AZ DISPLAYS, INC.

COMPLETE LCD SOLUTIONS

SPECIFICATIONS FOR
LIQUID CRYSTAL DISPLAY

PART NUMBER: **AGM3224I SERIES**

DATE: **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	•Color-STN (Negative & transmissive type) • with Anti glare upper polarizer .	-
(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

Outline Dimension

320X3(RGB)X240 DOTS

VIEWING DIRECTION

167.0±0.5
160.0±0.5
2−152.0±0.3
152.0±0.5
122.0±0.3 (BEZEL)
120.0±0.2 (LCD V.A)
P0.12x320x(RGB)-0.02=115.18 (LCD AA)
82.0±0.5

4−4.0±0.3
4−3.3±0.3
(50.5)

CN2 4 1
M63-M83-04 (MITSUMI)
(200.0)
Black
Red

4−∅3.5

(33.75)

CN1 16
1
4.0±1.0
6.0±1.0
(200.0)
P1.0X15±15.0
17.0±0.1

0.12
0.02
B B
G G
R R
0.1
0.34 0.02
0.36

25.0±0.3
1.0±0.2
(28.41)

4−6.0

(11.31)
1.0±0.2
8.5±0.3
4.0±0.3

P0.36X240−0.02=86.38 (LCD AA)
90.0±0.2 (LCD V.A)
92.0±0.3 (BEZEL)
2−101.0±0.3
109.0±0.5

4−6.8

7.0±0.5
0.5±0.2
8.5±0.5

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	$\overline{\text{DISP OFF}}$	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

CL1

CL2

$\overline{\text{DISP}}$

D0~D7

FLM

Timing Circuit

Column Driving Circuit

Y1

Y960

Row Driving Circuit

X1

X240

COLOR LCD PANEL
320" RGB" 240 DOTS

V_{DD}

V_{SS}

V_{CON}

Power Supply Circuit

CN2

VLED(+)

VLED(-)

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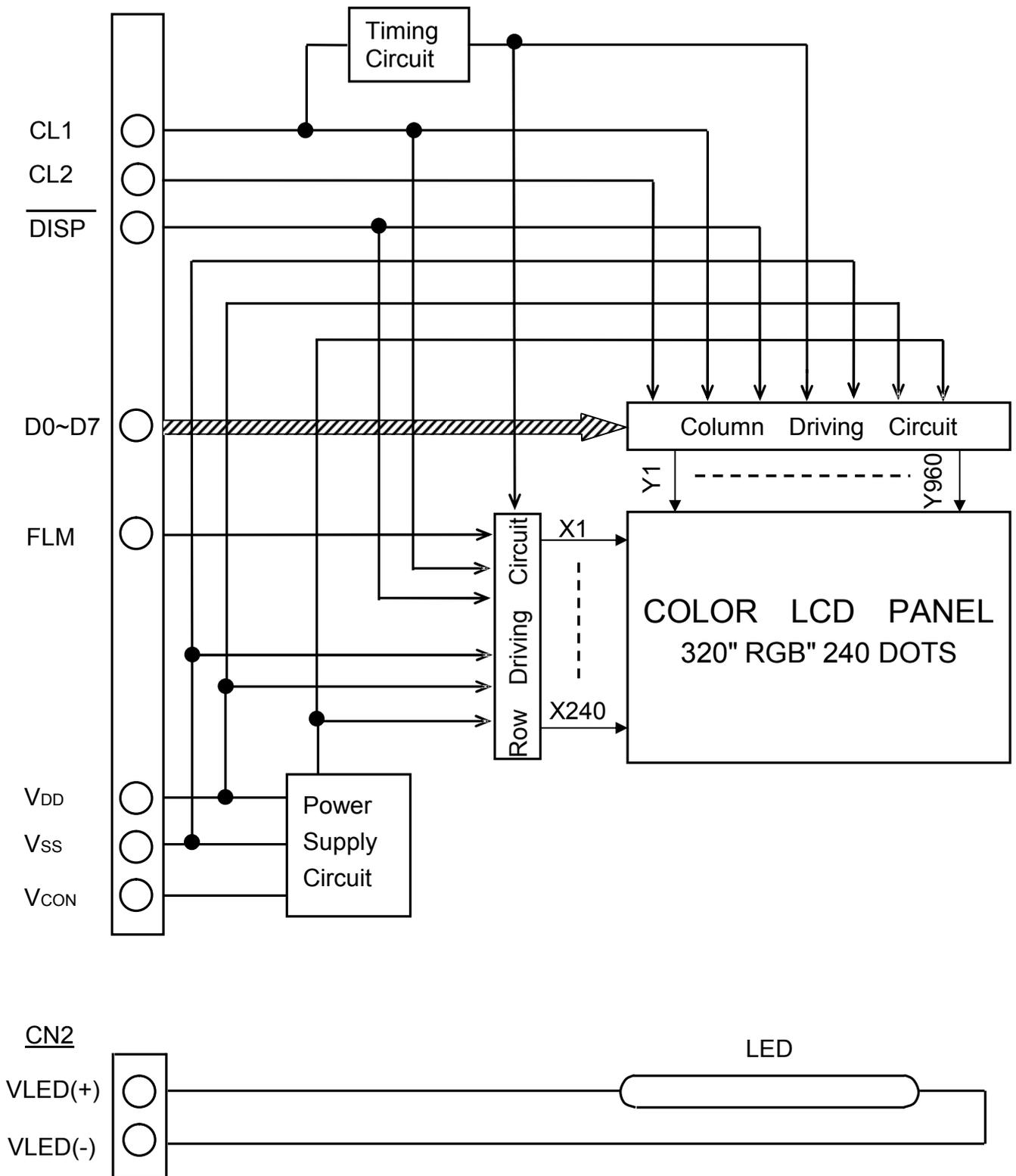
Power supply for Logic	$V_{DD}-V_{SS}$	-0.3	7.0	V
Contrast Adjustment Voltage	$V_{CON}-V_{SS}$	0	V_{DD}	V
Input voltage (Note 1)	Vi	-0.3	$V_{DD}+0.3$	V

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

Note 2. Ta=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. Ta 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. Ta<=40!C : 85%RH MAX.
Ta> 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).
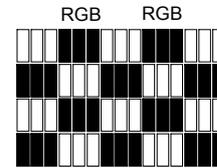
Electrical Characteristics

Electrical Characteristics of LCD

Item	Symbol	Condition	MIN.	Typ.	Max.	Unit
Power Supply for Logic	V_{DD}	V_{DD}-V_{SS}	3.15	3.3	5.5	V
Input Signal Voltage Note (2)	V_{IH}	#H$Level	$0.8V_{DD}$	!	V_{DD}	V
	V_{IL}	#L$Level	0	!	$0.2V_{DD}$	
Power supply current Note (4)	I_{DD}	V_{DD}=3.3V	!	95	160	mA
Input Leak Current	I_{con} Note(5)	V_{CON}=0.8~2.8V	!	0.5	1.0	mA
	I_{IN} Note(2)	V_{IN}=V_{DD} or V_{SS}	!	!	+/- 1.0	μA
Contrast Adjustment Voltage Note (1) Note (6)	Vcon	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)	fFLM	!	130	150	170	Hz

Note (1) In proportion as the V_{CON} voltage decrease the brightness will increase.
Note (2) FLM,CL1,CL2,DISPOFF,D0~D7.
Note (3) fFLM=150Hz,Ta=25!C,Display pattern is Black/White
    cross pattern as below.
Note (4) At all Q pattern.
Note (5) V_{CON}
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	VLED	(4.2)	(4.3)	(4.4)	V	Note 1
Current	ILED	-	288.0	-	mA	Note 2
Number of LED	-	-	16	-	EA	-
Power Consumption	-	-	1.24	-	W	Note 3

Note (1): VLED = VLED(+) %VLED(-) .
Note (2): The current of LED is 18 mA for each one.
    LED driving in constant current mode is recommended .
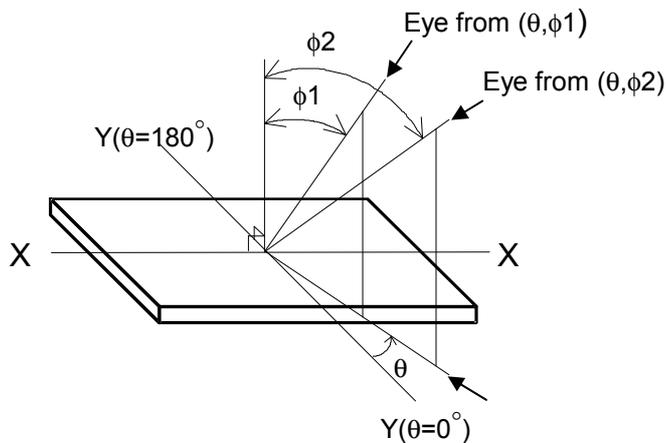Note (3): LED power consumption is around 0.0775W for each one.
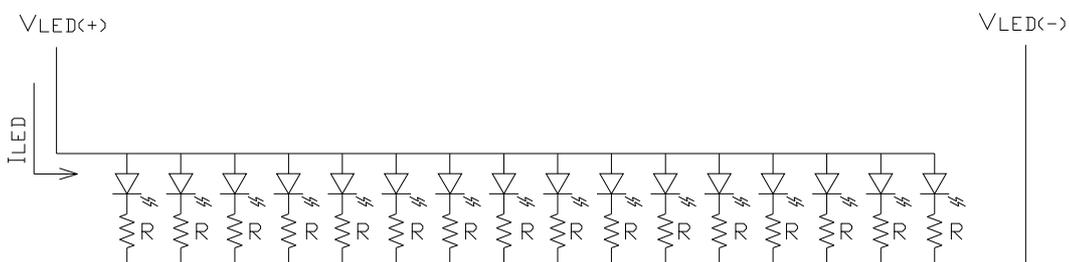
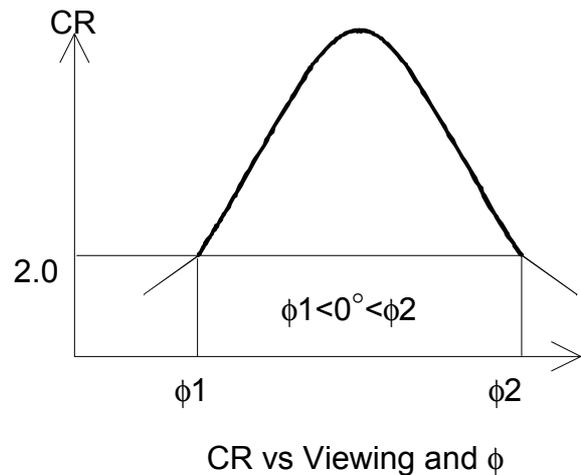# Optical Characteristics

Optical Characteristics of LCD   Ta= 25!C.(Backlight On)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle Range		φ1, φ2	θ=0°K&2	-	(40)	-	Deg.	Note 1,2
Contrast Ratio		K	θ=0° φ=0°	20	40	-	-	Note 2
Response Time	Rise	tr	θ=0°,φ=0°	-	(250)	-	ms	Note 2
	Fall	tf	θ=0°,φ=0°	-	(200)	-	ms	
Color Tone (CIE Coordinate)	R	x	θ=0°,φ=0°	(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 q and f   **Note 2.   Definition of Viewing angle f 1 and f 2**

Eye from $(θ,φ1)$
Eye from $(θ,φ2)$
$Y(θ=180°)$
X — X
θ
$Y(θ=0°)$

CR
2.0
$φ1<0°<φ2$
φ1   φ2
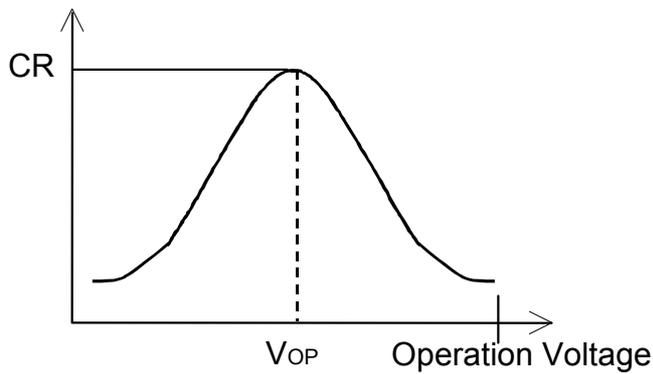
CR vs Viewing and φ

Definition of Contrast Ratio CR!

$$CR = \frac{\text{Brightness at selected dot (B1)}}{\text{Brightness at non-selected dot (B2)}}$$
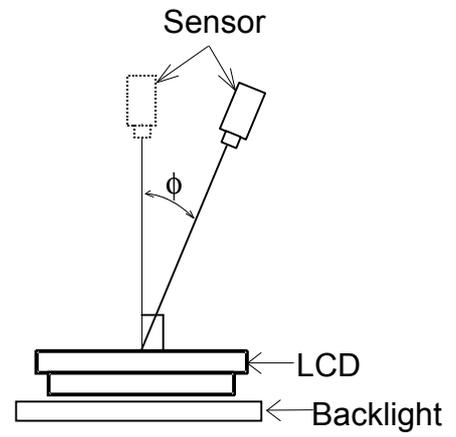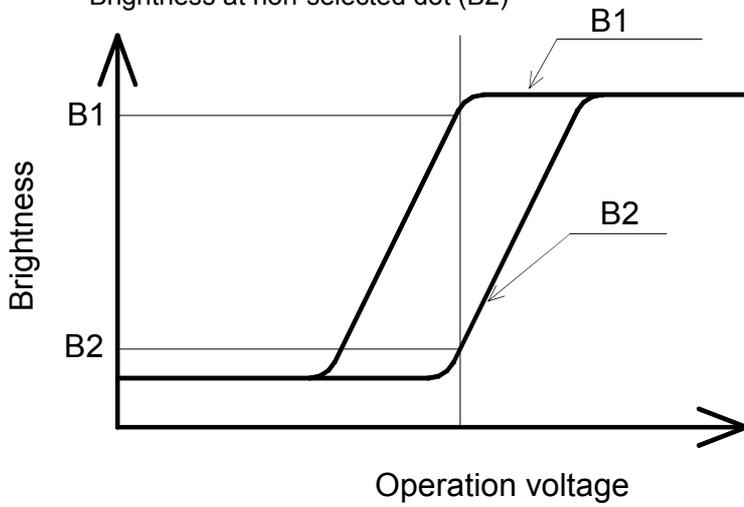
Sensor
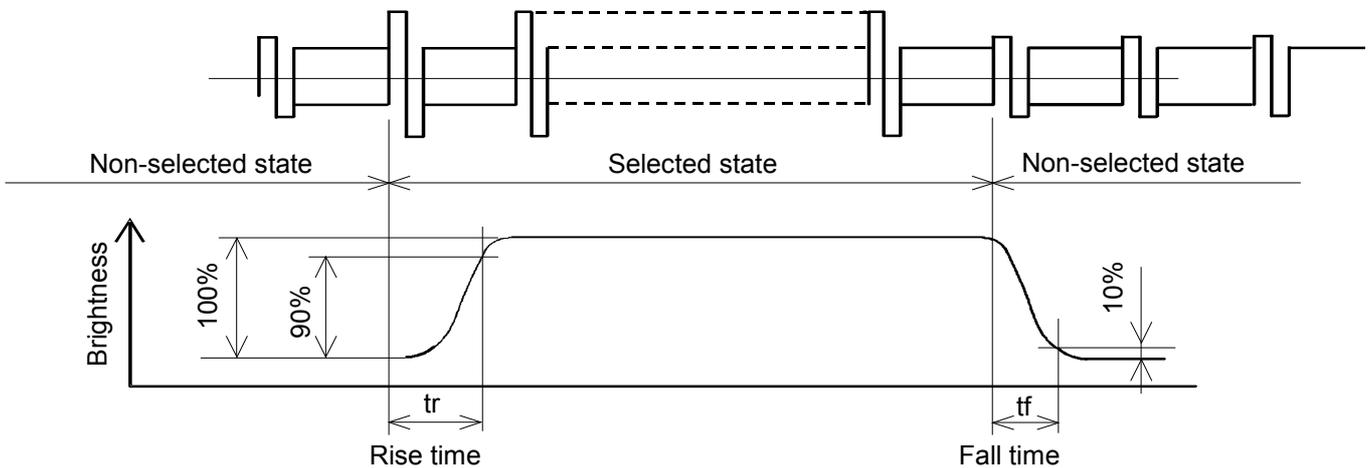
Sensor : BM-7
Aperture : 1!
Distance : 50 cm

LCD
Backlight

Note 4. Definition of CR! and V$_{OP}$!

Note 5. Definition of optical response time

Non-selected state   Selected state   Non-selected state

Brightness

100%

90%

10%

tr
Rise time

tf
Fall time

Optical Characteristics of Backlight

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

Note 1. Measurement Condition:
- Display data should be all #ON$(D0~D7=HIGH).
- VDD=5.0V, VLED=4.3V, ILED=288mA,V_{CON} should be adjusted at the voltage where the peak contrast is obtained by naked eyes as the #All Q$pattern.

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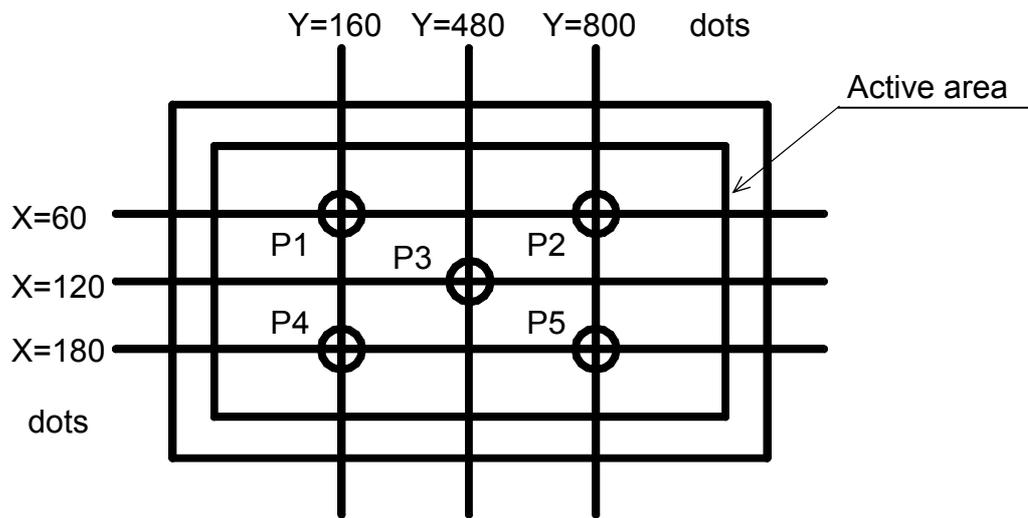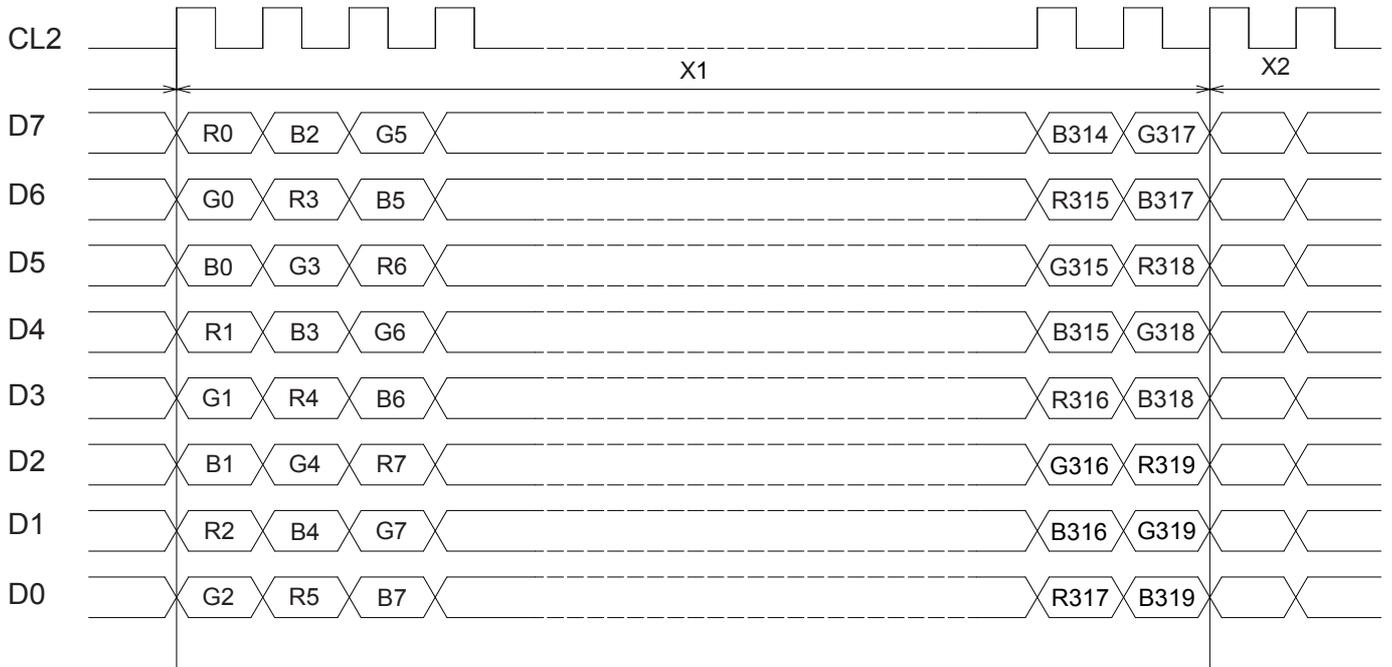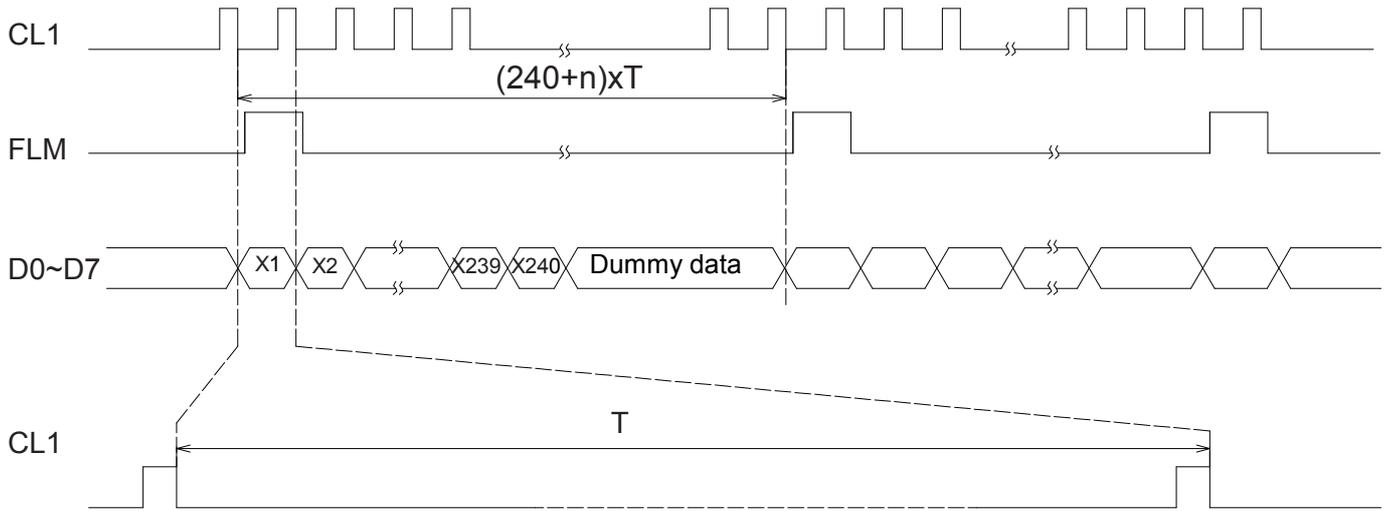

Note3. The brightness shall be the average of P1~P5 point.

Note 4. Definition of the brightness Uniformity

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

Interface Timing Chart

Timing   Chart

CL1

(240+n)xT

FLM

D0~D7 | X1 | X2 | X239 | X240 | Dummy data

CL1

T

CL2

X1

X2

|			
D7	R0	B2	G5	...	B314	G317
D6	G0	R3	B5	...	R315	B317
D5	B0	G3	R6	...	G315	R318
D4	R1	B3	G6	...	B315	G318
D3	G1	R4	B6	...	R316	B318
D2	B1	G4	R7	...	G316	R319
D1	R2	B4	G7	...	B316	G319
D0	G2	R5	B7	...	R317	B319

Electrical Characteristics

(MODE1) $(V_{DD}=3.0\sim4.5V$, $V_0=+10.0\sim+42.0V$, Ta=+0!C~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
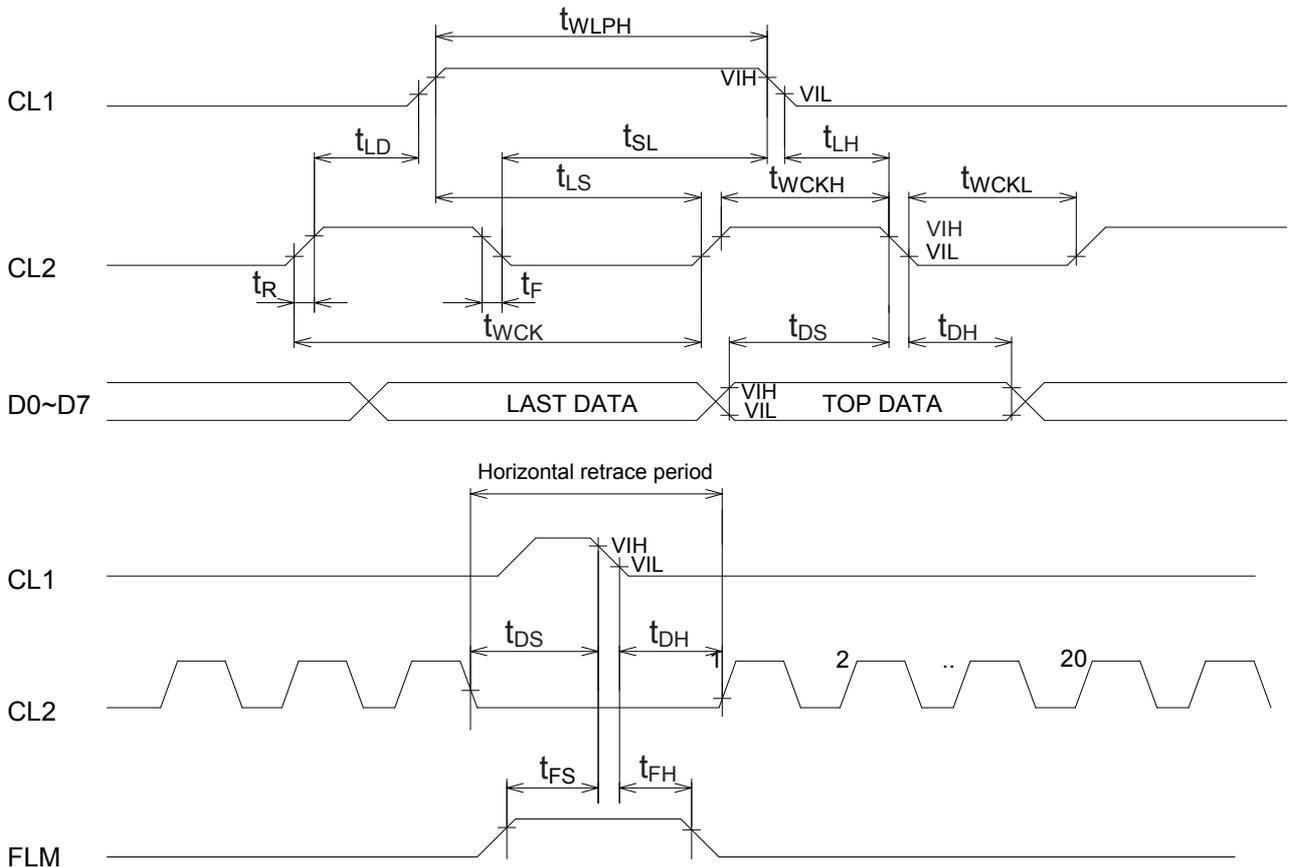
(MODE2)   (V_{DD}=4.5~5.5V , V_0= +10.0~ +42.0V, Ta=+0!C~50!C)

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.

POWER ON   POWER OFF
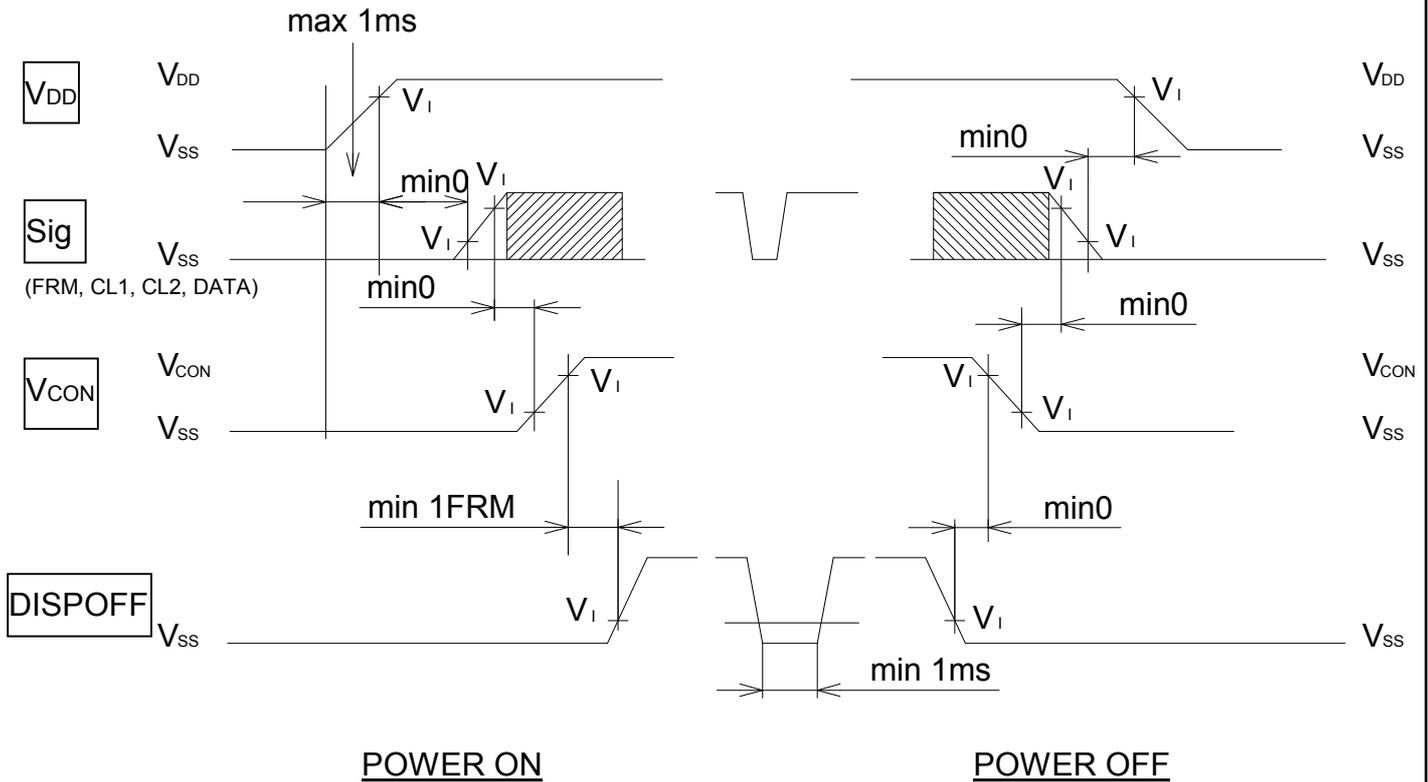
Note 1. Please keep the specified sequence because wrong sequence may cause permanent damage to the LCD panel.

Note 2. Please use $\overline{DISPOFF}$ function. Switching by other than the $\overline{DISPOFF}$ function may cause display deterioration.

Note 3. V_{CON} voltage should be set up to adjusted voltage before $\overline{DISPOFF}$ signal arises. Otherwise, when $\overline{DISPOFF}$ signal arises, adjusted contrast image may not be generated.

Note 4. Please keep the specified sequence of $\overline{DISPOFF}$ signal because if the signal is short enough, LCD panel may not be restarted. (min. 1ms)

Input Data Allocation Table

Data Signal	D7	D6	D5	D4	D3	D2	D1	D0	D7	D6	D5	D4		D4	D3	D2	D1	D0
X ＼ Y	1	2	3	4	5	6	7	8	9	10	11	12	-------	956	957	958	959	960
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