Specification For HINK 2.13''EPD

Model NO.: HINK-E0213A195

Product VER:A0

Customer Approval

Customer	
Approval By	
Date Of Approval	

It will be agreed by the receiver,if not sign back the Specification within 15days.

Prepared By	Checked By	Approval By
June		

Version	Content	Date	Producer
A0	New release	2021/3/29	June

CONTENTS

1. General Description

HINK-E0213A195 is an Active Matrix Electrophoretic Display (AMEPD), with interface and a reference system design. The 2.13" active area contains 250×122 pixels, and has 1-bit B/W full display capabilities. An integrated circuit contains gate buffer, source buffer, interface, timing control logic, oscillator, DC-DC. SRAM.LUT, VCOM and border are supplied with each panel.

2. Features

- 250×122 pixels display
- High contrast
- High reflectance
- Ultra wide viewing angle
- Ultra low power consumption
- Pure reflective mode
- Bi-stable display
- Commercial temperature range
- Landscape, portrait modes
- Hard-coat antiglare display surface
- Ultra Low current deep sleep mode
- On chip display RAM
- Low voltage detect for supply voltage
- High voltage ready detect for driving voltage
- Internal temperature sensor
- 10-byte OTP space for module identification
- Waveform stored in On-chip OTP
- Serial peripheral interface available
- On-chip oscillator
- On-chip booster and regulator control for generating VCOM, Gate and Source driving voltage
- I2C signal master interface to read external temperature sensor/built-in temperature sensor

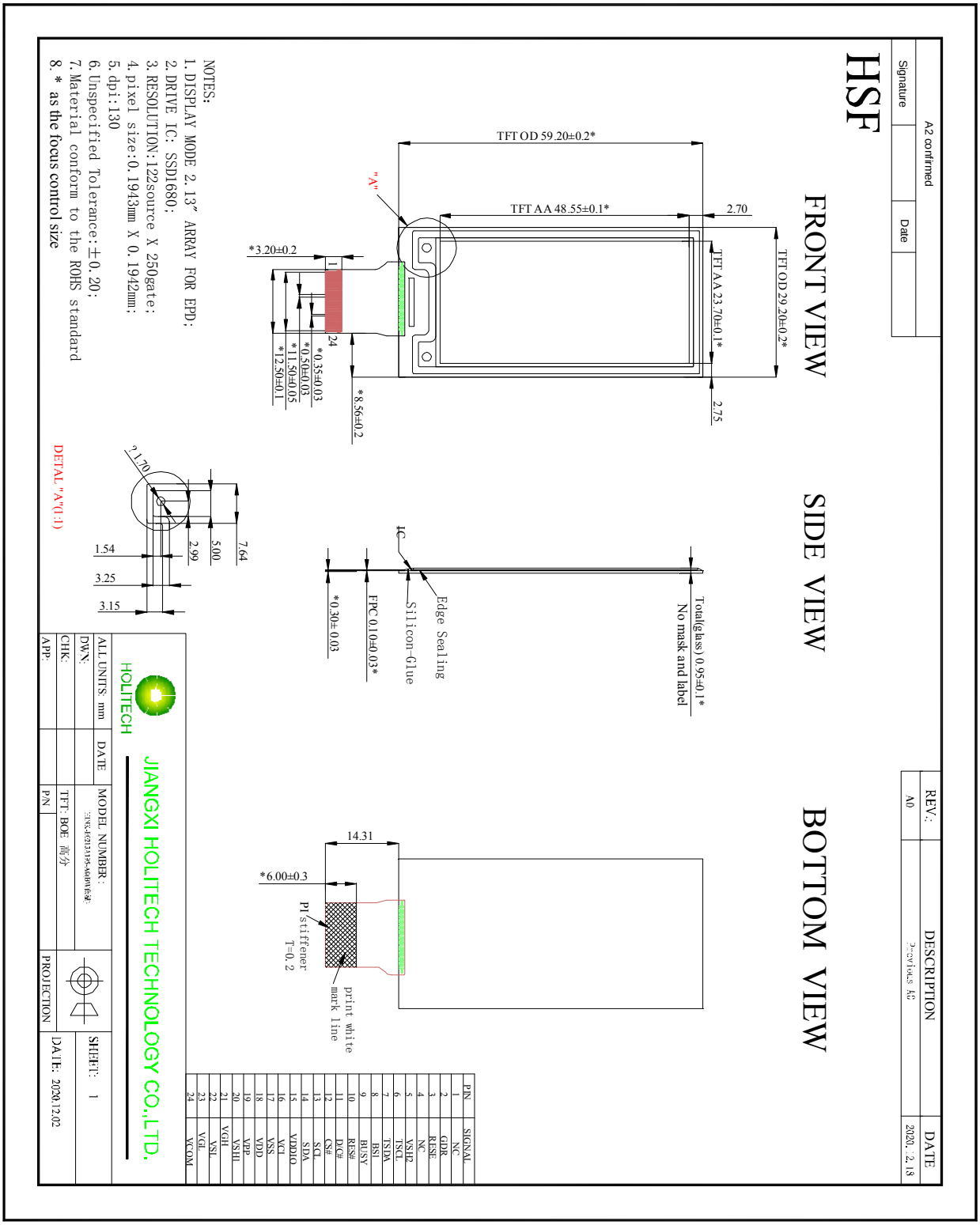
3. Application

Electronic Shelf Label System

4. Mechanical Specifications

Parameter	Specifications	Unit	Remark
Screen Size	2.13	Inch	
Display Resolution	122(H)×250(V)	Pixel	Dpi:130
Active Area	23.7(H)×48.55(V)	mm	
Pixel Pitch	0.1942×0.1943	mm	
Pixel Configuration	Rectangle		
Outline Dimension	29.2(H)×59.2 (V) ×0.95 (D)	mm	**Without masking film**
Weight	3.0±0.2	g	

5. Mechanical Drawing of EPD module



6. Input/Output Terminals

Pin #	Single	Description	Remark
1	NC	No connection and do not connect with other NC pins	Keep Open
2	GDR	N-Channel MOSFET Gate Drive Control	
3	RESE	Current Sense Input for the Control Loop	
4	NC	No connection and do not connect with other NC pins e	Keep Open
5	VSH2	This pin is Positive Source driving voltage	
6	TSCL	I2C Interface to digital temperature sensor Clock pin	
7	TSDA	I2C Interface to digital temperature sensor Date pin	
8	BS1	Bus selection pin	Note 6-5
9	BUSY	Busy state output pin	Note 6-4
10	RES #	Reset	Note 6-3
11	D/C #	Data /Command control pin	Note 6-2
12	CS #	Chip Select input pin	Note 6-1
13	SCL	serial clock pin (SPI)	
14	SDA	serial data pin (SPI)	
15	VDDIO	Power for interface logic pins	
16	VCI	Power Supply pin for the chip	
17	VSS	Ground	
18	VDD	Core logic power pin	
19	VPP	Power Supply for OTP Programming	
20	VSH1	This pin is Positive Source driving voltage	
21	VGH	This pin is Positive Gate driving voltage	
22	VSL	This pin is Negative Source driving voltage	
23	VGL	This pin is Negative Gate driving voltage	
24	VCOM	These pins are VCOM driving voltage	

Note 6-1: This pin (CS#) is the chip select input connecting to the MCU. The chip is enabled for MCU communication: only when CS# is pulled LOW.

Note 6-2: This pin (D/C#) is Data/Command control pin connecting to the MCU. When the pin is pulled HIGH, the data will be interpreted as data. When the pin is pulled LOW, the data will be interpreted as command.

Note 6-3: This pin (RES#) is reset signal input. The Reset is active low.

Note 6-4: This pin (BUSY) is Busy state output pin. When Busy is High the operation of chip should not be interrupted and any commands should not be issued to the module. The driver IC will put Busy pin High when the driver IC is working such as:

- Outputting display waveform; or
- Communicating with digital temperature sensor

Note 6-5: This pin (BS1) is for 3-line SPI or 4-line SPI selection. When it is "Low", 4-line SPI is selected. When it is "High", 3-line SPI (9 bits SPI) is selected.

7. MCU Interface

7.1 MCU interface selection

The HINK-E0213A195 can support 3-wire/4-wire serial peripheral interface. In the Module, the MCU interface is pin selectable by BS1 pins shown in.

Table 7-1: MCU interface selection

BS1	MPU Interface
L	4-lines serial peripheral interface (SPI)
H	3-lines serial peripheral interface (SPI) - 9 bits SPI

7.2 MCU Serial Peripheral Interface (4-wire SPI)

The 4-wire SPI consists of serial clock SCL, serial data SDA, D/C# and CS#,The control pins status in 4-wire SPI in writing command/data is shown in Table 7- 2and the write procedure 4-wire SPI is shown in Figue 7-2.

Table 7-2 : Control pins status of 4-wire SPI

Function	SCL pin	SDA pin	D/C# pin	CS# pin
Write command	↑	Command bit	L	L
Write data	↑	Data bit	H	L

Note:
(1) L is connected to VSS and H is connected to VDDIO
(2) ↑ stands for rising edge of signal

In the write mode, SDA is shifted into an 8-bit shift register on each rising edge of SCL in the order of D7, D6, ... D0. The level of D/C# should be kept over the whole byte. The data byte in the shift register is written to the Graphic Display Data RAM (RAM)/Data Byte register or command Byte register according to D/C# pin.

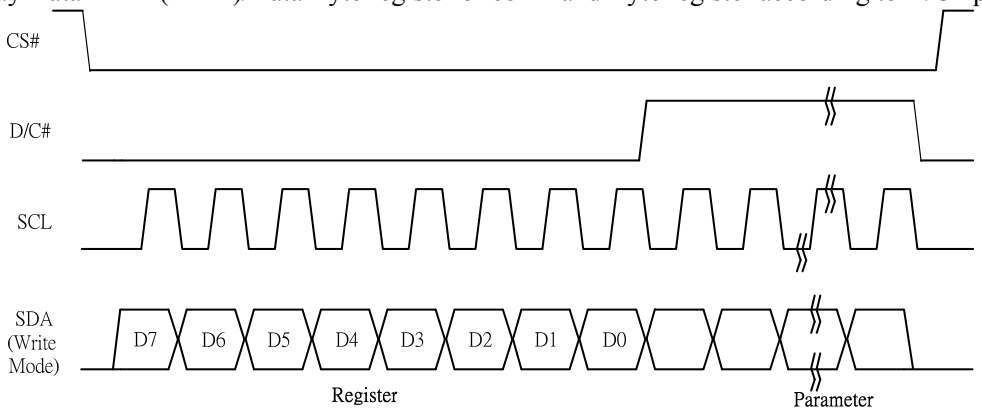


Figure 7-2: Write procedure in 4-wire SPI mode

In the Read mode:

1. After driving CS# to low, MCU need to define the register to be read.
2. SDA is shifted into an 8-bit shift register on each rising edge of SCL in the order of D7, D6, ... D0 with D/C# keep low.
3. After SCL change to low for the last bit of register, D/C# need to drive to high.
4. SDA is shifted out an 8-bit data on each falling edge of SCL in the order of D7, D6, … D0.
5. Depending on register type, more than 1 byte can be read out. After all byte are read, CS# need to drive to high to stop the read operation.

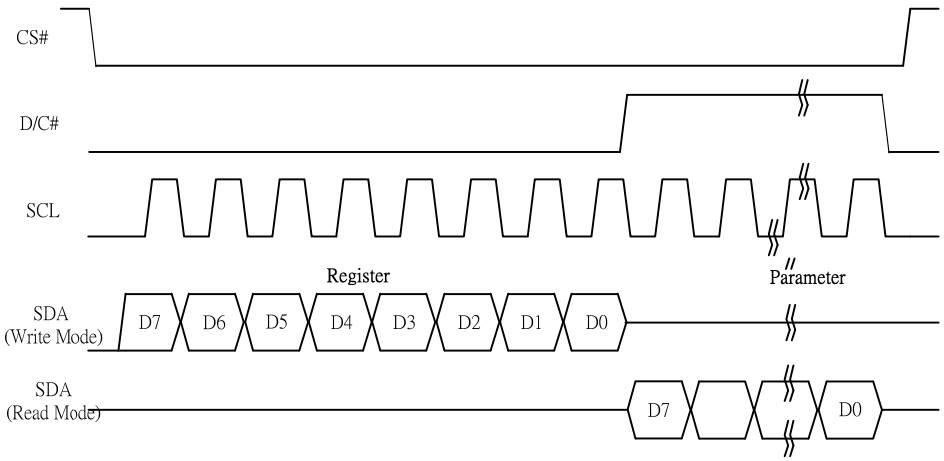


Figure 7-2: Read procedure in 4-wire SPI mode

7.3 MCU Serial Peripheral Interface (3-wire SPI)

The 3-wire SPI consists of serial clock SCL, serial data SDA and CS#. The operation is similar to 4-wire SPI while D/C# pin is not used and it must be tied to LOW. The control pins status in 3-wire SPI is shown in Table 7-3.

Table 7-3 : Control pins status of 3-wire SPI

Function	SCL pin	SDA pin	D/C# pin	CS# pin
Write command	↑	Command bit	Tie LOW	L
Write data	↑	Data bit	Tie LOW	L

Note:
(1)L is connected to V_{SS} and H is connected to V_{DDIO}
(2)↑ stands for rising edge of signal

In the write operation, a 9-bit data will be shifted into the shift register on each clock rising edge. The bit shifting sequence is D/C# bit, D7 bit, D6 bit to D0 bit. The first bit is D/C# bit which determines the following byte is command or data. When D/C# bit is 0, the following byte is command. When D/C# bit is 1, the following byte is data. shows the write procedure in 3-wire SPI

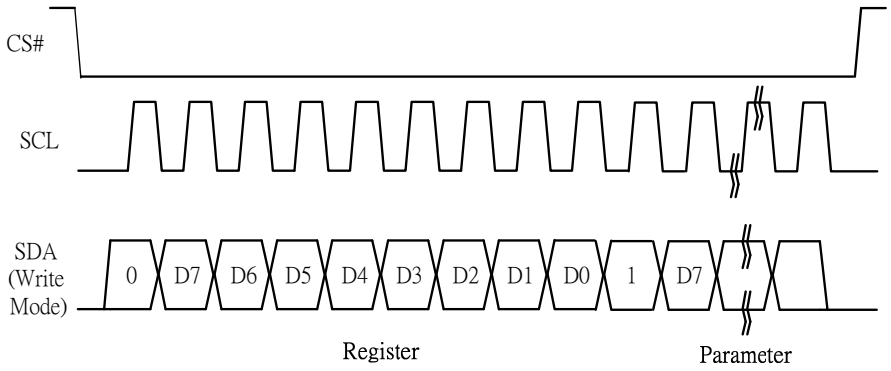


Figure 7-3: Write procedure in 3-wire SPI mode

In the Read mode:

1. After driving CS# to low, MCU need to define the register to be read.
2. D/C#=0 is shifted thru SDA with one rising edge of SCL
3. SDA is shifted into an 8-bit shift register on each rising edge of SCL in the order of D7, D6, ... D0.
4. D/C#=1 is shifted thru SDA with one rising edge of SCL
5. SDA is shifted out an 8-bit data on each falling edge of SCL in the order of D7, D6, … D0.
6. Depending on register type, more than 1 byte can be read out. After all byte are read, CS# need to drive to high to stop the read operation.

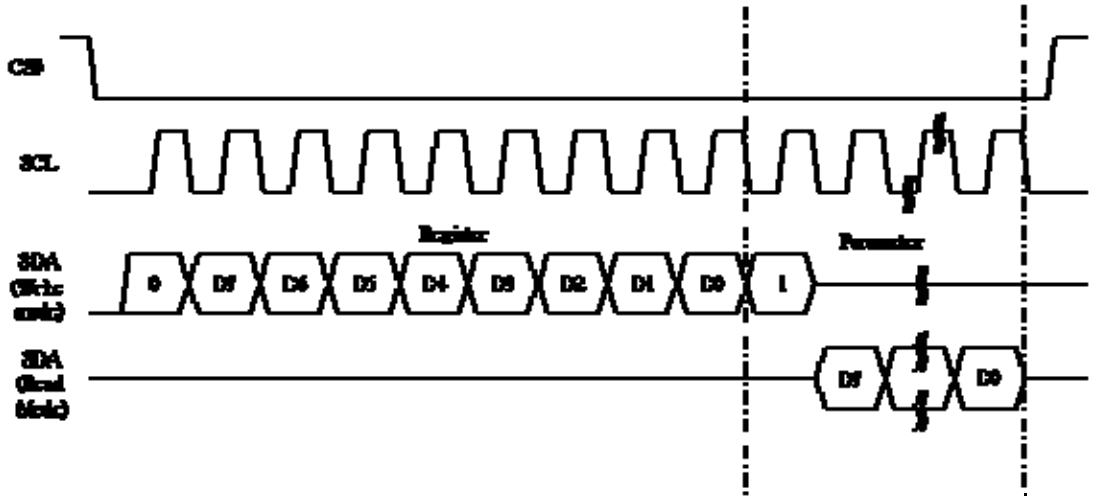


Figure 7-3: Read procedure in 3-wire SPI mode

8. Temperature sensor operation

Following is the way of how to sense the ambient temperature of the module. First, use an external temperature sensor to get the temperature value and converted it into HEX format with below mapping table, then send command 0x1A with the HEX temperature value to the module thru the SPI interface.

The temperature value to HEX conversion is as follow:

1. If the Temperature value MSByte bit D11 = 0, then

   The temperature is positive and value (DegC) = + (Temperature value) / 16

2. If the Temperature value MSByte bit D11 = 1, then

   The temperature is negative and value (DegC) = ~ (2's complement of Temperature value) / 16

12-bit binary (2's complement)	Hexadecimal Value	TR Value [DegC]
0111 1111 1111	7FF	128
0111 1111 1111	7FF	127.9
0110 0100 0000	640	100
0101 0000 0000	500	80
0100 1011 0000	4B0	75
0011 0010 0000	320	50
0001 1001 0000	190	25
0000 0000 0100	004	0.25
0000 0000 0000	000	0
1111 1111 1100	FFC	-0.25
1110 0111 0000	E70	-25
1100 1001 0000	C90	-55

9. COMMAND TABLE

<table>
<tr><th>R/W#</th><th>D/C#</th><th>Hex</th><th>D7</th><th>D6</th><th>D5</th><th>D4</th><th>D3</th><th>D2</th><th>D1</th><th>D0</th><th>Command</th><th>Description</th></tr>
<tr><td>0</td><td>0</td><td>01</td><td>01</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td rowspan="4">Driver Output control</td><td rowspan="4">Gate setting
A[8:0]= 127h [POR], 296 MUX
MUX Gate lines setting as (A[8:0] + 1).
B[2:0] = 000 [POR].
Gate scanning sequence and direction
B[2]: GD
Selects the 1st output Gate
GD=0 [POR],
G0 is the 1st gate output channel, gate output sequence is G0,G1, G2, G3, …
GD=1,
G1 is the 1st gate output channel, gate output sequence is G1, G0, G3, G2, …
B[1]: SM
Change scanning order of gate driver.
SM=0 [POR],
G0, G1, G2, G3…295 (left and right gate interlaced)
SM=1,
G0, G2, G4 …G294, G1, G3, …G295
B[0]: TB
TB = 0 [POR], scan from G0 to G295
TB = 1, scan from G295 to G0.</td></tr>
<tr><td>0</td><td>1</td><td>A7</td><td>A6</td><td>A5</td><td>A4</td><td>A3</td><td>A2</td><td>A1</td><td>A0</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>A8</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>B2</td><td>B1</td><td>B0</td></tr>
<tr><td colspan="13"></td></tr>
<tr><td>0</td><td>0</td><td>03</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td rowspan="2">Gate Driving voltage Control</td><td rowspan="2">Set Gate driving voltage
A[4:0] = 00h [POR]
VGH setting from 12V to 20V
<table>
<tr><td>A[4:0]</td><td>VGH</td><td>A[4:0]</td><td>VGH</td></tr>
<tr><td>07h</td><td>12</td><td>10h</td><td>16.5</td></tr>
<tr><td>08h</td><td>12.5</td><td>11h</td><td>17</td></tr>
<tr><td>09h</td><td>13</td><td>12h</td><td>17.5</td></tr>
<tr><td>0Ah</td><td>13.5</td><td>13h</td><td>18</td></tr>
<tr><td>0Bh</td><td>14</td><td>14h</td><td>18.5</td></tr>
<tr><td>0Ch</td><td>14.5</td><td>15h</td><td>19</td></tr>
<tr><td>0Dh</td><td>15</td><td>16h</td><td>19.5</td></tr>
<tr><td>0Eh</td><td>15.5</td><td>17h</td><td>20</td></tr>
<tr><td>0Fh</td><td>16</td><td>Other</td><td>NA</td></tr>
</table></td></tr>
<tr><td>0</td><td>1</td><td></td><td>0</td><td>0</td><td>0</td><td>A4</td><td>A3</td><td>A2</td><td>A1</td><td>A0</td></tr>
</table>

R/W#	D/C#	Hex	D7	D6	D5	D4	D3	D2	D1	D0	Command	Description
0	0	04	0	0	0	0	0	1	0	0	Source Driving voltage Control	Set Source driving voltage A[7:0] = 41h [POR], VSH1 at 15V B[7:0] = A8h [POR], VSH2 at 5V. C[7:0] = 32h [POR], VSL at -15V
0	1		A7	A6	A5	A4	A3	A2	A1	A0		
0	1		B7	B6	B5	B4	B3	B2	B1	B0		
0	1		C7	C6	C5	C4	C3	C2	C1	C0		

A[7]/B[7] = 1,
VSH1/VSH2 voltage setting from 2.4V to 8.8V

A/B[7:0]	VSH1/VSH2	A/B[7:0]	VSH1/VSH2
8Eh	2.4	AFh	5.7
8Fh	2.5	B0h	5.8
90h	2.6	B1h	5.9
91h	2.7	B2h	6
92h	2.8	B3h	6.1
93h	2.9	B4h	6.2
94h	3	B5h	6.3
95h	3.1	B6h	6.4
96h	3.2	B7h	6.5
97h	3.3	B8h	6.6
98h	3.4	B9h	6.7
99h	3.5	BAh	6.8
9Ah	3.6	BBh	6.9
9Bh	3.7	BCh	7
9Ch	3.8	BDh	7.1
9Dh	3.9	BEh	7.2
9Eh	4	BFh	7.3
9Fh	4.1	C0h	7.4
A0h	4.2	C1h	7.5
A1h	4.3	C2h	7.6
A2h	4.4	C3h	7.7
A3h	4.5	C4h	7.8
A4h	4.6	C5h	7.9
A5h	4.7	C6h	8
A6h	4.8	C7h	8.1
A7h	4.9	C8h	8.2
A8h	5	C9h	8.3
A9h	5.1	CAh	8.4
AAh	5.2	CBh	8.5
ABh	5.3	CCh	8.6
ACh	5.4	CDh	8.7
ADh	5.5	CEh	8.8
AEh	5.6	Other	NA

A[7]/B[7] = 0,
VSH1/VSH2 voltage setting from 9V to 17V

A/B[7:0]	VSH1/VSH2	A/B[7:0]	VSH1/VSH2
23h	9	3Ch	14
24h	9.2	3Dh	14.2
25h	9.4	3Eh	14.4
26h	9.6	3Fh	14.6
27h	9.8	40h	14.8
28h	10	41h	15
29h	10.2	42h	15.2
2Ah	10.4	43h	15.4
2Bh	10.6	44h	15.6
2Ch	10.8	45h	15.8
2Dh	11	46h	16
2Eh	11.2	47h	16.2
2Fh	11.4	48h	16.4
30h	11.6	49h	16.6
31h	11.8	4Ah	16.8
32h	12	4Bh	17
33h	12.2	Other	NA
34h	12.4		
35h	12.6		
36h	12.8		
37h	13		
38h	13.2		
39h	13.4		
3Ah	13.6		
3Bh	13.8		

C[7] = 0,
VSL setting from -9V to -17V

C[7:0]	VSL
1Ah	-9
1Ch	-9.5
1Eh	-10
20h	-10.5
22h	-11
24h	-11.5
26h	-12
28h	-12.5
2Ah	-13
2Ch	-13.5
2Eh	-14
30h	-14.5
32h	-15
34h	-15.5
36h	-16
38h	-16.5
3Ah	-17
Other	NA

R/W#	D/C#	Hex	D7	D6	D5	D4	D3	D2	D1	D0	Command	Description
0	0	08	0	0	0	0	1	0	0	0	User Command OTP Program	Program User Command Setting The command required CLKEN=1. Refer to Register 0x22 for detail. BUSY pad will output high during operation.
0	0	09	0	0	0	0	1	0	0	1	Write Register for User Command	Write Register for User Command Selection A[7:0] ~ D[7:0]: Reserved Details refer to Application Notes of User Command Setting
0	1		A7	A6	A5	A4	A3	A2	A1	A0		
0	1		B7	B6	B5	B4	B3	B2	B1	B0		
0	1		C7	C6	C5	C4	C3	C2	C1	C0		
0	1		D7	D6	D5	D4	D3	D2	D1	D0		
0	0	0A	0	0	0	0	1	0	1	0	Read Register for User Command	Read Register for User Command

R/W#	D/C#	Hex	D7	D6	D5	D4	D3	D2	D1	D0	Command	Description
0	0	0C	0	0	0	0	1	1	0	0	Booster Soft start Control	Booster Enable with Phase 1, Phase 2 and Phase 3 for soft start current and duration setting. A[7:0] -> Soft start setting for Phase1 = 8Bh [POR] B[7:0] -> Soft start setting for Phase2 = 9Ch [POR] C[7:0] -> Soft start setting for Phase3 = 96h [POR] D[7:0] -> Duration setting = 0Fh [POR] Bit Description of each byte: A[6:0] / B[6:0] / C[6:0]:
0	1		1	A6	A5	A4	A3	A2	A1	A0		
0	1		1	B6	B5	B4	B3	B2	B1	B0		
0	1		1	C6	C5	C4	C3	C2	C1	C0		
0	1		0	0	D5	D4	D3	D2	D1	D0		

Bit[6:4]	Driving Strength Selectio
000	1(Weakest)
001	2
010	3
011	4
100	5
101	6
110	7

Bit[3:0]	Min Off Time Setting of GDR [Time unit]
0000-0011	NA
0100	2.6
0101	3.2
0110	3.9
0111	4.6
1000	5.4
1001	6.3
1010	7.3
1011	8.4
1100	9.8
1101	11.5
1110	13.8
1111	16.5

D[5:0]: duration setting of phase
D[5:4]: duration setting of phase 3
D[3:2]: duration setting of phase 2
D[1:0]: duration setting of phase 1

Bit[1:0]	Duration of Phase [Approximation]
00	10ms
01	20ms
10	30ms
11	40ms

R/W#	D/C#	Hex	D7	D6	D5	D4	D3	D2	D1	D0	Command	Description
0	0	0F	0	0	0	0	1	1	1	1	Gate scan start position	Set the scanning start position of the gate driver. The valid range is from 0 to 295. A[8:0] = 000h [POR] When TB=0: SCN [8:0] = A[8:0] When TB=1: SCN [8:0] = 295 - A[8:0]
0	1		A7	A6	A5	A4	A3	A2	A1	A0		
0	1		0	0	0	0	0	0	0	A8		
0	0	10	0	0	0	1	0	0	0	0	Deep Sleep mode	Deep Sleep mode Control: A[1:0] : Description 00 Normal Mode [POR] 01 Enter Deep Sleep Mode 1 11 Enter Deep Sleep Mode 2 After this command initiated, the chip will enter Deep Sleep Mode, BUSY pad will keep output high. Remark: To Exit Deep Sleep mode, User required to send HWRESET to the driver
0	1		0	0	0	0	0	0	A1	A0		
0	0	11	0	0	0	1	0	0	0	1	Data Entry mode setting	Define data entry sequence A[2:0] = 011 [POR] A [1:0] = ID[1:0] Address automatic increment / decrement setting The setting of incrementing or decrementing of the address counter can be made independently in each upper and lower bit of the address. 00 –Y decrement, X decrement, 01 –Y decrement, X increment, 10 –Y increment, X decrement, 11 –Y increment, X increment [POR] A[2] = AM Set the direction in which the address counter is updated automatically after data are written to the RAM. AM= 0, the address counter is updated in the X direction. [POR] AM = 1, the address counter is updated in the Y direction.
0	1		0	0	0	0	0	A2	A1	A0		
0	0	12	0	0	0	1	0	0	1	0	SW RESET	It resets the commands and parameters to their S/W Reset default values except R10h-Deep Sleep Mode During operation, BUSY pad will output high. Note: RAM are unaffected by this command.

R/W#	D/C#	Hex	D7	D6	D5	D4	D3	D2	D1	D0	Command	Description
0	0	14	0	0	0	1	0	1	0	0	HV Ready Detection	HV ready detection A[7:0] = 00h [POR] The command required CLKEN=1 and ANALOGEN=1. Refer to Register 0x22 for detail. After this command initiated, HV Ready detection starts. BUSY pad will output high during detection. The detection result can be read from the Status Bit Read (Command 0x2F).
0	1		0	A6	A5	A4	A3	A2	A1	A0		A[6:4]=n for CD time: 10ms x n A[2:0]=m for Loop time m+1 The max HV ready duration is (10ms x A[6:4]) x (m+1) HV ready detection will be trigger after each cool down time. The detection will be completed when HV is ready. For 1 shot HV ready detection, A[7:0] can be set as 00h.
0	0	15	0	0	0	1	0	1	0	1	VCI Detection	VCI Detection A[2:0] = 100 [POR] , Detect level at 2.3V A[2:0] : VCI level Detect A[2:0] / VCI level 011 / 2.2V 100 / 2.3V 101 / 2.4V 110 / 2.5V 111 / 2.6V Other / NA The command required CLKEN=1 and ANALOGEN=1 Refer to Register 0x22 for detail. After this command initiated, VCI detection starts. BUSY pad will output high during detection. The detection result can be read from the Status Bit Read (Command 0x2F).
0	1		0	0	0	0	0	A2	A1	A0		
0	0	18	0	0	0	1	1	0	0	0	Temperature Sensor Control	Temperature Sensor Selection A[7:0] = 48h [POR], external temperatrure sensor A[7:0] = 80h Internal temperature sensor
0	1		A7	A6	A5	A4	A3	A2	A1	A0		
0	0	1A	0	0	0	1	1	0	1	0	Temperature Sensor Control (Write to temperature register)	Write to temperature register. Write to temperature register. [POR]
0	1		A11	A10	A9	A8	A7	A6	A5	A4		
0	1		A3	A2	A1	A0	0	0	0	0		
0	0	1B	0	0	0	1	1	0	1	1	Temperature Sensor Control (Read from temperature register)	Read from temperature register.
0	1		A11	A10	A9	A8	A7	A6	A5	A4		
0	1		A3	A2	A1	A0	0	0	0	0		

R/W#	D/C#	Hex	D7	D6	D5	D4	D3	D2	D1	D0	Command	Description
0	0	1C	0	0	0	1	1	1	0	0	Temperature SensorControl (WriteCommand to Externaltemperature sensor)	Write Command to External temperature sensor. A[7:0] = 00h [POR], B[7:0] = 00h [POR], C[7:0] = 00h [POR], A[7:6]
0	1		A7	A6	A5	A4	A3	A2	A1	A0		
0	1		B7	B6	B5	B4	B3	B2	B1	B0		
0	1		C7	C6	C5	C4	C3	C2	C1	C0		

A[7:6]	Select no of byte to be sent
00	Address + pointer
01	Address + pointer
10	Address + pointer + 1st parameter +2nd pointer
11	AddressA[5:0] – Pointer

A[5:0] – Pointer Setting
B[7:0] – 1st parameter
C[7:0] – 2nd parameter
The command required CLKEN=1.
Refer to Register 0x22 for detail.
After this command initiated, Write Command to external temperature sensor starts. BUSY pad will output high during operation.

0	0	20	0	0	1	0	0	0	0	0	Master Activation	Activate Display Update Sequence The Display Update Sequence Option is located at R22h. BUSY pad will output high during operation. User should not interrupt this operation to avoid corruption of panel images.

0	0	21	0	0	1	0	0	0	0	1	Display Update Control 1	RAM content option for Display Update A[7:0] = 00h [POR] B[7:0] = 00h [POR]
0	1		A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0		
0	1		B_7	0	0	0	0	0	0	0		

A[7:4] Red RAM option

0000
0100
1000

A[3:0] BW RAM option

0000
0100
1000

B[7] Source Output Mode

0	Available Source from S0 to S175
1	Available Source from S8 to S167

R/W#	D/C#	Hex	D7	D6	D5	D4	D3	D2	D1	D0	Command	Description
0	0	22	0	0	1	0	0	0	1	0	Display UpdateControl 2	Display Update Sequence Option: Display Update Sequence Option: A[7:0]= FFh (POR)
0	1		A7	A6	A5	A4	A3	A2	A1	A0		

	Parameter(in Hex)
Enable Clock Signal, Then Enable ANALOG Then DISPLAY with DISPLAY Mode 1 Then Disable ANALOG Then Disable OSC	C7
Enable Clock Signal, Then Enable ANALOG Then DISPLAY with DISPLAY Mode 2 Then Disable ANALOG Then Disable OSC	CF
Enable Clock Signal, Then Load LUT with DISPLAY Mode 1	90
Enable Clock Signal, Then Load Temperature value from I2C Single Master Interface Then Load LUT with DISPLAY Mode 1	B0
Enable Clock Signal, Then Load LUT with DISPLAY Mode 2	98
Enable Clock Signal, Then Load Temperature value from I2C Single Master Interface Then Load LUT with DISPLAY Mode 2	B8
Enable Clock Signal, Then Load LUT with DISPLAY Mode 1 To	91
Enable Clock Signal, Then Load Temperature value from I2C Single Master Interface Then Load LUT with DISPLAY Mode 1 To Disable Clock Signal	B1
Enable Clock Signal, Then Load LUT with DISPLAY Mode 2 To Disable Clock Signal	99
Enable Clock Signal, Then Load Temperature value from I2C Single Master Interface Then Load LUT with DISPLAY Mode 2 To Disable Clock Signal	B9
Enable ANALOG Then DISPLAY with DISPLAY Mode 1 Then Disable ANALOG Then Disable OSC	47
Enable ANALOG Then DISPLAY with DISPLAY Mode 2 Then Disable ANALOG Then Disable OSC	4F
To Enable Clock Signal (CLKEN=1)	80
To Enable Clock Signal, then Enable ANALOG (CLKEN=1, ANALOGEN=1)	C0
Enable ANALOG Then DISPLAY with DISPLAY Mode 1	44
Enable ANALOG Then DISPLAY with DISPLAY Mode 2	4C
To DISPLAY with DISPLAY Mode 1	4
To DISPLAY with DISPLAY Mode 2	0C
To Disable ANALOG, then Disable Clock Signal (CLKEN=0, ANALOGEN=0)	3
To Disable Clock Signal (CLKEN=0)	1

R/W#	D/C#	Hex	D7	D6	D5	D4	D3	D2	D1	D0	Command	Description
0	0	24	0	0	1	0	0	1	0	0	Write RAM (BW)	After this command, data entries will bewritten into the BW RAM until anothercommand is written. Address pointers willadvance accordingly For Write pixel: Content of Write RAM(BW) = 1 For Black pixel: Content of Write RAM(BW) = 0
0	0	26	0	0	1	0	0	1	1	0	Write RAM (RED)	After this command, data entries will bewritten into the RED RAM until anothercommand is written. Address pointers willadvance accordingly. For Red pixel: Content of Write RAM(RED) = 1 For non-Red pixel [Black or White]: Content of Write RAM(RED) = 0
0	0	27	0	0	1	0	0	1	1	1	Read RAM	After this command, data read on the MCU bus will fetch data from RAM [According to parameter of Register 41h to select reading RAM(BW) / RAM(RED)], until another command is written. Address pointers will advance accordingly. The 1st byte of data read is dummy data.
0	0	28	0	0	1	0	1	0	0	0	VCOM Sense	Enter VCOM sensing conditions and holdfor duration defined in 29h before readingVCOM value. The sensed VCOM voltage is stored in register The command required CLKEN=1 and ANALOGEN=1 Refer to Register 0x22 for detail. BUSY pad will output high during operation.
0	0	29	0	0	1	0	1	0	0	1	VCOM Sense Duration	Stabling time between entering VCOMsensing mode and reading acquired. A[3:0] = 09h [POR], duration = 10s. VCOM sense duration = (A[3:0]+1) sec
0	1		0	1	0	0	A3	A2	A1	A0		

<table>
<tr><th>R/W#</th><th>D/C#</th><th>Hex</th><th>D7</th><th>D6</th><th>D5</th><th>D4</th><th>D3</th><th>D2</th><th>D1</th><th>D0</th><th>Command</th><th>Description</th></tr>
<tr><td>0</td><td>0</td><td>2A</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>Program VCOM OTP</td><td>Program VCOM register into OTP
The command required CLKEN=1.
Refer to Register 0x22 for detail.
BUSY pad will output high during operation.</td></tr>
<tr><td colspan="13"></td></tr>
<tr><td>0</td><td>0</td><td>2B</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td rowspan="3">Write Register for VCOM Control</td><td rowspan="3">This command is used to reduce glitch when ACVCOM toggle. Two data bytes D04h and D63h should be set for this command.</td></tr>
<tr><td>0</td><td>1</td><td></td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td></td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td colspan="13"></td></tr>
<tr><td>0</td><td>0</td><td>2C</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td rowspan="2">Write VCOM register</td><td rowspan="2">Write VCOM register from MCU interface
A[7:0] = 00h [POR]
<table>
<tr><th>A[7:0]</th><th>VCOM</th><th>A[7:0]</th><th>VCOM</th></tr>
<tr><td>08h</td><td>-0.2</td><td>44h</td><td>-1.7</td></tr>
<tr><td>0Ch</td><td>-0.3</td><td>48h</td><td>-1.8</td></tr>
<tr><td>10h</td><td>-0.4</td><td>4Ch</td><td>-1.9</td></tr>
<tr><td>14h</td><td>-0.5</td><td>50h</td><td>-2</td></tr>
<tr><td>18h</td><td>-0.6</td><td>54h</td><td>-2.1</td></tr>
<tr><td>1Ch</td><td>-0.7</td><td>58h</td><td>-2.2</td></tr>
<tr><td>20h</td><td>-0.8</td><td>5Ch</td><td>-2.3</td></tr>
<tr><td>24h</td><td>-0.9</td><td>60h</td><td>-2.4</td></tr>
<tr><td>28h</td><td>-1</td><td>64h</td><td>-2.5</td></tr>
<tr><td>2Ch</td><td>-1.1</td><td>68h</td><td>-2.6</td></tr>
<tr><td>30h</td><td>-1.2</td><td>6Ch</td><td>-2.7</td></tr>
<tr><td>34h</td><td>-1.3</td><td>70h</td><td>-2.8</td></tr>
<tr><td>38h</td><td>-1.4</td><td>74h</td><td>-2.9</td></tr>
<tr><td>3Ch</td><td>-1.5</td><td>78h</td><td>-3</td></tr>
<tr><td>40h</td><td>-1.6</td><td>Other</td><td>NA</td></tr>
</table></td></tr>
<tr><td>0</td><td>1</td><td></td><td>A7</td><td>A6</td><td>A5</td><td>A4</td><td>A3</td><td>A2</td><td>A1</td><td>A0</td></tr>
<tr><td colspan="13"></td></tr>
<tr><td>0</td><td>0</td><td>2D</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td><td rowspan="12">OTP Register Read for Display Option</td><td rowspan="12">Read Register for Display Option:
A[7:0]: VCOM OTP Selection (Command 0x37, Byte A)
B[7:0]: VCOM Register (Command 0x2C)
C[7:0]~F[7:0]: Display Mode (Command 0x37, Byte B to Byte G) [5 bytes]
G[7:0]~H[7:0]: Waveform Version (Command 0x37, Byte H to Byte K) [4 bytes]</td></tr>
<tr><td>1</td><td>1</td><td></td><td>A7</td><td>A6</td><td>A5</td><td>A4</td><td>A3</td><td>A2</td><td>A1</td><td>A0</td></tr>
<tr><td>1</td><td>1</td><td></td><td>B7</td><td>B6</td><td>B5</td><td>B4</td><td>B3</td><td>B2</td><td>B1</td><td>B0</td></tr>
<tr><td>1</td><td>1</td><td></td><td>C7</td><td>C6</td><td>C5</td><td>C4</td><td>C3</td><td>C2</td><td>C1</td><td>C0</td></tr>
<tr><td>1</td><td>1</td><td></td><td>D7</td><td>D6</td><td>D5</td><td>D4</td><td>D3</td><td>D2</td><td>D1</td><td>D0</td></tr>
<tr><td>1</td><td>1</td><td></td><td>E7</td><td>E6</td><td>E5</td><td>E4</td><td>E3</td><td>E2</td><td>E1</td><td>E0</td></tr>
<tr><td>1</td><td>1</td><td></td><td>F7</td><td>F6</td><td>F5</td><td>F4</td><td>F3</td><td>F2</td><td>F1</td><td>F0</td></tr>
<tr><td>1</td><td>1</td><td></td><td>G7</td><td>G6</td><td>G5</td><td>G4</td><td>G3</td><td>G2</td><td>G1</td><td>G0</td></tr>
<tr><td>1</td><td>1</td><td></td><td>H7</td><td>H6</td><td>H5</td><td>H4</td><td>H3</td><td>H2</td><td>H1</td><td>H0</td></tr>
<tr><td>1</td><td>1</td><td></td><td>I7</td><td>I6</td><td>I5</td><td>I4</td><td>I3</td><td>I2</td><td>I1</td><td>I0</td></tr>
<tr><td>1</td><td>1</td><td></td><td>J7</td><td>J6</td><td>J5</td><td>J4</td><td>J3</td><td>J2</td><td>J1</td><td>J0</td></tr>
<tr><td>1</td><td>1</td><td></td><td>K7</td><td>K6</td><td>K5</td><td>K4</td><td>K3</td><td>K2</td><td>K1</td><td>K0</td></tr>
</table>

R/W#	D/C#	Hex	D7	D6	D5	D4	D3	D2	D1	D0	Command	Description
0	0	2E	0	0	1	0	1	1	1	0	User ID Read	Read 10 Byte User ID stored in OTP: A[7:0]]~J[7:0]: UserID (R38, Byte A and Byte J) [10 bytes]
1	1		A7	A6	A5	A4	A3	A2	A1	A0		
1	1		B7	B6	B5	B4	B3	B2	B1	B0		
1	1		C7	C6	C5	C4	C3	C2	C1	C0		
1	1		D7	D6	D5	D4	D3	D2	D1	D0		
1	1		E7	E6	E5	E4	E3	E2	E1	E0		
1	1		F7	F6	F5	F4	F3	F2	F1	F0		
1	1		G7	G6	G5	G4	G3	G2	G1	G0		
1	1		H7	H6	H5	H4	H3	H2	H1	H0		
1	1		I7	I6	I5	I4	I3	I2	I1	I0		
1	1		J7	J6	J5	J4	J3	J2	J1	J0		
0	0	2F	0	0	1	0	1	1	1	1	Status Bit Read	Read IC status Bit [POR 0x01] A[5]: HV Ready Detection flag [POR=0] 0: Ready 1: Not Ready A[4]: VCI Detection flag [POR=0] 0: Normal 1: VCI lower than the Detect level A[3]: [POR=0] A[2]: Busy flag [POR=0] 0: Normal 1: BUSY A[1:0]: Chip ID [POR=01] Remark: A[5] and A[4] status are not valid after RESET, they need to be initiated by command 0x14 and command 0x15 respectively.
1	1		0	0	A5	A4	0	A2	A1	A0		
0	0	31	0	0	1	1	0	0	0	1	Load WS OTP	Load OTP of Waveform Setting The command required CLKEN=1. Refer to Register 0x22 for detail. BUSY pad will output high during operation.
0	0	32	0	0	1	1	0	0	1	0	Write LUT register	Write LUT register from MCU interface [100 bytes], which contains the content of VS [nX-LUT], TP #[nX], RP#[n]).
0	1		A7	A6	A5	A4	A3	A2	A1	A0		
0	1		B7	B6	B5	B4	B3	B2	B1	B0		
0	1		:	:	:	:	:	:	:	:		
0	1		.	..	.	.	.	.	.	.		

R/W#	D/C#	Hex	D7	D6	D5	D4	D3	D2	D1	D0	Command	Description
0	0	34	0	0	1	1	0	1	0	0	CRC calculation	CRC calculation command for OTP content validation. For details, please refer to SSD1675B application note. BUSY pad will output high during operation.
0	0	35	0	0	1	1	0	1	0	1	CRC Status Read	CRC Status Read A[15:0] is the CRC read out value
1	1		A15	A14	A13	A12	A11	A10	A9	A8		
1	1		A7	A6	A5	A4	A3	A2	A1	A0		
0	0	36	0	0	1	1	0	1	1	0	Program OTP selection	Program OTP Selection according to the OTP Selection Control [R37h and R38h] The command required CLKEN=1. Refer to Register 0x22 for detail. BUSY pad will output high during operation.
0	1	37	0	0	1	1	0	1	1	1	Write Register for Display Option	Write Register for Display Option B[7:0] Display Mode for WS[7:0] C[7:0] Display Mode for WS[15:8] D[7:0] Display Mode for WS[23:16] E[7:0] Display Mode for WS[31:24] F[3:0] Display Mode for WS[35:32] 0: Display Mode 1 [POR] 1: Display Mode2 F[6]: PingPong for Display Mode 2 0: RAM ping-pong disable [POR] 1: RAM ping-pong enable G[7:0]~J[7:0] module ID /waveform version. Remarks: 1) A[7:0]~J[7:0] can be stored in OTP 2) RAM ping-pong function is not support for Display Mode 1
0	1		0	0	0	0	0	0	0	0		
0	1		B7	B6	B5	B4	B3	B2	B1	B0		
0	1		C7	C6	C5	C4	C3	C2	C1	C0		
0	1		D7	D6	D5	D4	D3	D2	D1	D0		
0	1		E7	E6	E5	E4	E3	E2	E1	E0		
0	1		F7	F6	F5	F4	F3	F2	F1	F0		
0	1		G7	G6	G5	G4	G3	G2	G1	G0		
0	1		H7	H6	H5	H4	H3	H2	H1	H0		
0	1		I7	I6	I5	I4	I3	I2	I1	I0		
0	1		J7	J6	J5	J4	J3	J2	J1	J0		
0	0	38	0	0	1	1	1	0	0	0	Write Register for User ID	Write Register for User ID A[7:0]]~J[7:0]: UserID [10 bytes] Remarks: A[7:0]~J[7:0] can be stored in OTP
0	1		A7	A6	A5	A4	A3	A2	A1	A0		
0	1		B7	B6	B5	B4	B3	B2	B1	B0		
0	1		C7	C6	C5	C4	C3	C2	C1	C0		
0	1		D7	D6	D5	D4	D3	D2	D1	D0		
0	1		E7	E6	E5	E4	E3	E2	E1	E0		
0	1		F7	F6	F5	F4	F3	F2	F1	F0		
0	1		G7	G6	G5	G4	G3	G2	G1	G0		
0	1		H7	H6	H5	H4	H3	H2	H1	H0		
0	1		I7	I6	I5	I4	I3	I2	I1	I0		
0	1		J7	J6	J5	J4	J3	J2	J1	J0		

R/W#	D/C#	Hex	D7	D6	D5	D4	D3	D2	D1	D0	Command	Description
0	0	39	0	0	1	1	1	0	0	1	OTP program mode	OTP program mode
0	1		0	0	0	0	0	0	0	0		OTP program mode A[1:0] = 11: Internal generated OTP A[1:0] = 11: Internal generated OTP programming voltage Remark: User is required to EXACTLY
0	0	3A	0	0	1	1	1	0	1	0	Set dummy line period	Set number of dummy line period A[6:0] = 30h [POR] A[6:0]: Number of dummy line period in term of TGate Available setting 0 to 127.
0	1		0	A6	A5	A4	A3	A2	A1	A0		
0	0	3B	0	0	1	1	1	0	1	1	Set Gate line width	Set Gate line width (TGate) A[3:0] = 1010 [POR] Remark: Default value will give 50Hz Frame frequency under 48 dummy line pulse setting.
0	1		0	0	0	0	A3	A2	A1	A0		

Frame Frequency [Hz]	Parameter of 0x3A	Parameter of 0x3B
25	0x29	0x0E
30	0x46	0x0D
35	0x48	0x0D
40	0x48	0x0C
45	0x28	0x0C
50	0x0F	0x0C
55	0x37	0x0B
60	0x21	0x0B
65	0x0E	0x0B
70	0x22	0x0A
75	0x11	0x0A
80	0x03	0x0A
85	0x17	0x09
90	0x0A	0x09
95	0x26	0x08
100	0x1A	0x08
105	0x0E	0x08
110	0x04	0x08
115	0x1D	0x07
120	0x13	0x07
125	0x0A	0x07
130	0x01	0x06
135	0x22	0x06
145	0x11	0x06
150	0x0A	0x06
155	0x03	0x06
160	0x1C	0x05
165	0x15	0x05
170	0x0E	0x05
175	0x07	0x05
180	0x01	0x05
185	0x21	0x04
190	0x1B	0x04
195	0x15	0x04
200	0x0F	0x04
Remark: Frame rate setting depends on resolution.		

<table>
<tr><th>R/W#</th><th>D/C#</th><th>Hex</th><th>D7</th><th>D6</th><th>D5</th><th>D4</th><th>D3</th><th>D2</th><th>D1</th><th>D0</th><th>Command</th><th>Description</th></tr>
<tr><td>0</td><td>0</td><td>3C</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td rowspan="2">Border Waveform Control</td><td rowspan="2">Select border waveform for VBD
A[7:0] = C0h [POR], set VBD as HIZ.
A [7:6] :Select VBD option
<table>
<tr><th>A[7:6]</th><th>Select VBD as</th></tr>
<tr><td>00</td><td>GS Transition,Defined in A[1:0]</td></tr>
<tr><td>01</td><td>Fix Level,Defined in A[5:4]</td></tr>
<tr><td>10</td><td>VCOM</td></tr>
<tr><td>11[POR]</td><td>HiZ</td></tr>
</table>
A [5:4] Fix Level Setting for VBD
<table>
<tr><th>A[5:4]</th><th>VBD level</th></tr>
<tr><td>00[POR]</td><td>VSS</td></tr>
<tr><td>01</td><td>VSH1</td></tr>
<tr><td>10</td><td>VSL</td></tr>
<tr><td>11</td><td>VSH2</td></tr>
</table>
A [1:0] GS Transition setting for VBD
<table>
<tr><th>A[1:0]</th><th>VBD Transition</th></tr>
<tr><td>00[POR]</td><td>LUT0</td></tr>
<tr><td>01</td><td>LUT1</td></tr>
<tr><td>10</td><td>LUT2</td></tr>
<tr><td>11</td><td>LUT3</td></tr>
</table></td></tr>
<tr><td>0</td><td>1</td><td></td><td>A7</td><td>A6</td><td>A5</td><td>A4</td><td>A3</td><td>A2</td><td>A1</td><td>A0</td></tr>
<tr><td colspan="13"></td></tr>
<tr><td>0</td><td>0</td><td>41</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>Read RAM Option</td><td>Read RAM Option
A[0]= 0 [POR]
0 : Read RAM corresponding to 24h
1 : Read RAM corresponding to 26h</td></tr>
<tr><td>0</td><td>1</td><td></td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>A0</td></tr>
<tr><td colspan="13">0</td></tr>
<tr><td>0</td><td>0</td><td>44</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td rowspan="3">Set RAM X - address Start / End position</td><td rowspan="3">Specify the start/end positions of the window address in the X direction by an address unit for RAM
A[5:0]: XSA[5:0], XStart, POR = 00h
B[5:0]: XEA[5:0], XEnd, POR = 13h</td></tr>
<tr><td>0</td><td>1</td><td></td><td>0</td><td>0</td><td>A5</td><td>A4</td><td>A3</td><td>A2</td><td>A1</td><td>A0</td></tr>
<tr><td>0</td><td>1</td><td></td><td>0</td><td>0</td><td>B5</td><td>B4</td><td>B3</td><td>B2</td><td>B1</td><td>B0</td></tr>
<tr><td colspan="13"></td></tr>
<tr><td>0</td><td>0</td><td>45</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td rowspan="5">Set Ram Y- address Start / End position</td><td rowspan="5">Specify the start/end positions of the window address in the Y direction by an address unit for RAM
A[8:0]: YSA[8:0], YStart, POR = 000h
B[8:0]: YEA[8:0], YEnd, POR = 127h</td></tr>
<tr><td>0</td><td>1</td><td></td><td>A7</td><td>A6</td><td>A5</td><td>A4</td><td>A3</td><td>A2</td><td>A1</td><td>A0</td></tr>
<tr><td>0</td><td>1</td><td></td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>A8</td></tr>
<tr><td>0</td><td>1</td><td></td><td>B7</td><td>B6</td><td>B5</td><td>B4</td><td>B3</td><td>B2</td><td>B1</td><td>B0</td></tr>
<tr><td>0</td><td>1</td><td></td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>B8</td></tr>
</table>

<table>
<tr><th>R/W#</th><th>D/C#</th><th>Hex</th><th>D7</th><th>D6</th><th>D5</th><th>D4</th><th>D3</th><th>D2</th><th>D1</th><th>D0</th><th>Command</th><th>Description</th></tr>
<tr><td>0</td><td>0</td><td>46</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>Auto Write RED RAM</td><td>Auto Write RED RAM for Regular Pattern
A[7:0] = 00h [POR]
Auto Write RED RAM for Regular Pattern
A[7:0] = 00h [POR]
A[7]: The 1st step value, POR = 0
A[6:4]: Step Height, POR= 000
Step of alter RAM in Y-direction according to Gate
<table>
<tr><td>A[6:4]</td><td>Height</td><td>A[6:4]</td><td>Height</td></tr>
<tr><td>000</td><td>8</td><td>100</td><td>128</td></tr>
<tr><td>001</td><td>16</td><td>101</td><td>256</td></tr>
<tr><td>010</td><td>32</td><td>110</td><td>296</td></tr>
<tr><td>011</td><td>64</td><td>111</td><td>NA</td></tr>
</table>
A[2:0]: Step Width, POR= 000
A[2:0]: Step Width, POR= 000
<table>
<tr><td>A[2:0]</td><td>Width</td><td>A[2:0]</td><td>Width</td></tr>
<tr><td>000</td><td>8</td><td>100</td><td>128</td></tr>
<tr><td>001</td><td>16</td><td>101</td><td>160</td></tr>
<tr><td>010</td><td>32</td><td>110</td><td>NA</td></tr>
<tr><td>011</td><td>64</td><td>111</td><td>NA</td></tr>
</table>
BUSY pad will output high during operation.</td></tr>
<tr><td>0</td><td>1</td><td></td><td>A7</td><td>A6</td><td>A5</td><td>A4</td><td>A3</td><td>A2</td><td>A1</td><td>A0</td><td>Auto Write RED RAM</td><td></td></tr>
<tr><td>0</td><td>0</td><td>47</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>Auto Write B/W RAM for Regular Pattern</td><td>Auto Write B/W RAM for Regular Pattern
A[7:0] = 00h [POR]
A[7]: The 1st step value, POR = 0
A[6:4]: Step Hieght, POR= 000
Step of alter RAM in Y-direction according to Gate
<table>
<tr><td>A[6:4]</td><td>Height</td><td>A[6:4]</td><td>Height</td></tr>
<tr><td>000</td><td>8</td><td>100</td><td>128</td></tr>
<tr><td>001</td><td>16</td><td>101</td><td>256</td></tr>
<tr><td>010</td><td>32</td><td>110</td><td>296</td></tr>
<tr><td>011</td><td>64</td><td>111</td><td>NA</td></tr>
</table>
A[2:0]: Step Width, POR= 000
A[2:0]: Step Width, POR= 000
<table>
<tr><td>A[2:0]</td><td>Width</td><td>A[2:0]</td><td>Width</td></tr>
<tr><td>000</td><td>8</td><td>100</td><td>128</td></tr>
<tr><td>001</td><td>16</td><td>101</td><td>160</td></tr>
<tr><td>010</td><td>32</td><td>110</td><td>NA</td></tr>
<tr><td>011</td><td>64</td><td>111</td><td>NA</td></tr>
</table>
During operation, BUSY pad will output high.</td></tr>
<tr><td>0</td><td>1</td><td></td><td>A7</td><td>A6</td><td>A5</td><td>A4</td><td>A3</td><td>A2</td><td>A1</td><td>A0</td><td></td><td></td></tr>
</table>

R/W#	D/C#	Hex	D7	D6	D5	D4	D3	D2	D1	D0	Command	Description
0	0	4E	0	1	0	0	1	1	1	0	Set RAM X address X address	Make initial settings for the RAM X address in the address counter (AC) address in the address counter (AC)
0	1		0	0	A5	A4	A3	A2	A1	A0		
0	0	4F	0	1	0	0	1	1	1	1	Set RAM Y address counter	Make initial settings for the RAM Y address in the address counter (AC) A[8:0]: 000h [POR].
0	1		A7	A6	A5	A4	A3 A	A2	A1	A0		
0	1		0	0	0	0	0	0	0	A8		
0	0	74	0	1	1	1	0	1	0	0	Set Analog Block Control	A[7:0]: 54h [POR]
0	1		A7	A6	A5	A4	A3 A	A2	A1	A0		
0	0	7E	0	1	1	1	1	1	1	0	Set Digital Block Control	A[7:0]: 3Bh [POR]
0	1		A7	A6	A5	A4	A3 A	A2	A1	A0		
0	0	7F	0	1	1	1	1	1	1	1	NOP	This command is an empty command; it does not have any effect on the display module. However it can be used to terminate Frame Memory Write or Read Commands.

10. Reference Circuit

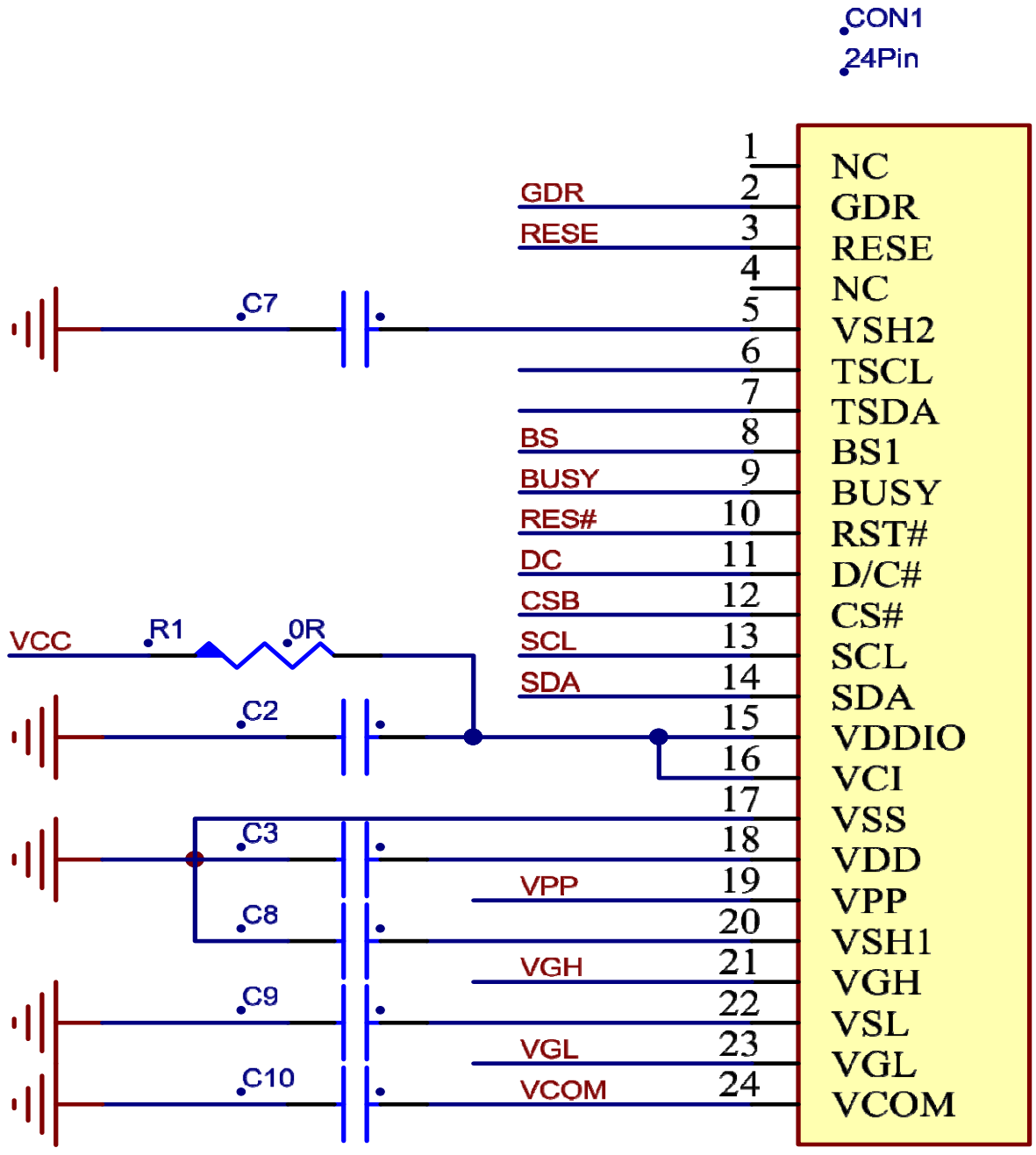


Figure. 10-1

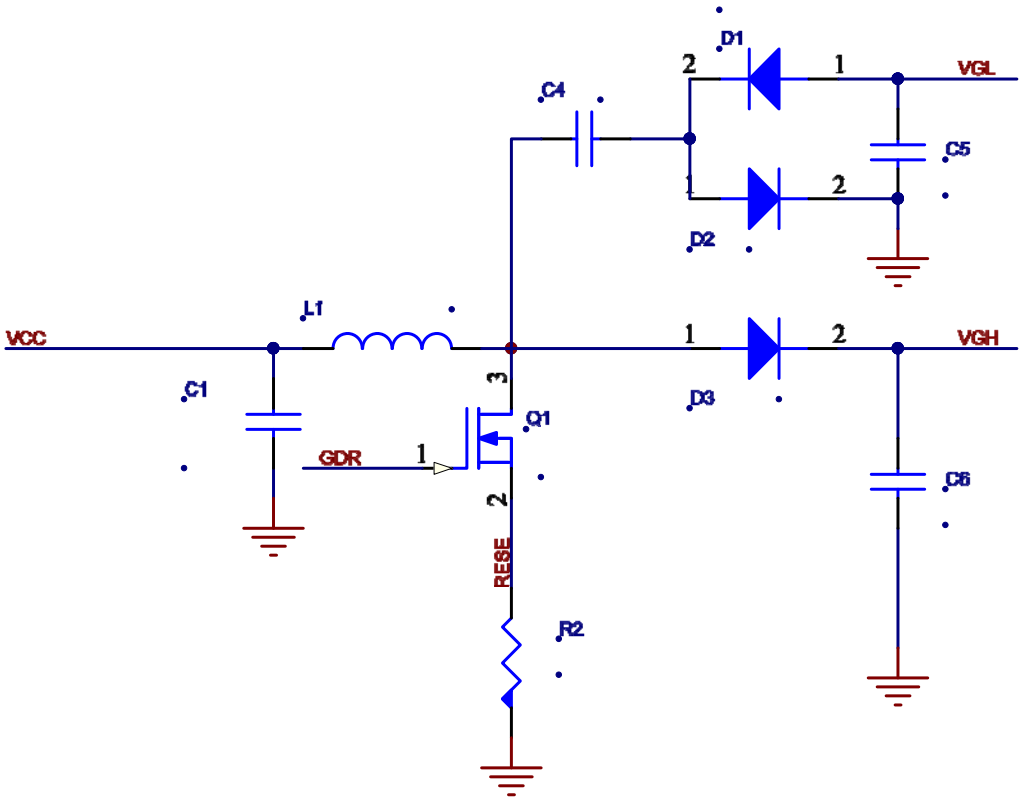


Figure. 10-2

Part Name	SSD1680Value /quirement/Reference Part
C1—C10	1uF/0603;X5R/X7R;Voltage Rating: 25V
C10	1uF/0603;X7R;Voltage Rating: 25V
D1—D3	MBR0530 1) Reverse DC voltage≥30V 2) Forward current≥500mA 3)Forward voltage≤430mV
R2	2.2 Ω/0603： 1% variation
Q1	NMOS:Si1304BDL/NX3008NBK 1） Drain-Source breakdown voltage ≥30V 2） Vgs（th）=0.9（Typ），1.3V（Max） 3） Rds on≤ 2.1Ω @ Vgs=2.5V
L1	47uH/CDRH2D18、LDNP-470NC Maximum DC current~420mA Maximum DC resistance~650mΩ

11. ABSOLUTE MAXIMUM RATING

Table 11-1: Maximum Ratings

Symbol	Parameter	Rating	Unit	Humidity	Unit	Note
V_{CI}	Logic supply voltage	-0.5 to +6.0	V	-	-	
T_{OPR}	Operation temperature range	-25 to 25	°C	-	%	
Tttg	Transportation temperature range	-25 to 60	°C	-	-	Note11-2

Note 11-1:Maximum ratings are those values beyond which damages to the device may occur.
Functional operation should be restricted to the limits in the Electrical Characteristics chapter.

Note11-2: Tstg is the transportation condition，the transport time is within 10 days for -25℃~0℃ or 25℃~60℃.

12.DC CHARACTERISTICS

The following specifications apply for: VSS=0V, VCI=3.3V, T_{OPR}=25℃.

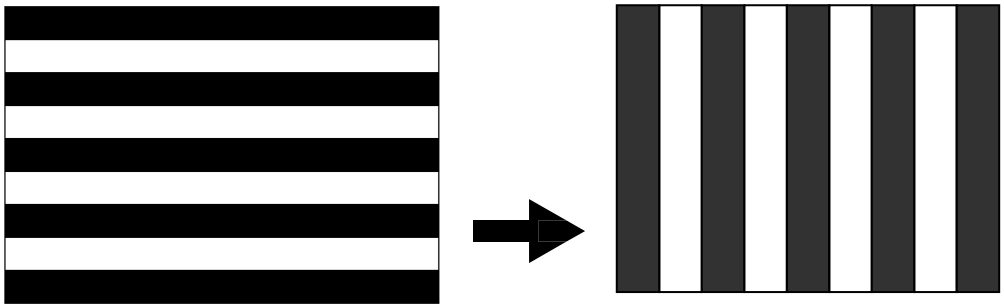
Table 12-1: DC Characteristics

Symbol	Parameter	Test Condition	Applicable pin	Min.	Typ.	Max.	Unit
VCI	VCI operation voltage	-	VCI	2.5	3	3.7	V
VIH	High level input voltage	-	SDA, SCL, CS#, D/C#, RES#, BS1	0.8VDDIO	-	-	V
VIL	Low level input voltage	-		-	-	0.2VDDIO	V
VOH	High level output voltage	IOH = -100uA	BUSY,	0.9VDDIO	-	-	V
VOL	Low level output voltage	IOL = 100uA		-	-	0.1VDDIO	V
Iupdate	Module operating current	-	-	-	4.5	-	mA
Isleep	Deep sleep mode	VCI=3.3V	-	-	-	3	uA

- The Typical power consumption is measured using associated 25℃ waveform with following pattern transition: from horizontal scan pattern to vertical scan pattern. (Note 12-1)
- The listed electrical/optical characteristics are only guaranteed under the controller & waveform provided by XingTai.
- Vcom value will be OTP before in factory or present on the label sticker.

Note 12-1

The Typical power consumption



13. Serial Peripheral Interface Timing

The following specifications apply for: VSS=0V, VCI=2.5V to 3.7V, T_{OPR}=25℃

Write mode

Symbol	Parameter	Min	Typ	Max	Unit
fSCL	SCL frequency (Write Mode)			20	MHz
tCSSU	Time CS# has to be low before the first rising edge of SCLK	20			ns
tCSHLD	Time CS# has to remain low after the last falling edge of SCLK	20			ns
tCSHIGH	Time CS# has to remain high between two transfers	100			ns
tSCLHIGH	Part of the clock period where SCL has to remain high	25			ns
tSCLLOW	Part of the clock period where SCL has to remain low	25			ns
tSISU	Time SI (SDA Write Mode) has to be stable before the next rising edge of SCL	10			ns
tSIHLD	Time SI (SDA Write Mode) has to remain stable after the rising edge of SCL	40			ns

Read mode

Symbol	Parameter	Min	Typ	Max	Unit
fSCL	SCL frequency (Read Mode)			2.5	MHz
tCSSU	Time CS# has to be low before the first rising edge of SCLK	100			ns
tCSHLD	Time CS# has to remain low after the last falling edge of SCLK	50			ns
tCSHIGH	Time CS# has to remain high between two transfers	250			ns
tSCLHIGH	Part of the clock period where SCL has to remain high	180			ns
tSCLLOW	Part of the clock period where SCL has to remain low	180			ns
tSOSU	Time SO(SDA Read Mode) will be stable before the next rising edge of SCL		50		ns
tSOHLD	Time SO (SDA Read Mode) will remain stable after the falling edge of SCL		0		ns

Note: All timings are based on 20% to 80% of VDDIO-VSS

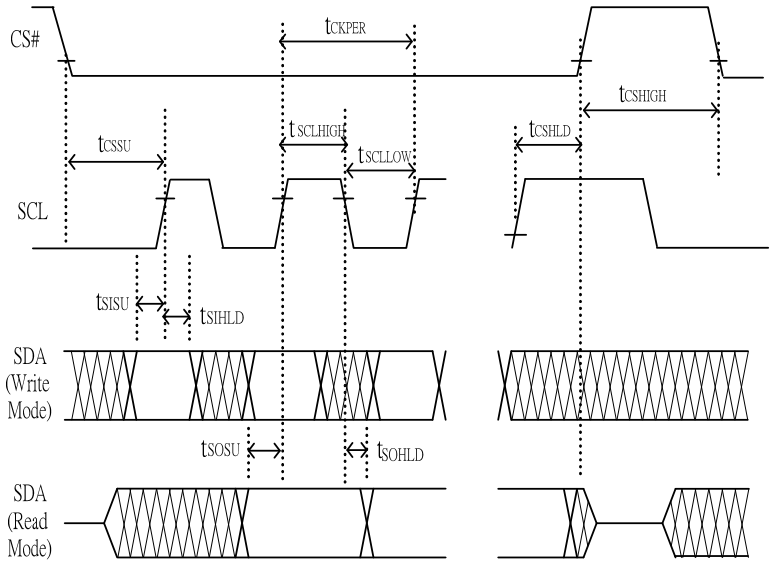


Figure 13-1 : Serial peripheral interface characteristics

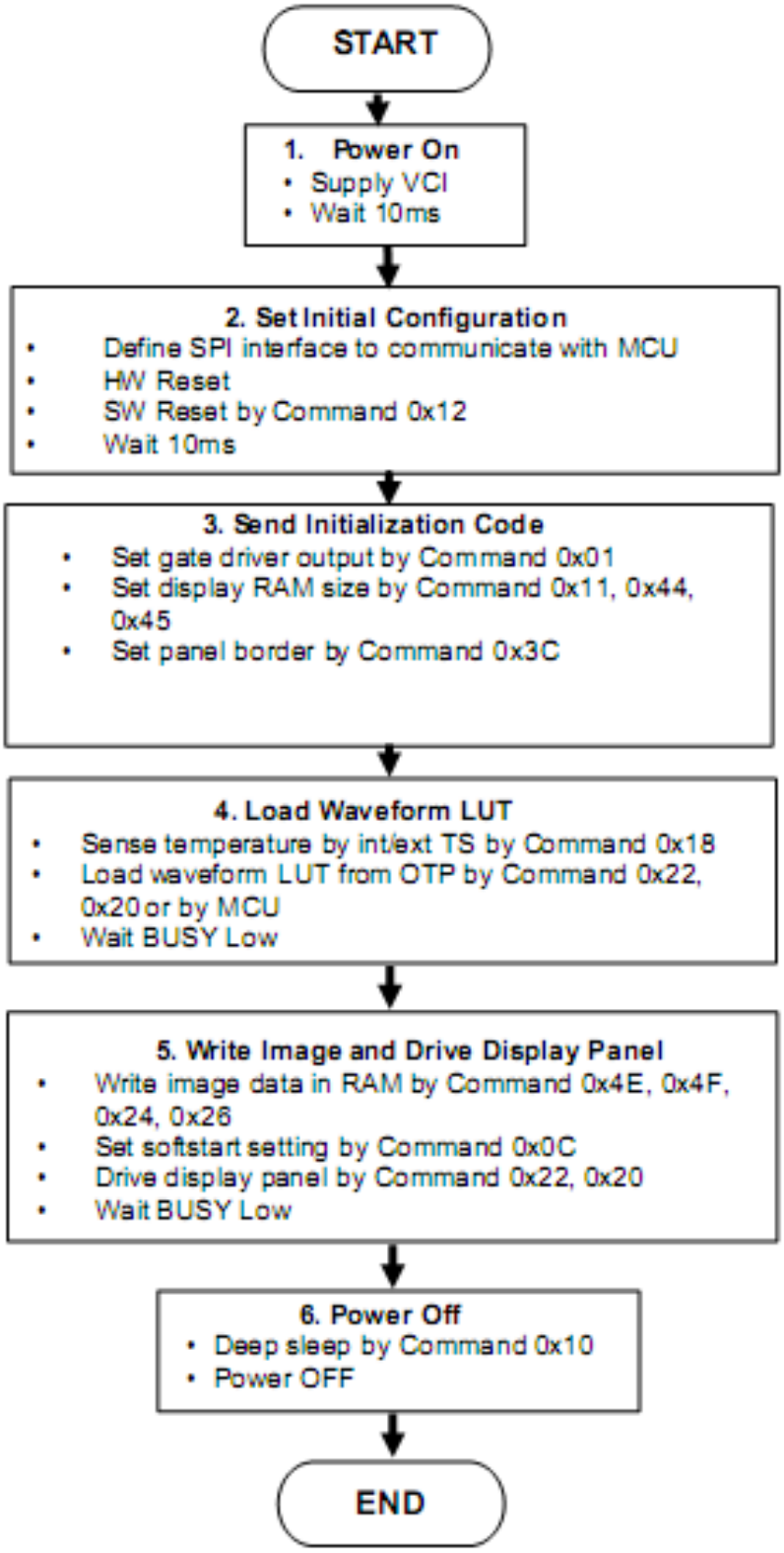
14 .Power Consumption

Parameter	Symbol	Conditions	TYP	Max	Unit	Remark
Panel power consumption during update	-	25℃	-	150	mAs	-
Deep sleep mode	-	25℃	-	3	uA	-

mAs=update average current×update time

15. Typical Operating Sequence

15.1 Normal Operation Flow



16. Optical characteristics

16.1 Specifications

Measurements are made with that the illumination is under an angle of 45 degrees, the detection is perpendicular unless otherwise specified.

T=25℃

SYMBOL	PARAMETER	CONDITIONS	MIN	TYPE	MAX	UNIT	Note
R	Reflectance	White	30	35	-	%	Note 16-1
Gn	2Grey Level	-	-	DS+(WS-DS)×n(m-1)	-	L*	-
CR	Contrast Ratio	indoor	-	10	-	-	-
Panel's life	-	-25℃～25℃		5years	-	-	Note 16-2

WS: White state, DS : Dark state

Note 16-1: Luminance meter : Eye - One Pro Spectrophotometer

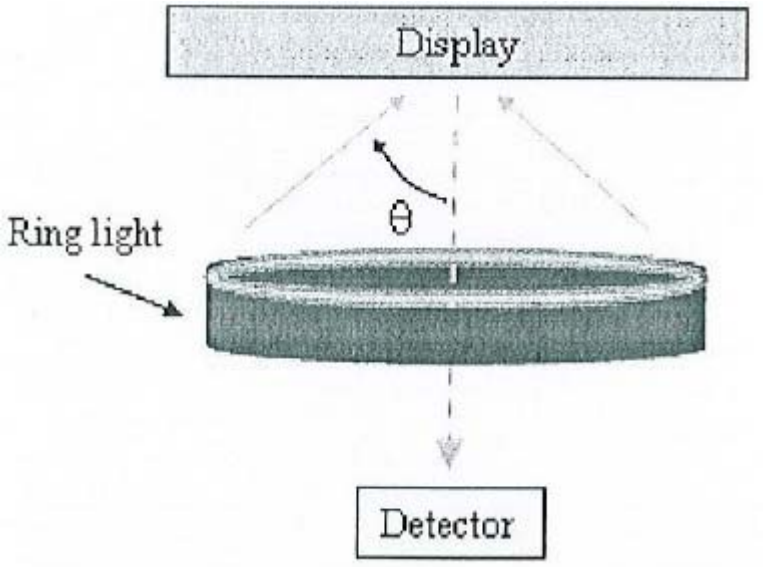
Note 16-2: We don't guarantee 5 years pixels display quality for humidity below 45%RH or above 70%RH; at least update 1 time per day.

16.2Definition of contrast ratio

The contrast ratio (CR) is the ratio between the reflectance in a full white area (R1) and the reflectance in a dark area (Rd)() :

R1: white reflectance Rd: dark reflectance

CR = R1/Rd

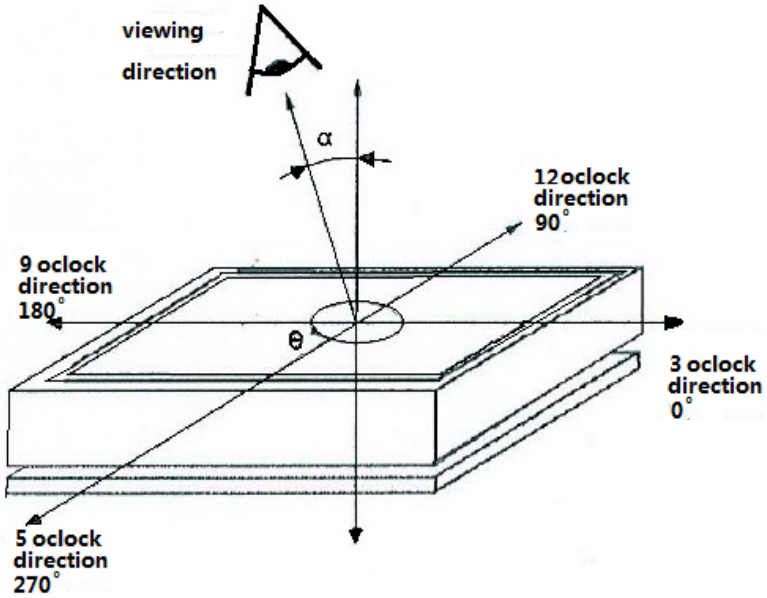


16.3 Reflection Ratio

The reflection ratio is expressed as :

R = Reflectance Factor $_{\text{white board}}$ x (L_{center} / $L_{\text{white board}}$)

L_{center} is the luminance measured at center in a white area (R=G =B=1) . $L_{\text{white board}}$ is the luminance of a standard white board . Both are measured with equivalent illumination source . The viewing angle shall be no more than 2 degrees .



17. HANDLING,SAFETY AND ENVIROMENTAL REQUIREMENTS

WARNING
The display module should be kept flat or fixed to a rigid, curved support with limited bending along the long axis. It should not be used for continual flexing and bending. Handle with care. Should the display break do not touch any material that leaks out. In case of contact with the leaked material then wash with water and soap.

CAUTION
The display module should not be exposed to harmful gases, such as acid and alkali gases, which corrode electronic components.
Disassembling the display module can cause permanent damage and invalidate the warranty agreements.
IPA solvent can only be applied on active area and the back of a glass. For the rest part, it is not allowed.
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.

Mounting Precautions
(1) It`s recommended that you consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the module.
(2) It`s recommended that you attach a transparent protective plate to the surface in order to protect the EPD. Transparent protective plate should have sufficient strength in order to resist external force.
(3) You should adopt radiation structure to satisfy the temperature specification.
(4) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the PS at high temperature and the latter causes circuit break by electro-chemical reaction.
(5) Do not touch, push or rub the exposed PS with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment. Do not touch the surface of PS for bare hand or greasy cloth. (Some cosmetics deteriorate the PS)
(6) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach the PS. Do not use acetone, toluene and alcohol because they cause chemical damage to the PS.
(7) Wipe off saliva or water drops as soon as possible. Their long time contact with PS causes deformations and color fading.

Data sheet status	
Product specification	The data sheet contains final product specifications.

Limiting values
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). 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 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 dose not form part of the specification.

Product Environmental certification
ROHS
REMARK
All The specifications listed in this document are guaranteed for module only. Post-assembled operation or component(s) may impact module performance or cause unexpected effect or damage and therefore listed specifications is not warranted after any Post-assembled operation.

18. Reliability test

	TEST	CONDITION	REMARK
1	High-Temperature Operation	T=40℃，RH=35%RH，For 240Hr	
2	Low-Temperature Operation	T = 0℃ for 240 hrs	
3	High-Temperature Storage	T=60℃ RH=35%RH For 240Hr	Test in white pattern
4	Low-Temperature Storage	T = -25℃ for 240 hrs	Test in white pattern
5	High Temperature, High-Humidity Operation	T=40℃，RH=90%RH，For 168Hr	
6	High Temperature, High-Humidity Storage	T=60℃，RH=80%RH，For 240Hr Test in white pattern	Test in white pattern
7	Temperature Cycle	-25℃(30min)~70℃(30min)，100 Cycle	Test in white pattern
8	Package Vibration	1.04G,Frequency : 20~200Hz Direction : X,Y,Z Duration: 30 minutes in each direction	Full packed for shipment
9	Package Drop Impact	Drop from height of 100 cm on Concrete surface Drop sequence:1 corner, 3edges, 6face One drop for each.	Full packed for shipment
10	UV exposure Resistance	765 W/㎡ for 168hrs,40℃	
11	Electrostatic discharge	Machine model: +/-250V,0Ω,200pF	

Actual EMC level to be measured on customer application.

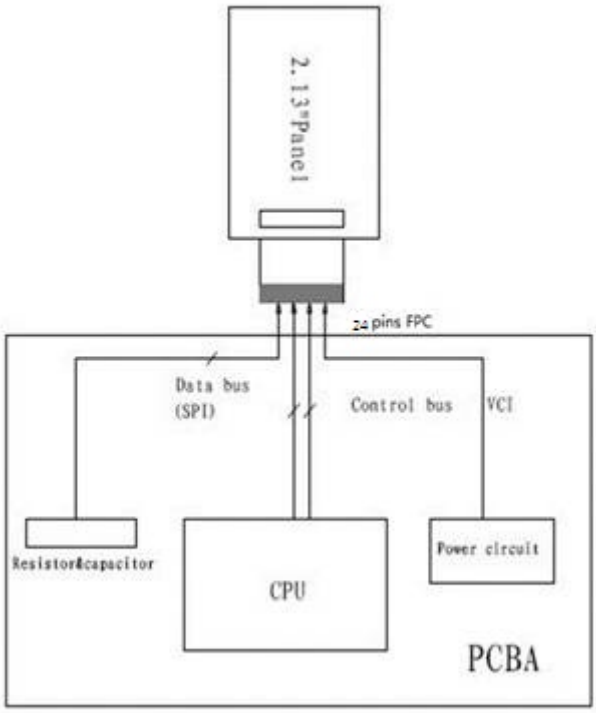
Note1：Stay white pattern for storage and non-operation test.

Note2：Operation is black/white/red pattern , hold time is 150S.

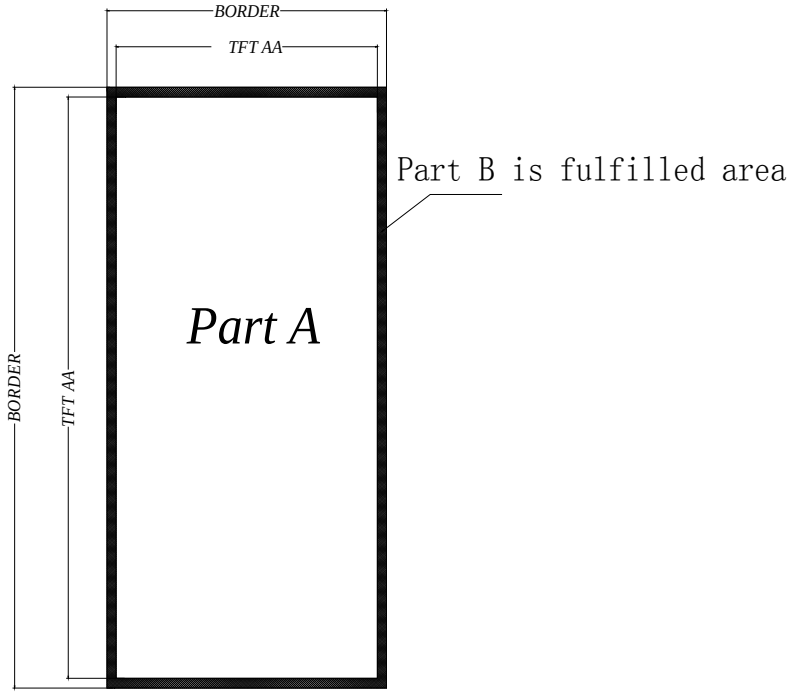
Note3：The function ,appearance, opticals should meet the requirements of the test before and after the test.

Note4：Keep testing after 2 hours placing at 20℃-25℃.

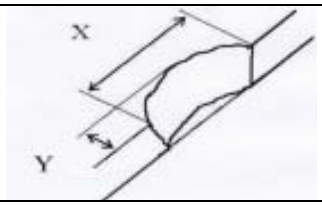
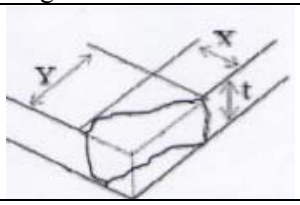
19. Block Diagram

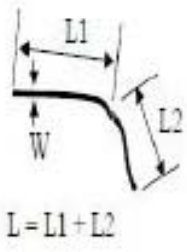


20. PartA/PartB specification

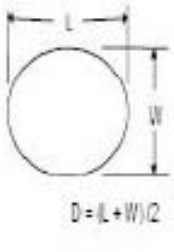


21. Point and line standard

Shipment Inspection Standard						
Equipment：Electrical test fixture, Point gauge						
Outline dimension	29.2(H)×59.2 (V) ×0.9(D)	Unit：㎜	Part-A	Active area	Part-B	Border area
Environment	Temperature	Humidity	Illuminance	Distance	Time	Angle
	19℃～25℃	55%±5%RH	800～1300Lux	300 ㎜	35Sec	
Defect type	Inspection method	Standard		Part-A		Part-B
Spot	Electric Display	D≤0.25 ㎜		Ignore		Ignore
		0.25 ㎜＜D≤0.4 ㎜		N≤4		Ignore
		D＞0.4 ㎜		Not Allow		Ignore
Display unwork	Electric Display	Not Allow		Not Allow		Ignore
Display error	Electric Display	Not Allow		Not Allow		Ignore
Scratch or line defect(include dirt)	Visual/Film card	L≤2 ㎜，W≤0.2 ㎜		Ignore		Ignore
		2.0mm＜L≤5.0mm，0.2＜W≤ 0.3mm,		N≤2		Ignore
		L＞5 ㎜，W＞0.3 ㎜		Not Allow		Ignore
PS Bubble	Visual/Film card	D≤0.2mm		Ignore		Ignore
		0.2mm≤D≤0.35mm & N≤4		N≤4		Ignore
		D＞0.35 mm		Not Allow		Ignore
Corner /Edge chipping	Visual/Film card	X≤6mm，Y≤0.4mm, Do not affect the electrode circuit (Edge chipping) X≤1mm，Y≤1mm, Do not affect the electrode circuit((Corner chipping) Ignore				
		 				
Remark	1.Cannot be defect & failure cause by appearance defect;					
	2.Cannot be larger size cause by appearance defect;					
	L=long W=wide D=point size N=Defects NO					



Line Defect



Spot Defect

L=long W=wide D=point size

22.Barcode

22-1 label appearance

ABBBBBBBCC
DDDEEEFGGG

22-2 QR scanned information（Total 28 code number+ 2 blank spaces）

A BBBBBBB CC □ DDD EEE F GGG □ H III J KKK
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

① A——The factory code
② BBBBBBB——Module name of EPD
③ CC——FPL model name
④ DDD——Date of production
⑤ EEE——Production lot
⑥ F——Separator
⑦ GGG——FPL Lot
⑧ H——Normal Lot
⑨ III——TFT、PS、EC.
⑩ J——IC
⑪ KKK——Serial NO.
□ blank spaces

23. Packing

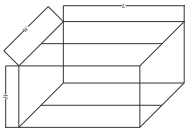
Packing Spec

Sheet No:

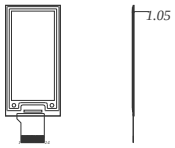
HOLITECH	Part No	HINK-E0213A50	DATE	2018.6.26	VER	A0	Page	2-1

一, Package Type: Box

Box No	HINK-E029A01-ZX-A0
Box size	515*322*170
Containment	360PCS



PRODUCT DRAWING



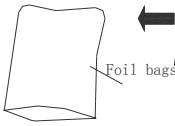
二,Inside package type:Plastic Tray unit: mm

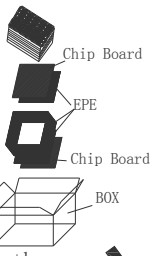
Plastic Tray	465*280*15	13 pcs
Anti-static foil bags	700*530*0.1	1 pcs
EPE(inside)	417.6*230.64*2	30 pcs
EPE(Up-Down)	485*145*10	2 pcs
EPE(Left-Right)	285*480*10	2 pcs
EPE(Front-back)	310*145*10	2 pcs
Chip board	500*306*5	2 pcs
Quantity/tray	30 pcs	
Tray number/sheet	12+1 Sheets	
Box	1	

Step 1:
Material: Tray, EPE
Put the product in to the tray and keep the dispaly side up. Then put anti-static EPE in to each holes.

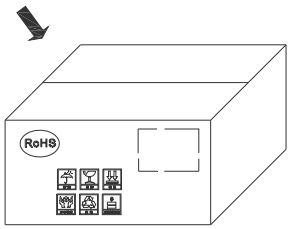
Step 2:
1) Must keep the angle 180 degree placed between the neighboring Plastic trays.
2) There are 12 layers product, total30*12=360pcs。
3) An empty Plastic tray intersects put on the top of the plastic trays.

Step 3:
1) In each case, put 2 bags of desiccant. then seal the trays with adhesive tapes.
2) Put the trays into foil bags.
3) heat seal the foil bags.





Step 4:
1)First put a chip board on the buttom of the box, then placed the down EPE, the left - right and front -back EPE.
2) Placed the sealed products into the box.
3) The last placed the up EPE on the top of the trays, and place a chip board on it.



Step 5:
1) Seal the box with adhensive tapes 。
2) Paste the lable onto the exterior box, and the lable can't cover the safety , transfer and RoSH sign。

Design	X.Z.P	Approve	J.P.F	Confirm	X.X.M
Date	2018.6.26	Date	2018.6.26	Date	2018.6.26

Packing Spec

Sheet No

HOLITECH	Part No	HINK-E0213A50	Date	2018.6.26	VER	A0	Page	2-2

The label outside the carton print as below

90.00

Label	
Customer Part No	
Customers Item No	A
MFG order No	B
MFG batch No	C
QTY	D
G.W	E
N.W	F
MFG Date	J
Carton No	
Remark	

65.00

NOTE:

1."A" Print customer Item No

2."B" Print customer Order No

3."C" Print MFG Batch No(Separate packing for different batch products. Mixed packing available for the odd number of different batch print all the batch NO&QTY accordingly if happened.

4."D"Print product qty

5."E"Print the G.W

6."F"Print the N.W

7."J"Print the MFG date

8.Before packing make sure the FPL batch ,item and qty are the same as which on the Final passed card.

Design	X.Z.P	Approve	J.P.F	Confirm	X.X.M
Date	2018.6.26	Date	2018.6.26	Date	2018.6.26