Data International Co., Ltd.

DATAVISION

APPROVAL   SHEET

Customer   :

Part Name   :   LCD MODULE

Model No.   :   **DVF-16236-S2FBLY**

Drawing No. :

Approved by :

Date   :

Approved	Checked	Prepared	Sheet Code:
		Will-Chiu	Preliminary

SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY MODULE
MODEL NO: DVF-16236-S2FBLY

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2005/8/11			222-20050704056-3

SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY MODULE
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1. SCOPE

The DVF-16236-S2FBLY, dot-matrix LCD unit of a 5 x 7- dot 16-character 2-line dot-matrix LCD panel, LCD driver, controller LSI and yellow green back-light LED fabricated on a single PCB. Incorporating mask ROM-based character generator and display data RAM in the controller LSI, the unit can efficiently display the desired characters under microprocessor control.

2. PRODUCT SPECIFICATIONS

2.1   General

- The LCD of the unit is STN (Super Twisted Nematic) Gray Transflective , Normal temperature type.
- Low power consumption with the dot-matrix LCD panel and CMOS LSI. Built-in back-light LED with high luminance and stable radiation.
- Thin, lightweight design permits easy installation in a variety of equipment.
- Allowing for being connected at general-purpose CMOS signal level, the unit can be easily interfaced to a microprocessor with common 4-bit and 8-bit parallel inputs and outputs.
- Multiplexing driving : 1/16duty, 1/4bias, 6 o'clock
- Built-in character generator ROM and RAM, and display data RAM:
  Character generator ROM
  225 different 5 x 7 dot-matrix character patterns (Alphanumeric and symbols)
  Character generator RAM
  8 different user programmed 5 x 7 dot-matrix patterns
  Display data RAM
  80 x 8 bits
- Numerous instructions
  Display clear, Cursor home, Display ON/OFF, Cursor ON/OFF, Blink character, Cursor shift, Display shift
- The unit operates from a single 5V power supply.

2.2   Mechanical Characteristics

Item	Characteristic
Number of Characters	16×2
Dot dimensions(mm)	0.55×0.65
Dot spacing (mm)	0.05
Character Size (mm)	2.95×5.55
Module dimensions (Horizontal × Vertical × Thickness, mm)	$85.0 \times 36.0 \times 14.2$max.
Viewing area (Horizontal × Vertical, mm)	62.2×17.9
Active area (Horizontal × Vertical, mm)	56.2×11.49

2.3 Absolute Maximum Ratings (Without LED back-light)

Maximum Absolute Power Ratings

Item	Symbol	Unit	Value
Power supply voltage(1)	V_{DD}	V	-0.3 to + 7.0
Power supply voltage(2)	V_{LCD}	V	VDD -15.0 to V_{DD} + 0.3
Input voltage	V_{IN}	V	-0.3 to V_{DD} + 0.3

* NOTE: Voltage greater than above may damage the circuit (VDD ≥ V1 ≥ V2 ≥ V3 ≥ V4 ≥ V5)

2.4 Electrical Characteristics (Without LED back-light)

DC Characteristics
$(V_{DD}$ = 4.5V to 5.5V, Ta = -30 to +85 °C)

Item	Symbol	Condition	Min	Typ	Max	Unit
Operating Voltage	V_{DD}	-	4.5	-	5.5	V
Supply Current	I_{DD1}	ceramic resonator fosc = 250 kHz		0.7	1.0	mA
	I_{DD2}	Resistor oscillation external clock operation fosc = 270 kHz	-	0.4	0.6	
Input Voltage (1) (except OSC1)	V_{IH1}	-	2.2	-	V_{DD}	V
	V_{IL1}	-	-0.3	-	0.6	
Input Voltage (2) (OSC1)	V_{IH2}	-	V_{DD}-1.0	-	V_{DD}	V
	V_{IL2}	-	-0.2	-	1.0	
Output Voltage (1) (DB0 to DB7)	V_{OH1}	I_{OH} = -0.205 mA	2.4	-	-	V
	V_{OL1}	I_{OL} = 1.2 µA	-	-	0.4	
Output Voltage (2) (except DB0 to DB7)	V_{OH2}	I_O = -40 µA	$0.9V_{DD}$	-	-	V
	V_{OL2}	I_O = 40 µA	-	-	$0.1V_{DD}$	
Voltage Drop	Vd_{COM}	$I_O = \pm 0.1$ mA	-	-	1	V
	Vd_{SEG}		-	-	1	
Input Leakage Current	I_{IL}	V_{IN} = 0 V to V_{DD}	-1	-	1	µA
Low Input Current	I_{IN}	V_{IN} = 0 V, V_{DD} = 5 V (PULL UP)	-50	-125	-250	
Internal Clock (external Rf)	f_{IC}	Rf = 91 kΩ ± 2% (V_{DD} = 5 V)	190	270	350	kHz
External Clock	f_{EC}		150	250	350	kHz
	duty	-	45	50	55	%
	tr, tf		-	-	0.2	µs
LCD Driving Voltage	V_{LCD}	V_{DD}-V_5 (1/5, 1/4 Bias)	4.6	-	10.0	V

AC Characteristics

$(V_{DD} = 4.5$ to 5.5 V, Ta $= -30$ to $+85^{o}C)$

Mode	Item	Symbol	Min	Typ	Max	Unit
Write Mode (Refer to Fig-6)	E Cycle Time	tc	500	-	-	ns
	E Rise / Fall Time	tr,tf	-	-	25	
	E Pulse Width (High, Low)	tw	220	-	-	
	R/W and RS Setup Time	tsu1	40	-	-	
	R/W and RS Hold Time	th1	10	-	-	
	Data Setup Time	tsu2	60	-	-	
	Data Hold Time	th2	10	-	-	
Read Mode (Refer to Fig-7)	E Cycle Time	tc	500	-	-	ns
	E Rise / Fall Time	tr,tf	-	-	25	
	E Pulse Width (High, Low)	tw	220	-	-	
	R/W and RS Setup Time	tsu	40	-	-	
	R/W and RS Hold Time	th	10	-	-	
	Data Output Delay Time	t_D	-	-	120	
	Data Hold Time	t_{DH}	20	-	-	
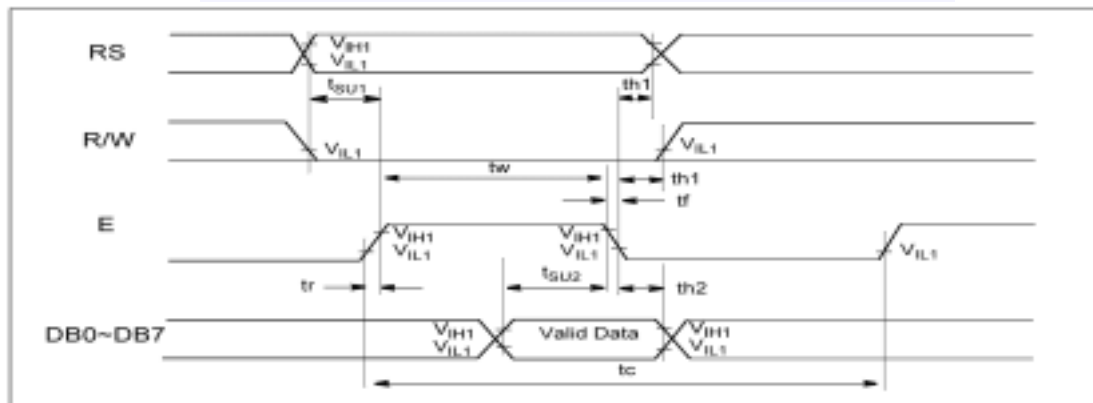
Fig-6. Write Mode Timing Diagram
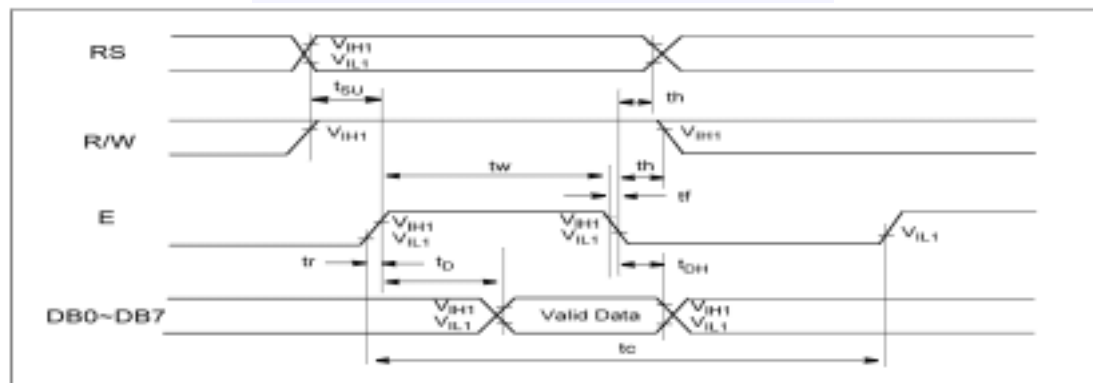
Fig-7. Read Mode Timing Diagram

2.5   Optical Characteristics

Absolute maximum ratings

Item	Symbol	Rating	Unit	Remarks
Storage temperature range	Tst	-20~70	°C	No condensation
Operating temperature range	Top	0~50	°C	No condensation

2.6   Optical Characteristics

1/16 duty, 1/4 bias, Vopr=4.6V

Item	Symbol	Temp.	Min.	Typ.	Max.	Unit
Driving voltage	Vop	0 °C	4.45	4.75	5.05	V
		20 °C	4.30	4.60	4.90	
		50 °C	4.15	4.45	4.75	
Contrast	Cr	20 °C	1.07	4.96	4.99	--
Frame freq.	f	--	32	64	128	Hz
Viewing angle*	θ_2-θ_1	20 °C	30	86	--	deg.
	ϕ		60	75	--	
Response time	t_{on}	20 °C	--	48	250	ms
	t_{off}		--	89	250	

2.6.1 Definition of optical characteristics

* Definition of angles ϕ and θ

Light (When reflected)

$Z (\theta = 0^\circ)$

Sensor

$\theta 2$

θ

$\theta 1$

i

$Y' (\phi = 180^\circ)$

$X (\phi = 90^\circ)$

X'

ϕ

LC panel

$Y (\phi = 0^\circ)$
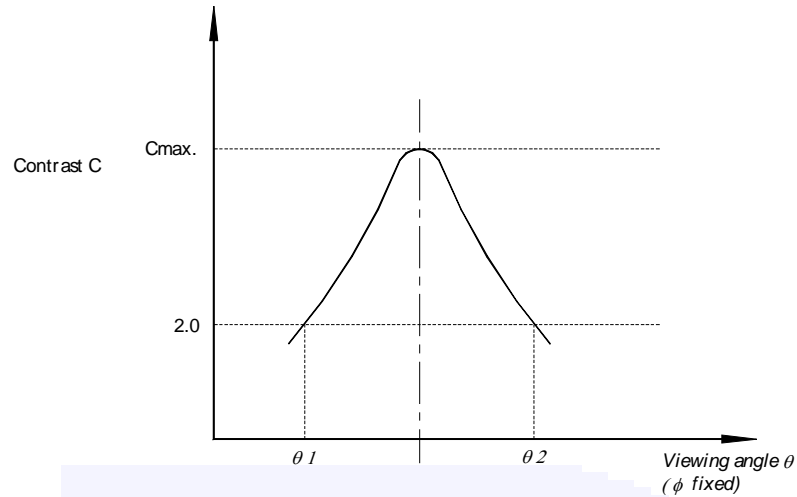$(\theta = 90^\circ)$

Z

Light (When transmitted)
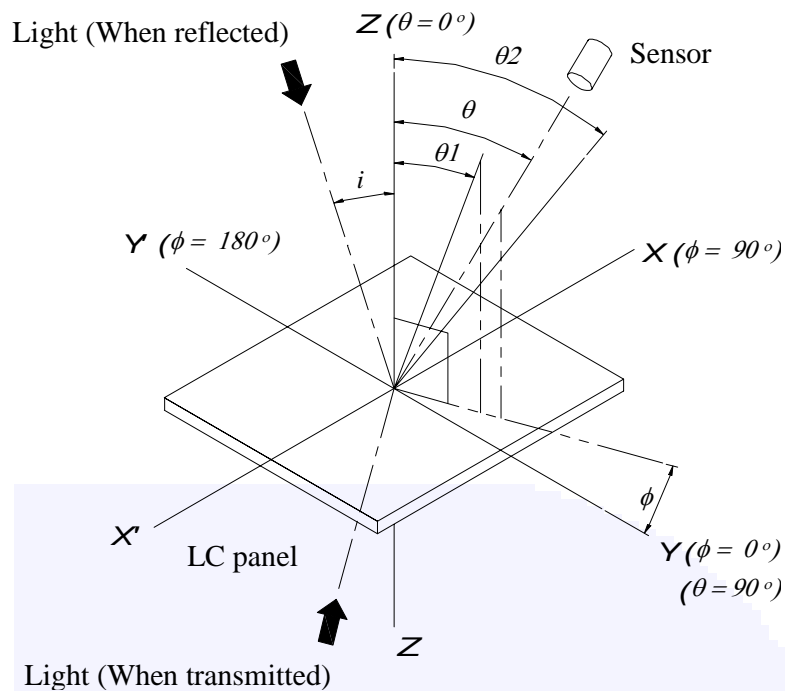
*Definition of contrast C

$$\text{Positive type } Cr = \frac{\text{Brightness of unselected portion(Bus)}}{\text{Brightness of selected portion(Bs)}}$$

Intensity

100

Selected Wave

Non-selected Wave

Cr Max

$Cr = Lon / Loff$

Vop

Driving Voltage(V)

[positive type]
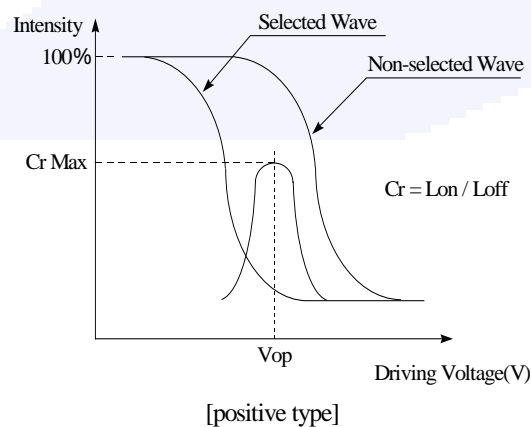
2.6.2   Definition of viewing angles $\theta1$ and $\theta2$

Note : Optimum vision with the naked eye and viewing angle θ at Cmax above are not always the same.

*   Definition of response time
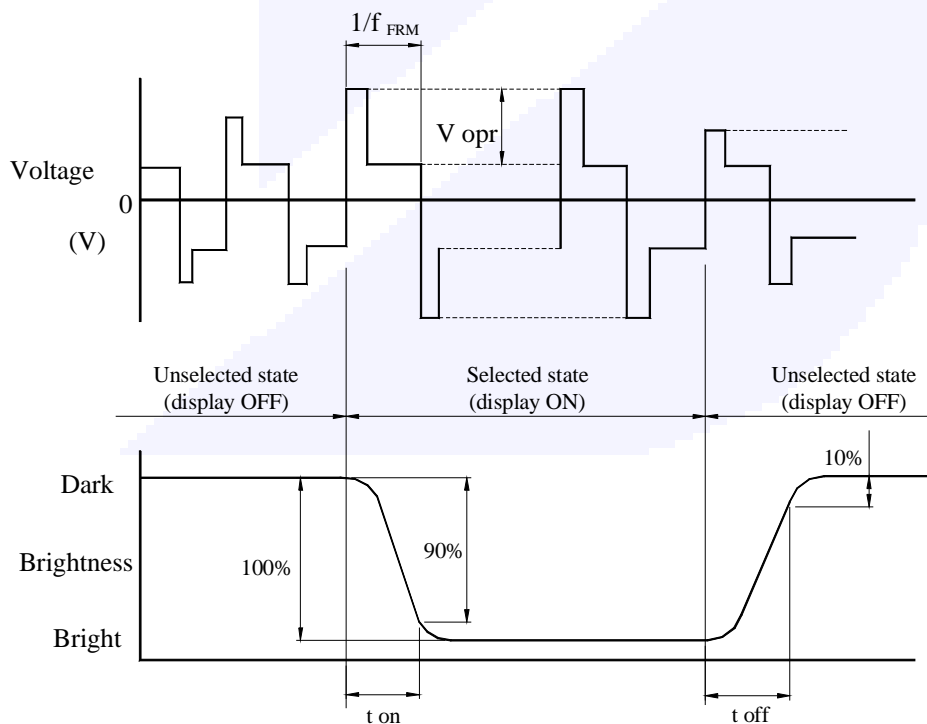
Vopr : Operating voltage (V)   ton : Response time (rise) (ms)

fFRM : Frame frequency (Hz)   toff : Response time (fall) (ms)

2.7　LED Back-light Characteristics

2.7.1 Absolute maximum ratings

Ta = 25°C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward voltage	V_f	If=120mA, Yellow Green	3.8	4.2	4.5	V
*Luminous Intensity	I_V	If=120mA, Yellow Green	250	390	530	LUX
Peak Emission Wavelength	λP	If=20mA, Yellow Green	--	573	--	nm
Spectrum Radiation Bandwidth	$\Delta\lambda$	If=20mA, Yellow Green	--	30	--	nm
Reverse　Current	I_R	VR=8V, Yellow Green	--	--	1.2	mA

Note: * Measured at the bare LED back-light unit.

2.7.2 LED Maximum Operating Range

Item	Symbol	Yellow Green	Unit
Power Dissipation	P_{AD}	1.08	W
Forward Current	I_F	240	mA
Reverse Voltage	V_R	8	V

3. RELIABILITY

3.1   Reliability

Test item	Test condition	Evaluation and assessment
Operation at high temperature and humidity	$40\,^{o}C\pm2\,^{o}C$ 90%RH for 240hours	No abnormalities in functions* and appearance**
Operation at high temperature	$50\,^{o}C\pm2\,^{o}C$ for 240 hours	No abnormalities in functions* and appearance**
Heat shock	$0\pm \sim +50\,^{o}C$ Left for 1 hour at each temperature, transition time 5 min, repeated 10times	No abnormalities in functions* and appearance**
Low temperature	$0 \pm2\,^{o}C$ for 240 hours	No abnormalities in functions* and appearance**
Vibration	Sweep for 1 min at 10 Hz, 55Hz, 10Hz, amplitude 1.5mm 2 hrs each in the X,Y and Z directions	No abnormalities in functions* and appearance**
Drop shock	Dropped onto a board from a height of 10cm	No abnormalities in functions* and appearance**

3.2   Liquid crystal panel service life
100,000 hours minimum at $25\,^{o}C\pm10\,^{o}C$

3.3   definition of panel service life
- Contrast becomes 30% of initial value
- Current consumption becomes three times higher than initial value
- Remarkable alignment deterioration occurs in LCK cell layer
- Unusual operation occurs in display functions

4. OPERATING INSTRUCTIONS

4.1 Input signal Function

NO.	Symbol	Function
1	VSS	0V Power Supply (GND Level)
2	VDD	Power supply for Logic circuit
3	V0	Power Supply for Driving the LCD Contrast
4	RS	Data / Instruction select
5	R/W	Read / Write select
6	E	Enable signal
7~14	DB0~DB7	Data Bus line
15	LED A	Power supply for LED +
16	LED K	Power supply for LED -

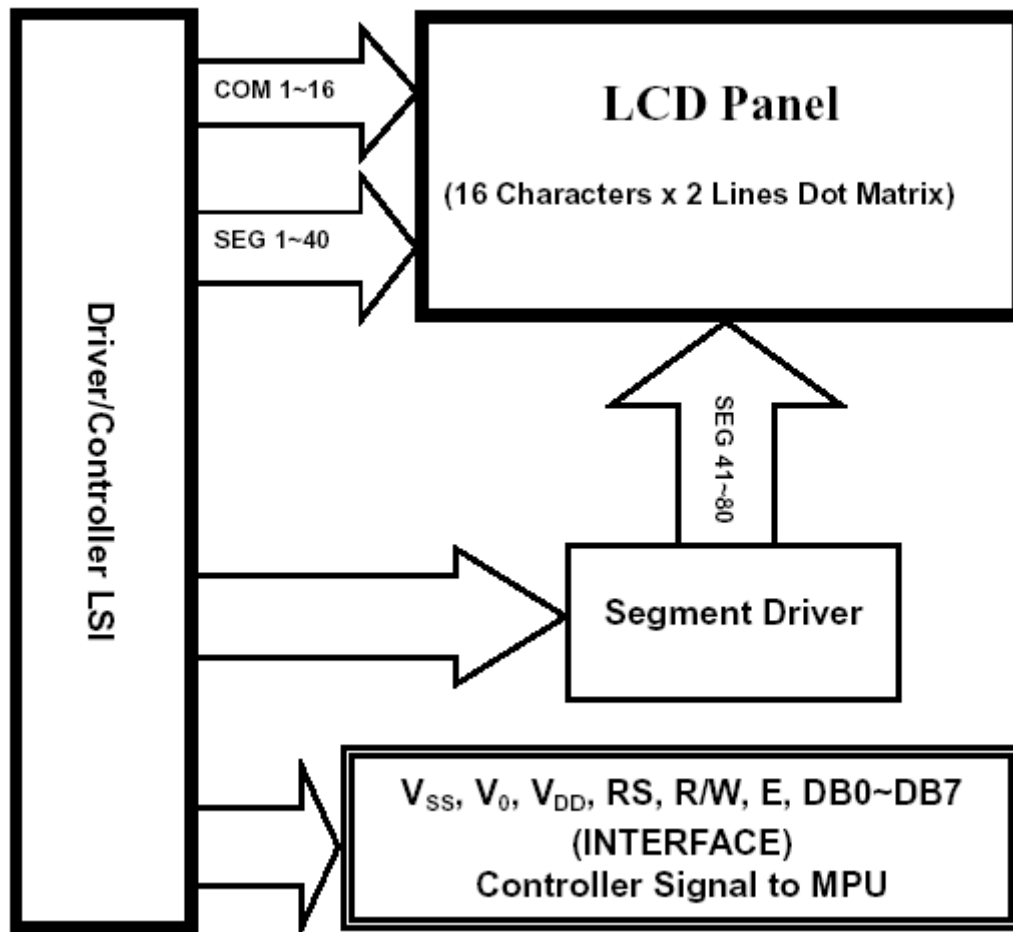### 4.1.1 Voltage Generator Circuit

Power Supply Circuit Diagram
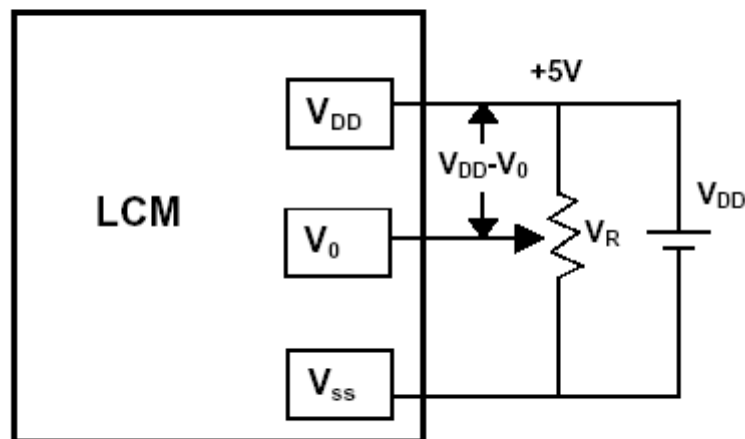
$V_{DD}-V_0$: LCD Driving Voltage
V_R : 10K~20K

4.1.2   Circuit Block Diagram

4.2 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	1	×	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted.	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 : 4-bit/8-bit), numbers of display line (N : 1-line/2-line, Display font type (F:0 ...)	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

* NOTE : When you make an MPU program with checking the Busy Flag (DB7), it must be necessary 1/2Fosc for executing the next instruction by falling E signal after the Busy Flag (DB7) goes to "0".

4.3 Font table

KS0070B-00

Thu Aug 14 16:53:42 1997

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5. NOTES

Safety

- If the LCD panel breaks, be careful not to get the liquid crystal in your mouth.   If the liquid crystal touches your skin or clothes, wash it off immediately using soap and plenty of water.

Handling

- Avoid static electricity as this can damage the CMOS LSI.
- The LCD panel is plate glass; do not hit or crush it.
- Do not remove the panel or frame from the module.
- The polarizing plate of the display is very fragile; handle it very carefully

Mounting and Design

- Mount the module by using the specified mounting part and holes.
- To protect the module from external pressure, leave a small gap by placing transparent plates (e.g. acrylic or glass) on the display surface, frame, and polarizing plate
- Design the system so that no input signal is given unless the power-supply voltage is applied.
- Keep the module dry.   Avoid condensation, otherwise the transparent electrodes may break.

Storage

- Store the module in a dark place where the temperature is $25\,^{o}C\pm10\,^{o}C$ and the humidity below 65% RH.
- Do not store the module near organic solvents or corrosive gases.
- Do not crush, shake, or jolt the module (including accessories).

Cleaning

- Do not wipe the polarizing plate with a dry cloth, as it may scratch the surface.
- Wipe the module gently with soft cloth soaked with a petroleum benzine.
- Do not use ketonic solvents (ketone and acetoe) or aromatic solvents (toluene and xylene), as they may damage the polarizing plate.

6. OPERATION PRECAUTIONS

Any changes that need to be made in this specification or any problems arising from it will be dealt with quickly by discussion between both companies.

P/N

9.40±0.3
14-ø1
2-ø2.50
71.20±0.3
62.20±0.3
56.20±0.3
2.5
4-ø1.00

A

1615

2.54×7
31±0.3
36±0.3

11.49

17.90±0.3
31.10±0.3

2 1

4-R0.5
A

K

RED LINE

2.50 2.54
45±0.3
80±0.3
85±0.3
120±3

9.10±0.3
1.60±0.3
LED BACKLIGHT
14.20Max.

2.95 0.60
0.55
5.55
0.65
0.39
0.05
0.05
0.05

A BLOCK

SOLDER SIDE

PIN
1.VSS
2.VDD
3.V0
4.RS
5.R/W
6.E
7.DB0
~
14.DB7
15.LED A
16.LED K

TOLERANCE GRADE(±)		
GRADE	A	B
~ 6	0.05	0.1
6 ~ 18	0.08	0.18
18 ~ 50	0.1	0.25
50 ~ 180	0.2	0.4
180~	0.3	0.5

DATA INTERNATIONAL CO.,

5				1	TOLERANCE GRADE 'B'		7		MECH.		DATE		TITLE	LCM(P143-2)
4				2			8		JASON		8/11/'05			
3				3			9		ELEC.		DATE			DVF-16236S2FBLY
2				4			10							
1	NEW RELEASE	8/11/'05	JASON	5			11		APPD.		DATE		DWG. NO.	
	REVISION RECORD	DATE	NAME	6			12							SHEET 1 OF 1