HITACHI

FOR MESSRS : _____ DATE : Oct.31,2007

CUSTOMER'S ACCEPTANCE SPECIFICATIONS

SP09Q02L0CLZZ

CONTENTS

* When product will be discontinued, customer will be informed by HITACHI with twelve months prior to discontinuation.
* This product is inhibited to apply in any life support instrument.

ACCEPTED BY; _____ PROPOSED BY; Dan Cheng

RECORD OF REVISION

DATE	SHEET No.	SUMMARY

3. GENERAL SPECIFICATIONS

(1) Part Name	SP09Q02L0CLZZ
(2) Module Size	89.0 (W)mm x 66.5 (H)mm x 5.5 (D) mm
(3) Active Area	71.985(W)mm x 47.985(H)mm
(4) Dot Size	0.30 (W)mm x 0.30 (H)mm
(5) Dot Pitch	0.285 (W)mm x 0.285 (H)mm
(6) Resolution	240 (W) x 160 (H) dots
(7) Duty Ratio	1/160
(8) Bias Ratio	1/9
(9) LCD Type	Transmissive type B/W F-STN (Negative Mode) with anti-glare type upper polarizer
(10) Viewing Direction	12 O'clock
(11) Backlight	White LED Life time : 35khr @25℃ Note : Life time for half of initial brightness.

4. ABSOLUTE MAXIMUM RATINGS

4.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS.

VSS=0V:STANDARD

ITEM	SYMBOL	MIN.	MAX.	UNIT	COMMENT
Power Supply for Logic	VDD-VSS	-0.3	7.0	V	
Power Supply for LC Drive	VLCD	0	30.0	V	
Input Voltage	Vi	-0.3	VDD+0.3	V	(Note 1,2)

Note 1 : $\overline{DOFF}$, FLM , CL1, CL2 , D0~D3 , M.

Note 2 : Make certain you are grounded when handling LCM.

4.2 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS.

I T E M	OPERATING		STORAGE		COMMENT
	MIN.	MAX.	MIN.	MAX.	
Ambient Temperature	0℃	70℃	-20℃	80℃	(Note 2,3,6)
Humidity	(Note 1)		(Note 1)		Without condensation
Vibration	-	2.45m/s^2 (0.25G)	-	11.76m/s^2 (1.2G) (Note 5)	1h max . (Note 4)
Shock	-	29.4m/s^2 (3 G)	-	490.0m/s^2 (50 G) (Note 5)	X、Y、Z Directions
Corrosive Gas	Not acceptable		Not acceptable		

Note 1 : Ta≦40℃: 85%RH max.
Ta>40℃: Absolute humidity must be lower than the humidity of 85%RH at 40℃

Note 2 : Ta at -20℃ < 48h , at 80℃ < 168h.

Note 3 : Background color changes slightly depending on ambient temperature . This phenomenon is reversible.

Note 4 : 5Hz~100Hz (Except resonance frequency)

Note 5 : This module should be operated normally after finish the test.

Note 6 : The operating temperature only guarantee the display can be operated ; regarding the contrast , response time , brightness and other features related to the quality are judged by Ta=25℃ condition .

5. ELECTRICAL CHARACTERISTICS

5.1 ELECTRICAL CHARACTERISTICS OF LCD

I T E M	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Power Supply Voltage for Logic	VDD-VSS	-	2.5	3.3	4.5	V
Power Supply Voltage for LCD Driving	VLCD-VSS	-	-	-	30.0	V
Input Voltage (Note 1)	Vi	H level	0.8VDD	-	VDD	V
		L level	0	-	0.2VDD	V
Power Supply Current For Logic , (Note 2)	IDD	VDD-VSS=3.3V VLCD-VSS=(16.2)V	-	0.02	-	mA
Power Supply Current for LC Driving , (Note 2)	ILCD	VDD-VSS=3.3V VLCD-VSS=(16.2)V	-	0.1	-	mA
Recommended LC Driving Voltage (Note 3)	VLCD-VSS	Ta= 0℃ , ϕ=0°	-	17.2	-	V
		Ta=25℃ , ϕ=0°	-	16.2	-	V
		Ta=50℃ , ϕ=0°	-	15.2	-	V
Frame Frequency (Note 4)	fFLM	-	70	75	80	Hz

Note 1 : $\overline{\text{DOFF}}$, FLM , CL1 , CL2, D0~D3,M.

Note 2 : fFLM=75Hz , Test pattern is all "Q".
VLCD-VSS=16.2V, Ta=25℃.

Note 3 : Recommended LC driving voltage change about ±1.0V by each module.
Test pattern is all "Q".

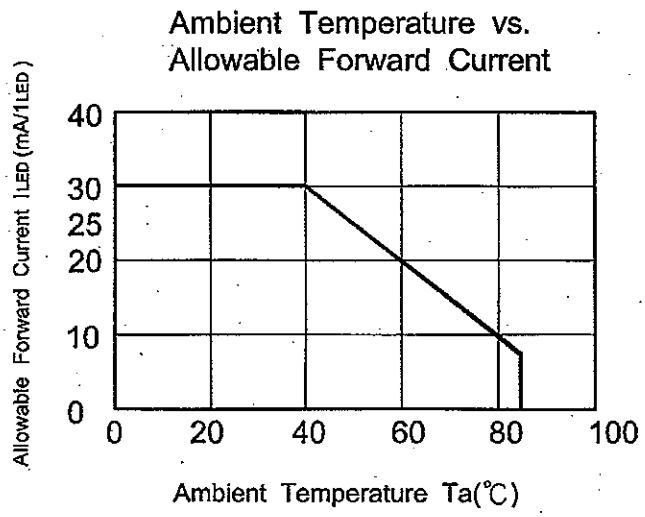
Note 4 : Need to make sure of flicking and rippling of display when setting the frame frequency in your set.

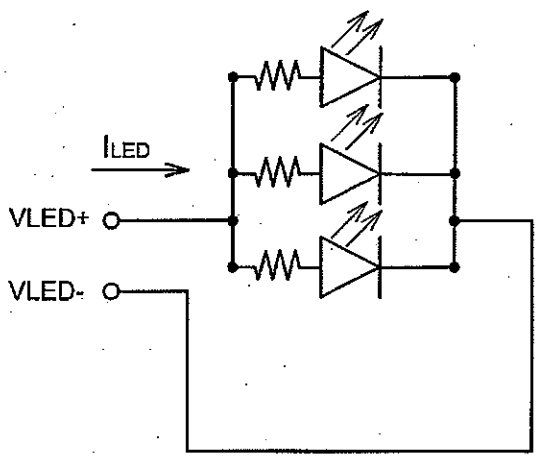
5.5 ELECTRICAL CHARACTERISTICS OF LED BACKLIGHT

Ta=25℃ (Backlight on)

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Power Supply Voltage for LED	VLED	-	-	5.0	5.2	V
Power Supply Current for LED	ILED	VLED=5.0V	-	(60)	75 (Note 1)	mA

Note 1 : The ILED changes depending on ambient temperature.





6. OPTICAL CHARACTERISTICS

6.1 OPTICAL CHARACTERISTICS OF LCD

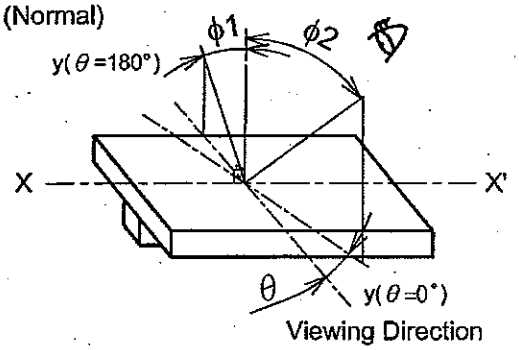
Ta=25℃(Backlight on)

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Viewing Angle	$\phi 2-\phi 1$	$K \geqq 2.0$	-	80	-	deg.	1,2
Contrast Ratio	K	$\phi=0°$, $\theta=0°$	-	30	-	-	3
Response Time (Rise)	tr	$\phi=0°$, $\theta=0°$	-	150	-	ms	4
Response Time (Fall)	tf	$\phi=0°$, $\theta=0°$	-	350	-	ms	4

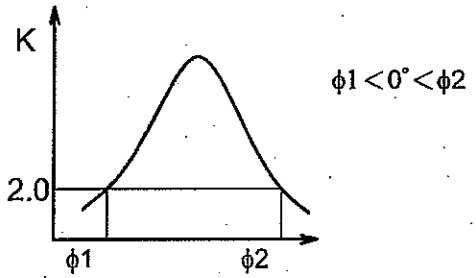
(Measure condition by HITACHI)

Note 1 : Definition of θ and ϕ

(Normal)



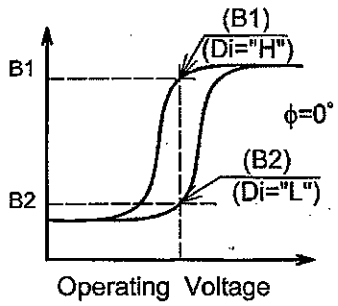
Note 2 : Definition of viewing angle $\phi 1$ and $\phi 2$

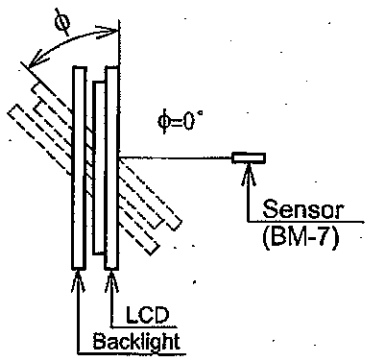


Contrast ratio K vs viewing angle ϕ

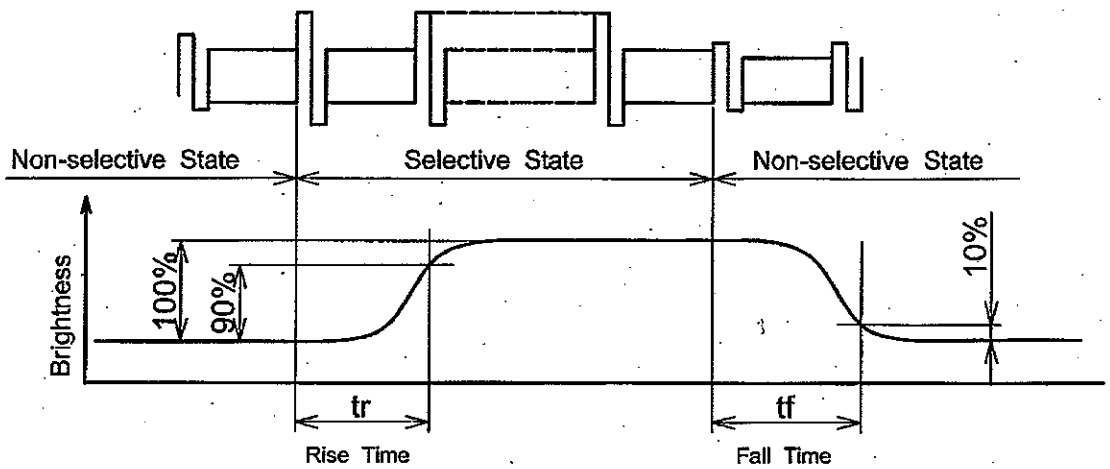
Note 3 : Definition of contrast "K"

$$K = \frac{\text{Brightness on selected dot (B1)}}{\text{Brightness on non-selected dot (B2)}}$$





Note 4 : Definition of optical response

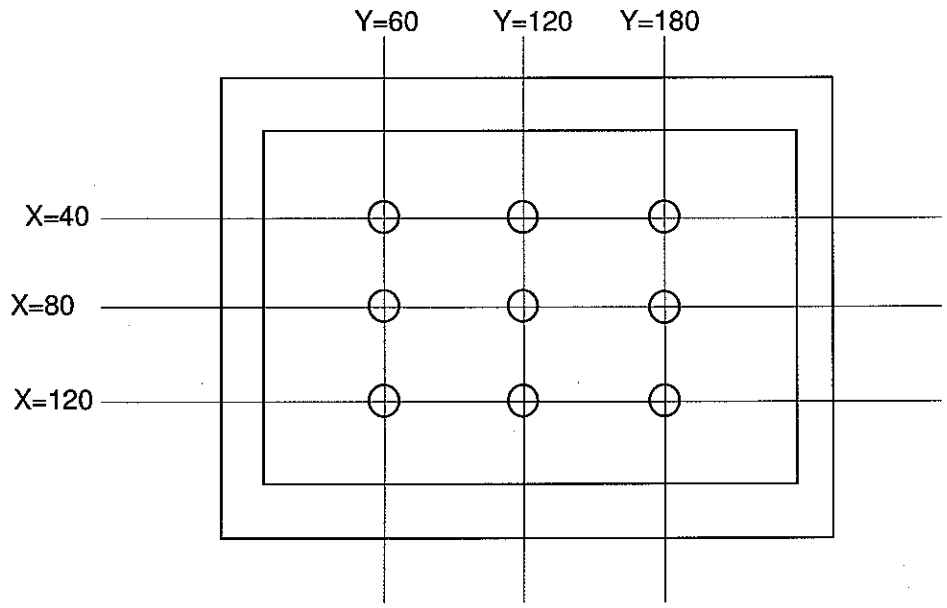


6.2 OPTICAL CHARACTERISTICS OF BACKLIGHT

(LCM, BACKLIGHT ON, Ta=25℃)

ITEM	MIN.	TYP.	MAX.	UNIT	NOTE
Brightness Uniformity	-	-	±35	%	(Note 1,2)
Brightness	-	90	-	cd/m^2	I_{LED}=60 mA

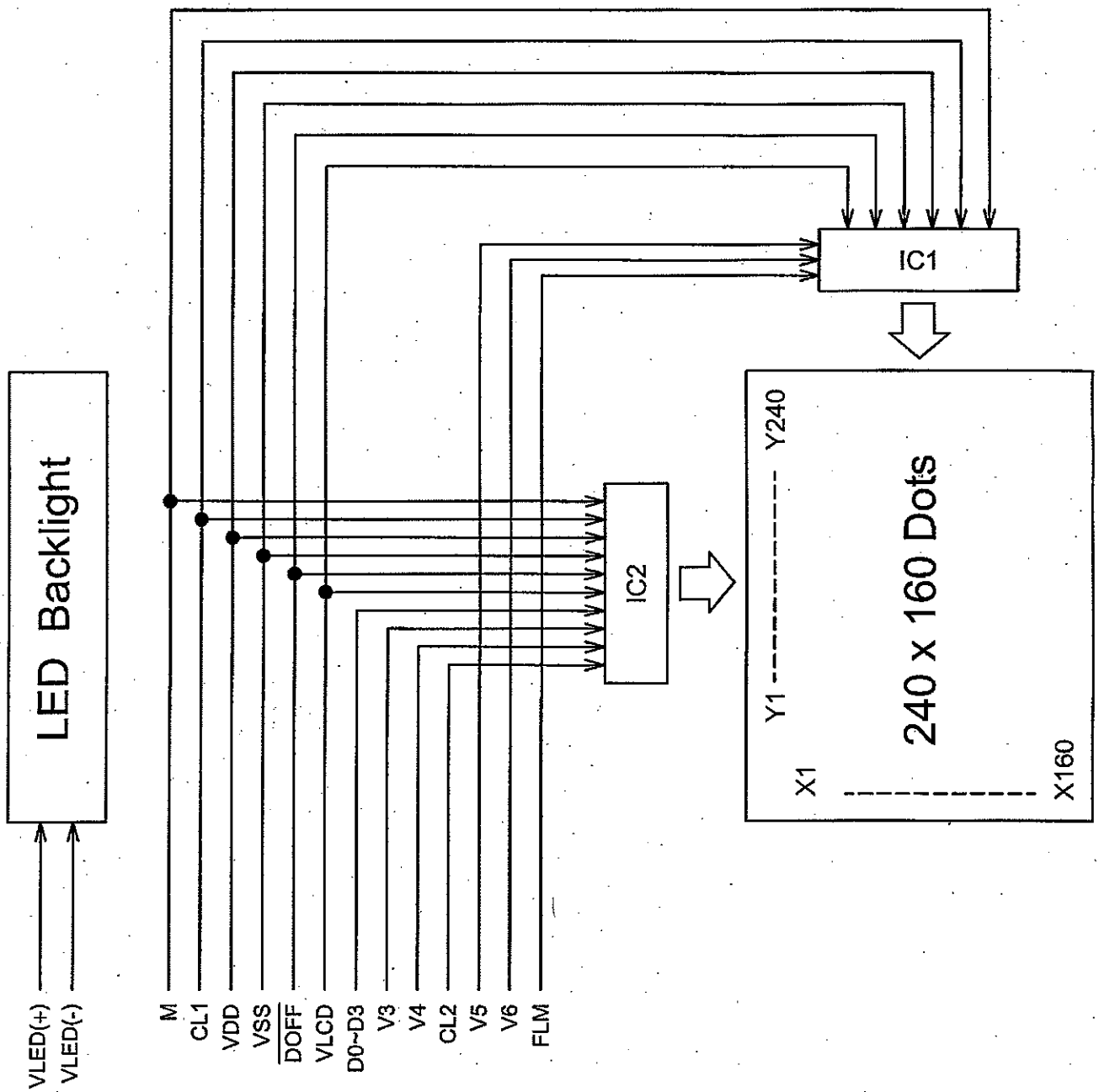
Note 1 : Measure of the following 9 places on the display.



Note 2 : Definition of brightness tolerance.

$$\left(\frac{\text{Max. or Min. Brightness} - \text{Average Brightness}}{\text{Average Brightness}} \right) \text{X } 100\%$$

7. BLOCK DIAGRAM



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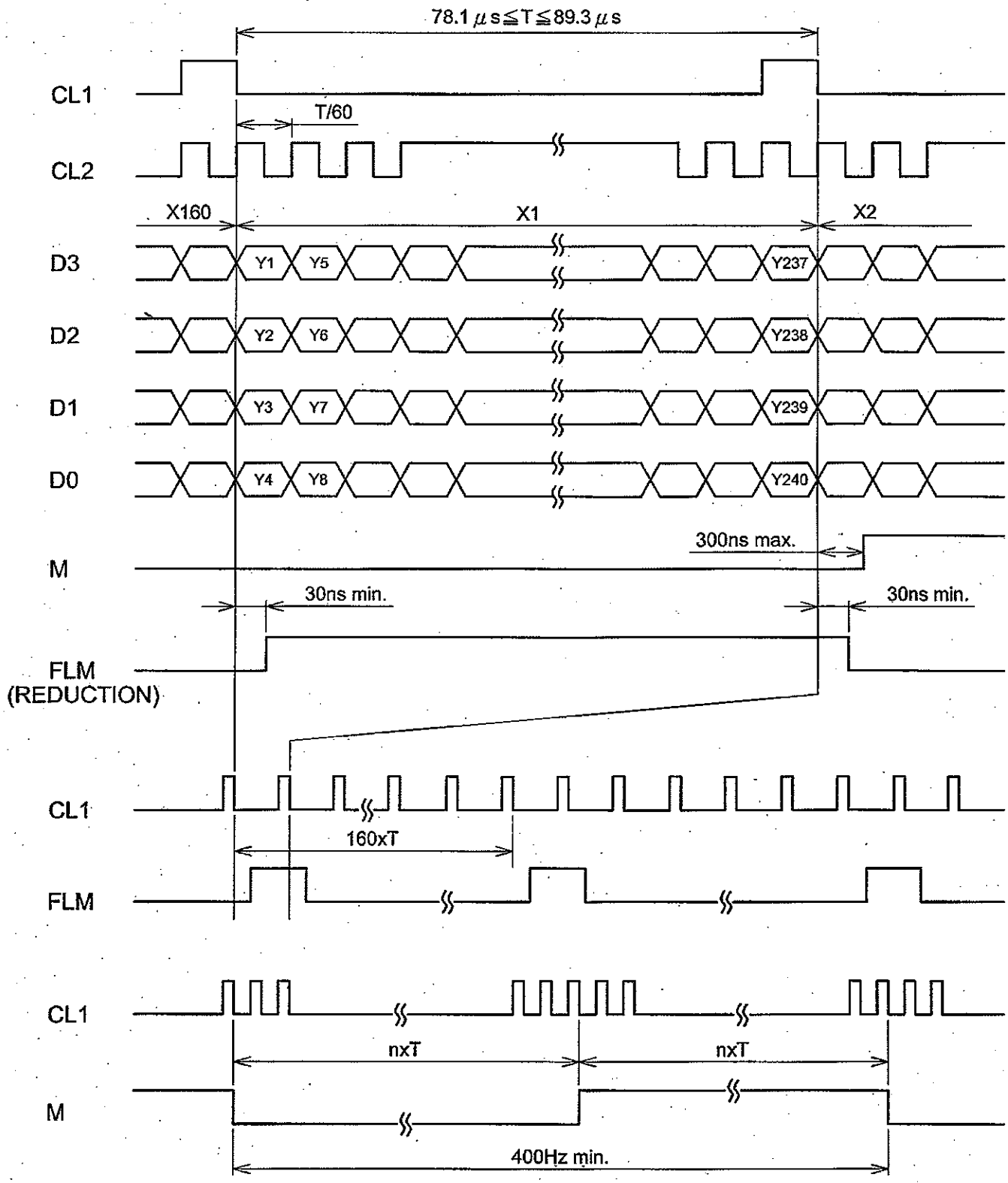
8. INTERFACE TIMING

8.1 TIMING CHART (4-BITS PARALLEL DATA INPUT)

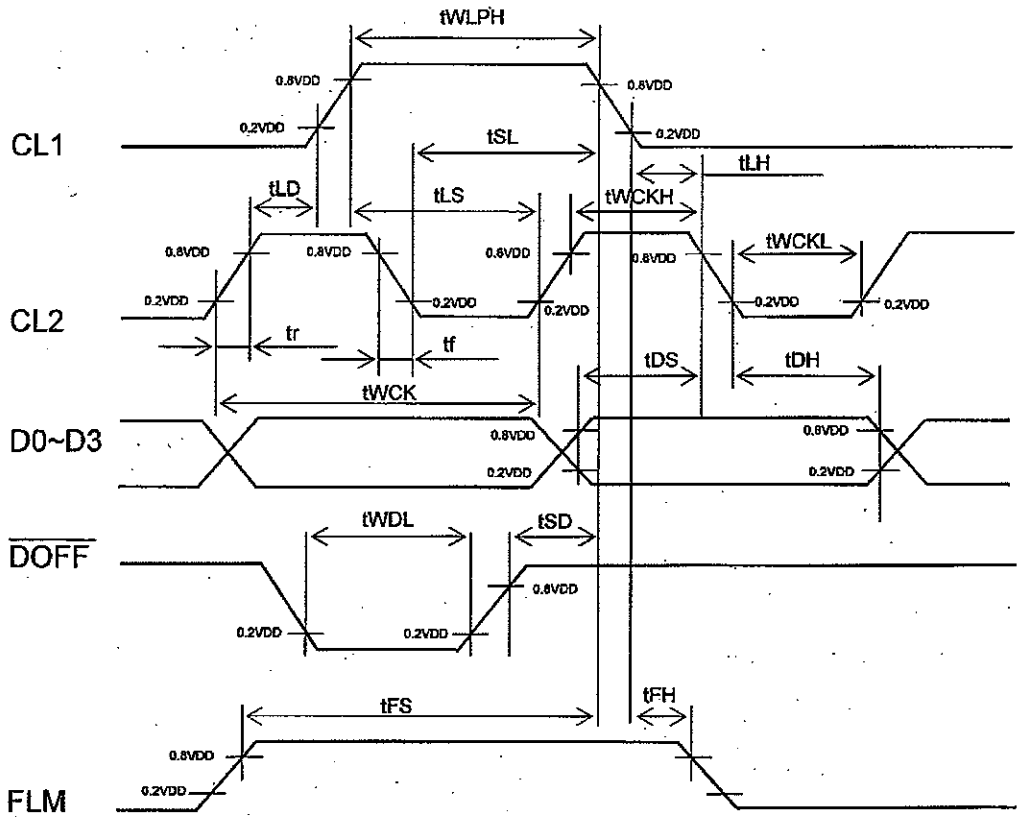


Note 1 : M signal should be kept 400Hz min. and 50% duty.
Note 2 : HITACHI recommend nxCL1 pulses of M signal 50%.
n=13

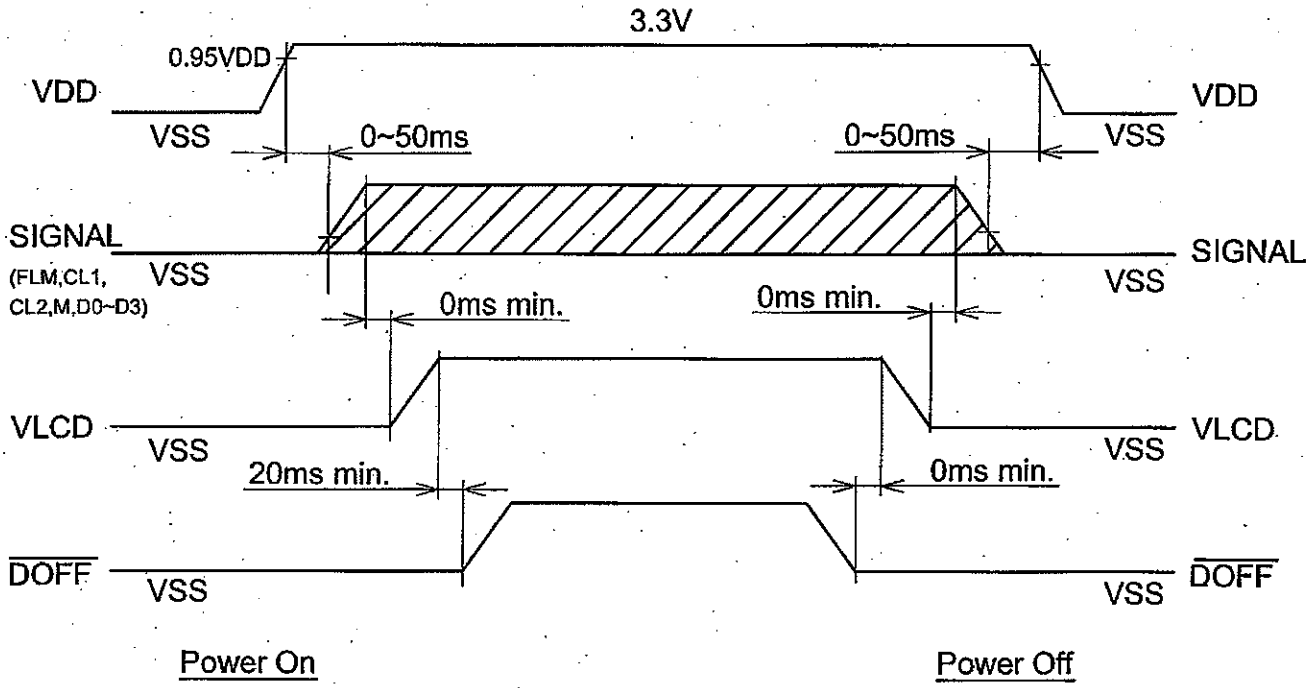
8.2 TIMING CHARACTERISTICS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITION
Shift Clock Period	tWCK	125	-	-	ns	tr , tf≦11ns
Shift Clock "H" Pulss Width	tWCKH	51	-	-	ns	
Shift Clock "L" Pulss Width	tWCKL	51	-	-	ns	
Data Setup Time	tDS	30	-	-	ns	
Data Hole Time	tDH	40	-	-	ns	
Latch Pulse "H" Pulse Width	tWLPH	51	-	-	ns	
Shift Clock Rise to Latch Pulse Rise Time	tLD	0	-	-	ns	
Shift Clock Rise to Latch Pulse Fall Time	tSL	51	-	-	ns	
Latch Pulse Rise to Shift Clock Rise Time	tLS	51	-	-	ns	
Latch Pulse Fall to Shift Clock Fall Time	tLH	51	-	-	ns	
Input Signal Rise Time	tr	-	-	50	ns	(Note 1)
Input Signal Fall Time	tf	-	-	50	ns	(Note 1)
$\overline{\text{DOFF}}$ Removal Time	tSD	100	-	-	ns	
$\overline{\text{DOFF}}$ Enable Pulse Time	tWDL	1.2	-	-	μs	
"FLM" Set Up Time	tFS	100	-	-	ns	-
"FLM" Hold Time	tFH	30	-	-	ns	-

Note 1 : (tWCK - tWCKH - tWCKL) /2 is the maximum in the case of high speed operation.



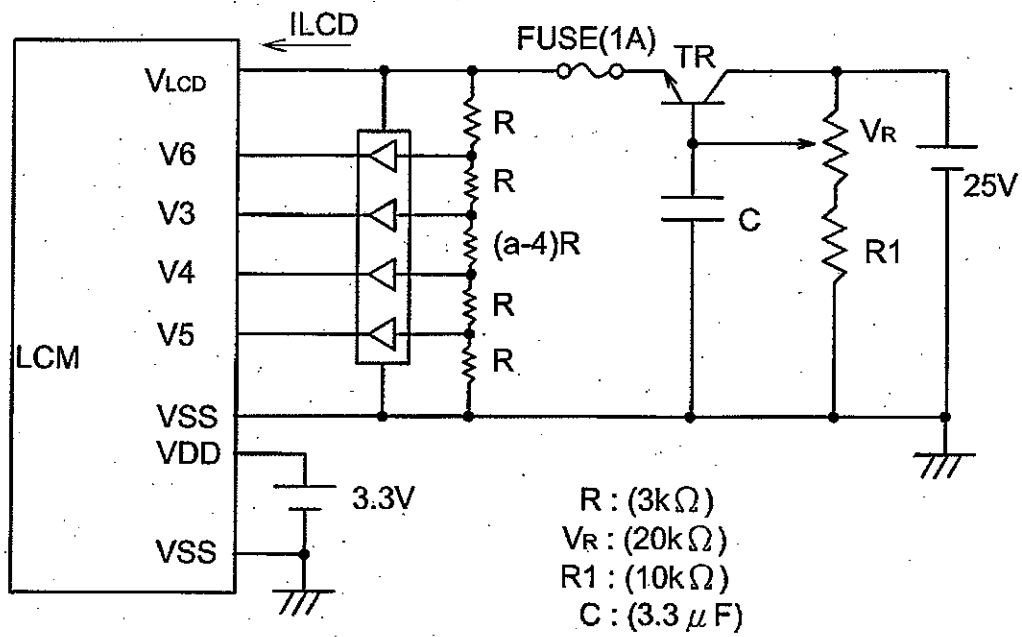
8.3 TIMING OF POWER SUPPLY AND INTERFACE SIGNAL



Note 1 : $\overline{DOFF}$ function takes priority even if the input signal status becomes irregular immediately after VDD power-on.

Note 2 : Please keep the specified sequence because wrong sequence may cause permanent damage to the LCM.

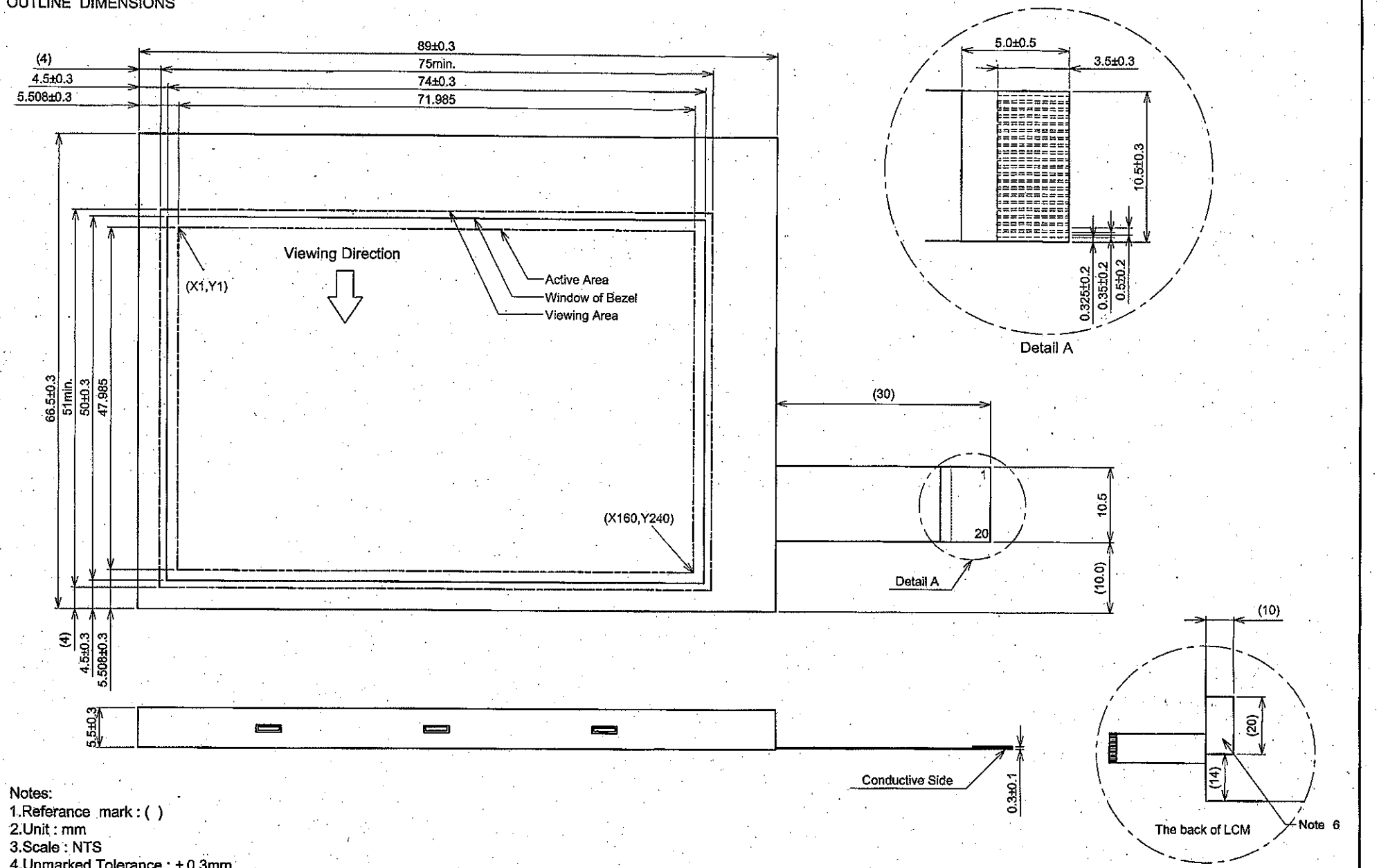
8.4 POWER SUPPLY FOR LCM



R : (3kΩ)
VR : (20kΩ)
R1 : (10kΩ)
C : (3.3 μF)
TR : (2N3904)
a : 8.3

9. OUTLINE DIMENSIONS

9.1 OUTLINE DIMENSIONS



Notes:
1. Referance mark : ( )
2. Unit : mm
3. Scale : NTS
4. Unmarked Tolerance : ± 0.3mm
5. Measurement when adding 9.8×10^4 Pa at the measuring point
6. We have 1mm high points of solder at VLED(+) and VLED(-)

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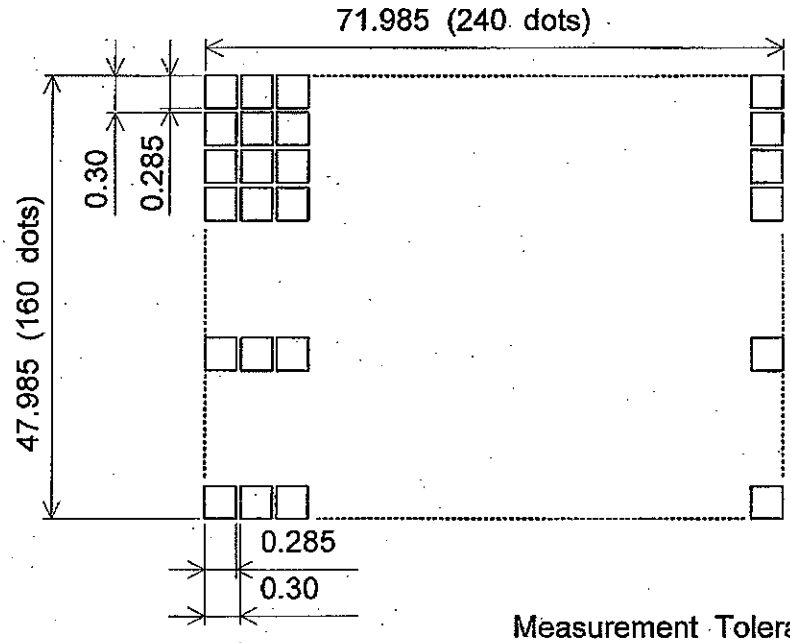
9.2 DISPLAY PATTERN



Scale : NTS
Unit : mm
Measurement Tolerance : ±0.1

9.3 INTERFACE PIN CONNECTION

9.3.1 CN1 : LCM I/F (0.5mm PITCH , 20PINS FPC)

PIN No.	SYMBOL	FUNCTION
1	VLED(+)	Power supply for LED backlight
2	VLED(-)	Power supply for LED backlight
3	M	Switch signal to convert LCD driver waveform into AC
4	$\overline{DOFF}$	Hi : Display on ; Low : Display off
5	FLM	Frame start signal data signal of the shift register of the Com driver
6	VLCD	Power supply for LCD
7	V6	Bias voltage for non-select (Com driver)
8	V3	Bias voltage for non-select (Seg driver)
9	V4	Bias voltage for non-select (Seg driver)
10	V5	Bias voltage for non-select (Com driver)
11	D0	Input data signal
12	D1	Input data signal
13	D2	Input data signal
14	D3	Input data signal
15	VDD	Power supply for logic
16	VSS	Ground
17	CL1	1) Latch pulse of display data 2) Shift clock for Com driver
18	VSS	Ground
19	CL2	Clock pulse for Seg shift
20	VSS	Ground

Suitable connector : Molex / 52745-2090 or 52746-2090