TENTATIVE

**All information in this technical data sheet is tentative and subject to change without notice.**

Preliminary

# 2.2”QVGA

## TECHNICAL SPECIFICATION

## T-55458GD022J-LW-A-AAN

## OPTREX CORPORATION.

Date: May.7,’08

# CONTENTS

# 1. APPLICATION

This specification applies to color TFT-LCD module, T-55458GD022J-LW-A-AAN.

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OPTREX classifies the usage of the TFT-LCD module as follows. Please confirm the usage before using the product.

(1) Standard Usage

Computers, office equipment, factory automation equipment, test and measurement equipment, communications, transportation equipment(automobiles, ships, trains, etc.), provided, however, that operation is not influenced by TFT-LCD directly.

(2) Special Usage

Medical equipment, safety equipment, transportation equipment, provided, however, that TFT-LCD is necessary to its operation.

(3) Specific Usage

Cockpit Equipment, military systems, aerospace equipment, nuclear reactor control systems, life support systems and any other equipment. OPTREX should make a contract that stipulate apportionment of responsibilities between OPTREX and our customer.

The product specified in this document is designed for “Standard Usage” unless otherwise specified in this document. If customers intend to use the product for applications other than those specified for “Standard Usage”, they should first contact OPTREX sales representative for it's intended use in writing.

OPTREX has been making continuous effort to improve the reliability of its products. Customers should implement sufficient reliability design of their application equipments such as redundant system design, fail-safe functions, anti-failure features.

OPTREX assumes no responsibility for any damage resulting from the use of the product that does not comply with the instructions and the precautions specified in this document.

Please contact and consult a OPTREX sales representative for any questions regarding this product.

## 2. OVERVIEW

T-55458GD022J-LW-A-AAN is 2.2" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs, control circuit, backlight unit.

240 × 320, 65k-color images are displayed on the 2.2" diagonal screen. Input power voltages are 3.0V for LCD and 1.8V for interface.

Driver circuit for LED backlight is not included in this module. General specifications are summarized in the following table:

| ITEM | SPECIFICATION |
|---|---|
| Display Area (mm) | 33.84(H) × 45.12(V)<br>(2.2-inch diagonal) |
| Number of Dots | 240 × 3 (H) × 320 (V) |
| Pixel Pitch (mm) | 0.141 (H) × 0.141 (V) |
| Color Pixel Arrangement | RGB vertical stripe |
| Display Mode | Normally white TN |
| Number of Color | 65k |
| Luminance (cd/m$^2$) | 200 |
| Wide Viewing Angle Technology | Optical compensation film |
| Viewing Angle (CR ≥ 10) | –65~65° (H)  –50~70° (V) |
| Surface Treatment | Clear and hard-coating 2H |
| Electrical Interface | CMOS |
| Optimum Viewing Angle (Contrast ratio) | 12 o'clock |
| Module Size (mm) | 39.8(W) ×  56.9(H) × 2.8(D) *) |
| Module Mass (g) | 13 |
| Backlight Unit | Edge-light, LED |

*) W/O FPC

Sign "(  )"represents preliminary value. Characteristic value without any note is typical value.

## 3. ABSOLUTE MAXIMUM RATINGS

| ITEM | SYMBOL | MIN. | MAX. | UNIT |
|---|---|---|---|---|
| Power Supply Voltage for LCD | VCC | –0.3 | 4.2 | V |
| Power Supply Voltage for Interface | VCCIO | –0.3 | 6.0 | V |
| Logic Input Voltage | VI | –0.3 | VCCIO+0.3 | V |
| Backlight (LED) Current | IF | -- | 30 | mA |
| Operation Temperature (Panel) Note 1,2) | $T_{op(Panel)}$ | –20 | 70 | °C |
| Operation Temperature (Ambient) Note 2) | $T_{op(Ambient)}$ | –20 | 70 | °C |
| Storage Temperature Note 2) | $T_{stg}$ | –20 | 80 | °C |

[Note]
1) Measured at the center of active area and at the center of panel back surface
2) Top,Tstg ≤ 40°C : 90%RH max. without condensation
Top,Tstg > 40°C : Absolute humidity shall be less than the value of 90%RH at 40°C without condensation.

## 4. ELECTRICAL CHARACTERISTICS

(1) TFT- LCD

Ambient Temperature : Ta = 25°C

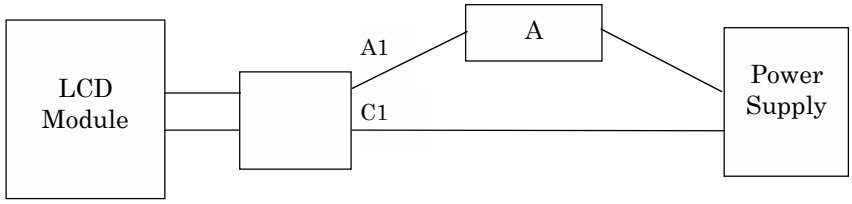
| ITEM | | SYMBOL | MIN. | TYP. | MAX. | UNIT | Remarks |
|---|---|---|---|---|---|---|---|
| Power Supply Voltage for LCD | | VCC | 2.7 | 3.0 | 3.3 | V | |
| Power Supply Voltage for Interface | | VCCIO | 1.65 | 1.8 | 3.3 | V | |
| Power Supply Current for LCD | | ICC | -- | 5.6 | 7.5 | mA | *) |
| Power Supply Current for Interface | | ICCIO | -- | 0.005 | 0.006 | mA | *) |
| Logic Input Voltage | High | VIH | 0.8×VCCIO | -- | -- | V | |
| | Low | VIL | -- | --- | 0.2×VCCIO | V | |

*) Display image at typical power supply current value is at VCC = +3.0V, VCCIO = +1.8 V, $f_H$=19 kHz, $f_V$=60 Hz CPU I/F, and 64-gray-bar pattern (6 bit).

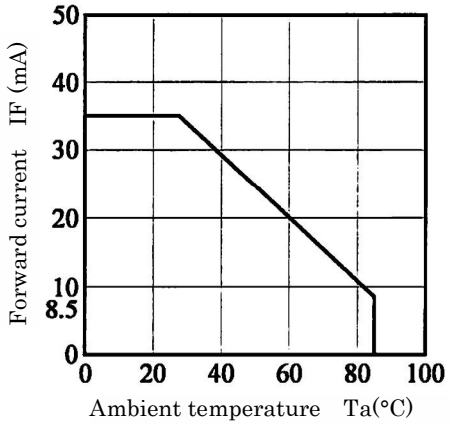
(2) Backlight

| ITEM | SYMBOL | MIN. | TYP. | MAX. | UNIT | Remarks |
|---|---|---|---|---|---|---|
| LED Voltage | VF | -- | (9.6) | 10.5 | V | IF = 20 mA, Ta = 25°C |
| | | -- | -- | (10.8) | V | IF = 20 mA, Ta = 0°C |
| | | -- | -- | (11.0) | V | IF = 20 mA, Ta = –20°C |
| LED Current | IF | -- | 15.0 | 20.0 | mA | *1), *2) |

[Note]
*1) Constant Current Drive
*2) Lamp Current measurement method



Diode IF-Ta CHARACTERISTICS DIAGRAM



## 5. INTERFACE PIN CONNECTION

TER2 (Interface Signal)
Corresponding connector: FH27-40S-0.4SH(05) (HRS)

| Pin No. | Pin Name |
|---|---|
| 1 | LED– |
| 2 | LED+ |
| 3 | VCC |
| 4 | GND |
| 5 | D0 |
| 6 | D1 |
| 7 | D2 |
| 8 | D3 |
| 9 | D4 |
| 10 | D5 |
| 11 | D6 |
| 12 | D7 |
| 13 | D8 |
| 14 | D9 |
| 15 | D10 |
| 16 | D11 |
| 17 | D12 |
| 18 | D13 |
| 19 | D14 |
| 20 | D15 |
| 21 | GND |
| 22 | GND |
| 23 | SI |
| 24 | GND |
| 25 | SCL |
| 26 | GND |
| 27 | CS |
| 28 | RESET |
| 29 | RS |
| 30 | WR |
| 31 | RD |
| 32 | VSYNC |
| 33 | HSYNC |
| 34 | GND |
| 35 | DOTCLK |
| 36 | GND |
| 37 | PSX |
| 38 | IF_SHARE |
| 39 | VCCIO |
| 40 | GND |

# 6. RECOMMENDED SEQUENCE

(1) Power ON Sequence (CPU I/F)

| | |
|---|---|
| Hardware reset | - |
| ↓ | |
| Command reset | R3 :0001h |
| ↓ | |
| Oscillation circuit start | R58 :0001h |
| ↓ | wait > 1 line (50μs) |
| γ setting | R82 :0021h |
| | R83 :0011h |
| | R36 :0048h |
| | R37 :005Dh |
| | R38 :0021h |
| | R39 :0036h |
| | R97 :000Ch |
| | R98 :0031h |
| | R99 :0018h |
| | R100:0026h |
| | R101:0020h |
| | R102:0020h |
| ↓ | |
| Horizontal timing setting | R46 :0032h |
| | R77 :0206h |
| | R78 :0001h |
| | R79 :0004h |
| ↓ | |
| Display area setting | R41 :0000h |
| | R42 :0000h |
| | R43 :00EFh |
| | R44 :013Fh |
| ↓ | |
| Window area setting | R8 :0000h |
| | R9 :00EFh |
| | R10 :0000h |
| | R11 :013Fh |
| ↓ | |
| Window mode setting | R5 :0000h |
| ↓ | |
| Other setting | R50 :0002h |
| ↓ | |
| Write address setting | R6 :0000h |
| | R7 :0000h |
| ↓ | |
| Displayed data input | - |
| ↓ | |
| Power supply setting | R25 :0008h |
| | R26 :0055h |
| | R27 :0022h |
| | R28 :1CFDh |
| | R29 :0000h |
| | R30 :0019h |
| | R31 :0028h |
| | R32 :0024h |
| | R24 :1F4Bh |
| ↓ | |
| Display start setting | R59 :0001h |
| | R0 :0000h |

(2) Power ON Sequence (RGB I/F)

| Setting Item | (Through mode) Register setting | (Capture mode) Register setting |
|---|---|---|
| Hardware reset | - | - |
| ↓ | | |
| Command reset | R3 :0001h | R3 :0001h |
| ↓ | | |
| Oscillation circuit start | R58 :0001h | R58 :0001h |
| ↓ | wait > 1 line (50μs) | |
| γ setting | R82 :0021h | R82 :0021h |
| | R83 :0011h | R83 :0011h |
| | R36 :0048h | R36 :0048h |
| | R37 :005Dh | R37 :005Dh |
| | R38 :0021h | R38 :0021h |
| | R39 :0036h | R39 :0036h |
| | R97 :000Ch | R97 :000Ch |
| | R98 :0031h | R98 :0031h |
| | R99 :0018h | R99 :0018h |
| | R100:0026h | R100:0026h |
| | R101:0020h | R101:0020h |
| | R102:0020h | R102:0020h |
| ↓ | | |
| RGB I/F Setting | R2 :0005h *) | R2 :0007h *) |
| | R60 :0000h | R60 :0000h |
| | R61 :013Fh | R61 :013Fh |
| | R62 :0021h *) | R62 :0021h *) |
| | R112:0020h *) | R63 :0000h |
| | | R64 :00EFh |
| | | R65 :0000h |
| | | R66 :013Fh |
| | | R112:0020h *) |
| ↓ | | |
| Horizontal timing setting | R46 :003Bh | R46 :003Bh |
| | R77 :0206h | R77 :0206h |
| | R78 :0001h | R78 :0001h |
| | R79 :0004h | R79 :0004h |
| ↓ | | |
| Display area setting | R41 :0000h | R41 :0000h |
| | R42 :0000h | R42 :0000h |
| | R43 :00EFh | R43 :00EFh |
| | R44 :013Fh | R44 :013Fh |
| ↓ | | |
| Other setting | R50 :0002h | R50 :0002h |
| ↓ | | |
| Write address setting | | R6 :0000h |
| | | R7 :0000h |
| ↓ | | |
| Display data input | - | - |
| ↓ | | |
| Power supply setting | R25 :0008h | R25 :0008h |
| | R26 :0055h | R26 :0055h |
| | R27 :0022h | R27 :0022h |
| | R28 :1CFDh | R28 :1CFDh |
| | R29 :0000h | R29 :0000h |
| | R30 :0019h | R30 :0019h |
| | R31 :0028h | R31 :0028h |
| | R32 :0024h | R32 :0024h |
| | R24 :1F4Bh | R24 :1F4Bh |
| ↓ | | |
| Display start setting | R59 :0001h | R59 :0001h |
| | R0 :0000h | R0 :0000h |

*) Please set it in conformity to a signal of the system side.

(3) Power OFF Sequence

(CPU I/F and RGB I/F)

| | |
|---|---|
| Stand-by mode (1) | R0 :0008h |
| ↓ | wait > 2 frame time |
| Stand-by mode (2) | R0 :000Ch |
| ↓ | |
| Power Supply OFF setting | R24 :1F4Ah |
| ↓ | |
| Oscillation circuit stop | R58 :0000h |

Setting Voltage

VGM=5.0V
VR=5.0V
VS=5.2V
RVDD=2.3V
VCOMp-p=5.0V
VCOMC=1.57V
VGH=VR × 3=15V
VGL=VR ×(-2)+VCL=-12.7~13.3V

(4) Timing Specification
See: Data sheet of Driver IC (uPD161704A (NEC))

CPU I/F Ta = 25°C

| ITEM | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|
| Address Set up Time | tAS | 0 | - | - | ns |
| Address Hold Time | tAH | 20 | - | - | ns |
| System Cycle Time (Writing) | tCYCW | 60 | - | - | ns |
| System Cycle Time (Reading) | tCYCR | 400 | - | - | ns |
| /WR Low Width | tCCLW | 25 | - | - | ns |
| /WR High Width | tCCHW | 25 | - | - | ns |
| /RD Low Width | tCCLR | 200 | - | - | ns |
| /RD High Width | tCCHR | 80 | - | - | ns |
| Data Set up Time | tDS | 40 | - | - | ns |
| Data Hold Time | tDH | 0 | - | - | ns |
| /CS Setup Time | tCSS | 75 | - | - | ns |
| /CS Hold Time | tCSH | 0 | - | - | ns |
| /RD Access Time | tACC | - | - | 200 | ns |
| Output Disable Time | tOH | - | - | 100 | ns |

RGB I/F Ta = 25°C

| ITEM | | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| DCLK | Frequency | fclk | - | 4.96 | 7.14 | MHz |
| | Period | tclk | 140 | - | - | ns |
| | Low Width | tclkl | 70 | - | - | ns |
| | High Width | tclkh | 70 | - | - | ns |
| DATA | Set up time | tDS | 60 | - | - | ns |
| /HSYNC | Hold time | tDH | 60 | - | - | ns |
| HSYNC | Horizontal Active Time | | 240 | 240 | 240 | tCLK |
| | Horizontal Back Porch *1) | tHBP | 1 | 4 | - | tCLK |
| | Pulse Width | tHSW | 1 | 4 | - | tCLK |
| VSYNC | Frequency | fV | 55 | 60 | 75 | Hz |
| | Period | tV | 13.3 | 16.7 | 18.2 | ms |
| | Vertical Active Time | | 320 | 320 | 320 | tH |
| | Vertical Back Porch *1) | tVBP | 1 | 1 | - | tH |
| | Pulse Width | tVSW | 1 | 1 | - | tH |

*1) W/O Pulse width

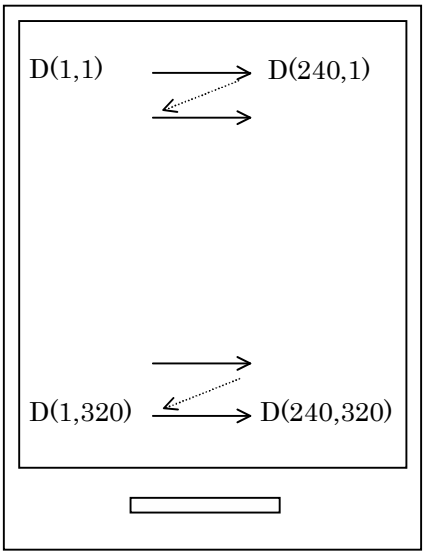
Serial I/F

Ta = 25°C

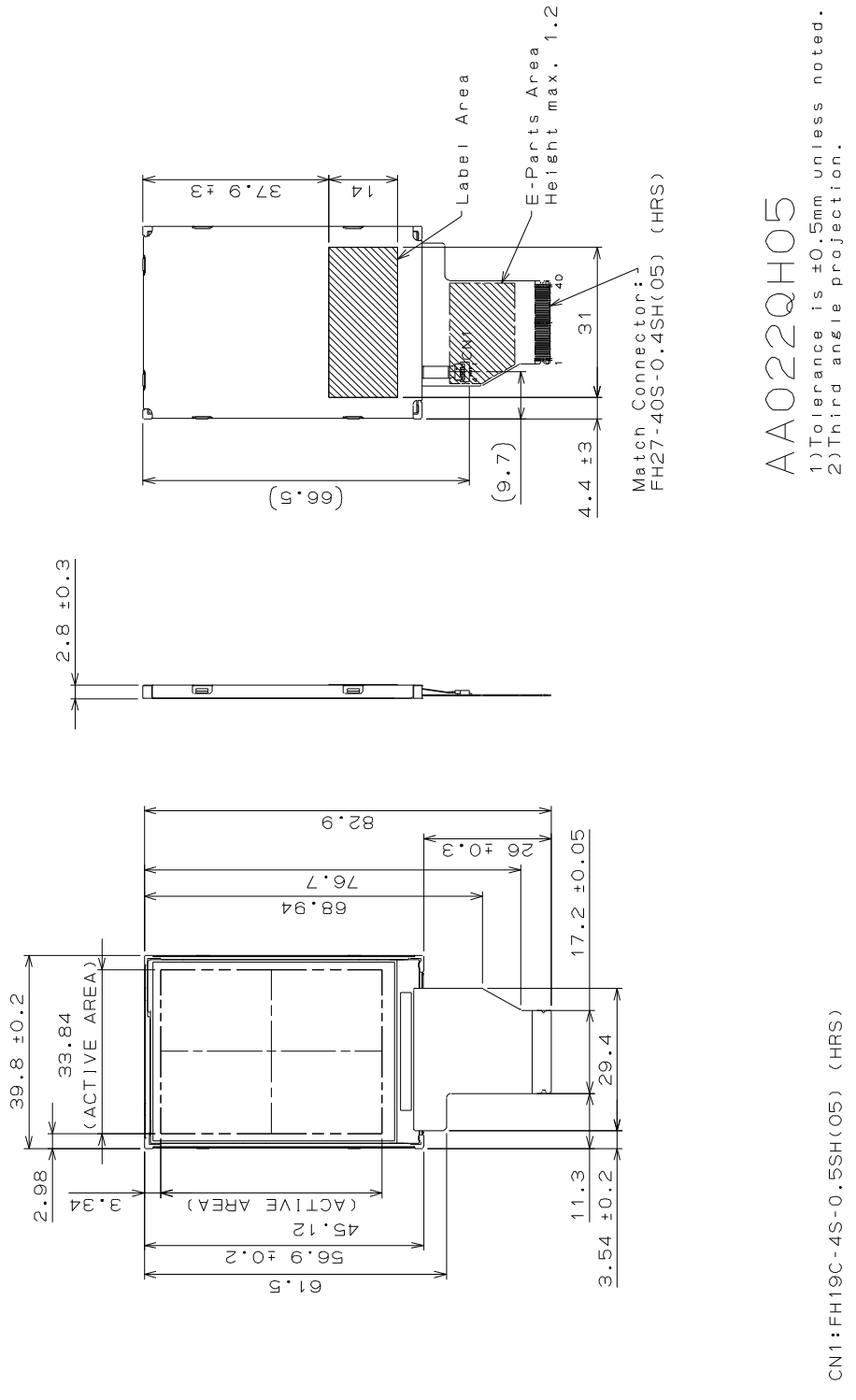
| ITEM | | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Serial Clock Cycle | | tSCYC | 66 | - | - | ns |
| SCL Low Width | | tSLW | 20 | - | - | ns |
| SCL High Width | | tSHW | 20 | - | - | ns |
| Address Set up Time | | tSAS | 10 | - | - | ns |
| Address Hold Time | | tSAH | 20 | - | - | ns |
| Data Set up Time | | tSDAS | 10 | - | - | ns |
| Data Hold Time | | tSDH | 20 | - | - | ns |
| CS-SCL Time | Set up Time | TCSS | 20 | - | - | ns |
| | Hold Time | TCSH | 20 | - | - | ns |

## 7. DISPLAY POSITION AND SCAN DIRECTION

D(X,Y) shows the data number of input signal for LCD panel signal processing PCB.



# 8. MECHANICAL SPECIFICATIONS




(Unit:mm)

## 9. OPTICAL CHARACTERISTICS

Ta=25°C, VCC=3.0V, VCCIO=1.8V, Input Signals: Typ. Values shown in Section 6

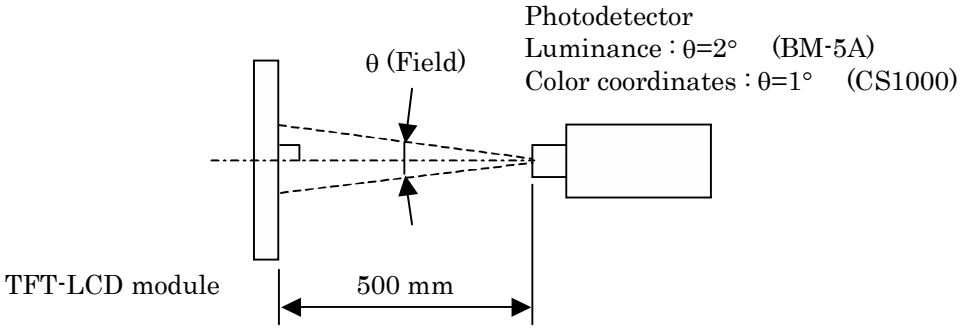
| ITEM | | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | Remarks |
|---|---|---|---|---|---|---|---|---|
| Contrast Ratio | | CR | $\theta_V$=0°, $\theta_H$=0° | 200 | 300 | -- | -- | *1)*2)*4) |
| Luminance | | Lw | $\theta_V$=0°, $\theta_H$=0° | 150 | 200 | -- | cd/m$^2$ | *1)*4) |
| Response Time | | tr | $\theta_V$=0°, $\theta_H$=0° | -- | 10 | -- | ms | *1)*3)*4) |
| | | tf | $\theta_V$=0°, $\theta_H$=0° | -- | 25 | -- | ms | *1)*3)*4) |
| Viewing Angle | Horizontal | $\theta_H$ | CR ≥ 10 | –50~50 | –65~65 | -- | -- | *1)*4) |
| | Vertical | $\theta_V$ | | –30~50 | –50~70 | -- | -- | *1)*4) |
| Image Sticking | | tis | 2 h | -- | -- | 2 | s | *5) |
| Color Coordinates | Red | Rx | $\theta_V$=0°, $\theta_H$=0° | (0.595) | (0.645) | (0.695) | -- | *1)*4) |
| | | Ry | | (0.295) | (0.345) | (0.395) | | |
| | Green | Gx | | (0.279) | (0.329) | (0.379) | | |
| | | Gy | | (0.576) | (0.626) | (0.676) | | |
| | Blue | Bx | | (0.104) | (0.154) | (0.204) | | |
| | | By | | (0.001) | (0.051) | (0.101) | | |
| | White | Wx | | (0.260) | (0.310) | (0.360) | | |
| | | Wy | | (0.265) | (0.315) | (0.365) | | |

[Note]

These items are measured using CS1000(MINOLTA) for color coordinates, EZContrast(ELDIM) for viewing angle and CS1000 or BM-5A(TOPCON) for others under the dark room condition (no ambient light) after more than 30 minutes from turning on the lamp unless noted.

Condition: IL=15.0 mA

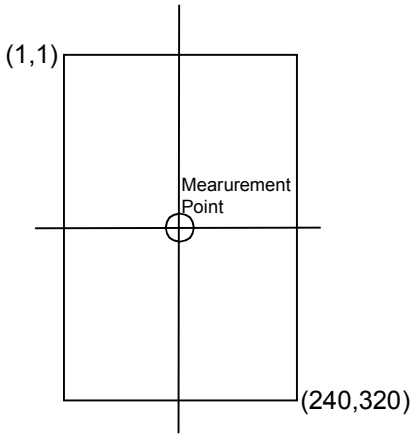
Measurement method for luminance and color coordinates is as follows.




The luminance is measured according to FLAT PANEL DISPLAY MEASUREMENTS STANDARD (VESA Standard).

*1) Measurement Point

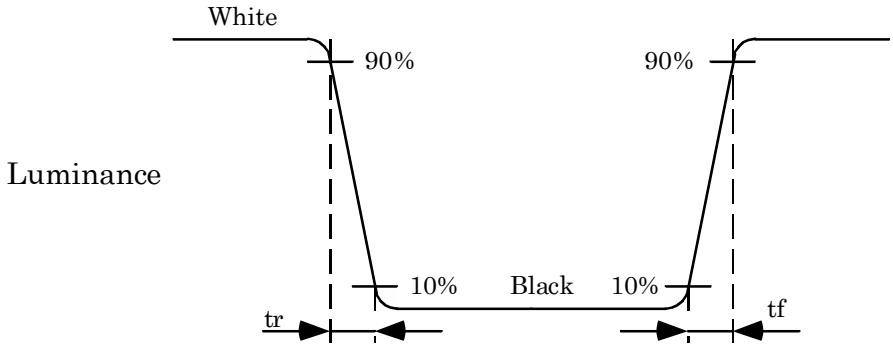
Contrast Ratio, Luminance, Response Time, Viewing Angle, Color Coordinates: Display Center



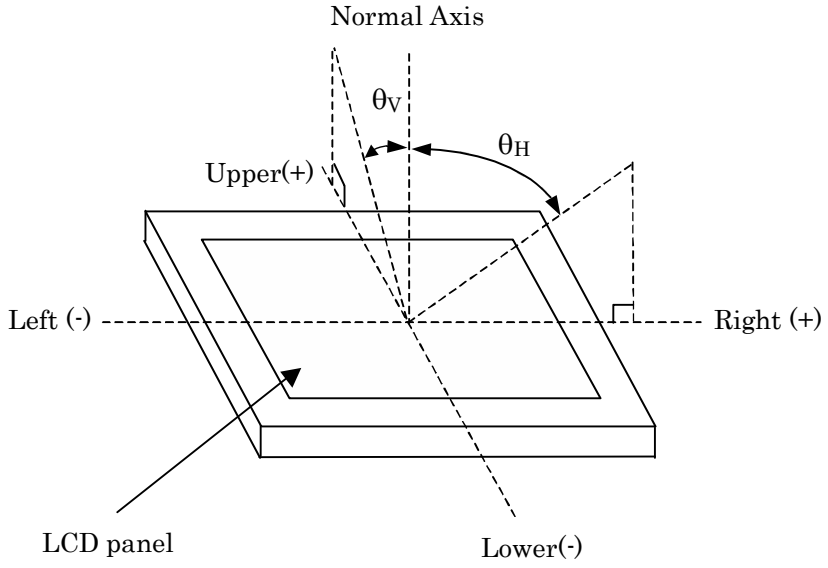

*2) Definition of Contrast Ratio

CR=Luminance with all white pixels / Luminance with all black pixels

*3) Definition of Response Time

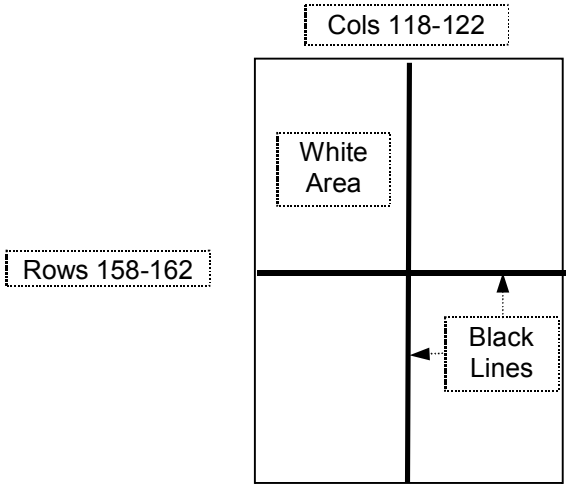



*4) Definition of Viewing Angle ($\theta_V$, $\theta_H$)



*5) Image Sticking

Continuously display the test pattern shown in the figure below for two-hours. Then display a completely white screen. The previous image shall not persist more than two seconds at 25°C.




TEST PATTERN FOR IMAGE STICKING TEST

## 10. RELIABILITY TEST CONDITION

(1) Temperature and Humidity

| ITEM | CONDITIONS |
|---|---|
| HIGH TEMPERATURE<br>HIGH HUMIDITY OPERATION | 40°C, 90%RH, 240 h<br>(No condensation) |
| HIGH TEMPERATURE OPERATION | 70°C, 240 h |
| LOW TEMPERATURE OPERATION | –20°C, 240 h |
| HIGH TEMPERATURE STORAGE | 80°C, 240 h |
| LOW TEMPERATURE STORAGE | –20°C, 240 h |
| THERMAL SHOCK (NON-OPERATION) | BETWEEN –20°C (1h) and 80°C(1h),<br>100 CYCLES |

(2) Shock & Vibration

| ITEM | CONDITIONS |
|---|---|
| SHOCK<br>(NON-OPERATION) | Shock level: 1470m/s$^2$ (150G)<br>Waveform: half sinusoidal wave, 2ms<br>Number of shocks: one shock input in each direction of three mutually perpendicular axis for a total of six shock inputs |
| VIBRATION<br>(NON-OPERATION) | Vibration level: 9.8m/s$^2$ (1.0G)<br>Waveform: sinusoidal<br>Frequency range: 5 to 500Hz<br>Frequency sweep rate: 0.5 octave /min<br>Duration: one sweep from 5 to 500 Hz in each of three mutually perpendicular axis(total 3 hours) |

(3) Judgment standard

The judgment of the above tests should be made as follow:

Pass: Normal display image, no damage of the display function. (ex. no line defect)
Partial transformation of the module parts should be ignored.

Fail: No display image, damage of the display function. (ex. line defect)

## 11. OTHER FEATURE

This LCD module complies with RoHS*) directive.

*) RoHS: Restriction of the use of certain hazardous substances in electrical and electronic equipment

# 12. HANDLING PRECAUTIONS FOR TFT-LCD MODULE

Please pay attention to the followings in handling TFT-LCD products;

### (1) ASSEMBLY PRECAUTION

a. Please do not bending or wrenching LCD in assembling. And please do not drop, bend or twist LCD module in handling.
b. Please design display housing in accordance with the following guide lines.
   (a) Housing case must be designed carefully so as not to put stresses on LCD all sides and not to wrench module. The stresses may cause non-uniformity even if there is no non-uniformity statically.
   (b) Under high temperature environment, performance and life time of LED may heavily shorten. When you design with our LCD product, please consider radiating heat and ventilation for good heat management.
   (c) Keep sufficient clearance between LCD module back surface and housing when the LCD module is mounted. Approximately 1.0mm of the clearance in the design is recommended taking into account the tolerance of LCD module thickness and mounting structure height on the housing.
   (d) When some parts, such as, FPC cable and ferrite plate, are installed underneath the LCD module, still sufficient clearance is required, such as 0.5mm. This clearance is, especially, to be reconsidered when the additional parts are implemented for EMI countermeasure.
   (e) Design the LED driver location and connector position carefully so as not to give stress to LED cable.
   (f) Keep sufficient clearance between LCD module and the others parts, such as inverter and speaker so as not to interface the LCD module. Approximately 1.0mm of the clearance in the design is recommended.
   (g) To avoid local elevation/decrease of temperature, considering location of heating element, heat release, thermal design should be done.
c. Please do not push or scratch LCD panel surface with anything hard. And do not soil LCD panel surface by touching with bare hands. (Polarizer film, surface of LCD panel is easy to be flawed.)
d. Please do not press any parts on the rear side such as source TCP, gate TCP, control circuit board and FPCs during handling LCD module. If pressing rear part is unavoidable, handle the LCD module with care not to damage them.
e. Please wipe off LCD panel surface with absorbent cotton or soft cloth in case of it being soiled.
f. Please wipe off drops of adhesives like saliva and water on LCD panel surface immediately. They might damage to cause panel surface variation and color change.
g. Please do not take a LCD module to pieces and reconstruct it. Resolving and reconstructing modules may cause them not to work well.
h. Please do not touch metal frames with bare hands and soiled gloves. A color change of the metal frames can happen during a long preservation of soiled LCD modules.
i. Please handle metal frame carefully because edge of metal frame is very sharp.
j. Please connect the metal frame of LCD module to GND in order to minimize the effect of external noise and EMI.
k. Be sure to connect the cables and the connecters correctly.

### (2) OPERATING PRECAUTIONS

a. Please be sure to turn off the power supply before connecting and disconnecting signal input cable.
b. The interface signal speed is very high. Please pay attention to transmission line design and other high speed signal precautions to satisfy signal specification.
c. A condensation might happen on the surface and inside of LCD module in case of sudden change of ambient temperature.
d. Please pay attention not to display the same pattern for very long time. Image might stick on

LCD. Even if image sticking happens, it may disappear as the operation time proceeds.

e. Please obey the same safe instructions as ones being prepared for ordinary electronic products.

### (3) PRECAUTIONS WITH ELECTROSTATICS

a. This LCD module use CMOS-IC on circuit board and TFT-LCD panel, and so it is easy to be affected by electrostatics. Please be careful with electrostatics by the way of your body connecting to the ground and so on.

b. Please remove protection film very slowly from the surface of LCD module to prevent from electrostatics occurrence.

### (4) STORAGE PRECAUTIONS

a. Please do not leave the LCDs in the environment of high humidity and high temperature such as 60°C90%RH.

b. Please do not leave the LCDs in the environment of low temperature; below -20°C.

### (5) SAFETY PRECAUTIONS

a. When you waste damaged or unnecessary LCDs, it is recommended to crush LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.

b. If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

c. Be sure to turn off the power supply when inserting or disconnecting the cable.

d. LED driver should be designed carefully to limit or stop it's function when LED over current is detected on the LED cable.

### (6) OTHERS

a. A strong incident light into LCD panel might cause display characteristics changing inferior because of polarizer film, color filter, and other materials becoming inferior. Please do not expose LCD module direct sunlight and strong UV rays.

b. Please pay attention to a panel side of LCD module not to contact with other materials in preserving it alone.

c. For the packaging box, please pay attention to the followings;

(a) Packaging box and inner case for LCD are designed to protect the LCDs from the damage or scratching during transportation. Please do not open except picking LCDs up from the box.

(b) Please do not pile them up more than TBD boxes. (They are not designed so.) And please do not turn over.

(c) Please handle packaging box with care not to give them sudden shock and vibrations. And also please do not throw them up.

(d) Packaging box and inner case for LCDs are made of cardboard. So please pay attention not to get them wet. (Such like keeping them in high humidity or wet place can occur getting them wet.)