

# AMOLED Display Driver IC Specification

**ICNA3512**

## Data Sheet

**Model Number:** ICNA3512  
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## Revision History

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# 1. Description

This document is written for providing a complete reference specification of ICNA3512. IC design engineers would be referring to this specification to design the IC, and test engineers to test the compliance of the manufactured IC to guarantee the performance, and system application engineers to assist the customers to make sure that they are using this IC properly.

The ICNA3512 Support flexible resolution for SPR Panel.

- 1200RGBG x 2950 with 1:1/1:2 MUX (Max. DSC 2-SS)
- 1280RGBG x 2800 with 1:1/1:2 MUX
  - Horizontal Resolution : 720+4N ~ 1280(Max.)  
720 ~ 1280 (SPR) x H-line with MUX 1:1 (2560 source channels)
  - 720 ~ 1280 (SPR) x H-line with MUX 1:2 (1280 source channels)
- Vertical Resolution : 2N(Max:2800@1280H)

The ICNA3512 is LTPS AMOLED driver IC for an AMOLED panel with SPR. This IC is a highly integrated Source driver, Panel Gate controller, GRAM, Power management and Timing controller so on. For high-speed data transfer, supports MIPI DSI. The driver can be connected directly to the interface bus. It stores the compressed gray scale display data sent from the AP in its internal display GRAM and generates AMOLED driving signals independently of the AP. Partially stored initialization registers in the OTP are automatically loaded during display start period. This IC has the low current consumption, source driver circuit, high-efficiency power circuit. In addition, power can be controlled more finely using command control.

\*MIPI: Mobile Industry Processor Interface, \*DSI: Display Serial Interface, \*AP: Application Processor, \*SPR: Sub Pixel Rendering. \*AMOLED: active-matrix organic light-emitting diode

## 2. Features

■ ICNA3512 supports the following key features:

■ Category: General

Items	Description
Display Type	<ul style="list-style-type: none"> <li>WFHD+ Portrait</li> </ul>
Display Resolution	<ul style="list-style-type: none"> <li>1200RGBG x 2950 with 1:1/1:2 MUX (Max. DSC 2-SS)</li> <li>1280RGBG x 2800 with 1:1/1:2 MUX</li> <li>Horizontal Resolution: 720+4N~1280(Max)</li> <li>720 ~ 1280 (SPR) x H-line with MUX 1:1 (2560 source channels)</li> <li>720 ~ 1280 (SPR) x H-line with MUX 1:2 (1280 source channels)</li> <li>Vertical Resolution: 2N(Max:2800@1280H)</li> </ul>
Sub Pixel Rendering	<ul style="list-style-type: none"> <li>RGBG SPR</li> <li>GGRB SPR</li> <li>Delta RGB SPR</li> </ul>
Color Depth	<ul style="list-style-type: none"> <li>24 or 30 bits</li> </ul>
Color Mode	<ul style="list-style-type: none"> <li>16.7 M colors/1Billion color</li> <li>8 or 10 colors</li> </ul>
Frame Rate	<ul style="list-style-type: none"> <li>Dynamic Frame Rate</li> <li>144Hz @ Command mode (Max.)</li> <li>144Hz @ Video mode (Max.)</li> <li>AOD(1~60Hz)</li> </ul>
Display Operation Mode	<ul style="list-style-type: none"> <li>Partial Mode</li> <li>Idle Mode</li> <li>AOD Mode</li> <li>Local High Brightness Mode (HBM)</li> </ul>
Frame Memory	<ul style="list-style-type: none"> <li>WFHD+ with 1/3 RAM</li> <li>Graphic RAM size: 28.672M-bits (1280 x 2800 x 24bit / 3)</li> </ul>
Package	<ul style="list-style-type: none"> <li>COP</li> </ul>
Operating Temperature	<ul style="list-style-type: none"> <li>-40°C ~ 85°C</li> </ul>

■ Category: Interface

Items	Description
MIPI	<ul style="list-style-type: none"> <li>MIPI DPHY 1-port, 4-lane, V1.1 / MIPI DSI: V1.2 for DPHY</li> <li>- MIPI Speed: 1.3Gbps/Lane</li> <li>MIPI CPHY 1-port, 3-trio / MIPI DSI-2: V1.0 for CPHY</li> <li>- MIPI Speed: 1.0Gsps/Trio</li> </ul>
Compression	<ul style="list-style-type: none"> <li>DSC V1.2a, Two Decoder</li> <li>- YCbCr Domain: One decoder only</li> <li>- RGB Domain: One or Two decoder</li> <li>Compression Ratio</li> <li>- 8BPC-8BPP: 16 / 48 bit (3:1 Compression, RGB)</li> <li>- 10BPC-8BPP: 16 / 60 bit (3.75:1 Compression, RGB)</li> <li>- 10BPC-10BPP : 20 / 60 bit (3:1 Compression, RGB)</li> <li>- 8BPC-12BPP : 24 / 48bit bit(2:1 Compression, RGB)</li> <li>- 10BPC-12BPP : 24 / 60bit bit(2.5:1 Compression, RGB)</li> <li>- 8BPC-6BPP: 12 / 32 bit (2.67:1 Compression, Native 422)</li> <li>- 8BPC-7BPP: 14 / 32 bit (2.29:1 Compression, Native 422)</li> <li>- 8BPC-8BPP: 16 / 32 bit (2:1 Compression, Native 422)</li> </ul>

	<ul style="list-style-type: none"> <li>- 8BPC-10BPP : 20 / 32 bit (1.6:1 Compression, Native 422)</li> <li>- 10BPC-7BPP: 14 / 40 bit (2.86:1 Compression, Native 422)</li> <li>- 10BPC-8BPP: 16 / 40 bit (2.5:1 Compression, Native 422)</li> <li>- 10BPC-10BPP: 20 / 40 bit (2:1 Compression, Native 422)</li> </ul>
Flash I/F	<ul style="list-style-type: none"> <li>• Serial peripheral interface (SPI)</li> <li>• Support several types of Flash Memory</li> </ul>

## ■ Category: Self-Diagnostic

Items	Description
Panel Related	<ul style="list-style-type: none"> <li>• Panel Crack Detection</li> </ul>
IC Related	<ul style="list-style-type: none"> <li>• Low Voltage Detection</li> <li>• SRAM CRC/ECC Comparison</li> <li>• Thermal Detection</li> <li>• UCS Checksum Error Check</li> </ul>

## ■ Category: Display Quality Technology

Items	Description
Image Enhancement	<ul style="list-style-type: none"> <li>• Scaling Up Function (HD to WFHD and FHD to WFHD)</li> <li>• Sharpness Enhancement</li> <li>• Contrast Optimization</li> <li>• High Dynamic Range</li> <li>• Color Gamut Mapping</li> <li>• Color Temperature Adjustment</li> </ul>

## ■ Category: AMOLED Panel Control Technology

Items	Description
Panel Structure	<ul style="list-style-type: none"> <li>• Sub Pixel Rendering           <ul style="list-style-type: none"> <li>→ RGBG SPR</li> <li>→ GGRB SPR</li> <li>→ Delta RGB SPR</li> </ul> </li> <li>• Notch, Round-Corner Compensation</li> </ul>
Panel Compensation	<ul style="list-style-type: none"> <li>• ELVDD Compensation</li> <li>• IR Drop Compensation (IRC) / Dynamic color control (DCC)</li> <li>• De-Mura/De-burn in Function</li> </ul>
Power Saving	<ul style="list-style-type: none"> <li>• Brightness Control</li> <li>• ACL/MCL</li> <li>• Always On Display (AOD)           <ul style="list-style-type: none"> <li>→ Image Sticking Prevention</li> <li>→ ELVDD, ELVSS are from the DDIC</li> </ul> </li> <li>• Dynamic ELVSS</li> </ul>

FPS Application	<ul style="list-style-type: none"> <li>• Finger Print Sensor (FPS) function with Local High Brightness Mode (HBM)</li> </ul>
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## ■ Category: AMOLED Panel Driving Control

Items	Description
GOA Timing	<ul style="list-style-type: none"> <li>• 16 sets GOA control outputs each side</li> <li>• Support GOA pin swapping function</li> <li>• EM Duty Function</li> </ul>
MUX	<ul style="list-style-type: none"> <li>• 1:1 (No MUX) / 1:2(MUX)</li> </ul>
Source	<ul style="list-style-type: none"> <li>• 2560 channel outputs (Max)</li> </ul>
Gamma	<ul style="list-style-type: none"> <li>• RGB Separate Digital Gamma Structure</li> </ul>
PMIC Control	<ul style="list-style-type: none"> <li>• SWIRE, SWIRE2 for on Module DC/DC converter</li> </ul>

## ■ Category: Supply Voltage Range

Items	Description
VDDI (I/O supply)	<ul style="list-style-type: none"> <li>• 1.65V ~ 1.95V (Typ. 1.8V)</li> </ul>
VCI (Analog supply)	<ul style="list-style-type: none"> <li>• 2.65V ~ 3.6V (Typ. 3.0V)</li> </ul>
AVDD (Source supply)	<ul style="list-style-type: none"> <li>• 6.0V ~ 8.0V (Typ. 7.3V)</li> </ul>
ELVDD	<ul style="list-style-type: none"> <li>• 4.6V ~ 5.0V (Default: 4.6V @ 400 mA)</li> </ul>
ELVSS	<ul style="list-style-type: none"> <li>• -0.8V ~ -6.4V (Default: -5.4V@ 400 mA)</li> </ul>
VDD (Logic supply)	<ul style="list-style-type: none"> <li>• 1.05V ~ 1.25V (Typ. 1.15V)</li> </ul>

## ■ Category: Output Voltage Range

Items	Description
VOUT2	<ul style="list-style-type: none"> <li>• 7.0V ~ 15.0V (Typ. 8.0V, Step: 0.5V)</li> <li>• Step-up converter for VGH</li> </ul>
VGH1	<ul style="list-style-type: none"> <li>• 3.0V ~ 14.5V (Typ. 7.0V, Step: 0.1V)</li> <li>• The positive voltage for GOA driver</li> </ul>
VGH2	<ul style="list-style-type: none"> <li>• 3.0V ~ 14.5V (Typ. 7.0V, Step: 0.1V)</li> <li>• The positive voltage for GOA driver</li> </ul>
VOUT4	<ul style="list-style-type: none"> <li>• -2.0V ~ -7.0V (Typ. -4.0V, Step: 0.5V)</li> <li>• Step-up converter for VGL</li> </ul>
VGL1	<ul style="list-style-type: none"> <li>• -15.0V ~ -3.0V (Typ. -7.0V, Step: 0.1V)</li> <li>• The negative voltage for GOA driver</li> </ul>
VGL2	<ul style="list-style-type: none"> <li>• -14.5V ~ -2.5V (Typ. -7.0V, Step: 0.1V)</li> <li>• The negative voltage for GOA driver</li> </ul>
VH_A	<ul style="list-style-type: none"> <li>• 0.5V ~ 6.0V (Typ. 3.0V, Step: 0.1V)</li> <li>• The OLED pixel reference voltage</li> </ul>
VL_A	<ul style="list-style-type: none"> <li>• -6.0V ~ -0.5V (Typ. -3.0V, Step: 0.1V)</li> <li>• The OLED pixel reference voltage</li> </ul>
VH_B	<ul style="list-style-type: none"> <li>• 0.5V ~ 6.0V (Typ. 3.0V, Step: 0.1V)</li> <li>• The OLED pixel reference voltage</li> </ul>
VL_B	<ul style="list-style-type: none"> <li>• -6.0V ~ -0.5V (Typ. -3.0V, Step: 0.1V)</li> <li>• The OLED pixel reference voltage</li> </ul>

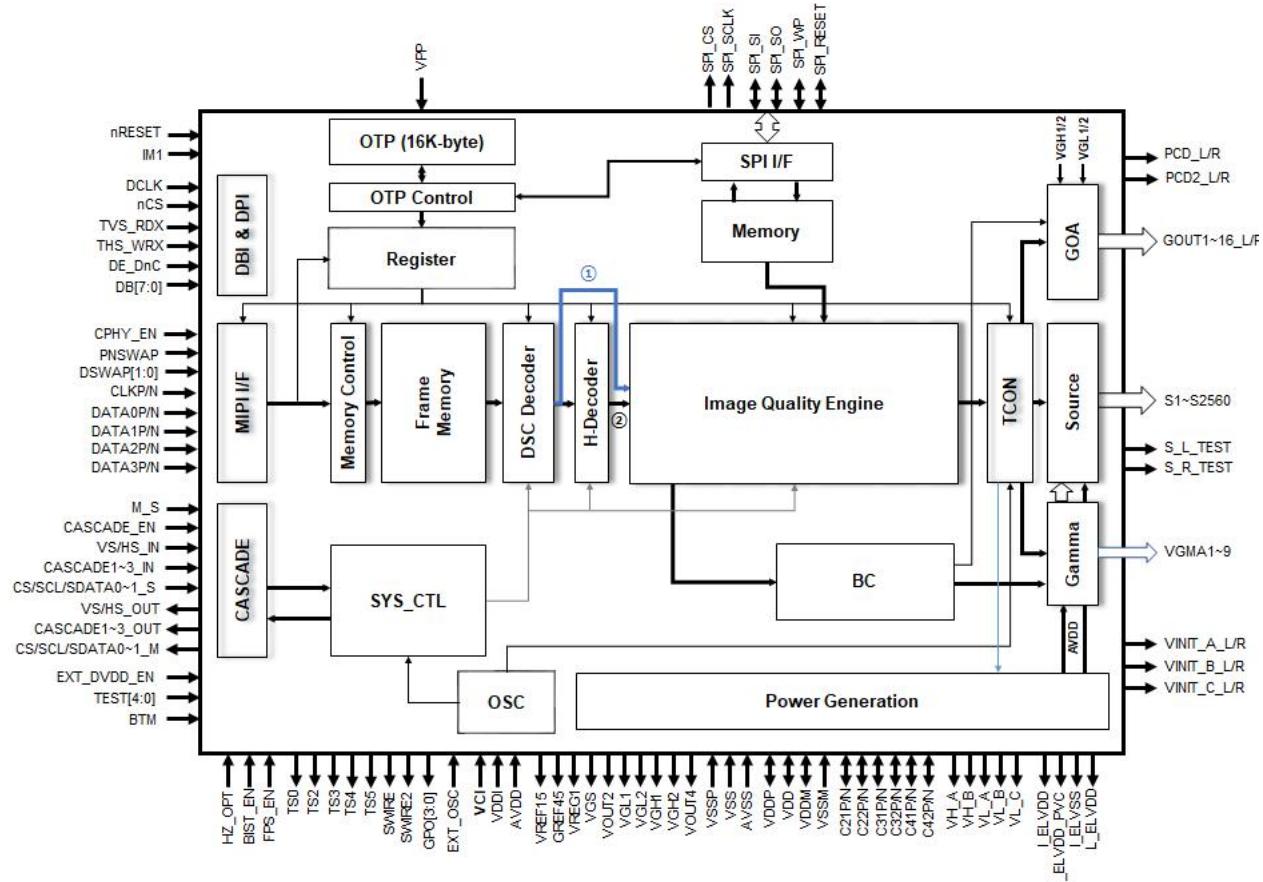
VL_C	<ul style="list-style-type: none"> <li>-6.0V ~ -0.5V (Typ. -3.0V, Step: 0.1V)</li> <li>The OLED pixel reference voltage</li> </ul>
VINIT_A	<ul style="list-style-type: none"> <li>-6.0V ~ 6.0V (Typ. -3.0V, Step: 0.1V)</li> <li>The OLED pixel reference voltage</li> </ul>
VINIT_B	<ul style="list-style-type: none"> <li>-6.0V ~ 6.0V (Typ. -3.0V, Step: 0.1V)</li> <li>The OLED pixel reference voltage</li> </ul>
VINIT_C	<ul style="list-style-type: none"> <li>-6.0V ~ -0.5V (Typ. -3.0V, Step: 0.1V)</li> <li>The OLED pixel reference voltage</li> </ul>
I_ELVDD	<ul style="list-style-type: none"> <li>2.6V ~ 5.7V (Typ. 4.6V, Step: 0.1V)</li> <li>The ELVDD voltage for AOD mode</li> </ul>
I_ELVSS	<ul style="list-style-type: none"> <li>-5.0V ~ -0.5V (Typ. -1.5V, Step: 0.1V)</li> <li>The ELVSS voltage for AOD mode</li> </ul>
VREG1	<ul style="list-style-type: none"> <li>4.5V ~ 7.6V (Typ. 6.5V, Step: 0.02V)</li> <li>Regulator output voltage generated from AVDD for high voltage of gamma circuit.</li> </ul>
VGS	<ul style="list-style-type: none"> <li>0.5V ~ 5.6V (Typ. 2.0V, Step: 0.02V)</li> <li>Regulator output voltage generated from AVDD for low voltage of gamma circuit.</li> </ul>

## ■ Category: Non-Volatile Memory (NVM)

Items	Description
Size	<ul style="list-style-type: none"> <li>16K-byte One-Time Programmable (OTP) NVM</li> </ul>
ID1	<ul style="list-style-type: none"> <li>OTP 8 times</li> </ul>
ID2, ID3	<ul style="list-style-type: none"> <li>OTP 3 times</li> </ul>
MIPI	<ul style="list-style-type: none"> <li>OTP 1 times &amp; Flash</li> </ul>
TCON	<ul style="list-style-type: none"> <li>OTP 1 times &amp; Flash</li> </ul>
DSC	<ul style="list-style-type: none"> <li>OTP 1 times &amp; Flash</li> </ul>
DGM, PIC	<ul style="list-style-type: none"> <li>OTP 1 times &amp; Flash</li> </ul>
BC (Band value)	<ul style="list-style-type: none"> <li>Flash only</li> </ul>
PWM	<ul style="list-style-type: none"> <li>OTP 1 times &amp; Flash</li> </ul>
CASCADE	<ul style="list-style-type: none"> <li>OTP 1 times &amp; Flash</li> </ul>
ODC, CTB	<ul style="list-style-type: none"> <li>OTP 1 times &amp; Flash</li> </ul>
SPR	<ul style="list-style-type: none"> <li>OTP 1 times &amp; Flash</li> </ul>
RN	<ul style="list-style-type: none"> <li>OTP 1 times &amp; Flash</li> </ul>
POC	<ul style="list-style-type: none"> <li>OTP 1 times &amp; Flash</li> </ul>
DEMURA	<ul style="list-style-type: none"> <li>OTP 1 times &amp; Flash</li> </ul>
IE	<ul style="list-style-type: none"> <li>OTP 1 times &amp; Flash</li> </ul>
BOIS_IP	<ul style="list-style-type: none"> <li>OTP 1 times &amp; Flash</li> </ul>

### 3. Device Overview

#### 3.1 Functional Block Diagram of the IC



## 4. Description of Pins

### 4.1 Pins for Power Supply

Symbol	I/O	Description
VDDI	P	<ul style="list-style-type: none"> <li>Power supply to I/O</li> <li>1.65 ~ 1.95V (Typ 1.8V)</li> <li>Connect a stabilizing capacitor</li> </ul>
VCI	P	<ul style="list-style-type: none"> <li>Power supply to analog power for the DDIC use</li> <li>2.65 ~ 3.6V (Typ 3.0V)</li> <li>Connect a stabilizing capacitor</li> </ul>
AVDD	P	<ul style="list-style-type: none"> <li>Power supply to analog power for the DDIC use</li> <li>6.0 ~ 8.0V (Typ 7.3V)</li> <li>Connect a stabilizing capacitor</li> </ul>
VDD	P	<ul style="list-style-type: none"> <li>Power supply to logic power</li> <li>1.05 ~ 1.25V (Typ 1.15V)</li> </ul>
VPP	P	<ul style="list-style-type: none"> <li>Power supply for internal OTP programming</li> <li>5.75 ~ 6.25V (Typ 6.0V)</li> <li>Leave it open when not used.</li> </ul>
VSS	P	Ground for overall system except reference voltage generation block
AVSS	P	Ground for analog reference voltage generation block
VSSM	P	Ground for MIPI-PHY block reference voltage generation block
VSSP	P	Ground for OSC block

### 4.2 Pins for MIPI Interface

Symbol	I/O	Description
CLKP CLKN	I	<ul style="list-style-type: none"> <li>DSI CLK+/- differential clock signals</li> <li>When IC enters to DSTB mode, please keep these pins to low</li> <li>Should be connected to VSSM when not used</li> </ul>
DATA0P DATA0N	I/O	
DATA1P DATA1N	I/O	<ul style="list-style-type: none"> <li>DSI D0~D3+/- differential data signals</li> <li>When IC enters to DSTB mode, please keep these pins to low</li> <li>Should be connected to VSSM when not used</li> </ul>
DATA2P DATA2N	I/O	
DATA3P DATA3N	I/O	

### 4.3 Pins for SPI Interface

- These pins are used to read and write the Flash-Memory.

Symbol	I/O	Description
F_SPI_CS	O	<ul style="list-style-type: none"> <li>• Chip Select</li> <li>• Leave it open when not used</li> </ul>
F_SPI_SCLK	O	<ul style="list-style-type: none"> <li>• A synchronous clock signal</li> <li>• Leave it open when not used</li> </ul>
F_SPI_SI	I/O	<ul style="list-style-type: none"> <li>• Serial Data Input</li> <li>• Leave it open when not used</li> </ul>
F_SPI_SO	I/O	<ul style="list-style-type: none"> <li>• Serial Data Output</li> <li>• Leave it open when not used</li> </ul>
F_SPI_WP	I/O	<ul style="list-style-type: none"> <li>• Write Protection (active low)</li> <li>• Leave it open when not used</li> </ul>
F_SPI_RESET	I/O	<ul style="list-style-type: none"> <li>• Reset</li> <li>• Leave it open when not used</li> </ul>

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#### 4.4 Pins for Interface Logic Control

Symbol	I/O	Description																																																																																																																																																																																																																																																																																																																														
nRESET	I	<ul style="list-style-type: none"> <li>This signal will reset the device and must be applied to properly initialize the chip.</li> <li>Signal is active low.</li> <li>There is no internal pull up resistor for this pin.</li> </ul>																																																																																																																																																																																																																																																																																																																														
IM1	I	<ul style="list-style-type: none"> <li>Interface Mode Selection</li> <li>- 0 : MIPI I/F (Default)</li> <li>- 1 : For Test</li> </ul>																																																																																																																																																																																																																																																																																																																														
PSWAP	I	<ul style="list-style-type: none"> <li>MIPI lane swap selection of Lane polarity</li> <li>- 1 : P→P, N→N (Default)</li> <li>- 0 : P→N, N→P</li> </ul>																																																																																																																																																																																																																																																																																																																														
DSWAP [1:0]	I	<table border="1"> <thead> <tr> <th colspan="3">PIN option</th> <th colspan="9">IC PAD</th> </tr> <tr> <th>CPHY_EN</th> <th>PSWAP</th> <th>DSWAP [1:0]</th> <th>D3P (3+)</th> <th>D3N (3-)</th> <th>D0P (0+)</th> <th>D0N (0-)</th> <th>CP (C+)</th> <th>CN (C-)</th> <th>D1P (1+)</th> <th>D1N (1-)</th> <th>D2P (2+)</th> <th>D2N (2-)</th> </tr> </thead> <tbody> <tr> <td rowspan="4">0</td> <td rowspan="4">0</td> <td>00</td> <td>0-</td> <td>0+</td> <td>1-</td> <td>1+</td> <td rowspan="4">C-</td> <td rowspan="4">C+</td> <td>2-</td> <td>2+</td> <td>3-</td> <td>3+</td> </tr> <tr> <td>01</td> <td>2-</td> <td>2+</td> <td>1-</td> <td>1+</td> <td>0-</td> <td>0+</td> <td>3-</td> <td>3+</td> </tr> <tr> <td>10</td> <td>3-</td> <td>3+</td> <td>2-</td> <td>2+</td> <td>1-</td> <td>1+</td> <td>0-</td> <td>0+</td> </tr> <tr> <td>11</td> <td>3-</td> <td>3+</td> <td>0-</td> <td>0+</td> <td>1-</td> <td>1+</td> <td>2-</td> <td>2+</td> </tr> <tr> <td rowspan="4">0</td> <td rowspan="4">1</td> <td>00</td> <td>0+</td> <td>0-</td> <td>1+</td> <td>1-</td> <td rowspan="4">C+</td> <td rowspan="4">C-</td> <td>2+</td> <td>2-</td> <td>3+</td> <td>3-</td> </tr> <tr> <td>01</td> <td>2+</td> <td>2-</td> <td>1+</td> <td>1-</td> <td>0+</td> <td>0-</td> <td>3+</td> <td>3-</td> </tr> <tr> <td>10</td> <td>3+</td> <td>3-</td> <td>2+</td> <td>2-</td> <td>1+</td> <td>1-</td> <td>0+</td> <td>0-</td> </tr> <tr> <td>11</td> <td>3+</td> <td>3-</td> <td>0+</td> <td>0-</td> <td>1+</td> <td>1-</td> <td>2+</td> <td>2-</td> </tr> <tr> <td rowspan="4">1</td> <td rowspan="4">0</td> <td>00</td> <td>C1</td> <td>B1</td> <td>A1</td> <td>C2</td> <td>B2</td> <td>A2</td> <td>X</td> <td>C0</td> <td>B0</td> <td>A0</td> </tr> <tr> <td>01</td> <td>C0</td> <td>B0</td> <td>A0</td> <td>C2</td> <td>B2</td> <td>A2</td> <td>X</td> <td>C1</td> <td>B1</td> <td>A1</td> </tr> <tr> <td>10</td> <td>C2</td> <td>B2</td> <td>A2</td> <td>C1</td> <td>B1</td> <td>A1</td> <td>X</td> <td>C0</td> <td>B0</td> <td>A0</td> </tr> <tr> <td>11</td> <td>C0</td> <td>B0</td> <td>A0</td> <td>C1</td> <td>B1</td> <td>A1</td> <td>X</td> <td>C2</td> <td>B2</td> <td>A2</td> </tr> <tr> <td rowspan="4">1</td> <td rowspan="9">1</td> <td>00</td> <td>A1</td> <td>B1</td> <td>C1</td> <td>A2</td> <td>B2</td> <td>C2</td> <td>X</td> <td>A0</td> <td>B0</td> <td>C0</td> </tr> <tr> <td>01</td> <td>A0</td> <td>B0</td> <td>C0</td> <td>A2</td> <td>B2</td> <td>C2</td> <td>X</td> <td>A1</td> <td>B1</td> <td>C1</td> </tr> <tr> <td>10</td> <td>A2</td> <td>B2</td> <td>C2</td> <td>A1</td> <td>B1</td> <td>C1</td> <td>X</td> <td>A0</td> <td>B0</td> <td>C0</td> </tr> <tr> <td>11</td> <td>A0</td> <td>B0</td> <td>C0</td> <td>A1</td> <td>B1</td> <td>C1</td> <td>X</td> <td>A2</td> <td>B2</td> <td>C2</td> </tr> <tr> <td colspan="3">LANE_SEL[1:0]</td><td colspan="5">D-PHY</td><td colspan="5">C-PHY</td></tr> <tr> <td colspan="3">00</td><td colspan="5">CP/CN, D0N/D0P</td><td colspan="5">A0/B0/C0</td></tr> <tr> <td colspan="3">01</td><td colspan="5">CP/CN, D0N/D0P, D1N/D1P</td><td colspan="5">A0/B0/C0, A1/B1/C1</td></tr> <tr> <td colspan="3">10</td><td colspan="5">CP/CN, D0N/D0P, D1N/D1P, D2N/D2P</td><td colspan="5" rowspan="6">A0/B0/C0, A1/B1/C1, A2/B2/C2</td></tr> <tr> <td colspan="3">11</td><td colspan="10" rowspan="5">CP/CN, D0N/D0P, D1N/D1P, D2N/D2P, D3N/D3P</td></tr> <tr> <td>EXT_DVDD_EN</td><td>I</td><td colspan="12"> <ul style="list-style-type: none"> <li>VDD Power Mode Selection</li> <li>- 0 : Internal VDD mode (Default), 1 : External VDD mode</li> </ul> </td></tr> <tr> <td>SWIRE2</td><td>O</td><td colspan="12"> <ul style="list-style-type: none"> <li>Swire protocol setting pin of Power IC (ELVSS, ELVDD)</li> <li>Leave it open when not used</li> </ul> </td></tr> <tr> <td>SWIRE</td><td>O</td><td colspan="12"> <ul style="list-style-type: none"> <li>Power IC enable control pin (AVDD)</li> <li>Leave it open when not used</li> </ul> </td></tr> <tr> <td>GPO[3:0]</td><td>O</td><td colspan="12"> <ul style="list-style-type: none"> <li>Default setting: GPO[0]=Vsync; 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SWIRE2	O	<ul style="list-style-type: none"> <li>Swire protocol setting pin of Power IC (ELVSS, ELVDD)</li> <li>Leave it open when not used</li> </ul>																																																																																																																																																																																																																																																																																																																														
SWIRE	O	<ul style="list-style-type: none"> <li>Power IC enable control pin (AVDD)</li> <li>Leave it open when not used</li> </ul>																																																																																																																																																																																																																																																																																																																														
GPO[3:0]	O	<ul style="list-style-type: none"> <li>Default setting: GPO[0]=Vsync; GPO[1]=Hsync; GPO[2]=TE; GPO[3]=Error Flag activated and selected by register command.</li> <li>Leave it open when not used</li> </ul>																																																																																																																																																																																																																																																																																																																														

\*NOTE: "1" = VDDI level, "0" = VSS level.

## 4.5 Pins for Analog Output of OLED Display Driving

Symbol	I/O	Description
S<1> ~ S<2560>	O	<ul style="list-style-type: none"> <li>• Source driver output pins</li> </ul>
GOUT1_L ~ GOUT16_L	O	<ul style="list-style-type: none"> <li>• Panel control pins from GOA driver</li> </ul>
GOUT1_R ~ GOUT16_R	O	<ul style="list-style-type: none"> <li>• Panel control pins from GOA driver</li> </ul>
VINIT_A_L/R	O	<ul style="list-style-type: none"> <li>• Initial voltage or reference voltage used for OLED panel.</li> <li>• This pad can be output VH_A or VL_A voltage.</li> <li>• If not used, please open these pins</li> </ul>
VINIT_B_L/R	O	<ul style="list-style-type: none"> <li>• Initial voltage or reference voltage used for OLED panel.</li> <li>• This pad can be output VH_B or VL_B voltage.</li> <li>• If not used, please open these pins</li> </ul>
VINIT_C_L/R	O	<ul style="list-style-type: none"> <li>• Initial voltage or reference voltage used for OLED panel.</li> <li>• This pad can be output VL_C voltage.</li> <li>• If not used, please open these pins</li> </ul>
S_L/R_TEST	O	<ul style="list-style-type: none"> <li>• Source output monitoring pad for test purpose, activated by command.</li> <li>• If not used, please open these pins</li> </ul>

## 4.6 Pins for DC/DC Convert Pins

Symbol	I/O	Description
VGH1	O	<ul style="list-style-type: none"> <li>• LDO output used for GOA</li> <li>• Connect a stabilizing capacitor</li> </ul>
VGH2	O	<ul style="list-style-type: none"> <li>• LDO output used for GOA</li> <li>• Connect a stabilizing capacitor</li> </ul>
VDD	O	<ul style="list-style-type: none"> <li>• LDO output used for logic circuit</li> <li>• Connect a stabilizing capacitor</li> </ul>
VDDM	O	<ul style="list-style-type: none"> <li>• LDO output used for MIPI block</li> <li>• Connect a stabilizing capacitor</li> </ul>
VDDP	O	<ul style="list-style-type: none"> <li>• LDO output used for OSC block</li> <li>• Connect a stabilizing capacitor</li> </ul>
VH_A	O	<ul style="list-style-type: none"> <li>• Internal regulator output for panel</li> <li>• Connect a stabilizing capacitor</li> <li>• If not used, please open these pins</li> </ul>
VL_A	O	<ul style="list-style-type: none"> <li>• Internal regulator output for panel</li> <li>• Connect a stabilizing capacitor</li> <li>• If not used, please open these pins</li> </ul>
VH_B	O	<ul style="list-style-type: none"> <li>• Internal regulator output for panel</li> <li>• Connect a stabilizing capacitor</li> <li>• If not used, please open these pins</li> </ul>
VL_B	O	<ul style="list-style-type: none"> <li>• Internal regulator output for panel</li> <li>• Connect a stabilizing capacitor</li> <li>• If not used, please open these pins</li> </ul>
VL_C	O	<ul style="list-style-type: none"> <li>• Internal regulator output for panel</li> <li>• Connect a stabilizing capacitor</li> <li>• If not used, please open these pins</li> </ul>
VREG1	O	<ul style="list-style-type: none"> <li>• LDO output used for source driver grayscale reference voltage.</li> <li>• Connect a stabilizing capacitor</li> </ul>

VGS	O	<ul style="list-style-type: none"> <li>LDO output used for source driver grayscale reference voltage.</li> <li>Connect a stabilizing capacitor</li> </ul>
VREF15	O	<ul style="list-style-type: none"> <li>LDO output for internal reference voltage</li> <li>Connect a stabilizing capacitor</li> </ul>
GREF45	O	<ul style="list-style-type: none"> <li>LDO output for internal reference voltage</li> <li>Connect a stabilizing capacitor</li> </ul>
L_ELVDD	O	<ul style="list-style-type: none"> <li>Internal regulator output for panel</li> <li>Connect a stabilizing capacitor</li> </ul>
I_ELVDD	O	<ul style="list-style-type: none"> <li>Internal regulator output for panel</li> <li>Connect a stabilizing capacitor</li> </ul>
I_ELVSS	O	<ul style="list-style-type: none"> <li>Internal regulator output for panel</li> <li>Connect a stabilizing capacitor</li> </ul>
VGL1	O	<ul style="list-style-type: none"> <li>Output voltage from step-up circuit which generate VGL1</li> <li>Connect a stabilizing capacitor</li> </ul>
VGL2	O	<ul style="list-style-type: none"> <li>LDO output used for GOA</li> <li>Connect a stabilizing capacitor</li> </ul>
VOUT2	O	<ul style="list-style-type: none"> <li>Output voltage from step-up circuit which generate VOUT2</li> <li>Connect a stabilizing capacitor</li> </ul>
VOUT4	O	<ul style="list-style-type: none"> <li>Output voltage from step-up circuit which generate VOUT4</li> <li>Connect a stabilizing capacitor</li> </ul>
C21P / C21N	O	<ul style="list-style-type: none"> <li>Capacitor connection pins for the step-up circuit which generate VOUT2</li> </ul>
C22P / C22N	O	
C31P / C31N	O	
C32P / C32N	O	<ul style="list-style-type: none"> <li>Capacitor connection pins for the step-up circuit which generate VGL</li> </ul>
C41P / C41N	O	
C42P / C42N	O	<ul style="list-style-type: none"> <li>Capacitor connection pins for the step-up circuit which generate VOUT4</li> </ul>

## 4.7 Test Pins

Symbol	I/O	Description
PCD_L PCD_R	O	<ul style="list-style-type: none"> <li>• PCD pins for measuring panel resistor.</li> <li>• Leave them open when not used.</li> <li>• Connect a stabilizing capacitor.</li> </ul>
PCD2_L PCD2_R	O	<ul style="list-style-type: none"> <li>• PCD2 pins for measuring panel resistor.</li> <li>• Leave them open when not used.</li> </ul>
TEST[4:0], TS0,2,5	I	<ul style="list-style-type: none"> <li>• Test pins, not accessible to user.</li> <li>• Must be floating for normal using.</li> </ul>
TS3,4	O	<ul style="list-style-type: none"> <li>• Test pins, not accessible to user.</li> <li>• Must be floating for normal using.</li> </ul>
EXT_OSC	I	<ul style="list-style-type: none"> <li>• Test pins, not accessible to user.</li> <li>• Must be Connected to floating or VSS for normal using</li> </ul>
DCLK	I	<ul style="list-style-type: none"> <li>• Pixel-clock</li> <li>• Should be connected to floating when not used</li> </ul>
DB[7:0]	I/O	<ul style="list-style-type: none"> <li>• Bi-directional data bus for DBI interface and DPI interface</li> <li>• Used for DPI-I/F or DBI-I/F</li> <li>• Leave it open when not used</li> </ul>
TVS_RDX	I	<ul style="list-style-type: none"> <li>• Read strobe (active low)</li> <li>• Used for DBI-I/F</li> <li>• Should be connected to VDDI or floating when not used</li> </ul>
THS_WRX	I	<ul style="list-style-type: none"> <li>• Write strobe (active low)</li> <li>• Should be connected to VDDI or floating when not used</li> </ul>
DnC	I	<ul style="list-style-type: none"> <li>• Data(high) or command(low) select</li> <li>• Should be connected to VDDI or floating when not used</li> </ul>
nCS	I	<ul style="list-style-type: none"> <li>• Chip select (active low)</li> <li>• Should be connected to VDDI or floating when not used</li> </ul>
BTM	I	<ul style="list-style-type: none"> <li>• Test pins, not accessible to user.</li> <li>• Must be Connected to DVSS for normal using</li> </ul>
HZ_OPT	I	<ul style="list-style-type: none"> <li>• Input pin to select discharge function for AVDD, ELVDD and ELVSS.</li> <li>• HZ_OPT=0 Discharge to GND during Reset Low / DSTB</li> <li>• HZ_OPT=1 Hi-Z during Reset Low / DSTB</li> </ul>
BIST_EN	I	<ul style="list-style-type: none"> <li>• Input pin for free-run mode control, internal weakly pull to DVSS.</li> <li>- BIST_EN=0: normal operation.</li> <li>- BIST_EN=1: free-run mode.</li> <li>• Leave it open or connected to DVSS for normal operation.</li> </ul>
FPS_EN	I	<ul style="list-style-type: none"> <li>•FPS_EN=0, FPS mode disable.</li> <li>•FPS_EN=1, FPS mode enable.</li> <li>•If not used, can be floating or connected to DVSS</li> </ul>
CPHY_EN	I	<ul style="list-style-type: none"> <li>•Input pin to select used MIPI interface.</li> <li>-CPHY_EN=0 MIPI D_PHY</li> <li>-CPHY_EN=1 MIPI C_PHY</li> </ul>
CASCADE_EN M_S	I	<ul style="list-style-type: none"> <li>•Input pins for driver IC application</li> <li>-CASCADE_EN=0; M_S=0 Single chip</li> <li>-CASCADE_EN=1; M_S=0 Cascade (Slave)</li> <li>-CASCADE_EN=1; M_S=1 Cascade (master)</li> </ul>
I_ELVDD_PVC	I	<ul style="list-style-type: none"> <li>•Input Pin to track ELVDD variation.</li> <li>•Connect to mid-end ELVDD from Panel.</li> <li>•If no used, please connect to U_ELVDD</li> </ul>
VS_OUT/IN, HS_OUT/IN CASCADEx_OUT/IN	I/O	<ul style="list-style-type: none"> <li>•Clock link pins when use cascade function. Leave them open when not used</li> <li>•Connect VS_OUT / IN together. Connect HS_OUT / IN together.</li> <li>•Connect CASCADEx_OUT and CASCADEx_IN together.</li> </ul>

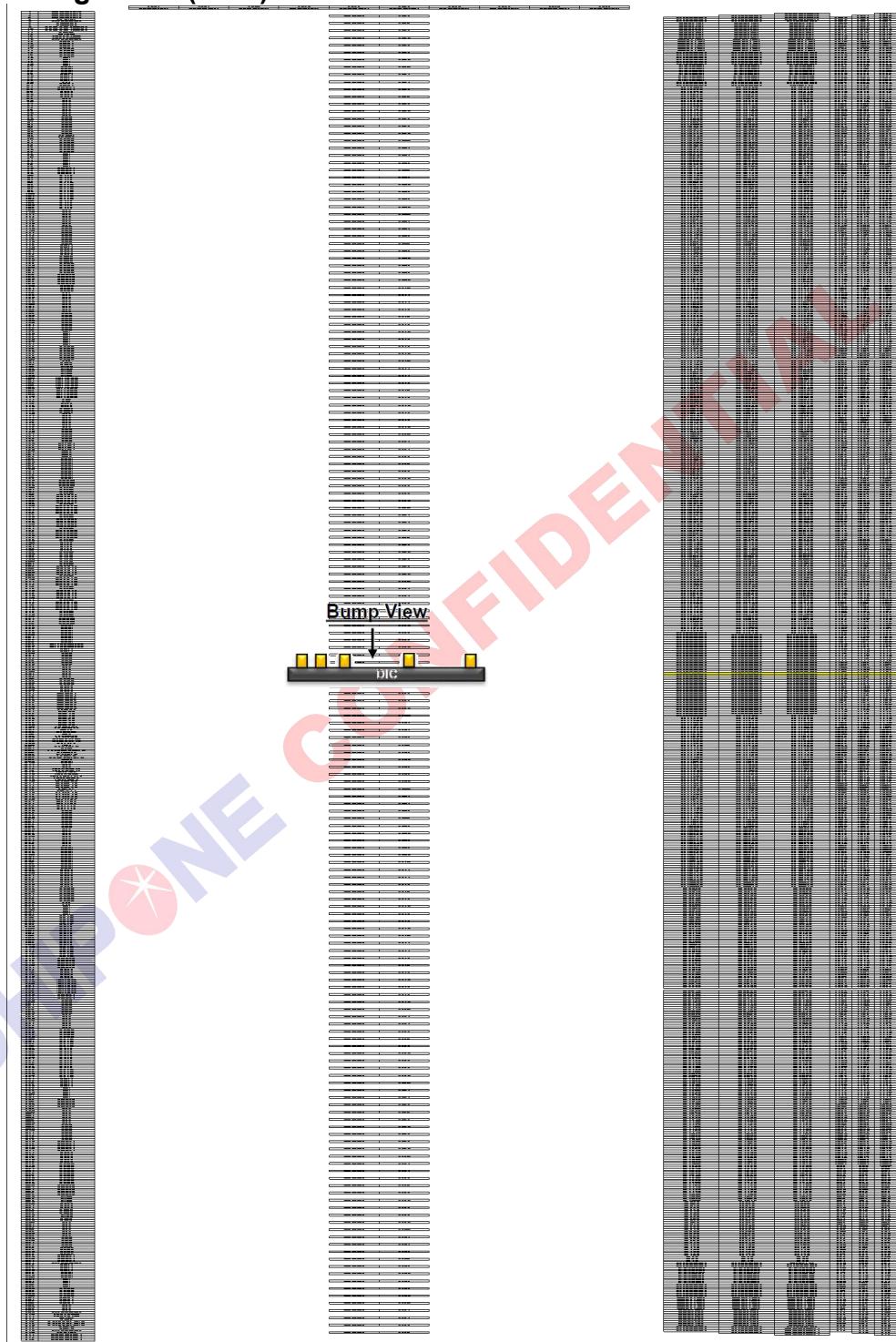
VGMA1~VGMA9		•Connect VGMAX of Master IC and Slave IC together.
CS_M/S, SCL_M/S, SDATA0_M/S, SDATA1_M/S	I/O	<ul style="list-style-type: none"> <li>•Link pins when use cascade function. Leave them open when not used</li> <li>•Connect CS_M and CS_S together. Connect SCL_M and SCL_S together</li> </ul>
TS7	O	• Dummy pin
VSSDUMMY	O	• Dummy pin
DUMMY_R1/R2	O	• SMT_L (Source output) and bonding res. for test pin
DUMMY_L3/L4	O	• SMT_R (Source output) and bonding res. for test pin
DUMMYO_R1/R2	O	• Dummy pin
DUMMYO_L3/L4	O	• Dummy pin
DUMMY_SL/SR	O	• Dummy pin
DUMMY	O	• Dummy pin

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## 5. PAD Specifications

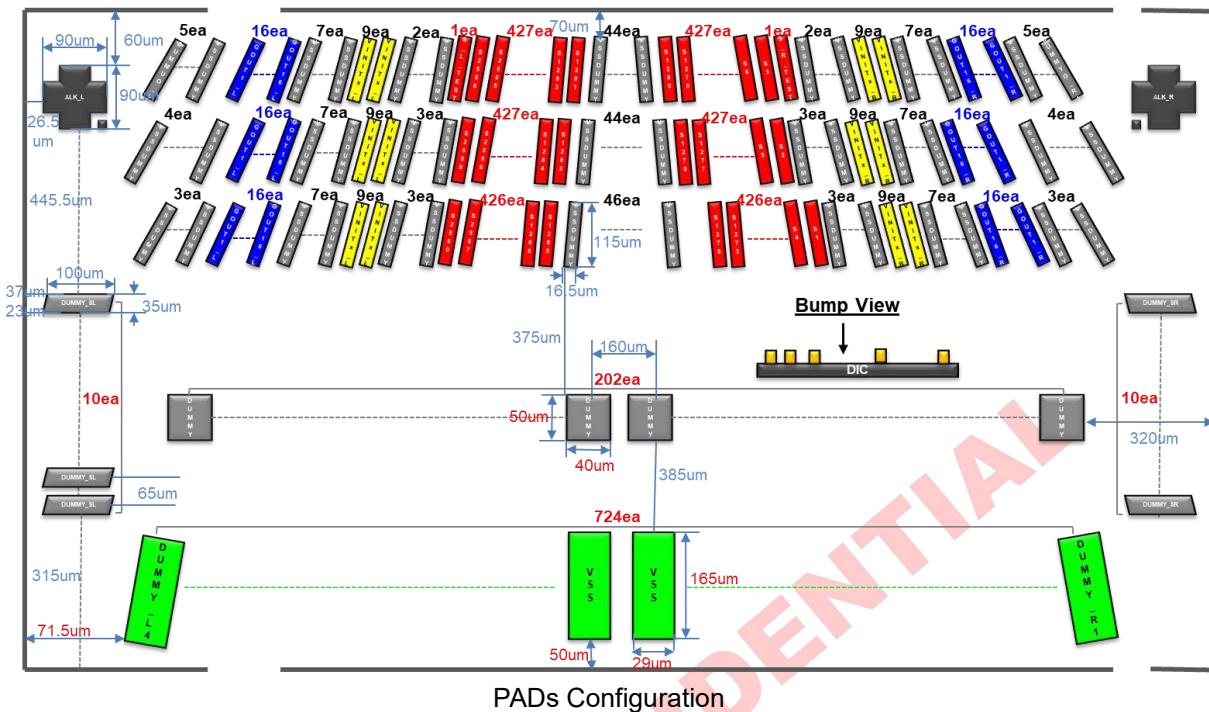
### 5.1 PAD Information

#### 5.1.1 PAD Assignment (COP)



Pad Assignments

### 5.1.2 PAD Configuration(COP)



Refer to Section Pad Coordinates.

### 5.1.3 Bump Information

Bump Information

Item	Pad No.	Size		Unit
		X (Length)	Y (Width)	
Pad Pitch	Input side	29	165	μm
	Output side1	16.5	115	
	Output side2	16.5	115	
	Output side3	16.5	115	
	Short Side	100	35	
	Center Side	40	50	
Bump Pad Height	Height	12um		
	Tolerance in chip	±2um		
Bump Dimple Height	-	TBD		
Chip thickness	-	Based on customer's requirement		

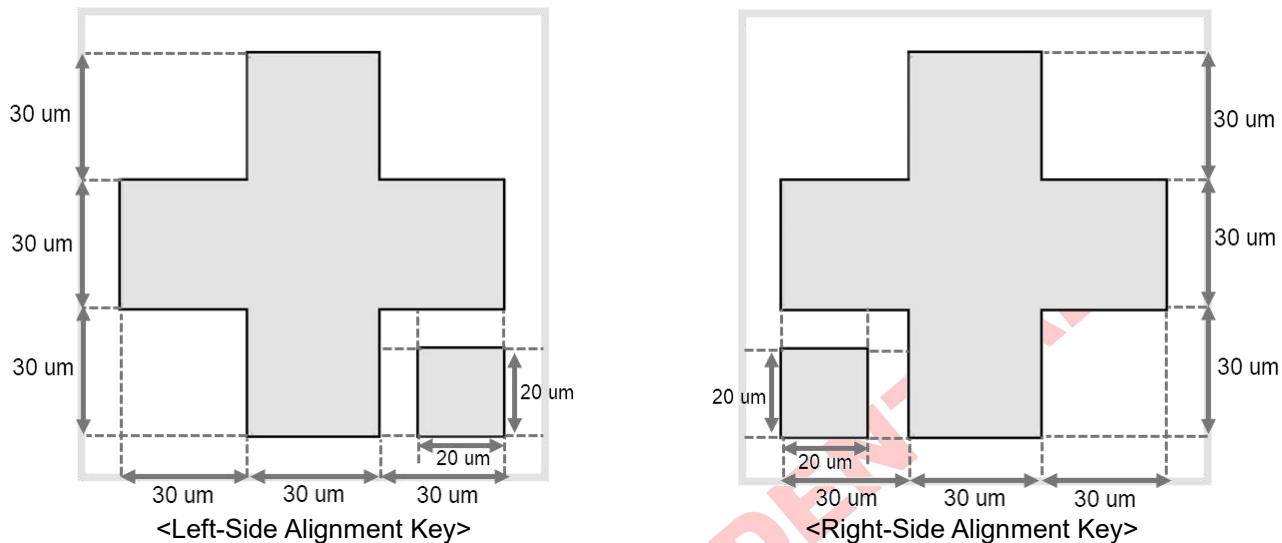
**\*NOTE:**

1. Dimension of bump pad size is based on bump TOP size.
2. Wafer thickness can be varied based on the customer's requirement.

### 5.1.4 Bump Dimension

\*NOTE: To get more detailed information for ICNA3512 bump pads arrangement and dimensions, please refer to the bump layout file, "ICNA3512\_COP\_BUMP.DXF".

### 5.1.5 Alignment Key



Alignment Key Coordinates

Item	Coordinates		Unit
	X	Y	
Left-side alignment key (Top)	-16348.5	670.5	μm
Right-side alignment key (Top)	16348.5	670.5	

## 6. Electrical Characteristics

### 6.1 Absolute Maximum Ratings

It defines the maximum operating conditions for the DDIC device. The values are based on experiments conducted with the devices and theoretical modeling of breakdown and damage mechanisms. The functional operation of the device is not implied for these conditions.

Absolute Maximum Ratings

Item	Symbol	Ratings	Unit
Supply Voltage for I/O	VDDI ~ VSS	TBD	V
LDO Output	VDD ~ VSS	TBD	V
LDO Output	VDDM ~ VSS	TBD	V
LDO Output	VDDP ~ VSSP	TBD	V
LDO Output	VH_A/B ~ AVSS	TBD	V
LDO Output	AVSS ~ VL_A/B	TBD	V
LDO Output	AVSS ~ VL_C	TBD	V
Supply Voltage for Analog	VCI ~ AVSS	TBD	V
Supply Voltage for Analog	AVDD ~ AVSS	TBD	V
Step-up Circuit	VOUT2 ~ AVSS	TBD	V
LDO Output	VGH ~ AVSS	TBD	V
Regulator Output	I_ELVDD ~ AVSS	TBD	V
LDO Output	VREG1 ~ AVSS	TBD	V
LDO Output	VGS ~ AVSS	TBD	V
Step-up Circuit	AVSS ~ VOUT4	TBD	V
Regulator Output	AVSS ~ I_ELVSS	TBD	V
Output	AVSS ~ VINIT_C	TBD	V
Step-up Circuit	AVSS ~ VGL1	TBD	V
Restriction	VOUT2 ~ VGL1	TBD	V
	AVSS ~ VGL1	TBD	V
	VH_A/B ~ VL_A/B	TBD	V
Supply Voltage for OTP	VPP ~ VSS	TBD	V
MIPI Differential Input	CLKP/CLKN DATAnP/DATAnN ~ VSSM	-0.3 to + 1.8	V
Input Voltage Range	V <sub>in</sub>	-0.3 to VDDI + 0.3	V
Output Voltage Range	V <sub>o</sub>	-0.3 to VDDI + 0.3	V
Operating Temperature	T <sub>opr</sub>	-40 to + 85	°C
Storage Temperature	T <sub>stg</sub>	-55 to + 125	°C

**\*NOTE:**

1. Absolute maximum ratings are the limit value of operating. Beyond those ranges, the IC cannot guarantee the safety. Conditions outside the range listed in the above table may cause permanent damage to the device, may not be recovered.
2. Absolute voltages are referenced to ground.
3. DATAnP/DATAnN, n = 0, 1, 2 and 3.

**\*CAUTION:**

Stresses beyond those listed under absolute maximum ratings may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under recommended operating conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability. Additionally, device operation at the absolute maximum ratings for extended periods of time may have adverse effects on the device.

## 6.2 DC Electrical Characteristics

DC Characteristics for Power Supply Voltage						
Category	Symbol	Condition	MIN	TYP	MAX	Unit
Supply Voltage for I/O	VDDI	—	1.65	1.80	1.95	V
Supply Voltage for Analog	VCI	—	2.65	3.00	3.60	V
Supply Voltage for Analog	AVDD	—	6.00	7.30	8.00	V
Supply Voltage for OTP	VPP	—	5.75	6.0	6.25	V

\*NOTE:  $T_A = -40$  to  $85^\circ\text{C}$

DC Characteristics for Generated Voltage						
Category	Symbol	Condition	MIN	TYP	MAX	Unit
LDO Output	VDD	-	1.05	1.15	1.25	V
LDO Output	VDDM	-	1.05	1.15	1.25	V
LDO Output	VDDP	-	1.05	1.15	1.25	V
LDO Output	VH_A/B	-	0.50	3.00	6.00	V
LDO Output	VL_A/B	-	-6.00	-3.00	-0.50	V
LDO Output	VL_C	-	-6.00	-3.00	-0.50	V
Step-up Circuit	VOUT2	-	7.50	8.00	15.00	V
Step-up Circuit	VGL1	-	-3.00	-7.00	-15.00	V
LDO Output	VGL2	-	-2.50	-6.50	-14.50	V
LDO Output	VGH1/2	-	3.00	7.00	14.50	V
Regulator Output	I(L)_ELVDD	-	2.60	4.60	5.70	V
LDO Output	VREG1	-	4.50	6.50	7.60	V
LDO Output	VGS	-	0.50	2.00	5.60	V
Step-up Circuit	VOUT4	-	-2.00	-4.00	-7.00	V
Regulator Output	I_ELVSS	-	-0.50	-1.50	-5.00	V
Regulator Output	VINIT_A/B	-	-6.00	-3.00	6.00	V
Regulator Output	VINIT_C	-	-0.50	-3.00	-6.00	V

\*NOTE:  $T_A = -40$  to  $85^\circ\text{C}$

DC Characteristic for Interface Signals						
Category	Symbol	Condition	MIN	TYP	MAX	Unit
Logic High Level Input Voltage	$V_{IH}$	—	$0.8 \times VDDI$	—	VDDI	V
Logic Low Level Input Voltage	$V_{IL}$	—	VSS	—	$0.2 \times VDDI$	V
Logic High Level Output Voltage	$V_{OH}$	$I_{OUT} = -1\text{mA}$	$0.8 \times VDDI$	—	VDDI	V
Logic Low level Output Voltage	$V_{OL}$	$I_{OUT} = +1\text{mA}$	VSS	—	$0.2 \times VDDI$	V
Logic High Level Leakage	$I_{IH}$	$V_{IN} = VDDI$	—	—	1.00	$\mu\text{A}$
Logic Low Level Leakage	$I_{IL}$	$V_{IN} = VSS$	-1.00	—	—	$\mu\text{A}$

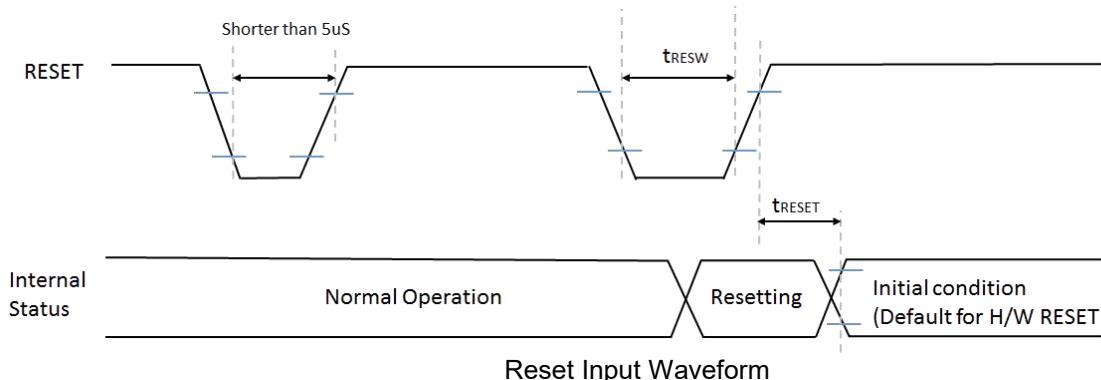
\*NOTE:  $T_A = -40$  to  $85^\circ\text{C}$

DC Characteristic for Source Output						
Category	Symbol	Condition	MIN	TYP	MAX	Unit
Source Output Range	S<n>	—	0.70	—	7.60	V
Source Output Deviation: mean value (channel to channel)	V <sub>DEV,POS</sub>	V <sub>SS</sub> + 0.7 V < V <sub>SO</sub> < AVDD – 0.5 V	—	—	TBD	mV

\*NOTE: T<sub>A</sub> = -40 to 85°C

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## 6.3 DC Characteristics for Reset



Reset Input Timing

Parameter	Symbol	Pin	Description	MIN	TYP	MAX	Unit
Reset low pulse width	$t_{RESW}$	nRESET		20	—	—	μs
Secure reset completion time	$t_{RESET}$	nRESET	Reset during Sleep In mode	—	—	5	ms
		nRESET	Reset during Sleep Out mode	—	—	120	ms
Reset un-reacted pulse width		nRESET		—	—	5	μs

**\*NOTE:**

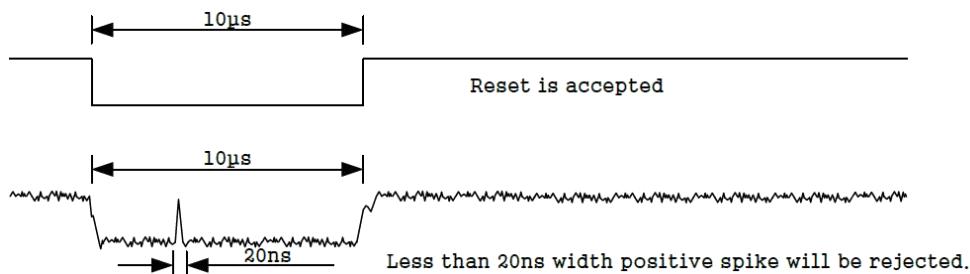
1. Spike due to an electrostatic discharge on RESET line does not cause irregular system reset according to the table as below.

RESET Pulse	
RESET Pulse	Action
Short than 5μs	Reset Rejected
Long than 20μs	Reset
Between 5μs and 20μs	Reset Start

2. During the resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120ms, when Reset Starts in sleep out mode. The display remains the blank state in sleep in mode) and then return to Default condition for H/W RESET.

3. During Reset Complete Time, values in OTP memory will be latched to internal register during this period. This loading is done every time when there is H/W RESET complete time ( $t_{RESET}$ ) within 5ms after a rising edge of RESET.

4. Spike Rejection also applies during a valid reset pulse as shown as below.



5. It is necessary to wait 5ms after releasing RESET before sending commands. Also Sleep Out command cannot be sent for 120m second.

6. There will be no abnormal visible effects on the display when S/W or H/W Reset is applied. Internal PoR (Power-on Reset) circuit generates a reset signal within 1ms after VDDI and VCI rise up to 90% of their typical value. It is necessary to wait 5m second after Power-on reset before sending commands; this is to allow time for OTP loading.

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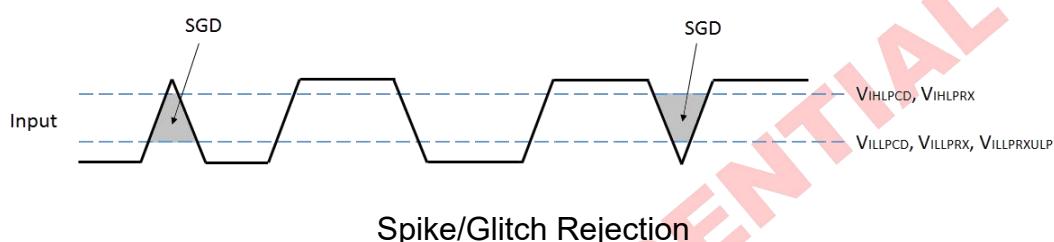
## 6.4 MIPI DSI Characteristics

### 6.4.1 DC Characteristics for MIPI DSI LP Mode

DC Characteristics for MIPI DSI LP Mode

Parameter	Symbol	Condition	Specification			Unit	Note
			MIN	TYP	MAX		
Logic high level input voltage	$V_{IHLPCD}$	LP-CD	450		1250	mV	
Logic Low level input voltage	$V_{ILLPCD}$	LP-CD			200	mV	
Logic high level input voltage	$V_{IHLPRX}$	LP-RX (CLK,D0)	740		1250	mV	
Logic Low level input voltage	$V_{ILLPRX}$	LP-RX (CLK,D0)			550	mV	
Logic Low level input voltage	$V_{ILLPRXULP}$	LP-RX(CLK ULP mode)			300	mV	
Logic high level input voltage	$V_{OHLPTX}$	LP-TX(D0)	1.1		1.25	V	
Logic Low level input voltage	$V_{OLLPTX}$	LP-TX(D0)	-50		50	mV	
Input pulse rejection	SGD	DSI-CLKP/N,DSI-DnP/N			300	Vps	1

\*Note: Peak interference amplitude max. is 200mV, and interference frequency min. is 450MHz.



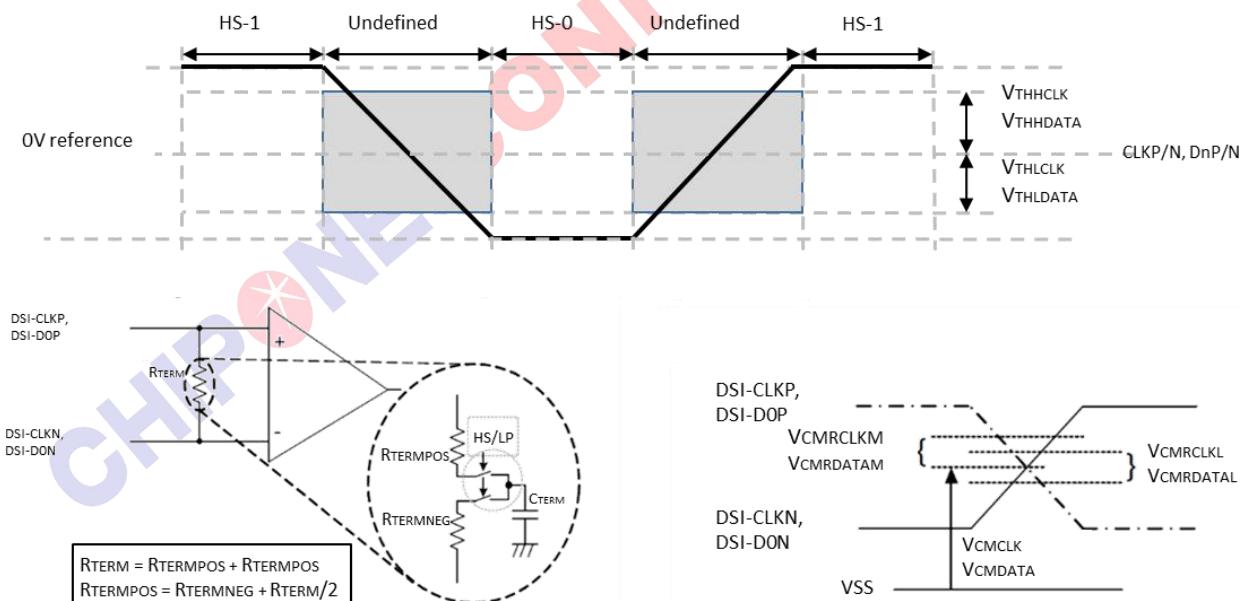
## 6.4.2 DC Characteristics for MIPI DSI HS Mode

DC Characteristics for MIPI DSI HS Mod

Parameter	Symbol	Condition	Specification			Unit	Note
			MIN	TYP	MAX		
Input voltage common mode range	$V_{CMCLK}$ $V_{CMDATA}$	CLKP/N, DnP/N	70		330	mV	1,2
Input voltage common mode variation ( $\leq 450\text{MHz}$ )	$V_{CMRCLKL}$ $V_{CMRDATAL}$	CLKP/N, DnP/N	-50		50	mV	3
Input voltage common mode variation ( $\geq 450\text{MHz}$ )	$V_{CMRCLKM}$ $V_{CMRDATAM}$	CLKP/N, DnP/N			100	mV	
Low-level differential input voltage threshold	$V_{THLCLK}$ $V_{THLDATA}$	CLKP/N, DnP/N	-70			mV	
High-level differential input voltage threshold	$V_{THHCLK}$ $V_{THHDATA}$	CLKP/N, DnP/N			70	mV	
Single-ended input low voltage	$V_{ILHS}$	CLKP/N, DnP/N	-40			mV	2
Single-ended input high voltage	$V_{IHHS}$	CLKP/N, DnP/N			460	mV	2
Differential input termination resistor	$R_{TERM}$	CLKP/N, DnP/N	80	100	125	$\Omega$	
Single-ended threshold voltage for termination enable	$V_{TERM\_EN}$	CLKP/N, DnP/N			450	mV	
Termination capacitor	$C_{TERM}$	CLKP/N, DnP/N			60	pF	

\*Note:

1. Includes 50mV (-50mV to 50mV) ground difference.
2. Without  $V_{CMRCLKM}$  /  $V_{CMRDATAM}$ .
3. Without 50mV (-50mV to 50mV) ground difference.
4. Dn = D0, D1, D2 and D3.

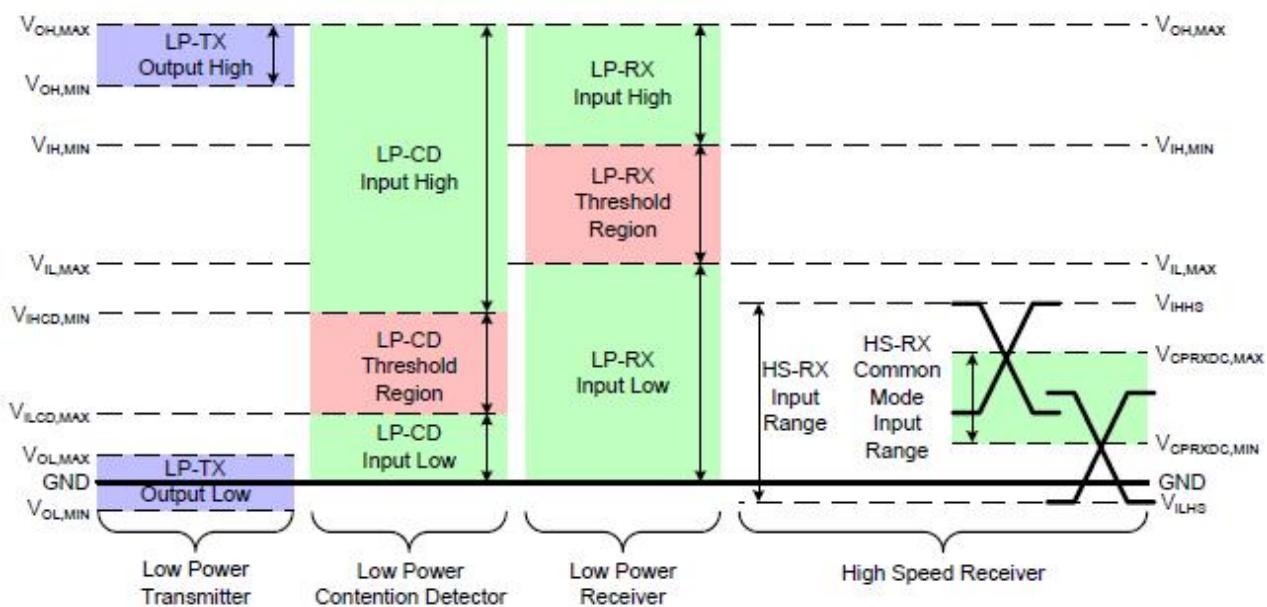


Differential voltage range, termination resistor and common mode voltage

### 6.4.3 DC Characteristics for C-PHY HS Mode

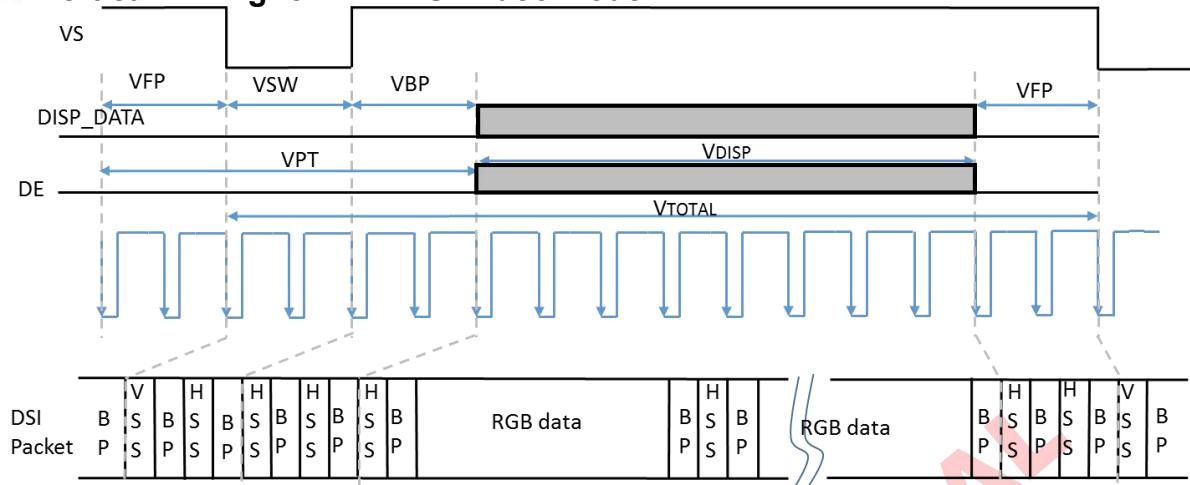
DC Characteristics for C-PHY HS Mode

Parameter	Symbol	Specification			Unit
		MIN	TYP	MAX	
Single-end input high voltage	VIHHS	-	-	535	mV
Common mode voltage	VCMRXDC	95	-	390	mV
Differential input impedance	ZID_AB,ZID_BC,ZID_CA	80	100	120	$\Omega$
Differential input high threshold	VIDTH	-	-	40	mV
Differential input low threshold	VIDTL	-40	-	-	mV
Single-end threshold for HS termination enable	VTERM-EN	-	-	450	mV



## 6.5 MIPI AC Timing Characteristics

### 6.5.1 Vertical Timing for MIPI DSI Video Mode

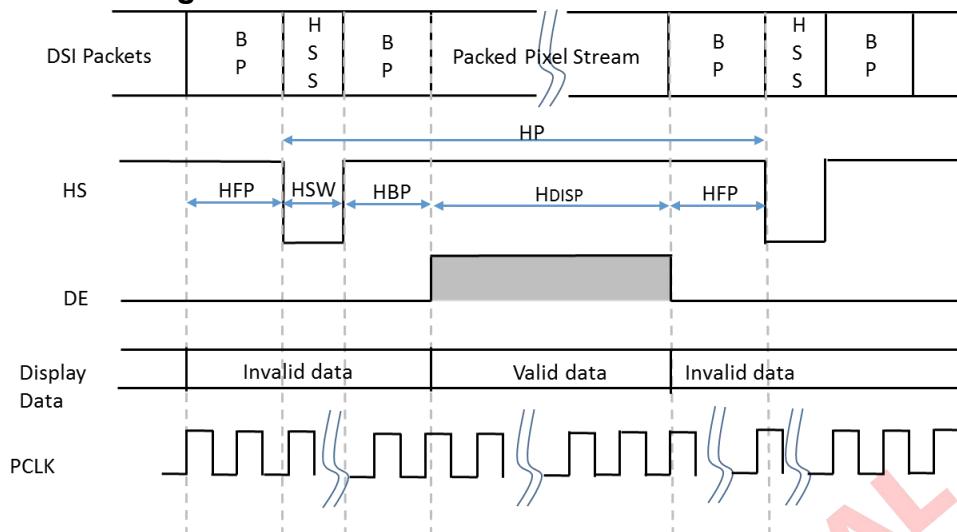


Vertical Timing for MIPI DSI Video Mode

Parameter	Symbol	Condition	Specification			Unit	Note
			MIN	TYP	MAX		
Vertical total	VTOTAL			2832		Line	
Vertical low pulse width	VSW			1		Line	1
Vertical front porch	VFP			16		Line	
Vertical back porch	VBP			15		Line	1
Vertical data start point		VSW+VBP		16		Line	1
Vertical blanking period	VPT	VSW+VBP+VFP		32		Line	
Vertical active area	VDISP			2800		Line	
Vertical frame rate	VFR			60		Hz	

\*Note: The VSW and VBP pulse width are related to GOA timing. The GOA timing must be set at corresponding position for normal display.

### 6.5.2 Horizontal Timing for MIPI DSI Video Mode

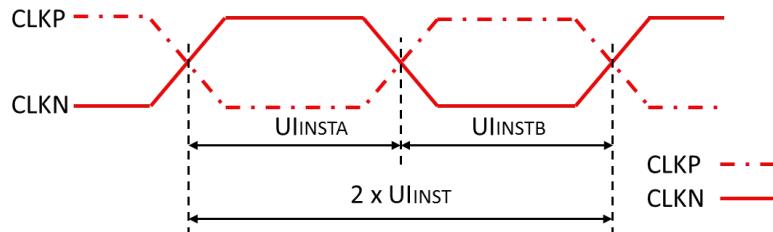


Horizontal Timing for MIPI DSI Video Mode

Parameter	Symbol	Condition	Specification			Unit	Note
			MIN	TYP	MAX		
HS low pulse width	HSW			TBD		nS	
Horizontal back porch	HBP			TBD		nS	
Horizontal front porch	HFP			TBD		nS	
Horizontal data start point		HSW+HBP		TBD		nS	
Horizontal blanking period	HBLK	HSW+HBP+HFP		TBD		nS	
Horizontal active area	HDISP			TBD		nS	

## 6.6 MIPI AC Characteristics

### 6.6.1 High-Speed Mode - Clock Timing

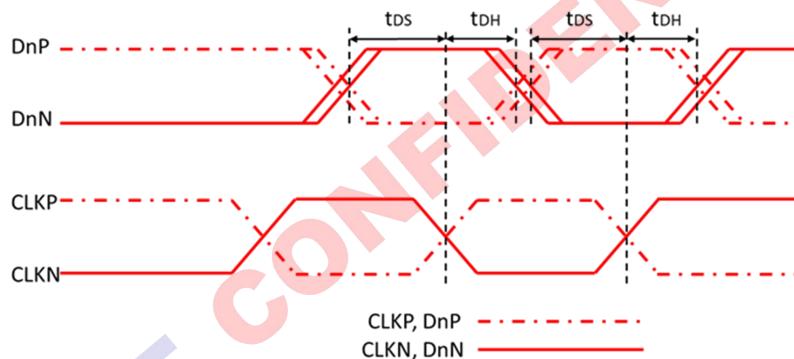


High-Speed Mode - Clock Timing

Signal	Symbol	Parameter	Specification			Unit	Note
			MIN	TYP	MAX		
CLK P/N	$2 \times UI_{INST}$	Double UI instantaneous	1.54		25	nS	
CLK P/N	$UI_{INSTA}, UI_{INSTB}$	UI instantaneous Half	0.77		12.5	nS	1

\*Note: UI =  $UI_{INSTA} = UI_{INSTB}$ .

### 6.6.2 High-Speed Mode - Clock / Data Timing

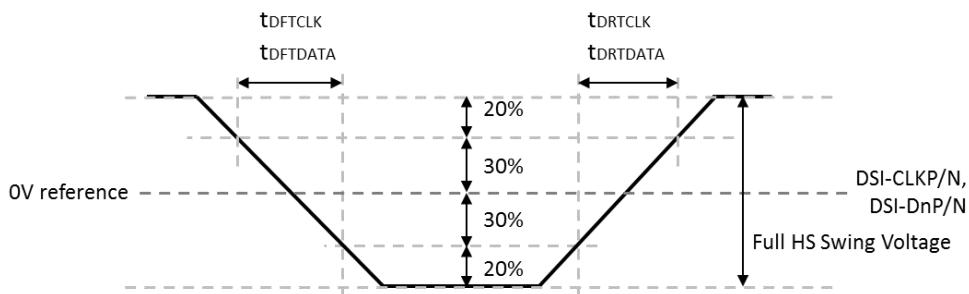


High-Speed Mode - Clock / Data Timing

Signal	Symbol	Parameter	Specification			Unit	Note
			MIN	TYP	MAX		
DnP/N	tds	Data to Clock Setup time	0.20*UI			UI	
	tDH	Clock to Data Hold time	0.20*UI			UI	

\*Note: Dn = D0, D1, D2 and D3.

### 6.6.3 High-Speed Mode - Rising and Falling Timing



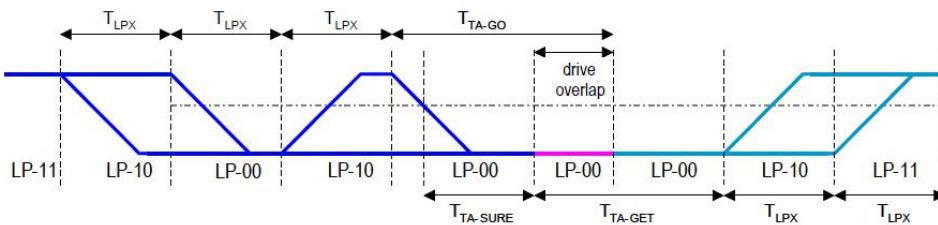
High-Speed Mode - Rising and Falling Timing

Parameter	Symbol	Conditions	Specification			Unit	Note
			MIN	TYP	MAX		
Differential Rise Time for Clock	tDRCLK	CLKP/N	150pS		0.3*UI		2,3
Differential Rise Time for Data	tDRDATA	DnP/N	150pS		0.3*UI		1,2,3
Differential Fall Time for Clock	tDFTCLK	CLKP/N	150pS		0.3*UI		2,3
Differential Fall Time for Data	tDFTDATA	DnP/N	150pS		0.3*UI		1,2,3

\*Note:

1. DnP/N, n = 0, 1, 2 and 3.
2. The display module has to meet timing requirements, which are defined for the transmitter (AP) on MIPI D-PHY standard.
3. DSİ-CLKP = CLKP. DSİ-CLKN = CLKN.
4. DSİ-DnP = DnP, n = 0, 1, 2 and 3. DSİ-DnN = DnN, n = 0, 1, 2 and 3.

#### 6.6.4 Low-Speed Mode - Bus Turn Around



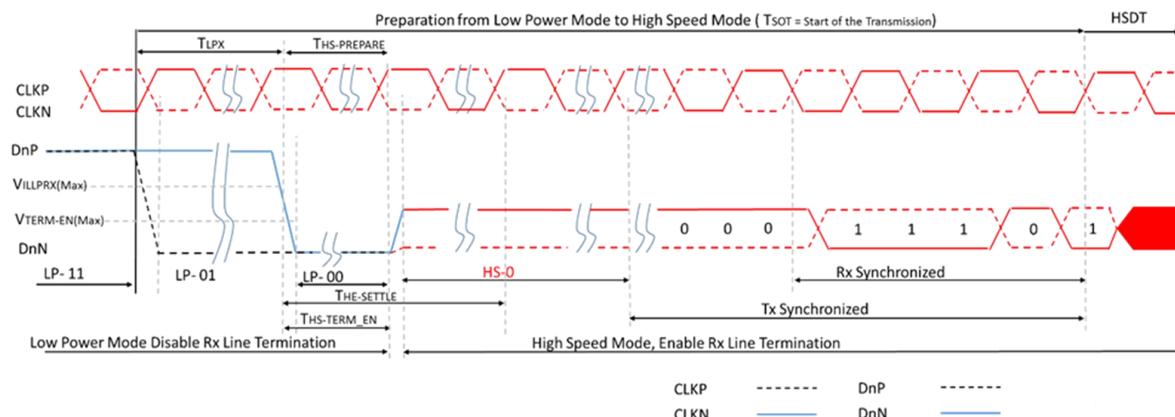
Bus Turn Around (BTA) Procedure

Low-Speed Mode - Bus Turn Around Timing

Signal	Symbol	Parameter	Specification			Unit	Note
			MIN	TYP	MAX		
D0P/N	$T_{LPX}$	Transmitted length of any Low-Power state period	50			nS	1
D0P/N	Ratio $T_{LPX}$	Ratio of $T_{LPX}(\text{MASTER})/T_{LPX}(\text{SLAVE})$ between Master and Slave side	2/3		3/2	-	1
D0P/N	$T_{TA\_SURE}$	Time that the new transmitter waits after the LP-10 state before transmitting the Bridge state (LP-00) during a Link Turnaround.	$T_{LPX}$		$2 * T_{LPX}$	nS	1
D0P/N	$T_{TA\_GET}$	Time that the new transmitter drives the Bridge state (LP-00) after accepting control during a Link Turnaround.	$5 * T_{LPX}$			nS	1
D0P/N	$T_{TA\_GO}$	Time that the transmitter drives the Bridge state (LP-00) before releasing control during a Link Turnaround.	$4 * T_{LPX}$			nS	1

\*Note: D0P = DS1-D0+, D0N = DS1-D0-.

### 6.6.5 Data Lanes from Low-Power Mode to High-Speed Mode

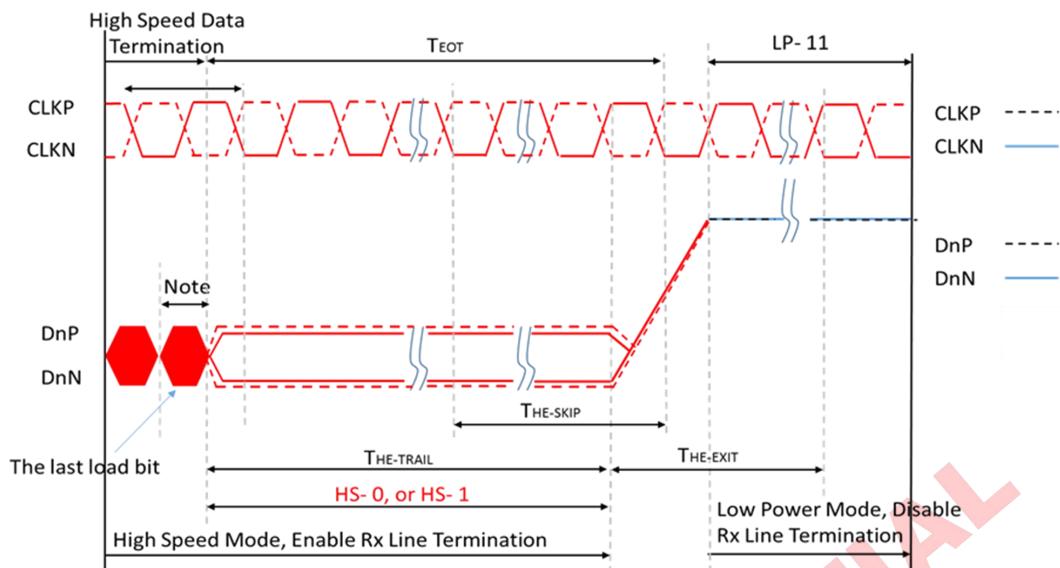


Data Lanes from Low-Power Mode to High-Speed Mode Timing

Signal	Symbol	Parameter	Specification			Unit	Note
			MIN	TYP	MAX		
DnP/N	T <sub>LPX</sub>	Length of any Low Power State Period	50			nS	1
DnP/N	T <sub>HS-PREPARE</sub>	Time to drive LP-00 to prepare for HS Transmission	40+4*UI		85+6*UI	nS	1
DnP/N	T <sub>HS-TREM-EN</sub>	Time to enable Data lane Receiver line termination measured from when Dn crosses VILMAX			35+4*UI	nS	1

\*Note: DnP/N, n = 0, 1, 2 and 3.

### 6.6.6 Data Lanes from High-Speed Mode to Low-Power Mode



Note:

If the last load bit is HS- 0, the transmitter changes from HS- 0 to HS- 1.

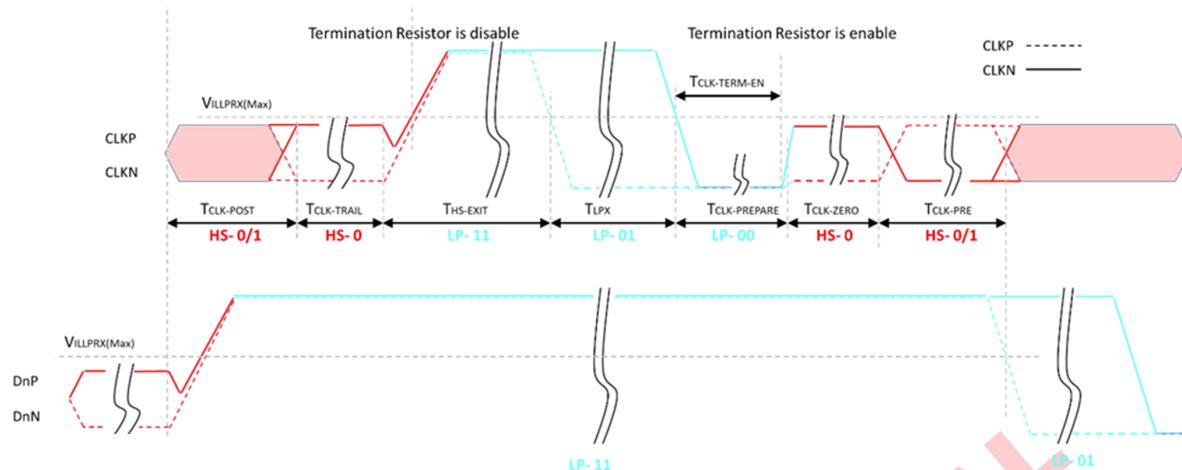
If the last load bit is HS- 1, the transmitter changes from HS- 1 to HS- 0

Data Lanes from High Speed Mode to Low Power Mode Timing

Signal	Symbol	Parameter	Specification			Unit	Note
			MIN	TYP	MAX		
DnP/N	T <sub>HS-SKIP</sub>	Time-Out at Display Module to ignore transition period of EoT	40		55+4*UI	nS	1
DnP/N	T <sub>THE-EXIT</sub>	Time to drive LP-11 after HS burst	100			nS	1

\*Note: DnP/N, n = 0, 1, 2 and 3.

### 6.6.7 DSI Clock Burst – High-Speed Mode to /from Low-Power Mode



DSI Clock Burst – High-Speed Mode to /from Low-Power Mode Timing

Signal	Symbol	Parameter	Specification			Unit	Note
			MIN	TYP	MAX		
CLKP/N	T <sub>CLK-POST</sub>	Time that the AP shall continue sending HS clock after the last associated Data Lanes has transitioned to LP mode	TBD			nS	
CLKP/N	T <sub>CLK-TRAIL</sub>	Time to drive HS differential state after last payload clock bit of a HS transmission burst	60			nS	
CLKP/N	T <sub>HS-EXIT</sub>	Time to drive LP-11 after HS burst	100			nS	
CLKP/N	T <sub>CLK-PREPARE</sub>	Time to drive LP-00 to prepare for HS transmission	38		95	nS	
CLKP/N	T <sub>CLK-TERM-EN</sub>	Time-out at Clock Lane to enable HS termination			38	nS	
CLKP/N	T <sub>CLK-PREPARE</sub> +T <sub>CLK-ZERO</sub>	Minimum lead HS-0 drive period before starting Clock	300			nS	
CLKP/N	T <sub>CLK-PRE</sub>	Time that the HS clock shall be driven prior to any associated Data Lane beginning the transition from LP to HS mode	8			UI	

\*Note: DnP/N, n = 0, 1, 2 and 3.

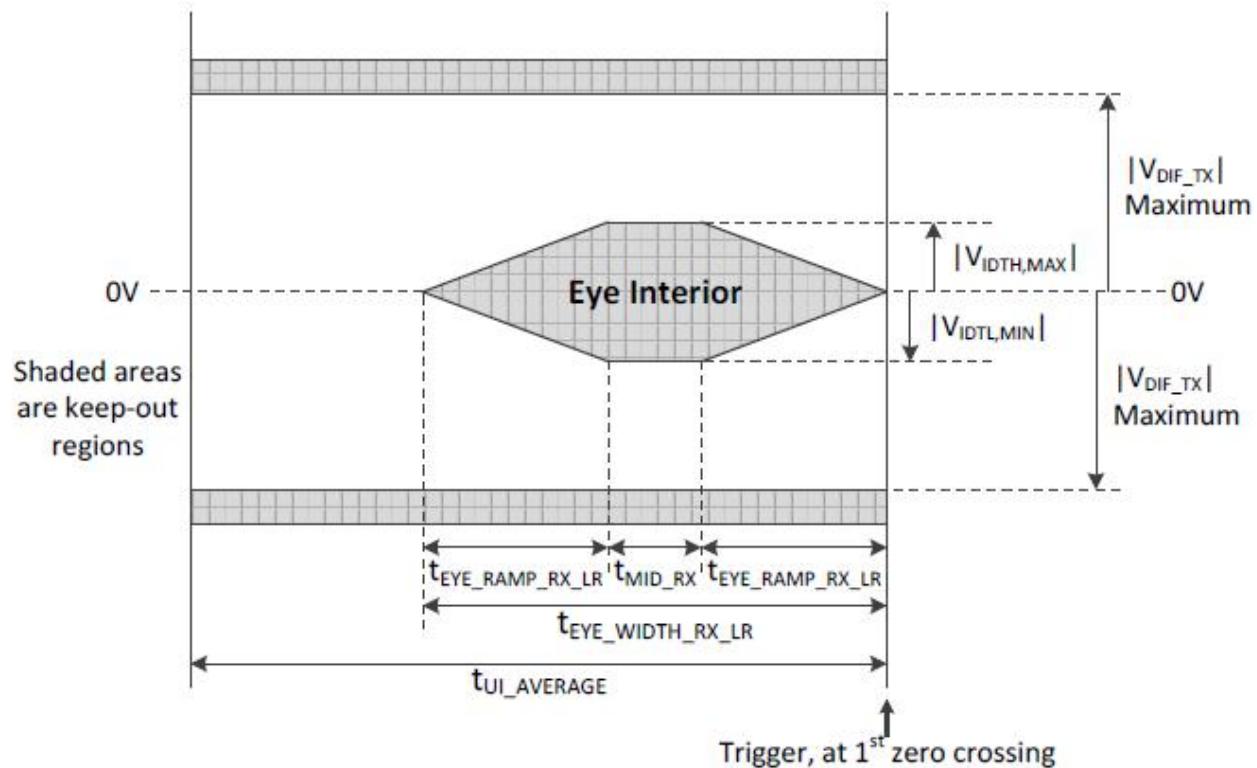
## 6.6.8 MIPI DSI2 Timing Characteristics

### 6.6.8.1 C-PHY High Speed Transmission

Symbol	Parameter	MIN	TYP	MAX	Unit
$t_{EYE\_RAMP\_RX\_LR}$	Eye ramp time at the receive	0.25	-	-	UI
$t_{EYE\_WIDTH\_RX\_LR}$	Eye width at the receive	0.5 (Note)	-	-	UI
$U_{INST}$	UI instantaneous	1	-	12.5	ns
$t_{UI\_AVERAGE}$	UI average	-	$U_{INST}$	-	ns

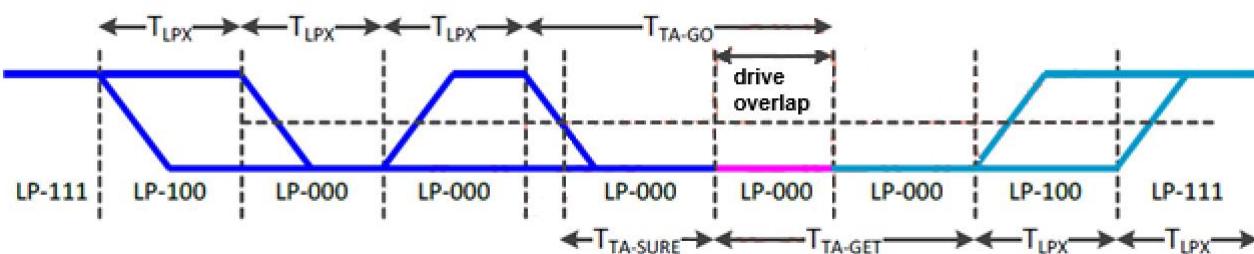
\*Note : 1.  $t_{EYE\_WIDTH\_RX\_LR} = 2*t_{EYE\_RAMP\_RX\_LR}+t_{MID\_RX}$

2.  $t_{MID\_RX}=t_{UI\_AVERAGE}-2500\text{ps}$ , at  $t_{UI\_AVERAGE}>2.5\text{ns}\sim12.5\text{ns}$



### 6.6.8.2 C-PHY Low Power Mode

Symbol	Parameter	MIN	TYP	MAX	Unit
<b>Turnaround Procedure</b>					
$T_{LPX}$	Transmitted length of any Low-Power state period	50			ns
Ratio_ $T_{LPX}$	Ratio of $T_{LPX}(\text{MASTER})/T_{LPX}(\text{SLAVE})$ between Master and Slave side	2/3		3/2	
$T_{TA-SURE}$	Time that the new transmitter waits after the LP-10 state before transmitting the Bridge state (LP-00) during a Link Turnaround.	$T_{LPX}$		$2xT_{LPX}$	ns
$T_{TA-GET}$	Time that the new transmitter drives the Bridge state (LP-00) after accepting control during a Link Turnaround.		$5xT_{LPX}$		ns
$T_{TA-GO}$	Time that the transmitter drives the Bridge state (LP-00) before releasing control during a Link Turnaround.		$4xT_{LPX}$		ns



### 6.6.8.3 C-PHY High Speed Transmission in Bursts

Symbol	Parameter	MIN	TYP	MAX	Unit
<b>High Speed Data Transmission in Bursts</b>					
t <sub>3-PREPARE</sub>	Time that the transmitter drives the 3-wire LP-000 line state immediately before the start of the HS transmission	38	-	95	ns
t <sub>3-TERM-EN</sub>	Time for the slave to enable the HS line termination, starting from the time point when the A, B and C wire cross V <sub>IL_MAX</sub>	Note4	-	38	ns
t <sub>3-SETTLE</sub>	Time interval during which the HS receiver should ignore any HS transitions on the lane, starting from the beginning of t <sub>3-PREPARE</sub>	95	-	300	ns
t <sub>HS-EXIT</sub>	Time that the transmitter drives LP-111 following a HS burst	100	-	-	ns
t <sub>LPX</sub>	Length of any Low-Power state period	50	-	-	ns
t <sub>3-POST</sub>	Time that the transmitter drives 4444444 after a HS burst	TBD	-	-	UI

\*Note 1) The minimum value depends on the symbol rate.

Implementations should ensure proper operation for all the supported symbol rates.

\*Note 2) UI means Unit Interval.

\*Note 3) TLPX is an internal state machine timing reference. Externally measured values may differ slightly from the specified values due to asymmetrical rise and fall times.

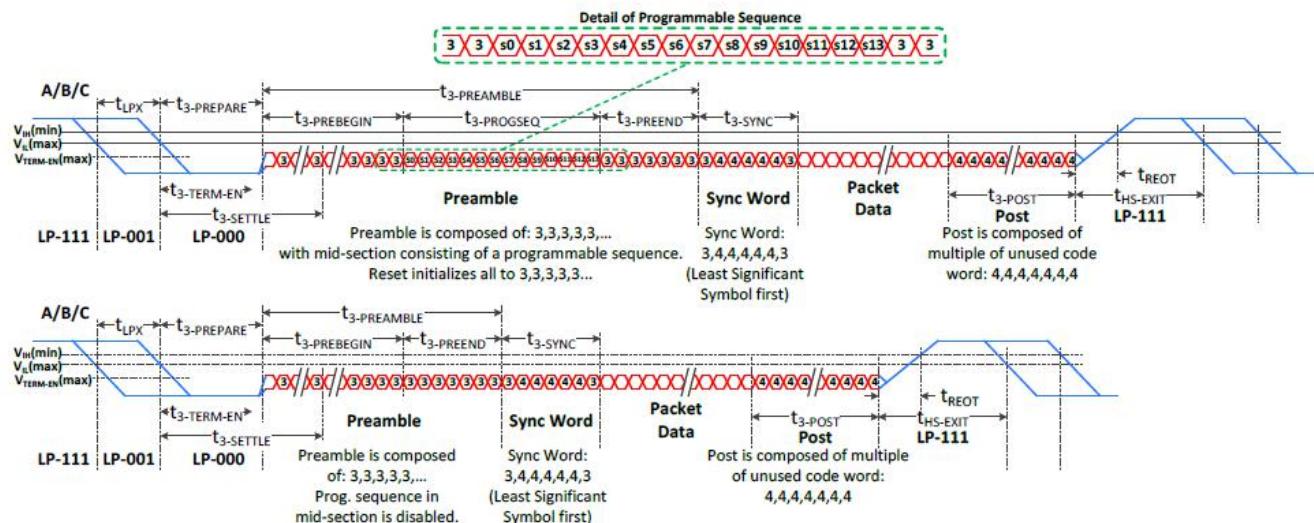
\*Note 4) Receiver termination impedances shall not be enabled until the single-ended voltages on all of A, B and C fall below VTERM-EN .

t<sub>3-PREPARE</sub> < t<sub>3-SETTLE</sub> < t<sub>3-PREPARE</sub> + t<sub>3-PREAMBLE</sub>

t<sub>3-PREAMBLE</sub> = t<sub>3-PREBEGIN</sub> + t<sub>3-PROGSEQ</sub> + t<sub>3-PREEND</sub>

t<sub>3-PROGSEQ</sub> = 14UI or 0UI

t<sub>3-SYNC</sub> = 7UI



## 6.7 ESD Protection Level

ESD Protection Level

Model	JEDEC	Level
Human Body Mode (HBM)	JESD22-A114-F	$\geq \pm 3KV$
Charged Device Mode (CDM)	JESD22-C101-D	$\geq \pm 800V$
Latch-up		150mA or $1.5*VDD_{max}$
TLP		500V or 4A

## 6.8 Latch-Up Protection Level

The device will not latch up at trigger current level less than  $\pm 150mA$ . (EIA/JESD78C)

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## 7. Interface Description

### 7.1 Interface Mode Selection

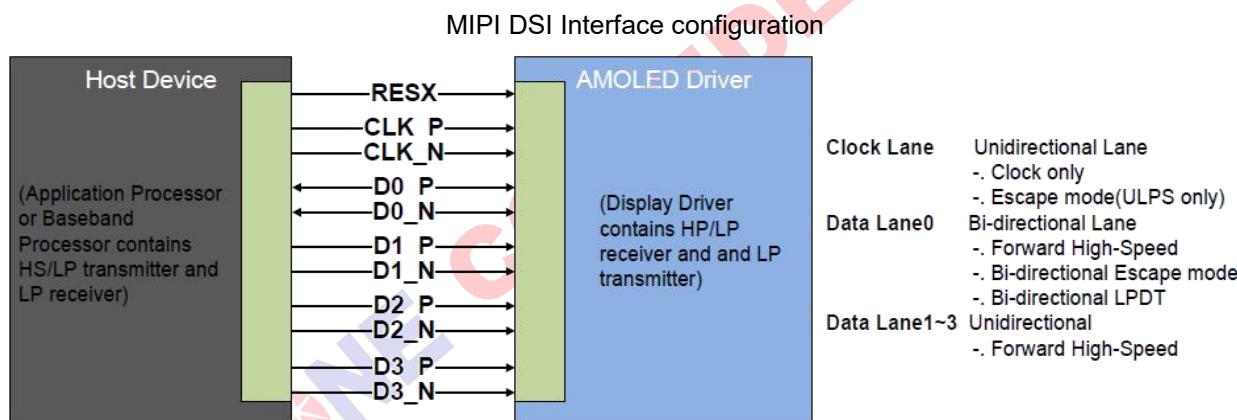
Following table shows the interface transfers instructions (include commands and parameters) and display data between the DDIC and the AP. This product supports the command transmission in MIPI mode through LPDT or HSDT.

Interface Mode Selection				
CPHY_EN	LANE_SEL[1:0]	Display Data transmitted by	Instruction transmitted by	Note
0	00	CP/CN, D0P/0N		
	01	CP/CN, D0P/D0N, D1P/D1N		-
	10	CP/CN, D0P/D0N, D1P/D1N, D2P/D2N		-
	11	CP/CN, D0P/D0N, D1P/D1N, D2P/D2N, D3P/D3N		Default
1	00	A0/B0/C0		-
	01	A0/B0/C0, A1/B1/C1		-
	1x	A0/B0/C0, A1/B1/C1, A2/B2/C2		Default

\*Note: IM1 should be connect "0"

## 7.2 MIPI Display Serial Interface (DSI)

MIPI DSI standard defines protocols between a host processor and Client peripheral devices that adhere to MIPI Alliance standards for mobile device interfaces. The DSI standard builds on existing standards by adopting pixel formats and command set defined in MIPI Alliance standards. DSI specifies the interface between a host processor and a peripheral such as a display module. It builds on existing MIPI Alliance specifications by adopting pixel formats and command set specified in DCS standards. The following figure shows a simplified DSI interface. From a conceptual viewpoint, a DSI-compliant interface performs the same functions as interfaces based on similar parallel display interfaces. It sends pixels or commands to the peripheral, and can read back status or pixel information from the peripheral. The main difference is that DSI serializes all pixel data, commands, and events that, in traditional or legacy interfaces, are normally conveyed to and from the peripheral on a parallel data bus with additional control signals. From a system or software point of view, the serialization and deserialization operations should be transparent. The most visible, and unavoidable, consequence of transformation to serial data and back to parallel is increased latency for transactions that require a response from the peripheral. For example, reading a pixel from the frame buffer on a display module has a higher latency using DSI. Another fundamental difference is the host processor's inability during a read transaction to throttle the rate, or size, of returned data.



### 7.2.1 MIPI DSI Feature

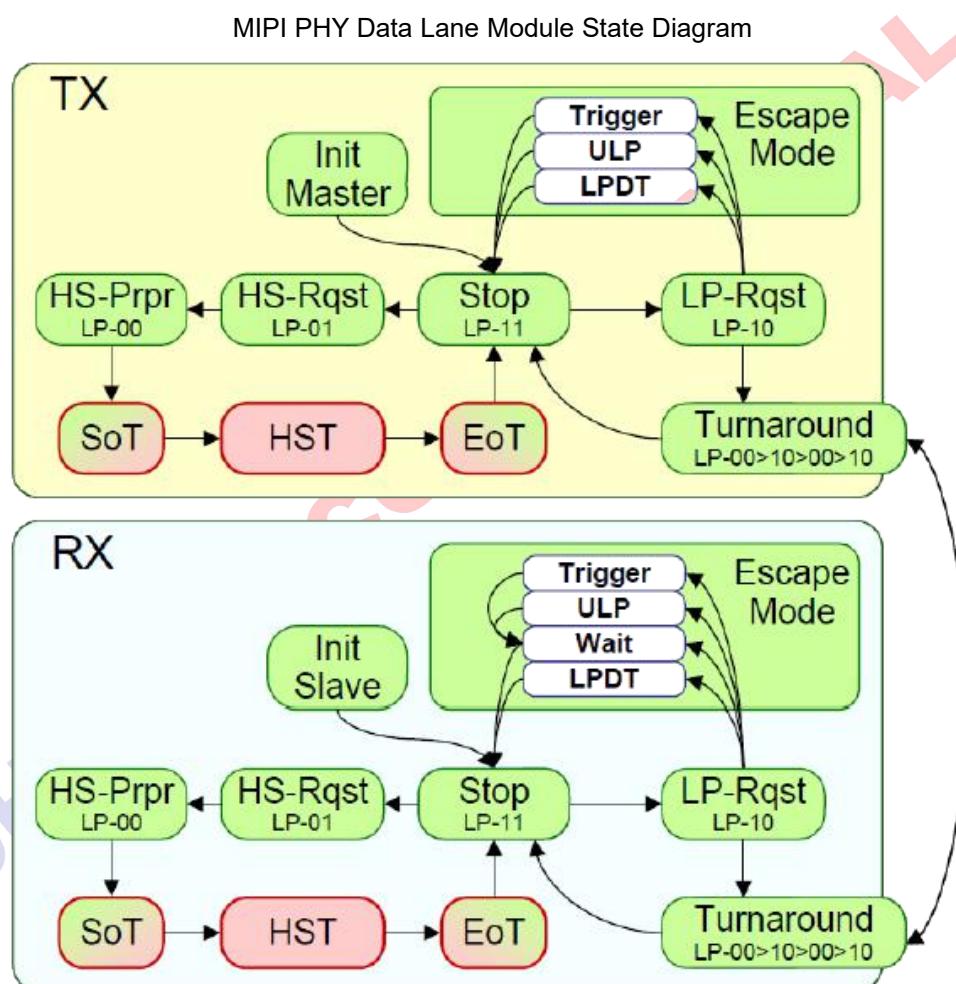
- 4 Data Lanes
- High Speed (HS) Transmission (Unidirectional)
- Low Power (LP) Transmission (Bidirectional)
- Command and Video modes are supported.
- Tearing effect (TE) signal is supported
- Diagnostic function – checksum and ECC error monitoring
- Functionality supported by Escape mode
- Packet-Based Protocol

## 7.2.2 MIPI DSI Physical Layer

The D-PHY provides a synchronous connection between master and slave. A practical PHY configuration consists of a clock signal and one or more data signals. The clock signal is unidirectional, originating at the master and terminating at the slave. The data signals can be either unidirectional or bi-directional, depending on the selected options. For half-duplex operation, the reverse direction bandwidth is one-fourth of the forward direction bandwidth. Token passing is used to control the communication direction of the link.

### 7.2.2.1 Global Operation Flow Diagram

The following figure shows the operational flow diagram for a Data Lane Module. Within both Tx and Rx four main processes can be distinguished: High-Speed Transmission, Escape mode, Turnaround and Initialization.



### 7.2.2.2 Lane State Definition

The display module uses data and clock lane differential pairs for DSI. Both differential lane pairs can be driven to Low Power (LP) or High Speed (HS) mode.

Low Power mode means that each line of the differential pair is used in the single ended mode, a differential receiver is disable (a termination resistor of the receiver is disable), and it can be driven into a low power mode. High Speed mode means that differential pairs (the termination resistor of the receiver is enable) are not used in the single ended mode. Different modes and protocols are used in each mode when transferring information from the AP to the display module and vice versa.

The State Codes of the High Speed (HS) and Low Power (LP) lane pair are defined as below.

**The State Codes of the High Speed (HS) and Low Power (LP) lane pair define**

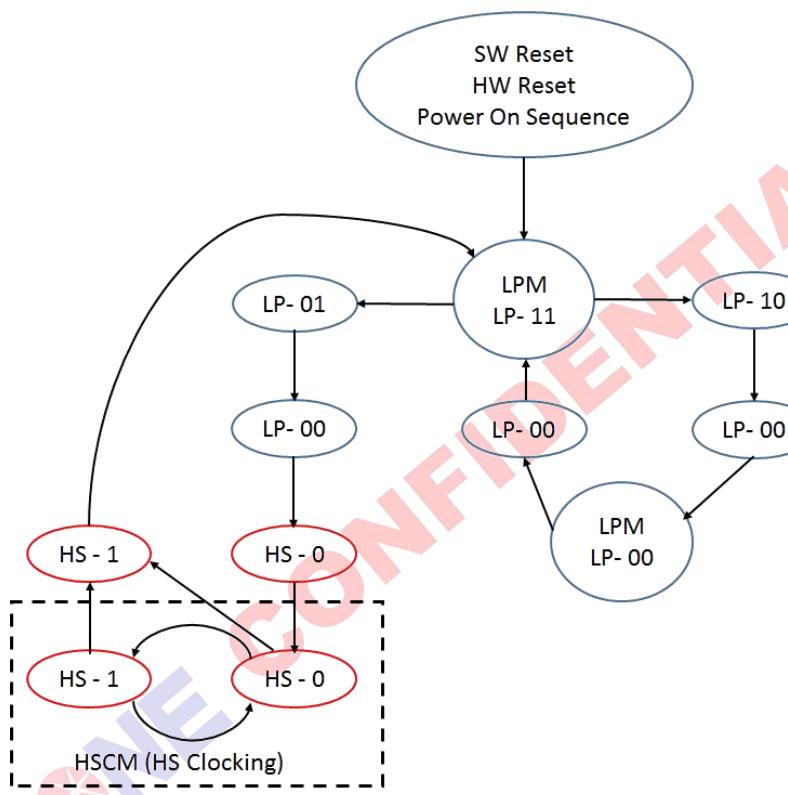
Lane Pair State Code	Line DC Voltage Levels		High Speed (HS)	Low Power	
	DATA_P	DATA_N		Burst Mode	Control Mode
HS-0	Low (HS)	High (HS)	Differential – 0	Note1	Note1
HS-1	High (HS)	Low (HS)	Differential – 1	Note1	Note1
LP-00	Low (LP)	Low (LP)	Not Defined	Bridge	Space
LP-01	Low (LP)	High (LP)	Not Defined	HS-Request	Mark-0
LP-10	High (LP)	Low (LP)	Not Defined	LP-Request	Mark-1
LP-11	High (LP)	High (LP)	Not Defined	Stop	Note 2

**\*Note:**

1. Low-Power Receivers (LP-Rx) of the lane pair will check the LP-00 state code when the Lane Pair is in the High Speed (HS) mode.
2. If Low-Power Receivers (LP-Rx) of the lane pair recognizes the LP-11 state code, then the lane pair will return to LP-11 of the Control Mode.
3. n = 0, 1, 2 and 3 (D1P/N, D2P/N and D3P/N lanes only for HS-0 and HS-1).

### 7.2.2.3 Clock Lane Module State

CLKP/N lanes can be driven into three different power modes: Low Power Mode (LPM), Ultra-Low Power Mode (ULPM) and High Speed Clock Mode (HSCM). Clock lane is in the single ended mode (LP = Low Power) when entering or leaving Low Power Mode (LPM) or Ultra-Low Power Mode (ULPM). Clock lane is in the single ended mode (LP = Low Power) when entering in or leaving High Speed Clock Mode (HSCM). These entering and leaving protocols use Clock lane in the single ended mode to generate an entering or leaving sequence. The principal flow chart of the different Clock lane power modes is illustrated as below.

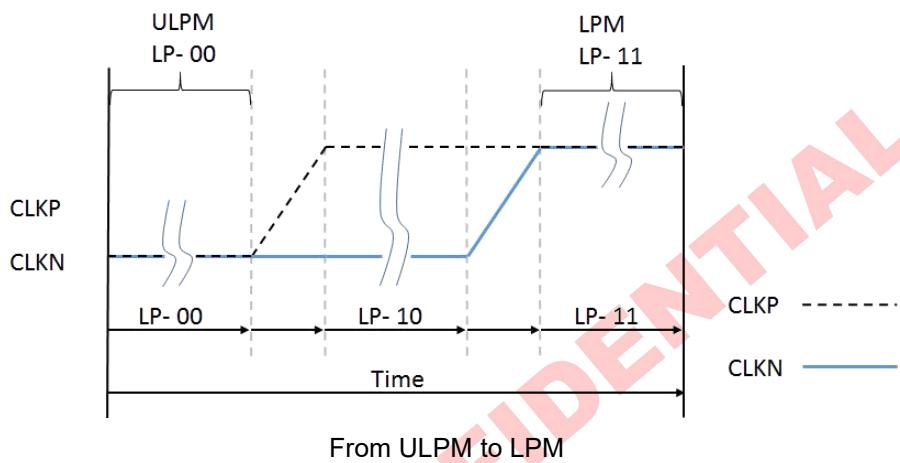


Clock Lane Module State Diagram

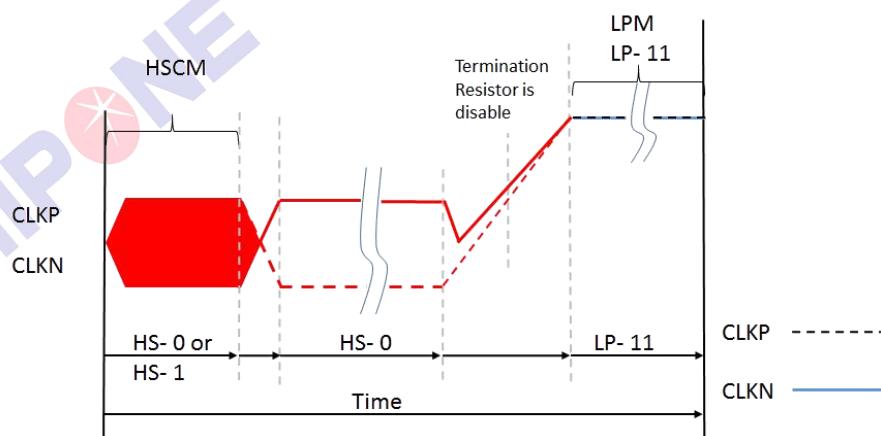
#### 7.2.2.4 Low Power Mode (LPM)

CLKP/N lanes can be driven to the Low Power Mode (LPM), when CLKP/N lanes enter LP-11 State Code, in three different ways:

- 1) After SW Reset, HW Reset or Power On Sequence => LP-11.
- 2) After CLKP/N lanes leave Ultra-Low Power Mode (ULPM, LP-00 State Code) => LP-10 => LP-11 (LPM). This sequence is illustrated as below.

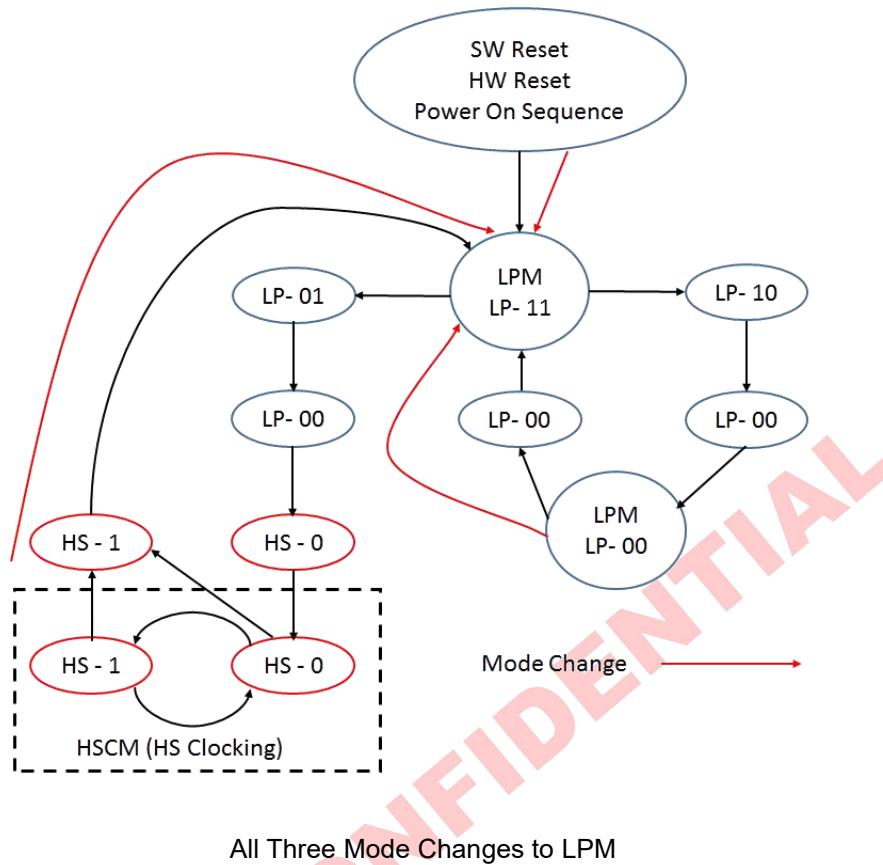


- 3) After CLKP/N lanes leave High Speed Clock Mode (HSCM, HS-0 or HS-1 State Code) => HS-0=> LP-11 (LPM). This sequence is illustrated as below.



From High Speed Clock Mode (HSCM) to LPM

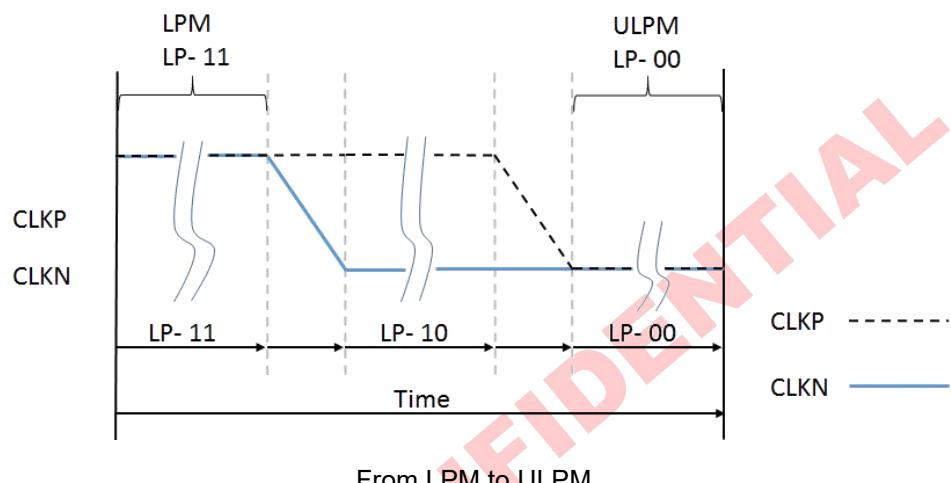
The changes of all the three modes are illustrated in the flow chart as below.



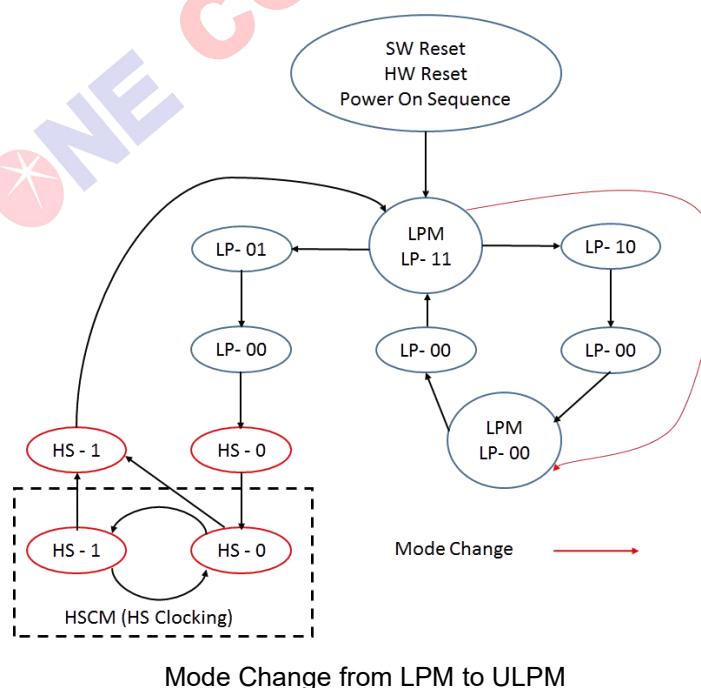
### 7.2.2.5 Ultra-Low Power Mode (ULPM)

CLKP/N lanes can be driven to the Low Power Mode (LPM), when CLKP/N lanes enter LP-11 State Code, in three different ways:

- 1) After SW Reset, HW Reset or Power On Sequence => LP-11.
  - 2) After CLKP/N lanes leave Ultra-Low Power Mode (ULPM, LP-00 State Code) => LP-10 => LP-11 (LPM).
- This sequence is illustrated as below.



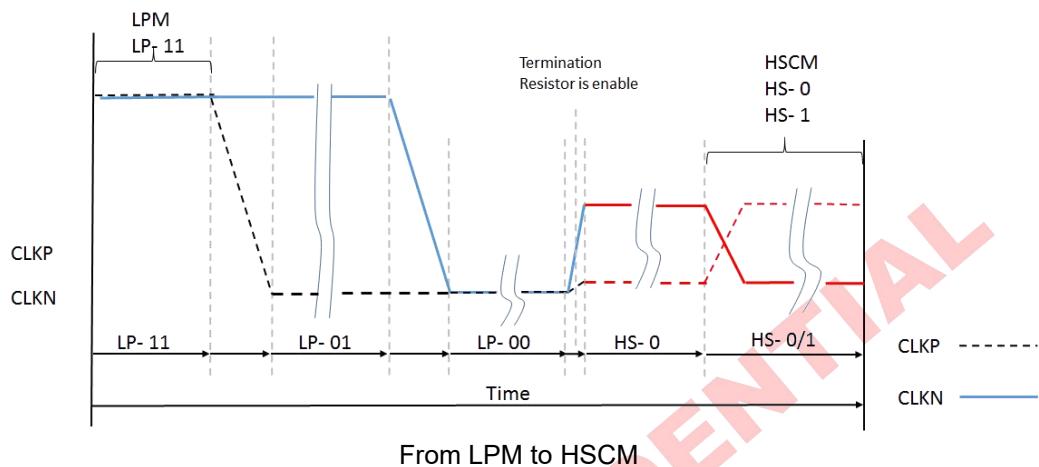
The mode change is also illustrated as below.



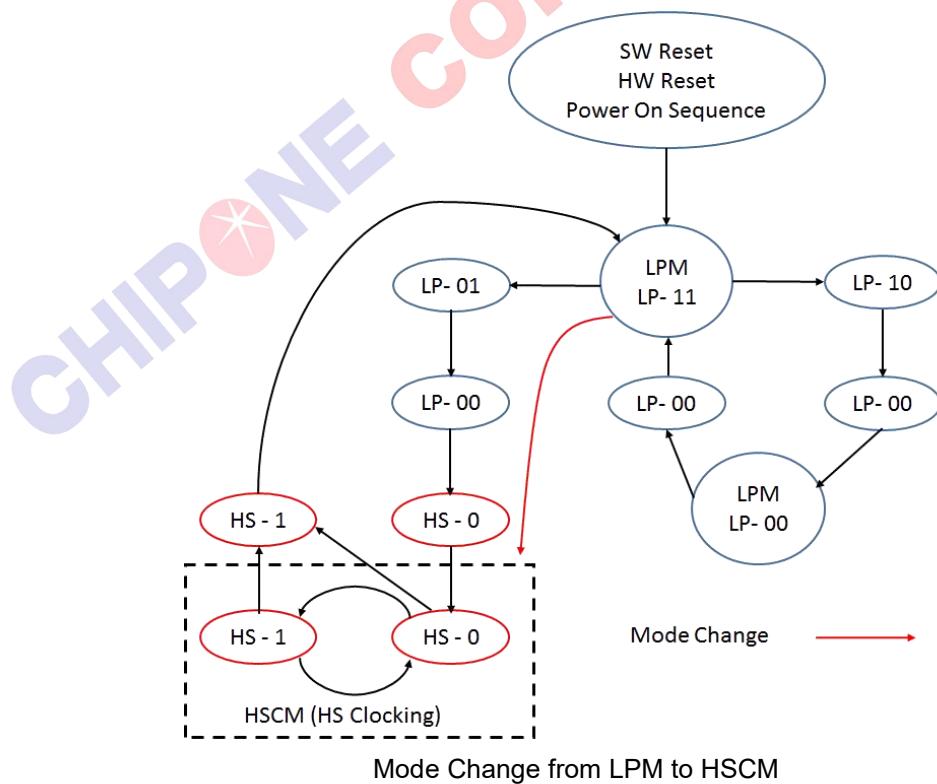
### 7.2.2.6 High-Speed Clock Mode (HSCM)

CLKP/N lanes can be driven to the High Speed Clock Mode (HSCM) when CLK lanes start to function between HS-0 and HS-1 State Codes. The only entering possibility is from the Low Power Mode (LPM, LP-11 State Code) => LP-01 => LP-00 => HS-0 => HS-0/1 (HSCM).

This sequence is illustrated as below.



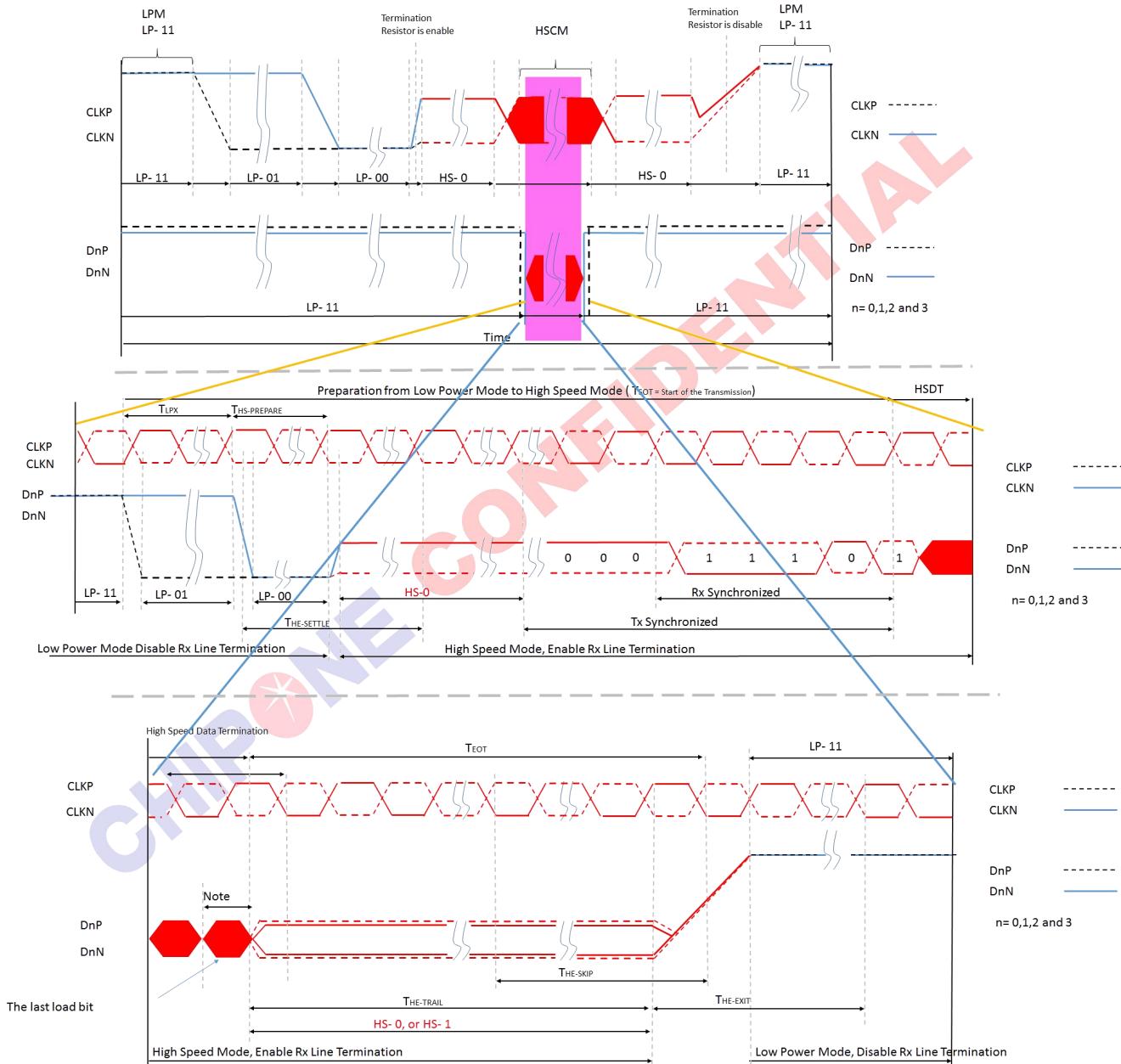
The mode change is also illustrated as below.



The high speed clock (CLKP/N) starts before high speed data is sent via data lanes. The high speed clock continues clocking after the high speed data sending is stopped.

The burst of the high speed clock consists of:

- Even number of transitions.
- Start state is HS- 0.
- End state is HS- 0.



Note:  
If the last load bit is HS- 0, the transmitter changes from HS- 0 to HS- 1.  
If the last load bit is HS- 1, the transmitter changes from HS- 1 to HS- 0

### High Speed Clock Burst

### 7.2.2.7 Data Lane Module State

D0P/N, and D1P/N Data lanes can be driven into different modes:

- Escape Mode (Only D0P/N data lane is used).
- High- Speed Data Transmission (all data lanes are used).
- Bus Turnaround Request (Only D0P/N data lane are used).

These modes and their entering codes are defined in the following table.

Modes and entering code define

Mode	Entering Mode Sequence	Leaving Mode Sequence
Escape Mode	LP- 11→ LP- 10→ LP- 00 → LP- 01 → LP- 00	LP- 00→ LP- 10→ LP- 11 ( Mark-1)
High- Speed Data Transmission	LP- 11→ LP- 01 → LP- 00 → HS- 0	( HS- 0 or HS- 1)→ LP11
Bus Turnaround Request	LP- 11→ LP- 10→ LP- 00 → LP- 10→ LP- 00	Hi- Z

### 7.2.2.8 Escape Modes

D0P/N data lanes can be used in different Escape Modes when data lanes are in the Low Power (LP) mode.

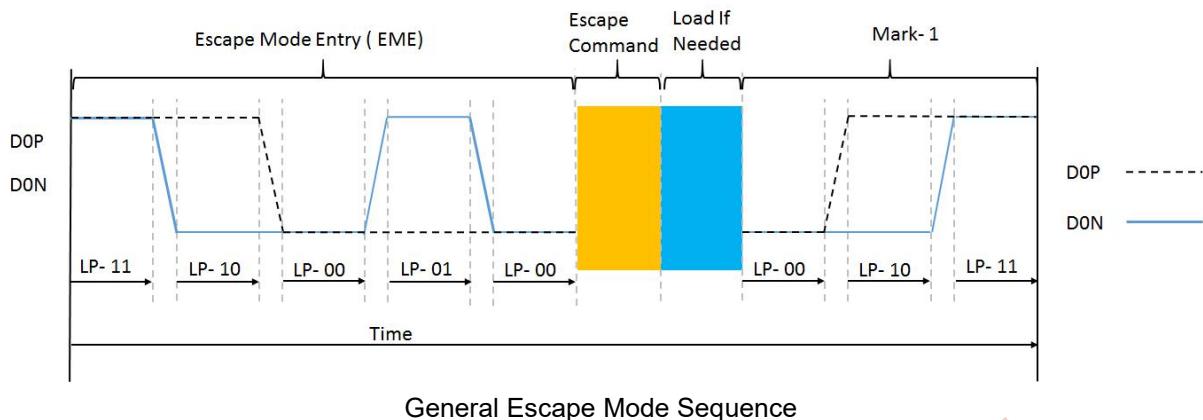
These Escape Modes are used to:

- Send “Low-Power Data Transmission” (LPDT) from the AP to the display module.
- Drive data lanes to “Ultra-Low Power State” (ULPS).
- Indicate “Remote Application Reset” (RAR), which can reset DSI link block in the D-IC.
- Indicate “Acknowledge” (ACK), which is used to transmit a non-error event from the display module to the AP.

The basic sequence of the Escape Mode is as follows:

- Start: LP-11.
- Escape Mode Entry (EME): LP-11 => LP-10 => LP-00 => LP-01 => LP-00.
- Escape Command (EC), which is coded, when one of the data lanes changes from low-to-high-to-low then this changed data lane presents the value of the current data bit (D0P = 1, D0N= 0). When DSI-D0 changes from low-to-high-to-low, the receiver will latch a data bit, which value is logical 0. The receiver will use this low-to-high-to-low transition as its internal clock.
- A load if it is needed.
- Exit Escape (Mark-1) LP-00 => LP-10 => LP-11.
- End: LP-11.

This basic construction is illustrated as below.



A total of eight Escape Commands (EC) are divided into two types: Mode and Trigger, as shown in the following table.

An example of the Mode type Escape Command is „Ultra-Low Power Mode”, where the AP instructs the display module to enter its Ultra-Low Power Mode.

Escape commands are defined in the following table.

Escape commands define

Escape Command	Command Type Mode / Trigger	Entry command Pattern (First Bit → Last Bit Transmitted)	Dn	D0
Low- Power Data Transmission	Mode	1110 0001 bin		x
Ultra- Low Power Mode	Mode	0001 1110 bin	x	x
Underdefined- 1, Note1	Mode	1001 1111 bin		
Underdefined- 2, Note1	Mode	1101 1110 bin		
Remote Application Reset	Trigger	0110 0010 bin		
Acknowledge	Trigger	0010 0001 bin		x
UnKnow- 5, Note1	Trigger	1010 0000 bin		

**\*Note:**

1. This Escape command support is not implemented on the display module.
2. n=1, 2 and 3.
3. x= supported.

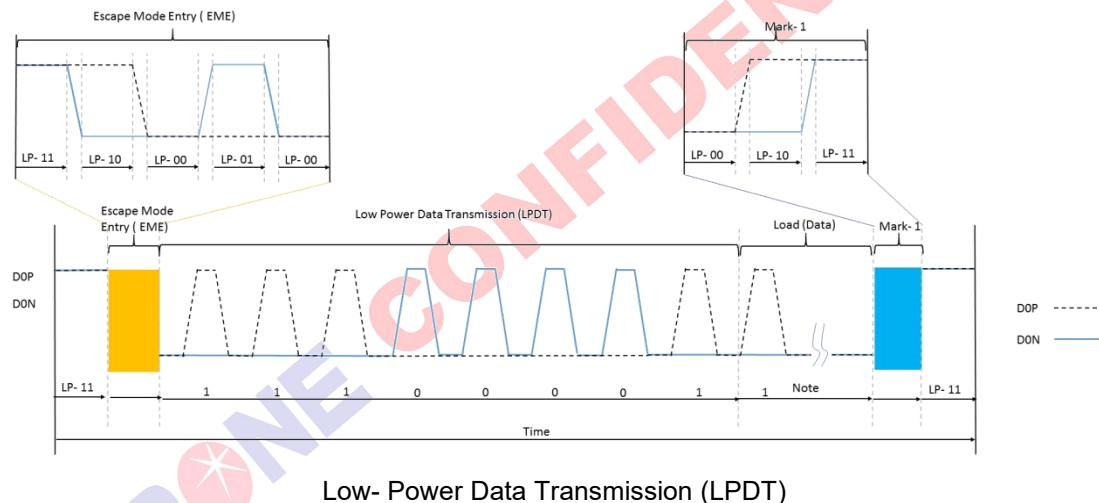
### 7.2.2.9 Low-Power Data Transmission (LPDT)

The AP can send data to the display module in the Low-Power Data Transmission (LPDT) mode when data lanes enter the Escape Mode and Low-Power Data Transmission (LPDT) command is sent to the display module.

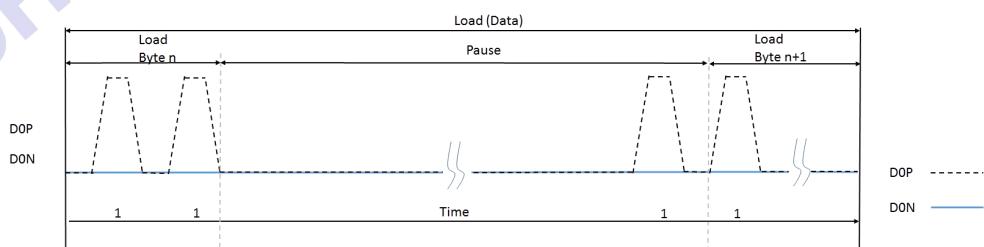
The display module also uses the same sequence when it sends data to the AP. The Low Power Data Transmission (LPDT) uses the following sequence:

- Start: LP-11.
- Escape Mode Entry (EME): LP-11 => LP-10 => LP-00 => LP-01 => LP-00.
- Low-Power Data Transmission (LPDT) command in the Escape Mode: 1110 0001 (first to last bit).
- Load (Data).
- One or more bytes (one byte = 8 bit).
- Data lanes are in pause mode when data lanes are stopped (both lanes are low) between bytes.
- Mark-1: LP-00 => LP-10 => LP-11.
- End: LP-11.

This sequence is illustrated for reference purposes as below.



\*Note: Load (Data) presents that the first bit is the logical 1 in this example.

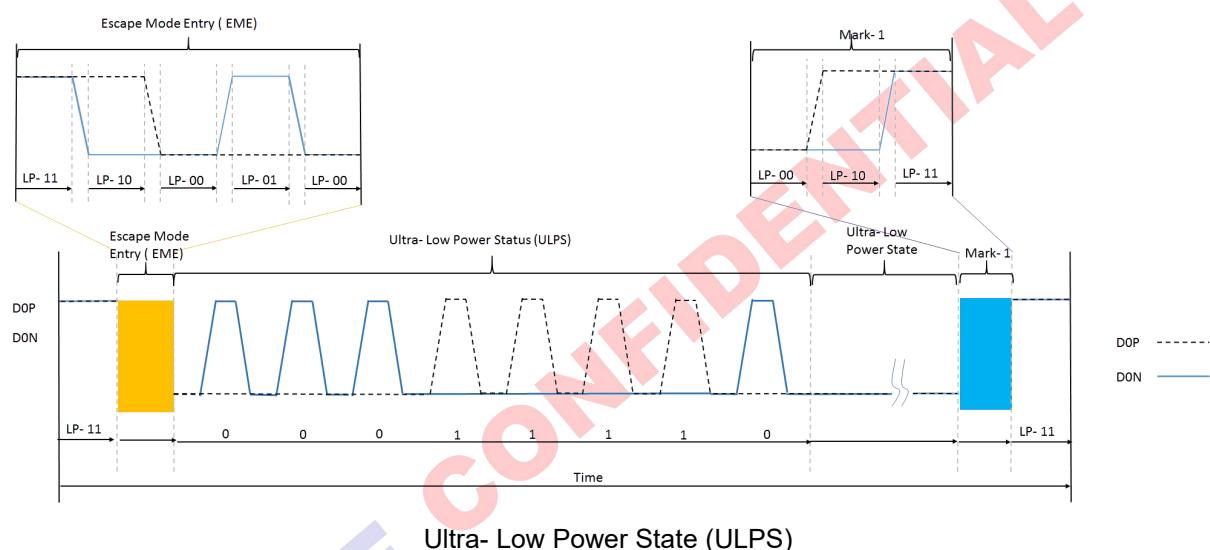


### 7.2.2.10 Ultra-Low Power State (ULPS)

The AP can force data lanes get into the Ultra-Low Power State (ULPS) mode when data lanes enter the Escape Mode. The Ultra-Low Power State (ULPS) uses the following sequence:

- Start: LP-11.
- Escape Mode Entry (EME): LP-11 => LP-10 => LP-00 => LP-01 => LP-00.
- Ultra-Low Power State (ULPS) command in the Escape Mode: 0001 1110 (first to last bit).
- Ultra-Low Power State (ULPS) when the AP keeps data lanes low.
- Mark-1: LP-00 => LP-10 => LP-11.
- End: LP-11 (Next command must wait 100us after data lanes leave ULPS).

This sequence is illustrated for reference purposes as below.

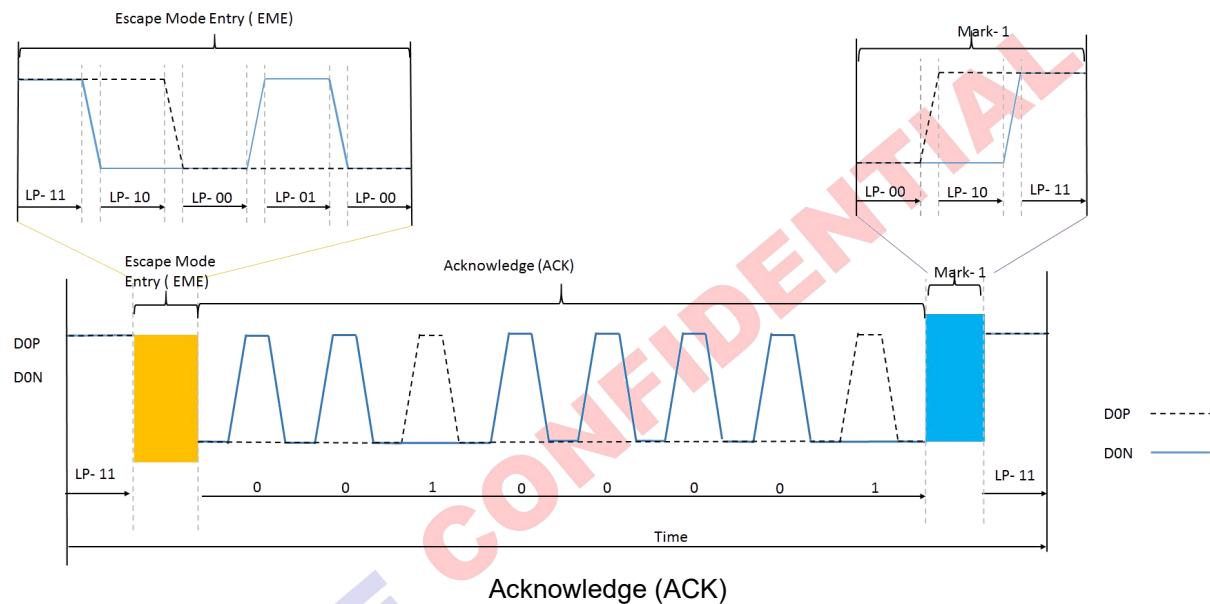


### 7.2.2.11 Acknowledge (ACK)

The display module can inform the AP an error is not recognized by Acknowledge (ACK). The display module sends the Acknowledge (ACK) with the following sequence:

- Start: LP-11.
- Escape Mode Entry (EME): LP-11 => LP-10 => LP-00 => LP-01 => LP-00.
- Acknowledge (ACK) command in the Escape Mode: 0010 0001 (first to last bit).
- Mark-1: LP-00 => LP-10 => LP-11.
- End: LP-11.
- 

This sequence is illustrated for reference purposes as below.

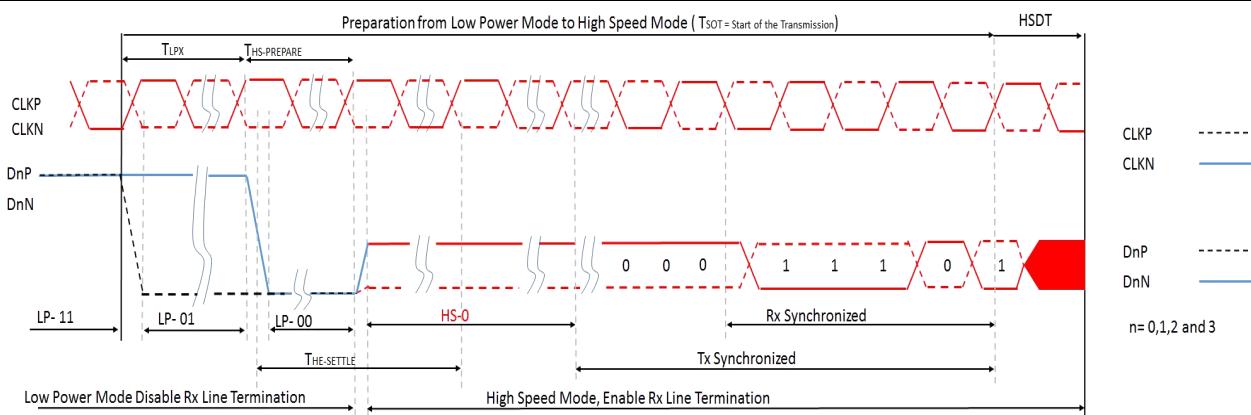


### 7.2.2.12 Entering High-Speed Data Transmission (TSOT of HSDT)

The display module enters High-Speed Data Transmission (HSDT) when Clock lane CLKP/N have already entered the High-Speed Clock Mode (HSCM) by the AP. See more information in the section “High-Speed Clock Mode (HSCM)”. Data lanes D0P/N and D1P/N of the display module enter the High-Speed Data Transmission (TSOT of HSDT) as follows:

- Start: LP-11.
- HS-Request: LP-01.
- HS-Settle: LP-00 => HS-0 (Rx: Lane Termination Enable).
- Rx Synchronization: 011101 (Tx (= AP) Synchronization: 0001 1101).
- End: High-Speed Data Transmission (HSDT) – Ready to receive High-Speed Data Load.

The sequence of entering High-Speed Data Transmission (TSOT of HSDT) is illustrated as below.



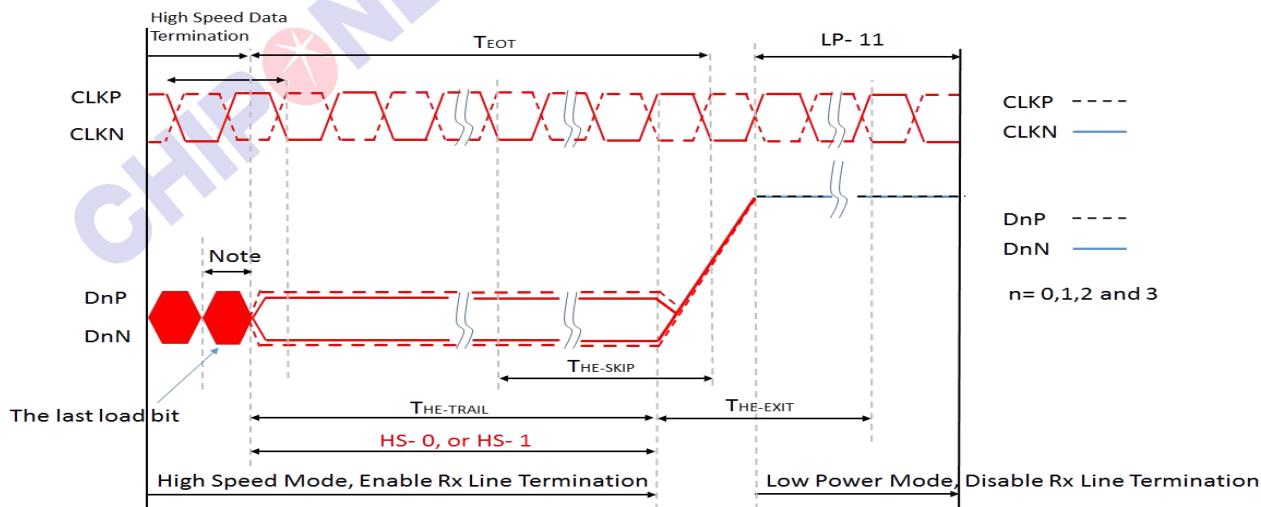
Entering High-Speed Data Transmission (TSOT of HSDT)

### 7.2.2.13 Leaving High-Speed Data Transmission (TEOP of HSDT)

The display module leaves the High-Speed Data Transmission (TEOT of HSDT) when Clock lane DSICLKPN are in the High-Speed Clock Mode (HSCM) by the AP, and this HSCM is kept until data lanes D0P/N and D1P/N are in the LP-11 mode. See more information in the section “High-Speed Clock Mode (HSCM)”. Data lanes D0P/N and D1P/N of the display module leave the High-Speed Data Transmission (TEOT of HSDT) as follows:

- Start: High-Speed Data Transmission (HSDT).
- Stops High-Speed Data Transmission.
- AP changes to HS-1, if the last load bit is HS-0.
- AP changes to HS-0, if the last load bit is HS-1.
- End: LP-11 (Rx: Lane Termination Disable).

The sequence of leaving High-Speed Data Transmission (TEOT of HSDT) is illustrated as below.



*Note:*

If the last load bit is HS- 0, the transmitter changes from HS- 0 to HS- 1.  
If the last load bit is HS- 1, the transmitter changes from HS- 1 to HS- 0

Leaving High-Speed Data Transmission (TEOT of HSDT)

## 7.2.3 MIPI DSI Protocol

### 7.2.3.1 Data Type (DT)

This Data Type (DT) also defines the used packet is a Short Packet (SPa) or a Long Packet (LPa). Data Types (DT) are different from the AP to the display module (or other devices) and vice versa. These Data Types (DT) are defined in the tables as below.

Data Types (DT) define List

Data Type (HEX)	Description	Packet Size
01h	Sync Event, V Sync Start	Short
11h	Sync Event, V Sync End	Short
21h	Sync Event, H Sync Start	Short
31h	Sync Event, H Sync End	Short
07h	Compression Mode Command	Short
08h	End of Transmission packet (EoTp)	Short
03h	Generic Short WRITE, no parameters	Short
13h	Generic Short WRITE, 1 parameter	Short
23h	Generic Short WRITE, 2 parameters	Short
04h	Generic READ, no parameters	Short
14h	Generic READ, 1 parameter	Short
24h	Generic READ, 2 parameters	Short
05h	DCS Short WRITE, no parameters	Short
15h	DCS Short WRITE, 1 parameter	Short
06h	DCS READ, no parameters	Short
37h	Set Maximum Return Packet Size	Short
09h	Null Packet, no data	Long
19h	Blanking Packet, no data	Long
29h	Generic Long Write	Long
39h	DCS Long Write/Write_LUT Command Packet	Long
0Ah	Picture Parameter Set	Long
0Bh	Compressed Pixel Stream	Long
0Ch	Loosely Packet Pixel Stream, 20-bit YCbCr, 4:2:2 Format	Long
2Ch	Packed Pixel Stream, 16-bit YCbCr, 4:2:2 Format	Long
3Eh	Packed Pixel Stream, 24-bit RGB, 8-8-8 Format	Long
X0h and XFh	DO NOT USE. All unspecified codes are reserved.	-

\*Note:

1. This can be used when the AP wants to make sure that it is the end of the transmission in High Speed Data

Transferring (HSDT) mode.

2. This can be used when data lanes are to be kept in High Speed Data Transferring (HSDT) Mode.

Data Type (DT) from the Display Module (or Other Devices) to the AP.

**Data Type (DT) from the Display Module (or Other Devices) to the AP**

From the Display Module to the AP		
Hex	Description	Short / Long Packet
02h	Acknowledge with Error Report	SPa ( Short Packet)
1Ch	DCS Read Long Response	LPa (Long Packet)
21h	DCS Read Short Response, 1 byte returned	SPa ( Short Packet)
22h	DCS Read Short Response, 2 byte returned	SPa ( Short Packet)
1Ah	Generic Read Long Response	LPa (Long Packet)
11h	Generic Read Short Response, 1 byte returned	SPa ( Short Packet)
12h	Generic Read Short Response, 2 byte returned	SPa ( Short Packet)

**\*Note:** The data type for Generic write/read: 1Ah, 11h, 12 will be disable (ignored packet) if bit DSIG is set to "0".

The receiver will ignore other Data Type (DT) if they are not defined on tables: "Data Type (DT) from the AP to the Display Module (or Other Devices)" or "Data Type (DT) from the Display Module (or Other Devices) to the AP".

### 7.2.3.2 Acknowledge with Error Report (AwER)

“Acknowledge with Error Report” (AwER), which is defined in Data Type (DT, 00 0010b), is always used in a Short Packet (SPa) from the display module to the AP. The Packet Data (PD) can include bits, which define the current error, when the corresponding bit is set to 1, as defined in the following table.

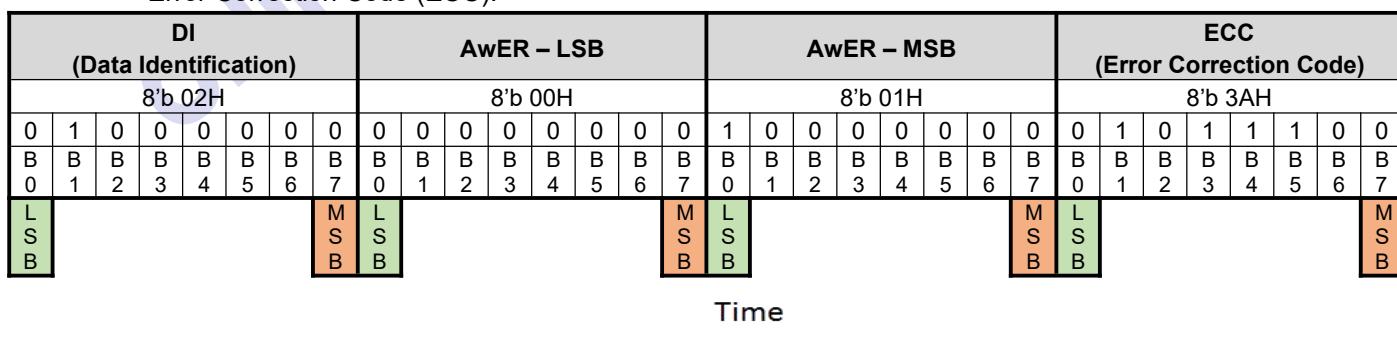
**Acknowledge with Error Report**

Bit	Description
0	SoT Error
1	SoT Sync Error
2	EoT Sync Error
3	Escape Mode Entry Command Error
4	Low-Power Transmit Sync Error
5	Any Protocol Timer Time-Out
6	False Control Error
7	Contention is Detected on the Display Module
8	ECC Error, single-bit (detected and corrected)
9	ECC Error, multi-bit (detected, not corrected)
10	Checksum Error (Long Packet only)
11	DSI Data Type (DT) Not Recognized
12	DSI Virtual Channel (VC) ID Invalid
13	Invalid Transmission Length
14	Reserved, Set to 0 internally
15	DSI Protocol Violation

These errors are included in all packages that have been received from the AP to the display module before the Bus Turnaround (BTA). The display module ignores the received packet which includes error or errors.

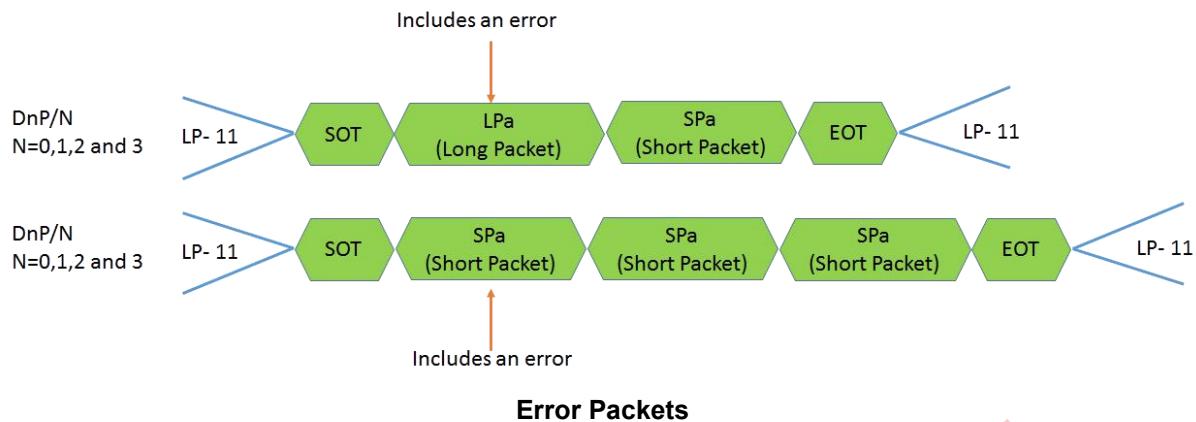
Acknowledge with Error Report (AwER) of a Short Packet (SPa) is defined as:

- Data Identification (DI):
  - Virtual Channel (VC, DI [7...6]): 00b.
  - Data Type (DT, DI [5...0]): 000010b.
- Packet Data (PD):
  - Bit 8: ECC Error, single-bit (detected and corrected).
  - AwER: 0100h.
- Error Correction Code (ECC).

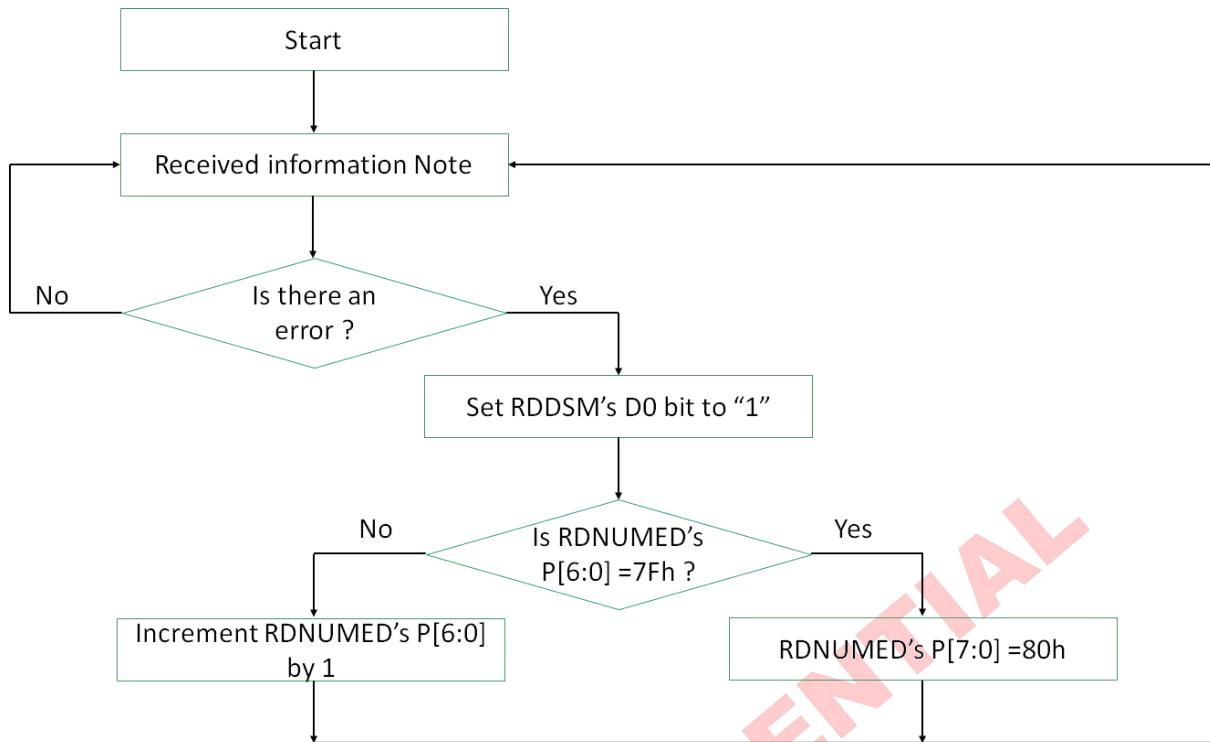


#### Acknowledge with Error Report (AwER) – Example

It is possible that the display module receives several packets, which include errors, from the AP before the AP performs the Bus Turnaround (BTA). Some examples are illustrated for reference purposes as below.



Therefore, a method is needed to check if there are errors in the previous packets. These errors of the previous packets can be detected by “Read Display Signal Mode (0Eh)” and “Read Number of the Errors on DSI (05h)” commands. The bit D0 of the “Read Display Signal Mode (0Eh)” command will be set to 1 if a received packet includes an error. The amount of packets, which include an **ECC** or **CRC** error, is calculated in the RDNUMED register, which can read “Read Number of the Errors on DSI (05h)” command. This command also sets the RDNUMED register to 00h and set the bit D0 of the “Read Display Signal Mode (0Eh)” command to 0 after the AP has read the RDNUMED register from the display module. The functionality of the RDNUMED register is illustrated for reference purposes as below.



Flow Chart for Errors on DSI

**\*Note:**

1. This information can be Interface or Packet Level Communication, but it is always from the AP to the display module.
2. CRC or ECC error

## 7.2.4 Video Mode Communication

Video Mode peripherals require pixel data delivered in real time. This section specifies the format and timing of DSI traffic for this type of display module.

### 7.2.4.1 Transmission Packet Sequences

DSI supports several formats, or packet sequences, for Video Mode data transmission. The peripheral's timing requirements dictate which format is appropriate. In the following sections, *Burst Mode* refers to time-compression of the RGB pixel (active video) portion of the transmission. In addition, these terms are used throughout the following sections:

- Non-Burst Mode with Sync Pulses – enables the peripheral to accurately reconstruct original video timing, including sync pulse widths.
- Non-Burst Mode with Sync Events – similar to above, but accurate reconstruction of sync pulse widths is not required, so a single Sync Event is substituted.
- Burst mode – RGB pixel packets are time-compressed, leaving more time during a scan line for LP mode (saving power) or for multiplexing other transmissions onto the DSI link.

In the following figure the Blanking or Low-Power Interval (BLLP) is defined as a period during which video packets such as pixel-stream and sync event packets are not actively transmitted to the peripheral. To enable PHY synchronization the host processor should periodically end HS transmission and drive the Data Lanes to the LP state. This transition should take place at least once per frame; shown as LPM in the figure in this section. It is recommended to return to LP state once per scan-line during the horizontal blanking time. Regardless of the frequency of BLLP periods, the host processor is responsible for meeting all documented peripheral timing requirements. Note, at lower frequencies BLLP periods will approach, or become, zero, and burst mode will be indistinguishable from non-burst mode.

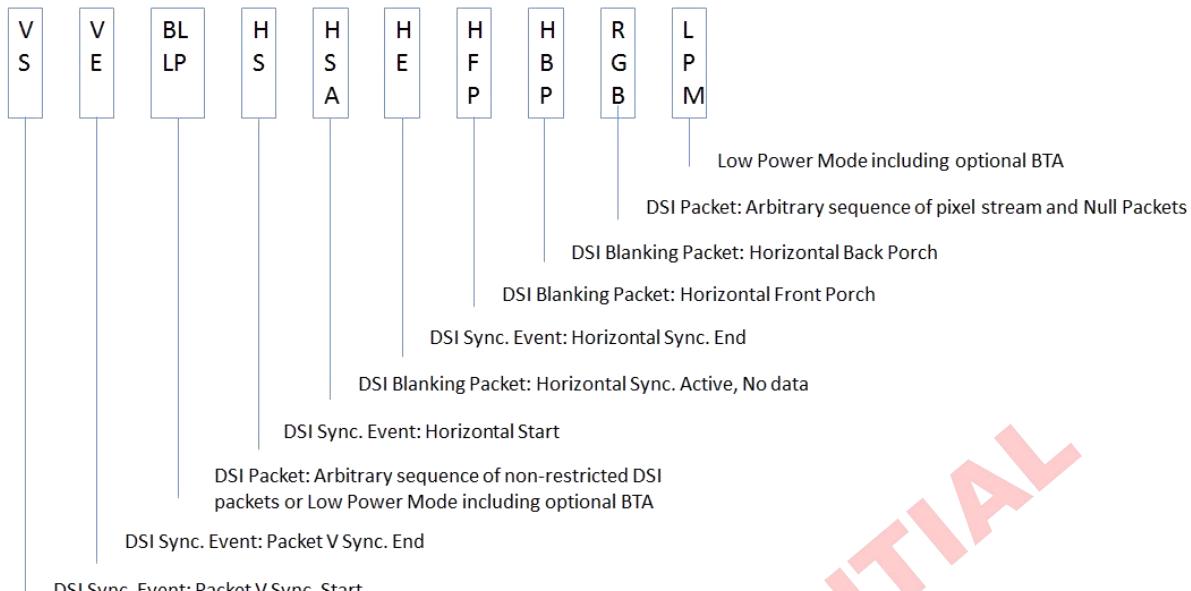
During the BLLP the DSI Link may do any of the following:

- Remain in Idle Mode with the host processor in LP-11 state and the peripheral in LP-RX.
- Transmit one or more non-video packets from the host processor to the peripheral using Escape Mode.
- Transmit one or more non-video packets from the host processor to the peripheral using HS Mode.
- If the previous processor-to-peripheral transmission ended with BTA, transmit one or more packets from the peripheral to the host processor using Escape Mode.
- Transmit one or more packets from the host processor to a different peripheral using a different Virtual Channel ID.

The sequence of packets within the BLLP or RGB portion of a HS transmission is arbitrary. The host processor may compose any sequence of packets, including iterations, within the limits of the packet format definitions. For all timing cases, the first line of a frame shall start with VS; all other lines shall start with HS. This is also true in the special case when VSA+VBP=0. Note that the position of synchronization packets, such as VS and HS, in time is of utmost importance since this has a direct impact on the visual performance of the display panel. Normally, RGB pixel data is sent with one full scan line of pixels in a single packet. If necessary, a horizontal scan-line of active pixels may be divided into two or more packets. However, individual pixels shall not be split across packets.

Transmission packet components used in the figure in this section are defined in figure as below unless

otherwise specified.

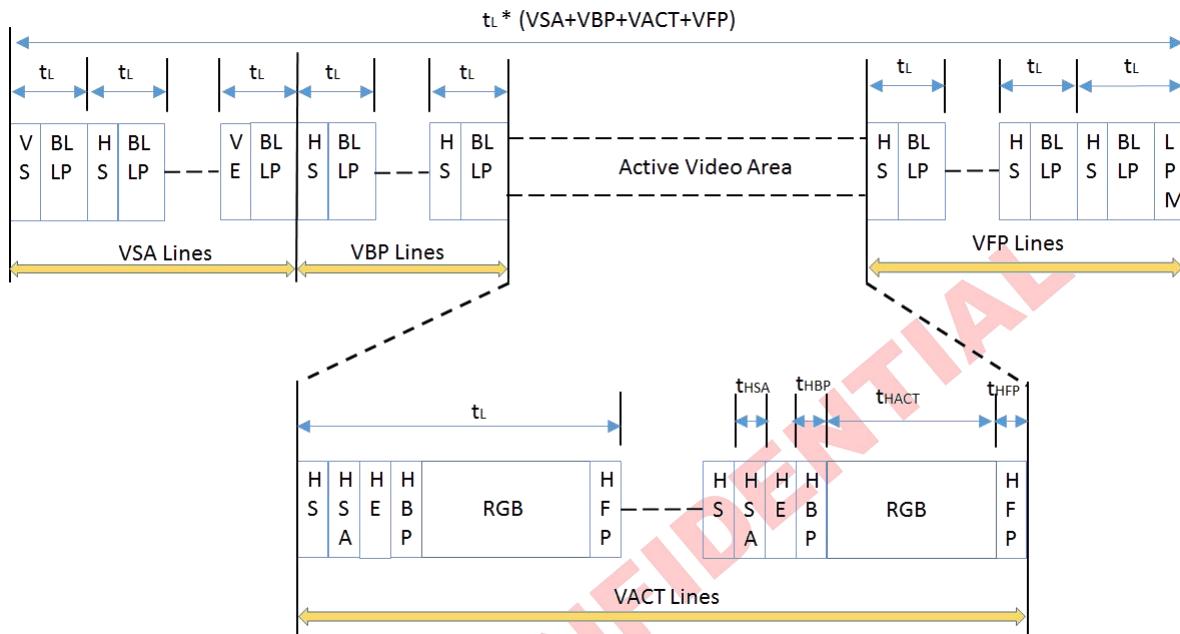


#### DSI Video Mode Interface Timing Legend

If a peripheral timing specification for HBP or HFP minimum period is zero, the corresponding Blanking Packet may be omitted. If the HBP or HFP maximum period is zero, the corresponding blanking packet shall be omitted.

### 7.2.4.2 Non-Burst Mode with Sync Pulses

With this format, the goal is to accurately convey DPI-type timing over the DSI serial Link. This includes matching DPI pixel-transmission rates, and widths of timing events like sync pulses. Accordingly, synchronization periods are defined using packets transmitting both start and end of sync pulses. An example of this mode is shown in the figure as below.



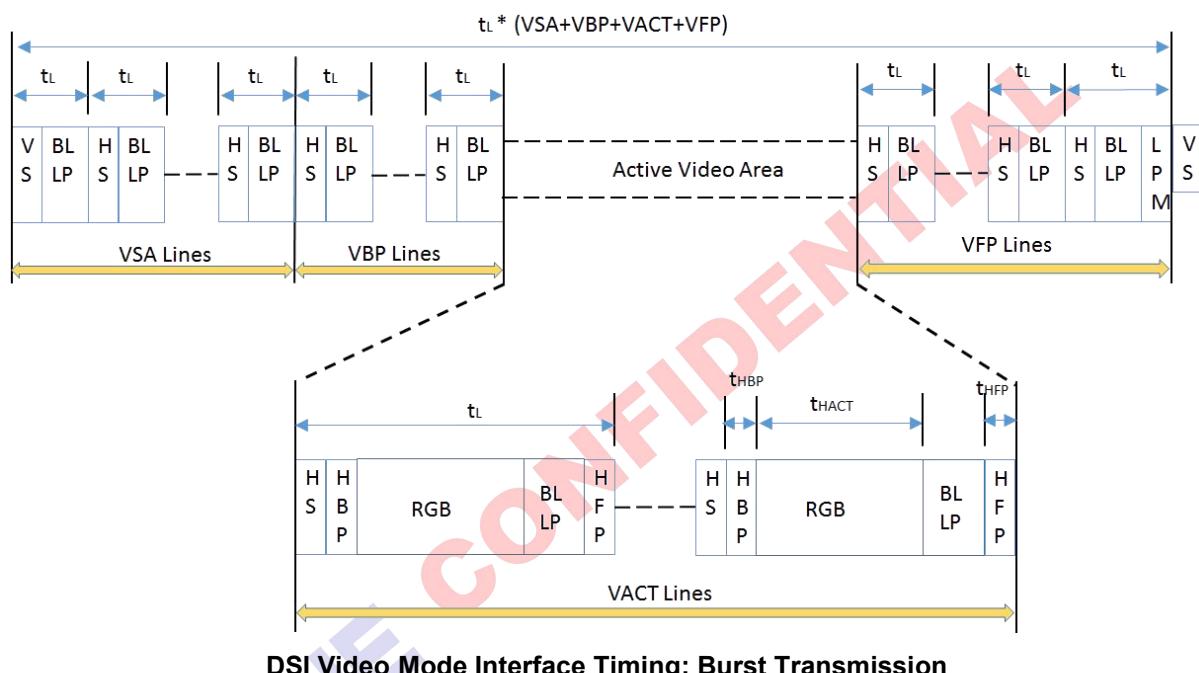
**DSI Video Mode Interface Timing: Non-Burst Transmission with Sync Start and End**

Normally, periods shown as HSA (Horizontal Sync Active), HBP (Horizontal Back Porch) and HFP (Horizontal Front Porch) are filled by Blanking Packets, with lengths (including packet overhead) calculated to match the period specified by the peripheral's data sheet.

Alternatively, if there is sufficient time to transition from HS to LP mode and back again, a timed interval in LP mode may substitute for a Blanking Packet, thus saving power.

### 7.2.4.3 Burst Mode

In this mode, blocks of pixel data can be transferred in a shorter time using a time-compressed burst format. This is a good strategy to reduce overall DSI power consumption, as well as enabling larger blocks of time for other data transmissions over the Link in either direction. There may be a line buffer or similar memory on the peripheral to accommodate incoming data at high speed. Following HS pixel data transmission, the bus goes to Low Power Mode, during which it may remain idle, i.e. the host processor remains in LP-11 state, or LP transmission may take place in either direction. If the peripheral takes control of the bus for sending data to the host processor, its transmission time shall be limited to ensure data underflow does not occur from its internal buffer memory to the display device. An example of this mode is shown in figure as below.



Similar to the Non-Burst Mode scenario, if there is sufficient time to transition from HS to LP mode and back again, a timed interval in LP mode may substitute for a Blanking Packet, thus saving power.

## 7.2.5 Display Data Compression Mode

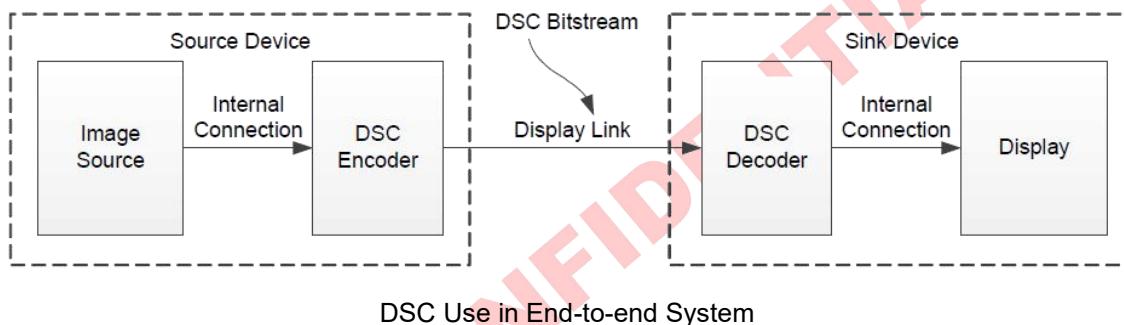
### 7.2.5.1 VESA Display Stream Compression (DSC)

The DSC Standard is a specification of the algorithms used for compressing and decompressing image display streams, including the specification of the syntax and semantics of the compressed video bitstream. DSC is designed for real-time systems, with real-time compression, transmission, decompression, and display.

The DSC algorithm is designed to enable low-cost hardware implementations of visually lossless video compression over display links. One of the main features is the ability to support of slices to enable partial update of compressed frame buffers, and for bounding the range of artifacts resulting from errors in the received bitstream.

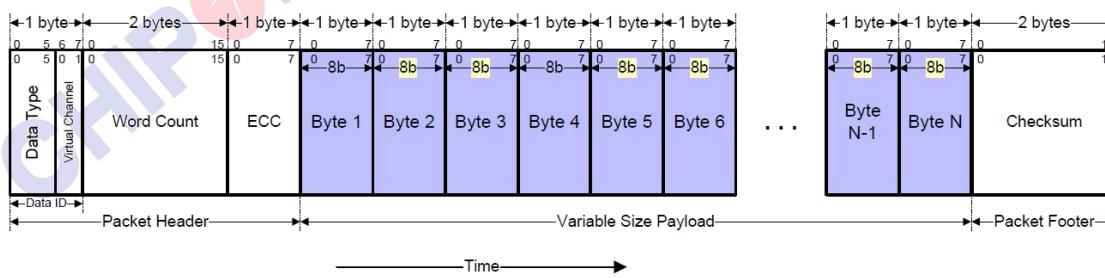
The standardization of DSC transmission has also been achieved to transfer compressed display data over MIPI Display Serial Interface (DSI).

\*VESA: Video Electronics Standards Association



### 7.2.5.2 Compressed Pixel Stream

The Compressed Pixel Stream is a long packet, which is defined in Data Type (DT, 00 1011b), that carries compressed data to a Video Mode display module. This packet shall consist of a DI byte, a two-byte non-zero WC, an ECC byte, a payload containing WC bytes and a two-byte checksum, shown in the figure as below.



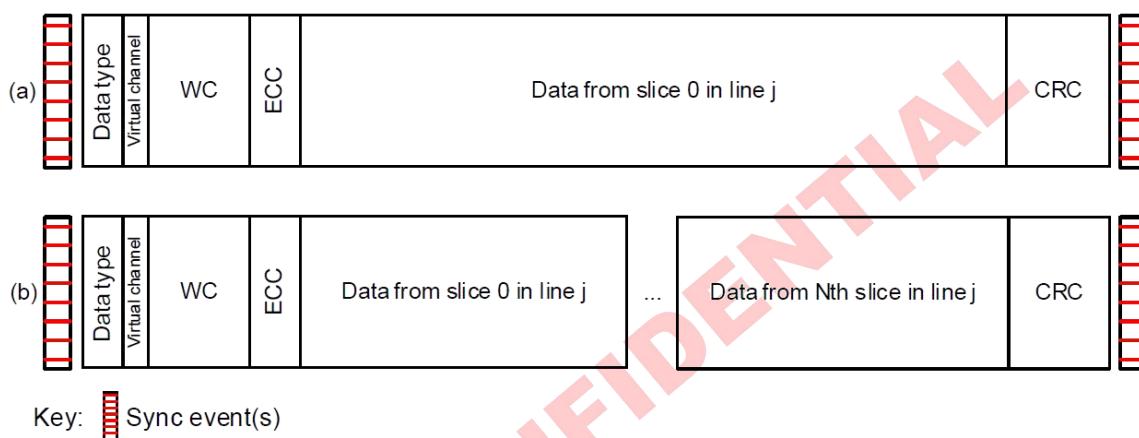
Compressed Pixel Stream Format, Long Packet

A compressed image is composed of data slices (a full slice usually ranges over several lines). The packet carries data from one or more compressed slice segments (called slice-widths) or chunks within one line time period. The specification of DSC Standard can limit the number of slice-widths of data carried in one line time.

The following two figures illustrate transporting a single slice-width of data or transporting multiple slice-widths of data in this packet. The slices have the same horizontal size that equates to the same packet size in a constant bit rate coding system. This behavior is defined by the coding system. For example, if the image is compressed to

have one slice-width of data horizontally, the following figure (a) shows the portion of slice 0 transported in line time period j is fully contained in one packet. In this case, the following figure 40 (a) is the only means to transport this portion of the slice-width of data. If the image is compressed to have more slices horizontally, the following figure (b) shows the Compressed Pixel Stream packet contains multiple slice-widths of data.

If the image is compressed to have more than one slice horizontally, an integral number of slice-widths of data may be carried by sequential Compressed Pixel Stream packets in one line time j. The following figure shows sequential packets that can contain slice-widths of data. This is one method that can segregate slice-widths when the receiver has multiple instantiations of decoders and this packet structure is used to identify slice-width boundaries.



One Line Containing One Packet with Data from One or More Compressed Slices

The Compressed Pixel Stream does not limit usage to any specific MIPI-compliant bitstream or standard. This packet shall only carry compressed image data with any pixel arrangement or component depth supported by the decoder.

### 7.2.5.3 Compression Mode Command

Some display stream compression parameters may be configured using the Compression Mode Command, which is a short packet consisting of a DI byte, a two-byte payload and an ECC byte. It is defined in Data Type (DT, 00 0111b).

This packet signals whether compression is enabled or disabled and the coding system used to create a bitstream that is carried by the Compressed Pixel Stream data type in Data Type (DT, 00 1011b).

## Compression Mode Parameters

SP Byte	Bit Location	Bit Description and Assigned Values
Data 0	7:6	Reserved, bits equal 0
Data 0	5:4	PPS selector 00 = PPS Table 1 (or no tables stored, default reset value) 01 = PPS Table 2 10 = PPS Table 3 11 = PPS Table 4
Data 0	3	Reserved
Data 0	2:1	Reserved, bits equal 0
Data 0	0	0 = compression disabled (default) 1 = compression enabled
Data 1	7:0	Reserved, bits equal 0

**\*Note:** Applies to video mode or command mode. In command mode, all bits are readable and writable, except reserved bits that use a defined value or are disallowed.

The Command mode contains a two-bit PPS Selector that may be used to enable a pre-stored PPS Table for controlling the compression decoder parameters. The processor sends this data type to change the decoder parameters that shall take effect following the next vertical sync or internal vertical sync (if using command mode). The PPS Selector is an optional field; if no table is stored in the receiver, the selector shall be 00b.

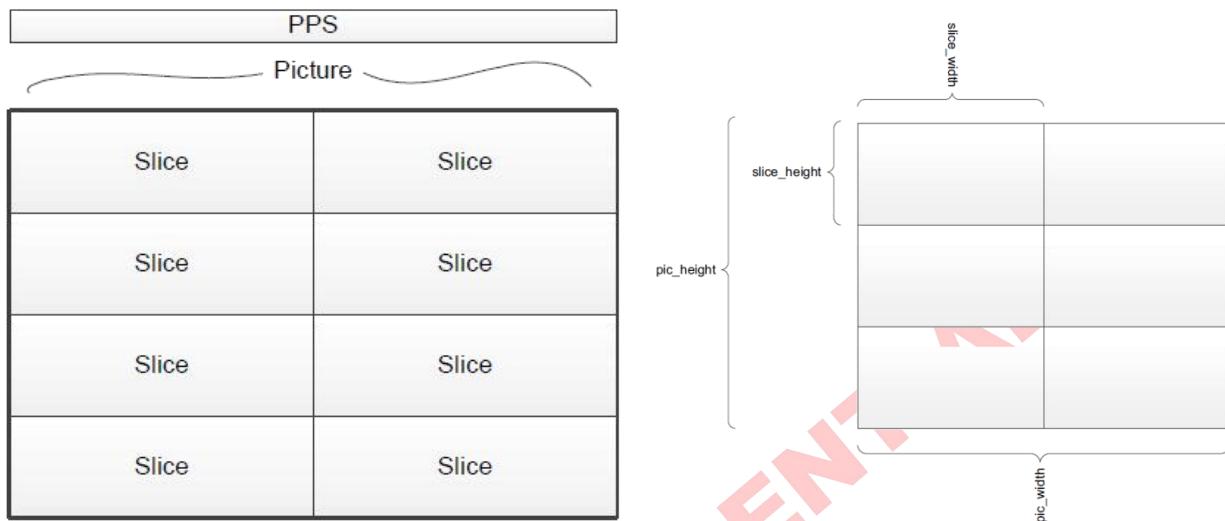
#### 7.2.5.4 Picture Parameter Set

The Picture Parameter Set (PPS) data type, which is defined in Data Type (DT, 00 1010b), is a long packet used to transmit a pre-defined set of parameters that control a compression coding system. The packet shall consist of a DI byte, a two-byte, non-zero WC, an ECC byte, a payload containing WC bytes, and a two-byte checksum.

The size, content and timing context of this long packet is defined by the coding system designated in the Compression Mode data type, Data Type (DT, 00 0111b), and transported in the Compressed Image Format data type, Data Type (DT, 00 1011b). Using this long packet, for example, may replace adding header markers to a bitstream.

If the peripheral receiver supports multiple, stored PPS tables, the received new PPS data is stored in the table designated by the Compression Mode PPS Selector if the table is writable.

The PPS table is a pre-defined set of compression parameters. The DSC encoder and DSC decoder should be set up the same compression parameter configuration in order to encode and decode the bitstream correctly. The PPS table should be transmitted when the DDIC initialized or the input resolution changed or compression ratio changed and so on.

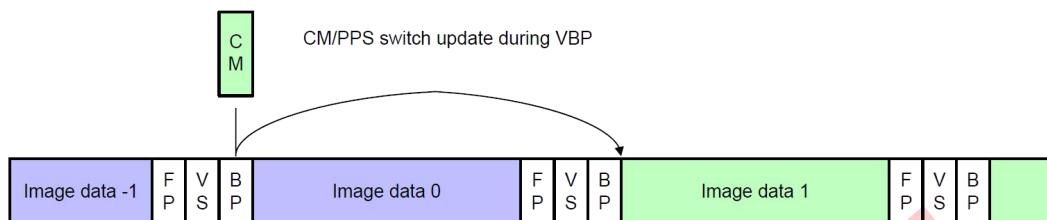
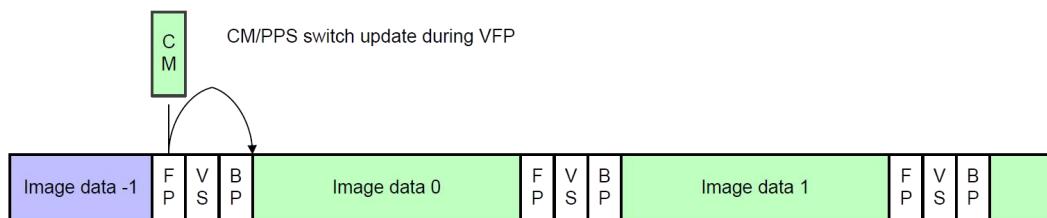


Relationship between Picture Parameter Set, Pictures, and Slices

**\*Note:**

1. Slice Height: The vertical frame dimension shall be evenly divisible by the number of lines per slice.
2. Partial Update: the minimum unit of partial update range is 1 slice. The detail addressing method, please refer the COSET (2Ah) and PASET (2Bh).

The PPS table change takes effect in a video mode peripheral that is processing a data stream after the next vertical sync, not within the same frame, as shown in the following figure. The PPS change takes effect in a command mode peripheral after the next signaled tearing effect, that is, either after a TE signal pulse or a TE Trigger Message.



PPS Update by Setting the Compression Mode Short Packet

**\*Note:**

VS = Vertical sync event

FP = Vertical front porch

BP = Vertical back porch

CM = Compression Mode short packet with PPS change

## 7.3 MIPI Display Serial Interface (DSI2)

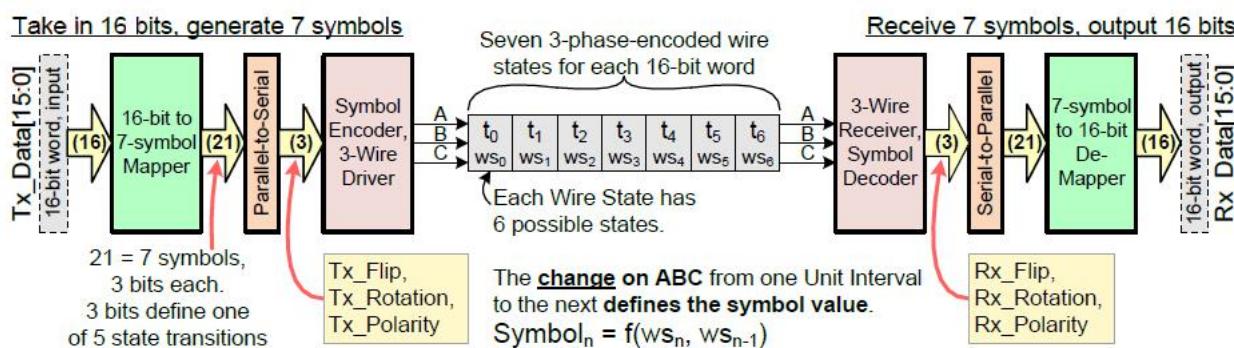
### 7.3.1 General Description for C-PHY

C-PHY describes a high-speed, rate-efficient PHY, especially suited for mobile applications where channel rate limitations are a factor. The needs of rate limited channels are accomplished through the use of 3-Phase symbol encoding technology delivering approximately 2.28 bits per symbol over a three-wire group of conductors. This C-PHY specification has been written primarily for the connection of cameras and displays to a host processor. Nevertheless, it can be applied to many other applications.

C-PHY has re-used many parts of the D-PHY standard. C-PHY was designed to coexist on the same IC pins as D-PHY so that dual-mode devices can be developed. C-PHY high-speed data coding differs substantially from the D-PHY clock-forwarding system, although the high-speed signal levels and terminations bear some similarity. The low-power mode of D-PHY is reused almost completely, and the transitions to and from the high-speed and low-power modes is very similar to the D-PHY standard.

The key characteristics of C-PHY coding are:

- ◆ Uses a group of three conductors rather than conventional pairs. The group of three wires is called a lane, and the individual lines of the lane are called: A, B and C. C-PHY does not have a separate clock lane.
- ◆ Within a three-wire lane, two of the three wires are driven to opposite levels; the third wire is terminated to a mid-level (at either one end or both ends), and the voltages at which the wires are driven changes at every symbol.
- ◆ Multiple bits are encoded into each symbol each, the data rate is ~2.28x the symbol rate. There is no additional overhead for line coding, such as 8b10b, which is not needed.
- ◆ Clock timing is encoded into each symbol. This is accomplished by requiring that the combination of voltages driven onto the wires must change at every symbol boundary. This simplifies clock recovery.
- ◆ C-PHY interface can co-exist on the same pins/pads as the D-PHY interface signals.

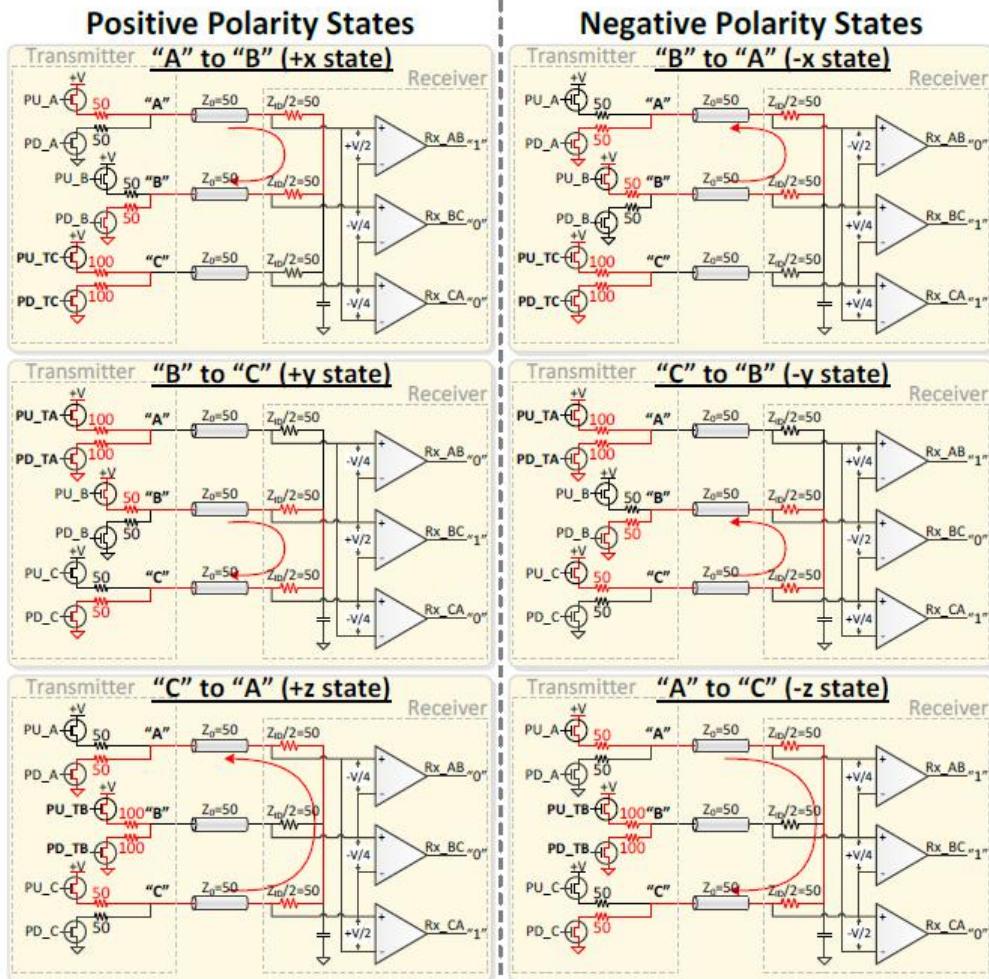


End-to-End Transmission of Data, 16-bit Word Conversion to Channel States

### 7.3.1.1 Lane Signaling States

The circuit examples below are simplified for the data encoding example; they are intended to illustrate the basic signaling states on the three-wire link. 6 driven states (called wire states) on a C-PHY lane are called: +x, -x, +y, -y, +z, and -z. Ex: the +x wire state is defined as A being driven high and B driven low, while the -x wire state is B driven high and A driven low.

The  
and  
voltage  
C-PHY  
defined



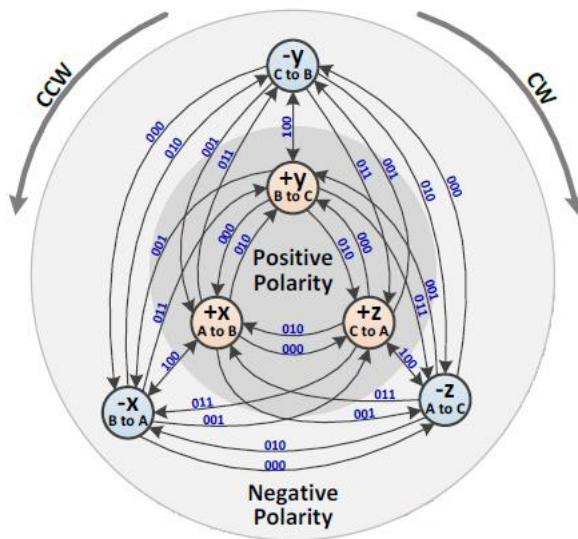
signal voltage  
differential  
for the six  
wire states are  
below:

Wire States	Wire Amplitude			Receiver Diff. Input Voltage			Receiver digital output		
	A	B	C	A-B	B-C	C-A	Rx_AB	Rx_BC	Rx_CA
+x	+x	+x	+x	+x	+x	+x	+x	+x	+x
$\frac{3}{4} V$	$\frac{3}{4} V$	$\frac{3}{4} V$	$\frac{3}{4} V$	$\frac{3}{4} V$	$\frac{3}{4} V$	$\frac{3}{4} V$	$\frac{3}{4} V$	$\frac{3}{4} V$	$\frac{3}{4} V$
$\frac{1}{4} V$	$\frac{1}{4} V$	$\frac{1}{4} V$	$\frac{1}{4} V$	$\frac{1}{4} V$	$\frac{1}{4} V$	$\frac{1}{4} V$	$\frac{1}{4} V$	$\frac{1}{4} V$	$\frac{1}{4} V$
$\frac{1}{2} V$	$\frac{1}{2} V$	$\frac{1}{2} V$	$\frac{1}{2} V$	$\frac{1}{2} V$	$\frac{1}{2} V$	$\frac{1}{2} V$	$\frac{1}{2} V$	$\frac{1}{2} V$	$\frac{1}{2} V$
$+\frac{1}{2} V$	$+\frac{1}{2} V$	$+\frac{1}{2} V$	$+\frac{1}{2} V$	$+\frac{1}{2} V$	$+\frac{1}{2} V$	$+\frac{1}{2} V$	$+\frac{1}{2} V$	$+\frac{1}{2} V$	$+\frac{1}{2} V$
$-\frac{1}{4} V$	$-\frac{1}{4} V$	$-\frac{1}{4} V$	$-\frac{1}{4} V$	$-\frac{1}{4} V$	$-\frac{1}{4} V$	$-\frac{1}{4} V$	$-\frac{1}{4} V$	$-\frac{1}{4} V$	$-\frac{1}{4} V$

### 7.3.1.2 Compressed Pixel Stream

With six possible wire states (as shown below Figure and above Table) there are always 5 possible transitions to the next wire state from any present wire state. The possible state transitions are illustrated in the

state diagram. The symbol value is defined by the change in wire state values from one unit interval to the next.



### 7.3.1.3 Symbol Encoding and Decoding

Each symbol shall be represented using a 3-bit number having one of five values: 000, 001, 010, 011 and 100.

The symbol values are based on the specific transitions between the wire states as below. These transitions are derived from the 3-bit symbol value where each bit defines a particular wire state change parameter: flip, rotate, and polarity. The flip, rotate and polarity bits affect the wire state as follows:

**Five Possible Transitions from Previous State to Present State (Encoding)**

Symbol Input Value	Previous Wire State, interval N-1						What Happens
	+x	-x	+y	-y	+z	-z	
000	+z	-z	+x	-x	+y	-y	Rotate CCW, polarity is Same
001	-z	+z	-x	+x	-y	+y	Rotate CCW, polarity is Opposite
010	+y	-y	+z	-z	+x	-x	Rotate CW, polarity is Same
011	-y	+y	-z	+z	-x	+x	Rotate CW, polarity is Opposite
1XX	-x	+x	-y	+y	-z	+z	Same phase, polarity is Opposite

\*Notes:

1. Symbol Input value is: [Tx\_Flip, Tx\_Rotation, Tx\_Polarity]
2. Values in the table show the Present Wire State transmitted during interval N, as a function of the Previous Wire State transmitted during interval N-1, and 3-bit Symbol Value.

**Receive Transition Mapping (Decoding)**

Present Wire State [Rx_AB, Rx_BC, Rx_CA]	Previous Wire State [prev_Rx_AB, prev_Rx_BC, prev_Rx_CA] (wire state received during interval N-1)

(received during interval N)	+x [100]	+x [100]	+x [100]	+x [100]	+x [100]	+x [100]
+x state [100]	N/A	1xx	000	001	010	011
-x state [011]	1xx	N/A	001	000	011	010
+y state [010]	010	011	n/a	1xx	000	001
-y state [101]	011	010	N/A	n/a	001	000
+z state [001]	000	001	010	011	N/A	1xx
-z state [110]	001	000	011	010	1xx	N/A
	symbol value above = [Rx_Flip, Rx_Rotation, Rx_Polarity]					

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## 7.3.2 Interface Level Communication for C-PHY

### 7.3.2.1 General

The display module uses data and clock lane differential pairs for DSI2 (DSI2-1M). Both differential lane pairs can be driven Low Power (LP) or High Speed (HS) mode.

Low Power mode means that each line of the differential pair is used in single end mode and a differential receiver is disabled (A termination resistor of the receiver is disabled) and it can be driven into a low power mode.

High Speed mode means that differential pairs (The termination resistor of the receiver is enabled) are not used in the single end mode. There are used different modes and protocol in each mode when there is wanted to transfer information from the MCU to the display module and vice versa.

The State Codes of the High Speed (HS) and Low Power (LP) lane pair are defined below

State Code	Line Voltage Levels			High-Speed	Low-Power	
	A Line	B Line	C Line	Burst Mode	Control Mode	Escape Mode
HS_+X	HS High	HS Low	HS Mid	+x state	N/A, Note 1	N/A, Note 1
HS+-X	HS Low	HS High	HS Mid	-x state	N/A, Note 1	N/A, Note 1
HS_+Y	HS Mid	HS High	HS Low	+y state	N/A, Note 1	N/A, Note 1
HS_-Y	HS Mid	HS Low	HS High	-y state	N/A, Note 1	N/A, Note 1
HS_+Z	HS Low	HS Mid	HS High	+z state	N/A, Note 1	N/A, Note 1
HS_-Z	HS High	HS Mid	HS Low	-z state	N/A, Note 1	N/A, Note 1
LP-000	LP Low	LP Low	LP Low	N/A	Bridge	Space
LP-001	LP Low	LP Low	LP High	N/A	HS-Rqst	Mark-0

\*Notes:

1. During high-speed transmission the low-power Receivers observe LP-000 on the lines.
2. If LP-111 occurs during escape mode the lane returns to Stop state (Control Mode LP-111)

### 7.3.2.2 DSI2-DATA Lanes

DSI2-An/Bn/Cn Data Lanes can be driven in different modes which are:

- Escape Mode (Only DSI2-D0 A/B/C data lanes is used)
- High-Speed Data Transmission (all data lanes are used)
- Bus Turnaround Request (Only DSI2-D0 A/B/C data lanes is used)

These modes and their entering codes are defined on the following table.

Mode	Entering Mode Sequence	Leaving Mode Sequence
Escape Mode	LP-111=>LP-100=>LP-000=>LP-001=>LP-000	LP-000=>LP-100=>LP-111 (Mark-1)
High-Speed Data Transmission	LP-111=>LP-001=>LP-000=>3333333	4444444 =>LP-111
Bus Turnaround Request	LP-111 >LP-100=>LP-000=>LP-100=>LP-000	High-Z

### Escape Modes

Data lanes (DSI2-A0/B0/C0) can be used in different Escape Modes when data lanes are in Low Power (LP) mode.

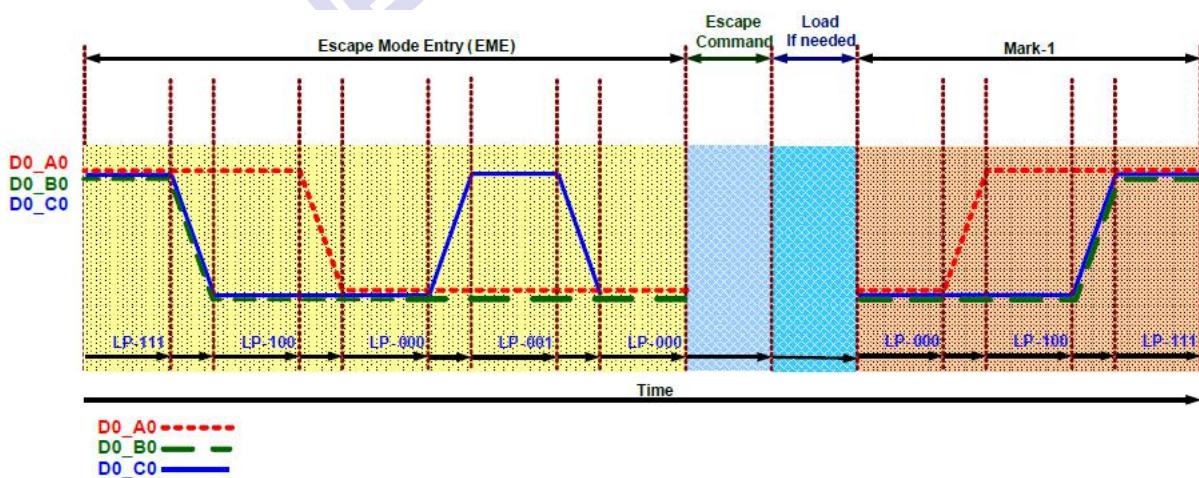
These Escape Modes are used to:

- Send “Low-Power Data Transmission” (LPDT) e.g. from the MCU to the display module
- Drive data lanes to “Ultra-Low Power State” (ULPS)
- Indicate “Remote Application Reset” (RAR), which is reset the display module
- Indicate “Tearing Effect” (TE), which is used for a TE trigger event from the display module to the MCU
- Indicate “Acknowledge” (ACK), which is used for a non-error event from the display module to the MCU

The basic sequence of the Escape Mode is as follow

- Start: LP-111
- Escape Mode Entry (EME): LP-111 =>LP-100 =>LP-000 =>LP-001 =>LP-000
- Escape Command (EC), which is coded, when one of the data lanes is changing from low-to-high-to-low then this changed data lane is presenting a value of the current data bit (DSI2-D0\_A0 = 1, DSI2-D0\_B0 = 0, DSI2-D0\_C0 = 0) e.g. when DSI2-D0\_C0 is changing from low-to-high-to-low, the receiver is latching a data bit, which value is logical 0. The receiver is using this low-to-high-to-low transition for its internal clock.
- A load if it is needed
- Exit Escape (Mark-1) LP-000 =>LP-100 =>LP-111
- End: LP-111

This basic construction is illustrated below:



### General Escape Mode Sequence

A total of eight Escape Commands (EC) are divided into two types: Mode and Trigger, as shown in the following table.

An example of the Mode type Escape Command is „Ultra-Low Power Mode”, where the AP instructs the display module to enter its Ultra-Low Power Mode.

Escape commands are defined in the following table.

Escape commands define

Escape Command	Command Type Mode / Trigger	Entry command Pattern (First Bit→ Last Bit Transmitted)	Dn	D0
Low- Power Data Transmission	Mode	1110 0001 bin		x
Ultra- Low Power Mode	Mode	0001 1110 bin	x	x
Underdefined- 1, Note1	Mode	1001 1111 bin		
Underdefined- 2, Note1	Mode	1101 1110 bin		
Remote Application Reset	Trigger	0110 0010 bin		
Acknowledge	Trigger	0010 0001 bin		x
UnKnow- 5, Note1	Trigger	1010 0000 bin		

**\*Note:**

1. This Escape command support is not implemented on the display module.
2. n=1, 2 and 3.
3. x= supported.

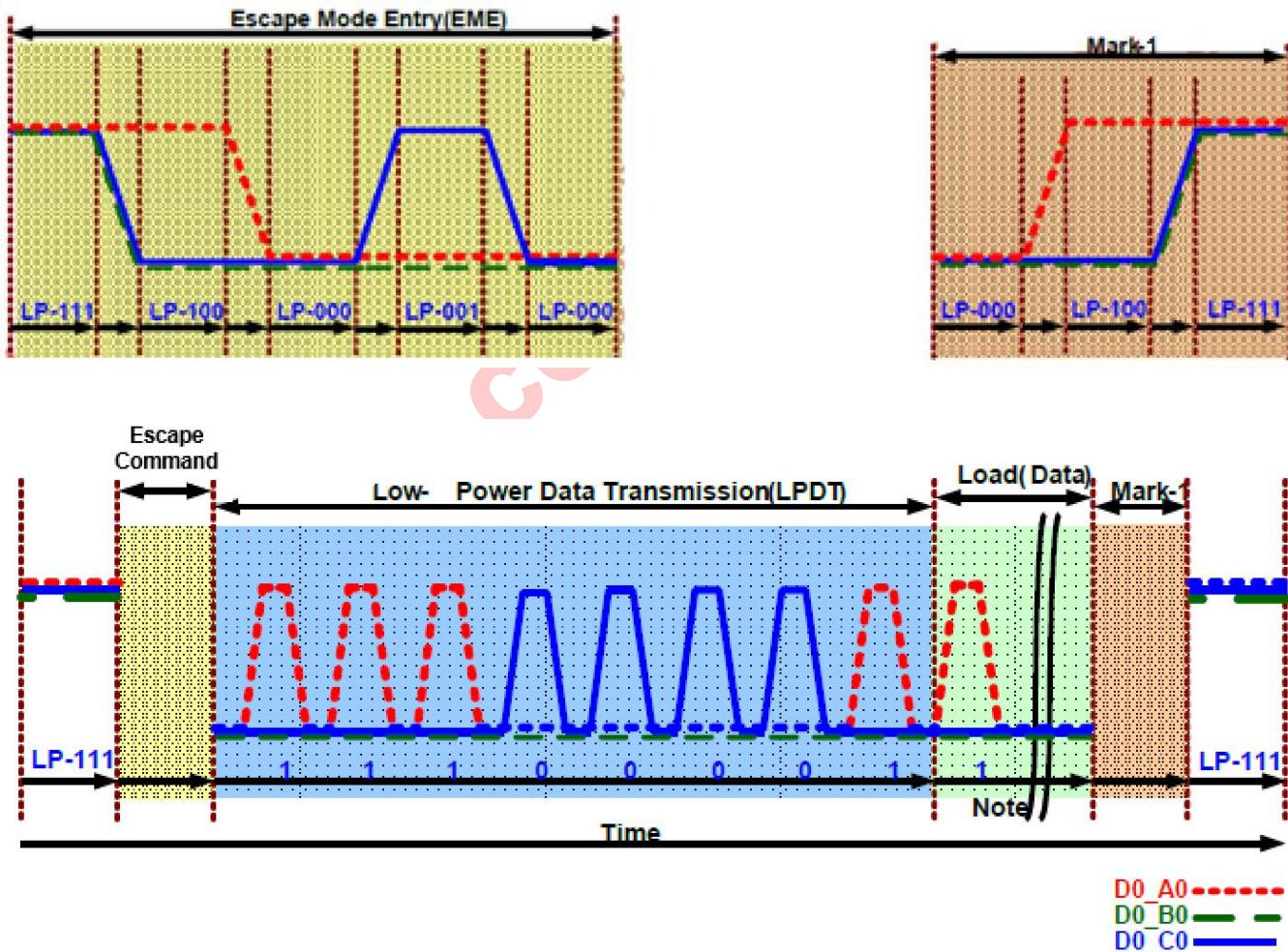
### Low-Power Data Transmission (LPDT)

The MCU can send data to the display module in Low-Power Data Transmission (LPDT) mode when data lanes are entering in Escape Mode and Low-Power Data Transmission (LPDT) command has been sent to the display module. The display module is also using the same sequence when it is sending data to the MCU.

The Low Power Data Transmission (LPDT) is using a following sequence:

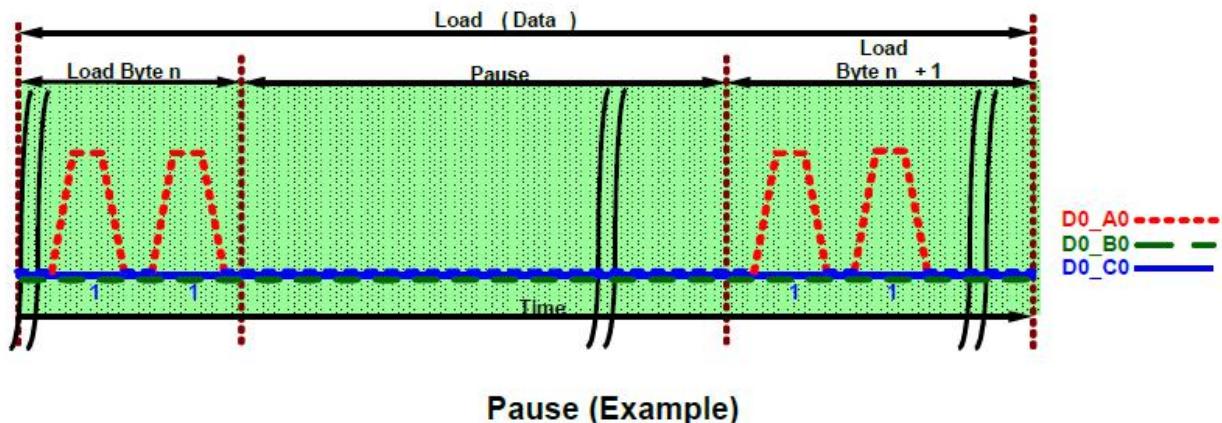
- Start: LP-111
- Escape Mode Entry (EME): LP-111 =>LP-100 =>LP-000 =>LP-001 =>LP-000
- Low-Power Data Transmission (LPDT) command in Escape Mode: 1110 0001 (First to Last bit)
- Load (Data):
- One or more bytes (8 bit)
- Data lanes are in pause mode when data lanes are stopped (Both lanes are low) between bytes
- Mark-1: LP-000 =>LP-100 =>LP-111
- End: LP-111

This sequence is illustrated for reference purposes below:



\*Note: Load (Data) is presenting that the first bit is logic 'al1' in this example

## Low-Power Data Transmission (LPDT)



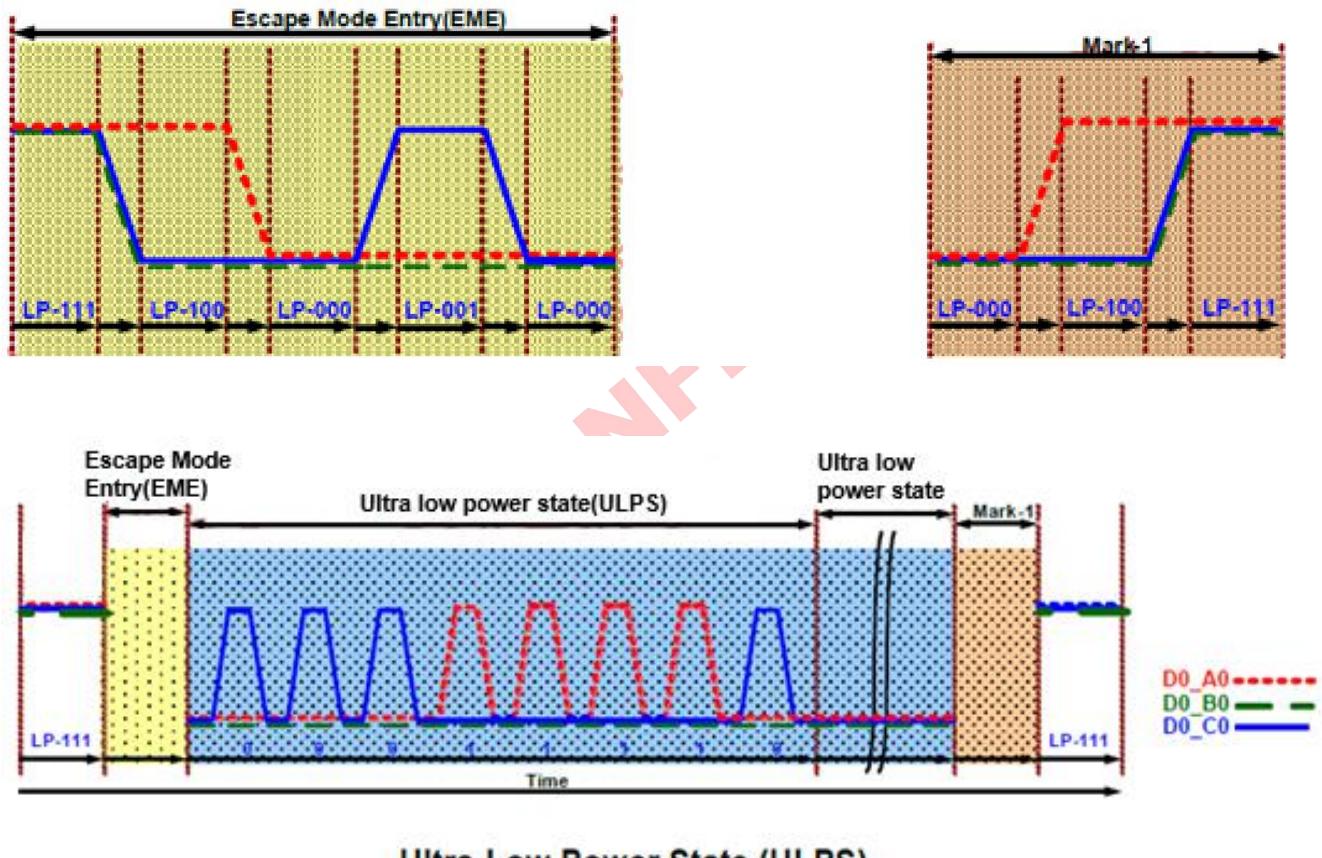
### Ultra-Low Power State (ULPS)

The MCU can force data lanes in Ultra-Low Power State (ULPS) mode when data lanes are entering in Escape Mode.

The Ultra-Low Power State (ULPS) is using a following sequence:

- Start: LP-111
- Escape Mode Entry (EME): LP-111 =>LP-100 =>LP-000 =>LP-001 =>LP-000
- Ultra-Low Power State (ULPS) command in Escape Mode: 0001 1110 (First to Last bit)
- Ultra-Low Power State (ULPS) when the MCU is keeping data lanes low
- Mark-1: LP-000 =>LP-100 =>LP-111
- End: LP-111

This sequence is illustrated for reference purposes below:



**Ultra-Low Power State (ULPS)**

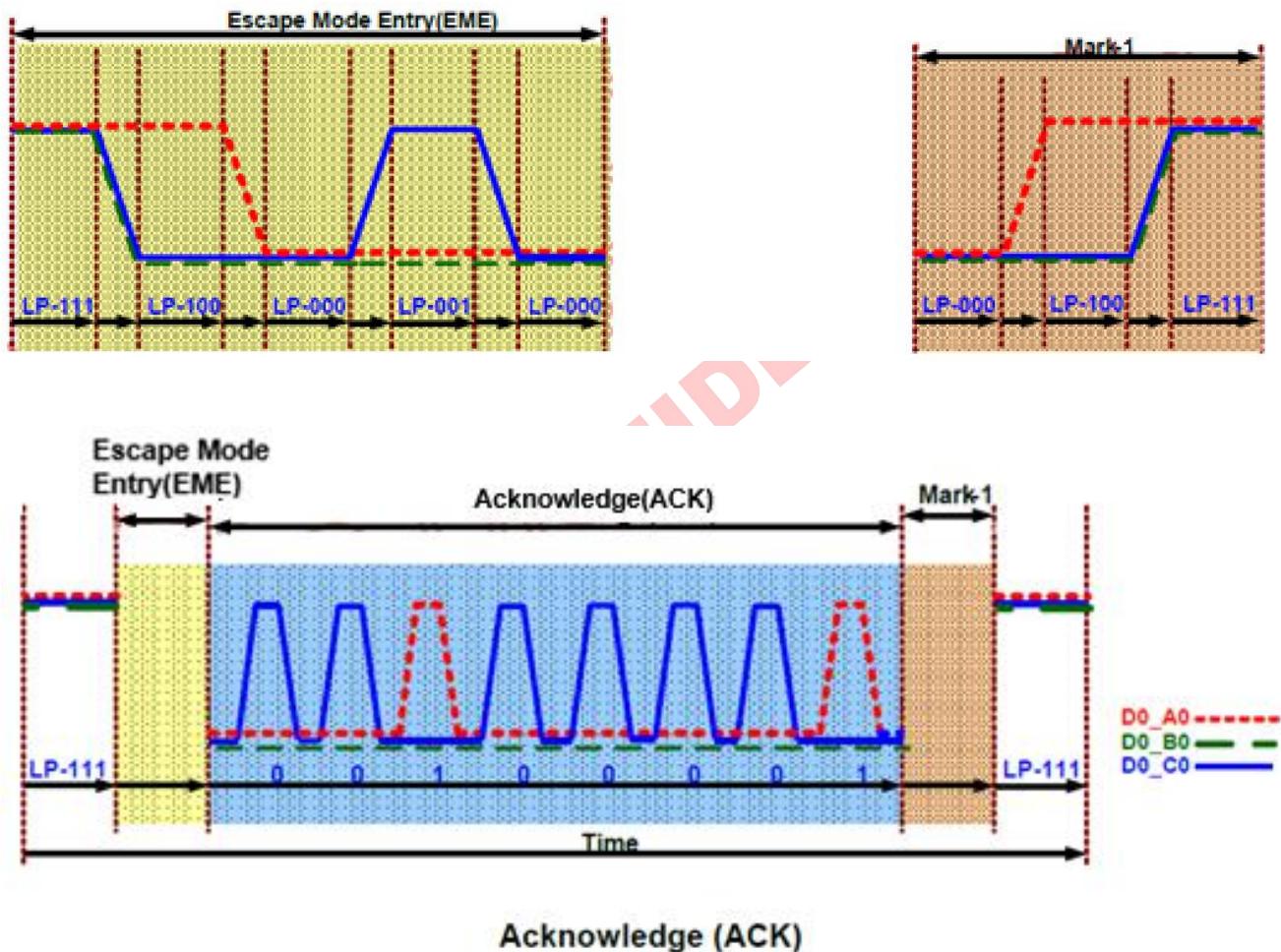
**Acknowledge (ACK)**

The display module can inform to the MCU when an error has not recognized on it by Acknowledge (ACK).

The Acknowledge (ACK) is using a following sequence:

- Start: LP-111
- Escape Mode Entry (EME): LP-111 =>LP-100 =>LP-000 =>LP-001 =>LP-000
- Acknowledge (ACK) command in Escape Mode: 0010 0001 (First to Last bit)
- Mark-1: LP-000 =>LP-100 =>LP-111
- End: LP-111

This sequence is illustrated for reference purposes below:



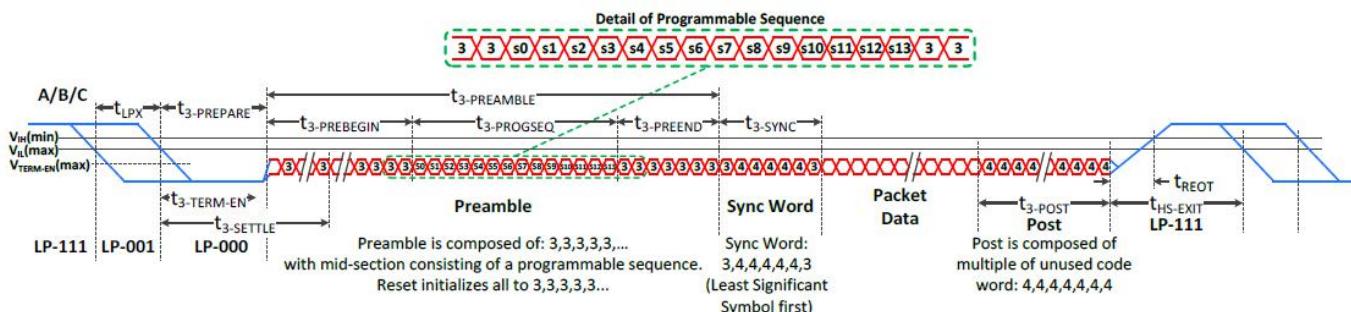
**High Speed Data Transmission (HSDT)****Entering High-Speed Data Transmission (T<sub>SOT</sub> of HSDT)**

The display module is entering High-Speed Data Transmission (HSDT) by the MCU.

Data lanes of the display module are entering (T<sub>SOT</sub>) in the High-Speed Data Transmission (HSDT) as follows

- Start: LP-111
- HS-Request: LP-001
- HS-Settle: LP-000 => 333333 (Rx: Lane Termination Enable)
- Rx Synchronization: 3444443 (Sync Word), Least Significant Symbol first
- End: High-Speed Data Transmission (HSDT) – Ready to receive High-Speed Data Load

This same entering High-Speed Data Transmission (T<sub>SOT</sub> of HSDT) sequence is illustrated below

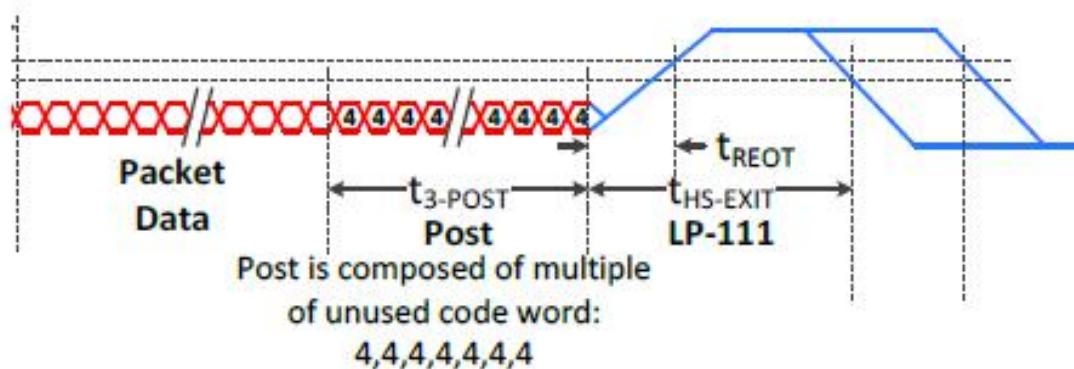
**Leaving High-Speed Data Transmission (T<sub>EOT</sub> of HSDT)**

The display module is leaving the High-Speed Data Transmission (T<sub>EOT</sub> of HSDT) by the MCU and this HSCM is kept until data lanes are in LP-111 mode.

Data lanes of the display module are leaving from the High-Speed Data Transmission (T<sub>EOT</sub> of HSDT) as follows

- Start: High-Speed Data Transmission (HSDT)
- Stops High-Speed Data Transmission
- MCU changes to 4444444, Post is composed of multiple of unused code
- End: LP-111 (Rx: Lane Termination Disable)

This same leaving High-Speed Data Transmission (T<sub>EOT</sub> of HSDT) sequence is illustrated below



### 7.3.3 Packet Level Communication for C-PHY

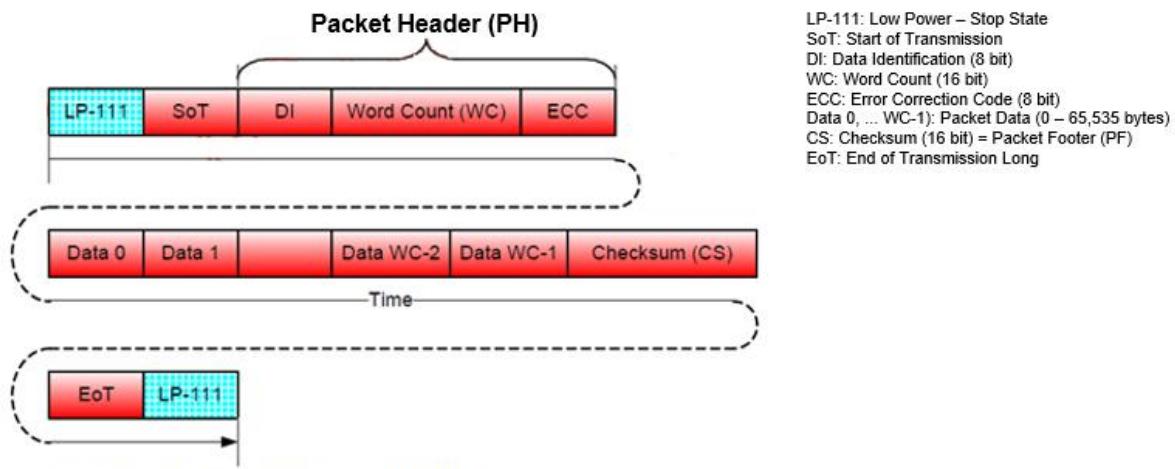
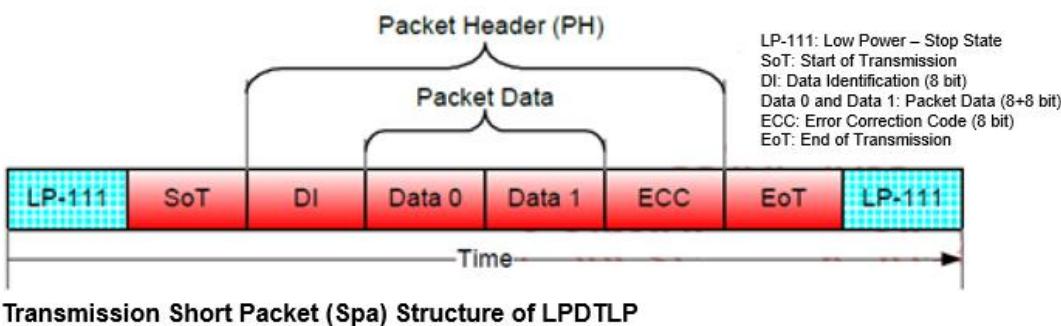
#### 7.3.3.1 Short Packet (SPa) and Long Packet (LPa) Structure for C-PHY

Short Packet (SPa) and Long Packet (LPa) are always used when data transmission is done in Low Power Data Transmission (LPDT) or High-Speed Data Transmission (HSDT) modes.

The lengths of the packets are

- Short Packet (SPa): 4 bytes
- Long Packet (LPa): From 6 to 65,541 bytes

The type (SPa or LPa) of the packet can be recognized from their package headers (PH).

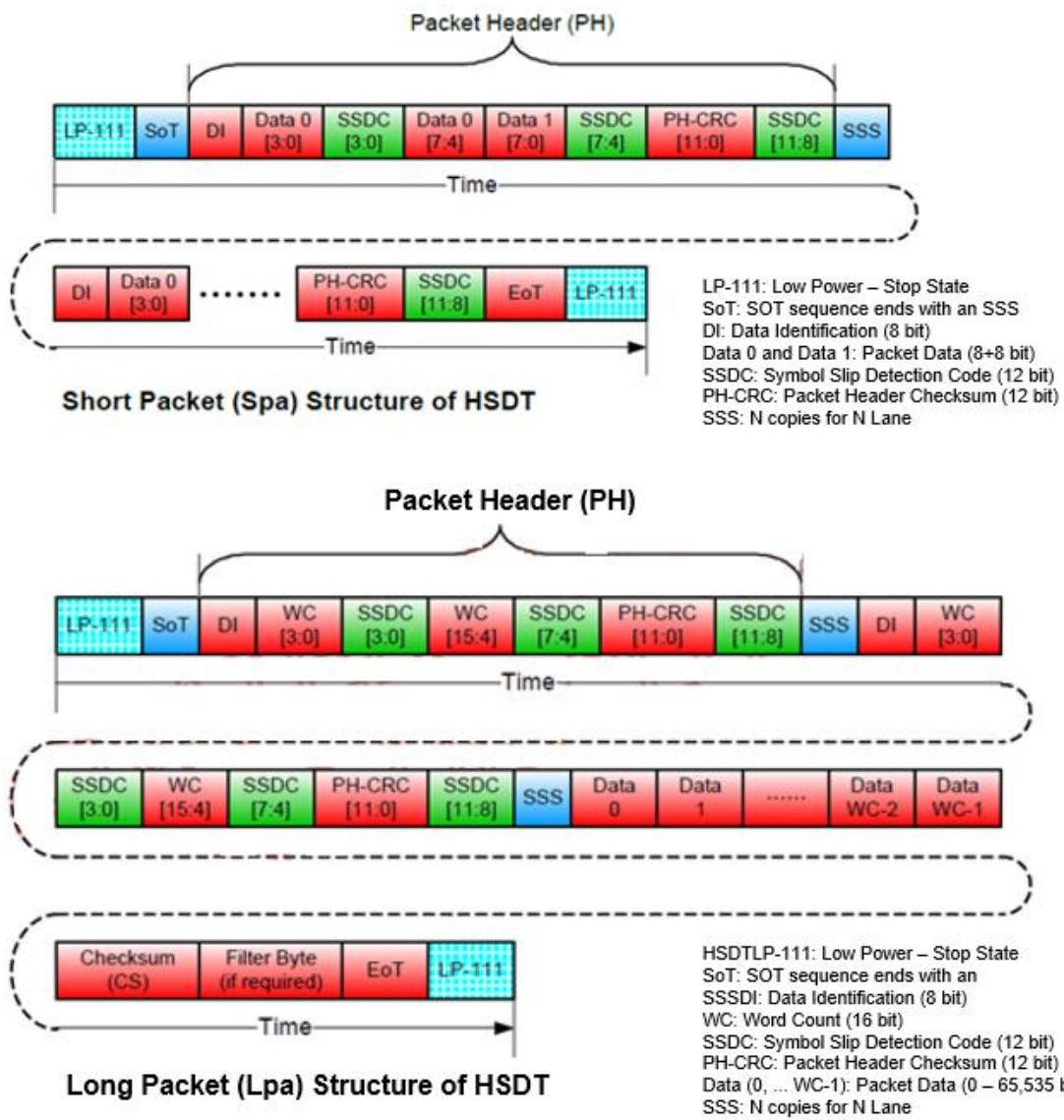


Note:

Short Packet (SPa) Structure and Long Packet (LPa) Structure are presenting a single packet sending (= Includes LP-111, SoT and EoT for each packet sending).

The other possibility is that there is not needed SoT, EoT and LP-111 between packets if packets have sent in multiple packet format e.g.

- \* LP-111 =>SoT =>SPa =>LPa =>SPa =>SPa =>EoT =>LP-111
- \* LP-111 =>SoT =>SPa =>SPa =>SPa =>EoT =>LP-111
- \* LP-111 =>SoT =>LPa =>LPa =>EoT =>LP-111



## 8. Functional Description

### 8.1 Tearing Effect Information

The tearing effect output line supplies to the AP a panel synchronization signal. This signal can be enabled or disabled by the tearing effect line off & on commands. The mode of the tearing effect line is defined by the parameter of the tearing effect line on command.

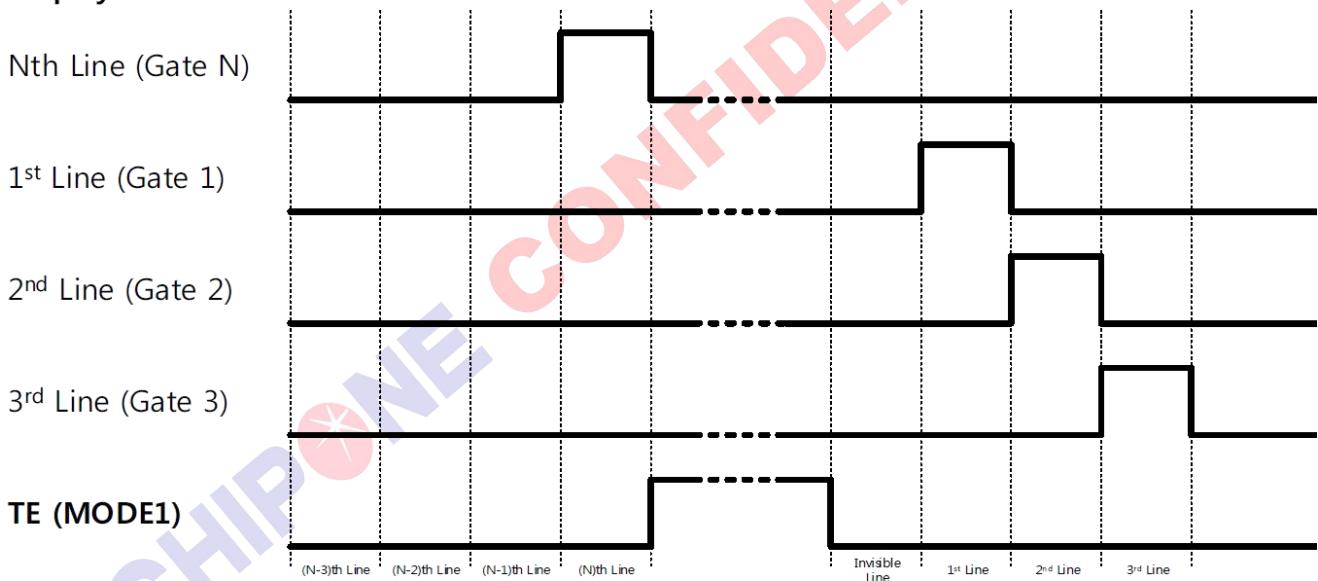
The setting of the tearing effect line is defined by the instructions of:

1. TEOFF (34h)
2. TEON (35h)
3. TESCAN (44h)

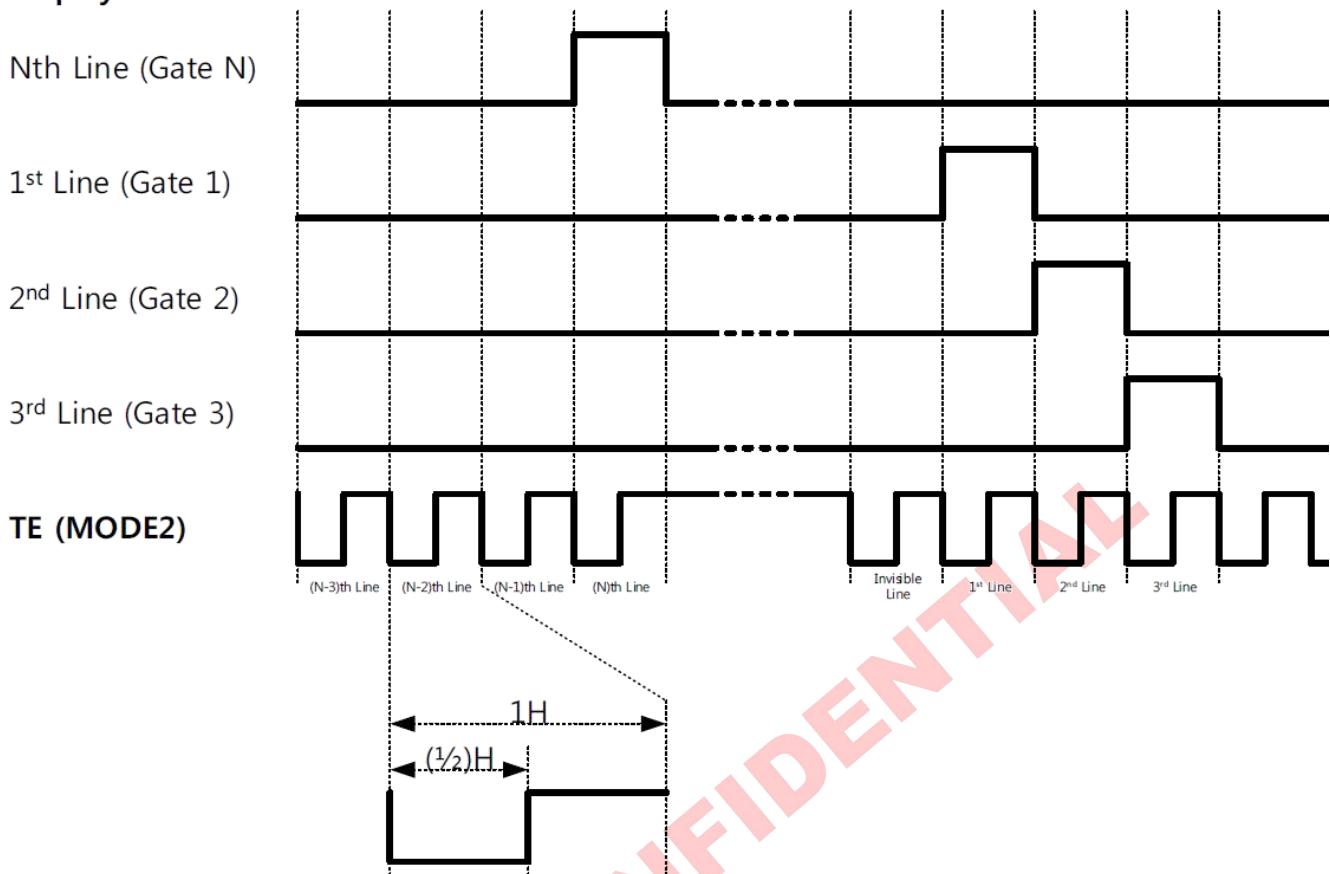
#### 8.1.1 Tearing Effect Line Modes

[Mode 1]: the Tearing Effect Output signal consists of V-Sync and V-Blanking information only:

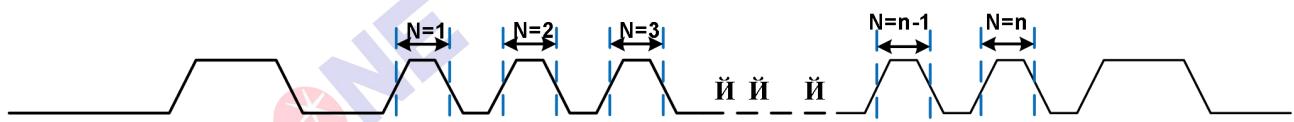
**Display Gate Scan**



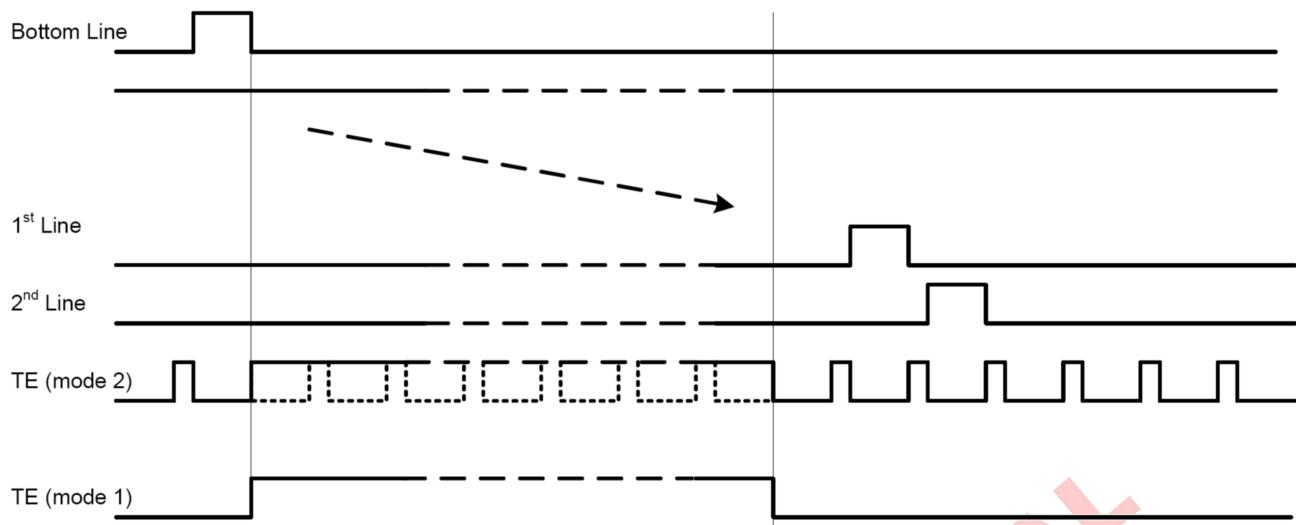
[Mode 2]: the tearing effect output signal consists of V-Blanking and H-Blanking which are included of V-sync and H-sync information:

**Display Gate Scan**

[Mode 3]: This mode turn on the tearing effect output signal when vertical scanning reaches line N. In the following figure, it shows that TE only output one line period pulse that can be selected by TESCAN (44h).

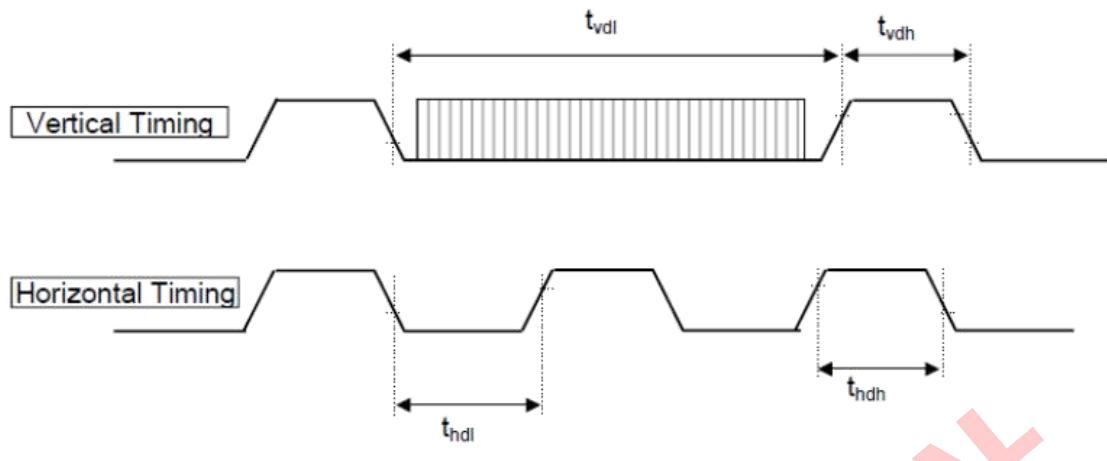


N = the N-th scanning line which set by register TESCAN (44h).



\*NOTE: During sleep in mode, the tearing effect output signal is active low.

### 8.1.2 Tearing Effect Line Timing

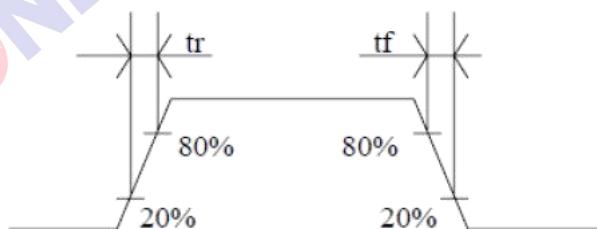


Tearing Effect Line Timing

Parameter	Symbol	MIN	TYP	MAX	Unit	Note
Vertical timing low duration	tvdl	—	—	—	μs	
Vertical timing high duration	tvdh	16	—	VBP[11:0]+VFP[11:0]-1	hsync	
Horizontal timing low duration	thdl	—	—	—	μs	
Horizontal timing high duration	thdh	—	—	1/2	hsync	
Rise time	Tr	—	—	25	ns	Cload = 70pF Rload = 50Ω
Fall time	Tf	—	—	25	ns	

\*Note:

1. The signal's rise and fall times (tf, tr) are stipulated to be equal to or less than 15 ns.
2. The signal's rise and fall times (tf, tr) are simulation result.



Rise and Fall Times

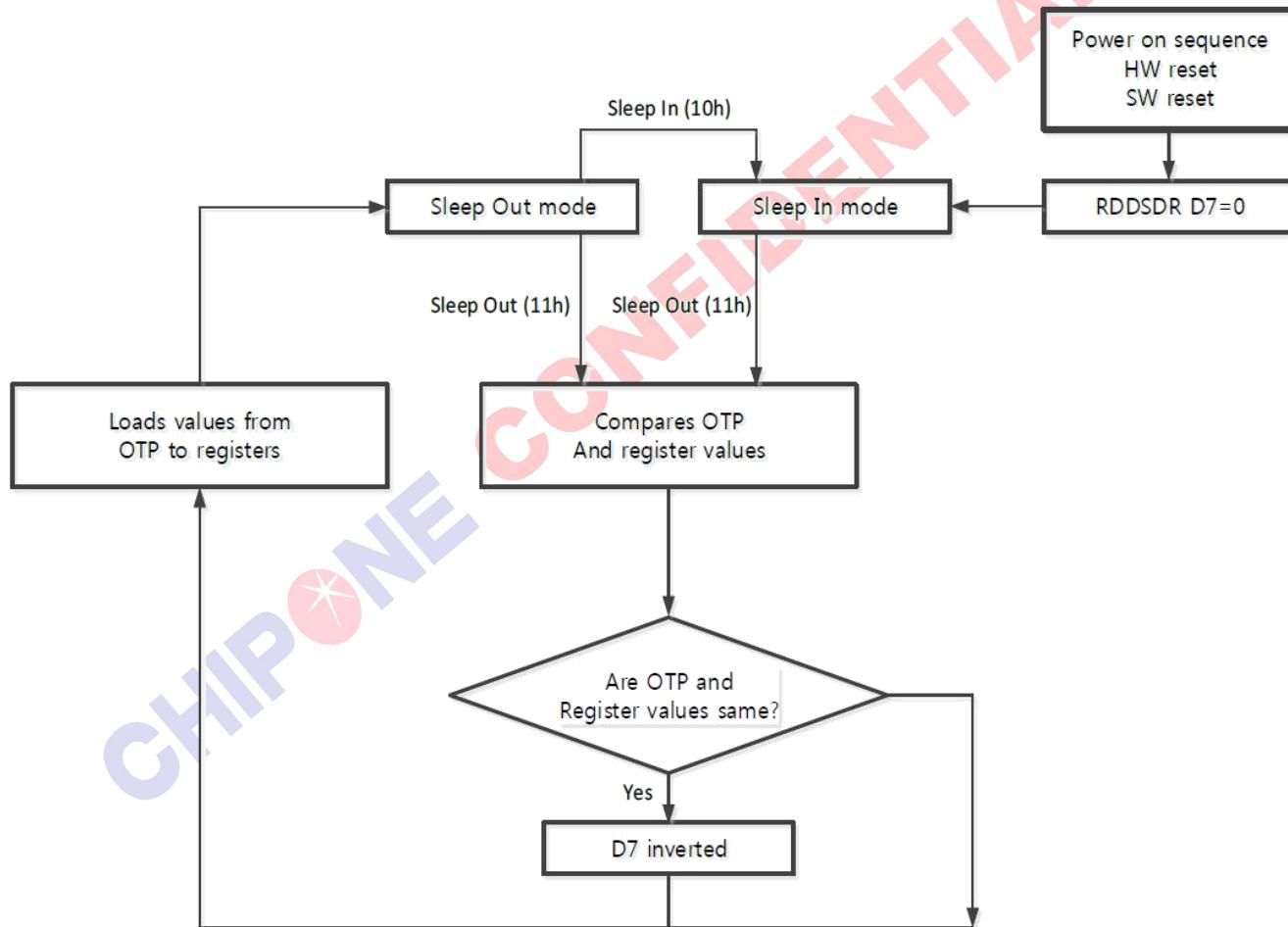
## 8.2 Sleep Out Command and Self-Diagnostic Functions

### 8.2.1 Register Loading Detection

Sleep out command is a trigger for an internal function of the display module which indicates, if the display module loading function of factory default values from OTP to registers of the display controller is working properly.

There are compared factory values of the OTP and register values of the display controller by the display controller (1st step: Compares register and OTP) values, 2nd step: Loads OTP value to register. If those both values (OTP and register values) are same, there is inverted (increased by 1) a bit, which is defined in command "Read Display Self-Diagnostic Result (0FH)" (RDDSDR) (The used bit of this command is D7). If those both values are not same, this bit (D7) is not inverted (not increased by 1).

The flow chart for this internal function is following.



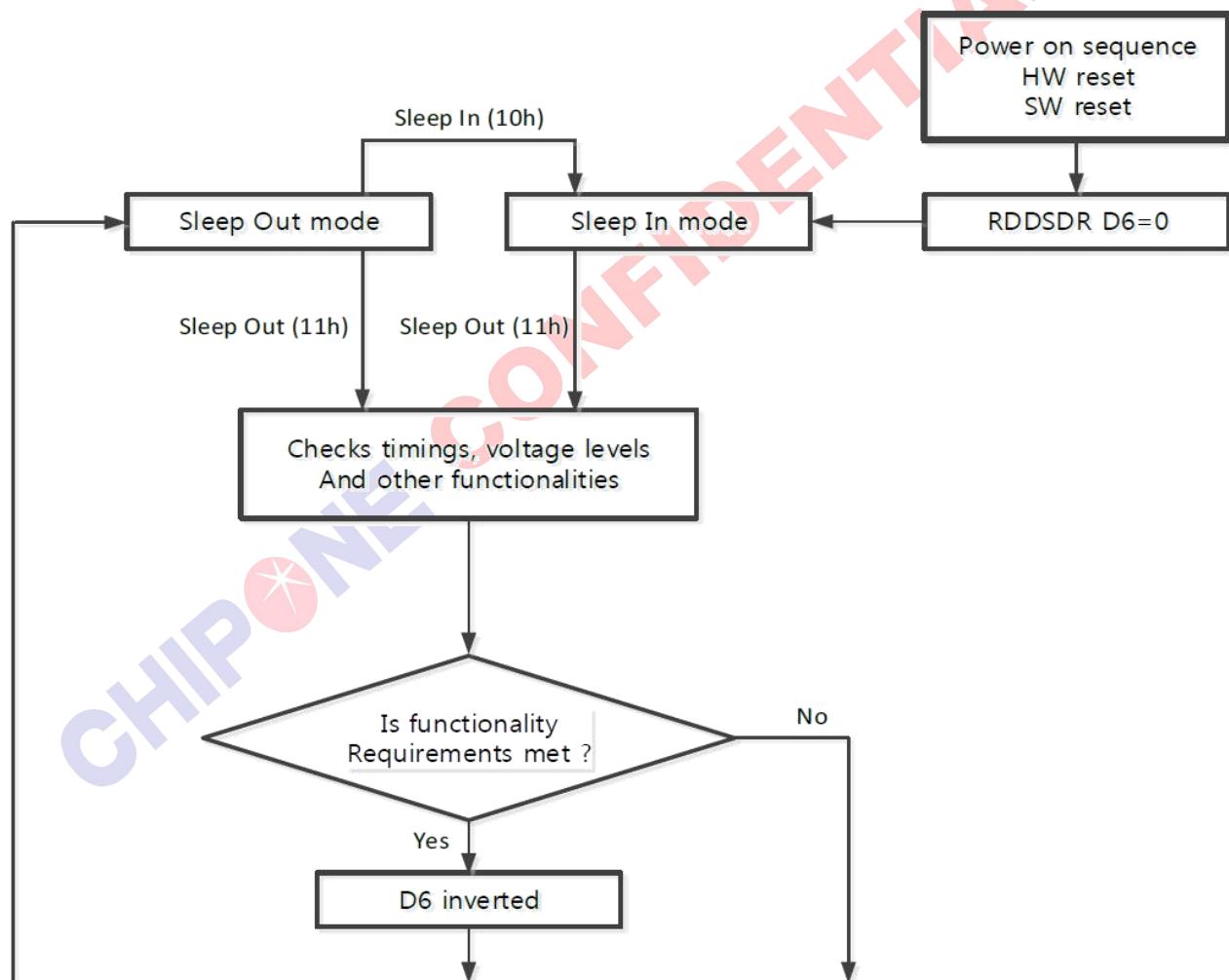
Flowchart of Register Loading Detection

## 8.2.2 Functionality Detection

Sleep out command is a trigger for an internal function of the display module, which indicates, if the display module is still running and meets functionality requirements.

The internal function (the display controller) is comparing, if the display module is still meeting functionality requirements (e.g. Step up circuit voltage levels, timings, etc.) If functionality requirement is met, there is inverted (Increased by 1) a bit, which defined in command “Read Display Self-Diagnostic Result (0FH)” (RDDSDR) (the used bit of this command is D6). If functionality requirement is not same, this bit (D6) is not inverted (= Not increased by 1) and the used TE-line is set to low (registers, what are set by “Tearing Effect Line On (35H)” command, are keeping their current values) when it can only be reactivated “Tearing Effect Line On (35H)” command.

The flow chart for this internal function is following:

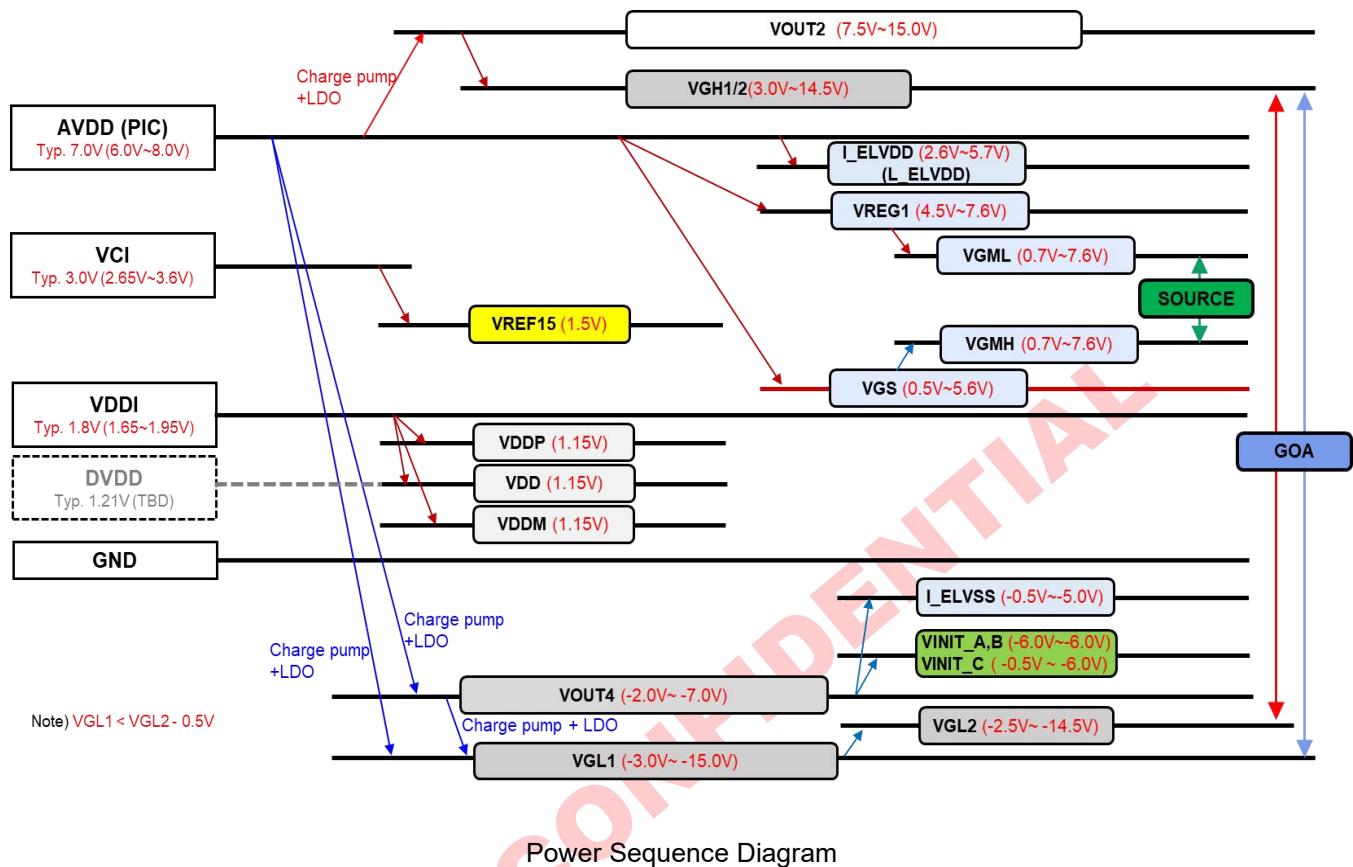


Flowchart of Functionality Detection

\*NOTE: There is needed 120ms after sleep out command, when there is changing from sleep in mode to sleep out mode, before there is possible to check if functionality requirements are met and a value of RDDSDR's D6 is valid. Otherwise there is 10ms delay for D6's value when Sleep out command is sent in Sleep out mode.

## 8.3 Power

### 8.3.1 Power Generation Diagram



**\*Note:**

1. VGL1 should be the lowest voltage in the chip.
2. VOUT2 should be the highest voltage in the chip
3. Source Output Range: 0.7V ~ 7.6V

### 8.3.2 Power ON Sequence

If nRESET line is held high or unstable by the host during power on, then a hardware reset must be applied after both VCI and VDDI have been applied – otherwise correct functionality is not guaranteed. There is no timing restriction upon this hardware reset.

If nRESET line is held Low (and stable) by the host during Power On, then the nRESET must be held low for minimum 10μsec after both VCI and VDDI have been applied.

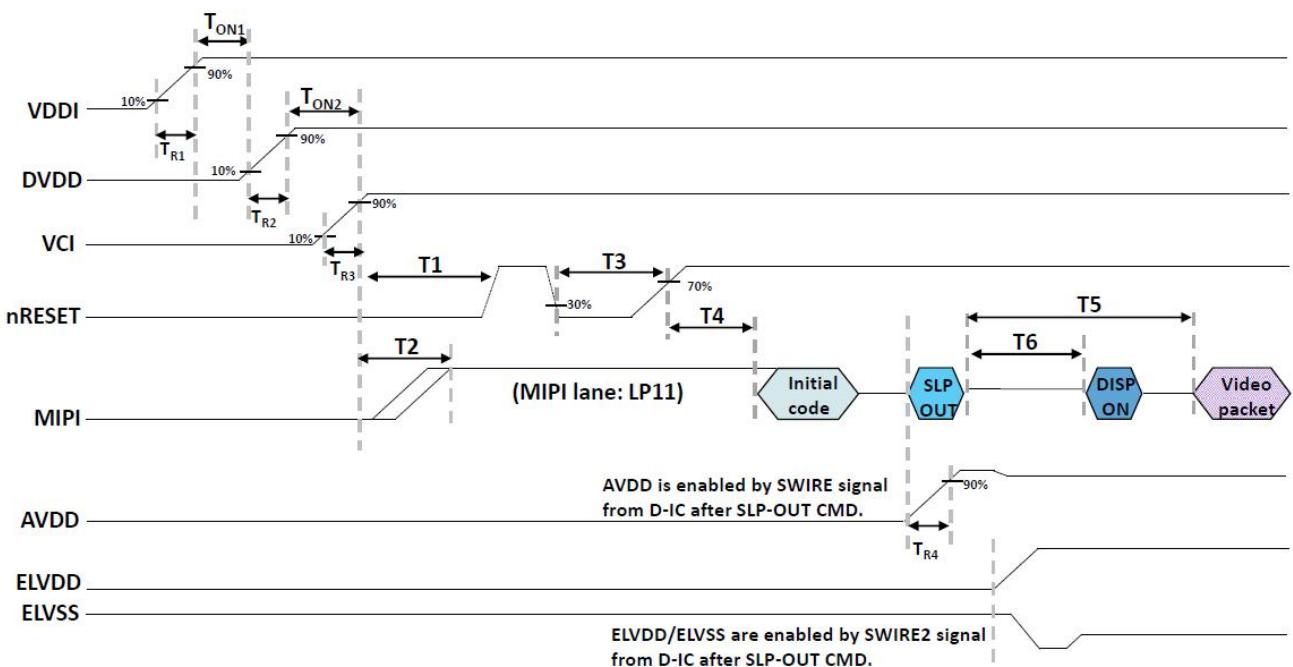
The power on sequence for different power input modes are shown as below.

Power ON Sequence Timing

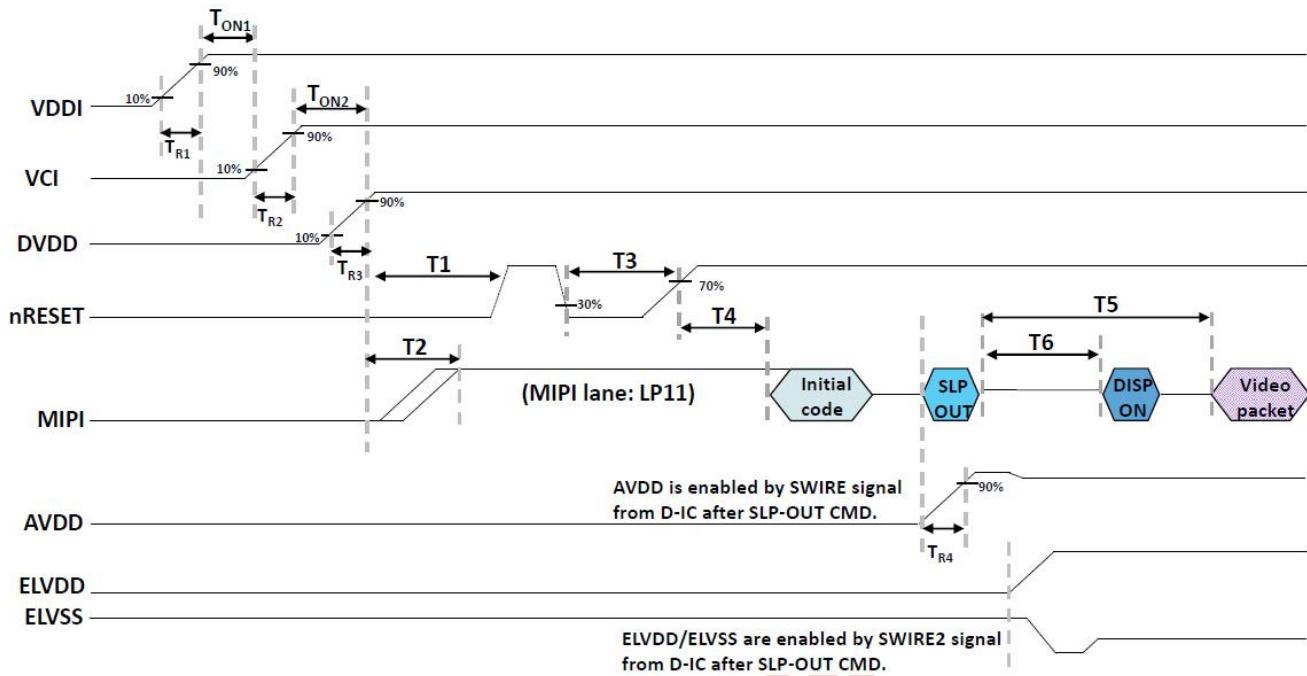
Symbol	Description	Value			Unit	Note
		Min.	Typ.	Max.		
T <sub>ON1</sub>	VDDI on to DVDD on delay	>0	-	-	μs	
T <sub>ON2</sub>	CASE1 : DVDD on to VCI on power delay time CASE2 : VCI on to DVDD on power delay time	>0	-	-	ms	
T <sub>1</sub>	CASE1 : VCI on to valid to nRESET high CASE2 : DVDD on to valid to nRESET high	10	-	-	ms	
T <sub>2</sub>	CASE1 : VCI to MIPI bus ready delay CASE2 : DVDD to MIPI bus ready delay	0	-	T <sub>1</sub>	ms	
T <sub>3</sub>	nRESET low period	50	-	-	us	
T <sub>4</sub>	nRESET high to OTP code re-load ready	15	-	-	ms	
T <sub>5</sub>	Sleep-out command received to video packet transmit delay.	80	-	-	ms	
T <sub>6</sub>	Sleep-out command received to display on command transmit delay	>0	-	-	μs	
T <sub>R1</sub>	VDDI power rising time	0.3	-	2	ms	
T <sub>R2</sub>	DVDD power rising time	0.3	-	2	ms	
T <sub>R3</sub>	VCI power rising time	0.3	-	2	ms	
T <sub>R4</sub>	AVDD power rising time	0.3	-	5	ms	

The Power on sequence is shown as below.

#### Power On Sequence for External DVDD\_CASE1



## Power On Sequence for External DVDD\_CASE2



Power on sequence

\*Note: Unless otherwise specified, timing herein shows cross point at 50% of signal/power level.

## 8.3.3 Power OFF Sequence

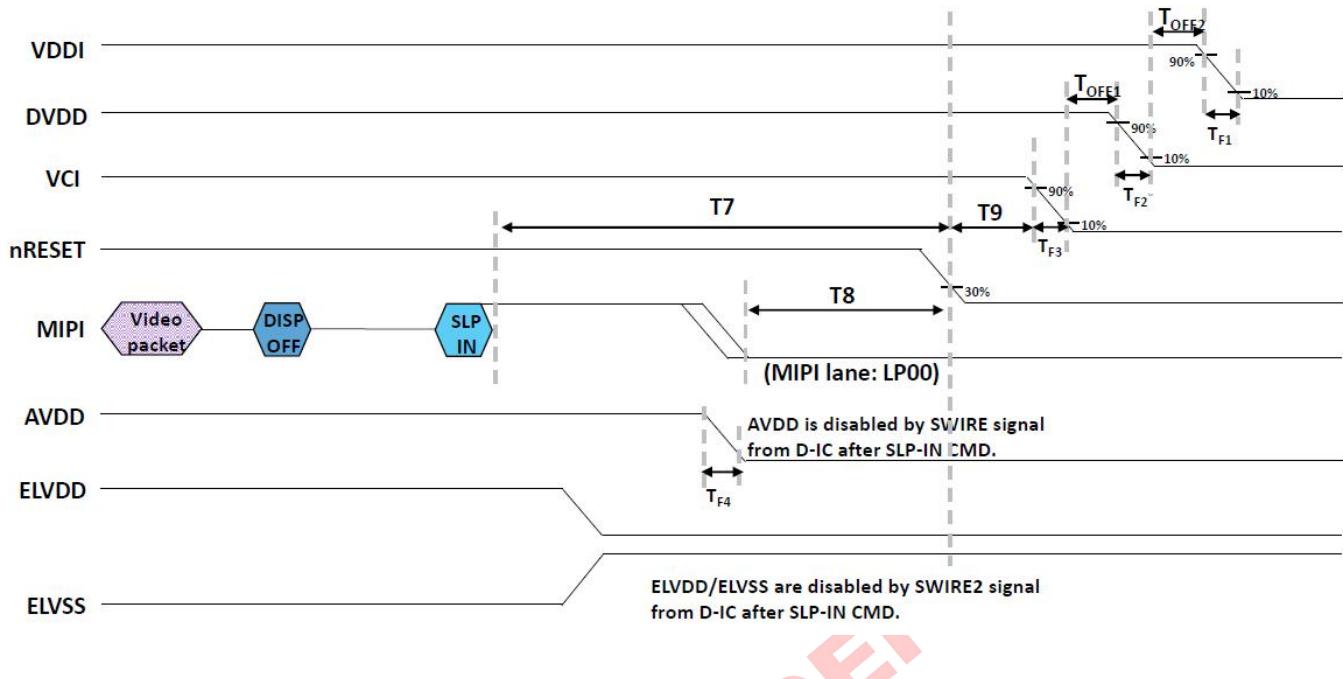
The power off sequence for different power input modes are shown as below.

Power OFF Sequence Timing

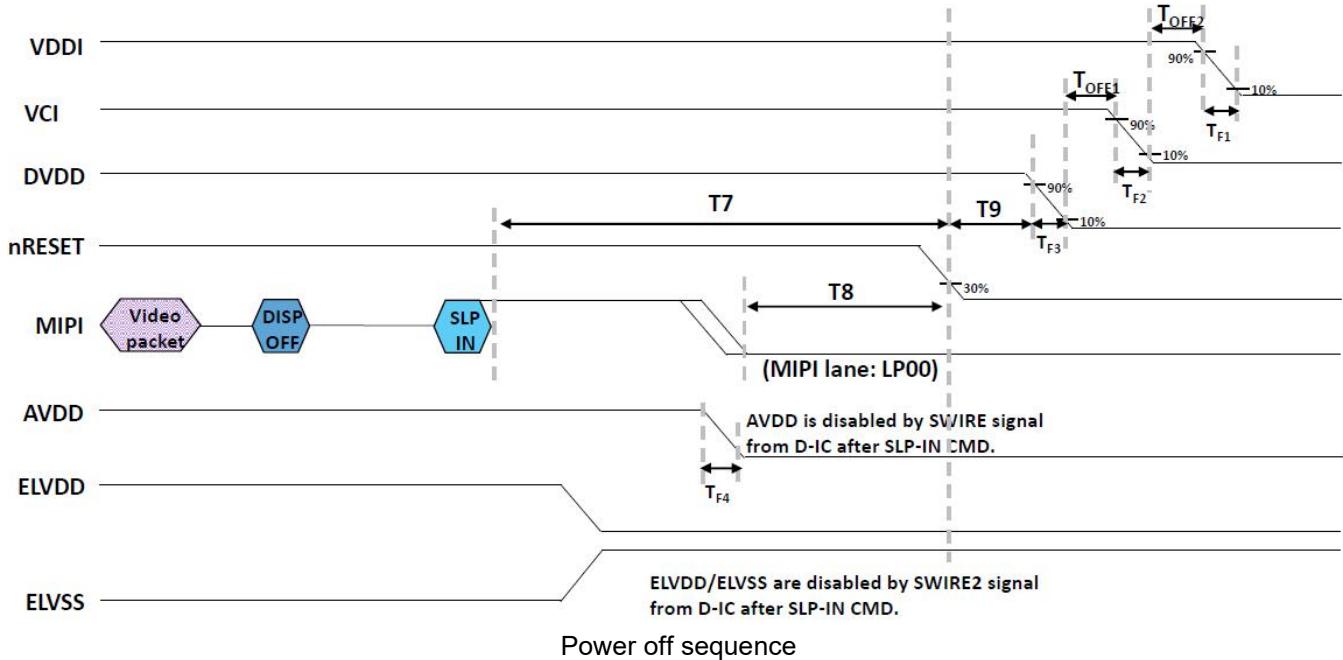
Symbol	Description	Value			Unit	Note
		Min.	Typ.	Max.		
T <sub>OFF1</sub>	CASE1 : VCI off to DVDD off delay CASE2 : DVDD off to VCI off delay	>0	-	-	μs	
T <sub>OFF2</sub>	CASE1 : DVDD off to VDDI off delay CASE2 : VCI off to VDDI off delay	>0	-	-	μs	
T <sub>7</sub>	Sleep-in command received to valid to nRESET low	100	-	-	ms	
T <sub>8</sub>	MIPI ultra low power mode to valid to nRESET low	0	-	-	μs	
T <sub>9</sub>	nRESET low to VCI off delay	0	-	-	μs	
T <sub>F1</sub>	VDDI power falling time	0.3	-	2	ms	
T <sub>F2</sub>	DVDD power falling time	0.3	-	2	ms	
T <sub>F3</sub>	VCI power falling time	0.3	-	2	ms	
T <sub>F4</sub>	AVDD power falling time	0.3	-	5	ms	

The power off sequence is shown as below:

### Power Off Sequence for External DVDD\_CASE1



### Power Off Sequence for External DVDD\_CASE2



**\*Note:**

1. Unless otherwise specified, timing herein shows cross point at 50% of signal/power level.
2. Keep VGH is equal to or larger than VCI during power off sequence.

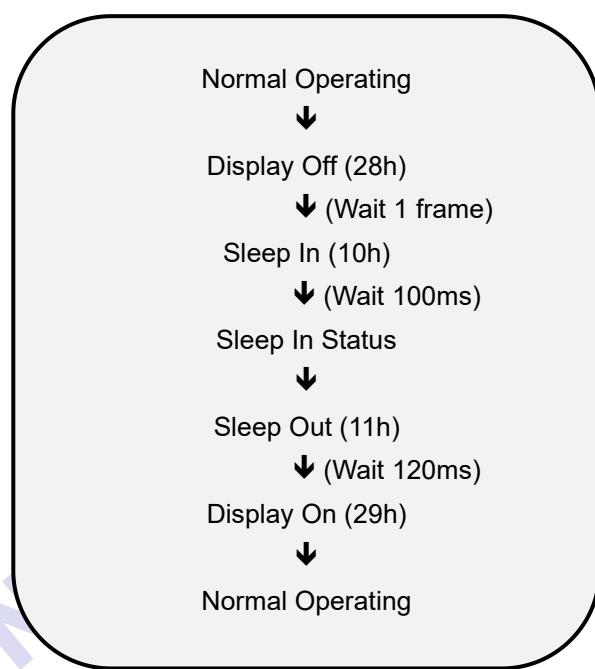
### 8.3.4 Abrupt Power Off

The abrupt power-off represents a situation where, for e.g. a battery is removed without the expected power off sequence. There will not be any damages for the display module or the display module will not cause any damages for the host or lines of the interface. At an abrupt power-off, the display will go blank and there will not be any visible effects with 1 second on the display (Blank display) and remains blank until "Power-on Sequence" powers it up. Blank display means: For normally white panel, the blank display indicates white display. For normally black panel, the blank display indicates black display.

### 8.3.5 Sleep In/Out Flow

This DDIC supports sleep mode for low power consumption.

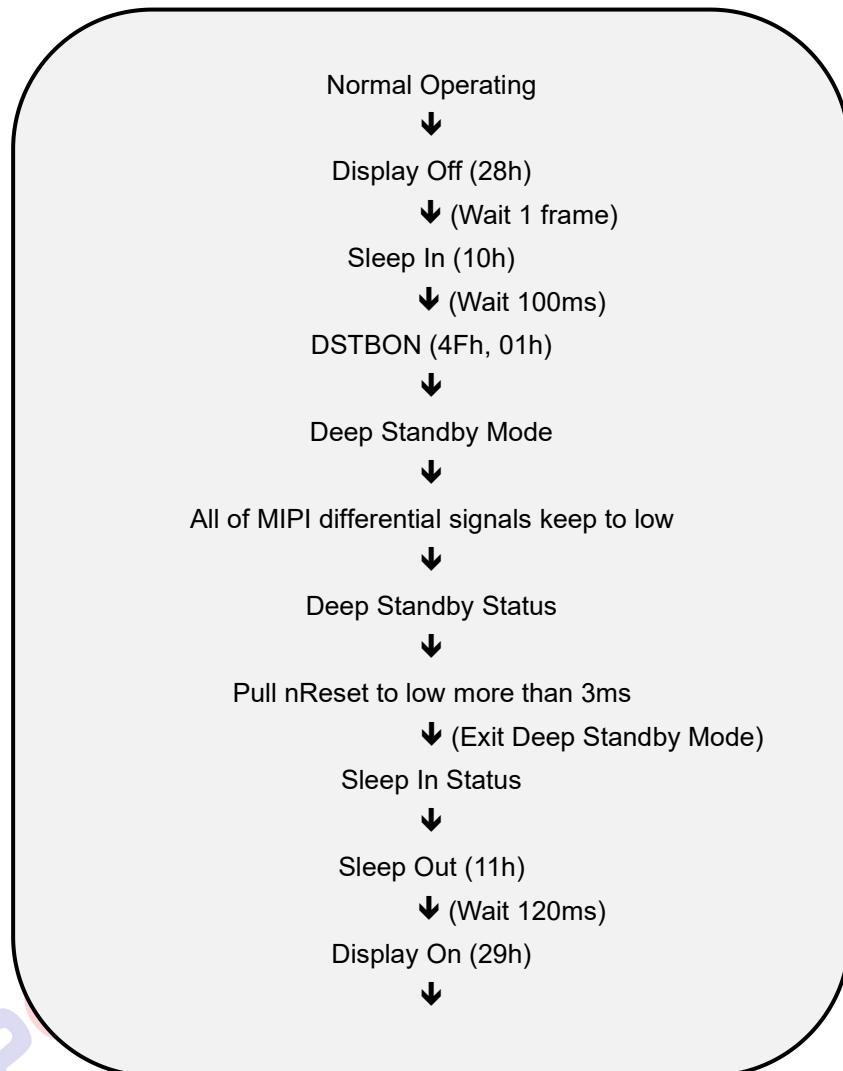
Flow chart of sleep mode



### 8.3.6 Deep Standby Flow

This DDIC supports deep standby mode for ultra-low power consumption.

Flow chart of deep standby mode



## 8.4 Source

### 8.4.1 Source Driver

The source driver circuit consists of 2560 drivers (S<1> to S<2560>). Display data is latched when 2560 channel data has arrived. Then the latched data enables the source drivers to output to expected voltage level. When less than 2560 sources are required, the unused source outputs should be left open and the available source outputs are presented as following table.

Connection between source outputs and AMOLED panel with SPR

Source Output	Panel Connection	Source Output	Panel Connection
Symbol	1280 x RGBG	Symbol	1080 x RGBG
VSSDUMMY...	Leave it open	VSSDUMMY...	Leave it open
S<1>	R1	S<1>	R1
S<2>	G1	S<2>	G1
S<3>	B2	S<3>	B2
S<4>	G2	S<4>	G2
S<5>	R3	S<5>	R3
S<6>	G3	S<6>	G3
...	...	...	...
S<1275>	B638	S<1075>	B538
S<1276>	G638	S<1076>	G538
S<1277>	R639	S<1077>	R539
S<1278>	G639	S<1078>	G539
S<1279>	B720	S<1079>	B540
S<1280>	G720	S<1080>	G540
VSSDUMMY...	Leave it open	VSSDUMMY...	Leave it open
S<1281>	R721	S<1481>	R541
S<1282>	G721	S<1482>	G541
S<1283>	B722	S<1483>	B542
S<1284>	G722	S<1484>	G542
S<1285>	R723	S<1485>	R543
S<1286>	G723	S<1486>	G543
...	...	...	...
S<2555>	B1278	S<2555>	B1078
S<2556>	G1278	S<2556>	G1078
S<2557>	R1279	S<2557>	R1079
S<2558>	G1279	S<2558>	G1079
S<2559>	B1280	S<2559>	B1080
S<2560>	G1280	S<2560>	G1080
VSSDUMMY...	Leave it open	VSSDUMMY...	Leave it open

\*Note: Horizontal Resolution:720+4N RGBG

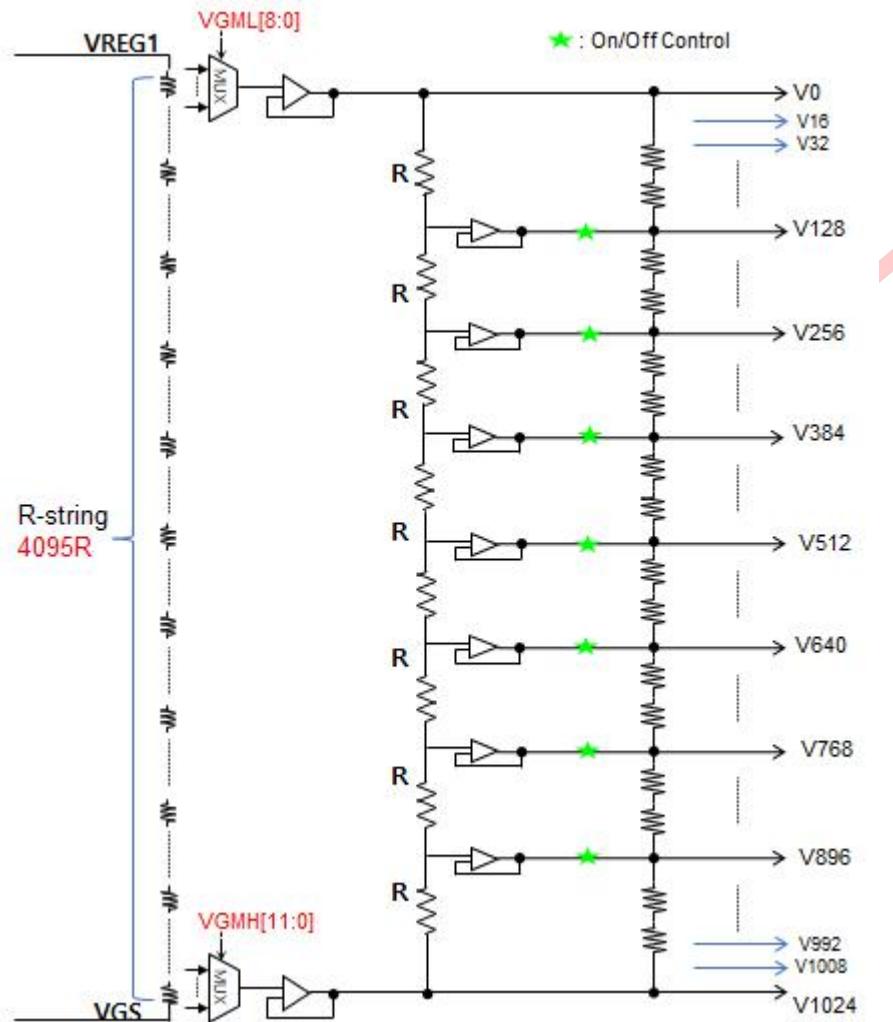
### 8.4.2 Gamma Adjustment Function

This DDIC provides the gamma adjustment function to display 16.7M colors simultaneously for each R/G/B color. The gamma adjustment executed by the high/mid/low level adjustment registers determines grayscale reference levels. Furthermore, you can adjust them to match AMOLED panel and a gamma for each R/G/B color, respectively.

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### 8.4.3 Structure of Grayscale Generator

The structure of grayscale generator is shown as below. This has totally 9 voltage taps. These 9 voltage levels (V0-V1023) between VREG1 and VGS are determined by the reference adjustment register, the amplitude adjustment register, the micro-adjustment register. These tap voltage levels make 1024 gray levels ranging from V0 to V1023 with the internal ladder resistor network.



Structure of Grayscale generator

## 8.5 One-Time Programmable (OTP) Control

This DDIC has an embedded OTP (One Time Programmable Device, EG0016K8TA04DDY03A) which is consist of one OTP IP (16K x 8bit) in eMemory Technology Inc. The EG0016K8TA04DDY03A is programmed by 1.1V, 3.3V power supply and 6V external VPP high voltage supply.

DC Specification

Operating Mode	Power Pin	Min.	Typ.	Max.	Unit
Read mode	VDD	0.99	1.1	1.21	V
	VDD2	2.3	3.3	4.8	V
	VPP	VDD2/VSS/Floating			
	VSS	0			V
Write mode	VDD	0.99	1.1	1.21	V
	VDD2	1.62	3.3	4.8	V
	VPP	5.75	6	6.25	V
	VSS	0			V

### 8.5.1 OTP Address Configuration

This DDIC's OTP control IP support auto write function from logic register to OTP cell. The number of auto write for each IP is different. Auto write time of each IP is supported 1 ~ 8 times.

Items	Description
Size	• 16K-byte One-Time Programmable (OTP) NVM
ID1	• OTP 8 times
ID2, ID3	• OTP 3 times
MIPI	• OTP 1 time & FLASH
TCON	• OTP 1time & FLASH
DSC	• OTP 1time & FLASH
DGM, PIC	• OTP 1time & FLASH
GAMMA	• Only FLASH
PWM, BC	• OTP 1 time & FLASH
CASCADE	• OTP 1 time & FLASH
ODC,CTB	• OTP 1 time & FLASH
SPR	• OTP 1 time & FLASH
RN	• OTP 1 time & FLASH
IE	• OTP 1 time & FLASH
DEMURA	• OTP 1 time & FLASH

\*Note: Please refer the ICNA3512 Application Note of the OTP programming.

## 9. Command

### 9.1 List of User Command

Operational Code is abbreviated by OpCode, Read/Write/Command is abbreviated by RWC, and Number of Parameter bytes is abbreviated by Num. of Para.

List of User Command (Level-1)

OpCode (Hex)	Command	RWC	Num. of Para.	Description
00h	NOP	C	0	No Operation
01h	SWRESET	C	0	Software Reset
05h	RDNUMPE	R	1	Read Number of the Errors on Primary DSI
0Ah	RDDPM	R	1	Read Display Power Mode
0Bh	RDDMADCTL	R	1	Read Display Memory Access Control
0Dh	RDDIM	R	1	Read Display Image Mode
0Eh	RDDSM	R	1	Read Display Signal Mode
0Fh	RDDSDR	R	1	Read Display Self-Diagnostic Result
10h	SLPIN	C	0	Sleep In
11h	SLPOUT	C	0	Sleep Out
12h	PTLON	C	0	Partial Mode On
13h	NORON	C	0	Normal Mode On
20h	INVOFF	C	0	Display Inversion Off
21h	INVON	C	0	Display Inversion On
22h	ALLPOFF	C	0	All Pixel Off
23h	ALLPON	C	0	All Pixel On
28h	DISPOFF	C	0	Display Off
29h	DISPON	C	0	Display On
2Ah	COSET	W	4	Write Column Address Set
2Bh	PASET	W	4	Write Page Address Set
2Ch	RAMWR	W	Variable	Memory Write
30h	PTLAR	W	4	Write Partial Area Row Set
31h	PTLAC	W	4	Write Partial Area Column Set
32h	RTE	C	0	Request TE
34h	TEOFF	C	0	Tearing Effect Line Off
35h	TEON	W	1	Write Tearing Effect Line On
36h	MADCTL	W	1	Memory Data Access Control
38h	IDLEOFF	C	0	Idle Mode Off
39h	IDLEON	C	0	Idle Mode On
3Ch	RAMWRC	W	1	Memory Write Continue
40h	WRREGION	W	1	Write Multi Region Value

41h	RDREGION	R	1	Read Multi Region Value
42h	WRUPSCM	W	1	Write Scale-up Value
43h	RDUPSCM	R	1	Read Scale-up Value
44h	TESCAN	W	2	Write Tear Scanline
45h	RDTESCAN	R	3	Read Scanline
48h	WRDSIM	W	1	Write DSI MODE
49h	RDDSIM	R	1	Read DSI MODE
4Fh	DSTBON	W	1	Write Deep Standby On
51h	WRDISBV	W	5	Write Display Brightness
52h	RDDISBV	R	5	Read Display Brightness Value
53h	WRCTRL	W	1	Write Control Display
54h	RDCTRL	R	1	Read Control Display Value
55h	WRACL	W	2	Write ACL Value
56h	RDACL	R	2	Read ACL Value
57h	WRIE	W	1	Write IE Value
58h	RDIE	R	1	Read IE Value
59h	WRCM	W	1	Write CM Value
5Ah	RDCM	R	1	Read CM Value
5Dh	WRMCL	W	2	Write MCL Value
5Eh	RDMCL	R	2	Read MCL Value
63h	WRLTPOMD	W	1	Write LTPO Value
64h	RDLTPOMD	R	1	Read LTPO Value
65h	WRMANDLY	W	5	WR MAN Delay Value
66h	RDMANDLY	R	5	RD MAN Delay Value
68h	RDMANVTEO	R	2	RD MAN VTE Value
69h	WRMSYNC	W	1	Write MSYNC Value
6Ah	RDMSYNC	R	1	Read MSYNC Value
6Bh	WRQSYNC	W	1	Write QSYNC Value
6Ch	RDQSYNC	R	1	Read QSYNC Value
6Dh	WRQSYNCTO	W	4	Write QSYNC Timeout Value
6Eh	RDQSYNCTO	R	4	Read QSYNC Timeout Value
71h	WRTEMP	W	1	Write TEMP Value
72h	RDTEMP	R	1	Read TEMP Value
73h	RDWCX	R	1	Read W Coor. X
74h	RDWCY	R	1	Read W Coor. Y
76h	RDRCX	R	1	Read R Coor. X
77h	RDRCY	R	1	Read R Coor. Y
78h	RDGCX	R	1	Read G Coor. X
79h	RDGCY	R	1	Read G Coor. Y

7Bh	RDBCX	R	1	Read B Coor. X
7Ch	RDWBCY	R	1	Read B Coor. Y
80h	OSC CALIB	W	1	Write OSC Calibration Value
84h	RDBRL	R	1	Read BR Low Byte
85h	RDBRH	R	1	Read BR High Byte
8Fh	RDERRFLAG	R	1	Read Error Flag Status
90h	AODSET	W	1	Write AOD Value
91h	WRVR_CTRL	W	1	Write VR Value
92h	RDVR_CTRL	R	1	Read VR Value
93h	WRRNEN	W	1	Write RN Value
94h	RDRNEN	R	1	Read RN Value
95h	WTECC_WT	W	1	Write ECC Value
96h	RDECC_WT	R	1	Read ECC Value
97h	WRFPS	W	3	Write FPS Value
98h	RDFPS	R	3	Read FPS Value
99h	WRFPSOFFSET	W	4	Write FPS Offset Value
9Ah	RDFPSOFFSET	R	4	Read FPS Offset Value
9Bh	PARA_SEL	W	1	MCS Parameter Selection (Only Use Chipone)
9Ch	UCS LOCK	W	1	UCS Lock (Only Use Chipone)
9Dh	WRFPSCGAIN	W	4	Write FPS Gain Value
9Eh	RDFPSCGAIN	R	4	Read FPS Gain Value
9Fh	REG SEL	W	1	MCS Group Selection (Only Use Chipone)
A0h	RDDIC	R	27	Read DIC Info.
A1h	RDDDB	R	24	Read DDB Start
A2h	RDPPS	R	Variable	Read PPS
A8h	RDDDBC	R	Variable	Read DDB Continue
A9h	RDPPSC	R	Variable	Read Continue PPS
AAh	RDFCS	R	Variable	Read First Checksum
AFh	RDCCS	R	Variable	Read Continue Checksum
B1h	RDID_IPX	R	19	Read ID Value (Hidden)
DAh	RDID1	R	1	Read ID1
DBh	RDID2	R	1	Read ID2
DCh	RDID3	R	1	Read ID3
FDh	MCS LOCK	W	1	MCS Lock (Only Use Chipone)

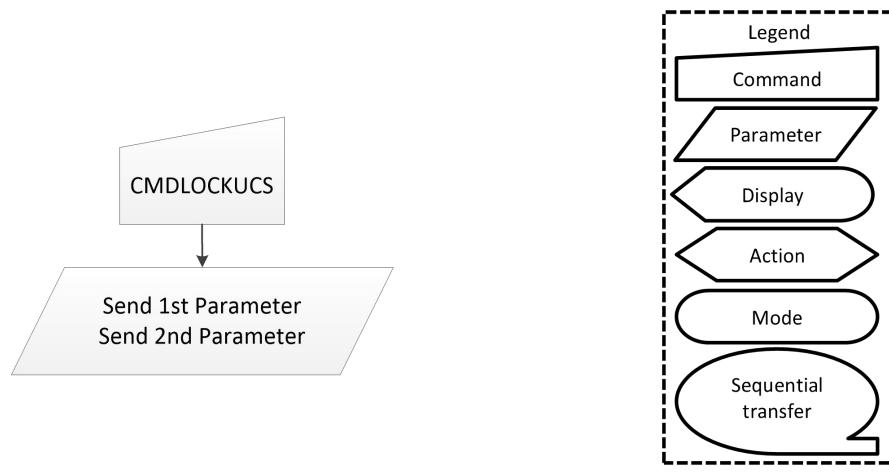
\*Note: Parameters of the command are stored onto registers when the last parameter of the command has been received. Also, parameters of the command are not stored onto registers if there has been happen a break.

## 9.2 User Command and Manufacture Command Access

### 9.2.1 (9Ch) CMDLOCKUCS: User Command Access

Command Set		CMDLOCKUCS								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
CMDLOCKUCS	W	1	0	0	1	1	1	0	0	9Ch
Parameter	1	UCS LOCK[7:0]								

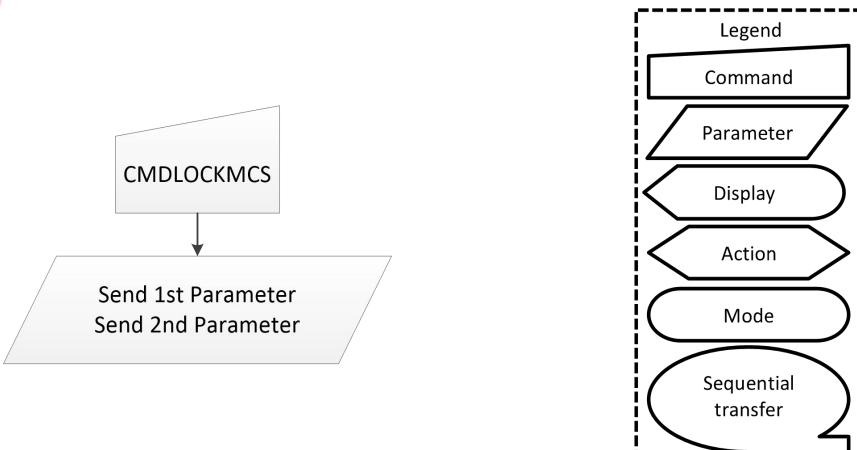
**NOTE:** “-”Don’t care.

Description	This command is used to lock or unlock the User Command (Level-1) Sets.	
	Instruction	Parameter
	9Ch	UCS LOCK[7:0]
	9Ch	UCS LOCK[7:0]
Restriction	-	
Register Availability	Status	Availability
	Normal Mode On, Idle Mode Off, Sleep Out	Yes
	Normal Mode On, Idle Mode On, Sleep Out	Yes
	Partial Mode On, Idle Mode Off, Sleep Out	Yes
	Partial Mode On, Idle Mode On, Sleep Out	Yes
	Sleep In	Yes
Default	Status	Default Value
	Power On Sequence	PIN1: A5h, PIN2: A5h
	S/W Reset	PIN1: A5h, PIN2: A5h
	H/W Reset	PIN1: A5h, PIN2: A5h
Flow Chart		Legend Command Parameter Display Action Mode Sequential transfer

### 9.2.2 (FDh) CMDLOCKMCS: Manufacture Command Access

Command Set		CMDLOCKMCS									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
CMDLOCKMCS	W	1	1	1	1	1	1	0	1	FDh	
Parameter	1	MCS_LOCK[7:0]									

NOTE: “-”Don’t care.

<b>Description</b>	This command is used to lock or unlock the Manufacture Command (Level-2) Sets.			
	Instruction	Parameter	Value	Description
	FDh	MCS_LOCK[7:0]	5Ah, 5Ah	Lock Disable
<b>Restriction</b>	-			
<b>Register Availability</b>	Status		Availability	
	Normal Mode On, Idle Mode Off, Sleep Out		Yes	
	Normal Mode On, Idle Mode On, Sleep Out		Yes	
	Partial Mode On, Idle Mode Off, Sleep Out		Yes	
	Partial Mode On, Idle Mode On, Sleep Out		Yes	
	Sleep In		Yes	
<b>Default</b>	Status		Default Value	
	Power On Sequence		PIN1: 5Ah, PIN2: 5Ah	
	S/W Reset		PIN1: 5Ah, PIN2: 5Ah	
	H/W Reset		PIN1: 5Ah, PIN2: 5Ah	
<b>Flow Chart</b>	 <pre> graph TD     A[CMDLOCKMCS] --&gt; B[/Send 1st Parameter&lt;br/&gt;Send 2nd Parameter/]     style B fill:#fff,stroke:#000,stroke-width:1px     C[Legend]     C --- D[Command]     C --- E[Parameter]     C --- F[Display]     C --- G[Action]     C --- H[Mode]     C --- I[Sequential transfer]   </pre>			

## 9.3 Description of User Command

### 9.3.1 (00h) NOP: No Operation

Command Set		NOP								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
NOP	C	0	0	0	0	0	0	0	0	00h
Parameter	-	No Parameter								

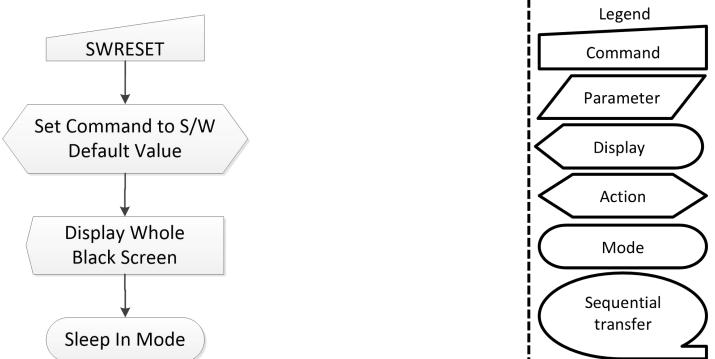
**NOTE:** “-”Don’t care.

Description	This command is an empty command. It does not have any effect on the display module.													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>NA</td> </tr> <tr> <td>S/W Reset</td> <td>NA</td> </tr> <tr> <td>H/W Reset</td> <td>NA</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	NA	S/W Reset	NA	H/W Reset	NA				
Status	Default Value													
Power On Sequence	NA													
S/W Reset	NA													
H/W Reset	NA													
Flow Chart	 <pre> graph TD     NOP[NOP] --&gt; NonAction{Non-Action}     subgraph Legend [Legend]         direction TB         R1[Command]         T1[Parameter]         L1[Display]         R2[Action]         O1[Mode]         B1[Sequential transfer]     end </pre>													

### 9.3.2 (01h) SWRESET: Software Reset

Command Set		SWRESET								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
SWRESET	C	0	0	0	0	0	0	0	1	01h
Parameter	-	No Parameter								

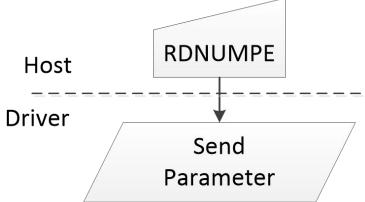
NOTE: “-”Don’t care.

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)													
Restriction	<p>It will be necessary to wait 5m second before sending new command following software reset. The display module loads all display suppliers' factory default values to the registers during this 5m second in sleep in status.</p> <p>If software reset is applied during sleep out mode, it will be necessary to wait 120m second before sending sleep out command.</p> <p>Software reset command cannot be sent during sleep out sequence.</p>													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>N/A</td> </tr> <tr> <td>S/W Reset</td> <td>N/A</td> </tr> <tr> <td>H/W Reset</td> <td>N/A</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	N/A	S/W Reset	N/A	H/W Reset	N/A				
Status	Default Value													
Power On Sequence	N/A													
S/W Reset	N/A													
H/W Reset	N/A													
Flow Chart	 <pre> graph TD     SWRESET([SWRESET]) --&gt; Set[Set Command to S/W Default Value]     Set --&gt; Display[Display Whole Black Screen]     Display --&gt; Sleep[Sleep In Mode]     </pre> <p><b>Legend:</b></p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>													

### 9.3.3 (05h) RDNUMPE: Read Number of the Errors on Primary DSI

Command Set		RDNUMPE									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RDNUMPE	R	0	0	0	0	0	1	0	1	05h	
Parameter	1	NUMED[7:0]									

**NOTE:** “-”Don’t care.

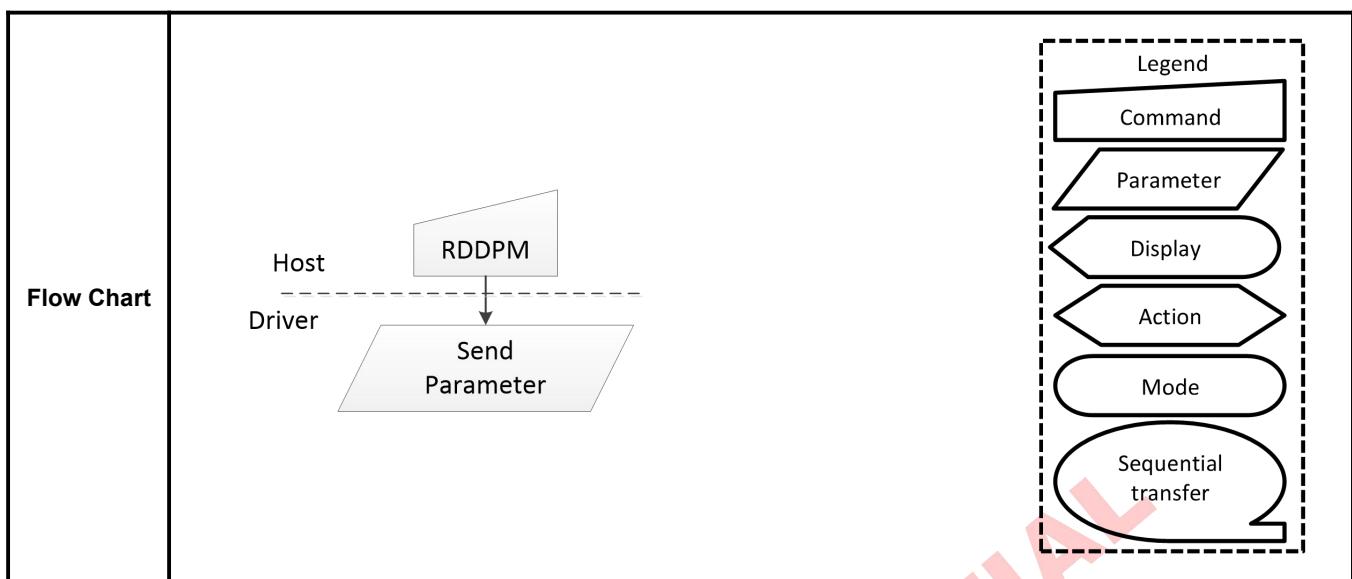
Description	This command returns the number of corrupted packets previously received on the DSI link. For each parameter, NUMED[7] is set to ‘1’ if there is overflow with NUMED[6:0] bits.													
Restriction	Only ECC single-bit errors, ECC multi-bit errors and Checksum errors are included in the error counter functionality.													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													
Flow Chart	 <pre> graph TD     Host[Host] -- RDNUMPE --&gt; Driver[Driver]     Driver -- "Send Parameter" --&gt; Send[Send Parameter]   </pre>	<p>Legend</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>												

## 9.3.4 (0Ah) RDDPM: Read Display Power Mode

Command Set		RDDPM								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
RDDPM	R	0	0	0	0	1	0	1	0	0Ah
Parameter	1	BVST	IDLEON	PTLON	SLPOUT	NORON	DISPON	0	0	08h

NOTE: “-”Don’t care.

<b>Description</b>	This command indicates the current status of the display as described in the table below:														
	Bit	Description	Value												
	D7	Booster Voltage Status	“1” = Booster on, “0” = Booster off												
	D6	Idle Mode On/Off	“1” = Idle Mode On, “0” = Idle Mode Off												
	D5	Partial Mode On/Off	“1” = Partial Mode On, “0” = Partial Mode Off												
	D4	Sleep In/Out	“1” = Sleep Out, “0” = Sleep In												
	D3	Display Normal Mode On/Off	“1” = Normal Display On, “0” = Normal Display Off												
	D2	Display On/Off	“1” = Display On, “0” = Display Off												
	D1	Not Used	“0”												
<b>Restriction</b>	D7 bit, Booster Voltage Status, keeps “1” after booster is normally enabled in spite of going back to sleep status. This bit is only initialized by reset.														
<b>Register Availability</b>	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>			Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability														
Normal Mode On, Idle Mode Off, Sleep Out	Yes														
Normal Mode On, Idle Mode On, Sleep Out	Yes														
Partial Mode On, Idle Mode Off, Sleep Out	Yes														
Partial Mode On, Idle Mode On, Sleep Out	Yes														
Sleep In	Yes														
<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>98h</td> </tr> <tr> <td>S/W Reset</td> <td>08h</td> </tr> <tr> <td>H/W Reset</td> <td>08h</td> </tr> </tbody> </table>			Status	Default Value	Power On Sequence	98h	S/W Reset	08h	H/W Reset	08h					
Status	Default Value														
Power On Sequence	98h														
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Status	Default Value														
Power On Sequence	98h														
S/W Reset	08h														
H/W Reset	08h														

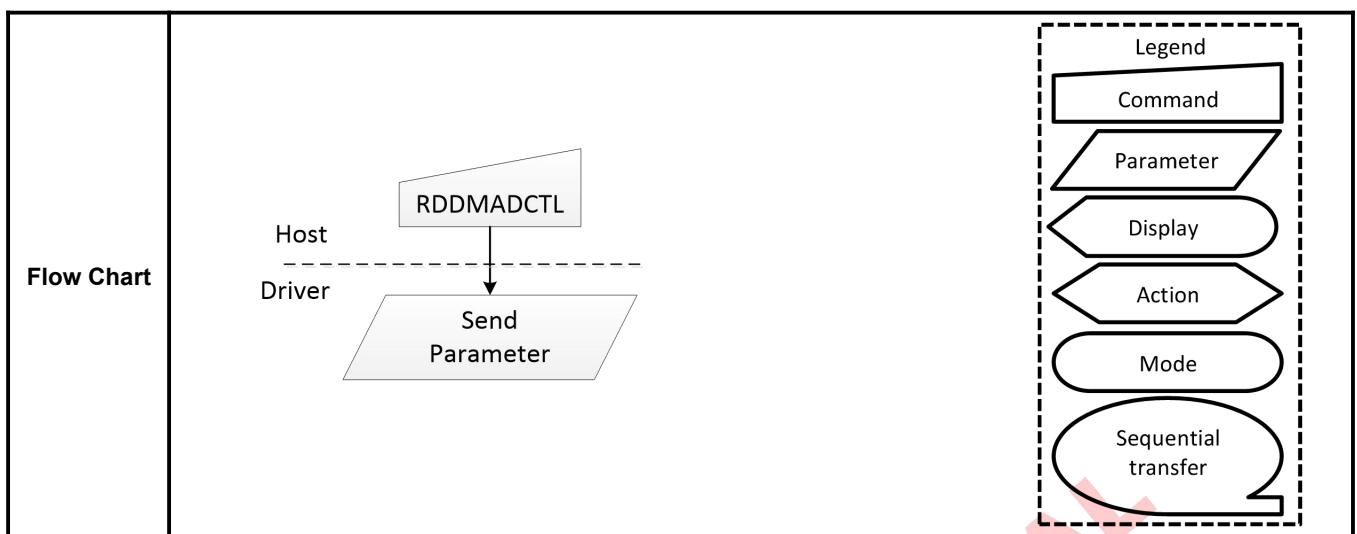


### 9.3.5 (0Bh) RDDMADCTL: Read Display Memory Access Control

Command Set		RDDMADCTL									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RDDMADCTL	R	0	0	0	0	1	0	1	1	0Bh	
Parameter	1	0	0	0	0	0	0	FH	0	00h	

NOTE: “-”Don’t care.

<b>Description</b>	This command indicates the current status of the display as described in the table below:	
	Bit	Description
	D7	Not Used
	D6	Not Used
	D5	Not Used
	D4	Not Used
	D3	Not Used
	D2	Not Used
	D1	FH
	D0	Not Used
<b>Restriction</b>	-	
<b>Register Availability</b>	Status	Availability
	Normal Mode On, Idle Mode Off, Sleep Out	Yes
	Normal Mode On, Idle Mode On, Sleep Out	Yes
	Partial Mode On, Idle Mode Off, Sleep Out	Yes
	Partial Mode On, Idle Mode On, Sleep Out	Yes
	Sleep In	Yes
<b>Default</b>	Status	Default Value
	Power On Sequence	00h
	S/W Reset	00h
	H/W Reset	00h

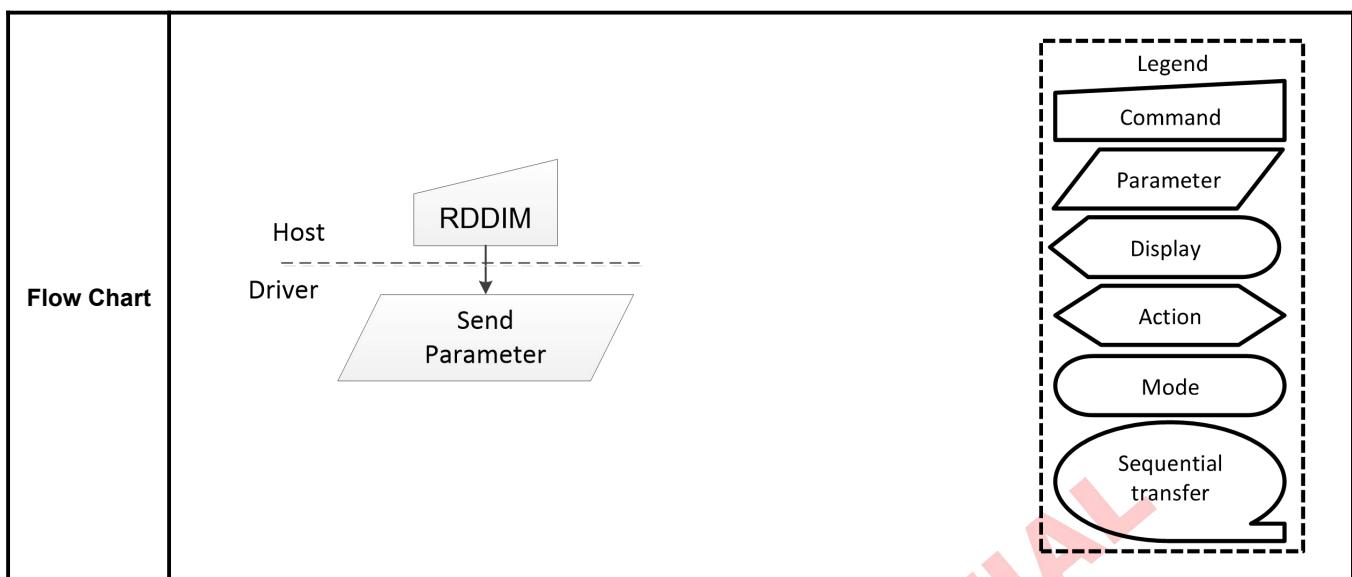


### 9.3.6 (0Dh) RDDIM: Read Display Image Mode

Command Set		RDDIM								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
RDDIM	R	0	0	0	0	1	1	0	1	0Dh
Parameter	1	0	0	0	ALLPON	ALLPOFF	0	0	0	00h

NOTE: “-”Don’t care.

<b>Description</b>	This command indicates the current status of the display as described in the table below:													
	Bit	Description												
	D7	Not Used												
	D6	Not Used												
	D5	Not Used												
	D4	All Pixels On												
	D3	All Pixels Off												
	D2	Not Used												
	D1	Not Used												
	D0	Not Used												
<b>Restriction</b>	-													
<b>Register Availability</b>	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
<b>Default</b>	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													

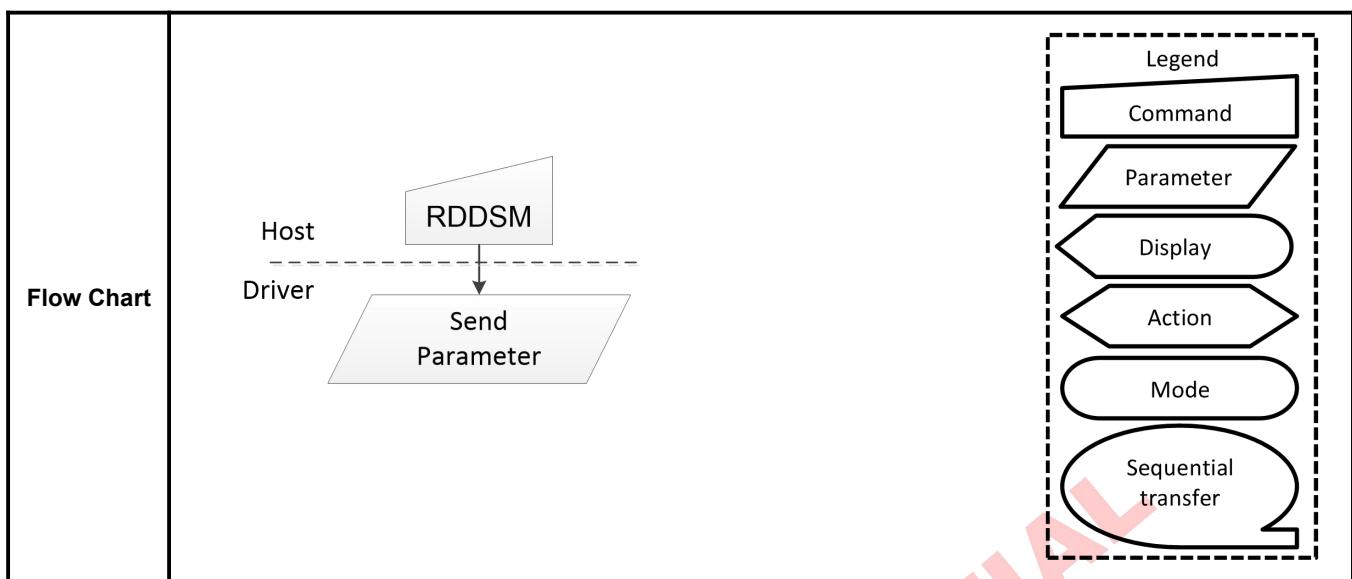


### 9.3.7 (0Eh) RDDSM: Read Display Signal Mode

Command Set		RDDSM									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RDDSM	R	0	0	0	0	1	1	1	0	0Eh	
Parameter	1	0	0	0	0	0	0	0	DSIE	00h	

NOTE: “-”Don’t care.

<b>Description</b>	This command indicates the current status of the display as described in the table below:													
	Bit	Description												
	D7	Not Used												
	D6	Not Used												
	D5	Not Used												
	D4	Not Used												
	D3	Not Used												
	D2	Not Used												
	D1	Not Used												
	D0	Error on DSI “1” = Error, “0” = No Error												
<b>Restriction</b>	-													
<b>Register Availability</b>	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
<b>Default</b>	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													

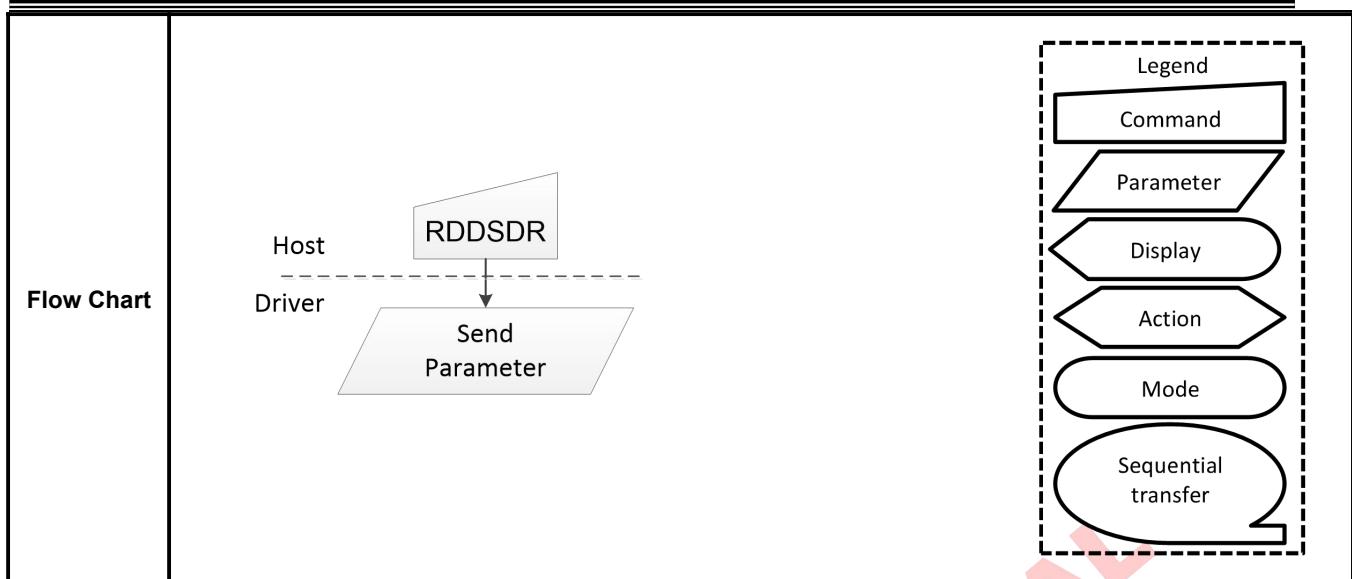


### 9.3.8 (0Fh) RDDSDR: Read Display Self-Diagnostic Result

Command Set		RDDSDR									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RDDSDR	R	0	0	0	0	1	1	1	1	0Fh	
Parameter	1	RLDT	FNDT	0	0	0	0	0	CKSUM	00h	

NOTE: “-”Don’t care.

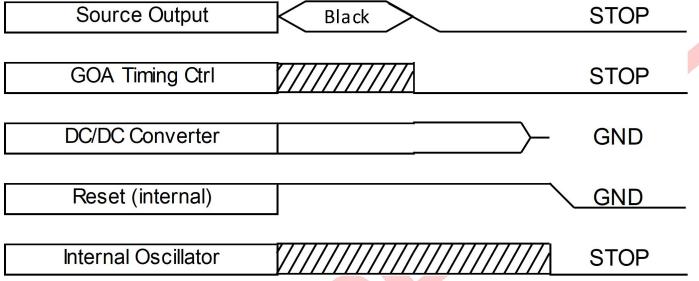
<b>Description</b>	This command indicates the status of the display self-diagnostic results after Sleep Out – command														
	Bit	Description	Value												
	D7	Register Loading Detection	“0” = OTP & Register are not same “1” = OTP & Register are same												
	D6	Functionality Detection	“0” = Booster voltage levels, timing is not met “1” = Booster voltage levels, timing is met												
	D5	Not Used	“0”												
	D4	Not Used	“0”												
	D3	Not Used	“0”												
	D2	Not Used	“0”												
	D1	Not Used	“0”												
	D0	Checksums comparison	“0” = Checksums are same “1” = Checksums are not same												
<b>Restriction</b>	-														
<b>Register Availability</b>	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>			Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability														
Normal Mode On, Idle Mode Off, Sleep Out	Yes														
Normal Mode On, Idle Mode On, Sleep Out	Yes														
Partial Mode On, Idle Mode Off, Sleep Out	Yes														
Partial Mode On, Idle Mode On, Sleep Out	Yes														
Sleep In	Yes														
<b>Default</b>	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>			Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value														
Power On Sequence	00h														
S/W Reset	00h														
H/W Reset	00h														

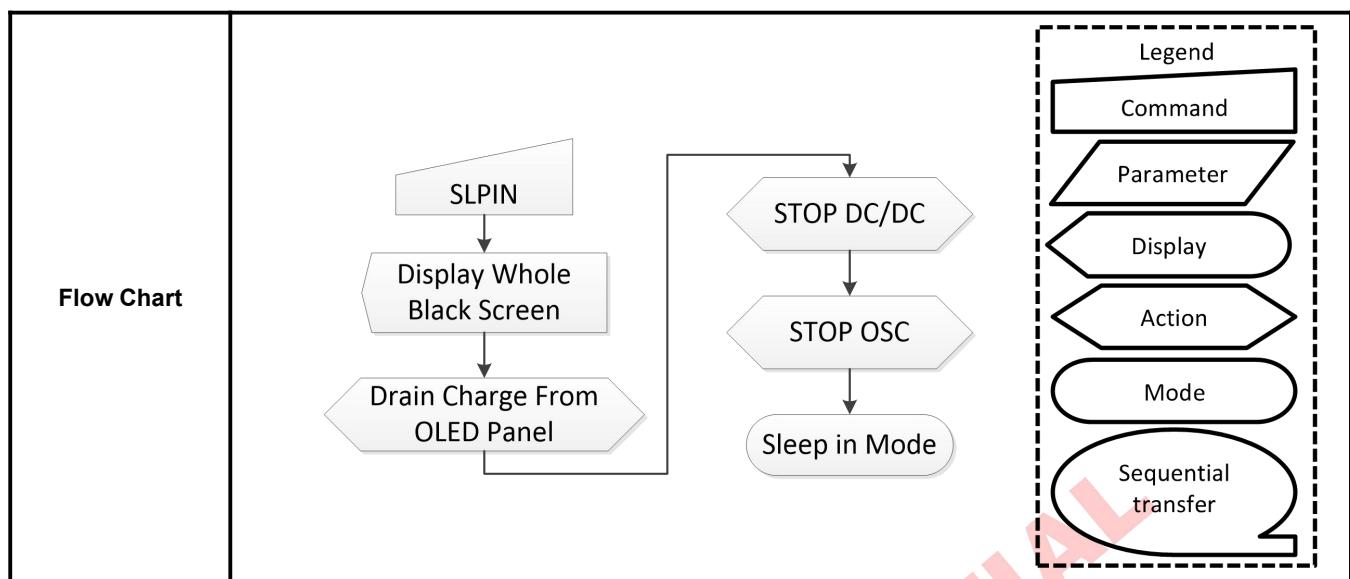


### 9.3.9 (10h) SLPIN: Sleep In

Command Set		SLPIN									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
SLPIN	C	0	0	0	1	0	0	0	0	10h	
Parameter	-	No Parameter									

**NOTE:** “-”“Don’t care.

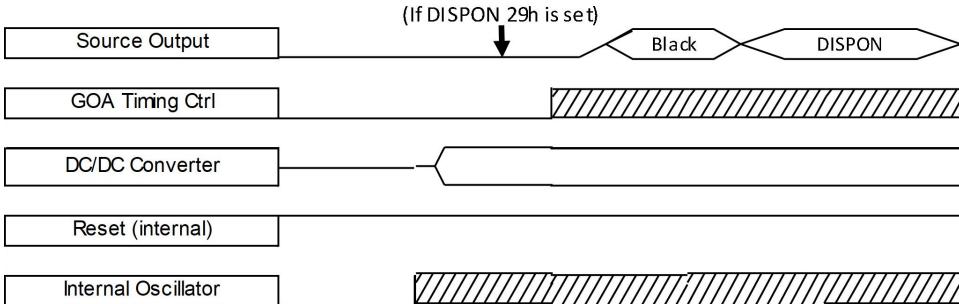
<b>Description</b>	<p>This command causes the AMOLED module to enter the minimum power consumption mode. In this mode the DC/DC converter is stopped, internal oscillator is stopped, and panel scanning is stopped. The control Interface such as registers is still working and keeps its values.</p> 												
<b>Restriction</b>	<p>This command has no effect when module is already in sleep in mode. Sleep in mode can only be left by “SLPOUT (11h)”. It will be necessary to wait 5m second before sending next command; this is to allow time for the supply voltages and clock circuits to stabilize. It will be necessary to wait 120m second after sending sleep out command (When in sleep in mode) before sleep in command can be sent.</p>												
<b>Register Availability</b>	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>	Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability												
Normal Mode On, Idle Mode Off, Sleep Out	Yes												
Normal Mode On, Idle Mode On, Sleep Out	Yes												
Partial Mode On, Idle Mode Off, Sleep Out	Yes												
Partial Mode On, Idle Mode On, Sleep Out	Yes												
Sleep In	Yes												
<b>Default</b>	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>Sleep In Mode</td> </tr> <tr> <td>S/W Reset</td> <td>Sleep In Mode</td> </tr> <tr> <td>H/W Reset</td> <td>Sleep In Mode</td> </tr> </tbody> </table>	Status	Default Value	Power On Sequence	Sleep In Mode	S/W Reset	Sleep In Mode	H/W Reset	Sleep In Mode				
Status	Default Value												
Power On Sequence	Sleep In Mode												
S/W Reset	Sleep In Mode												
H/W Reset	Sleep In Mode												

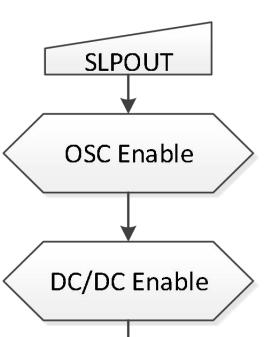
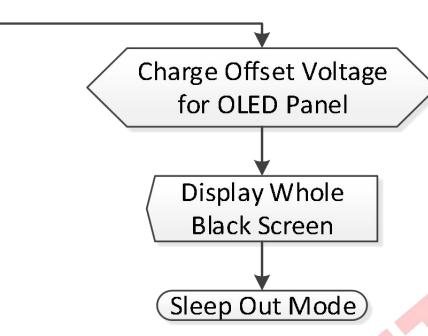


## 9.3.10 (11h) SLPOUT: Sleep Out

Command Set		SLPOUT								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
SLPOUT	C	0	0	0	1	0	0	0	1	11h
Parameter	-	No Parameter								

NOTE: “-”Don’t care.

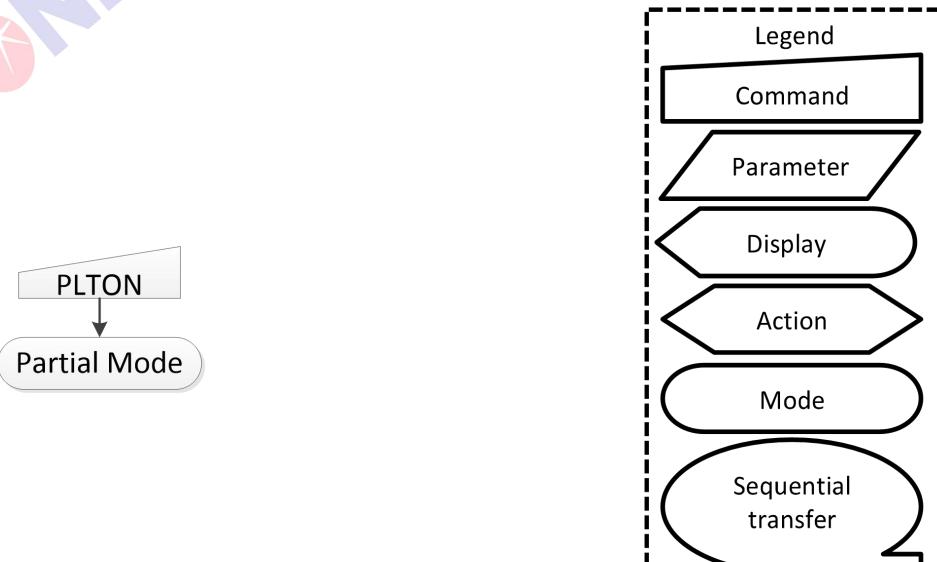
Description	<p>This command turns off sleep mode. In this mode the DC/DC converter is enabled, Internal oscillator is started, and panel scanning is started.</p> 												
Restriction	<p>This command has no effect when AMOLED module is already in sleep out mode. Sleep out mode can only be exit by the sleep in command (10h). It will be necessary to wait 5m second before sending next command; this is to allow time for the supply voltages and clock circuits to stabilize. This DDIC loads all default values of extended and test command to the registers during this 5m second and there cannot be any abnormal visual effect on the display image if those default and register values are same when this load is done and when it is already sleep out mode. This DDIC is doing self-diagnostic functions during this 5m second. It will be necessary to wait 120m second after sending sleep in command (when in sleep out mode) before sleep out command can be sent.</p>												
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>	Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability												
Normal Mode On, Idle Mode Off, Sleep Out	Yes												
Normal Mode On, Idle Mode On, Sleep Out	Yes												
Partial Mode On, Idle Mode Off, Sleep Out	Yes												
Partial Mode On, Idle Mode On, 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
Flow Chart		 <p>Legend</p> <ul style="list-style-type: none"><li>Command</li><li>Parameter</li><li>Display</li><li>Action</li><li>Mode</li><li>Sequential transfer</li></ul>

### 9.3.11 (12h) PTION: Partial Mode On

Command Set		PTION								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
PTION	C	0	0	0	1	0	0	1	0	12h
Parameter	-	No Parameter								

NOTE: “-”Don’t care.

Description	This command turns on partial mode. The partial mode window is described by the partial area command (30h). To leave partial mode, the normal display mode command (13h) should be written.													
Restriction	This command has no effect on when Partial Display mode is active.													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>Normal display mode on</td> </tr> <tr> <td>S/W Reset</td> <td>Normal display mode on</td> </tr> <tr> <td>H/W Reset</td> <td>Normal display mode on</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	Normal display mode on	S/W Reset	Normal display mode on	H/W Reset	Normal display mode on				
Status	Default Value													
Power On Sequence	Normal display mode on													
S/W Reset	Normal display mode on													
H/W Reset	Normal display mode on													
Flow Chart	 <pre> graph TD     PLTON[PLTON] --&gt; PartialMode([Partial Mode])     subgraph Legend [Legend]         direction TB         L1[Command]         L2[Parameter]         L3[Display]         L4[Action]         L5[Mode]         L6[Sequential transfer]     end </pre>													

## 9.3.12 (13h) NORON: Normal Mode On

Command Set		NORON								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
NORON	C	0	0	0	1	0	0	1	1	13h
Parameter	-	No Parameter								

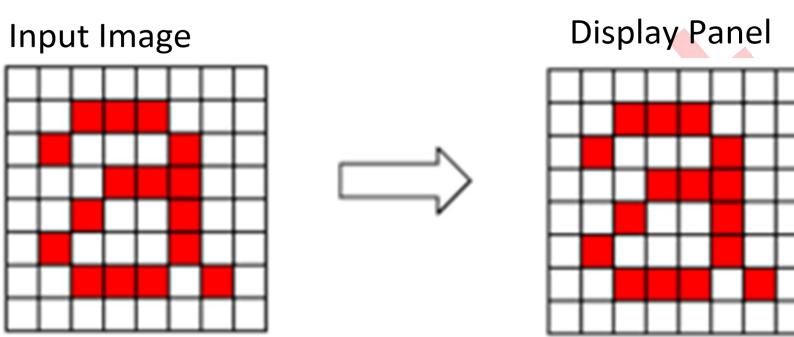
NOTE: “-”Don’t care.

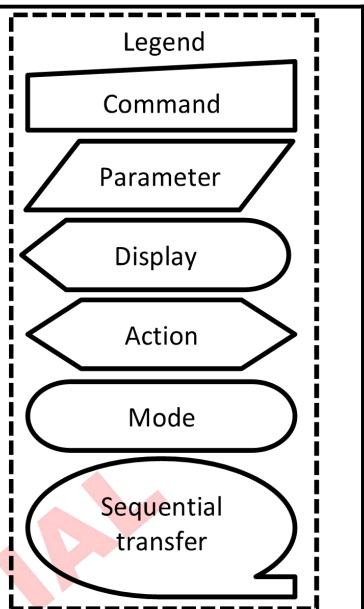
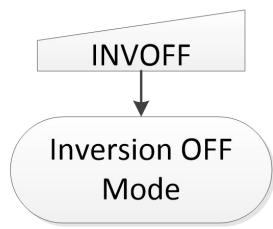
Description	This command returns the display to normal mode. To leave partial mode or all pixel on/off mode, the normal display mode command (13h) should be written.													
Restriction	This command has no effect on when Normal Display mode is active.													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>Normal display mode on</td> </tr> <tr> <td>S/W Reset</td> <td>Normal display mode on</td> </tr> <tr> <td>H/W Reset</td> <td>Normal display mode on</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	Normal display mode on	S/W Reset	Normal display mode on	H/W Reset	Normal display mode on				
Status	Default Value													
Power On Sequence	Normal display mode on													
S/W Reset	Normal display mode on													
H/W Reset	Normal display mode on													
Flow Chart	<pre> graph TD     NORON[NORON] --&gt; NormalDisplayMode((Normal Display Mode))     </pre> <p>The flowchart shows a rectangular box labeled "NORON" with a downward-pointing arrow pointing to an oval labeled "Normal Display Mode".</p> <p><b>Legend:</b></p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>													

### 9.3.13 (20h) INVOFF: Display Inversion Off

Command Set		INVOFF								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
INVOFF	C	0	0	1	0	0	0	0	0	20h
Parameter	-	No Parameter								

**NOTE:** “-”Don’t care.

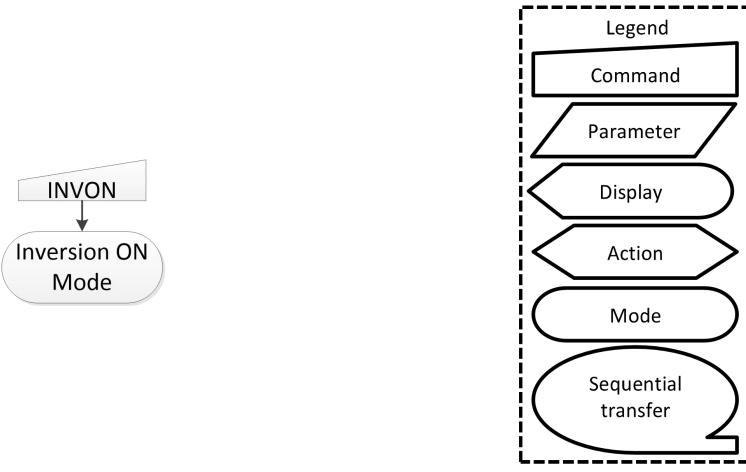
<b>Description</b>	<p>This command is used to recover from display inversion mode.          This command makes no change of contents of frame memory, also output is not changed.          This command does not change any other status.</p> <div style="text-align: center; margin-top: 20px;">  </div>												
<b>Restriction</b>	This command has no effect when module is already the display image.												
<b>Register Availability</b>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="background-color: #d3d3d3;">Status</th> <th style="background-color: #d3d3d3;">Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>	Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability												
Normal Mode On, Idle Mode Off, Sleep Out	Yes												
Normal Mode On, Idle Mode On, Sleep Out	Yes												
Partial Mode On, Idle Mode Off, Sleep Out	Yes												
Partial Mode On, Idle Mode On, Sleep Out	Yes												
Sleep In	Yes												
<b>Default</b>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="background-color: #d3d3d3;">Status</th> <th style="background-color: #d3d3d3;">Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>Display Inversion off</td> </tr> <tr> <td>S/W Reset</td> <td>Display Inversion off</td> </tr> <tr> <td>H/W Reset</td> <td>Display Inversion off</td> </tr> </tbody> </table>	Status	Default Value	Power On Sequence	Display Inversion off	S/W Reset	Display Inversion off	H/W Reset	Display Inversion off				
Status	Default Value												
Power On Sequence	Display Inversion off												
S/W Reset	Display Inversion off												
H/W Reset	Display Inversion off												

**Flow Chart**

## 9.3.14 (21h) INVON: Display Inversion On

Command Set		INVON								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
INVON	C	0	0	1	0	0	0	0	1	21h
Parameter	-	No Parameter								

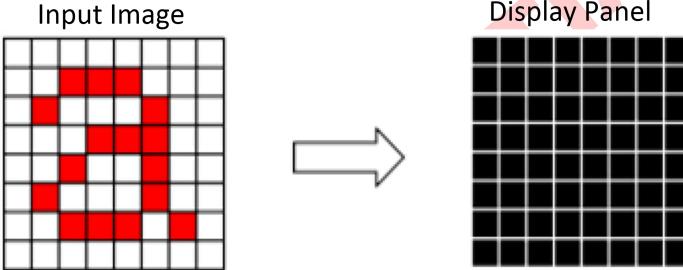
NOTE: “-”Don’t care.

Description	This command is used to enter display inversion mode.  This command makes no change of contents of frame memory, but changes output.  Ex) 00_00_00 -> FF_FF_FF  This command does not change any other status.  To exit from display inversion on, the display inversion off command (20h) should be written.													
Restriction	This command has no effect when module is already inverting the display image.													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>Display Inversion off</td> </tr> <tr> <td>S/W Reset</td> <td>Display Inversion off</td> </tr> <tr> <td>H/W Reset</td> <td>Display Inversion off</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	Display Inversion off	S/W Reset	Display Inversion off	H/W Reset	Display Inversion off				
Status	Default Value													
Power On Sequence	Display Inversion off													
S/W Reset	Display Inversion off													
H/W Reset	Display Inversion off													
Flow Chart	 <pre> graph TD     INVON[INVON] --&gt; InversionONMode((Inversion ON Mode))     style InversionONMode fill:none,stroke:none     </pre> <p>Legend:</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>													

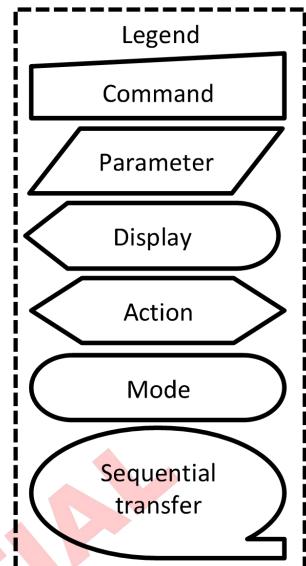
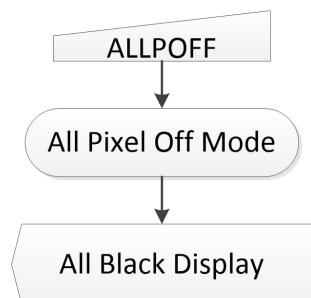
### 9.3.15 (22h) ALLPOFF: All Pixel Off

Command Set		ALLPOFF									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
ALLPOFF	C	0	0	1	0	0	0	1	0	22h	
Parameter	-	No Parameter									

NOTE: “-”Don’t care.

Description	<p>This command turns the display panel black in sleep out mode and a status of the display on/off register can be "on" or "off".</p> <p>This command makes no change of contents of frame memory.</p> <p>This command does not change any other status.</p> <p>All pixel on, normal display mode on commands are used to leave this mode. The display panel is showing the content of the frame memory after normal display on command.</p> <div style="text-align: center; margin-top: 20px;">  </div>												
Restriction	This command has no effect when module is already in all pixel off mode.												
Register Availability	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="background-color: #cccccc;">Status</th> <th style="background-color: #cccccc;">Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>	Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability												
Normal Mode On, Idle Mode Off, Sleep Out	Yes												
Normal Mode On, Idle Mode On, Sleep Out	Yes												
Partial Mode On, Idle Mode Off, Sleep Out	Yes												
Partial Mode On, Idle Mode On, Sleep Out	Yes												
Sleep In	Yes												
Default	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="background-color: #cccccc;">Status</th> <th style="background-color: #cccccc;">Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>All Pixel Off</td> </tr> <tr> <td>S/W Reset</td> <td>All Pixel Off</td> </tr> <tr> <td>H/W Reset</td> <td>All Pixel Off</td> </tr> </tbody> </table>	Status	Default Value	Power On Sequence	All Pixel Off	S/W Reset	All Pixel Off	H/W Reset	All Pixel Off				
Status	Default Value												
Power On Sequence	All Pixel Off												
S/W Reset	All Pixel Off												
H/W Reset	All Pixel Off												

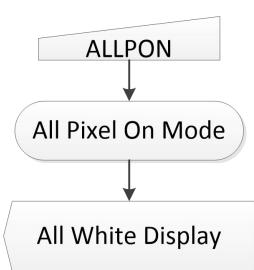
## Flow Chart



### 9.3.16 (23h) ALLPON: All Pixel On

Command Set		ALLPON									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
ALLPON	C	0	0	1	0	0	0	1	1	23h	
Parameter	-	No Parameter									

**NOTE:** “-”Don’t care.

Description	This command turns the display panel white in sleep out mode and a status of the display on/off register can be "on" or "off".  This command does not change any other status.  "All Pixels Off" or "Normal Display Mode On" or "Partial Mode On" commands are used to leave this mode.													
Restriction	This command has no effect when module is already in all pixel on mode.													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>All Pixel Off</td> </tr> <tr> <td>S/W Reset</td> <td>All Pixel Off</td> </tr> <tr> <td>H/W Reset</td> <td>All Pixel Off</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	All Pixel Off	S/W Reset	All Pixel Off	H/W Reset	All Pixel Off				
Status	Default Value													
Power On Sequence	All Pixel Off													
S/W Reset	All Pixel Off													
H/W Reset	All Pixel Off													
Flow Chart	 <pre> graph TD     ALLPON[ALLPON] --&gt; APOM[All Pixel On Mode]     APOM --&gt; AW[All White Display]   </pre>	<p>Legend</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>												

## 9.3.17 (28h) DISPOFF: Display Off

Command Set		DISPOFF									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
DISPOFF	C	0	0	1	0	1	0	0	0	28h	
Parameter	-	No Parameter									

NOTE: “-”Don’t care.

Description	This command is used to enter into DISPLAY OFF mode. In this mode, the output is disabled and blank page inserted.  This command does not change any other status.  There will be no abnormal visible effect on the display.													
Restriction	This command has no effect when module is already in display off mode.													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>Display Off</td> </tr> <tr> <td>S/W Reset</td> <td>Display Off</td> </tr> <tr> <td>H/W Reset</td> <td>Display Off</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	Display Off	S/W Reset	Display Off	H/W Reset	Display Off				
Status	Default Value													
Power On Sequence	Display Off													
S/W Reset	Display Off													
H/W Reset	Display Off													
Flow Chart	<pre> graph TD     A[DISPOFF] --&gt; B([Display Off Mode])     B --&gt; C[All Black Display]     </pre> <p>Legend:</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>													

### 9.3.18 (29h) DISPON: Display On

Command Set		DISPON									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
DISPON	C	0	0	1	0	1	0	0	1	29h	
Parameter	-	No Parameter									

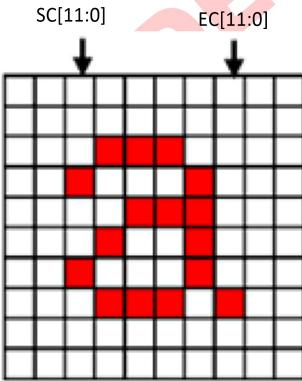
**NOTE:** “-”Don’t care.

Description	This command causes the display module to start displaying the image data on the display device.  This command does not change any other status.													
Restriction	This command has no effect when module is already in display on mode.													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>Display Off</td> </tr> <tr> <td>S/W Reset</td> <td>Display Off</td> </tr> <tr> <td>H/W Reset</td> <td>Display Off</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	Display Off	S/W Reset	Display Off	H/W Reset	Display Off				
Status	Default Value													
Power On Sequence	Display Off													
S/W Reset	Display Off													
H/W Reset	Display Off													
Flow Chart	<pre> graph TD     A[DISPON] --&gt; B([Display On Mode])     style A fill:#e0f2e0,stroke:#333,stroke-width:1px     style B fill:#e0f2e0,stroke:#333,stroke-width:1px     %% Legend     %% Command: rectangle     %% Parameter: trapezoid     %% Display: diamond     %% Action: parallelogram     %% Mode: trapezoid     %% Sequential transfer: oval   </pre>													

### 9.3.19 (2Ah) COSET: Write Column Address Set

Command Set		COSET								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
COSET	W	0	0	1	0	1	0	1	0	2Ah
Parameter	1	0	0	0	0	SC[11:8]				00h
Parameter	2	SC[7:0]						00h		
Parameter	3	0	0	0	0	EC[11:8]				05h
Parameter	4	EC[7:0]						9Fh		

**NOTE:** “-”Don’t care.

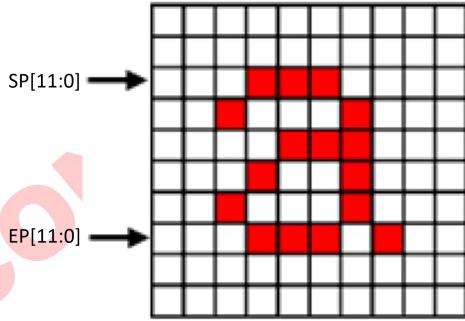
<b>Description</b>	<p>This command defines the column extent of the frame memory accessed by the host processor with the read_memory_continue and write_memory_continue commands.</p> <p>This command makes No Change on the other driver status.</p> <p>The values of SC[15:0] and EC[15:0] are referred when RAMWR command comes.</p> <p>Each value represents one column line in the Frame Memory.</p> <p>MIPI Packet size to transfer should be transferred by the value of CASET.</p> 
<b>Restriction</b>	<ol style="list-style-type: none"> <li>1. SC[11:0] always must be equal to or less than EC[11:0].</li> <li>2. SC[11:0] should be multiple of slice width.</li> <li>3. EC[11:0] should be multiple of slice width - 1.</li> <li>4. Window size should be multiple of slice width.</li> </ol>

Register Availability	Status	Availability
	Normal Mode On, Idle Mode Off, Sleep Out	Yes
	Normal Mode On, Idle Mode On, Sleep Out	Yes
	Partial Mode On, Idle Mode Off, Sleep Out	Yes
	Partial Mode On, Idle Mode On, Sleep Out	Yes
	Sleep In	Yes
Default	Status	Default Value
	Power On Sequence	SC[11:0]: 000h, EC[11:0]:59Fh
	S/W Reset	SC[11:0]: 000h, EC[11:0]:59Fh
	H/W Reset	SC[11:0]: 000h, EC[11:0]:59Fh
Flow Chart	<pre> graph TD     CASET[CASET] --&gt; SC[SC[11:0] EC[11:0]]     SC --&gt; PASET[PASET]     PASET --&gt; SP[SP[11:0] EP[11:0]]   </pre>	<pre> graph TD     RAMWR[RAMWR] --&gt; CompData[Compressed Image Data]     CompData --&gt; AnyCommand[Any Command]   </pre> <p>Legend:</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>

### 9.3.20 (2Bh) PASET: Write Page Address Set

Command Set		PASET									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
PASET	W	0	0	1	0	1	0	1	1	2Bh	
Parameter	1	0	0	FMEM_WT _MASK_M	FMEM_WT _MASK_S	SP[11:8]				00h	
Parameter	2	SP[7:0]						00h			
Parameter	3	0	0	0	0	EP[11:8]				0Bh	
Parameter	4	EP[7:0]						8Fh			

**NOTE:** “-”Don’t care.

<b>Description</b>	<p>This command defines the page extent of the frame memory accessed by the host processor with the write_memory_continue and read_memory_continue command.</p> <p>This command makes No Change on the other driver status.</p> <p>The values of SP[15:0] and EP[15:0] are referred when RAMWR command comes.</p> <p>Each value represents one column line in the Frame Memory.</p>  <p>FMEM_WT_MASK_M: Write control for master IC's frame memory in CASCADE mode</p> <ul style="list-style-type: none"> <li>- 0h : No masking</li> <li>- 1h : Write masking</li> </ul> <p>FMEM_WT_MASK_S: Write control for slave IC's frame memory in CASCADE mode</p> <ul style="list-style-type: none"> <li>- 0h : No masking</li> <li>- 1h : Write masking</li> </ul>
	<p>1. SP[11:0] always must be equal to or less than EP[11:0].</p> <p>2. SP[11:0] should be multiple of slice height.</p> <p>3. EP[11:0] should be multiple of slice height - 1.</p> <p>4. Window size should be multiple of slice height.</p>

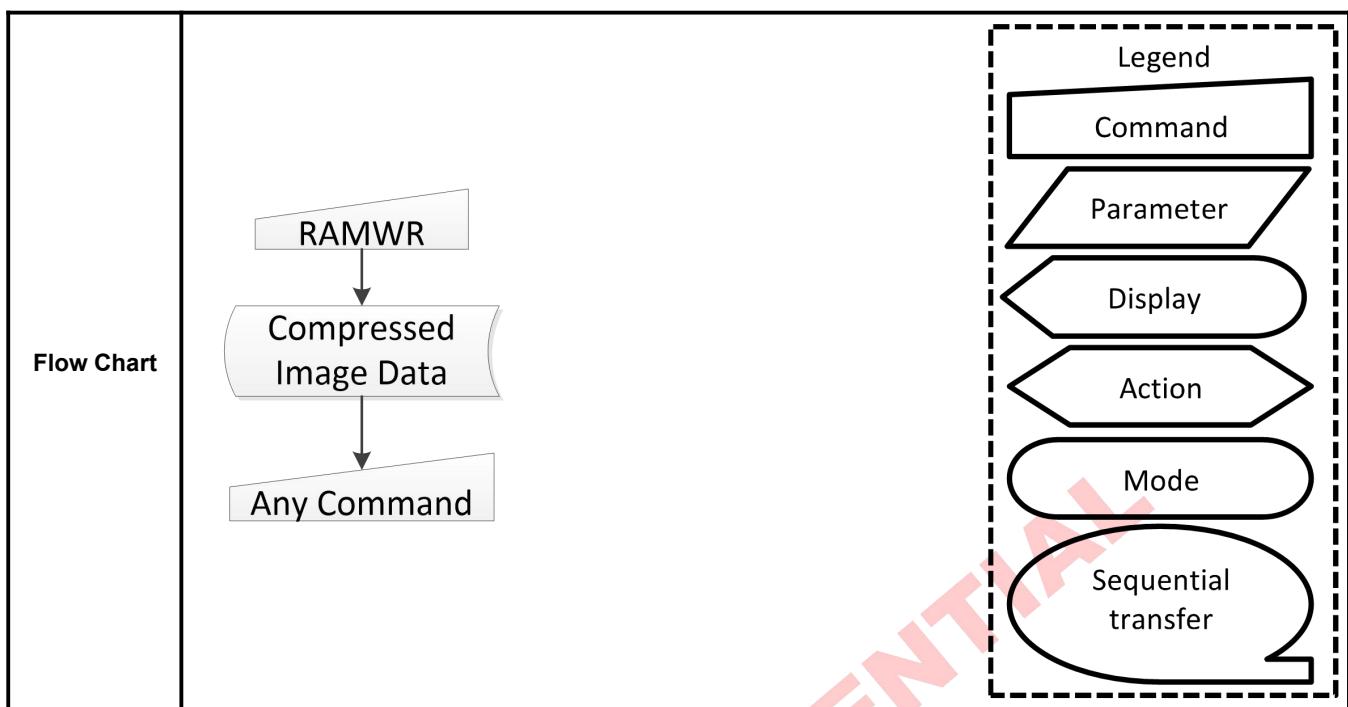
Register Availability	Status	Availability
	Normal Mode On, Idle Mode Off, Sleep Out	Yes
	Normal Mode On, Idle Mode On, Sleep Out	Yes
	Partial Mode On, Idle Mode Off, Sleep Out	Yes
	Partial Mode On, Idle Mode On, Sleep Out	Yes
	Sleep In	Yes
Default	Status	Default Value
	Power On Sequence	SP[11:0]: 000h, EP[11:0]:B8Fh
	S/W Reset	SP[11:0]: 000h, EP[11:0]:B8Fh
	H/W Reset	SP[11:0]: 000h, EP[11:0]:B8Fh
Flow Chart	<pre> graph TD     CASET[CASET] --&gt; SC[SC[11:0] EC[11:0]]     SC --&gt; PASET[PASET]     PASET --&gt; SP[SP[11:0] EP[11:0]]   </pre>	<pre> graph TD     RAMWR[RAMWR] --&gt; CID[Compressed Image Data]     CID --&gt; AC[Any Command]   </pre> <p><b>Legend:</b></p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>

### 9.3.21 (2Ch) RAMWR: Memory Write

Command Set		RAMWR									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RAMWR	W	0	0	1	0	1	1	0	0	2Ch	
Parameter	1	D1[7]	D1[6]	D1[5]	D1[4]	D1[3]	D1[2]	D1[1]	D1[0]	variable	
Parameter	...	...	...	...	...	...	...	...	...	...	
Parameter	N	Dn[7]	Dn[6]	Dn[5]	Dn[4]	Dn[3]	Dn[2]	Dn[1]	Dn[0]	variable	

NOTE: “-“Don’t care.

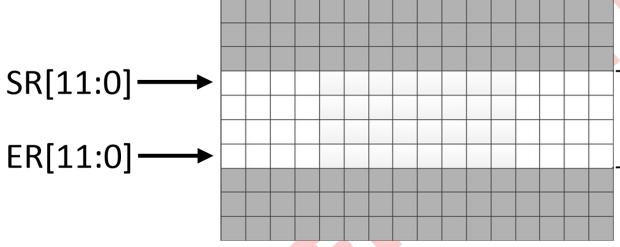
Description	This command is used to transfer data from host processor to frame memory. This command makes no change to the other driver status. When this command is accepted, the column register and the page register are reset to the Start Column/Start Page positions.													
Restriction	There are some restrictions on the command. No access to the frame memory in Sleep In mode. The total number of parameters sent by 2Ch and 3Ch is determined by memory window area. User will send parameters according to memory window area set by 2Ah, 2Bh.													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>Contents of memory is set randomly</td> </tr> <tr> <td>S/W Reset</td> <td>Contents of memory is set randomly</td> </tr> <tr> <td>H/W Reset</td> <td>Contents of memory is set randomly</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	Contents of memory is set randomly	S/W Reset	Contents of memory is set randomly	H/W Reset	Contents of memory is set randomly				
Status	Default Value													
Power On Sequence	Contents of memory is set randomly													
S/W Reset	Contents of memory is set randomly													
H/W Reset	Contents of memory is set randomly													

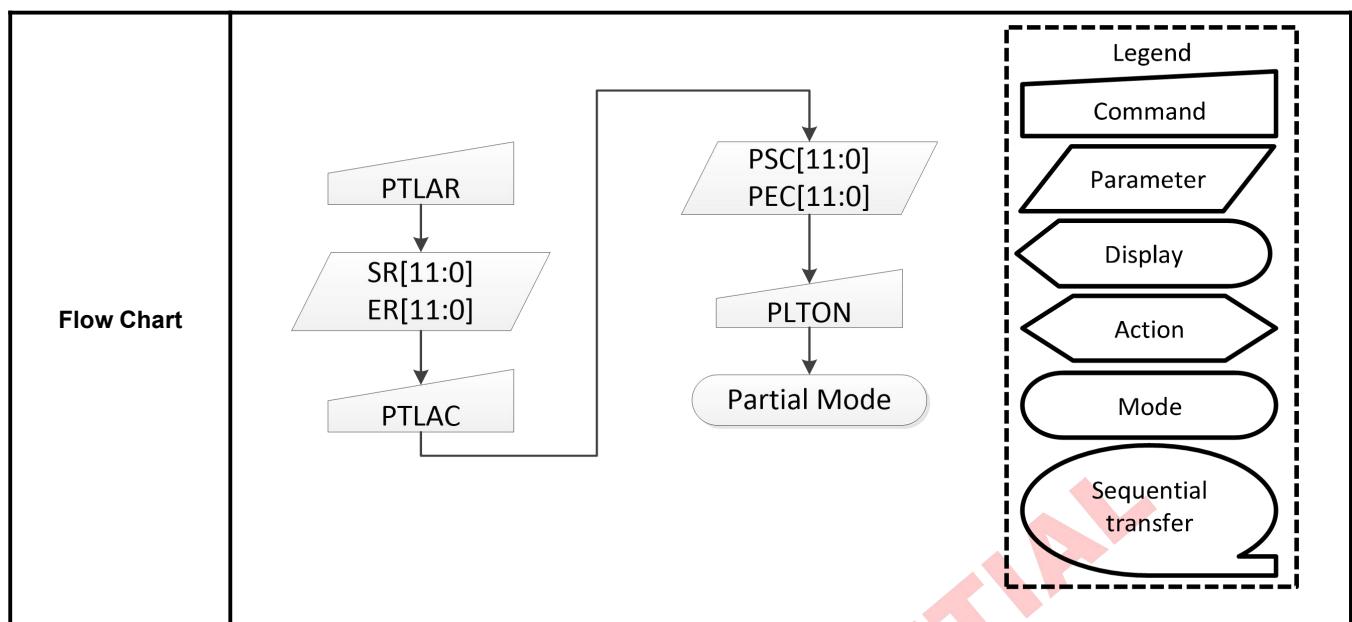


### 9.3.22 (30h) PTLAR: Write Partial Area Raw Set

Command Set		PTLAR									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
PTLAR	W	0	0	1	1	0	0	0	0	30h	
Parameter	1	0	0	0	0	SR[11:8]				00h	
Parameter	2	SR[7:0]						00h			
Parameter	3	0	0	0	0	ER[11:8]				0Bh	
Parameter	4	ER[7:0]						8Fh			

**NOTE:** “-”Don’t care.

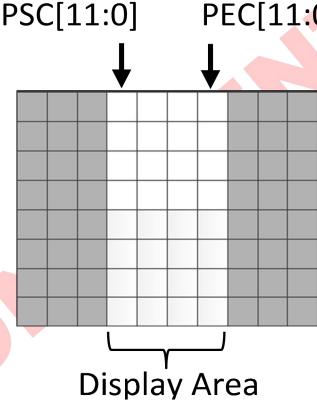
Description	This command defines the partial mode’s display area. There are two parameters associated with this command, the first defines the Start Row (SR) and the second defines the End Row(ER), as illustrated in the figures below. SR and ER refer to the Frame Memory Line Pointer.  												
Restriction	SR[11:0] and ER[11:0] cannot exceed the last vertical line number.												
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>	Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability												
Normal Mode On, Idle Mode Off, Sleep Out	Yes												
Normal Mode On, Idle Mode On, Sleep Out	Yes												
Partial Mode On, Idle Mode Off, Sleep Out	Yes												
Partial Mode On, Idle Mode On, Sleep Out	Yes												
Sleep In	Yes												
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>SR[11:0]: 000h, ER[11:0]:B8Fh</td> </tr> <tr> <td>S/W Reset</td> <td>SR[11:0]: 000h, ER[11:0]:B8Fh</td> </tr> <tr> <td>H/W Reset</td> <td>SR[11:0]: 000h, ER[11:0]:B8Fh</td> </tr> </tbody> </table>	Status	Default Value	Power On Sequence	SR[11:0]: 000h, ER[11:0]:B8Fh	S/W Reset	SR[11:0]: 000h, ER[11:0]:B8Fh	H/W Reset	SR[11:0]: 000h, ER[11:0]:B8Fh				
Status	Default Value												
Power On Sequence	SR[11:0]: 000h, ER[11:0]:B8Fh												
S/W Reset	SR[11:0]: 000h, ER[11:0]:B8Fh												
H/W Reset	SR[11:0]: 000h, ER[11:0]:B8Fh												



## 9.3.23 (31h) PTLAC: Write Partial Area Column Set

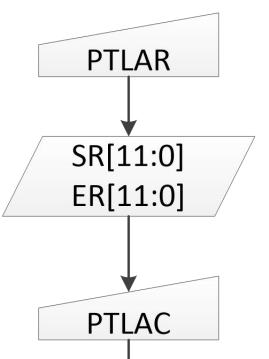
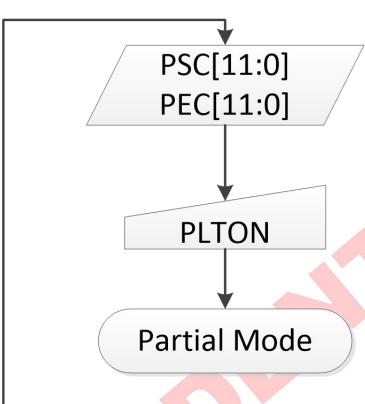
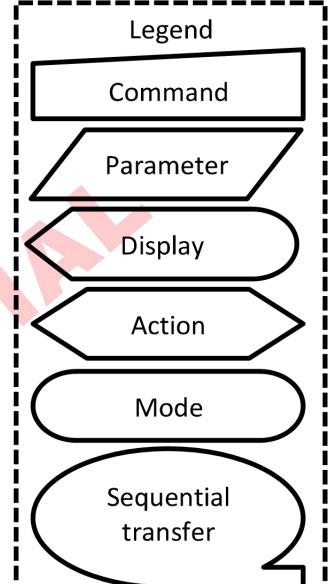
Command Set		PTLAC									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
PTLAC	W	0	0	1	1	0	0	0	1	31h	
Parameter	1	0	0	0	0	PSC[11:8]				00h	
Parameter	2	PSC[7:0]						PEC[11:8]			00h
Parameter	3	0	0	0	0	PEC[11:8]				05h	
Parameter	4	PEC[7:0]						Display Area			9Fh

**NOTE:** “-”Don’t care.

Description	<p>This command defines the partial mode’s display area. There are two parameters associated with this command, the first defines the Start Column (PSC) and the second defines the End Column (PEC), as illustrated in the figures below. PSC and PEC refer to the Source Column Pointer.</p> 												
Restriction	PSC[15:0] and PEC[15:0] cannot exceed the last column number.												
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>	Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability												
Normal Mode On, Idle Mode Off, Sleep Out	Yes												
Normal Mode On, Idle Mode On, Sleep Out	Yes												
Partial Mode On, Idle Mode Off, Sleep Out	Yes												
Partial Mode On, Idle Mode On, Sleep Out	Yes												
Sleep In	Yes												

Default	Status	Default Value
	Power On Sequence	PSC[11:0]: 000h, PEC[11:0]:59Fh
	S/W Reset	PSC[11:0]: 000h, PEC[11:0]:59Fh
	H/W Reset	PSC[11:0]: 000h, PEC[11:0]:59Fh

Flow Chart		
		

### 9.3.24 (32h) RTE : Request TE

Command Set		RTE								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
RTE	C	0	0	1	1	0	0	1	0	32h
Parameter	-	No Parameter								

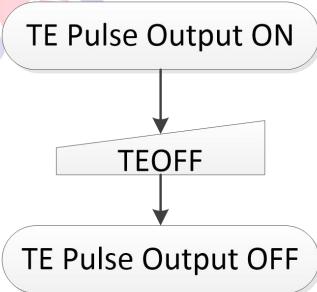
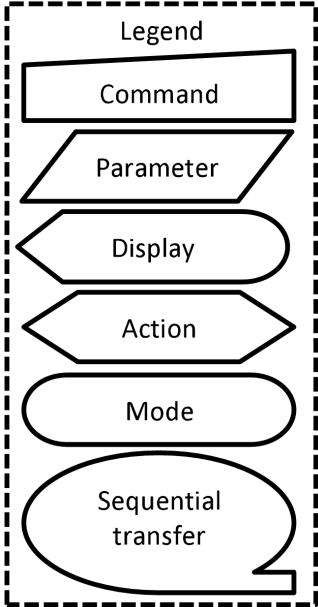
**NOTE:** “-”Don’t care.

Description	This command is a new command for MSYNC to notice DDIC from AP.  This command does not change any other status.													
Restriction	This command has no effect when module is already in display on mode.													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>Display Off</td> </tr> <tr> <td>S/W Reset</td> <td>Display Off</td> </tr> <tr> <td>H/W Reset</td> <td>Display Off</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	Display Off	S/W Reset	Display Off	H/W Reset	Display Off				
Status	Default Value													
Power On Sequence	Display Off													
S/W Reset	Display Off													
H/W Reset	Display Off													
Flow Chart	<pre> graph TD     RTE[RTE] --&gt; RequestTE([Request TE])     subgraph Legend [Legend]         direction TB         C[Command] --- P[Parameter]         D[Display] --- A[Action]         M[Mode] --- ST[Sequential transfer]     end </pre>													

### 9.3.25 (34h) TEOFF: Tearing Effect Line Off

Command Set		TEOFF									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
TEOFF	C	0	0	1	1	0	1	0	0	34h	
Parameter	-	No Parameter									

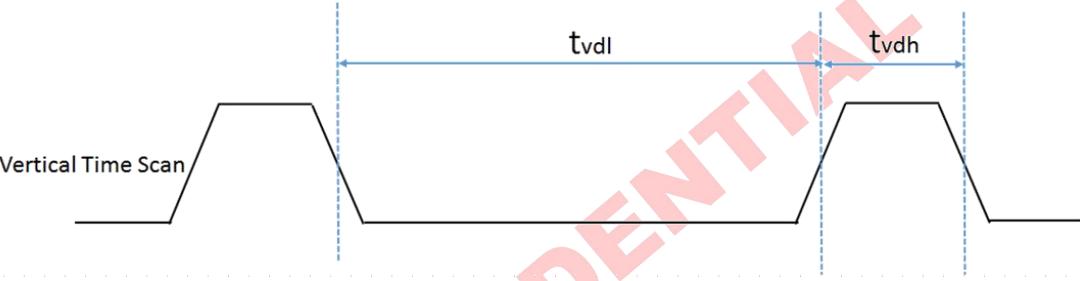
**NOTE:** “-”Don’t care.

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	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>OFF</td> </tr> <tr> <td>S/W Reset</td> <td>OFF</td> </tr> <tr> <td>H/W Reset</td> <td>OFF</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	OFF	S/W Reset	OFF	H/W Reset	OFF				
Status	Default Value													
Power On Sequence	OFF													
S/W Reset	OFF													
H/W Reset	OFF													
Flow Chart	 <pre> graph TD     A([TE Pulse Output ON]) --&gt; B[/TEOFF/]     B --&gt; C([TE Pulse Output OFF])     </pre>	 <pre> graph LR     Legend[Legend] --- Command[Command]     Legend --- Parameter[Parameter]     Legend --- Display[Display]     Legend --- Action[Action]     Legend --- Mode[Mode]     Legend --- Sequential[Sequential transfer]     </pre>												

### 9.3.26 (35h) TEON: Write Tearing Effect Line On

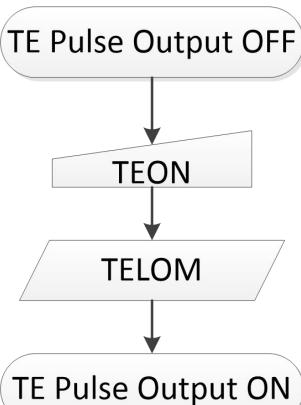
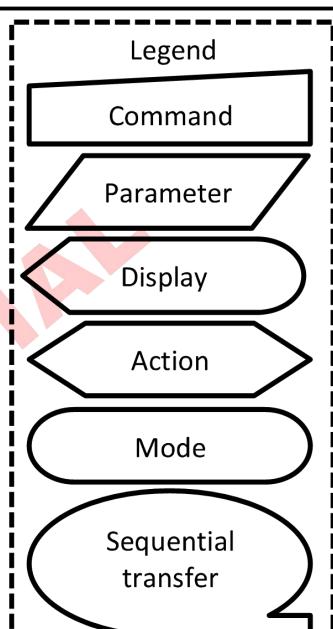
Command Set		TEON								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
TEON	W	0	0	1	1	0	1	0	1	35h
Parameter	1	0	0	0	0	0	0	0	TELOM	00h

NOTE: “-”Don’t care.

Description	<p>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.</p> <p>When TELOM = “0”: The Tearing Effect Output line consists of V-Blanking information only.</p>  <p>When TELOM = “1”: The Tearing Effect Output line consists of both V-Blanking and H-Blinking information.</p>  <p>*Note: During Sleep In Mode with Tearing Effect Line On, Tearing Effect Output pin will be active Low.</p>												
Restriction	This command has no effect when Tearing Effect output is already ON.												
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>	Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability												
Normal Mode On, Idle Mode Off, Sleep Out	Yes												
Normal Mode On, Idle Mode On, Sleep Out	Yes												
Partial Mode On, Idle Mode Off, Sleep Out	Yes												
Partial Mode On, Idle Mode On, Sleep Out	Yes												
Sleep In	Yes												

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

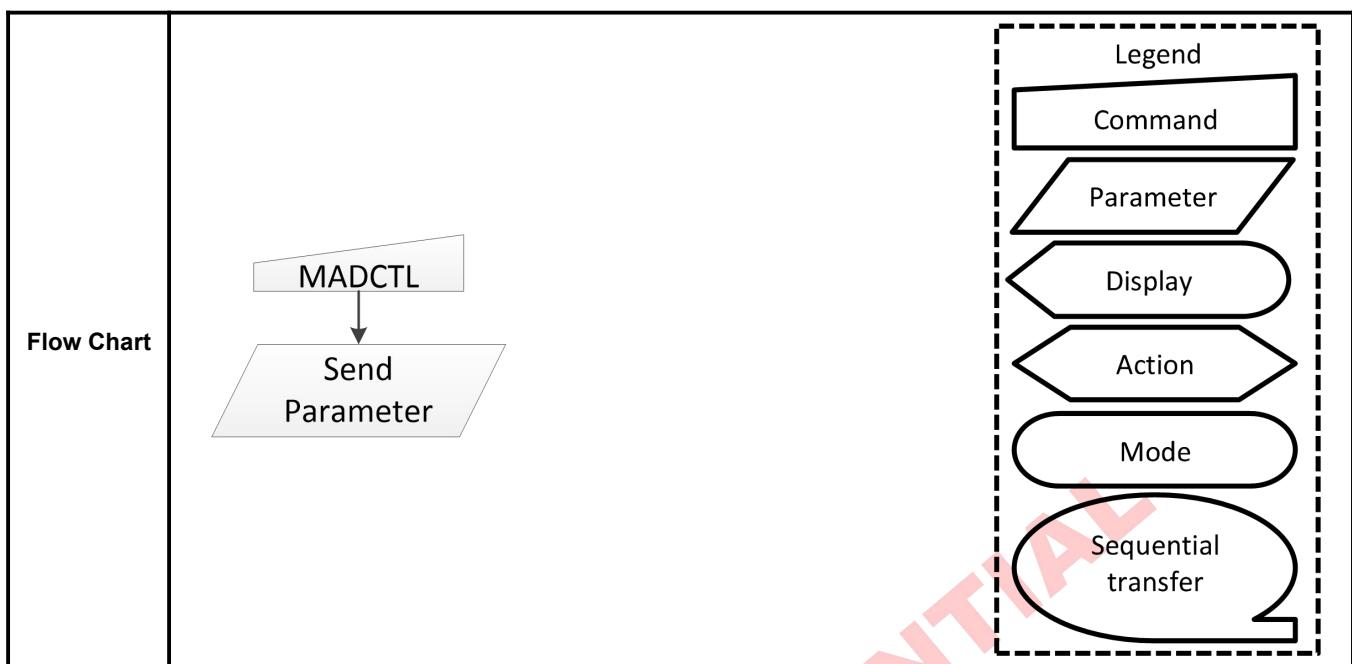
Flow Chart		

## 9.3.27 (36h) MADCTL: Memory Data Access Control

Command Set		MADCTL									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
MADCTL	W	0	0	1	1	0	1	1	0	36h	
Parameter	1	0	0	0	0	0	0	FH	0	00h	

NOTE: “-”Don’t care.

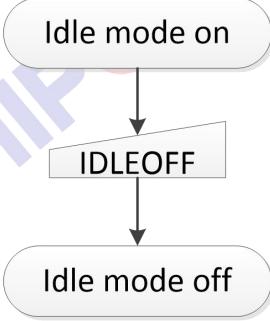
Description	This command defines scanning direction of display image. This command makes no change on the other driver status. MADCTL field is described in the table below:	
	Bit	Description
	D7	Not Used
	D6	Not Used
	D5	Not Used
	D4	Not Used
	D3	Not Used
	D2	Not Used
	D1	FH
	D0	Not Used
Restriction	-	
Register Availability	Status	Availability
	Normal Mode On, Idle Mode Off, Sleep Out	Yes
	Normal Mode On, Idle Mode On, Sleep Out	Yes
	Partial Mode On, Idle Mode Off, Sleep Out	Yes
	Partial Mode On, Idle Mode On, Sleep Out	Yes
	Sleep In	Yes
Default	Status	Default Value
	Power On Sequence	00h
	S/W Reset	00h
	H/W Reset	00h



### 9.3.28 (38h) IDLEOFF: Idle Mode Off

Command Set		IDLEOFF									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
IDLEOFF	C	0	0	1	1	1	0	0	0	38h	
Parameter	-	No Parameter									

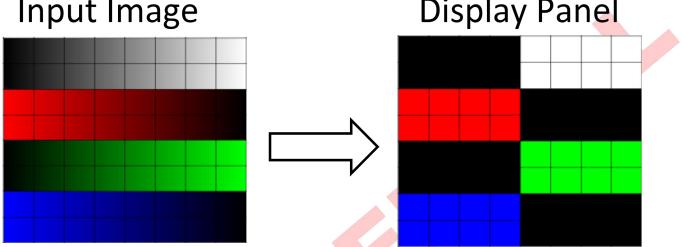
**NOTE:** “-”Don’t care.

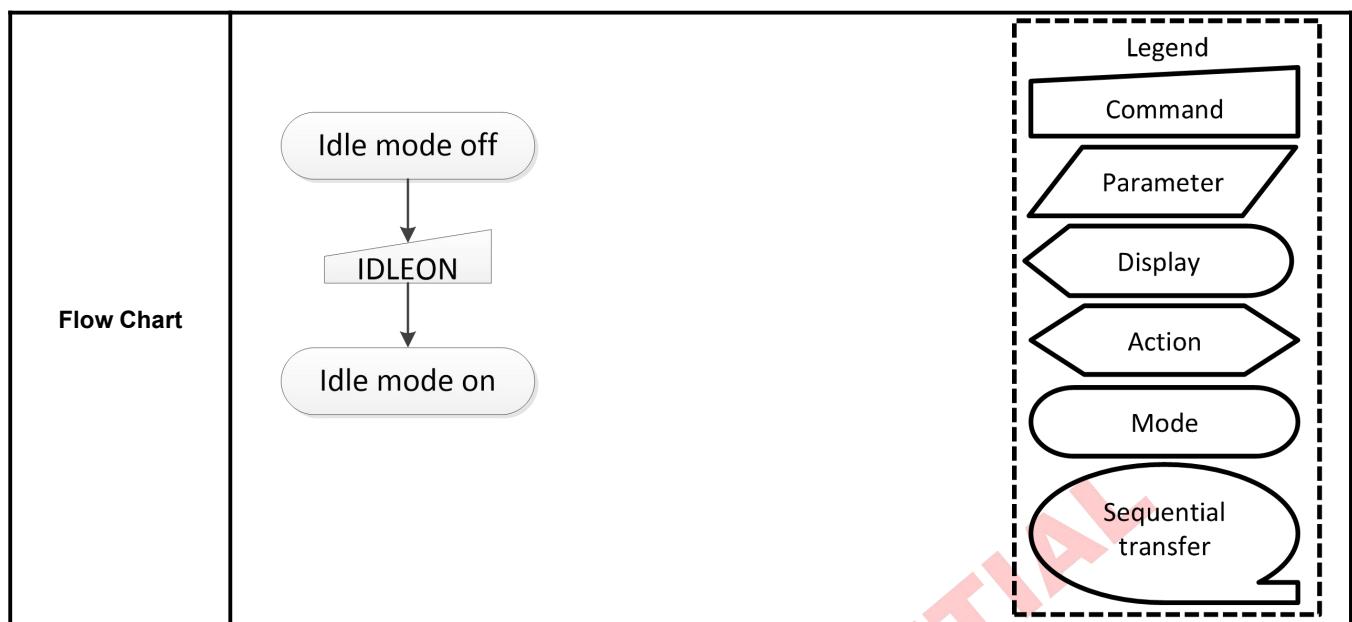
Description	This command is used to recover from Idle mode on.													
Restriction	This command has no effect when module is already in Idle Off mode.													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>Idle mode Off</td> </tr> <tr> <td>S/W Reset</td> <td>Idle mode Off</td> </tr> <tr> <td>H/W Reset</td> <td>Idle mode Off</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	Idle mode Off	S/W Reset	Idle mode Off	H/W Reset	Idle mode Off				
Status	Default Value													
Power On Sequence	Idle mode Off													
S/W Reset	Idle mode Off													
H/W Reset	Idle mode Off													
Flow Chart	 <pre> graph TD     A([Idle mode on]) --&gt; B[/IDLEOFF/]     B --&gt; C([Idle mode off])     </pre> <p><b>Legend</b></p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>													

### 9.3.29 (39h) IDLEON: Idle Mode On

Command Set		IDLEON									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
IDLEON	C	0	0	1	1	1	0	0	1	39h	
Parameter	-	No Parameter									

**NOTE:** “-”Don’t care.

Description	<p>This command causes the display module to enter Idle Mode. In Idle Mode, color expression is reduced. Colors are shown on the display device using the MSB of each of the R, G and B color components in the Input Image.</p> 												
Restriction	This command has no effect when module is already in idle on mode.												
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>	Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability												
Normal Mode On, Idle Mode Off, Sleep Out	Yes												
Normal Mode On, Idle Mode On, Sleep Out	Yes												
Partial Mode On, Idle Mode Off, Sleep Out	Yes												
Partial Mode On, Idle Mode On, Sleep Out	Yes												
Sleep In	Yes												
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>Idle mode Off</td> </tr> <tr> <td>S/W Reset</td> <td>Idle mode Off</td> </tr> <tr> <td>H/W Reset</td> <td>Idle mode Off</td> </tr> </tbody> </table>	Status	Default Value	Power On Sequence	Idle mode Off	S/W Reset	Idle mode Off	H/W Reset	Idle mode Off				
Status	Default Value												
Power On Sequence	Idle mode Off												
S/W Reset	Idle mode Off												
H/W Reset	Idle mode Off												

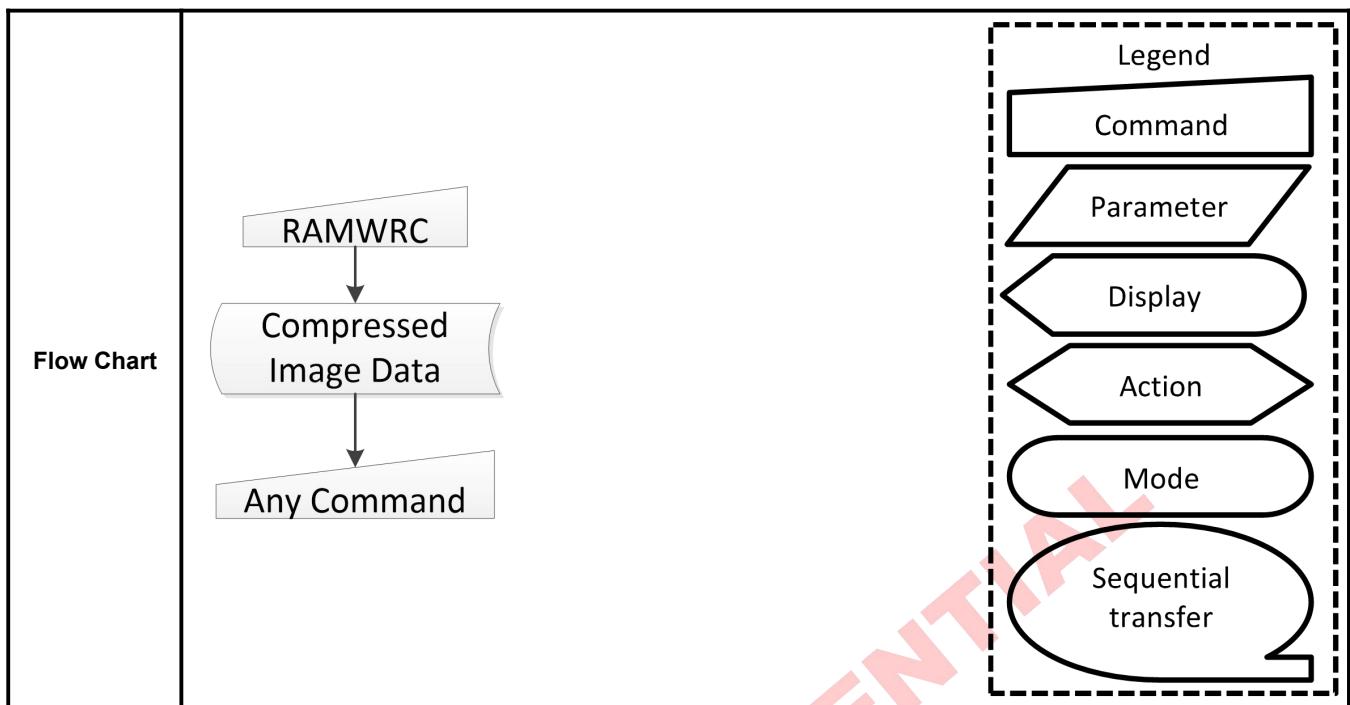


## 9.3.30 (3Ch) RAMWRC: Memory Write Continue

Command Set		RAMWRC									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RAMWRC	W	0	0	1	1	1	1	0	0	3Ch	
Parameter	1	D1[7]	D1[6]	D1[5]	D1[4]	D1[3]	D1[2]	D1[1]	D1[0]	variable	

NOTE: “-”Don’t care.

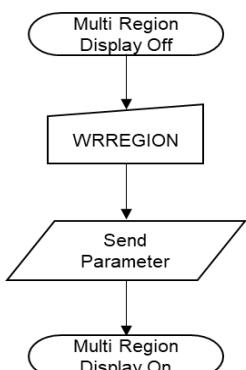
Description	This command is used to transfer data from host processor to frame memory. If there is wanted to continue memory write after "Memory Write (2Ch)" command. This command makes no change to the other driver status. When this command is accepted, the column register and the page register are not reset to the Start Column/Start Page positions as it has been done on "Memory Write (2Ch)" command.													
Restriction	There are some restrictions on the command. No access to the frame memory in Sleep In mode. The total number of parameters sent by 2Ch and 3Ch is determined by memory window area. User will send parameters according to memory window area set by 2Ah, 2Bh.													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>Contents of memory is set randomly</td> </tr> <tr> <td>S/W Reset</td> <td>Contents of memory is set randomly</td> </tr> <tr> <td>H/W Reset</td> <td>Contents of memory is set randomly</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	Contents of memory is set randomly	S/W Reset	Contents of memory is set randomly	H/W Reset	Contents of memory is set randomly				
Status	Default Value													
Power On Sequence	Contents of memory is set randomly													
S/W Reset	Contents of memory is set randomly													
H/W Reset	Contents of memory is set randomly													



### 9.3.31 (40h) WRREGION: Write MULTI REGION Value

Command Set		WRREGION								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
WRREGION	W	0	1	0	0	0	0	0	0	40h
Parameter	1	0	0	0	0	0	0	MULTI_PRS[1:0]	03h	

NOTE: “-”Don’t care.

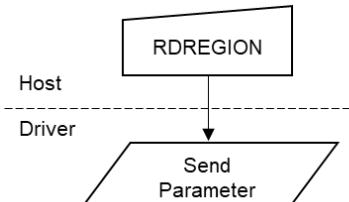
<b>Description</b>	This command causes the DDIC to enter MULTI REGION Mode.	
	MULTI_PRS[1:0]:	Description
	2'b00	Setting Disabled
	2'b01	Only A display On
	2'b10	Only B display On
	2'b11	A+B display On
<b>Restriction</b>	-	
<b>Register Availability</b>	Status	Availability
	Normal Mode On, Idle Mode Off, Sleep Out	Yes
	Normal Mode On, Idle Mode On, Sleep Out	Yes
	Partial Mode On, Idle Mode Off, Sleep Out	Yes
	Partial Mode On, Idle Mode On, Sleep Out	Yes
	Sleep In	Yes
<b>Default</b>	Status	Default Value
Power On Sequence	Contents of memory is set randomly	
S/W Reset	Contents of memory is set randomly	
H/W Reset	Contents of memory is set randomly	
<b>Flow Chart</b>	 <pre> graph TD     A([Multi Region Display Off]) --&gt; B[WRREGION]     B --&gt; C{Send Parameter}     C --&gt; D([Multi Region Display On])     </pre>	<b>Legend</b> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>

### 9.3.32 (41h) RDREGION: Read MULTI REGION Value

Command Set	RDREGION
-------------	----------

Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
RDREGION	R	0	1	0	0	0	0	0	1	41h
Parameter	1	0	0	0	0	0	0	MULTI_PRS[1:0]	03h	

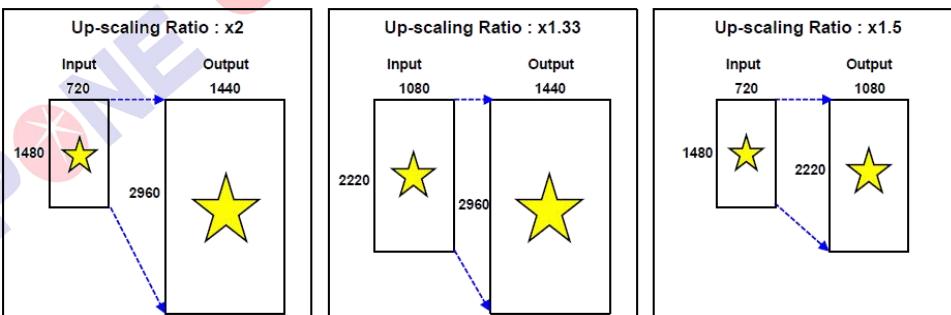
NOTE: “-”Don’t care.

<b>Description</b>	<table border="1"> <tr> <td>MULTI_PRS[1:0]:</td><td>Description</td></tr> <tr> <td>2'b00</td><td>Setting Disabled</td></tr> <tr> <td>2'b01</td><td>Only A display On</td></tr> <tr> <td>2'b10</td><td>Only B display On</td></tr> <tr> <td>2'b11</td><td>A+B display On</td></tr> </table>		MULTI_PRS[1:0]:	Description	2'b00	Setting Disabled	2'b01	Only A display On	2'b10	Only B display On	2'b11	A+B display On	This command causes the DDIC to enter MULTI REGION Mode.
MULTI_PRS[1:0]:	Description												
2'b00	Setting Disabled												
2'b01	Only A display On												
2'b10	Only B display On												
2'b11	A+B display On												
<b>Restriction</b>													
<b>Register Availability</b> <table border="1"> <tr> <th>Status</th> <th>Availability</th> </tr> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability												
Normal Mode On, Idle Mode Off, Sleep Out	Yes												
Normal Mode On, Idle Mode On, Sleep Out	Yes												
Partial Mode On, Idle Mode Off, Sleep Out	Yes												
Partial Mode On, Idle Mode On, Sleep Out	Yes												
Sleep In	Yes												
<b>Default</b> <table border="1"> <tr> <th>Status</th> <th>Default Value</th> </tr> <tr> <td>Power On Sequence</td> <td>Contents of memory is set randomly</td> </tr> <tr> <td>S/W Reset</td> <td>Contents of memory is set randomly</td> </tr> <tr> <td>H/W Reset</td> <td>Contents of memory is set randomly</td> </tr> </table>		Status	Default Value	Power On Sequence	Contents of memory is set randomly	S/W Reset	Contents of memory is set randomly	H/W Reset	Contents of memory is set randomly				
Status	Default Value												
Power On Sequence	Contents of memory is set randomly												
S/W Reset	Contents of memory is set randomly												
H/W Reset	Contents of memory is set randomly												
<b>Flow Chart</b>  <pre> graph TD     RDREGION[RDREGION] --&gt; Host  SP[/Send Parameter/]     RDREGION -.-&gt; Driver  SP     </pre>		<b>Legend</b> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>											

### 9.3.33 (42h) WRUPSCM: Write Scale-up Value

Command Set		WRUPSCM								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
WRUPSCM	W	0	1	0	0	0	0	1	0	42h
Parameter	1	0	0	0	SCALER_EN	0	0	SCALER_MODE[1:0]		00h

**NOTE:** “-”Don’t care.

<b>Description</b>	<p>This command causes the DDIC to enter Up-Scaling Mode. This function converts image from a lower resolution to a higher resolution.</p> <p>It can support three kinds of up-scaling ratio : x2, x1.5, x1.33</p> <p>SCALER_EN:</p> <ul style="list-style-type: none"> <li>- “0” = Turn off Up-Scaling Mode.</li> <li>- “1” = Turn on Up-Scaling Mode.</li> </ul> <p>SCALER_MODE[1:0]:</p> <table border="1"> <thead> <tr> <th>SCALER_MODE[1:0]:</th><th>Description</th></tr> </thead> <tbody> <tr> <td>2'b00</td><td>up-scaling ratio x1.33</td></tr> <tr> <td>2'b01</td><td>up-scaling ratio x2</td></tr> <tr> <td>2'b10</td><td>up-scaling ratio x1.5</td></tr> <tr> <td>2'b11</td><td>Reserved</td></tr> </tbody> </table> <p>Some examples of up-scaling application resolution:</p> 		SCALER_MODE[1:0]:	Description	2'b00	up-scaling ratio x1.33	2'b01	up-scaling ratio x2	2'b10	up-scaling ratio x1.5	2'b11	Reserved
SCALER_MODE[1:0]:	Description											
2'b00	up-scaling ratio x1.33											
2'b01	up-scaling ratio x2											
2'b10	up-scaling ratio x1.5											
2'b11	Reserved											
<b>Restriction</b>	Scaling-Up function is only available in command mode.											

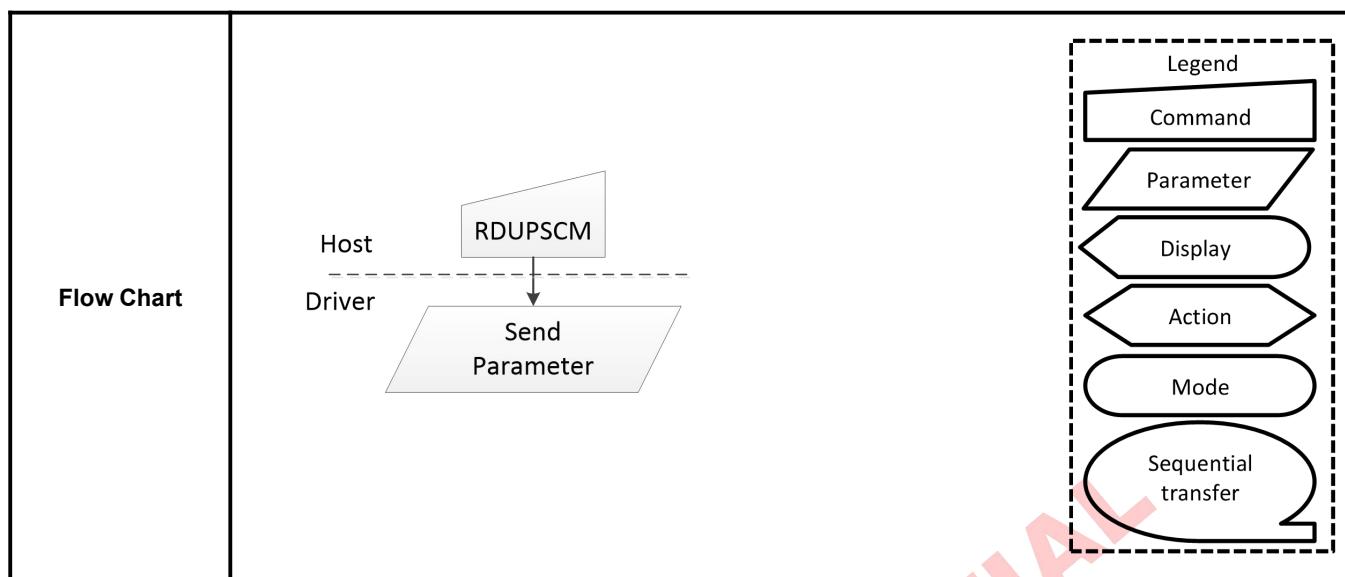
Register Availability	Status	Availability
	Normal Mode On, Idle Mode Off, Sleep Out	Yes
	Normal Mode On, Idle Mode On, Sleep Out	Yes
	Partial Mode On, Idle Mode Off, Sleep Out	Yes
	Partial Mode On, Idle Mode On, Sleep Out	Yes
	Sleep In	Yes
Default	Status	Default Value
	Power On Sequence	00h
	S/W Reset	00h
	H/W Reset	00h
Flow Chart	<pre> graph TD     WRUPSCM[WRUPSCM] --&gt; SCALER[SCALER_EN = 1 &amp; SCALER_MODE[1:0]]     SCALER --&gt; ScalingUpMode{Scaling-Up Mode}     ScalingUpMode --&gt; RAMWR[RAMWR &amp; RAMWRC]     </pre>	<pre> graph TD     CompImage[Compressed Image Data] --&gt; DispImage[Display Scaling-Up Image]     </pre> <p><b>Legend:</b></p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>

### 9.3.34 (43h) RDUPSCM: Read Scale-up Value

Command Set		RDUPSCM								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
RDUPSCM	R	0	1	0	0	0	0	1	1	43h
Parameter	1	0	0	0	SCALER_EN	0	0	SCALER_MODE[1:0]		00h

NOTE: “-”Don’t care.

<b>Description</b>	This command indicates the Up-Scaling Mode status of the display as described as below:													
	<b>SCALER_EN:</b> - “0” = Turn off Up-Scaling Mode. - “1” = Turn on Up-Scaling Mode.													
<b>SCALER_MODE[1:0]:</b>														
<table border="1"> <thead> <tr> <th>SCALER_MODE[1:0]:</th><th>Description</th></tr> </thead> <tbody> <tr> <td>2'b00</td><td>up-scaling ratio x2</td></tr> <tr> <td>2'b01</td><td>up-scaling ratio x1.5</td></tr> <tr> <td>2'b10</td><td>up-scaling ratio x1.33</td></tr> <tr> <td>2'b11</td><td>Reserved</td></tr> </tbody> </table>		SCALER_MODE[1:0]:	Description	2'b00	up-scaling ratio x2	2'b01	up-scaling ratio x1.5	2'b10	up-scaling ratio x1.33	2'b11	Reserved			
SCALER_MODE[1:0]:	Description													
2'b00	up-scaling ratio x2													
2'b01	up-scaling ratio x1.5													
2'b10	up-scaling ratio x1.33													
2'b11	Reserved													
<b>Restriction</b>	-													
<b>Register Availability</b>	<table border="1"> <thead> <tr> <th>Status</th><th>Availability</th></tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr> <td>Sleep In</td><td>Yes</td></tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
	Status	Availability												
	Normal Mode On, Idle Mode Off, Sleep Out	Yes												
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	Partial Mode On, Idle Mode Off, Sleep Out	Yes												
	Partial Mode On, Idle Mode On, Sleep Out	Yes												
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<b>Default</b>	<table border="1"> <thead> <tr> <th>Status</th><th>Default Value</th></tr> </thead> <tbody> <tr> <td>Power On Sequence</td><td>00h</td></tr> <tr> <td>S/W Reset</td><td>00h</td></tr> <tr> <td>H/W Reset</td><td>00h</td></tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
	Status	Default Value												
	Power On Sequence	00h												
	S/W Reset	00h												
H/W Reset	00h													

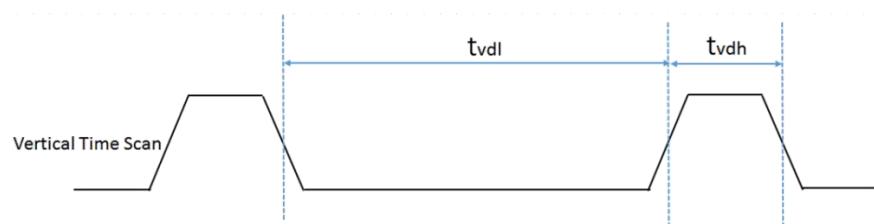
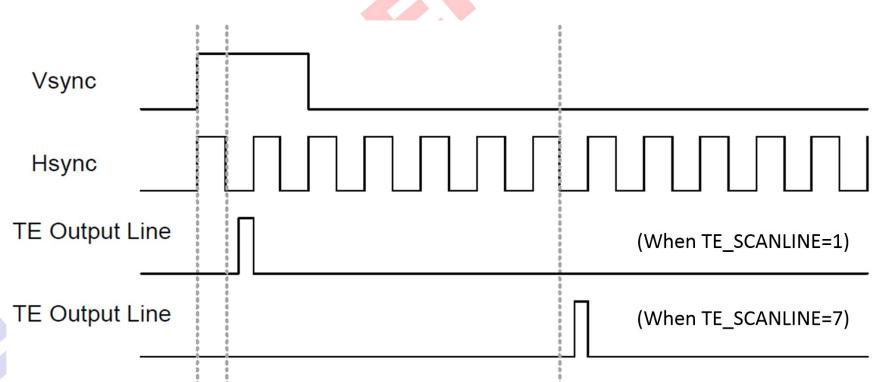


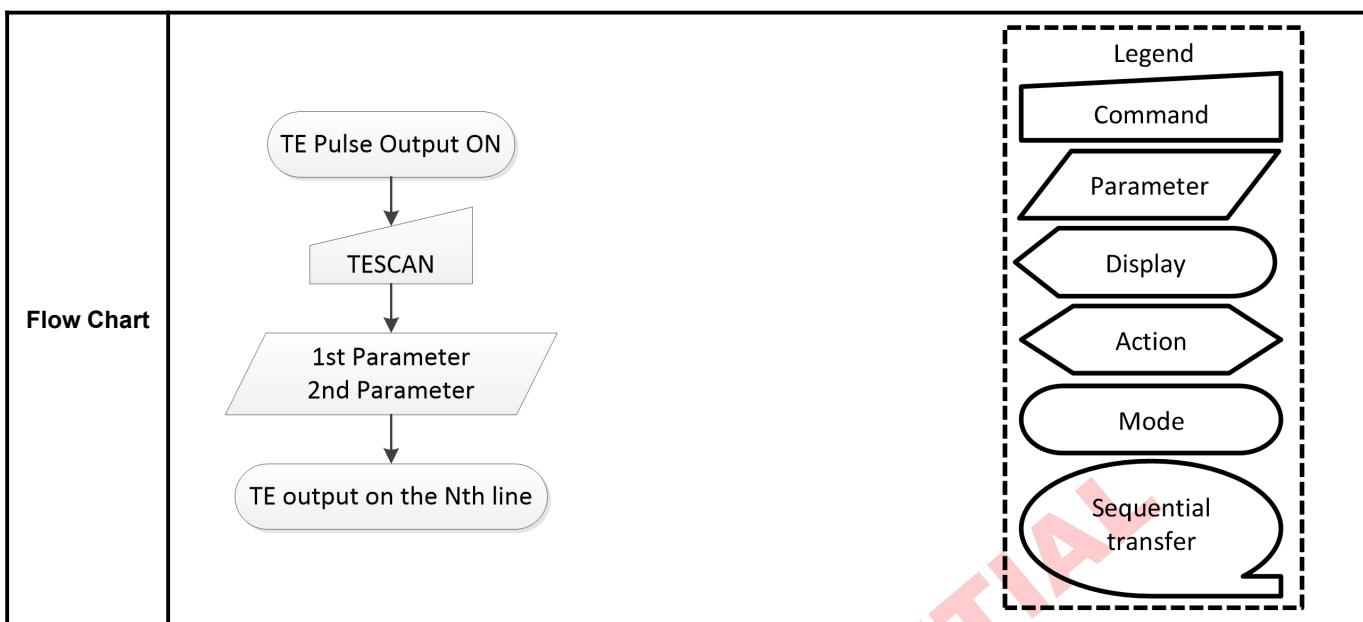
### 9.3.35 (44h) TESCAN: Write Tear Scanline

Command Set		TESCAN									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
TESCAN	W	0	1	0	0	0	1	0	0	44h	
Parameter	1	TE_SCANLINE[15:8]									
Parameter	2	TE_SCANLINE[7:0]									

**NOTE:** “-”Don’t care.

Description	<p>This command turns on the display module's Tearing Effect output signal on the TE signal line when the display module reaches line TE_SCANLINE.</p> <p>When TE_SCANLINE =1, Tearing Effect output line is on at the first line of VSYNC.</p> <p>The Tearing Effect Output line shall be active low when the display module is in Sleep mode.</p> <p>Note that TESCAN with TE_SCANLINE = 0 is equivalent to TEON with TELOM = 0.</p> <p>This command takes effect on the frame following the current frame. Therefore, if the Tear Effect (TE) output is already ON, the TE output shall continue to operate as programmed by the previous TEON, or TESCAN, command until the end of the frame.</p>													
Restriction	TE_SCANLINE[15:0] always must be less than VBP + VFP + VSYNC + VACT.													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
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Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>000h</td> </tr> <tr> <td>S/W Reset</td> <td>000h</td> </tr> <tr> <td>H/W Reset</td> <td>000h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	000h	S/W Reset	000h	H/W Reset	000h				
Status	Default Value													
Power On Sequence	000h													
S/W Reset	000h													
H/W Reset	000h													

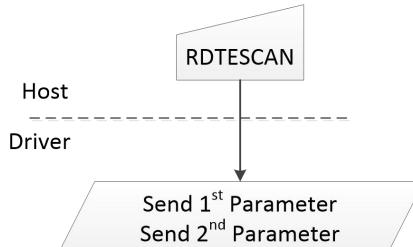
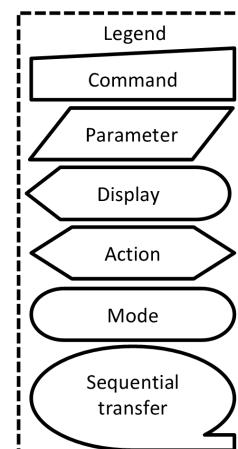
	TEON	TESCAN	TE Pulse Output
Description	TELOM	TE_SCANLINE	The Tearing Effect Output line consists of V-blanking information only.
	0	0	 <p>Vertical Time Scan</p>
	0	$\neq 0$	<p>The Tearing Effect Output Line consists of Nth line information</p>  <p>Vsync</p> <p>Hsync</p> <p>TE Output Line (When TE_SCANLINE=1)</p> <p>TE Output Line (When TE_SCANLINE=7)</p>
	1	X	<p>The Tearing Effect Output Line consists of both V-Blanking and H- Blanking information.</p>  <p>Vertical Time Scale</p>



### 9.3.36 (45h) RDTESCAN: Read Scanline

Command Set		RDTESCAN									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RDTESCAN	R	0	1	0	0	0	1	0	1	45h	
Parameter	1	0	0	0	0	0	0	SCANLINE[17:16]		00h	
Parameter	2	SCANLINE[15:8]							00h		
Parameter	3	SCANLINE[7:0]							00h		

NOTE: “-”“Don’t care.

Description	This command returns the current scan line, N, used to update the display module. The total number of scan lines on display is defined as VBP + VFP + VSYNC + VACT. The first scan line is defined as the first line of V Sync and is denoted as Line 0.  When in Sleep in mode, the returned value is undefined.													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>000h</td> </tr> <tr> <td>S/W Reset</td> <td>000h</td> </tr> <tr> <td>H/W Reset</td> <td>000h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	000h	S/W Reset	000h	H/W Reset	000h				
Status	Default Value													
Power On Sequence	000h													
S/W Reset	000h													
H/W Reset	000h													
Flow Chart	 <pre> graph TD     Host -- RDTESCAN --&gt; Driver     Driver -- "Send 1<sup>st</sup> Parameter" --&gt; Param1     Driver -- "Send 2<sup>nd</sup> Parameter" --&gt; Param2   </pre>	 <pre> graph LR     subgraph Legend         L1[Command]         L2[Parameter]         L3[Display]         L4[Action]         L5[Mode]         L6[Sequential transfer]     end   </pre>												

### 9.3.37 (48h) WRDSIM: Write DSI MODE

Command Set		WRDSIM								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
WRDSIM	W	0	1	0	0	1	0	0	0	48h
Parameter	1	0	0	HFR_MODE[1:0]		0	0	DSI_MODE[1:0]		00h

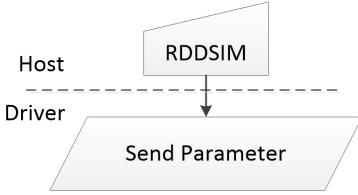
NOTE: “-”Don’t care.

<b>Description</b>	<p>This command is used to select display operation mode. Power, GOA and Source timing can be set in 60Hz and 90Hz mode separately. When display operation mode is changed, please follow display mode change sequence.</p> <table border="1"> <tr> <td>DSI_MODE[1:0]</td><td>Display operation mode</td><td>Mode</td><td>HFR_MODE[1:0]</td><td>Display Refresh Rate</td></tr> <tr> <td>2'b00</td><td>Command Mode</td><td>Through GRAM</td><td>2'b00</td><td>Normal Mode</td></tr> <tr> <td>2'b01</td><td>Reserved</td><td>Reserved</td><td>2'b01</td><td>HF1 Mode</td></tr> <tr> <td>2'b10</td><td rowspan="2">Video Mode</td><td>Through GRAM</td><td>2'b10</td><td>HF2 Mode</td></tr> <tr> <td>2'b11</td><td>Bypass GRAM</td><td>2'b11</td><td>HF3 Mode</td></tr> </table>						DSI_MODE[1:0]	Display operation mode	Mode	HFR_MODE[1:0]	Display Refresh Rate	2'b00	Command Mode	Through GRAM	2'b00	Normal Mode	2'b01	Reserved	Reserved	2'b01	HF1 Mode	2'b10	Video Mode	Through GRAM	2'b10	HF2 Mode	2'b11	Bypass GRAM	2'b11	HF3 Mode		
DSI_MODE[1:0]	Display operation mode	Mode	HFR_MODE[1:0]	Display Refresh Rate																												
2'b00	Command Mode	Through GRAM	2'b00	Normal Mode																												
2'b01	Reserved	Reserved	2'b01	HF1 Mode																												
2'b10	Video Mode	Through GRAM	2'b10	HF2 Mode																												
2'b11		Bypass GRAM	2'b11	HF3 Mode																												
<b>Restriction</b>	-																															
<b>Register Availability</b>	<table border="1"> <tr> <th>Status</th> <th>Availability</th> </tr> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </table>					Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes															
Status	Availability																															
Normal Mode On, Idle Mode Off, Sleep Out	Yes																															
Normal Mode On, Idle Mode On, Sleep Out	Yes																															
Partial Mode On, Idle Mode Off, Sleep Out	Yes																															
Partial Mode On, Idle Mode On, Sleep Out	Yes																															
Sleep In	Yes																															
<table border="1"> <tr> <th>Status</th> <th>Default Value</th> </tr> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </table>					Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h																				
Status	Default Value																															
Power On Sequence	00h																															
S/W Reset	00h																															
H/W Reset	00h																															
<table border="1"> <tr> <td>WRDSIM</td> <td>HFR_MODE[1:0] &amp; DSI_MODE[1:0]</td> <td>New Control Value</td> <td>Legend</td> </tr> <tr> <td>↓</td> <td>↓</td> <td>↓</td> <td>Command</td> </tr> <tr> <td></td> <td></td> <td></td> <td>Parameter</td> </tr> <tr> <td></td> <td></td> <td></td> <td>Display</td> </tr> <tr> <td></td> <td></td> <td></td> <td>Action</td> </tr> <tr> <td></td> <td></td> <td></td> <td>Mode</td> </tr> <tr> <td></td> <td></td> <td></td> <td>Sequential transfer</td> </tr> </table>					WRDSIM	HFR_MODE[1:0] & DSI_MODE[1:0]	New Control Value	Legend	↓	↓	↓	Command				Parameter				Display				Action				Mode				Sequential transfer
WRDSIM	HFR_MODE[1:0] & DSI_MODE[1:0]	New Control Value	Legend																													
↓	↓	↓	Command																													
			Parameter																													
			Display																													
			Action																													
			Mode																													
			Sequential transfer																													

### 9.3.38 (49h) RDDSIM: Read DS1 MODE

Command Set		RDDSIM								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
RDDSIM	R	0	1	0	0	1	0	0	1	49h
Parameter	1	0	0	HFR_MODE[1:0]		0	0	DSI_MODE[1:0]		00h

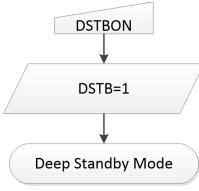
NOTE: “-”Don’t care.

<b>Description</b>	This command returns the status of display operation mode.						
	DSI_MODE[1:0]	Display operation mode	Mode	HFR_MODE[1:0]	Display Refresh Rate		
	2'b00	Command Mode	Through GRAM	2'b00	Normal Mode		
	2'b01	Reserved	Reserved	2'b01	HF1 Mode		
	2'b10	Video Mode	Through GRAM	2'b10	HF2 Mode		
	2'b11		Bypass GRAM	2'b11	HF3 Mode		
<b>Restriction</b>	-						
<b>Register Availability</b>	Status			Availability			
	Normal Mode On, Idle Mode Off, Sleep Out			Yes			
	Normal Mode On, Idle Mode On, Sleep Out			Yes			
	Partial Mode On, Idle Mode Off, Sleep Out			Yes			
	Partial Mode On, Idle Mode On, Sleep Out			Yes			
	Sleep In			Yes			
<b>Default</b>	Status			Default Value			
	Power On Sequence			00h			
	S/W Reset			00h			
	H/W Reset			00h			
<b>Flow Chart</b>	 <pre> graph TD     Host[Host] -- RDDSIM --&gt; Driver[Driver]     Driver -- "Send Parameter" --&gt; RDDSIM   </pre> <p>Legend:</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>						

### 9.3.39 (4Fh) DSTBON: Write Deep Standby On

Command Set		DSTBON									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
DSTBON	W	0	1	0	0	1	1	1	1	4Fh	
Parameter	1	0	0	0	0	0	0	0	DSTB	00h	

**NOTE:** “-”Don’t care.

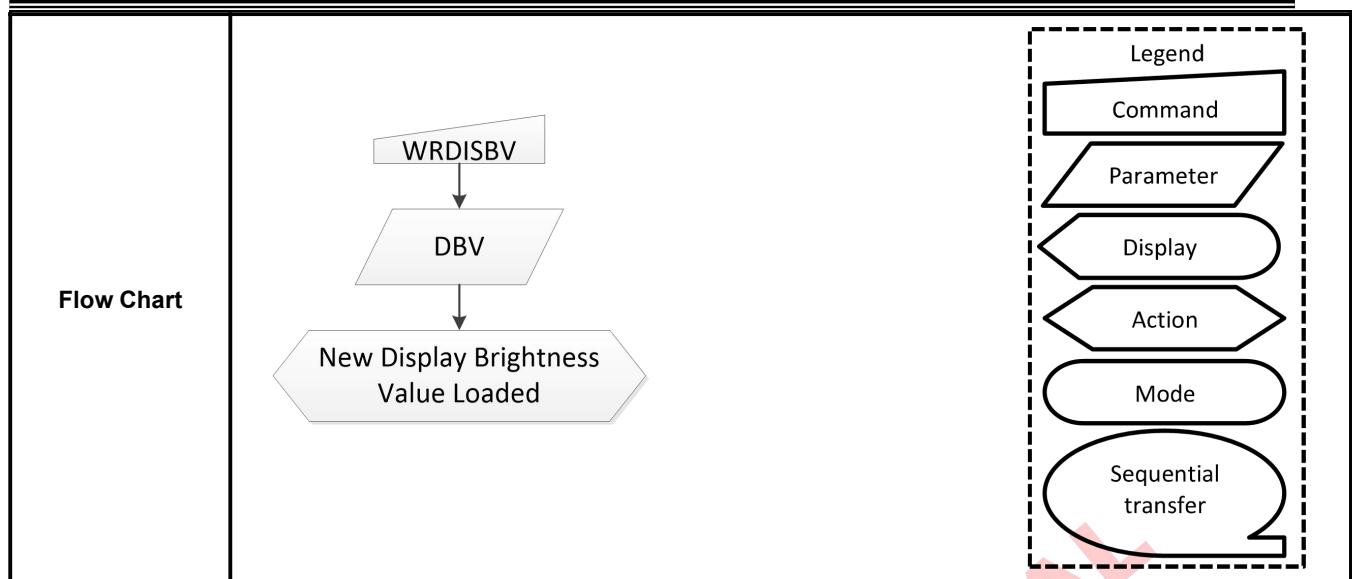
Description	This command is used to enter deep standby mode. DSTB=“1”, enter deep standby mode.  <b>*Notes:</b> 1. To exit Deep Standby Mode, set RESX low pulse more than 3m second to pin nRESET. 2. If user wants to enter DSTB mode from Normal Display directly, it should enter sleep-in & display-off mode first, and wait 2 frames or more time for completing power-down sequence, and then execute this command to enter DSTB mode.													
Restriction	This command is only valid sleep mode.													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>No</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>No</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>No</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>No</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	No	Normal Mode On, Idle Mode On, Sleep Out	No	Partial Mode On, Idle Mode Off, Sleep Out	No	Partial Mode On, Idle Mode On, Sleep Out	No	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	No													
Normal Mode On, Idle Mode On, Sleep Out	No													
Partial Mode On, Idle Mode Off, Sleep Out	No													
Partial Mode On, Idle Mode On, Sleep Out	No													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													
Flow Chart	 <pre> graph TD     DSTBON[DSTBON] --&gt; DSTB1{DSTB=1}     DSTB1 --&gt; DSTBON[Deep Standby Mode]   </pre> <p>Legend:      Command      Parameter      Display      Action      Mode      Sequential transfer   </p>													

### 9.3.40 (51h) WRDISBV: Write Display Brightness

Command Set		WRDISBV									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
WRDISBV	W	0	1	0	1	0	0	0	1	51h	
Parameter	1	DBV1[7:0]									
Parameter	2	0	0	0	0	0	0	DBV1[12:8]			00h
Parameter	3	DBV2[7:0]									
Parameter	4	0	0	0	0	0	0	DBV2[12:8]			00h
Parameter	5	ELVSS_OFF _EN	ELVSS_OFF _SIGN	ELVSS_OFF_DBV[5:0]							

**NOTE:** “-”Don’t care.

Description	This command is used to adjust the brightness value of the display.  It should be checked what is the relationship between this written value and output brightness of the display. This relationship is defined on the display module specification.  In principle relationship is that 0000h value means the lowest brightness and 1FFFh value means the highest brightness.  DBV1[12:0] : Brightness control for A area DBV2[12:0] : Brightness control for B area ELVSS_OFF_EN: Control On/Off for ELVSS offset value ELVSS_OFF_SIGN: Control sign bit for ELVSS offset value ELVSS_OFF_DBV[5:0]: Control for ELVSS offset value												
Restriction	-												
Register Availability	<table border="1"> <tr> <th>Status</th> <th>Availability</th> </tr> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </table>	Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability												
Normal Mode On, Idle Mode Off, Sleep Out	Yes												
Normal Mode On, Idle Mode On, Sleep Out	Yes												
Partial Mode On, Idle Mode Off, Sleep Out	Yes												
Partial Mode On, Idle Mode On, Sleep Out	Yes												
Sleep In	Yes												
Default	<table border="1"> <tr> <th>Status</th> <th>Default Value</th> </tr> <tr> <td>Power On Sequence</td> <td>000h</td> </tr> <tr> <td>S/W Reset</td> <td>000h</td> </tr> <tr> <td>H/W Reset</td> <td>000h</td> </tr> </table>	Status	Default Value	Power On Sequence	000h	S/W Reset	000h	H/W Reset	000h				
Status	Default Value												
Power On Sequence	000h												
S/W Reset	000h												
H/W Reset	000h												

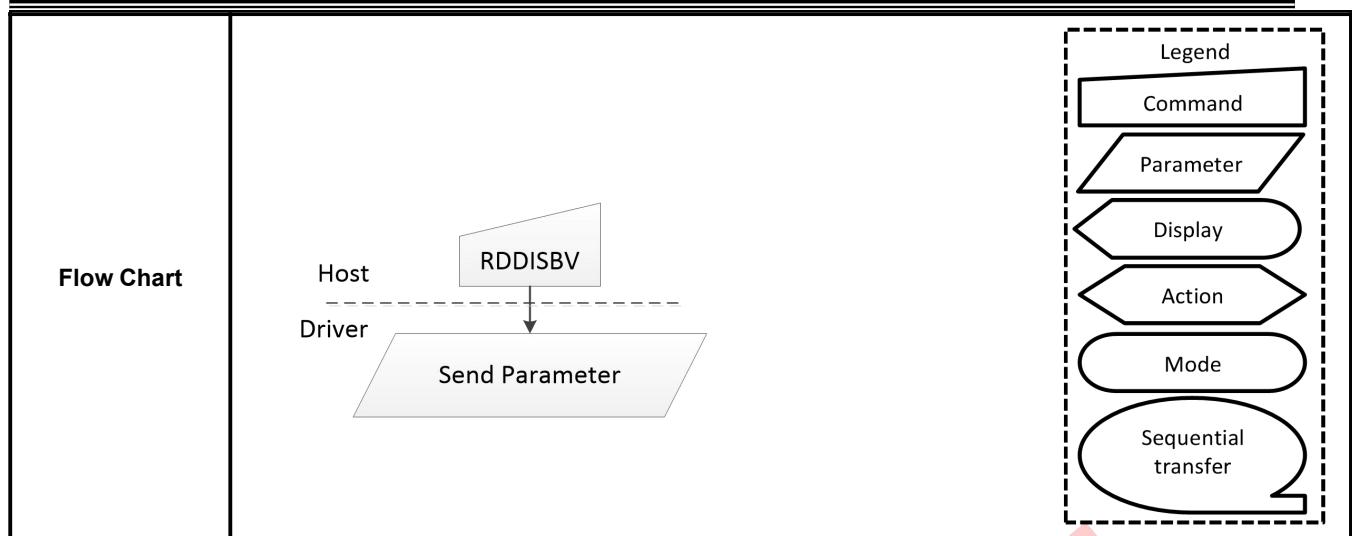


### 9.3.41 (52h) RDDISBV: Read Display Brightness Value

Command Set		RDDISBV								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
RDDISBV	R	0	1	0	1	0	0	1	0	52h
Parameter	1	DBV1[7:0]								
Parameter	2	0	0	0	0	0	0	DBV1[12:8]		00h
Parameter	3	DBV2[7:0]								
Parameter	4	0	0	0	0	0	0	DBV2[12:8]		00h
Parameter	5	ELVSS_OFF _EN	ELVSS_OFF _SIGN	ELVSS_OFF_DBV[5:0]						00h

**NOTE:** “-”Don’t care.

Description	This command is used to adjust the brightness value of the display.  It should be checked what is the relationship between this written value and output brightness of the display. This relationship is defined on the display module specification.  In principle relationship is that 0000h value means the lowest brightness and 1FFFh value means the highest brightness.  DBV1[12:0] : Brightness control for A area DBV2[12:0] : Brightness control for B area ELVSS_OFF_EN: Control On/Off for ELVSS offset value ELVSS_OFF_SIGN: Control sign bit for ELVSS offset value ELVSS_OFF_DBV[5:0]: Control for ELVSS offset value												
Restriction	-												
Register Availability	<table border="1"> <tr> <th>Status</th> <th>Availability</th> </tr> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </table>	Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability												
Normal Mode On, Idle Mode Off, Sleep Out	Yes												
Normal Mode On, Idle Mode On, Sleep Out	Yes												
Partial Mode On, Idle Mode Off, Sleep Out	Yes												
Partial Mode On, Idle Mode On, Sleep Out	Yes												
Sleep In	Yes												
Default	<table border="1"> <tr> <th>Status</th> <th>Default Value</th> </tr> <tr> <td>Power On Sequence</td> <td>000h</td> </tr> <tr> <td>S/W Reset</td> <td>000h</td> </tr> <tr> <td>H/W Reset</td> <td>000h</td> </tr> </table>	Status	Default Value	Power On Sequence	000h	S/W Reset	000h	H/W Reset	000h				
Status	Default Value												
Power On Sequence	000h												
S/W Reset	000h												
H/W Reset	000h												



### 9.3.42 (53h) WRCTRL: Write Control Display

Command Set		WRCTRL								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
WRCTRL	W	0	1	0	1	0	0	1	1	53h
Parameter	1	HBM_MODE[1:0]	BCTL	0	BC_DIM_EN	BC_DC_EN	0	HBM_EN	00h	

NOTE: “-”Don’t care.

<b>Description</b>	This command is used to control OLED brightness.						
	HBM_MODE[1:0]: Select the high brightness threshold						
	HBM_MODE[1:0]	HBM Area Luminance control (in HBM mode)					
	2'h0	Max gamma threshold is normal area					
	2'h1	Max gamma threshold is HBM3 area					
	2'h2	Max gamma threshold is HBM2 area					
	2'h3	Max gamma threshold is HBM1 area					
	BCTL: Brightness On/Off control						
	<table border="1"> <tr> <th>BCTL</th><th>Description</th></tr> <tr> <td>0</td><td>Off</td></tr> <tr> <td>1</td><td>On</td></tr> </table>		BCTL	Description	0	Off	1
BCTL	Description						
0	Off						
1	On						
BC_DIM_EN: Brightness control with dimming effect							
<table border="1"> <tr> <th>BC_DIM_EN</th><th>Description</th></tr> <tr> <td>0</td><td>Display Dimming is off</td></tr> <tr> <td>1</td><td>Display Dimming is on</td></tr> </table>		BC_DIM_EN	Description	0	Display Dimming is off	1	Display Dimming is on
BC_DIM_EN	Description						
0	Display Dimming is off						
1	Display Dimming is on						
HBM_EN: High Brightness Mode control							
<table border="1"> <tr> <th>HBM_EN</th><th>Description</th></tr> <tr> <td>0</td><td>HBM Off</td></tr> <tr> <td>1</td><td>HBM On</td></tr> </table>		HBM_EN	Description	0	HBM Off	1	HBM On
HBM_EN	Description						
0	HBM Off						
1	HBM On						
BC_DC_EN : Control On/Off for DC mode (When HW_ENs is 1)							
<table border="1"> <tr> <th>BC_DC_EN</th><th>Description</th></tr> <tr> <td>0</td><td>DC Off</td></tr> <tr> <td>1</td><td>DC On</td></tr> </table>		BC_DC_EN	Description	0	DC Off	1	DC On
BC_DC_EN	Description						
0	DC Off						
1	DC On						
<b>Restriction</b>	-						

<b>Register Availability</b>	Status	Availability
	Normal Mode On, Idle Mode Off, Sleep Out	Yes
	Normal Mode On, Idle Mode On, Sleep Out	Yes
	Partial Mode On, Idle Mode Off, Sleep Out	Yes
	Partial Mode On, Idle Mode On, Sleep Out	Yes
	Sleep In	Yes
<b>Default</b>	Status	Default Value
	Power On Sequence	00h
	S/W Reset	00h
	H/W Reset	00h
<b>Flow Chart</b>	<pre> graph TD     WRCTRL[WRCTRL] --&gt; HBM_MODE[HBM_MODE[1:0], BCTL, BC_DIM_EN, HBM_EN]     HBM_MODE --&gt; NCV[New Control Value]     </pre>	<b>Legend</b> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>

### 9.3.43 (54h) RDCTRL: Read Control Value Display

Command Set		RDCTRL								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
RDCTRL	R	0	1	0	1	0	1	0	0	54h
Parameter	1	HBM_MODE[1:0]	BCTL	0	BC_DIM_EN	BC_DC_EN	0	HBM_EN	00h	

NOTE: “-”Don’t care.

<b>Description</b>	This command is used to read the setting status of OLED brightness control.						
	HBM_MODE[1:0]: Select the high brightness threshold						
	HBM_MODE[1:0]	HBM Area Luminance control (in HBM mode)					
	2'h0	Max gamma threshold is normal area					
	2'h1	Max gamma threshold is HBM3 area					
	2'h2	Max gamma threshold is HBM2 area					
	2'h3	Max gamma threshold is HBM1 area					
	BCTL: Brightness control						
	<table border="1"> <thead> <tr> <th>BCTL</th><th>Description</th></tr> </thead> <tbody> <tr> <td>0</td><td>Off</td></tr> <tr> <td>1</td><td>On</td></tr> </tbody> </table>		BCTL	Description	0	Off	1
BCTL	Description						
0	Off						
1	On						
BC_DIM_EN: Brightness control with dimming effect							
<table border="1"> <thead> <tr> <th>BC_DIM_EN</th><th>Description</th></tr> </thead> <tbody> <tr> <td>0</td><td>Display Dimming is off</td></tr> <tr> <td>1</td><td>Display Dimming is on</td></tr> </tbody> </table>		BC_DIM_EN	Description	0	Display Dimming is off	1	Display Dimming is on
BC_DIM_EN	Description						
0	Display Dimming is off						
1	Display Dimming is on						
HBM_EN: High Brightness Mode control							
<table border="1"> <thead> <tr> <th>HBM_EN</th><th>Description</th></tr> </thead> <tbody> <tr> <td>0</td><td>HBM Off</td></tr> <tr> <td>1</td><td>HBM On</td></tr> </tbody> </table>		HBM_EN	Description	0	HBM Off	1	HBM On
HBM_EN	Description						
0	HBM Off						
1	HBM On						
BC_DC_EN : Control On/Off for DC mode (When HW_ENs is 1)							
<table border="1"> <thead> <tr> <th>BC_DC_EN</th><th>Description</th></tr> </thead> <tbody> <tr> <td>0</td><td>DC Off</td></tr> <tr> <td>1</td><td>DC On</td></tr> </tbody> </table>		BC_DC_EN	Description	0	DC Off	1	DC On
BC_DC_EN	Description						
0	DC Off						
1	DC On						
<b>Restriction</b>	-						

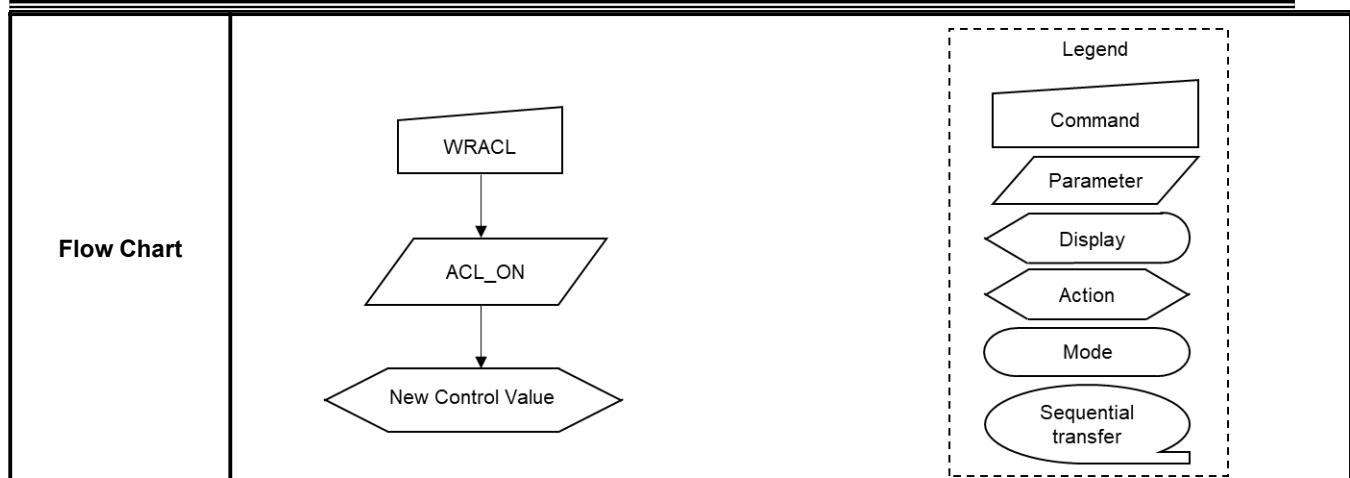
<b>Register Availability</b>	Status	Availability
	Normal Mode On, Idle Mode Off, Sleep Out	Yes
	Normal Mode On, Idle Mode On, Sleep Out	Yes
	Partial Mode On, Idle Mode Off, Sleep Out	Yes
	Partial Mode On, Idle Mode On, Sleep Out	Yes
	Sleep In	Yes
<b>Default</b>	Status	Default Value
	Power On Sequence	00h
	S/W Reset	00h
	H/W Reset	00h
<b>Flow Chart</b>	<pre> graph TD     Host[Host] --&gt; RDCTRL[RDCTRL]     RDCTRL --&gt; Driver[Driver]     subgraph Legend [Legend]         direction TB         C[Command]         P[Parameter]         D[Display]         A[Action]         M[Mode]         ST[Sequential transfer]     end     </pre>	<p>Legend</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>

## 9.3.44 (55h) WRACL: Write ACL Value

Command Set		WRACL									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
WRICL	W	0	1	0	1	0	1	0	1	55h	
Parameter	1	ACL_CMD[9:8]		0	0	0	0	ACL[1:0]		00h	
Parameter	2	ACL_CMD[7:0]								00h	

**NOTE:** “-”Don’t care.

<b>Description</b>	This command is used to adjust Automatic Current Limit (ACL) for power saving.													
	ACL_CMD[9:0]: AL value that receives command from AP.													
	ACL[1:0] : Control for ACL mode													
	<table border="1"> <thead> <tr> <th>ACL[1:0]</th><th>Description</th></tr> </thead> <tbody> <tr> <td>2'h0</td><td>ACL Off</td></tr> <tr> <td>2'h1</td><td>ACL Rate1</td></tr> <tr> <td>2'h2</td><td>ACL Rate2</td></tr> <tr> <td>2'h3</td><td>ACL Rate3</td></tr> </tbody> </table>		ACL[1:0]	Description	2'h0	ACL Off	2'h1	ACL Rate1	2'h2	ACL Rate2	2'h3	ACL Rate3		
ACL[1:0]	Description													
2'h0	ACL Off													
2'h1	ACL Rate1													
2'h2	ACL Rate2													
2'h3	ACL Rate3													
<b>Restriction</b>														
-														
<b>Register Availability</b>	<table border="1"> <thead> <tr> <th>Status</th><th>Availability</th></tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr> <td>Sleep In</td><td>Yes</td></tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
<b>Default</b>	<table border="1"> <thead> <tr> <th>Status</th><th>Default Value</th></tr> </thead> <tbody> <tr> <td>Power On Sequence</td><td>00h</td></tr> <tr> <td>S/W Reset</td><td>00h</td></tr> <tr> <td>H/W Reset</td><td>00h</td></tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													



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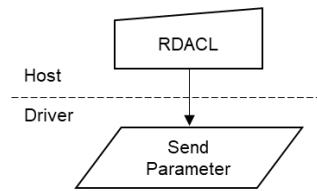
### 9.3.45 (56h) RDACL: Read ACL Value

Command Set		RDACL								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
RDICL	R	0	1	0	1	0	1	1	0	56h
Parameter	1	ACL_CMD[9:8]	0	0	0	0	0	ACL[1:0]		00h
Parameter	2				ACL_CMD[7:0]					00h

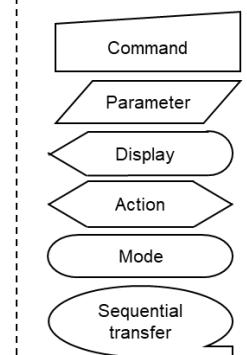
**NOTE:** “-”Don’t care.

<b>Description</b>	This command is used to read the status of Automatic Current Limit (ACL) for power saving.													
	ACL_CMD[9:0]: AL value that receives command from AP.													
	ACL[1:0] : Control for ACL mode													
	ACL[1:0]	Description												
	2'h0	ACL Off												
	2'h1	ACL Rate1												
<b>Restriction</b>	-													
<b>Register Availability</b>	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
	Status	Availability												
	Normal Mode On, Idle Mode Off, Sleep Out	Yes												
	Normal Mode On, Idle Mode On, Sleep Out	Yes												
	Partial Mode On, Idle Mode Off, Sleep Out	Yes												
	Partial Mode On, Idle Mode On, Sleep Out	Yes												
Sleep In	Yes													
<b>Default</b>	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
	Status	Default Value												
	Power On Sequence	00h												
	S/W Reset	00h												
H/W Reset	00h													

low Chart



Legend



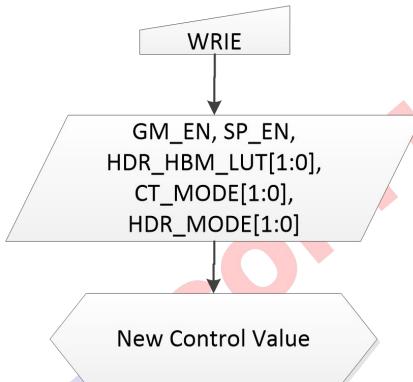
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### 9.3.46 (57h) WRIE: Write IE Value

Command Set		WRIE									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
WRIE	W	0	1	0	1	0	1	1	1	57h	
Parameter	1	CE_ON	0	0	PAPERMODE_ON	HDR_ON	ENSUN_ON	EDGE_ON	CONST_ON	00h	

NOTE: “-”Don’t care.

Description	This command is used to control Image Enhancement function.	
	CE_ON : CE On/Off Control	
	CE_ON	Description
	0	Off
	1	On
	PAPERMODE_ON : E-PAPER MODE On/Off Control	
	PAPERMODE_ON	Description
	0	Off
	1	On
	HDR_ON: HDR On/Off Control	
	HDR_ON	Description
	0	Off
	1	On
	ENSUN_ON: SLR(Sun Light Readable) On/Off Control	
	ENSUN_ON	Description
	0	Off
	1	On
	EDGE_ON: Sharpness On/Off Control	
	EDGE_ON	Description
	0	Off
	1	On
	CONST_ON: Contrast On/Off Control	
	CONT_ON	Description
	0	Off
	1	On
Restriction	-	

<b>Register Availability</b>	Status	Availability
	Normal Mode On, Idle Mode Off, Sleep Out	Yes
	Normal Mode On, Idle Mode On, Sleep Out	Yes
	Partial Mode On, Idle Mode Off, Sleep Out	Yes
	Partial Mode On, Idle Mode On, Sleep Out	Yes
	Sleep In	Yes
<b>Default</b>	Status	Default Value
	Power On Sequence	00h
	S/W Reset	00h
	H/W Reset	00h
<b>Flow Chart</b>	 <p>The flowchart illustrates the write operation. It starts with a rectangular input 'WRIE' pointing to a trapezoidal node containing control register addresses: GM_EN, SP_EN, HDR_HBM_LUT[1:0], CT_MODE[1:0], and HDR_MODE[1:0]. An arrow from this node points down to a hexagonal output 'New Control Value'.</p>	<b>Legend</b> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>

### 9.3.47 (58h) RDIE: Read IE Value

Command Set		RDIE									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RDIE	R	0	1	0	1	1	0	0	0	58h	
Parameter	1	CE_ON	0	0	PAPERMODE_ON	HDR_ON	ENSUN_ON	EDGE_ON	CONST_ON	00h	

NOTE: “-”Don’t care.

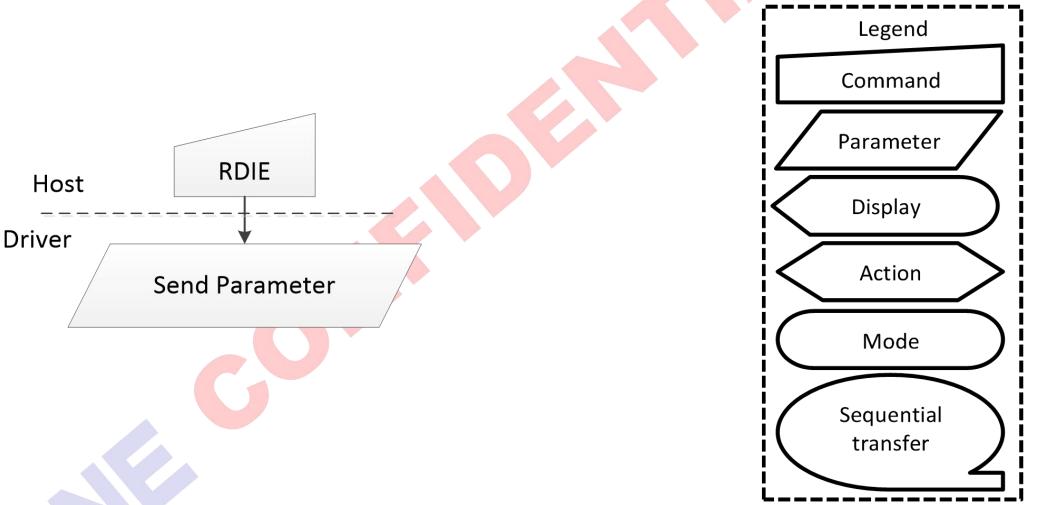
Description	This command is used to read the status of Image Enhancement Function.	
	CE_ON : CE On/Off Control	
	CE_ON	Description
	0	Off
	1	On
	PAPERMODE_ON : E-PAPER MODE On/Off Control	
	PAPERMODE_ON	Description
	0	Off
	1	On
Restriction	HDR_ON: HDR On/Off Control	
	HDR_ON	Description
	0	Off
	1	On
	ENSUN_ON: SLR(Sun Light Readable) On/Off Control	
	ENSUN_ON	Description
	0	Off
	1	On
Restriction	EDGE_ON: Sharpness On/Off Control	
	EDGE_ON	Description
	0	Off
	1	On
	CONST_ON: Contrast On/Off Control	
	CONT_ON	Description
	0	Off
	1	On

Register Availability	Status	Availability
	Normal Mode On, Idle Mode Off, Sleep Out	Yes
	Normal Mode On, Idle Mode On, Sleep Out	Yes
	Partial Mode On, Idle Mode Off, Sleep Out	Yes
	Partial Mode On, Idle Mode On, Sleep Out	Yes
	Sleep In	Yes

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

Flow Chart	
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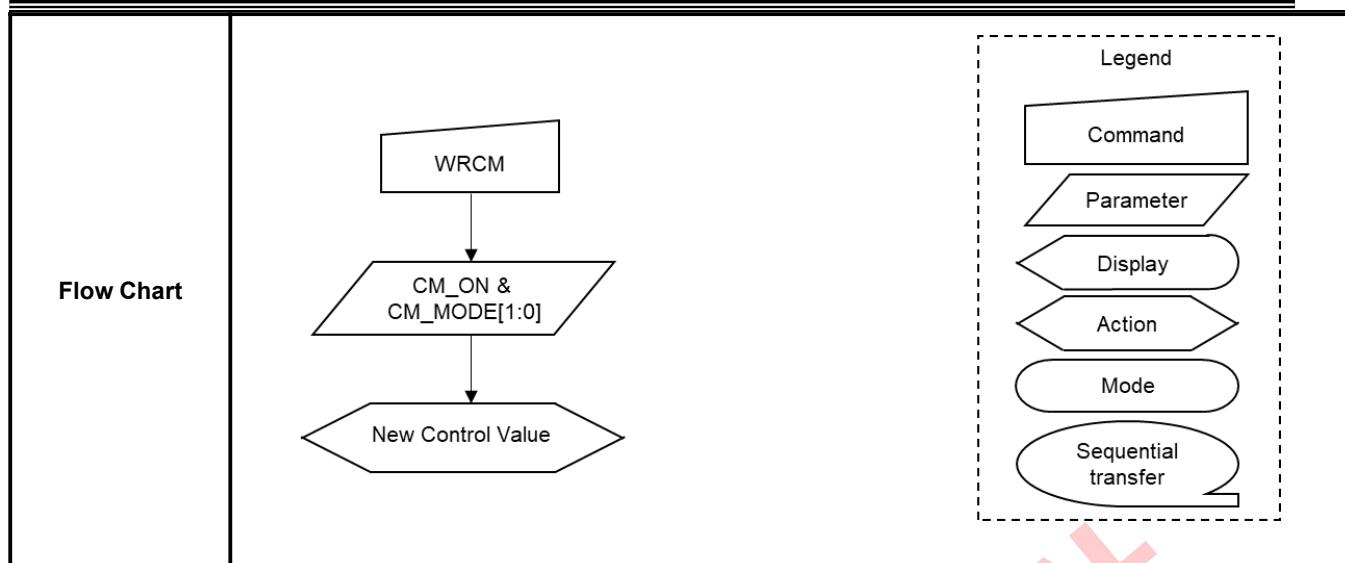
## 9.3.48 (59h) WRCM: Write CM Value

Command Set		WRCM									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
WRCM	W	0	1	0	1	1	0	0	1	59h	
Parameter	1	0	0	0	CM_ON	0	0	CM_MODE[1:0]	00h		

NOTE: “-”Don’t care.

Description	This command is used to control Color Management function.										
	CM_ON: Color Management On/Off Control										
<table border="1"> <tr> <th>CM_N</th> <th>Description</th> </tr> <tr> <td>0</td> <td>Off</td> </tr> <tr> <td>1</td> <td>On</td> </tr> </table>		CM_N	Description	0	Off	1	On				
CM_N	Description										
0	Off										
1	On										
CM_MODE[1:0]: Color Management Mode Control											
<table border="1"> <tr> <th>CM_MODE[1:0]</th> <th>Description</th> </tr> <tr> <td>2'h0</td> <td>Mode 0</td> </tr> <tr> <td>2'h1</td> <td>Mode 1</td> </tr> <tr> <td>2'h2</td> <td>Mode 2</td> </tr> <tr> <td>2'h3</td> <td>Mode 3</td> </tr> </table>		CM_MODE[1:0]	Description	2'h0	Mode 0	2'h1	Mode 1	2'h2	Mode 2	2'h3	Mode 3
CM_MODE[1:0]	Description										
2'h0	Mode 0										
2'h1	Mode 1										
2'h2	Mode 2										
2'h3	Mode 3										
Restriction	-										

Register Availability	Status	Availability
	Normal Mode On, Idle Mode Off, Sleep Out	Yes
	Normal Mode On, Idle Mode On, Sleep Out	Yes
	Partial Mode On, Idle Mode Off, Sleep Out	Yes
	Partial Mode On, Idle Mode On, Sleep Out	Yes
		Sleep In
Default	Status	Default Value
	Power On Sequence	00h
	S/W Reset	00h
	H/W Reset	00h



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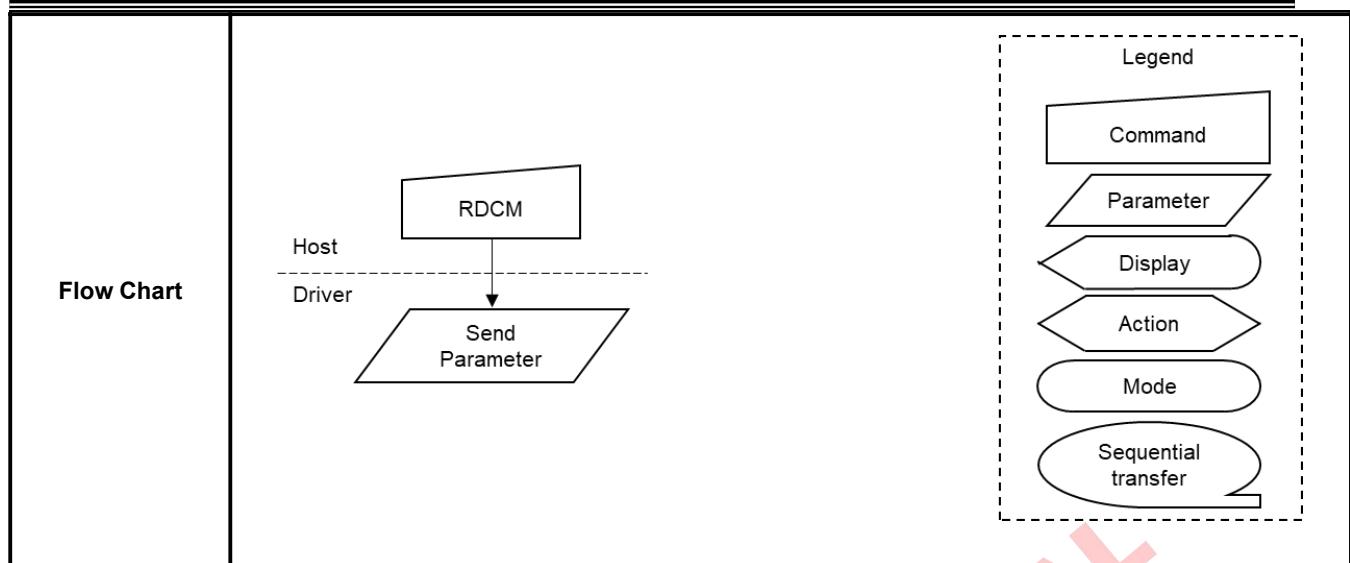
## 9.3.49 (5Ah) RDCM: Read CM Value

Command Set		RDCM									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RDCM	R	0	1	0	1	1	0	1	0	5Ah	
Parameter	1	0	0	0	CM_ON	0	0	CM_MODE[1:0]	00h		

NOTE: “-”Don’t care.

Description	This command is used to control Color Management function.	
	CM_ON: Color Management On/Off Control	
	CM_ON	Description
		0 Off
		1 On
CM_MODE[1:0]: Color Management Mode Control		
		CM_MODE[1:0] Description
		2'h0 Mode 0
		2'h1 Mode 1
		2'h2 Mode 2
		2'h3 Mode 3
Restriction	-	

Register Availability	Status	Availability
	Normal Mode On, Idle Mode Off, Sleep Out	Yes
	Normal Mode On, Idle Mode On, Sleep Out	Yes
	Partial Mode On, Idle Mode Off, Sleep Out	Yes
	Partial Mode On, Idle Mode On, Sleep Out	Yes
		Sleep In
		Yes
Default	Status	Default Value
	Power On Sequence	00h
	S/W Reset	00h
	H/W Reset	00h

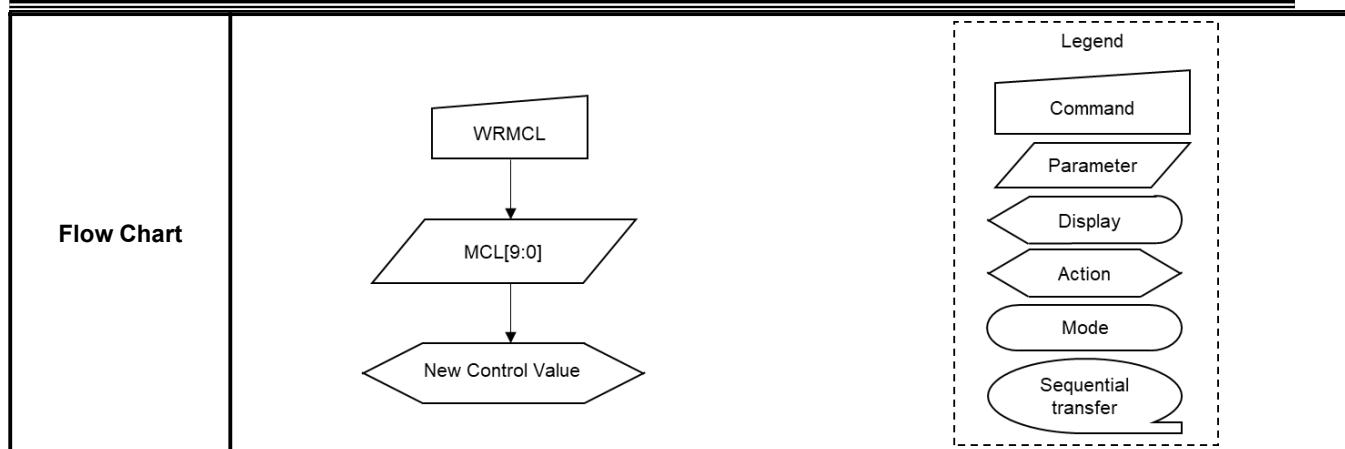


### 9.3.50 (5Dh) WRMCL: Write MCL Value

Command Set		WRMCL									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
WRMCL	W	0	1	0	1	1	1	0	1	5Dh	
Parameter	1	0	0	0	0	0	0	MCL[9:8]		00h	
Parameter	2	MCL[7:0]								00h	

**NOTE:** “-”Don’t care.

Description	This command is used to adjust Max Current Limit (MCL) for power saving.  MCL[9:0]: Control for MCL Command from HOST												
Restriction	-												
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>	Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability												
Normal Mode On, Idle Mode Off, Sleep Out	Yes												
Normal Mode On, Idle Mode On, Sleep Out	Yes												
Partial Mode On, Idle Mode Off, Sleep Out	Yes												
Partial Mode On, Idle Mode On, Sleep Out	Yes												
Sleep In	Yes												
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>	Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value												
Power On Sequence	00h												
S/W Reset	00h												
H/W Reset	00h												



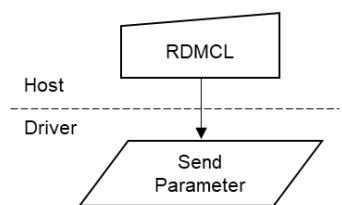
### 9.3.51 (5Eh) RDMCL: Read MCL Value

Command Set		RDMCL									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RDMCL	R	0	1	0	1	1	1	1	0	5Eh	
Parameter	1	0	0	0	0	0	0	MCL[9:8]		00h	
Parameter	2	MCL[7:0]									

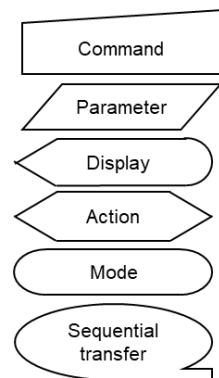
**NOTE:** “-”Don’t care.

Description	This command is used to adjust Max Current Limit (MCL) for power saving.  MCL[9:0]: Control for MCL Command from HOST												
Restriction	-												
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>	Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability												
Normal Mode On, Idle Mode Off, Sleep Out	Yes												
Normal Mode On, Idle Mode On, Sleep Out	Yes												
Partial Mode On, Idle Mode Off, Sleep Out	Yes												
Partial Mode On, Idle Mode On, Sleep Out	Yes												
Sleep In	Yes												
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>	Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value												
Power On Sequence	00h												
S/W Reset	00h												
H/W Reset	00h												

## Flow Chart



## Legend

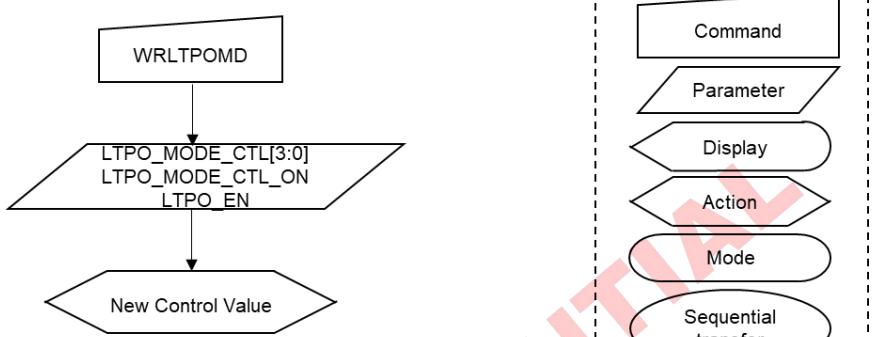


### 9.3.52 (63h) WRLTPOMD : Write LTPO Value

Command Set		WRLTPOMD									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
WRMCL	W	0	1	1	0	0	0	1	1	63h	
Parameter	1	LTPO_MODE_CTL[3:0]		0		LTPO_MODE_CTL_O	LTPO_EN		00h		

NOTE: “-”Don’t care.

Description	This command is used to control LTPO function.	
	LTPO_MODE_CTL[3:0]: LTPO Mode Control	
	LTPO_MODE_CTL[3:0]	Description
	4'h0	Mode 1
Description	4'h1	Mode 2
	4'h2	Mode 3
	4'h3	Mode 4
	4'hE	Mode 15
Description	4'hF	Mode 16
	LTPO_MODE_CTL_ON: LTPO Mode Control On/Off Control	
	LTPO_MODE_CTL_ON	Description
	0	Off
Description	1	On
	LTPO_EN: LTPO On/Off Control	
	LTPO_EN	Description
	0	Off
Restriction	-	
	Register Availability	
	Status	
	Normal Mode On, Idle Mode Off, Sleep Out	
	Yes	
Register Availability	Normal Mode On, Idle Mode On, Sleep Out	
	Partial Mode On, Idle Mode Off, Sleep Out	
	Partial Mode On, Idle Mode On, Sleep Out	
	Sleep In	
	Yes	

Default	<table border="1"><thead><tr><th>Status</th><th>Default Value</th></tr></thead><tbody><tr><td>Power On Sequence</td><td>00h</td></tr><tr><td>S/W Reset</td><td>00h</td></tr><tr><td>H/W Reset</td><td>00h</td></tr></tbody></table>	Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h
Status	Default Value								
Power On Sequence	00h								
S/W Reset	00h								
H/W Reset	00h								
Flow Chart									

### 9.3.53 (64h) RDLTPOMD : Read LTPO Value

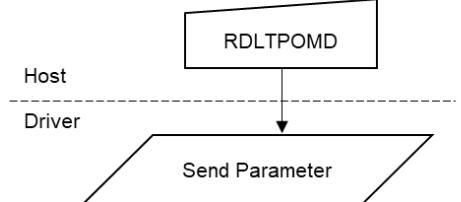
Command Set		WRLTPOMD								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
WRMCL	R	0	1	1	0	0	1	0	0	64h
Parameter	1	LTPO_MODE_CTL[3:0]			0	0	LTPO_MODE_CTL_ON		LTPO_EN	00h

NOTE: “-”Don’t care.

Description	This command is used to control LTPO function.	
	LTPO_MODE_CTL[3:0]: LTPO Mode Control	
	LTPO_MODE_CTL[3:0]	Description
	4'h0	Mode 1
Description	4'h1	Mode 2
	4'h2	Mode 3
	4'h3	Mode 4
	4'hE	Mode 15
Description	4'hF	Mode 16
	LTPO_MODE_CTL_ON: LTPO Mode Control On/Off Control	
	LTPO_MODE_CTL_ON	Description
	0	Off
Description	1	On
	LTPO_EN: LTPO On/Off Control	
	LTPO_EN	Description
	0	Off
Restriction	-	
	Register Availability	
	Status	
	Normal Mode On, Idle Mode Off, Sleep Out	
	Yes	
Register Availability	Normal Mode On, Idle Mode On, Sleep Out	
	Partial Mode On, Idle Mode Off, Sleep Out	
	Partial Mode On, Idle Mode On, Sleep Out	
	Sleep In	
	Yes	

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

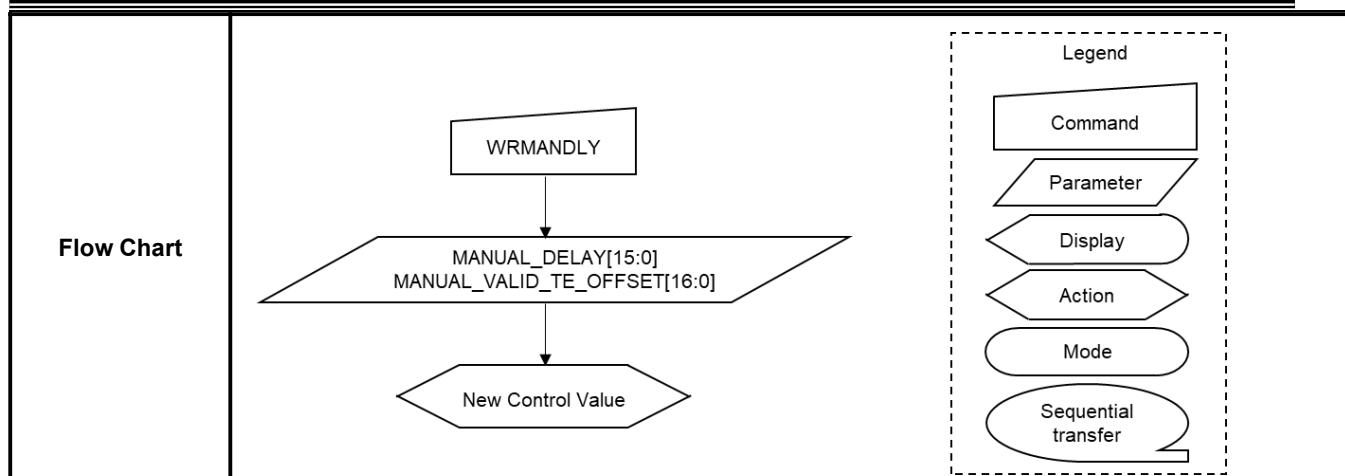
Flow Chart		Legend			
		Command	Parameter	Display	Action

### 9.3.54 (65h) WRMANDLY : Write Manual Delay Value

Command Set		WRMANDLY								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
WRMCL	W	0	1	1	0	0	1	0	1	65h
Parameter	1	MANUAL_DELAY[7:0]								
Parameter	2	MANUAL_DELAY[15:8]								
Parameter	3	MANUAL_VALID_TE_OFFSET[7:0]								
Parameter	4	MANUAL_VALID_TE_OFFSET[15:8]								
Parameter	5	0	0	0	0	0	0	0	MANUAL_VALID_TE_OFFSET[16]	00h

NOTE: “-”Don’t care.

Description	This command is used to control MSYNC function.  MANUAL_DELAY[15:0] : Manual AFP set by AP when manual delay mode is enabled.  MANUAL_VALID_TE_OFFSET[16:0] : Manual Valid TE Offset set by AP when manual delay mode is enabled.													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													

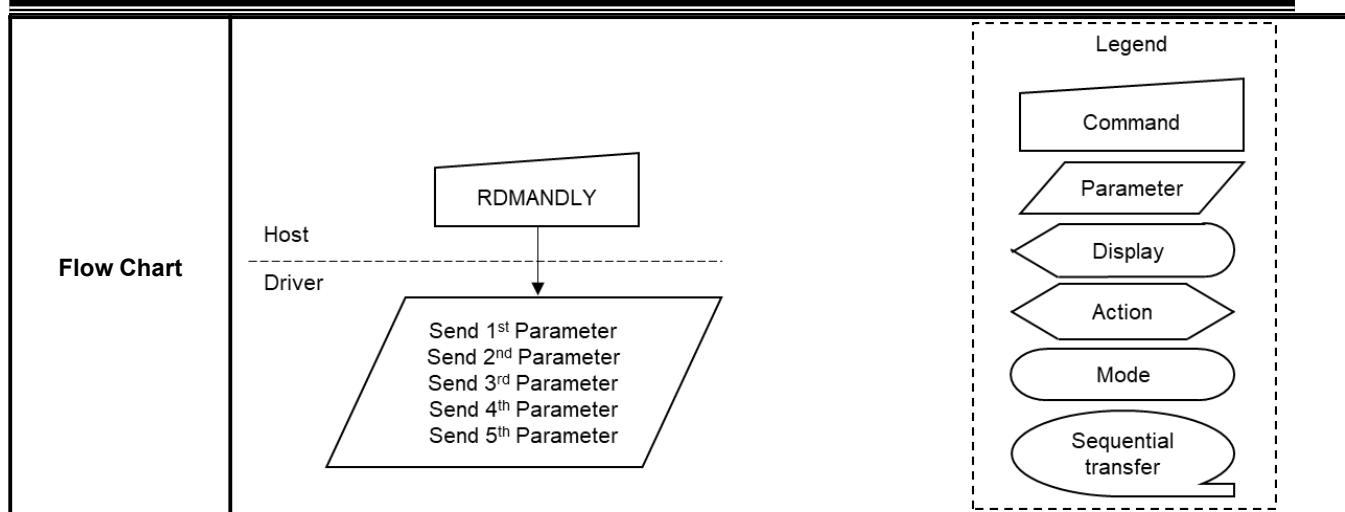


### 9.3.55 (66h) RDMANDLY : Read Manual Delay Value

Command Set		WRMANDLY								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
WRMCL	R	0	1	1	0	0	1	1	0	66h
Parameter	1	MANUAL_DELAY[7:0]								
Parameter	2	MANUAL_DELAY[15:8]								
Parameter	3	MANUAL_VALID_TE_OFFSET[7:0]								
Parameter	4	MANUAL_VALID_TE_OFFSET[15:8]								
Parameter	5	0	0	0	0	0	0	0	MANUAL_VALID_TE_OFFSET[16]	00h

NOTE: “-”Don’t care.

Description	This command is used to control MSYNC function.  MANUAL_DELAY[15:0] : Manual AFP set by AP when manual delay mode is enabled.  MANUAL_VALID_TE_OFFSET[16:0] : Manual Valid TE Offset set by AP when manual delay mode is enabled.													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													

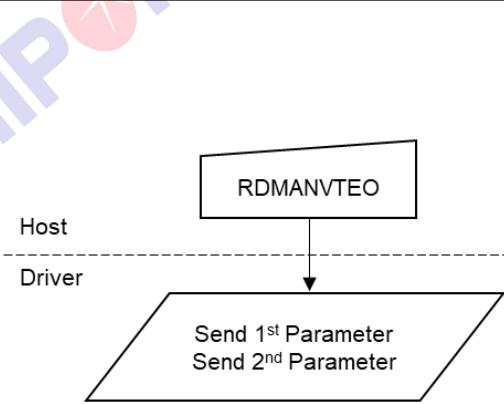


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### 9.3.56 (68h) RDMANVTEO : Read Manual VTEO Value

Command Set		WRMANDLY								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
WRMCL	R	0	1	1	0	1	0	0	0	68h
Parameter	1	VALID_TE_OFFSET[7:0]								
Parameter	2	VALID_TE_OFFSET[15:8]								

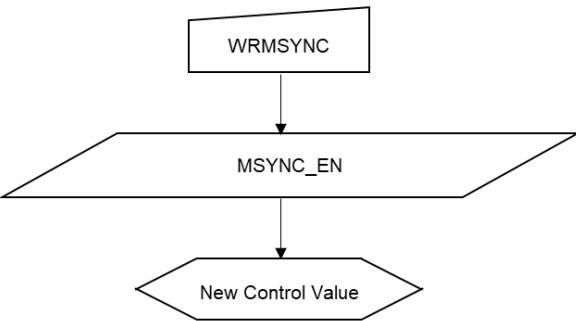
**NOTE:** “-”Don’t care.

Description	This command is used to control MSYNC function.  RDMANVTEO[15:0] : DDIC Internal Valid Offset Counter when manual delay mode is enabled.													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													
Flow Chart	 <pre> graph TD     Host[Host] --&gt; RDMANVTEO[RDMANVTEO]     RDMANVTEO --&gt; Send1[Send 1st Parameter]     RDMANVTEO --&gt; Send2[Send 2nd Parameter]     </pre>	<p>Legend</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>												

### 9.3.57 (69h) WRMSYNC : Write MSYNC Value

Command Set		WRMANDLY								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
WRMCL	W	0	1	1	0	1	0	0	1	69h
Parameter	1	0	0	0	0	0	0	0	MSYNC_EN	00h

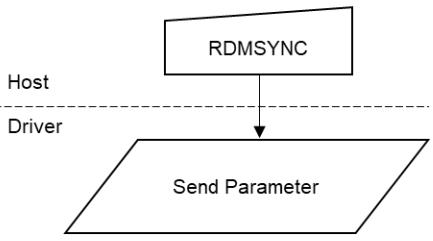
**NOTE:** “-”Don’t care.

<b>Description</b>	<p>This command is used to control MSYNC function.</p> <p>MSYNC_EN: Msync On/Off Control</p> <table border="1"> <thead> <tr> <th>MSYNC_EN</th><th>Description</th></tr> </thead> <tbody> <tr> <td>0</td><td>Off</td></tr> <tr> <td>1</td><td>On</td></tr> </tbody> </table>		MSYNC_EN	Description	0	Off	1	On						
MSYNC_EN	Description													
0	Off													
1	On													
<b>Restriction</b>	-													
<b>Register Availability</b>	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
<b>Default</b>	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													
<b>Flow Chart</b>	 <pre> graph TD     WRMSYNC[WRMSYNC] --&gt; MSYNC_EN{MSYNC_EN}     MSYNC_EN --&gt; NCV{New Control Value}   </pre>	<b>Legend</b> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>												

### 9.3.58 (6Ah) RDMSYNC : Read MSYNC Value

Command Set		WRMANDLY								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
WRMCL	R	0	1	1	0	1	0	1	0	6Ah
Parameter	1	0	0	0	0	0	0	0	MSYNC_EN	00h

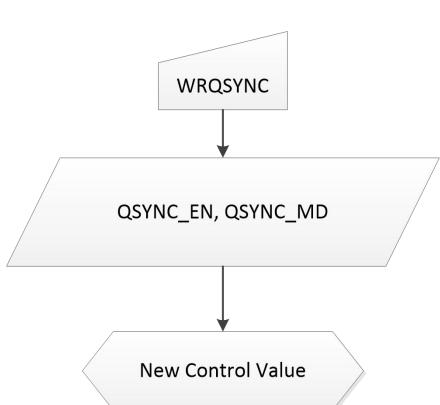
**NOTE:** “-”Don’t care.

Description	<p>This command is used to control MSYNC function.</p> <p>MSYNC_EN: Msync On/Off Control</p> <table border="1"> <thead> <tr> <th>MSYNC_EN</th><th>Description</th></tr> </thead> <tbody> <tr> <td>0</td><td>Off</td></tr> <tr> <td>1</td><td>On</td></tr> </tbody> </table>		MSYNC_EN	Description	0	Off	1	On						
MSYNC_EN	Description													
0	Off													
1	On													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													
Flow Chart	 <pre> graph TD     Host[Host] -- RDMSYNC --&gt; Driver[Driver]     Driver -- "Send Parameter" --&gt; Send[Send Parameter]   </pre>	<p>Legend</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>												

### 9.3.59 (6Bh) WRQSYNC: Write QSYNC Value

Command Set		WRQSYNC								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
WRQSYNC	W	0	1	1	0	1	0	1	1	6Bh
Parameter	1	0	0	0	0	0	0	0	QSYNC_EN	00h

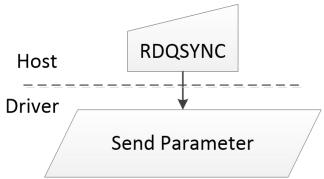
**NOTE:** “-”Don’t care.

Description	This command is used to control QSYNC function.  QSYNC_EN: Qsync or Pixel Sync On/Off Control													
	<table border="1"> <thead> <tr> <th>QSYNC_EN</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Off</td> </tr> <tr> <td>1</td> <td>On</td> </tr> </tbody> </table>		QSYNC_EN	Description	0	Off	1	On						
QSYNC_EN	Description													
0	Off													
1	On													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													
Flow Chart	 <pre> graph TD     WRQSYNC[WRQSYNC] --&gt; QSyncEN[QSYNC_EN, QSYNC_MD]     QSyncEN --&gt; NewControlValue[New Control Value]     </pre>	<p>Legend</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>												

### 9.3.60 (6Ch) RDQSYNC: Read QSYNC Value

Command Set		RDQSYNC								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
RDQSYNC	R	0	1	1	0	1	1	0	0	6Ch
Parameter	1	0	0	0	0	0	0	0	QSYNC_EN	00h

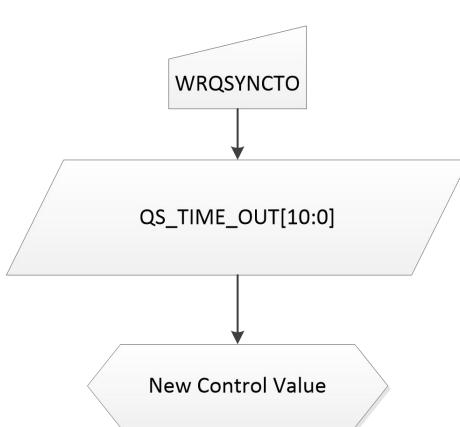
NOTE: “-”Don’t care.

<b>Description</b>	This command is used to read the status of QSYNC function.  QSYNC_EN: Qsync or Pixel Sync On/Off Control													
	<table border="1"> <thead> <tr> <th>QSYNC_EN</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Off</td> </tr> <tr> <td>1</td> <td>On</td> </tr> </tbody> </table>		QSYNC_EN	Description	0	Off	1	On						
QSYNC_EN	Description													
0	Off													
1	On													
<b>Restriction</b>	-													
<b>Register Availability</b>	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
<b>Default</b>	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													
<b>Flow Chart</b>	 <pre> graph TD     Host -- RDQSYNC --&gt; Driver     Driver -- Send Parameter --&gt; None   </pre> <p>Legend:</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>													

### 9.3.61 (6Dh) WRQSYNCTO: Write QSYNC Timeout Value

Command Set		WRQSYNCTO									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
WRQSYNCTO	W	0	1	1	0	1	1	0	1	6Dh	
Parameter	1	QS_TIME_OUT[15:8]									
Parameter	2	QS_TIME_OUT[7:0]									
Parameter	3	TE_EXT_TIME_OUT[15:8]									
Parameter	4	TE_EXT_TIME_OUT[7:0]									

**NOTE:** “-”Don’t care.

Description	This command is used to control QSYNC function. QS_TIME_OUT[15:0]: Qsync Time Out Value TE_EXT_TIME_OUT[15:0]: TE Extension Time Out Value													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													
Flow Chart	 <pre> graph TD     WRQSYNCTO[WRQSYNCTO] --&gt; QS[QS_TIME_OUT[10:0]]     QS --&gt; NCV[New Control Value]   </pre> <p>Legend:</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>													

### 9.3.62 (6Eh) RDQSYNCTO: Read QSYNC Timeout Value

Command Set		RDQSYNCTO								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
RDQSYNCTO	R	0	1	1	0	1	1	1	0	6Eh
Parameter	1	QS_TIME_OUT[15:8]								
Parameter	2	QS_TIME_OUT[7:0]								
Parameter	3	TE_EXT_TIME_OUT[15:8]								
Parameter	4	TE_EXT_TIME_OUT[7:0]								

**NOTE:** “-”Don’t care.

Description	This command is used to read the status of QSYNC function. QS_TIME_OUT[15:0]: Qsync Time Out Value TE_EXT_TIME_OUT[15:0]: TE Extension Time Out Value													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>000h</td> </tr> <tr> <td>S/W Reset</td> <td>000h</td> </tr> <tr> <td>H/W Reset</td> <td>000h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	000h	S/W Reset	000h	H/W Reset	000h				
Status	Default Value													
Power On Sequence	000h													
S/W Reset	000h													
H/W Reset	000h													
Flow Chart	<pre> graph TD     Host -- RDQSYNCTO --&gt; Driver     subgraph Legend [Legend]         direction TB         C[Command] --- P[Parameter]         D[Display] --- A[Action]         M[Mode] --- ST[Sequential transfer]     end     subgraph Sequence [ ]         direction TB         P1{Send 1st Parameter} --- P2{Send 2nd Parameter}     end     </pre>													

### 9.3.63 (71h) WRTEMP: Write TEMP Value

Command Set	WRTEMP
-------------	--------

Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
WRTEMP	W	0	1	1	1	0	0	0	1	71h
Parameter	1					TEMP[7:0]				00h

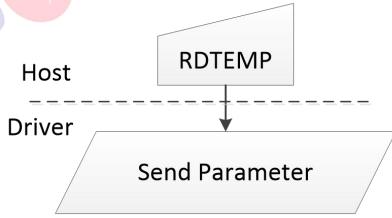
NOTE: “-”Don’t care.

Description	This command is used to control temperature function. TEMP[7:0]: Temperature Data from HOST													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													
Flow Chart	<pre> graph TD     WRTEMP[WRTEMP] --&gt; TEMP[TEMP[7:0]]     TEMP --&gt; NCV[New Control Value]     </pre> <p>Legend:</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>													

### 9.3.64 (72h) RDTEMP: Read TEMP Value

Command Set		RDTEMP									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RDTEMP	R	0	1	1	1	0	0	1	0	72h	
Parameter	1	TEMP[7:0]									

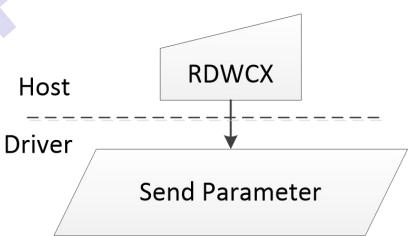
**NOTE:** “-”Don’t care.

Description	This command is used to control temperature function. TEMP[7:0]: Temperature Data from HOST													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													
Flow Chart	 <pre> graph TD     Host[Host] -- RDTEMP --&gt; Driver[Driver]     Driver -- Send Parameter --&gt; SendParameter[/Send Parameter/] </pre> <p>Legend:</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>													

### 9.3.65 (73h) RDWCX: Read W Coor. X

Command Set		RDWCX									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RDWCX	R	0	1	1	1	0	0	1	1	73h	
Parameter	1	READ_W_X[7:0]									

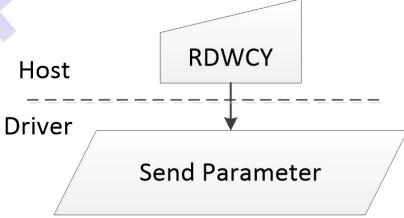
NOTE: “-”Don’t care.

Description	This command is used to read the status. READ_W_X[7:0]: WX bits (WX[7:0]) of white color characteristics													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													
Flow Chart	 <pre> graph TD     Host -- RDWCX --&gt; Driver     Driver -- Send Parameter --&gt; None   </pre> <p>Legend:</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>													

### 9.3.66 (74h) RDWCY: Read W Coor. Y

Command Set		RDWCY								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
RDWCY	R	0	1	1	1	0	1	0	0	74h
Parameter	1	READ_W_Y[7:0]								

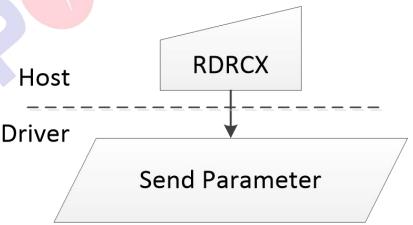
**NOTE:** “-”Don’t care.

Description	This command is used to read the status. READ_W_Y[7:0]: WY bits (WY[7:0]) of white color characteristics													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													
Flow Chart	 <pre> graph TD     Host -- RDWCY --&gt; Driver     Driver -- "Send Parameter" --&gt; null   </pre> <p>Legend:</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>													

### 9.3.67 (76h) RDRCX: Read R Coor. X

Command Set		RDRCX								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
RDRCX	R	0	1	1	1	0	1	1	0	76h
Parameter	1	READ_R_X[7:0]								

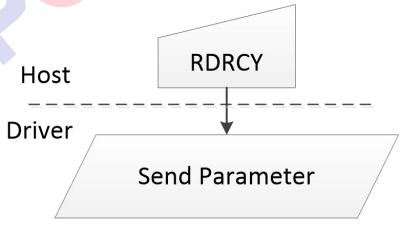
**NOTE:** “-”Don’t care.

Description	This command is used to read the status. READ_R_X[7:0]: RX bits (RX[7:0]) of Red color characteristics.													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													
Flow Chart	 <pre> graph TD     Host -- RDRCX --&gt; Driver     Driver -- "Send Parameter" --&gt; null   </pre> <p><b>Legend</b></p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>													

### 9.3.68 (77h) RDRCY: Read R Coor. Y

Command Set		RDRCY									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RDRCY	R	0	1	1	1	0	1	1	1	77h	
Parameter	1	READ_R_Y[7:0]									

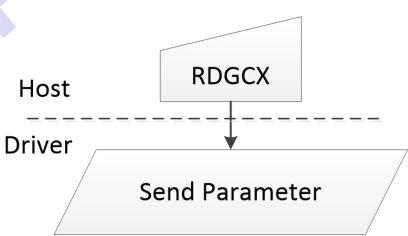
**NOTE:** “-”Don’t care.

Description	This command is used to read the status. READ_R_Y[7:0]: RY bits (RY[7:0]) of Red color characteristics.													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
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Sleep In	Yes													
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Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													
Flow Chart	 <pre> graph TD     Host -- RDRCY --&gt; Driver     Driver -- "Send Parameter" --&gt; None   </pre> <p>Legend:</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>													

### 9.3.69 (78h) RDGCX: Read G Coor. X

Command Set		RDGCX								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
RDGCX	R	0	1	1	1	1	0	0	0	78h
Parameter	1	READ_G_X[7:0]								

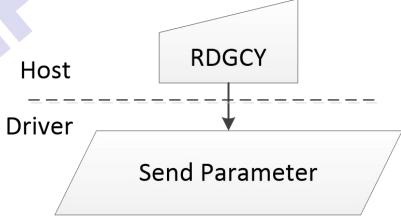
**NOTE:** “-”Don’t care.

Description	This command is used to read the status. READ_G_X[7:0]: GX bits (GX[7:0]) of Green color characteristics													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
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Sleep In	Yes													
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Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													
Flow Chart	 <pre> graph TD     Host[Host] -- RDGCX --&gt; Driver[Driver]     Driver -- "Send Parameter" --&gt; SendParam[/Send Parameter/] </pre> <p>Legend:</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>													

### 9.3.70 (79h) RDGCY: Read G Coor. Y

Command Set		RDGCY									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RDGCY	R	0	1	1	1	1	0	0	1	79h	
Parameter	1	READ_G_Y[7:0]									

NOTE: “-”Don’t care.

Description	This command is used to read the status. READ_G_Y[7:0]: GY bits (GY[7:0]) of Green color characteristics													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
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Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													
Flow Chart	 <pre> graph TD     Host -- RDGCY --&gt; Driver     Driver -- "Send Parameter" --&gt; null   </pre> <p>Legend:</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>													

## 9.3.71 (7Bh) RDBCX: Read B Coor. X

Command Set		RDBCX								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
RDBCX	R	0	1	1	1	1	0	1	1	7Bh
Parameter	1	READ_B_X[7:0]								

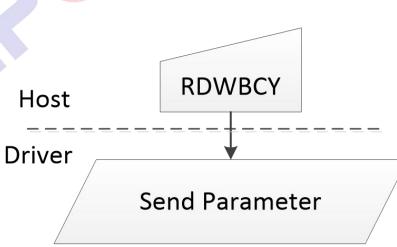
NOTE: “-”Don’t care.

Description	This command is used to read the status. READ_B_X[7:0]: BX bits (BX[7:0]) of Blue color characteristics.													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													
Flow Chart	<pre> graph TD     Host --&gt; RDBCX[RDBCX]     RDBCX --&gt; SendParam[Send Parameter]     subgraph Legend [Legend]         direction TB         L1[Command]         L2[Parameter]         L3[Display]         L4[Action]         L5[Mode]         L6[Sequential transfer]     end </pre> <p>The flowchart illustrates the communication between the Host and the Driver. The Host initiates the process by sending the RDBCX command to the Driver. The Driver then performs the action of sending a parameter. A legend on the right side defines the symbols used in the flowchart: a rectangle for Command, a trapezoid for Parameter, a parallelogram for Display, a diamond for Action, an oval for Mode, and an ellipse for Sequential transfer.</p>													

### 9.3.72 (7Ch) RDWBCY: Read B Coor. Y

Command Set		RDWBCY								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
RDWBCY	R	0	1	1	1	1	1	0	0	7Ch
Parameter	1	READ_B_Y[7:0]								

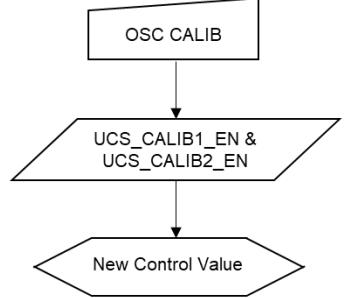
**NOTE:** “-”Don’t care.

Description	This command is used to read the status. READ_B_Y[7:0]: BY bits (BY[7:0]) of Blue color characteristics													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													
Flow Chart	 <pre> graph TD     Host -- RDWBCY --&gt; Driver     Driver -- "Send Parameter" --&gt; None   </pre> <p>Legend:</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>													

### 9.3.73 (80h) OSC CALIB: OSC Calibration Control

Command Set		OSC CALIB								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
OSC CALIB	W	1	0	0	0	0	0	0	0	80h
Parameter	1	0	CALIB_TARG_SEL[2:0]			0	0	UCS_CALIB2_EN	UCS_CALIB1_EN	00h

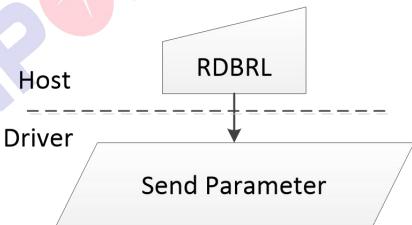
**NOTE:** “-”Don’t care.

<b>Description</b>	<p>This command is used to write for OSC Calibration 1/2 Control.</p> <p>CALIB_TARG_SEL[2:0] : Calibration Target Selection Control.</p> <p>UCS_CALIB1_EN : OSC128 Calibration1 Enable/Disable Control</p> <p>UCS_CALIB2_EN : OSC155 Calibration2 Enable/Disable Control</p>													
<b>Restriction</b>	-													
<b>Register Availability</b>	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
<b>Default</b>	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													
<b>Flow Chart</b>	 <pre> graph TD     A[OSC CALIB] --&gt; B{UCS_CALIB1_EN &amp; UCS_CALIB2_EN}     B --&gt; C{New Control Value}   </pre> <p><b>Legend</b></p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>													

### 9.3.74 (84h) RDBRL: Read BR Low Byte

Command Set		RDBRL									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RDBRL	R	1	0	0	0	0	1	0	0	84h	
Parameter	1	READ_BR[7:0]									

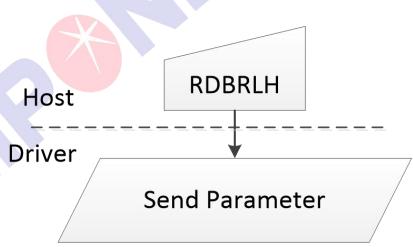
NOTE: “-”Don’t care.

Description	This command is used to read the status.													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
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Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													
Flow Chart	 <pre> graph TD     Host --&gt; RDBRL[RDBRL]     RDBRL --&gt; SendParameter[Send Parameter]     subgraph Legend [Legend]         direction TB         L1[Command]         L2[Parameter]         L3[Display]         L4[Action]         L5[Mode]         L6[Sequential transfer]     end </pre>													

### 9.3.75 (85h) RDBRH: Read BR High Byte

Command Set		RDBRH									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RDBRH	R	1	0	0	0	0	1	0	1	85h	
Parameter	1	READ_BR[15:8]									

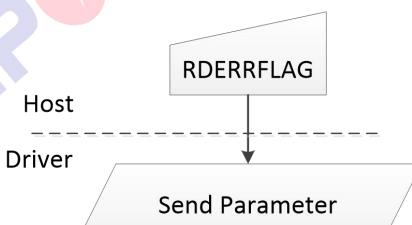
NOTE: “-”Don’t care.

Description	This command is used to read the status.													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													
Flow Chart	 <pre> graph TD     Host[Host] --&gt; RDBRLH[RDBRLH]     RDBRLH --&gt; SendParam[Send Parameter]     SendParam --&gt; Driver[Driver]     </pre>	Legend <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>												

### 9.3.76 (8Fh) RDERRFLAG: Read Error Flag Status

Command Set		RDERRFLAG									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RDERRFLAG	R	1	0	0	0	1	1	1	1	8Fh	
Parameter	1	READ_ERR_FLAG[7:0]									00h

**NOTE:** “-”Don’t care.

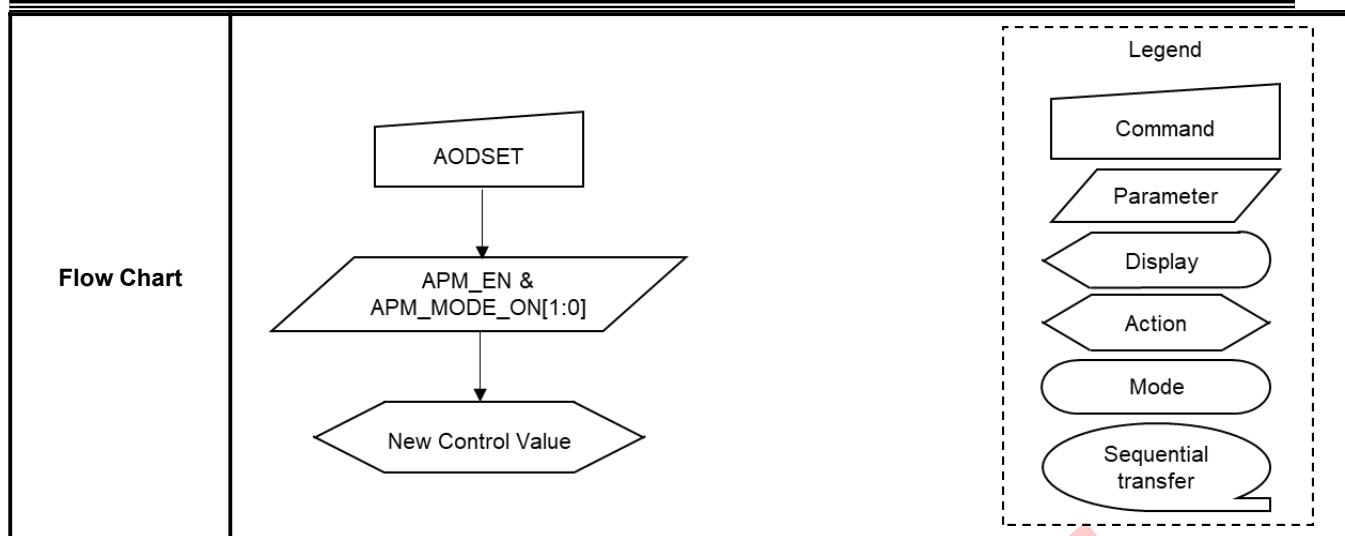
Description	This command is used to read the status. READ_ERR_FLAG[7:0]: Error Flag Information													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													
Flow Chart	 <pre> graph TD     Host[Host] -- RDERRFLAG --&gt; Driver[Driver]     Driver -- Send Parameter --&gt; SendParam[/Send Parameter/] </pre> <p><b>Legend</b></p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>													

### 9.3.77 (90h) AODSET: Write AOD Value

Command Set		AODSET								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
AODSET	W	1	0	0	1	0	0	0	0	90h
Parameter	1	APM_EN	0	0	0	0	0	0	AOD_MODE_ON	00h

NOTE: “-”Don’t care.

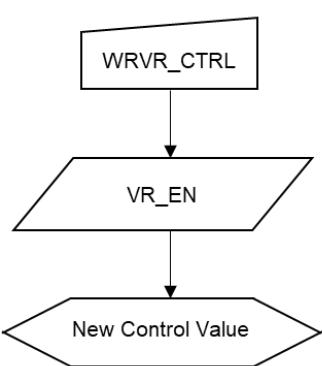
<b>Description</b>	This command is used to control AOD Mode function.													
	APM_EN: Auto Pixel Moving On/Off Control													
	<table border="1"> <thead> <tr> <th>APM_EN</th><th>Description</th></tr> </thead> <tbody> <tr> <td>0</td><td>Off</td></tr> <tr> <td>1</td><td>On</td></tr> </tbody> </table>		APM_EN	Description	0	Off	1	On						
APM_EN	Description													
0	Off													
1	On													
AOD_MODE_ON: AOD Mode On/Off Control														
<table border="1"> <thead> <tr> <th>AOD_MODE_ON</th><th>Description</th></tr> </thead> <tbody> <tr> <td>0</td><td>AOD MODE OFF</td></tr> <tr> <td>1</td><td>AOD MODE ON</td></tr> </tbody> </table>			AOD_MODE_ON	Description	0	AOD MODE OFF	1	AOD MODE ON						
AOD_MODE_ON	Description													
0	AOD MODE OFF													
1	AOD MODE ON													
<b>Restriction</b>	-													
<b>Register Availability</b>	<table border="1"> <thead> <tr> <th>Status</th><th>Availability</th></tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr> <td>Sleep In</td><td>Yes</td></tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
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Sleep In	Yes													
<b>Default</b>	<table border="1"> <thead> <tr> <th>Status</th><th>Default Value</th></tr> </thead> <tbody> <tr> <td>Power On Sequence</td><td>00h</td></tr> <tr> <td>S/W Reset</td><td>00h</td></tr> <tr> <td>H/W Reset</td><td>00h</td></tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													



### 9.3.78 (91h) WRVR\_CTRL: Write VR Value

Command Set		WRVR_CTRL									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
WRVR_CTRL	W	1	0	0	1	0	0	0	1	91h	
Parameter	1	0	0	0	0	0	0	0	VR_EN	00h	

**NOTE:** “-”Don’t care.

<b>Description</b>	This command is used to control VR function.													
	VR_EN: VR Mode On/Off Control													
	<table border="1"> <thead> <tr> <th>VR_EN</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Off</td> </tr> <tr> <td>1</td> <td>On</td> </tr> </tbody> </table>		VR_EN	Description	0	Off	1	On						
VR_EN	Description													
0	Off													
1	On													
<b>Restriction</b>	-													
<b>Register Availability</b>	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
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Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													
<b>Flow Chart</b>	<pre> graph TD     WRVR_CTRL[WRVR_CTRL] --&gt; VR_EN{VR_EN}     VR_EN --&gt; NewControlValue{New Control Value}     </pre> 	<p>Legend</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>												

## 9.3.79 (92h) RDVR\_CTRL: Read VR Value

Command Set		RDVR_CTRL								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
RDVR_CTRL	R	1	0	0	1	0	0	1	0	92h
Parameter	1	0	0	0	0	0	0	0	VR_EN	00h

NOTE: “-”Don’t care.

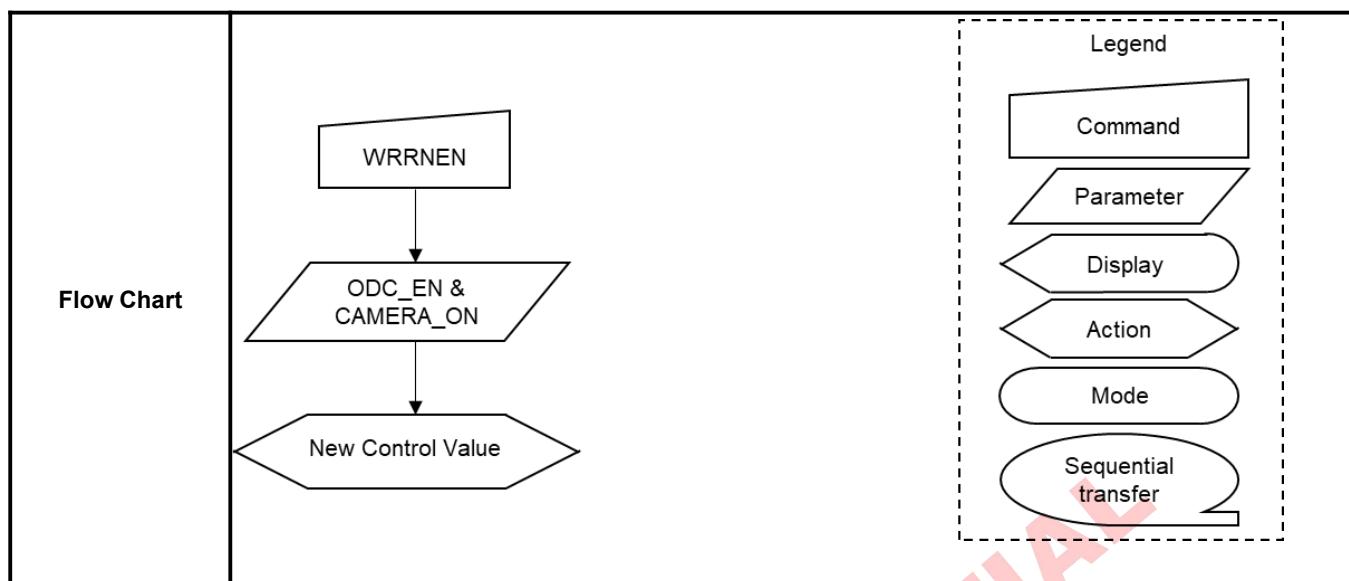
Description	This command is used to control VR function.  VR_EN: VR Mode On/Off Control													
	<table border="1"> <thead> <tr> <th>VR_EN</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Off</td> </tr> <tr> <td>1</td> <td>On</td> </tr> </tbody> </table>		VR_EN	Description	0	Off	1	On						
VR_EN	Description													
0	Off													
1	On													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
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Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													
Flow Chart	<pre> graph TD     Host[Host] -- RDVR_CTRL --&gt; Driver[Driver]     Driver -- "Send Parameter" --&gt; Send[/Send Parameter/]   </pre>	<p>Legend</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>												

## 9.3.80 (93h) WRRNEN: Write RN Value

Command Set		WRRNEN								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
WRRNEN	W	1	0	0	1	0	0	1	1	93h
Parameter		1	0	0	0	ODC_EN	0	0	CAMERA_ON	00h

NOTE: “-”Don’t care.

Description	ODC_EN: ODC On/Off Control													
	ODC_EN	Description												
	0	Off												
	1	On												
CAMERA_ON: Camera on/off Control														
	CAMERA_ON	Description												
	0	Off												
	1	On												
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													



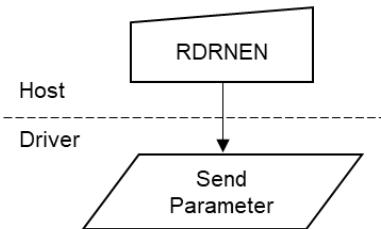
### 9.3.81 (94h) RDRNEN: Read RN Value

Command Set		RDRNEN									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RDRNEN	R	1	0	0	1	0	1	0	0	94h	
Parameter	1	0	0	0	ODC_EN	0	0	0	CAMERA_ON	00h	

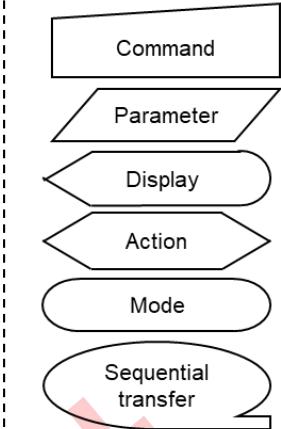
NOTE: “-”Don’t care.

<b>Description</b>	ODC_EN: ODC On/Off Control													
	ODC_EN	Description												
	0	Off												
	1	On												
<b>Restriction</b>	CAMERA_ON: Camera on/off Control													
	CAMERA_ON	Description												
	0	Off												
	1	On												
<b>Register Availability</b>	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
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Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
<b>Default</b>	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													

## Flow Chart



## Legend



**9.3.82 (95h) WTECC\_WT: Write ECC Value**

Command Set		WTECC_WT									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
WTECC_WT	W	1	0	0	1	0	1	0	1	95h	
Parameter	1	0	0	0	0	0	0	0	ECC_WT	00h	

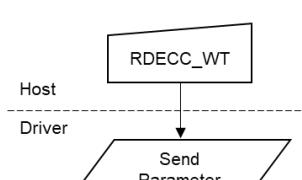
**NOTE:** “-”Don’t care.

Description	This command is used to control OTP.  ECC_WT : OTP Auto Write Start signal for ECC registers													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
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Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													
Flow Chart	<pre> graph TD     A[WTECC_WT] --&gt; B[ECC_WT]     B --&gt; C[New Control Value]   </pre> <p><b>Legend:</b></p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>													

### 9.3.83 (96h) RDECC\_WT: Read ECC Value

Command Set		RDECC_WT									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RDECC_WT	R	1	0	0	1	0	1	1	0	96h	
Parameter	1	0	0	0	0	0	0	0	ECC_WT	00h	

NOTE: “-”Don’t care.

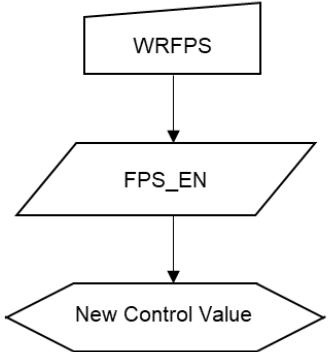
Description	This command is used to control OTP.  ECC_WT : ECC_WT : OTP Auto Write Start signal for ECC registers													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													
Flow Chart	 <pre> graph TD     Host[Host] --&gt; RDECC_WT[RDECC_WT]     RDECC_WT --&gt; SendParam[/Send Parameter/]     subgraph Legend [Legend]         Command[Command]         Parameter[Parameter]         Display[Display]         Action[Action]         Mode[Mode]         Sequential[Sequential transfer]     end </pre>													

### 9.3.84 (97h) WRFPS: Write FPS

Command Set		WRFPS								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
WRFPS	W	1	0	0	1	0	1	1	1	97h
Parameter	1	0	0	0	0	0	0	0	FPS_EN	00h
Parameter	2	FPS_GAIN_CTRL_EN	0	0	0	FPS_GAIN[11:8]				00h
Parameter	3	FPS_GAIN[7:0]								00h

NOTE: “-”Don’t care.

<b>Description</b>	This command is used to control FPS function.													
	FPS_EN : FPS Mode On/Off Control													
	<table border="1"> <thead> <tr> <th>FPS_EN</th><th>Description</th></tr> </thead> <tbody> <tr> <td>0</td><td>Off</td></tr> <tr> <td>1</td><td>On</td></tr> </tbody> </table>		FPS_EN	Description	0	Off	1	On						
FPS_EN	Description													
0	Off													
1	On													
FPS_GAIN_CTRL_EN : Alpha Gain On/Off Control														
<table border="1"> <thead> <tr> <th>FPS_GAIN_CTRL_EN</th><th>Description</th></tr> </thead> <tbody> <tr> <td>0</td><td>Off</td></tr> <tr> <td>1</td><td>On</td></tr> </tbody> </table>		FPS_GAIN_CTRL_EN	Description	0	Off	1	On							
FPS_GAIN_CTRL_EN	Description													
0	Off													
1	On													
FPS_GAIN[11:0] : Alpha Gain value control														
$\frac{\text{Input Image} \times \text{FPS_GAIN}[11:0]}{4096}, 0 < \text{FPS_GAIN}[11:0] \leq 4095$														
<b>Restriction</b>	-													
<b>Register Availability</b>	<table border="1"> <thead> <tr> <th>Status</th><th>Availability</th></tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr> <td>Sleep In</td><td>Yes</td></tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
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Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													

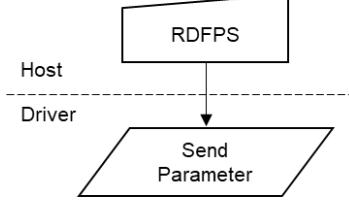
Default	<table border="1"><thead><tr><th>Status</th><th>Default Value</th></tr></thead><tbody><tr><td>Power On Sequence</td><td>00h</td></tr><tr><td>S/W Reset</td><td>00h</td></tr><tr><td>H/W Reset</td><td>00h</td></tr></tbody></table>	Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h
Status	Default Value								
Power On Sequence	00h								
S/W Reset	00h								
H/W Reset	00h								
Flow Chart	 <p>Legend</p> <ul style="list-style-type: none"><li>Command</li><li>Parameter</li><li>Display</li><li>Action</li><li>Mode</li><li>Sequential transfer</li></ul>								

### 9.3.85 (98h) RDPFS: Read FPS

Command Set		RDFPS									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RDFPS	R	1	0	0	1	1	0	0	0	98h	
Parameter	1	0	0	0	0	0	0	0	FPS_EN	00h	
Parameter	2	FPS_GAIN_CTRL_EN	0	0	0	FPS_GAIN[11:8]				00h	
Parameter	3	FPS_GAIN[7:0]								00h	

NOTE: “-”Don’t care.

<b>Description</b>	This command is used to control FPS function.													
	FPS_EN: FPS Mode On/Off Control													
	<table border="1"> <thead> <tr> <th>FPS_EN</th><th>Description</th></tr> </thead> <tbody> <tr> <td>0</td><td>Off</td></tr> <tr> <td>1</td><td>On</td></tr> </tbody> </table>		FPS_EN	Description	0	Off	1	On						
FPS_EN	Description													
0	Off													
1	On													
FPS_GAIN_CTRL_EN : Alpha Gain On/Off Control														
<b>Restriction</b>	<table border="1"> <thead> <tr> <th>FPS_GAIN_CTRL_EN</th><th>Description</th></tr> </thead> <tbody> <tr> <td>0</td><td>Off</td></tr> <tr> <td>1</td><td>On</td></tr> </tbody> </table>		FPS_GAIN_CTRL_EN	Description	0	Off	1	On						
FPS_GAIN_CTRL_EN	Description													
0	Off													
1	On													
FPS_GAIN[11:0] : Alpha Gain value control														
$\frac{\text{Input Image} \times \text{FPS_GAIN}[11:0]}{4096}, 0 < \text{FPS_GAIN}[11:0] \leq 4095$														
-														
<b>Register Availability</b>	<table border="1"> <thead> <tr> <th>Status</th><th>Availability</th></tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr> <td>Sleep In</td><td>Yes</td></tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													

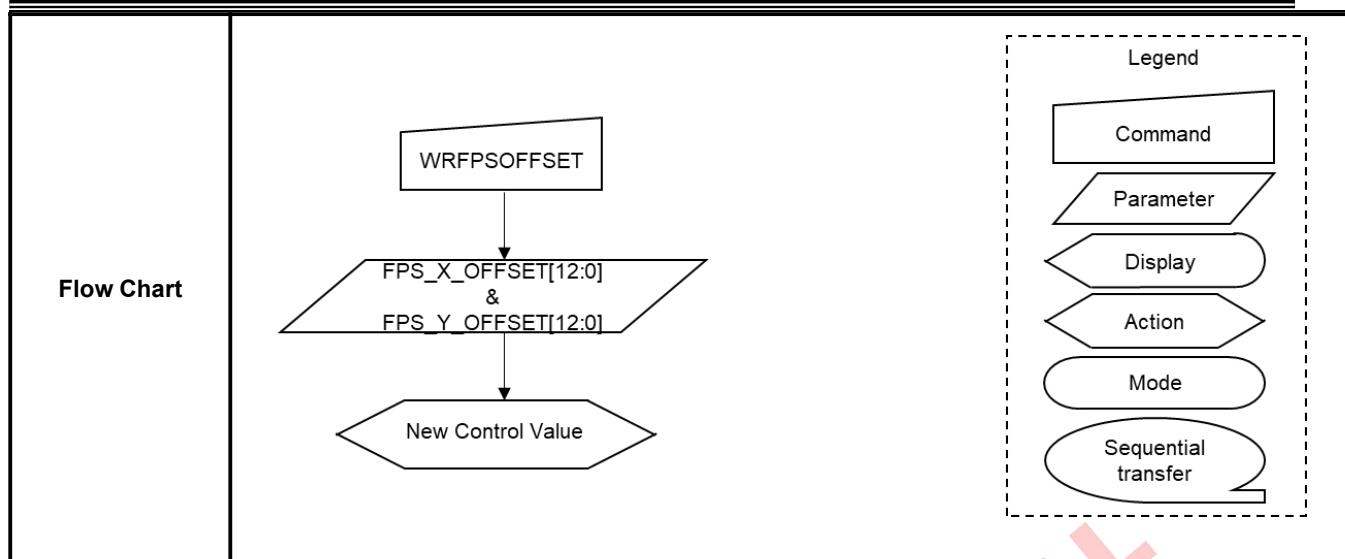
Default	<table border="1"><thead><tr><th>Status</th><th>Default Value</th></tr></thead><tbody><tr><td>Power On Sequence</td><td>00h</td></tr><tr><td>S/W Reset</td><td>00h</td></tr><tr><td>H/W Reset</td><td>00h</td></tr></tbody></table>	Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h
Status	Default Value								
Power On Sequence	00h								
S/W Reset	00h								
H/W Reset	00h								
Flow Chart	 <p>The flowchart illustrates the communication process. It starts with a rectangular box labeled "RDFPS" at the top. An arrow points down from this box to a trapezoidal box labeled "Send Parameter". The word "Host" is positioned above the "RDFPS" box, and "Driver" is positioned below the "Send Parameter" box, indicating the direction of data flow.</p> <p><b>Legend:</b></p> <ul style="list-style-type: none"><li>Command</li><li>Parameter</li><li>Display</li><li>Action</li><li>Mode</li><li>Sequential transfer</li></ul>								

### 9.3.86 (99h) WRFPSOFFSET: Write FPS Offset Value

Command Set		WRFPSOFFSET								
Inst / Para	W /R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
WRFPSOFFSET	W	1	0	0	1	1	0	0	1	99h
Parameter	1	0	0	0	FPS_X_OFFSET[12:8]					00h
Parameter	2	FPS_X_OFFSET[7:0]							00h	
Parameter	3	0	0	0	FPS_Y_OFFSET[12:8]					00h
Parameter	4	FPS_Y_OFFSET[7:0]							00h	

**NOTE:** “-”Don’t care.

Description	This command is used to control FPS function.  FPS_X/Y_OFFSET : FPS X position offset FPS_X/Y_OFFSET[12] is sign bit If FPS_X/Y_OFFSET[12] = 0, FPS Circle x position is FPS_X_POS + FPS_X_OFFSET[11:0] If FPS_X/Y_OFFSET[12] = 1, FPS Circle x position is FPS_X_POS - FPS_X_OFFSET[11:0]													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
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Normal Mode On, Idle Mode On, Sleep Out	Yes													
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Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>OTP Value</td> </tr> <tr> <td>S/W Reset</td> <td>OTP Value</td> </tr> <tr> <td>H/W Reset</td> <td>OTP Value</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	OTP Value	S/W Reset	OTP Value	H/W Reset	OTP Value				
Status	Default Value													
Power On Sequence	OTP Value													
S/W Reset	OTP Value													
H/W Reset	OTP Value													

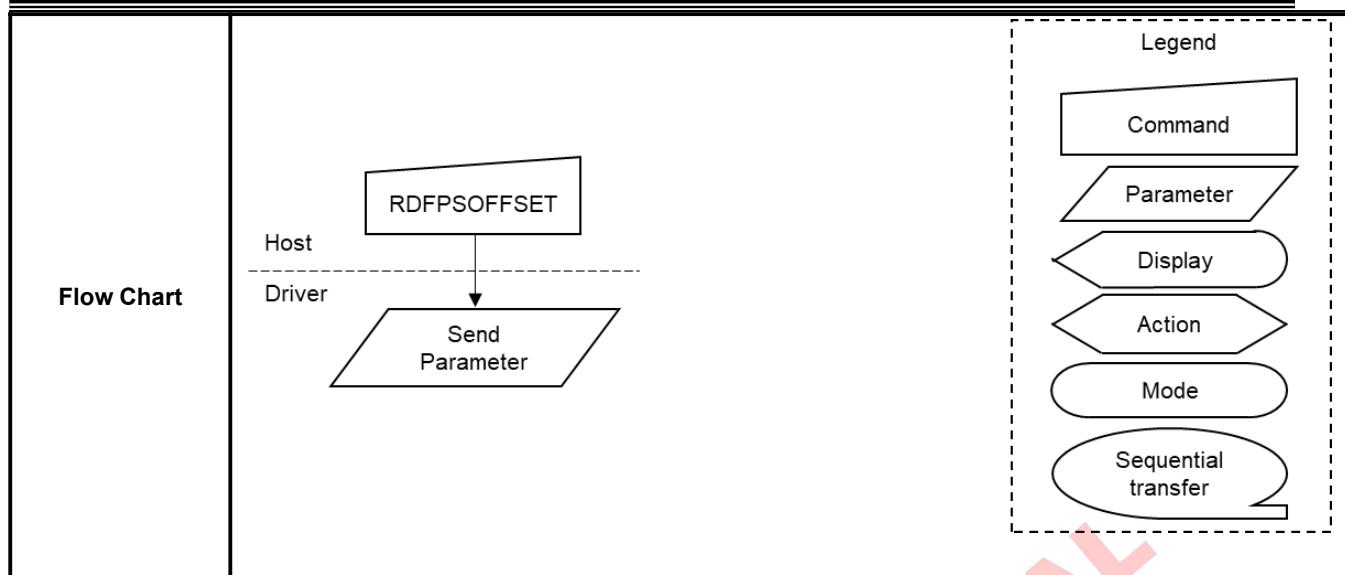


### 9.3.87 (9Ah) RDFPSOFFSET: Read FPS Offset Value

Command Set		RDFPSOFFSET								
Inst / Para	W /R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
RDFPSOFFSET	R	1	0	0	1	1	0	1	0	9Ah
Parameter	1	0	0	0	FPS_X_OFFSET[12:8]					00h
Parameter	2	FPS_X_OFFSET[7:0]							00h	
Parameter	3	0	0	0	FPS_Y_OFFSET[12:8]					00h
Parameter	4	FPS_Y_OFFSET[7:0]							00h	

**NOTE:** “-”Don’t care.

Description	This command is used to control FPS function.  FPS_X/Y_OFFSET : FPS X position offset FPS_X/Y_OFFSET[12] is sign bit If FPS_X/Y_OFFSET[12] = 0, FPS Circle x position is FPS_X_POS + FPS_X_OFFSET[11:0] If FPS_X/Y_OFFSET[12] = 1, FPS Circle x position is FPS_X_POS - FPS_X_OFFSET[11:0]													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>OTP Value</td> </tr> <tr> <td>S/W Reset</td> <td>OTP Value</td> </tr> <tr> <td>H/W Reset</td> <td>OTP Value</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	OTP Value	S/W Reset	OTP Value	H/W Reset	OTP Value				
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Power On Sequence	OTP Value													
S/W Reset	OTP Value													
H/W Reset	OTP Value													

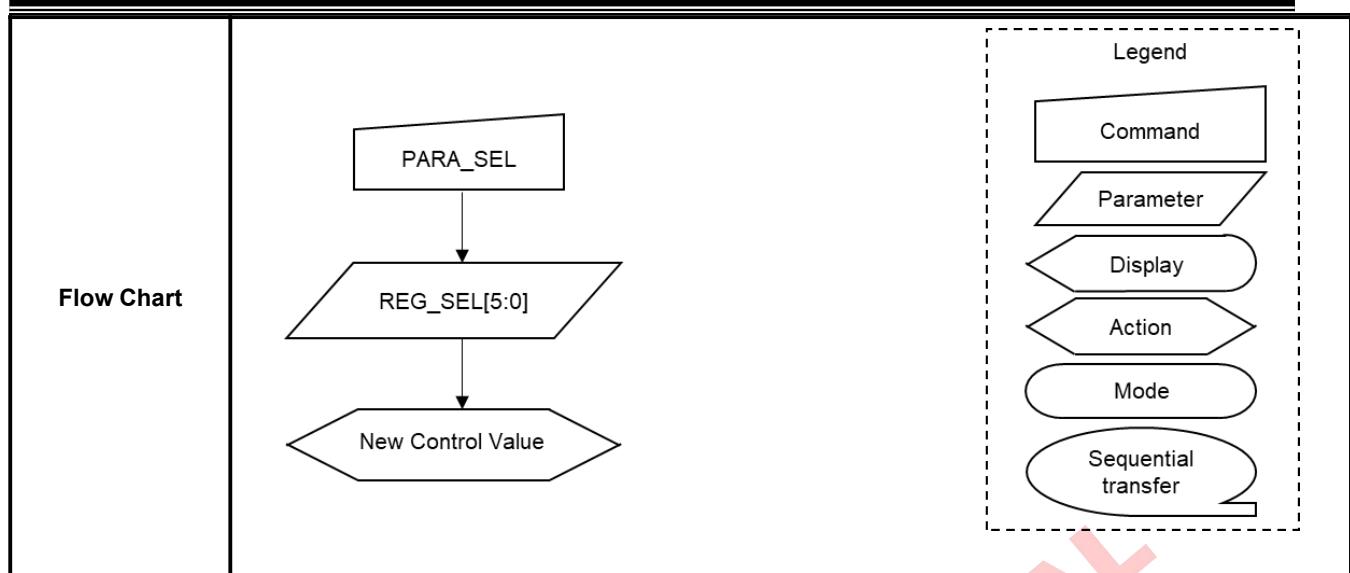


### 9.3.88 (9Bh) PARA\_SEL: MCS Parameter Value

Command Set		PARA_SEL									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
PARA_SEL	W	1	0	0	1	1	0	1	1	9Bh	
Parameter	1	0	0	REG_SEL[5:0]						00h	

NOTE: “-”Don’t care.

<b>Description</b>	This command is used to control Register Parameter Selection													
	REG_SEL[5:0]	Description												
	00h	1'st Parameter												
	01h	2'nd Parameter												
	02h	3'rd Parameter												
	03h	4'th Parameter												
	04h	5'th Parameter												
	05h	6'th Parameter												
	06h	7'th Parameter												
	07h	8'th Parameter												
	08h	9'th Parameter												
	09h	10'th Parameter												
	0Ah	11'th Parameter												
	0Bh	12'th Parameter												
	0Ch	13'th Parameter												
	.....	.....												
	3Fh	64'th Parameter												
<b>Restriction</b>	-													
<b>Register Availability</b>	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
<b>Default</b>	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>OTP Value</td> </tr> <tr> <td>S/W Reset</td> <td>OTP Value</td> </tr> <tr> <td>H/W Reset</td> <td>OTP Value</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	OTP Value	S/W Reset	OTP Value	H/W Reset	OTP Value				
Status	Default Value													
Power On Sequence	OTP Value													
S/W Reset	OTP Value													
H/W Reset	OTP Value													

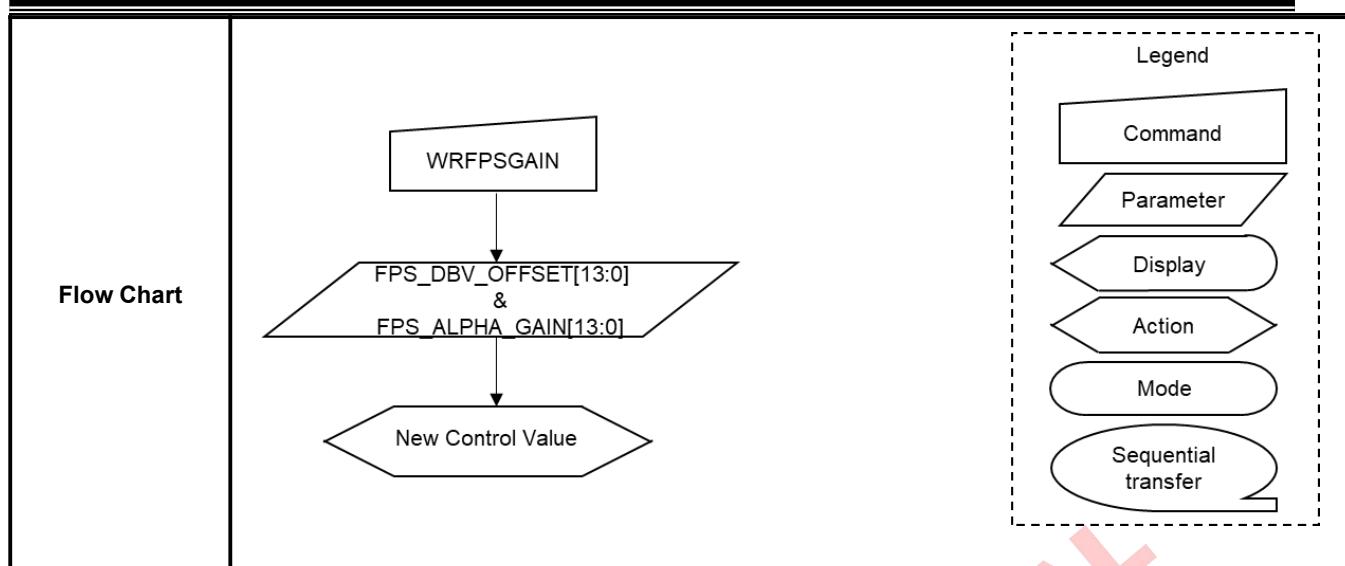


## 9.3.89 (9Dh) WRFPSEGAIN: Write FPS Gain Value

Command Set		WRFPSEGAIN									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
WRFPSEGAIN	W	1	0	0	1	1	1	0	1	9Dh	
Parameter	1	0	0	FPS_DBV_OFFSET[13:8]						00h	
Parameter	2	FPS_DBV_OFFSET[7:0]								00h	
Parameter	3	0	0	FPS_ALPHA_GAIN[13:8]						20h	
Parameter	4	FPS_ALPHA_GAIN[7:0]								00h	

NOTE: “-”Don’t care.

Description	This command is used to control FPS function.  FPS_DBV_OFFSET : DBV Offset when FPS turn on FPS_DBV_OFFSET[13] is sign bit If FPS_DBV_OFFSET[13] = 0, DBV = DBV – FPS_DBV_OFFSET[12:0] If FPS_DBV_OFFSET[13] = 1, DBV = DBV + FPS_DBV_OFFSET[12:0]  FPS_ALPHA_GAIN : DBV Gain when FPS turn on FPS1_GAIN(DGM Block) = FPS1_GAIN(BC Block) * FPS_ALPHA_GAIN												
Restriction	-												
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>	Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability												
Normal Mode On, Idle Mode Off, Sleep Out	Yes												
Normal Mode On, Idle Mode On, Sleep Out	Yes												
Partial Mode On, Idle Mode Off, Sleep Out	Yes												
Partial Mode On, Idle Mode On, Sleep Out	Yes												
Sleep In	Yes												
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>OTP Value</td> </tr> <tr> <td>S/W Reset</td> <td>OTP Value</td> </tr> <tr> <td>H/W Reset</td> <td>OTP Value</td> </tr> </tbody> </table>	Status	Default Value	Power On Sequence	OTP Value	S/W Reset	OTP Value	H/W Reset	OTP Value				
Status	Default Value												
Power On Sequence	OTP Value												
S/W Reset	OTP Value												
H/W Reset	OTP Value												

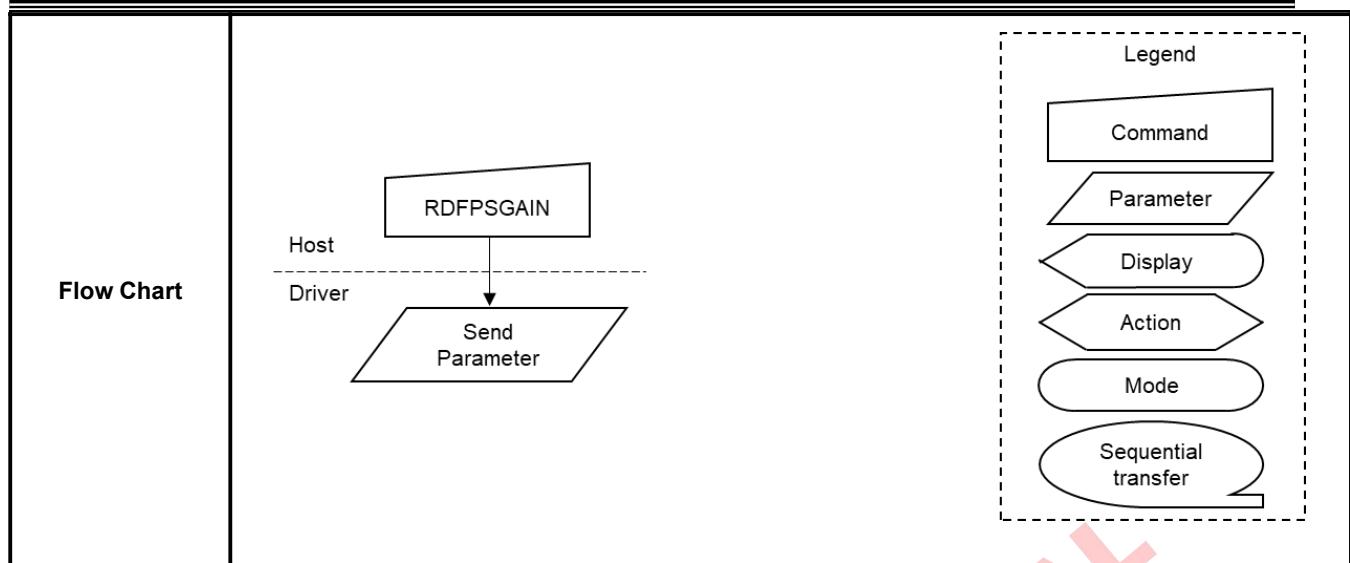


### 9.3.90 (9Eh) RDFPSGAIN: Read FPS Gain Value

Command Set		RDFPSGAIN									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RDFPSGAIN	R	1	0	0	1	1	1	1	0	9Eh	
Parameter	1	0	0	FPS_DBV_OFFSET[13:8]						00h	
Parameter	2	FPS_DBV_OFFSET[7:0]									
Parameter	3	0	0	FPS_ALPHA_GAIN[13:8]						20h	
Parameter	4	FPS_ALPHA_GAIN[7:0]									

**NOTE:** “-”Don’t care.

Description	This command is used to control FPS function.  FPS_DBV_OFFSET : DBV Offset when FPS turn on FPS_DBV_OFFSET[13] is sign bit If FPS_DBV_OFFSET[13] = 0, DBV = DBV – FPS_DBV_OFFSET[12:0] If FPS_DBV_OFFSET[13] = 1, DBV = DBV + FPS_DBV_OFFSET[12:0]  FPS_ALPHA_GAIN : DBV Gain when FPS turn on FPS1_GAIN(DGM Block) = FPS1_GAIN(BC Block) * FPS_ALPHA_GAIN												
Restriction	-												
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>	Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability												
Normal Mode On, Idle Mode Off, Sleep Out	Yes												
Normal Mode On, Idle Mode On, Sleep Out	Yes												
Partial Mode On, Idle Mode Off, Sleep Out	Yes												
Partial Mode On, Idle Mode On, Sleep Out	Yes												
Sleep In	Yes												
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>OTP Value</td> </tr> <tr> <td>S/W Reset</td> <td>OTP Value</td> </tr> <tr> <td>H/W Reset</td> <td>OTP Value</td> </tr> </tbody> </table>	Status	Default Value	Power On Sequence	OTP Value	S/W Reset	OTP Value	H/W Reset	OTP Value				
Status	Default Value												
Power On Sequence	OTP Value												
S/W Reset	OTP Value												
H/W Reset	OTP Value												

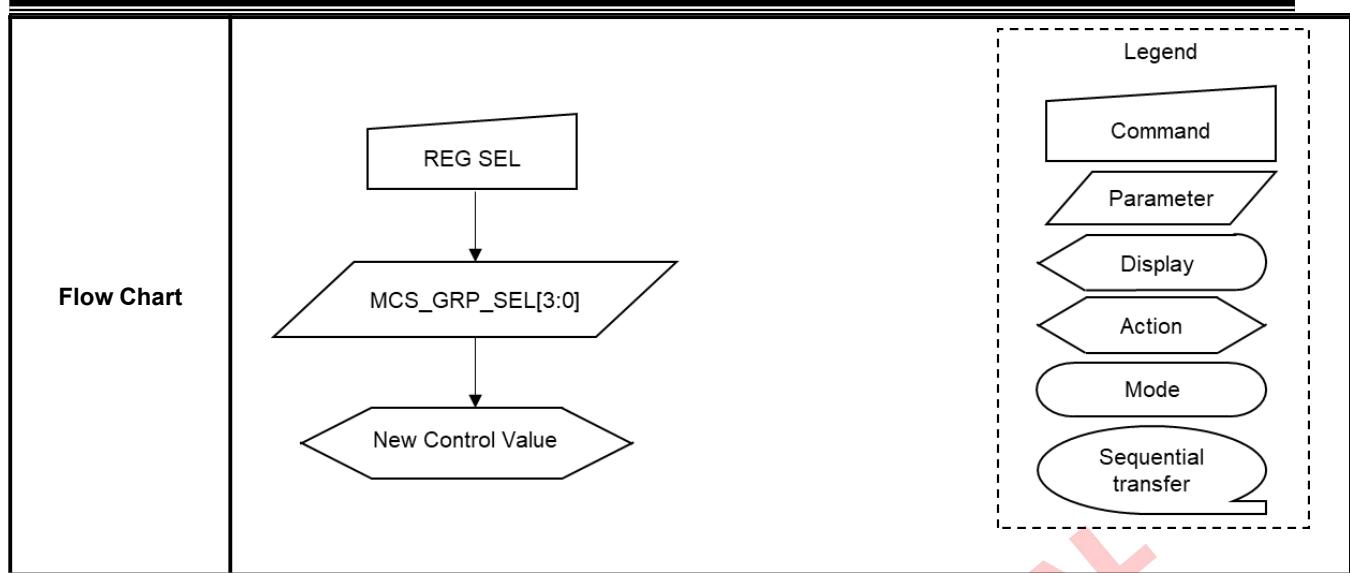


### 9.3.91 (9Fh) REG SEL: MCS Group Selection

Command Set		REG SEL									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
REG SEL	W	1	0	0	1	1	1	1	1	9Fh	
Parameter	1	0	0	0	0	MCS_GRP_SEL[3:0]				00h	

NOTE: “-”Don’t care.

<b>Description</b>	This command is used to control Register Group Selection	
	MCS_GRP_SEL[3:0]	Description
	0h	Disable MCS Group Selection
	1h	Register Group 1
	2h	Register Group 2
	3h	Register Group 3
	4h	Register Group 4
	5h	Register Group 5
	6h	Register Group 6
	7h	Register Group 7
	8h	Register Group 8
	9h	Register Group 9
	Ah	Register Group A
	Bh	Register Group B
	Ch	Register Group C
	Dh	Register Group D
	Eh	Register Group E
<b>Restriction</b>	-	
<b>Register Availability</b>	Status	Availability
	Normal Mode On, Idle Mode Off, Sleep Out	Yes
	Normal Mode On, Idle Mode On, Sleep Out	Yes
	Partial Mode On, Idle Mode Off, Sleep Out	Yes
	Partial Mode On, Idle Mode On, Sleep Out	Yes
	Sleep In	Yes
<b>Default</b>	Status	Default Value
	Power On Sequence	OTP Value
	S/W Reset	OTP Value
	H/W Reset	OTP Value

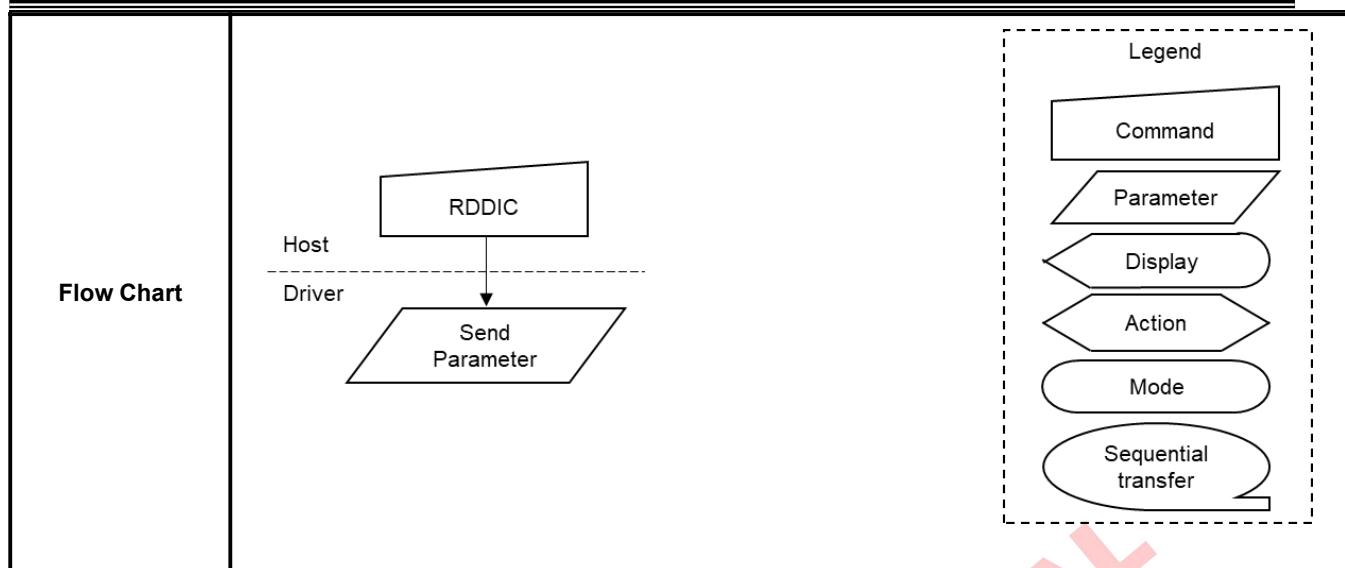


### 9.3.92 (A0h) RDDIC: Read DIC

Command Set		RDDIC									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RDDIC	R	1	0	1	0	0	0	0	0	A0h	
Parameter	1	0	0	1	1	0	1	0	1	35h	
Parameter	2	0	0	0	1	0	0	1	0	12h	
Parameter	3	REV_ID[7:0]								00h	
Parameter	4	LOT_ID1[7:0]								00h	
Parameter	Nth	LOT_IDn[7:0]								00h	
Parameter	27	LOT_ID24[7:0]								00h	

**NOTE:** “-”Don’t care.

Description														
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr> <td>Sleep In</td><td>Yes</td></tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td><td>OTP Value</td></tr> <tr> <td>S/W Reset</td><td>OTP Value</td></tr> <tr> <td>H/W Reset</td><td>OTP Value</td></tr> </tbody> </table>		Status	Default Value	Power On Sequence	OTP Value	S/W Reset	OTP Value	H/W Reset	OTP Value				
Status	Default Value													
Power On Sequence	OTP Value													
S/W Reset	OTP Value													
H/W Reset	OTP Value													



### 9.3.93 (A1h) RDDDB: Read DDB Start

Command Set		RDDDB									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RDDDB	R	1	0	1	0	0	0	0	1	A1h	
Parameter	1	IDX1[7:0]								OTP	
Parameter	Nth	IDXn[7:0]								OTP	
Parameter	24	IDX24[7:0]								OTP	

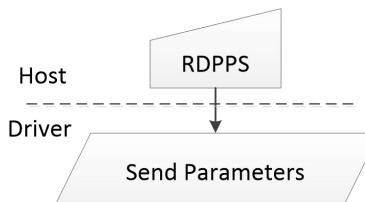
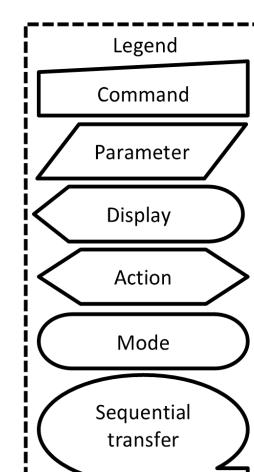
**NOTE:** ““Don’t care.

Description	This command returns supplier identification and display module model/revision information.  NOTE: This information is not the same RDID1(DAh) : Read ID1, RDID2(DBh) : Read ID2 and RDID3(DCh) : Read ID3 commands are returning.  This read sequence can be interrupted by any command and it can be continued by “RDDDBC (A8h)” when the first parameter, what has been transferred, is the parameter, which has not been sent e.g. RDDDBS → 1st parameter has been sent → 2nd Parameter has been sent → interrupt → RDDDBC → 3rd parameter of the RDDDBS has been sent.													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
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Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>OTP Value</td> </tr> <tr> <td>S/W Reset</td> <td>OTP Value</td> </tr> <tr> <td>H/W Reset</td> <td>OTP Value</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	OTP Value	S/W Reset	OTP Value	H/W Reset	OTP Value				
Status	Default Value													
Power On Sequence	OTP Value													
S/W Reset	OTP Value													
H/W Reset	OTP Value													
Flow Chart	<p>The flowchart illustrates the communication sequence between the Host and the Driver. The Host initiates the process by sending an RDDDB command to the Driver. The Driver then responds by sending parameters. A legend on the right side of the diagram provides a key for the symbols used in the flowchart:</p> <ul style="list-style-type: none"> <li>Command: Represented by a square symbol.</li> <li>Parameter: Represented by a triangle symbol.</li> <li>Display: Represented by a diamond symbol.</li> <li>Action: Represented by a hexagon symbol.</li> <li>Mode: Represented by an oval symbol.</li> <li>Sequential transfer: Represented by a circle symbol.</li> </ul>													

### 9.3.94 (A2h) RDPPS: Read PPS

Command Set		RDPPS								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
RDPPS	R	1	0	1	0	0	0	1	0	A2h
Parameter	1	PPS1[7:0]								OTP
Parameter	Nth	PPSN[7:0]								OTP
Parameter	128	PPS128[7:0]								OTP

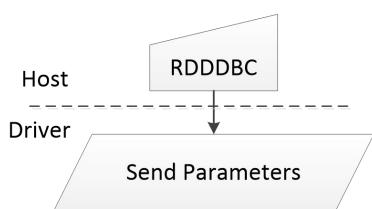
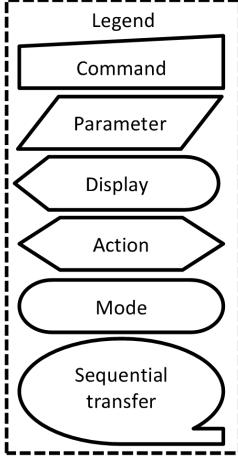
**NOTE:** “—”“Don’t care.

Description	This command returns DSC PPS (picture parameter set) table data. There's 4 table for PPS set. if host want to read specific table's PPS data, host should set PPSSEL(compress mode command packet. MIPI DSI Data type 0x07 0x01) table value first.													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
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Sleep In	Yes													
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Status	Default Value													
Power On Sequence	OTP Value													
S/W Reset	OTP Value													
H/W Reset	OTP Value													
Flow Chart	 <pre> graph TD     Host[Host] -- RDPPS --&gt; Driver[Driver]     Driver -- "Send Parameters" --&gt; Send[Send Parameters]   </pre>	 <p>Legend</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>												

### 9.3.95 (A8h) RDDDBC: Read DDB Continue

Command Set		RDDDBC								
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX
RDDDBC	R	1	0	1	0	1	0	0	0	A8h
Parameter	1	IDX1[7:0]							OTP	
Parameter	Nth	IDXn[7:0]							OTP	
Parameter	128	IDX128[7:0]							OTP	

**NOTE:** “—”Don’t care.

Description	This command returns supplier's identification and display module model/revision information from the point where RDDDBS command was interrupt by another command e.g. RDDDBS was interrupted after 2nd parameter. The first parameter, what RDDDBC is returning is 3rd parameter.	
Restriction	-	
Register Availability	Status	Availability
	Normal Mode On, Idle Mode Off, Sleep Out	Yes
	Normal Mode On, Idle Mode On, Sleep Out	Yes
	Partial Mode On, Idle Mode Off, Sleep Out	Yes
	Partial Mode On, Idle Mode On, Sleep Out	Yes
Default	Sleep In	Yes
	Status	Default Value
	Power On Sequence	OTP Value
	S/W Reset	OTP Value
Flow Chart	H/W Reset	OTP Value
	 <pre> graph TD     Host[Host] -- "RDDDBC" --&gt; Driver[Driver]     Driver -- "Send Parameters" --&gt; Send[Send Parameters]   </pre>	
 <p>Legend</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>		

### 9.3.96 (A9h) RDPPSC: Read Continue PPS

Command Set		RDPPSC									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RDPPSC	R	1	0	1	0	1	0	0	1	A9h	
Parameter	1	PPS1[7:0]								OTP	
Parameter	Nth	PPSn[7:0]								OTP	
Parameter	128	PPS128[7:0]								OTP	

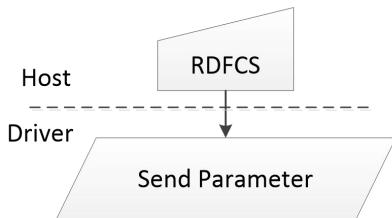
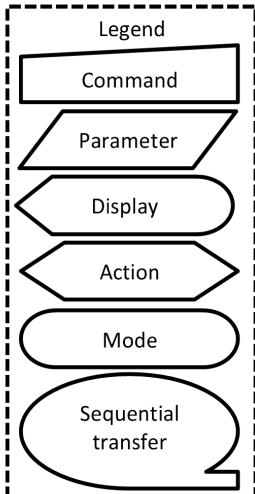
NOTE: ““Don’t care.

Description	<p>This command returns DSC PPS (picture parameter set) table data.</p> <p>There's 4 table for PPS set. if host want to read specific table's PPS data, host should set PPSSEL(compress mode command packet. MIPI DSI Data type 0x07 0x01) table value first.</p> <p>This command returns DSC PPS (picture parameter set) table data from the point where RDPPS command was interrupt by another command e.g. RDPPS was interrupted after 2nd parameter. The first parameter, what RDPPSC is returning is 3rd parameter.</p>													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
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Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>OTP Value</td> </tr> <tr> <td>S/W Reset</td> <td>OTP Value</td> </tr> <tr> <td>H/W Reset</td> <td>OTP Value</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	OTP Value	S/W Reset	OTP Value	H/W Reset	OTP Value				
Status	Default Value													
Power On Sequence	OTP Value													
S/W Reset	OTP Value													
H/W Reset	OTP Value													
Flow Chart	 <pre> graph TD     Host -- RDPPSC --&gt; Driver     Driver -- Send Parameters --&gt; None     </pre> <p>Legend:</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>													

### 9.3.97 (AAh) RDFCS: Read First Checksum

Command Set		RDFCS									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RDFCS	R	1	0	1	0	1	0	1	0	AAh	
Parameter	1	FCS[7:0]									

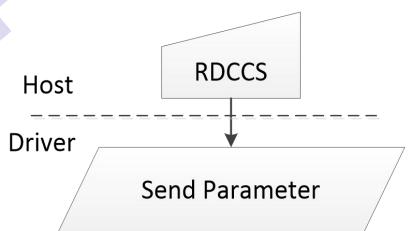
**NOTE:** “-”Don’t care.

Description	This command returns the first checksum what has been calculated from “User Command Set” area registers (not included “Manufacture Command Set”) after the write access to those registers has been done.													
Restriction	It will be necessary to wait 150ms after there is the last write access on “User Command Set” area registers before there can read this checksum value.													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													
Flow Chart	 <pre> graph TD     Host[Host] --&gt; RDFCS[RDFCS]     RDFCS --&gt; SendParam[Send Parameter]     SendParam --&gt; Driver[Driver]     </pre>	 <pre> graph LR     subgraph Legend [Legend]         direction TB         L1[Command] --- R1[ ]         L2[Parameter] --- R2[ ]         L3[Display] --- R3[ ]         L4[Action] --- R4[ ]         L5[Mode] --- R5[ ]         L6[Sequential transfer] --- R6[ ]     end     </pre>												

### 9.3.98 (AFh) RDCCS: Read Continue Checksum

Command Set		RDCCS									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RDCCS	R	1	0	1	0	1	1	1	1	AFh	
Parameter	1	CCS[7:0]									00h

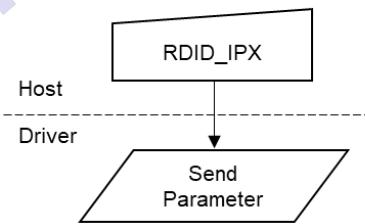
**NOTE:** “-”Don’t care.

Description	This command returns the continue checksum what has been calculated continuously after the first checksum has calculated from some “User Command Set” area registers after the write access to those registers has been done.													
Restriction	It will be necessary to wait 300ms after there is the last write access on “User Command Set” area registers before there can read this checksum value.													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
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Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h				
Status	Default Value													
Power On Sequence	00h													
S/W Reset	00h													
H/W Reset	00h													
Flow Chart	 <pre> graph TD     Host[Host] -- RDCCS --&gt; Driver[Driver]     Driver -- "Send Parameter" --&gt; SendParam[/Send Parameter/]     </pre>	<p>Legend</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>												

### 9.3.99 (B1h) RDID\_UDI: Read ID\_UDI - Please do not open to BOE.

Command Set		RDID_IPX									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RDID_IPX	R	1	0	1	1	0	0	0	1	B1h	
Parameter	1	UDI1[7:0]								00h	
Parameter	Nth	UDIn[7:0]								00h	
Parameter	19	UDI19[7:0]								00h	

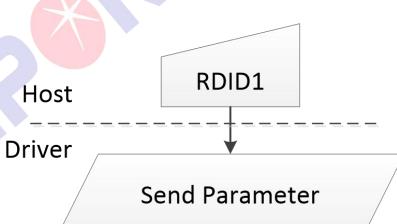
**NOTE:** “-”Don’t care.

Description	This read byte identifies a User Defined Information.													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
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Sleep In	Yes													
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Status	Default Value													
Power On Sequence	OTP Value													
S/W Reset	OTP Value													
H/W Reset	OTP Value													
Flow Chart	 <pre> graph TD     Host -- RDID_IPX --&gt; Driver     Driver -- "Send Parameter" --&gt; None   </pre>	<p>Legend</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>												

### 9.3.100 (DAh) RDID1: Read ID1

Command Set		RDID1									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RDID1	R	1	1	0	1	1	0	1	0	DAh	
Parameter	1	DM_ID1[7:0]									

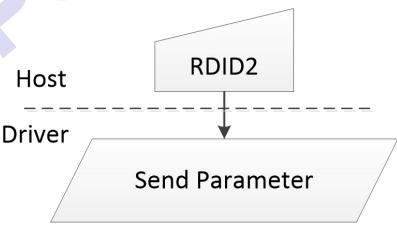
**NOTE:** “-”Don’t care.

Description	This read byte identifies the OLED module's manufacturer.													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
Normal Mode On, Idle Mode On, Sleep Out	Yes													
Partial Mode On, Idle Mode Off, Sleep Out	Yes													
Partial Mode On, Idle Mode On, Sleep Out	Yes													
Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>OTP Value</td> </tr> <tr> <td>S/W Reset</td> <td>OTP Value</td> </tr> <tr> <td>H/W Reset</td> <td>OTP Value</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	OTP Value	S/W Reset	OTP Value	H/W Reset	OTP Value				
Status	Default Value													
Power On Sequence	OTP Value													
S/W Reset	OTP Value													
H/W Reset	OTP Value													
Flow Chart	 <pre> graph TD     Host -- RDID1 --&gt; Driver     Driver -- "Send Parameter" --&gt; Output     </pre> <p>Legend:</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>													

### 9.3.101 (DBh) RDID2: Read ID2

Command Set		RDID2									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RDID2	R	1	1	0	1	1	0	1	1	DBh	
Parameter	1	DM_ID2[7:0]									

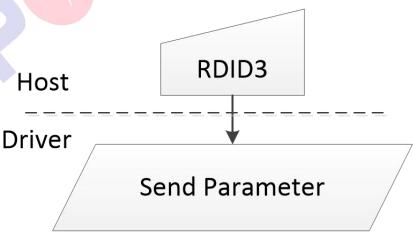
**NOTE:** “-”Don’t care.

Description	This read byte is used to track the OLED module/driver version. It is defined by internal and changes each time a revision is made to the display, material or construction specifications.													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
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Sleep In	Yes													
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>OTP Value</td> </tr> <tr> <td>S/W Reset</td> <td>OTP Value</td> </tr> <tr> <td>H/W Reset</td> <td>OTP Value</td> </tr> </tbody> </table>		Status	Default Value	Power On Sequence	OTP Value	S/W Reset	OTP Value	H/W Reset	OTP Value				
Status	Default Value													
Power On Sequence	OTP Value													
S/W Reset	OTP Value													
H/W Reset	OTP Value													
Flow Chart	 <pre> graph TD     Host[Host] -- RDID2 --&gt; Driver[Driver]     Driver -- "Send Parameter" --&gt; Send[Send Parameter]     </pre> <p><b>Legend</b></p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>													

### 9.3.102 (DCh) RDID3: Read ID3

Command Set		RDID3									
Inst / Para	W/R	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]	HEX	
RDID3	R	1	1	0	1	1	1	0	0	DCh	
Parameter	1	DM_ID3[7:0]									

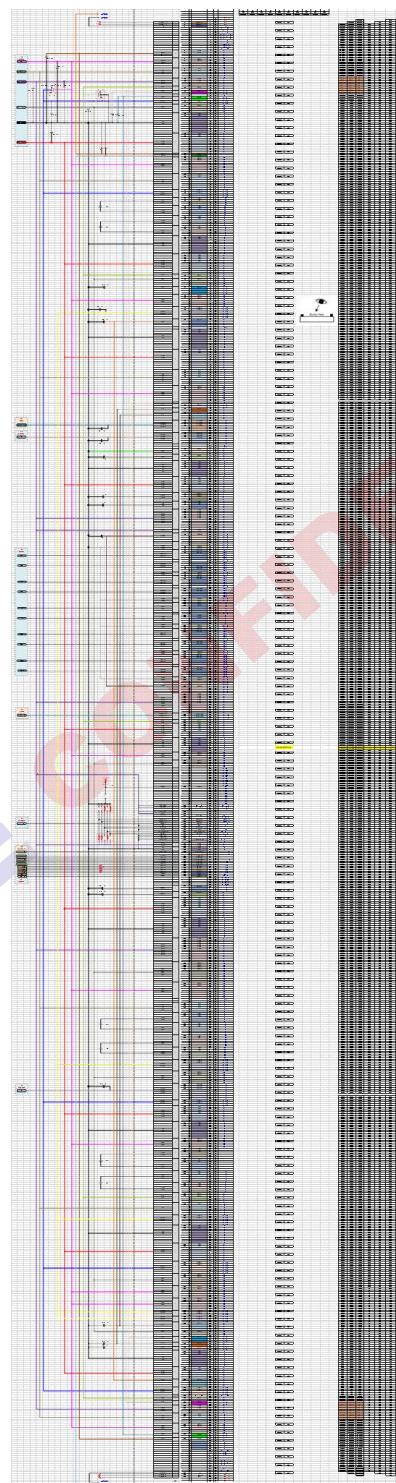
NOTE: “-”Don’t care.

Description	This read byte identifies the OLED module/driver. It is specified by end customer and for this display module project.													
Restriction	-													
Register Availability	<table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In</td> <td>Yes</td> </tr> </tbody> </table>		Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
Status	Availability													
Normal Mode On, Idle Mode Off, Sleep Out	Yes													
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Status	Default Value													
Power On Sequence	OTP Value													
S/W Reset	OTP Value													
H/W Reset	OTP Value													
Flow Chart	 <pre> graph TD     Host[Host] -- RDID3 --&gt; Driver[Driver]     Driver -- Send Parameter --&gt; SendParam[/Send Parameter/] </pre> <p>Legend:</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>													

## 10. Appendix

### 10.1 Application Circuit

A typical application circuit is shown in following figure.



## 10.2 Configuration of External Components

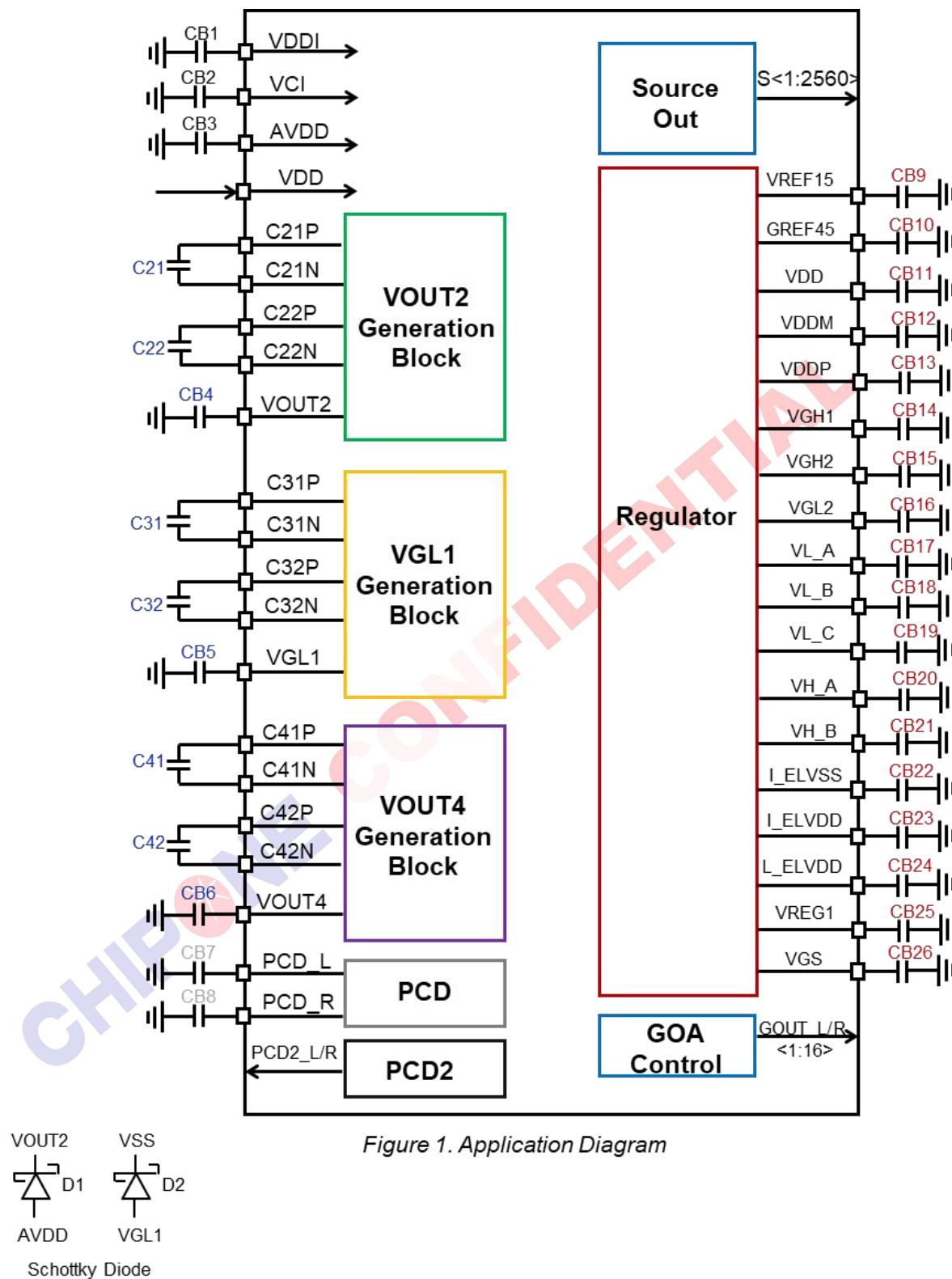


Figure 1. Application Diagram

## 10.3 Specifications of External Components

The following tables show the specifications of external element connected to the ICNA3512'S power Supply circuit. e position.

Table1 Capacitor

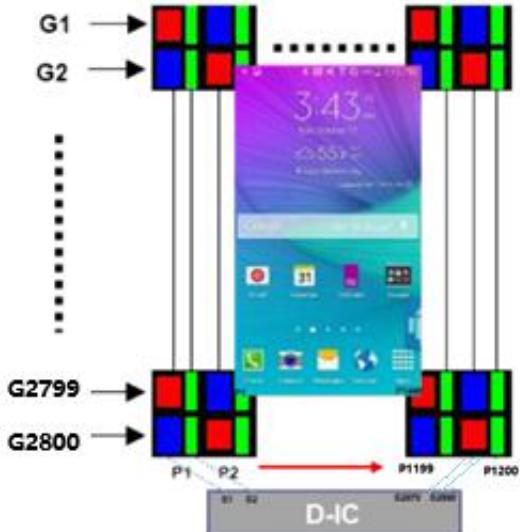
Component Number	Recommended Voltage	Capacity	Tolerance
CB7, CB8 (option)	6V	10.0nF	±10%
CB12, CB13	6V		
CB25, CB26	10V	1.0µF	±10%
C21, C22, C31, C32, C41, C42	25V		
CB9	6V		
CB6, CB10, CB17, CB18, CB19, CB20, CB21, CB22, CB23, CB24	10V	2.2µF	±10%
CB4, CB5, CB14, CB15, CB16	25V		
CB1, CB2, CB11	6V		
CB3	10V	4.7µF	±10%

Table2 of Schottky Diode

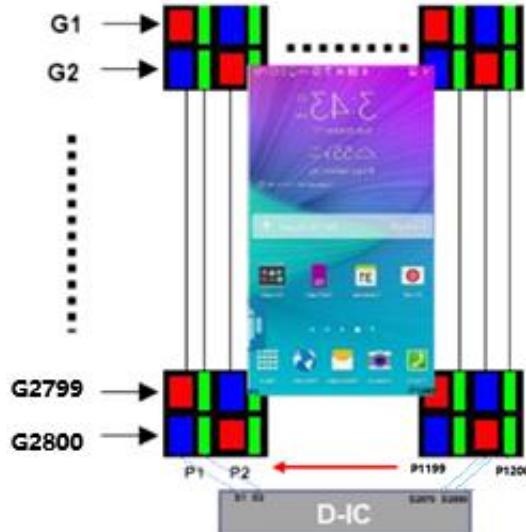
Component Number	Schottky Diode
D1, D2	VF < 0.4V / 100mA at 25°C, VR > 10V

## 10.4 Display Module Position

The position of an AMOLED panel with SPR is always at top as below. When MADCTL's (36h) parameter is 00h and the arrangement of sub pixel rendering is RGBG, the DDIC can support many kinds of connection between the DDIC's source outputs and AMOLED panel with SPR.



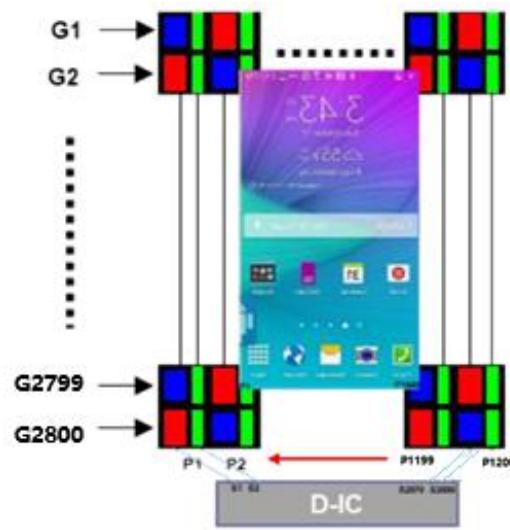
[Case 1]: SW\_MODE = 00, SDIR = 0



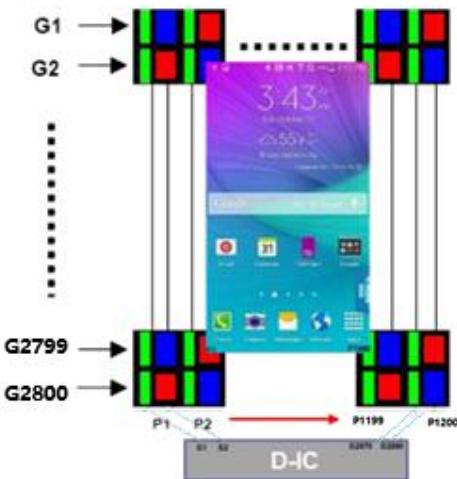
[Case 2]: SW\_MODE = 00, SDIR = 1



[Case 3]: SW\_MODE = 01, SDIR = 0



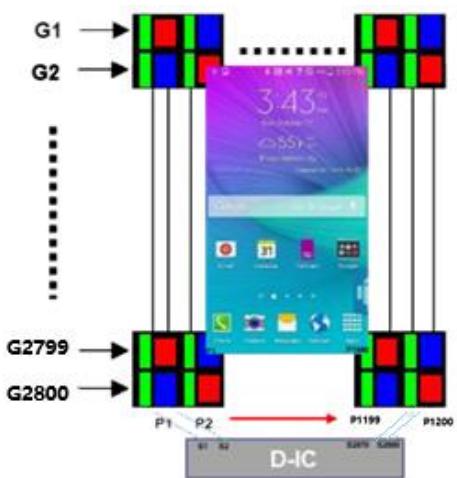
[Case 4]: SW\_MODE = 01, SDIR = 1



[Case 5]: SW\_MODE = 11, SDIR = 0



[Case 6]: SW\_MODE = 11, SDIR = 1



[Case 7]: SW\_MODE = 10, SDIR = 0



[Case 8]: SW\_MODE = 10, SDIR = 1

## 10.5 Pad Coordinates

Pad List:

Pad no.	Pad Name	Center Coordinate	
		X	Y
1	DUMMY_L4	-16300.78	-622.5
2	DUMMY_L3	-16255.6875	-622.5
3	DUMMY_L3	-16210.595	-622.5
4	DUMMY_L3	-16165.505	-622.5
5	PCD2_L	-16120.4125	-622.5
6	VSSDUMMY	-16075.32	-622.5
7	VS_OUT	-16030.2275	-622.5
8	HS_OUT	-15985.135	-622.5
9	CASCADE3_OUT	-15940.045	-622.5
10	CASCADE2_OUT	-15894.9525	-622.5
11	CASCADE1_OUT	-15849.86	-622.5
12	CS_M	-15804.7675	-622.5
13	SCL_M	-15759.675	-622.5
14	SDATA1_M	-15714.5825	-622.5
15	SDATA0_M	-15669.4925	-622.5
16	VSSDUMMY	-15624.4	-622.5
17	VGH1	-15579.3075	-622.5
18	VGH1	-15534.215	-622.5
19	VGH1	-15489.1225	-622.5
20	VGH1	-15444.03	-622.5
21	AVDD	-15398.94	-622.5
22	AVDD	-15353.8475	-622.5
23	AVDD	-15308.755	-622.5
24	AVDD	-15263.6625	-622.5
25	AVDD	-15218.57	-622.5
26	VCI	-15173.4775	-622.5
27	VCI	-15128.3875	-622.5
28	VCI	-15083.295	-622.5
29	VCI	-15038.2025	-622.5
30	VCI	-14993.11	-622.5
31	VDDI	-14948.0175	-622.5
32	VDDI	-14902.9275	-622.5
33	VDDI	-14857.835	-622.5
34	VDDI	-14812.7425	-622.5

35	VGL1	-14767.65	-622.5
36	VGL1	-14722.5575	-622.5
37	VGL2	-14677.465	-622.5
38	VGL2	-14632.375	-622.5
39	TS1	-14587.2825	-622.5
40	VGH2	-14542.19	-622.5
41	VGH2	-14497.0975	-622.5
42	VOUT2	-14452.005	-622.5
43	VOUT2	-14406.9125	-622.5
44	AVSS	-14361.8225	-622.5
45	AVSS	-14316.73	-622.5
46	AVSS	-14271.6375	-622.5
47	AVSS	-14226.545	-622.5
48	VSS	-14181.4525	-622.5
49	VSS	-14136.3625	-622.5
50	VSS	-14091.27	-622.5
51	VSS	-14046.1775	-622.5
52	VSS	-14001.085	-622.5
53	VSS	-13955.9925	-622.5
54	VSS	-13910.9	-622.5
55	VSS	-13865.81	-622.5
56	VSS	-13820.7175	-622.5
57	VSS	-13775.625	-622.5
58	VDD	-13730.5325	-622.5
59	VDD	-13685.44	-622.5
60	VDD	-13640.3475	-622.5
61	VDD	-13595.2575	-622.5
62	VDD	-13550.165	-622.5
63	VDD	-13505.0725	-622.5
64	VDD	-13459.98	-622.5
65	VDD	-13414.8875	-622.5
66	VDD	-13369.7975	-622.5
67	VDD	-13324.705	-622.5
68	PCD_L	-13279.6125	-622.5
69	PCD_R	-13234.52	-622.5
70	AVDD	-13189.4275	-622.5
71	AVDD	-13144.335	-622.5

72	AVDD	-13099.245	-622.5		112	VSS	-11295.5625	-622.5
73	AVDD	-13054.1525	-622.5		113	VSS	-11250.47	-622.5
74	AVDD	-13009.06	-622.5		114	VSS	-11205.3775	-622.5
75	AVDD	-12963.9675	-622.5		115	VSS	-11160.285	-622.5
76	AVDD	-12918.875	-622.5		116	VSS	-11115.1925	-622.5
77	AVDD	-12873.7825	-622.5		117	VSS	-11070.1	-622.5
78	VCI	-12828.6925	-622.5		118	VDD	-11025.01	-622.5
79	VCI	-12783.6	-622.5		119	VDD	-10979.9175	-622.5
80	VCI	-12738.5075	-622.5		120	VDD	-10934.825	-622.5
81	VCI	-12693.415	-622.5		121	VDD	-10889.7325	-622.5
82	VCI	-12648.3225	-622.5		122	VDD	-10844.64	-622.5
83	VCI	-12603.23	-622.5		123	VDD	-10799.5475	-622.5
84	VCI	-12558.14	-622.5		124	VDD	-10754.4575	-622.5
85	VCI	-12513.0475	-622.5		125	VDD	-10709.365	-622.5
86	VOUT2	-12467.955	-622.5		126	VDD	-10664.2725	-622.5
87	VOUT2	-12422.8625	-622.5		127	VDD	-10619.18	-622.5
88	VOUT2	-12377.77	-622.5		128	VGL1	-10574.0875	-622.5
89	VOUT2	-12332.68	-622.5		129	VGL1	-10528.9975	-622.5
90	C22P	-12287.5875	-622.5		130	AVSS	-10483.905	-622.5
91	C22P	-12242.495	-622.5		131	AVSS	-10438.8125	-622.5
92	C22P	-12197.4025	-622.5		132	AVSS	-10393.72	-622.5
93	C22P	-12152.31	-622.5		133	AVSS	-10348.6275	-622.5
94	C22N	-12107.2175	-622.5		134	VH_A	-10303.535	-622.5
95	C22N	-12062.1275	-622.5		135	VH_A	-10258.445	-622.5
96	C22N	-12017.035	-622.5		136	VH_A	-10213.3525	-622.5
97	C22N	-11971.9425	-622.5		137	VH_A	-10168.26	-622.5
98	C22N	-11926.85	-622.5		138	AVDD	-10123.1675	-622.5
99	C21N	-11881.7575	-622.5		139	AVDD	-10078.075	-622.5
100	C21N	-11836.665	-622.5		140	AVDD	-10032.9825	-622.5
101	C21N	-11791.575	-622.5		141	AVDD	-9987.8925	-622.5
102	C21N	-11746.4825	-622.5		142	AVDD	-9942.8	-622.5
103	C21N	-11701.39	-622.5		143	AVDD	-9897.7075	-622.5
104	C21P	-11656.2975	-622.5		144	VOUT4	-9852.615	-622.5
105	C21P	-11611.205	-622.5		145	VOUT4	-9807.5225	-622.5
106	C21P	-11566.115	-622.5		146	VOUT4	-9762.4325	-622.5
107	C21P	-11521.0225	-622.5		147	VOUT4	-9717.34	-622.5
108	C21P	-11475.93	-622.5		148	VOUT4	-9672.2475	-622.5
109	VSS	-11430.8375	-622.5		149	VOUT4	-9627.155	-622.5
110	VSS	-11385.745	-622.5		150	VH_B	-9582.0625	-622.5
111	VSS	-11340.6525	-622.5		151	VH_B	-9536.97	-622.5

152	VH_B	-9491.88	-622.5
153	VH_B	-9446.7875	-622.5
154	TS2	-9401.695	-622.5
155	VSS	-9356.6025	-622.5
156	VSS	-9311.51	-622.5
157	VSS	-9266.4175	-622.5
158	VSS	-9221.3275	-622.5
159	VSS	-9176.235	-622.5
160	VSS	-9131.1425	-622.5
161	VSS	-9086.05	-622.5
162	VSS	-9040.9575	-622.5
163	VSS	-8995.8675	-622.5
164	VSS	-8950.775	-622.5
165	VDD	-8905.6825	-622.5
166	VDD	-8860.59	-622.5
167	VDD	-8815.4975	-622.5
168	VDD	-8770.405	-622.5
169	VDD	-8725.315	-622.5
170	VDD	-8680.2225	-622.5
171	VDD	-8635.13	-622.5
172	VDD	-8590.0375	-622.5
173	VDD	-8544.945	-622.5
174	VDD	-8499.8525	-622.5
175	VCI	-8454.7625	-622.5
176	VCI	-8409.67	-622.5
177	VCI	-8364.5775	-622.5
178	VCI	-8319.485	-622.5
179	VCI	-8274.3925	-622.5
180	VCI	-8229.3	-622.5
181	VCI	-8184.21	-622.5
182	VCI	-8139.1175	-622.5
183	AVDD	-8094.025	-622.5
184	AVDD	-8048.9325	-622.5
185	AVDD	-8003.84	-622.5
186	AVDD	-7958.75	-622.5
187	AVDD	-7913.6575	-622.5
188	AVDD	-7868.565	-622.5
189	AVDD	-7823.4725	-622.5
190	AVDD	-7778.38	-622.5
191	TS3	-7733.2875	-622.5
192	VL_A	-7688.1975	-622.5
193	VL_A	-7643.105	-622.5
194	VL_B	-7598.0125	-622.5
195	VL_B	-7552.92	-622.5
196	VL_C	-7507.8275	-622.5
197	VL_C	-7462.735	-622.5
198	VL_C	-7417.645	-622.5
199	VL_C	-7372.5525	-622.5
200	L_ELVDD	-7327.46	-622.5
201	L_ELVDD	-7282.3675	-622.5
202	L_ELVDD	-7237.275	-622.5
203	L_ELVDD	-7192.185	-622.5
204	L_ELVDD	-7147.0925	-622.5
205	L_ELVDD	-7102	-622.5
206	I_ELVDD	-7056.9075	-622.5
207	I_ELVDD	-7011.815	-622.5
208	I_ELVDD	-6966.7225	-622.5
209	I_ELVDD	-6921.6325	-622.5
210	I_ELVDD	-6876.54	-622.5
211	I_ELVDD	-6831.4475	-622.5
212	TS0	-6786.355	-622.5
213	TS4	-6741.2625	-622.5
214	VSSP	-6696.17	-622.5
215	VSSP	-6651.08	-622.5
216	VSSP	-6605.9875	-622.5
217	VDDP	-6560.895	-622.5
218	VDDP	-6515.8025	-622.5
219	VDDP	-6470.71	-622.5
220	VSS	-6425.62	-622.5
221	VSS	-6380.5275	-622.5
222	VSS	-6335.435	-622.5
223	VSS	-6290.3425	-622.5
224	VSS	-6245.25	-622.5
225	VSS	-6200.1575	-622.5
226	VSS	-6155.0675	-622.5
227	VSS	-6109.975	-622.5
228	VDD	-6064.8825	-622.5
229	VDD	-6019.79	-622.5
230	VDD	-5974.6975	-622.5
231	VDD	-5929.605	-622.5

232	VDD	-5884.5115	-622.5		272	DATA3N	-4080.8325	-622.5
233	VDD	-5839.4225	-622.5		273	DATA3N	-4035.74	-622.5
234	VDD	-5794.33	-622.5		274	DATA3N	-3990.6475	-622.5
235	VDD	-5749.2375	-622.5		275	VSSM	-3945.555	-622.5
236	VREG1	-5704.145	-622.5		276	VSSM	-3900.4625	-622.5
237	VREG1	-5659.0525	-622.5		277	DATAOP	-3855.3725	-622.5
238	VREG1	-5613.9625	-622.5		278	DATAOP	-3810.28	-622.5
239	VREG1	-5568.87	-622.5		279	DATAOP	-3765.1875	-622.5
240	VGS	-5523.7775	-622.5		280	DATAOP	-3720.095	-622.5
241	VGS	-5478.685	-622.5		281	DATAOP	-3675.0025	-622.5
242	VGS	-5433.5925	-622.5		282	VSSM	-3629.91	-622.5
243	VGS	-5388.5025	-622.5		283	DATA0N	-3584.82	-622.5
244	VDDI	-5343.41	-622.5		284	DATA0N	-3539.7275	-622.5
245	VDDI	-5298.3175	-622.5		285	DATA0N	-3494.635	-622.5
246	VDDI	-5253.225	-622.5		286	DATA0N	-3449.5425	-622.5
247	VDDI	-5208.1325	-622.5		287	DATA0N	-3404.45	-622.5
248	VDDI	-5163.04	-622.5		288	VSSM	-3359.3575	-622.5
249	VDDI	-5117.95	-622.5		289	VSSM	-3314.2675	-622.5
250	VDDI	-5072.8575	-622.5		290	CLKP	-3269.175	-622.5
251	VDDI	-5027.765	-622.5		291	CLKP	-3224.0825	-622.5
252	VDDI	-4982.6725	-622.5		292	CLKP	-3178.99	-622.5
253	VDDI	-4937.58	-622.5		293	CLKP	-3133.8975	-622.5
254	VDDI	-4892.4875	-622.5		294	CLKP	-3088.805	-622.5
255	VDDI	-4847.3975	-622.5		295	VSSM	-3043.715	-622.5
256	VDDM	-4802.305	-622.5		296	CLKN	-2998.6225	-622.5
257	VDDM	-4757.2125	-622.5		297	CLKN	-2953.53	-622.5
258	VDDM	-4712.12	-622.5		298	CLKN	-2908.4375	-622.5
259	VDDM	-4667.0275	-622.5		299	CLKN	-2863.345	-622.5
260	VSSM	-4621.9375	-622.5		300	CLKN	-2818.255	-622.5
261	VSSM	-4576.845	-622.5		301	VSSM	-2773.1625	-622.5
262	VSSM	-4531.7525	-622.5		302	VSSM	-2728.07	-622.5
263	VSSM	-4486.66	-622.5		303	DATA1P	-2682.9775	-622.5
264	DATA3P	-4441.5675	-622.5		304	DATA1P	-2637.885	-622.5
265	DATA3P	-4396.475	-622.5		305	DATA1P	-2592.7925	-622.5
266	DATA3P	-4351.385	-622.5		306	DATA1P	-2547.7025	-622.5
267	DATA3P	-4306.2925	-622.5		307	DATA1P	-2502.61	-622.5
268	DATA3P	-4261.2	-622.5		308	VSSM	-2457.5175	-622.5
269	VSSM	-4216.1075	-622.5		309	DATA1N	-2412.425	-622.5
270	DATA3N	-4171.015	-622.5		310	DATA1N	-2367.3325	-622.5
271	DATA3N	-4125.9225	-622.5		311	DATA1N	-2322.24	-622.5

312	DATA1N	-2277.15	-622.5		352	VDD	-473.4675	-622.5
313	DATA1N	-2232.0575	-622.5		353	VDD	-428.375	-622.5
314	VSSM	-2186.965	-622.5		354	VDD	-383.2825	-622.5
315	VSSM	-2141.8725	-622.5		355	VDD	-338.19	-622.5
316	DATA2P	-2096.78	-622.5		356	VDD	-293.0975	-622.5
317	DATA2P	-2051.69	-622.5		357	VSS	-248.0075	-622.5
318	DATA2P	-2006.5975	-622.5		358	VSS	-202.915	-622.5
319	DATA2P	-1961.505	-622.5		359	VSS	-157.8225	-622.5
320	DATA2P	-1916.4125	-622.5		360	VSS	-112.73	-622.5
321	VSSM	-1871.32	-622.5		361	VSS	-67.6375	-622.5
322	DATA2N	-1826.2275	-622.5		362	VSS	-22.545	-622.5
323	DATA2N	-1781.1375	-622.5		363	VSS	22.545	-622.5
324	DATA2N	-1736.045	-622.5		364	AVDD	67.6375	-622.5
325	DATA2N	-1690.9525	-622.5		365	AVDD	112.73	-622.5
326	DATA2N	-1645.86	-622.5		366	AVDD	157.8225	-622.5
327	VSSM	-1600.7675	-622.5		367	AVDD	202.915	-622.5
328	VSSM	-1555.675	-622.5		368	AVSS	248.0075	-622.5
329	VSSM	-1510.585	-622.5		369	AVSS	293.0975	-622.5
330	VSSM	-1465.4925	-622.5		370	AVSS	338.19	-622.5
331	VDDM	-1420.4	-622.5		371	AVSS	383.2825	-622.5
332	VDDM	-1375.3075	-622.5		372	VGMA1	428.375	-622.5
333	VDDM	-1330.215	-622.5		373	VGMA2	473.4675	-622.5
334	VDDM	-1285.125	-622.5		374	VGMA3	518.5575	-622.5
335	VDDI	-1240.0325	-622.5		375	VGMA4	563.65	-622.5
336	VDDI	-1194.94	-622.5		376	VGMA5	608.7425	-622.5
337	VDDI	-1149.8475	-622.5		377	VGMA6	653.835	-622.5
338	VDDI	-1104.755	-622.5		378	VGMA7	698.9275	-622.5
339	VDDI	-1059.6625	-622.5		379	VGMA8	744.02	-622.5
340	VDDI	-1014.5725	-622.5		380	VGMA9	789.11	-622.5
341	VDDI	-969.48	-622.5		381	PSWAP	834.2025	-622.5
342	VDDI	-924.3875	-622.5		382	DB<0>	879.295	-622.5
343	VDDI	-879.295	-622.5		383	DB<1>	924.3875	-622.5
344	VDDI	-834.2025	-622.5		384	DB<2>	969.48	-622.5
345	I_ELVDD_PVC	-789.11	-622.5		385	DB<3>	1014.5725	-622.5
346	I_ELVDD_PVC	-744.02	-622.5		386	DB<4>	1059.6625	-622.5
347	I_ELVDD_PVC	-698.9275	-622.5		387	DB<5>	1104.755	-622.5
348	VGL1	-653.835	-622.5		388	DB<6>	1149.8475	-622.5
349	VGL1	-608.7425	-622.5		389	DB<7>	1194.94	-622.5
350	VDD	-563.65	-622.5		390	TVS_RDX	1240.0325	-622.5
351	VDD	-518.5575	-622.5		391	THS_WRX	1285.125	-622.5

392	DCLK	1330.215	-622.5		432	GREF45	3133.8975	-622.5
393	DE_DnC	1375.3075	-622.5		433	VREF15	3178.99	-622.5
394	nCS	1420.4	-622.5		434	VREF15	3224.0825	-622.5
395	EXT_OSC	1465.4925	-622.5		435	VREF15	3269.175	-622.5
396	TEST<0>	1510.585	-622.5		436	VDD	3314.2675	-622.5
397	DSWAP<0>	1555.675	-622.5		437	VDD	3359.3575	-622.5
398	DSWAP<1>	1600.7675	-622.5		438	VDD	3404.45	-622.5
399	nRESET	1645.86	-622.5		439	VDD	3449.5425	-622.5
400	IM1	1690.9525	-622.5		440	VDD	3494.635	-622.5
401	CPHY_EN	1736.045	-622.5		441	VDD	3539.7275	-622.5
402	BTM	1781.1375	-622.5		442	VDD	3584.82	-622.5
403	EXT_DVDD_EN	1826.2275	-622.5		443	VDD	3629.91	-622.5
404	HZ_OPT	1871.32	-622.5		444	VDD	3675.0025	-622.5
405	BIST_EN	1916.4125	-622.5		445	VDD	3720.095	-622.5
406	FPS_EN	1961.505	-622.5		446	VSS	3765.1875	-622.5
407	CASCADE_EN	2006.5975	-622.5		447	VSS	3810.28	-622.5
408	M_S	2051.69	-622.5		448	VSS	3855.3725	-622.5
409	VDDI	2096.78	-622.5		449	VSS	3900.4625	-622.5
410	VDDI	2141.8725	-622.5		450	VSS	3945.555	-622.5
411	VSS	2186.965	-622.5		451	VSS	3990.6475	-622.5
412	VSS	2232.0575	-622.5		452	VSS	4035.74	-622.5
413	F_SPI_SCLK	2277.15	-622.5		453	VSS	4080.8325	-622.5
414	F_SPI_SCLK	2322.24	-622.5		454	VSS	4125.9225	-622.5
415	F_SPI_SI	2367.3325	-622.5		455	VSS	4171.015	-622.5
416	F_SPI_SO	2412.425	-622.5		456	VDDI	4216.1075	-622.5
417	F_SPI_RESET	2457.5175	-622.5		457	VDDI	4261.2	-622.5
418	F_SPI_WP	2502.61	-622.5		458	VDDI	4306.2925	-622.5
419	F_SPI_CS	2547.7025	-622.5		459	VDDI	4351.385	-622.5
420	GPO<0>	2592.7925	-622.5		460	VDDI	4396.475	-622.5
421	GPO<1>	2637.885	-622.5		461	VDDI	4441.5675	-622.5
422	GPO<2>	2682.9775	-622.5		462	VDDI	4486.66	-622.5
423	GPO<3>	2728.07	-622.5		463	VDDI	4531.7525	-622.5
424	SWIRE	2773.1625	-622.5		464	VDDI	4576.845	-622.5
425	SWIRE2	2818.255	-622.5		465	VDDI	4621.9375	-622.5
426	TEST<1>	2863.345	-622.5		466	VDDI	4667.0275	-622.5
427	TEST<2>	2908.4375	-622.5		467	VDDI	4712.12	-622.5
428	TEST<3>	2953.53	-622.5		468	AVSS	4757.2125	-622.5
429	TEST<4>	2998.6225	-622.5		469	AVSS	4802.305	-622.5
430	GREF45	3043.715	-622.5		470	AVSS	4847.3975	-622.5
431	GREF45	3088.805	-622.5		471	AVSS	4892.4875	-622.5

472	AVSS	4937.58	-622.5		512	C42N	6741.2625	-622.5
473	AVSS	4982.6725	-622.5		513	C42N	6786.355	-622.5
474	AVSS	5027.765	-622.5		514	C42N	6831.4475	-622.5
475	AVSS	5072.8575	-622.5		515	C42N	6876.54	-622.5
476	AVSS	5117.95	-622.5		516	VOUT4	6921.6325	-622.5
477	AVSS	5163.04	-622.5		517	VOUT4	6966.7225	-622.5
478	AVDD	5208.1325	-622.5		518	VOUT4	7011.815	-622.5
479	AVDD	5253.225	-622.5		519	VOUT4	7056.9075	-622.5
480	AVDD	5298.3175	-622.5		520	VOUT4	7102	-622.5
481	AVDD	5343.41	-622.5		521	VOUT4	7147.0925	-622.5
482	AVDD	5388.5025	-622.5		522	AVSS	7192.185	-622.5
483	AVDD	5433.5925	-622.5		523	AVSS	7237.275	-622.5
484	AVDD	5478.685	-622.5		524	AVSS	7282.3675	-622.5
485	AVDD	5523.7775	-622.5		525	AVSS	7327.46	-622.5
486	TS7	5568.87	-622.5		526	AVSS	7372.5525	-622.5
487	TS5	5613.9625	-622.5		527	AVSS	7417.645	-622.5
488	VCI	5659.0525	-622.5		528	I_ELVSS	7462.735	-622.5
489	VCI	5704.145	-622.5		529	I_ELVSS	7507.8275	-622.5
490	VCI	5749.2375	-622.5		530	I_ELVSS	7552.92	-622.5
491	VCI	5794.33	-622.5		531	I_ELVSS	7598.0125	-622.5
492	VCI	5839.4225	-622.5		532	I_ELVSS	7643.105	-622.5
493	C41N	5884.515	-622.5		533	I_ELVSS	7688.1975	-622.5
494	C41N	5929.605	-622.5		534	I_ELVSS	7733.2875	-622.5
495	C41N	5974.6975	-622.5		535	I_ELVSS	7778.38	-622.5
496	C41N	6019.79	-622.5		536	VOUT2	7823.4725	-622.5
497	C41N	6064.8825	-622.5		537	VOUT2	7868.565	-622.5
498	C41P	6109.975	-622.5		538	VOUT2	7913.6575	-622.5
499	C41P	6155.0675	-622.5		539	VDD	7958.75	-622.5
500	C41P	6200.1575	-622.5		540	VDD	8003.84	-622.5
501	C41P	6245.25	-622.5		541	VDD	8048.9325	-622.5
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504	C42P	6380.5275	-622.5		544	VDD	8184.21	-622.5
505	C42P	6425.62	-622.5		545	VDD	8229.3	-622.5
506	C42P	6470.71	-622.5		546	VDD	8274.3925	-622.5
507	C42P	6515.8025	-622.5		547	VSS	8319.485	-622.5
508	C42P	6560.895	-622.5		548	VSS	8364.5775	-622.5
509	C42P	6605.9875	-622.5		549	VSS	8409.67	-622.5
510	C42N	6651.08	-622.5		550	VSS	8454.7625	-622.5
511	C42N	6696.17	-622.5		551	VSS	8499.8525	-622.5

552	VSS	8544.945	-622.5		592	VCI	10348.6275	-622.5
553	VSS	8590.0375	-622.5		593	VOUT4	10393.72	-622.5
554	VSS	8635.13	-622.5		594	VOUT4	10438.8125	-622.5
555	AVDD	8680.2225	-622.5		595	VOUT4	10483.905	-622.5
556	AVDD	8725.315	-622.5		596	VOUT4	10528.9975	-622.5
557	AVDD	8770.405	-622.5		597	VOUT4	10574.0875	-622.5
558	AVDD	8815.4975	-622.5		598	VSS	10619.18	-622.5
559	AVDD	8860.59	-622.5		599	VSS	10664.2725	-622.5
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561	C31N	8950.775	-622.5		601	VSS	10754.4575	-622.5
562	C31N	8995.8675	-622.5		602	VSS	10799.5475	-622.5
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564	C31N	9086.05	-622.5		604	VSS	10889.7325	-622.5
565	C31P	9131.1425	-622.5		605	VSS	10934.825	-622.5
566	C31P	9176.235	-622.5		606	VSS	10979.9175	-622.5
567	C31P	9221.3275	-622.5		607	VDD	11025.01	-622.5
568	C31P	9266.4175	-622.5		608	VDD	11070.1	-622.5
569	C31P	9311.51	-622.5		609	VDD	11115.1925	-622.5
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573	C32P	9491.88	-622.5		613	VDD	11295.5625	-622.5
574	C32P	9536.97	-622.5		614	VDD	11340.6525	-622.5
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586	VGL1	10078.075	-622.5		626	AVSS	11881.7575	-622.5
587	VCI	10123.1675	-622.5		627	AVSS	11926.85	-622.5
588	VCI	10168.26	-622.5		628	AVDD	11971.9425	-622.5
589	VCI	10213.3525	-622.5		629	AVDD	12017.035	-622.5
590	VCI	10258.445	-622.5		630	AVDD	12062.1275	-622.5
591	VCI	10303.535	-622.5		631	AVDD	12107.2175	-622.5

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636	AVDD	12332.68	-622.5		676	VH_B	14136.3625	-622.5
637	AVDD	12377.77	-622.5		677	VH_B	14181.4525	-622.5
638	AVDD	12422.8625	-622.5		678	VOUT2	14226.545	-622.5
639	AVDD	12467.955	-622.5		679	VOUT2	14271.6375	-622.5
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644	VOUT4	12693.415	-622.5		684	VGL1	14497.0975	-622.5
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646	VL_C	12783.6	-622.5		686	VGL2	14587.2825	-622.5
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652	AVSS	13054.1525	-622.5		692	VCI	14857.835	-622.5
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655	VH_A	13189.4275	-622.5		695	VCI	14993.11	-622.5
656	VL_B	13234.52	-622.5		696	AVDD	15038.2025	-622.5
657	VL_B	13279.6125	-622.5		697	AVDD	15083.295	-622.5
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662	VSS	13505.0725	-622.5		702	VGH2	15308.755	-622.5
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733	DUMMYO_R2	16146.5125	647.5
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