






DOCUMENT NUMBER AND REVISION  
VL-FS-MDLS161615D-01 REV. A  
(MDLS161615D-LV-G)

DOCUMENT TITLE:  
SPECIFICATION  
OF  
LCD MODULE TYPE  
MODEL NUMBER: MDLS161615D-01

DEPARTMENT	NAME	SIGNATURE	DATE
PREPARED BY	PHILIP CHENG		2003/07/25
CHECKED BY	TOM LEE		2003/7/25
APPROVED BY	CYRUS CHEUNG		2003/7/25

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### **Specification of LCD Module Type Model No.: MDLS161615D-01**

#### **1. General Description**

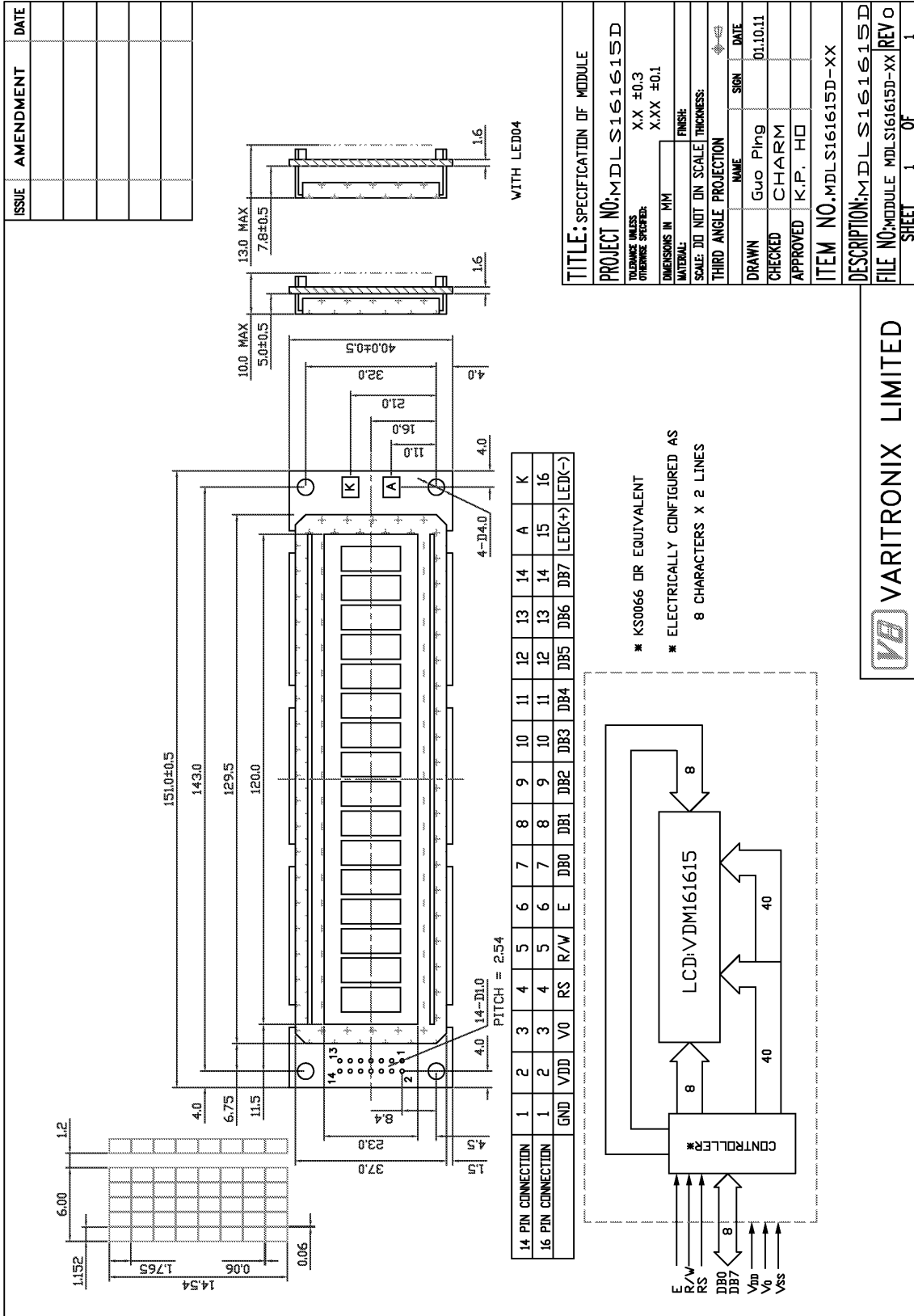
- 16 characters(5 x 8 dots) x 1 line STN Positive Yellow Reflective LCD Character Module.
- Viewing Angle: 6 O'clock direction.
- Driving duty: 1/16 Duty, 1/5 bias.
- 'SAMSUNG' KS0066UP-10BCC(Die form) LCD Controller & Driver or equivalent.

#### **2. Mechanical Specifications**

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

Table 1

Parameter	Specifications	Unit
Outline dimensions	151.0(W) x 40.0(H) x 10.0 MAX.(D)	mm
Effective viewing area	120.0(W) x 23.0(H)	mm
Display format	16 characters x 1 line	-
Character size	6.00(W) x 14.54(H) (5 x 8 dots)	mm
Character spacing	1.2(W)	mm
Character pitch	7.2(W)	mm
Dot size	1.152(W) x 1.765(H)	mm
Dot spacing	0.06(W) x 0.06(H)	mm
Dot pitch	1.212(W) x 1.825(H)	mm
Weight	TBD	grams



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Figure 1: Module Specification



### 3. Interface signals

Table 2

Pin No.	Symbol	Description
1	GND	Ground (0V).
2	VDD	Power supply for logic (+5.0V).
3	V0	Power supply for LCD driver.
4	RS	Register Select Input: "High" for Data register (for read and write). "Low" for Instruction register (for write), Busy flag, address counter (for read).
5	R/W	Read/Write signal: 'High' for Read mode. 'Low' for Write mode.
6	E	Enable. Start signal for data read /write.
7	DB0	Data input/output (LSB)
8	DB1	Data input/output
9	DB2	Data input/output
10	DB3	Data input/output
11	DB4	Data input/output
12	DB5	Data input/output
13	DB6	Data input/output
14	DB7	Data input/output (MSB)
A or 15	LED(+)	Anode of LED Backlight.
K or 16	LED(-)	Cathode of LED Backlight.



#### 4. Absolute Maximum Ratings

##### 4.1 Electrical Maximum Ratings (Ta = 25 °C)

Table 3

Parameter	Symbol	Min.	Max.	Unit
Power Supply voltage (Logic)	VDD-GND	-0.3	+7.0	V
Power Supply voltage (LCD drive)	VLCD =VDD-V0	-0.3	+15.0	V
Input voltage	Vin	-0.3	VDD+0.3	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 Condition

Table 4

Item	Operating Temperature (Topr)		Storage Temperature (Tstg)		Remark
	Min.	Max.	Min.	Max.	
Ambient Temperature	0°C	+50°C	-10°C	+60°C	Dry
Humidity	95% max. RH for Ta ≤ 40°C < 95% RH for Ta > 40°C				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 <sup>2</sup> = 100g Number of shocks : 3 shocks in 3 mutually perpendicular axes.				3 directions



## 5. Electrical Specifications

### 5.1 Typical Electrical Characteristics

At Ta = 25 °C, VDD = 5V±5%, GND=0V.

Table 5

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply voltage (Logic)	VDD -GND		4.75	5.0	5.25	V
Supply voltage (LCD)	VLCD =VDD -V0	VDD = 5V, Note (1)	4.3	4.5	4.7	V
Input signal voltage for E,DB0-DB7,R/W,RS.	V <sub>IH</sub>	"H" level	2.2	-	VDD	V
	V <sub>IL</sub>	"L" level	-0.3	-	0.6	V
Supply Current (Logic & LCD)	IDD	Character mode, VDD = 5V	-	0.9	1.4	mA
		Checker board mode, VDD = 5V	-	1.2	2.1	mA
Supply Current (LCD)	I0	Character mode, VDD=5V, Note (1)	-	0.4	0.6	mA
		Checker board mode, VDD=5V, Note (1)	-	0.4	0.6	mA

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





## 5.2 Timing Specifications

At  $T_a = 0\text{ }^{\circ}\text{C}$  To  $+50\text{ }^{\circ}\text{C}$ ,  $V_{DD} = +5V \pm 5\%$ ,  $GND = 0V$ .

Refer to Fig. 2, the bus timing diagram for write mode.

Table 6

Parameter	Symbol	Min.	Max.	Unit
E Cycle Time	$t_c$	500	-	ns
E Rise/Fall Time	$t_R, t_F$	-	20	ns
E Pulse Width(high, low)	$t_w$	230	-	ns
R/W and RS Setup Time	$t_{SU1}$	40	-	ns
R/W and RS Hold Time	$t_{H1}$	10	-	ns
Data Set-up Time	$t_{SU2}$	80	-	ns
Data Hold Time	$t_{H2}$	10	-	ns

Refer to Fig. 3, the bus timing diagram for read mode.

Table 7

Parameter	Symbol	Min.	Max.	Unit
E Cycle Time	$t_c$	500	-	ns
E Rise/Fall Time	$t_R, t_F$	-	20	ns
E Pulse Width(high, low)	$t_w$	230	-	ns
R/W and RS Setup Time	$t_{SU}$	40	-	ns
R/W and RS Hold Time	$t_H$	10	-	ns
Data Output Delay Time	$t_D$	-	120	ns
Data Hold Time	$t_{DH}$	5	-	ns

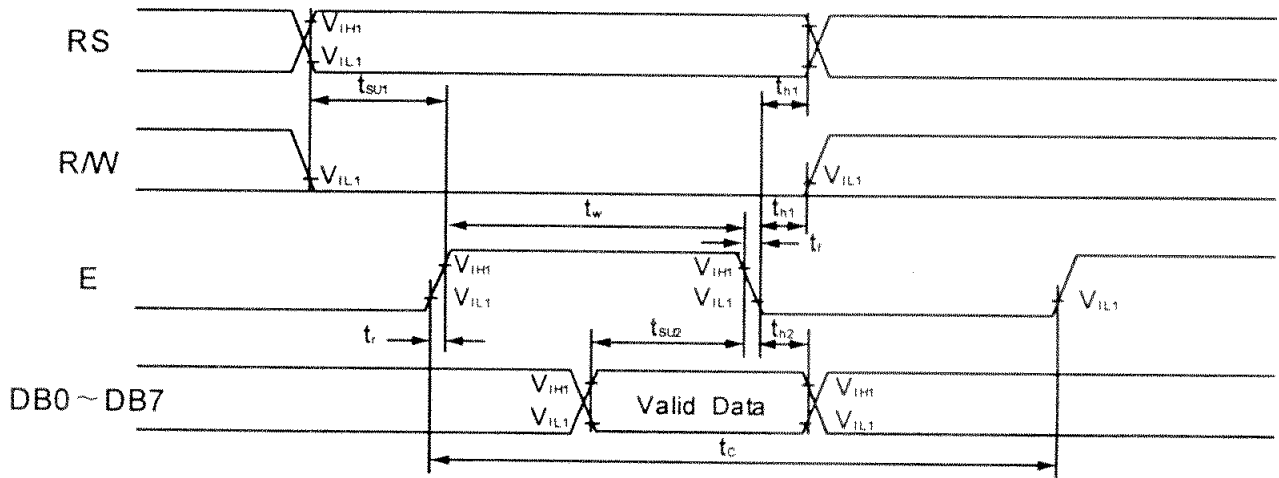


Figure 2: Write Mode Timing Diagram

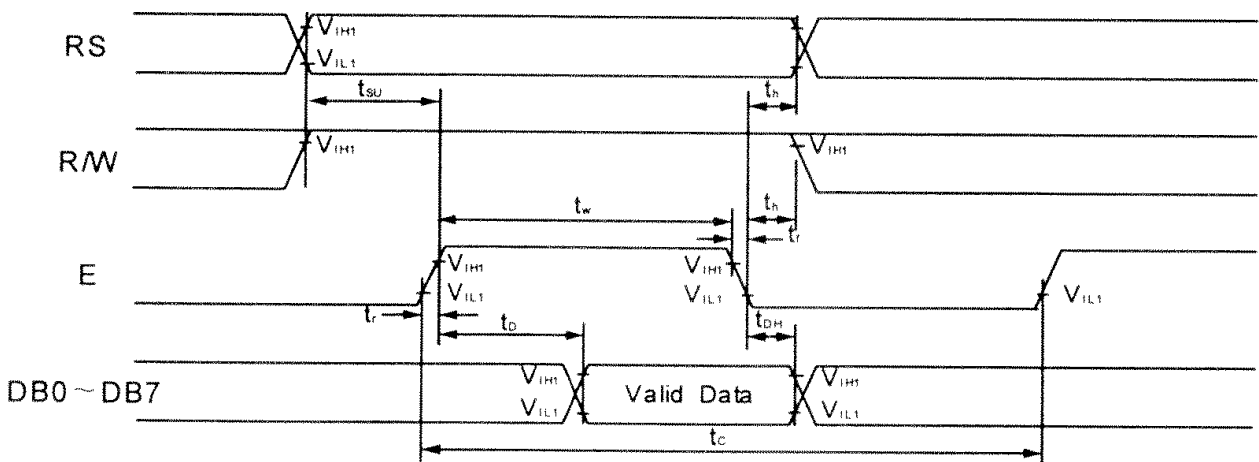


Figure 3: Read Mode Timing Diagram



### 5.3 Timing Diagram of VDD Against V0.

Power on sequence shall meet the requirement of Figure 4, the timing diagram of VDD against V0.

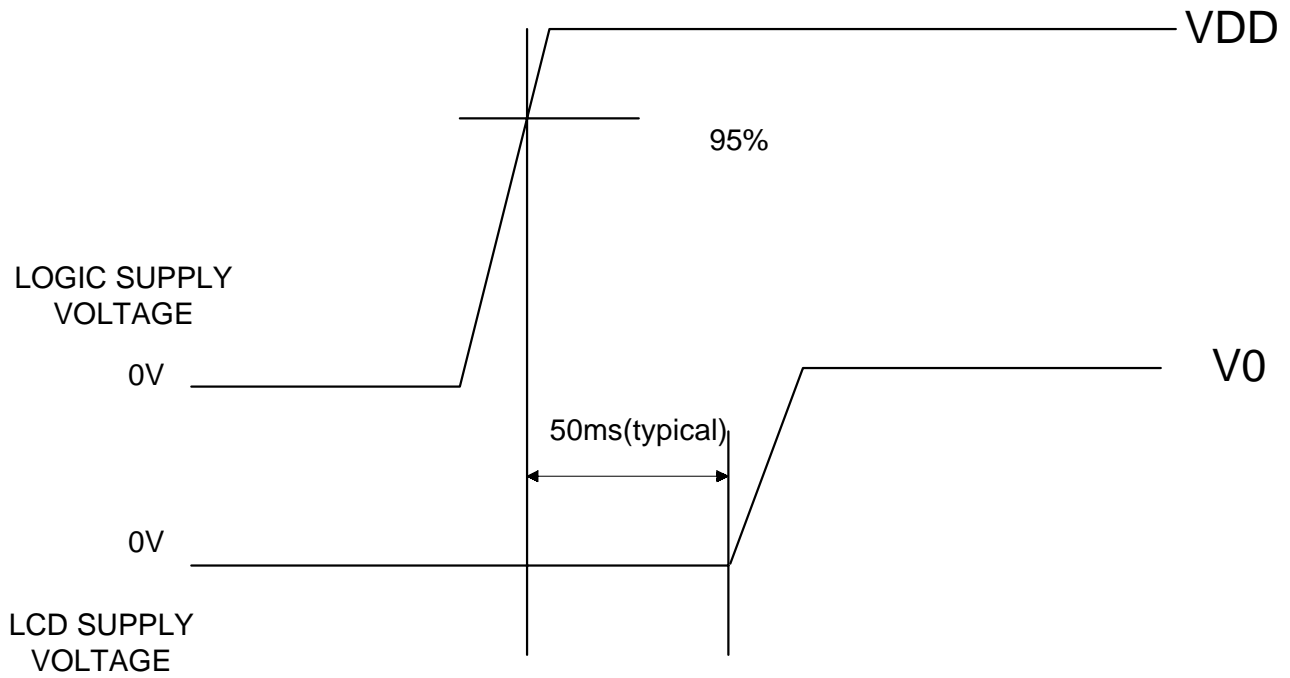
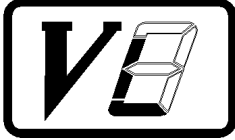


Figure 4: Timing Diagram of VDD Against V0.





## 7. Instruction Table

Instruction	Instruction Code										Description	Execution time (fosc= 270 kHz)
	RS	R/W	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	1.53 ms
Return Home	0	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.	1.53 ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	SH	Assign cursor moving direction and enable the shift of entire display.	39 μs
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.	39 μs
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.	39 μs
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:5×11dots/5×8 dots)	39 μs
Set CGRAM Address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter.	39 μs
Set DDRAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter.	39 μs
Read Busy Flag and Address	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.	0 μs
Write Data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM).	43 μs
Read Data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM).	43 μs

\* "-": don't care

NOTE: When an MPU program with checking the Busy Flag(DB7) is made, it must be necessary 1/2Fosc is necessary for executing the next instruction by the falling edge of the 'E' signal after the Busy Flag (DB7) goes to "Low".

"Varitronix Limited reserves the right to change this specification."

FAX:(852) 2343-9555.

URL:<http://www.varitronix.com>

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