# 3.52 inch
# E-paper Display Series
# GDEY0352F51

GooDisplay®

Dalian Good Display Co., Ltd.

# Product Specifications

| | |
|---|---|
| **Customer** | **Standard** |
| **Description** | **3.52" E-PAPER DISPLAY** |
| **Model Name** | **GDEY0352F51** |
| **Date** | **2023 / 08 / 08** |
| **Revision** | **1.0** |

| | Design Engineering | | |
|---|---|---|---|
| | **Approval** | **Check** | **Design** |
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## 1. Over View

GDEY0352F51 is a reflective electrophoretic technology display module on an active matrix TFT substrate. The panel is capable of displaying black, white, yellow and red images depending on the associated lookup table used. The circuitry on the panel includes an integrated gate and source driver, timing controller, oscillator, DC-DC boost circuit, and memory to store the frame buffer and lookup tables, and additional circuitry to control VCOM and BORDER settings.

## 2. Features

- Highlight Red and Yellow color
- High contrast
- High reflectance
- Ultra wide viewing angle
- Ultra low power consumption
- Pure reflective mode
- Bi-stable display
- Antiglare hard-coated front-surface
- Low current deep sleep mode
- On chip display RAM
- 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
- $I^2C$ signal master interface to read external temperature sensor
- Available in COG package

## 3. Mechanical Specifications

| Parameter | Specifications | Unit | Remark |
|---|---|---|---|
| Screen Size | 3.52 | Inch | |
| Display Resolution | 180(H)×384 (V) | Pixel | Dpi: 120 |
| Active Area | 37.98×81.02 | mm | |
| Pixel Pitch | 0.211×0.211 | mm | |
| Pixel Configuration | Rectangle | | |
| Outline Dimension | 43.98(H)×93.42(V) ×1.0(D) | mm | |
| Weight | 7.58±0.5 | g | |

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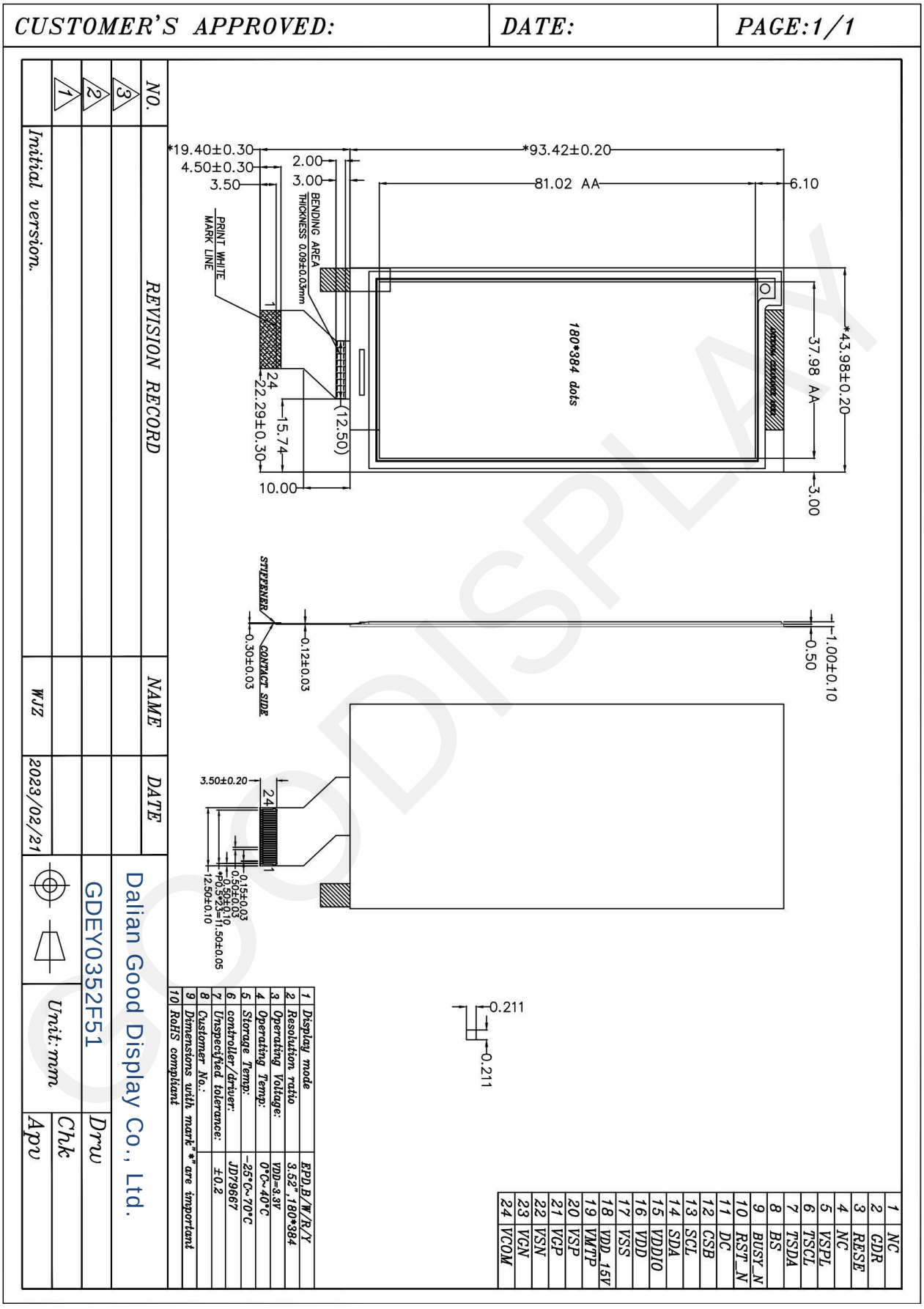
# 4. Mechanical Drawing of EPD module

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## 5. Input /Output Pin Assignment

| No. | Name | I/O | Description | Remark |
|---|---|---|---|---|
| 1 | NC | | Do not connect with other NC pins | Keep Open |
| 2 | GDR | O | This pin is N-MOS gate control. | |
| 3 | RESE | P | Current sense input for control loop. | |
| 4 | NC | NC | Do not connect with other NC pins | Keep Open |
| 5 | VSPL | P | Positive source voltage | |
| 6 | TSCL | O | $I^2C$ clock for external temperature sensor<br>($I^2C$ interface need external pull high resistance.)<br>Must pull high or low if not used. | |
| 7 | TSDA | I/O | $I^2C$ data for external temperature sensor<br>($I^2C$ interface need external pull high resistance.)<br>Must pull high or low if not used.(Default low) | |
| 8 | BS | I | Input interface setting. | |
| 9 | BUSY_N | O | This pin indicates the driver status. | |
| 10 | RST_N | I | Global reset pin. Low reset. (normal pull high) | |
| 11 | DC | I | Serial communication Command/Data input | |
| 12 | CSB | I | Serial communication chip select. | |
| 13 | SCL | I | Serial communication clock input. | |
| 14 | SDA | I/O | Serial communication data input. | |
| 15 | VDDIO | P | IO voltage supply | |
| 16 | VDD | P | Digital/Analog power. | |
| 17 | VSS | P | Ground | |
| 18 | VDD_15V | P | 1.5V voltage input &output | |
| 19 | VMTP | P | MTP program power (10.1V) | |
| 20 | VSP | P | Positive source voltage | |
| 21 | VGP | P | Positive gate voltage | |
| 22 | VSN | P | Negative Source driving voltage | |
| 23 | VGN | P | Negative gate voltage | |
| 24 | VCOM | O | VCOM driving voltage | |

Note: I: Input, O: Output, P: Power, D: Dummy, S: Shorted line, M: Mark, PI: Power input, O: Power output,I/O: Input / Output. PS: Power Setting, C: Capacitor pin.

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# 6. Electrical Characteristics

## 6.1 Absolute Maximum Rating

| Parameter | Symbol | Rating | Unit |
|---|---|---|---|
| Logic supply voltage | VDD, AVDD,VDDIO, VDD1,VPP | -0.3 to +6.0 | V |
| Logic Input voltage | VI | -0.3 to VDDIO+0.3 | V |
| Operating Temp range | TOPR | 0 to +40 | ºC |
| Storage Temp range | TSTG | -25 to +70 | ºC |
| Optimal Storage Temp | TSTGo | 23±2 | ºC |
| Optimal Storage Humidity | HSTGo | 55±10 | %RH |

Note: Absolute Maximum Ratings are stress ratings. Stresses in excess of these ratings can cause permanent damage to the device. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this data sheet is not implied. Exposing device to the absolute maximum ratings in a long period of time may degrade the device and affect its reliability.

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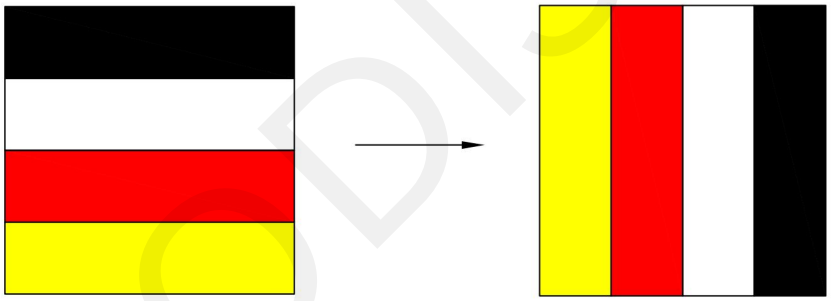
## 6.2 Panel DC Characteristics

| Parameter | Symbol | Conditions | Applicable pin | Min. | Typ. | Max | Units |
|---|---|---|---|---|---|---|---|
| Single ground | $V_{SS}$ | - | | - | 0 | - | V |
| Logic supply voltage | $V_{IO}$ | - | VIO | 2.3 | 3.3 | 3.6 | V |
| Core logic voltage | $V_{DD}$ | | VDD | 2.3 | 3.3 | 3.6 | V |
| High level input voltage | $V_{IH}$ | - | - | $0.7V_{IO}$ | - | $V_{IO}$ | V |
| Low level input voltage | $V_{IL}$ | - | - | GND | - | $0.3V_{DD}$ | V |
| High level output voltage | $V_{OH}$ | IOH = 400uA | - | $V_{IO}$ -0.4 | - | - | V |
| Low level output voltage | $V_{OL}$ | IOL = -400uA | - | GND | - | GND +0.4 | V |
| Typical power | $P_{TYP}$ | $V_{CI}$ =3.3V | - | - | 19.14 | - | mW |
| Deep sleep mode | $P_{STPY}$ | $V_{CI}$ =3.3V | - | - | 0.003 | - | mW |
| Typical operating current | Iopr_$V_{CI}$ | $V_{CI}$ =3.3V | - | - | 5.8 | - | mA |
| Image update time | - | 25 ℃ | - | - | 26 | - | sec |
| Stand-by current | Ist_$V_{DD}$ | | - | - | 1 | 5 | uA |

Notes: 1. The typical power is measured with following transition from horizontal 4 scale pattern to vertical 4 scale pattern.



2.The deep sleep power is the consumed power when the panel controller is in deep sleep mode.

3.The listed electrical/optical characteristics are only guaranteed under the controller & waveform provided by Good Display.

4.Electrical measurement：Multimeter

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## 6.3 AC Characteristics

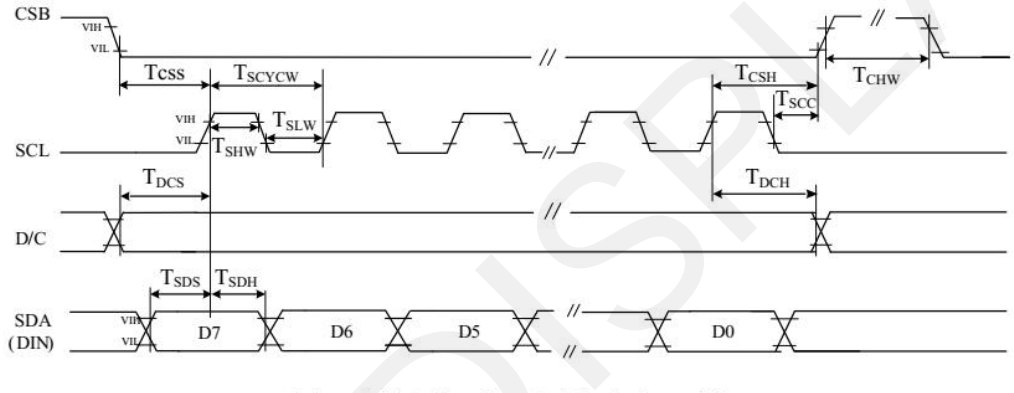
### 6.3.1 MCU Interface Selection

The 3-wire/4-wire serial port as communication interface for all the function and command setting.

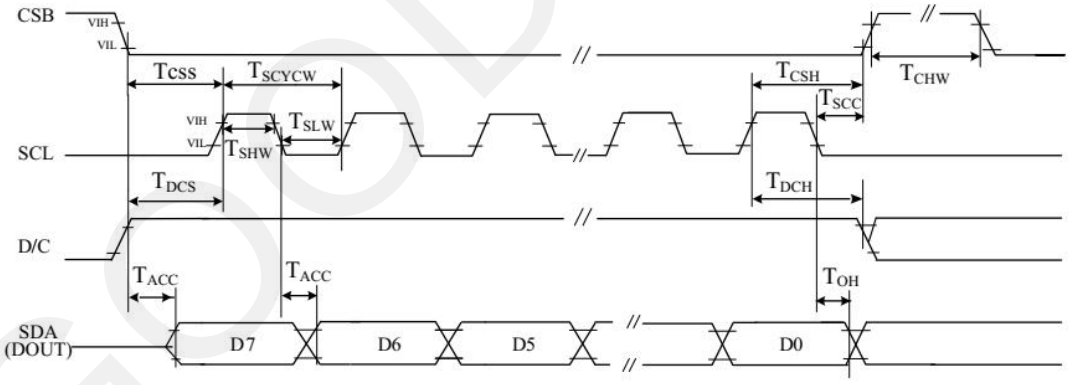
3-wire/4-wire engine act as a "slave mode" for all the time, and will not issue any command to the 3-wire/4-wire bus itself.

Under read mode, 3-wire/4-wire engine will return the data during "Data phase". The returned data should be latched at the rising edge of SCL by external controller. Data in the "Hi-Z phase" will be ignored by 3-wire/4-wire engine during write operation, and should be ignored during read operation also. During read operation, external controller should float SDA pin under "Hi-Z phase" and "Data phase".

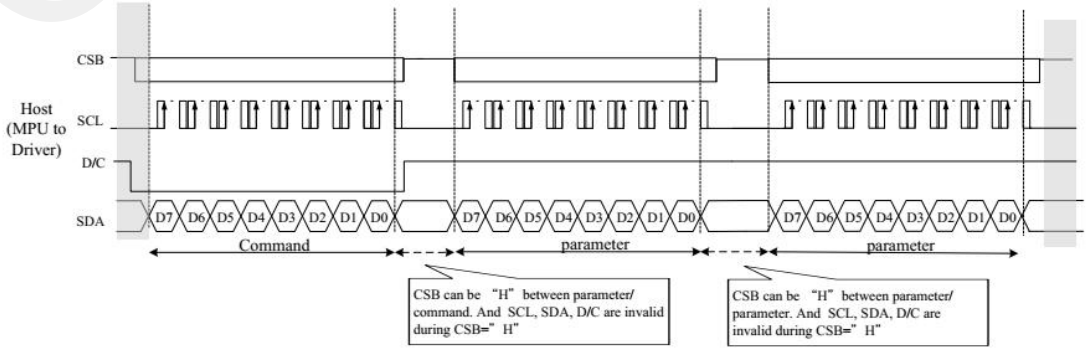
### 6.3.2 MCU Serial Interface (4-wire SPI)




4 pin serial interface characteristics(write mode)




4 pin serial interface characteristics(read mode)

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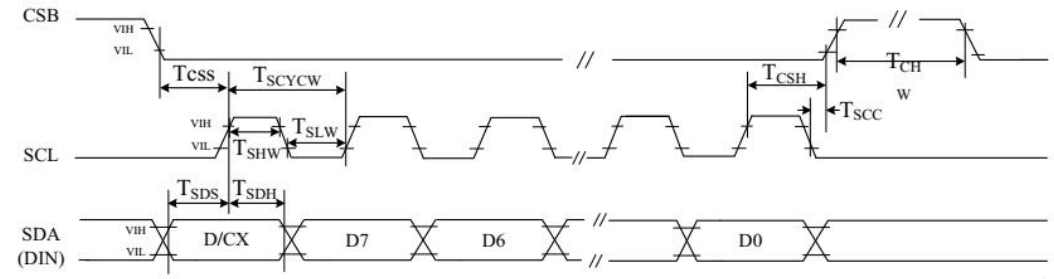
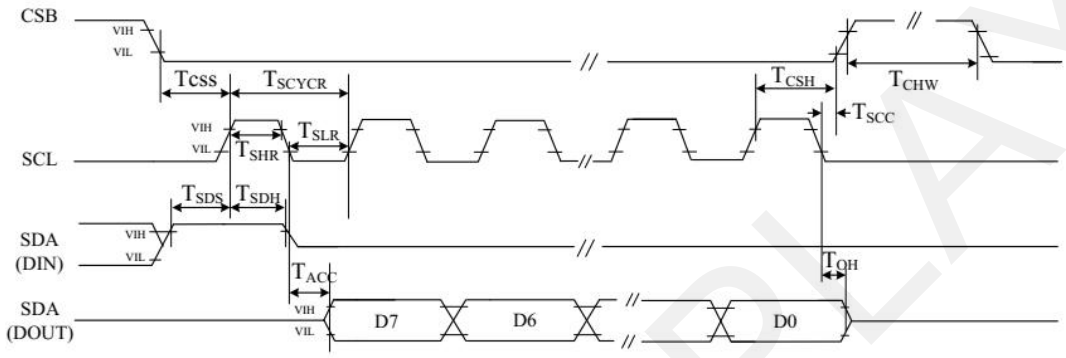
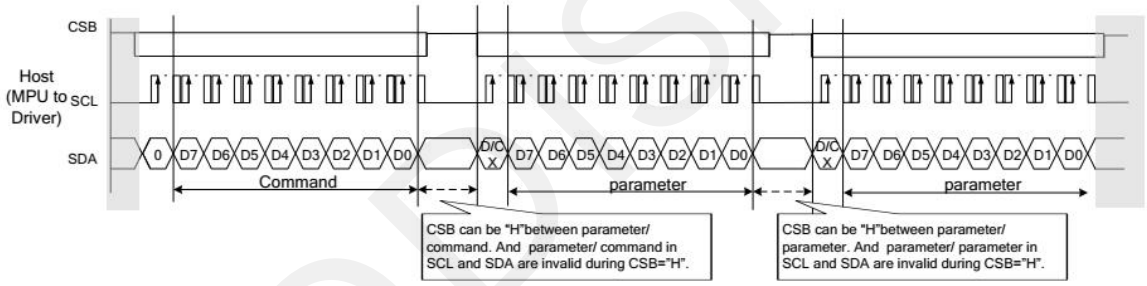
## 6.3.3 MCU Serial Interface (3-wire SPI)




3 pin serial interface characteristics (write mode)




3 pin serial interface characteristics (read mode)

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# 7. Command Table

| Address | command | | | Bit | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| R00H | Panel setting (PSR) | W | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 00H |
| | | W | 1 | RES[1] | RES[0] | PST_MODE | - | UD | SHL | SHD_N | RST_N | 0Fh |
| | | W | 1 | LUT_EN | - | FOPT | VCMZ | TS_AUTO | TIEG | NORG | VC_LUTZ | 09h |
| R01H | Power setting (PWR) | W | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 01H |
| | | W | 1 | - | - | - | - | V_MODE | VSC_EN | VDS_EN | VDG_EN | 07h |
| | | W | 1 | - | - | - | - | - | - | VGPN [1] | VGPN [0] | 00h |
| | | W | 1 | - | VSPL_0[6] | VSPL_0[5] | VSPL_0[4] | VSPL_0[3] | VSPL_0[2] | VSPL_0[1] | VSPL_0[0] | 00h |
| | | W | 1 | - | VSP_1[6] | VSP_1 [5] | VSP_1 [4] | VSP_1 [3] | VSP_1 [2] | VSP_1 [1] | VSP_1 [0] | 00h |
| | | W | 1 | - | VSN_1[6] | VSN_1[5] | VSN_1[4] | VSN_1[3] | VSN_1[2] | VSN_1[1] | VSN_1[0] | 00h |
| | | W | 1 | - | VSPL_1[6] | VSPL_1[5] | VSPL_1[4] | VSPL_1[3] | VSPL_1[2] | VSPL_1[1] | VSPL_1[0] | 00h |
| R02H | Power OFF(POF) | W | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 02H |
| | | W | 1 | - | - | - | - | - | - | - | EDSE | 00h |
| R03H | Power off Sequence Setting(PFS) | W | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 03H |
| | | W | 1 | T_VDS_OFF2[1:0] | | T_VDPG_OFF[1:0] | | T_VDS_ON[1:0] | | T_VDS_OFF[1:0] | | 00h |
| | | W | 1 | VGP_LEN[3:0] | | | | VGP_EXT[3:0] | | | | 54 |
| | | W | 1 | XON_DLY | | | | XON_LEN | | | | 44 |
| R04H | Power ON (PON) | W | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 04H |
| R06H | Booster Soft Start (BTST) | W | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 06H |
| | | W | 1 | - | - | - | - | PHB_SFT[1:0] | | PHA_SFT[1:0] | | 00h |
| | | W | 1 | - | - | PHA_ON[5:0] | | | | | | 02h |
| | | W | 1 | - | - | PHA_OFF[5:0] | | | | | | 07h |
| | | W | 1 | - | - | PHB_ON[5:0] | | | | | | 02h |
| | | W | 1 | - | - | PHB_OFF[5:0] | | | | | | 07h |
| | | W | 1 | - | - | PHC_ON[5:0] | | | | | | 02h |
| | | W | 1 | - | - | PHC_OFF[5:0] | | | | | | 07h |
| R07H | Deep Sleep(DSLP) | W | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 07H |
| | | W | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | A5h |
| R10H | Data Start transmission (DTM) | W | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 10H |
| | | W | 1 | # | # | # | # | # | # | # | # | 00H |
| R11H | Data Stop (DSP) | W | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 11H |
| | | R | 1 | Data_flag | - | - | - | - | - | - | - | -- |
| R12H | Display Refresh (DRF) | W | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 12H |
| | | W | 1 | - | - | - | - | - | Gate_seq | - | AC/DC VCOM | 00H |
| R17H | Auto sequence (AUTO) | W | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 17H |
| | | W | 1 | Code[7] | Code[6] | Code[5] | Code[4] | Code[3] | Code[2] | Code[1] | Code[0] | A5h |
| R30H | PLL control (PLL) | W | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 30H |
| | | W | 1 | - | - | - | - | Dyna | | FR[2:0] | | 02h |
| R40H | Temperature Sensor Command (TSC) | W | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 40H |
| | | R | 1 | D10/TS[7] | D9/TS[7] | D8/TS[6] | D7/TS[5] | D6/TS[4] | D5/TS[3] | D4/TS[2] | D3/TS[1] | -- |
| | | R | 1 | D2/ TS[9] | D1/TS[8] | D0 | - | - | - | - | - | -- |
| R41H | Temperature Sensor Calibration (TSE) | W | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 41H |
| | | W | 1 | TSE | - | - | TO[4] | TO[3] | TO[2] | TO[1] | TO0] | 00h |
| R42H | Temperature Sensor Write (TSW) | W | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 42H |
| | | W | 1 | WATTR[7] | WATTR[6] | WATTR[5] | WATTR[4] | WATTR[3] | WATTR[2] | WATTR[1] | WATTR[0] | 00h |
| | | W | 1 | WMSB[7] | WMSB[6] | WMSB[5] | WMSB[4] | WMSB[3] | WMSB[2] | WMSB[1] | WMSB[0] | 00h |
| | | W | 1 | WLSB[7] | WLSB[6] | WLSB[5] | WLSB[4] | WLSB[3] | WLSB[2] | WLSB[1] | WLSB[0] | 00h |
| R43H | Temperature Sensor | W | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 43H |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Read (TSR) | R | 1 | RMSB[7] | RMSB[6] | RMSB[5] | RMSB[4] | RMSB[3] | RMSB[2] | RMSB[1] | RMSB[0] | -- |
| | | R | 1 | RLSB[7] | RLSB[6] | RLSB[5] | RLSB[4] | RLSB[3] | RLSB[2] | RLSB[1] | RLSB[0] | -- |
| R50H | VCOM and DATA interval setting (CDI) | W | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 50H |
| | | W | 1 | VBD[2] | VBD[1] | VBD[0] | DDX | CDI[3] | CDI[2] | CDI[1] | CDI[0] | 97h |
| R51H | Lower Power Detection (LPD) | W | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 51H |
| | | R | 1 | - | - | - | - | - | - | - | LPD | -- |
| R61H | Resolution setting(TRES) | W | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 61H |
| | | W | 1 | - | - | - | - | - | - | HRES(9) | HRES(8) | 00h |
| | | W | 1 | HRES(7) | HRES(6) | HRES(5) | HRES(4) | HRES(3) | HRES(2) | 0 | 0 | 00h |
| | | W | 1 | - | - | - | - | - | - | VRES(8) | VRES(0) | 00h |
| | | W | 1 | VRES(7) | VRES(6) | VRES(5) | VRES(4) | VRES(3) | VRES(2) | VRES(1) | VRES(0) | 00h |
| R65H | Gate/Source Start Setting(GSST) | W | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 65H |
| | | W | 1 | - | - | - | - | - | - | S_start(9) | S_start(8) | 00h |
| | | W | 1 | S_start(7) | S_start(6) | S_start(5) | S_start(4) | S_start(3) | S_start(2) | 0 | 0 | 00h |
| | | W | 1 | - | - | - | - | - | - | G_start(9) | G_start(8) | 00h |
| | | W | 1 | G_start(7) | G_start(6) | G_start(5) | G_start(4) | G_start(3) | G_start(2) | G_start(1) | G_start(0) | 00h |
| R70H | REVISION (REV) | W | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 70H |
| | | R | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 05h |
| | | R | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 02h |
| | | R | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 01h |
| R80H | Auto Measure Vcom (AMV) | W | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 80 H |
| | | W | 1 | P[1] | P[0] | AMVT[1] | AMVT[0] | XON | AMVS | AMV | AMVE | 00h |
| R81H | Vcom Value (VV) | W | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 81H |
| | | R | 1 | - | VV[6] | VV[5] | VV[4] | VV[3] | VV[2] | VV[1] | VV[0] | -- |
| R82H | Vcom_DC Setting register(VDCS) | W | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 82H |
| | | W | 1 | MTP_VCM | VDCS[6] | VDCS[5] | VDCS[4] | VDCS[3] | VDCS[2] | VDCS[1] | VDCS[0] | 00h |
| R83H | Partial Window (PTLW) | W | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 83H |
| | | W | 1 | - | - | - | - | - | - | HRST(9) | HRST(8) | 00h |
| | | W | 1 | HRST(7) | HRST(6) | HRST(5) | HRST(4) | HRST(3) | HRST(2) | 0 | 0 | 00h |
| | | W | 1 | - | - | - | - | - | - | HRED(9) | HRED(8) | 00h |
| | | W | 1 | HRED(7) | HRED(6) | HRED(5) | HRED(4) | HRED(3) | HRED(2) | 0 | 0 | 00h |
| | | W | 1 | - | - | - | - | - | - | VRST(9) | VRST(8) | 00h |
| | | W | 1 | VRST(7) | VRST(6) | VRST(5) | VRST(4) | VRST(3) | VRST(2) | VRST(1) | VRST(0) | 00h |
| | | W | 1 | - | - | - | - | - | - | VRST(9) | VRST(8) | 00h |
| | | W | 1 | VRST(7) | VRST(6) | VRST(5) | VRST(4) | VRST(3) | VRST(2) | VRST(1) | VRST(0) | 00h |
| | | W | 1 | - | - | - | - | - | - | - | PMOD | 00h |
| R90H | Program mode(PGM) | W | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 90H |
| R91H | Active Program(APG) | W | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 91H |
| R92H | Read MTP data (RMTP) | W | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 92H |
| | | R | 1 | # | # | # | # | # | # | # | # | - |
| R9EH | REVISION2 (REV2) | W | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 9EH |
| | | R | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 01h |
| R9FH | Read MTP Reserved Bytes(RMRB) | W | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 9FH |
| | | R | 1 | # | # | # | # | # | # | # | # | - |
| RE3H | Power saving(PWS) | W | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | E3H |
| | | W | 1 | VCOM_W [3] | VCOM_W [2] | VCOM_W [1] | VCOM_W [0] | SD_W[3] | SD_W[2] | SD_W[2] | SD_W[0] | 00h |
| RE4H | LVD voltage Select(LVSEL) | W | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | E4H |
| | | W | 1 | - | - | - | - | - | - | LVD_SEL [1] | LVD_SEL [0] | 03h |
| | | R | 1 | Chk_CRC[7:0] | | | | | | | | 00h |
| | | R | 1 | MTP_CRC[7:0] | | | | | | | | 00h |

| R00H | Bit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inst/Para | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| PSR | W | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 00H |
| 1st Parameter | W | 1 | RES[1] | RES[0] | PST_MODE | - | UD | SHL | SHD_N | RST_N | 0Fh |
| 2nd Parameter | W | 1 | LUT_EN | - | FOPT | VCMZ | TS_AUTO | TIEG | NORG | VC_LUTZ | 09h |

NOTE: "-" Don't care, can be set to VDD or GND level

Description

-The command defines as :

1st parameter

| Bit | Name | Description |
|---|---|---|
| 0 | RST_N | RST_N function<br>1: no effect. (default)<br>0: Booster OFF, Register data are set to their default values, and Source/Boder/Vcom: floating |
| 1 | SHD_N | SHD_N function<br>0 : Booster OFF, register data are kept, and Source/Boder/Vcom are kept 0V or floating.<br>1 : Booster on. (default) |
| 2 | SHL | SHL function<br>0: Shift left; First data=Sn→Sn-1 →…→S2→Last data=S1.<br>1: Shift right: First data=S1→S2 →…→Sn-1→Last data=Sn. (default) |
| 3 | UD | UD function<br>0:Scan down; First line=Gn→Gn-1 →…→G2→Last line=G1.<br>1:Scan up; First line=G1→G2 →…→Gn-1→Last line=Gn. (default) |
| 5 | PST_MODE | Power switch operation mode<br>0:Power switching time in the period of frame scanning.(default)<br>1:Power switching time in the external period before frame scanning. |
| 7-6 | RES[1,0] | Resolution setting<br>00: Display resolution is 200x384 (default)<br>01: Display resolution is 184x384<br>10: Display resolution is 168x384<br>11: Display resolution is 200x200 |

**2nd parameter**

| Bit | Name | Description |
|---|---|---|
| 0 | VC_LUTZ | VCOM status function<br>0 : No effect<br>1 : After refreshing display,the output of VCOM is set to floating automatically (default) |
| 1 | NORG | VCOM status function<br>0 : No effect (default)<br>1 : After refreshing display, VCOM is tied to GND before power off |
| 2 | TIEG | VGN power off status function<br>0 : No effect (default)<br>1 : Power off, VGN will be tied to GND |
| 3 | TS_AUTO | Temperature sensing will be activated automatically one time<br>0 : Before enabling booster,Temperature Sensor will be activated automatically one time.<br>1 : When RST_N low to high,Temperature Sensor will be activated automatically one time. (default) |
| 4 | VCMZ | VCOM status function<br>0 : No effect (default)<br>1 : VCOM is always floating |
| 5 | FOPT | FOPT function<br>0: Scan 1 frame after waveform finished(default)<br>1: No scan after waveform finished and switch the source channel output to Hiz. |

Priority of VCOM setting: VCMZ > NORG > FOPT > VC_LUTZ

FOPT setting is part of refreshing display.
FOPT: Power off floating.

Notes:
1. Non-select gate line keep at VGN for DSP/DRF and AMV
2. Dummy source line follow LUTC for DSP/DRF
3. When SHD_N become low, DCDC will turn off. Register and SRAM data will keep until VDD turn off.SD output and VCOM will base on previous condition. It may have two condition:0V or floating.
4. When RST_N become low, driver will reset. All register will reset to default value. All of the driver's functions will disable. Source/Gate/Border/VCOM will be released to floating

Restriction

| R01H | Bit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inst/Para | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| PWR | W | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 01h |
| 1st Parameter | W | 1 | - | - | - | - | V_MODE | VSC_EN | VDS_EN | VDG_EN | 07h |
| 2nd Parameter | W | 1 | - | - | - | - | - | - | VGPN [1] | VGPN [0] | 00h |
| 3rd Parameter | W | 1 | - | VSPL_0 [6:0] | | | | | | | 00h |
| 4th Parameter | W | 1 | - | VSP_1 [6:0] | | | | | | | 00h |
| 5th Parameter | W | 1 | - | VSN_1 [6:0] | | | | | | | 00h |
| 6th Parameter | W | 1 | - | VSPL_1 [6:0] | | | | | | | 00h |

NOTE: "-" Don't care, can be set to VDD or GND level

Description

-The command defines as :

**1st Parameter:**

| Bit | Name | Description |
|---|---|---|
| 0 | VDG_EN | Gate power selection.<br>0 : External gate power from VGP/VGN pins.<br>1 : Internal DCDC function for generate VGP/VGN. (default) |
| 1 | VDS_EN | Source power selection.<br>0 : External source power from VSP/VSN pins.<br>1 : Internal regulator function for generate VSP/VSN (default) |
| 2 | VSC_EN | Source LV power selection.<br>0 : External source power from VSPL pins.<br>1 : Internal regulator function for generate VSPL (default) |
| 3 | V_MODE | Source Power switching mode.<br>0: Mode0(default)<br>1: Mode1 |

**2nd Parameter:**

| Bit | Name | Description |
|---|---|---|
| 1-0 | VGPN | VGPN Voltage Level.<br>00: VGP=20 v, VGN=-20v (default)<br>01: VGP=17 v, VGN=-17v<br>10: VGP=15 v, VGN=-15v<br>11: VGP=10 v, VGN=-10v |

3rd & 4th & 6th Parameter: Internal VSP_1/VSPL_0/ VSPL_1 power selection

| Bit | Name | Description |
|---|---|---|
| 6-0 | VSP_1 & VSPL_0 & VSPL_1 | **Internal VSP & VSPL power selection.** |

| bit[6:0] | | Voltage(V) | bit [6:0] | | Voltage(V) | bit [6:0] | | Voltage(V) |
|---|---|---|---|---|---|---|---|---|
| 0000000 | 00h | 3 | 0101001 | 29h | 7.1 | 1010010 | 52h | 11.2 |
| 0000001 | 01h | 3.1 | 0101010 | 2Ah | 7.2 | 1010011 | 53h | 11.3 |
| 0000010 | 02h | 3.2 | 0101011 | 2Bh | 7.3 | 1010100 | 54h | 11.4 |
| 0000011 | 03h | 3.3 | 0101100 | 2Ch | 7.4 | 1010101 | 55h | 11.5 |
| 0000100 | 04h | 3.4 | 0101101 | 2Dh | 7.5 | 1010110 | 56h | 11.6 |
| 0000101 | 05h | 3.5 | 0101110 | 2Eh | 7.6 | 1010111 | 57h | 11.7 |
| 0000110 | 06h | 3.6 | 0101111 | 2Fh | 7.7 | 1011000 | 58h | 11.8 |
| 0000111 | 07h | 3.7 | 0110000 | 30h | 7.8 | 1011001 | 59h | 11.9 |
| 0001000 | 08h | 3.8 | 0110001 | 31h | 7.9 | 1011010 | 5Ah | 12 |
| 0001001 | 09h | 3.9 | 0110010 | 32h | 8 | 1011011 | 5Bh | 12.1 |
| 0001010 | 0Ah | 4 | 0110011 | 33h | 8.1 | 1011100 | 5Ch | 12.2 |
| 0001011 | 0Bh | 4.1 | 0110100 | 34h | 8.2 | 1011101 | 5Dh | 12.3 |
| 0001100 | 0Ch | 4.2 | 0110101 | 35h | 8.3 | 1011110 | 5Eh | 12.4 |
| 0001101 | 0Dh | 4.3 | 0110110 | 36h | 8.4 | 1011111 | 5Fh | 12.5 |
| 0001110 | 0Eh | 4.4 | 0110111 | 37h | 8.5 | 1100000 | 60h | 12.6 |
| 0001111 | 0Fh | 4.5 | 0111000 | 38h | 8.6 | 1100001 | 61h | 12.7 |
| 0010000 | 10h | 4.6 | 0111001 | 39h | 8.7 | 1100010 | 62h | 12.8 |
| 0010001 | 11h | 4.7 | 0111010 | 3Ah | 8.8 | 1100011 | 63h | 12.9 |
| 0010010 | 12h | 4.8 | 0111011 | 3Bh | 8.9 | 1100100 | 64h | 13 |
| 0010011 | 13h | 4.9 | 0111100 | 3Ch | 9 | 1100101 | 65h | 13.1 |
| 0010100 | 14h | 5 | 0111101 | 3Dh | 9.1 | 1100110 | 66h | 13.2 |
| 0010101 | 15h | 5.1 | 0111110 | 3Eh | 9.2 | 1100111 | 67h | 13.3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 0010110 | 16h | 5.2 | 0111111 | 3Fh | 9.3 | 1101000 | 68h | 13.4 |
| 0010111 | 17h | 5.3 | 1000000 | 40h | 9.4 | 1101001 | 69h | 13.5 |
| 0011000 | 18h | 5.4 | 1000001 | 41h | 9.5 | 1101010 | 6Ah | 13.6 |
| 0011001 | 19h | 5.5 | 1000010 | 42h | 9.6 | 1101011 | 6Bh | 13.7 |
| 0011010 | 1Ah | 5.6 | 1000011 | 43h | 9.7 | 1101100 | 6Ch | 13.8 |
| 0011011 | 1Bh | 5.7 | 1000100 | 44h | 9.8 | 1101101 | 6Dh | 13.9 |
| 0011100 | 1Ch | 5.8 | 1000101 | 45h | 9.9 | 1101110 | 6Eh | 14 |
| 0011101 | 1Dh | 5.9 | 1000110 | 46h | 10 | 1101111 | 6Fh | 14.1 |
| 0011110 | 1Eh | 6 | 1000111 | 47h | 10.1 | 1110000 | 70h | 14.2 |
| 0011111 | 1Fh | 6.1 | 1001000 | 48h | 10.2 | 1110001 | 71h | 14.3 |
| 0100000 | 20h | 6.2 | 1001001 | 49h | 10.3 | 1110010 | 72h | 14.4 |
| 0100001 | 21h | 6.3 | 1001010 | 4Ah | 10.4 | 1110011 | 73h | 14.5 |
| 0100010 | 22h | 6.4 | 1001011 | 4Bh | 10.5 | 1110100 | 74h | 14.6 |
| 0100011 | 23h | 6.5 | 1001100 | 4Ch | 10.6 | 1110101 | 75h | 14.7 |
| 0100100 | 24h | 6.6 | 1001101 | 4Dh | 10.7 | 1110110 | 76h | 14.8 |
| 0100101 | 25h | 6.7 | 1001110 | 4Eh | 10.8 | 1110111 | 77h | 14.9 |
| 0100110 | 26h | 6.8 | 1001111 | 4Fh | 10.9 | 1111000 | 78h | 15 |
| 0100111 | 27h | 6.9 | 1010000 | 50h | 11 | other | | 15 |
| 0101000 | 28h | 7 | 1010001 | 51h | 11.1 | | | |

5th Parameter: Internal VSN_1 power selection

| Bit | Name | Description |
|---|---|---|
| 6-0 | VSN_1 | **Internal VSN power selection.** |

| bit[6:0] | | Voltage(V) | bit [6:0] | | Voltage(V) | bit [6:0] | | Voltage(V) |
|---|---|---|---|---|---|---|---|---|
| 0000000 | 00h | -3 | 0101001 | 29h | -7.1 | 1010010 | 52h | -11.2 |
| 0000001 | 01h | -3.1 | 0101010 | 2Ah | -7.2 | 1010011 | 53h | -11.3 |
| 0000010 | 02h | -3.2 | 0101011 | 2Bh | -7.3 | 1010100 | 54h | -11.4 |
| 0000011 | 03h | -3.3 | 0101100 | 2Ch | -7.4 | 1010101 | 55h | -11.5 |
| 0000100 | 04h | -3.4 | 0101101 | 2Dh | -7.5 | 1010110 | 56h | -11.6 |
| 0000101 | 05h | -3.5 | 0101110 | 2Eh | -7.6 | 1010111 | 57h | -11.7 |
| 0000110 | 06h | -3.6 | 0101111 | 2Fh | -7.7 | 1011000 | 58h | -11.8 |
| 0000111 | 07h | -3.7 | 0110000 | 30h | -7.8 | 1011001 | 59h | -11.9 |
| 0001000 | 08h | -3.8 | 0110001 | 31h | -7.9 | 1011010 | 5Ah | -12 |
| 0001001 | 09h | -3.9 | 0110010 | 32h | -8 | 1011011 | 5Bh | -12.1 |
| 0001010 | 0Ah | -4 | 0110011 | 33h | -8.1 | 1011100 | 5Ch | -12.2 |
| 0001011 | 0Bh | -4.1 | 0110100 | 34h | -8.2 | 1011101 | 5Dh | -12.3 |
| 0001100 | 0Ch | -4.2 | 0110101 | 35h | -8.3 | 1011110 | 5Eh | -12.4 |
| 0001101 | 0Dh | -4.3 | 0110110 | 36h | -8.4 | 1011111 | 5Fh | -12.5 |
| 0001110 | 0Eh | -4.4 | 0110111 | 37h | -8.5 | 1100000 | 60h | -12.6 |
| 0001111 | 0Fh | -4.5 | 0111000 | 38h | -8.6 | 1100001 | 61h | -12.7 |
| 0010000 | 10h | -4.6 | 0111001 | 39h | -8.7 | 1100010 | 62h | -12.8 |
| 0010001 | 11h | -4.7 | 0111010 | 3Ah | -8.8 | 1100011 | 63h | -12.9 |
| 0010010 | 12h | -4.8 | 0111011 | 3Bh | -8.9 | 1100100 | 64h | -13 |
| 0010011 | 13h | -4.9 | 0111100 | 3Ch | -9 | 1100101 | 65h | -13.1 |
| 0010100 | 14h | -5 | 0111101 | 3Dh | -9.1 | 1100110 | 66h | -13.2 |
| 0010101 | 15h | -5.1 | 0111110 | 3Eh | -9.2 | 1100111 | 67h | -13.3 |
| 0010110 | 16h | -5.2 | 0111111 | 3Fh | -9.3 | 1101000 | 68h | -13.4 |
| 0010111 | 17h | -5.3 | 1000000 | 40h | -9.4 | 1101001 | 69h | -13.5 |
| 0011000 | 18h | -5.4 | 1000001 | 41h | -9.5 | 1101010 | 6Ah | -13.6 |
| 0011001 | 19h | -5.5 | 1000010 | 42h | -9.6 | 1101011 | 6Bh | -13.7 |
| 0011010 | 1Ah | -5.6 | 1000011 | 43h | -9.7 | 1101100 | 6Ch | -13.8 |
| 0011011 | 1Bh | -5.7 | 1000100 | 44h | -9.8 | 1101101 | 6Dh | -13.9 |
| 0011100 | 1Ch | -5.8 | 1000101 | 45h | -9.9 | 1101110 | 6Eh | -14 |
| 0011101 | 1Dh | -5.9 | 1000110 | 46h | -10 | 1101111 | 6Fh | -14.1 |
| 0011110 | 1Eh | -6 | 1000111 | 47h | -10.1 | 1110000 | 70h | -14.2 |
| 0011111 | 1Fh | -6.1 | 1001000 | 48h | -10.2 | 1110001 | 71h | -14.3 |
| 0100000 | 20h | -6.2 | 1001001 | 49h | -10.3 | 1110010 | 72h | -14.4 |
| 0100001 | 21h | -6.3 | 1001010 | 4Ah | -10.4 | 1110011 | 73h | -14.5 |
| 0100010 | 22h | -6.4 | 1001011 | 4Bh | -10.5 | 1110100 | 74h | -14.6 |
| 0100011 | 23h | -6.5 | 1001100 | 4Ch | -10.6 | 1110101 | 75h | -14.7 |
| 0100100 | 24h | -6.6 | 1001101 | 4Dh | -10.7 | 1110110 | 76h | -14.8 |
| 0100101 | 25h | -6.7 | 1001110 | 4Eh | -10.8 | 1110111 | 77h | -14.9 |
| 0100110 | 26h | -6.8 | 1001111 | 4Fh | -10.9 | 1111000 | 78h | -15 |
| 0100111 | 27h | -6.9 | 1010000 | 50h | -11 | other | | -15 |
| 0101000 | 28h | -7 | 1010001 | 51h | -7.1 | | | |

Notes:

1. VSP_0/VSN_0 voltage output is ±15 V fixed value.
2. When switching Mode0 or Mode1,the voltage output is:
   Mode0: VSP_0(+15) / VSN_0 (-15) / VSPL_0 (+3~+15)
   Mode1: VSP_1(+3 ~ +15) / VSN_1(-3 ~ -15) / VSPL_1(+3 ~ +15)

| | Mode0 | Mode1 |
|---|---|---|
| VSP | VSP_0(+15) | VSP_1(+3~+15) |
| VSN | VSN_0(-15) | VSN_1(-3~-15) |
| VSPL | VSPL_0(+3~+15) | VSPL_1(+3~+15) |

3. If gate voltage is set to +/-15v, +/-10v, IC will auto correct source voltage as follows
   I. VGP- VSP_0 / VSPL_0 / VSP_1 / VSPL_1 >= 2v
   II. VGN- VSN_0 / VSN_1 >= -2v
   For example:

| | symbol | Voltage setting | Real Voltage |
|---|---|---|---|
| Voltage | VGP | 10v | +10v |
| | VGN | 10v | -10v |
| | VSP_0 | +15v | +8v |
| | VSN_0 | -15v | -8v |
| | VSP_1 | +5v | +5v |
| | VSN_1 | -5v | -5v |
| | VSPL | +15v | +8v |
| | VCOMH | +15v+(-2v) | +8v +(-2v) |
| | VCOML | -15v+(-2v) | -8v +(-2v) |
| | VCOMDC | -2v | -2v |

4. Voltage setting limit: VSP_0 ≥ VSPL_0 , VSP_1 ≥ VSPL_1

Restriction

| R02H | Bit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inst/Para | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| POF | W | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 02H |
| 1st Parameter | W | 1 | - | - | - | - | - | - | - | EDSE | 00 |

*NOTE: "-" Don't care, can be set to VDD or GND level*

Description

-The command defines as :

- After power off command, driver will power off base on power off sequence.
- After power off command, BUSY_N signal will drop from high to low. When finish the power off sequence, BUSY_N singal will rise from low to high.
- Power off command will turn off charge pump, T-con, source driver, gate driver, VCOM, temperature sensor, but register and SRAM data will keep until VDD off.
- SD output and VCOM will base on previous condition. It may have two conditions: 0v or floating.

1st parameter

| Bit | Name | Description |
|---|---|---|
| 0 | EDSE | EPD Discharge Trigger<br>0 : Disable EPD discharge (default)<br>1 : Enable EPD discharge |

Restriction: This command only active when BUSY_N = "1".

| R03H | Bit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inst/Para | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| PFS | W | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 03H |
| 1st Parameter | W | 1 | - | | T_VDPG_OFF [1:0] | | - | | T_VDS_OFF [1:0] | | 00h |
| 2nd Parameter | W | 1 | VGP_LEN[3:0] | | | | VGP_EXT[3:0] | | | | 54h |
| 3rd Parameter | W | 1 | XON_DLY[3:0] | | | | XON_LEN[3:0] | | | | 44h |

*NOTE: "-" Don't care, can be set to VDD or GND level*

Description

-The command defines as :

1st Parameter:

| Bit | Name | Description |
|---|---|---|
| 1-0 | T_VDS_OFF | Power off sequence of VSP /VSN<br>00: 20 ms (default)<br>01: 40 ms<br>10: 60 ms<br>11: 80 ms |
| 5-4 | T_VDPG_OFF | Power off sequence of VGP and VGN<br>00: 20 ms (default)<br>01: 40 ms<br>10: 60 ms<br>11: 80 ms |

2nd Parameter

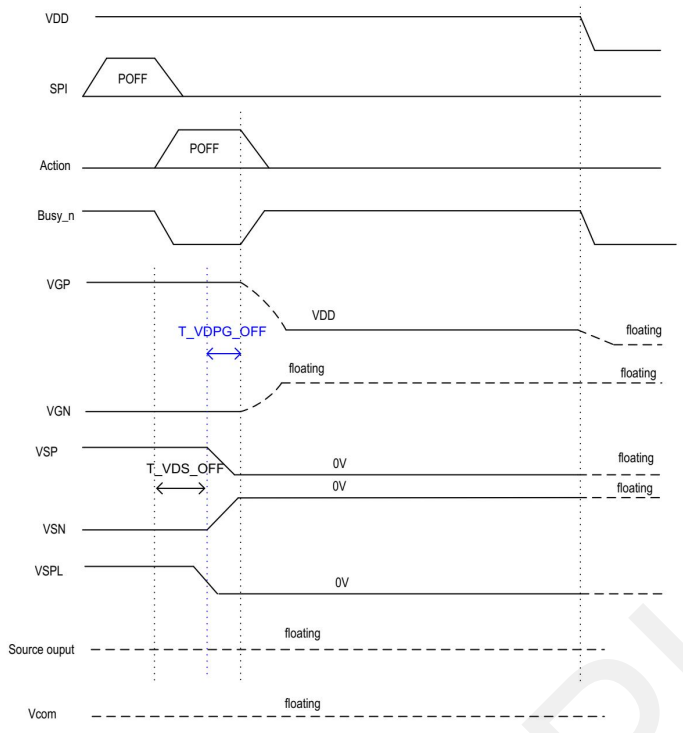
| Bit | Name | Description |
|---|---|---|
| 1-0 | VGP_EXT | VGP extension time<br>0000: 0 ms<br>0001: 500 ms<br>0010: 1000 ms<br>0011: 1500 ms<br>0100: 2000 ms (default)<br>0101: 2500 ms<br>0110: 3000 ms<br>0111: 3500 ms<br>1000: 4000 ms<br>1001: 4500 ms<br>1010: 5000 ms<br>1011: 5500 ms<br>1100: 6000 ms<br>1101: 6500 ms |
| 7-4 | VGP_LEN | When power off, the length of time VGP stay 10V<br>0000: 0 ms<br>0001: 500 ms<br>0010: 1000 ms<br>0011: 1500 ms<br>0100: 2000 ms<br>0101: 2500 ms (default)<br>0110: 3000 ms<br>0111: 3500 ms<br>1000: 4000 ms<br>1001: 4500 ms<br>1010: 5000 ms<br>1011: 5500 ms<br>1100: 6000 ms<br>1101: 6500 ms |

3rd Parameter:

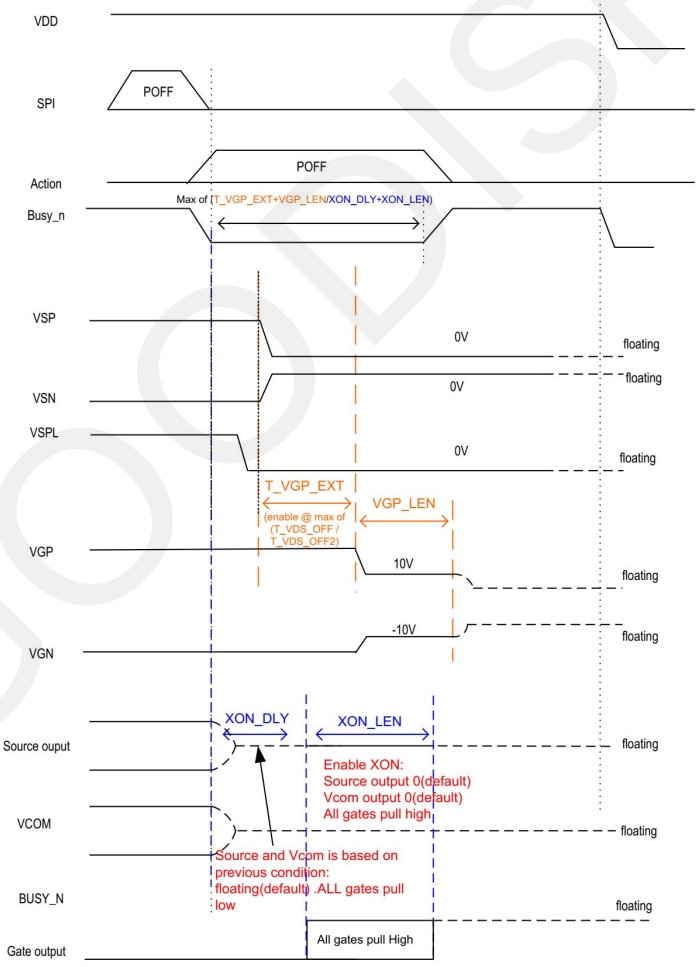
| Bit | Name | Description |
|---|---|---|
| 3-0 | XON_LEN | XON enable time<br>0000: 0 ms<br>0001: 500 ms<br>0010: 1000 ms<br>0011: 1500 ms<br>0100: 2000 ms (default)<br>0101: 2500 ms<br>0110: 3000 ms<br>0111: 3500 ms<br>1000: 4000 ms<br>1001: 4500 ms<br>1010: 5000 ms<br>1011: 5500 ms<br>1100: 6000 ms |
| 7-4 | XON_DLY | XON delay time<br>0000: 0 ms<br>0001: 500 ms<br>0010: 1000 ms<br>0011: 1500 ms<br>0100: 2000 ms (default)<br>0101: 2500 ms<br>0110: 3000 ms<br>0111: 3500 ms<br>1000: 4000 ms<br>1001: 4500 ms<br>1010: 5000 ms<br>1011: 5500 ms<br>1100: 6000 ms |

GOODISPLAY

**Power off Sequence(R02h=00)**




**Power off Sequence(R02h=01)**




| | |
|---|---|
| Restriction | |

GOODISPLAY

| R04H | Bit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inst/Para | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| PON | W | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 04H |

*NOTE: "-" Don't care, can be set to VDD or GND level*

| | |
|---|---|
| Description | -The command defines as :<br>● After power on command, driver will power on base on power on sequence.<br>● After power on command, BUSY_N signal will drop from high to low. When finishing the power on sequence, BUSY_N signal will rise from low to high. |
| Restriction | This command only active when BUSY_N = "1". |

| R06H | Bit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inst/Para | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| BTST | W | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 06H |
| 1st Parameter | W | 1 | - | - | - | - | PHB_SFT [1:0] | | PHA_SFT [1:0] | | 17h |
| 2nd Parameter | W | 1 | - | - | PHA_ON [5:0] | | | | | | 02h |
| 3rd Parameter | W | 1 | - | - | PHA_OFF [5:0] | | | | | | 07h |
| 4th Parameter | W | 1 | - | - | PHB_ON [5:0] | | | | | | 02h |
| 5th Parameter | W | 1 | - | - | PHB_OFF [5:0] | | | | | | 07h |
| 6th Parameter | W | 1 | - | - | PHC_ON [5:0] | | | | | | 02h |
| 7th Parameter | W | 1 | - | - | PHC_OFF [5:0] | | | | | | 07h |

*NOTE: "-" Don't care, can be set to VDD or GND level*

Description

-The command define as follows:

1st Parameter:

| Bit | Name | Description |
|---|---|---|
| 1-0 | PHA_SFT | Soft start period of phase A:<br>00: 10mS (default)<br>01: 20mS<br>10: 30mS<br>11: 40mS |
| 3-2 | PHB_SFT | Soft start period of phase B:<br>00: 10mS (default)<br>01: 20mS<br>10: 30mS<br>11: 40mS |

| | Bit[5:0] | Description | Bit[5:0] | Description | Bit[5:0] | Description |
|---|---|---|---|---|---|---|
| Driving strength of PHA_ON & PHB_ON & PHC_ON | 000000 | strength1 | 010110 | strength23 | 101100 | strength45 |
| | 000001 | strength2 | 010111 | strength24 | 101101 | strength46 |
| | 000010 | strength3 | 011000 | strength25 | 101110 | strength47 |
| | 000011 | strength4 | 011001 | strength26 | 101111 | strength48 |
| | 000100 | strength5 | 011010 | strength27 | 110000 | strength49 |
| | 000101 | strength6 | 011011 | strength28 | 110001 | strength50 |
| | 000110 | strength7 | 011100 | strength29 | 110010 | strength51 |
| | 000111 | strength8 | 011101 | strength30 | 110011 | strength52 |
| | 001000 | strength9 | 011110 | strength31 | 110100 | strength53 |
| | 001001 | strength10 | 011111 | strength32 | 110101 | strength54 |
| | 001010 | strength11 | 100000 | strength33 | 110110 | strength55 |
| | 001011 | strength12 | 100001 | strength34 | 110111 | strength56 |
| | 001100 | strength13 | 100010 | strength35 | 111000 | strength57 |
| | 001101 | strength14 | 100011 | strength36 | 111001 | strength58 |
| | 001110 | strength15 | 100100 | strength37 | 111010 | strength59 |
| | 001111 | strength16 | 100101 | strength38 | 111011 | strength60 |
| | 010000 | strength17 | 100110 | strength39 | 111100 | strength61 |
| | 010001 | strength18 | 100111 | strength40 | 111101 | strength62 |
| | 010010 | strength19 | 101000 | strength41 | 111110 | strength63 |
| | 010011 | strength20 | 101001 | strength42 | 111111 | strength64 |
| | 010100 | strength21 | 101010 | strength43 | | |
| | 010101 | strength22 | 101011 | strength44 | | |

GOOD DISPLAY

| Description | | Bit[5:0] | Description | Bit[5:0] | Description | Bit[5:0] | Description |
|---|---|---|---|---|---|---|---|
| | Minimum OFF time setting of PHA_OFF & PHB_OFF & PHC_OFF | 000000 | Period1 | 010110 | Period23 | 101100 | Period45 |
| | | 000001 | Period2 | 010111 | Period24 | 101101 | Period46 |
| | | 000010 | Period3 | 011000 | Period25 | 101110 | Period47 |
| | | 000011 | Period4 | 011001 | Period26 | 101111 | Period48 |
| | | 000100 | Period5 | 011010 | Period27 | 110000 | Period49 |
| | | 000101 | Period6 | 011011 | Period28 | 110001 | Period50 |
| | | 000110 | Period7 | 011100 | Period29 | 110010 | Period51 |
| | | 000111 | Period8 | 011101 | Period30 | 110011 | Period52 |
| | | 001000 | Period9 | 011110 | Period31 | 110100 | Period53 |
| | | 001001 | Period10 | 011111 | Period32 | 110101 | Period54 |
| | | 001010 | Period11 | 100000 | Period33 | 110110 | Period55 |
| | | 001011 | Period12 | 100001 | Period34 | 110111 | Period56 |
| | | 001100 | Period13 | 100010 | Period35 | 111000 | Period57 |
| | | 001101 | Period14 | 100011 | Period36 | 111001 | Period58 |
| | | 001110 | Period15 | 100100 | Period37 | 111010 | Period59 |
| | | 001111 | Period16 | 100101 | Period38 | 111011 | Period60 |
| | | 010000 | Period17 | 100110 | Period39 | 111100 | Period61 |
| | | 010001 | Period18 | 100111 | Period40 | 111101 | Period62 |
| | | 010010 | Period19 | 101000 | Period41 | 111110 | Period63 |
| | | 010011 | Period20 | 101001 | Period42 | 111111 | Period64 |
| | | 010100 | Period21 | 101010 | Period43 | | |
| | | 010101 | Period22 | 101011 | Period44 | | |
| Restriction | | | | | | | |

| R07H | Bit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inst/Para | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| DSLP | W | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 07H |
| 1st Parameter | W | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | A5h |

*NOTE: "-" Don't care, can be set to VDD or GND level*

| Description | The command define as follows:<br>After this command is transmitted, the chip would enter the deep-sleep mode to save power.<br>The deep sleep mode would return to standby by hardware reset.<br>The only one parameter is a check code, the command would be excited if check code = 0xA5. |
|---|---|
| Restriction | This command only active when BUSY_N = "1". |

| R10H | Bit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inst/Para | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| DTM1 | W | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 10H |
| 1st Parameter | W | 1 | Pixel1 | | Pixel2 | | Pixel3 | | Pixel4 | | 00h |
| 2nd Parameter | W | 1 | : | | : | | : | | : | | 00h |
| … | W | 1 | Pixel(n-3) | | Pixel(n-2) | | Pixel(n-1) | | Pixel(n) | | 00h |
| Mth Parameter | W | 1 | Pixel1 | | Pixel2 | | Pixel3 | | Pixel4 | | 00h |

*NOTE: "-" Don't care, can be set to VDD or GND level*

| Description | The command define as follows:<br>The register is indicates that user start to transmit data, then write to SRAM. While data transmission complete, user must send command 12H. Then chip will start to send data/VCOM for panel.<br><br>Pixel [1~n][1:0]: 2-bit/pixel |
|---|---|
| Restriction | |

| Image Data | DDX=1(default) | | DDX=0 | |
|---|---|---|---|---|
| Pixel[1:0] | Gray level select | IP output LUT select | Gray level select | IP output LUT select |
| 00b | Gray0 | ogray00 | Gray3 | ogray03 |
| 01b | Gray1 | ogray01 | Gray2 | ogray02 |
| 10b | Gray2 | ogray02 | Gray1 | ogray01 |
| 11b | Gray3 | ogray03 | Gray0 | ogray00 |

GOODISPLAY

| R12H | Bit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inst/Para | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| DRF | W | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 12H |
| 1st Parameter | W | 1 | - | - | - | - | - | - | - | AC/DC VCOM | 00h |

*NOTE: "-" Don't care, can be set to VDD or GND level*

| | |
|---|---|
| Description | -The command defines as :<br>While users send this command, driver will refresh display (data/VCOM) base on SRAM data and LUT.<br>**AC/DC VCOM:**<br>**0: AC VCOM, VCOM will follow LUTC when updating image. (default)**<br>1: DC VCOM, VCOM will always be VCOMDC when updating image<br><br>After display refresh command, BUSY_N signal will become "0" |
| Restriction | This command only actives when BUSY_N = "1" |

| R17H | Bit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inst/Para | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| Auto Sequence | W | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 17H |
| 1st Parameter | W | 1 | Code[7] | Code[6] | Code[5] | Code[4] | Code[3] | Code[2] | Code[1] | Code[0] | A5h |

| | |
|---|---|
| Description | 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.<br><br>AUTO (0x17) + Code(0xA5) = (PON→DRF→POF)<br>AUTO (0x17) + Code(0xA7) = (PON→DRF→POF→DSLP) |
| Restriction | This command only actives when BUSY_N = "1". |

| R30H | Bit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inst/Para | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| PLL | W | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 30H |
| 1st Parameter | W | 1 | - | - | - | - | Dyna | FR[2:0] | | | 02h |

*NOTE: "-" Don't care, can be set to VDD or GND level*

Description

-The command defines as:

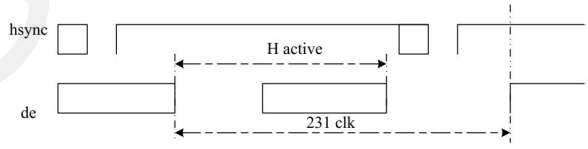
The command controls the PLL clock frequency. The PLL structure must support the following frame rates:

| bit3 | Dynamic frame rate |
|---|---|
| 0 | Disable(default) |
| 1 | Enable |

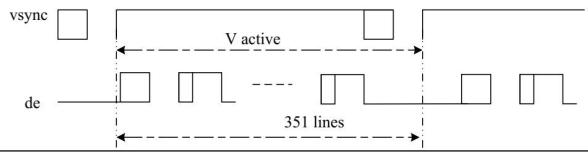
| FR[2:0] | Frame rate |
|---|---|
| 000 | 12.5 Hz |
| 001 | 25 Hz |
| 010 | 50 Hz(default) |
| 011 | 65 Hz |
| 100 | 75 Hz |
| 101 | 85 Hz |
| 110 | 100 Hz |
| 111 | 120 Hz |

remark

-Horizental




-Vertical




Restriction

GOODISPLAY

| R40H | Bit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inst/Para | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| TSC | W | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 40H |
| 1st Parameter | R | 1 | D10/TS[9] | D9/TS[8] | D8/TS[7] | D7/TS[6] | D6/TS[5] | D5/TS[4] | D4/TS[3] | D3/TS[2] | - |
| 2nd Parameter | R | 1 | D2/TS[1] | D1/ TS[0] | D0 | - | - | - | - | - | - |

*NOTE: "-" Don't care, can be set to VDD or GND level*

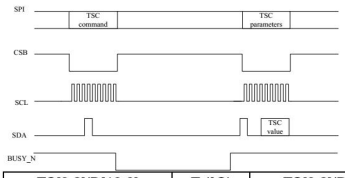
Description

-The command define as follows:

This command indicates the temperature value.

If R41H(TSE) bit7 set to 0, this command reads internal temperature sensor value.

If R41H(TSE) bit7 set to 1, this command reads external (LM75) temperature sensor value




| TS[9:2]/D[10:3] | T (°C) | TS[9:2]/D[10:3] | T (°C) | TS[9:2]/D[10:3] | T (°C) |
|---|---|---|---|---|---|
| 11100111 | -25 | 00000000 | 0 | 00011001 | 25 |
| 11101000 | -24 | 00000001 | 1 | 00011010 | 26 |
| 11101001 | -23 | 00000010 | 2 | 00011011 | 27 |
| 11101010 | -22 | 00000011 | 3 | 00011100 | 28 |
| 11101011 | -21 | 00000100 | 4 | 00011101 | 29 |
| 11101100 | -20 | 00000101 | 5 | 00011110 | 30 |
| 11101101 | -19 | 00000110 | 6 | 00011111 | 31 |
| 11101110 | -18 | 00000111 | 7 | 00100000 | 32 |
| 11101111 | -17 | 00001000 | 8 | 00100001 | 33 |
| 11110000 | -16 | 00001001 | 9 | 00100010 | 34 |
| 11110001 | -15 | 00001010 | 10 | 00100011 | 35 |
| 11110010 | -14 | 00001011 | 11 | 00100100 | 36 |
| 11110011 | -13 | 00001100 | 12 | 00100101 | 37 |
| 11110100 | -12 | 00001101 | 13 | 00100110 | 38 |
| 11110101 | -11 | 00001110 | 14 | 00100111 | 39 |
| 11110110 | -10 | 00001111 | 15 | 00101000 | 40 |
| 11110111 | -9 | 00010000 | 16 | 00101001 | 41 |
| 11111000 | -8 | 00010001 | 17 | 00101010 | 42 |
| 11111001 | -7 | 00010010 | 18 | 00101011 | 43 |
| 11111010 | -6 | 00010011 | 19 | 00101100 | 44 |
| 11111011 | -5 | 00010100 | 20 | 00101101 | 45 |
| 11111100 | -4 | 00010101 | 21 | 00101110 | 46 |
| 11111101 | -3 | 00010110 | 22 | 00101111 | 47 |
| 11111110 | -2 | 00010111 | 23 | 00110000 | 48 |
| 11111111 | -1 | 00011000 | 24 | 00110001 | 49 |

| TS[1:0] | T (°C) |
|---|---|
| 00 | +0 |
| 01 | +0.25 |
| 10 | +0.5 |
| 11 | +0.75 |

Restriction: This command only actives when BUSY_N = "1".

| R41H | Bit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inst/Para | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| TSE | W | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 41H |
| 1st Parameter | W | 1 | TSE | - | TO[5] | TO[4] | TO[3] | TO[2] | TO[1] | TO[0] | 00h |

*NOTE: "-" Don't care, can be set to VDD or GND level*

Description

-The command defines as:

This command indicates the driver IC temperature sensor enable and calibration function.

Reserve one temperature offset TO[3:0] for calibration

1. TO[3]: mean '+' or '-' , while 0 is '+' ; 1 is '-'
2. TO[2:0]: mean temperature offset value

| Bit | Name | Description |
|---|---|---|
| 3-0 | TO[3:0] | Temperature level:<br>0000: +0℃ (default)<br>0001: +0.5℃<br>0010: +1℃<br>0011: +1.5℃<br>0100: +2℃<br>0101: +2.5℃<br>0110: +3℃<br>0111: +3.5℃<br>1000: -4℃<br>1001: -3.5℃<br>1010: -3℃<br>1011: -2.5℃<br>1100: -2℃<br>1101: -1.5℃<br>1110: -1℃<br>1111: -0.5℃ |

GOODDISPLAY

| | | |
|---|---|---|
| 5-4 | TO[5:4] | 0: +0.0℃ (default)<br>1: +0.25℃ |
| 7 | TSE | Internal temperature sensor enable<br>0: Internal temperature sensor enable.(default)<br>1: Internal temperature sensor disable, using external temperature sensor. |

Restriction: This command only actives after R04H(PON)

| R50H | Bit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inst/Para | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| CDI | W | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 50H |
| 1st Parameter | W | 1 | VBD[2] | VBD[1] | VBD [0] | DDX | CDI[3] | CDI[2] | CDI[1] | CDI[0] | 97h |

*NOTE: "-" Don't care, can be set to VDD or GND level*

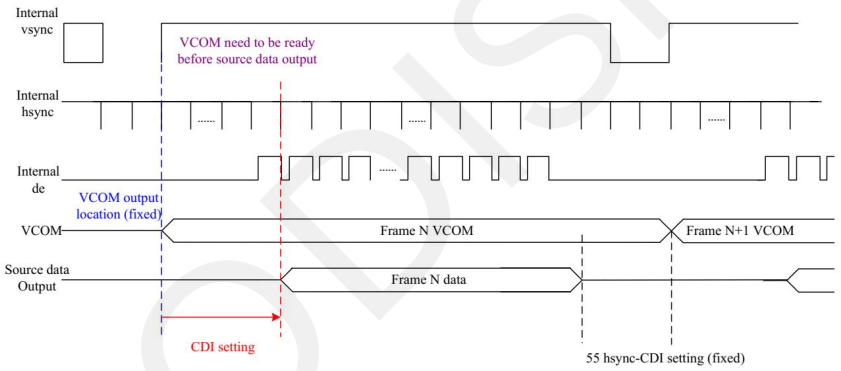
Description

-The command defines as:

1st Parameter:

**CDI[1:0]:** This command indicates the interval of VCOM and data output. When setting the vertical back porch, the total blanking will be keep (55hsync).

| Bit | Name | Description |
|---|---|---|
| 3-0 | CDI[3:0] | Vcom and data interval<br>0000: 17 hsync<br>0001:16 hsync<br>0010:15 hsync<br>0011:14 hsync<br>0100:13 hsync<br>0101:12 hsync<br>0110:11 hsync<br>0111:10 hsync(default)<br>1000:9 hsync<br>1001:8 hsync<br>1010:7 hsync<br>1011:6 hsync<br>1100:5 hsync<br>1101:4 hsync<br>1110:3 hsync<br>1111:2 hsync |




**VBD[2:0]:** Border data selection. (from LUT output by IP port border_w[1:0])

This register will make boarder pin output being mapped to a certain gray scale.

| Bit 4 | Bit7-5 | Description | IP setting for Border LUT select |
|---|---|---|---|
| DDX | VBD[2:0] | Gray level | |
| 0 | 000 | Floating | N/A |
| | 001 | Gray3 | border_buf=011 |
| | 010 | Gray2 | border_buf=010 |
| | 011 | Gray1 | border_buf=001 |
| | 100 | Gray0 | border_buf=000 |
| 1 (default) | 000 | Gray0 | border_buf=000 |
| | 001 | Gray1 | border_buf=001 |
| | 010 | Gray2 | border_buf=010 |
| | 011 | Gray3 | border_buf=011 |
| | 100 | Floating | N/A |

Border output voltage level: The level selection is based on mapping LUT data.

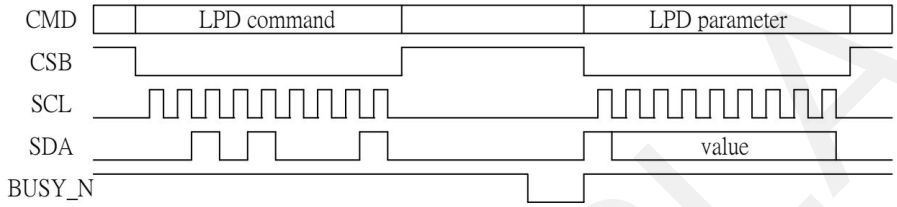
Ex: Gray 1 waveform is mapping to 15V,without VCOM offset, the real output on Boarder pin shall be 15V.

Boarder output will follow FOPT definition being defined in R00h.

Restriction

| R51H | Bit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inst/Para | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| LPD | W | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 51H |
| 1st Parameter | R | 1 | - | - | - | - | - | - | - | LPD | -- |

*NOTE: "-" Don't care, can be set to VDD or GND level*

| | |
|---|---|
| Description | -The command defines as:<br>This command indicates the input power condition. Host can read this data to understand the battery's condition.<br>When LPD="1", system input power is normal.<br>When LPD="0", system input power is lower (VDD<2.5v, which could be select in RE4H (LVSEL)).<br><br>1st Parameter:<br>Bit / Name / Description<br>0 / LPD / 0: Low power input<br>1: Normal status<br><br>  |
| Restriction | - This command only actives when BUSY_N = "1". |

| R61H | Bit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inst/Para | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| TRES | W | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 61H |
| 1st Parameter | W | 1 | - | - | - | - | - | - | HRES(9) | HRES(8) | 00h |
| 2nd Parameter | W | 1 | HRES(7) | HRES(6) | HRES(5) | HRES(4) | HRES(3) | HRES(2) | 0 | 0 | 00h |
| 3rd Parameter | W | 1 | - | - | - | - | - | - | VRES(9) | VRES(8) | 00h |
| 4th Parameter | W | 1 | VRES(7) | VRES(6) | VRES(5) | VRES(4) | VRES(3) | VRES(2) | VRES(1) | VRES(0) | 00h |

*NOTE: "-" Don't care, can be set to VDD or GND level*

| | |
|---|---|
| Description | -The command define as follows:<br>When using register:<br>Horizontal display resolution = HRES<br>Vertical display resolution = VRES<br><br>Channel disable calculation:<br>GD : First G active = G0; LAST active GD= first active +VRES[9:0] -1<br>SD : First active channel: =S0 ; LAST active SD= first active +HRES[9:2]*8-1<br><br>EX :200X384<br>GD: First G active = G0<br>LAST active GD= 0+384-1= 383; (G383)<br>SD : First active channel: =S0<br>LAST active SD=0+50*4-1=199; (S199)<br>R61H = 00h,C8h, 01h, 80h (解析度直接轉 16 進制即為設定值)<br><br>**Note: Only supports source 200.ch for source 184ch. above** |
| Restriction | |

| R65H | Bit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inst/Para | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| GSST | W | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 65H |
| 1st Parameter | W | 1 | - | - | - | - | - | - | S_start[9] | S_start[8] | 00h |
| 2nd Parameter | W | 1 | S_start[7] | S_start[6] | S_start[5] | S_start[4] | S_start[3] | S_start[2] | - | - | 00h |
| 3rd Parameter | W | 1 | - | - | - | - | - | - | G_start[9] | G_start[8] | 00h |
| 4th Parameter | W | 1 | G_start[7] | G_start[6] | G_start[6] | G_start[4] | G_start[3] | G_start[2] | G_start[1] | G_start[0] | 00h |

*NOTE: "-" Don't care, can be set to VDD or GND level*

| | |
|---|---|
| Description | -The command define as follows:<br><br>1.S_Start [9:2] describe which source output line is the first date line<br>2.G_Start[9:0] describe which gate line is the first scan line |
| Restriction | |

| R70H | Bit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inst/Para | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| REV | W | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 70H |
| 1st Parameter | R | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 03h |
| 2nd Parameter | R | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 02h |
| 3rd Parameter | R | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 01h |

*NOTE: "-" Don't care, can be set to VDD or GND level*

| | |
|---|---|
| Description | -The command defines as:<br>The LUT_REV is read from:<br><br>1st & 2nd & 3rd Parameter : |

| Bit | Description |
|---|---|
| 3-0 | CHIP_REV |

| | |
|---|---|
| Restriction | |

| R80H | Bit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inst/Para | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| AMV | W | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 80H |
| 1st Parameter | W | 1 | - | - | AMVT[1] | AMVT[0] | XON | AMVS | AMV | AMVE | 10h |

*NOTE: "-" Don't care, can be set to VDD or GND level*

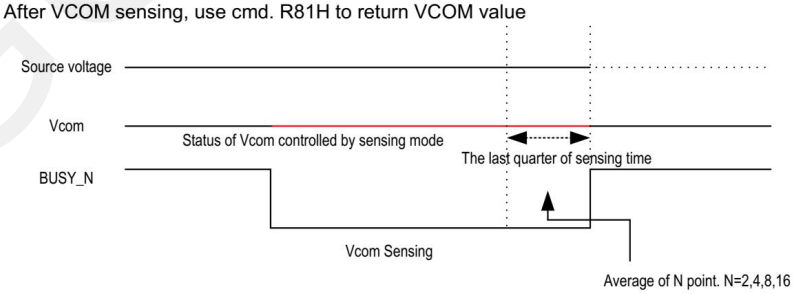
Description

-The command defines as:
This command indicates the IC status. Host can read this data to understand the IC status.

1st Parameter:

| Bit | Name | Description |
|---|---|---|
| 0 | AMVE | AMVE: Auto Measure Vcom Setting<br>0: Auto measure VCOM disable (default)<br>1: Auto measure VCOM enable |
| 1 | AMV | AMV: Analog signal<br>0:Get Vcom value from R81h(default)<br>1:Get Vcom value in analog signal |
| 2 | AMVS | AMVS: setting for Source output of AMV<br>0: Source output 0V during Auto Measure VCOM period. (default)<br>1: Source output VSPL_0 during Auto Measure VCOM period. |
| 3 | XON | XON: setting for all Gate ON of AMV<br>0: Gate normally scan during Auto Measure VCOM period. (default)<br>1: All Gate ON during Auto Measure VCOM period. |
| 5-4 | AMVT[1:0] | The sensing time of VCOM detection<br>00: 5s (default)<br>01: 10s<br>10: 15s<br>11: 20s |

After VCOM sensing, use cmd. R81H to return VCOM value




**Note:**
**1.VCOM設定至最小0V(R82h=80h)**
**2.外部穩壓電容floating**

| | |
|---|---|
| Restriction | This command only actives when BUSY_N = "1". |

GOOD DISPLAY

| R81H | Bit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inst/Para | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| VV | W | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 81H |
| 1st Parameter | R | 1 | - | - | VV[5] | VV[4] | VV[3] | VV[2] | VV[1] | VV[0] | -- |

*NOTE: "-" Don't care, can be set to VDD or GND level*

Description

-The command defines as:
This command could get the VCOM value

1st Parameter:

| Bit | Name | Description |
|---|---|---|
| 6-0 | VV[6:0] | VCOM value |

| VCOM[6:0] | | Voltage(V) | VCOM[6:0] | | Voltage(V) | VCOM[6:0] | | Voltage(V) |
|---|---|---|---|---|---|---|---|---|
| 0000000 | 00h | 0 | 0011100 | 1Ch | -1.4 | 0111000 | 38h | -2.8 |
| 0000001 | 01h | -0.05 | 0011101 | 1Dh | -1.45 | 0111001 | 39h | -2.85 |
| 0000010 | 02h | -0.1 | 0011110 | 1Eh | -1.5 | 0111010 | 3Ah | -2.9 |
| 0000011 | 03h | -0.15 | 0011111 | 1Fh | -1.55 | 0111011 | 3Bh | -2.95 |
| 0000100 | 04h | -0.2 | 0100000 | 20h | -1.6 | 0111100 | 3Ch | -3 |
| 0000101 | 05h | -0.25 | 0100001 | 21h | -1.65 | 0111101 | 3Dh | -3.05 |
| 0000110 | 06h | -0.3 | 0100010 | 22h | -1.7 | 0111110 | 3Eh | -3.1 |
| 0000111 | 07h | -0.35 | 0100011 | 23h | -1.75 | 0111111 | 3Fh | -3.15 |
| 0001000 | 08h | -0.4 | 0100100 | 24h | -1.8 | 1000000 | 40h | -3.2 |
| 0001001 | 09h | -0.45 | 0100101 | 25h | -1.85 | 1000001 | 41h | -3.25 |
| 0001010 | 0Ah | -0.5 | 0100110 | 26h | -1.9 | 1000010 | 42h | -3.3 |
| 0001011 | 0Bh | -0.55 | 0100111 | 27h | -1.95 | 1000011 | 43h | -3.35 |
| 0001100 | 0Ch | -0.6 | 0101000 | 28h | -2 | 1000100 | 44h | -3.4 |
| 0001101 | 0Dh | -0.65 | 0101001 | 29h | -2.05 | 1000101 | 45h | -3.45 |
| 0001110 | 0Eh | -0.7 | 0101010 | 2Ah | -2.1 | 1000110 | 46h | -3.5 |
| 0001111 | 0Fh | -0.75 | 0101011 | 2Bh | -2.15 | 1000111 | 47h | -3.55 |
| 0010000 | 10h | -0.8 | 0101100 | 2Ch | -2.2 | 1001000 | 48h | -3.6 |
| 0010001 | 11h | -0.85 | 0101101 | 2Dh | -2.25 | 1001001 | 49h | -3.65 |
| 0010010 | 12h | -0.9 | 0101110 | 2Eh | -2.3 | 1001010 | 4Ah | -3.7 |
| 0010011 | 13h | -0.95 | 0101111 | 2Fh | -2.35 | 1001011 | 4Bh | -3.75 |
| 0010100 | 14h | -1 | 0110000 | 30h | -2.4 | 1001100 | 4Ch | -3.8 |
| 0010101 | 15h | -1.05 | 0110001 | 31h | -2.45 | 1001101 | 4Dh | -3.85 |
| 0010110 | 16h | -1.1 | 0110010 | 32h | -2.5 | 1001110 | 4Eh | -3.9 |
| 0010111 | 17h | -1.15 | 0110011 | 33h | -2.55 | 1001111 | 4Fh | -3.95 |
| 0011000 | 18h | -1.2 | 0110100 | 34h | -2.6 | 1010000 | 50h | -4 |
| 0011001 | 19h | -1.25 | 0110101 | 35h | -2.65 | other | | -4 |
| 0011010 | 1Ah | -1.3 | 0110110 | 36h | -2.7 | | | |
| 0011011 | 1Bh | -1.35 | 0110111 | 37h | -2.75 | | | |

Restriction

| R82H | Bit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inst/Para | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| VDCS | W | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 82H |
| 1st Parameter | W | 1 | MTP_VCM | VDCS[6] | VDCS[5] | VDCS [4] | VDCS [3] | VDCS [2] | VDCS [1] | VDCS [0] | 00h |

*NOTE: "-" Don't care, can be set to VDD or GND level*

Description

-The command defines as:
This command set the VCOM DC value. Driver will base on this value for VCM_DC.
1st Parameter:
1st Parameter:

| Bit | Name | Description |
|---|---|---|
| | | VCOM value |

| VCOM[6:0] | | Voltage(V) | VCOM[6:0] | | Voltage(V) | VCOM[6:0] | | Voltage(V) |
|---|---|---|---|---|---|---|---|---|
| 0000000 | 00h | 0(default) | 0011100 | 1Ch | -1.4 | 0111000 | 38h | -2.8 |
| 0000001 | 01h | -0.05 | 0011101 | 1Dh | -1.45 | 0111001 | 39h | -2.85 |
| 0000010 | 02h | -0.1 | 0011110 | 1Eh | -1.5 | 0111010 | 3Ah | -2.9 |
| 0000011 | 03h | -0.15 | 0011111 | 1Fh | -1.55 | 0111011 | 3Bh | -2.95 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6-0 | VDCS[6:0] | 0000100 | 04h | -0.2 | 0100000 | 20h | -1.6 | 0111100 | 3Ch | -3 |
| | | | 0000101 | 05h | -0.25 | 0100001 | 21h | -1.65 | 0111101 | 3Dh | -3.05 |
| | | | 0000110 | 06h | -0.3 | 0100010 | 22h | -1.7 | 0111110 | 3Eh | -3.1 |
| | | | 0000111 | 07h | -0.35 | 0100011 | 23h | -1.75 | 0111111 | 3Fh | -3.15 |
| | | | 0001000 | 08h | -0.4 | 0100100 | 24h | -1.8 | 1000000 | 40h | -3.2 |
| | | | 0001001 | 09h | -0.45 | 0100101 | 25h | -1.85 | 1000001 | 41h | -3.25 |
| | | | 0001010 | 0Ah | -0.5 | 0100110 | 26h | -1.9 | 1000010 | 42h | -3.3 |
| | | | 0001011 | 0Bh | -0.55 | 0100111 | 27h | -1.95 | 1000011 | 43h | -3.35 |
| | | | 0001100 | 0Ch | -0.6 | 0101000 | 28h | -2 | 1000100 | 44h | -3.4 |
| | | | 0001101 | 0Dh | -0.65 | 0101001 | 29h | -2.05 | 1000101 | 45h | -3.45 |
| | | | 0001110 | 0Eh | -0.7 | 0101010 | 2Ah | -2.1 | 1000110 | 46h | -3.5 |
| | | | 0001111 | 0Fh | -0.75 | 0101011 | 2Bh | -2.15 | 1000111 | 47h | -3.55 |
| | | | 0010000 | 10h | -0.8 | 0101100 | 2Ch | -2.2 | 1001000 | 48h | -3.6 |
| | | | 0010001 | 11h | -0.85 | 0101101 | 2Dh | -2.25 | 1001001 | 49h | -3.65 |
| | | | 0010010 | 12h | -0.9 | 0101110 | 2Eh | -2.3 | 1001010 | 4Ah | -3.7 |
| | | | 0010011 | 13h | -0.95 | 0101111 | 2Fh | -2.35 | 1001011 | 4Bh | -3.75 |
| | | | 0010100 | 14h | -1 | 0110000 | 30h | -2.4 | 1001100 | 4Ch | -3.8 |
| | | | 0010101 | 15h | -1.05 | 0110001 | 31h | -2.45 | 1001101 | 4Dh | -3.85 |
| | | | 0010110 | 16h | -1.1 | 0110010 | 32h | -2.5 | 1001110 | 4Eh | -3.9 |
| | | | 0010111 | 17h | -1.15 | 0110011 | 33h | -2.55 | 1001111 | 4Fh | -3.95 |
| | | | 0011000 | 18h | -1.2 | 0110100 | 34h | -2.6 | 1010000 | 50h | -4 |
| | | | 0011001 | 19h | -1.25 | 0110101 | 35h | -2.65 | other | -4 | |
| | | | 0011010 | 1Ah | -1.3 | 0110110 | 36h | -2.7 | | | |
| | | | 0011011 | 1Bh | -1.35 | 0110111 | 37h | -2.75 | | | |

| | | | |
|---|---|---|---|
| | 7 | MTP_VCM | Follow MTP VCOM value in MTP mode<br>0: From the setting of MTP (default)<br>1:From the setting of register |
| Restriction | | | |

| R83H | Bit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inst/Para | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| PTL | W | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 83H |
| 1st Parameter | W | 1 | - | - | - | - | - | - | HRST[9] | HRST[8] | 00h |
| 2nd Parameter | W | 1 | HRST[7] | HRST[6] | HRST[5] | HRST[4] | HRST[3] | HRST[2] | - | - | 00h |
| 3rd Parameter | W | 1 | - | - | - | - | - | - | HRED[9] | HRED[8] | 00h |
| 4th Parameter | W | 1 | HRED[7] | HRED[6] | HRED[5] | HRED[4] | HRED[3] | HRED[2] | - | - | 00h |
| 5th Parameter | W | 1 | - | - | - | - | - | - | VRST[9] | VRST[8] | 00h |
| 6th Parameter | W | 1 | VRST[7] | VRST[6] | VRST[5] | VRST[4] | VRST[3] | VRST[2] | VRST[1] | VRST[0] | 00h |
| 7th Parameter | W | 1 | - | - | - | - | - | - | VRED[9] | VRED[8] | 00h |
| 8th Parameter | W | 1 | VRED[7] | VRED[6] | VRED[5] | VRED[4] | VRED[3] | VRED[2] | VRED[1] | VRED[0] | 00h |
| 9th Parameter | W | 1 | - | - | - | - | - | - | - | PMODE | 00h |

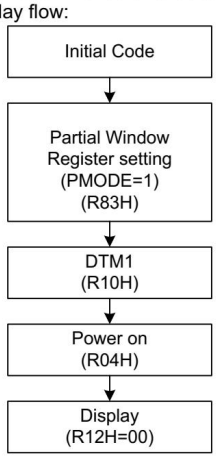
*NOTE: "-" Don't care, can be set to VDD or GND level*

Description

-This command sets partial window.

| Name | Description |
|---|---|
| HRST[9:2] | Horizontal start address |
| HRED[9:2] | Horizontal end address. HRED must be greater than HRST. |
| VRST[9:0] | Vertical start address. |
| VRED[9:0] | Vertical end address. VRED must be greater than VRST. |
| PMODE | 0: disable partial mode(default)<br>1: enable partial mode |

Note:
No matter HRST[1:0] ,HRST[9:8],HRED[9:8],VRST[9],VRED[9] value being filled, it's always be 00b.
No matter HRED[1:0] value being filled, it's always be 11b.

| | |
|---|---|
| | **Gates scan both inside and outside of the partial window.**<br>Partial display flow:<br>  |
| Restriction | |

| **R90H** | Bit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inst/Para | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| PGM | W | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | A0H |

*NOTE: "-" Don't care, can be set to VDD or GND level*

| | |
|---|---|
| Description | -The command define as follows:<br>After this command is issued, the chip would enter the program mode.<br>The mode would return to standby by hardware reset. |
| Restriction | This command only actives when BUSY_N = "1". |

| **R91H** | Bit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inst/Para | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| APG | W | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 91H |

*NOTE: "-" Don't care, can be set to VDD or GND level*

| | |
|---|---|
| Description | -The command define as follows:<br>After this command is transmitted, the programming state machine would be activated. |
| Restriction | The BUSY flag would change state from 0 to 1 while the programming is completed. |

| **R92H** | Bit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inst/Para | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| RMTP | W | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 92H |
| 1st Parameter | R | 1 | Dummy | | | | | | | | - |
| 2nd Parameter | R | 1 | The data of address 0x000 in the MTP | | | | | | | | - |
| 3rd Parameter | R | 1 | The data of address 0x001 in the MTP | | | | | | | | - |
| 4th Parameter | R | 1 | : | | | | | | | | - |
| 5th Parameter | R | 1 | The data of address (n-1) in the MTP | | | | | | | | - |
| 6th~(m-1)th Parameter | R | 1 | ..... | | | | | | | | - |
| mth Parameter | R | 1 | The data of address (n) in the MTP | | | | | | | | - |

*NOTE: "-" Don't care, can be set to VDD or GND level*

| | |
|---|---|
| Description | -The command define as follows:<br>The command is used for reading the content of MTP for checking the data of programming.<br>The value of (n) is depending on the amount of programmed data, the max address = 0x17FF. |
| Restriction | This command only actives when BUSY_N = "1". |

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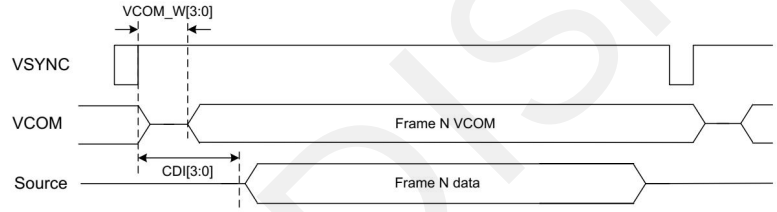
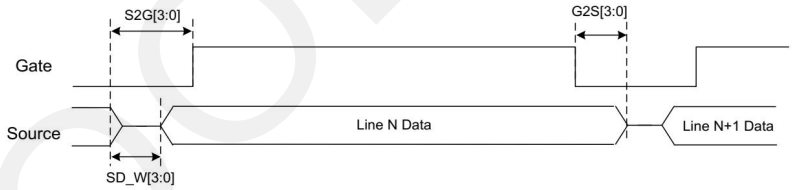
| R9FH | Bit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inst/Para | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| RMRB | W | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 9FH |
| 1st Parameter | R | 1 | Dummy | | | | | | | | - |
| 2nd Parameter | R | 1 | The data of address 0x16F7 in the MTP | | | | | | | | 00h |
| 3rd Parameter | R | 1 | : | | | | | | | | 00h |
| : | R | 1 | : | | | | | | | | 00h |
| 97th Parameter | R | 1 | : | | | | | | | | 00h |
| 98th Parameter | R | 1 | : | | | | | | | | 00h |
| 101th Parameter | R | 1 | The data of address 0x175A in the MTP | | | | | | | | 00h |

*NOTE: "-" Don't care, can be set to VDD or GND level*

| | |
|---|---|
| Description | -The command define as follows:<br>The command is used for reading the content of MTP Reserved Byte for checking the data of programming.<br><br>This command could read these information from MTP directly. |
| Restriction | This command only actives when BUSY_N = "1". |

| RE3H | Bit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inst/Para | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| PWS | W | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | E3H |
| 1st Parameter | W | 1 | VCOM_W[3:0] | | | | SD_W[3:0] | | | | 00h |

*NOTE: "-" Don't care, can be set to VDD or GND level*

| | |
|---|---|
| Description | - 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.<br><br>VCOM_W: VCOM power saving width (unit = line period)<br>  <br>SD_W: Source power saving width (unit = 660nS)<br>  |
| Restriction | |

| RE4H | Bit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inst/Para | R/W | D/CX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Code |
| LVSEL | W | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | E4H |
| 1st Parameter | W | 1 | - | - | - | - | - | - | LVD_SEL[1:0] | | 03h |

*NOTE: "-" Don't care, can be set to VDD or GND level*

| | |
|---|---|
| Description | 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) |

| | |
|---|---|
| Restriction | |

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## 8. Optical Specifications

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

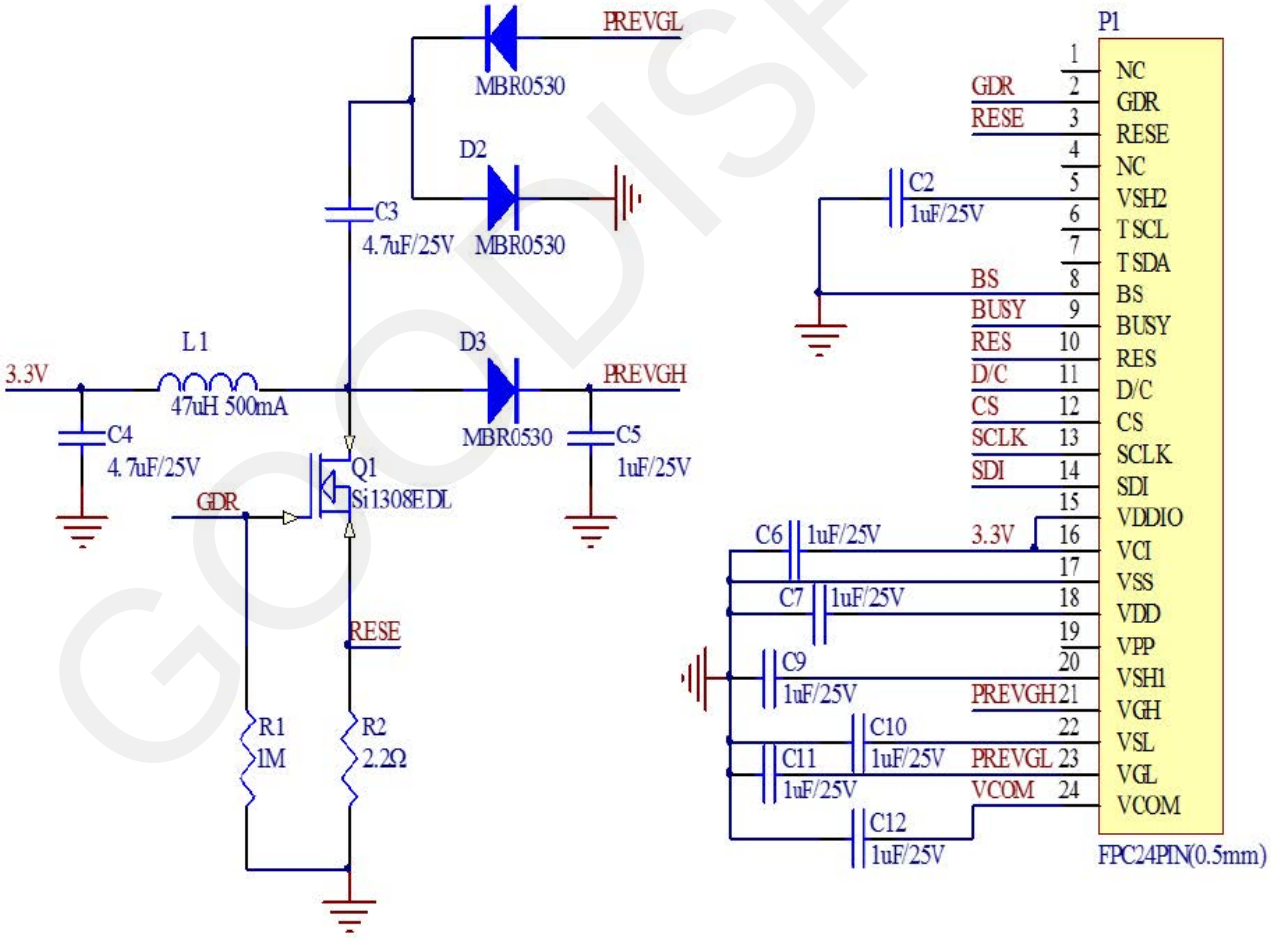
| Symbol | Parameter | Conditions | Min | Typ. | Max | Units | Notes |
|---|---|---|---|---|---|---|---|
| R | White Reflectivity | White | 30 | 35 | - | % | 8-1 |
| CR | Contrast Ratio | Indoor | 8:1 | | - | | 8-2 |
| GN | 2Grey Level | - | | DS+(WS-DS)*n(m-1) | | | 8-3 |
| T update | Image update time | at 25 °C | | 26 | - | sec | |
| Life | | Topr | | 1000000times or 5years | | | |

Notes: 8-1. Luminance meter: Eye-One Pro Spectrophotometer.

8-2. CR=Surface Reflectance with all white pixel/Surface Reflectance with all black pixels.

8-3. WS: White state, DS: Dark state

## 9. Typical Application Circuit

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## 10. Reliability test

| NO | Test items | Test condition |
|---|---|---|
| 1 | Low-Temperature Storage | T = -25°C, 240 h<br>Test in white pattern |
| 2 | High-Temperature Storage | T=60° C，RH=35%，240h<br>Test in white pattern |
| 3 | High-Temperature Operation | T=40° C，RH=35%，240h |
| 4 | Low-Temperature Operation | 0° C，240h |
| 5 | High-Temperature, High-Humidity Operation | T=40° C，RH=80%，240h |
| 6 | High Temperature, High Humidity Storage | T=50° C，RH=90%, 240h<br>Test in white pattern |
| 7 | Temperature Cycle | 1 cycle:[-25℃ 30min]→[+60℃ 30 min] : 50 cycles<br>Test in white pattern |
| 8 | UV exposure Resistance | 765W/m² for 168hrs,40 °C<br>Test in white pattern |
| 9 | ESD Gun | Air+/-15KV;Contact+/-8KV<br>(Test finished product shell, not display only)<br>Air+/-8KV;Contact+/-6KV<br>(Naked EPD display, no including IC and FPC area)<br>Air+/-4KV;Contact+/-2KV<br>(Naked EPD display, including IC and FPC area) |

Note: Put in normal temperature for 1hour after test finished, display performance is ok.

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# 11. Handling, Safety and Environmental Requirements

| WARNING |
| --- |
| The display glass may break when it is dropped or bumped on a hard surface. Handle with care.<br>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. |

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

| Data sheet status | |
| --- | --- |
| Product specification | The data sheet contains final product specifications. |
| **Limiting values** | |
| Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134).<br>Stress above one or more of the limiting values may cause permanent damage to the device.<br>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 |

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## 12. Matched Development Kit

Our Development Kit designed for SPI E-paper Display aims to help users to learn how to use E-paper Display more easily. It can refresh black-white E-paper Display, three-color (black, white and red/Yellow) E-paper Display and four-color(black, white, red and yellow) Good Display 's E-paper Display. And it is also added the functions of USB serial port, FLASH chip, font chip, current detection ect.
Development Kit consists of the development board and the pinboard.

Supported development platforms include STM32, ESP32, ESP8266, Arduino UNO, etc. More details, please click to the following links:

| | |
|---|---|
| STM32 | https://www.good-display.com/product/219.html |
| ESP32 | https://www.good-display.com/product/338.html |
| ESP8266 | https://www.good-display.com/product/220.html |
| Arduino UNO | https://www.good-display.com/product/222.html |

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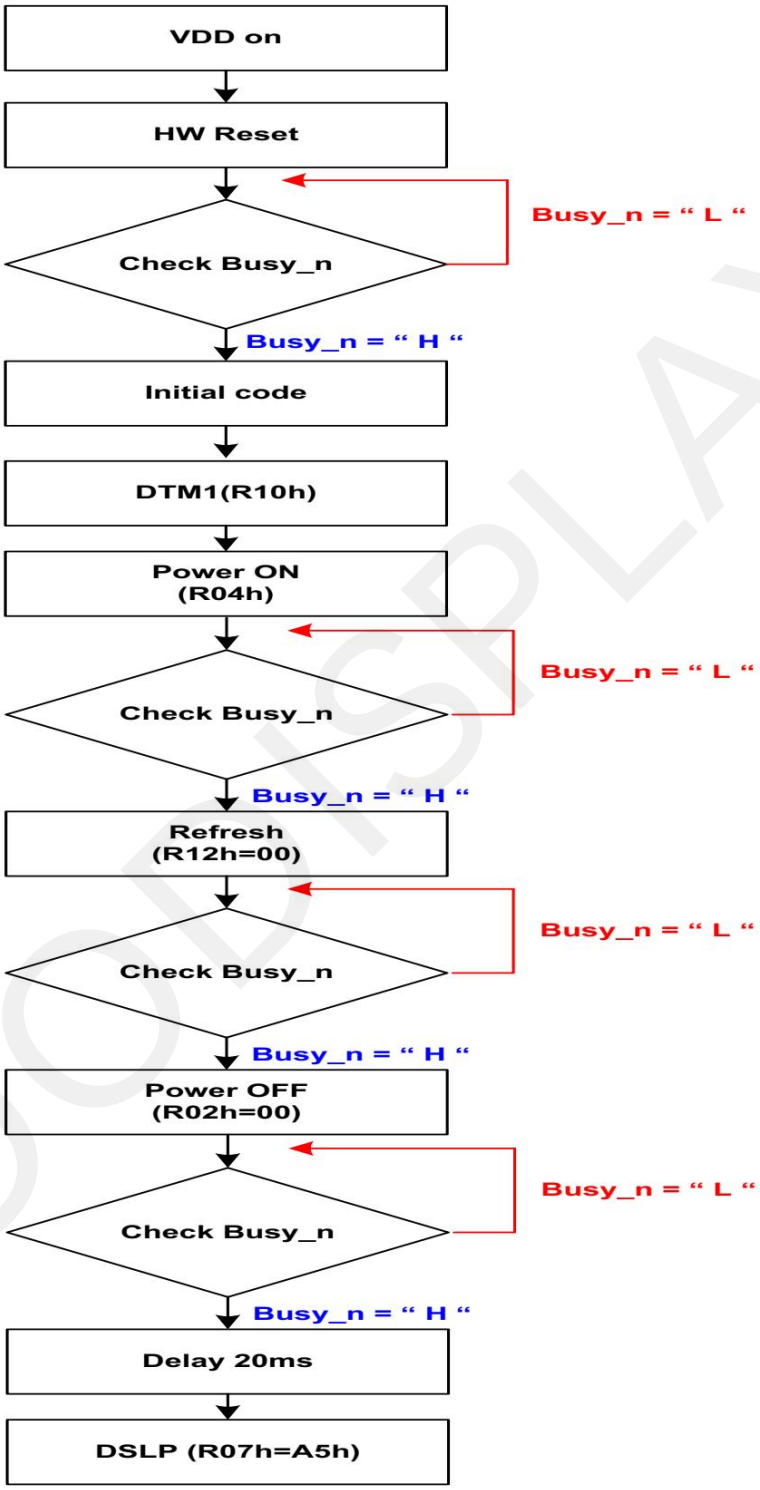
# 13. Typical Operating Sequence

## 13.1 Normal Operation Flow

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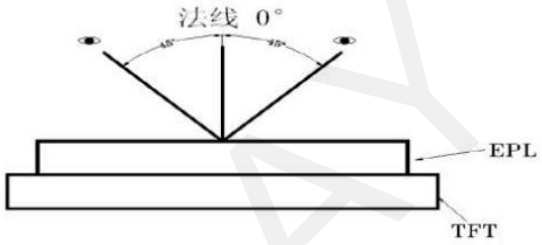
# 14. Inspection method and condition

## 14. 1 Inspection condition

| Item | Condition |
|---|---|
| Illuminance | 800~1500 lux |
| Temperature | 22℃±3℃ |
| Humidity | 55±10 %RH |
| Distance | ≥30cm |
| Angle | Vertical fore and aft 45 |
| Inspection method | By eyes |

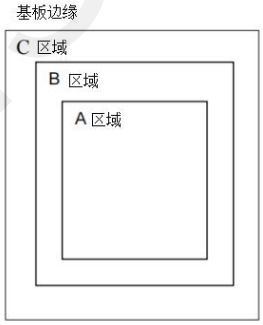



## 14. 2 Zone definition

A Zone： Active area

B Zone： Border zone

C Zone： From B zone edge to panel edge

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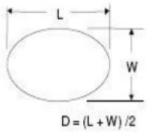
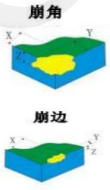
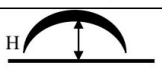
# 14. 3 General inspection standards for products

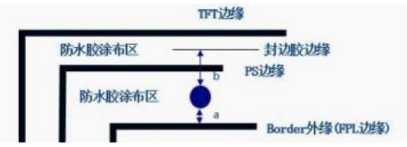
## 14.3.1 Appearance inspection standard

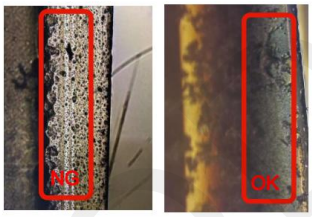
| Inspection item | | Figure | | A zone inspection standard | B/C zone | Inspection method | MAJ/ MIN |
|---|---|---|---|---|---|---|---|
| Spot defects | Spot defects such as dot, foreign matter, air bubble, and dent etc. | Diameter D=(L+W)/2 (L-length、W-width ) Measuring method shown in the figure below   | The distance between the two spots should not be less than 10mm | 7.5"-13.3"Module（Not include 7.5"）：<br>D＞1mm N=0 0.5＜D≤0.8 N≤4 D≤0.5 Ignore 0.8＜D≤1 N≤2<br><br>4.2"-7.5"Module（Not include 4.2"）：<br>D＞0.5 N=0 0.4＜D≤0.5 N≤2 D≤0.25 Ignore 0.25＜D≤0.4 N≤4<br><br>Module below 4.2"：<br>D＞0.5 N=0 0.4＜D≤0.5 N≤1<br>D≤0.25 Ignore 0.25＜D≤0.4 N≤4<br>0.1mm＜D≤0.25 N≤3/cm² | Foreign matter<br><br>D≤1mm Pass | Check by eyes<br><br>Film gauge | MIN |

| Inspection item | | Figure | | A zone inspection standard | B/C zone | Inspection method | MAJ/ MIN |
|---|---|---|---|---|---|---|---|
| Line defects | Line defects such as scratch, hair etc. | L-Length，W-Width, (W/L)＜1/4 Judged by line，<br><br>(W/L)≥1/4 Judged by dot | The distance between the two lines should not be less than 5mm | 7.5"-13.3"Module（Not include 7.5"）：<br>L＞10mm,N=0 W＞0.8mm，N=0<br>5mm≤L≤10mm，0.5mm≤W≤0.8mm N≤2 L≤5mm，W≤0.5mm Ignore<br><br>4.2"-7.5"Module（Not include 4.2"）：<br>L＞8mm,N=0 W＞0.2mm，N=0<br>2mm≤L≤8mm，0.1mm≤W≤0.2mm N≤4 L≤2mm，W≤0.1mm Ignore<br><br>Module below 4.2"：<br>L＞5mm,N=0 W＞0.2mm，N=0<br>2mm≤L≤5mm，0.1mm≤W≤0.2mm N≤4<br>L≤2mm，W≤0.1mm Ignore | Ignore | Check by eyes<br><br>Film gauge | MIN |

| Inspection item | | Figure | Inspection standard | Inspection method | MAJ/ MIN |
|---|---|---|---|---|---|
| Panel chipping and crack defects | TFT panel chipping | X the length, Y the width, Z the chipping height, T the thickness of the panel   | Chipping at the edge：<br>Module over 7.5"（Include 7.5"）：<br>X≤ 6mm,Y≤1mm Z≤T N=3 Allowed<br><br>Module below 7.5"(Not include 7.5")：<br>X≤ 3mm,Y≤1mm Z≤T N=3 Allowed<br><br>Chipping on the corner：<br>IC sideX≤2mm Y≤2mm, Non-IC sideX≤1mm Y≤1mm . Allowed<br><br>Note：<br>Chipping should not damage the edge wiring. If it does not affect the display, allowed | Check by eyes、<br><br>Film gauge | MIN |
| | Crack | | Crack at any zone of glass , Not allowed | Check by eyes、Film gauge | MIN |
| | Burr edge | | No exceed the positive and negative deviation of the outline dimensions X+Y≤0.2mm Allowed | Calliper | MIN |
| | Curl of panel |   Curl height | Curl height H≤Total panel length 1% Allowed | Check by eyes | MIN |

GOODISPLAY

| Inspection item | | Figure | Inspection standard | Inspection method | MAJ / MIN |
|---|---|---|---|---|---|
| PS defect | Water proof film | | 1 .Waterproof film damage, wrinkled, open edge, not allowed<br>2. Exceeding the edge of module(according to the lamination drawing) Not allowed<br>3. Edge warped exceeds height of technical file, not allowed | Check by eyes | MIN |
| RTV defect | Adhesive effect | | Adhesive height exceeds the display surface, not allowed | Check by eyes | MIN |
| | | | 1 .Overflow, exceeds the panel side edge, affecting the size, not allowed<br>2 .No adhesive at panel edge≤1mm, mo exposure of wiring, allowed<br>3. No adhesive at edge and corner1*1mm, no exposure of wiring, allowed | | |
| | | | Protection adhesive, coverage width within W≤1.5mm, no break of adhesive, allowed | | |
| | Adhesive re-fill | | Dispensing is uniform, without obvious concave and breaking, bubbling and swell, not higher than the upper surface of the PS, and the diameter of the adhesive re-filling is not more than 8mm, allowed | Check by eyes | MIN |
| EC defect | Adhesive bubble |  | 1、 Effective edge sealing area of hot melt products ≥1/2 edge sealing area;<br>2、Bubble a+b≥1/2 effective width, N≤3, spacing≥5mm , allowed<br>No exposure of wiring, allowed | Check by eyes | MIN |

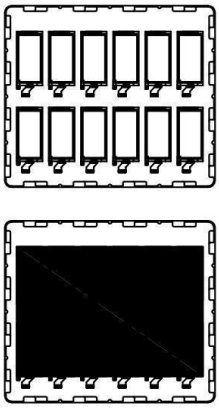
| Inspection item | | Figure | Inspection standard | Inspection method | MAJ/ MIN |
|---|---|---|---|---|---|
| EC defect | Adhesive effect |  | 1 .Overflow, exceeds the panel side edge, affecting the size, not allowed<br>2.No adhesive at panel edge≤1mm, mo exposure of wiring, allowed<br>3.No adhesive at edge and corner 1*1mm, no exposure of wiring, allowed<br>4. Adhesive height exceeds the display surface, not allowed | Visual, caliper | MIN |
| Silver dot adhesive defect | Silver dot adhesive | | 1、Single silver dot dispensing amount ≥1mm, allowed<br>2、One of the double silver dot dispensing amount is ≥1mm and the other has adhesive (no reference to 1mm) Allowed | Visual | MIN |
| | | | Silver dot dispensing residue on the panel ≤0.2mm, allowed | Film gauge | MIN |
| FPC defect | FPC wiring | | FPC, TCP damage / gold finger peroxidation, adhesive residue, not allowed | Visual | MIJ |
| | FPC golden finger | | The height of burr edge of TCP punching surface ≧ 0.4mm, not allowed | Caliper | MIN |
| | FPC damage/crease | | Damage and breaking, not allowed<br>Crease does not affect the electrical performance display, allowed | Check by eyes | MIN |

GOOD DISPLAY

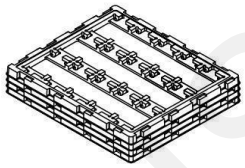
# 15. Packaging

PACKLING ORDER:

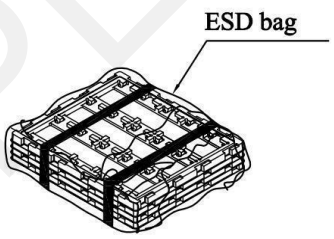
1) Putting 12 pcs Modules on each PET tray.And cover a dedicated EPE film.



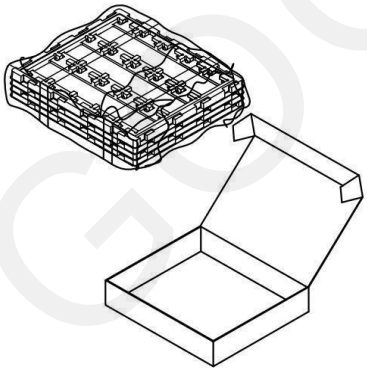
2) Putting 9 pcs PET trays together with 1 empty tray on the top of PET tray.



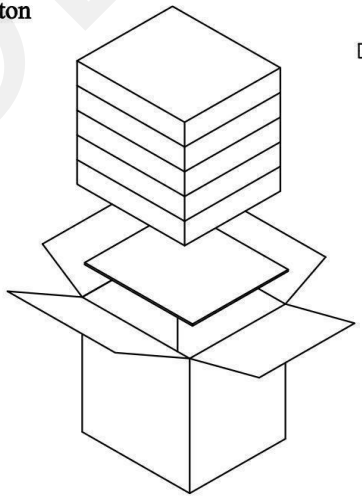
3) the tray together with rubber band



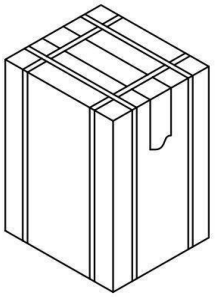

4) Putting in the inner small carton



5) Putting 5 small cartons into one outcarton



6) Packing finished



Note:12 pcs in a tray, 9 trays in a inner carton, 5 inner cartons in a out carton, so 12x9x5=540pcs/Outcarton

Dimension (Small carton ): 385*325*87㎜ Dimension (Out carton ): 394*344*470㎜

GOODISPLAY

## 16. Precautions

(1) Do not apply pressure to the EPD panel in order to prevent damaging it.

(2) Do not connect or disconnect the interface connector while the EPD panel is in operation.

(3) Do not touch IC bonding area. It may scratch TFT lead or damage IC function.

(4) Please be mindful of moisture to avoid its penetration into the EPD panel, which may cause damage during operation.

(5) If the EPD Panel / Module is not refreshed every 24 hours, a phenomena known as "Ghosting" or "Image Sticking" may occur. It is recommended to refreshed the ESL / EPD Tag every 24 hours in use case. It is recommended that customer ships or stores the ESL / EPD Tag with a completely white image to avoid this issue

(6) High temperature, high humidity, sunlight or fluorescent light may degrade the EPD panel's performance. Please do not expose the unprotected EPD panel to high temperature, high humidity, sunlight, or fluorescent for long periods of time.

GOODISPLAY