SPECIFICATION OF
LCD MODULE
PRODUCT NO.: LM_84_101____

SPEC. NO.: LM101-0

APPROVED BY

LCD DEPARTMENT
ELECTRONIC MATERIALS DIVISION
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EDITED ON : NOV.20.1997

SALES MANAGER	DESIGN MANAGER	PERSON IN CHARGE

RECORDS OF REVISION

DATE	REVISED NO.	REF. PAGE	SUMMARY	CHECK & APPROVAL
11.20.97'	0	18.18	First Issue	

1. MECHANICAL DATA

(1) Product No.	LM_84_101_ _____
(2) Module Size	84.0 (W)mm x 44.0 (H)mm x MAX12.5 (D)mm (LED B.L.) 84.0 (W)mm x 44.0 (H)mm x MAX9.5 (D)mm (W/O, EL B.L.)
(3) Dot Size	1.25 (W)mm x 0.93 (H)mm
(4) Dot Pitch	1.30 (W)mm x 0.98 (H)mm
(5) Number of Characters	8 (W) x 1 (H)Characters
(6) Character Format	5 (W) x 11 (H)Dots
(7) Duty	1/11
(8) LCD Display Mode	STN:☐ Gray Mode ☐ Yellow Mode ☐ Blue Mode FSTN:☐ Black and White(Normal White/Positive Image) ☐ Black and White(Normal Black/Negative Image) Rear Polarizer: ☐ Reflective ☐ Transflective ☐ Transmissive
(9) Viewing Direction	☐ 6 O'clock ☐ 12 O'clock ☐ ___O'clock
(10) Backlight	None
(11) Weight	36g

Note :

LM_84_103_ _____

Back Light
K : None Back Light
M : LED Back Light
N : EL Back Light

Reflective/Transmissive
R : Reflective
S : Transflective
T : Transmissive
P : Transflective(High Transmissive)

Option
C : Anti-Glare
D : Wide Temp. Double Power.
L : Wide Temp. Single Power.
1
2
: Version
9

Mode/View Angle
A : Gray , 6 Clock
B : Gray , 12 Clock
C : Yellow , 6 Clock
D : Yellow , 12 Clock
E : Blue , 6 Clock
F : Blue , 12 Clock
G : Normally Black , 6 Clock
H : Normally Black , 12 Clock
J : Normally White , 6 Clock
K : Normally White , 12 Clock

2. ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

Vss=0V

ITEM	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VDD−VSS	−0.3	6.5	V	
Input Voltage	VI	−0.3	VDD	V	
Static Electricity	−	−	−	−	Note 1

Note 1 LCM should be grounded during handling LCM.

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	NORMAL TEMP.				WIDE TEMP.			
	OPERATING		STORAGE		OPERATING		STORAGE	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
Ambient Temperature	0	50	−20	70	−20	70	−30	80
Humidity (Without Condensation)	Note 1,3		Note 2,3		Note 3,4		Note 3,5	

Note 1 Ta ≦ 50°C : 85%RH max
Ta > 50°C : Absolute humidity must be lower than the humidity of 85%RH at 50°C

Note 2 Ta at −20°C will be < 48hrs, at 70°C will be < 120hrs

Note 3 Background color changes slightly depending on ambient temperature. This phenomenon is reversible.

Note 4 Ta ≦ 70°C : 75%RH max
Ta > 70°C : Absolute humidity must be lower than the humidity of 75%RH at 70°C

Note 5 Ta at −30°C will be < 48hrs, at 80°C will be < 120hrs

3. ELECTRICAL CHARACTERISTICS

(FOR NORMAL TEMPERATURE of LCM)

(VDD=5V±10%)

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Input Voltage	VIH	H level	0.8VDD	–	VDD	V
	VIO	L level	0	–	0.2VDD	V
Recommended LC Driving Voltage (NORMAL TEMP. LCM)	VDD–VO (Vop)	0℃	–	3.9	4.3	V
		25℃	3.5	3.8	4.2	
		50℃	3.2	3.5	–	
Recommended LC Driving Voltage (WIDE TEMP. and DOUBLE POWER LCM)	VDD–VO (Vop)	–20℃	4.9	5.6	6.4	V
		0℃	4.7	5.5	6.3	
		25℃	4.6	5.4	6.2	
		70℃	4.0	4.7	5.4	
Power Supply Current	IDD	VDD = 5.0V	–	–	2.8	mA
LED Power Supply Current	I LED	V_{BL} = 5V_{DC} (R_{BL} = 5Ω)	–	200	–	mA

4.1 OPTICAL CHARACTERISTICS

(FOR NORMAL TEMPERATURE MODE LCM)

AT V_{OP}

ITEM / MODE		Cr(Contrast Ratio) 25℃ MIN.	Cr(Contrast Ratio) 25℃ TYP.	θ(Viewing Angle) 25℃ MIN.	θ(Viewing Angle) 25℃ TYP.	φ(Viewing Angle) 25℃ MIN.	φ(Viewing Angle) 25℃ TYP.
R	A	3.0	4.0	30	50	20	25
	C	3.5	7.0	40	60	25	35
	J						
S	A	2.5	3.5	25	45	20	30
	C	3.5	6.0	35	55	20	30
	J						
T	E/F	2.0	3.0	25	40	20.	25
	C/D	2.0	4.5	25	40	20	25
NOTE		NOTE6		NOTE5			

AT $\phi=0^\circ$ $\theta=0^\circ$

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	0℃	–	460	900	ms	NOTE 2
		25℃	–	110	220		
		50℃	–	65	130		
Response Time (fall)	Tf	0℃	–	420	800	ms	NOTE 2
		25℃	–	140	250		
		50℃	–	90	155		

NOTE :

R: REFLECTIVE
S: TRANSFLECTIVE
T: TRANSMISSIVE
A: GRAY
C: YELLOW
E: BLUE
G: NORMALLY BLACK
J: NORMALLY WHITE

4.2 OPTICAL CHARACTERISTICS

(FOR WIDE TEMPERATURE MODE LCM)

AT Vop

ITEM / MODE		Cr(Contrast Ratio) 25℃ MIN.	Cr(Contrast Ratio) 25℃ TYP.	θ(Viewing Angle) 25℃ MIN.	θ(Viewing Angle) 25℃ TYP.	ϕ(Viewing Angle) 25℃ MIN.	ϕ(Viewing Angle) 25℃ TYP.
R	A						
	C	5.5	9	50	80	25	40
	J						
S	A						
	C						
	J						
T	E						
	G						
NOTE		NOTE6		NOTE5			

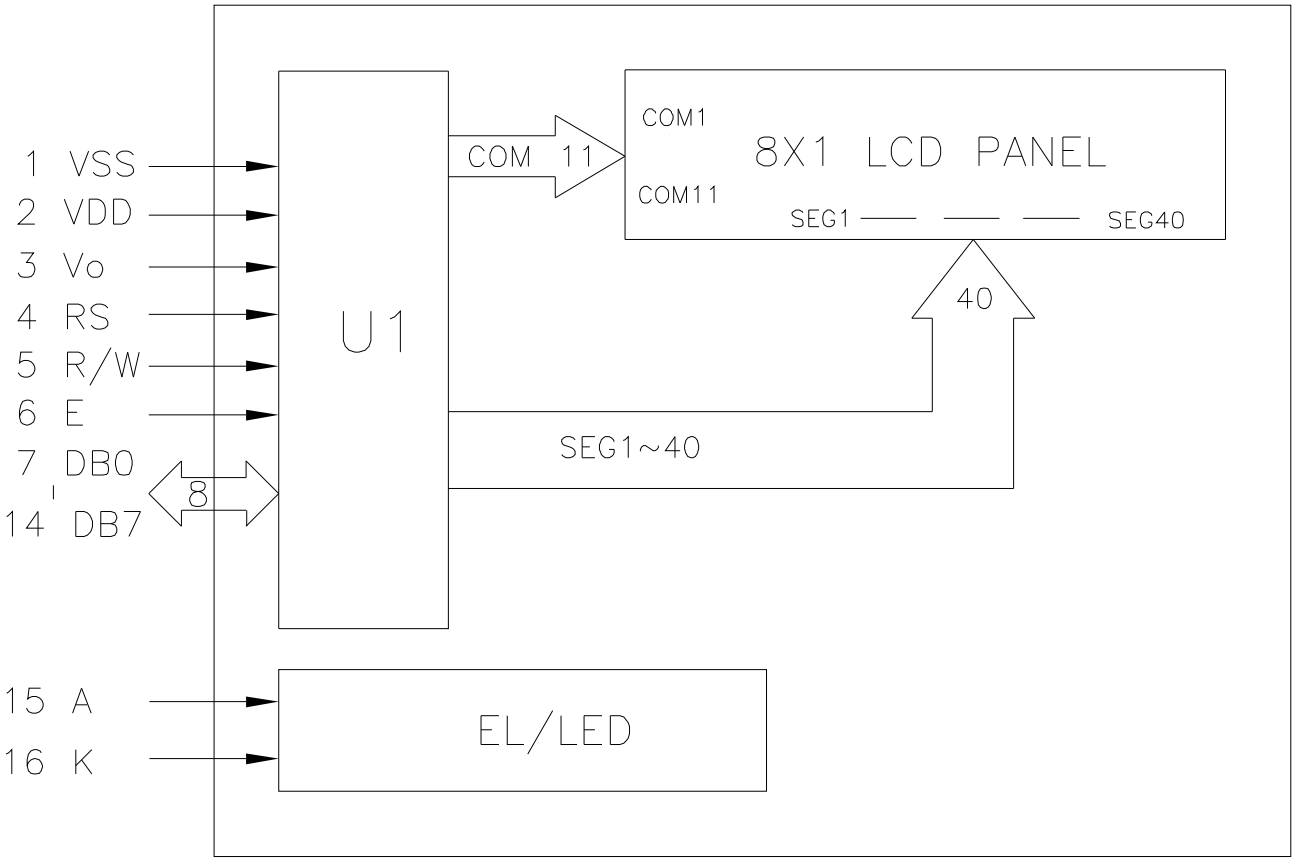
AT ϕ=0° θ=0°

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	−20℃	−	1000	2000	ms	NOTE 2
		0℃	−	180	360		
		25℃	−	80	160		
		70℃	−	50	100		
Response Time (fall)	Tf	−20℃	−	1500	2400	ms	NOTE 2
		0℃	−	300	560		
		25℃	−	90	190		
		70℃	−	50	100		

NOTE :

R: REFLECTIVE
S: TRANSFLECTIVE
T: TRANSMISSIVE
A: GRAY
C: YELLOW
E: BLUE
G: NORMALLY BLACK
J: NORMALLY WHITE

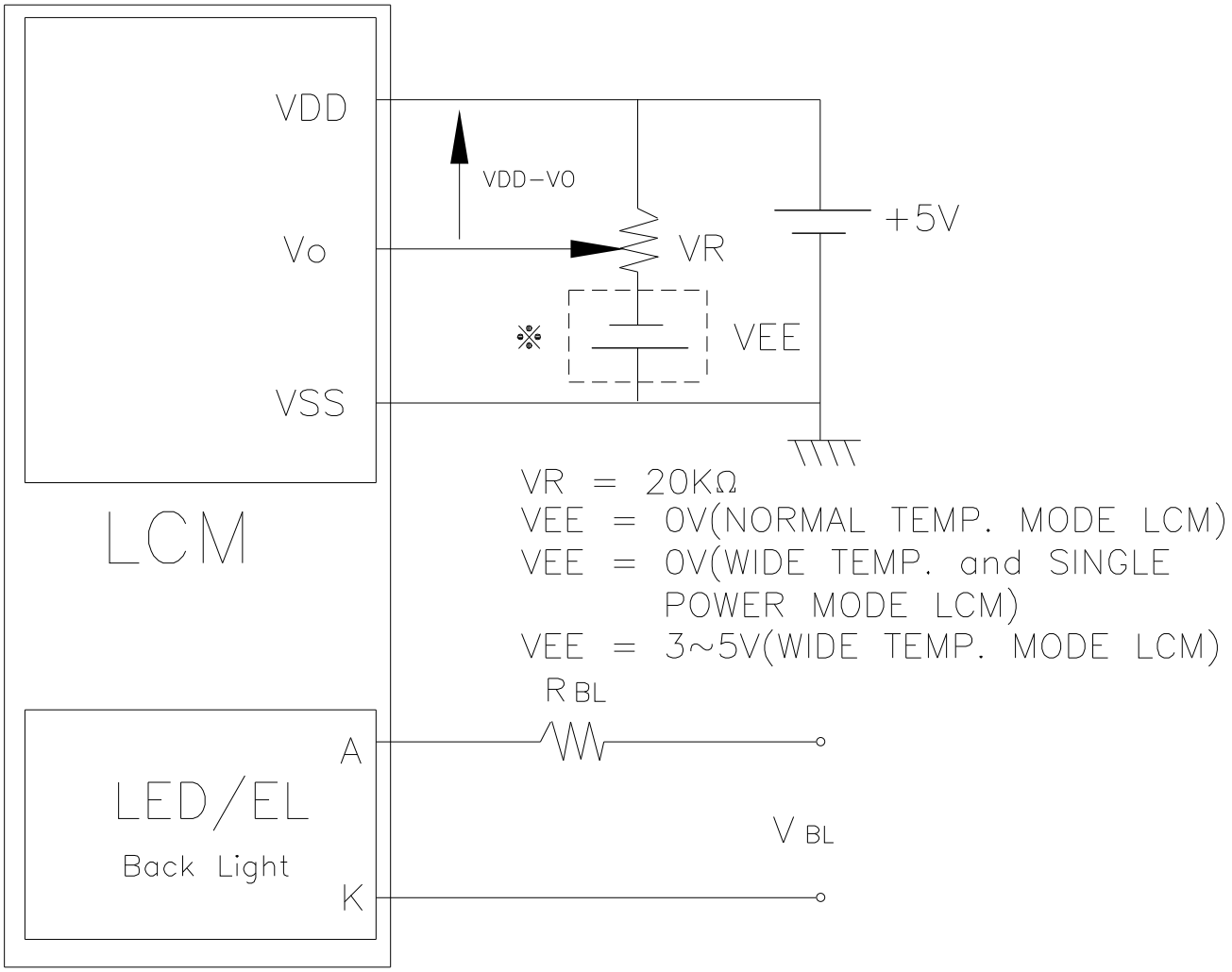
5. BLOCK DIAGRAM



6. INTERNAL PIN CONNECTION

Pin No.	Symbol	Level	Function	
1	V_{SS}	—	0V	Power Supply
2	V_{DD}	—	+3.3V	
3	V_O	LCD Contrast Voltage		
4	RS	H/L	L:INSTRUCTION CODE INPUT H:DATA INPUT	
5	R/W	H/L	H:DATA READ (FROM LCM TO MPU) L:DATA WRITE (FROM MPU TO LCM)	
6	E	H,H->L	ENABLE SIGNAL	
7	DB0	H/L	DATA BUS LINE	
8	DB1	H/L		
9	DB2	H/L		
10	DB3	H/L		
11	DB4	H/L		
12	DB5	H/L		
13	DB6	H/L		
14	DB7	H/L		
15	A	—	Power Supply For LED/EL	
16	K	—		

7.POWER SUPPLY



Recommended Value for R_{BL} and V_{BL}

ITEM / Back Light / Interface	R_{BL}		V_{BL}	
	LED	EL	LED	EL
14 PIN (A,K)	5Ω	0Ω	5V DC	110V AC 400Hz
16 PIN	0Ω			

8. TIMING CHARACTERISTICS

(VDD=2.7 to 4.5V, Ta=-20 to +75°C)

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Enable cycle time	t_{cyc}	Fig.a, Fig.b	1000	–	–	ns
Enable pulse width	PW_{EH}	Fig.a, Fig.b	450	–	–	ns
Enable rise/fall time	t_{Er}, t_{Ef}	Fig.a, Fig.b	–	–	25	ns
RS,R/W set up time	t_{AS}	Fig.a, Fig.b	60	–	–	ns
Data delay time	t_{DDR}	Fig.b	–	–	360	ns
Data set up time	t_{DSW}	Fig.a	195	–	–	ns
Hold time	t_H	Fig.a, Fig.b	5	–	–	ns

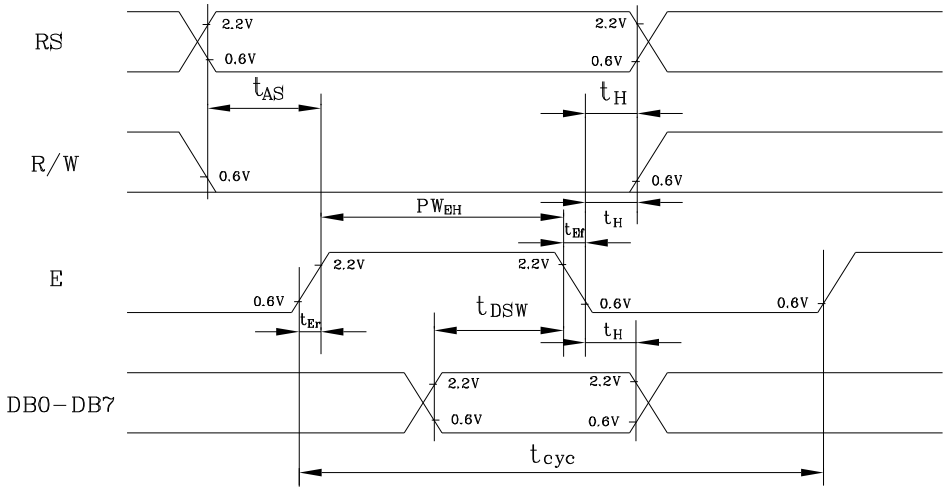


Fig. a Interface timing (data write)

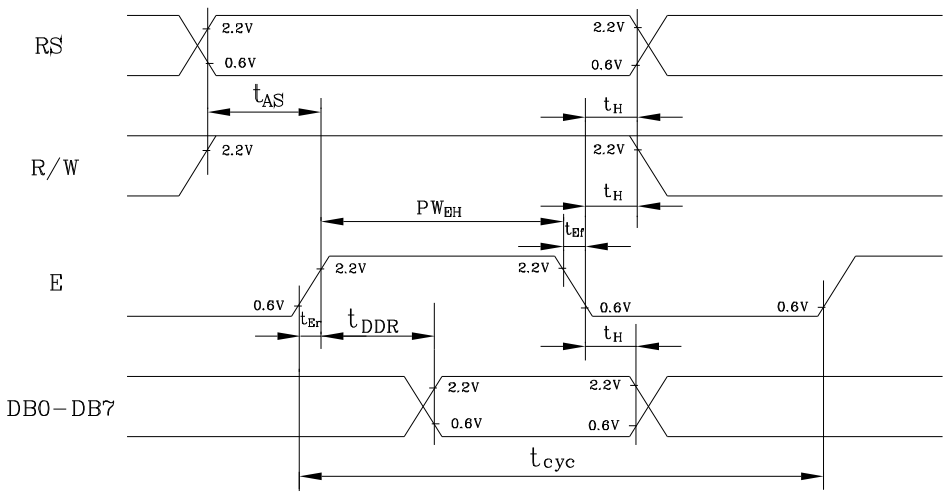


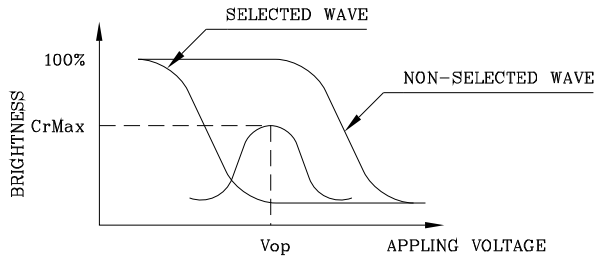
Fig. b Interface timing (data read)

9. RELIABILITY TEST

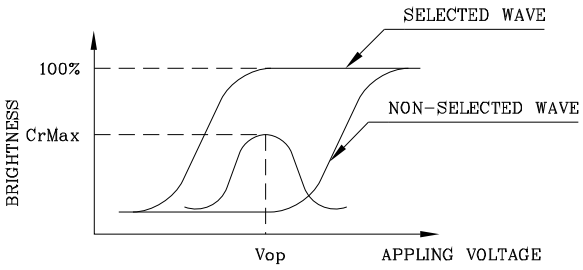
NO	ITEM	CONDITION			STANDARD	NOTE
1	High Temp. Leaving	70°C	120HR		Appearance without defect	
2	Low Temp. Leaving	−20°C	120HR		Appearance without defect	
3	High Temp. & High Humi. Leaving	40°C 90%RH	120HR		Appearance without defect	
4	Thermal Shock	−20°C,30min→ 25°C.5min →→ 60°C,30min→ 25°C.5min (1cycle)			Appearance without defect	5 cycles

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



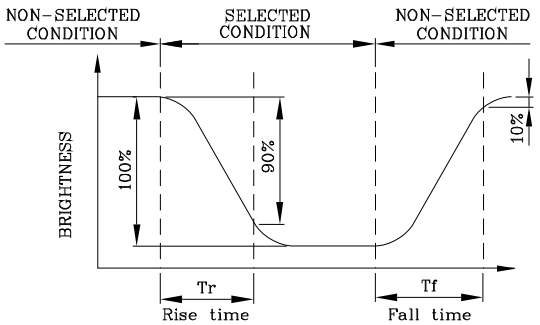
(negative type)

*Conditions

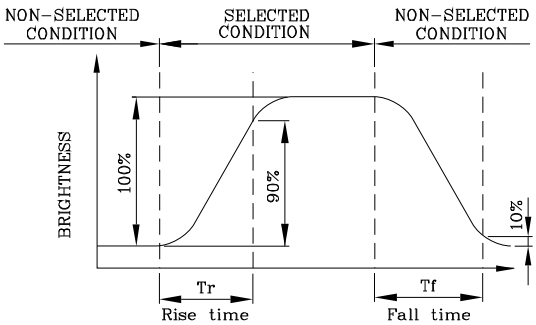
Viewing Angle : 0
Frame Frequency : 70Hz
Appling Waveform : I/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



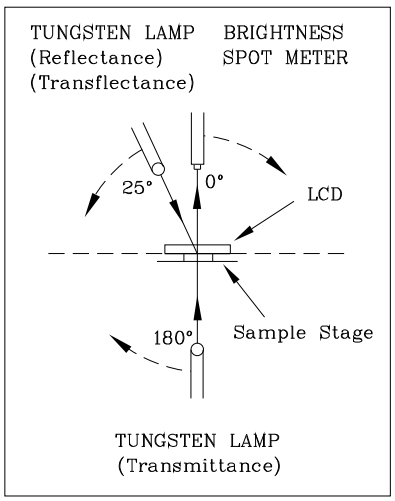
(negative type)

*Conditions

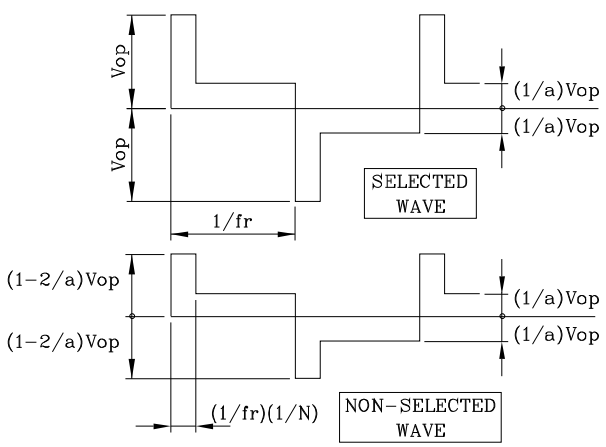
Operating Voltage : Vop
Viewing Angle (θ,ϕ) : (0,0)
Frame Frequency : 70Hz
Appling Waveform : I/N duty 1/a bias

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms

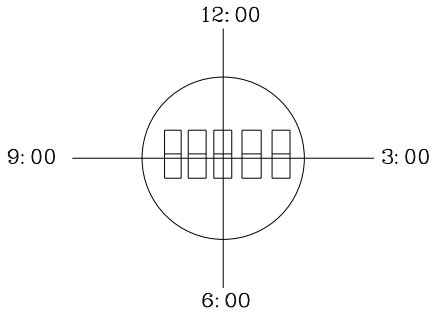


Multiplex Driving (I/N duty 1/a bias)



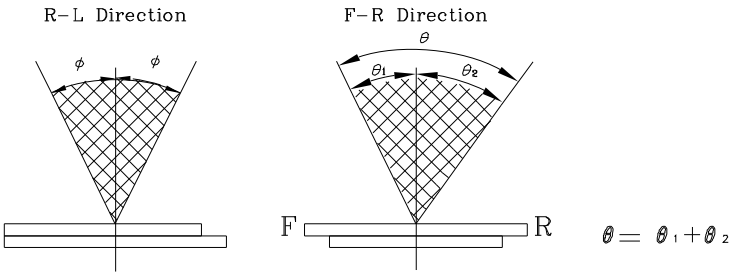
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



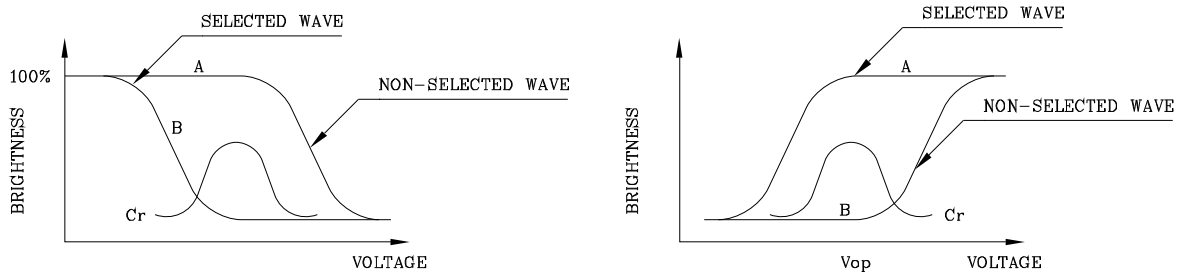
$\theta = \theta_1 + \theta_2$

*Conditions

Operating Voltage : Vop
Frame Frequency : 70Hz
Appling Waveform : 1/N duty 1/a bias
Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type) (negative type)

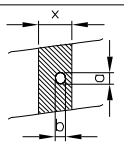
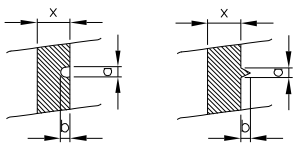
Contrast Ratio : Cr=A/B

*Conditions

Viewing Angle : 0
Frame Frequency : 70Hz
Appling Waveform : 1/N duty 1/a bias

LCD PRODUCT QUALITY STANDARD

(1) DISPLAY APPEARANCE

<table>
<tr><th>NO</th><th>ITEM</th><th>C R I T E R I A</th></tr>
<tr><td>1.</td><td>INCLUSI-ONS (BLACK SPOT , WHITE SPOT , DUST)</td><td>(1) ROUND TYPE
<table>
<tr><th>DIAMETER mm (a*)</th><th>NO. OF DEFECT*</th></tr>
<tr><td>a ≦ 0.20
0.20 < a ≦ 0.35
0.35 < a</td><td>NEGLECT
5 MAX
NONE</td></tr>
</table>
(2) LINEAR TYPE
<table>
<tr><th>LENGTH mm(L)</th><th>WIDTH mm(W)</th><th>NO. OF DEFECT</th></tr>
<tr><td>N A
L ≦ 3
3 < L</td><td>W ≦ 0.03
0.03 < W ≦ 0.08
0.08 < W</td><td>NEGLECT
6
NONE</td></tr>
</table></td></tr>
<tr><td>2.</td><td>SCRATCH</td><td>1.SCRATCH ON PROTECTIVE FILM IS PERMITTED .
2.SCRATCH ON POLARIZER SHALL BE AS FOLLOW:
(1) ROUND TYPE
<table>
<tr><th>DIAMETER mm (a*)</th><th>NO. OF DEFECT*</th></tr>
<tr><td>a ≦ 0.15
0.15 < a ≦ 0.20
0.20 < a</td><td>NEGLECT
2 MAX
NONE</td></tr>
</table>
(2) LINEAR TYPE
BE JUDGED BY 1.-(2) LINEAR TYPE</td></tr>
<tr><td>3.</td><td>DENT</td><td>DIAMETER < 1.5mm</td></tr>
<tr><td>4.</td><td>BUBBLE</td><td>NOT EXCEEDING 0.5mm AVERAGE DIAMETER IS ACCEPTABLE BETWEEN GLASS AND POLARIZING FILM.</td></tr>
<tr><td>5.</td><td>PIN HOLE</td><td>(a+b)/2 ≦ 0.15 mm
MAXIMUM NUMBER:IGNORED
0.15 < (a+b)/2 ≦ 0.20
MAXIMUM NUMBER:10
  </td></tr>
<tr><td>6.</td><td>DOT DEFECT</td><td>(a+b)/2 ≦ 0.20 mm
MAXIMUM NUMBER:IGNORED
0.20 < (a+b)/2 ≦ 0.30
MAXIMUM NUMBER:5
x = WIDTH
  </td></tr>
<tr><td>7.</td><td>CONTRAST IRREGUL-ARITY (SPOT)</td><td>DIAMETER SPEC. — NO. OF DEFECT*
a ≦ 0.50 mm — NEGLECT
0.50 < a ≦ 0.75 — 5
0.75 < a ≦ 1.00 — 3
1.00 < a — NONE</td></tr>
<tr><td>8.</td><td>DOT WIDTH</td><td>DESIGN WIDTH±15%</td></tr>
<tr><td>9.</td><td>COLOR TONE AND UNIFOR-MITY</td><td>OBVIOUS UNEVEN COLOR IS NOT PERMITTED</td></tr>
</table>

(2) NOTE:

- SAFETY
  1. If the LCD panel breaks, be careful not to get the liquid crystal to touch your skin.
  2. If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

- HANDLING
  1. Avoid static electricity which can damage the CMOS LSI.
  2. Do not remove the panel or frame from the module.
  3. The polarizing plate of the display is very fragile. So, please handle it very carefully.
  4. Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.
  5. Do not use ketonics solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.

- STORAGE
  1. Store the panel or module in a dark place where the temperature is 25°C±5°C and the humidity is below 65% RH.
  2. Do not place the module near organics solvents or corrosive gases.
  3. Do not crush, shake, or jolt the module.

- TERMS OF WARRANT
  1. Acceptance inspection period
     The period is within one month after the arrival of contracted commodity at the buyer's factory site.
  2. Applicable warrant period
     The period is within twelve months since the date of shipping out under normal using and storage conditions.

- THE OPERATING LIFE TIME OF BACK LIGHT
  LED : 50,000HR
  EL : 5,000HR
  CCFT : 10,000HR

CONTROL and DISPLAY COMMAND

COMMAND	RS	R/W	DB_7	DB_6	DB_5	DB_4	DB_3	DB_2	DB_1	DB_0	EXCUTION TIME (FOSC=250kHz)	REMARK
DISPLAY CLEAR	L	L	L	L	L	L	L	L	L	H	1.64ms	
RETURN HOME	L	L	L	L	L	L	L	L	H	X	1.64ms	CURSOR MOVE TO FIRST DIGIT
ENTRY MODE SET	L	L	L	L	L	L	L	H	I/D	SH	40μS	• I/D: SET CURSOR MOVE DIRECTION I/D: H = INCREASE; L = DECREASE • SH: SPECIFIES SHIFT OF DISPLAY SH: H = DISPLAY IS SHIFTED; L = DISPLAY IS NOT SHIFTED
DISPLAY ON/OFF	L	L	L	L	L	L	H	D	C	B	40μS	• DISPLAY D: H = DISPLAY ON; L = DISPLAY OFF • CURSOR C: H = CURSOR ON; L = CURSOR OFF • BLINKING B: H = BLINKING ON; L = BLINKING OFF
SHIFT	L	L	L	L	L	H	S/C	R/L	X	X	40μS	SC: H = DISPLAY SHIFT; L = CURSOR MOVE R/L: H = RIGHT SHIFT; L = LEFT SHIFT
SET FUNCTION	L	L	L	L	H	DL	0	F	X	X	40μS	DL: H = 8 BITS INTERFACE; L = 4 BITS INTERFACE N: H = 2 LINE DISPLAY; L = 1 LINE DISPLAY F: H = 5 X 10 DOTS; L = 5 X 7 DOTS
SET CG RAM ADDRESS	L	L	L	H	CG RAM address (corresponds to cursor address)						40μS	CG RAM Data is sent and received after this setting
SET DD RAM ADDRESS	L	L	H	DD RAM address							40μS	DD RAM Data is sent and received after this setting
READ BUSY FLAG & ADDRESS	L	H	BF	Address Counter used for Both DD & CG RAM address							0μS	BF: H = Busy; L = Ready -Reads BF indication internal operating is being performed. -reads address counter contents
WRITE DATA	H	L	Write Data								46μS	Write data into DD or CG RAM
READ DATA	H	H	Read Data								46μS	Read data form DD or CGRAM

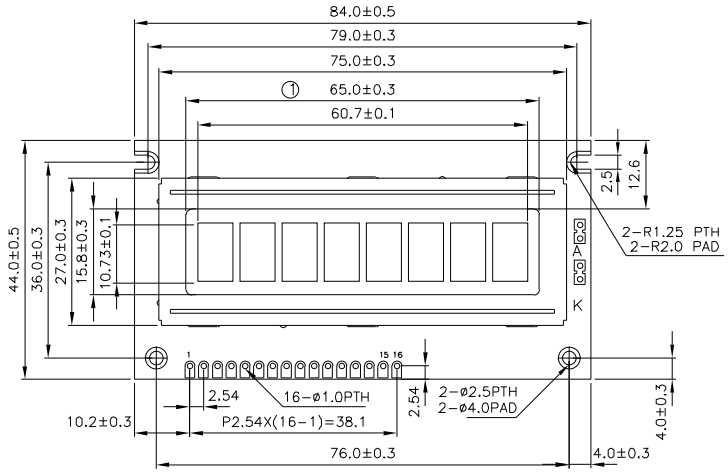
X : Don't care

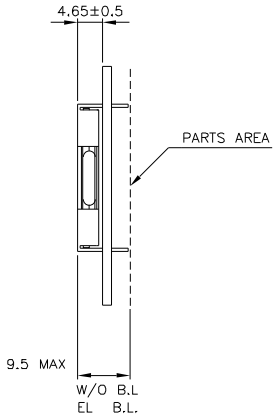
DISPLAY PATTERN (40x1)

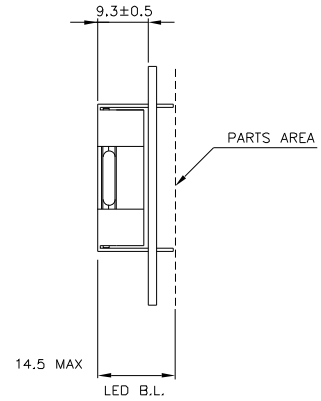
Display Data RAM address

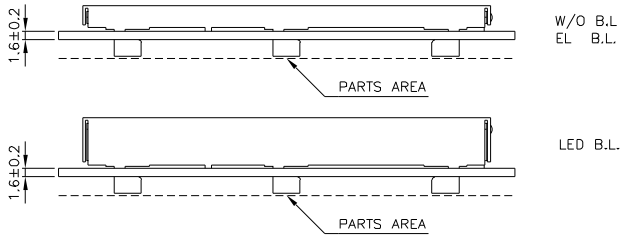
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	.....	36	37	38	39	40
00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13	.....	23	24	25	26	27

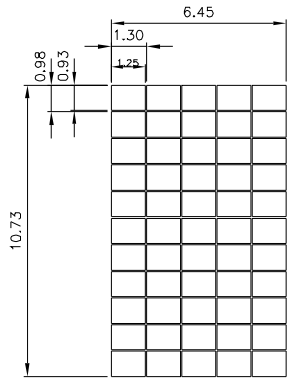
CHARACTER PATTERN











No	Symbol	Function	
1	VSS	0V	Power
2	VDD	+3.3V	Supply
3	Vo	LCD Contrast	
4	RS	Function Select	
5	R/$\overline{W}$	Read/$\overline{\text{Write}}$	
6	E	Enable Signal	
7	DB0	Data Bus Line	
8	DB1		
9	DB2		
10	DB3		
11	DB4		
12	DB5		
13	DB6		
14	DB7		
15	A	Power Supply For LED/EL	
16	K		

* Controller Driver : KS0066U-00 OR Compatible

NOTES :

1. Resolution: 8x1 Characters
2. Character Format: 5x11 Dots
3. General Tolerance: ±0.5mm

產品編號	LMxX84X101XD		南亞塑膠工業股份有限公司 NAN YA PLASTICS CORPORATION	
	NAME	DATE		
APPROVE			TITLE	製品圖
CHECK			DWG-NO	MK-X101XD Rev.B
DESIGN			THIRD ANGLE PROJECT	UNIT : mm
DRAW	MAY PING	86.11.20		SCALE :