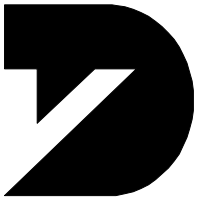
Data International Co., Ltd.



DATAVISION

APPROVAL SHEET

Customer	**:**	
Part Name	**:**	**LCD MODULE**
Model No.	**:**	**DG-32240-27-SNCW-HCDTC**
Drawing No.	**:**	
Approved by	**:**	
Date	**:**	

Approved	Checked	Prepared	Sheet Code:
		Ming-Chun Chen	318-1053

CONTENTS

1. SCOPE

This specification covers the engineering requirements for the DGA-32240-27-SNCW-HCDTC liquid crystal module.

2. PRODUCT SPECIFICATIONS

2.1 General

- 320 × 240 dot matrix LCD
- STN (Blue mode)
- Negative , 6 o'clock , Wide temperature type
- Back-light: CCFL , White
- With touch panel #9504
- Multiplexing driving : 1/240 duty, 1/14 bias
- Built-in controller 1335

2.2 Mechanical Characteristics

Item	Characteristic
Dot configuration	320 × 240
Dot dimensions(mm)	0.34 × 0.34
Dot spacing (mm)	0.02
Module dimensions (Horizontal × Vertical × Thickness, mm)	167.1 × 109.0 × 11.0max.
Viewing area (Horizontal × Vertical, mm)	120.0 × 90.0
Active area (Horizontal × Vertical, mm)	115.17 × 86.37

2.3 Absolute Maximum Ratings (Without CCFL back-light)

Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply voltage range	V_{DD}	–0.3 to 7.0	V
Input voltage range	V_{IN}	–0.3 to V_{DD} + 0.3	V
Power dissipation	P_D	300	mW
Operating temperature range	T_{opg}	–20 to 75	°C
Storage temperature range	T_{stg}	–65 to 150	°C
Soldering temperature (10 seconds). See note 1.	T_{solder}	260	°C

Notes:

1. The humidity resistance of the flat package may be reduced if the package is immersed in solder. Use a soldering technique that does not heatstress the package.
2. If the power supply has a high impedance, a large voltage differential can occur between the input and supply voltages. Take appropriate care with the power supply and the layout of the supply lines. (See section 6.2.)
3. All supply voltages are referenced to V_{SS} = 0V.

2.4 Electrical Characteristics (Without CCFL back-light)

V_{DD} = 4.5 to 5.5V, V_{SS} = 0V, T_a = –20 to 75°C

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Supply voltage	V_{DD}		4.5	5.0	5.5	V
Register data retention voltage	V_{OH}		2.0	—	6.0	V
Input leakage current	I_{LI}	V_I = V_{DD}. See note 5.	—	0.05	2.0	µA
Output leakage current	I_{LO}	V_I = V_{SS}. See note 5.	—	0.10	5.0	µA
Operating supply current	I_{opr}	See note 4.	—	11	15	mA
Quiescent supply current	I_Q	Sleep mode, V_{OSC1} = $V_{\overline{CS}}$ = $V_{\overline{RD}}$ = V_{DD}	—	0.05	20.0	µA
Oscillator frequency	f_{OSC}	Measured at crystal, 47.5% duty cycle. See note 6.	1.0	—	10.0	MHz
External clock frequency	f_{CL}		1.0	—	10.0	MHz
Oscillator feedback resistance	R_f		0.5	1.0	3.0	MΩ
TTL						
HIGH-level input voltage	V_{IHT}	See note 1.	0.5V_{DD}	—	V_{DD}	V
LOW-level input voltage	V_{ILT}	See note 1.	V_{SS}	—	0.2V_{DD}	V
HIGH-level output voltage	V_{OHT}	I_{OH} = –5.0 mA. See note 1.	2.4	—	—	V
LOW-level output voltage	V_{OLT}	I_{OL} = 5.0 mA. See note 1.	—	—	V_{SS} + 0.4	V
CMOS						
HIGH-level input voltage	V_{IHC}	See note 2.	0.8V_{DD}	—	V_{DD}	V
LOW-level input voltage	V_{ILC}	See note 2.	V_{SS}	—	0.2V_{DD}	V
HIGH-level output voltage	V_{OHC}	I_{OH} = –2.0 mA. See note 2.	V_{DD} – 0.4	—	—	V
LOW-level output voltage	V_{OLC}	I_{OH} = 1.6 mA. See note 2.	—	—	V_{SS} + 0.4	V
Open-drain						
LOW-level output voltage	V_{OLN}	I_{OL} = 6.0 mA.	—	—	V_{SS} + 0.4	V
Schmitt-trigger						
Rising-edge threshold voltage	V_{T+}	See note 3.	0.5V_{DD}	0.7V_{DD}	0.8V_{DD}	V
Falling-edge threshold voltage	$V_{T–}$	See note 3.	0.2V_{DD}	0.3V_{DD}	0.5V_{DD}	V

Notes:

1. D0 to D7, A0, $\overline{CS}$, $\overline{RD}$, $\overline{WR}$, VD0 to VD7, VA0 to VA15, $\overline{VRD}$, $\overline{VWR}$ and $\overline{VCE}$ are TTL-level inputs.
2. SEL1 is CMOS-level inputs. YD, XD0 to XD3, XSCL, LP, WF, YDIS are CMOS-level outputs.
3. $\overline{RES}$ is a Schmitt-trigger input. The pulsewidth on $\overline{RES}$ must be at least 200 µs. Note that pulses of more than a few seconds will cause DC voltages to be applied to the LCD panel.
4. f_{OSC} = 10 MHz, no load (no display memory), internal character generator, 256 × 200 pixel display. The operating supply current can be reduced by approximately 1 mA by setting both CLO and the display OFF.
5. VD0 to VD7 and D0 to D7 have internal feedback circuits so that if the inputs become high-impedance, the input state immediately prior to that is held. Because of the feedback circuit, input current flow occurs when the inputs are in an intermediate state.
6. Because the oscillator circuit input bias current is in the order of µA, design the printed circuit board so as to reduce leakage currents.

2.5 Optical Characteristics Absolute maximum ratings

Item	Symbol	Rating	Unit
Operating temperature range	Top	-20~70	°C
Storage temperature range	Tst	-30~80	°C

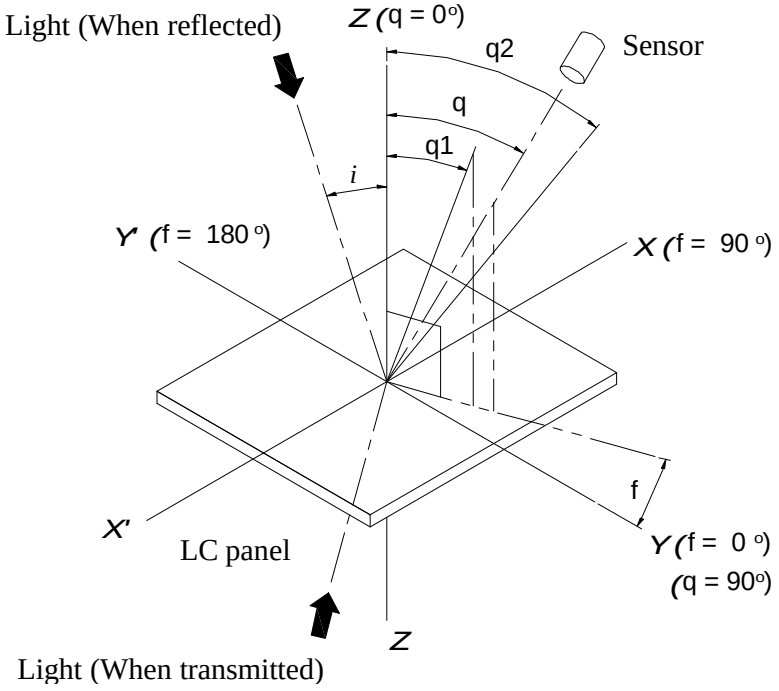
2.6 Optical Characteristics

1/240 duty, 1/14 bias

Item	Symbol	Temp.	Min.	Typ.	Max.	Unit
Driving voltage	Vop	0 °C	23.6	24.3	25.0	V
		25 °C	22.8	23.5	24.2	
		50 °C	21.9	22.6	23.3	
Contrast ratio	CR	θ=0° ϕ=0°	4.3	5.4	--	--
Frame freq.	fF	--	--	70	--	Hz
Viewing angle*	θ_1	25 °C	--	43	--	deg.
	θ_2		--	29	--	
Response time	t_{on}	25 °C	--	157	--	ms
	t_{off}		--	255	--	

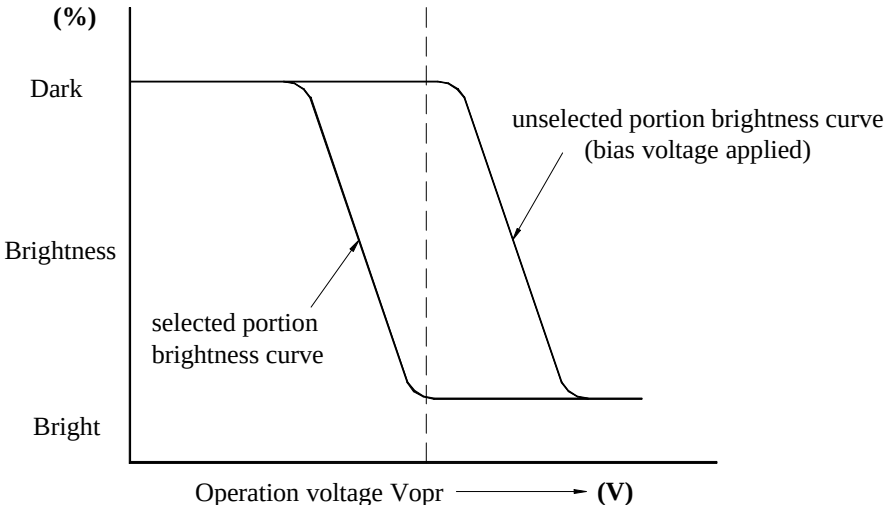
2.6.1 Definition of optical characteristics

*Definition of angles ϕ and θ

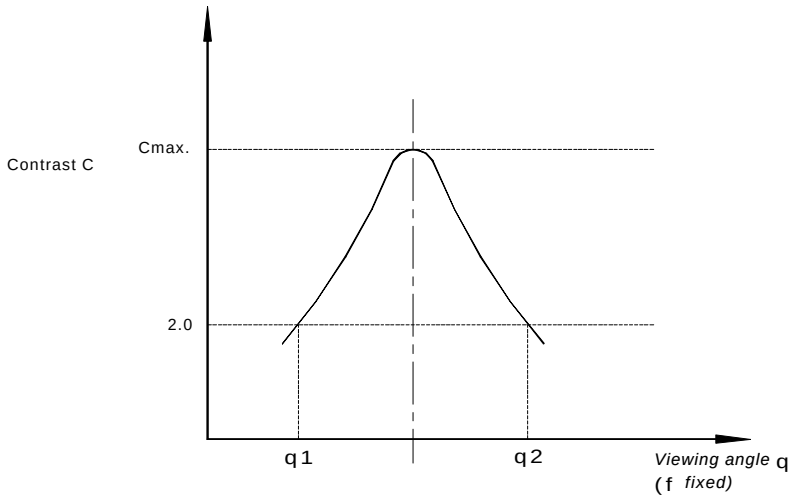


*Definition of contrast C

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

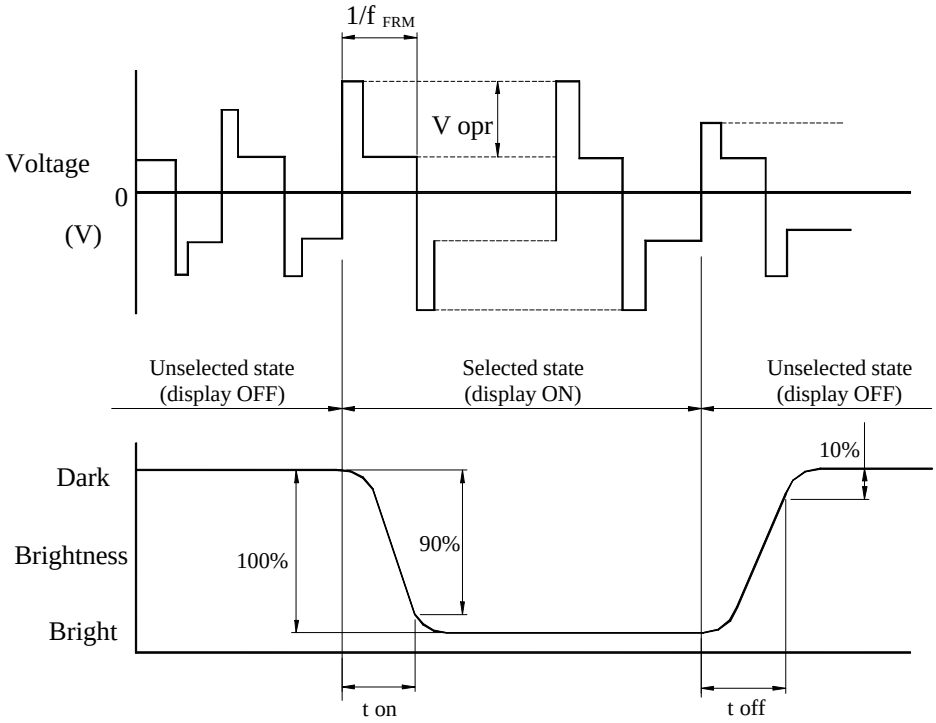


*Definition of viewing angles θ1 and θ2



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 CCFL Electrical Specifications

2.7.1 Absolute maximum Conditions

The half-brightness life of the back light shall be kept as specified under the following absolute maximum conditions.

Power Consumption Ta=25°C, fL=55KHz	1.35W
Tube current Ta=25°C, fL=55KHz	5.0±1.0mArms max.

2.7.2 Electrical characteristics

The following operating conditions are recommended for the back light unit.

Start Voltage	630Vrms	at Ta=25°C
Tube Voltage	270Vrms	at Ta=25°C
Tube Current	5.0±0.5mArms	at Ta=25°C
Drive frequency	60±35KHz typ	at Ta=25°C

2.7.3 Initial Optical Characteristics

The unit shall satisfy the following criteria at 25±2°C ambient temperature, 45%-85% relative humidity, no air flow and with applying rating input voltage and input current by using TDK L10L inverter.

Brightness Uniformity	75%	
Average Brightness	550cd/m^2 min.	at Ta=25°C
(Measurement shall be continuous on for 30 minutes)		
Chromaticity	x=0.3475±0.0015 y=0.3750±0.0005	

2.7.4 Life

the unit shall satisfy the following criteria at 25±5°C ambient temperature, with 5mA tube current by using TDK L10L inverter.

Half-Brightness Life of Unit 15,000 Hours min.

The definition of half-brightness life is either average brightness reach to 50% of initial average brightness or lamp stopping light emission.

2.7.5 Operating Conditions

Temperature	0 to 50°C	Humidity	30 to 85%RH

2.7.6 Storage Conditions

Temperature	-20 to 80°C	Humidity	5 to 90%RH

2.8 Touch panel Specification

2.8.1 Typical Optical characteristics

- Visible Light Transmission : >80%@550nm.
- Haze : 5%±2% through hard coated PET only
- Operation temperature
  From -10°C to 50°C (Humidity : 90% RH)
- Storage temperature
  From -20°C to 70°C (At Ambient Humidity)

2.8.2 Electrical

- Operating Voltage : 5.5V or less
- Contact current : 20mA(maximum)
- Circuit close resistance : X : 650±200W
  Y: 300±200W
- Circuit open resistance : >20MΩ at 25VDC
- Contact bounce : <15ms
- Linear Test : ±1.5% or Less

2.8.3 Linearity

- Linear Test Specification :
  Direction X : – 1.5% or less
  Direction Y : ± 1.5% or less
- Line Test Circuit for Y Coordinate
  Add 5V between Y1 and Y2, touch the point C0R0 to C9R9 separately, and measure the voltage from X1.

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

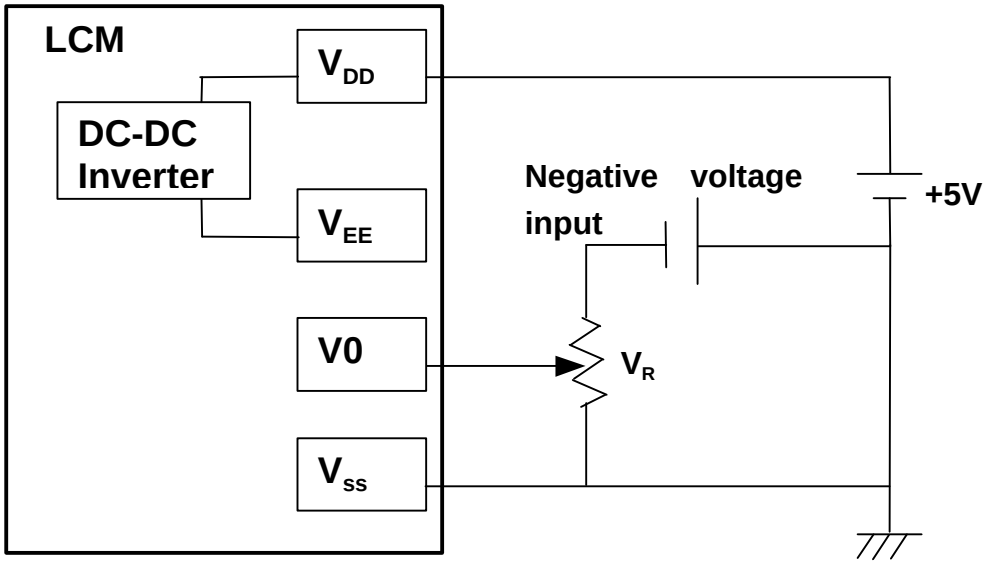
- Contrast becomes 30% of initial value
- Current consumption becomes three times higher than initial value
- Remarkable alignment deterioration occurs in LCD cell layer
- Unusual operation occurs in display functions

4. OPERATING INSTRUCTIONS

4.1 Input signal Function

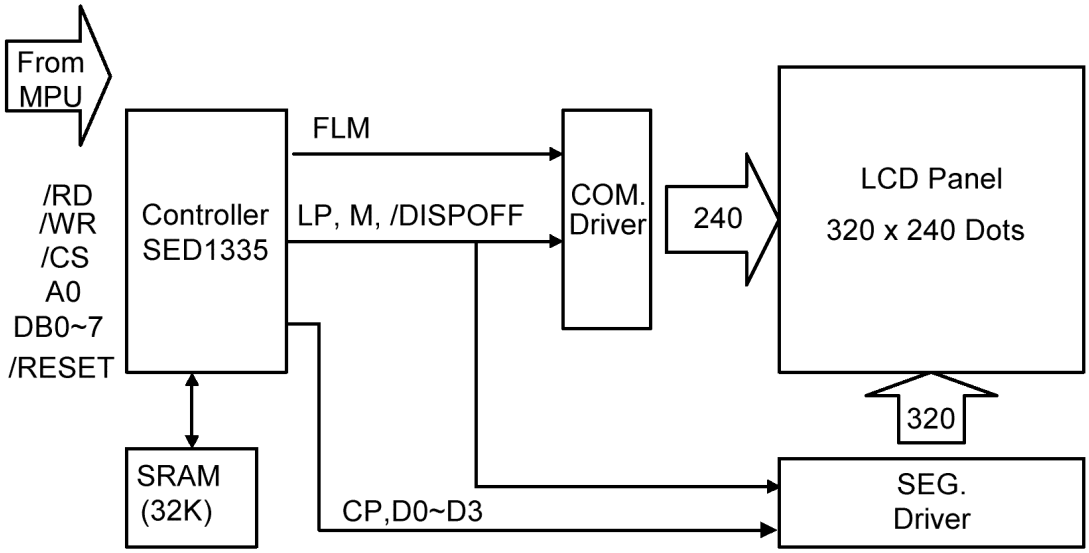
NO.	Symbol	Function
1	VSS	Ground (0V)
2	VDD	Power supply for Logic circuit (+)
3	V0	Power supply for LCD Contrast adjustment
4	A0	Data Type Selection
5	/WR	80 Series: Read Signal 68 Series: Enable Signal(E)
6	/RD	80 Series: Read Signal 68 Series: Enable Signal(E)
7~14	DB0~DB7	Display Data
15	/CS	Chip select Signal
16	/RESET	Rest Signal
17	VEE/NC	Power supply for LCD driving / NC
18	SEL1	8080or6800 family interface select
19	DCLK	External Clock Input. This clock runs the SAR conversion process and synchronizes serial data I/O.
20	/CS	Chip Select Input.Controls conversion timing and enables the serial input/output register.
21	DIN	Serial Data Input. If CS is LOW, data is latched on rising edge of DCLK.
22	DOUT	Serial Data Output. Data is shifted on the falling edge of DCLK. This output is high impedance when CS is High.
23	PEN	Pen interrupt.
24	PEN1	Pen interrupt setting.
25	IN3	Auxiliary Input 1. ADC input Channel 3.
26	IN4	Auxiliary Input 2. ADC input Channel 4.

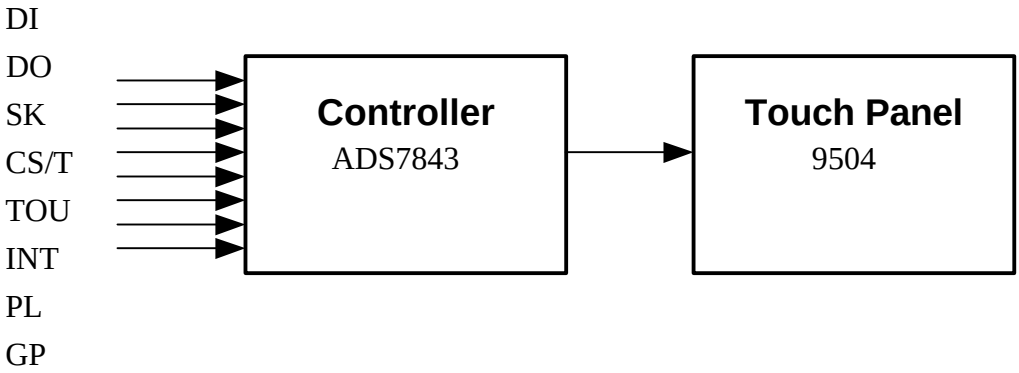
4.2 Voltage Generator Circuit



V_R : 10K~20K Ohms
LCM :Built-in DC-DC inverter

4.3 Circuit Block Diagram





4.4 Pin Description

Name	Number		Type	Description
	SED1335F0A	SED1335F0B		
VA0 to VA15	27 to 28 30 to 43	1 to 6 50 to 59	Output	VRAM address bus
$\overline{VWR}$	44	7	Output	VRAM write signal
$\overline{VCE}$	45	8	Output	Memory control signal
$\overline{VRD}$	46	9	Output	VRAM read signal
$\overline{RES}$	47	10	Input	Reset
NC	28, 48, 49	11, 12, 60	—	No connection
$\overline{RD}$	50	13	Input	8080 family: Read signal 6800 family: Enable clock (E)
$\overline{WR}$	51	14	Input	8080 family: Write signal 6800 family: R/$\overline{W}$ signal
SEL2	52	15	Input	8080 or 6800 family interface select
SEL1	53	16	Input	8080 or 6800 family interface select
XG	54	17	Input	Oscillator connection
XD	55	18	Output	Oscillator connection
$\overline{CS}$	56	19	Input	Chip select
A0	57	20	Input	Data type select
V_{DD}	58	21	Supply	2.7 to 5.5V supply
D0 to D7	59 to 60 1 to 6	22 to 29	Input/output	Data bus
XD0 to XD3	7 to 10	30 to 33	Output	X-driver data
XECL	11	34	Output	X-driver enable chain clock
XSCL	12	35	Output	X-driver data shift clock
V_{SS}	13	36	Supply	Ground
LP	14	37	Output	Latch pulse
WF	15	38	Output	Frame signal
YDIS	16	39	Output	Power-down signal when display is blanked
YD	17	40	Output	Scan start pulse
YSCL	18	41	Output	Y-driver shift clock
VD0 to VD7	19 to 26	42 to 49	Input/output	VRAM data bus

4.5 The Command Set

Class	Command	Code											Hex	Command Description	Command Read Parameters	
		$\overline{RD}$	$\overline{WR}$	A0	D7	D6	D5	D4	D3	D2	D1	D0			No. of Bytes	Section
System control	SYSTEM SET	1	0	1	0	1	0	0	0	0	0	0	40	Initialize device and display	8	8.2.1
	SLEEP IN	1	0	1	0	1	0	1	0	0	1	1	53	Enter standby mode	0	8.2.2
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	1	8.3.1
	SCROLL	1	0	1	0	1	0	0	0	1	0	0	44	Set display start address and display regions	10	8.3.2
	CSRFORM	1	0	1	0	1	0	1	1	1	0	1	5D	Set cursor type	2	8.3.3
	CGRAM ADR	1	0	1	0	1	0	1	1	1	0	0	5C	Set start address of character generator RAM	2	8.3.6
	CSRDIR	1	0	1	0	1	0	0	1	1	CD 1	CD 0	4C to 4F	Set direction of cursor movement	0	8.3.4
	HDOT SCR	1	0	1	0	1	0	1	1	0	1	0	5A	Set horizontal scroll position	1	8.3.7
	OVLAY	1	0	1	0	1	0	1	1	0	1	1	5B	Set display overlay format	1	8.3.5
Drawing control	CSRW	1	0	1	0	1	0	0	0	1	1	0	46	Set cursor address	2	8.4.1
	CSRR	1	0	1	0	1	0	0	0	1	1	1	47	Read cursor address	2	8.4.2
Memory control	MWRITE	1	0	1	0	1	0	0	0	0	1	0	42	Write to display memory	—	8.5.1
	MREAD	1	0	1	0	1	0	0	0	0	1	1	43	Read from display memory	—	8.5.2

Notes:

1. In general, the internal registers of the SED1335 series 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 1 data item) are handled as follows:

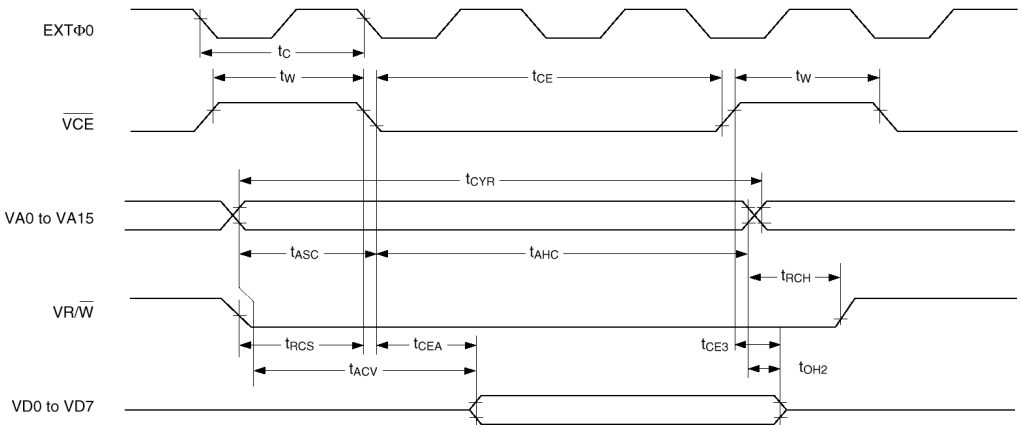
   a. CSRW, CSRR: Each byte is processed individually. The microprocessor may read or write just the low byte of the cursor address.

   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.

4.6 Timing Characteristics

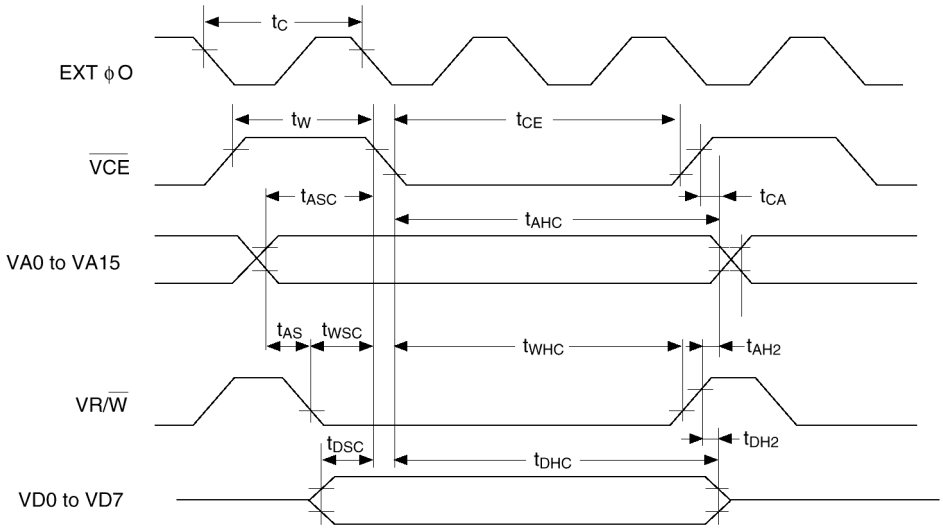
Display memory read timing



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		
EXT ϕ0	tC	Clock period	100	—	125	—	ns	CL = 100 pF
VCE	tW	VCE HIGH-level pulsewidth	tC – 50	—	tC – 50	—	ns	
	tCE	VCE LOW-level pulsewidth	2tC – 30	—	2tC – 30	—	ns	
VA0 to VA15	tCYR	Read cycle time	3tC	—	3tC	—	ns	
	tASC	Address setup time to falling edge of VCE	tC – 70	—	tC – 100	—	ns	
	tAHC	Address hold time from falling edge of VCE	2tC – 30	—	2tC – 40	—	ns	
VRD	tRCS	Read cycle setup time to falling edge of VCE	tC – 45	—	tC – 60	—	ns	
	tRCH	Read cycle hold time from rising edge of VCE	0.5tC	—	0.5tC	—	ns	
VD0 to VD7	tACV	Address access time	—	3tC – 100	—	3tC – 115	ns	
	tCEA	VCE access time	—	2tC – 80	—	2tC – 90	ns	
	tOH2	Output data hold time	0	—	0	—	ns	
	tCE3	VCE to data off time	0	—	0	—	ns	

Display memory write 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		
EXT ϕ0	tC	Clock period	100	—	125	—	ns	CL = 100 pF
VCE	tW	VCE HIGH-level pulsewidth	tC – 50	—	tC – 50	—	ns	
	tCE	VCE LOW-level pulsewidth	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	

Note: VD0 to VD7 are latching input/outputs. While the bus is high impedance, VD0 to VD7 retain the write data until the data read from the memory is placed on the bus.

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).

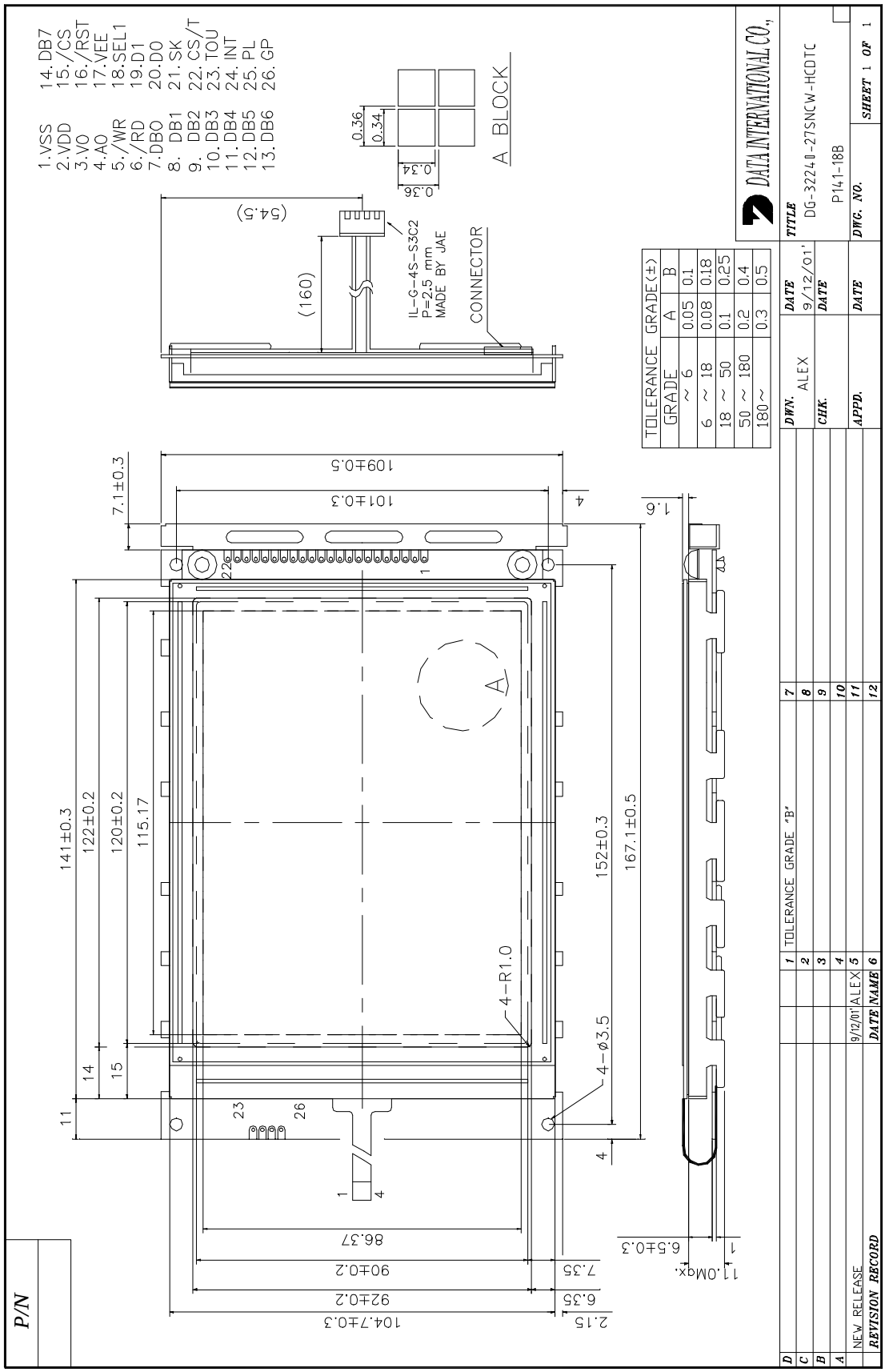
Cleaning

- 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



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.

8.4 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.

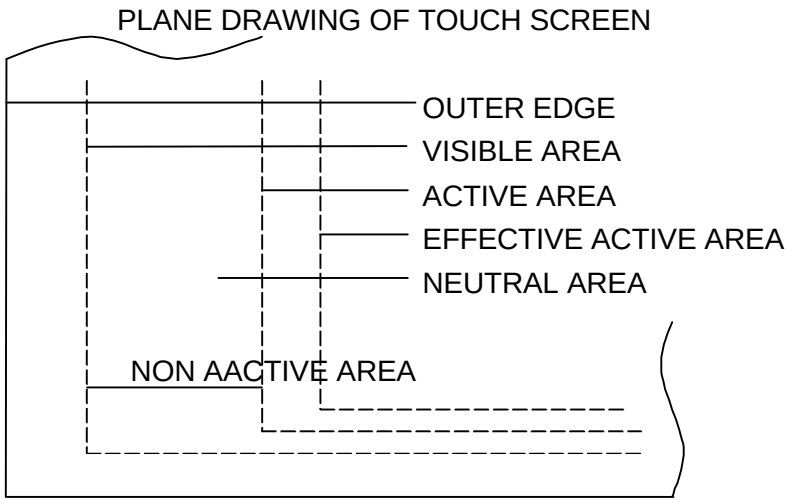
8.4.4. PRECAUTION ON ASSEMBLY

- 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.

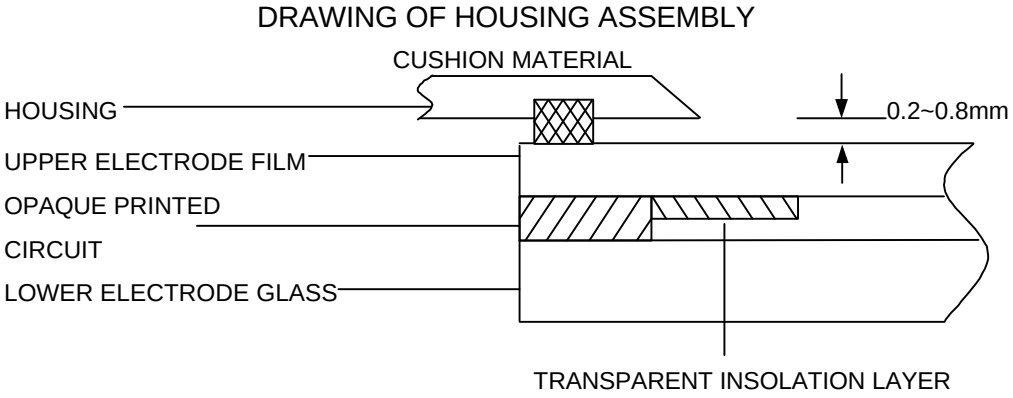
8.4.5. PRECAUTION ON HANDLING

- 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