Display Zone

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PRODUCT SPECIFICATION

LCD MODULE

MODEL: DCP202G-NSV-WBW

CUSTOMER'S APPROVAL	
CUSTOMER:	
SIGNATUER:	
DATE:	

MODE OF DISPLAY

Display Model

☐TN positive ☐TN negative
■VATN negative
STN: ☐Yellow green ☐Grey
☐Blue（negative）
☐FSTN positive
☐FSTN negative

Display condition

☐Reflective type
☐Transflective type
■Transmissive type
☐Others

Viewing direction

■6 0'clock
☐12 0'clock
☐3 0'clock
☐9 0'clock

Numbering System

Numbering	D	C	P	20	2	G	-	N	S	V	-	W	B	W	-	00
N0.	1	2	3	4	5	6	-	7	8	9	-	10	11	12	-	13

N0.	DESCRIPTION
1	Display Zone
2	**Display Type**
	C=Characters D=Customize G=Graphic O=COG
3	**Communication Interface**
	P=Parallel R=RS232 S=SPI I=I2C
4-5	**Display format or size**
	Character number per line or Row dots quantity and Character lines or column dots quantity Customize coding
6	**Version No.**
	A-Z series number
7	**Polarizer Type**
	R=Positive/Reflective F=Positive/Transflective M=Positive/Transmissive N=Negative/Transmissive
8	**Backlight Type**
	N=Without Backlight S=With Side Or Edge LED Backlight E=With EL backlight L=With Bottom LED Backlight
9	**LCD Type**
	T=TN H=HTN Y=STN Yellow-Green G=STN Gray B=STN Blue F=FSTN V=VATN
10	**Backlight color**
	A=Amber B=Blue O=Orange PG=Green YG= Yellow Green R=Red W=White
11	**View Angle**
	B=Bottom View（6H) T=Top View（12H) L=Left View （9H) R=Right View（3H)
12	**Temperature Range**
	S= Normal Temperature W=Wide Temperature
13	**Special requirements**
	00--99 series number represents the special needs of the product

DCP162A Specification Revision History

Version	Date	Description
1.0	2023/6/12	1st Edition

CONTENTS

1. SPECIFICATIONS

1.1 Features

Item	Standard Value
Display Type	20x2 characters
LCD Type	VATN, Negative, TRANSMISSIVE
Driving Method	1/16Duty, 1/5Bias
Viewing Direction	6 O'clock
Backlight Type	SIDE White
Temperature Range	Wide
Interface	6800 8-bit MPU
Driver IC	ST7066 or Equivalent
Font Type	English-Japanese

1.2 Mechanical Specifications

Item	Standard Value	Unit
Outline Dimension	182.00(L) X 60.00(W) X 14.00(T)	mm
Viewing Area	147.00(L) X 35.20(W)	mm
Active Area	137.00(L) X 29.20(W)	mm
Dot size	1.10(L) X 1.50(W)	mm
Dot pitch	1.20(L) X 1.60(W)	mm
Character size	5.90(L) X 12.70(W)	mm
Weight		g

1.3 Electrical Characteristics

DC characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	TOP	Absolute Max	-20	-	+70	ºC
Storage Temperature Range	TST	Absolute Max	-30	-	+80	ºC
Supply Voltage	VDD	-	4.7	5.0	5.3	V
Supply Current	IDD	VDD = 5.0V TOP = 25°C	0.5	1.25	2.0	mA
Supply for LCD (contrast)	VLCD		4.2	4.4	4.6	V
"H" Level input	VIH	-	0.7*VDD	-	VDD	V
"L" Level input	VIL	-	VSS	-	0.6	V
"H" Level output	VOH	-	3.9	-	VDD	V
"L" Level output	VOL	-	VSS	-	0.4	V

Backlight information

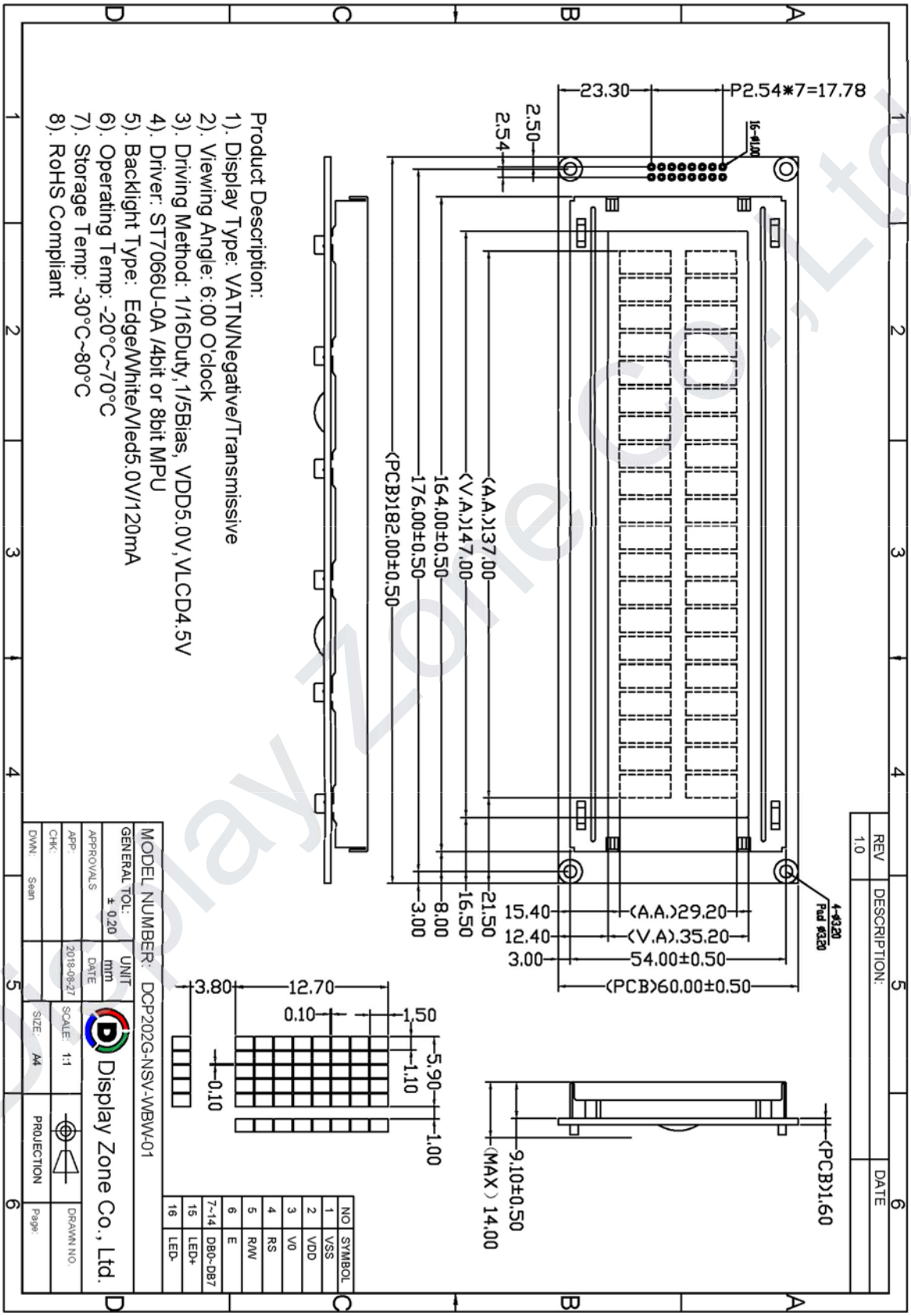
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Voltage	Vf	If=120mA	4.8	5.0	5.2	V
Reverse Current	Ir	If=5v	--	--	--	uA
Wavelength (Without LCD)	λd	If=120mA	--	--	--	nm
Luminous Intensity (without LCD)	Lv Sub	If=120mA	--	--	--	cd/m2
Uniformity	Δ%	IvMin/IvMax*100%	75	-	-	%
Color	White					

1.4 Optical Characteristics:

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	TOP	φY+	CR ≥ 2	-	55	-	º
	Bottom	φY-		-	85	-	º
	Left	θX-		-	55	-	º
	Right	θX+		-	85	-	º
Contrast Ratio		CR	-	2	5	-	º
Response Time	Rise	TR	TOP = 25°C	-	150	250	ms
	Fall	TF		-	200	300	ms

2. MODULE STRUCTURE

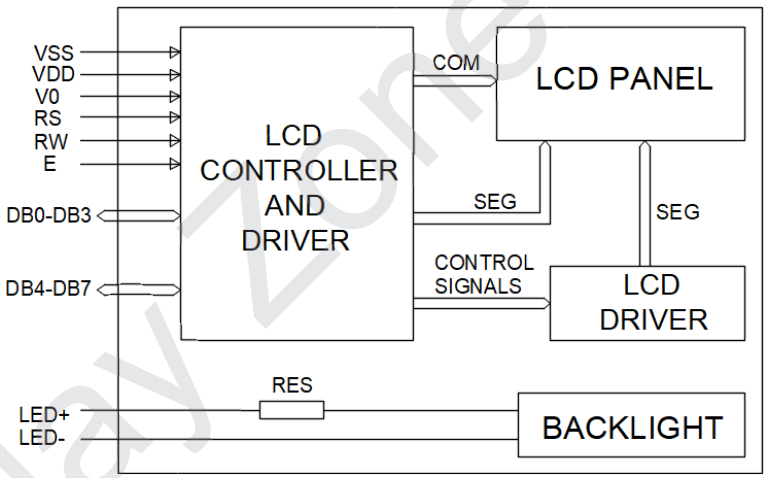
2.1 Mechanical Drawing



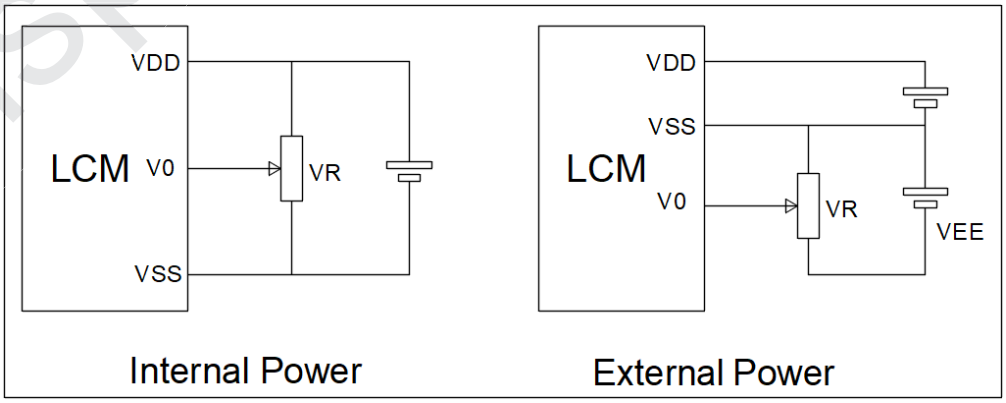
2.2 Interface Pin Description

Pin No.	Symbol	External Connection	Function Description
1	VSS	Power Supply	Ground
2	VDD	Power Supply	Supply Voltage for Logic (+5.0V)
3	V0	Adj Power Supply	Contrast adjustment
4	RS	MPU	Register Select signal. RS=0: Command, RS=1: Data
5	R/W	MPU	Read/Write select signal, R/W=1: Read R/W: =0: Write
6	E	MPU	Operation Enable signal. Falling edge triggered.
7-10	DB0~DB3	MPU	Four low order bi-directional three-state data bus lines. These four are not used during 4-bit operation.
11-14	DB4~DB7	MPU	Four high order bi-directional three-state data bus lines.
15	LED+	Power Supply	Backlight Anode (+5.0V via on-board resistor)
16	LED-	Power Supply	Backlight Cathode (Ground)

2.3 Block diagram



2.4 Contrast adjust



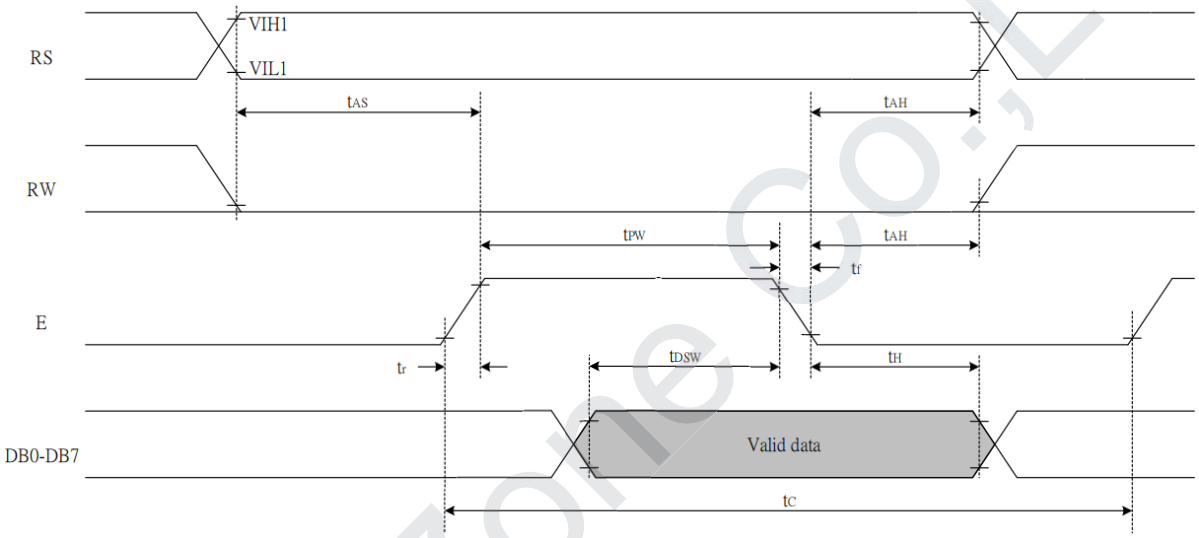
V_{DD}~V_0: LCD Driving voltage VR: 10k~20k

2.5 DISPLAY CHARACTER ADDRESS CODE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13
40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	50	51	52	53

2.6 Timing Characteristics

Write mode timing diagram



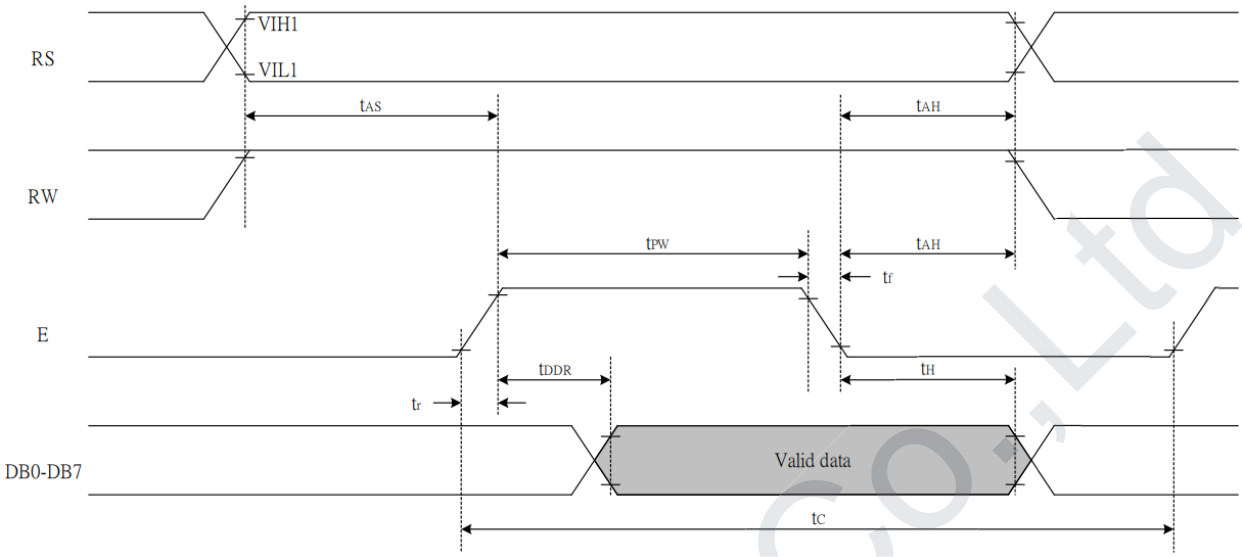
Write cycle (Ta=25℃, VDD=3.3V)

Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
Tc	Enable Cycle Time	Pin E	1200	-	-	ns
Tpw	Enable Pulse Width	Pin E	460	-	-	ns
TR,TF	Enable Rise/Fall Time	Pin E	-	-	25	ns
TAS	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
TAH	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
TDSW	Data Setup Time	Pins: DBO-DB7	80	-	-	ns
TH	Data Hold Time	Pins: DBO-DB7	10	-	-	ns

Write cycle (Ta=25℃, VDD=5.0V)

Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
Tc	Enable Cycle Time	Pin E	1200	-	-	ns
Tpw	Enable Pulse Width	Pin E	140	-	-	ns
TR,TF	Enable Rise/Fall Time	Pin E	-	-	25	ns
TAS	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
TAH	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
TDSW	Data Setup Time	Pins: DBO-DB7	40	-	-	ns
TH	Data Hold Time	Pins: DBO-DB7	10	-	-	ns

Read mode timing diagram



Read cycle (Ta=25℃, VDD=3.3V)

Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
Tc	Enable Cycle Time	Pin E	1200	-	-	ns
Tpw	Enable Pulse Width	Pin E	480	-	-	ns
TR,TF	Enable Rise/Fall Time	Pin E	-	-	25	ns
TAS	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
TAH	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
TDDR	Data Setup Time	Pins: DBO-DB7	-	-	320	ns
TH	Data Hold Time	Pins: DBO-DB7	10	-	-	ns

Read cycle (Ta=25℃, VDD=5.0V)

Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
Tc	Enable Cycle Time	Pin E	1200	-	-	ns
Tpw	Enable Pulse Width	Pin E	140	-	-	ns
TR,TF	Enable Rise/Fall Time	Pin E	-	-	25	ns
TAS	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
TAH	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
TDDR	Data Setup Time	Pins: DBO-DB7	-	-	100	ns
TH	Data Hold Time	Pins: DBO-DB7	10	-	-	ns

2.7 Instruction description

2.71 Outline

To overcome the speed difference between the internal clock of ST7066U and the MPU clock, ST7066U performs internal operations by storing control in formations to IR or DR. The internal operation is determined according to the signal from MPU, composed of read/write and data bus.

Instructions can be divided largely into four groups:

1). ST7066U function set instructions (set display methods, set data length, etc.)

2). Address set instructions to internal RAM

3). Data transfer instructions with internal RAM

4). Others

The address of the internal RAM is automatically increased or decreased by 1.

Note: during internal operation, busy flag (DB7) is read “High”.

Busy flag check must be preceded by the next instruction.

2.72 Instruction Table

Instruction	Instruction Code										Description	Description Time (270KHz)
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM. and set DDRAM address to "00H" from AC	1.52 ms
Return Home	0	0	0	0	0	0	0	0	1	x	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.52 ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction and specifies display shift. These operations are performed during data write and read.	37 us
Display ON/OFF	0	0	0	0	0	0	1	D	C	B	D=1:entire display on C=1:cursor on B=1:cursor position on	37 us
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	x	x	Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.	37 us
Function Set	0	0	0	0	1	DL	N	F	x	x	DL:interface data is 8/4 bits N:number of line is 2/1 F:font size is 5x11/5x8	37 us
Set CGRAM address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter	37 us
Set DDRAM address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter	37 us
Read Busy flag and address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.	0 us
Write data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM)	37 us
Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM)	37 us

NOTE:

When an MPU program with checking the busy flag (DB7) is made, it must be necessary 1/2fosc is necessary for executing the next instruction by the falling edge of the “E” signal after the busy flag (DB7) goes to “Low”.

2.73 Contents

1）Clear display

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	0	0	0	1

Clear all the display data by writing “20H” (space code) to all DDRAM address, and set DDRAM address to “00H” into AC (address counter).
Return cursor to the original status, namely, bring the cursor to the left edge on the fist line of the display.
Make the entry mode increment (I/D=“High”).

2）Return home

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	0	0	1	-

Return home is cursor return home instruction.
Set DDRAM address to “00H” into the address counter.
Return cursor to its original site and return display to its original status, if shifted.
Contents of DDRAM does not change.

3）Entry mode set

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	0	1	I/D	SH

Set the moving direction of cursor and display.
I/D: increment / decrement of DDRAM address (cursor or blink)
When I/D=“high”, cursor/blink moves to right and DDRAM address is increased by 1.
When I/D=“Low”, cursor/blink moves to left and DDRAM address is increased by 1.
*CGRAM operates the same way as DDRAM, when reading from or writing to CGRAM.
SH: shift of entire display
When DDRAM read (CGRAM read/write) operation or SH=“Low”, shifting of entire display is not performed. If SH =“High” and DDRAM write operation, shift of entire display is performed according to I/D value. (I/D=“high”. shift left, I/D=“Low”. Shift right).

4）Display ON/OFF control

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	1	D	C	B

Control display/cursor/blink ON/OFF 1 bit register.
D: Display ON/OFF control bit
When D=“High”, entire display is turned on.
When D=“Low”, display is turned off, but display data remains in DDRAM.
C: cursor ON/OFF control bit
When D=“High”, cursor is turned on.
When D=“Low”, cursor is disappeared in current display, but I/D register preserves its data.
B: Cursor blink ON/OFF control bit
When B=“High”, cursor blink is on, which performs alternately between all the “High” data and display characters at the cursor position.

When B=“Low”, blink is off.

5）Cursor or display shift

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	1	S/C	R/L	-	-

Shifting of right/left cursor position or display without writing or reading of display data.
This instruction is used to correct or search display data.
During 2-line mode display, cursor moves to the 2nd line after the 40th digit of the 1st line.
Note that display shift is performed simultaneously in all the lines.
When display data is shifted repeatedly, each line is shifted individually.
When display shift is performed, the contents of the address counter are not changed.

Shift patterns according to S/C and R/L bits

S/C	R/L	Operation
0	0	Shift cursor to the left, AC is decreased by 1
0	1	Shift cursor to the right, AC is increased by 1
1	0	Shift all the display to the left, cursor moves according to the display
1	1	Shift all the display to the right, cursor moves according to the display

6) Function set

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	DL	N	F	-	-

DL: Interface data length control bit
When DL=“High”, it means 8-bit bus mode with MPU.
When DL=“Low”, it means 4-bit bus mode with MPU. Hence, DL is a signal to select 8-bit or 4-bit bus mode.
When 4-but bus mode, it needs to transfer 4-bit data twice.
N: Display line number control bit
When N=“Low”, 1-line display mode is set.
When N=“High”, 2-line display mode is set.
F: Display line number control bit
When F=“Low”, 5x8 dots format display mode is set.
When F=“High”, 5x11 dots format display mode.

7) Set CGRAM address

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0

Set CGRAM address to AC.
The instruction makes CGRAM data available from MPU.

8) Set DDRAM address

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0

Set DDRAM address to AC.

This instruction makes DDRAM data available form MPU.
When 1-line display mode (N=LOW), DDRAM address is form “00H” to “4FH”.In 2-line display mode (N=High), DDRAM address in the 1st line form “00H” to “27H”, and DDRAM address in the 2nd line is from “40H” to “67H”.

9）Read busy flag & address

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0

This instruction shows whether ST7066U is in internal operation or not.
If the resultant BF is “High”, internal operation is in progress and should wait BF is to be LOW, which by then the nest instruction can be performed. In this instruction you can also read the value of the address counter.

10）Write data to RAM

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
1	0	D7	D6	D5	D4	D3	D2	D1	D0

Write binary 8-bit data to DDRAM/CGRAM.
The selection of RAM from DDRAM, and CGRAM, is set by the previous address set instruction (DDRAM address set, CGRAM address set).
RAM set instruction can also determine the AC direction to RAM.
After write operation. The address is automatically increased/decreased by 1, according to the entry mode.

11）Read data from RAM

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
1	1	D7	D6	D5	D4	D3	D2	D1	D0

Read binary 8-bit data from DDRAM/CGRAM.
The selection of RAM is set by the previous address set instruction. If the address set instruction of RAM is not performed before this instruction, the data that has been read first is invalid, as the direction of AC is not yet determined. If RAM data is read several times without RAM address instructions set before, read operation, the correct RAM data can be obtained from the second. But the first data would be incorrect, as there is no time margin to transfer RAM data.
In case of DDRAM read operation, cursor shift instruction plays the same role as DDRAM address set instruction, it also transfers RAM data to output data register.
After read operation, address counter is automatically increased/decreased by 1 according to the entry mode.
After CGRAM read operation, display shift may not be executed correctly.

NOTE: In case of RAM write operation, AC is increased/decreased by 1 as in read operation.
At this time, AC indicates next address position, but only the previous data can be read by the read instruction.

2.74 Initial Program Code Example

➢ **Initial Program Code Example For 8051 MPU(8 Bit Interface):**

```
;-------------------------------------------------------------------------------
INITIAL_START:
        CALL    DELAY40mS

        MOV     A,#38H          ;FUNCTION SET
        CALL    WRINS_NOCHK     ;8 bit,N=1,5*7dot
        CALL    DELAY37uS

        MOV     A,#38H          ;FUNCTION SET
        CALL    WRINS_NOCHK     ;8 bit,N=1,5*7dot
        CALL    DELAY37uS

        MOV     A,#0FH          ;DISPLAY ON
        CALL    WRINS_CHK
        CALL    DELAY37uS

        MOV     A,#01H          ;CLEAR DISPLAY
        CALL    WRINS_CHK
        CALL    DELAY1.52mS

        MOV     A,#06H          ;ENTRY MODE SET
        CALL    WRINS_CHK       ;CURSOR MOVES TO RIGHT
        CALL    DELAY37uS
;-------------------------------------------------------------------------------
MAIN_START:

        XXXX
        XXXX
        XXXX
        XXXX
          .
          .
          .
          .
;-------------------------------------------------------------------------------
WRINS_CHK:
        CALL    CHK_BUSY
WRINS_NOCHK:
        CLR     RS                      ;EX:Port 3.0
        CLR     RW                      ;EX:Port 3.1
        SETB    E                       ;EX:Port 3.2
        MOV     P1,A                    ;EX:Port 1=Data Bus
        CLR     E
        MOV     P1,#FFH                 ;For Check Busy Flag
        RET
;-------------------------------------------------------------------------------
CHK_BUSY:                               ;Check Busy Flag
        CLR     RS
        SETB    RW
        SETB    E
        JB      P1.7,$
        CLR     E
        RET
```

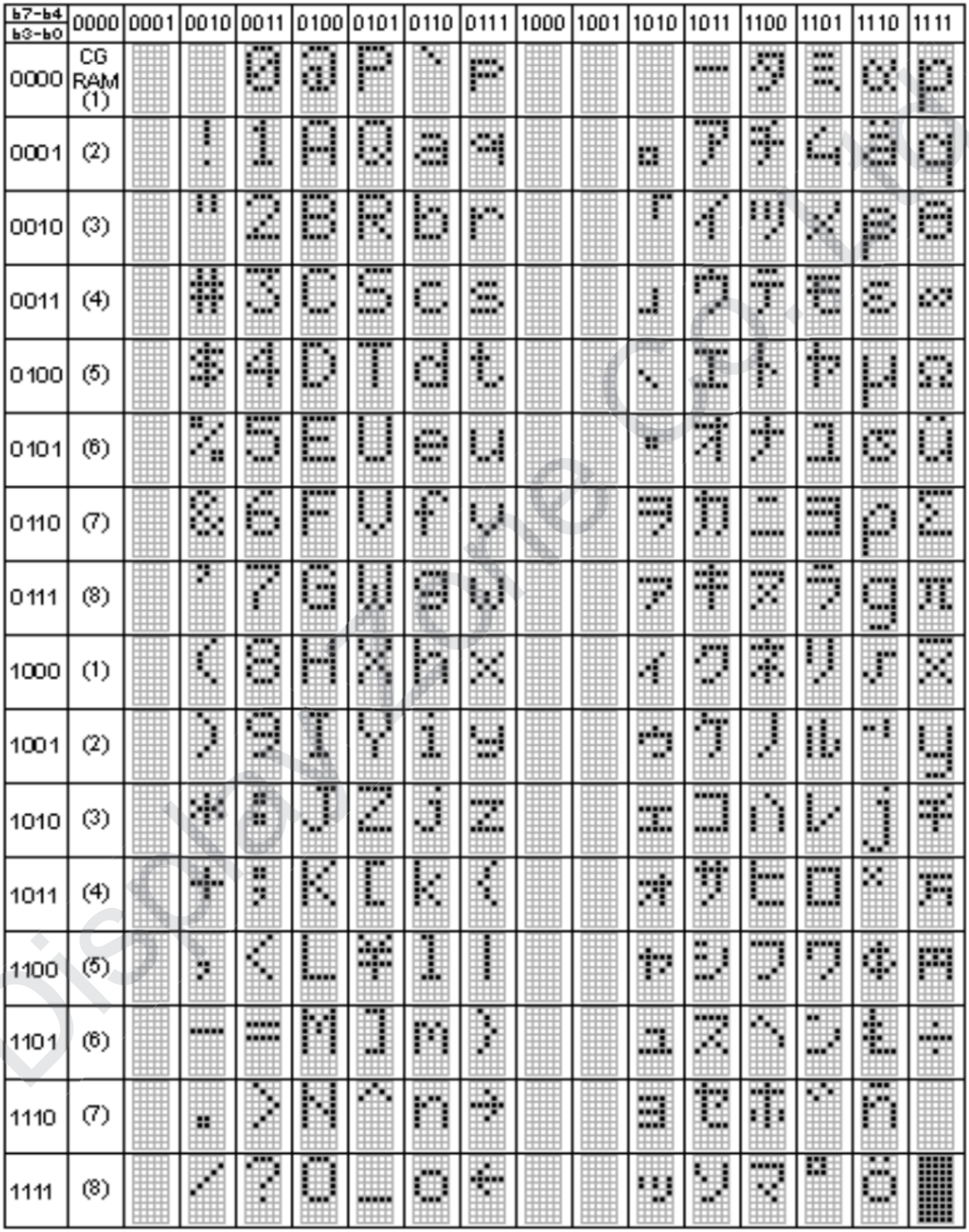
➢ **Initial Program Code Example For 8051 MPU(4 Bit Interface):**

```
;-----------------------------------------------------------------
INITIAL_START:
        CALL    DELAY40mS

        MOV     A,#38H          ;FUNCTION SET
        CALL    WRINS_ONCE      ;8 bit,N=1,5*7dot
        CALL    DELAY37uS

        MOV     A,#28H          ;FUNCTION SET
        CALL    WRINS_NOCHK     ;4 bit,N=1,5*7dot
        CALL    DELAY37uS

        MOV     A,#28H          ;FUNCTION SET
        CALL    WRINS_NOCHK     ;4 bit,N=1,5*7dot
        CALL    DELAY37uS

        MOV     A,#0FH          ;DISPLAY ON
        CALL    WRINS_CHK
        CALL    DELAY37uS

        MOV     A,#01H          ;CLEAR DISPLAY
        CALL    WRINS_CHK
        CALL    DELAY1.52mS

        MOV     A,#06H          ;ENTRY MODE SET
        CALL    WRINS_CHK
        CALL    DELAY37uS
;-----------------------------------------------------------------
MAIN_START:
        XXXX
        XXXX
        XXXX
        XXXX
          .
          .
          .
          .
          .
          .
          .
          .
          .
          .
```

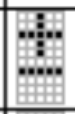
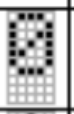
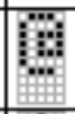
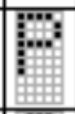
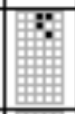
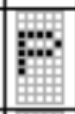
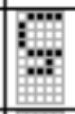
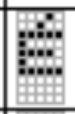
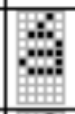
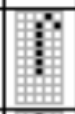
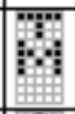
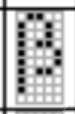
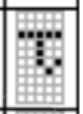
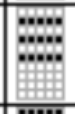
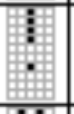
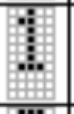
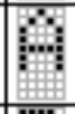
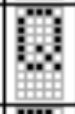
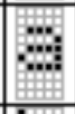
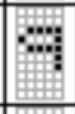
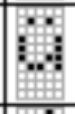
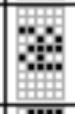
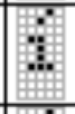
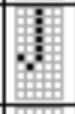
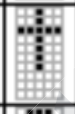
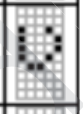
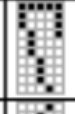
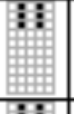
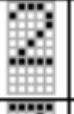
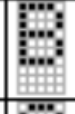
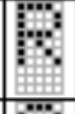
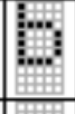
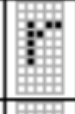
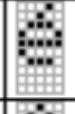
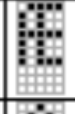
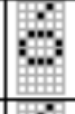
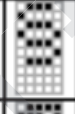
```
;-----------------------------------------------------------------
WRINS_CHK:
        CALL    CHK_BUSY
WRINS_NOCHK:
        PUSH    A
        ANL     A,#F0H
        CLR     RS              ;EX:Port 3.0
        CLR     RW              ;EX:Port 3.1
        SETB    E               ;EX:Port 3.2
        MOV     P1,A            ;EX:Port1=Data Bus
        CLR     E
        POP     A
        SWAP    A
WRINS_ONCE:
        ANL     A,#F0H
        CLR     RS
        CLR     RW
        SETB    E
        MOV     P1,A
        CLR     E
        MOV     P1,#FFH         ;For Check Bus Flag
        RET
;-----------------------------------------------------------------
CHK_BUSY:                       ;Check Busy Flag
        PUSH    A
        MOV     P1,#FFH
$1
        CLR     RS
        SETB    RW
        SETB    E
        MOV     A,P1
        CLR     E
        MOV     P1,#FFH
        CLR     RS
        SETB    RW
        SETB    E
        NOP
        CLR     E
        JB      A.7,$1
        POP     A
        RET
```

2.8 Character Generator ROM

English /Japan



English / European

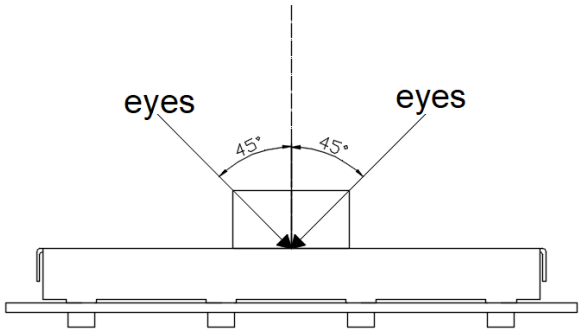
b7-b4 / b3-b0	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	CG RAM (1)															
0001	(2)															
0010	(3)															
0011	(4)															
0100	(5)															
0101	(6)															
0110	(7)															
0111	(8)															
1000	(1)															
1001	(2)															
1010	(3)															
1011	(4)															
1100	(5)															
1101	(6)															
1110	(7)															
1111	(8)															

English / European

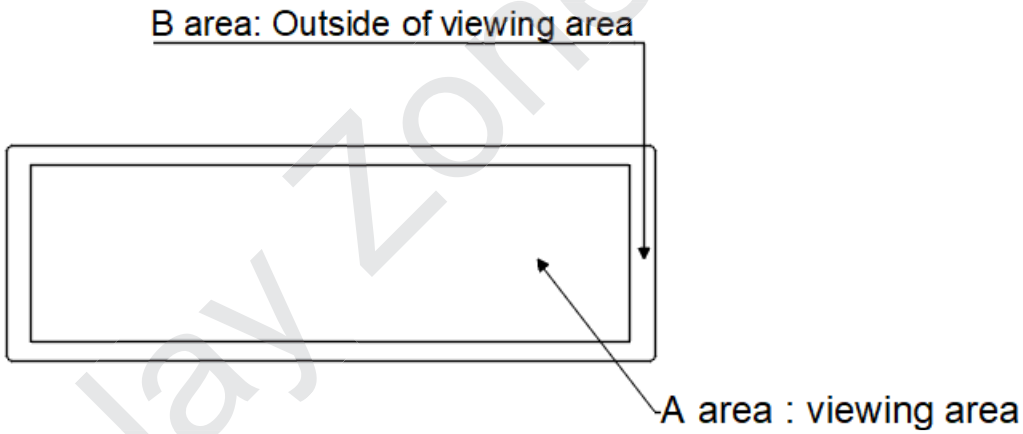
2.9 Quality Specifications

Inspection Standard : MIL-STD-105E Table Normal Inspection Single Sampling Level I.
Equipment: Gauge, MIL-STD、Powertip Tester、Sample
Defect Level : Major Defect AQL 0.4; Minor Defect AQL 1.5.
OUT Going Defect Level : Sampling.
Manner of appearance test:

1). The test be under 40Wx2 fluorescent light ' and distance of view must be at 30 cm.
2). The test direction is base on about around 45° of vertical line. (Fig. 1)
3). Definition of area. (Fig. 2)



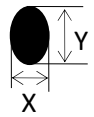
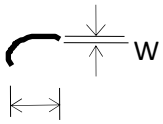
(Fig. 1)



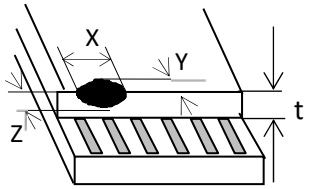
(Fig. 2)

Specification:

NO	Item	Criterion	Level
01	Product condition	1.1 The part number is inconsistent with work order of Production.	Major
		1.2 Mixed production types.	Major
		1.3 Assembled in inverse direction.	Major
02	Quantity	2.1 The quantity is inconsistent with work order of production.	Major
03	Outline dimension	3.1 Product dimension and structure must conform to Structure diagram	Major
04	Electrical Testing	4.1 Missing line character、dot and icon.	Major
		4.2 No function or no display.	Major
		4.3 Output data is error.	Major
		4.4 LCD viewing angle defect.	Major
		4.5 Current consumption exceeds product specifications.	Major

05	Black or white dot、scratch、contamination Round type  ϕ = (X+Y)/2  	5.1 Round type: 5.1.1 display only: • White and black spots on display 0.25mm, no more than Four white or black spots present. • Densely spaced: NO more than two spots or lines with in 3mm 5.1.2 Nom-display: Dimension (diameter: Φ) Acceptance(Q'ty) Φ≤0.20mm Accept no dense 0.10mm<Φ≤0.20mm 3 0.20mm<Φ≤0.25mm 2 Total 4 5.1.3 Line type: Dimension (diameter : Φ) Acceptance (Q'ty) Length width A area B area --- w≤0.03mm Accept no dense Don't counts L≤3.0mm 0.03mm<Φ≤0.05mm 4 Don't count L≤2.5mm 0.05mm<Φ0.075mm Don't count --- w>0.075mm As round type	Minor
06	Polarizer Bubble	Dimension (diameter: Φ) Acceptance(Q'ty) A area B area Φ≤0.20mm Accept no dense Don't count 0.20mm<Φ≤0.50mm 3 Don't count 0.50mm<Φ≤1.00mm 2 Don't count Φ>1.00mm 0 Don't count Total quantity 4 Don't count	Minor

<table>
<tr>
<td>07</td>
<td>Chip

Remark:
X: Length direction
Y: Short direction
Z: Thickness direction
t: Glass thickness
W: Terminal Width</td>
<td>


Acceptable criterion
<table>
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<tr><td>≤2</td><td>0.5mm</td><td>≤t/2</td></tr>
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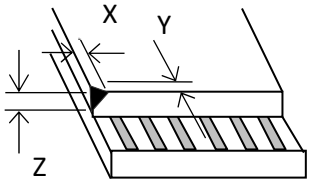

Acceptable criterion
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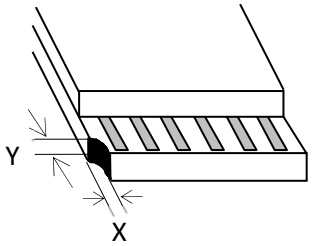

Acceptable criterion
<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>≤3</td><td>≤2</td><td rowspan="2">≤t</td></tr>
<tr><td colspan="2">shall not reach to ITO</td></tr>
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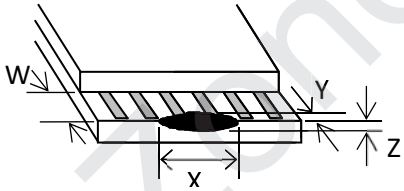

Acceptable criterion
<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>Disregard</td><td>≤0.2</td><td>≤t</td></tr>
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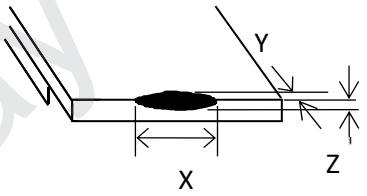
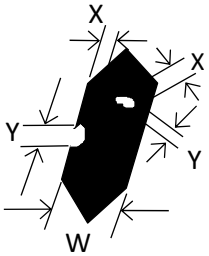
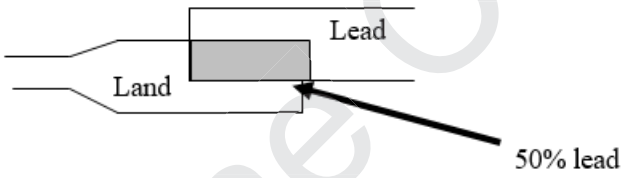
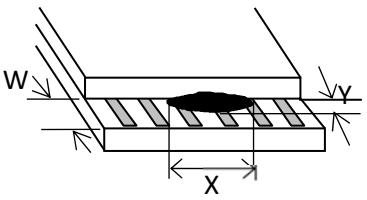
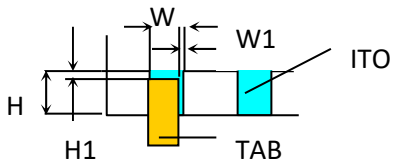


Acceptable criterion
<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>≤5</td><td>≤2</td><td>≤t/3</td></tr>
</table>
</td>
<td>Minor</td>
</tr>
<tr>
<td>08</td>
<td>Segment pattern
W = Segment width
ϕ = (X+Y)/2</td>
<td>
(1) Pin hole
ϕ < 0.10mm is acceptable.


<table>
<tr><th>Point Size</th><th>Acceptable Qty</th></tr>
<tr><td>ϕ≤1/4W</td><td>Disregard</td></tr>
<tr><td>1/4W< ϕ≤1/2W</td><td>1</td></tr>
<tr><td>ϕ>1/2W</td><td>0</td></tr>
</table>
Unit: mm
</td>
<td>Minor</td>
</tr>
</table>

09	Backlight elements	（1） Backlight can't work normally. （2） Backlight doesn't light or color is wrong. （3） Illumination source flickers when lit.	Major
10	Soldering	（1） Not allow heavy dirty and solder ball on PCB. (The size of dirty refer to point and dust defect) （2） Over 50% of lead should be soldered on Land. 	Major
11	Wire	(1) Copper wire should not be rusted (2) Not allow crack on copper wire connection. (3) Not allow reversing the position of the flat cable. (4) Not allow exposed copper wire inside the flat cable.	Major
12	PCB	(1) Not allow screw rust or damage. (2) Not allow missing or wrong putting of component.	Major
13	Protruded W: Terminal Width	 Acceptable criteria: $Y \leq 0.4$	Major

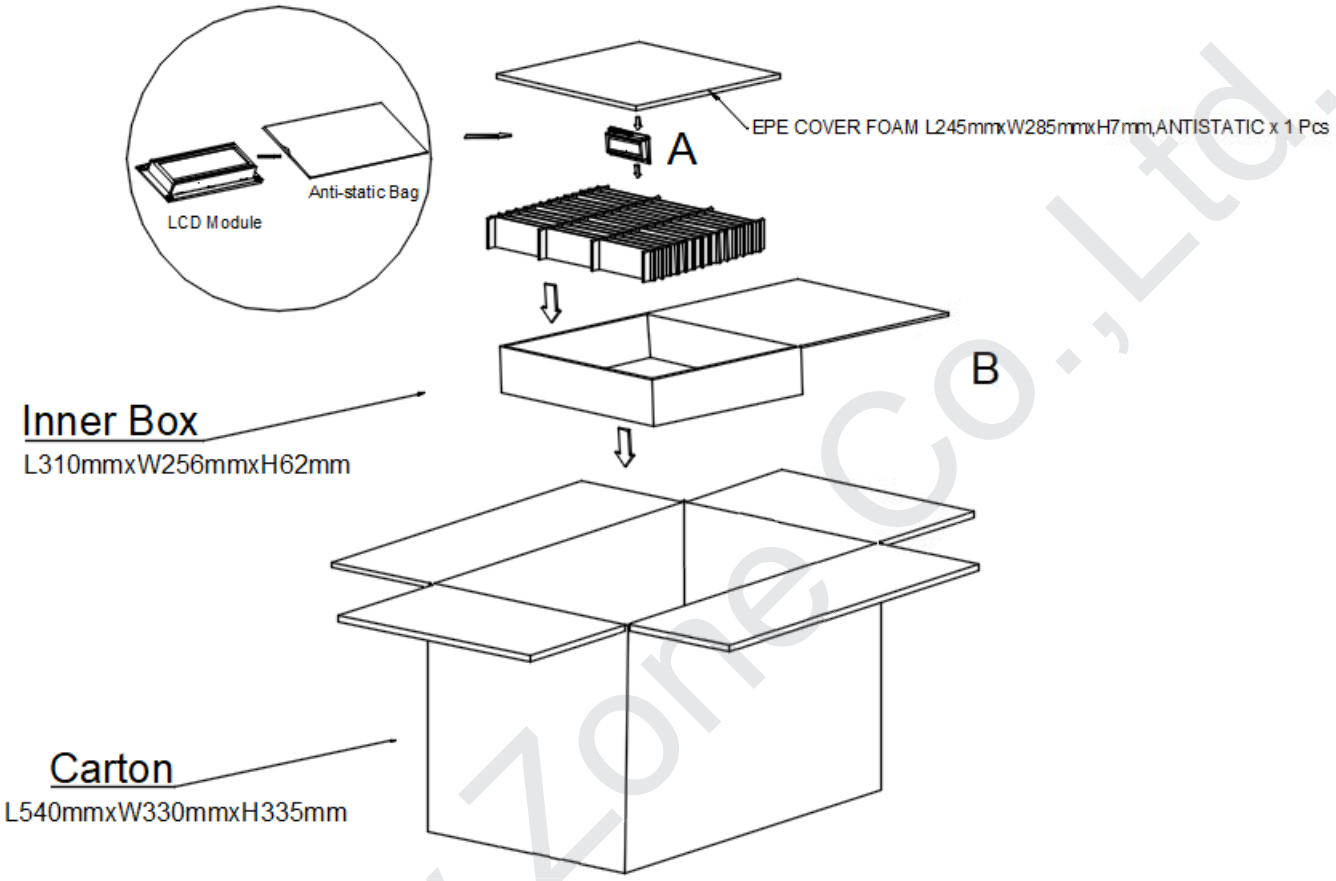
14	TAB	1）Position  W1≤1/3W H1≤1/3H	Major
15	Total no. of acceptable Defect	A.Zone Maximum 2 minor non-conformities per one unit. Defect distance: each point to be separated over 10mm B. Zone It is acceptable when it is no trouble for quality and assembly in customer's end product.	Major

Reliability test condition:

Item	Content	Condition	Note
High Temperature storage	Endurance test applying the high storage temperature for a long time.	+80°C,48hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	+80°C,48hrs	1，2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C 48hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C,48hrs	1，2
High Temperature / Humidity Operation	Endurance test applying the electric stress (voltage & current) and the high thermal with high humidity stress for a long time.	+40°C,90% RH, 48hrs	1，2
Thermal Shock resistance	Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress.	0°C,30min->25°C,5min->50°C,30min = 1 cycle 10 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-55Hz, 15mm amplitude.60 sec in each of 3 directions X,Y,Z For 15 minutes	3
Static electricity test	Endurance test applying electric static discharge.	VS=800V, RS=1.5kΩ, CS=100pF One time	

Note 1: No condensation to be observed.
Note 2: Conducted after 4 hours of storage at 25°C, 0%RH.
Note 3: Test performed on product itself, not inside a container.

3.0 Package Specifications



Item	Quantity
LCD Module （A）	1-45 Per Inner Box (45 as Major / Maximum)
Inner Box （B）	1-10 Per Carton (10 as Major / Maximum)

4.0 Precautions When Using These LCM Display Modules

Precaution for using LCD/LCM

LCD/LCM is assembled and adjusted with a high degree of precision. Do not attempt to make any alteration or modification. The followings should be noted.

General Precautions:

1). LCD panel is made of glass. Avoid excessive mechanical shock or applying strong pressure onto the surface of display area.

2). The polarizer used on the display surface is easily scratched and damaged. Extreme care should be taken when handling. To clean dust or dirt off the display surface, wipe gently with cotton, or other soft material soaked with isoproply alcohol, ethyl alcohol or trichlorotriflorothane, do not use water, ketone or

aromatics and never scrub hard.
3). Do not tamper in any way with the tabs on the metal frame.
4). Do not make any modification on the PCB without consulting Display Zone
5). When mounting a LCM, make sure that the PCB is not under any stress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.
6). Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels and also cause rainbow on the display.
7). Be careful not to touch or swallow liquid crystal that might leak from a damaged cell. Any liquid crystal adheres to skin or clothes, wash it off immediately with soap and water.

Static Electricity Precautions:
1). CMOS-LSI is used for the module circuit; therefore operators should be grounded whenever he/she comes into contact with the module.
2). Do not touch any of the conductive parts such as the LSI pads; the copper leads on the PCB and the interface terminals with any parts of the human body.
3). Do not touch the connection terminals of the display with bare hand; it will cause disconnection or defective insulation of terminals.
4). The modules should be kept in anti-static bags or other containers resistant to static for storage.
5). Only properly grounded soldering irons should be used.
6). If an electric screwdriver is used, it should be grounded and shielded to prevent sparks.
7). The normal static prevention measures should be observed for work clothes and working benches.
8). Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

Soldering Precautions:
1). Soldering should be performed only on the I/O terminals.
2). Use soldering irons with proper grounding and no leakage.
3). Soldering temperature: 280°C +10°C
4). Soldering time: 3 to 4 second.
5). Use eutectic solder with resin flux filling.
6). If flux is used, the LCD surface should be protected to avoid spattering flux.
7). Flux residue should be removed.

Operation Precautions:
1). The viewing angle can be adjusted by varying the LCD driving voltage Vo.
2). Since applied DC voltage causes electro-chemical reactions, which deteriorate the display, the applied pulse waveform should be a symmetric waveform such that no DC component remains. Be sure to use the specified operating voltage.
3). Driving voltage should be kept within specified range; excess voltage will shorten display life.
4). Response time increases with decrease in temperature.
5). Display color may be affected at temperatures above its operational range.
6). Keep the temperature within the specified range usage and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel-off or generate bubbles.
7). For long-term storage over 40°C is required, the relative humidity should be kept below 60%,and avoid

direct sunlight.

Limited Warranty

Display Zone LCDs and modules are not consumer products, but may be incorporated by Display Zone's customers into consumer products or components thereof, Display Zone does not warrant that its LCDs and components are fit for any such particular purpose.

The liability of Display Zone is limited to repair or replacement on the terms set forth below. Display Zone will not be responsible for any subsequent or consequential events or injury or damage to any personnel or user including third party personnel and/or user. Unless otherwise agreed in writing between Display Zone and the customer, Display Zone will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with Display Zone general LCD inspection standard . (Copies available on request)

No warranty can be granted if any of the precautions state in handling liquid crystal display above has been disregarded. Broken glass, scratches on polarizer mechanical damages as well as defects that are caused accelerated environment tests are excluded from warranty.

In returning the LCD/LCM, they must be properly packaged; there should be detailed description of the failures or defect.

Unless relevant quality agreements signed with customer and law enforcement, for a period of 12 months from date of production, all products (except automotive products) Display Zone will replace or repair any of its LCD/LCM modules which are found to be functional defect when inspected in accordance with Display Zone LCD/LCM acceptance standards (copies available upon request). Cosmetic/visual defects must be returned to Display Zone within 90 days of shipment. Confirmation of such date should be based on freight documents. The warranty liability of Display Zone is limited to repair and/or replacement on the terms above. Display Zone will not be responsible for any subsequent or consequential events.