HITACHI

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FOR MESSRS. _____ DATE. Nov.20,2002

CUSTOMER'S ACCEPTANCE SPECIFICATIONS

SP10Q002-Z1

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

ACCEPTED BY; _____

PROPOSED BY; H. Ogawa

RECORD OF REVISION

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<tr><td>7B64PS- 2709
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Page 9-3/3</td><td>I/F function revise :
FRAME → FLM
LOAD → CL1
CP → CL2
$\overline{\text{DISP OFF}}$ → $\overline{\text{DOFF}}$</td></tr>
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3. GENERAL SPECIFICATIONS

(1)	Part Name	SP10Q002-Z1
(2)	Module Size	120.0(W)mm×80.0(H)mm×7.0(D)mm
(3)	Effective Display Area	88.1 mm min. × 60.0 mm min.
(4)	Dot Size	0.335(W)mm × 0.335(H)mm
(5)	Dot Pitch	0.35(W)mm × 0.35(H)mm
(6)	Number of Dots	240 (W) × 160 (H)dots
(7)	Duty	1/160
(8)	LCD	Film type back/white (Negative type) The upper polarizer is anti-glare type. (Hardness : 3H) The bottom polarizer is transmissive type.
(9)	Viewing Direction	6 O'clock
(10)	Backlight	Cold cathode fluorescent lamp.
(11)	Weight	(80g)

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	Vi	-0.3	VDD+0.3	V	Note 1
Input Current	Ii	0	1	A	
Static Electricity	-	-	100	V	Note 2

Note 1. $\overline{DOFF}$, FLM , CL1,CL2 , D0~D3.
Note 2. Make certain you are grounded when handling LCM.

4.2 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS.

ITEM	OPERATING		STORAGE		COMMENT
	MIN.	MAX.	MIN.	MAX.	
Ambient Temperature	0℃ Note 6	40℃	-20℃	60℃	Note 2,3
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)	XYZ Directions Note 5
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 60℃ < 168h.

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

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

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

Note 6 Higher starting voltage of CFL and higher LCD driving voltage are needed while operating at 0℃.
The life time of CFL will be reduced while operating at 0℃ need to make sure of value of IL and characteristics of inverter.
Also the response time at 0℃ will be slower.

5. ELECTRICAL CHARACTERISTICS

5.1 ELECTRICAL CHARACTERISTICS

I T E M	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Power Supply Voltage For Logic	VDD-VSS	-	4.75	5.0	5.25	V
			3.0	3.3	3.6	
Power Supply Voltage For Lc Driving	VEE-VSS	-	-23.1	-22.0	-20.9	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	Note 2	-	1.9	-	mA
Power Supply Current For LC Driving Note 2	IEE	Note 2	-	1.5	-	mA
Recommended LC LC Driving Voltage Note 3	VDD-VEE	Ta= 0℃ , ϕ=0°	-	22.4	-	V
		Ta=25℃ , ϕ=0°	-	20.5	-	V
		Ta=40℃ , ϕ=0°	-	19.2	-	V
Frame Frequency Note 4	fFLM	-	70	75	140	Hz

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

Note 2 fFLM =75Hz,Test pattern is all "Q".
VDD-VEE=20.5V,Ta=25℃

Note 3 Recommended LC driving voltage fluctuate 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 FLM frequency in your set.

5.2 ELECTRICAL CHARACTERISTICS OF BACKLIGHT

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	COMMENT
Lamp Voltage	VL	-	300	-	V	Ta=25℃
Frequency	fL	40	70	85	kHz	Ta=25℃
Lamp Current	IL	4	4.5	5	mA	Ta=25℃
Starting Discharge Voltage	VS Note 2	(1000)	-	-	V	Ta=25℃

Note 1 : Please certainly inform HITACHI before designing lamp drive circuit according to the above specifications.

Note 2 : Staring discharge voltage is increased when LCM is operating at lower temperature.
Please check the characteristics of inverter before appling to your set.

Note 3 : Average life time of CFL will be decreased when LCM is operating at lower temperature.

Note 4 : Under lower driving frequency of the inverter, a certain backlight (From CFL & CFL reflection sheet) may generate sound noise. Before designing the inverter, please consider drining frequency and check sound noise from the backlight system.

Note 5 : CFL life time.
MTBF=About 20K Hours at 25℃ IL=4.5mA
Please note that MTBF is not a guaranteed value.
This is a target value for LCM design.

Note 6 : Recommend inverter is INVC445(12V) and INVC473(5V).

6. OPTICAL CHARACTERISTICS

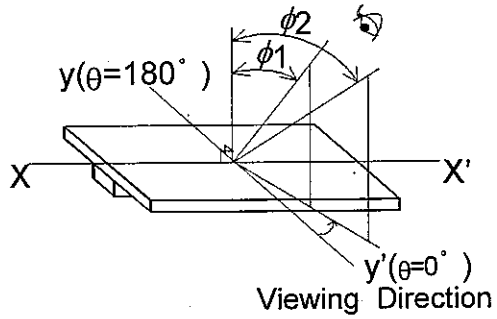
6.1 OPTICAL CHARACTERISTICS

Ta=25°C(BACKLIGHT ON)

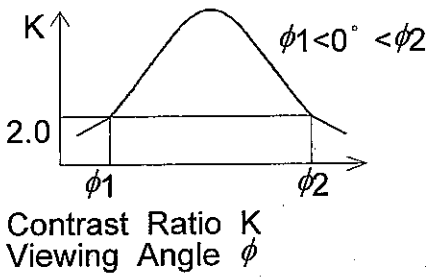
ITEM	SYMBOL	CONDITIONAL	MIN.	TYP.	MAX.	UNIT	NOTE
Viewing Angle	$\phi 2-\phi 1$	K≧2.0	-	40	-	Deg.	1,2
Contrast Ratio	K	ϕ=0° , θ=0°	-	20	-	-	3
Response Time (Rise)	tr	ϕ=0° , θ=0°	-	160	-	ms	4
Response Time (Fall)	tf	ϕ=0° , θ=0°	-	110	-	ms	4

(Measure Condition By HITACHI)

Note 1. Definition of θ and ϕ (Normal)

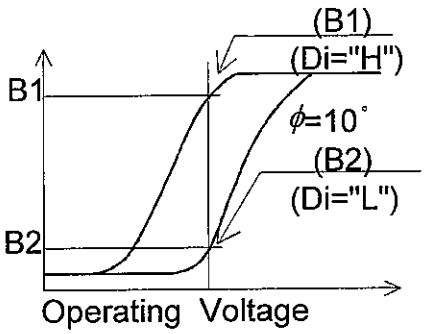


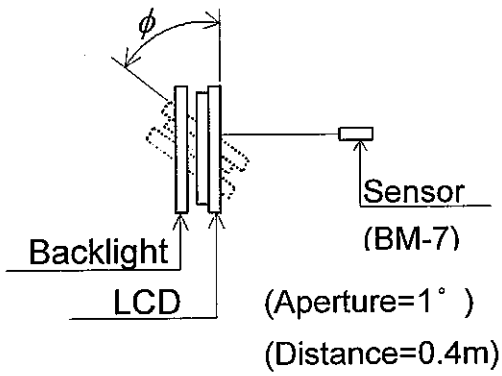
Note 2. Definition of viewing angle $\phi 1$ and $\phi 2$:



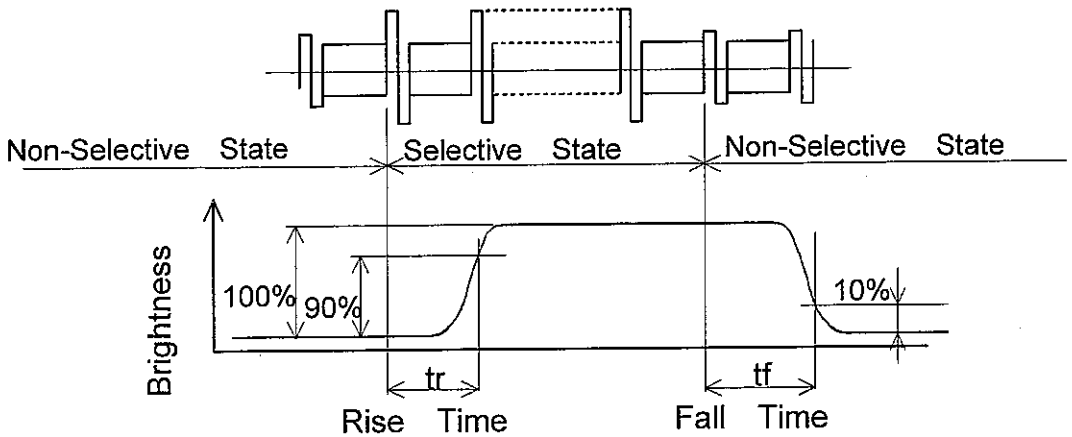
Note 3. Definition of contrast "K"

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





Note 4. Definition of optical response



6.2 OPTICAL CHARACTERISTICS OF BACKLIGHT

(LCM,BACKLIGHT ON , Ta=25℃)

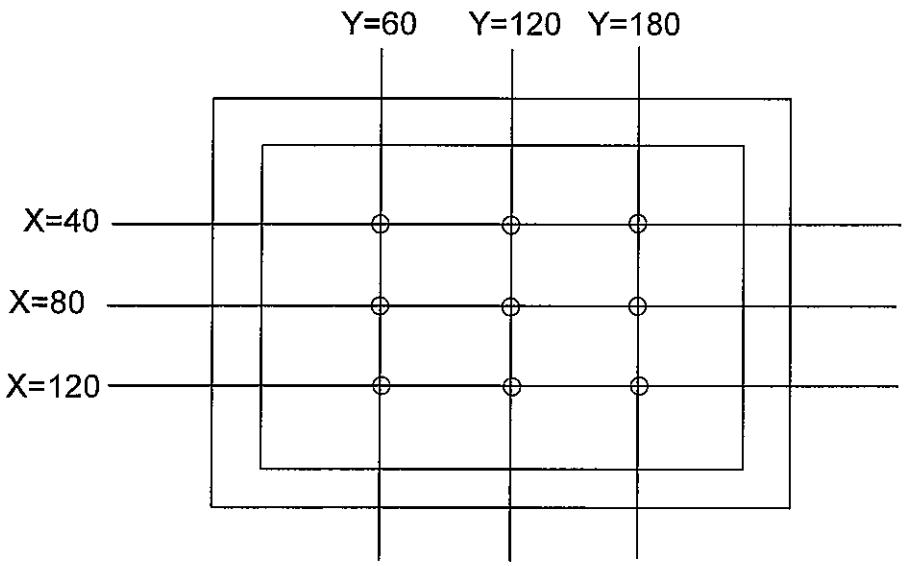
ITEM	MIN.	TYP.	MAX.	UNIT	NOTE
Brightness	80.0	120.0	-	cd/m^2	IL=4.5mA Note 1,2
Rise Time	-	5	-	Minute	IL=4.5mA Brightness 80%
Brightness Uniformity	-	-	±30	%	Under mentioned Note 1,3

CFL : Initial, Ta=25℃, VDD-VEE=20.5V
Display data should be all "ON".

Note 1. Measurement after 10 minutes of CFL operating.

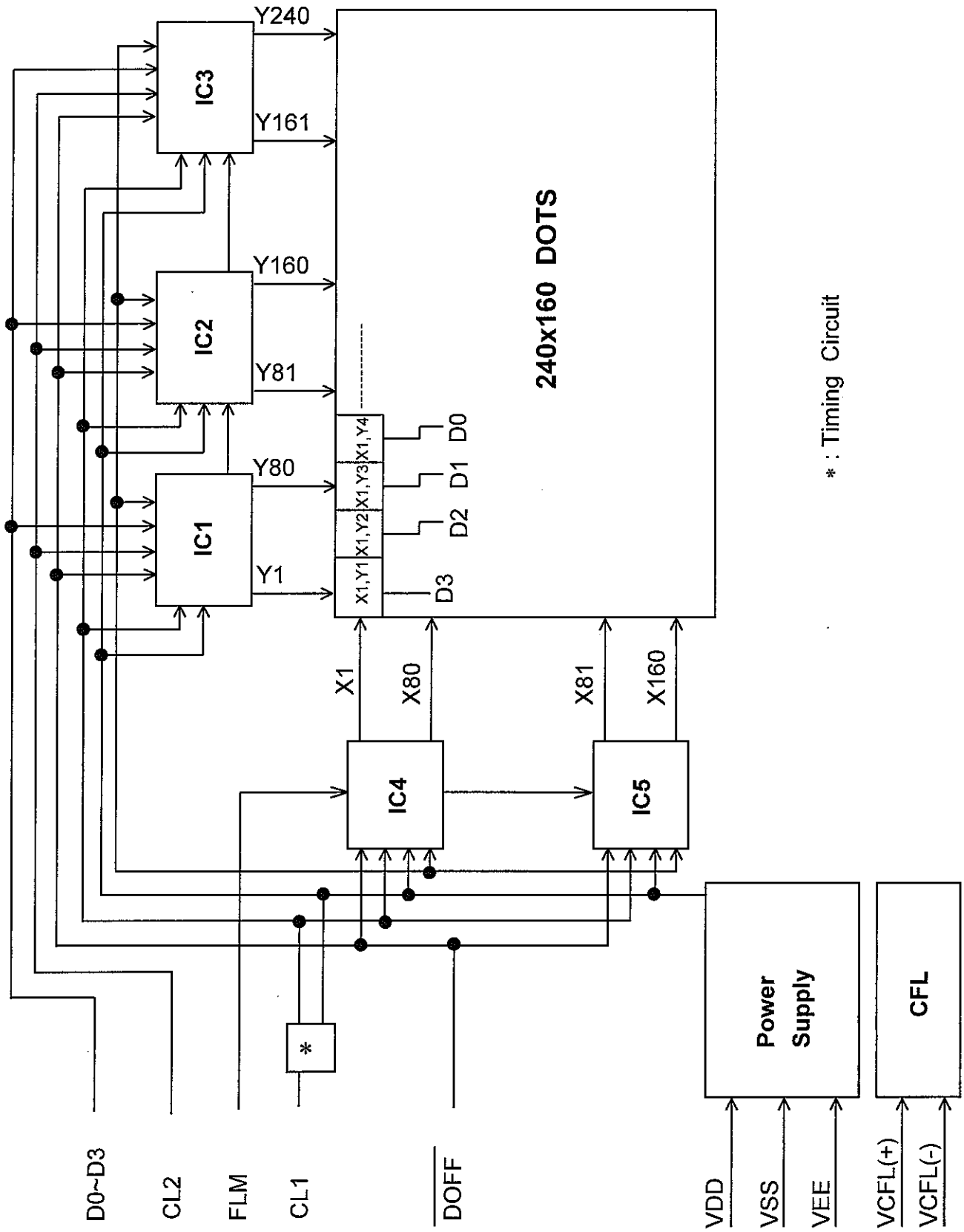
Note 2. Brightness control : 100%

Note 3.Measurement of the following 9 places on the display.
Definition of the brightness tolerance.



$$\left(\frac{\text{Max or min brightness - Average brightness}}{\text{Average brightness}}\right) \text{x100\%}$$

7. BLOCK DIAGRAM



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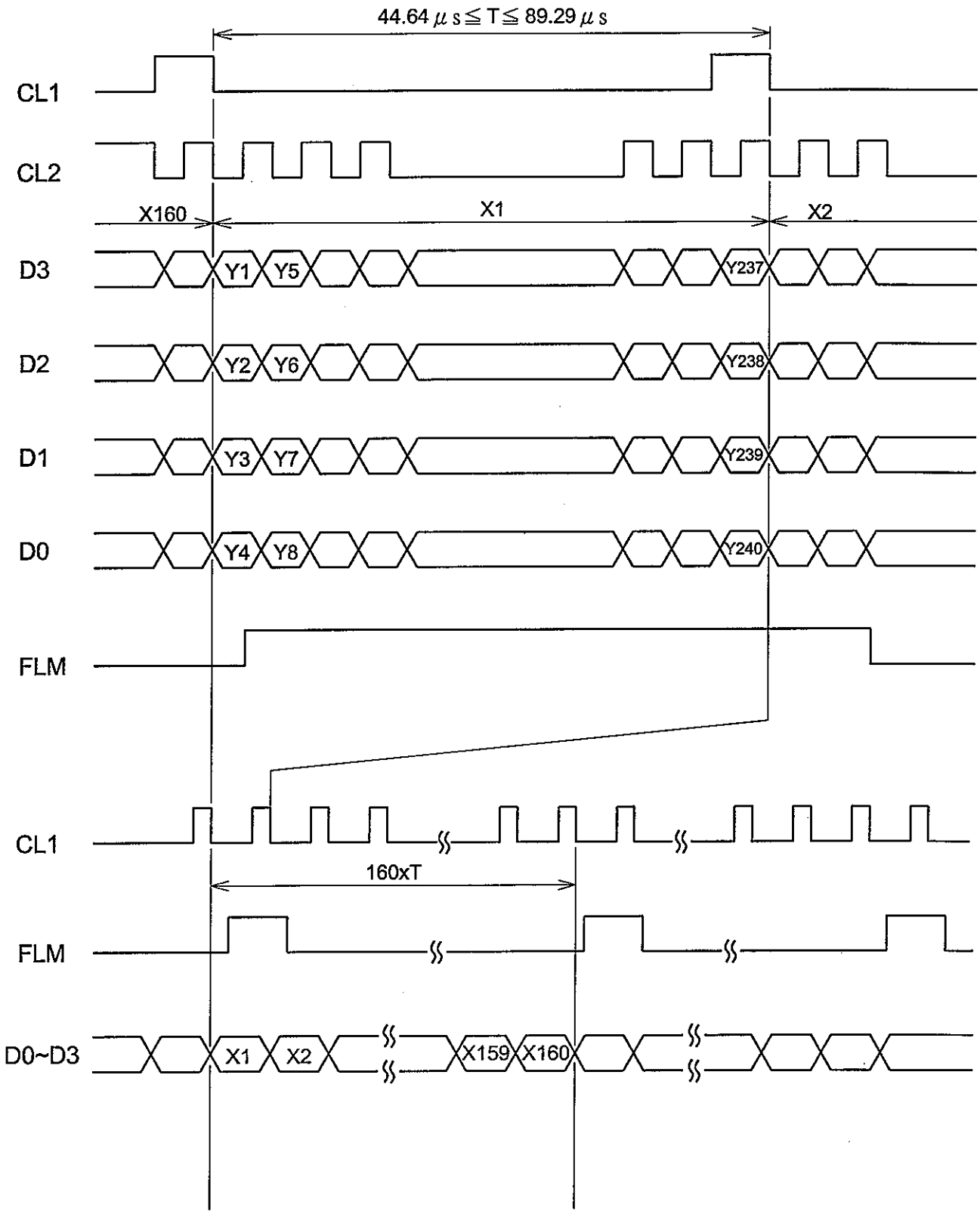
8. INTERFACE TIMING

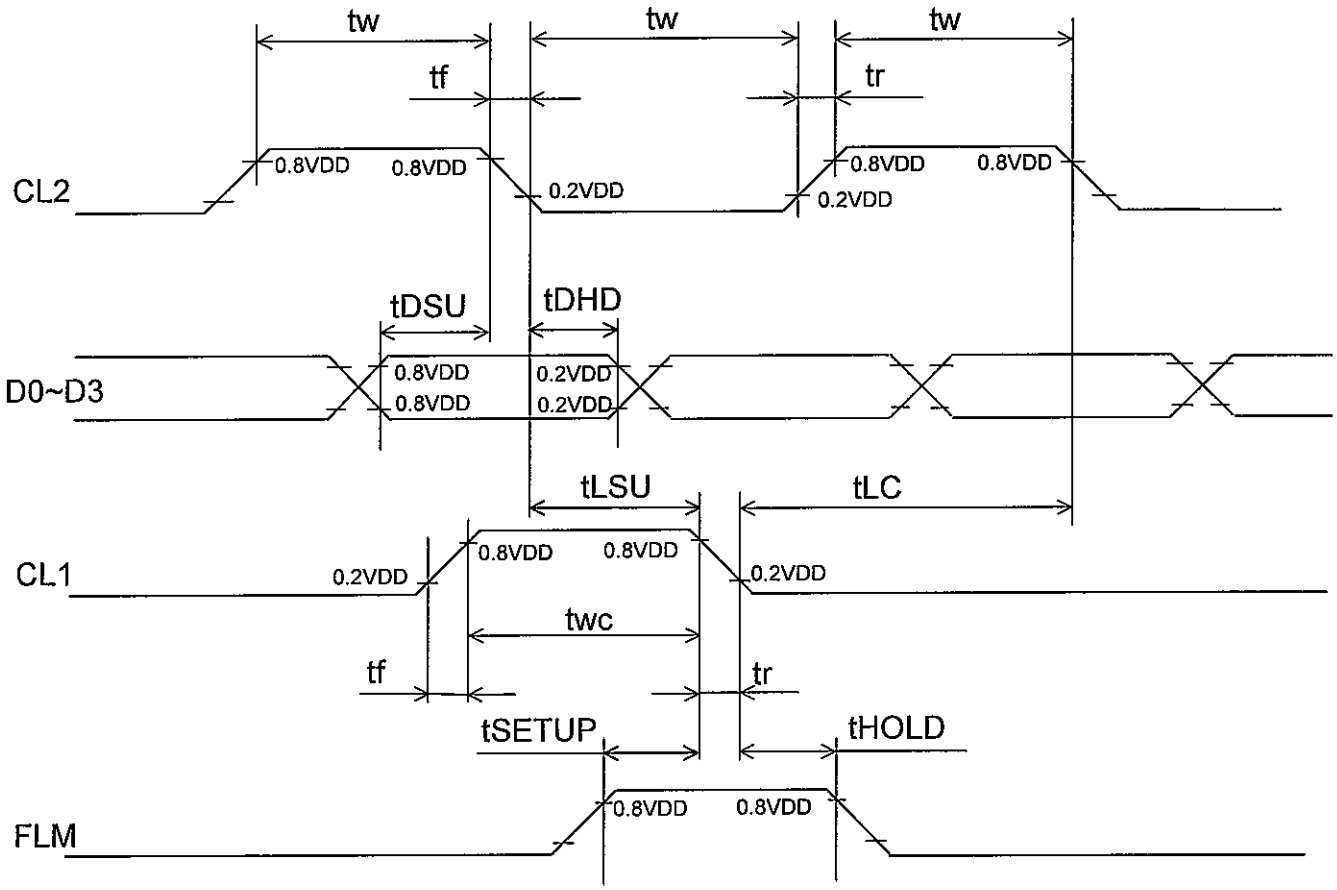
8.1 TIMING CHART



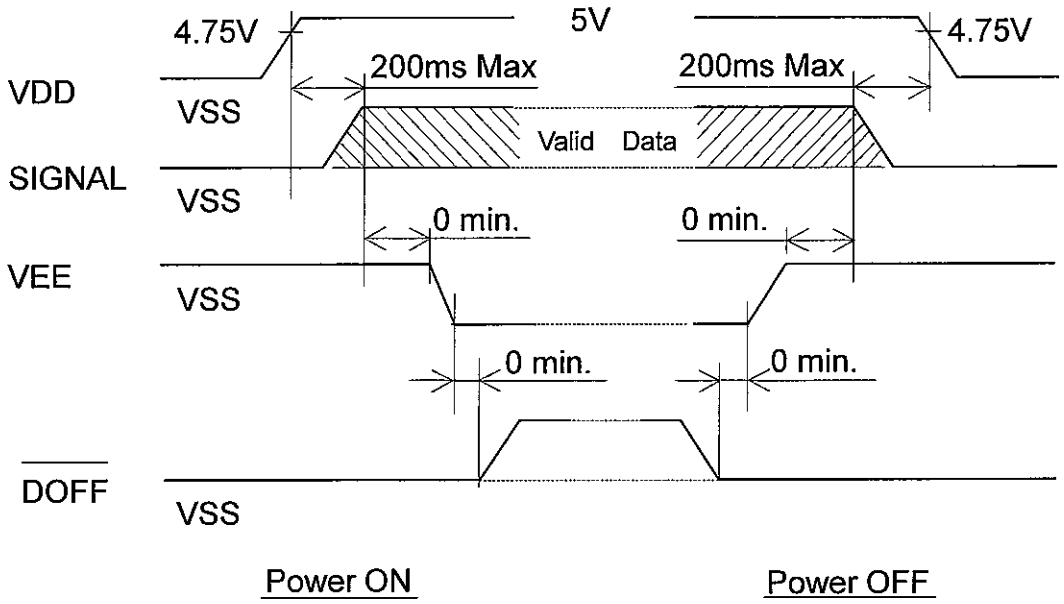
8.2 TIMING CHARACTERISTICS

0℃≦Ta≦40℃,VDD=5V±5%

ITEM	SYMBOL	MIN.	TYP.	MAX.	UMIT
CL2 Frequency	fCP	-	-	6.5	MHz
CL2 Pulse Width	tw	63	-	-	ns
CL2 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 → CL2 Time	tLC	80	-	-	ns
"FLM" Set Up Time	tSETUP	100	-	-	ns
"FLM" Hold Time	tHOLD	100	-	-	ns
"CL1" Pulse Width	tWC	125	-	-	ns

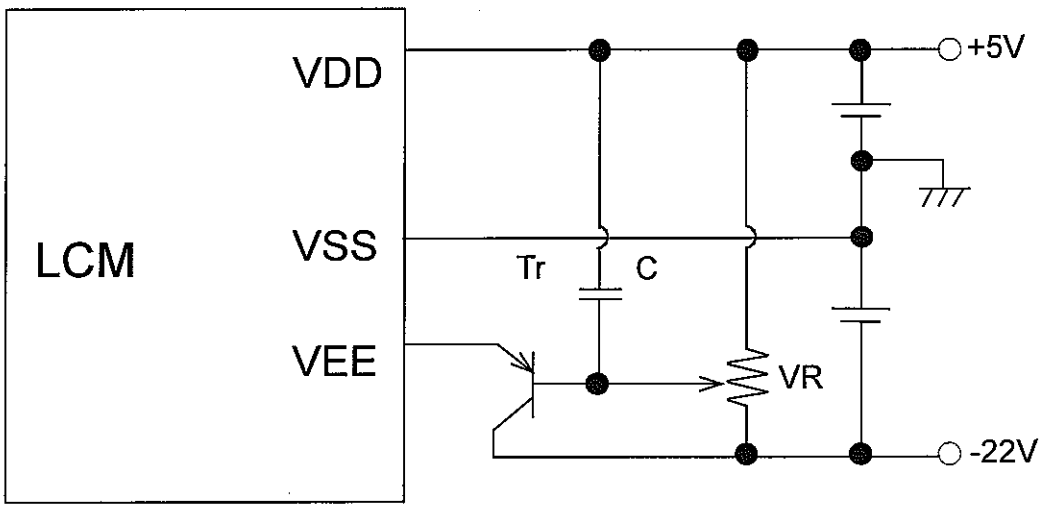


8.3 TIMING OF POWER SUPPLY AND INTERFACE SIGNAL



The missing pixels may occur when the lcm is driven except above power interface timing sequence.

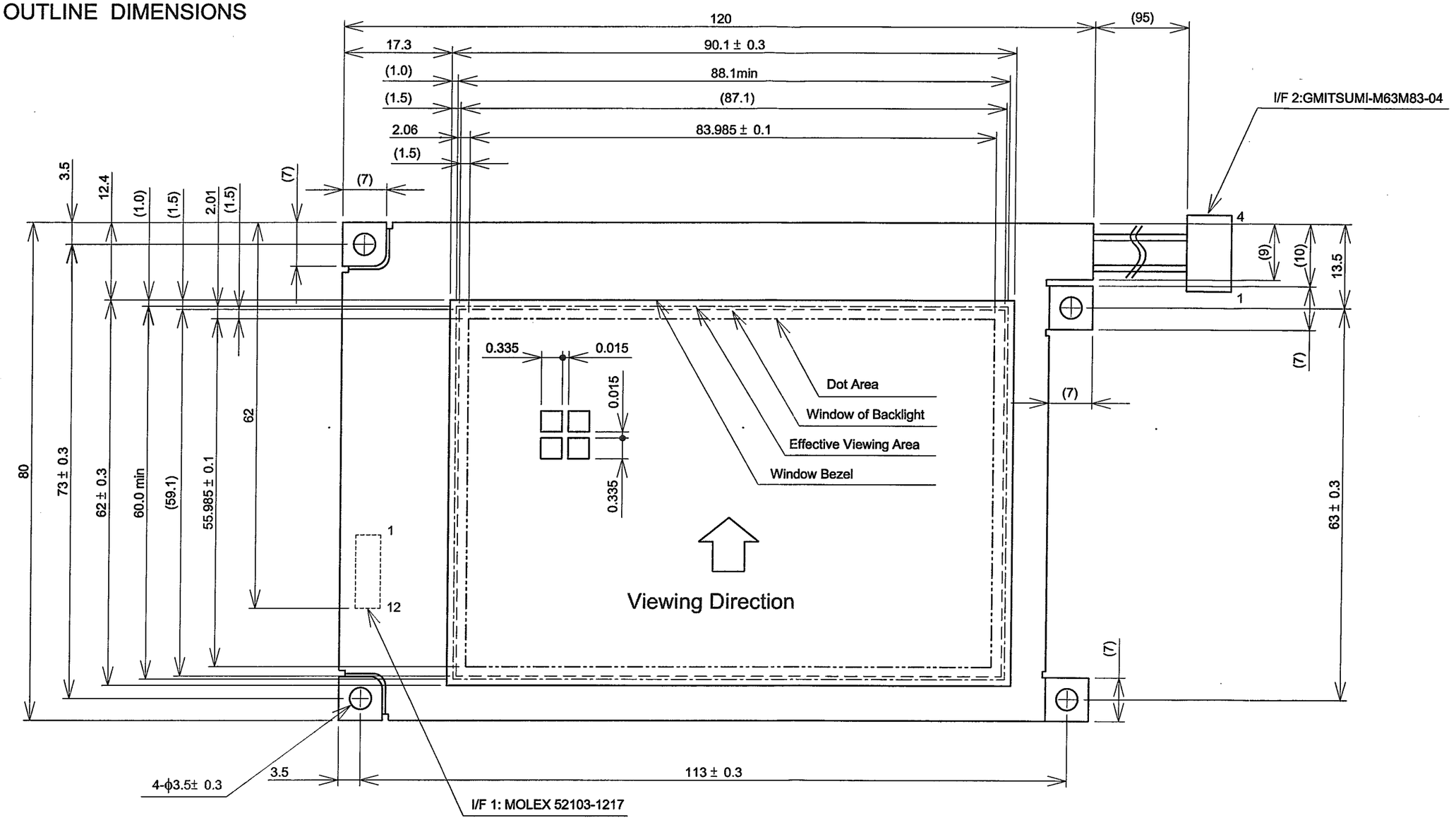
8.4 POWER SUPPLY FOR LCM



C : 3.3μF(Aluminum electrolytic capacitor)
VR:10~20kΩ
Tr:2SA673APKC(hFE=100,IC=500mA)or equivalent Tr.

9. OUTLINE DIMENSIONS

9.1 OUTLINE DIMENSIONS



Referance mark : ( )
Unit : mm
Scale : NTS
Tolerance Not Specified : ± 0.5mm

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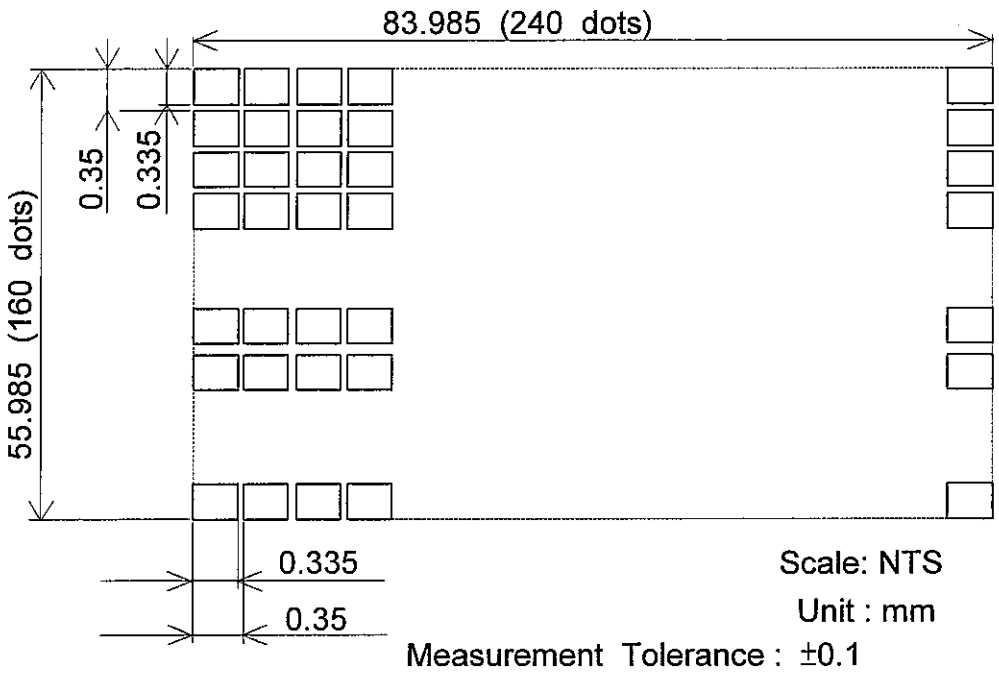
9.2 DISPLAY PATTERN



Scale: NTS

Unit : mm

Measurement Tolerance : ±0.1

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9.3 INTERFACE PIN CONNECTION

I/F1 : Molex/52103-1217

(Suitable FPC : 1.0 Pitch , Pin, 0.3t)

INTERFACE		PIN No.	SIGNAL	LEVEL	FUNCTION
LCM	I/F1	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
		6	VEE	-	Power Supply For LC
		7	D0	H/L	Display Data
		8	D1		
		9	D2		
		10	D3		
		11	$\overline{DOFF}$	H/L	H:ON / L:OFF
		12	GND	-	GND

INTERFACE		PIN No.	SIGNAL	LEVEL	FUNCTION
LCM	CFL I/F2	1	VCFL(+)	-	CFL Supply For CFL
		2	N.C	-	
		3	N.C	-	
		4	VCFL(-)	-	CFL GND

CFL I/F2 : MItsumi/M63M83-04

Suitable Connector : Mitsumi M61M73-04

Mitsumi M60-04-30-1149(Straight)

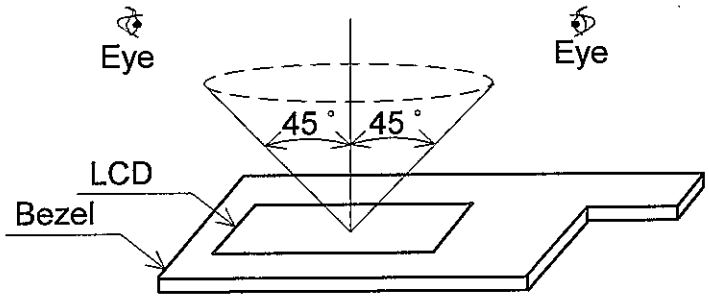
Mitsumi M60-04-30-1349(Angle)

10. APPEARANCE STANDARD

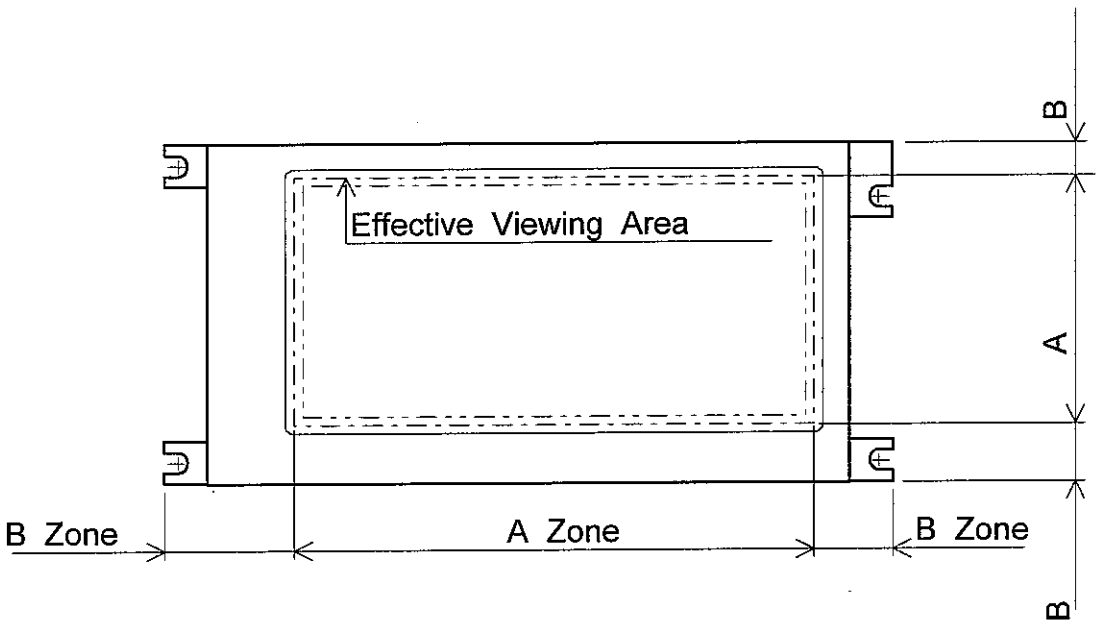
10.1 APPEARANCE INSPECTION CONDITION

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 ° from the vertical line to the center of LCD.



10.2 DEFINITION OF EACH ZONE



A Zone : effective viewing area (Refer to our drawing)

B Zone : except A zone

10.3 APPEARANCE SPECIFICATION

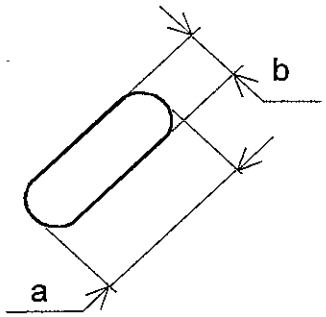
*) If the problem occurs about this item, the responsible person of both party (customer and HITACHI) will discuss more detail.

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		O	-
		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			O	-
		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 Dia-Meter 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			O	O
	Color Tone	To Be Judge By HITACHI Limit Sample			O	-
	Color Uniformity	Same As Above			O	-
	Pinhole	(a + b)/2≦0.15max. No .Acceptable Ignore			O	-
		0.15<(a + b)/2≦0.3max. No .Acceptable≦10				
		C≦0.03 Ignore				

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

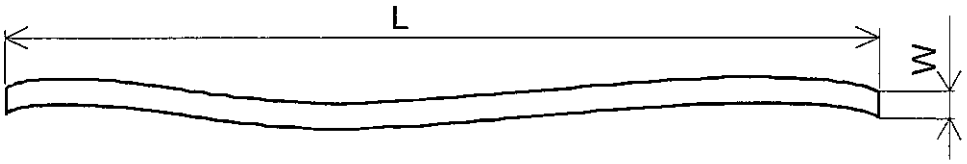
NOTE

(1) Definition of average diameter D

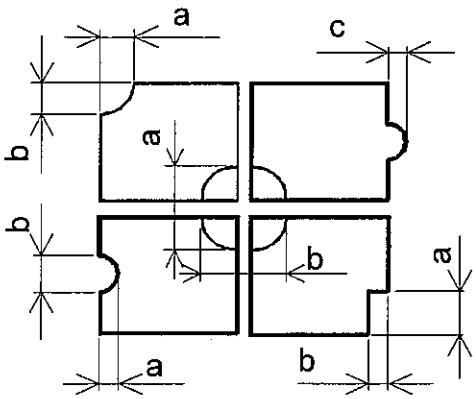


$$D = \frac{a+b}{2}$$

(2) Definition of length L and width W



(3) Definition of pinhole

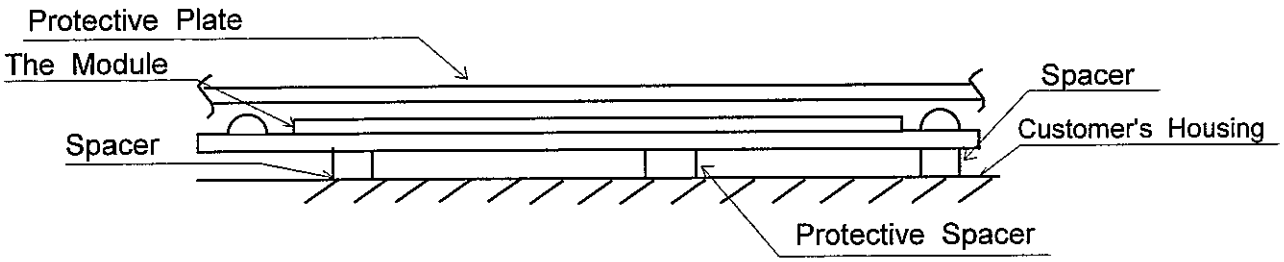


c:Salienec

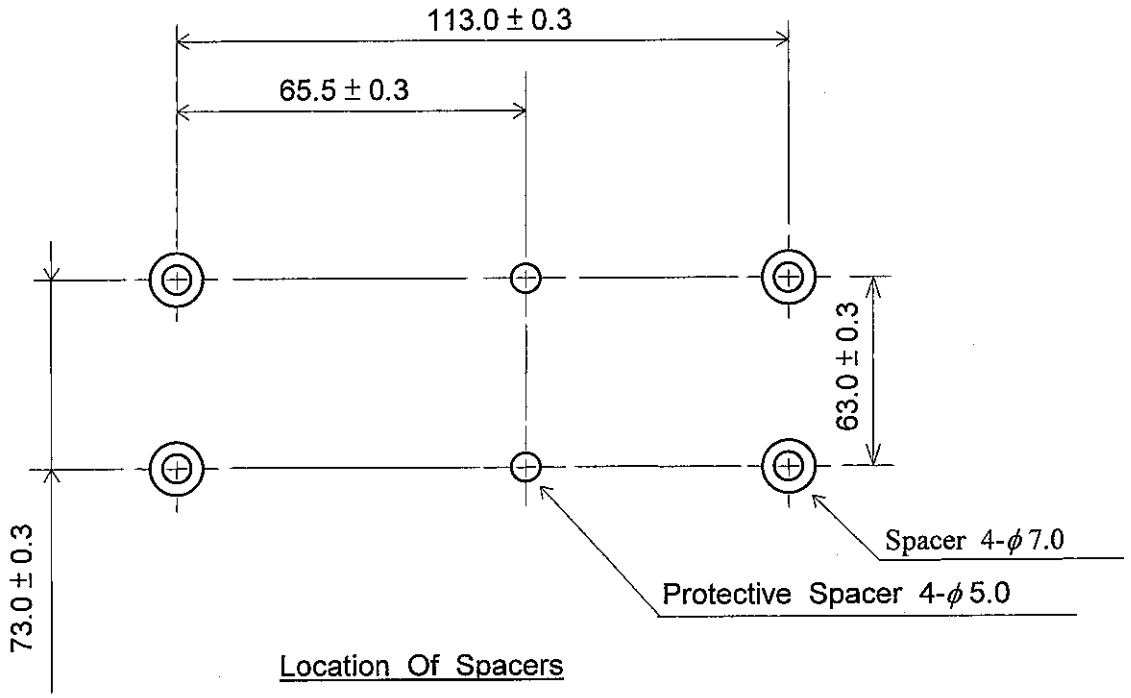
11. PRECAUTION IN DESIGN

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(VEE) and viewing angle range.

Setting VEE 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 (5 ±0.25V) if above sequence is not kept, C-MOS LSIs of LCD modules may be damaged due to latch up problem.

11.5 PACKAGING

(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℃ 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 storing.

(2) Since upper polarizers and lower aluminum plates tend to be easily damaged, they should be handled with full care so as not to get them touched, pushed or rubbed by a piece of glass. Tweezers and anything else which are harder than a pencil lead 3H.

(3) As the adhesives used for adhering upper/lower polarizes and aluminum plates 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 other than the above.

(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 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) Fogy dew deposited on the surface and contact terminals due to coldness will be cause 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 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 down, etc.

11.6 CAUTION FOR OPERATION

(1) It is an indispensable condition to drive LCD's 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 LCD's 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 LCD's show dark blue color in hem.
However those phenomena do not mean malfunction or out of order with LCD's 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 displayed 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℃ 50%RH less is required.

11.7 STORAGE

In case of storing for a long period time (For instance, 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 for 0℃ to 35℃.

(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 for us.)

11.8 SAFETY

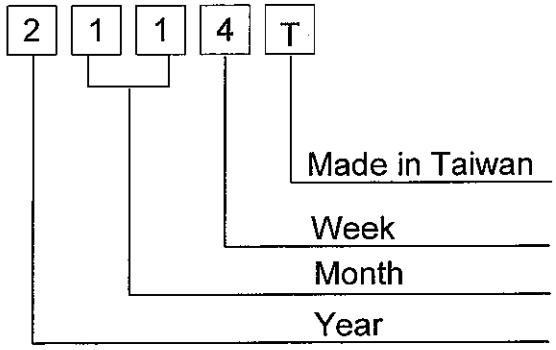
(1) It is recommendable to crash damaged or unnecessary LCD's into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol, which should up later.

(2) When any liquid leaked out of a damaged glass cell in contact with your hands, please wash it off well with soap and water.

12. DESIGNATION OF LOT MARK

Lot mark

Lot mark is consisted of 4 digit number.



YEAR	FIGURE IN LOT MARK
2002	2
2003	3
2004	4
2005	5
2006	6

Note 1. Some products have alphabet at the end or the first.

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
01~07	1
08~14	2
15~21	3
22~28	4
29~31	5

Location of lot mark : On the back side of LCM

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13. PRECAUTIPON FOR USE

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

(2) On the following occasion, 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 requests , please contact HITACHI.