Ordering number : EN2674A

SANYO No.2674A

DM2021

20 Characters×2 Lines

Liquid Crystal Dot Matrix Display Module

Overview

The DM2021 is a liquid crystal dot matrix display module that consists of LCD panel LCD-5121, LCD control driver LC7985NA, and driver SED1181 and is capable of providing 20 characters×2 lines display. It contains a controller, a data RAM, and a character generator ROM required for providing display. Data interfacing is in 4-bit parallel or 8-bit parallel and data can be written in or read from a microprocessor.

General Specifications

1. Display method	1/5 bias 1/16 duty
2. Display content	20 characters×2 lines
3. Dots organizing 1 character	5×8 dots
4. Display data RAM	80×8 bits
5. Character generator ROM	160-character JIS font set + 32-character Refer to Table 1.
6. Character generator RAM	64×8 bits 5×7 dots 8 characters
7. Instruction function	Refer to Table 2.
8. Circuit diagram	Refer to Fig. 3.

Outline

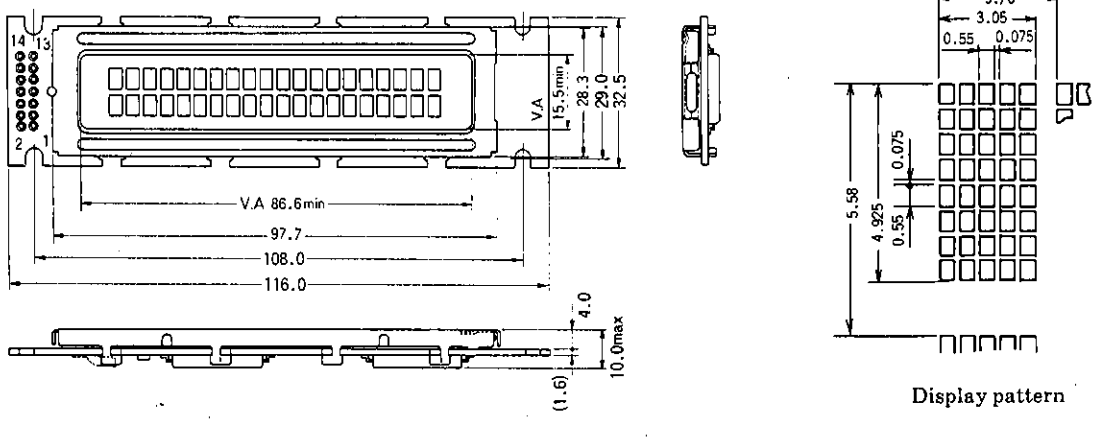
1. Module outline	116.0 (L)×32.5 (W)×10 (T) [mm³]
2. View area	86.0×15.5 [mm²]
3. Dot size	0.55×0.55 [mm²]
4. Dot pitch	0.625×0.625 [mm²]
5. Character size (5×8 dots)	3.05×4.925 [mm²]

Absolute Maximum Ratings at Ta = 25°C

			unit
Maximum Supply Voltage	$V_{DD}-V_{SS}$	−0.3 to +7	V
Input Voltage	V_I	−0.3 to V_{DD}+0.3	V
LCD Drive Voltage	$V_{DD}-V_O$	−0.3 to +13.3	V
Operating Temperature	**Topr**	0 to +50	°C
Storage Temperature	Tstg	−20 to +70	°C

Module Dimensions 5008

(unit: mm)

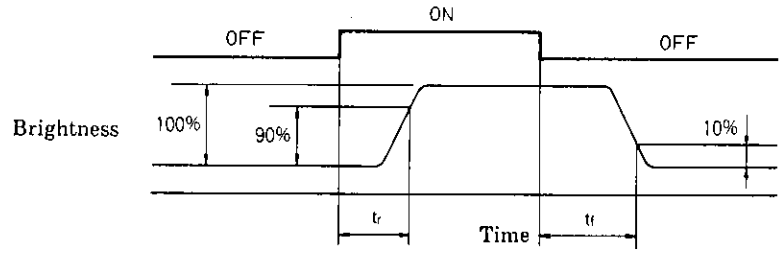


Display pattern

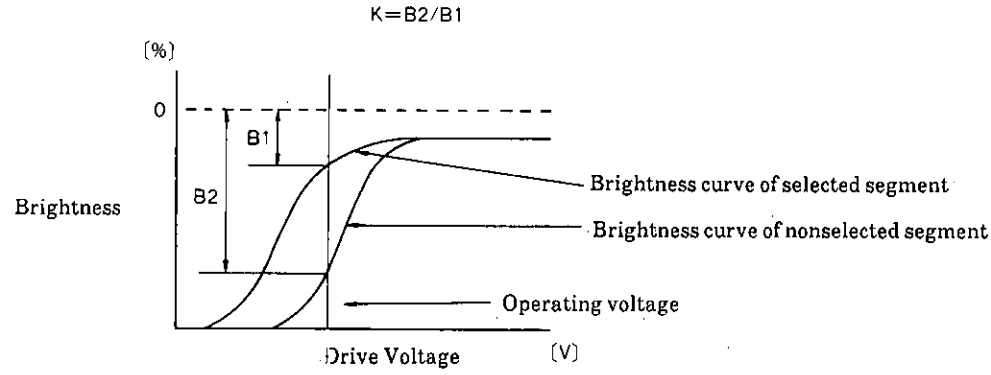
Electro-optical Characteristics at Ta = 25°C, $V_{DD} - V_{SS}$ = 5V unless otherwise specified

			min	typ	max	unit
Input 'H'-Level Voltage	V_{IH}		2.2		V_{DD}	V
Input 'L'-Level Voltage	V_{IL}		0		0.6	V
Output 'H'-Level Voltage	V_{OH}	DB_0 to DB_7, $-I_{OH}$ = 0.2mA	2.4		V_{DD}	V
Output 'L'-Level Voltage	V_{OL}	DB_0 to DB_7, $-I_{OL}$ = 1.2mA	0		0.4	V
Pull-up MOS Current	I_P	DB_0 to DB_7, RS, R/W	50	125	250	μA
Current Dissipation	I_{DD}	No input/output current included		(1.5)	3.0	mA
Oscillation Frequency	F_{OSC}		190	270	350	kHz
Viewing Angle	$\phi 2 - \phi 1$	K = 1.4, θ = 0°	20	30		deg.
Contrast Ratio	K	ϕ = 20°, θ = 0°	3.0			
Rise Time	t_r	ϕ = 20°, θ = 0°		200	300	ms
Fall Time	t_f	ϕ = 20°, θ = 0°		300	450	ms
LCD Drive Voltage	$V_{DD} - V_O$	Ta = 0°C, ϕ = 20°, θ = 0°, K ≧ 3	4.4	4.5	4.6	V
(Recommended Value)		Ta = 25°C, ϕ = 20°, θ = 0°, K ≧ 3	4.0	4.1	4.2	V
1/16 Duty		Ta = 50°C, ϕ = 20°, θ = 0°, K ≧ 3	3.4	3.5	3.6	V

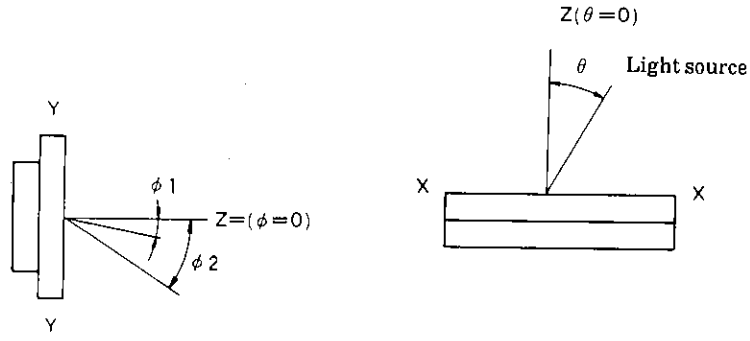
(1) Test Condition for Response Time (t_r, t_f)



(2) Definition of Contrast Ratio [K]



(3) Contrast Ratio Measuring Method



Angles ϕ and θ are defined as shown above.
The light source is placed in the θ direction at an angle of 30° and the sensor is placed in the ϕ direction to measure the contrast.

Pin Description

No.	Pin Name	Function
1	V_{SS}	(−) power supply pin 0V
2	V_{DD}	(+) power supply pin +5V
3	V_O	Pin for applying LCD drive voltage
4	RS	Input pin, HI = Data, LOW = Instruction
5	R/W	Input pin, HI = Read, LOW = Write
6	E	Input pin, Enable signal
7	DB_0	Data bus line
8	DB_1	
9	DB_2	
10	DB_3	
11	DB_4	
12	DB_5	
13	DB_6	
14	DB_7	

Timing Characteristics			min	typ	max	unit
Enable Cycle Time	t_{cycE}	Figs.1,2	1000			ns
Enable Pulse Width [High Level]	P_{WEH}		450			ns
Enable Rise/Fall Time	t_{Er},t_{Ef}				25	ns
Setup Time [RS/RW-E]	t_{As}		140			ns
Address Hold Time	t_{AH}		10			ns
Data Delya Time	t_{DDR}				320	ns
Data Setup Time	t_{DSW}		195			ns
Data Hold Time	t_H(t_{DHR})		10(20)			ns

Write Operation

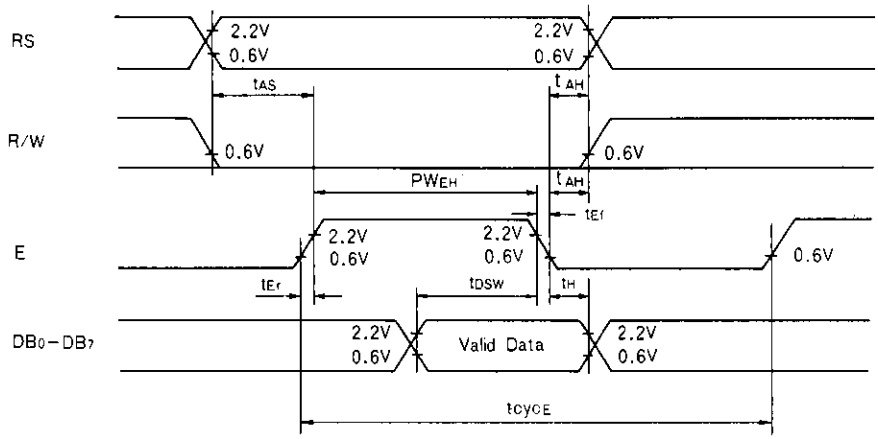


Fig.1 Interface Timing (Data Write)

Read Operation

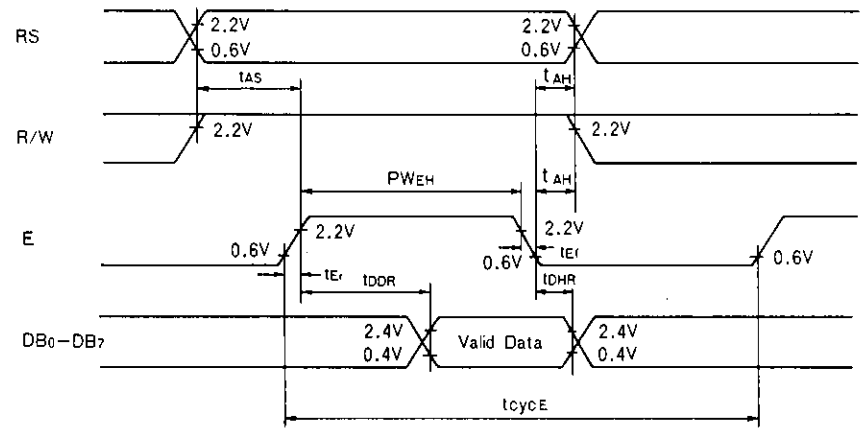


Fig.2 Interface Timing (Data Read)

Table 1 Character Code

Low-order 4bits \ Hi-order 4 bits	0000	0010	0011	0100	0101	0110	0111	1010	1011	1100	1101	1110	1111
××××0000	CG RAM (1)												
××××0001	(2)												
××××0010	(3)												
××××0011	(4)												
××××0100	(5)												
××××0101	(6)												
××××0110	(7)												
××××0111	(8)												
××××1000	(1)												
××××1001	(2)												
××××1010	(3)												
××××1011	(4)												
××××1100	(5)												
××××1101	(6)												
××××1110	(7)												
××××1111	(8)												

(Note) The CG RAM is a character generator RAM used to store the character patterns that can be program-rewritten, as desired, by the user.

Table 2 Instruction Function

Instruction	Code										Contents	Execution Time (f_{OSC}=250kHz)
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Display clear	0	0	0	0	0	0	0	0	0	1	Clears all display and returns the cursor to the home position (address 0).	82μs to 1.64ms
Cursor home	0	0	0	0	0	0	0	0	1	*	Returns the cursor to the home position address 0). Also returns the display being shifted to the original position. The DD RAM contents remain unaffected.	40μs to 1.6ms
Entry mode set	0	0	0	0	0	0	0	1	I/D	S	Sets the cursor move direction and specifies whether or not the shift the display. These operations are performed during data write and read.	40μs
Display ON/OFF control	0	0	0	0	0	0	1	D	C	B	Sets all display ON/OFF (D), cursor ON/OFF (C), cursor position character blink (B).	40μs
Cursor/display shift	0	0	0	0	0	1	S/C	R/L	*	*	Moves the cursor and shifts the display without affecting the DD RAM contents.	40μs
Function set	0	0	0	0	1	DL	N	F	*	*	Sets the interface data length (DL), number of display lines (L), and character font (F).	40μs
CG RAM address set	0	0	0	1	A_{CG}						Sets the CG RAM address. RAM data is sent/received after this setting.	40μs
DD RAM address set	0	0	1	A_{DD}							Sets the DD RAM address. DD RAM data is sent/received after this setting	40μs
Busy flag/address read	0	1	BF	AC							Reads the contents of busy flag (BF) indicating internal operation is in progress and reads the contents of address counter.	1μs
CG RAM/DD RAM data write	1	0	Write data								Writes data into the DD RAM or CG RAM.	40μs
CG RAM/DD RAM data read	1	1	Read data								Reads data from the DD RAM or CG RAM.	40μs
	I/D=1: Increment (+1) I/D=0: Decrement (−1) S=1: Accompanied by display shift S/C=1: Display chift S/C=0: Cursor move R/L=1: Right-shift R/L=0: Left-shift DL=1: 8 bits DL=0: 4 bits N=1: 2 lines N=0: 1 line F=1: 5×10 dots F=0: 5×7 dots BF=1: Internally operating BF=0: Possible to accept instruction										DD RAM: Display data RAM CG RAM: Character generator RAM A_{CG}: CG RAM address A_{DD}: DD RAM address Corresponds to cursor address. AC: Address counter used for both DD RAM and CG RAM.	The change in the frequency (f_{OSC}) also causes the execution time to be changed. (Example) When f_{OSC}=270kHz, $40\mu s \times \frac{250}{270} = 37\mu s$

Fig. 3 Circuit Diagram DM2021

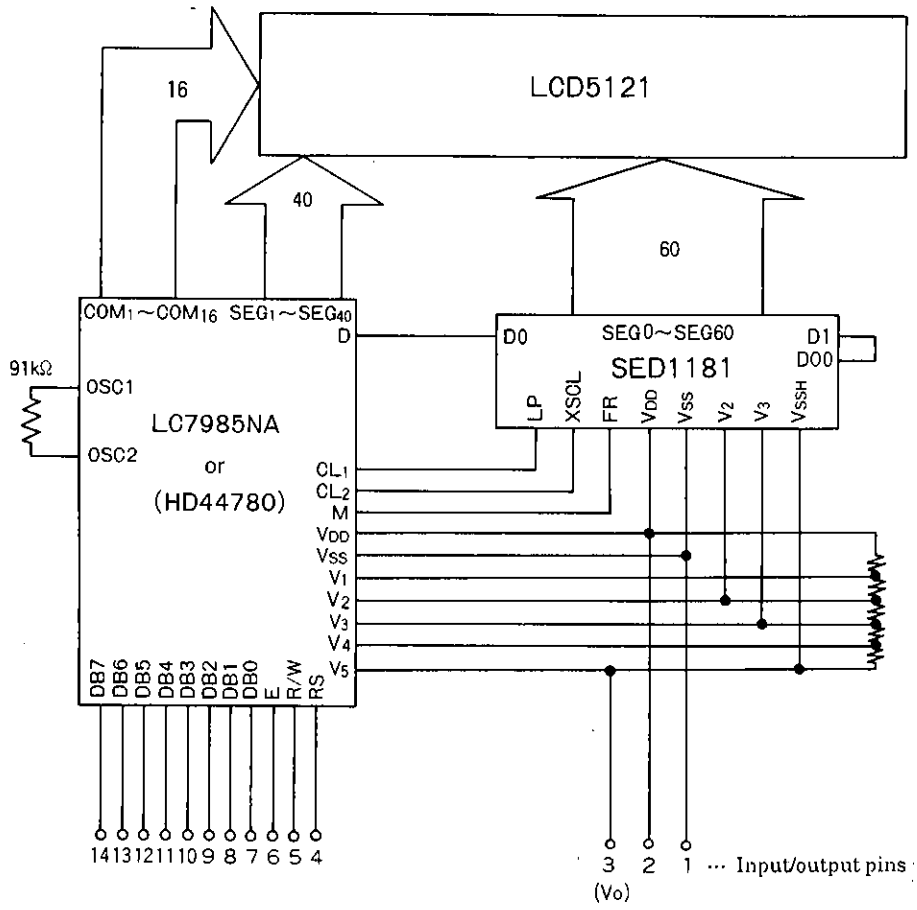
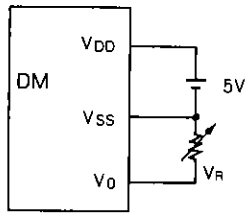


Fig. 4 Sample Power Supply



V_{DD}-V_O : LCD drive voltage
The LCD drive voltage can be varied from approximately 3V to 5V by a variable resistor of 5kΩ connected across V_{SS} and V_O.