

液晶之友 电话: 020-33819057
Http://www.lcdfriends.com

SPECIFICATION FOR LCD MODULE

Model No. TM0236AKFW

| | |
|----------------------|--------------|
| Prepared by: | Date: |
| Checked by : | Date: |
| Verified by : | Date: |
| Approved by: | Date: |

TIANMA MICROELECTRONICS CO., LTD

Rev. 2.0

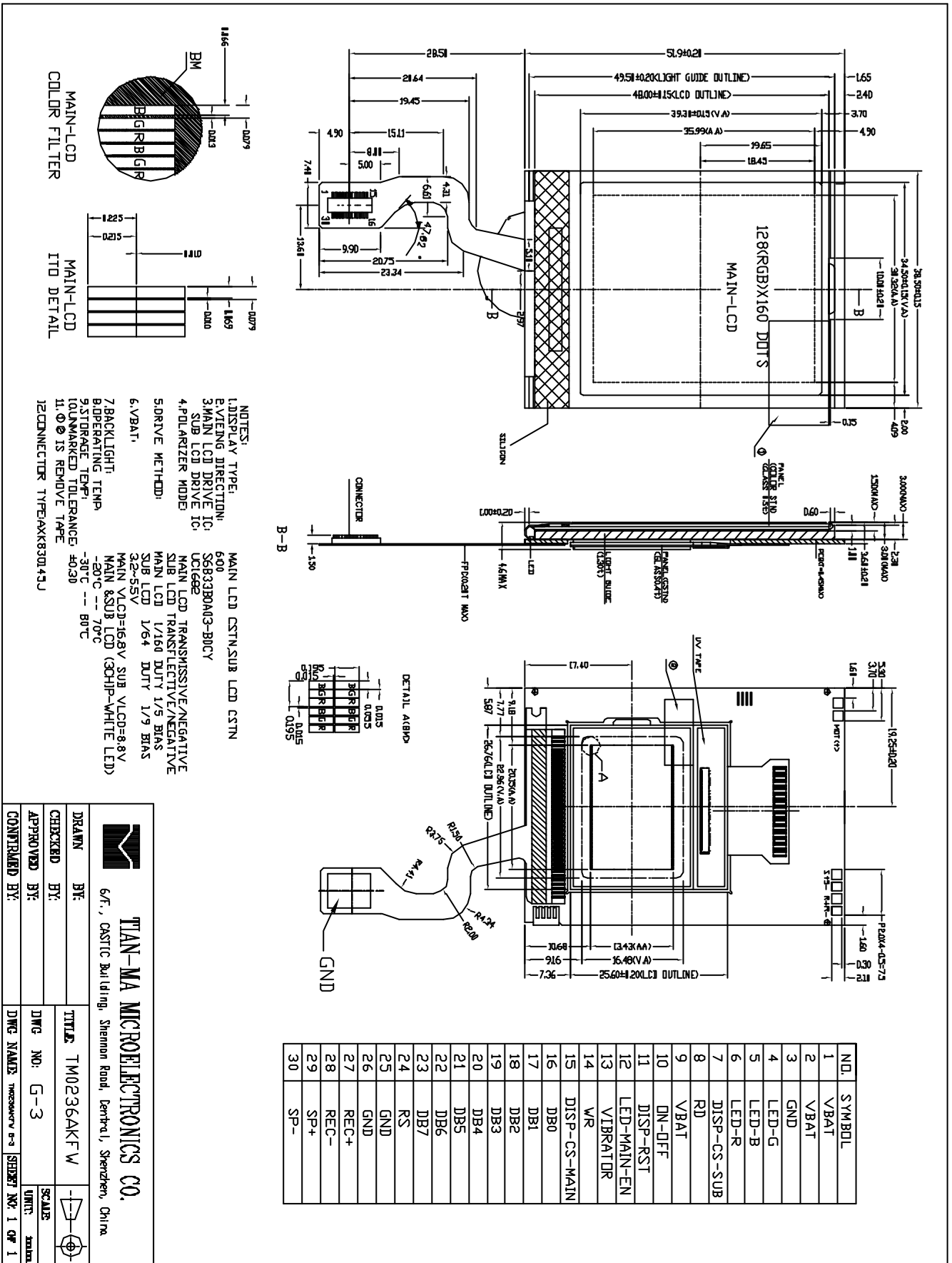
REVISION RECORD

| Date | Ver. | Ref. Page | Revision No. | Revision Items |
|-------------|-------------|------------------|---------------------|-----------------------|
| | | | | |

1 General Specifications:

| ITEM | CONTENTS | | UNIT |
|-----------------------|---------------------------------------|------------------------|---------|
| | MAIN LCD | SUB LCD | |
| LCD TYPE | COLOR STN | COLOR STN | --- |
| LCD DUTY | 1/160 | 1/64 | --- |
| LCD BIAS | 1/5 | 1/9 | --- |
| VIEWING DIRECTION | 6:00 | 6:00 | O'CLOCK |
| GLASS AREA(WXH) | 38.5X48.0 | 26.76X25.6 | MM |
| VIEWING AREA(WXH) | 34.5X39.3 | 22.96X16.48 | MM |
| ACTIVE AREA(WXH) | 30.32X35.99 | 20.15X13.43 | MM |
| NUMBER OF DOTS | 128(R+G+B)X160 | 96X64 | |
| DOTS SIZE(WXH) | 0.213X0.225 | 0.195X0.195 | MM |
| DOT PITCH(WXH) | 0.225X0.237 | 0.210X0.210 | MM |
| CONTROLLER | S6B33B0A03-B0CY | UC1682xGAD-U0 | --- |
| VDD | 3.0 | | V |
| LCD OPERATING VOLTAGE | 16.8 | 8.8 | V |
| OUTLINE DIMENSIONS | REFER TO OUTLINE DRAWING ON NEXT PAGE | | |
| BACKLIGHT | LED(WHITE) | LED(WHITE) | --- |
| OPERATING TEMPERAT | -20---+70 | -20---+70 | --- |
| STORAGE TEMPERATURE | -30---+80 | -30---+80 | --- |
| WEIGHT | TBD | | --- |
| DATA TRANSFER | 8 BIT PARALLEL | | --- |
| POLARIZER MODE | TRANSMISSIVE /NEGATIVE | TRANSMISSIVE /NEGATIVE | --- |

2. Outline Drawing



- NOTES:
- 1 DISPLAY TYPE: MAIN LCD CSTN/SUB LCD CSTN
 - 2 EYEING DIRECTION: 60°
 - 3 MAIN LCD DRIVE IC: S8B33B0AN3-B0CY
 - 4 SUB LCD DRIVE IC: UC1662
 - 5 POLARIZER MODE: MAIN LCD TRANSMISSIVE/NEGATIVE
 - 6 DRIVE METHOD: SUB LCD TRANSLLECTIVE/NEGATIVE
 - 7 VBAT: MAIN LCD 1/160 DUTY 1/5 BIAS
 - 8 BACKLIGHT: 3.2-5.5V
 - 9 OPERATING TEMP: MAIN VLCD=16.8V SUB VLCD=8.8V
 - 10 STORAGE TEMP: MAIN & SUB LCD (3CHIP-WHITE LED)
 - 11 UNMARKED TOLERANCE: -20°C --- 70°C
 - 12 MARKED TOLERANCE: -30°C --- 80°C
 - 13 CONNECTOR TYPE: AXK830143J

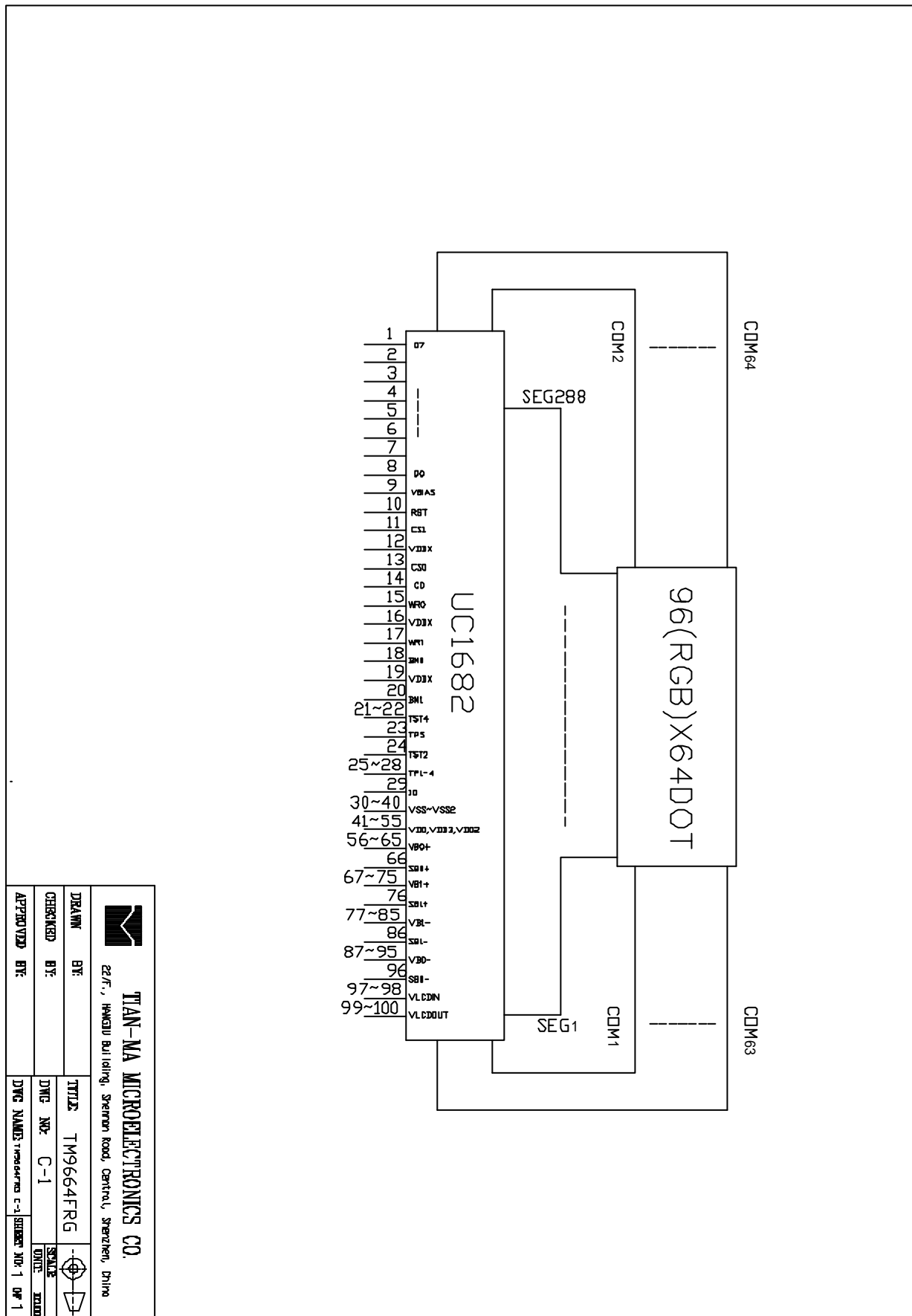
| NO. | SYMBOL |
|-----|--------------|
| 1 | VBAT |
| 2 | VBAT |
| 3 | GND |
| 4 | LED-G |
| 5 | LED-B |
| 6 | LED-R |
| 7 | DISP-CS-SUB |
| 8 | RD |
| 9 | VBAT |
| 10 | DN-OFF |
| 11 | DISP-RST |
| 12 | LED-MAIN-EN |
| 13 | VIBRATOR |
| 14 | WR |
| 15 | DISP-CS-MAIN |
| 16 | DB0 |
| 17 | DB1 |
| 18 | DB2 |
| 19 | DB3 |
| 20 | DB4 |
| 21 | DB5 |
| 22 | DB6 |
| 23 | DB7 |
| 24 | RS |
| 25 | GND |
| 26 | GND |
| 27 | REC+ |
| 28 | REC- |
| 29 | SP+ |
| 30 | SP- |



TIAN-MA MICROELECTRONICS CO.
6/F., CASTIC Building, Shennan Road, Lantian, Shenzhen, China

| | | | |
|----------------|------------|--------|-----|
| DRAWN BY: | TM0236AKFW | SCALE: | 1:1 |
| CHECKED BY: | | UNIT: | mm |
| APPROVED BY: | G-3 | | |
| CONTROLLED BY: | | | |

3.2 Circuit Block Diagram Of Sub LCD



TIAN-MA MICROELECTRONICS CO.

22/F., HANKOU Building, Shenzhen Road, Central, Shenzhen, China

| | | | |
|--------------|-------|------------|--------|
| DRAWN BY: | DATE: | TITLE: | SCALE: |
| CHECKED BY: | DATE: | DWG. NO.: | DATE: |
| APPROVED BY: | DATE: | DWG. NAME: | DATE: |

4 Absolute Maximum Ratings(Ta=25)

| ITEM | SYMBOL | MIN | MAX | UNIT |
|-----------------------------------|----------|------|-------------|------|
| Power supply voltage(1) | VBAT | 3.0 | 5.0 | V |
| Power supply voltage(2) | LCD_VCC | -0.3 | 4.0 | V |
| Power supply Voltage for main LCD | VLCD-GND | -0.3 | 20 | V |
| Logic signal Input voltage | Vt | -0.3 | LCD_VCC+0.3 | V |
| Operating temperature | Topr | -20 | +70 | |
| Storage temperature | Tst | -30 | +80 | |

Notes:

1. If the module is used above these absolute maximum ratings.It may become permanently damaged.Using the module within the following electrical characteristic conditions are also exceeded,the module will malfunction and cause poor reliability.
2. LCD_VCC>GND must be maintained.

5. Electrical Specifications and Instruction Code (V_{SS}=0V, T_a=25 °C)

5.1 Electrical characteristics

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|------------------|-----------------------------------|------------|------|------------|------|
| | | | | | | |
| Supply voltage for logic | VBATT | --- | 3.2 | 3.8 | 4.5 | V |
| Operation voltage for main LCD | VLCD1 | 25 | | 16.8 | | V |
| Operation voltage for SUB LCD | VLCD2 | 25 | | 8.8 | | V |
| Input voltage 'H' Level | V _{IH} | LCD_VCC=3.0V | 0.8VDD | --- | LCD_VCC | V |
| Input voltage 'L' Level | V _{IL} | LCD_VCC=3.0V | 0 | --- | 0.2VDD | V |
| Output voltage 'H' level | V _{OH} | VDD=3.0V VDD=2.75V | 0.8LCD_VCC | --- | LCD_VCC | V |
| Output voltage 'L' level | V _{OL} | --- | 0 | --- | 0.2LCD_VCC | V |
| Current consumption for MAIN LCD normal operation | IDD1 | LCD-VCC-GND=3.0V 1/160DUTY | --- | 1.2 | 2.0 | mA |
| Current consumption for SUB LCD normal operation | IDD2 | LCD-VCC-GND=3.0V 1/64DUTY | --- | 0.15 | 0.35 | mA |
| Supply Voltage (LED) | V _{LED} | --- | --- | 5 | --- | V |
| Supply current (LED) | I _{LED} | --- | --- | 45 | 60.0 | mA |

5.2 Interface Signals

| Pin NO. | Symbol | Function |
|---------|--------------|--|
| 1 | VBAT | Power supply pin |
| 2 | VBAT | Power supply pin |
| 3 | GND | Ground pin |
| 4 | LED-G | Indication LED(GREEN)ON |
| 5 | LED-B | Indication LED(BLUE)ON |
| 6 | LED-R | Indication LED(RED)ON |
| 7 | DISP-CS-SUB | SUB chip selection input pin:Active"L" |
| 8 | RD | E is read enable clock input pin.When E="L",DB0~DB7 are in output status. |
| 9 | VBAT | Power supply pin. |
| 10 | ON-OFF | LDO ON/OFF |
| 11 | DISP-RST | Chip reset signal input pin:Active"L" |
| 12 | LED-MAIN-EN | LED backlight enable pin.when"H"the LED backlight is turn on. |
| 13 | VIBRTOR | Motor control pin. |
| 14 | WR | WR is write enable clock input pin.DB0~DB7 are latched at the rising edge of the RW signal. |
| 15 | DISP-CS-MAIN | Main LCD(CSTN)chip selection input pin:Active"L". |
| 16 | DB0 | 8bit Bi-directional data bus. |
| 17 | DB1 | |
| 18 | DB2 | |
| 19 | DB3 | |
| 20 | DB4 | |
| 21 | DB5 | |
| 22 | DB6 | |
| 23 | DB7 | |
| 24 | RS | Command/data select input pin. RS="L" input DB7~DB0 is control data;RS="L" input DB7~DB0 is display data. |
| 25 | GND | Ground pin. |
| 26 | GND | Ground pin. |
| 27 | REC+ | Connect to REC. |
| 28 | REC- | Connect to REC. |
| 29 | SP + | Connect to speaker. |
| 30 | SP - | Connect to speaker. |

5.3 Interface Timing Chart

Note: Please refer to SAMSUNG S6B33B0A / ULTRACHIP UC1682 / ANALOGIC AAT3113 data sheet for more details.

SAMSUNG S6B33B0A INTERFACE PROTOCOL

Read / Write Characteristics (8080-series MPU)

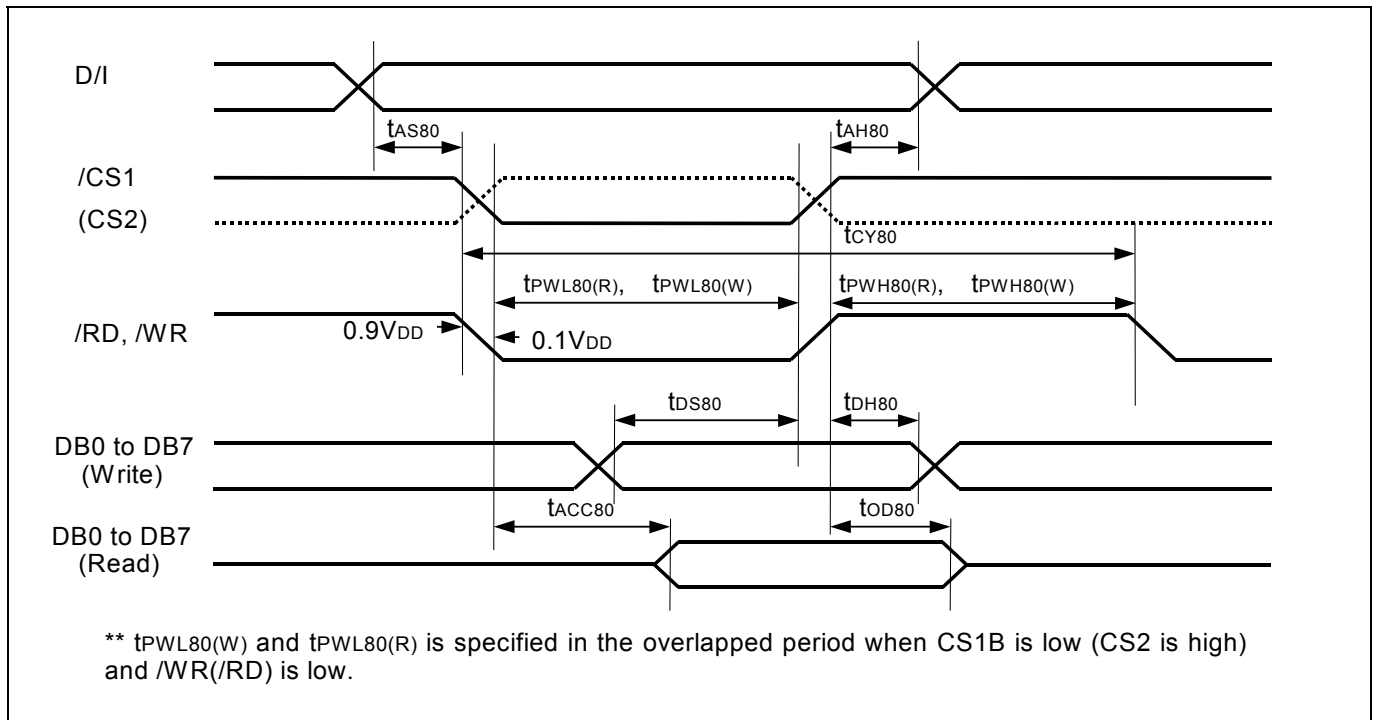


Figure 25. Parallel Interface (8080-series MPU) Timing Diagram

Table 17. AC Characteristics (8080-series Parallel Mode)

(VDD3 = 1.8 to 3.3V, Ta = -30 to +70°C)

| Item | Signal | Symbol | Condition | Min. | | Max. (3.3V/1.8V) | Unit |
|---|-------------------|---------------------------|-------------|------------|-----------|---------------------|------|
| | | | | 3.3V | 1.8V | | |
| Address setup time Address hold time | D/I | t_{AS80} t_{AH80} | | 0 0 | 0 0 | - - | ns |
| System cycle time | | t_{CY80} | | 150 | 360 | - | ns |
| Pulse width low for write Pulse width High for write | WRB (WRB) | t_{PWLW} t_{PWHW} | | 50 30 | 100 75 | - - | ns |
| Pulse width low for read Pulse width high for read | RDB (RDB) | t_{PWLr} t_{PWHr} | | 50 30 | 100 75 | - - | ns |
| Data setup time Data hold time | DB0 to DB15 | t_{DS80} t_{DH80} | | 5 8 | 10 14 | - - | ns |
| Read access time Output disable time | | t_{ACC80} t_{OD80} | CL = 100 pF | - | - | 60 / 120 | ns |
| | | | | t_{EWHR} | | | |

NOTE: *1. The input signal rise time and fall time (t_r , t_f) is specified at 10 ns or less.
 $(t_r + t_f) < (t_{CY80} - t_{PWLW} - t_{PWHW})$ for write, $(t_r + t_f) < (t_{CY80} - t_{PWLr} - t_{PWHr})$ for read

INSTRUCTION DESCRIPTION (S6B33B0)

| Instruction Name | D/I | WRB | RDB | DB15 ~DB8 | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | Hex. | Parameter |
|--------------------------------|-----|-----|-----|--------------|--------------------|-----|-----|-----|-----|-----|-----|-----|------|-----------|
| Non Operation | 0 | 0 | 1 | * | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 00 | |
| Oscillation Mode Set | 0 | 0 | 1 | * | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 02 | 1Byte |
| Driver Output Mode Set | 0 | 0 | 1 | * | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 10 | 1Byte |
| DC-DC Select | 0 | 0 | 1 | * | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 20 | 1Byte |
| Driving current & Bias Set | 0 | 0 | 1 | * | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 22 | 1Byte |
| DCDC Clock Division Set | 0 | 0 | 1 | * | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 24 | 1Byte |
| DCDC and AMP ON/OFF set | 0 | 0 | 1 | * | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 26 | 1Byte |
| Temperature Compensation Set | 0 | 0 | 1 | * | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 28 | 1Byte |
| Contrast Control(1) | 0 | 0 | 1 | * | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 2A | 1Byte |
| Contrast Control(2) | 0 | 0 | 1 | * | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 2B | 1Byte |
| Standby Mode OFF | 0 | 0 | 1 | * | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 2C | - |
| Standby Mode ON | 0 | 0 | 1 | * | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 2D | - |
| DDRAM Burst Mode OFF | 0 | 0 | 1 | * | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 2E | - |
| DDRAM Burst Mode ON | 0 | 0 | 1 | * | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 2F | - |
| Addressing Mode Set | 0 | 0 | 1 | * | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 30 | 1Byte |
| ROW Vector Mode Set | 0 | 0 | 1 | * | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 32 | 1Byte |
| N-line Inversion Set | 0 | 0 | 1 | * | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 34 | 1Byte |
| Entry Mode Set | 0 | 0 | 1 | * | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 40 | 1Byte |
| X-address Area Set | 0 | 0 | 1 | * | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 42 | 2Byte |
| Y-address Area Set | 0 | 0 | 1 | * | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 43 | 2Byte |
| RAM Skip Area Set | 0 | 0 | 1 | * | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 45 | 1Byte |
| Display OFF | 0 | 0 | 1 | * | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 50 | - |
| Display ON | 0 | 0 | 1 | * | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 51 | - |
| Specified Display Pattern Set | 0 | 0 | 1 | * | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 53 | 1Byte |
| Partial Display Mode Set | 0 | 0 | 1 | * | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 55 | 1Byte |
| Partial Display Start Line Set | 0 | 0 | 1 | * | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 56 | 1Byte |
| Partial Display End Line Set | 0 | 0 | 1 | * | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 57 | 1Byte |
| Area Scroll Mode Set | 0 | 0 | 1 | * | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 59 | 4Byte |
| Scroll Start Line Set | 0 | 0 | 1 | * | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 5A | 1Byte |
| Set Display Data Length | X | X | X | * | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | FC | 1Byte |
| Display Data Write | 1 | 0 | 1 | | Display Data Write | | | | | | | | - | - |
| Display Data Read | 1 | 1 | 0 | | Display Data Read | | | | | | | | - | - |
| Status Read | 0 | 1 | 0 | 0 | Status Data Read | | | | | | | | - | - |
| Test Mode1 | 0 | 0 | 1 | * | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | FF | - |
| Test Mode2 | 0 | 0 | 1 | * | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | FE | - |
| Test Mode3 | 0 | 0 | 1 | * | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | FD | - |
| Test Mode4 | 0 | 0 | 1 | * | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | FB | - |
| Test Mode5 | 0 | 0 | 1 | * | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | FA | - |
| Test Mode6 | 0 | 0 | 1 | * | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | F9 | - |

*: Don' t care

Parameter: The number of parameter bytes that follows instruction data.

UC1682 AC CHARACTERISTICS

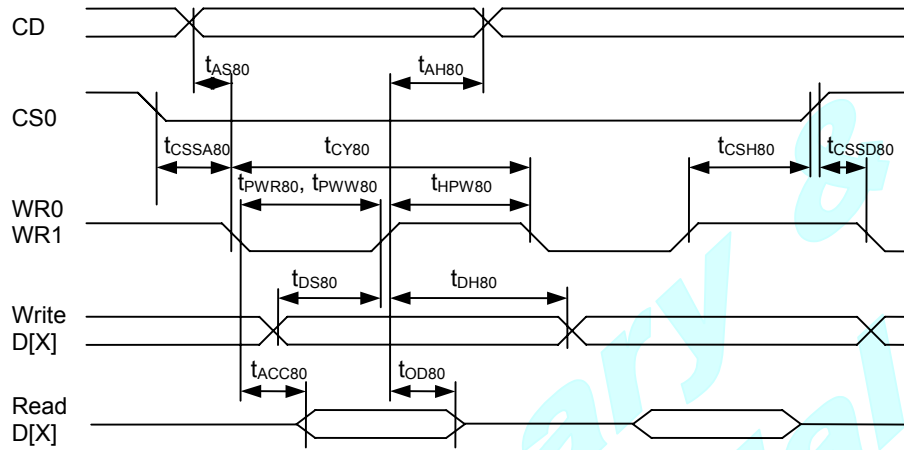


FIGURE 15: Parallel Bus Timing Characteristics (for 8080 MCU)

($V_{DD}=2.5V$ to $3.3V$, $T_a = -30$ to $+85^{\circ}C$)

| Symbol | Signal | Description | Condition | Min. | Max. | Units |
|--|----------|---|---------------|--------------------------|----------|-------|
| t_{AS80} t_{AH80} | CD | Address setup time Address hold time | | 0 10 | – | ns |
| t_{CY80} | | System cycle time 8 bits bus (read) (write) 4 bits bus (read) (write) | | 140 128 128 128 | – | ns |
| t_{PWR80} | WR1 | Pulse width 8 bits (read) 4 bits | | 65 35 | – | ns |
| t_{PWW80} | WR0 | Pulse width 8 bits (write) 4 bits | | 35 35 | – | ns |
| t_{HPW80} | WR0, WR1 | High pulse width 8 bits bus (read) (write) 4 bits bus (read) (write) | | 65 35 35 35 | – | ns |
| t_{DS80} t_{DH80} | D0~D7 | Data setup time Data hold time | | 30 10 | – | ns |
| t_{ACC80} t_{OD80} | | Read access time Output disable time | $C_L = 100pF$ | – 10 | 50 50 | ns |
| t_{SSA80} t_{CSSD80} t_{CSH80} | CS1/CS0 | Chip select setup time | | 10 10 20 | | ns |

COMMAND TABLE

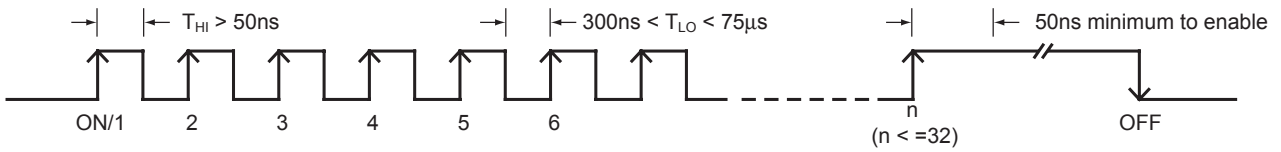
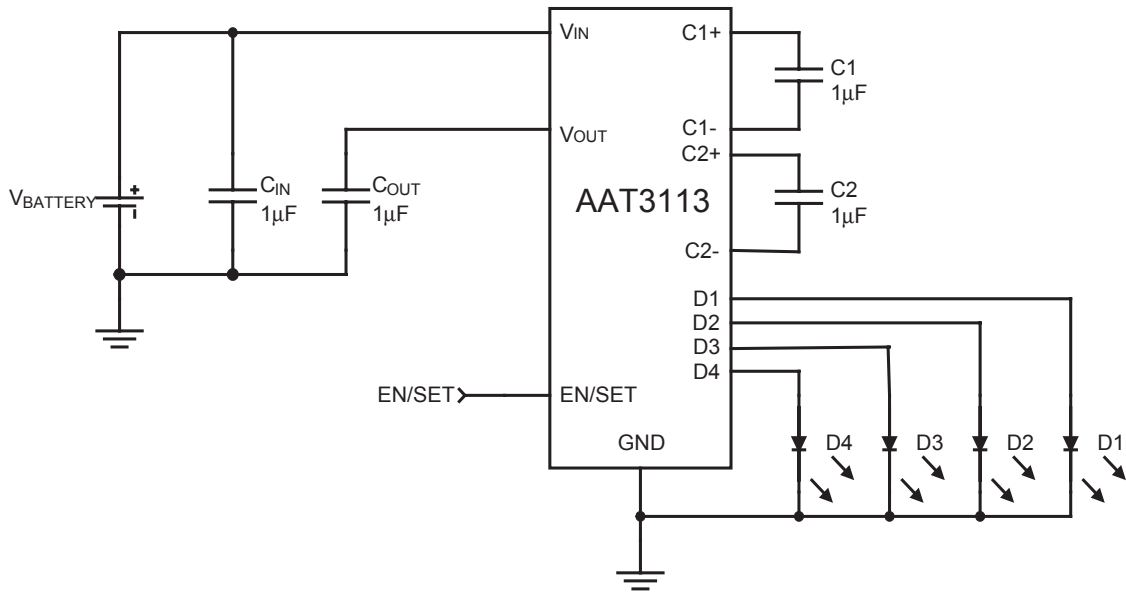
The following is a list of host commands supported by UC1680

C/D: 0: Control, 1: Data
W/R: 0: Write Cycle, 1: Read Cycle
Useful Data bits
- Don't Care

| | Command | C/D | W/R | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Action | Default |
|----|--|-----|-----|----|----|----|----|----|----|----|----|----------------------------------|------------|
| 1 | Write Data Byte | 1 | 0 | # | # | # | # | # | # | # | # | Write 1 byte | N/A |
| 2 | Read Data Byte | 1 | 1 | # | # | # | # | # | # | # | # | Read 1 byte | N/A |
| 3 | Get Status | 0 | 1 | - | MX | MY | WA | DE | WS | OD | OS | Get Status | N/A |
| 4 | Set Column Address LSB | 0 | 0 | 0 | 0 | 0 | 0 | # | # | # | # | Set CA[3:0] | 0 |
| | Set Column Address MSB | 0 | 0 | 0 | 0 | 0 | 1 | - | # | # | # | Set CA[6:4] | 0 |
| 5 | Set Temp. Compensation | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | # | # | Set TC[1:0] | 0 |
| 6 | Set Panel Loading | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | # | # | Set PC[1:0] | 01b |
| 7 | Set Pump Control | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | # | # | Set PC[3:2] | 11b |
| 8 | Set Adv. Program Control (double byte command) | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | R | Set APC[R][7:0], R = 0, or 1 | N/A |
| | | 0 | 0 | # | # | # | # | # | # | # | # | | |
| 9 | Set Scroll Line LSB | 0 | 0 | 0 | 1 | 0 | 0 | # | # | # | # | Set SL[3:0] | 0 |
| | Set Scroll Line MSB | 0 | 0 | 0 | 1 | 0 | 1 | # | # | # | # | Set SL[7:4] | 0 |
| 10 | Set Row Address LSB | 0 | 0 | 0 | 1 | 1 | 0 | # | # | # | # | Set RA[3:0] | 0 |
| | Set Row Address MSB | 0 | 0 | 0 | 1 | 1 | 1 | # | # | # | # | Set RA[7:4] | 0 |
| 11 | Set V _{BIAS} Potentiometer (double-byte command) | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Set PM[7:0] | 83H |
| | | 0 | 0 | # | # | # | # | # | # | # | # | | |
| 12 | Set Partial Display Control | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | # | # | Set LC[9:8] | 0: Disable |
| 13 | Set RAM Address Control | 0 | 0 | 1 | 0 | 0 | 0 | 1 | # | # | # | Set AC[2:0] | 001b |
| 14 | Set Fixed Lines | 0 | 0 | 1 | 0 | 0 | 1 | # | # | # | # | Set FL[3:0] | 0 |
| 15 | Set Line Rate | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | # | # | Set LC[4:3] | 10b |
| 16 | Set All-Pixel-ON | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | # | Set DC[1] | 0 |
| 17 | Set Inverse Display | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | # | Set DC[0] | 0 |
| 18 | Set Display Enable | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | # | # | Set DC[3:2] | 10b |
| 19 | Set Color Mask | 0 | 0 | 1 | 0 | 1 | 1 | 0 | # | # | # | Set MSK[2:0] | 0 |
| 20 | Set LCD Mapping Control | 0 | 0 | 1 | 1 | 0 | 0 | 0 | # | # | # | Set LC[2:0] | 0 |
| 21 | Set Color Pattern | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | # | Set LC[5] | 0 (BGR) |
| 22 | Set Color Mode | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | # | # | Set LC[7:6] | 10b (65K) |
| 23 | System Reset | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | System Reset | N/A |
| 24 | NOP | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | No operation | N/A |
| 25 | Set Test Control (double byte command) | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | TT | | For testing only. Do not use. | N/A |
| | | 0 | 0 | # | # | # | # | # | # | # | # | | |
| 26 | Set LCD Bias Ratio | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | # | # | Set BR[1:0] | 11b (12) |
| 27 | Reset Cursor Update Mode | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | AC[3]=0, CA=CR | AC[3]=0 |
| 28 | Set Cursor Update Mode | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | AC[3]=1, CR=CA | AC[3]=1 |
| 29 | Set COM End | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | Set CEN[7:0] | 159 |
| | | 0 | 0 | # | # | # | # | # | # | # | # | | |
| 30 | Set Partial Display Start | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | Set DST[7:0] | 0 |
| | | 0 | 0 | # | # | # | # | # | # | # | # | | |
| 31 | Set Partial Display End | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | Set DEN[7:0] | 159 |
| | | 0 | 0 | # | # | # | # | # | # | # | # | | |

Application Circuits

Typical AAT3113 Application Circuit:



Enable / Disable / LED Brightness Level Set Data Input

Current Levels (mA)

| Code | 20 mA max |
|------|-----------|
| 1 | 0.549 |
| 2 | 0.627 |
| 3 | 0.706 |
| 4 | 0.784 |
| 5 | 0.863 |
| 6 | 1.020 |
| 7 | 1.098 |
| 8 | 1.255 |
| 9 | 1.412 |
| 10 | 1.569 |
| 11 | 1.804 |
| 12 | 1.961 |
| 13 | 2.275 |
| 14 | 2.510 |
| 15 | 2.824 |
| 16 | 3.137 |

| Code | 20 mA max |
|------|-----------|
| 17 | 3.529 |
| 18 | 4.000 |
| 19 | 4.471 |
| 20 | 5.020 |
| 21 | 5.647 |
| 22 | 6.353 |
| 23 | 7.059 |
| 24 | 7.922 |
| 25 | 8.941 |
| 26 | 10.039 |
| 27 | 11.216 |
| 28 | 12.627 |
| 29 | 14.118 |
| 30 | 15.843 |
| 31 | 17.804 |
| 32 | 20.000 |

6. Optical Characteristics

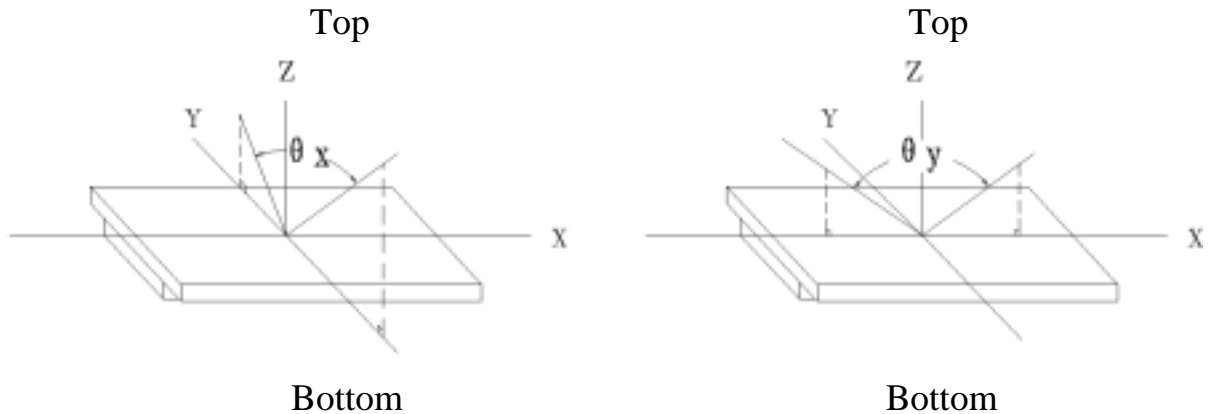
6.1 Optical Characteristics

$V_{LCD}=16.8V$ $T_a=25$

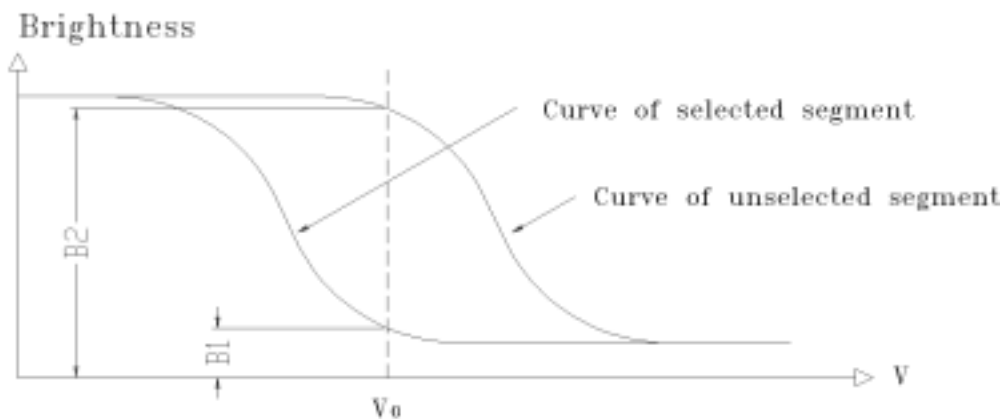
| Item | Symbol | Condition | | Min. | Typ. | Max. | Unit |
|--------------------------|----------|----------------------------|----------------------------|------|----------|------|------|
| Viewing Angle | x | $C_r \geq 2$ | $y=0^\circ$ | MAIN | -50--+50 | | Deg |
| | | | | SUB | -60--36 | | |
| | y | | $x=0^\circ$ | MAIN | -30--+45 | | |
| | | | | SUB | -42--40 | | |
| Contrast Ratio | C_r | $x=0^\circ$ $y=0^\circ$ | 30 | 40 | 60 | -- | |
| Response Time | Turn on | T_{on} | $x=0^\circ$ $y=0^\circ$ | - | - | 180 | ms |
| | Turn off | T_{off} | | 70 | - | 90 | |
| Color Of CIE Coord-Inate | White | x | $x=0^\circ$ $y=0^\circ$ | - | 0.30 | - | - |
| | | y | | - | 0.36 | - | - |
| | Red | x | $x=0^\circ$ $y=0^\circ$ | - | 0.53 | - | - |
| | | y | | - | 0.37 | - | - |
| | Green | x | $x=0^\circ$ $y=0^\circ$ | - | 0.31 | - | - |
| | | y | | - | 0.51 | - | - |
| | Blue | x | $x=0^\circ$ $y=0^\circ$ | - | 0.16 | - | - |
| | | y | | - | 0.18 | - | - |

6.2 Definition of Optical Characteristics

6.2.1 Definition of Viewing Angle



6.2.2 Definition of Contrast Ratio

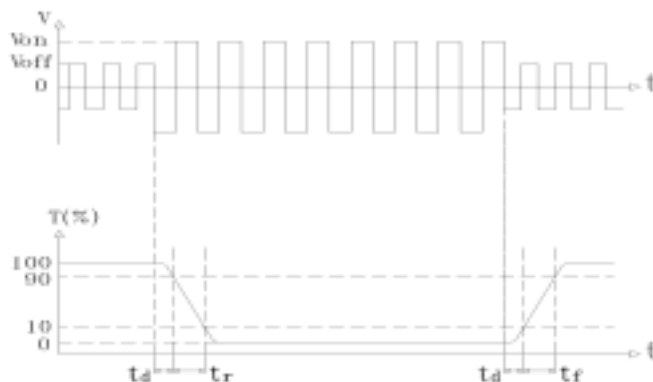


$$\text{Contrast Ratio} = B2/B1 = \frac{\text{unselected state brightness}}{\text{selected state brightness}}$$

Measuring Conditions:

- 1) Ambient Temperature: 25 ;
- 2) Frame frequency: 70.0Hz

6.2.3 Definition of Response time



Turn on time: $t_{on} = t_d + t_r$ Turn off time: $t_{off} = t_d + t_f$

Measuring Condition:

- 1) Operating Voltage: MAIN-LCD 16.8V SUB-LCD 8.8 V
- 2) Frame frequency: 70.0Hz

6.3 Brightness Characteristic

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|------------|--------|-----------|------|------|------|-------------------|
| Brightness | Bp | Ta=25 ±3 | 100 | - | - | cd/m ² |
| Uniformity | Bp | 30-80%RH | 7.5 | - | - | % |

Note:

1. The data is measured after LED are turned on for 5 minutes.
2. Testing conditions LED: VLED =5.0 V (DC)
 LCD: All dots are on (White color)
3. Brightness in the center of the LCD panel.
4. Definition of Uniformity (Bp)
 $Bp = Bp (\text{Min.}) / Bp (\text{Max.}) \times 100 (\%)$
 Bp (Max.) = Maximum brightness in 9 measurement spots
 Bp (Min.) = Minimum brightness in 9 measurement spots

7. Reliability

7. Reliability

7.1 Content of Reliability Test

Ta=25

| No. | Test Item | Content of Test | Test condition |
|-----|------------------------------------|---|---|
| 1 | High Temperature Storage | Endurance test applying the high storage temperature for a long time | 80 ±2 240H Restore 4H at 25 |
| 2 | Low Temperature Storage | Endurance test applying the low storage temperature for a long time | -30 ±2 240H Restore 4H at 25 |
| 3 | High Temperature Operation | Endurance test applying the electric stress (voltage & current) and the thermal stress to the element for a long time | 70 ±2 240H Restore 4H at 25 |
| 4 | Low Temperature Operation | Endurance test applying the electric stress under low temperature for a long time | -20 ±2 240H Restore 4H at 25 |
| 5 | High Temperature /Humidity Storage | Endurance test applying the high temperature and high humidity storage for a long time | 60 ±2 90%RH 240H Restore 4H at 25 |
| 6 | Temperature Cycle | Endurance test applying the low and high temperature cycle -30 25 80 25 30min 5min 30min 5min 1 cycle | -30 /80 10 cycles Restore 4H at 25 |
| 7 | Vibration Test (package state) | Endurance test applying the vibration during transportation | 10Hz~150Hz, 100m/s ² , 120min |
| 8 | Shock Test (package state) | Endurance test applying the shock during transportation | Half- sine wave, 300m/s ² , 18ms |
| 9 | Atmospheric Pressure Test | Endurance test applying the atmospheric pressure during transportation by air | 25kPa 16H Restore 2H |

7.2 Failure Judgment Criterion

| Criterion Item | Test Item No. | | | | | | | | | Failure Judgement Criterion |
|--------------------------|--|---|---|---|---|---|---|---|---|-------------------------------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| Basic Specification | √ | √ | √ | √ | √ | √ | √ | √ | √ | Out of the basic Specification |
| Electrical specification | √ | √ | √ | √ | √ | | | | | Out of the electrical specification |
| Mechanical Specification | | | | | | | √ | √ | | Out of the mechanical specification |
| Optical Characteristic | √ | √ | √ | √ | √ | √ | | | √ | Out of the optical specification |
| Note | For test item refer to 8.1 | | | | | | | | | |
| Remark | Basic specification = Optical specification + Mechanical specification | | | | | | | | | |

8. Quality Level

| Examination or Test | At $T_a=25$ (unless otherwise stated) | Inspection | | | | |
|---|--|----------------|------|------|----|------------------------------|
| | | Min. | Max. | Unit | IL | AQL |
| External Visual Inspection | Under normal illumination and eyesight condition, the distance between eyes and LCD is 25cm. | See Appendix A | | | II | Major 1.0 Minor 2.5 |
| Display Defects | Under normal illumination and eyesight condition, display on inspection. | See Appendix B | | | II | Major 1.0 Minor 2.5 |
| Note: Major defects: Open segment or common, Short, Serious damages, Leakage Miner defects: Others Sampling standard conforms to GB2828 | | | | | | |

9. Precautions for Use of LCD Modules

9.1 Handling Precautions

10.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

9.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

9.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

9.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

9.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

- Isopropyl alcohol
- Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

- Water
- Ketone
- Aromatic solvents

9.1.6 Do not attempt to disassemble the LCD Module.

9.1.7 If the logic circuit power is off, do not apply the input signals.

9.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

- a. Be sure to ground the body when handling the LCD Modules.
- b. Tools required for assembly, such as soldering irons, must be properly ground.
- c. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
- d. The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

9.2 Storage precautions

9.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

9.2.2 The LCD modules should be stored under the storage temperature range.

If the LCD modules will be stored for a long time, the recommend condition is:

Temperature : 0 ~ 40


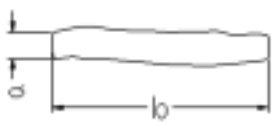
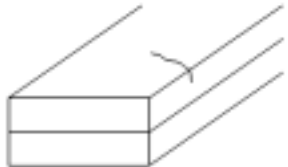
Relatively humidity: 80%

9.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

9.3 The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.

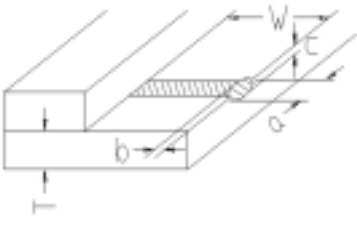
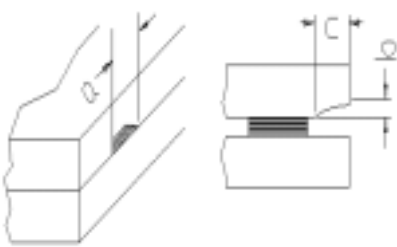
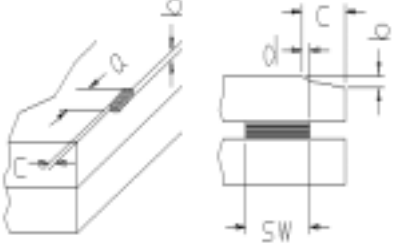
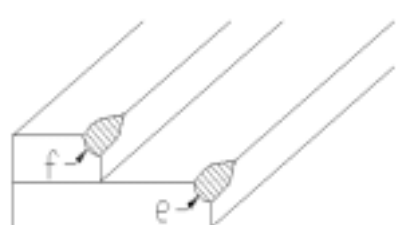
Appendix A

Inspection items and criteria for appearance defects

| Items | Contents | Criteria | | |
|---------------------------------|---|---------------------------------|----------------------------|------------------------------|
| Leakage | | Not permitted | | |
| Rainbow | | According to the limit specimen | | |
| Polarizer | Wrong polarizer attachment | Not permitted | | |
| | Bubble between polarizer and glass | Not counted | Max. 3 defects allowed | |
| | | $\phi < 0.3\text{mm}$ | 0.3mm ϕ 0.5mm | |
| | Scratches of polarizer | According to the limit specimen | | |
| Black spot (in viewing area) |  | Not counted | Max. 3 spots allowed | Max. 3 spots (lines) allowed |
| | | $X < 0.2\text{mm}$ | 0.2mm X 0.5mm | |
| | | $X = (a+b)/2$ | | |
| Black line (in viewing area) |  | Not counted | Max. 3 lines allowed | Max. 3 spots (lines) allowed |
| | | $a < 0.02\text{mm}$ | 0.02mm a 0.05mm b 2.0mm | |
| Progressive cracks |  | Not permitted | | |

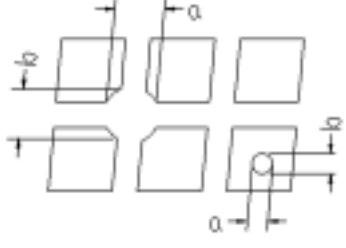
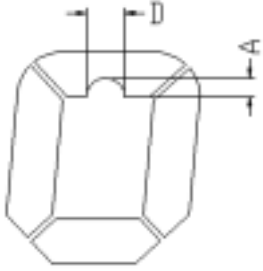
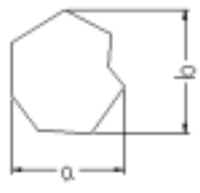
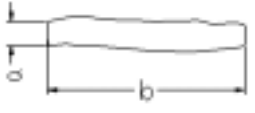
Appendix A

Inspection item and criteria for appearance defects (continued)

| Items | Contents | Criteria | | | | | | | |
|--|---|------------------------------------|---------------|-----------------------|-----------------------|-----------------------|--|--|--|
| Glass Cracks | Cracks on pads  | a | b | c | Max. 2 cracks allowed | Max. 5 cracks allowed | | | |
| | | 3mm | W/5 | T/2 | | | | | |
| | | 2mm | W/5 | $T/2 < C < T$ | | | | | |
| | Cracks on contact side  | a | b | | Max. 2 cracks allowed | | | | |
| | | 3mm | T/2 | | | | | | |
| | | 2mm | $T/2 < b < T$ | | | | | | |
| | | C shall be not reach the seal area | | | | | | | |
| | Cracks on non-contact side  | a | b | | Max. 2 cracks allowed | | | | |
| | | 3mm | T/2 | | | | | | |
| | | 2mm | $T/2 < b < T$ | | | | | | |
| | C 0.5mm | | | | | | | | |
| | d SW/3 | | | | | | | | |
| Corner cracks  | $e < 2.0\text{mm}^2$ $f < 2.0\text{mm}^2$ | | | Max. 3 cracks allowed | | | | | |

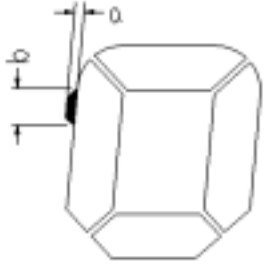
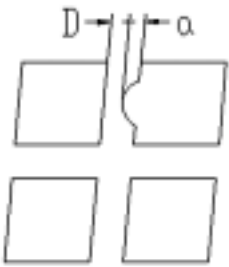
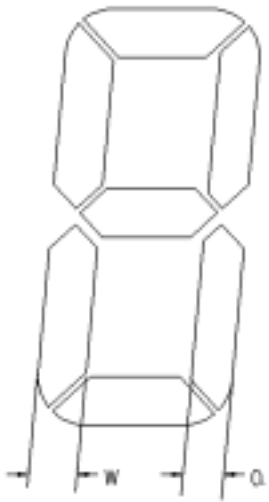
Appendix B

Inspection items and criteria for display defects

| Items | Contents | Criteria | | | |
|---------------------------------------|---|--------------------------------------|----------------------------|--|-----------------------------|
| Open segment or open common | | Not permitted | | | |
| Short | | Not permitted | | | |
| Wrong viewing angle | | Not permitted | | | |
| Contrast ratio uneven | | According to the limit specimen | | | |
| Crosstalk | | According to the limit specimen | | | |
| Pin holes and cracks in segment (DOT) |  | Not counted | Max.3 dots allowed | | Max.3 dots allowed |
| | | $X < 0.1\text{mm}$ | 0.1mm X 0.2mm | | |
| | | $X = (a+b)/2$ | | | |
| |  | Not counted | Max.2 dots allowed | | |
| $A < 0.1\text{mm}$ | | 0.1mm A 0.2mm $D < 0.25\text{mm}$ | | | |
| Black spot (in viewing area) |  | Not counted | Max.3 spots allowed | | Max.3 spots (lines) allowed |
| | | $X < 0.1\text{mm}$ | 0.1mm X 0.2mm | | |
| | | $X = (a+b)/2$ | | | |
| Black line (in viewing area) |  | Not counted | Max.3 lines allowed | | Max.3 spots (lines) allowed |
| | | $a < 0.02\text{mm}$ | 0.02mm a 0.05mm b 0.5mm | | |

Appendix B

Inspection items and criteria for display defects (continued)

| Items | Content | Criteria | | | |
|---------------------------|---|---|--------------------------|-----------------------|--|
| Transformation of segment |  | Not counted | Max. 2 defects allowed | Max.3 defects allowed | |
| | | $x < 0.1\text{mm}$ | 0.1mm x 0.2mm | | |
| | | $x=(a+b)/2$ | | | |
| |  | Not counted | Max. 1 defects allowed | | |
| | | $a < 0.1\text{mm}$ | 0.1mm a 0.2mm $D > 0$ | | |
| |  | Max.2 defects allowed $0.8W \leq a \leq 1.2W$ $a = \text{measured value of width}$ $W = \text{nominal value of width}$ | | | |