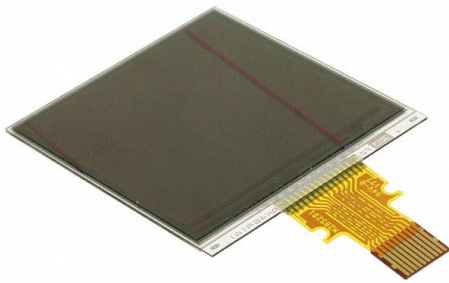


LS013B7DH03 Datasheet

www.digi-electronics.com



<https://www.DiGi-Electronics.com>

| | |
|------------------------------|--|
| DiGi Electronics Part Number | LS013B7DH03-DG |
| Manufacturer | Sharp Microelectronics |
| Manufacturer Product Number | LS013B7DH03 |
| Description | LCD TFT 1.28" 128X128 FPC |
| Detailed Description | Graphic LCD Display Module Transflective TFT - Mo nochrome Serial 1.28" (32.51mm) 128 x 128 |

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Manufacturer Product Number:

LS013B7DH03

Series:

-

Display Type:

TFT - Monochrome

Touchscreen:

-

Viewing Area:

23.04mm W x 23.04mm H

Dot Pixels:

128 x 128

Graphics Color:

-

Dot Size:

-

Base Product Number:

LS013B7

Manufacturer:

Sharp Microelectronics

Product Status:

Active

Display Mode:

Transflective

Diagonal Screen Size:

1.28" (32.51mm)

Backlight:

-

Interface:

Serial

Background Color:

-

Dot Pitch:

0.18mm W x 0.18mm H

Environmental & Export classification

RoHS Status:

RoHS Compliant

ECCN:

EAR99

Moisture Sensitivity Level (MSL):

1 (Unlimited)

HTSUS:

8524.91.1000

| | | |
|--|--|---|
| | <p style="text-align: center;">SHARP</p> <p style="text-align: center;">DISPLAY DEVICE BUSINESS GROUP SHARP CORPORATION</p> <p style="text-align: center;">SPECIFICATION</p> | FILE No. LD-26X06A |
| | | ISSUE : 07-Oct-14 |
| | | PAGE : 27pages |
| | | APPLICABLE GROUP DISPLAY DEVICE BUSINESS GROUP |

REVISION : 14-Oct-14

DEVICE SPECIFICATION FOR

LCD Module

MODEL No.

LS013B7DH03

These parts are complied with the RoHS directive.

CUSTOMER'S APPROVAL

BY _____

BY 
 T. Ohnishi

DEPARTMENT GENERAL MANAGER
 DEVELOPMENT DEPARTMENT III
 DISPLAY DEVICE UNIT III
 DISPLAY DEVICE BUSINESS DIVISION I
 SHARP CORPORATION

SHARPSPEC No.
LD-26X06AMODEL No.
LS013B7DH03PAGE
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SPEC No.

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[For handling and system design]

- (1) Handle with care as glass is used in this LCD panel. Dropping or contact against hard object may cause cracks or chips.
 - (2) Be careful to handle this LCD panel in order to avoid injury yourself by panel's edge as this panel is made of glass and might be a sharp edge.
 - (3) Do not scratch the surface of the polarizer as it is easily damaged.
 - (4) Water droplets on the polarizer must be wiped off immediately as they may cause color changes, or other defects if remained for a long time.
 - (5) Do not leave the LCD panel in direct sun or under ultraviolet ray.
 - (6) To clean LCD panel surface, wipe clean with absorbent cotton or soft cloth. If further cleaning is needed, use IPA (isopropyl alcohol) and wipe clean lightly on surface only. Do not use organic solvents as it may damage the LCD panel terminal area which uses organic material. Also, do not directly touch with finger. When the terminals cleaning are needed, those should be wiped by a soft cloth or a cotton swab without directly touching by hand.
 - (7) Do not expose gate driver, etc. on the panel (circuit area outside panel display area) to light as it may not operate properly. Design that shields gate driver, etc. from light is required when mounting the LCD module.
 - (8) To avoid circuit failure, do not touch panel terminal area.
 - (9) Support for the LCD panel should be carefully designed to avoid stress that exceeds specification on glass surface.
 - (10) When handling LCD module and assembling them into cabinets, be noted that storage in the environment of oxidization or deoxidization gas and the use of such materials as reagent, solvent, adhesive, resin, and etc. which generate these gasses, may cause corrosion and discoloration of LCD modules.
 - (11) To avoid picture uniformity failure, do not put a seal or an adhesive material on the panel surface.
 - (12) Do not use chloroprene rubber as it generates chlorine gas and affects reliability in LCD panel connective area.
 - (13) Protective film is attached to the surface of polarizer on LCD panel to prevent scratches or other damages. Remove this protective film before use. In addition, do not attach the protective film which is removed from LCD module again. When the LCD panel which has the reattached protective film is needed to storage for a long time, the polarizer might have a damage with picture quality failure.
 - (14) Panel is susceptible to mechanical stress and such stress may affect the display. Place the panel on flat surface to avoid stress caused by twist, bend, etc.
 - (15) When transporting LCD panels, secure them in LCD panel tray to avoid mechanical stress. The tray should be conductive to protect LCD panels from static charge.
- Material used in set or epoxy resin (amine type hardening agent) from packaging, and silicon adhesive (dealcoholized or oxime) all release gas which may affect quality of polarizer. Do confirm compatibility with user materials.

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(16) As this LCD module is composed electronic circuits, it is sensitive to electrostatic discharge of 200V or more.

Handle with care using cautions for the followings:

- Operators
Operators must wear anti-static wears to prevent electrostatic charge up to and discharge from human body.
- Equipment and containers
Process equipment such as conveyer, soldering iron, working bench and containers may possibly generate electrostatic charge up and discharge. Equipment must be grounded through 100Mohms resistance. Use ion blower.
- Floor
Floor plays an important role in leaking static electricity generated in human body or equipment. If the floor is made of insulated material (such as polymer or rubber material), such static electricity may charge. Proper measure should be taken to avoid static electricity charge (electrostatic earth: 100Mohms). There is a possibility that the static electricity is charged to them without leakage in case of insulating floor, so the electrostatic earth: $1 \times 10^8 \Omega$ should be made.
- Humidity
Humidity in work area relates to surface resistance of the persons or objects that generate electrostatics, and it can be manipulated to prevent electrostatic charge. Humidity of 40% or lower increases electrostatic earth resistance and promotes electrostatic charging. Therefore, the humidity in the work area should be kept above 40%. Specifically for film peeling process or processes that require human hands, humidity should be kept above 50% and use electricity removal blower.
- Transportation/Storage
Containers and styroform used in transportation and storage may charge electrostatic (from friction and peeling) or electrostatic charge from human body, etc. may cause containers and styroform to have induced charge. Proper electrostatic measure should be taken for containers and storage material.

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4**[For operating LCD module]**

- (1) Do not operate the LCD panel under outside of electrical specification. Otherwise LCD panel may be damaged.
- (2) Do not use the LCD panel under outside of specified driving timing chart. Otherwise LCD panel may not have proper picture quality.
- (3) A still image should be displayed less than two hours, if it is necessary to display still image longer than two hour, display image data must be refreshed in order to avoid sticking image on LCD panel.
- (4) If LCD module takes a static electricity, as the display image which is written into pixel memory might not be displayed, Data update should be executed frequently.
- (5) It is neither a breakdown nor a defective indication though very slight change in black level might be periodically seen in a black part on the black display image according to the source of light (angle of the luminance and the source of light).

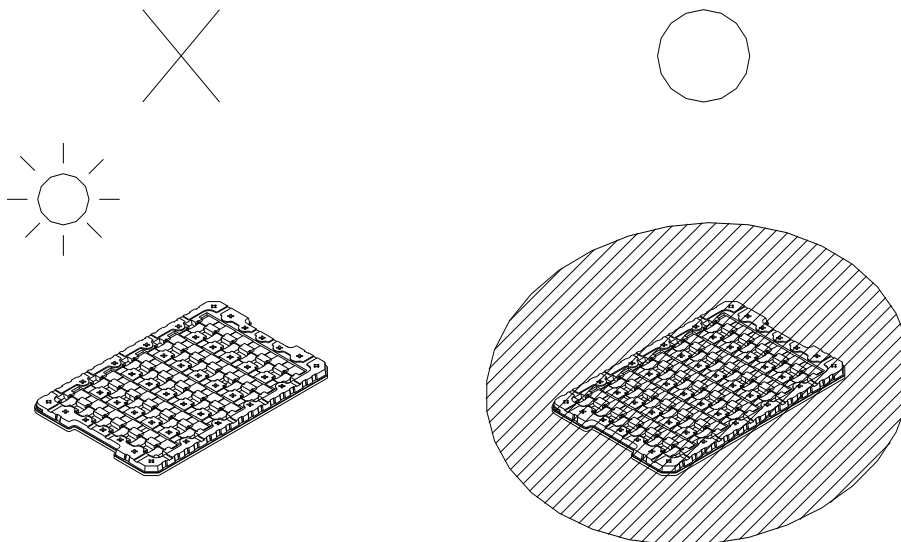
[Precautions for Storage]

- (1) After opening the package, do not leave the LCD panel in direct sun or under strong ultraviolet ray. Store in dark place.
- (2) In temperature lower than specified rating, liquid crystal material will coagulate. In temperature higher than specified rating, it isotropically liquifies. In either condition, the liquid crystal may not recover its original condition. Store the LCD panel in at or around room temperature as much as possible. Also, storing the LCD panel in high humidity will damage the polarizer. Store in normal room temperature as much as possible.

(3) Keeping Method

a. Don't keeping under the direct sunlight.

b. Keeping in the tray under the dark place.



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5**[Other Notice]**

- (1) Operation outside specified environmental conditions cannot be guaranteed.
- (2) As power supply (VDD-GND, VDDA-GND) impedance is lowered during use, bus controller should be inserted near LCD module as much as possible.
- (3) Polarizer is applied over LCD panel surface. Liquid crystal inside LCD panel deteriorates with ultraviolet ray. The panel should not be left in direct sun or under strong ultraviolet ray for prolonged period of time even with the polarizer.
- (4) Disassembling the LCD module will cause permanent damage to the module. Do not disassemble the module.
- (5) If LCD panel is broken, do not ingest the liquid crystal from the broken panel. If hand, leg, or clothes come in contact with liquid crystal, wash off immediately with soap.
- (6) ODS (specific chlorofluorocarbon, specific halon, 1-1-1 trichloroethane, carbon tetrachloride) are not used or contained in material or all production processes of this product.
- (7) Observe all other precautionary requirements in handling general electronic components.

Discarding liquid crystal modules

LCD Panel : Dispose of as glass waste. This LCD module contains no harmful substances.

The liquid crystal panel contains no dangerous or harmful substances.

This liquid crystal panel contains only an extremely small amount of liquid crystal (approximately 100mg) and therefore it will not leak even if the panel should break.

Its median lethal dose (LD50) is greater than 2,000 mg/kg and a mutagenetic (Aims test: negative) material is used.

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7**1. Scope of application**

Reflective active-matrix with slightly transmissive type memory liquid crystal display module with 128 x128 panel which uses CG silicon thin film transistor.

2. Overview

- 1.28 inch 128 x 128 monochrome HR-TFT transfective panel
- Transmissive mode is available by implementation with backlight. (Transmission ratio is around 0.2%)
- 128x 128 dot stripe arrangement
- Display control with serial data signal communication
- Arbitrary gate line is selectable to data update
- Internal 1bit memory within the panel for data memory
- Thin, light and compact module with monolithic technology
- Super low power consumption TFT panel
- With FPC (Applicable connector: Refer to recommended connector on page 23.)

3. Mechanical specification

Table 3 Module mechanical specification table

| Item | Specification | Unit |
|---------------------------|--------------------------|--------------------|
| Screen size (diagonal) | 3.259[1.28"] | cm |
| Active display area | 23.04(H) x 23.04(V) | mm |
| Dot structure | 128(H) x 128(V) | dot |
| Dot pitch | 0.18(H) x 0.18(V) | mm |
| Pixel array | Stripe Array | — |
| Module outline dimensions | 26.6(W)×30.3(H)×0.741(D) | mm |
| Mass | 1.2 | g |
| Surface hardness | At least 3H (initial) | Pencil hardness |



| | | |
|------------------------------|---------------------------------|------------------|
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|------------------------------|---------------------------------|------------------|

4. Input Terminal names and function

4-1) Input Terminal

Table 4

| No. | Code | I/O | Voltage | Signal name | Remark |
|-----|----------|-----|-----------|------------------------------------|--------------|
| 1 | SCLK | I | 0/3.0 (V) | Serial clock signal | |
| 2 | SI | I | 0/3.0 (V) | Serial input signal | |
| 3 | SCS | I | 0/3.0 (V) | Chip select signal | |
| 4 | EXTCOMIN | I | 0/3.0 (V) | COM inversion polarity input pin | |
| 5 | DISP | I | 0/3.0 (V) | Display ON/OFF switching signal | 【Remark 4-2】 |
| 6 | VDDA | I | 3.0(V) | Power source for Analog | |
| 7 | VDD | I | 3.0(V) | Power source for Logic | |
| 8 | EXTMODE | I | 0/3.0 (V) | COM inversion mode switch terminal | 【Remark 4-1】 |
| 9 | VSS | I | 0(V) | Logic ground | |
| 10 | VSSA | I | 0(V) | Analogue ground | |

【Remark 4-1】 “H”=EXTCOMIN singal enabled, “L”=Serial input flag enabled.

When “H”, connect EXTMODE to VDD and when “L” to VSS.

【Remark 4-2】 ON/OFF for LCD display only. Memory data is maintained.

When “H”, displays with memory data, and when “L”, displays all white with memory data maintained.

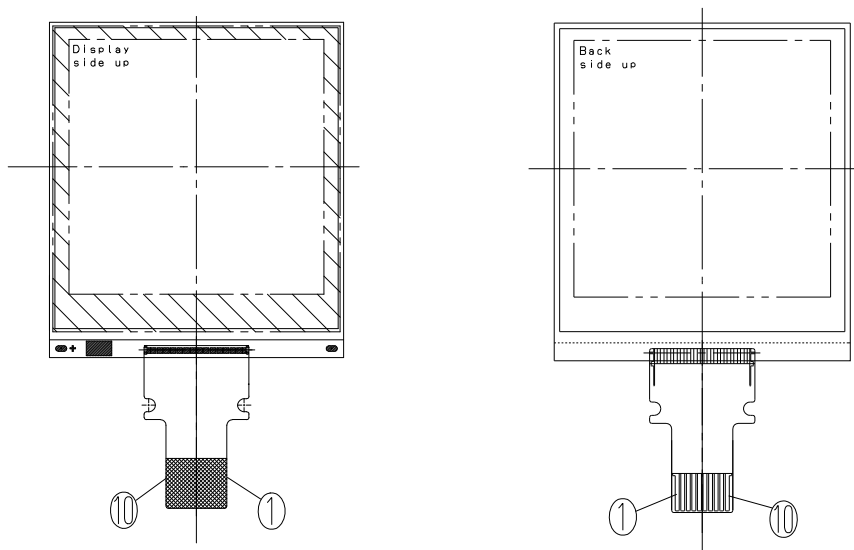


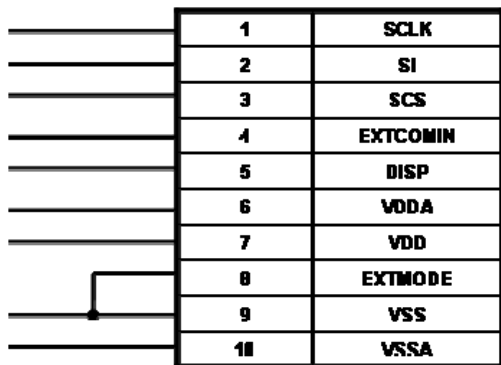
Figure 4-1 Terminals assaied number



| | | |
|------------------------------|---------------------------------|-----------|
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|------------------------------|---------------------------------|-----------|

Recommended Circuit

COM signal serial input
EXTMODE="L"



External COM signal input
EXTMODE="H"

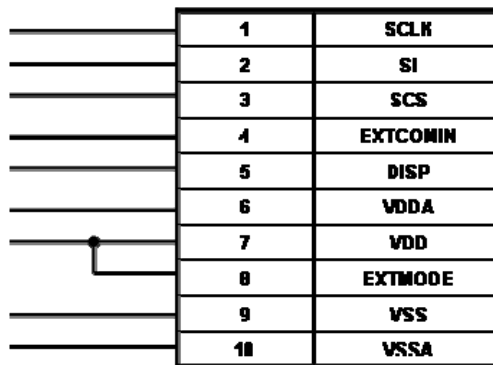


Figure 4-2 Recommended circuit

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10**5. Absolute Maximum Rating**

Table 5 (GND=0V)

| Item | | Code | MIN. | MAX. | Unit | Remark |
|--|---------------------|-------|------|------|------|----------------|
| Power supply Voltage | Analog Power Supply | VDDA | -0.3 | +3.6 | V | |
| | Logic Power Supply | VDD | -0.3 | +3.6 | V | 【Remark 5-1】 |
| Input signal terminal voltage (high) | | | | VDD | V | 【Remark 5-2】 |
| Input signal terminal voltage (low) | | | -0.3 | | V | |
| Storage temperature | | Tstg | -30 | +80 | °C | 【Remark 5-3,4】 |
| Operating temperature (Panel surface temperature) | | Topr1 | -20 | +70 | °C | 【Remark 5-5】 |

【Remark 5-1】 Also applicable to EXTMODE.

【Remark 5-2】 Applicable to SCLK, SI, SCS, DISP, EXTCOMIN.

【Remark 5-3】 Do not exceed this rating in any area of the module.

【Remark 5-4】 Maximum wet-bulb temperature should be 57°C or lower. Do not allow condensation.
Condensation may cause electrical leak and the module may not meet s specification.

【Remark 5-5】 Operating temperature is temperature that guarantess operation only. For contrast, response speed, and other display quty, module is evaluated at Ta=+25°C.

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11**6. Electrical Characteristics**

6-1) TFT LCD Panel Driving Part

Table 6-1 Recommended Operating Condition

VSS(GND)=0V, Ta= +25°C

| Item | | Code | MIN. | TYP. | MAX. | Unit | Remark |
|----------------------|---------------------|------|---------|------|---------|------|--------------|
| Power supply voltage | Analog power Supply | VDDA | +2.7 | +3.0 | +3.3 | V | |
| | Logic power supply | VDD | +2.7 | +3.0 | +3.3 | V | 【Remark 6-1】 |
| Input signal voltage | Hi | VIH | VDD-0.1 | — | VDD | V | 【Remark 6-2】 |
| | Lo | VIL | VSS | — | VSS+0.1 | V | |

【Remark 6-1】 Also applicable to EXTMODE="H".

【Remark 6-2】 Applies to SCLK, SI, SCS, DISP, EXTCOMIN.

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6-2) Power supply sequence

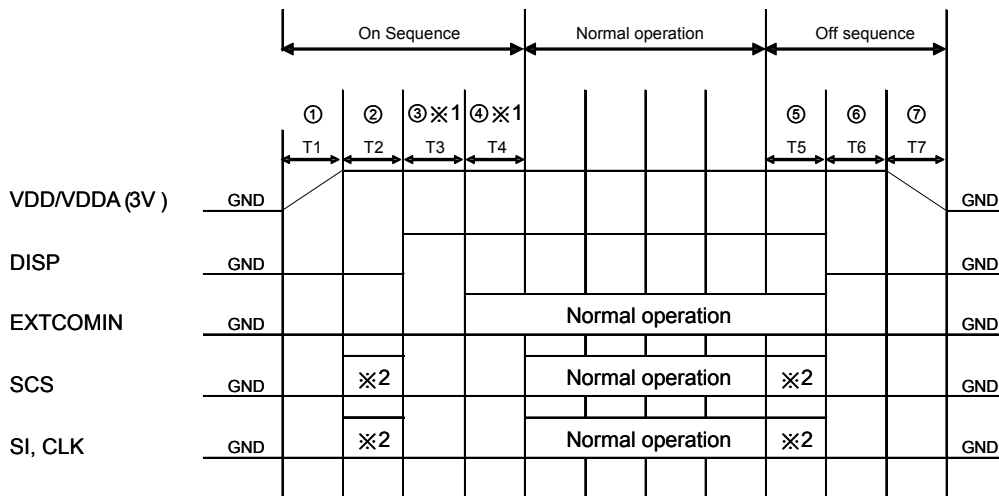


Figure 6-1 Power source sequence

※ Refer to timing chart and AC timing characteristics for detail

※ 1. (3) and (4) may be opposite (however, TCOM polarity inversion will not occur even with EXTCOMIN between DISP="L". Also, when DISP and EXTCOMIN are simultaneously started up, allow 30us or more before SCS starts up (It may be less than 60us).

※ 2. Setting value for pixel memory initialization

SCS=Driving accordingly to clear pixel internal memory method (use all clear flag or write all screen white)

S1=M2 (all clear flag) = "H" or write white

SCLK: Normal Driving

[ON Sequence]

(1) 3V rise time (depends on IC)

(2) Pixel memory initialisation

Use M2 (all clear flag) to initialise (at least once).

tsSCS + SCLK: at least 16ck + thSCS (refer to All Clear timing chart) Or

Write whole screen white (at least 1 frame)

(3) Release time for initialisation of TCOM latch T3: 30us or more

Time required to release COM related latch circuit initialisation which is initializing using DISP signals

(4) TCOM polarity initialisation time T4: 30us or more

Time required initialising TCOM polarity accordingly to EXTCOMIN input

[Normal Operation]

Duration of normal driving

[Off Sequence]

(5) Pixel memory initialisation time Contents same as (2)

(6) VA, VB, VCOM initialisation time T6: 30us or more

(7) 3V falling time (Depends on IC)

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6-3) Input Signal Basic characteristics

Table 6-3-1 (Ta=25°C, SCS, SCLK, SI, DISP, EXTCOMIN=3.0V, VDD=3.0V, VSS pin=0V)

| Pin name | Item | Code | Min | Typ. | Max | Unit | Notes |
|----------|-----------------|-------|-------|------|-------|------|-------|
| SCS | Frame frequency | fSCS | 54 | | 65 | Hz | (*1) |
| SCLK | Clock frequency | fSCLK | - | 1 | 1.1 | MHz | |
| - | Vertical period | tV | 15.38 | | 18.52 | msec | |
| - | COM frequency | fCOM | 27 | | 32.5 | Hz | |

(*1) Please use a frame frequency in the range where there are no problems with the display quality.

Table 6-3-2 Input signals (Ta=25°C, SCS, SCLK, SI, DISP, EXTCOMIN=3.0V, VDD=3.0V, VSS pin=0V)

| Pin name | Item | Code | Min | Typ. | Max | Unit | Notes |
|---------------|----------------------|------------|--------|------|------|------|------------------|
| SCS | SCS rise time | trSCS | | | 50 | nsec | |
| | SCS fall time | tfSCS | | | 50 | nsec | |
| | SCS Highwidth | twSCSH | 153.45 | | | μsec | Data update mode |
| | | | 22.55 | | | μsec | Display mode |
| | SCS Low width | twSCSL | 6 | | | μsec | |
| | SCS set up time | tsSCS | 6 | | | μsec | |
| SCS hold time | thSCS | 2 | | | μsec | | |
| SI | SI rise time | frSI | | | 50 | nsec | |
| | SI rise time | trSI | | | 50 | nsec | |
| | SI set up time | tsSCS | 227 | | | nsec | |
| | SI hold time | thSI | 525 | | | nsec | |
| SCLK | SCLK rise time | trSCLK | | | 50 | nsec | |
| | SCLK fall time | tfSCLK | | | 50 | nsec | |
| | SCLK High width | twSCLKH | 404.55 | 450 | | nsec | |
| | SCLK Low width | twSCLKL | 404.55 | 450 | | nsec | |
| EXTCOMIN | EXTCOMIN frequency | fEXTCOMIN | 54 | | 65 | Hz | (*1) |
| | EXTCOMIN rise time | trEXTCOMIN | | | 50 | nsec | |
| | EXTCOMIN fall time | tfEXTCOMIN | | | 50 | nsec | |
| | EXTCOMIN High width | twEXTCOMIN | 2 | | | μsec | |
| | EXTCOMIN set up time | tsEXTCOMIN | 5 | | | μsec | |
| | EXTCOMIN hold time | thEXTCOMIN | 0 | | | μsec | |
| DISP | DISP rise time | trDISP | | | 50 | nsec | |
| | DISP fall time | tfDISP | | | 50 | nsec | |

(*1) Please make the EXTCOMIN frequency less than the frame rate frequency.

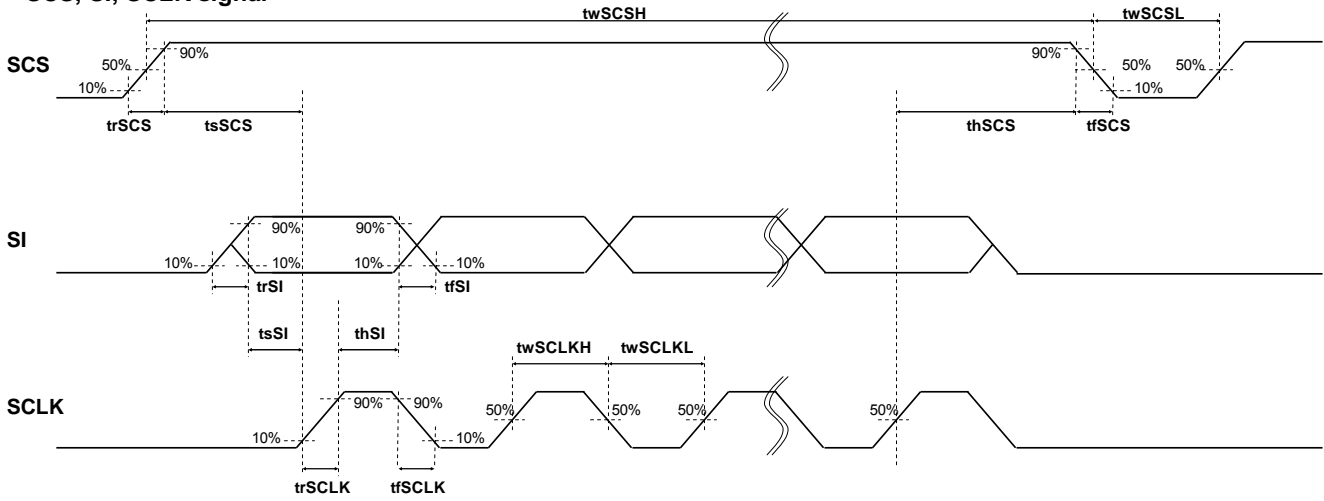


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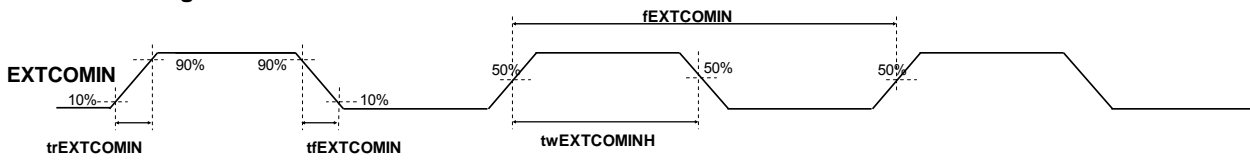
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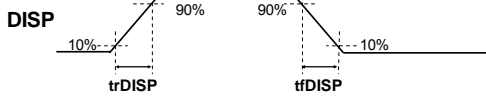
SCS, SI, SCLK signal



EXTCOMIN signal



DISP signal



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LS013B7DH03PAGE
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6-4) Power Consumption (Average)

Table 6-4

Ta=25°C

| Item | Min | TYP | MAX | Unite | Remark |
|-------------------------|-----|-----|-----|-------|--------------|
| Measurement Condition 1 | - | 12 | 50 | uW | 【Remark 6-4】 |
| Measurement Condition 2 | - | 50 | 130 | uW | 【Remark 6-4】 |

*Measurement Condition 1

Display mode (no display data update), Display pattern: Vertical stripe display

*Measurement Condition 2

Data update mode (with display data update: 1Hz)

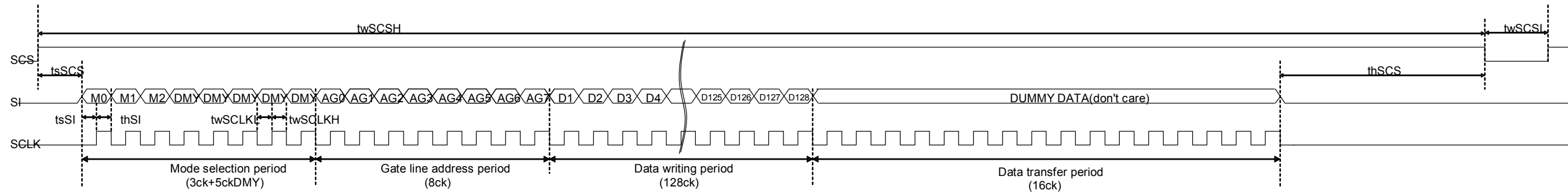
Common inversion with VDD=3V、VDDA=3V、fSCLK=1MHz、fSCS=1Hz, Display pattern: Vertical stripe display

【Remark 6-4】 This is value in steady condition, not the value of peak power at the time of COM operation.
Some margining for power supply is recommended. We recommend capacitor for VDD and VDDA.
(If VDD and VDDA are on separate systems, we recommend capacitor for each.)

6-5) Input Timing chart

6-5-1 Data update mode (1 line)

Updates data of only one specified line. (M0="H", M2="L")



M0: Mode flag. Set for "H". Data update mode (Memory internal data update)

When "L", display mode (maintain memory internal data).

M1: It can be "H" or "L".

M2: All clear flag.

All Clear Mode set to "L". Refer to 'All clear timing chart'

D1-D128: Image data. "L" = black display. "H" = white display.

DUMMY DATA: Dummy data. It can be "H" or "L" ("L" is recommended.)

- ※ Data write period
Data is being stored in 1st latch block of binary driver on panel.
- ※ Data transfer period
Data written in 1st latch is being transferred (written) to pixel internal memory circuit.

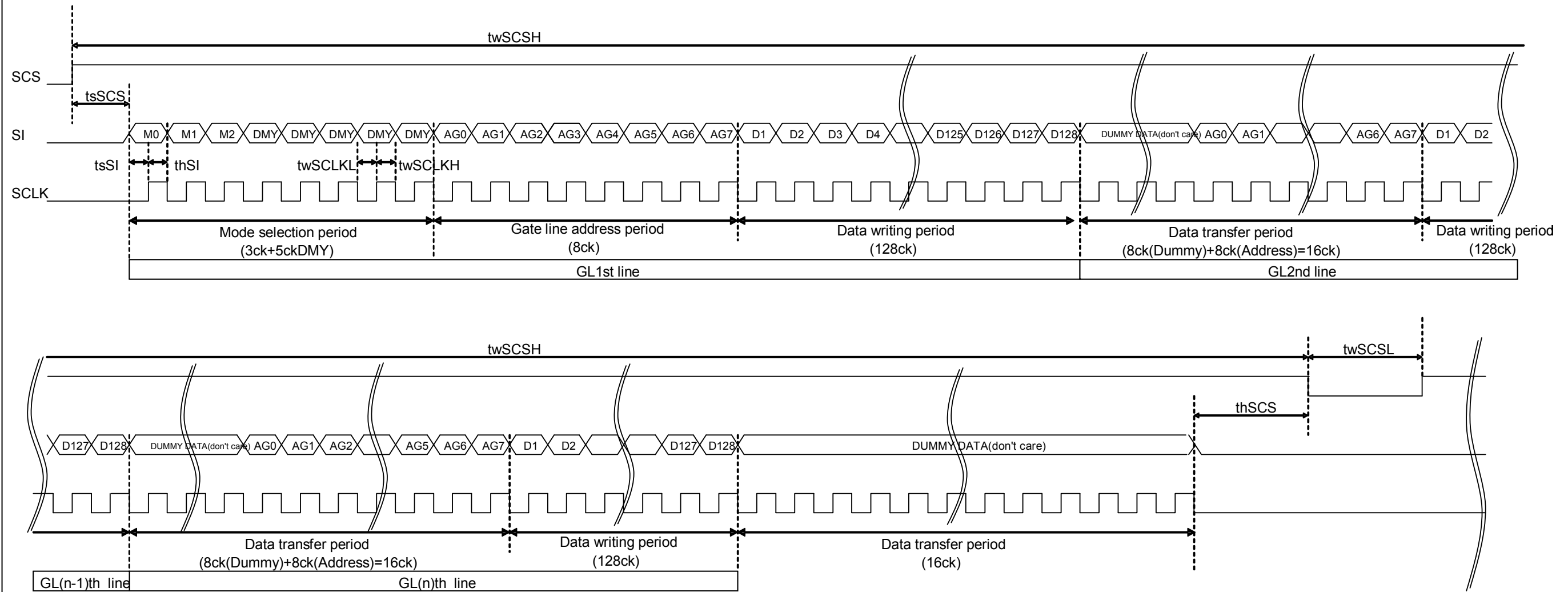
]

Gate line address selection table <same as 6-6-2 Address Line Setup>

| GL | AG0 | AG1 | AG2 | AG3 | AG4 | AG5 | AG6 | AG7 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 5 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 6 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 7 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 8 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| : | : | : | : | : | : | : | : | : |
| 121 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |
| 122 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 |
| 123 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 |
| 124 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |
| 125 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |
| 126 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| 127 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| 128 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |

6-5-2) Data Update Mode (Multiple Lines)

Updates arbitrary multiple lines data. (M0="H", M2="L")



M0: Mode flag. Set for "H". Data update mode (Memory internal data update)
When "L", display mode (maintain memory internal data).

M1: It can be "H" or "L".

M2: All clear flag.

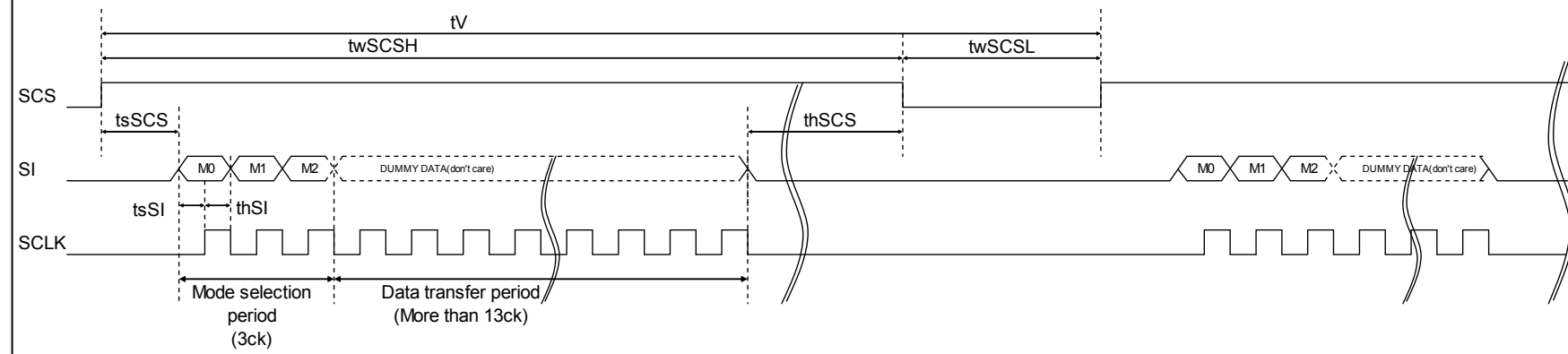
All Clear Mode set to "L". Refer to 'All clear timing chart'

D1-D128: Image data. "L" = black display. "H" = white display.

- ※ Data write period
Data is being stored in 1st latch block of binary driver on panel.
- ※ Data transfer period
For example, during GL2 line data transfer period, GL 2nd line address is latched and GL 1st line data is transferred from 1st latch to pixel internal memory circuit at the same time.

6-5-3 Display Mode

Maintains memory internal data (maintains current display). (M0="L", M2="L")



M0: Mode flag.

When "L", display mode (maintain memory internal data).

Set for "H". Data update mode (Memory internal data update)

M1: It can be "H" or "L".

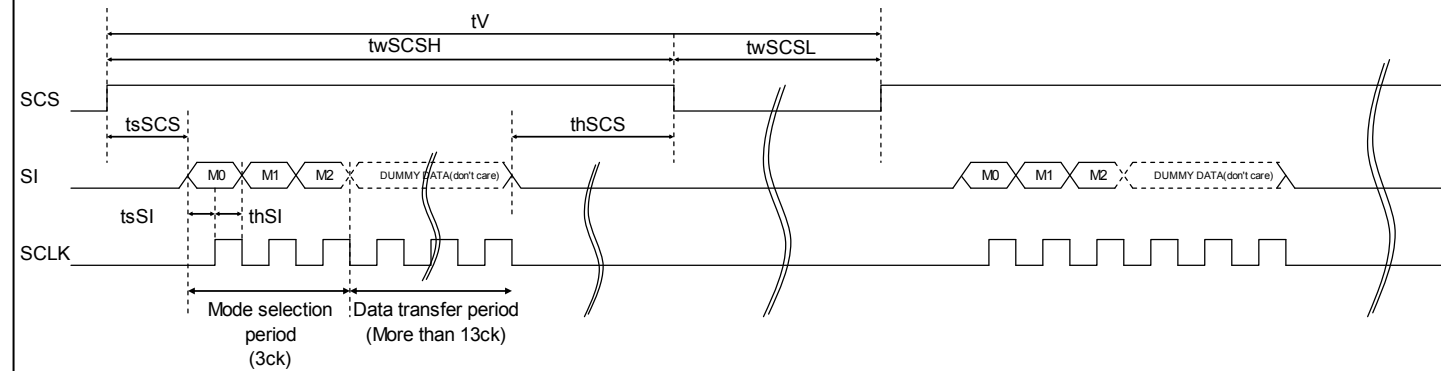
M2: All clear flag.

All Clear Mode set to "L". Refer to 'All clear timing chart'

DUMMY DATA: Dummy data. It can be "H" or "L" ("L" is recommended.)

6-5-4 All Clear Mode

Clears memory internal data and writes white. (M0="L", M2="H")



M0: Mode flag.

Set it "L".

M1: It can be "H" or "L".

M2: All clear flag.

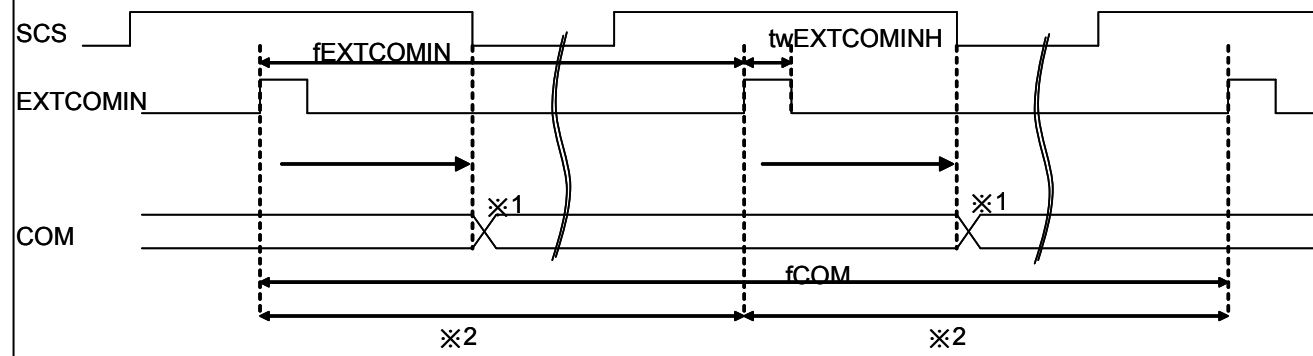
Set it "H"

DUMMY DATA: Dummy data. It can be "H" or "L" ("L" is recommended.)

6-5-5 COM Inversion

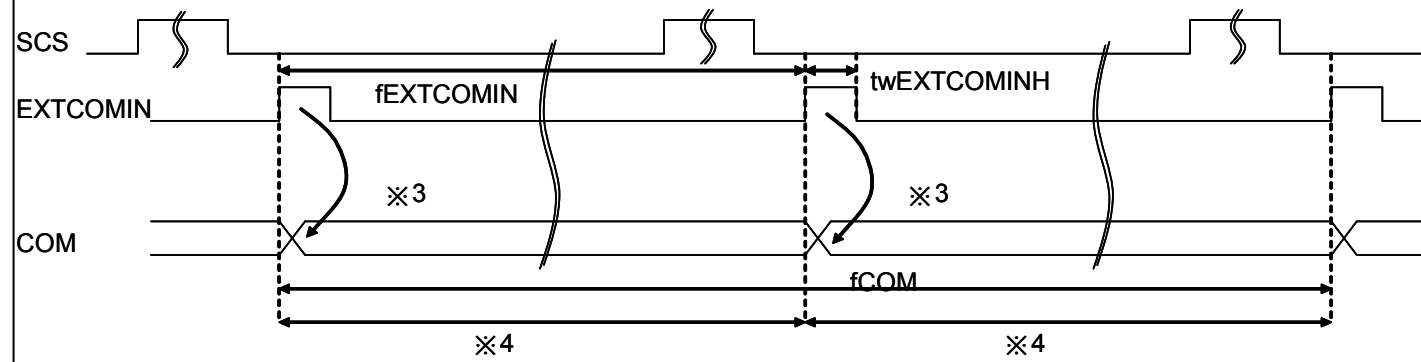
EXTCOMIN has 2 timing conditions:

(1): The EXTCOMIN input during high period of the SCS signal



- ※ 1: LC inversion polarity has been set by the falling edge of SCS signal.
- ※ 2: The period of EXTCOMIN should be constant.

(2): the EXTCOMIN input during low period of the SCS signal



- ※ 3: LC inversion polarity has been set by the rising edge of EXTCOMIN.
- ※ 4: The period of EXTCOMIN should be constant.

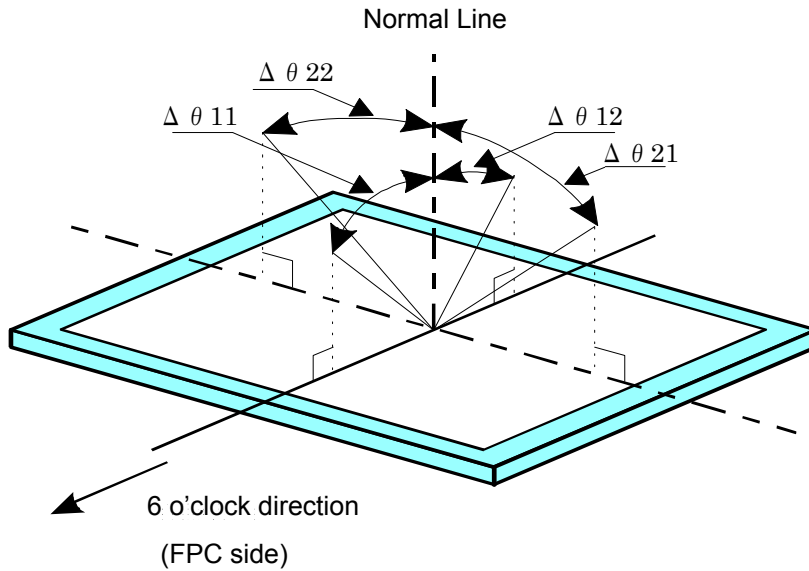
7. Optical Characteristics

Table 7

Ta=25°C

| Item | Code | MIN. | TYP. | MAX. | Unit | Remark |
|----------------------------|-------|---------|------|------|-----------|----------------|
| Viewing Angle CR≥2 | H | θ21,θ22 | 40 | 60 | °(Degree) | 【Remark 7-1】 |
| | V | θ11 | 40 | 60 | °(Degree) | |
| | | θ12 | 40 | 60 | °(Degree) | |
| Contrast Ratio | CR. | 14 | 18 | | | 【Remark 7-2,3】 |
| Reflection Ratio | R | 14 | 18 | | % | 【Remark 7-3】 |
| Transmissition Ratio | T | | 0.2 | | % | 【Remark 7-5】 |
| Response Speed | Rise | τr | 10 | 20 | ms | 【Remark 7-3,4】 |
| | Fall | τd | 20 | 40 | ms | |
| Panel Surface Chromaticity | White | x | | 0.31 | | 【Remark 7-3】 |
| | | y | | 0.33 | | |

【Remark 7-1】Definition of Viewing Angle



【Remark 7-2】 Definition of Contrast Ratio

Defined as shown in below formula

$$\text{Contrast Ratio (CR)} = \frac{\text{Reflection intensity of white display}}{\text{Reflection intensity of black display}}$$

| | | |
|------------------------------|---------------------------------|------------|
| SPEC No. LD-26X06A | MODEL No. LS013B7DH03 | PAGE 22 |
|------------------------------|---------------------------------|------------|

【Remark 7-3】 Optical Characteristics Measurement Equipment

Contrast ratio, reflective ratio and panel surface chromaticity are measured as shown in Figure 7-2, and Response speed is measured as shown in Figure 7-3. Both measurement methods are done in dark Room or equivalent.

Measurement Equipment (CM-2002)

Measurement Equipment (LCD-5200)

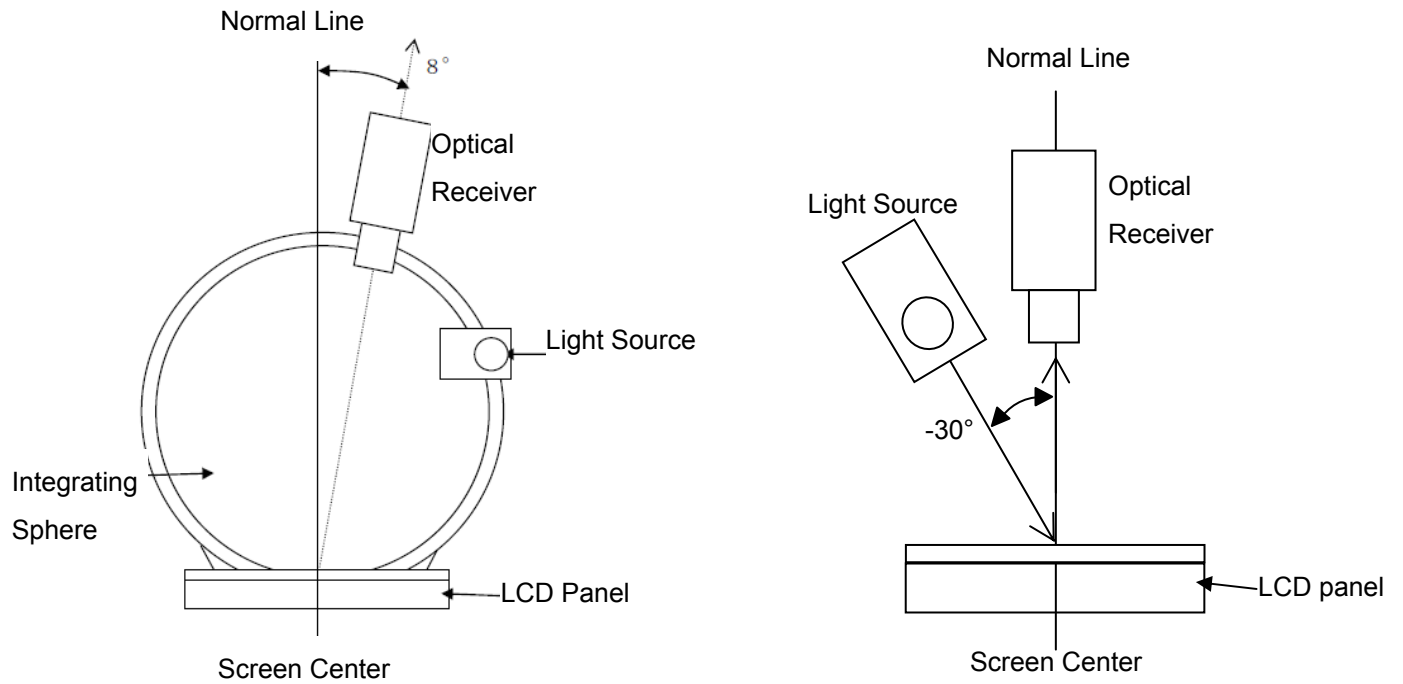


Figure 7-2 Measurement of contrast, reflective ratio and panel surface chromaticity

【Remark 7-4】 Definition of Response Speed (Reflection Ratio Change)

Input signal for white and black as shown below and define by the change in time it takes for optical receiver output.

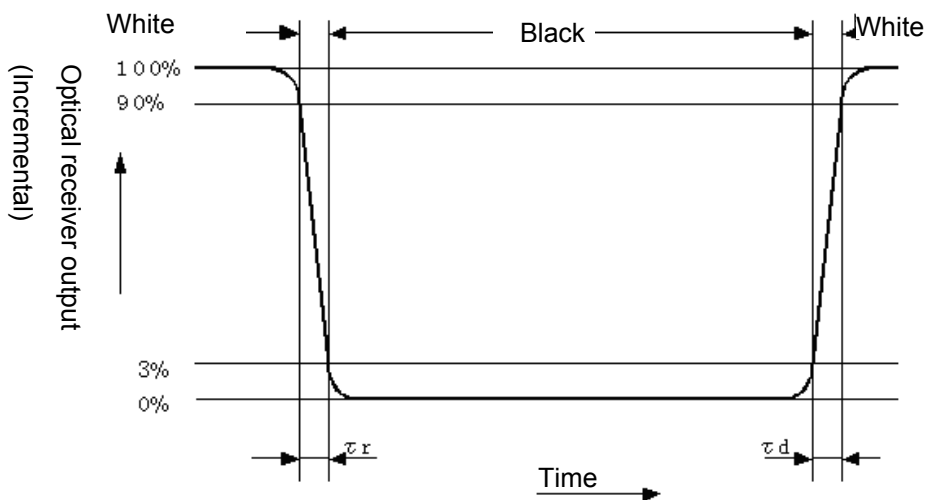


Figure 7-3 Measurement of response speed

【Remark 7-5】 Panel luminance calculation.

Backlight can be implemented underneath the panel, display can be shown with the luminance which is depended on the Backlight luminance. The luminance can be calculated by “the panel transmissivity (0.2%)” multiply “Backlight luminance”.



| | | |
|------------------------------|---------------------------------|-------------------|
| SPEC No. LD-26X06A | MODEL No. LS013B7DH03 | PAGE 23 |
|------------------------------|---------------------------------|-------------------|

8. Outline Dimension

Figure 8-1 1.28 inch 128x128 Monochrome Outline Dimension

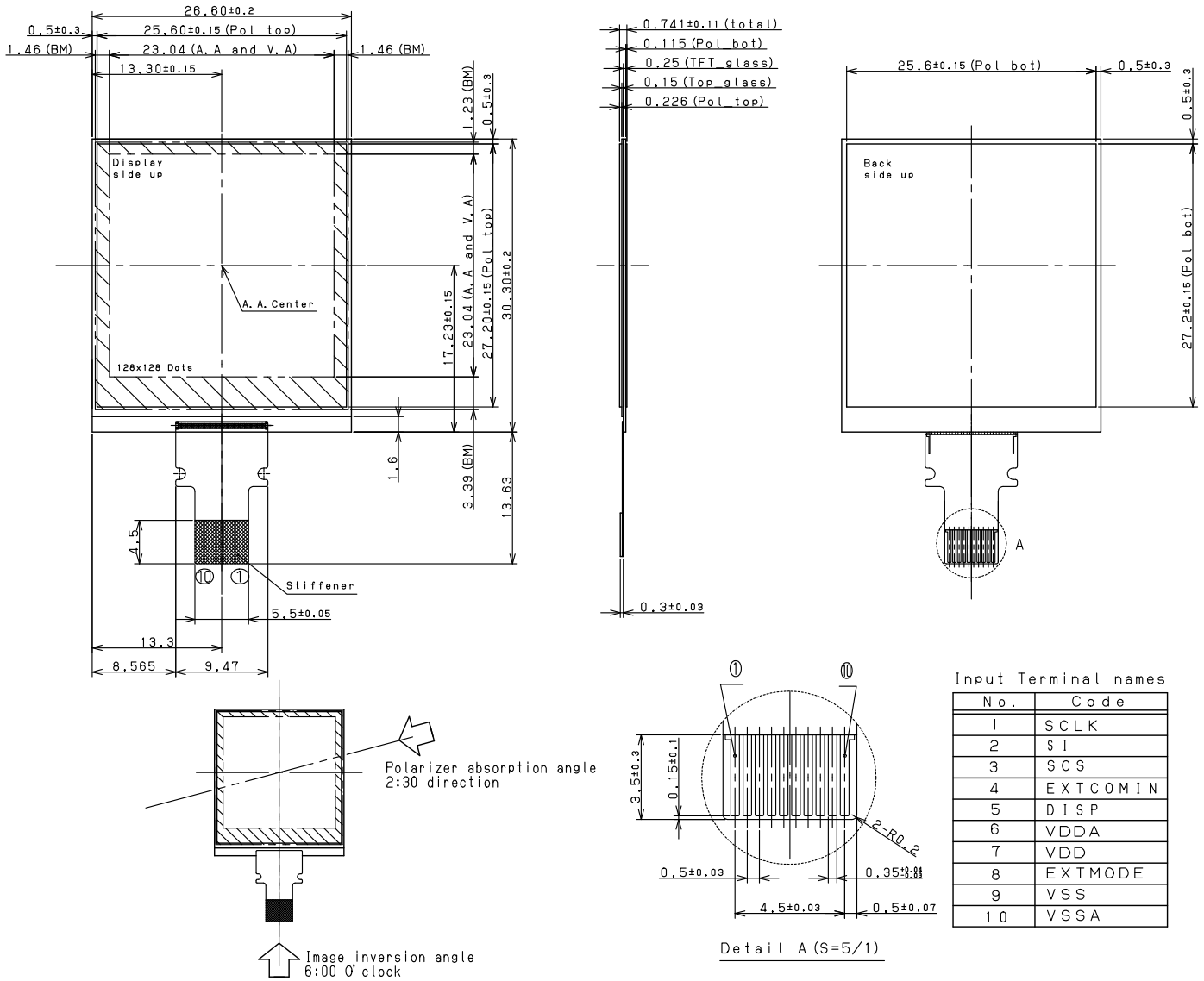


Figure 8-1 Module Outline

<Recommended Connector> Panasonic: AYF531035 (Contact: Bottom side)
 SMK FP12 Series: CFP-4610-0150F (Contact: Bottom side)
 Molex: 51441-1093 (Contact: Bottom side)

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LD-26X06AMODEL No.
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24**8-2) FPC Bend Specification**

When bending FPC, bend where specified in Condition (1) and the bend R should be more than R specified in Condition (2). FPC is not to contact glass edge, and there should be no stress to connective area between panel and FPC.

Condition (1) FPC bend recommended area: 0.8mm – 6.0mm from glass edge.

Condition (2) Minimum bend R: Inner diameter R0.45

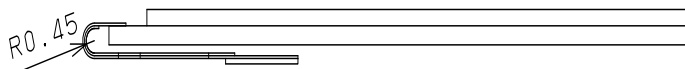


Figure 8-2

【Remark 8-1】 Do not bend backward (toward polarizer film side)

【Remark 8-2】 Bend frequency: 3 times or less (Repeat bend condition: 180° ~ 0°)

<Recommended Connector> Panasonic: AYF531035 (Contact: Upper side)

SMK FP12 series : CFP-4510-0150F (Contact: Upper side)

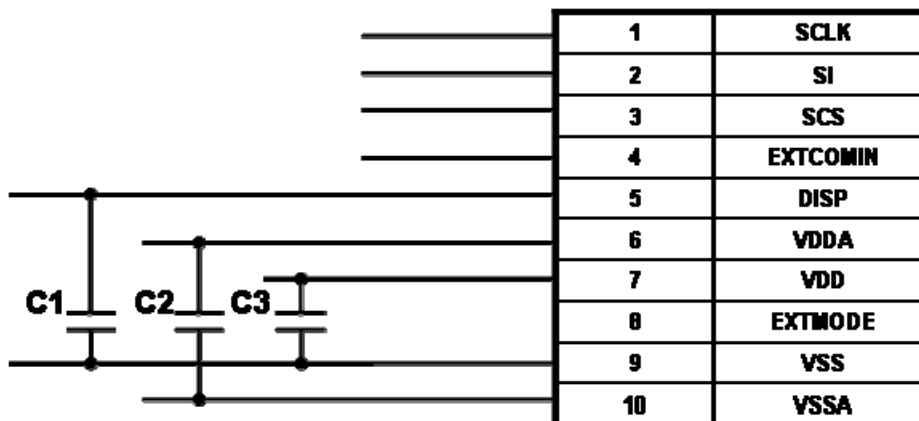
9. Example of external circuit

Figure 9-1 External circuit diagram (recommended)

<Recommended Capacitor>

C1: Between DISP-VSS, B characteristics 0.1uF ceramic capacitor

C2: Between VDDA-VSS, B characteristics 1uF or more cerac capacitor

C3: Between VDD-VSS, B characteristics 1uF or more ceramic capacitor

※ Above circuit and parts are only recommendation

For actual use, please evaluate their conformity with your system and design.

(Capacitor pressure resistance can be larger than resistance indicated above.)

10. Packaging

10-1 Lot number display

Displayed by printing. The display position is shown in Figure 10-1 outline dimension diagram.

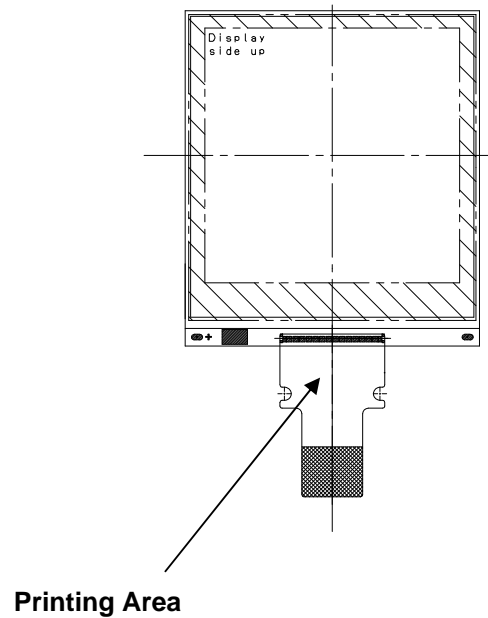
Display contents

(1)(2)

0412Q

00001A

(3)



Serial number specification

- (1) Last digit of the year
- (2) Month and date of manufacture
- (3) 5 digit consecutive numbers

Figure 10-1 Lot number printing position

10-2 Carton storage conditions

(1) Max number stacked: 8

Max number stored: 2240pcs

(2) Environment

- Temperature 0~40°C
- Humidity Less than 60% RH(at 40°C)

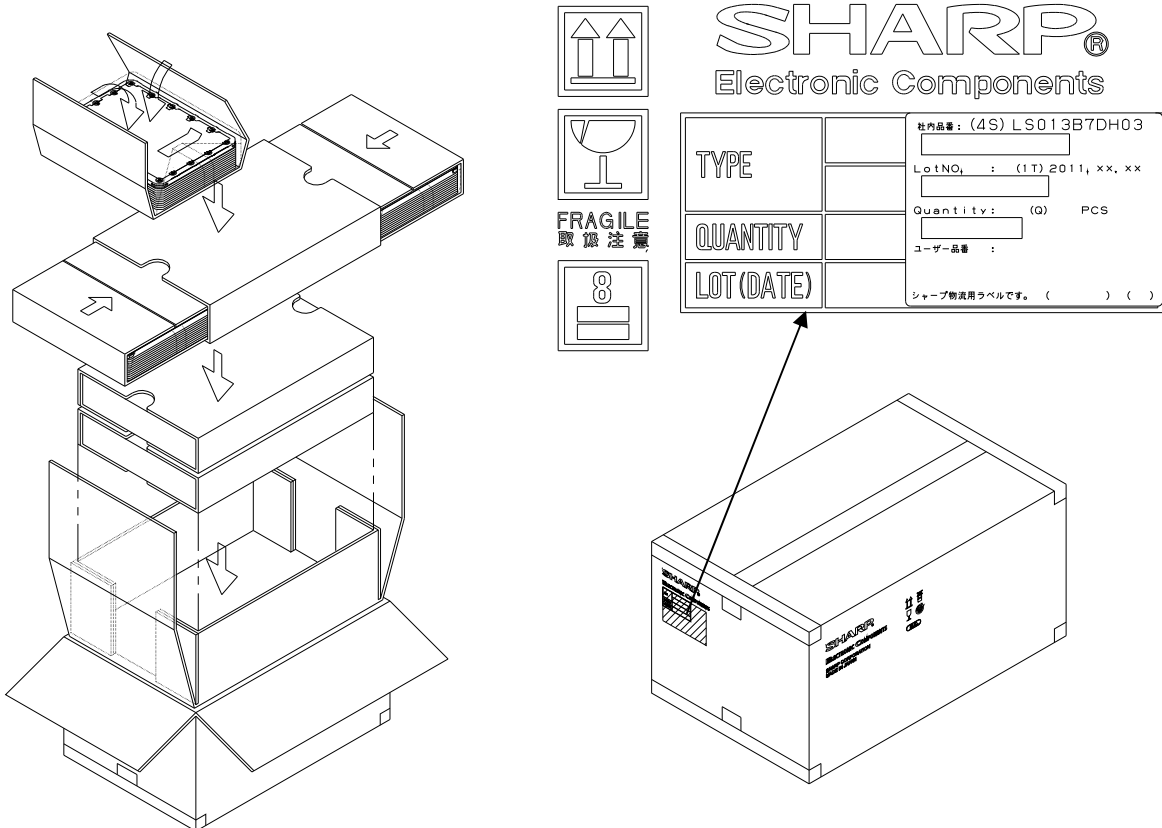
There should be no condensation at low temperatures even with high humidity.

- Atmosphere No toxic gases that significantly corrode the electronic parts and wiring material such as acid and alkali should be detected.
- Period Around 3 months
- Unpacking In order to prevent electrostatic damage to TFT modules, room humidity should be made over 50% RH and take effective measure such as use of earth when opening the package.

10-3 Packing

The packing condition is shown in Figure 10-2.

The packaging is designed such that the module does not break during transit.



Packaging size : 578mmx382mmx255mm

Figure 10-2: packing condition

SHARPSPEC No.
LD-26X06AMODEL No.
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27**11. Reliability test conditions**

Table 11 Reliability test items

| | Test items | Test contents | | Notes |
|---|------------------------------------|---|----------------------|-------|
| 1 | High temperature storage | Ta=80°C | 240h (Non-operating) | |
| 2 | Low temp. storage | Ta=-30°C | 240h (Non-operating) | |
| 3 | High temp. high humidity operation | Tp=40°C /95%RH | 240h | |
| 4 | High temp. operation | Tp=70°C | 240h | |
| 5 | Low temp. operation | Tp=-20°C | 240h | |
| 6 | Thermal shock | Ta=-30°C (1h)~+80°C (1h)/cycle=5 cycles (Non-operating) | | |
| 7 | Electrostatic resistance | ±200V、200pF(0Ω) Once each pin | | |

【NB】Ta=ambient temperature、Tp=panel temperature

(Evaluation method)

In the standard condition, there shall be no practical problems that may affect the display function.

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