

# **AZ DISPLAYS, INC.**

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*COMPLETE LCD SOLUTIONS*

## **SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY**

**PART NUMBER:**  
**DATE:**

**AGM3224I SERIES**  
**MAR. 13, 2007**

# LCD Module

## Main Data

No.	Item	Contents	Unit
(1)	Module size	167.0(W) x 109.0(H) x 8.5 (D)	mm
(2)	Viewing area	120.0 (W) x 90.0 (H)	mm
(3)	Dot Number	320 x 3 (R.G.B) (W) x 240 (H)	dots
(4)	Dot Size	0.10(W) x 0.34(H)	mm
(5)	Dot pitch	0.12(W) x 0.36(H)	mm
(6)	LCD type	<ul style="list-style-type: none"> <li>•Color-STN (Negative &amp; transmissive type)</li> <li>• with Anti glare upper polarizer .</li> </ul>	-
(7)	Contrast ratio	40	-
(8)	Duty	1/242	-
(9)	Viewing direction	6 O clock	-
(10)	Operating temperature	0 ~ +50	!C
(11)	Storage temperature	-20 ~ +60	!C
(12)	Backlight	LED x 16	pcs
(13)	Power Supply Voltage	VDD=5.0 V or 3.3 V Vcon=1.8 V	V
(14)	Weight	200 (Approx.)	g



## Interface Pin Connection

CN1

FFC Pitch 1.0mm, width 17.0mm.

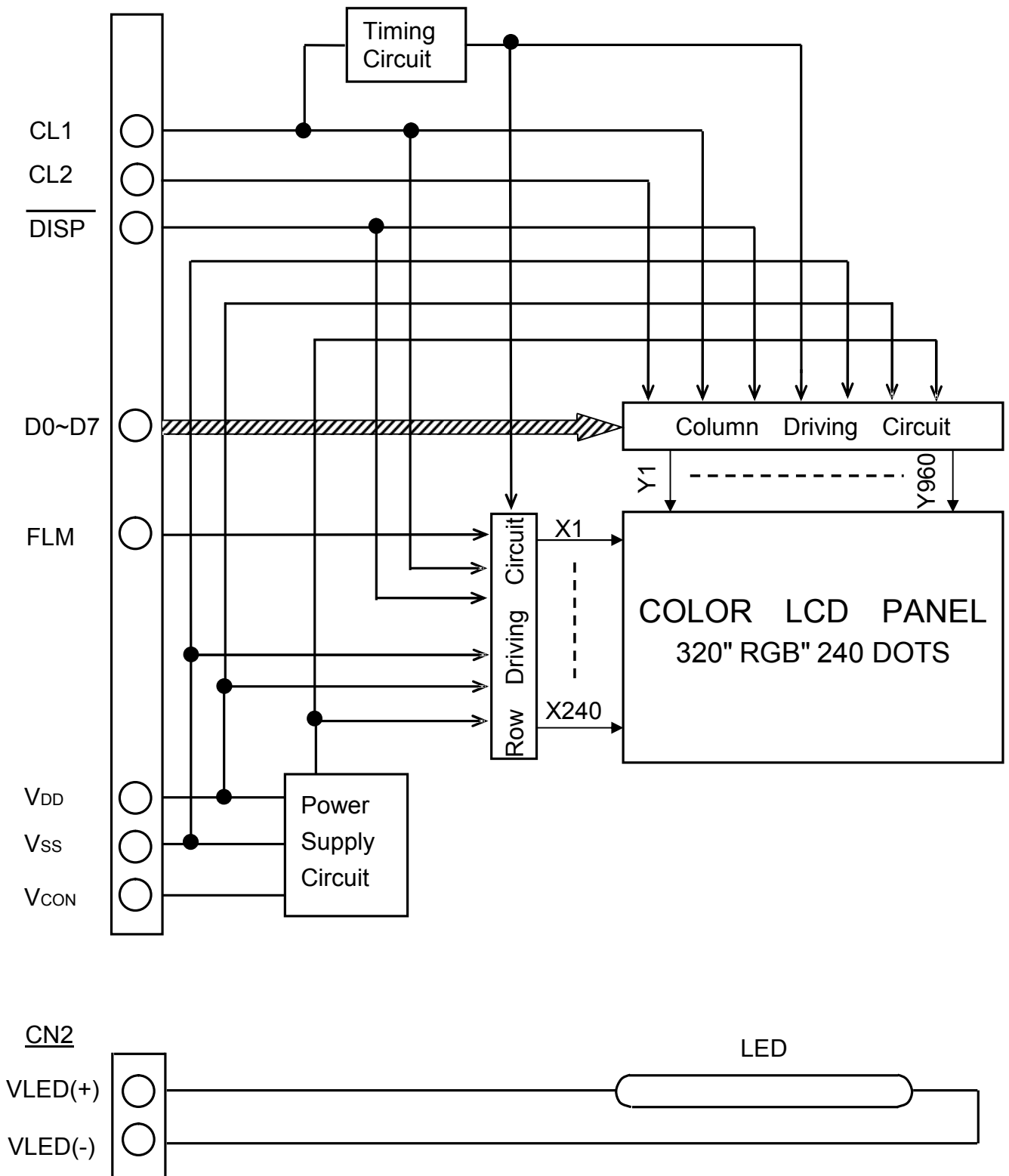
Pin No.	Signal	Pin Function
1	FLM	First Line Marker
2	CL1	Input data latch signal (LOAD)
3	CL2	Data shift clock (CP)
4	<u>DISP OFF</u>	Display control signal H:ON L:OFF
5	VDD	Power supply for Logic
6	VSS	GND
7	VCON	Contrast adjust
8	D0	Display data
9	D1	Display data
10	D2	Display data
11	D3	Display data
12	D4	Display data
13	D5	Display data
14	D6	Display data
15	D7	Display data
16	VSS	GND

CN2 M63-M83-04 (MITSUMI)

Pin No.	Signal	Function
1	LED(+)	Power supply voltage for LED
2	LED(-)	LED GND

Pin No.	Signal	Function
1	LED(+)	Power supply voltage for LED
2	-	-----
3	-	-----
4	LED(-)	LED GND

# Block Diagram



Power supply for Logic	$V_{DD}-V_{SS}$	-0.3	7.0	V
Contrast Adjustment Voltage	$V_{CON}-V_{SS}$	0	$V_{DD}$	V
Input voltage (Note 1)	$V_i$	-0.3	$V_{DD}+0.3$	V

Note 1. FLM,CL1,CL2,DISP,D0~D7.

Note 2.  $T_a=25!C$

Note 3. Make certain you are grounded when handling LCM.

### Environmental Absolute Maximum Ratings

Item	Operating		Storage		Remark
	MIN.	MAX.	MIN.	MAX.	
Ambient Temperature	0!C	50!C	-20!C	60!C	Note1,2,3
Humidity	Note 4		Note 4		No Condensation
Vibration	-	2.45m/s	-	11.76 m/s Note 5	1h max Note 6
Shock	-	29.4m/s	-	490 m/s Note 5	XYZ directions 11ms

Note 1.  $T_a$  at -20!C -----<48hours, at 60!C -----<120 hours.

Note 2. Background color changes slightly depending on ambient temperature.  
The phenomenon is reversible.

Note 3.  $T_a \leq 40!C$  : 85%RH MAX.

$T_a > 40!C$  : Absolute humidity must be lower than the humidity of 85% RH at 40!C.

Note 4. The module should be operated normally after the test is finished.

Note 5. 5Hz ~ 100Hz (Except resonance frequency).

# Electrical Characteristics

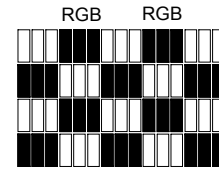
## Electrical Characteristics of LCD

Item	Symbol	Condition	MIN.	Typ.	Max.	Unit
Power Supply for Logic	V <sub>DD</sub>	V <sub>DD</sub> -V <sub>SS</sub>	3.15	3.3	5.5	V
Input Signal Voltage Note (2)	V <sub>IH</sub>	#1\$Level	0.8V <sub>DD</sub>	!	V <sub>DD</sub>	V
	V <sub>IL</sub>	#L\$Level	0	!	0.2V <sub>DD</sub>	
Power supply current Note (4)	I <sub>DD</sub>	V <sub>DD</sub> =3.3V	!	95	160	mA
Input Leak Current	I <sub>con</sub> Note(5)	V <sub>CON</sub> =0.8~2.8V	!	0.5	1.0	mA
	I <sub>IN</sub> Note(2)	V <sub>IN</sub> =V <sub>DD</sub> or V <sub>SS</sub>	!	!	+/- 1.0	μA
Contrast Adjustment Voltage Note (1) Note (6)	V <sub>con</sub>	Ta=0!C, φ=0°	0.3	!	!	V
		Ta=25!C, φ=0°	1.3	1.8	2.3	
		Ta=40!C, φ=0°	!	!	3.3	
Frame Frequency Note (7)	f <sub>FLM</sub>	!	130	150	170	Hz

Note (1) In proportion as the V<sub>CON</sub> voltage decrease the brightness will increase.

Note (2) FLM,CL1,CL2,DISPOFF,D0~D7.

Note (3) f<sub>FLM</sub>=150Hz,Ta=25!C,Display pattern is Black/White cross pattern as below.



Note (4) At all Q pattern.

Note (5) V<sub>CON</sub>

Note (6) Recommended Contrast Adjustment Voltage fluctuates about " 0.5V by each module.

Note (7) Need to make sure of flickering and rippling of display when setting the Frame Frequency in your set.

## Electrical Characteristics of Backlight

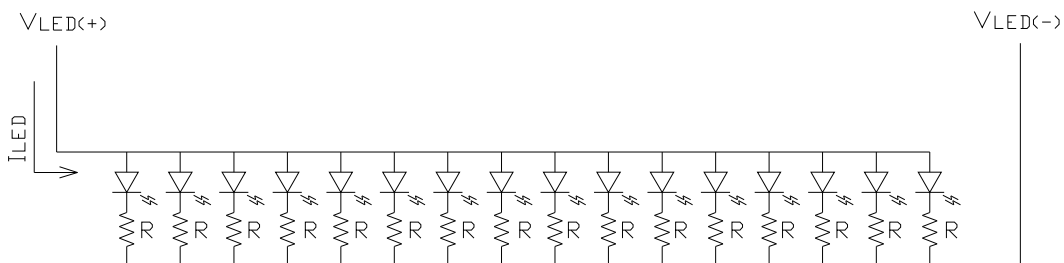
Item	Symbol	Min.	Typ.	Max.	Unit	Condition
Voltage	V <sub>LED</sub>	(4.2)	(4.3)	(4.4)	V	Note 1
Current	I <sub>LED</sub>	-	288.0	-	mA	Note 2
Number of LED	-	-	16	-	EA	-
Power Consumption	-	-	1.24	-	W	Note 3

Note (1): V<sub>LED</sub> = V<sub>LED</sub>(+) %V<sub>LED</sub>(-).

Note (2): The current of LED is 18 mA for each one.

LED driving in constant current mode is recommended .

Note (3): LED power consumption is around 0.0775W for each one.



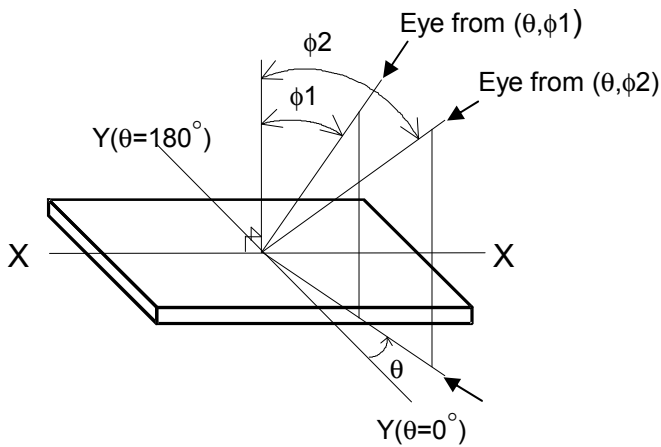
# Optical Characteristics

## Optical Characteristics of LCD

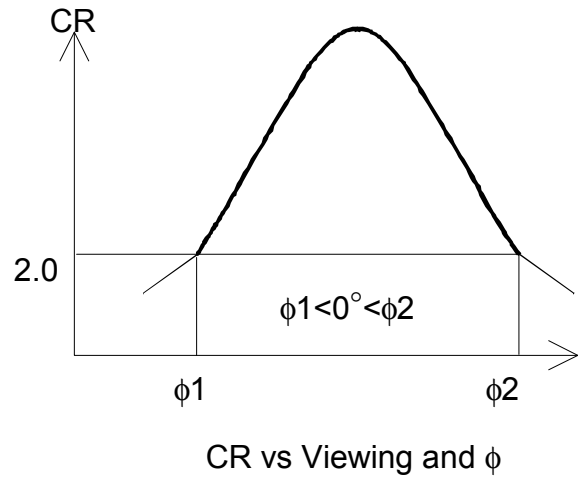
Ta= 25!C.(Backlight On)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark	
Viewing Angle Range	$\phi 1, \phi 2$	$\theta=0^\circ$ K&2	-	(40)	-	Deg.	Note 1,2	
Contrast Ratio	K	$\theta=0^\circ, \phi=0^\circ$	20	40	-	-	Note 2	
Response Time	Rise	$\theta=0^\circ, \phi=0^\circ$	-	(250)	-	ms	Note 2	
	Fall	$\theta=0^\circ, \phi=0^\circ$	-	(200)	-	ms		
Color Tone (CIE Coordinate)	R	x	$\theta=0^\circ, \phi=0^\circ$	(0.44)	(0.49)	(0.54)	-	-
		y		(0.26)	(0.31)	(0.36)	-	-
	G	x		(0.26)	(0.31)	(0.36)	-	-
		y		(0.49)	(0.54)	(0.59)	-	-
	B	x		(0.10)	(0.15)	(0.20)	-	-
		y		(0.07)	(0.12)	(0.17)	-	-
	W	x		(0.22)	(0.27)	(0.32)	-	-
		y		(0.27)	(0.32)	(0.37)	-	-

**Note 1. Definition of  $\theta$  and  $\phi$**



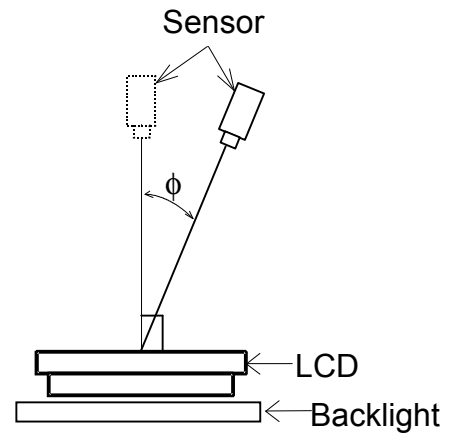
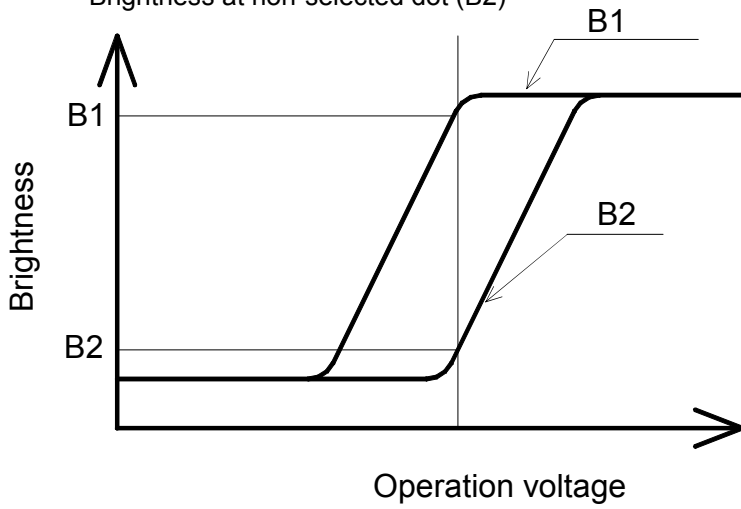
**Note 2. Definition of Viewing angle  $\phi 1$  and  $\phi 2$**





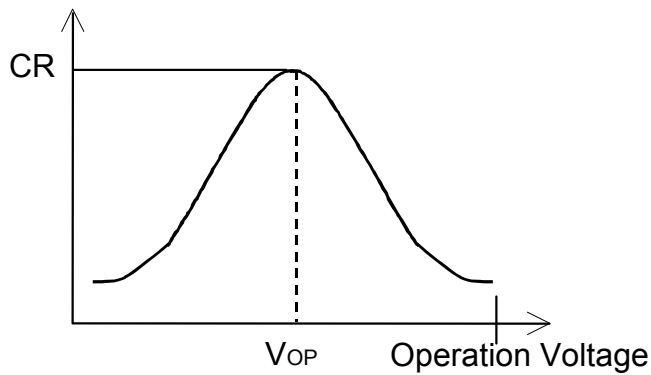
**Definition of Contrast Ratio CR!**

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

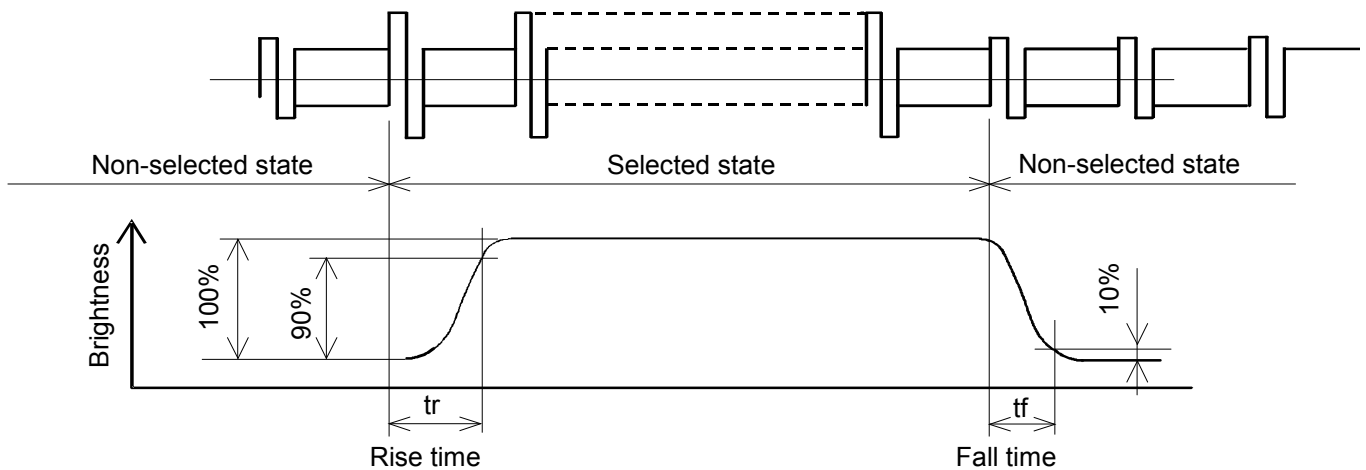


Sensor : BM-7  
Aperture : 1!  
Distance : 50 cm

**Note 4. Definition of CR! and V<sub>OP</sub>!**



**Note 5. Definition of optical response time**



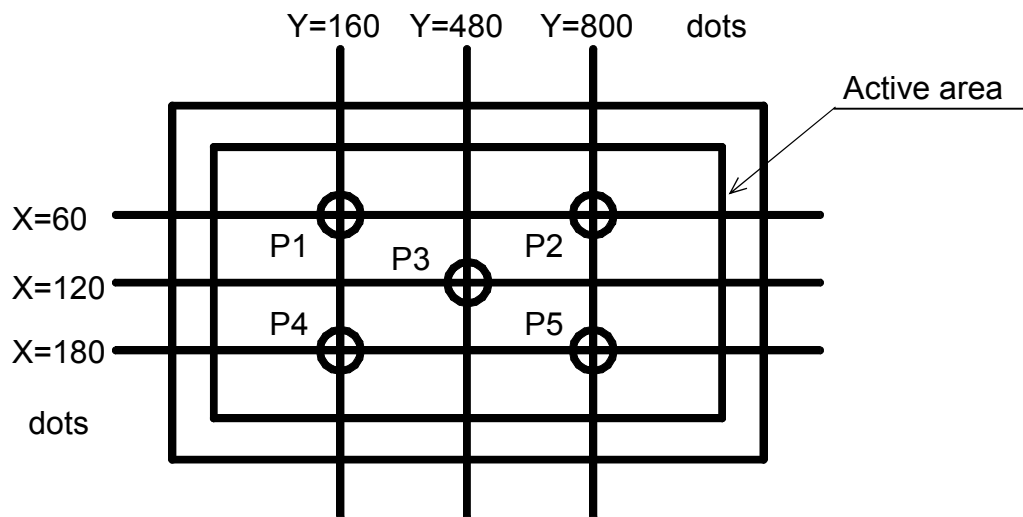
## Optical Characteristics of Backlight

Item	Min.	Typ.	Max.	Unit	Remark
Brightness	100	150	-	cd/m <sup>2</sup>	Note 1,2,3
Brightness Uniformity	-	-	' 30	%	Note 2,3,4

Note 1. Measurement Condition:

- Display data should be all #ON\$(D0~D7=HIGH).
- VDD=5.0V, VLED=4.3V, ILED=288mA, VCON should be adjusted at the voltage where the peak contrast is obtained by naked eyes as the #All Q\$ pattern.

Note 2. Measurement of the following 5 points on the display.



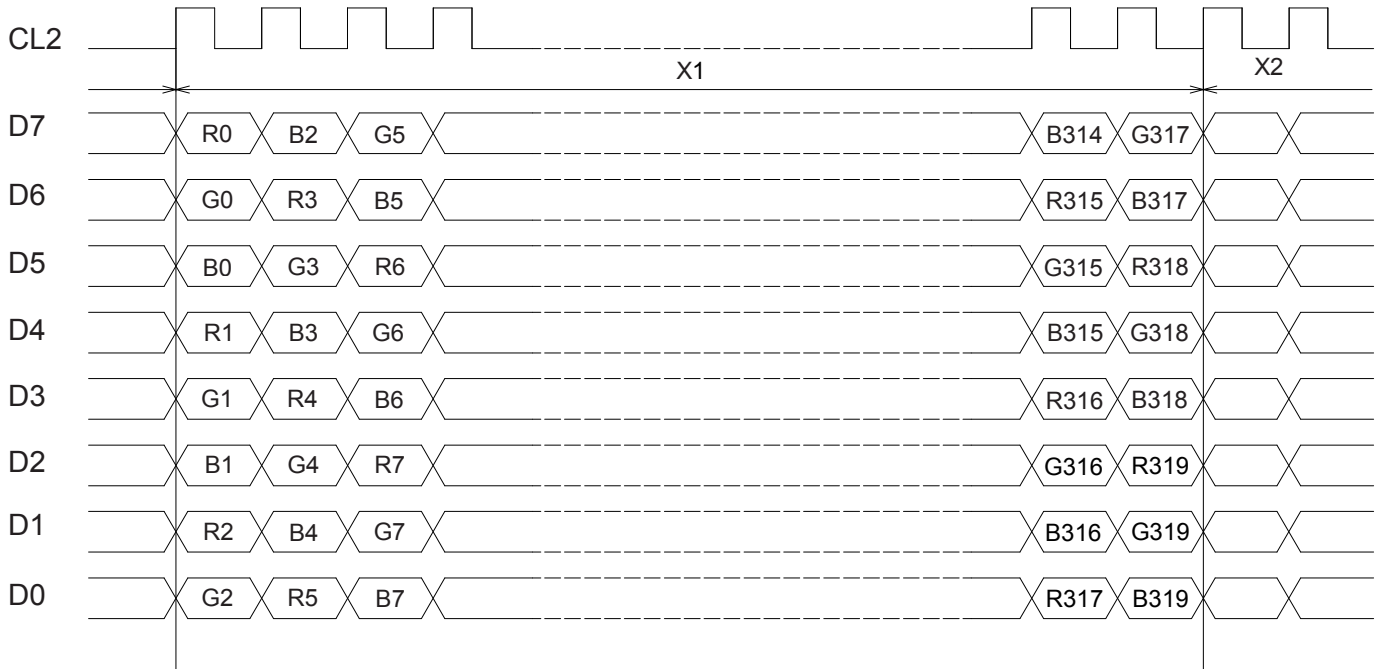
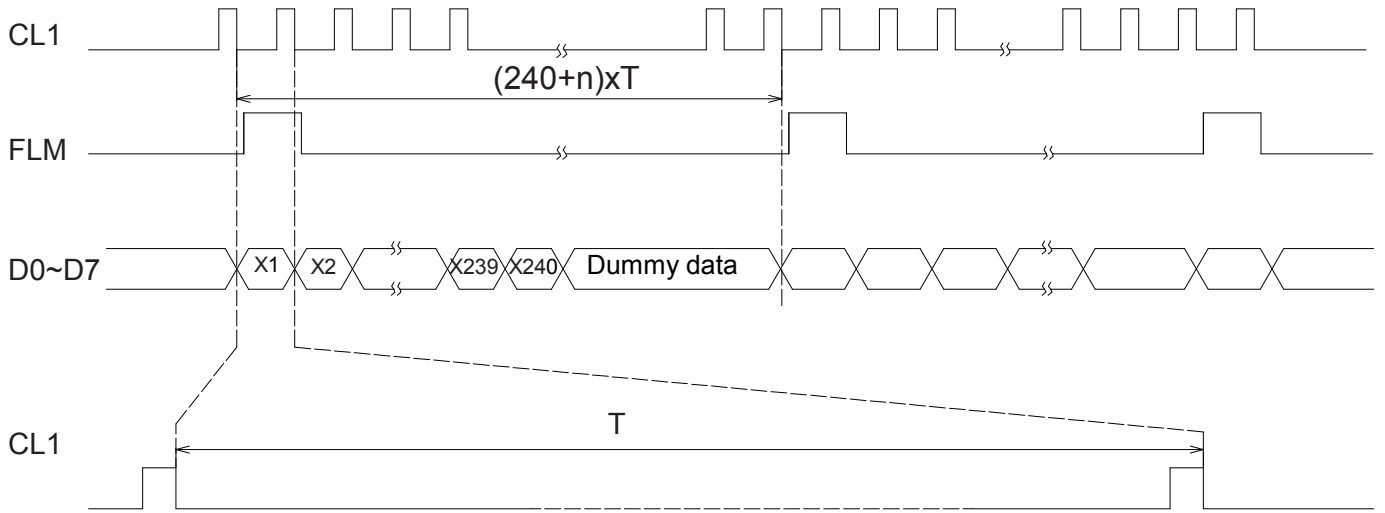
Note3. The brightness shall be the average of P1~P5 point.

Note 4. Definition of the brightness Uniformity

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

# Interface Timing Chart

## Timing Chart



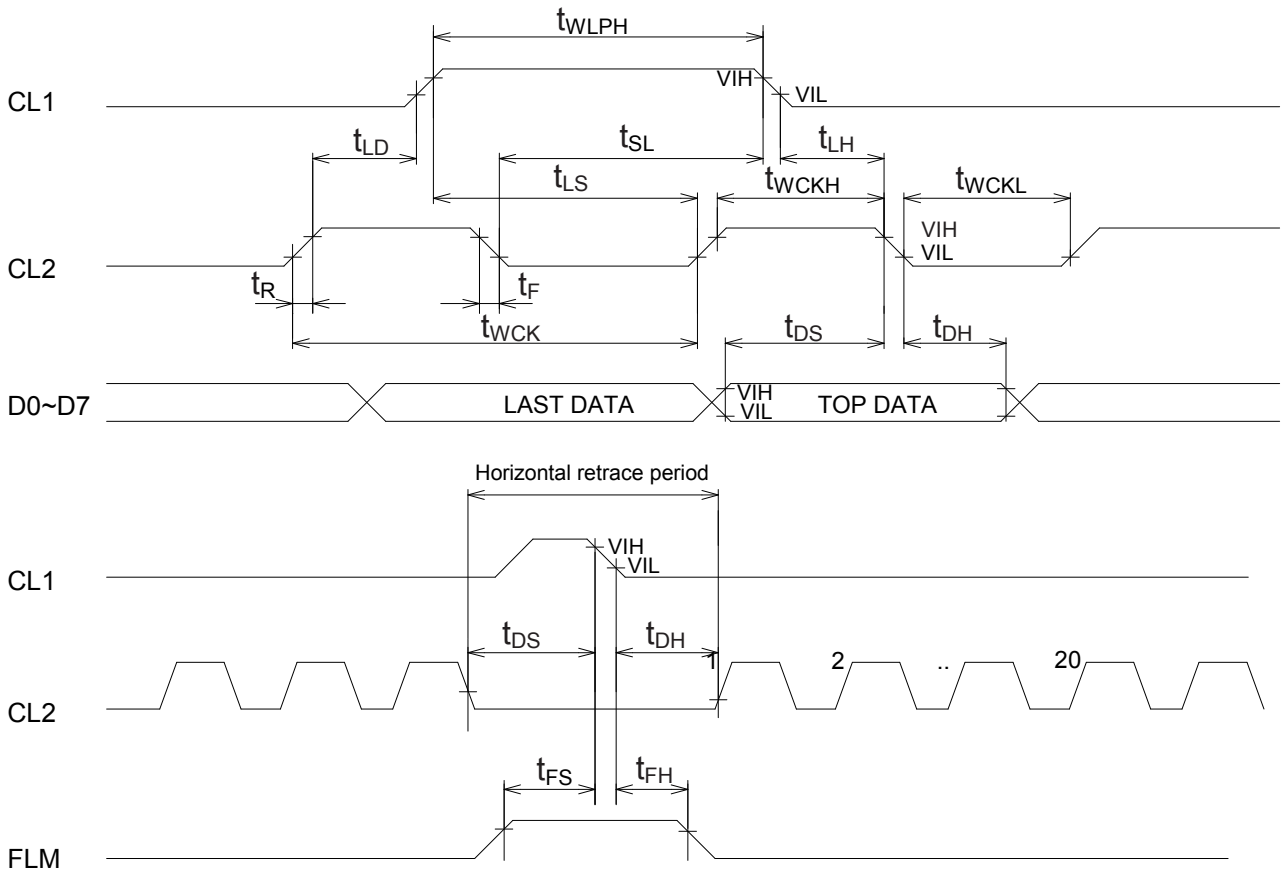
# Electrical Characteristics

(MODE1)

( $V_{DD}=3.0\sim 4.5V$ ,  $V_0=+10.0\sim +42.0V$ ,  $T_a=+0!C\sim 50!C$ )

Item	Symbol	Min.	Typ.	Max.	Unit
Shift clock period	$t_{WCK}$	66	-	-	ns
Shift clock #H\$ pulse wide	$t_{WCKH}$	23	-	-	ns
Shift clock #L\$ pulse wide	$t_{WCKL}$	23	-	-	ns
Data setup time	$t_{DS}$	10	-	-	ns
Data hold time	$t_{DH}$	25	-	-	ns
Latch pulse #H\$ pulse wide	$t_{WLPH}$	30	-	-	ns
Shift clock rise to latch pulse rise time	$t_{LD}$	10	-	-	ns
Shift clock fall to latch pulse fall time	$t_{SL}$	30	-	-	ns
Latch pulse rise to shift clock rise time	$t_{LS}$	30	-	-	ns
Latch pulse fall to shift clock fall time	$t_{LH}$	30	-	-	ns
Enable setup time	$t_{TS}$	12	-	-	ns
Input signal rise time	$t_R$	-	-	50	ns
Input signal fall time	$t_F$	-	-	50	ns
Output delay time	$t_D$	-	-	44	ns
FLM setup time	$t_{FS}$	30	-	-	ns
FLM hold time	$t_{FH}$	50	-	-	ns

Note 1:  $(t_{WCK} - t_{WCKH} - t_{WCKL})/2$  is maximum in the case of high speed operation



(MODE2)

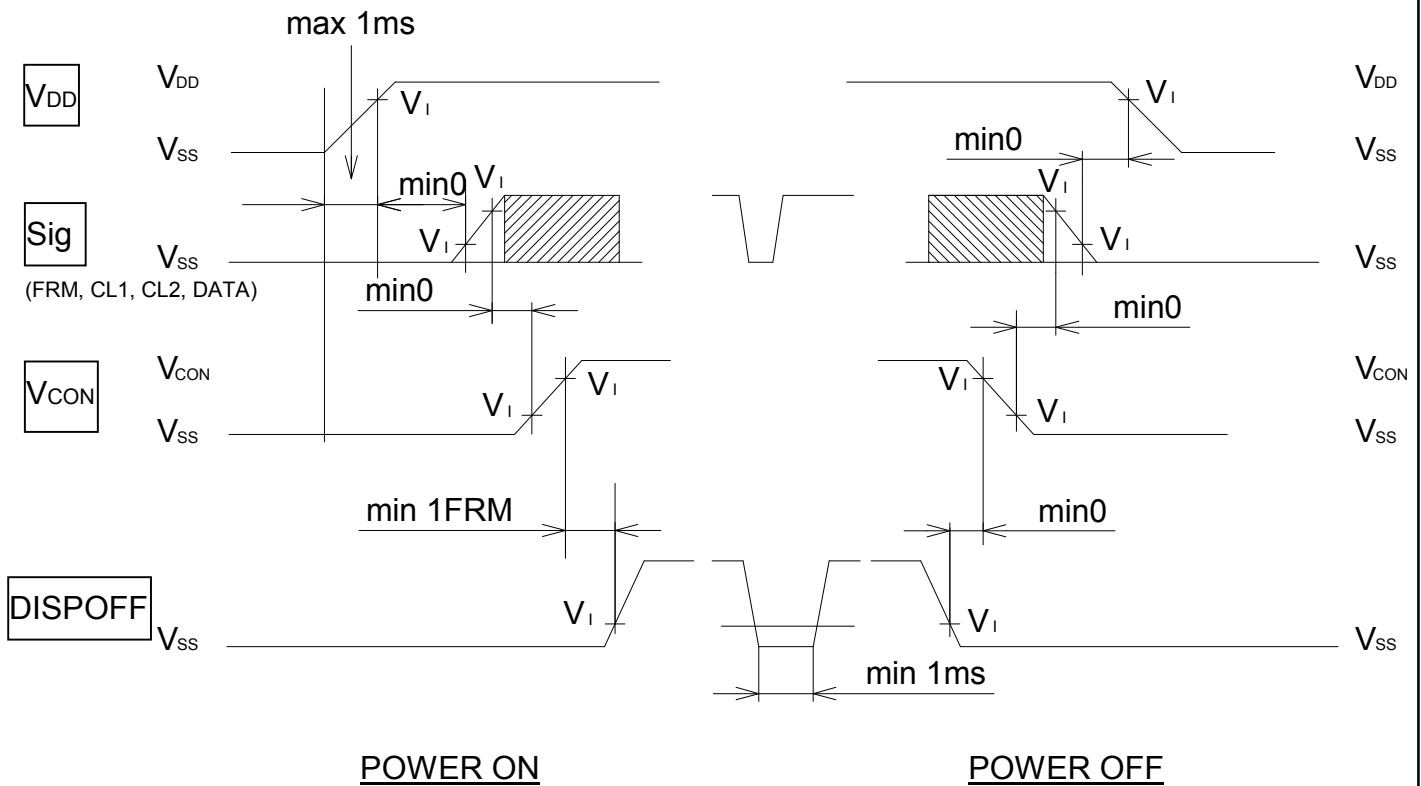
( $V_{DD}=4.5\sim 5.5V$ ,  $V_0=+10.0\sim +42.0V$ ,  $T_a=+0!C\sim 50!C$ )

Item	Symbol	Min.	Typ.	Max.	Unit
Shift clock period	$t_{WCK}$	40	-	-	ns
Shift clock #H\$ pulse wide	$t_{WCKH}$	12	-	-	ns
Shift clock #L\$ pulse wide	$t_{WCKL}$	14	-	-	ns
Data setup time	$t_{DS}$	5	-	-	ns
Data hold time	$t_{DH}$	15	-	-	ns
Latch pulse #H\$ pulse wide	$t_{WLPH}$	15	-	-	ns
Shift clock rise to latch pulse rise time	$t_{LD}$	5	-	-	ns
Shift clock fall to latch pulse fall time	$t_{SL}$	25	-	-	ns
Latch pulse rise to shift clock rise time	$t_{LS}$	25	-	-	ns
Latch pulse fall to shift clock fall time	$t_{LH}$	25	-	-	ns
Enable setup time	$t_{TS}$	5	-	-	ns
Input signal rise time (Note 1)	$t_R$	-	-	50	ns
Input signal fall time (Note 1)	$t_F$	-	-	50	ns
Output delay time	$t_D$	-	-	28	ns
FLM setup time	$t_{FS}$	30	-	-	ns
FLM hold time	$t_{FH}$	50	-	-	ns

Note 1:  $(t_{WCK} - t_{WCKH} - t_{WCKL})/2$  is maximum in the case of high speed operation

## Power Supply and Signal Sequence

Do not apply DC voltage to the LCD panel because that induces the electrochemical reaction and reduces its life time. Please follow the power supply ON/OFF sequence to prevent DC driving of LCD or latch-up of COMS LSI, as shown below.



- Note 1. Please keep the specified sequence because wrong sequence may cause permanent damage to the LCD panel.
- Note 2. Please use DISPOFF function. Switching by other than the DISPOFF function may cause display deterioration.
- Note 3. V<sub>CON</sub> voltage should be set up to adjusted voltage before DISPOFF signal arises. Otherwise, when DISPOFF signal arises, adjusted contrast image may not be generated.
- Note 4. Please keep the specified sequence of DISPOFF signal because if the signal is short enough, LCD panel may not be restarted. (min. 1ms)

### Input Data Allocation Table

Data Signal	D 7	D 6	D 5	D 4	D 3	D 2	D 1	D 0	D 7	D 6	D 5	D 4		D 4	D 3	D 2	D 1	D 0
Y 1	2	3	4	5	6	7	8	9	10	11	12	-----	9 5 6	9 5 7	9 5 8	9 5 9	9 5 0	
X 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
6	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
7	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
8	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
9	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
10	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
238	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
239	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
240	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B

R : RED  
 G : GREEN  
 B : BLUE