

Data International Co., Ltd.



APPROVAL SHEET

Customer : _____

Part Name : **LCD MODULE**

Model No. : **DGA-32240-17-WNCW-H**

Drawing No. : _____

Approved by : _____

Date : _____

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**SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY MODULE
MODEL NO: DGA-32240-17-WNCW-H**

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**SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY MODULE
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1. SCOPE

This specification covers the engineering requirements for the DGA-32240-17-WNCW-H liquid crystal module.

2. PRODUCT SPECIFICATIONS

2.1 General

- 320 × 240 dot matrix LCD
- FSTN(Blue Mode)
- Negative , Wide temperature type
- Back-light: C.C.F.L , White
- Multiplexing driving : 1/240 duty, 1/14 bias

2.2 Mechanical Characteristics

Item	Characteristic
Dot configuration	320 × 240
Dot dimensions(mm)	0.34 × 0.34
Dot spacing (mm)	0.02
Module dimensions (Horizontal × Vertical × Thickness, mm)	167.1 × 109.0 × 11.0max.
Viewing area (Horizontal × Vertical, mm)	120.0 × 90.0
Active area (Horizontal × Vertical, mm)	115.17 × 86.37

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2.3 Absolute Maximum Ratings (Without CCFL back-light)

Absolute Maximum Ratings at Ta = 25 ±2°C, V_{SS} = 0 V

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage (logic)	V _{DD} max		-0.3 to +7.0	V
Maximum supply voltage (LCD)	V _{DD} -V _{EE} max	*1	0 to 35	V
Maximum input voltage	V _i max		-0.3 to V _{DD} + 0.3	V
Storage temperature	T _{stg}		-40 to +125	°C

Note: 1. V_{DD} ≥ V₁ > V₃ > V₄ > V_{EE}

Allowable Operating Ranges at Ta = -20 to +75°C, V_{SS} = 0 V

Parameter	Symbol	Conditions	min	typ	max	Unit
Supply voltage (logic)	V _{DD}		4.5		5.5	V
Supply voltage (LCD)	V _{DD} -V _{EE}	*2, 3	12		32	V
Input high level voltage	V _{IH}	DI1 to DI4, CP, LOAD, CDI, R/L, M, DISP OFF	0.8 V _{DD}			V
Input low level voltage	V _{IL}	DI1 to DI4, CP, LOAD, CDI, R/L, M, DISP OFF			0.2 V _{DD}	V
CP (shift clock)	f _{CP}	CP			6.0	MHz
CP pulse width	t _{WC}	CP	50			ns
LOAD pulse width	t _{WL}	LOAD	50			ns
Setup time	t _{SETUP}	DI1 to DI4 → CP	30			ns
Hold time	t _{HOLD}	DI1 to DI4 → CP	30			ns
CP → LOAD	t _{CL}	CP → LOAD	80			ns
LOAD → CP	t _{LC}	LOAD → CP	110			ns
CP and LOAD rise time	t _R	CP, LOAD			*4	ns
CP and LOAD fall time	t _F	CP, LOAD			*4	ns

Note: 2. V_{DD} ≥ V₁ > V₃ > V₄ > V_{EE}

3. When the power is turned on, either the logic system power must be turned on before the LCD drive system power or else they must both be turned on at the same time. When the power is turned off, either the LCD drive system power must be turned off before the logic system power, or else both must be turned off at the same time.
4. The CP and LOAD rise time (t_R) and the CP and LOAD fall time (t_F) must satisfy equations ① and ② below at the same time.

① $t_R, t_F < \frac{1}{2 f_{CP}} - t_{WC}$

② $t_R, t_F < 50 \text{ ns}$

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2.4 Electrical Characteristics (Without CCFL back-light)

Electrical Characteristics at Ta = 25°C ± 2°C, V_{DD} = 5 V ± 10%

Parameter	Symbol	Conditions	min	typ	max	Unit
Input high level current	I _{IH}	V _{IN} = V _{DD} : LOAD, CP, CDI, R/L, D11 to D14, M, DISP OFF			1	μA
Input low level current	I _{IL}	V _{IN} = V _{SS} : LOAD, CP, CDI, R/L, D11 to D14, M, DISP OFF	-1			μA
Output high level voltage	V _{OH}	I _{OH} = -400 μA: CDO	V _{DD} - 0.4			V
Output low level voltage	V _{OL}	I _{OL} = 400 μA: CDO			0.4	V
Driver on resistance	R _{ON} (1)	V _{DD} -V _{EE} = 30 V, V _{DE} -V _O = 0.5 V: O1 to O80*5		1.5	3.0	kΩ
	R _{ON} (2)	V _{DD} -V _{EE} = 20 V, V _{DE} -V _O = 0.5 V: O1 to O80*5		2.0	3.5	kΩ
Standby current drain	I _{ST}	CDI = V _{DD} , V _{DD} -V _{EE} = 30 V, CP = 6.0 MHz, output unloaded: V _{SS}			200	μA
operating current drain	I _{SS} *6	V _{DD} -V _{EE} = 30 V, CP = 6 MHz, LOAD = 14 kHz, M = 35 Hz: V _{SS}			4.0	mA
	I _{EE} *7	V _{DD} -V _{EE} = 30 V, CP = 6 MHz, LOAD = 14 kHz, M = 35 Hz: V _{EE}			0.5	mA
Input capacitance	CI	f = 6.0 MHz: CP		5		pF

Note: 5. V_{DE} = one of V1, V3, V4 or V_{EE}, V1 = V_{DD}, V3 = 15/17 (V_{DD}-V_{EE}), V4 = 2/17 (V_{DD} - V_{EE})
6. I_{SS} is the current flowing from V_{DD} to V_{SS}.
7. I_{EE} is the current flowing from V_{DD} to V_{EE}.

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2.5 Optical Characteristics Absolute maximum ratings

Item	Symbol	Rating	Unit
Operating temperature range	Top	-20~70	°C
Storage temperature range	Tst	-30~80	°C

2.6 Optical Characteristics

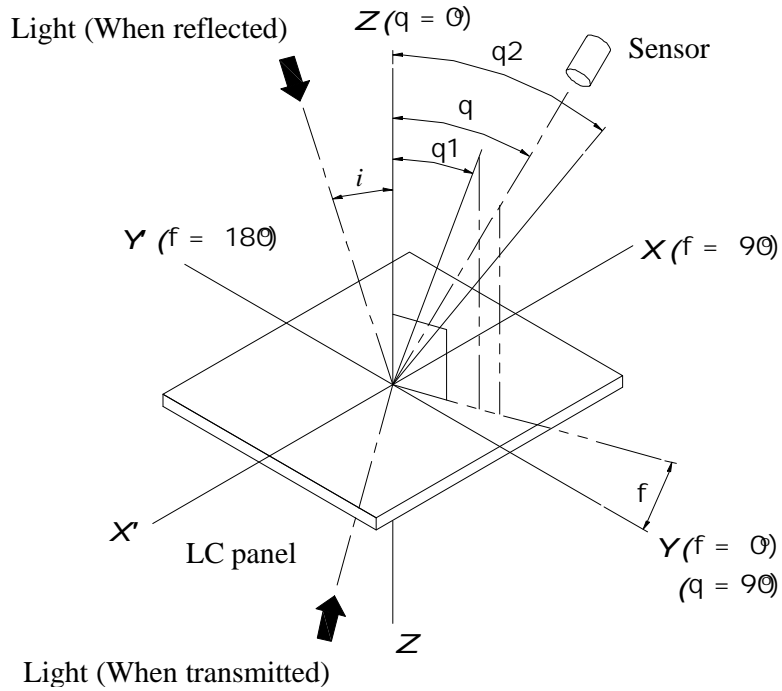
1/240 duty, 1/14 bias, Vopr=23.2V

Item	Symbol	Temp.	Min.	Typ.	Max.	Unit
Driving voltage	Vop	0°C	23.4	24.1	24.8	V
		25°C	22.5	23.2	23.9	
		50°C	21.7	22.3	23.0	
Contrast ratio	CR	$\theta=0^\circ$ $\phi=0^\circ$	3.9	4.9	--	--
Frame freq.	fF	--	--	70	--	Hz
Viewing angle*	θ_1	25°C	--	38	--	deg.
	θ_2		--	22	--	
Response time	t_{on}	25°C	--	107	--	ms
	t_{off}		--	340	--	

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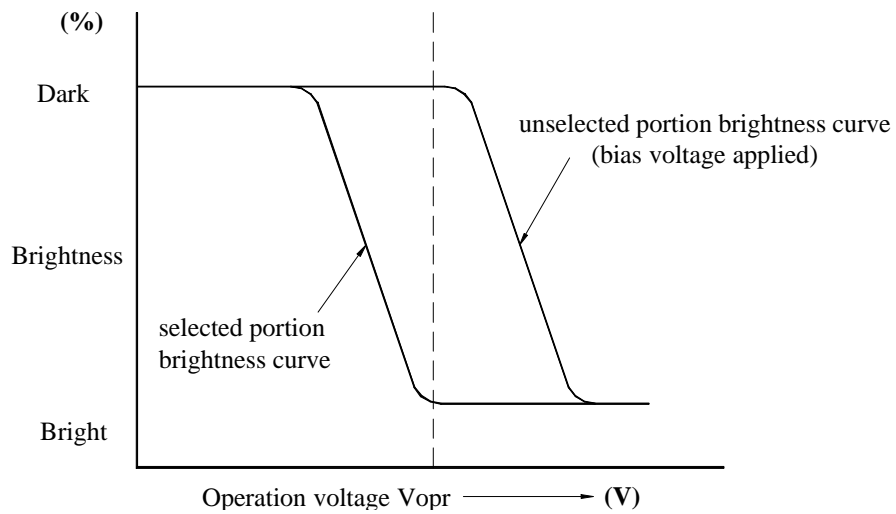
2.6.1 Definition of optical characteristics

*Definition of angles ϕ and θ



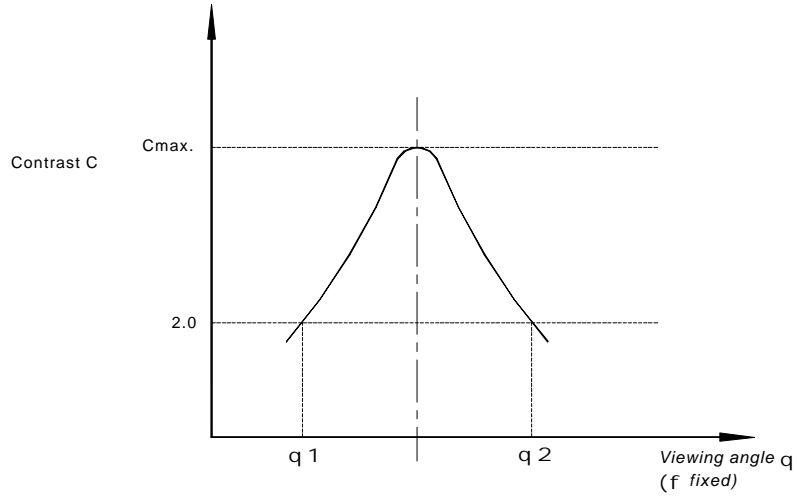
*Definition of contrast C

$$C = \frac{B1}{B2} = \frac{\text{Brightness of selected portion}}{\text{Brightness of unselected portion}}$$



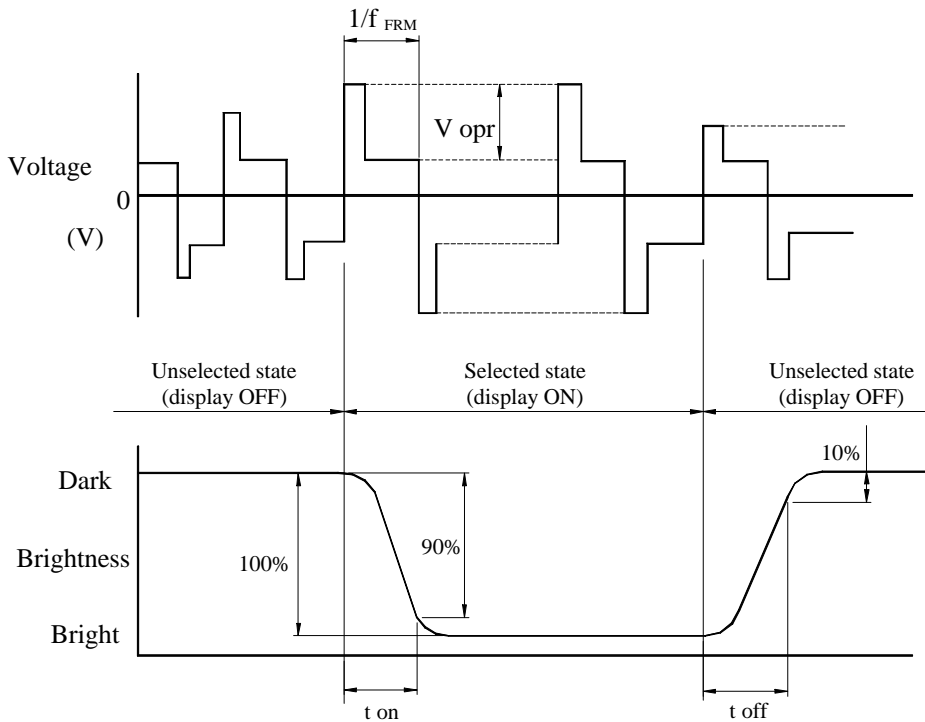
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*Definition of viewing angles θ_1 and θ_2



Note : Optimum vision with the naked eye and viewing angle θ at Cmax above are not always the same.

*Definition of response time



V_{opr} : Operating voltage (V)

t_{on} : Response time (rise) (ms)

f_{FRM} : Frame frequency (Hz)

t_{off} : Response time (fall) (ms)

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2.7 CCFL Electrical Specifications

2.7.1 Absolute maximum Conditions

The half-brightness life of the back light shall be kept as specified under the following absolute maximum conditions.

Power Consumption	2.5W
Ta=25°C, fL=30KHz	
Tube current	
Ta=25°C, fL=30KHz	6.0mArms max.

2.7.2 Electrical characteristics

The following operating conditions are recommended for the back light unit.

Start Voltage	400Vrms	at Ta=25°C
Tube Voltage	350Vrms	at Ta=25°C
Tube Current	5.0mArms	at Ta=25°C
Drive frequency	30KHz typ	at Ta=25°C

2.7.3 Initial Optical Characteristics

The unit shall satisfy the following criteria at 25±2°C ambient temperature, 30%-85% relative humidity, no air flow and with applying rating input voltage and input current by using TDK CXA-L10L inverter.

Brightness Uniformity	80%	
Average Brightness	200cd/m ² min.	at Ta=25°C
(Measurement shall be continuous on for 30 minutes)		
Chromaticity	x=0.300min. 0.320typ. 0.340max.	
	y=0.355min. 0.375typ. 0.395max.	

2.7.4 Life

the unit shall satisfy the following criteria at 25±5°C ambient temperature, with 5mA tube current by using TDK CXA-L10L inverter.

Half-Brightness Life of Unit 10,000 Hours min.

The definition of half-brightness life is either average brightness reach to 50% of initial average brightness or lamp stopping light emission.

2.7.5 Operating Conditions

Temperature	0 to 50°C	Humidity	20 to 90%RH
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2.7.6 Storage Conditions

Temperature	-20 to 70°C	Humidity	5 to 90%RH
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3. RELIABILITY

3.1 Reliability

Test item	Test condition	Evaluation and assessment
Operation at high temperature and humidity	40°C±2°C 90%RH for 500hours	No abnormalities in functions* and appearance**
Operation at high temperature	60°C±2°C for 500 hours	No abnormalities in functions* and appearance**
Heat shock	-20± ~ +60°C Left for 1 hour at each temperature, transition time 5 min, repeated 10times	No abnormalities in functions* and appearance**
Low temperature	-20±2°C for 500 hours	No abnormalities in functions* and appearance**
Vibration	Sweep for 1 min at 10 Hz, 55Hz, 10Hz, amplitude 1.5mm 2 hrs each in the X,Y and Z directions	No abnormalities in functions* and appearance**
Drop shock	Dropped onto a board from a height of 10cm	No abnormalities in functions* and appearance**

* Dissipation current, contrast and display functions

** Polarizing filter deterioration, other appearance defects

3.2 Liquid crystal panel service life

100,000 hours minimum at 25°C±10°C

3.3 Definition of panel service life

- Contrast becomes 30% of initial value
- Current consumption becomes three times higher than initial value
- Remarkable alignment deterioration occurs in LCD cell layer
- Unusual operation occurs in display functions

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4. OPERATING INSTRUCTIONS

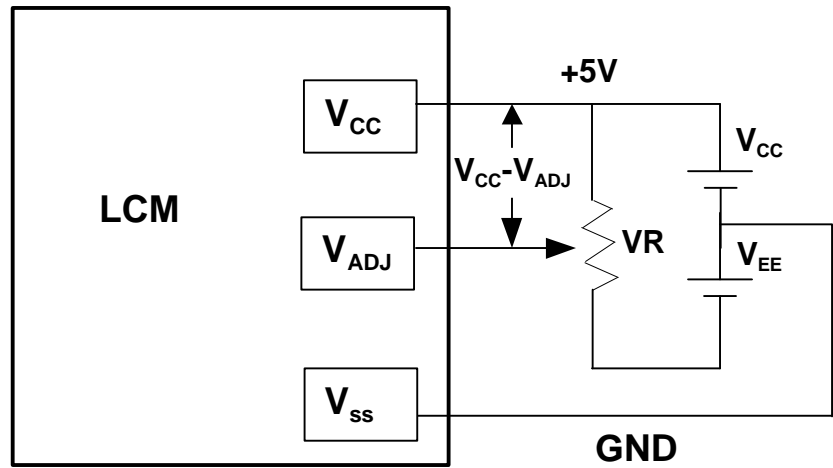
4.1 Input signal Function

NO.	Symbol	Function
1-4	D0-D3	Display Data
5	/DISPOFF	H: on L: off
6	FLM	First line market
7	M	Frame reverse signal
8	LP	Data latch
9	CP	Data shift
10	VCC	Power supply for Logic circuit (+)
11	VSS	Ground (0V)
12	VLCD	Power supply for LCD (-)
13	VADJ	Operating voltage LCD driving
14	FGND	Front panel ground

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4.2 Voltage Generator Circuit

Power Supply Circuit Diagram

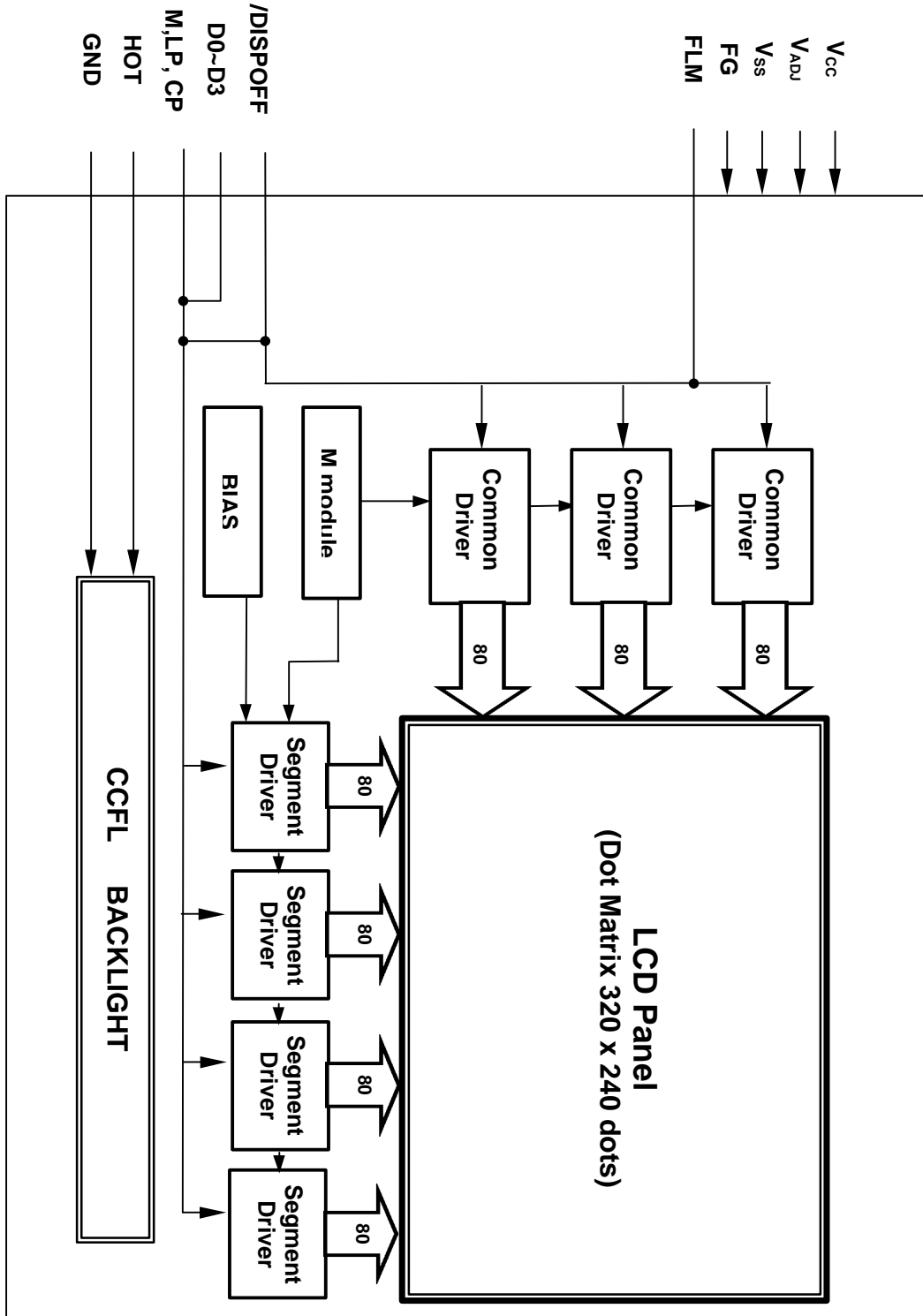


$V_{CC} - V_{ADJ}$: LCD Driving Voltage
 VR : 10K~20K



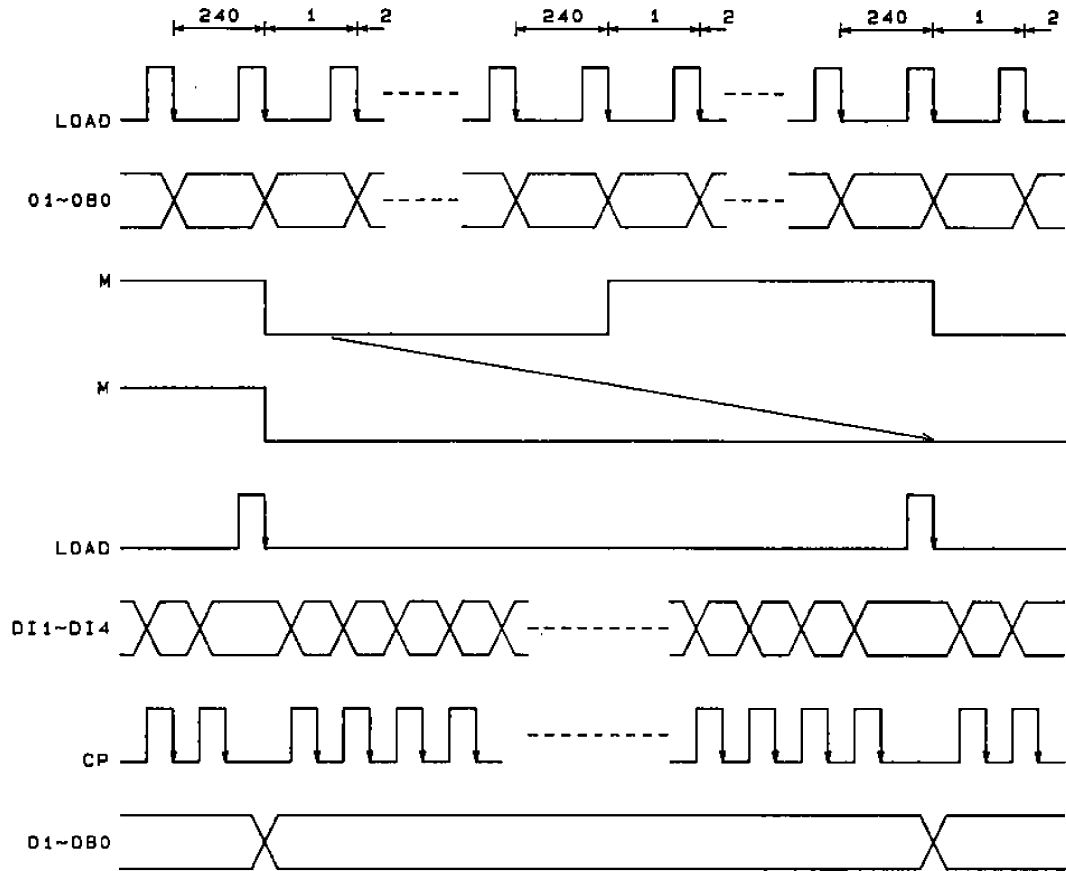
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4.3 Circuit Block Diagram



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4.4 Timing Characteristics



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5. NOTES

Safety

- If the LCD panel breaks, be careful not to get the liquid crystal in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and plenty of water.

Handling

- Avoid static electricity as this can damage the CMOS LSI.
- The LCD panel is plate glass; do not hit or crush it.
- Do not remove the panel or frame from the module.
- The polarizing plate of the display is very fragile; handle it very carefully

Mounting and Design

- Mount the module by using the specified mounting part and holes.
- To protect the module from external pressure, leave a small gap by placing transparent plates (e.g. acrylic or glass) on the display surface, frame, and polarizing plate
- Design the system so that no input signal is given unless the power-supply voltage is applied.
- Keep the module dry. Avoid condensation, otherwise the transparent electrodes may break.

Storage

- Store the module in a dark place where the temperature is $25^{\circ}\text{C}\pm 10^{\circ}\text{C}$ and the humidity below 65% RH.
- Do not store the module near organic solvents or corrosive gases.
- Do not crush, shake, or jolt the module (including accessories).

Cleaning

- Do not wipe the polarizing plate with a dry cloth, as it may scratch the surface.
- Wipe the module gently with soft cloth soaked with a petroleum benzine.
- Do not use ketonic solvents (ketone and acetone) or aromatic solvents (toluene and xylene), as they may damage the polarizing plate.

6. OPERATION PRECAUTIONS

Any changes that need to be made in this specification or any problems arising from it will be dealt with quickly by discussion between both companies.

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7. LCM Dimension

