



MULTI-INNO TECHNOLOGY CO., LTD.

LCD MODULE SPECIFICATION

Model : MI128128OK

Revision	
Engineering	
Date	
Our Reference	



DOCUMENT REVISION HISTORY

DOCUMENT REVISION FROM TO	DATE	DESCRIPTION	CHANGED BY	CHECKED BY
A	2007.03.26	First Release.	ZHANG YAN FANG	MOON WU



CONTENTS

	<u>Page No.</u>
1. GENERAL DESCRIPTION	4
2. MECHANICAL SPECIFICATIONS	4
3. INTERFACE SIGNALS	7
4. ABSOLUTE MAXIMUM RATINGS	8
4.1. ELECTRICAL MAXIMUM RATINGS FOR IC ONLY	8
4.2. ENVIRONMENTAL CONDITIONS	8
5. ELECTRICAL SPECIFICATIONS	9
5.1 TYPICAL ELECTRICAL CHARACTERISTICS	9
5.2 TIMING CHARACTERISTICS	9
5.3 POWER UP/DOWN SEQUENCE	11
6. ELECTRICAL & OPTICAL CHARACTERISTICS	13
6.1 OPTICAL CHARACTERISTICS	13
7. REMARK	14
8. LCD COSMETIC CONDITIONS	15



**Preliminary Specification
of
LCD Module Type
Model No.: MI128128OK**

1. General Description

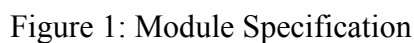
- 1.44" color STN, 128 x RGB x 128 dots, 65K, Negative, Transmissive, dot matrix LCD module.
- Driving scheme: 1/128 duty, 1/12 bias.
- Viewing angle: 6 O'clock.
- 'ULTRACHIP' UC1697V (COG) CSTN LCD Controller/Driver or equivalent.
- FPC connection.
- Normally white.
- Low power.
- Thin thickness.
- White LED backlight.
- "RoHS" compliance.

2. Mechanical Specifications

The mechanical detail is shown in Fig.1 and summarized in Table 1 below.

Table 1

Parameter		Specifications	Unit
Outline dimensions		33.80(W) x 48.60(H) x 3.1 (D) (Include FPC and component area & backlight.)	mm
Color STN 128 x RGB x 128	Viewing area	28.10(W) x 28.20 (H)	mm
	Active area	25.49(W) x 26.49(H)	mm
	Display format	128 x RGB x 128	dots
	Color configuration	RGB stripe	-
	Dot size	0.1892 (RGB)(W) x 0.197 (H)	mm
	Dot spacing	0.01 (W) x 0.01 (H)	mm
	Dot pitch	0.1992(RGB)(W) x 0.207(H)	mm
Weight		Approx. TBD	gram



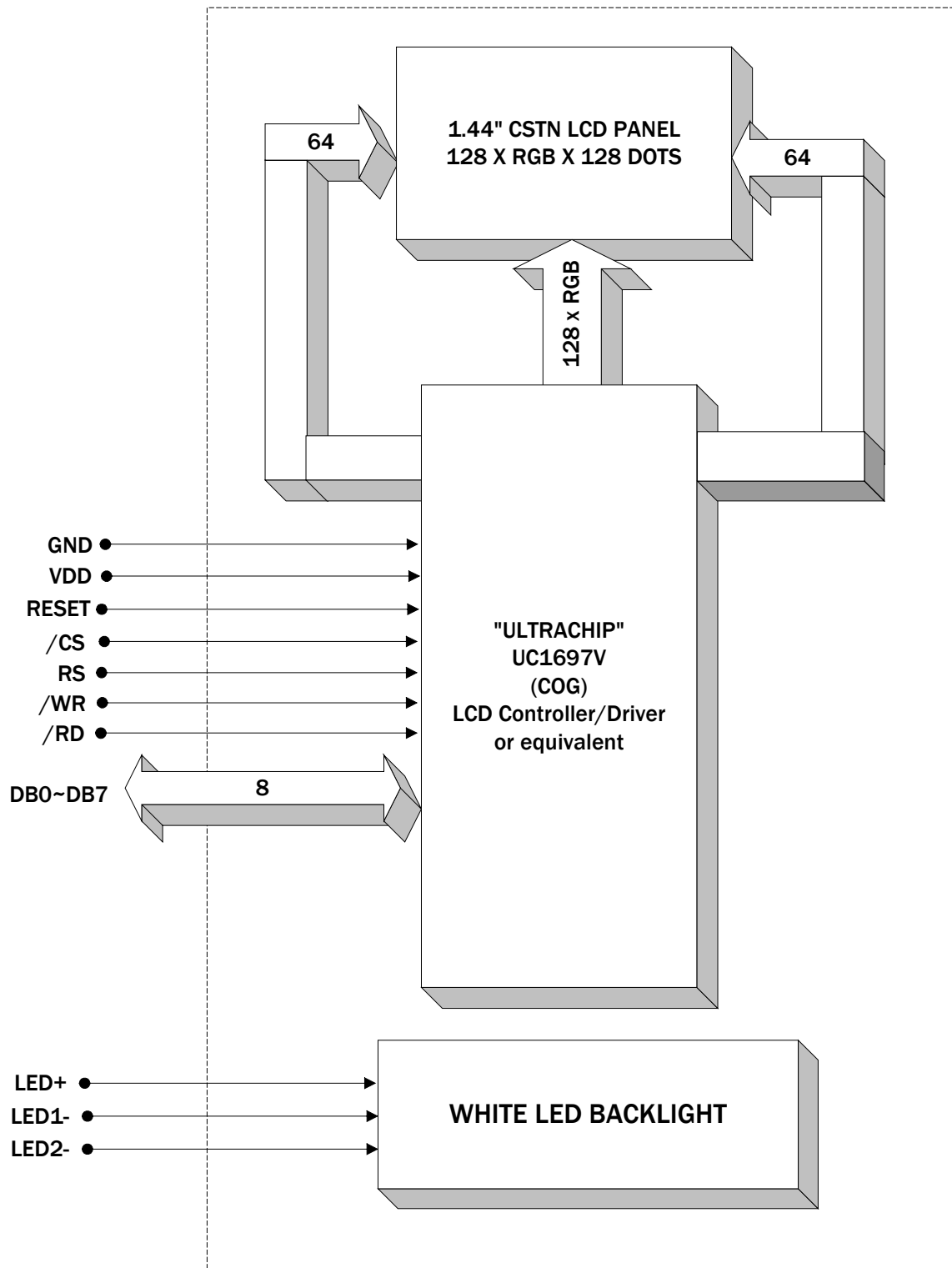


Figure 2: Block Diagram.



3. Interface signals

Table 2

Pin No.	Symbol	Description
1	GND	Ground.
2	VDD	Power supply.
3	OTPD	No connection.
4	OTPG	No connection.
5	RESET	When RST="L", all control registers are re-initialized by their default states. An RC Filter has been included on-chip. There is no need for external RC noise filter. When RST is not used, connect the pin to VDD.
6	RS (CD)	Select Control data or Display data for read/write operation. Connect CD to GND when not used. "L": Control data "H": Display data.
7	/WR (WR0)	WR0 controls the write operation of the host interface.
8	/RD (WR1)	WR1 controls the read operation of the host interface.
9	DB0	Data bus.
10	DB1	
11	DB2	
12	DB3	
13	DB4	
14	DB5	
15	DB6	
16	DB7	
17	/CS	Chip Select. Chip is selected when CS1= "H" and CS0 = "L". When the chip is not selected, DB[7:0] will be high impedance.
18	GND	Ground.
19	LED+	Anode of backlight input.
20	LED2-	Cathode of backlight input.
21	LED1-	Cathode of backlight input.
22	GND	Ground.



4. Absolute Maximum Ratings

4.1 Electrical Maximum Ratings for IC Only

Table 3

Parameter	Symbol	Min.	Max.	Unit
Supply Voltage range	VDD	-0.3	+4.0	V
	VDD2	-0.3	+4.0	V
	VDD3	-0.3	+4.0	V
Voltage difference between VDD and VDD2/3	VDD2/3-VDD	-	1.6	V
LCD Driving voltage	VLCD	-0.3	+19.8	V
Input voltage range	Vin	-0.4	VDD+0.5	V

Note: The modules may be destroyed if they are used beyond the absolute maximum ratings.

All voltage values are referenced to GND = 0V.

4.2 Environmental Conditions

Table 4

Item	Operating temperature (Topr)		Storage temperature (Tstg) (Note 1)		Remark
	Min.	Max.	Min.	Max.	
Ambient temperature (Ta)	-20°C	+70°C	-30°C	+80°C	Dry
Humidity (Note 1)	90% max. RH for Ta ≤ 40°C < 50% RH for 40°C < Ta ≤ Maximum operating temperature				No condensation
Vibration (IEC 68-2-6) cells must be mounted on a suitable connector	Frequency: 10 ~ 55 Hz Amplitude: 0.75 mm Duration: 20 cycles in each direction.				3 directions
Shock (IEC 68-2-27) Half-sine pulse shape	Pulse duration: 11 ms Peak acceleration: 981 m/s ² = 100g Number of shocks: 3 shocks in 3 mutually perpendicular axes.				3 directions

Note 1: Product cannot sustain at extreme storage conditions for long time.

5. Electrical Specifications

5.1 Typical Electrical Characteristics

At Ta = 25 °C, VDD = 2.8V, GND=0V.

Table 5

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply voltage (logic)	VDD-GND		-	2.8	-	V
Supply voltage (LCD)	VLCD	At Ta = -20 °C, VDD=3.0V, Note 1	-	TBD	-	V
		At Ta =25 °C, VDD=3.0V,Note 1	-	TBD	-	V
		At Ta =70 °C, VDD=3.0V, Note 1	-	TBD	-	V
Input signal voltage	V _{IH}	“H” level	0.8VDD	-	-	V
	V _{IL}	“L” level	-	-	0.2VDD	V
Supply Current (Logic & LCD)	IDD		-	TBD	-	mA
Supply voltage of white LED backlight	VLED	Forward current =15 x 2 =30mA	3.0	3.2	3.4	V
Luminance of backlight (on the backlight surface)		Number of LED dies=2	3200	-	-	cd/m ²

Note (1): There is tolerance in optimum LCD driving voltage during production and it will be within the specified range.

5.2 Timing Characteristics

5.2.1 Reset Timing

At Ta = -20 °C To +70°C, VDD = 2.8V, GND=0V.

Table 6

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

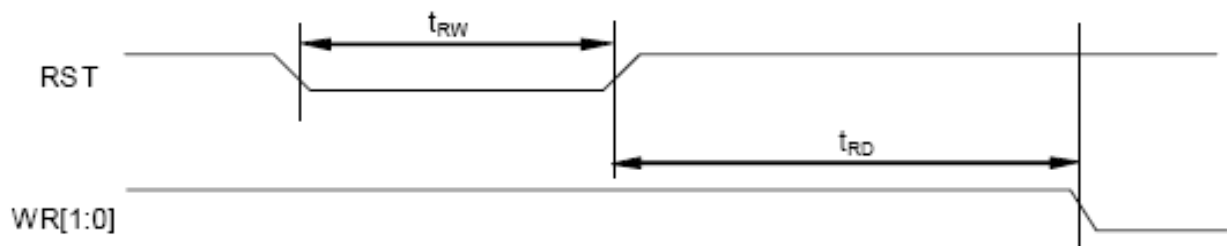


Figure 3:Reset Timing

5.2.2 Read / Write Characteristics (8080-series MPU)

At $T_a = -20\text{ }^{\circ}\text{C}$ $T_o = 70\text{ }^{\circ}\text{C}$, $V_{DD} = 2.8\text{V}$, $GND=0\text{V}$.

Table 7

Symbol	Signal	Description	Condition	Min.	Max.	Units
t _{AS80}	CD	Address setup time		0	–	nS
t _{AH80}		Address hold time		0		
t _{CY80}		System cycle time			–	nS
		16-bit bus (read)		170		
		(write)		130		
		8-bit bus (read)		100		
		(write)		80		
t _{PWR80}	WR1	Pulse width 16-bit (read)		85	–	nS
		8-bit		50		
t _{PWW80}	WR0	Pulse width 16-bit (write)		65	–	nS
		8-bit		40		
t _{HPW80}	WR0, WR1	High pulse width			–	nS
		16-bit bus (read)		85		
		(write)		65		
		8-bit bus (read)		50		
		(write)		40		
t _{DS80}	D0~D15	Data setup time		30	–	nS
t _{DH80}		Data hold time		0		
t _{ACC80}		Read access time	C _L = 100pF	–	60	nS
t _{OD80}		Output disable time		15	30	
t _{CSSA80}	CS1/CS0	Chip select setup time		0		nS
t _{CSH80}				0		

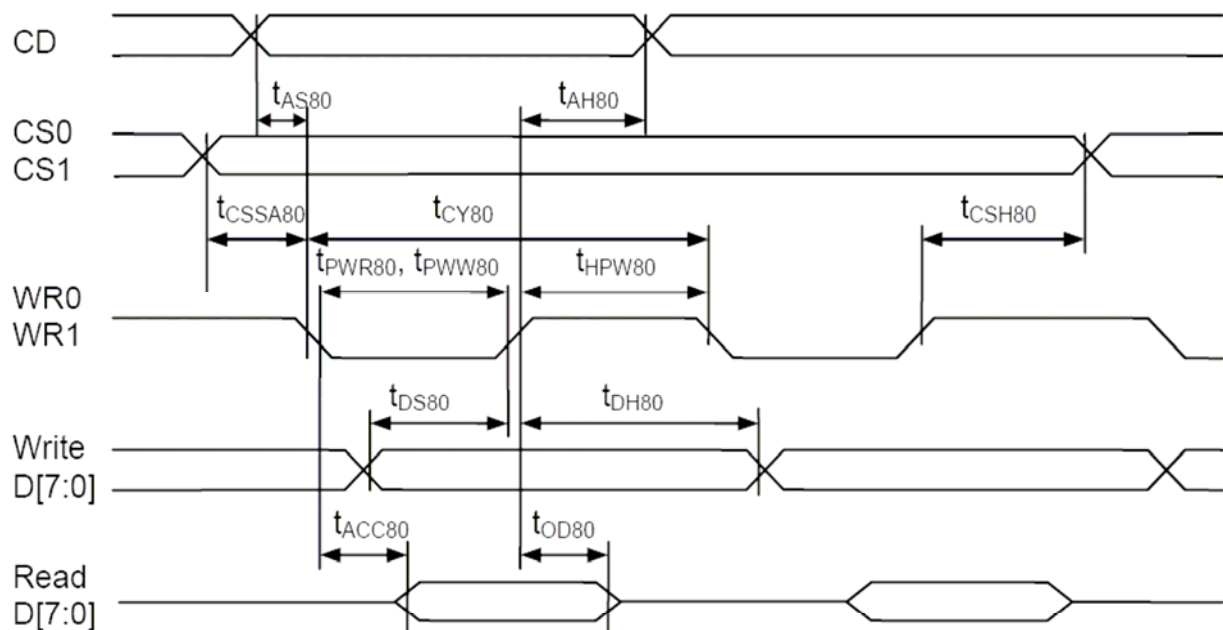


Figure 4: Parallel Bus Timing Characteristics (for 8080 MCU)

5.3 Power up/down sequence

1) Power -up sequence

UC1697V power-up sequence is simplified by built-in “Power Ready” flags and the automatic invocation of System-Reset command after Power-ON-Reset.

System programmers are only required to wait 150 ms before the CPU starting to issue commands to UC1697v. No additional time sequences are required between enabling the charge pump, turning on the display drivers, writing to RAM or any other commands.

However, while turning on VDD, VDD2/3 should be started not later than VDD.

Delay allowance between VDD and VDD2/3 is illustrated as Figure 6.

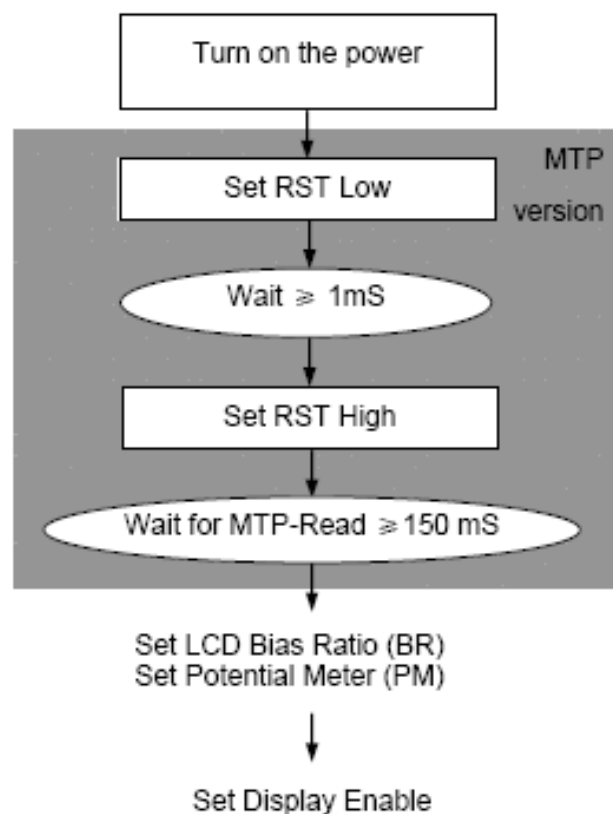


Figure 5: Reference Power-Up Sequence

2) Power -down sequence

To prevent the charge stored in capacitors CBX and CL from damaging the LCD, when VDD is switched off, use Reset mode to enable the built-in draining circuit and discharge these capacitors.

The draining resistor is 10 K Ω for both VLCD and VB+. It is recommended to wait 3 x RC for VLCD and 1.5 x RC for VB. For example, if CL is 0.1 μ F, then the draining time required for VLCD is ~3 mS.

When internal VLCD is not used, UC1697v will NOT drain VLCD during RESET. System designers need to make sure external VLCD source is properly drained off before turning off VDD.

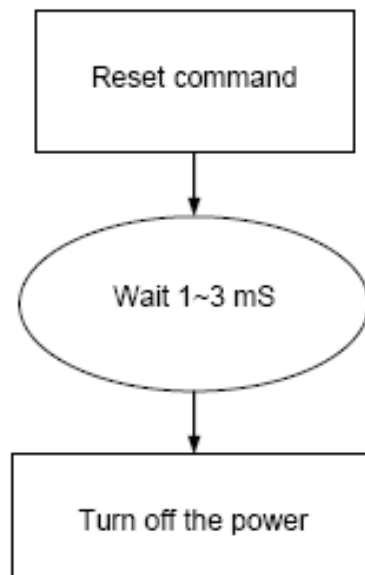


Figure 6: Reference Power-Down Sequence

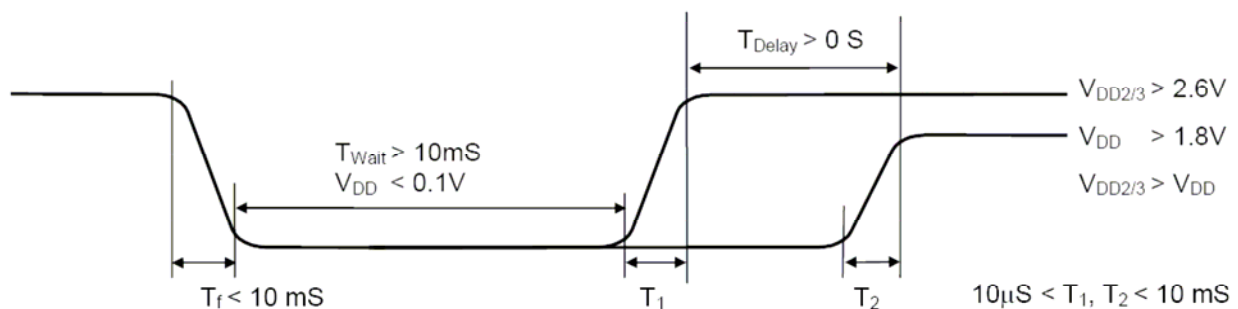


Figure 7: Delay allowance and Power Off-On Sequence

6. Electrical & Optical Characteristics

Table 8

Item	Symbol	Condition		Min.	Typ.	Max.	Unit	Remark
Response Time	Tr	at normal	-20	-	2500	3000	ms	A
			25	-	160	320		
	Td	at normal	-20	-	2200	2700		
			25	-	150	320		
Contrast Ratio	CR	at normal	25	20	32	-	-	A
Transmittance	T	-		4	8	-	%	A
Viewing Conc	-	CR>2	at normal	-50, +35			deg	A
				-40, +40				
Chromaticity Coordinate	White	X	at normal	-	0.28	-	-	B
		Y		-	0.3	-		
	Red	X	at normal	-	0.57	-		
		Y		-	0.33	-		
	Green	X	at normal	-	0.3	-		
		Y		-	0.51	-		
	Blue	X	at normal	-	0.15	-		
		Y		-	0.16	-		
Color Gamut (NTSC)		-		-	25	-	%	-

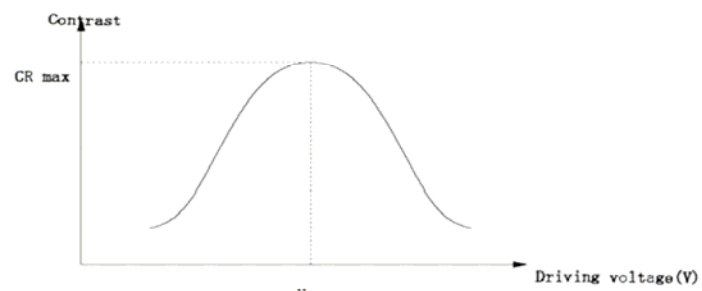
A-- Measurement by DMS machine
(Scheme B, 128 duty, 1/12 bias, 100Hz frequency)

B-- Measuring by IC driving

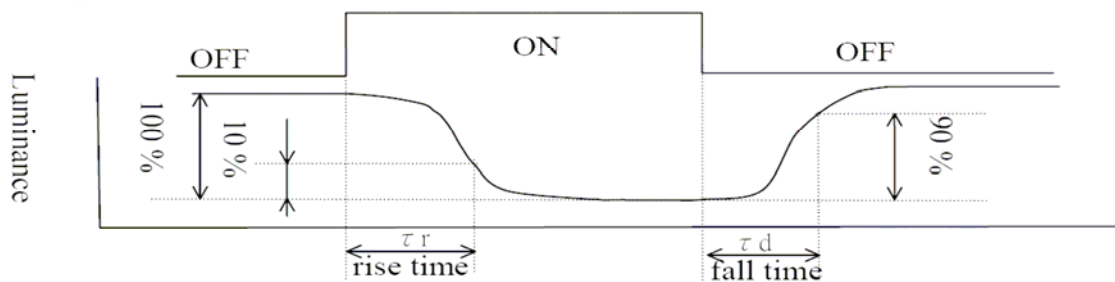
6.1 Optical Characteristics Definition

1) Contrast Ratio

$$CR(\text{contrast}) = \frac{\text{Brightness all pixels "White"}}{\text{Brightness all pixels "Black"}}$$



2) Response Time





7. Remark

HANDLING LCD AND LCD MODULES

1. Liquid Crystal Display (LCD)

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

- (1) Keep the temperature within range for use and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel-off or bubble generation. When storage for a long period over 40° C is required, the relative humidity should be kept below 60%.
- (2) Do not contact the exposed polarizers 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. Never scrub hard.
- (3) Varitronix does not responsible for any polarizer defect after the protective film has been removed from the display
- (4) 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.
- (5) PETROLEUM BENZIN is recommended to remove adhesives used to attach front/rear polarizers and reflectors, while chemicals like acetone, toluene, ethanol and isopropyl alcohol will cause damage to the polarizer. Avoid oil and fats. Avoid lacquer and epoxies which might contain solvents and hardeners to cause electrode erosion. Some solvents will also soften the epoxy covering the DIL pins and thereby weakening the adhesion of the epoxy on glass. This will cause the exposed electrodes to erode electrochemically when operating in high humidity and condensing environment.
- (6) Glass can be easily chipped or cracked from rough handling, especially at corners and edges.
- (7) Do not drive LCD with DC voltage.
- (8) When soldering DIL pins, avoid excessive heat and keep soldering temperature between 260°C to 300°C for no more than 5 seconds. Never use wave or reflow soldering.

2. Liquid Crystal Display Modules (MDL)

2.1 Mechanical Considerations

MDL's 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 (conductive rubber), especially when inserting an EL panel.

- (4) When mounting a MDL 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.
- (6) If FPCA need to be bent, please refer the suggested bending area on the specification. The stiffener and component area on FPC/FFC/COF must not be bent during or after assembly (Note: for those models with FPC/FFC/COF+stiffener).
- (7) Sharp bending should be avoided on FPC to prevent track cracking.

2.2 Static Electricity

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

- (1) The operator should be grounded whenever he 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 part 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 statics, a relative humidity of 50 - 60% is recommended.

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 is 280°C $\pm$ 10°C.
- (4) Soldering time: 3 to 4 seconds.
- (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.
- (7) Use proper de-soldering methods (e.g. suction type desoldering irons) to remove lead wires from the I/O terminals when necessary. Do not repeat the soldering/ desoldering process more than three times as the pads and plated through holes may be damaged.

2.4 Label

Identification labels will be stuck on the module without

obstructing the viewing area of display.

3. Operation

- (1) The viewing angle can be adjusted by varying the LCD driving voltage V_o .
- (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 destructive and the display will return to normal once the temperature falls back to range.
- (5) Mechanical disturbance during operation (such as pressing on the viewing area) may cause the segments to appear "fractured". They will recover once the display is turned off.
- (6) Condensation at terminals will cause malfunction and possible electrochemical reaction. Relative humidity of the environment should therefore be kept below 60%.
- (7) Display performance may vary out of viewing area. If there is any special requirement on performance out of viewing area, please consult Varitronix.

4. Storage and Reliability

- (1) LCD's should be kept in sealed polyethylene bags while MDL's should use antistatic ones. If properly sealed, there is no need for desiccant.
- (2) Store in dark places and do not expose to sunlight or fluorescent light. Keep the temperature between 0°C and 35°C and the relative humidity low. Please consult MULTI-INNO for other storage requirements.
- (3) Water condensation will affect reliability performance of the display and is not allowed.
- (4) Semi-conductor device on the display is sensitive to light and should be protected properly.
- (5) Power up/down sequence.
 - a) Power Up: in general, LCD supply voltage, V_o must be supplied after logic voltage, VDD becomes steady. Please refer to related IC data sheet for details.
 - b) Power Down: in general, LCD supply voltage, V_o must be removed before logic voltage, VDD turns off. Please refer to related IC data sheet for details.

5. Safety

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 times.

LIMITED WARRANTY

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

1. The liability of MULTI-INNO is limited to repair or replacement on the terms set forth below. MULTI-INNO 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 MULTI-INNO and the customer, MULTI-INNO will only replace or repair any of its LCD which is found defective electrically or visually when inspected in

accordance with MULTI-INNO LCD Acceptance Standards (copies available on request), for a period of one year from the date of shipment. Confirmation of such date shall be based on freight documents.

2. No warranty can be granted if any of the precautions stated in HANDLING LCD and LCD Modules above have been disregarded. Broken glass, scratches on polarizers, mechanical damages as well as defects that are caused by accelerated environmental tests are excluded from warranty.
3. In returning the LCD and Modules, they must be properly packaged and there should be detailed description of the failures or defects.

IMPORTANT NOTICE

The information presented in this document has been carefully checked and is believed to be accurate, however, no responsibility is assumed for inaccuracies. MULTI-INNO reserves the right to make changes to any specifications without further notice for performance, reliability, production technique and other considerations. MULTI-INNO does not assume any liability arising out of the application or use of products herein. Please see Limited Warranty in the previous section.