

# NAN YA PLASTICS CORPORATION

SPECIFICATION OF  
LCD MODULE  
PRODUCT NO.: LMCH9\_214\_

SPEC. NO.: LM214-0-~~0~~△

CUSTOMER
APPROVED BY
DATE:

LCD DEPARTMENT  
ELECTRONIC MATERIALS DIVISION  
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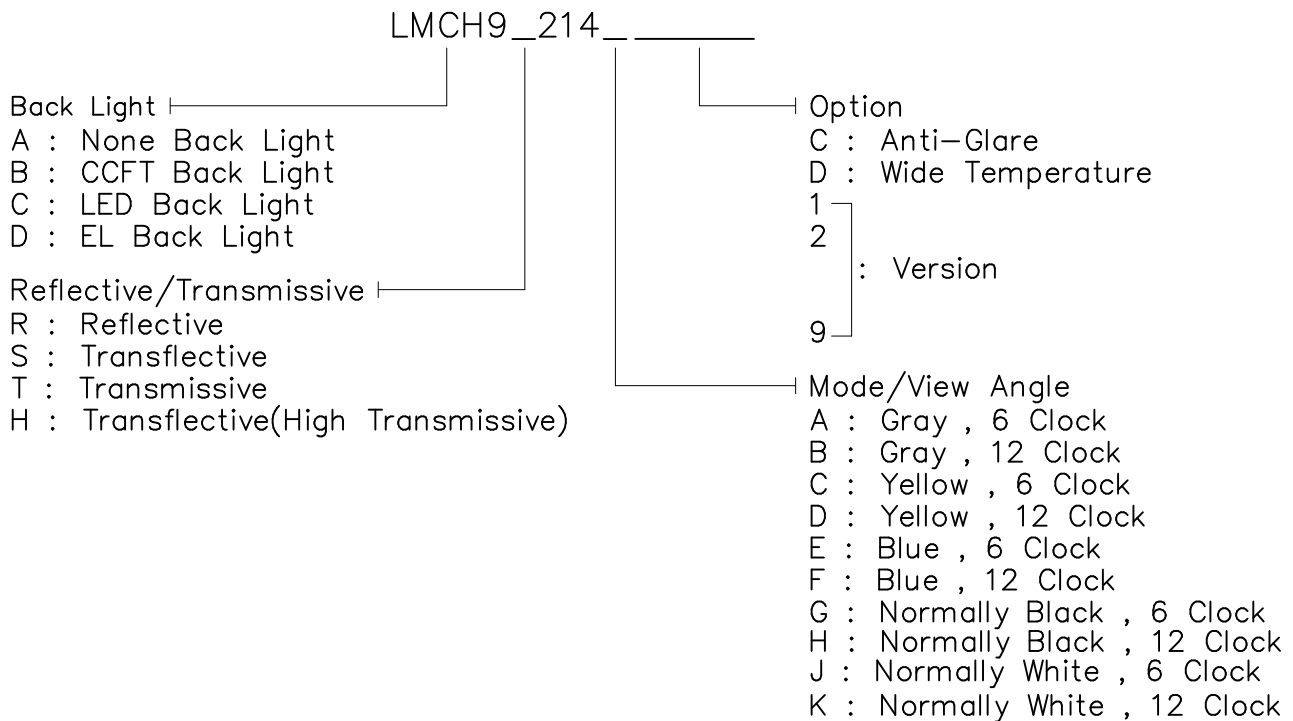
SALE MANAGER	TECHNICAL APPROVE	DESIGN MANAGER	DESIGN CHECK	DESIGNER



# 1. MECHANICAL DATA

- (1) Product No. LMCH9\_214\_ \_\_\_\_
- (2) Module Size 170.0 (W)mm x 93.015 (H)mm x MAX 15.8 (D)mm
- (3) Dot Size 0.47 (W)mm x 0.47 (H)mm
- (4) Dot Pitch 0.5 (W)mm x 0.5 (H)mm
- (5) Number of Dots 240 (W) x 128 (H)Dots
- (6) Duty 1/128
- (7) 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
- (8) Viewing Direction  6 O'clock  12 O'clock  \_\_\_\_O'clock
- (9) Backlight LED
- (10) Weight 180 g

Note :



## 2. ABSOLUTE MAXIMUM RATINGS

### (1) ELECTRICAL ABSOLUTE RATINGS

GND=0V Standard

ITEM	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VDD-GND	-0.3	5.5	V	
Power Supply for LC Drive	VDD-VEE	0	24.0	V	
Input Voltage	VI	GND	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 2,4		Note 3,4		Note 4,5		Note 4,6	

Note 2  $T_a \leq 50^\circ\text{C}$  : 85% RH max

$T_a > 50^\circ\text{C}$  : Absolute humidity must be lower than the humidity of 85%RH at  $50^\circ\text{C}$

Note 3  $T_a$  at  $-20^\circ\text{C}$  will be < 48hrs, at  $70^\circ\text{C}$  will be < 120hrs

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

Note 5  $T_a \leq 70^\circ\text{C}$  : 75%RH max.

$T_a > 70^\circ\text{C}$  : Absolute humidity must be lower than the humidity of 75%RH at  $70^\circ\text{C}$

Note 6  $T_a$  at  $-30^\circ\text{C}$  will be < 48hrs, at  $80^\circ\text{C}$  will be < 120hrs

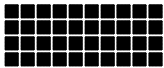
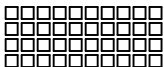
### 3. ELECTRICAL CHARACTERISTICS

(VDD = 5V±10%)

ITEM	SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Logic Circuit Power Supply	VIH	H level		0.8VDD	—	VDD	V
	VIO	L level		0	—	0.2VDD	V
LCD Driver Power Supply (Normal Temp. LCM)	VDD-VEE	VDD=5.0V 1/13 Bias	0°C	—	19.9	21.1	V
			25°C	17.8	18.5	19.2	V
			50°C	16.6	17.0	—	V
LCD Driver Power Supply (Wide Temp. LCM)	VDD-VEE	VDD=5.0V 1/13 Bias	-20°C	—	20.8	21.6	V
			0°C	19.0	19.8	20.4	V
			25°C	18.9	19.7	20.3	V
			50°C	18.8	19.6	20.2	V
			70°C	18.1	18.9	—	V
Power Consumption For LCM	Pd	VDD = 5.0V VEE = -13.5V		—	80	—	mW
Supply Current (LCM)	IDD	VDD = 5.0V VEE = -13.5V		—	8.6	—	mA
	IEE			—	2.7	—	
LED Power Supply Current	ILED	VBL = 4.2V±0.2V RBL = 0Ω		—	720	—	mA

### 3.1 BRIGHTNESS CHARACTERISTICS

ILED=720 mA VBL=4.2V±0.2V RBL= 0Ω (VDD = 5V±10%)

ITEM	CONDITION	MIN.	TYP.	MAX.	UNIT
BRIGHTNESS of LCM (LMCH9T214C)		—	6	—	cd/m <sup>2</sup>
		—	22	—	
	POWER OFF of LCM	—	26	—	

## 4. OPTICAL CHARACTERISTICS

(FOR NORMAL TEMPERATURE MODE LCM)

AT V<sub>OP</sub>

ITEM MODE		Cr(Contrast Ratio)		$\theta$ (Viewing Angle)		$\phi$ (Viewing Angle)	
		25℃		25℃		25℃	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
S	A	—	—	—	—	—	—
	C	—	—	—	—	—	—
	J	3.5	6	40	55	20	30
T	C	—	—	—	—	—	—
	E	3	6	35	65	25	40
note		NOTE6		NOTE5			

note:

S: TRANSFLECTIVE  
T: TRANSMISSIVE  
A: GRAY

C: YELLOW  
E: BLUE  
J: NORMALLY WHITE

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

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	0℃	—	500	1000	ms	NOTE 2
		25℃	—	120	240		
		50℃	—	70	140		
Response Time (fall)	Tf	0℃	—	700	1200	ms	NOTE 2
		25℃	—	140	260		
		50℃	—	80	150		

## 4.1 OPTICAL CHARACTERISTICS

(FOR WIDE TEMPERATURE MODE LCM)

AT  $V_{OP}$

ITEM MODE		Cr(Contrast Ratio)		$\theta$ (Viewing Angle)		$\phi$ (Viewing Angle)	
		25°C		25°C		25°C	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
S	A	3	4	40	60	28	35
T	A	—	2.5	20	40	15	20
	E	3	4	40	60	15	25
note		NOTE6		NOTE5			

note:

S: TRANSFLECTIVE  
T: TRANSMISSIVE  
A: GRAY

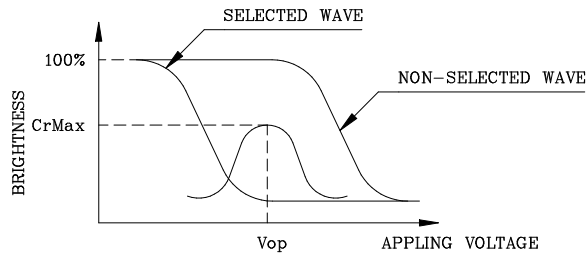
C: YELLOW  
E: BLUE  
J: NORMALLY WHITE

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

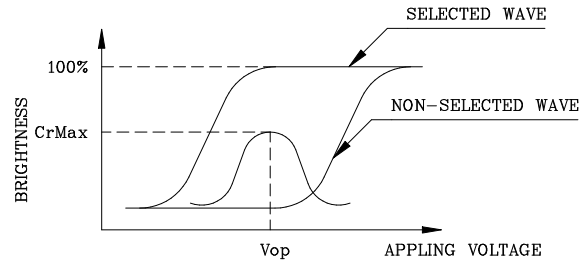
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	-20°C	—	2200	4400	ms	NOTE 2
		0°C	—	440	880		
		25°C	—	120	240		
		50°C	—	60	120		
		70°C	—	50	100		
Response Time (fall)	Tf	-20°C	—	3000	5000	ms	NOTE 2
		0°C	—	550	1100		
		25°C	—	180	350		
		50°C	—	80	150		
		70°C	—	70	130		

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



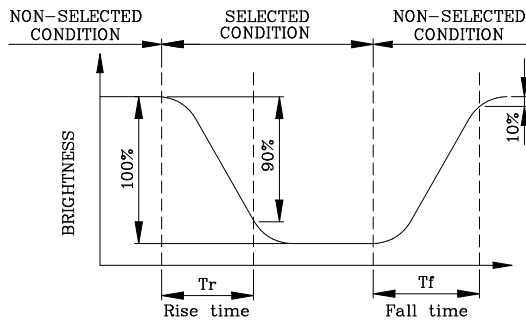
(negative type)

\*Conditions

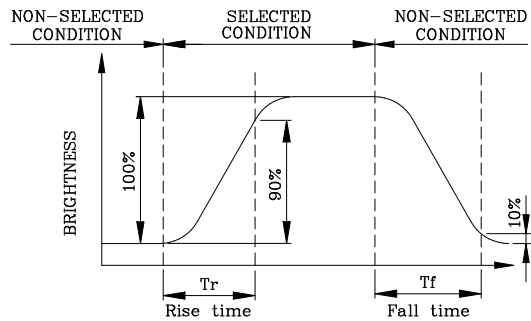
Viewing Angle : 0  
Frame Frequency : 70Hz  
Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



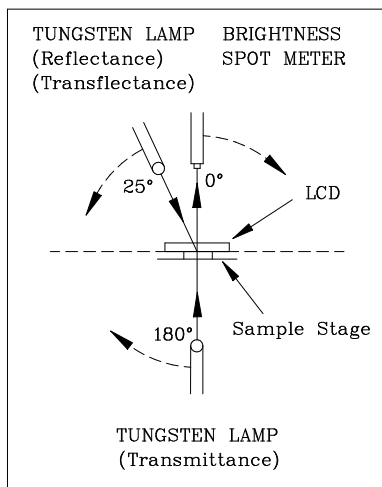
(negative type)

\*Conditions

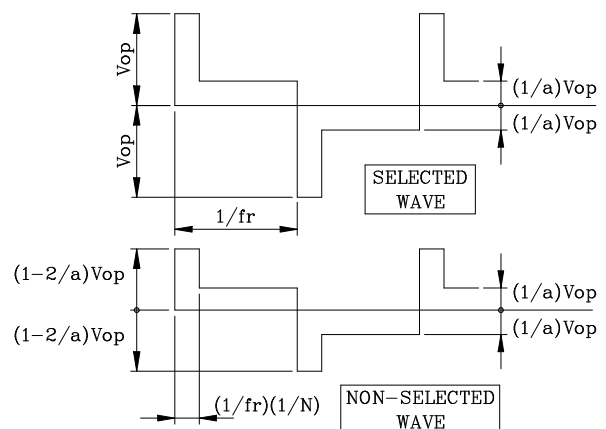
Operating Voltage : Vop  
Viewing Angle ( $\theta, \phi$ ) : (0,0)  
Frame Frequency : 70Hz  
Applying Waveform : 1/N duty 1/a bias

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



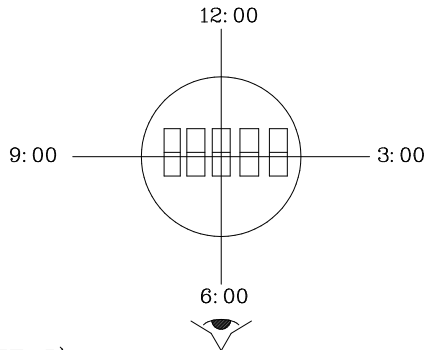
Multiplex Driving ( 1/N duty 1/a bias )





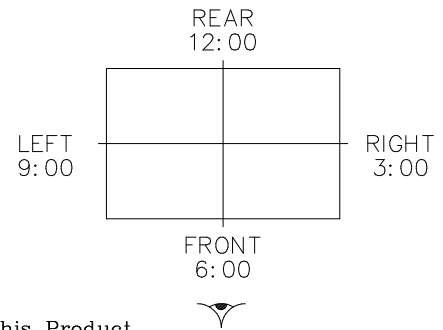
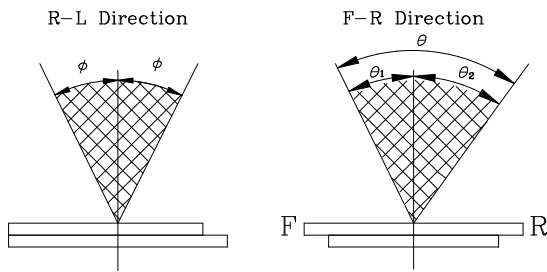
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



\*For This Product  
 The Viewing Direction Is 6 O'clock  
 So  $\theta_1 > \theta_2$

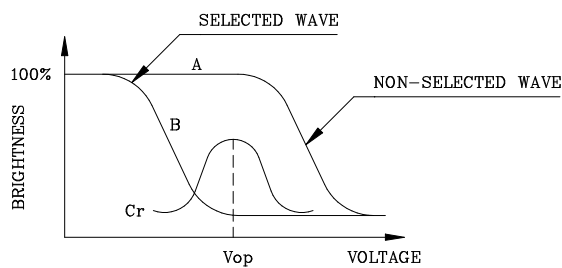
$$\theta = \theta_1 + \theta_2$$

\*Conditions

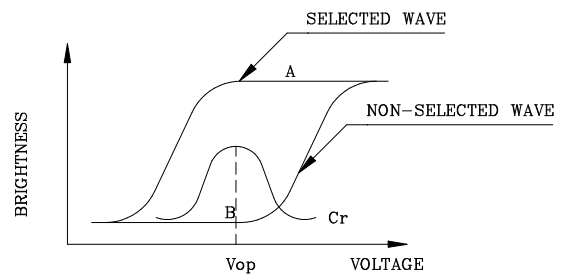
Operating Voltage :  $V_{op}$   
 Frame Frequency : 70Hz  
 Applying Waveform : 1/N duty 1/a bias  
 Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



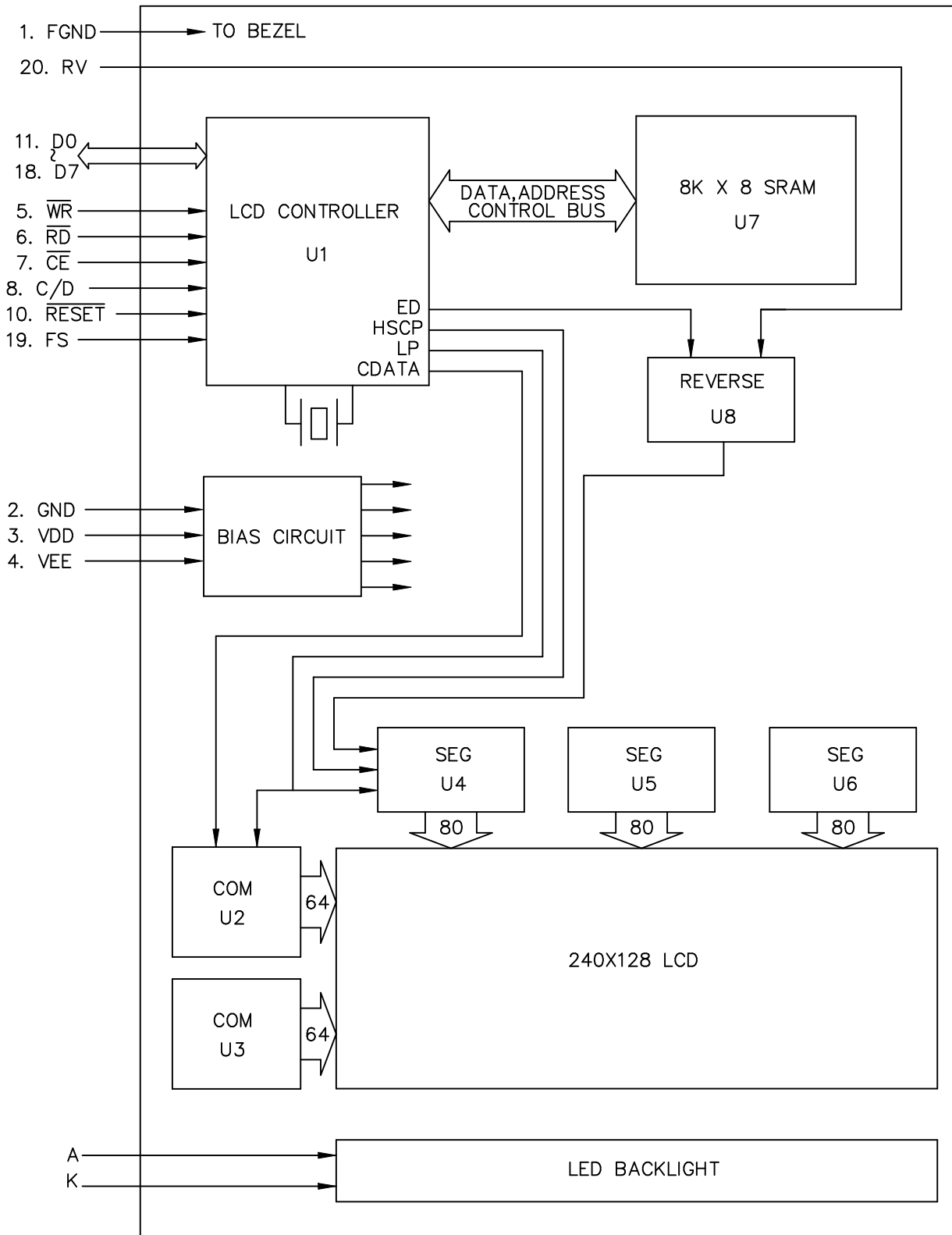
(negative type)

$$\text{Contrast Ratio : } Cr = A/B$$

\*Conditions

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

# 5. BLOCK DIAGRAM

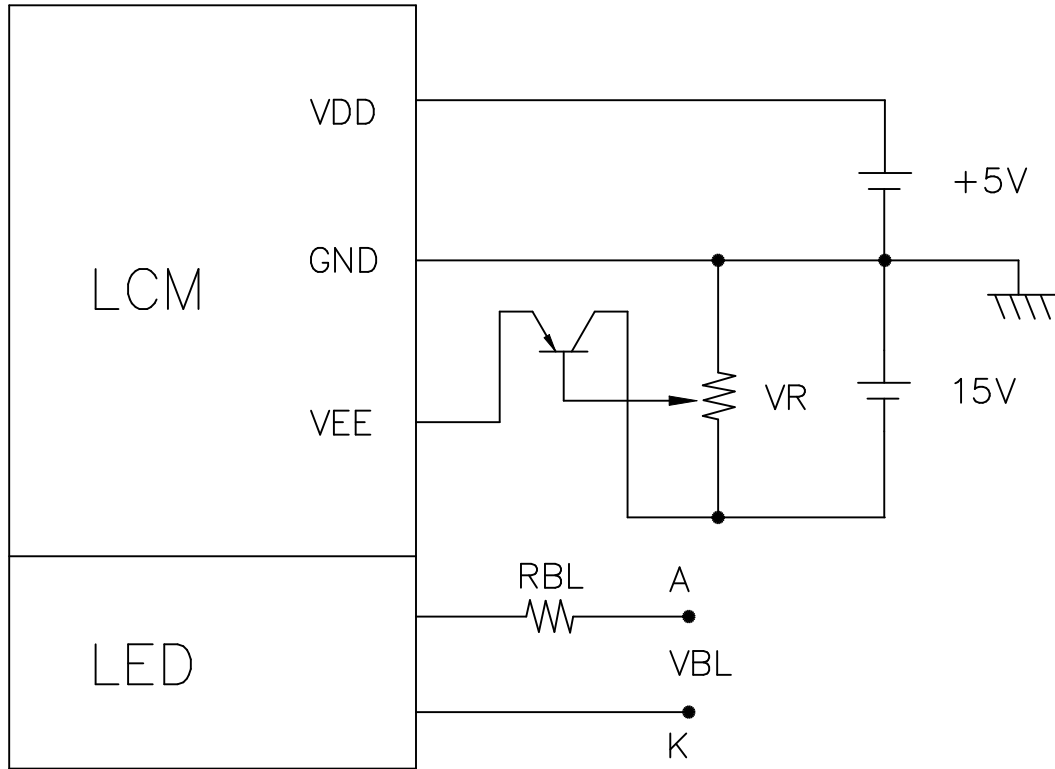


REV/DATE	R0/ 10.21,98'					APP	CHK	BY
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## 6. INTERNAL PIN CONNECTION

PIN NO.	SYMBOL	FUNCTION
1	FGND	FRAME GROUND (0V)
2	GND	GROUND
3	VDD	POWER SUPPLY FOR LOGIC (+5V)
4	VEE	POWER SUPPLY FOR LC DRIVING
5	$\overline{WR}$	DATA WRITE
6	$\overline{RD}$	DATA READ
7	$\overline{CE}$	CHIP ENABLE
8	C/D	$\overline{WR}$ ="L",C/D="H" : COMMAND WRITE $\overline{WR}$ ="L",C/D="L" : DATA WRITE $\overline{RD}$ ="L",C/D="H" : STATUS READ $\overline{RD}$ ="L",C/D="L" : DATA READ
9	NC	NO CONNECTION
10	$\overline{RESET}$	CONTROLLER RESET
11	D0	DATA INPUT/OUTPUT
12	D1	DATA INPUT/OUTPUT
13	D2	DATA INPUT/OUTPUT
14	D3	DATA INPUT/OUTPUT
15	D4	DATA INPUT/OUTPUT
16	D5	DATA INPUT/OUTPUT
17	D6	DATA INPUT/OUTPUT
18	D7	DATA INPUT/OUTPUT
19	FS	FONT SELECT      CONNECT TO VDD : 6X8 PIXELS/CHARACTER CONNECT TO GND : 8X8 PIXELS/CHARACTER
20	RV	DISPLAY DATA REVERSE      RV=H : REVERSE DISPLAY RV=L : NORMAL DISPLAY

## 7. POWER SUPPLY



1.  $VR = 10K \sim 20K$
2.  $VBL = 4.2 \pm 0.2V$   
 $RBL = 0 \Omega$

# 8. TIMING CHARACTERISTICS

## 8-1 INTERFACE TIMING

@VDD = 5V±10%

ITEM	ITEM	CONDITION	MIN.	MAX.	UNIT
C/D SET UP TIME	$t_{CDS}$	Fig.	100	-	ns
C/D HOLD TIME	$t_{CDH}$	Fig.	10	-	ns
$\overline{CE}, \overline{RD}, \overline{WR}$ CLOCK WIDTH	$t_{CP}, t_{RP}, t_{WP}$	Fig.	80	-	ns
DATA SET UP TIME	$t_{DS}$	Fig.	80	-	ns
DATA HOLD TIME	$t_{DH}$	Fig.	40	-	ns
ACCESS TIME	$t_{ACC}$	Fig.	-	150	ns
DATA OUTPUT HOLD TIME	$t_{OH}$	Fig.	10	50	ns

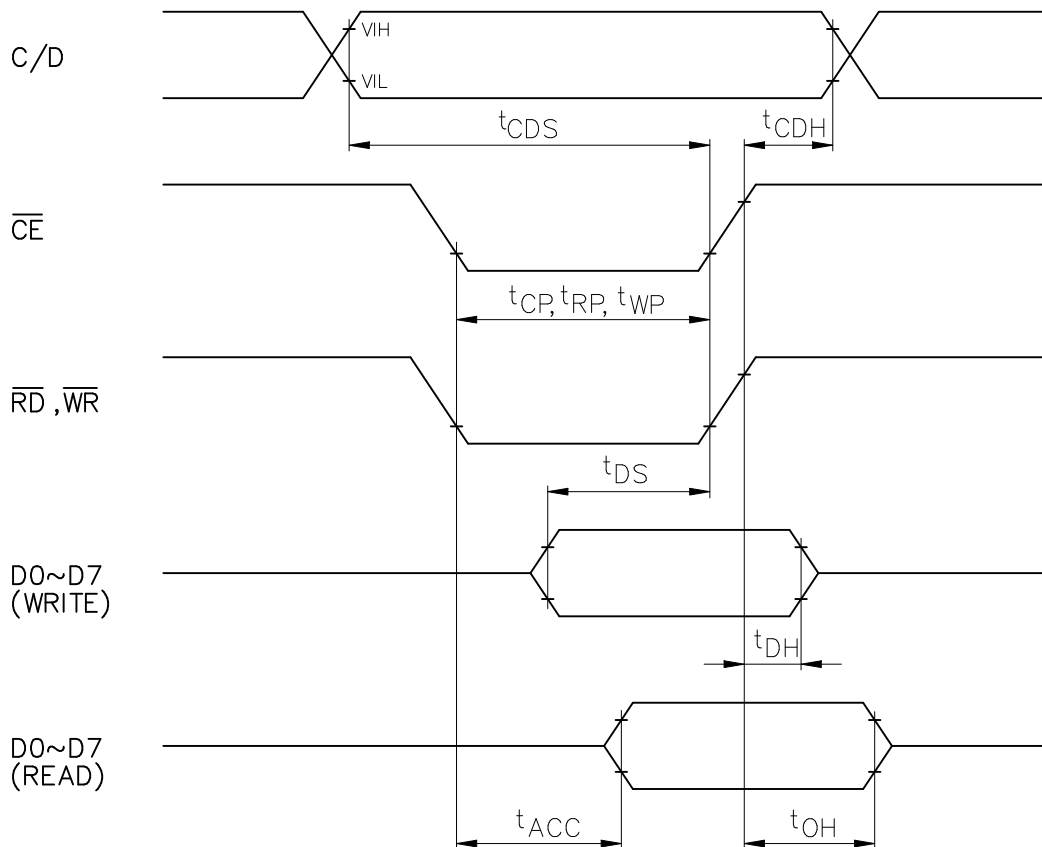
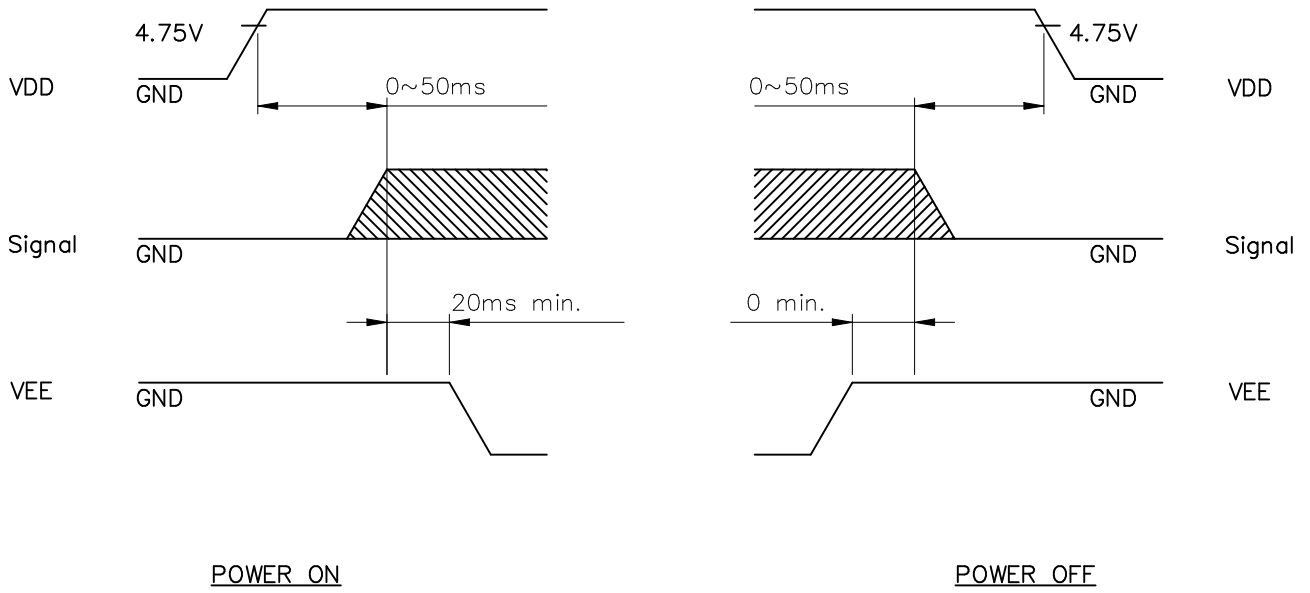


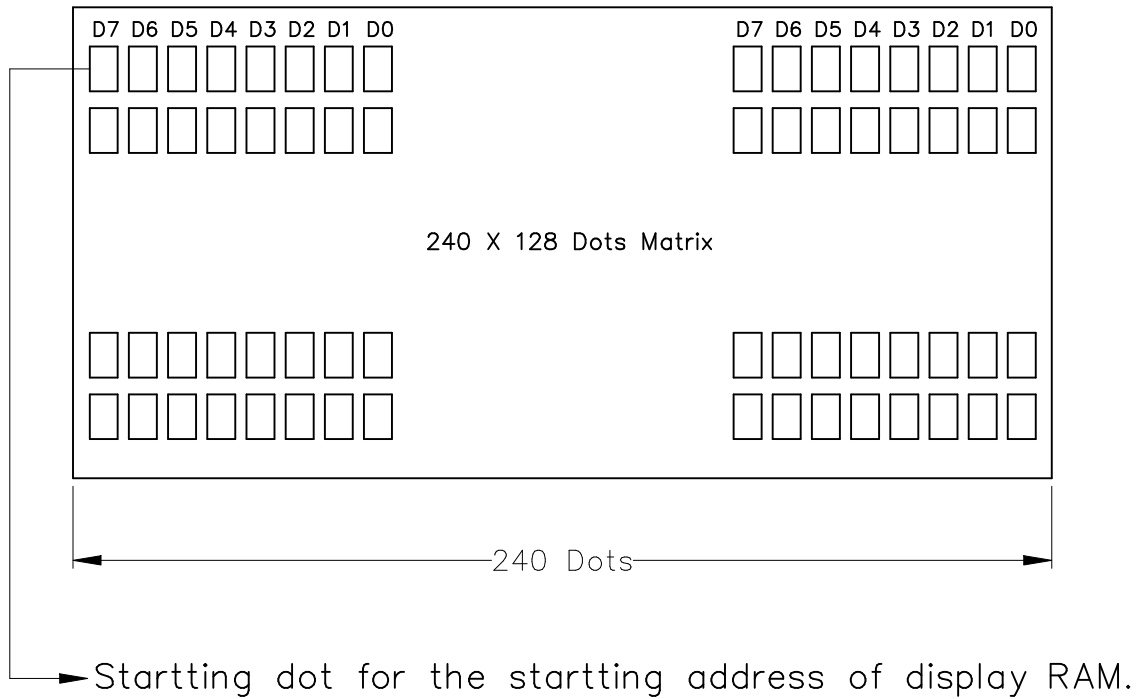
Fig. INTERFACE TIMING CHART

8-2 POWER ON/OFF TIMING



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

# 9. DISPLAY PATTERN



D0~D7 are 8 bits transmitted data, where D0 is LSB and D7 is MSB.

9-2 COMMAND LIST

COMMAND	CODE	D1	D2	FUNCTION
REGISTER SET	00100001	X address	X address	Cursor pointer set
	00100010	Data	OOH	Offset register set
	00100100	Low address	High address	Address pointer set
CONTROL WORD SET	01000000	Low address	High address	Text home address set
	01000001	Columns	OOH	Text area set
	01000010	Low address	High address	Graphic home address set
	01000011	Columns	OOH	Graphic area set
MODE SET	1000X000	—	—	"OR" mode
	1000X001	—	—	"EXOR" mode
	1000X011	—	—	"AND" mode
	1000X100	—	—	"Text attribute" mode
	10000XXX	—	—	Internal CG ROM mode
	10001XXX	—	—	External CG RAM mode
DISPLAY MODE	10010000	—	—	Display off
	1001XX10	—	—	Cursor on, blink off
	1001XX11	—	—	Cursor on, blink on
	100101XX	—	—	Text on, graphic off
	100110XX	—	—	Text off, graphic on
	100111XX	—	—	Text on, graphic on
CURSOR PATTERN SELECT	10100000	—	—	1 line cursor
	10100001	—	—	2 lines cursor
	10100010	—	—	3 lines cursor
	10100011	—	—	4 lines cursor
	10100100	—	—	5 lines cursor
	10100101	—	—	6 lines cursor
	10100110	—	—	7 lines cursor
	10100111	—	—	8 lines cursor
DATA AUTO READ/WRITE	10110000	—	—	Data auto write set
	10110001	—	—	Data auto read set
	10110010	—	—	Auto reset
DATA READ WRITE	11000000	Data	—	Data write and ADP increment
	11000001	—	—	Data read and ADP increment
	11000010	Data	—	Data write and ADP decrement
	11000011	—	—	Data read and ADP decrement
	11000100	Data	—	Data write and ADP nonvariable
	11000101	—	—	Data read and ADP nonvariable
SCREEN PEEK	11100000	—	—	Screen peek
SCREEN COPY	11101000	—	—	Screen copy
BIT SET/RESET	11110XXX	—	—	bit reset
	11111XXX	—	—	bit set
	1111X000	—	—	bit0(LSB)
	1111X001	—	—	bit1
	1111X010	—	—	bit2
	1111X011	—	—	bit3
	1111X100	—	—	bit4
	1111X101	—	—	bit5
	1111X110	—	—	bit6
	1111X111	—	—	bit7(MSB)



**\* STATUS READ**

Before sending data (read/write), command it is necessary to check the status.

T6963C status word format is following :

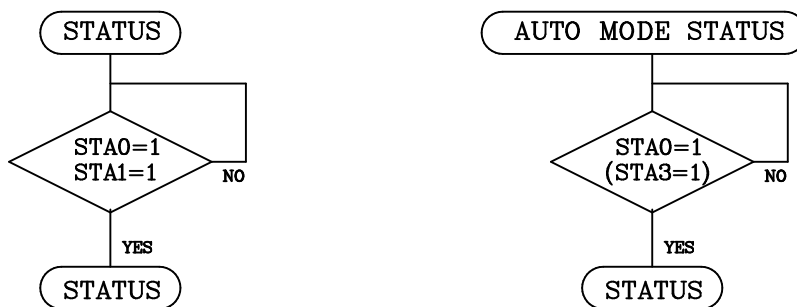
LSB	D0	STA0	Check capability of command execution	0: Disable 1: Enable
	D1	STA1	Check capability of data read/write	0: Disable 1: Enable
	D2	STA2	Check capability of auto mode data read	0: Disable 1: Enable
	D3	STA3	Check capability of auto mode data write	0: Disable 1: Enable
	D4	STA4	Not use	
	D5	STA5	Check capability of controller operation	0: Disable 1: Enable
	D6	STA6	Error flag. Using screen peek/copy command	0: Disable 1: Enable
MSB	D7	STA7	Check the condition blink	0: Disable 1: Enable

Note 1: It is necessary to check STA0 and STA1 at the same time. The error is happened by sending data at executing command.

Note 2: The status check will be enough to check STA0/STA1.

Note 3: STA2/STA3 are valid in auto mode STA0/STA1 are invalid.

Status checking flow



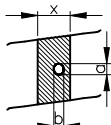
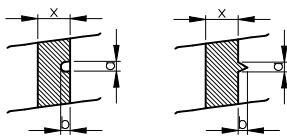
Note 4: It is impossible to save status check in the case of command of MSB0. To have the delay time cannot be save status check. The interrupt of hardware is happened at the end of lines. If command of MSB0 is sent in this period, the command executing is waited. The state of waiting doesn't disregarded or rewrites data of waiting command.

## 10. 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

LCD PRODUCT QUALITY STANDARD

(1) DISPLAY APPEARANCE

NO	ITEM	C R I T E R I A																	
1.	INCLUSIONS (BLACK SPOT, WHITE SPOT, DUST)	(1) ROUND TYPE																	
		<table border="1"> <thead> <tr> <th colspan="3">DIAMETER mm (a*)</th> <th>NO. OF DEFECT*</th> </tr> </thead> <tbody> <tr> <td></td> <td>a</td> <td>≅ 0.20</td> <td>NEGLECT</td> </tr> <tr> <td>0.20</td> <td>&lt; a</td> <td>≅ 0.35</td> <td>5 MAX</td> </tr> <tr> <td>0.35</td> <td>&lt; a</td> <td></td> <td>NONE</td> </tr> </tbody> </table>	DIAMETER mm (a*)			NO. OF DEFECT*		a	≅ 0.20	NEGLECT	0.20	< a	≅ 0.35	5 MAX	0.35	< a		NONE	
DIAMETER mm (a*)			NO. OF DEFECT*																
	a	≅ 0.20	NEGLECT																
0.20	< a	≅ 0.35	5 MAX																
0.35	< a		NONE																
		(2) LINEAR TYPE																	
		<table border="1"> <thead> <tr> <th>LENGTH mm(L)</th> <th>WIDTH mm(W)</th> <th>NO. OF DEFECT</th> </tr> </thead> <tbody> <tr> <td>N A</td> <td>W ≅ 0.03</td> <td>NEGLECT</td> </tr> <tr> <td>L ≅ 3</td> <td>0.03 &lt; W ≅ 0.08</td> <td>6</td> </tr> <tr> <td>3 &lt; L</td> <td>0.08 &lt; W</td> <td>NONE</td> </tr> </tbody> </table>	LENGTH mm(L)	WIDTH mm(W)	NO. OF DEFECT	N A	W ≅ 0.03	NEGLECT	L ≅ 3	0.03 < W ≅ 0.08	6	3 < L	0.08 < W	NONE					
LENGTH mm(L)	WIDTH mm(W)	NO. OF DEFECT																	
N A	W ≅ 0.03	NEGLECT																	
L ≅ 3	0.03 < W ≅ 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																	
		<table border="1"> <thead> <tr> <th colspan="3">DIAMETER mm (a*)</th> <th>NO. OF DEFECT*</th> </tr> </thead> <tbody> <tr> <td></td> <td>a</td> <td>≅ 0.15</td> <td>NEGLECT</td> </tr> <tr> <td>0.15</td> <td>&lt; a</td> <td>≅ 0.20</td> <td>2 MAX</td> </tr> <tr> <td>0.20</td> <td>&lt; a</td> <td></td> <td>NONE</td> </tr> </tbody> </table>	DIAMETER mm (a*)			NO. OF DEFECT*		a	≅ 0.15	NEGLECT	0.15	< a	≅ 0.20	2 MAX	0.20	< a		NONE	
DIAMETER mm (a*)			NO. OF DEFECT*																
	a	≅ 0.15	NEGLECT																
0.15	< a	≅ 0.20	2 MAX																
0.20	< a		NONE																
		(2) LINEAR TYPE BE JUDGED BY 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 ≅ 0.15 mm MAXIMUM NUMBER: IGNORED 0.15 < (a+b)/2 ≅ 0.20 MAXIMUM NUMBER: 10																	
6.	DOT DEFECT	(a+b)/2 ≅ 0.20 mm MAXIMUM NUMBER: IGNORED 0.20 < (a+b)/2 ≅ 0.30 MAXIMUM NUMBER: 5 x = WIDTH																	
7.	CONTRAST IRREGULARITY (SPOT)	DIAMETER SPEC. a ≅ 0.50 mm 0.50 < a ≅ 0.75 0.75 < a ≅ 1.00 1.00 < a	NO. OF DEFECT* NEGLECT 5 3 NONE																
8.	DOT WIDTH	DESIGN WIDTH ±15%																	
9.	COLOR TONE AND UNIFORMITY	OBVIOUS UNEVEN COLOR IS NOT PERMITTED																	

(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  $25^{\circ}\text{C}\pm 5^{\circ}\text{C}$  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

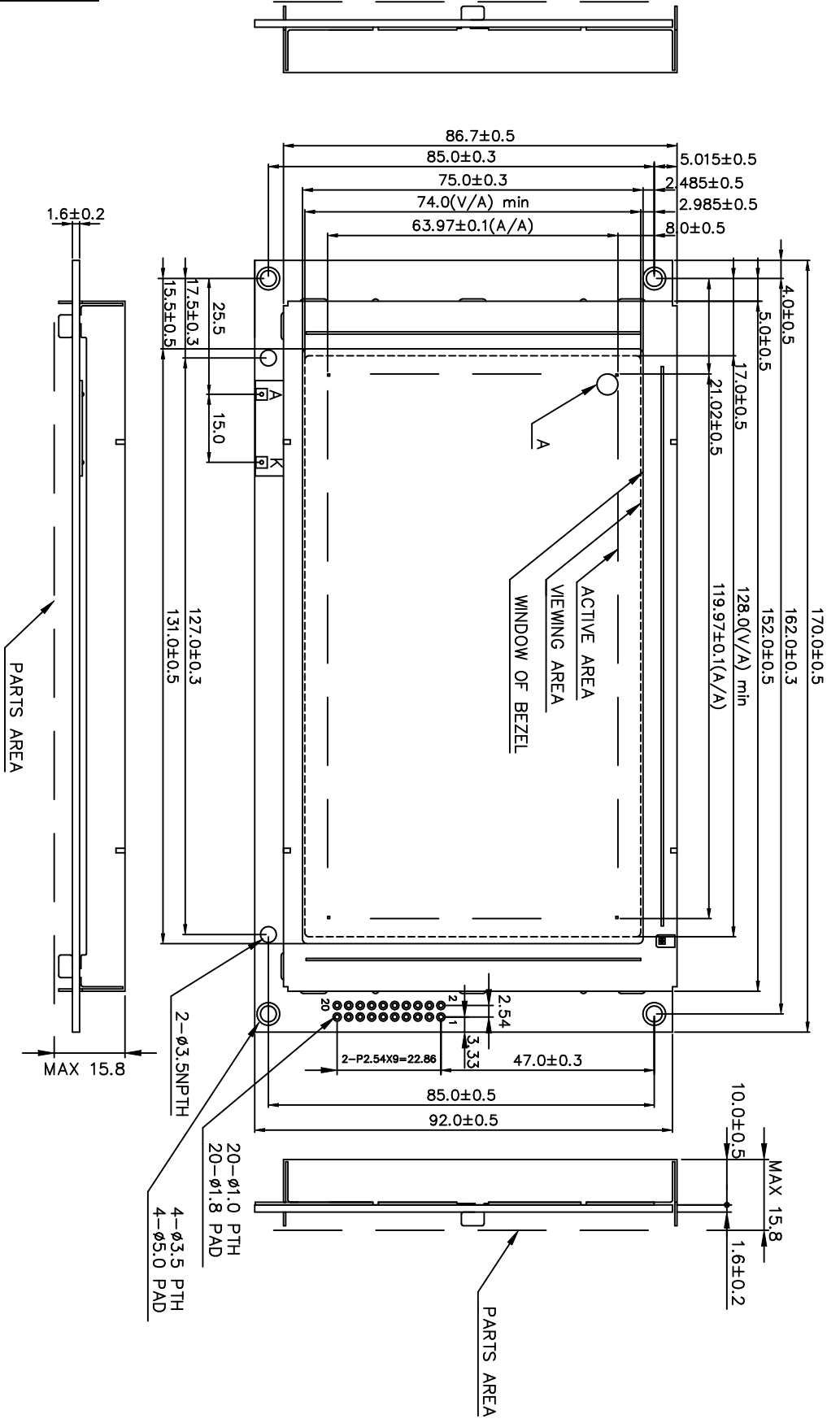
- 1.Acceptance inspection period  
The period is within one month after the arrival of contracted commodity at the buyer's factory site.
- 2.Applicable warrant period  
The period is within twelve months since the date of shipping out under normal using and storage conditions.

- THE OPERATING LIFE TIME OF BACK LIGHT

LED : BRIGHTNESS DECAY RATE 10%/1000 hrs.

REV/DATE	R0/ 10.21,98'					APP	CHK	BY
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PIN NO.	SYMBOL
1	FGND
2	GND
3	VDD
4	VEE
5	WR
6	RD
7	OE
8	C/D
9	NC
10	RESET
11	D0
12	D1
13	D2
14	D3
15	D4
16	D5
17	D6
18	D7
19	FS
20	RV



NOTE:

1. Resolution : 240x128 Dots
2. Back Light : LED
3. General Tolerance :  $\pm 0.5$ mm

產品編號	LMCH9X214X	南亞塑膠工業股份有限公司
NAME		NAN YA PLASTICS CORPORATION
DATE		
TITLE		製品圖
DWG-NO	MCAXX214X	Rev.A
CHECK		
DESIGN		
DRAW	MAY PING	87.10.21
THIRD ANGLE PROJECT		
UNIT	mm	
SCALE	1/1	