

Dalian Dongfu Color Display Co.,Ltd

LCD Module User Manual  
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REVISION RECORD		
REV. NO.	DATA	REVISION ITEMS
1.0	JAN 20, 2006	First Release Version

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## 1.Scope

This manual defines general provisions as well as inspection standards for standard LCD module. If the event of unforeseen problem or unspecified items may occur, please contact the nearest supplier or our company.

## 2.Warranty

If module is not stored or used as specified in this manual, it will be void the 12- month warranty.

## 3.Features

### 3-1. Features

- (1) Display mode: Transmissive/negative  
STN LCD
- (2) Display color: Display dots: White  
Background :Blue
- (3) Display Format: 320(w)×240(h) full dots
- (4)Input data: 8-bit parallel data interfaced from a MPU
- (5) Multiplex ratio: 1/240 Duty, 1/16Bias
- (6) Viewing direction: 6 O'clock
- (7) Back light : LED White
- (8) Controller: RA8835
- (9) VDD:3.3V

### 3-2. Mechanical features

Item	Specifications	Unit
Outline dimensions	96.8(W)×85.7(H) ×10.9Max.(T)	mm
Viewing Area	78.79(W)×59.59(H)	mm
Image Area	76.79(W)×57.59(H)	mm
Number of Dots	320 (W)×240(H)	---
Dot Size	0.225(W)×0.225(H)	mm
Dot Pitch	0.24(W)×0.24(H)	mm
Weight	---	g

### 3-3. Absolute maximum ratings

Item	Symbol	Condition	Min	Max	Units
Power supply for logic	Vdd-Vss	25℃	-0.3	7.0	V
Operating voltage for LCD	Vdd-V0	25℃	-0.3	28.0	V
Input voltage	Vin	25℃	-0.3	Vdd+0.3	V
Operating temperature	Top	---	- 20	70	℃
Storage temperature	Tstg	---	- 30	80	℃

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Note:

- 1) The modules may be destroyed if they are used beyond absolute maximum ratings. In ordinary operation, it is desirable to use them within recommended operation conditions. Using the modules beyond these conditions may cause malfunction and poor reliability.
- 2) All voltage values are referenced to GND=0V.

### 3-4 Electrical Characteristics

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit	
Supply Voltage	Vdd	—	2.7	3.3	4.5	V	
Register data retention voltage	Voh	—	2.0	----	6.0		
Input leakage current	ILI	VI=Vdd	---	0.05	2.0	uA	
Output leakage current	ILO	VI=Vdd	---	0.10	5.0		
Quiescent supply current	IQ	Sleep mode Vosc1=V/cs=V/rd=Vdd	---	0.05	20.0	uA	
Oscillator frequency	Fosc	Measured at crystal 47.5% duty cycle	1.0	---	8.0	MHz	
External clock frequency	Fcl		1.0	----	8.0	MHz	
Oscillator feedback resistance	Rf		0.7	----	3.0	MΩ	
TTL							
Input Voltage	"H" Level	Vih	Note 1	0.5Vdd	—	Vdd	V
	"L" Level	Vil	Note 1	Vss	—	0.2Vdd	
Output Voltage	"H" Level	Vih	IOH=-5.0mA, Note 1	2.4	—	—	
	"L" Level	Vil	IOL=5.0mA, Note 1	—	—	Vss+0.4	
COMS							
Input Voltage	"H" Level	Vih	Note 2	0.8Vdd	—	Vdd	V
	"L" Level	Vil	Note 2	Vss	—	0.2Vdd	
Output Voltage	"H" Level	Vih	IOH=-2.0mA, Note 2	Vdd-0.4	—	—	
	"L" Level	Vil	IOL=1.6mA, Note 2	—	—	Vss+0.4	

Note: <1>D0 to D7,A0,/CS,/RD,/WR,VD0 to VD7,VA0 toVA15,/VRD,/VWRand/vce are ttl-level inputs  
 <2>SEL1 and NT/PL are CMOS-level inputs.YD,XD0toXD3,XSCL,XECL,LP,WF,YSCL,YDIS and CLO are CMOS-level outputs.

### 3-5 Electro-optical Characteristics

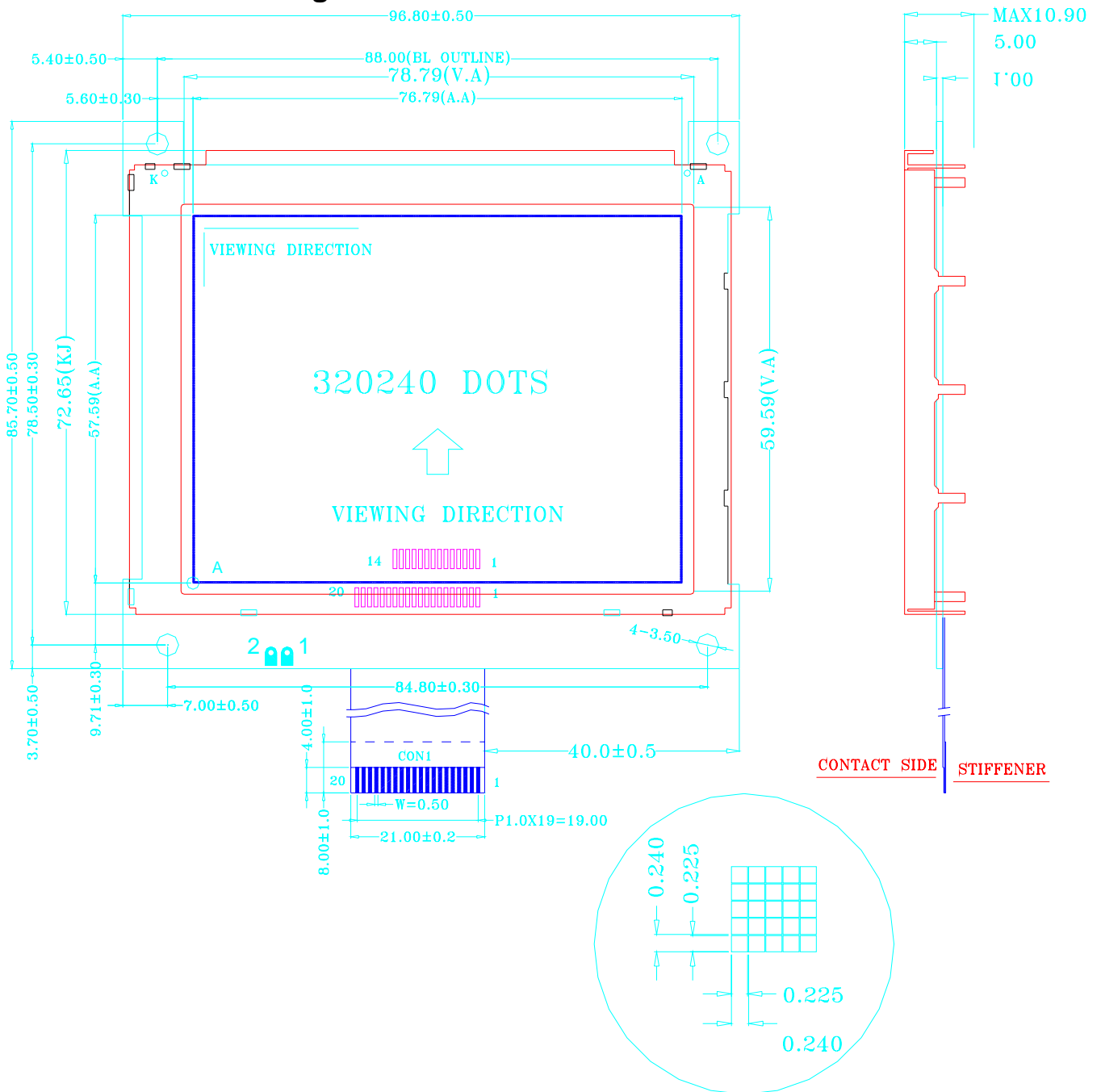
Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
LCD Driving Voltage (Recommended voltage)	Vop	-20℃	---	---	---	V
		25℃	---	21.2	---	
		70℃	---	---	---	
Current consumption (No B/L)	Idd	----	—	20	---	mA
Power supply for logic	Vdd-Vss	25℃	2.7	3.3	4.5	V

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## 3-6 LED back light specifications

Item	Unit	Standard Values			Condition
		Min.	Typ.	Max.	
Supply Voltage	V	—	3.2	---	—
Current	mA	---	70	---	---
Luminous Color	—	White			---
Operating Temp.	°C	-20 ~ +70			—
Storage Temp.	°C	-30 ~ +80			—

## 4. Mechanical Diagram



## 5.I/O Terminal

### 5-1 I/O Connection

#### CN1(with controller IC )

Pin No.	Symbol	Function
1	Vss	Power supply (GND)
2	NC	No connection
3	Vdd	Power supply (+3.3V)
4	/RES	Controller reset signal
5	/CS	When /CS=L,the chip is enabled.
6	A0	Register select signal A0=1, Instruction register ,A0=0, Data register
7	/WR	Chip select 8080: Write signal; 6800: W/R signal
8	/RD	8080: Read signal; 6800: Enable signal
9-16	DB0-DB7	Data bus line
17	NC	No connection
18	LED+	Back light +
19	NC	No connection
20	NC	No connection

#### CN2(without controller IC )

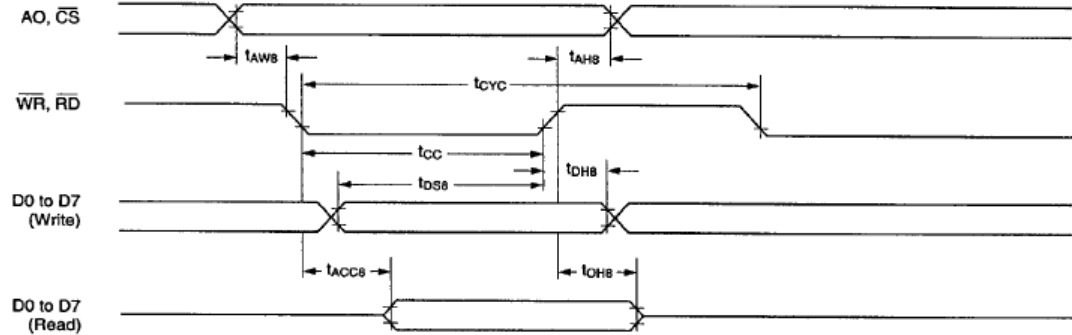
Pin No.	Symbol	Function
1	NC	No connection
2	Vdd	Power supply (+3.3V)
3	FRAME	Scan start pulse
4	GND	Power supply (GND)
5	LP	Input data latch signal
6	GND	Power supply (GND)
7	M	AC Signal for lcd
8	/DOFF	H/L,Power down output signal
9	CP	Data Input Clock Signal
10	D3	H/L,Display Data Signal
11	D2	
12	D1	
13	D0	
14	LED+	Back light +

#### CN3:

Pin No.	Symbol	Function
1	CP	Data Input Clock Signal
2	GND	Power supply ( Digital GND)

5-2 Signal timing diagram

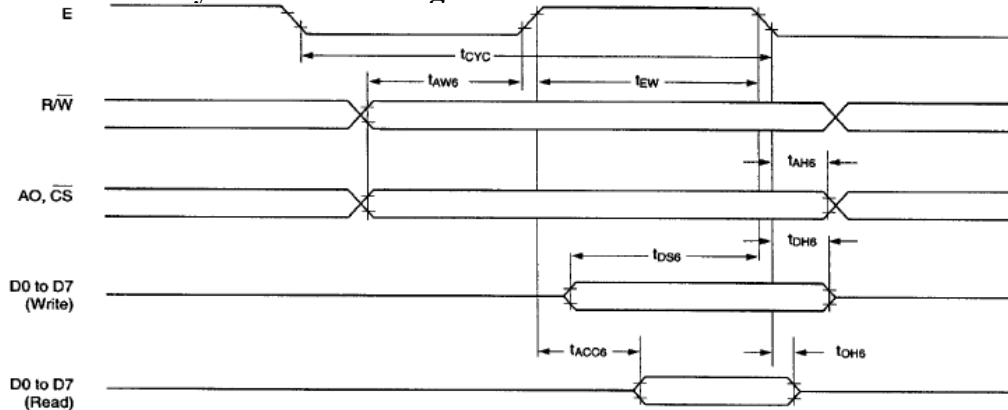
5-2-1 8080 family interface Timing



Ta = -20 to 75°C

Signal	Symbol	Parameter	VDD = 4.5 to 5.5V		VDD = 2.7 to 4.5V		Unit	Condition
			min	max	min	max		
A0, CS	tAH8	Address hold time	10	—	10	—	ns	CL = 100 pF
	tAW8	Address setup time	0	—	0	—	ns	
WR, RD	tCYC	System cycle time	See note	—	See note	—	ns	
	tCC	Strobe pulsewidth	120	—	150	—	ns	
D0 to D7	tDS8	Data setup time	120	—	120	—	ns	
	tDH8	Data hold time	5	—	5	—	ns	
	tACC8	RD access time	—	50	—	80	ns	
	tOH8	Output disable time	10	50	10	55	ns	

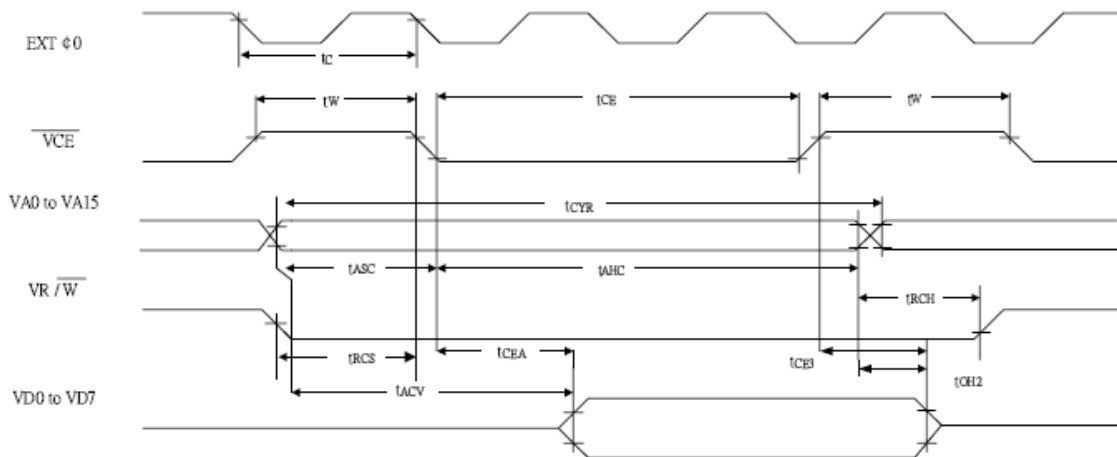
5-2-2 6800 family interface Timing



Ta = -20 to 75°C

Signal	Symbol	Parameter	VDD = 4.5 to 5.5V		VDD = 2.7 to 4.5V		Unit	Condition
			min	max	min	max		
A0, CS, R/W	tCYC6	System cycle time	See note	—	See note	—	ns	CL = 100 pF
	tAW6	Address setup time	0	—	10	—	ns	
	tAH6	Address hold time	0	—	0	—	ns	
D0 to D7	tDS6	Data setup time	100	—	120	—	ns	
	tDH6	Data hold time	0	—	0	—	ns	
	tOH6	Output disable time	10	50	10	75	ns	
	tACC6	Access time	—	85	—	130	ns	
E	tEW	Enable pulsewidth	120	—	150	—	ns	

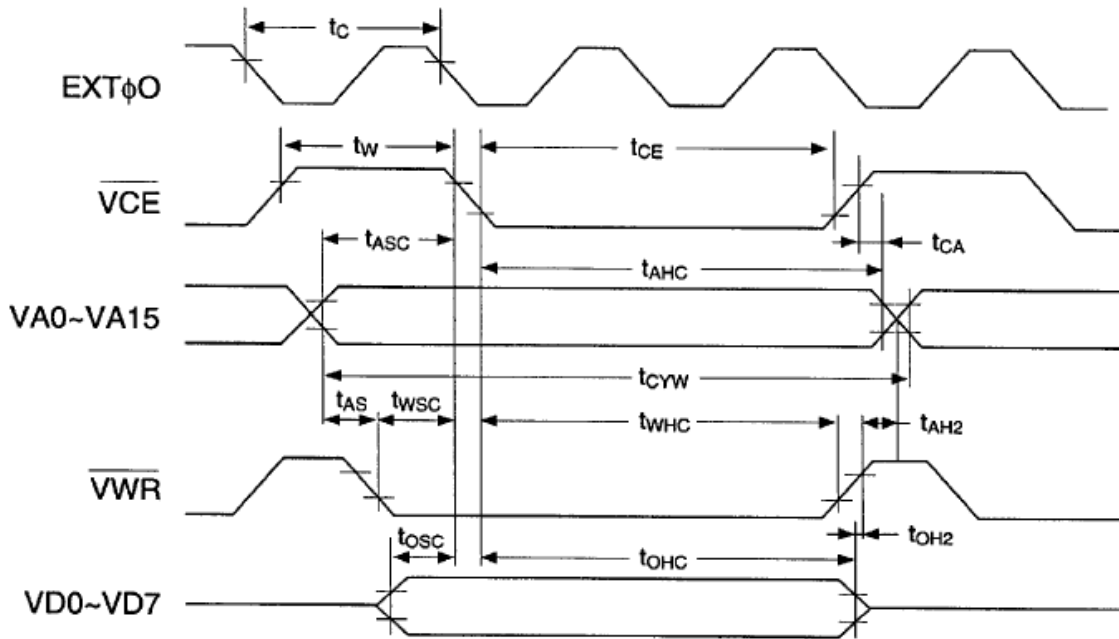
5-2-3 Display Memory Read Timing



Ta = -20 to 75°C

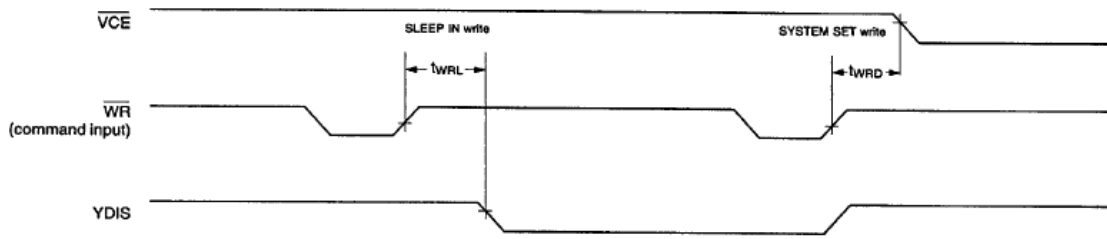
Signal	Symbol	Parameter	V <sub>DD</sub> = 4.5 to 5.5V		V <sub>DD</sub> = 2.7 to 4.5V		Unit	Condition
			Min.	Max.	Min.	Max.		
EXT Φ0	t <sub>C</sub>	Clock period	100	—	125	—	ns	CL = 100 pF
VCE	t <sub>W</sub>	VCE HIGH-level pulse width	t <sub>C</sub> - 50	—	t <sub>C</sub> - 50	—	ns	
	t <sub>CE</sub>	VCE LOW-level pulse width	2t <sub>C</sub> - 30	—	2t <sub>C</sub> - 30	—	ns	
VA0 to VA15	t <sub>CYR</sub>	Read cycle time	3t <sub>C</sub>	—	3t <sub>C</sub>	—	ns	
	t <sub>ASC</sub>	Address setup time to falling edge of VCE	t <sub>C</sub> - 70	—	t <sub>C</sub> - 100	—	ns	
	t <sub>AHC</sub>	Address hold time from falling edge of VCE	2t <sub>C</sub> - 30	—	2t <sub>C</sub> - 40	—	ns	
VRD	t <sub>RCS</sub>	Read cycle setup time to falling edge of VCE	t <sub>C</sub> - 45	—	t <sub>C</sub> - 60	—	ns	
	t <sub>RCH</sub>	Read cycle hold time from rising edge of VCE	0.5t <sub>C</sub>	—	0.5t <sub>C</sub>	—	ns	
VD0 to VD7	t <sub>ACV</sub>	Address access time	—	3t <sub>C</sub> - 100	—	3t <sub>C</sub> - 115	Ns	
	t <sub>CEA</sub>	VCE access time	—	2t <sub>C</sub> - 80	—	2t <sub>C</sub> - 90	Ns	
	t <sub>OH2</sub>	Output data hold time	0	—	0	—	ns	
	t <sub>CE3</sub>	VCE to data off time	0	—	0	—	ns	

5-2-4 Display Memory Write Timing



Signal	Symbol	Parameter	VDD = 4.5 to 5.5V		VDD = 2.7 to 4.5V		Unit	Condition
			min	max	min	max		
EXT φ0	tc	Clock period	100	—	125	—	ns	CL = 100 pF
VCE	tw	VCE HIGH-level pulse-width	tc - 50	—	tc - 50	—	ns	
	tce	VCE LOW-level pulse-width	2tc - 30	—	2tc - 30	—	ns	
VA0 to VA15	tcyw	Write cycle time	3tc	—	3tc	—	ns	
	taHC	Address hold time from falling edge of VCE	2tc - 30	—	2tc - 40	—	ns	
	tasc	Address setup time to falling edge of VCE	tc - 70	—	tc - 110	—	ns	
	tca	Address hold time from rising edge of VCE	0	—	0	—	ns	
	tAS	Address setup time to falling edge of VWR	0	—	0	—	ns	
	tAH2	Address hold time from rising edge of VWR	10	—	10	—	ns	
VWR	twsc	Write setup time to falling edge of VCE	tc - 80	—	tc - 115	—	ns	
	twhc	Write hold time from falling edge of VCE	2tc - 20	—	2tc - 20	—	ns	
VD0 to VD7	tdsc	Data input setup time to falling edge of VCE	tc - 85	—	tc - 125	—	ns	
	tdhc	Data input hold time from falling edge of VCE	2tc - 30	—	2tc - 30	—	ns	
	tDH2	Data hold time from rising edge of VWR	5	50	5	50	ns	

5-2-5 Sleep In Command Timing



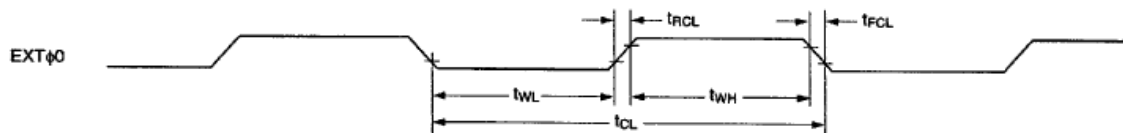
Ta = -20 to 75°C

Signal	Symbol	Parameter	V <sub>DD</sub> = 4.5 to 5.5V		V <sub>DD</sub> = 2.7 to 4.5V		Unit	Condition
			Min.	Max.	Min.	Max.		
WR	t <sub>WRD</sub>	VCE falling-edge delay time	note 1.	—	note 1.	—	ns	CL = 100 pF
	t <sub>WRL</sub>	YDIS falling-edge delay time	—	note 2.	—	note 2.	ns	

Notes:

1. t<sub>WRD</sub> = 18t<sub>C</sub> + t<sub>OSS</sub> + 40 (t<sub>OSS</sub> is the time delay from the sleep state until stable operation)
2. t<sub>WRL</sub> = 36t<sub>C</sub> · [TC/R] · [L/F] + 70

5-2-6 External Oscillator Signal Timing



Signal	Symbol	Parameter	V <sub>DD</sub> = 4.5 to 5.5V		V <sub>DD</sub> = 2.7 to 4.5V		Unit	Condition
			min	max	min	max		
EXT φ0	t <sub>RCL</sub>	External clock rise time	—	15	—	15	ns	
	t <sub>FCL</sub>	External clock fall time	—	15	—	15	ns	
	t <sub>WH</sub>	External clock HIGH-level pulsewidth	See note 1	See note 2	See note 1	See note 2	ns	
	t <sub>WL</sub>	External clock LOW-level pulsewidth	See note 1	See note 2	See note 1	See note 2	ns	
	t <sub>C</sub>	External clock period	100	—	125	—	ns	

Notes:

1.  $(t_c - t_{RCL} - t_{FCL}) \times \frac{475}{1000} < t_{WH}, t_{WL}$
2.  $(t_c - t_{RCL} - t_{FCL}) \times \frac{525}{1000} > t_{WH}, t_{WL}$

5-3 display command

Class	Command	Code											Hex	Command Description
		RD	WR	A0	D7	D6	D5	D4	D3	D2	D1	D0		
System control	SYSTEM SET	1	0	1	0	1	0	0	0	0	0	0	40	Initialize device and display
	SLEEP IN	1	0	1	0	1	0	1	0	0	1	1	53	Enter standby mode
Display control	DISP ON/OFF	1	0	1	0	1	0	1	1	0	0	D	58, 59	Enable and disable display and display flashing
	SCROLL	1	0	1	0	1	0	0	0	1	0	0	44	Set display start address and display regions
	CSRFORM	1	0	1	0	1	0	1	1	1	0	1	5D	Set cursor type
	CGRAM ADR	1	0	1	0	1	0	1	1	1	0	0	5C	Set start address of character generator RAM
	CSRDIR	1	0	1	0	1	0	0	1	1	CD 1	CD 0	4C to 4F	Set direction of cursor movement
	HDOT SCR	1	0	1	0	1	0	1	1	0	1	0	5A	Set horizontal scroll position
	OVLAY	1	0	1	0	1	0	1	1	0	1	1	5B	Set display overlay format
Drawing control	CSRW	1	0	1	0	1	0	0	0	1	1	0	46	Set cursor address
	CSRR	1	0	1	0	1	0	0	0	1	1	1	47	Read cursor address
Memory control	MWRITE	1	0	1	0	1	0	0	0	0	1	0	42	Write to display memory
	MREAD	1	0	1	0	1	0	0	0	0	1	1	43	Read from display memory

Notes:

1. In general, the internal registers of the SED1330F/1335F/1336F are modified as each command parameter is input. However, the microprocessor does not have to set all the parameters of a command and may send a new command before all parameters have been input. The internal registers for the parameters that have been input will have been changed but the remaining parameter registers are unchanged.
 

2-byte parameters (where two bytes are treated as one data item) are handled as follows:

  - a. CSRW, CSRR: Each byte is processed individually. The microprocessor may read or write just the low byte of the cursor address.
  - b. SYSTEM SET, SCROLL, CGRAM ADR: Both parameter bytes are processed together. If the command is changed after half of the parameter has been input, the single byte is ignored.
2. APL and APH are 2-byte parameters, but are treated as two 1-byte parameters.

## 6. Quality Level

### 6-1 Inspection conditions

6-1-1 The environmental conditions for inspection shall be as follows:

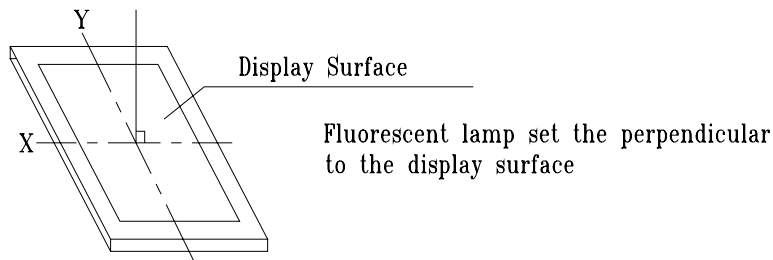
Room temperature:  $20 \pm 3^{\circ}\text{C}$

Humidity:  $65 \pm 20\% \text{ RH}$

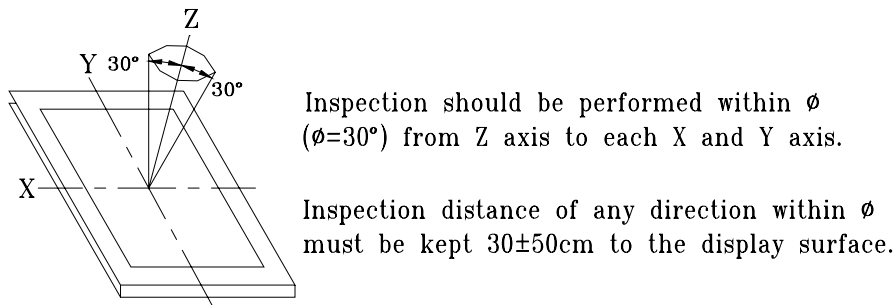
6-1-2 The external visual inspection:

The inspection shall be performed by using a 20W fluorescent lamp for illumination and the distance between LCD and the eyes of the inspector should be at least 30cm.

(1) Light method



(2) Inspection distance and angle



### 6-2 Sampling procedures for each item's acceptance level table

Defect type	Sampling procedure	AQL
Major defect	MIL-STD-105D Inspection Level I Normal inspection Single sample inspection	QC/-07-2006(1)
Minor defect	MIL-STD-105D Inspection Level I Normal inspection Single sample inspection	QC/-07-2006(1)

### 6-3 Classification of defects

6-3-1 Major defect

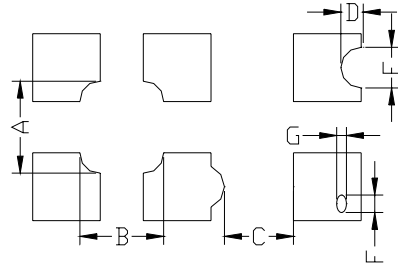
A major defect refers to a defect that may substantially degrade usability for product applications.

6-3-2 Minor defect

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A minor defect refers to a defect that deviates from existing standards almost unrelated to the effective use of the product or its operation.

### 6-4 Inspection standar

Item	Criterion for defects	Defect type																					
1) Display on inspection	(1) Non display                      (2) Vertical line is deficient (3) Horizontal line is deficient   (4) Cross line is deficient	Major																					
2) Black / White spot	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Size <math>\Phi</math> (mm)</th> <th>Acceptable number</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.3</math></td> <td>Ignore (note)</td> </tr> <tr> <td><math>0.3 &lt; \Phi \leq 0.45</math></td> <td>3</td> </tr> <tr> <td><math>0.45 &lt; \Phi \leq 0.6</math></td> <td>1</td> </tr> <tr> <td><math>0.3 &lt; \Phi</math></td> <td>0</td> </tr> </tbody> </table> <p style="text-align: center;">(Note) Not allowed if four more spots crowd together</p>	Size $\Phi$ (mm)	Acceptable number	$\Phi \leq 0.3$	Ignore (note)	$0.3 < \Phi \leq 0.45$	3	$0.45 < \Phi \leq 0.6$	1	$0.3 < \Phi$	0	Minor											
Size $\Phi$ (mm)	Acceptable number																						
$\Phi \leq 0.3$	Ignore (note)																						
$0.3 < \Phi \leq 0.45$	3																						
$0.45 < \Phi \leq 0.6$	1																						
$0.3 < \Phi$	0																						
3) Black / White line	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Length (mm)</th> <th>Width (mm)</th> <th>Acceptable number</th> </tr> </thead> <tbody> <tr> <td><math>L \leq 10</math></td> <td><math>W \leq 0.03</math></td> <td>Ignore</td> </tr> <tr> <td><math>5.0 \leq L \leq 10</math></td> <td><math>0.03 &lt; W \leq 0.04</math></td> <td>3</td> </tr> <tr> <td><math>5.0 \leq L \leq 10</math></td> <td><math>0.04 &lt; W \leq 0.05</math></td> <td>2</td> </tr> <tr> <td><math>1.0 \leq L \leq 10</math></td> <td><math>0.05 &lt; W \leq 0.06</math></td> <td>2</td> </tr> <tr> <td><math>1.0 \leq L \leq 10</math></td> <td><math>0.06 &lt; W \leq 0.08</math></td> <td>1</td> </tr> <tr> <td><math>L \leq 10</math></td> <td><math>0.08 &lt; W</math></td> <td>follows 2) point defect</td> </tr> </tbody> </table> <p style="text-align: center;">Defects separate with each other at an interval of more than 20mm.</p>	Length (mm)	Width (mm)	Acceptable number	$L \leq 10$	$W \leq 0.03$	Ignore	$5.0 \leq L \leq 10$	$0.03 < W \leq 0.04$	3	$5.0 \leq L \leq 10$	$0.04 < W \leq 0.05$	2	$1.0 \leq L \leq 10$	$0.05 < W \leq 0.06$	2	$1.0 \leq L \leq 10$	$0.06 < W \leq 0.08$	1	$L \leq 10$	$0.08 < W$	follows 2) point defect	Minor
Length (mm)	Width (mm)	Acceptable number																					
$L \leq 10$	$W \leq 0.03$	Ignore																					
$5.0 \leq L \leq 10$	$0.03 < W \leq 0.04$	3																					
$5.0 \leq L \leq 10$	$0.04 < W \leq 0.05$	2																					
$1.0 \leq L \leq 10$	$0.05 < W \leq 0.06$	2																					
$1.0 \leq L \leq 10$	$0.06 < W \leq 0.08$	1																					
$L \leq 10$	$0.08 < W$	follows 2) point defect																					
4) Display pattern	 <p style="text-align: center;">[Unit: mm]</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td><math>A+B \leq 0.45</math></td> <td><math>0 &lt; C</math></td> <td><math>D+E \leq 0.35</math></td> <td><math>F+G \leq 0.35</math></td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">2</td> <td style="text-align: center;">2</td> <td style="text-align: center;">2</td> </tr> </table> <p>Note: 1) Up to 3 damages acceptable 2) Not allowed if there are two or more pinholes every 3 of fourths inch.</p>	$A+B \leq 0.45$	$0 < C$	$D+E \leq 0.35$	$F+G \leq 0.35$	2	2	2	2	Minor													
$A+B \leq 0.45$	$0 < C$	$D+E \leq 0.35$	$F+G \leq 0.35$																				
2	2	2	2																				
5) Spot-like contrast irregularity	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Size <math>\Phi</math> (mm)</th> <th>Acceptable Number</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.7</math></td> <td>Ignore (note)</td> </tr> <tr> <td><math>0.7 &lt; \Phi \leq 1.0</math></td> <td>3</td> </tr> <tr> <td><math>1.0 &lt; \Phi \leq 1.5</math></td> <td>1</td> </tr> <tr> <td><math>1.5 &lt; \Phi</math></td> <td>0</td> </tr> </tbody> </table> <p>Note: 1) Conformed to limit samples. 2) Intervals of defects are more than 30mm.</p>	Size $\Phi$ (mm)	Acceptable Number	$\Phi \leq 0.7$	Ignore (note)	$0.7 < \Phi \leq 1.0$	3	$1.0 < \Phi \leq 1.5$	1	$1.5 < \Phi$	0	Minor											
Size $\Phi$ (mm)	Acceptable Number																						
$\Phi \leq 0.7$	Ignore (note)																						
$0.7 < \Phi \leq 1.0$	3																						
$1.0 < \Phi \leq 1.5$	1																						
$1.5 < \Phi$	0																						

## LCD Module User Manual

Item	Criterion for defects			Defect type
6) Bubbles in polarizer	Size $\Phi$ (mm)	Acceptable Number		Minor
	$\Phi \leq 0.4$	Ignore (note)		
	$0.4 < \Phi \leq 0.65$	2		
	$0.65 < \Phi \leq 1.2$	1		
	$1.2 < \Phi$	0		
7) Scratches and dent on the polarizer	Scratches and dent on the polarizer shall be in the accordance with "2) Black/white spot", and "3) Black/White line".			Minor
8) Stains on the surface of LCD panel	Stains which cannot be removed even when wiped lightly with a soft cloth or similar cleaning.			Minor
9) Rainbow color	No rainbow color is allowed in the optimum contrast on state within the active area.			Minor
10) Viewing area encroachment	Polarizer edge or line is visible in the opening viewing area due to polarizer shortness or sealing line.			Minor
11) Bezel appearance	Rust and deep damages that are visible in the bezel are rejected.			Minor
12) Defect of land surface contact	Evident crevices that are visible are rejected.			Minor
13) Parts mounting	(1) Failure to mount parts (2) Parts not in the specifications are mounted (3) For example: Polarity is reversed, HSC or TCP falls off.			Major
14) Part alignment	(1) LSI, IC lead width is more than 50% beyond pad outline. (2) More than 50% of LSI, IC leads is off the pad outline.			Minor
15) Conductive foreign matter (solder ball, solder hips)	(1) $0.45 < \Phi, N \geq 1$			Major
	(2) $0.3 < \Phi \leq 0.45, N \geq 1$ $\Phi$ : Average diameter of solder ball (unit: mm)			Minor
	(3) $0.5 < L, N \geq 1$ $L$ : Average length of solder chip (unit: mm)			Minor
16) PCB pattern damage	(1) Deep damage is found on copper foil and the pattern is nearly broken.			Major
	(2) Damage on copper foil other than 1) above			Minor
17) Faulty PCB correction	(1) Due to PCB copper foil pattern burnout, the pattern is connected, using a jumper wire for repair; 2 or more places are corrected per PCB. (2) Short-circuited part is cut, and no resist coating has been performed.			Minor
18) Bezel flaw	Bezel claw missing or not bent			Minor
19) Indication on name plate (sampling indication label)	(1) Failure to stamp or label error, or not legible. (all acceptable if legible) (2) The separation is more than 1/3 for indication discoloration, in which the characters can be checked.			Minor

## 7. Reliability

### 7-1 Lifetime

50,000 hours (25°C in the room without ray of sun)

Item	Condition	Criterion
1) High Temperature Operating	60°C 96hrs	No cosmetic failure is allowable. Contrast ratio should be between initial value $\pm$ 10%. Total current consumption should be below double of initial value.
2) Low Temperature Operation	-20°C 96hrs	
3) Humidity	40°C, 90%RH, 96hrs	No cosmetic failure is allowable. Contrast ratio should be between initial value $\pm$ 20%. Total current consumption should be below double of initial value.
4) High Temperature	70°C 96hrs	
5) Low Temperature	-30°C 96hrs	
6) Thermal shock	25°C→30°C→25°C→70°C 5(min) 30(min) 5(min) 30(min) 5 cycle, 55~60%RH	
7) Vibration	10~55~10hz amplitude: 1.5mm 2hrs for each direction (X,Y,Z)	No defects in cosmetic and operational function are allowable. Total current consumption should be below double of initial value.

### 7-2 Items of reliability

## 8. Handling Precautions

### 8-1 Mounting method

A panel of LCD module consists of two thin glass plates with polarizers that easily get damaged.

And since the module is so constructed as to be fixed by utilizing fitting holes in the printed circuit board (PCB).

Extreme care should be used when handling the LCD modules.

### 8-2 Cautions of LCD handling and cleaning

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

- Isopropyl alcohol
- Ethyl alcohol
- Trichlorotrifluoroethane

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

### 8-3 Caution against static charge

The LCD module uses C-MOS LSI drivers. So we recommend you:

Connect any unused input terminal to  $V_{dd}$  or  $V_{ss}$ . Do not input any signals before power

is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

### 8-4 Packaging

- Module employs 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 direct to sunshine or high temperature/humidity.

### 8-5 Caution for operation

- It is an indispensable condition to drive LCD module within the limits of the specified voltage since the higher voltage over the limits may cause the shorter life of LCD module.  
An electrochemical reaction due to DC (direct current) causes LCD undesirable deterioration so that the uses of DC (direct current) drive should be avoided.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD module may show dark color in them. However those phenomena do not mean malfunction or out of order of LCD module, which will come back in the specified operating temperature.

### 8-6 Storage

In the case of storing for a long period of time, the following ways are recommended:

- Storage in polyethylene bag with the opening sealed so as not to enter fresh air outside in it. And with not desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light is. Keeping the storage temperature range.
- Storing with no touch on polarizer surface by any thing else.

### 8-7 Safety

- It is recommendable to crash damaged or unnecessary LCD into pieces and to wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.
- When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well at once with soap and water.

## 9. Precautions for Use

**9-1** Both parties should provide a limit sample on an occasion when both parties agree its necessity.

The judgement by a limit sample shall take effect after the limit sample has been established and confirmed by both parties

**9-2** On the following occasions, the handling of problem should be decided through discussion and agreement between responsible of the both parties.

- When a question is arisen in this manual.
- When a new problem is arisen which is not specified in this manual.
- Some problem is arisen due to the change of inspection and operating conditions in users.
- When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.