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	SPECIFICATION	MOBILE LIQUID CRYSTAL DISPLAY GROUP

DEVICE SPECIFICATION FOR

TFT-LCD Module

MODEL No.

LQ231U1LW31

These parts have corresponded with the RoHS directive.

☐ CUSTOMER'S APPROVAL

DATE _____

BY _____

PRESENTED
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RECORDS OF REVISION

LQ231U1LW31

SPEC No.	DATE	REVISED		SUMMARY	NOTE
		No.	PAGE		
LD-21810	Sep. 01. 2009	-	-	-	1 st Issue

1. Application

This specification sheets applies to the color TFT-LCD module LQ231U1LW31.

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2. Overview

This module is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver ICs, control circuit, power supply circuit and a back light unit. Graphics and texts can be displayed on a 1600× RGB× 1200 dots panel with about 16,777,216 colors by using LDI (LVDS Display Interface) and supplying +5.0V DC supply voltages for TFT-LCD panel driving and applying +12.0V DC supply voltage for LED backlight-driving DC/DC converter.

It is a wide viewing-angle-module, high brightness(500cd/) and high speed response specification.

These LCD modules have corresponded with the RoHS directive.

3. Mechanical Specifications

Parameter	Specifications	Unit
Display size	59 (23.1") Diagonal	cm
Active area	470.4 (H)× 352.8 (V)	mm
Pixel format	1600 (H)× 1200 (V)	Pixel
	(1 pixel R+G+B dots)	
Aspect ratio	4:3	
Pixel pitch	0.294 (H)× 0.294 (V)	mm
Pixel configuration	R, G, B vertical stripe	
Display mode	Normally black	
Unit outline dimensions *1	530.0(W)× 431.5(H) × 23.9(D)TYP	mm
Mass	4,500 (max)	g
Surface treatment (Haze value)	Anti-glare coating : (Haze value 40%, Hardness 2H)	

*1.Note: excluding back light cables and connecters.

The thickness of module (D) doesn't contain the projection.

Outline dimensions are shown in Fig.1.

4. Input Terminals

4-1. TFT-LCD panel driving

CN1 (Interface signals and +5.0V power supply)

Using connectors	FI-WE31P-HFE (Japan Aviation Electronics Industry, Limited)
Corresponding connectors	FI-W31M (Japan Aviation Electronics Industry, Limited)
	FI-C3-A3-15000(Contact)
Using LVDS receiver	Type contained in a control IC
	(DS90CF386 (NS Corporation) or equivalent)
Corresponding LDI Transmitter	DS90C387 (NS Corporation) or equivalent)
	Non-DC Balanced Mode

Table 4-1-1   LDI Interface signals

Pin No.	Symbol	Function	Remark
1	Vcc	+5V power supply	
2	Vcc	+5V power supply	
3	Vcc	+5V power supply	
4	Vcc	+5V power supply	
5	GND	GND	
6	GND	GND	
7	GND	GND	
8	NC	NC	
9	GMCH	Gamma control(High)	
10	GMCL	Gamma control(Low)	
11	RxO0-	Receiver signal of LDI (O0-)	LDI
12	RxO0+	Receiver signal of LDI (O0+)	LDI
13	RxO1-	Receiver signal of LDI (O1-)	LDI
14	RxO1+	Receiver signal of LDI (O1+)	LDI
15	RxO2-	Receiver signal of LDI (O2-)	LDI
16	RxO2+	Receiver signal of LDI (O2+)	LDI
17	RxO-	Receiver CLK of LDI(OC-)	LDI
18	RxO+	Receiver CLK of LDI(OC+)	LDI
19	RxO3-	Receiver signal of LDI (O3-)	LDI
20	RxO3+	Receiver signal of LDI (O3+)	LDI
21	RxE0-	Receiver signal of LDI (E0-)	LDI
22	RxE0+	Receiver signal of LDI (E0+)	LDI
23	RxE1-	Receiver signal of LVDS (E1-)	LDI
24	RxE1+	Receiver signal of LDI (E1+)	LDI
25	RxE2-	Receiver signal of LDI (E2-)	LDI
26	RxE2+	Receiver signal of LDI (E2+)	LDI
27	RxE3-	Receiver signal of LDI (E3-)	LDI
28	RxE3+	Receiver signal of LDI (E3+)	LDI
29	NC	NC	
30	LVDSGND	LVDSGND	
31	LVDSGND	LVDSGND	

Note1: Resistance (RVR) between GMCL and GMCH enables Gamma adjustment.

   (See Fig.4-5-1: RVR=OPEN recommended)

Note2: There is a possibility that trouble occurs in initial and long-term reliability when using

   it besides corresponding connector.

4-2. Data Mapping

1) 8 bit input

Table 4-2-1 and Fig4-2-2 shows the pin assignment of the input signals.

<u>Table 4-2-1 LDI Input signals</u>

VGA-TFT Data Signal		Input Data Pin (DS90C387)	Output Data Pin (DS90CF386)	LCD Unit Data Signal
LSB	R0	R16	R16	RO0
	R1	R17	R17	RO1
	R2	R10	R10	RO2
	R3	R11	R11	RO3
	R4	R12	R12	RO4
	R5	R13	R13	RO5
	R6	R14	R14	RO6
MSB	R7	R15	R15	RO7
LSB	G0	G16	G16	GO0
	G1	G17	G17	GO1
	G2	G10	G10	GO2
	G3	G11	G11	GO3
	G4	G12	G12	GO4
	G5	G13	G13	GO5
	G6	G14	G14	GO6
MSB	G7	G15	G15	GO7
LSB	B0	B16	B16	BO0
	B1	B17	B17	BO1
	B2	B10	B10	BO2
	B3	B11	B11	BO3
	B4	B12	B12	BO4
	B5	B13	B13	BO5
	B6	B14	B14	BO6
MSB	B7	B15	B15	BO7
LSB		R16	R26	RE0
		R17	R27	RE1
		R10	R20	RE2
		R11	R21	RE3
		R12	R22	RE4
		R13	R23	RE5
		R14	R24	RE6
MSB		R15	R25	RE7
LSB		G16	G26	GE0
		G17	G27	GE1
		G10	G20	GE2
		G11	G21	GE3
		G12	G22	GE4
		G13	G23	GE5
		G14	G24	GE6
MSB		G15	G25	GE7
LSB		B16	B26	BE0
		B17	B27	BE1
		B10	B20	BE2
		B11	B21	BE3
		B12	B22	BE4
		B13	B23	BE5
		B14	B24	BE6
MSB		B15	B25	BE7

LD21810-5

LDI Interface block diagram(Single input Dual output)

A/D Board   CABLE   LCD

Graphic Controller
Note-1)

LVDS TX
PinNo. DS90C387

Control IC(Built in LVDS)
(DS90CF386 or equivalent)

GC	Pin	LVDS TX	RxO	Cable	RxO	Control IC	LCD
R0	4	R16				R16	RO0
R1	3	R17				R17	RO1
R2	10	R10				R10	RO2
R3	9	R11				R11	RO3
R4	8	R12				R12	RO4
R5	7	R13	RxO0-	50	R1 RxO0-	R13	RO5
R6	6	R14	RxO0+	49	R2 RxO0+	R14	RO6
R7	5	R15				R15	RO7
G0	94	G16				G16	GO0
G1	93	G17	RxO1-	47	P1 RxO1-	G17	GO1
G2	2	G10	RxO1+	46	P2 RxO1+	G10	GO2
G3	1	G11				G11	GO3
G4	100	G12				G12	GO4
G5	99	G13	RxO2-	45	N1 RxO2-	G13	GO5
G6	96	G14	RxO2+	44	N2 RxO2+	G14	GO6
G7	95	G15				G15	GO7
B0	86	B16				B16	BO0
B1	85	B17	RxO3-	39	L1 RxO3-	B17	BO1
B2	92	B10	RxO3+	38	L2 RxO3+	B10	BO2
B3	91	B11				B11	BO3
B4	90	B12				B12	BO4
B5	89	B13				B13	BO5
B6	88	B14				B14	BO6
B7	87	B15				B15	BO7
					M1 RxOC-		
					M2 RxOC+		
		R16				R26	RE0
		R17				R27	RE1
		R10				R20	RE2
		R11				R21	RE3
		R12				R22	RE4
		R13	RxE0-	37	J1 RxE0-	R23	RE5
		R14	RxE0+	36	J2 RxE0+	R24	RE6
		R15				R25	RE7
		G16				G26	GE0
		G17	RxE1-	34	H1 RxE1-	G27	GE1
		G10	RxE1+	33	H2 RxE1+	G20	GE2
		G11				G21	GE3
		G12				G22	GE4
		G13	RxE2-	32	G1 RxE2-	G23	GE5
		G14	RxE2+	31	G2 RxE2+	G24	GE6
		G15				G25	GE7
		B16				B26	BE0
		B17	RxE3-	29	E1 RxE3-	B27	BE1
		B10	RxE3+	28	E2 RxE3+	B20	BE2
		B11				B21	BE3
		B12				B22	BE4
		B13				B23	BE5
		B14				B24	BE6
		B15				B25	BE7

Note-2

Hsync	54	Hsync	RxC-	42	F1 RxEC-	Hsync	Hsync
Vsync	55	Vsync	RxC+	41	F2 RxEC+	Vsync	Vsync
DE	56	DE				DE	DE
CLOCK	11	CLKIN				CLKOUT	CLOCK

Note-1) Signal configuration
EVEN DATA(ROx,BOx,GOx: 1'st,3'rd,5th·········data)
ODD DATA(REx,GEx,BEx : 2'nd,4'th,6'th·········data)
Note-2) Hsync, Vsync Not use.
Note-3) Use twisted differential cable   impedance 100
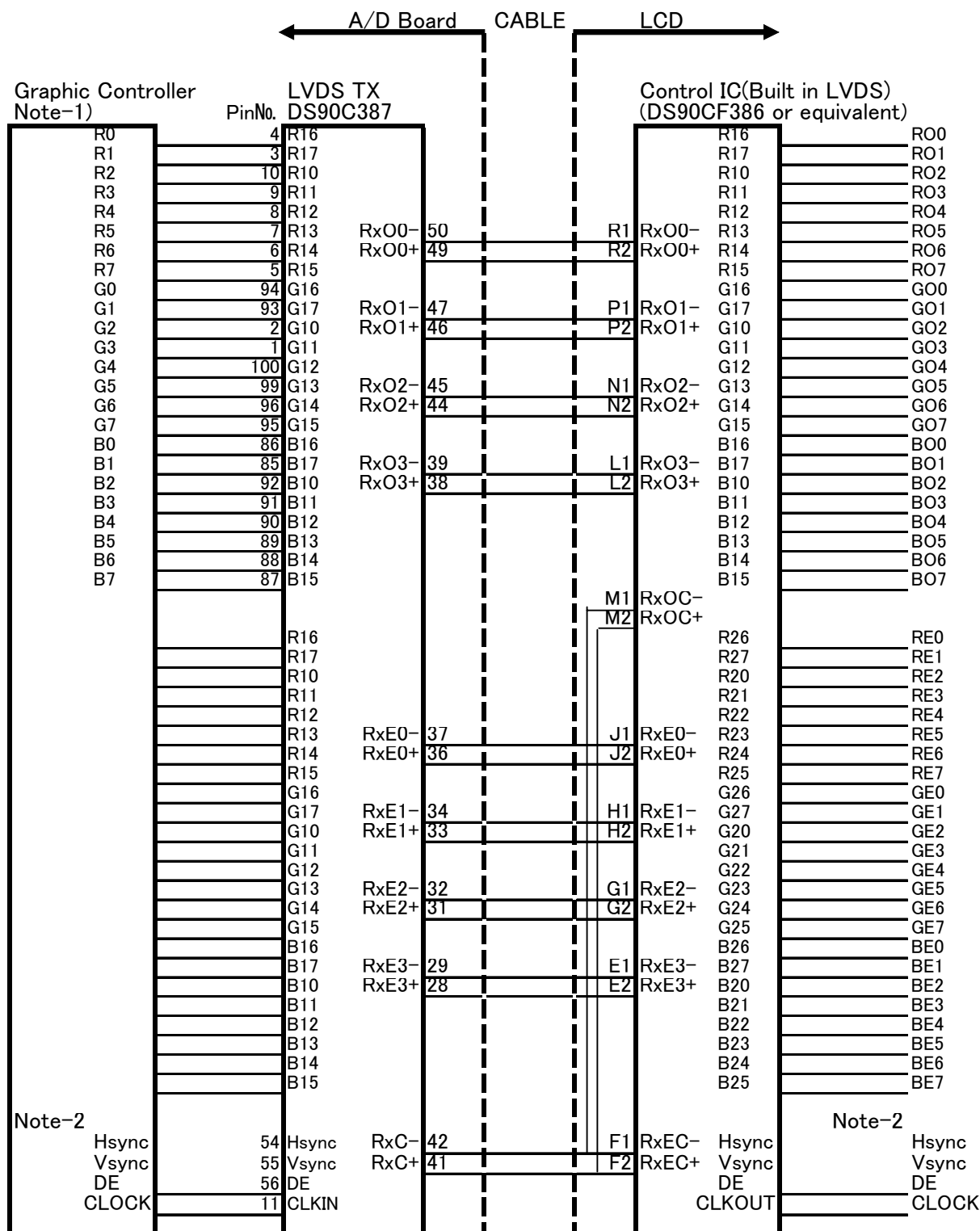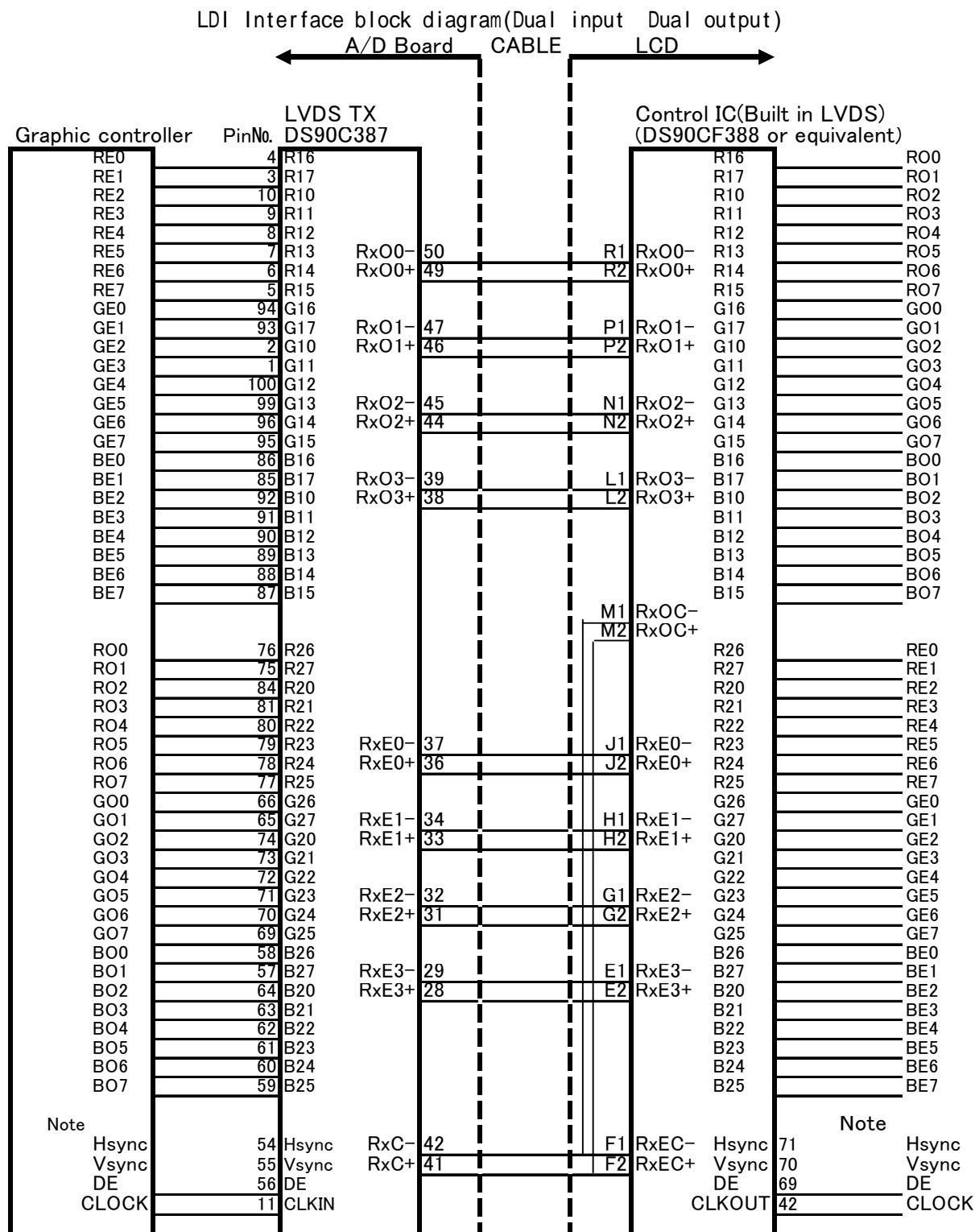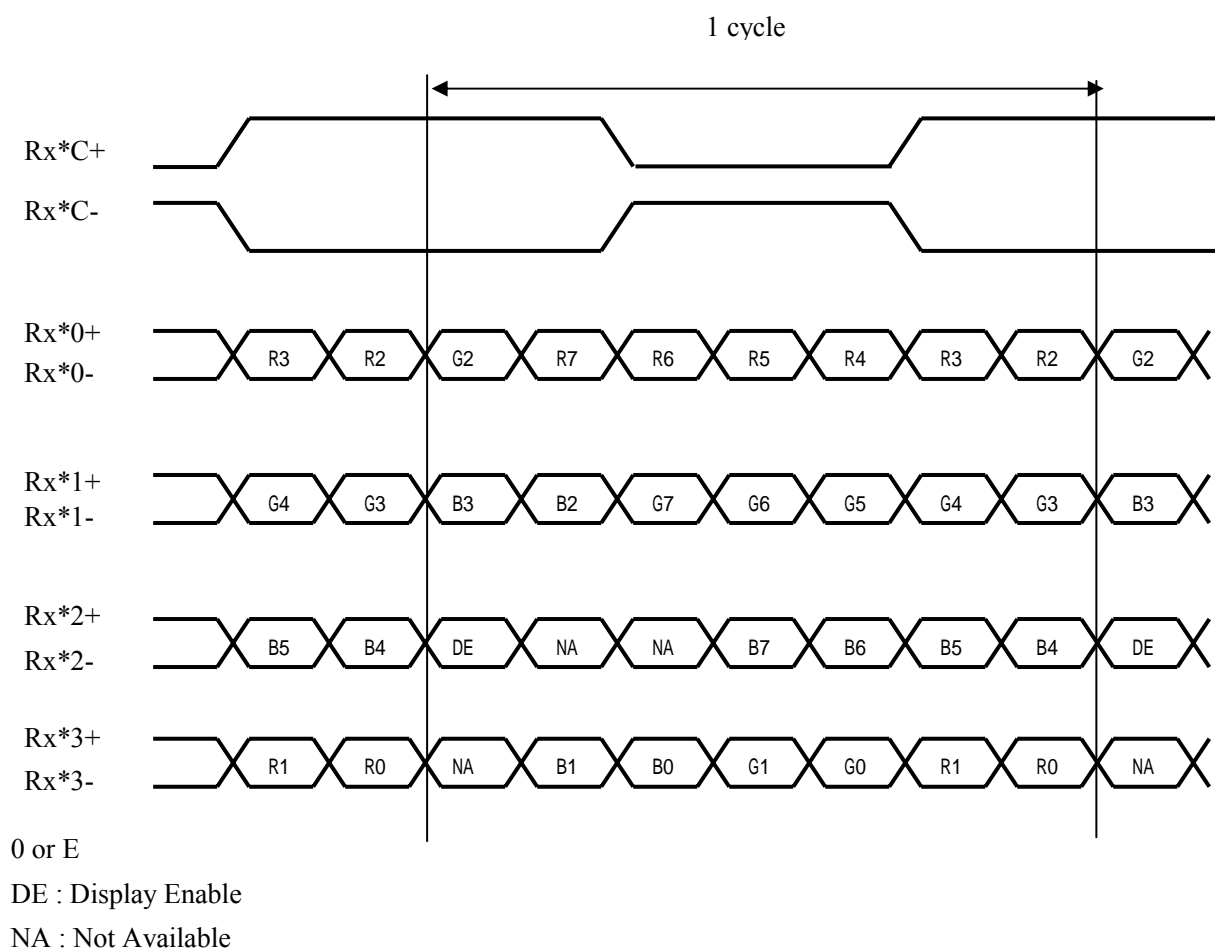Note-4) DS90C387:Non-DC Balanced Mode

Figure 4-2-2 Interface pin assignment

Table 4-2-3 LDI Input signals(Dual input)

VGA-TFT Data Signal		Input Data Pin (DS90C387)	Output Data Pin (DS90CF386)	LCD Unit Data Signal
LSB	RE0	R16	R16	RO0
	RE1	R17	R17	RO1
	RE2	R10	R10	RO2
	RE3	R11	R11	RO3
	RE4	R12	R12	RO4
	RE5	R13	R13	RO5
	RE6	R14	R14	RO6
MSB	RE7	R15	R15	RO7
LSB	GE0	G16	G16	GO0
	GE1	G17	G17	GO1
	GE2	G10	G10	GO2
	GE3	G11	G11	GO3
	GE4	G12	G12	GO4
	GE5	G13	G13	GO5
	GE6	G14	G14	GO6
MSB	GE7	G15	G15	GO7
LSB	BE0	B16	B16	BO0
	BE1	B17	B17	BO1
	BE2	B10	B10	BO2
	BE3	B11	B11	BO3
	BE4	B12	B12	BO4
	BE5	B13	B13	BO5
	BE6	B14	B14	BO6
MSB	BE7	B15	B15	BO7
LSB	RO0	R26	R26	RE0
	RO1	R27	R27	RE1
	RO2	R20	R20	RE2
	RO3	R21	R21	RE3
	RO4	R22	R22	RE4
	RO5	R23	R23	RE5
	RO6	R24	R24	RE6
MSB	RO7	R25	R25	RE7
LSB	GO0	G26	G26	GE0
	GO1	G27	G27	GE1
	GO2	G20	G20	GE2
	GO3	G21	G21	GE3
	GO4	G22	G22	GE4
	GO5	G23	G23	GE5
	GO6	G24	G24	GE6
MSB	GO7	G25	G25	GE7
LSB	BO0	B26	B26	BE0
	BO1	B27	B27	BE1
	BO2	B20	B20	BE2
	BO3	B21	B21	BE3
	BO4	B22	B22	BE4
	BO5	B23	B23	BE5
	BO6	B24	B24	BE6
MSB	BO7	B25	B25	BE7

LDI Interface block diagram(Dual input Dual output)

A/D Board ← CABLE → LCD

Graphic controller — PinNo. — LVDS TX DS90C387 | Control IC(Built in LVDS) (DS90CF388 or equivalent)

Graphic controller	PinNo.	TX pin	Diff	Cable pin	RX diff	RX signal	CtrlIC pin	LCD
RE0	4	R16					R16	RO0
RE1	3	R17					R17	RO1
RE2	10	R10					R10	RO2
RE3	9	R11					R11	RO3
RE4	8	R12					R12	RO4
RE5	7	R13	RxO0−	50	R1	RxO0−	R13	RO5
RE6	6	R14	RxO0+	49	R2	RxO0+	R14	RO6
RE7	5	R15					R15	RO7
GE0	94	G16					G16	GO0
GE1	93	G17	RxO1−	47	P1	RxO1−	G17	GO1
GE2	2	G10	RxO1+	46	P2	RxO1+	G10	GO2
GE3	1	G11					G11	GO3
GE4	100	G12					G12	GO4
GE5	99	G13	RxO2−	45	N1	RxO2−	G13	GO5
GE6	96	G14	RxO2+	44	N2	RxO2+	G14	GO6
GE7	95	G15					G15	GO7
BE0	86	B16					B16	BO0
BE1	85	B17	RxO3−	39	L1	RxO3−	B17	BO1
BE2	92	B10	RxO3+	38	L2	RxO3+	B10	BO2
BE3	91	B11					B11	BO3
BE4	90	B12					B12	BO4
BE5	89	B13					B13	BO5
BE6	88	B14					B14	BO6
BE7	87	B15					B15	BO7
					M1	RxOC−		
					M2	RxOC+		
RO0	76	R26					R26	RE0
RO1	75	R27					R27	RE1
RO2	84	R20					R20	RE2
RO3	81	R21					R21	RE3
RO4	80	R22					R22	RE4
RO5	79	R23	RxE0−	37	J1	RxE0−	R23	RE5
RO6	78	R24	RxE0+	36	J2	RxE0+	R24	RE6
RO7	77	R25					R25	RE7
GO0	66	G26					G26	GE0
GO1	65	G27	RxE1−	34	H1	RxE1−	G27	GE1
GO2	74	G20	RxE1+	33	H2	RxE1+	G20	GE2
GO3	73	G21					G21	GE3
GO4	72	G22					G22	GE4
GO5	71	G23	RxE2−	32	G1	RxE2−	G23	GE5
GO6	70	G24	RxE2+	31	G2	RxE2+	G24	GE6
GO7	69	G25					G25	GE7
BO0	58	B26					B26	BE0
BO1	57	B27	RxE3−	29	E1	RxE3−	B27	BE1
BO2	64	B20	RxE3+	28	E2	RxE3+	B20	BE2
BO3	63	B21					B21	BE3
BO4	62	B22					B22	BE4
BO5	61	B23					B23	BE5
BO6	60	B24					B24	BE6
BO7	59	B25					B25	BE7
Note								Note
Hsync	54	Hsync	RxC−	42	F1	RxEC−	Hsync 71	Hsync
Vsync	55	Vsync	RxC+	41	F2	RxEC+	Vsync 70	Vsync
DE	56	DE					DE 69	DE
CLOCK	11	CLKIN					CLKOUT 42	CLOCK

Note-1 Hsync, Vsync Not use
Note-2 Use twisted differential cable   impedance   100
Note-3 DS90C387:Non-DC Balanced Mode

Figure 4-2-4 Interface pin assignment

4-3. Input signal timing chart

1 cycle

Rx*C+

Rx*C-

Rx*0+ Rx*0-	R3	R2	G2	R7	R6	R5	R4	R3	R2	G2
Rx*1+ Rx*1-	G4	G3	B3	B2	G7	G6	G5	G4	G3	B3
Rx*2+ Rx*2-	B5	B4	DE	NA	NA	B7	B6	B5	B4	DE
Rx*3+ Rx*3-	R1	R0	NA	B1	B0	G1	G0	R1	R0	NA

0 or E

DE : Display Enable

NA : Not Available

4-4. Backlight

CN2

Using connector   : S12B-PH-SM4-TB (JST)

Corresponding connector : PHR-12 (JST)   Cable : AWG#24   recommended

Pin No.	Symbol	Function	Remark
1	V_{LED}	+12.0V LED Backlight power supply	
2	V_{LED}	+12.0V LED Backlight power supply	
3	V_{LED}	+12.0V LED Backlight power supply	
4	V_{LED}	+12.0V LED Backlight power supply	
5	V_{LED}	+12.0V LED Backlight power supply	
6	LED GND	LED GND	
7	LED GND	LED GND	
8	LED GND	LED GND	
9	LED GND	LED GND	
10	LED GND	LED GND	
11	Vcnt	BL ON/OFF	
12	Vvr	Brightness control	
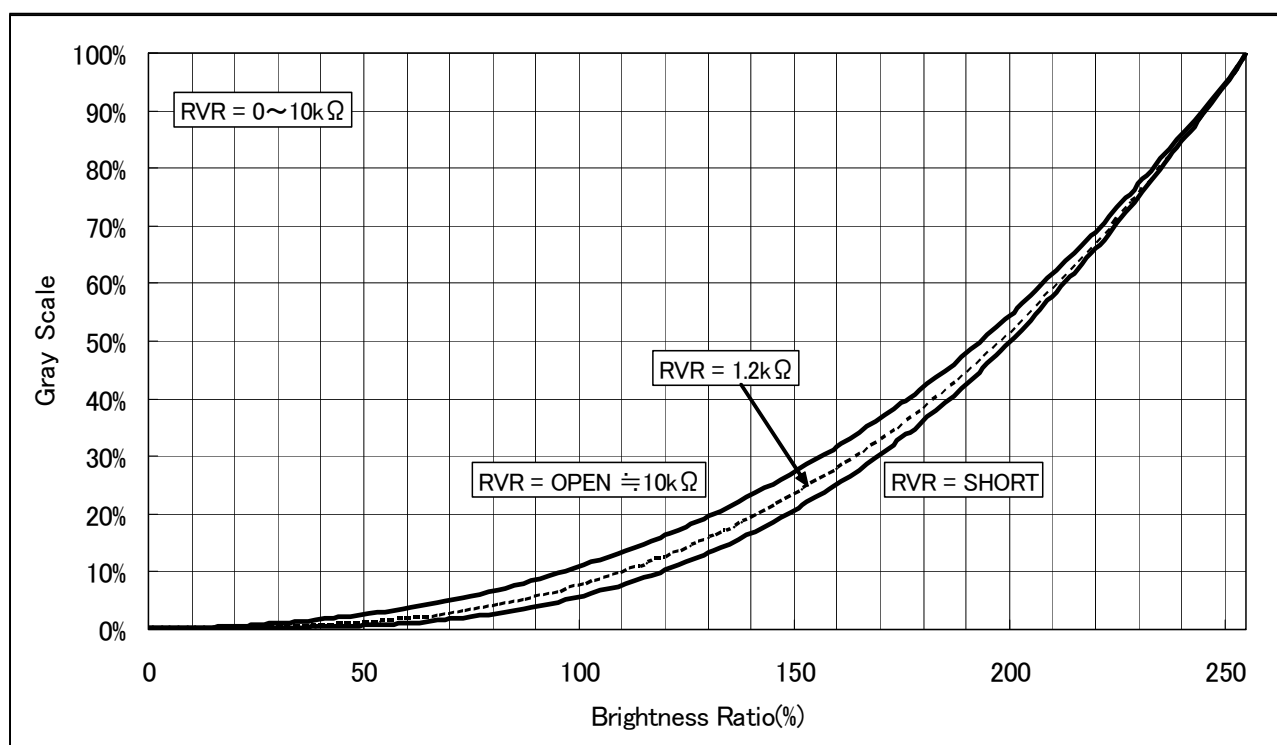
Figure 4-5-1 Gamma characteristics

Note) Fig.4-5-1 shows reference characteristics but dose not guarantee it.

5. Absolute Maximum Ratings

Parameter	Symbol	Condition	Terminal Symbol	Ratings		Unit	Remark
Supply voltage	Vcc	Ta=25	Vcc	-0.3	+ 6.0		Note1
LED Supply voltage	V_{LED}	Ta=25	V_{LED}	-0.3	+ 14.0		
Input voltage	V_L	Ta=25	LVDS input signal	-0.3	+3.6		
	Vcnt	Ta=25	Vcnt	-0.3	VLED		
	Vvr	Ta=25	Vvr	0	4.0		
LED temperature	T_{LED}			+90			Note2
Storage temperature	T_{STG}	Ambient		-20	+ 65		Note1
Operating temperature	T_{OPA}	Ambient		min	0		Note1
		Panel surface (Active area)		max	+ 60		

Note1   Humidity   90%RH Max.   (Ta   40   )

Maximum wet-bulb temperature at 39   or less.   (Ta>40   )

No condensation.

Note2   The measurement point refers to Fig. 1.

Note3   There is a possibility of causing deterioration in the irregularity and others of the screen and the display fineness when preserving or using it in more than 60 .

Note4   When ambient temperature is more than 50 , please cool the back side of the LCD module by a fan.

6. Electrical Characteristics

6-1. TFT-LCD panel driving

Ta +25

arameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Supply voltage		V_{CC}	+4.75	+5.0	+5.25	V	Note2
Current dissipation	Vcc=5.0V	I_{CC}		1100	1800	mA	Note3
Input voltage for LDI	LDI signal	V_L	0		2.4	V	
Permissive input ripple voltage		V_{RP}			100	mVp-p	Vcc=+5.0V
Differential input threshold voltage	High	V_{TH}			$V_{CM}+100$	mV	V_{CM}=+1.2V
	Low	V_{TL}	$V_{CM}-100$			mV	Note1
Terminal resistor		R_T		100			Differential input

Note1　　V_{CM} : Common mode voltage of LDI driver.

Note2　　On-off condition for supply voltage　　　　Vcc-dip conditions
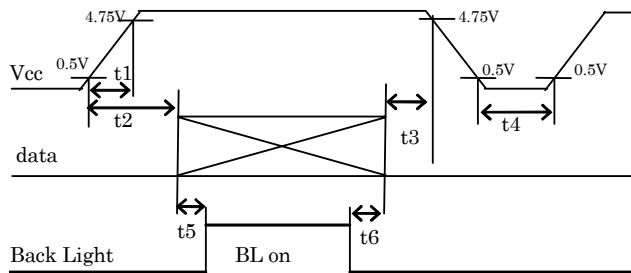
0　t1　20ms　　　　0　t2　40ms

0　t3　40ms　　　　0.5s　t4

100ms　t5　　　　100ms　t6
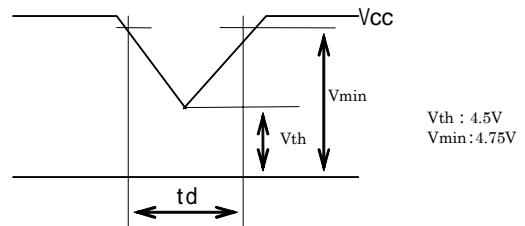
1) Vth　Vcc　Vmin

td　20ms

2) Vcc<Vth

Vcc-dip conditions should also follow the on-off conditions for supply voltage.

Note3　　Current dissipation
　　　　Standard value: 16-gray-bar pattern
　　　　(Measurement condition Vcc=+5.0V, 1/Tc=81MHz, Ta=25　)
　　　　Refer to Chapter 8 for RGB each gray scale
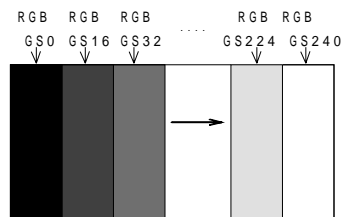
　　　　Maximum value: vertical　2dot checker (0/256-255/256)
　　　　(Measurement condition Vcc=+4.75V, 1/Tc=81MHz, Ta=25　)
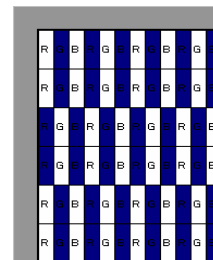
6-2. Backlight

The backlight system is an edge-lighting type with white-LED.

(It is usually required to measure under the following condition.condition: Ta=25 ± 2)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Supply voltage	V_{LED}	11.4	12.0	12.6	V	
Current dissipation	I_{LED}		5.0	5.8	A	V_{LED} = 12.0V Vvr =0V
Brightness Control Voltage	V_{VR}	0	-	3.5	V	Note1
LED ON/OFF Low Voltage	$V_{cnt}L$	0		1.0	V	Note2
LED ON/OFF High Voltage	$V_{cnt}H$	4.5		V_{LED}	V	Note2
LED life time	-	30,000	50,000	-	h	LED only

The reference LED life time is 30,000h defined by below.

(Continuous turning on at LED Junction temperature（Tj）100℃,

LED Current (If) = 150mA (equal to Max.Brightness)

A state only for LED)

When a brightness of LED surface became 50% of the specifications minimum.

【Note1】 V_{VR} input :0V= Max.Brightness 3.5V=Min. Brightness

【Note2】 V_{cnt} input : Low or OPEN = BL turn on High = BL turn off

【Note3】

On-off condition for supply voltage
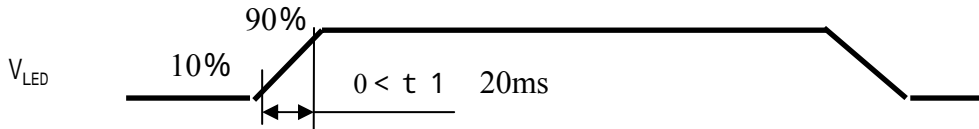
V_{LED}-dip conditions
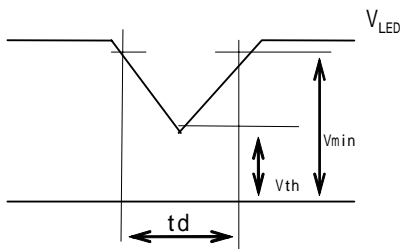
Vth 10.5V

Vmin 10.8V

1) Vth V_{LED} Vmin

td 20ms

2) V_{LED}<Vth

7. Timing characteristics of input signals

7-1. Timing characteristics

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Clock signal	Frequency	1/Tc	77.18	81	85	MHz	
ENAB signal	Horizontal period	TH	865	1080	1130	clock	Note2
			11.3	13.3	14.65	μs	
	Horizontal period (High)	THd	800	800	800	clock	
	Vertical period	TV	1220	1250	1280	line	Note1
			15.9	16.7	17.5	ms	Note2
	Vertical period (High)	TVd	1200	1200	1200	line	

Note1 In case of using the long vertical period, the deterioration of display quality, flicker etc. may occur.

Note2 The horizontal display position is determined by ENAB signal and the input data corresponding
to the rising edge of DCLK is displayed at the left end of the active area.
Regarding the vertical display position, the data starting form following ENAB rising is displayed
at the top of the active area in case of no rising ENAB more than 2003clk from ENAB rising.
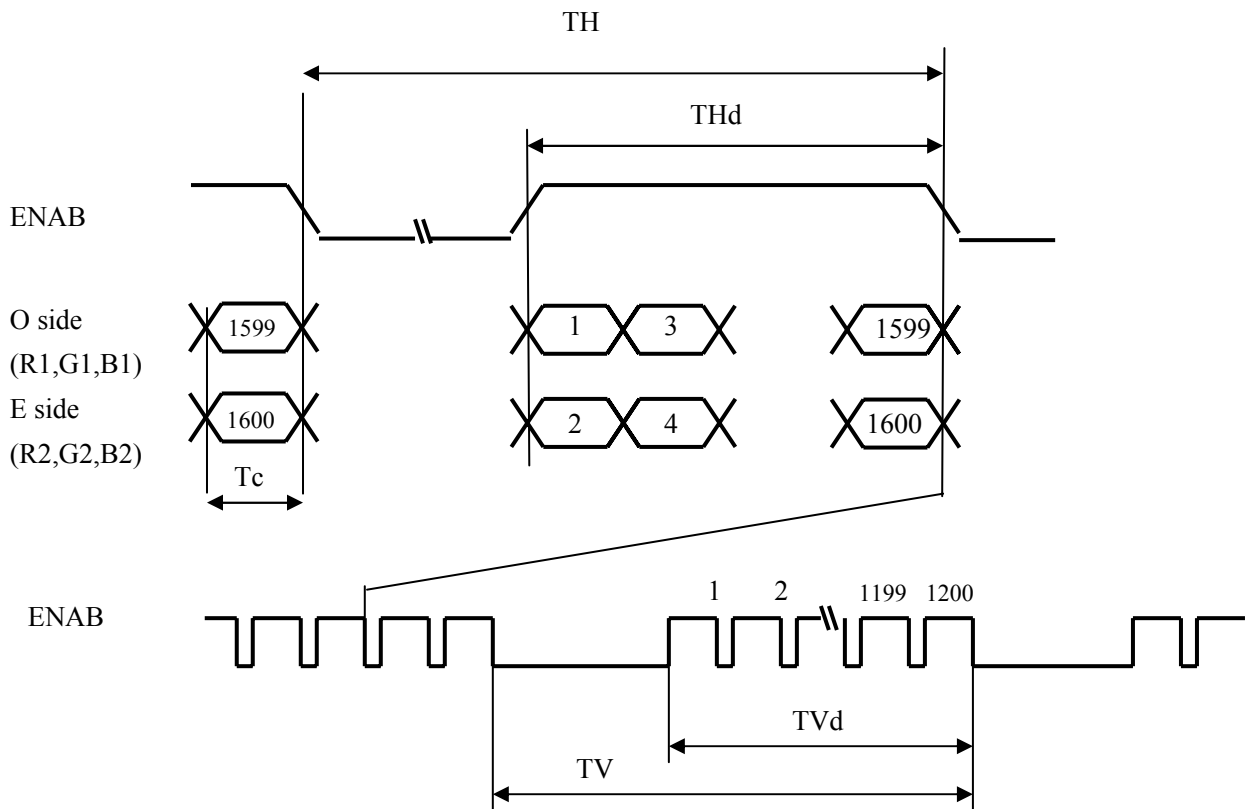
7-2. Input Data Signals and Display Position on the screen

Display position of input data (H, V)

Two pixels data is sampled at the same time.

DO (odd 1 data): RO0　RO7, GO0　GO7, BO0　BO7

DE (even 1 data): RE0　RE7, GE0　GE7, BE0　BE7
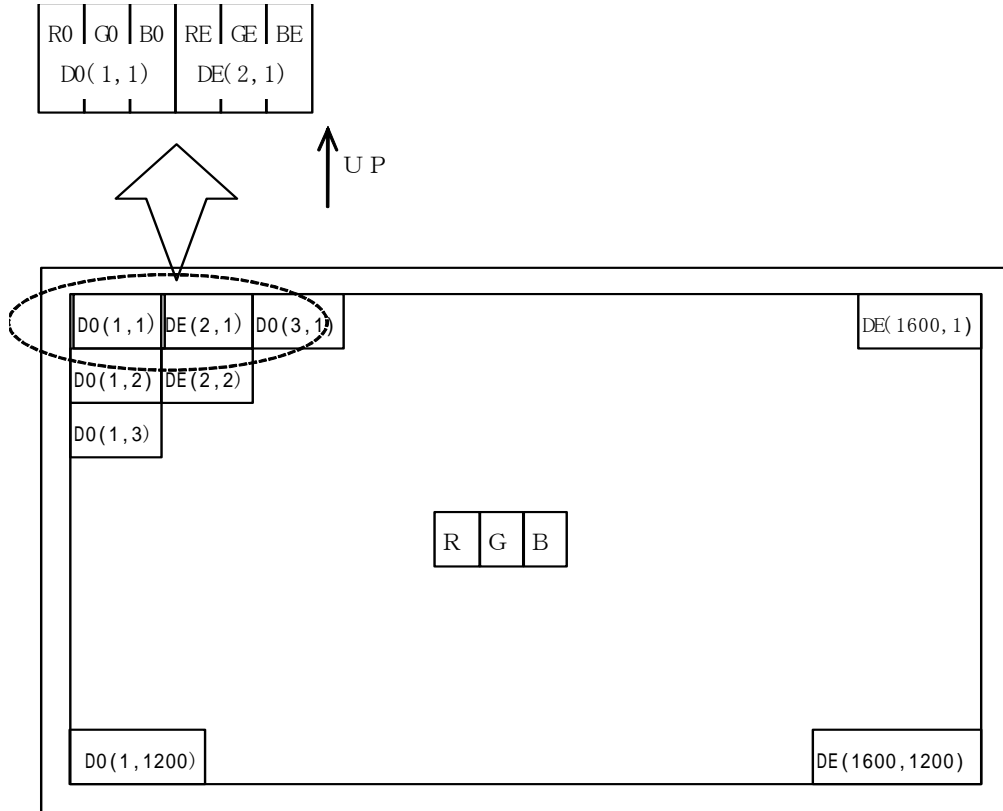
8. Input Signals, Basic Display Colors and Gray Scale of Each Color

8-1. 8bit input

Colors & Gray scale	Gray Scale	R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7
Basic Color Black		O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Blue		O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	1	1	1	1	1	1	1	1
Green		O	O	O	O	O	O	O	O	1	1	1	1	1	1	1	1	O	O	O	O	O	O	O	O
Cyan		O	O	O	O	O	O	O	O	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red		1	1	1	1	1	1	1	1	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Magenta		1	1	1	1	1	1	1	1	O	O	O	O	O	O	O	O	1	1	1	1	1	1	1	1
Yellow		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	O	O	O	O	O	O	O	O
White		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale of Red Black	0	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
⇧	1	1	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Darker	2	O	1	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
⇧	↓				↓									↓								↓			
⇩	↓				↓									↓								↓			
Brighter	253	1	O	1	1	1	1	1	1	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
⇩	254	O	1	1	1	1	1	1	1	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Red	255	1	1	1	1	1	1	1	1	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Gray Scale of Green Black	0	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
⇧	1	O	O	O	O	O	O	O	O	1	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Darker	2	O	O	O	O	O	O	O	O	O	1	O	O	O	O	O	O	O	O	O	O	O	O	O	O
⇧	↓				↓									↓								↓			
⇩	↓				↓									↓								↓			
Brighter	253	O	O	O	O	O	O	O	O	1	O	1	1	1	1	1	1	O	O	O	O	O	O	O	O
⇩	254	O	O	O	O	O	O	O	O	O	1	1	1	1	1	1	1	O	O	O	O	O	O	O	O
Green	255	O	O	O	O	O	O	O	O	1	1	1	1	1	1	1	1	O	O	O	O	O	O	O	O
Gray Scale of Blue Black	0	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
⇧	1	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	1	O	O	O	O	O	O	O
Darker	2	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	1	O	O	O	O	O	O
⇧	↓				↓									↓								↓			
⇩	↓				↓									↓								↓			
Brighter	253	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	1	O	1	1	1	1	1	1
⇩	254	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	1	1	1	1	1	1	1
Blue	255	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	1	1	1	1	1	1	1	1

0 : Low level voltage,   1 : High level voltage.

Each basic color can be displayed in 256 gray scales of red, 256 gray scales of green, and 256 gray scales of blue from 8 bit data signals. According to the combination of total 24 bit data signals, 16,777,216 color display can be achieved on the screen.

9. Optical Characteristics

Ta=25 , Vcc =+5.0V

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	Horizontal	21, 22	CR 10	85			Deg.	
	Vertical	11, 12		85			Deg.	
	All direction				80		Deg.	
Contrast ratio		CRn	Optimum viewing angle	350	600			Note2,4
Response Time (Black White Black)		r+ d			12		ms	Note3(Condition2),4,5
Response Time Rise or decay (Gray scale)		avg			8		ms	Average response time
Chromaticity of White	x	x	=0°	0.257	0.292	0.337		Note4
	y	y		0.290	0.315	0.370		
Chromaticity of Red	x	x			0.629			
	y	y			0.362			
Chromaticity of Green	x	x			0.322			
	y	y			0.610			
Chromaticity of Blue	x	x			0.149			
	y	y			0.108			
Luminance of white		Y_{LI}		400	500		cd/m^2	Note4
White Uniformity		w				1.33		Note5

The measurement shall be executed 30 minutes after lighting at rating.

The optical characteristics shall be measured in a dark room or equivalent state with the method shown in Fig.9 below.
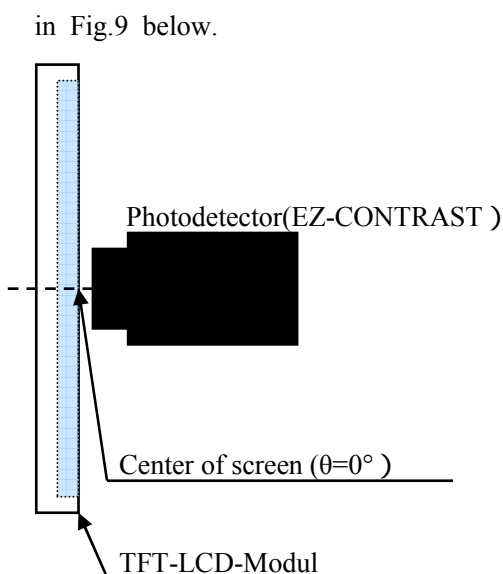
Fig9-1 Viewing angle measurement method

Photodetector(EZ-CONTRAST

Center of screen (θ=0°

TFT-LCD-Modul

Photodetector
Response Time (BM-5A)
Contrast ratio/Luminance/
Chromaticity (SR-3)

mm

Field=1°

Center of screen(θ=0°)

TFT-LCD-Module
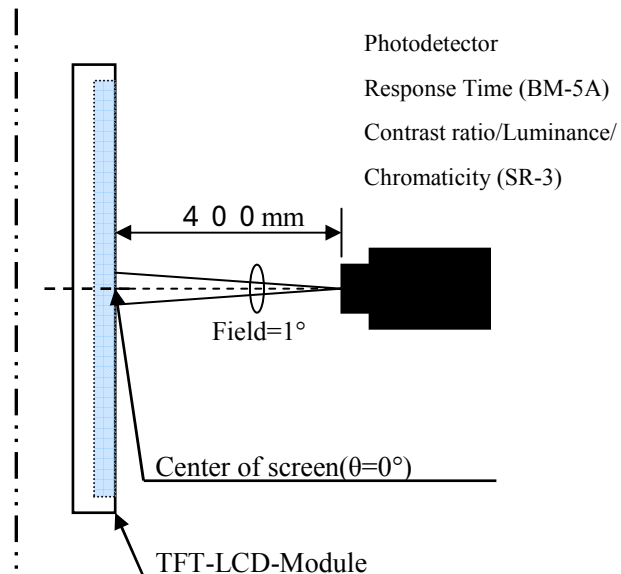
Fig9-2 Luminance/Contrast ratio/Response time/Chromaticity measurement method

Fig9 Optical characteristics measurement method

Note1　Definitions of viewing angle range:
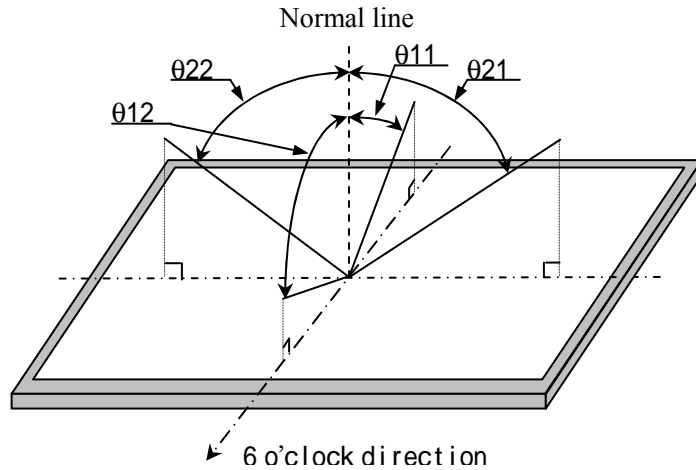
Note2　Definition of contrast ratio:

The contrast ratio is defined as the following.

$$\text{Contrast Ratio (CR)} \quad \frac{\text{Luminance (brightness) with all pixels white}}{\text{Luminance (brightness) with all pixels black}}$$

Note3　Definition of response time:

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".
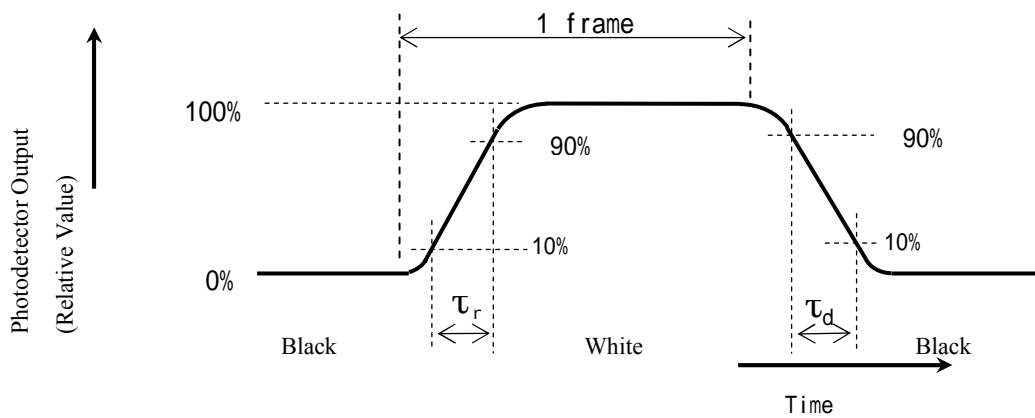
Note4　This shall be measured at center of the screen.

Note5　Definition of white uniformity:

White uniformity is defined as the following with nine measurements (①～⑨).

$$\frac{(\text{Maximum luminance} \quad ①～⑨)}{(\text{Minimum luminance} \quad ①～⑨)}$$
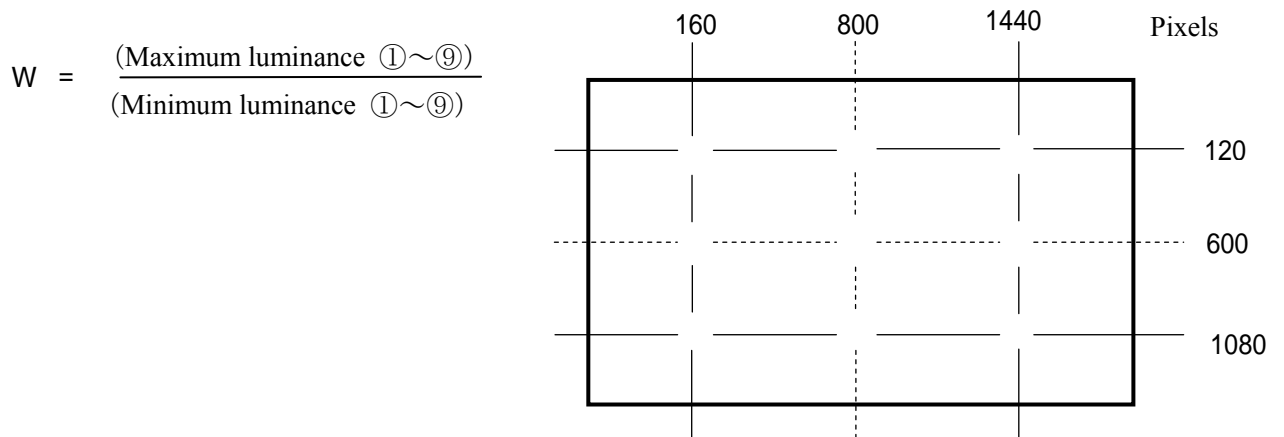
10. Display dignity

The item concerning externals and the display dignity is decided by the shipment inspection standard book..

11. Handling Precautions
a) Be sure to turn off the power supply when inserting or disconnecting the cable.
b) Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.
c) Since the front polarizer is easily damaged, pay attention not to scratch it.
Blow away dust on the polarizer with antistatic N_2 blow. It is undesirable to wipe off because a polarizer is sensitive.
It is recommended to peel off softly using the adhesive tape when soil or finger oil is stuck to the polarizer.
When unavoidable, wipe off carefully with a cloth for wiping lenses.
d) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
e) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
f) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface.
Handle with care.
g) Since CMOS LSI is used in this module, take care of static electricity and set the human earth when handling. Observe all other precautionary requirements in handling components.
h) Since there is a circuit board in the module back, stress is not added at the time of a design assembly.
If stress is added, there is a possibility that circuit parts may be damaged.
i) Protection film is attached to the module surface to prevent it from being scratched .
Peel the film off slowly, just before the use, with strict attention to electrostatic charges.
Blow off 'dust' on the polarizer by using ionized nitrogen.
j) The polarizer surface on the panel is treated with Anti-Glare for low reflection. In case of attaching protective board over the LCD, be careful about the optical interface fringe etc. which degrades display quality.
k) Do not expose the LCD panel to direct sunlight.
Lightproof shade etc. should be attached when LCD panel is used under such environment.
If a light strong against a LCD panel is irradiated, it may lead to degradation of the panel characteristic and display grace may get worse.
l) Connect GND to 4 place of mounting holes to stabilize against EMI and external noise.
m) When handling LCD modules and assembling them into cabinets, please be noted that long-term storage in the environment of oxidization or deoxidization gas, and the use of such materials as reagent, solvent, adhesive, resin, etc. which generate these gasses, may cause corrosion, discoloration, degradation of display grace, and abnormalities of operation.
n) When install LCD modules in the cabinet, please tighten with "torque = max 0.441 N m (max 4.5kgf cm).
Be sure to confirm it in the same condition as it is installed in your instrument.
o) Liquid crystal contained in the panel may leak if the LCD is broken. Rinse it as soon as possible if it gets inside your eye or mouth by mistake.
p) Notice : Never dismantle the module , because it will cause failure.
Moreover, please do not peel off and do not cut the tapes pasted to the product.
However, the tape fixed panel protection film is excluded.
q) Be careful when using it for long time with fixed pattern display as it may cause afterimage.
(Please use a screen saver etc., in order to avoid an afterimage.)
r) Adjusting volume has been set optimally before shipment, so do not change any adjusted value.
If adjusted value is changed, the specification may not be satisfied.
s) If a minute particle enters in the module and adheres to an optical material, it may cause display non-uniformity issue, etc. Therefore, fine-pitch filters have to be installed to cooling and inhalation hole if you intend to install a fan.
t) The LED used for this product is very sensitive to the temperature. Luminance decreases rapidly when it isused for a long time under the environment of the high temperature. Please consult our company when it is used under the environment like the above mentioned.
u) 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 regardless of contact or noncontact to polarizer film.
Be sure to confirm the component of them.

12. Packing form

Product countries / Areas	JAPAN
Piling number of cartons	8 (MAX)
Packing quantity in one carton	2pcs
Carton size [mm]	630(W) × 515(D) × 195(H)
Total mass of one carton filled with full modules	11kg
Packing form is shown	Page 22 Fig.2

13 Reliability test items

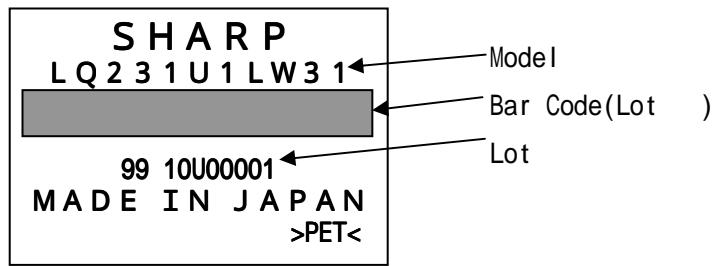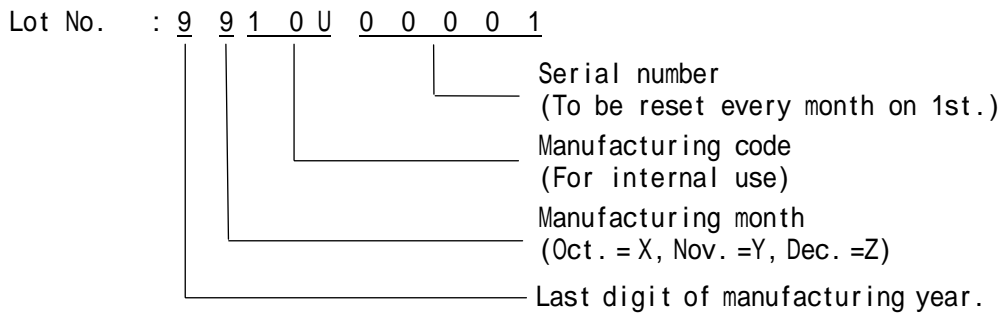| No	Test item	Conditions	
1	High temperature storage test	Ta = 65 240h	
2	Low temperature storage test	Ta = -20 240h	
3	High temperature & high humidity operation test	Ta = 40 ; 90%RH 240h (No condensation)	
4	High temperature operation test	Ta = 60 240h (Panel surface:Activ Area)	
5	Low temperature operation test	Ta = 0 240h	
6	Vibration test	Waveform : Sine wave Frequency : 10 57Hz/Vibration width (one side) : 0.076mm : 57 500Hz/Gravity : $9.8m/s^2$ Sweep time : 11minutes Test period : 3 hours (1 hour for each direction of X,Y,Z)	Note
7	Shock test	Max. gravity : $147m/s^2$ Pulse width : 6ms, sine half-wave Direction : ± X, ± Y, ± Z, once for each direction.	

Note
  A gap of panel shall not occur by vibration or the shock.
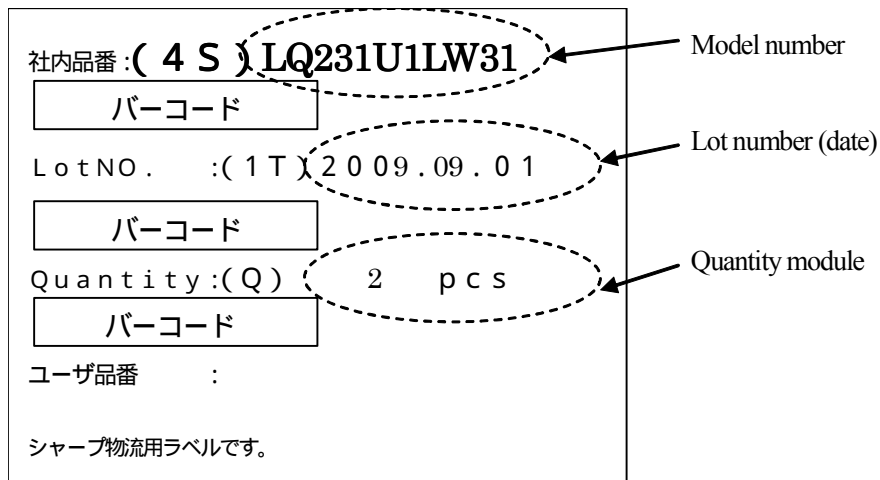
Result Evaluation Criteria
  Under the display quality test conditions with normal operation state, these shall be no change
  which may affect practical display function.

14. Others

14-1. Lot No. Label

Lot No.   : 9 9 1 0 U 0 0 0 0 1

Serial number
(To be reset every month on 1st.)

Manufacturing code
(For internal use)

Manufacturing month
(Oct. =X, Nov. =Y, Dec. =Z)

Last digit of manufacturing year.

Model

Bar Code(Lot   )

Lot

99 10U00001

>PET<

14-2. Packing box Label

LQ231U1LW31 — Model number

9 09 — Lot number (date)

2 — Quantity module

14-3. The chemical ozone depleting substance is not used.

14-4. If any problem occurs in relation to the description of this specification, it shall be resolved
through discussion with spirit of cooperation.

The figure left below (cardboard box recycling symbol mark) is written to the packing box.

And, the figure right below is written to the packing box of the settlement for the RoHS restriction.

R.C.   RoHS Compliance   means it suits the RoHS directive.

This LCD module is compliant with RoHS Directive.

R.C.

Cardboard box

Recycling symbol mark

Mark for RoHS directive

15 Range of storage temperature and humidity environmental condition

Temperature   0   40

Relative humidity   90   and below

Note   Please manage as average value of the storage temperature and humidity environment referring to the following condition.

Summer 20   35   85   and below,   Winter 5   15   85   and below

Please manage within 240 hours in total at the time kept under the environment of 40 90%RH.

Direct sunlight

Please keep it in the state of wrapping or the darkroom so that direct sunshine should not strike directly into the product.

Ambient atmosphere

Please do not keep it in the place with the danger of the generation of the causticity gas and the volatile solvent.
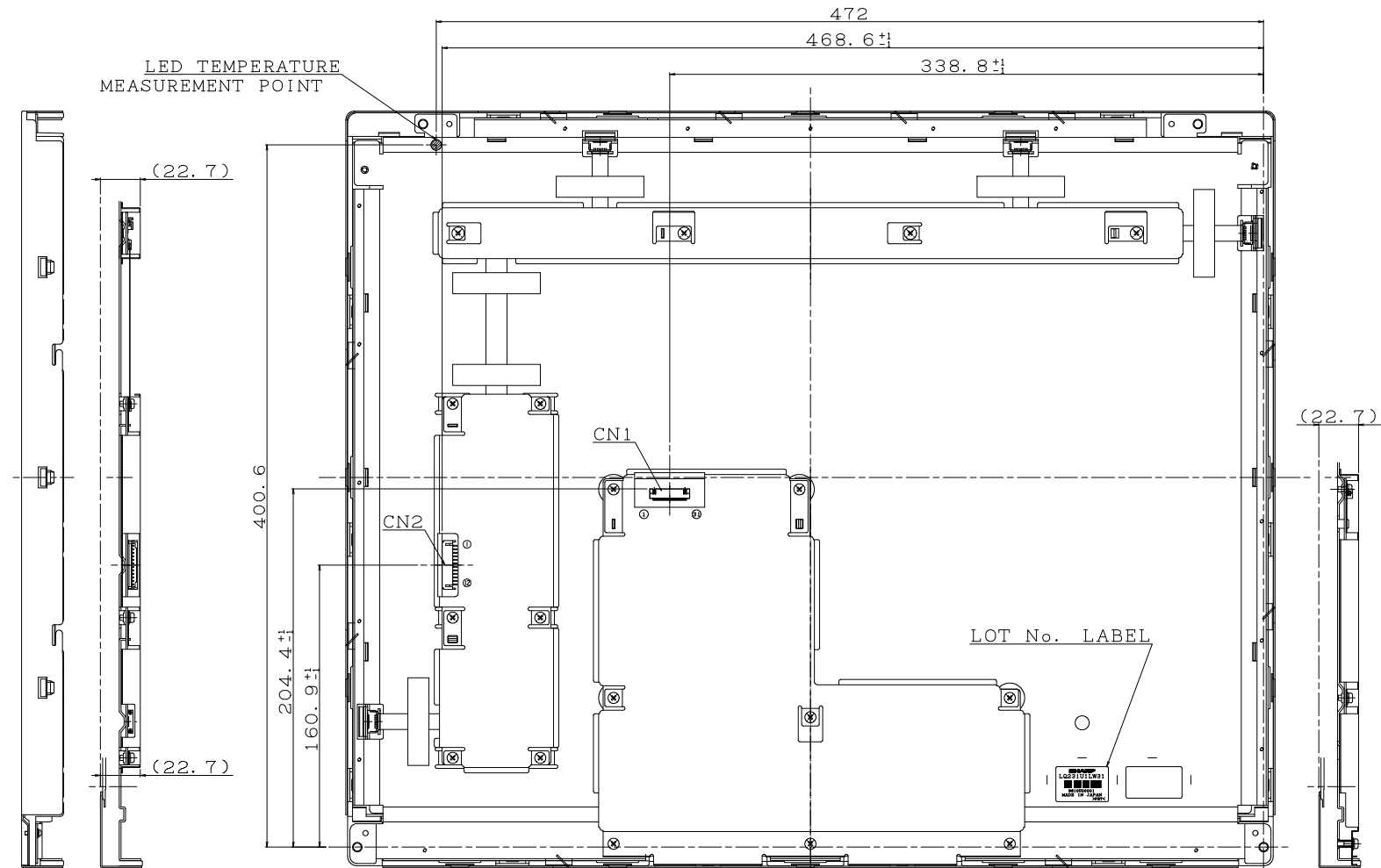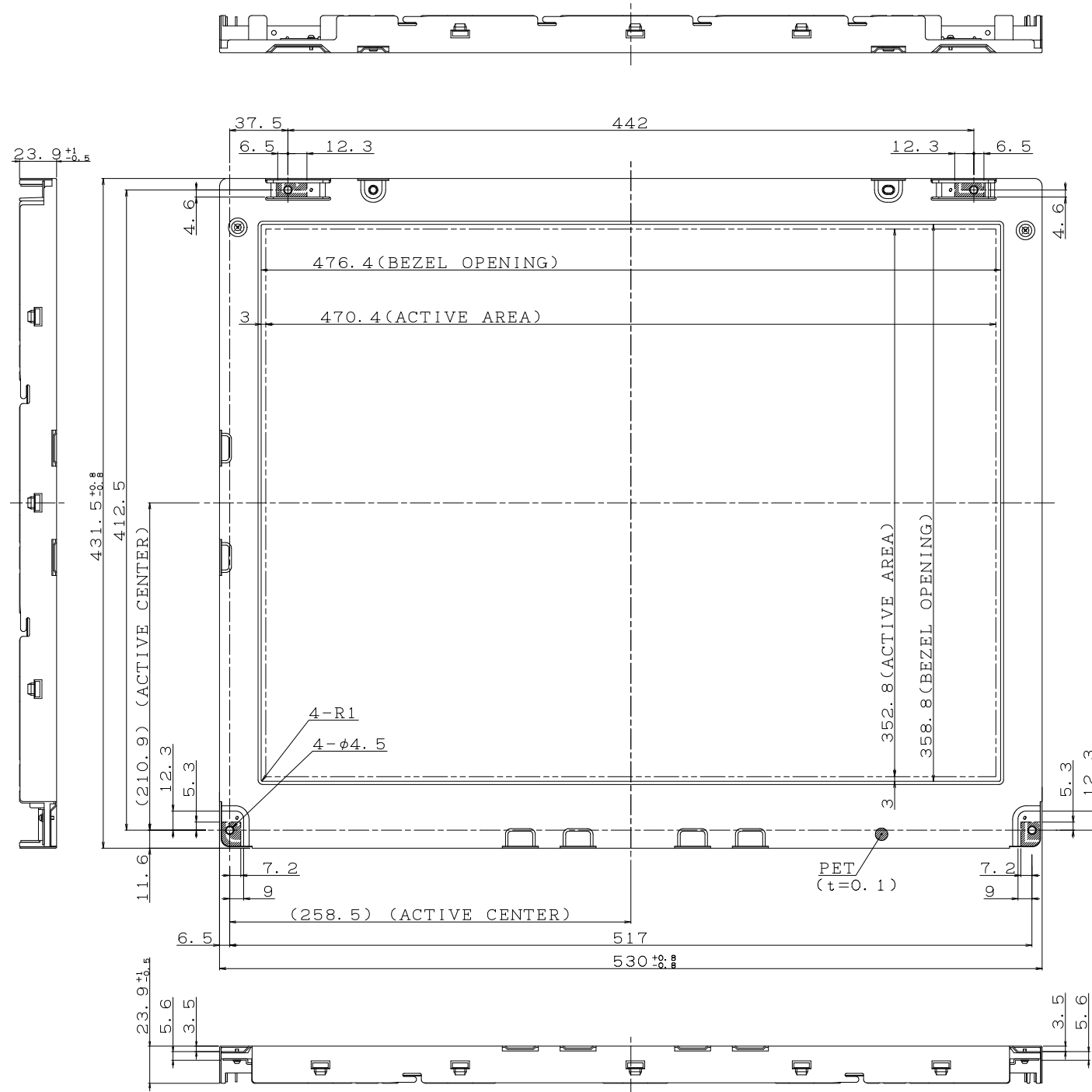
Dewy condensation prevention

Please do not put the wrapping box directly on the floor, and keep it on palette or rack to avoid dewy condensation.

Moreover, please put it in a constant direction correctly to improve ventilation under the palette.

Please separate from the wall in the storage warehouse and keep it.

Please pay attention that ventilation is improved, and set up the ventilator etc. in the warehouse.

Please manage so that there is no rapid temperature change more than natural environment.

Storage period

Please keep within one year under the above-mentioned storage condition.

LD21810-21

LED TEMPERATURE MEASUREMENT POINT

LOT No. LABEL

476.4(BEZEL OPENING)
470.4(ACTIVE AREA)
442
37.5
6.5 12.3 12.3 6.5
4.6 4.6
3
4-R1
4-φ4.5
PET (t=0.1)
7.2 7.2
9 9
(258.5) (ACTIVE CENTER)
6.5
517
530±0.8
23.9±0.5
5.6 3.5
23.9±0.5
431.5±0.8
412.5
(210.9) (ACTIVE CENTER)
12.3 5.3
11.6
5.3 12.3
(22.7)
(22.7)
(22.7)
352.8(ACTIVE AREA)
358.8(BEZEL OPENING)
472
468.6±1
338.8±1
400.6
204.4±1
160.9±1
CN1
CN2

CN1: Japan Aviation Electronics Industry,Limited
MODEL No. FI-WE31P-HFE

1	Vcc	9	GMCH	17	RxO-	25	RxE2-
2	Vcc	10	GMCL	18	RxO+	26	RxE2+
3	Vcc	11	RxO0-	19	RxO3-	27	RxE3-
4	Vcc	12	RxO0+	20	RxO3+	28	RxE3+
5	GND	13	RxO1-	21	RxE0-	29	NC
6	GND	14	RxO1+	22	RxE0+	30	LVDSGND
7	GND	15	RxO2-	23	RxE1-	31	LVDSGND
8	NC	16	RxO2+	24	RxE1+		

CN1 PIN ASSIGN

CN2: Japan Solderless Terminal Mfg Co Ltd(JST)
MODEL No. S12B-PH-SM4-TB

1	VLED	7	LED GND
2	VLED	8	LED GND
3	VLED	9	LED GND
4	VLED	10	LED GND
5	VLED	11	Vcnt
6	LED GND	12	Vvr

CN2 PIN ASSIGN

BEZEL/DISPLAY POSITION

A C B
ACTIVE AREA
BEZEL OPENING AREA
E D F
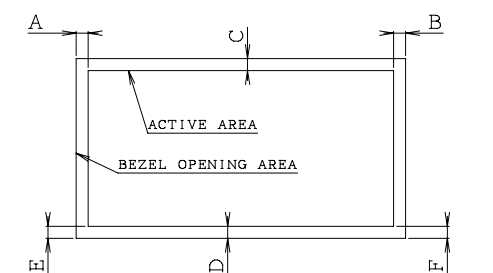
1) TOLERANCE X-DIRECTION A:3.0 ±0.8
2) TOLERANCE Y-DIRECTION B:3.0 ±0.8
3) TOLERANCE Y-DIRECTION C:3.0 ±0.8
4) TOLERANCE Y-DIRECTION D:3.0 ±0.8
5) OBLIQUITY OF DISPLAY AREA |E-F|<0.8

UNSPECIFIED TOLERANCE TO BE ±1.0

UNIT:mm

Fig1;LQ231U1LW31 Outline dimensions

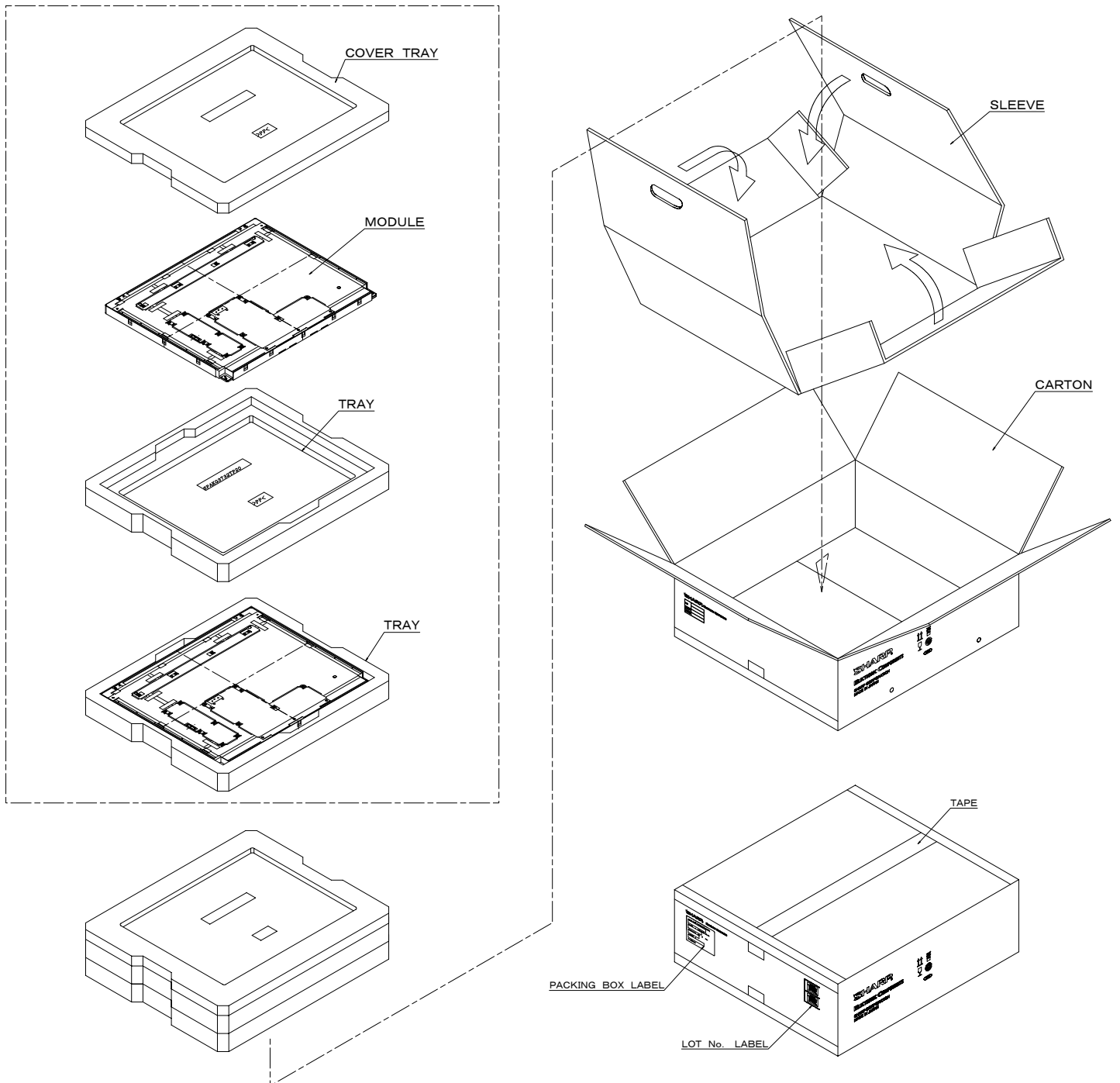COVER TRAY

MODULE

TRAY

TRAY

SLEEVE

CARTON

TAPE

PACKING BOX LABEL

LOT No. LABEL

Fig2：Packing Form