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## LCD MODULE SPECIFICATION FOR CUSTOMER'S APPROVAL

CUSTOMER : Standard

MODULE TYPE : MTG-F24160XFWNSEB

APPROVED BY: (FOR CUSTOMER USE ONLY)

Approved By	Checked By	Prepared By	MT File No	Date Issued

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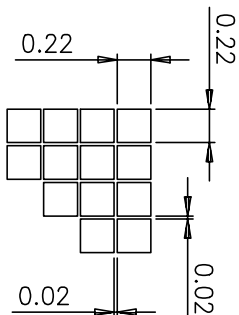
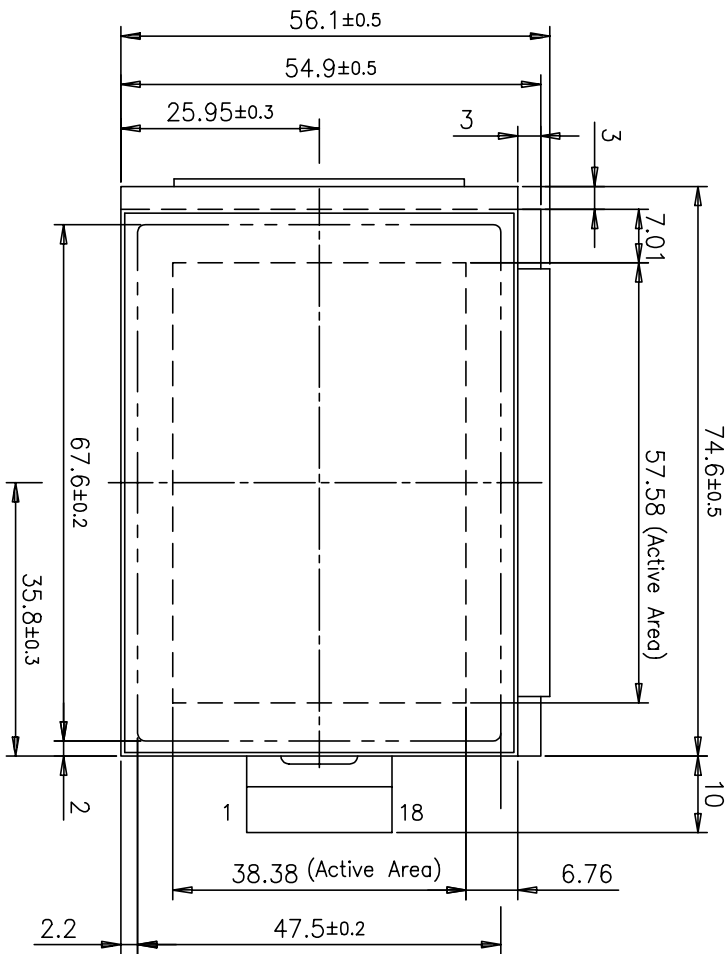
**SPECIFICATION FOR**  
**LIQUID CRYSTAL DISPLAY MODULE**  
**MODEL NO. : MTG-F24160XFWNSEB**

View Direction	<input checked="" type="checkbox"/> 6 O'clock		<input type="checkbox"/> 12 O'clock	
LCD Type	<input checked="" type="checkbox"/> FSTN Positive		<input type="checkbox"/> FSTN Negative	
	<input type="checkbox"/> STN Gray	<input type="checkbox"/> STN Yellow Green	<input type="checkbox"/> STN Blue	
Rear Polarizer	<input type="checkbox"/> Reflective	<input checked="" type="checkbox"/> Transflective		<input type="checkbox"/> Transmissive
Backlight Type	<input type="checkbox"/> LED	<input type="checkbox"/> Internal Power	<input checked="" type="checkbox"/> EL	<input type="checkbox"/> 5V input
		<input type="checkbox"/> External Power	<input type="checkbox"/> CCFL	<input type="checkbox"/> 12V input
Backlight Color	<input type="checkbox"/> White	<input type="checkbox"/> Amber	<input checked="" type="checkbox"/> Blue Green	<input type="checkbox"/> Yellow Green
Temperature Range	<input checked="" type="checkbox"/> Normal		<input type="checkbox"/> Wide	
			<input type="checkbox"/> Super Wide	
EL Driver IC	<input type="checkbox"/> Build-in		<input checked="" type="checkbox"/> Not Build-in	
Touch Screen	<input type="checkbox"/> With		<input checked="" type="checkbox"/> Without	

**TO BE VERY CAREFUL !**

The TCP package ICs are very easy to be destroyed by static charge, make sure the user is grounded when handling the LCM.

REV.	DESCRIPTION	DRAWN	CHECK	APP'D	DATE



Note: 1. Excluding the Touch Panel

2. EL Backlight

3. Lcd Driver IC: SHARP LH1560F3 + LH1562F4

PIN ASSIGNMENT									
1. V5	5. FRAME	9. DF	13. V3	17. DB0					
2. V2	6. VGND	10. D-OFF	14. DB3	18. NC					
3. VEE	7. LOAD	11. CP	15. DB2	19. NC					
4. VDD	8. VSS	12. V4	16. DB1	20. NC					

NO.	M-24160X	1	12-4-98'	---	---
PART NAME		Q'TY	DATE:	MATERIAL	FINISH
DRAWN	CHEK	APP'D	UNIT:MM	SCALE: 1/1	PRODUCT: MTG-24160X
				UNLESS OTHERWISE SPECIFIED TOLERANCE ON FRACTIONS DECIMALS ANGLES 0.10 0.5°	DWG NO.: G24160X0
					FILE: DWG\MTG240\G24160X0
					SHEET / Rev: A



Chris Luo

## GENERAL SPECIFICATION

Item	Content
Display Resolution	240(H)× 160(W)
Dimensional Outline(mm)	54.9(W)× 74.6(W)× 5.2(D) max
Display mode	Transflective Type with EL
Circuit	Common-Driver IC, Segment-driver IC
Interface	Data (D0~D3), FLM, CL1, CL2, V <sub>EE</sub> , EL Enable

## ABSOLUTE MAXIMUN RATING

### (1) Electrical Absolute Ratings

Item	Symbol	Min.	Max.	Unit	Note
Power Supply for Logic	V <sub>DD</sub> -V <sub>SS</sub>	-0.3	6.5	Volt	
Power Supply for LCD	V <sub>EE</sub> -V <sub>SS</sub>	0	40.0	Volt	
Input Voltage	V <sub>I</sub>	-0.3	V <sub>DD</sub>	Volt	
Static Electricity	-	-	-	-	Note 1

Note 1 : Operator should be grounded during handling LCM.

### (2) Environmental Absolute Maximum Ratings

Item	Normal Temperature				Wide Temperature			
	Operating		Storage		Operating		Storage	
	Max,	Min.	Max,	Min.	Max,	Min.	Max,	Min.
Ambient Temperature	0℃	+50℃	-20℃	+70℃	-20℃	+70℃	-30℃	+80℃
Humidity(without condensation)	Note 2,4		Note 3,5		Note 4,5		Note 4,6	

Note 2 Ta ≤ 50℃ : 80% RH max

Ta > 50℃ : Absolute humidity must be lower than the humidity of 85%RH at 50℃

Note 3 Ta at -20℃ will be <48hrs at 70℃ will be <120hrs when humidity is higher than 75%.

Note 4 Background color changes slightly depending on ambient temperature. This phenomenon is reversible.

Note 5 Ta ≤ 70℃ : 75RH max

Ta > 70℃ : absolute humidity must be lower than the humidity of 75%RH at 70℃

Note 6 Ta at -30℃ will be <48hrs, at 80 °C will be <120hrs when humidity is higher than 75%.

## ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ	Max.	Unit	note
Power Supply for Logic	$V_{DD}-V_{SS}$	-	2.7	3.0	5.5	Volt	
Input Voltage	$V_{IL}$	L level	$V_{SS}$	$0.2 V_{DD}$	-	Volt	
	$V_{IH}$	H level	$0.8 V_{DD}$	$V_{DD}$	-	Volt	
LCM Recommend LCD Module Driving Voltage	$V_{EE}-V_{SS}$	$T_a=0^{\circ}C$	-	-	-	Volt	
		$T_a=25^{\circ}C$	18.4	18.7	19.0		
		$T_a=50^{\circ}C$	-	-	-		
Power Supply Current for LCM	$I_{DD}$	$V_{DD}=3.3V$ $V_{EE}-V_{SS}=18.7V$ FLM=64Hz	-	0.1	-	mA	
	$I_{EE}$		-	1.3	-		

## OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ	Max.	Unit	note
Viewing angle range	$\Phi f(12\text{ o'clock})$	When $Cr \geq 2$	-	41	-	Degree	9,10
	$\Phi b(6\text{ o'clock})$		-	34	-		
	$\Phi l(9\text{ o'clock})$		-	35	-		
	$\Phi r(3\text{ o'clock})$		-	30	-		
Rise Time	$T_r$	$V_{EE}-V_{SS}=18.7V$		140		mS	
Fall Time	$T_f$			239			
Frame frequency	Frm		-	64	-	Hz	8,10
Contrast	Cr	-	-	6.9	-		7

## MECHANICAL SPECIFICATION

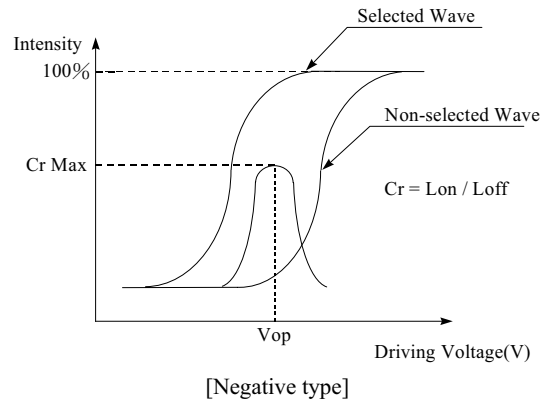
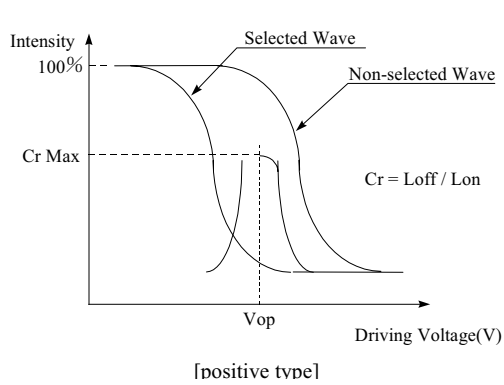
ITEM	DESCRIPTION	
Product No.		MTG-F24160XFWNSEB
Module Size		54.9(W)mm× 76.1(H)mm× 5.2(D)mm Max
Dot Size		0.22(W)mm× 0.22(H)mm
Dot Pitch		0.24(W)mm× 0.24(H)mm
Resolution		240(W)× 160(H) Dots Matrix
Duty Ratio		1/160 Duty
LCD Display Mode	STN	<input type="checkbox"/> Gray Mode <input type="checkbox"/> Yellow Mode <input type="checkbox"/> Blue Mode
	FSTN	<input checked="" type="checkbox"/> Black & White(Normally White/Positive Image) <input type="checkbox"/> Black & White(Normally White/Negative Image)
	Rear Polarizer:	<input type="checkbox"/> Reflective <input checked="" type="checkbox"/> Transflective <input type="checkbox"/> Transmissive <input type="checkbox"/> Transflective(High Transmissive)
Viewing Direction		<input checked="" type="checkbox"/> 6 O'clock <input type="checkbox"/> 12 O'clock <input type="checkbox"/> 3 O'clock <input type="checkbox"/> 9 O'clock
Backlight		<input type="checkbox"/> W/O <input type="checkbox"/> CCFL <input checked="" type="checkbox"/> EL <input type="checkbox"/> LED
Controller		Without
DC/DC Converter		Without
EL Driver		Optional

## INTERFACE PIN ASSIGNMENT

PIN NO.	PIN OUT	FUNCTION DESCRIPTION
1	EL/NC	<ul style="list-style-type: none"> <li>◦ If EL driver not build-in : Power supply for EL. Typical 100V/400Hz. Make sure J1 and J13 are short.</li> <li>◦ If EL driver build-in : No connection.</li> </ul>
2	EL/NC	
3	V <sub>EE</sub>	LCD driver supply voltage
4	V <sub>DD</sub>	Logic supply voltage
5	FLM	Frame start signal (Data signal from the common driver shift register)
6	F_GND	Frame Ground
7	CL1	Common driver data shift signal: also latches the data of the line immediately above.
8	V <sub>SS</sub>	GND
9	NC	No Connection
10	DisplayOFF	Turn the Display OFF. Active LOW
11	CL2	Clock pulse for segment shift register
12	NC	No Connection
13	NC	No Connection
14	D3	Data Bus
15	D2	
16	D1	
17	D0	
18	NC/ EL Enable	<ul style="list-style-type: none"> <li>◦ If EL driver not build-in : No Connection</li> <li>◦ If EL driver build-in : Enable signal for EL driver circuit</li> </ul>



## [Note 7] Definition of Operation Voltage (Vop)

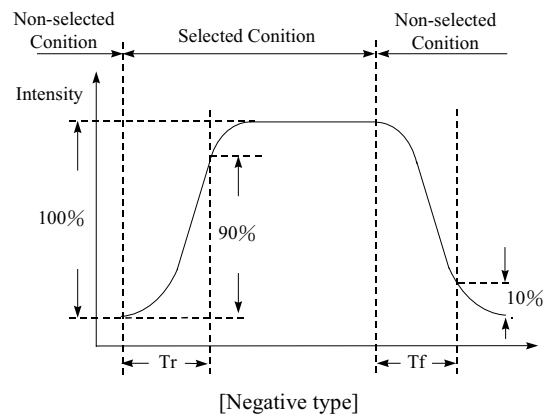
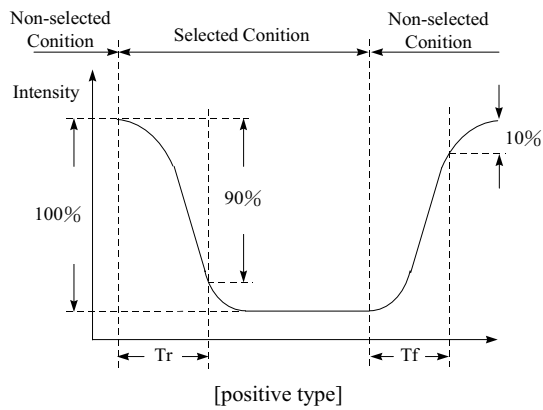


## [Note 8] Definition of Response Time (Tr, Tf)

Conditions:

Operating Voltage : Vop

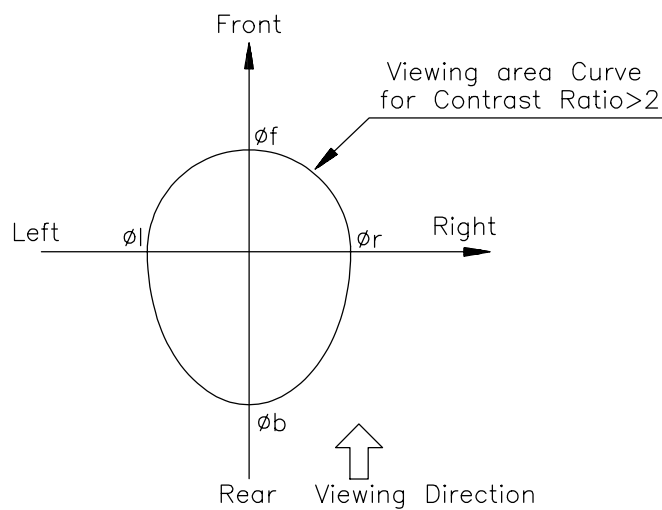
Viewing Angle( $\theta$ ,  $\varphi$ ):  $0^\circ$ ,  $0^\circ$



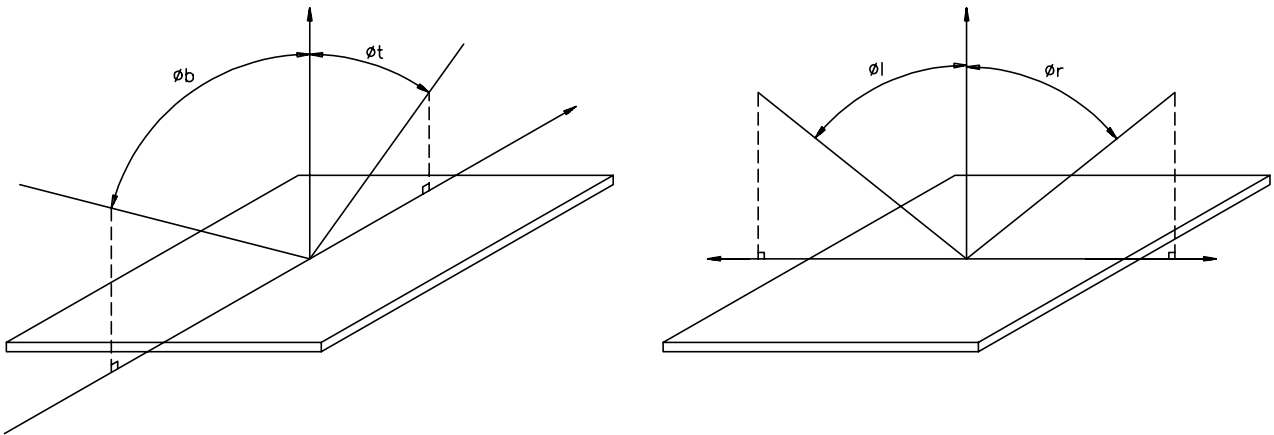
Frame Frequency : 64 Hz

Driving Wave form : 1/N duty, 1/a bias

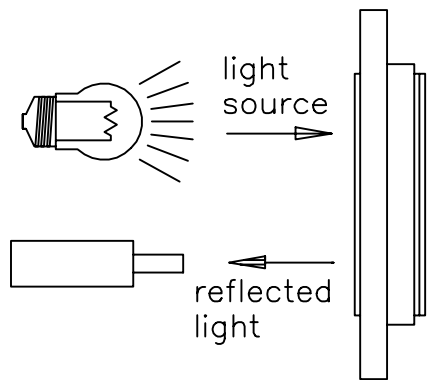
## [Note 9] Definition of Viewing Direction



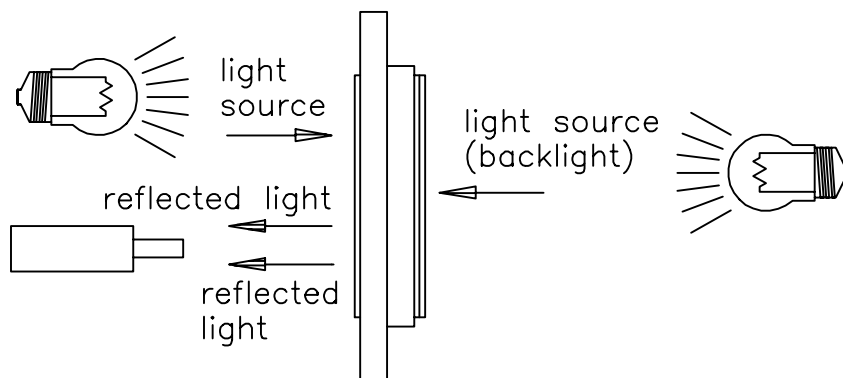
**[Note 10] Definition of viewing angle**



**[Note 11] Description of Measuring Equipment**

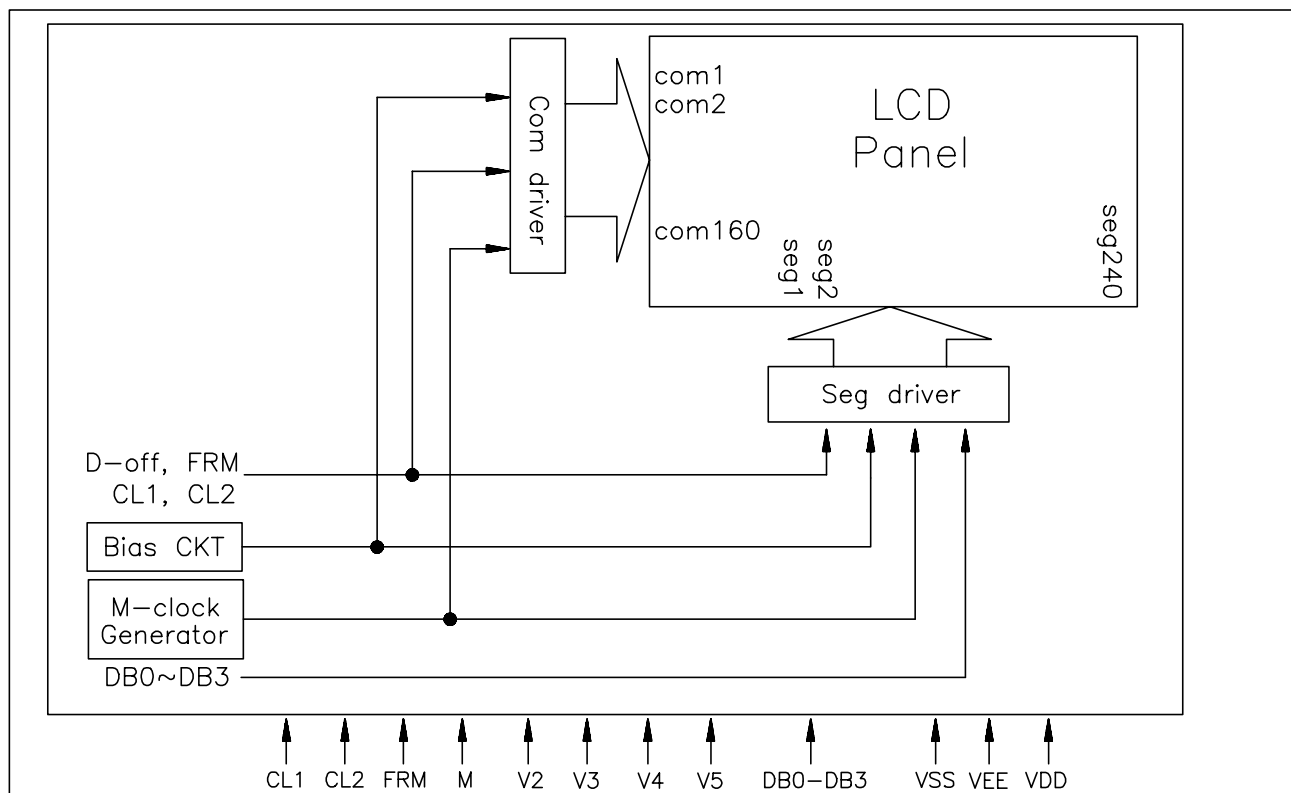


Reflective type



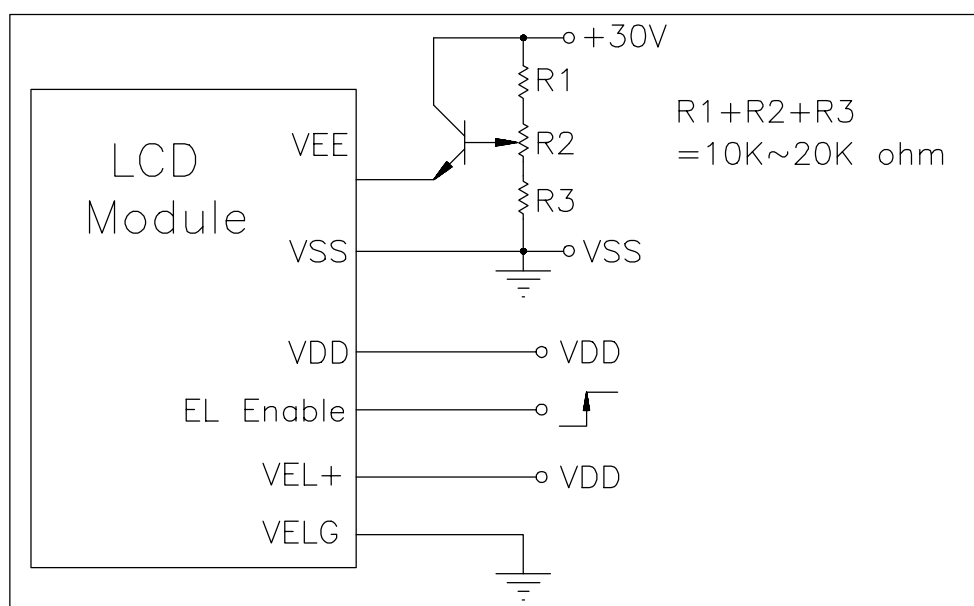
Transflective type

## BLOCK DIAGRAM



Built-in M-clock generating circuit, User do not have to supplier M-clock.

## POWER SUPPLY

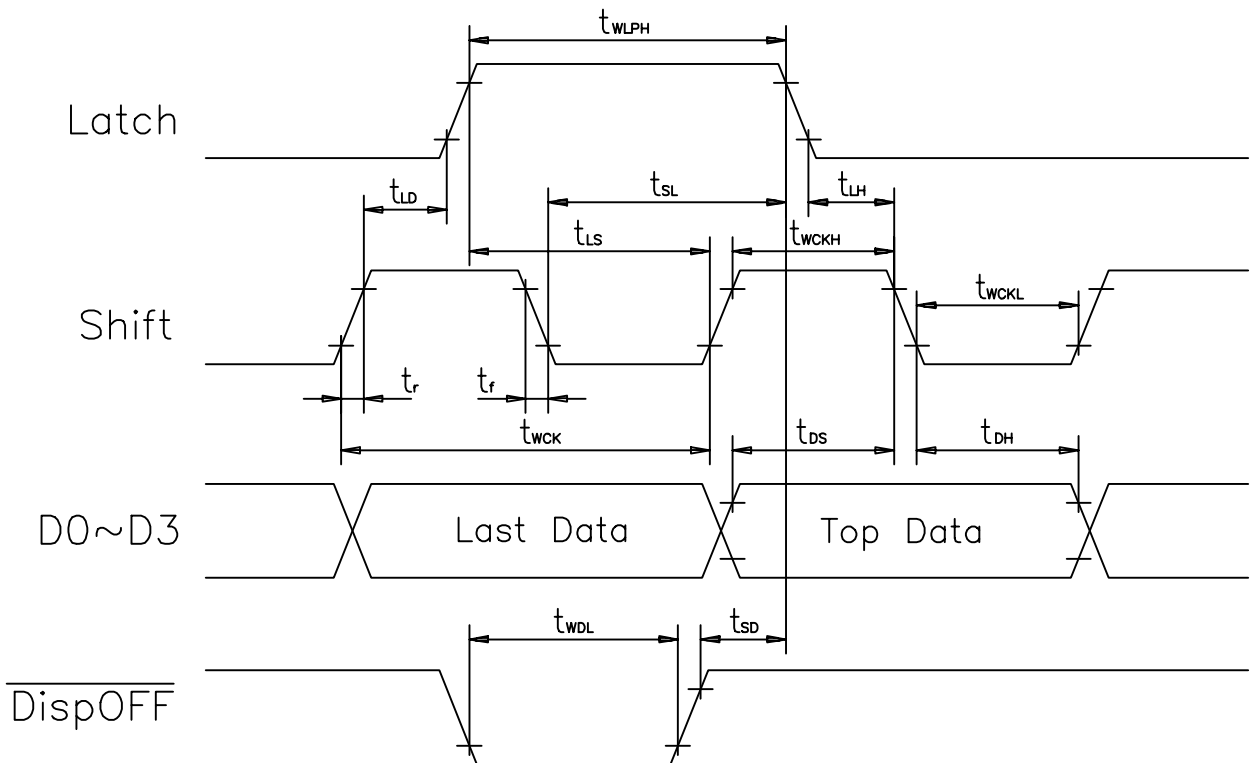


## TIMING CHARACTERISTICS

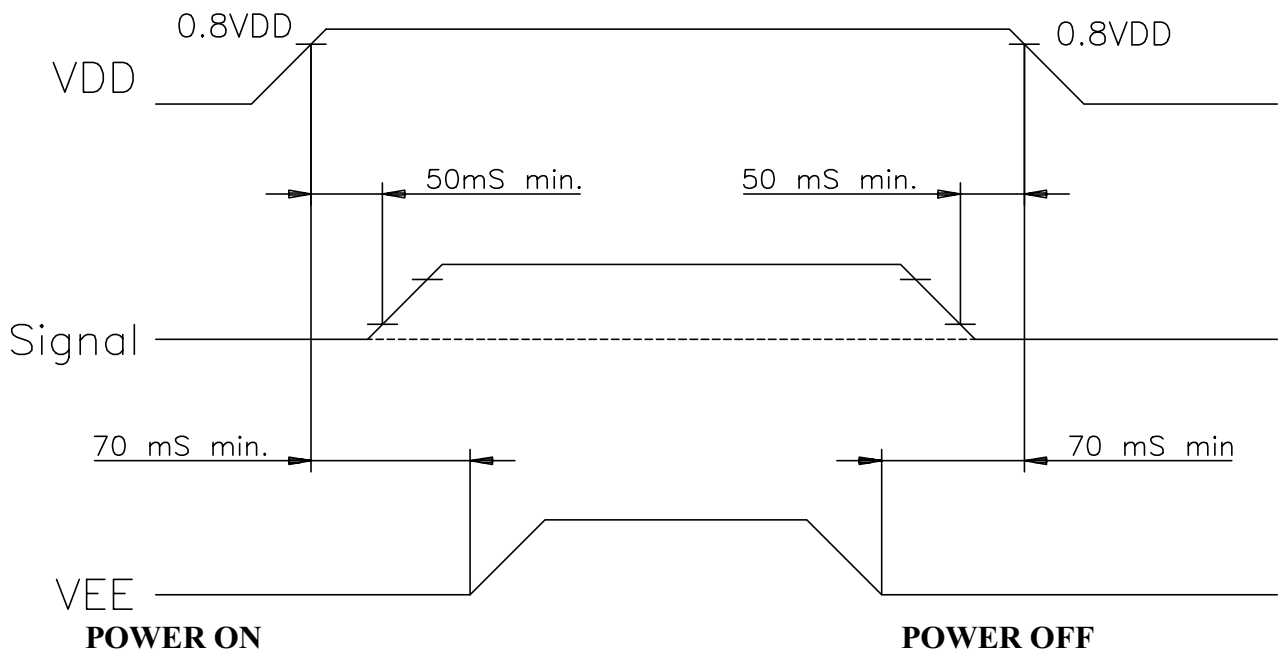
1 Segment interface timing: ( $V_{SS}=V_S=0V$ ,  $V_{DD}=2.5V$  to  $4.5V$ ,  $V_{EE}=+15.0$  to  $+24V$ ,  $T_a=0$  to  $50^{\circ}C$ )

Item	Symbol	Test Condition	Min.	Max.	Unit
Shift clock cycle time <sup>*1</sup>	$t_{WCK}$	$t_r, t_f \leq 11 \text{ ns}$	125	-	ns
Shift clock Pulse Width	$t_{WCKH}, t_{WCKL}$		51	-	ns
Data Set Up Time	$t_{DS}$		30	-	ns
Data Hold Time	$t_{DH}$		40	-	ns
Latch pulse 'H' width	$t_{WLPH}$		51	-	ns
Input signal Rise/Fall Time	$t_r, t_f$		-	50	ns
Shift clock rise to Latch pulse rise	$t_{LD}$		0	-	ns
Shift clock fall to Latch pulse fall	$t_{SL}$		51	-	ns
Latch pulse rise to shift clock rise	$t_{LS}$		51	-	ns
Latch pulse fall to shift clock fall	$t_{LH}$		51	-	ns
Enable setup time	$t_s$		36	-	ns
DispOFF remove time	$t_{SD}$		100	-	ns
DispOFF 'L' pulse width	$t_{WDL}$		2	-	$\mu s$

【Note】 : \*1 Take the cascade connection into consideration.



## 2 Power ON/OFF Timing



The missing pixels may occur when the LCM is driven beyond above power interface timing sequence.

## DISPLAY PATTERN

## First Data

	SEG1	SEG2	SEG3	SEG4		SEG157	SEG158	SEG159	SEG240
COM1	D3	D2	D1	D0	.....	D3	D2	D1	D0
COM2	D3	D2	D1	D0	.....	D3	D2	D1	D0
COM159	D3	D2	D1	D0	.....	D3	D2	D1	D0
COM160	D3	D2	D1	D0	.....	D3	D2	D1	D0

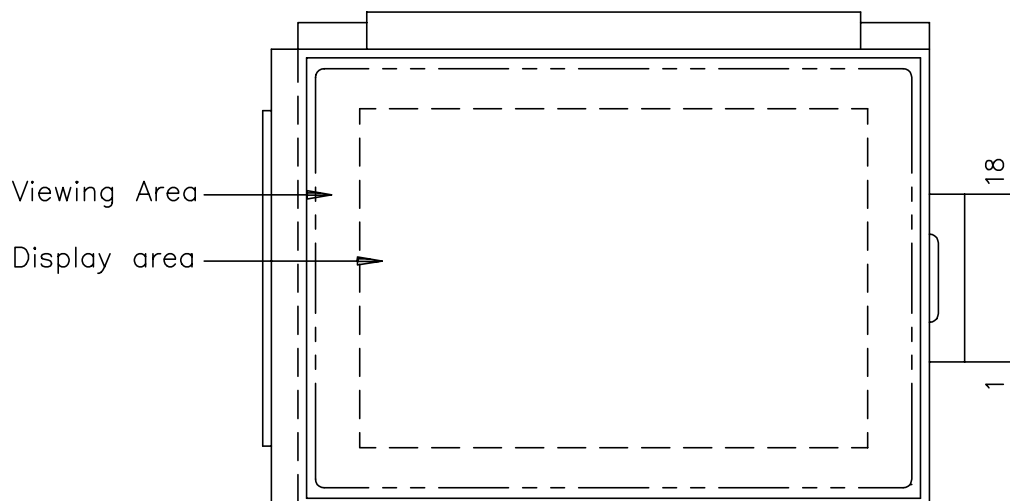
## RELIABILITY TEST

No	Item	Conditions		Note
1	High Temp. Operation	50°C	240HR	
2	High Temp. Storage	70°C	240HR	
3	Low Temp. Operation	0°C	240HR	
4	Low Temp. Storage	-20°C	240HR	
5	High Temp./Humid Storage	40°C 90%RH	240HR	
6	Thermal Shock	-20°C ,30min +40°C ,30min	10 cycles	
7	Vibration Test ( IEC-68-2-6 )	Frequency : 10~55 Hz Duration : 20 times, 6 min/time Amplitude : 0.75 mm	-	
8	Shock ( IEC 68-2-27)	Duration : 11 mS Acceleration : 100g	-	X, Y, Z direction
9	Drop Test	91 cm dropped on a pine plate	-	1 corner 3 edges

## APPEARANCE CHECK

### CONDIITON OF APPEARANCE CHECK:

- (1) Specimen shall be checked by eyes in distance of 30cm under 40w-fluorescence lamp.
- (2) Checking direction shall be in 45 degree from perpendicular line op specimen surface.



## HANDLING PRECAUTIONS

- (1) Treat polarizer very carefully since it is easy to be damaged.
- (2) When cleaning the display surface, use soft cloth (e.g. gauss) with a solvent (recommended below) and wipe lightly.

- ◆ ethyl alcohol

- ◆ iso-propanol

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvents:

- ◆ water

- ◆ ketone

- ◆ aromatics

- (3) Direct current causes electro-chemical reaction with remarkable degradation of the display quality. Give careful consideration to prevent direct current at ON/OFF timing and during operation.
- (4) Avoid strong shock and drop from the height.
- (5) To prevent LCD panels from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity.
- (6) Give careful consideration to avoid electrical static discharge which causes uneven contrast.
- (7) Even a small condensation on the contact pads (terminals) causes electro-chemical reaction which makes missing row and column. Give careful attention to avoid condensation. When assembling with zebra connector, clean the surface of the pads with alcohol and keep the air very clean.



## LCD PRODUCT QUALITY STANDARD

### DISPLAY APPEARANCE

No	Item	Criteria
1	inclusions (black spot, white spot, dust)	(1)round type diameter mm(a*)      no of defect* $a \leq 0.20$ neglect $0.20 < a \leq 0.35$ 5max $0.35 < a$ none (2)linear type length mm(l)      width mm(W)      no. of defect na $W \leq 0.03$ neglect $1 \leq 3$ $0.03 < W \leq 0.08$ 6 $3 < l$ $0.08 < W$ none
2	scratch	1.scratch on protective film is permitted. 2.scratch on polarizer shall be as follow: (1)round type diameter mm(a*)      no of defect $a \leq 0.15$ neglect $0.15 < a \leq 0.20$ 2 max $0.20 < a$ none (2)linear type be judged bye 1.-(2) linear type
3	dent	diameter < 1.5mm
4	bubble	not exceeding 0.5mm average diameter is acceptable between glass and polarizing film
5	pin hole	$(a+b)/2 \leq 0.15\text{mm}$ maximum number: ignored $0.15 < (a+b)/2 \leq 0.20\text{mm}$ maximum number:10
6	dot defect	$(a+b)/2 \leq 0.20\text{mm}$ maximum number: ignored $0.20 < (a+b)/2 \leq 0.30\text{mm}$ maximum number:5 x=width
7	contrast irregularity(spot)	diameter spec      no of defect $a \leq 0.50\text{mm}$ neglect $0.50 < a \leq 0.75$ 5 $0.75 < a \leq 1.00$ 3 $1.00 < a$ none
8	dot width	design width $\pm 15\%$
9	color tone and uniformity	obvious uneven color is not permitted

## REVISION HISTORY

[illegible]