

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.

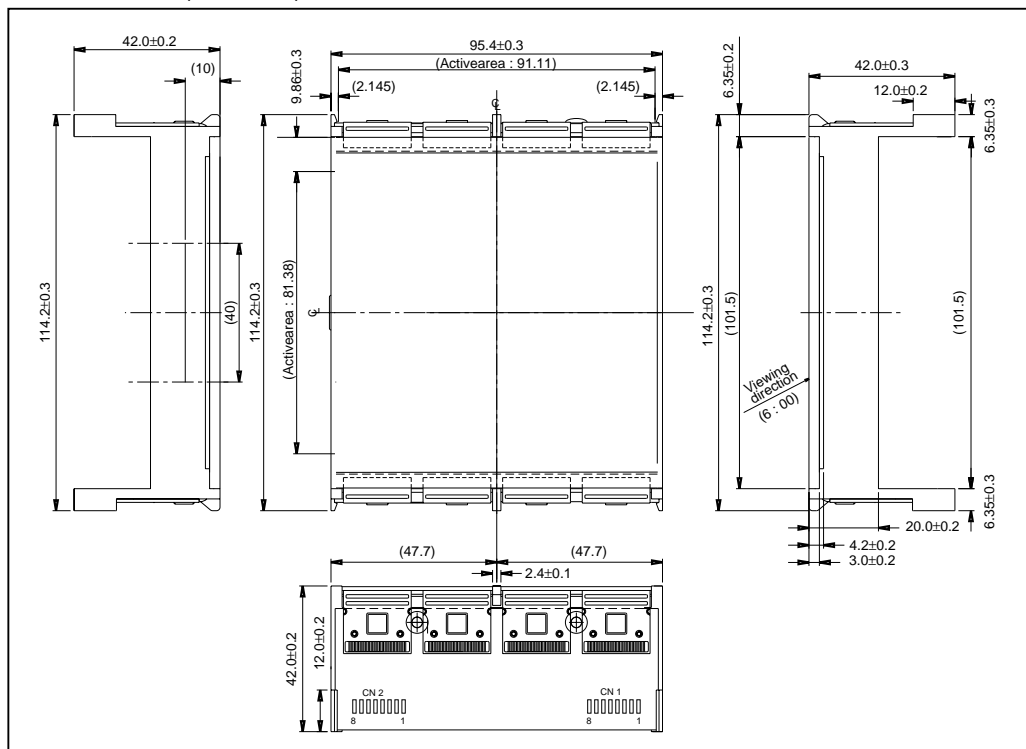
●Applications

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

●Features

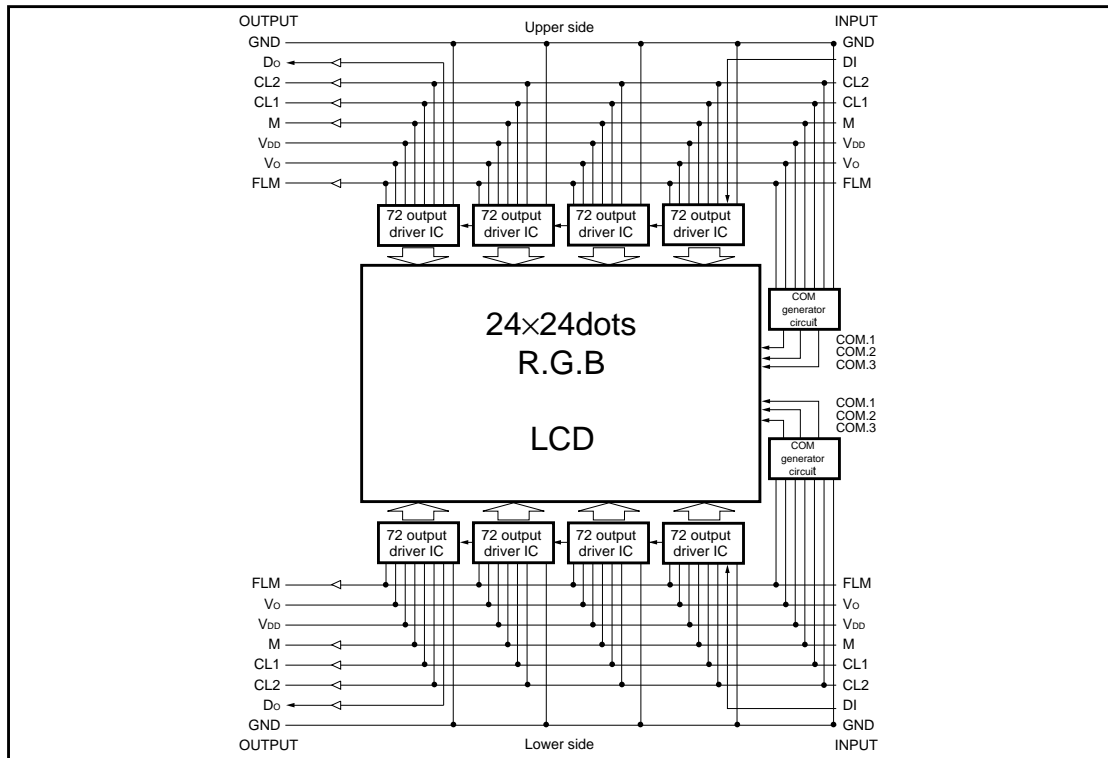
- 1) Wide viewing angle, high contrast, and fast response.
- 2) Compact and light weight for easy assembly.
- 3) Supports negative or positive display.
- 4) Low power consumption.

●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 _{DD} | - | 5 volts |
| 7 | VO | - | Liquid crystal drive power supply |
| 8 | FLM | IN | Frame start signal |

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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 _{DD} | – | 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 _{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 |

Output (CN2)

| Pin No. | Symbol | IN/OUT | Function |
|---------|-----------------|--------|-----------------------------------|
| 1 | FLM | OUT | Frame start signal |
| 2 | VO | – | Liquid crystal drive power supply |
| 3 | V _{DD} | – | 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 _{DD} | –0.3~+7.0 | V |
| | LCD drive | V _{DD} -V _O | –0.3~+7.0 | V |
| Input voltage | | V _{IN} | –0.3~V _{DD} +0.3 | V |
| Operating temperature | | T _{opr} | 0~+50 | °C |
| Storage temperature | | T _{stg} | –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 _{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} | 3.5 | 4.2 | 5.0 | V | Ta=25°C |
| Current dissipation | I _{DD} | – | – | 25.0 | mA | f _{CL} =1MHz, f _M =70Hz |

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

| Parameter | Symbol | Applicable terminal | Min. | Typ. | Max. | Unit |
|-----------------------|------------------|---------------------|------|------|------|------|
| Shift frequency *1 | 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 |

●Timing characteristics

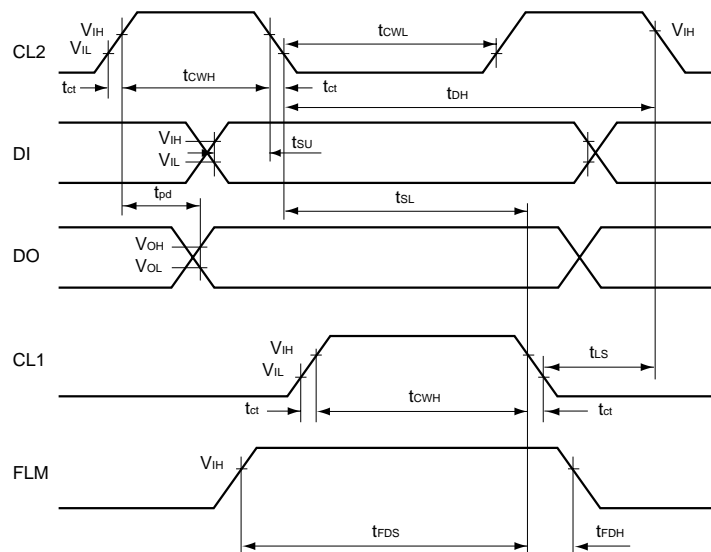


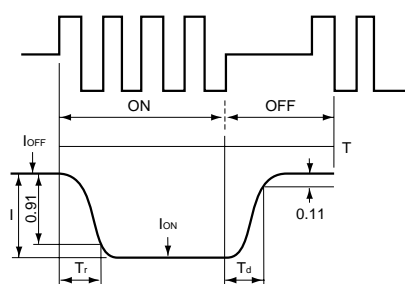
Fig.1

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 | θ | 25 | 0 | – | deg | K≥3 φ=180° |
| | | Right-left | φ | 25 | –40 | – | | 40 |
| 3 | Contrast ratio | K | 25 | 15 | 30 | – | | φ=180° θ=10° |

(Note 1) Response time definition and condition



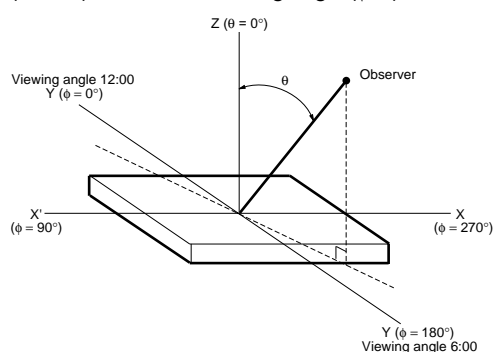
Tr : Time for segment to darken 90% after selective waveform switches to non-selective waveform.

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

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 (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-axis.

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

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(Note 3) Definition of contrast ratio

<Definition>

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

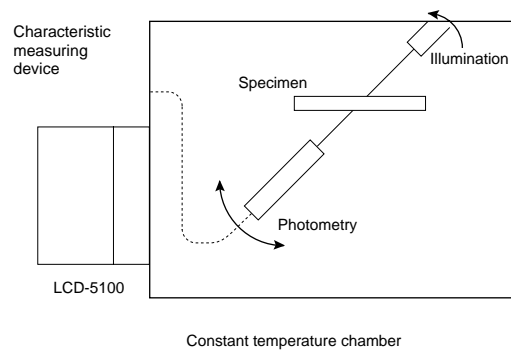
Except, $n=1$ with positive display and $n=-1$ with negative display.

< Measurement conditions >

Drive conditions : As per specifications

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

(Note 4) Principles of optical measuring equipment

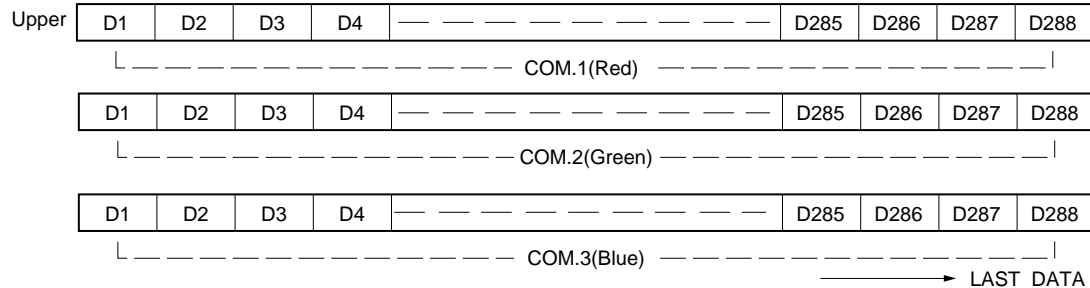


Liquid crystal displays

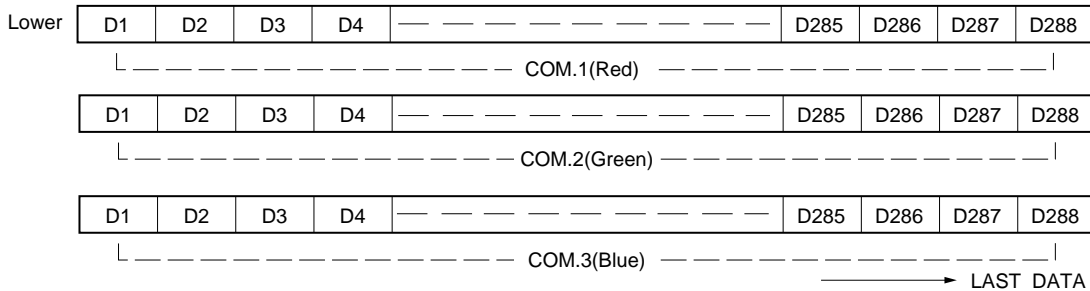
●Data format (data and display mapping)

| | | | | | | | | | |
|-------|------------|------------|------------|------------|-----|-------------|-------------|-------------|-------------|
| 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 ←

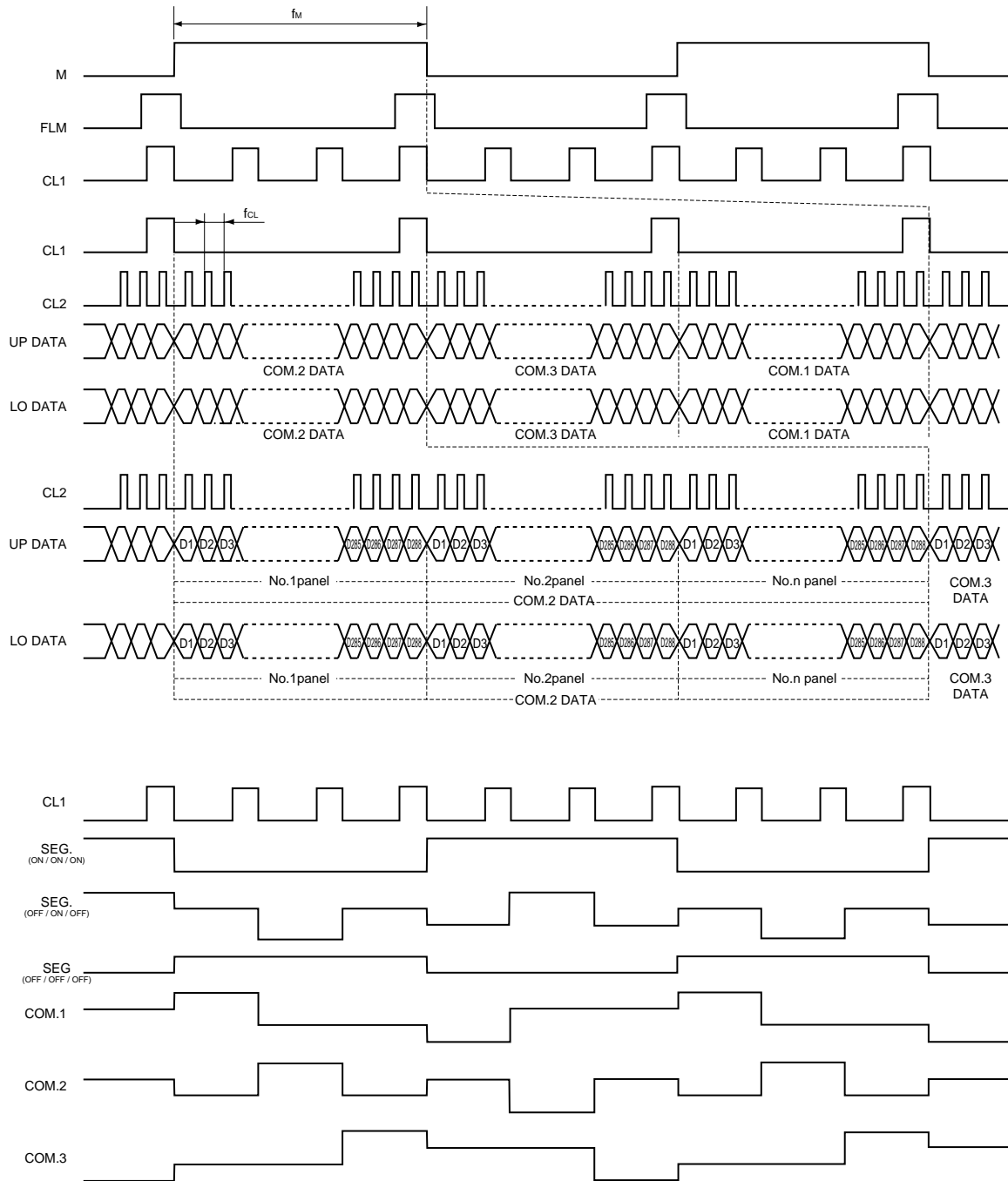


FIRST DATA ←



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 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.