

NAN YA PLASTICS CORP.
ELEC. MATERIALS DIV.
LCD DEPARTMENT

SPECIFICATION

SPEC. NO. : LT245-0
DATE : Feb,26, 1999
SHEET NO. : 1/19

U.S. MARKETING ARM:

MARK PRODUCTS CORPORATION
800 N. EDGEWOOD AVENUE
WOOD DALE, IL 60191
TEL: 630-787-9089
FAX: 630-787-9015

SPECIFICATION OF
16x2 COG LCD MODULE
PRODUCT NO.: LTK62R245A__

SPEC. NO.: LT245-0-~~0~~[△]

CUSTOMER
APPROVED BY
DATE:

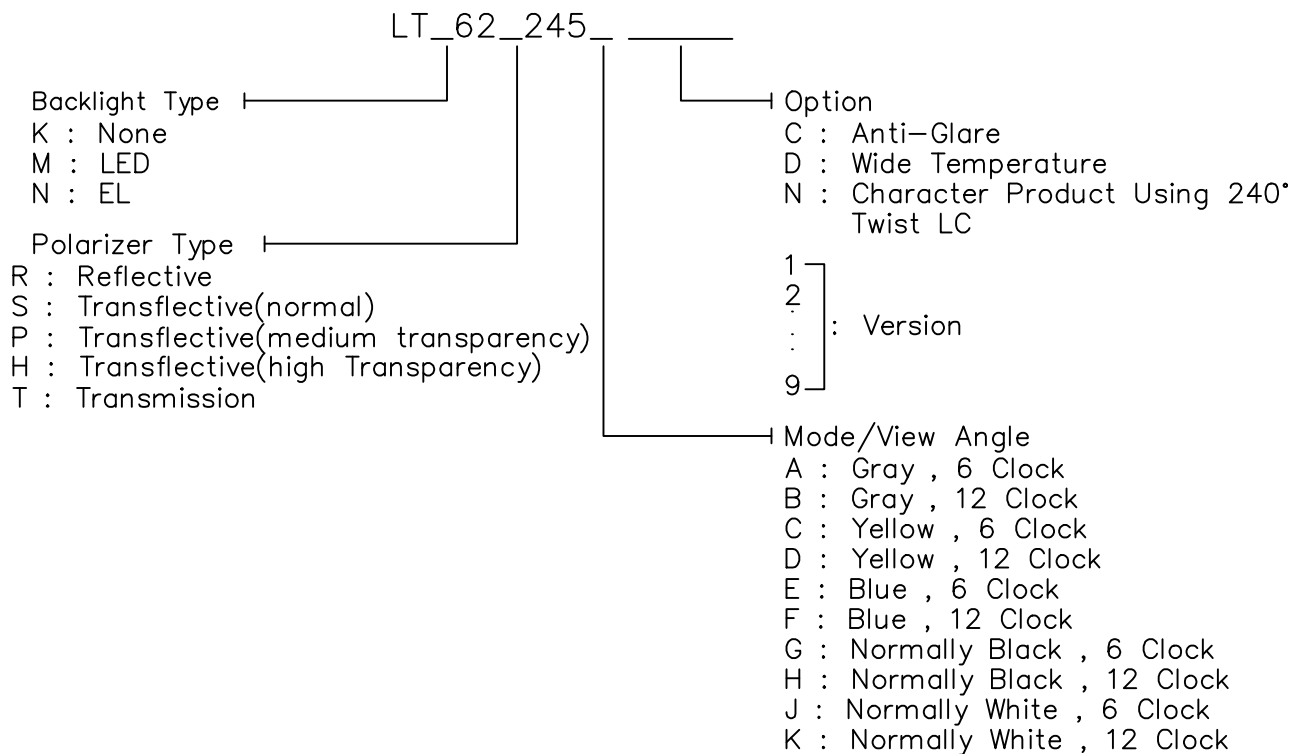
SALE MANAGER	TECHNICAL APPROVE	DESIGN MANAGER	DESIGN CHECK	DESIGNER

REV/DATE	R0/ 02.26.99'					APP	CHK	BY
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1. MECHANICAL DATA

- (1) Product No. LTK62R245_ _____
- (2) Module Size 65.0 (W)mm x 27.7 (H)mm x MAX2.0 (D)mm
(W/O B.L.)
- (3) Dot Size 0.55 (W)mm x 0.60 (H)mm
- (4) Dot Pitch 0.60 (W)mm x 0.65 (H)mm
- (5) Number of Characters 16 (W) x 2 (H)Characters
- (6) Character Format 5 (W) x 8 (H)Dots
- (7) Duty 1/16
- (8) LCD Display Mode STN: Gray 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
- (10) Backlight W/O
- (11) Weight Approx. 6.5 g
- (12) Controller(COG) FCS2314AK

Note :



REV/DATE	R0/ 02.26.99'					APP	CHK	BY
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2. ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

VSS=0V

	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VDD-VSS	-0.3	5.5	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 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°C

Note 3 T_a at -20°C will be < 48hrs, at 70°C will be < 120hrs

Note 4 Background color will change slightly depending on ambient temperature.
at 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°C

Note 6 T_a at -30°C will be < 48hrs, at 80°C will be < 120hrs

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3. ELECTRICAL CHARACTERISTICS

(VDD= 5V ± 10%)

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	
Input Voltage	VIH	H level	0.8VDD	-	VDD	V	
	VIL	L level	0	-	0.2VDD	V	
Recommended LCD Driving Voltage (NORMAL TEMP. LCM)	VDD-V5 (VLCD)	FRM= 70Hz DUTY= 1/16 Bias= 1/5	0℃	4.3	4.7	5.1	V
			25℃	4.1	4.5	4.9	
			50℃	4.0	4.4	4.8	
Recommended LCD Driving Voltage (WIDE TEMP. LCM)	VDD-V5 (VLCD)	FRM= 70Hz DUTY= 1/16 Bias= 1/5	-20℃	-	-	-	V
			0℃	-	-	-	
			25℃	-	-	-	
			50℃	-	-	-	
			70℃	-	-	-	
Power Supply Current	IDD	VDD = 5.0V	-	0.82	-	mA	

4. OPTICAL CHARACTERISTICS

(FOR NORMAL TEMPERATURE MODE LCM)

AT V_{OP}

ITEM MODE		Cr(Contrast Ratio)		θ (Viewing Angle)		ϕ (Viewing Angle)	
		25 τ		25 τ		25 τ	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
R	A	-	-	-	-	-	-
	C	-	-	-	-	-	-
	J	-	-	-	-	-	-
S	A	-	4.0	-	50	-	40
	C	-	8.0	-	80	-	50
	J	-	-	-	-	-	-
T	E	-	-	-	-	-	-
	D	-	4.0	-	85	-	38
NOTE		NOTE6		NOTE5			

NOTE :

R: REFLECTIVE
S: TRANSFLECTIVE
T: TRANSMISSIVE
A/B: GRAY

C/D: YELLOW
E/F: BLUE
G/H: NORMALLY BLACK
J/K: NORMALLY WHITE

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

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	0 τ	-	700	1100	ms	NOTE 2
		25 τ	-	170	260		
		50 τ	-	100	150		
Response Time (fall)	Tf	0 τ	-	400	600	ms	NOTE 2
		25 τ	-	120	180		
		50 τ	-	50	80		

4-1.OPTICAL CHARACTERISTICS

(FOR WIDE TEMPERATURE MODE LCM)

AT Vop

ITEM MODE		Cr(Contrast Ratio)		θ (Viewing Angle)		ϕ (Viewing Angle)	
		25℃		25℃		25℃	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
R	A	-	-	-	-	-	-
	C	-	-	-	-	-	-
	J	-	-	-	-	-	-
S	A	-	-	-	-	-	-
	C	-	-	-	-	-	-
	J	-	-	-	-	-	-
T	E	-	-	-	-	-	-
	G	-	-	-	-	-	-
NOTE		NOTE6		NOTE5			

NOTE :

R: REFLECTIVE
S: TRANSFLECTIVE
T: TRANSMISSIVE
A/B: GRAY

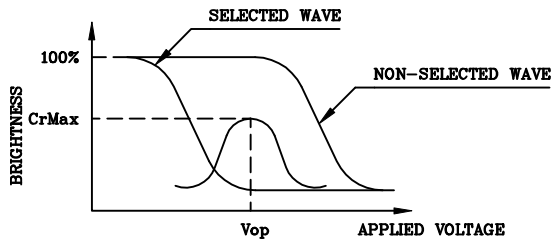
C/D: YELLOW
E/F: BLUE
G/H: NORMALLY BLACK
J/K: NORMALLY WHITE

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

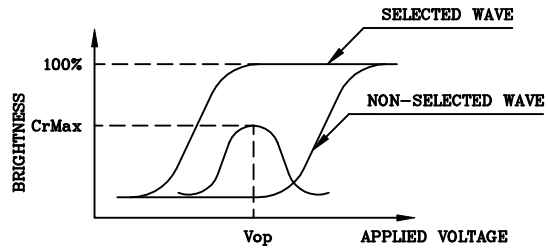
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	-20℃	-	-	-	ms	NOTE 2
		0℃	-	-	-		
		25℃	-	-	-		
		50℃	-	-	-		
		70℃	-	-	-		
Response Time (fall)	Tf	-20℃	-	-	-	ms	NOTE 2
		0℃	-	-	-		
		25℃	-	-	-		
		50℃	-	-	-		
		70℃	-	-	-		

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



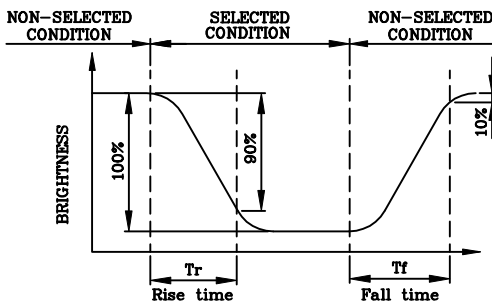
(negative type)

*Conditions

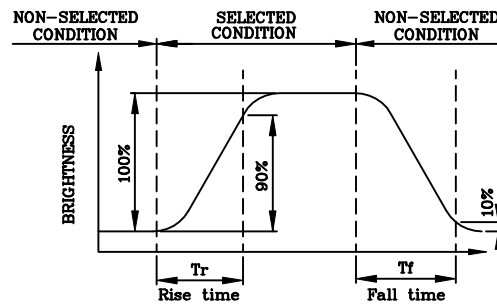
Viewing Angle : 0
Frame Frequency : 70Hz
Applied Waveform : 1/N duty, 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



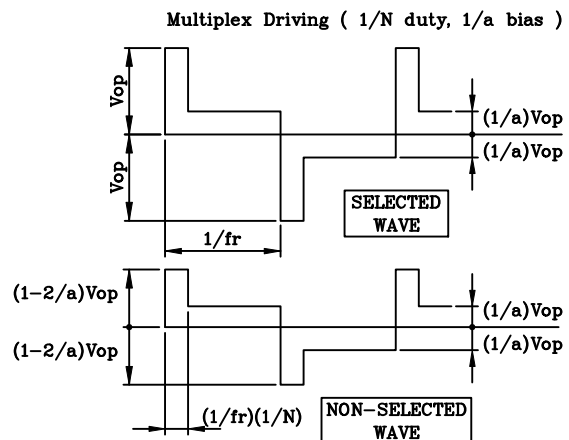
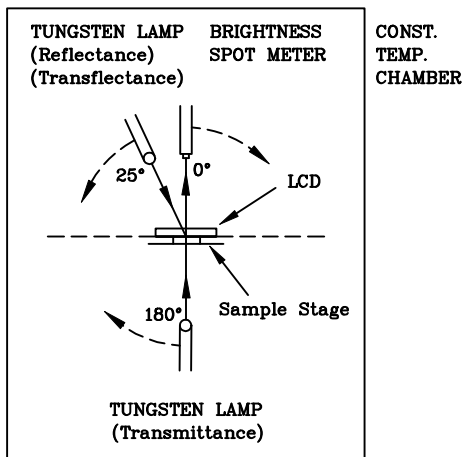
(negative type)

*Conditions

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

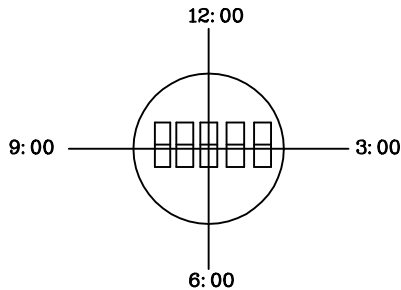
(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



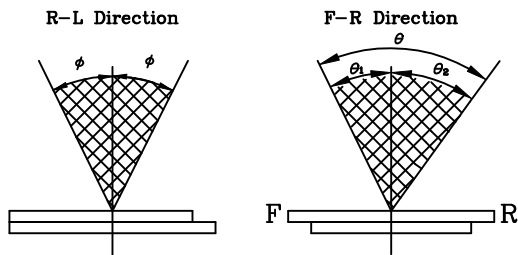
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



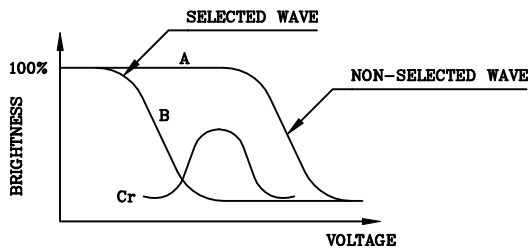
$$\theta = \theta_1 + \theta_2$$

*Conditions

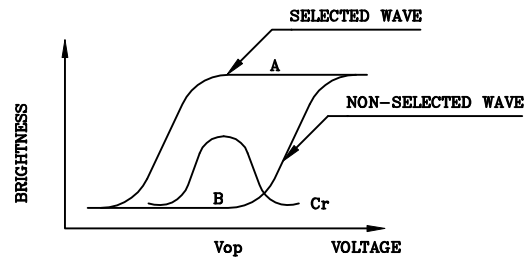
Operating Voltage : V_{op}
 Frame Frequency : 70Hz
 Applied Waveform : 1/N duty, 1/a bias
 Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



(negative type)

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

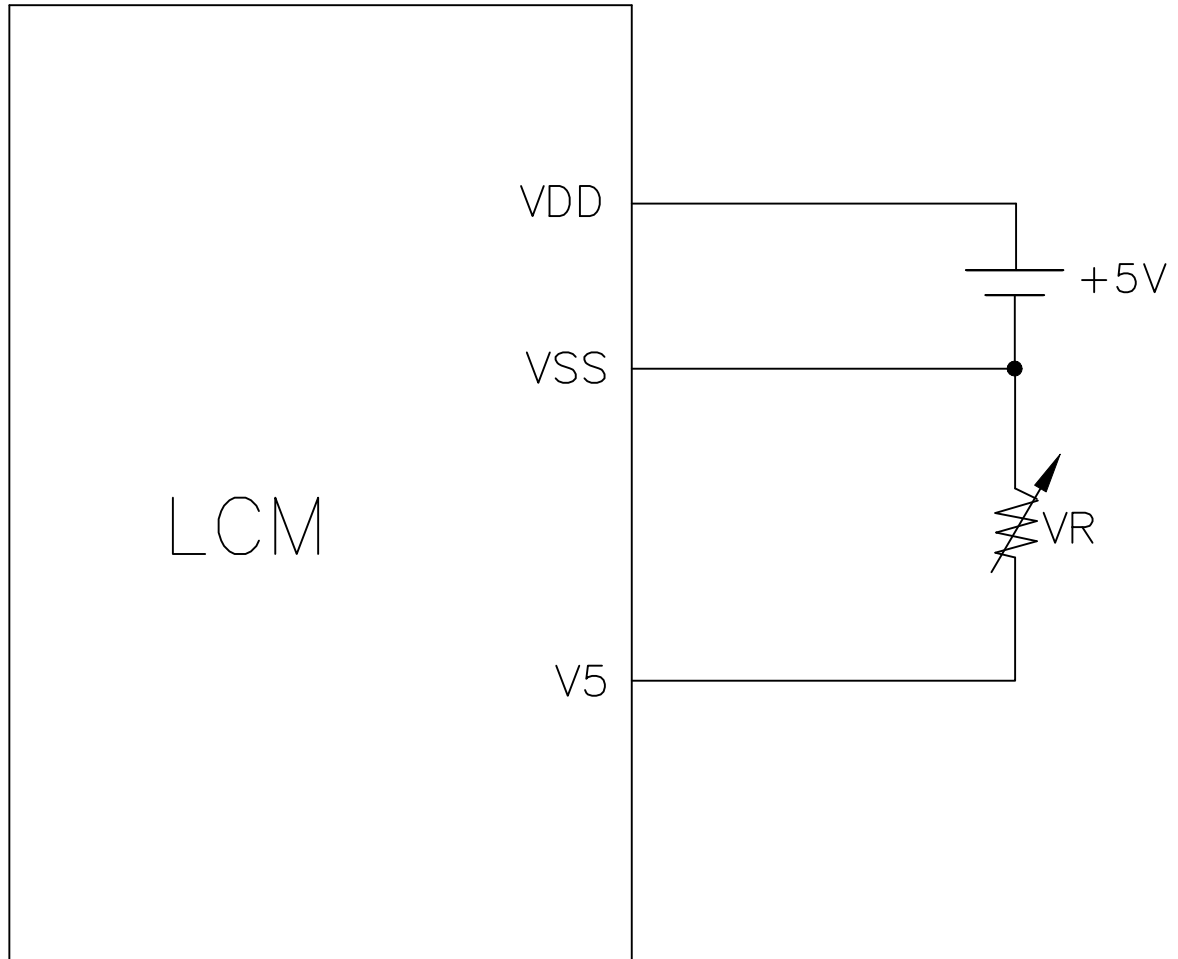
*Conditions

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

5. INTERNAL PIN CONNECTION

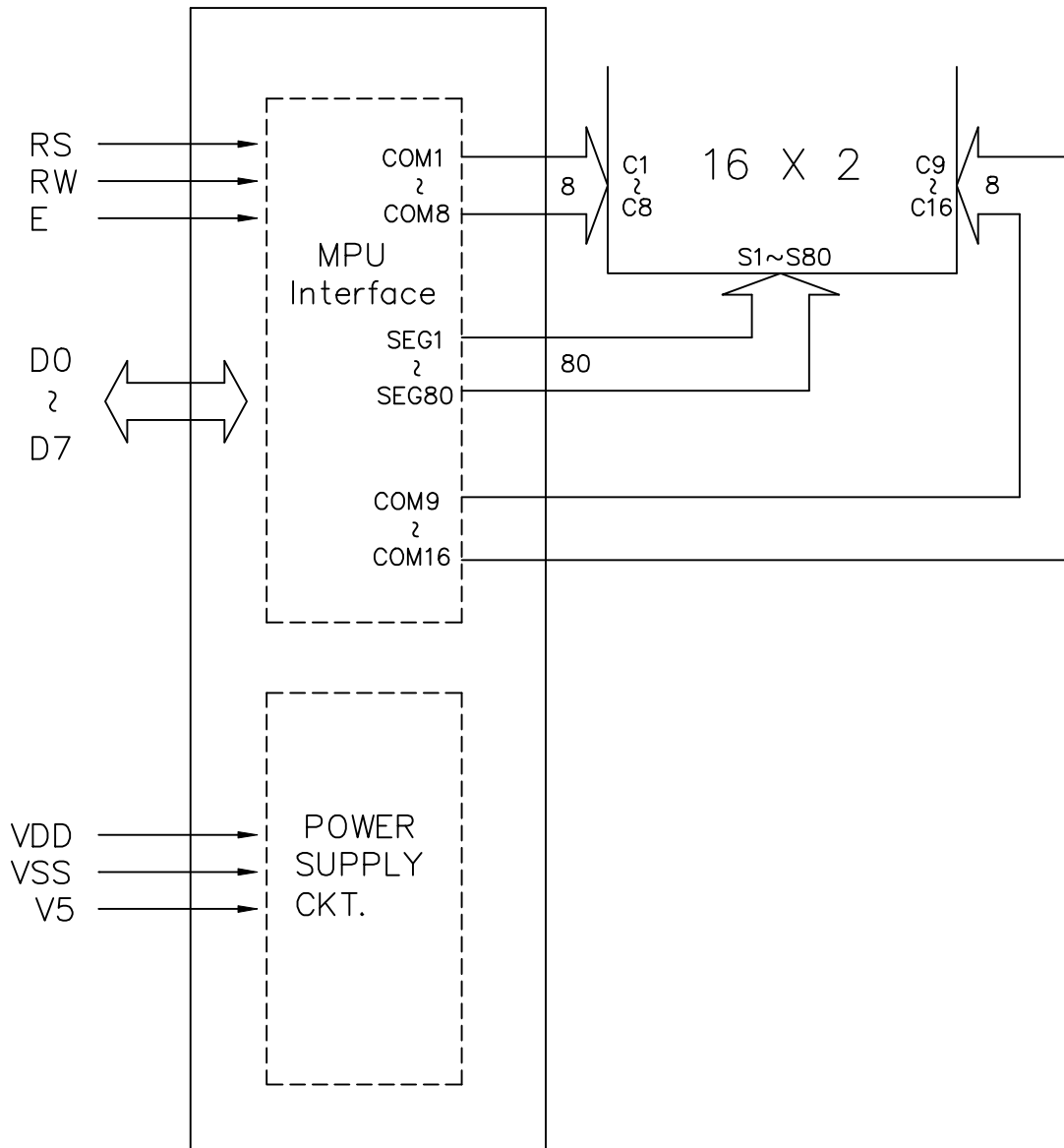
PinNo.	Symbol	Function
1	RS	Selects registers L: Instruction register(for write) Busy flag/Address counter (for read) H: Data register(for read/write)
2	RW	L : write H : read
3	E	Starts data for read/write
4	D0	Data Bus
5	D1	
6	D2	
7	D3	
8	D4	
9	D5	
10	D6	
11	D7	
12	VSS	0V(GND)
13	VDD	5.0V(LOGIC)
14	V5	Adjust contrast of LCM

6. POWER SUPPLY



VR : 5K Ω

7. MPU INTERFACE/BLOCK DIAGRAM



8. COMMAND

Instruction	Code										Description	Execution Time
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Clear display	0	0	0	0	0	0	0	0	0	1	Clears entire display and sets DDRAM address 0 in address counter.	1.64ms
Cursor home	0	0	0	0	0	0	0	0	1	—	Sets DDRAM address 0 in address counter. Also returns display from being shifted to original position. DDRAM contents remain unchanged.	1.64ms
Entry mode set	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction and specifies display shift. These operations are performed during data write and read.	40us
Display on/off control	0	0	0	0	0	0	1	D	C	B	D: Sets entire display on/off C: Sets cursor on/off B: Sets blinking of cursor position	40us
Cursor display shift	0	0	0	0	0	1	S/C	R/L	—	—	Moves cursor and shifts display without changing DDRAM contents. S/C: 1=display 0=cursor shift R/L: 1=right 0=left	40us
Function set	0	0	0	0	1	DL	N	SD1	SD2	CD	DL: Sets interface data length (1=8bit 0=4bit) N: Line number (0:1-line, 1:2-lines) SD1,2: SEG data transfer direction* CD: COM data transfer direction (1=COM16-1 0=COM1-16)	40us
Set CGRAM address	0	0	0	1	ACG						Sets CGRAM address	40us
Set DDRAM address	0	0	1	ADD						Sets DDRAM address	40us	
Read busy flag and address	0	1	BF	AC						BF: Indicating internal operation (1=active 0=non active) AC: Address counter contents	0us	
Write data	1	0	DATA						Write data into CGRAM, or DDRAM	40us		
Read data	1	1	DATA						Read data from CGRAM, or DDRAM	40us		

Note: Execution time is when oscillation frequency is 270kHz.

9. TIMING CHARACTERISTICS

Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Enable cycle time	t_{cyc}	Fig.a, Fig.b	500	-	-	ns
Enable pulse width	PW_{EH}	Fig.a, Fig.b	230	-	-	ns
Enable rise/fall time	t_{Er}, t_{Ef}	Fig.a, Fig.b	-	-	20	ns
RS, R/W set up time	t_{AS}	Fig.a, Fig.b	40	-	-	ns
RS, R/W hold time	t_{H1}	Fig.a, Fig.b	10	-	-	ns
Data set up time	t_{DSW}	Fig.a	60	-	-	ns
Data output delay time	t_{DDR}	Fig.b	-	-	120	ns
Data write hold time	t_{H2}	Fig.a	10	-	-	ns
Data read hold time	t_{H2}	Fig.b	5	-	-	ns

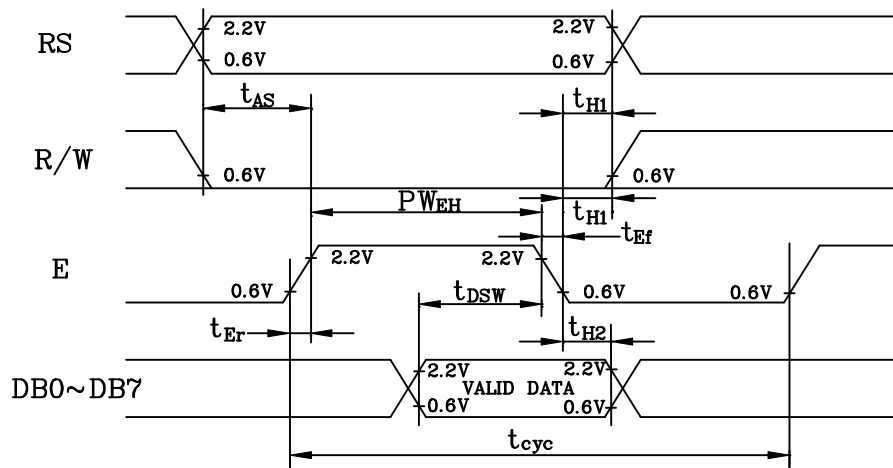


Fig.a Interface timing (data write)

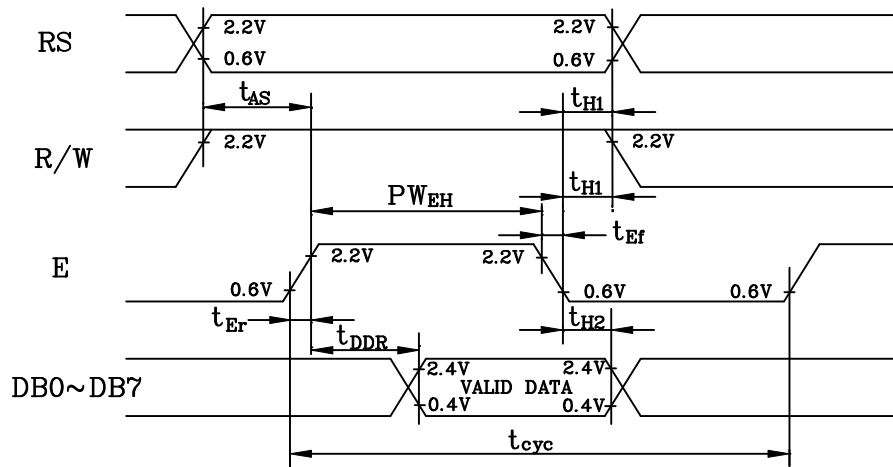
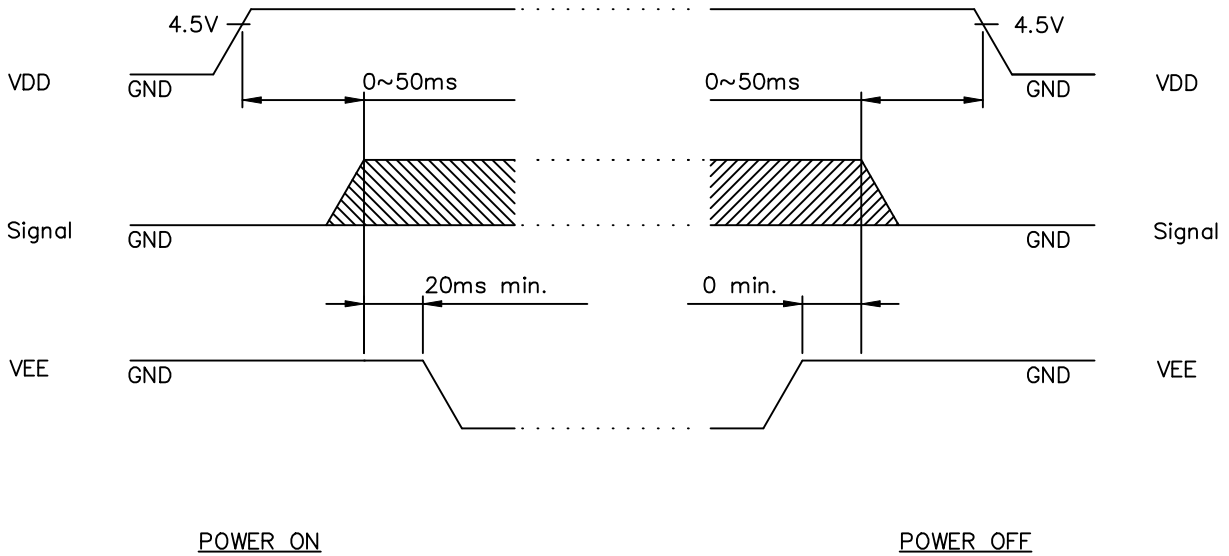


Fig.b Interface timing (data read)

9.1 POWER ON/OFF TIMING



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

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NAN YA PLASTICS CORP.
ELEC. MATERIALS DIV.
LCD DEPARTMENT

SPECIFICATION

SPEC. NO. : LT245-0
DATE : Feb,26, 1999
SHEET NO. : 15/19

11. PATTERN

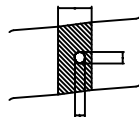
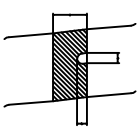
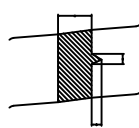
REV/DATE	R0/ 02.26.99'					APP	CHK	BY
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10. RELIABILITY TEST

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

11.LCD PRODUCT QUALITY STANDARD

(1) DISPLAY APPEARANCE

NO	ITEM	C R I T E R I A																					
1.	INCLUSIONS (BLACK SPOT , WHITE SPOT , DUST)	<p>(1) ROUND TYPE</p> <table border="1"> <thead> <tr> <th>DIAMETER mm (a*)</th> <th>NO. OF DEFECT*</th> </tr> </thead> <tbody> <tr> <td>$a \leq 0.20$</td> <td>NEGLECT</td> </tr> <tr> <td>$0.20 < a \leq 0.35$</td> <td>5 MAX</td> </tr> <tr> <td>$0.35 < a$</td> <td>NONE</td> </tr> </tbody> </table> <p>(2) LINEAR TYPE</p> <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>$W \leq 0.03$</td> <td>NEGLECT</td> </tr> <tr> <td>$L \leq 3$</td> <td>$0.03 < W \leq 0.08$</td> <td>6</td> </tr> <tr> <td>$3 < L$</td> <td>$0.08 < W$</td> <td>NONE</td> </tr> </tbody> </table>		DIAMETER mm (a*)	NO. OF DEFECT*	$a \leq 0.20$	NEGLECT	$0.20 < a \leq 0.35$	5 MAX	$0.35 < a$	NONE	LENGTH mm(L)	WIDTH mm(W)	NO. OF DEFECT	N A	$W \leq 0.03$	NEGLECT	$L \leq 3$	$0.03 < W \leq 0.08$	6	$3 < L$	$0.08 < W$	NONE
DIAMETER mm (a*)	NO. OF DEFECT*																						
$a \leq 0.20$	NEGLECT																						
$0.20 < a \leq 0.35$	5 MAX																						
$0.35 < a$	NONE																						
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N A	$W \leq 0.03$	NEGLECT																					
$L \leq 3$	$0.03 < W \leq 0.08$	6																					
$3 < L$	$0.08 < W$	NONE																					
2.	SCRATCH	<p>1.SCRATCH ON PROTECTIVE FILM IS PERMITTED . 2.SCRATCH ON POLARIZER SHALL BE AS FOLLOW: (1) ROUND TYPE</p> <table border="1"> <thead> <tr> <th>DIAMETER mm (a*)</th> <th>NO. OF DEFECT*</th> </tr> </thead> <tbody> <tr> <td>$a \leq 0.15$</td> <td>NEGLECT</td> </tr> <tr> <td>$0.15 < a \leq 0.20$</td> <td>2 MAX</td> </tr> <tr> <td>$0.20 < a$</td> <td>NONE</td> </tr> </tbody> </table> <p>(2) LINEAR TYPE BE JUDGED BY 1.-(2) LINEAR TYPE</p>		DIAMETER mm (a*)	NO. OF DEFECT*	$a \leq 0.15$	NEGLECT	$0.15 < a \leq 0.20$	2 MAX	$0.20 < a$	NONE												
DIAMETER mm (a*)	NO. OF DEFECT*																						
$a \leq 0.15$	NEGLECT																						
$0.15 < a \leq 0.20$	2 MAX																						
$0.20 < a$	NONE																						
3.	DENT	DIAMETER < 1.5mm																					
4.	BUBBLE	NOT EXCEEDING 0.5mm AVERAGE DIAMETER IS ACCEPTABLE BETWEEN GLASS AND POLARIZING FILM.																					
5.	PIN HOLE	$(a+b)/2 \leq 0.15$ mm MAXIMUM NUMBER:IGNORED $0.15 < (a+b)/2 \leq 0.20$ MAXIMUM NUMBER:10																					
6.	DOT DEFECT	$(a+b)/2 \leq 0.20$ mm MAXIMUM NUMBER:IGNORED $0.20 < (a+b)/2 \leq 0.30$ MAXIMUM NUMBER:5 x = WIDTH	 																				
7.	CONTRAST IRREGULARITY (SPOT)	DIAMETER SPEC. $a \leq 0.50$ mm $0.50 < a \leq 0.75$ $0.75 < a \leq 1.00$ $1.00 < a$	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 allow 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.Prevent all contact with static electricity, which can damage the CMOS ICs. The module is packaged in a static-shielding bag to prevent damage during shipment, warehousing and removal from the shipping carton.
- 2.Do not remove the panel or frame from the module.
- 3.The polarizing plate on the front surface of the display is very fragile and easily scratched. The module is shipped with a protective liner which must be removed from the polarizing plate prior to assembly.
- 4.Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of polarizing plate.
- 5.Do not use ketonics solvent or aromatic solvent on the polarizing plate. Use a soft cloth soaked with plastic-lens cleaning solution.

• 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 WARRANTY

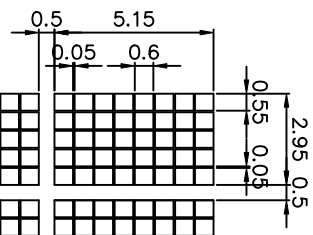
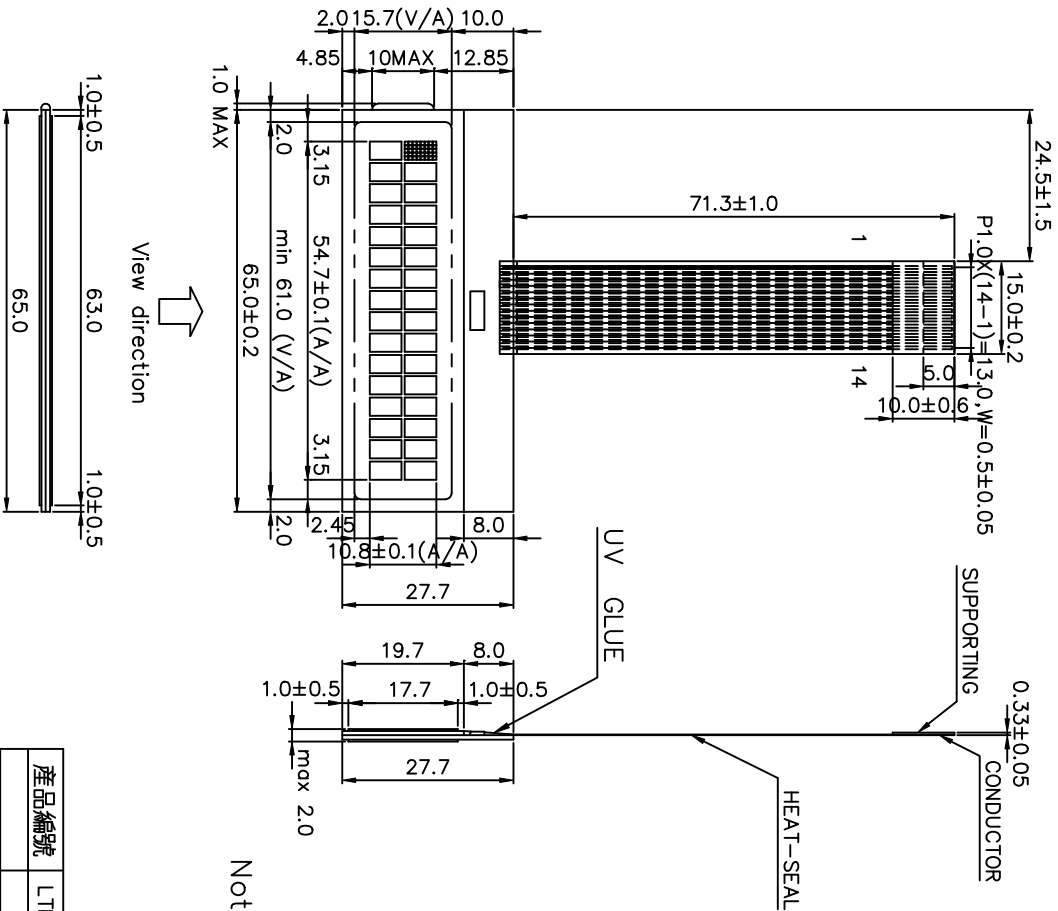
- 1.Acceptance inspection period
The inspection period is within one month after the arrival of the contracted goods at the buyer's factory site.
- 2.Applicable warranty period
The warranty period is within twelve months from the date of invoice under normal usage and storage conditions.

• TYPICAL OPERATING LIFETIME OF BACKLIGHT

- LED : 50,000HR
EL : 5,000HR
CCFT : 10,000HR

REV/DATE	R0/ 02.26.99'					APP	CHK	BY
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PinNo.	Symbol	Function
1	RS	Selects registers L: Instruction register(for write) Busy flag/Address counter (for read) H: Data register(for read/write)
2	RW	L : write H : read
3	E	Starts data for read/write
4	D0	Data Bus
5	D1	
6	D2	
7	D3	
8	D4	
9	D5	Data Bus (MSB)
10	D6	
11	D7	
12	VSS	0V(GND)
13	VDD	5.0V(LOGIC)
14	V5	Adjust contrast of LCM



Note:

1. General Tolerance: ±0.3mm
2. Glass Thickness : 0.7mm
3. 16X2 Characters
4. COG IC: FCS2314AK

產品編號	LTK62_245_	南亞塑膠工業股份有限公司
DATE		NAN YA PLASTICS CORPORATION
APPORVE		製器圖
CHECK		DWG-NO TKX245X
DESIGN		Rev.0
DRAW	KIKI	UNIT : mm
	88.02.28	SCALE : 0.85/1
		THIRD ANGLE PROJECT