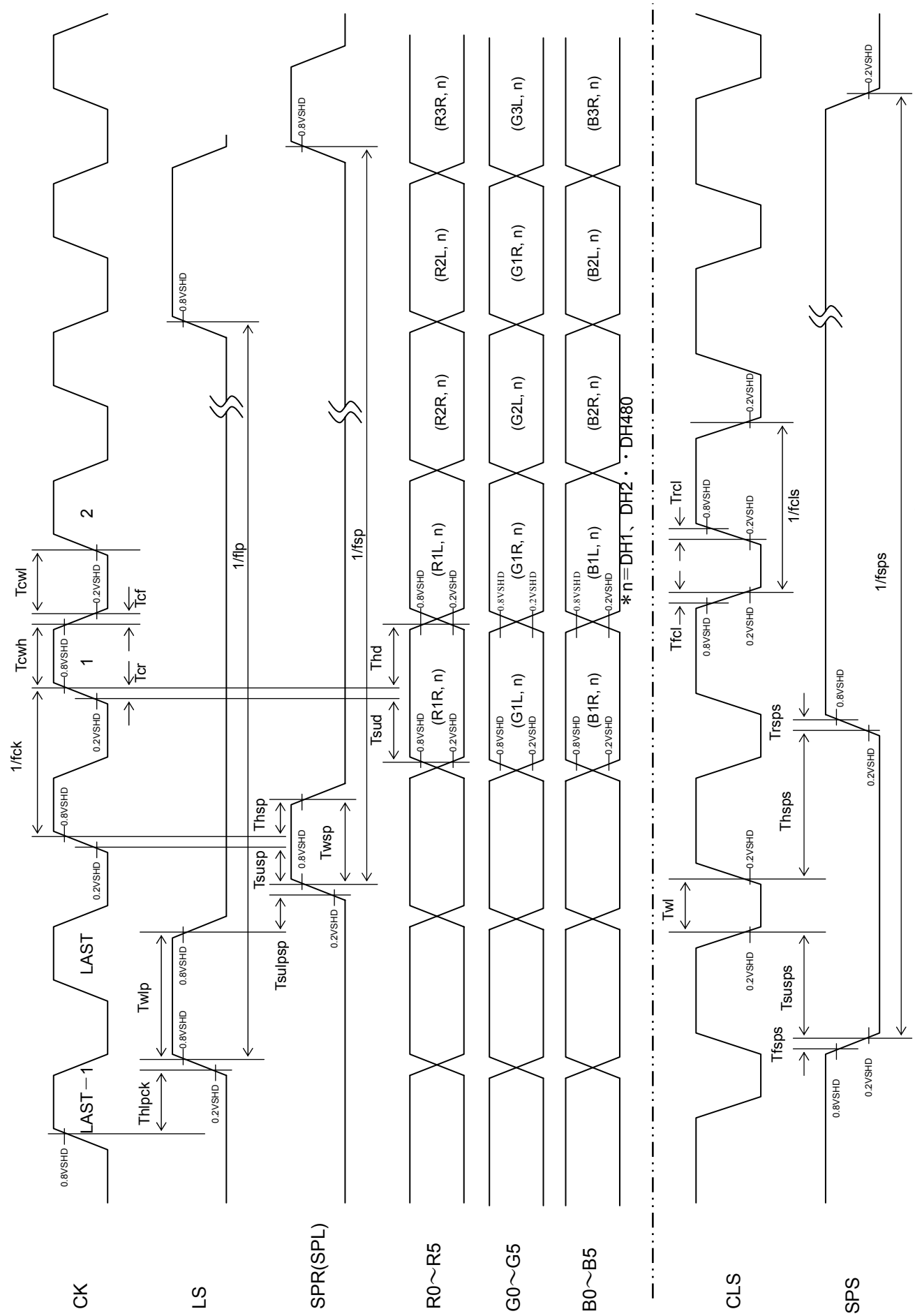


Fig4-1 input signal waveform

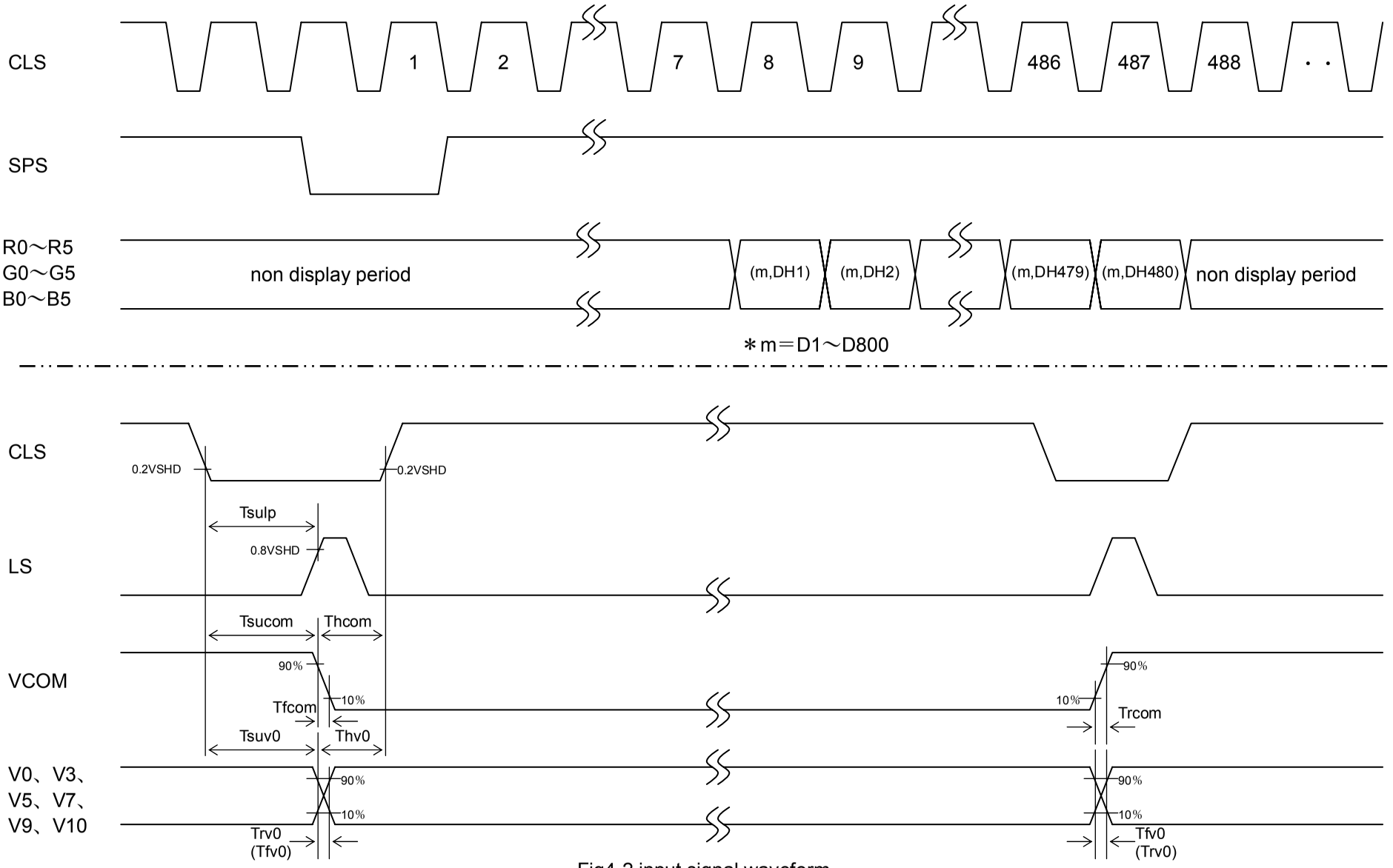


Fig4-2 input signal waveform