LONDATECH

Date: 2006.07.13

Specifications for Approval

Customer : _____

Model name : LMG122321A-YTDSYW-NN REV: A

Description : LIQUID CRYSRAL DISPLAY MODULE

DESIGN	CHECK	APPROVED
EVEN	LYDIA	

Customer Approval	☐ **Accept** ☐ **Reject** **Comment:** **Approved by:**

LCM MODULE NUMBERING SYSTEM

PART NUMBER: LMAx……yB-CDEFGHI-JK

L: LONDA TECHNOLOGY
M: MODULE
A: DISPLAY CONTENTS C--- CHARACTER TYPE
G--- GRAPHIC TYPE
S---SEGMENT TYPE
x……: CHARACTERS Vs. LINES FOR CM
COLUMNS Vs. ROWS FOR GM
SERIALS NUMBER FOR SM
y: DISTRIBUTE ACCORDING TO SIZE
B： VERSION OF PCB
C: LCD TYPE:
Y---YELLOW STN G---GRAY STN B---BLUE STN
F---FSTN T---TN
D: POLARIZER TYPE:
R--- REFLECTIVE T--- TRANSFLECTIVE
M--- TRANSMISSIVE
E: VIEWING TEMPRETURE:
U--- 12:00 D--- 6:00 L--- 9:00 R--- 3:00
F: BACKLIGHT TYPE:
D---BOTTOM LED S---SIDE LED E--- EL C--- CCFL
N---NO BACKLIGHT
G: COLOR OF BACKLIGHT：
Y---YELLOW/GREEN G--- GREEN B--- BLUE
W--- WHITE O--- ORANGE A--- AMBER
H:OPERATING TEMPRETURE:
N--- NORMAL, W--- EXTENDED , X:ESPECIALLY EXTENDED
I: DENOTE DIFFERENT CHARACTER TABLE:
NORMAL ELLIPSIS, T--- TAB , G--- COG
–JK:
FOR CM:
J: IC TYPE: A--- KS0066U B--- SPLC780
K: CHARACTER STOREROOM SEQUENCE NUMBER
FOR GM:
J: BACKLIGHT DRIVER
Y--- WITH N--- WITHOUT
K: DC-DC CONVERTER
Y--- WITH N--- WITHOUT

CONTENTS

1 FEATURES

The features of LCD are as follows

* Display mode : STN, Positive. Transflective
* Color : Display dot : Dark Black
  Background: Yellow-Green
* Display format : 122 Dots X 32 Dots
* Interface Input Data : 8-Bit
* Driving Method : 1/32Duty, 1/6Bias
* Viewing Direction : 6 O'clock
* Backlight : SIDE LED (YELLOW-GREEN)
* Drive IC : NT7450

2. MECHANICAL SPECIFICATIONS

Item	Specification	Unit
Module Size	84(W) x 44(H) x 13.0(T)	mm
Number of Dots	122(W) x 32(H) Dots	mm
Viewing Area	60.0(W) x 18 (H)	mm
Effective display area	53.64(W) x 15.64(H)	mm
Dot Size	0.40(W) x 0.45(H)	mm
Dot Pitch	0.44(W) x 0.49(H)	mm

3. ELECTRICAL SPECIFICATIONS

3-1 ABSOLUTR MAZIMUM RATINGS (Ta = 25 °C)

Item	Symbol	Standard Value			Unit
		Min.	Typ.	Max.	
Supply Voltage For Logic	$V_{DD} – V_{SS}$	0	_	6.5	V
Supply Voltage For LCD Drive	$V_{OP} = V_{DD} – V_0$	0	_	15	V
Input Voltage	V1	V_{SS}	_	V_{DD}	V
Operating Temp.	Top	-20	_	+70	°C *
Storage Temp.	Tst	-30	_	+80	°C

*. NOTE: The response time will be extremely slow when the operating temperature is around -20℃, and the back ground will become darker at high temperature operating.

3-2 ELECTICAL CHARACTERISTICS

Item		Symbol	Test Condition	Min.	Typ.	Max.	Unit
Logic supply Voltage		V_{DD} - V_{SS}		2.4	5.0	7.0	V
LCD Drive		V_{OP}=V_{DD} – V0		3.5	-	13	V
Input Voltage	"H" Level	V IH	V_{DD}=5.0V ± 5%	VSS+2.0	-	V_{DD}	V
	"L" Level	V IL		VSS	-	VSS+0.8	V
Frame Frequency		fFLM	V_{DD} =5.0V	-	-	2K	HZ
Current Consumption		IDD	V_{DD} =5.0V V_{DD}-V_0=13.1V V/R=160Kohm		1.60	3.0	mA

3-3. BACKLIGHT

3-3-1. Absolute Maximum Ratings

Item	Symbol	Condition	Min.	Typ.	Max	Unit
Forward Current	IF	Ta= 25℃	-	10	40	mA
Reverse Voltage	VR		-	-	8	V
Power Dissipation	PD	Ta= 25℃	-	-	200	mW

3-3-2. Opto-electronic Characteristics

Item	Symbol	Condition	Min.	Typ.	Max	Unit
Forward Voltage	VF	Ta= 25℃ IF= 35mA	-	5.0	5.5	V
Luminous	-		35	-	-	cd/m²

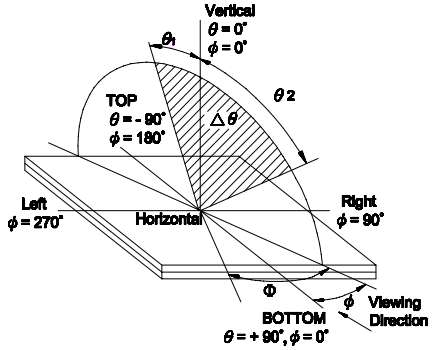
4. POWER SUPPLY

※ V_{DD} - V_0 = Operating voltage for LCD

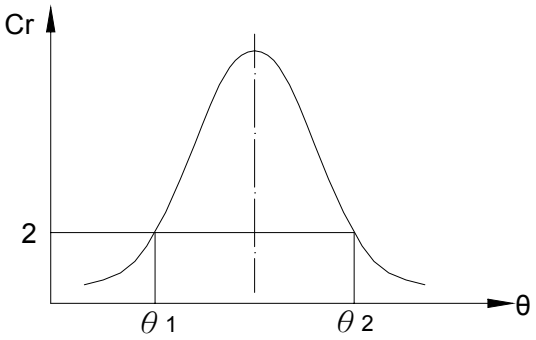
5. ELECTRO – OPTICAL CHARACTERISTICS

Item	Symbol	Temp.	Min.	Typ.	Max.	Unit	Conditions	Note
Viewing Angle	|Θ2 – Θ1|	25℃	30	80	-	Deg.	-	1,2
	Φ		60	85	-			
Contrast Ratio	Cr	25℃	2	5.3	5.9	-	Θ=0° Φ=0°	3
Response Time(rise)	Tr	25℃	-	91	250	ms	Θ=0° Φ=0°	4
		0℃	-	950	1150			
Response Time(fall)	Tf	25℃	-	151	250	ms	Θ=0° Φ=0°	4
		0℃	-	950	1150			

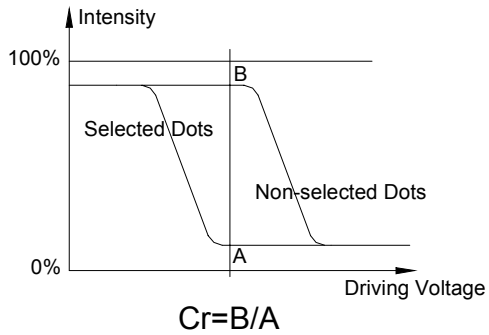
Note1 . Definition of Angle Θ&Φ



Note2. Definition of Viewing Angle Θ1&Θ2

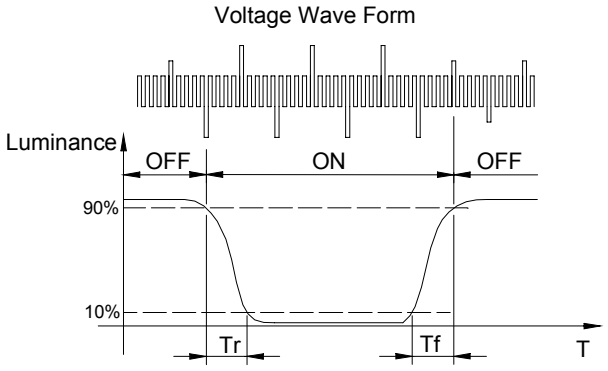


Note3 . Definition of Contrast Cr



Cr=B/A

Note4. Definition of Optical Response

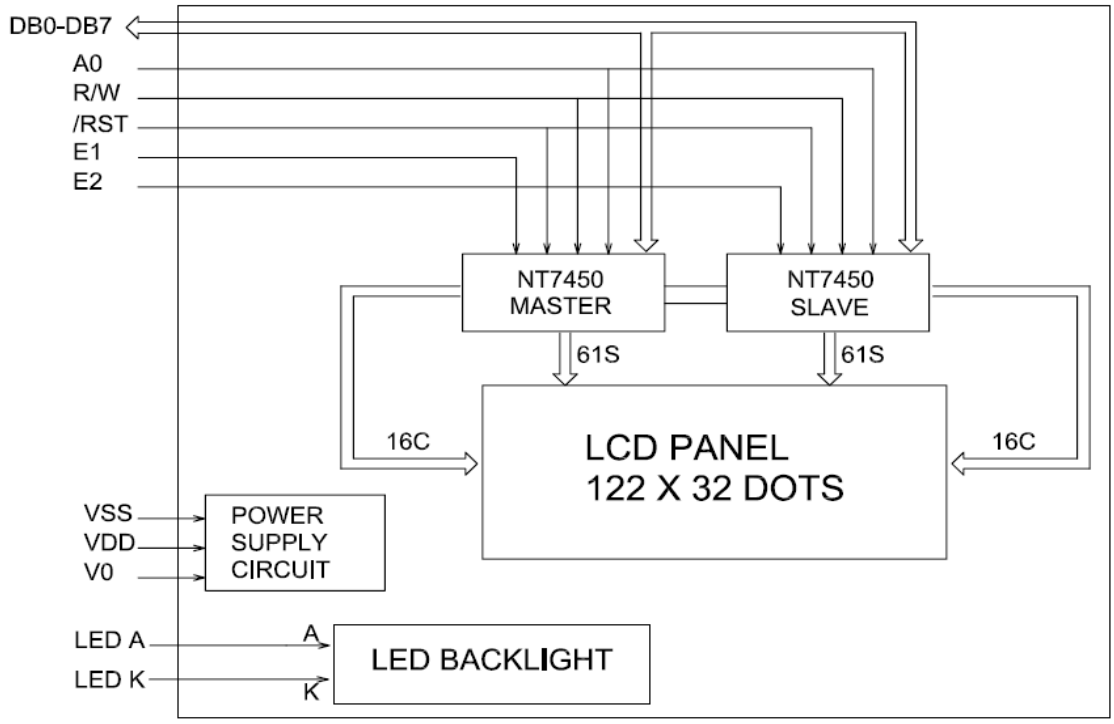


6. TERMINAL FUNCTIONS AND BLOCK DIAGRAM

6-1. INTERFACE PIN FUNCTION DESCRIPTION

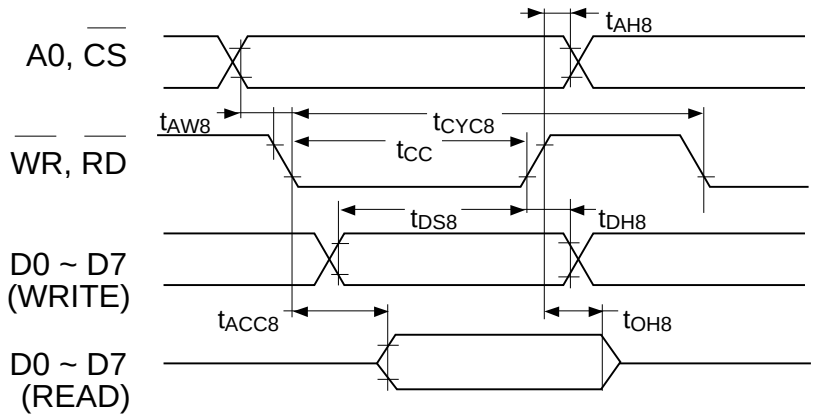
PIN NO.	SYMBOL	FUNCIONS
1	VSS	Ground
2	VDD	Power supply for logic circuit(5.0V)
3	V0	Operating voltage for LCD driving(Variable)?CONTRAST ADJUST
4	A0	Input, Usually connected to the low-order bit of the MPU address bus and used to indentify the data or command A0=0:D0-D7 are display control data A0=1: D0-D7 are display data
5	E1	Chip Selection Signal for IC1
6	E2	Chip Selection Signal for IC2
7	R/W	Used as input pins of read control signal (if R\W is high) or write control signal (if low)
8-15	DB0-DB7	Three-state I/O The 8-bit bi-directional data buses to be connected to the 8-or 16-bit standard MPU data buses
16	RST	Input ,the system is reset during edge sense of the signal. the interface type to the 68-series or 80-series MPU is selected by the level input as follows : High level: 68 series MPU interface Low level: 80 series MPU interface
17	A	Backlight (+) 5.0V
18	K	Backlight (-)

6-2. BLOCK DIAGRAM



7 TIMING CHARACTERISTICS

7.1 System Bus Read/Write I (80 Family MPU)



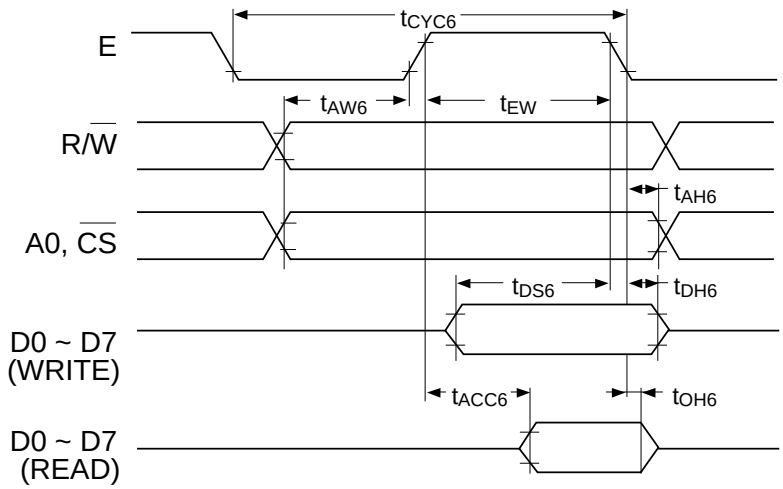
Ta = –20 to 75°C, V_{SS} = –5.0V ± 10%, Unit: ns

Signal	Symbol	Parameter	Min.	Max.	Condition
A0, $\overline{CS}$	t_{AH8}	Address hold time	10		
	t_{AW8}	Address setup time	20		
$\overline{WR}$, $\overline{RD}$	t_{CYC8}	System cycle time	1000		
	t_{CC}	Control pulse width	200		
D0–D7	t_{DS8}	Data setup time	80		
	t_{DH8}	Data hold time	10		
	t_{ACC8}	$\overline{RD}$ access time		90	CL = 100pF
	t_{OH8}	Output disable time	10	60	

*1. Each of the values where V_{SS} = –3.0V is about 200% of that where V_{SS} = –5.0V (i.e., the listed value).

*2. The rise or fall time of input signals should be less than 15 ns.

7.2 System Bus Read/Write II (68 Family MPU)



Ta = –20 to 75°C, V_{SS} = –5.0V ± 10%, Unit: ns

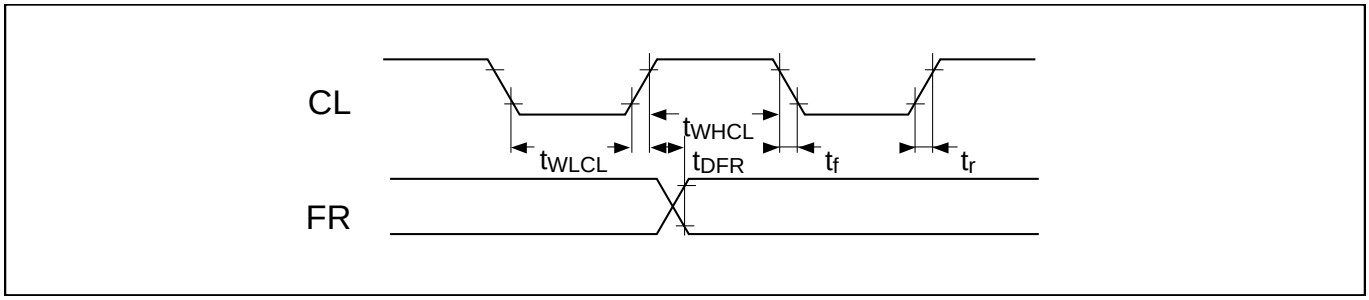
Signal	Symbol	Parameter		Min.	Max.	Condition
A0, CS R/W	t CYC6*1	System cycle time		1000		
	t AW6	Address setup time		20		
	t AH6	Address hold time		10		
D0–D7	t DS6	Data setup time		80		
	t DH6	Data hold time		10		
	tOH6	Output disable time		10	60	CL = 100pF
	t ACC6	Access time			90	
E	t EW	Enable pulse width	Read	100		
			Write	80		

*1. t CYC6 indicates the cycle time during which CS•E = “H”. It does not mean the cycle time of signal E.

*2. Each of the values where V_{SS} = –3.0V is about 200% of that where V_{SS} = –5.0V (i.e., the listed value).

*3. The rise or fall time of input signals should be less than 15 ns.

7.3 Display Control Timing



7.3.1 Input Timing

Ta = –20 to 75°C, V_{SS} = –5.0V ± 10%
Unit: µs (t_{WLCL}, t_{WHCL}, t_{DFR}), ns (tr, tf)

Signal	Symbol	Parameter	Min.	Typ.	Max.	Condition
CL	t_{WLCL}	Low level pulse width	35			
	t_{WHCL}	High level pulse width	35			
	t_r	Rise time		30	150	
	t_f	Fall time		30	150	
FR	t_{DFR}	FR delay time	–2.0	0.2	2.0	

7.3.2 Output Timing

Ta = –20 to 75°C, V_{SS} = –5.0V ± 10%, Unit: µs

Signal	Symbol	Parameter	Min.	Typ.	Max.	Condition
FR	t_{DFR}	FR delay time		0.2	0.4	CL = 100pF

*1. The listed FR input delay time applies to the NT7450 and NT7450 (slave).
The listed FR output delay time applies to the NT7450 (master).

*2. Each of the values where V_{SS} = –3.0V is about 200% of that where V_{SS} = –5.0V (i.e., the listed value).

8. INSTRUCTION SET

Table 3 lists the commands used with the LMG122321A. This LSI uses a combination of A0, R/$\overline{W}$ (RD, $\overline{WR}$) to identify a data bus signal. Interpretation and execution of a command depends not on external clock but on internal timing alone. Therefore, a command can be executed so fast that no busy check is needed.

A detailed description of commands follows.

8.1 DISPLAY ON/OFF

This command forces all display to turn on or off.

		R/W								
A0	$\overline{RD}$	$\overline{WR}$	D7							D0
0	1	0	1	0	1	0	1	1	1	D

D 0 = Display OFF
1 = Display ON

8.2 DISPLAY START LINE

This command specifies a line address thus marking the display line that corresponds to COM0. Display begins with the specified line address and covers as many lines as match the display duty in address ascending order. Dynamic line address change with the Display Start Line command enables column-wise scrolling or page change.

		R/W								
A0	$\overline{RD}$	$\overline{WR}$	D7							D0
0	1	0	1	1	0	A4	A3	A2	A1	A0

– High-order bits

A4	A3	A2	A1	A0	Line address
0	0	0	0	0	0
0	0	0	0	1	1
		—			—
		—			—
1	1	1	1	1	31

8.3 SET PAGE ADDRESS

This command is used to specify a page address equivalent to a row address for MPU access to the display data RAM. A required bit of the display data RAM can be accessed by specifying its page address and column address. Changing the page address causes no change in display.

		R/W								
A0	$\overline{RD}$	$\overline{WR}$	D7							D0
0	1	0	1	0	1	1	1	0	A1	A0

A1	A0	Page
0	0	0
0	1	1
1	0	2
1	1	3

8.4 COLUMN ADDRESS

This command specifies a display data RAM column address. The column address is incremented by 1 each time the MPU accesses from the set address to the display data RAM. Thus, it is possible for the MPU to gain continuous access to only the data. This incrementing stops with address 80; the page address is not continuously changed.

		R/W								
A0	$\overline{RD}$	$\overline{WR}$	D7							D0
0	1	0	0	A6	A5	A4	A3	A2	A1	A0

A6	A5	A4	A3	A2	A1	A0	Column address
0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	1
			—				—
			—				—
1	0	0	1	1	1	1	79

8.5 READ STATUS

		R/W								
A0	$\overline{RD}$	$\overline{WR}$	D7							D0
0	0	1	Busy	ADC	ON/ OFF	Reset	0	0	0	0

BUSY: BUSY being "1" means that system is performing an internal operation or is reset. No command is accepted before BUSY = "0". As long as the cycle time requirement is met, no BUSY check is needed.

ADC: Indicates assignment of column addresses to segment drivers.

0: Inverted (column address 79-n ↔ segment driver n)
1: Forward (column address n ↔ segment driver n)

ON/OFF: Indicates display on or off.

0: Display on
1: Display off

This bit has polarity reverse to the Display ON/OFF command.

RESET: Indicates that system is being initialized by the $\overline{RES}$ signal or the Reset command.

0: Display mode
1: Being reset

8.6 WRITE DISPLAY DATA

This command allows the MPU to write 8 bits of data into the display data RAM. Once the data is written, the column address is automatically incremented by 1; this enables the MPU to write multi-word data continuously.

		R/W								
A0	$\overline{RD}$	$\overline{WR}$	D7							D0
1	1	0	Write data							

8.7 READ DISPLAY DATA

This command allows the MPU to read 8 bits of data from the display data RAM location specified by a column address and a page address. Once the data is read, the column address is automatically incremented by 1; this enables the MPU to read multi-word data continuously.

A dummy read is needed immediately after the column address is set. For details, see 3. (1)–(c).??

		R/W								
A0	RD	WR	D7							D0
1	0	1	Read data							

8.8 SELECT ADC

This command inverts the relation of assignment between display data RAM column addresses and segment driver outputs. In other words, the Select ADC command can software-invert the order of segment driver output pins, reducing the restrictions on the configuration of ICs at LCD module assembly.

Incrementing the column address by 1, which takes place after the MPU writing or reading display data.

A0	RD	WR	D7							D0
0	1	0	1	0	1	0	0	0	0	D

D = 0: Clockwise output (forward)
D = 1: Counterclockwise output (reverse)

8.9 STATIC DRIVE ON/OFF

This command forces all display to be on and, at the same time, all common output to be selected.

		R/W								
A0	RD	WR	D7							D0
0	1	0	1	0	1	0	0	1	0	D

D = 0: Static drive off
D = 1: Static drive on

8.10 SELECT DUTY

This command is used to select the duty (degree of multiplexity) of LCD driving.

		R/W								
A0	RD	WR	D7							D0
0	1	0	1	0	1	0	1	0	0	D

D = 0: Duty 1/16
D = 1: Duty 1/32

8.11 READ MODIFY WRITE

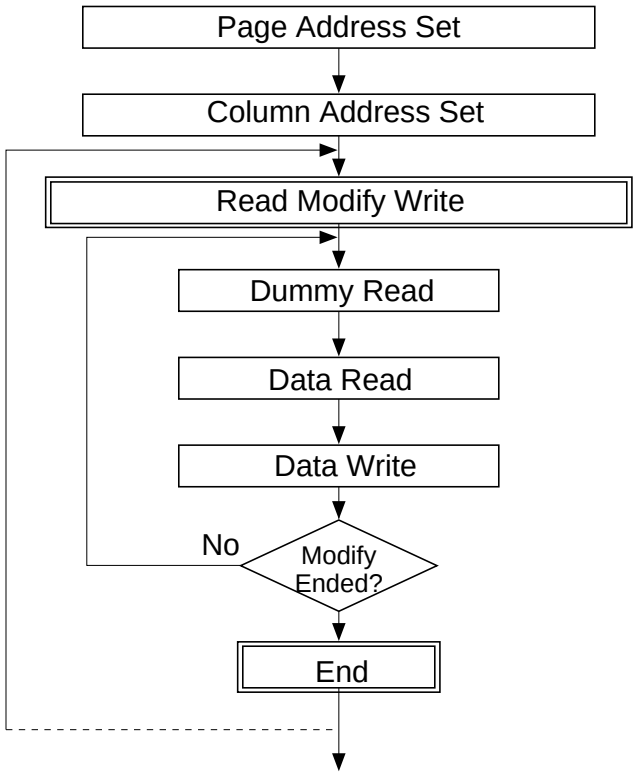
This command is used with the End command in a pair. Once it has been entered, the column address will be incremented not by the Read Display Data command but by the Write Display Data command only. This mode will stay until the End command is entered.

Entry of the End command causes the column address to return to the address which was valid when the Read Modify Write command was entered. This function lessens the load of the MPU when the data in a specific display area are repeatedly updated (as blinking cursor).

		R/W								
A0	RD	RD	D7							D0
0	1	0	1	1	1	0	0	0	0	0

Even in the Read Modify Write mode, any command other than Read/Write Data and Set Column Address may be used.

8.11 Cursor Blinking Sequence

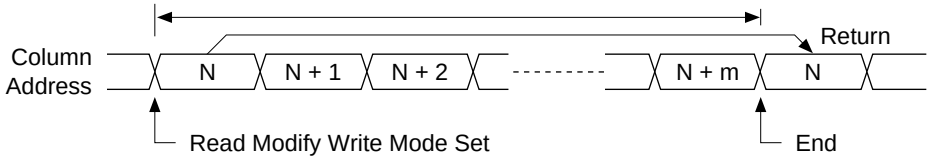


8.12 END

This command cancels the Read Modify Write command, returning the column address to the initial mode address.

		R/W								
A0	RD	WR	D7							D0
0	1	0	1	1	1	0	1	1	1	0

8.12.1 End Timing



8.13 RESET

This command initializes the display start line register, column address counter, and page address counter without any effect on the display data RAM.

The reset operation follows entry of the Reset command.

		R/W								
A0	RD	WR	D7							D0
0	1	0	1	1	1	0	0	0	1	0

Initialization at power-on is performed not by the Reset command but by a reset signal applied to the $\overline{RES}$ pin.

8.14 SAVE POWER (COMBINED COMMAND)

Static drive going on with display off invokes power-saving mode, reducing current consumption to nearly static current level. During this mode, the LMG122321A holds the following conditions:

(a) It stops driving the LCD; the segment and common driver outputs are at VDD level.

(b) Oscillation and external clock input are disabled; OSC2 is in floating condition.

(c) The display data and operational mode are held.

The power-saving mode is cancelled by display on or static drive off.

If an external resistor division circuit is used to give LCD driving voltage level, the current flowing into the resistors must be cut off by the power-save signal.

8.14.1 External Resistor Division Circuit

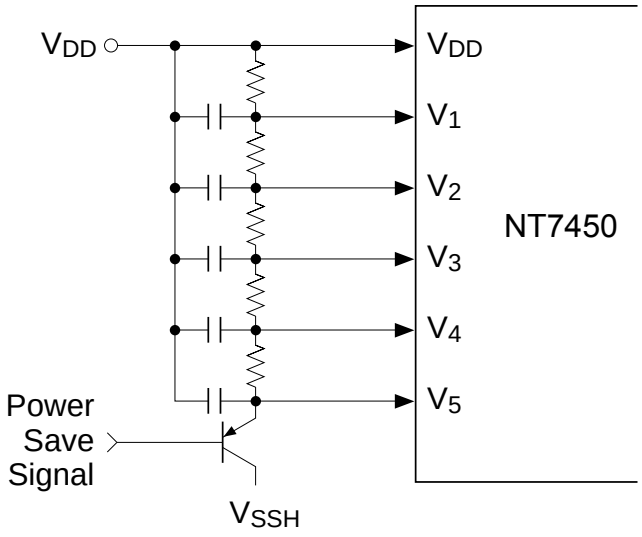


Table 3 Commands

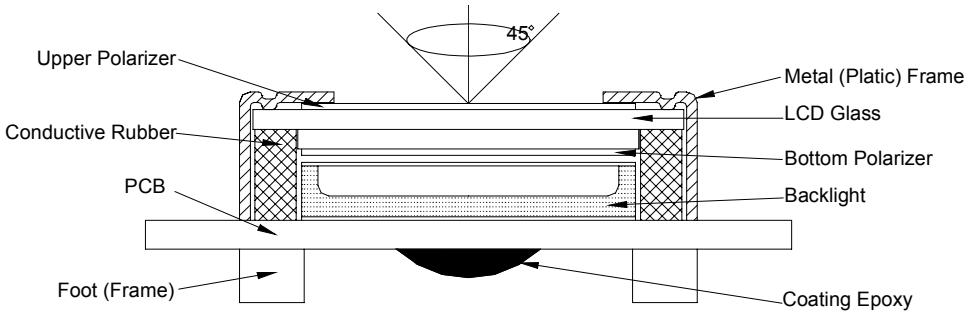
	Command	Code											Function	
		A0	$\overline{RD}$	$\overline{WR}$	D7	D6	D5	D4	D3	D2	D1	D0		
(1)	Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0/1	Turns all display on or off, independently of display RAM data or internal status. 1: ON 0: OFF (Power-saving mode with static drive on)*	
(2)	Display start line	0	1	0	1	1	0	Display Start Address (0–31)					Specifies RAM line corresponding to uppermost line (COM0) of display.	
(3)	Set page address	0	1	0	1	0	1	1	1	0	Page (0–3)		Sets display RAM page in page address register.	
(4)	Set column (segment) address	0	1	0	0	Column Address (0–79)							Sets display RAM column address in column address register.	
(5)	Read status	0	0	1	Busy	ADC	ON/OFF	RESET	0	0	0	0	Reads the following status: BUSY 1: Internal operation, 0: Ready ADC 1: CW output (forward), 0: CCW output (reverse) ON/OFF 1: Display off, 0: Display on RESET 1: Being reset, 0: Normal	
(6)	Write display data	1	1	0	Write Data								Writes data from data bus into display RAM.	Display RAM location whose address has been preset is accessed. After access, the column address is incremented by 1.
(7)	Read display data	1	0	1	Read Data								Reads data from display RAM onto data bus.	
(8)	Select ADC	0	1	0	1	0	1	0	0	0	0	0/1	Used to invert relationship of assignment between display RAM column addresses and segment driver outputs. 0: CW output (forward) 1: CCW output (reverse)	
(9)	Static drive ON/OFF	0	1	0	1	0	1	0	0	1	0	0/1	Selects normal display or static driving operation. 1: Static drive (power-saving mode) 0: Normal driving	
(10)	Select duty	0	1	0	1	0	1	0	1	0	0	0/1	Selects LCD cell driving duty. 1: 1/32 0: 1/16	
(11)	Read modify write	0	1	0	1	1	1	0	0	0	0	0	Increments column address counter by 1 when display data is written. (This is not done when data is read.)	
(12)	End	0	1	0	1	1	1	0	1	1	1	0	Clears read modify write mode.	
(13)	Reset	0	1	0	1	1	1	0	0	0	1	0	Sets display start line register on the first line. Also sets column address counter and page address counter to 0.	

* With display off (command (1)), static drive going on (9) invokes power-saving mode.

9. QUALITY SPECIFICATIONS

9 - 1. LCM Appearance and Electric inspection Condition

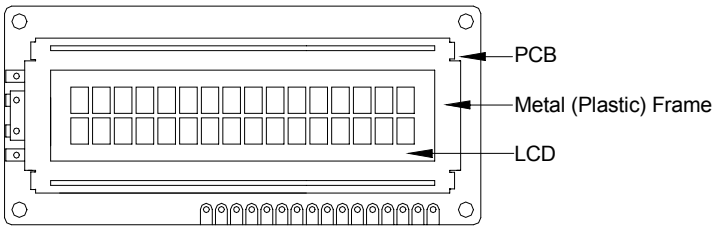
1. Inspection will be done by placing LCM 30cm away from inspector's eyeballs under normal illumination.



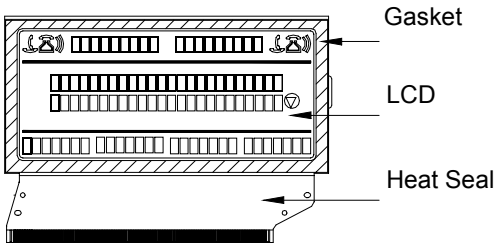
2. View Angle: with in 45°around perpendicular line.

9 - 2. Definition

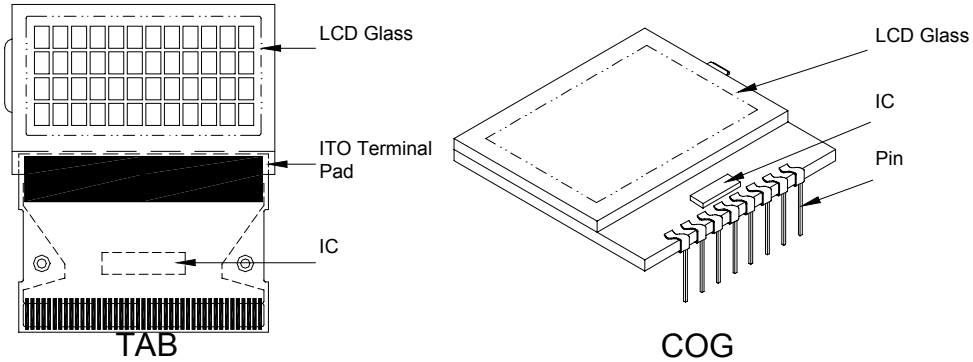
1. COB



2. Heat Seal



3. TAB and COG



9. QUALITY SPECIFICATIONS (Continued)

9-3. Sampling Plan and Acceptance

1. Sampling Plan

MIL - STD - 105E (‖) ordinary single inspection is used.

2. Acceptance

Major defect: AQL = 0.25%

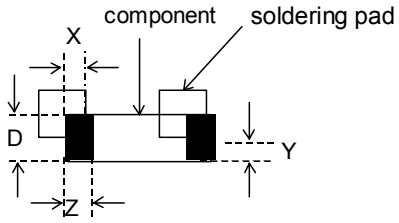
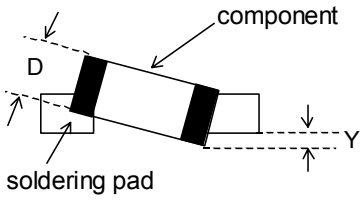
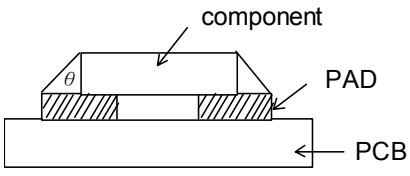
Minor defect: AQL = 0.65%

9-4. Criteria

1. COB

Defect	Inspection Item	Inspection Standards	
Major	PCB copper flakes peeling off	Any copper flake in viewing Area should be greater than 1.0mm^2	Reject
Major	Height of coating epoxy	Exceed the dimension of drawing	Reject
Major	Void or hole of coating epoxy	Expose bonding wire or IC	Reject
Major	PCB cutting defect	Exceed the dimension of drawing	Reject

2. SMT

Defect	Inspection Item	Inspection Standards	
Minor	Component marking not readable		Reject
Minor	Component height	Exceed the dimension Of drawing	Reject
Major	Component solder defect (missing , extra, wrong component or wrong orientation		Reject
Minor	Component position shift 	X < 3/4Z Y > 1/3D	Reject Reject
Minor	Component tilt 	Y > 1/3D	Reject
Minor	Insufficient solder 	$\theta \leq 20^{\circ}$	Reject

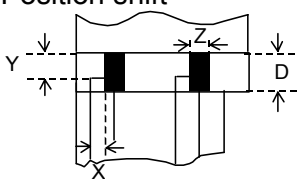
9. QUALITY SECIFICATIONS (Continued)

9-4. Criteria (Continued)

3. Metal (Plastic) Frame

Defect	Inspection Item	Inspection Standards		
Major	Crack / breakage	Anywhere		Reject
Minor	Frame Scratch	W	L	Acceptable of Scratch
		w<0.1mm	Any	Ignore
		0.1≤w<0.2mm	L≤5.0mm	2
		0.2≤w<0.3mm	L≤3.0mm	1
		w≥0.3mm	Any	0
		Note : 1. Above criteria applicable to scratch lines with distance greater than 5mm. 2. Scratch on the back side of frame (not visible) can be ignored .		
Minor	Frame Dent , Prick $\Phi = \frac{L + W}{2}$			Acceptable of Dents / Pricks
		$\Phi \leq 1.0$mm		2
		$1.0 < \Phi \leq 1.5$mm		1
		$1.5\text{mm} < \Phi$		0
		Note : 1. Above criteria applicable to any two dents / pricks with distance greater than 5mm 2. Dent / prick on the back side of frame (not visible) can be ignored		
Minor	Frame Deformation	Exceed the dimension of drawing		
Minor	Metal Frame Oxidation	Any rust		

4. Flexible Film Connector (FFC)

Defect	Inspection Item	Inspection Standards	
Minor	Tilted soldering	Within the angle +5°	Acceptable
Minor	Uneven solder joint /bump		Reject
Minor	Hole $\Phi = \frac{L + W}{2}$	Expose the conductive line	Reject
		Φ > 1.0mm	Reject
Minor	Position shift 	Y > 1/3D	Reject
		X > 1/2Z	Reject

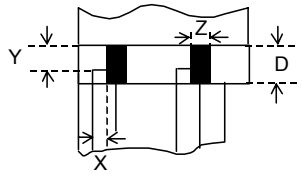
9. QUALITY SPECIFICATIONS (Continued)

9-4. Criteria (Continued)

5. Screw

Defect	Inspection Item	Inspection Standards	
Major	Screw missing/loosen		Reject
Minor	Screw oxidation	Any rust	Reject
Minor	Screw deformation	Difficult to accept screw driver	Reject

6. Heatseal 、TCP 、FPC

Defect	Inspection Item	Inspection Standards	
Major	Scratch expose conductive layer		Reject
Minor	HS Hole $\Phi = \frac{L + W}{2}$	Φ> 0.5mm	Reject
Major	Adhesion strength	Less than the specification	Reject
Minor	Position shift 	Y > 1/3D	Reject
		X > 1/2Z	Reject
Major	Conductive line break		Reject

7. LED Backing Protective Film and Others

Defect	Inspection Item	Inspection Standards	
Minor	LED dirty, prick	Acceptable number of units	
		$\Phi \leq$0.10mm	Ignore
		0.10< $\Phi \leq$0.15mm	2
		0.15< $\Phi \leq$0.2mm	1
		Φ>0.2mm	0
		The distance between any two spots should be $\geq$5mm Any spot/dot/void outside of viewing area is acceptable	
Minor	Protective film tilt	Not fully cover LCD	Reject
Major	COG coating	Not fully cover ITO circuit	Reject

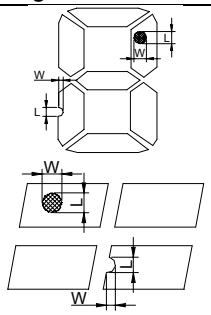
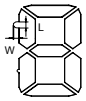
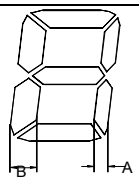
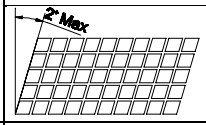
8. Electric Inspection

Defect	Inspection Item	Inspection Standards	
Major	Short		Reject
Major	Open		Reject

9. QUALITY SPECIFICATIONS (Continued)

9-4. Criteria (Continued)

9. Inspection Specification of LCD

Defect	Inspect Item		Inspection Standards				
Minor	Linear Defect	∗ Glass Scratch ∗ Polarizer Scratch ∗ Fiber and Linear material	W	W≤0.03		0.03<W≤0.05	W>0.05
			L	L<5		L<3	Any
			ACC. NO.	1		1	Reject
			Note	L is the length and W is the width of the defect			
Minor	Black Spot and Polarizer Pricked	∗ Foreign material between glass and polarizer or glass and glass ∗ Polarizer hole or protuberance by external force	Φ	Φ≤0.1	0.1<Φ≤0.15	0.15<Φ≤0.2	Φ>0.2
			ACC. NO.	3EA / 100mm^2	2	1	0
			Note	Φ is the average diameter of the defect. Distance between two defects > 10mm.			
Minor	White Spot and Bubble in polarizer	∗ Unobvious transparant foreign material between glass and glass or glass and polarizer ∗ Air protuberance between polarizer and glass	Φ	Φ≤0.3		0.3<Φ≤0.5	0.5<Φ
			ACC. NO.	3EA / 100mm^2		1	0
			Note	Φ is the average diameter of the defect. Distance between two defects > 10mm.			
Minor	Segment Defect		Φ	Φ≤0.10	0.10<Φ≤0.20	0.20<Φ≤0.25	Φ>0.25
			ACC. NO.	3EA / 100mm^2	2	1	0
			Note	W is more than 1/2 segment width			Reject
				$\Phi = \frac{L + W}{2}$ Distance between two defect is 10mm			
Minor	Protuberant Segment	 Φ = (L + W) / 2	Φ	Φ≤0.10	0.10<Φ≤0.20	0.20<Φ≤0.25	Φ>0.25
			W	Glue	W≤1/2 Seg W≤0.2	W≤1/2 Seg W≤0.2	Ignore
			ACC. NO.	3EA / 100mm^2	2	1	0
Minor	Assembly Mis-alignment		1. Segment				
			B	B≤0.4mm		0.4<B≤1.0mm	B>1.0mm
			B-A	B-A<1/2B		B-A<0.2	B-A<0.25
			Judge	Acceptable		Acceptable	Acceptable
			2. Dot Matrix				
			Deformation>2°				Reject
Minor	Stain on LCD Panel Surface		Accept when stains can be wiped lightly with a soft cloth or a similar one. Otherwise, judged according to the above items: “Black spot” and “White Spot”				

10. RELIABILITY

NO.	Item	Condition	Criterion
1	High Temperature Operating	70℃, 240Hrs	No defect in cosmetic and operational function allowable. Total current Consumption should be below double of initial value.
2	Low Temperature Operating	- 2 0 ℃, 240Hrs	
3	High Humidity	60℃, 90%RH, 96Hrs	
4	High Temperature Storage	80℃, 240Hrs	
5	Low Temperature Storage	-30℃, 240Hrs	
6	Vibration	Random wave 10 ~ 100Hz Acceleration: 2g 2 Hrs per direction(X,Y,Z)	
7	Thermal Shock	-30℃ to 25℃ to 80℃ (60Min) (5Min) (60Min) 10Cycles	
8	ESD Testing	Contract Discharge Voltage: +1 ~ 5kV and –1 ~ –5kV	There will be discharged ten times at every discharging voltage cycle. The voltage gap is 1kV.
		Air Discharge Voltage: +1 ~ 8kV and –1 ~ -8kV	

Note: 1) Above conditions are suitable for GOLDENTEK standard products.

2) For restrict products, the test conditions listed as above must be revised.

11. HANDLING PRECAUTION

(1) Mounting Method

The panel of the LCD Module consists of two thin glass plates with polarizers which easily get damaged since the Module is fixed by utilizing fitting holes in the printed circuit board. Extreme care should be taken when handling the LCD Modules.

(1) Caution of LCD handling & cleaning

When cleaning the display surface, use soft cloth with solvent (recommended below) and wipe lightly.

- Isopropyl alcohol
- Ethyl alcohol
- Trichloro trifloro thane

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

Do not use the following solvent:

- Water
- Ketone
- Aromatics

(3) Caution against static charge

The LCD Module use C-MOS LSI drivers, so we recommend that you connect any unused input terminal to VDD or VSS, do not input any signals before power is turned on. And ground your body, Work/assembly table. And assembly equipment to protect against static electricity.

(4) Packaging

- Modules use LCD elements, and must be treated as such. Avoid intense shock and falls from a height.
- To prevent modules from degradation. Do not operate or store them exposed directly to sunshine or high temperature/humidity.

(5) Caution for operation

- It is indispensable to drive LCD's within the specified voltage limit since the higher voltage than the limit shorten LCD life. An electrochemical reaction due to direct current causes LCD deterioration, Avoid the use of direct current drive.

11. HANDLING PRECAUTION (Continued)

- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them.

However those phenomena do not mean malfunction or out of order with LCD's. Which will come back in the specified operating temperature range.

- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.

Usage under the relative condition of 40°C, 50%RH or less is reequired.

(6) Storage

In the case of storing for a long period of time (for instance.) For years) for the purpose or replacement use, The following ways are recommended.

- Storage in a polyethylene bag with sealed so as not to enter fresh air outside in it, And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light is. Keeping temperature in the specified storage temperature range.
- Storing with no touch on polarizer surface by the anything else. (It is recommended to store them as they have been contained in the inner container at the time of delivery)

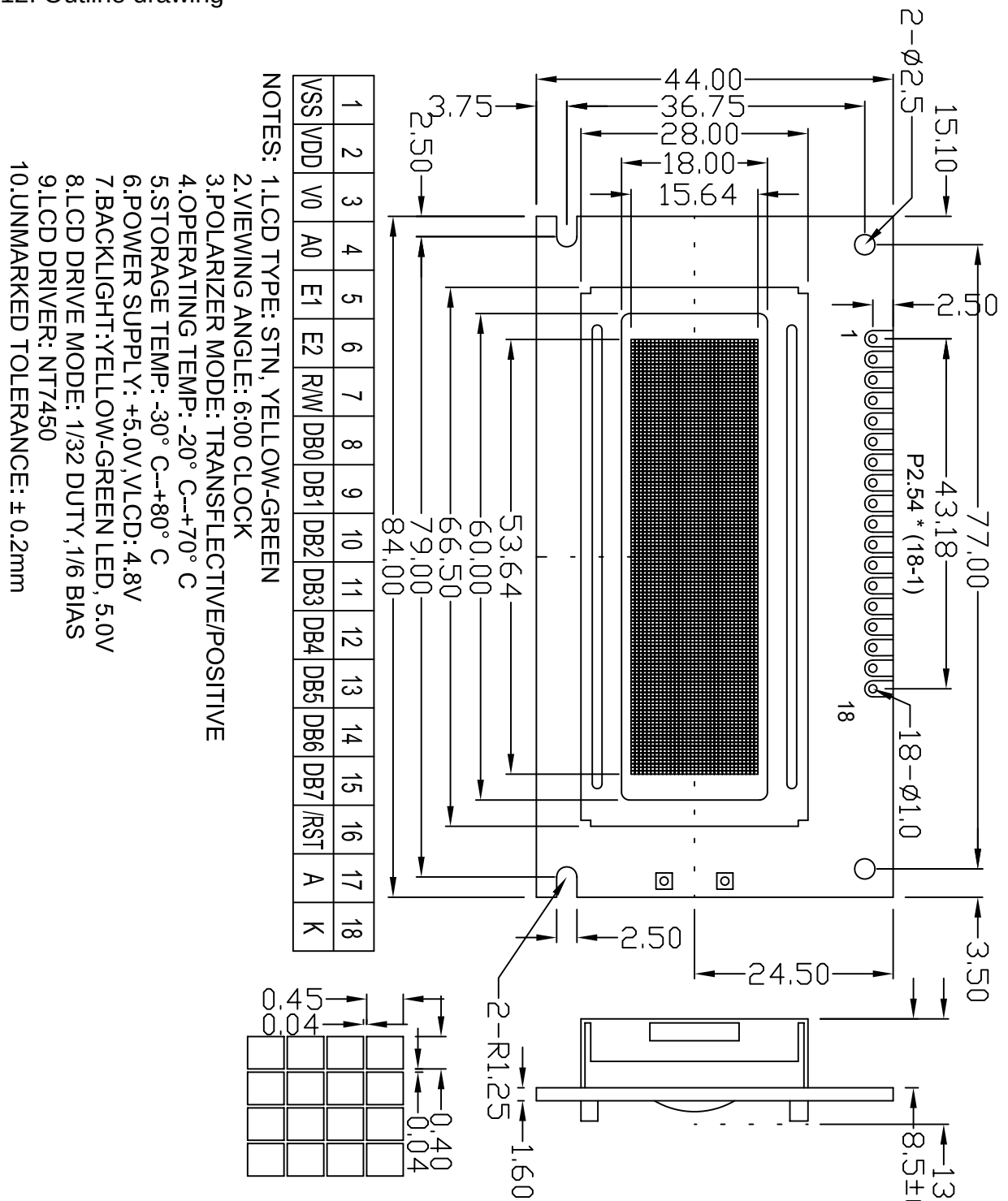
(7) Safety

- It is recommendable to crash damaged or unnecessary LCD into pieces and wash off liquid crystal by using solvents such as acetone and ethanol.

Which should be burned up later.

- When any liquid crystal leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water.

12. Outline drawing



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
VSS	VDD	V0	A0	E1	E2	R/W	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	/RST	A	K

NOTES: 1.LCD TYPE: STN, YELLOW-GREEN
2.VIEWING ANGLE: 6:00 CLOCK
3.POLARIZER MODE: TRANSFLECTIVE/POSITIVE
4.OPERATING TEMP: -20° C--+70° C
5.STORAGE TEMP: -30° C--+80° C
6.POWER SUPPLY: +5.0V,VLCD: 4.8V
7.BACKLIGHT:YELLOW-GREEN LED, 5.0V
8.LCD DRIVE MODE: 1/32 DUTY,1/6 BIAS
9.LCD DRIVER: NT7450
10.UNMARKED TOLERANCE: ± 0.2mm