

HITACHI

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FOR MESSRS : _____

DATE: Jul.28,2004

CUSTOMER'S ACCEPTANCE SPECIFICATIONS **SP12Q01L6ALZZ** **CONTENTS**

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* When product will be discontinued, customer will be informed by HITACHI with twelve months prior announcement.

ACCEPTED BY: _____

PROPOSED BY: Jimmy Ho

RECORD OF REVISION

DATE	SHEET No.	SUMMARY

3. GENERAL SPECIFICATIONS

(1) Part Name	SP12Q01L6ALZZ
(2) Module Size	129.6(W)mm x 92.6(H)mm x 7.5(D)mm
(3) Effective Area	100(W)mm min. x 75.5(H)mm min.
(4) Dot Size	0.285(W)mm x 0.285(H)mm
(5) Dot Pitch	0.3(W)mm x 0.3(H)mm
(6) Dot Number	320 (W) x 240 (H)
(7) Duty Ratio	1/240
(8) LCD Type	Transmissive type F-B / W STN The upper polarizer is Anti-Glare Type.
(9) Viewing Direction	6 O'clock
(10) Viewing Angle	Wide Viewing Angle
(11) Operating Temperature	Wide Temperature Range
(12) Backlight Type	LED(Color : white)
(13) Weight	(110g)

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	6.5	V	
Power Supply for LC Drive	VDD-VEE	0	27.5	V	
Input Voltage	V_i	-0.3	VDD+0.3	V	(Note 1)
Input Current	I_i	0	1	A	
Static Electricity	-	-	100	-	(Note 2)

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

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	-20°C	70°C (Note 5)	-30°C	80°C	(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)	(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 : $T_a \leq 40^\circ\text{C}$: 85%RH max.

$T_a > 40^\circ\text{C}$: Absolute humidity must be lower than the humidity of 85%RH at 40°C.

Note 2 : T_a at -20°C ---< 48h , at 60°C ---< 168h.

Note 3 : Background color changes slightly depending on ambient temperature.

This phenomenon is reversible.

Higher LCD driving voltage is needed while operating at 0°C.

Note 4 : 5Hz~100Hz(Except resonance frequency and X, Y, Z each direction within 1h)

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

Note 6 : The response time will be slower under low temperature.

5. ELECTRICAL CHARACTERISTICS

5.1 ELECTRICAL CHARACTERISTICS

I T E M	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Power Supply Voltage for Logic	VDD-VSS	-	3.0	5.0	5.25	V
Power Supply Voltage For LC Driving	VEE-VSS	-	-	-22.0	-	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=5.0V VEE-VSS=-22.0V	-	8.0	-	mA
Power Supply Current For LC Driving Note 2	IEE	VDD-VSS=5.0V VEE-VSS=-22.0V	-	6.0	-	mA
Recommended LC Driving Voltage Note 4	VDD-VEE	Ta=-20°C , $\phi=0^\circ$	-	-	-	V
		Ta=25°C , $\phi=0^\circ$	-	(23.0)	-	V
		Ta=70°C , $\phi=0^\circ$	-	-	-	V
Frame Frequency	fFLM	-	70	-	(140)	Hz

Note 1 : DOFF , FLM , CL1 , CL2 , D0~D3.

Note 2 : fFLM=75HZ
VDD-VEE=23.0V,Ta=25°C.

Note 3 : Recommended LC driving voltage fluctuate about $\pm 1.0V$ by each module.
Test pattern is all "Q"

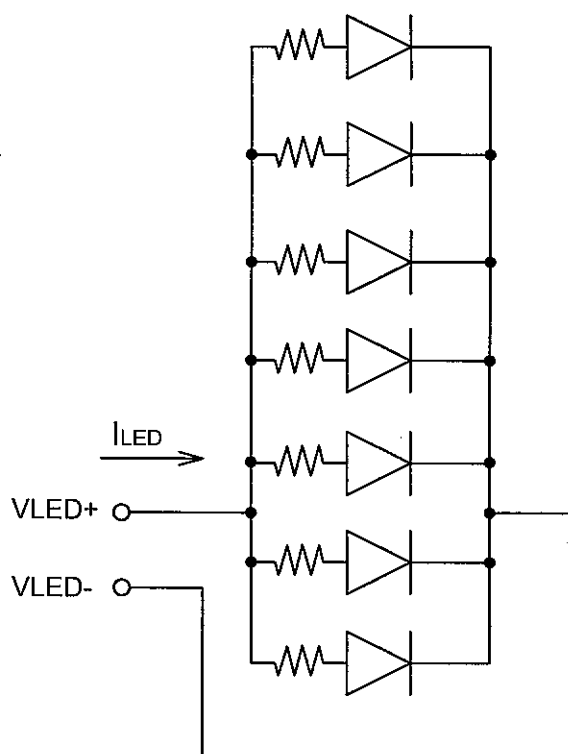
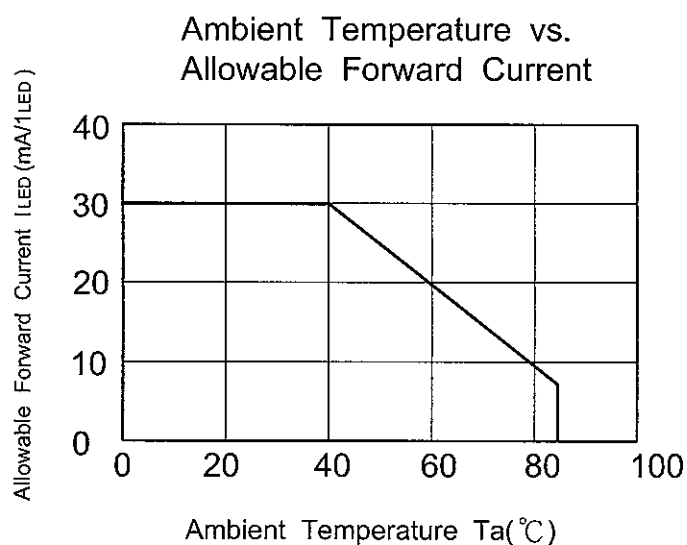
Note 4 : Need to make sure of flickering and rippling of display when setting the frame frequency in your set.

5.2 ELECTRICAL CHARACTERISTICS OF LED BACKLIGHT

$T_a=25^{\circ}\text{C}$ (Backlight on)

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Power Supply Voltage for LED	VLED	-	(4.8)	(5)	(5.2)	V
Power Supply Current for LED (Note 1)	ILED	-	-	(140)	-	mA

Note 1 : The ILED changes depending on ambient temperature.



6. OPTICAL CHARACTERISTICS

6.1 OPTICAL CHARACTERISTICS

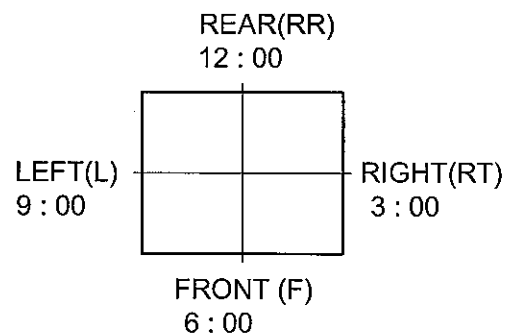
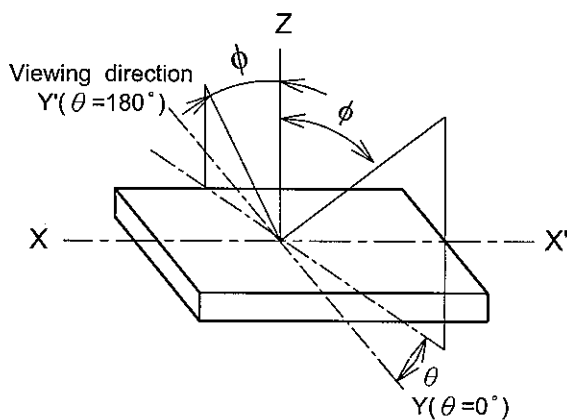
Ta=25 °C (Backlight on)

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Viewing Area	$\phi_{RR}-\phi_F$	$K \geq 2.0$	-	80	-	deg	1,2
	$\phi_{RT}-\phi_L$			90			
Contrast Ratio	K	$\phi=0^\circ, \theta=0^\circ$	-	(20)	-	-	3,5,6
Response Time (Rise)	tr	$\phi=0^\circ, \theta=0^\circ$	-	(280)	-	ms	4
Response Time (Fall)	tf	$\phi=0^\circ, \theta=0^\circ$	-	(280)	-	ms	4

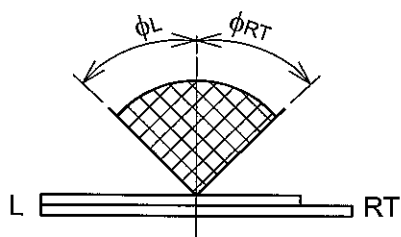
(Measurement condition : HITACHI standard)

Note 2~7 : See next page.

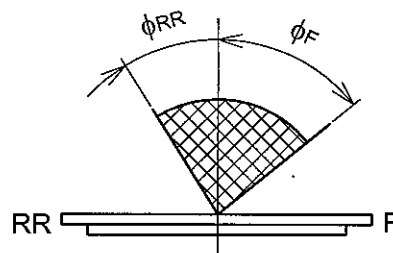
Note 1 : Definition of Viewing Angle



LEFT-RIGHT Direction



REAR-FRONT Direction

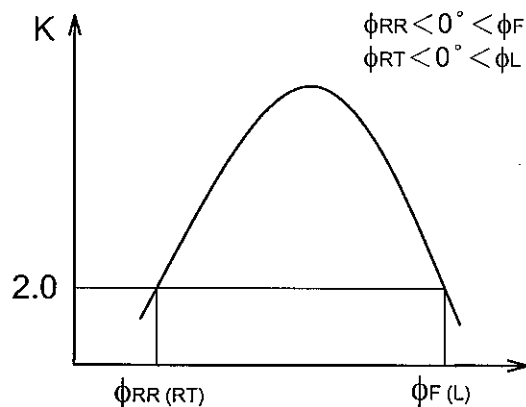


* The viewing direction of this product is 6 O'clock.

So $\phi_F > \phi_{RR}$

Note 2 : Definition of viewing angle

ϕ_{RR} and ϕ_F , ϕ_{RT} and ϕ_L

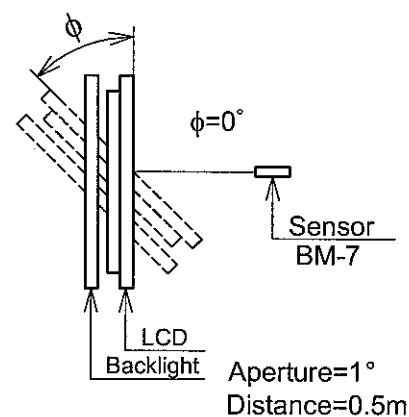
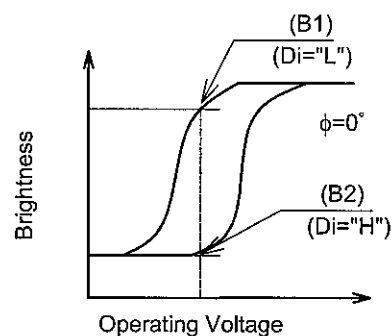


Viewing Angle

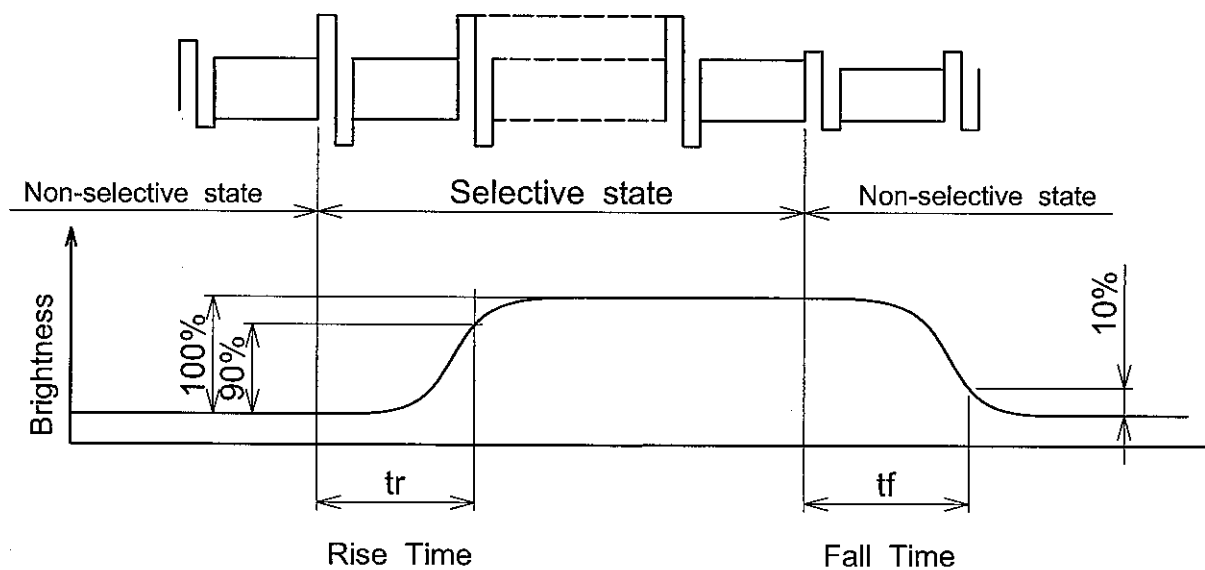
Contrast ratio K vs viewing angle ϕ

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 time



6.2 OPTICAL CHARACTERISTICS OF BACKLIGHT

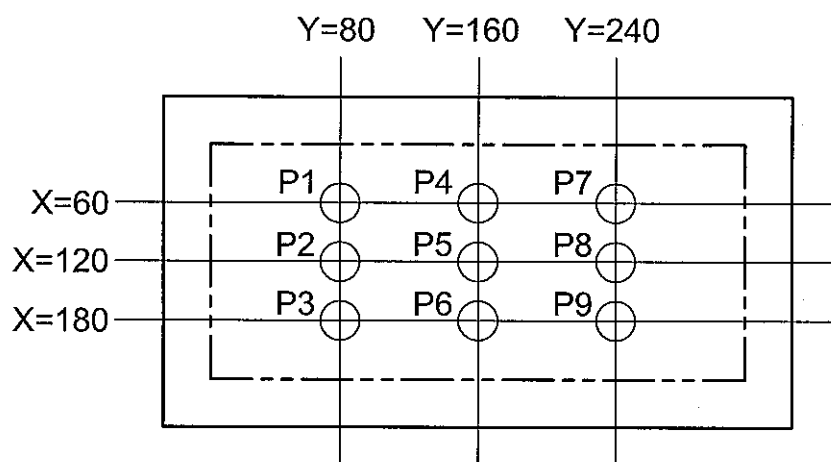
(Backlight ON)

ITEM	MIN.	TYP.	MAX.	UNIT	NOTE
Brightness	—	(60)	—	cd/m ²	I _{LED} =(140mA)
Brightness uniformity	—	—	±40	%	Undermentioned (Note 1)

T_a=25°C VDD-VEE=23.0V

Display data should be all "ON".

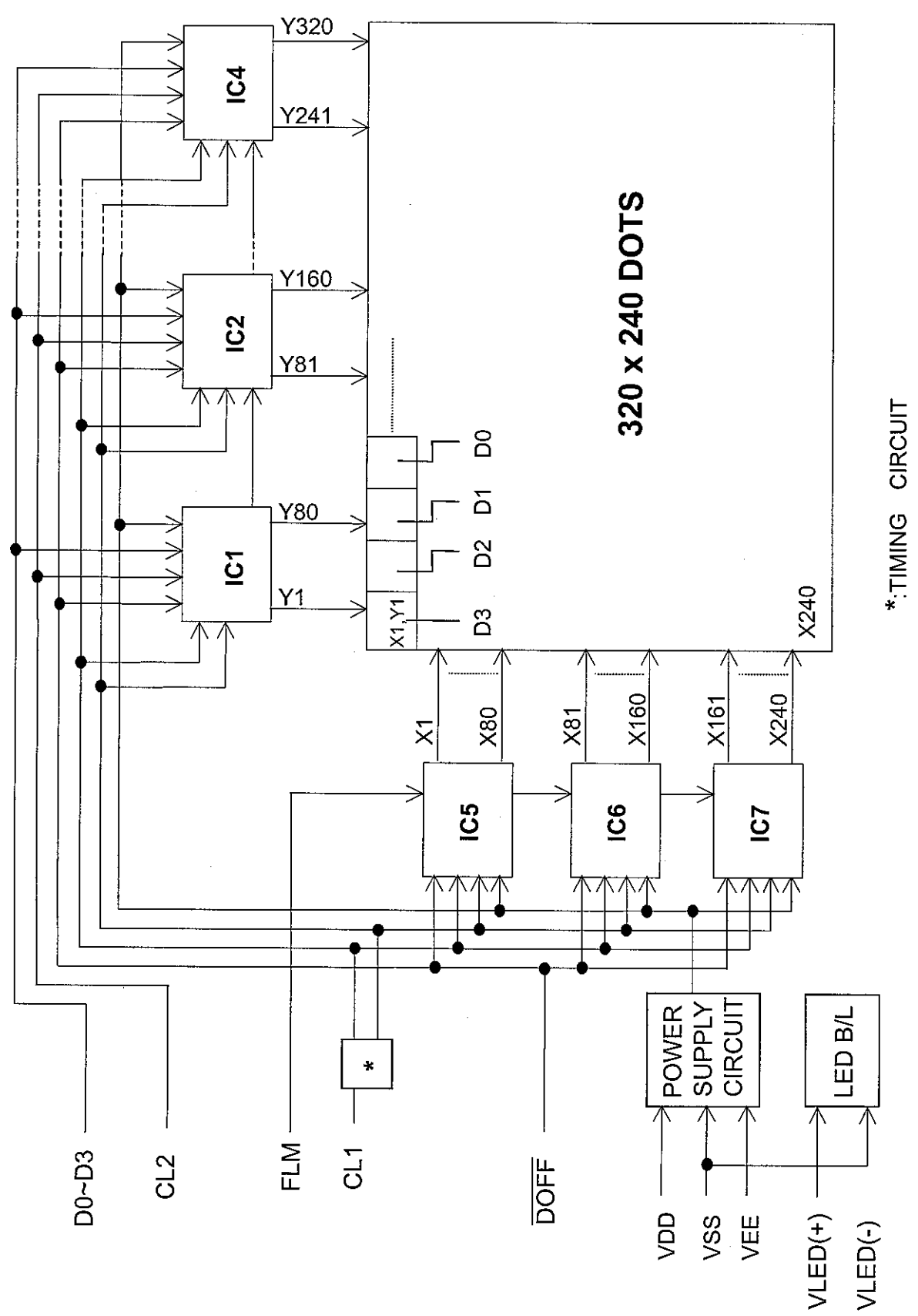
Note 1 : Measurement of the following 9 places on the display.



Definition of the brightness tolerance.

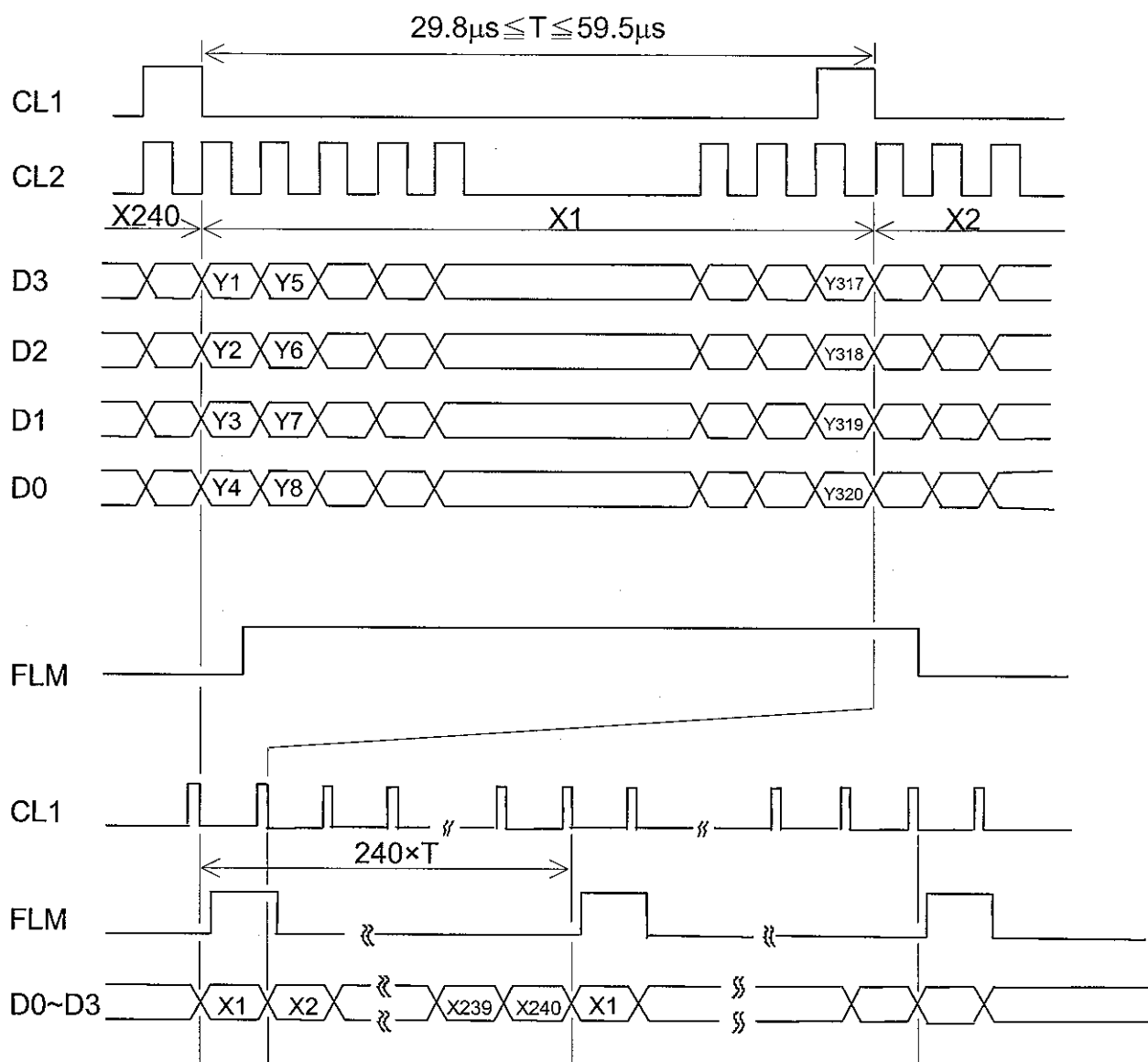
$$\left(\frac{\text{max. Brightness or min. Brightness} - \text{Average Brightness}}{\text{Average Brightness}} \right) \times 100$$

7. BLOCK DIAGRAM



8. INTERFACE TIMING CHART

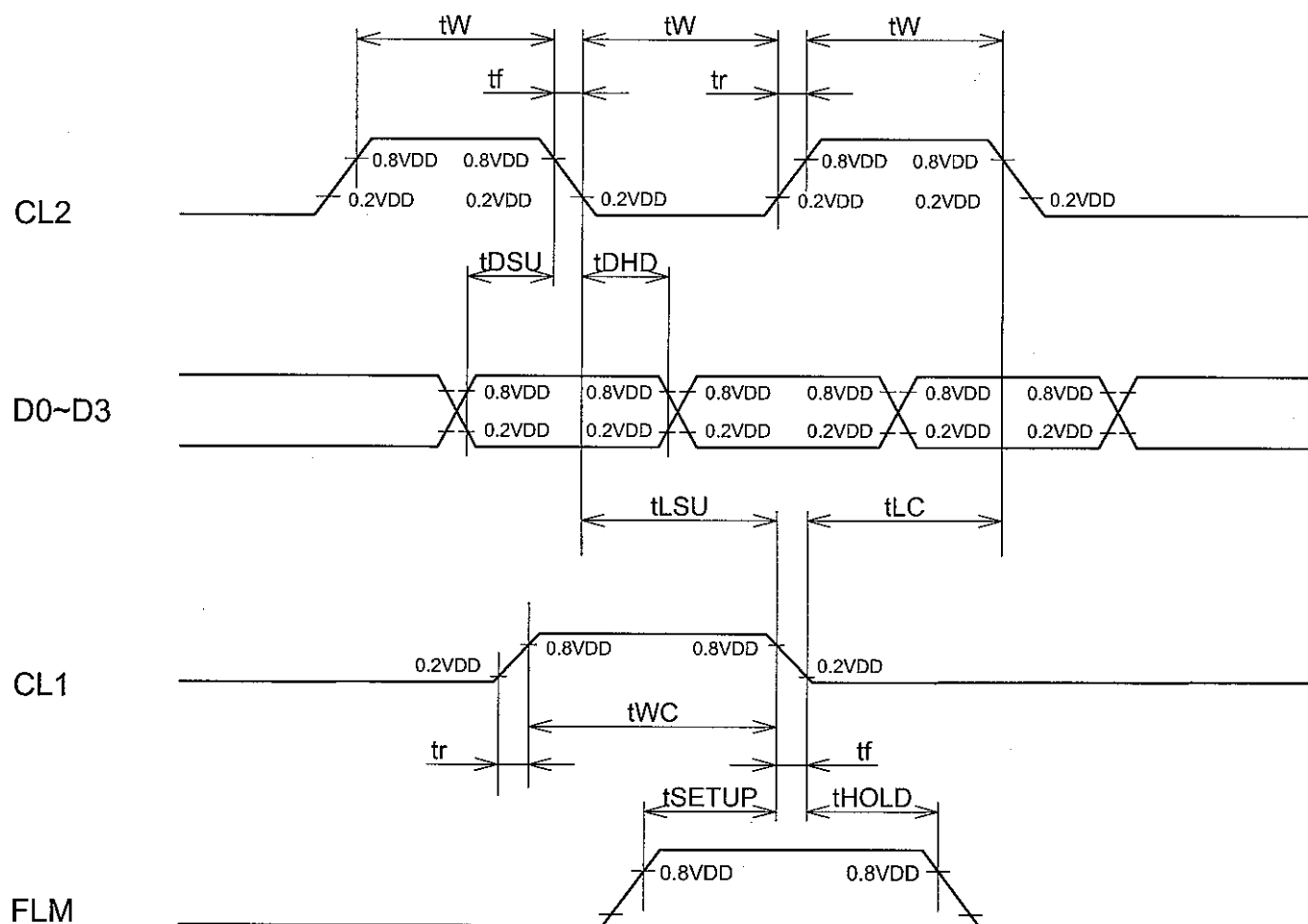
8.1 INTERFACE TIMING CHART



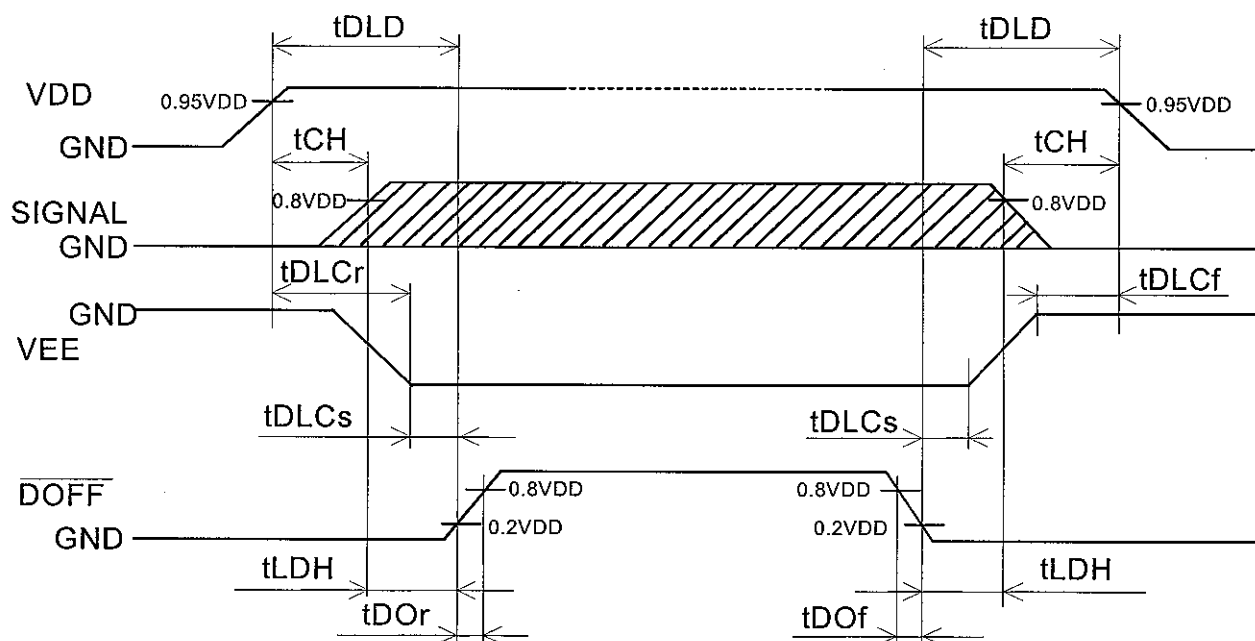
8.2 TIMING CHARACTERISTICS

$0^{\circ}\text{C} \leq T_a \leq 40^{\circ}\text{C}$, $V_{DD}=5\text{V} \pm 5\%$

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT
"CL2" Clock Frequency	fCL2	-	-	40	MHz
"CL2" Clock Pulse Width	tW	63	-	-	ns
Clock Rise , Fall Time	tr,tf	-	-	20	ns
Data Set Up Time	tDSU	50	-	-	ns
Data Hold Time	tDHD	50	-	-	ns
CL1 Set Up Time	tLSU	80	-	-	ns
CL1 Hold Time	tLC	80	-	-	ns
"FLM" Set Up Time	tSETUP	100	-	-	ns
"FLM" Hold Time	tHOLD	100	-	-	ns
"CL1" Pulse Width	tWC	125	-	-	ns



8.3 POWER ON/OFF TIMING SEQUENCE

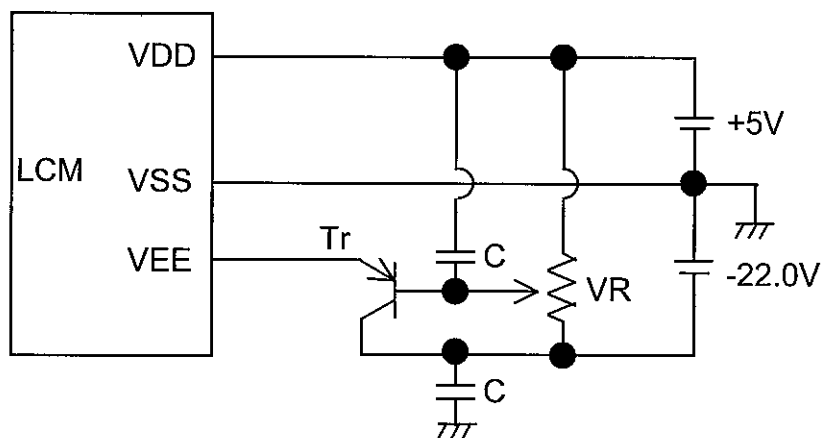


SYMBOL	MIN.	MAX.	UNIT	COMMENT
tDLD	200	-	ms	(Note 1)
tCH	0	-	ms	
tLDH	0	-	ms	
tDOr	-	100	ns	(Note 2)
tDOF	-	100	ns	
tDLCr	20	-	ms	
tDLCf	0	-	ms	
tDLCs	20	-	ms	

Note 1 : Please keep the specified sequence because wrong sequence may cause permanent damage to the LCD panel.

Note 2 : HITACHI recommends you to use DOFF function. display quality may deteriorate if you don't use DOFF function.

8.4 POWER SUPPLY FOR LCM

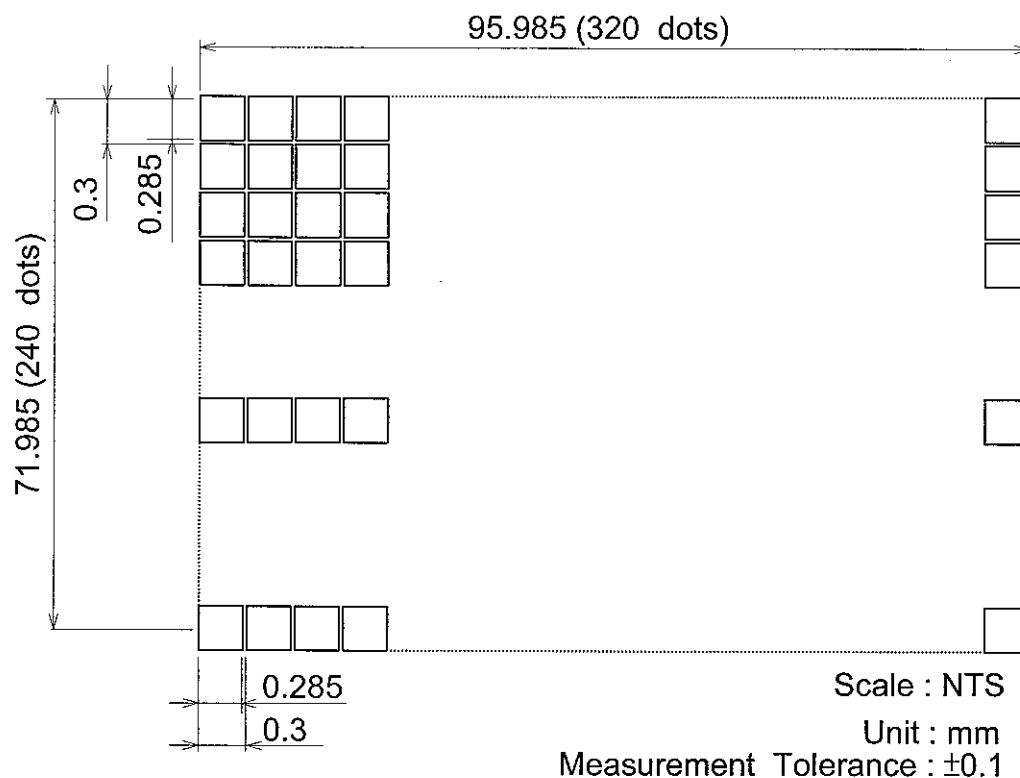


Note 1 : C : 3.3 μ F (aluminum electrolytic capacitor)

VR : 10~20k Ω

Tr : 2SA673APKC (hfe=100 , IC=500mA) or equivalent Tr.

8.5 DISPLAY PATTERN

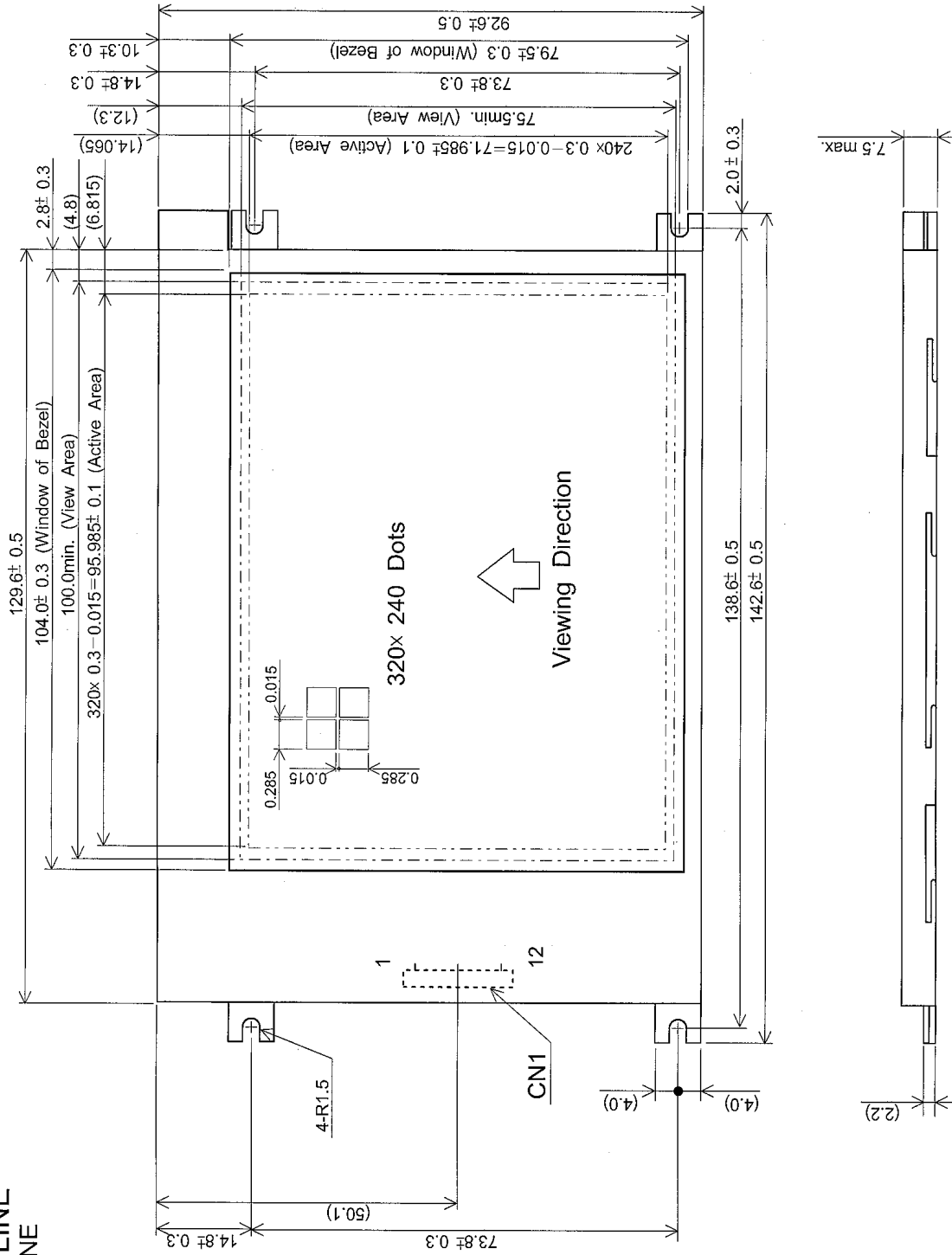


9.3 INTERNAL PIN CONNECTION

CN1 : Molex / 52103-1217(Suitable FPC : pitch 1.0mm 12 pins , 0.3t)

INTERFACE		PIN No.	SIGNAL	LEVEL	FUNCTION
LCM	I/F	1	FLM	H	First Line Marker
		2	CL1	H→L	Data Latch
		3	CL2	H→L	Data Shift
		4	VDD	-	Power Supply for Logic
		5	VSS	-	GND and Power Supply for LED(-)
		6	VEE	-	Power Supply for LC
		7	D0	H/L	Display Data
		8	D1		
		9	D2		
		10	D3		
		11	DOFF	H/L	H:ON / L:OFF
		12	VLED(+)	-	Power Supply for LED(+)

9. DIMENSIONAL OUTLINE 9.1 DIMENSIONAL OUTLINE



Note 1 : CN1 : MOLEX/52103-1217.

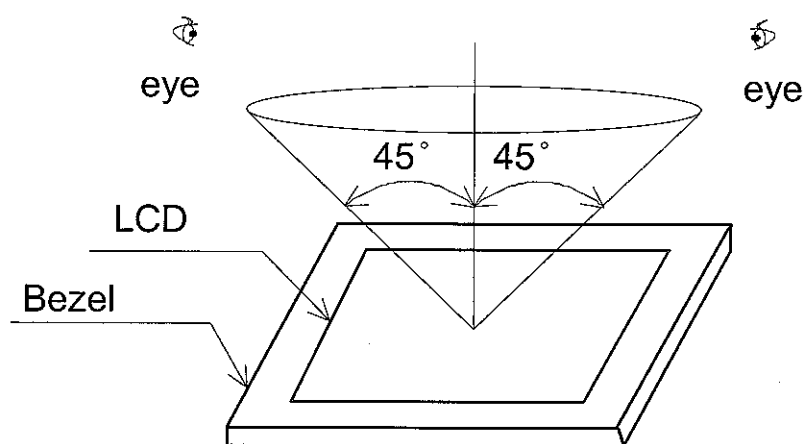
Unit : mm
Scale : NTS

10. APPEARANCE STANDARD

10.1 APPEARANCE INSPECTION CONDITION

Visual inspection should be done under the following condition.

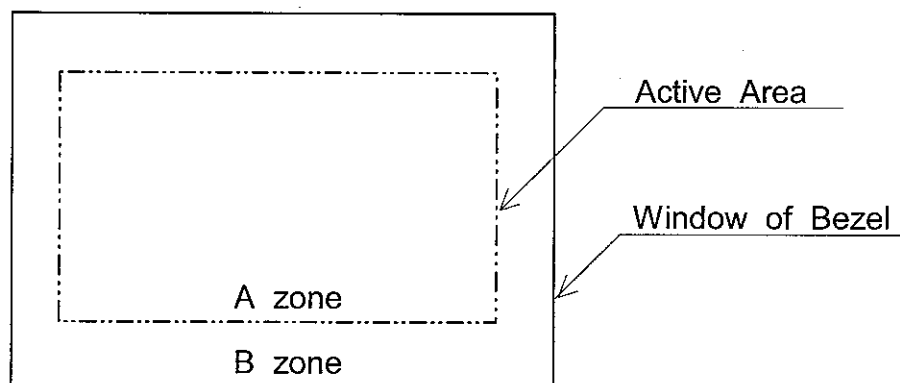
- (1) In the dark room.
- (2) With CFL panel lighted with prescribed inverter circuit.
- (3) With eyes 25cm distance from LCM.
- (4) Viewing angle within 45 degrees from the vertical line to the center of LCD.



10.2 DEFINITION OF EACH ZONE

A zone : Within the active area line specified at page 9-1/1 of this document.

B zone : Area between the window of bezel line and the active area line specified at page 9-1/1 of this document.



10.3 APPEARANCE SPECIFICATION

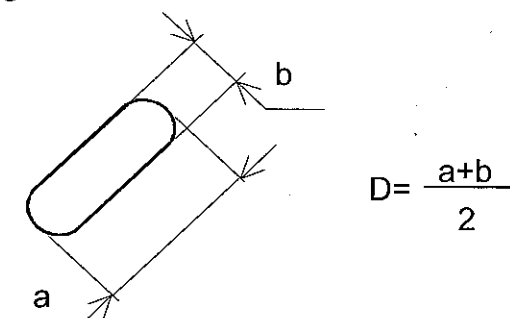
*) If the problem occurs about this item, the responsible person of both party (customer and HITACHI) will discuss more detail.

No.	ITEM	CRITERIA		A	B	
L C D	Scratches	Distinguished one is not acceptable (To be judged by HITACHI limit sample)		*	-	
	Dent	Same as above		*	-	
	Wrinkles in Polarizer	Same as above		*	-	
	Bubbles	Average Diameter D(mm)	Maximum Number Acceptable	○	-	
		D≤0.2	Ignore			
		0.2<D≤0.3	12			
		0.3<D≤0.5	3			
		0.5<D	None			
	Stains, Foreign Materials Dark Spot	Filamentous		○	*	
		Length L(mm)	Width W(mm)			Maximum Number Acceptable
		L≤2.0	W≤0.03			Ignore
		L≤3.0	0.03<W≤0.05			6
		-	0.05<W			None
		Round				
		Average Diameter D(mm)	Maximum Number Acceptable			Space
		D<0.2	Ignore			-
		0.2 ≤D<0.33	8			10mm
		0.33≤D	None			-
		The Whole Number	Filamentous + Round = 10			
		Those Wiped Out Easily Are Acceptable		○	○	
	Color Tone	To Be Judge By HITACHI Limit Sample		*	-	
	Color Uniformity	Same As Above		*	-	
	Pinhole	Average Diameter D(mm)	Maximum Number Acceptable	○	-	
		D≤0.15	Ignore			
		0.15<D≤0.3	10			
		C≤0.03	Ignore			

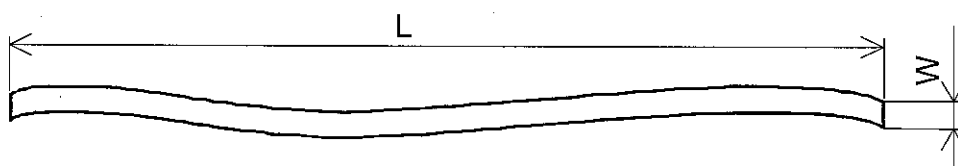
No.	ITEM	CRITERIA				A	B
L C D	Contrast Irregularity (Spot)	Average Diameter D(mm)	Contrast	Maximum Number Acceptable	Minimum Space		
		$D \leq 0.25$	To Be Judged By HITACHI Limit Sample	Ignore	-	○	-
		$0.25 < D \leq 0.35$		≤ 10	20mm		
		$0.35 < D \leq 0.5$		≤ 4	20mm		
		$0.5 < D$		None	-		
	Contrast Irregularity (Filamentous)	Width D(mm)	Length L(mm)	Maximum Number Acceptable	Minimum Space		
		$W \leq 0.25$	$L \leq 1.2$	≤ 2	20mm	○	-
		$W \leq 0.2$	$L \leq 1.5$	≤ 3	20mm		
		$W \leq 0.15$	$L \leq 2.0$	≤ 3	20mm		
		$W \leq 0.1$	$L \leq 3.0$	≤ 4	20mm		
		The Whole Number			≤ 6		
	Rubbing Scratch	To Be Judged By HITACHI Standard				*	-

Note

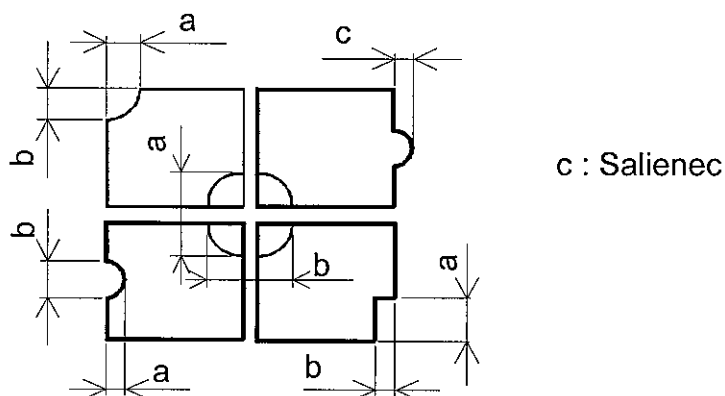
(1) Definition of average diameter D



(2) Definition of length L and width W



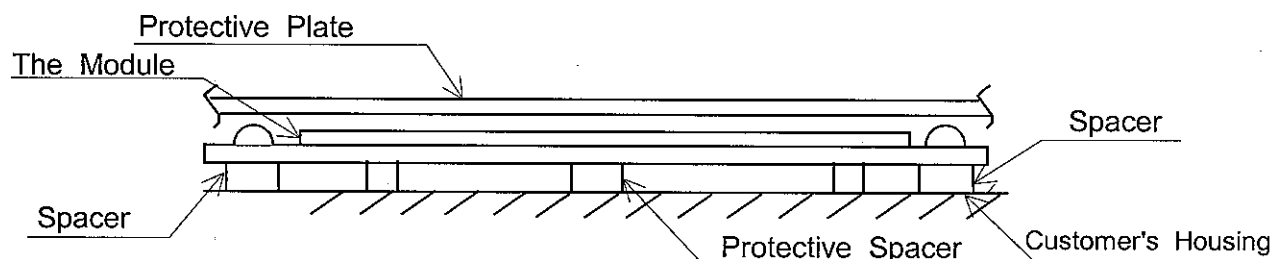
(3) Definition of pinhole



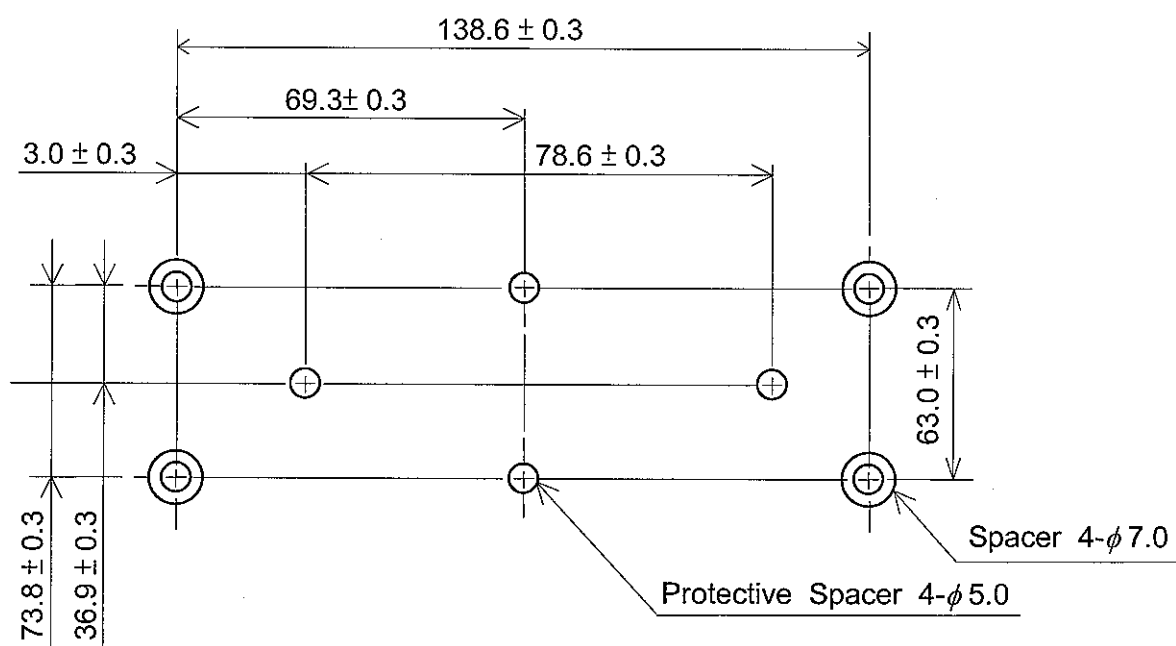
11. PRECAUTION IN DESIGN

11.1 MOUNTING METHOD

Since the module 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.



Example Of Mounting



Location Of Spacers

- (1) Use of protective plate, made of an 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 0.5mm.
- (3) We recommend you to use protective spacer as figure for protecting LCD module from any kind of shock to your set.

11.2 LC DRIVING VOLTAGE(V_{EE}) AND VIEWING ANGLE RANGE

Setting V_{EE} out of the recommended condition will be a cause for a change of viewing angle range.

11.3 CAUTION AGAINST STATIC CHARGE

As this module is provided with C-MOS LSIs, The care to take such a precaution as to grounding the operator's body is required when handling it.

11.4 POWER ON SEQUENCE

Input signals should not be applied to LCD module before power supply voltage is applied and reaches to specified voltage ($5V \pm 5\%$).

If above sequence is not kept, C-MOS LSIs of LCD modules may be damaged due to latch up problem.

11.5 PACKING

- (1) No. Leaving products is preferable in the place of high humidity for a long period of time. For their storage in the place where temperature is 35°C or higher, special care to prevent them from high humidity is required. A combination of high temperature and high humidity may cause them polarization degradation as well as bubble generation and polarizer peel-off. Please keep the temperature and humidity within the specified range for use and storage.
- (2) Since upper/bottom polarizers tend to be easily damaged, They should be handled full with care so as not get them touched, pushed or rubbed.
- (3) As the adhesives used for adhering upper/bottom polarizers are made of organic substances which will be deteriorated by a chemical reaction with such chemicals as acetone, toluene, ethanol and isopropyl alcohol. The following solvents are recommended for use:
normal hexane
Please contact us when it is necessary for you to use chemicals.
- (4) Lightly wipe to clean the dirty surface with absorbent cotton waste or other soft material like chamois, soaked in the chemicals recommended without scrubbing it hardly. To prevent the display surface from damage and keep the appearance in good state, it is sufficient, in general, to wipe it with absorbent cotton.
- (5) Immediately wipe off saliva or water drop attached on the display area because its long period adherence may cause deformation or faded color on the spot.
- (6) Foggy dew deposited on the surface and contact terminals due to coldness will be caused for polarizer damage, stain and dirt on product. When necessary to take out the products from some place at low temperature for test, etc. It is required for them to be warmed up in a container once at the temperature higher than that of room.

- (7) Touching the display area and contact terminals with bare hands and contaminating them are prohibited, because the stain on the display area and poor insulation between terminals are often caused by being touched by bare hands.
(there are some cosmetics detrimental to polarizers.)
- (8) In general the quality of glass is fragile so that it tends to be cracked or chipped in handling, specially on its periphery. Because be careful not to give it sharp shock caused by dropping down, etc.

11.6 CAUTION FOR OPERATION

- (1) It is an indispensable condition to drive LCDs within the specified voltage limit since the higher voltage than the limit causes the shorter LCD life. An electrochemical reaction due to direct current causes LCDs undesirable deterioration, so that the use of direct current driver should be avoided.
- (2) Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCDs show dark bull color in them. However those phenomena do not mean malfunction or out of order with LCDs which will come back in the specified operating temperature range.
- (3) If the display area is pushed hard during operation, some font will be abnormally display but it resumes normal condition after turning off once.
- (4) A slight dew depositing on terminals is a cause for electrochemical reaction resulting in terminal open circuit. Usage under the relative condition of 40°C 50%RH or less is required.

11.7 STORAGE

In case of storing for a long period of time (for instance, for years) for the purpose of replacement use, the following ways are recommended.

- (1) Storage in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it, and with no desiccant.
- (2) Placing in a dark place where neither exposure to direct sunlight nor light is, keeping temperature in the range from 0°C to 35°C.
- (3) Storing with no touch on polarizer surface by anything else. (It is recommended to store them as they have been contained in the inner container at the time of delivery from us.)

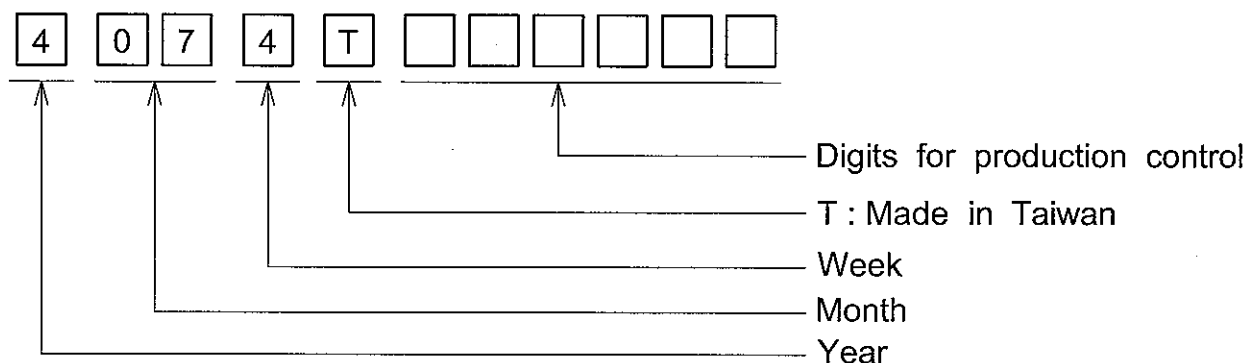
11.8 SAFETY

- (1) It is recommendable to crash damage or unnecessary LCDs into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.
- (2) When any liquid leaked out of a damage glass cell comes in contact with your hands, please wash it off well with soap and water.

12. DESIGNATION OF LOT MARK

12.1 LOT MARK

Lot mark is consisted of 4 digits for production lot and 6 digits for production control.



YEAR	FIGURE IN LOT MARK
2004	4
2005	5
2006	6
2007	7
2008	8

MONTH	FIGURE IN LOT MARK	MONTH	FIGURE IN LOT MARK
Jan.	01	Jul.	07
Feb.	02	Aug.	08
Mar.	03	Sep.	09
Apr.	04	Oct.	10
May	05	Nov.	11
Jun.	06	Dec.	12

WEEK (DAY IN CALENDAR)	FIGURE IN LOT MARK
1~7	1
8~14	2
15~21	3
22~28	4
29~31	5

LOCATION OF LOT MARK :
On the back side of LCM.

13. PRECAUTION FOR USE

13.1 A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity. Judgement by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

13.2 On the following occasions, the handling of the problem should be decided through discussion and agreement between responsible persons of the both parties.

- (1) When a question is arisen in the specifications.
- (2) When a new problem is arisen which is not specified in this specifications.
- (3) When an inspection specifications change or operating condition change in customer is reported to HITACHI, and some problem is arisen in this specification due to the change.
- (4) When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.

The precaution that should be observed when handling LCM have been explained above. If any points are unclear or if you have any request, please contact HITACHI.