MULTI-INNO TECHNOLOGY CO., LTD.

LCD MODULE SPECIFICATION

Model : MI2002M

Revision	
Engineering	
Date	
Our Reference	

MODE OF DISPLAY

Display mode	**Display condition**	**Viewing direction**
☐ TN positive	☐ Reflective type	☐ 6 O' clock
☐ TN negative	☐ Transflective type	☐ 12 O' clock
STN : ☐ Yellow green	☐ Transmissive type	☐ 3 O' clock
☐ Grey	☐ Others	☐ 9 O' clock
☐ Blue (negative)		
☐ FSTN positive		
☐ FSTN negative		

LCD MODULE NUMBER NOTATION:

M I 2 0 0 2 M:

MI: Multi-inno product series number

2002: 20 characters X 2 Lines character LCM

M: Series number

GENERAL DESCRIPTION

Display mode : 20 Characters x 2 Lines COB LCD module

Interface : 8 bit parallel

Driving method : 1/16 duty, 1/5 bias

Controller IC : Sunplus SPLC780C or equivalent
For the detailed information, please refer to the IC specifications.

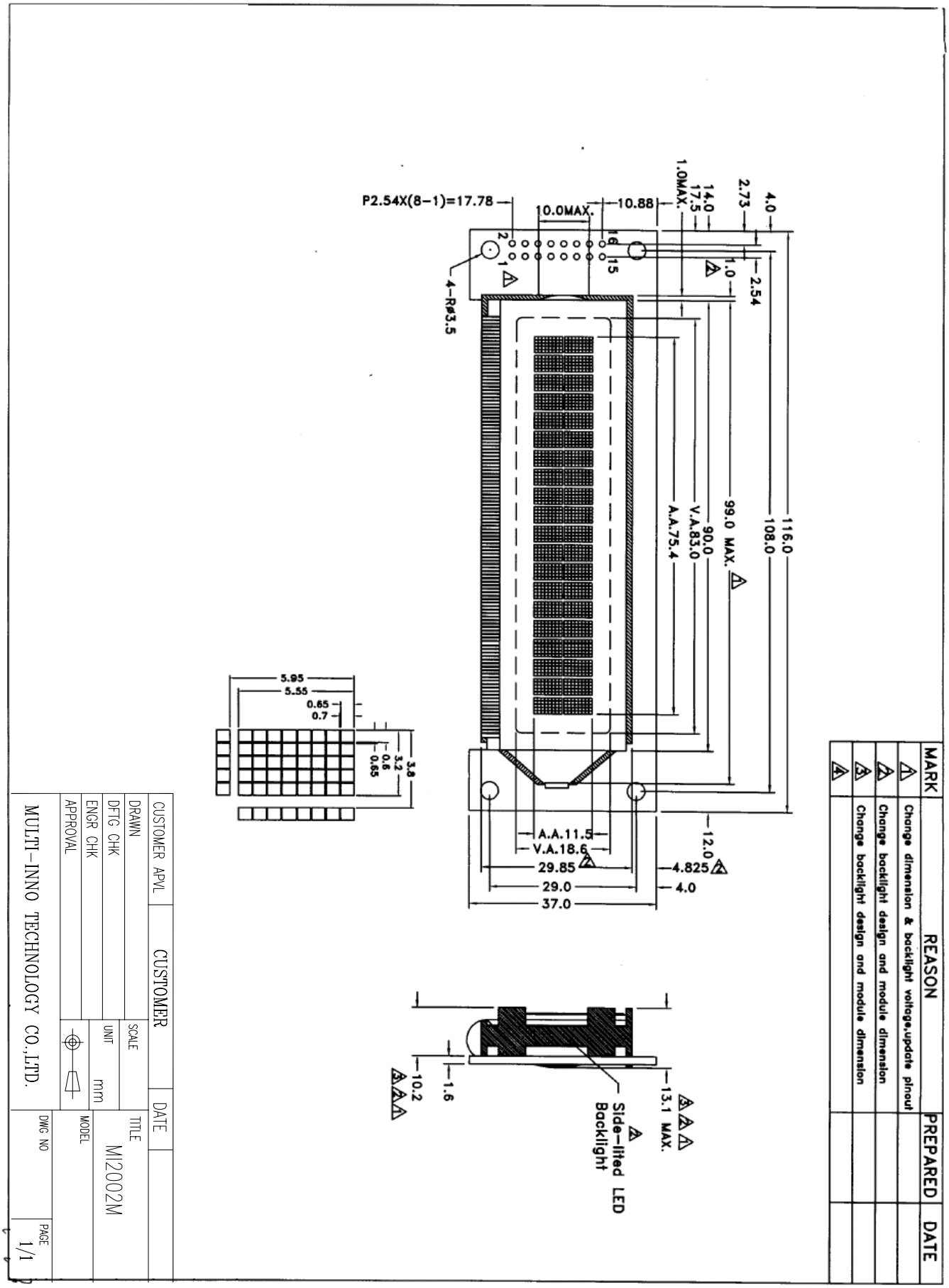
MECHANICAL DIMENSIONS

Item	Dimension	Unit	Item	Dimension	Unit
Outline Dimension	116.0(L)x37.0(W)x13.1MAX.(H)	mm	Character Size	3.2(L)x5.55(W)	mm
Viewing Area	83.0(L)x18.6(W)	mm	Dot Size	0.60(L)x0.65(W)	mm
Character Pitch	3.8(L)x5.95(W)	mm	–	–	–

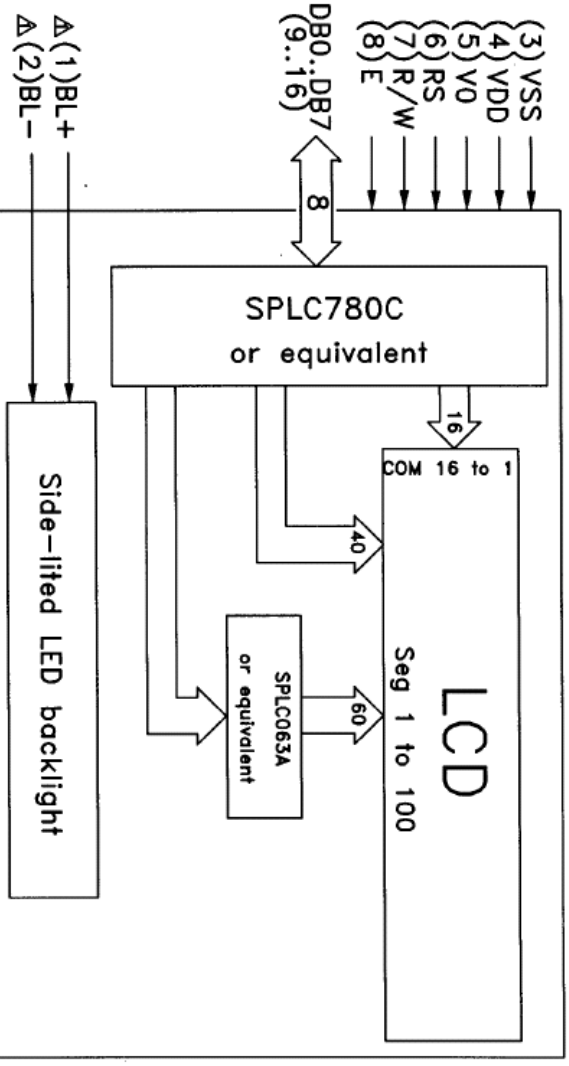
CONNECTOR PIN ASSIGNMENT

Pin No.	Symbol	Function
1	A	Supply Voltage for Backlight (+VE)
2	K	Supply Voltage for Backlight (-VE)
3	VSS	Ground
4	VDD	Supply Voltage for Logic
5	VO	Input Voltage for LCD
6	RS	Register Select Input
7	R/W	Read / Write
8	E	Enable Signal
9	DB0	Data Bus Line
10	DB1	
11	DB2	
12	DB3	
13	DB4	
14	DB5	
15	DB6	
16	DB7	

COUNTER DRAWING OF MODUAL DIMENSION



COUNTER DRAWING OF PIN OUT & BLOCK DIAGRAM



PIN NO.	SYMBOL	FUNCTION
1	BL+	Supply voltage for backlight(+)
2	BL-	Supply voltage for backlight(-)
3	VSS	Supply voltage(0V,ground)
4	VDD	Supply voltage for logic
5	V0	Input voltage for LCD
6	RS	Register select input
7	R/W	Read/write
8	E	Enable signal
9	DB0	Data bus line
10	DB1	
11	DB2	
12	DB3	
13	DB4	
14	DB5	
15	DB6	
16	DB7	

CUSTOMER APVL	CUSTOMER	DATE	
DRAWN		SCALE	TITLE MI2002M
DFTG CHK		UNIT mm	
ENGR CHK			MODEL
APPROVAL			DWG NO
MULTI-INNO TECHNOLOGY CO.,LTD.			PAGE 1/1

ELECTRICAL CHARACTERISTICS

Conditions: VSS=0V, Ta=25℃

Item	Symbol	MIN.	TYP.	MAX.	Unit	Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage for Logic	VDD	4.5	5.0	5. 5	V	"H"Level Input Voltage	VIH	2.2	—	VDD	V
Supply Current for Logic	IDD	—	1.5	2.0	mA	"L"Level Input Voltage	VIL	-0.3	—	0.6	V
Input Voltage for LCD (*)	VO	-0.2	0	0.2	V	—	—	—	—	—	—
EL Backlight Voltage (VEL)											
EL (@ Frequency 400Hz)	VBL	—	—	—	Vrms	—	—	—	—	—	—
Side-lited LED Backlight Forward Voltage (VF)						**Side-lited LED Backlight Forward Current (IF)**					
White	VBL	4.9	5.0	5.1	V	White	IBL	—	15	25	mA
Blue	VBL	—	—	—	V	Blue	IBL	—	—	—	mA
Yellow Green	VBL	—	—	—	V	Yellow Green	IBL	—	—	—	mA
Array LED Backlight Forward Voltage (VF)						**Array LED Backlight Forward Current (IF)**					
Yellow Green	VBL	—	—	—	V	Yellow Green	IBL	—	—	—	mA
Amber	VBL	—	—	—	V	Amber	IBL	—	—	—	mA
Orange	VBL	—	—	—	V	Orange	IBL	—	—	—	mA
Soft Orange	VBL	—	—	—	V	Soft Orange	IBL	—	—	—	mA

Note (*) : VO (0V) represents operating voltage of LCD module having optimum contrast distributed in range of (5V ±0.2V)

ABSOLUTE MAXIMUM RATINGS

Please make sure not to exceed the following maximum rating values under the worst application conditions.

Item	Symbol	Rating (for normal temperature)	Rating (for wide temperature)	Unit
Supply Voltage	VDD	-0.3 to 7	-0.3 to 7	V
Input Voltage	VIN	-0.3 to VDD +0.3	-0.3 to VDD +0.3	V
Operating Temperature	Topr	0 to 50	-20 to 70	℃
Storage Temperature	Tstg	-10 to 60	-30 to 80	℃

INSTRUCTIONS

Instruction	Instruction Code										Description	Execution time (fosc=270KHz)
	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM and set DDRAM address to "00H" from AC	1.52ms
Return Home	0	0	0	0	0	0	0	0	1	-	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.52ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Assign cursor moving direction and enable the shift of entire display	38μs
Display ON/ OFF Control	0	0	0	0	0	0	1	D	C	B	Set display(D), cursor(C), and blinking of cursor(B) on/off control bit.	38μs
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	-	-	Set cursor moving and display shift control bit, and the direction, without changing of DDRAM data.	38μs
Function Set	0	0	0	0	1	DL	N	F	-	-	Set interface data length (DL: 8-bit/4-bit), numbers of display line (N: 2-line/1-line) and, display font type (F:5x10 dots/5x8 dots)	38μs
Set CGRAM Address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter.	38μs
Set DDRAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in counter	38μs
Read Busy Flag and Address Counter	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.	
Write Data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM).	38μs
Read Data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM).	38μs

Note: "-": don't care

	I / D	= 1: Increment	AC: Address counter used for both DD and CG RAM address.	
	I / D	= 0: Decrement		
	S	= 1: Accompanies display shift		
	S / C	= 1: Display shift		
	S / C	= 0: Cursor move		
	R / L	= 1: shift to the right		
	R / L	= 0: shift to the left		
	DL	= 1: 8 bits		
	DL	= 0: 4 bits		
	N	= 1: 2 lines		
	N	= 0: 1 line		
	F	= 1: 5 x 10 dots		
	F	= 0: 5 x 7 dots		
	BF	= 1: Internally operating		
	BF	= 0: Can accept instruction		

DISPLAY DD RAM AND CHARACTER POSITION

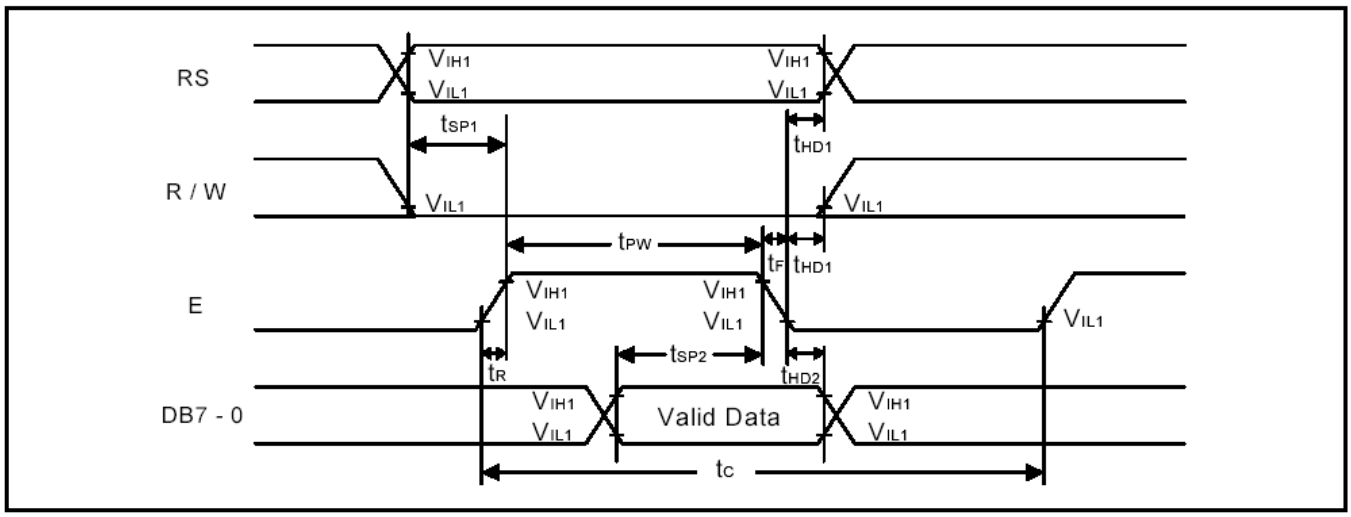
20x2, 1/16 DUTY CYCLE

	1	2		20	DISPLAY POSITION
line 1	00	01	· · · · · · · · · · · · · · · · · · · ·	13	DD RAM ADDRESS
line 2	40	41	· · · · · · · · · · · · · · · · · · · ·	53	

WRITE MODE

Characteristics	Symbol	Limit			Unit	Test Condition
		Min.	Typ.	Max.		
E Cycle Time	t_C	500	-	-	ns	Pin E
E Pulse Width	t_{PW}	230	-	-	ns	Pin E
E Rise/Fall Time	t_R, t_F	-	-	20	ns	Pin E
Address Setup Time	t_{SP1}	40	-	-	ns	Pins: RS, R/W, E
Address Hold Time	t_{HD1}	10	-	-	ns	Pins: RS, R/W, E
Data Setup Time	t_{SP2}	80	-	-	ns	Pins: DB0 - DB7
Data Hold Time	t_{HD2}	10	-	-	ns	Pins: DB0 - DB7

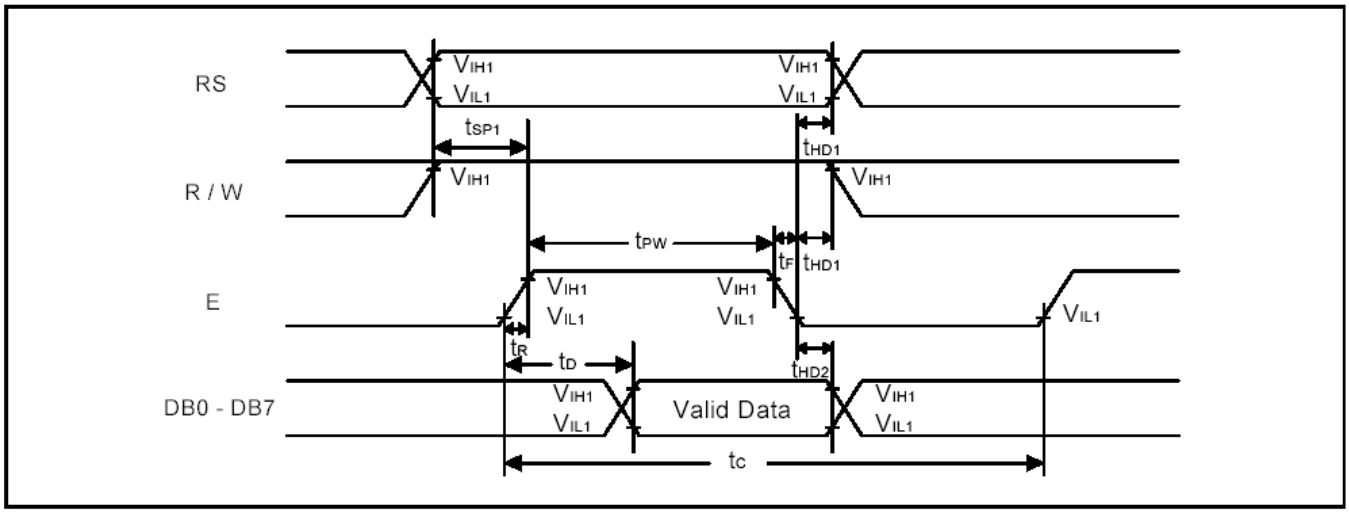
WRITE MODE TIMING DIAGRAM



READ MODE

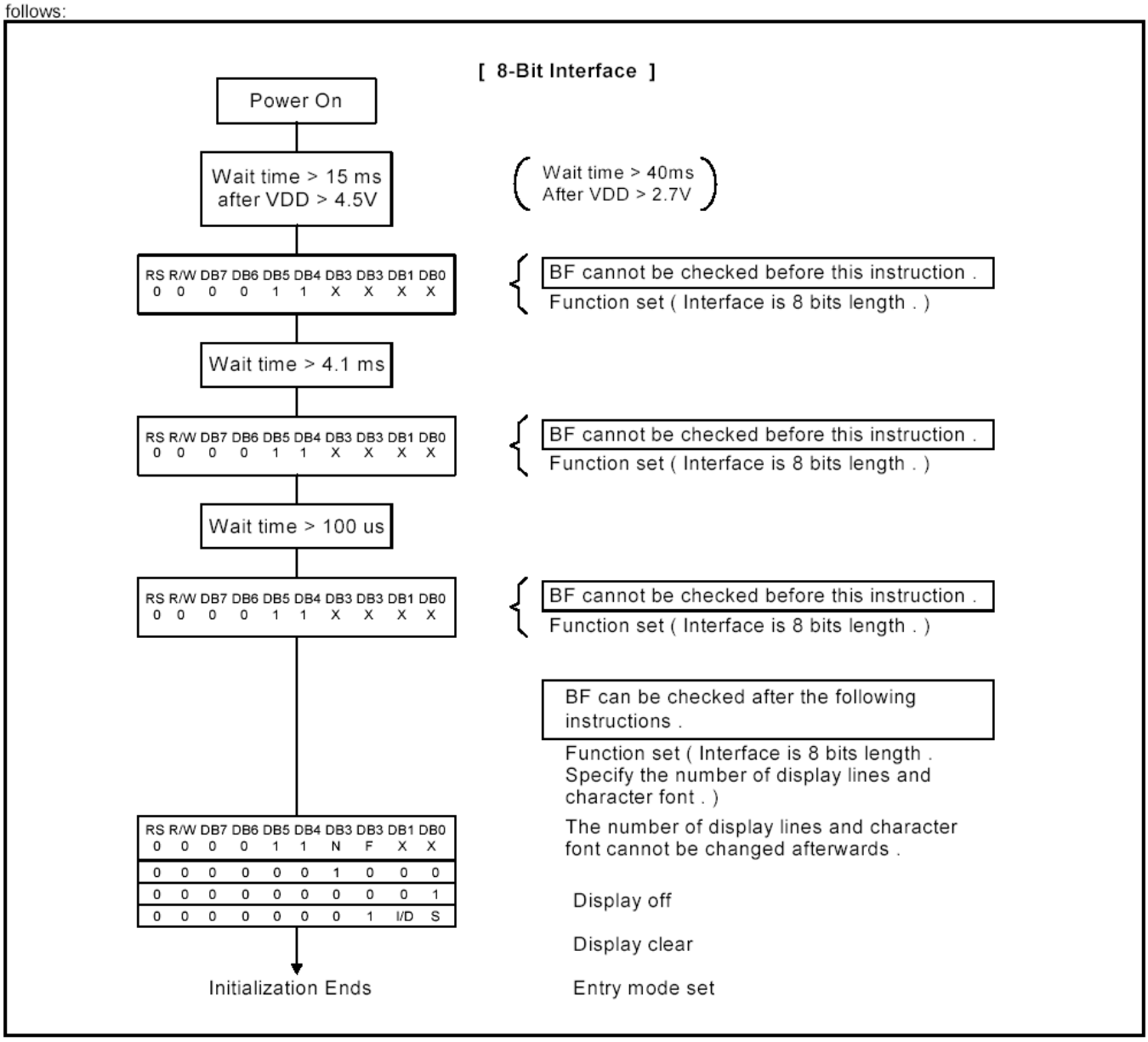
Characteristics	Symbol	Limit			Unit	Test Condition
		Min.	Typ.	Max.		
E Cycle Time	t_C	500	-	-	ns	Pin E
E Pulse Width	t_W	230	-	-	ns	Pin E
E Rise/Fall Time	t_R, t_F	-	-	20	ns	Pin E
Address Setup Time	t_{SP1}	40	-	-	ns	Pins: RS, R/W, E
Address Hold Time	t_{HD1}	10	-	-	ns	Pins: RS, R/W, E
Data Output Delay Time	t_D	-	-	120	ns	Pins: DB0 - DB7
Data hold time	t_{HD2}	5.0	-	-	ns	Pin DB0 - DB7

READ MODE TIMING DIAGRAM



INITIALIZATION FLOWCHART

At power on, SPLC780C starts the internal auto-reset circuit and executes the initial instructions. The initial procedures are shown as follows:



ELECTRO-OPTICAL CHARACTERISTICS

MEASURING CONDITION: POWER SUPPLY = V_{OP} / 64 Hz
TEMPERATURE = 22 ± 5 °C
RELATIVE HUMIDITY = 60 ± 15 %

ITEM	SYMBOL	UNIT	TYP. TN	TYP. STN
RESPONSE TIME	Ton	ms	130	150
	Toff	ms	170	190
CONTRAST RATIO	Cr	-	8	15
VIEWING ANGLE (6 O'clock) (Cr ≥ 2)	$V_{3:00}$	°	70	45
	$V_{6:00}$	°	45	70
	$V_{9:00}$	°	70	45
	$V_{12:00}$	°	5	60

THE ELECTRO-OPTICAL CHARACTERISTICS ARE MEASURED VALUE BUT NOT GUARANTEED ONES.

RELIABILITY OF LCD MODULE

ITEM	TEST CONDITION FOR NORMAL TEMPERATURE	TEST CONDITION FOR WIDE TEMPERATURE	TIME
High temperature operating	50°C	70°C	240 hours
Low temperature operating	0°C	-20°C	240 hours
High temperature storage	60°C	80°C	240 hours
Low temperature storage	-10°C	-30°C	240 hours
Temperature-humidity storage	40°C 90% R.H.	60°C 90% R.H.	96 hours
Temperature cycling	-10°C to 60°C 30 Min Dwell	-30°C to 80°C 30 Min Dwell	5 cycle
Vibration Test at LCM Level	Freq 10-55 Hz Sweep rate: 10-55-10 at 1 min Sweep mode Linear Displacement: 2 mm p-p 1 Hour each for X, Y, Z	Freq 10-55 Hz Sweep rate: 10-55-10 at 1 min Sweep mode Linear Displacement: 2 mm p-p 1 Hour each for X, Y, Z	—

QUALITY STANDARD OF LCD MODULE

1.0	**Sampling Method**		
	Sampling Plan : MIL STD 105 E Class of AQL : Level II/Single Sampling Critical : 0.25% Major 0.65% Minor 1.5%		
2.0	**Defect Group**	**Failure Category**	**Failure Reasons**
	Critical Defect 0.25%(AQL)	Malfunction	Open Short Burnt or dead component Missing part/improper part P.C.B. Broken
	Major Defect 0.65%(AQL)	Poor Insulation	Potential short High current Component damage or scratched or Lying too close improper coating
		Poor Conduction	Damage joint Wrong polarity Wrong spec. part Uneven/intermittent contact Loose part Copper peeling Rust or corrosion or dirt‘s
	Minor Defect 1.5%(AQL)	Cosmetic Defect	Minor scratch Flux residue Thin solder Poor plating Poor marking Crack solder Poor bending Poor packing Wrong size

HANDLING PRECAUTIONS

(1) CAUTION OF LCD HANDLING & CLEANING

The polarizing plate on the surface of the panel is made from organic substances. Be very careful for chemicals not to touch the plate or it leads the polarizing plate to deteriorate.

If the use of a chemical is unavoidable, wipe the panel lightly with soft materials, such as gauze and absorbent cotton, soaked in a solvent.

*Usable solvent: Alcohol (ethanol, IPA and the like)
*Appropriate solvent: Ketones, ethyl alcohol

Avoid wiping with a dry cloth, since it could damage the surface of the polarizing plate and others.

(2) CAUTION AGAINST STATIC CHARGE

The LCD modules use CMOS LSI drivers, so customers are recommended that any unused input terminal would be connected to V_{DD} or V_{SS}, do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

(3) PACKAGING

Avoid intense shock and falls from a height and do not operate or store them exposed to direct sunshine or high temperature/humidity for long periods.

(4) CAUTION FOR OPERATION

The viewing angle can be adjusted by varying the LCD driving voltage VO.

Driving voltage should be kept within specified range, excess voltage shortens display life.

Response time increases with decrease in temperature.

Display may turn black or dark Blue at temperature above its operational range; this is however not destructive and the display will return to normal once the temperature falls back to range.

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.

Condensation at terminals will cause malfunction and possible electrochemical reaction. Relative humidity of the environment should therefore be kept below 60%.

(5) SAFETY

Liquid crystal may leak out of a damaged LCD, it is recommended to wash off the liquid crystal by using solvents such as acetone or ethanol and should be burned up later.

If any liquid leaks out of a damaged glass cell comes in contact with your hands, wash it off with soap and water immediately.

WARRANTY

Multi-Inno will replace or repair any of her LCD module in accordance with her LCD specification for a period of one year from date of shipment. The warranty liability of Multi-Inno is limited to repair and/or replacement. Multi-Inno will not be responsible for any subsequent or consequential event.