

TIANMA Microelectronics (U.S.A.) Inc.

SPECIFICATION FOR LCD MODULE

Model No. TM320240DCGU

To:

☐ Customer's Approval

Date: _____

By: _____

Presented

By: _____

Tianma Microelectronics (U.S.A.) Inc.

REVISION RECORD

Date	Ref. Page	Revision No.	Revision Items	Check & Approval

模块部
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1 Display Specifications

1.1 Display type:

1.2 Display color*: FSTN

Display color:

Blue-Black

Background color:

Black-White

1.3 Polarizer mode: Transmissive

1.4 Viewing Angle: 12:00

1.5 Driving Duty: 1/240

1.6 Backlight: CCFL

* Color tone is slightly changed by temperature and driving voltage.

2 Mechanical Specifications

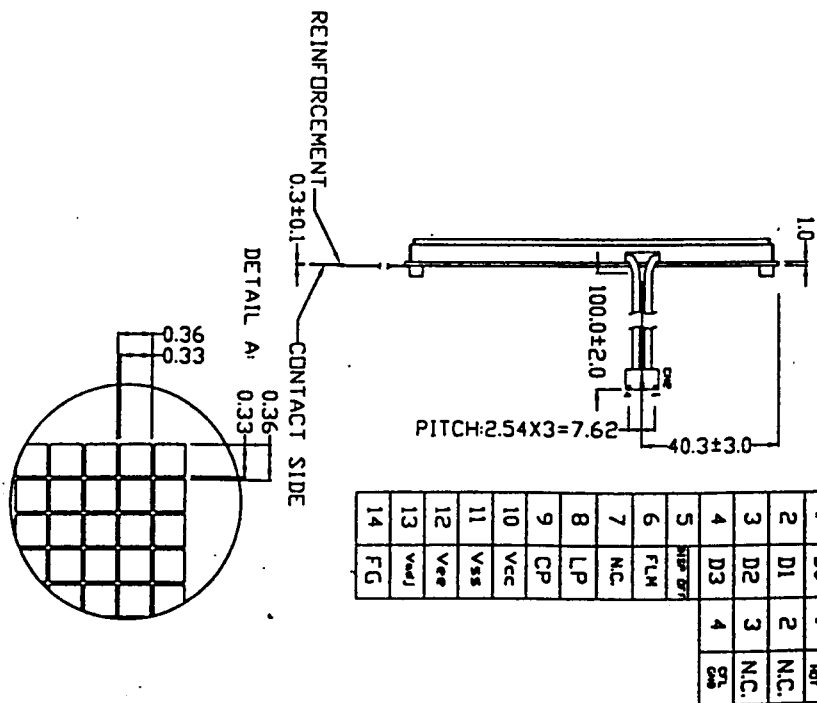
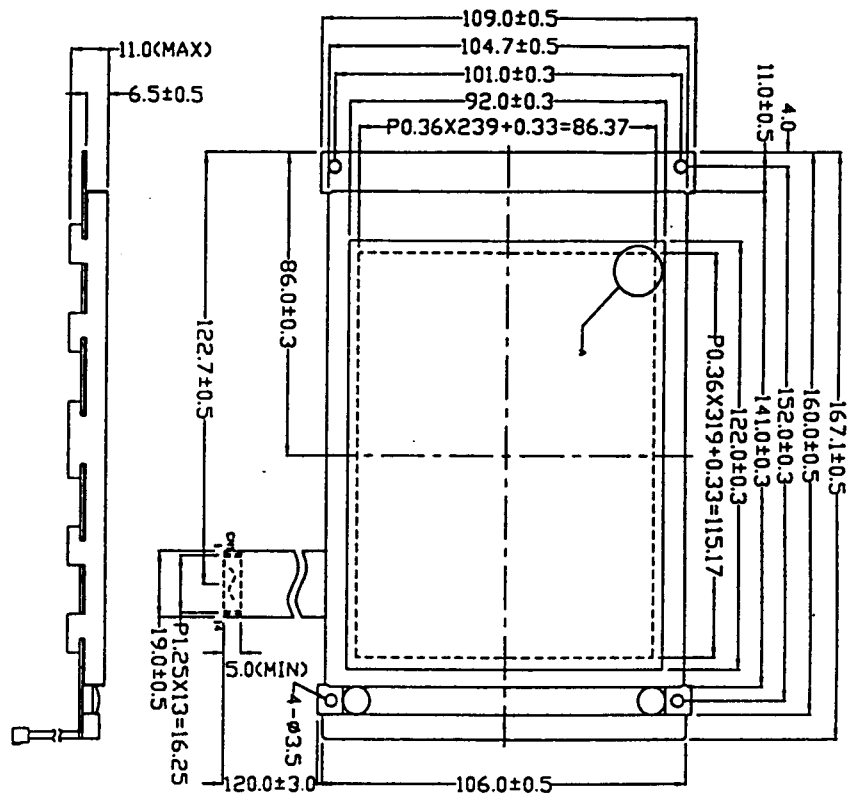
2.1 Outline Dimensions: Refer to outline drawing on page: 2

2.2 Dot Matrix: 320×240

2.3 Dot size: 0.33×0.33(mm)

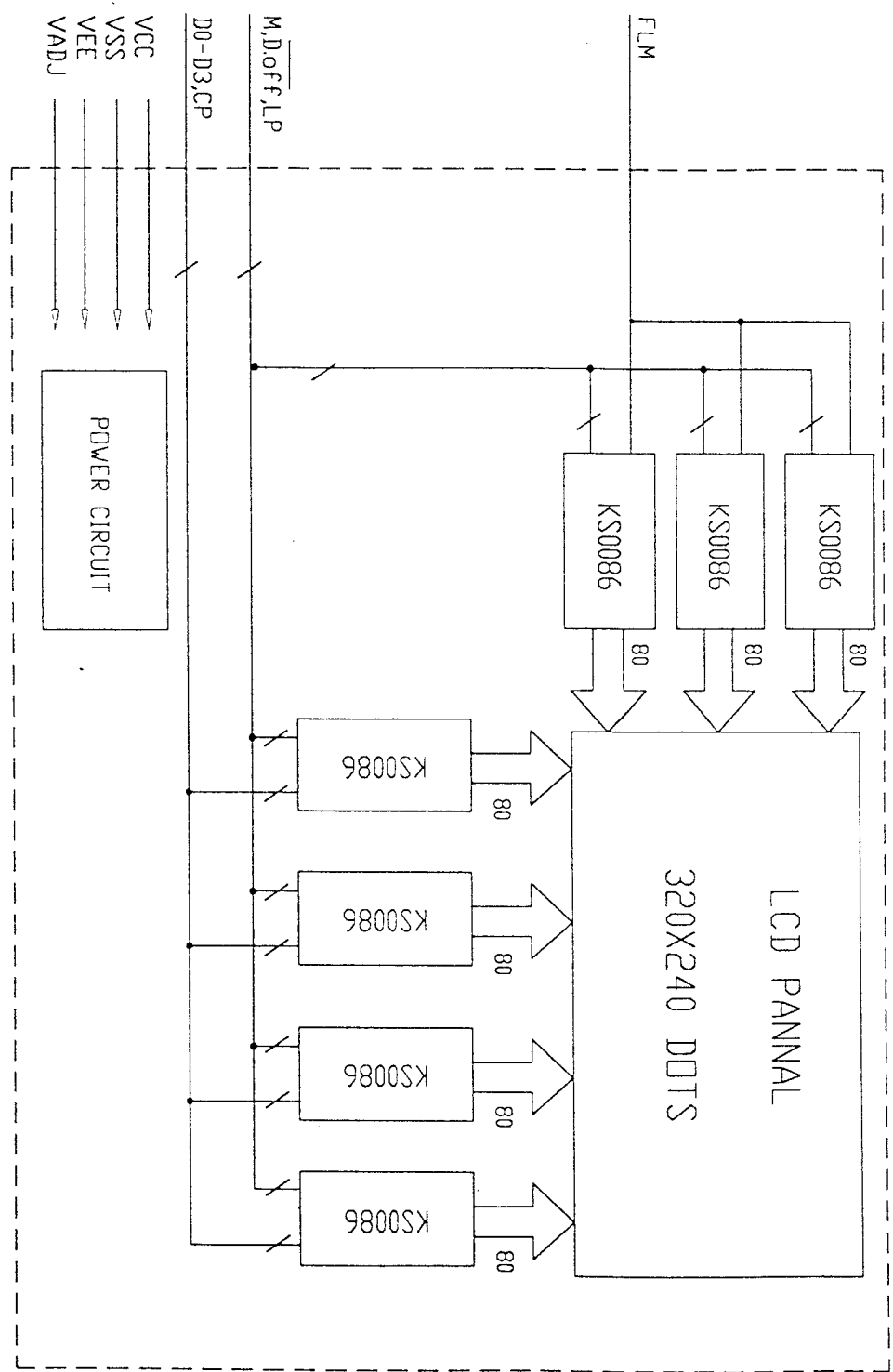
2.4 Dot pitch: 0.36×0.36(mm)

2.5 Weight: 260 g



PIN ASSIGNMENT		PIN ASSIGNMENT	
PIN NO.	SYMBOL	PIN NO.	SYMBOL
1	DO	1	DS NOT
2	D1	2	N.C.
3	D2	3	N.C.
4	D3	4	DS
5	DS NOT		
6	FLM		
7	N.C.		
8	LP		
9	CP		
10	VCC		
11	VSS		
12	Vee		
13	VddJ		
14	FG		

3 Circuit Block Diagram



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4 Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	$V_{DD} - V_{SS}$	0	5.5	V	
LCD Driving Voltage	V_{LCD}	-	28.0		
Operating Temperature Range	T_{OP}	0	50	°C	No Condensation
Storage Temperature Range	T_{ST}	-20	60		

5 Electrical Specifications and Instruction Code

5.1 Electrical characteristics

Item		Symbol	Min.	Typ.	Max.	Unit	Remark
Supply Voltage (Logic)		$V_{DD}-V_{SS}$	2.7	5.0	5.5	V	
Supply Voltage (LCD Drive)		$V_{DD}-V_{EE}$	-	22.6	-	V	
Supply Voltage (CCFL Driver)			200	510	820	V	
Input Signal Voltage	'H'Level	V_{IH}	$0.8V_{DD}$	-	$V_{DD}+0.3$	V	
	'L'Level	V_{IL}	0.3	-	$0.2 V_{DD}$	V	
Supply current (Logic)		I_{DD}	-	-	35.0	mA	
Supply current (LCD Drive)		I_{EE}	-	-	5.0	mA	
Supply current (CCFL Drive)				5		mA	

5.2 Interface Signals

CN1

Pin No.	Symbol	Level	Description
1	D0	H/L	Data bit0
2	D1	H/L	Data bit1
3	D2	H/L	Data bit2
4	D3	H/L	Data bit3
5	D.off	H/L	Display off("H" =on, "L" =off)
6	FLM	H/L	indicate the beginning of each frame
7	NC		No Connection
8	LP	H→L	Data latch clock (CL1)
9	CP	H→L	Data shift clock (CL2)
10	VCC	5.0V	Power supply voltage for logic and LCD(+)
11	VSS	0V	Ground
12	VEE	-22.0V	Power supply voltage for LCD
13	Vadj	-17.6V	Operating voltage for LCD drive(-)Variable
14	FG		Frame Ground

CN2

1	FL	200-820v	CCFL Power Supply
2	NC		No Connection
3	NC		No Connection
4	FL GND	0v	Gnd

5.3 Interface Timing Chart:

(1) Segment driver application

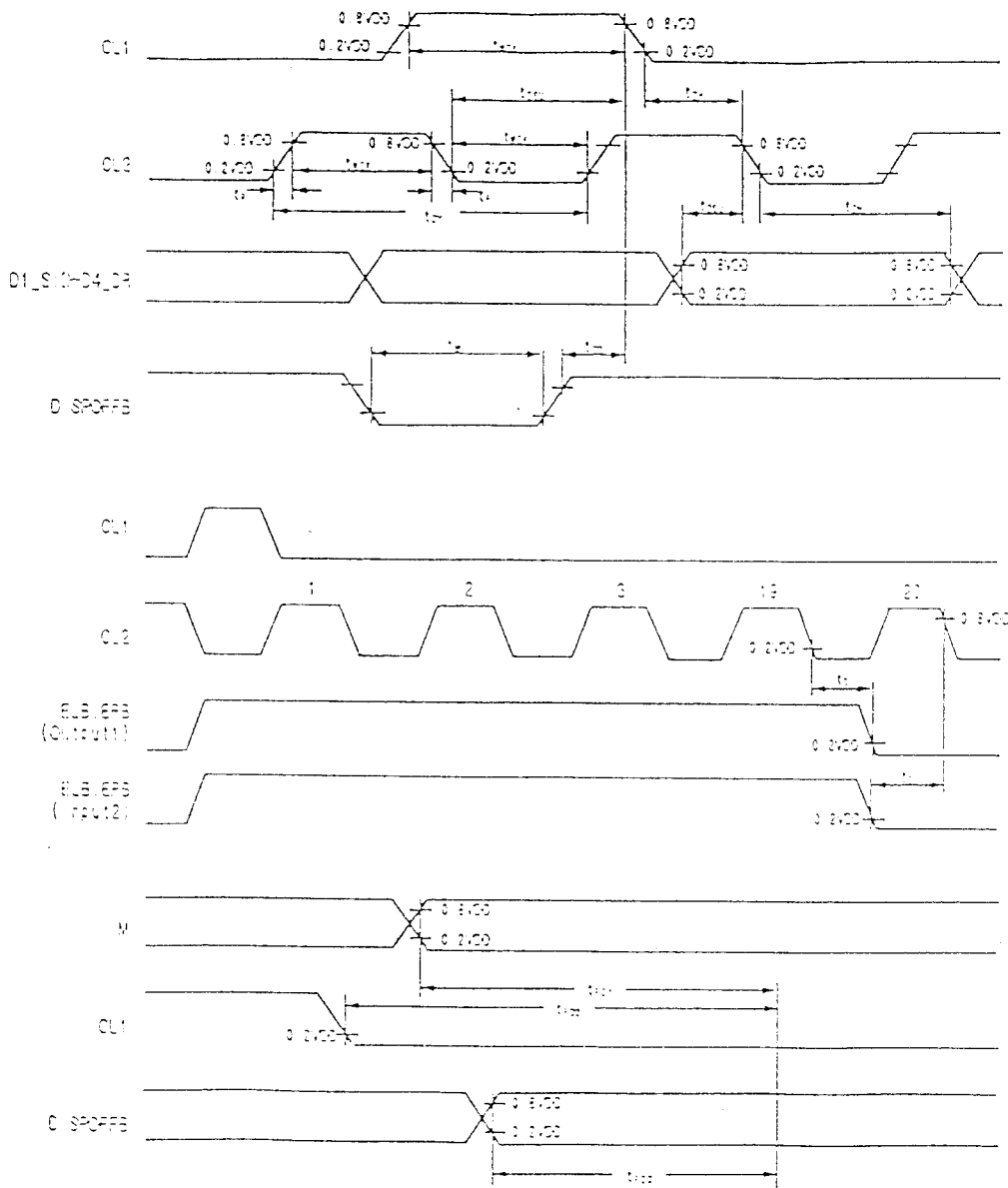
AC Characteristics

(1) SEGMENT DRIVER APPLICATION

(VSS = GND, Ta = -30 ~ +85°C)

Characteristics	Symbol	Conditions	VDD=5V ± 10%			VDD=3V ± 10%			Unit
			MIN	TYP	MAX	MIN	TYP	MAX	
Clock Cycle Time	t _{cy}	Duty = 50%	125	-	-	250	-	-	ns
Clock Pulse Width	t _{clk}	-	45	-	-	95	-	-	
Clock Rise/Fall Time	t _{af}	-	-	-	30	-	-	30	
Data Set-Up Time	t _{su}	-	30	-	-	65	-	-	
Data Hold Time	t _h	-	30	-	-	65	-	-	
Clock Set-Up Time	t _{su}	-	80	-	-	120	-	-	
Clock Hold Time	t _h	-	80	-	-	120	-	-	
Propagation Delay Time	t _p	ELB Output	-	-	60	-	-	105	
		ERB Output	-	-	60	-	-	105	
ELB, ERB Set-Up Time	t _{su}	ELB Input	30	-	-	65	-	-	
		ERB Input	30	-	-	65	-	-	
DISPOFFB Low Pulse Time	t _{wl}	-	12	-	-	12	-	-	μs
DISPOFFB Clear Time	t _{cp}	-	100	-	-	100	-	-	ns
VI-OUT	t _{opi}	C _L = 15pF	-	-	12	-	-	12	V
Propagation Delay Time									
OL1-OUT	t _{opi}		-	-	12	-	-	12	
Propagation Delay Time									
DISPOFFB-OUT	t _{opi}	C _L = 15pF	-	-	12	-	-	12	V
Propagation Delay Time									

AC Characteristics (continued)
 (3) SEGMENT DRIVER APPLICATION TIMING



(2) Common driver application

AC Characteristics (continued)

(2) COMMON DRIVER APPLICATION

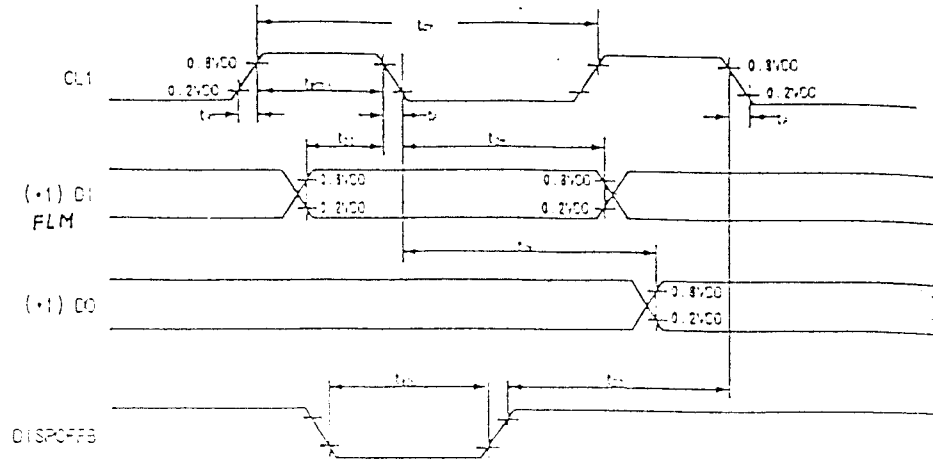
(VSS = 0V, Ta = -30 - +85°C)

Characteristics	Symbol	Conditions	VDD=5V ± 10%			VDD=3V ± 10%			Unit
			MIN	TYP	MAX	MIN	TYP	MAX	
Clock Cycle Time	t _{cy}	Duty = 50%	250	-	-	500	-	-	ns
Clock Pulse Width	t _{wckH}	-	45	-	-	95	-	-	
Clock Rise/Fall Time	t _{r/f}	-	-	-	50	-	-	50	
Data Set-Up Time	t _{osu}	-	30	-	-	65	-	-	
Data Hold Time	t _{oh}	-	30	-	-	65	-	-	
DISPOFFB Low Pulse Width	t _{wL}	-	1.2	-	-	1.2	-	-	μs
DISPOFFB Clear Time	t _{co}	-	100	-	-	100	-	-	ns
Output Delay Time	t _{oL}	C _L = 15pF	-	-	200	-	-	250	
M-OUT	t _{po1}		-	-	1.0	-	-	1.2	μs
Propagation Delay Time	t _{po2}		-	-	1.0	-	-	1.2	
CH-OUT	t _{po2}		-	-	1.0	-	-	1.2	
Propagation Delay Time	t _{po2}		-	-	1.0	-	-	1.2	
DISPOFFB-OUT	t _{po3}		-	-	1.0	-	-	1.2	
Propagation Delay Time	t _{po3}		-	-	1.0	-	-	1.2	

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AC Characteristics (continued)

(4) COMMON DRIVER APPLICATION TIMING



(+1) When single-type interface mode

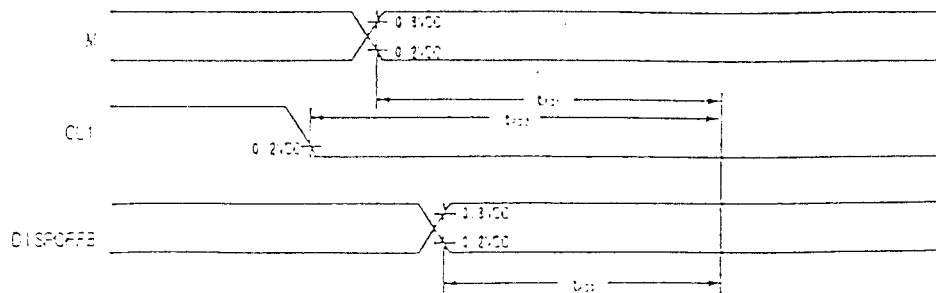
D1 => D3_DL(S-L='L'), D4_DF(S-L='H')

D0 => D4_DR(S-L='L'), D3_DL(S-L='H')

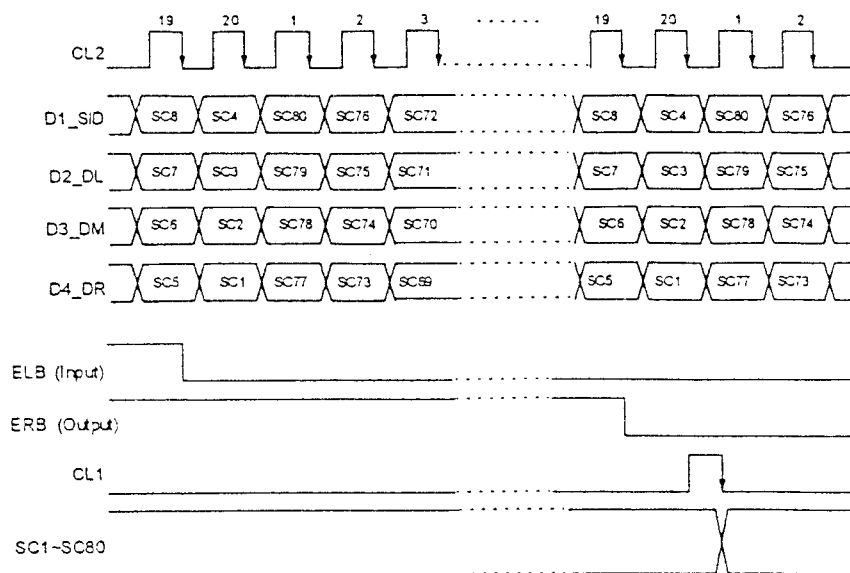
When dual-type interface mode

D1 => D3_DL and D3_OH(S-L='L'), D4_DF and D3_OH(S-L='H')

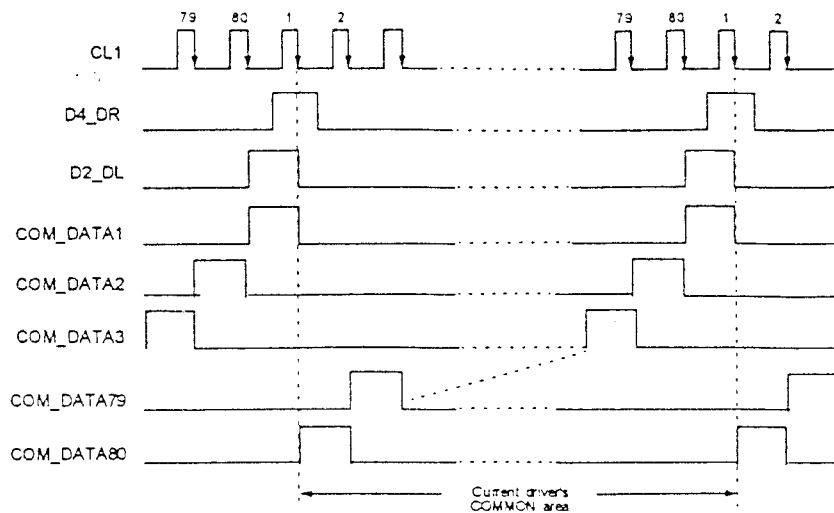
D0 => D4_DR(S-L='L'), D3_DL(S-L='H')



(3)Segment Driver Operating Timing Diagram



(4) Common Driver Operating Timing Diagram

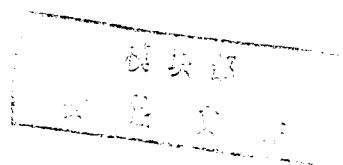


6. Optical Characteristics

6.1 Optical Characteristics

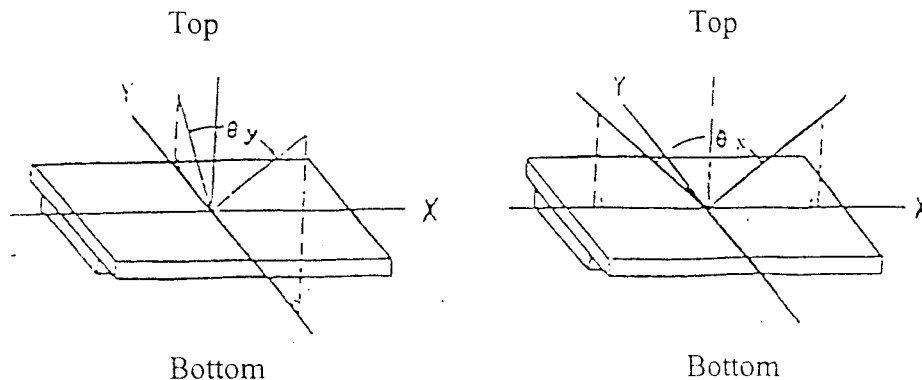
$T_{OP}=25^{\circ}\text{C}$

Item		Symbol	Condition		Min.	Typ.	Max.	Unit	Remark
Viewing Angle		θ_x	$Cr \geq 2$	$\theta_y = 0^{\circ}$	-30	--	30	Deg	
		θ_y		$\theta_x = 0^{\circ}$	-30	--	20		
Contrast Ratio		Cr	$\theta_x = 0^{\circ}$ $\theta_y = 0^{\circ}$		3.0				
Response Time	Turn on	T_{on}	$\theta_x = 0^{\circ}$ $\theta_y = 0^{\circ}$				350	ms	
	Turn off	T_{off}					350		

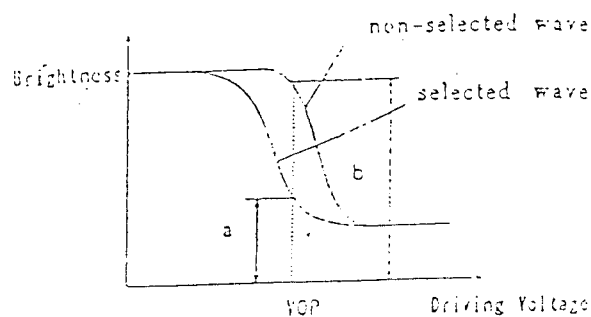


6.2 Definition of optical characteristics

6.2.1 Definition of viewing Angle(see fig. as follow)



6.2.2 Definition of Contrast Ratio(see fig. as follow)

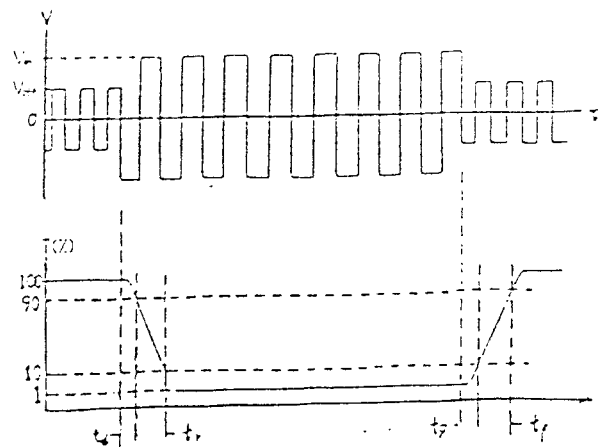


$$\text{Contrast Ratio} = b / a = \frac{\text{non-selected state brightness}}{\text{selected state brightness}}$$

Measuring Conditions:

- 1) Ambient Temperature: 25°C ;
- 2) Frame frequency: 64Hz

6.2.3 Definition of Response time(see fig. as follow)



Turn-on time: $t_{on} = t_d + t_r$

Turn-off time: $t_{off} = t_d + t_f$

Measuring Condition:

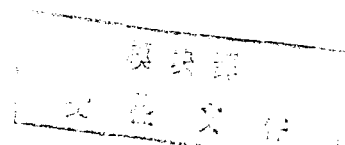
- 1) Operating Voltage: 22.6V ;
- 2) Frame frequency: 64Hz

7. Reliability

7.1 Content of Reliability Test

($T_{OP}=25^{\circ}\text{C}$)

No.	Test Item	Content of Test	Test condition
1	High Temperature Storage	Endurance test applying the high storage temperature for a long time	60°C 96H
2	Low Temperature Storage	Endurance test applying the low storage temperature for a long time	-20°C 96H
3	High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the thermal stress to the element for a long time	50°C 96H
4	Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time	0°C 96H
5	High Temperature /Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time	40°C 90%RH 96H
6	Temperature Cycle	Endurance test applying the low and high temperature cycle $\begin{array}{ccccccc} -20^{\circ}\text{C} & \longleftrightarrow & 25^{\circ}\text{C} & \longleftrightarrow & 60^{\circ}\text{C} & \longleftrightarrow & 25^{\circ}\text{C} \\ 30\text{min} & & 5\text{min} & & 30\text{min} & & 5\text{min} \\ \longleftarrow & & & & & & \longrightarrow \\ & & & & & & 1 \text{ cycle} \end{array}$	-20°C/60°C 10 cycles
7	Vibration Test (package state)	Endurance test applying the vibration during transportation	10Hz~150Hz, 50m/s ² , 40min
8	Shock Test (package state)	Endurance test applying the shock during transportation	Half-sinewave, 100m/s ² , 11ms
9	Atmospheric Pressure Test	Endurance test applying the atmospheric pressure during transportation by air	40kPa 16H



7.2 Failure Judgment Criterion

Criterion Item	Test Item No.									Failure Judgement Criterion
	1	2	3	4	5	6	7	8	9	
Basic Specification	0	0	0	0	0	0	0	0	0	Out of the basic Specification
Electrical specification	0	0	0	0	0					Out of the electrical specification
Mechanical Specification							0	0		Out of the mechanical specification
Optical Characteristic	0	0	0	0	0	0			0	Out of the optical specification
Remark	Basic specification = Optical specification + Mechanical specification									

8 Precautions for use of LCD Modules

8.1 Handling Precautions

- 8.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- 8.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.
- 8.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- 8.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- 8.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

- Isopropyl alcohol

- Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

- Water

- Ketone

- Aromatic solvents

- 8.1.6 Do not attempt to disassemble the LCD Module. Especially, do not attempt to peel off the heat seal.
- 8.1.7 If the logic circuit power is off, do not apply the input signals.
- 8.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
 - a. Be sure to ground the body when handling the LCD Modules.
 - b. Tools required for assembly, such as soldering irons, must be properly ground.
 - c. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
 - d. The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

8.2 Storage precautions

8.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

8.2.2 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

temperature : $0^{\circ}\text{C} \sim 40^{\circ}\text{C}$

relatively humidity: $\leq 80\%$

8.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

8.3 The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.