NEWHAVEN DISPLAY INTERNATIONAL

# User's Guide

# NHD-240128WG-AFTI-VZ#-C5

# LCM

(Liquid Crystal Display Graphic Module)

RoHS Compliant

| | |
|---|---|
| **NHD-** | Newhaven Display |
| **240128-** | 240 x 128 pixels |
| **WG-** | W= Factory Line G= Display Mode: Graphic |
| **A-** | Model/Serial Number |
| **F-** | White CCFL B/L |
| **T-** | FSTN-(negative) |
| **I-** | Transmissive, 6:00 View, Wide Temperature (-20 ~ +70c) |
| **VZ#-** | Built-in Negative voltage, RoHS Compliant |
| **C5-** | Special 5-pin B/L Connector |

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# 1.Module Classification Information

NHD 240128 W G - A F T I – VZ#-C5
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ 9

① Brand：Newhaven Display

② Display Font：240 x 128 Dots

③ Factory Line: W

④ Display Type：H→ Character Type, G→ Graphic Type, C→ Color

⑤ Model / Serial number = **A**

⑥ Backlight Type：

| | | |
|---|---|---|
| | N→ Without backlight | |
| | B→ EL, Blue green | A→ LED, Amber |
| | D→ EL, Green | R→ LED, Red |
| | W→ EL, White | O→ LED, Orange |
| | **F**→ CCFL, White | G→ LED, Green |
| | Y→ LED, Yellow Green | T→ LED, White |

⑦ LCD Mode：

| | | |
|---|---|---|
| | B→ TN Positive, Gray | T→ FSTN Negative |
| | N→ TN Negative, | C→ STN Color |
| | G→ STN Positive, Gray | **F**→ FSTN Positive |
| | Y→ STN Positive, Yellow Green | M→ STN Negative, Blue |

⑧ LCD Polarize Type/ Temperature range/ View direction

| | | |
|---|---|---|
| | A→ Reflective, N.T, 6:00 | **H**→ Transflective, W.T,6:00 |
| | D→ Reflective, N.T, 12:00 | K→ Transflective, W.T,12:00 |
| | G→ Reflective, W. T, 6:00 | C→ Transmissive, N.T,6:00 |
| | J→ Reflective, W. T, 12:00 | F→ Transmissive, N.T,12:00 |
| | B→ Transflective, N.T,6:00 | I→ Transmissive, W. T, 6:00 |
| | E→ Transflective, N.T.12:00 | L→ Transmissive, W.T,12:00 |

9 Special Code **VZ#** : Built-in Negative voltage, RoHS Compliant

C5= Special 5-pin B/L Connector

# 2.Precautions in use of LCD Modules

(1)Avoid applying excessive shocks to the module or making any alterations or modifications to it.
(2)Don't make extra holes on the printed circuit board, modify its shape or change the components of LCD module.
(3)Don't disassemble the LCM.
(4)Don't operate it above the absolute maximum rating.
(5)Don't drop, bend or twist LCM.
(6)Soldering: only to the I/O terminals.
(7)Storage: please storage in anti-static electricity container and clean environment.

# 3.General Specification

| Item | Dimension | Unit |
|---|---|---|
| Number of Characters | 240 x 128 dots | - |
| Module dimension | 170.0 x 103.5 x 14.0(MAX) | mm |
| View area | 129.0 x 75.0 | mm |
| Active area | 119.97 x 63.97 | mm |
| Dot size | 0.47 x 0.47 | mm |
| Dot pitch | 0.5 x 0.5 | mm |
| LCD type | FSTN, Negative, Transmissive | |
| Duty | 1/128 | |
| View direction | 6 o'clock | |
| Backlight Type | CCFL ,White | |

# 4.Absolute Maximum Ratings

| Item | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Operating Temperature | $T_{OP}$ | -20 | - | +70 | ℃ |
| Storage Temperature | $T_{ST}$ | -30 | - | +80 | ℃ |
| Input Voltage | $V_I$ | Vss | - | $V_{DD}$ | V |
| Supply Voltage For Logic | $V_{DD}$-$V_{SS}$ | -0.3 | - | +7 | V |
| Supply Voltage For LCD | $V_{DD}$-$V_0$ | 0 | - | | V |
| Negative Voltage Output | $V_{EE}$ | - | -22V | - | V |

# 5.Electrical Characteristics

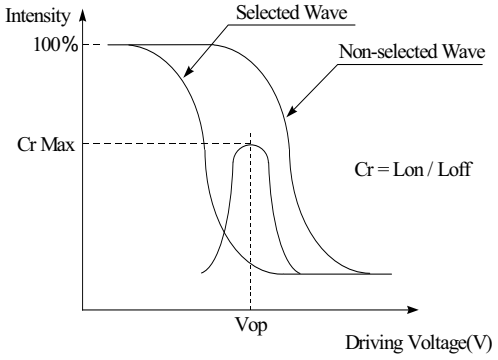
| Item | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Supply Voltage For Logic | $V_{DD}$-$V_{SS}$ | - | 4.75 | 5.0 | 5.25 | V |
| Supply Voltage For LCD | $V_{DD}$-$V_0$ | Ta=-20℃<br>Ta=25℃<br>Ta=70℃ | -<br>-<br>16.3 | 18.0 | 20.1<br>-<br>- | V<br>V<br>V |
| Input High Volt. | $V_{IH}$ | - | $V_{DD}$-2.2 | - | $V_{DD}$ | V |

| | | | | | | |
|---|---|---|---|---|---|---|
| Input Low Volt. | $V_{IL}$ | - | 0 | - | 0.8 | V |
| Output High Volt. | $V_{OH}$ | - | $V_{DD}$-0.3 | - | $V_{DD}$ | V |
| Output Low Volt. | $V_{OL}$ | - | 0 | - | 0.3 | V |
| Supply Current | $I_{DD}$ | $V_{DD}$=5V | - | 23 | - | mA |

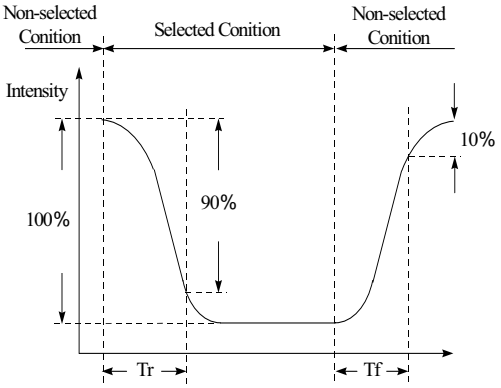
# 6.Optical Characteristics

| Item | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| View Angle | (V)θ | CR≧ 2 | 30 | - | 60 | deg |
| | (H)φ | CR≧ 2 | -45 | - | 45 | deg |
| Contrast Ratio | CR | - | - | 5 | - | - |
| Response Time | T rise | - | - | 200 | 300 | ms |
| | T fall | - | - | 200 | 300 | ms |

**Definition of Operation Voltage (Vop)** **Definition of Response Time ( Tr , Tf )**




[positive type]



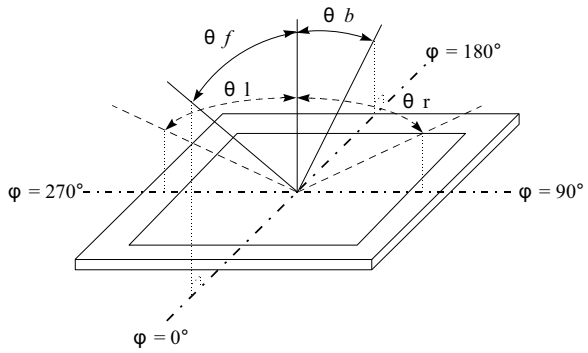

[positive type]

**Conditions :**

Operating Voltage : Vop  Viewing Angle(θ , φ ) : 0° , 0°

Frame Frequency : 64 HZ  Driving Waveform : 1/N duty , 1/a bias

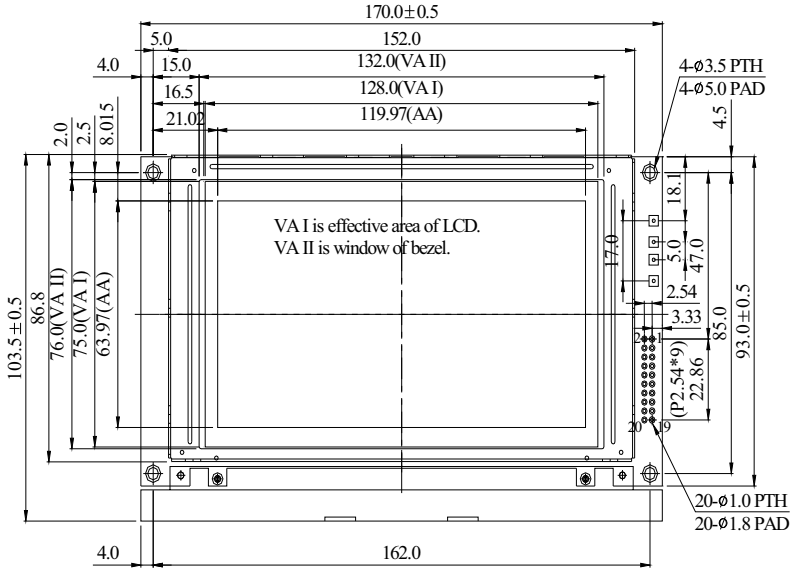
**Definition of viewing angle(CR≧ 2)**



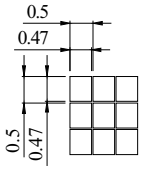

# 7.Interface Description

| Pin No. | Symbol | Level | Description |
|---|---|---|---|
| 1 | FG | - | Frame ground ( Connected to bezel ) |
| 2 | Vss | - | GND |
| 3 | Vdd | - | Power supply ( +5 V ) |
| 4 | Vo | - | Power supply for LCD driver |
| 5 | WR | L | Data write. Write data into T6963C when WR = L |
| 6 | RD | L | Data read. Read data from T6963C when RD = L |
| 7 | CE | L | L : Chip enable |
| 8 | C/D | H / L | WR=L , C/D=H : Command Write C/D=L: Data write<br>RD=L , C/D=H : Status Read C/D=L: Data read |
| 9 | Vee | - | Negative voltage |
| 10 | RESET | H / L | H : Normal ; L : Initialize T6963C |
| 11 | DB0 | H / L | Data bus line |
| 12 | DB1 | H / L | Data bus line |
| 13 | DB2 | H / L | Data bus line |
| 14 | DB3 | H / L | Data bus line |
| 15 | DB4 | H / L | Data bus line |
| 16 | DB5 | H / L | Data bus line |
| 17 | DB6 | H / L | Data bus line |
| 18 | DB7 | H / L | Data bus line |
| 19 | FS | MD2 | Pins for selection of font; H : 6 * 8 , L : 8 * 8 |
| 20 | RV | H / L | H:Reverse H:Normal |

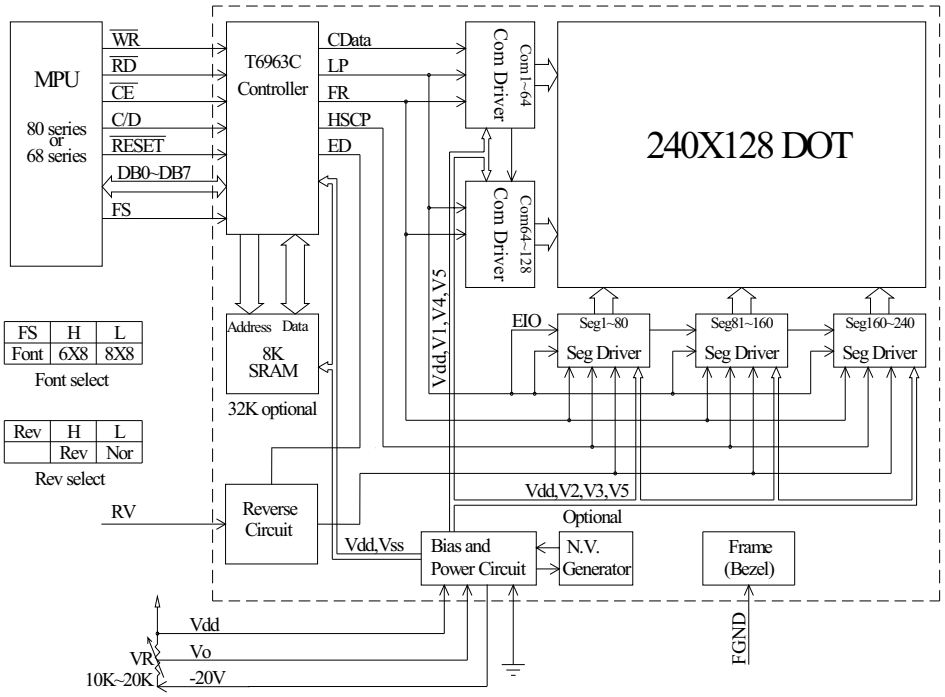
# 8.Contour Drawing &Block Diagram




| PIN NO. | SYMBOL |
|---|---|
| 1 | FGND |
| 2 | GND |
| 3 | Vdd |
| 4 | Vee |
| 5 | $\overline{WR}$ |
| 6 | RD |
| 7 | $\overline{CE}$ |
| 8 | C/D |
| 9 | NC |
| 10 | $\overline{RESET}$ |
| 11 | DB0 |
| 12 | DB1 |
| 13 | DB2 |
| 14 | DB3 |
| 15 | DB4 |
| 16 | DB5 |
| 17 | DB6 |
| 18 | DB7 |
| 19 | FS |
| 20 | RV |




DOT SIZE
SCALE 10/1




External contrast adjustment.

# 9.Display control instruction

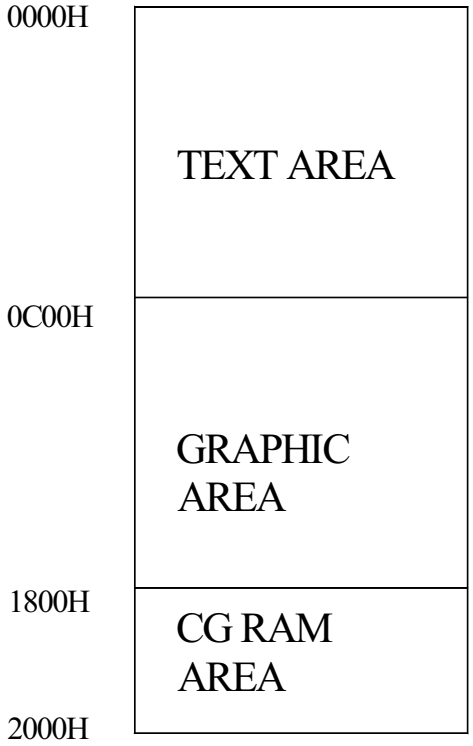
The LCD Module has built in a T6963C LSI controller, It has an 8-bit parallel data bus and

control lines for writing or reading through an MPU interface, it has a 128-word character generator ROM ( refer to Table 1. ), which can control an external display RAM of up to 8K bytes. Allocation of text, graphics and external character generator RAM can be made easily and the display window can be moved freely within the allocated memory range.

**•RAM Interface**

The external RAM is used to store display data( text, graphic and external CG data ). It can be freely allocated to the memory area( 8 K byte max ).

Recommend




· Flowchart of communications with MPU

(1) Status Read

A status check must be performed before data is read or written.

Status check

The Status of T6963C can be read from the data lines.

| | |
|---|---|
| $\overline{RD}$ | L |
| $\overline{WR}$ | H |
| $\overline{CE}$ | L |
| C/D | H |
| Do to D7 | H |

The T6963C status word format is as follows:

MSB LSB

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| STA7 | STA6 | STA5 | STA4 | STA3 | STA2 | STA1 | STA0 |
| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |

| | | |
|---|---|---|
| STA0 | Check command execution capability | 0:Disable<br>1:Enable |
| STA1 | Check data read/write Capability | 0:Disable<br>1:Enable |
| STA2 | Check Auto mode data read capability | 0:Disable<br>1:Enable |
| STA3 | Check Auto mode data write capability | 0:Disable<br>1:Enable |
| STA4 | Not used | - |
| STA5 | Check controller operation capability | 0:Disable<br>1:Enable |
| STA6 | Error flag. Used for Screen Peek and Screen copy commands. | 0:No error<br>1:Error |
| STA7 | Check the blink condition | 0:Disable off<br>1:Normal display |

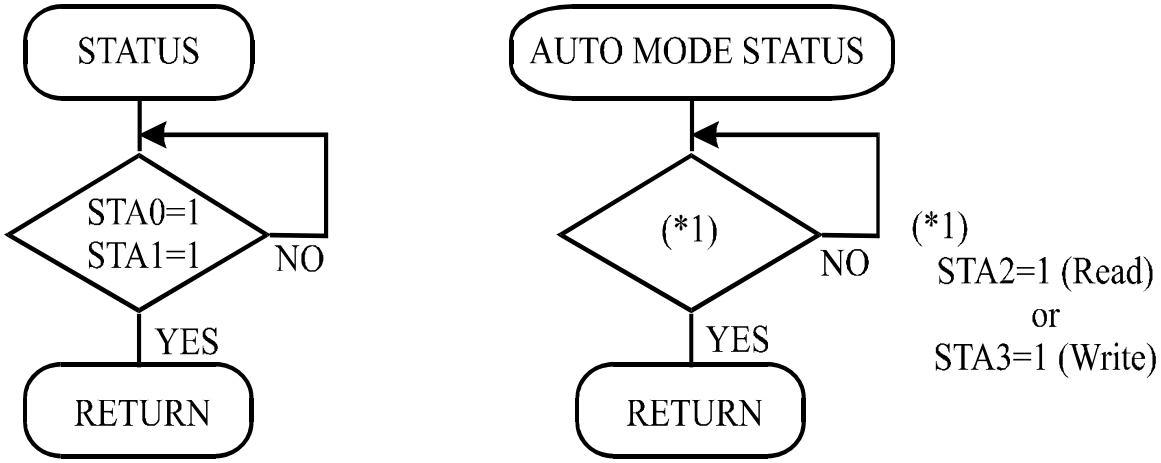
(Note 1) It is necessary to check STA0 and STA1 at the same time.
There is a possibility of erroneous operation due to a hardware interrupt.

(Note 2) For most modes STA0/STA1 are used as a status check.

(Note 3) STA2 and STA3 are valid in Auto mode; STA0 and STA1 are invalid.

Status Checking flow

(a) (b)




(Note 4) When using the MSB=0 command, a Status Read must be performed.

If a status check is not carried out, the T6963C cannot operate normally, even after a delay time.

The hardware interrupt occurs during the address calculation period (at the end of each line).

If a MSB=0 command is sent to the T6963C during this period, the T6963C enters Wait status.

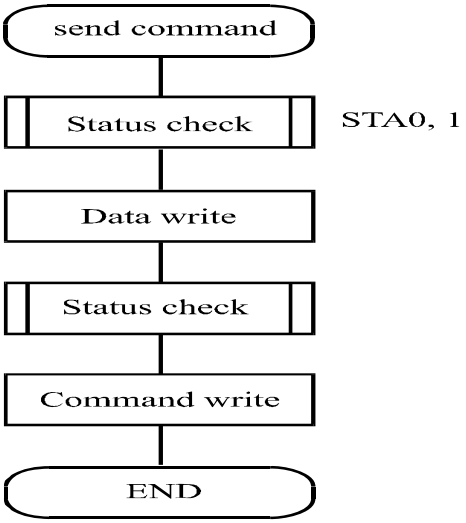
If a status check is not carried out in this state before the next command is sent, there is the possibility that the command or data date will not be received.

(2) Setting date

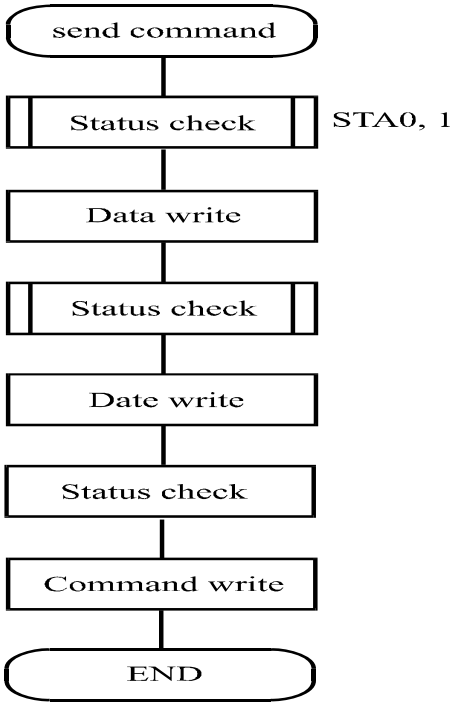
When using the T6963C, first set the data, then set the command.

Procedure for sending a command

(a)The case of 1 date




(b)The case of 2 data




(Note) When sending more than two data, the last datum (or last two data) is valid.

. COMMAND DEFINITIONS

| COMMAND | CODE | D1 | D2 | FUNCTION |
|---|---|---|---|---|
| REGISTERS SETTING | 00100001<br>00100010<br>00100100 | X address<br>Date<br>Low address | Y address<br>00H<br>High address | Set Cursor Pointer<br>Set Offset Register<br>Set Address Pointer |
| SET CONTROL WORD | 01000000<br>01000001<br>01000010<br>01000011 | Low address<br>Columns<br>Low address<br>Columns | High address<br>00H<br>High address<br>00H | Set Text Home Address<br>Set Text Area<br>Set Graphic Home Address<br>Set Graphic Area |
| MODE SET | <br>1000×000<br>1000×001<br>1000×011<br>1000×100<br>10000×××<br>10001××× | -<br>-<br>-<br>-<br>-<br>-<br>- | -<br>-<br>-<br>-<br>-<br>-<br>- | <br>OR mode<br>EXOR mode<br>AND mode<br>Text Attribute mode<br>Internal CG ROM mode<br>External CG RAM mode |
| DISPLAY MODE | <br>10010000<br>1001××10<br>1001××11<br>100101××<br>100110××<br>100111×× | -<br>-<br>-<br>-<br>-<br>-<br>- | -<br>-<br>-<br>-<br>-<br>-<br>- | <br>Display off<br>Cursor on, blink off<br>Cursor on, blink on<br>Text on, graphic off<br>Text off, graphic on<br>Text on, graphic on |
| CURSOR PATTERN SELECT | <br>10100000<br>10100001<br>10100010<br>10100011<br>10100100<br>10100101<br>10100110<br>10100111 | -<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>- | -<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>- | <br>1-line cursor<br>2-line cursor<br>3-line cursor<br>4-line cursor<br>5-line cursor<br>6-line cursor<br>7-line cursor<br>8-line cursor |
| DATA AUTO READ/WRITE | 10110000<br>10110001<br>10110010 | -<br>-<br>- | -<br>-<br>- | Set Data Auto Write<br>Set Data Auto Read<br>Auto Reset |
| DATA READ/WRITE | <br>11000000<br>11000001<br>11000010<br>11000011<br>11000100<br>11000101 | Data<br>-<br>Data<br>-<br>Data<br>- | -<br>-<br>-<br>-<br>-<br>- | Data Write and Increment ADP<br>Data Read and Increment ADP<br>Data Write and Decrement ADP<br>Data Read and Decrement ADP Data<br>Write and Nonvariable ADP<br>Data Read and Nonvariable ADP |
| SCREEN PEEK | 11100000 | - | - | Screen Peek |

X : invalid

| COMMAND | CODE | D1 | D2 | FUNCTION |
|---|---|---|---|---|
| SCREEN COPY | 11101000 | - | - | Screen Copy |
| BIT SET/RESET | 11110××× | - | - | Bit Reset |

| | | | | |
|---|---|---|---|---|
| | 11111×××<br>1111× 001<br>1111× 001<br>1111× 010<br>1111× 011<br>1111× 100<br>1111× 101<br>1111× 110<br>1111× 110 | -<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>- | -<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>- | Bit Set<br>Bit 0 (LSB)<br>Bit 1<br>Bit 2<br>Bit 3<br>Bit 4<br>Bit 5<br>Bit 6<br>Bit 7 (MSB) |

X: invalid

. Setting registers

| CODE | HEX. | FUNCTION | D1 | D2 |
|---|---|---|---|---|
| 00100001 | 21H | SET CURSOR POINTER | X ADRS | Y ADRS |
| 00100010 | 23H | SET OFFSET REGISTER | DATA | 00H |
| 00100100 | 24H | SET ADDRESS POINTER | LOW ADRS | HIGH ADRS |

(1) Set Cursor Pointer

The position of the cursor is specified by X ADRS and Y ADRS. The cursor position can only be moved by this command. Data read/write from the MPU never changes the cursor pointer. X ADRS and Y ADRS are specified as follows.

X ADRS 00H to 4FH (lower 7 bits are valid)

Y ADRS 00H to 1FH (lower 5 bits are valid)

Single-Scan

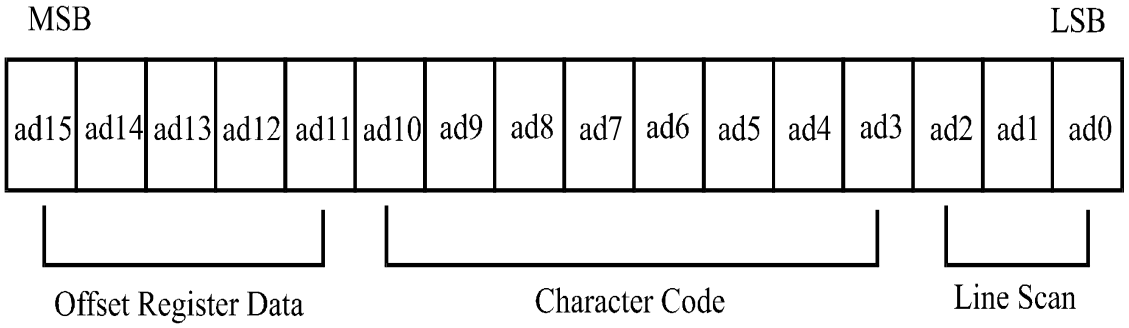
X ADRS 00 to 4FH

Y ADRS 00H to 0FH

(2) Set Offset Register

The offset register is used to determine the external character generator RAM area.

The T6963C has a 16-bit address bus as follows.




T6963C assign External character generator, when character code set 80H TO FFH in using internal character generator. Character code 00H to 80H assign External character generator, when

External generator mode.

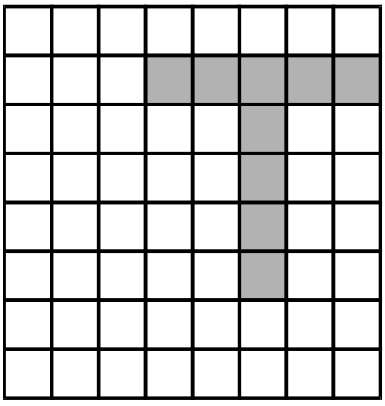
The senior five bits define the start address in external memory of the CG RAM area. The next eight bits represent the character code of the character. In internal CG ROM, character codes 00H to 7FH represent the predefined “internal” CG ROM characters, and codes 80H to FFH represent the user’s own “external” characters. In external CG ROM mode, all 256 codes from 00H to FFH can be used to represent the user’s own characters. The three least significant bits indicate one of the eight rows of eight dots that define the character’s shape.

The relationship between display RAM address and offset register

| Offset register data | CG RAM hex. address (start to end) |
|---|---|
| 00000 | 0000 to 07 FFH |
| 00001 | 0800 to 0FFFH |
| 00010 | 1000 to 17FFH |
| | |
| 11100 | E000 to E7FFH |
| 11101 | E800 to EFFFH |
| 11110 | F000 to F7FFH |
| 11111 | F800 to FFFFH |

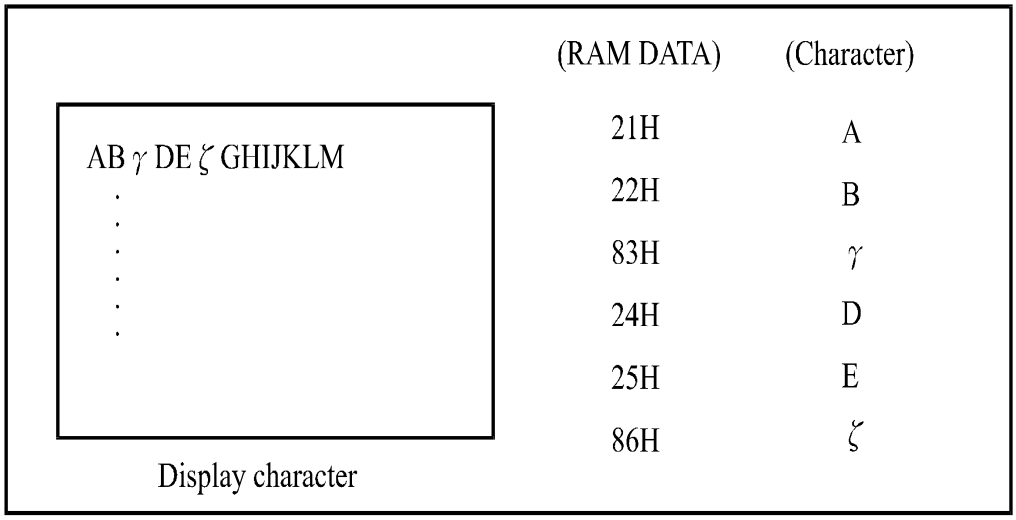
(Example 1)

| | | | | | |
|---|---|---|---|---|---|
| Offset register | 02H | | | | |
| Character code | 80H | | | | |
| Character generator RAM start address | 0001 | 0100 | 0000 | 0000 | |
| | 1 | 4 | 0 | 0 | H |



| (address) | (data) |
|---|---|
| 1400H | 00H |
| 1401H | 1FH |
| 1402H | 04H |
| 1403H | 04H |
| 1404H | 04H |
| 1405H | 04H |
| 1406H | 04H |
| 1407H | 00H |

(Example 2) The relationship between display RAM data and display characters

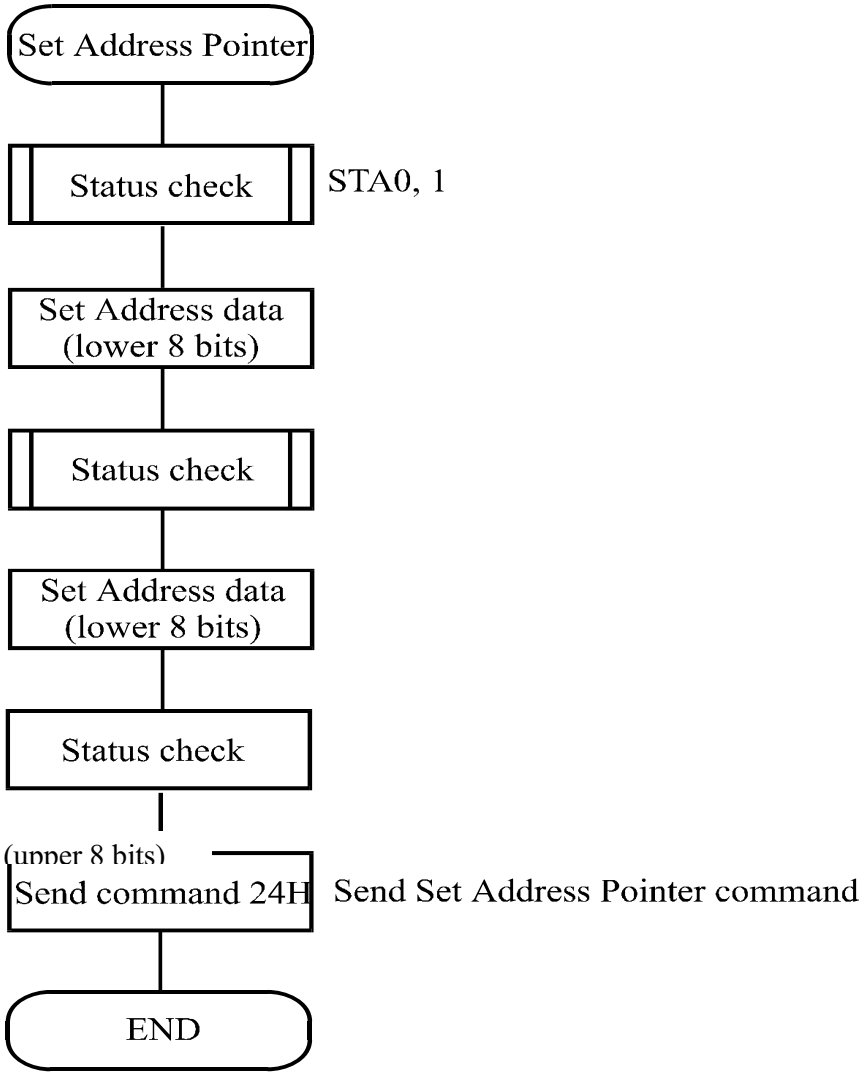



γ and ζ are displayed by character generator RAM.

(3) Set Address Pointer

The Set Address Pointer command is used to indicate the start address for writing to (or reading from)external RAM.

The Flowchart for Set Address Pointer command




. Set Control Word

| CODE | HEX. | FUNCTION | D1 | D2 |
|---|---|---|---|---|
| 01000000 | 40H | Set Text Home Address | Low address | High address |

| | | | | |
|---|---|---|---|---|
| 01000001 | 41H | Set Text Area | Columns | 00H |
| 01000010 | 42H | Set Graphic Home Address | Low address | High address |
| 01000011 | 43H | Set Graphic Area | Columns | 00H |

The home address and column size are defined by this command.

(1) Set Text Home Address

The starting address in the external display RAM for text display is defined by this command.

The text home address indicates the leftmost and uppermost position.

The relationship between external display RAM address and display position

| | | |
|---|---|---|
| TH | - | TH+CL |
| TH+TA | - | TH+TA+CL |
| (TH+TA)+TA | - | TH+2TA+CL |
| (TH+2TA)+TA | - | TH+3TA+CL |
| - | - | - |
| TH+(n-1) TA | - | TH+(n-1) TA+CL |

TH: Text home address

TA: Text area number (columns)

CL: Columns are fixed by hardware (pin-programmable).

(Example)

Text home address : 0000H

Text area : 0020H

: 32 Columns

: 4 Lines

| | | | | |
|---|---|---|---|---|
| 0000H | 0001H | - | 001EH | 001FH |
| 0020H | 0021H | - | 003EH | 002FH |
| 0040H | 0041H | - | 005EH | 005FH |
| 0060H | 0061H | - | 007EH | 007FH |

(2) Set Graphic Home Address

The starting address of the external display RAM used for graphic display is defined by this command. The graphic home address indicates the leftmost and uppermost position.

The relationship between external display RAM address and display position

| | | |
|---|---|---|
| GH | - | GH+GL |
| GH+GA | - | GH+GA+CL |
| (GH+GA)+GA | - | GH+2GA+CL |
| (GH+2GA)+GA | - | GH+3GA+CL |
| - | - | - |
| GH+(n-1) GA | - | GH+(n-1) GA+CL |

GH: Graphic home address

GA: Graphic area number (columns)

CL: Columns are fixed by hardware (pin-programmable).

(Example)

Graphic home address : 0000H

Graphic area : 0020H

: 32 Columns

: 2 Lines

| | | | | |
|---|---|---|---|---|
| 0000H | 0001H | - | 001EH | 001FH |
| 0020H | 0021H | - | 003EH | 003FH |
| 0040H | 0041H | - | 005EH | 005FH |
| 0060H | 0061H | - | 007EH | 007FH |
| 0080H | 0081H | - | 009EH | 009FH |
| 00A0H | 00A1H | - | 00BEH | 00BFH |
| 00C0H | 00C1H | – | 00DEH | 00DFH |
| 00E0H | 00E1H | - | 00FEH | 00FFH |

| | | | | |
|---|---|---|---|---|
| 0100H | 0101H | - | 011EH | 011FH |
| 0120H | 0121H | - | 013EH | 013FH |
| 0140H | 0141H | - | 015EH | 014FH |
| 0160H | 0161H | - | 017EH | 017FH |
| 0180H | 0181H | - | 109EH | 019FH |
| 01A0H | 01A1H | - | 01BEH | 01BFH |
| 01C0H | 01C1H | - | 01DEH | 01DFH |
| 01E0H | 01E1H | - | 01FEH | 01FFH |

(3) Set Text Area

The display columns are defined by the hardware Setting. This command can be used to adjust the columns of the display.

(Example)

LCD size 20 columns, 4lines

Text home address 0000H

Text area 0014H

Set 32 columns, 4 Lines

| | | | | | | |
|---|---|---|---|---|---|---|
| 0000 | 0001 | …… | 0013 | 0014 | …… | 001F |
| 0014 | 0015 | …… | 0027 | 0028 | …… | 0033 |
| 0028 | 0029 | …… | 003B | 003C | …… | 0047 |
| 003C | 003D | …… | 004F | 0050 | …… | 005B |

(4) Set Graphic Area

The display columns are defined by the hardware setting. This command can be used to adjust the columns of the graphic display.

(Example)

LCD size 20 columns, 2lines

Graphic home address : 0000H

Graphic are : 0014H

Set 32 columns, 2 Lines

| | | | | | | |
|---|---|---|---|---|---|---|
| 0000 | 0001 | …… | 0013 | 0014 | …… | 001F |
| 0014 | 0015 | …… | 0027 | 0028 | …… | 0033 |
| 0028 | 0029 | …… | 003B | 003C | …… | 0047 |
| 003C | 003D | …… | 004F | 0050 | …… | 005B |
| 0050 | 0051 | …… | 0063 | 0064 | …… | 006F |
| 0064 | 0065 | …… | 0077 | 0078 | …… | 0083 |
| 0078 | 0079 | …… | 008B | 008C | …… | 0097 |
| 008C | 008D | …… | 009F | 00A0 | …… | 00AB |
| 00A0 | 00A1 | …… | 00B3 | 00B4 | …… | 00BF |
| 00B4 | 00B5 | …… | 00C7 | 00C8 | …… | 00D3 |
| 00C8 | 00C9 | …… | 00DB | 00DC | …… | 00E7 |
| 00DC | 00DD | …… | 00EF | 00F0 | …… | 00FD |
| 00F0 | 00F1 | …… | 0103 | 0104 | …… | 011F |
| 0104 | 0105 | …… | 0127 | 0128 | …… | 0123 |
| 0128 | 0129 | …… | 013B | 0013C | …… | 00147 |
| 013C | 013D | …… | 014F | 0150 | …… | 015B |

LCD

If the graphic area setting is set to match the desired number of columns on the LCD, the addressing scheme will be automatically modified so that the start address of each line equals the end address of the previous line +1.

. Mode set

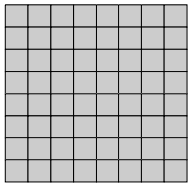
| CODE | FUNCTION | OPERAND |
|---|---|---|
| 1000x000 | OR Mode | - |
| 1000x001 | EXOR Mode | - |
| 1000x011 | AND Mode | - |
| 1000x100 | TEXT ATTRIBUTE Mode | - |
| 10000xxx | Internal Character Generator Mode | - |
| 10001xxx | External Character Generator Mode | - |

X: invalid

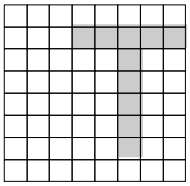
The display mode is defined by this command. The display mode does not change until the next

command is sent. The logical OR, EXOR, AND of text or graphic display can be displayed. In Internal Character Generator mode, character codes 00H to 7FH are assigned to the built-in character generator ROM. The character codes 80H to FFH are automatically assigned to the external character generator RAM.

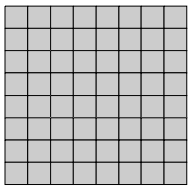
(Example)



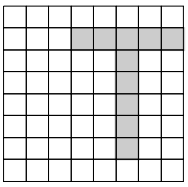
GRAPHIC



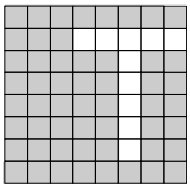
TEXT



"OR"



"AND"



"TXOR"

(Note) Attribute functions can only be applied to text display, since the attribute data is placed in the graphic RAM area.

Attribute function

The attribute operations are Reverse display, Character blink and Inhibit. The attribute data is written into the graphic area which was defined by the Set Control Word command. Only text display is possible in Attribute Function mode; graphic display is automatically disabled. However, the Display Mode command must be used to turn both Text and Graphic on in order for the Attribute function to be available.

The attribute data for each character in the text area is written to the same address in the graphic area. The Attribute function is defined as follows.

Attribute RAM 1byte

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| × | × | × | × | d3 | d2 | d1 | d0 |

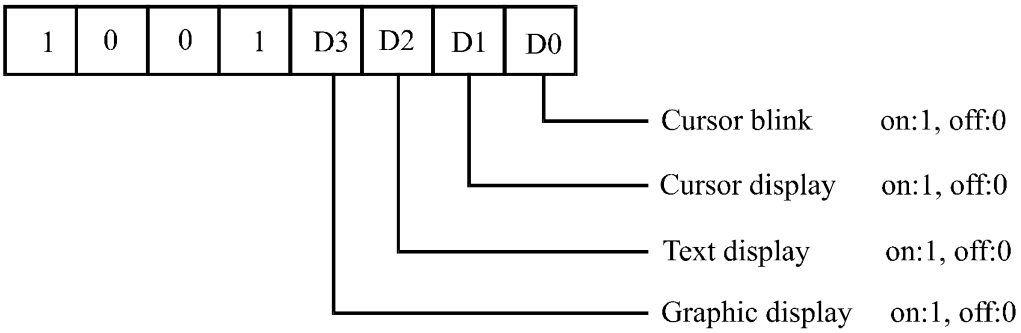
| **d3** | **d2** | **d1** | **d0** | **FUNCTION** |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | Normal display |
| 0 | 1 | 0 | 1 | Reverse display |
| 0 | 0 | 1 | 1 | Inhibit display |
| 1 | 0 | 0 | 0 | Blink of normal display |
| 1 | 1 | 0 | 1 | Blink of reverse display |
| 1 | 0 | 1 | 1 | Blink of inhibit display |

X: invalid

· Display mode

| CODE | FUNCTION | OPERAND |
|---|---|---|
| 10010000 | Display off | - |
| 1001xx10 | Cursor on, blink off | - |
| 1001xx11 | Cursor on, blink on | - |
| 100101xx | Text on, graphic off | - |
| 100110xx | Text off, graphic on | - |
| 100111xx | Text on, graphic on | - |

X:invalid




(Note) It is necessary to turn on “Text display” and “Graphic display” in the following cases.

a) Combination of text/graphic display

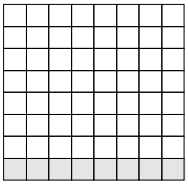
b) Attribute function

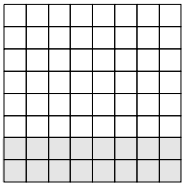
· Cursor pattern select

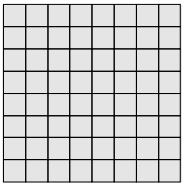
| CODE | FUNCTION | OPERAND |
|---|---|---|
| 10100000 | 1-line cursor | - |
| 10100001 | 2-line cursor | - |
| 10100010 | 3-line cursor | - |
| 10100011 | 4-line cursor | - |

| | | |
|---|---|---|
| 10100100 | 5-line cursor | - |
| 10100101 | 6-line cursor | - |
| 10100110 | 7-line cursor | - |
| 10100111 | 8-line cursor | - |

When cursor display is ON, this command selects the cursor pattern in the range 1 line to 8 lines.
The cursor address is defined by the Cursor Pointer Set command.


1-line cursor


2-line cursor

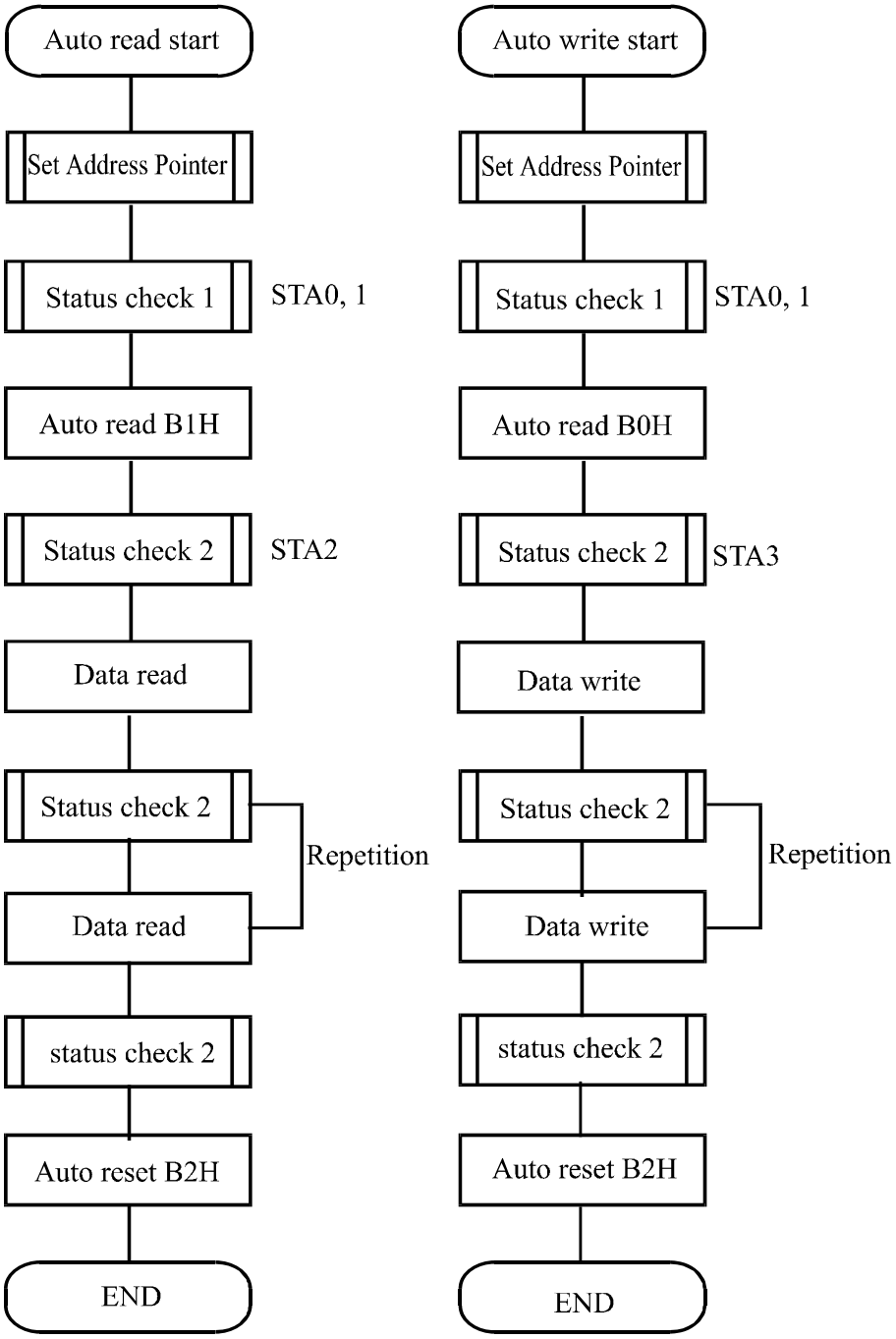

8-line cursor

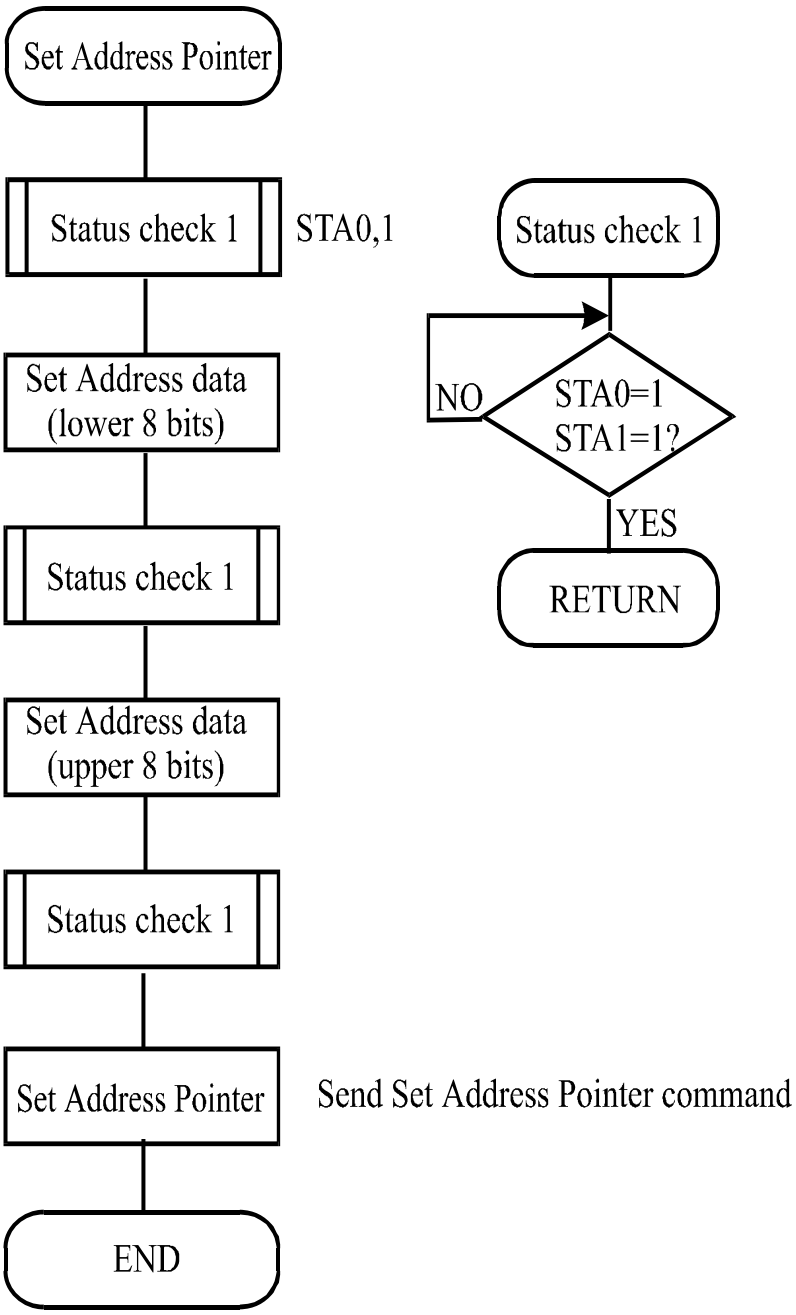
· Data Auto Read/Write

| CODE | HEX. | FUNCTION | OPERAND |
|---|---|---|---|
| 10110000 | B0H | Set Data Auto Write | - |
| 10110001 | B1H | Set Data Auto Read | - |
| 10110010 | B2H | Auto Reset | - |

The command is convenient for sending a full screen of data from the external display RAM. After setting Auto mode, a Data Write (or Read) command is need not be sent between each datum. A Data Auto Write (or Read) command must be sent after a Set Address Pointer command. After this command, the address pointer is automatically incremented by 1 after each datum. In Auto mode, the T6963C cannot accept any other commands.
The Auto Reset command must be sent to the T69963C after all data has been sent, to clear Auto mode.
(Note) A Status check for Auto mode
(STA2, STA3 should be checked between sending of each datum. Auto Reset should be performed after checking STA3=1 (STA2=1.) Refer to the following flowchart.

a)Auto Read mode b)Auto Write mode


Auto read start
Set Address Pointer
Status check 1
STA0, 1
Auto read B1H
Status check 2
STA2
Data read
Status check 2
Repetition
Data read
status check 2
Auto reset B2H
END
Auto write start
Set Address Pointer
Status check 1
STA0, 1
Auto read B0H
Status check 2
STA3
Data write
Status check 2
Repetition
Data write
status check 2
Auto reset B2H
END


Set Address Pointer
Status check 1
STA0,1
Set Address data
(lower 8 bits)
Status check 1
Set Address data
(upper 8 bits)
Status check 1
Set Address Pointer
Send Set Address Pointer command
END
Status check 1
NO
STA0=1
STA1=1?
YES
RETURN
Status check 2
NO
STA2=1
STA3=1?
YES
RETURN

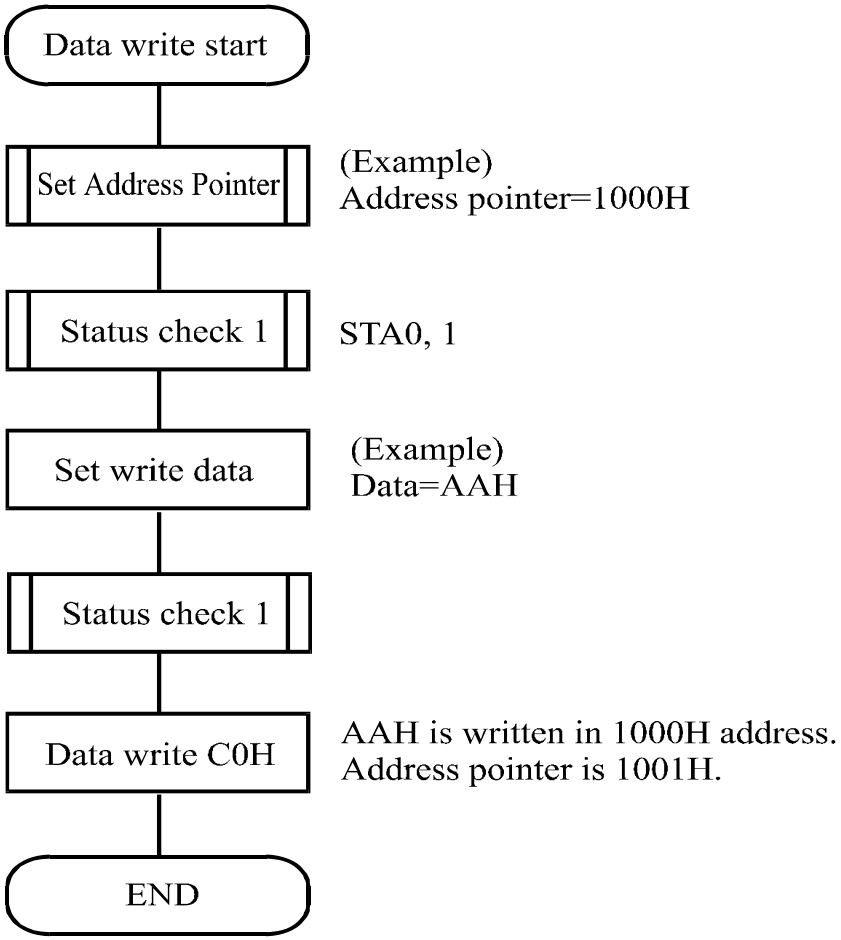
· Date Read/Write

| CODE | HEX. | FUNCTION | OPERAND |
|---|---|---|---|
| 11000000 | C0H | Data Write and Increment ADP | Data |
| 11000001 | C1H | Data Read and Increment ADP | - |
| 11000010 | C2H | Data Write and Decrement ADP | Data |
| 11000011 | C3H | Data Read and Decrement ADP | - |
| 11000100 | C4H | Data Write and Nonvariable ADP | Data |
| 11000101 | C5H | Data Read and Nonvariable ADP | - |

This command is used for writing data from the MPU to external display RAM, and reading data from external display RAM to the MPU. Data Write/Data Read should be executed after setting address using Set Address Pointer command. The address pointer can be automatically incremented or decremented using this command.

(Note) This command is necessary for each 1-byte datum.

Refer to the following flowchart.



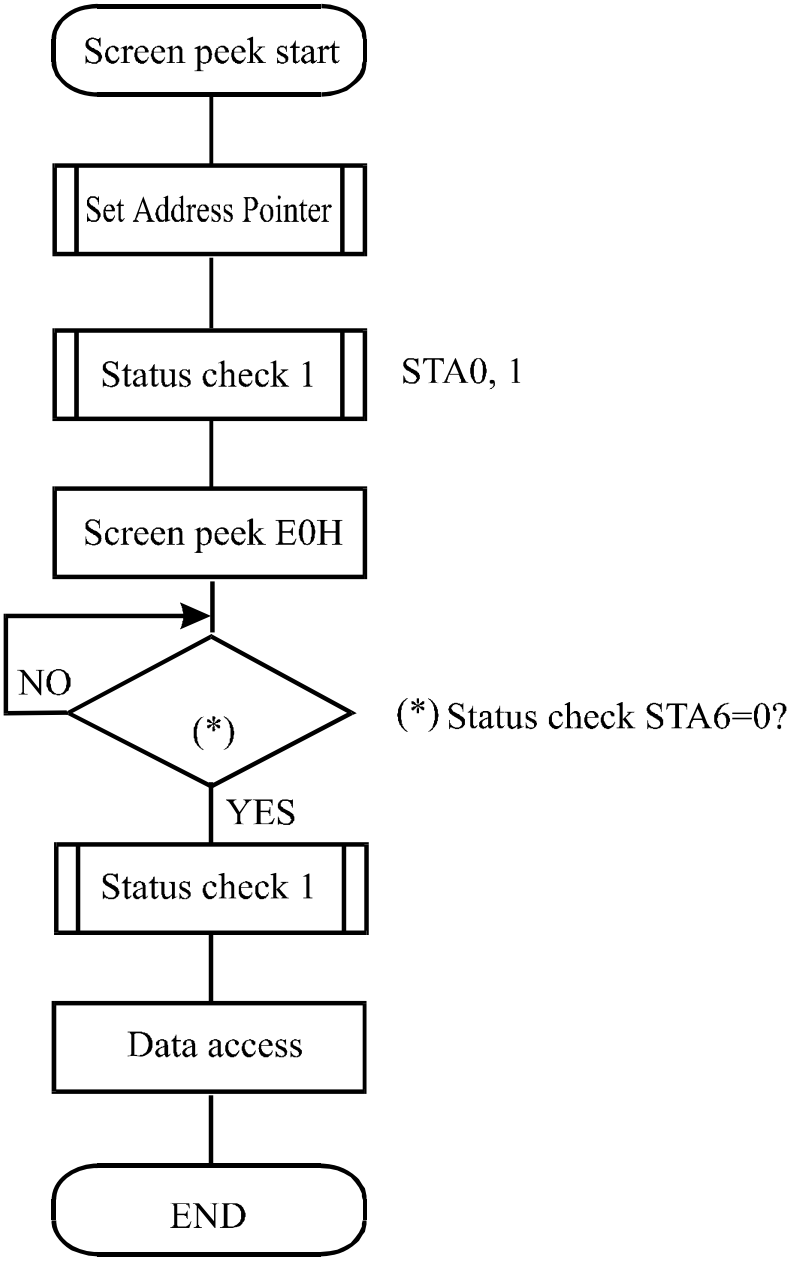
· Screen Peek

| CODE | HEX. | FUNCTION | OPERAND |
|---|---|---|---|
| 11100000 | E0H | Screen Peek | - e |

This command is used to transfer 1 byte of displayed data to the data stack; this byte can then be read from the MPU by data access. The logical combination of text and graphic display data on the LCD screen can be read by this command.

The status (STA6) should be checked just after the Screen Peek command. If the address determined by the Set Address Pointer command is not in the graphic area, this commands is ignored and a status flag (STA6) is set.

Refer to the following flowchart.




· Screen Copy

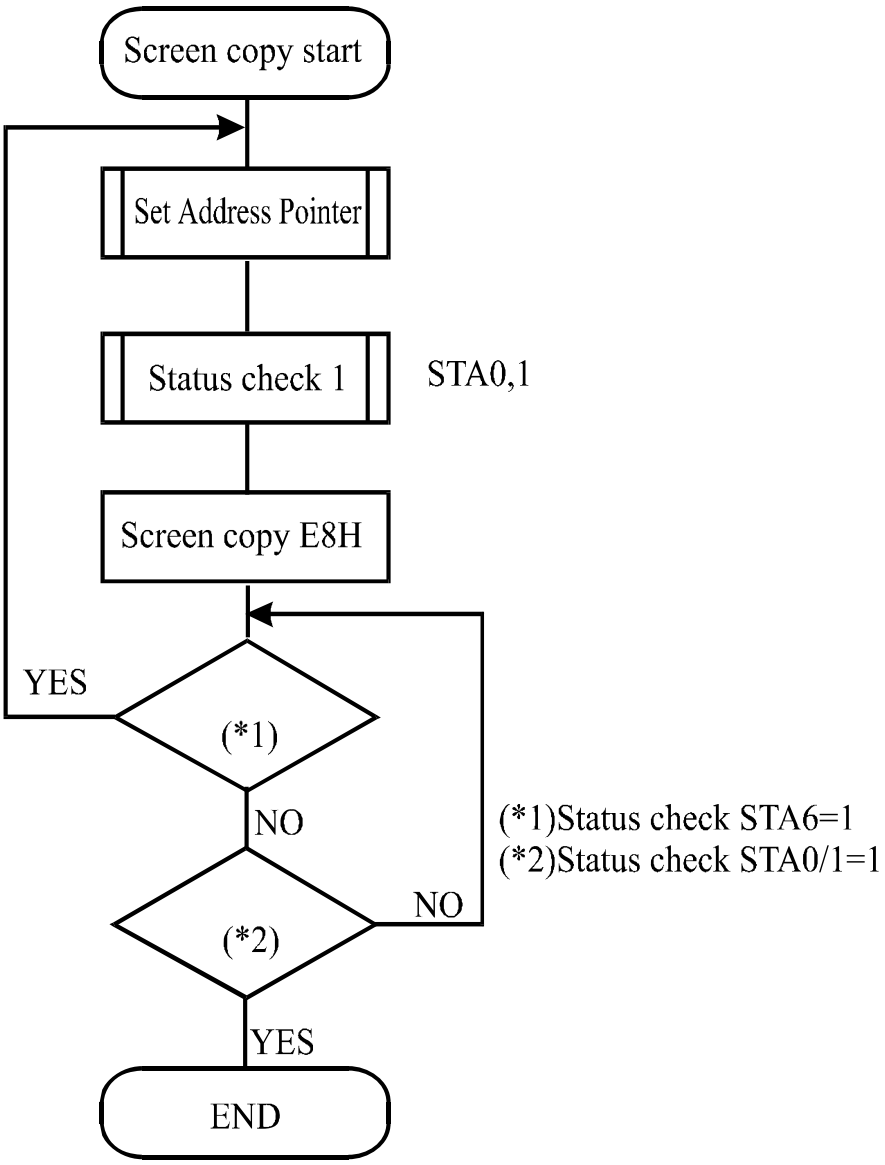
| CODE | HEX. | FUNCTION | OPERAND |
|---|---|---|---|
| 11101000 | E8H | Screen Copy | - |

This command copies a single raster line of data to the graphic area.

The start point must be set using the Set Address Pointer command.

(Note 1) If the attribute function is being used, this command is not available.
(With Attribute data is graphic area data.)

Refer to the following flowchart.



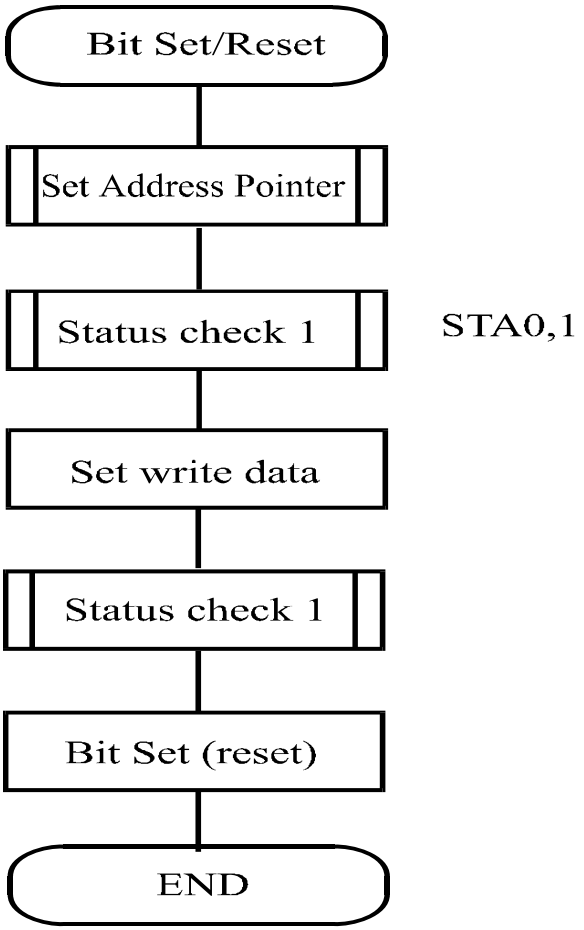

· Bit Set/Reset

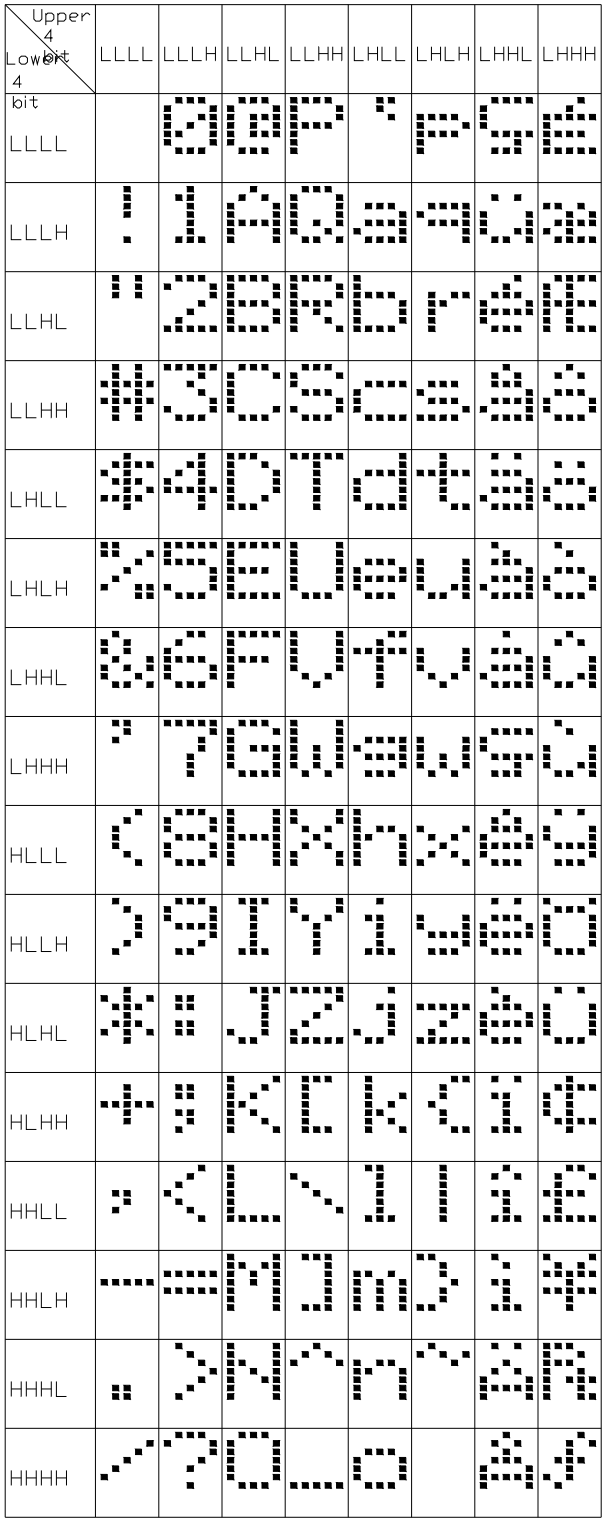
| CODE | FUNCTION | OPERAND |
|---|---|---|
| 11110xxx | Bit Reset | - |
| 11111xxx | Bit Set | - |
| 1111x000 | Bit 0 (LSB) | - |
| 1111x001 | Bit 1 | - |

| | | |
|---|---|---|
| 1111x010 | Bit 2 | - |
| 1111x011 | Bit 3 | - |
| 1111x100 | Bit 4 | - |
| 1111x101 | Bit 5 | - |
| 1111x110 | Bit 6 | - |
| 1111x111 | Bit 7 (MSB) | - |

X: invalid

This command use to set or reset a bit of the byte specified by the address pointer.
Only one bit can be set/reset at a time.
Refer to the following flowchart.




Upper 4 bit
Lower 4 bit
LLLL
LLLH
LLHL
LLHH
LHLL
LHLH
LHHL
LHHH
HLLL
HLLH
HLHL
HLHH
HHLL
HHLH
HHHL
HHHH

# 10.Timing Characteristics

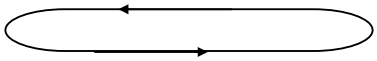
**Bus Timing**

( $V_{SS}$ = 0 V , $V_{DD}$ = 5 V )

| Item | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| C/D Set-up Time | $t_{CDS}$ | 100 | - | - | ns |
| C/D Hold Time | $t_{CDH}$ | 10 | - | - | ns |
| CE, RD, WR Pulse Width | $t_{CDS}$, $t_{RD}$, $t_{WR}$ | 80 | - | - | ns |
| Data Set-up Time | $t_{DS}$ | 80 | - | - | ns |
| Data Hold Time | $t_{DH}$ | 40 | - | - | ns |
| Access Time | $t_{ACC}$ | - | - | 150 | ns |
| Output Hold Time | $t_{OH}$ | 10 | - | 50 | ns |

# 11.Reliability

## Content of Reliability Test (wide temperature, -20℃~70℃)

| Environmental Test | | | |
|---|---|---|---|
| **Test Item** | **Content of Test** | **Test Condition** | **Note** |
| High Temperature storage | Endurance test applying the high storage temperature for a long time. | 80℃<br>200hrs | 2 |
| Low Temperature storage | Endurance test applying the high storage temperature for a long time. | -30℃<br>200hrs | 1,2 |
| High Temperature Operation | Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time. | 70℃<br>200hrs | ____ |
| Low Temperature Operation | Endurance test applying the electric stress under low temperature for a long time. | -20℃<br>200hrs | 1 |
| High Temperature/ Humidity Operation | The module should be allowed to stand at 60 ℃,90%RH max<br>For 96hrs under no-load condition excluding the polarizer,<br>Then taking it out and drying it at normal temperature. | 60℃,90%RH<br>96hrs | 1,2 |
| Thermal shock resistance | The sample should be allowed stand the following 10 cycles of operation<br>-20℃ 25℃ 70℃<br>  <br>30min 5min 30min<br>1 cycle | -20℃/70℃<br>10 cycles | ____ |
| Vibration test | Endurance test applying the vibration during transportation and using. | Total fixed amplitude : 1.5mm<br>Vibration Frequency : 10~55Hz<br>One cycle 60 seconds to 3 directions of X,Y,Z for Each 15 minutes | 3 |
| Static electricity test | Endurance test applying the electric stress to the terminal. | VS=800V,RS=1.5kΩ<br>CS=100pF<br>1 time | ____ |

**Note1: No dew condensation to be observed.**

**Note2: The function test shall be conducted after 4 hours storage at the normal Temperature and humidity after remove from the test chamber.**

**Note3: Vibration test will be conducted to the product itself without putting it in a container.**

# 12.Backlight Information

**No.2 3 4 5 shall be lighted at constant lamp current ( IL : 5.0 mA ) and shall be measured 3 minutes after the table below. The measurement shall be conducted on the condition that ambient temperature : 25 ± 2 ℃humidity : 30 ~ 85%, with no wind.**

| NO | Items | Requirements | Remarks |
|---|---|---|---|
| 1 | Lamp Current (IL) | 5.0 ± 0.5 (mArms) | |
| 2 | Lamp Voltage (VL) | 328 ± 20 (Vrms) | |
| 3 | Lamp Power (P)<br>(Reference Value) | 1.03 (Wrms) | VL * IL |
| 4 | Luminance | 250 min ($cd/m^2$) | Note 1 |
| 5 | Chromaticity (X)<br>(Y) | 0.308 ± 0.01<br>0.330 ± 0.01 | Note 2 |
| 6 | Starting Voltage (VS) | 530 MAX (25℃) (Vrms)<br>650 MAX (0℃) (Vrms) | Note 3 |
| 7 | Life time | 10000 min (h) | Note 4 |

**Note 1. The average value is measured though the glass.**

**Note 2. The tube center / center point shall be measured.**

**Note 3. All the tubes shall be lighted. Slide in method shall be used for voltage application.**

**Note 4.Life**

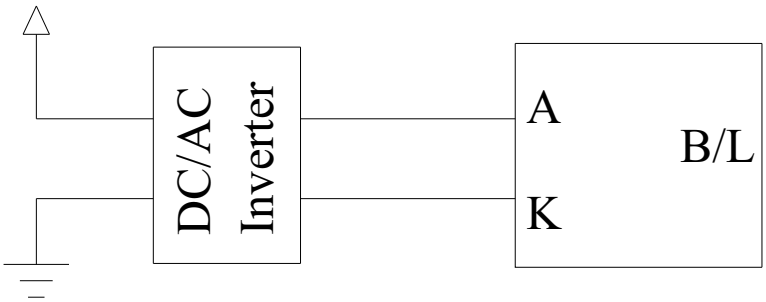
**Judgment conditions.**

**A The luminance becomes 50% of the initial luminance.**

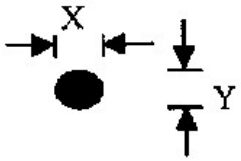
**B Not normal lighting.**

**C When a severe appearance failure is found.**

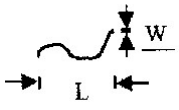
CCFL B\L drives directly from A , K.




## 13. Inspection specification

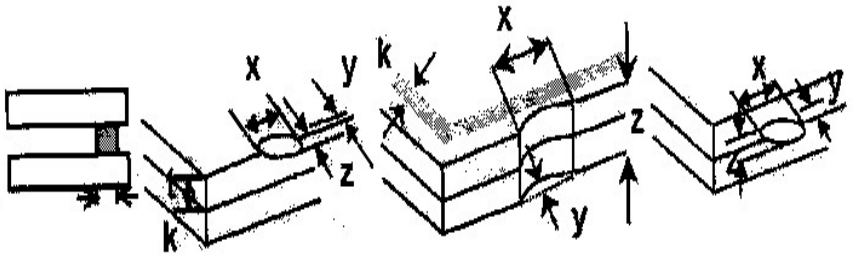
<table>
<tr><th>NO</th><th>Item</th><th>Criterion</th><th>AQL</th></tr>
<tr><td>01</td><td>Electrical Testing</td><td>1.1 Missing vertical, horizontal segment, segment contrast defect.<br>1.2 Missing character , dot or icon.<br>1.3 Display malfunction.<br>1.4 No function or no display.<br>1.5 Current consumption exceeds product specifications.<br>1.6 LCD viewing angle defect.<br>1.7 Mixed product types.<br>1.8 Contrast defect.</td><td>0.65</td></tr>
<tr><td>02</td><td>Black or white spots on LCD (display only)</td><td>2.1 White and black spots on display ≦ 0.25mm, no more than three white or black spots present.<br>2.2 Densely spaced: No more than two spots or lines within 3mm</td><td>2.5</td></tr>
<tr><td rowspan="2">03</td><td rowspan="2">LCD black spots, white spots, contamination (non-display)</td><td>3.1 Round type : As following drawing<br>Φ =( x + y ) / 2<br> 

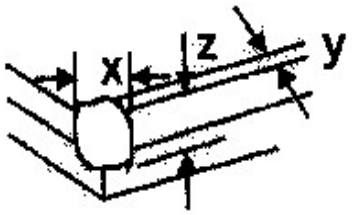
<table>
<tr><th>SIZE</th><th>Acceptable Q TY</th></tr>
<tr><td>Φ ≦ 0.10</td><td>Accept no dense</td></tr>
<tr><td>0.10 < Φ ≦ 0.20</td><td>2</td></tr>
<tr><td>0.20 < Φ ≦ 0.25</td><td>1</td></tr>
<tr><td>0.25 < Φ</td><td>0</td></tr>
</table></td><td>2.5</td></tr>
<tr><td>3.2 Line type : (As following drawing)</td><td>2.5</td></tr>
</table>

<table>
<tr>
<td></td>
<td></td>
<td> 

<table>
<tr><th>Length</th><th>Width</th><th>Acceptable Q TY</th></tr>
<tr><td>---</td><td>W≦ 0.02</td><td>Accept no dense</td></tr>
<tr><td>L≦ 3.0</td><td>0.02 < W≦ 0.03</td><td rowspan="2">2</td></tr>
<tr><td>L≦ 2.5</td><td>0.03 < W≦ 0.05</td></tr>
<tr><td>---</td><td>0.05 < W</td><td>As round type</td></tr>
</table>
</td>
<td></td>
</tr>
<tr>
<td>04</td>
<td>Polarizer bubbles</td>
<td>If bubbles are visible, judge using black spot specifications, not easy to find, must check in specify direction.
<table>
<tr><th>Size Φ</th><th>Acceptable Q TY</th></tr>
<tr><td>Φ≦ 0.20</td><td>Accept no dense</td></tr>
<tr><td>0.20 < Φ≦ 0.50</td><td>3</td></tr>
<tr><td>0.50 < Φ≦ 1.00</td><td>2</td></tr>
<tr><td>1.00 < Φ</td><td>0</td></tr>
<tr><td>Total Q TY</td><td>3</td></tr>
</table>
</td>
<td>2.5</td>
</tr>
</table>

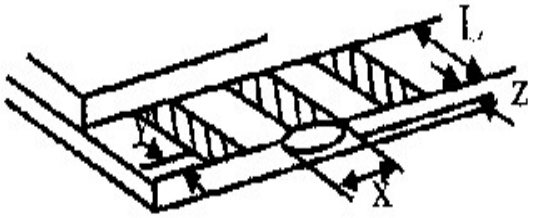
| NO | Item | Criterion | AQL |
|---|---|---|---|
| 05 | Scratches | Follow NO.3 LCD black spots, white spots, contamination | |

<table>
<tr>
<td>06</td>
<td>Chipped glass</td>
<td>
Symbols Define:<br>
x: Chip length y: Chip width z: Chip thickness<br>
k: Seal width t: Glass thickness a: LCD side length<br>
L: Electrode pad length:<br><br>
6.1 General glass chip :<br>
6.1.1 Chip on panel surface and crack between panels:<br>


<table>
<tr><th>z: Chip thickness</th><th>y: Chip width</th><th>x: Chip length</th></tr>
<tr><td>Z≦ 1/2t</td><td>Not over viewing area</td><td>x≦ 1/8a</td></tr>
<tr><td>1/2t < z≦ 2t</td><td>Not exceed 1/3k</td><td>x≦ 1/8a</td></tr>
</table>
⊙ If there are 2 or more chips, x is total length of each chip.<br><br>
6.1.2 Corner crack:<br>


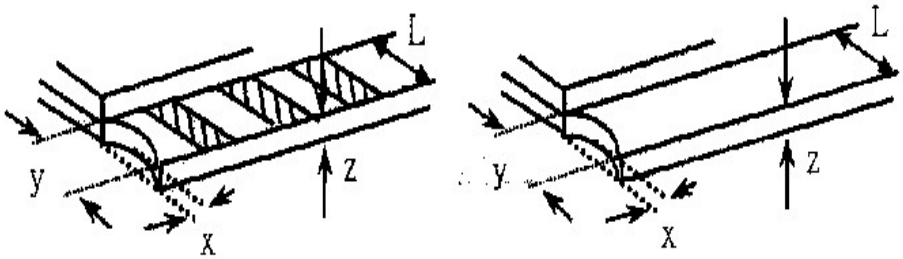
<table>
<tr><th>z: Chip thickness</th><th>y: Chip width</th><th>x: Chip length</th></tr>
<tr><td>Z≦ 1/2t</td><td>Not over viewing area</td><td>x≦ 1/8a</td></tr>
<tr><td>1/2t < z≦ 2t</td><td>Not exceed 1/3k</td><td>x≦ 1/8a</td></tr>
</table>
⊙ If there are 2 or more chips, x is the total length of each chip.
</td>
<td>2.5</td>
</tr>
</table>

| NO | Item | Criterion | AQL |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 06 | Glass crack | Symbols :<br>x: Chip length y: Chip width z: Chip thickness<br>k: Seal width t: Glass thickness a: LCD side length<br>L: Electrode pad length<br>6.2 Protrusion over terminal :<br>6.2.1 Chip on electrode pad :<br>  <br> | 2.5 |

| y: Chip width | x: Chip length | z: Chip thickness |
|---|---|---|
| y≦ 0.5mm | x≦ 1/8a | 0 < z ≦ t |

6.2.2 Non-conductive portion:

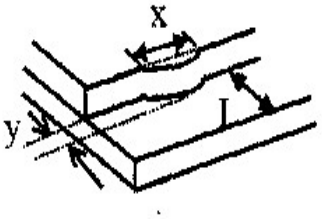



| y: Chip width | x: Chip length | z: Chip thickness |
|---|---|---|
| y≦ L | x≦ 1/8a | 0 < z ≦ t |

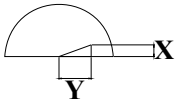
⊙ If the chipped area touches the ITO terminal, over 2/3 of the ITO must remain and be inspected according to electrode terminal specifications.

⊙ If the product will be heat sealed by the customer, the alignment mark not be damaged.

6.2.3 Substrate protuberance and internal crack.




| y: width | x: length |
|---|---|
| y≦ 1/3L | x ≦ a |

| NO | Item | Criterion | AQL |
|---|---|---|---|
| 07 | Cracked glass | The LCD with extensive crack is not acceptable. | 2.5 |
| 08 | Backlight elements | 8.1 Illumination source flickers when lit.<br>8.2 Spots or scratched that appear when lit must be judged. Using LCD spot, lines and contamination standards.<br>8.3 Backlight doesn’ t light or color wrong. | 0.65<br>2.5<br>0.65 |
| 09 | Bezel | 9.1 Bezel may not have rust, be deformed or have fingerprints, stains or other contamination.<br>9.2 Bezel must comply with job specifications. | 2.5<br>0.65 |
| 10 | PCB、COB | 10.1 COB seal may not have pinholes larger than 0.2mm or contamination.<br>10.2 COB seal surface may not have pinholes through to the IC.<br>10.3 The height of the COB should not exceed the height indicated in the assembly diagram.<br>10.4 There may not be more than 2mm of sealant outside the seal area on the PCB. And there should be no more than three places.<br>10.5 No oxidation or contamination PCB terminals.<br>10.6 Parts on PCB must be the same as on the production characteristic chart. There should be no wrong parts, missing parts or excess parts.<br>10.7 The jumper on the PCB should conform to the product characteristic chart.<br>10.8 If solder gets on bezel tab pads, LED pad, zebra pad or screw hold pad, make sure it is smoothed down.<br>10.9 The Scraping testing standard for Copper Coating of PCB<br>  <br>**X * Y<=2mm$^2$** | 2.5<br>2.5<br>0.65<br>2.5<br>2.5<br>0.65<br>0.65<br>2.5<br>2.5 |

| | | | |
|---|---|---|---|
| 11 | Soldering | 11.1 No un-melted solder paste may be present on the PCB.<br>11.2 No cold solder joints, missing solder connections, oxidation or icicle.<br>11.3 No residue or solder balls on PCB.<br>11.4 No short circuits in components on PCB. | 2.5<br>2.5<br>2.5<br>0.65 |

| NO | Item | Criterion | AQL |
|---|---|---|---|
| 12 | General appearance | 12.1 No oxidation, contamination, curves or, bends on interface Pin (OLB) of TCP.<br>12.2 No cracks on interface pin (OLB) of TCP.<br>12.3 No contamination, solder residue or solder balls on product.<br>12.4 The IC on the TCP may not be damaged, circuits.<br>12.5 The uppermost edge of the protective strip on the interface pin must be present or look as if it cause the interface pin to sever.<br>12.6 The residual rosin or tin oil of soldering (component or chip component) is not burned into brown or black color.<br>12.7 Sealant on top of the ITO circuit has not hardened.<br>12.8 Pin type must match type in specification sheet.<br>12.9 LCD pin loose or missing pins.<br>12.10 Product packaging must the same as specified on packaging specification sheet.<br>12.11 Product dimension and structure must conform to product specification sheet. | 2.5<br>0.65<br>2.5<br>2.5<br>2.5<br>2.5<br>2.5<br>0.65<br>0.65<br>0.65<br>0.65 |

# 14. Material List of Components for RoHs

1. Newhaven Display Intl. hereby declares that all of or part of products (with the mark "#"in code), including, but not limited to, the LCM, accessories or packages, manufactured and/or delivered to your company (including your subsidiaries and affiliated company) directly or indirectly by our company (including our subsidiaries or affiliated companies) do not intentionally contain any of the substances listed in all applicable EU directives and regulations, including the following substances.

Exhibit A：The Harmful Material List

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| Material | (Cd) | (Pb) | (Hg) | (Cr6+) | PBBs | PBDEs |
|---|---|---|---|---|---|---|
| Limited Value | 100 ppm | 1000 ppm | 1000 ppm | 1000 ppm | 1000 ppm | 1000 ppm |
| Above limited value is set up according to RoHS. | | | | | | |

2.Process for RoHS requirement：

(1) Use the Sn/Ag/Cu soldering surface；the surface of Pb-free solder is rougher than we used before.

(2) Heat-resistance temp.：

Reflow：250 ,30 seconds Max.；

Connector soldering wave or hand soldering：320 , 10 seconds max.

(3) Temp. curve of reflow, max. Temp.：235±5 ；

Recommended customer’s soldering temp. of connector：280 , 3 seconds.

# OCEAN CHIPS
## Океан Электроники
## Поставка электронных компонентов

Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «**JONHON**», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «**FORSTAR**».

AVIC JONHON

**«JONHON»** (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

**«FORSTAR»** (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).

FORSTAR®

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Web: http://oceanchips.ru/
Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А