ER-EPD037-1

E-Paper Display Module Datasheet

EastRising Technology Co., Limited

Attention:

A. Some specifications of IC are not listed in this datasheet. Please refer to the IC datasheet for more details.

B. The related documents for interfacing, demo code, IC datasheet are all available, please download from our web.

C. Please pay more attention to "INSPECTION CRITERIA" in this datasheet. We assume you already agree with these criterions when you place an order with us. No more recommendations.

REV	Description	Release Date
1.0	Preliminary Release	Jul-09-2020

CONTENTS

1. ORDERING INFORMATION

1.1 Order Number

Order Number	Description
ER-EPD037-1B	3.7 inch E-Paper (E-ink) Display White/Black Color
ER-EPD037-1Y	3.7 inch E-Paper (E-ink) Display Yelllow/White/Black Color
ER-EPD037-1R	3.7 inch E-Paper (E-ink) Display Red/White/Black Color
ER-EPD037-1-5070	3.7 inch E-Paper (E-ink) Display with Arduino Shield
ER-EPD037-1-5103	3.7 inch E-Paper (E-ink) Display with Raspberry Pi HAT

1.2 Image

ER-EPD037-1B ↓

ER-EPD037-1Y ↓

ER-EPD037-1R ↓

ER-EPD037-1B-5070 ↓

ER-EPD037-1Y-5070 ↓

ER-EPD037-1R-5070 ↓

ER-EPD037-1B-5103 ↓

ER-EPD037-1Y-5103 ↓

ER-EPD037-1R-5103 ↓

2. SPECIFICATION

2.1 Display Specification

Item	Standard Value		Unit
Display Format	240 x416		Pixels
Display Connector	FFC		--
FPC Connector	24 Pin,0.5mm Pitch, SMD Horizontal Type Bottom contact		--
Operating Temperature	ER-EPD037-1B	0 ~ 40	℃
	ER-EPD037-1R	0 ~ 40	
	ER-EPD037-1Y	0 ~ 40	
Storage Temperature	ER-EPD037-1B	-25 ~ 60	℃
	ER-EPD037-1R	-25 ~ 60	
	ER-EPD037-1Y	-25 ~ 60	
Sunlight Readable	Yes		--

2.2 Mechanical Specification

Item	Standard Value	Unit
Screen Size	3.7	inch
Outline Dimension with FPC Folded	53.00(W) x 92.99(H)x1.05(T)	mm
Active Area	47.04(W) x81.54(H)	mm
Dot Pitch	0.202x0.203	mm

2.3 Electrical Specification

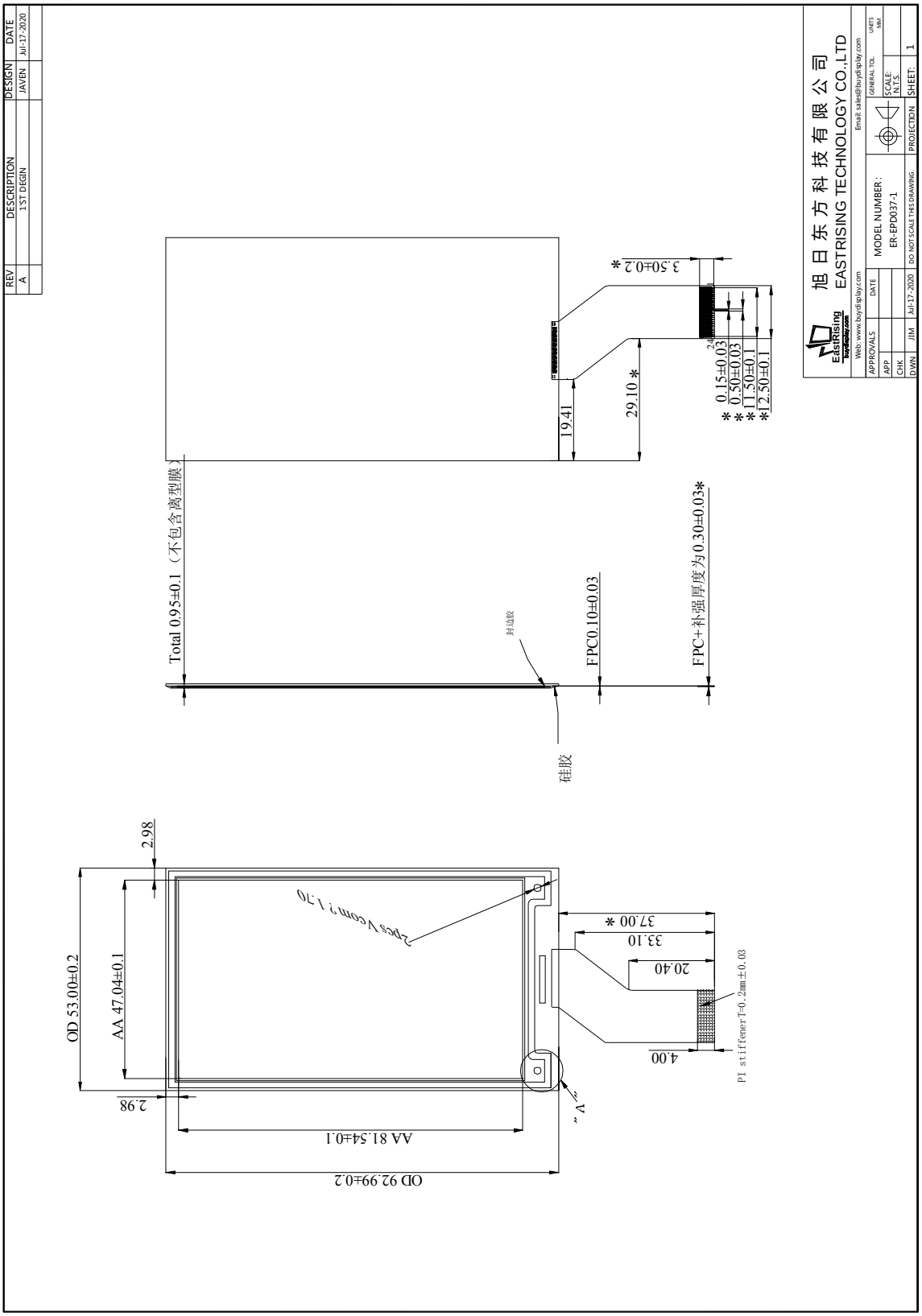
Item	Standard Value	Unit
IC Package	COG	--
Controller	HT0001	--
Interface	3/4 Wire SPI	--

2.4 Optical Specification

Item	Standard Value	Unit
LCD Type	E-Ink Display (E-Paper Display)	--
Viewing Angle Range	Left:85 , Right:85 , Up:85 , Down:85	deg

3. OUTLINE DRAWING

3.1 ER-EPD037-1 Outline Drawing



4. ELECTRICAL SPEC

4.1 Pin Configuration

Pin #	Single	Description	Remark
	B.P	BONDING PIN	
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	Keep Open
5	VDHR	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	BS	Bus selection pin	Note 4-5
9	BUSY_N	Busy state output pin	Note 4-4
10	RST_N	Reset	Note 4-3
11	DC	Data /Command control pin	Note 4-2
12	CSB	Chip Select input pin	Note 4-1
13	SCL	serial clock pin (SPI)	
14	SDA	serial data pin (SPI)	
15	VDDIO	Power for interface logic pins	
16	VDD	Power Supply pin for the chip	
17	GND	Ground	
18	VDDD	Core logic power pin	
19	VPP	Power Supply for OTP Programming	
20	VDH(VSH)	Positive source driver Voltage	
21	VGH	Positive Gate driving voltage	
22	VDL(VSL)	Negative Source driving voltage	
23	VGL	Negative Gate voltage.	
24	VCOM	VCOM driving voltage	

Note 4-1: This pin (CSB) is the chip select input connecting to the MCU. The chip is enabled for MCU communication: only when CSB is pulled LOW.
Note 4-2: This pin (DC) 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 4-3: This pin (RST_N) is reset signal input. The Reset is active low.

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

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

Note 4-5: This pin (BS) 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.

5. Host interfaces

HT0001 provides 3-wire/4-wire serial interface for command and display data transferred from the MCU. The serial interface supports 8-bit mode. Data can be input/output by clocks while the chip is active (CSB =LOW). While input, data are written in order from MSB at the clock rising edge. When too many parameters are input, the chip accepts only defined parameters, and ignores undefined ones.

BS	Interface	CSB	DC	SCL	SDA
High	3-wire SPI	Available	Fix to GND	Available	Available
Low	4-wire SPI	Available	Available	Available	Available

3 wire SPI format

Data / Command is recognized with the first bit transferred. Data are transferred in the unit of 9 bits. To prevent malfunction due to noise, it is recommended to set the CSB signal to HIGH every 9 bits. (The serial counter is reset at the rising edge of the CSB signal.)

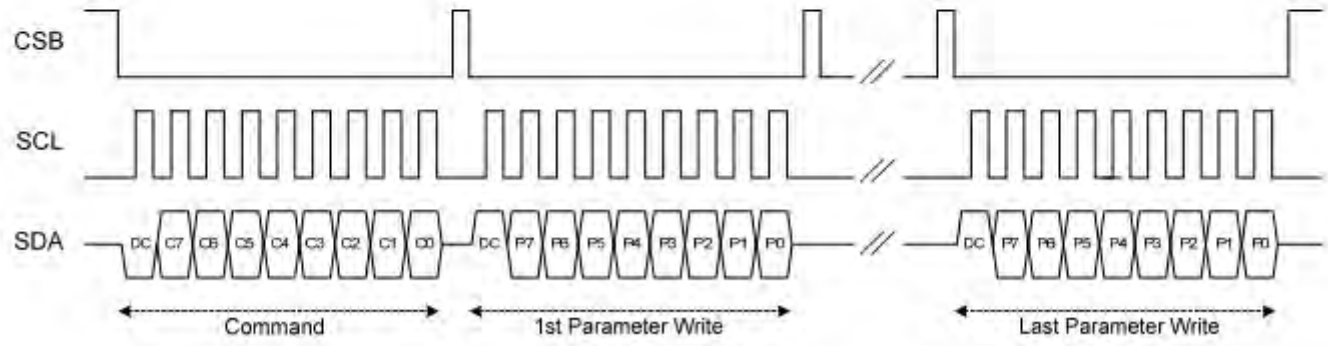


Figure: 3-wire SPI write operation

The MSB bit of data will be output at SDA pin after the 1st SCL falling edge, if the 1st input data at SDA is high.

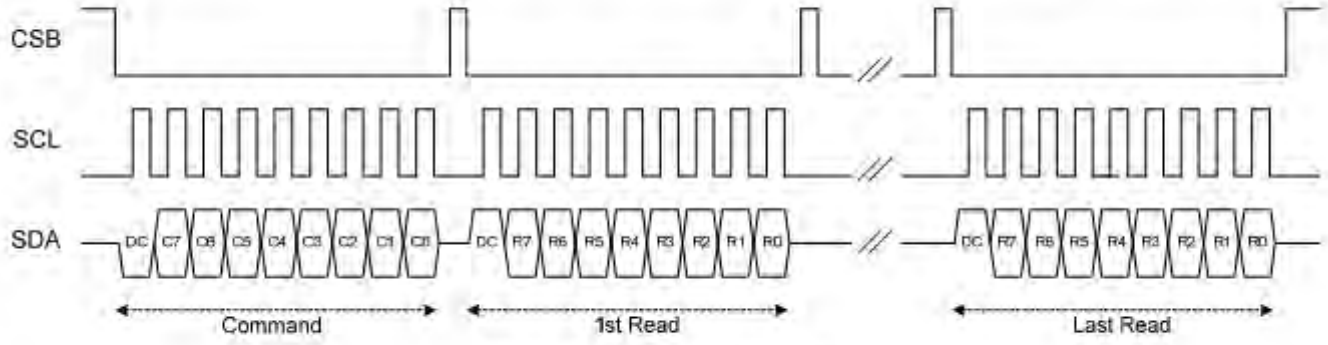


Figure: 3-wire SPI read operation

4 wire SPI format

Data / Command is recognized with DC pin. Data are transferred in the unit of 8 bits. To prevent malfunction due to noise, it is recommended to set the CSB signal to HIGH every 8 bits. (The serial counter is reset at the rising edge of the CSB signal.)

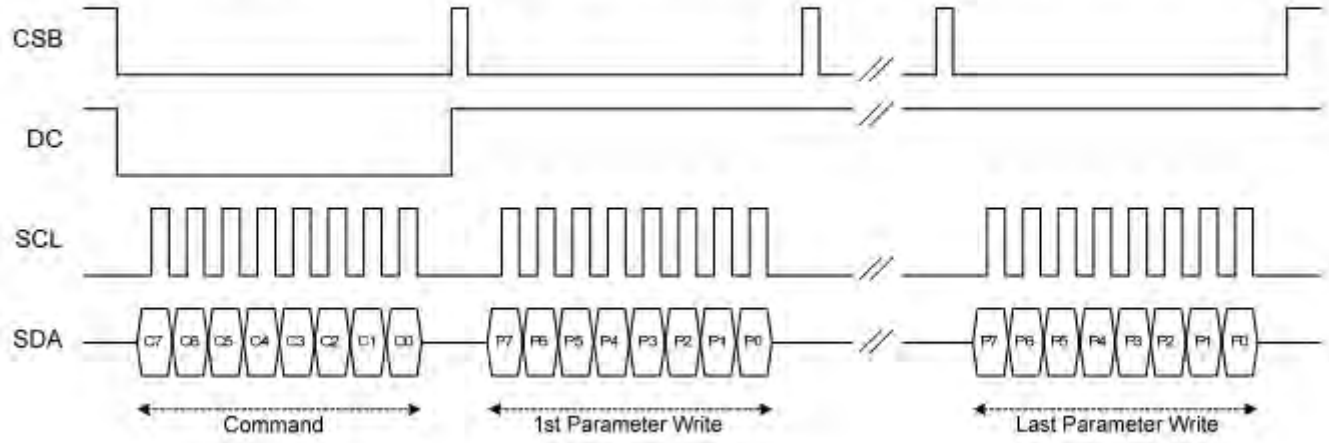


Figure: 4-wire SPI write operation

The MSB bit of data will be output at SDA pin after the CSB falling edge, if DC pin is High.

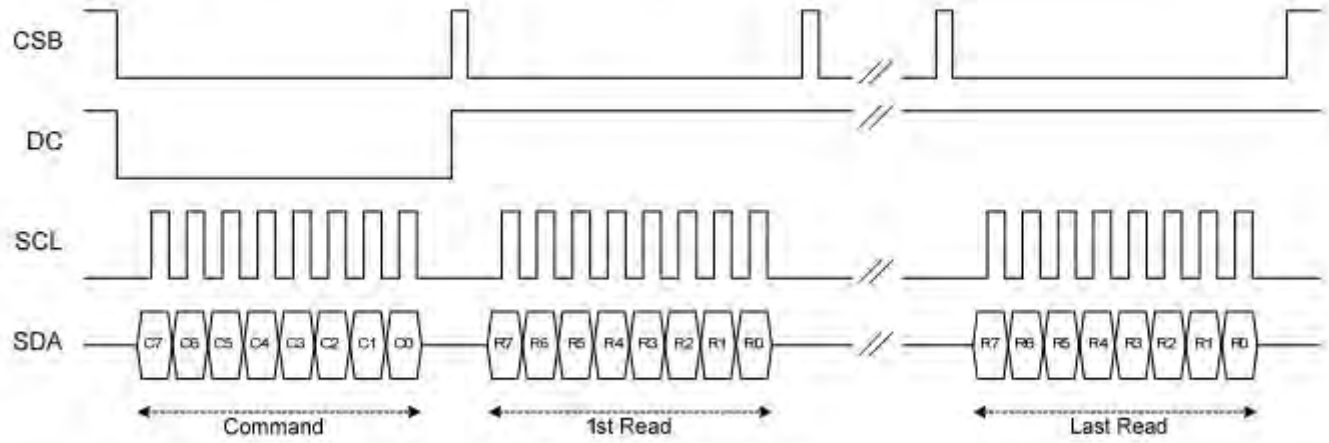


Figure: 4-wire SPI read operation

6. 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	Decimal Value	Value [DegC]
0111 1111 0000	7F0	2032	127
0111 1110 1110	7EE	2030	126.875
0111 1110 0010	7E2	2018	126.125
0111 1101 0000	7D0	2000	125
0001 1001 0000	190	400	25
0000 0000 0010	002	2	0.125
0000 0000 0000	000	0	0
1111 1111 1110	FFE	-2	-0.125
1110 0111 0000	E70	-400	-25
1100 1001 0010	C92	-878	-54.875
1100 1001 0000	C90	-880	-55

7. COMMAND TABLE

W/R: 0: Write Cycle 1: Read Cycle C/D: 0: Command / 1: Data D7~D0: –: Don't Care #: Valid Data

#	Command	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	Registers	Default
1	Panel Setting (PSR)	0	0	0	0	0	0	0	0	0	0		00H
		0	1	--	--	#	#	#	#	#	#	REG, KW/R, UD, SHL, SHD_N, RST_N	0FH
2	Power Setting (PWR)	0	0	0	0	0	0	0	0	0	1		01H
		0	1	--	--	--	--	--	#	#	#	VSR_EN, VS_EN, VG_EN	03H
		0	1	--	--	--	--	#	#	#	#	VCOM_HV, VG_LVL[2:0]	00H
		0	1	--	--	#	#	#	#	#	#	VDH_LVL[5:0]	3FH
		0	1	--	--	#	#	#	#	#	#	VDL_LVL[5:0]	3FH
		0	1	--	--	#	#	#	#	#	#	VDHR_LVL[5:0]	0DH
3	Power OFF (POF)	0	0	0	0	0	0	0	0	1	0		02H
4	Power OFF Sequence Setting (PFS)	0	0	0	0	0	0	0	0	1	1		03H
		0	1	--	--	#	#	--	--	--	--	T_VDS_OFF[1:0]	00H
5	Power ON (PON)	0	0	0	0	0	0	0	1	0	0		04H
6	Power ON Measure (PMES)	0	0	0	0	0	0	0	1	0	1		05H
7	Booster Soft Start (BTST)	0	0	0	0	0	0	0	1	1	0		06H
		0	1	#	#	#	#	#	#	#	#	BT_PHA[7:0]	17H
		0	1	#	#	#	#	#	#	#	#	BT_PHB[7:0]	17H
		0	1	--	--	#	#	#	#	#	#	BT_PHC[5:0]	17H
8	Deep sleep (DSLP)	0	0	0	0	0	0	0	1	1	1		07H
		0	1	1	0	1	0	0	1	0	1	Check code	A5H
9	Display Start Transmission 1 (DTM1, White/Black Data) (x-byte command)	0	0	0	0	0	1	0	0	0	0	K/W or OLD Pixel Data	10H
		0	1	#	#	#	#	#	#	#	#	KPXL[1:8]	-
		0	1	:	:	:	:	:	:	:	:	:	:
		0	1	#	#	#	#	#	#	#	#	KPXL[n-7:n]	-
10	Data Stop (DSP)	0	0	0	0	0	1	0	0	0	1		11H
		1	1	#	--	--	--	--	--	--	--		00H
11	Display Refresh (DRF)	0	0	0	0	0	1	0	0	1	0		12H
12	Display Start transmission 2 (DTM2, Red Data) (x-byte command)	0	0	0	0	0	1	0	0	1	1	Red or NEW Pixel Data	13H
		0	1	#	#	#	#	#	#	#	#	RPXL[1:8]	-
		0	1	:	:	:	:	:	:	:	:	:	:
		0	1	#	#	#	#	#	#	#	#	RPXL[n-7:n]	-
13	Auto Sequence (AUTO)	0	0	0	0	0	1	0	1	1	1		17H
		0	1	1	0	1	0	0	1	0	1	Check code	A5H
14	VCOM LUT (LUTC) (61-byte command, structure of bytes 2~7 repeated 10 times)	0	0	0	0	1	0	0	0	0	0		20H
		0	1	#	#	#	#	#	#	#	#	Level select-0~3[1:0]	-
		0	1	:	:	:	:	:	:	:	:	Number of frames-0[7:0]	-
		0	1	:	:	:	:	:	:	:	:	Number of frames-1[7:0]	-
		0	1	:	:	:	:	:	:	:	:	Number of frames-2[7:0]	-
		0	1	:	:	:	:	:	:	:	:	Number of frames-3[7:0]	-
		0	1	#	#	#	#	#	#	#	#	Times to repeat[7:0]	-

#	Command	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	Registers	Default
15	W2W LUT (LUTWW) (43-byte command, structure of bytes 2~7 repeated 7 times)	0	0	0	0	1	0	0	0	0	1		21H
		0	1	#	#	#	#	#	#	#	#	Level select-0~3[1:0]	-
		0	1	:	:	:	:	:	:	:	:	Number of frames-0[7:0]	-
		0	1	:	:	:	:	:	:	:	:	Number of frames-1[7:0]	-
		0	1	:	:	:	:	:	:	:	:	Number of frames-2[7:0]	-
		0	1	:	:	:	:	:	:	:	:	Number of frames-3[7:0]	-
		0	1	#	#	#	#	#	#	#	#	Times to repeat[7:0]	-
16	K2W LUT (LUTKW / LUTR) (61-byte command, structure of bytes 2~7 repeated 10 times)	0	0	0	0	1	0	0	0	1	0		22H
		0	1	#	#	#	#	#	#	#	#	Level select-0~3[1:0]	-
		0	1	:	:	:	:	:	:	:	:	Number of frames-0[7:0]	-
		0	1	:	:	:	:	:	:	:	:	Number of frames-1[7:0]	-
		0	1	:	:	:	:	:	:	:	:	Number of frames-2[7:0]	-
		0	1	:	:	:	:	:	:	:	:	Number of frames-3[7:0]	-
		0	1	#	#	#	#	#	#	#	#	Times to repeat[7:0]	-
17	W2K LUT (LUTWK / LUTW) (61-byte command, structure of bytes 2~7 repeated 10 times)	0	0	0	0	1	0	0	0	1	1		23H
		0	1	#	#	#	#	#	#	#	#	Level select-0~3[1:0]	-
		0	1	:	:	:	:	:	:	:	:	Number of frames-0[7:0]	-
		0	1	:	:	:	:	:	:	:	:	Number of frames-1[7:0]	-
		0	1	:	:	:	:	:	:	:	:	Number of frames-2[7:0]	-
		0	1	:	:	:	:	:	:	:	:	Number of frames-3[7:0]	-
		0	1	#	#	#	#	#	#	#	#	Times to repeat[7:0]	-
18	K2K LUT (LUTKK / LUTK) (61-byte command, structure of bytes 2~7 repeated 10 times)	0	0	0	0	1	0	0	1	0	0		24H
		0	1	#	#	#	#	#	#	#	#	Level select-0~3[1:0]	-
		0	1	:	:	:	:	:	:	:	:	Number of frames-0[7:0]	-
		0	1	:	:	:	:	:	:	:	:	Number of frames-1[7:0]	-
		0	1	:	:	:	:	:	:	:	:	Number of frames-2[7:0]	-
		0	1	:	:	:	:	:	:	:	:	Number of frames-3[7:0]	-
		0	1	#	#	#	#	#	#	#	#	Times to repeat[7:0]	-
19	LUT option (LUTOPT)	0	0	0	0	1	0	1	0	1	0		2AH
		0	1	#	#	--	--	--	--	--	--	STATE_XON[9:8]	00H
		0	1	#	#	#	#	#	#	#	#	STATE_XON[7:0]	00H
20	PLL control (PLL)	0	0	0	0	1	1	0	0	0	0		30H
		0	1	--	--	--	--	#	#	#	#	FRS[3:0]	04H
21	Temperature Sensor Calibration (TSC)	0	0	0	1	0	0	0	0	0	0		40H
		1	1	#	#	#	#	#	#	#	#	D[10:3] / TS[7:0]	00H
		1	1	#	#	#	--	--	--	--	--	D[2:0] / -	00H
22	Temperature Sensor Selection (TSE)	0	0	0	1	0	0	0	0	0	1		41H
		0	1	#	--	--	--	#	#	#	#	TSE,TO[3:0]	00H
23	Temperature Sensor Write (TSW)	0	0	0	1	0	0	0	0	1	0		42H
		0	1	#	#	#	#	#	#	#	#	WATTR[7:0]	00H
		0	1	#	#	#	#	#	#	#	#	WMSB[7:0]	00H
		0	1	#	#	#	#	#	#	#	#	WLSB[7:0]	00H
24	Temperature Sensor Read (TSR)	0	0	0	1	0	0	0	0	1	1		43H
		1	1	#	#	#	#	#	#	#	#	RMSB[7:0]	00H
		1	1	#	#	#	#	#	#	#	#	RLSB[7:0]	00H

#	Command	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	Registers	Default
25	Panel Break Check (PBC)	0	0	0	1	0	0	0	1	0	0		44H
		1	1	--	--	--	--	--	--	--	#	PSTA	00H
26	VCOM and data interval setting (CDI)	0	0	0	1	0	1	0	0	0	0		50H
		0	1	#	--	#	#	--	–	#	#	BDZ, BDV[1:0], DDX[1:0]	31H
		0	1	--	--	--	–	#	#	#	#	CDI[3:0]	07H
27	Lower Power Detection (LPD)	0	0	0	1	0	1	0	0	0	1		51H
		1	1	--	--	--	--	--	--	--	#	LPD	01H
28	TCON setting (TCON)	0	0	0	1	1	0	0	0	0	0		60H
		0	1	#	#	#	#	#	#	#	#	S2G[3:0], G2S[3:0]	22H
29	Resolution setting (TRES)	0	0	0	1	1	0	0	0	0	1		61H
		0	1	#	#	#	#	#	0	0	0	HRES[7:3]	F0H
		0	1	--	--	--	--	--	--	#	#	VRES[9:0]	02H
		0	1	#	#	#	#	#	#	#	#		00H
30	Gate/Source Start setting (GSST)	0	0	0	1	1	0	0	1	0	1		65H
		0	1	#	#	#	#	#	0	0	0	HST[7:3]	00H
		0	1	--	--	--	--	--	--	--	#	VST[8:0]	00H
		0	1	#	#	#	#	#	#	#	#		00H
31	Revision (REV)	0	0	0	1	1	1	0	0	0	0		70H
		1	1	#	#	#	#	#	#	#	#	LUT_REV[7:0]	FFH
32	Get Status (FLG)	0	0	0	1	1	1	0	0	0	1		71H
		1	1	--	#	#	#	#	#	#	#	PTL_FLAG ,I²C_ERR, I²C_BUSYN, DATA_FLAG, PON, POF, BUSY_N	13H
33	Auto Measurement VCOM (AMV)	0	0	1	0	0	0	0	0	0	0		80H
		0	1	--	--	#	#	#	#	#	#	AMVT[1:0], XON,AMVS, AMV, AMVE	10H
34	Read VCOM Value (VV)	0	0	1	0	0	0	0	0	0	1		81H
		1	1	--	--	#	#	#	#	#	#	VV[5:0]	00H
35	VCOM_DC Setting (VDCS)	0	0	1	0	0	0	0	0	1	0		82H
		0	1	--	--	#	#	#	#	#	#	VDCS[5:0]	00H
36	Partial Window (PTL)	0	0	1	0	0	1	0	0	0	0		90H
		0	1	#	#	#	#	#	0	0	0	HRST[7:3]	00H
		0	1	#	#	#	#	#	1	1	1	HRED[7:3]	EFH
		0	1	--	--	--	--	--	--	--	#	VRST[8:0]	00H
		0	1	#	#	#	#	#	#	#	#		00H
		0	1	--	--	--	--	--	--	--	#	VRED[8:0]	01H
		0	1	#	#	#	#	#	#	#	#		FFH
		0	1	--	--	--	--	--	--	--	#	PT_SCAN	01H
37	Partial In (PTIN)	0	0	1	0	0	1	0	0	0	1		91H
38	Partial Out (PTOUT)	0	0	1	0	0	1	0	0	1	0		92H
39	Program Mode (PGM)	0	0	1	0	1	0	0	0	0	0		A0H
40	Active Programming (APG)	0	0	1	0	1	0	0	0	0	1		A1H
41	Read OTP (ROTP)	0	0	1	0	1	0	0	0	1	0		A2H
		1	1	#	#	#	#	#	#	#	#	Data of Address = 000h	N/A
		1	1	:	:	:	:	:	:	:	:	:	N/A
		1	1	#	#	#	#	#	#	#	#	Data of Address = n	N/A
42	Cascade Setting (CCSET)	0	0	1	1	1	0	0	0	0	0		E0H
		0	1	--	--	--	--	--	--	#	#	TSFIX, CCEN	00H

#	Command	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	Registers	Default
43	Power Saving (PWS)	0	0	1	1	1	0	0	0	1	1		E3H
		0	1	#	#	#	#	#	#	#	#	VCOM_W[3:0], SD_W[3:0]	00H
44	LVD Voltage Select (LVSEL)	0	0	1	1	1	0	0	1	0	0		E4H
		0	1	--	--	--	--	--	--	#	#	LVD_SEL[1:0]	03H
45	Force Temperature (TSSET)	0	0	1	1	1	0	0	1	0	1		E5H
		0	1	#	#	#	#	#	#	#	#	TS_SET[7:0]	00H

Note: (1) All other register addresses are invalid or reserved, and should NOT be used.

(2) Any bits shown here as 0 must be written with a 0. All unused bits should also be set to zero. Device malfunction may occur if this is not done.

(3) Commands are processed on the 'stop' condition of the interface.

(4) Registers marked 'W/R' can be read, but the contents are written when the SPI command completes – so the contents can be read and altered. The user can subsequently write the register to restore the contents following an SPI read.

8.COMMAND DESCRIPTION

W/R: 0: Write Cycle / 1: Read Cycle C/D: 0: Command / 1: Data D7-D0: –: Don't Care

(1) PANEL SETTING (PSR) (REGISTER: R00H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Setting the panel	0	0	0	0	0	0	0	0	0	0	00H
	0	1	-	-	REG	KW/R	UD	SHL	SHD_N	RST_N	0FH

REG: LUT selection

0: LUT from OTP. (Default)
1: LUT from register.

KW/R: Black / White / Red

0: Pixel with Black/White/Red, KWR mode. (Default)
1: Pixel with Black/White, KW mode.

UD: Gate Scan Direction

0: Scan down. First line to Last line: Gn-1 → Gn-2 → Gn-3 → ... → G0
1: Scan up. (Default) First line to Last line: G0 → G1 → G2 → ... . → Gn-1

SHL: Source Shift Direction

0: Shift left. First data to Last data: Sn-1 → Sn-2 → Sn-3 → ... → S0
1: Shift right. (Default) First data to Last data: S0 → S1 → S2 → ... . → Sn-1

SHD_N: Booster Switch

0: Booster OFF
1: Booster ON (Default)

When SHD_N becomes LOW, charge pump will be turned OFF, register and SRAM data will keep until VDD OFF. And Source/Gate/Border/VCOM will be released to floating.

RST_N: Soft Reset

0: Reset. Booster OFF, Register data are set to their default values, all drivers will be reset, and all functions will be disabled. Source/Gate/Border/VCOM will be released to floating.

1: No effect (Default).

(2) POWER SETTING (PWR) (R01H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Selecting Internal/External Power	0	0	0	0	0	0	0	0	0	1	01H
	0	1	-	-	-	-	-	VSR_EN	VS_EN	VG_EN	07H
	0	1	-	-	-	-	VCOM_HV	VG_LVL[2:0]			00H
	0	1	-	-	VDH_LVL[5:0]						3FH
	0	1	-	-	VDL_LVL[5:0]						3FH
	0	1	-	-	VDHR_LVL[5:0]						0DH

VSR_EN: Source LV power selection
0 : External source power from VDHR pins
1 : Internal DC/DC function for generating VDHR. (Default)

VS_EN: Source power selection
0 : External source power from VDH/VDL pins
1 : Internal DC/DC function for generating VDH/VDL. (Default)

VG_EN: Gate power selection
0 : External gate power from VGH/VGL pins
1 : Internal DC/DC function for generating VGH/VGL. (Default)

VCOM_HV: VCOM Voltage Level
0 : VCOMH=VDH+VCOM_DC, VCOML=VDL+VCOM_DC. (Default)
1 : VCOMH=VGH, VCOML=VGL

VG_LVL[2:0]:VGH / VGL Voltage Level selection.

VG_LVL[2:0]	VGH/VGL Voltage Level
000	VGH=9V, VGL= -9V
001	VGH=10V, VGL= -10V
010	VGH=11V, VGL= -11V
011	VGH=12V, VGL= -12V
100	VGH=17V, VGL= -17V
101	VGH=18V, VGL= -18V
110	VGH=19V, VGL= -19V
111 **(Default)**	VGH=20V, VGL= -20V

VDH_LVL[5:0]: Internal VDH power selection for K/W pixel.(**Default value: 11 1111b**)

VDH_LVL	Voltage	VDH_LVL	Voltage	VDH_LVL	Voltage	VDH_LVL	Voltage
000000	2.4 V	010001	5.8 V	100010	9.2 V	110011	12.6 V
000001	2.6 V	010010	6.0 V	100011	9.4 V	110100	12.8 V
000010	2.8 V	010011	6.2 V	100100	9.6 V	110101	13.0 V
000011	3.0 V	010100	6.4 V	100101	9.8 V	110110	13.2 V
000100	3.2 V	010101	6.6 V	100110	10.0 V	110111	13.4 V
000101	3.4 V	010110	6.8 V	100111	10.2 V	111000	13.6 V
000110	3.6 V	010111	7.0 V	101000	10.4 V	111001	13.8 V
000111	3.8 V	011000	7.2 V	101001	10.6 V	111010	14.0 V
001000	4.0 V	011001	7.4 V	101010	10.8 V	111011	14.2 V
001001	4.2 V	011010	7.6 V	101011	11.0 V	111100	14.4 V
001010	4.4 V	011011	7.8 V	101100	11.2 V	111101	14.6 V
001011	4.6 V	011100	8.0 V	101101	11.4 V	111110	14.8 V
001100	4.8 V	011101	8.2 V	101110	11.6 V	**111111**	**15.0 V**
001101	5.0 V	011110	8.4 V	101111	11.8 V		
001110	5.2 V	011111	8.6 V	110000	12.0 V		
001111	5.4 V	100000	8.8 V	110001	12.2 V		
010000	5.6 V	100001	9.0 V	110010	12.4 V		

VDL_LVL[5:0]: Internal VDL power selection for K/W pixel. (**Default value: 11 1111b**)

VDL_LVL	Voltage	VDL_LVL	Voltage	VDL_LVL	Voltage	VDL_LVL	Voltage
000000	-2.4 V	010001	-5.8 V	100010	-9.2 V	110011	-12.6 V
000001	-2.6 V	010010	-6.0 V	100011	-9.4 V	110100	-12.8 V
000010	-2.8 V	010011	-6.2 V	100100	-9.6 V	110101	-13.0 V
000011	-3.0 V	010100	-6.4 V	100101	-9.8 V	110110	-13.2 V
000100	-3.2 V	010101	-6.6 V	100110	-10.0 V	110111	-13.4 V
000101	-3.4 V	010110	-6.8 V	100111	-10.2 V	111000	-13.6 V
000110	-3.6 V	010111	-7.0 V	101000	-10.4 V	111001	-13.8 V
000111	-3.8 V	011000	-7.2 V	101001	-10.6 V	111010	-14.0 V
001000	-4.0 V	011001	-7.4 V	101010	-10.8 V	111011	-14.2 V
001001	-4.2 V	011010	-7.6 V	101011	-11.0 V	111100	-14.4 V
001010	-4.4 V	011011	-7.8 V	101100	-11.2 V	111101	-14.6 V
001011	-4.6 V	011100	-8.0 V	101101	-11.4 V	111110	-14.8 V
001100	-4.8 V	011101	-8.2 V	101110	-11.6 V	**111111**	**-15.0 V**
001101	-5.0 V	011110	-8.4 V	101111	-11.8 V		
001110	-5.2 V	011111	-8.6 V	110000	-12.0 V		
001111	-5.4 V	100000	-8.8 V	110001	-12.2 V		
010000	-5.6 V	100001	-9.0 V	110010	-12.4 V		

VDHR_LVL[5:0]: Internal VDHR power selection for Red pixel. (**Default value: 00 1101b**)

VDHR_LVL	Voltage	VDHR_LVL	Voltage	VDHR_LVL	Voltage	VDHR_LVL	Voltage
000000	2.4 V	010001	5.8 V	100010	9.2 V	110011	12.6 V
000001	2.6 V	010010	6.0 V	100011	9.4 V	110100	12.8 V
000010	2.8 V	010011	6.2 V	100100	9.6 V	110101	13.0 V
000011	3.0 V	010100	6.4 V	100101	9.8 V	110110	13.2 V
000100	3.2 V	010101	6.6 V	100110	10.0 V	110111	13.4 V
000101	3.4 V	010110	6.8 V	100111	10.2 V	111000	13.6 V
000110	3.6 V	010111	7.0 V	101000	10.4 V	111001	13.8 V
000111	3.8 V	011000	7.2 V	101001	10.6 V	111010	14.0 V
001000	4.0 V	011001	7.4 V	101010	10.8 V	111011	14.2 V
001001	4.2 V	011010	7.6 V	101011	11.0 V	111100	14.4 V
001010	4.4 V	011011	7.8 V	101100	11.2 V	111101	14.6 V
001011	4.6 V	011100	8.0 V	101101	11.4 V	111110	14.8 V
001100	4.8 V	011101	8.2 V	101110	11.6 V	111111	15.0 V
001101	**5.0 V**	011110	8.4 V	101111	11.8 V		
001110	5.2 V	011111	8.6 V	110000	12.0 V		
001111	5.4 V	100000	8.8 V	110001	12.2 V		
010000	5.6 V	100001	9.0 V	110010	12.4 V		

(3) POWER OFF (POF) (R02H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Turning OFF the power	0	0	0	0	0	0	0	0	1	0	02H

After the Power OFF command, the driver will be powered OFF. Refer to the POWER MANAGEMENT section for the sequence.

This command will turn off booster, controller, source driver, gate driver, VCOM, and temperature sensor, but register data will be kept until VDD turned OFF or Deep Sleep Mode. Source/Gate/Border/VCOM will be released to floating.

(4) POWER OFF SEQUENCE SETTING (PFS) (R03H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Setting Power OFF sequence	0	0	0	0	0	0	0	0	1	1	03H
	0	1	-	-	T_VDS_OFF[1:0]		-	-	-	-	00H

T_VDS_OFF[1:0]: Source to gate power off interval time.

00b: 1 frame (Default) 01b: 2 frames 10b: 3 frames 11b: 4 frame

(5) POWER ON (PON) (REGISTER: R04H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Turning ON the power	0	0	0	0	0	0	0	1	0	0	04H

After the Power ON command, the driver will be powered ON. Refer to the POWER MANAGEMENT section for the sequence.

This command will turn on booster, controller, regulators, and temperature sensor will be activated for one-time sensing before enabling booster. When all voltages are ready, the BUSY_N signal will return to high.

(6) POWER ON MEASURE (PMES) (R05H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
	0	0	0	0	0	0	0	1	0	1	05H

This command enables the internal bandgap, which will be cleared by the next POF.

(7) BOOSTER SOFT START (BTST) (R06H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Starting data transmission	0	0	0	0	0	0	0	1	1	0	06H
	0	1	BT_PHA[7:6]		BT_PHA[5:3]			BT_PHA[2:0]			17H
	0	1	BT_PHB[7:6]		BT_PHB[5:3]			BT_PHB[2:0]			17H
	0	1	-	-	BT_PHC[5:3]			BT_PHC[2:0]			17H

BT_PHA[7:6]: Soft start period of phase A.

00b: 10mS 01b: 20mS 10b: 30mS 11b: 40mS

BT_PHA[5:3]: Driving strength of phase A

000b: strength 1 001b: strength 2 **010b: strength 3** 011b: strength 4
100b: strength 5 101b: strength 6 110b: strength 7 111b: strength 8 (strongest)

BT_PHA[2:0]: Minimum OFF time setting of GDR in phase A

000b: 0.27uS 001b: 0.34uS 010b: 0.40uS 011b: 0.54uS
100b: 0.80uS 101b: 1.54uS 110b: 3.34uS **111b: 6.58uS**

BT_PHB[7:6]: Soft start period of phase B.

00b: 10mS 01b: 20mS 10b: 30mS 11b: 40mS

BT_PHB[5:3]: Driving strength of phase B

000b: strength 1 001b: strength 2 **010b: strength 3** 011b: strength 4
100b: strength 5 101b: strength 6 110b: strength 7 111b: strength 8 (strongest)

BT_PHB[2:0]: Minimum OFF time setting of GDR in phase B

000b: 0.27uS 001b: 0.34uS 010b: 0.40uS 011b: 0.54uS
100b: 0.80uS 101b: 1.54uS 110b: 3.34uS **111b: 6.58uS**

BT_PHC[5:3]: Driving strength of phase C

000b: strength 1 001b: strength 2 **010b: strength 3** 011b: strength 4
100b: strength 5 101b: strength 6 110b: strength 7 111b: strength 8 (strongest)

BT_PHC[2:0]: Minimum OFF time setting of GDR in phase C

000b: 0.27uS 001b: 0.34uS 010b: 0.40uS 011b: 0.54uS
100b: 0.80uS 101b: 1.54uS 110b: 3.34uS **111b: 6.58uS**

(8) DEEP SLEEP (DSLP) (R07H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Deep Sleep	0	0	0	0	0	0	0	1	1	1	07H
	0	1	1	0	1	0	0	1	0	1	A5H

After this command is transmitted, the chip will enter Deep Sleep Mode to save power. Deep Sleep Mode will return to Standby Mode by hardware reset. The only one parameter is a check code, the command will be executed if check code = 0xA5.

(9) DATA START TRANSMISSION 1 (DTM1) (R10H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Starting data transmission	0	0	0	0	0	1	0	0	0	0	10H
	0	1	Pixel1	Pixel2	Pixel3	Pixel4	Pixel5	Pixel6	Pixel7	Pixel8	--
	0	1	:	:	:	:	:	:	:	:	--
	0	1	Pixel(n-7)	Pixel(n-6)	Pixel(n-5)	Pixel(n-4)	Pixel(n-3)	Pixel(n-2)	Pixel(n-1)	Pixel(n)	--

This command starts transmitting data and write them into SRAM.

In KW mode, this command writes "OLD" data to SRAM.

In KWR mode, this command writes "K/W" data to SRAM.

In Program mode, this command writes "OTP" data to SRAM for programming.

(10) DATA STOP (DSP) (R11H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Stopping data transmission	0	0	0	0	0	1	0	0	0	1	11H
	1	1	data_flag	-	-	-	-	-	-	-	00H

Check the completeness of data. If data is complete, start to refresh display.

Data_flag: Data flag of receiving user data.

0: Driver didn't receive all the data.
1: Driver has already received all the one-frame data (DTM1 and DTM2).

After "Data Start" (R10h) or "Data Stop" (R11h) commands and when data_flag=1, the refreshing of panel starts and BUSY_N signal will become "0".

(11) DISPLAY REFRESH (DRF) (R12H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Refreshing the display	0	0	0	0	0	1	0	0	1	0	12H

While user sent this command, driver will refresh display (data/VCOM) according to SRAM data and LUT.

After Display Refresh command, BUSY_N signal will become "0" and the refreshing of panel starts.

(12) DATA START TRANSMISSION 2 (DTM2) (R13H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Starting data transmission	0	0	0	0	0	1	0	0	1	1	13H
	0	1	Pixel1	Pixel2	Pixel3	Pixel4	Pixel5	Pixel6	Pixel7	Pixel8	--
	0	1	:	:	:	:	:	:	:	:	--
	0	1	Pixel(n-7)	Pixel(n-6)	Pixel(n-5)	Pixel(n-4)	Pixel(n-3)	Pixel(n-2)	Pixel(n-1)	Pixel(n)	--

This command starts transmitting data and write them into SRAM.

In KW mode, this command writes "NEW" data to SRAM.

In KWR mode, this command writes "RED" data to SRAM.

(13) AUTO SEQUENCE (AUTO) (R17H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Auto Sequence	0	0	0	0	0	1	0	1	1	1	17H
	0	1	1	0	1	0	0	1	0	1	A5H

The command can enable the internal sequence to execute several commands continuously. The successive execution can minimize idle time to avoid unnecessary power consumption and reduce the complexity of host's control procedure. The sequence contains several operations, including PON, DRF, POF, DSLP.

AUTO (0x17) + Code(0xA5) = (PON → DRF → POF)

AUTO (0x17) + Code(0xA7) = (PON → DRF → POF → DSLP)

(14) VCOM LUT (LUTC) (R20H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Build Look-up Table for VCOM (61-byte command, structure of bytes 2~7 repeated 10 times)	0	0	0	0	1	0	0	0	0	0	20H
	0	1	LEVEL SELECT-0		LEVEL SELECT-1		LEVEL SELECT-2		LEVEL SELECT-3		--
	0	1	NUMBER OF FRAMES-0								--
	0	1	NUMBER OF FRAMES-1								--
	0	1	NUMBER OF FRAMES-2								--
	0	1	NUMBER OF FRAMES-3								--
	0	1	TIMES TO REPEAT								--

This command stores VCOM Look-Up Table with 10 groups of data. Each group contains information for one state and is stored with 6 bytes (byte 2~7, 8~13, 14~19, 20~25, ...), while the sixth byte indicates how many times that phase will repeat.

Bytes 2, 8, 14, 20, 26, 32, 38, 44, 50, 56:

D[7:6], D[5:4], D[3:2], D[1:0]: Level Selection

00b: VCOM_DC
01b: VDH+VCOM_DC (VCOMH)
10b: VDL+VCOM_DC (VCOML)
11b: Floating

Bytes 3~6, 9~12, 15~18, 21~24, 27~30, 33~36, 39~42, 45~48, 51~54, 57~60:

Number of Frames

0000 0000b: 0 frame
: :
: :
1111 1111b: 255 frames

Bytes 7, 13, 19, 25, 31, 37, 43, 49, 55, 61:

Times to Repeat

0000 0000b: 0 time
: :
: :
1111 1111b: 255 times

If KW/R=0 (KWR mode), all 10 groups are used.

If KW/R=1 (KW mode), only 7 groups are used.

(15) W2W LUT (LUTWW) (R21H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Build White Look-up Table for W2W (43-byte command, structure of bytes 2~7 repeated 7 times)	0	0	0	0	1	0	0	0	0	1	21H
	0	1	LEVEL SELECT-0		LEVEL SELECT-1		LEVEL SELECT-2		LEVEL SELECT-3		--
	0	1	NUMBER OF FRAMES-0								--
	0	1	NUMBER OF FRAMES-1								--
	0	1	NUMBER OF FRAMES-2								--
	0	1	NUMBER OF FRAMES-3								--
	0	1	TIMES TO REPEAT								--

This command stores White-to-White Look-Up Table with 7 groups of data. Each group contains information for one state and is stored with 6 bytes (byte 2~7, 8~13, 14~19, 20~25, ...), while the sixth byte indicates how many times that phase will repeat.

Bytes 2, 8, 14, 20, 26, 32, 38:

Level Selection.

00b: GND
01b: VDH
10b: VDL
11b: VDHR

Bytes 3~6, 9~12, 15~18, 21~24, 27~30, 33~36, 39~42:

Number of Frames

0000 0000b: 0 frame
: :
: :
1111 1111b: 255 frames

Bytes 7, 13, 19, 25, 31, 37, 43:

Times to Repeat

0000 0000b: 0 time
: :
: :
1111 1111b: 255 times

If KW/R=0 (KWR mode), LUTWW is not used.

If KW/R=1 (KW mode), LUTWW is used.

(16) K2W LUT (LUTKW / LUTR) (R22H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Build Look-up Table for K2W or Red (61-byte command, structure of bytes 2~7 repeated 10 times)	0	0	0	0	1	0	0	0	1	0	22H
	0	1	LEVEL SELECT-0		LEVEL SELECT-1		LEVEL SELECT-2		LEVEL SELECT-3		--
	0	1	NUMBER OF FRAMES-0								--
	0	1	NUMBER OF FRAMES-1								--
	0	1	NUMBER OF FRAMES-2								--
	0	1	NUMBER OF FRAMES-3								--
	0	1	TIMES TO REPEAT								--

This command stores White-to-White Look-Up Table with 10 groups of data. Each group contains information for one state and is stored with 6 bytes (byte 2~7, 8~13, 14~19, 20~25, ...), while the sixth byte indicates how many times that phase will repeat.

Bytes 2, 8, 14, 20, 26, 32, 38, 44, 50, 56:

Level Selection.

00b: GND
01b: VDH
10b: VDL
11b: VDHR

Bytes 3~6, 9~12, 15~18, 21~24, 27~30, 33~36, 39~42, 45~48, 51~54, 57~60:

Number of Frames

0000 0000b: 0 frame
: :
: :
1111 1111b: 255 frames

Bytes 7, 13, 19, 25, 31, 37, 43, 49, 55, 61:

Times to Repeat

0000 0000b: 0 time
: :
: :
1111 1111b: 255 times

If KW/R=0 (KWR mode), all 10 groups are used.

If KW/R=1 (KW mode), only 7 groups are used.

(17) W2K LUT (LUTWK / LUTW) (R23H)

This command builds Look-up Table for White-to-Black. Please refer to K2W LUT (LUTKW/LUTR) for similar definition details.

Regardless of KW/R=0 or KW/R=1, LUTWK/LUTW is used.

(18) K2K LUT (LUTKK / LUTK) (R24H)

This command builds Look-up Table for Black-to-Black. Please refer to K2W LUT (LUTKW/LUTR) for similar definition details.

Regardless of KW/R=0 or KW/R=1, LUTKK/LUTK is used.

(19) LUT Option (LUTOPT) (R2AH)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
LUT Option	0	0	0	0	1	0	1	0	1	0	2AH
	0	1	STATE_XON[9:8]		-	-	-	-	-	-	00H
	0	1	STATE_XON[7:0]								00H

This command sets XON control enable.

STATE_XON[9:0]:

All Gate ON (Each bit controls one state, STATE_XON [0] for state-1, STATE_XON [1] for state-2 .....)

00 0000 0000b: no All-Gate-ON

00 0000 0001b: State-1 All-Gate-ON

00 0000 0011b: State-1 and State2 All-Gate-ON

(21) PLL Control (PLL) (R30H)

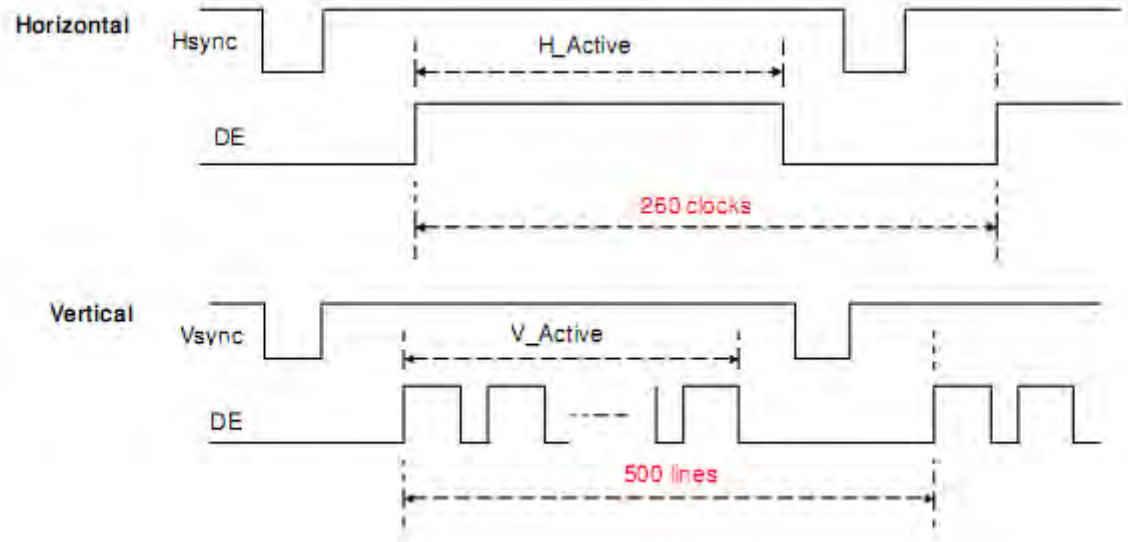
Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Controlling PLL	0	0	0	0	1	1	0	0	0	0	30H
	0	1	-	-	-	-	FRS[3:0]				04H

The command controls the PLL clock frequency. The PLL structure must support the following frame rates:

FMR[3:0]: Frame rate setting

FRS	Frame rate
0000	10Hz
0001	20Hz
0010	30Hz
0011	40Hz
0100	**50Hz**
0101	60Hz
0110	70Hz
0111	80Hz

FRS	Frame rate
1000	90Hz
1001	100Hz
1010	110Hz
1011	120Hz
1100	130Hz
1101	140Hz
1110	150Hz
1111	200Hz



(22) TEMPERATURE SENSOR CALIBRATION (TSC) (R40H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Sensing Temperature	0	0	0	1	0	0	0	0	0	0	40H
	1	1	D10/TS7	D9/TS6	D8/TS5	D7/TS4	D6 / TS3	D5 / TS2	D4 / TS1	D3 / TS0	00H
	1	1	D2	D1	D0	-	-	-	-	-	00H

This command enables internal or external temperature sensor, and reads the result.

TS[7:0]: When TSE (R41h) is set to 0, this command reads internal temperature sensor value.

D[10:0]: When TSE (R41h) is set to 1, this command reads external LM75 temperature sensor value.

TS[7:0]/D[10:3]	Temp. (°C)
1110_0111	-25
1110_1000	-24
1110_1001	-23
1110_1010	-22
1110_1011	-21
1110_1100	-20
1110_1101	-19
1110_1110	-18
1110_1111	-17
1111_0000	-16
1111_0001	-15
1111_0010	-14
1111_0011	-13
1111_0100	-12
1111_0101	-11
1111_0110	-10
1111_0111	-9
1111_1000	-8
1111_1001	-7
1111_1010	-6
1111_1011	-5
1111_1100	-4
1111_1101	-3
1111_1110	-2
1111_1111	-1

TS[7:0]/D[10:3]	Temp. (°C)
0000_0000	0
0000_0001	1
0000_0010	2
0000_0011	3
0000_0100	4
0000_0101	5
0000_0110	6
0000_0111	7
0000_1000	8
0000_1001	9
0000_1010	10
0000_1011	11
0000_1100	12
0000_1101	13
0000_1110	14
0000_1111	15
0001_0000	16
0001_0001	17
0001_0010	18
0001_0011	19
0001_0100	20
0001_0101	21
0001_0110	22
0001_0111	23
0001_1000	24

TS[7:0]/D[10:3]	Temp. (°C)
0001_1001	25
0001_1010	26
0001_1011	27
0001_1100	28
0001_1101	29
0001_1110	30
0001_1111	31
0010_0000	32
0010_0001	33
0010_0010	34
0010_0011	35
0010_0100	36
0010_0101	37
0010_0110	38
0010_0111	39
0010_1000	40
0010_1001	41
0010_1010	42
0010_1011	43
0010_1100	44
0010_1101	45
0010_1110	46
0010_1111	47
0011_0000	48
0011_0001	49

(23) TEMPERATURE SENSOR ENABLE (TSE) (R41H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Enable Temperature Sensor /Offset	0	0	0	1	0	0	0	0	0	1	41H
	0	1	TSE	-	-	-	TO[3:0]				00H

This command selects Internal or External temperature sensor.

TSE: Internal temperature sensor switch

0: Enable (default) 1: Disable; using external sensor.

TO[3:0]: Temperature offset.

TO[3:0]	Calibration
0000 b	**+0 (Default)**
0001	+1
0010	+2
0011	+3
0100	+4
0101	+5
0110	+6
0111	+7

TO[3:0]	Calibration
1000	-8
1001	-7
1010	-6
1011	-5
1100	-4
1101	-3
1110	-2
1111	-1

(24) Temperature Sensor Write (TSW) (R42H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Write External Temperature Sensor	0	0	0	1	0	0	0	0	1	0	42H
	0	1	WATTR[7:0]								00H
	0	1	WMSB[7:0]								00H
	0	1	WLSB[7:0]								00H

This command writes the temperature sensed by the temperature sensor.

WATTR[7:6]: I²C Write Byte Number

00b : 1 byte (head byte only)
01b : 2 bytes (head byte + pointer)
10b : 3 bytes (head byte + pointer + 1st parameter)
11b : 4 bytes (head byte + pointer + 1st parameter + 2nd parameter)

WATTR[5:3]: User-defined address bits (A2, A1, A0)

WATTR[2:0]: Pointer setting

WMSB[7:0]: MSByte of write-data to external temperature sensor

WLSB[7:0]: LSByte of write-data to external temperature sensor

(25) Temperature Sensor Read (TSR) (R43H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Read External Temperature Sensor	0	0	0	1	0	0	0	0	1	1	43H
	1	1	RMSB[7:0]								00H
	1	1	RLSB[7:0]								00H

This command reads the temperature sensed by the temperature sensor.

RMSB[7:0]: MSByte read data from external temperature sensor

RLSB[7:0]: LSByte read data from external temperature sensor

(26) Panel Glass Check (PBC)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Check Panel Glass	0	0	0	1	0	0	0	1	0	0	44H
	1	1	-	-	-	-	-	-	-	PSTA	00H

This command is used to enable panel check, and to disable after reading result.

PSTA: 0: Panel check fail (panel broken) 1: Panel check pass

(27) VCOM AND DATA INTERVAL SETTING (CDI) (R50H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Set Interval between VCOM and Data	0	0	0	1	0	1	0	0	0	0	50h
	0	1	BDZ	-	BDV[1:0]		-	-	DDX[1:0]		31h
	0	1	-	-	-	-	CDI[3:0]				07H

This command indicates the interval of VCOM and data output. When setting the vertical back porch, the total blanking will be kept (20 Hsync).

BDZ: Border Hi-Z control

0: Border output Hi-Z disabled (default) 1: Border output Hi-Z enabled

BDV[1:0]: Border LUT selection

KWR mode (KW/R=0)

DDX[0]	BDV[1:0]	LUT
0	00	LUTBD
	01	LUTR
	10	LUTW
	11	LUTK
1 (Default)	00	LUTK
	01	LUTW
	10	LUTR
	11	LUTBD

KW mode (KW/R=1)

DDX[0]	BDV[1:0]	LUT
0	00	LUTBD
	01	LUTKW (1 → 0)
	10	LUTWK (0 → 1)
	11	LUTKK (0 → 0)
1 (Default)	00	LUTKK (0 → 0)
	01	LUTWK (1 → 0)
	10	LUTKW (0 → 1)
	11	LUTBD

DDX[1:0]: Data polality.

Under KWR mode (KW/R=0):

DDX[1] is for RED data.
DDX[0] is for K/W data,

DDX[1:0]	Data (Red, K/W)	LUT
00	00	LUTW
	01	LUTK
	10	LUTR
	11	LUTR
01 (Default)	00	LUTK
	01	LUTW
	10	LUTR
	11	LUTR

DDX[1:0]	Data (Red, K/W)	LUT
10	00	LUTR
	01	LUTR
	10	LUTW
	11	LUTK
11	00	LUTR
	01	LUTR
	10	LUTK
	11	LUTW

Under KW mode (KW/R=1):

DDX[1]=0 is for KW mode with NEW/OLD,
DDX[1]=1 is for KW mode without NEW/OLD.

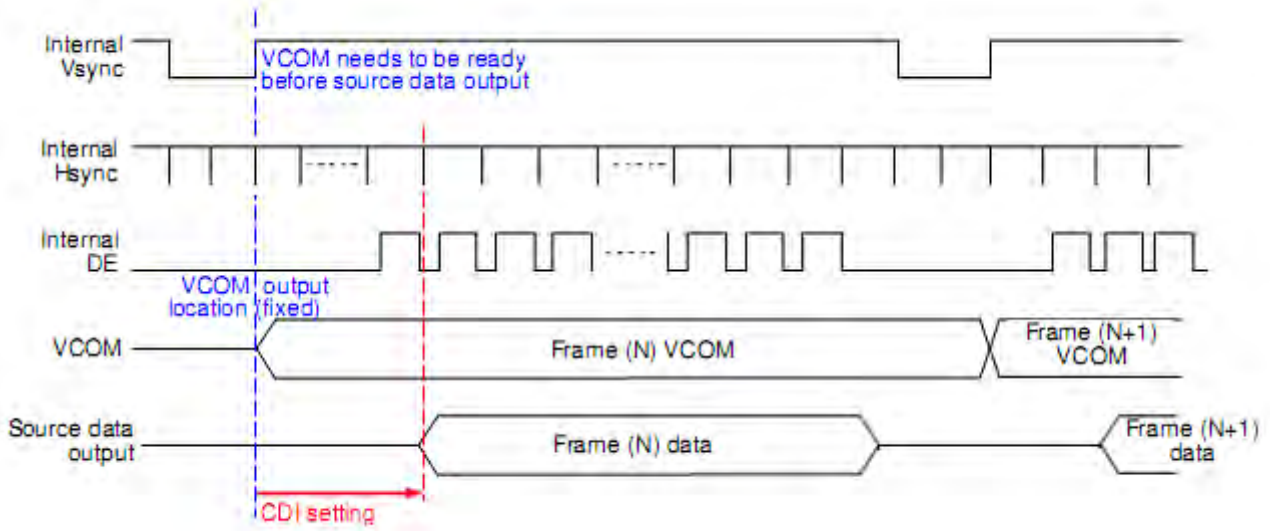
DDX[1:0]	Data (NEW, OLD)	LUT
00	00	LUTWW (0 → 0)
	01	LUTKW (1 → 0)
	10	LUTWK (0 → 1)
	11	LUTKK (1 → 1)
01 (Default)	00	LUTKK (0 → 0)
	01	LUTWK (1 → 0)
	10	LUTKW (0 → 1)
	11	LUTWW (1 → 1)

DDX[1:0]	Data (NEW)	LUT
10	0	LUTKW (1 → 0)
	1	LUTWK (0 → 1)
11	0	LUTWK (1 → 0)
	1	LUTKW (0 → 1)

CDI[3:0]: VCOM and data interval

CDI[3:0]	VCOM and Data Interval
0000 b	17 hsync
0001	16
0010	15
0011	14
0100	13
0101	12
0110	11
0111	**10 (Default)**

CDI[3:0]	VCOM and Data Interval
1000	9
1001	8
1010	7
1011	6
1100	5
1101	4
1110	3
1111	2



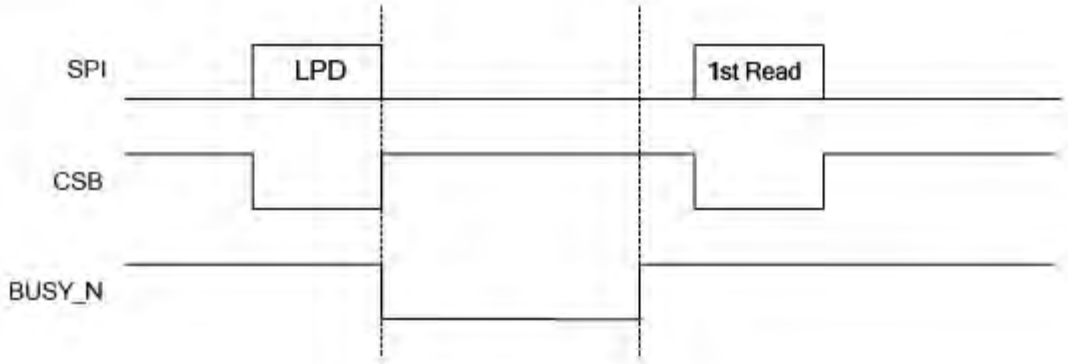
(28) Low Power Detection (LPD) (R51H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Detect Low Power	0	0	0	1	0	1	0	0	0	1	51h
	1	1	-	-	-	-	-	-	-	LPD	01h

This command indicates the input power condition. Host can read this flag to learn the battery condition.

LPD: Internal Low Power Detection Flag

0: Low power input (VDD < 2.5V, 2.4V, 2.3V, or 2.2V, selected by LVD_SEL[1:0] in command LVSEL)
1: Normal status (default)



(30) TCON Setting (TCON) (R60H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Set Gate/Source Non-overlap Period	0	0	0	1	1	0	0	0	0	0	60h
	0	1	S2G[3:0]				G2S[3:0]				22h

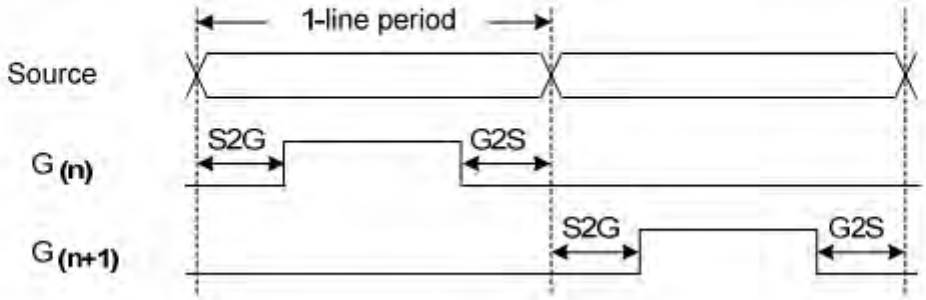
This command defines non-overlap period of Gate and Source.

S2G[3:0] or G2S[3:0]: Source to Gate / Gate to Source Non-overlap period

S2G[3:0] or G2S[3:0]	Period
0000 b	4
0001	8
0010	**12 (Default)**
0011	16
0100	20
0101	24
0110	28
0111	32

S2G[3:0] or G2S[3:0]	Period
1000 b	36
1001	40
1010	44
1011	48
1100	52
1101	56
1110	60
1111	64

Period Unit = 667 nS.



(31) RESOLUTION SETTING (TRES) (R61H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Set Display Resolution	0	0	0	1	1	0	0	0	0	1	61h
	0	1	HRES[7:3]					0	0	0	F0h
	0	1	-	-	-	-	-	-	VRES[9]	VRES[8]	02h
	0	1	VRES[7:0]								00h

This command defines resolution setting.

HRES[7:3]: Horizontal Display Resolution (Value range: 01h ~ 1Eh)

VRES[9:0]: Vertical Display Resolution (Value range: 01h ~ 200h)

Active channel calculation, assuming HST[7:0]=0, VST[8:0]=0:

Gate: First active gate = G0;
Last active gate = VRES[9:0] – 1

Source: First active source = S0;
Last active source = HRES[7:3]*8 – 1

Example: 128 (source) x 272 (gate), assuming HST[7:0]=0, VST[8:0]=0

Gate: First active gate = G0,
Last active gate = G271; (VRES[8:0] = 272, 272 – 1 = 271)

Source: First active source = S0,
Last active source = S127; (HRES[7:3]=16, 16*8 – 1 = 127)

(32) GATE/SOURCE START SETTING (GSST) (R65H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Set Gate/Source Start	0	0	0	1	1	0	0	1	0	1	65h
	0	1	HST[7:3]					0	0	0	00h
	0	1	-	-	-	-	-	-	-	VST[8]	00h
	0	1	VST[7:0]								00h

This command defines resolution start gate/source position.

HST[7:3]: Horizontal Display Start Position (Source). (Value range: 00h ~ 1Dh)

VST[8:0]: Vertical Display Start Position (Gate). (Value range: 000h ~ 1FFh)

Example : For 128(Source) x 240(Gate)
HST[7:3] = 4 (HST[7:0] = 4*8 = 32),
VST[8:0] = 32

Gate: First active gate = G32 (VST[8:0] = 32),
Last active gate = G271 (VRES[8:0] = 240, VST[8:0] = 32, 240-1+32=271)

Source: First active source = S32 (HST[7:0]= 32),
Last active source = S239 (HRES[8:0] = 128, HST[7:0] = 32, 128-1+32=239)

(33) REVISION (REV) (R70H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Chip Revision	0	0	0	1	1	1	0	0	0	0	70h
	1	1	LUT_REV								FFh

The LUT_REV is read from OTP address = 0x001 or 0xC01.

(34) GET STATUS (FLG) (R71H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Read Flags	0	0	0	1	1	1	0	0	0	1	71h
	1	1	-	PTL_ Flag	I²C_ERR	I²C_ BUSYN	Data_ Flag	PON	POF	BUSY_N	13h

This command reads the IC status.

PTL_Flag: Partial display status (high: partial mode)

I²C_ERR: I²C master error status

I²C_BUSYN: I²C master busy status (low active)

Data_Flag: Driver has already received all the one frame data

PON: Power ON status

POF: Power OFF status

BUSY_N: Driver busy status (low active)

(35) AUTO MEASURE VCOM (AMV) (R80H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Automatically measure VCOM	0	0	1	0	0	0	0	0	0	0	80h
	0	1	-	-	AMVT[1:0]		XON	AMVS	AMV	AMVE	10h

This command reads the IC status.

AMVT[1:0]: Auto Measure VCOM Time

00b: 3s
10b: 8s
01b: 5s (default)
11b: 10s

XON: All Gate ON of AMV

0: Gate normally scan during Auto Measure VCOM period. (default)
1: All Gate ON during Auto Measure VCOM period.

AMVS: Source output of AMV

0: Source output 0V during Auto Measure VCOM period. (default)
1: Source output VDHR during Auto Measure VCOM period.

AMV: Analog signal

0: Get VCOM value with the VV command (R81h) (default)
1: Get VCOM value in analog signal. (External analog to digital converter)

AMVE: Auto Measure VCOM Enable (/Disable)

0: No effect (default)
1: Trigger auto VCOM sensing.

(36) VCOM VALUE (VV) (R81H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Automatically measure VCOM	0	0	1	0	0	0	0	0	0	1	81h
	1	1	-	-	VV[5:0]						00h

This command gets the VCOM value.

VV[5:0]: VCOM Value Output

VV [5:0]	VCOM Voltage (V)	VV [5:0]	VCOM Voltage (V)	VV [5:0]	VCOM Voltage (V)
00 0000b	-0.10	01 0100b	-1.10	10 1000b	-2.10
00 0001b	-0.15	01 0101b	-1.15	10 1001b	-2.15
00 0010b	-0.20	01 0110b	-1.20	10 1010b	-2.20
00 0011b	-0.25	01 0111b	-1.25	10 1011b	-2.25
00 0100b	-0.30	01 1000b	-1.30	10 1100b	-2.30
00 0101b	-0.35	01 1001b	-1.35	10 1101b	-2.35
00 0110b	-0.40	01 1010b	-1.40	10 1110b	-2.40
00 0111b	-0.45	01 1011b	-1.45	10 1111b	-2.45
00 1000b	-0.50	01 1100b	-1.50	11 0000b	-2.50
00 1001b	-0.55	01 1101b	-1.55	11 0001b	-2.55
00 1010b	-0.60	01 1110b	-1.60	11 0010b	-2.60
00 1011b	-0.65	01 1111b	-1.65	11 0011b	-2.65
00 1100b	-0.70	10 0000b	-1.70	11 0100b	-2.70
00 1101b	-0.75	10 0001b	-1.75	11 0101b	-2.75
00 1110b	-0.80	10 0010b	-1.80	11 0110b	-2.80
00 1111b	-0.85	10 0011b	-1.85	11 0111b	-2.85
01 0000b	-0.90	10 0100b	-1.90	11 1000b	-2.90
01 0001b	-0.95	10 0101b	-1.95	11 1001b	-2.95
01 0010b	-1.00	10 0110b	-2.00	11 1010b	-3.00
01 0011b	-1.05	10 0111b	-2.05	11 1011b	-3.05

(37) VCOM_DC SETTING (VDCS) (R82H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Set VCOM_DC	0	0	1	0	0	0	0	0	1	0	82h
	0	1	-	-	VDCS[5:0]						00h

This command sets VCOM_DC value

VDCS[5:0]: VCOM_DC Setting

VDCS [5:0]	VCOM Voltage (V)	VDCS [5:0]	VCOM Voltage (V)	VDCS [5:0]	VCOM Voltage (V)
00 0000b	-0.10	01 0100b	-1.10	10 1000b	-2.10
00 0001b	-0.15	01 0101b	-1.15	10 1001b	-2.15
00 0010b	-0.20	01 0110b	-1.20	10 1010b	-2.20
00 0011b	-0.25	01 0111b	-1.25	10 1011b	-2.25
00 0100b	-0.30	01 1000b	-1.30	10 1100b	-2.30
00 0101b	-0.35	01 1001b	-1.35	10 1101b	-2.35
00 0110b	-0.40	01 1010b	-1.40	10 1110b	-2.40
00 0111b	-0.45	01 1011b	-1.45	10 1111b	-2.45
00 1000b	-0.50	01 1100b	-1.50	11 0000b	-2.50
00 1001b	-0.55	01 1101b	-1.55	11 0001b	-2.55
00 1010b	-0.60	01 1110b	-1.60	11 0010b	-2.60
00 1011b	-0.65	01 1111b	-1.65	11 0011b	-2.65
00 1100b	-0.70	10 0000b	-1.70	11 0100b	-2.70
00 1101b	-0.75	10 0001b	-1.75	11 0101b	-2.75
00 1110b	-0.80	10 0010b	-1.80	11 0110b	-2.80
00 1111b	-0.85	10 0011b	-1.85	11 0111b	-2.85
01 0000b	-0.90	10 0100b	-1.90	11 1000b	-2.90
01 0001b	-0.95	10 0101b	-1.95	11 1001b	-2.95
01 0010b	-1.00	10 0110b	-2.00	11 1010b	-3.00
01 0011b	-1.05	10 0111b	-2.05	others	-3.00

(38) Partial Window (PTL) (R90h)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Set Partial Window	0	0	1	0	0	1	0	0	0	0	90h
	0	1	HRST[7:3]					0	0	0	00h
	0	1	HRED[7:3]					1	1	1	Efh
	0	1	-	-	-	-	-	-	-	VRST[8]	00h
	0	1	VRST[7:0]								00h
	0	1	-	-	-	-	-	-	-	VRED[8]	01h
	0	1	VRED[7:0]								FFh
	0	1	-	-	-	-	-	-	-	PT_SCAN	01h

This command sets partial window.

HRST[7:3]: Horizontal start channel bank. (Value range: 00h~1Dh)

HRED[7:3]: Horizontal end channel bank. (Value range: 00h~1Dh). HRED must be greater than HRST.

VRST[8:0]: Vertical start line. (Value range: 000h~1FFh)

VRED[8:0]: Vertical end line. (Value range: 000h~1FFh). VRED must be greater than VRST.

PT_SCAN: 0: Gates scan only inside of the partial window.
1: Gates scan both inside and outside of the partial window. (default)

(39) Partial In (PTIN) (R91h)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Partial In	0	0	1	0	0	1	0	0	0	1	91h

This command makes the display enter partial mode.

(40) Partial Out (PTOUT) (R92h)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Partial Out	0	0	1	0	0	1	0	0	1	0	92h

This command makes the display exit partial mode and enter normal mode.

(41) Program Mode (PGM) (RA0h)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Enter Program Mode	0	0	1	0	1	0	0	0	0	0	A0h

After this command is issued, the chip would enter the program mode.

After the programming procedure completed, a hardware reset is necessary for leaving program mode.

(42) Active Program (APG) (RA1h)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Active Program OTP	0	0	1	0	1	0	0	0	0	1	A1h

After this command is transmitted, the programming state machine would be activated.

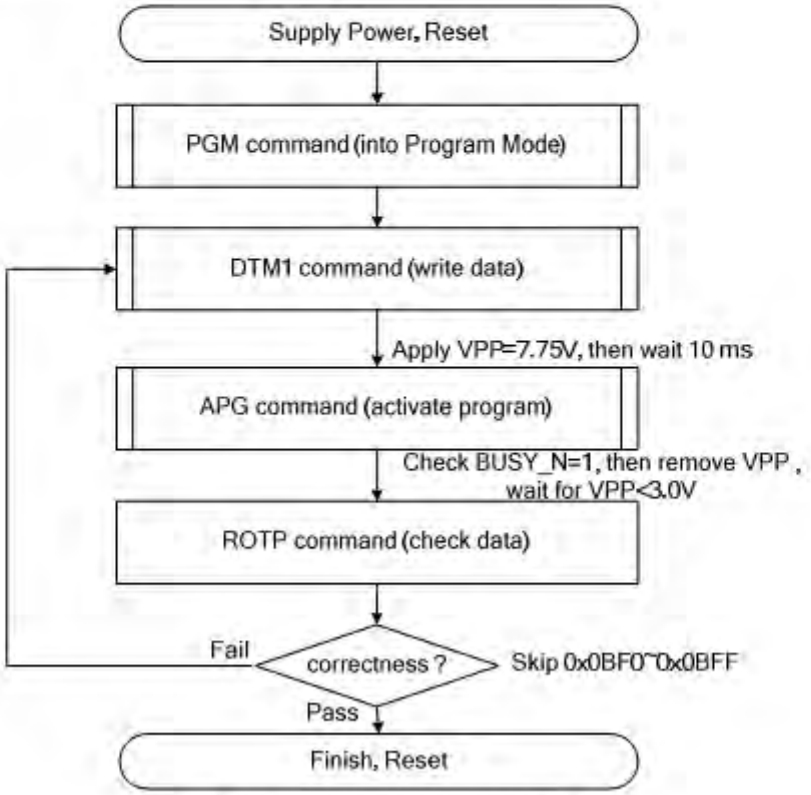
The BUSY_N flag would fall to 0 until the programming is completed.

(43) READ OTP DATA (ROTP) (RA2H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Read OTP data for check	0	0	1	0	1	0	0	0	1	0	A2h
	1	1	The data of address 0x000 in the OTP								--
	1	1	The data of address 0x001 in the OTP								--
	1	1	:								--
	1	1	The data of address (n-1) in the OTP								--
	1	1	The data of address (n) in the OTP								--

The command is used for reading the content of OTP for checking the data of programming.

The value of (n) is depending on the amount of programmed data, the max address = 0x17FF.



The sequence of programming OTP.

(44) CASCADE SETTING (CCSET) (RE0H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Set Cascade Option	0	0	1	1	1	0	0	0	0	0	E0h
	0	1	-	-	-	-	-	-	TSFIX	CCEN	00h

This command is used for cascade.

TSFIX: Let the value of slave's temperature is same as the master's.

0: Temperature value is defined by internal temperature sensor / external LM75. (default)

1: Temperature value is defined by TS_SET[7:0] registers.

CCEN: Output clock enable/disable.

0: Output 0V at CL pin. (default)

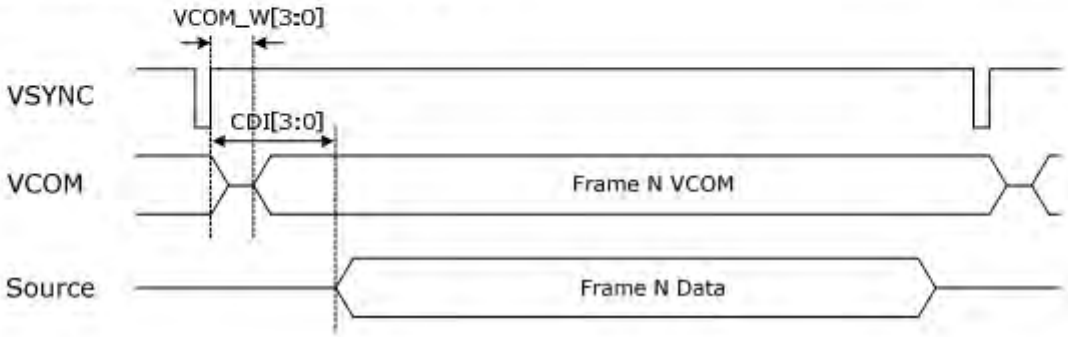
1: Output clock at CL pin to slave chip.

(45) POWER SAVING (PWS) (RE3H)

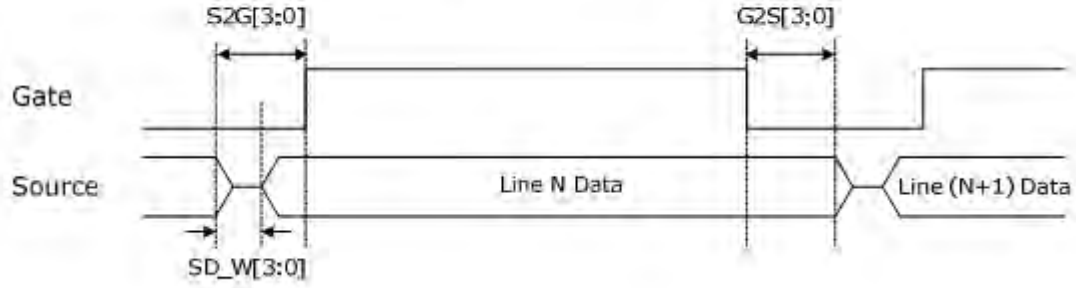
Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Power Saving for VCOM & Source	0	0	1	1	1	0	0	0	1	1	E3h
	0	1	VCOM_W[3:0]				SD_W[3:0]				00h

This command is set for saving power during refreshing period. If the output voltage of VCOM / Source is from negative to positive or from positive to negative, the power saving mechanism will be activated. The active period width is defined by the following two parameters.

VCOM_W[3:0]: VCOM power saving width (Unit: line period)



SD_W[3:0]: Source power saving width (Unit: 660nS)



(46) LVD VOLTAGE SELECT (LVSEL) (RE4H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Select LVD Voltage	0	0	1	1	1	0	0	1	0	0	E4h
	0	1	-	-	-	-	-	-	LVD_SEL[1:0]		03h

LVD_SEL[1:0]: Low Power Voltage selection

LVD_SEL[1:0]	LVD value
00	< 2.2 V
01	< 2.3 V
10	< 2.4 V
11	< 2.5 V (default)

(47) FORCE TEMPERATURE (TSSET) (RE5H)

Action	W/R	C/D	D7	D6	D5	D4	D3	D2	D1	D0	
Force Temperature Value for Cascade	0	0	1	1	1	0	0	1	0	1	E5h
	0	1	TS_SET[7:0]								00h

This command is used for cascade to fix the temperature value of master and slave chip.

9. Reference Circuit

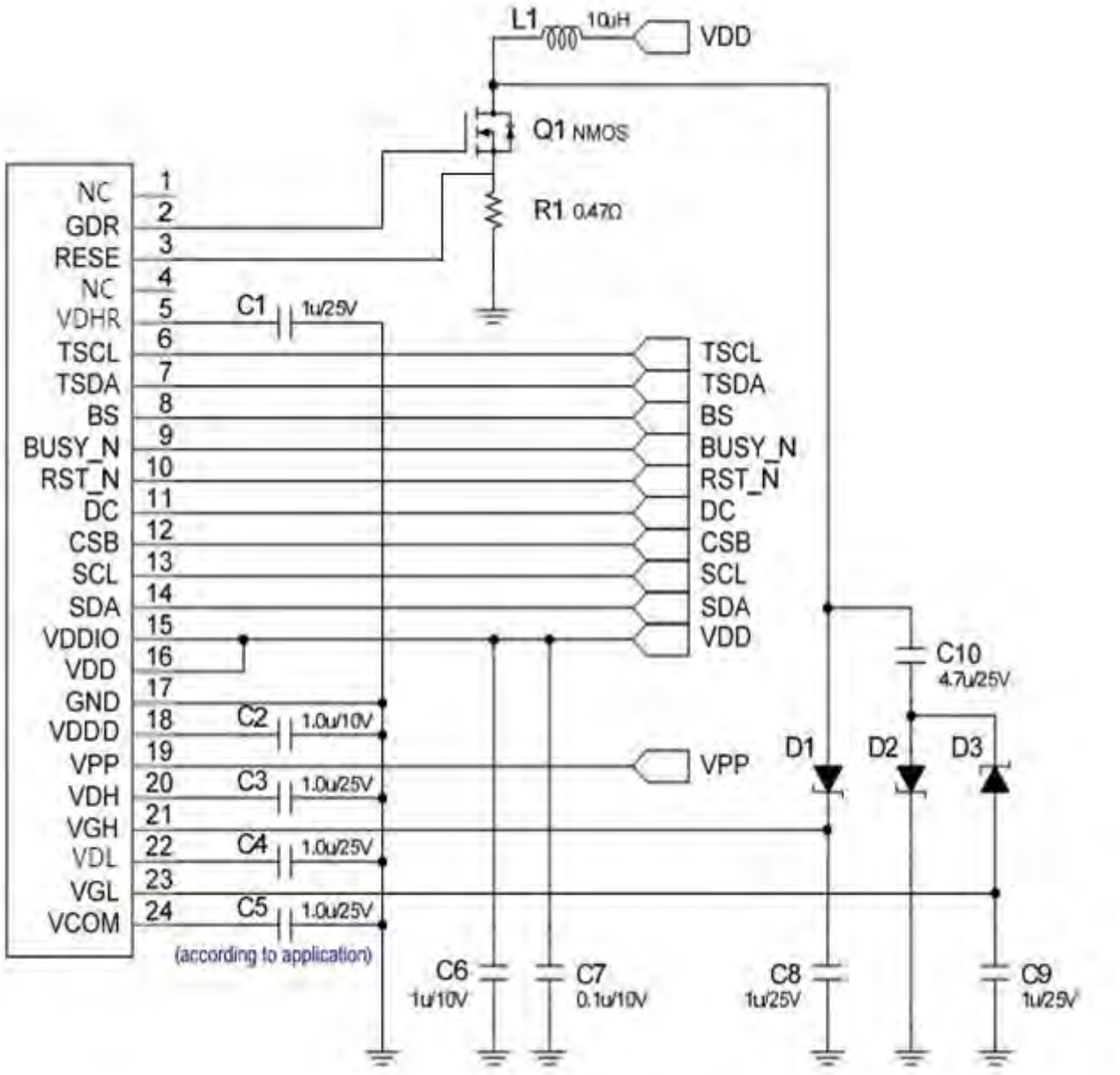


Figure. 9-1

10. ABSOLUTE MAXIMUM RATING

Table 12-1: Maximum Ratings

Symbol	Parameter	Rating	Unit	Humidity	Unit	Note
V_{DD}	Logic supply voltage	-0.5 to +6.0	V	-	-	
T_{OPR}	Operation temperature range	0 to 40	℃	45 to70	%	Note10-1
Tttg	Transportation temperature range	-25 to 60	℃	-	-	Note10-2
Tstg	Storage condition	0 to 40	℃	45 to70	%	Maximum storage time: 5 years
-	After opening the package	0 to 40	℃	45 to70	%	

Note 10-1: We guarantee the single pixel display quality for 0-35℃, but we only guarantee the barcode readable for 35-40℃. Normal use is recommended to refresh every 24 hours.

Note10-2: Tttg is the transportation condition, the transport time is within 10 days for -25℃~0℃ or 40℃~60℃.

Note 10-3：When the three-color product is stored. The display screen should be kept white and face up. In addition, please be sure to refresh the e-paper every three months.

11.DC CHARACTERISTICS

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

Table 11-1: DC Characteristics

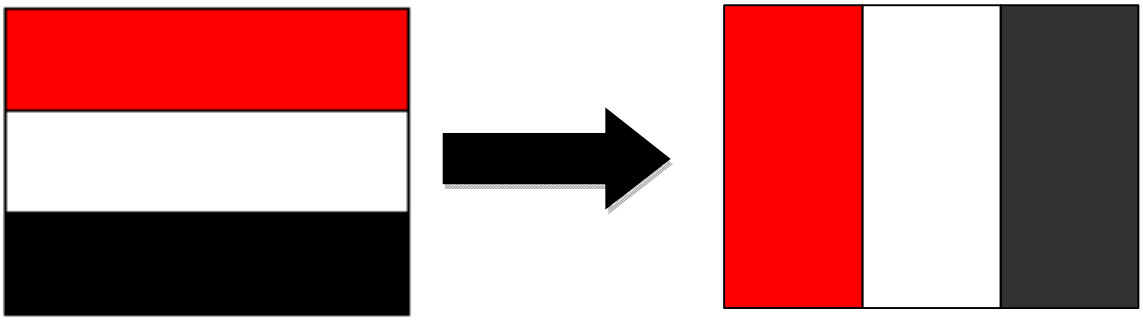
Symbol	Parameter	Test Condition	Applicable pin	Min.	Typ.	Max.	Unit
VDD	VDD operation voltage		VDD	2.5	3.3	3.6	V
VIH	High level input voltage		SDA, SCL, CS#, D/C#, RES#, BS1	0.7VDDIO		VDDIO	V
VIL	Low level input voltage			0		0.3VDDIO	V
VOH	High level output voltage	IOH = 400uA	BUSY	VDDIO-0.4			V
VOL	Low level output voltage	IOL = -400uA		0		0.4	V
Iupdate	Module operating current			-	9	-	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 11-1)

- 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 11-1

The Typical power consumption



12. AC Characteristics

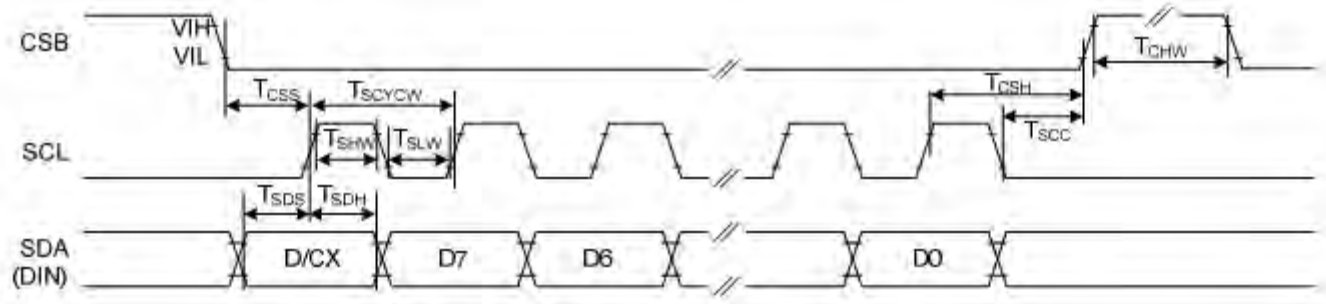


Figure: 3-wire Serial Interface Characteristics (Write mode)

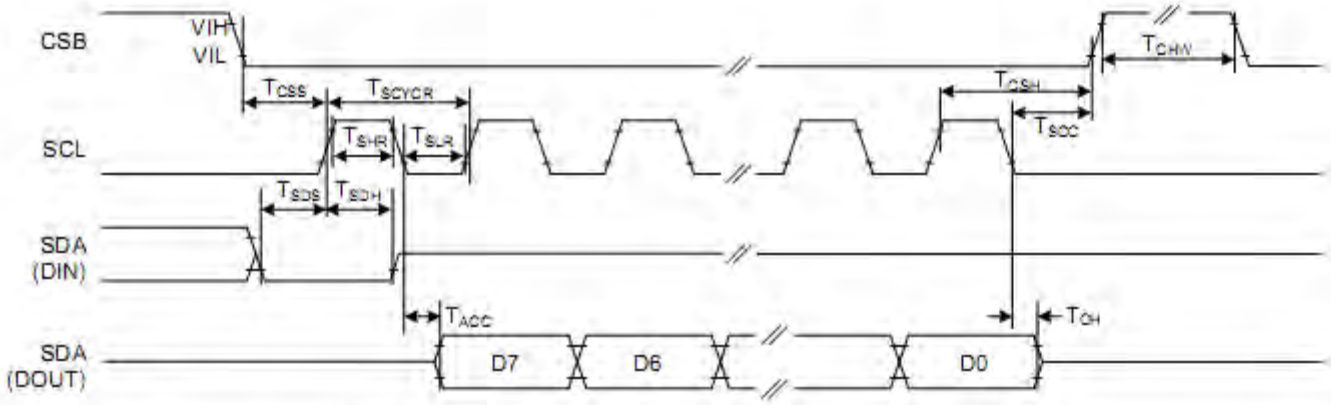


Figure: 3-wire Serial Interface Characteristics (Read mode)

Symbol	Signal / Parameter	Conditions	Min.	Typ.	Max.	Unit
T_{CSS}	CSB	Chip select setup time	60			ns
T_{CSH}		Chip select hold time	65			ns
T_{SCC}		Chip select setup time	20			ns
T_{CHW}		Chip select setup time	40			ns
T_{SCYCW}	SCL	Serial clock cycle (Write)	100			ns
T_{SHW}		SCL "H" pulse width (Write)	35			ns
T_{SLW}		SCL "L" pulse width (Write)	35			ns
T_{SCYCR}		Serial clock cycle (Read)	350			ns
T_{SHR}		SCL "H" pulse width (Read)	175			ns
T_{SLR}		SCL "L" pulse width (Read)	175			ns
T_{SDS}	SDA (DIN)	Data setup time	30			ns
T_{SDH}		Data hold time	30			ns
T_{ACC}	SDA (DOUT)	Access time			350	ns
T_{OH}		Output disable time	15			ns

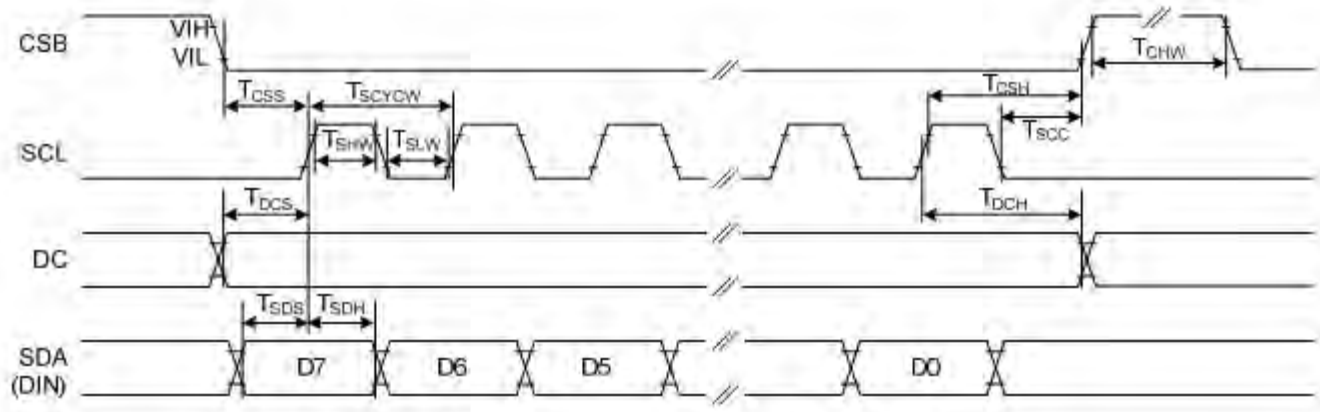


Figure: 4-wire Serial Interface Characteristics (Write mode)

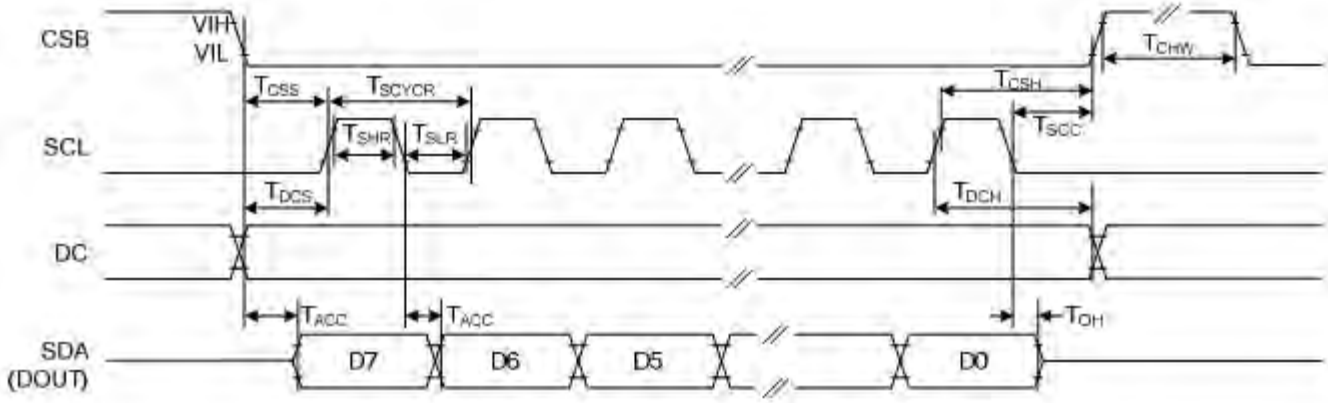


Figure: 4-wire Serial Interface Characteristics (Read mode)

Symbol	Signal / Parameter	Conditions	Min.	Typ.	Max.	Unit
T_{CSS}	CSB	Chip select setup time	60			ns
T_{CSH}		Chip select hold time	65			ns
T_{SCC}		Chip select setup time	20			ns
T_{CHW}		Chip select setup time	40			ns
T_{SCYCW}	SCL	Serial clock cycle (Write)	100			ns
T_{SHW}		SCL "H" pulse width (Write)	35			ns
T_{SLW}		SCL "L" pulse width (Write)	35			ns
T_{SCYCR}		Serial clock cycle (Read)	350			ns
T_{SHR}		SCL "H" pulse width (Read)	175			ns
T_{SLR}		SCL "L" pulse width (Read)	175			ns
T_{DCS}	DC	DC setup time	30			ns
T_{DCH}		DC hold time	30			ns
T_{SDS}	SDA (DIN)	Data setup time	30			ns
T_{SDH}		Data hold time	30			ns
T_{ACC}	SDA (DOUT)	Access time			350	ns
T_{OH}		Output disable time	15			ns

13. Power Consumption

Parameter	Symbol	Conditions	TYP	Max	Unit	Remark
Panel power consumption during update	-	25℃	-	180	mAs	-
Deep sleep mode	-	25℃	-	3	uA	-

MAS=update average current ×update time

14.Optical characteristics

14.1 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	TYP.	MAX	UNIT	Note
R	Reflectance	White	30	35	-	%	Note 14-1
Gn	2Grey Level	-	-	DS+(WS-DS)×n(m-1)	-	L*	-
CR	Contrast Ratio	-	10	15	-		-
KS	Black State L* value		-	13	14		Note 14-1
	Black State a* value		-	3	4		Note 14-1
WS	White State L* value		63	65	-		Note 14-1
RS	Red State L* value	Red	25	28	-		Note 14-1
	Red State a* value	Red	36	40	-		Note 14-1
Panel's life	-	0℃～40℃		5years	-	-	Note 14-2
Panel	Image Update	Storage and transportation	-	Update the white screen	-	-	-
	Update Time	Operation	-	Suggest Updated once a day	-	-	-

WS : White state, KS : Black state, RS: Red state

Note 14-1 : Luminance meter : i - One Pro Spectrophotometer

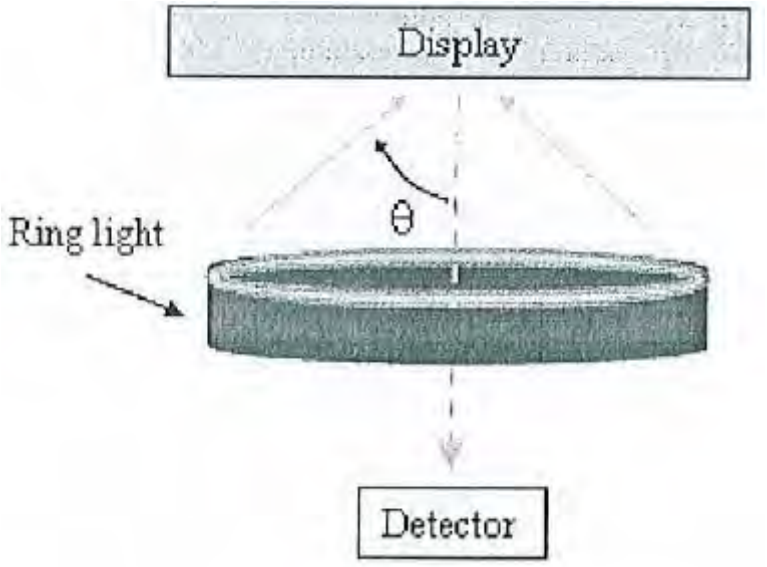
Note 14-2:We don't guarantee 5 years pixels display quality for humidity below 45%RH or above 70%RH;
Suggest Updated once a day;

14.2 Definition 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

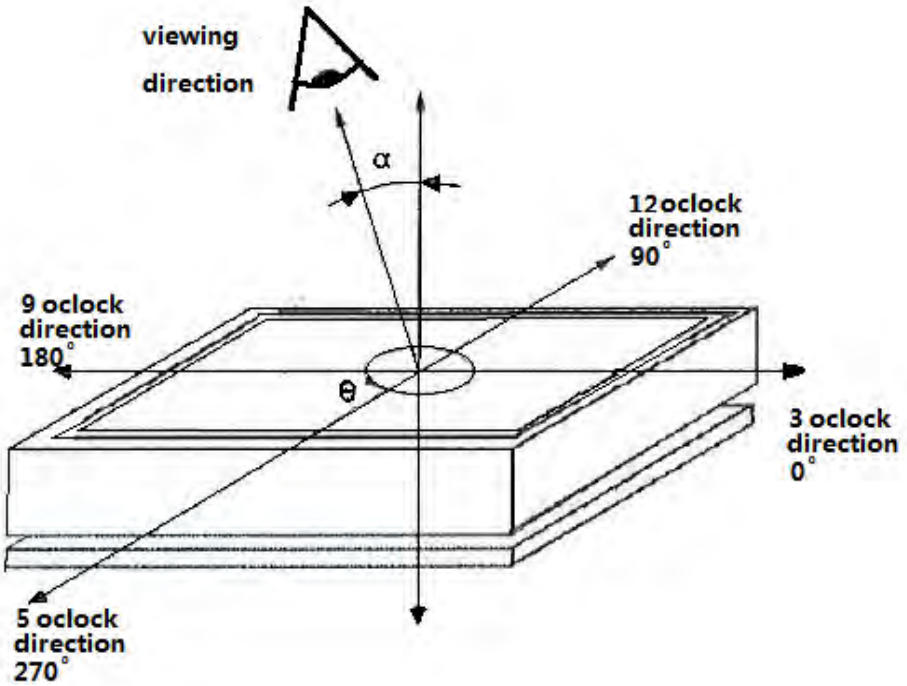


14.3 Reflection Ratio

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.



15. HANDLING, SAFETY AND ENVIROMENTAL REQUIREMENTS

WARNING
The display glass may break when it is dropped or bumped on a hard surface. Handle with care. Should the display break, do not touch the electrophoretic material. In case of contact with electrophoretic material, 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.	
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.

16. Reliability test

	TEST	CONDITION	METHOD	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=50℃ 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=50℃，RH=90%RH，For 240Hr Test in white pattern		
7	Temperature Cycle	-25℃(30min)~60℃(30min)，50 Cycle Test in white pattern		
8	Package Vibration	1.04G,Frequency : 10~500Hz Direction : X,Y,Z Duration:1hours 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.

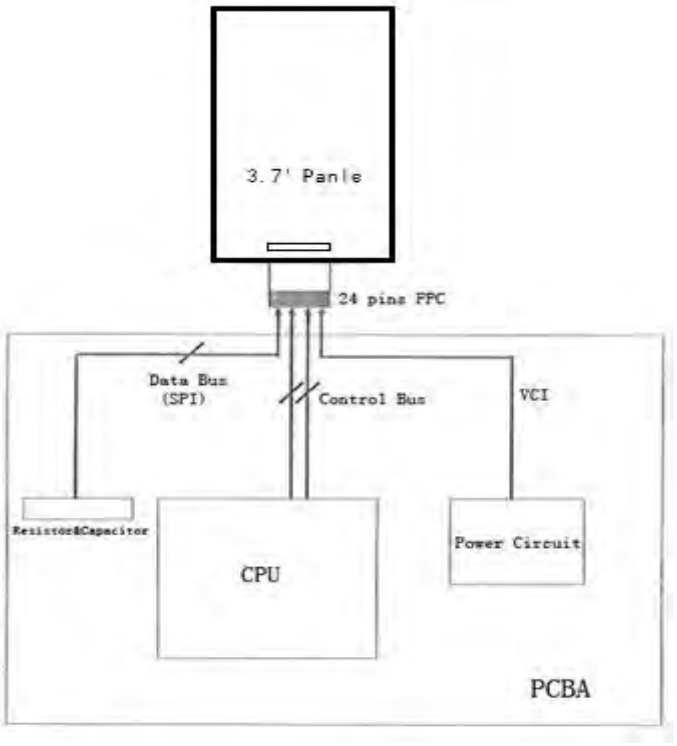
Note1：Stay white pattern for storage and non-operation test.

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

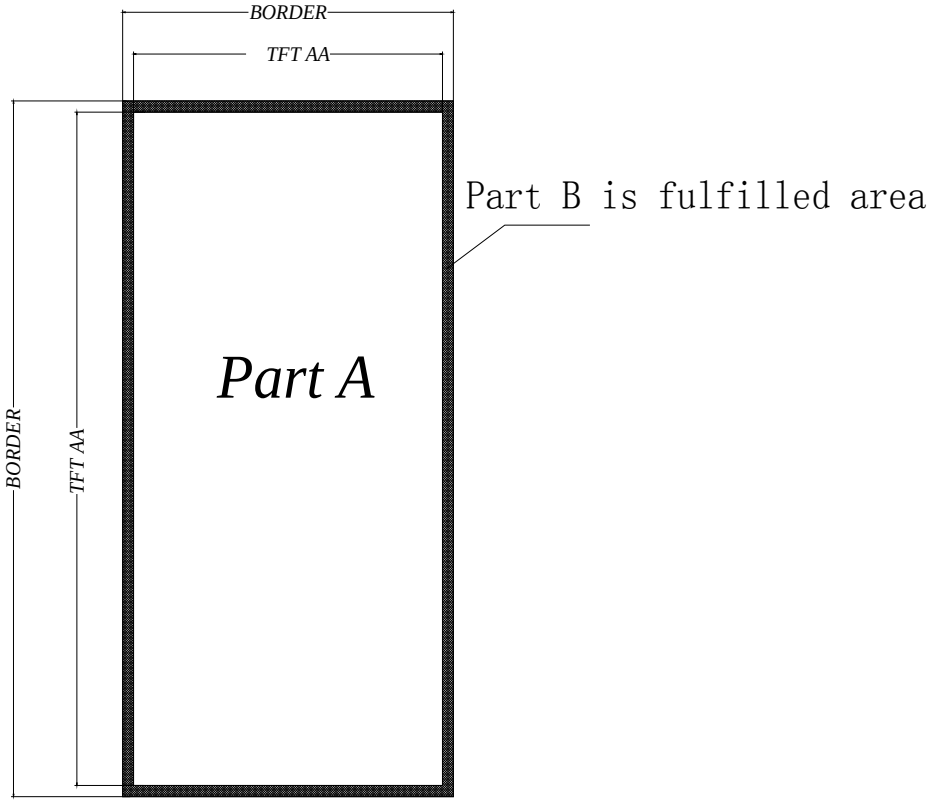
Note3：The function,appearence,opticals should meet the requirements of the test before and after the test.

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

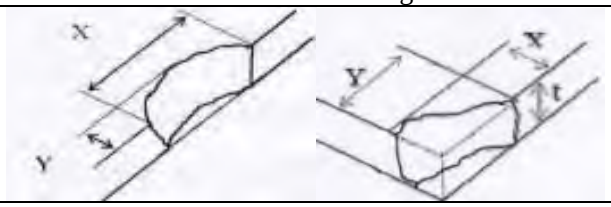
17. Block Diagram

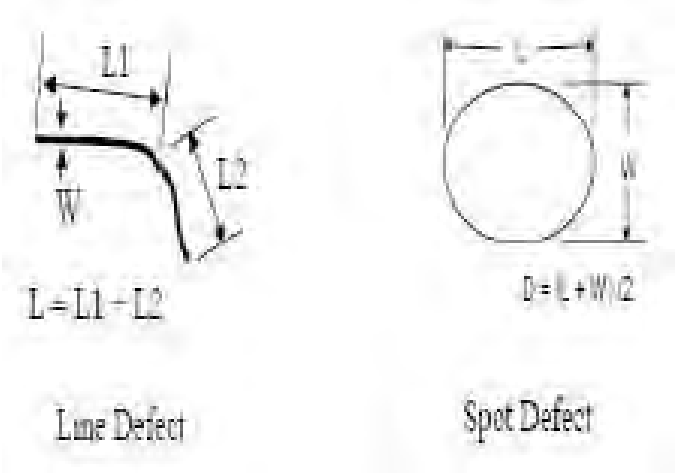


18.PartA/PartB specification



19. Point and line standard

<table>
<tr><th colspan="7">Shipment Inspection Standard</th></tr>
<tr><td colspan="7">Equipment：Electrical test fixture, Point gauge</td></tr>
<tr><td>Outline dimension</td><td>53(H) × 92.99(V) × 1.05(D)</td><td>Unit：㎜</td><td>Part-A</td><td>Active area</td><td>Part-B</td><td>Border area</td></tr>
<tr><td rowspan="2">Environment</td><td>Temperature</td><td>Humidity</td><td>Illuminance</td><td>Distance</td><td>Time</td><td>Angle</td></tr>
<tr><td>19℃～25℃</td><td>55%±5%RH</td><td>800～1300Lux</td><td>300 ㎜</td><td>35Sec</td><td></td></tr>
<tr><td>Defet type</td><td>Inspection method</td><td colspan="2">Standard</td><td colspan="2">Part-A</td><td>Part-B</td></tr>
<tr><td rowspan="3">Spot</td><td rowspan="3">Electric Display</td><td colspan="2">D≤0.25 ㎜</td><td colspan="2">Ignore</td><td>Ignore</td></tr>
<tr><td colspan="2">0.25 ㎜＜D≤0.4 ㎜</td><td colspan="2">N≤4</td><td>Ignore</td></tr>
<tr><td colspan="2">D＞0.4 ㎜</td><td colspan="2">Not Allow</td><td>Ignore</td></tr>
<tr><td>Display unwork</td><td>Electric Display</td><td colspan="2">Not Allow</td><td colspan="2">Not Allow</td><td>Ignore</td></tr>
<tr><td>Display error</td><td>Electric Display</td><td colspan="2">Not Allow</td><td colspan="2">Not Allow</td><td>Ignore</td></tr>
<tr><td rowspan="3">Scratch or line defect(include dirt)</td><td rowspan="3">Visual/Film card</td><td colspan="2">L≤2 ㎜，W≤0.2 ㎜</td><td colspan="2">Ignore</td><td>Ignore</td></tr>
<tr><td colspan="2">2.0mm＜L≤5.0mm，0.2＜W≤0.3mm,</td><td colspan="2">N≤2</td><td>Ignore</td></tr>
<tr><td colspan="2">L＞5 ㎜，W＞0.3 ㎜</td><td colspan="2">Not Allow</td><td>Ignore</td></tr>
<tr><td rowspan="3">PS Bubble</td><td rowspan="3">Visual/Film card</td><td colspan="2">D≤0.2mm</td><td colspan="2">Ignore</td><td>Ignore</td></tr>
<tr><td colspan="2">0.2mm≤D≤0.35mm & N≤4</td><td colspan="2">N≤4</td><td>Ignore</td></tr>
<tr><td colspan="2">D＞0.35 mm</td><td colspan="2">Not Allow</td><td>Ignore</td></tr>
<tr><td rowspan="2">Side Fragment</td><td rowspan="2">Visual/Film card</td><td colspan="5">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</td></tr>
<tr><td colspan="5"> 
</td></tr>
<tr><td rowspan="3">Remark</td><td colspan="6">1.Cannot be defect & failure cause by appearance defect；</td></tr>
<tr><td colspan="6">2.Cannot be larger size cause by appearance defect；</td></tr>
<tr><td colspan="6">L=long W=wide D=point size N=Defects NO</td></tr>
</table>



L=long W=wide D=point size

20. INSPECTION CRITERIA

20.1 Acceptable Quality Level

Each lot should satisfy the quality level defined as follows

Partition	AQL	Definition
A. Major	0.4%	Functional defective as product
B. Minor	1.5%	Satisfy all functions as product but not satisfy cosmetic standard

20.2 Definition of Lot

One lot means the delivery quantity to customer at one time.

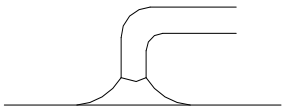
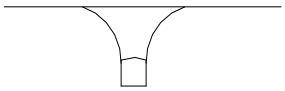
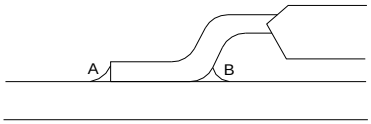
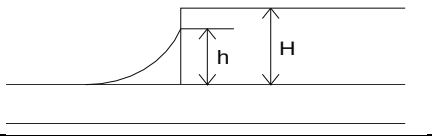
20 .3 Condition of Cosmetic Inspection

◆ INSPECTION AND TEST
-FUNCTION TEST
-APPEARANCE INSPECTION
-PACKING SPECIFICTION

◆ INSPECTION CONDITION
- Put under the lamp (20W) at a distance 100mm from
- Tilt upright 45 degree by the front (back) to inspect LCD appearance.

◆ AQL INSPECTION LEVEL
- SAMPLING METHOD: MIL-STD-105D
- SAMPLING PLAN: SINGLE
- MAJOR DEFECT: 0.4% (MAJOR)
- MINOR DEFECT: 1.5% (MINOR)
- GENERAL LEVEL: II/NORMAL

20.4 Module Cosmetic Criteria

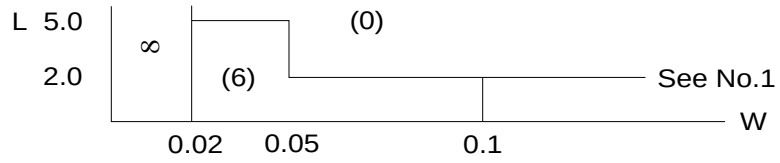
No.	Item	Judgment Criterion	Partition
1	Difference in Spec.	None allowed	Major
2	Pattern Peeling	No substrate pattern peeling and floating	Major
3	Soldering Defects	No soldering missing	Major
		No soldering bridge	Major
		No cold soldering	Minor
4	Resist Flaw on Substrate	Invisible copper foil(¢ 0.5mm or more)on substrate pattern	Minor
5	Accretion of Metallic Foreign Matter	No soldering dust	Minor
		No accretion of metallic foreign matters(Not exceed ¢ 0.2mm)	
6	Stain	No stain to spoil cosmetic badly	Minor
7	Plate Discoloring	No plate fading, rusting and discoloring	Minor
8	Solder Amount 1.Lead Parts	a. Soldering side of PCB Solder to form a' Filet' all around t Solder should not hide the lead form  b.Components side (In case of 'Through Hole PCB') Solder to reach the Components side of PCB 	Minor
	2.Flat Packages	Either 'toe' (A) or 'heal' (B) of the lead to be covered by Filet' Lead form to be assume over solder. 	Minor
	3.Chips	(3/2) H≧h≧(1/2)H 	Minor

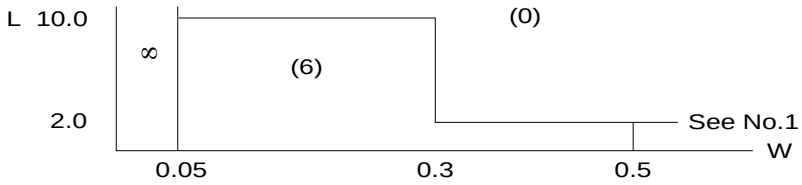
9	Backlight Defects	1.Light fails or flickers.(Major) 2. Color and luminance do not correspond to specifications. (Major) 3.Exceeds standards for display' s blemishes, foreign matter, dark lines or scratches.(Minor)	See list ←
10	PCB Defects	Oxidation or contamination on connectors.* 2. Wrong parts, missing parts, or parts not in specification.* 3.Jumpers set incorrectly.(Minor) 4.Solder(if any)on bezel, LED pad, zebra pad, or screw hole pad is not smooth.(Minor) *Minor if display functions correctly. Major if the display fails.	See list ←
11	Soldering Defects	1. Unmelted solder paste. 2. Cold solder joints, missing solder connections, or oxidation.* 3. Solder bridges causing short circuits.* 4. Residue or solder balls. 5. Solder flux is black or brown. *Minor if display functions correctly. Major if the display fails.	Minor

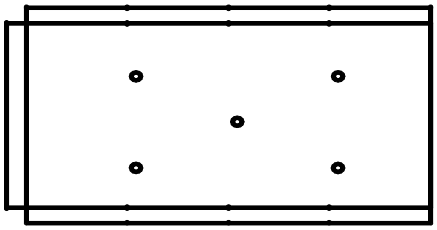
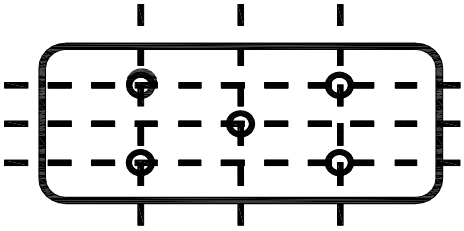
20.5 Screen Cosmetic Criteria (Non-Operating)

<table>
<tr><th>No.</th><th>Defect</th><th>Judgment Criterion</th><th>Partition</th></tr>
<tr><td>1</td><td>Spots</td><td>In accordance with Screen Cosmetic Criteria (Operating) No.1.</td><td>Minor</td></tr>
<tr><td>2</td><td>Lines</td><td>In accordance with Screen Cosmetic Criteria (Operation) No.2.</td><td>Minor</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Bubbles in Polarizer</td><td><table><tr><td>Size: d mm</td><td>Acceptable Qty in active area</td></tr><tr><td>d≦0.3
0.3<d≦1.0
1.0<d≦1.5
1.5<d</td><td>Disregard
3
1
0</td></tr></table></td><td>Minor</td></tr>
<tr><td></td><td></td></tr>
<tr><td>4</td><td>Scratch</td><td>In accordance with spots and lines operating cosmetic criteria, When the light reflects on the panel surface, the scratches are not to be remarkable.</td><td>Minor</td></tr>
<tr><td>5</td><td>Allowable density</td><td>Above defects should be separated more than 30mm each other.</td><td>Minor</td></tr>
<tr><td>6</td><td>Coloration</td><td>Not to be noticeable coloration in the viewing area of the LCD panels.
Back-lit type should be judged with back-lit on state only.</td><td>Minor</td></tr>
<tr><td>7</td><td>Contamination</td><td>Not to be noticeable.</td><td>Minor</td></tr>
</table>

20.6 Screen Cosmetic Criteria (Operating)

<table>
<tr><th>No.</th><th>Defect</th><th>Judgment Criterion</th><th>Partition</th></tr>
<tr><td>1</td><td>Spots</td><td>A) Clear
<table>
<tr><td>Size:d mm</td><td>Acceptable Qty in active area</td></tr>
<tr><td>d≦0.1
0.1<d≦0.2
0.2<d≦0.3
0.3<d</td><td>Disregard
6
2
0</td></tr>
</table>
Note: Including pin holes and defective dots which must be within one pixel Size.
Unclear
<table>
<tr><td>Size:d mm</td><td>Acceptable Qty in active area</td></tr>
<tr><td>d≦0.2
0.2<d≦0.5
0.5<d≦0.7
0.7<d</td><td>Disregard
6
2
0</td></tr>
</table></td><td>Minor</td></tr>
<tr><td>2</td><td>Lines</td><td>A) Clear
 

Note: () – Acceptable Qty in active area
L - Length (mm)
W -Width(mm)
∞-Disregard
B) Unclear
 
</td><td>Minor</td></tr>
<tr><td colspan="4">Clear' = The shade and size are not changed by Vo.
Unclear' = The shade and size are changed by Vo.</td></tr>
</table>

No.	Defect	Judgment Criterion	Partition
3	Rubbing line	Not to be noticeable.	Minor
4	Allowable density	Above defects should be separated more than 10mm each other.	Minor
5	Rainbow	Not to be noticeable.	Minor
6	Dot size	To be 95%~105%of the dot size (Typ.) in drawing. Partial defects of each dot (ex.pin-hole) should be treated as spot. (see Screen Cosmetic Criteria (Operating) No.1)	Minor
7	Brightness (only back-lit Module)	Brightness Uniformity must be BMAX/BMIN≦2 - BMAX : Max.value by measure in 5 points - BMIN : Min.value by measure in 5 points Divide active area into 4 vertically and horizontally. Measure 5 points shown in the following figure. 	Minor
8	Contrast Uniformity	Contrast Uniformity must be BmAX/BMIN≦2 Measure 5 points shown in the following figure. Dashed lines divide active area into 4 vertically and horizontally. Measuring points are located at the inter-sections of dashed line.  Note: BMAX – Max.value by measure in 5 points. BMIN – Min.value by measure in 5 points. O – Measuring points in ¢10mm.	Minor

Note:
(1) Size: d=(long length + short length)/2
(2) The limit samples for each item have priority.
(3) Complexed defects are defined item by item, but if the number of defects is defined in above table, the total number should not exceed 10.

(4) In case of 'concentration', even the spots or the lines of 'disregarded' size should not be allowed. Following three situations should be treated as 'concentration'.
-7 or over defects in circle of ¢5mm.
-10 or over defects in circle of ¢10mm
-20 or over defects in circle of ¢20mm

21. PRECAUTIONS FOR USING

21.1 Handling Precautions

- This device is susceptible to Electro-Static Discharge (ESD) damage. Observe Anti-Static precautions.
- EastRising display panel is made of glass. Do not subject it to a mechanical shock by dropping it or impact.
- If EastRising display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.
- Do not apply excessive force to the EastRising display surface or the adjoining areas since this may cause the color tone to vary.
- The polarizer covering the EastRising display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- If EastRising display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following Isopropyl or alcohol.
- Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the Water.
- Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.
- Install the EastRising LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the cable or the backlight cable.
- Do not attempt to disassemble or process EastRising LCD module.
- NC terminal should be open. Do not connect anything.
- If the logic circuit power is off, do not apply the input signals.
- To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
  -Be sure to ground the body when handling EastRising LCD modules.
  -Tools required for assembling, such as soldering irons, must be properly grounded.

-To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions.
-The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

21.2 Power Supply Precautions

- Identify and, at all times, observe absolute maximum ratings for both logic and LC drivers. Note that there is some variance between models.
- Prevent the application of reverse polarity to VDD and VSS, however briefly.
- Use a clean power source free from transients. Power-up conditions are occasionally jolting and may exceed the maximum ratings of EastRising modules.
- The VDD power of EastRising module should also supply the power to all devices that may access the display. Don’ t allow the data bus to be driven when the logic supply to the module is turned off.

21.3 Operating Precautions

- DO NOT plug or unplug EastRising module when the system is powered up.
- Minimize the cable length between EastRising module and host MPU.
- For models with backlights, do not disable the backlight by interrupting the HV line. Unload inverters produce voltage extremes that may arc within a cable or at the display.
- Operate EastRising module within the limits of the modules temperature specifications.

21.4 Mechanical/Environmental Precautions

- Improper soldering is the major cause of module difficulty. Use of flux cleaner is not recommended as they may seep under the electrometric connection and cause display failure.
- Mount EastRising module so that it is free from torque and mechanical stress.
- Surface of the LCD panel should not be touched or scratched. The display front surface is an easily scratched, plastic polarizer. Avoid contact and clean only when necessary with soft, absorbent cotton dampened with petroleum benzene.
- Always employ anti-static procedure while handling EastRising module.
- Prevent moisture build-up upon the module and observe the environmental constraints for storage tem
- Do not store in direct sunlight
- If leakage of the liquid crystal material should occur, avoid contact with this material, particularly ingestion. If the body or clothing becomes contaminated by the liquid crystal material, wash thoroughly with water and soap.

21.5 Storage Precautions

When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.
Keep EastRising modules in bags (avoid high temperature / high humidity and low temperatures below 0 ºC.
Whenever possible, EastRising LCD modules should be stored in the same conditions in which they were shipped from our company.

21.6 Others

Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.
If EastRising LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.
To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity etc., exercise care to avoid holding the following sections when handling the modules.
-Exposed area of the printed circuit board.
-Terminal electrode sections.

22. USING LCD MODULES

22.1 Liquid Crystal Display Modules

EastRising LCD is composed of glass and polarizer. Pay attention to the following items when handling.

- Please keep the temperature within specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.
- Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.).
- N-hexane is recommended for cleaning the adhesives used to attach front/rear polarizers and reflectors made of organic substances which will be damaged by chemicals such as acetone, toluene, ethanol and isopropyl alcohol.
- When EastRising display surface becomes dusty, wipe gently with absorbent cotton or other soft material like chamois soaked in petroleum benzin. Do not scrub hard to avoid damaging the display surface.
- Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading.
- Avoid contacting oil and fats.
- Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizers. After products are tested at low temperature they must be warmed up in a container before coming is contacting with room temperature air.
- Do not put or attach anything on EastRising display area to avoid leaving marks on.
- Do not touch the display with bare hands. This will stain the display area and degradate insulation between terminals (some cosmetics are determinated to the polarizers).
- As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping.

22.2 Installing LCD Modules

- Cover the surface with a transparent protective plate to protect the polarizer and LC cell.
- When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be±0.1mm.

22.3 Precaution for Handling LCD Modules

Since EastRising LCM has been assembled and adjusted with a high degree of precision; avoid applying excessive shocks to the module or making any alterations or modifications to it.

- Do not alter, modify or change the shape of the tab on the metal frame.
- Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
- Do not damage or modify the pattern writing on the printed circuit board.
- Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.
- Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
- Do not drop, bend or twist EastRising LCM.

22.4 Electro-Static Discharge Control

Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC.

- Make certain that you are grounded when handing LCM.
- Before remove LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential.
- When soldering the terminal of LCM, make certain the AC power source for the soldering iron does not leak.
- When using an electric screwdriver to attach LCM, the screwdriver should be of ground potentiality to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.
- As far as possible make the electric potential of your work clothes and that of the work bench the ground potential.
- To reduce the generation of static electricity be careful that the air in the work is not too dried. A relative humidity of 50%-60% is recommended.

22.5 Precaution for Soldering to EastRising LCM

- Observe the following when soldering lead wire, connector cable and etc. to the LCM.
  -Soldering iron temperature : 280℃±10℃
  -Soldering time: 3-4 sec.
  -Solder: eutectic solder.

If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation. (This does not apply in the case of a non-halogen type of flux.) It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage due to flux spatters.

- When soldering the electroluminescent panel and PC board, the panel and board should not be detached more than three times. This maximum number is determined by the temperature and time conditions mentioned above, though there may be some variance depending on the temperature of the soldering iron.
- When remove the electroluminescent panel from the PC board, be sure the solder has completely melted, the soldered pad on the PCs board could be damaged.

22.6 Precaution for Operation

- Driving the EastRising LCD in the voltage above the limit shortens its life.
- Response time is greatly delayed at temperature below the operating temperature range. However, this does not mean the LCD will be out of the order. It will recover when it returns to the specified temperature range.
- If EastRising display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.
- Condensation on terminals can cause an electrochemical reaction disrupting the terminal circuit. Therefore, it must be used under the relative condition of 40℃, 50% RH.
- When turning the power on, input each signal after the positive/negative voltage becomes stable.

22.7 Limited Warranty

Unless agreed between EastRising and customer, EastRising will replace or repair any of its LCD modules which are found to be functionally defective when inspected in accordance with EastRising LCD acceptance standards (copies available upon request) for a period of one year from date of shipments. Cosmetic/visual defects must be returned to EastRising within 90 days of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of EastRising limited to repair and/or replacement on the terms set forth above. EastRising will not be responsible for any subsequent or consequential events.

22.8 Return Policy

No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are:
-Broken LCD glass.
-PCB eyelet damaged or modified.
-PCB conductors damaged.
-Circuit modified in any way, including addition of components.
-PCB tampered with by grinding, engraving or painting varnish.
-Soldering to or modifying the bezel in any manner.
Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned with sufficient description of the failures or defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB eyelet’ s, conductors and terminals.

23. IMAGE STICKING

23.1 What is Image Sticking?

If you remain a fixed image on LCD Display for a long period of time, you may experience a phenomenon called Image S ticking. Image Sticking - sometimes also called "image retention" or "ghosting" - is a phenomenon where a faint outline of a previously displayed image remains visible on the screen when the image is changed. It can occur at variable levels of intensity depending on the specific image makeup, as well as the amount of time the core image elements are allowed to remain unchanged on the screen.

23.2 What Causes Image Sticking and How to Avoid?

1. The e-Paper display cannot be powered on for a long time, you must set e-Paper display to sleep mode or power off when it needn't refresh ,otherwise e-Paper keeps in high voltage status for long time which will damage e-Paper and cannot be fixed. We suggest customers to update e-Paper display every 24 hours or at least 10 days to update again. Otherwise, ghost of the last content may cannot be cleared. It is also recommended that customer ships or stores the e-Paper display with completely white image to avoid image sticking issue and refresh.
2. Three-color e-Paper display is normal to be a little "color" . You can refresh it to white to keep it upward for storage.
3. The e-Paper display ignores the data sent when it is in sleep mode, you need to initialize it for properly refreshing. The e-Paper display cannot refresh directly under sunlight. The refresh steps should be done indoor.
4. For those e-Paper displays which support partial refresh, you cannot use partial refresh all the time. A full refresh should be done to clear screen after several times (partial refresh), otherwise, e-Paper display will be damaged and cannot fixed.

24. STORAGE

We recommend customers to refresh three-color e-Paper displays one by one if storage period is more than half a year, otherwise the image on display may be unclear as below image shows.