

1. Mechanical data

(1) NUMBER OF DOTS ----- 320 W * 240 H DOTS

(2) MODULE SIZE ----- 167.5 W * 109.0 H * 10.0 T (max) mm

(3) EFFECTIVE AREA ----- 120.5 * 92.0 W(min) H mm

(4) ACTIVE AREA----- 115.17 W * 86.37 H mm

(5) DOT SIZE ----- 0.33 W * 0.33 H mm

(6) DOT PITCH-----0.36 W * 0.36 H mm

2. Absolute maximum ratings

2.1 Electrical absolute maximum ratings

| <i>I T E M</i> | <i>SYMBOL</i> | <i>MIN.</i> | <i>MAX.</i> | <i>UNIT</i> | <i>COMMENT</i> |
|-------------------------------------|----------------------------------|-----------------|-----------------|------------------|----------------|
| POWER SUPPLY FOR LOGIC | V _{DD} -V _{SS} | 0 | 5.5 | V | ----- |
| INPUT VOLTAGE | V _I | V _{SS} | V _{DD} | V | ----- |
| STATIC ELECTRICITY | ----- | ----- | 100 | V | NOTE (1) |
| POWER SUPPLY FOR LCD | V _{EE} -V _{SS} | ----- | 30.0 | V | ----- |
| POWER SUPPLY FOR CCFL BACKLIGHT | V _S | ----- | AC1000 | V _{rms} | ----- |
| | f _{FL} | ----- | 55.0 | KHz | ----- |
| STARTING VOLTAGE FOR CCFL BACKLIGHT | V _{start1} | AC550 | ----- | V _{rms} | Ta = 25 |
| | V _{start2} | AC700 | ----- | V _{rms} | Ta = 25 |
| POWER SUPPLY FOR LED | V _{LED} | ----- | 6.0 | V | ----- |

NOTE (1): ELECTRO-STATIC DISCHARGE RESISTANCE IS TESTED BY CHARGING A 200PF CAPACITOR AND DISCHARGING IT BY CONTACT WITH A INTERFACE CONNECTOR PIN.

2.2 Environmental absolute maximum ratings

| <i>I T E M</i> | <i>OPERATING</i> | | <i>STORAGE</i> | | <i>COMMENT</i> |
|-----------------------|------------------|-------------|----------------|-------------|---|
| | <i>MIN.</i> | <i>MAX.</i> | <i>MIN.</i> | <i>MAX.</i> | |
| AMBIENT TEMPERATURE | -20 | 70 | -20 | 70 | ----- |
| HUMIDITY | NOTE (2) | | NOTE (2) | | NO CONDENSATION |
| VIBRATION NOTE (3) | ----- | 0.5G | ----- | 2G | 10 300HZ XYZ DIRECTIONS 1 Hr EACH |
| SHOCK NOTE (3) | ----- | 3G | ----- | 50G | 10 msec XYZ DIRECTIONS 1 TIME EACH |
| CORROSIVE GAS | NOT ACCEPTABLE | | NOT ACCEPTABLE | | ----- |

NOTE (2): Ta = 70 : 75% RH MAX.

Ta > 70 : ABSOLUTE HUMIDITY MUST BE LOWER THAN THE HUMIDITY OF 75% RH AT 70 .

NOTE (3): 1G = 9.8 m/s²

3. Electrical characteristics

$T_a = 25$

$V_{DD} = 5.0 \pm 0.25 V$

| ITEM | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | |
|---|-----------------|---|-------------|--------|-------------|-----------|---|
| POWER SUPPLY VOLTAGE FOR CIRCUIT | $V_{DD}-V_{SS}$ | ----- | 4.75 | 5.0 | 5.25 | V | |
| INPUT VOLTAGE | V_{IH} | H LEVEL | $0.8V_{DD}$ | ----- | V_{DD} | V | |
| | V_{IL} | L LEVEL | V_{SS} | ----- | $0.2V_{DD}$ | V | |
| POWER SUPPLY VOLTAGE FOR LCD DRIVING | $V_{EE}-V_{SS}$ | ----- | 27.5 | 28.0 | 28.5 | V | |
| POWER SUPPLY CURRENT, NOTE (1) | I_{DD} | $V_{DD}-V_{SS} = 5.0V$ | ----- | 20.0 | 30.0 | mA | |
| POWER SUPPLY LCD CURRENT | I_{EE} | $V_o-V_{SS} = 23.5V$ | ----- | 5.0 | 7.0 | mA | |
| RECOMMENDED LCD DRIVING VOLTAGE,NOTE(2) | V_o-V_{SS} | STN/ FSTN DUTY =1/240 =10° NOTE(3) | Ta=-20°C | ----- | 24.9 | ----- | V |
| | | | Ta= 0°C | ----- | 23.9 | ----- | V |
| | | | Ta= 25°C | ----- | 23.5 | ----- | V |
| | | | Ta= 50°C | ----- | 22.6 | ----- | V |
| | | | Ta= 70°C | ----- | 21.7 | ----- | V |
| CCFL LAMP | V_{FL} | $f_{FL} = 35KHz$ | ----- | 270 | ----- | V_{rms} | |
| | I_{FL} | $V_{FL} = 270 V_{rms}$ $f_{FL} = 35 KHz$ | ----- | 5.0 | ----- | $mArms$ | |
| CCFL LIFETIME | ----- | $V_{FL}=270V_{rms}$ $f_{FL}=35KHZ$ | ----- | 30,000 | ----- | Hr | |
| FLM FREQUENCY | F_{FLM} | ----- | 70 | 75 | 80 | Hz | |
| POWER SUPPLY CURRENT FOR LED BACKLIGHT | I_{LED} | $V_{LED} = +4.0 V$ | ----- | 120.0 | 160.0 | mA | |

NOTE (1): THE DISPLAY PATTERN IS ALL "ON", OR ALL "OFF"

(2): RECOMMENDED LCD DRIVING VOLTAGE MAY FLUCTUATE ABOUT $\pm 0.5V$ BY EACH MODULE.

(3): = 0° : VIEWING ANGLE AT 6 O'CLOCK
= 180° : VIEWING ANGLE AT 12 O'CLOCK

4. Optical characteristics

STN TYPE LCD

Ta = 25 V_{DD}-V_O = 23.5V

| ITEM | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | NOTE |
|----------------|-----------|--------------------|------|------|------|------|---------|
| VIEWING ANGLE | 2- 1 | K = 2.0 NOTE(1) | 30 | 40 | ---- | deg. | NOTE(2) |
| CONTRAST RATIO | K | = 10° NOTE(1) | 3.0 | 4.0 | ---- | ---- | NOTE(2) |
| RESPONSE TIME | tr (rise) | = 10° NOTE(1) | ---- | 200 | 350 | ms | NOTE(2) |
| | tf (fall) | = 10° NOTE(1) | ---- | 300 | 400 | ms | NOTE(2) |

FSTN TYPE LCD

Ta = 25 V_{DD}-V_O = 23.5V

| ITEM | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | NOTE |
|----------------|-----------|--------------------|------|------|------|------|---------|
| VIEWING ANGLE | 2- 1 | K = 2.0 NOTE(1) | 30 | 40 | ---- | deg. | NOTE(2) |
| CONTRAST RATIO | K | = 10° NOTE(1) | 4.0 | 5.0 | ---- | ---- | NOTE(2) |
| RESPONSE TIME | tr (rise) | = 10° NOTE(1) | ---- | 200 | 350 | ms | NOTE(2) |
| | tf (fall) | = 10° NOTE(1) | ---- | 300 | 400 | ms | NOTE(2) |

Brightness for backlight

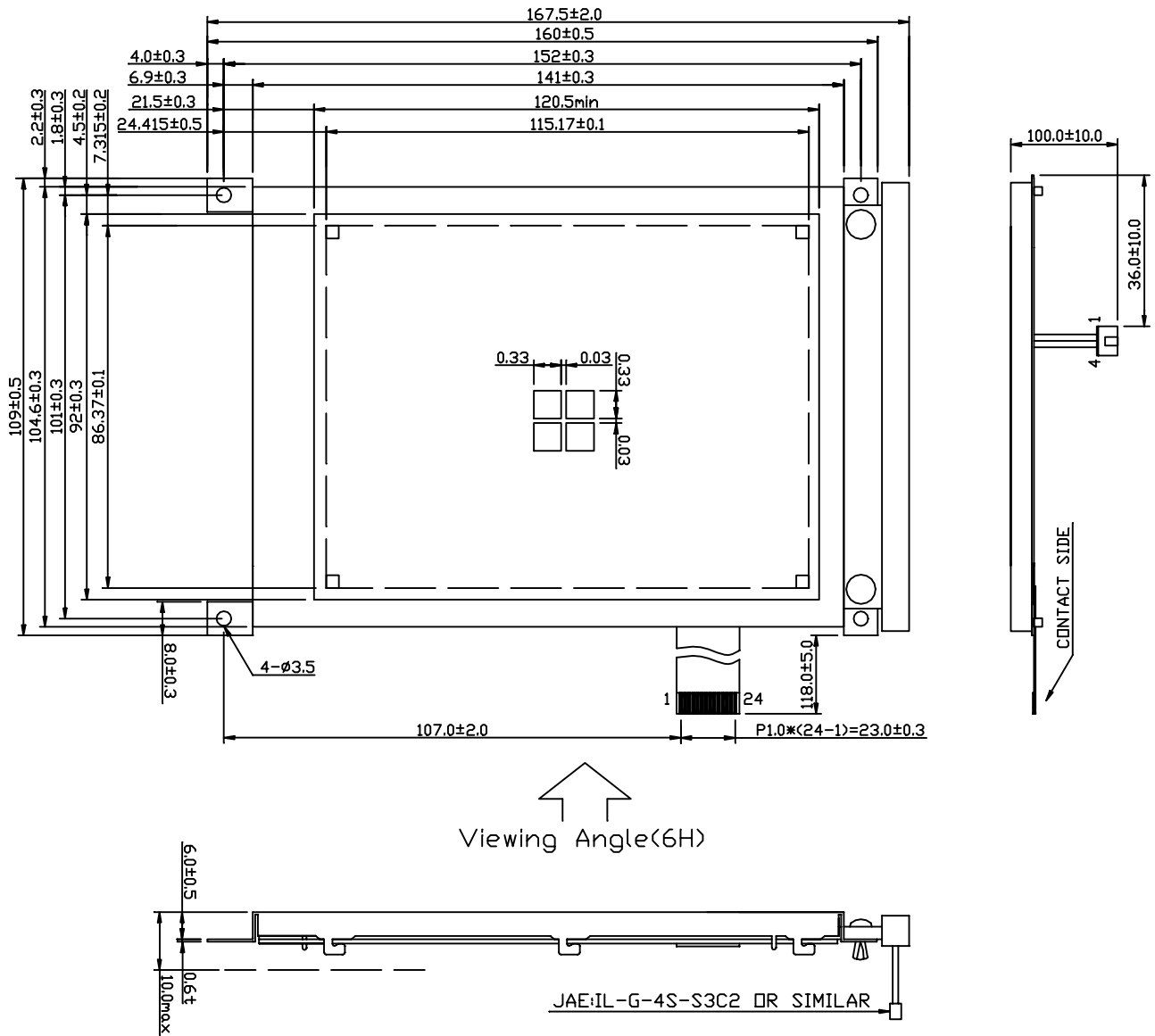
| Symbol | Condition | MIN. | TYP. | MAX. | UNIT | Backlight Type | Note | |
|--------|---|--------------|-------|------|-------|-------------------|-------------|-------------|
| B | V _{FL} =270Vrms f _{FL} =35KHZ STN/FSTN POSITIVE | Dots all on | ----- | 5 | ----- | cd/m ² | CCFL | |
| | | Dots all off | ----- | 60 | ----- | | | |
| | V _{FL} =270Vrms f _{FL} =35KHZ STN/FSTN NEGATIVE | Dots all on | ----- | 160 | ----- | | | LED (WHITE) |
| | | Dots all off | ----- | 60 | ----- | | | |
| | = 0° = 0° STN/FSTN POSITIVE | Dots all on | ----- | 5 | ----- | | LED (WHITE) | |
| | | Dots all off | ----- | 160 | ----- | | | |
| | = 0° = 0° STN/FSTN NEGATIVE | Dots all on | ----- | 160 | ----- | | | LED (WHITE) |
| | | Dots all off | ----- | 5 | ----- | | | |

Note (1): = 0° WHEN VIEWING ANGLE AT 6 O'CLOCK
= 180° WHEN VIEWING ANGLE AT 12 O'CLOCK

(2): SEE CUSTOMER ACCEPTANCE STANDARD SPECIFICATION FOR DEFINITION OF OPTICAL CHARACTERISTICS.

(3): UNDER NORMAL TEMPERATURE AND HUMIDITY IN A DARK ROOM.

5. Outline dimension



NOTE :

1.UNIT : mm

2.SCALE : NTS

5.1 Interface

(a) Pin Assignment

| <i>PIN NO.</i> | <i>SYMBOL</i> | <i>FUNCTION</i> |
|----------------|---------------------------------|---|
| 1 | V _{SS} | POWER SUPPLY (GND) |
| 2 | V _{DD} | POWER SUPPLY (+5V) |
| 3 | V _O | OPERATING VOLTAGE FOR LCD DRIVING |
| 4 | A _O | DATA TYPE SELECTION |
| 5 | $\overline{WR}(R/\overline{W})$ | (When 8080-series) : \overline{WR} IS (L) (When 6800-series) : Read mode : R/ \overline{W} IS (H) Write mode : R/ \overline{W} IS (L) |
| 6 | \overline{RD}/E | \overline{RD} : (When to 8080-series) E : (When to 6800-series) |
| 7 | D ₀ | DATA INPUT/OUTPUT |
| 8 | D ₁ | DATA INPUT/OUTPUT |
| 9 | D ₂ | DATA INPUT/OUTPUT |
| 10 | D ₃ | DATA INPUT/OUTPUT |
| 11 | D ₄ | DATA INPUT/OUTPUT |
| 12 | D ₅ | DATA INPUT/OUTPUT |
| 13 | D ₆ | DATA INPUT/OUTPUT |
| 14 | D ₇ | DATA INPUT/OUTPUT |
| 15 | \overline{CS} | CHIP SELECTION |
| 16 | V _{EE} | POWER SUPPLY FOR LCD DRIVING (OUTPUT) |
| 17 | SEL1 | 8080 OR 6800 FAMILY INTERFACE SELECT |
| 18 | \overline{RES} | L: RESET |
| 19 | F.G | FRAME GROUND |
| 20 | N.C | NO CONNECTION |
| 21 | N.C | NO CONNECTION |
| 22 | N.C | NO CONNECTION |
| 23 | N.C | NO CONNECTION |
| 24 | N.C | NO CONNECTION |

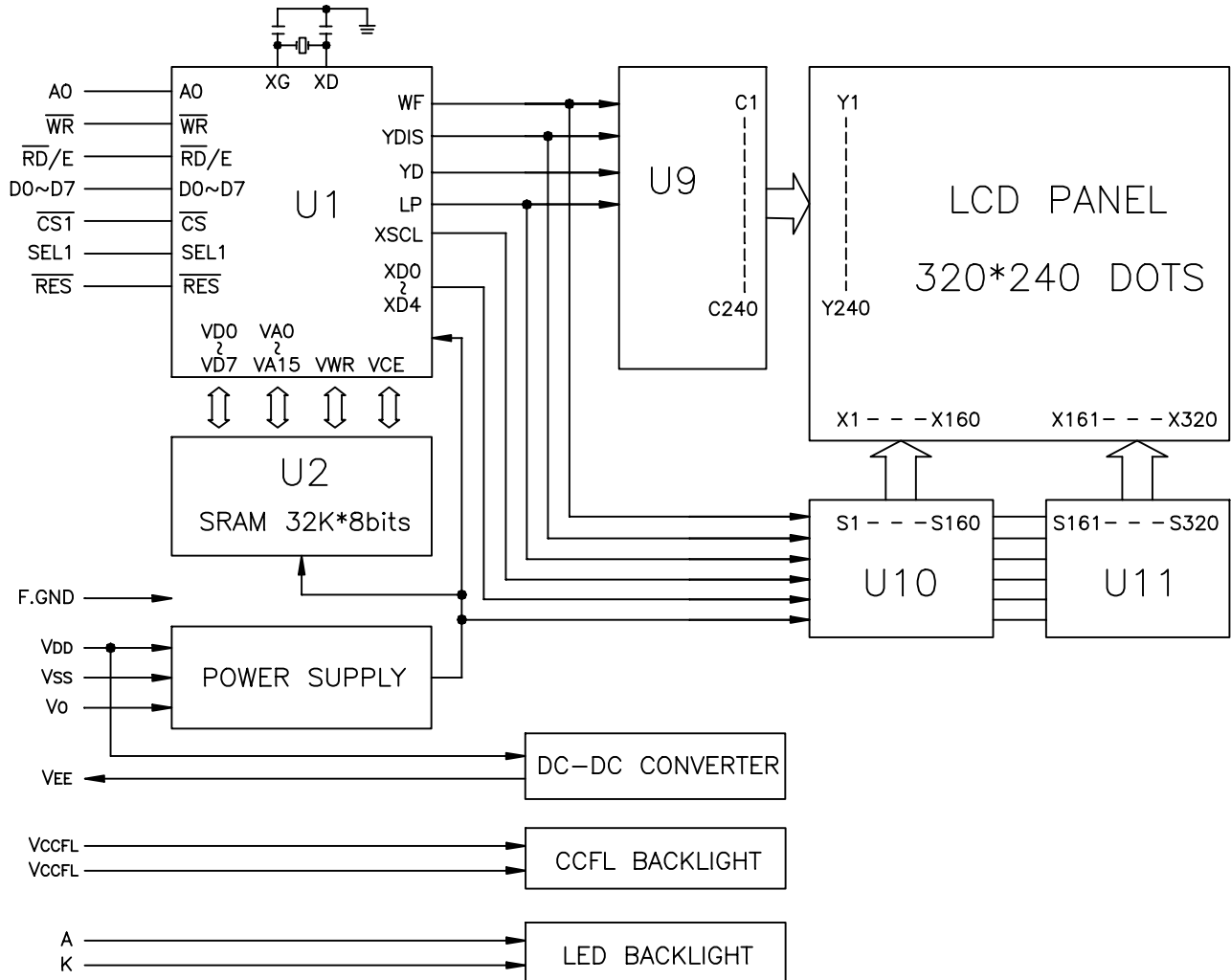
(b) CCFL Connector

| <i>PIN NO.</i> | <i>SYMBOL</i> | <i>FUNCTION</i> |
|----------------|-------------------|-------------------------------|
| 1 | V _{CCFL} | POWER SUPPLY VOLTAGE FOR CCFL |
| 2 | N.C | NO CONNECTION |
| 3 | N.C | NO CONNECTION |
| 4 | V _{CCFL} | POWER SUPPLY VOLTAGE FOR CCFL |

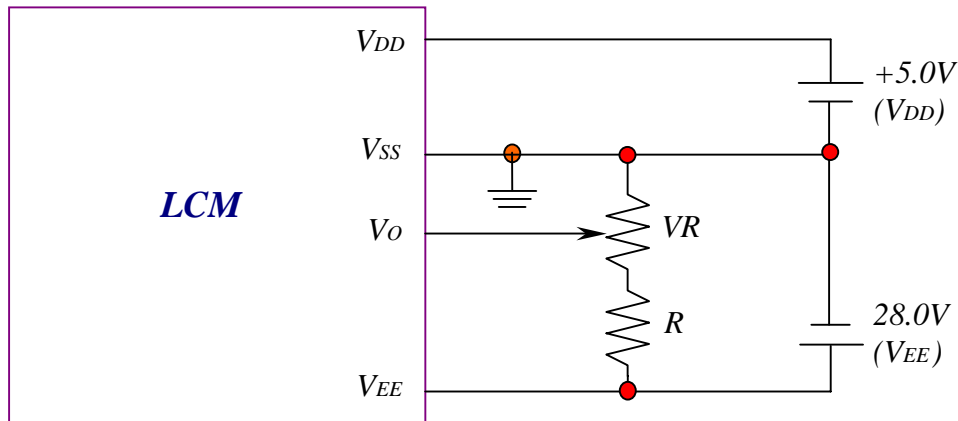
(c) LED Connector

| <i>PIN NO.</i> | <i>SYMBOL</i> | <i>FUNCTION</i> |
|----------------|---------------|---------------------------------|
| 1 | A | POWER SUPPLY VOLTAGE FOR LED(+) |
| 2 | N.C | NO CONNECTED |
| 3 | N.C | NO CONNECTED |
| 4 | K | POWER SUPPLY VOLTAGE FOR LED(-) |

6. Block diagram



7. Power supply for LCM

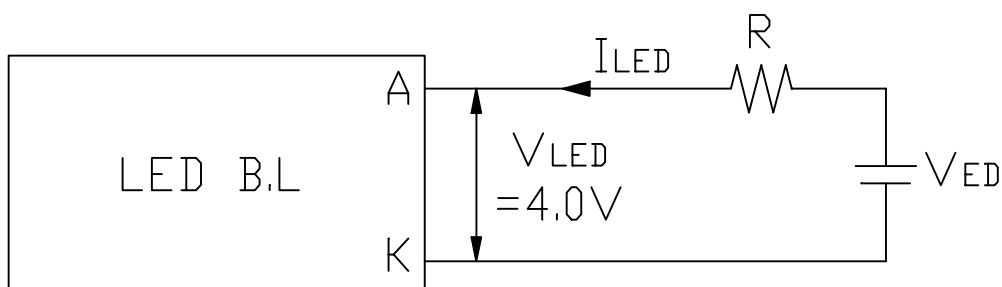
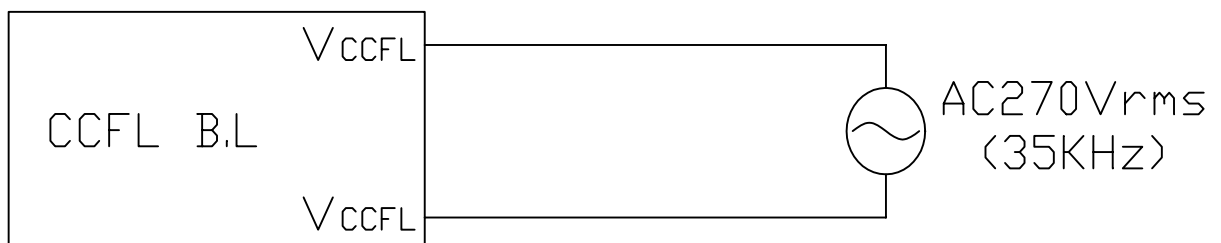


$V_o - V_{SS}$: LCD DRIVING VOLTAGE

RECOMMEND RESISTOR R: $V_o - V_{SS} \quad 1.5V$

V_R : 200K

7.1 Power supply for backlight



$$R = (V_{ED} - V_{LED}) / I_{LED}, \quad L R \quad 1W, \quad I_{LED} \leq 160.0 \text{ mA (max)}$$