# DATA SHEET

*( DOC No. HX8279-D-DS )*

# HX8279-D

1803 CH TFT LCD Source Driver with MIPI TCON

*Version 03 August, 2016*

**Himax Technologies, Inc.**
http://www.himax.com.tw

## Revision History

August, 2016

| Version | Date | Description of Changes |
|---|---|---|
| 01 | 2016/05/09 | New setup. |
| 02 | 2016/08/09 | Page 26<br>1. Modify 'Figure 5.3: External VSP/VSN and internal VGH/VGL power structure'.<br>Page 27<br>2. Modify 'Figure 5.4: All power is from external power IC'.<br>Page 111<br>3. Modify chapter '12.3 DC electrical characteristics'. |
| 03 | 2016/08/29 | Page 28, 30<br>1. Add the note for writing GOA registers. |

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# 1. General Description

HX8279-D is 1803 channel outputs source driver with MIPI TCON. The TCON generates the horizontal and vertical control timing to source driver and gate driver.

The source driver is for high-end displays. It is most suitable for 1200RGBx1920, 1080RGBx1920, 1200RGBx1600, and 600RGBx1024 and full 8bit output which are more superior in color depth. Since the output circuit of this source driver incorporates an operational amplifier with low power dissipation, and performs wide voltage supply range and small output deviation. Therefore, a high quality display with less crosstalk can be achieved.

# 2. Features

- MIPI interface support 2/4 lanes
- Support Multi-Drop and R/L type MIPI interface
- Two chip cascade solution for high resolution TFT LCD driver
- 1803 channel output, build in source driver and TCON
  - Channel number 1803 is for zigzag panel(M+1 and M+3) only
- Resolution:
  - Two chip solution for 1200RGBx1920, 1080RGBx1920, and 1200RGBx1600
  - One chip solution for 600RGB x 1024
- Support gamma curve adjustment by analog gamma and the RGB separated positive/negative digital gamma **(It can set thru MIPI command)**
- 256 gray scale driving output compliant to 8bit display data
- Driving scheme support 1/2/1+2/4 dot, and column inversion
- Support CABC function
- Support Color enhancement function
- Support external gate driver controlled signals and GOA function
- Support BIST mode
- Support stripe and zigzag panel
- Support VGH & VGL external charge pump controlled signals
- Support 8 times OTP for VCOM and 1 time OTP for gamma programming
- Only request three powers(VDD,VSP,VSN) from HOST
- Digital power range VDD:1.7V~2.0V
- Analog power range VSP:4.5V~6.0V VSN:-4.5V~-6.0V
- Output bump pitch is 12μm
- COG package

# 3. Block Diagram

## 3.1 Function block diagram

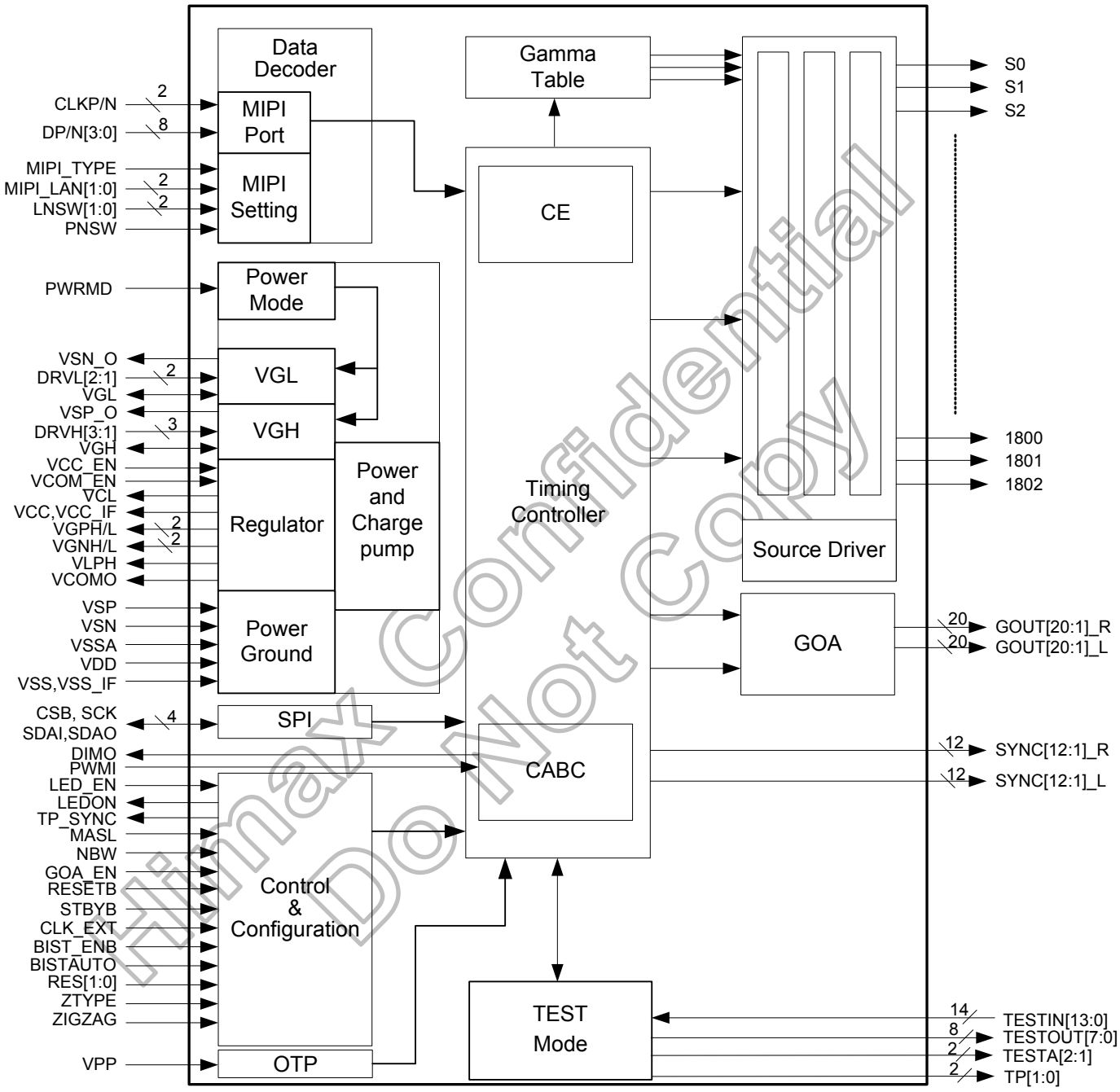



**Figure 3.1: System function block diagram**

# 4. Pin Description

## 4.1 Pin description

### 4.1.1 Global pin

| Pin name | I/O | I/O power | Description |
|---|---|---|---|
| RESETB | In | VDD | Global reset. |
| STBYB | In | VDD | Standby mode selection.**(Default pull high)**<br>STBYB=H,Normal mode.<br>STBYB=L,Standby mode.<br>(AND reg page0 0xB2[6]) |
| ZIGZAG | In | VCC | Enable zigzag driver method. **(Default pull high)**<br>ZIGZAG=H, Panel type is zigzag.<br>ZIGZAG=L, Panel type is stripe.<br>(XOR reg page0 0xB2[3]) |
| ZTYPE | In | VCC | Zigzag panel type selection. **(Default pull high)**<br>ZTYPE=L, Zigzag panel type is TYPE0.<br>ZTYPE=H, Zigzag panel type is TYPE1.<br>(XOR reg page0 0xB2[2]) |
| PWRMD | In | VCC | Power mode selection. **(Default pull high)**<br>HX8279-D can use charge pump to generate VGH, and VGL These function is enabled by PWRMD.<br>PWRMD=H,Use external VGH/VGL<br>PWRMD=L,Use internal VGH/VGL<br>(XOR reg page0 0xB3[4]) |
| MASL | In | VCC | Define chip is master or slave.**(Default pull high)**<br>MASL=H, Chip is master.<br>MASL=L, Chip is slave. |
| RES0<br>RES1 | In | VCC | Resolution display selection. **(Default RES[1:0]=11b)**<br>600RGBx1024 is for one chip application only. **(X means no disable channel)**<br>RES1 / RES0 / Resolution / Disable channel<br>0 / 0 / 1200RGBx1600 / X<br>0 / 1 / 1080RGBx1920 / 811~990<br>1 / 0 / 600RGBx1024 / X<br>1 / 1 / 1200RGBx1920 / X<br>(XOR reg page0 0xB3[1:0]) |
| MIPI_TYPE | In | VCC | MIPI type selection.**(Default pull low)**<br>MIPI_TYPE=H, R/L type.<br>MIPI_TYPE=L, Multi-drop type.<br>(XOR reg page0 0xB8[4]) |
| LNSW1<br>LNSW0 | In | VCC | MIPI data lane swap. **(Default LNSW[1:0]=11b)** Please refer chapter 4.4.<br>(XOR reg page0 0xB8[1:0]) |
| MIPI_LAN0<br>MIPI_LAN1 | In | VCC | MIPI lane number configuration.**(Default MIPI_LAN[1:0]=11b)**<br>MIPI_LAN1 / MIPI_LAN0 / MIPI Lane number<br>0 / 0 / Reserve<br>0 / 1 / 2 Lanes<br>1 / 0 / Reserve<br>1 / 1 / 4 Lanes<br>(XOR reg page0 0xB8[3:2]) |
| PNSW | In | VCC | MIPI data lane P/N swap. **(Default pull low)**<br>PNSW=H,P/N swap<br>PNSW=L,P/N normal<br>(XOR reg page0 0xB8[5]) |
| GOA_EN | In | VCC | GOA function enable. **(Default pull high)**<br>GOA_EN=H, GOA function is enable.<br>GOA_EN=L, GOA function is disable.<br>(XOR reg page0 0xB8[7]) |

| Pin name | I/O | I/O power | Description |
|---|---|---|---|
| NBW | In | VCC | Normal display selection. **(Default pull high)**<br>NBW=H, Normal black panel type.<br>NBW=L, Normal white panel type.<br>(XOR reg page0 0xB2[1]) |
| CLK_EXT | In | VCC | External CLK input for TCON. This pin is for Test only. Float it if not used. **(Default pull high)** |
| CSB | In | VDD | SPI chip select. Suggest reserving test pad for debug. **(Default pull high)** |
| SCK | In | VDD | SPI clock input. Suggest reserving test pad for debug. **(Default pull high)** |
| SDAI | In | VDD | SPI data input. Suggest reserving test pad for debug. **(Default pull high)** |
| SDAO | Out | VDD | SPI data output. Suggest reserving test pad for debug. Float it if not used. |
| BIST_ENB | In | VCC | BIST pattern selection. **(Default pull high)**<br>BIST_ENB=H, Self test mode is disable.<br>BIST_ENB=L, Self test mode is enable.<br>(XOR reg page0 0xB2[0]) |
| BISTAUTO | In | VCC | BIST display automatically change pattern. **(Default pull high)**<br>BISTAUTO=H, Automatically change pattern<br>BISTAUTO=L,Fix pattern |
| LED_EN | In | VCC | LEDON output control. **(Default pull high)**<br>LED_EN=H, LEDON output enable<br>LED_EN=L, LEDON output disable<br>(XOR reg page0 0xB3[2]) |
| LEDON | Out | VDD | LED driver enable/ disable control signal. Float it if not used.<br>Control by pin LED_EN XOR reg page0 0xB3[2] and power on/off sequence |
| DIMO | Out | VDD | PWM control signal for brightness of the LED backlight. This pin is connected to the external LED driver. Float it if not used. |
| PWMI | In | VDD | PWM signal input for DIMO. Control by page4 0xB7[2]. **(Default pull high)** |
| TP_SYNC | Out | VDD | Sync signal for touch panel. Float it if not used. |
| VCC_EN | In | VDD | VCC regulator output selection. **(Default pull high)**<br>VCC_EN=H.VCC output regulator is enable.<br>VCC_EN=L.VCC output regulator is disable. |
| VCOM_EN | In | VCC | VCOM OP enable. **(Default pull high)**<br>VCOM_EN=H, VCOM OP enable,ouput VCOM<br>VCOM_EN=L, VCOM OP disable,outut floating |
| RP1EN | In | VCC | 1st repair OP on/off control. **(Default pull high)**<br>RP1EN=H,Rrepair OP enable<br>RP1EN=L, Repair OP disable<br>(XOR reg page0 0xB6[6]) |
| RP2EN | In | VCC | 2nd repair OP on/off control. **(Default pull high)**<br>RP2EN=H, Repair OP enable<br>RP2EN=L, Repair OP disable<br>(XOR reg page0 0xB6[5]) |



### 4.1.2 Synchronize pin

| Pin name | I/O | Description |
|---|---|---|
| SYNC1_R<br>~ SYNC12_R | In/Out | Synchronized signals between master and slave.<br>These pins at right side of chip. |
| SYNC1_L<br>~ SYNC12_L | In/Out | Synchronized signals between master and slave.<br>These pins at left side of chip. |

### 4.1.3 MIPI interface

| Pin name | I/O | Description |
|---|---|---|
| CLKP/CLKN | In | MIPI clock input pin. |
| DP0/DN0<br>DP1/DN1<br>DP2/DN2<br>DP3/DN3 | In | MIPI data input pin. |

**Note:** (1) IO cell voltage is VCC_IF.

### 4.1.4 Gate driver (GOA) control pin

| Pin name | I/O | Description |
|---|---|---|
| GOUT1_R<br>~ GOUT20_R | Out | GOA control signal at right side. |
| GOUT1_L<br>~ GOUT20_L | Out | GOA control signal at left side. |

**Note:** (1) IO cell voltage is between VGH and VGL.

### 4.1.5 Source output pin

| Pin name | I/O | Description |
|---|---|---|
| S0 | Out | Source output pin. It is available when zigzag function enable. |
| S1~S1800 | Out | Source output pin. |
| S1801,S1802 | Out | Source output pin. It is available when zigzag function enable. |

**Note:** (1) IO cell voltage is between VSP and VSN.

### 4.1.6 Charge pump and regulator pin

| Pin name | I/O | Description |
|---|---|---|
| VCC | Out | Regulator voltage for digital circuit. **(1.55V)** |
| VCC_IF | Out | Regulator voltage for MIPI interface circuit. **(1.55V)** |
| VGPH | Out | Regulator high voltage for positive gamma. **(4V ~ 5.5V)** |
| VGPL | Out | Regulator low voltage for positive gamma. **(0.1V ~ 1.6V)** |
| VGNH | Out | Regulator high voltage for negative gamma. **(-4V ~ -5.5V)** |
| VGNL | Out | Regulator low voltage for negative gamma. **(-0.1V ~ -1.6V)** |
| VLPH | Out | Regulator output for MIPI LP mode. **(1.2V)** |
| VCOMO | Out | VCOM op output. **(-0.2V ~ -2.75V)** |
| VCL | Out | Regulator output voltage for source level shift. **(-2.4V)** |
| DRVH3<br>DRVH2<br>DRVH1 | Out | VGH charge pump control signals. Float it if not used. |
| DRVL2<br>DRVL1 | Out | VGL charge pump control signals. Float it if not used. |
| VSP_O | Out | VGH charge pump control signals. Float it if not used. |
| VSN_O | Out | VGL charge pump control signals. Float it if not used. |
| RP1O | Out | 1st repair OP output. Float it if not used. |
| RP2O | Out | 2nd repair OP output. Float it if not used. |
| RP1I | In | 1st repair OP input. Float it if not used. |
| RP2I | In | 2nd repair OP input. Float it if not used. |

**Note:** (1) IO cell voltage is based on supply capability.

### 4.1.7 Power and ground pin

| Pin name | I/O | Description |
|---|---|---|
| VDD | Power | Power supply for digital power regulator. **(1.7V~2.0V)** |
| VSN | Power | Power supply for analog circuit. **(-4.5V ~ -6V)** |
| VSP | Power | Power supply for analog circuit. **(4.5V ~ 6V)** |
| VGL | Power | Power supply for GOA and gate drive. It provides from internal or external power. This supply voltage must be connected to the chip, even GOA function doesn't use. **(-6.7V ~ -16.0V)** |
| VGL1_L/R | Power | Power supply for Gait provides different voltage level for GOUT_R7/GOUT_R8/GOUT_L7/GOUT_L8 output. If don't use, connect the pins to VGL. **(-6.7V ~ -16.0V)** |
| VGH | Power | Power supply for GOA and gate drive. It provides from internal or external power. This supply voltage must be connected to the chip, even GOA function doesn't use. **(8.7V ~ 18.0V)** |
| VPP | Power | Power supply for OTP. Reserve 0.1 CAP. connected to GND for using internal VPP.Float it for normal operation. **(8.5V)** |
| VSS | GND | Ground for digital circuit. **(0V)** |
| VSS_IF | GND | Ground for MIPI interface. **(0V)** |
| VSSA | GND | Ground for analog circuit. **(0V)** |

### 4.1.8 Others

| Pin name | I/O | Description |
|---|---|---|
| TESTOUT0 ~ TESTOUT7 | Out | Test pin. Float these pin for normal operation. |
| TESTIN0 ~ TESTIN13 | In | Test pin. Float these pin for normal operation. |
| TESTA1 TESTA2 | Out | Test pin. Float these pin for normal operation. |
| TP0,TP1 | In | Test pin. Float these pin for normal operation. |
| COMR1 COMR2 | - | VCOM through pin. |
| COML1 COML2 | - | VCOM through pin. |
| COM3~5 | - | Bonding impedance measure pin. |
| SHIELDING | - | Chip shielding pads. It is floating internal. |

## 4.2 Value of wiring resistance to each pin

The input wiring resistance values affect power or signal integrity and the display quality. So be sure to design using values that do not exceed those recommendations as below.

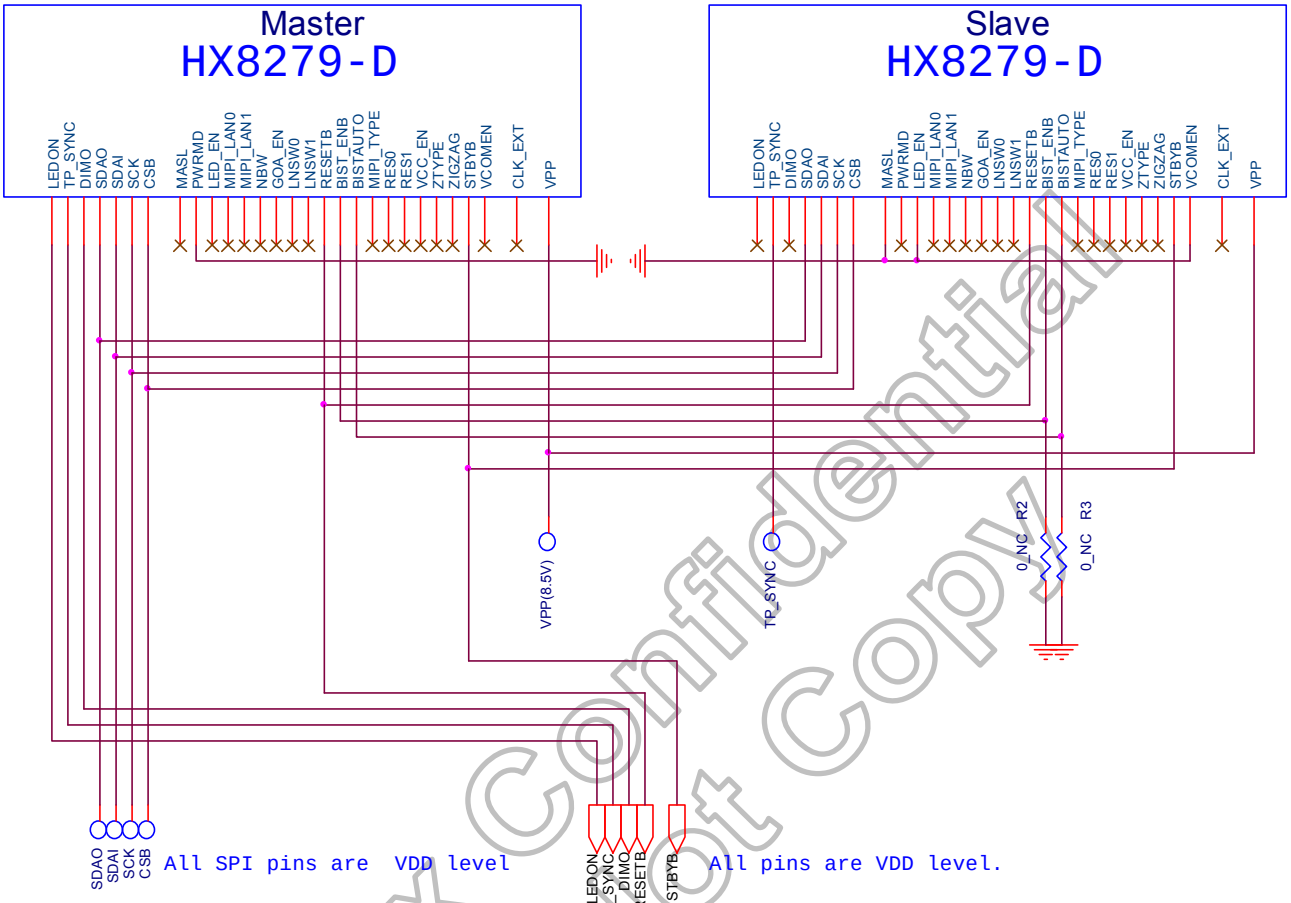
| Pin Type | Pin Name | Resistance value(Ω) | Capacitance value(pF) |
|---|---|---|---|
| Power & Ground | VDD | < 3 | - |
| | VSP, VSN | < 3 | - |
| | VSS | < 3 | - |
| | VSS_IF | < 5 | - |
| | VCC_IF | < 5 | - |
| | VCC | < 3 | - |
| | VSSA | < 3 | - |
| Charge Pump & Regulator | VLPH | < 5 | - |
| | VGL/VGL1 | < 5 | - |
| | VGH | < 5 | - |
| | VCOMO | < 10 | - |
| | VGPH | < 10 | - |
| | VGPL | < 10 | - |
| | VGNH | < 10 | - |
| | VGNL | < 10 | - |
| | VCL | < 5 | - |
| | DRVH1,DRVH2,DRVH3 | < 5 | - |
| | VSP_O, VSN_O | < 3 | - |
| | DRVL1,DRVL2,DRVL3 | < 5 | - |
| GOA | GOUT1_R~GOUT20_R | <100 | - |
| | GOUT1_L~GOUT20_L | <100 | - |
| MIPI Interface | CKP, CLKN | < 10 | < 0.9 |
| | DP0, DN0 | < 10 | < 0.9 |
| | DP1, DN1 | < 10 | < 0.9 |
| | DP2, DN2 | < 10 | < 0.9 |
| | DP3, DN3 | < 10 | < 0.9 |
| Synchronized signals | SYNC1_L | RC < 40ns | RC < 40ns |
| | SYNC2_L | RC < 40ns | RC < 40ns |
| | SYNC3_L | RC < 40ns | RC < 40ns |
| | SYNC4_L | RC < 40ns | RC < 40ns |
| | SYNC5_L | RC < 40ns | RC < 40ns |
| | SYNC6_L | RC < 40ns | RC < 40ns |
| | SYNC7_L | RC < 40ns | RC < 40ns |
| | SYNC8_L | RC < 40ns | RC < 40ns |
| | SYNC9_L | RC < 40ns | RC < 40ns |
| | SYNC10_L | RC < 40ns | RC < 40ns |
| | SYNC11_L | RC < 40ns | RC < 40ns |
| | SYNC12_L | RC < 40ns | RC < 40ns |
| | SYNC1_R | RC < 40ns | RC < 40ns |
| | SYNC2_R | RC < 40ns | RC < 40ns |
| | SYNC3_R | RC < 40ns | RC < 40ns |
| | SYNC4_R | RC < 40ns | RC < 40ns |
| | SYNC5_R | RC < 40ns | RC < 40ns |
| | SYNC6_R | RC < 40ns | RC < 40ns |
| | SYNC7_R | RC < 40ns | RC < 40ns |
| | SYNC8_R | RC < 40ns | RC < 40ns |
| | SYNC9_R | RC < 40ns | RC < 40ns |
| | SYNC10_R | RC < 40ns | RC < 40ns |
| | SYNC11_R | RC < 40ns | RC < 40ns |
| | SYNC12_R | RC < 40ns | RC < 40ns |

| Pin Type | Pin Name | Resistance value(Ω) | Capacitance value(pF) |
|---|---|---|---|
| Control & Hardware Configuration | ZIGZAG | < 200 | - |
| | ZTYPE | < 200 | - |
| | PWRMD | < 200 | - |
| | RES0, RES1 | < 200 | - |
| | MIPI_TYPE | < 200 | - |
| | BISTAUTO | < 200 | - |
| | BIST_ENB | < 200 | - |
| | CLK_EXT | < 100 | - |
| | RESETB | < 100 | - |
| | LNSW0, LNSW1 | < 200 | - |
| | GOA_EN | < 200 | - |
| | NBW | < 200 | - |
| | MIPI_LAN0, MIPI_LAN1 | < 200 | - |
| | MASL | < 200 | - |
| | RP1EN | < 200 | - |
| | RP2EN | < 200 | - |
| | VCC_EN | < 200 | - |
| | VCOM_EN | < 200 | - |
| | LED_EN | < 200 | - |
| | LEDON | < 200 | - |
| | DIMO | < 200 | < 20 |
| | PWMI | < 200 | < 20 |
| | CSB | < 200 | - |
| | SCK | < 200 | - |
| | SDAI | < 200 | - |
| | SDAO | < 200 | < 20 |

**Table 4.1: Wiring resistance values**

## 4.3 Hardware pin configuration for FPC/PCB

Here is shows hardware pin configuration of Master and Slave.




**Note:** (1) PWRMD is low. The system only needs to supply three powers VDD, VSP and VSN.
(2) The settings apply to 1200RGBx1920 GOA zigzag type0 panel and use 4 lanes multi-drop mipi input.
(3) Use internal VCOM.

**Figure 4.1: Hardware pin configuration example**

## 4.4 MIPI interface pin mapping table

This table shows the mapping with pad name and MIPI lanes. It could configure by hardware pin LNSW0 and LNSW1.

- LNSW0 and LNSW1 are for swap MIPI data pair.

| Pad Name / Configuration | | DP3 | DN3 | DP2 | DN2 | CLKP | CLKN | DP1 | DN1 | DP0 | DN0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| LNSW0 | LNSW1 | MIPI lanes mapping table | | | | | | | | | |
| 0 | 0 | DP0 | DN0 | DP3 | DN3 | CLKP | CLKN | DP2 | DN2 | DP1 | DN1 |
| 1 | 0 | DP2 | DN2 | DP3 | DN3 | CLKP | CLKN | DP0 | DN0 | DP1 | DN1 |
| 0 | 1 | DP3 | DN3 | DP0 | DN0 | CLKP | CLKN | DP1 | DN1 | DP2 | DN2 |
| 1 | 1 | DP3 | DN3 | DP2 | DN2 | CLKP | CLKN | DP1 | DN1 | DP0 | DN0 |

**Note:** (1) Mark is default.

**Table 4.2: MIPI interface mapping table**

### 4.5 MIPI interface type selection

There are two types of MIPI interface in this chip – Multi-Drop and RL.

Multi-drop type consist of two chips and works through same MIPI bus. The buses have the advantage of simplicity, but bad latency is between two chips.

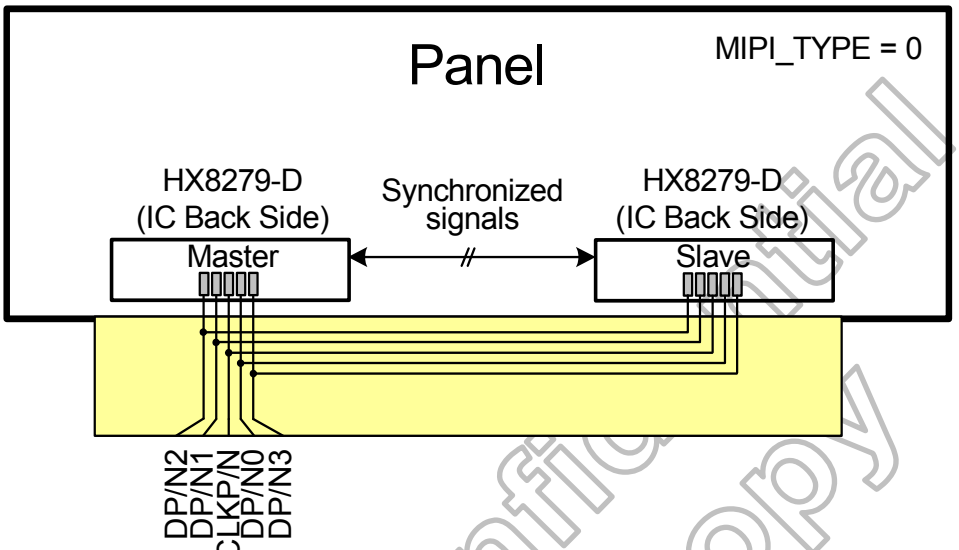



**Figure 4.2: MIPI multi drop type interface**

RL type is a point-to-point interconnect between the application processor and HX8279-D. The buses have the advantage of high band width and low latency.

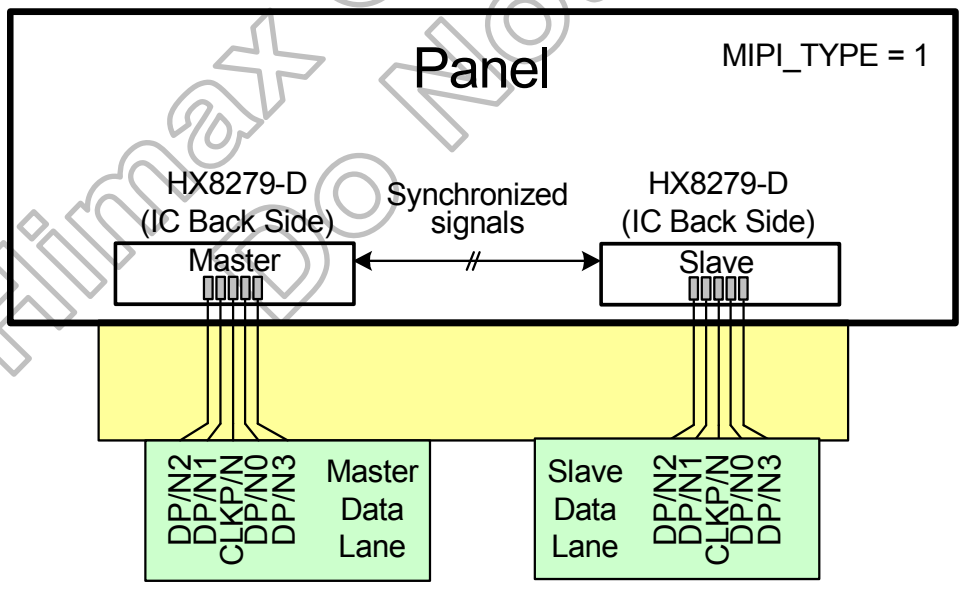



**Figure 4.3: MIPI RL type interface**

## 4.6 Application block diagram

Here is shows application for HX8279-D.If use external VGH/VGL, VGH/VGL must connect to HX8279-D in all application.

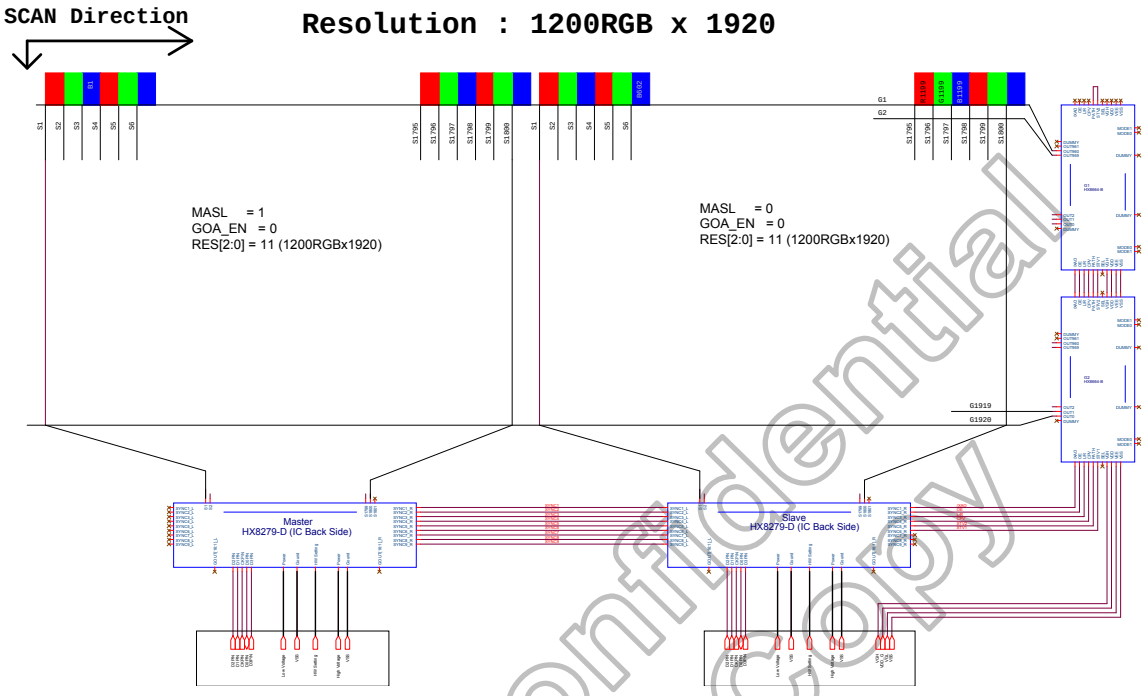



**Figure 4.4: Application for 1200RGBx1920 with external GD**

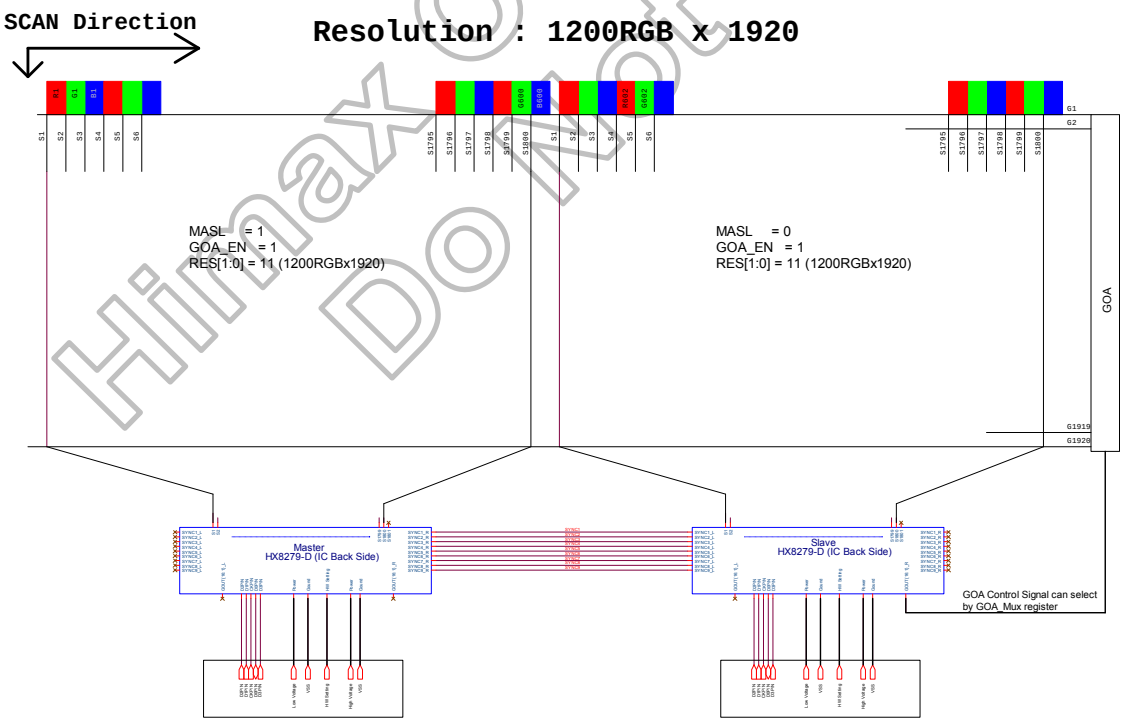



**Figure 4.5: Application for 1200RGBx1920 with single side of GOA**

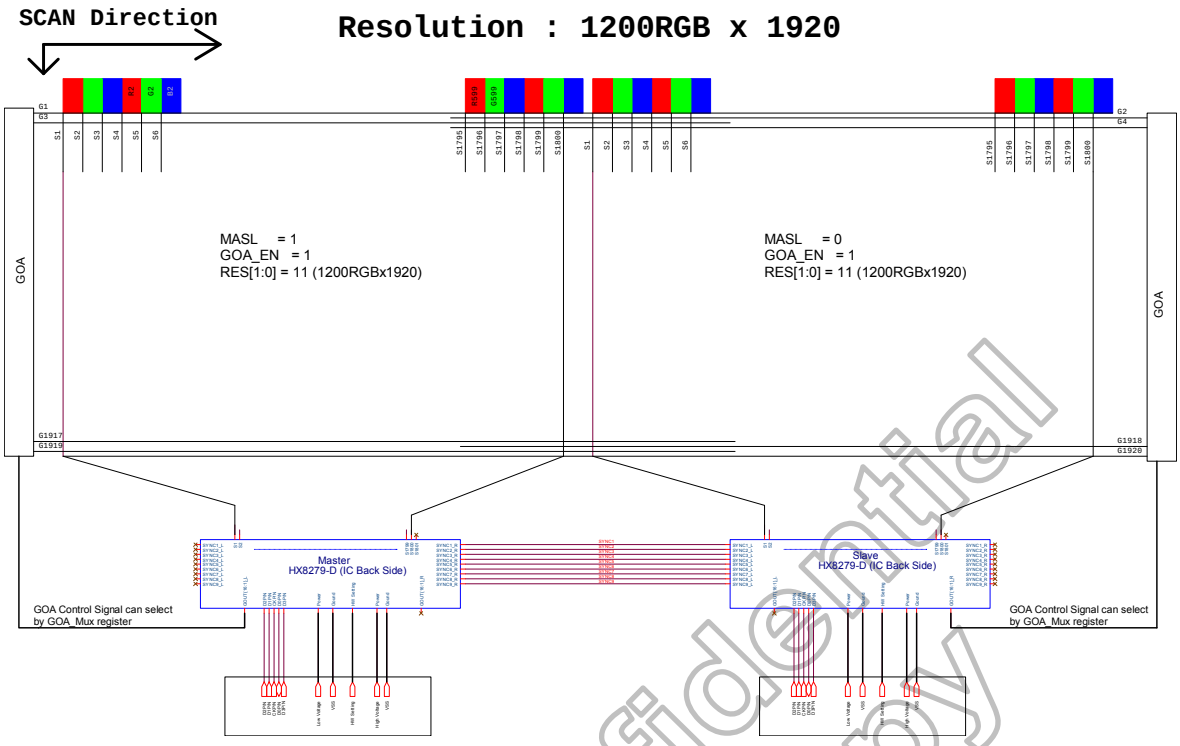



**Figure 4.6: Application for 1200RGBx1920 with two side of GOA**

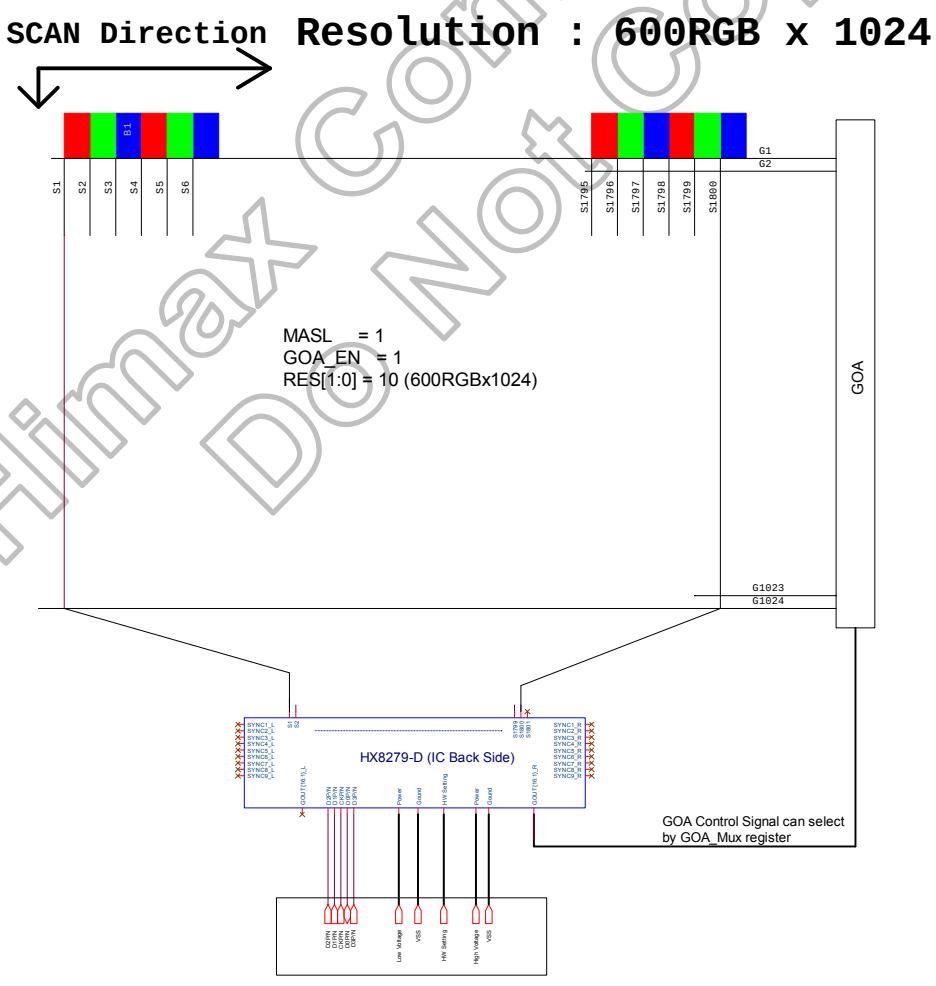



**Figure 4.7: Application for 600RGBx1024 with single side of GOA**

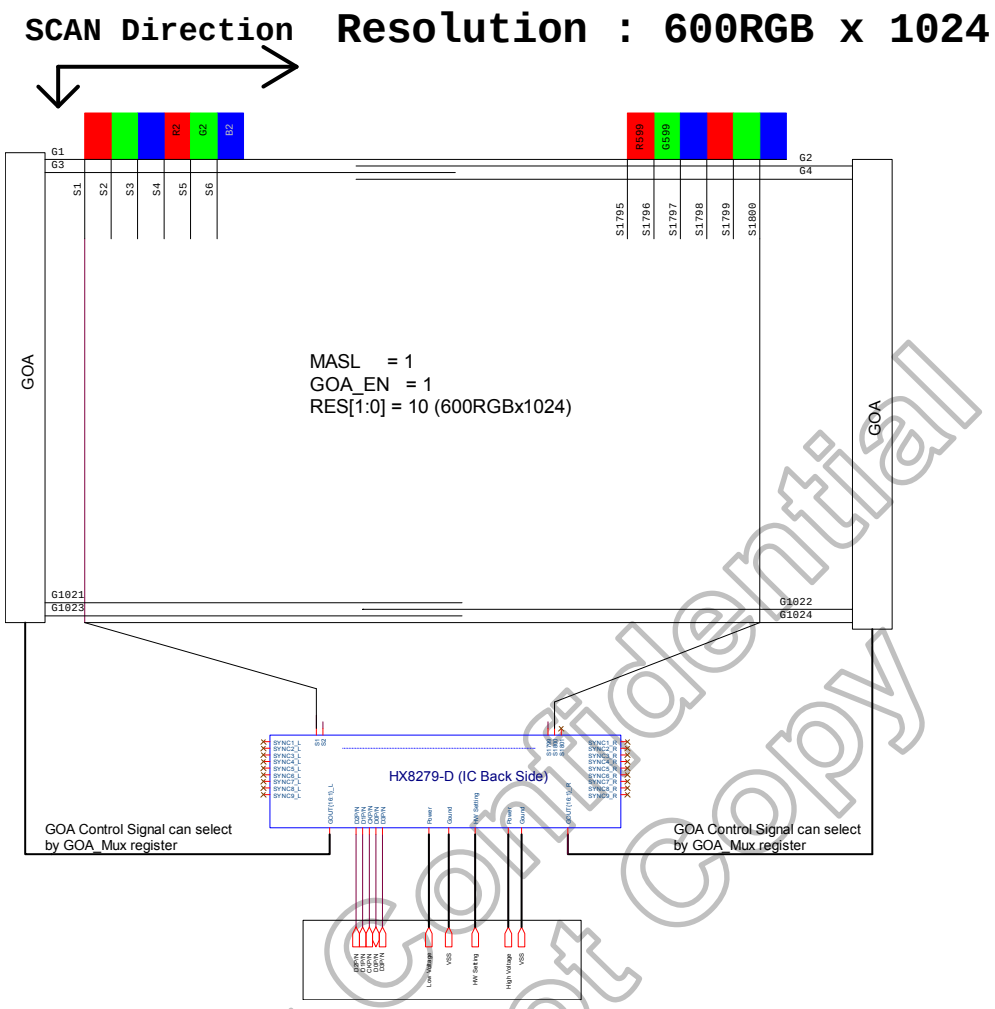



**Figure 4.8: Application for 600RGBx1024 with two side of GOA**

# 5. Power Application

## 5.1 Application power circuit

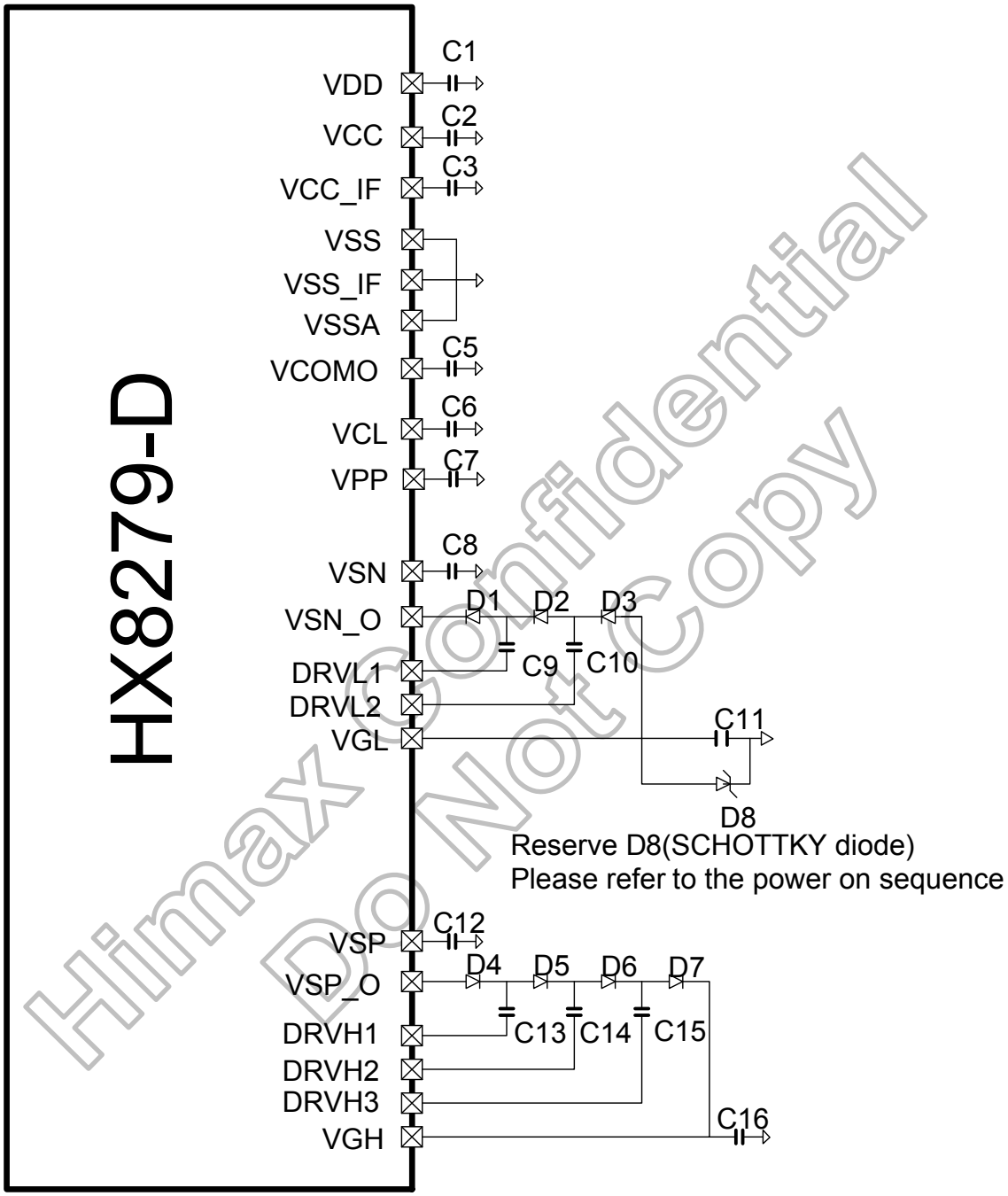



**Figure 5.1: Power function typical application**

## 5.2 Power generation diagram

### 5.2.1 Power generation diagram

The HX8279-D incorporates external charge pump control signals for VGH/VGL.

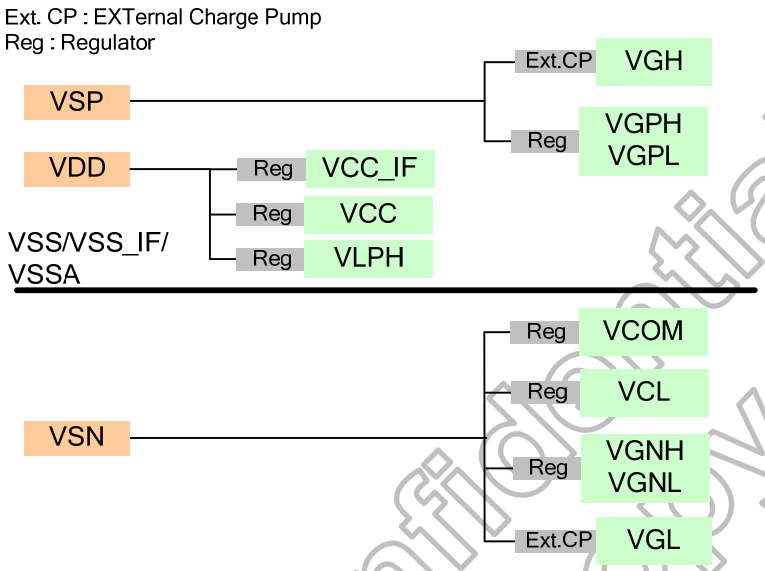


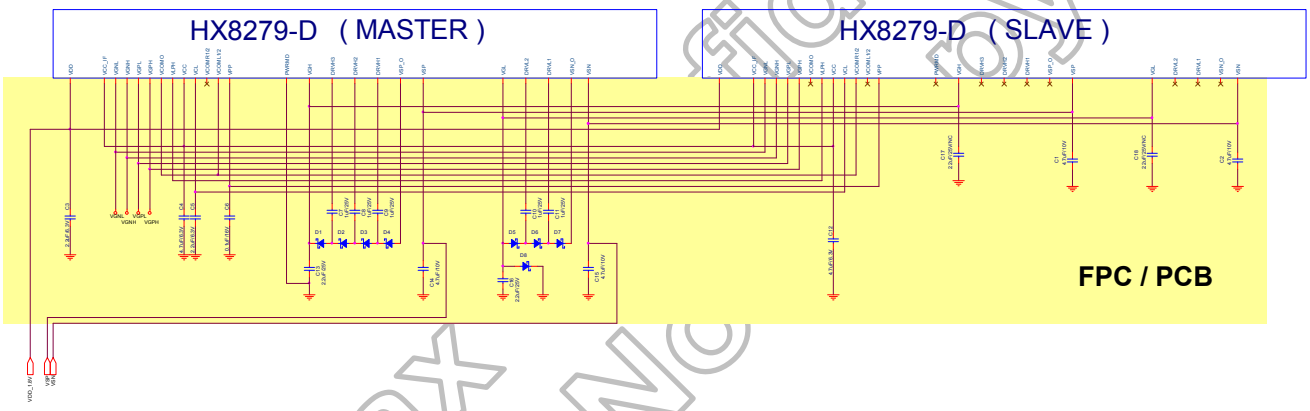

**Figure 5.2: Power architecture**

## 5.3 Power circuit structure

### 5.3.1 Internal VGH/VGL

This case is used external VSP/VSN to generate VGH/VGL.

- Main voltages from external power IC, then supply to master and slave
  - VDD
- External voltage supply to master and slave
  - VSP and VSN
- Voltages are generated by external charge pump of master, then supply to slave
  - VGL and VGH
- Voltages are generated by regulator of master, then supply to slave.
  - VCL,VCOM, VGPH, VGPL, VGNH, and VGNL
- Voltages are generated by regulator of Master and Slave, then to connect wire together each other
  - VCC, VCC_IF, and VLPH




| HW Set | Master | Slave |
|---|---|---|
| PWRMD | L | X |
| VCC_EN | H | H |

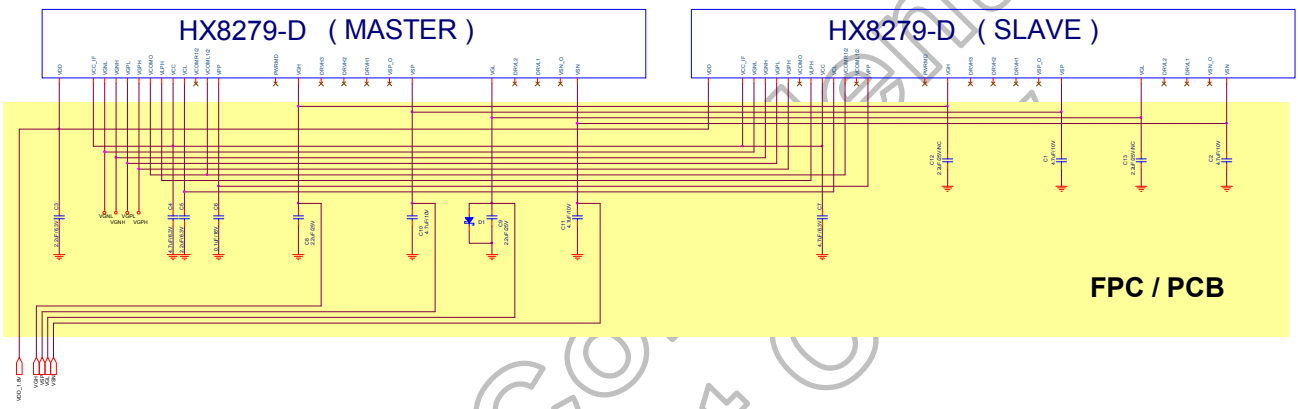
**Note:** (1) Slave IC only enables regulator for VCC, VCC_IF, and VLPH. Others power functions are all disable when cascade mode is used.
(2) Reserve D9 to prevent latch up issue.
(3) "X" means don't care. It can set to high, low or floating.

**Figure 5.3: External VSP/VSN and internal VGH/VGL power structure**

### 5.3.2 External VGH/VGL

This case is used all external power supply voltage

- Main voltages from external power IC, then supply to Master and Slave.
  - VDD
- External voltage supply to Master and Slave.
  - VSP, VSN, VGH, and VGL
- Voltages are generated by regulator of Master, then supply to Slave.
  - VCL,VCOM, VGPH, VGPL, VGNH, and VGNL
- Voltages are generated by regulator of Master and Slave, then to connect wire together each other.
  - VCC, VCC_IF, and VLPH




| HW Set | Master | Slave |
|---|---|---|
| PWRMD | H | H |
| VCC_EN | H | H |

**Note:** (1) Slave IC only enables regulator for VCC, VCC_IF, and VLPH. Others power functions are all disable when cascade mode is used.

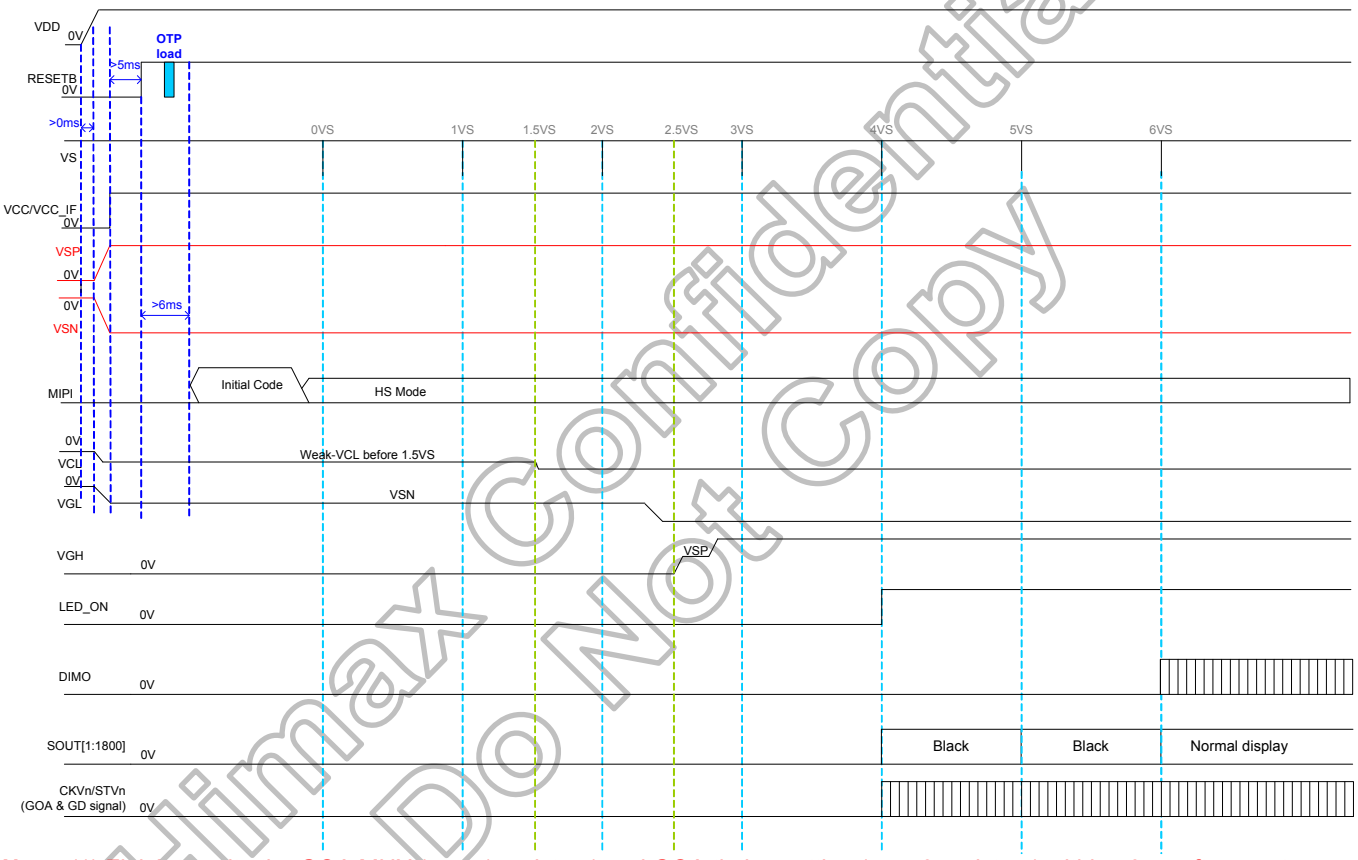
**Figure 5.4: All power is from external power IC**

## 5.4 Power on/off sequence

### 5.4.1 Power on sequence PWRMD=0 ➔ max. Power on time=7VS

After reset state or exit STB mode, the power on sequence will start.

To prevent the device from damage due to latch up, The VGL will be earlier than VGH. At 2.25VS the VGL negative high voltage will be generated via the external charge pump circuit. Then at 2.5VS the VGH positive high voltage can be generated via the external charge pump circuit. One SCHOTTKY diode is necessary between VGL and GND when VDD and VSP start at the same time.




**Note:** (1) Finish to write the GOA MUX (page1 registers) and GOA timing setting (page3 registers) within 50ms after reset pulls to high.

**Figure 5.5: Power on sequence with PWRMD=0 and repair OP disable**

### 5.4.2 Power off sequence PWRMD=0 ➔ max. Power off time=5VS

When enter STB mode, the STBYB signal will be set to low. The power off sequence will start.

**Power-off sequence**
**External VSP/VSN. Internal VGH/VGL.**

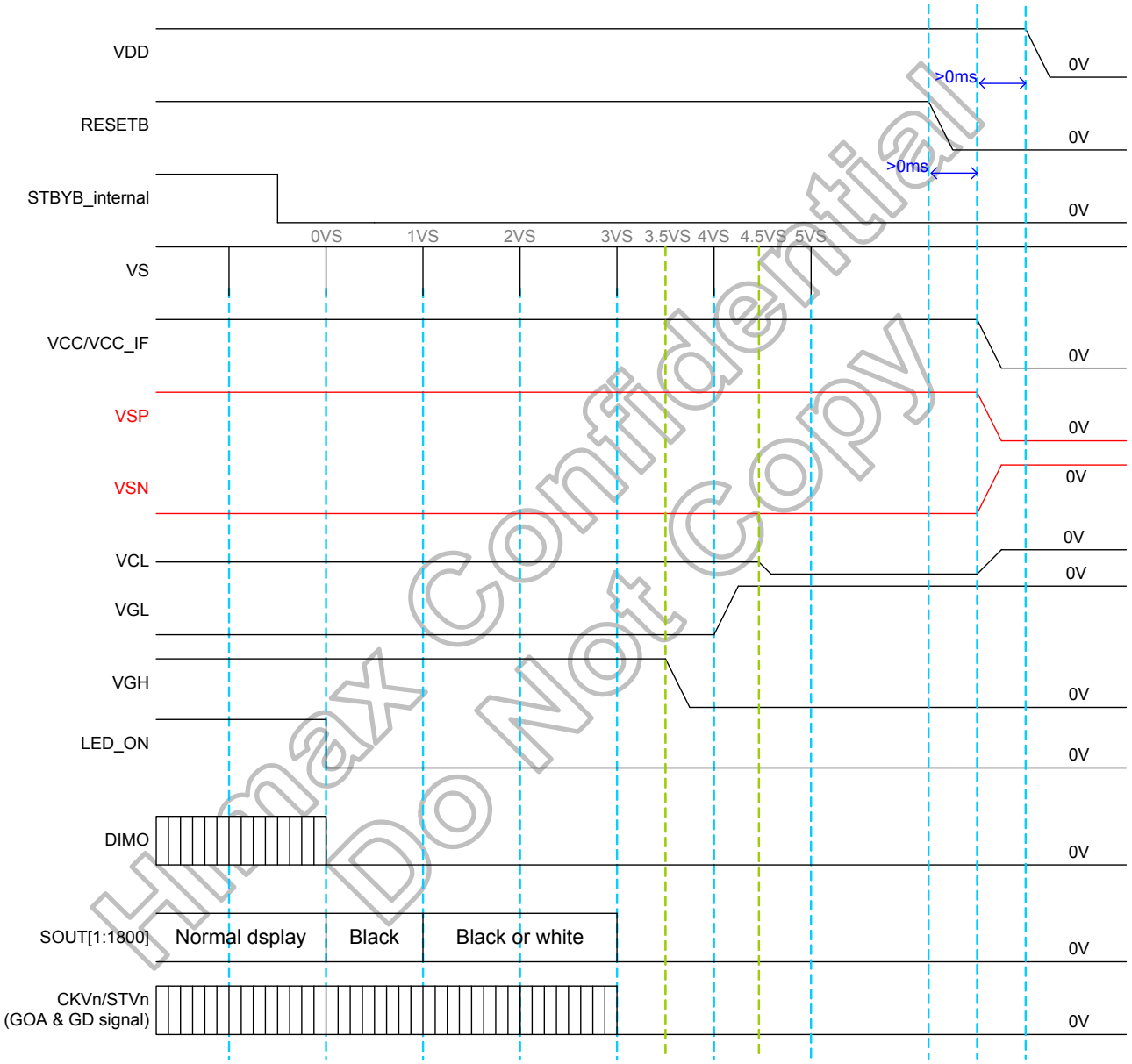
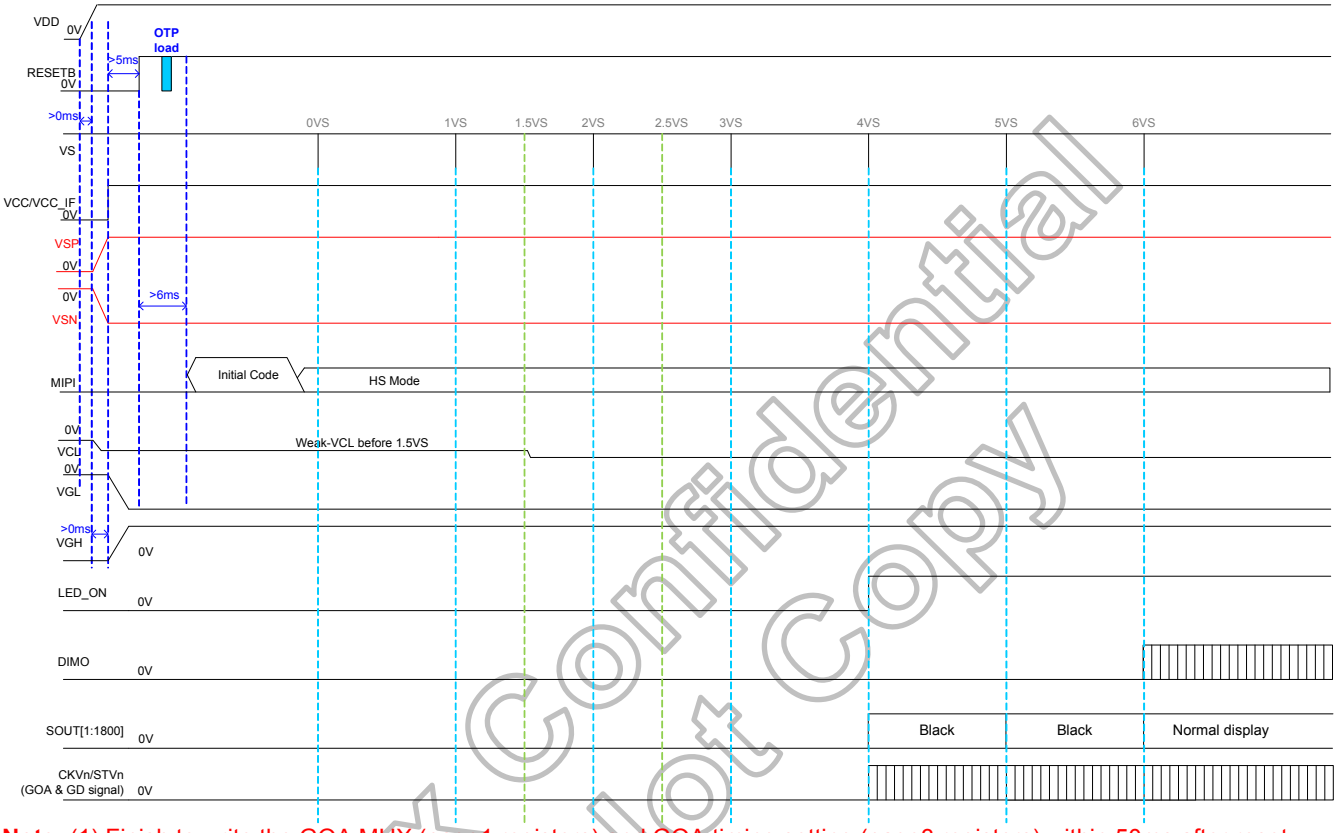





**Figure 5.6: Power off sequence with PWRMD=0**

### 5.4.3 Power on sequence PWRMD=1 ➔ Max. Power on time=6VS

After reset state or exit STB mode, the power on sequence will start. One SCHOTTKY diode is necessary between VGL and GND when VDD and VSP start at the same time.




**Note:** (1) Finish to write the GOA MUX (page1 registers) and GOA timing setting (page3 registers) within 50ms after reset pulls to high

**Figure 5.7: Power on sequence with PWRMD=1 and repair OP disable**

### 5.4.4 Power off sequence PWRMD=1 ➔ max. Power off time=4.5VS

When enter STB mode, the STBYB signal will be set to low then the power off sequence will start.

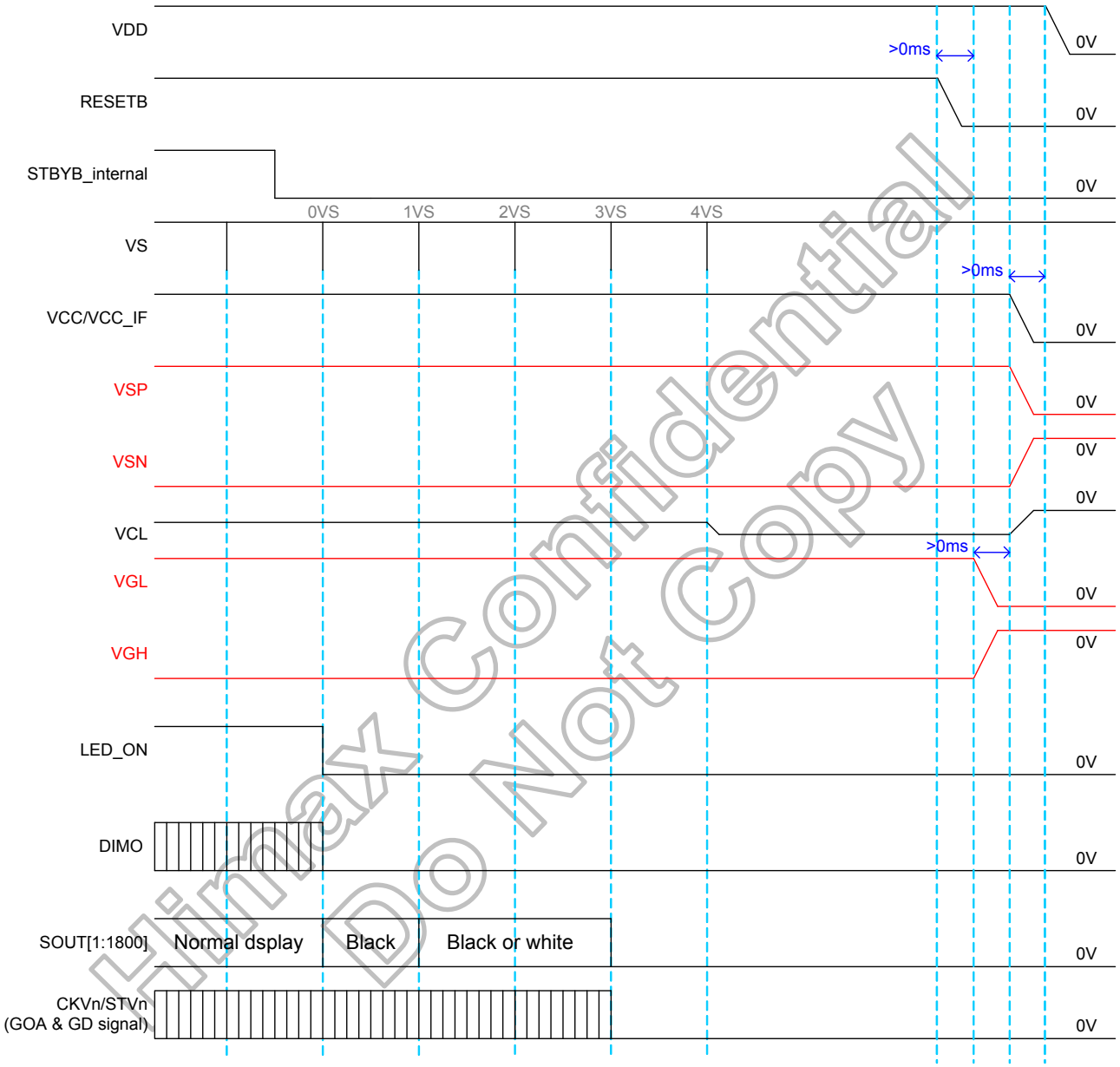



**Figure 5.8: Power off sequence with PWRMD=1**

# 6. Panel Application

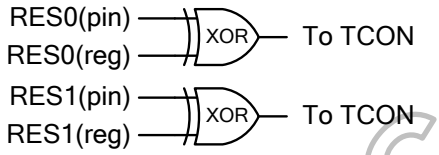
HX8279-D can support display resolution up to 1920 for vertical active line, and 1200RGB for horizontal active line. It also can support 2 type of driving method – Stripe and Zigzag. When horizontal display resolution is over 600RGB, the chip cascade mode must be used. A cascade connection can synchronize signals between 2 chips. We are called master and slave.

HX8279-D also can generate gate controller timing. These signals can support for general gate driver or GOA **(Gate driver on Array)**.

## 6.1 Display resolution

### 6.1.1 Display resolution configuration

Resolution selection can set by hardware or register. Hardware pin name is RES0 ~ RES1. Register address is locates 0xB3[1:0] at page0. The relationship between pin and register is shows below.

| Combination Logic | Formula | | |
|---|---|---|---|
|  | RES0(1)(PIN) | RES0(1)(REG) | RES0(1)(TCON) |
| | 0 | 0 | 0 |
| | 0 | 1 | 1 |
| | 1 | 0 | 1 |
| | 1 | 1 | 0 |

| TCON RES[1:0] | Resolution |
|---|---|
| 00 | 1200RGB x 1600 (default) |
| 01 | 1080RGB x 1920 |
| 10 | 600RGB x 1024 |
| 11 | 1200RGB x 1920 |

**Note:** (1) 600RGBx1024 only for one chip application.

**Table 6.1: Display resolution setting**

### 6.1.2 Source output channel valid range

The channel of available output depends on the horizontal resolution, and non-available channel always locate at centre channel numbers. The source output pin must be floating if don't used.

| Horizontal resolution | Master IC | | | Slave IC | | |
|---|---|---|---|---|---|---|
| | Enable channel | Disable channel | Enable channel | Enable channel | Disable channel | Enable channel |
| 1200 RGB | 1 - 900 | x | 901 - 1800 | 1 - 900 | x | 901 - 1800 |
| 1080 RGB | 1 - 810 | 811 - 990 | 991 - 1800 | 1 - 810 | 811 - 990 | 991 - 1800 |
| 600 RGB | 1 - 900 | x | 901 - 1800 | x | | |

**Note:** (1) 600RGB is only for one chip application.

**Table 6.2: Source output enable/disable channel for stripe panel**

Channel number 0, 1801 and 1802 is only for zigzag driving method.

| Horizontal resolution | Master IC | | | Slave IC | | |
|---|---|---|---|---|---|---|
| | Enable channel | Disable channel | Enable channel | Enable channel | Disable channel | Enable channel |
| 1200 RGB | 0 - 900 | x | 901 – 1800 | 0 - 900 | x | 901 – 1802 |
| 1080 RGB | 0 - 810 | 811- 990 | 991 – 1800 | 0 - 810 | 811 - 990 | 991 – 1802 |
| 600 RGB | 0 - 900 | x | 901 – 1802 | x | | |

**Note:** (1) 600RGB is only for one chip application.

**Table 6.3: Source output enable/disable channel for zigzag panel**

## 6.2 Cascade connection

### 6.2.1 Cascade mode of synchronized signals

Synchronized signal is for synchronization with master and slave. Others function is gate control signal. The gate timing can be for external gate driver. This gate control signals isn't support dual gate timing.

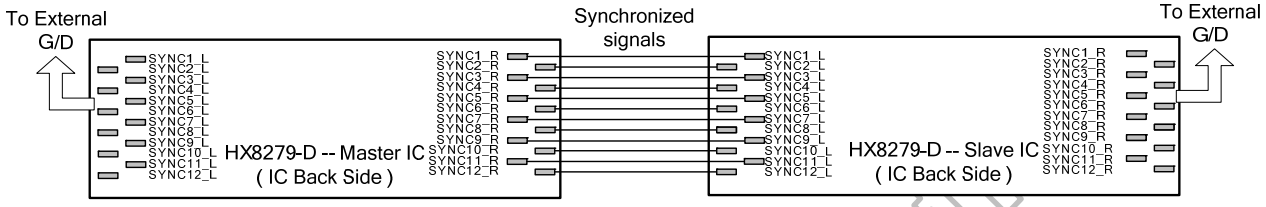



**Figure 6.1: Cascade mode of synchronized signals**

### 6.2.2 Synchronized signals of two chips cascade

| Name | I/O | Description of master | I/O | Description of slave |
|---|---|---|---|---|
| SYNC1_R | O | POL sync signal to Slave. | O | /XAO: Gate output all on. |
| SYNC2_R | O | GAS sync signal to Slave. | O | OE: Output enables control. |
| SYNC3_R | O | NO_MIPI sync signal to Slave / BIST sync signal to Slave. | O | UD: Shift direction control signal. |
| SYNC4_R | I | CABC sync signal from Slave / DPHY scan in. | O | CPV to external GD. |
| SYNC5_R | O | CABC sync signal to Slave | O | UD=0, STV output control signal. UD=1, This pin is Hi-z. |
| SYNC6_R | O | CABC sync signal to Slave / DPHY scan out. | O | UD=1, STV output control signal. UD=0, This pin is Hi-z. |
| SYNC7_R | I | CABC sync signal from Slave | O | - |
| SYNC8_R | I/O | No MIPI signal between master and Slave. | O | - |
| SYNC9_R | O | Internal sync signal | O | Internal sync signal |
| SYNC10_R | O | Internal sync signal | O | Internal sync signal |
| SYNC11_R | O | Internal sync signal | O | Internal sync signal |
| SYNC12_R | O | Internal sync signal | O | Internal sync signal |
| **Name** | **I/O** | **Description of master** | **I/O** | **Description of slave** |
| SYNC1_L | O | /XAO: Gate output all on. | I | POL sync signal from Master. |
| SYNC2_L | O | OE: Output enables control. | I | GAS sync signal from Master. |
| SYNC3_L | O | UDB: Shift direction control signal. **(UDB always is inversion of UD)** | I | NO_MIPI sync signal from Master / BIST sync signal from Master. |
| SYNC4_L | O | CPV to external GD. | O | CABC sync signal to Master / DPHY scan out. |
| SYNC5_L | O | UDB=1, STV output control signal. UDB=0, This pin is Hi-z. | I | CABC sync signal from Master |
| SYNC6_L | O | UDB=0, STV output control signal. UDB=1, This pin is Hi-z. | I | CABC sync signal from Master / DPHY scan in. |
| SYNC7_L | O | - | O | CABC sync signal to Master |
| SYNC8_L | O | - | I/O | No MIPI signal between master and Slave. |
| SYNC9_L | O | Internal sync signal | O | Internal sync signal |
| SYNC10_L | O | Internal sync signal | O | Internal sync signal |
| SYNC11_L | O | Internal sync signal | O | Internal sync signal |
| SYNC12_L | O | Internal sync signal | O | Internal sync signal |

**Table 6.4: Synchronized signals decryption with two chip cascade**

### 6.2.3 Synchronized signals of one chip application

The chip is used for one chip application. Both side of chip are synchronized signals.

| Name | I/O | Description of SYNC_R | I/O | Description of SYNC_L |
|---|---|---|---|---|
| SYNC1 | O | /XAO: Gate output all on. | O | /XAO: Gate output all on. |
| SYNC2 | O | OE: Output enables control. | O | OE: Output enables control. |
| SYNC3 | O | UD: Shift direction control signal. | O | UDB: Shift direction control signal. **(UDB always is inversion of UD)** |
| SYNC4 | O | CPV to external GD. | O | CPV to external GD. |
| SYNC5 | O | UD=H, This pin is Hi-z.<br>UD=L, STV output control signal. | O | UDB=H, STV output control signal.<br>UDB=L, This pin is Hi-z. |
| SYNC6 | O | UD=H, STV output control signal.<br>UD=L, This pin is Hi-z. | O | UDB=H, This pin is Hi-z.<br>UDB=L, STV output control signal. |
| SYNC7 | O | - | O | - |
| SYNC8 | O | - | O | - |
| SYNC9_L | O | - | O | - |
| SYNC10_L | O | - | O | - |
| SYNC11_L | O | - | O | - |
| SYNC12_L | O | - | O | - |

**Table 6.5: Synchronized signals description with one chip application**

## 6.3 GOA function

The HX8279-D can support GOA/GIP **(Gate driver on array)** function. The function enable can set by hardware or register. Hardware pin name is GOA_EN. Register address is locates 0xB8[7] at page0. The relationship between pin and register is shows below.

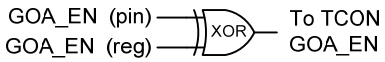
| Combination Logic | Truth table | | |
|---|---|---|---|
|  | **PIN** | **REG** | **To TCON** |
| | 0 | 0 | 0 |
| | 0 | 1 | 1 |
| | 1 | 0 | 1 **(Default)** |
| | 1 | 1 | 0 |

**Table 6.6: Truth table of GOA enable**

| SEL[5:0] | GOA Output |
|---|---|
| 0x00 | VGL |
| 0x01 | STV1 |
| 0x02 | STV2 |
| 0x03 | STV3 |
| 0x04 | STV4 |
| 0x05 | CKV1 |
| 0x06 | CKV2 |
| 0x07 | CKV3 |
| 0x08 | CKV4 |
| 0x09 | CKV5 |

| SEL[5:0] | GOA Output |
|---|---|
| 0x0A | CKV6 |
| 0x0B | CKV7 |
| 0x0C | CKV8 |
| 0x0D | CLR1 |
| 0x0E | CLR2 |
| 0x0F | CLR3 |
| 0x10 | CLR4 |
| 0x11 | FLC1 |
| 0x12 | FLC2 |
| 0x13 | GCKA |

| SEL[5:0] | GOA Output |
|---|---|
| 0x14 | GCKB |
| 0x15 | DIR |
| 0x16 | DIRB |
| 0x17 | STV5 |
| 0x18 | STV6 |
| 0x19 | STV7 |
| 0x1A | STV8 |
| 0x1B | CKV9 |
| 0x1C | CKV10 |
| 0x1D | CKV11 |

| SEL[5:0] | GOA Output |
|---|---|
| 0x1E | CKV12 |
| 0x1F | CKV13 |
| 0x20 | CKV14 |
| 0x21 | CKV15 |
| 0x22 | CKV16 |
| 0x23 | FLC1B |
| 0x24 | FLC2B |
| Others | VGH |

**Table 6.7: GOA pin mapping table**

## 6.4 Panel structure

### 6.4.1 Driving method for panel structure

HX8279-D can support 2 types of driving method – stripe and zigzag. The normal application is stripe. However for special case will be used zigzag. The number 0, 1801 and 1802 of source output channel is for zigzag.

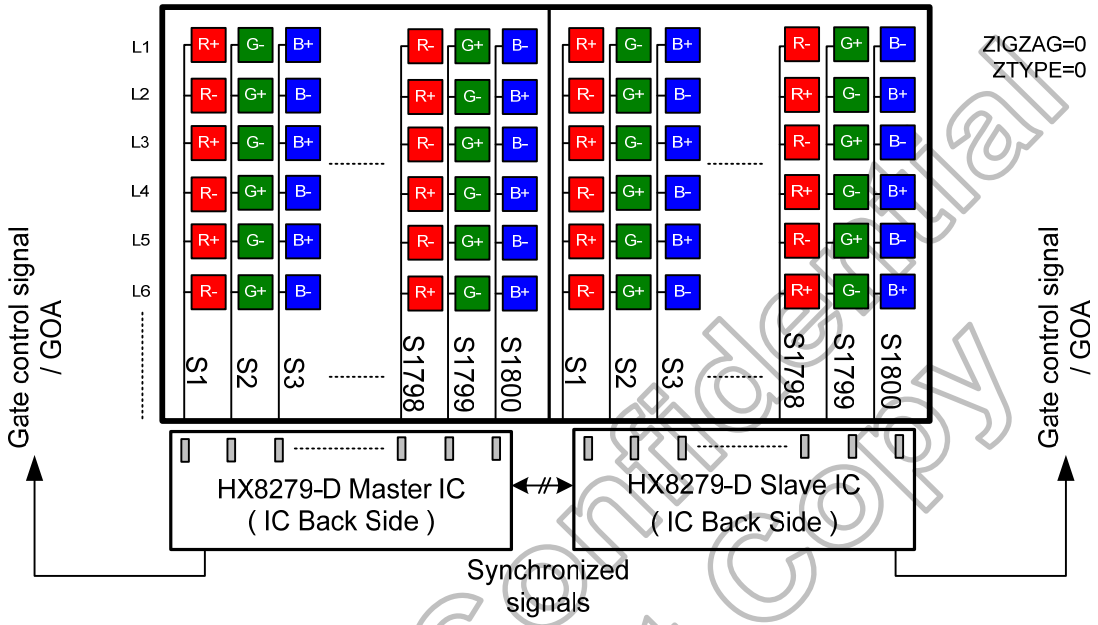
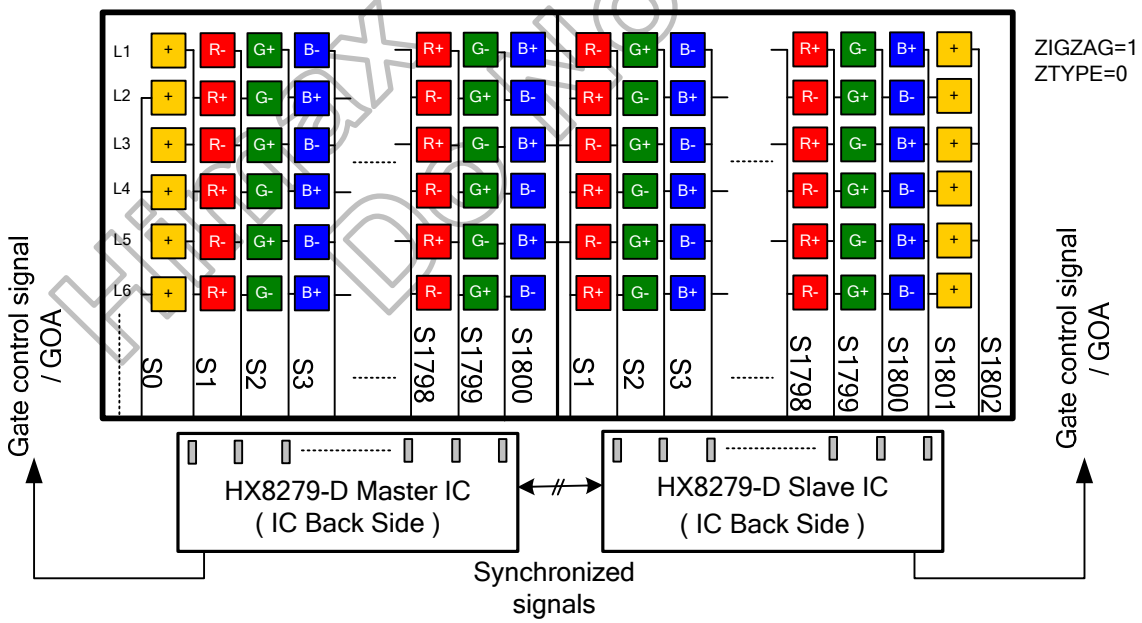
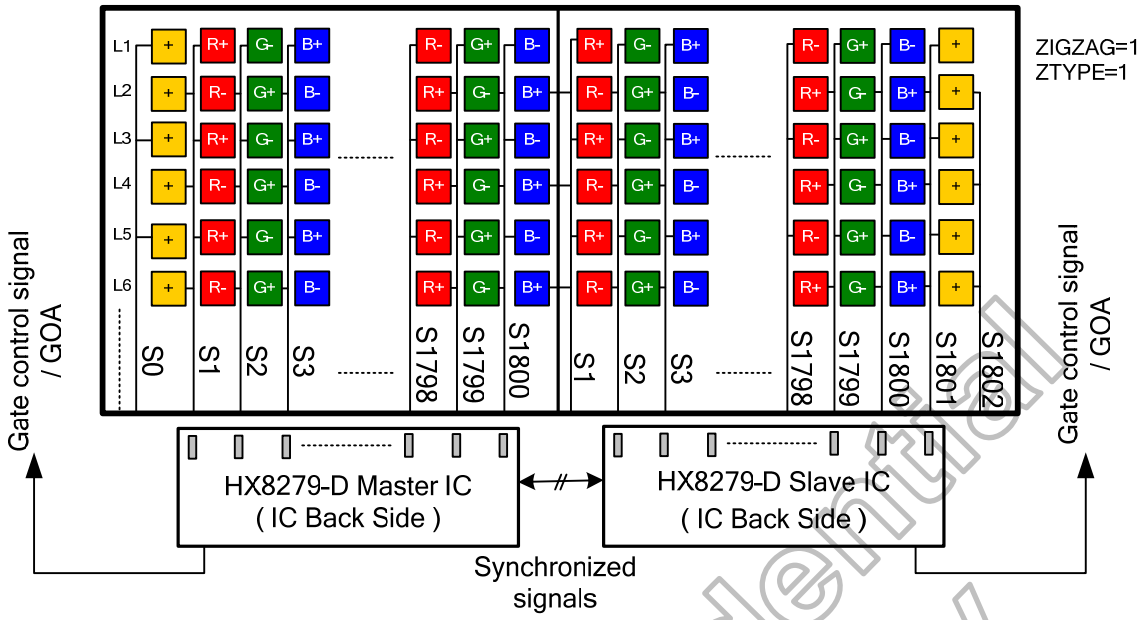



**Figure 6.2: 1200RGBx1600 stripe driving method**




**Note:** (1) Dummy data is setting by ZDATA[7:0] of register(reg page0 0xB5).
(2) Ztype is "0", the zigzag type is 0.

**Figure 6.3: 1200RGBx1600 zigzag type0 driving method**




**Note:** (1) Dummy data is setting by ZDATA[7:0] of register(reg page0 0xB5).
(2) Ztype is "1", the zigzag type is 1.

**Figure 6.4: 1200RGBx1600 zigzag type1 driving method**

# 7. MIPI Interface

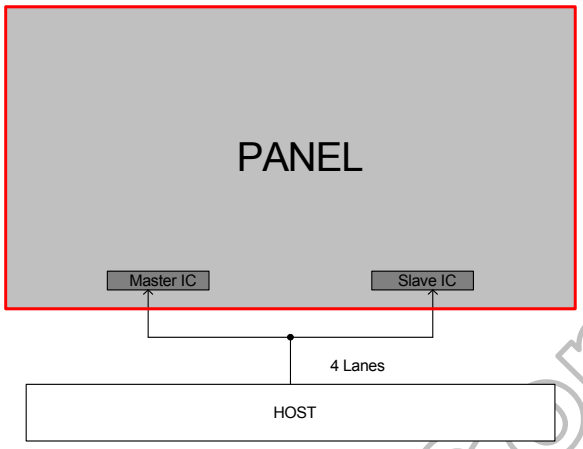
HX8279-D supports 2 types MIPI:

- Multi-Drop type, support 2 Lanes and 4 Lanes only.
- Left/right type, support 2+2 Lanes and 4+4 Lanes only.

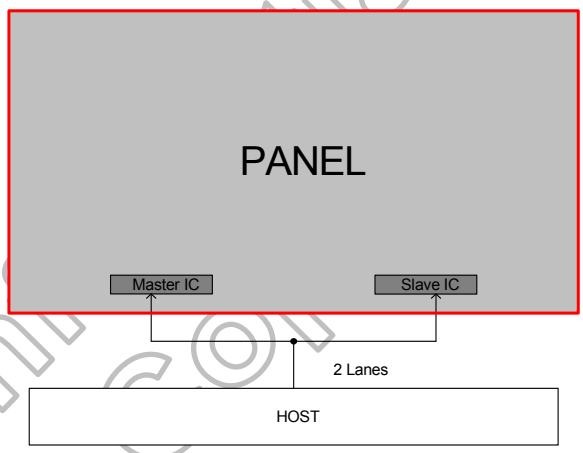
## 7.1 MIPI total bandwidth and maximal operation frequency

The maximum operation frequency per lane = 1Gbps.

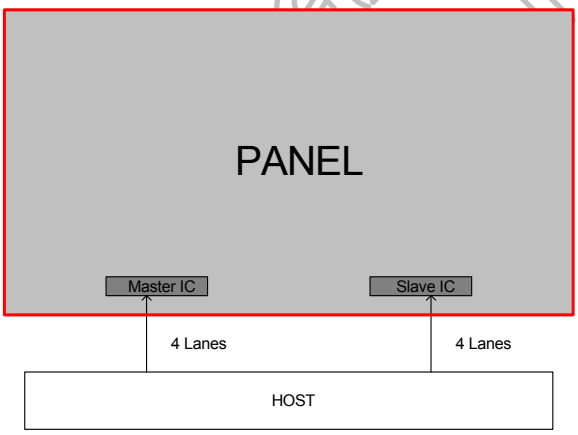
Multi-Drop MIPI (4 Lanes) :



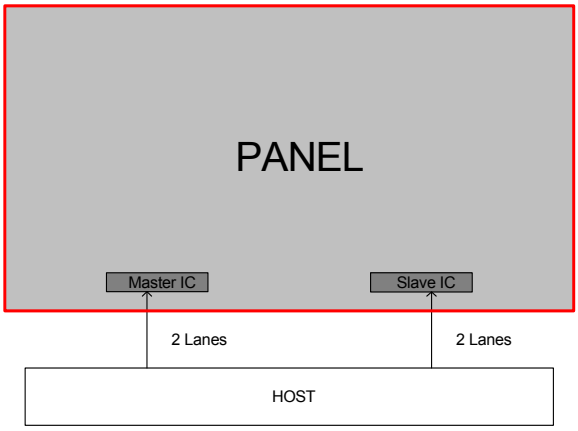

Multi-Drop MIPI (2 Lanes) :




Left / Right MIPI (4 Lanes) :

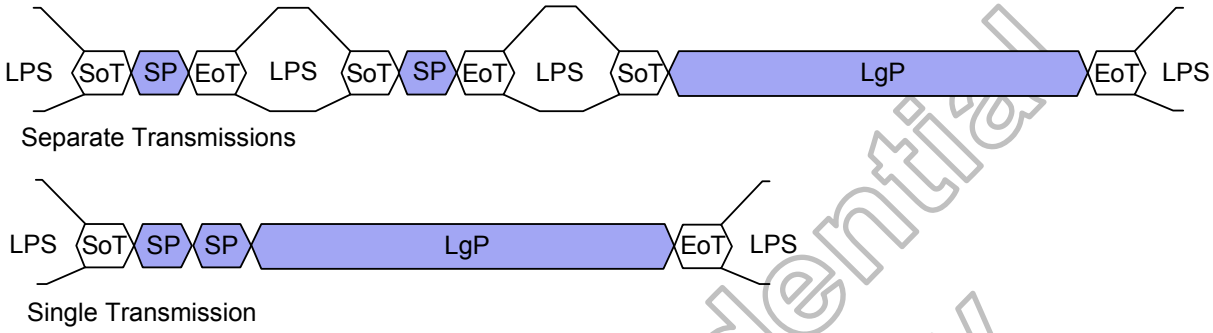



Left / Right MIPI (2 Lanes) :



## 7.2 DSI protocol

The protocol layer appends packet-protocol information and headers. The receiver side of a DSI Link performs the converse of the transmitter side, decomposing the packet into parallel data, signal events and commands. The DSI protocol permits multiple packets which is useful for events such as peripheral initialization, where many registers may be loaded separate write commands at system startup. Below figure is illustrates multiple HS Transmission packets.

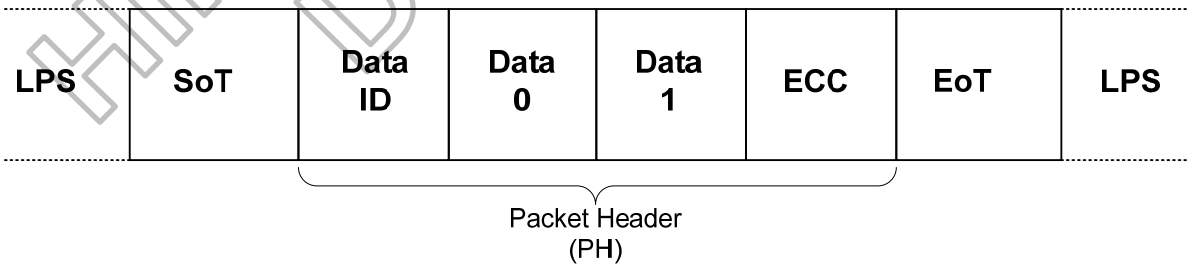



**Note:** (1) LPS: Low Power State;
SoT: Start of Transmission
SP: Short Packet
LgP: Long Packet
EoT: End of Transmission

**Figure 7.1: Multiple packets transmission**

The packet includes two types which are Long packet and Short packet. The first byte of the packet, the Data Identifier **(DI)**, includes information specifying the type of the packet. Command Mode systems send commands and an associated set of parameters, with the number of parameters depending on the command type.

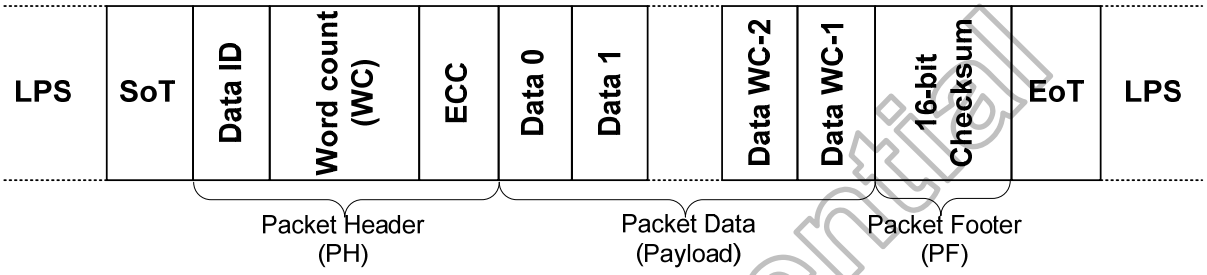
***Short packets*** are four bytes in length including the ECC. Short packet is used for most Command Mode commands and associated parameters. Where Short packets format include an 8-bit Data ID followed by two command or data bytes and an 8-bit ECC. Below figure is shows the structure of the Short packet.




**Note:** (1) DI **(Data ID)**: Contain Virtual Channel Identifier and Data Type.
ECC **(Error Correction Code)**: The Error Correction Code allows single-bit errors to be corrected and 2-bit errors to be detected in the Short Packet.

**Figure 7.2: Structure of the short packet**

***Long packets*** specify the payload length using a two-byte Word Count Field and then the payload maybe from 0 to 65,535 bytes in length. Thus Long packets permit transmission of large blocks of pixel or other data. Figure 7.3 shows the structure of the Long packet. Long Packet Header composed of three elements: an 8-bit Data Identifier, a 16-bit Word Count, and 8-bit ECC. An application-specific Data Payload has Word Count * bytes following the Packet Header. The Packet Footer has one element, a 16-bit checksum. Long packets can be from 6 to 65,541 bytes in length. Where 65,541 bytes = 4 bytes PH + ($2^{16}$-1) bytes Payload + 2 bytes PF




**Note:** (1) DI **(Data ID)**: Contain Virtual Channel Identifier and Data Type.
WC **(Word Count)**: The receiver uses WC to determine the packet end.
ECC **(Error Correction Code)**: The Error Correction Code allows single-bit errors to be corrected and 2-bit errors to be detected in the Packet Header.
PF **(Packet Footer)**: Mean 16-bit Checksum.

**Figure 7.3: Structure of the long packet**

According to packet form, basic elements include DI and ECC. Below Table is shows format of Data ID.

| DI7 | DI6 | DI5 | DI4 | DI3 | DI2 | DI1 | DI0 |
|---|---|---|---|---|---|---|---|
| VC **(Virtual Channel)** | | DT **(Data Type)** | | | | | |

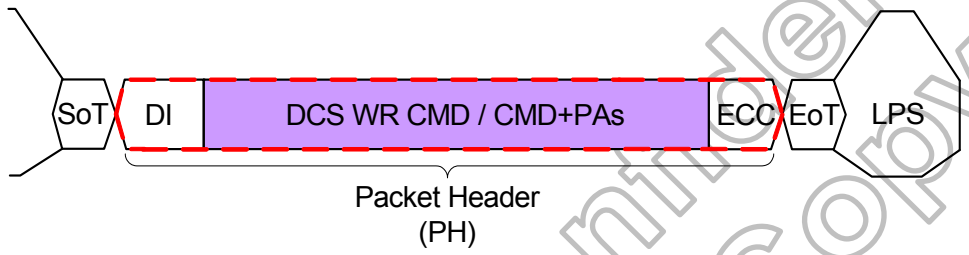
**Note:** (1) DI[7:6]→These two bits identify the data as directed to one of four virtual channels.
DI[5:0]→These six bits specify the Data Type, which specifies the size, format, and in some case, the interpretation of the packet contents.

**Table 7.1: Format of data ID**

Due to Data Type **(DT)** mean format of transmission type. Below Figure 7.5 is shows short / long-packet transmission command sequence. Long packet writes command / parameters / pixel Data


**Note:** (1) DI: Write suitable Data type.
WC: Write number of Payload Data.
Ex: One CMD write, WC setting as 1.
CMD+PAs write, WC setting as number of **(CMD+PAs)**.
CMD+DATA write, WC setting as number of **(CMD+Pixel DATA)**.

**Figure 7.4: Long packet writes command / parameters**




**Note:** (1) D I: Write suitable Data type.
Ex: One CMD write, DI+DCS WR CMD
CMD+PAs write, DI+DCS WR CMD+PAs.

**Figure 7.5: Show short-packet / long-packet transmission command sequence**

## 7.3 Processor to peripheral (forward direction) packets data types

The set of transaction types sent from the host processor to a peripheral, such as a display module, are shown in Table 6.2 Data Types for Processor-sourced Packets.

| Data type (Hex) | Data type (Binary) | Description packet | Size |
|---|---|---|---|
| 01h | 00_0001 | Sync Event, V Sync Start | Short |
| 11h | 01_0001 | Sync Event, V Sync End | Short |
| 21h | 10_0001 | Sync Event, H Sync Start | Short |
| 31h | 11_0001 | Sync Event, H Sync End | Short |
| 08h | 00_1000 | End of Transmission packet **(EoTp)** | Short |
| 22h | 10_0010 | Shut Down Peripheral Command | Short |
| 32h | 11_0010 | Turn On Peripheral Command | Short |
| 03h | 00_0011 | Generic Short WRITE, no parameter | Short |
| 13h | 01_0011 | Generic Short WRITE, 1 parameter | Short |
| 23h | 10_0011 | Generic Short WRITE, 2 parameter | Short |
| 04h | 00_0100 | Generic READ, no parameter | Short |
| 14h | 01_0100 | Generic READ, 1 parameter | Short |
| 24h | 10_0100 | Generic READ, 2 parameter | Short |
| 05h | 00_0101 | DCS Short WRITE, no parameter | Short |
| 15h | 01_0101 | DCS Short WRITE, 1 parameter | Short |
| 06h | 00_0110 | DCS READ, no parameters | Short |
| 37h | 11_0111 | Set Maximum Return Packet Size | Short |
| 09h | 00_1001 | Null Packet, no data | Long |
| 19h | 01_1001 | Blanking Packet, no data | Long |
| 29h | 10_1001 | Generic Long Write | Long |
| 39h | 11_1001 | DCS Long Write/write_LUT Command Packet | Long |
| 0Eh | 00_1110 | Packed Pixel Stream, 16-bit RGB, 5-6-5 Format | Long |
| 1Eh | 01_1110 | Packed Pixel Stream, 18-bit RGB, 6-6-6 Format | Long |
| 2Eh | 10_1110 | Loosely Packed Pixel Stream, 18-bit RGB, 6-6-6 Format | Long |
| 3Eh | 11_1110 | Packed Pixel Stream, 24-bit RGB, 8-8-8 Format | Long |
| x0h and xFh, unspecified | xx_0000<br>xx_1111 | DO NOT USE<br>All unspecified codes are reserved | - |

**Table 7.2: Data types for processor-sourced packets**

Under tables list all detail function of all data types

| **Sync event (H start, H end, V start, V end), data type=xx 0001 (x1h)** | | |
|---|---|---|
| **Data type (Hex)** | **Function description** | **Number of byte** |
| 01h | V Sync start, Start of VSA pulse. | 4 bytes **(DI+00h+00h+ECC)** |
| 11h | V Sync End, End of VSA pulse. | |
| 21h | H Sync Start, Start of HSA pulse. | |
| 31h | H Sync End, End of HSA pulse. | |

**Note:** (1) V Sync Start and V Sync End event represents the start and end of the VSA, respectively. Similarly H Sync Start and H Sync End event represents the start and end of the HSA, respectively.

| **End of Transmission packet (EoT)** | | |
|---|---|---|
| **Data type (Hex)** | **Function description** | **Number of byte** |
| 08h | End of Transmission packet **(EoTp)**. | 4 bytes **(DI+00h+00h+ECC)** |

| **Display status (shutdown command, turn-on command)** | | |
|---|---|---|
| **Data type (Hex)** | **Function description** | **Number of byte** |
| 22h | Shutdown Peripheral command that turns off the display in a Video Mode display for power saving. | 4 bytes **(DI+00h+00h+ECC)** |
| 32h | Turn On Peripheral command that turns on the display in Video Mode display for normal display. | |

**Note:** (1) When use shutdown command; interface shall remain powered in order to receive the turn-on, or wake-up, command.

| **Generic Short WRITE Packet with 0,1,2 parameter** | | |
|---|---|---|
| **Data type (Hex)** | **Function description** | **Number of byte** |
| 03h | Generic Short WRITE, no parameter. | **(DI+00h+00h+ECC)** |
| 13h | Generic Short WRITE, 1 parameter. | **(DI+P1+00h+ECC)** |
| 23h | Generic Short WRITE, 2 parameter. | **(DI+P1+P2+ECC)** |

**Note:** (1) P1=parameter1, P2=parameter2

| **Generic READ Request with 0,1,2 parameter** | | |
|---|---|---|
| **Data type (Hex)** | **Function description** | **Number of byte** |
| 04h | Generic READ no parameter. | **(DI+00h+00h+ECC)** |
| 14h | Generic READ 1 parameter. | **(DI+P1+00h+ECC)** |
| 24h | Generic READ 2 parameter. | **(DI+P1+P2+ECC)** |

**Note:** (1) P1=parameter1, P2=parameter2

| **DCS Show WRITE Command with 0,1 parameter** | | |
|---|---|---|
| **Data type (Hex)** | **Function description** | **Number of byte** |
| 05h | DCS Short WRITE, no parameter. | **(DI+DCS+00h+ECC)** |
| 15h | DCS Short WRITE, 1 parameter. | **(DI+DCS+P1+ECC)** |

**Note:** (1) P1=parameter1, DCS=DCS Command

| DCS command setting | | |
|---|---|---|
| **Data type (Hex)** | **Function description** | **Number of bytes** |
| 06h | DCS Read command, the returned data may be of Short or Long packet format. | 4 bytes **(DI+DCS CMD+00h+ECC)** |
| 39h | DCS Long Write/ Write _ LUT Command is used to send larger blocks of data to a display module that implements the Display Command Set. | Up to 65541 bytes **(DI+WC+ECC+DCS CMD +Payload DATA+PF)** |

**Note:** (1) For write part, If DCS Short Write command is followed by BTA, the peripheral shall respond with ACK when no error was detected in the transmission **(Host → Slave)**. Unless an error was detected, the peripheral shall respond with Acknowledge with Error Report.

(2) When use DCS Read Command, the Set Max Return Packet Size command will limit the size of returning packets.

(3) The peripheral shall respond to DCS Read Command Request in one of the following ways:

- If an error was detected and corrected in Packet Header field by the peripheral, it shall send *Acknowledge with Error Report*. So the peripheral shall transmit the requested READ data packet with suitable ECC in the same transmission.
- If no error was detected by the peripheral, it shall send the requested READ packet **(Short or Long)** with appropriate ECC and Checksum, if either or both features are enabled.

(4) One byte <= Length of payload DATA <= $2^{16}$-1

| Return packet size setting | | |
|---|---|---|
| **Data type (Hex)** | **Function description** | **Number of bytes** |
| 37h | Set Maximum Return Packet Size that specifies the maximum size of the payload in a Long packet transmitted from peripheral back to the host processor. | 4 bytes **(DI+Maximum Return Packet Size+ECC)** |

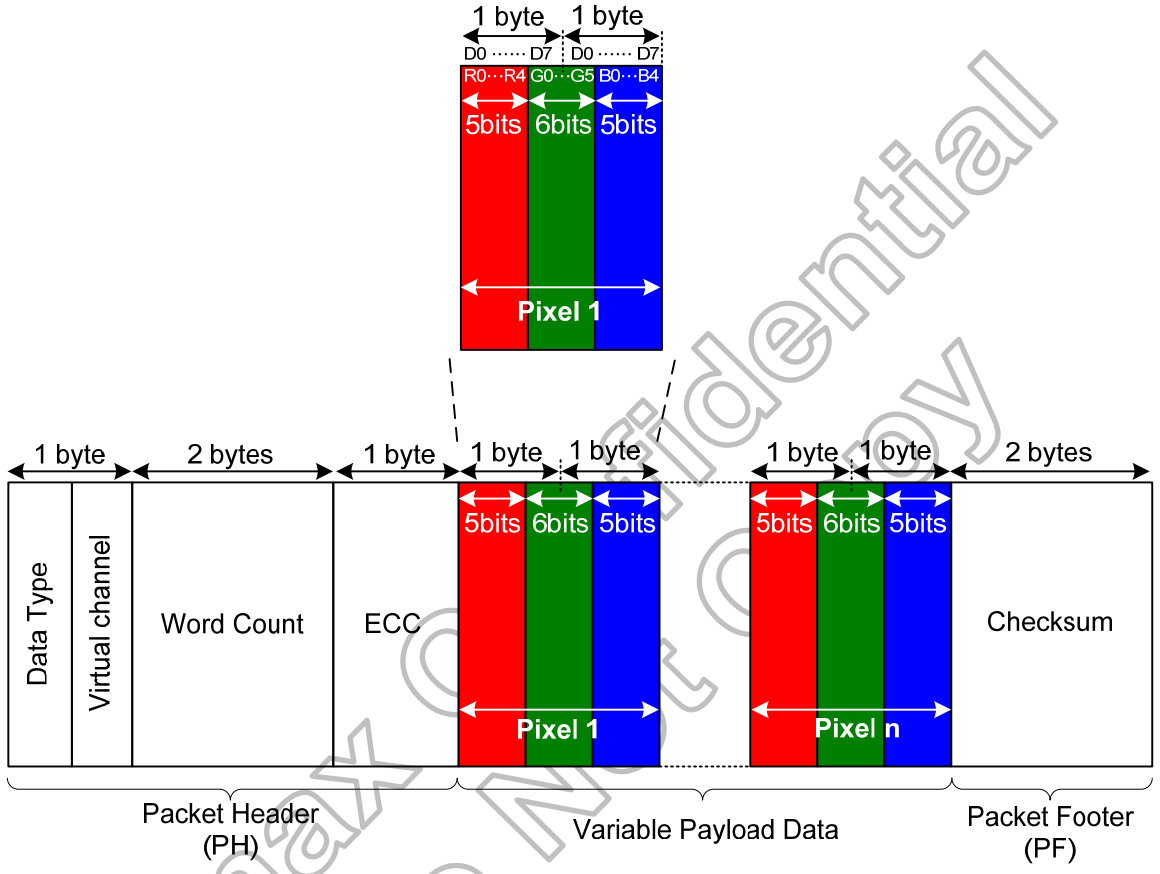
**Note:** (1) The two-byte value is transmitted with LS byte first. And during a power-on or Reset sequence, the Maximum Return Packet Size shall be set by the peripheral to a default value of one.

| Variable data packet | | |
|---|---|---|
| **Data type (Hex)** | **Function description** | **Number of bytes** |
| 09h | Null Packet is a mechanism for keeping the serial Data Lane**(s)** in High-Speed mode while sending dummy data. | Up to 65541 bytes **(DI+WC+ECC+DCS CMD+Payload DATA +PF)** |
| 19h | Blanking packet is used to convey blanking timing information in a Long packet. | |

**Note:** (1) When Null Packet, the Payload Data belong “null” Data, actual data values sent are irrelevant because the peripheral does not capture or store the data.

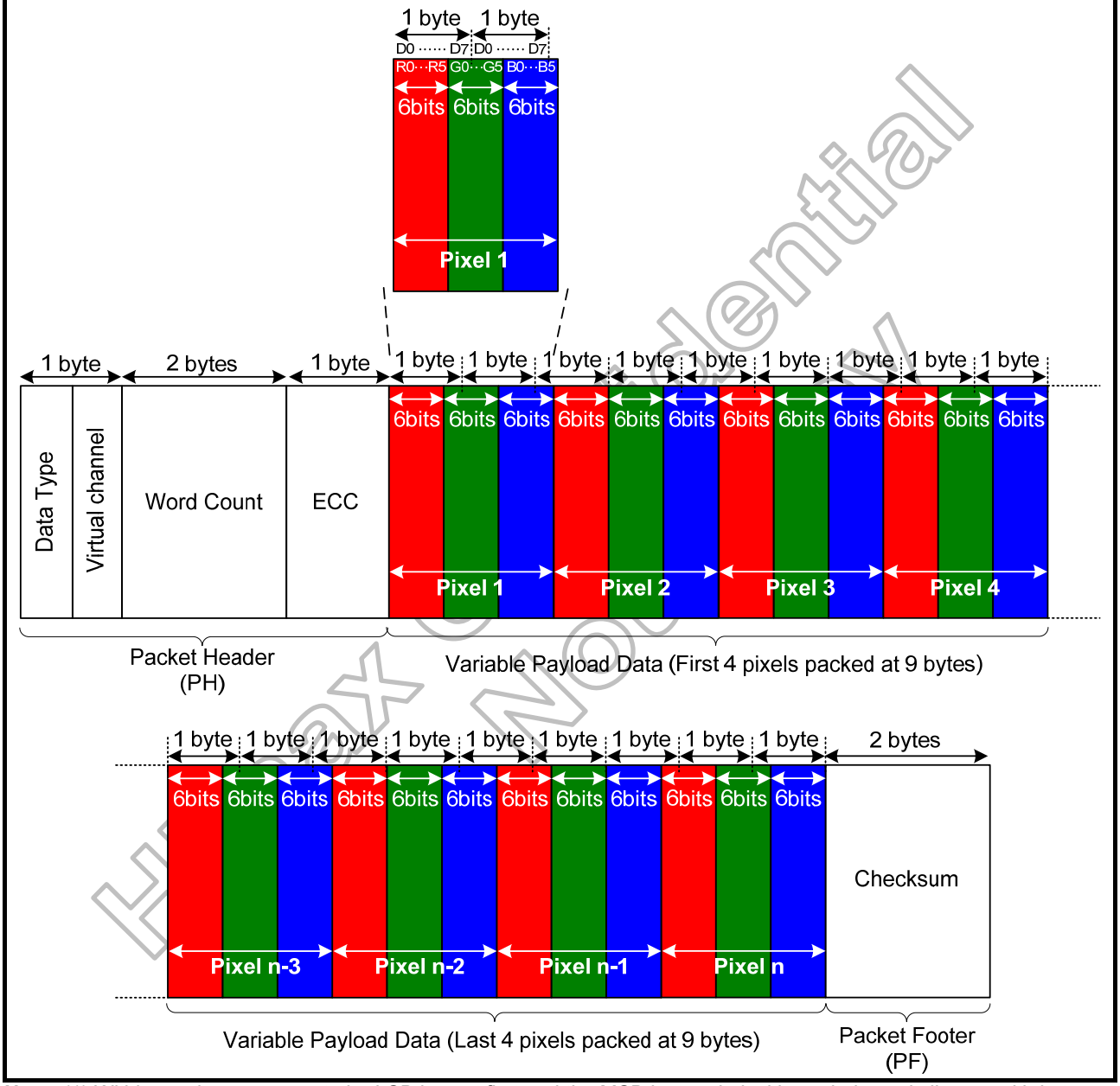
(2) When Blanking packet, the packet represents a period between active scan lines of a Video Mode display.

| Data stream format – 16bit Format | | |
|---|---|---|
| **Data type (Hex)** | **Function description** | **Number of bytes** |
| 0Eh | Packed Pixel Stream 16-Bit Format is used to transmit image data formatted as 16-bit pixels to a Video Mode display module. Pixel format is "**(5-bit)** red, **(6-bit)** green and **(5-bit)** blue". | Up to 65541 bytes **(DI+WC+ECC+DCS CMD+Payload DATA+ PF)** |



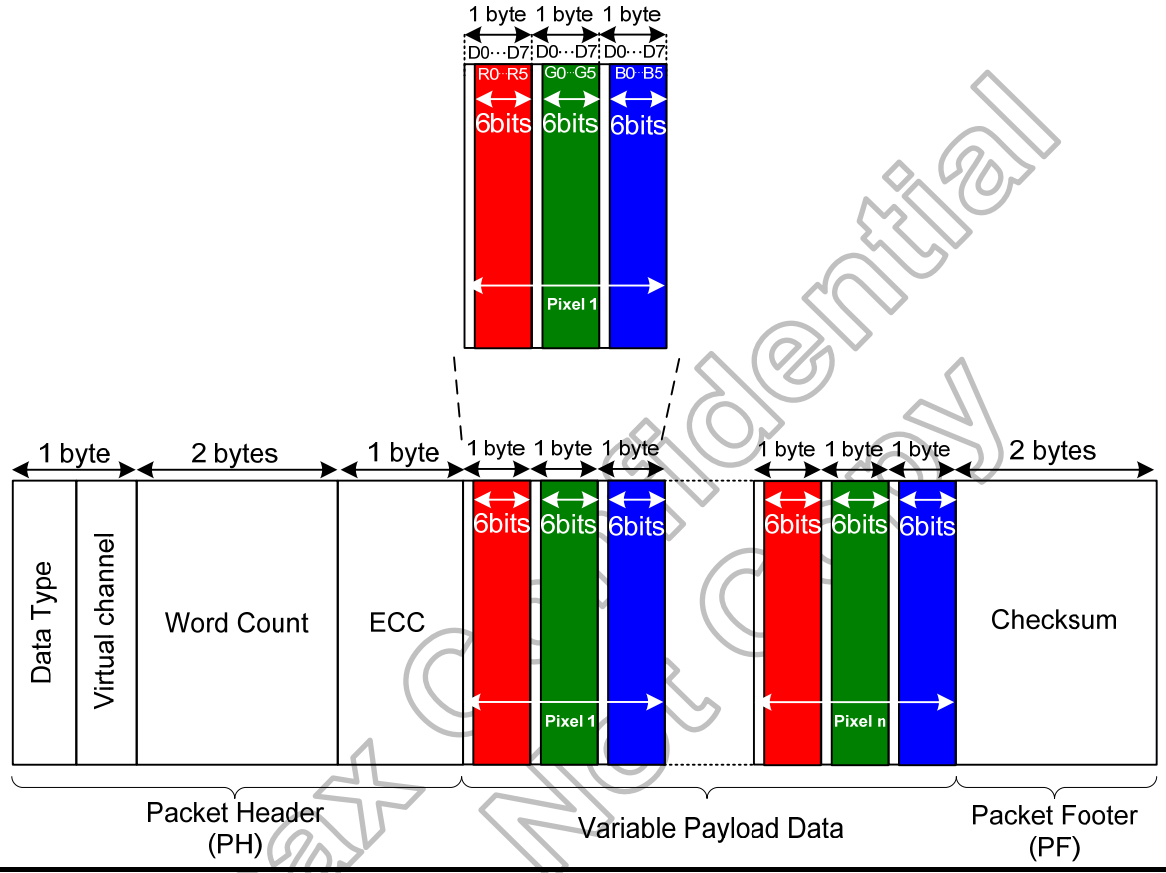

**Note:** (1) Within a color component, the "LSB is sent first, the MSB last ".

| Data stream format – 18bit Format | | |
|---|---|---|
| **Data type (Hex)** | **Function description** | **Number of bytes** |
| 1Eh | Packed Pixel Stream 18-Bit Format is used to transmit image data formatted as 18-bit pixels to a Video Mode display module. Pixel format is "**(6-bit)** red, **(6-bit)** green and **(6-bit)** blue". | Up to 65541 bytes **(DI+WC+ECC+DCS CMD+Payload DATA+PF)** |



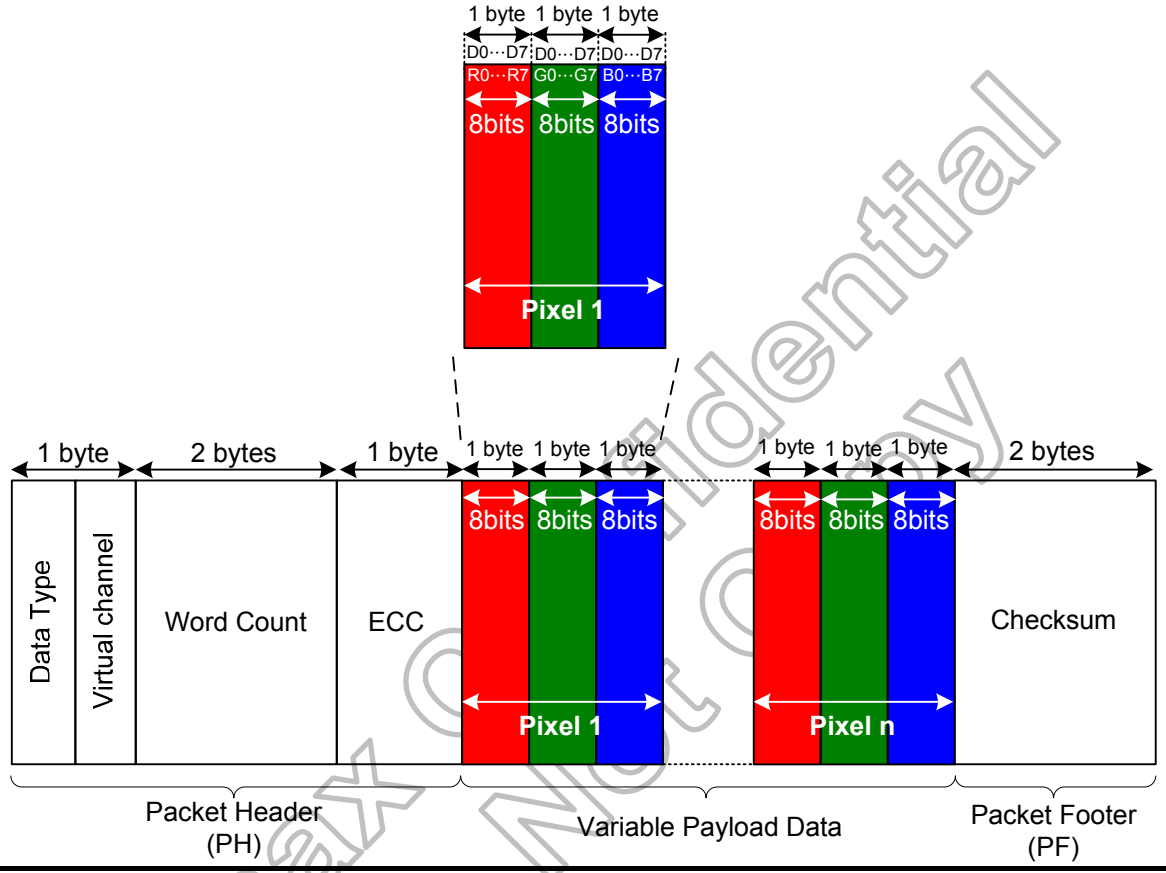

**Note:** (1) Within a color component, the LSB is sent first and the MSB last and pixel boundaries only line up with byte boundaries every four pixels **(nine bytes)**. Preferably, display modules employing this format have a horizontal extent **(width in pixels)** evenly divisible by four, so no partial bytes remain at the end of the display line data. It is possible to send pixel data that represent a line width that is not a multiple of four pixels, but display logic on the receiver end shall dispose of the extra bits of the partial byte at the end of active display and ensure a "clean start" for the next line.

| Data stream format – 18bit Format | | |
|---|---|---|
| **Data type (Hex)** | **Function description** | **Number of bytes** |
| 2Eh | Packed Pixel Stream 18-Bit Format, each R, G, or B color component is one byte form, but the valid pixel bits occupy bits [7:2] and bits [1:0] of are ignored. Pixel format is "**(6-bit)** red, **(6-bit)** green and **(6-bit)** blue". | Up to 65541 bytes **(DI+WC+ECC+DCS CMD+Payload DATA+PF)** |




**Note:** (1) Within a color component, the LSB is sent first, the MSB last and with this format, pixel boundaries line up with byte boundaries every three bytes.

| Data stream forma – 24bit Format | | |
|---|---|---|
| **Data Type (Hex)** | **Function Description** | **Number of bytes** |
| 3Eh | Packed Pixel Stream 24-Bit Format is used to transmit image data formatted as 24-bit pixels to a Video Mode display module. Pixel format is **(8-bit)** red, **(8-bit)** green and **(8-bit)** blue. | Up to 65541 bytes **(DI+WC+ECC+DCS CMD +Payload DATA+PF)** |

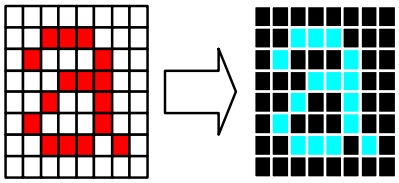



**Note:** (1) Within a color component, the LSB is sent first, the MSB last and with this format, pixel boundaries line up with byte boundaries every three bytes.

## 7.4 Display command set (DCS)

| Command | Hex | Description | Number of Parameters |
|---|---|---|---|
| Enter invert mode | 21h | Displayed image colors are inverted. | 0 |
| Enter sleep mode | 10h | Power for the display panel is off. | 0 |
| Exit invert mode | 20h | Displayed image colors are not inverted. | 0 |
| Exit sleep mode | 11h | Power for the display panel is on. | 0 |
| Get display mode | 0Dh | Get the current display mode from the peripheral. | 1 |
| Get power mode | 0Ah | Get the current power mode. | 1 |
| Get signal mode | 0Eh | Get display module signaling mode. | 1 |
| Nop | 00h | No operation. | 0 |
| Set address mode | 36h | Set the data order for transfers from the host to the display module and from the frame memory to the display device. | 1 |
| Set display off | 28h | Blanks the display device. | 0 |
| Set display on | 29h | Show the image on the display device. | 0 |
| Set tear off | 34h | Synchronization information is not sent from the display module to the host processor. | 0 |
| Set tear on | 35h | Synchronization information is sent from the display module to the host processor at the start of VFP | 1 |
| Set tear scan line | 44h | Synchronization information is sent from the display module to the host processor when the display device refresh reaches the provided scan line. | 2 |
| Soft reset | 01h | Software Reset. | 0 |

### 7.4.1 Enter_invert_mode (21h)

| 21H | Enter_invert_mode (Display Inversion On)→INVON | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Direction | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |
| Command | H→D | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 21 |
| Parameter | NO PARAMETER | | | | | | | | | |
| Description | This command is used to enter into display inversion mode. This command makes no change of contents of frame memory. Every bit is inverted from the frame memory to the display. This command does not change any other status.<br>(Example)<br>memory display<br>  | | | | | | | | | |
| Restriction | This command has no effect when module is already in inversion no mode. | | | | | | | | | |

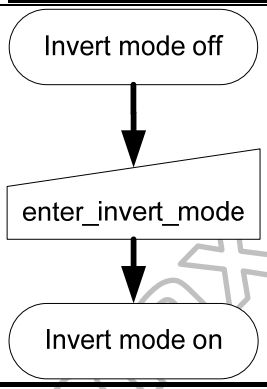
Register Availability

| Status | Availability |
|---|---|
| Sleep Out | Yes |
| Sleep In | Yes |

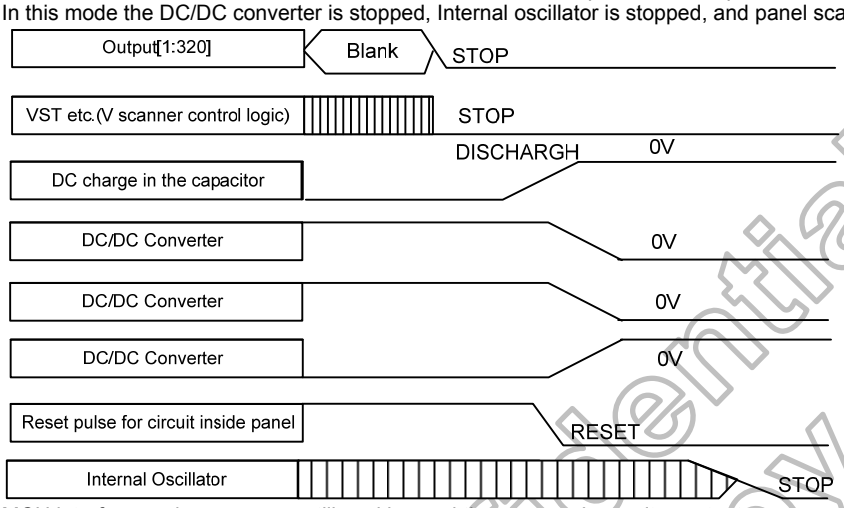
Default

| Status | Default Value |
|---|---|
| Power On Sequence | Display Inversion Off |
| S/W Reset | Display Inversion Off |
| H/W Reset | Display Inversion Off |

Flow Chart



### 7.4.2 Enter_sleep_mode (10h)

| 10H | Enter_sleep_mode (Sleep In)→SLPIN | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Direction | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |
| Command | H→D | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 10 |
| Parameter | NO PARAMETER | | | | | | | | | |
| Description | This command causes the LCD module to enter the minimum power consumption mode.<br>In this mode the DC/DC converter is stopped, Internal oscillator is stopped, and panel scanning is stopped.<br>  <br>MCU interface and memory are still working and the memory keeps its contents. | | | | | | | | | |
| Restriction | This command has no effect when module is already in sleep in mode. Sleep In Mode can only be left by the Sleep Out Command **(11h)**. It will be necessary to wait 5msec before sending next command; this is to allow time for the supply voltages and clock circuits to stabilize. It will be necessary to wait 120msec after sending Sleep Out command **(when in Sleep In Mode)** before Sleep In command can be sent. | | | | | | | | | |

Register Availability

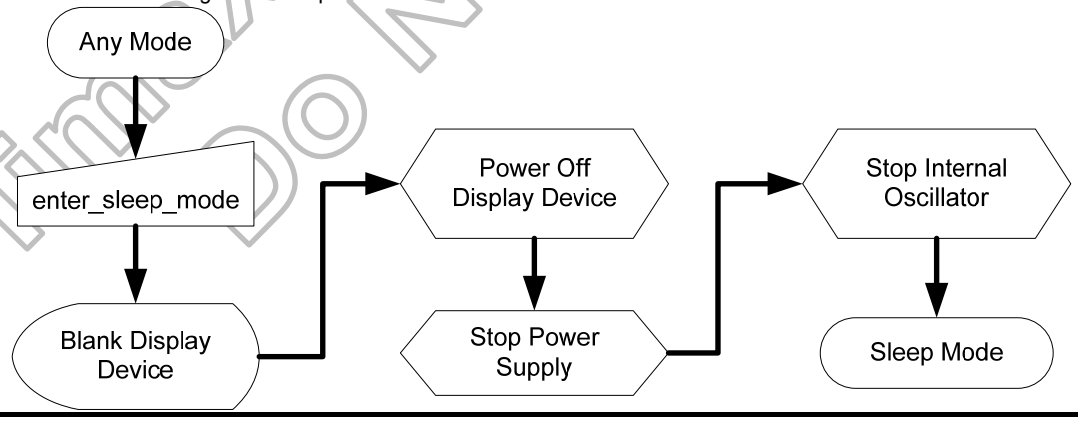
| Status | Availability |
|---|---|
| Sleep Out | Yes |
| Sleep In | Yes |

Default

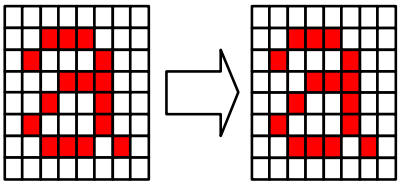
| Status | Default Value |
|---|---|
| Power On Sequence | Sleep In Mode |
| S/W Reset | Sleep In Mode |
| H/W Reset | Sleep In Mode |

Flowchart

It takes 120msec to get into Sleep In mode after SLPIN command issued.



### 7.4.3 Exit_invert_mode (20h)

| 20H | Exit_invert_mode (Display Inversion Off)→INVOFF | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Direction | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |
| Command | H→D | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 20 |
| Parameter | NO PARAMETER | | | | | | | | | |
| Description | This command is used to recover from display inversion mode.<br>This command makes no change of contents of frame memory.<br>This command does not change any other status.<br>(Example)<br>memory display  | | | | | | | | | |
| Restriction | This command has no effect when module is already in inversion off mode. | | | | | | | | | |

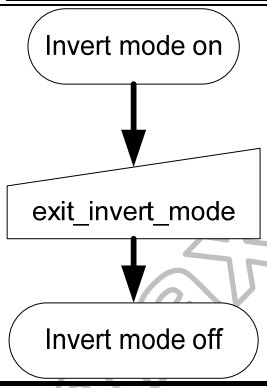
Register Availability

| Status | Availability |
|---|---|
| Sleep Out | Yes |
| Sleep In | Yes |

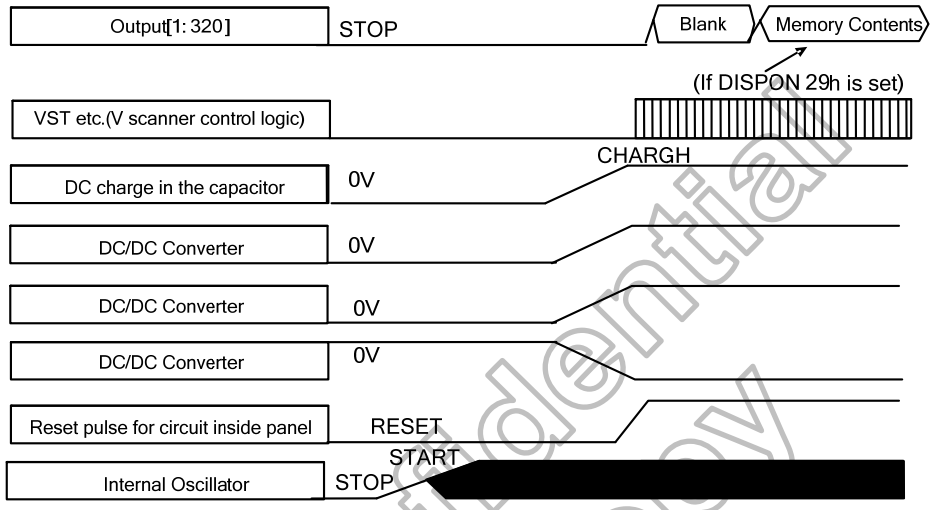
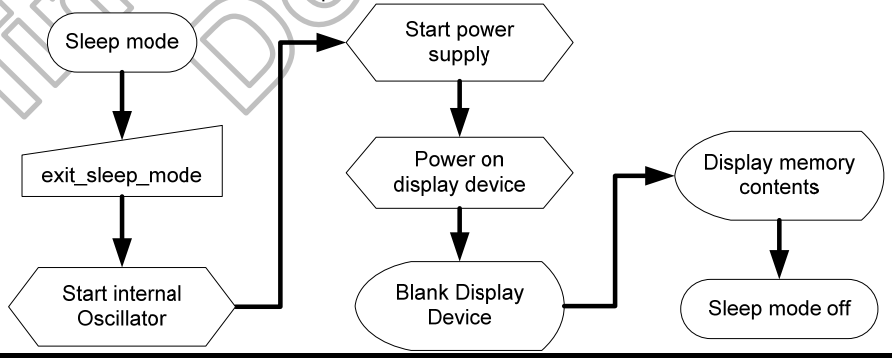
Default

| Status | Default Value |
|---|---|
| Power On Sequence | Display Inversion Off |
| S/W Reset | Display Inversion Off |
| H/W Reset | Display Inversion Off |

Flow Chart



### 7.4.4 Exit_sleep_mode (11h)

| 11H | Exit_sleep_mode (Sleep Out)→SLPOUT | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Direction | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |
| Command | H→D | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 11 |
| Parameter | NO PARAMETER | | | | | | | | | |
| Description | This command turns off sleep mode. In this mode the DC/DC converter is enabled, Internal oscillator is started, and panel scanning is started.   | | | | | | | | | |
| Restriction | This command has no effect when module is already in sleep out mode. Sleep Out Mode can only be left by the Sleep In Command (10h). It will be necessary to wait 5msec before sending next command; this is to allow time for the supply voltages and clock circuits to stabilize. The display module loads all display supplier's factory default values to the registers during this 5msec and there cannot be any abnormal visual effect on the display image if factory default and register values are same when this load is done and when the display module is already Sleep Out –mode. The display module is doing self-diagnostic functions during this 5msec. It will be necessary to wait 120msec after sending Sleep In command (when in Sleep Out mode) before Sleep Out command can be sent. | | | | | | | | | |
| Register Availability | Status: Sleep Out → Availability: Yes<br>Status: Sleep In → Availability: Yes | | | | | | | | | |
| Default | Status: Power On Sequence → Default Value: Sleep In Mode<br>Status: S/W Reset → Default Value: Sleep In Mode<br>Status: H/W Reset → Default Value: Sleep In Mode | | | | | | | | | |
| Flow Chart | It takes 120msec to become Sleep Out mode after SLPOUT command issued.   | | | | | | | | | |

### 7.4.5 Get_display_mode (0Dh)

| 0DH | Get_display_mode (Read Display Image Mode)→RDDIM | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Direction | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |
| Command | H→D | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0D |
| 1st parameter | D→H | 0 | 0 | D5 | 0 | 0 | 0 | 0 | 0 | xx |
| Description | This command indicates the current status of the display :<br>**Bit D5 – Inversion On/Off**<br>'0' = Inversion is Off.<br>'1' = Inversion is On.<br>**Bit D7,D6,D4,D3,D2,D1,D0- Not Defined**<br>Set to '0' | | | | | | | | | |
| Restrictions | - | | | | | | | | | |

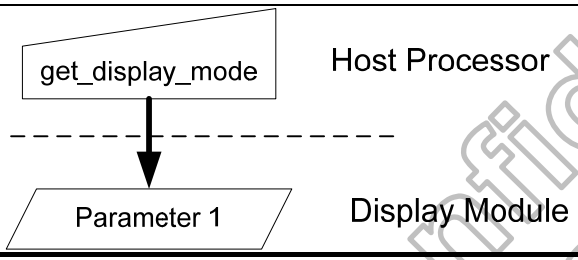
Register Availability

| Status | Availability |
|---|---|
| Sleep Out | Yes |
| Sleep In | Yes |

Default

| Status | Default Value |
|---|---|
| Power On Sequence | 00h |
| S/W Reset | No change |
| H/W Reset | 00h |

Flow Chart



### 7.4.6 Get_pixel_format (0Ch)

| 0C H | Get_pixel_format (Read Display COLMOD)→RDDCOLMOD | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Direction | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |
| Command | H→D | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0C |
| 1st parameter | D→H | 0 | D6 | D5 | D4 | 0 | 0 | 0 | 0 | xx |

**Description**

This command indicates the current status of the display as described in the table below:

| Bit | Description | Comment |
|---|---|---|
| D7 | Reserved | Set to '0' |
| D6 | DPI Interface Pixel format | - |
| D5 | | - |
| D4 | | - |
| D3 | Reserved | Set to '0' |
| D2 | DBI Interface Pixel format -> Not Defined | Set to '0' |
| D1 | | Set to '0' |
| D0 | | Set to '0' |

Bits D6, D5, D4 – DPI Pixel Format Definition
Bits D2, D1, D0 – DBI Pixel Format Definition-> Not Defined.

| Interface Color Format | D6 | D5 | D4 |
|---|---|---|---|
| Not Defined | 0 | 0 | 0 |
| Not Defined | 0 | 0 | 1 |
| Not Defined | 0 | 1 | 0 |
| Not Defined | 0 | 1 | 1 |
| Not Defined | 1 | 0 | 0 |
| 16 bit/pixel | 1 | 0 | 1 |
| 18 bit/pixel | 1 | 1 | 0 |
| 24 bit/pixel | 1 | 1 | 1 |

If a particular interface, either DSI or DPI, is not used then the corresponding bits in the parameter returned from the display module are undefined.

**Restrictions**

-

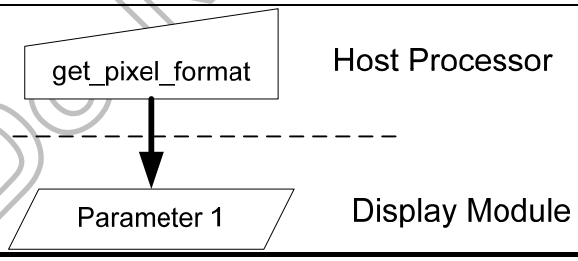
**Register Availability**

| Status | Availability |
|---|---|
| Sleep Out | Yes |
| Sleep In | Yes |

**Default**

| Status | Default Value |
|---|---|
| Power On Sequence | 24-bit/pixel |
| S/W Reset | 24-bit/pixel |
| H/W Reset | 24-bit/pixel |

**Flow Chart**



### 7.4.7 Get_power_mode (0Ah)

| 0AH | Get_power_mode (Read Display Power Mode)→RDDPM | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Direction | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |
| Command | H→D | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0A |
| 1st parameter | D→H | 0 | 0 | 0 | D4 | 0 | D2 | 0 | 0 | xx |

**Description**

This command indicates the current status of the display as described in the table below:

| Bit | Description | Comment |
|---|---|---|
| D7 | Not Defined | Set to '0' |
| D6 | Not Defined | Set to '0' |
| D5 | Not Defined | Set to '0' |
| D4 | Sleep In/Out | - |
| D3 | Not Defined | Set to '0' |
| D2 | Display On/Off | - |
| D1 | Not Defined | Set to '0' |
| D0 | Not Defined | Set to '0' |

**Bit D4 – Sleep In/Out**
'0' = Sleep In Mode.
'1' = Sleep Out Mode.
**Bit D2 – Display On/Off**
'0' = Display is Off.
'1' = Display is On.
**Bit D7,D6,D5,D3,D1,D0 – Not Defined**
Set to '0'

**Restrictions**

-

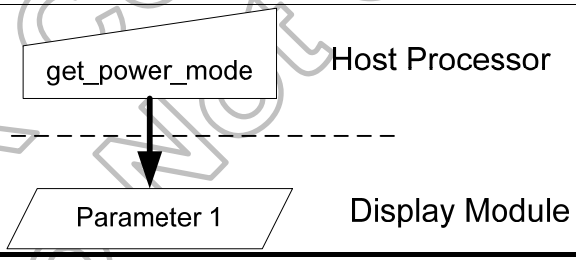
**Register Availability**

| Status | Availability |
|---|---|
| Sleep Out | Yes |
| Sleep In | Yes |

**Default**

| Status | Default Value |
|---|---|
| Power On Sequence | 00h |
| S/W Reset | 00h |
| H/W Reset | 00h |

**Flow Chart**



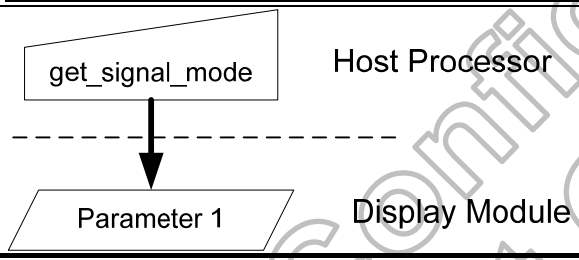
### 7.4.8 Get_signal_mode (0Eh)

| 0EH | Get_signal_mode (Read Display Signal Mode)→RDDSM | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Direction** | **D7** | **D6** | **D5** | **D4** | **D3** | **D2** | **D1** | **D0** | **HEX** |
| Command | H→D | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0E |
| 1st parameter | D→H | D7 | D6 | 0 | 0 | 0 | 0 | 0 | 0 | xx |
| Description | This command indicates the current status of the display as described in the table below:<br>**Bit D7 – Tearing Effect Line On/Off**<br>'0' = Tearing Effect Line Off.<br>'1' = Tearing Effect On.<br>**Bit D6 – Tearing Effect Line Output Mode**<br>See section set_tear_on **(35h)** for mode definitions.<br>'0' = Mode 0. **(M=0)**<br>'1' = Mode 1. **(M=1)**<br>**Bit [D5:D0]** –reserved<br>Set to '0'. | | | | | | | | | |
| Restrictions | - | | | | | | | | | |

| Register Availability | |
|---|---|
| **Status** | **Availability** |
| Sleep Out | Yes |
| Sleep In | Yes |

| Default | |
|---|---|
| **Status** | **Default Value** |
| Power On Sequence | 00h |
| S/W Reset | 00h |
| H/W Reset | 00h |

Flow Chart



### 7.4.9 NOP (00h)

| 00H | NOP (No Operation) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Direction | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |
| Command | H→D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 00 |
| Parameter | NO PARAMETER | | | | | | | | | |
| Description | This command is an empty command; it does not have any effect on the display module. However it can be used to terminate Frame Memory Write as described in RAMWR **(Memory Write)** or RAMRD **(Memory Read)** command. | | | | | | | | | |
| Restriction | - | | | | | | | | | |
| Register Availability | **Status** \| **Availability**<br>Sleep Out \| Yes<br>Sleep In \| Yes | | | | | | | | | |
| Default | **Status** \| **Default Value**<br>Power On Sequence \| N/A<br>S/W Reset \| N/A<br>H/W Reset \| N/A | | | | | | | | | |
| Flow Chart | - | | | | | | | | | |

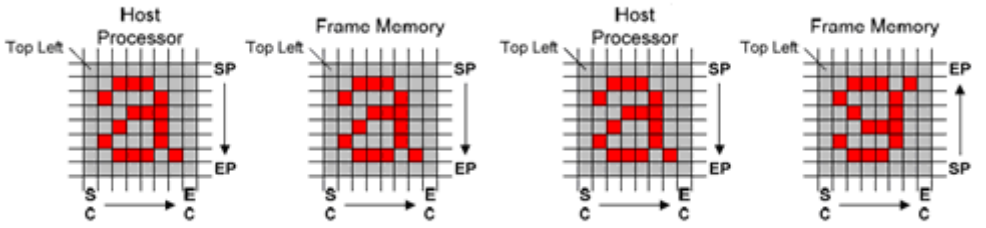
## 7.4.10 Set_address_mode (36h)

| 36H | Set_address_mode (Memory Access Control)→MADCTL | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Direction | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |
| Command | H→D | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 36 |
| 1st parameter | H→D | 0 | 0 | 0 | 0 | BGR | 0 | MX | MY | - |

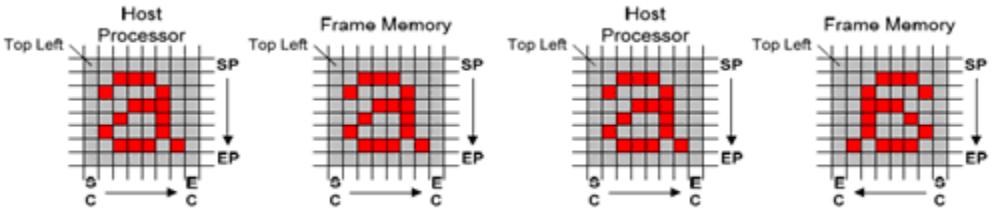
**Description**

This command defines read/write scanning direction of frame memory. This command makes no change on the other driver status. Below table is bit assignment.

| Bit | Name | Description |
|---|---|---|
| B7 | Not Defined | - |
| B6 | Not Defined | - |
| B5 | Not Defined | - |
| B4 | Not Defined | - |
| B3 | RGB-BGR ORDER (BGR) | Color selector switch control<br>0=RGB color filter panel,<br>1=BGR color filter panel |
| B2 | Not Defined | - |
| B1 | COLUMN ADDRESS ORDER (MX) | 0= left to right , 1= right to left |
| B0 | PAGE ADDRESS ORDER (MY) | 0= top to bottom , 1= bottom to top |




D0=0 D0=1




D1=0 D1=1


D3=0


D3=1

**Restriction**

-

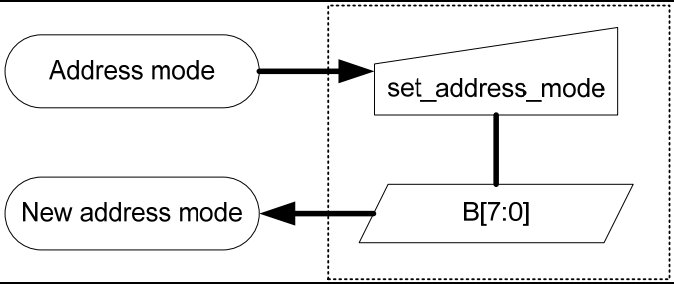
**Register Availability**

| Status | Availability |
|---|---|
| Sleep Out | Yes |
| Sleep In | Yes |

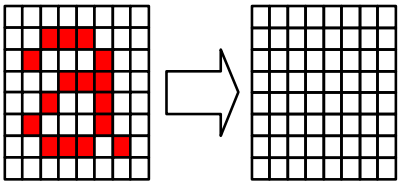
**Default**

| Status | Default Value |
|---|---|
| Power On Sequence | 00h |
| S/W Reset | No change |
| H/W Reset | 00h |

**Flow Chart**



### 7.4.11 Set_display_off (28h)

| 28H | Set_display_off (Display Off)→DISPOFF | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Direction | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |
| Command | H→D | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 28 |
| Parameter | NO PARAMETER | | | | | | | | | |
| Description | This command is used to enter into DISPLAY OFF mode. In this mode, the output from Frame Memory is disabled and blank page inserted. This command makes no change of contents of frame memory. This command does not change any other status. There will be no abnormal visible effect on the display.<br>(Example)<br>memory display  | | | | | | | | | |
| Restriction | This command has no effect when module is already in display off mode. | | | | | | | | | |

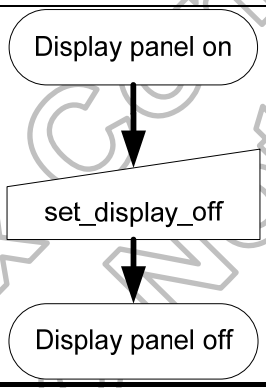
Register Availability

| Status | Availability |
|---|---|
| Sleep Out | Yes |
| Sleep In | Yes |

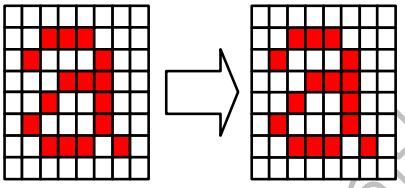
Default

| Status | Default Value |
|---|---|
| Power On Sequence | Display Off |
| S/W Reset | Display Off |
| H/W Reset | Display Off |

Flow Chart



### 7.4.12 Set_display_on (29h)

| 29H | Set_display_on (Display On)→DISPON | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Direction | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |
| Command | H→D | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 29 |
| Parameter | NO PARAMETER | | | | | | | | | |
| Description | This command is used to recover from DISPLAY OFF mode. Output from the Frame Memory is enabled. This command makes no change of contents of frame memory. This command does not change any other status.<br>(Example)<br>memory display<br>  | | | | | | | | | |
| Restriction | This command has no effect when module is already in display on mode. | | | | | | | | | |

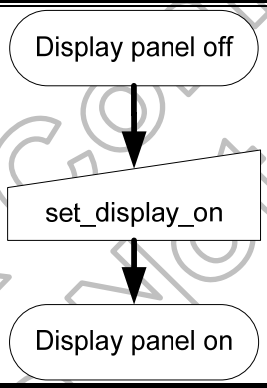
Register Availability

| Status | Availability |
|---|---|
| Sleep Out | Yes |
| Sleep In | Yes |

Default

| Status | Default Value |
|---|---|
| Power On Sequence | Display Off |
| S/W Reset | Display Off |
| H/W Reset | Display Off |

Flow Chart



### 7.4.13 Set_tear_off (34h)

| 34H | Set_tear_off (Tearing Effect Line OFF)→TEOFF | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Direction | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |
| Command | H→D | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 34 |
| Parameter | No Parameter | | | | | | | | | |
| Description | This command is used to turn OFF the Tearing Effect output signal from the TE signal line. | | | | | | | | | |
| Restriction | This command has no effect when Tearing Effect output is already OFF. | | | | | | | | | |

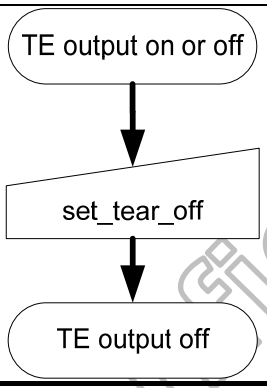
Register Availability

| Status | Availability |
|---|---|
| Sleep Out | Yes |
| Sleep In | Yes |

Default

| Status | Default Value |
|---|---|
| Power On Sequence | Tearing Effect Off |
| S/W Reset | Tearing Effect Off |
| H/W Reset | Tearing Effect Off |

Flow Chart



### 7.4.14 Set_tear_on (35h)

| 35H | Set_tear_off (Tearing Effect Line ON)→TEON | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Direction | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |
| Command | H→D | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 35 |
| 1stparameter | H→D | - | - | - | - | - | - | - | M | - |

**Description**

This command is used to turn ON the Tearing Effect output signal from the TE signal line. The Tearing Effect Line On has one parameter which describes the mode of the Tearing Effect Output Line. **(X=Don't Care)**

When **M=0 (mode0)** :
The Tearing Effect Output line consists of V-Blanking information only:


When **M=1 (mode1)** :
The Tearing Effect Output Line consists of both V-Blanking and H-Blanking information:


**Note:** During Sleep In Mode with Tearing Effect Line On, Tearing Effect Output pin will be active Low.

**Restriction**

This command has no effect when Tearing Effect output is already ON.

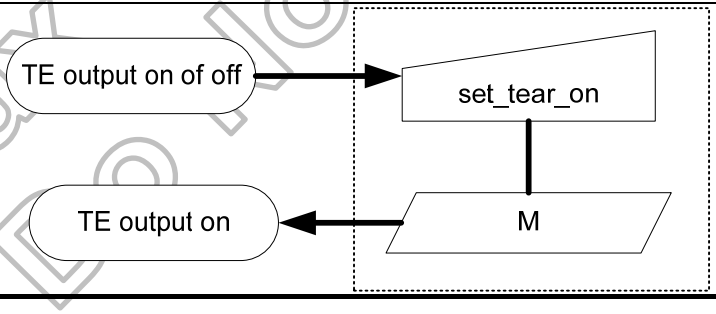
**Register Availability**

| Status | Availability |
|---|---|
| Sleep Out | Yes |
| Sleep In | Yes |

**Default**

| Status | Default Value |
|---|---|
| Power On Sequence | Tearing Effect Off |
| S/W Reset | Tearing Effect Off |
| H/W Reset | Tearing Effect Off |

**Flow Chart**

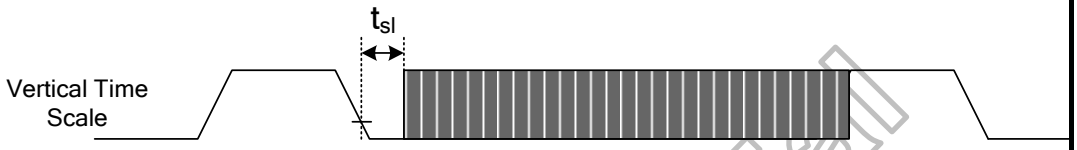


### 7.4.15 Set_tear_scanline (44h)

| 44H | Set_tear_scanline (Tear Effect Scan Lines)→TESL | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Direction | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |
| Command | H→D | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 44 |
| 1st parameter | H→D | N15 | N14 | N13 | N12 | N11 | N10 | N9 | N8 | 00..FF |
| 2nd parameter | H→D | N7 | N6 | N5 | N4 | N3 | N2 | N1 | N0 | 00..FF |

**Description**

This command is turns on the display module's Tearing Effect output signal on the TE signal Line when the display module reaches line N. The Tearing Effect Line On has one parameter which describes the mode of the Tearing Effect Output Line. The Tearing Effect Output line consists of V-Blanking information only:




**Note:** That N=0 is equivalent to set_tear_on with M=0.(default value of N is 0)
The Tearing Effect Output Line shall be active low when the display module is in Sleep mode.

**Restriction**

The command has no effect when Tearing Effect output is already ON.

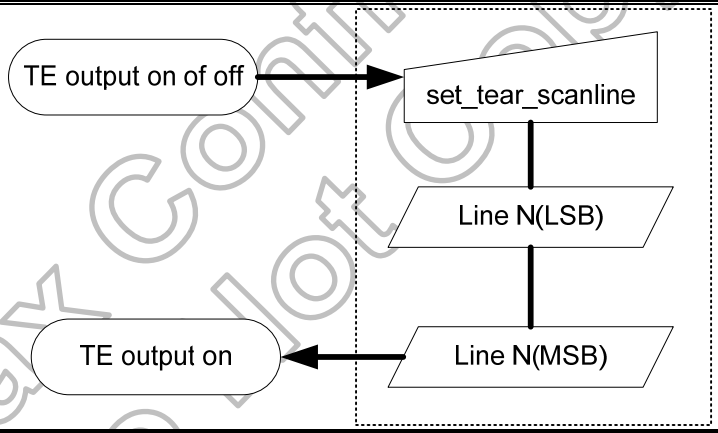
**Register Availability**

| Status | Availability |
|---|---|
| Sleep Out | Yes |
| Sleep In | Yes |

**Default**

| Status | Default Value |
|---|---|
| Power On Sequence | N[15:0]=0000h |
| S/W Reset | N[15:0]=0000h |
| H/W Reset | N[15:0]=0000h |

**Flow Chart**



### 7.4.16 Soft_reset (01h)

| 01H | SWRESET (Software Reset) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Direction | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |
| Command | H→D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 01 |
| Parameter | NO PARAMETER | | | | | | | | | |
| Description | When the Software Reset command is written, it causes a software reset. It resets the commands and parameters to their S/W Reset default values. **(See default tables in each command description.)** The display is blank immediately.<br>**Note:** The frame memory contents are unaffected by this command. | | | | | | | | | |
| Restriction | It will be necessary to wait 5msec before sending new command following software reset. The display module loads all display suppliers' factory default values to the registers during this 5m sec. If SW Reset is applied during Sleep In mode, it will be necessary to wait 120m sec before sending Sleep Out command. SW Reset command cannot be sent during Sleep Out mode. | | | | | | | | | |

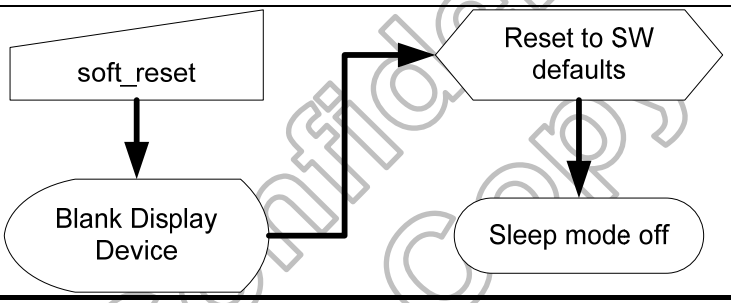
Register Availability

| Status | Availability |
|---|---|
| Sleep Out | Yes |
| Sleep In | Yes |

Default

| Status | Default Value |
|---|---|
| Power On Sequence | N/A |
| S/W Reset | N/A |
| H/W Reset | N/A |

Flow Chart



## 7.5 MIPI video input timing

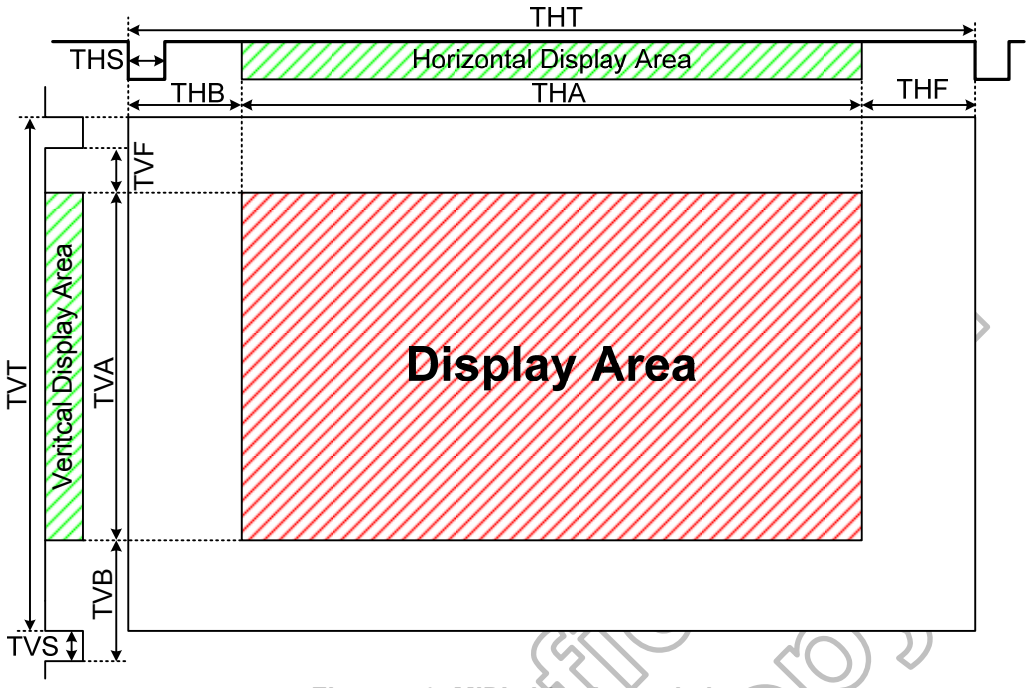
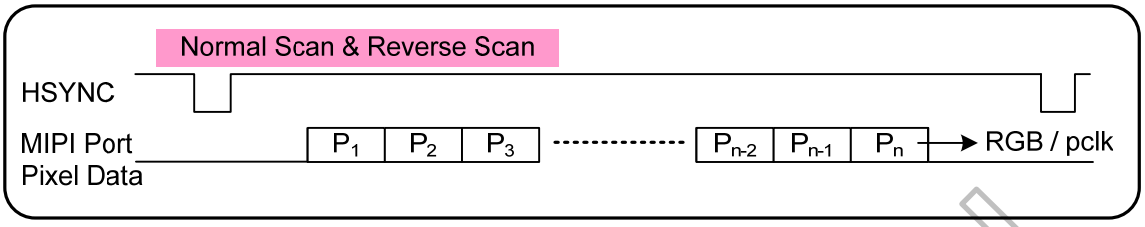



**Figure 7.6: MIPI video input timing**

### 7.5.1 Video input timing for Multi-Drop type

MIPI Multi-Drop type when normal or reverse scan.




| Input Timing | Symbol | 1200RGBx1920 | | | 1200RGBx1600 | | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| PCLK Frequency | - | - | 156 | - | - | 131 | - | MHz |
| Horizontal Total | THT | - | 1340 | 2047 | - | 1340 | 2047 | DCLK |
| Horizontal Synchronization | THS | - | 24 | - | - | 24 | - | DCLK |
| Horizontal Back Porch | THB | - | 80 | - | - | 80 | - | DCLK |
| Horizontal Address | THA | - | 1200 | - | - | 1200 | - | DCLK |
| Horizontal Front Porch | THF | - | 60 | - | - | 60 | - | DCLK |
| Vertical Frequency | - | - | 60 | - | - | 60 | - | Hz |
| Vertical Total(1) | TVT | - | 1944 | 2047 | - | 1624 | 1750 | THT |
| Vertical Synchronization | TVS | - | 2 | - | - | 2 | - | THT |
| Vertical Back Porch | TVB | - | 10 | - | - | 10 | - | THT |
| Vertical Address | TVA | - | 1920 | - | - | 1600 | - | THT |
| Vertical Front Porch | TVF | - | 14 | - | - | 14 | - | THT |

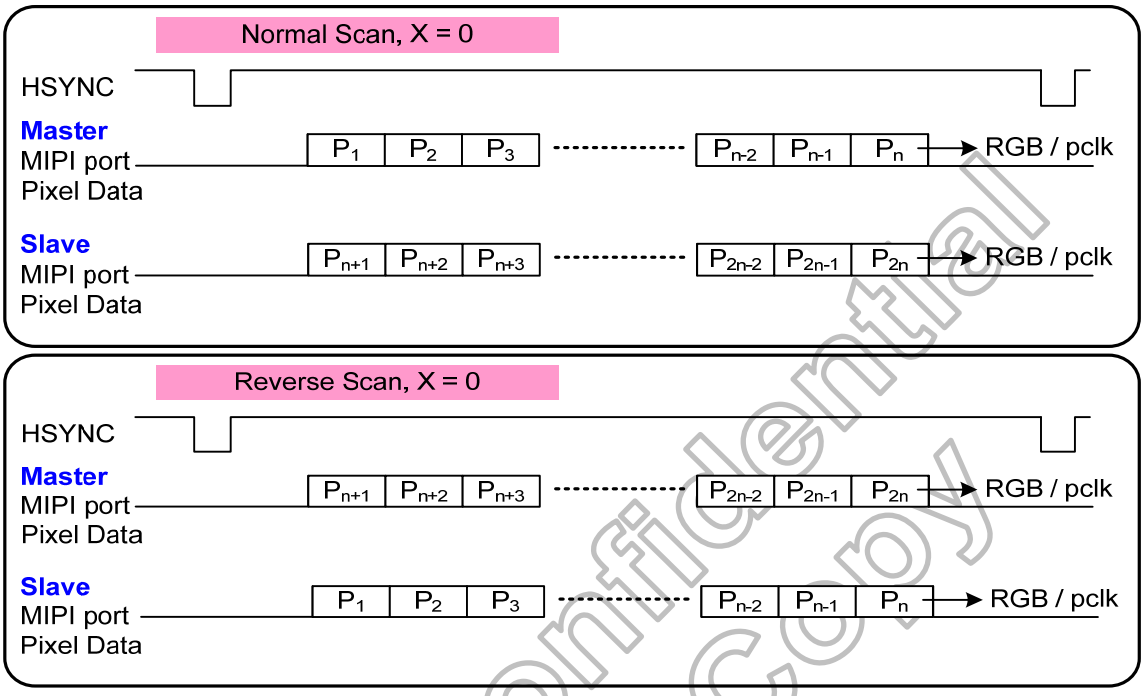
| Input Timing | Symbol | 1080RGBx1920 | | | 600RGBx1024 | | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| PCLK Frequency | - | - | 142 | - | - | 48 | - | MHz |
| Horizontal Total | THT | - | 1220 | 2047 | - | 760 | 1200 | DCLK |
| Horizontal Synchronization | THS | - | 24 | - | - | 24 | - | DCLK |
| Horizontal Back Porch | THB | - | 80 | - | - | 80 | - | DCLK |
| Horizontal Address | THA | - | 1080 | - | - | 600 | - | DCLK |
| Horizontal Front Porch | THF | - | 60 | - | - | 80 | - | DCLK |
| Vertical Frequency | - | - | 60 | - | - | 60 | - | Hz |
| Vertical Total | TVT | - | 1944 | 2047 | - | 1056 | 1176 | THT |
| Vertical Synchronization | TVS | - | 2 | - | - | 2 | - | THT |
| Vertical Back Porch | TVB | - | 10 | - | - | 10 | - | THT |
| Vertical Address | TVA | - | 1920 | - | - | 1024 | - | THT |
| Vertical Front Porch | TVF | - | 14 | - | - | 22 | - | THT |

**Note:** (1) (Vertical frequency) x THTxTVTx24bits →total operation bandwidth.
(2) THA+THB+THF ≧ THT in minimum value setting.

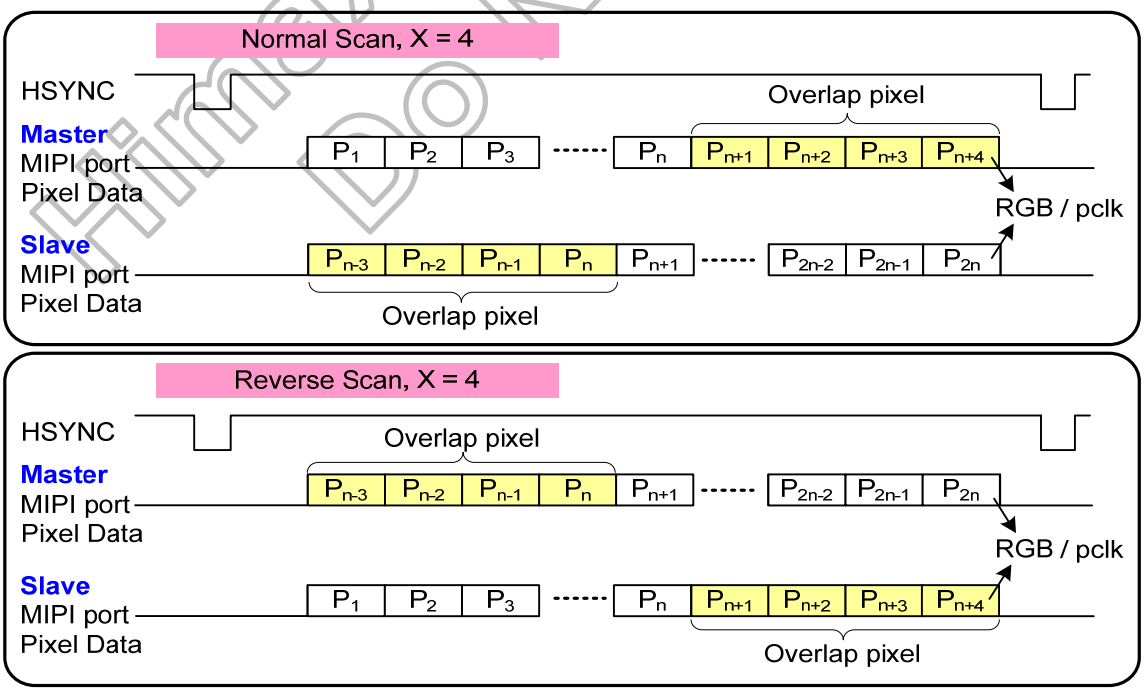
**Table 7.3: MIPI input video timing for multi-drop type**

### 7.5.2 Video input timing for RL type

MIPI R/L type timing when normal and reverse scan. Below figure is no overlap X=0 between left and right display data. The value of X can be setting by page0 0xB7[2:1].




At MIPI R/L type, it supports overlap X= 2,4 between left and right display data. Below figure is example for overlap X=4. The value of X can be setting by REG OVERLAP (page0 0xB7[2:1]). **The overlap pixel must be sent in the zigzag panel application.**



| Input Timing | Symbol | 1200RGBx1920 | | | 1200RGBx1600 | | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| PCLK Frequency | - | - | 86 | - | - | 72 | - | MHz |
| Horizontal Total | THT | - | 740 | 1200 | - | 740 | 1200 | DCLK |
| Horizontal Synchronization | THS | - | 24 | - | - | 24 | - | DCLK |
| Horizontal Back Porch | THB | - | 80 | - | - | 80 | - | DCLK |
| Horizontal Address | THA | | 600 | - | - | 600 | - | DCLK |
| Horizontal Front Porch | THF | - | 60 | - | - | 60 | - | DCLK |
| Vertical Frequency | - | - | 60 | - | - | 60 | - | Hz |
| Vertical Total | TVT | - | 1944 | 2047 | - | 1624 | 2047 | THT |
| Vertical Synchronization | TVS | - | 2 | - | - | 2 | - | THT |
| Vertical Back Porch | TVB | - | 10 | - | - | 10 | - | THT |
| Vertical Address | TVA | - | 1920 | - | - | 1600 | - | THT |
| Vertical Front Porch | TVF | - | 14 | - | - | 14 | - | THT |

| Input Timing | Symbol | 1080RGBx1920 | | | Unit |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| PCLK Frequency | - | - | 77 | - | MHz |
| Horizontal Total | THT | - | 660 | 1080 | DCLK |
| Horizontal Synchronization | THS | - | 24 | - | DCLK |
| Horizontal Back Porch | THB | - | 80 | - | DCLK |
| Horizontal Address | THA | - | 540 | - | DCLK |
| Horizontal Front Porch | THF | - | 60 | - | DCLK |
| Vertical Frequency | - | - | 60 | - | Hz |
| Vertical Total | TVT | - | 1944 | 2047 | THT |
| Vertical Synchronization | TVS | - | 2 | - | THT |
| Vertical Back Porch | TVB | - | 10 | - | THT |
| Vertical Address | TVA | - | 1920 | - | THT |
| Vertical Front Porch | TVF | - | 14 | - | THT |

**Note:** (1) (Vertical frequency) x THTxTVTx24bits →total operation bandwidth.
(2) THA+THB+THF ≧ THT in minimum value setting.

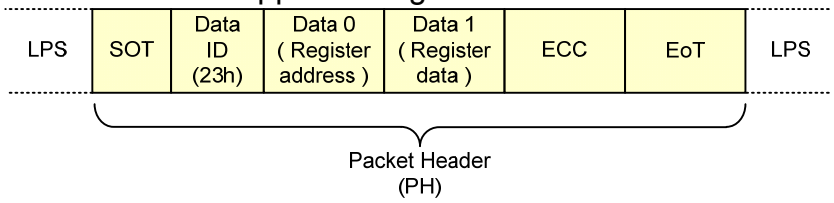
**Table 7.4: MIPI input video timing for RL type**

# 8. Register table

The HX8279-D can set internal register by MIPI or SPI.

## 8.1 MIPI control register

The HX8279-D supports the generic short write command to set internal register.




**Note:** (1) Data ID: Contain virtual channel identifier and data type.
(2) ECC **(Error Correction Code)**: The error correction code allows single-bit errors to be corrected and 2-bit errors to be detected in the short packet.

**Figure 8.1: Support the DSI data short write**

## 8.2 SPI control register

The HX8279-D supports the 4-wire serial peripheral interface **(SPI)** to set internal register. The basic operation of SPI interface is shown below. The Host asserts the CSB when it wants to initiate a read or write transaction. This is followed by the Host sending 16 pulses on the SPI clock **(SCK)**. The 8th bit of SCK pulses is the read/write command. **(0=Write, 1=Read)**. The Host de-asserts the CSB to indicate end of transfer.

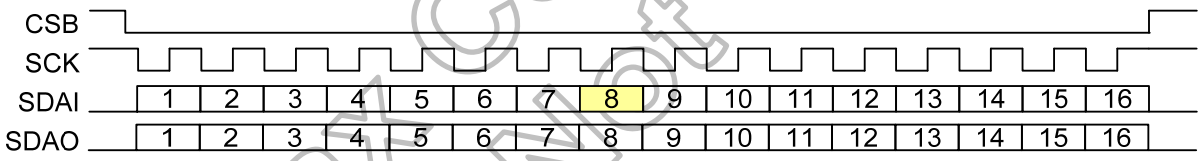



**Figure 8.2: SPI basic operation**

## 8.3 SPI read/write timing

The typical SPI writes operation is shows following figure.

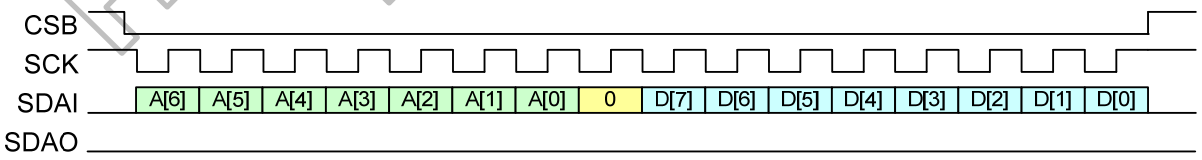



**Figure 8.3: SPI write operation**

The typical SPI reads operation is shows following figure.

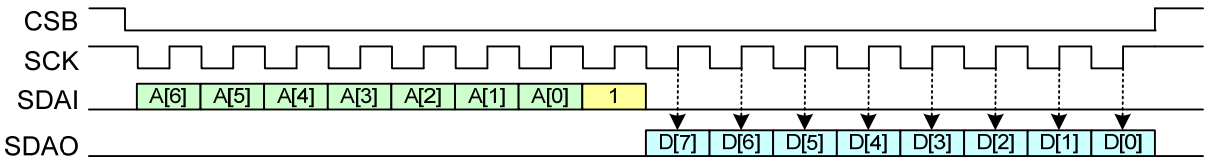



**Figure 8.4: SPI read operation**

## 8.4 Register table list

Register page selection

| Addr[7:0] | Default[7:0] | OTP | Bit name | Data[7:0] | | | | | | | | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |
| 0xB0 | 0Fh | | Page_sel | - | - | - | - | 1 | 1 | 1 | 1 | Register page selection 0~12 |

The register page selection is set up individually by MIPI and SPI.

MSB bit [7] of address is only for MIPI interface. The SPI must be ignored its.

### 8.4.1 Register of page 0

| MIPI Addr[7:0] | Default[7:0] | OTP | Bit name | Data[7:0] | | | | | | | | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |
| 0xB1 | 00h | v | VENDER_ID[6:0] | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | driver ID and module ID |
| 0xB2 | 40h | v | SLEEP | - | 1 | - | - | - | - | - | - | sleep mode control |
| | | v | UPDNB | - | - | 0 | - | - | - | - | - | V-scan direction control |
| | | v | LR | - | - | - | 0 | - | - | - | - | H-scan direction control |
| | | v | ZIGZAG | - | - | - | - | 0 | - | - | - | panel type selection |
| | | v | ZTYPE | - | - | - | - | - | 0 | - | - | Zigzag type selection |
| | | v | NBW | - | - | - | - | - | - | 0 | - | panel normal white/black selection |
| | | v | BISTB | - | - | - | - | - | - | - | 0 | BIST mode control |
| 0xB3 | 08h | v | DISP_ON | 0 | - | - | - | - | - | - | - | display on/off control |
| | | v | LPM_CTRL | - | 0 | 0 | - | - | - | - | - | low power mode selection |
| | | v | PWRMD | - | - | - | 0 | - | - | - | - | power mode selection |
| | | v | VRES_FIX | - | - | - | - | 1 | - | - | - | display vertical line decide by(1):RES[2:0] or (0) VRES |
| | | v | LED_EN | - | - | - | - | - | 0 | - | - | LEDON pin output control |
| | | v | RES[1:0] | - | - | - | - | - | - | 0 | 0 | resolution selection |
| 0xB4 | C0h | v | VRES[7:0] | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | vertical resolution selection |
| 0xB5 | 00h | v | ZDATA[7:0] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ZigZag dummy data selection |
| 0xB6 | 00h | v | RP1EN | - | 0 | - | - | - | - | - | - | odd repair OP on/off control. |
| | | v | RP2EN | - | - | 0 | - | - | - | - | - | even repair OP on/off control. |
| | | v | CABC_CTRL[1:0] | - | - | - | - | 0 | 0 | - | - | CABC-Mode selection |
| | | v | DITHER_EN | - | - | - | - | - | - | 0 | - | dithering on/off control |
| | | v | D_GAM_EN | - | - | - | - | - | - | - | 0 | digital gamma on/off control |
| 0xB7 | 00h | v | OVERLAP | - | - | - | - | - | 0 | 0 | - | MIPI OVERLAP selection |
| | | v | PCLK_SEL | - | - | - | - | - | - | - | 0 | TCON PCLK source |
| 0xB8 | 00h | v | GOA_EN | 0 | - | - | - | - | - | - | - | GOA on/off control |
| | | v | PNSW | - | - | 0 | - | - | - | - | - | MIPI pin polarity swap |
| | | v | MIPI_TYPE | - | - | - | 0 | - | - | - | - | MIPI mode selection |
| | | v | LNSW | - | - | - | - | 0 | 0 | - | - | MIPI lane swap |
| | | v | MIPI_LAN | - | - | - | - | - | - | 0 | 0 | MIPI lane number selection |
| 0xBA | 8Ch | v | BLREV | 1 | 0 | - | - | - | - | - | - | source output at V-blanking |
| | | v | BLREVONOFF | - | - | 0 | - | - | - | - | - | source output at power on off |
| | | v | INV_SEL2 | - | - | - | 0 | - | - | - | - | data inversion select |
| | | v | SD_ISSEL[1:0] | - | - | - | - | 1 | 1 | - | - | source bias current select |
| | | v | INV_SEL[1:0] | - | - | - | - | - | - | 0 | 0 | data inversion select |
| 0xBD | 71h | v | T_VCOMS[7:0] | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | VCOM voltage selection |
| 0xBE | 70h | v | LPM_VCOMS[7:0] | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | VCOM voltage selection in LPM |
| 0xBF | 19h | v | VGHS[4:0] | - | - | - | 1 | 1 | 0 | 0 | 1 | VGH voltage selection |
| 0xC0 | 10h | v | VGLS[4:0] | - | - | - | 1 | 0 | 0 | 0 | 0 | VGL voltage selection |
| 0xC1 | 1Fh | v | VGLXSP | - | - | - | 1 | - | - | - | - | VGH boosting multiple selection |
| | | v | VGHXSP[1:0] | - | - | - | - | 1 | 1 | - | - | VGH boosting multiple selection |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | V | CPCLKH [1:0] | - | - | - | - | - | - | 1 | 1 | VGH/VGL charge pump clock selection |
| 0xC2 | 04h | V | VGPHS[4:0] | - | - | - | 0 | 0 | 1 | 0 | 0 | positive gamma_H selection |
| 0xC3 | 02h | V | VGPLS[4:0] | - | - | - | 0 | 0 | 0 | 1 | 0 | positive gamma_L selection |
| 0xC4 | 04h | V | VGNHS[4:0] | - | - | - | 0 | 0 | 1 | 0 | 0 | negative gamma_H selection |
| 0xC5 | 02h | V | VGNLS[4:0] | - | - | - | 0 | 0 | 0 | 1 | 0 | negative gamma_L selection |
| 0xC6 | 10h | V | STILLIMG_DET_NUM | - | 0 | 0 | 1 | 0 | 0 | 0 | 0 | still image detect frame number |
| 0xC7 | 00h | V | REF_NUM[3:0] | - | - | - | - | 0 | 0 | 0 | 0 | define refresh frame number when still image time |
| 0xC8 | 02h | V | NOREF_NUM[7:0] | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | define no refresh frame number when still image time |
| 0xCC | 08h | V | POCSD_CTL[1:0] | - | 0 | 0 | - | - | - | - | - | SD offset cancel method selection |
| | | V | SD_EQW[4:0] | - | - | - | 0 | 1 | 0 | 0 | 0 | source eq0/eq1 width adjsutmention |
| 0xCD | 5Ch | | VPP_EN | 0 | - | - | - | - | - | - | - | Internal VPP enable |
| 0xF9 | 5Dh | V | GOA_GAS | - | - | - | - | 1 | - | - | - | GOA output selection when GAS enable |
| | | V | GOA_POWERON | - | - | - | - | - | 1 | - | - | CLR1/CLR2 output selection when power on |
| | | V | GOA_POWEROFF | - | - | - | - | - | - | 0 | - | GOA output selection when power off |
| | | V | FLC2B_SEL | - | - | - | - | - | - | - | 1 | FLC2B output selection |
| 0XFB | 01h | | GRB | - | - | - | - | - | - | - | 1 | SPI registers reset |
| 0xFC | 82h | | PRODUCTID1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | PRODUCTID1 (82) |
| 0xFD | 79h | | PRODUCTID2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | PRODUCTID2(79) |
| 0xFE | 0Dh | | PRODUCTID3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | PRODUCTID3(0D) |
| 0xFF | 04h | | CHIPID | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | IC version ID 01 for version A (READ only) |

### 8.4.2 Register of page 1(OTP & GOA MUX)

| Addr[7:0] | Default[7:0] | OTP | Bit name | Data[7:0] | | | | | | | | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |
| 0xB1 | 00h | | OTP Group | - | - | 0 | 0 | 0 | 0 | 0 | 0 | OTP trimming group select. The group range is from group0 to group35 |
| 0xB2 | 5ah | | OTP pwd | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | set to 0xA5 to enable 0xB3 command. |
| 0xB3 | 00h | | OTP_BURST_WR | 0 | - | - | - | - | - | - | - | auto OTP program mode write command |
| | | | OTP_re_Load | - | - | - | - | - | 0 | - | - | OTP auto re-load command. |
| | | | OTP_WR | - | - | - | - | - | - | - | 0 | OTP burst write command |
| 0xB9 | 00h | | DISABLE_OTP | - | - | 0 | 0 | - | - | - | - | 00: M/S OTP enable 01: Master OTP enable Slave OTP disable 11: M/S OTP disable 10: Master OTP disable Slave OTP enable |
| 0xBB | 0 | | bust_write_index[7:0] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | burst program Group index(group0~7) |
| 0xBC | 0 | | bust_write_index[15:8] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | burst program Group index(group8~15) |
| 0xBD | 0 | | bust_write_index[23:16] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | burst program Group index(group16~23) |
| 0xBE | 0 | | bust_write_index[31:24] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | burst program Group index(group24~31) |
| 0xBF | 0 | | bust_write_index[35:31] | - | - | - | - | 0 | 0 | 0 | 0 | burst program Group index(groupu32~35) |
| **GOA MUX** | | | | | | | | | | | | |
| 0xC0 | 09h | v | GOUTL_1_STB | 0 | 0 | - | - | - | - | - | - | GOUTL_1 level in standby mode |
| | | v | GOUTL_1_SEL[5:0] | - | - | 0 | 0 | 1 | 0 | 0 | 1 | Mux goa signal to GINL1 ref GOUT SEL mapping table |
| 0xC1 | 09h | v | GOUTL_2_STB | 0 | 0 | - | - | - | - | - | - | GOUTL_2 level in standby mode |
| | | v | GOUTL_2_SEL[5:0] | - | - | 0 | 0 | 1 | 0 | 0 | 1 | Mux goa signal to GINL2 ref GOUT SEL mapping table |
| 0xC2 | 07h | v | GOUTL_3_STB | 0 | 0 | - | - | - | - | - | - | GOUTL_3 level in standby mode |
| | | v | GOUTL_3_SEL[5:0] | - | - | 0 | 0 | 0 | 1 | 1 | 1 | Mux goa signal to GINL3 ref GOUT SEL mapping table |
| 0xC3 | 07h | v | GOUTL_4_STB | 0 | 0 | - | - | - | - | - | - | GOUTL_4 level in standby mode |
| | | v | GOUTL_4_SEL[5:0] | - | - | 0 | 0 | 0 | 1 | 1 | 1 | Mux goa signal to GINL4 ref GOUT SEL mapping table |
| 0xC4 | 05h | v | GOUTL_5_STB | 0 | 0 | - | - | - | - | - | - | GOUTL_5 level in standby mode |
| | | v | GOUTL_5_SEL[5:0] | - | - | 0 | 0 | 0 | 1 | 0 | 1 | Mux goa signal to GINL5 ref GOUT SEL mapping table |
| 0xC5 | 05h | v | GOUTL_6_STB | 0 | 0 | - | - | - | - | - | - | GOUTL_6 level in standby mode |
| | | v | GOUTL_6_SEL[5:0] | - | - | 0 | 0 | 0 | 1 | 0 | 1 | Mux goa signal to GINL6 ref GOUT SEL mapping table |
| 0xC6 | 16h | v | GOUTL_7_STB | 0 | 0 | - | - | - | - | - | - | GOUTL_7 level in standby mode |
| | | v | GOUTL_7_SEL[5:0] | - | - | 0 | 1 | 0 | 1 | 1 | 0 | Mux goa signal to GINL7 ref GOUT SEL mapping table |
| 0xC7 | 16h | v | GOUTL_8_STB | 0 | 0 | - | - | - | - | - | - | GOUTL_8 level in standby mode |
| | | v | GOUTL_8_SEL[5:0] | - | - | 0 | 1 | 0 | 1 | 1 | 0 | Mux goa signal to GINL8 ref GOUT SEL mapping table |
| 0xC8 | 0Eh | v | GOUTL_9_STB | 0 | 0 | - | - | - | - | - | - | GOUTL_9 level in standby mode |
| | | v | GOUTL_9_SEL[5:0] | - | - | 0 | 0 | 1 | 1 | 1 | 0 | Mux goa signal to GINL9 ref GOUT SEL mapping table |
| 0xC9 | 0Eh | v | GOUTL_10_STB | 0 | 0 | - | - | - | - | - | - | GOUTL_10 level in standby mode |
| | | v | GOUTL_10_SEL[5:0] | - | - | 0 | 0 | 1 | 1 | 1 | 0 | Mux goa signal to GINL10 ref GOUT SEL mapping table |
| 0xCA | 0Bh | v | GOUTL_11_STB | 0 | 0 | - | - | - | - | - | - | GOUTL_11 level in standby mode |
| | | v | GOUTL_11_SEL[5:0] | - | - | 0 | 0 | 1 | 0 | 1 | 1 | Mux goa signal to GINL11 ref GOUT SEL mapping table |
| 0xCB | 0Bh | v | GOUTL_12_STB | 0 | 0 | - | - | - | - | - | - | GOUTL_12 level in standby mode |
| | | v | GOUTL_12_SEL[5:0] | - | - | 0 | 0 | 1 | 0 | 1 | 1 | Mux goa signal to GINL12 ref GOUT SEL mapping table |
| 0xCC | 0Dh | v | GOUTL_13_STB | 0 | 0 | - | - | - | - | - | - | GOUTL_13 level in standby mode |
| | | v | GOUTL_13_SEL[5:0] | - | - | 0 | 0 | 1 | 1 | 0 | 1 | Mux goa signal to GINL13 ref GOUT SEL mapping table |
| 0xCD | 0Dh | v | GOUTL_14_STB | 0 | 0 | - | - | - | - | - | - | GOUTL_14 level in standby mode |
| | | v | GOUTL_14_SEL[5:0] | - | - | 0 | 0 | 1 | 1 | 0 | 1 | Mux goa signal to GINL14 ref GOUT SEL mapping table |
| 0xCE | 15h | v | GOUTL_15_STB | 0 | 0 | - | - | - | - | - | - | GOUTL_15 level in standby mode |
| | | v | GOUTL_15_SEL[50] | - | - | 0 | 1 | 0 | 1 | 0 | 1 | Mux goa signal to GINL15 ref GOUT SEL mapping table |
| 0xCF | 15h | v | GOUTL_16_STB | 0 | 0 | - | - | - | - | - | - | GOUTL_16 level in standby mode |
| | | v | GOUTL_16_SEL[5:0] | - | - | 0 | 1 | 0 | 1 | 0 | 1 | Mux goa signal to GINL16 ref GOUT SEL mapping table |
| 0xD0 | 01h | v | GOUTL_17_STB | 0 | 0 | - | - | - | - | - | - | GOUTL_17 level in standby mode |
| | | v | GOUTL_17_SEL[5:0] | - | - | 0 | 0 | 0 | 0 | 0 | 1 | Mux goa signal to GINL17 ref GOUT SEL mapping table |
| 0xD1 | 01h | v | GOUTL_18_STB | 0 | 0 | - | - | - | - | - | - | GOUTL_18 level in standby mode |
| | | v | GOUTL_18_SEL[5:0] | - | - | 0 | 0 | 0 | 0 | 0 | 1 | Mux goa signal to GINL18 ref GOUT SEL mapping table |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0xD2 | 03h | V | GOUTL_19_STB | 0 | 0 | - | - | - | - | - | - | GOUTL_19 level in standby mode |
| | | V | GOUTL_19_SEL[5:0] | - | - | 0 | 0 | 0 | 0 | 1 | 1 | Mux goa signal to GINL19 ref GOUT SEL mapping table |
| 0xD3 | 03h | V | GOUTL_20_STB | 0 | 0 | - | - | - | - | - | - | GOUTL_20 level in standby mode |
| | | V | GOUTL_20_SEL[5:0] | - | - | 0 | 0 | 0 | 0 | 1 | 1 | Mux goa signal to GINL20 ref GOUT SEL mapping table |
| 0xD4 | 0Ah | V | GOUTR_1_STB | 0 | 0 | - | - | - | - | - | - | GOUTR_1 level in standby mode |
| | | V | GOUTR_1_SEL[5:0] | - | - | 0 | 0 | 1 | 0 | 1 | 0 | Mux goa signal to GINR1 ref GOUT SEL mapping table |
| 0xD5 | 0Ah | V | GOUTR_2_STB | 0 | 0 | - | - | - | - | - | - | GOUTR_2 level in standby mode |
| | | V | GOUTR_2_SEL[5:0] | - | - | 0 | 0 | 1 | 0 | 1 | 0 | Mux goa signal to GINR2 ref GOUT SEL mapping table |
| 0xD6 | 08h | V | GOUTR_3_STB | 0 | 0 | - | - | - | - | - | - | GOUTR_3 level in standby mode |
| | | V | GOUTR_3_SEL[5:0] | - | - | 0 | 0 | 1 | 0 | 0 | 0 | Mux goa signal to GINR3 ref GOUT SEL mapping table |
| 0xD7 | 08h | V | GOUTR_4_STB | 0 | 0 | - | - | - | - | - | - | GOUTR_4 level in standby mode |
| | | V | GOUTR_4_SEL[5:0] | - | - | 0 | 0 | 1 | 0 | 0 | 0 | Mux goa signal to GINR4 ref GOUT SEL mapping table |
| 0xD8 | 06h | V | GOUTR_5_STB | 0 | 0 | - | - | - | - | - | - | GOUTR_5 level in standby mode |
| | | V | GOUTR_5_SEL[5:0] | - | - | 0 | 0 | 0 | 1 | 1 | 0 | Mux goa signal to GINR5 ref GOUT SEL mapping table |
| 0xD9 | 06h | V | GOUTR_6_STB | 0 | 0 | - | - | - | - | - | - | GOUTR_6 level in standby mode |
| | | V | GOUTR_6_SEL[5:0] | - | - | 0 | 0 | 0 | 1 | 1 | 0 | Mux goa signal to GINR6 ref GOUT SEL mapping table |
| 0xDA | 16h | V | GOUTR_7_STB | 0 | 0 | - | - | - | - | - | - | GOUTR_7 level in standby mode |
| | | V | GOUTR_7_SEL[5:0] | - | - | 0 | 1 | 0 | 1 | 1 | 0 | Mux goa signal to GINR7 ref GOUT SEL mapping table |
| 0xDB | 16h | V | GOUTR_8_STB | 0 | 0 | - | - | - | - | - | - | GOUTR_8 level in standby mode |
| | | V | GOUTR_8_SEL[5:0] | - | - | 0 | 1 | 0 | 1 | 1 | 0 | Mux goa signal to GINR8 ref GOUT SEL mapping table |
| 0xDC | 0Eh | V | GOUTR_9_STB | 0 | 0 | - | - | - | - | - | - | GOUTR_9 level in standby mode |
| | | V | GOUTR_9_SEL[5:0] | - | - | 0 | 0 | 1 | 1 | 1 | 0 | Mux goa signal to GINR9 ref GOUT SEL mapping table |
| 0xDD | 0Eh | V | GOUTR_10_STB | 0 | 0 | - | - | - | - | - | - | GOUTR_10 level in standby mode |
| | | V | GOUTR_10_SEL[5:0] | - | - | 0 | 0 | 1 | 1 | 1 | 0 | Mux goa signal to GINR10 ref GOUT SEL mapping table |
| 0xDE | 0Ch | V | GOUTR_11_STB | 0 | 0 | - | - | - | - | - | - | GOUTR_11 level in standby mode |
| | | V | GOUTR_11_SEL[5:0] | - | - | 0 | 0 | 1 | 1 | 0 | 0 | Mux goa signal to GINR11 ref GOUT SEL mapping table |
| 0xDF | 0Ch | V | GOUTR_12_STB | 0 | 0 | - | - | - | - | - | - | GOUTR_12 level in standby mode |
| | | V | GOUTR_12_SEL[5:0] | - | - | 0 | 0 | 1 | 1 | 0 | 0 | Mux goa signal to GINR12 ref GOUT SEL mapping table |
| 0xE0 | 0Dh | V | GOUTR_13_STB | 0 | 0 | - | - | - | - | - | - | GOUTR_13 level in standby mode |
| | | V | GOUTR_13_SEL[5:0] | - | - | 0 | 0 | 1 | 1 | 0 | 1 | Mux goa signal to GINR13 ref GOUT SEL mapping table |
| 0xE1 | 0Dh | V | GOUTR_14_STB | 0 | 0 | - | - | - | - | - | - | GOUTR_14 level in standby mode |
| | | V | GOUTR_14_SEL[5:0] | - | - | 0 | 0 | 1 | 1 | 0 | 1 | Mux goa signal to GINR14 ref GOUT SEL mapping table |
| 0xE2 | 15h | V | GOUTR_15_STB | 0 | 0 | - | - | - | - | - | - | GOUTR_15 level in standby mode |
| | | V | GOUTR_15_SEL[5:0] | - | - | 0 | 1 | 0 | 1 | 0 | 1 | Mux goa signal to GINR15 ref GOUT SEL mapping table |
| 0xE3 | 15h | V | GOUTR_16_STB | 0 | 0 | - | - | - | - | - | - | GOUTR_16 level in standby mode |
| | | V | GOUTR_16_SEL[5:0] | - | - | 0 | 1 | 0 | 1 | 0 | 1 | Mux goa signal to GINR16 ref GOUT SEL mapping table |
| 0xE4 | 02h | V | GOUTR_17_STB | 0 | 0 | - | - | - | - | - | - | GOUTR_17 level in standby mode |
| | | V | GOUTR_17_SEL[5:0] | - | - | 0 | 0 | 0 | 0 | 1 | 0 | Mux goa signal to GINR17 ref GOUT SEL mapping table |
| 0xE5 | 02h | V | GOUTR_18_STB | 0 | 0 | - | - | - | - | - | - | GOUTR_18 level in standby mode |
| | | V | GOUTR_18_SEL[5:0] | - | - | 0 | 0 | 0 | 0 | 1 | 0 | Mux goa signal to GINR18 ref GOUT SEL mapping table |
| 0xE6 | 04h | V | GOUTR_19_STB | 0 | 0 | - | - | - | - | - | - | GOUTR_19 level in standby mode |
| | | V | GOUTR_19_SEL[5:0] | - | - | 0 | 0 | 0 | 1 | 0 | 0 | Mux goa signal to GINR19 ref GOUT SEL mapping table |
| 0xE7 | 04h | V | GOUTR_20_STB | 0 | 0 | - | - | - | - | - | - | GOUTR_20 level in standby mode |
| | | V | GOUTR_20_SEL[5:0] | - | - | 0 | 0 | 0 | 1 | 0 | 0 | Mux goa signal to GINR20 ref GOUT SEL mapping table |

### 8.4.3 Register of page 2(analog gamma)

| Addr[7:0] | Default[7:0] | OTP | Bit name | Data[7:0] | | | | | | | | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |
| 0xC0 | 00h | v | T_PVP0[2:0] | - | - | - | - | - | 0 | 0 | 0 | V0 positive gamma op's input voltage. |
| 0xC1 | 07h | v | T_PVP1[5:0] | - | - | 0 | 0 | 0 | 1 | 1 | 1 | V4 positive gamma op's input voltage. |
| 0xC2 | 10h | v | T_PVP2[5:0] | - | - | 0 | 1 | 0 | 0 | 0 | 0 | V8 positive gamma op's input voltage. |
| 0xC3 | 1Fh | v | T_PVP3[5:0] | - | - | 0 | 1 | 1 | 1 | 1 | 1 | V16 positive gamma op's input voltage. |
| 0xC4 | 1Fh | v | T_PVP4[5:0] | - | - | 0 | 1 | 1 | 1 | 1 | 1 | V28 positive gamma op's input voltage. |
| 0xC5 | 1Fh | v | T_PVP5[5:0] | - | - | 0 | 1 | 1 | 1 | 1 | 1 | V40 positive gamma op's input voltage. |
| 0xC6 | 1Fh | v | T_PVP6[5:0] | - | - | 0 | 1 | 1 | 1 | 1 | 1 | V56 positive gamma op's input voltage. |
| 0xC7 | 1Fh | v | T_PVP7[5:0] | - | - | 0 | 1 | 1 | 1 | 1 | 1 | V80 positive gamma op's input voltage. |
| 0xC8 | 1Fh | v | T_PVP8[5:0] | - | - | 0 | 1 | 1 | 1 | 1 | 1 | V128 positive gamma op's input voltage. |
| 0xC9 | 1Fh | v | T_PVP9[5:0] | - | - | 0 | 1 | 1 | 1 | 1 | 1 | V176 positive gamma op's input voltage. |
| 0xCA | 1Fh | v | T_PVP10[5:0] | - | - | 0 | 1 | 1 | 1 | 1 | 1 | V200 positive gamma op's input voltage. |
| 0xCB | 1Fh | v | T_PVP11[5:0] | - | - | 0 | 1 | 1 | 1 | 1 | 1 | V216 positive gamma op's input voltage. |
| 0xCC | 1Fh | v | T_PVP12[5:0] | - | - | 0 | 1 | 1 | 1 | 1 | 1 | V228 positive gamma op's input voltage. |
| 0xCD | 1Fh | v | T_PVP13[5:0] | - | - | 0 | 1 | 1 | 1 | 1 | 1 | V240 positive gamma op's input voltage. |
| 0XCE | 1Fh | v | T_PVP14[5:0] | - | - | 0 | 1 | 1 | 1 | 1 | 1 | V248 positive gamma op's input voltage. |
| 0xCF | 20h | v | T_PVP15[5:0] | - | - | 1 | 0 | 0 | 0 | 0 | 0 | V252 positive gamma op's input voltage. |
| 0xD0 | 07h | v | T_PVP16[2:0] | - | - | - | - | - | 1 | 1 | 1 | V255 positive gamma op's input voltage. |
| 0xD2 | 00h | v | T_PVN0[2:0] | - | - | - | - | - | 0 | 0 | 0 | V0 negative gamma op's input voltage. |
| 0xD3 | 07h | v | T_PVN1[5:0] | - | - | 0 | 0 | 0 | 1 | 1 | 1 | V4 negative gamma op's input voltage. |
| 0xD4 | 10h | v | T_PVN2[5:0] | - | - | 0 | 1 | 0 | 0 | 0 | 0 | V8 negative gamma op's input voltage. |
| 0xD5 | 1Fh | v | T_PVN3[5:0] | - | - | 0 | 1 | 1 | 1 | 1 | 1 | V16 negative gamma op's input voltage. |
| 0xD6 | 1Fh | v | T_PVN4[5:0] | - | - | 0 | 1 | 1 | 1 | 1 | 1 | V28 negative gamma op's input voltage. |
| 0xD7 | 1Fh | v | T_PVN5[5:0] | - | - | 0 | 1 | 1 | 1 | 1 | 1 | V40 negative gamma op's input voltage. |
| 0xD8 | 1Fh | v | T_PVN6[5:0] | - | - | 0 | 1 | 1 | 1 | 1 | 1 | V56 negative gamma op's input voltage. |
| 0xD9 | 1Fh | v | T_PVN7[5:0] | - | - | 0 | 1 | 1 | 1 | 1 | 1 | V80 negative gamma op's input voltage. |
| 0xDA | 1Fh | v | T_PVN8[5:0] | - | - | 0 | 1 | 1 | 1 | 1 | 1 | V128 negative gamma op's input voltage. |
| 0xDB | 1Fh | v | T_PVN9[5:0] | - | - | 0 | 1 | 1 | 1 | 1 | 1 | V176 negative gamma op's input voltage. |
| 0xDC | 1Fh | v | T_PVN10[5:0] | - | - | 0 | 1 | 1 | 1 | 1 | 1 | V200 negative gamma op's input voltage. |
| 0xDD | 1Fh | v | T_PVN11[5:0] | - | - | 0 | 1 | 1 | 1 | 1 | 1 | V216 negative gamma op's input voltage. |
| 0xDE | 1Fh | v | T_PVN12[5:0] | - | - | 0 | 1 | 1 | 1 | 1 | 1 | V228 negative gamma op's input voltage. |
| 0xDF | 1Fh | v | T_PVN13[5:0] | - | - | 0 | 1 | 1 | 1 | 1 | 1 | V240 negative gamma op's input voltage. |
| 0xE0 | 1Fh | v | T_PVN14[5:0] | - | - | 0 | 1 | 1 | 1 | 1 | 1 | V248 negative gamma op's input voltage. |
| 0xE1 | 20h | v | T_PVN15[5:0] | - | - | 1 | 0 | 0 | 0 | 0 | 0 | V252 negative gamma op's input voltage. |
| 0xE2 | 07h | v | T_PVN16[2:0] | - | - | - | - | - | 1 | 1 | 1 | V255 negative gamma op's input voltage. |

### 8.4.4 Register of page 3 (GOA)

| MIPI Addr[7:0] | Default[7:0] | OTP | Bit name | Data[7:0] | | | | | | | | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |
| 0xB9 | 00 | | Reserved | 0 | - | - | - | - | - | - | - | Reserved |
| | | v | FLC_SEL | - | 0 | - | - | - | - | - | - | FLC output selection |
| | | | Reserved | - | - | 0 | 0 | 0 | 0 | 0 | 0 | Reserved |
| 0xBB | 00h | | Reserved | 0 | 0 | 0 | 0 | 0 | - | - | - | Reserved |
| | | v | STV_PREC[3:0] | - | - | - | - | - | 0 | 0 | 0 | STV pre-charge width adjustment |
| 0xBC | 00h | v | CKV_FALL_PREC[7:0] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | CKV falling pre-charge width adjustment. |
| 0xBE | 01h | | Reserved | 0 | 0 | - | - | - | - | - | - | Reserved |
| | | v | GOA_UD | - | - | 0 | - | - | - | - | - | GOA scan direction selection |
| | | | Reserved | - | - | - | 0 | - | - | - | - | Reserved |
| | | v | CKV_BLANKON | - | - | - | - | 0 | - | - | - | Blanking all on enable. |
| | | v | GOA_PHASE[2:0] | - | - | - | - | - | 0 | 0 | 1 | GOA phase selection. |
| 0xBF | 10h | | Reserved | 0 | 0 | - | - | - | - | - | - | Reserved |
| | | v | GOA_Tn_FACTOR | - | - | 0 | 1 | - | - | - | - | GOA Timing (T0~T5) adjustment factor selection. |
| | | | Reserved | - | - | - | - | 0 | 0 | 0 | 0 | Reserved |
| 0xC2 | 00h | v | GOA_T0[7:0] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Odd STV falling position adjustment. |
| 0xC3 | 3Ah | v | GOA_T1[7:0] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Odd STV rising position adjustment. |
| 0xC4 | 00h | v | GOA_T2[7:0] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Odd CKV falling position adjustment. |
| 0xC5 | 3Ah | v | GOA_T3[7:0] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Odd CKV rising position adjustment. |
| 0xC6 | 00h | v | GOA_T4[7:0] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Odd GCK falling position adjustment. |
| 0xC7 | 01h | v | GOA_T5[7:0] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Odd GCK rising position adjustment. |
| 0xC8 | 0Dh | | Reserved | 0 | 0 | 0 | - | - | - | - | - | Reserved |
| | | v | STV_LEAD[4:0] | - | - | - | 0 | 0 | 1 | 0 | 1 | GOA STV leads time setting. |
| 0xC9 | 0Bh | v | Reserved | 0 | 0 | 0 | - | - | - | - | - | Reserved |
| | | v | CKV_LEAD[4:0] | - | - | - | 0 | 0 | 0 | 1 | 1 | GOA CKV leads time setting. |
| 0xCA | 42h | v | CKV_NONOVERLAP | 0 | - | - | - | - | - | - | - | CKV non-overlap control |
| | | | Reserved | - | 1 | - | - | - | - | - | - | Reserved |
| | | v | CKV_DUMMY[5:0] | - | - | 0 | 0 | 0 | 0 | 1 | 0 | GOA CKV dummy number in V-blanking |
| 0xCB | 00h | v | CKV_RISE_PREC[7:0] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | CKV rising pre-charge width adjustment. |
| 0xCC | 44h | v | STV_WIDTH[3:0] | 0 | 1 | 0 | 0 | - | - | - | - | GOA STV width setting. |
| | | v | CKV_WIDTH[3:0] | - | - | - | - | 0 | 1 | 0 | 0 | GOA CKV width setting. |
| 0xCD | 07h | v | GOA_FLC[7:0] | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | GOA FLC toggle frame setting. |
| 0xCE | 03h | | Reserved | 0 | - | - | - | - | - | - | - | Reserved |
| | | v | GOA_FLCA_LEAD[6:0] | - | 0 | 0 | 0 | 0 | 0 | 1 | 1 | FLCA lead 1st DE toggle number. |
| 0xCF | 68h | v | FLC_sync | 0 | - | - | - | - | - | - | - | FLC sync selection |
| | | | Reserved | - | 0 | 0 | 0 | - | - | - | - | Reserved |
| | | v | CLR_adjsel | - | - | - | - | 1 | - | - | - | CLR adjustment selection |
| | | v | CLR_WD[10:8] | - | - | - | - | - | 0 | 0 | 0 | CLR width adjustment |
| 0xD0 | 05h | v | CKV_BLANK_SHIFT[7:0] | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | Blank CKV shift from the last DE. |
| 0xD1 | 06h | v | CKV_BLANK_WIDTH[7:0] | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | Blank CKV width adjustment. |
| 0xD2 | 00h | v | CLR1_WD[7:0] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | GOA CLR1 width adjustment |
| 0xD3 | 00h | v | CLR234_WD[7:0] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | GOA CLR2/3/4 width adjustment |
| 0xD4 | 88h | v | CLR1_POL | 1 | - | - | - | - | - | - | - | CLR1 polarity setting. |
| | | v | CLR1_START[6:0] | - | 0 | 0 | 0 | 1 | 0 | 0 | 0 | CLR1 start position. |
| 0xD5 | 09h | v | CLR2_POL | 0 | - | - | - | - | - | - | - | CLR2 polarity setting. |
| | | v | CLR2_START[6:0] | - | 0 | 0 | 0 | 1 | 0 | 0 | 1 | CLR2 start position. |
| 0xD6 | 03h | v | CLR3_POL | 0 | - | - | - | - | - | - | - | CLR3 polarity setting. |
| | | v | CLR3_START[6:0] | - | 0 | 0 | 0 | 0 | 0 | 1 | 1 | CLR3 start position. |
| 0xD7 | 04h | v | CLR4_POL | 0 | - | - | - | - | - | - | - | CLR4 polarity setting. |
| | | v | CLR4_START[6:0] | - | 0 | 0 | 0 | 0 | 1 | 0 | 0 | CLR4 start position. |
| 0xD8 | 00h | v | CLR2/3/4_START_MSB[3:0] | 0 | 0 | 0 | 0 | - | - | - | - | MSB[10:7] of CLR2/3/4 start position. |
| | | v | CLR1_START_MSB[3:0] | - | - | - | - | 0 | 0 | 0 | 0 | MSB[10:7] of CLR1 start position. |
| 0xD9 | 00h | | Reserved | 0 | 0 | 0 | 0 | 0 | - | - | - | Reserved |
| | | v | CLR4_LEAD | - | - | - | - | - | 0 | - | - | GOA CLR4 offset direction setting. |
| | | v | CLR3_LEAD | - | - | - | - | - | - | 0 | - | GOA CLR3 offset direction setting. |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | v | CLR2_LEAD | - | - | - | - | - | - | - | 0 | GOA CLR2 offset direction setting. |
| 0xDB | 00h | | Reserved | 0 | 0 | 0 | 0 | 0 | - | - | - | Reserved |
| | | v | FLC_NONOVLAP[1:0] | - | - | - | - | - | 0 | 0 | - | FLC overlap setting. |
| | | v | CLR1_LEAD | - | - | - | - | - | - | - | 0 | GOA CLR1 offset direction setting. |
| 0xDD | 01h | v | GOA_T2B[7:0] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Tune even CKV falling time. |
| 0xDE | 3Ah | v | GOA_T3B[7:0] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Tune even CKV rising time. |
| 0xE6 | 00h | v | GOA_T0B[7:0] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Tune even STV falling time. |
| 0xE7 | 3Ah | v | GOA_T1B[7:0] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Tune even STV rising time. |

### 8.4.5 Register of page 5 (MIPI)

Address (M) is for master, Address(S) is for slave, Address (M/S) is for master and slave

| Addr[7:0] | Default[7:0] | OTP | Bit name | Data[7:0] | | | | | | | | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |
| 0xB1(M/S) | EDh | v | Reserved | 1 | 1 | 1 | 0 | - | - | - | - | Reserved |
| | | v | R_EoTpEN | - | - | - | - | 1 | - | - | - | Decode EoTp packet enable |
| | | v | Reserved | - | - | - | - | - | 1 | 0 | 1 | Reserved |
| 0xB3(M/S) | 33h | v | Ths_settle | 0 | 0 | 1 | - | - | - | - | - | Ths_settle adjustment |
| | | v | Lhs_settle | - | - | - | 1 | - | - | - | - | Ths_settle time latch by OSC25 edge selection. |
| | | v | T_TLPX | - | - | - | - | 0 | 0 | 1 | 1 | TLPX time of BTA adjustment |
| 0xC0(M)<br>0xD9(S) | 05h | v | TR_EN[7:6] | 0 | 0 | - | - | - | - | - | - | Terminal resistor enable |
| | | v | TRC_VAL[2:0] | - | - | - | - | - | 1 | 0 | 1 | Terminal resistor of CLK lane value adjustment |
| 0xC2(M)<br>0xDB(S) | 55h | v | Reserved | - | 1 | 0 | 1 | - | - | - | - | Reserved |
| | | v | TRD_VAL[2:0] | - | - | - | - | - | 1 | 0 | 1 | Terminal resistor of data lane value adjustment |
| 0xC5(M/S) | 18h | v | TUNEC | - | 0 | 0 | 1 | - | - | - | - | CLK lane skew adjustment |
| | | v | Reserved | - | - | - | - | 1 | - | - | - | Reserved |
| 0xC6(M)<br>0xDC(S) | 00h | v | TUNED1 | - | 0 | 0 | 0 | - | - | - | - | Data lane1 skew adjustment |
| | | v | TUNED0 | - | - | - | - | - | 0 | 0 | 0 | Data lane0 skew adjustment |
| 0xC7(M)<br>0xDD(S) | 00h | v | TUNED3 | - | 0 | 0 | 0 | - | - | - | - | Data lane3 skew adjustment |
| | | v | TUNED2 | - | - | - | - | - | 0 | 0 | 0 | Data lane2 skew adjustment |

### 8.4.6 Register of page 6 (Engineer)

| Addr[7:0] | Default[7:0] | OTP | Bit name | Data[7:0] | | | | | | | | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |
| 0xB8 | 5Ah | | Engineer_PWD | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | Engineer_PWD=A5h to enable engineer register |
| 0xBC | 33h | v | POCGM_CTL | - | 0 | 0 | 0 | - | - | - | - | Gamma chopper control |
| | | v | POCGMD_CTL | - | - | - | - | - | 0 | 0 | 0 | Gamma buffer chopper control |
| 0xC0 | 5Ah | | Function_EN | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | Function_EN=A5h to enable in-house function |
| 0xC7 | 0Ah | v | VCCIFS | - | - | - | - | 1 | 0 | - | - | VCCIF adjustment. |
| | | v | VCCS | - | - | - | - | - | - | 1 | 0 | VCC adjustment |
| 0xD5 | 26h | v | GOE_WD | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | Source delay time adjustment(CKV falling to Source off) |

### 8.4.7 Register of digital gamma

Page 7/10: Red positive/negative gamma
Page 8/11: Green positive/negative gamma
Page 9/12: Blue positive/negative gamma

**Page 7/8/9/10/11/12 register table**

| Addr[7:0] | Default[7:0] | OTP | Bit name | Data[7:0] | | | | | | | | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |
| 0xB1 | 00h | v | DGMA1[7:0] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Digital gamma V0 Reference |
| 0xB2 | 04h | v | DGMA2[7:0] | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | Digital gamma V1 Reference |
| 0xB3 | 0Ch | v | DGMA3[7:0] | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | Digital gamma V3 Reference |
| 0xB4 | 1Ch | v | DGMA4[7:0] | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | Digital gamma V7 Reference |
| 0xB5 | 2Ch | v | DGMA5[7:0] | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | Digital gamma V11 Reference |
| 0xB6 | 3Ch | v | DGMA6[7:0] | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | Digital gamma V15 Reference |
| 0xB7 | 5Ch | v | DGMA7[7:0] | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | Digital gamma V23 Reference |
| 0xB8 | 7Ch | v | DGMA8[7:0] | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | Digital gamma V31 Reference |
| 0xB9 | BCh | v | DGMA9[7:0] | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | Digital gamma V47 Reference |
| 0xBA | FCh | v | DGMA10[7:0] | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | Digital gamma V63 Reference |
| 0xBB | 7Ch | v | DGMA11[7:0] | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | Digital gamma V95 Reference |
| 0xBC | FCh | v | DGMA12[7:0] | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | Digital gamma V127 Reference |
| 0xBD | 00h | v | DGMA13[7:0] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Digital gamma V128 Reference |
| 0xBE | 80h | v | DGMA14[7:0] | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Digital gamma V160 Reference |
| 0xBF | 00h | v | DGMA15[7:0] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Digital gamma V192 Reference |
| 0xC0 | 40h | v | DGMA16[7:0] | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | Digital gamma V208 Reference |
| 0xC1 | 80h | v | DGMA17[7:0] | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Digital gamma V224 Reference |
| 0xC2 | A0h | v | DGMA18[7:0] | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | Digital gamma V232 Reference |
| 0xC3 | C0h | v | DGMA19[7:0] | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | Digital gamma V240 Reference |
| 0xC4 | D0h | v | DGMA20[7:0] | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | Digital gamma V244 Reference |
| 0xC5 | E0h | v | DGMA21[7:0] | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | Digital gamma V248 Reference |
| 0xC6 | F0h | v | DGMA22[7:0] | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | Digital gamma V252 Reference |
| 0xC7 | F8h | v | DGMA23[7:0] | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | Digital gamma V254 Reference |
| 0xC8 | FCh | v | DGMA24[7:0] | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | Digital gamma V255 Reference |
| 0xC9 | 00h | v | DGMA1[9:8] | 0 | 0 | - | - | - | - | - | - | Digital gamma V0 Reference |
| | | v | DGMA2[9:8] | - | - | 0 | 0 | - | - | - | - | Digital gamma V1 Reference |
| | | v | DGMA3[9:8] | - | - | - | - | 0 | 0 | - | - | Digital gamma V3 Reference |
| | | v | DGMA4[9:8] | - | - | - | - | - | - | 0 | 0 | Digital gamma V7 Reference |
| 0xCA | 00h | v | DGMA5[9:8] | 0 | 0 | - | - | - | - | - | - | Digital gamma V11 Reference |
| | | v | DGMA6[9:8] | - | - | 0 | 0 | - | - | - | - | Digital gamma V15 Reference |
| | | v | DGMA7[9:8] | - | - | - | - | 0 | 0 | - | - | Digital gamma V23 Reference |
| | | v | DGMA8[9:8] | - | - | - | - | - | - | 0 | 0 | Digital gamma V31 Reference |
| 0xCB | 05h | v | DGMA9[9:8] | 0 | 0 | - | - | - | - | - | - | Digital gamma V47 Reference |
| | | v | DGMA10[9:8] | - | - | 0 | 0 | - | - | - | - | Digital gamma V63 Reference |
| | | v | DGMA11[9:8] | - | - | - | - | 0 | 1 | - | - | Digital gamma V95 Reference |
| | | v | DGMA12[9:8] | - | - | - | - | - | - | 0 | 1 | Digital gamma V127 Reference |
| 0xCC | AFh | v | DGMA13[9:8] | 1 | 0 | - | - | - | - | - | - | Digital gamma V128 Reference |
| | | v | DGMA14[9:8] | - | - | 1 | 0 | - | - | - | - | Digital gamma V160 Reference |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | v | DGMA15[9:8] | - | - | - | - | 1 | 1 | - | - | Digital gamma V192 Reference |
| | | v | DGMA16[9:8] | - | - | - | - | - | - | 1 | 1 | Digital gamma V208 Reference |
| 0xCD | FFh | v | DGMA17[9:8] | 1 | 1 | - | - | - | - | - | - | Digital gamma V224 Reference |
| | | v | DGMA18[9:8] | - | - | 1 | 1 | - | - | - | - | Digital gamma V232 Reference |
| | | v | DGMA19[9:8] | - | - | - | - | 1 | 1 | - | - | Digital gamma V240 Reference |
| | | v | DGMA20[9:8] | - | - | - | - | - | - | 1 | 1 | Digital gamma V244 Reference |
| 0xCE | FFh | v | DGMA21[9:8] | 1 | 1 | - | - | - | - | - | - | Digital gamma V248 Reference |
| | | v | DGMA22[9:8] | - | - | 1 | 1 | - | - | - | - | Digital gamma V252 Reference |
| | | v | DGMA23[9:8] | - | - | - | - | 1 | 1 | - | - | Digital gamma V254 Reference |
| | | v | DGMA24[9:8] | - | - | - | - | - | - | 1 | 1 | Digital gamma V255 Reference |

# 9. Register Description

## 9.1 Register of page 0

| Address [7:0] | Data [7:0] (Default) 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Name | Description | OTP |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0xB1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | VENDER_ID[6:0] | The register is defines vender id for customer. | v |
| 0xB2 | - | - | - | - | - | - | - | 0 | BISTB | TCON BIST mode control. | v |
| | - | - | - | - | - | - | 0 | - | NBW | Normal Black and Normal white panel selection. | v |
| | - | - | - | - | - | 0 | - | - | ZTYPE | When zigzag function is enabled that selection type of Zigzag. | v |
| | - | - | - | - | 0 | - | - | - | ZIGZAG | Panel driving method selection. | v |
| | - | - | - | 0 | - | - | - | - | LR | Horizontal direction control. MIPI DCS 0x36 set_address_mode [2] command and SPI register do XOR operation. | v |
| | - | - | 0 | - | - | - | - | - | UPDNB | Vertical direction control. MIPI DCS 0x36 set_address_mode [1] command and SPI register do XOR operation. | v |
| | - | 1 | - | - | - | - | - | - | SLEEP | TCON sleep mode control. MIPI DCS 0x10 enter_sleep_mode is sleep mode, and 0x11 exit_sleep_mode is normal mode. MIPI DCS command does AND with SPI register. | v |

| Combination Logic | Truth table PIN/MIPI | REG | To TCON | To TCON |
|---|---|---|---|---|
| BIST_EN (pin), BISTB (reg) → XOR → To TCON BIST | 0 | 0 | 0 | 0: BIST mode. 1: Normal mode. |
| | 0 | 1 | 1 | |
| | 1 | 0 | 1 | |
| | 1 | 1 | 0 | |
| NBW (pin), NBW (reg) → XOR → To TCON NBW | 0 | 0 | 0 | 0: Normal white panel. 1: Normal black panel. |
| | 0 | 1 | 1 | |
| | 1 | 0 | 1 | |
| | 1 | 1 | 0 | |
| ZTYPE (pin), ZTYPE (reg) → XOR → To TCON ZTYPE | 0 | 0 | 0 | 0: Zigzag type 0 1: Zigzag type 1 |
| | 0 | 1 | 1 | |
| | 1 | 0 | 1 | |
| | 1 | 1 | 0 | |
| ZIGZAG (pin), ZIGZAG (reg) → XOR → To TCON ZIGZAG | 0 | 0 | 0 | 0: Stripe driving method. 1: Zigzag driving method. |
| | 0 | 1 | 1 | |
| | 1 | 0 | 1 | |
| | 1 | 1 | 0 | |
| MIPI DCS 0x36[6], LR (SPI) → XOR → To TCON LR | 0 | 0 | 0 | 0: Left to right. 1: Right to left. |
| | 0 | 1 | 1 | |
| | 1 | 0 | 1 | |
| | 1 | 1 | 0 | |
| MIPI DCS 0x36[7], UPDNB (SPI) → XOR → To TCON UPDNB | 0 | 0 | 0 | 0: Bottom to top. 1: Top to Bottom. |
| | 0 | 1 | 1 | |
| | 1 | 0 | 1 | |
| | 1 | 1 | 0 | |
| MIPI DCS 0x10,0x11, Sleep (SPI) → AND → To TCON Sleep | 0 **(0x10)** | 0 | 0 | 0: Sleep mode. 1: Normal mode. |
| | 0 **(0x10)** | 1 | 0 | |
| | 1 **(0x11)** | 0 | 0 | |
| | 1 **(0x11)** | 1 | 1 | |

**Table 9.1: TCON configuration 1-truth table**

| Address [7:0] | Data [7:0] (Default) 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Name | Description | OTP |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0xB3 | - | - | - | - | - | - | 0 | 0 | RES[1:0] | Resolution selection | v |
| | - | - | - | - | - | 0 | - | - | LED_EN | LEDON pin output control.<br>0:disable<br>1: enable | v |
| | - | - | - | - | 1 | - | - | - | VRES_FIX | Display vertical line decides by RES [2:0] or VRES [7:0]. This function is for TEST.<br>0: Vertical line decides by VRES [7:0].(page0 0xB4)<br>1: Vertical line decides by RES [2:0].(page0 0xB3 | v |
| | - | - | - | 0 | - | - | - | - | PWRMD | Power mode control.<br>0: internal VGH/VGL 1:external VGH/VGL | v |
| | - | 0 | 0 | - | - | - | - | - | LPM_CTRL | LPM mode control.<br>00:normal mode<br>01:LPM01 mode MIPI TX manu control display frame rate<br>1x:LPM10 mode driver auto detect still image and control display frame rate by register(page0 0xC6,0xC7,0xC8) | v |
| | 0 | - | - | - | - | - | - | - | DISP_ON | MIPI DCS 0x29 displays on and DCS 0x28 display off command. This DCS command does XOR with SPI. | v |

| Combination Logic | Truth table PIN/MIPI | REG | To TCON | To TCON |
|---|---|---|---|---|
| RES0 (pin), RES0 (reg) XOR → To TCON RES0 | 0 | 0 | 0 | 00b:1200RGBx1600<br>01b:108RGBx1920<br>10b: 600RGBx1024<br>11b: 1200RGBx1920 |
| | 0 | 1 | 1 | |
| | 1 | 0 | 1 | |
| | 1 | 1 | 0 | |
| RES1 (pin), RES1 (reg) XOR → To TCON RES1 | 0 | 0 | 0 | |
| | 0 | 1 | 1 | |
| | 1 | 0 | 1 | |
| | 1 | 1 | 0 | |
| | 0 | 1 | 1 | |
| | 1 | 0 | 1 | |
| | 1 | 1 | 0 | |
| LED_EN(pin), LED_EN(reg) XOR → To TCON LED_EN | 0 | 0 | 0 | 0:LEDON pin output disable<br>1:LEDON pin output enable. |
| | 0 | 1 | 1 | |
| | 1 | 0 | 1 | |
| | 1 | 1 | 0 | |
| PWRMD(pin), PWRMD(reg) XOR → To TCON PWRMD | 0 | 0 | 0 | 0:Internal VGH/VGL<br>1:External VGH/VGL |
| | 0 | 1 | 1 | |
| | 1 | 0 | 1 | |
| | 1 | 1 | 0 | |
| MIPI DCS 0x28, 0x29, DISP_ON (SPI) XOR → To TCON DISP | 0 **(0x28)** | 0 | 0 | 0: Display off.<br>1: Display on. |
| | 0 **(0x28)** | 1 | 1 | |
| | 1 **(0x29)** | 0 | 1 | |
| | 1 **(0x29)** | 1 | 0 | |

**Table 9.2: TCON configuration 2-truth table**

| Address [7:0] | Data [7:0] (Default) 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Name | Description | OTP |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0xB4 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | VRES[7:0] | When VRES_FIX is set enable, the veridical display line decide by this register. The VRES range is 80 ~ 255 and step is 8H. The max veridical display line must be less than V-display.<br>e.g. RES[2:0] is set 1200RGBx1920, VRES[7:0] < 0xF0 | v |
| 0xB5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ZDATA[7:0] | Zigzag panel dummy data set. When Zigzag driving method is enable. This data will be dummy line of source output. | v |
| 0xB6 | - | - | - | - | - | - | - | 0 | D_GAM_EN | Digital gamma function enables.<br>0: Disable.<br>1: Enable. | v |
| | - | - | - | - | - | - | 0 | - | DITHER_EN | Dithering function enables. If D_GAM_EN set to disable, the dithering function will be disable even set enable.<br>0: Disable.<br>1: Enable. | v |
| | - | - | - | - | 0 | 0 | - | - | CABC_CTRL[1:0] | CABC mode selection.<br>00b:Bypass mode.<br>01b:UI mode.<br>10b:Still mode<br>11b: Moving mode. | v |
| | - | - | 0 | - | - | - | - | - | RP2EN | 2nd repair OP enable/disable control(XOR pin)<br>0: Disable.<br>1: Enable. | v |
| | - | 0 | - | - | - | - | - | - | RP1EN | 1st repair OP enalbe/disable control(XOR pin)<br>0: Disable.<br>1: Enable. | v |
| 0xB7 | - | - | - | - | - | - | - | 0 | PCLK_SEL | TCON PCLK source path selection.<br>0: From OSC IP.<br>1:From EXT_CLK. | v |
| | - | - | - | - | - | 0 | 0 | - | OVERLAP[1:0] | Overlap select for MIPI RL type mode.<br>0: no pixel overlap<br>1: 2 pixel overlap<br>2: 4 pixel overlap<br>3: reserve | v |
| 0xB8 | - | - | - | - | - | - | 0 | 0 | MIPI_LAN | MIPI lane number selection(XOR pin MIPI_LAN)<br>00: reserve<br>01: 2 lans<br>10: reserve<br>11: 4 lans | v |
| | - | - | - | - | 0 | 0 | - | - | LNSW | MIPI lane swap(XOR pin LNSW)<br>Please see chapter 4.3. | v |
| | - | - | - | 0 | - | - | - | - | MIPI_TYPE | MIPI mode selection(XOR pin MIPI_TYPE)<br>0: multi drop mode<br>1: RL mode | v |
| | - | - | 0 | - | - | - | - | - | PNSW | MIPI pin polarity swap(XOR pin PNSW)<br>0: P/N not swap<br>1: P/N swap | v |
| | 0 | - | - | - | - | - | - | - | GOA_EN | GOA on/off control(XOR pin GOA_EN)<br>0: GOA off<br>1: GOA on | v |
| 0xBA | - | - | - | - | - | - | 0 | 0 | INV_SEL[1:0] | POL inversion selection. This function isn't support in BIST mode and Free mode.For ZIGZAG panel only has column inversion. For strip panel<br>00b: 1line 1dot inversion.<br>01b: 1+2line 1dot inversion.<br>10b: 2line 1dot inversion.<br>11b: Column inversion. | v |
| | - | - | - | - | 1 | 1 | - | - | SD_ISEL[1:0] | Source bias selection. 00:83% 01:125% 10:167% 11:100% | v |
| | - | - | - | 0 | - | - | - | - | INV_SEL2 | INV_SEL[1 :0]=01 selection<br>0: 1+2line 1dot inversion<br>1: 4line 1dot inversion | v |
| | - | - | 0 | - | - | - | - | - | BLREVONOFF | Source output at power on/off<br>0: Hi-z.<br>1: GND. | v |
| | 1 | 0 | - | - | - | - | - | - | BLREV[1:0] | Source output selection at V-blanking.<br>00b: Keep output the last line.<br>01b: Hi-z.<br>1xb: GND. | v |

<table>
<tr><th rowspan="2">Address [7:0]</th><th colspan="8">Data [7:0] (Default)</th><th rowspan="2">Name</th><th rowspan="2">Description</th><th rowspan="2">OTP</th></tr>
<tr><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>0xBD</td><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>T_VCOMS[7:0]</td><td>VCOM voltage selection.<br>VCOM=-0.2-0.01xT_VCOMS[7:0].<br><table><tr><th>T_VCOMS[7:0]</th><th>Output VCOM(V)</th></tr><tr><td>0x00</td><td>-0.20</td></tr><tr><td>0x01</td><td>-0.21</td></tr><tr><td>0x02</td><td>-0.22</td></tr><tr><td>0x03</td><td>-0.23</td></tr><tr><td colspan="2">:</td></tr><tr><td>0x7F</td><td>-1.47</td></tr><tr><td>0x80</td><td>-1.48</td></tr><tr><td>0x81</td><td>-1.49</td></tr><tr><td colspan="2">:</td></tr><tr><td>0xFD</td><td>-2.73</td></tr><tr><td>0xFE</td><td>-2.74</td></tr><tr><td>0xFF</td><td>-2.75</td></tr></table></td><td>v</td></tr>
<tr><td>0xBE</td><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>LPM_VCOMS[7:0]</td><td>VCOM voltage selection in LPM mode. Range refer to T_VCOMS table</td><td>v</td></tr>
<tr><td>0xBF</td><td>-</td><td>-</td><td>-</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>VGHS[4:0]</td><td>VGH voltage selection. Range is from 8.7V to 18V. Step=0.3V. (Default=16.2V)<br><table><tr><th>VGHS[4:0]</th><th>Output VGH(V)</th></tr><tr><td>0</td><td>8.7</td></tr><tr><td>1</td><td>9.0</td></tr><tr><td>2</td><td>9.3</td></tr><tr><td>3</td><td>9.6</td></tr><tr><td colspan="2">:</td></tr><tr><td>29</td><td>17.4</td></tr><tr><td>30</td><td>17.7</td></tr><tr><td>31</td><td>18.0</td></tr></table></td><td>v</td></tr>
<tr><td>0xC0</td><td>-</td><td>-</td><td>-</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>VGLS[4:0]</td><td>VGL voltage selection. Range is from -6.7V to -16V. Step=0.3V. (Default=-11.5V)<br><table><tr><th>VGLS[4:0]</th><th>Output VGL(V)</th></tr><tr><td>0</td><td>-6.7V</td></tr><tr><td>1</td><td>-7.0V</td></tr><tr><td>2</td><td>-7.3V</td></tr><tr><td>3</td><td>-7.6V</td></tr><tr><td colspan="2">:</td></tr><tr><td>29</td><td>-15.4V</td></tr><tr><td>30</td><td>-15.7V</td></tr><tr><td>31</td><td>-16.0V</td></tr></table></td><td>v</td></tr>
<tr><td rowspan="3">0xC1</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>1</td><td>1</td><td>CPCLKH [1:0]</td><td>VGH/VGL charge pump clock.<br>00b:4H 01b:2H 10b:1H 11b:0.5H</td><td>v</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td><td>1</td><td>1</td><td>-</td><td>-</td><td>VGHXSP[1:0]</td><td>VGH boosting multiple selection<br>00: 2X<br>01: 3X<br>10: 4X<br>11: 4X</td><td>v</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>1</td><td>-</td><td>-</td><td>-</td><td>-</td><td>VGLXSP</td><td>VGL boosting multiple selection<br>0: -2X<br>1: -3X</td><td>v</td></tr>
<tr><td>0xC2</td><td>-</td><td>-</td><td>-</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>VGPHS[4:0]</td><td>Positive gamma high voltage selection . Range is from 4V ~ 5.5V. (Default=4.2V) Step=0.05V.<br><table><tr><th>VPHS[4:0]</th><th>Output VGPH(V)</th></tr><tr><td>0x00</td><td>4.00V</td></tr><tr><td>0x01</td><td>4.05V</td></tr><tr><td>0x02</td><td>4.10V</td></tr><tr><td>0x03</td><td>4.15V</td></tr><tr><td colspan="2">:</td></tr><tr><td>0x1D</td><td>5.45V</td></tr><tr><td>0x1E</td><td>5.50V</td></tr><tr><td>0x1F</td><td>5.50V</td></tr></table></td><td>v</td></tr>
</table>

| Address [7:0] | Data [7:0] (Default) 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Name | Description | OTP |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0xC3 | - | - | - | 0 | 0 | 0 | 1 | 0 | VGPLS[4:0] | Positive gamma low voltage selection. Range is from 0.1V ~ 1.6V. **(Default=0.2V)** Step=0.05V. | v |
| 0xC4 | - | - | - | 0 | 0 | 1 | 0 | 0 | VGNHS[4:0] | Negative gamma high voltage selection. Range is from -4V ~ -5.5V. **(Default=-4.2V)**. Step=0.05V. | v |
| 0xC5 | - | - | - | 0 | 0 | 0 | 1 | 0 | VGNLS[4:0] | Negative gamma low voltage selection. Range is from -0.1V ~ -1.6V. **(Default=-0.2V)** Step=0.05V. | v |
| 0xC6 | - | 0 | 0 | 1 | 0 | 0 | 0 | 0 | STILLIMG_DET_NUM | Still image detect frame number. Detect still image input to enter LPM10 mode.2n frames/step(value 0 can't use) | v |
| 0xC7 | - | - | - | - | 0 | 0 | 0 | 0 | RER_NUM | Refresh frame number in LPM10 mode. 2n+1 frames/step | v |
| 0xC8 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | NOREF_NUM | No refresh frame number in LPM10 mode 2n+1 frames/step | v |
| 0xCC | - | - | - | 0 | 1 | 0 | 0 | 0 | EQ0/1W[4:0](1) | Source EQ0/1 time setting. EQ0/1W is N. $T_{EQ0}$=4N*40ns(EQ0/1W=0 N=0,EQ0/1W<4 N=3) | v |
| | - | 0 | 0 | - | - | - | - | - | POCSD_CTL[1:0] | Source output offset cancel method selection. 00:1+2line 01:2line 10:1line 11:off | v |
| 0xCD | 0 | - | - | - | - | - | - | - | VPP_EN | 1:internal VPP enable 0:internal VPP disable | |
| 0xF9 | - | - | - | - | - | - | - | 1 | FLC2B_SEL | FLC2B signal output selection. 1: VGL output 0:FLC2B output | v |
| | - | - | - | - | - | - | 0 | - | GOA_POWEROFF | 1:GOA keeps VGH 0:GOA keeps active | v |
| | - | - | - | - | - | 1 | - | - | GOA_POWERON | CLR1/2 output selection when power on 1:CLR1 keeps VGL,CLR2 keeps VGH 0:CLR1 keeps VGH,CLR2 keeps VGL | v |
| | - | - | - | - | 1 | - | - | - | GOA_GAS | GOA output when GAS enable 1:VGH 0:VGL | v |
| | 0 | 1 | 0 | 1 | - | - | - | - | Reserved | Reserved | - |
| 0xFB | - | - | - | - | - | - | - | 1 | GRB | All spi register reset 1: normal 0: reset register | - |
| 0xFC | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | PRODUCTID1 | Read only. The value is 0x82 | - |
| 0xFD | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | PRODUCTID2 | Read only. The value is 0x79 | - |
| 0xFE | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | PRODUCTID3 | Read only. The value is 0x0D | - |
| 0xFF | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | CHIPID | Read only. | - |

**VPLS[4:0] / Output VGPL(V)**

| VPLS[4:0] | Output VGPL(V) |
|---|---|
| 0x00 | 0.10V |
| 0x01 | 0.15V |
| 0x02 | 0.20V |
| 0x03 | 0.25V |
| : | |
| 0x1D | 1.55V |
| 0x1E | 1.60V |
| 0x1F | 1.60V |

**VNHS[4:0] / Output VGNH(V)**

| VNHS[4:0] | Output VGNH(V) |
|---|---|
| 0x00 | -4.00V |
| 0x01 | -4.05V |
| 0x02 | -4.10V |
| 0x03 | -4.15V |
| : | |
| 0x1D | -5.45V |
| 0x1E | -5.50V |
| 0x1F | -5.50V |

**VNLS[4:0] / Output VGNL(V)**

| VNLS[4:0] | Output VGNL(V) |
|---|---|
| 0x00 | -0.10V |
| 0x01 | -0.15V |
| 0x02 | -0.20V |
| 0x03 | -0.25V |
| : | |
| 0x1D | -1.55V |
| 0x1E | -1.60V |
| 0x1F | -1.60V |

**Note:** (1)EQ0: SOUT pre charge to GND when SOUT polarization change.
EQ1:SOUT charges sharing by odd CHs short and even CHs short when n line and n+1 line datas are different up to 1/2.

## 9.2 Register of page 1(OTP & GOA MUX)

| Address [7:0] | Data [7:0] (Default) 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Name | Description | OTP |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0xB1 | - | - | 0 | 0 | 0 | 0 | 0 | 0 | OTP_GROUP[4:0] | OTP trimming group select. The group range is from group0 to group35 | - |
| 0xB2 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | OTP_PWD[7:0] | Set to 0xA5 to enable 0xB3 command. | - |
| 0xB3 | - | - | - | - | - | - | - | 0 | OTP_WR(1) | Auto OTP program mode write command | - |
| | - | - | - | - | - | 0 | - | - | OTP_RE_LOAD | OTP auto re-load command. | - |
| | 0 | - | - | - | - | - | - | - | OTP_BURST_WR(2) | OTP burst write command | - |
| 0xB9 | - | - | 0 | 0 | - | - | - | - | DISABLE_OTP[1:0] | OTP function disables. | - |

| DISABLE_ OTP | Master OTP function | Slave OTP function |
|---|---|---|
| 00b | Enable | Enable |
| 01b | Enable | Disable |
| 10b | Disable | Enable |
| 11b | Disable | Disable |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0xBB | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | OTP_BURST_INDEX[7:0] | Burst program group index(group0~7) | - |
| 0xBC | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | OTP_BURST_INDEX[15:8] | Burst program group index(group8~15) | - |
| 0xBD | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | OTP_BURST_INDEX[23:16] | Burst program group index(group16~23) | - |
| 0xBE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | OTP_BURST_INDEX[31:24] | Burst program group index(group24~31) | - |
| 0xBF | - | - | - | - | 0 | 0 | 0 | 0 | OTP_BURST_INDEX[35:32] | Burst program group index(group32~35) | - |

**Note:**
(1) OTP auto program mode (program by group) sequence：
Write OTP setting value→write OTP group N(0xB1=N)→write 0xB2=0xA5→write 0xB3[0]=1
(2) OTP burst write mode(program by group index) sequence：
Write OTP setting value→write group index(0xBB[n]=1,n mean OTP group)→ write 0xB2=0xA5→write 0xB3[7]=1
EX. Program OTP group 5,10,,20,30,35
Write OTP setting value→
write 0xBB[5]=1(group5),0xBC[3]=1(group10),0xBD[4]=1(group20),0xBE[6]=1(group30),0xBF[3]=1(group35)
→ write 0xB2=0xA5→write 0xB3[7]=1

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0xC0~0xD3 | - | - | 0 | 0 | 0 | 0 | 0 | 0 | GOUTL_[20:1]_SEL | Mux GOA signal to GOUTL pin. | v |
| | 0 | 0 | - | - | - | - | - | - | GOUTL_[20:1]_STB | GOUTR_20 level in standby mode 00:VGL 01:VGH 10:GND 11:reserve | v |
| 0xD4~0xE7 | - | - | 0 | 0 | 0 | 0 | 0 | 0 | GOUTR_[20:1]_SEL | Mux GOA signal to GOUTR pin. | v |
| | 0 | 0 | - | - | - | - | - | - | GOUTR_[20:1]_STB | GOUTR_20 level in standby mode 00:VGL 01:VGH 10:GND 11:reserve | v |

| SEL[5:0] | GOA Output |
|---|---|
| 0x00 | VGL |
| 0x01 | STV1 |
| 0x02 | STV2 |
| 0x03 | STV3 |
| 0x04 | STV4 |
| 0x05 | CKV1 |
| 0x06 | CKV2 |
| 0x07 | CKV3 |
| 0x08 | CKV4 |
| 0x09 | CKV5 |

| SEL[5:0] | GOA Output |
|---|---|
| 0x0A | CKV6 |
| 0x0B | CKV7 |
| 0x0C | CKV8 |
| 0x0D | CLR1 |
| 0x0E | CLR2 |
| 0x0F | CLR3 |
| 0x10 | CLR4 |
| 0x11 | FLC1 |
| 0x12 | FLC2 |
| 0x13 | GCKA |

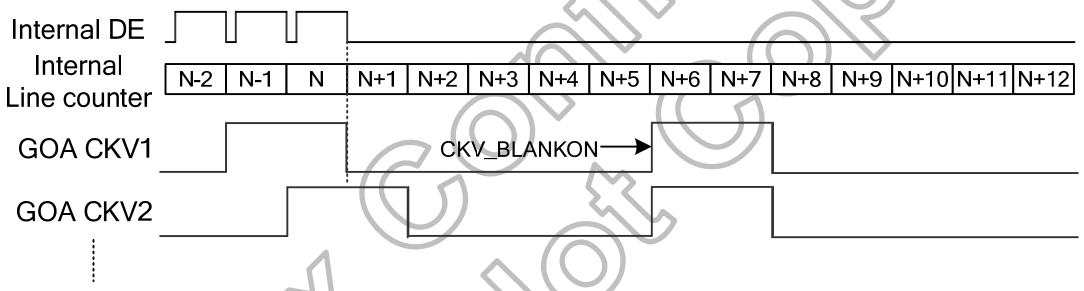
| SEL[5:0] | GOA Output |
|---|---|
| 0x14 | GCKB |
| 0x15 | DIR |
| 0x16 | DIRB |
| 0x17 | STV5 |
| 0x18 | STV6 |
| 0x19 | STV7 |
| 0x1A | STV8 |
| 0x1B | CKV9 |
| 0x1C | CKV10 |
| 0x1D | CKV11 |

| SEL[5:0] | GOA Output |
|---|---|
| 0x1E | CKV12 |
| 0x1F | CKV13 |
| 0x20 | CKV14 |
| 0x21 | CKV15 |
| 0x22 | CKV16 |
| 0x23 | FLC1B |
| 0x24 | FLC2B |
| Others | VGH |

## 9.3 Register of page 3(GOA)

| Address [7:0] | Data [7:0] (Default) 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Name | Description | OTP |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0xB9 | - | - | 0 | 0 | 0 | 0 | 0 | 0 | Reserved | Reserved | - |
| | - | 0 | - | - | - | - | - | - | FLC_SEL | FLC output selection<br>1:for CPT signal output 0:for FLC output | v |
| | 0 | - | - | - | - | - | - | - | Reserved | Reserved | - |
| 0xBB | - | - | - | - | - | 0 | 0 | 0 | STV_PREC[2:0] | STV pre-charge width adjustment<br>1 OSC25M/step | v |
| | 0 | 0 | 0 | 0 | - | - | - | - | Reserved | Reserved | - |
| 0xBC | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | CKV_FALL_PREC[7:0] | CKV falling pre-charge width adjustment.<br>1 OSC25M/step | v |
| 0xBE | - | - | - | - | - | 0 | 0 | 1 | GOA_PHASE[2:0] | GOA phase selection.<br>000b:4 phase.<br>001b:8 phase.<br>010b:6 phase.<br>011b:12phase.<br>100b:16 phase.<br>others: Reserve. | v |
| | - | - | - | - | 0 | - | - | - | CKV_BLANKON | CKV blanking on enable.<br>0:Disable.<br>1:Enable. | v |
| | - | - | - | 0 | - | - | - | - | Reserved | Reserved | - |
| | - | - | 0 | - | - | - | - | - | GOA_UD | GOA scan direction selection.XOR page0 0xB2[5] | v |
| | 0 | 0 | - | - | - | - | - | - | Reserved | Reserved | - |

**Note:** (1)




| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0xBF | - | - | - | - | 0 | 0 | 0 | 0 | Reserved | Reserved | - |
| | - | - | 0 | 1 | - | - | - | - | GOA_Tn_FACTOR | GOA Timing (T0~T5) adjustment factor selection.<br>00: Tnx1<br>01: Tnx2.<br>10: Tnx4<br>11: Tnx8 | v |
| | 0 | 0 | - | - | - | - | - | - | Reserved | Reserved | - |
| 0xC2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | GOA_T0[7:0] | Odd STV falling position adjustment.<br>T0=GOA_T0[7:0] x GOA_Tn_FACTOR. | v |
| 0xC3 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | GOA_T1[7:0] | Odd STV rising position adjustment.<br>T1=GOA_T1[7:0] x GOA_Tn_FACTOR. | v |
| 0xC4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | GOA_T2[7:0] | Odd CKV falling position adjustment.<br>T2=GOA_T2[7:0] x GOA_Tn_FACTOR. | v |
| 0xC5 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | GOA_T3[7:0] | Odd CKV rising position adjustment.<br>T3=GOA_T3[7:0] x GOA_Tn_FACTOR. | v |
| 0xC6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | GOA_T4[7:0] | Odd GCK falling position adjustment.<br>T4=GOA_T4[7:0] x GOA_Tn_FACTOR. | v |
| 0xC7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | GOA_T5[7:0] | Odd GCK rising position adjustment.<br>T5=GOA_T5[7:0] x GOA_Tn_FACTOR. | v |

**Note:** (2) Unit is OSC25M.

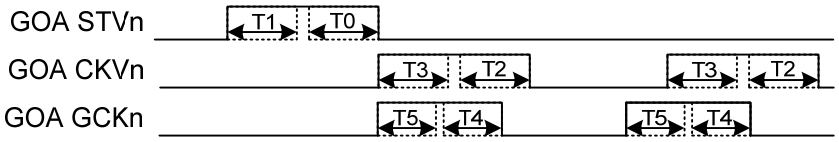



**Figure 9.1: GOA timing tune**

| Address [7:0] | Data [7:0] (Default) 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Name | Description | OTP |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0xC8 | - | - | - | 0 | 1 | 1 | 0 | 1 | STV_LEAD[4:0] | GOA STV leads time adjustment. | v |
| | 0 | 0 | 0 | - | - | - | - | - | Reserved | Reserved | - |
| 0xC9 | - | - | - | 0 | 1 | 0 | 1 | 1 | CKV_LEAD[4:0] | GOA CKV leads time adjustment. | v |
| | 0 | 0 | 0 | - | - | - | - | - | Reserved | Reserved | - |

**Note:** (3) a. Unit is H.
b. VT is meats V-total.

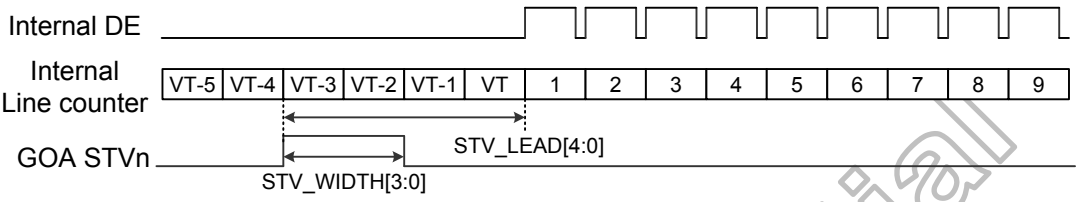



**Figure 9.2: GOA STV time chart**

(4)a. Unit is H.
b. VT is meats V-total.

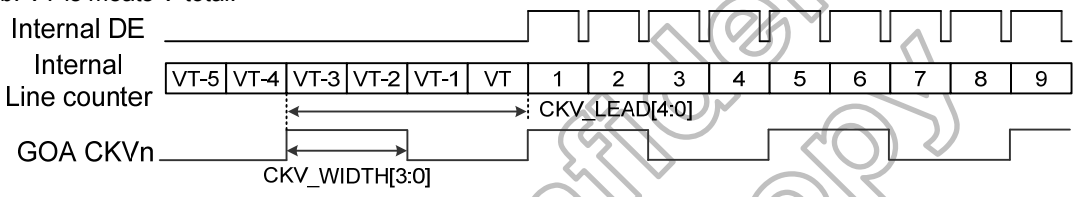



**Figure 9.3: GOA CKV time chart**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0xCA | - | - | 0 | 0 | 0 | 0 | 1 | 0 | CKV_DUMMY[5:0] | GOA CKV dummy number in V-blanking.<br>The total number is CKV_DUMMY[5:0]xGOA Phase, | v |
| | - | 0 | - | - | - | - | - | - | Reserved | Reserved | - |
| | 0 | - | - | - | - | - | - | - | CKV_NONOVERLAP | CKV non-overlap control<br>0: Non-overlap<br>1: overlap | v |

**Note:** (5) a. N is meats V-Active lines.
b. DUMMY must be less than V-front porch.

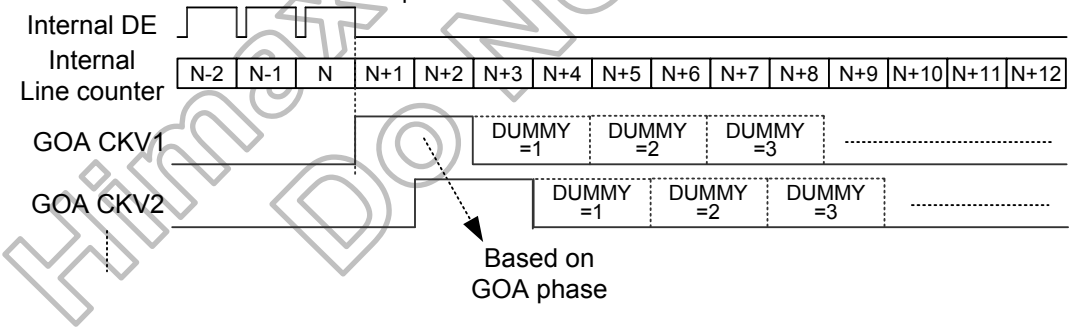



**Figure 9.4: GOA CKV dummy chart**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0xCB | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | CKV_RISE_PREC[7:0] | CKV rising pre-charge width adjustment.<br>1 OSC25M/step | v |

**Note:** (6)

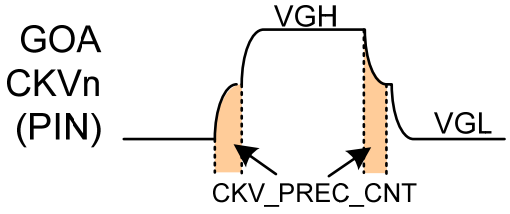



**Figure 9.5: GOA precharge time chart**

| Address [7:0] | Data [7:0] (Default) 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Name | Description | OTP |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0xCC | - | - | - | - | 0 | 1 | 0 | 0 | CKV_WIDTH[3:0] | GOA CKV width adjustment. | v |
| | 0 | 1 | 0 | 0 | - | - | - | - | STV_WIDTH[3:0] | GOA STV width adjustment. | v |
| 0xCD | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | GOA_FLC[7:0] | GOA FLC toggle frame adjustment. The toggle frame range is 1 ~ 127 frames. | v |

**Note:** (7)

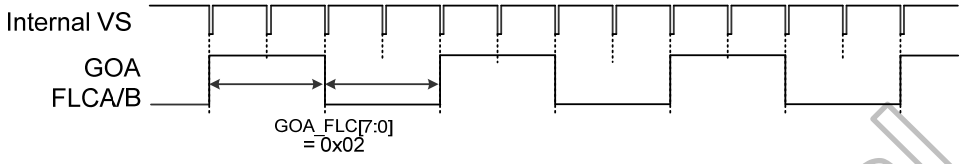



**Figure 9.6: GOA FLC time chart**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0xCE | - | 0 | 1 | 0 | 0 | 0 | 0 | 0 | GOA_FLCA_LEAD[6:0] | FLCA lead 1st DE toggle number. | v |
| | 0 | - | - | - | - | - | - | - | Reserved | Reserved | - |
| 0xCF | - | - | - | - | - | 0 | 0 | 0 | CLR_WD[10:8] | CLR width adjustment bits[10:8] | v |
| | - | - | - | - | 1 | - | - | - | CLR_adjsel | CLR adjustment selection<br>1:rising adjust 0:width adjust | v |
| | - | 1 | 1 | 0 | - | - | - | - | Reserved | Reserved | - |
| | 0 | - | - | - | - | - | - | - | FLC_sync | FLC sync selection<br>1:Sync with 1st STV 0:Sync with last DE | v |
| 0xD0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | CKV_BLANK_SHIFT[7:0] | Blank CKV shift from the last DE.<br>H/step | v |
| 0xD1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | CKV_BLANK_WIDTH[7:0] | Blank CKV width adjustment.<br>H/step | v |
| 0xD2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | CLR1_WD[7:0] | GOA CLR1 width adjustment<br>CLR1_WIDTH[10:0]=CLR1234_WD_MSB[2:0]x256 + CLR1_WD[7:0] | v |
| 0xD3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | CLR234_WD[7:0] | GOA CLR234 width adjustment.<br>CLR234_WIDTH[10:0]=CLR1234_WD_MSB[2:0]x256+CLR234_WD[7:0] | v |

**Note:** (8) a. Unit is H.
b. The total value must be less than V-front porch.

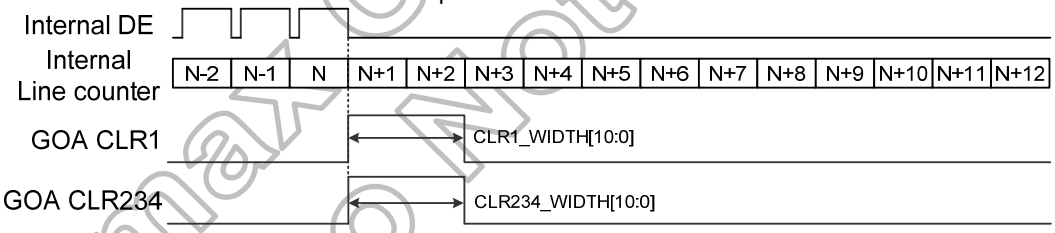



**Figure 9.7: CLR width time chart**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0xD4 | - | 0 | 0 | 0 | 1 | 0 | 0 | 0 | CLR1_START[6:0] | CLR1 start position.<br>CLR1_ST[10:0]=CLR1_START_MSB[3:0]x128+CLR1_START[6:0] | v |
| | 1 | - | - | - | - | - | - | - | CLR1_POL | CLR1 polarity setting.<br>0: Non-inversion.<br>1: Inversion. | v |
| 0xD5 | - | 0 | 0 | 0 | 1 | 0 | 0 | 1 | CLR2_START[6:0] | CLR2 start position.<br>CLR2_ST[10:0]=CLR234_START_MSB[3:0]x128+CLR2_START[6:0] | v |
| | 0 | - | - | - | - | - | - | - | CLR2_POL | CLR2 polarity setting.<br>0: Non-inversion.<br>1: Inversion. | v |
| 0xD6 | - | 0 | 0 | 0 | 0 | 0 | 1 | 1 | CLR3_START[6:0] | CLR3 start position.<br>CLR3_ST[10:0]=CLR234_START_MSB[3:0]x128+CLR3_START[6:0] | v |
| | 0 | - | - | - | - | - | - | - | CLR3_POL | CLR3 polarity setting.<br>0: Non-inversion.<br>1: Inversion. | v |
| 0xD7 | - | 0 | 0 | 0 | 0 | 1 | 0 | 0 | CLR4_START[6:0] | CLR4 start position.<br>CLR4_ST[10:0]=CLR234_START_MSB[3:0]x128+CLR4_START[6:0] | v |
| | 0 | - | - | - | - | - | - | - | CLR4_POL | CLR4 polarity setting.<br>0: Non-inversion.<br>1: Inversion. | v |

| Address [7:0] | Data [7:0] (Default) 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Name | Description | OTP |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0xD8 | - | - | - | - | 0 | 0 | 0 | 0 | CLR1_START_MSB[3:0] | MSB[10:7] of CLR1 start position. | v |
| | 0 | 0 | 0 | 0 | - | - | - | - | CLR2/3/4_START_MSB[3:0] | MSB[10:7] of CLR2/3/4 start position. | v |

**Note:** (9) a. Unit is H-total.
b. The total value must be less than V-total

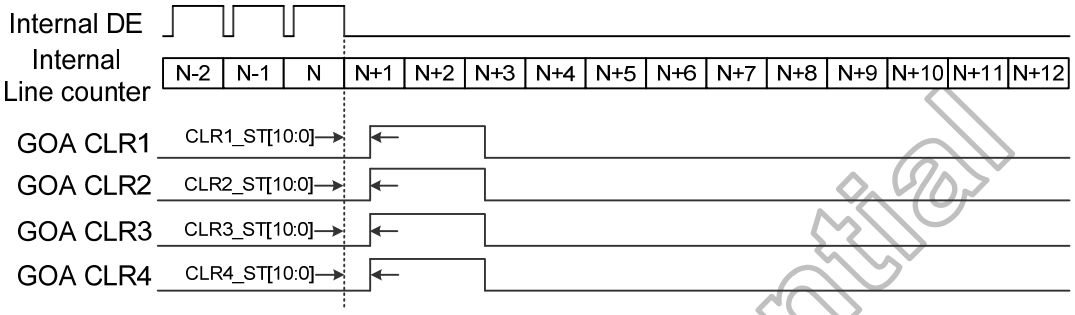



**Figure 9.8: CLR start position time chart**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0xD9 | - | - | - | - | - | - | - | 0 | CLR2_LEAD | GOA CLR2 offset direction setting. | v |
| | - | - | - | - | - | - | 0 | - | CLR3_LEAD | GOA CLR3 offset direction setting. | v |
| | - | - | - | - | - | 0 | - | - | CLR4_LEAD | GOA CLR4 offset direction setting. | v |
| | 0 | 0 | 0 | 0 | 0 | - | - | - | Reserved | Reserved | - |
| 0xDB | - | - | - | - | - | - | - | 0 | CLR1_LEAD | GOA CLR1 offset direction setting. | v |
| | - | - | - | - | 0 | 0 | 0 | - | FLC_NONOVLAP[1:0] | FLC overlap setting.<br>00b:0H<br>x1b:1H<br>10b:2H | v |
| | 0 | 0 | 0 | 0 | - | - | - | - | Reserved | Reserved | - |
| 0xDD | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | GOA_T2B[7:0] | Even CKV falling position adjustment.<br>T0=GOA_T2B[7:0] x GOA_Tn_FACTOR. | v |
| 0xDE | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | GOA_T3B[7:0] | Even CKV rising position adjustment.<br>T0=GOA_T3B[7:0] x GOA_Tn_FACTOR. | v |
| 0xE6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | GOA_T0B[7:0] | Even STV falling position adjustment.<br>T0=GOA_T0B[7:0] x GOA_Tn_FACTOR. | v |
| 0xE7 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | GOA_T1B[7:0] | Even STV rising position adjustment.<br>T0=GOA_T1B[7:0] x GOA_Tn_FACTOR. | v |

## 9.4 Register of page 5(MIPI)

Address(M) is for master, Address(S) is for slave, Address(M/S) is for master and slave

| Address [7:0] | Data [7:0] (Default) | | | | | | | | Name | Description | OTP |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | | |
| 0xB1 | - | - | - | - | - | 1 | 0 | 1 | Reserved | Reserved | v |
| | - | - | - | - | 1 | - | - | - | R_EoTpEN | Decode EoTp packet enable.<br>0:disable<br>1:enable | v |
| | 1 | 1 | 1 | 0 | - | - | - | - | Reserved | Reserved | v |
| 0xB3 | - | - | - | - | 0 | 0 | 1 | 1 | T_TLPX | TLPX time of BTA adjustment<br>TLPX time=T_TLPX*40ns | v |
| | - | - | - | 1 | - | - | - | - | Lhs_settle | Ths_settle time latch by OSC25 edge selection.<br>1:rising 0:falling | v |
| | 0 | 0 | 1 | - | - | - | - | - | Ths_settle | Ths_settle adjustment<br>Ths_settle time=(Ths_settle+1)*40ns | v |
| 0xC0(M)<br>0xD9(S) | - | - | - | - | - | 1 | 0 | 1 | TRC_VAL | Terminal resistor of CLK lane value adjustment<br>TR_ADJ[2:0] / TR(ohm)<br>000 / 255<br>001 / 192<br>010 / 153<br>011 / 128<br>100 / 118<br>101 / 102<br>110 / 90<br>111 / 81 | v |
| | 0 | 0 | - | - | - | - | - | - | TR_EN | Terminal resistor enable<br>00: turn on TR<br>10: turn off TR | v |
| 0xC2(M)<br>0xDB(S) | - | - | - | - | - | 1 | 0 | 1 | TRD_VAL | Terminal resistor of data lane value adjustment<br>TR_ADJ[2:0] / TR(ohm)<br>000 / 255<br>001 / 192<br>010 / 153<br>011 / 128<br>100 / 118<br>101 / 102<br>110 / 90<br>111 / 81 | v |
| | | 1 | 0 | 1 | | | | | Reserved | Reserved | v |
| 0xC5(M/S) | - | - | - | - | 1 | - | - | - | Reserved | Reserved | v |
| | - | 0 | 0 | 1 | - | - | - | - | TUNEC | CLK lane skew adjustment | v |
| 0xC6(M)<br>0xDC(S) | - | - | - | - | - | 0 | 0 | 0 | TUNED0 | Data lane0 skew adjustment | v |
| | - | 0 | 0 | 0 | - | - | - | - | TUNED1 | Data lane1 skew adjustment | v |
| 0xC7(M)<br>0xDD(S) | - | - | - | - | - | 0 | 0 | 0 | TUNED2 | Data lane2 skew adjustment | v |
| | - | 0 | 0 | 0 | - | - | - | - | TUNED3 | Data lane3 skew adjustment | v |

## 9.5 Register of page 6(Engineer)

<table>
<tr><th rowspan="2">Address [7:0]</th><th colspan="8">Data [7:0] (Default)</th><th rowspan="2">Name</th><th rowspan="2">Description</th><th rowspan="2">OTP</th></tr>
<tr><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>0xB8</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>Engineer_PWD</td><td>Engineer_PWD = A5h to enable engineer register</td><td>v</td></tr>
<tr><td rowspan="2">0xBC</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>0</td><td>0</td><td>0</td><td>POCGMD_CTL</td><td>Gamma buffer chopper control<br><table><tr><th>Value</th><th>POCGMD_CTL</th></tr><tr><td>0</td><td>1 line</td></tr><tr><td>1</td><td>2 line</td></tr><tr><td>2</td><td>4 line</td></tr><tr><td>3</td><td>1 frame</td></tr><tr><td>4</td><td>2 frame</td></tr><tr><td>5</td><td>4 frame</td></tr><tr><td>6</td><td>8 frame</td></tr><tr><td>7</td><td>Non toggle</td></tr></table></td><td>v</td></tr>
<tr><td>-</td><td>0</td><td>0</td><td>0</td><td>-</td><td>-</td><td>-</td><td>-</td><td>POCGM_CTL</td><td>Gamma chopper control<br><table><tr><th>Value</th><th>POCGM_CTL</th></tr><tr><td>0</td><td>1 line</td></tr><tr><td>1</td><td>2 line</td></tr><tr><td>2</td><td>4 line</td></tr><tr><td>3</td><td>1 frame</td></tr><tr><td>4</td><td>2 frame</td></tr><tr><td>5</td><td>4 frame</td></tr><tr><td>6</td><td>8 frame</td></tr><tr><td>7</td><td>Non toggle</td></tr></table></td><td>v</td></tr>
<tr><td>0xC0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>Function_EN</td><td>Function_EN=A5h to enable in-house function</td><td>v</td></tr>
<tr><td rowspan="2">0xC7</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>1</td><td>0</td><td>VCCS</td><td>VCC adjustment<br>00:1,45mV,01:1.5mV,10:1.55mV,11:1.6mV</td><td>v</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td><td>1</td><td>0</td><td>-</td><td>-</td><td>VCCIFS</td><td>VCCIF adjustment.<br>00:1,45mV,01:1.5mV,10:1.55mV,11:1.6mV</td><td>v</td></tr>
<tr><td>0xD5</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>GOE_WD</td><td>Source delay time adjustment(CKV falling to Source off)<br>Source delay time=GOE_WD*40ns</td><td>v</td></tr>
</table>

# 10. Function Description

## 10.1 BIST function

When BIST_ENB is trigger to low, then HX8279-D will leave normal operation mode and starts to generate the BIST pattern to LCD panel without MIPI input signals.

### 10.1.1 BIST output timing

| BIST mode | H-active | H-total | V-total | Frame rate(Hz) | osc_freq(MHz) |
|---|---|---|---|---|---|
| 1200RGBx1920 | 600 | 690 | 1940 | 60 | 80 |
| 1200RGBx1600 | 600 | 696 | 1620 | 60 | 68 |
| 1080RGBx1920 | 540 | 632 | 1940 | 60 | 74 |
| 600RGBx1024 | 300 | 345 | 1044 | 60 | 21 |

**Note:** (1) BIST mode is 2-pixel/dclk.

**Table 10.1: BIST mode with multi drop type**

| BIST mode | H-active | H-total | V-total | Frame rate(Hz) | osc_freq(MHz) |
|---|---|---|---|---|---|
| 1200RGBx1920 | 300 | 420 | 1940 | 56 | 46 |
| 1200RGBx1600 | 300 | 420 | 1620 | 57 | 39 |
| 1080RGBx1920 | 270 | 380 | 1940 | 56 | 42 |
| 600RGBx1024 | 300 | 430 | 1044 | 55 | 25 |

**Note:** (1) BIST mode is 4-pixel/dclk.

**Table 10.2: BIST mode with RL type**

### 10.1.2 BIST pattern

The BIST pattern is illustrated as below figure. Each pattern will display about 127 frames.

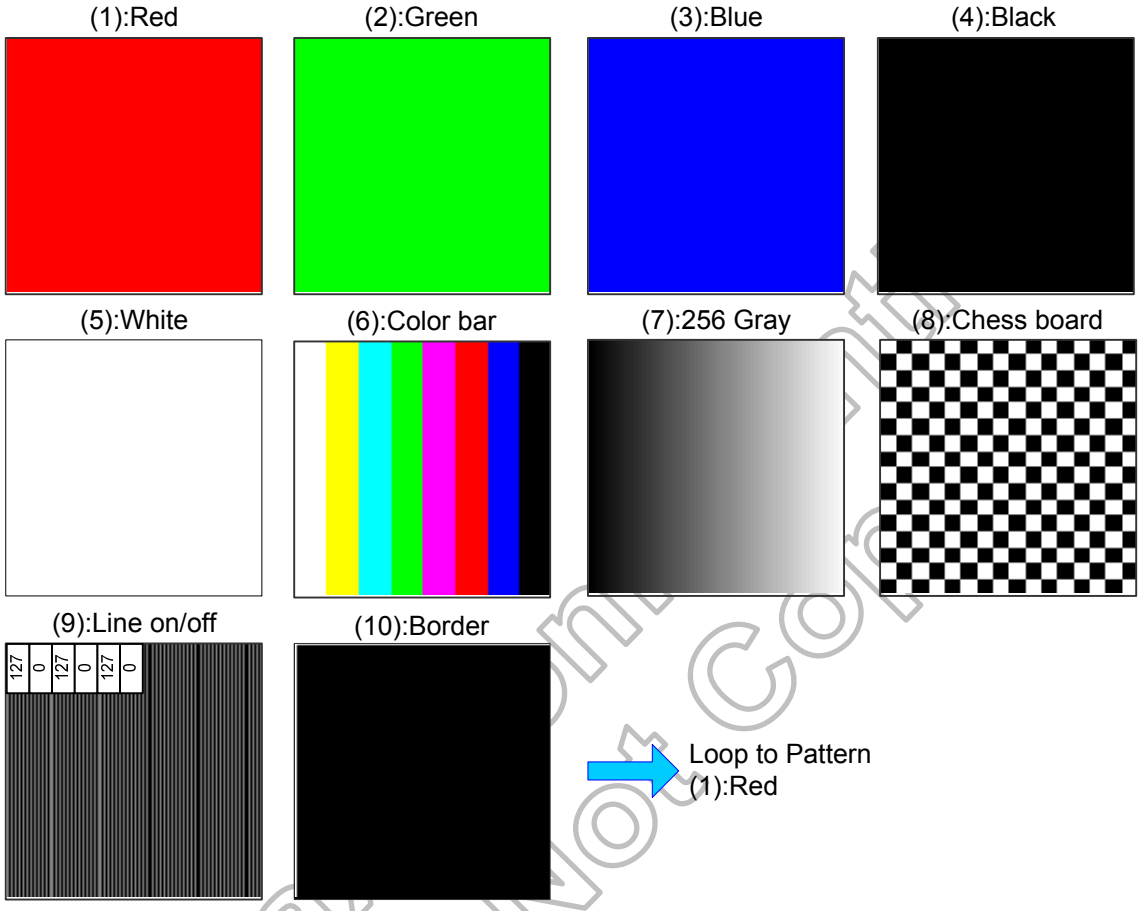



**Figure 10.1: BIST pattern loop**

## 10.2 OTP function

### 10.2.1 OTP programming by internal VPP and OTP time check flow

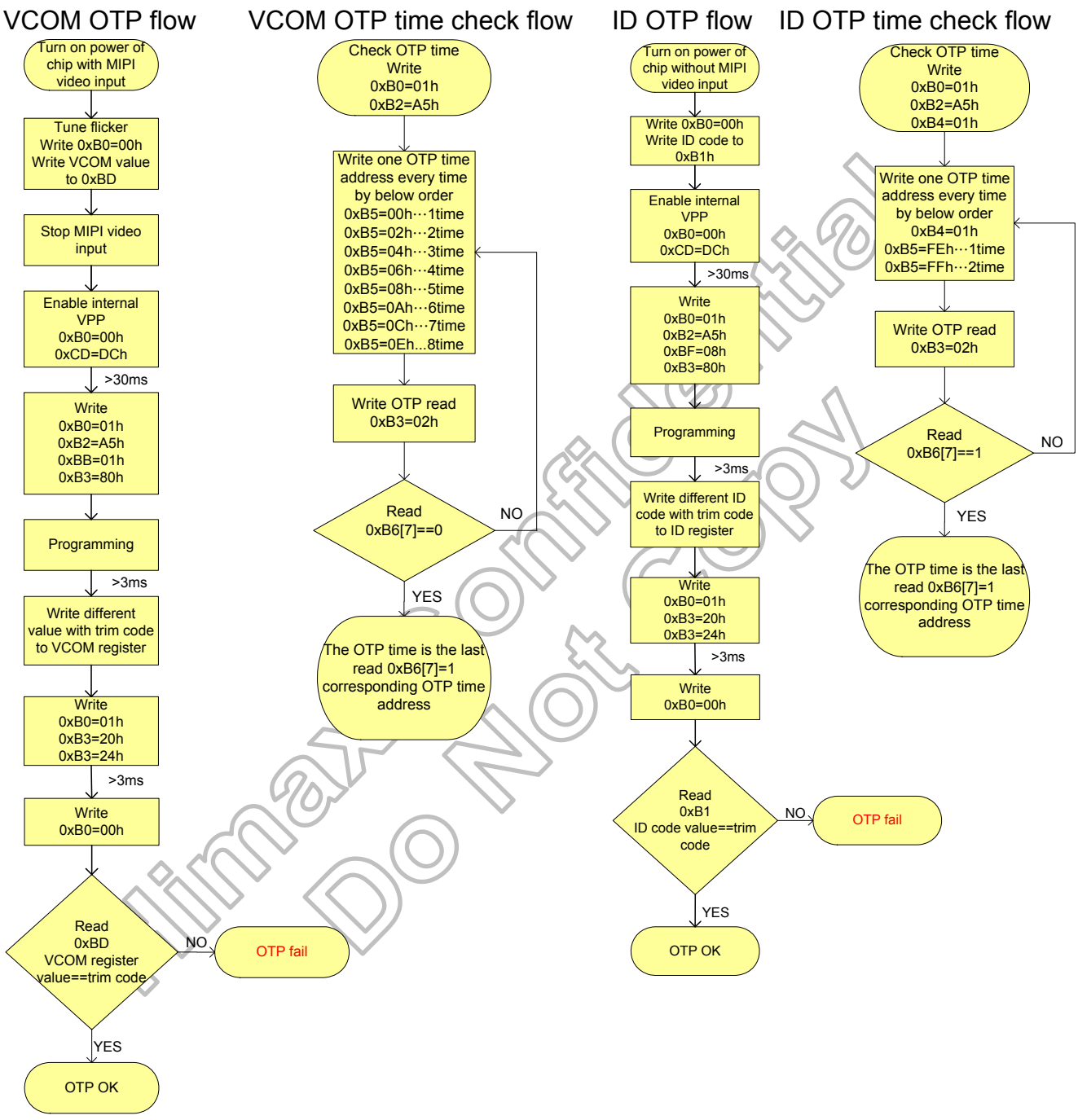



**Figure 10.2: OTP of VCOM and ID programming flow**

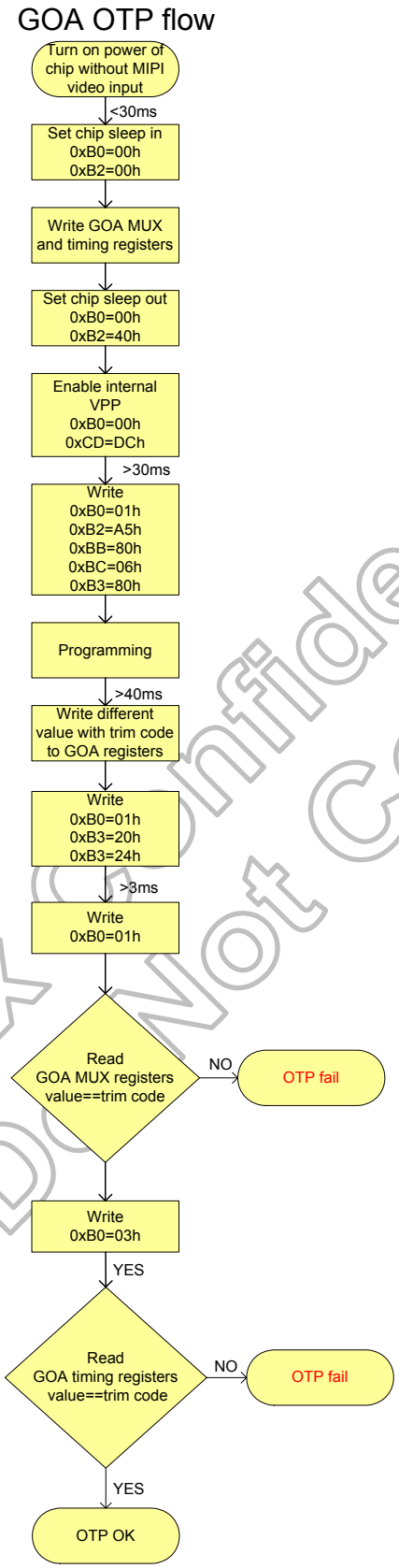



**Figure 10.3: OTP of GOA programming flow**

## 10.2.2 OTP group table

| OTP_index | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Group | SPI page | SPI address |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | W1 | - | - | - | - | | - | | GROUP0 | page0 | - |
| 1 | T_VCOMS[7:0] | | | | | | | | | | 3D |
| 2 | W2 | - | - | - | - | | - | | | | - |
| 3 | T_VCOMS[7:0] | | | | | | | | | | 3D |
| 4 | W3 | - | - | - | - | | - | | | | - |
| 5 | T_VCOMS[7:0] | | | | | | | | | | 3D |
| 6 | W4 | - | - | - | - | | - | | | | - |
| 7 | T_VCOMS[7:0] | | | | | | | | | | 3D |
| 8 | W5 | - | - | - | - | | - | | | | - |
| 9 | T_VCOMS[7:0] | | | | | | | | | | 3D |
| 10 | W6 | - | - | - | - | | - | | | | - |
| 11 | T_VCOMS[7:0] | | | | | | | | | | 3D |
| 12 | W7 | - | - | - | - | | - | | | | - |
| 13 | T_VCOMS[7:0] | | | | | | | | | | 3D |
| 14 | W8 | - | - | - | - | | - | | | | - |
| 15 | T_VCOMS[7:0] | | | | | | | | | | 3D |
| 16 | W1 | - | - | - | - | | - | | GROUP1 | | - |
| 17 | LPM_VCOMS[7:0] | | | | | | | | | | 3E |
| 18 | W1 | - | UPDNB | LR | ZIGZAG | ZTYPE | NBW | BISTB | GROUP2 | | 32 |
| 19 | DISP_ON | LPM_CTRL[1:0] | | PWRMD | VRES_FIX | LED_EN | RES[1:0] | | | | 33 |
| 20 | VRES[7:0] | | | | | | | | | | 34 |
| 21 | ZDATA[7:0] | | | | | | | | | | 35 |
| 22 | - | RP1EN | RP2EN | - | CABC_CTRL[1:0] | | DITHER_EN | D_GAM_EN | | | 36 |
| 23 | - | - | - | OVERLAP[3:0] | | | | PCLK_SEL | | | 37 |
| 24 | GOA_EN | VCOM_EN | PNSW | MIPI_TYPE | LNSW[1:0] | | MIPI_LAN[1:0] | | | | 38 |
| 26 | BLREV[1:0] | | BLREVONFF | INV_SEL2 | SD_ISSEL[1:0] | | INV_SEL[1:0] | | | | 3a |
| 27 | W1 | - | - | VGHS[4:0] | | | | | GROUP3 | | 3f |
| 28 | - | - | - | VGLS[4:0] | | | | | | | 40 |
| 29 | - | - | - | VGLXSP[1:0] | VGHXSP[1:0] | | CPCLKH [1:0] | | | | 41 |
| 30 | - | - | - | VPHS[4:0] | | | | | | | 42 |
| 31 | - | - | - | VPLS[4:0] | | | | | | | 43 |
| 32 | - | - | - | VNHS[4:0] | | | | | | | 44 |
| 33 | - | - | - | VNLS[4:0] | | | | | | | 45 |
| 34 | W1 | STILLIMG_DET_NUM[6:0] | | | | | | | GROUP4 | | 46 |
| 35 | - | - | - | - | REF_NUM[3:0] | | | | | | 47 |
| 36 | NOREF_NUM[7:0] | | | | | | | | | | 48 |
| 40 | W1 | POCSD_CTL[1:0] | | SD_EQW[4:0] | | | | | GROUP5 | | 4c |
| 44 | W1 | - | - | - | - | - | - | - | GROUP7 | page1 | - |
| 45 | GOUTL_1_STB[1:0] | GOUTL_1_SEL[5:0] | | | | | | | | | 40 |
| 46 | GOUTL_2_STB[1:0] | GOUTL_2_SEL[5:0] | | | | | | | | | 41 |
| 47 | GOUTL_3_STB[1:0] | GOUTL_3_SEL[5:0] | | | | | | | | | 42 |
| 48 | GOUTL_4_STB[1:0] | GOUTL_4_SEL[5:0] | | | | | | | | | 43 |
| 49 | GOUTL_5_STB[1:0] | GOUTL_5_SEL[5:0] | | | | | | | | | 44 |
| 50 | GOUTL_6_STB[1:0] | GOUTL_6_SEL[5:0] | | | | | | | | | 45 |
| 51 | GOUTL_7_STB[1:0] | GOUTL_7_SEL[5:0] | | | | | | | | | 46 |
| 52 | GOUTL_8_STB[1:0] | GOUTL_8_SEL[5:0] | | | | | | | | | 47 |

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|---|---|---|---|---|---|---|---|---|---|
| 53 | GOUTL_9_STB[1:0] | GOUTL_9_SEL[5:0] | | | | | | | 48 |
| 54 | GOUTL_10_STB[1:0] | GOUTL_10_SEL[5:0] | | | | | | | 49 |
| 55 | GOUTL_11_STB[1:0] | GOUTL_11_SEL[5:0] | | | | | | | 4a |
| 56 | GOUTL_12_STB[1:0] | GOUTL_12_SEL[5:0] | | | | | | | 4b |
| 57 | GOUTL_13_STB[1:0] | GOUTL_13_SEL[5:0] | | | | | | | 4c |
| 58 | GOUTL_14_STB[1:0] | GOUTL_14_SEL[5:0] | | | | | | | 4d |
| 59 | GOUTL_15_STB[1:0] | GOUTL_15_SEL[5:0] | | | | | | | 4e |
| 60 | GOUTL_16_STB[1:0] | GOUTL_16_SEL[5:0] | | | | | | | 4f |
| 61 | GOUTL_17_STB[1:0] | GOUTL_17_SEL[5:0] | | | | | | | 50 |
| 62 | GOUTL_18_STB[1:0] | GOUTL_18_SEL[5:0] | | | | | | | 51 |
| 63 | GOUTL_19_STB[1:0] | GOUTL_19_SEL[5:0] | | | | | | | 52 |
| 64 | GOUTL_20_STB[1:0] | GOUTL_20_SEL[5:0] | | | | | | | 53 |
| 65 | GOUTR_1_STB[1:0] | GOUTR_1_SEL[5:0] | | | | | | | 54 |
| 66 | GOUTR_2_STB[1:0] | GOUTR_2_SEL[5:0] | | | | | | | 55 |
| 67 | GOUTR_3_STB[1:0] | GOUTR_3_SEL[5:0] | | | | | | | 56 |
| 68 | GOUTR_4_STB[1:0] | GOUTR_4_SEL[5:0] | | | | | | | 57 |
| 69 | GOUTR_5_STB[1:0] | GOUTR_5_SEL[5:0] | | | | | | | 58 |
| 70 | GOUTR_6_STB[1:0] | GOUTR_6_SEL[5:0] | | | | | | | 59 |
| 71 | GOUTR_7_STB[1:0] | GOUTR_7_SEL[5:0] | | | | | | | 5a |
| 72 | GOUTR_8_STB[1:0] | GOUTR_8_SEL[5:0] | | | | | | | 5b |
| 73 | GOUTR_9_STB[1:0] | GOUTR_9_SEL[5:0] | | | | | | | 5c |
| 74 | GOUTR_10_STB[1:0] | GOUTR_10_SEL[5:0] | | | | | | | 5d |
| 75 | GOUTR_11_STB[1:0] | GOUTR_11_SEL[5:0] | | | | | | | 5e |
| 76 | GOUTR_12_STB[1:0] | GOUTR_12_SEL[5:0] | | | | | | | 5f |
| 77 | GOUTR_13_STB[1:0] | GOUTR_13_SEL[5:0] | | | | | | | 60 |
| 78 | GOUTR_14_STB[1:0] | GOUTR_14_SEL[5:0] | | | | | | | 61 |
| 79 | GOUTR_15_STB[1:0] | GOUTR_15_SEL[5:0] | | | | | | | 62 |
| 80 | GOUTR_16_STB[1:0] | GOUTR_16_SEL[5:0] | | | | | | | 63 |
| 81 | GOUTR_17_STB[1:0] | GOUTR_17_SEL[5:0] | | | | | | | 64 |
| 82 | GOUTR_18_STB[1:0] | GOUTR_18_SEL[5:0] | | | | | | | 65 |
| 83 | GOUTR_19_STB[1:0] | GOUTR_19_SEL[5:0] | | | | | | | 66 |
| 84 | GOUTR_20_STB[1:0] | GOUTR_20_SEL[5:0] | | | | | | | 67 |
| 85 | W1 | - | - | - | - | T_PVP_0[2:0] | | | 40 |
| 86 | - | - | T_PVP_1[5:0] | | | | | | 41 |
| 87 | - | - | T_PVP_2[5:0] | | | | | | 42 |
| 88 | - | - | T_PVP_3[5:0] | | | | | | 43 |
| 89 | - | - | T_PVP_4[5:0] | | | | | | 44 |
| 90 | - | - | T_PVP_5[5:0] | | | | | | 45 |
| 91 | - | - | T_PVP_6[5:0] | | | | | | 46 |
| 92 | - | - | T_PVP_7[5:0] | | | | | | 47 |
| 93 | - | - | T_PVP_8[5:0] | | | | GROUP8 | page2 | 48 |
| 94 | - | - | T_PVP_9[5:0] | | | | | | 49 |
| 95 | - | - | T_PVP_10[5:0] | | | | | | 4a |
| 96 | - | - | T_PVP_11[5:0] | | | | | | 4b |
| 97 | - | - | T_PVP_12[5:0] | | | | | | 4c |
| 98 | - | - | T_PVP_13[5:0] | | | | | | 4d |
| 99 | - | - | T_PVP_14[5:0] | | | | | | 4e |
| 100 | - | - | T_PVP_15[5:0] | | | | | | 4f |
| 101 | - | - | - | - | - | T_PVP_16[2:0] | | | 50 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| **103** | - | - | - | - | - | T_PVN_0[2:0] | | | | | 52 |
| **104** | - | - | T_PVN_1[5:0] | | | | | | | | 53 |
| **105** | - | - | T_PVN_2[5:0] | | | | | | | | 54 |
| **106** | - | - | T_PVN_3[5:0] | | | | | | | | 55 |
| **107** | - | - | T_PVN_4[5:0] | | | | | | | | 56 |
| **108** | - | - | T_PVN_5[5:0] | | | | | | | | 57 |
| **109** | - | - | T_PVN_6[5:0] | | | | | | | | 58 |
| **110** | - | - | T_PVN_7[5:0] | | | | | | | | 59 |
| **111** | - | - | T_PVN_8[5:0] | | | | | | | | 5a |
| **112** | - | - | T_PVN_9[5:0] | | | | | | | | 5b |
| **113** | - | - | T_PVN_10[5:0] | | | | | | | | 5c |
| **114** | - | - | T_PVN_11[5:0] | | | | | | | | 5d |
| **115** | - | - | T_PVN_12[5:0] | | | | | | | | 5e |
| **116** | - | - | T_PVN_13[5:0] | | | | | | | | 5f |
| **117** | - | - | T_PVN_14[5:0] | | | | | | | | 60 |
| **118** | - | - | T_PVN_15[5:0] | | | | | | | | 61 |
| **119** | - | - | - | - | - | T_PVN_16[2:0] | | | | | 62 |
| **120** | W1 | - | - | - | - | - | - | - | Group9 | page3 | - |
| **122** | - | - | - | - | STV_PREC[3:0] | | | | | | 3b |
| **123** | CKV_FALL_PREC[7:0] | | | | | | | | | | 3c |
| **124** | spi_goa_ckv_prec_cnt_1stFrame[7:0] | | | | | | | | | | 3d |
| **125** | - | - | - | - | CKV_BLANKON | GOA_PHASE[2:0] | | | | | 3e |
| **126** | - | - | GOA_Tn_FACTOR[1:0] | | - | - | - | - | | | 3f |
| **127** | W1 | - | - | - | - | - | - | - | GROUP10 | | - |
| **128** | GOA_T0[7:0] | | | | | | | | | | 42 |
| **129** | GOA_T1[7:0] | | | | | | | | | | 43 |
| **130** | GOA_T2[7:0] | | | | | | | | | | 44 |
| **131** | GOA_T3[7:0] | | | | | | | | | | 45 |
| **132** | GOA_T4[7:0] | | | | | | | | | | 46 |
| **133** | GOA_T5[7:0] | | | | | | | | | | 47 |
| **134** | - | - | - | STV_LEAD[4:0] | | | | | | | 48 |
| **135** | - | - | - | CKV_LEAD[4:0] | | | | | | | 49 |
| **136** | CKV_NONOVERLAP | - | CKV_DUMMY[5:0] | | | | | | | | 4a |
| **137** | CKV_RISE_PREC[7:0] | | | | | | | | | | 4b |
| **138** | STV_WIDTH[3:0] | | | | CKV_WIDTH[3:0] | | | | | | 4c |
| **139** | GOA_FLC[7:0] | | | | | | | | | | 4d |
| **140** | - | GOA)FLCA_LEAD[6:0] | | | | | | | | | 4e |
| **142** | CKV_BLANK_SHIFT[7:0] | | | | | | | | | | 50 |
| **143** | CKV_BLANK_WIDTH[7:0] | | | | | | | | | | 51 |
| **144** | CLR1_WD[7:0] | | | | | | | | | | 52 |
| **145** | CLR234_WD[7:0] | | | | | | | | | | 53 |
| **146** | CLR1_POL | CLR1_START[6:0] | | | | | | | | | 54 |
| **147** | CLR2_POL | CLR2_START[6:0] | | | | | | | | | 55 |
| **148** | CLR3_POL | CLR3_START[6:0] | | | | | | | | | 56 |
| **149** | CLR4_POL | CLR4_START[6:0] | | | | | | | | | 57 |
| **150** | CLR2/3/4_START_MSB[3:0] | | | | CLR1_START_MSB[3:0] | | | | | | 58 |
| **151** | - | - | - | - | - | CLR4_LEAD | CLR3_LEAD | CLR2_LEAD | | | 59 |
| **153** | - | - | - | - | - | FLC_NONOVLAP[1:0] | | CLR1_LEAD | | | 5b |
| **155** | GOA_T2B[7:0] | | | | | | | | | | 5d |
| **156** | GOA_T3B[7:0] | | | | | | | | | | 5e |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 164 | GOA_T0B[7:0] | | | | | | | | | | | 66 |
| 165 | GOA_T1B[7:0] | | | | | | | | | | | 67 |
| 166 | W2 | - | - | - | - | - | - | - | | | | - |
| 167 | GOA_T0[7:0] | | | | | | | | | | | 42 |
| 168 | GOA_T1[7:0] | | | | | | | | | | | 43 |
| 169 | GOA_T2[7:0] | | | | | | | | | | | 44 |
| 170 | GOA_T3[7:0] | | | | | | | | | | | 45 |
| 171 | GOA_T4[7:0] | | | | | | | | | | | 46 |
| 172 | GOA_T5[7:0] | | | | | | | | | | | 47 |
| 173 | - | - | - | STV_LEAD[4:0] | | | | | | | | 48 |
| 174 | - | - | - | CKV_LEAD[4:0] | | | | | | | | 49 |
| 175 | CKV_NONOVERLAP | - | CKV_DUMMY[5:0] | | | | | | | | | 4a |
| 176 | CKV_RISE_PREC[7:0] | | | | | | | | | | | 4b |
| 177 | STV_WIDTH[3:0] | | | | CKV_WIDTH[3:0] | | | | | | | 4c |
| 178 | GOA_FLC[7:0] | | | | | | | | | | | 4d |
| 179 | - | GOA)FLCA_LEAD[6:0] | | | | | | | | | | 4e |
| 181 | CKV_BLANK_SHIFT[7:0] | | | | | | | | | | | 50 |
| 182 | CKV_BLANK_WIDTH[7:0] | | | | | | | | | | | 51 |
| 183 | CLR1_WD[7:0] | | | | | | | | | | | 52 |
| 184 | CLR234_WD[7:0] | | | | | | | | | | | 53 |
| 185 | CLR1_POL | CLR1_START[6:0] | | | | | | | | | | 54 |
| 186 | CLR2_POL | CLR2_START[6:0] | | | | | | | | | | 55 |
| 187 | CLR3_POL | CLR3_START[6:0] | | | | | | | | | | 56 |
| 188 | CLR4_POL | CLR4_START[6:0] | | | | | | | | | | 57 |
| 189 | CLR2/3/4_START_MSB[3:0] | | | | CLR1_START_MSB[3:0] | | | | | | | 58 |
| 190 | - | - | - | - | - | CLR4_LEAD | CLR3_LEAD | CLR2_LEAD | | | | 59 |
| 192 | - | - | - | - | - | FLC_NONOVLAP[1:0] | | CLR1_LEAD | | | | 5b |
| 194 | GOA_T2B[7:0] | | | | | | | | | | | 5d |
| 195 | GOA_T3B[7:0] | | | | | | | | | | | 5e |
| 203 | GOA_T0B[7:0] | | | | | | | | | | | 66 |
| 204 | GOA_T1B[7:0] | | | | | | | | | | | 67 |
| 324 | W1 | - | - | - | - | - | - | - | | | | - |
| 325 | PGMA1R[7:0] | | | | | | | | | | | 31 |
| 326 | PGMA2R[7:0] | | | | | | | | | | | 32 |
| 327 | PGMA3R[7:0] | | | | | | | | | | | 33 |
| 328 | PGMA4R[7:0] | | | | | | | | | | | 34 |
| 329 | PGMA5R[7:0] | | | | | | | | | | | 35 |
| 330 | PGMA6R[7:0] | | | | | | | | | | | 36 |
| 331 | PGMA7R[7:0] | | | | | | | | | | | 37 |
| 332 | PGMA8R[7:0] | | | | | | | | | | | 38 |
| 333 | PGMA9R[7:0] | | | | | | | | | | | 39 |
| 334 | PGMA10R[7:0] | | | | | | | | | | GROUP29 | page7 | 3a |
| 335 | PGMA11R[7:0] | | | | | | | | | | | 3b |
| 336 | PGMA12R[7:0] | | | | | | | | | | | 3c |
| 337 | PGMA13R[7:0] | | | | | | | | | | | 3d |
| 338 | PGMA14R[7:0] | | | | | | | | | | | 3e |
| 339 | PGMA15R[7:0] | | | | | | | | | | | 3f |
| 340 | PGMA16R[7:0] | | | | | | | | | | | 40 |
| 341 | PGMA17R[7:0] | | | | | | | | | | | 41 |
| 342 | PGMA18R[7:0] | | | | | | | | | | | 42 |
| 343 | PGMA19R[7:0] | | | | | | | | | | | 43 |
| 344 | PGMA20R[7:0] | | | | | | | | | | | 44 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 345 | PGMA21R[7:0] | | | | | | | | | | | 45 |
| 346 | PGMA22R[7:0] | | | | | | | | | | | 46 |
| 347 | PGMA23R[7:0] | | | | | | | | | | | 47 |
| 348 | PGMA24R[7:0] | | | | | | | | | | | 48 |
| 349 | PGMA1R[9:8] | | PGMA2R[9:8] | | PGMA3R[9:8] | | PGMA4R[9:8] | | | | | 49 |
| 350 | PGMA5R[9:8] | | PGMA6R[9:8] | | PGMA7R[9:8] | | PGMA8R[9:8] | | | | | 4a |
| 351 | PGMA9R[9:8] | | PGMA10R[9:8] | | PGMA11R[9:8] | | PGMA12R[9:8] | | | | | 4b |
| 352 | PGMA13R[9:8] | | PGMA14R[9:8] | | PGMA15R[9:8] | | PGMA16R[9:8] | | | | | 4c |
| 353 | PGMA17R[9:8] | | PGMA18R[9:8] | | PGMA19R[9:8] | | PGMA20R[9:8] | | | | | 4d |
| 354 | PGMA21R[9:8] | | PGMA22R[9:8] | | PGMA23R[9:8] | | PGMA24R[9:8] | | | | | 4e |
| 355 | W1 | - | - | - | - | - | - | - | | | | - |
| 356 | PGMA1G[7:0] | | | | | | | | | | | 31 |
| 357 | PGMA2G[7:0] | | | | | | | | | | | 32 |
| 358 | PGMA3G[7:0] | | | | | | | | | | | 33 |
| 359 | PGMA4G[7:0] | | | | | | | | | | | 34 |
| 360 | PGMA5G[7:0] | | | | | | | | | | | 35 |
| 361 | PGMA6G[7:0] | | | | | | | | | | | 36 |
| 362 | PGMA7G[7:0] | | | | | | | | | | | 37 |
| 363 | PGMA8G[7:0] | | | | | | | | | | | 38 |
| 364 | PGMA9G[7:0] | | | | | | | | | | | 39 |
| 365 | PGMA10G[7:0] | | | | | | | | | | | 3a |
| 366 | PGMA11G[7:0] | | | | | | | | | | | 3b |
| 367 | PGMA12G[7:0] | | | | | | | | | | | 3c |
| 368 | PGMA13G[7:0] | | | | | | | | | | | 3d |
| 369 | PGMA14G[7:0] | | | | | | | | | | | 3e |
| 370 | PGMA15G[7:0] | | | | | | | | | | GROUP30 | page8 3f |
| 371 | PGMA16G[7:0] | | | | | | | | | | | 40 |
| 372 | PGMA17G[7:0] | | | | | | | | | | | 41 |
| 373 | PGMA18G[7:0] | | | | | | | | | | | 42 |
| 374 | PGMA19G[7:0] | | | | | | | | | | | 43 |
| 375 | PGMA20G[7:0] | | | | | | | | | | | 44 |
| 376 | PGMA21G[7:0] | | | | | | | | | | | 45 |
| 377 | PGMA22G[7:0] | | | | | | | | | | | 46 |
| 378 | PGMA23G[7:0] | | | | | | | | | | | 47 |
| 379 | PGMA24G[7:0] | | | | | | | | | | | 48 |
| 380 | PGMA1G[9:8] | | PGMA2G[9:8] | | PGMA3G[9:8] | | PGMA4G[9:8] | | | | | 49 |
| 381 | PGMA5G[9:8] | | PGMA6G[9:8] | | PGMA7G[9:8] | | PGMA8G[9:8] | | | | | 4a |
| 382 | PGMA9G[9:8] | | PGMA10G[9:8] | | PGMA11G[9:8] | | PGMA12G[9:8] | | | | | 4b |
| 383 | PGMA13G[9:8] | | PGMA14G[9:8] | | PGMA15G[9:8] | | PGMA16G[9:8] | | | | | 4c |
| 384 | PGMA17G[9:8] | | PGMA18G[9:8] | | PGMA19G[9:8] | | PGMA20G[9:8] | | | | | 4d |
| 385 | PGMA21G[9:8] | | PGMA22G[9:8] | | PGMA23G[9:8] | | PGMA24G[9:8] | | | | | 4e |
| 386 | W1 | - | - | - | - | - | - | - | | | | - |
| 387 | PGMA1B[7:0] | | | | | | | | | | | 31 |
| 388 | PGMA2B[7:0] | | | | | | | | | | | 32 |
| 389 | PGMA3B[7:0] | | | | | | | | | | | 33 |
| 390 | PGMA4B[7:0] | | | | | | | | | | | 34 |
| 391 | PGMA5B[7:0] | | | | | | | | | | GROUP31 | page9 35 |
| 392 | PGMA6B[7:0] | | | | | | | | | | | 36 |
| 393 | PGMA7B[7:0] | | | | | | | | | | | 37 |
| 394 | PGMA8B[7:0] | | | | | | | | | | | 38 |
| 395 | PGMA9B[7:0] | | | | | | | | | | | 39 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 396 | PGMA10B[7:0] | | | | | | | | | | 3a |
| 397 | PGMA11B[7:0] | | | | | | | | | | 3b |
| 398 | PGMA12B[7:0] | | | | | | | | | | 3c |
| 399 | PGMA13B[7:0] | | | | | | | | | | 3d |
| 400 | PGMA14B[7:0] | | | | | | | | | | 3e |
| 401 | PGMA15B[7:0] | | | | | | | | | | 3f |
| 402 | PGMA16B[7:0] | | | | | | | | | | 40 |
| 403 | PGMA17B[7:0] | | | | | | | | | | 41 |
| 404 | PGMA18B[7:0] | | | | | | | | | | 42 |
| 405 | PGMA19B[7:0] | | | | | | | | | | 43 |
| 406 | PGMA20B[7:0] | | | | | | | | | | 44 |
| 407 | PGMA21B[7:0] | | | | | | | | | | 45 |
| 408 | PGMA22B[7:0] | | | | | | | | | | 46 |
| 409 | PGMA23B[7:0] | | | | | | | | | | 47 |
| 410 | PGMA24B[7:0] | | | | | | | | | | 48 |
| 411 | PGMA1B[9:8] | | PGMA2B[9:8] | | PGMA3B[9:8] | | PGMA4B[9:8] | | | | 49 |
| 412 | PGMA5B[9:8] | | PGMA6B[9:8] | | PGMA7B[9:8] | | PGMA8B[9:8] | | | | 4a |
| 413 | PGMA9B[9:8] | | PGMA10B[9:8] | | PGMA11B[9:8] | | PGMA12B[9:8] | | | | 4b |
| 414 | PGMA13B[9:8] | | PGMA14B[9:8] | | PGMA15B[9:8] | | PGMA16B[9:8] | | | | 4c |
| 415 | PGMA17B[9:8] | | PGMA18B[9:8] | | PGMA19B[9:8] | | PGMA20B[9:8] | | | | 4d |
| 416 | PGMA21B[9:8] | | PGMA22B[9:8] | | PGMA23B[9:8] | | PGMA24B[9:8] | | | | 4e |
| 417 | W1 | - | - | - | - | - | - | - | | | - |
| 418 | NGMA1R[7:0] | | | | | | | | | | 31 |
| 419 | NGMA2R[7:0] | | | | | | | | | | 32 |
| 420 | NGMA3R[7:0] | | | | | | | | | | 33 |
| 421 | NGMA4R[7:0] | | | | | | | | | | 34 |
| 422 | NGMA5R[7:0] | | | | | | | | | | 35 |
| 423 | NGMA6R[7:0] | | | | | | | | | | 36 |
| 424 | NGMA7R[7:0] | | | | | | | | | | 37 |
| 425 | NGMA8R[7:0] | | | | | | | | | | 38 |
| 426 | NGMA9R[7:0] | | | | | | | | | | 39 |
| 427 | NGMA10R[7:0] | | | | | | | | | | 3a |
| 428 | NGMA11R[7:0] | | | | | | | | | | 3b |
| 429 | NGMA12R[7:0] | | | | | | | | GROUP32 | page10 | 3c |
| 430 | NGMA13R[7:0] | | | | | | | | | | 3d |
| 431 | NGMA14R[7:0] | | | | | | | | | | 3e |
| 432 | NGMA15R[7:0] | | | | | | | | | | 3f |
| 433 | NGMA16R[7:0] | | | | | | | | | | 40 |
| 434 | NGMA17R[7:0] | | | | | | | | | | 41 |
| 435 | NGMA18R[7:0] | | | | | | | | | | 42 |
| 436 | NGMA19R[7:0] | | | | | | | | | | 43 |
| 437 | NGMA20R[7:0] | | | | | | | | | | 44 |
| 438 | NGMA21R[7:0] | | | | | | | | | | 45 |
| 439 | NGMA22R[7:0] | | | | | | | | | | 46 |
| 440 | NGMA23R[7:0] | | | | | | | | | | 47 |
| 441 | NGMA24R[7:0] | | | | | | | | | | 48 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 442 | NGMA1R[9:8] | | NGMA2R[9:8] | | NGMA3R[9:8] | | NGMA4R[9:8] | | | | 49 |
| 443 | NGMA5R[9:8] | | NGMA6R[9:8] | | NGMA7R[9:8] | | NGMA8R[9:8] | | | | 4a |
| 444 | NGMA9R[9:8] | | NGMA10R[9:8] | | NGMA11R[9:8] | | NGMA12R[9:8] | | | | 4b |
| 445 | NGMA13R[9:8] | | NGMA14R[9:8] | | NGMA15R[9:8] | | NGMA16R[9:8] | | | | 4c |
| 446 | NGMA17R[9:8] | | NGMA18R[9:8] | | NGMA19R[9:8] | | NGMA20R[9:8] | | | | 4d |
| 447 | NGMA21R[9:8] | | NGMA22R[9:8] | | NGMA23R[9:8] | | NGMA24R[9:8] | | | | 4e |
| 448 | W1 | - | - | - | - | - | - | - | | | - |
| 449 | NGMA1G[7:0] | | | | | | | | | | 31 |
| 450 | NGMA2G[7:0] | | | | | | | | | | 32 |
| 451 | NGMA3G[7:0] | | | | | | | | | | 33 |
| 452 | NGMA4G[7:0] | | | | | | | | | | 34 |
| 453 | NGMA5G[7:0] | | | | | | | | | | 35 |
| 454 | NGMA6G[7:0] | | | | | | | | | | 36 |
| 455 | NGMA7G[7:0] | | | | | | | | | | 37 |
| 456 | NGMA8G[7:0] | | | | | | | | | | 38 |
| 457 | NGMA9G[7:0] | | | | | | | | | | 39 |
| 458 | NGMA10G[7:0] | | | | | | | | | | 3a |
| 459 | NGMA11G[7:0] | | | | | | | | | | 3b |
| 460 | NGMA12G[7:0] | | | | | | | | | | 3c |
| 461 | NGMA13G[7:0] | | | | | | | | | | 3d |
| 462 | NGMA14G[7:0] | | | | | | | | | | 3e |
| 463 | NGMA15G[7:0] | | | | | | | | GROUP33 | page11 | 3f |
| 464 | NGMA16G[7:0] | | | | | | | | | | 40 |
| 465 | NGMA17G[7:0] | | | | | | | | | | 41 |
| 466 | NGMA18G[7:0] | | | | | | | | | | 42 |
| 467 | NGMA19G[7:0] | | | | | | | | | | 43 |
| 468 | NGMA20G[7:0] | | | | | | | | | | 44 |
| 469 | NGMA21G[7:0] | | | | | | | | | | 45 |
| 470 | NGMA22G[7:0] | | | | | | | | | | 46 |
| 471 | NGMA23G[7:0] | | | | | | | | | | 47 |
| 472 | NGMA24G[7:0] | | | | | | | | | | 48 |
| 473 | NGMA1G[9:8] | | NGMA2G[9:8] | | NGMA3G[9:8] | | NGMA4G[9:8] | | | | 49 |
| 474 | NGMA5G[9:8] | | NGMA6G[9:8] | | NGMA7G[9:8] | | NGMA8G[9:8] | | | | 4a |
| 475 | NGMA9G[9:8] | | NGMA10G[9:8] | | NGMA11G[9:8] | | NGMA12G[9:8] | | | | 4b |
| 476 | NGMA13G[9:8] | | NGMA14G[9:8] | | NGMA15G[9:8] | | NGMA16G[9:8] | | | | 4c |
| 477 | NGMA17G[9:8] | | NGMA18G[9:8] | | NGMA19G[9:8] | | NGMA20G[9:8] | | | | 4d |
| 478 | NGMA21G[9:8] | | NGMA22G[9:8] | | NGMA23G[9:8] | | NGMA24G[9:8] | | | | 4e |
| 479 | W1 | - | - | - | - | - | - | - | | | - |
| 480 | NGMA1B[7:0] | | | | | | | | | | 31 |
| 481 | NGMA2B[7:0] | | | | | | | | | | 32 |
| 482 | NGMA3B[7:0] | | | | | | | | GROUP34 | page12 | 33 |
| 483 | NGMA4B[7:0] | | | | | | | | | | 34 |
| 484 | NGMA5B[7:0] | | | | | | | | | | 35 |
| 485 | NGMA6B[7:0] | | | | | | | | | | 36 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 486 | NGMA7B[7:0] | | | | | | 37 |
| 487 | NGMA8B[7:0] | | | | | | 38 |
| 488 | NGMA9B[7:0] | | | | | | 39 |
| 489 | NGMA10B[7:0] | | | | | | 3a |
| 490 | NGMA11B[7:0] | | | | | | 3b |
| 491 | NGMA12B[7:0] | | | | | | 3c |
| 492 | NGMA13B[7:0] | | | | | | 3d |
| 493 | NGMA14B[7:0] | | | | | | 3e |
| 494 | NGMA15B[7:0] | | | | | | 3f |
| 495 | NGMA16B[7:0] | | | | | | 40 |
| 496 | NGMA17B[7:0] | | | | | | 41 |
| 497 | NGMA18B[7:0] | | | | | | 42 |
| 498 | NGMA19B[7:0] | | | | | | 43 |
| 499 | NGMA20B[7:0] | | | | | | 44 |
| 500 | NGMA21B[7:0] | | | | | | 45 |
| 501 | NGMA22B[7:0] | | | | | | 46 |
| 502 | NGMA23B[7:0] | | | | | | 47 |
| 503 | NGMA24B[7:0] | | | | | | 48 |
| 504 | NGMA1B[9:8] | NGMA2B[9:8] | NGMA3B[9:8] | NGMA4B[9:8] | | | 49 |
| 505 | NGMA5B[9:8] | NGMA6B[9:8] | NGMA7B[9:8] | NGMA8B[9:8] | | | 4a |
| 506 | NGMA9B[9:8] | NGMA10B[9:8] | NGMA11B[9:8] | NGMA12B[9:8] | | | 4b |
| 507 | NGMA13B[9:8] | NGMA14B[9:8] | NGMA15B[9:8] | NGMA16B[9:8] | | | 4c |
| 508 | NGMA17B[9:8] | NGMA18B[9:8] | NGMA19B[9:8] | NGMA20B[9:8] | | | 4d |
| 509 | NGMA21B[9:8] | NGMA22B[9:8] | NGMA23B[9:8] | NGMA24B[9:8] | | | 4e |
| 510 | W1 | VENDER_ID[6:0] | | | GROUP35 | page0 | 31 |
| 511 | W2 | VENDER_ID[6:0] | | | | page0 | 31 |

# 11. Gamma Adjustment Function

## 11.1 Gamma voltage generator for source driver

The HX8279-D incorporates digital gamma adjustment function. Gamma adjustment operation is implemented by deciding the 10bit levels firstly in digital gamma adjustment control registers then dithering 8bit data to match the LCD panel. These registers are available for both polarities per RGB.

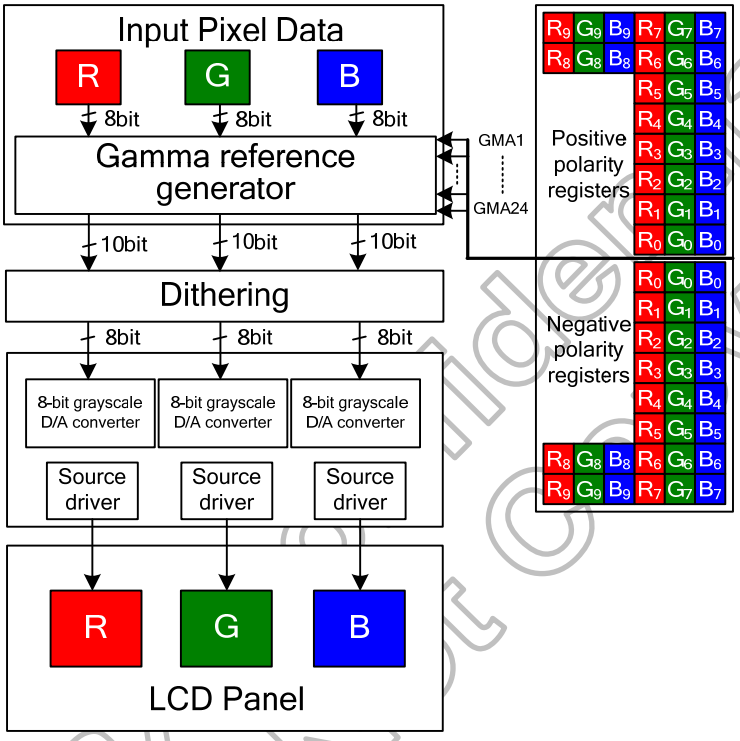
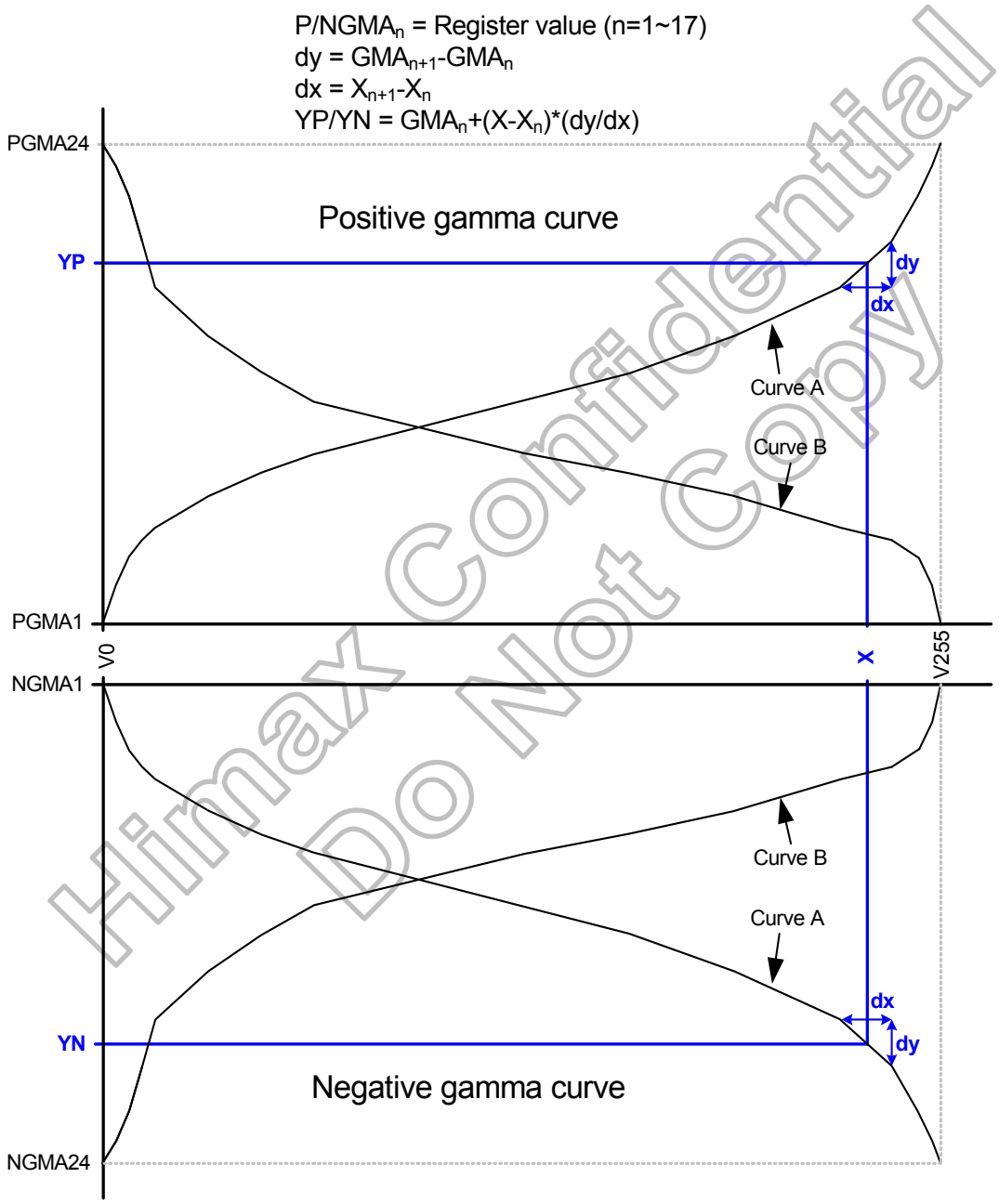



**Figure 11.1: Grayscale control**

## 11.2 Digital gamma curve adjustment

The gamma correction are done by 24-segment piecewise linear interpolation. The 24 segments are defined with 24 register values for level 0, 1, 3, 7, 11, 15, 23, 31, 47, 63, 95, 127, 128, 160, 192, 208, 224, 232, 240, 244, 248, 252, 254 and 255. These 24 register values defined the positive and negative gamma curve and RGB data. The gamma correction output data is then fed to 10-bit data to TCON dithering IP then generates 8-bit DAC and OP to drive the source lines on the panel.




**Note:** (1) Curve A is for normal black panel. Curve B is for normal white panel.

**Figure 11.2: Digital gamma curve adjustment**

## 11.3 Gamma reference voltage generator

The block consists of two gamma resister streams, one is for positive polarity and the other is for negative polarity. Gamma high/low voltage can be adjusted by VGPH, VGPL, VGNH, and VGNL.The gamma correction is done by 17 reference voltages. The 17 reference voltages are defined with 17 register values for level 0, 4, 8, 16, 28, 40, 56, 80, 128, 176, 200, 216, 228, 240, 248, 252 and 255.

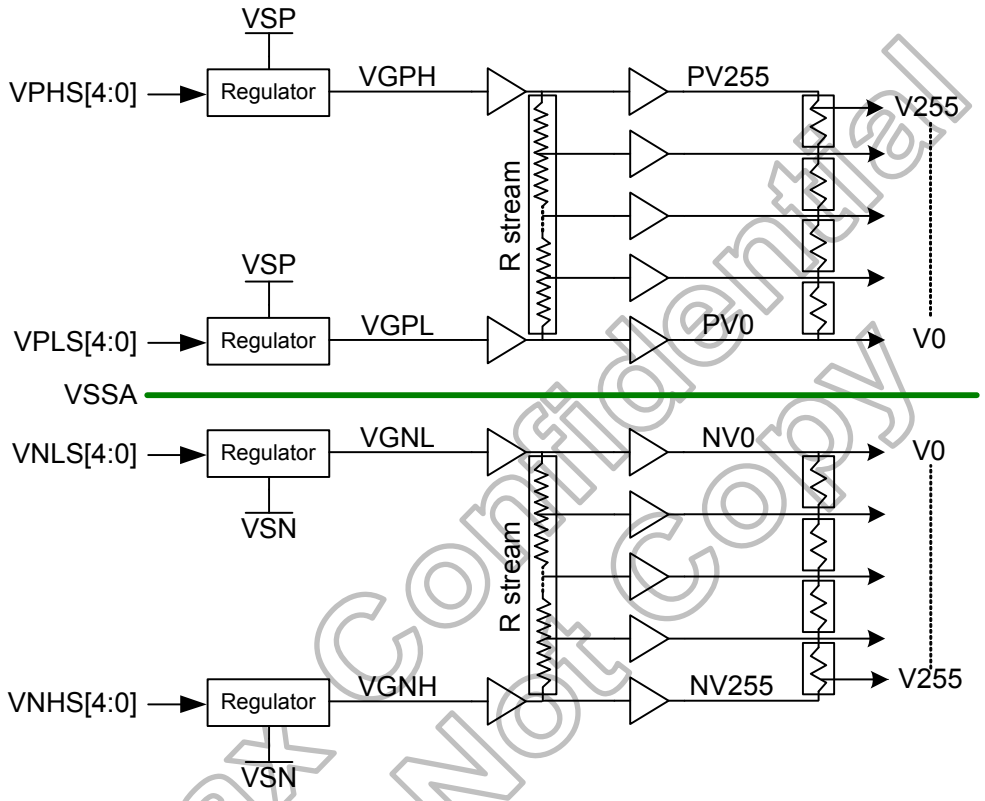



**Figure 11.3: Gamma reference voltage generator diagram**

## 11.4 Gamma table

| Positive/Negative gamma resistor rate (Ω) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R1 | 1.25 | R33 | 2 | R65 | 1.25 | R97 | 1.1 | R129 | 1.05 | R161 | 1.25 | R193 | 1.625 | R225 | 2.75 |
| R2 | 4.75 | R34 | 2 | R66 | 1.25 | R98 | 1.1 | R130 | 1.05 | R162 | 1.25 | R194 | 1.625 | R226 | 3 |
| R3 | 4.75 | R35 | 2 | R67 | 1.25 | R99 | 1.1 | R131 | 1.05 | R163 | 1.25 | R195 | 1.625 | R227 | 3 |
| R4 | 4.75 | R36 | 2 | R68 | 1.25 | R100 | 1.1 | R132 | 1.05 | R164 | 1.25 | R196 | 1.625 | R228 | 3 |
| R5 | 4.75 | R37 | 2 | R69 | 1.208 | R101 | 1.05 | R133 | 1.1 | R165 | 1.333 | R197 | 1.75 | R229 | 3 |
| R6 | 7.75 | R38 | 2 | R70 | 1.208 | R102 | 1.05 | R134 | 1.1 | R166 | 1.333 | R198 | 1.75 | R230 | 3 |
| R7 | 7.75 | R39 | 2 | R71 | 1.208 | R103 | 1.05 | R135 | 1.1 | R167 | 1.333 | R199 | 1.75 | R231 | 3 |
| R8 | 6.5 | R40 | 2 | R72 | 1.208 | R104 | 1.05 | R136 | 1.1 | R168 | 1.333 | R200 | 1.75 | R232 | 3 |
| R9 | 6.5 | R41 | 1.833 | R73 | 1.208 | R105 | 1 | R137 | 1.1875 | R169 | 1.333 | R201 | 1.75 | R233 | 3.5 |
| R10 | 4.25 | R42 | 1.833 | R74 | 1.208 | R106 | 1 | R138 | 1.1875 | R170 | 1.333 | R202 | 1.75 | R234 | 3.5 |
| R11 | 4.25 | R43 | 1.833 | R75 | 1.208 | R107 | 1 | R139 | 1.1875 | R171 | 1.333 | R203 | 1.75 | R235 | 3.5 |
| R12 | 5.5 | R44 | 1.833 | R76 | 1.208 | R108 | 1 | R140 | 1.1875 | R172 | 1.333 | R204 | 1.75 | R236 | 3.5 |
| R13 | 5.5 | R45 | 1.75 | R77 | 1.208 | R109 | 1 | R141 | 1.208 | R173 | 1.375 | R205 | 1.8333 | R237 | 3.5 |
| R14 | 4.25 | R46 | 1.75 | R78 | 1.208 | R110 | 1 | R142 | 1.208 | R174 | 1.375 | R206 | 1.8333 | R238 | 3.5 |
| R15 | 4 | R47 | 1.75 | R79 | 1.208 | R111 | 1 | R143 | 1.208 | R175 | 1.375 | R207 | 1.8333 | R239 | 3.5 |
| R16 | 3.25 | R48 | 1.75 | R80 | 1.208 | R112 | 1 | R144 | 1.208 | R176 | 1.375 | R208 | 1.8333 | R240 | 4 |
| R17 | 3.25 | R49 | 1.625 | R81 | 1.208 | R113 | 1 | R145 | 1.208 | R177 | 1.5 | R209 | 2 | R241 | 4.75 |
| R18 | 3.25 | R50 | 1.625 | R82 | 1.208 | R114 | 1 | R146 | 1.208 | R178 | 1.5 | R210 | 2 | R242 | 4.75 |
| R19 | 3.25 | R51 | 1.625 | R83 | 1.208 | R115 | 1 | R147 | 1.208 | R179 | 1.5 | R211 | 2 | R243 | 4.2 |
| R20 | 3.25 | R52 | 1.625 | R84 | 1.208 | R116 | 1 | R148 | 1.208 | R180 | 1.5 | R212 | 2 | R244 | 4.25 |
| R21 | 3.25 | R53 | 1.5 | R85 | 1.208 | R117 | 1 | R149 | 1.208 | R181 | 1.5 | R213 | 2.125 | R245 | 6 |
| R22 | 3.25 | R54 | 1.5 | R86 | 1.208 | R118 | 1 | R150 | 1.208 | R182 | 1.5 | R214 | 2.125 | R246 | 6 |
| R23 | 3.25 | R55 | 1.5 | R87 | 1.208 | R119 | 1 | R151 | 1.208 | R183 | 1.5 | R215 | 2.125 | R247 | 6 |
| R24 | 2.75 | R56 | 1.5 | R88 | 1.208 | R120 | 1 | R152 | 1.208 | R184 | 1.5 | R216 | 2.125 | R248 | 6 |
| R25 | 2.75 | R57 | 1.375 | R89 | 1.125 | R121 | 1 | R153 | 1.208 | R185 | 1.5 | R217 | 2.25 | R249 | 7 |
| R26 | 2.75 | R58 | 1.375 | R90 | 1.125 | R122 | 1 | R154 | 1.208 | R186 | 1.5 | R218 | 2.25 | R250 | 7 |
| R27 | 2.75 | R59 | 1.375 | R91 | 1.125 | R123 | 1 | R155 | 1.208 | R187 | 1.5 | R219 | 2.25 | R251 | 9 |
| R28 | 2.75 | R60 | 1.375 | R92 | 1.125 | R124 | 1 | R156 | 1.208 | R188 | 1.5 | R220 | 2.25 | R252 | 9 |
| R29 | 2.75 | R61 | 1.333 | R93 | 1.125 | R125 | 1 | R157 | 1.25 | R189 | 1.5 | R221 | 2.333 | R253 | 15.5 |
| R30 | 2.5 | R62 | 1.333 | R94 | 1.125 | R126 | 1 | R158 | 1.25 | R190 | 1.5 | R222 | 2.333 | R254 | 15.5 |
| R31 | 2.5 | R63 | 1.333 | R95 | 1.125 | R127 | 1 | R159 | 1.25 | R191 | 1.5 | R223 | 2.333 | R255 | 38.25 |
| R32 | 2.25 | R64 | 1.333 | R96 | 1.125 | R128 | 1 | R160 | 1.25 | R192 | 1.5 | R224 | 2.333 | | |

**Note:** (1) 8.5Ω/unit.

# 12. DC Characteristics

## 12.1 Absolute maximum ratings

| Parameter | Symbol | Spec. | | | Unit |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| Supply power voltage | VDD | -0.30 | - | 2.1 | V |
| VSP voltage | VSP | -0.30 | - | 6.60 | V |
| VSN voltage | VSN | -6.60 | - | 0.30 | V |
| VPP **(OTP power)** | VPP | - | - | 9.0 | V |
| VGH voltage | VGH | -0.30 | - | VGL+34V | V |
| VGL voltage | VGL | VGH-34V | - | 0.30 | V |
| Operating Temperature | $T_{OPR}$ | -20 | - | +85 | ℃ |
| Storage temperature | $T_{STG}$ | -55 | - | 125 | ℃ |

## 12.2 Typical operating condition

| Parameter | Symbol | Spec. | | | Unit |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| Supply power voltage | VDD | 1.7 | 1.8 | 2.0 | V |
| VSP voltage | VSP | 4.5 | - | 6.0 | V |
| VSN voltage | VSN | -4.5 | - | -6.0 | V |
| VGH voltage(external VGH) | VGH_EXT | 8.7 | - | 20 | V |
| VGL voltage(external VGL) | VGL_EXT | -18 | - | -6.7 | V |
| VGH voltage(internal VGH) | VGH_INT | 8.7 | - | 18 | V |
| VGL voltage(internal VGL) | VGL_INT | -16 | - | -6.7 | V |
| VPP **(OTP power)** | VPP | 8.0 | 8.25 | 8.5 | V |

## 12.3 DC electrical characteristics

**(Test condition: VDD=1.7~2.0V, $T_A$=-20℃~+85℃,VSS=VSSA=VSS_IF=0V)**

| Parameter | | Symbol | Spec. | | | Unit | Note |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| VDD input high level voltage | | VIH1 | 0.8 x VDD | - | VDD | V | - |
| VDD input low level voltage | | VIL1 | VSS | - | 0.2 x VDD | V | - |
| VCC input high level voltage | | VIH2 | 0.8 x VCC | - | VCC | V | - |
| VCC input low level voltage | | VIL2 | VSS | - | 0.2 x VCC | V | - |
| Input leakage current | | IL1 | -1 | - | +1 | μA | - |
| SDAO output high level voltage | | VOH | 0.8 x VDD | - | VDD | V | - |
| SDAO output low level voltage | | VOL | VSS | - | 0.2 x VDD | V | - |
| VLPH output voltage | | VLPH | 1.1 | 1.2 | 1.4 | V | $I_{(VLPH)}$<10mA |
| VCL output voltage | | VCL | -2.1 | -2.4 | -3.00 | V | $I_{(VCORE)}$<60mA |
| VGH output voltage | | VGH | 8.7 | - | 18 | V | $I_{(VGH)}$<5mA |
| VGL output voltage | | VGL | -16 | - | -6.7 | V | $I_{(VGL)}$<5mA |
| VGPH output voltage | | VGPH | 4.0 | 4.5 | 5.5 | V | - |
| VGPL output voltage | | VGPL | 0.1 | 0.2 | 1.6 | V | - |
| VGNH output voltage | | VGNH | -5.5 | -4.5 | -4.0 | V | - |
| VGNL output voltage | | VGNL | -1.6 | -0.2 | -0.1 | V | - |
| Driving current of GOUT outputs | | IGOS | 1 | - | - | mA | GOUT1~20<br>VO=15V vs 14.7V<br>VGH=15V,VGL=-13V |
| Sinking current of GOUT outputs | | IGOD | 1 | - | - | mA | GOUT1~20<br>VO=-13V vs -12.7V<br>VGH=15V,VGL=-13V |
| VCOM output voltage | | VCOM | -2.75 | - | -0.20 | V | - |
| Input terminal pull-high resistance | | RPU | - | 300 | - | KΩ | VDD=1.8V |
| Input terminal pull-low resistance | | RPD | - | 300 | - | KΩ | |
| Source output level deviation | Gray code= 0 ~ 14<br>Gray code= 241 ~ 255 | - | 40 | - | - | mV | - |
| | Gray code= 15 ~ 31<br>Gray code= 208 ~ 240 | - | 30 | - | - | mV | |
| | Gray code= 32 ~ 207 | - | 20 | - | - | mV | |
| Source output offset deviation | Gray code= 0 ~ 14<br>Gray code= 241 ~ 255 | - | 50 | - | - | mV | - |
| | Gray code= 15 ~ 31<br>Gray code= 208 ~ 240 | - | 40 | - | - | mV | |
| | Gray code= 32 ~ 207 | - | 30 | - | - | mV | |
| Withstanding current capability | IVDD capability | - | - | - | 40 | mA | - |
| | IVSP capability | - | - | - | 50 | | |
| | IVSN capability | - | - | - | -50 | | |
| VSP current consumption | Standby mode | Ivsps | - | - | 1.2 | mA | Note(2) |
| VSN current consumption | Standby mode | Ivsns | - | - | 0.15 | mA | Note(2) |
| VDD current consumption | Normal mode | Ivdd | - | - | 30 | mA | Note(1) |
| | Standby mode | Ivdds | - | - | 1.1 | mA | Note(2) |
| VPP operation current | | $I_{VPP}$ | - | - | 8 | mA | - |

**Note:** (1) Condition: one chip current ,VDD=1.8V, 1200RGBx1920 resolution ,MIPI frequency 950mbps,frame rate 60Hz, all setting are default.

(2) Condition: one chip current, all function and MIPI input stop. And let MIPI input state keep ULPS to reduce more current consumption in standby mode.

## 12.4 MIPI DC characteristics

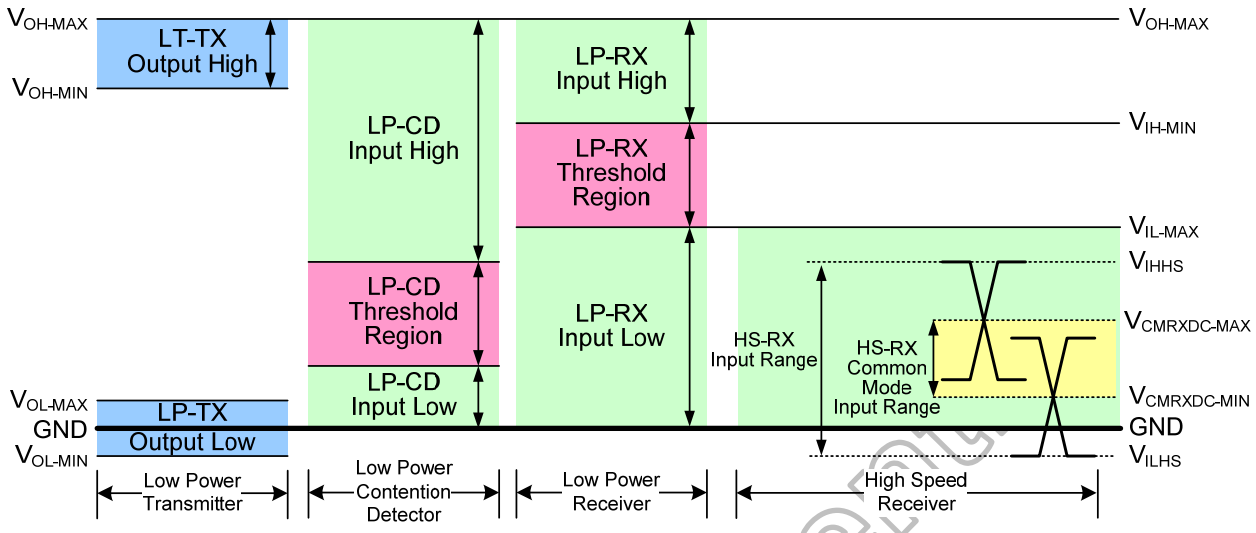



**Figure 12.1: MIPI signaling and contention voltage levels**

### DC characteristics for MIPI LP mode

| Parameter | Symbol | Spec. | | | Unit |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| Logic 1 input voltage | $V_{IH}$ | 880 | - | - | mV |
| Logic 0 input voltage | $V_{IL}$ | 0 | - | 550 | mV |
| Logic 1 output voltage | $V_{OH}$ | 1.1 | 1.2 | 1.3 | V |
| Logic 0 output voltage | $V_{OL}$ | -50 | - | 50 | mV |

### DC characteristics for MIPI HS mode

| Parameter | Symbol | Spec. | | | Unit |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| Common-mode voltage HS Receive mode | $V_{CMRXDC}$ | 70 | - | 330 | mV |
| *Differential input high threshold | $V_{IDTH}$ | - | - | 70 | mV |
| *Differential input low threshold | $V_{IDTL}$ | -70 | - | - | mV |
| Single-ended input high voltage | $V_{IHHS}$ | - | - | 460 | mV |
| Single-ended input low voltage | $V_{ILHS}$ | -40 | - | - | mV |
| Differential input impedance | $Z_{ID}$ | 80 | 100 | 125 | Ω |
| HS transmit differential voltage **(VDP-VDN)** | \|VOD\| | 140 | 200 | 270 | mV |

**Note:** (1) $V_{IDTH}$ and $V_{IDTL}$ only for reference, related to power and ground noise, this spec need to check on panel performance to fine tune

# 13. AC Characteristics

## 13.1 MIPI AC characteristics

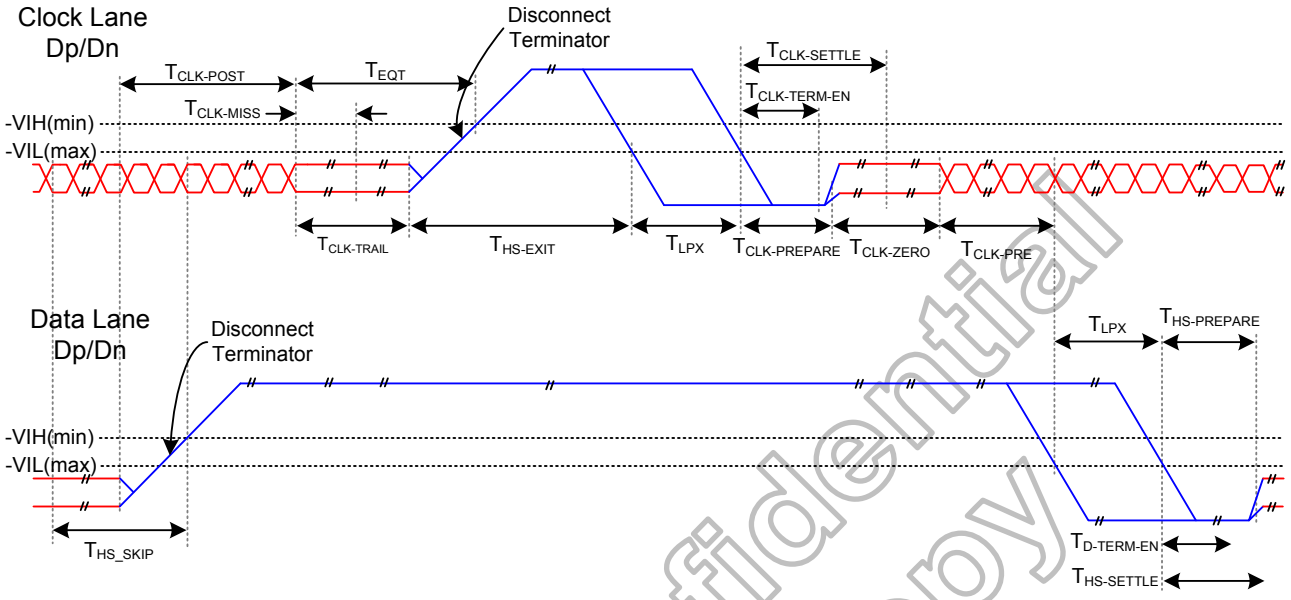



**Figure 13.1: Switching the clock lane between clock transmission and low-power mode**

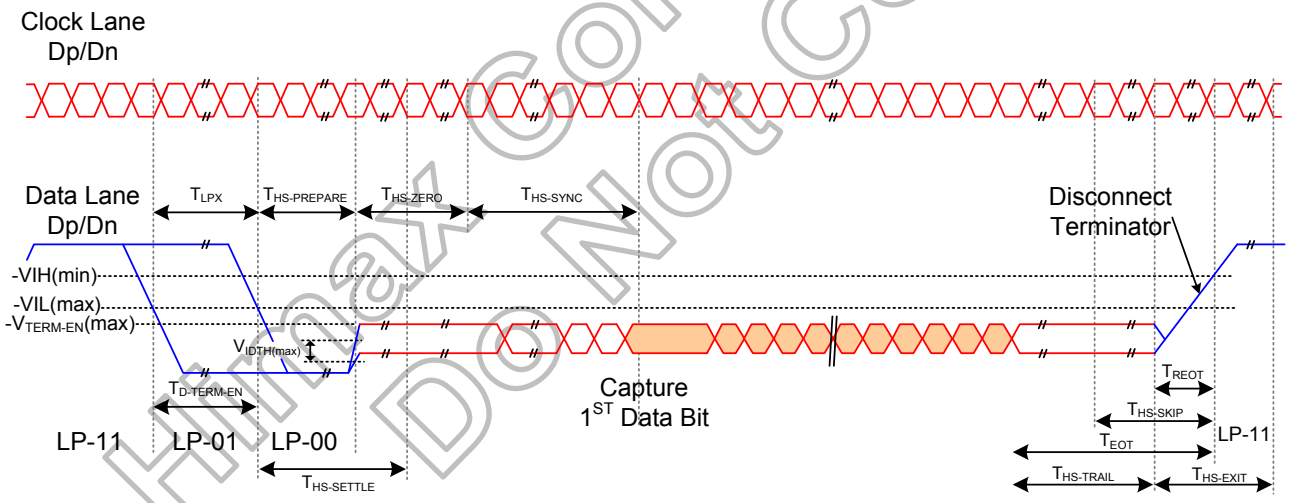



**Figure 13.2: Timing of high-speed data transmission in bursts**

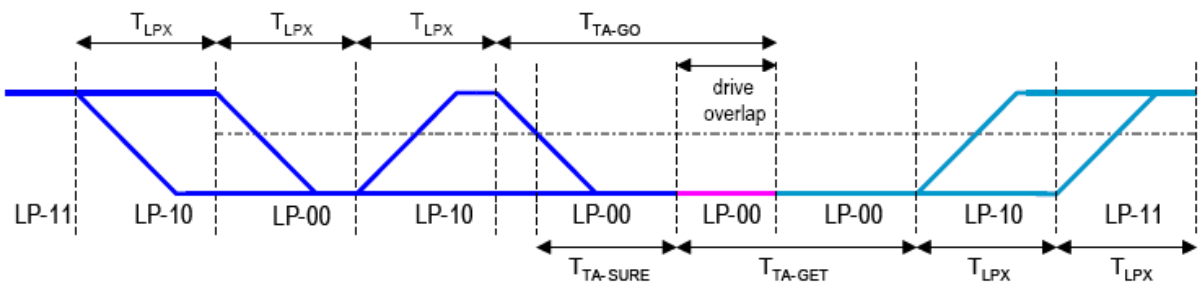



**Figure 13.3: Turnaround Procedure**

## MIPI AC Characteristics

| Parameter | Description | Spec. | | | Unit |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| $T_{REOT}$ | 30%-85% rise time and fall time | - | - | 35 | ns |
| $T_{CLK-MISS}$ | Timeout for receiver to detect absence of Clock transitions and disable the Clock Lane HS-RX. | - | - | 60 | ns |
| $T_{CLK-POST}$*1 | Time that the transmitter continues to send HS clock after the last associated Data Lane has transitioned to LP Mode. Interval is defined as the period from the end of THS-TRAIL to the beginning of $T_{CLK-TRAIL}$. | 60 ns + 52*UI **(For DCS)** | - | - | ns |
| $T_{CLK-PRE}$ | Time that the HS clock shall be driven by the transmitter prior to any associated Data Lane beginning the transition from LP to HS mode. | 8 | - | - | ns |
| $T_{CLK-SETTLE}$ | Time interval during which the HS receiver shall ignore any Clock Lane HS transitions, starting from the beginning of $T_{CLK-PRE}$. | 95 | - | 300 | ns |
| $T_{CLK-TERM-EN}$ | Time for the Clock Lane receiver to enable the HS line termination, starting from the time point when Dn crosses $V_{IL,MAX}$. | Time for Dn to reach $V_{TERM-EN}$ | - | 38 | ns |
| $T_{HS-SETTLE}$ | Time interval during which the HS receiver shall ignore any Data Lane HS transitions, starting from the beginning of $T_{HSPREPARE}$. | 85 ns + 6*UI | | 145 ns + 10*UI | ns |
| $T_{EOT}$ | Time from start of $T_{HS-TRAIL}$ or $T_{CLK-TRAIL}$ period to start of LP-11 state | - | - | 105ns+48*UI | - |
| $T_{HS-EXIT}$ (1) | time to drive LP-11 after HS burst | 100 | - | - | ns |
| $T_{HS-PREPARE}$ | Time to drive LP-00 to prepare for HS transmission | 40ns + 4*UI | - | 85ns+6*UI | ns |
| $T_{HS-PREPARE}$ + $T_{HS-ZERO}$ | $T_{HS-PREPARE}$ + Time to drive HS-0 before the Sync sequence | 145ns + 10*UI | - | - | ns |
| $T_{HS-SKIP}$ | Time-out at RX to ignore transition period of EoT | 40 | - | 55ns+4*UI | ns |
| $T_{HS-TRAIL}$ | Time to drive flipped differential state after last payload data bit of a HS transmission burst | 60 + 4*UI | - | - | ns |
| $T_{LPX}$ | Length of any Low-Power state period | 50 | - | - | ns |
| Ratio $T_{LPX}$ | Ratio of $T_{LPX(MASTER)}$/$T_{LPS(SLAVE)}$ between Master and Slave side | 2/3 | - | 3/2 | - |
| $T_{TA-GET}$ | Time to drive LP-00 by new TX | $5*T_{LPX}$ | | | ns |
| $T_{TA-GO}$ | Time to drive LP-00 after Turnaround Request | $4*T_{LPX}$ | | | ns |
| $T_{TA-SURE}$ | Time-out before new TX side starts driving | $T_{LPX}$ | - | $2*T_{LPX}$ | ns |

**Note:** (1) For image transmission:
$T_{CLK-POST}$ min value =164 when MIPI max frequency per lane = 0.53Gbps.
$T_{CLK-POST}$ min value =112 when MIPI max frequency per lane = 1Gbps

## 13.2 MIPI data-clock timing specification

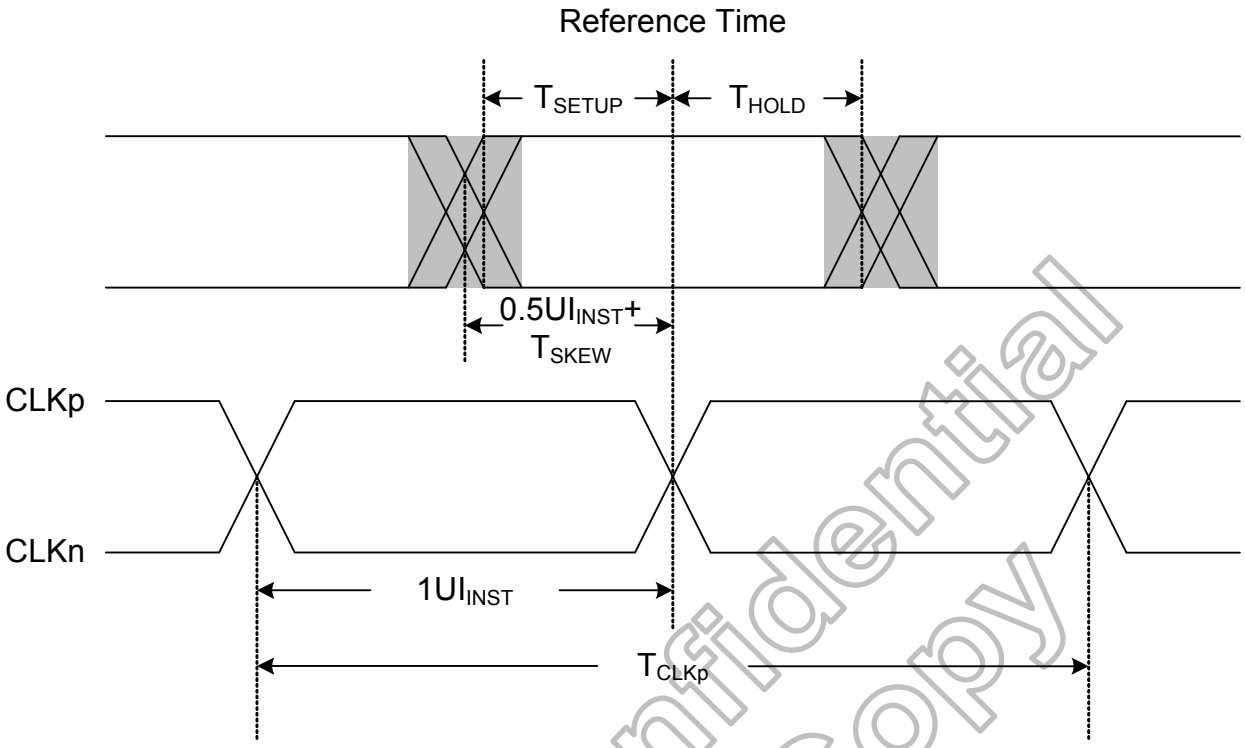
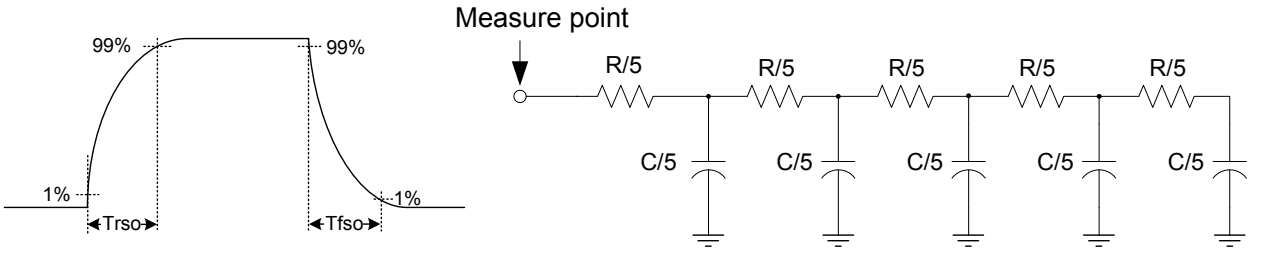



**Figure 13.4: Data to clock timing**

| Parameter | Symbol | Spec. | | | Unit |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| UI instantaneous | $UI_{INST}$ | 1.0 | - | 12.5(1) | ns |
| Data to clock setup time | $T_{SETUP}$ | 0.3 | - | - | $UI_{INST}$ |
| Data to clock hold time | $T_{HOLD}$ | 0.3 | - | - | $UI_{INST}$ |

**Note:** (1) This value corresponds to a minimum 80 Mbps data rate.

## 13.3 Source output timing

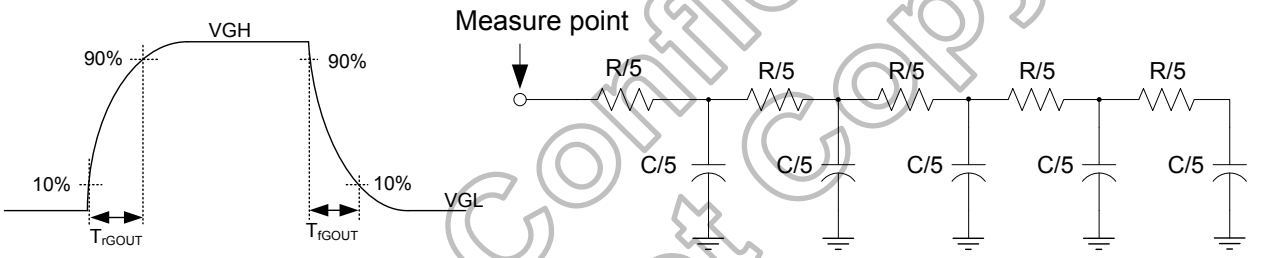



| Parameter | Symbol | Conditions | Spec. | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Source driver rising time | trSO | Load R=7.94KΩ, Load C = 85.84pF, Voltage: -5V←→5V VSN=-5.1V, VSP=5.1V | - | - | 6.0 | μs |
| Source driver falling time | tfSO | | - | - | 6.0 | μs |

**Note:** (1) Himax can support simulation for customer design.

**Table 13.1: Source output timing**

Panel control signal output 1 **(GOUT1_L~GOUT20_L, GOUT1_R~GOUT20_R)**

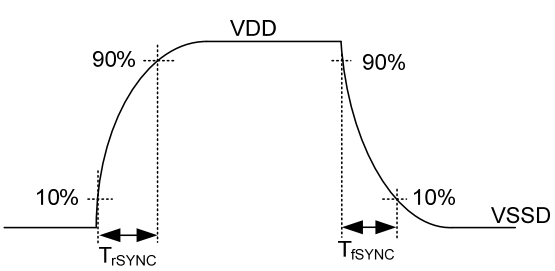


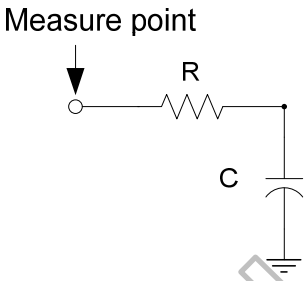

| Parameter | Symbol | Conditions | Spec. | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Panel control signal rising time | $T_{rGOUT}$ | LOAD R=1780Ω LOAD C=1273pF VGH=+16V, VGL=-16.0V | - | - | 5 | μs |
| Panel control signal falling time | $T_{fGOUT}$ | | - | - | 5 | μs |

**Note:** (1) Himax can support simulation for customer design.

**Table 13.2: GOA output timing**

Panel control signal output 2 **(SYNC1_L~ SYNC8_L, SYNC1_R~ SYNC8_R)**




| Parameter | Symbol | Conditions | Spec. | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Panel synchronization signal rising time | $T_{rSYNC}$ | LOAD R = 1KΩ | - | - | 60 | ns |
| Panel synchronization signal falling time | $T_{fSYNC}$ | LOAD C = 40pF | - | - | 60 | ns |

**Note:** (1) Himax can support simulation for customer design.

**Table 13.3: Synchronization signals output timing**

## 13.4 Serial interface characteristics

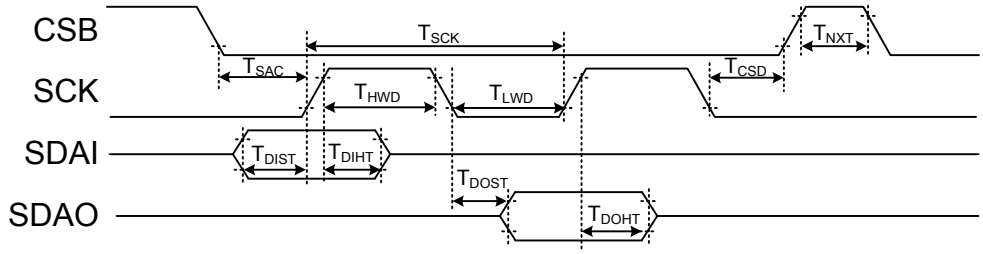



**Figure 13.5: Serial interface characteristics**

**(VSS=0V, VDD=1.7~2.0V, Ta=-20 to 85℃)**

| Parameter | Symbol | Conditions | Spec. | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| CSB assertion to first clock edge | $T_{SAC}$ | - | 120 | - | - | ns |
| CSB reassertion from last clock edge | $T_{CSD}$ | - | 120 | - | - | ns |
| CSB next control enable | $T_E$ | - | 200 | - | - | ns |
| SCK period time | $T_{SCK}$ | - | 200 | - | - | ns |
| SCK high period time | $T_{HWD}$ | - | 100 | - | - | ns |
| SCK low period time | $T_{LWD}$ | - | 100 | - | - | ns |
| SDAI input data setup time | $T_{DIST}$ | - | 50 | - | - | ns |
| SDAI input data hold time | $T_{DIHT}$ | - | 50 | - | - | ns |
| SDAO output data setup time | $T_{DOST}$ | - | 60 | - | 100 | ns |
| SDAO output data hold time | $T_{DOHT}$ | - | 60 | - | 100 | ns |

**Table 13.4: AC characteristic of SPI interface**

## 13.5 Timing requirements for RESETB

When RESETB of the reset pin equals to Low, it will be in the condition of reset. When it is in the condition of reset, it will make the device recover the initial set.

However, in order to avoid the reset noise cause reset, there is a mechanism to judge about whether the reset is needed or not.

The closed interval of low can be shown as the following.

**(VDD=1.7V~2.0V, VSS=0V, $T_A$=-20℃~+85℃)**

| Parameter | Symbol | Conditions | Spec. | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Reset low pulse width | Trst | - | 20 | - | - | μs |

**Table 13.5: Reset timing**

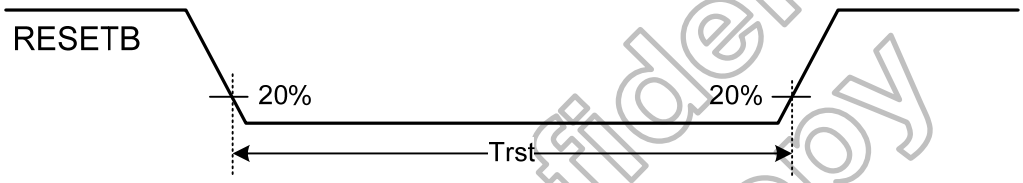



**Figure 13.6: Reset timing**

# 14. Pin Assignment (IC Face View)

## 14.1 Pad sequence

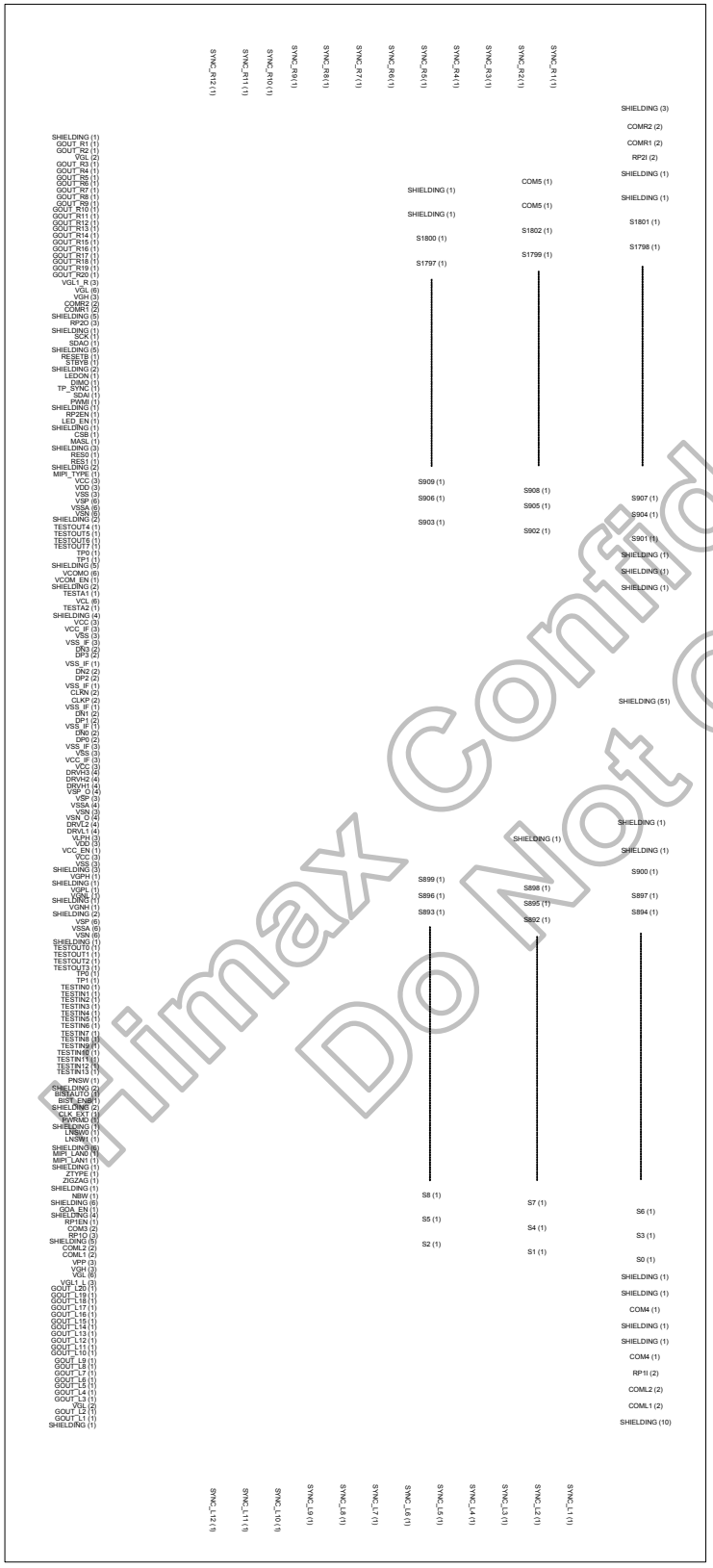
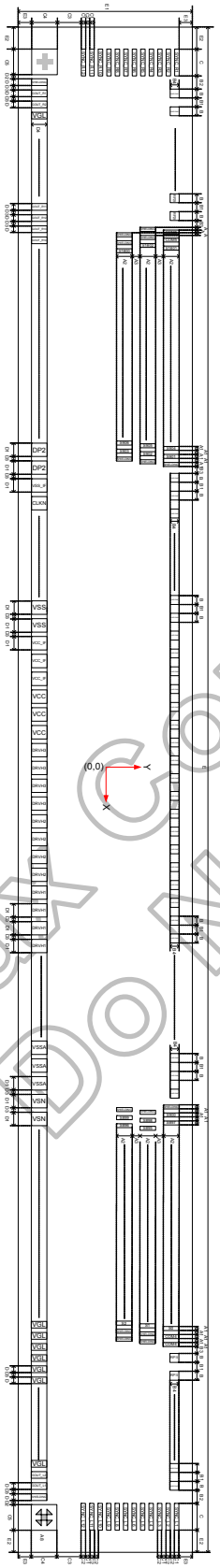



**Figure 14.1: Pad sequence**

## 14.2 Bump information

### 14.2.1 Chip outline dimensions



Chip size (w/o scribe line): 28420um x 695um
Chip size (w/i scribe line): 28500um x 775um
Bump height: 12um (+/-3um)
Bump hardness: 80HV (+/-20HV)
IC thickness: 300um (+/-10um)
Total bump area: 3910060 $um^2$

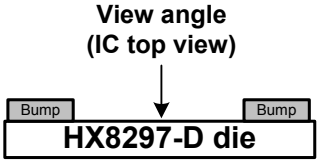



**Figure 14.2: Chip outline dimensions**

### 14.2.2 Pad information

**(Unit: μm)**

| Symbol | Dimension |
|---|---|
| A | 12 |
| A1 | 18 |
| A2 | 70 |
| A3 | 35 |
| B | 40 |
| B1 | 40 |
| B2 | 59 |
| B3 | 31 |
| B4 | 40 |
| C | 120 |
| C1 | 20 |
| C2 | 18 |
| C3 | 108 |
| C4 | 115 |
| C5 | 115 |
| D | 30 |
| D1 | 60 |
| D2 | 18 |
| D3 | 20 |
| D4 | 70 |
| E | 28500 **(max.)** |
| E1 | 775 **(max.)** |
| E2 | 97 **(max.)** |
| E3 | 57 **(max.)** |

### 14.2.3 Alignment mark

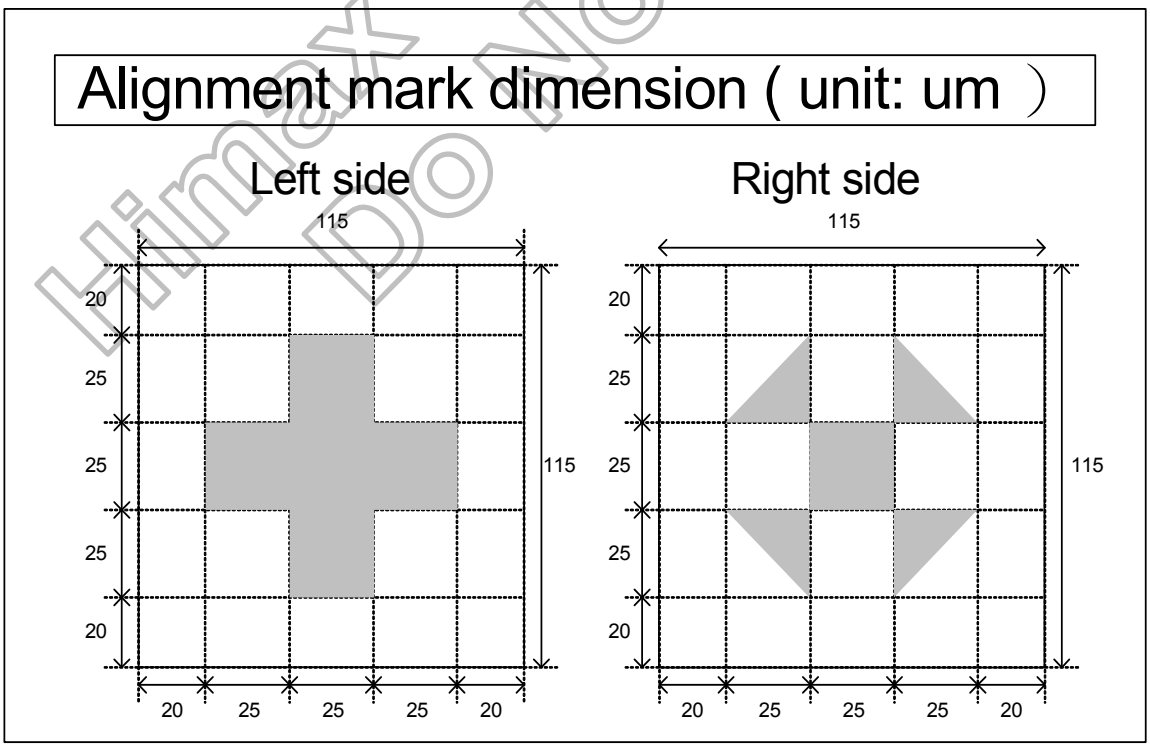



**Figure 14.3: Alignment mark**

## 14.3 Pad coordinates

**(Unit: μm)**

| No. | Name | X | Y | Bump size |
|---|---|---|---|---|
| 1 | SHIELDING | -14005 | -295.5 | 30x70 |
| 2 | GOUT_R1 | -13955 | -295.5 | 30x70 |
| 3 | GOUT_R2 | -13905 | -295.5 | 30x70 |
| 4 | VGL | -13855 | -295.5 | 30x70 |
| 5 | VGL | -13805 | -295.5 | 30x70 |
| 6 | GOUT_R3 | -13755 | -295.5 | 30x70 |
| 7 | GOUT_R4 | -13705 | -295.5 | 30x70 |
| 8 | GOUT_R5 | -13655 | -295.5 | 30x70 |
| 9 | GOUT_R6 | -13605 | -295.5 | 30x70 |
| 10 | GOUT_R7 | -13555 | -295.5 | 30x70 |
| 11 | GOUT_R8 | -13505 | -295.5 | 30x70 |
| 12 | GOUT_R9 | -13455 | -295.5 | 30x70 |
| 13 | GOUT_R10 | -13405 | -295.5 | 30x70 |
| 14 | GOUT_R11 | -13355 | -295.5 | 30x70 |
| 15 | GOUT_R12 | -13305 | -295.5 | 30x70 |
| 16 | GOUT_R13 | -13255 | -295.5 | 30x70 |
| 17 | GOUT_R14 | -13205 | -295.5 | 30x70 |
| 18 | GOUT_R15 | -13155 | -295.5 | 30x70 |
| 19 | GOUT_R16 | -13105 | -295.5 | 30x70 |
| 20 | GOUT_R17 | -13055 | -295.5 | 30x70 |
| 21 | GOUT_R18 | -13005 | -295.5 | 30x70 |
| 22 | GOUT_R19 | -12955 | -295.5 | 30x70 |
| 23 | GOUT_R20 | -12905 | -295.5 | 30x70 |
| 24 | VGL1_R | -12855 | -295.5 | 30x70 |
| 25 | VGL1_R | -12805 | -295.5 | 30x70 |
| 26 | VGL1_R | -12755 | -295.5 | 30x70 |
| 27 | VGL | -12705 | -295.5 | 30x70 |
| 28 | VGL | -12655 | -295.5 | 30x70 |
| 29 | VGL | -12605 | -295.5 | 30x70 |
| 30 | VGL | -12555 | -295.5 | 30x70 |
| 31 | VGL | -12505 | -295.5 | 30x70 |
| 32 | VGL | -12455 | -295.5 | 30x70 |
| 33 | VGH | -12405 | -295.5 | 30x70 |
| 34 | VGH | -12355 | -295.5 | 30x70 |
| 35 | VGH | -12305 | -295.5 | 30x70 |
| 36 | COMR2 | -12240 | -295.5 | 60x70 |
| 37 | COMR2 | -12160 | -295.5 | 60x70 |
| 38 | COMR1 | -12080 | -295.5 | 60x70 |
| 39 | COMR1 | -12000 | -295.5 | 60x70 |
| 40 | SHIELDING | -11920 | -295.5 | 60x70 |
| 41 | SHIELDING | -11840 | -295.5 | 60x70 |
| 42 | SHIELDING | -11760 | -295.5 | 60x70 |
| 43 | SHIELDING | -11680 | -295.5 | 60x70 |
| 44 | SHIELDING | -11600 | -295.5 | 60x70 |
| 45 | RP2O | -11520 | -295.5 | 60x70 |
| 46 | RP2O | -11440 | -295.5 | 60x70 |
| 47 | RP2O | -11360 | -295.5 | 60x70 |
| 48 | SHIELDING | -11280 | -295.5 | 60x70 |
| 49 | SCK | -11200 | -295.5 | 60x70 |
| 50 | SDAO | -11120 | -295.5 | 60x70 |
| 51 | SHIELDING | -11040 | -295.5 | 60x70 |
| 52 | SHIELDING | -10960 | -295.5 | 60x70 |
| 53 | SHIELDING | -10880 | -295.5 | 60x70 |
| 54 | SHIELDING | -10800 | -295.5 | 60x70 |
| 55 | SHIELDING | -10720 | -295.5 | 60x70 |
| 56 | RESETB | -10640 | -295.5 | 60x70 |
| 57 | STBYB | -10560 | -295.5 | 60x70 |
| 58 | SHIELDING | -10480 | -295.5 | 60x70 |
| 59 | SHIELDING | -10400 | -295.5 | 60x70 |
| 60 | LEDON | -10320 | -295.5 | 60x70 |
| 61 | DIMO | -10240 | -295.5 | 60x70 |
| 62 | TP_SYNC | -10160 | -295.5 | 60x70 |
| 63 | SDAI | -10080 | -295.5 | 60x70 |
| 64 | PWMI | -10000 | -295.5 | 60x70 |
| 65 | SHIELDING | -9920 | -295.5 | 60x70 |
| 66 | RP2EN | -9840 | -295.5 | 60x70 |
| 67 | LED_EN | -9760 | -295.5 | 60x70 |
| 68 | SHIELDING | -9680 | -295.5 | 60x70 |
| 69 | CSB | -9600 | -295.5 | 60x70 |
| 70 | MASL | -9520 | -295.5 | 60x70 |
| 71 | SHIELDING | -9440 | -295.5 | 60x70 |
| 72 | SHIELDING | -9360 | -295.5 | 60x70 |
| 73 | SHIELDING | -9280 | -295.5 | 60x70 |
| 74 | RES0 | -9200 | -295.5 | 60x70 |
| 75 | RES1 | -9120 | -295.5 | 60x70 |
| 76 | SHIELDING | -9040 | -295.5 | 60x70 |
| 77 | SHIELDING | -8960 | -295.5 | 60x70 |
| 78 | MIPI_TYPE | -8880 | -295.5 | 60x70 |
| 79 | VCC | -8800 | -295.5 | 60x70 |
| 80 | VCC | -8720 | -295.5 | 60x70 |
| 81 | VCC | -8640 | -295.5 | 60x70 |
| 82 | VDD | -8560 | -295.5 | 60x70 |
| 83 | VDD | -8480 | -295.5 | 60x70 |
| 84 | VDD | -8400 | -295.5 | 60x70 |
| 85 | VSS | -8320 | -295.5 | 60x70 |
| 86 | VSS | -8240 | -295.5 | 60x70 |
| 87 | VSS | -8160 | -295.5 | 60x70 |
| 88 | VSP | -8080 | -295.5 | 60x70 |
| 89 | VSP | -8000 | -295.5 | 60x70 |
| 90 | VSP | -7920 | -295.5 | 60x70 |
| 91 | VSP | -7840 | -295.5 | 60x70 |
| 92 | VSP | -7760 | -295.5 | 60x70 |
| 93 | VSP | -7680 | -295.5 | 60x70 |
| 94 | VSSA | -7600 | -295.5 | 60x70 |
| 95 | VSSA | -7520 | -295.5 | 60x70 |
| 96 | VSSA | -7440 | -295.5 | 60x70 |
| 97 | VSSA | -7360 | -295.5 | 60x70 |
| 98 | VSSA | -7280 | -295.5 | 60x70 |
| 99 | VSSA | -7200 | -295.5 | 60x70 |
| 100 | VSN | -7120 | -295.5 | 60x70 |
| 101 | VSN | -7040 | -295.5 | 60x70 |
| 102 | VSN | -6960 | -295.5 | 60x70 |
| 103 | VSN | -6880 | -295.5 | 60x70 |
| 104 | VSN | -6800 | -295.5 | 60x70 |
| 105 | VSN | -6720 | -295.5 | 60x70 |
| 106 | SHIELDING | -6640 | -295.5 | 60x70 |
| 107 | SHIELDING | -6560 | -295.5 | 60x70 |
| 108 | TESTOUT4 | -6480 | -295.5 | 60x70 |
| 109 | TESTOUT5 | -6400 | -295.5 | 60x70 |
| 110 | TESTOUT6 | -6320 | -295.5 | 60x70 |
| 111 | TESTOUT7 | -6240 | -295.5 | 60x70 |
| 112 | TP0 | -6160 | -295.5 | 60x70 |
| 113 | TP1 | -6080 | -295.5 | 60x70 |
| 114 | SHIELDING | -6000 | -295.5 | 60x70 |
| 115 | SHIELDING | -5920 | -295.5 | 60x70 |
| 116 | SHIELDING | -5840 | -295.5 | 60x70 |
| 117 | SHIELDING | -5760 | -295.5 | 60x70 |
| 118 | SHIELDING | -5680 | -295.5 | 60x70 |
| 119 | VCOMO | -5600 | -295.5 | 60x70 |
| 120 | VCOMO | -5520 | -295.5 | 60x70 |
| 121 | VCOMO | -5440 | -295.5 | 60x70 |
| 122 | VCOMO | -5360 | -295.5 | 60x70 |
| 123 | VCOMO | -5280 | -295.5 | 60x70 |
| 124 | VCOMO | -5200 | -295.5 | 60x70 |
| 125 | VCOM_EN | -5120 | -295.5 | 60x70 |
| 126 | SHIELDING | -5040 | -295.5 | 60x70 |
| 127 | SHIELDING | -4960 | -295.5 | 60x70 |
| 128 | TESTA1 | -4880 | -295.5 | 60x70 |
| 129 | VCL | -4800 | -295.5 | 60x70 |
| 130 | VCL | -4720 | -295.5 | 60x70 |
| 131 | VCL | -4640 | -295.5 | 60x70 |
| 132 | VCL | -4560 | -295.5 | 60x70 |
| 133 | VCL | -4480 | -295.5 | 60x70 |
| 134 | VCL | -4400 | -295.5 | 60x70 |
| 135 | TESTA2 | -4320 | -295.5 | 60x70 |
| 136 | SHIELDING | -4240 | -295.5 | 60x70 |
| 137 | SHIELDING | -4160 | -295.5 | 60x70 |
| 138 | SHIELDING | -4080 | -295.5 | 60x70 |
| 139 | SHIELDING | -4000 | -295.5 | 60x70 |
| 140 | VCC | -3920 | -295.5 | 60x70 |
| 141 | VCC | -3840 | -295.5 | 60x70 |
| 142 | VCC | -3760 | -295.5 | 60x70 |
| 143 | VCC_IF | -3680 | -295.5 | 60x70 |
| 144 | VCC_IF | -3600 | -295.5 | 60x70 |
| 145 | VCC_IF | -3520 | -295.5 | 60x70 |
| 146 | VSS | -3440 | -295.5 | 60x70 |
| 147 | VSS | -3360 | -295.5 | 60x70 |
| 148 | VSS | -3280 | -295.5 | 60x70 |
| 149 | VSS_IF | -3200 | -295.5 | 60x70 |
| 150 | VSS_IF | -3120 | -295.5 | 60x70 |
| 151 | VSS_IF | -3040 | -295.5 | 60x70 |
| 152 | DN3 | -2960 | -295.5 | 60x70 |
| 153 | DN3 | -2880 | -295.5 | 60x70 |
| 154 | DP3 | -2800 | -295.5 | 60x70 |
| 155 | DP3 | -2720 | -295.5 | 60x70 |
| 156 | VSS_IF | -2640 | -295.5 | 60x70 |
| 157 | DN2 | -2560 | -295.5 | 60x70 |
| 158 | DN2 | -2480 | -295.5 | 60x70 |
| 159 | DP2 | -2400 | -295.5 | 60x70 |
| 160 | DP2 | -2320 | -295.5 | 60x70 |
| 161 | VSS_IF | -2240 | -295.5 | 60x70 |
| 162 | CLKN | -2160 | -295.5 | 60x70 |
| 163 | CLKN | -2080 | -295.5 | 60x70 |
| 164 | CLKP | -2000 | -295.5 | 60x70 |
| 165 | CLKP | -1920 | -295.5 | 60x70 |
| 166 | VSS_IF | -1840 | -295.5 | 60x70 |
| 167 | DN1 | -1760 | -295.5 | 60x70 |
| 168 | DN1 | -1680 | -295.5 | 60x70 |
| 169 | DP1 | -1600 | -295.5 | 60x70 |
| 170 | DP1 | -1520 | -295.5 | 60x70 |
| 171 | VSS_IF | -1440 | -295.5 | 60x70 |
| 172 | DN0 | -1360 | -295.5 | 60x70 |
| 173 | DN0 | -1280 | -295.5 | 60x70 |
| 174 | DP0 | -1200 | -295.5 | 60x70 |
| 175 | DP0 | -1120 | -295.5 | 60x70 |
| 176 | VSS_IF | -1040 | -295.5 | 60x70 |
| 177 | VSS_IF | -960 | -295.5 | 60x70 |
| 178 | VSS_IF | -880 | -295.5 | 60x70 |
| 179 | VSS | -800 | -295.5 | 60x70 |
| 180 | VSS | -720 | -295.5 | 60x70 |
| 181 | VSS | -640 | -295.5 | 60x70 |
| 182 | VCC_IF | -560 | -295.5 | 60x70 |
| 183 | VCC_IF | -480 | -295.5 | 60x70 |
| 184 | VCC_IF | -400 | -295.5 | 60x70 |
| 185 | VCC | -320 | -295.5 | 60x70 |
| 186 | VCC | -240 | -295.5 | 60x70 |
| 187 | VCC | -160 | -295.5 | 60x70 |
| 188 | DRVH3 | -80 | -295.5 | 60x70 |
| 189 | DRVH3 | 0 | -295.5 | 60x70 |
| 190 | DRVH3 | 80 | -295.5 | 60x70 |
| 191 | DRVH3 | 160 | -295.5 | 60x70 |
| 192 | DRVH2 | 240 | -295.5 | 60x70 |
| 193 | DRVH2 | 320 | -295.5 | 60x70 |
| 194 | DRVH2 | 400 | -295.5 | 60x70 |
| 195 | DRVH2 | 480 | -295.5 | 60x70 |
| 196 | DRVH1 | 560 | -295.5 | 60x70 |
| 197 | DRVH1 | 640 | -295.5 | 60x70 |
| 198 | DRVH1 | 720 | -295.5 | 60x70 |
| 199 | DRVH1 | 800 | -295.5 | 60x70 |
| 200 | VSP_O | 880 | -295.5 | 60x70 |
| 201 | VSP_O | 960 | -295.5 | 60x70 |
| 202 | VSP_O | 1040 | -295.5 | 60x70 |
| 203 | VSP_O | 1120 | -295.5 | 60x70 |
| 204 | VSP | 1200 | -295.5 | 60x70 |
| 205 | VSP | 1280 | -295.5 | 60x70 |
| 206 | VSP | 1360 | -295.5 | 60x70 |
| 207 | VSSA | 1440 | -295.5 | 60x70 |
| 208 | VSSA | 1520 | -295.5 | 60x70 |
| 209 | VSSA | 1600 | -295.5 | 60x70 |
| 210 | VSSA | 1680 | -295.5 | 60x70 |
| 211 | VSN | 1760 | -295.5 | 60x70 |
| 212 | VSN | 1840 | -295.5 | 60x70 |
| 213 | VSN | 1920 | -295.5 | 60x70 |
| 214 | VSN_O | 2000 | -295.5 | 60x70 |
| 215 | VSN_O | 2080 | -295.5 | 60x70 |
| 216 | VSN_O | 2160 | -295.5 | 60x70 |
| 217 | VSN_O | 2240 | -295.5 | 60x70 |
| 218 | DRVL2 | 2320 | -295.5 | 60x70 |
| 219 | DRVL2 | 2400 | -295.5 | 60x70 |
| 220 | DRVL2 | 2480 | -295.5 | 60x70 |
| 221 | DRVL2 | 2560 | -295.5 | 60x70 |
| 222 | DRVL1 | 2640 | -295.5 | 60x70 |
| 223 | DRVL1 | 2720 | -295.5 | 60x70 |
| 224 | DRVL1 | 2800 | -295.5 | 60x70 |
| 225 | DRVL1 | 2880 | -295.5 | 60x70 |
| 226 | VLPH | 2960 | -295.5 | 60x70 |
| 227 | VLPH | 3040 | -295.5 | 60x70 |
| 228 | VLPH | 3120 | -295.5 | 60x70 |
| 229 | VDD | 3200 | -295.5 | 60x70 |
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| 231 | VDD | 3360 | -295.5 | 60x70 |
| 232 | VCC_EN | 3440 | -295.5 | 60x70 |
| 233 | VCC | 3520 | -295.5 | 60x70 |
| 234 | VCC | 3600 | -295.5 | 60x70 |
| 235 | VCC | 3680 | -295.5 | 60x70 |
| 236 | VSS | 3760 | -295.5 | 60x70 |
| 237 | VSS | 3840 | -295.5 | 60x70 |
| 238 | VSS | 3920 | -295.5 | 60x70 |
| 239 | SHIELDING | 4000 | -295.5 | 60x70 |
| 240 | SHIELDING | 4080 | -295.5 | 60x70 |

| No. | Name | X | Y | Bump size |
|---|---|---|---|---|
| 241 | SHIELDING | 4160 | -295.5 | 60x70 |
| 242 | VGPH | 4240 | -295.5 | 60x70 |
| 243 | SHIELDING | 4320 | -295.5 | 60x70 |
| 244 | VGPL | 4400 | -295.5 | 60x70 |
| 245 | VGNL | 4480 | -295.5 | 60x70 |
| 246 | SHIELDING | 4560 | -295.5 | 60x70 |
| 247 | VGNH | 4640 | -295.5 | 60x70 |
| 248 | SHIELDING | 4720 | -295.5 | 60x70 |
| 249 | SHIELDING | 4800 | -295.5 | 60x70 |
| 250 | VSP | 4880 | -295.5 | 60x70 |
| 251 | VSP | 4960 | -295.5 | 60x70 |
| 252 | VSP | 5040 | -295.5 | 60x70 |
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| 254 | VSP | 5200 | -295.5 | 60x70 |
| 255 | VSP | 5280 | -295.5 | 60x70 |
| 256 | VSSA | 5360 | -295.5 | 60x70 |
| 257 | VSSA | 5440 | -295.5 | 60x70 |
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| 262 | VSN | 5840 | -295.5 | 60x70 |
| 263 | VSN | 5920 | -295.5 | 60x70 |
| 264 | VSN | 6000 | -295.5 | 60x70 |
| 265 | VSN | 6080 | -295.5 | 60x70 |
| 266 | VSN | 6160 | -295.5 | 60x70 |
| 267 | VSN | 6240 | -295.5 | 60x70 |
| 268 | SHIELDING | 6320 | -295.5 | 60x70 |
| 269 | TESTOUT0 | 6400 | -295.5 | 60x70 |
| 270 | TESTOUT1 | 6480 | -295.5 | 60x70 |
| 271 | TESTOUT2 | 6560 | -295.5 | 60x70 |
| 272 | TESTOUT3 | 6640 | -295.5 | 60x70 |
| 273 | TP0 | 6720 | -295.5 | 60x70 |
| 274 | TP1 | 6800 | -295.5 | 60x70 |
| 275 | TESTIN0 | 6880 | -295.5 | 60x70 |
| 276 | TESTIN1 | 6960 | -295.5 | 60x70 |
| 277 | TESTIN2 | 7040 | -295.5 | 60x70 |
| 278 | TESTIN3 | 7120 | -295.5 | 60x70 |
| 279 | TESTIN4 | 7200 | -295.5 | 60x70 |
| 280 | TESTIN5 | 7280 | -295.5 | 60x70 |
| 281 | TESTIN6 | 7360 | -295.5 | 60x70 |
| 282 | TESTIN7 | 7440 | -295.5 | 60x70 |
| 283 | TESTIN8 | 7520 | -295.5 | 60x70 |
| 284 | TESTIN9 | 7600 | -295.5 | 60x70 |
| 285 | TESTIN10 | 7680 | -295.5 | 60x70 |
| 286 | TESTIN11 | 7760 | -295.5 | 60x70 |
| 287 | TESTIN12 | 7840 | -295.5 | 60x70 |
| 288 | TESTIN13 | 7920 | -295.5 | 60x70 |
| 289 | PNSW | 8000 | -295.5 | 60x70 |
| 290 | SHIELDING | 8080 | -295.5 | 60x70 |
| 291 | SHIELDING | 8160 | -295.5 | 60x70 |
| 292 | BISTAUTO | 8240 | -295.5 | 60x70 |
| 293 | BIST_ENB | 8320 | -295.5 | 60x70 |
| 294 | SHIELDING | 8400 | -295.5 | 60x70 |
| 295 | SHIELDING | 8480 | -295.5 | 60x70 |
| 296 | CLK_EXT | 8560 | -295.5 | 60x70 |
| 297 | PWRMD | 8640 | -295.5 | 60x70 |
| 298 | SHIELDING | 8720 | -295.5 | 60x70 |
| 299 | LNSW0 | 8800 | -295.5 | 60x70 |
| 300 | LNSW1 | 8880 | -295.5 | 60x70 |
| 301 | SHIELDING | 8960 | -295.5 | 60x70 |
| 302 | SHIELDING | 9040 | -295.5 | 60x70 |
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| 304 | SHIELDING | 9200 | -295.5 | 60x70 |
| 305 | SHIELDING | 9280 | -295.5 | 60x70 |
| 306 | SHIELDING | 9360 | -295.5 | 60x70 |
| 307 | MIPI_LAN0 | 9440 | -295.5 | 60x70 |
| 308 | MIPI_LAN1 | 9520 | -295.5 | 60x70 |
| 309 | SHIELDING | 9600 | -295.5 | 60x70 |
| 310 | ZTYPE | 9680 | -295.5 | 60x70 |
| 311 | ZIGZAG | 9760 | -295.5 | 60x70 |
| 312 | SHIELDING | 9840 | -295.5 | 60x70 |
| 313 | NBW | 9920 | -295.5 | 60x70 |
| 314 | SHIELDING | 10000 | -295.5 | 60x70 |
| 315 | SHIELDING | 10080 | -295.5 | 60x70 |
| 316 | SHIELDING | 10160 | -295.5 | 60x70 |
| 317 | SHIELDING | 10240 | -295.5 | 60x70 |
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| 320 | GOA_EN | 10480 | -295.5 | 60x70 |
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| 322 | SHIELDING | 10640 | -295.5 | 60x70 |
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| 324 | SHIELDING | 10800 | -295.5 | 60x70 |
| 325 | RP1EN | 10880 | -295.5 | 60x70 |
| 326 | COM3 | 10960 | -295.5 | 60x70 |
| 327 | COM3 | 11040 | -295.5 | 60x70 |
| 328 | RP1O | 11120 | -295.5 | 60x70 |
| 329 | RP1O | 11200 | -295.5 | 60x70 |
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| 337 | COML2 | 11840 | -295.5 | 60x70 |
| 338 | COML1 | 11920 | -295.5 | 60x70 |
| 339 | COML1 | 12000 | -295.5 | 60x70 |
| 340 | VPP | 12080 | -295.5 | 60x70 |
| 341 | VPP | 12160 | -295.5 | 60x70 |
| 342 | VPP | 12240 | -295.5 | 60x70 |
| 343 | VGH | 12305 | -295.5 | 60x70 |
| 344 | VGH | 12355 | -295.5 | 60x70 |
| 345 | VGH | 12405 | -295.5 | 60x70 |
| 346 | VGL | 12455 | -295.5 | 60x70 |
| 347 | VGL | 12505 | -295.5 | 60x70 |
| 348 | VGL | 12555 | -295.5 | 60x70 |
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| 352 | VGL1_L | 12755 | -295.5 | 60x70 |
| 353 | VGL1_L | 12805 | -295.5 | 60x70 |
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| 355 | GOUT_L20 | 12905 | -295.5 | 60x70 |
| 356 | GOUT_L19 | 12955 | -295.5 | 60x70 |
| 357 | GOUT_L18 | 13005 | -295.5 | 60x70 |
| 358 | GOUT_L17 | 13055 | -295.5 | 60x70 |
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| 360 | GOUT_L15 | 13155 | -295.5 | 60x70 |
| 361 | GOUT_L14 | 13205 | -295.5 | 60x70 |
| 362 | GOUT_L13 | 13255 | -295.5 | 60x70 |
| 363 | GOUT_L12 | 13305 | -295.5 | 60x70 |
| 364 | GOUT_L11 | 13355 | -295.5 | 60x70 |
| 365 | GOUT_L10 | 13405 | -295.5 | 60x70 |
| 366 | GOUT_L9 | 13455 | -295.5 | 60x70 |
| 367 | GOUT_L8 | 13505 | -295.5 | 60x70 |
| 368 | GOUT_L7 | 13555 | -295.5 | 60x70 |
| 369 | GOUT_L6 | 13605 | -295.5 | 60x70 |
| 370 | GOUT_L5 | 13655 | -295.5 | 60x70 |
| 371 | GOUT_L4 | 13705 | -295.5 | 60x70 |
| 372 | GOUT_L3 | 13755 | -295.5 | 60x70 |
| 373 | VGL | 13805 | -295.5 | 60x70 |
| 374 | VGL | 13855 | -295.5 | 60x70 |
| 375 | GOUT_L2 | 13905 | -295.5 | 60x70 |
| 376 | GOUT_L1 | 13955 | -295.5 | 60x70 |
| 377 | SHIELDING | 14005 | -295.5 | 60x70 |
| 378 | SYNC_L12 | 14093 | -97.5 | 120x20 |
| 379 | SYNC_L11 | 14093 | -59.5 | 120x20 |
| 380 | SYNC_L10 | 14093 | -21.5 | 120x20 |
| 381 | SYNC_L9 | 14093 | 16.5 | 120x20 |
| 382 | SYNC_L8 | 14093 | 54.5 | 120x20 |
| 383 | SYNC_L7 | 14093 | 92.5 | 120x20 |
| 384 | SYNC_L6 | 14093 | 130.5 | 120x20 |
| 385 | SYNC_L5 | 14093 | 168.5 | 120x20 |
| 386 | SYNC_L4 | 14093 | 206.5 | 120x20 |
| 387 | SYNC_L3 | 14093 | 244.5 | 120x20 |
| 388 | SYNC_L2 | 14093 | 282.5 | 120x20 |
| 389 | SYNC_L1 | 14093 | 320.5 | 120x20 |
| 390 | SHIELDING | 13954 | 310.5 | 40x40 |
| 391 | SHIELDING | 13874 | 310.5 | 40x40 |
| 392 | SHIELDING | 13794 | 310.5 | 40x40 |
| 393 | SHIELDING | 13714 | 310.5 | 40x40 |
| 394 | SHIELDING | 13634 | 310.5 | 40x40 |
| 395 | SHIELDING | 13554 | 310.5 | 40x40 |
| 396 | SHIELDING | 13474 | 310.5 | 40x40 |
| 397 | SHIELDING | 13394 | 310.5 | 40x40 |
| 398 | SHIELDING | 13314 | 310.5 | 40x40 |
| 399 | SHIELDING | 13234 | 310.5 | 40x40 |
| 400 | COML1 | 13154 | 310.5 | 40x40 |
| 401 | COML1 | 13074 | 310.5 | 40x40 |
| 402 | COML2 | 12994 | 310.5 | 40x40 |
| 403 | COML2 | 12914 | 310.5 | 40x40 |
| 404 | RP1I | 12834 | 310.5 | 40x40 |
| 405 | RP1I | 12754 | 310.5 | 40x40 |
| 406 | COM4 | 12694 | 295.5 | 18x70 |
| 407 | SHIELDING | 12682 | 190.5 | 18x70 |
| 408 | SHIELDING | 12670 | 85.5 | 18x70 |
| 409 | COM4 | 12658 | 295.5 | 18x70 |
| 410 | SHIELDING | 12646 | 190.5 | 18x70 |
| 411 | SHIELDING | 12634 | 85.5 | 18x70 |
| 412 | S0 | 12622 | 295.5 | 18x70 |
| 413 | S1 | 12610 | 190.5 | 18x70 |
| 414 | S2 | 12598 | 85.5 | 18x70 |
| 415 | S3 | 12586 | 295.5 | 18x70 |
| 416 | S4 | 12574 | 190.5 | 18x70 |
| 417 | S5 | 12562 | 85.5 | 18x70 |
| 418 | S6 | 12550 | 295.5 | 18x70 |
| 419 | S7 | 12538 | 190.5 | 18x70 |
| 420 | S8 | 12526 | 85.5 | 18x70 |
| 421 | S9 | 12514 | 295.5 | 18x70 |
| 422 | S10 | 12502 | 190.5 | 18x70 |
| 423 | S11 | 12490 | 85.5 | 18x70 |
| 424 | S12 | 12478 | 295.5 | 18x70 |
| 425 | S13 | 12466 | 190.5 | 18x70 |
| 426 | S14 | 12454 | 85.5 | 18x70 |
| 427 | S15 | 12442 | 295.5 | 18x70 |
| 428 | S16 | 12430 | 190.5 | 18x70 |
| 429 | S17 | 12418 | 85.5 | 18x70 |
| 430 | S18 | 12406 | 295.5 | 18x70 |
| 431 | S19 | 12394 | 190.5 | 18x70 |
| 432 | S20 | 12382 | 85.5 | 18x70 |
| 433 | S21 | 12370 | 295.5 | 18x70 |
| 434 | S22 | 12358 | 190.5 | 18x70 |
| 435 | S23 | 12346 | 85.5 | 18x70 |
| 436 | S24 | 12334 | 295.5 | 18x70 |
| 437 | S25 | 12322 | 190.5 | 18x70 |
| 438 | S26 | 12310 | 85.5 | 18x70 |
| 439 | S27 | 12298 | 295.5 | 18x70 |
| 440 | S28 | 12286 | 190.5 | 18x70 |
| 441 | S29 | 12274 | 85.5 | 18x70 |
| 442 | S30 | 12262 | 295.5 | 18x70 |
| 443 | S31 | 12250 | 190.5 | 18x70 |
| 444 | S32 | 12238 | 85.5 | 18x70 |
| 445 | S33 | 12226 | 295.5 | 18x70 |
| 446 | S34 | 12214 | 190.5 | 18x70 |
| 447 | S35 | 12202 | 85.5 | 18x70 |
| 448 | S36 | 12190 | 295.5 | 18x70 |
| 449 | S37 | 12178 | 190.5 | 18x70 |
| 450 | S38 | 12166 | 85.5 | 18x70 |
| 451 | S39 | 12154 | 295.5 | 18x70 |
| 452 | S40 | 12142 | 190.5 | 18x70 |
| 453 | S41 | 12130 | 85.5 | 18x70 |
| 454 | S42 | 12118 | 295.5 | 18x70 |
| 455 | S43 | 12106 | 190.5 | 18x70 |
| 456 | S44 | 12094 | 85.5 | 18x70 |
| 457 | S45 | 12082 | 295.5 | 18x70 |
| 458 | S46 | 12070 | 190.5 | 18x70 |
| 459 | S47 | 12058 | 85.5 | 18x70 |
| 460 | S48 | 12046 | 295.5 | 18x70 |
| 461 | S49 | 12034 | 190.5 | 18x70 |
| 462 | S50 | 12022 | 85.5 | 18x70 |
| 463 | S51 | 12010 | 295.5 | 18x70 |
| 464 | S52 | 11998 | 190.5 | 18x70 |
| 465 | S53 | 11986 | 85.5 | 18x70 |
| 466 | S54 | 11974 | 295.5 | 18x70 |
| 467 | S55 | 11962 | 190.5 | 18x70 |
| 468 | S56 | 11950 | 85.5 | 18x70 |
| 469 | S57 | 11938 | 295.5 | 18x70 |
| 470 | S58 | 11926 | 190.5 | 18x70 |
| 471 | S59 | 11914 | 85.5 | 18x70 |
| 472 | S60 | 11902 | 295.5 | 18x70 |
| 473 | S61 | 11890 | 190.5 | 18x70 |
| 474 | S62 | 11878 | 85.5 | 18x70 |
| 475 | S63 | 11866 | 295.5 | 18x70 |
| 476 | S64 | 11854 | 190.5 | 18x70 |
| 477 | S65 | 11842 | 85.5 | 18x70 |
| 478 | S66 | 11830 | 295.5 | 18x70 |
| 479 | S67 | 11818 | 190.5 | 18x70 |
| 480 | S68 | 11806 | 85.5 | 18x70 |

| No. | Name | X | Y | Bump size |
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| 481 | S69 | 11794 | 295.5 | 18x70 |
| 482 | S70 | 11782 | 190.5 | 18x70 |
| 483 | S71 | 11770 | 85.5 | 18x70 |
| 484 | S72 | 11758 | 295.5 | 18x70 |
| 485 | S73 | 11746 | 190.5 | 18x70 |
| 486 | S74 | 11734 | 85.5 | 18x70 |
| 487 | S75 | 11722 | 295.5 | 18x70 |
| 488 | S76 | 11710 | 190.5 | 18x70 |
| 489 | S77 | 11698 | 85.5 | 18x70 |
| 490 | S78 | 11686 | 295.5 | 18x70 |
| 491 | S79 | 11674 | 190.5 | 18x70 |
| 492 | S80 | 11662 | 85.5 | 18x70 |
| 493 | S81 | 11650 | 295.5 | 18x70 |
| 494 | S82 | 11638 | 190.5 | 18x70 |
| 495 | S83 | 11626 | 85.5 | 18x70 |
| 496 | S84 | 11614 | 295.5 | 18x70 |
| 497 | S85 | 11602 | 190.5 | 18x70 |
| 498 | S86 | 11590 | 85.5 | 18x70 |
| 499 | S87 | 11578 | 295.5 | 18x70 |
| 500 | S88 | 11566 | 190.5 | 18x70 |
| 501 | S89 | 11554 | 85.5 | 18x70 |
| 502 | S90 | 11542 | 295.5 | 18x70 |
| 503 | S91 | 11530 | 190.5 | 18x70 |
| 504 | S92 | 11518 | 85.5 | 18x70 |
| 505 | S93 | 11506 | 295.5 | 18x70 |
| 506 | S94 | 11494 | 190.5 | 18x70 |
| 507 | S95 | 11482 | 85.5 | 18x70 |
| 508 | S96 | 11470 | 295.5 | 18x70 |
| 509 | S97 | 11458 | 190.5 | 18x70 |
| 510 | S98 | 11446 | 85.5 | 18x70 |
| 511 | S99 | 11434 | 295.5 | 18x70 |
| 512 | S100 | 11422 | 190.5 | 18x70 |
| 513 | S101 | 11410 | 85.5 | 18x70 |
| 514 | S102 | 11398 | 295.5 | 18x70 |
| 515 | S103 | 11386 | 190.5 | 18x70 |
| 516 | S104 | 11374 | 85.5 | 18x70 |
| 517 | S105 | 11362 | 295.5 | 18x70 |
| 518 | S106 | 11350 | 190.5 | 18x70 |
| 519 | S107 | 11338 | 85.5 | 18x70 |
| 520 | S108 | 11326 | 295.5 | 18x70 |
| 521 | S109 | 11314 | 190.5 | 18x70 |
| 522 | S110 | 11302 | 85.5 | 18x70 |
| 523 | S111 | 11290 | 295.5 | 18x70 |
| 524 | S112 | 11278 | 190.5 | 18x70 |
| 525 | S113 | 11266 | 85.5 | 18x70 |
| 526 | S114 | 11254 | 295.5 | 18x70 |
| 527 | S115 | 11242 | 190.5 | 18x70 |
| 528 | S116 | 11230 | 85.5 | 18x70 |
| 529 | S117 | 11218 | 295.5 | 18x70 |
| 530 | S118 | 11206 | 190.5 | 18x70 |
| 531 | S119 | 11194 | 85.5 | 18x70 |
| 532 | S120 | 11182 | 295.5 | 18x70 |
| 533 | S121 | 11170 | 190.5 | 18x70 |
| 534 | S122 | 11158 | 85.5 | 18x70 |
| 535 | S123 | 11146 | 295.5 | 18x70 |
| 536 | S124 | 11134 | 190.5 | 18x70 |
| 537 | S125 | 11122 | 85.5 | 18x70 |
| 538 | S126 | 11110 | 295.5 | 18x70 |
| 539 | S127 | 11098 | 190.5 | 18x70 |
| 540 | S128 | 11086 | 85.5 | 18x70 |
| 541 | S129 | 11074 | 295.5 | 18x70 |
| 542 | S130 | 11062 | 190.5 | 18x70 |
| 543 | S131 | 11050 | 85.5 | 18x70 |
| 544 | S132 | 11038 | 295.5 | 18x70 |
| 545 | S133 | 11026 | 190.5 | 18x70 |
| 546 | S134 | 11014 | 85.5 | 18x70 |
| 547 | S135 | 11002 | 295.5 | 18x70 |
| 548 | S136 | 10990 | 190.5 | 18x70 |
| 549 | S137 | 10978 | 85.5 | 18x70 |
| 550 | S138 | 10966 | 295.5 | 18x70 |
| 551 | S139 | 10954 | 190.5 | 18x70 |
| 552 | S140 | 10942 | 85.5 | 18x70 |
| 553 | S141 | 10930 | 295.5 | 18x70 |
| 554 | S142 | 10918 | 190.5 | 18x70 |
| 555 | S143 | 10906 | 85.5 | 18x70 |
| 556 | S144 | 10894 | 295.5 | 18x70 |
| 557 | S145 | 10882 | 190.5 | 18x70 |
| 558 | S146 | 10870 | 85.5 | 18x70 |
| 559 | S147 | 10858 | 295.5 | 18x70 |
| 560 | S148 | 10846 | 190.5 | 18x70 |
| 561 | S149 | 10834 | 85.5 | 18x70 |
| 562 | S150 | 10822 | 295.5 | 18x70 |
| 563 | S151 | 10810 | 190.5 | 18x70 |
| 564 | S152 | 10798 | 85.5 | 18x70 |
| 565 | S153 | 10786 | 295.5 | 18x70 |
| 566 | S154 | 10774 | 190.5 | 18x70 |
| 567 | S155 | 10762 | 85.5 | 18x70 |
| 568 | S156 | 10750 | 295.5 | 18x70 |
| 569 | S157 | 10738 | 190.5 | 18x70 |
| 570 | S158 | 10726 | 85.5 | 18x70 |
| 571 | S159 | 10714 | 295.5 | 18x70 |
| 572 | S160 | 10702 | 190.5 | 18x70 |
| 573 | S161 | 10690 | 85.5 | 18x70 |
| 574 | S162 | 10678 | 295.5 | 18x70 |
| 575 | S163 | 10666 | 190.5 | 18x70 |
| 576 | S164 | 10654 | 85.5 | 18x70 |
| 577 | S165 | 10642 | 295.5 | 18x70 |
| 578 | S166 | 10630 | 190.5 | 18x70 |
| 579 | S167 | 10618 | 85.5 | 18x70 |
| 580 | S168 | 10606 | 295.5 | 18x70 |
| 581 | S169 | 10594 | 190.5 | 18x70 |
| 582 | S170 | 10582 | 85.5 | 18x70 |
| 583 | S171 | 10570 | 295.5 | 18x70 |
| 584 | S172 | 10558 | 190.5 | 18x70 |
| 585 | S173 | 10546 | 85.5 | 18x70 |
| 586 | S174 | 10534 | 295.5 | 18x70 |
| 587 | S175 | 10522 | 190.5 | 18x70 |
| 588 | S176 | 10510 | 85.5 | 18x70 |
| 589 | S177 | 10498 | 295.5 | 18x70 |
| 590 | S178 | 10486 | 190.5 | 18x70 |
| 591 | S179 | 10474 | 85.5 | 18x70 |
| 592 | S180 | 10462 | 295.5 | 18x70 |
| 593 | S181 | 10450 | 190.5 | 18x70 |
| 594 | S182 | 10438 | 85.5 | 18x70 |
| 595 | S183 | 10426 | 295.5 | 18x70 |
| 596 | S184 | 10414 | 190.5 | 18x70 |
| 597 | S185 | 10402 | 85.5 | 18x70 |
| 598 | S186 | 10390 | 295.5 | 18x70 |
| 599 | S187 | 10378 | 190.5 | 18x70 |
| 600 | S188 | 10366 | 85.5 | 18x70 |
| 601 | S189 | 10354 | 295.5 | 18x70 |
| 602 | S190 | 10342 | 190.5 | 18x70 |
| 603 | S191 | 10330 | 85.5 | 18x70 |
| 604 | S192 | 10318 | 295.5 | 18x70 |
| 605 | S193 | 10306 | 190.5 | 18x70 |
| 606 | S194 | 10294 | 85.5 | 18x70 |
| 607 | S195 | 10282 | 295.5 | 18x70 |
| 608 | S196 | 10270 | 190.5 | 18x70 |
| 609 | S197 | 10258 | 85.5 | 18x70 |
| 610 | S198 | 10246 | 295.5 | 18x70 |
| 611 | S199 | 10234 | 190.5 | 18x70 |
| 612 | S200 | 10222 | 85.5 | 18x70 |
| 613 | S201 | 10210 | 295.5 | 18x70 |
| 614 | S202 | 10198 | 190.5 | 18x70 |
| 615 | S203 | 10186 | 85.5 | 18x70 |
| 616 | S204 | 10174 | 295.5 | 18x70 |
| 617 | S205 | 10162 | 190.5 | 18x70 |
| 618 | S206 | 10150 | 85.5 | 18x70 |
| 619 | S207 | 10138 | 295.5 | 18x70 |
| 620 | S208 | 10126 | 190.5 | 18x70 |
| 621 | S209 | 10114 | 85.5 | 18x70 |
| 622 | S210 | 10102 | 295.5 | 18x70 |
| 623 | S211 | 10090 | 190.5 | 18x70 |
| 624 | S212 | 10078 | 85.5 | 18x70 |
| 625 | S213 | 10066 | 295.5 | 18x70 |
| 626 | S214 | 10054 | 190.5 | 18x70 |
| 627 | S215 | 10042 | 85.5 | 18x70 |
| 628 | S216 | 10030 | 295.5 | 18x70 |
| 629 | S217 | 10018 | 190.5 | 18x70 |
| 630 | S218 | 10006 | 85.5 | 18x70 |
| 631 | S219 | 9994 | 295.5 | 18x70 |
| 632 | S220 | 9982 | 190.5 | 18x70 |
| 633 | S221 | 9970 | 85.5 | 18x70 |
| 634 | S222 | 9958 | 295.5 | 18x70 |
| 635 | S223 | 9946 | 190.5 | 18x70 |
| 636 | S224 | 9934 | 85.5 | 18x70 |
| 637 | S225 | 9922 | 295.5 | 18x70 |
| 638 | S226 | 9910 | 190.5 | 18x70 |
| 639 | S227 | 9898 | 85.5 | 18x70 |
| 640 | S228 | 9886 | 295.5 | 18x70 |
| 641 | S229 | 9874 | 190.5 | 18x70 |
| 642 | S230 | 9862 | 85.5 | 18x70 |
| 643 | S231 | 9850 | 295.5 | 18x70 |
| 644 | S232 | 9838 | 190.5 | 18x70 |
| 645 | S233 | 9826 | 85.5 | 18x70 |
| 646 | S234 | 9814 | 295.5 | 18x70 |
| 647 | S235 | 9802 | 190.5 | 18x70 |
| 648 | S236 | 9790 | 85.5 | 18x70 |
| 649 | S237 | 9778 | 295.5 | 18x70 |
| 650 | S238 | 9766 | 190.5 | 18x70 |
| 651 | S239 | 9754 | 85.5 | 18x70 |
| 652 | S240 | 9742 | 295.5 | 18x70 |
| 653 | S241 | 9730 | 190.5 | 18x70 |
| 654 | S242 | 9718 | 85.5 | 18x70 |
| 655 | S243 | 9706 | 295.5 | 18x70 |
| 656 | S244 | 9694 | 190.5 | 18x70 |
| 657 | S245 | 9682 | 85.5 | 18x70 |
| 658 | S246 | 9670 | 295.5 | 18x70 |
| 659 | S247 | 9658 | 190.5 | 18x70 |
| 660 | S248 | 9646 | 85.5 | 18x70 |
| 661 | S249 | 9634 | 295.5 | 18x70 |
| 662 | S250 | 9622 | 190.5 | 18x70 |
| 663 | S251 | 9610 | 85.5 | 18x70 |
| 664 | S252 | 9598 | 295.5 | 18x70 |
| 665 | S253 | 9586 | 190.5 | 18x70 |
| 666 | S254 | 9574 | 85.5 | 18x70 |
| 667 | S255 | 9562 | 295.5 | 18x70 |
| 668 | S256 | 9550 | 190.5 | 18x70 |
| 669 | S257 | 9538 | 85.5 | 18x70 |
| 670 | S258 | 9526 | 295.5 | 18x70 |
| 671 | S259 | 9514 | 190.5 | 18x70 |
| 672 | S260 | 9502 | 85.5 | 18x70 |
| 673 | S261 | 9490 | 295.5 | 18x70 |
| 674 | S262 | 9478 | 190.5 | 18x70 |
| 675 | S263 | 9466 | 85.5 | 18x70 |
| 676 | S264 | 9454 | 295.5 | 18x70 |
| 677 | S265 | 9442 | 190.5 | 18x70 |
| 678 | S266 | 9430 | 85.5 | 18x70 |
| 679 | S267 | 9418 | 295.5 | 18x70 |
| 680 | S268 | 9406 | 190.5 | 18x70 |
| 681 | S269 | 9394 | 85.5 | 18x70 |
| 682 | S270 | 9382 | 295.5 | 18x70 |
| 683 | S271 | 9370 | 190.5 | 18x70 |
| 684 | S272 | 9358 | 85.5 | 18x70 |
| 685 | S273 | 9346 | 295.5 | 18x70 |
| 686 | S274 | 9334 | 190.5 | 18x70 |
| 687 | S275 | 9322 | 85.5 | 18x70 |
| 688 | S276 | 9310 | 295.5 | 18x70 |
| 689 | S277 | 9298 | 190.5 | 18x70 |
| 690 | S278 | 9286 | 85.5 | 18x70 |
| 691 | S279 | 9274 | 295.5 | 18x70 |
| 692 | S280 | 9262 | 190.5 | 18x70 |
| 693 | S281 | 9250 | 85.5 | 18x70 |
| 694 | S282 | 9238 | 295.5 | 18x70 |
| 695 | S283 | 9226 | 190.5 | 18x70 |
| 696 | S284 | 9214 | 85.5 | 18x70 |
| 697 | S285 | 9202 | 295.5 | 18x70 |
| 698 | S286 | 9190 | 190.5 | 18x70 |
| 699 | S287 | 9178 | 85.5 | 18x70 |
| 700 | S288 | 9166 | 295.5 | 18x70 |
| 701 | S289 | 9154 | 190.5 | 18x70 |
| 702 | S290 | 9142 | 85.5 | 18x70 |
| 703 | S291 | 9130 | 295.5 | 18x70 |
| 704 | S292 | 9118 | 190.5 | 18x70 |
| 705 | S293 | 9106 | 85.5 | 18x70 |
| 706 | S294 | 9094 | 295.5 | 18x70 |
| 707 | S295 | 9082 | 190.5 | 18x70 |
| 708 | S296 | 9070 | 85.5 | 18x70 |
| 709 | S297 | 9058 | 295.5 | 18x70 |
| 710 | S298 | 9046 | 190.5 | 18x70 |
| 711 | S299 | 9034 | 85.5 | 18x70 |
| 712 | S300 | 9022 | 295.5 | 18x70 |
| 713 | S301 | 9010 | 190.5 | 18x70 |
| 714 | S302 | 8998 | 85.5 | 18x70 |
| 715 | S303 | 8986 | 295.5 | 18x70 |
| 716 | S304 | 8974 | 190.5 | 18x70 |
| 717 | S305 | 8962 | 85.5 | 18x70 |
| 718 | S306 | 8950 | 295.5 | 18x70 |
| 719 | S307 | 8938 | 190.5 | 18x70 |
| 720 | S308 | 8926 | 85.5 | 18x70 |

| No. | Name | X | Y | Bump size |
|---|---|---|---|---|
| 721 | S309 | 8914 | 295.5 | 18x70 |
| 722 | S310 | 8902 | 190.5 | 18x70 |
| 723 | S311 | 8890 | 85.5 | 18x70 |
| 724 | S312 | 8878 | 295.5 | 18x70 |
| 725 | S313 | 8866 | 190.5 | 18x70 |
| 726 | S314 | 8854 | 85.5 | 18x70 |
| 727 | S315 | 8842 | 295.5 | 18x70 |
| 728 | S316 | 8830 | 190.5 | 18x70 |
| 729 | S317 | 8818 | 85.5 | 18x70 |
| 730 | S318 | 8806 | 295.5 | 18x70 |
| 731 | S319 | 8794 | 190.5 | 18x70 |
| 732 | S320 | 8782 | 85.5 | 18x70 |
| 733 | S321 | 8770 | 295.5 | 18x70 |
| 734 | S322 | 8758 | 190.5 | 18x70 |
| 735 | S323 | 8746 | 85.5 | 18x70 |
| 736 | S324 | 8734 | 295.5 | 18x70 |
| 737 | S325 | 8722 | 190.5 | 18x70 |
| 738 | S326 | 8710 | 85.5 | 18x70 |
| 739 | S327 | 8698 | 295.5 | 18x70 |
| 740 | S328 | 8686 | 190.5 | 18x70 |
| 741 | S329 | 8674 | 85.5 | 18x70 |
| 742 | S330 | 8662 | 295.5 | 18x70 |
| 743 | S331 | 8650 | 190.5 | 18x70 |
| 744 | S332 | 8638 | 85.5 | 18x70 |
| 745 | S333 | 8626 | 295.5 | 18x70 |
| 746 | S334 | 8614 | 190.5 | 18x70 |
| 747 | S335 | 8602 | 85.5 | 18x70 |
| 748 | S336 | 8590 | 295.5 | 18x70 |
| 749 | S337 | 8578 | 190.5 | 18x70 |
| 750 | S338 | 8566 | 85.5 | 18x70 |
| 751 | S339 | 8554 | 295.5 | 18x70 |
| 752 | S340 | 8542 | 190.5 | 18x70 |
| 753 | S341 | 8530 | 85.5 | 18x70 |
| 754 | S342 | 8518 | 295.5 | 18x70 |
| 755 | S343 | 8506 | 190.5 | 18x70 |
| 756 | S344 | 8494 | 85.5 | 18x70 |
| 757 | S345 | 8482 | 295.5 | 18x70 |
| 758 | S346 | 8470 | 190.5 | 18x70 |
| 759 | S347 | 8458 | 85.5 | 18x70 |
| 760 | S348 | 8446 | 295.5 | 18x70 |
| 761 | S349 | 8434 | 190.5 | 18x70 |
| 762 | S350 | 8422 | 85.5 | 18x70 |
| 763 | S351 | 8410 | 295.5 | 18x70 |
| 764 | S352 | 8398 | 190.5 | 18x70 |
| 765 | S353 | 8386 | 85.5 | 18x70 |
| 766 | S354 | 8374 | 295.5 | 18x70 |
| 767 | S355 | 8362 | 190.5 | 18x70 |
| 768 | S356 | 8350 | 85.5 | 18x70 |
| 769 | S357 | 8338 | 295.5 | 18x70 |
| 770 | S358 | 8326 | 190.5 | 18x70 |
| 771 | S359 | 8314 | 85.5 | 18x70 |
| 772 | S360 | 8302 | 295.5 | 18x70 |
| 773 | S361 | 8290 | 190.5 | 18x70 |
| 774 | S362 | 8278 | 85.5 | 18x70 |
| 775 | S363 | 8266 | 295.5 | 18x70 |
| 776 | S364 | 8254 | 190.5 | 18x70 |
| 777 | S365 | 8242 | 85.5 | 18x70 |
| 778 | S366 | 8230 | 295.5 | 18x70 |
| 779 | S367 | 8218 | 190.5 | 18x70 |
| 780 | S368 | 8206 | 85.5 | 18x70 |
| 781 | S369 | 8194 | 295.5 | 18x70 |
| 782 | S370 | 8182 | 190.5 | 18x70 |
| 783 | S371 | 8170 | 85.5 | 18x70 |
| 784 | S372 | 8158 | 295.5 | 18x70 |
| 785 | S373 | 8146 | 190.5 | 18x70 |
| 786 | S374 | 8134 | 85.5 | 18x70 |
| 787 | S375 | 8122 | 295.5 | 18x70 |
| 788 | S376 | 8110 | 190.5 | 18x70 |
| 789 | S377 | 8098 | 85.5 | 18x70 |
| 790 | S378 | 8086 | 295.5 | 18x70 |
| 791 | S379 | 8074 | 190.5 | 18x70 |
| 792 | S380 | 8062 | 85.5 | 18x70 |
| 793 | S381 | 8050 | 295.5 | 18x70 |
| 794 | S382 | 8038 | 190.5 | 18x70 |
| 795 | S383 | 8026 | 85.5 | 18x70 |
| 796 | S384 | 8014 | 295.5 | 18x70 |
| 797 | S385 | 8002 | 190.5 | 18x70 |
| 798 | S386 | 7990 | 85.5 | 18x70 |
| 799 | S387 | 7978 | 295.5 | 18x70 |
| 800 | S388 | 7966 | 190.5 | 18x70 |

| No. | Name | X | Y | Bump size |
|---|---|---|---|---|
| 801 | S389 | 7954 | 85.5 | 18x70 |
| 802 | S390 | 7942 | 295.5 | 18x70 |
| 803 | S391 | 7930 | 190.5 | 18x70 |
| 804 | S392 | 7918 | 85.5 | 18x70 |
| 805 | S393 | 7906 | 295.5 | 18x70 |
| 806 | S394 | 7894 | 190.5 | 18x70 |
| 807 | S395 | 7882 | 85.5 | 18x70 |
| 808 | S396 | 7870 | 295.5 | 18x70 |
| 809 | S397 | 7858 | 190.5 | 18x70 |
| 810 | S398 | 7846 | 85.5 | 18x70 |
| 811 | S399 | 7834 | 295.5 | 18x70 |
| 812 | S400 | 7822 | 190.5 | 18x70 |
| 813 | S401 | 7810 | 85.5 | 18x70 |
| 814 | S402 | 7798 | 295.5 | 18x70 |
| 815 | S403 | 7786 | 190.5 | 18x70 |
| 816 | S404 | 7774 | 85.5 | 18x70 |
| 817 | S405 | 7762 | 295.5 | 18x70 |
| 818 | S406 | 7750 | 190.5 | 18x70 |
| 819 | S407 | 7738 | 85.5 | 18x70 |
| 820 | S408 | 7726 | 295.5 | 18x70 |
| 821 | S409 | 7714 | 190.5 | 18x70 |
| 822 | S410 | 7702 | 85.5 | 18x70 |
| 823 | S411 | 7690 | 295.5 | 18x70 |
| 824 | S412 | 7678 | 190.5 | 18x70 |
| 825 | S413 | 7666 | 85.5 | 18x70 |
| 826 | S414 | 7654 | 295.5 | 18x70 |
| 827 | S415 | 7642 | 190.5 | 18x70 |
| 828 | S416 | 7630 | 85.5 | 18x70 |
| 829 | S417 | 7618 | 295.5 | 18x70 |
| 830 | S418 | 7606 | 190.5 | 18x70 |
| 831 | S419 | 7594 | 85.5 | 18x70 |
| 832 | S420 | 7582 | 295.5 | 18x70 |
| 833 | S421 | 7570 | 190.5 | 18x70 |
| 834 | S422 | 7558 | 85.5 | 18x70 |
| 835 | S423 | 7546 | 295.5 | 18x70 |
| 836 | S424 | 7534 | 190.5 | 18x70 |
| 837 | S425 | 7522 | 85.5 | 18x70 |
| 838 | S426 | 7510 | 295.5 | 18x70 |
| 839 | S427 | 7498 | 190.5 | 18x70 |
| 840 | S428 | 7486 | 85.5 | 18x70 |
| 841 | S429 | 7474 | 295.5 | 18x70 |
| 842 | S430 | 7462 | 190.5 | 18x70 |
| 843 | S431 | 7450 | 85.5 | 18x70 |
| 844 | S432 | 7438 | 295.5 | 18x70 |
| 845 | S433 | 7426 | 190.5 | 18x70 |
| 846 | S434 | 7414 | 85.5 | 18x70 |
| 847 | S435 | 7402 | 295.5 | 18x70 |
| 848 | S436 | 7390 | 190.5 | 18x70 |
| 849 | S437 | 7378 | 85.5 | 18x70 |
| 850 | S438 | 7366 | 295.5 | 18x70 |
| 851 | S439 | 7354 | 190.5 | 18x70 |
| 852 | S440 | 7342 | 85.5 | 18x70 |
| 853 | S441 | 7330 | 295.5 | 18x70 |
| 854 | S442 | 7318 | 190.5 | 18x70 |
| 855 | S443 | 7306 | 85.5 | 18x70 |
| 856 | S444 | 7294 | 295.5 | 18x70 |
| 857 | S445 | 7282 | 190.5 | 18x70 |
| 858 | S446 | 7270 | 85.5 | 18x70 |
| 859 | S447 | 7258 | 295.5 | 18x70 |
| 860 | S448 | 7246 | 190.5 | 18x70 |
| 861 | S449 | 7234 | 85.5 | 18x70 |
| 862 | S450 | 7222 | 295.5 | 18x70 |
| 863 | S451 | 7210 | 190.5 | 18x70 |
| 864 | S452 | 7198 | 85.5 | 18x70 |
| 865 | S453 | 7186 | 295.5 | 18x70 |
| 866 | S454 | 7174 | 190.5 | 18x70 |
| 867 | S455 | 7162 | 85.5 | 18x70 |
| 868 | S456 | 7150 | 295.5 | 18x70 |
| 869 | S457 | 7138 | 190.5 | 18x70 |
| 870 | S458 | 7126 | 85.5 | 18x70 |
| 871 | S459 | 7114 | 295.5 | 18x70 |
| 872 | S460 | 7102 | 190.5 | 18x70 |
| 873 | S461 | 7090 | 85.5 | 18x70 |
| 874 | S462 | 7078 | 295.5 | 18x70 |
| 875 | S463 | 7066 | 190.5 | 18x70 |
| 876 | S464 | 7054 | 85.5 | 18x70 |
| 877 | S465 | 7042 | 295.5 | 18x70 |
| 878 | S466 | 7030 | 190.5 | 18x70 |
| 879 | S467 | 7018 | 85.5 | 18x70 |
| 880 | S468 | 7006 | 295.5 | 18x70 |

| No. | Name | X | Y | Bump size |
|---|---|---|---|---|
| 881 | S469 | 6994 | 190.5 | 18x70 |
| 882 | S470 | 6982 | 85.5 | 18x70 |
| 883 | S471 | 6970 | 295.5 | 18x70 |
| 884 | S472 | 6958 | 190.5 | 18x70 |
| 885 | S473 | 6946 | 85.5 | 18x70 |
| 886 | S474 | 6934 | 295.5 | 18x70 |
| 887 | S475 | 6922 | 190.5 | 18x70 |
| 888 | S476 | 6910 | 85.5 | 18x70 |
| 889 | S477 | 6898 | 295.5 | 18x70 |
| 890 | S478 | 6886 | 190.5 | 18x70 |
| 891 | S479 | 6874 | 85.5 | 18x70 |
| 892 | S480 | 6862 | 295.5 | 18x70 |
| 893 | S481 | 6850 | 190.5 | 18x70 |
| 894 | S482 | 6838 | 85.5 | 18x70 |
| 895 | S483 | 6826 | 295.5 | 18x70 |
| 896 | S484 | 6814 | 190.5 | 18x70 |
| 897 | S485 | 6802 | 85.5 | 18x70 |
| 898 | S486 | 6790 | 295.5 | 18x70 |
| 899 | S487 | 6778 | 190.5 | 18x70 |
| 900 | S488 | 6766 | 85.5 | 18x70 |
| 901 | S489 | 6754 | 295.5 | 18x70 |
| 902 | S490 | 6742 | 190.5 | 18x70 |
| 903 | S491 | 6730 | 85.5 | 18x70 |
| 904 | S492 | 6718 | 295.5 | 18x70 |
| 905 | S493 | 6706 | 190.5 | 18x70 |
| 906 | S494 | 6694 | 85.5 | 18x70 |
| 907 | S495 | 6682 | 295.5 | 18x70 |
| 908 | S496 | 6670 | 190.5 | 18x70 |
| 909 | S497 | 6658 | 85.5 | 18x70 |
| 910 | S498 | 6646 | 295.5 | 18x70 |
| 911 | S499 | 6634 | 190.5 | 18x70 |
| 912 | S500 | 6622 | 85.5 | 18x70 |
| 913 | S501 | 6610 | 295.5 | 18x70 |
| 914 | S502 | 6598 | 190.5 | 18x70 |
| 915 | S503 | 6586 | 85.5 | 18x70 |
| 916 | S504 | 6574 | 295.5 | 18x70 |
| 917 | S505 | 6562 | 190.5 | 18x70 |
| 918 | S506 | 6550 | 85.5 | 18x70 |
| 919 | S507 | 6538 | 295.5 | 18x70 |
| 920 | S508 | 6526 | 190.5 | 18x70 |
| 921 | S509 | 6514 | 85.5 | 18x70 |
| 922 | S510 | 6502 | 295.5 | 18x70 |
| 923 | S511 | 6490 | 190.5 | 18x70 |
| 924 | S512 | 6478 | 85.5 | 18x70 |
| 925 | S513 | 6466 | 295.5 | 18x70 |
| 926 | S514 | 6454 | 190.5 | 18x70 |
| 927 | S515 | 6442 | 85.5 | 18x70 |
| 928 | S516 | 6430 | 295.5 | 18x70 |
| 929 | S517 | 6418 | 190.5 | 18x70 |
| 930 | S518 | 6406 | 85.5 | 18x70 |
| 931 | S519 | 6394 | 295.5 | 18x70 |
| 932 | S520 | 6382 | 190.5 | 18x70 |
| 933 | S521 | 6370 | 85.5 | 18x70 |
| 934 | S522 | 6358 | 295.5 | 18x70 |
| 935 | S523 | 6346 | 190.5 | 18x70 |
| 936 | S524 | 6334 | 85.5 | 18x70 |
| 937 | S525 | 6322 | 295.5 | 18x70 |
| 938 | S526 | 6310 | 190.5 | 18x70 |
| 939 | S527 | 6298 | 85.5 | 18x70 |
| 940 | S528 | 6286 | 295.5 | 18x70 |
| 941 | S529 | 6274 | 190.5 | 18x70 |
| 942 | S530 | 6262 | 85.5 | 18x70 |
| 943 | S531 | 6250 | 295.5 | 18x70 |
| 944 | S532 | 6238 | 190.5 | 18x70 |
| 945 | S533 | 6226 | 85.5 | 18x70 |
| 946 | S534 | 6214 | 295.5 | 18x70 |
| 947 | S535 | 6202 | 190.5 | 18x70 |
| 948 | S536 | 6190 | 85.5 | 18x70 |
| 949 | S537 | 6178 | 295.5 | 18x70 |
| 950 | S538 | 6166 | 190.5 | 18x70 |
| 951 | S539 | 6154 | 85.5 | 18x70 |
| 952 | S540 | 6142 | 295.5 | 18x70 |
| 953 | S541 | 6130 | 190.5 | 18x70 |
| 954 | S542 | 6118 | 85.5 | 18x70 |
| 955 | S543 | 6106 | 295.5 | 18x70 |
| 956 | S544 | 6094 | 190.5 | 18x70 |
| 957 | S545 | 6082 | 85.5 | 18x70 |
| 958 | S546 | 6070 | 295.5 | 18x70 |
| 959 | S547 | 6058 | 190.5 | 18x70 |
| 960 | S548 | 6046 | 85.5 | 18x70 |

| No. | Name | X | Y | Bump size |
|---|---|---|---|---|
| 961 | S549 | 6034 | 295.5 | 18x70 |
| 962 | S550 | 6022 | 190.5 | 18x70 |
| 963 | S551 | 6010 | 85.5 | 18x70 |
| 964 | S552 | 5998 | 295.5 | 18x70 |
| 965 | S553 | 5986 | 190.5 | 18x70 |
| 966 | S554 | 5974 | 85.5 | 18x70 |
| 967 | S555 | 5962 | 295.5 | 18x70 |
| 968 | S556 | 5950 | 190.5 | 18x70 |
| 969 | S557 | 5938 | 85.5 | 18x70 |
| 970 | S558 | 5926 | 295.5 | 18x70 |
| 971 | S559 | 5914 | 190.5 | 18x70 |
| 972 | S560 | 5902 | 85.5 | 18x70 |
| 973 | S561 | 5890 | 295.5 | 18x70 |
| 974 | S562 | 5878 | 190.5 | 18x70 |
| 975 | S563 | 5866 | 85.5 | 18x70 |
| 976 | S564 | 5854 | 295.5 | 18x70 |
| 977 | S565 | 5842 | 190.5 | 18x70 |
| 978 | S566 | 5830 | 85.5 | 18x70 |
| 979 | S567 | 5818 | 295.5 | 18x70 |
| 980 | S568 | 5806 | 190.5 | 18x70 |
| 981 | S569 | 5794 | 85.5 | 18x70 |
| 982 | S570 | 5782 | 295.5 | 18x70 |
| 983 | S571 | 5770 | 190.5 | 18x70 |
| 984 | S572 | 5758 | 85.5 | 18x70 |
| 985 | S573 | 5746 | 295.5 | 18x70 |
| 986 | S574 | 5734 | 190.5 | 18x70 |
| 987 | S575 | 5722 | 85.5 | 18x70 |
| 988 | S576 | 5710 | 295.5 | 18x70 |
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| 991 | S579 | 5674 | 295.5 | 18x70 |
| 992 | S580 | 5662 | 190.5 | 18x70 |
| 993 | S581 | 5650 | 85.5 | 18x70 |
| 994 | S582 | 5638 | 295.5 | 18x70 |
| 995 | S583 | 5626 | 190.5 | 18x70 |
| 996 | S584 | 5614 | 85.5 | 18x70 |
| 997 | S585 | 5602 | 295.5 | 18x70 |
| 998 | S586 | 5590 | 190.5 | 18x70 |
| 999 | S587 | 5578 | 85.5 | 18x70 |
| 1000 | S588 | 5566 | 295.5 | 18x70 |
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| 1002 | S590 | 5542 | 85.5 | 18x70 |
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| 1004 | S592 | 5518 | 190.5 | 18x70 |
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| 1021 | S609 | 5314 | 295.5 | 18x70 |
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| 1026 | S614 | 5254 | 85.5 | 18x70 |
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| 1032 | S620 | 5182 | 85.5 | 18x70 |
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| 1036 | S624 | 5134 | 295.5 | 18x70 |
| 1037 | S625 | 5122 | 190.5 | 18x70 |
| 1038 | S626 | 5110 | 85.5 | 18x70 |
| 1039 | S627 | 5098 | 295.5 | 18x70 |
| 1040 | S628 | 5086 | 190.5 | 18x70 |
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| 1044 | S632 | 5038 | 85.5 | 18x70 |
| 1045 | S633 | 5026 | 295.5 | 18x70 |
| 1046 | S634 | 5014 | 190.5 | 18x70 |
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| 1052 | S640 | 4942 | 190.5 | 18x70 |
| 1053 | S641 | 4930 | 85.5 | 18x70 |
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| 1055 | S643 | 4906 | 190.5 | 18x70 |
| 1056 | S644 | 4894 | 85.5 | 18x70 |
| 1057 | S645 | 4882 | 295.5 | 18x70 |
| 1058 | S646 | 4870 | 190.5 | 18x70 |
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| 1067 | S655 | 4762 | 190.5 | 18x70 |
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| 1070 | S658 | 4726 | 190.5 | 18x70 |
| 1071 | S659 | 4714 | 85.5 | 18x70 |
| 1072 | S660 | 4702 | 295.5 | 18x70 |
| 1073 | S661 | 4690 | 190.5 | 18x70 |
| 1074 | S662 | 4678 | 85.5 | 18x70 |
| 1075 | S663 | 4666 | 295.5 | 18x70 |
| 1076 | S664 | 4654 | 190.5 | 18x70 |
| 1077 | S665 | 4642 | 85.5 | 18x70 |
| 1078 | S666 | 4630 | 295.5 | 18x70 |
| 1079 | S667 | 4618 | 190.5 | 18x70 |
| 1080 | S668 | 4606 | 85.5 | 18x70 |
| 1081 | S669 | 4594 | 295.5 | 18x70 |
| 1082 | S670 | 4582 | 190.5 | 18x70 |
| 1083 | S671 | 4570 | 85.5 | 18x70 |
| 1084 | S672 | 4558 | 295.5 | 18x70 |
| 1085 | S673 | 4546 | 190.5 | 18x70 |
| 1086 | S674 | 4534 | 85.5 | 18x70 |
| 1087 | S675 | 4522 | 295.5 | 18x70 |
| 1088 | S676 | 4510 | 190.5 | 18x70 |
| 1089 | S677 | 4498 | 85.5 | 18x70 |
| 1090 | S678 | 4486 | 295.5 | 18x70 |
| 1091 | S679 | 4474 | 190.5 | 18x70 |
| 1092 | S680 | 4462 | 85.5 | 18x70 |
| 1093 | S681 | 4450 | 295.5 | 18x70 |
| 1094 | S682 | 4438 | 190.5 | 18x70 |
| 1095 | S683 | 4426 | 85.5 | 18x70 |
| 1096 | S684 | 4414 | 295.5 | 18x70 |
| 1097 | S685 | 4402 | 190.5 | 18x70 |
| 1098 | S686 | 4390 | 85.5 | 18x70 |
| 1099 | S687 | 4378 | 295.5 | 18x70 |
| 1100 | S688 | 4366 | 190.5 | 18x70 |
| 1101 | S689 | 4354 | 85.5 | 18x70 |
| 1102 | S690 | 4342 | 295.5 | 18x70 |
| 1103 | S691 | 4330 | 190.5 | 18x70 |
| 1104 | S692 | 4318 | 85.5 | 18x70 |
| 1105 | S693 | 4306 | 295.5 | 18x70 |
| 1106 | S694 | 4294 | 190.5 | 18x70 |
| 1107 | S695 | 4282 | 85.5 | 18x70 |
| 1108 | S696 | 4270 | 295.5 | 18x70 |
| 1109 | S697 | 4258 | 190.5 | 18x70 |
| 1110 | S698 | 4246 | 85.5 | 18x70 |
| 1111 | S699 | 4234 | 295.5 | 18x70 |
| 1112 | S700 | 4222 | 190.5 | 18x70 |
| 1113 | S701 | 4210 | 85.5 | 18x70 |
| 1114 | S702 | 4198 | 295.5 | 18x70 |
| 1115 | S703 | 4186 | 190.5 | 18x70 |
| 1116 | S704 | 4174 | 85.5 | 18x70 |
| 1117 | S705 | 4162 | 295.5 | 18x70 |
| 1118 | S706 | 4150 | 190.5 | 18x70 |
| 1119 | S707 | 4138 | 85.5 | 18x70 |
| 1120 | S708 | 4126 | 295.5 | 18x70 |
| 1121 | S709 | 4114 | 190.5 | 18x70 |
| 1122 | S710 | 4102 | 85.5 | 18x70 |
| 1123 | S711 | 4090 | 295.5 | 18x70 |
| 1124 | S712 | 4078 | 190.5 | 18x70 |
| 1125 | S713 | 4066 | 85.5 | 18x70 |
| 1126 | S714 | 4054 | 295.5 | 18x70 |
| 1127 | S715 | 4042 | 190.5 | 18x70 |
| 1128 | S716 | 4030 | 85.5 | 18x70 |
| 1129 | S717 | 4018 | 295.5 | 18x70 |
| 1130 | S718 | 4006 | 190.5 | 18x70 |
| 1131 | S719 | 3994 | 85.5 | 18x70 |
| 1132 | S720 | 3982 | 295.5 | 18x70 |
| 1133 | S721 | 3970 | 190.5 | 18x70 |
| 1134 | S722 | 3958 | 85.5 | 18x70 |
| 1135 | S723 | 3946 | 295.5 | 18x70 |
| 1136 | S724 | 3934 | 190.5 | 18x70 |
| 1137 | S725 | 3922 | 85.5 | 18x70 |
| 1138 | S726 | 3910 | 295.5 | 18x70 |
| 1139 | S727 | 3898 | 190.5 | 18x70 |
| 1140 | S728 | 3886 | 85.5 | 18x70 |
| 1141 | S729 | 3874 | 295.5 | 18x70 |
| 1142 | S730 | 3862 | 190.5 | 18x70 |
| 1143 | S731 | 3850 | 85.5 | 18x70 |
| 1144 | S732 | 3838 | 295.5 | 18x70 |
| 1145 | S733 | 3826 | 190.5 | 18x70 |
| 1146 | S734 | 3814 | 85.5 | 18x70 |
| 1147 | S735 | 3802 | 295.5 | 18x70 |
| 1148 | S736 | 3790 | 190.5 | 18x70 |
| 1149 | S737 | 3778 | 85.5 | 18x70 |
| 1150 | S738 | 3766 | 295.5 | 18x70 |
| 1151 | S739 | 3754 | 190.5 | 18x70 |
| 1152 | S740 | 3742 | 85.5 | 18x70 |
| 1153 | S741 | 3730 | 295.5 | 18x70 |
| 1154 | S742 | 3718 | 190.5 | 18x70 |
| 1155 | S743 | 3706 | 85.5 | 18x70 |
| 1156 | S744 | 3694 | 295.5 | 18x70 |
| 1157 | S745 | 3682 | 190.5 | 18x70 |
| 1158 | S746 | 3670 | 85.5 | 18x70 |
| 1159 | S747 | 3658 | 295.5 | 18x70 |
| 1160 | S748 | 3646 | 190.5 | 18x70 |
| 1161 | S749 | 3634 | 85.5 | 18x70 |
| 1162 | S750 | 3622 | 295.5 | 18x70 |
| 1163 | S751 | 3610 | 190.5 | 18x70 |
| 1164 | S752 | 3598 | 85.5 | 18x70 |
| 1165 | S753 | 3586 | 295.5 | 18x70 |
| 1166 | S754 | 3574 | 190.5 | 18x70 |
| 1167 | S755 | 3562 | 85.5 | 18x70 |
| 1168 | S756 | 3550 | 295.5 | 18x70 |
| 1169 | S757 | 3538 | 190.5 | 18x70 |
| 1170 | S758 | 3526 | 85.5 | 18x70 |
| 1171 | S759 | 3514 | 295.5 | 18x70 |
| 1172 | S760 | 3502 | 190.5 | 18x70 |
| 1173 | S761 | 3490 | 85.5 | 18x70 |
| 1174 | S762 | 3478 | 295.5 | 18x70 |
| 1175 | S763 | 3466 | 190.5 | 18x70 |
| 1176 | S764 | 3454 | 85.5 | 18x70 |
| 1177 | S765 | 3442 | 295.5 | 18x70 |
| 1178 | S766 | 3430 | 190.5 | 18x70 |
| 1179 | S767 | 3418 | 85.5 | 18x70 |
| 1180 | S768 | 3406 | 295.5 | 18x70 |
| 1181 | S769 | 3394 | 190.5 | 18x70 |
| 1182 | S770 | 3382 | 85.5 | 18x70 |
| 1183 | S771 | 3370 | 295.5 | 18x70 |
| 1184 | S772 | 3358 | 190.5 | 18x70 |
| 1185 | S773 | 3346 | 85.5 | 18x70 |
| 1186 | S774 | 3334 | 295.5 | 18x70 |
| 1187 | S775 | 3322 | 190.5 | 18x70 |
| 1188 | S776 | 3310 | 85.5 | 18x70 |
| 1189 | S777 | 3298 | 295.5 | 18x70 |
| 1190 | S778 | 3286 | 190.5 | 18x70 |
| 1191 | S779 | 3274 | 85.5 | 18x70 |
| 1192 | S780 | 3262 | 295.5 | 18x70 |
| 1193 | S781 | 3250 | 190.5 | 18x70 |
| 1194 | S782 | 3238 | 85.5 | 18x70 |
| 1195 | S783 | 3226 | 295.5 | 18x70 |
| 1196 | S784 | 3214 | 190.5 | 18x70 |
| 1197 | S785 | 3202 | 85.5 | 18x70 |
| 1198 | S786 | 3190 | 295.5 | 18x70 |
| 1199 | S787 | 3178 | 190.5 | 18x70 |
| 1200 | S788 | 3166 | 85.5 | 18x70 |

| No. | Name | X | Y | Bump size |
|---|---|---|---|---|
| 1201 | S789 | 3154 | 295.5 | 18x70 |
| 1202 | S790 | 3142 | 190.5 | 18x70 |
| 1203 | S791 | 3130 | 85.5 | 18x70 |
| 1204 | S792 | 3118 | 295.5 | 18x70 |
| 1205 | S793 | 3106 | 190.5 | 18x70 |
| 1206 | S794 | 3094 | 85.5 | 18x70 |
| 1207 | S795 | 3082 | 295.5 | 18x70 |
| 1208 | S796 | 3070 | 190.5 | 18x70 |
| 1209 | S797 | 3058 | 85.5 | 18x70 |
| 1210 | S798 | 3046 | 295.5 | 18x70 |
| 1211 | S799 | 3034 | 190.5 | 18x70 |
| 1212 | S800 | 3022 | 85.5 | 18x70 |
| 1213 | S801 | 3010 | 295.5 | 18x70 |
| 1214 | S802 | 2998 | 190.5 | 18x70 |
| 1215 | S803 | 2986 | 85.5 | 18x70 |
| 1216 | S804 | 2974 | 295.5 | 18x70 |
| 1217 | S805 | 2962 | 190.5 | 18x70 |
| 1218 | S806 | 2950 | 85.5 | 18x70 |
| 1219 | S807 | 2938 | 295.5 | 18x70 |
| 1220 | S808 | 2926 | 190.5 | 18x70 |
| 1221 | S809 | 2914 | 85.5 | 18x70 |
| 1222 | S810 | 2902 | 295.5 | 18x70 |
| 1223 | S811 | 2890 | 190.5 | 18x70 |
| 1224 | S812 | 2878 | 85.5 | 18x70 |
| 1225 | S813 | 2866 | 295.5 | 18x70 |
| 1226 | S814 | 2854 | 190.5 | 18x70 |
| 1227 | S815 | 2842 | 85.5 | 18x70 |
| 1228 | S816 | 2830 | 295.5 | 18x70 |
| 1229 | S817 | 2818 | 190.5 | 18x70 |
| 1230 | S818 | 2806 | 85.5 | 18x70 |
| 1231 | S819 | 2794 | 295.5 | 18x70 |
| 1232 | S820 | 2782 | 190.5 | 18x70 |
| 1233 | S821 | 2770 | 85.5 | 18x70 |
| 1234 | S822 | 2758 | 295.5 | 18x70 |
| 1235 | S823 | 2746 | 190.5 | 18x70 |
| 1236 | S824 | 2734 | 85.5 | 18x70 |
| 1237 | S825 | 2722 | 295.5 | 18x70 |
| 1238 | S826 | 2710 | 190.5 | 18x70 |
| 1239 | S827 | 2698 | 85.5 | 18x70 |
| 1240 | S828 | 2686 | 295.5 | 18x70 |
| 1241 | S829 | 2674 | 190.5 | 18x70 |
| 1242 | S830 | 2662 | 85.5 | 18x70 |
| 1243 | S831 | 2650 | 295.5 | 18x70 |
| 1244 | S832 | 2638 | 190.5 | 18x70 |
| 1245 | S833 | 2626 | 85.5 | 18x70 |
| 1246 | S834 | 2614 | 295.5 | 18x70 |
| 1247 | S835 | 2602 | 190.5 | 18x70 |
| 1248 | S836 | 2590 | 85.5 | 18x70 |
| 1249 | S837 | 2578 | 295.5 | 18x70 |
| 1250 | S838 | 2566 | 190.5 | 18x70 |
| 1251 | S839 | 2554 | 85.5 | 18x70 |
| 1252 | S840 | 2542 | 295.5 | 18x70 |
| 1253 | S841 | 2530 | 190.5 | 18x70 |
| 1254 | S842 | 2518 | 85.5 | 18x70 |
| 1255 | S843 | 2506 | 295.5 | 18x70 |
| 1256 | S844 | 2494 | 190.5 | 18x70 |
| 1257 | S845 | 2482 | 85.5 | 18x70 |
| 1258 | S846 | 2470 | 295.5 | 18x70 |
| 1259 | S847 | 2458 | 190.5 | 18x70 |
| 1260 | S848 | 2446 | 85.5 | 18x70 |
| 1261 | S849 | 2434 | 295.5 | 18x70 |
| 1262 | S850 | 2422 | 190.5 | 18x70 |
| 1263 | S851 | 2410 | 85.5 | 18x70 |
| 1264 | S852 | 2398 | 295.5 | 18x70 |
| 1265 | S853 | 2386 | 190.5 | 18x70 |
| 1266 | S854 | 2374 | 85.5 | 18x70 |
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| 1271 | S859 | 2314 | 190.5 | 18x70 |
| 1272 | S860 | 2302 | 85.5 | 18x70 |
| 1273 | S861 | 2290 | 295.5 | 18x70 |
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| 1278 | S866 | 2230 | 85.5 | 18x70 |
| 1279 | S867 | 2218 | 295.5 | 18x70 |
| 1280 | S868 | 2206 | 190.5 | 18x70 |
| 1281 | S869 | 2194 | 85.5 | 18x70 |
| 1282 | S870 | 2182 | 295.5 | 18x70 |
| 1283 | S871 | 2170 | 190.5 | 18x70 |
| 1284 | S872 | 2158 | 85.5 | 18x70 |
| 1285 | S873 | 2146 | 295.5 | 18x70 |
| 1286 | S874 | 2134 | 190.5 | 18x70 |
| 1287 | S875 | 2122 | 85.5 | 18x70 |
| 1288 | S876 | 2110 | 295.5 | 18x70 |
| 1289 | S877 | 2098 | 190.5 | 18x70 |
| 1290 | S878 | 2086 | 85.5 | 18x70 |
| 1291 | S879 | 2074 | 295.5 | 18x70 |
| 1292 | S880 | 2062 | 190.5 | 18x70 |
| 1293 | S881 | 2050 | 85.5 | 18x70 |
| 1294 | S882 | 2038 | 295.5 | 18x70 |
| 1295 | S883 | 2026 | 190.5 | 18x70 |
| 1296 | S884 | 2014 | 85.5 | 18x70 |
| 1297 | S885 | 2002 | 295.5 | 18x70 |
| 1298 | S886 | 1990 | 190.5 | 18x70 |
| 1299 | S887 | 1978 | 85.5 | 18x70 |
| 1300 | S888 | 1966 | 295.5 | 18x70 |
| 1301 | S889 | 1954 | 190.5 | 18x70 |
| 1302 | S890 | 1942 | 85.5 | 18x70 |
| 1303 | S891 | 1930 | 295.5 | 18x70 |
| 1304 | S892 | 1918 | 190.5 | 18x70 |
| 1305 | S893 | 1906 | 85.5 | 18x70 |
| 1306 | S894 | 1894 | 295.5 | 18x70 |
| 1307 | S895 | 1882 | 190.5 | 18x70 |
| 1308 | S896 | 1870 | 85.5 | 18x70 |
| 1309 | S897 | 1858 | 295.5 | 18x70 |
| 1310 | S898 | 1846 | 190.5 | 18x70 |
| 1311 | S899 | 1834 | 85.5 | 18x70 |
| 1312 | S900 | 1822 | 295.5 | 18x70 |
| 1313 | SHIELDING | 1810 | 190.5 | 18x70 |
| 1314 | SHIELDING | 1798 | 85.5 | 18x70 |
| 1315 | SHIELDING | 1786 | 295.5 | 18x70 |
| 1316 | SHIELDING | 1726 | 310.5 | 40x40 |
| 1317 | SHIELDING | 1646 | 310.5 | 40x40 |
| 1318 | SHIELDING | 1566 | 310.5 | 40x40 |
| 1319 | SHIELDING | 1486 | 310.5 | 40x40 |
| 1320 | SHIELDING | 1406 | 310.5 | 40x40 |
| 1321 | SHIELDING | 1326 | 310.5 | 40x40 |
| 1322 | SHIELDING | 1246 | 310.5 | 40x40 |
| 1323 | SHIELDING | 1166 | 310.5 | 40x40 |
| 1324 | SHIELDING | 1086 | 310.5 | 40x40 |
| 1325 | SHIELDING | 1006 | 310.5 | 40x40 |
| 1326 | SHIELDING | 926 | 310.5 | 40x40 |
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| 1328 | SHIELDING | 766 | 310.5 | 40x40 |
| 1329 | SHIELDING | 686 | 310.5 | 40x40 |
| 1330 | SHIELDING | 606 | 310.5 | 40x40 |
| 1331 | SHIELDING | 526 | 310.5 | 40x40 |
| 1332 | SHIELDING | 446 | 310.5 | 40x40 |
| 1333 | SHIELDING | 366 | 310.5 | 40x40 |
| 1334 | SHIELDING | 286 | 310.5 | 40x40 |
| 1335 | SHIELDING | 206 | 310.5 | 40x40 |
| 1336 | SHIELDING | 126 | 310.5 | 40x40 |
| 1337 | SHIELDING | 46 | 310.5 | 40x40 |
| 1338 | SHIELDING | -34 | 310.5 | 40x40 |
| 1339 | SHIELDING | -114 | 310.5 | 40x40 |
| 1340 | SHIELDING | -194 | 310.5 | 40x40 |
| 1341 | SHIELDING | -274 | 310.5 | 40x40 |
| 1342 | SHIELDING | -354 | 310.5 | 40x40 |
| 1343 | SHIELDING | -434 | 310.5 | 40x40 |
| 1344 | SHIELDING | -514 | 310.5 | 40x40 |
| 1345 | SHIELDING | -594 | 310.5 | 40x40 |
| 1346 | SHIELDING | -674 | 310.5 | 40x40 |
| 1347 | SHIELDING | -754 | 310.5 | 40x40 |
| 1348 | SHIELDING | -834 | 310.5 | 40x40 |
| 1349 | SHIELDING | -914 | 310.5 | 40x40 |
| 1350 | SHIELDING | -994 | 310.5 | 40x40 |
| 1351 | SHIELDING | -1074 | 310.5 | 40x40 |
| 1352 | SHIELDING | -1154 | 310.5 | 40x40 |
| 1353 | SHIELDING | -1234 | 310.5 | 40x40 |
| 1354 | SHIELDING | -1314 | 310.5 | 40x40 |
| 1355 | SHIELDING | -1394 | 310.5 | 40x40 |
| 1356 | SHIELDING | -1474 | 310.5 | 40x40 |
| 1357 | SHIELDING | -1554 | 310.5 | 40x40 |
| 1358 | SHIELDING | -1634 | 310.5 | 40x40 |
| 1359 | SHIELDING | -1714 | 310.5 | 40x40 |
| 1360 | SHIELDING | -1794 | 310.5 | 40x40 |
| 1361 | SHIELDING | -1874 | 310.5 | 40x40 |
| 1362 | SHIELDING | -1954 | 310.5 | 40x40 |
| 1363 | SHIELDING | -2034 | 310.5 | 40x40 |
| 1364 | SHIELDING | -2114 | 310.5 | 40x40 |
| 1365 | SHIELDING | -2194 | 310.5 | 40x40 |
| 1366 | SHIELDING | -2274 | 310.5 | 40x40 |
| 1367 | SHIELDING | -2334 | 295.5 | 18x70 |
| 1368 | SHIELDING | -2346 | 190.5 | 18x70 |
| 1369 | SHIELDING | -2358 | 85.5 | 18x70 |
| 1370 | S901 | -2370 | 295.5 | 18x70 |
| 1371 | S902 | -2382 | 190.5 | 18x70 |
| 1372 | S903 | -2394 | 85.5 | 18x70 |
| 1373 | S904 | -2406 | 295.5 | 18x70 |
| 1374 | S905 | -2418 | 190.5 | 18x70 |
| 1375 | S906 | -2430 | 85.5 | 18x70 |
| 1376 | S907 | -2442 | 295.5 | 18x70 |
| 1377 | S908 | -2454 | 190.5 | 18x70 |
| 1378 | S909 | -2466 | 85.5 | 18x70 |
| 1379 | S910 | -2478 | 295.5 | 18x70 |
| 1380 | S911 | -2490 | 190.5 | 18x70 |
| 1381 | S912 | -2502 | 85.5 | 18x70 |
| 1382 | S913 | -2514 | 295.5 | 18x70 |
| 1383 | S914 | -2526 | 190.5 | 18x70 |
| 1384 | S915 | -2538 | 85.5 | 18x70 |
| 1385 | S916 | -2550 | 295.5 | 18x70 |
| 1386 | S917 | -2562 | 190.5 | 18x70 |
| 1387 | S918 | -2574 | 85.5 | 18x70 |
| 1388 | S919 | -2586 | 295.5 | 18x70 |
| 1389 | S920 | -2598 | 190.5 | 18x70 |
| 1390 | S921 | -2610 | 85.5 | 18x70 |
| 1391 | S922 | -2622 | 295.5 | 18x70 |
| 1392 | S923 | -2634 | 190.5 | 18x70 |
| 1393 | S924 | -2646 | 85.5 | 18x70 |
| 1394 | S925 | -2658 | 295.5 | 18x70 |
| 1395 | S926 | -2670 | 190.5 | 18x70 |
| 1396 | S927 | -2682 | 85.5 | 18x70 |
| 1397 | S928 | -2694 | 295.5 | 18x70 |
| 1398 | S929 | -2706 | 190.5 | 18x70 |
| 1399 | S930 | -2718 | 85.5 | 18x70 |
| 1400 | S931 | -2730 | 295.5 | 18x70 |
| 1401 | S932 | -2742 | 190.5 | 18x70 |
| 1402 | S933 | -2754 | 85.5 | 18x70 |
| 1403 | S934 | -2766 | 295.5 | 18x70 |
| 1404 | S935 | -2778 | 190.5 | 18x70 |
| 1405 | S936 | -2790 | 85.5 | 18x70 |
| 1406 | S937 | -2802 | 295.5 | 18x70 |
| 1407 | S938 | -2814 | 190.5 | 18x70 |
| 1408 | S939 | -2826 | 85.5 | 18x70 |
| 1409 | S940 | -2838 | 295.5 | 18x70 |
| 1410 | S941 | -2850 | 190.5 | 18x70 |
| 1411 | S942 | -2862 | 85.5 | 18x70 |
| 1412 | S943 | -2874 | 295.5 | 18x70 |
| 1413 | S944 | -2886 | 190.5 | 18x70 |
| 1414 | S945 | -2898 | 85.5 | 18x70 |
| 1415 | S946 | -2910 | 295.5 | 18x70 |
| 1416 | S947 | -2922 | 190.5 | 18x70 |
| 1417 | S948 | -2934 | 85.5 | 18x70 |
| 1418 | S949 | -2946 | 295.5 | 18x70 |
| 1419 | S950 | -2958 | 190.5 | 18x70 |
| 1420 | S951 | -2970 | 85.5 | 18x70 |
| 1421 | S952 | -2982 | 295.5 | 18x70 |
| 1422 | S953 | -2994 | 190.5 | 18x70 |
| 1423 | S954 | -3006 | 85.5 | 18x70 |
| 1424 | S955 | -3018 | 295.5 | 18x70 |
| 1425 | S956 | -3030 | 190.5 | 18x70 |
| 1426 | S957 | -3042 | 85.5 | 18x70 |
| 1427 | S958 | -3054 | 295.5 | 18x70 |
| 1428 | S959 | -3066 | 190.5 | 18x70 |
| 1429 | S960 | -3078 | 85.5 | 18x70 |
| 1430 | S961 | -3090 | 295.5 | 18x70 |
| 1431 | S962 | -3102 | 190.5 | 18x70 |
| 1432 | S963 | -3114 | 85.5 | 18x70 |
| 1433 | S964 | -3126 | 295.5 | 18x70 |
| 1434 | S965 | -3138 | 190.5 | 18x70 |
| 1435 | S966 | -3150 | 85.5 | 18x70 |
| 1436 | S967 | -3162 | 295.5 | 18x70 |
| 1437 | S968 | -3174 | 190.5 | 18x70 |
| 1438 | S969 | -3186 | 85.5 | 18x70 |
| 1439 | S970 | -3198 | 295.5 | 18x70 |
| 1440 | S971 | -3210 | 190.5 | 18x70 |

| No. | Name | X | Y | Bump size |
|---|---|---|---|---|
| 1441 | S972 | -3222 | 85.5 | 18x70 |
| 1442 | S973 | -3234 | 295.5 | 18x70 |
| 1443 | S974 | -3246 | 190.5 | 18x70 |
| 1444 | S975 | -3258 | 85.5 | 18x70 |
| 1445 | S976 | -3270 | 295.5 | 18x70 |
| 1446 | S977 | -3282 | 190.5 | 18x70 |
| 1447 | S978 | -3294 | 85.5 | 18x70 |
| 1448 | S979 | -3306 | 295.5 | 18x70 |
| 1449 | S980 | -3318 | 190.5 | 18x70 |
| 1450 | S981 | -3330 | 85.5 | 18x70 |
| 1451 | S982 | -3342 | 295.5 | 18x70 |
| 1452 | S983 | -3354 | 190.5 | 18x70 |
| 1453 | S984 | -3366 | 85.5 | 18x70 |
| 1454 | S985 | -3378 | 295.5 | 18x70 |
| 1455 | S986 | -3390 | 190.5 | 18x70 |
| 1456 | S987 | -3402 | 85.5 | 18x70 |
| 1457 | S988 | -3414 | 295.5 | 18x70 |
| 1458 | S989 | -3426 | 190.5 | 18x70 |
| 1459 | S990 | -3438 | 85.5 | 18x70 |
| 1460 | S991 | -3450 | 295.5 | 18x70 |
| 1461 | S992 | -3462 | 190.5 | 18x70 |
| 1462 | S993 | -3474 | 85.5 | 18x70 |
| 1463 | S994 | -3486 | 295.5 | 18x70 |
| 1464 | S995 | -3498 | 190.5 | 18x70 |
| 1465 | S996 | -3510 | 85.5 | 18x70 |
| 1466 | S997 | -3522 | 295.5 | 18x70 |
| 1467 | S998 | -3534 | 190.5 | 18x70 |
| 1468 | S999 | -3546 | 85.5 | 18x70 |
| 1469 | S1000 | -3558 | 295.5 | 18x70 |
| 1470 | S1001 | -3570 | 190.5 | 18x70 |
| 1471 | S1002 | -3582 | 85.5 | 18x70 |
| 1472 | S1003 | -3594 | 295.5 | 18x70 |
| 1473 | S1004 | -3606 | 190.5 | 18x70 |
| 1474 | S1005 | -3618 | 85.5 | 18x70 |
| 1475 | S1006 | -3630 | 295.5 | 18x70 |
| 1476 | S1007 | -3642 | 190.5 | 18x70 |
| 1477 | S1008 | -3654 | 85.5 | 18x70 |
| 1478 | S1009 | -3666 | 295.5 | 18x70 |
| 1479 | S1010 | -3678 | 190.5 | 18x70 |
| 1480 | S1011 | -3690 | 85.5 | 18x70 |
| 1481 | S1012 | -3702 | 295.5 | 18x70 |
| 1482 | S1013 | -3714 | 190.5 | 18x70 |
| 1483 | S1014 | -3726 | 85.5 | 18x70 |
| 1484 | S1015 | -3738 | 295.5 | 18x70 |
| 1485 | S1016 | -3750 | 190.5 | 18x70 |
| 1486 | S1017 | -3762 | 85.5 | 18x70 |
| 1487 | S1018 | -3774 | 295.5 | 18x70 |
| 1488 | S1019 | -3786 | 190.5 | 18x70 |
| 1489 | S1020 | -3798 | 85.5 | 18x70 |
| 1490 | S1021 | -3810 | 295.5 | 18x70 |
| 1491 | S1022 | -3822 | 190.5 | 18x70 |
| 1492 | S1023 | -3834 | 85.5 | 18x70 |
| 1493 | S1024 | -3846 | 295.5 | 18x70 |
| 1494 | S1025 | -3858 | 190.5 | 18x70 |
| 1495 | S1026 | -3870 | 85.5 | 18x70 |
| 1496 | S1027 | -3882 | 295.5 | 18x70 |
| 1497 | S1028 | -3894 | 190.5 | 18x70 |
| 1498 | S1029 | -3906 | 85.5 | 18x70 |
| 1499 | S1030 | -3918 | 295.5 | 18x70 |
| 1500 | S1031 | -3930 | 190.5 | 18x70 |
| 1501 | S1032 | -3942 | 85.5 | 18x70 |
| 1502 | S1033 | -3954 | 295.5 | 18x70 |
| 1503 | S1034 | -3966 | 190.5 | 18x70 |
| 1504 | S1035 | -3978 | 85.5 | 18x70 |
| 1505 | S1036 | -3990 | 295.5 | 18x70 |
| 1506 | S1037 | -4002 | 190.5 | 18x70 |
| 1507 | S1038 | -4014 | 85.5 | 18x70 |
| 1508 | S1039 | -4026 | 295.5 | 18x70 |
| 1509 | S1040 | -4038 | 190.5 | 18x70 |
| 1510 | S1041 | -4050 | 85.5 | 18x70 |
| 1511 | S1042 | -4062 | 295.5 | 18x70 |
| 1512 | S1043 | -4074 | 190.5 | 18x70 |
| 1513 | S1044 | -4086 | 85.5 | 18x70 |
| 1514 | S1045 | -4098 | 295.5 | 18x70 |
| 1515 | S1046 | -4110 | 190.5 | 18x70 |
| 1516 | S1047 | -4122 | 85.5 | 18x70 |
| 1517 | S1048 | -4134 | 295.5 | 18x70 |
| 1518 | S1049 | -4146 | 190.5 | 18x70 |
| 1519 | S1050 | -4158 | 85.5 | 18x70 |
| 1520 | S1051 | -4170 | 295.5 | 18x70 |

| No. | Name | X | Y | Bump size |
|---|---|---|---|---|
| 1521 | S1052 | -4182 | 190.5 | 18x70 |
| 1522 | S1053 | -4194 | 85.5 | 18x70 |
| 1523 | S1054 | -4206 | 295.5 | 18x70 |
| 1524 | S1055 | -4218 | 190.5 | 18x70 |
| 1525 | S1056 | -4230 | 85.5 | 18x70 |
| 1526 | S1057 | -4242 | 295.5 | 18x70 |
| 1527 | S1058 | -4254 | 190.5 | 18x70 |
| 1528 | S1059 | -4266 | 85.5 | 18x70 |
| 1529 | S1060 | -4278 | 295.5 | 18x70 |
| 1530 | S1061 | -4290 | 190.5 | 18x70 |
| 1531 | S1062 | -4302 | 85.5 | 18x70 |
| 1532 | S1063 | -4314 | 295.5 | 18x70 |
| 1533 | S1064 | -4326 | 190.5 | 18x70 |
| 1534 | S1065 | -4338 | 85.5 | 18x70 |
| 1535 | S1066 | -4350 | 295.5 | 18x70 |
| 1536 | S1067 | -4362 | 190.5 | 18x70 |
| 1537 | S1068 | -4374 | 85.5 | 18x70 |
| 1538 | S1069 | -4386 | 295.5 | 18x70 |
| 1539 | S1070 | -4398 | 190.5 | 18x70 |
| 1540 | S1071 | -4410 | 85.5 | 18x70 |
| 1541 | S1072 | -4422 | 295.5 | 18x70 |
| 1542 | S1073 | -4434 | 190.5 | 18x70 |
| 1543 | S1074 | -4446 | 85.5 | 18x70 |
| 1544 | S1075 | -4458 | 295.5 | 18x70 |
| 1545 | S1076 | -4470 | 190.5 | 18x70 |
| 1546 | S1077 | -4482 | 85.5 | 18x70 |
| 1547 | S1078 | -4494 | 295.5 | 18x70 |
| 1548 | S1079 | -4506 | 190.5 | 18x70 |
| 1549 | S1080 | -4518 | 85.5 | 18x70 |
| 1550 | S1081 | -4530 | 295.5 | 18x70 |
| 1551 | S1082 | -4542 | 190.5 | 18x70 |
| 1552 | S1083 | -4554 | 85.5 | 18x70 |
| 1553 | S1084 | -4566 | 295.5 | 18x70 |
| 1554 | S1085 | -4578 | 190.5 | 18x70 |
| 1555 | S1086 | -4590 | 85.5 | 18x70 |
| 1556 | S1087 | -4602 | 295.5 | 18x70 |
| 1557 | S1088 | -4614 | 190.5 | 18x70 |
| 1558 | S1089 | -4626 | 85.5 | 18x70 |
| 1559 | S1090 | -4638 | 295.5 | 18x70 |
| 1560 | S1091 | -4650 | 190.5 | 18x70 |
| 1561 | S1052 | -4182 | 190.5 | 18x70 |
| 1562 | S1053 | -4194 | 85.5 | 18x70 |
| 1563 | S1054 | -4206 | 295.5 | 18x70 |
| 1564 | S1055 | -4218 | 190.5 | 18x70 |
| 1565 | S1056 | -4230 | 85.5 | 18x70 |
| 1566 | S1057 | -4242 | 295.5 | 18x70 |
| 1567 | S1058 | -4254 | 190.5 | 18x70 |
| 1568 | S1059 | -4266 | 85.5 | 18x70 |
| 1569 | S1060 | -4278 | 295.5 | 18x70 |
| 1570 | S1061 | -4290 | 190.5 | 18x70 |
| 1571 | S1062 | -4302 | 85.5 | 18x70 |
| 1572 | S1063 | -4314 | 295.5 | 18x70 |
| 1573 | S1064 | -4326 | 190.5 | 18x70 |
| 1574 | S1065 | -4338 | 85.5 | 18x70 |
| 1575 | S1066 | -4350 | 295.5 | 18x70 |
| 1576 | S1067 | -4362 | 190.5 | 18x70 |
| 1577 | S1068 | -4374 | 85.5 | 18x70 |
| 1578 | S1069 | -4386 | 295.5 | 18x70 |
| 1579 | S1070 | -4398 | 190.5 | 18x70 |
| 1580 | S1071 | -4410 | 85.5 | 18x70 |
| 1581 | S1072 | -4422 | 295.5 | 18x70 |
| 1582 | S1073 | -4434 | 190.5 | 18x70 |
| 1583 | S1074 | -4446 | 85.5 | 18x70 |
| 1584 | S1075 | -4458 | 295.5 | 18x70 |
| 1585 | S1076 | -4470 | 190.5 | 18x70 |
| 1586 | S1077 | -4482 | 85.5 | 18x70 |
| 1587 | S1078 | -4494 | 295.5 | 18x70 |
| 1588 | S1079 | -4506 | 190.5 | 18x70 |
| 1589 | S1080 | -4518 | 85.5 | 18x70 |
| 1590 | S1081 | -4530 | 295.5 | 18x70 |
| 1591 | S1082 | -4542 | 190.5 | 18x70 |
| 1592 | S1083 | -4554 | 85.5 | 18x70 |
| 1593 | S1084 | -4566 | 295.5 | 18x70 |
| 1594 | S1085 | -4578 | 190.5 | 18x70 |
| 1595 | S1086 | -4590 | 85.5 | 18x70 |
| 1596 | S1087 | -4602 | 295.5 | 18x70 |
| 1597 | S1088 | -4614 | 190.5 | 18x70 |
| 1598 | S1089 | -4626 | 85.5 | 18x70 |
| 1599 | S1090 | -4638 | 295.5 | 18x70 |
| 1600 | S1091 | -4650 | 190.5 | 18x70 |

| No. | Name | X | Y | Bump size |
|---|---|---|---|---|
| 1601 | S1092 | -4662 | 85.5 | 18x70 |
| 1602 | S1093 | -4674 | 295.5 | 18x70 |
| 1603 | S1094 | -4686 | 190.5 | 18x70 |
| 1604 | S1095 | -4698 | 85.5 | 18x70 |
| 1605 | S1096 | -4710 | 295.5 | 18x70 |
| 1606 | S1097 | -4722 | 190.5 | 18x70 |
| 1607 | S1098 | -4734 | 85.5 | 18x70 |
| 1608 | S1099 | -4746 | 295.5 | 18x70 |
| 1609 | S1100 | -4758 | 190.5 | 18x70 |
| 1610 | S1101 | -4770 | 85.5 | 18x70 |
| 1611 | S1102 | -4782 | 295.5 | 18x70 |
| 1612 | S1103 | -4794 | 190.5 | 18x70 |
| 1613 | S1104 | -4806 | 85.5 | 18x70 |
| 1614 | S1105 | -4818 | 295.5 | 18x70 |
| 1615 | S1106 | -4830 | 190.5 | 18x70 |
| 1616 | S1107 | -4842 | 85.5 | 18x70 |
| 1617 | S1108 | -4854 | 295.5 | 18x70 |
| 1618 | S1109 | -4866 | 190.5 | 18x70 |
| 1619 | S1110 | -4878 | 85.5 | 18x70 |
| 1620 | S1111 | -4890 | 295.5 | 18x70 |
| 1621 | S1112 | -4902 | 190.5 | 18x70 |
| 1622 | S1113 | -4914 | 85.5 | 18x70 |
| 1623 | S1114 | -4926 | 295.5 | 18x70 |
| 1624 | S1115 | -4938 | 190.5 | 18x70 |
| 1625 | S1116 | -4950 | 85.5 | 18x70 |
| 1626 | S1117 | -4962 | 295.5 | 18x70 |
| 1627 | S1118 | -4974 | 190.5 | 18x70 |
| 1628 | S1119 | -4986 | 85.5 | 18x70 |
| 1629 | S1120 | -4998 | 295.5 | 18x70 |
| 1630 | S1121 | -5010 | 190.5 | 18x70 |
| 1631 | S1122 | -5022 | 85.5 | 18x70 |
| 1632 | S1123 | -5034 | 295.5 | 18x70 |
| 1633 | S1124 | -5046 | 190.5 | 18x70 |
| 1634 | S1125 | -5058 | 85.5 | 18x70 |
| 1635 | S1126 | -5070 | 295.5 | 18x70 |
| 1636 | S1127 | -5082 | 190.5 | 18x70 |
| 1637 | S1128 | -5094 | 85.5 | 18x70 |
| 1638 | S1129 | -5106 | 295.5 | 18x70 |
| 1639 | S1130 | -5118 | 190.5 | 18x70 |
| 1640 | S1131 | -5130 | 85.5 | 18x70 |
| 1641 | S1132 | -5142 | 295.5 | 18x70 |
| 1642 | S1133 | -5154 | 190.5 | 18x70 |
| 1643 | S1134 | -5166 | 85.5 | 18x70 |
| 1644 | S1135 | -5178 | 295.5 | 18x70 |
| 1645 | S1136 | -5190 | 190.5 | 18x70 |
| 1646 | S1137 | -5202 | 85.5 | 18x70 |
| 1647 | S1138 | -5214 | 295.5 | 18x70 |
| 1648 | S1139 | -5226 | 190.5 | 18x70 |
| 1649 | S1140 | -5238 | 85.5 | 18x70 |
| 1650 | S1141 | -5250 | 295.5 | 18x70 |
| 1651 | S1142 | -5262 | 190.5 | 18x70 |
| 1652 | S1143 | -5274 | 85.5 | 18x70 |
| 1653 | S1144 | -5286 | 295.5 | 18x70 |
| 1654 | S1145 | -5298 | 190.5 | 18x70 |
| 1655 | S1146 | -5310 | 85.5 | 18x70 |
| 1656 | S1147 | -5322 | 295.5 | 18x70 |
| 1657 | S1148 | -5334 | 190.5 | 18x70 |
| 1658 | S1149 | -5346 | 85.5 | 18x70 |
| 1659 | S1150 | -5358 | 295.5 | 18x70 |
| 1660 | S1151 | -5370 | 190.5 | 18x70 |
| 1661 | S1152 | -5382 | 85.5 | 18x70 |
| 1662 | S1153 | -5394 | 295.5 | 18x70 |
| 1663 | S1154 | -5406 | 190.5 | 18x70 |
| 1664 | S1155 | -5418 | 85.5 | 18x70 |
| 1665 | S1156 | -5430 | 295.5 | 18x70 |
| 1666 | S1157 | -5442 | 190.5 | 18x70 |
| 1667 | S1158 | -5454 | 85.5 | 18x70 |
| 1668 | S1159 | -5466 | 295.5 | 18x70 |
| 1669 | S1160 | -5478 | 190.5 | 18x70 |
| 1670 | S1161 | -5490 | 85.5 | 18x70 |
| 1671 | S1162 | -5502 | 295.5 | 18x70 |
| 1672 | S1163 | -5514 | 190.5 | 18x70 |
| 1673 | S1164 | -5526 | 85.5 | 18x70 |
| 1674 | S1165 | -5538 | 295.5 | 18x70 |
| 1675 | S1166 | -5550 | 190.5 | 18x70 |
| 1676 | S1167 | -5562 | 85.5 | 18x70 |
| 1677 | S1168 | -5574 | 295.5 | 18x70 |
| 1678 | S1169 | -5586 | 190.5 | 18x70 |
| 1679 | S1170 | -5598 | 85.5 | 18x70 |
| 1680 | S1171 | -5610 | 295.5 | 18x70 |

| No. | Name | X | Y | Bump size |
|---|---|---|---|---|
| 1681 | S1212 | -6102 | 85.5 | 18x70 |
| 1682 | S1213 | -6114 | 295.5 | 18x70 |
| 1683 | S1214 | -6126 | 190.5 | 18x70 |
| 1684 | S1215 | -6138 | 85.5 | 18x70 |
| 1685 | S1216 | -6150 | 295.5 | 18x70 |
| 1686 | S1217 | -6162 | 190.5 | 18x70 |
| 1687 | S1218 | -6174 | 85.5 | 18x70 |
| 1688 | S1219 | -6186 | 295.5 | 18x70 |
| 1689 | S1220 | -6198 | 190.5 | 18x70 |
| 1690 | S1221 | -6210 | 85.5 | 18x70 |
| 1691 | S1222 | -6222 | 295.5 | 18x70 |
| 1692 | S1223 | -6234 | 190.5 | 18x70 |
| 1693 | S1224 | -6246 | 85.5 | 18x70 |
| 1694 | S1225 | -6258 | 295.5 | 18x70 |
| 1695 | S1226 | -6270 | 190.5 | 18x70 |
| 1696 | S1227 | -6282 | 85.5 | 18x70 |
| 1697 | S1228 | -6294 | 295.5 | 18x70 |
| 1698 | S1229 | -6306 | 190.5 | 18x70 |
| 1699 | S1230 | -6318 | 85.5 | 18x70 |
| 1700 | S1231 | -6330 | 295.5 | 18x70 |
| 1701 | S1232 | -6342 | 190.5 | 18x70 |
| 1702 | S1233 | -6354 | 85.5 | 18x70 |
| 1703 | S1234 | -6366 | 295.5 | 18x70 |
| 1704 | S1235 | -6378 | 190.5 | 18x70 |
| 1705 | S1236 | -6390 | 85.5 | 18x70 |
| 1706 | S1237 | -6402 | 295.5 | 18x70 |
| 1707 | S1238 | -6414 | 190.5 | 18x70 |
| 1708 | S1239 | -6426 | 85.5 | 18x70 |
| 1709 | S1240 | -6438 | 295.5 | 18x70 |
| 1710 | S1241 | -6450 | 190.5 | 18x70 |
| 1711 | S1242 | -6462 | 85.5 | 18x70 |
| 1712 | S1243 | -6474 | 295.5 | 18x70 |
| 1713 | S1244 | -6486 | 190.5 | 18x70 |
| 1714 | S1245 | -6498 | 85.5 | 18x70 |
| 1715 | S1246 | -6510 | 295.5 | 18x70 |
| 1716 | S1247 | -6522 | 190.5 | 18x70 |
| 1717 | S1248 | -6534 | 85.5 | 18x70 |
| 1718 | S1249 | -6546 | 295.5 | 18x70 |
| 1719 | S1250 | -6558 | 190.5 | 18x70 |
| 1720 | S1251 | -6570 | 85.5 | 18x70 |
| 1721 | S1252 | -6582 | 295.5 | 18x70 |
| 1722 | S1253 | -6594 | 190.5 | 18x70 |
| 1723 | S1254 | -6606 | 85.5 | 18x70 |
| 1724 | S1255 | -6618 | 295.5 | 18x70 |
| 1725 | S1256 | -6630 | 190.5 | 18x70 |
| 1726 | S1257 | -6642 | 85.5 | 18x70 |
| 1727 | S1258 | -6654 | 295.5 | 18x70 |
| 1728 | S1259 | -6666 | 190.5 | 18x70 |
| 1729 | S1260 | -6678 | 85.5 | 18x70 |
| 1730 | S1261 | -6690 | 295.5 | 18x70 |
| 1731 | S1262 | -6702 | 190.5 | 18x70 |
| 1732 | S1263 | -6714 | 85.5 | 18x70 |
| 1733 | S1264 | -6726 | 295.5 | 18x70 |
| 1734 | S1265 | -6738 | 190.5 | 18x70 |
| 1735 | S1266 | -6750 | 85.5 | 18x70 |
| 1736 | S1267 | -6762 | 295.5 | 18x70 |
| 1737 | S1268 | -6774 | 190.5 | 18x70 |
| 1738 | S1269 | -6786 | 85.5 | 18x70 |
| 1739 | S1270 | -6798 | 295.5 | 18x70 |
| 1740 | S1271 | -6810 | 190.5 | 18x70 |
| 1741 | S1272 | -6822 | 85.5 | 18x70 |
| 1742 | S1273 | -6834 | 295.5 | 18x70 |
| 1743 | S1274 | -6846 | 190.5 | 18x70 |
| 1744 | S1275 | -6858 | 85.5 | 18x70 |
| 1745 | S1276 | -6870 | 295.5 | 18x70 |
| 1746 | S1277 | -6882 | 190.5 | 18x70 |
| 1747 | S1278 | -6894 | 85.5 | 18x70 |
| 1748 | S1279 | -6906 | 295.5 | 18x70 |
| 1749 | S1280 | -6918 | 190.5 | 18x70 |
| 1750 | S1281 | -6930 | 85.5 | 18x70 |
| 1751 | S1282 | -6942 | 295.5 | 18x70 |
| 1752 | S1283 | -6954 | 190.5 | 18x70 |
| 1753 | S1284 | -6966 | 85.5 | 18x70 |
| 1754 | S1285 | -6978 | 295.5 | 18x70 |
| 1755 | S1286 | -6990 | 190.5 | 18x70 |
| 1756 | S1287 | -7002 | 85.5 | 18x70 |
| 1757 | S1288 | -7014 | 295.5 | 18x70 |
| 1758 | S1289 | -7026 | 190.5 | 18x70 |
| 1759 | S1290 | -7038 | 85.5 | 18x70 |
| 1760 | S1291 | -7050 | 295.5 | 18x70 |
| 1761 | S1292 | -7062 | 190.5 | 18x70 |
| 1762 | S1293 | -7074 | 85.5 | 18x70 |
| 1763 | S1294 | -7086 | 295.5 | 18x70 |
| 1764 | S1295 | -7098 | 190.5 | 18x70 |
| 1765 | S1296 | -7110 | 85.5 | 18x70 |
| 1766 | S1297 | -7122 | 295.5 | 18x70 |
| 1767 | S1298 | -7134 | 190.5 | 18x70 |
| 1768 | S1299 | -7146 | 85.5 | 18x70 |
| 1769 | S1300 | -7158 | 295.5 | 18x70 |
| 1770 | S1301 | -7170 | 190.5 | 18x70 |
| 1771 | S1302 | -7182 | 85.5 | 18x70 |
| 1772 | S1303 | -7194 | 295.5 | 18x70 |
| 1773 | S1304 | -7206 | 190.5 | 18x70 |
| 1774 | S1305 | -7218 | 85.5 | 18x70 |
| 1775 | S1306 | -7230 | 295.5 | 18x70 |
| 1776 | S1307 | -7242 | 190.5 | 18x70 |
| 1777 | S1308 | -7254 | 85.5 | 18x70 |
| 1778 | S1309 | -7266 | 295.5 | 18x70 |
| 1779 | S1310 | -7278 | 190.5 | 18x70 |
| 1780 | S1311 | -7290 | 85.5 | 18x70 |
| 1781 | S1312 | -7302 | 295.5 | 18x70 |
| 1782 | S1313 | -7314 | 190.5 | 18x70 |
| 1783 | S1314 | -7326 | 85.5 | 18x70 |
| 1784 | S1315 | -7338 | 295.5 | 18x70 |
| 1785 | S1316 | -7350 | 190.5 | 18x70 |
| 1786 | S1317 | -7362 | 85.5 | 18x70 |
| 1787 | S1318 | -7374 | 295.5 | 18x70 |
| 1788 | S1319 | -7386 | 190.5 | 18x70 |
| 1789 | S1320 | -7398 | 85.5 | 18x70 |
| 1790 | S1321 | -7410 | 295.5 | 18x70 |
| 1791 | S1322 | -7422 | 190.5 | 18x70 |
| 1792 | S1323 | -7434 | 85.5 | 18x70 |
| 1793 | S1324 | -7446 | 295.5 | 18x70 |
| 1794 | S1325 | -7458 | 190.5 | 18x70 |
| 1795 | S1326 | -7470 | 85.5 | 18x70 |
| 1796 | S1327 | -7482 | 295.5 | 18x70 |
| 1797 | S1328 | -7494 | 190.5 | 18x70 |
| 1798 | S1329 | -7506 | 85.5 | 18x70 |
| 1799 | S1330 | -7518 | 295.5 | 18x70 |
| 1800 | S1331 | -7530 | 190.5 | 18x70 |
| 1801 | S1332 | -7542 | 85.5 | 18x70 |
| 1802 | S1333 | -7554 | 295.5 | 18x70 |
| 1803 | S1334 | -7566 | 190.5 | 18x70 |
| 1804 | S1335 | -7578 | 85.5 | 18x70 |
| 1805 | S1336 | -7590 | 295.5 | 18x70 |
| 1806 | S1337 | -7602 | 190.5 | 18x70 |
| 1807 | S1338 | -7614 | 85.5 | 18x70 |
| 1808 | S1339 | -7626 | 295.5 | 18x70 |
| 1809 | S1340 | -7638 | 190.5 | 18x70 |
| 1810 | S1341 | -7650 | 85.5 | 18x70 |
| 1811 | S1342 | -7662 | 295.5 | 18x70 |
| 1812 | S1343 | -7674 | 190.5 | 18x70 |
| 1813 | S1344 | -7686 | 85.5 | 18x70 |
| 1814 | S1345 | -7698 | 295.5 | 18x70 |
| 1815 | S1346 | -7710 | 190.5 | 18x70 |
| 1816 | S1347 | -7722 | 85.5 | 18x70 |
| 1817 | S1348 | -7734 | 295.5 | 18x70 |
| 1818 | S1349 | -7746 | 190.5 | 18x70 |
| 1819 | S1350 | -7758 | 85.5 | 18x70 |
| 1820 | S1351 | -7770 | 295.5 | 18x70 |
| 1821 | S1352 | -7782 | 190.5 | 18x70 |
| 1822 | S1353 | -7794 | 85.5 | 18x70 |
| 1823 | S1354 | -7806 | 295.5 | 18x70 |
| 1824 | S1355 | -7818 | 190.5 | 18x70 |
| 1825 | S1356 | -7830 | 85.5 | 18x70 |
| 1826 | S1357 | -7842 | 295.5 | 18x70 |
| 1827 | S1358 | -7854 | 190.5 | 18x70 |
| 1828 | S1359 | -7866 | 85.5 | 18x70 |
| 1829 | S1360 | -7878 | 295.5 | 18x70 |
| 1830 | S1361 | -7890 | 190.5 | 18x70 |
| 1831 | S1362 | -7902 | 85.5 | 18x70 |
| 1832 | S1363 | -7914 | 295.5 | 18x70 |
| 1833 | S1364 | -7926 | 190.5 | 18x70 |
| 1834 | S1365 | -7938 | 85.5 | 18x70 |
| 1835 | S1366 | -7950 | 295.5 | 18x70 |
| 1836 | S1367 | -7962 | 190.5 | 18x70 |
| 1837 | S1368 | -7974 | 85.5 | 18x70 |
| 1838 | S1369 | -7986 | 295.5 | 18x70 |
| 1839 | S1370 | -7998 | 190.5 | 18x70 |
| 1840 | S1371 | -8010 | 85.5 | 18x70 |
| 1841 | S1372 | -8022 | 295.5 | 18x70 |
| 1842 | S1373 | -8034 | 190.5 | 18x70 |
| 1843 | S1374 | -8046 | 85.5 | 18x70 |
| 1844 | S1375 | -8058 | 295.5 | 18x70 |
| 1845 | S1376 | -8070 | 190.5 | 18x70 |
| 1846 | S1377 | -8082 | 85.5 | 18x70 |
| 1847 | S1378 | -8094 | 295.5 | 18x70 |
| 1848 | S1379 | -8106 | 190.5 | 18x70 |
| 1849 | S1380 | -8118 | 85.5 | 18x70 |
| 1850 | S1381 | -8130 | 295.5 | 18x70 |
| 1851 | S1382 | -8142 | 190.5 | 18x70 |
| 1852 | S1383 | -8154 | 85.5 | 18x70 |
| 1853 | S1384 | -8166 | 295.5 | 18x70 |
| 1854 | S1385 | -8178 | 190.5 | 18x70 |
| 1855 | S1386 | -8190 | 85.5 | 18x70 |
| 1856 | S1387 | -8202 | 295.5 | 18x70 |
| 1857 | S1388 | -8214 | 190.5 | 18x70 |
| 1858 | S1389 | -8226 | 85.5 | 18x70 |
| 1859 | S1390 | -8238 | 295.5 | 18x70 |
| 1860 | S1391 | -8250 | 190.5 | 18x70 |
| 1861 | S1392 | -8262 | 85.5 | 18x70 |
| 1862 | S1393 | -8274 | 295.5 | 18x70 |
| 1863 | S1394 | -8286 | 190.5 | 18x70 |
| 1864 | S1395 | -8298 | 85.5 | 18x70 |
| 1865 | S1396 | -8310 | 295.5 | 18x70 |
| 1866 | S1397 | -8322 | 190.5 | 18x70 |
| 1867 | S1398 | -8334 | 85.5 | 18x70 |
| 1868 | S1399 | -8346 | 295.5 | 18x70 |
| 1869 | S1400 | -8358 | 190.5 | 18x70 |
| 1870 | S1401 | -8370 | 85.5 | 18x70 |
| 1871 | S1402 | -8382 | 295.5 | 18x70 |
| 1872 | S1403 | -8394 | 190.5 | 18x70 |
| 1873 | S1404 | -8406 | 85.5 | 18x70 |
| 1874 | S1405 | -8418 | 295.5 | 18x70 |
| 1875 | S1406 | -8430 | 190.5 | 18x70 |
| 1876 | S1407 | -8442 | 85.5 | 18x70 |
| 1877 | S1408 | -8454 | 295.5 | 18x70 |
| 1878 | S1409 | -8466 | 190.5 | 18x70 |
| 1879 | S1410 | -8478 | 85.5 | 18x70 |
| 1880 | S1411 | -8490 | 295.5 | 18x70 |
| 1881 | S1412 | -8502 | 190.5 | 18x70 |
| 1882 | S1413 | -8514 | 85.5 | 18x70 |
| 1883 | S1414 | -8526 | 295.5 | 18x70 |
| 1884 | S1415 | -8538 | 190.5 | 18x70 |
| 1885 | S1416 | -8550 | 85.5 | 18x70 |
| 1886 | S1417 | -8562 | 295.5 | 18x70 |
| 1887 | S1418 | -8574 | 190.5 | 18x70 |
| 1888 | S1419 | -8586 | 85.5 | 18x70 |
| 1889 | S1420 | -8598 | 295.5 | 18x70 |
| 1890 | S1421 | -8610 | 190.5 | 18x70 |
| 1891 | S1422 | -8622 | 85.5 | 18x70 |
| 1892 | S1423 | -8634 | 295.5 | 18x70 |
| 1893 | S1424 | -8646 | 190.5 | 18x70 |
| 1894 | S1425 | -8658 | 85.5 | 18x70 |
| 1895 | S1426 | -8670 | 295.5 | 18x70 |
| 1896 | S1427 | -8682 | 190.5 | 18x70 |
| 1897 | S1428 | -8694 | 85.5 | 18x70 |
| 1898 | S1429 | -8706 | 295.5 | 18x70 |
| 1899 | S1430 | -8718 | 190.5 | 18x70 |
| 1900 | S1431 | -8730 | 85.5 | 18x70 |
| 1901 | S1432 | -8742 | 295.5 | 18x70 |
| 1902 | S1433 | -8754 | 190.5 | 18x70 |
| 1903 | S1434 | -8766 | 85.5 | 18x70 |
| 1904 | S1435 | -8778 | 295.5 | 18x70 |
| 1905 | S1436 | -8790 | 190.5 | 18x70 |
| 1906 | S1437 | -8802 | 85.5 | 18x70 |
| 1907 | S1438 | -8814 | 295.5 | 18x70 |
| 1908 | S1439 | -8826 | 190.5 | 18x70 |
| 1909 | S1440 | -8838 | 85.5 | 18x70 |
| 1910 | S1441 | -8850 | 295.5 | 18x70 |
| 1911 | S1442 | -8862 | 190.5 | 18x70 |
| 1912 | S1443 | -8874 | 85.5 | 18x70 |
| 1913 | S1444 | -8886 | 295.5 | 18x70 |
| 1914 | S1445 | -8898 | 190.5 | 18x70 |
| 1915 | S1446 | -8910 | 85.5 | 18x70 |
| 1916 | S1447 | -8922 | 295.5 | 18x70 |
| 1917 | S1448 | -8934 | 190.5 | 18x70 |
| 1918 | S1449 | -8946 | 85.5 | 18x70 |
| 1919 | S1450 | -8958 | 295.5 | 18x70 |
| 1920 | S1451 | -8970 | 190.5 | 18x70 |

| No. | Name | X | Y | Bump size |
|---|---|---|---|---|
| 1921 | S1452 | -8982 | 85.5 | 18x70 |
| 1922 | S1453 | -8994 | 295.5 | 18x70 |
| 1923 | S1454 | -9006 | 190.5 | 18x70 |
| 1924 | S1455 | -9018 | 85.5 | 18x70 |
| 1925 | S1456 | -9030 | 295.5 | 18x70 |
| 1926 | S1457 | -9042 | 190.5 | 18x70 |
| 1927 | S1458 | -9054 | 85.5 | 18x70 |
| 1928 | S1459 | -9066 | 295.5 | 18x70 |
| 1929 | S1460 | -9078 | 190.5 | 18x70 |
| 1930 | S1461 | -9090 | 85.5 | 18x70 |
| 1931 | S1462 | -9102 | 295.5 | 18x70 |
| 1932 | S1463 | -9114 | 190.5 | 18x70 |
| 1933 | S1464 | -9126 | 85.5 | 18x70 |
| 1934 | S1465 | -9138 | 295.5 | 18x70 |
| 1935 | S1466 | -9150 | 190.5 | 18x70 |
| 1936 | S1467 | -9162 | 85.5 | 18x70 |
| 1937 | S1468 | -9174 | 295.5 | 18x70 |
| 1938 | S1469 | -9186 | 190.5 | 18x70 |
| 1939 | S1470 | -9198 | 85.5 | 18x70 |
| 1940 | S1471 | -9210 | 295.5 | 18x70 |
| 1941 | S1472 | -9222 | 190.5 | 18x70 |
| 1942 | S1473 | -9234 | 85.5 | 18x70 |
| 1943 | S1474 | -9246 | 295.5 | 18x70 |
| 1944 | S1475 | -9258 | 190.5 | 18x70 |
| 1945 | S1476 | -9270 | 85.5 | 18x70 |
| 1946 | S1477 | -9282 | 295.5 | 18x70 |
| 1947 | S1478 | -9294 | 190.5 | 18x70 |
| 1948 | S1479 | -9306 | 85.5 | 18x70 |
| 1949 | S1480 | -9318 | 295.5 | 18x70 |
| 1950 | S1481 | -9330 | 190.5 | 18x70 |
| 1951 | S1482 | -9342 | 85.5 | 18x70 |
| 1952 | S1483 | -9354 | 295.5 | 18x70 |
| 1953 | S1484 | -9366 | 190.5 | 18x70 |
| 1954 | S1485 | -9378 | 85.5 | 18x70 |
| 1955 | S1486 | -9390 | 295.5 | 18x70 |
| 1956 | S1487 | -9402 | 190.5 | 18x70 |
| 1957 | S1488 | -9414 | 85.5 | 18x70 |
| 1958 | S1489 | -9426 | 295.5 | 18x70 |
| 1959 | S1490 | -9438 | 190.5 | 18x70 |
| 1960 | S1491 | -9450 | 85.5 | 18x70 |
| 1961 | S1492 | -9462 | 295.5 | 18x70 |
| 1962 | S1493 | -9474 | 190.5 | 18x70 |
| 1963 | S1494 | -9486 | 85.5 | 18x70 |
| 1964 | S1495 | -9498 | 295.5 | 18x70 |
| 1965 | S1496 | -9510 | 190.5 | 18x70 |
| 1966 | S1497 | -9522 | 85.5 | 18x70 |
| 1967 | S1498 | -9534 | 295.5 | 18x70 |
| 1968 | S1499 | -9546 | 190.5 | 18x70 |
| 1969 | S1500 | -9558 | 85.5 | 18x70 |
| 1970 | S1501 | -9570 | 295.5 | 18x70 |
| 1971 | S1502 | -9582 | 190.5 | 18x70 |
| 1972 | S1503 | -9594 | 85.5 | 18x70 |
| 1973 | S1504 | -9606 | 295.5 | 18x70 |
| 1974 | S1505 | -9618 | 190.5 | 18x70 |
| 1975 | S1506 | -9630 | 85.5 | 18x70 |
| 1976 | S1507 | -9642 | 295.5 | 18x70 |
| 1977 | S1508 | -9654 | 190.5 | 18x70 |
| 1978 | S1509 | -9666 | 85.5 | 18x70 |
| 1979 | S1510 | -9678 | 295.5 | 18x70 |
| 1980 | S1511 | -9690 | 190.5 | 18x70 |
| 1981 | S1512 | -9702 | 85.5 | 18x70 |
| 1982 | S1513 | -9714 | 295.5 | 18x70 |
| 1983 | S1514 | -9726 | 190.5 | 18x70 |
| 1984 | S1515 | -9738 | 85.5 | 18x70 |
| 1985 | S1516 | -9750 | 295.5 | 18x70 |
| 1986 | S1517 | -9762 | 190.5 | 18x70 |
| 1987 | S1518 | -9774 | 85.5 | 18x70 |
| 1988 | S1519 | -9786 | 295.5 | 18x70 |
| 1989 | S1520 | -9798 | 190.5 | 18x70 |
| 1990 | S1521 | -9810 | 85.5 | 18x70 |
| 1991 | S1522 | -9822 | 295.5 | 18x70 |
| 1992 | S1523 | -9834 | 190.5 | 18x70 |
| 1993 | S1524 | -9846 | 85.5 | 18x70 |
| 1994 | S1525 | -9858 | 295.5 | 18x70 |
| 1995 | S1526 | -9870 | 190.5 | 18x70 |
| 1996 | S1527 | -9882 | 85.5 | 18x70 |
| 1997 | S1528 | -9894 | 295.5 | 18x70 |
| 1998 | S1529 | -9906 | 190.5 | 18x70 |
| 1999 | S1530 | -9918 | 85.5 | 18x70 |
| 2000 | S1531 | -9930 | 295.5 | 18x70 |
| 2001 | S1532 | -9942 | 190.5 | 18x70 |
| 2002 | S1533 | -9954 | 85.5 | 18x70 |
| 2003 | S1534 | -9966 | 295.5 | 18x70 |
| 2004 | S1535 | -9978 | 190.5 | 18x70 |
| 2005 | S1536 | -9990 | 85.5 | 18x70 |
| 2006 | S1537 | -10002 | 295.5 | 18x70 |
| 2007 | S1538 | -10014 | 190.5 | 18x70 |
| 2008 | S1539 | -10026 | 85.5 | 18x70 |
| 2009 | S1540 | -10038 | 295.5 | 18x70 |
| 2010 | S1541 | -10050 | 190.5 | 18x70 |
| 2011 | S1542 | -10062 | 85.5 | 18x70 |
| 2012 | S1543 | -10074 | 295.5 | 18x70 |
| 2013 | S1544 | -10086 | 190.5 | 18x70 |
| 2014 | S1545 | -10098 | 85.5 | 18x70 |
| 2015 | S1546 | -10110 | 295.5 | 18x70 |
| 2016 | S1547 | -10122 | 190.5 | 18x70 |
| 2017 | S1548 | -10134 | 85.5 | 18x70 |
| 2018 | S1549 | -10146 | 295.5 | 18x70 |
| 2019 | S1550 | -10158 | 190.5 | 18x70 |
| 2020 | S1551 | -10170 | 85.5 | 18x70 |
| 2021 | S1552 | -10182 | 295.5 | 18x70 |
| 2022 | S1553 | -10194 | 190.5 | 18x70 |
| 2023 | S1554 | -10206 | 85.5 | 18x70 |
| 2024 | S1555 | -10218 | 295.5 | 18x70 |
| 2025 | S1556 | -10230 | 190.5 | 18x70 |
| 2026 | S1557 | -10242 | 85.5 | 18x70 |
| 2027 | S1558 | -10254 | 295.5 | 18x70 |
| 2028 | S1559 | -10266 | 190.5 | 18x70 |
| 2029 | S1560 | -10278 | 85.5 | 18x70 |
| 2030 | S1561 | -10290 | 295.5 | 18x70 |
| 2031 | S1562 | -10302 | 190.5 | 18x70 |
| 2032 | S1563 | -10314 | 85.5 | 18x70 |
| 2033 | S1564 | -10326 | 295.5 | 18x70 |
| 2034 | S1565 | -10338 | 190.5 | 18x70 |
| 2035 | S1566 | -10350 | 85.5 | 18x70 |
| 2036 | S1567 | -10362 | 295.5 | 18x70 |
| 2037 | S1568 | -10374 | 190.5 | 18x70 |
| 2038 | S1569 | -10386 | 85.5 | 18x70 |
| 2039 | S1570 | -10398 | 295.5 | 18x70 |
| 2040 | S1571 | -10410 | 190.5 | 18x70 |
| 2041 | S1572 | -10422 | 85.5 | 18x70 |
| 2042 | S1573 | -10434 | 295.5 | 18x70 |
| 2043 | S1574 | -10446 | 190.5 | 18x70 |
| 2044 | S1575 | -10458 | 85.5 | 18x70 |
| 2045 | S1576 | -10470 | 295.5 | 18x70 |
| 2046 | S1577 | -10482 | 190.5 | 18x70 |
| 2047 | S1578 | -10494 | 85.5 | 18x70 |
| 2048 | S1579 | -10506 | 295.5 | 18x70 |
| 2049 | S1580 | -10518 | 190.5 | 18x70 |
| 2050 | S1581 | -10530 | 85.5 | 18x70 |
| 2051 | S1582 | -10542 | 295.5 | 18x70 |
| 2052 | S1583 | -10554 | 190.5 | 18x70 |
| 2053 | S1584 | -10566 | 85.5 | 18x70 |
| 2054 | S1585 | -10578 | 295.5 | 18x70 |
| 2055 | S1586 | -10590 | 190.5 | 18x70 |
| 2056 | S1587 | -10602 | 85.5 | 18x70 |
| 2057 | S1588 | -10614 | 295.5 | 18x70 |
| 2058 | S1589 | -10626 | 190.5 | 18x70 |
| 2059 | S1590 | -10638 | 85.5 | 18x70 |
| 2060 | S1591 | -10650 | 295.5 | 18x70 |
| 2061 | S1592 | -10662 | 190.5 | 18x70 |
| 2062 | S1593 | -10674 | 85.5 | 18x70 |
| 2063 | S1594 | -10686 | 295.5 | 18x70 |
| 2064 | S1595 | -10698 | 190.5 | 18x70 |
| 2065 | S1596 | -10710 | 85.5 | 18x70 |
| 2066 | S1597 | -10722 | 295.5 | 18x70 |
| 2067 | S1598 | -10734 | 190.5 | 18x70 |
| 2068 | S1599 | -10746 | 85.5 | 18x70 |
| 2069 | S1600 | -10758 | 295.5 | 18x70 |
| 2070 | S1601 | -10770 | 190.5 | 18x70 |
| 2071 | S1602 | -10782 | 85.5 | 18x70 |
| 2072 | S1603 | -10794 | 295.5 | 18x70 |
| 2073 | S1604 | -10806 | 190.5 | 18x70 |
| 2074 | S1605 | -10818 | 85.5 | 18x70 |
| 2075 | S1606 | -10830 | 295.5 | 18x70 |
| 2076 | S1607 | -10842 | 190.5 | 18x70 |
| 2077 | S1608 | -10854 | 85.5 | 18x70 |
| 2078 | S1609 | -10866 | 295.5 | 18x70 |
| 2079 | S1610 | -10878 | 190.5 | 18x70 |
| 2080 | S1611 | -10890 | 85.5 | 18x70 |
| 2081 | S1612 | -10902 | 295.5 | 18x70 |
| 2082 | S1613 | -10914 | 190.5 | 18x70 |
| 2083 | S1614 | -10926 | 85.5 | 18x70 |
| 2084 | S1615 | -10938 | 295.5 | 18x70 |
| 2085 | S1616 | -10950 | 190.5 | 18x70 |
| 2086 | S1617 | -10962 | 85.5 | 18x70 |
| 2087 | S1618 | -10974 | 295.5 | 18x70 |
| 2088 | S1619 | -10986 | 190.5 | 18x70 |
| 2089 | S1620 | -10998 | 85.5 | 18x70 |
| 2090 | S1621 | -11010 | 295.5 | 18x70 |
| 2091 | S1622 | -11022 | 190.5 | 18x70 |
| 2092 | S1623 | -11034 | 85.5 | 18x70 |
| 2093 | S1624 | -11046 | 295.5 | 18x70 |
| 2094 | S1625 | -11058 | 190.5 | 18x70 |
| 2095 | S1626 | -11070 | 85.5 | 18x70 |
| 2096 | S1627 | -11082 | 295.5 | 18x70 |
| 2097 | S1628 | -11094 | 190.5 | 18x70 |
| 2098 | S1629 | -11106 | 85.5 | 18x70 |
| 2099 | S1630 | -11118 | 295.5 | 18x70 |
| 2100 | S1631 | -11130 | 190.5 | 18x70 |
| 2101 | S1632 | -11142 | 85.5 | 18x70 |
| 2102 | S1633 | -11154 | 295.5 | 18x70 |
| 2103 | S1634 | -11166 | 190.5 | 18x70 |
| 2104 | S1635 | -11178 | 85.5 | 18x70 |
| 2105 | S1636 | -11190 | 295.5 | 18x70 |
| 2106 | S1637 | -11202 | 190.5 | 18x70 |
| 2107 | S1638 | -11214 | 85.5 | 18x70 |
| 2108 | S1639 | -11226 | 295.5 | 18x70 |
| 2109 | S1640 | -11238 | 190.5 | 18x70 |
| 2110 | S1641 | -11250 | 85.5 | 18x70 |
| 2111 | S1642 | -11262 | 295.5 | 18x70 |
| 2112 | S1643 | -11274 | 190.5 | 18x70 |
| 2113 | S1644 | -11286 | 85.5 | 18x70 |
| 2114 | S1645 | -11298 | 295.5 | 18x70 |
| 2115 | S1646 | -11310 | 190.5 | 18x70 |
| 2116 | S1647 | -11322 | 85.5 | 18x70 |
| 2117 | S1648 | -11334 | 295.5 | 18x70 |
| 2118 | S1649 | -11346 | 190.5 | 18x70 |
| 2119 | S1650 | -11358 | 85.5 | 18x70 |
| 2120 | S1651 | -11370 | 295.5 | 18x70 |
| 2121 | S1652 | -11382 | 190.5 | 18x70 |
| 2122 | S1653 | -11394 | 85.5 | 18x70 |
| 2123 | S1654 | -11406 | 295.5 | 18x70 |
| 2124 | S1655 | -11418 | 190.5 | 18x70 |
| 2125 | S1656 | -11430 | 85.5 | 18x70 |
| 2126 | S1657 | -11442 | 295.5 | 18x70 |
| 2127 | S1658 | -11454 | 190.5 | 18x70 |
| 2128 | S1659 | -11466 | 85.5 | 18x70 |
| 2129 | S1660 | -11478 | 295.5 | 18x70 |
| 2130 | S1661 | -11490 | 190.5 | 18x70 |
| 2131 | S1662 | -11502 | 85.5 | 18x70 |
| 2132 | S1663 | -11514 | 295.5 | 18x70 |
| 2133 | S1664 | -11526 | 190.5 | 18x70 |
| 2134 | S1665 | -11538 | 85.5 | 18x70 |
| 2135 | S1666 | -11550 | 295.5 | 18x70 |
| 2136 | S1667 | -11562 | 190.5 | 18x70 |
| 2137 | S1668 | -11574 | 85.5 | 18x70 |
| 2138 | S1669 | -11586 | 295.5 | 18x70 |
| 2139 | S1670 | -11598 | 190.5 | 18x70 |
| 2140 | S1671 | -11610 | 85.5 | 18x70 |
| 2141 | S1672 | -11622 | 295.5 | 18x70 |
| 2142 | S1673 | -11634 | 190.5 | 18x70 |
| 2143 | S1674 | -11646 | 85.5 | 18x70 |
| 2144 | S1675 | -11658 | 295.5 | 18x70 |
| 2145 | S1676 | -11670 | 190.5 | 18x70 |
| 2146 | S1677 | -11682 | 85.5 | 18x70 |
| 2147 | S1678 | -11694 | 295.5 | 18x70 |
| 2148 | S1679 | -11706 | 190.5 | 18x70 |
| 2149 | S1680 | -11718 | 85.5 | 18x70 |
| 2150 | S1681 | -11730 | 295.5 | 18x70 |
| 2151 | S1682 | -11742 | 190.5 | 18x70 |
| 2152 | S1683 | -11754 | 85.5 | 18x70 |
| 2153 | S1684 | -11766 | 295.5 | 18x70 |
| 2154 | S1685 | -11778 | 190.5 | 18x70 |
| 2155 | S1686 | -11790 | 85.5 | 18x70 |
| 2156 | S1687 | -11802 | 295.5 | 18x70 |
| 2157 | S1688 | -11814 | 190.5 | 18x70 |
| 2158 | S1689 | -11826 | 85.5 | 18x70 |
| 2159 | S1690 | -11838 | 295.5 | 18x70 |
| 2160 | S1691 | -11850 | 190.5 | 18x70 |

| No. | Name | X | Y | Bump size |
|---|---|---|---|---|
| 2161 | S1692 | -11862 | 85.5 | 18x70 |
| 2162 | S1693 | -11874 | 295.5 | 18x70 |
| 2163 | S1694 | -11886 | 190.5 | 18x70 |
| 2164 | S1695 | -11898 | 85.5 | 18x70 |
| 2165 | S1696 | -11910 | 295.5 | 18x70 |
| 2166 | S1697 | -11922 | 190.5 | 18x70 |
| 2167 | S1698 | -11934 | 85.5 | 18x70 |
| 2168 | S1699 | -11946 | 295.5 | 18x70 |
| 2169 | S1700 | -11958 | 190.5 | 18x70 |
| 2170 | S1701 | -11970 | 85.5 | 18x70 |
| 2171 | S1702 | -11982 | 295.5 | 18x70 |
| 2172 | S1703 | -11994 | 190.5 | 18x70 |
| 2173 | S1704 | -12006 | 85.5 | 18x70 |
| 2174 | S1705 | -12018 | 295.5 | 18x70 |
| 2175 | S1706 | -12030 | 190.5 | 18x70 |
| 2176 | S1707 | -12042 | 85.5 | 18x70 |
| 2177 | S1708 | -12054 | 295.5 | 18x70 |
| 2178 | S1709 | -12066 | 190.5 | 18x70 |
| 2179 | S1710 | -12078 | 85.5 | 18x70 |
| 2180 | S1711 | -12090 | 295.5 | 18x70 |
| 2181 | S1712 | -12102 | 190.5 | 18x70 |
| 2182 | S1713 | -12114 | 85.5 | 18x70 |
| 2183 | S1714 | -12126 | 295.5 | 18x70 |
| 2184 | S1715 | -12138 | 190.5 | 18x70 |
| 2185 | S1716 | -12150 | 85.5 | 18x70 |
| 2186 | S1717 | -12162 | 295.5 | 18x70 |
| 2187 | S1718 | -12174 | 190.5 | 18x70 |
| 2188 | S1719 | -12186 | 85.5 | 18x70 |
| 2189 | S1720 | -12198 | 295.5 | 18x70 |
| 2190 | S1721 | -12210 | 190.5 | 18x70 |
| 2191 | S1722 | -12222 | 85.5 | 18x70 |
| 2192 | S1723 | -12234 | 295.5 | 18x70 |
| 2193 | S1724 | -12246 | 190.5 | 18x70 |
| 2194 | S1725 | -12258 | 85.5 | 18x70 |
| 2195 | S1726 | -12270 | 295.5 | 18x70 |
| 2196 | S1727 | -12282 | 190.5 | 18x70 |
| 2197 | S1728 | -12294 | 85.5 | 18x70 |
| 2198 | S1729 | -12306 | 295.5 | 18x70 |
| 2199 | S1730 | -12318 | 190.5 | 18x70 |
| 2200 | S1731 | -12330 | 85.5 | 18x70 |
| 2201 | S1732 | -12342 | 295.5 | 18x70 |
| 2202 | S1733 | -12354 | 190.5 | 18x70 |
| 2203 | S1734 | -12366 | 85.5 | 18x70 |
| 2204 | S1735 | -12378 | 295.5 | 18x70 |
| 2205 | S1736 | -12390 | 190.5 | 18x70 |
| 2206 | S1737 | -12402 | 85.5 | 18x70 |
| 2207 | S1738 | -12414 | 295.5 | 18x70 |
| 2208 | S1739 | -12426 | 190.5 | 18x70 |
| 2209 | S1740 | -12438 | 85.5 | 18x70 |
| 2210 | S1741 | -12450 | 295.5 | 18x70 |
| 2211 | S1742 | -12462 | 190.5 | 18x70 |
| 2212 | S1743 | -12474 | 85.5 | 18x70 |
| 2213 | S1744 | -12486 | 295.5 | 18x70 |
| 2214 | S1745 | -12498 | 190.5 | 18x70 |
| 2215 | S1746 | -12510 | 85.5 | 18x70 |
| 2216 | S1747 | -12522 | 295.5 | 18x70 |
| 2217 | S1748 | -12534 | 190.5 | 18x70 |
| 2218 | S1749 | -12546 | 85.5 | 18x70 |
| 2219 | S1750 | -12558 | 295.5 | 18x70 |
| 2220 | S1751 | -12570 | 190.5 | 18x70 |
| 2221 | S1752 | -12582 | 85.5 | 18x70 |
| 2222 | S1753 | -12594 | 295.5 | 18x70 |
| 2223 | S1754 | -12606 | 190.5 | 18x70 |
| 2224 | S1755 | -12618 | 85.5 | 18x70 |
| 2225 | S1756 | -12630 | 295.5 | 18x70 |
| 2226 | S1757 | -12642 | 190.5 | 18x70 |
| 2227 | S1758 | -12654 | 85.5 | 18x70 |
| 2228 | S1759 | -12666 | 295.5 | 18x70 |
| 2229 | S1760 | -12678 | 190.5 | 18x70 |
| 2230 | S1761 | -12690 | 85.5 | 18x70 |
| 2231 | S1762 | -12702 | 295.5 | 18x70 |
| 2232 | S1763 | -12714 | 190.5 | 18x70 |
| 2233 | S1764 | -12726 | 85.5 | 18x70 |
| 2234 | S1765 | -12738 | 295.5 | 18x70 |
| 2235 | S1766 | -12750 | 190.5 | 18x70 |
| 2236 | S1767 | -12762 | 85.5 | 18x70 |
| 2237 | S1768 | -12774 | 295.5 | 18x70 |
| 2238 | S1769 | -12786 | 190.5 | 18x70 |
| 2239 | S1770 | -12798 | 85.5 | 18x70 |
| 2240 | S1771 | -12810 | 295.5 | 18x70 |
| 2241 | S1772 | -12822 | 190.5 | 18x70 |

| No. | Name | X | Y | Bump size |
|---|---|---|---|---|
| 2242 | S1773 | -12834 | 85.5 | 18x70 |
| 2243 | S1774 | -12846 | 295.5 | 18x70 |
| 2244 | S1775 | -12858 | 190.5 | 18x70 |
| 2245 | S1776 | -12870 | 85.5 | 18x70 |
| 2246 | S1777 | -12882 | 295.5 | 18x70 |
| 2247 | S1778 | -12894 | 190.5 | 18x70 |
| 2248 | S1779 | -12906 | 85.5 | 18x70 |
| 2249 | S1780 | -12918 | 295.5 | 18x70 |
| 2250 | S1781 | -12930 | 190.5 | 18x70 |
| 2251 | S1782 | -12942 | 85.5 | 18x70 |
| 2252 | S1783 | -12954 | 295.5 | 18x70 |
| 2253 | S1784 | -12966 | 190.5 | 18x70 |
| 2254 | S1785 | -12978 | 85.5 | 18x70 |
| 2255 | S1786 | -12990 | 295.5 | 18x70 |
| 2256 | S1787 | -13002 | 190.5 | 18x70 |
| 2257 | S1788 | -13014 | 85.5 | 18x70 |
| 2258 | S1789 | -13026 | 295.5 | 18x70 |
| 2259 | S1790 | -13038 | 190.5 | 18x70 |
| 2260 | S1791 | -13050 | 85.5 | 18x70 |
| 2261 | S1792 | -13062 | 295.5 | 18x70 |
| 2262 | S1793 | -13074 | 190.5 | 18x70 |
| 2263 | S1794 | -13086 | 85.5 | 18x70 |
| 2264 | S1795 | -13098 | 295.5 | 18x70 |
| 2265 | S1796 | -13110 | 190.5 | 18x70 |
| 2266 | S1797 | -13122 | 85.5 | 18x70 |
| 2267 | S1798 | -13134 | 295.5 | 18x70 |
| 2268 | S1799 | -13146 | 190.5 | 18x70 |
| 2269 | S1800 | -13158 | 85.5 | 18x70 |
| 2270 | S1801 | -13170 | 295.5 | 18x70 |
| 2271 | S1802 | -13182 | 190.5 | 18x70 |
| 2272 | SHIELDING | -13194 | 85.5 | 18x70 |
| 2273 | COM5 | -13206 | 295.5 | 18x70 |
| 2274 | SHIELDING | -13218 | 190.5 | 18x70 |
| 2275 | SHIELDING | -13230 | 85.5 | 18x70 |
| 2276 | COM5 | -13242 | 295.5 | 18x70 |
| 2277 | SHIELDING | -13254 | 190.5 | 18x70 |
| 2278 | RP2I | -13314 | 310.5 | 40x40 |
| 2279 | RP2I | -13394 | 310.5 | 40x40 |
| 2280 | COMR1 | -13474 | 310.5 | 40x40 |
| 2281 | COMR1 | -13554 | 310.5 | 40x40 |
| 2282 | COMR2 | -13634 | 310.5 | 40x40 |
| 2283 | COMR2 | -13714 | 310.5 | 40x40 |
| 2284 | SHIELDING | -13794 | 310.5 | 40x40 |
| 2285 | SHIELDING | -13874 | 310.5 | 40x40 |
| 2286 | SHIELDING | -13954 | 310.5 | 40x40 |
| 2287 | SYNC_R1 | -14093 | 320.5 | 120x20 |
| 2288 | SYNC_R2 | -14093 | 282.5 | 120x20 |
| 2289 | SYNC_R3 | -14093 | 244.5 | 120x20 |
| 2290 | SYNC_R4 | -14093 | 206.5 | 120x20 |
| 2291 | SYNC_R5 | -14093 | 168.5 | 120x20 |
| 2292 | SYNC_R6 | -14093 | 130.5 | 120x20 |
| 2293 | SYNC_R7 | -14093 | 92.5 | 120x20 |
| 2294 | SYNC_R8 | -14093 | 54.5 | 120x20 |
| 2295 | SYNC_R9 | -14093 | 16.5 | 120x20 |
| 2296 | SYNC_R10 | -14093 | -21.5 | 120x20 |
| 2297 | SYNC_R11 | -14093 | -59.5 | 120x20 |
| 2298 | SYNC_R12 | -14093 | -97.5 | 120x20 |

| Name | X | Y | Bump size |
|---|---|---|---|
| Alignment_Mark | -14095.5 | -273 | 115x115 |
| Alignment_Mark | 14095.5 | -273 | 115x115 |

# 15. Ordering Information

| Part No. | Package Type |
|---|---|
| HX8279-D00XPDxxx | X : mean fab code<br>PD : mean COG<br>xxx : mean chip thickness **(μm)** |