

# 24×24 dots 8 Color large-sized liquid crystal display unit

## RCU1381U-A

Thanks to the high contrast and wide viewing angle of the RCU1381U-A, which is provided by its unique design technology, this module brings forth new applications in brand new LCD fields. ROHM large-sized LCD units are perfect displays for information or sign boards. As a media for informational display, large-sized LCD units must possess high visibility, wide viewing angles, and other such superior qualities. ROHM large-sized LCDs boast an excellent track record and possess guaranteed functionality for assured satisfaction in a variety of situations.

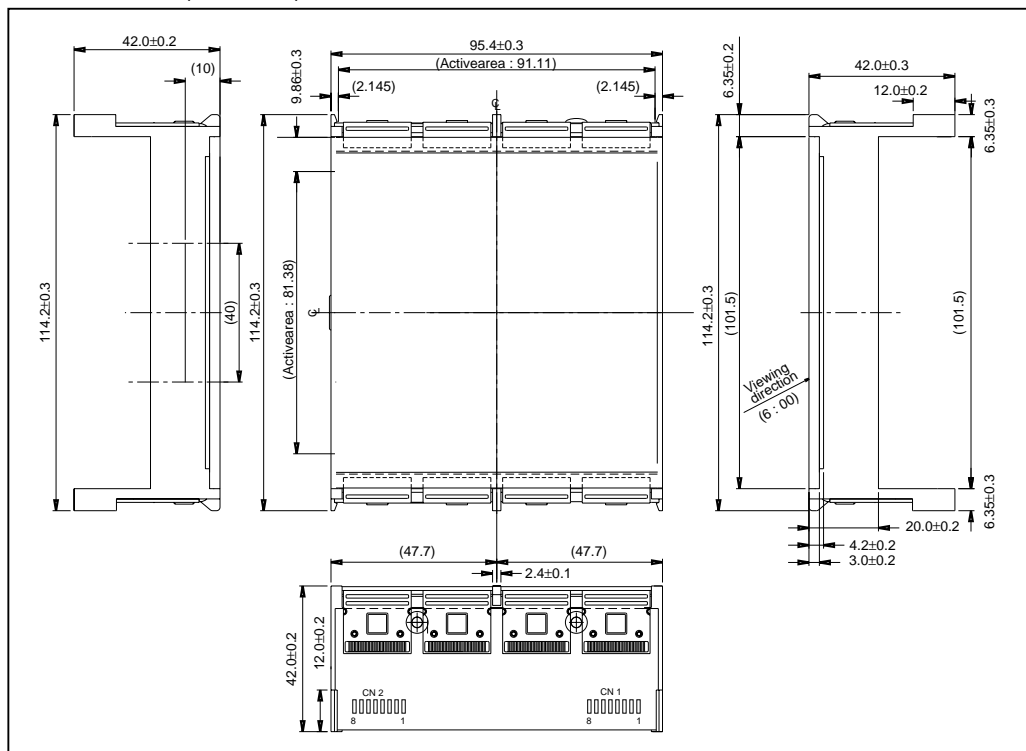
### ●Applications

Public displays such as airport displays, train station displays, information boards, and billboards.

### ●Features

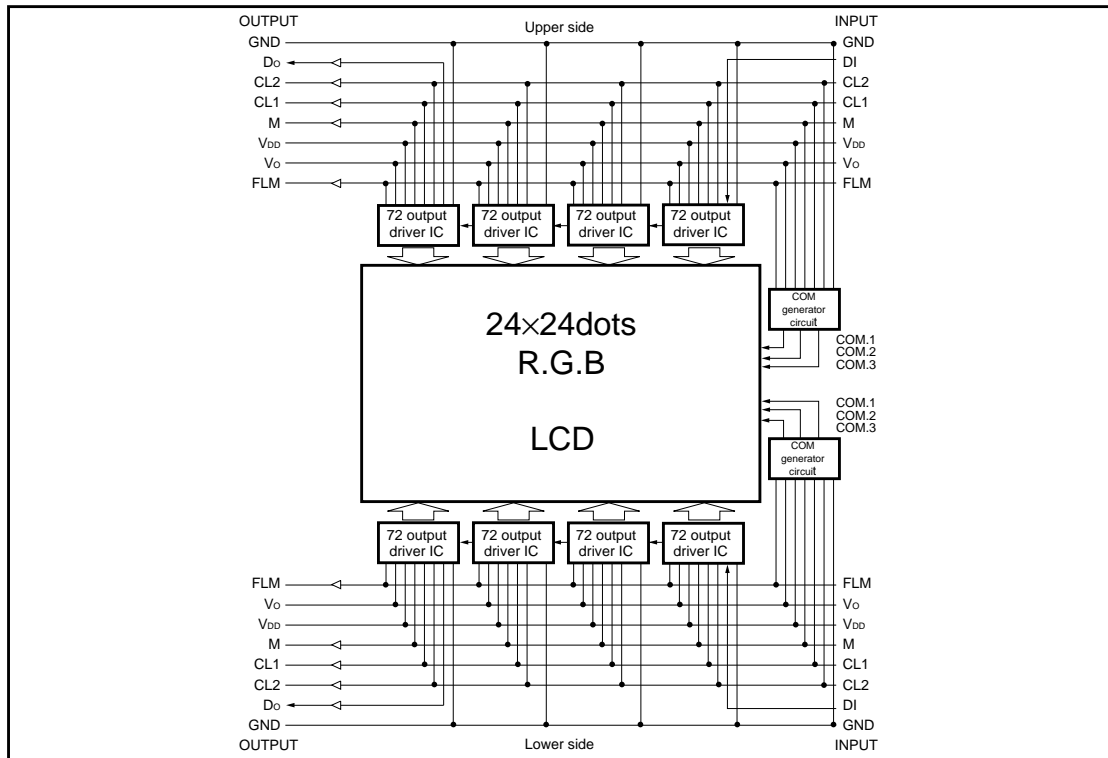
- 1) Wide viewing angle, high contrast, and fast response.
- 2) Compact and light weight for easy assembly.
- 3) Supports negative or positive display.
- 4) Low power consumption.

### ●External dimensions (Units : mm)



Liquid crystal displays

●Block diagram



●Pin functions

(1) Upper board  
Input (CN3)

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

## Liquid crystal displays

## Output (CN4)

Pin No.	Symbol	IN/OUT	Function
1	GND	–	Ground potential
2	DO	OUT	Display data signal
3	CL2	OUT	Shift register shift signal
4	CL1	OUT	Data latch signal
5	M	OUT	AC conversion signal
6	V <sub>DD</sub>	–	5 volts
7	VO	–	Liquid crystal drive power supply
8	FLM	OUT	Frame start signal

(2) Lower board  
Input (CN1)

Pin No.	Symbol	IN/OUT	Function
1	FLM	IN	Frame start signal
2	VO	–	Liquid crystal drive power supply
3	V <sub>DD</sub>	–	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

## Output (CN2)

Pin No.	Symbol	IN/OUT	Function
1	FLM	OUT	Frame start signal
2	VO	–	Liquid crystal drive power supply
3	V <sub>DD</sub>	–	5 volts
4	M	OUT	AC conversion signal
5	CL1	OUT	Data latch signal
6	CL2	OUT	Shift register shift signal
7	DO	OUT	Display data signal
8	GND	–	Ground potential

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

Parameter		Symbol	Limits	Unit
Power supply voltage	Logic circuit	V <sub>DD</sub>	–0.3~+7.0	V
	LCD drive	V <sub>DD</sub> -V <sub>O</sub>	–0.3~+7.0	V
Input voltage		V <sub>IN</sub>	–0.3~V <sub>DD</sub> +0.3	V
Operating temperature		T <sub>opr</sub>	0~+50	°C
Storage temperature		T <sub>stg</sub>	–10~+60	°C

Liquid crystal displays

●Electrical characteristics (Ta=25°C, VDD=5.0V±0.25V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
High level input voltage	V <sub>IH</sub>	3.5	–	–	V	
Low level input voltage	V <sub>IL</sub>	–	–	1.5	V	
High level output voltage	V <sub>OH</sub>	4.6	–	–	V	I <sub>OH</sub> =–0.4mA
Low level output voltage	V <sub>OL</sub>	–	–	0.4	V	I <sub>OH</sub> =+0.4mA
Recommended LCD drive voltage	V <sub>LCD</sub>	3.5	4.2	5.0	V	Ta=25°C
Current dissipation	I <sub>DD</sub>	–	–	25.0	mA	f <sub>CL</sub> =1MHz, f <sub>M</sub> =70Hz

●AC characteristics (Ta=25°C, VDD=5.0)

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

●Timing characteristics

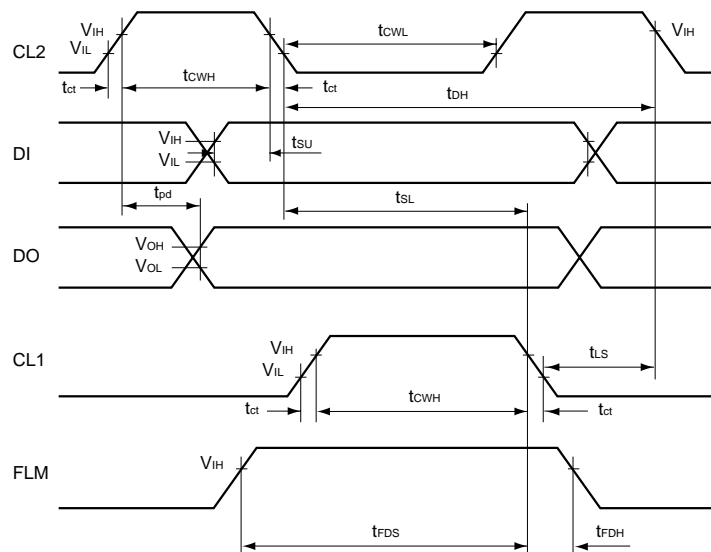


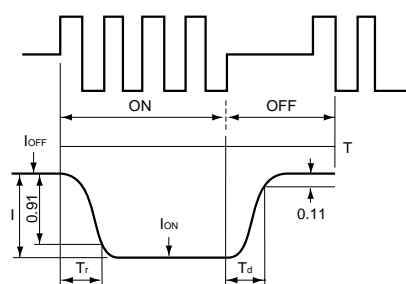
Fig.1

## Liquid crystal displays

## ●Optical characteristics (Ta=25°C)

No.	Parameter	Symbol	Temperature (°C)	Min.	Typ.	Max.	Unit	Note
1	Response speed	Tr	25	–	75	150	ms	(Note 1)
			0	–	500	1000		
		Td	25	–	60	120		
			0	–	360	750		
2	Viewing angle (Note 2)	Front-back	$\theta$	25	0	–	deg	$K \geq 3$ $\phi = 180^\circ$
		Right-left	$\phi$	25	–40	–		$K \geq 3$ $\theta = 10^\circ$
3	Contrast ratio	K	25	15	30	–		$\phi = 180^\circ$ $\theta = 10^\circ$

(Note 1) Response time definition and condition

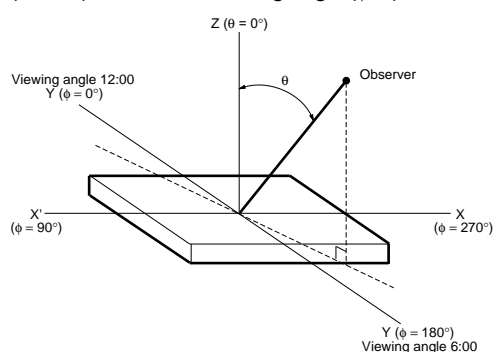


Tr : Time for segment to darken 90% after selective waveform switches to non-selective waveform.

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

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

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

(Note 2) Definition of viewing angle ( $\phi$ ,  $\theta$ )(1)  $\phi$  : Angle subtended by the Y-Y'-axis and the observer's position projected onto the XY-plane.(2)  $\theta$  : Angle subtended by observer and the normal Z-axis.

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

## Liquid crystal displays

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(Note 3) Definition of contrast ratio

<Definition>

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

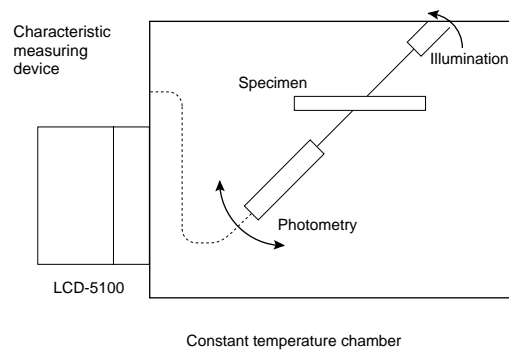
Except,  $n=1$  with positive display and  $n=-1$  with negative display.

< Measurement conditions >

Drive conditions : As per specifications

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

(Note 4) Principles of optical measuring equipment



Liquid crystal displays

●Data format (data and display mapping)

Upper	D1 RGB	D13 RGB	D25 RGB	D37 RGB	---	D241 RGB	D253 RGB	D265 RGB	D277 RGB
	D2 RGB	D14 RGB	D26 RGB	D38 RGB	---	D242 RGB	D252 RGB	D266 RGB	D278 RGB
	D3 RGB	D15 RGB	D27 RGB	D39 RGB	---	D243 RGB	D251 RGB	D265 RGB	D279 RGB
	D4 RGB	D16 RGB	D28 RGB	D40 RGB	---	D244 RGB	D250 RGB	D264 RGB	D280 RGB
	D5 RGB				---				D281 RGB
	D6 RGB				---				D282 RGB
	D7 RGB				---				D283 RGB
	D8 RGB				---				D284 RGB
	D9 RGB	D21 RGB	D33 RGB	D45 RGB	---	D249 RGB	D261 RGB	D273 RGB	D285 RGB
	D10 RGB	D22 RGB	D34 RGB	D46 RGB	---	D250 RGB	D262 RGB	D274 RGB	D286 RGB
	D11 RGB	D23 RGB	D35 RGB	D47 RGB	---	D251 RGB	D263 RGB	D275 RGB	D287 RGB
	D12 RGB	D24 RGB	D36 RGB	D48 RGB	---	D252 RGB	D264 RGB	D276 RGB	D288 RGB
Lower	D1 RGB	D13 RGB	D25 RGB	D37 RGB	---	D241 RGB	D253 RGB	D265 RGB	D277 RGB
	D2 RGB	D14 RGB	D26 RGB	D38 RGB	---	D242 RGB	D252 RGB	D266 RGB	D278 RGB
	D3 RGB	D15 RGB	D27 RGB	D39 RGB	---	D243 RGB	D251 RGB	D265 RGB	D279 RGB
	D4 RGB	D16 RGB	D28 RGB	D40 RGB	---	D244 RGB	D250 RGB	D264 RGB	D280 RGB
	D5 RGB				---				D281 RGB
	D6 RGB				---				D282 RGB
	D7 RGB				---				D283 RGB
	D8 RGB				---				D284 RGB
	D9 RGB	D21 RGB	D33 RGB	D45 RGB	---	D249 RGB	D261 RGB	D273 RGB	D285 RGB
	D10 RGB	D22 RGB	D34 RGB	D46 RGB	---	D250 RGB	D262 RGB	D274 RGB	D286 RGB
	D11 RGB	D23 RGB	D35 RGB	D47 RGB	---	D251 RGB	D263 RGB	D275 RGB	D287 RGB
	D12 RGB	D24 RGB	D36 RGB	D48 RGB	---	D252 RGB	D264 RGB	D276 RGB	D288 RGB

FIRST DATA ←

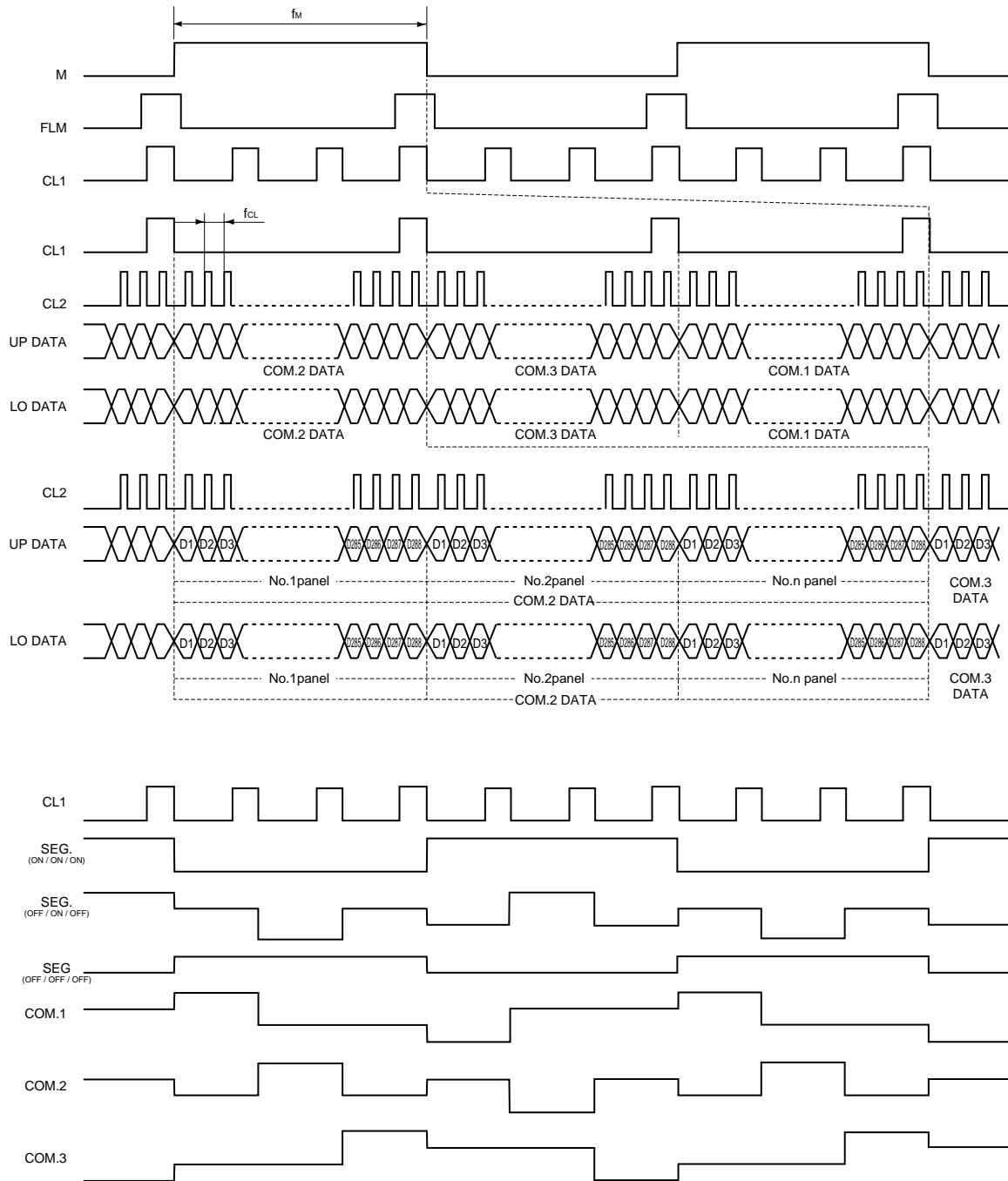
Upper	D1	D2	D3	D4	---	D285	D286	D287	D288	
	COM.1(Red)									
	D1	D2	D3	D4	---	D285	D286	D287	D288	
COM.2(Green)										
D1	D2	D3	D4	---	D285	D286	D287	D288		
COM.3(Blue)										
									→ LAST DATA	

FIRST DATA ←

Lower	D1	D2	D3	D4	---	D285	D286	D287	D288	
	COM.1(Red)									
	D1	D2	D3	D4	---	D285	D286	D287	D288	
COM.2(Green)										
D1	D2	D3	D4	---	D285	D286	D287	D288		
COM.3(Blue)										
									→ LAST DATA	

Liquid crystal displays

●Timing chart





## Liquid crystal displays

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### ●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 latch-up 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.