Liquid Crystal Displays

20 characters × 2 lines COG module
RCM2234R-A / B

The RCM2234R-A / B is a reflective TN type liquid crystal module with a built-in controller / driver LSI and a display capacity of 20 characters × 2 lines.

●**Applications**

Printers, Copiers, Facsimiles, etc

●**Features**

(1) 5×7 dot character matrix with cursor.

(2) Interfaces with 4-bit, 8-bit MPUs.

(3) Displays up to 240 characters and special symbols.

(4) Custom character patterns are displayed with the character RAM.

(5) Abundant instruction set including clear display, cursor on/off, and character blinking.

(6) Compact and lightweight for easy assembly to the host instrument.

(7) Operable on single 5V power supply.

(8) Low power consumption.

●**External dimensions** (Unit : mm) (Viewing direction : 6 : 00)

Dot detail

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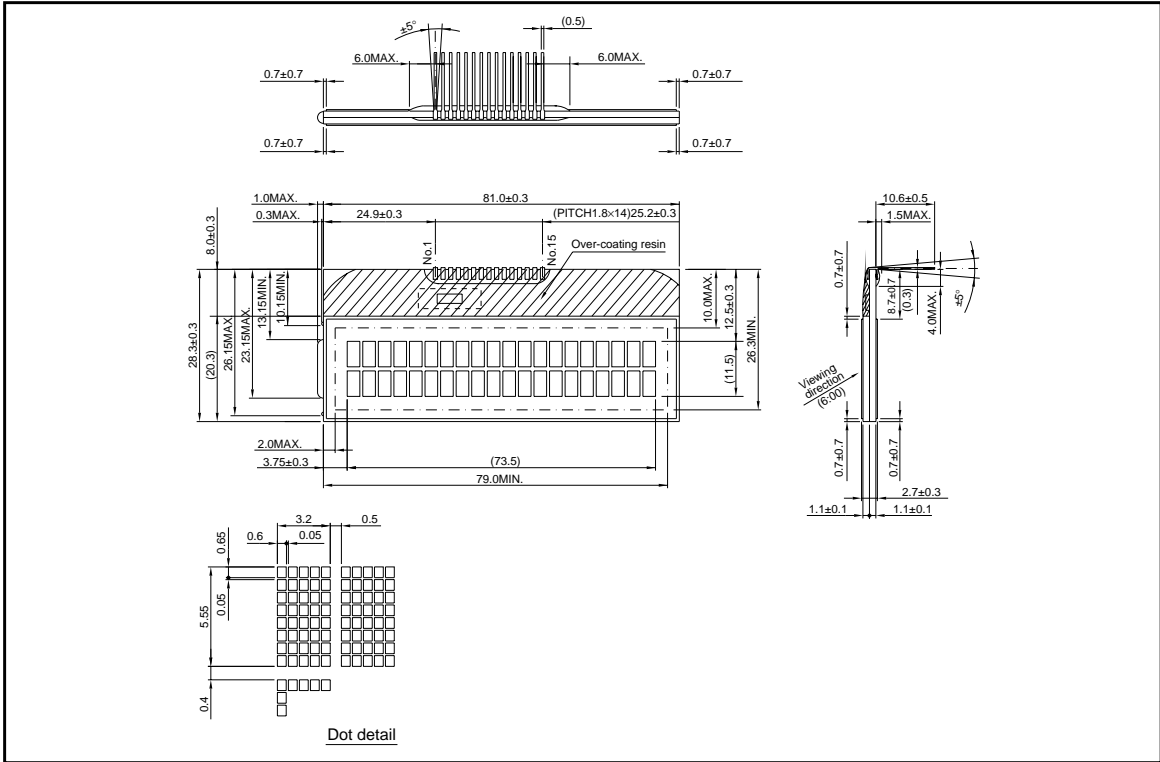
Liquid Crystal Displays

● **Block diagram**

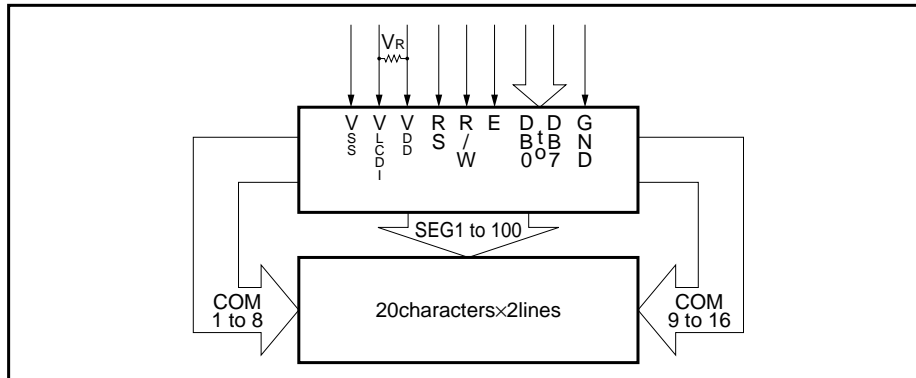Fig.1

Note 1. (V_{LCDI}-V5)V is applied to LCD as driving voltage. Optimal driving voltage changes by viewing angle or temperature,
therefore adjusting V5 voltage in the condition that LCD is mounted on board is necessary.
2. Considering variation of power voltage and optimal driving voltage, V5 voltage should be adjustable.
3. V_R : 10kΩ to 20kΩ (variable)

● **Pin assignments**

Pin No.	symbol	Pin No.	symbol
1	V_{SS}	9	DB2
2	V_{LCDI}	10	DB3
3	V_{DD}	11	DB4
4	RS	12	DB5
5	R / W	13	DB6
6	E	14	DB7
7	DB0	15	GND
8	DB1		

● **Absolute maximum ratings** (Ta=25°C)

Parameter	Symbol	Min.	Max.	Unit	Notes
Power voltage (1)	V_{DD}	−0.3	7.0	V	–
Power voltage (2)	V_{LCDI}	−0.3	12.0	V	–
Input voltage	V_{IN}	−0.3	V_{DD}+0.3	V	Input terminal
Operation temperature	Topr	0	50	°C	–
Storage temperature	Tstg	−20	70	°C	–

Note 1.Use of LSI above the absolute maximum ratings may cause permanent LSI damage.
2.All voltage values are shown using V_{SS}=0V as a reference.
3.Power supply must be retained in the relationship of V_{DD}-V_{SS}.

Liquid Crystal Displays

●**Electrical characteristics** (V_{DD}=5.0V, Ta=25°C)

Parameter	Symbol	Terminal Name	Min.	Typ.	Max.	Unit	Conditions
Logic power voltage	V_{DD}		4.75	5.0	5.25	V	
LCD power voltage	V_{LCDI}		3.0	–	5.0		
H input voltage (1)	V_{IH}	E, RS, SEL1,	$0.7V_{DD}$	–	V_{DD}	V	
L input voltage (2)	V_{IL}	DB0 to DB7	V_{SS}	–	0.7	V	
H output voltage	V_{OH}	DB0 to DB7	$0.8V_{DD}$	–	–	V	IOH= –100µA
L output voltage	V_{OL}		–	–	$0.2V_{DD}$	V	IOL=100µA
Clock oscillation frequency	fosc		175	250	325	kHz	LCD drive resistance
LCD driving voltage	V_{LCD}		3.0	–	5.0	V	
Current consumption	I_{DD}	V_{DD}	–	700	1400	µA	Check pattern

●**Optical characteristics** (Ta=25°C)

(1) Viewing direction 6:00
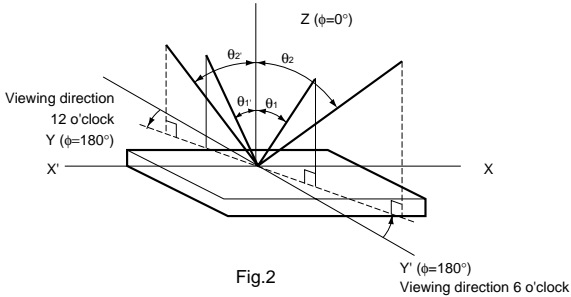
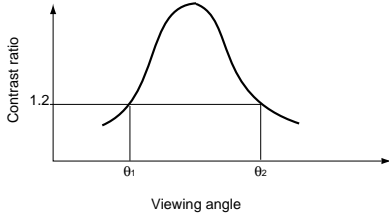| Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Response time	t_r	–	100	250	ms	θ=10°, φ=0°
Response time	t_d	–	150	250	ms	θ=10°, φ=0°
Contrast ratio	K	–	3	–	–	θ=10°, φ=0°
Viewing angle	$θ_1$	–	–	0	deg	K≥1.2 φ=0°
	$θ_2$	20	–	–		
	φ	±30	–	–	deg	K≥1.2 θ=20°

(2) Viewing direction 12:00

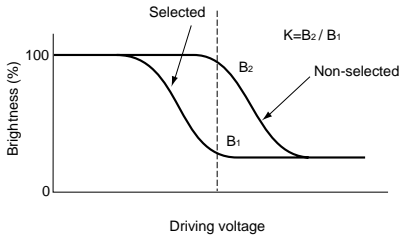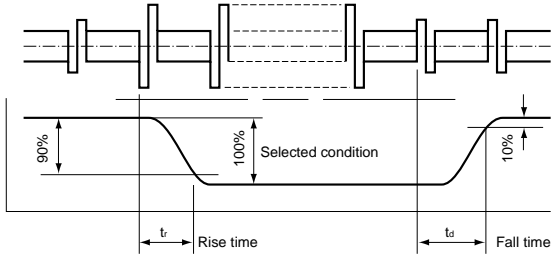| Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Response time	t_r	–	100	250	ms	θ'=10°, φ=180°
Response time	t_d	–	150	250	ms	θ'=10°, φ=180°
Contrast ratio	K	–	3	–	–	θ'=10°, φ=180°
Viewing angle	$θ_1'$	–	–	0	deg	K≥1.2 φ=180°
	$θ_2'$	20	–	–		
	φ	150 to 210	–	–	deg	K≥1.2 θ'=20°

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Liquid Crystal Displays

(1) Definition θ and φ

Z (φ=0°)

θ2' θ2

Viewing direction
12 o'clock
Y (φ=180°)

θ1' θ1

X'   X

Fig.2

Y' (φ=180°)
Viewing direction 6 o'clock

(2) Definition of viewing angles θ1 and θ2

Contrast ratio

1.2

θ1   θ2

Viewing angle

Fig.3

(3) Definition of contrast ratio "K"

Selected

K=B₂ / B₁

B₂

Non-selected

100

Brightness (%)

B₁

0

Driving voltage

Fig.4

(4) Definition of optical response

90%   100%   Selected condition   10%

t_r   Rise time   t_d   Fall time

Fig.5

● **Terminal function**

| Symbol	I/O Terminal	Function
V_{SS}	Input	V_{SS}=0V
V_{LCDI}	Input	LCD driving voltage input terminal $3.0 \leq V_{LCDI} \leq 5.0$
V_{DD}	Input	V_{DD}=4.75 to 5.25V
RS	Input	Register selected signal L: Instruction register (at write) Busy flag / address counter (at read) H: Data register (at write & read)
R / W	Input	Read / Write select signal L: Write H: Read
E	Input	Data Read / Write enable signal
DB0 to DB3	Input / Output	Data bus four-state bi-directional
DB4 to DB7	Input / Output	Data bus four-state bi-directional

● **Timing characteristics**

Write operation
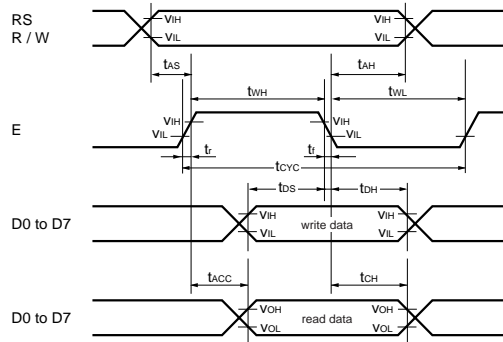
Fig.6

Item	Symbol	Min.	Typ.	Max.	Unit	Condition
Address set up time	t_{AS}	120	—	—	ns	at write
		120	—	—	ns	at read
Address hold time	t_{AH}	20	—	—	ns	
"E" pulse width H level	t_{WH}	500	—	—	ns	
"E" pulse width L level	t_{WL}	500	—	—	ns	
Cycle time	t_{CYC}	1000	—	—	ns	
Data setup time	t_{DS}	200	—	—	ns	
Data hold time	t_{DH}	20	—	—	ns	
Output disable time	t_{ACC}	—	—	95	ns	
Output data hold time	t_{CH}	40	—	—	ns	
"E" rise / fall time	t_r, t_f	—	—	10	ns	

＊ Numbers above mentioned are driver IC's number as a single unit.
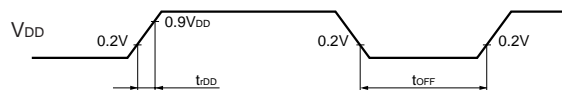 In designing, please set the timing with sufficient margin.

● **Reset Circuit**

The busy flag indicating internal operating state is H level in the period of 2ms after Reset operation starting. External input is not available in this state. After 2ms passes or confirms the busy flag is L level the instruction can be acceptable.
If the power supply conditions are not met, the integrated reset circuit will not operate properly. Execute initialization by instruction.

Item	Symbol	Min.	Typ.	Max.	Unit	Condition
Power rise time	t_{rDD}	0.1	–	10	ms	–
Power OFF time	t_{OFF}	1	–	–	ms	–

Note : The power OFF time specifies the time during which the power is off when the instantaneous power failure occurs or power ON/OFF repeated.

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●**Instruction**

Instruction	Instruction code										Description	Time (Max.)
	RS	RW	D7	D6	D5	D4	D3	D2	D1	D0		
Display Clear	0	0	0	0	0	0	0	0	0	1	Clears entire display and sets DDRAM address 0 in address counter.	3.3ms
Cursor Home	0	0	0	0	0	0	0	0	1	*	Sets DDRAM address 0 in the address counter shifted display returns to the original state. DDRAM data does not change.	3.3ms
Entry Mode Set	0	0	0	0	0	0	0	1	I / D	S	I/D : Specifies cursor / display shift (I/D=1 : +1 I/D=0 : −1) S : Executes the shift operation (S=1 : shift S=0 : no shift) These operation are performed during data write and read.	80µs
Display ON / OFF Control	0	0	0	0	0	0	1	D	C	B	D : All display ON / OFF (1 : ON, 0 : OFF) C : Cursor ON / OFF (1 : ON, 0 : OFF) B : Cursor position blink ON / OFF (1 : ON, 0 : OFF)	80µs
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	*	*	Shifts the cursor or display without changing DDRAM data S / C : (1 : Display shift, 0 : Cursor shift) R / L : Specifies the shift direction (1 : Right shift, 0 : Left shift)	80µs
Function Set	0	0	0	0	1	DL	N	*	*	*	Sets function for the internal operation DL : (1:8bit, 0:4bit) N : (1:2line, 0:1line)	80µs
CGRAM Address set	0	0	0	1	ACG						Assigns the CGRAM address	80µs
DDRAM Address set	0	0	1	ADD							Assigns the DDRAM address	80µs
Busy flag Address counter read	0	1	BF	AC							BF : Reads the internal operation state (1 : In operation, 0 : Completed operation) AC : Reads the address counter value.	—
Data write	1	0	Write data								Writes data into DD / CGRAM	80µs
Data read	1	1	Read data								Read data from DD / CGRAM	80µs

Note) *1.In designing, please set the timing with sufficient margin.
        *2.When frequency changes, operation time also change.
        *3.SEG / COM forward directions are prescribed as below by ITO patterns.
            SEG1→SEG100, COM1→COM16

(* : Don't care)

Liquid Crystal Displays

● **Character code and corresponding character pattern**

The character code table shows the correspondence between the upper 4 bits (columns 0000 through 1111) and the lower 4 bits (rows 0000 through 1111) of the character codes, with the CGRAM characters located in column 0000.

●**Operation note**

(1) Handling precautions

- Protect the module from strong shocks as they can cause damage or defective operation.
- The polarizing plate on the surface of the module is soft and can easily be scratched. Wipe away dirt and dust using an alcohol-based cleanser.
- If the liquid crystal panel is damaged and the liquid crystal contacts your clothing or body, wash immediately with soap and water.
- If the module is to be used for long periods subjected to direct sunlight, employ a filter to block the ultravioletrays.
- Do not use the module in areas of high temperature or high humidity. Do not use the module locations exposed to direct sunlight or fluorescent light.
- A protective film (polyethylene) is pasted over ROHM liquid crystal modules to protect the panel surfaces. When peeling this film off, be sure to peel as slow as possible in order to minimize the generation of static electricity.

(2) Precautions during operation

- Do not connect or disconnect the module while the power supply is turned on.
- Input the input signal after the module power supply is turned on. When turning if off, turn off the input signal first. Otherwise the IC may be damaged by the latch-up phenomenon.

(3) Precautions during installation

- Be sure to use a grounded soldering iron when performing any installation procedures.
- Be careful to avoid damage from static electricity. A CMOS-IC is used in the modules circuitry that can be easily damaged by static electricity.

(4) Precautions during unit assembly

- In order to protect the polarizing plate from dirt or scratches, it is recommended to use a protective cover on the front surface.

(5) Precautions for COG module

- Do not subject the front and back surface of the IC to light. Doing so may cause defective operation.
- When peeling off the protective film of the panel, use of an ion blower or other device to reduce the generation of static electricity is recommended.
- No special measures are taken to prevent the generation of static electricity on the module. Therefore, be sure to take the appropriate measures to prevent the generation of electrical charge on the LCD module by the design of the product itself.

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