TENTATIVE

HITACHI

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12 / 5V

For Messrs : _____ Date : Apr.12.'96

CUSTOMER'S ACCEPTANCE SPECIFICATIONS

LMG9980ZWCC

CONTENTS

Accepted by : _____ Proposed by : S. Endoh

RECORD OF REVISION

Date	Sheet No.	Summary

3. MECHANICAL DATA

(1) Part name	LMG9980ZWCC
(2) Module size	275.0(W) mm × 202.5(H) mm × 8.0 typ (D)mm
(3) Display size	246.0(W) mm × 184.5(H) mm Diagonal size 31cm (12.1")
(4) Dot pitch	0.1025(W) mm × 0.3075(H) mm
(5) Number of dots	800 × 3 (R,G,B)(W) × 600 (H) Dots
(6) Duty	1/300
(7) LCD	Film type (negative type) The upper polarizer is an anti-glare type. (Hardness:3H)
(8) Viewing direction	12 O'clock
(9) Back light	Cold Cathode Fluorescent Lamp (CFL) × 1
(10) Weight	(490) typ
(11) Power supply Voltage	3.3V or 5V only

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	6.0	V	
Contrast Adjustment Voltage	VCON-VSS	0	6.0	V	
Input Voltage	Vi	-0.3	VDD+0.3	V	Note 1
Input Current	Ii	0	1	A	
Static Electricity	-	-	-	-	Note 2

Note 1 $\overline{\text{DISP OFF}}$, FLM, CL1, CL2, UD0~UD7, LD0~LD7

Note 2 Make certains you are grounded when handling LCM

4.2 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	OPERATING		STORAGE		COMMENT
	MIN.	MAX.	MIN.	MAX.	
Ambient Temperature	5℃	40℃	-20℃	60℃	Note 2, 3
Humidity	Note 1		Note 1		Without condensation
Vibration	-	2.45 m/s^2 (0.25G)	-	11.76m/s^2 (1.2G) Note 5	Note 4
Shock	-	29.4 m/s^2 (3G)	-	490 m/s^2 (50G) Note 5	XYZ 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 60℃------<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 When LCM is operated at 5℃, the life time of CFL will be reduced. Need to make sure of value of IL and characteristics of inverter. Also the response time at 5℃ will be slower.

5. ELECTRICAL CHARACTERISTICS

5.1 ELECTRICAL CHARACTERISTICS OF LCD

VSS = 0V

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Power Supply Voltage	VDD	VDD-VSS=3.3V	3.15	3.30	5.25	V
		VDD-VSS=5.0V	4.75	5.00	3.45	
Contrast Adjustment Voltage (Note 1)	VCON	-	0.8	-	2.8	V
Input Voltage for Logic Circuits (Note 2)	Vi	"H" level	0.8VDD	-	VDD	V
		"L" level	0	-	0.2VDD	
Power Supply Current (Note 3) (Note 7)	IDD	VDD-VSS=5.0V	-	(150)	T.B.D	mA
		VDD-VSS=3.3V	-	(330)	T.B.D	
Input Leak Current	Icon(Note 4)	Vcon=0.8～2.8V	-	-	(20)	μA
	Iin (Note 2)	Vin=VDDorVSS	-	-	T.B.D	
Contrast Adjustment Voltage (Note 5)	VCON	Ta= 5℃, ϕ=0°	(0.8)	-	-	V
		Ta=25℃, ϕ=0°	-	(1.8)	-	
		Ta=40℃, ϕ=0°	-	-	(2.8)	
Frame Frequency (Note 6)	fFLM	-	(60)	(120)	(130)	Hz

(Note 1) In proportion as the VCON voltage decrease the brightness will increase.

(Note 2) $\overline{\text{DISP OFF}}$, FLM, CL1, CL2, UD0～UD7, LD0～LD7

(Note 3) fFLM=120Hz, Ta=25℃, Display pattern:Checker pattern.

(Note 4) VCON

(Note 5) Recommended Contrast Adjustment Voltage fluctautes about ±0.3V by each module.

(Note 6) Need to make sure of flickering and rippling of display when setting the Frame Frequency in your set.

(Note 7) Rush Current of Power ON : (2Apeak×25ms)

5.2 ELECTRICAL CHARACTERISTICS OF BACKLIGHT

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Lamp Voltage	VL	-	(700)	-	Vrms	Ta=25℃
Frequency	fL	T.B.D	(60)	T.B.D	kHz	
Lamp Current (1Lamp)	IL	T.B.D	(4.5)	(5.0)	mA	Ta=25℃
Starting discharge Voltage	VS (Note 2)	(1600)	-	-	Vrms	Ta= 5℃

(Note 1) Please design your lamp driving circuit (inverter) according to the above specifications, and inform Hitachi of it.

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

(Note 3) Average life time of CFL will be decreased when LCM is opreating at lower temperature.

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

(Note 5) When ICFL is used over 4.5mA, it may cause uneven contrast near CFL location, due to heat dispersion from CFL.

6. OPTICAL CHARACTERISTICS

6.1 OPTICAL CHARACTERISTICS OF LCD

Ta=25℃ (Backlight On)

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Viewing area		$\phi 2-\phi 1$	$\theta=0°$, $K\geqq 2.0$	-	(40)	-	deg	1), 2)
Contrast ratio		K	$\phi=0°$, $\theta=0°$	15	(30)	-	-	3), 5), 6)
Response time (rise)		tr	$\phi=0°$, $\theta=0°$	-	(170)	-	ms	4)
Response time (fall)		tf	$\phi=0°$, $\theta=0°$	-	(130)	-	ms	4)
Color tone (Primary color)	Red	x	$\phi=0°$ $\theta=0°$	-	(0.57)	-	-	7)
		y		-	(0.33)	-	-	
	Green	x		-	(0.29)	-	-	
		y		-	(0.55)	-	-	
	Blue	x		-	(0.17)	-	-	
		y		-	(0.14)	-	-	
	White	x		-	(0.29)	-	-	
		y		-	(0.30)	-	-	

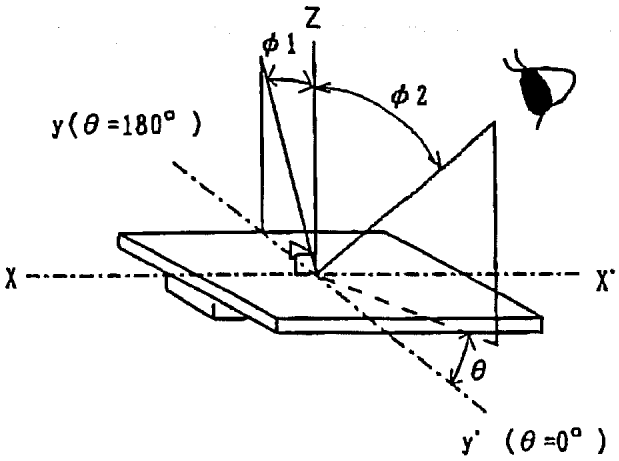
(Measurement condition : Hitachi standard)

Note 1)～7) : See next page.

Note 1. Definition of θ and ϕ

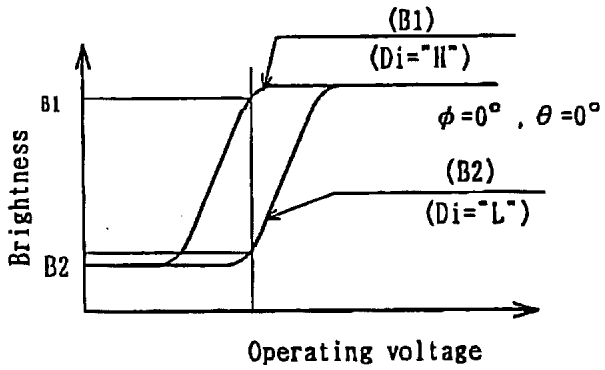
(Normal)

Viewing direction

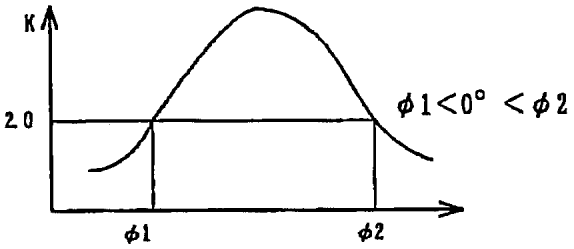


Note 3. Definition of contrast "K"

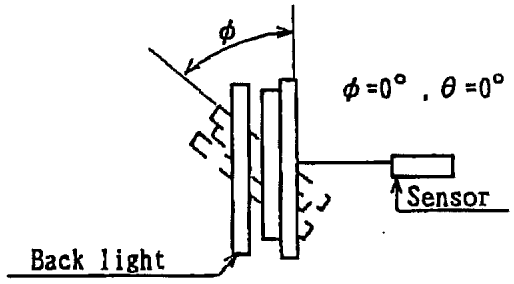
$$K = \frac{\text{Brightness on selected area (B1)}}{\text{Brightess on non-selected area (B2)}}$$



Note2. Definition of viewing angle $\phi 1$ and $\phi 2$

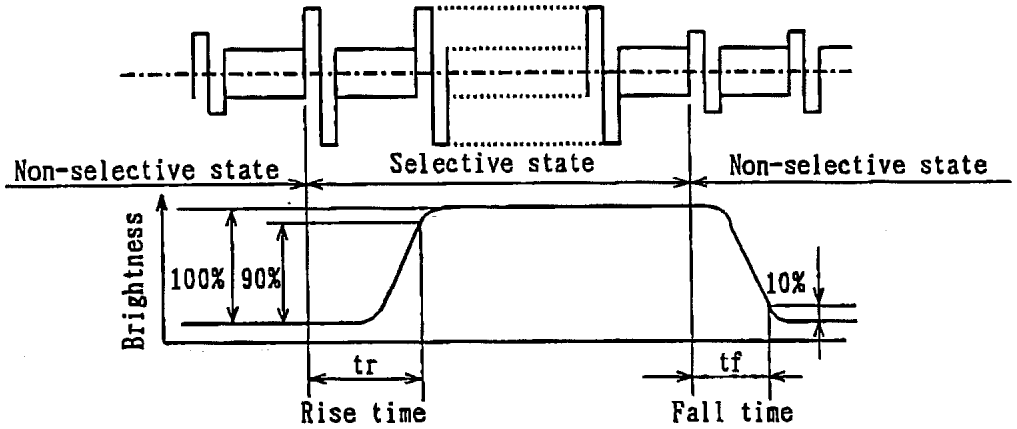


Contrast ratio K vs viewing angle ϕ



Senser : BM-7 or correspondence equipment

Note 4. Definition of optical response time



Note 5. Hitachi will not do 100% inspection for minimum value. Minimum value is for reference.

Note 6. Hitachi will do sampling inspection for minimum value.

Note 7. The LCD driving voltage should be adjusted at the voltage where the peak contrast is obtained.

6.2 OPTICAL CHARACTERISTICS OF BACKLIGHT

ITEM	MIN.	TYP.	MAX.	UNIT	NOTE
Brightness	T.B.D	(70)	-	cd/m²	IL=4.5mA Note 1), 2)
Rise time	-	5	-	Minute	IL=4.5mA Brightness 80%
Brightness Uniformity	-	-	±30	%	Undermentioned Note 1), 4)

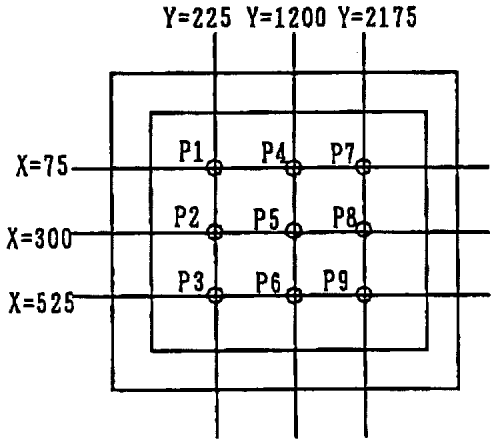
(Measurement condition : Hitachi standard)

CFL : INITIAL, Ta=25℃
Display data should be all "ON"
The LCD driving voltage should be adjusted at the voltage where the peak contrast is obtained, when set pattern is all "Q".

(Note 1) Measurement after 10 minutes from CFL operating.
Average value of 9 points (Note 3).

(Note 2) Brightness control : 100%

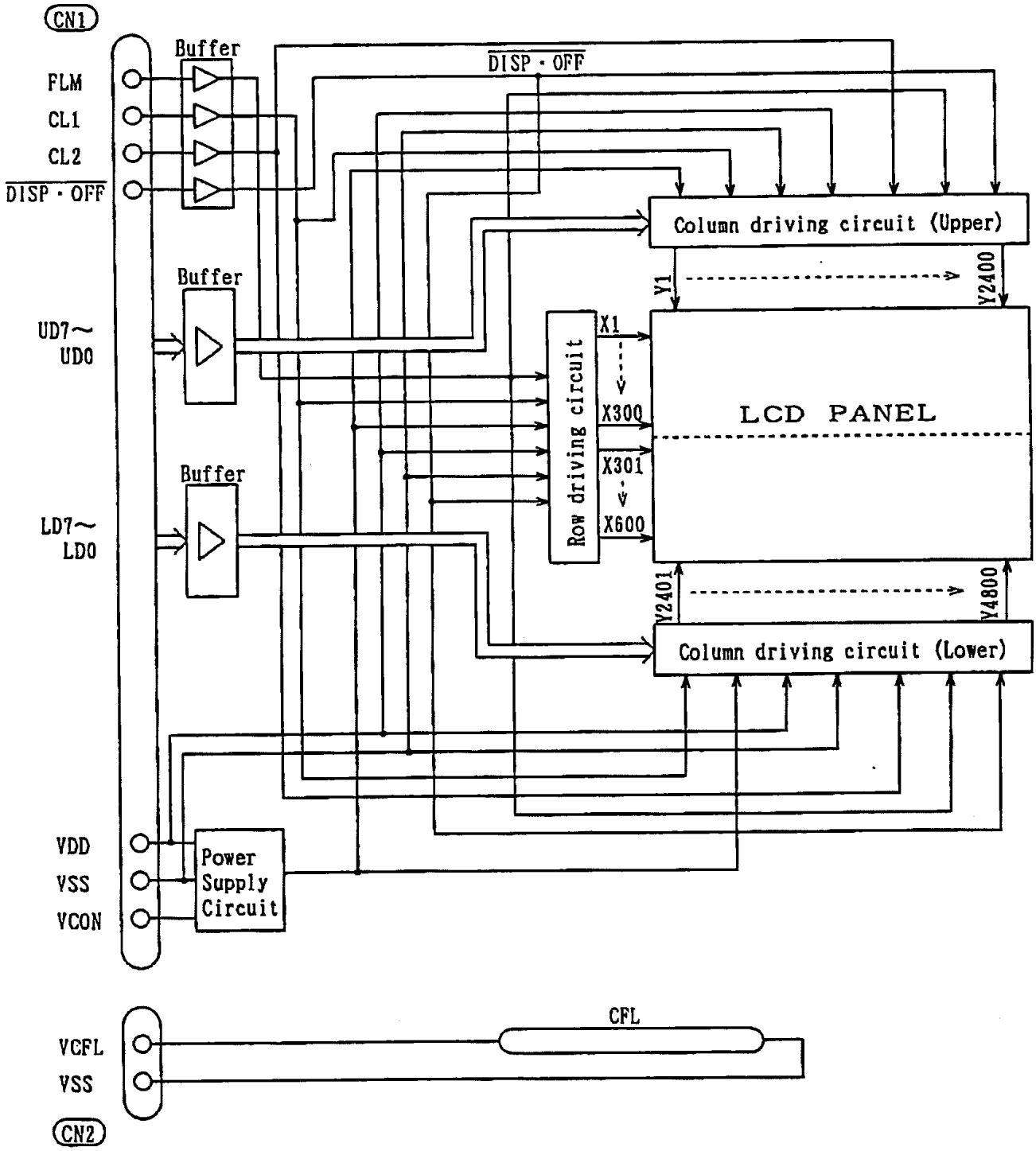
(Note 3) Measurement of the following 9 places on the display.



(Note 4) Definition of the brightness tolerance.

$$\left(\frac{\text{Max brightness or Min brightness - Average brightness}}{\text{Average brighteness}}\right)\times 100$$

7. BLOCK DIAGRAM



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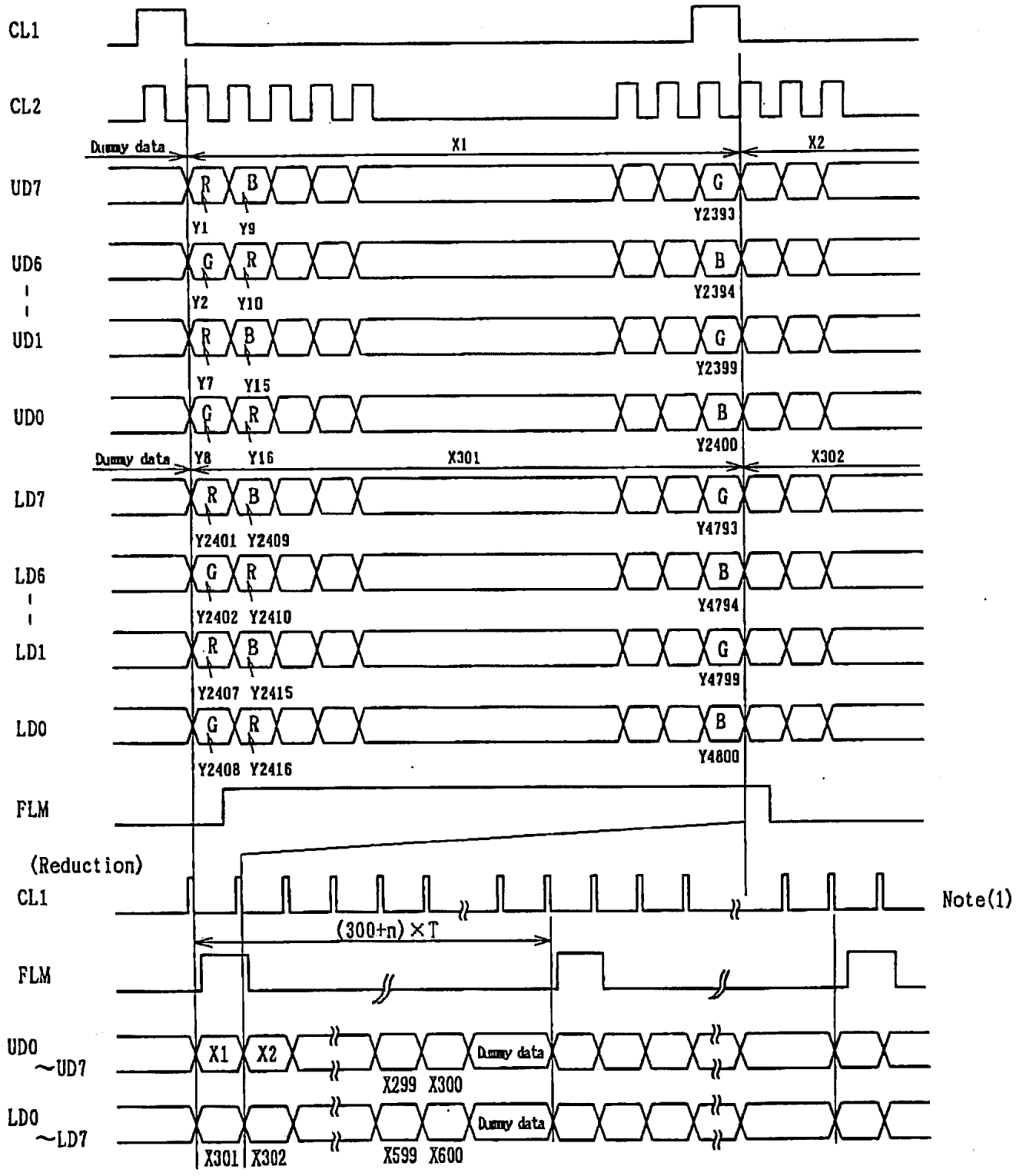
8. INTERFACE TIMING CHART

8.1 TIMING CHART

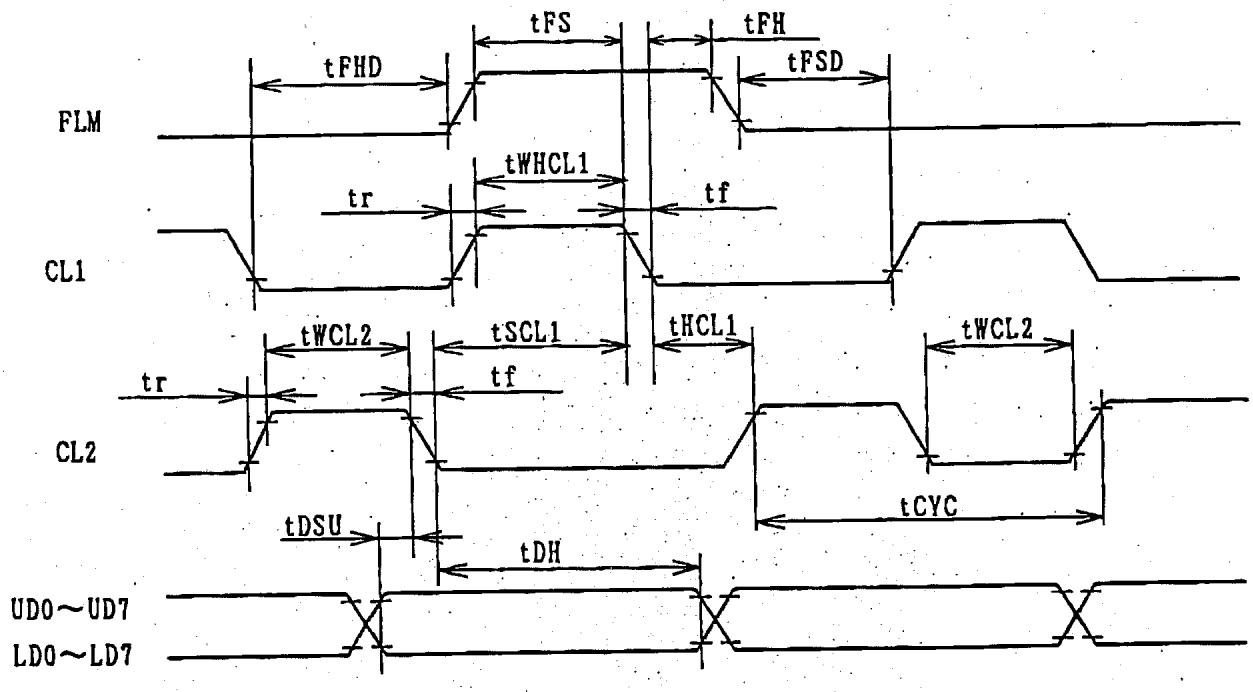


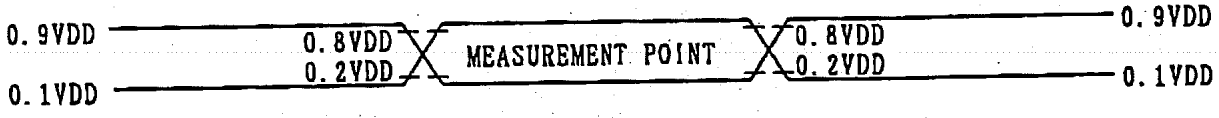
Note(1) : The interval of CL1 pulse must be same including the vertical blanking period.

8.2 INTERFACE TIMING SPECIFICATION

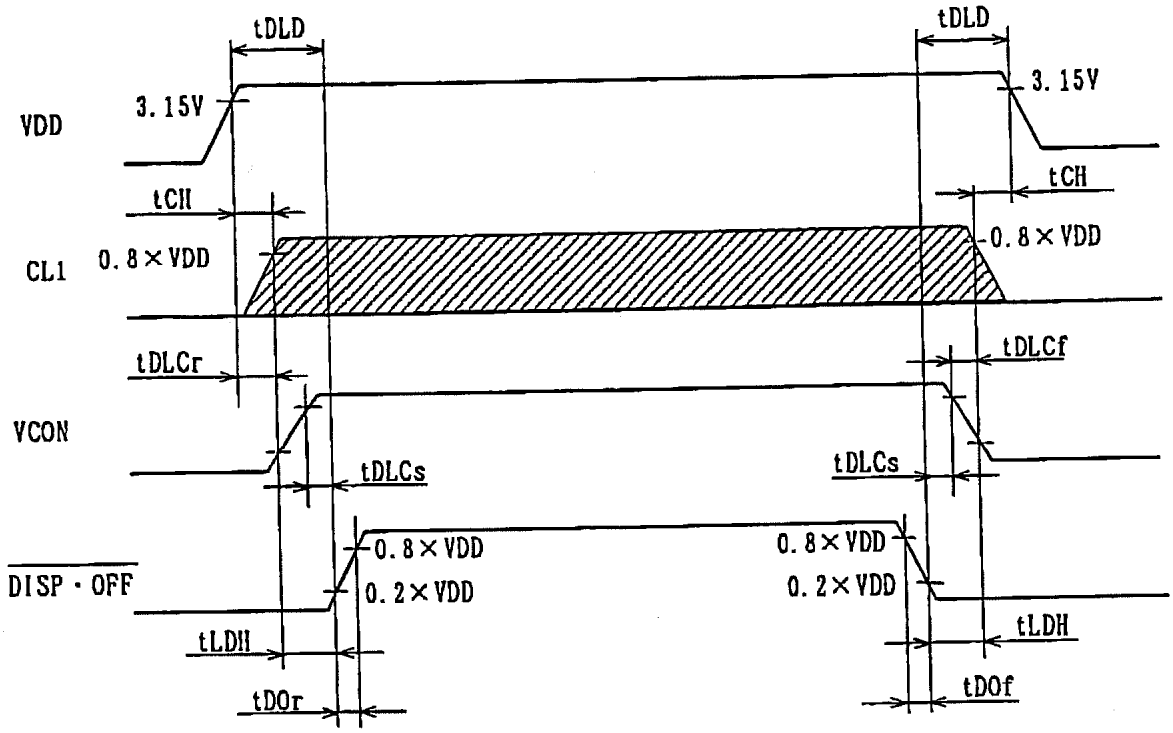
(VDD=3.3±0.15V, VDD=5±0.25V, VSS=0V, Vcon=0.8～2.8V, Ta=+5℃～+40℃)

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT
CL1 pulse width "H"	tWHCL1	150	-	-	ns
Clock cycle time	tCYC	50	-	-	ns
CL2 pulse width	tWCL2	20	-	-	ns
Clock set up time	tSCL1	110	-	-	ns
Clock hold time	tHCL1	110	-	-	ns
Clock rise fall time	tr, tf	-	-	50	ns
Data set up time	tDSU	15	-	-	ns
Data hold time	tDH	15	-	-	ns
"FLM" set up time	tFS	120	-	-	ns
"FLM" hold time	tFH	300	-	-	ns
set up time	tFSD	120	-	-	ns
hold time	tFHD	120	-	-	ns





8.3 POWER ON/OFF SEQUENCE



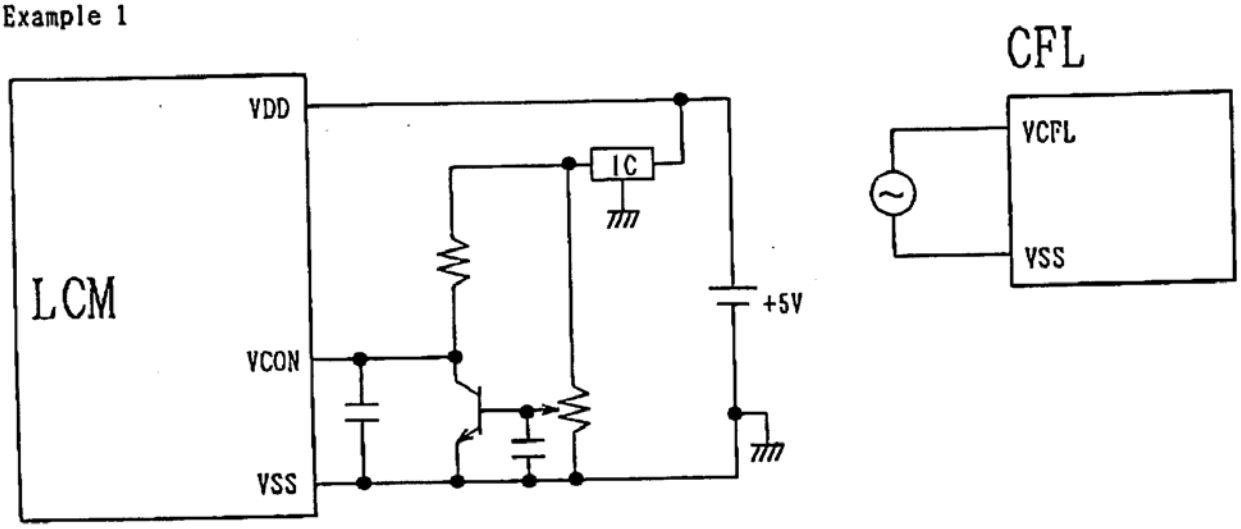
SYMBOL	MIN	MAX	UNIT	COMMENT
tDLD	0		ms	(Note 1)
tCH	0	200	ms	
tLDH	0		ms	
tDOr		100	ns	(Note 2)
tDOf		100	ns	
tDLCr	0		ms	
tDLCf	0		ms	
tDLCs	20		ms	

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

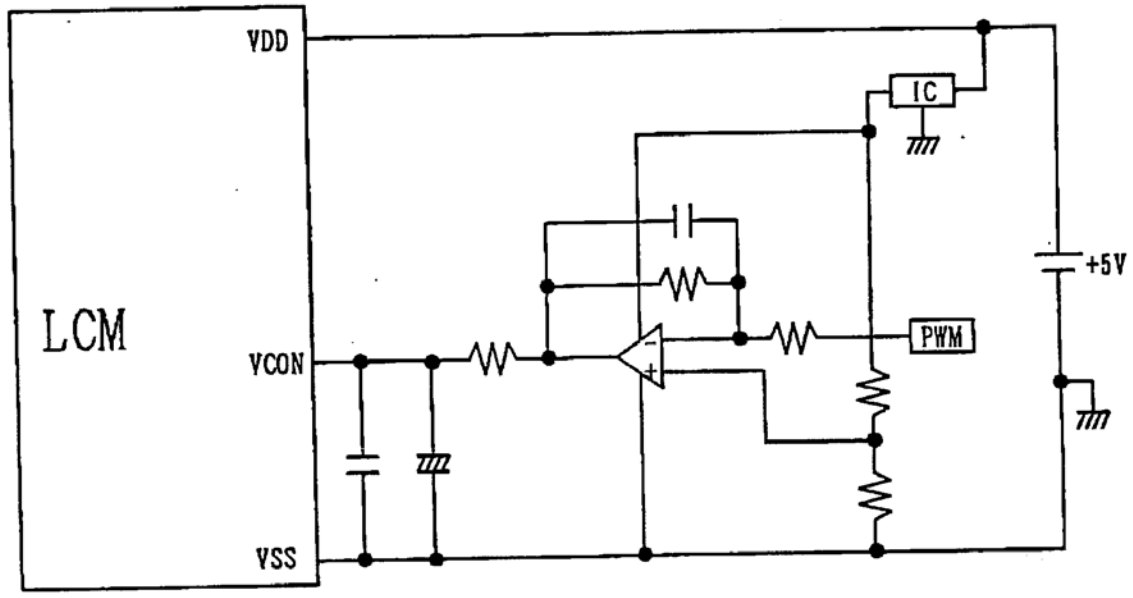
(Note 2) Hitachi recommends you to use $\overline{\text{DISP・OFF}}$ function.
Display quality may deteriorate if you don't use $\overline{\text{DISP・OFF}}$ function.

8.4 POWER SUPPLY FOR LCM

Example 1



Example 2



IC : 3-terminal Voltage Regulator.

8.5 INPUT DATA ALLOCATION TABLE

Data Signal	UD7	UD6	UD5	UD4	UD3	UD2	UD1	UD0	UD7	UD6	UD5	UD4		UD4	UD3	UD2	UD1	UD0
Y / X	1	2	3	4	5	6	7	8	9	10	11	12		2396	2397	2398	2399	2400
UPPER PANEL 1	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
UPPER PANEL 2	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
UPPER PANEL 3	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
UPPER PANEL 4	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
UPPER PANEL 5	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
UPPER PANEL ⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮		⋮	⋮	⋮	⋮	⋮
UPPER PANEL 298	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
UPPER PANEL 299	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
UPPER PANEL 300	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
LOWER PANEL 301	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
LOWER PANEL 302	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
LOWER PANEL 303	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
LOWER PANEL 304	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
LOWER PANEL 305	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
LOWER PANEL ⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮		⋮	⋮	⋮	⋮	⋮
LOWER PANEL 598	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
LOWER PANEL 599	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
LOWER PANEL 600	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
X / Y	2401	2402	2403	2404	2405	2406	2407	2408	2409	2410	2411	2412		4796	4797	4798	4799	4800
Data Signal	LD7	LD6	LD5	LD4	LD3	LD2	LD1	LD0	LD7	LD6	LD5	LD4		LD4	LD3	LD2	LD1	LD0

R : RED
G : GREEN
B : BLUE

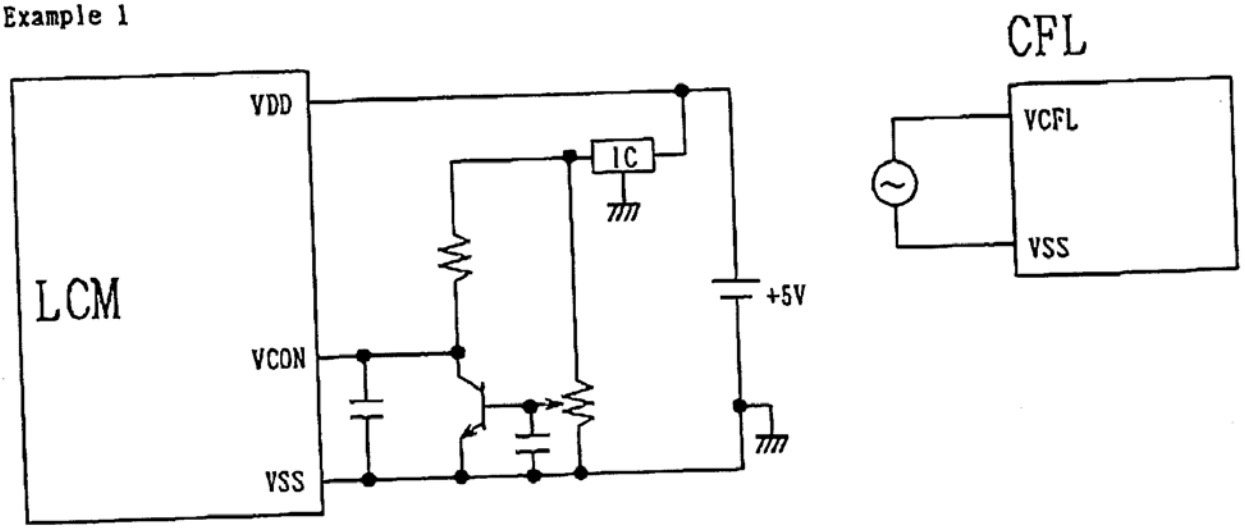
8.5 INPUT DATA ALLOCATION TABLE

Data Signal		UD7	UD6	UD5	UD4	UD3	UD2	UD1	UD0	UD7	UD6	UD5	UD4		UD4	UD3	UD2	UD1	UD0
Y / X		1	2	3	4	5	6	7	8	9	10	11	12		2396	2397	2398	2399	2400
UPPER PANEL	1	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
	2	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
	3	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
	4	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
	5	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮		⋮	⋮	⋮	⋮	⋮
	298	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
	299	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
	300	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
LOWER PANEL	301	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
	302	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
	303	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
	304	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
	305	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮		⋮	⋮	⋮	⋮	⋮
	598	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
	599	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
	600	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
X / Y		2401	2402	2403	2404	2405	2406	2407	2408	2409	2410	2411	2412		4796	4797	4798	4799	4800
Data Signal		LD7	LD6	LD5	LD4	LD3	LD2	LD1	LD0	LD7	LD6	LD5	LD4		LD4	LD3	LD2	LD1	LD0

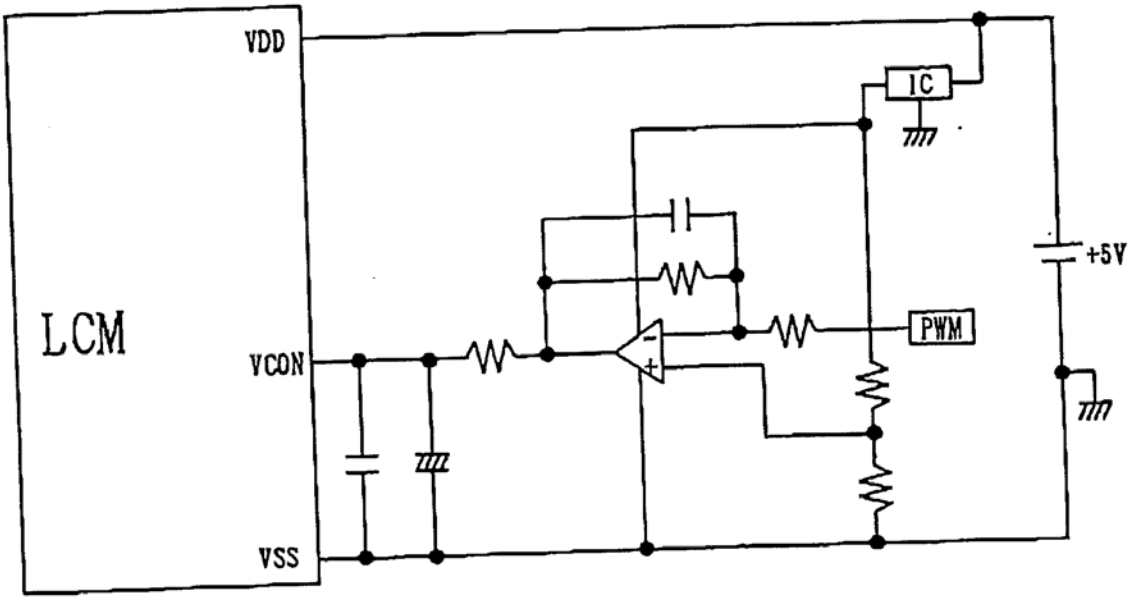
R : RED
G : GREEN
B : BLUE

8.4 POWER SUPPLY FOR LCM

Example 1



Example 2



IC : 3-terminal Voltage Regulator.

8.6 INTERNAL PIN CONNECTION

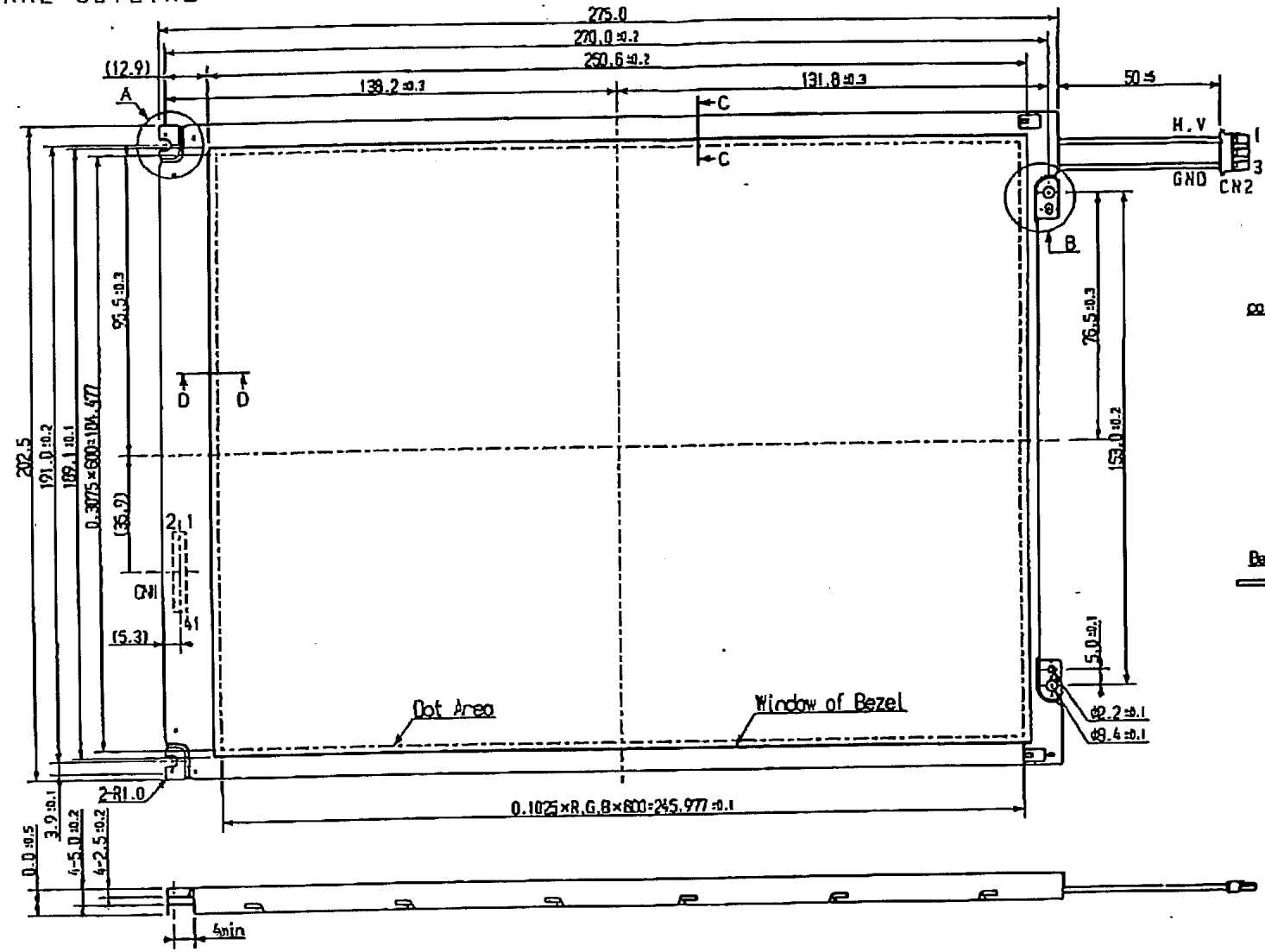
CN1 HIROSE : DF9B-41P-1V

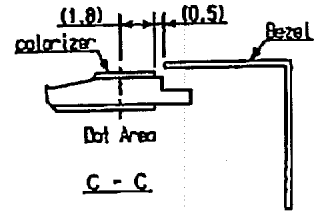
PIN No.	SIGNAL	LEVEL	FUNCTION
1	GND	—	GND
2	CL2	H → L	Data Shift
3	GND	—	GND
4	GND	—	GND
5	CL1	H → L	Data Latch
6	FLM	H	First Line Marker
7	GND	—	GND
8	GND	—	GND
9	VDD	—	Power Supply for LCD
10	$\overline{\text{DISP·OFF}}$	H / L	H : ON / L : OFF
11	GND	—	GND
12	GND	—	GND
13	GND	—	GND
14	LD7	H / L	Display Data (Lower Column)
15	LD6		
16	LD5		
17	LD4		
18	LD3		
19	LD2		
20	LD1		
21	LD0		
22	GND	—	GND
23	GND	—	GND
24	GND	—	GND
25	UD0	H / L	Display Data (Upper Column)
26	UD1		
27	UD2		
28	UD3		
29	UD4		
30	UD5		
31	UD6		
32	UD7		
33	GND	—	GND
34	GND	—	GND
35	GND	—	GND
36	VDD	—	Power Supply for LCD
37	VDD	—	Power Supply for LCD
38	VCON	—	Contrast Adjust
39	N.C	—	—
40	GND	—	GND
41	GND	—	GND

CN2 JST : BHR-03VS-1 (Suitable Connector : JST SM02 (8.0) B-BHS)

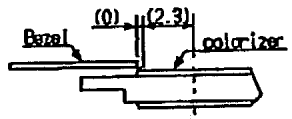
PIN No.	SIGNAL	LEVEL	FUNCTION
1	VCFL	A C	Power Supply for CFL
2	N.C	—	—
3	VSS	—	GND for CFL

9. DIMENSIONAL OUTLINE

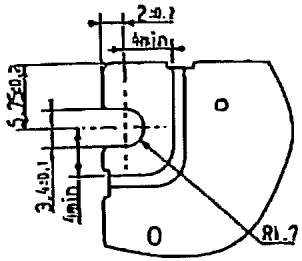




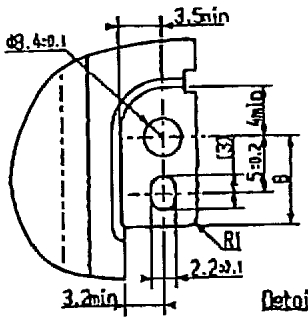
C - C



D - D



Detail of A



Detail of B

CN1 HIROSE:DF9B-41P-1V
CN2 JST:BHR-03VS-1

Unit:mm
Scale:NTS
* Measurment tolerance: ±0.5

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