

DISPLAY Elektronik GmbH

DATA SHEET

LCD MODULE

DEM 240128D SBH-PW-N (TOUCH)

Product specification

Version :9

15/Jan/2007

GENERAL SPECIFICATION

MODULE NO. :

DEM 240128D SBH-PW-N (TOUCH)

CUSTOMER P/N

VERSION NO.	CHANGE DESCRIPTION	DATE
9	CHANGED JUMPER RESISTOR DESCRIPTION	09/01/2007

PREPARED BY: LMM

DATE: 09/01/2007

APPROVED BY: MH

DATE: 15/01/2007

CONTENTS

1. FUNCTIONS & FEATURES -----	2
2. MODULE ARTWORK -----	2
3. EXTERNAL DIMENSIONS-----	3
4. BLOCK DIAGRAM -----	3
5. PIN ASSIGNMENT-----	5
6. POWER SUPPLY -----	6
7. ABSOLUTE MAXIMUM RATINGS -----	6
8. PCB DRAWING AND DESCRIPTION-----	7
9. ELECTRICAL CHARACTERISTICS -----	8
10. TOUCH PANEL SPECIFICATIONS-----	10
11. BACKLIGHT ELECTRICAL/OPTICAL SPECIFICATIONS -----	15
12. PRECAUTION FOR USING LCM -----	16
13. LCD MODULES HANDLING PRECAUTIONS -----	18
14. OTHERS -----	18

DEM 240128D SBH-PW-N (TOUCH) Product Specification

1. FUNCTIONS & FEATURES

- LCD TYPE:

Module Model	LCD Type	Remark
DEM 240128D SBH-PW-N (TOUCH)	STN BLUE Transmissive Negative Mode	ROHS Conformed

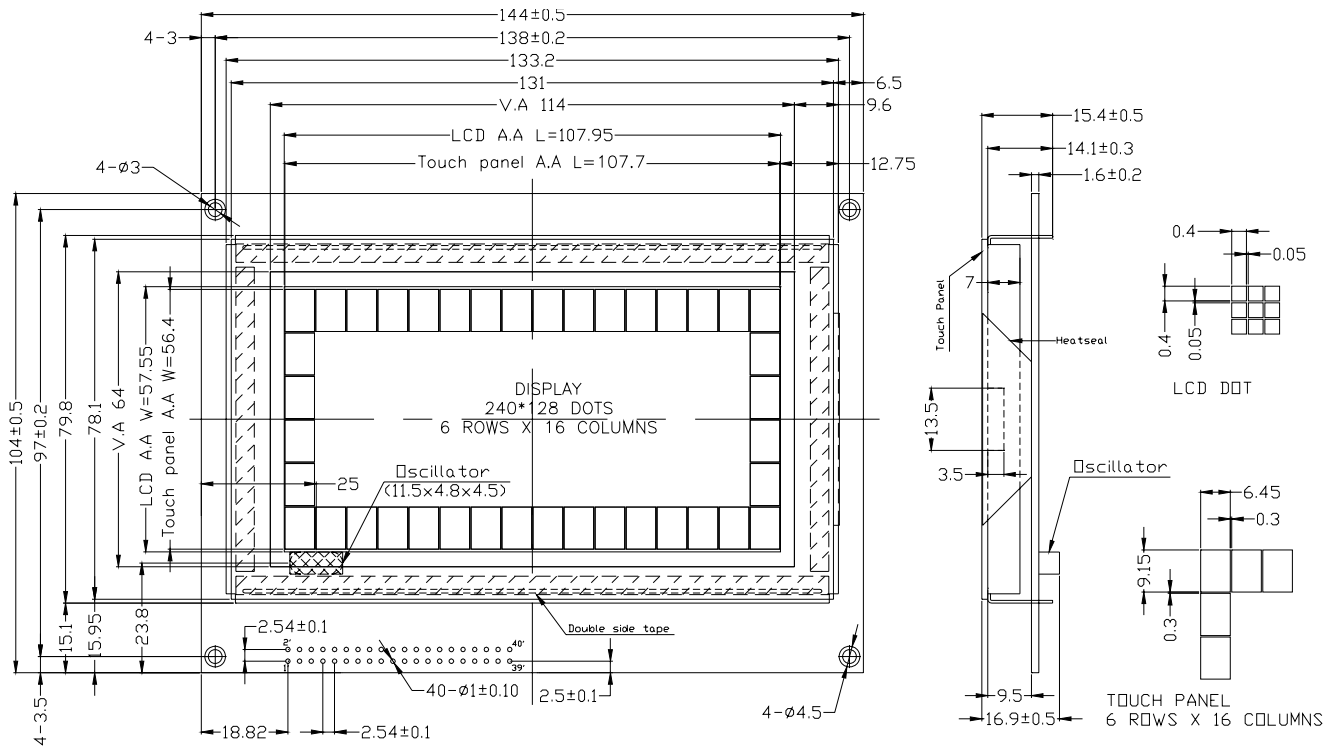
- Glass Thickness : 1.1mm
- Viewing Direction : 6 o'clock
- Driving Scheme : 1/128 Duty, 1/12 Bias
- Power Supply for logic : 5.0 Volt (typ.)
- Backlight Color : LED, White, Lightguide
- Display Content : 240 x 128 Dots
- V_{LCD} : 20.0 Volt (typ.)
- Operating Temperature : -20°C to +70°C
- Storage Temperature : -25°C to +75°C
- Driver IC : S6B0086 (Samsung)
- Controller IC : T6963C (Toshiba)
- With touch panel : Digital, 16x6 (columns-rows), anti-glare-type

2. MODULE ARTWORK

- Module Size : 144.0 x 104.0 x 14.1 mm
- Viewing Area : 114.0 x 64.0 mm (LCD and Touch panel)
- Active Area : 107.7 x 56.4 mm (Touch panel)
- Active Area : 107.9 x 57.6 mm (LCD)
- Dot Pitch : 0.45 x 0.45 mm (LCD)
- Dot Pitch : 6.75 x 9.45 mm (Touch panel)
- Dot Size : 0.40 x 0.40 mm (LCD)
- Dot Size : 6.45 x 9.15 mm (Touch panel)
- Dot Gap : 0.05 mm (LCD)
- Dot Gap : 0.30 mm (Touch panel)

DEM 240128D SBH-PW-N (TOUCH) Product Specification

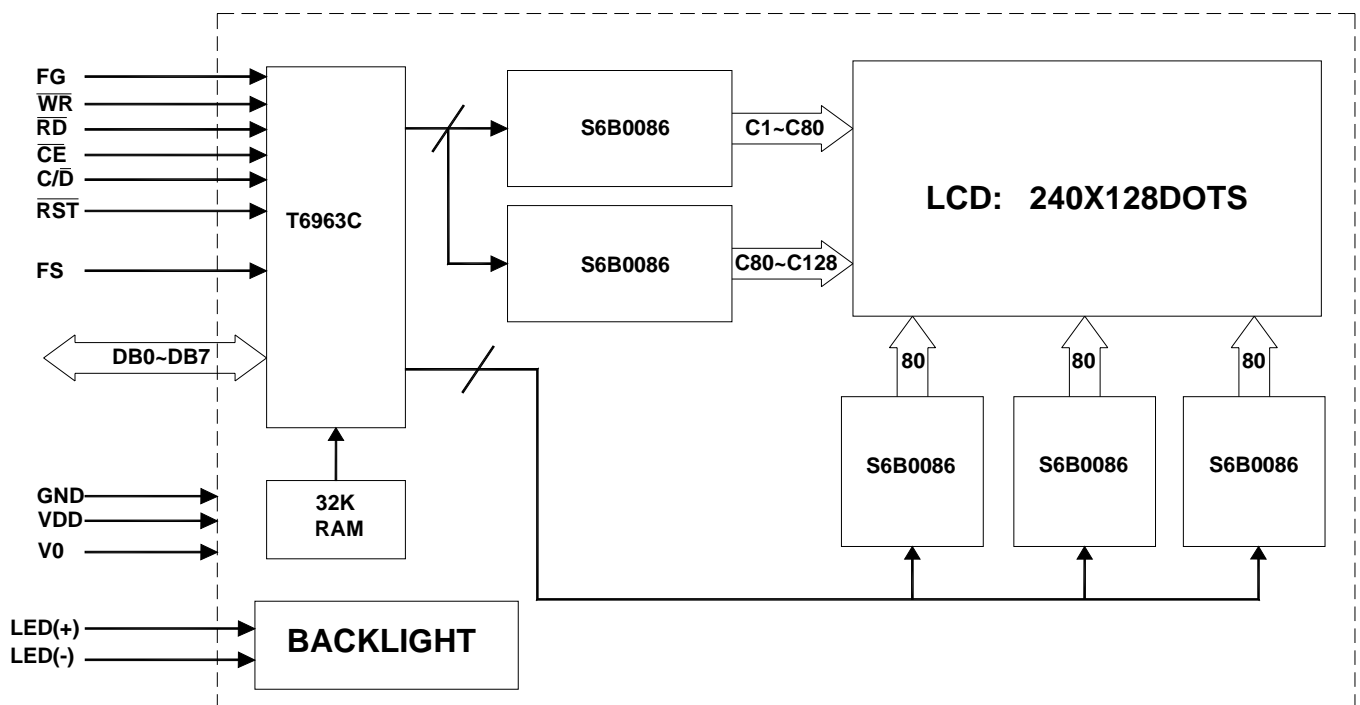
3. EXTERNAL DIMENSIONS



Remarks:
 1, Unmarked tolerance is ±0.3
 2, All materials comply with RoHs.

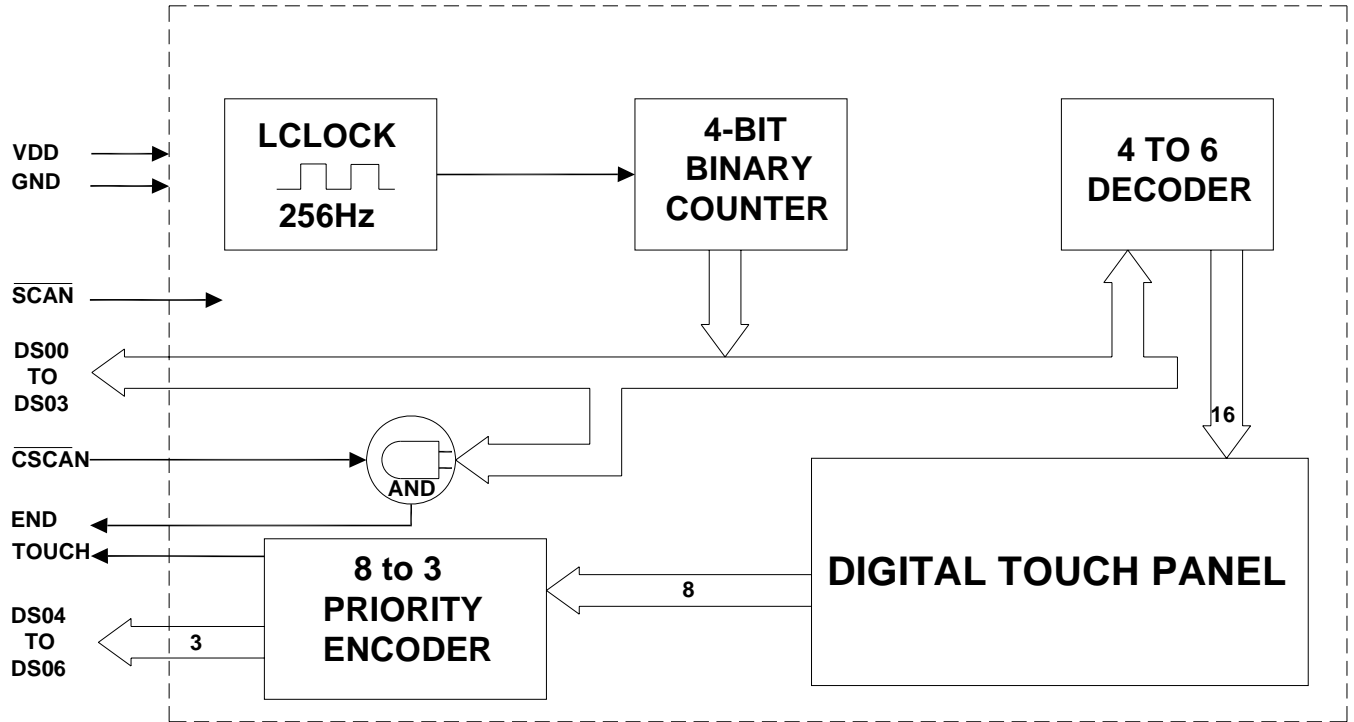
4. BLOCK DIAGRAM

4.1 Block Diagram Of LCD Module



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4.2 Digital Touch Screen Auto-Scanning Block Diagram



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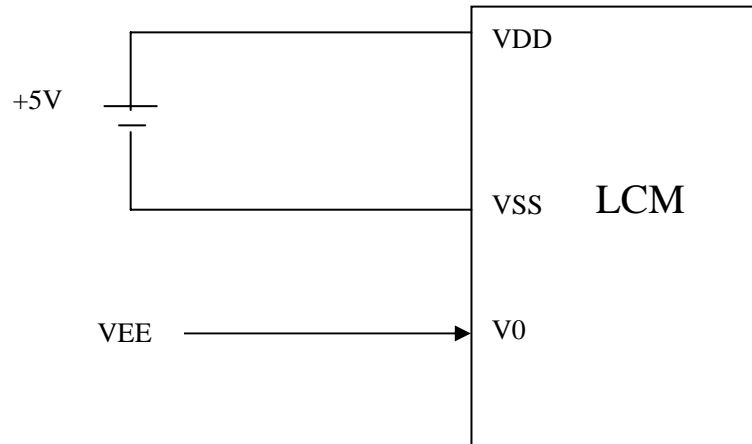
5. PIN ASSIGNMENT

NO.	SYMBOL	FUNCTION
1	FG	Frame ground
2	/CSCAN	Active LOW: Force column scan counter to run continuously in order to obtain a complete cycle
3	VSS	Ground(0V)
4,6,8,10	DS00~DS03	4 bits to indicate the column being scanned: range0 to 15 corresponding to COL1 to COL16, with DS00 as LSB. Output is latched at the most recently touched position. When read while "TOUCH" is positive, the touched column is identified.*
5	VDD	Power supply for logic (+5Volt)
7	V0	Power supply for LCD drive (-15Volt (typ.))
9	/WR	Write Command or data to module when "L"
11	/RD	Read Command or data from module when "L"
12,14,16	DS04~DS06	3bits to indicate the row being scanned: range 0 to 7 corresponding to ROW1 to ROW8, with DS4 as LSB & DS6 as MSB. Output is latched at the most recently touched position. When read while "TOUCH" is positive, the touched column is identified.*
13	/CE	Enable LCD controller when "L"
15	C//D	Command/data select. "H" for command read/write. "L" for data read/write
17	/RST	LCD Controller reset. Controller initialize and DB00-DB07 are set to be high impedance when/RST is "L"
18	//SCAN	Active LOW: Standby to scan. Scanning will begin when a touch is identified at any of the sensing position, and will continue until touch is removed.
19,21,23,25, 27,29,31,33,	DB0~DB7	LCD data input/output. DB0(pin10) is LSB and DB7(pin17) is MSB.
20	END	A 4ms positive pulse generated at the end of a complete scan cycle (Max cycle time: 64ms)
22	TOUCH	A 2ms positive pulse when scanning reaches an identified touch position. It can be used as an interrupt.
24,26,28,30,3 2,34,36,38,40	NC.	No Connection
35	FS	Font select. "H" for 6x8 font & "L" for 8x8 font
37	LED+(A)	Please refer to item 8.1 PCB drawing and description
39	LED - (K)	

* If DS00 to DS06 is read at the "END, then the last touched position will be identified.

DEM 240128D SBH-PW-N (TOUCH) Product Specification

6. POWER SUPPLY



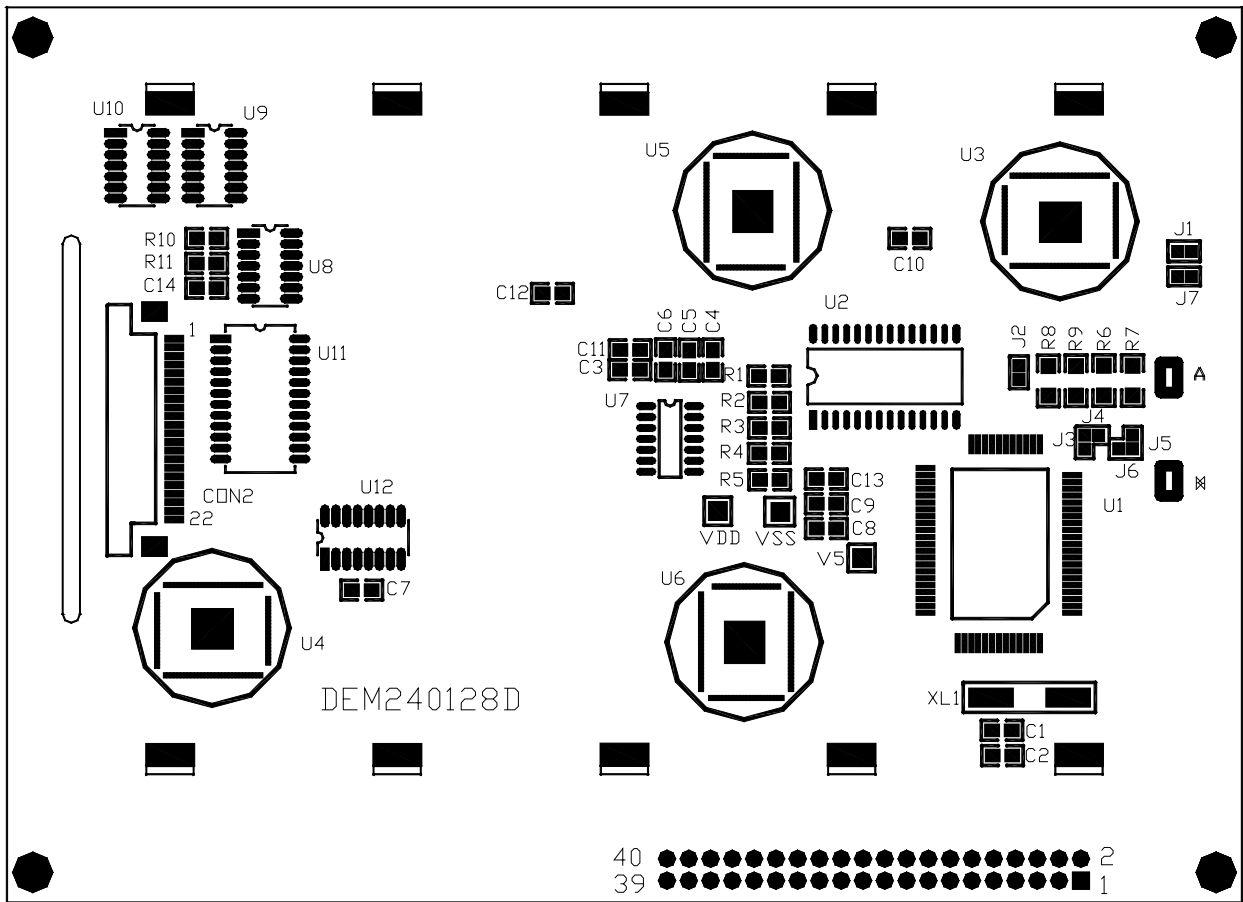
7. ABSOLUTE MAXIMUM RATINGS ($V_{SS}=0\text{Volt}$, $T_a=25^\circ\text{C}$)

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage (Logic)	V_{DD}	-0.3 to 7.0	V
Input voltage	V_{IN}	-0.3 to $V_{DD} + 0.3$	V
Operating Temperature	T_{opr}	-20 to +70	$^\circ\text{C}$
Storage Temperature	T_{stg}	-25 to +75	$^\circ\text{C}$

DEM 240128D SBH-PW-N (TOUCH) Product Specification

8. PCB DRAWING AND DESCRIPTION

8.1. PCB DRAWING



DESCRIPTION:

8-1-1. The polarity of the pin 37 and the pin 39:

symbol	symbol state	J3,J5	J6, J4	LED Polarity	
				37Pin	39 Pin
J6,J4	Each solder-bridge	Each closed	Each open	Anode	Cathode
J3,J5	Each solder-bridge	Each open	Each closed	Cathode	Anode

Note: In application module, J3=J5 = closed, J4=J6= open.

8-1-2. The J1 is metal-bezel GND to module GND and J7 is mounting holes GND to module GND.

Note: In application module, J1= J7=closed,

8-1-3. The LED resistor on board are used when J2 is open

Note: In application module, J2=open

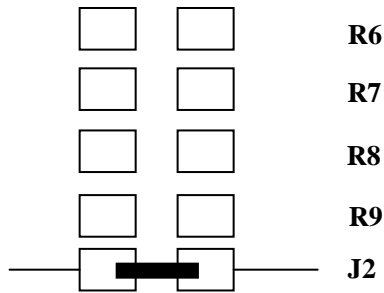
8-1-4. The R6 and the R7, R8, R9 are the LED resistor.

Note: In application module, R8=27 Ohm; R6= R7= R9=open

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8.2 Example application

8-2-1. The LED resistors on board can be disabled when J2 is closed. Then customer needs to use external resistors



8-2-2. The 37 pin is the anode and the 39 pin is the cathode as following.



8-2-3. The 37 pin is the cathode and the 39 pin is the anode as following.



8-2-4. The metal-bezel is on ground as following.



8-2-5. The holes is on ground as following



9. ELECTRICAL CHARACTERISTICS

1). DC Characteristics

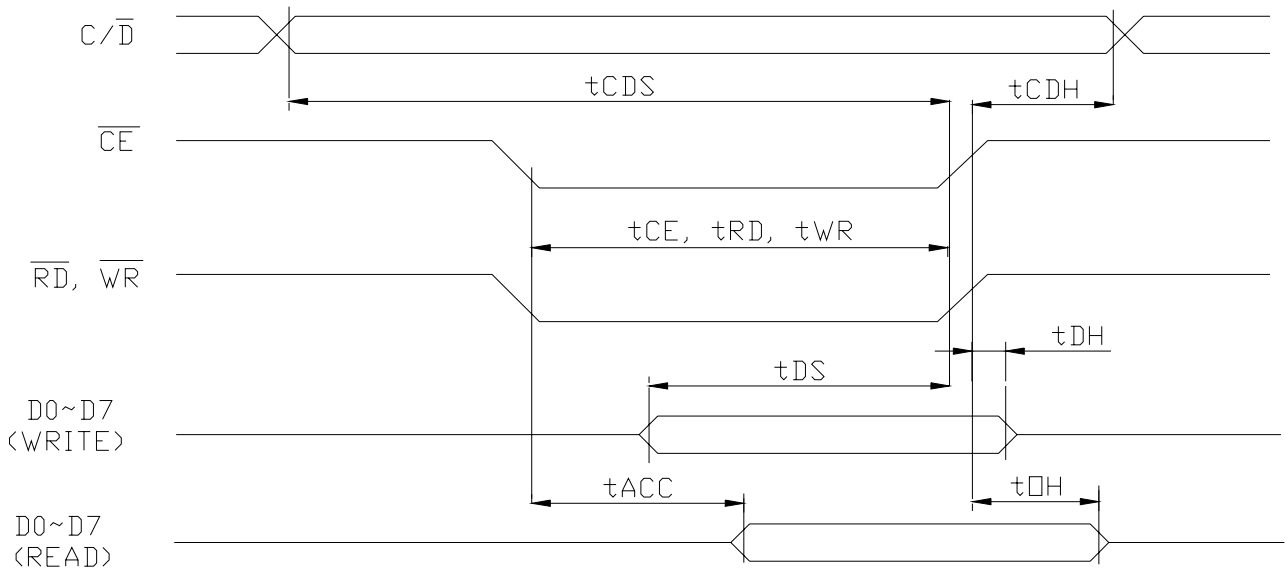
Ta=25°C, VSS=0V

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Supply Voltage (Logic)	$V_{DD}-V_{SS}$	-	4.5	5.0	5.5	V
High Level Input Voltage	V_{IH}	$V_{DD}=5.0V\pm 10\%$	$V_{DD}-2.2$	-	V_{DD}	V
Low Level Input Voltage	V_{IL}	$V_{DD}=5.0V\pm 10\%$	0	-	0.8	V
High Level Output Voltage	V_{OH}	$I_{OH}=0.75mA$	$V_{DD}-0.3$	-	V_{DD}	V
Low Level Output Voltage	V_{OL}	$I_{OL}=0.75mA$	0	-	0.3	V
Current Consumption(Operating)	$I_{DD(1)}$	$V_{DD}=5.0V$ $f_{OSC} = 3.0 MHz$	-	3.3	6.0	mA
Current Consumption(Halt)	$I_{DD(2)}$	$V_{DD}=5.0V$			3	uA

2). AC Characteristics

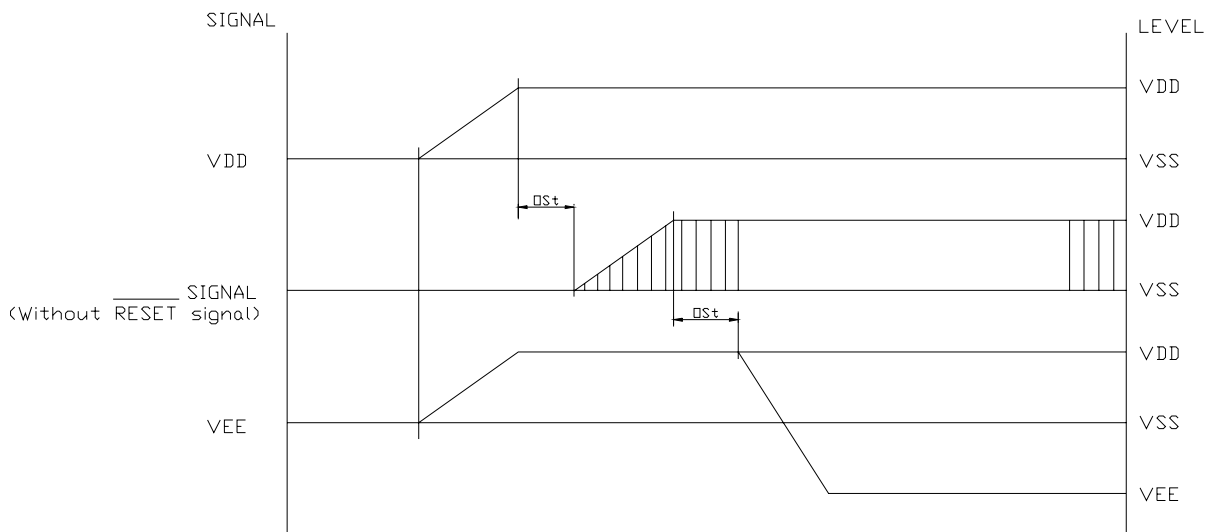
Parameter	Symbol	Min.	Max.	Units
C/D Setup Time	t_{CDS}	100	-	ns
C/D Hold Time	t_{CDH}	10	-	ns
CE, RD, WR Pulse Width	t_{CE}, t_{RD}, t_{WR}	80	-	ns
Data Setup Time	t_{DS}	80	-	ns
Data Hold Time	t_{DH}	40	-	ns
Access Time	t_{ACC}	-	150	ns
Output Hold Time	t_{OH}	10	50	ns

DEM 240128D SBH-PW-N (TOUCH) Product Specification

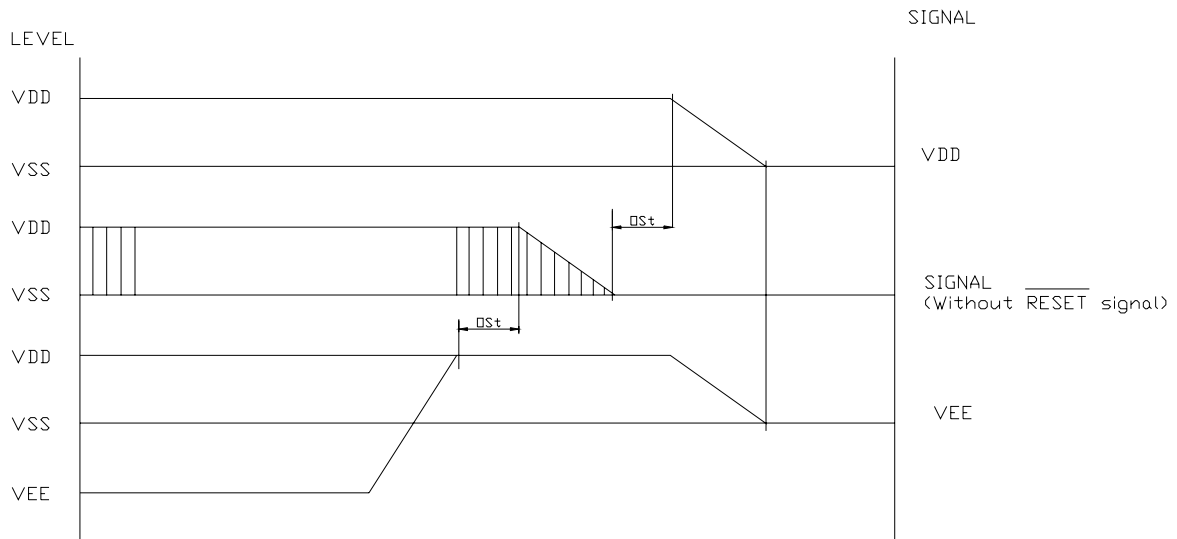


3). Power Supply ON/OFF Sequence

- ON Sequence

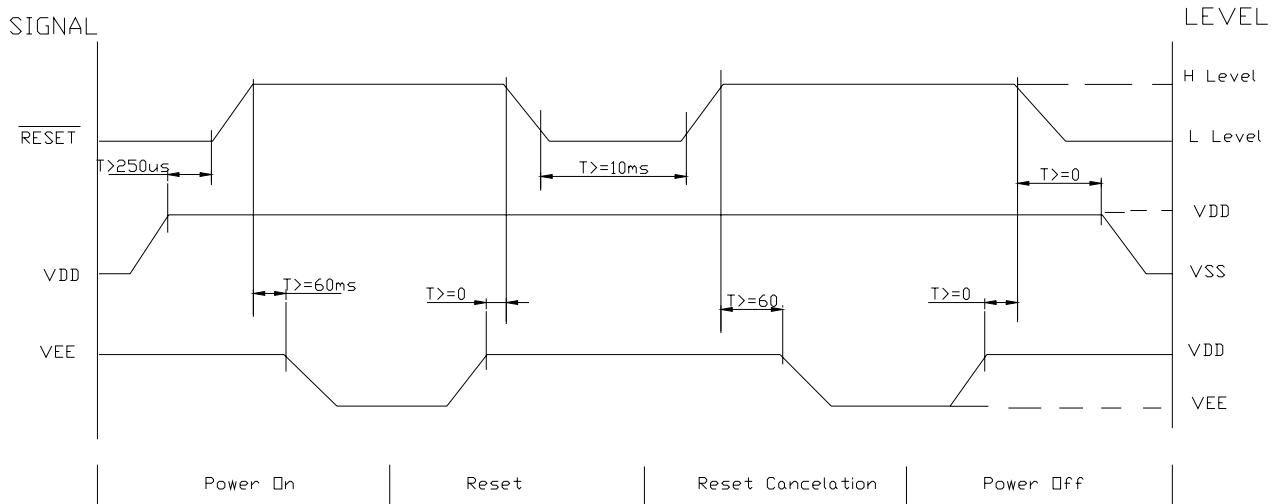


- OFF Sequence



DEM 240128D SBH-PW-N (TOUCH) Product Specification

● Reset Sequence



Please maintain the above sequence when turning on and off the power supply of the module.

If VEE is supplied to the module while internal alternate signal for LCD driving (M) is unstable or RESET is active, DC component will be supplied to the LCD panel. This may cause damage to the LCD module.

10. TOUCH PANEL SPECIFICATIONS

10.1 Electrical Characteristics of Digital Touch Panel

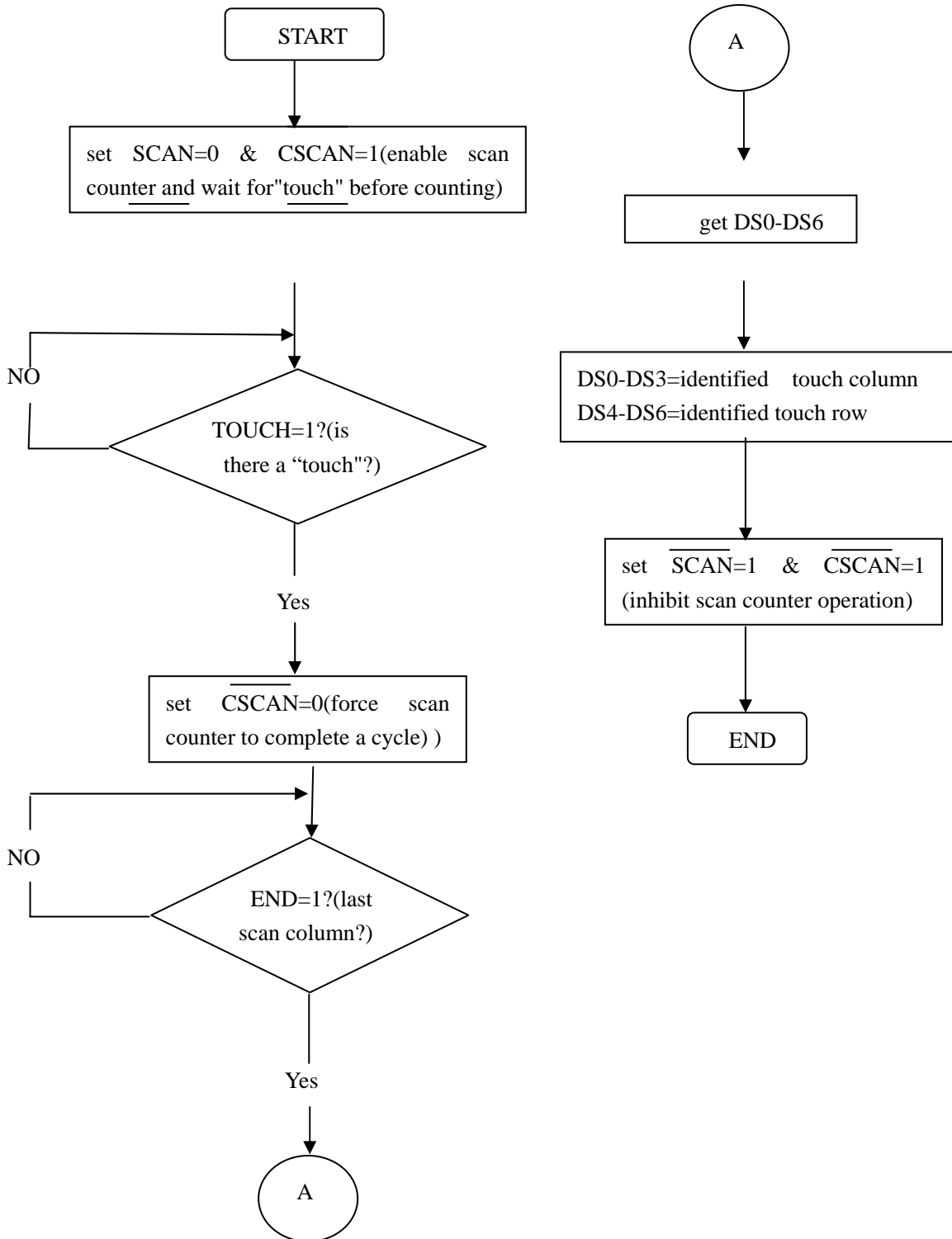
- 1). Max rating: DC. 10Volt, 1mA
- 2). Insulating resistance: More than 100meg-ohms at DC. 25 Volts.
- 3). Contact resistance: 20K Ohms or less.
- 4). Contact bounce: Less than 15 msec (*Input by finger).
- 5) Withstand voltage: Withstanding an applied voltage of AC. 25 Volts (50Hz, 0.5mA) each terminal for one minutes. Shall not be any mechanical or electrical failures.

10.2 Mechanical Characteristics of Digital Touch Panel

- 1). Activation force: 10~35 gf (Diagonal cross point except dot spacer).
- 2). Using by the silicon finger, hardness test with $\theta=60^\circ$ of R=10mm
- 3). Surface hardness: 2H (based on pencil hardness test with JIS K5400).
- 4). Total light transparency: 70% or more.
- 5). Transmission Haze: 6.0% (typical value).

DEM 240128D SBH-PW-N (TOUCH) Product Specification

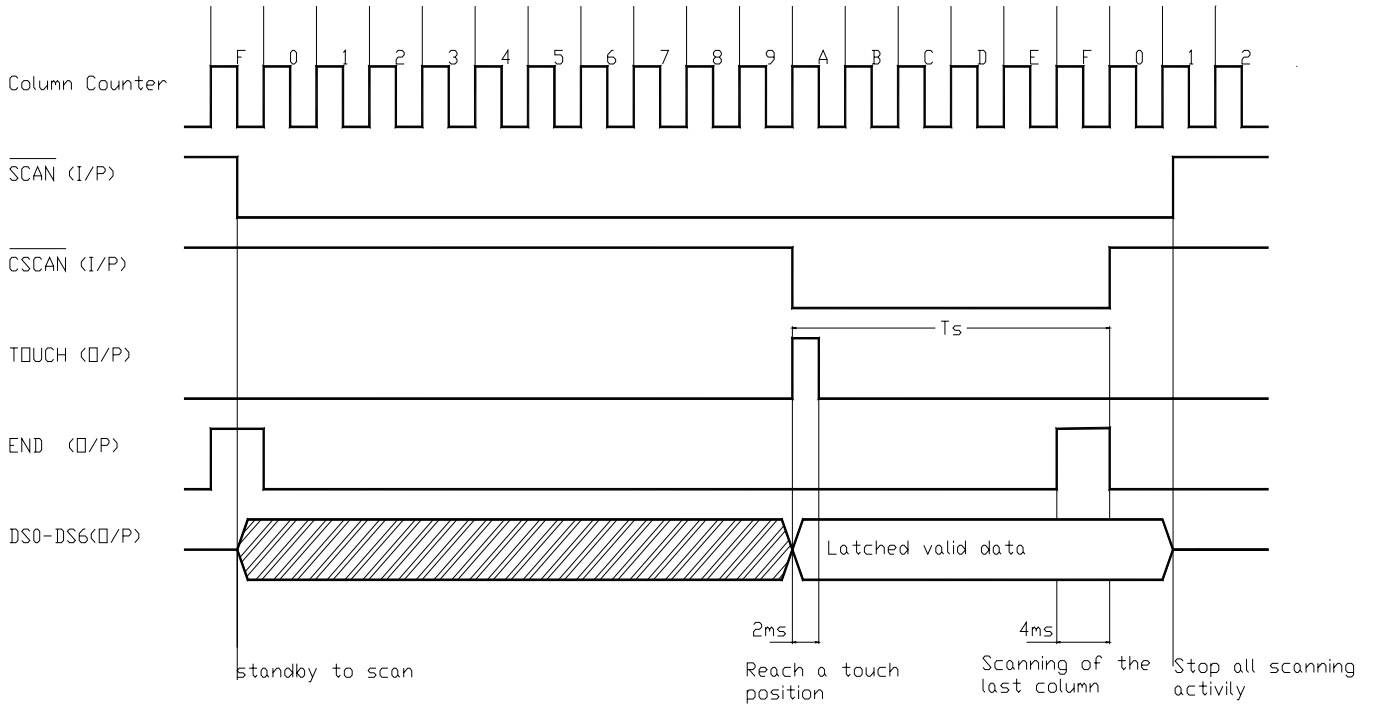
10.3 Flow Chart of Touch Panel Programming



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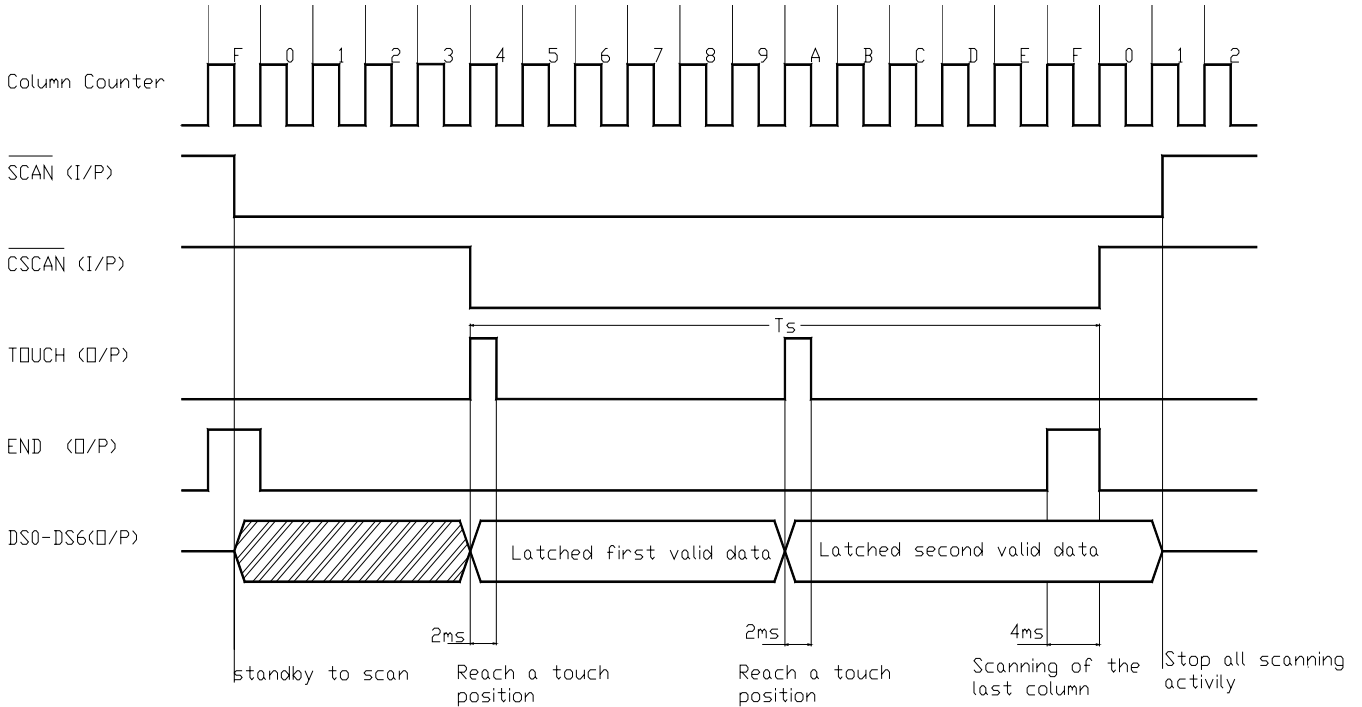
10.4 Timing Diagrams for Digital Touch Panel Auto-Scanning Mode

CASE1:Single key is pressed (column11-row4 is pressed)



- Remark: 1. Max. $T_s=64ms$ (dependent on which key is pressed)
 2. No. of TOUCH pulse=No. of key pressed at one time

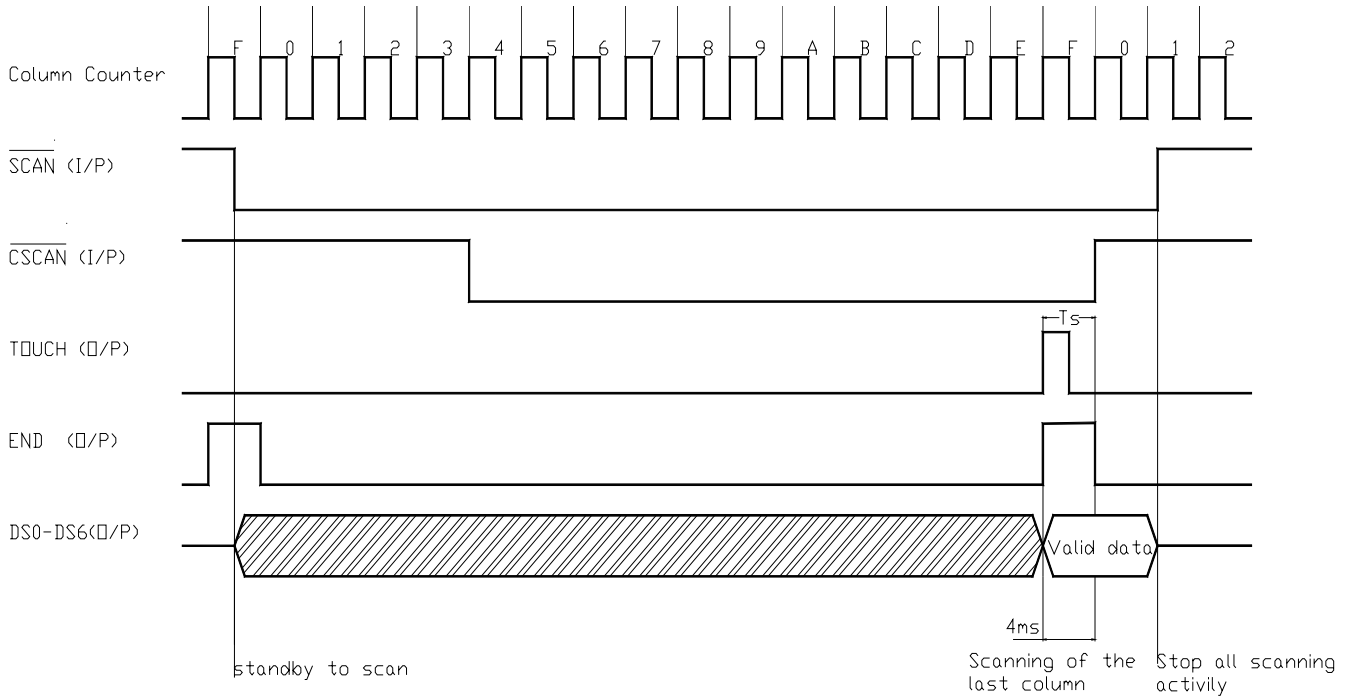
CASE2:Double keys are pressed (column5-rows4 and column11-rows4 are pressed)



- Remark: 1. Max. $T_s= 64ms$ (dependent on which key is pressed).
 2. No. of TOUCH pulse=No. of key pressed at one time.

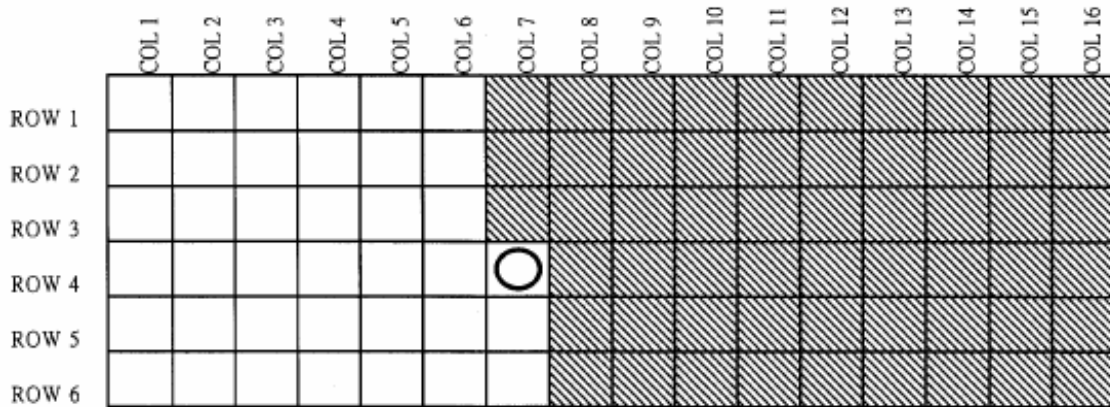
DEM 240128D SBH-PW-N (TOUCH) Product Specification

CASE3:last column key pressed (column 5-rows4 are pressed)



- Remark: 1. Max. $T_s = 64\text{ms}$ (dependent on which key is pressed).
 2. No. of TOUCH pulse = No. of key pressed at one time.

10.5 Multiple Touch Situation



Column on the Right have higher priority than column on the Left.

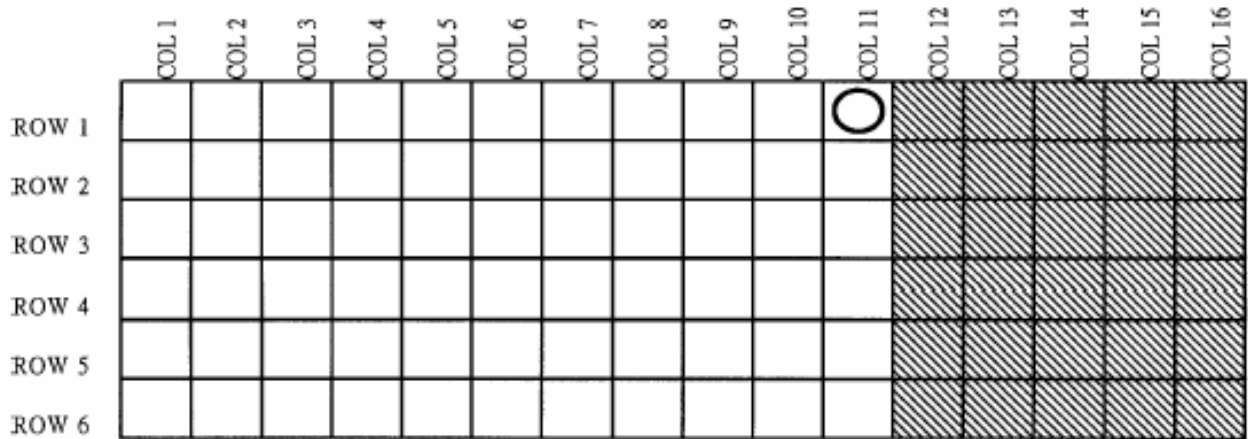
Row on the Upper have higher priority than row on the Lower.

Column have higher priority than Row.

The above demonstration is when you press column 7 - row 4 with another key at the same times, the keys inside gray area have higher priority than column 7 - row 4. However, when you press column 7 - row 4 with the key inside white area, column 7 - row 4 have higher priority.

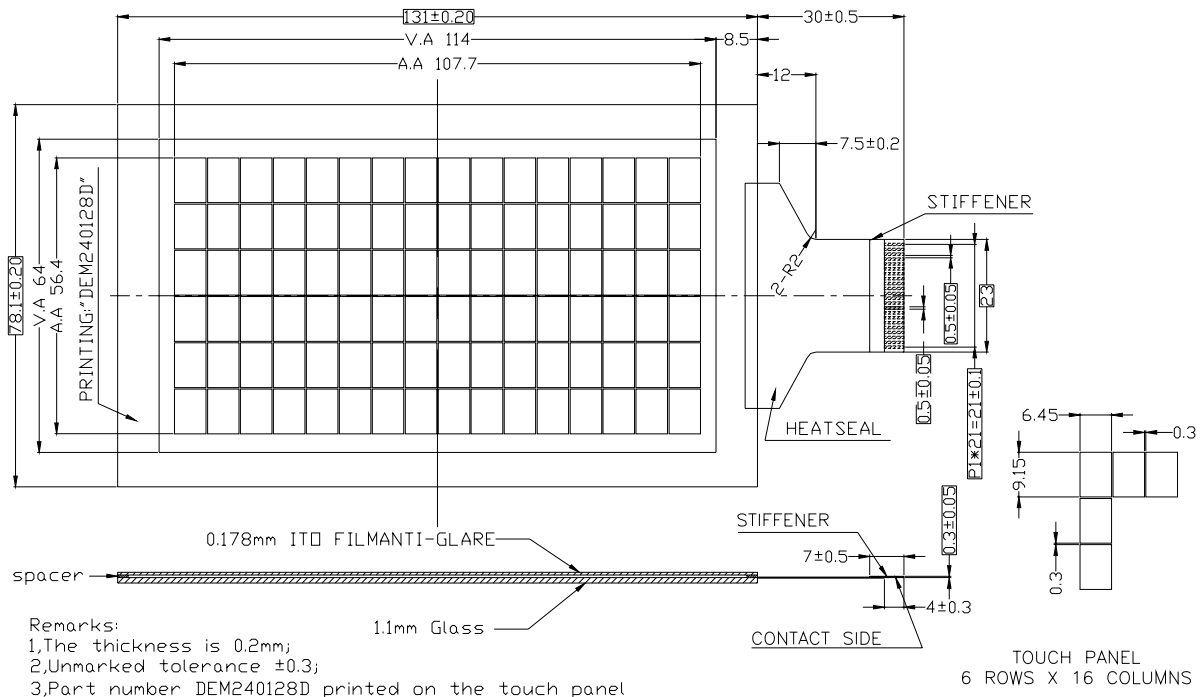
For example, if you press column 7 - row 4 with column 11 - row 2, the hardware will output column 11 - row 2. Another example, if you press column 7 - row 4 with column 3 - row 1, the hardware will output column 7 - row 4.

DEM 240128D SBH-PW-N (TOUCH) Product Specification



This is another example. When user press on column 11 - row 1 with another key at the same time. Gray area means have higher priority than column 11 - row 1.

10.6 Touch Panel Drawing



DEM 240128D SBH-PW-N (TOUCH) Product Specification

11. BACKLIGHT ELECTRICAL/OPTICAL SPECIFICATIONS

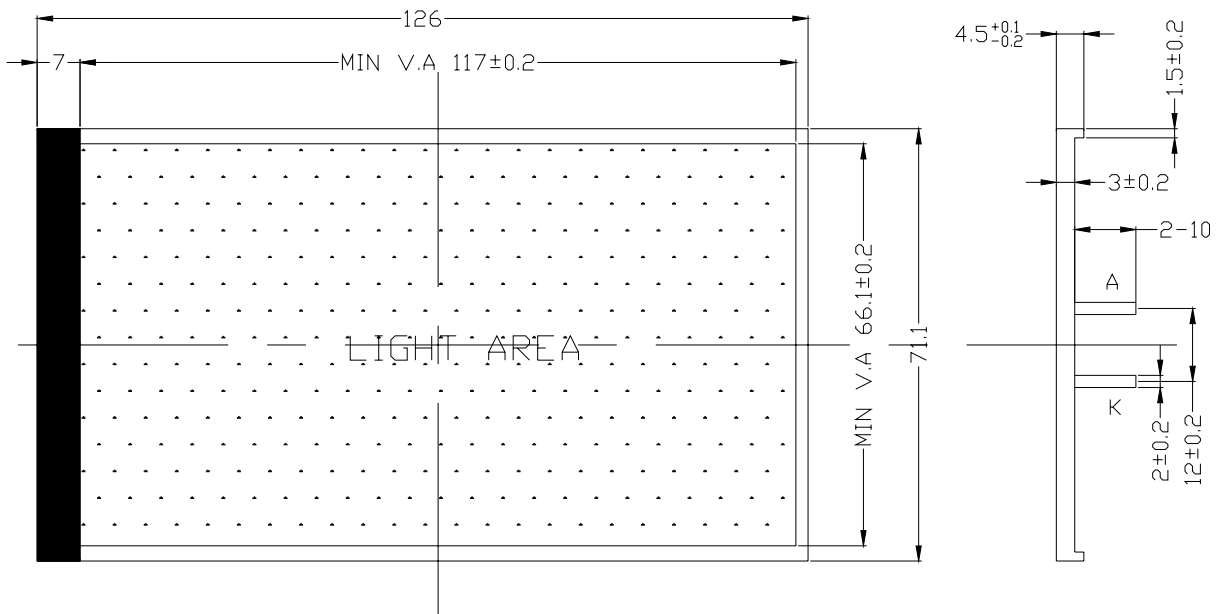
11.1 Absolute Maximum Ratings (Ta=25°C)

Item	Symbol	Conditions	Rating	Unit
Absolute Maximum Forward Current	Ifm		75	mA
Peak Forward Current	Ifp	1 msec Plus 10% Duty Cycle	120	mA
Reverse Voltage	Vr		1	V
Power Dissipation	Pd		225	mW

11.2 Backlight Electro/Optical Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Condition
Forward Voltage	Vf	2.9	3.2	3.4	V	If=45mA
Reverse Current	Ir		30		uA	Vr=0.8V
Peak Wave Length	λ_p				nm	
Spectral Line Half Width	$\Delta \lambda$				nm	
Luminance	Lv	60	90		cd/m ²	If=45mA
Backlight Color		White				

11.3 Backlight Drawing



UNLESS TOLERANCE ± 0.3
 THE COLOR IS WHITE
 THE MATERIAL IS LEAD-FREE

12. PRECAUTION FOR USING LCM

12.1 LIQUID CRYSTAL DISPLAY (LCD)

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

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

12.2 Liquid Crystal Display modules

12.2.1 Mechanical considerations

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

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

12.2.2. Static Electricity

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

- (1). The operator should be grounded whenever he/she comes into contact with the module. Never touch any of the conductive parts such as the LSI pads, the copper leads on the PCB and the interface terminals with any parts of the human body.
- (2). The modules should be kept in antistatic bags or other containers resistant to static for storage.
- (3). Only properly grounded soldering irons should be used.
- (4). If an electric screwdriver is used, it should be well grounded and shielded from commutator sparks.
- (5). The normal static prevention measures should be observed for work clothes and working benches; for the latter conductive (rubber) mat is recommended.
- (6). Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

12.2.3. Soldering

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

DEM 240128D SBH-PW-N (TOUCH) Product Specification

12.2.4 Operation

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

2.5 Storage

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

2.6 Limited Warranty

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

DEM 240128D SBH-PW-N (TOUCH) Product Specification

13. LCD MODULES HANDLING PRECAUTIONS

- Please remove the protection foil of polarizer before using.
- The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- If the display panel is damaged and the liquid crystal substance inside it leaks out, do not get any in your mouth. If the substance come into contact with your skin or clothes promptly wash it off using soap and water.
- Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarize carefully.
- To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
 - Be sure to ground the body when handling the LCD module.
 - Tools required for assembly, such as soldering irons, must be properly grounded.
 - To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
 - The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.
- Storage precautions
When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps. Keep the modules in bags designed to prevent static electricity charging under low temperature / normal humidity conditions (avoid high temperature / high humidity and low temperatures below 0°C). Whenever possible, the LCD modules should be stored in the same conditions in which they were shipped from our company.

14. OTHERS

- Liquid crystals solidify at low temperature (below the storage temperature range) leading to defective orientation of liquid crystal or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subjected to a strong shock at a low temperature.
- If the LCD modules have been operating for a long time showing the same display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. Abnormal operating status can be resumed to be normal condition by suspending use for some time. It should be noted that this phenomena does not adversely affect performance reliability.
- To minimize the performance degradation of the LCD modules resulting from caused by static electricity, etc. exercise care to avoid holding the following sections when handling the modules:
 - Exposed area of the printed circuit board
 - Terminal electrode sections

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