

Display Elektronik GmbH

DATA SHEET

LCD MODULE

DEM 122032A SBH-PW-N

Product specification

Version : 0

14/Dec./2006

DOCUMENT REVISION HISTORY

Version	DATE	DESCRIPTION	CHANGED BY
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CONTENTS

1. Functions & Features	2
2. Mechanical specifications	2
3. Block diagram	2
4. Dimensional Outline	3
5. Pin description	4
6. Maximum absolute limit	5
7. Electrical characteristics	6
8. Timing Characteristics	6
9. Control and display command	7
10. Backlight characteristics	8
11. Electro-Optical characteristics	8
12. Precaution for using LCD / LCM	9

1. FUNCTIONS & FEATURES

- 1.1. Format : 122x32dots
- 1.2. LCD mode : STN-BLUE / Negative transmissive mode
- 1.3. Viewing direction : 6 o'clock
- 1.4. Driving scheme : 1/32 Duty cycle, 1/5 Bias
- 1.5. Power supply voltage(V_{DD}) : 5.0 Volt (typ.)
- 1.6. LCD driving voltage : 4.1Volt (typ.)
- 1.7. Operation temp : -20 ~ 70°C
- 1.8. Storage temp : -30 ~ 80°C
- 1.9. Backlight : LED, Lightguide, White

2. MECHANICAL SPECIFICATIONS

- 2.1. Module size : 80.0 x 36.0 x 13.5 mm(max.)
- 2.2. Viewing area : 60.5x 18.5 mm
- 2.3. Dot pitch : 0.44 x 0.49 mm
- 2.4. Dot size : 0.40 x 0.45 mm

3. BLOCK DIAGRAM

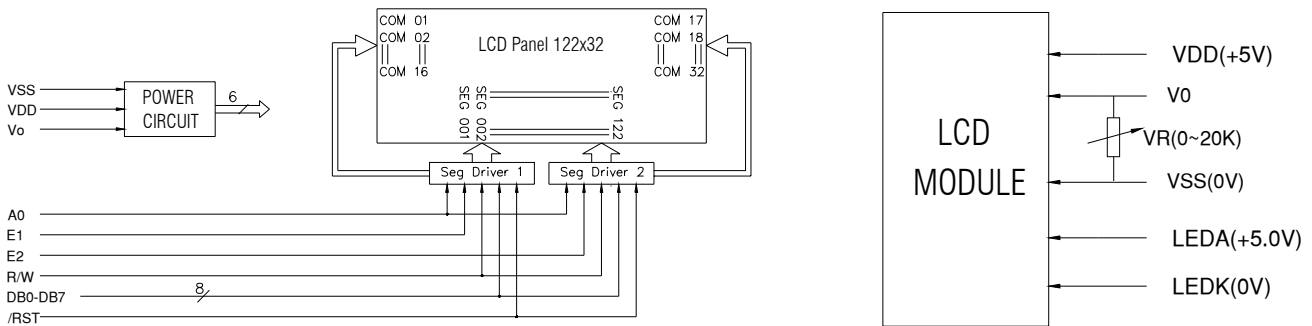
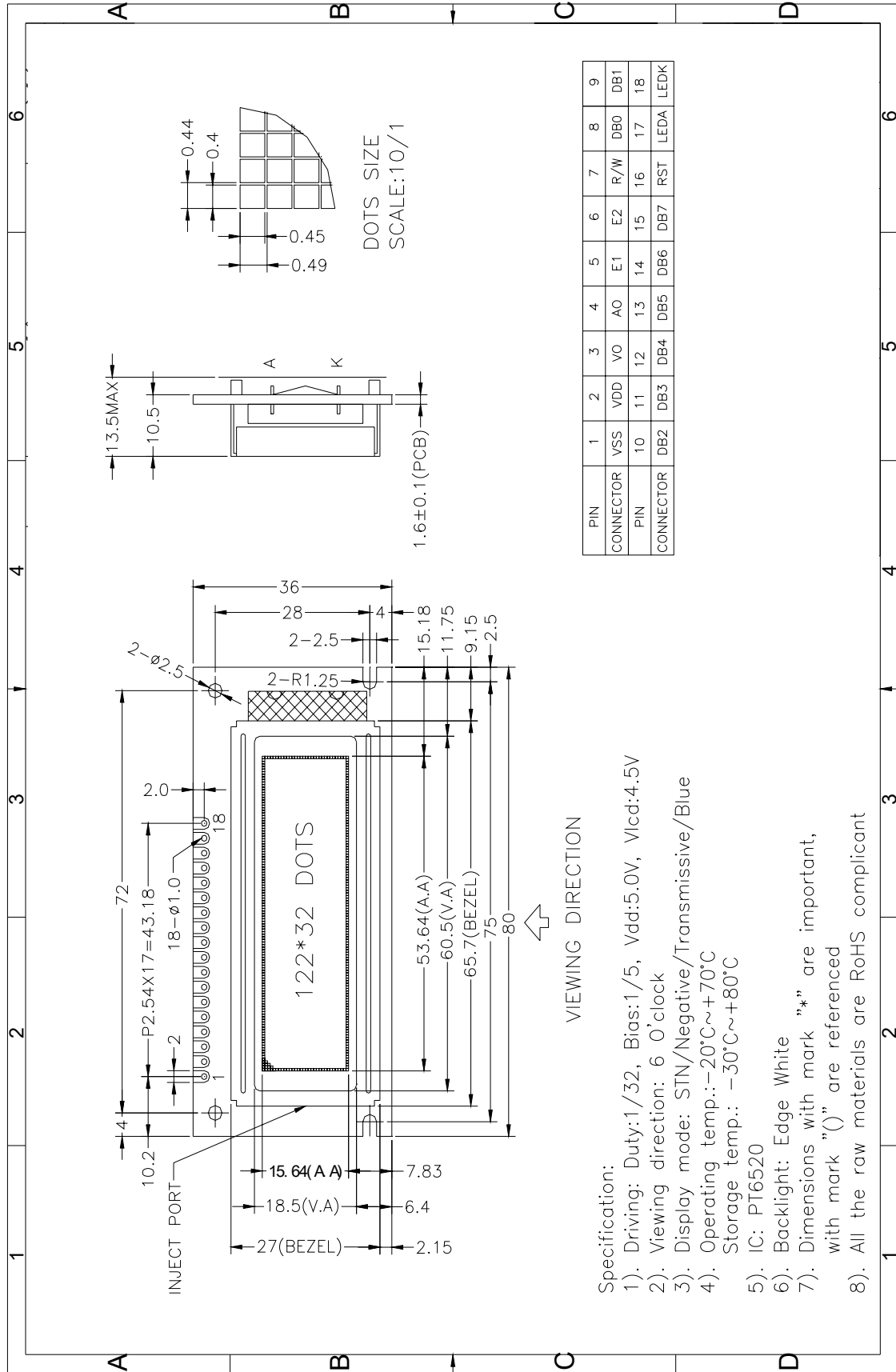


Figure 1. Block diagram

4. DIMENSIONAL OUTLINE



- Specification:
- 1). Driving: Duty:1/32, Bias:1/5, Vdd:5.0V, Vlcd:4.5V
 - 2). Viewing direction: 6 O'clock
 - 3). Display mode: STN/Negative/Transmissive/Blue
 - 4). Operating temp.: -20°C~+70°C
Storage temp.: -30°C~+80°C
 - 5). IC: PT6520
 - 6). Backlight: Edge White
 - 7). Dimensions with mark "*" are important, with mark "()" are referenced
 - 8). All the raw materials are RoHS compliant

5. PIN DESCRIPTION

No.	Symbol	Function
1	VSS	GND
2	VDD	Power supply
3	VO	Supply voltage for LCD drive
4	A0	Register selection. (H: Data register L: Instruction register)
5	E1	Enable signal for IC1(left half of the panel)
6	E2	Enable signal for IC2(right half of the panel)
7	R/W	Read /write selection. (H: Read L: write)
8~15	DB0~DB7	Data bus lines
16	/RST	Reset signal(The rise of the signal is for active and keep RET='h')
17	LED+ (A)	Power supply for backlight (5Volt)
18	LED- (K)	Power supply for backlight (GND)

6. MAXIMUM ABSOLUTE LIMIT (of IC):

Parameter	Symbol	Condition	Unit
Supply voltage (1)	V _{SS}	-8.0 ~ +0.3	V
Supply voltage (2)	V ₅	-16.5 ~ +0.3	V
Supply voltage (3)	V ₁ , V ₄ , V ₂ , V ₃	V ₅ ~ +0.3	V
Input voltage	V _{IN}	V _{SS} - 0.3 ~ +0.3	V
Output voltage	V _O	V _{SS} - 0.3 ~ +0.3	V
Allowable loss	P _D	250	mW
Operating temperature	T _{opr}	-30 ~ +85	°C
Storage temperature	T _{stg}	-65 ~ +150	°C
Soldering temperature/time	T _{solder}	260 / 10 (at lead)	°C / Sec

Notes:

- All voltages are based on VDD = 0V.
- The following condition must always hold true with voltages V1, V2, V3, V4 and V5:
 $VDD \geq V1 \geq V2 \geq V3 \geq V4 \geq V5$
- The LSI may be permanently damaged if used with any value in excess of the absolute maximum ratings. During normal operation, the LSI should preferably be used within the specified electrical characteristics. Failure to meet them can cause the LSI to malfunction or lose its reliability.
- Generally, flat package LSIs may have moisture resistance lowered when solder dipped. In mounting LSIs on a board, it is recommended to use a method which is least unlikely to give thermal stress on the package resin.

7. ELECTRICAL CHARACTERISTICS

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Applicable Pin
Operating voltage (1)	Recommended	V _{SS}	*1	-5.5	-5.0	-4.5	V	V _{SS}
	Allowable			-7.0	—	-2.4		
Operating voltage (2)	Recommended	V5		-13.0	—	-3.5	V	V5
	Allowable			-13.0	—	—		*10
	Allowable	V1, V2		$0.6 \times V5$	—	V _{DD}	V	V1, V2
	Allowable	V3, V4		V5	—	$0.4 \times V5$	V	V3, V4
High-level input voltage	V _{IHT}			V _{SS} + 2.0	—	V _{DD}	V	*2
	V _{IHC}			$0.2 \times V_{SS}$	—	V _{DD}		*3
Low-level input voltage	V _{ILT}			V _{SS}	—	V _{SS} + 0.8	V	*2
	V _{ILC}			V _{SS}	—	$0.8 \times V_{SS}$		*3
High-level output voltage	V _{OHT}	I _{OH} = -3.0 mA		V _{SS} + 2.4	—	—	V	*4
	V _{OHC1}	I _{OH} = -2.0 mA		V _{SS} + 2.4	—	—		*5
	V _{OHC2}	I _{OH} = -120 μA		$0.2 \times V_{SS}$	—	—		OSC2
Low-level output voltage	V _{OLT}	I _{OL} = 3.0 mA		—	—	V _{SS} + 0.4	V	*4
	V _{OLC1}	I _{OL} = 2.0 mA		—	—	V _{SS} + 0.4		*5
	V _{OLC2}	I _{OL} = 120 μA		—	—	$0.8 \times V_{SS}$		OSC2
Input leakage current	I _I			-1.0	—	1.0	μA	*6
Output leakage current	I _O			-3.0	—	3.0	μA	*7
LCD driver ON resistor	R _{ON}	T _a = 25°C	V5 = -5.0V	—	5.0	7.5	kΩ	SEG0-79 *11 COM0-15
			V5 = -3.5V	—	10.0	50.0		
Static current dissipation	I _{DDQ}	$\overline{CS} = CL = V_{DD}$		—	0.05	1.0	μA	V _{DD}
Dynamic current dissipation	I _{DD} (1)	During display V5 = -5.0V	f _{CL} = 2 kHz	—	2.0	5.0	μA	V _{DD} *12
			R _f = 1 MΩ	—	9.5	15.0		*13
			f _{CL} = 18 kHz	—	5.0	10.0		*14
	I _{DD} (2)	During access t _{cy} = 200 kHz		—	300	500	μA	*8
Input pin capacitance	C _{IN}	T _a = 25°C	f = 1 MHz	—	5.0	8.0	pF	All input pins
Oscillation frequency	f _{OSC}	R _f = 1.0 MΩ ± 2%	V _{SS} = -5.0V	15	18	21	kHz	*9
		R _f = 1.0 MΩ ± 2%	V _{SS} = -3.0V	11	16	21		
Reset time	t _R			1.0	—	1000	μs	RES

Notes:

- *1. Operation over a wide range of voltages is guaranteed, except where a sudden voltage change occurs during access.
- *2. Pins A0, D0 – D7, E (\overline{RD}), $\overline{R/W}$ (\overline{WR}) and \overline{CS}
- *3. Pins CL, FR, M/S and \overline{RES}
- *4. Pins D0 – D7
- *5. Pin FR
- *6. Pins A0, E (\overline{RD}), $\overline{R/W}$ (\overline{WR}), \overline{CS} , CL and \overline{RES}
- *7. Applicable when pins D0 – D7 and FR are at high impedance.
- *8. This value is current consumption when a vertical stripe pattern is written at t_{cy}. Current consumption during access is nearly proportionate to access frequency (t_{cy}). Only T_{DD} (1) is consumed while no access is made.
- *9. Relationship between the oscillation frequency, frame and R_f (see Figures 5.1 – 5.3).
- *10. Operating voltage ranges of V_{SS} and V5 (see Figure 5.4).
- *11. Resistance with a voltage of 0.1V applied between the output pin (SEG.COM) and each power pin (V1, V2, V3, V4). It is specified within the operating voltage range.
- *12, 13, 14. Current consumed by each discrete IC, not including LCD panel and wiring capacitances.
- *12. Applicable to SED1520F_{AA} and SED1521F_{AA}
- *13. Applicable to SED1520F_{0A}
- *14. Applicable to SED1521F_{0A}

8. TIMING CHARACTERISTICS

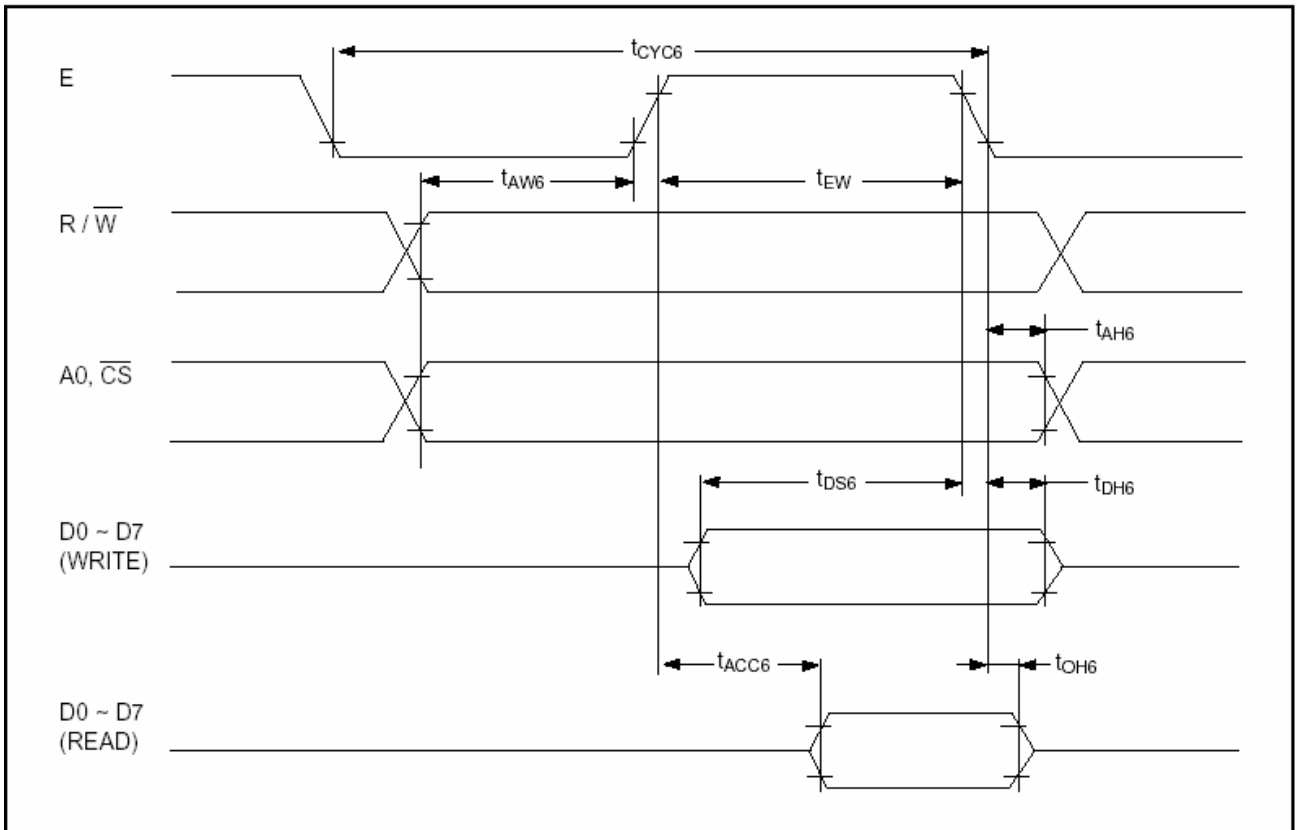
Ta = -20 to 75°C, VSS = -5.0V ±10%

Parameter	Symbol	Signal	Condition	Min	Typ	Max	Unit
System cycle time	tCYC6 *1	A0, \overline{CS}	CL = 100 pF	1000	—	—	ns
Address setup time	tAW6	R/ \overline{W}		20	—	—	ns
Address hold time	tAH6			10	—	—	ns
Data setup time	tDS6	D0 – D7		80	—	—	ns
Data hold time	tDH6			10	—	—	ns
Output disable time	tOH6			10	—	60	ns
Access time	tACC6				—	—	90
Enable pulse width: Read	tEW	E		100	—	—	ns
Enable pulse width: Write				80	—	—	ns

*1 tCYC6 indicates the cycle time during which $\overline{CS} \cdot E = "H"$. It does not mean the cycle time of signal E.

*2 Each of the values where VSS = -3.0V is about 200% of that where VSS = -5.0V (i.e., the listed value).

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



System bus read/write II (68-family MPU)

9. CONTROL AND DISPLAY INSTRUCTION

	Command	Code											Function
		A0	RD	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)				0	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)						0	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
(7)	Read Display Data	1	0	1	Read Data						0	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.

10. BACK LIGHT CHARACTERISTICS

LCD Module with lightguide LED-Backlight
ELECTRICAL RATINGS

Ta = 25°C

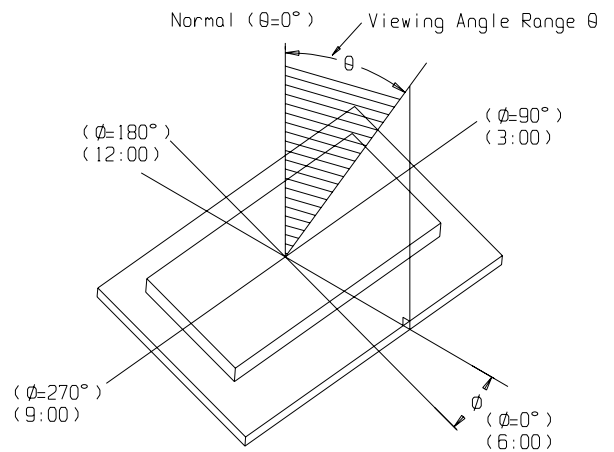
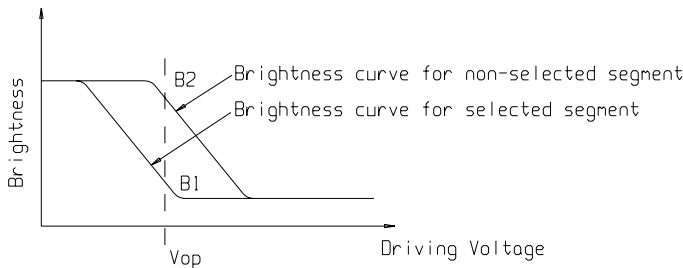
Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	VF	IF=40mA	3.0	3.2	3.4	V
Reverse Current	IR	VR=5V	---	---	10	uA
Color	White					
Current of module (inkl. LED-resistors on board)	~ 40mA (5Volt at Pin 17/18)					

11. ELECTRO-OPTICAL CHARACTERISTICS

(V_{OP} =4.5V, Ta = 25°C)

Item	Symbol	Condition	Min	Typ	Max	Unit
Operating Voltage	Vop	Ta = -20°C	4.7	5.0	5.3	V
		Ta = 25°C	4.2	4.5	4.8	
		Ta = 70°C	3.7	4.0	4.3	
Response time	Tr	Ta = 25°C	---	185	---	ms
	Tf		---	200	---	ms
Contrast	Cr	Ta = 25°C	---	4	---	---
Viewing angle range	θ	Cr≥2	-40	---	+40	deg
	Φ		-40	---	+40	deg

$$Cr = \frac{\text{Brightness of non-selected segment}(B2)}{\text{Brightness of selected segment}(B1)}$$



12. PRECAUTION FOR USING LCD/LCM

LCD/LCM is assembled and adjusted with a high degree of precision. Do not attempt to make any alteration or modification. The followings should be noted.

General Precautions:

1. LCD panel is made of glass. Avoid excessive mechanical shock or applying strong pressure onto the surface of display area.
2. The polarizer used on the display surface is easily scratched and damaged. Extreme care should be taken when handling. To clean dust or dirt off the display surface, wipe gently with cotton, or other soft material soaked with isopropyl alcohol, ethyl alcohol or trichlorotrifluoroethane, do not use water, ketone or aromatics and never scrub hard.
3. Do not tamper in any way with the tabs on the metal frame.
4. Do not make any modification on the PCB without consulting DISPLAY.
5. 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.
6. Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels and also cause rainbow on the display.
7. Be careful not to touch or swallow liquid crystal that might leak from a damaged cell. Any liquid crystal adheres to skin or clothes, wash it off immediately with soap and water.

Static Electricity Precautions:

1. CMOS-LSI is used for the module circuit; therefore operators should be grounded whenever he/she comes into contact with the module.
2. Do not 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.
3. Do not touch the connection terminals of the display with bare hand; it will cause disconnection or defective insulation of terminals.
4. The modules should be kept in anti-static bags or other containers resistant to static for storage.
5. Only properly grounded soldering irons should be used.
6. If an electric screwdriver is used, it should be grounded and shielded to prevent sparks.
7. The normal static prevention measures should be observed for work clothes and working benches.
8. Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

Soldering Precautions:

1. Soldering should be performed only on the I/O terminals.
2. Use 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 second.
5. Use eutectic solder with resin flux filling.
6. If flux is used, the LCD surface should be protected to avoid spattering flux.
7. Flux residue should be removed.

Operation Precautions:

1. The viewing angle can be adjusted by varying the LCD driving voltage V_o .
2. Since applied DC voltage causes electro-chemical reactions, which deteriorate the display, the applied pulse waveform should be a symmetric waveform such that no DC component remains. Be sure to use the specified operating voltage.
3. Driving voltage should be kept within specified range; excess voltage will shorten display life.
4. Response time increases with decrease in temperature.
5. Display color may be affected at temperatures above its operational range.
6. Keep the temperature within the specified range usage and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel-off or generate bubbles.
7. For long-term storage over 40°C is required, the relative humidity should be kept below 60%, and avoid direct sunlight.

Limited Warranty

DISPLAY LCDs and modules are not consumer products, but may be incorporated by our customers into consumer products or components thereof, DISPLAY does not warrant that its LCDs and components are fit for any such particular purpose.

1. The liability of DISPLAY is limited to repair or replacement on the terms set forth below. DISPLAY will not be responsible for any subsequent or consequential events or injury or damage to any personnel or user including third party personnel and/or user. Unless otherwise agreed in writing between DISPLAY and the customer, DISPLAY will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with DISPLAY general LCD inspection standard (Copies available on request)
2. No warranty can be granted if any of the precautions state in handling liquid crystal display above has been disregarded. Broken glass, scratches on polarizer mechanical damages as well as defects that are caused accelerated environment tests are excluded from warranty.
3. In returning the LCD/LCM, they must be properly packaged; there should be detailed description of the failures or defect.