

# DATA IMAGE CORPORATION

## LCD Module Specification

ITEM NO.: CM4020S1LYC2J3-01

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Approved by	Checked by QC. Div	Checked by Pro. Div	Checked by R&D. Div.	Drawn by
	Final Revision:	Sheet Code:	Issued Date: 1998/12/08	Total Page: 24

## 2. RECORD OF REVISION

Rev	Date	Item	Page	Comment

### 3. GENERAL SPECIFICATION

Display Format : 40characters (W) × 2lines (H)  
Character Size : 3.2 (W) × 5.55 (H) mm  
View Area : 154 (W) × 16.5 (H) mm  
General Dimensions : 182 (W) × 33.5 (H) × 15 (T) mm Max.  
Weight : 100 g max.

LCD Type : ☐ STN Gray ☒ STN Yellow ☐ FSTN

Polarizer mode : ☐ Reflective ☒ Transflective

☐ Transmissive ☐ Negative

View Angle : ☒ 6 O' clock ☐ 12 O' clock ☐ Others \_\_\_\_\_

Backlight : ☒ LED ☐ EL ☐ CCFL

Backlight Color : ☒ Yellow green ☐ Amber ☐ Blue Green

☐ White ☐ Others

Controller / Driver : HD44780

Temperature Range : ☒ Normal ☐ Wide Temperature  
Operating 0 to 50°C Operating -20 to 70°C  
Storage -20 to 70°C Storage -30 to 80°C

W/CABLE 260m/m

## 4. ABSOLUTE MAXIMUM RATINGS

### 4.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS

$V_{SS}=0V$ ,  $T_a=25^{\circ}C$

Item	Symbol	Min.	Max.	Unit
Supply Voltage (Logic)	$V_{DD}-V_{SS}$	0	7	V
Supply Voltage (LCD Driver)	$V_{DD}-V_{EE}$	1.5	13.5	V
Input Voltage	$V_I$	$V_{SS}$	$V_{DD}$	V
Operating Temperature	$T_{OP}$	0	50	$^{\circ}C$
Storage Temperature	$T_{STG}$	-20	70	$^{\circ}C$

### 4.2 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

Item	Operating		Storage		Comment
	(Min.)	Max.)	(Min.)	(Max.)	
Ambient Temp	0	50	-20	70	Note (1)
Humidity	Note (2)		Note(2)		Without Condensation
Vibration	--	4.9M/S <sup>2</sup>	--	19.6M/S <sup>2</sup>	XYZ Direction
Shock	--	29.4M/S <sup>2</sup>	--	490M/S <sup>2</sup>	XYZ Direction

Note(1)  $T_a = 0^{\circ}C$  : 50Hr Max.

Note(2)  $T_a \leq 40^{\circ}C$  : 90% RH Max.

$T_a \geq 40^{\circ}C$  : Absolute humidity must be lower than the humidity of 90% RH at  $40^{\circ}C$ .

## 5. ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage (Logic)	V <sub>DD</sub> -V <sub>SS</sub>		2.75	--	5.5	V
Supply Voltage (LCD)	V <sub>DD</sub> -V <sub>EE</sub>	0°C	4.3	4.7	4.9	V
		25°C	4.2	4.5	4.8	
		50°C	3.6	3.9	4.3	
Input Voltage	V <sub>IH</sub>	--	0.7*V <sub>DD</sub>	--	V <sub>DD</sub>	V
	V <sub>IL</sub>		V <sub>SS</sub>	--	0.3*V <sub>DD</sub>	
Logic Supply Current	I <sub>DD</sub>	V <sub>DD</sub> -V <sub>SS</sub> =5V	2.1	2.3	2.5	mA

## 6. ELECTRO-OPTICAL CHARACTERISTICS

ITEM	Symbol	Condition	Min.	Typ.	Max.	Unit	Ref.
Rise Time	Tr	0°C	--	423	634	ms	Note (1)
		25°C		116	174		
Fall Time	Tf	0°C	--	951	1427	ms	
		25°C		180	270		
Contrast	CR	25°C					Note (3)
View Angle	θ1~θ2	25°C & CR≥3	--	80	--		Note (2)
	Ø1, Ø2		--	40	--		
Frame Frequency	Ff	25°C	--	64	--	Hz	

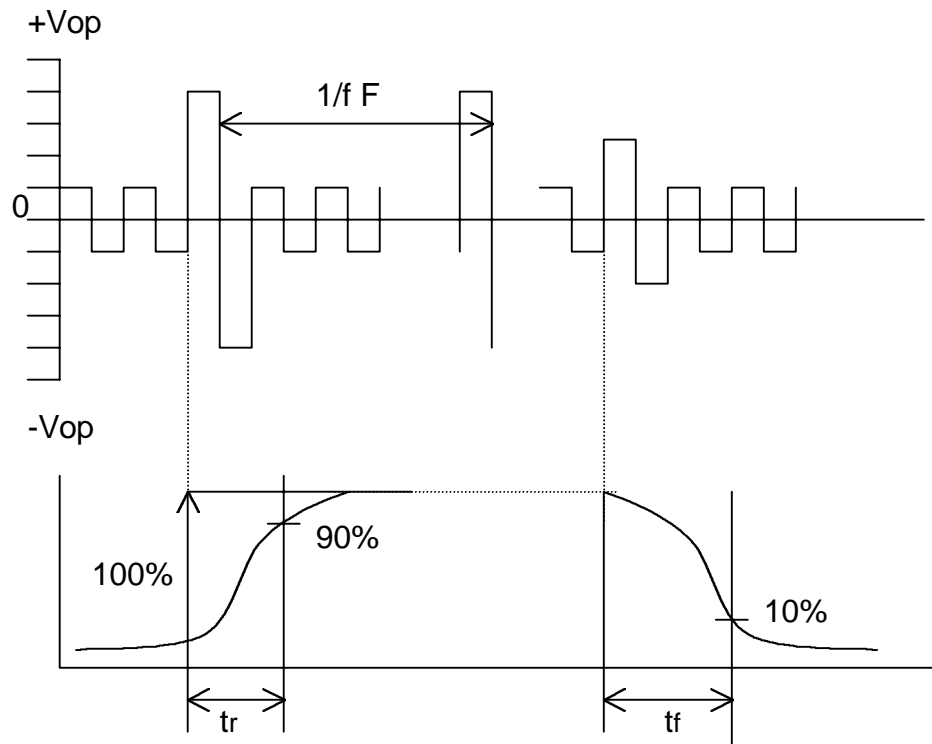
Note (1) & (2) : See next page

Note (3) : Contrast ratio is defined under the following condition:

$$CR = \frac{\text{Brightness of non-selected condition}}{\text{Brightness of selected condition}}$$

- ( a ). Temperature ----- 25°C
- ( b ). Frame frequency ---- 64Hz
- ( c ). Viewing angle ----- θ= 0°, Ø = 0°
- ( d ). Operating voltage --- 4.5V

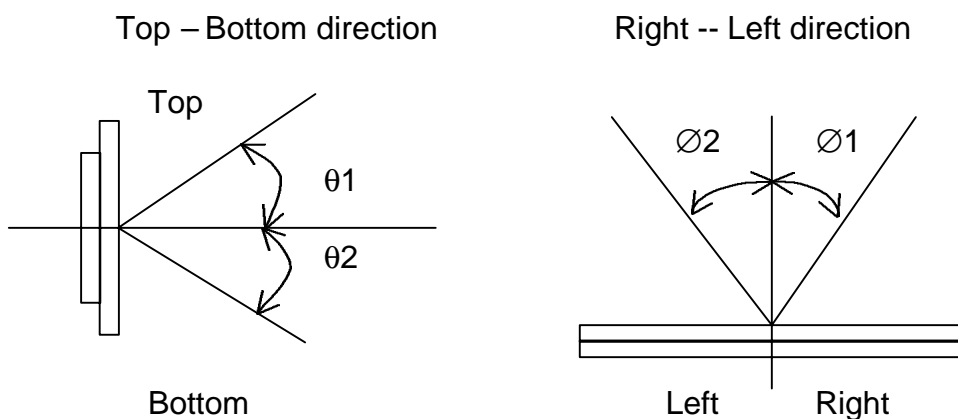
Note (1) Response time is measured as the shortest period of time possible between the change in state of an LCD segment as demonstrated below:



Condition:

- (a) . Temperature ----- $25^{\circ}\text{C}$
- (b) . Frame frequency -----  $64\text{Hz}$
- (c) . View Angle -----  $\theta = 0^{\circ}, \varnothing = 0^{\circ}$
- (d) . Operating voltage -----  $4.5\text{V}$

Note (2) Definition of View Angle



## 6.1 LED ELECTRO-OPTICAL CHARACTERISTIC

Ta = 25°C

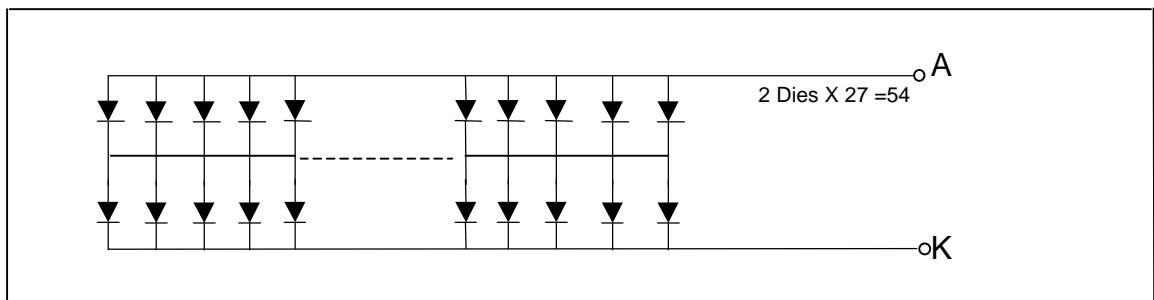
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Voltage	V <sub>F</sub>	IF = 370mA Yellow Green	--	4.2	4.6	V
Luminous Intensity	I <sub>V</sub>	IF = 370mA Yellow Green	70	130	--	cd/m <sup>2</sup>
Peak Emission	λ <sub>P</sub>	IF = 370mA Yellow Green	--	572	--	nm
Spectrum Radiation	Δλ	IF = 370mA Yellow Green	--	30	--	nm
Reverse Current	I <sub>R</sub>	VR = 8V Yellow Green	--	--	0.2	mA

Note : Measured at the bard LED backlight unit.

## 6.2 LED MAXIMUM OPERATING RANGE

Item	Symbol	Yellow Green	Unit
Power Dissipation	P <sub>AD</sub>	1.9	W
Forward Current	I <sub>AF</sub>	600	mA
Reverse Voltage	V <sub>R</sub>	8	V

### 6.2.1 LED ARRAY BLOCK DIAGRAM



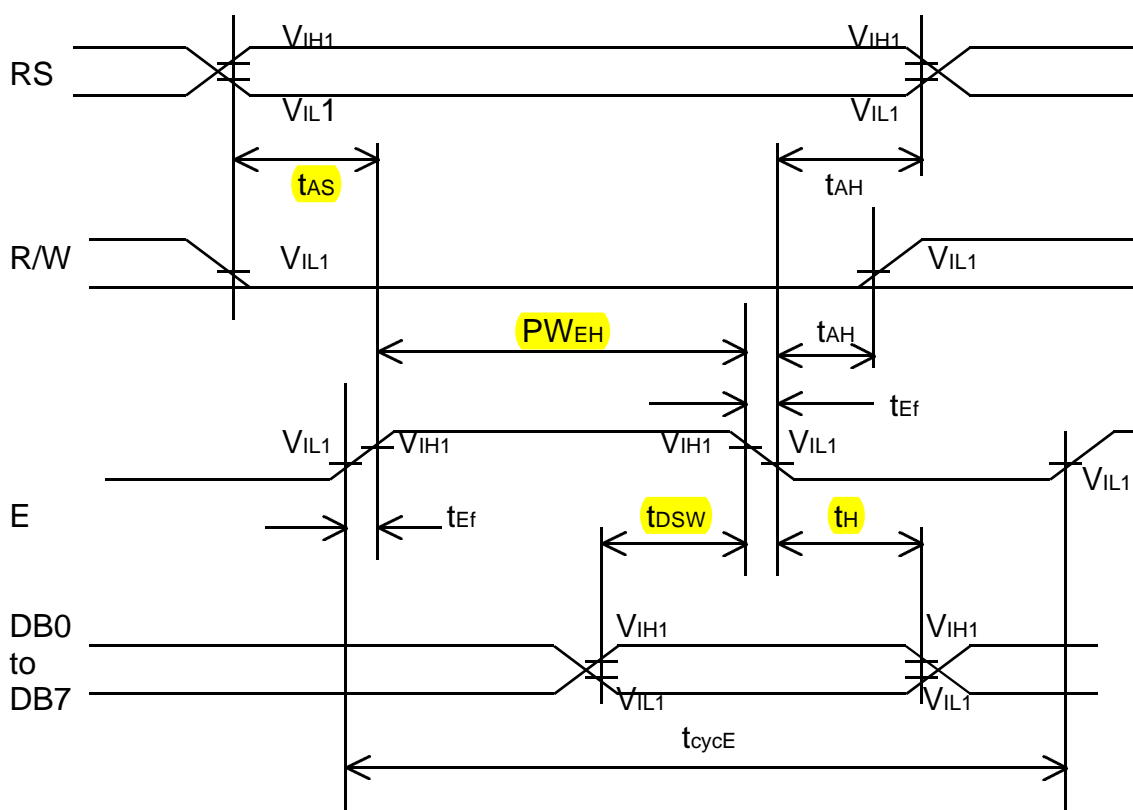
### 6.2.2 LED POWER SOURCE

LED	Option	Power source	Jumper setting
	A	VDD/VSS	J1,J3,R9
	B	15K/16A	J2,J5,J7
	C	A/K	NONE
GND	Nil	15A/16K	J2,J4,J6
	BZL GND		J8
	FRM GND		J9

## 7. TIMING CHARACTERISTICS

### 7.1 WRITE TIMING

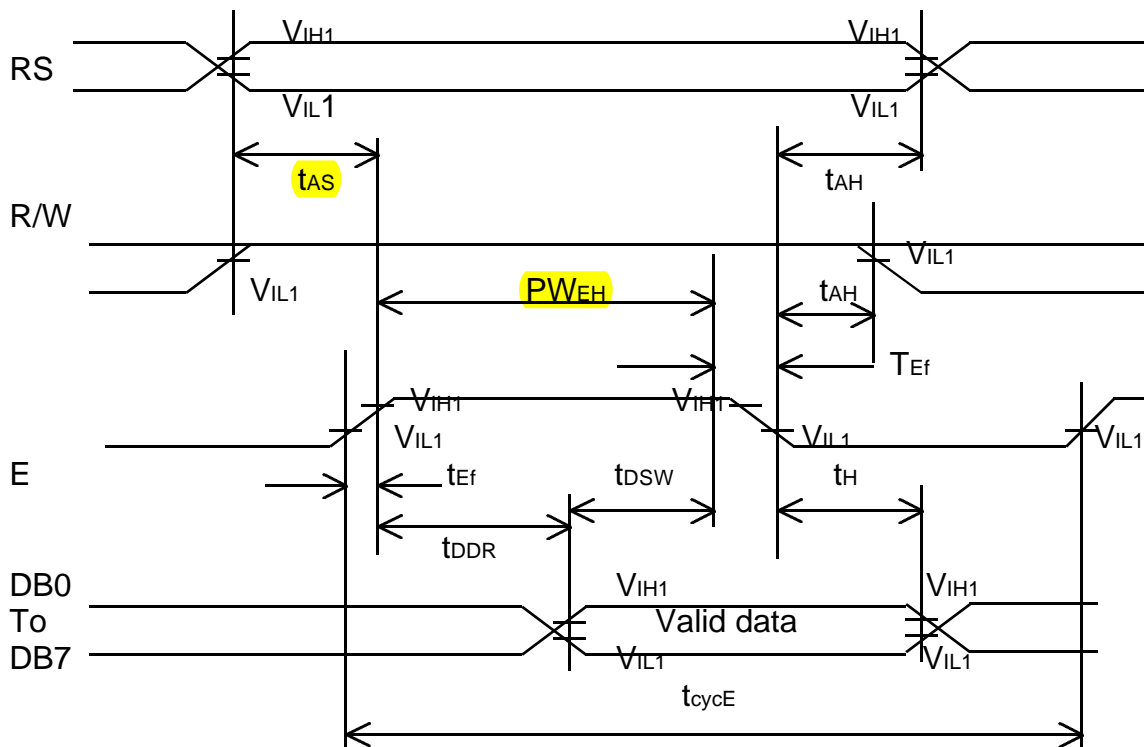
Item	Symbol	Condition	Min.	Max.	Unit
Enable cycle time	<b>tcycE</b>	V <sub>DD</sub> = 5V	<b>1000</b>	--	ns
Enable pulse width (high level)	<b>PWEH</b>		<b>450</b>	--	
Enable rise/fall time	<b>tEr, tEf</b>		--	25	
Address set-up time (RS, R/W, to E)	<b>tAS</b>		<b>60</b>	--	
Address hold time	<b>tAH</b>		<b>20</b>	--	
Data set-up time	<b>tDSW</b>		195	--	
Data hold time	<b>tH</b>		10	--	





## 7.2 READ TIMING

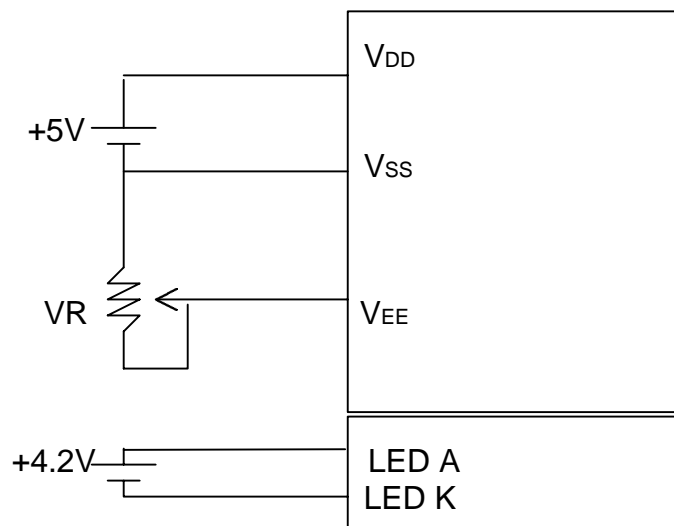
Item	Symbol	Condition	Min.	Max.	Unit
Enable cycle time	<b>tcycE</b>	VDD = 5V	<b>1000</b>	--	ns
Enable pulse width(high level)	PWEH		<b>450</b>	--	
Enable rise/fall time	tEr, tEf		--	25	
Address set-up time (RS, R/W, to E)	<b>tAS</b>		60	--	
Address hold time	tAH		20	--	
Data set-up time	tDDR		--	360	
Data hold time	tDHR		5	--	



## 8. PIN CONNECTIONS

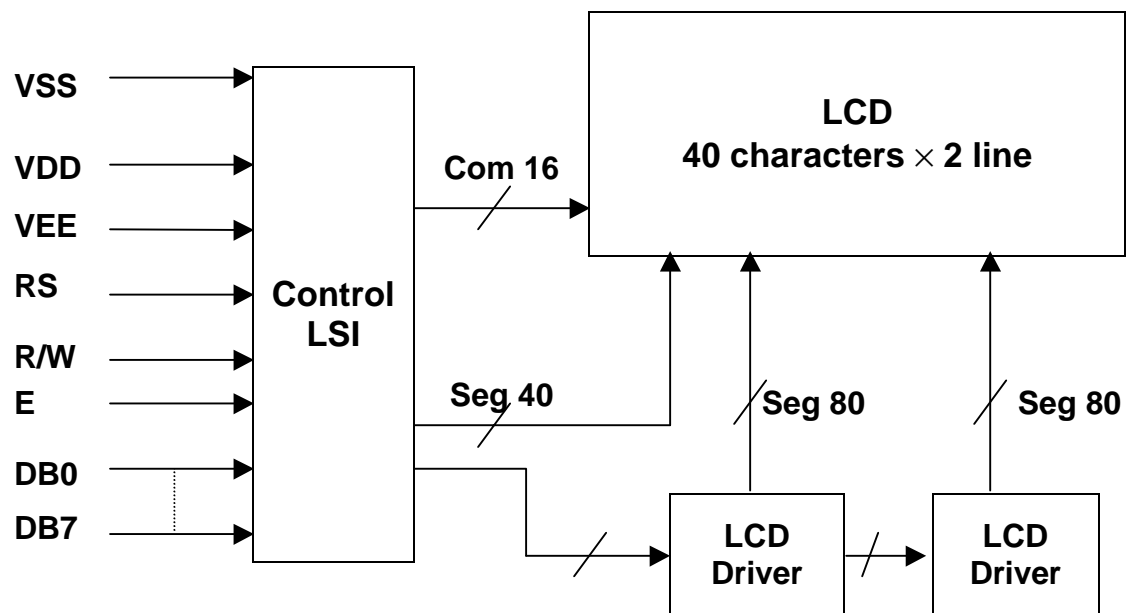
No.	Symbol	Function
1	VSS	Ground, 0V
2	VDD	Logic power supply, +5V
3	VEE	Voltage for LCD drive
4	RS	Data / Instruction register select
5	R/W	Read / Write
6	E	Enable signal, start data read/write
7	DB0	Data Bus Line
8	DB1	
9	DB2	
10	DB3	
11	DB4	
12	DB5	
13	DB6	
14	DB7	
15	LED A	LED Anode, power supply +
16	LED K	LED Cathode, ground 0V

## 9. POWER SUPPLY



VR = 10K

## 10. BLOCK DIAGRAM



## 10.1 INSTRUCTIONS

Instruction	CODE										DESCRIPTION	Executed Time(max) focs=250KHz
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Clear all display and returns the cursor to the home position (Address 0)	1.64mS
Cursor At Home	0	0	0	0	0	0	0	0	1	*	Returns the cursor to the home position (Address 0). Also returns the display being shifted to the original position DDRAM contents remain unchanged	1.64mS
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets the cursor move direction and specifies or not to shift the display. These operations are performed during data write and read.	40μS
Display On/Off Control	0	0	0	0	0	0	1	D	C	B	Sets the ON/OFF of all display (D) cursor ON/OFF (C), and blink of cursor position character (B)	40μS
Cursor/Display Shift	0	0	0	0	0	1	S/C	R/L	*	*	Moves the cursor and shifts the display without changing DDRAM contents	40μS
Function Set	0	0	0	0	1	DL	N	F	*	*	Sets interface data length (DL), number of display lines(N) and character font (F).	40μS
CGRAM Address Set	0	0	0	1	A <sub>CG</sub>						Sets the CGRAM, data is sent and received after this setting.	40μS
DDRAM Address Set	0	0	1	A <sub>DD</sub>						Sets the CGRAM, data is sent and received after this setting.	40μS	
Busy Flag/ Address Read	0	1	BF	AC						Reads Busy flag (FB) indicating internal operation is being performed and reads address counter contents.		0μS
CGRAM/DDRAM Data Write	1	0	W <sub>RITE</sub> D <sub>ATA</sub>						Writes data into DDRAM or CGRAM		40μS	
CGRAM/DDRAM Data Read	1	1	R <sub>EAD</sub> D <sub>ATA</sub>						Reads data into DDRAM or CGRAM		40μS	

Code	Description	Executed Time (max.)	
I/D=1: Increment I/D=0: Decrement S=1: With display shift S/C=1: Display shift S/C=0: Cursor movement R/L=1: Shift to the right R/L=0: Shift to the left DL=1 : 8-bit	DL = 0:4-bit 1/16 duty 1/8 duty, 1/11 duty F= 1: 5x10 dots F=0: 5x7 dots BF=1: Internal Operation is being performed BF=0: Instruction acceptable	DDRAM: Display Data RAM CGRAM: Character Generator RAM ACG: CGRAM Address ADD: DDRAM Address Corresponds to cursor address AC: Address Counter, used for both DDRAM and CGRAM *: Invalid	Fcp or fosc = 250kHz However, when frequency changes, execution time also changes  Example If fcp or fosc is 270kHz 40μS x 250 = 37μS 270

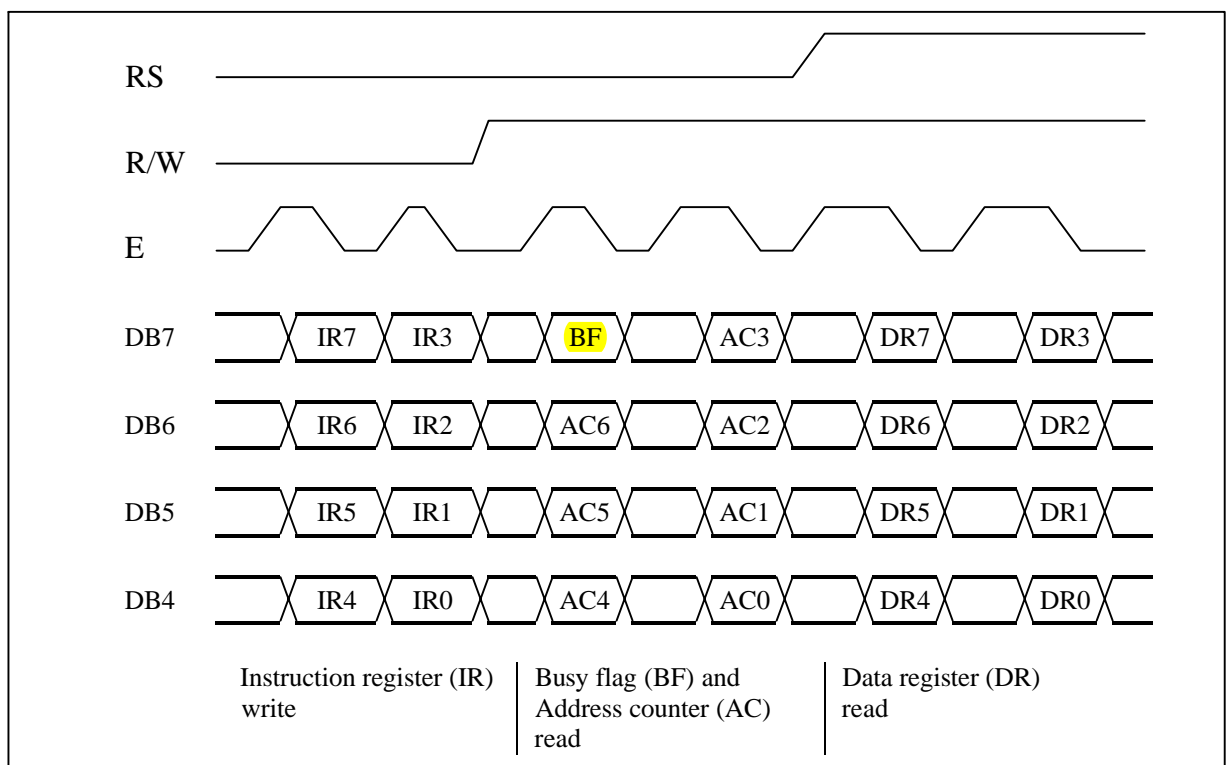
## 10.2 8-Bit Operation, 8-Digit×2-Line Display Example

Step	Instruction										Display	Operation
No	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
1	<b>Power supply on</b> (the HD44780U is initialized by the Internal reset circuit)											Initialized. No display.
2	<b>Function set</b> 0 0 0 0 1 1 1 0 * *											Sets to 8-bit operation and selects 2-line display and 5×8 dot character font.
3	<b>Display on/off control</b> 0 0 0 0 0 0 1 1 1 0											Turns on display and cursor. All display is <b>in space mode</b> because of initialization.
4	<b>Entry mode set</b> 0 0 0 0 0 0 0 1 1 0											Sets mode to increment the address by one and to shift the cursor to the right at the time of write to the DD/CGRAM. Display is not shifted.
5	<b>Write data to CGRAM/DDRAM</b> 1 0 0 1 0 0 1 0 0 0											Writes H. DDRAM has already been selected by initialization when the power was turned on. The cursor is incremented by one and shifted to the right
6												
7	<b>Write data to CGRAM/DDRAM</b> 1 0 0 1 0 0 1 0 0 1											Writes I.
8	<b>Set DDRAM address</b> 0 0 1 1 0 0 0 0 0 0											Sets DDRAM address so that the cursor is positioned at the Head of the second line.
9	<b>Write data to CGRAM/DDRAM</b> 1 0 0 1 0 0 1 1 0 1											Writes M.
10												
11	<b>Write data to CGRAM/DDRAM</b> 1 0 0 1 0 0 1 1 1 1											Writes O.
12	<b>Entry mode set</b> 0 0 0 0 0 0 0 1 1 1											Sets mode to shift display at the time of write.
13	<b>Write data to CGRAM/DDRAM</b> 1 0 0 1 0 0 1 1 0 1											Writes M. Display is shifted to the left. The first and second lines both shift at the same time.
14												
15	<b>Return home</b> 0 0 0 0 0 0 0 0 1 0											Returns both display and cursor to the original position (address 0).

### 10.3 Interfacing to the MPU

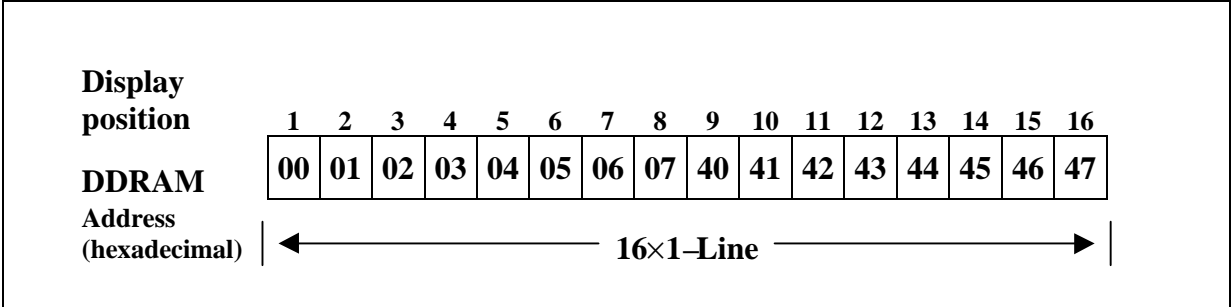
The HD44780U can send data in either two 4-bit operations, thus allowing interfacing with 4- or 8-bit MPUs.

- For 4-bit interface data, only four bus lines (DB4 to DB7) are used for transfer. Bus lines DB0 to FB3 are **disabled**. The data transfer between the HD44780U and the MPU is completed after the 4-bit data has been transferred twice. As for the order of data transfer, the four high order bits (for 8-bit operation, DB4 to DB7) are transferred before the four low order bits (for 8-bit operation, DB0 to DB3). The **busy flag must be checked** (one instruction) after the 4-bit data has been transferred twice. Two more 4-bit operations then transfer the busy flag and address counter data.

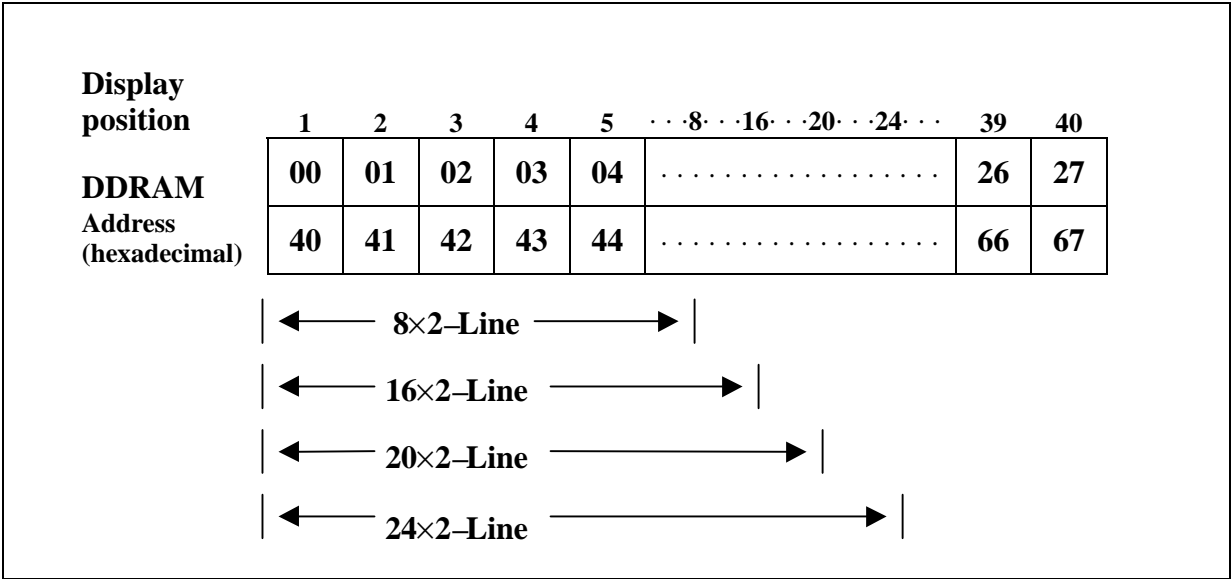


4-Bit Transfer Example

10.4 1-Line Display



2-Line Display



## 10.5 CGRAM

Relationship between CGRAM Addresses, Character Codes (DDRAM) and Patterns (CGRAM Data)

For 5×8 dot character patterns

Character Codes (DDRAM data)								CGRAM Address								Character Patterns (CGRAM data)								
7	6	5	4	3	2	1	0	5	4	3	2	1	0	7	6	5	4	3	2	1	0			
High				Low				High				Low				High				Low				
0 0 0 0 * 0 0 0								0 0 0				0	0	0		*	*	*	1	1	1	1	0	 Character Pattern (1) Cursor position
												0	0	1		1	0	0	1	0	0	1		
												0	1	0		1	0	0	0	1	0	1		
												0	1	1		1	1	1	1	0	0	1		
												1	0	0		1	0	1	0	0	1	0		
												1	1	0		1	0	0	0	1	0	1		
												1	1	1		1	1	1	1	0	0	1		
0 0 0 0 * 0 0 1								0 0 1				0	0	0		*	*	*	1	0	0	0	1	 Character Pattern (2) Cursor position
												0	0	1		0	1	0	1	0	0	1		
												0	1	0		1	1	1	1	1	1	1		
												0	1	1		0	0	1	0	0	0	1		
												1	0	0		1	1	1	1	1	1	1		
												1	0	1		0	0	1	0	0	0	1		
												1	1	0		0	0	1	0	0	0	1		
												0	0	0		*	*	*	0	0	0	0	0	Cursor position
												0	0	1										

0 0 0 0 * 1 1 1								1 1 1				1 0 0 1 0 1 1 1 0 1 1 1											
																* * *							

- Notes :
- Character code bits 0 to 2 correspond to CGRAM address bits 3 to 5 (3 bits: 8 types).
  - CGRAM address bits 0 to 2 designate the **character pattern line position**. The 8th line is the cursor position and its display is formed by a logical OR with the cursor. Maintain the 8th line data, corresponding to the cursor display position, at 0 as the cursor display.  
If the 8th line data is 1, 1 bits will light up the 8th line regardless of the cursor presence.
  - Character pattern row positions correspond to CGRAM data bits 0 to 4 (bit 4 being at the left).
  - As shown Table 5, **CGRAM character patterns** are selected when **character code bits 4 to 7 are all 0**. However, since character code bit 3 has no effect, the R display example above can be selected by either character code 00H or 08H.
  - 1 for CGRAM data corresponds to display selection and 0 to non-selection.
- \* Indicates no effect.



## 10.6 Correspondence between Character Codes and Character Patterns (ROM Code:A00)

Upper 4 bits Lower 4 bits	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
xxxx0000	CG RAM 1)			0	a	P	`	P				一	夕	ミ	α	p
xxxx0001	(2)		!	1	A	Q	a	q			。	ア	チ	厶	ä	q
xxxx0010	(3)		"	2	B	R	b	r			「	イ	ツ	×	β	θ
xxxx0011	(4)		#	3	C	S	c	s			」	ウ	テ	モ	ε	ω
xxxx0100	(5)		\$	4	D	T	d	t			、	エ	ト	ホ	μ	Ω
xxxx0101	(6)		%	5	E	U	e	u			・	オ	ナ	ユ	ϵ	Ü
xxxx0110	(7)		&	6	F	V	f	v			ヲ	カ	ニ	ヨ	ρ	Σ
xxxx0111	(8)		'	7	G	W	g	w			フ	キ	ヌ	ラ	g	π
xxxx1000	(1)		(	8	H	X	h	x			ィ	ク	ネ	リ	フ	×
xxxx1001	(2)		)	9	I	Y	i	y			ウ	ケ	ノ	ル	´	Y
xxxx1010	(3)		*	:	J	Z	j	z			エ	コ	ハ	レ	j	〒
xxxx1011	(4)		+	;	K	L	k	l			オ	サ	ヒ	ロ	*	斤
xxxx1100	(5)		,	<	L	¥	l	l			カ	シ	フ	ワ	¢	円
xxxx1101	(6)		-	=	M	J	m	}			ユ	ズ	ハ	ン	も	÷
xxxx1110	(7)		.	>	N	^	n	→			ヨ	セ	ホ	°	°	
xxxx1111	(8)		/	?	O	_	o	←			ッ	ソ	マ	°	ö	■

Note: The user can specify any pattern for character-generator RAM.

## 11. QUALITY ASSURANCE

### 11.1 Test Condition

#### 11.1.1 Temperature and Humidity(Ambient Temperature)

Temperature :  $20 \pm 2^{\circ}\text{C}$

Humidity :  $65 \pm 5\%$

#### 11.1.2 Operation

Unless specified otherwise, test will be conducted under function state.

#### 11.1.3 Container

Unless specified otherwise, vibration test will be conducted to the product itself without putting it in a container.

#### 11.1.4 Test Frequency

In case of related to deterioration such as shock test. It will be conducted only once.

#### 11.1.5 Test Method

No.	Parameter	Conditions	Regulations
1	High Temperature Operating	$50 \pm 2^{\circ}\text{C}$	Note 3
2	Low Temperature Operating	$0 \pm 2^{\circ}\text{C}$	Note 3
3	High Temperature Storage	$70 \pm 2^{\circ}\text{C}$	Note 3
4	Low Temperature Storage	$-20 \pm 2^{\circ}\text{C}$	Note 3
5	Vibration Test (Non-operation state)	Total fixed amplitude : 1.5mm Vibration Frequency : 10 ~ 55Hz One cycle 60 seconds to 3 directions of X.Y.Z. for each 15 minutes	Note 3
6	Damp Proof Test (Non-operation state)	$40^{\circ}\text{C} \pm 2^{\circ}\text{C}$ , 90~95%RH, 96h	Note 1,2
7	Shock Test (Non-operation state)	To be measured after dropping from 60cm high once concrete surface in packing state	Note 3

Note 1: Returned under normal temperature and humidity for 4 hrs.

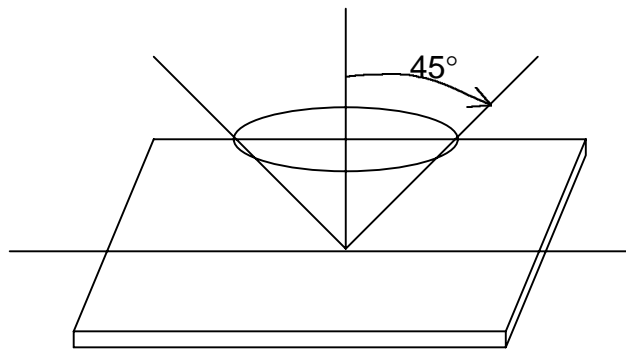
Note 2: No dew condensation to be observed.

Note 3: No change on display and in operation under the test condition

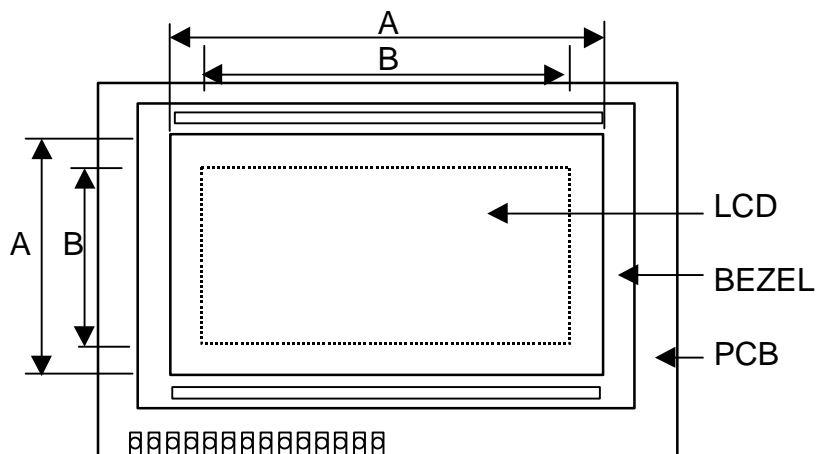
## 11.2 Inspection condition

### 11.2.1 Inspection conditions

The LCD shall be inspected under 40W white fluorescent light. The distance between the eyes and the sample shall be more than 30 cm. All directions for inspecting the sample should be within  $45^\circ$  against perpendicular line.



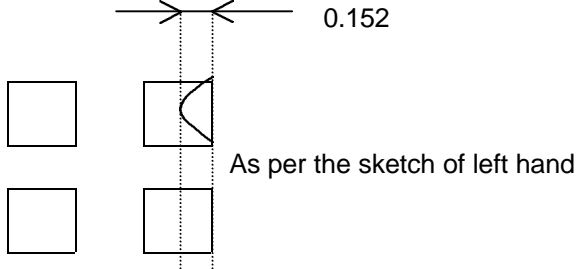
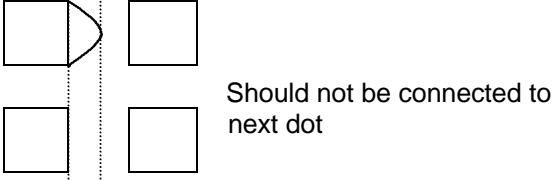
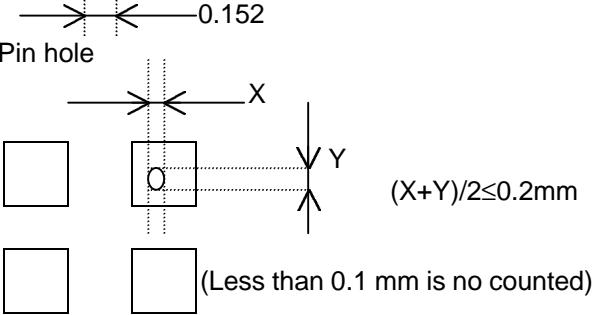
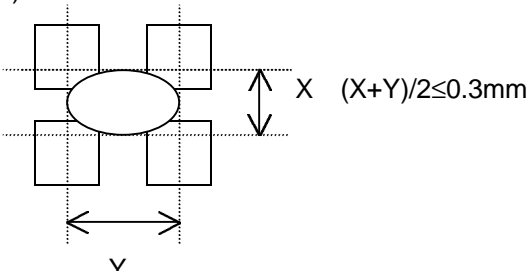
### 11.2.2 Definition of applicable Zones



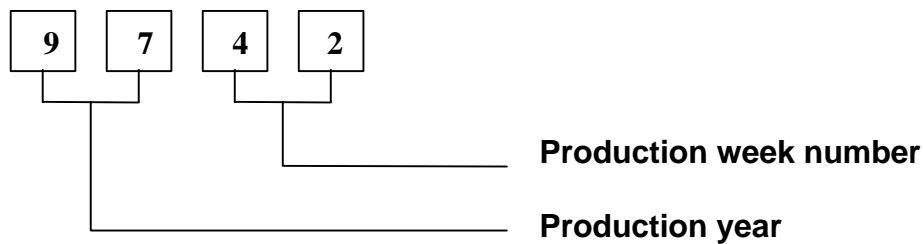
TYPICAL LCM

A : VIEWING AREA  
B : ACTIVE AREA

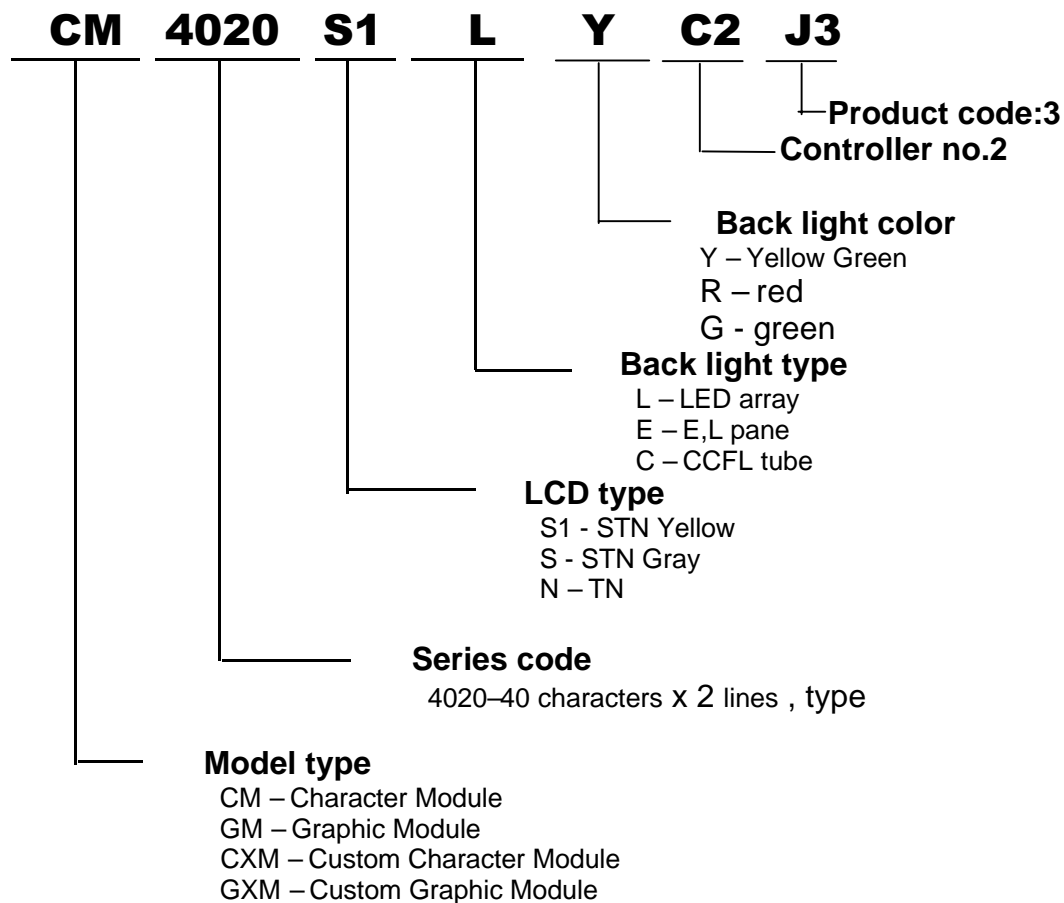
NO.	Parameter	Criteria																														
1	Black and white Spots Foreign Substances	Round Shape																														
		<table><tr><th rowspan="2">Zone Dimension</th><th colspan="3">Acceptable number</th><th rowspan="2">Class Of Defects</th><th rowspan="2">Acceptable level</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td><math>D \leq 0.2</math></td><td>*</td><td>*</td><td>*</td><td rowspan="4">Minor</td><td rowspan="4">2.5</td></tr><tr><td><math>0.2 \leq D \leq 0.3</math></td><td>3</td><td>4</td><td>*</td></tr><tr><td><math>0.3 \leq D \leq 0.4</math></td><td>2</td><td>3</td><td>*</td></tr><tr><td><math>D &lt; 0.3</math></td><td>0</td><td>1</td><td>*</td></tr></table>	Zone Dimension	Acceptable number			Class Of Defects	Acceptable level	A	B	C	$D \leq 0.2$	*	*	*	Minor	2.5	$0.2 \leq D \leq 0.3$	3	4	*	$0.3 \leq D \leq 0.4$	2	3	*	$D < 0.3$	0	1	*			
		Zone Dimension		Acceptable number					Class Of Defects	Acceptable level																						
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		$D < 0.3$	0	1	*																											
		$D = (\text{Long} + \text{Short}) / 2$ * : Disregard																														
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Zone X(mm) Y(mm)		Acceptable number			Class Of Defects	Accept- Able level																										
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X : Length      Y : Width      * : Disregard																																
Total defects should not exceed 5																																
2	Air Bubbles (between glass & polarizer)	<table><tr><th rowspan="2">Zone Dimension</th><th colspan="3">Acceptable number</th><th rowspan="2">Class Of Defects</th><th rowspan="2">Acceptable Level</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td><math>D \leq 0.3</math></td><td>*</td><td>*</td><td>*</td><td rowspan="4">Minor</td><td rowspan="4">2.5</td></tr><tr><td><math>0.3 &lt; D \leq 0.4</math></td><td>3</td><td>*</td><td>*</td></tr><tr><td><math>0.4 &lt; D \leq 0.6</math></td><td>2</td><td>3</td><td>*</td></tr><tr><td><math>0.6 &lt; D</math></td><td>0</td><td>0</td><td>*</td></tr></table>	Zone Dimension	Acceptable number			Class Of Defects	Acceptable Level	A	B	C	$D \leq 0.3$	*	*	*	Minor	2.5	$0.3 < D \leq 0.4$	3	*	*	$0.4 < D \leq 0.6$	2	3	*	$0.6 < D$	0	0	*			
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		Total defects shall not excess 3.																														

3	The Shape of Dot	<p>(1) Dot shape (with Dent)</p>  <p>As per the sketch of left hand</p> <p>(2) Dot shape (with Projection)</p>  <p>Should not be connected to next dot</p> <p>(3) Pin hole</p>  <p>(Less than 0.1 mm is no counted)</p> <p>(4) Deformation</p>  <p>Total acceptable number : 1/dot, 5/cell</p>
4	Polarizer Scratches	Refer to the sample
5	Polarizer Dirts	If the stains are removed easily from LCD panel surface, the module is not defective
6	Complex Foreign Substance Defects	Black spots, line shaped foreign substances or air bubbles between glass & polarizer should be 5 pieces maximum in total
7	Distance between Different Foreign Substance Defects	$D \leq 0.2$ : 20 mm or more $0.2 \leq D$ : 40mm or more

## 12. LOT NUMBERING SYSTEM



## 13. LCM NUMBERING SYSTEM



## 14. PRECAUTION FOR USING LCM

### 1. LIQUID CRYSTAL DISPLAY (LCD)

LCD is made up of glass, organic sealant, organic fluid, and polymer based polarizers. The following precautions should be taken when handling,

- (1). Keep the temperature within range of use and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel off or bubble.
- (2). Do not contact the exposed polarizers with anything harder than an HB pencil lead. To clean dust off the display surface, wipe gently with cotton, chamois or other soft material soaked in petroleum benzin.
- (3). Wipe off saliva or water drops immediately. Contact with water over a long period of time may cause polarizer deformation or color fading, while an active LCD with water condensation on its surface will cause corrosion of ITO electrodes.
- (4). Glass can be easily chipped or cracked from rough handling, especially at corners and edges.
- (5). Do not drive LCD with DC voltage.

### 2. Liquid Crystal Display Modules

#### 2.1 Mechanical Considerations

LCM are assembled and adjusted with a high degree of precision. Avoid excessive shocks and do not make any alterations or modifications. The following should be noted.

- (1). Do not tamper in any way with the tabs on the metal frame.
- (2). Do not modify the PCB by drilling extra holes, changing its outline, moving its components or modifying its pattern.
- (3). Do not touch the elastomer connector, especially insert an backlight panel (for example, EL).
- (4). When mounting a LCM make sure that the PCB is not under any stress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.
- (5). Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels.

#### 2.2. Static Electricity

LCM contains CMOS LSI's and the same precaution for such devices should apply, namely

- (1). The operator should be grounded whenever he/she comes into contact with the module. Never touch any of the conductive parts such as the LSI pads, the copper leads on the PCB and the interface terminals with any parts of the human body.
- (2). The modules should be kept in antistatic bags or other containers resistant to static for storage.
- (3). Only properly grounded soldering irons should be used.
- (4). If an electric screwdriver is used, it should be well grounded and shielded from commutator sparks.

(5) The normal static prevention measures should be observed for work clothes and working benches; for the latter conductive (rubber) mat is recommended.

(6). Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

### 2.3 Soldering

- (1). Solder only to the I/O terminals.
- (2). Use only soldering irons with proper grounding and no leakage.
- (3). Soldering temperature :  $280^{\circ}\text{C} \pm 10^{\circ}\text{C}$
- (4). Soldering time: 3 to 4 sec.
- (5). Use eutectic solder with resin flux fill.
- (6). If flux is used, the LCD surface should be covered to avoid flux spatters. Flux residue should be removed after wards.

### 2.4 Operation

- (1). The viewing angle can be adjusted by varying the LCD driving voltage V0.
- (2). Driving voltage should be kept within specified range; excess voltage shortens display life.
- (3). Response time increases with decrease in temperature.
- (4). Display may turn black or dark blue at temperatures above its operational range; this is (however not pressing on the viewing area) may cause the segments to appear "fractured".
- (5). Mechanical disturbance during operation (such as pressing on the viewing area) may cause the segments to appear "fractured".

### 2.5 Storage

If any fluid leaks out of a damaged glass cell, wash off any human part that comes into contact with soap and water. Never swallow the fluid. The toxicity is extremely low but caution should be exercised at all the time.

### 2.6 Limited Warranty

Unless otherwise agreed between DATA IMAGE and customer, DATA IMAGE will replace or repair any of its LCD and LCM which is found to be defective electrically and visually when inspected in accordance with DATA IMAGE acceptance standards, for a period on one year from date of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of DATA IMAGE is limited to repair and/or replacement on the terms set forth above. DATA IMAGE will not responsible for any subsequent or consequential events.

15 OUTLINE DRAWING

