Display Elektronik GmbH

DATA SHEET

LCD MODULE

DEM 128128D SBH-PW-N

Product Specification **Version : 0**

DOCUMENT REVISION HISTORY

Version	DATE	DESCRIPTION	CHANGED BY
00	18.12.2009	First issue	MHO

CONTENTS

1. FUNCTIONS & FEATURES

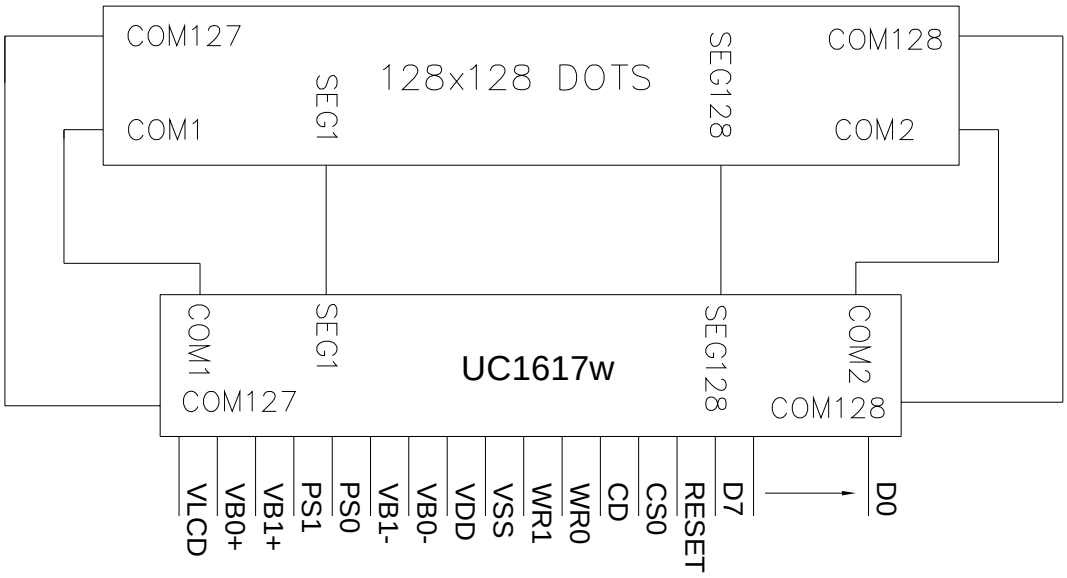
MODULE NAME	LCD TYPE
DEM 128128D SBH-PW-N	STN Negative Transmissive Blue Mode

- Format : COG, 128x128 Dots
- Viewing direction : 6 o'clock
- Driving scheme : 1/128 Duty cycle, 1/11 Bias
- Power supply voltage (V_{DD}) : 3.0 Volt (typ.)
- LCD driving voltage (VLCD) : 12.0V (typ.)
- Operation temp : -20°C to +70°C
- Storage temp : -30 to +85°C
- Backlight : LED, Lightguide, White

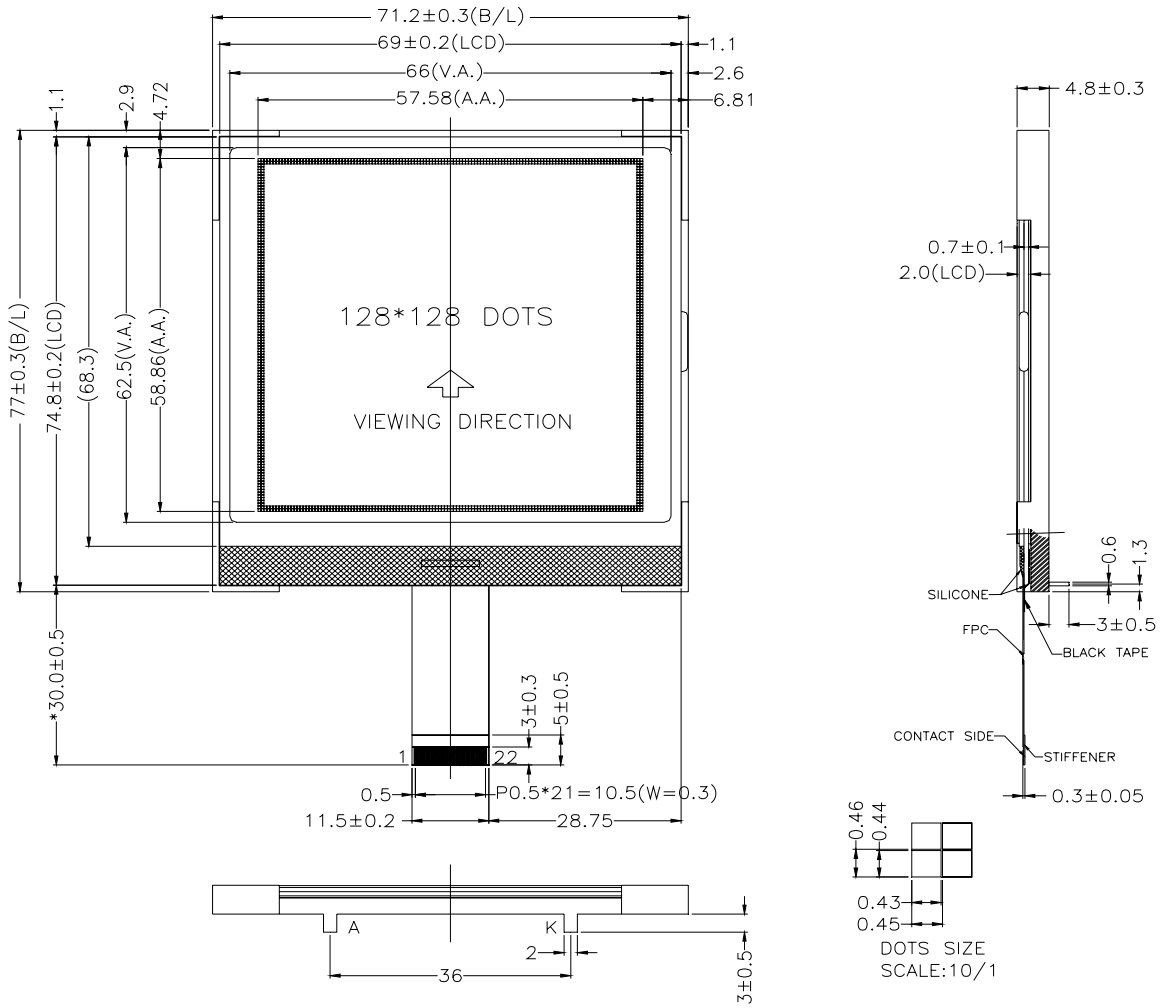
2. MECHANICAL SPECIFICATIONS

- Module size : 71.2 x 77.0 x 4.8 mm (without FPC)
- Viewing area : 66.0 x 62.5 mm
- Dot pitch : 0.45 x 0.46 mm
- Dot size : 0.43 x 0.44 mm
- Dot gap : 0.02 mm

3. BLOCK DIAGRAM



4. DIMENSIONAL OUTLINE



5. PIN DESCRIPTION

<table>
<tr><th>No.</th><th>Symbol</th><th></th></tr>
<tr><td>1</td><td>VLCD</td><td>High voltage LCD Power Supply</td></tr>
<tr><td>2,3,
6,7</td><td>VB0+,VB1+,
VB1-.VB0-</td><td>LCD Bias Voltages</td></tr>
<tr><td>4,5</td><td>PS1 ,PS0</td><td>Bus mode: The interface bus mode is determined by BM[1:0] and D[7:6] by the following relationship:
<table>
<tr><th>BM[1:0]</th><th>D[7:6]</th><th>Mode</th></tr>
<tr><td>11</td><td>Data</td><td>6800/8-bit</td></tr>
<tr><td>10</td><td>Data</td><td>8080/8-bit</td></tr>
<tr><td>01</td><td>11</td><td>2-wire I^2C</td></tr>
<tr><td>00</td><td>10</td><td>4-wire SPI w/ 8-bit token
(S8: conventional)</td></tr>
<tr><td>00</td><td>11</td><td>3-wire SPI w/ 8-bit token
(S8uc: Ultra-Compact)</td></tr>
</table></td></tr>
<tr><td>8</td><td>VDD</td><td>Power supply for logic(+3.3V)</td></tr>
<tr><td>9</td><td>VSS</td><td>Power ground(0V)</td></tr>
<tr><td>10,11</td><td>WR1,WR0</td><td>WR[1:0] controls the read/write operation of the host interface.</td></tr>
<tr><td>12</td><td>CD</td><td>Selects control data or display data for read/write operation
“L”: Control data; “H”: Display data</td></tr>
<tr><td>13</td><td>CS0</td><td>This is the chip select signal</td></tr>
<tr><td>14</td><td>RESET</td><td>The RESET signal</td></tr>
<tr><td>15~22</td><td>D7~D0</td><td>Parallel host interfaces.</td></tr>
</table>

6. MAXIMUM ABSOUTE LIMIT

Maximum Ratings (Voltage Reference to VSS)(for IC)

In accordance with IEC134, note 1 and 2.

Symbol	Parameter	Min.	Max.	Unit
V_{DD}	Logic Supply voltage	-0.3	+4.0	V
V_{DD2}	LCD Generator Supply voltage	-0.3	+4.0	V
V_{DD3}	Analog Circuit Supply voltage	-0.3	+4.0	V
$V_{DD2/3}$-V_{DD}	Voltage difference between V_{DD} and $V_{DD2/3}$	--	1.6	V
V_{LCD}	LCD Generated voltage (-30°C ~ +80°C)	-0.3	+19.8	V
V_{IN}	Digital input signal	-0.4	V_{DD} + 0.5	V
T_{OPR}	Operating temperature range	-30	+85	°C
T_{STR}	Storage temperature	-55	+125	°C

Notes

1. V_{DD} is based on V_{SS} = 0V
2. Stress beyond ranges listed above may cause permanent damages to the device.

7. ELECTRICAL CHARACTERISTICS

DC CHARACTERISTICS

DC CHARACTERISTICS

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{DD}	Supply for digital circuit		1.65		3.45	V
$V_{DD2/3}$	Supply for bias & pump		2.5		3.45	V
V_{LCD}	Charge pump output	$V_{DD2/3} \geq$ 2.6V, 25°C		14	15	V
V_D	LCD data voltage	$V_{DD2/3} \geq$ 2.6V, 25°C	0.89		1.78	V
V_{IL}	Input logic LOW				$0.2V_{DD}$	V
V_{IH}	Input logic HIGH		$0.8V_{DD}$			V
V_{OL}	Output logic LOW				$0.2V_{DD}$	V
V_{OH}	Output logic HIGH		$0.8V_{DD}$			V
I_{IL}	Input leakage current				1.5	µA
I_{SB}	Standby current	$V_{DD} = V_{DD2/3}$ = 3.3V, Temp = 85 °C			50	µA
C_{IN}	Input capacitance			5	10	pF
C_{OUT}	Output capacitance			5	10	pF
$R_{ON(SEG)}$	SEG output impedance	V_{LCD} = 15V		1.5	2.0	kΩ
$R_{ON(COM)}$	COM output impedance	V_{LCD} = 15V		1.5	2.0	kΩ
f_{LINE}	Average Line rate	LC[4:3] = 10b	-10%	21.1	+10%	kHz

POWER CONSUMPTION

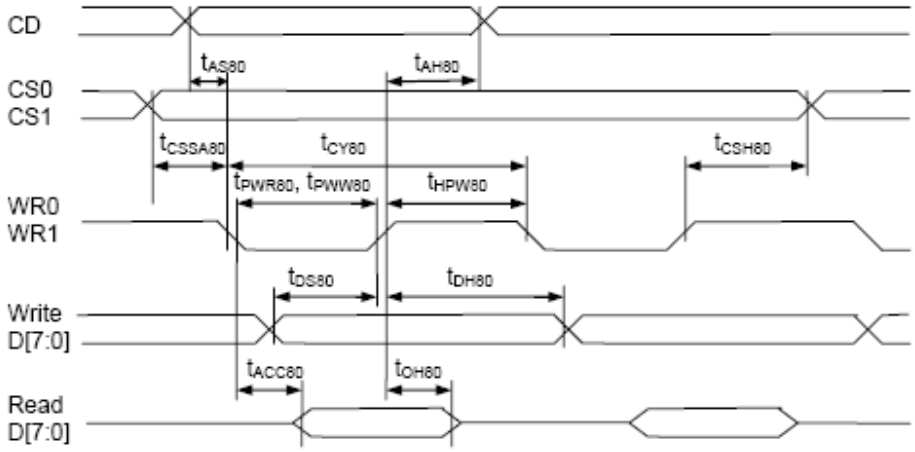
V_{DD} = 2.7V,
V_{LCD} = 14V,
Mux Rate = 128,
C_B = 2.2µF,
All HV outputs are open circuit.

Bias Ratio = 11,
Line Rate = 10b,
Bus mode = 6800,
Temperature = 25°C,

PM = 78,
Panel Loading (PC[1:0]) = 10b,
C_L = 330nF,
OTP=00H,

Display Pattern	Conditions	Typ. (µA)	Max. (µA)
All-OFF	Bus = idle	576	806
2-pixel checker	Bus = idle	704	986
-	Bus = idle (standby current)	-	5

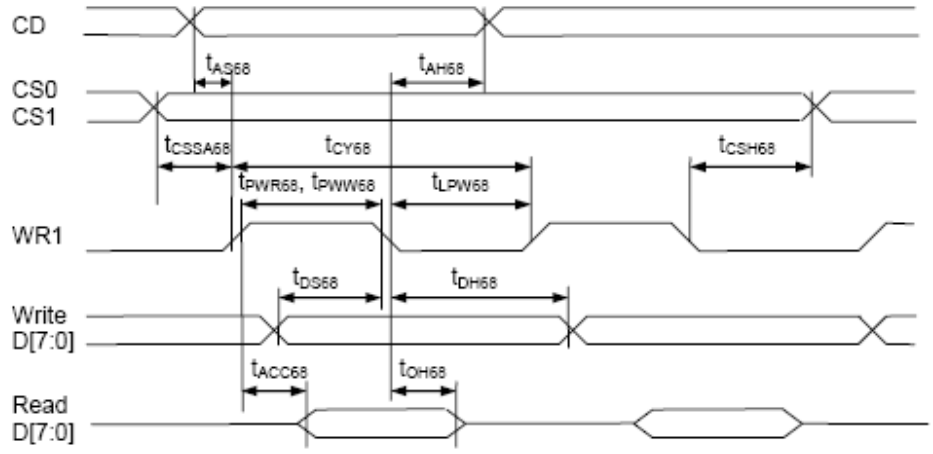
8. TIMING CHARACTERISTICS



Parallel Bus Timing Characteristics (for 8080 MCU)

($2.5V \leq V_{DD} < 3.3V$, Ta= –30 to +85°C)

Symbol	Signal	Description	Condition	Min.	Max.	Units
t_{AS80} t_{AH80}	CD	Address setup time Address hold time		0 0	–	nS
t_{CY80}		System cycle time (read) (write)		170 130	–	nS
t_{PWR80}	WR1	Pulse width (read)		85	–	nS
t_{PWW80}	WR0	Pulse width (write)		65	–	nS
t_{HPW80}	WR0, WR1	High pulse width (read) (write)		85 65	–	nS
t_{DS80} t_{DH80}	D0~D7	Data setup time Data hold time		30 0	–	nS
t_{ACC80} t_{OH80}		Read access time Output disable time	C_L = 100pF	– –	65 30	nS
t_{CSSA80} t_{CSH80}	CS1/CS0	Chip select setup time Chip select hold time		5 5		nS



Parallel Bus Timing Characteristics (for 6800 MCU)

($2.5V \leqslant V_{DD} < 3.3V$, Ta= –30 to +85°C)

Symbol	Signal	Description	Condition	Min.	Max.	Units
t_{AS68} t_{AH68}	CD	Address setup time Address hold time		0 0	–	nS
t_{CY68}		System cycle time (read) (write)		170 130	–	nS
t_{PWR68}	WR1	Pulse width (read)		85	–	nS
t_{PWW68}		Pulse width (write)		65	–	nS
t_{LPW68}		Low pulse width (read) (write)		85 65	–	nS
t_{DS68} t_{DH68}	D0~D7	Data setup time Data hold time		30 0	–	nS
t_{ACC68} t_{OH68}		Read access time Output disable time	C_L = 100pF	– –	70 30	nS
t_{CSSA68} t_{CSH68}	CS1/CS0	Chip select setup time Chip select hold time		5 5		nS

RESET TIMING

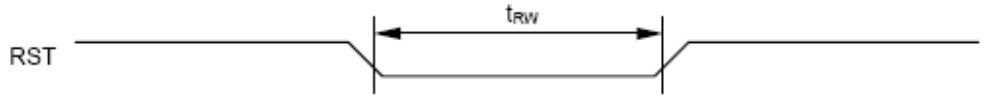


FIGURE 17: Reset Characteristics

($1.65V \leqslant V_{DD} < 3.3V$, Ta= –30 to +85°C)

Symbol	Signal	Description	Condition	Min.	Max.	Units
t_{RW}	RST	Reset low pulse width		3	–	µS
t_{RD}	RST, WR	Reset to WR pulse delay		10	–	mS

9. CONTROL AND DISPLAY INSTRUCTION

The following is a list of host commands supported by UC1617w

C/D: 0: Control, 1: Data
W/R: 0: Write Cycle, 1: Read Cycle

\# Useful Data bits
– Don't Care

	Command	C/D	W/R	D7	D6	D5	D4	D3	D2	D1	D0	Action	Default
1	Write Data Byte	1	0	#	#	#	#	#	#	#	#	Write 1 byte	N/A
2	Read Data Byte	1	1	#	#	#	#	#	#	#	#	Read 1 byte	N/A
3	Get Status	0	1	1	MX	MY	WA	DE	WS	MD	MS	Get {Status, Ver, PMO, Product Code, PID, MID}	N/A
				Ver		PMO[5:0]							
				Product Code				PID		MID			
4	Set Page_C Address	0	0	0	0	0	#	#	#	#	#	Set CA[4:0]	0H
5	Set Temp. Compensation	0	0	0	0	1	0	0	1	#	#	Set TC[1:0]	00b
6	Set Panel Loading	0	0	0	0	1	0	1	0	#	#	Set PC[1:0]	10b
7	Set Pump Control	0	0	0	0	1	0	1	1	#	#	Set PC[3:2]	11b
8	Set Adv. Program Control (double-byte command)	0	0	0	0	1	1	0	0	R	R	Set APC[R][7:0], R = 0, 1 or 2	N/A
		0	0	#	#	#	#	#	#	#	#		
9	Set Scroll Line LSB	0	0	0	1	0	0	#	#	#	#	Set SL[3:0]	0H
	Set Scroll Line MSB	0	0	0	1	0	1	-	#	#	#	Set SL[6:4]	0H
10	Set Row Address LSB	0	0	0	1	1	0	#	#	#	#	Set RA[3:0]	00H
	Set Row Address MSB	0	0	0	1	1	1	-	#	#	#	Set RA[6:4]	00H
11	Set V_{BIAS} Potentiometer (double-byte command)	0 0	0 0	1 #	0 #	0 #	0 #	0 #	0 #	0 #	1 #	Set PM[7:0]	4EH
12	Set Partial Display Control	0	0	1	0	0	0	0	1	#	#	Set LC[9:8]	00b: Disable
13	Set RAM Address Control	0	0	1	0	0	0	1	#	#	#	Set AC[2:0]	001b
14	Set Fixed Lines	0	0	1 #	0 #	0 #	1 #	0 #	0 #	0 #	0 #	Set {FLT, FLB}	0
15	Set Line Rate	0	0	1	0	1	0	0	0	#	#	Set LC[4:3]	00b
16	Set All-Pixel-ON	0	0	1	0	1	0	0	1	0	#	Set DC[1]	0b
17	Set Inverse Display	0	0	1	0	1	0	0	1	1	#	Set DC[0]	0b
18	Set Display Enable	0	0	1	0	1	0	1	1	#	#	Set DC[3:2]	10b
19	Set LCD Mapping Control	0	0	1	1	0	0	0	#	#	#	Set LC[2:0]	000b
20	Set N-Line Inversion	0	0	1 -	1 -	0 -	0 -	1 #	0 #	0 #	0 #	Set NIV[3:0]	6H
21	Set LCD Gray Shade	0	0	1	1	0	1	0	#	#	#	Set LC[7:5]	001b
22	System Reset	0	0	1	1	1	0	0	0	1	0	System Reset	N/A
23	NOP	0	0	1	1	1	0	0	0	1	1	No operation	N/A
24	Set Test Control (double-byte command)	0	0	1	1	1	0	0	1	TT		For testing only. Do not use.	N/A
		0	0	#	#	#	#	#	#	#	#		
25	Set LCD Bias Ratio	0	0	1	1	1	0	1	0	#	#	Set BR[1:0]	11b: 11
26	Reset Cursor Update Mode	0	0	1	1	1	0	1	1	1	0	AC[3]=0, CA=CR	AC[3]=0
27	Set Cursor Update Mode	0	0	1	1	1	0	1	1	1	1	AC[3]=1, CR=CA	AC[3]=1
28	Set COM End	0 0	0 0	1 -	1 #	1 #	1 #	0 #	0 #	0 #	1 #	Set CEN[6:0]	127
29	Set Partial Display Start	0 0	0 0	1 -	1 #	1 #	1 #	0 #	0 #	1 #	0 #	Set DST[6:0]	0
30	Set Partial Display End	0 0	0 0	1 -	1 #	1 #	1 #	0 #	0 #	1 #	1 #	Set DEN[6:0]	127

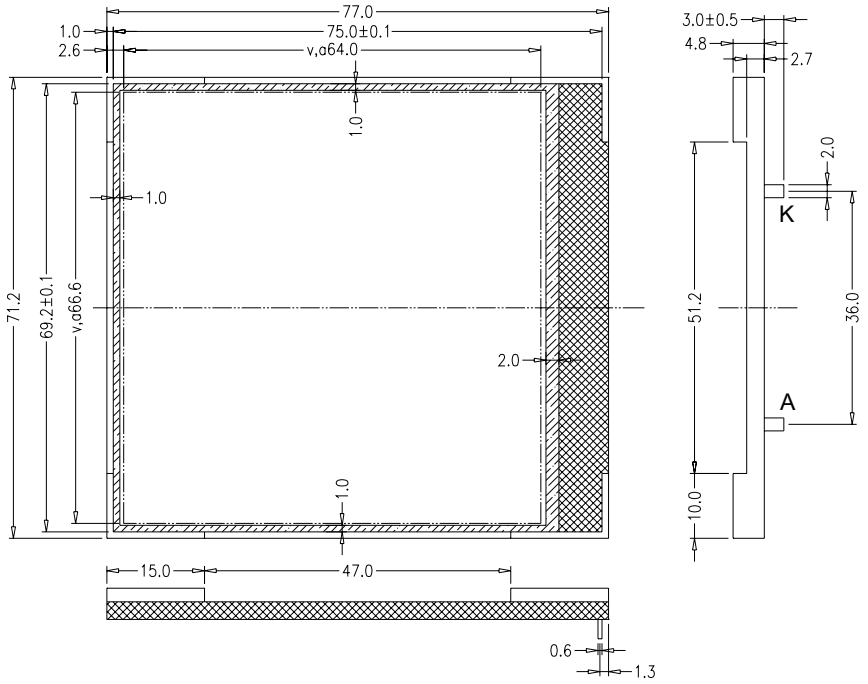
	Command	C/D	W/R	D7	D6	D5	D4	D3	D2	D1	D0	Action		Default
31	Set Window Program Starting Page_C Address	0 0	0 0	1 -	1 -	1 -	1 #	0 #	1 #	0 #	0 #	Shared with MTP commands	Set WPC0	0
32	Set Window Programming Starting Row Address	0 0	0 0	1 -	1 #	1 #	1 #	0 #	1 #	0 #	1 #		Set WPP0	0
33	Set Window Programming Ending Page_C Address	0 0	0 0	1 -	1 -	1 -	1 #	0 #	1 #	1 #	0 #		Set WPC1	31
34	Set Window Programming Ending Row Address	0 0	0 0	1 -	1 #	1 #	1 #	0 #	1 #	1 #	1 #		Set WPP1	127
35	Enable window program	0	0	1	1	1	1	1	0	0	#	Set AC[4]		0: Disable
36	Set MTP Operation control	0 0	0 0	1 -	0 -	1 #	1 #	1 #	0 #	0 #	0 #	Set MTPC[5:0]		10H
37	Set MTP Write Mask	0 0	0 0	1 #	0 #	1 #	1 #	1 #	0 #	0 #	1 #	Set MTPM[7:0]		0
38	Set V_{MTP1} Potentiometer	0 0	0 0	1 #	1 #	1 #	1 #	0 #	1 #	0 #	0 #	Shared with Window Program commands	Set MTP1	N/A
39	Set V_{MTP2} Potentiometer	0 0	0 0	1 #	1 #	1 #	1 #	0 #	1 #	0 #	1 #		Set MTP2	
40	Set MTP Write Timer	0 0	0 0	1 #	1 #	1 #	1 #	0 #	1 #	1 #	0 #		Set MTP3	
41	Set MTP Read Timer	0 0	0 0	1 #	1 #	1 #	1 #	0 #	1 #	1 #	1 #		Set MTP4	

Notes:

- Any bit patterns other than the commands listed above may result in undefined behavior.
- The interpretation of commands (37)~(41) depends on register MTPC[3].
- Commands (38)~(41) are shared with commands (31)~(34) and have exactly the same code.
  When MTPC[3]=0, commands (38)~(41) are interpreted as `Window Programming` commands.
  When MTPC[3]=1, they are the `MTP Control` commands.
- MTPM and PM are actually the same register. Only one of the commands (37 or 11) is valid at any time, and it is determined by MTPC[3].
- After MTP-ERASE or MTP-PROGRAM operation, before resuming normal operation, please always
  a) Remove TST4 power source,
  b) Do a full V_{DD} ON-OFF-ON cycle.

10. BACK LIGHT CHARACTERISTICS

LCD Module with Edge white LED Backlight



ELECTRICAL RATINGS. Ta = 25°C

Item	Symbol	Condition	Min	Typ.	Max	Unit
Forward Volatge	VF	IF=60mA	3.3	3.5	3.7	V
Reverse Current	IR	VR=0.8V	---	30	---	mA
Luminous Intensity(Without LCD)	Lv	IF=60mA	---	---	---	cd/m2
Color coordinates		IF=60mA	X=0.26 Y=0.26	---	X=0.30 Y=0.30	
Color	white					

Note:

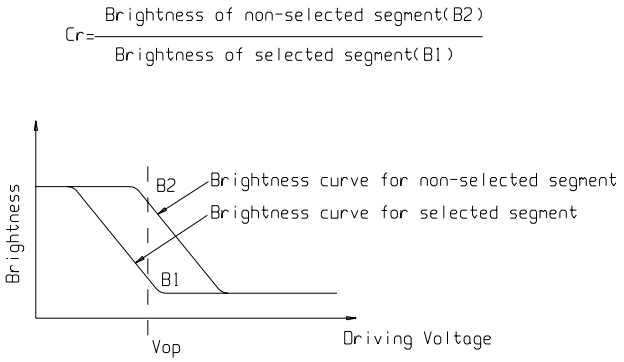
when the temperature exceed 25°C, the approved current decrease rate for Backlight change as the temperature increase is: -0.36x6mA/°C (below 25°C, the current refer to constant, which would not change with temperature).

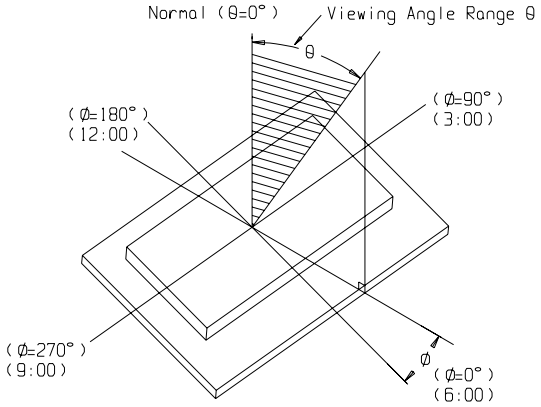
11. ELECTRO-OPTICAL CHARACTERISTICS

(V_{DD} = 3.0V, Ta = 25°C)

Item	Symbol	Condition	Min	Typ.	Max	Unit
Operating Voltage for LCD	Vop	Ta =-20°C	12.3	12.5	12.8	V
		Ta = 25°C	11.7	12.0	12.3	
		Ta = 70°C	11.2	11.5	11.8	
Response time	Tr	Ta = 25°C	---	250	500	ms
	Tf		---	300	600	ms
Contrast	Cr	Ta = 25°C	2	4	---	---
Viewing angle range	θ	Cr≥2	-35	---	+35	deg
	Φ		-35	---	+40	deg

The following charts is for your reference of the data in the above form.





12. PRECAUTION FOR USING LCD/LCM

After reliability test, recovery time should be 24 hours minimum. Moreover, functions, performance and appearance shall be free from remarkable deterioration within 50,000 hours(average) under ordinary operating and storage conditions room temperature (20±8°C), normal humidity (below 65% RH), and in the area not exposed to direct sun light. Using LCM beyond these conditions will shorten the life time.

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 isoproply alcohol, ethyl alcohol or trichlorotriflorothane, 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 made any modification on the PCB without consulting AV.
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: 350°C±10°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 Vo.
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 DISPLAY's 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.