



LCD Module Technical Specification

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Type No. **T-51639D084U-FW-A-AA**

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1. OVERVIEW

T-51639D084U-FW-A-AA is 8.4” color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs, control circuit, and backlight unit.

By applying 6 bit digital data, 1024 × 768, 262 K-color images are displayed on the 8.4” diagonal screen. Input power voltage is single 3.3V for LCD driving.

Inverter for backlight is not included in this module. General specifications are summarized in the following table:

ITEM	SPECIFICATION
Display Area (mm)	171.264(H) × 128.448 (V) (8.43-inch diagonal)
Number of Dots	1024 × 3 (H) × 768 (V)
Pixel Pitch (mm)	0.16725 (H) × 0.16725 (V)
Color Pixel Arrangement	RGB vertical stripe
Display Mode	normally white
Number of Color	262 K
Optimum Viewing Angle(Contrast ratio)	12 o'clock
Brightness (cd/m ²)	300
Module Size (mm)	205.0 (W) × 152.4 (H) × 11.3 (D)
Module Mass (g)	380 (Typ)
Backlight Unit	CCFL, 2-tubes, edge-light, replaceable
Surface Treatment	Anti-glare and hard-coating 3H

Characteristic value without any note is typical value.

The LCD product described in this specification is designed and manufactured for the standard use in OA equipment and consumer products, such as computers, communication equipment, industrial robots, AV equipment and so on.

Do not use the LCD product for the equipment that require the extreme high level of reliability, such as aerospace applications, submarine cables, nuclear power control systems and medical or other equipment for life support.

OPTREX assumes no responsibility for any damage resulting from the use of the LCD product in disregard of the conditions and handling precautions in this specification.

If customers intend to use the LCD product for the above items or other no standard items, please contact our sales persons in advance.

2. ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	MIN.	MAX.	UNIT
Power Supply Voltage for LCD	VCC	0	4.0	V
Logic Input Voltage	VI	-0.3	VCC+0.3	V
Lamp Voltage	VL	0	3,000	Vrms
Lamp Current	IL	0	15	mArms
Lamp Frequency	FL	--	60	kHz
Operation Temperature *1)	T _{op}	0	50	°C
Storage Temperature *1)	T _{stg}	-20	60	°C

[Note]

*1) Top, Tstg ≤ 40°C : 90% RH max. without condensation

Top, Tstg > 40°C : Absolute humidity should be less than the value of 90% RH at 40°C without condensation.

3. ELECTRICAL CHARACTERISTICS

(1) TFT- LCD

Ambient Temperature : Ta = 25°C

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	Remarks
Power Supply Voltages for LCD *)	VCC	3.0	3.3	3.6	V	Note A) (See next page)
Power Supply Currents for LCD	ICC	--	350	450	mA	Note B) (See next page)

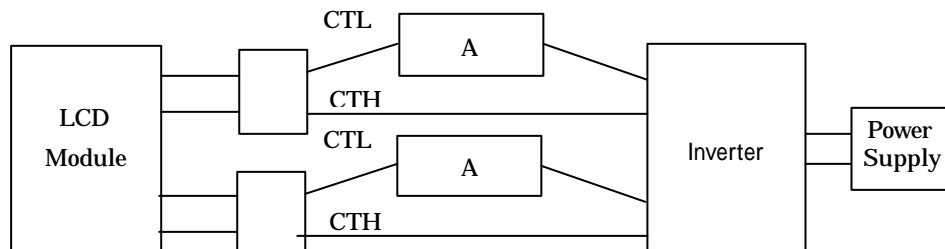
*) at the Input connector

(2) Backlight

Ta = 25°C

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	Remarks
Lamp Voltage	VL	--	450	--	Vrms	IL = 6.0 mArms
Lamp Current *1)	IL	--	6.0	6.5	mArms	*1)
Starting Lamp Voltage	VS	950	--	--	Vrms	Ta = 25°C
		1,170	--	--	Vrms	Ta = 0°C
Lamp Frequency *2)	FL	30	--	60	kHz	*2)
Lamp Life Time	LT	50,000	--	--	h	IL = 6.0 mArms Continuous Operation

*1) Lamp Current measurement method (The current meter is inserted in low voltage line.)



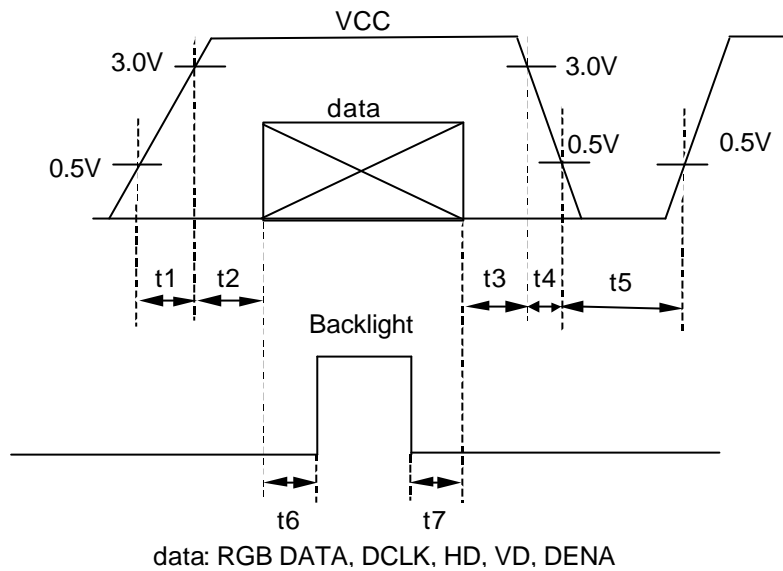
*2) Lamp frequency of inverter may produce interference with horizontal synchronous frequency, and this may cause horizontal beat on the display. Therefore, please adjust lamp frequency, and keep

inverter as far from module as possible or use electronic shielding between inverter and module to avoid the interference.

[Note]

A) Power and signals sequence:

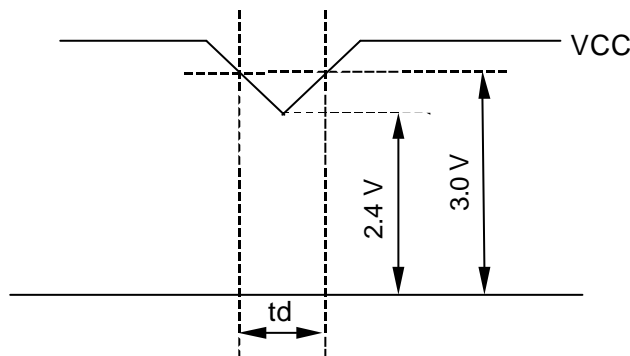
- $t1 \leq 10\text{ms}$
- $0 < t2 \leq 50\text{ms}$
- $0 < t3 \leq 50\text{ms}$
- $t4 \leq 50\text{ms}$
- $400\text{ms} \leq t5$
- $20\text{ms} \leq t6$
- $0 \leq t7$



VCC-dip conditions:

- 1) When $2.4\text{ V} \leq VCC < 3.0\text{ V}$, $t_d \leq 10\text{ ms}$
- 2) When $VCC < 2.4\text{ V}$

VCC-dip conditions should also follow the power and signals sequence.



B) Current condition:

Typical: 64- gray- bar-pattern
 $VCC = 3.3\text{ V}$, $f_H = 48.4\text{ kHz}$, $f_V = 60\text{ Hz}$, $f_{CLK} = 65\text{ MHz}$
Normal value, not peak value

4. INTERFACE PIN CONNECTION

CN 1(INTERFACE SIGNAL)

Used connector: FI-SEB20P-HF(JAE)

Corresponding connector: FI-S20S[for discrete Wire],FI-SE20M[for SMT]

Pin No.	Symbol	Function
1	VCC	+3.3V Power supply
2	VCC	+3.3V Power supply
3	GND	
4	GND	
5	Link 0-	R0, R1, R2, R3, R4, R5, G0 *)
6	Link 0+	R0, R1, R2, R3, R4, R5, G0 *)
7	GND	
8	Link 1-	G1, G2, G3, G4, G5, B0, B1 *)
9	Link 1+	G1, G2, G3, G4, G5, B0, B1 *)
10	GND	
11	Link 2-	B2, B3, B4, B5, HD, VD, DENA *)
12	Link 2+	B2, B3, B4, B5, HD, VD, DENA *)
13	GND	
14	CLKIN-	Clock-
15	CLKIN+	Clock+
16	GND	
17	N.C.	This pin should be open.
18	TEST	This pin should be open. Test signal output for only internal test use.
19	TEST	This pin should be open. Test signal output for only internal test use.
20	SC	High:Reverse Scan , Low:Normal Scan

*) See; Timing Chart(P8) and LVDS Data Mapping(P9)

CN 2,3 (BACKLIGHT)

Backlight-side connector: BHSR-03VS-1(JST)

Inverter-side connector: SM02(8.0)B-BHS-1-TB(JST)[for SMT]

BHMR-030(JST)[for discrete Wire]

Pin No.	Symbol	Function
1	CTH	VBLH (High Voltage)
3	CTL	VBLL (Low Voltage)

[Note]

VBLH-VBLL = VL

5. INTERFACE TIMING

(1) Timing Specifications

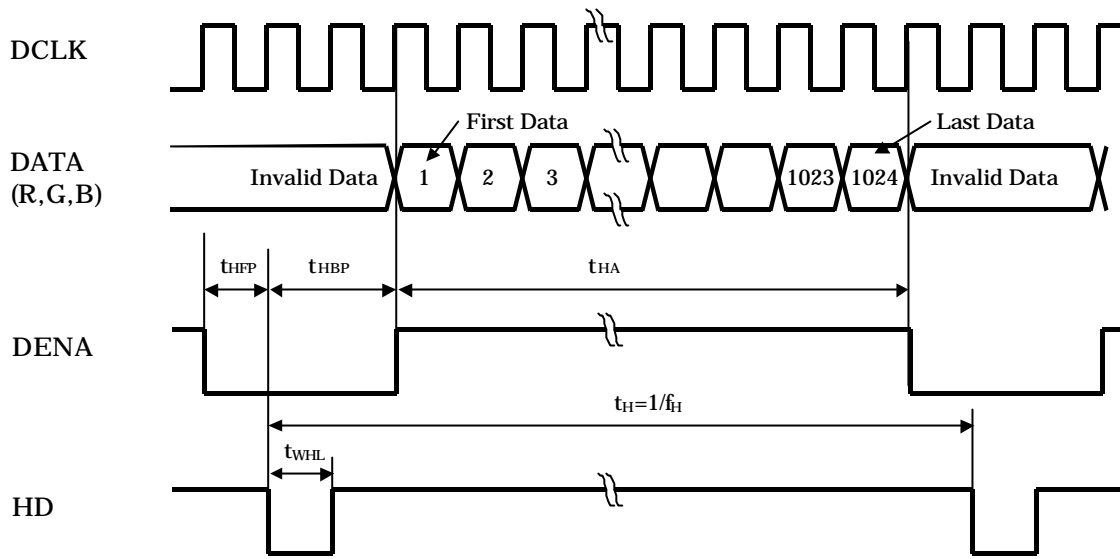
ITEM		SYMBOL	MIN.	TYP.	MAX.	UNIT	
LCD Timing LVDS Transmitter Input	DCLK	Frequency	f_{CLK}	43.6	65	66.6	MHz
		Period	t_{CLK}	15	15.4	22.9	ns
	DENA	Horizontal Active Time	t_{HA}	1024	1024	1024	t_{CLK}
		Horizontal Front Porch	t_{HFP}	0	24	--	t_{CLK}
		Horizontal Back Porch	t_{HBP}	4	296	--	t_{CLK}
		Vertical Active Time	t_{VA}	768	768	768	t_H
		Vertical Front Porch	t_{VFP}	2	3	--	t_H
		Vertical Back Porch	t_{VBP}	1	35	--	t_H
		HD	Frequency	f_H	42.4	48.4	55.9
	Period		t_H	17.9	20.7	23.6	μ s
	Low Width		t_{WHL}	1	136	--	t_{CLK}
	VD	Frequency	f_V	55	60	62	Hz
		Period	t_V	16.1	16.7	18.2	ms
		Low Width	t_{WVL}	1	6	--	t_H

[Note]

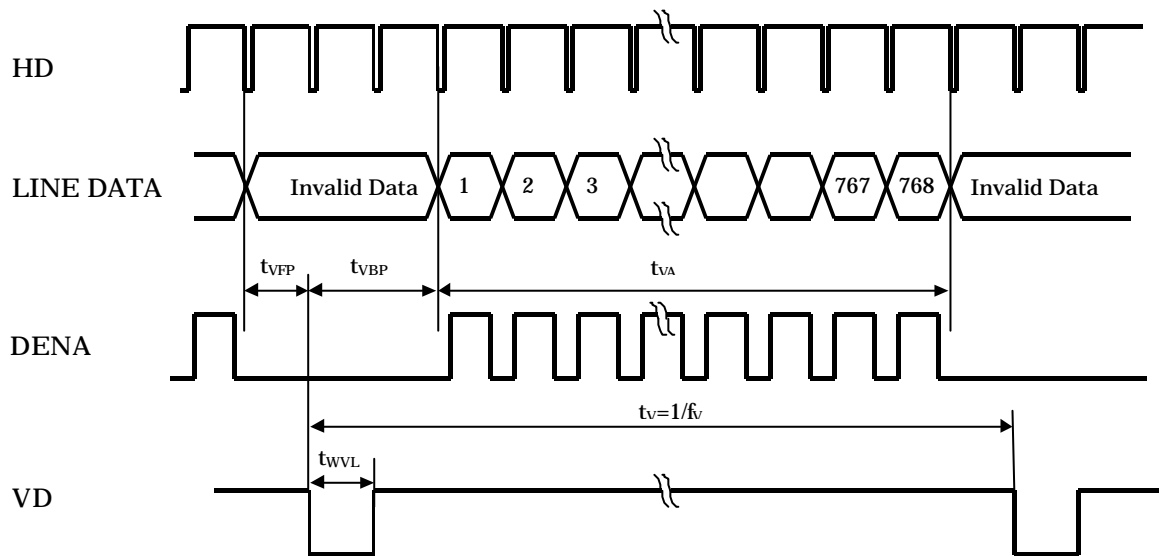
- 1) Polarities of HD and VD are negative in this specification.
- 2) DENA (Data Enable) should always be positive polarity as shown in the timing specification.
- 3) DCLK should appear during all invalid period, and HD should appear during invalid period of frame cycle.
- 4) LVDS timing follows the timing specifications of LVDS receiver IC: THC63LVDF84A(Thine).

(2) Timing Chart

a. Horizontal Timing Chart



b. Vertical Timing Chart



(3) LVDS Data Mapping

Cell	Input pin *)	Data
P0C1	TxIN0	R0
P0C2	TxIN1	R1
P0C3	TxIN2	R2
P0C4	TxIN3	R3
P0C5	TxIN4	R4
P0C6	TxIN5	R5
P0C7	TxIN6	G0
P1C1	TxIN7	G1
P1C2	TxIN8	G2
P1C3	TxIN9	G3
P1C4	TxIN10	G4
P1C5	TxIN11	G5
P1C6	TxIN12	B0
P1C7	TxIN13	B1
P2C1	TxIN14	B2
P2C2	TxIN15	B3
P2C3	TxIN16	B4
P2C4	TxIN17	B5
P2C5	TxIN18	HD
P2C6	TxIN19	VD
P2C7	TxIN20	DENA
Ref-CLK1	TxCLKIN	DCLK

*) : Pin definition of DS90C363(NS)

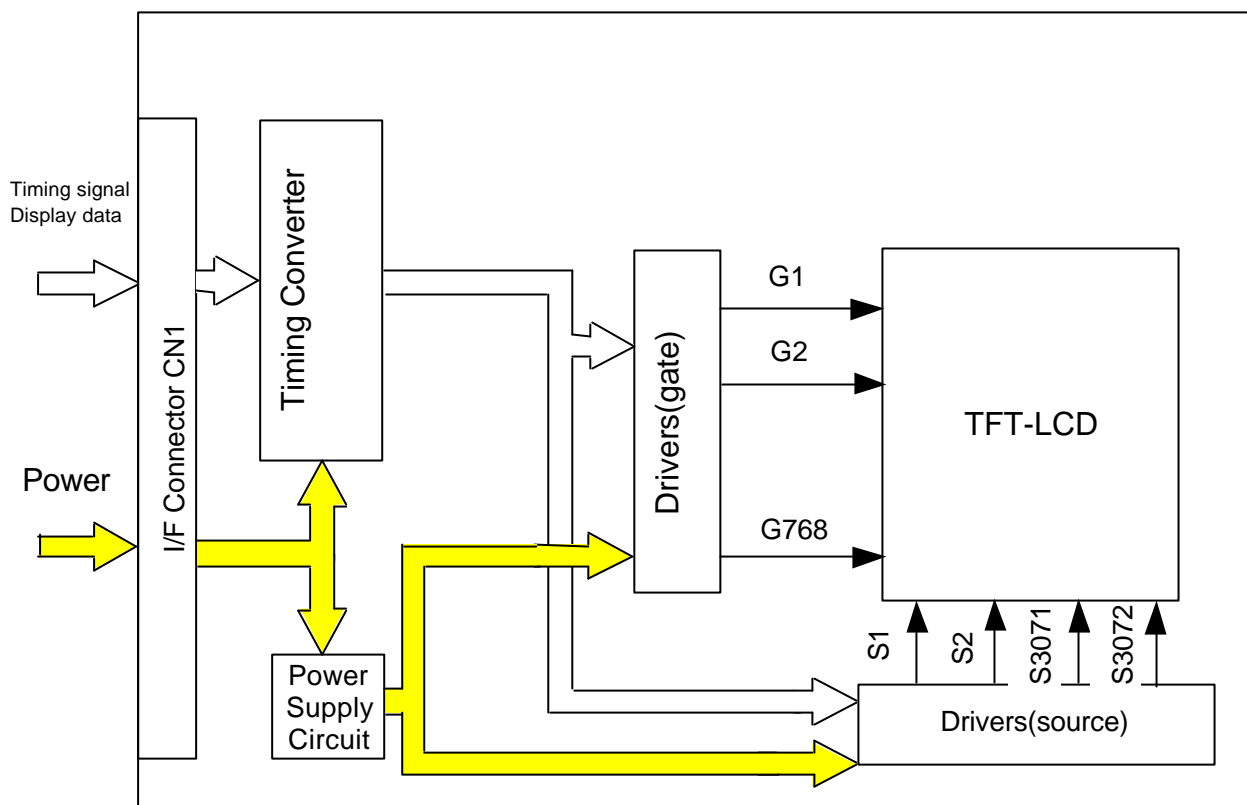
(4) Color Data Assignment

COLOR	INPUT DATA	R DATA						G DATA						B DATA					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
		MS					LSB	MS					LSB	MS					LSB
		B					B	B					B	B					B
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	BLUE(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	CYAN	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	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
RED	RED (0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	RED (2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	GREEN (0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN (1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	GREEN (2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	GREEN(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	GREEN(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
BLUE	BLUE(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	BLUE(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	BLUE(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	BLUE(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	BLUE(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

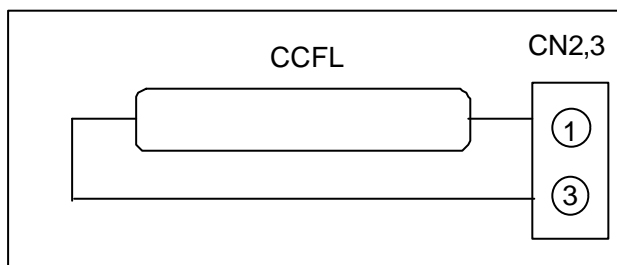
[Note] 1) Definition of gray scale
 Color (n) --- n indicates gray scale level.
 Higher n means brighter level.

2) Data 1:High, 0: Low

6. BLOCK DIAGRAM

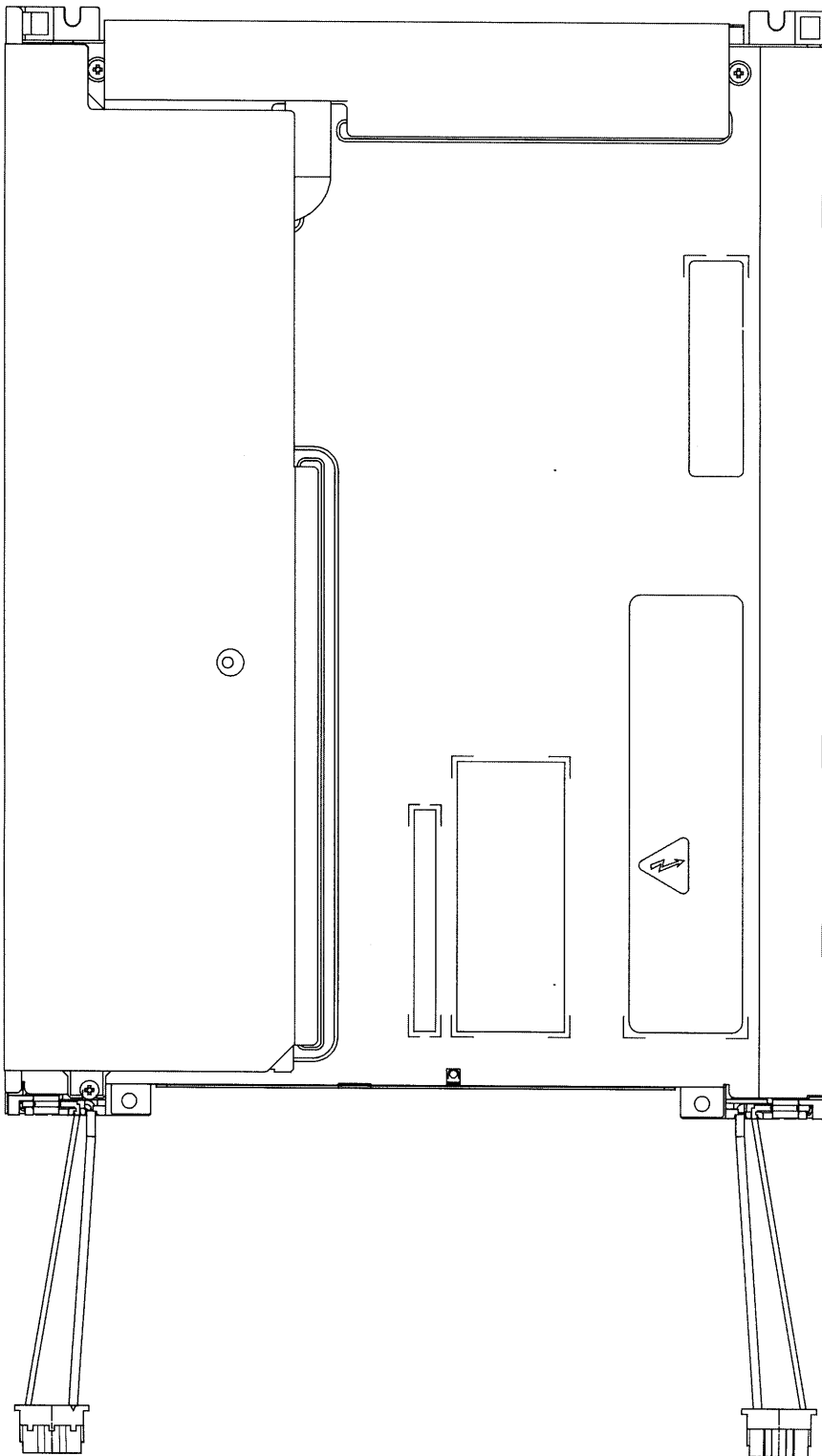


BACKLIGHT



(2) Rear Side

AA084XA02
*01.09.19
*02.08.09



[Note]

We recommend you referring to the detailed drawing for your design.
Please contact our company sales representative when you need the detailed drawing.

8. OPTICAL CHARACTERISTICS

Ta = 25°C, VCC = 3.3 V, Input Signals: Typ. Values shown in Section 5

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	Remarks
Contrast Ratio		CR	$\theta = \phi = 0^\circ$	--	350	--	--	*1)*3)
Luminance		Lw	$\theta = \phi = 0^\circ$	250	300	--	cd/m ²	*2)*3)
Response Time		tr	$\theta = \phi = 0^\circ$	--	6	--	ms	*3)*4)
		tf	$\theta = \phi = 0^\circ$	--	19	--	ms	*3)*4)
Viewing Angle	Horizontal	ϕ	CR ≥ 10	--	-60~60	--	°C	*3)
	Vertical	θ		--	-40~50	--	°C	*3)
Image Sticking		tis	2 h	--	--	2	s	*5)
Color Coordinates	Red	Rx	$\theta = \phi = 0^\circ$	0.559	0.589	0.619	--	*3)
		Ry		0.306	0.336	0.366		
	Green	Gx		0.297	0.327	0.357		
		Gy		0.498	0.528	0.558		
	Blue	Bx		0.128	0.158	0.188		
		By		0.131	0.161	0.191		
	White	Wx		0.302	0.332	0.362		
		Wy		0.309	0.339	0.369		

[Note]

These items are measured using CS1000(MINOLTA) for color coordinates, and CS1000 or BM-5A(TOPCON) for others under the dark room condition (no ambient light) after more than 30 minutes from turning on the lamp unless noted.

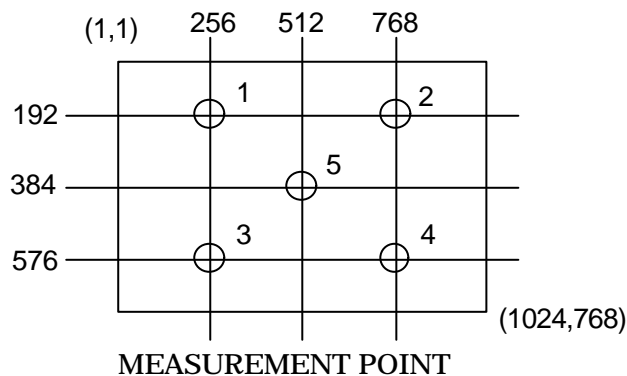
Condition: IL = 6.0 mArms, FL = 55 kHz

*1) Definition of Contrast Ratio

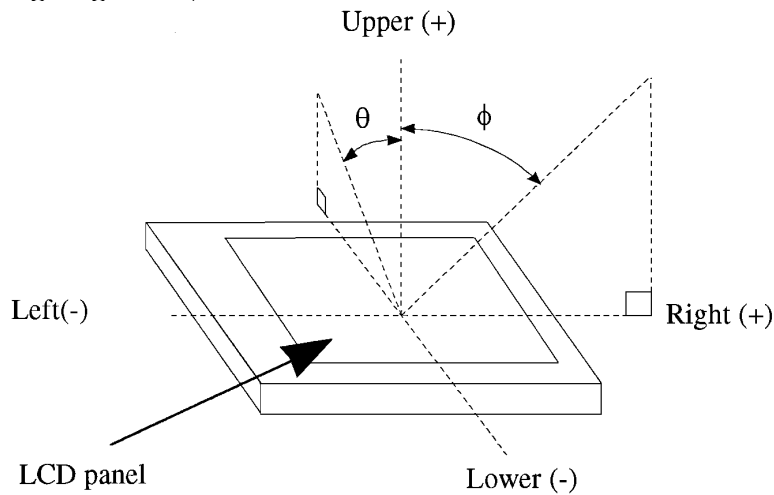
CR = ON (White) Luminance / OFF(Black) Luminance: average of 5 points shown in a figure below

*2) Definition of Luminance

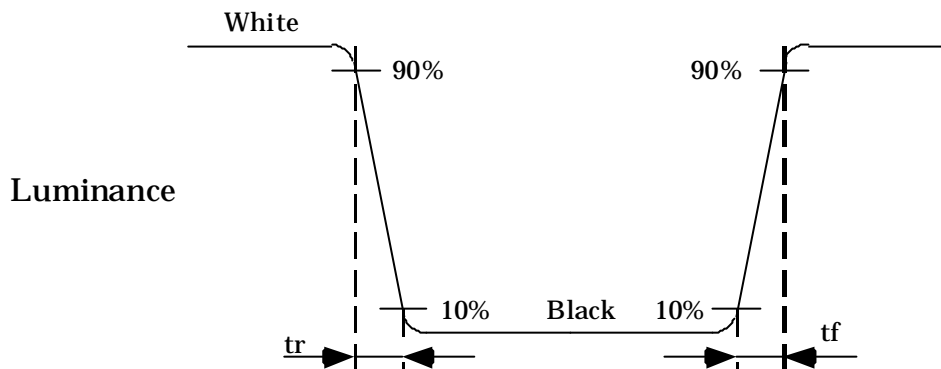
Lw = ON (White) Luminance: average of 5 points: average of 5 points shown in a figure below



***3) Definition of Viewing Angle (θ , ϕ)**



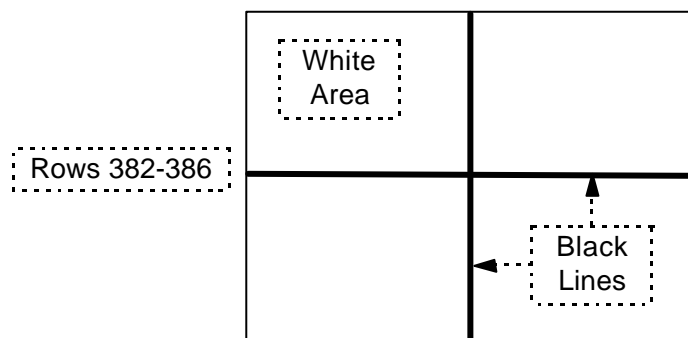
***4) Definition of Response Time**



***5) Image Sticking**

Continuously display the test pattern shown in the figure below for two-hours. Then display a completely white screen. The previous image shall not persist more than two seconds at 25°C.

Cols 510-514



TEST PATTERN FOR IMAGE STICKING TEST

9. RELIABILITY TEST CONDITION

(1) Temperature and Humidity

TEST ITEM	CONDITIONS
HIGH TEMPERATURE HIGH HUMIDITY OPERATION	40°C, 90%RH, 240 h (No condensation)
HIGH TEMPERATURE STORAGE	60°C, 96 h
LOW TEMPERATURE STORAGE	-20°C, 96 h
THERMAL SHOCK	BETWEEN -20°C (1h) and 60°C(1h), 5 CYCLES

(2) Shock & Vibration

ITEM	CONDITIONS
SHOCK (NON-OPERATION)	Shock level: 980 m/s ² (100 G) Waveform: half sinusoidal wave, 2 ms Number of shocks: one shock input in each direction of three mutually Perpendicular axes for a total of six shock inputs
VIBRATION (NON-OPERATION)	Vibration level: 9.8 m/s ² (1.0 G) Waveform: sinusoidal Frequency range: 5 to 500Hz Frequency sweep rate: 0.5 octave /min Duration: one sweep from 5 to 500 Hz in each of three mutually Perpendicular axis(each x,y,z axis: 1 hour, total 3 hours)

(3) Judgment standard

The judgment of the above tests should be made as follow:

Pass: Normal display image with no obvious non-uniformity and no line defect.

Partial transformation of the module parts should be ignored.

Fail: No display image, obvious non-uniformity, or line defects.

10. INVERTED SCAN CAPABILITY

This module has the capability of inverting scan direction by signaling from controller.

Note that scan direction cannot be changed during operation.

The following figure shows the relation between the display position and the scan direction.

DISPLAY POSITION

Normal scan: SC = "L"

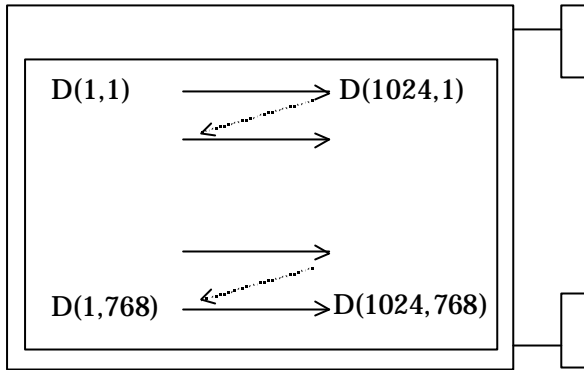
D(1, 1)	D(2, 1)	---	D(X, 1)	---	D(1023, 1)	D(1024, 1)
D(1, 2)	D(2, 2)	---	D(X, 2)	---	D(1023, 2)	D(1024, 2)
⋮	⋮	+	+	+	⋮	⋮
D(1, Y)	D(2, Y)	---	D(X, Y)	---	D(1023, Y)	D(1024, Y)
⋮	⋮	+	+	+	⋮	⋮
D(1,767)	D(2,767)	---	D(X,767)	---	D(1023,767)	D(1024,767)
D(1,768)	D(2,768)	---	D(X,768)	---	D(1023,768)	D(1024,768)

Reverse scan: SC = "H"

D(1024,768)	D(1023,768)	---	D(X,768)	---	D(2,768)	D(1,768)
D(1024,767)	D(1023,767)	---	D(X,767)	---	D(2,767)	D(1,767)
⋮	⋮	+	+	+	⋮	⋮
D(1024, Y)	D(1023, Y)	---	D(X, Y)	---	D(2, Y)	D(1, Y)
⋮	⋮	+	+	+	⋮	⋮
D(1024, 2)	D(1023, 2)	---	D(X, 2)	---	D(2, 2)	D(1, 2)
D(1024, 1)	D(1023, 1)	---	D(X, 1)	---	D(2, 1)	D(1, 1)

The following drawings shows the relationship between the viewing direction and the scan direction.

Normal scan



Reverse scan

