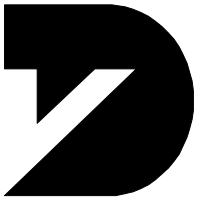
Data International Co., Ltd.



DATAVISION

APPROVAL SHEET

Customer :

Part Name : **LCD MODULE**

Model No. : **DG-16080-11-WFBEW**

Drawing No. :

Approved by :

Date :

Approved	Checked	Prepared	Sheet Code:
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SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY MODULE
MODEL NO: DG-16080-11-WFBEW

CONTENTS

1. SCOPE

This specification covers the engineering requirements for the DG-16080-11-WFBEW liquid crystal module.

2. PRODUCT SPECIFICATIONS

2.1 General

- 160 × 80 dot matrix LCD
- FSTN (B&W)
- Transflective , 6 o'clock
- Back-light: E.L , White
- Multiplexing driving : 1/80duty, 1/9bias

2.2 Mechanical Characteristics

Item	Characteristic
Dot configuration	160 × 80
Dot dimensions(mm)	0.39 × 0.39
Dot spacing (mm)	0.03
Module dimensions (Horizontal × Vertical × Thickness, mm)	96.0 × 66.0 × 11.0max.
Viewing area (Horizontal × Vertical, mm)	72.0 × 48.0
Active area (Horizontal × Vertical, mm)	67.17 × 43.97

2.3 Absolute Maximum Ratings (Without EL back-light)

Absolute Maximum Ratings/T_a=25°C, GND=0V

				unit
Maximum Supply Voltage	V_{DD} max		−0.3to+7.0	V
Input Voltage	V_I		−0.3toV_{DD}+0.3	V
Output Voltage	V_O		−0.3toV_{DD}+0.3	V
Allowable Power Dissipation	Pd max	Ta=75℃	200	mW
Operating Temperature	Topr		−20to+75	℃
Storage Temperature	Tstg		−55to+125	℃

2.4 Electrical Characteristics (Without EL back-light)

Allowable Operating Conditions/T_a=−20 to +75°C, GND=0V

			min	typ	max	unit
Supply Voltage	V_{DD}		4.75		5.25	V
Input "H"-Level Voltage	V_{IH1}	All input, I/O terminals except for $\overline{SYNC}$, CR	2.2		V_{DD}	V
Input "L"-Level Voltage	V_{IL1}	〃 〃	0		0.8	V
Input "H"-Level Voltage	V_{IH2}	$\overline{SYNC}$, CR	0.7V_{DD}		V_{DD}	V
Input "L"-Level Voltage	V_{IL2}	$\overline{SYNC}$, CR	0		0.3V_{DD}	V
Output "H"-Level Voltage	V_{OH1}	I_{OH}=−0.6mA DB0to7, $\overline{WE}$, MA0to15, MD0to7	2.4		V_{DD}	V
Output "L"-Level Voltage	V_{OL1}	I_{OL}=1.6mA DB0to7, $\overline{WE}$, MA0to15, MD0to7	0		0.4	V
Output "H"-Level Voltage	V_{OH2}	I_{OH}=−0.6mA $\overline{SYNC}$, CPO, FLM, CL1, CL2, D1, D2, MA, MB	V_{DD}−0.4		V_{DD}	V
Output "L"-Level Voltage	V_{OL2}	I_{OL}=0.6mA $\overline{SYNC}$, CPO, FLM, CL1, CL2, D1, D2, MA, MB	0		0.4	V

Electrical Characteristics/T_a=−20 to +75°C, GND=0V, V_{DD}=5V±5%			min	typ	max	unit
Input Leak Current	I_{IN}	V_{IN}= 0toV_{DD}, $\overline{CS}$, E, RS, R/W, $\overline{RES}$	−5		5	μA
Current Dissipation	I_{CC1}	CR oscillation, f_{OSC}= 600kHz		2	4	mA
Current Dissipation	I_{CC2}	External clock, f_{CP}=2.5MHz		3	5	mA
Pull-up Current	I_{PL}	V_{IN}=GND, DB0to7, RD0to7, MD0to7		10	20	μA

2.5 Optical Characteristics Absolute maximum ratings

Item	Symbol	Rating	Unit
Applied voltage AC	VAC	20	V
Operating temperature range	Top	-20~70	°C
Storage temperature range	Tst	-30~70	°C

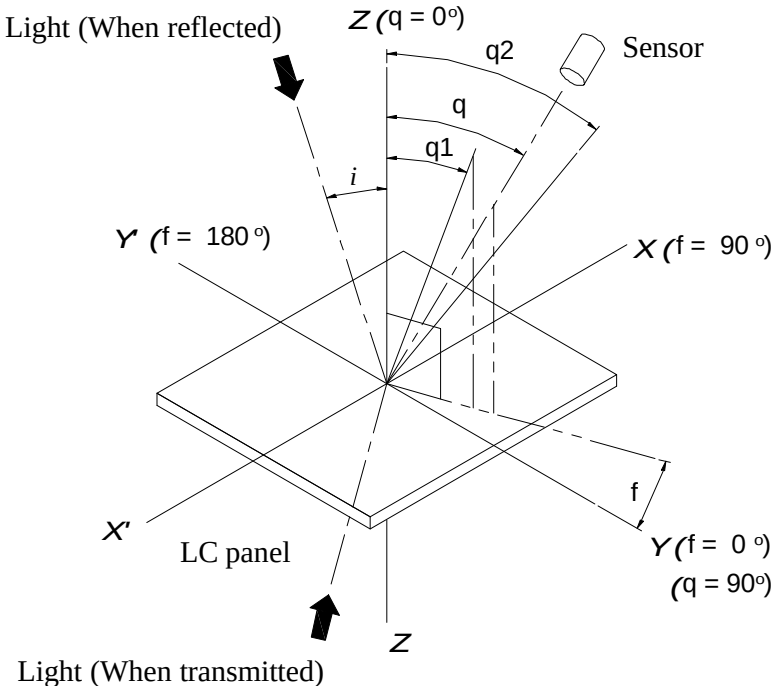
2.6 Optical Characteristics

1/80 duty, 1/9 bias

Item	Symbol	Temp.	Min.	Typ.	Max.	Unit
Driving voltage	Vop	-20 °C	9.00	9.48	9.95	V
		25 °C	9.00	9.48	9.95	
		70 °C	8.40	8.85	9.30	
Contrast ratio	CR	θ=0° ϕ=0°	--	3	--	--
Frame freq.	fF	--	--	64	--	Hz
Viewing angle*	θ_1	25 °C	-30	--	--	deg.
	θ_2		30	--	--	
Response time	t_{on}	25 °C	--	300	450	ms
	t_{off}		--	500	750	

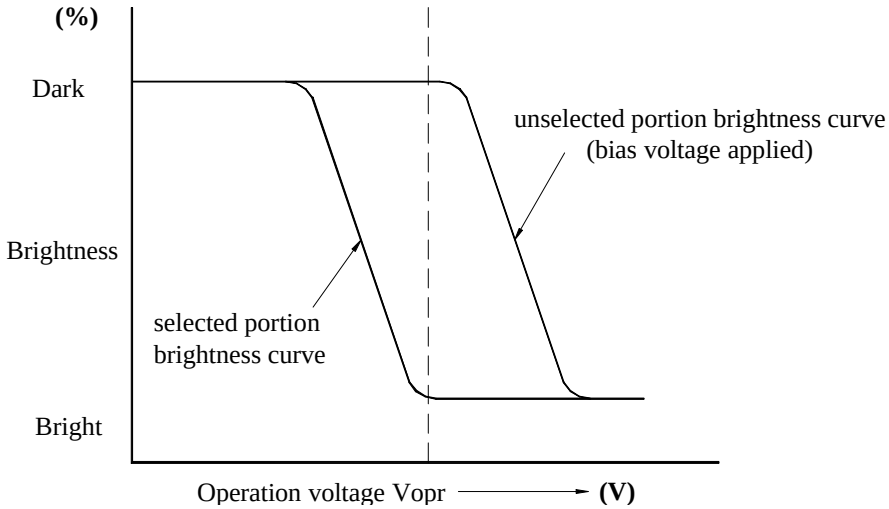
2.6.1 Definition of optical characteristics

* Definition of angles ϕ and θ

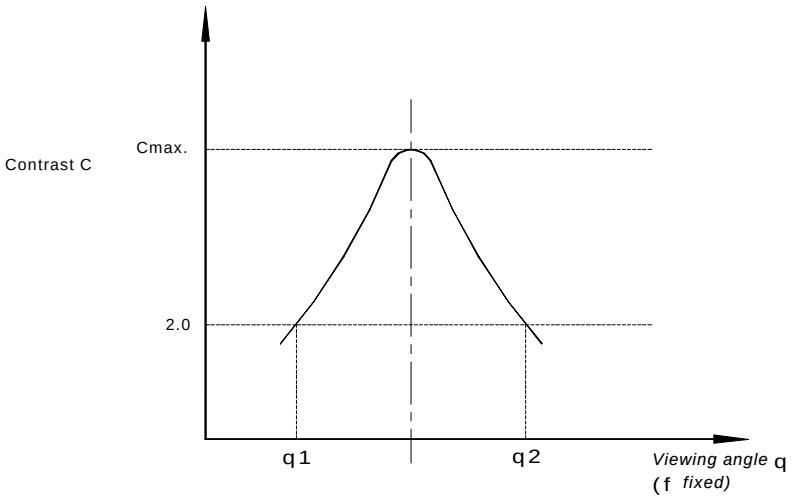


*Definition of contrast C

$$C = \frac{B1}{B2} = \frac{\text{Brightness of selected portion}}{\text{Brightness of unselected portion}}$$

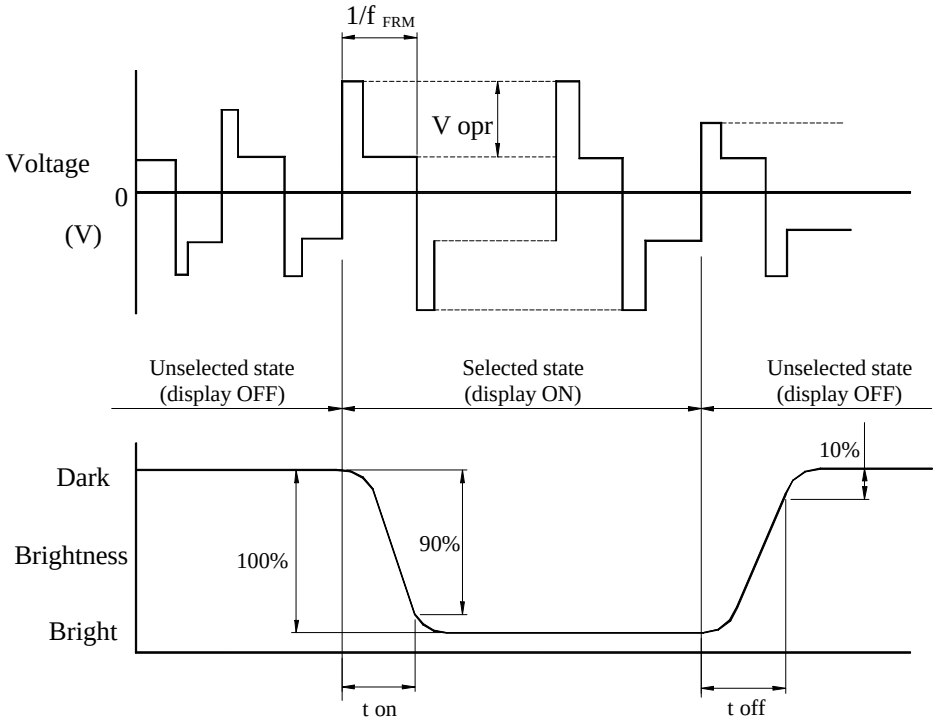


* Definition of viewing angles θ1 and θ2



Note : Optimum vision with the naked eye and viewing angle θ at Cmax above are not always the same.

* Definition of response time



Vop : Operating voltage (V)
fFRM : Frame frequency (Hz)
ton : Response time (rise) (ms)
toff : Response time (fall) (ms)

2.7 EL Electrical Specifications

2.7.1 Maximum Operating Condition

Voltage : AC 150Vrms
Frequency : 1KHz
Operation Temperature : -20°C ~50°C
Storage Temperature : -30°C ~60°C

2.7.2 Standard Operating Condition

Voltage : AC 100Vrms
Frequency : 400Hz , sine wave

2.7.3 Electric Characteristics

(Temp. 20°C)

Item	Dimension	Condition	Standard		
			Min	Typ	Max
Brightness	cd/m^2	AC 100Vrms, 400Hz	45	55	--
Uniformity	%	AC 100Vrms, 400Hz	85	90	--
Current consumption	mA/cm^2	AC 100Vrms, 400Hz	--	0.12	0.17
Chromaticity	X	AC 100Vrms, 400Hz	0.30	0.32	0.34
	Y		0.34	0.36	0.38
Capacitance	pF/cm^2	AC 1kHz, 1V	490	700	910

2.8 Touch panel specifications

2.8.1 Electrical Characteristics

2.8.1.1 Rating

Maximum voltage is DC 5V

Current is less than 1mA at contact point of top layer with bottom layer.

2.8.1.2 Insulation resistance : 10MΩ or more at DC25V

2.8.1.3 Terminal resistance

Between XL and XR: 300~850Ω

Between YU and YL: 200~750Ω

2.8.1.4 Static electricity

15KV 100Ω 250pF (Non-trouble)

2.8.1.5 Linearity : Less than ±1.0%

2.8.1.6 Capacitance between top and bottom of the electrode

100nF. max. (Put the weight 3g/cm^2 on)

2.8.2 Mechanical Characteristics

2.8.2.1 Actuation Force : 10g~80g

2.8.2.2 Input : R=0.8 stylus or finger ((R: Radius)

2.8.2.3 Trancparency : Typical 79% (According to JIS-K7015.)

2.8.2.4 The strength of a heat-sealed area

>150g/cm by peeling test with 90 degrees.

2.8.2.5 Surface hardness

Pencil hardness 3H or more according to JIS-K5400.

3. RELIABILITY

3.1 Reliability

Test item	Test condition	Evaluation and assessment
Operation at high temperature and humidity	40 °C±2 °C 90%RH for 500hours	No abnormalities in functions* and appearance**
Operation at high temperature	60 °C±2 °C for 500 hours	No abnormalities in functions* and appearance**
Heat shock	-20± ~ +60 °C Left for 1 hour at each temperature, transition time 5 min, repeated 10times	No abnormalities in functions* and appearance**
Low temperature	-20±2 °C for 500 hours	No abnormalities in functions* and appearance**
Vibration	Sweep for 1 min at 10 Hz, 55Hz, 10Hz, amplitude 1.5mm 2 hrs each in the X,Y and Z directions	No abnormalities in functions* and appearance**
Drop shock	Dropped onto a board from a height of 10cm	No abnormalities in functions* and appearance**

* Dissipation current, contrast and display functions

** Polarizing filter deterioration, other appearance defects

3.2 Liquid crystal panel service life

100,000 hours minimum at 25 °C±10 °C

3.3 Definition of panel service life

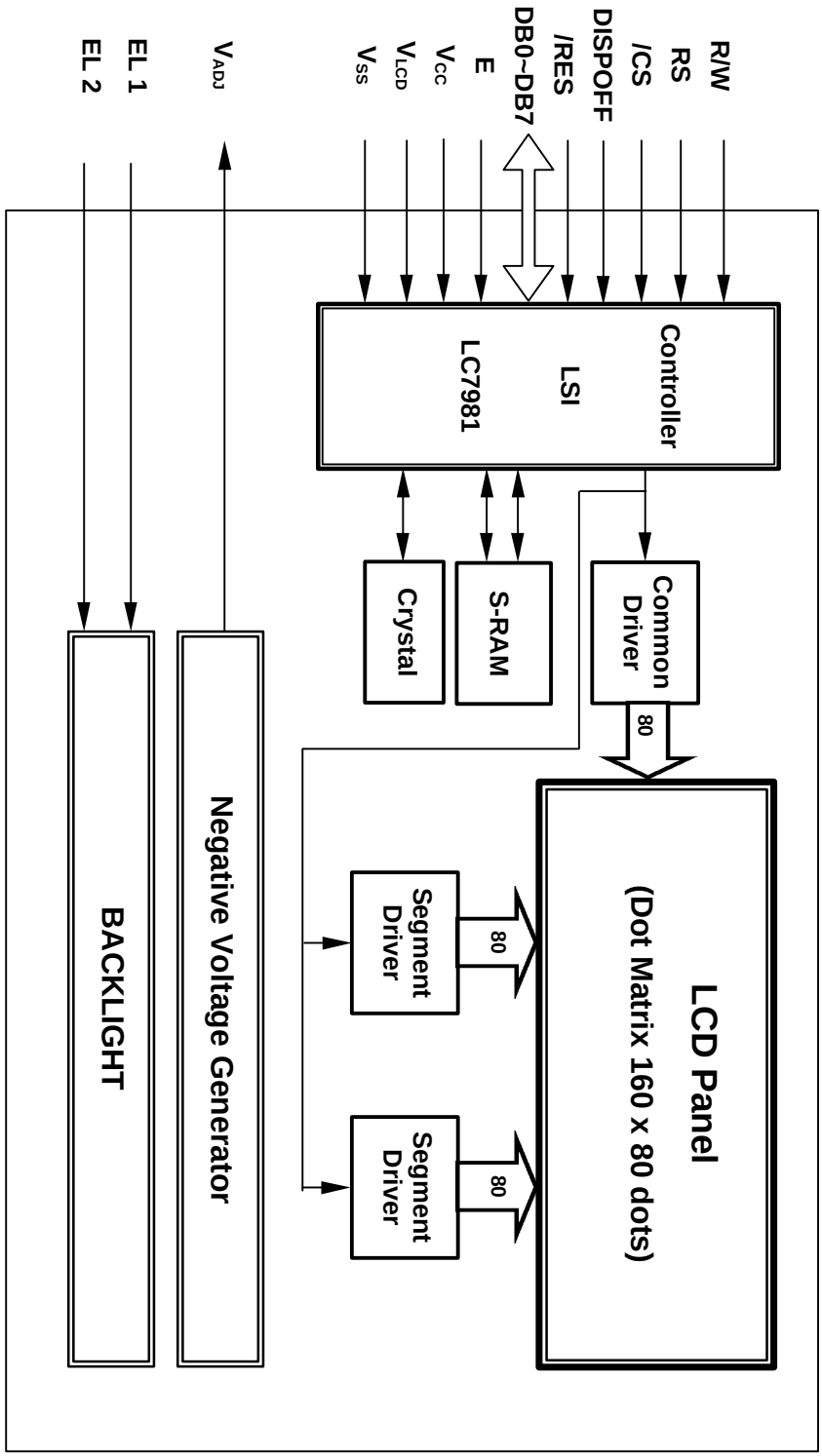
- Contrast becomes 30% of initial value
- Current consumption becomes three times higher than initial value
- Remarkable alignment deterioration occurs in LCD cell layer
- Unusual operation occurs in display functions

4. OPERATING INSTRUCTIONS

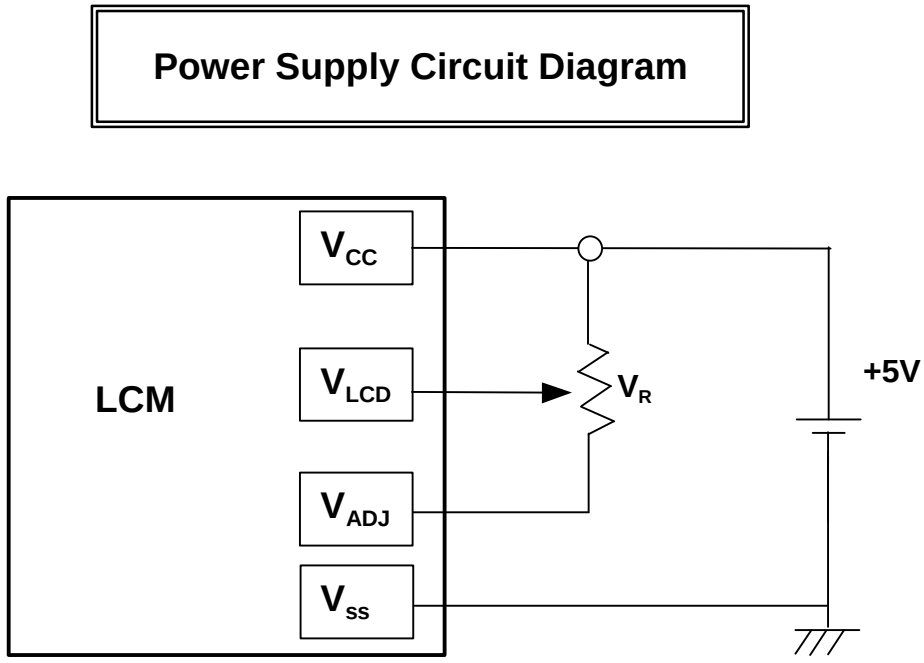
4.1 Input signal Function

NO.	Symbol	Function
1	VSS	Ground (0V)
2	VCC	Power supply for Logic circuit (+)
3	VADJ	Voltage level for LCD contrast
4	RS	H: Instruction L: Data
5	R/W	Read/Write Data
6	E	Enable
7-14	DB0-DB7	Data Bus Line
15	/CS	Code/Data
16	/RES	Reset active L
17	VLCD	Power supply for LCD
18	DISPOFF	Display OFF when low level
19	EL 1	Power supply for EL
20	EL 2	Power supply for EL

4.2 Circuit Block Diagram



4.3 Voltage Generator Circuit



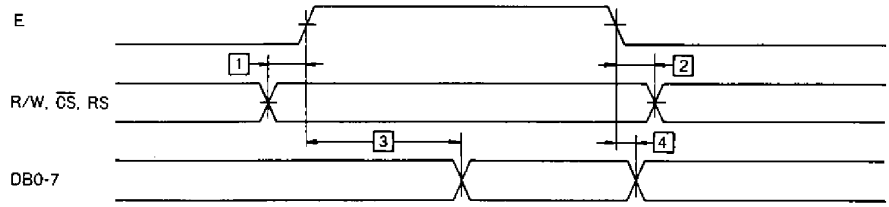
V_{CC} – V_{ADJ} : LCD Driving Voltage
V_R : 10K~20K Ohms

4.4 Timing Characteristics

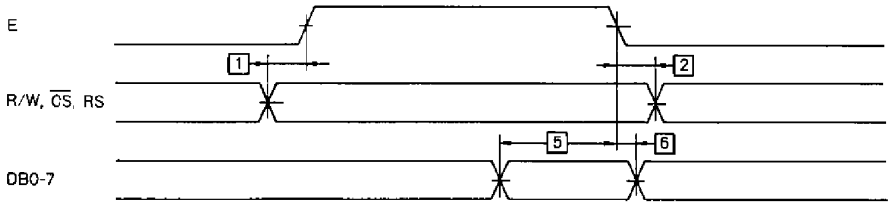
Timing Characteristics

- **Bus read/write operation 1**

READ CYCLE



WRITE CYCLE

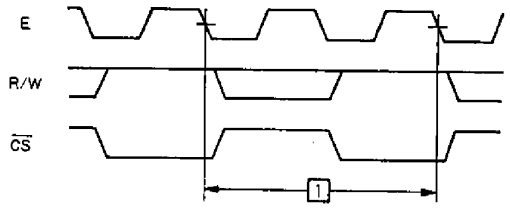


Ta=−20to+75℃, V_{DD}= 5 V± 5 %, GND= 0 V

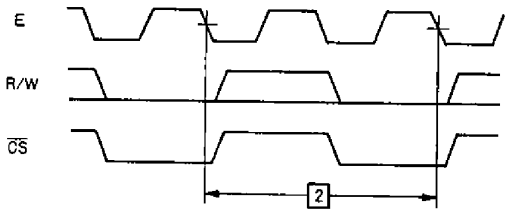
No.	Item	Symbol	min	typ	max	unit	Conditions
1	Address set-up time	tAS	90			ns	
2	Address hold time	tAH	10			ns	
3	Data delay time (read)	tDDR			140	ns	C_L=50pF
4	Data hold time (read)	tDHR	10			ns	
5	Data set-up time (write)	tDSW	220			ns	
6	Data hold time (wirte)	tDHW	20			ns	

- **Bus read/write operation 2**

DATA READ CYCLE



DATA WRITE CYCLE

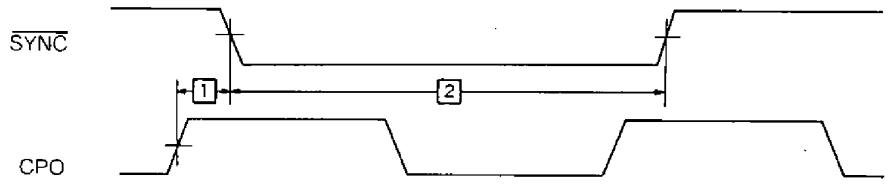


Ta=−20to+75℃, V_{DD}= 5 V± 5 %, GND= 0 V

No.	Item	Symbol	min	typ	max	unit	Instruction register value
1	Read cycle time	tRCY			$\frac{(Hp+2)\times10^3}{Fosc}+200$	ns	0 DH
2	Write cycle time	tWCY1			$\frac{(2Hp+2)\times10^3}{Fosc}+200$	ns	0 EH, 0 FH
2	Write cycle time	tWCY2			$\frac{(Hp+2)\times10^3}{Fosc}+200$	ns	0 CH
2	Write cycle time	tWCY3			$\frac{2000}{Fosc}+200$	ns	00H, 01H, 02H, 03H 04H, 08H, 09H 0 AH, 0 BH

Notes: (1) In the character mode, Hp is the number of horizontal dots per character in a character display. In the graphic mode, Hp indicates how many bits from RAM appear in a 1-byte display.
(2) F_{OSC} is the oscillating frequency, expressed in MHz.
(3) All measurement points are at 1.5V.

- **Parallel operation (at master mode)**

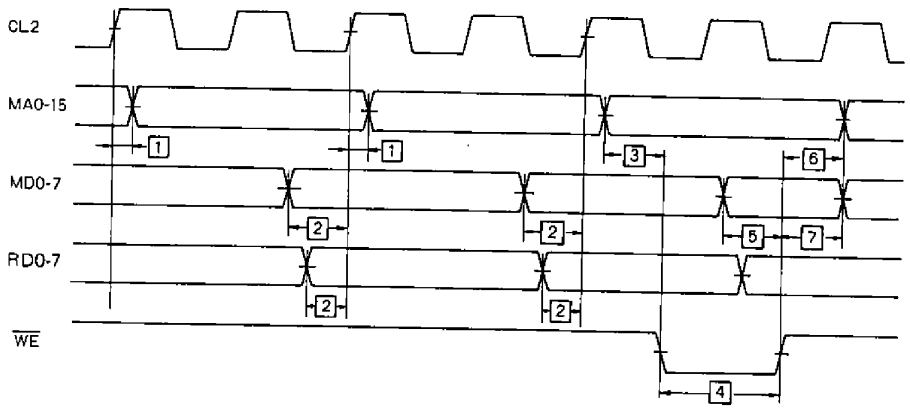


Ta=−20to+75℃, V_{DD}= 5 V± 5 %, GND= 0 V

No	Item	Symbol	min	typ	max	unit	Conditions
1	SYNC delay time	tDSY			100	ns	
2	SYNC pulse width	tWSY	350			ns	

Notes: (1) All output terminals are under no load.
(2) All measurement points are at 0.5V_{DD}.

- Interface with external RAM and ROM



READ CYCLE Ta=−20to+75℃, VDD=5 V± 5 %, GND=0 V

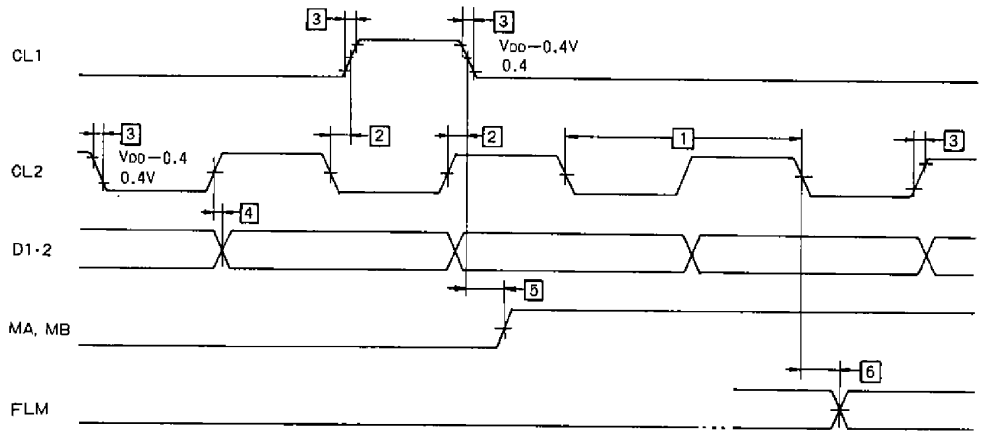
No.	Item	Symbol	min	typ	max	unit	Conditions
1	MA0-15 read address delay time	tDMAR			95	ns	
2	MD0-7·RD0-7 set-up time	tSMDR	105			ns	

WRITE CYCLE Ta=−20to+75℃, VDD=5 V± 5 %, GND=0 V

No.	Item	Symbol	min	typ	max	unit	Conditions
3	Memory address set-up time	tSMAW	50			ns	
4	$\overline{WE}$ pulse width	tWWE	350			ns	
5	Memory data set-up time	tSMDW	250			ns	
6	Memory address hold time	tHMAW	50			ns	
7	Memory data hold time	tHMDW	50			ns	

lotes: (1) All output terminals are under no load.
(2) All measurement points are at 1.5V.

- **Interface with the driver LSI**



Ta=−20to+75℃, V_{DD}= 5 V± 5 %, GND= 0 V

No	Item	Symbol	min	typ	max	unit	Conditions
1	Clock cycle time	tCYC	400			ns	
2	Clock phase difference	tDCL			100	ns	
3	Clock rise/fall time	tCRF			30	ns	
4	D1·2 phase difference	tDD			100	ns	
5	MA, MB phase difference	tDMA			200	ns	
6	FLM phase difference	tDFM			200	ns	

Notes: (1) All output terminals are under no load.
(2) All measurement points other than those specified are at $0.5V_{DD}$.

4.5 Pin Function

Pin Function

Description	Pin No.	Function
DB0 to 7	21 to 28	Data bus ----- Three-state I/O common terminal, terminal for transmitting/receiving data to/from the MPU.
$\overline{CS}$	15	Chip select ----- Selection allowed when $\overline{CS}$=0
R/W	17	Read/write ----- R/W=1 ----- MPU ←LC7981 R/W=0 ----- MPU →LC7981
RS	18	Register select ----- RS=1 ----- instruction register RS=0 ----- data register
E	16	Enable ----- Data is written on the negative transition of E. Data can be read while E=1.
CR, R, C	6, 7, 8	Terminals for the CR oscillator
$\overline{RES}$	14	Reset ----- Setting RES to 0 selects display OFF, slave mode, and Hp=6.
MA0 to 15	1 to 4 49 to 60	Address output for the display RAM. For character display, raster address for external CG is output at MA12 to 15.
MD0 to 7	30 to 37	Display data bus ----- Three-state I/O common terminals.
RD0 to 7	38 to 45	ROM data input ----- Dot data from the external character generator is input.
$\overline{WE}$	13	Write enable ----- Display RAM write signal.
CL2	46	Display data shift clock signal.
CL1	11	Display data latch signal.
FLM	10	Frame signal.
MA	19	LC drive signal ----- AC signal ----- A system
MB	5	LC drive signal ----- AC signal ----- B system
D1, D2	47, 48	Display data serial output ----- D1----- for the upper screen D2 ----- for the lower screen
CPO	9	Clock for slave
$\overline{SYNC}$	12	Sync signal for parallel operation ---- Three-state input/output common terminal Master mode ----- Sync signal is output. Slave mode ----- Sync signal is input.

4.6 Display control instruction

- **Display control instruction**

Display is controlled by writing data into the instruction register and 13 data registers. The instruction registe and the data register are distinguished by the RS signal. First, write 4-bit data in the instruction register whe RS=1, then specify the code of the data register. Next, with RS=0, write 8-bit data in the data register, whic executes the specified instruction.

A new instruction cannot be accepted while an old instruction is being executed. As the Busy flag is set unde this condition, write an instruction only after reading the Busy flag and making sure that it is 0.

However, the next instruction can be executed without checking the busy flag when the maximum read cyc time or the write cycle time has been exceeded after execution of the previous data read instruction or the dat write instruction. The busy flag does not change when data is written into the instruction register (RS=1) Therefore, the busy flag need not be checked immediately after writing data into the instruction register.

1) Mode control

Write code "00H" (in hexadecimal notation) in the instruction register and specify the mode control register.

Register	R/W	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction register	0	1	0	0	0	0	0	0	0	0
Mode control register	0	0	0	0	MODE Data					

DB5	DB4	DB3	DB2	DB1	DB0	Cursor/blink	CG	Graphic/character display
1/0	1/0	0	0	0	0	Cursor OFF	Built-in CG	Character display
		0	1			Cursor ON		
		1	0			Cursor OFF character blink		
		1	1			Cursor blink		
		0	0		1	Cursor OFF	External CG	
		0	1			Cursor ON		
		1	0			Cursor OFF character blink		
		1	1			Cursor blink		
		0	0	1	0			Graphic mode
Display ON/OFF	Master/slave	Blink	Cursor	Mode	External/ built-in CG			

1 : master mode
0 : slave mode

1 : display ON
0 : display OFF

2) Setting the character pitch

Register	R/W	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction register	0	1	0	0	0	0	0	0	0	1
Character pitch register	0	0	(Vp−1) Binary				0	(Hp−1) Binary		

Vp is the number of vertical dots per character. Determine Vp with the pitch between two vertically placed characters taken into consideration. This value is meaningful only in the character display mode: It is invalid in the graphic mode.
In character mode, Hp indicates the number of horizontal dots per character, from the leftmost part of one character to the leftmost part of the next. In the graphic mode, Hp indicates how many bits (or dots) from RAM appear in a 1-byte display.
Hp must take one of the following three values.

Hp	DB2	DB1	DB0	
6	1	0	1	Horizontal character pitch 6
7	1	1	0	〃 7
8	1	1	1	〃 8

3) Setting the number of characters

Register	R/W	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction register	0	1	0	0	0	0	0	0	1	0
Character number register	0	0	(H_N−1) Binary							

In the character display mode, H_N indicates the number of characters in the horizontal direction. In the graphic mode, it indicates the number of bytes in the horizontal direction. The total number of dots positioned horizontally on the screen n is given by the formula

$n = Hp \times H_N$.

Even numbers in the range 2 to 256 (decimal) can be set as H_N.

4) Setting the time division number (display duty)

Register	R/W	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction register	0	1	0	0	0	0	0	0	1	1
Time division register	0	0	(Nx−1) Binary							

Consequently, 1/Nx is the display duty.
Decimal numbers within the range 1 to 256 can be set as Nx.

5) Setting the cursor position

Register	R/W	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction register	0	1	0	0	0	0	0	1	0	0
Cursor position register	0	0	0	0	0	0	(Cp−1) Binary			

In the character display mode, Cp indicates the line at which the cursor is displayed. For example, when Cp=8 (decimal) is specified, the cursor is displayed beneath the character of the 5 x 7 dot-font. The horizontal length of the cursor equals Hp (the horizontal character pitch). Decimal values in the range 1 to 16 can be assigned to Cp. When the value is less than the vertical character pitch Vp (Cp ≦ Vp), display priority is given to the cursor (provided the cursor display is ON). The cursor is not displayed when CP<Vp. The horizontal length of the cursor equals Hp.

6) Setting the display start lower address

Register	R/W	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction register	0	1	0	0	0	0	1	0	0	0
Display start address register (lower byte)	0	0	(start address lower byte) binary							

7) Setting the display start upper address

Register	R/W	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction register	0	1	0	0	0	0	1	0	0	1
Display start address register (upper byte)	0	0	(start address upper byte) binary							

This instruction writes the display start address value in the display start address register. The display start address is the RAM address at which data to be displayed at the leftmost position of the top line of the screen is stored. The start address consists of 16 bits (upper and lower).

8) Setting the cursor (lower) address (RAM read/write lower address)

Register	R/W	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction register	0	1	0	0	0	0	1	0	1	0
Cursor address counter (lower byte)	0	0	(cursor address lower byte) binary							

9) Setting the cursor (upper) address (RAM read/write upper address)

Register	R/W	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction register	0	1	0	0	0	0	1	0	1	1
Cursor address counter (upper byte)	0	0	(cursor address upper byte) binary							

This instruction writes the cursor address value in the cursor address counter. The cursor address indicates the address for exchanging display data and character codes with RAM. In other words, data at the address specified by the cursor address is read from or written into RAM. In character display, the cursor is displayed at the position specified by the cursor address.

The cursor address is divided into a lower address (8 bits) and an upper address (8 bits). It should be set in accordance with the following rules.

1	To rewrite (set) both lower and upper addresses:	First set the lower address, then the upper.
2	To rewrite the lower address:	Always reset the upper address after setting the lower address.
3	To rewrite the upper address only:	Set the upper address. It is necessary to reset the lower address.

The cursor address counter is a 16-bit up-counter with set/reset functions: when the Nth bit goes from 1 to 0, the count of the (N + 1)th bit increments by one. Accordingly, when the lower address is set so that the lower MSB (8th bit) changes from 1 to 0, the LSB (1st bit) of the upper counter must increment by one. When setting the cursor address, set the lower and upper addresses as a 2-byte continuous instruction.

10) Writing display data

Regisiter	R/W	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction register	0	1	0	0	0	0	1	1	0	0
RAM	0	0	MSB (pattern data, character code)							LSB

Write code "0CH" in the instruction register. Then, write 8-bit data with RS=0, and the data is written into RAM as display data or character codes at the address specified by the cursor address counter. After writing, the coun of the cursor address counter increments by 1.

11) Reading display data

Register	R/W	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction register	0	1	0	0	0	0	1	1	0	1
RAM	1	0	MSB (pattern data, character code)							LSB

Write "0DH" in the instruction register. Then, establish the read status with RS=0, and data in the RAM can be read. The procedure for reading data is as follows:

This instruction outputs the contents of the data output register to DB0 to 7, then transfers the RAM data indicated by the cursor address to the data output register. It then increments the cursor address by 1, which means that correct data cannot be read in the first read operation. The specified value is output in the second read operation. Accordingly, a dummy read operation must be performed once when reading data after setting the cursor address.

12) Bit clear

Register	R/W	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction register	0	1	0	0	0	0	1	1	1	0
Bit clear	0	0	0	0	0	0	0	(NB− 1) Binary		

13) Bit set

Register	R/W	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction register	0	1	0	0	0	0	1	1	1	1
Bit set	0	0	0	0	0	0	0	(NB− 1) Binary		

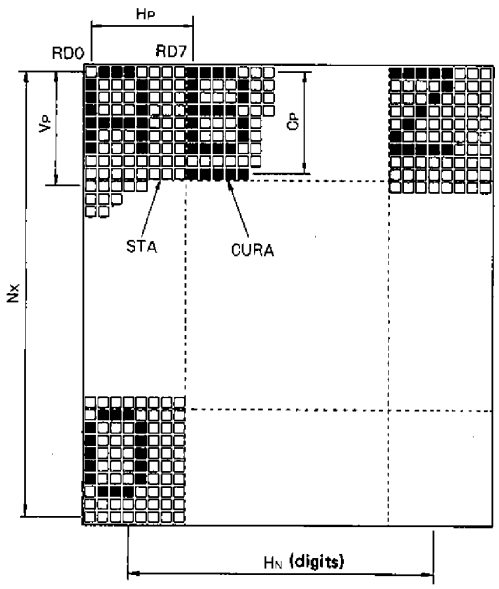
As the bit-clear or bit-set instruction, 1 bit of a 1 byte of data in display RAM is set to 0 or 1. The bit specified by N_B is set to 0 for the bit-clear instruction and 1 for the bit-set instruction. The RAM address is specified by the cursor address, which is automatically incremented by 1 at the completion of the instruction. NB is a value in the range from 1 to 8. The LSB is indicated by N_B=1, and the MSB by N_B=8.

14) Reading the BUSY flag

Register	R/W	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Busy flag	1	1	1 / 0	*						

The busy flag is output to DB7 when read mode is established with RS=1. The busy flag is set to 1 while any of the instructions 1) through 13) is being executed. It is set to 0 at the completion of the execution, allowing the next instruction to be accepted. No other instruction can be accepted when the busy flag is 1. Accordingly, before writing an instruction and data, it is necessary to ensure that the busy flag is 0. However, the next instruction can be executed without checking the busy flag when the maximum read cycle time or the write cycle time has been exceeded after execution of the previous data read instruction or the data write instruction.
The busy flag does not change when data is written into the instruction register (RS=1). Therefore, the busy flag need not be checked immediately after writing data into the instruction register.
Specification of the instruction register is unnecessary to read the busy flag.

The relation between the LCD panel display and Hp, H_N, Vp, Cp, and Nx.

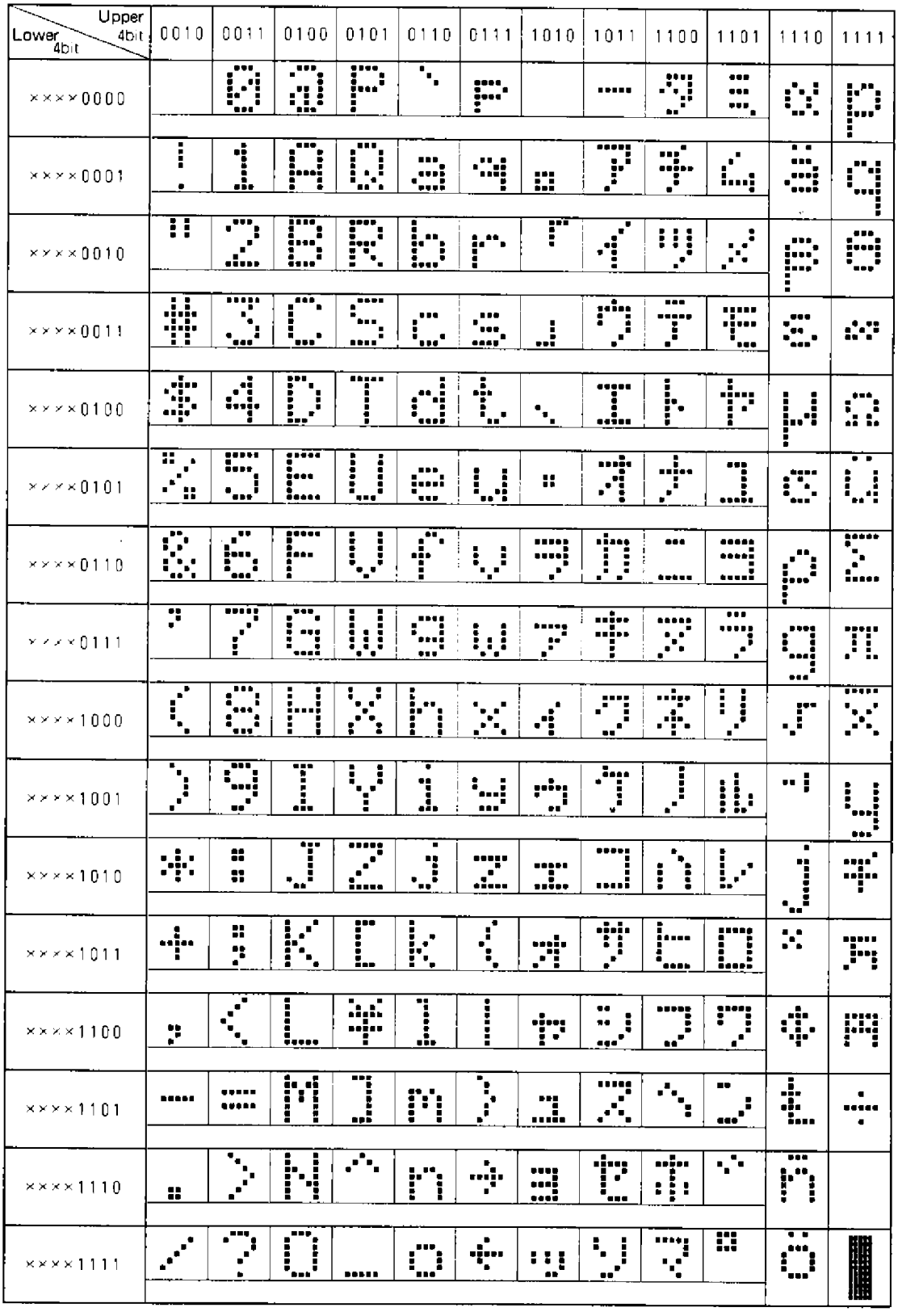


Symbol	Description	Contents	Value
Hp	Horizontal character pitch	Character pitch in the horizontal direction	6 to 8 dots
H_N	Number of characters in the horizontal direction	Number of characters (digits) per horizontal line or the number of words per line (graphic)	Even digits in the range 2 to 256
V_p	Vertical character pitch	Character pitch in the vertical direction	1 to 16 dots
Cp	Cursor position	The line number at which the cursor is to be displayed	1 to 16 lines
Nx	Number of lines in the vertical direction	Display duty	1 to 256 lines

Note)
When the number of vertical dots on the screen is m and that of horizontal dots is n,

1/m = 1/Nx = display duty
n = Hp x H_N
m/Vp = number of display lines
Cp≦Vp

4.7 Built-in character generator



5. NOTES

Safety

- If the LCD panel breaks, be careful not to get the liquid crystal in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and plenty of water.

Handling

- Avoid static electricity as this can damage the CMOS LSI.
- The LCD panel is plate glass; do not hit or crush it.
- Do not remove the panel or frame from the module.
- The polarizing plate of the display is very fragile; handle it very carefully

Mounting and Design

- Mount the module by using the specified mounting part and holes.
- To protect the module from external pressure, leave a small gap by placing transparent plates (e.g. acrylic or glass) on the display surface, frame, and polarizing plate
- Design the system so that no input signal is given unless the power-supply voltage is applied.
- Keep the module dry. Avoid condensation, otherwise the transparent electrodes may break.

Storage

- Store the module in a dark place where the temperature is 25°C±10°C and the humidity below 65% RH.
- Do not store the module near organic solvents or corrosive gases.
- Do not crush, shake, or jolt the module (including accessories).

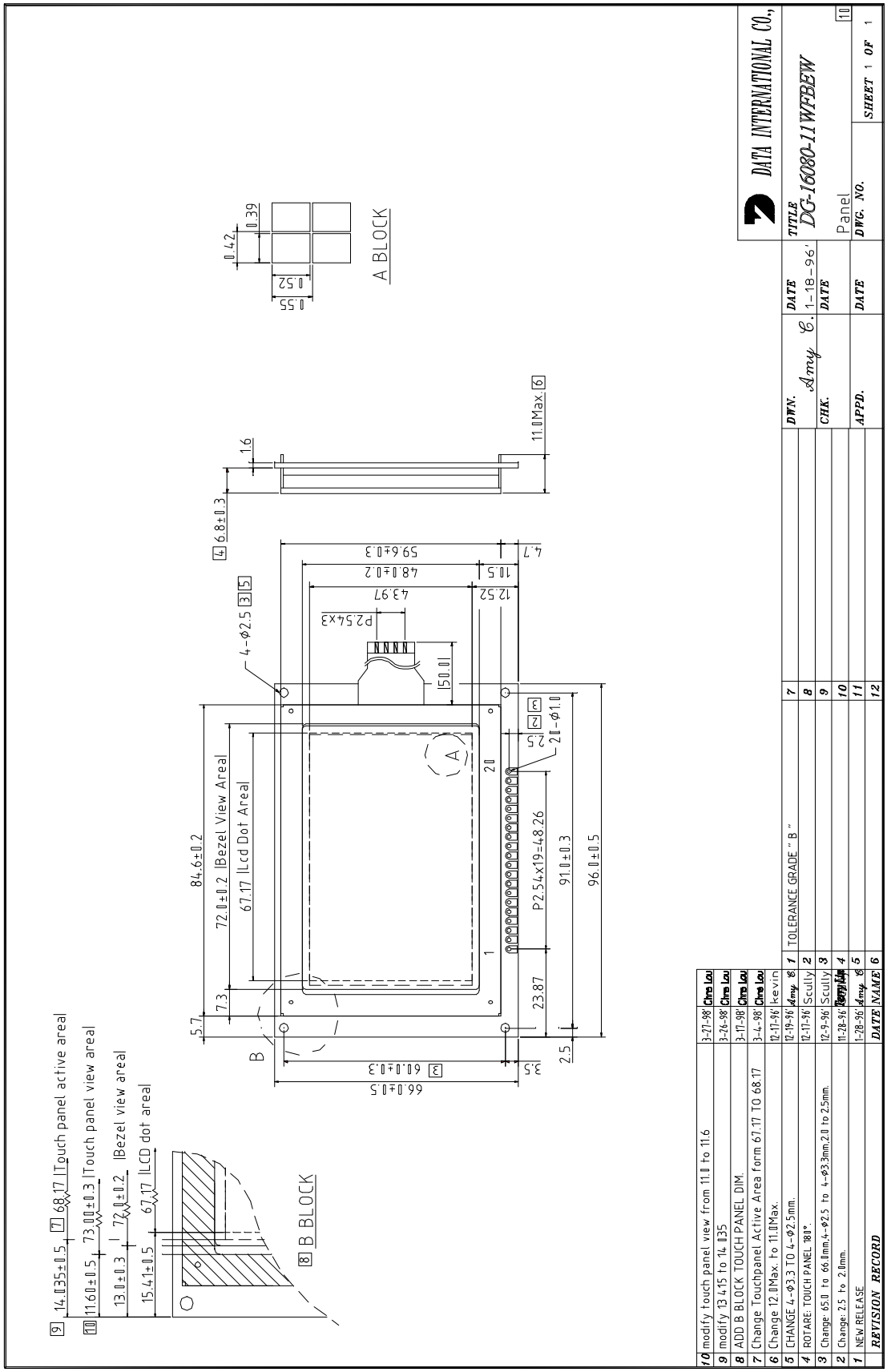
Cleaning

- Do not wipe the polarizing plate with a dry cloth, as it may scratch the surface.
- Wipe the module gently with soft cloth soaked with a petroleum benzine.
- Do not use ketonic solvents (ketone and acetoe) or aromatic solvents (toluene and xylene), as they may damage the polarizing plate.

6. OPERATION PRECAUTIONS

Any changes that need to be made in this specification or any problems arising from it will be dealt with quickly by discussion between both companies.

7. LCM Dimension



10	modify touch panel view from 11.0 to 11.6	3-27-98	Chris Lau	
9	modify 13.4±0.15 to 14.035	3-26-98	Chris Lau	
8	ADD B BLOCK TOUCH PANEL DIM.	3-17-98	Chris Lau	
7	Change Touchpanel Active Area form 67.17 TO 68.17	3-4-98	Chris Lau	
6	Change 12.0Max. to 11.0Max.	12-17-96	kevin	
5	CHANGE 4-φ3.3 TO 4-φ2.5mm.	12-19-96	Amy	
4	ROTARE: TOUCH PANEL 180°.	12-17-96	Scully	
3	Change: 65.0 to 66.0mm,4-φ2.5 to 4-φ3.3mm,2.0 to 2.5mm.	12-9-96	Scully	
2	Change: 2.5 to 2.0mm.	11-28-96	Terry Liu	
1	NEW RELEASE	1-28-96	Amy	

8. Instruction for touch panel

Following precaution should be taken on use of Touch Screen (ITO resistive analog detective type and matrix detective type.)

8.1 PRECAUTION ON DESIGNING TOUCH PANEL

(Please see touch panel plane drawing 1.)

8.1.1 ACTIVE AREA

Active area is described as inputted area by pen or finger, which assures quality clarified on the specifications related to input action such as functional property, optical property and durability.

- For detection of coordinates and calibration, it should be always conducted within active area. If it is conducted outside of the active area, it may cause functional error.
- Area, which is actually inputted by pen of finger, should be designed within active area. If it is designed outside of the active area, it may cause functional error.

8.1.2 NEUTRAL AREA

Neutral area is located in outside of the active area by 0.2~1.0mm (inside of non active area by 0.2~1.0mm), coordinated can be detected, but its location is in outside of the area which assures quality clarified on specifications related to input action such as functional property, optical property and durability.

Functional property, optical property and durability.

- Neural area detects coordinates when inputted by pen or finger, but it may cause functional error when it is transacted as data detected.
- Since a role of the neutral area is to protect non-active area, hard pushing by tip of a pen, etc. may cause deterioration of its durability.

8.1.3 VISIBLE AREA

This is transparent area without printed silver electrode or flexible print circuit printed with opaque ink, it assures quality clarified on specifications related to appearance standard.

8.1.4 NON ACTIVE AREA

Upper electrode or lower electrode of the non-active area is printed with transparent insulation ink; it is located in outside of the active area. Input by pen does not work in this area.

- Non active area is printed with insulation ink, hard push may cause transformation of upper electrode film, active area located near may contact together, may generate conductive power.
- Since a role of non-active area is to hold flatness of the upper electrode film on its structure, hard pushing by pen or on housing may cause functional error.

8.2 PRECAUTION ON DESIGNING PRINT CIRCUIT OR TOUCH PANEL

8.2.1. There is contact resistance between upper and lower electrode of the

Touch Panel. Setting impedance of receiving circuit high enough on the design is recommended. Lower impedance may cause functional error.

8.2.2. Conduction between upper and lower electrode generates contact resistance. Data input by pen or finger should be started after the contact resistance become stable enough. Otherwise it may cause functional error.

8.2.3. Touch Panel picks up noise easily, any measures such as earth, etc. is recommended. Otherwise it may cause functional error.

8.3 PRECAUTION ON DESIGNING HOUSING

(Please sees drawing of housing assembly 2.)

8.3.1. TO RETAIN SPACE BETWEEN UPPER ELECTRODE FILM AND HOUSING TOP.

- Retain 0.2~0.8mm space above the non-active area not to make pressure on upper electrode film. If there is any pressure on it. It may cause functional error due to transformation of the upper electrode film.
- Flexible material such as robber is recommended for cushion materials. It should be fixed outside of visible area. If it is placed over non-active area, it may cause functional error due to transformation of the upper electrode film.

8.3.2. TO ASSEMBLE ON HOUSING

- To fix Touch Panel on Housing, supporting Touch Panel from backside (lower electrode glass) is recommended. If upper electrode film is fixed with both sides adhesive tape, it may lead to pooling off of the upper electrode film due to repeated input pressure.
- TO PREVENT SWELLIG OF UPPER ELECTRODE FILM OF TOUCH PANEL CAUSED BY ATMOSPHERIC PRESSURE DIFFERENCE BETWEEN INSIDE ND OUTSIDE OF THE DEVICE. ETC.

  If upper electrode film swells caused by atmospheric pressure difference between inside and outside of the device, etc., it may cause deterioration of durability of Touch Panel and may cause functional error.
- TO PREVENT DEW CONDENSATION ON TOUCH PANEL AND TO PREVENT ANY LIQUID SUCH AS WATER. VAPOR FROM COMING INTO TOUCH SCREEN.

  Upper electrode film and lower electrode glass of Touch Panel are fixed with adhesive, and they're set up a vent hole between them. This shows liquid may penetrate into Touch Panel easily due to its structure, any measures on designing the Housing to prevent the penetration is required. Penetration of liquid may cause functional error.

8.4 PRECAUTION ON UNPACKING AND ASSEMBLING TOUCH PANEL.

8.4.1. STORAGE

Store the product without unpacking a place where temperature and humidity is within the range clarified on specifications.

8.4.2. UNPACKING

- Check upper and lower side and be sure to unpack from upper side.
- Be careful not to hit the product when any tool such as sharp knife is to be used for unpacking.
- Do not hold and pull out flexible tail, otherwise it may cause shut down of the flexible print circuit.
- Any treatment is not made for glass edge. It may be sharp and may cause any injury when handled by bare hands. Wear fingers tall or glove and handle with extra care.

8.4.3. HANDLING

- Pick up outside of visible area for handling. Do not pick up canter of the visible area and flexible tail.
- Do not stack up the products and do not place anything on the product. It may cause scratch or transformation.
- Wipe out any dirt on the product with dried flexible cloth. If it is heave dirt, wipe it out with flexible cloth with some ethyl alcohol. Upper electrode film and lower electrode glass of Touch Panel are fixed with adhesive, and they're set up a vent hole between them. Therefore ethyl alcohol may penetrate into Touch Panel easily from the edge, so extra care is required. It may cause functional error.

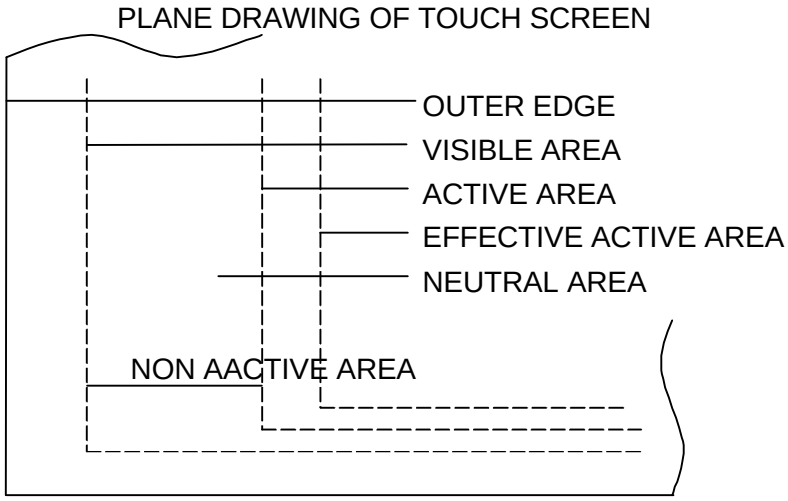
8.4.4. PRECAUTION ON ASSEMBLY

- Be careful not to generate excess distortion on heat sealed area and flexible tail. It may cause functional error.
- Be careful not to scratch the product on assembly.

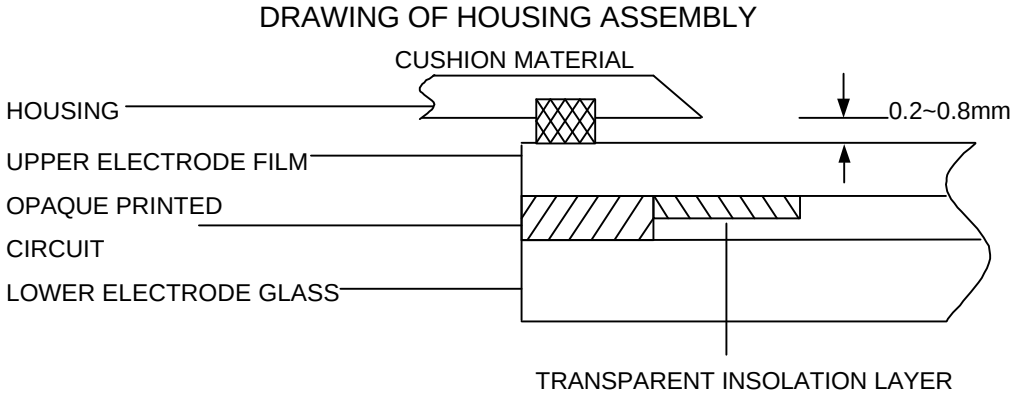
8.4.5. PRECAUTION ON HANDLING

- Handle the product within the range of temperature and humidity clarified on specifications.
- Use finger or polyacetal pen attached for input to Touch Panel. Surface of the Touch Panel is bar-code treated, film surface may be damaged if inputted by ball-point pen or metal piece.
- Do not expose Touch Panel to direct sunlight for long period of time. Polyester film is used on Touch Panel, exposure to direct sunlight for long period of time may cause discoloration.
- If Chemical stays on the Touch Panel for long period of time, upper electrode film may be swelled and may cause functional error. If it is to be used under sever circumstances, another measures for water protection is required.

8.5 If any other question may be arise; please feel free to contact us.



DRAWING 1



DRAWING 2