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For Messrs.

Date

CUSTOMER'S ACCEPTANCE SPECIFICATIONS

LM215XB

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Accepted by: _____

Proposed by: _____

Sh.
No.

3284PS 2501-LM215XB-1

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RECORD OF REVISION

Date	Sheet No.	Summary

Mobara Works,
Hitachi, Ltd.

Date

Sept. 9 '86

Sh.
No.

8284 PS

2502-LM215XB-1

Page

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Type : LM215XB

Description : 128 x 480 dots matrix

1. ABSOLUTE MAXIMUM RATINGS

1.1 Electrical Absolute Maximum Ratings

I T E M	SYMBOL	MIN	MAX	UNIT
Logic circuit power supply voltage	VDD-Vss	0	7	V
LC driver circuit power supply voltage	VDD-VEE	0	19.0	V
LC driving voltage	VDD-Vo	0	18.5	V
Input voltage	Vi	Vss	VDD	V

1.2 Environmental Absolute Maximum Ratings

ITEM	OPERATING		STORAGE		COMMENT
	MIN	MAX	MIN	MAX	
Temperature	0℃	40℃	-20℃ Note2	60℃	≤ 168Hours Note3
Vibration		0.5G		0.5G	
Shock		3 G		10 G	XYZ direction
Corrosive gas	Not acceptable		Not acceptable		
Humidity	Note 1		Note 1		without condensation

Note 1 ; Ta = < 40℃ : 80%RH max

Ta > 40℃ : Absolute humidity must be lower than the humidity of
80%RH at 40℃.

Note 2 ; Ta = -20℃ : ≤ 48hr

Note 3 ; Background color of LCD changes depending upon temperature as follows.

0℃ : Yellow Orange

↓
25℃ : Yellow Green

↓
40℃ : Bluish Green

2. ELECTRICAL CHARACTERISTICS

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Logic circuit power supply voltage	VDD-Vss		4.75	5.0	5.25	V
LC driver circuit power supply voltage	VEE-Vss		-13.25	-13.5	-13.75	V
Input voltage	ViH		$0.7 \times VDD$		VDD	V
	ViL		0		$0.3 \times VDD$	V
Input capacitance(1)	Cin1	Note 2			200	pF
Input capacitance(2)	Cin2	Note 3			50	pF
Logic circuit power supply current(Note 1)	IDD	VDD=5.0V VEE=-13.5V		6		mA
LC driver circuit power supply current (Note 1)	IEE	VDD=5.0V VEE=-13.5V		3		mA
Recommended LC driving voltage 1/100 duty , $\phi = 10^\circ$	VDD-Vo	Ta= 0°C		(15.5)		V
		Ta=25°C		(14.5)		V
		Ta=40°C		(14.0)		V
Frequency of CL ₂	fCL ₂		1.08	1.15	1.23	MHz

Note 1 ; fCL₂ = 1.15MHz , D₁ to D₄ = GND(Vss), VDD-Vo = 15.8(V)

Note 2 ; M, CL₁, CL₂

Note 3 ; FLM, D₁ to D₄

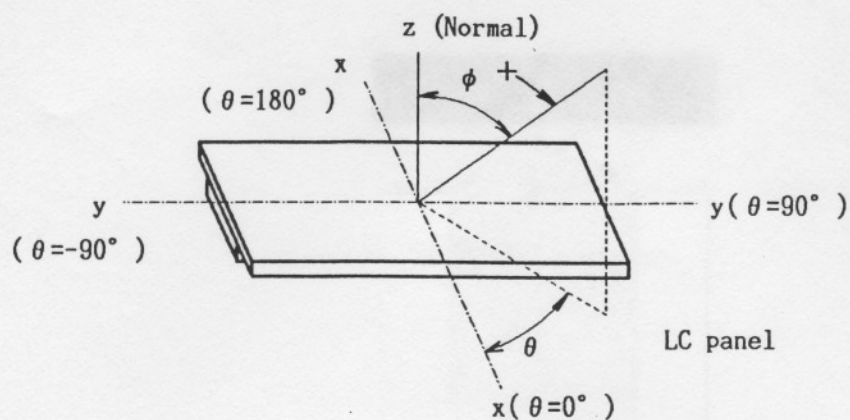
3. OPTICAL CHARACTERISTICS

Ta=25°C 1/64 duty drive VDD=5V VDD-Vo=15.8(V)

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Viewable area	$\phi 2 - \phi 1$	K=1.4		30		deg. Notel
Contrast ratio	K	$\phi = 10^\circ$		(4)		
		($\phi = 25^\circ$)		(3.5)		
Response time(rise)	tr	$\phi = 10^\circ$		(200)		ms
Response time(fall)	tf	$\phi = 10^\circ$		(400)		ms

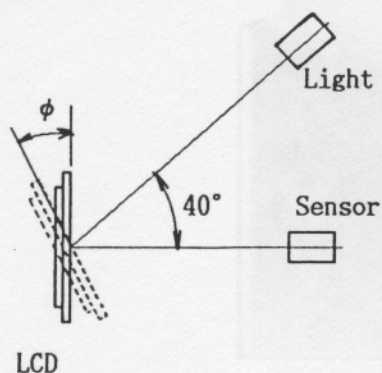
Note 1 ; $\phi 1 \geq -10^\circ$, $\phi 2 \leq 40^\circ$

Note 2 ; The Definition of Viewing Angle ϕ and θ .



Note 3 ; If customers change the LC driving voltage ($V_{DD}-V_o$) characteristics will be changed.

Note 4 ; Position of Light;
(Viewing Angle)



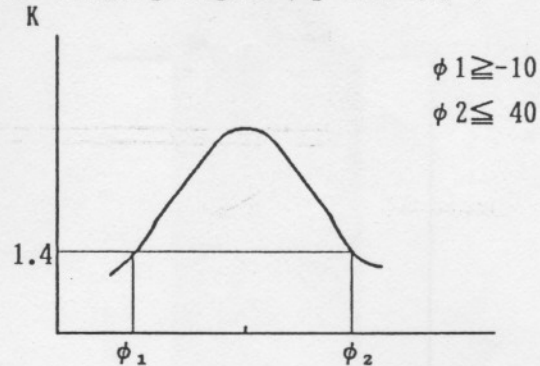
$\theta = 0^\circ$

Measurement point
is center of LCD.

Note 5 ; The Definition of Contrast Ratio K ;

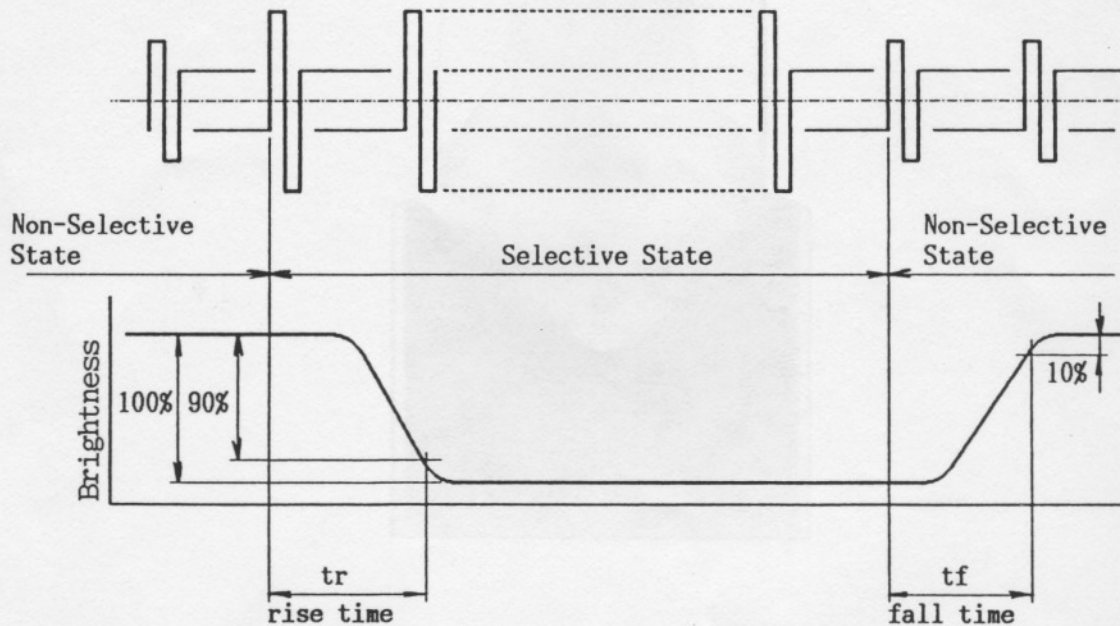
$$\text{Contrast Ratio } K = \frac{\text{Brightness of Non-selective Dot}}{\text{Brightness of Selective Dot}}$$

Note 6 ; The Definition of Viewing Angle ϕ_1 and ϕ_2 ;

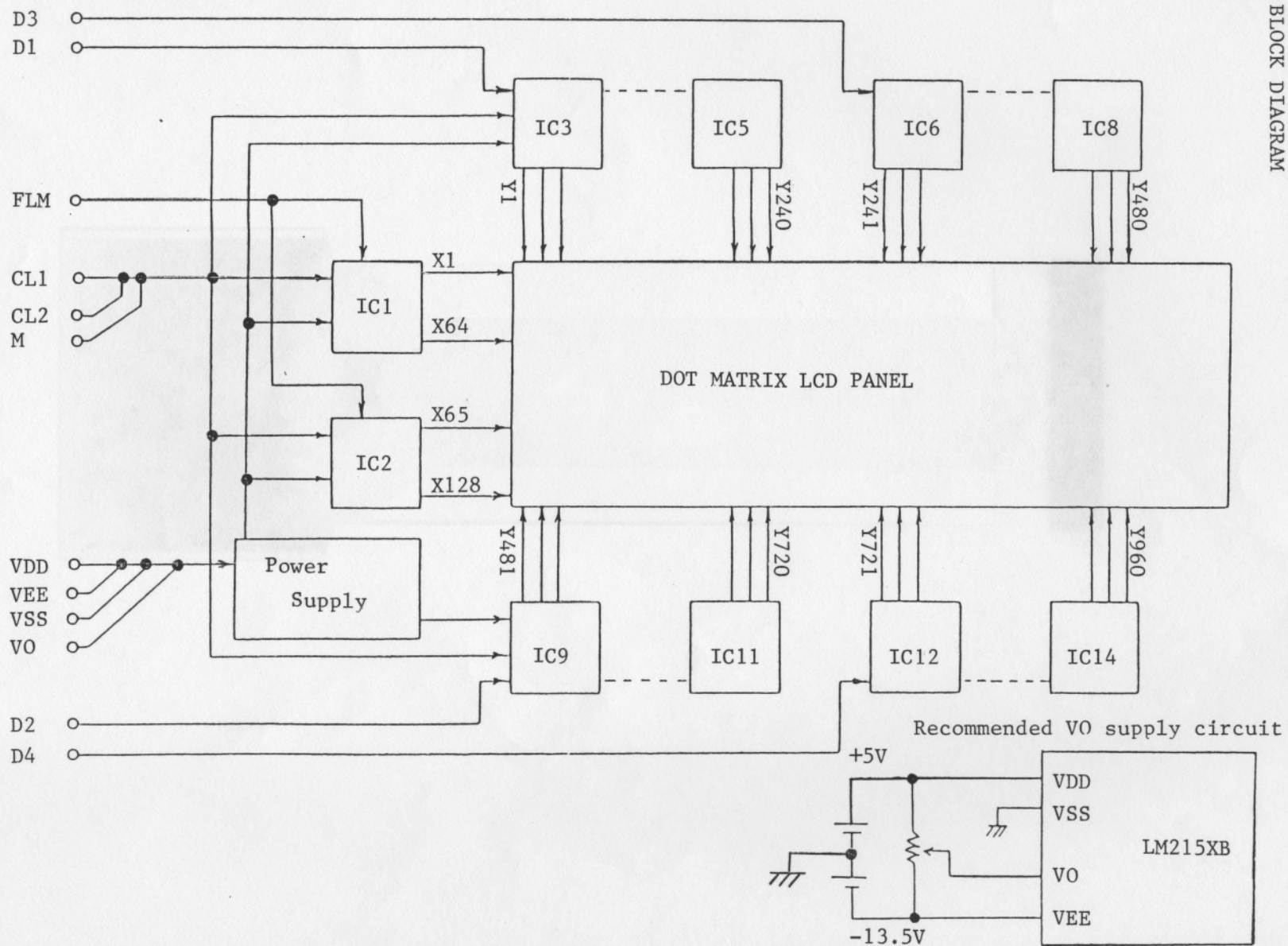


Contrast Ratio K vs Viewing Angle ϕ

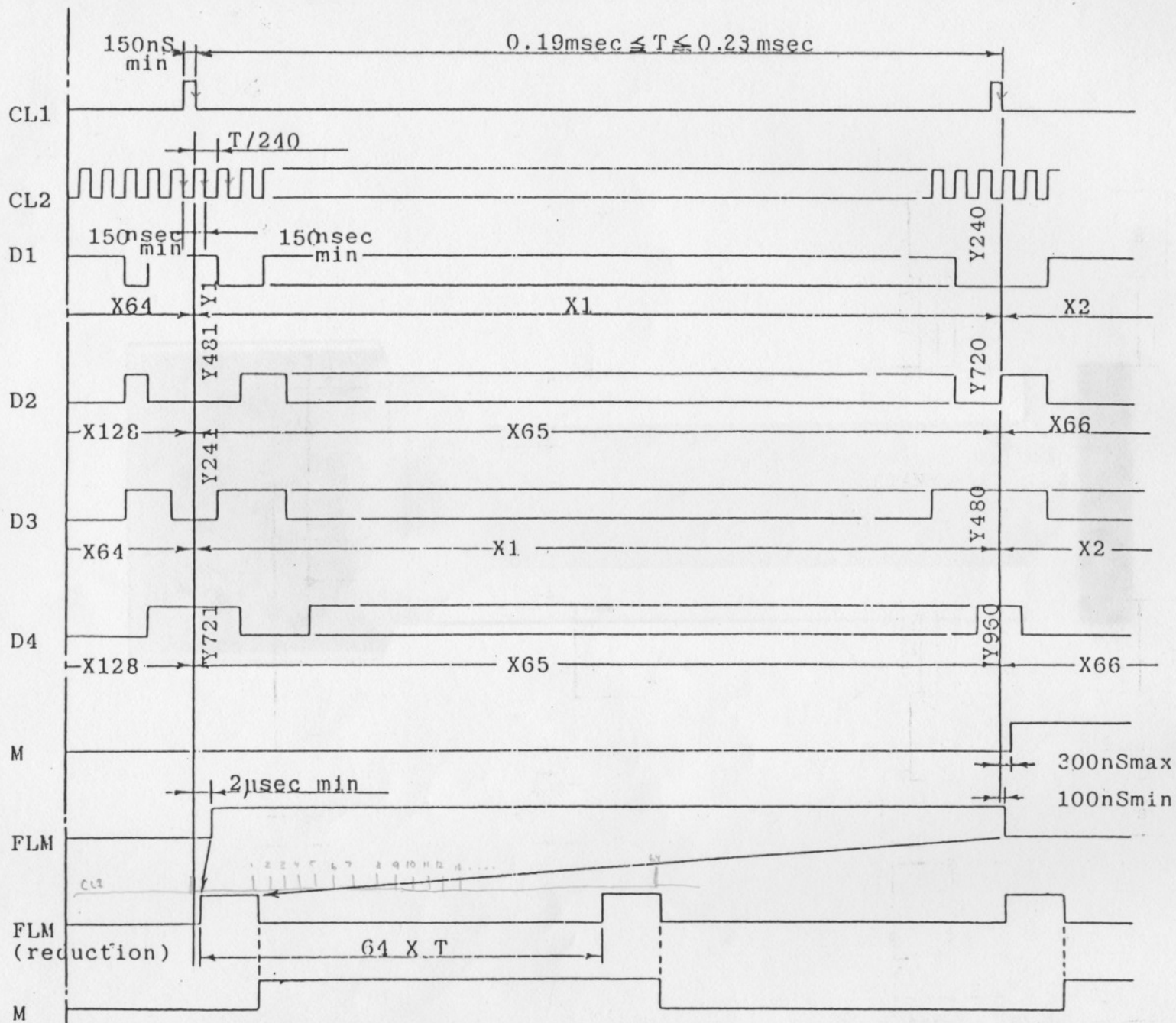
Note 7 ; the Definition of Optical Response Time ;



4. BLOCK DIAGRAM



5 INTERFACE TIMING CHART



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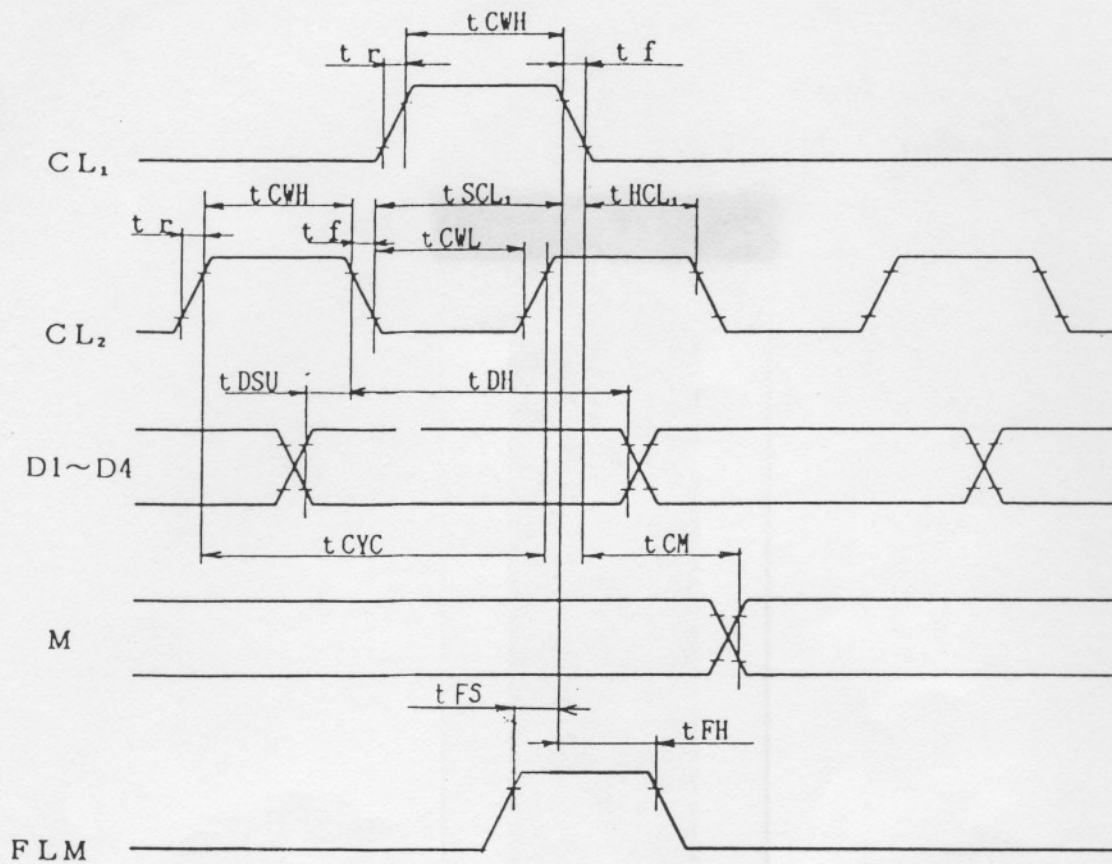
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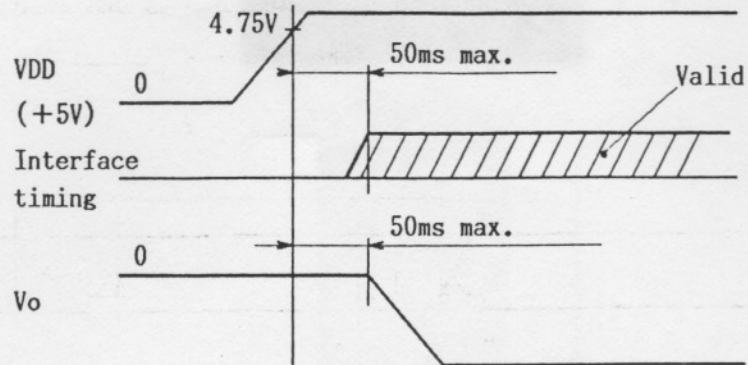
1. TIMING

1) Detail timing

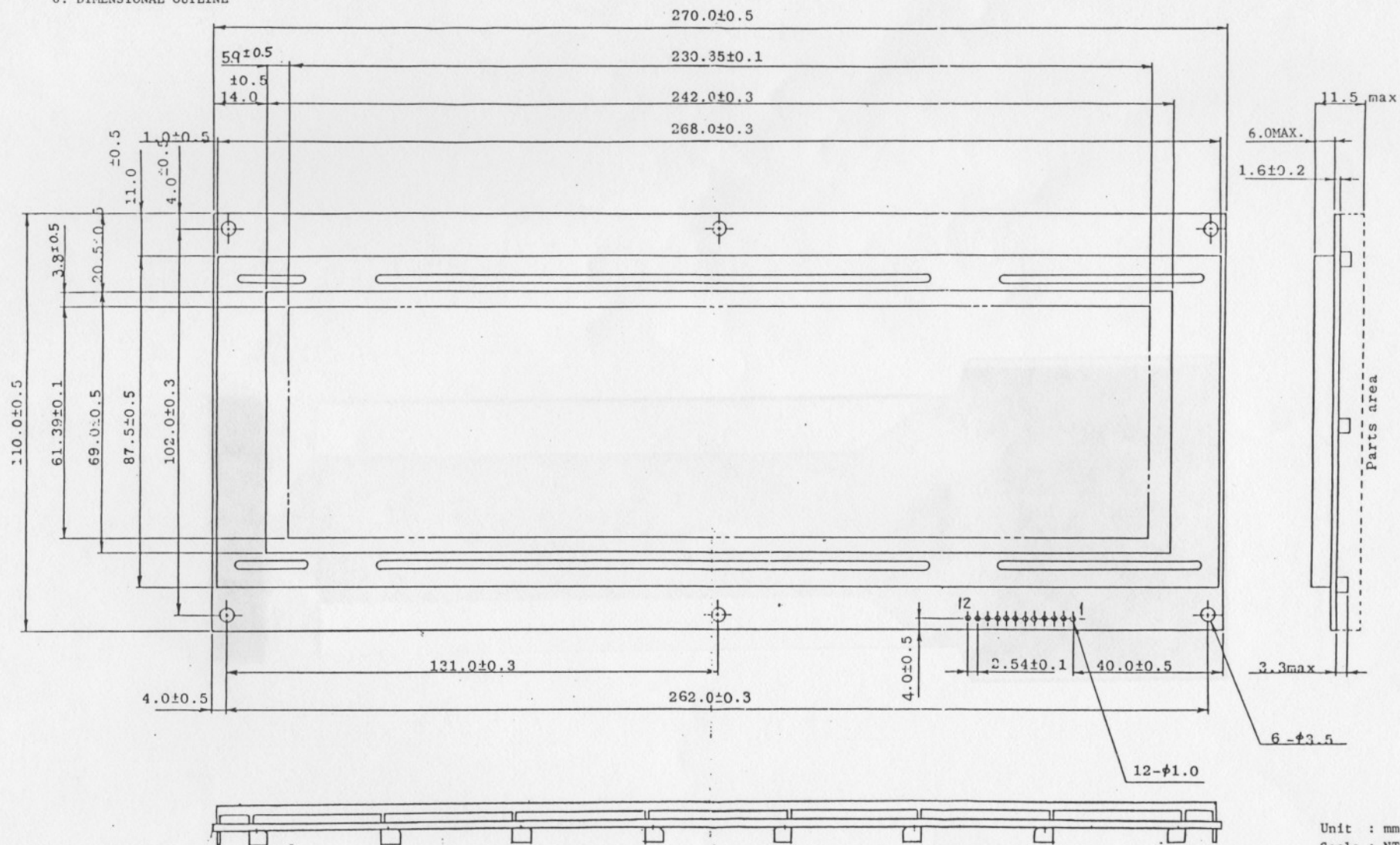


I T E M	SYMBOL	MIN	TYP	MAX	UNIT
CL_2 cycle time	t_{CYC}	416			ns
CL_2 pulse width(H)	t_{CWH}	150			ns
CL_2 pulse width(L)	t_{CWL}	150			ns
CL_1 setup time(1)	t_{SCL_1}	150			ns
CL_1 setup time(2)	t_{HCL_1}	150			ns
clock rise/fall time	t_r, t_f			30	ns
Data setup time	t_{DSU}	100			ns
Data hold time	t_{DH}	100			ns
CL_1 delay time	t_{CL}	150			ns
M delay time	t_{CM}			300	ns
FLM setup time	t_{FS}	100			ns
FLM hold time	t_{FH}	100			ns

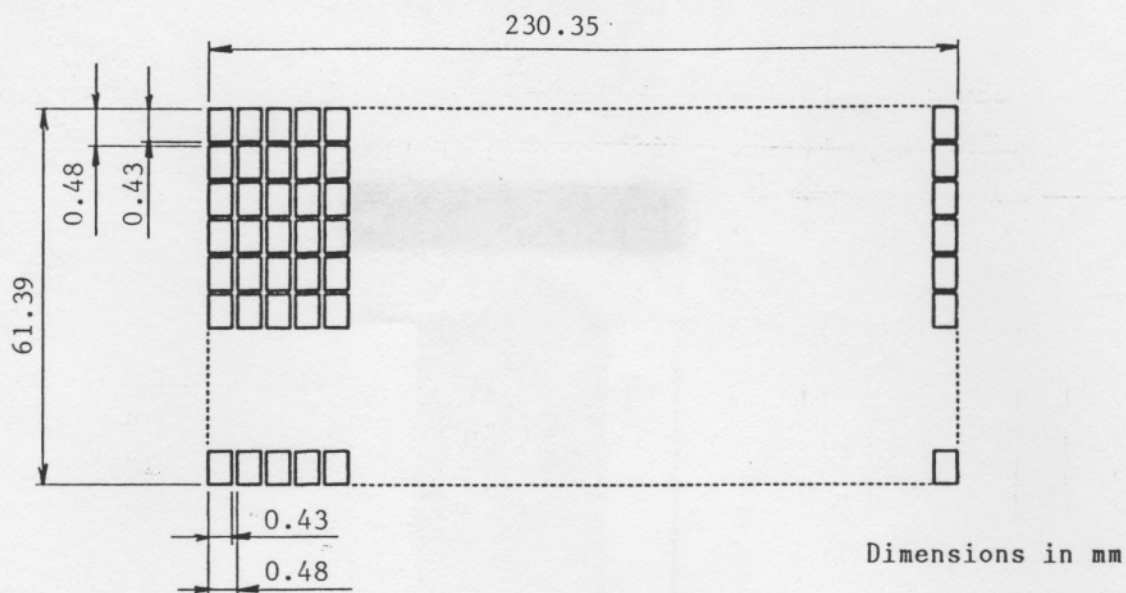
5.3 Power and Interface timing Sequence



6. DIMENSIONAL OUTLINE



Note 1; Detail Drawing of Matrix Pattern



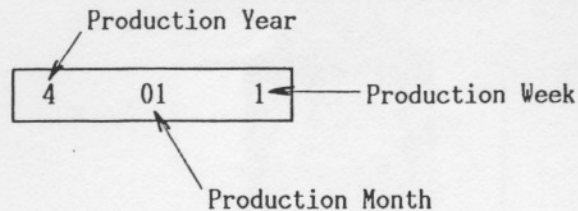
Note 2 ; Interface Pin Assignment

PIN NO.	SYMBOL	LEVEL	FUNCTION
1	D1	H/L	Serial row data (upper left half)
2	D2	H/L	Serial row data (lower left half)
3	FLM	H	The FLM signal indicates the begining of each display cycle.
4	M	H/L	Control signal for AC driving
5	CL ₁	H→L	The CL ₁ latches the serial data in the sift registers.
6	CL ₂	H→L	Clock signal for shifting the serial data.
7	D3	H/L	Serial row data (upper right half)
8	D4	H/L	Serial row data (lower right half)
9	VDD	-	Power supply for logic circuit
10	Vss	-	Ground
11	VEE	-	Power supply for LC driving
12	Vo	-	Operating voltage for LC driving

7. Description of Production Number

For example

1984 February Twenty Fourth



Production Year (one figure)1984 Year 4
 Production Month (double figure).....January 01
 Production Week (one figure).....First Week 1

Production Year

Year	Mark
'80	0
'81	1
'82	2
'83	3
'84	4
.	.
.	.
.	.
'89	9

Production Month

Minth	Mark
Jan	01
Feb	02
Mar	03
Apr	04
May	05
Jun	06
Jul	07
Aug	08
Sep	09
Oct	10
Nov	11
Dec	12

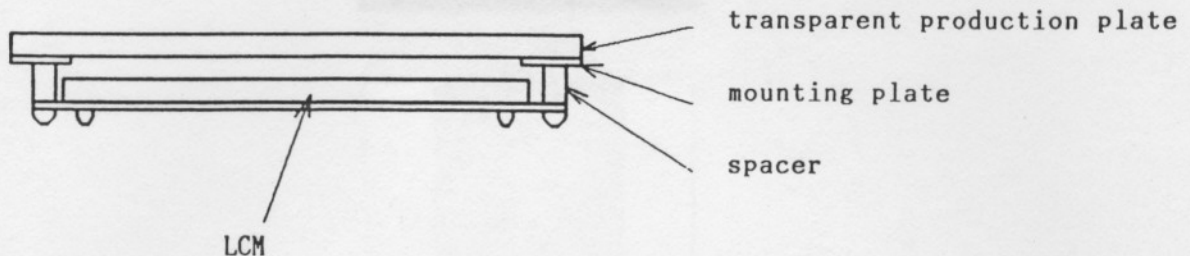
Production Week

Date	Week	Mark
21 § 27	1st	1
28 § 03	2nd	2
04 § 10	3th	3
11 § 17	4th	4
18 § 20	5th	5

8. PRECAUTION IN DESIGN

8.1 Mounting Method

Since LCM is so constructed as to be fixed by utilizing fitting holes in the printed circuit board as shown below, it is necessary to take consideration the following items on attachment to a frame.



AN EXAMPLE OF LCM MOUNTING

- (1) Use of a protective plate, made of any acrylic plate, etc.
In order to protect a polarizer and LC cell.
- (2) To prevent the module cover from being pressed, the spacers between the module and the fitting plates should be longer than 5.5 in mm.
LCM ; Liquid Crystal Module

8.2 Handling Precautions

- (1) Since the liquid crystal cells are made of glass, do not apply strong impact for them.
- (2) If the liquid crystal material touches your body when broken, wash it off with water immediately.
- (3) The LCD module has C-MOS LSI and has also protection circuit against static electricity. Do not touch LSI's pins or connector's pins directly. When you touch them, earth your body to the ground.

8.3 LCD Driving Voltage (V_o) and Viewing Angle Range

Contrast of liquid crystal display has viewing angle dependency. It is necessary to obtain the optimum viewing angle range by adjusting the driving Voltage (V_o).

9. PRECAUTION FOR USE

9.1 A limit sample should be provided by the both on a occasion when the party agreed its necessity.

Judgement by a limit sample shall take effect after the limit sample has been established and confirmed by the both party.

9.2 On the following occasions, the handing of the problem should be decided through discussion and agreement between responsible persons of the both party.

- (1) When a question is around in this specifications.
- (2) When a new problem is around which is not specified in this specifications.
- (3) When a new problem is around during the sample evaluation by the customer's set at the customer.
- (4) When a inspection specifications change or operating condition change in customer is reported to Hitachi, and some problem is around in this specifications due to the change.