	LCD MODULE SPECIFICATIONS	SPEC NO	
	GDW016-SB01	REV NO	2.00

Type: Standard
Model No. GDW016-SB01

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Revision History

Rev.	Issued Date	Revised Contents
1.0	2014.04.08	Initial Version
1.1	2014.04.15	Add the alternating pattern display sign
1.2	2014.08.06	Add Software Part

TECHNICAL SPECIFICATION

CONTENTS

1. Application

TheGDW016-SB01is an e-paper segment panel with EPD driver. The display size is 1.6 inch with segment panel which includes 112 segments, one COM and one background pins. The power consumption is very low, and the display quality and reliability is very suitable for product design-in of all kind of applications where low power consumption and readable under sunlight is strongly demanded in design.

2. Features

- High contrast segment display
- 112 segments design
- High reflectance
- Ultra wide viewing angle
- Ultra low power consumption
- Commercial temperature range
- EPD segment driver module
- IIC interface slave mode
- Low power charge pump with output programmable

3. Specification

No.	Item	Description
1	Display Type	Segment
2	Display Scale	Black, White
3	Contrast Ratio	10:1
4	Viewing Angle	180 degree Full Angle
5	Driving Voltage	+/-15V (Normal) , +/-18V (Max)
6	Driver Chip	Tt30120 COF
7	Power Consumption	0.5μA/cm^2 (Normal)
8	Reflectance	>35%
9	Response Time	240ms (Normal)
10	E-ink film Version	V220S
11	Operating Life	>1,000,000 times
12	Drive Mode	Segment Drive Directly
13	Operating Temperature	0~50℃
14	Storage Temperature	-20~70℃

4. Mechanical Specifications

Parameter	Specifications	Unit	Remark
Screen Size	1.6	Inch	--
View Area	31.5(L)*27(W)	mm	--
FPL	34.5(L)*28(W)	mm	--
Outline Dimension	73.4(L)*32(W)*0.6(T)	mm	--
Segment Number	112	segment	--
Display Scale	2		Black and White
Module Weight	2	g	

5. Driver IC Electrical Characteristics

5.1 Absolute Maximum Ratings

Symbol	Description	Rating	Unit
VDD	Supply Voltage	-0.5～+3.6	V
Vin	Input Voltage	-0.5～VDD+0.5	V
Vout	Output Voltage	-0.5～VDD+0.5	V
ESD	ESD Protection Human Mode	3	KV

5.2 Recommended Operating Conditions

Description	Symbol	Value			Unit
		Min	Typ	Max	
Working voltage	VDD	2.2	3	3.6	V
Driver supply voltage	Vdrv		30	32	V
Ripple	Vrip		200		mV
Hi-V1	Vpp15		15V		V,(load=15M ohm)
Hi-V2	Vpp30		30V		V,(load=15M ohm)
Stop mode current	Istop		0.1		μA
Pumping enable current	Icpen		350		μA
Input high voltage	VIH		0.8*VDD		V
Input low voltage	VIL		0.2*VDD		V
2-wires speed(SCL&SDA)	FI²C			1M	Hz
2-wires load capacitance	CI²C		15		pF

Note: 2-wires represent SCL & SDA pins

6. Software Part

6.1 driver control register

REGISTER Address	Data							
	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
$00H	Y008	Y007	Y006	Y005	Y004	Y003	Y002	Y001
$01H	Y016	Y015	Y014	Y013	Y012	Y011	Y010	Y009
$02H	Y024	Y023	Y022	Y021	Y020	Y019	Y018	Y017
$03H	Y032	Y031	Y030	Y029	Y028	Y027	Y026	Y025
$04H	Y040	Y039	Y038	Y037	Y036	Y035	Y034	Y033
$05H	Y048	Y047	Y046	Y045	Y044	Y043	Y042	Y041
$06H	Y056	Y055	Y054	Y053	Y052	Y051	Y050	Y049
$07H	Y064	Y063	Y062	Y061	Y060	Y059	Y058	Y057
$08H	Y072	Y071	Y070	Y069	Y068	Y067	Y066	Y065
$09H	Y080	Y079	Y078	Y077	Y076	Y075	Y074	Y073
$0AH	Y088	Y087	Y086	Y085	Y084	Y083	Y082	Y081
$0BH	Y096	Y095	Y094	Y093	Y092	Y091	Y090	Y089
$0CH	Y104	Y103	Y102	Y101	Y100	Y099	Y098	Y097
$0DH	Y112	Y111	Y110	Y109	Y108	Y107	Y106	Y105
$0EH	Y120	Y119	Y118	Y117	Y116	Y115	Y114	Y113
$0FH	#	#	#	#	#	#	Y122	Y121
$10H	CPEN	PUMPH	VPP15	CKCH	Load	OEB	VSEL1	VSEL0

Y1~Y122 output setting：

Y1~Y120 mapping to segment pins

Y121 correspond to COM(Common) pin

Y122 correspond to BG(Background) pin

The output voltage (0V,15V,30V) for Y[1:122] are selectable

Bit"n" = 1 , correspondence pins output VPP or half VPP

Bit"n" = 0 , correspondence pins output GND = 0V

Example：

If users wants Y9, Y11, Y13, Y15 would output VPP Y10, Y12, Y14,Y16 would output "0V"

Register $01H = 01010101

Register "$10h" bit7 "CPEN": Charge pump on / off

CPEN=1 , charge pump enable

CPEN=0 , charge pump disable

Register "$10h" bit6 "PUMPH"：Adjust VPP up to 30V or 40V

PUMPH=1：VPP up to 40V

PUMPH=0：VPP up to 30V

Register "$10h" bit5 "VPP15" ：Half VPP output switch

VPP15=1：Hi-V channels logic high will output VX5, the voltage equal to half VPP.

VPP15=0：Hi-V channels logic high will output VPP.

Table of Hi-V pumping setting

	PUMPH=1	PUMPH=0
VPP15=1	VPP=20V	VPP=15V
VPP15=0	VPP=40V	VPP=30V

Register"$10h" bit4 "CKCH"：Adjustable frequency of internal oscillator.
CKCH=1：Low frequency clock for driver.
CKCH=0：Faster frequency clock for driver.
Register"$10h" bit3 "Load"：Load or Latch Hi-V channels buffer for output synchronous
Load=1：Load data to Hi-V channel buffer
Load=0：Latch the data of all Hi-V channels
Register"$10h" bit2 "OEB"：Hi-V channel floating switch
OEB=1：All Hi-V channels switch to floating state (Hi impedance mode)
OEB=0：All Hi-V channels switch to output enable
Register"$10h" bit0~1 "VSEL0~1"：Adjustable internal reference voltage
All the selection show in Table3

VSEL[1：0]	V1D5
00	1.5V
01	1.6V
10	1.7V
11	1.8V

6.2 Program Example

(1)After tt30120 Reset,Power up charge pump.

```
void tj120disload()
{
    unsigned char tjdata16;
    //cpen    pumph    vpp15    ckch    load    oeb    vsel1    vsel0
    //1       0        1        1       0       1      0        0
    tjdata16=0xb4;
    ISendStr(tj120address,0x10,&tjdata16,1);
}
   delay   1s
```

(2)Open Voltage working on EPD

```
void tj120enload()
{
    unsigned char tjdata16;
    //cpen    pumph    vpp15    ckch    load    oeb    vsel1    vsel0
    //1       0        1        1       1       0      0        0
    tjdata16=0xb8;
```

```
        ISendStr(tj120address,0x10,&tjdata16,1);
    }
```

Different temperature need different working time:

0 ℃ ~ 10℃	600 ms【White --> Black	or	Black --> White】
11℃ ~ 20℃	360 ms【White --> Black	or	Black --> White】
21℃ ~ 50℃	250 ms【White --> Black	or	Black --> White】

(3)Close Voltage working on EPD

```
    void tj120disload()
    {
        unsigned char tjdata16;
        //cpen    pumph    vpp15    ckch    load    oeb    vsel1    vsel0
        //1       0        1        1       0       1      0        0
        tjdata16=0xb4;
        ISendStr(tj120address,0x10,&tjdata16,1);
    }
```

(4)Power down charge pump.

```
    void tj120powerdisable()
    {
        uchar tianjianiicram;
        //cpen    pumph    vpp15    ckch    load    oeb    vsel1    vsel0
        //0       0        1        1       0       1      0        0
        tianjianiicram=0x34;
        ISendStr(tj120address,0x10,&tianjianiicram,1);
    }
```

(5)Write all “1” to display segment. If the com value is 0,the corresponding segment will be black.

```
  for(i=0;i<15;i++)
    {
        tianjingdata[i]=0xff;
    }
    tianjingdata [15]=0x02;
    Sendtotianjiang120(0,tj120acttime);
    //tt30120 [0x00    to    0x0e      =0xff]
    //tt30120 [0x0f=0x02{bg==1,com==0}]
```

(6)Write all “0” to display segment. If the com value is 1,the corresponding segment will be white.

```
  for(i=0;i<15;i++)
    {
        tianjingdata[i]=0x00;
    }
    tianjingdata [15]=0x01;
```

```
Sendtotianjiang120(1,tj120acttime);
//tt30120 [0x00    to    0x0e      =0x00]
//tt30120 [0x0f=0x02{bg==0,com==1}]
```

(7)Now background is white,all segments are white.

```
We will set segment0 to black.
tianjingdata[0]=0x01;
for(i=1;i<15;i++)
{
      tianjingdata[i]=0x00;
}
tianjingdata [15]=0x02;
Sendtotianjiang120(0,tj120acttime);
//tt30120[0x00=0x01]
//tt30120[0x01    to    0x0e =0x00]
//tt30120[0x0f=0x01 {bg==0,com==0}]
```

6.3Control signal waveform

Format of one-byte(2-wires serial interface)

This byte could be $00H ~ $10H, see chapter2.3 EPD driver control register.

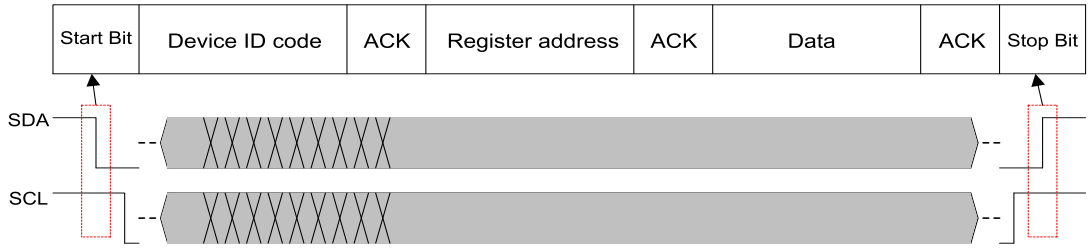


Figure 6

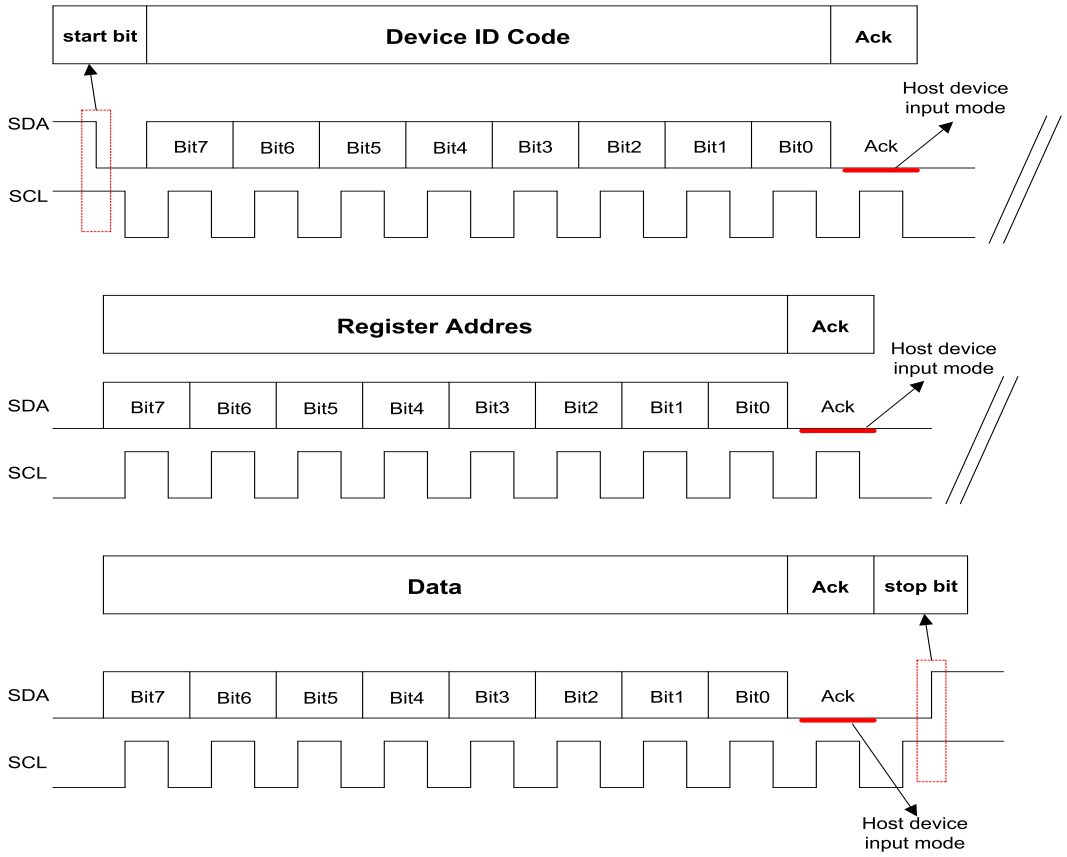


Figure 7

Device ID code：

ID code defined by (A0&A1) pins. See figure5 multi-driver application. Control signal input 8-bits “111100A1,A0” (A1,A0)=00,01,10,11 then only matched driver will operate.

Register address：

Address of control register from $00H ~ $10H. The control signal here follow Device ID code

Data of register：

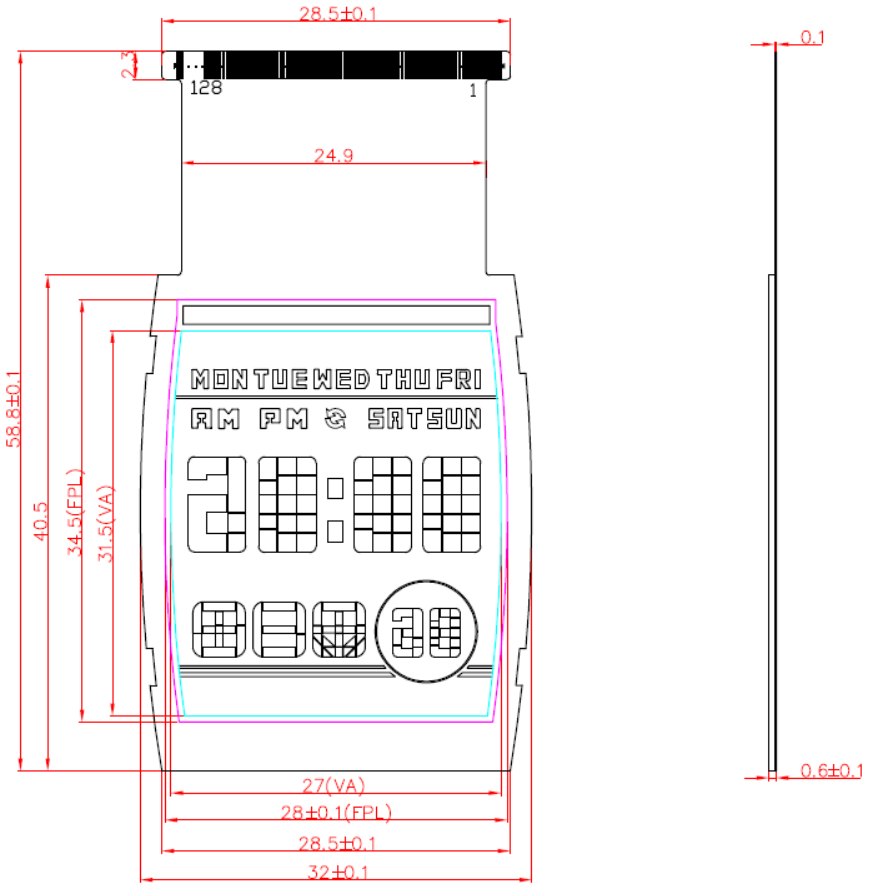
Definition of all control register see chapter2.3 EPD driver control register.

Condition setting

Perform with one driver and ID code (A1,A0)=00

7. Mechanical Drawing of Panel

7.1 Panel Physical Character (Unit: mm)



Notes：(Panel thickness: mm)

(1) FPL: 0.2

(2) FPC: 0.1

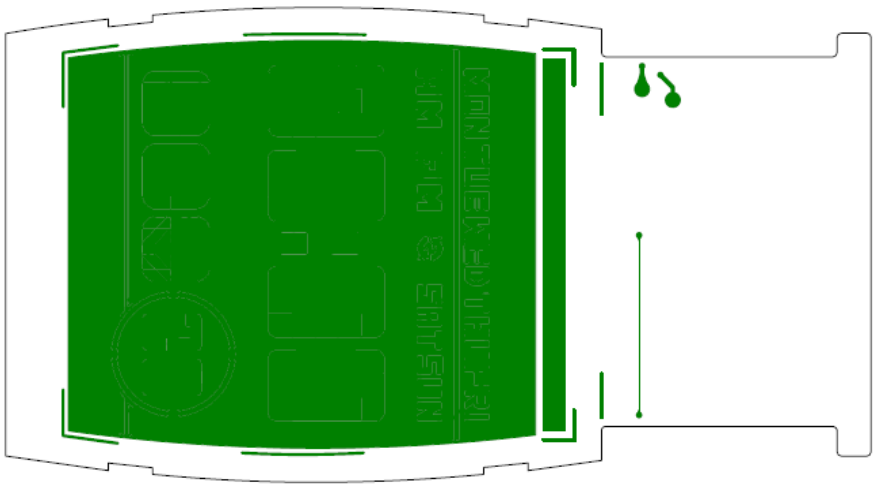
(3) PS: 0.2

(4) Aluminum: 0.1

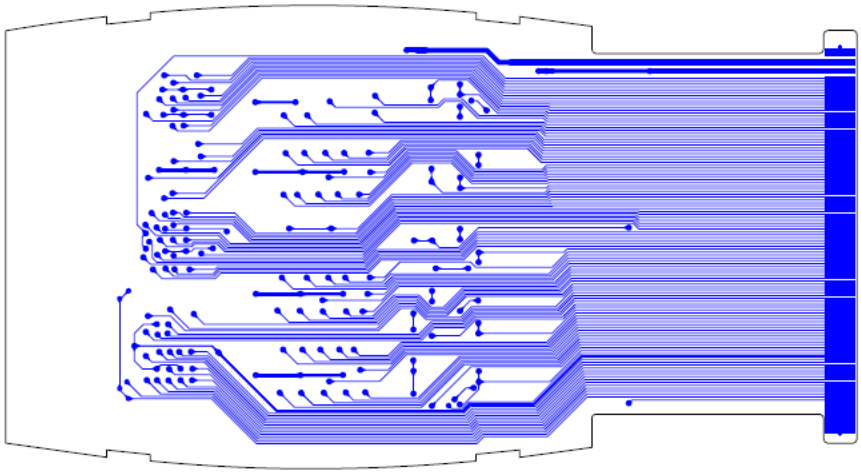
7.2 Layout Drawing

(1) Panel Layout

Top Side

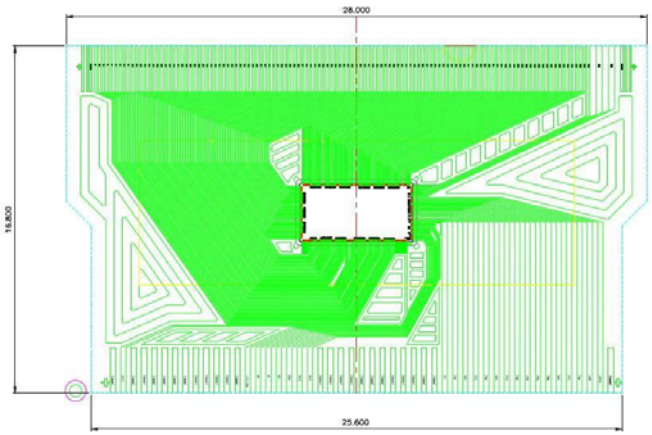


Bottom Side

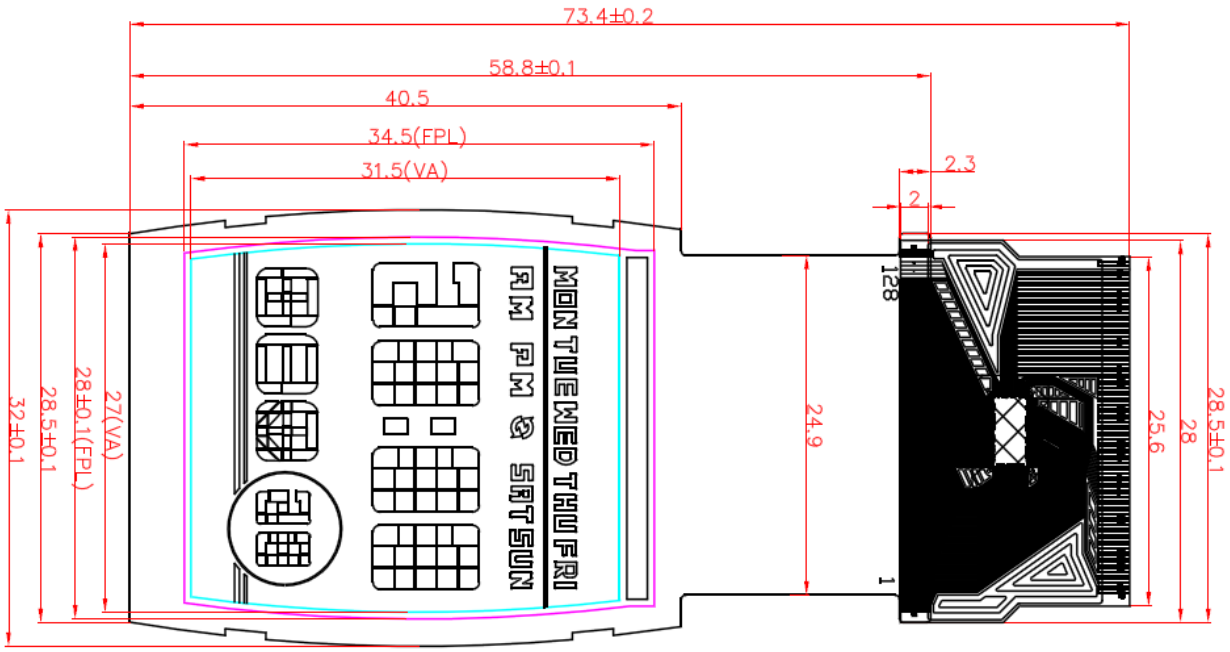


(2) Driver Layout

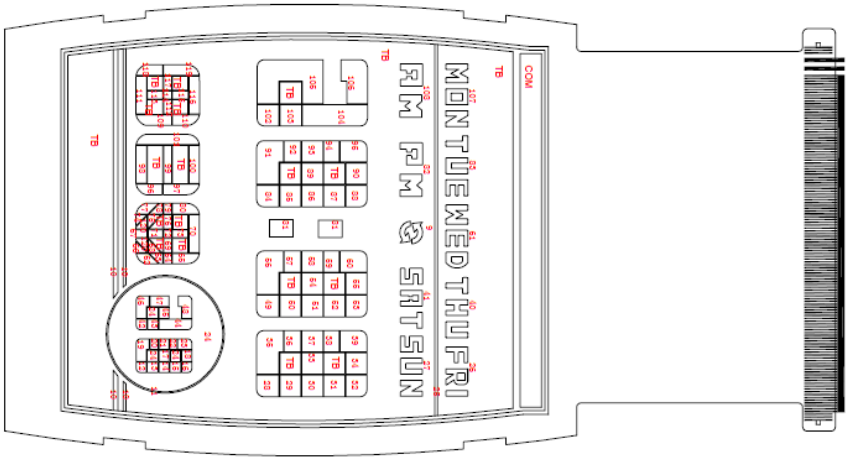
Top Side



(3) Assembling Drawing:



(5) Panel Segments Definition



7.3 Input/Output Terminals

Pin#	Signal	Description
1	V1D5	Charge pump reference voltage
2	LOGICEN	Select the control interface
		LOGICEN=1 2-wires serial interface
		LOGICEN=0 SPI interface
3	A0	Device ID setting bit0
4	A1	Device ID setting bit1
5	SCL	2-wires serial interface clock input
6	SDA	2-wires serial interface data input
7	GND	Negative power source
8	NC	
9	VDD	Positive power source
10	PP1	Positive terminal for charge pump capacitor
11	PM1	Negative terminal for charge pump capacitor
12	VX2	Charge pump output pin about 2.5V
13	PP2	Positive terminal for charge pump capacitor
14	PM2	Negative terminal for charge pump capacitor
15	VX3	Charge pump output pin about 5V
16	PP3	Positive terminal for charge pump capacitor
17	PM3	Negative terminal for charge pump capacitor
18	VX4	Charge pump output pin about 7.5V
19	PP4	Positive terminal for charge pump capacitor
20	PM4	Negative terminal for charge pump capacitor
21	VX5	Charge pump output pin about 15V
22	PP5	Positive terminal for charge pump capacitor
23	PM5	Negative terminal for charge pump capacitor
24	VPP	Charge pump output pin about 30V
25	NC	

8. Appearance Inspection Standard

8.1 Purpose

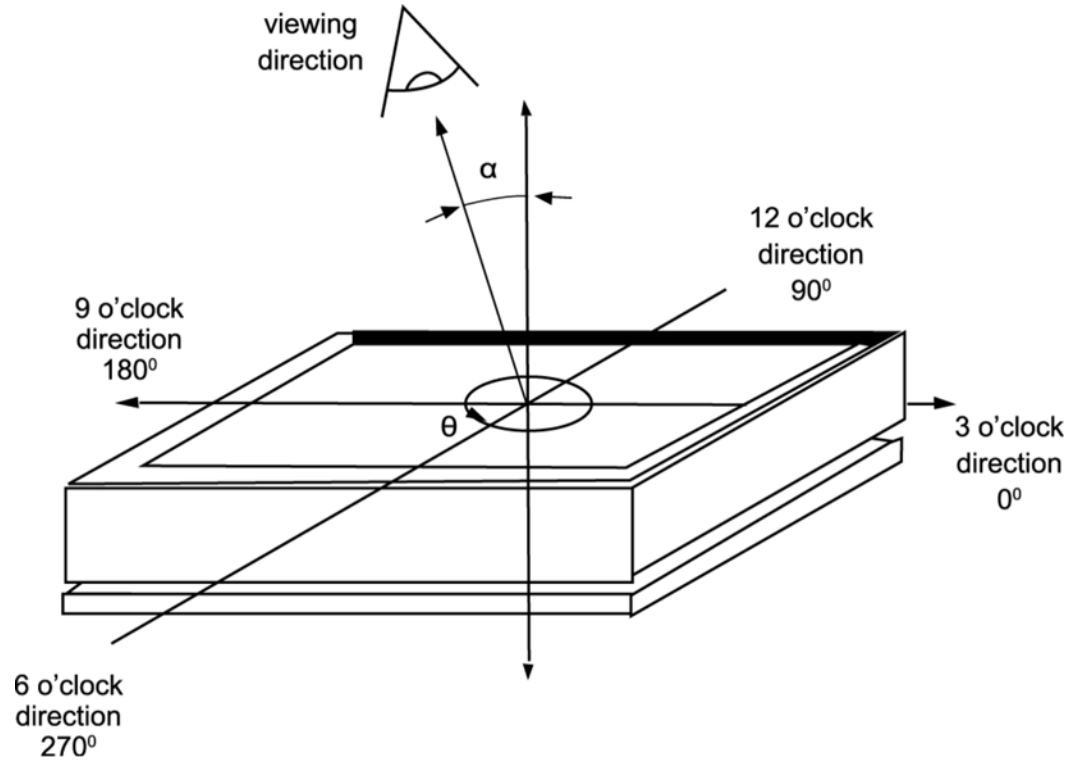
To establish and communicate a standardized method of inspecting segmented products (SDC/SDM) that are supplied by Good Display Holdings Inc. for cosmetic issues in a uniform and subjective way.

8.2 Inspection conditions

（1）Viewing Angle (Major X-Axis)

Item	Condition
α = 45°	Inspection under non-operating condition
α = 45°	Inspection under operating condition

*The inspection shall be carried within the viewing angle range



（2）Environmental testing and inspection

Item	Condition
Ambient Temperature	25±5℃
Ambient Humidity	40 ~70% RH
ESD	< ±200V

8.3 Sampling conditions

（1）Lot size: Quantity of shipment lot per model.

（2）Sampling type: Normal inspection, single sampling.

（3）Inspection Level: Level II.

The inspection level determines the relationship between the lot or batch size and the sample size. Three inspection levels: I, II, and III for general use & normally, inspection Level II is used. Sampling table: GB/T2828_1-2003, unless otherwise agreed in writing.

8.4 Acceptance Quality Level (AQL)

This is usually defined as the worst case quality level, in percentage or ratio, that is still considered as acceptable. An acceptable quality level is an inspection standard describing the maximum number of defects that could be considered acceptable during the random sampling of an inspection.

Item	**AQL level**
Major defect	0.65
Minor defect	1.5

8.5 Classification of defects

The defects found during inspection are sometimes classified as either a major or minor defect as defined below.

（1）Major defect

Major defects can result in the product's failure, reducing its marketability, usability or salability.

（2）Minor defect

Minor defects do not affect the product's marketability or usability, but represent workmanship defects that make the product fall short of defined quality standards.

8.6 Quality Criteria

Inspection conditions

Item	**Condition**
Ambient luminance	1000~1300 lux (Typical: 1150lux ± 150)
Ambient temperature	23℃± 5℃
Humidity	40~70 % RH
Supply voltage	As described in Specification sheet
Viewing distance	30 ± 10cm
Viewing Angle	45°

8.7 Specifications for Defects

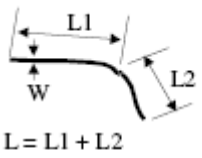
The following table outlines the allowable defect limits for the display cell.

Area of Interest	Type of Defect	Size (mm)	Allowable Quantity	Note
Active Area	Spot / bubble	D≤0.30	Ignore	
		0.3<D≤0.4	4	
		D>0.4	0	
	Line	L≤0.7，W≤0.2	2	
		L≤0.7，W>0.2	0	
		L>0.7	0	
	Barrier wrinkle	Not allowed		
Inactive Area	Spot / bubble	Zone A any size	Ignore	
		Zone B any size	Ignore	Defect may be partially or completely within Zone B.
Display Back	Foreign Material	D≤1.0	Ignore	
		D>1.0	0	
	Barrier wrinkle		Ignore	

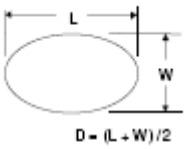
Note: Spot and Line defect specifications are applied to the entire Active Area of the display cell.

Figure 1 – Spot and Line Description

● Definition for L/W and D



Line Defect



Spot Defect

9. Reliability Test

	TEST	CONDITION	METHOD	REMARK
1	High-Temperature Operation	T = +50°C, RH = 30% for 240 hrs	IEC60068-2-2Bp	At the end of the test,electric,mechanical,and optical specifications shall be satisfied.
2	Low-Temperature Storage	T = -25°C for 240 hrs(Test In White Pattern)	IEC60068-2-1Ab	At the end of the test,electric,mechanical,and optical specifications shall be satisfied.
3	High-Temperature, High-Humidity Operation	T = +40°C, RH = 90% for 168 hrs	IEC60068-2-3Ca	At the end of the test,electric,mechanical, specifications shall be satisfied.
4	Temperature Cycle	1 cycle:[-25℃ 30min]→[+70℃ 30 min] : 100 cycles(Test In White Pattern)	IEC0068-2-14	At the end of the test,electric,mechanical,specifications shall be satisfied.
5	Package Drop Impact	Drop from height of 122 cm on concrete surface. Drop sequence: 1 corner, 3 edges, 6 faces One drop for each.	full packed for shipment	At the end of the test,electric,mechanical,and optical specifications shall be satisfied.

Actual EMC level to be measured on customer application

Note: The protective film must be removed before temperature test.

10. HANDLING, SAFETY AND ENVIROMENTAL REQUIREMENTS

CAUTION
The display module should not be exposed to harmful gases, such as acid and alkali gases, which corrode electronics components.
Disassembling the display module can cause permanent damage and invalidates the warranty agreements.

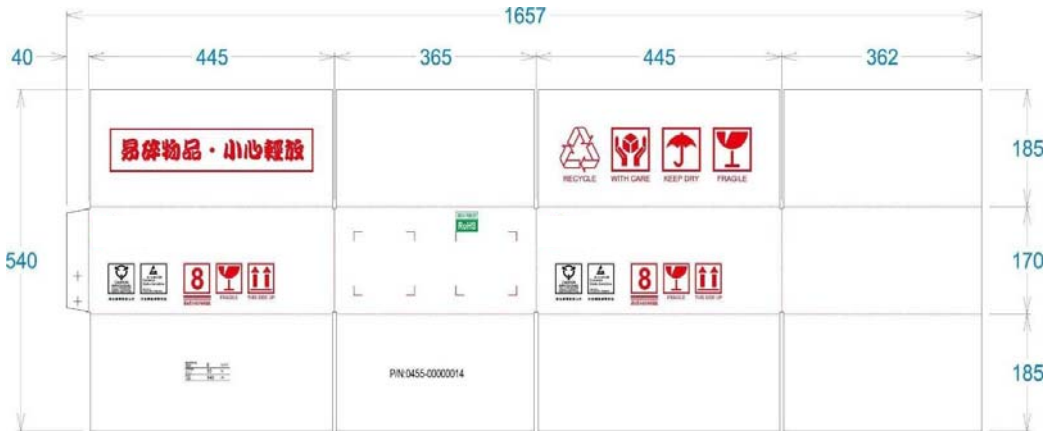
This part doesn't contain any substances which are specified as level-II in SS-00259.

Observe general precautions that are common to handling delicate electronic components. The glass can break and front surfaces can easily be damaged. Moreover the display is sensitive to static electricity and other rough environmental conditions.

Data sheet status	
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

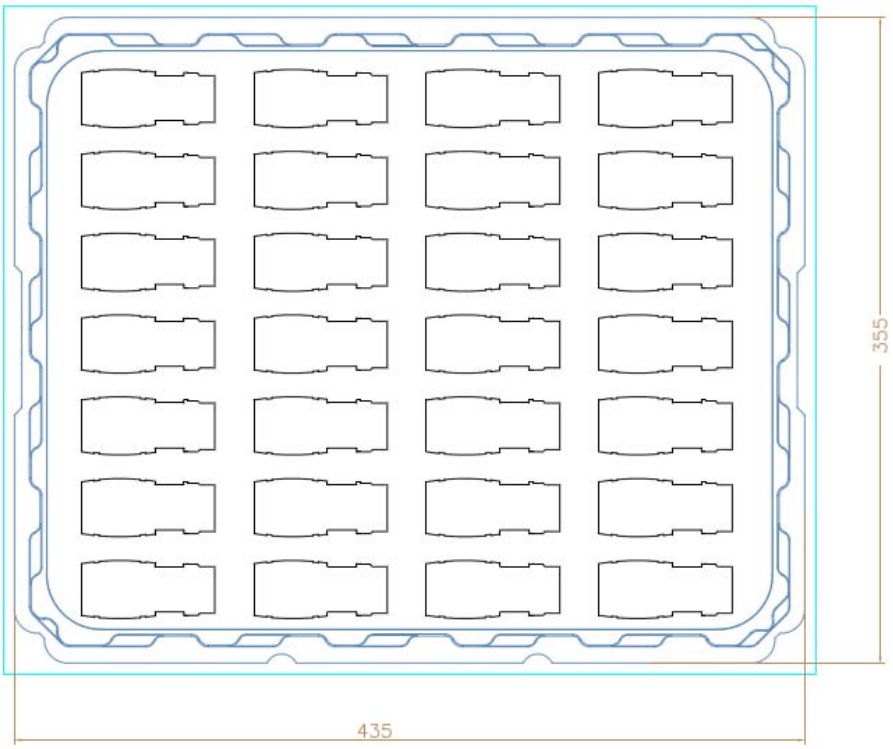
11. Packing

11.1 Carton 445 (L) * 365 (W) * 170(H) mm



11.2 Tray 435 (L) * 355 (W) *10.8(H) mm

@@ 28 pcs/tray



11.3 Antistatic bag 580 (L) * 450 (H) mm

11.4 Antirust * 2

11.5 Desiccant * 2

11.6 White foam * 2

11.7 Carton Label

@@ 21 Tray / Carton, 28*20 = 560 pcs Panel / carton.