

GRAPHIC TYPE LCD MODULE

PVG1216031CL05 (Main)

PRODUCT SPECIFICATIONS

★ CAUTION ★

The product described by these specifications is designed to be used with ordinary electronic equipment or devices, such as audio/video equipment, office-automation equipment, communication devices, and other. Should you intend to use this product with equipment or devices that could endanger or affect human life (such as medical instruments, transportation equipment, aerospace machinery, nuclear-reactor controllers, fuel controllers, and all other safety devices and equipment), please be sure to consult our sales representatives in advance.

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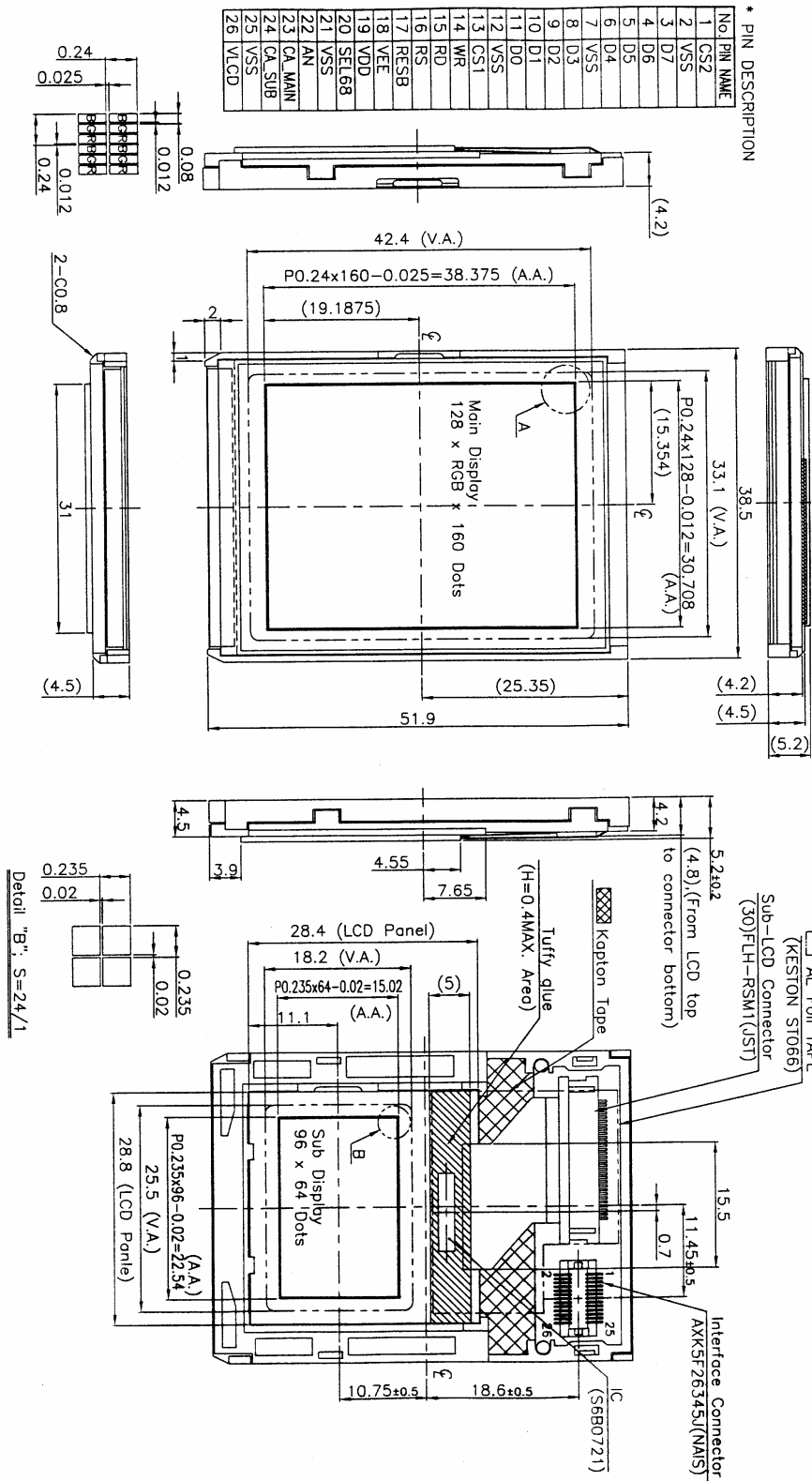
1.0 COMPOSITION

Display type: [128 (RGB) ×160 Dots Matrix LCD Module]
Driving method: 1/163 Duty
View Direction: [6 O'clock]
Backlight: LED / 3 white LEDs in parallel

2.0 MECHANICAL SPECIFICATIONS

| ITEM | STANDARD VALUES | UNITS |
|-------------------|---------------------------------|-------|
| LCD type | Transmissive/Negative Color STN | |
| Dot arrangement | 128(RGB) ×160 | dots |
| Module size | 38.5 (W) ×51.9 (H) ×5.2 (D) | mm |
| View area | 33.10 (W) ×42.40 (H) | mm |
| Active area | 30.708 (W) × 38.375 (H) | mm |
| Dot size | 0.228 (W) ×0.215 (H) | mm |
| Dot pitch | 0.24 (W) × 0.24 (H) | mm |
| Viewing direction | 6 O'clock | |

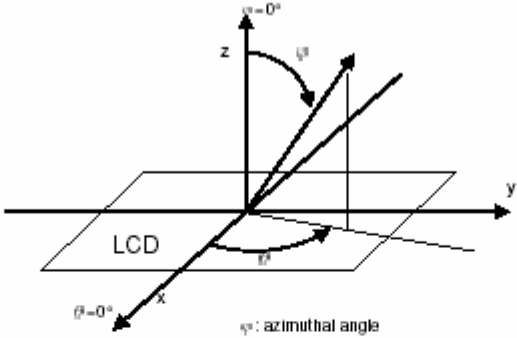
3.0 DIMENSIONAL DIAGRAM



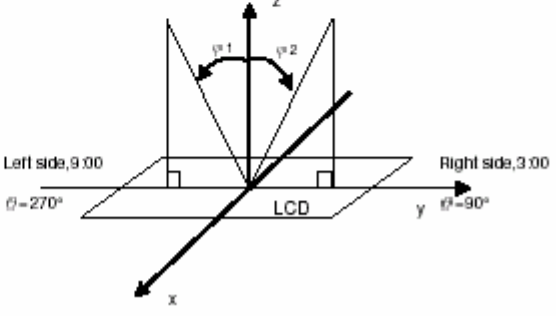
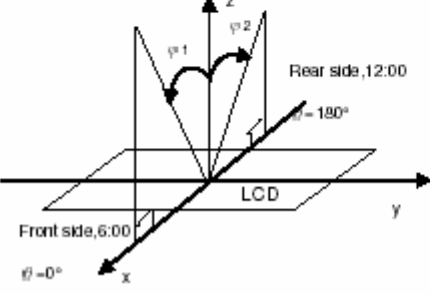
4.0 OPTICAL CHARACTERISTICS

| ITEM | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNIT | |
|---------------------------------------|-------------|--------------------------|--|-------|--------|------|-----|
| Viewing Angle | θ | $\phi = 0^\circ$ | $T_a = 25^\circ\text{C}$ $C_r \geq 2.0$ | - | 35 | - | Deg |
| | | $\phi = 180^\circ$ | | - | 30 | - | |
| | | $\phi = 90^\circ$ | | - | 30 | - | |
| | | $\phi = 270^\circ$ | | - | 30 | - | |
| Contrast Ratio (Transmissive mode) | C_r (MAX) | $T_a = 25^\circ\text{C}$ | - | 45 | - | | |
| Response time | T_R | $T_a = 25^\circ\text{C}$ | - | 110 | 165 | | |
| | T_F | $T_a = 25^\circ\text{C}$ | - | 200 | 300 | | |
| Frame Frequency | f_{FLM} | - | - | 80 | - | Hz | |
| Chromatic -ity | Red | x | $\phi = 0^\circ, \theta = 0^\circ$ | - | 0.5136 | -- | |
| | | y | | - | 0.3425 | - | |
| | Green | x | | - | 0.3221 | - | |
| | | y | | - | 0.5255 | - | |
| | Blue | x | | - | 0.1702 | - | |
| | | y | | - | 0.1806 | - | |
| | White | x | | - | 0.3017 | - | |
| | | y | | - | 0.3586 | - | |
| LCD driving voltage | VOP | $T_a = 25^\circ\text{C}$ | 12.7 | 13.1V | 13.5 | V | |

4.1 θ and ϕ

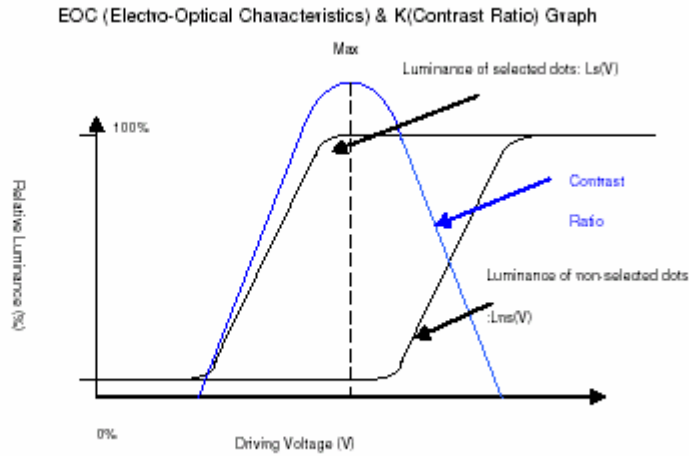


ϕ : azimuthal angle
 θ : polar angle

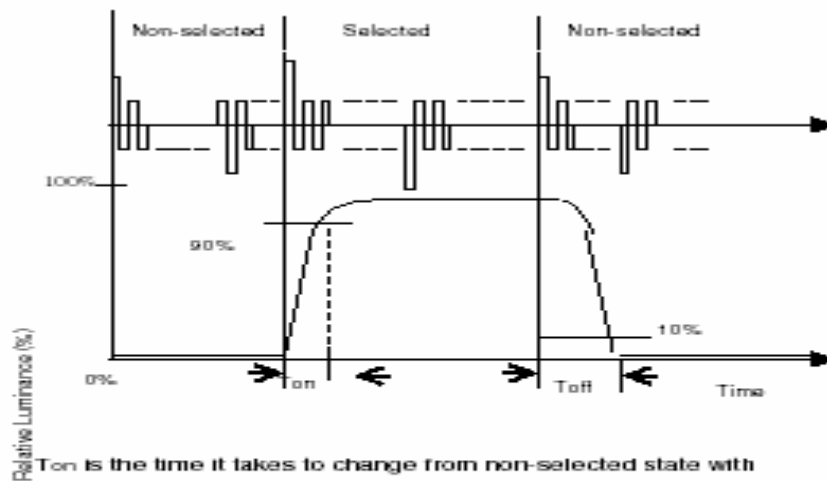


4.2 Contrast ratio Cr

(*) Contrast Ratio (K) = $L_s(V) / L_{ns}(V)$

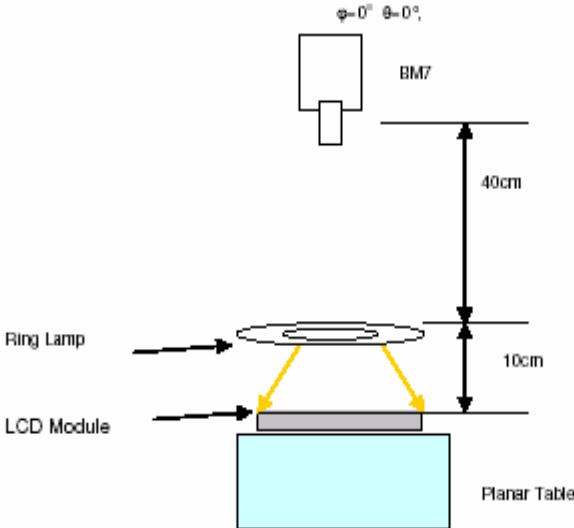


4.3 Response times T_R and T_F



4.4 Optical measurement system

To measure the Brightness, Contrast, Reflectance, Contrast, the detector should be aligned to the normal direction of the LCD surface corresponding azimuthally angle $\varphi=0^\circ$



5.0 ELECTRICAL SPECIFICATIONS

| ITEM | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|--------------------------|-----------------------|----------------------------------|---------------------|------|---------------------|-------------------|
| Power-supply voltage | $V_{DD}-V_{SS}$ | $T_a = 25\text{ }^\circ\text{C}$ | 1.7 | 3.0 | 3.3 | V |
| Input voltage | V_{IH} | $V_{DD} = 3.0\text{ V}$ | $0.8 \times V_{DD}$ | — | V_{DD} | |
| | V_{IL} | | 0 | — | $0.2 \times V_{DD}$ | |
| Supply current for logic | I_{DD} | $V_{DD} = 3.0\text{V}$ | — | 2.56 | — | mA |
| LCD driving voltage | $V_{LCD}-V_{SS}$ | $T_a = 25\text{ }^\circ\text{C}$ | — | 13.1 | — | V |
| Brightness | $I_{LED}=45\text{mA}$ | $T_a = 25\text{ }^\circ\text{C}$ | — | 175 | — | Cd/m ² |

NOTE: The supply voltage for VLCD has to be adjusted by VR or software

5.1 LED Characteristics

MAIN LCD

| PARAMETER | SYMBOL | MIN | TYP | MAX | UNITS | CONDITION |
|-----------------------|-----------|-----|-----|-----|-------|---|
| LED Voltage | V_{LED} | — | 3.6 | 4 | V | $T_a = 25\text{ }^\circ\text{C}$ $V_{LED} = 3.6\text{ V}$ 3 LEDs in parallel |
| LED Current | I_{LED} | — | 15 | 20 | mA | |
| LED Power consumption | P_{LED} | — | 162 | — | mW | |

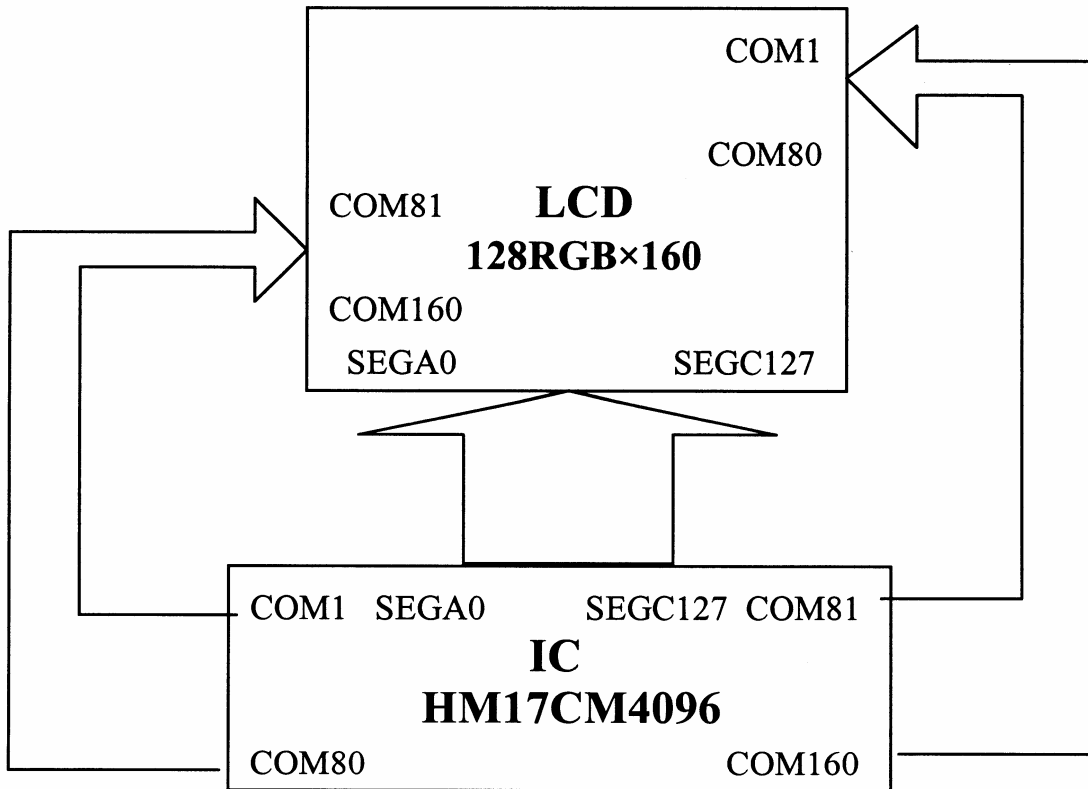
※1 LED chip voltage = 3.6V , then 3 LEDs in parallel voltage = 3.6V(LED driver voltage) , total current = 45mA . And Total LED Power consumption =162 mW . (TYP)

6.0 TERMINAL FUNCTIONS

| Pin No | Symbol | Level | Function |
|--------|---------|-------|---|
| 1 | CS2 | - | Chip select input pin for sub LCD (“L”active) |
| 2 | VSS | - | Ground |
| 3 | D7 | - | Data bus |
| 4 | D6 | - | Data bus |
| 5 | D5 | - | Data bus |
| 6 | D4 | - | Data bus |
| 7 | VSS | - | Ground |
| 8 | D3 | - | Data bus |
| 9 | D2 | - | Data bus |
| 10 | D1 | - | Data bus |
| 11 | D0 | - | Data bus |
| 12 | VSS | - | Ground |
| 13 | CS1 | - | Chip select input pin for main LCD (“L”active) |
| 14 | WR | - | Write control input pin (“L”active) |
| 15 | RD | - | Read control input pin (“L”active) |
| 16 | RS | - | Register select pin |
| 17 | RESB | - | Reset signal input pin (“L”active) |
| 18 | VEE | - | VEE level pin (For LCD driving) |
| 19 | VDD | - | VDD level pin (For logic driving) |
| 20 | SEL68 | - | CPU interface selection port (H=68 series, L=80 series) |
| 21 | VSS | - | Ground |
| 22 | AN | - | ALL LED back light (Anode) |
| 23 | CA_MAIN | - | LED back light for main LCD (Cathode) |
| 24 | CA_SUB | - | LED back light for sub LCD (Cathode) |
| 25 | VSS | - | Ground |
| 26 | VLCD | - | Hight voltage power supply output pin |

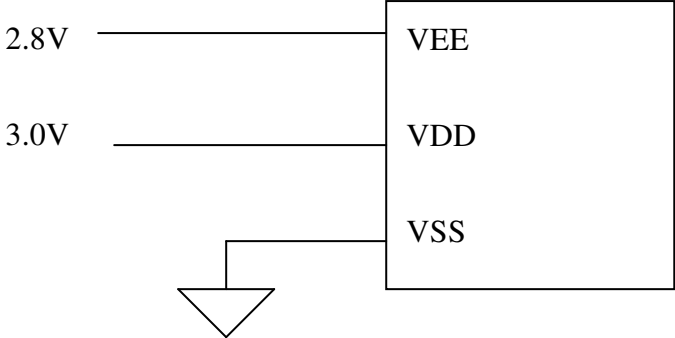
7.0 BLOCK DIAGRAM

Main LCD



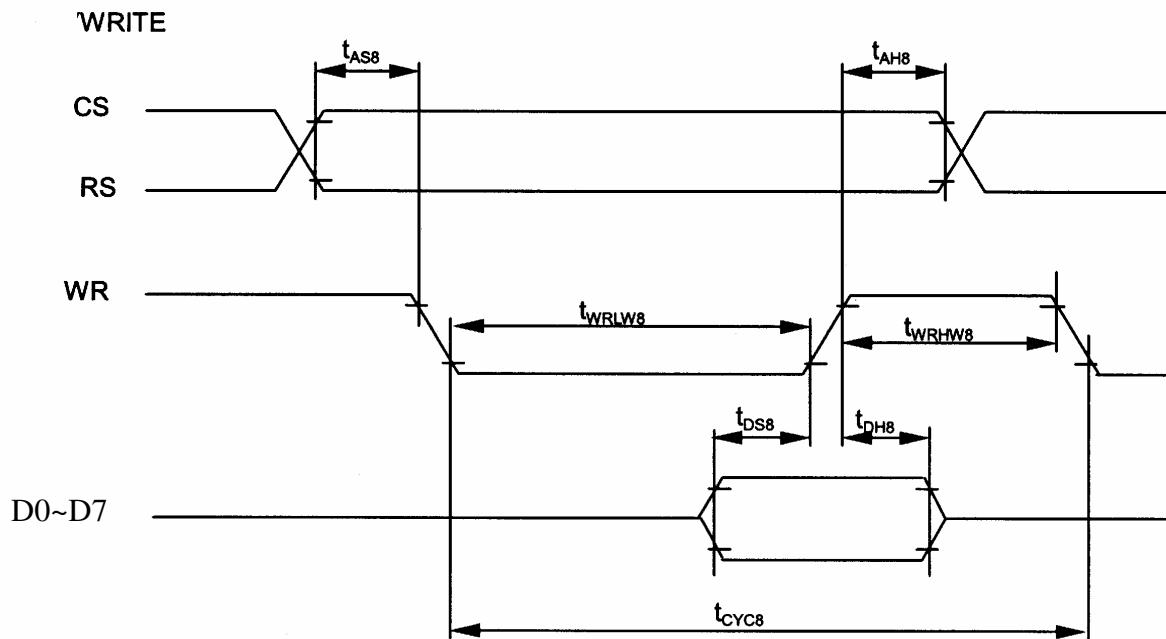
8.0 POWER SUPPLY CIRCUIT

PVG1216031CL05 MODULE



9.0 AC CHARACTERISTICS

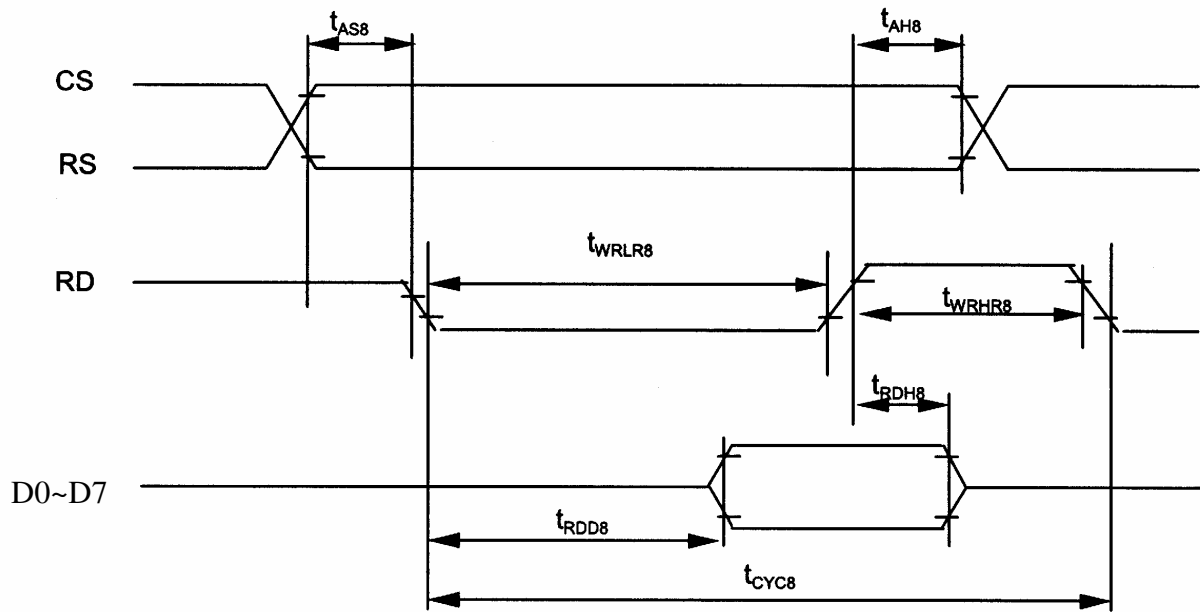
SYSTEM BUS READ / WRITE TIMING (80 series CPU interface)



| ITEM | SYMBOL | CONDITION | MIN. | MAX. | UNIT | PORT |
|-----------------------|-------------|-----------|------|------|------|-------|
| Address hold timing | t_{AH8} | | 0 | | ns | CS |
| Address setup timing | t_{AS8} | | 0 | | ns | RS |
| System cycle timing | t_{CYC8} | | 90 | | ns | |
| Write "L" pulse width | t_{WRLW8} | | 35 | | ns | WR |
| Write "H" pulse width | t_{WRH8} | | 35 | | ns | |
| Data setup timing | t_{DS8} | | 30 | | ns | D0~D7 |
| Data hold timing | t_{DH8} | | 5 | | ns | |

notice) All timing reference is 20% and 80% of V_{DD} .

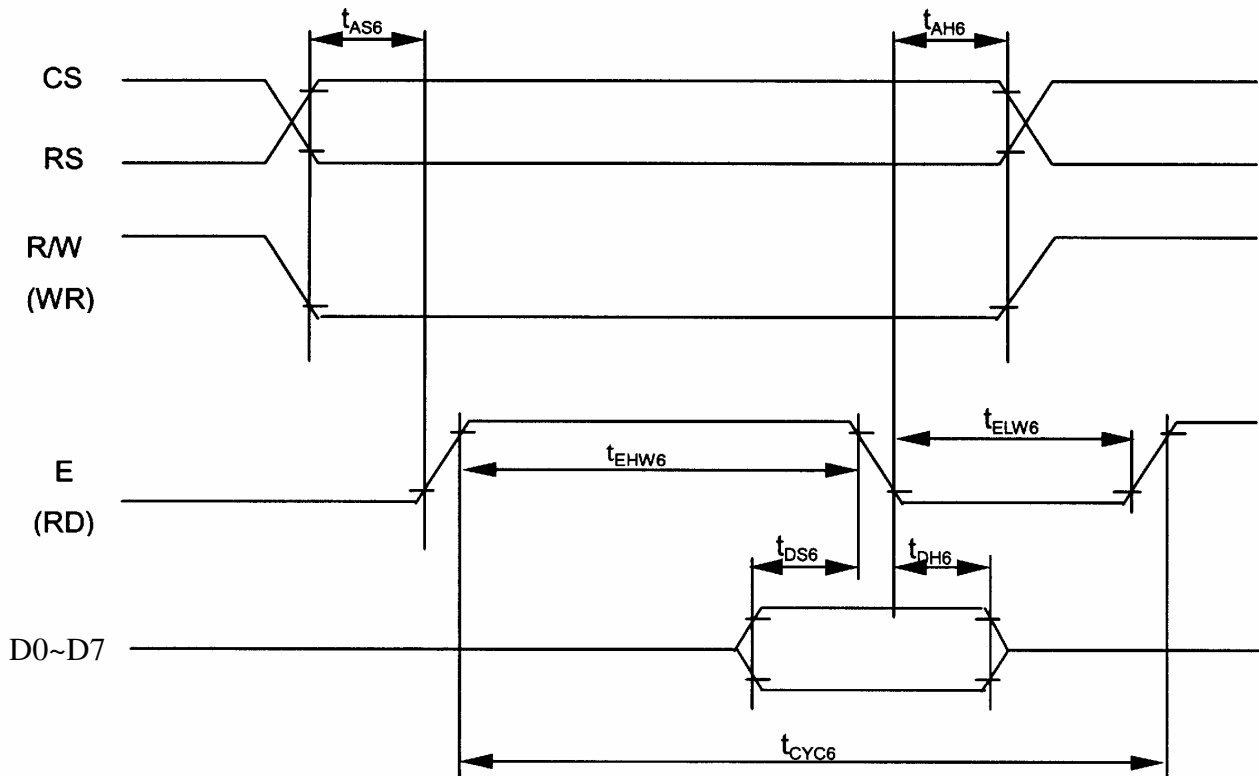
(READ TIMING)



| ITEM | SYMBOL | CONDITION | MIN. | MAX. | UNIT | PORT |
|-----------------------------|-------------|-----------|------|------|------|-------|
| Address hold timing | t_{AH8} | | 0 | | ns | CS |
| Address setup timing | t_{AS8} | | 0 | | ns | RS |
| System cycle timing | t_{CYC8} | | 180 | | ns | RD |
| read "L" pulse width | t_{WRLR8} | | 80 | | ns | |
| read "H" pulse width | t_{WRHR8} | | 80 | | ns | |
| read data output delay time | t_{RDD8} | CL=15pF | | 60 | ns | D0~D7 |
| read data output hold time | t_{RDH8} | | 0 | | ns | |

notice) All timing reference is 20% and 80% of V_{DD} .

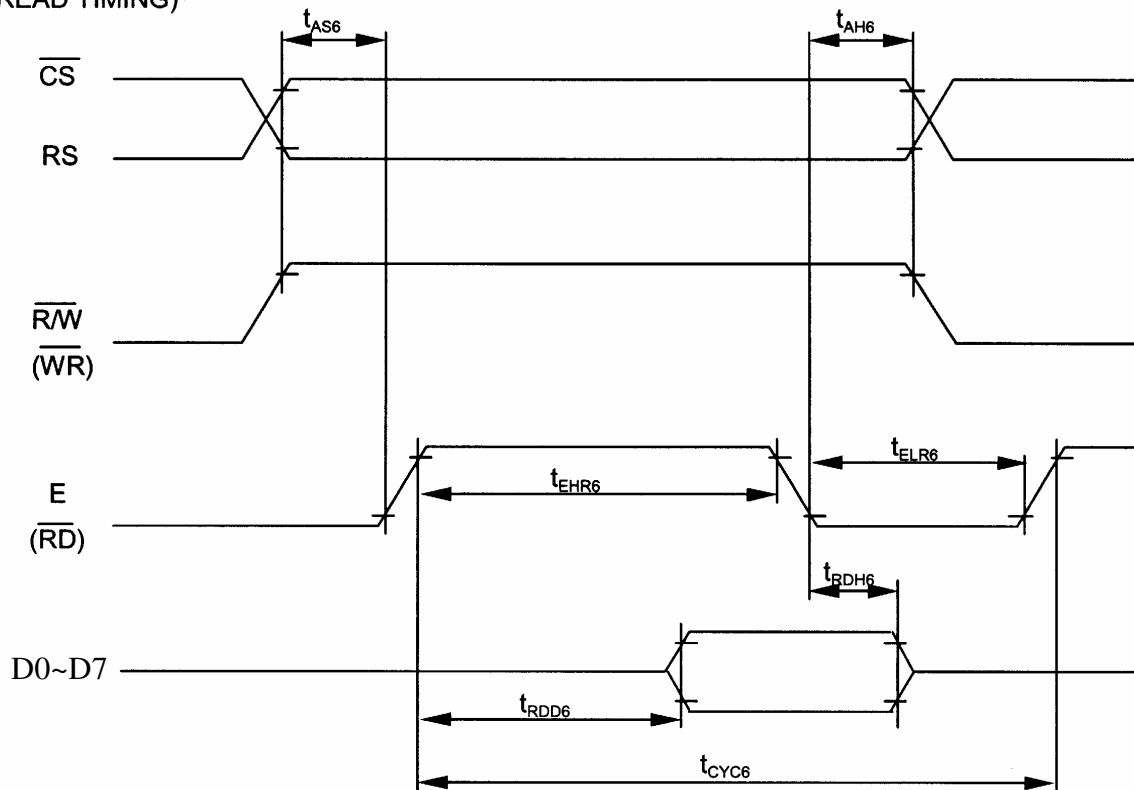
SYSTEM BUS READ / WRITE TIMING (68 series CPU interface)
(WRITE TIMING)



| ITEM | SYMBOL | CONDITION | MIN. | MAX. | UNIT | PORT |
|------------------------|------------|-----------|------|------|------|-------|
| Address hold timing | t_{AH6} | | 0 | | ns | CS |
| Address setup timing | t_{AS6} | | 0 | | ns | RS |
| System cycle timing | t_{CYC6} | | 90 | | ns | E |
| Enable "L" pulse width | t_{ELW6} | | 35 | | ns | |
| Enable "H" pulse width | t_{EHW6} | | 35 | | ns | |
| Data setup timing | t_{DS6} | | 40 | | ns | D0~D7 |
| Data hold timing | t_{DH6} | | 5 | | ns | |

notice) All timing reference is 20% and 80% of V_{DD} .

(READ TIMING)



| ITEM | SYMBOL | CONDITION | MIN. | MAX. | UNIT | PORT |
|-----------------------------|------------|-----------|------|------|------|-----------------|
| Address hold timing | t_{AH6} | | 0 | | ns | \overline{CS} |
| Address setup timing | t_{AS6} | | 0 | | ns | RS |
| System cycle timing | t_{CYC6} | | 180 | | ns | E |
| Enable "L" pulse width | t_{ELR6} | | 80 | | ns | E |
| Enable "H" pulse width | t_{EHR6} | | 80 | | ns | E |
| read data output delay time | t_{RDD6} | $CL=15pF$ | | 70 | ns | $D0\sim D7$ |
| read data output hold time | t_{RDH6} | | 0 | | ns | $D0\sim D7$ |

notice) All timing reference is 20% and 80% of V_{DD} .

10.0 MAXIMUM ABSOLUTE VALUES

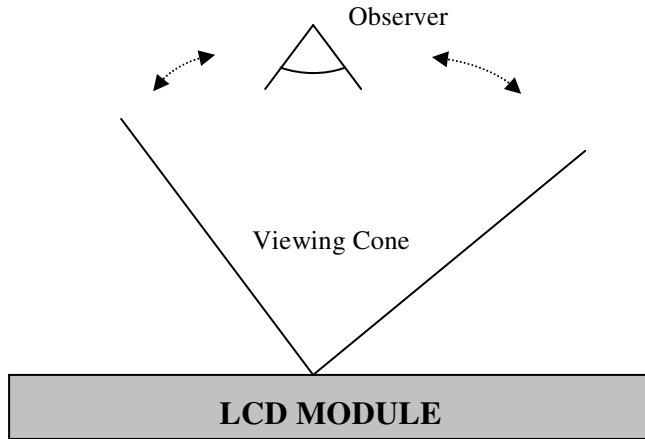
| ITEM | SYMBOL | MIN | MAX | UNITS |
|--------------------------------|--------------------|------|------|-------|
| Operating temperature | T_{OP} | -20 | 70 | °C |
| Storage temperature | T_{ST} | -30 | 80 | |
| Supply voltage for logic | $V_{DD} - V_{SS}$ | -0.3 | +4.0 | V |
| Supply voltage for LCD driving | $V_{LCD} - V_{SS}$ | -0.3 | +20 | |

11.0 RELIABILITY

| ITEM | CONDITIONS | CRITERIA |
|----------------------------|---|--|
| High temperature operation | 70 °C for 200 hours | <ul style="list-style-type: none"> ◆ No defect in cosmetic and operational functions. ◆ Total current consumption below double of initial value. |
| Low temperature operation | -20 °C for 200 hours | |
| High humidity storage | 40 °C, 90 % RH for 240 hours | |
| High temperature storage | 80 °C for 200 hours | |
| Low temperature storage | -30 °C for 200 hours | |
| Temperature cycling | -30 °C (30 min) ↓↑ 25 °C (5 min) ↓↑ 80 °C (30 min) CYCLES: 10 | |
| Vibration | Random Wave: 40~500 Hz Acceleration: 5g Each Direction (x, y, z): 50 sec | |

12.0 COSMETIC CRITERIA

12.1 Inspection Method



Inspection Conditions

- Ambient light: 20 W Fluorescent Lamp
- Viewing distance: 30 cm
- Viewing Angle: within viewing cone

12.2 LCD Panel Criteria

| DEFECT | JUDGMENT CRITERION | | | |
|--|--|----------------------------------|------------------------------------|--------------------|
| | Size d (mm) | Acceptable quantity in view area | Acceptable quantity in active area | Minimum separation |
| Spots (LCD or polarizer) | $d \leq 0.1$ | Disregard | Disregard | 20mm (min) |
| | $0.1 < d \leq 0.2$ | 2 | 1 | |
| | $0.2 < d \leq 0.3$ | 0 | 0 | |
| | $d > 0.3$ | 0 | 0 | |
| | Note: $d = (\text{Length} + \text{Width})/2$ | | | |
| Polarizer Bubbles | Size d (mm) | | Acceptable quantity in view area | |
| | $d \leq 0.3$ | | Disregard | |
| | $0.3 < d \leq 0.6$ | | 3 | |
| | $0.6 < d \leq 1.0$ | | 1 | |
| | $d > 1.0$ | | 0 | |
| Note: $d = (\text{Length} + \text{Width})/2$ | | | | |
| Lines | Width W (mm) Length L (mm) | | Acceptable quantity in view area | Minimum separation |
| | $W \leq 0.03$ | | 2 | 20mm (min) |
| | $0.03 < W \leq 0.08$ | $L \leq 2.0$ | 1 | |

| | | |
|--|----------|------------------------|
| | W > 0.08 | See criteria for Spots |
|--|----------|------------------------|

13.0 PRECAUTIONS

13.1 Static charge

Since this LCD module contains CMOS LSIs that are sensitive to static charge, care must be taken when handling it.

13.2 Operation

1. It is essential to drive the LCD within the specified voltage limits, since a higher driving voltage than allowed causes a shorter LCD lifetime. Under these circumstances, electrochemical reactions will result in undesirable deterioration of the LCD.
2. The response time of the LC fluid is considerably longer at low temperatures than in the normal operating temperature range. On the other hand, the LCD will show a dark blue color at high temperatures. Those phenomena do not indicate a malfunction or defect of the LCD. Back at normal temperatures, the LCD will return to its original behavior.
3. If the display area is pressed hard during operation, some abnormal display patterns might appear. However, the display will resume normal operation after turning the module off and on.
4. Moisture on the terminals could cause an electrochemical reaction resulting in an open terminal connection. If the environmental temperature is higher than 40°C, it is required that the relative humidity is 50% or less.

13.3 Packaging

1. Do not leave the product in a place of high humidity for a long period. For storage in a location where the temperature is 35°C or higher, special care to protect the product from high humidity is required. A combination of high temperature and high humidity may cause polarization degradation and damage as well. Please keep the temperature and humidity within the specified range for storing.
2. Since LCD panels tend to be easily damaged, they should be handled with full care. Avoid any contact with materials that have a hardness of more than 2H.
3. Adhesives used for adhering upper/lower polarizers and aluminum plates are made of organic substances that will deteriorate by chemical reactions with for example chemicals such as acetone, toluene, ethanol, and isopropylalcohol. Please prevent the use of these chemicals and contact us when it is necessary for you to use other chemicals.
4. Immediately wipe off saliva or water drops from the display area with an absorbent cotton cloth, without scrubbing it. If adhered for a long period, such particles might cause deformation or faded color.
5. Moisture deposited on the display surface and contact terminals due to low temperatures will

be a cause for polarizer damage, stains, and dirt. Before use, such panels should be slowly warmed up to a temperature that is higher than room temperature.

6. Touching the display area and contact terminals with bare hands is harmful to polarizer and may lead to poor insulation at the terminals.
7. The glass is fragile and can be cracked or chipped easily by handling, in particular on near its edge. Please prevent sudden shocks or exposing the glass to other sorts of stress.

13.4 Long-term storage

For long-term storage the following methods are highly recommended:

1. Store the product in a polyethylene bag with a sealed opening to prevent fresh air entering from the outside. Placing it with a desiccant is not necessary.
2. Store the product in a dark place, with the temperature in the range from 0 °C to 35 °C.
3. Keep the sensitive polarizer surface of the LCD panels clear of any contact. We recommend using the container that was used by Picvue to deliver the products.

13.5 Cleaning of the product

To clean the product make sure to use absorbent cotton cloth or other soft material like chamois. Make sure to rub it gently, and do not use chemicals when cleaning.

14.0 FINAL REMARKS

1. The above specifications are the binding criteria for Picvue's outgoing quality inspection.
2. The customer is kindly requested to inform Picvue as soon as possible on any questions, remarks, and disagreements regarding these specifications.
3. Picvue is not responsible for damage to its products due to neglect of the precautions as described in the previous chapter.

APPENDIX—

REVISION RECORD

| REV | REVISION ITEM | DATE |
|------------|----------------------|-------------|
| NEW | _____ | OCT.30,2003 |
| A | | |
| B | | |
| C | | |
| D | | |
| E | | |
| F | | |
| G | | |
| H | | |
| I | | |
| J | | |
| K | | |
| L | | |
| M | | |
| N | | |