

RCM1990U-A

●Applications

●Features

- 1) Wide viewing angle, high contrast, and fast response.
- 2) Compact and light weight for easy assembly.
- 3) Low power consumption.

[illegible]

Input (CN3)

Pin No.	Symbol	IN/OUT	Function
1	FLM	IN	Frame start signal
2	VO	–	Liquid crystal drive power supply
3	V _{DD}	–	5 volts
4	M	IN	AC conversion signal for liquid crystal drive output
5	CL1	IN	Data latch signal, displays at rise / fall edge
6	CL2	IN	Shift register shift signal, reads data at rise / fall
7	DI	IN	Display data signal (1 : On, 0 : Off)
8	GND	–	Ground potential

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8	GND	–	Ground potential

Liquid crystal displays

●Absolute maximum ratings (Ta=25°C)

Parameter		Symbol	Limits	Unit
Power supply voltage	Logic circuit	V _{DD}	-0.3 to +7.0	V
	LCD drive	V _{DD} -V _{EE}	-0.3 to +7.0	V
Input voltage		V _{IN}	-0.3 to V _{DD} +0.3	V
Operating temperature		T _{opr}	0 to +50	°C
Storage temperature		T _{stg}	-10 to +60	°C

●Electrical characteristics (Ta=25°C, V_{DD}=5.0V±0.25V)

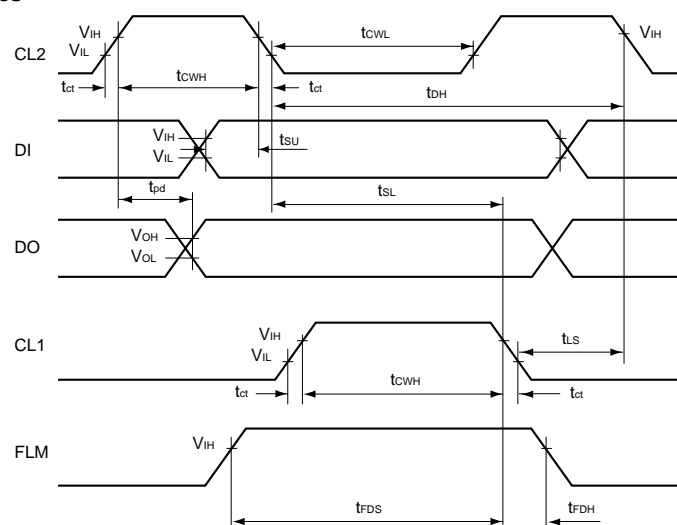
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
High level input voltage	V _{IH}	3.5	—	—	V	
Low level input voltage	V _{IL}	—	—	1.5	V	
High level output voltage	V _{OH}	4.6	—	—	V	I _{OH} =-0.4mA
Low level output voltage	V _{OL}	—	—	0.4	V	I _{OH} =+0.4mA
Recommended LCD drive voltage	V _{LCD}	—	5.0	—	V	Ta=25°C
Current dissipation	I _{DD}	—	1.0	3.0	mA	f _{CL} =1MHz, f _M =70Hz

●AC characteristics (Ta=25°C, V_{DD}=5.0)

Parameter	Symbol	Applicable terminal	Min.	Typ.	Max.	Unit
Shift frequency	f _{CL}	CL2	—	—	1	MHz
High level lock width	t _{CWH}	CL1, CL2	470	—	—	ns
Low level lock width	t _{CWL}	CL2	470	—	—	ns
Data setup time	t _{SU}	DI	120	—	—	ns
Clock setup time 1	t _{SL}	CL2	220	—	—	ns
Clock setup time 2	t _{LS}	CL1	220	—	—	ns
Data hold time	t _{DH}	DI	120	—	—	ns
FLM setup time	t _{FDS}	FLM	120	—	—	ns
FLM hold time	t _{FDH}	FLM	120	—	—	ns
Clock rise / fall time	t _{ct}	CL1, CL2	—	—	50	ns
Output delay time	t _{pd}	DO	—	—	250	ns
AC conversion signal	f _M	M	—	70	—	Hz

Liquid crystal displays

●Timing characteristics

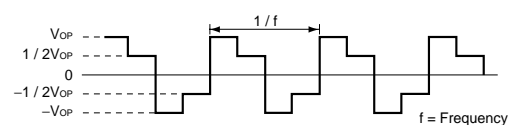


●Optical characteristics (Ta=25°C)

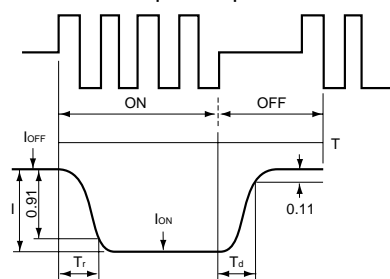
No.	Parameter		Symbol	Temperature (°C)	Min.	Typ.	Max.	Unit	Note
1	Response speed		Tr	25	—	65	130	ms	(Note 2)
				0	—	400	800		
			Td	25	—	45	100		
				0	—	150	300		
2	Viewing angle	Front-back	θ	25	0	—	60	deg	(Note 3) K≥3
		Right-left	φ	25	90	—	270		
3	Contrast ratio		K	25	20	40	—		φ=180° θ=10°

(Note 1) Drive waveform

Static drive



(Note 2) Definition of response speed



Liquid crystal displays

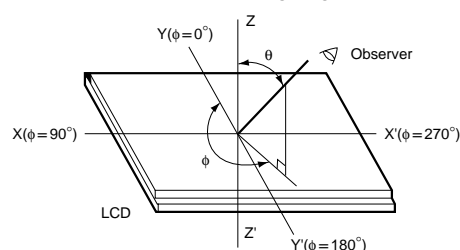
Tr : Time for segment to darken 90% after selective waveform switches to non-selective waveform.

$$\phi=180^\circ, \theta=10^\circ$$

Td : Time for segment to darken 90% after selective waveform switches to non-selective waveform.

$$\phi=180^\circ, \theta=10^\circ$$

(Note 3) Definition of viewing angle (ϕ , θ)



(1) ϕ : Angle subtended by the Y-Y'-axis and the observer's position projected onto the XY-plane.

(2) θ : Angle subtended by observer and the normal Z-Z'axis. (X-axis and Y-axis are positive)

(3) Maximum viewing angle : The direction with highest contrast expressed at the time axis (refer to above table).

(Note 4) Definition of contrast ratio

<Definition>

$$\text{Contrast ratio} = \left(\frac{\text{Luminance during application of non-selective waveform}}{\text{Luminance during application of selective waveform}} \right)^n$$

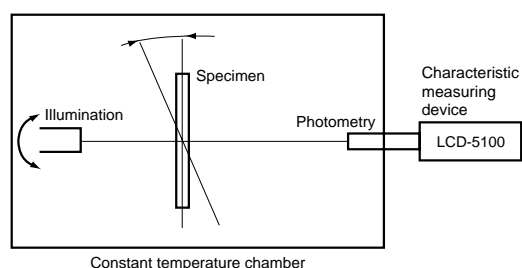
Except, $n=1$ with positive display and $n=-1$ with negative display.

< Measurement conditions >

Drive conditions : As per specifications

Viewing angle : $\phi=180^\circ, \theta=10^\circ$

(Note 5) Principles of optical measuring equipment



Liquid crystal displays

●Data format (data and display mapping)

D1	D17	D33	D49	D65	D81	—	—	—	—	—	D177	D193	D209	D225	D241
D2	D18	D34	D50	D66	D82	—	—	—	—	—	D178	D194	D210	D226	D242
D3	D19	D35	D51	D67	D83	—	—	—	—	—	D179	D195	D211	D227	D243
D4	D20	D36	D52	D68	D84	—	—	—	—	—	D180	D196	D212	D228	D244
D5															D245
D6															D246
D7															D247
D8															D248
D9															D249
D10															D250
D11															D251
D12															D252
D13	D29	D45	D61	D77	D93	—	—	—	—	—	D189	D205	D221	D237	D253
D14	D30	D46	D62	D78	D94	—	—	—	—	—	D190	D206	D222	D238	D254
D15	D31	D47	D63	D79	D95	—	—	—	—	—	D191	D207	D223	D239	D255
D16	D32	D48	D64	D80	D96	—	—	—	—	—	D192	D208	D224	D240	D256

FIRST DATA ←

D2	D4	D6	D8									D250	D252	D254	D256
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COM.2 DATA

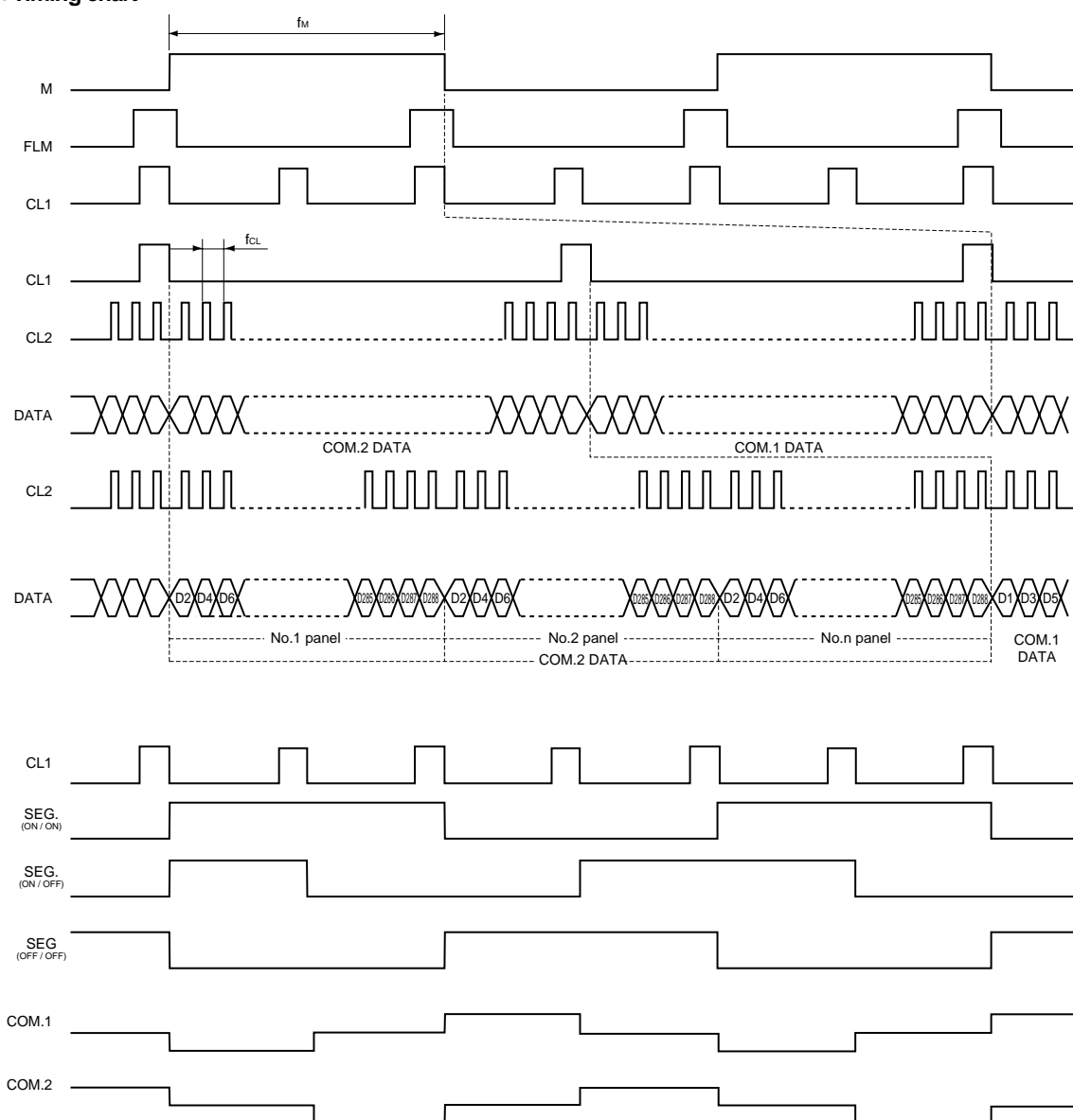
D1	D3	D5	D7									D249	D251	D253	D255
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COM.1 DATA

→ LAST DATA

Liquid crystal displays

●Timing chart



Liquid crystal displays

●Operation notes

(1) Attention points in handling

- 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 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 ultraviolet rays.
- Do not store the module in areas of high temperature or high humidity. Do not store the module in locations exposed to direct sunlight or fluorescent light.

(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 it off, turn off the input signal first. Otherwise the IC may be damaged by the latchup phenomenon.

(3) Precautions during installation

- 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.
- Do not remove the liquid crystal panel from the unit.
- Do not touch the back side of the liquid crystal panel.

(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.

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