

字符型液晶显示模块使用手册

FM0802D



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1. FEATURE

- * Display Format: 8 Characters X 2 lines
- * Display mode : Positive Reflective type, STN-grey mode
- * Driving method: 1/16 Duty 1/5 Bias
- * Input Data: 4 bits or 8 bits interface available
- *Viewing direction: 6 o'clock
- *With LED backlight

2 MECHANICAL SPECIFICATIONS

| Item | Specification | Unit |
|-----------------|---------------|------|
| Module size | 58x32x14.0Max | mm |
| Viewing Area | 38.0x16.0 | mm |
| Character Size | 2.96x5.56 | mm |
| Character Pitch | 3.55x5.94 | mm |
| Dot Size | 0.56x0.56 | mm |
| Weight | | g |

3. ABSOLUTE MAXIMUM RATINGS

3-1. Electrical absolute maximum rating

| Item | | Symbol | Value | | | Unit | Condition |
|----------------|-------|---------|-------|------|---------|------|-----------|
| | | | Min | Type | Max | | |
| Supply voltage | Logic | VDD-Vss | 0 | - | 7.0 | V | Ta=25°C |
| | LCD | VDD-Vo | 0 | - | 13.5 | V | Ta=25°C |
| Input voltage | | VI | -0.3 | - | VDD+0.3 | V | Ta=25°C |

3-2 Environmental conditions

| Item | Symbol | Min | Max | Unit |
|---|--|---|-----|------|
| Operating temperature | T_{opr} | 0 | 50 | °C |
| Storage temperature | T_{stg} | -20 | -70 | °C |
| Humidity (Ambient temperature= T_a) | $T_a \leq 40^\circ\text{C}$ | 95% RH max. | | |
| | $T_a > 40^\circ\text{C}$ (Below maximum temp) | Absolute humidity shall be less than 95% RH at $T_a = 40^\circ\text{C}$ | | |

4. ELECTRICAL CHARACTERISTICS

| Item | | Symbol | Spec. Value | | | Unit | Condition |
|----------------|------------|-----------------|-------------|-----|-----|------|--------------------------|
| | | | Min | Typ | Max | | |
| Supply voltage | Logic | VDD-Vss | 4.5 | 5.0 | 5.5 | V | |
| | LCD | VDD-Vo | 3.8 | 4.2 | | V | $T_a = 25^\circ\text{C}$ |
| Supply | Current | IDD | - | 1.0 | 2.0 | mA | VDD=5.0V |
| Input voltage | High level | V _{IH} | 2.2 | - | VDD | V | - |
| | Low level | V _{IL} | -0.3 | - | 0.6 | V | - |
| Output voltage | High level | V _{OH} | 2.4 | - | - | V | I _{OH} =-0.2 mA |
| | Low level | V _{OL} | | | 0.4 | V | I _{OL} =1.2 mA |

5. CHARACTERISTICS OF BACKLIGHTING (LED UNIT)

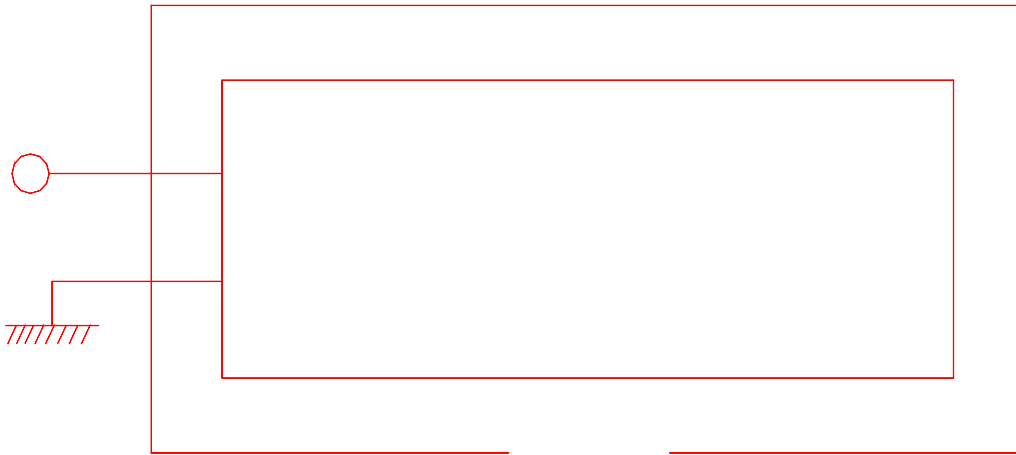
5-1 Absolute maximum rating

| Item | Symbol | Condition | Min | Max | Unit |
|-------------------|----------------|--------------------------|-----|-----|------|
| Forward current | I_F | $T_a = 25^\circ\text{C}$ | - | 90 | mA |
| Reverse voltage | V _R | $T_a = 25^\circ\text{C}$ | - | 8 | V |
| Power dissipation | P _D | $T_a = 25^\circ\text{C}$ | - | 450 | mW |

5-2 Opto-electric characteristics

| (+5.0V) Item | Symbol | Condition | Min | Type | Max | Unit |
|-----------------|----------------|----------------------|---------|------|-----|-------------------|
| Forward voltage | V _F | T _a =25°C | 3.9 | 4.2 | 4.5 | V |
| Luminous | | I _F =60mA | CIRCUIT | - | - | cd/m ² |

K 5-3 LED CIRCUIT DIAGRAM



6. ELECTRIC-OPTICAL CHARACTERISTIC

6-1. STN Type

Condition: VDD=+5.0V, T_a=25°C

| Item | Symbol | Min | Typ | Max | Unit | Condition | Note |
|------------------------|-------------------|-----|-----|-----|------|---------------|------|
| Viewing | θ _{2-θ1} | 70 | - | +90 | deg | Cr=2.0 | 1.2 |
| Angle | ∅ | -90 | - | +90 | | | |
| Contrast Ratio | Cr | - | 4 | - | - | θ=20° ∅=0° | 3 |
| Response Time(rise) | Tr | - | 110 | - | ms | θ=20° ∅=0° | 4 |
| Response Time(fall) | Tf | - | 110 | - | ms | θ=20° ∅=0° | 4 |

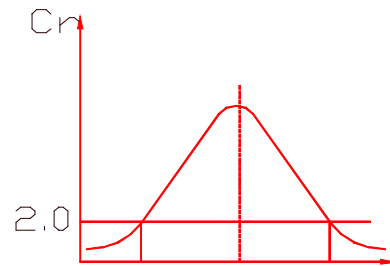
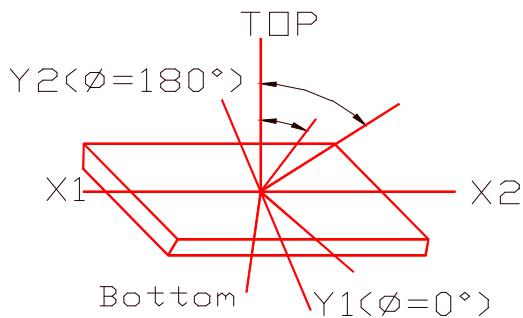
6-2. TN Type

Condition: VDD=+5.0V, Ta=25°C

| Item | Symbol | Min | Typ | Max | Unit | Condition | Note |
|---------------------|-----------------------|-----|-----|-----|---------------------|--|------|
| Viewing Angle | $\theta 2 - \theta 1$ | 40 | - | - | deg | $\theta 1 < \sigma < \theta 2$ $Cr = 2.0$ | 1.2 |
| | \emptyset | | | | | | |
| Contrast Ratio | Cr | - | 4 | - | $\theta 1$ σ | $\theta = 20^\circ$ $\theta 2$ $\emptyset = 0^\circ$ | 3 |
| Response Time(rise) | Tr | - | 110 | - | ms | $\theta = 20^\circ$ $\emptyset = 0^\circ$ | 4 |
| Response Time(fall) | Tf | - | 110 | - | ms | $\theta = 20^\circ$ $\emptyset = 0^\circ$ | 4 |

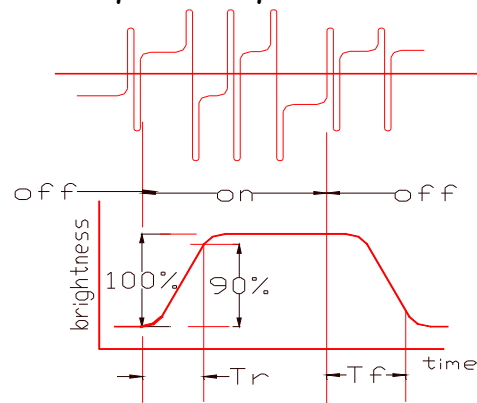
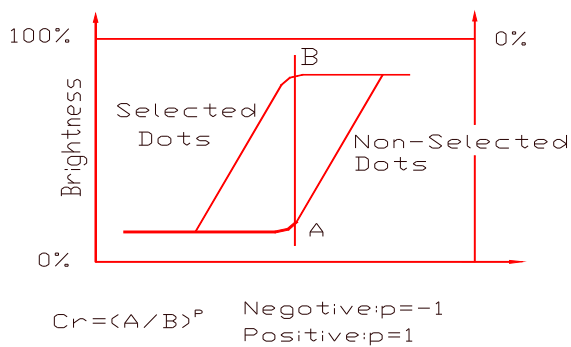
NOTE: $\emptyset = 0$ means viewing direction

Note 1. Definition of angle θ and \emptyset Note 2. Definition of viewing $\theta 1$ and $\theta 2$



Note 3.

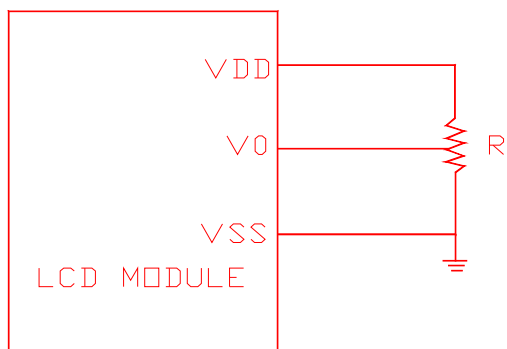
Definition of contrast Cr Note 4. Definition of optical response



7. INTERFACE PIN ASSIGNMENT

| Pin No | Symbol | Level | Description |
|--------|----------------|--------|-------------------------------------|
| 1 | Vss(GND) | 0V | Ground |
| 2 | VDD | +5.0V | Supply voltage for logic and LCD |
| 3 | V ₀ | - | Operating voltage for LCD |
| 4 | RS | H/L | Signal to select registers |
| 5 | R/W | H/L | Signal to select "read" and "write" |
| 6 | E | H, H/L | Enable signal |
| 7 | DB0 | H/L | Data bit0 |
| 8 | DB1 | H/L | Data bit1 |
| 9 | DB2 | H/L | Data bit2 |
| 10 | DB3 | H/L | Data bit3 |
| 11 | DB4 | H/L | Data bit4 |
| 12 | DB5 | H/L | Data bit5 |
| 13 | DB6 | H/L | Data bit6 |
| 14 | DB7 | H/L | Data bit7 |
| A | LED + | - | Backlight Supply |
| K | LED- | - | |

8. POWER SUPPLY BLOCK DIAGRAM

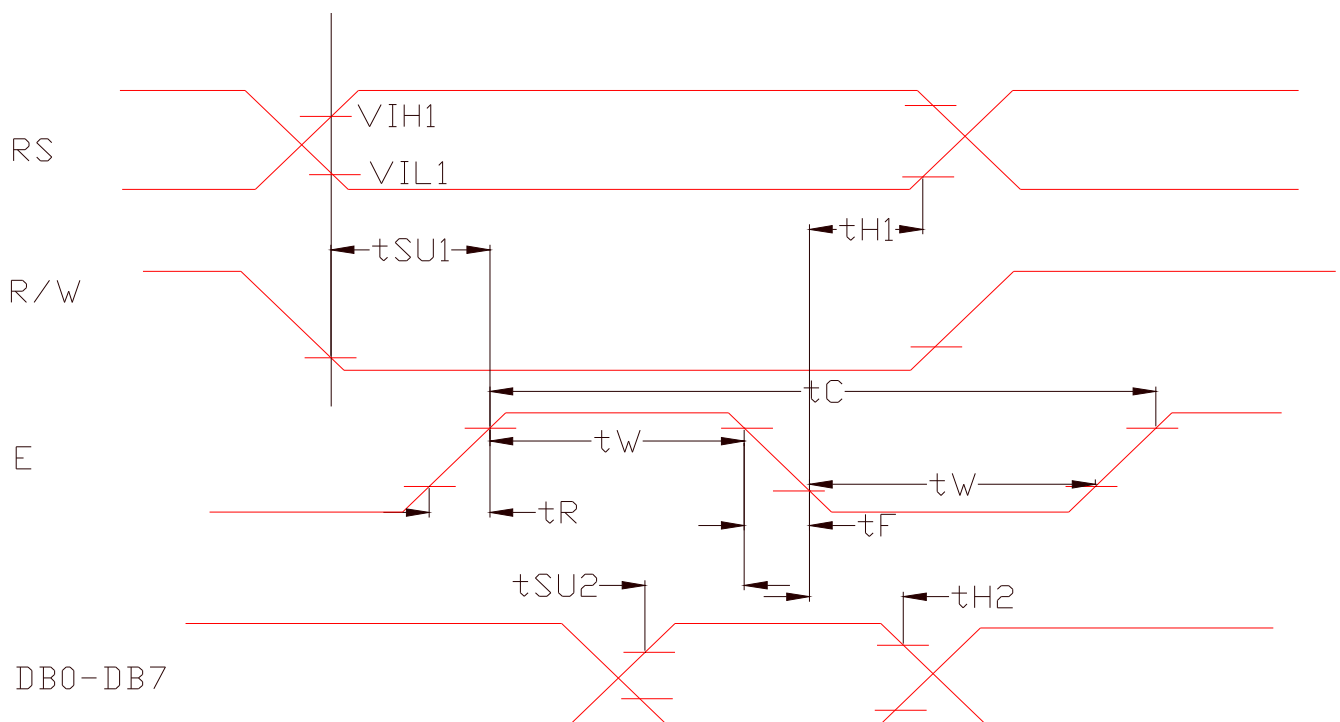


VDD-V₀:LCD DRIVING VOLTAGE

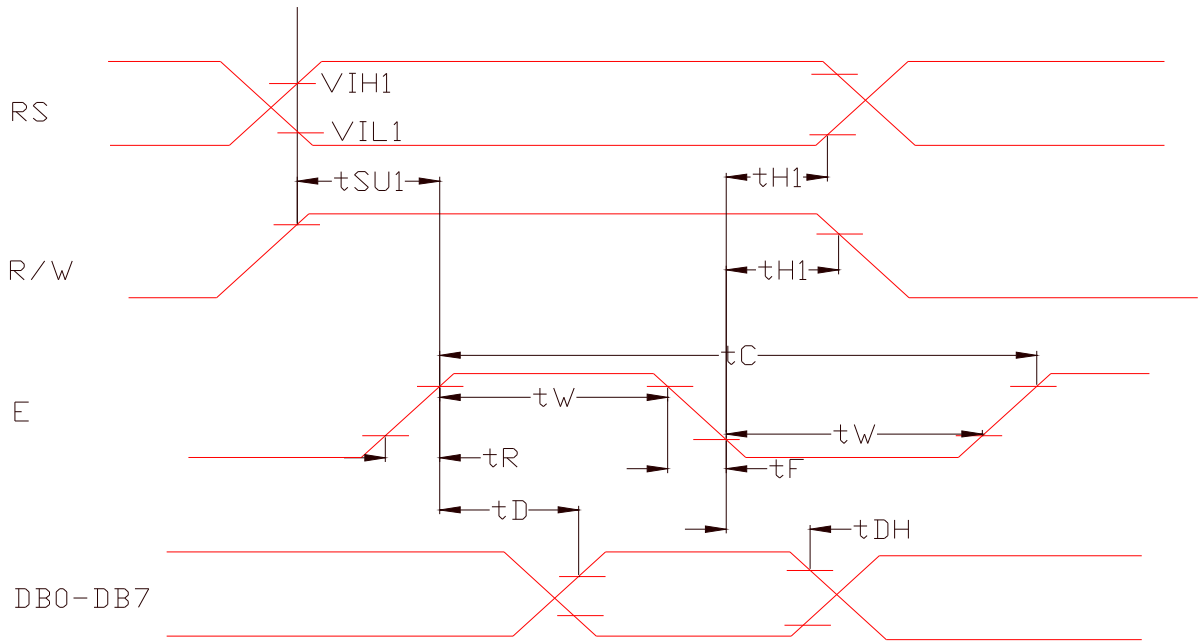
9. TIME CHARACTERISTICS

Condition: VDD=+5.0V±0.5V. Vss=0V Ta=25 °C

| Parameter | Symbol | Min | Max | Unit |
|---------------------------|-----------|-----|-----|------|
| E cycle time | t_c | 500 | - | Ns |
| E Pulse width (High, Low) | t_w | 220 | - | Ns |
| E rise time | t_R | - | 25 | ns |
| E fall time | t_F | - | 25 | Ns |
| R/W and RS set-up time | t_{SU1} | 40 | - | Ns |
| R/W and RS hold time | t_{H1} | 10 | - | Ns |
| Data setup time (write) | t_{SU2} | 60 | - | Ns |
| Data delay time (read) | t_D | - | 120 | ns |
| Data hold time (write) | t_{H2} | 10 | - | ns |
| Data hold time (read) | t_{DH} | 20 | - | ns |



CPU WRITING TIMING



CPU READING TIMING

10. INSTRUCTIONS SYSTEM

10-1. Display clear

RS R/W DB7 DB6..... DB0 Execution time

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|--------|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1.64ms |
|---|---|---|---|---|---|---|---|---|---|---|--------|

This command will clear entire display and set DD RAM address "0" in address counter.

10-2. Return home

RS R/W DB7 DB6..... DBO Execution time

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|--------|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | * | 1.64ms |
|---|---|---|---|---|---|---|---|---|---|--------|

Set DD RAM address "0" in address counter. Also returns display being shifted to original position and DD RAM contents remain unchange.

10-3. Entry mode set

RS R/W DB7 DB6..... DBO Execution time

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|-----|----|------|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | I/D | SH | 42µs |
|---|---|---|---|---|---|---|---|-----|----|------|

Set cursor move direction and specifies shift of display. These operations are performed during data write and read.

I/D: Set cursor move direction. H: Increase

L: Decrease

SH: Specifies shift of display. H: Display is shifted.

L: Display is not shifted.

10-4. Display on/off

RS R/W DB7 DB6..... DBO Execution time

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|------|
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | D | C | B | 42µs |
|---|---|---|---|---|---|---|---|---|---|------|

Sets ON/OFF of entire display.

D: Display on/off. H: on.

L: off.

C: Cursor on/off H: on.

L: off.

B: Blinking on/off H: on.

L: off.

10-5. Cursor or display shift

RS R/W DB7 DB6..... DB0 Execution time

| | | | | | | | | | | |
|---|---|---|---|---|---|-----|-----|---|---|------------|
| 0 | 0 | 0 | 0 | 0 | 1 | S/C | R/L | * | * | 42 μ s |
|---|---|---|---|---|---|-----|-----|---|---|------------|

This command moves cursor and shift display without changing DD RAM contents.

SC: H: Display shift.

L: Cursor move.

R/L: H: Right shift.

L: Left shift.

10-6. Set function

RS R/W DB7 DB6..... DB0 Execution time

| | | | | | | | | | | |
|---|---|---|---|---|----|---|---|---|---|------------|
| 0 | 0 | 0 | 0 | 1 | DL | N | F | * | * | 42 μ s |
|---|---|---|---|---|----|---|---|---|---|------------|

This command sets interface data length (DL) and Number of display lines (N) and character fonts (F).

DL: H: 8 Bits interface.

L: 4 Bits interface.

N: H: 2 Lines display.

L: 1 Lines display.

F: H: 5X10 dots.

L: 5X7 dots.

10-7. Set CG RAM address

RS R/W DB7 DB6..... DB0 Execution time

| | | | | | |
|---|---|---|---|----------------|------|
| 0 | 0 | 0 | 1 | CG RAM ADDRESS | 42μs |
|---|---|---|---|----------------|------|

CG RAM address corresponds to cursor address.

This command sets CG RAM address. CG RAM data is sent and received after this setting.

10-8. Set DD RAM address

RS R/W DB7 DB6..... DBO Execution time

| | | | | |
|---|---|---|----------------|------|
| 0 | 0 | 1 | DD RAM ADDRESS | 42μs |
|---|---|---|----------------|------|

This command sets DD RAM address. DD RAM data is sent and received after this setting.

10-9. Read busy flag & address

RS R/W DB7 DB6..... DBO Execution time

| | | | | |
|---|---|----|---|-----|
| 0 | 1 | BF | Address counter used for both DD & CG RAM address | 0μs |
|---|---|----|---|-----|

This command reads busy flag (BF) indicating internal operation is being performed and reads address counter.

BF: H: Busy

L: Ready.

10-10. Write data

RS R/W DB7 DB6..... DBO Execution time

| | | | |
|---|---|------------|------|
| 1 | 0 | WRITE DATA | 46μs |
|---|---|------------|------|

This instruction writes data into DD RAM or CG RAM.

10-11. Read data

RS R/W DB7 DB6..... DBO Execution time

| | | | |
|---|---|-----------|------|
| 1 | 1 | READ DATA | 46μs |
|---|---|-----------|------|

This instruction reads data from DD RAM or CG RAM.

NOTE: “*”: Don’t care.

10. CHARACTER PATTERN

| Higher 4 bits Lower 4 bits | 0010 | 0011 | 0100 | 0101 | 0110 | 0111 | 1010 | 1011 | 1100 | 1101 | 1110 | 1111 |
|-------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| XXXX0000 | | 0 | a | P | \ | P | - | 9 | E | o | P | |
| XXXX0001 | ! | 1 | A | Q | a | M | a | 7 | 7 | 4 | a | 9 |
| XXXX0010 | " | 2 | B | R | b | r | T | / | v | Y | P | a |
| XXXX0011 | # | 3 | C | S | c | s | J | o | t | E | s | ∞ |
| XXXX0100 | \$ | 4 | D | T | d | t | \ | I | t | † | M | a |
| XXXX0101 | % | 5 | E | U | e | u | . | 7 | + | 1 | o | U |
| XXXX0110 | & | 6 | F | V | f | v | 7 | カ | 二 | 3 | P | Z |
| XXXX0111 | ' | 7 | G | W | g | w | 7 | + | ア | ウ | g | π |
| XXXX1000 | (| 8 | H | X | h | x | 4 | o | 水 | U | J | ア |
| XXXX1001 |) | 9 | I | Y | i | y | 9 | 7 | 川 | 川 | Y | U |
| XXXX1010 | * | : | J | Z | j | z | z | コ | ン | ク | J | 7 |
| XXXX1011 | + | ; | K | L | k | l | カ | サ | ヒ | ロ | ア | ア |
| XXXX1100 | , | < | L | * | l | l | カ | ロ | コ | コ | o | ア |
| XXXX1101 | - | = | M | I | m | i | カ | ア | ク | ク | o | + |
| XXXX1110 | . | > | N | ^ | n | + | 3 | ヒ | ホ | ホ | ñ | |
| XXXX1111 | / | ? | O | _ | o | ← | w | ウ | マ | マ | o | |

12. EXTERNAL DIMENSION

