

## RM67199 Datasheet

Single Chip Driver with 16.7M color  
for 1080RGBx1920 OLED driver

CONFIDENTIAL

**Revision : 0.0**

**Date : Mar. 21, 2017**

## Revision History

Version	Date	Description	Page
0.0	2017/3/21	Initial	

CONFIDENTIAL

## Table of Contents

<b>1. General Description .....</b>	<b>6</b>
<b>2. Features .....</b>	<b>6</b>
<b>3. Pin Description .....</b>	<b>9</b>
<b>3.1 Power Supply Pins .....</b>	<b>9</b>
<b>3.2 Interface Pins .....</b>	<b>10</b>
<b>3.3 MIPI Interface Pins .....</b>	<b>11</b>
<b>3.5 Driver Output Pins (Pins for Panel).....</b>	<b>14</b>
<b>3.6 DC/DC Converter Pins.....</b>	<b>15</b>
<b>3.7 Pass Pins .....</b>	<b>17</b>
<b>3.8 Test Pins.....</b>	<b>17</b>
<b>4. Function Description .....</b>	<b>18</b>
<b>4.1 Interface Type Selection .....</b>	<b>18</b>
<b>4.2 Serial Interface .....</b>	<b>18</b>
4.2.1 Write Cycle and Sequence .....	18
4.2.2 Read Cycle and Sequence .....	20
4.2.3 Break and Pause Sequence .....	21
<b>4.3 Display Serial Interface (DSI) .....</b>	<b>22</b>
4.3.1 DSI Protocol.....	23
4.3.2 Processor to Peripheral Transactions.....	25
4.3.3 Peripheral-to-Processor LP Transmission.....	30
4.3.4 DSI Video Mode Interface Timing.....	33
4.3.5 Error Correction Code (ECC).....	34
4.3.6 Notice.....	35
<b>4.4 Tearing Effect Output.....</b>	<b>36</b>
4.4.1 Tearing Effect Line Mode.....	36
4.4.2 Tearing Effect Line Timing.....	38
<b>5. Command.....</b>	<b>39</b>
<b>5.1. Command List.....</b>	<b>39</b>
<b>5.2. Command Description.....</b>	<b>43</b>
(0000h) NOP .....	43
(0100h) SWRESET : Software Reset.....	44
(0400h~0402h) RDDID : Get Display ID.....	45
(0500h) RDNUMED : Get Number of Errors on DSI .....	46
(0A00h) RDDPDM : Get Power Mode.....	47
(0B00h) RDDMADCTR : Get Address Mode .....	48
(0C00h) RDDCOLMOD : Get Pixel Format .....	49
(0D00h) RDDDIM : Get Display Mode .....	50
(0E00h) RDDSM : Get Signal Mode .....	51
(0F00h) RDDSDR : Get Diagnostic Result .....	52
(1000h) SLPIN : Enter Sleep mode .....	53
(1100h) SLPOUT : Exit Sleep Mode .....	54
(2000h) INVOFF : Exit Invert Mode .....	55

(2100h) INVON : Enter Invert Mode .....	56
(2200h) ALLPOFF : Set All Pixel Off.....	57
(2300h) ALLPON : Set All Pixel On.....	58
(2800h) DISPOFF : Set Display Off.....	59
(2900h) DISPON : Set Display On .....	60
(2C00h) RAMWR : Write Memory Start.....	61
(3400h) TEOFF : Set Tear OFF.....	62
(3500h) TEON : Set Tear ON.....	63
(3600h) MADCTR : Set Address Mode .....	64
(3800h) IDMOFF : Exit Idle Mode .....	66
(3900h) IDMON : Enter_idle_mode.....	67
(3A00h) COLMOD : Set Pixel Format.....	68
(3C00h) RAMWRC : Write Memory Continuous .....	69
(4400h) STESL : Set Tear Scanline.....	70
(4500h) GSL : Get Scanline.....	71
(4F00h) DSTBON : Set Deep Standby Mode.....	72
(5100h) WRDISBV : Write Display Brightness .....	73
(5200h) RDDISBV : Read Display Brightness.....	74
(5300h) WRCTRLD : Write Control Display.....	75
(5400h) RDCTRLD : Read Control Display.....	76
(5800h) WRCE : Write CE .....	77
(5900h) RDCE : Read CE .....	78
(5A00h) WRCE1 : Write CE1.....	79
(5B00h) RDCE1 : Read CE1 .....	80
(5C00h) WRCE2 : Write CE2 .....	81
(5D00h) RDCE2 : Read CE2 .....	82
(6200h) WRTMR : Write CE3 (temper).....	83
(6300h) RDTMR : Read CE3 (temper).....	84
(6400h) WRPA : Write CE4 (Paper) .....	85
(6500h) RDPA : Read CE4 (Paper).....	86
(6600h) WRWB : Write CE5 (WB).....	87
(6700h) RDWB : Read CE5 (WB).....	88
(6A00h) WRHDR : Write CE6 (HDR) .....	89
(6B00h) RDHDR : Read CE6 (HDR).....	90
(A100h ~ A104h) RDDDBS : Read DDB Start .....	91
(A800h ~ A804h) RDDDBC : Read DDB Continue .....	92
(AA00h) RDFCS : Read First Checksum.....	93
(AF00h) RDCCS : Read Continue Checksum .....	94
(C200h) SETDSIMODE : Set DSI Mode.....	95
(DA00h) RDCTRLD1 : Read Control ID1 .....	96
(DB00h) RDCTRLD2 : Read Control ID2 .....	97
(DC00h) RDCTRLD3 : Read Control ID3 .....	98
(FE00h) WRMAUCCTR : Write CMD Page Switch .....	99
(FF00h) RDMAUCCTR : Read CMD Page.....	100

<b>6. Electrical Characteristics .....</b>	<b>101</b>
<b>6.1 Absolute Maximum Ratings.....</b>	<b>101</b>
<b>6.2 ESD Protection Level.....</b>	<b>101</b>
<b>6.3 Latch-Up Protection Level .....</b>	<b>101</b>
<b>6.4 DC Characteristics.....</b>	<b>102</b>
6.4.1 Basic Characteristics.....	102
<b>6.5 AC Characteristics.....</b>	<b>107</b>

---

6.5.1 Serial Interface Characteristics.....	107
6.5.2 DSI Timing Characteristics .....	108
6.5.3 Reset Timing .....	112
<b>7. Power Generation.....</b>	<b>113</b>
7.1 DC/DC Converter Circuit .....	113
7.2 External Component.....	114
<b>8. Power Sequence .....</b>	<b>116</b>
8.1 Power On Sequence .....	116
8.2 Power Off Sequence .....	117
<b>9. Chip Information .....</b>	<b>118</b>

CONFIDENTIAL

## 1. General Description

The RM67199 device is a single chip solution for LTPS AMOLED that incorporates gate drivers and is capable of 1080RGBx1920 operation. It utilizes SPR (sub pixel rendering) algorithm to reduce pixel size while keeping the same picture quality. It includes embedded SRAM which is utilized as frame buffer. Also a timing controller with glass interface level-shifters and a glass power supply circuit is incorporated.

The RM67199 supports MIPI Interface and serial peripheral interfaces (SPI).

The RM67199 is also able to make gamma correction settings separately for RGB dots to allow benign adjustments according to panel characteristics, resulting in higher display qualities. A deep standby mode is also supported for high power saving.

This LSI is very suitable for small and medium-sized portable mobile solutions requiring long-term driving capabilities especially for cellular phone application.

## 2. Features

- Single chip FHD AMOLED controller/driver
- Display resolution option
  - FHD SPR (1080x 2x 1920)
  - HD Real (720x 3x 1280)
- Display Data Memory
- Display mode (Color mode)
  - Full color mode: 16.7M-colors (24-bit)
  - Reduce color mode: 262K colors (18-bit)
  - Reduce color mode: 65K colors (16-bit)
  - Idle mode: 8-colors
- Interface
  - 3-wire/4-wire SPI
  - MIPI Display Serial Interface, Support 3 & 4 data lanes (max data rate is 1Gbps/lane)
- Abundant color display and drawing functions
  - Programmable gamma correction function for 16.7 million color display
  - Individual gamma correction setting for RGB dots
- Color Enhancement
  - Local Saturation Adjustment
  - Sharpness/Skin Tone/Local Hue Adjustment
- Rendering IP
  - Support FHD Rendering function
  - Support RGB delta and RGBG rendering types

- Peripheral Control Timing and Power Generator
  - Internal oscillator
  - 2160ch output
  - Support programmable GOA control
  - Internal Pump for AVEE/VCL/VGH/VGL
  - Support 8-bit DAC output
  - Support S-wire interface for power IC control
- Miscellaneous Function
  - Built-in OTP (MTP) for adjusting gamma, timing, and etc.
- Operating Condition
  - VDDI: 1.65V~ 3.6V (for Regulator Power Source/Interface Power)
  - VDDA/VDDDB/VDDR: 2.5V~ 3.6V (for Analog Power Supply)
  - VCC/VDDAM: 1.65V~ 3.6V (for DVDD/MVDDA Regulator)
  - AVDD: 4.5V~ 6.5V
  - Operating temperature: -40~85°C
  - Storage temperature: -55~ 125°C
- Package: COG

CONFIDENTIAL

## ■ Power Supply Specification

No.	Item	Description	
1	Source Driver	2160 pins	
2	Gate control timing Level shift	VGHR - VGLR	
3	Input Voltage	VDDI	1.65V ~ 3.3V
		VDD (VDDA/VDDDB/VDDR)	2.5V ~ 3.6V
		VCC	Connect to VDDI
		VDDAM	Connect to VDDI
		AVDD	4.5V ~ 6.5V
4	OLED drive voltages	VGHR	3.5V ~ 12V (Step= 0.1V)
		VGLR	-3.5V ~ -12V (Step= -0.1V)
		VREFP5	0.2V ~ 6V (Step= 0.1V)
		VREFN5	-0.2V ~ -6V (Step= -0.1V)
5	Internal step-up circuits	AVEE	AVDD x (-1)
		VGH	AVDD + VDD, AVDD x 2 AVDD x 2+ VDD, AVDD x 3
		VGL	AVEE – AVDD, AVEE x 2 – VDD AVEE x 2 – AVDD
		VCL	VDD x (-1)

### 3. Pin Description

#### 3.1 Power Supply Pins

Signal	I/O	Function
VDDA	P	Power supply for Analog circuit VDDA, VDDDB and VDDDR should be the same input voltage level
VDDDB	P	Power supply for DC/DC converter VDDA, VDDDB and VDDDR should be the same input voltage level
VDDDR	P	Power supply for Regulator system VDDA, VDDDB and VDDDR should be the same input voltage level
VDDAM	P	Power supply for MIPI analog regulator system
VDDI	P	Power supply for interface system except MIPI interface
VCC	P	Power supply for Regulator system VCC needs connected to VDDI
AVDD	P	Power supply for Analog system
VSSA	P	System ground for Analog circuit
VSSB	P	System ground for DC/DC converter
VSSR	P	System ground for regulator system
VSSAM	P	System ground for internal MIPI analog system
VSSI	P	System ground for interface system except MIPI interface
DVSS	P	System ground for internal digital system
AVSS	P	System ground for source OP system.
MTP_PWR	P	MTP programming power supply pin (8V typical) Must be left open or connected to DVSS in normal condition.

### 3.2 Interface Pins

Signal	I/O	Function
CSX	I	Chip select input pin ("Low" enable) in 80-series MPU I/F and SPI I/F. This pin is not used for MIPI I/F, please connect to VSSI.
SCL	I	SCL: Synchronous clock signal in SPI I/F. This pin is not used for MIPI I/F, please connect to VSSI.
DCX	I	Display data / command selection in 8-bit SPI I/F. DCX = "0" : Command DCX = "1" : Display data or Parameter This pin is not used for 9-bit/16-bit SPI or MIPI I/F, please connect to VSSI.
SDI	I/O	SDI: serial input signals in SPI I/F. The data is input on the rising/falling edge of the SCL signal. This pin is not used for MIPI I/F, please connect to VSSI.
SDO	O	Serial output signal in SPI I/F. The data is output on the rising/falling edge of the SCL signal. If the host places the SDI line into high-impedance state during the read interval, the SDI and SDO can be tied together. This pin is not used for MIPI I/F, please open it.

CONFIDENTIAL

### 3.3 MIPI Interface Pins

Signal	I/O	Function									
HSSI_CLK_P HSSI_CLK_N	I	-These pins are DSI-CLK+/- differential clock signals if MIPI interface is used. -HSSI_CLK_P/N are differential small amplitude signals. Ensure the trace length is shortest so that the COG resistance is less than 10 ohm. -If not used, please connect these pins to VSSAM.									
HSSI_D0_P HSSI_D0_N	I/O	-These pins are DSI-D0+/- differential data signals if MIPI interface is used. -HSSI_D0_P/N are differential small amplitude signals. Ensure the trace length is shortest so that the COG resistance is less than 10 ohm. -If not used, please connect these pins to VSSAM.									
HSSI_D1_P HSSI_D1_N	I/O	-These pins are DSI-D1+/- differential data signals if MIPI interface is used. -HSSI_D1_P/N are differential small amplitude signals. Ensure the trace length is shortest so that the COG resistance is less than 10 ohm. -If not used, please connect these pins to VSSAM.									
HSSI_D2_P HSSI_D2_N	I/O	-These pins are differential data signals if MIPI interface is used. -HSSI_D2_P/N are differential small amplitude signals. Ensure the trace length is shortest so that the COG resistance is less than 10 ohm. -If not used, please connect these pins to VSSAM.									
HSSI_D3_P HSSI_D3_N	I/O	-These pins are differential data signals if MIPI interface is used. -HSSI_D3_P/N are differential small amplitude signals. Ensure the trace length is shortest so that the COG resistance is less than 10 ohm. -If not used, please connect these pins to VSSAM.									
LANSEL[1:0]	I	Input pin to select number of data lanes in MIPI interface.									
		<table border="1"> <thead> <tr> <th>LANSEL[1]</th> <th>LANSEL[0]</th> <th>DATA LANE of MIPI</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1</td> <td>4 data lane</td> </tr> <tr> <td>1</td> <td>0</td> <td>3 data lane</td> </tr> </tbody> </table>	LANSEL[1]	LANSEL[0]	DATA LANE of MIPI	1	1	4 data lane	1	0	3 data lane
		LANSEL[1]	LANSEL[0]	DATA LANE of MIPI							
1	1	4 data lane									
1	0	3 data lane									
If not used, please connect to VSSI.											

DSWAP[2:0] PSWAP	I	Input pin to select HSSI_D0/D1/D2/D3 data lane sequence and polarity in high speed interface only.											
		For MIPI interface, both DSWAP and PSWAP function are available.											
		If not used, please connect to VSSI.											
		PSWAP	DSWAP[2:0]	HSSI_ D3_P	HSSI_ D3_N	HSSI_ D0_P	HSSI_ D0_N	HSSI_ CLK_P	HSSI_ CLK_N	HSSI_ D1_P	HSSI_ D1_N	HSSI_ D2_P	HSSI_ D2_N
		0	000	D3P	D3N	D0P	D0N	CLKP	CLKN	D1P	D1N	D2P	D2N
			001	D3P	D3N	D2P	D2N	CLKP	CLKN	D1P	D1N	D0P	D0N
			010	D2P	D2N	D1P	D1N	CLKP	CLKN	D0P	D0N	D3P	D3N
			011	D0P	D0N	D1P	D1N	CLKP	CLKN	D2P	D2N	D3P	D3N
			100	D3P	D3N	D1P	D1N	CLKP	CLKN	D0P	D0N	D2P	D2N
			101	D3P	D3N	D1P	D1N	CLKP	CLKN	D2P	D2N	D0P	D0N
			110	D2P	D2N	D0P	D0N	CLKP	CLKN	D1P	D1N	D3P	D3N
			111	D0P	D0N	D2P	D2N	CLKP	CLKN	D1P	D1N	D3P	D3N
		1	000	D3N	D3P	D0N	D0P	CLKN	CLKP	D1N	D1P	D2N	D2P
			001	D3N	D3P	D2N	D2P	CLKN	CLKP	D1N	D1P	D0N	D0P
010	D2N		D2P	D1N	D1P	CLKN	CLKP	D0N	D0P	D3N	D3P		
011	D0N		D0P	D1N	D1P	CLKN	CLKP	D2N	D2P	D3N	D3P		
100	D3N		D3P	D1N	D1P	CLKN	CLKP	D0N	D0P	D2N	D2P		
101	D3N		D3P	D1N	D1P	CLKN	CLKP	D2N	D2P	D0N	D0P		
110	D2N		D2P	D0N	D0P	CLKN	CLKP	D1N	D1P	D3N	D3P		
111	D0N		D0P	D2N	D2P	CLKN	CLKP	D1N	D1P	D3N	D3P		

NOTE: "1" = VDDI level, "0" = VSSI level.

### 3.4 Interface Logic Pins

Signal	I/O	Function															
RSTN	I	This signal will reset the device and must be applied to properly initialize the chip. Signal is active low.															
IM[1:0]	I	Interface type selection. The connections of IM[1:0] which not shown in table are invalid.															
		<table border="1"> <thead> <tr> <th>IM[:0]</th> <th>Display Data</th> <th>Command</th> </tr> </thead> <tbody> <tr> <td>00</td> <td>MIPI DSI,</td> <td>MIPI DSI or 16-bit SPI</td> </tr> <tr> <td>01</td> <td>N/A</td> <td>9-bit SPI3 (SCL rising edge trigger), SDI/SDO</td> </tr> <tr> <td>10</td> <td>N/A</td> <td>8-bit SPI4 (SCL rising edge trigger), SDI/SDO</td> </tr> <tr> <td>11</td> <td>N/A</td> <td>16-bit SPI</td> </tr> </tbody> </table>	IM[:0]	Display Data	Command	00	MIPI DSI,	MIPI DSI or 16-bit SPI	01	N/A	9-bit SPI3 (SCL rising edge trigger), SDI/SDO	10	N/A	8-bit SPI4 (SCL rising edge trigger), SDI/SDO	11	N/A	16-bit SPI
		IM[:0]	Display Data	Command													
		00	MIPI DSI,	MIPI DSI or 16-bit SPI													
		01	N/A	9-bit SPI3 (SCL rising edge trigger), SDI/SDO													
10	N/A	8-bit SPI4 (SCL rising edge trigger), SDI/SDO															
11	N/A	16-bit SPI															
00	MIPI DSI,	MIPI DSI or 16-bit SPI															
01	N/A	9-bit SPI3 (SCL rising edge trigger), SDI/SDO															
10	N/A	8-bit SPI4 (SCL rising edge trigger), SDI/SDO															
11	N/A	16-bit SPI															
BSTM[2:0]	I	Boost mode selection pin.															
		<table border="1"> <thead> <tr> <th colspan="3">BSTM[2:0]</th> <th>Mode (Default= 111)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>4PWR (VDDI, VDD, AVDD, AVEE) AVDD: by external power AVEE: by external power</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>3PWR (VDDI, VDD, AVDD) AVDD: enabled by OLED_EN AVEE: by internal CP</td> </tr> </tbody> </table>	BSTM[2:0]			Mode (Default= 111)	0	0	0	4PWR (VDDI, VDD, AVDD, AVEE) AVDD: by external power AVEE: by external power	1	1	1	3PWR (VDDI, VDD, AVDD) AVDD: enabled by OLED_EN AVEE: by internal CP			
		BSTM[2:0]			Mode (Default= 111)												
0	0	0	4PWR (VDDI, VDD, AVDD, AVEE) AVDD: by external power AVEE: by external power														
1	1	1	3PWR (VDDI, VDD, AVDD) AVDD: enabled by OLED_EN AVEE: by internal CP														
0	0	0	4PWR (VDDI, VDD, AVDD, AVEE) AVDD: by external power AVEE: by external power														
BIST_EN	I	Normal/BIST/model selection by BIST_EN: 0: Normal Mode 1: BIST Mode (Please connect to "L" for Normal Operation)															
SWIRE	O	Swire protocol setting pin (Note: "H" = VDDI level, "L" = VSSI level.)															
OLED_EN	O	Power IC enable control pin (Note: "H" = VDDI level, "L" = VSSI level.)															
TE_R TE_L	O	Tearing effect output pin to synchronize MCU to frame writing, activated by SW command. When this pin is not activated, this pin is output low. If not used, please open this pin.															

NOTE: "1" = VDDI level, "0" = VSSI level.

### 3.5 Driver Output Pins (Pins for Panel)

Signal	I/O	Function
S[1:2160]	O	Pixel electrode driving output
GOUT[1:12]	O	GOA control signals, Level shift output, (VGHR-VGLR)
GOUT[13:24]	O	GOA control signals, Level shift output, (VGHR-VGLR)

CONFIDENTIAL

### 3.6 DC/DC Converter Pins

Signal	I/O	Function
AVEE	O	Output voltage from step-up circuit 2, generated from AVDD. Connect a capacitor for stabilization.
VCL	O	Output voltage from step-up circuit 3, generated from VDDDB. Connect a capacitor for stabilization.
VGH	O	Output voltage from step-up circuit 4. Connect a capacitor for stabilization.
VGL	O	Output voltage from step-up circuit 5. Connect a capacitor for stabilization.
C21P, C21N C22P, C22N	I/O	Capacitor connection pins for the step-up circuit to generate VGH. Connect capacitor as requirement. When not in used, please open these pins.
C23P, C23N C24P, C24N	I/O	Capacitor connection pins for the step-up circuit to generate VGL. Connect capacitor as requirement. When not in used, please open these pins.
C41P, C41N	I/O	Capacitor connection pins for the step-up circuit to generate VCL Connect capacitor as requirement.
C51P, C51N	I/O	Capacitor connection pins for the step-up circuit to generate AVEE Connect capacitor as requirement.
VGHR	O	Output voltage generated from VGH. LDO output used for panel voltage. Connect a capacitor for stabilization. When not in use, please open this pin.
VGLR	O	Output voltage generated from VGL. LDO output used for panel voltage. Connect a capacitor for stabilization. When not in use, please open this pin.
VGMP	O	Output voltage generated from AVDD. LDO output for positive gamma high voltage generator.
VGSP	O	Output voltage generated from AVDD. LDO output for positive gamma low voltage generator.
VREF	O	Regulator output for internal reference voltage. Connect capacitor for stabilization.
DVDD	O	Regulator output for logic system power. Connect a capacitor for stabilization.
MVDDA	O	Regulator output for internal MIPI/MDDI analog system (1.2V typical) Connect a capacitor for stabilization. If not use MIPI or MDDI interface, please open this pin.

---

---

VREFP5	<input type="radio"/>	Regulator output for VREFP5 (0.2~6V)
VREFN5	<input type="radio"/>	Regulator output for VREFN5 (-0.2~-6V)

CONFIDENTIAL

### 3.7 Pass Pins

Signal	I/O	Function
PASS1	I/O	Pass Pin (The PASS1 of ILB Pin is internally connected to that of OLB)
PASS3	I/O	Pass Pin (The PASS3 of ILB Pin is internally connected to that of OLB)
PADA	I/O	Pass Pin (The PADA of ILB Pin is internally connected to that of OLB)
PADB	I/O	Pass Pin (The PADB of ILB Pin is internally connected to that of OLB)

### 3.8 Test Pins

Signal	I/O	Function
S[N]_DUMMY (N=0, 2161, 2162)	O	Test pin. Not accessible to user. Must be left open. (Do not connect to any routing line on the panel)
ANA_TEST[1:0]	O	Test pin. Not accessible to user. Must be left open.
TEST[1:14]	I/O	Test pins. Not accessible to user. Must be left open.
DE	I	Test pin. This pin is not used, please connect to VSSI.
VS	I	Test pin. This pin is not used, please connect to VSSI.
HS	I	Test pin. This pin is not used, please connect to VSSI.
PCLK	I	Test pin. This pin is not used, please connect to VSSI.
D[7:0]	I	Test pins. These pins are not used, please connect to VSSI.
DB_MODE[2:0]	I	Test pins. Not accessible to user. Must be left open or connect to VSSI.
DUMMY[1:350]	I	Dummy pins. These pins are not used.

## 4. Function Description

### 4.1 Interface Type Selection

Interface type selection. The connections of IM[1:0] which not shown in table are invalid.

IM[1:0]	Display Data	Command
00	MIPI DSI,	MIPI DSI or 16-bit SPI
01	N/A	9-bit SPI3 (SCL rising edge trigger), SDI/SDO
10	N/A	8-bit SPI4 (SCL rising edge trigger), SDI/SDO
11	N/A	16-bit SPI

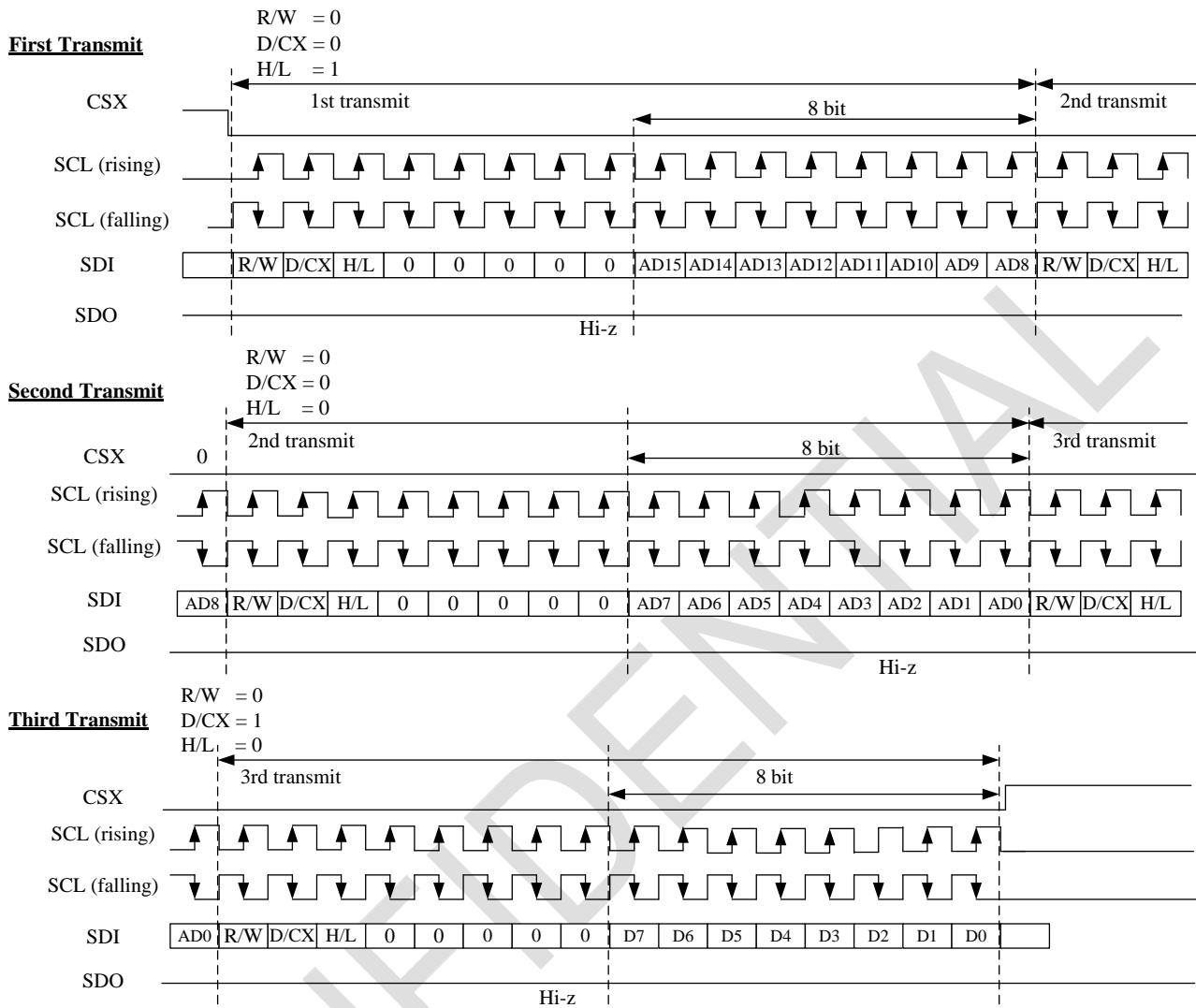
### 4.2 Serial Interface

#### 4.2.1 Write Cycle and Sequence

During a write cycle the host processor sends a single bit of data to the display module via the interface. The SPI interface utilizes CSX, SCL and SDI and SDO signals. SCL is driven from high to low then pulled back to high during the write cycle. The host processor provides information during the write cycle while the display module reads the host processor information on the rising edge of SCL.

During the write sequence the host processor writes one or more bytes of information to the display module via the interface. The write sequence is initiated when CSX is driven from high to low and ends when CSX is pulled high. Each byte is either nine or sixteen write cycles in length. If the optional DCX signal is used a byte is eight write cycles long. DCX is driven low while command information is on the interface and is pulled high when data is present.

The SPI interface write command sequences are described in the following figure.

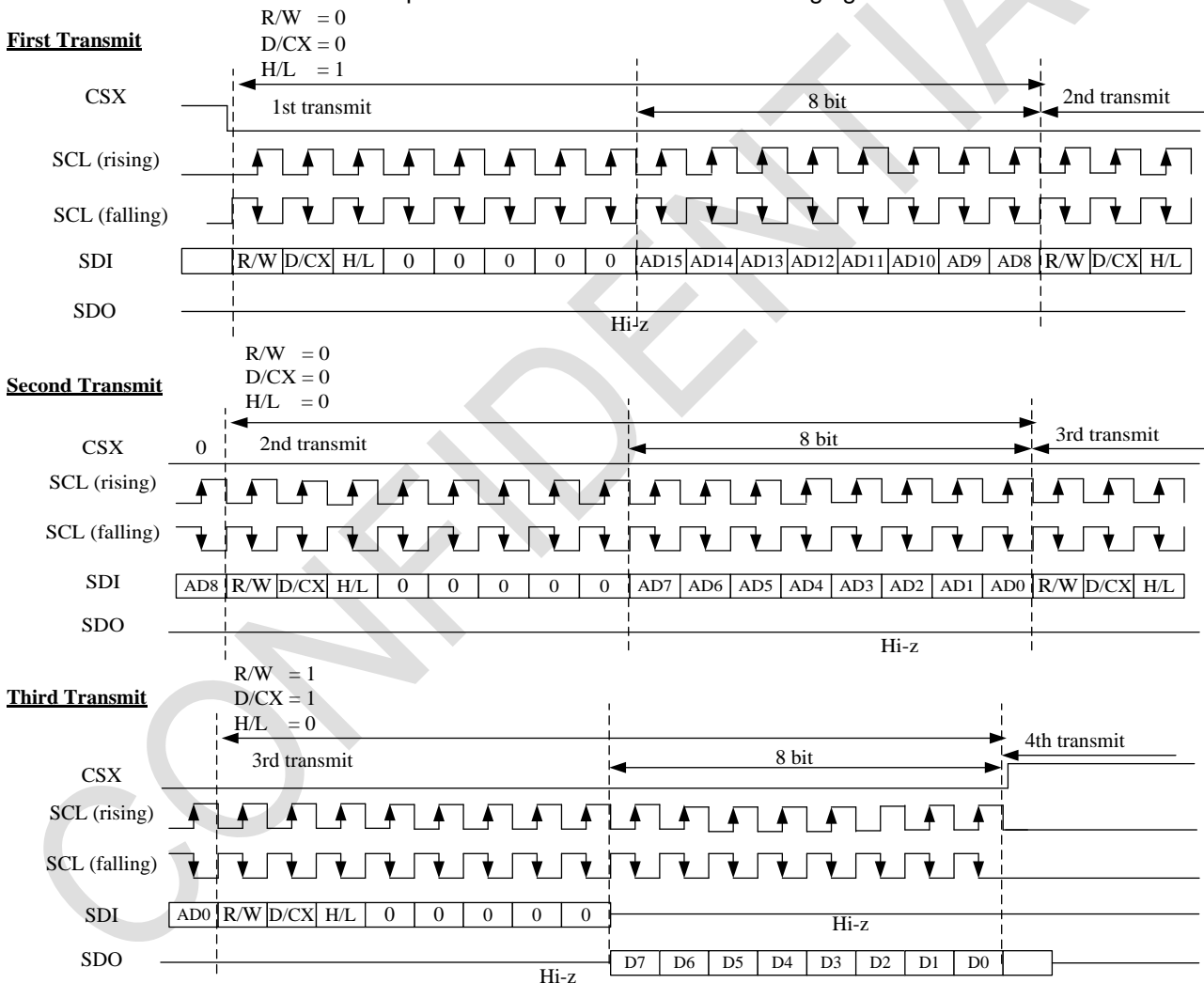


## 4.2.2 Read Cycle and Sequence

During a read cycle the host processor reads a single bit of data from the display module via the interface. The SPI interface utilizes CSX, SCL and DIN signals. SCL is driven from high to low then pulled back to high during the read cycle. The display module provides information during the read cycle while the host processor reads the display module information on the rising edge of SCL.

During the read sequence the host processor reads one or more bytes of information from the display module via the interface. The read sequence is initiated when CSX is driven from high to low and ends when CSX is pulled high. Each byte is either nine or sixteen write cycles in length. If the optional DCX signal is used a byte is eight read cycles long. DCX is driven low while command information is on the interface and is pulled high when data is present.

The SPI interface read command sequences are described in the following figure.

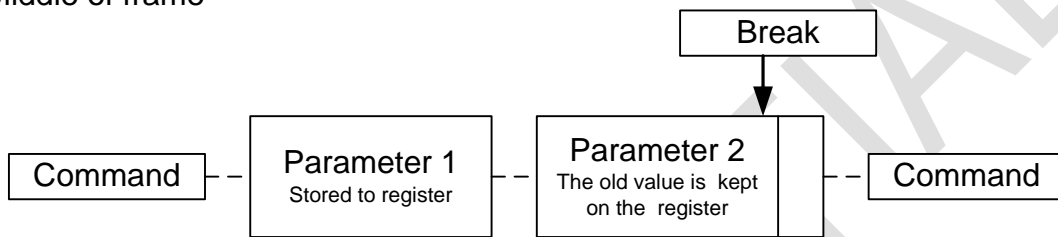


## 4.2.3 Break and Pause Sequence

The host processor can break a read or write sequence by pulling the CSX signal high during a command or data byte. The display module shall reset its interface so it will be ready to receive the same byte when CSX is again driven low.

The host processor can pause a read or write sequence by pulling the CSX signal high between command or data bytes. The display module shall wait for the host processor to drive CSX low before continuing the read or write sequence at the point where the sequence was paused.

### 1. Middle of frame

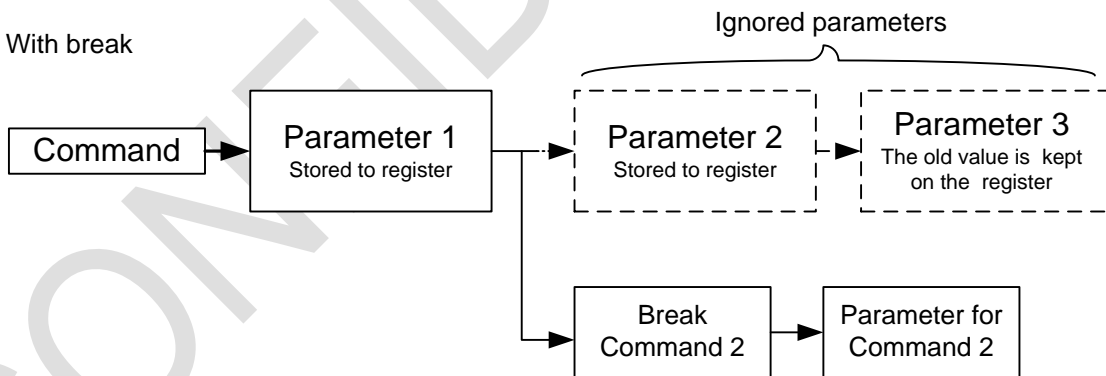


### 2. Between frames

Without break



With break



Break can be e.g. another command or noise pulse.

### 4.3 Display Serial Interface (DSI)

DSI-compliant peripherals support either of two basic modes of operation: Command Mode and Video Mode. The mode definitions reflect the primary intended use of DSI for display interconnect, but are not intended to restrict DSI from operating in other applications.

RM67199 is capable of both Command Mode operation and Video Mode operation. Command Mode refers to operation in which transactions primarily take the form of sending commands and data to a display module that incorporates a display controller. The display controller may include local registers and a frame buffer. Systems using Command Mode write to, and read from, the registers and frame buffer memory. The host processor indirectly controls activity at the peripheral by sending commands, parameters and data to the display controller.

The host processor can also read display module status information or the contents of the frame memory. Command Mode operation requires a bidirectional interface. Video Mode refers to operation in which transfers from the host processor to the peripheral take the form of a real-time pixel stream. In normal operation, the display module relies on the host processor to provide image data at sufficient bandwidth to avoid flicker or other visible artifacts in the displayed image. Video information should only be transmitted using High Speed Mode.

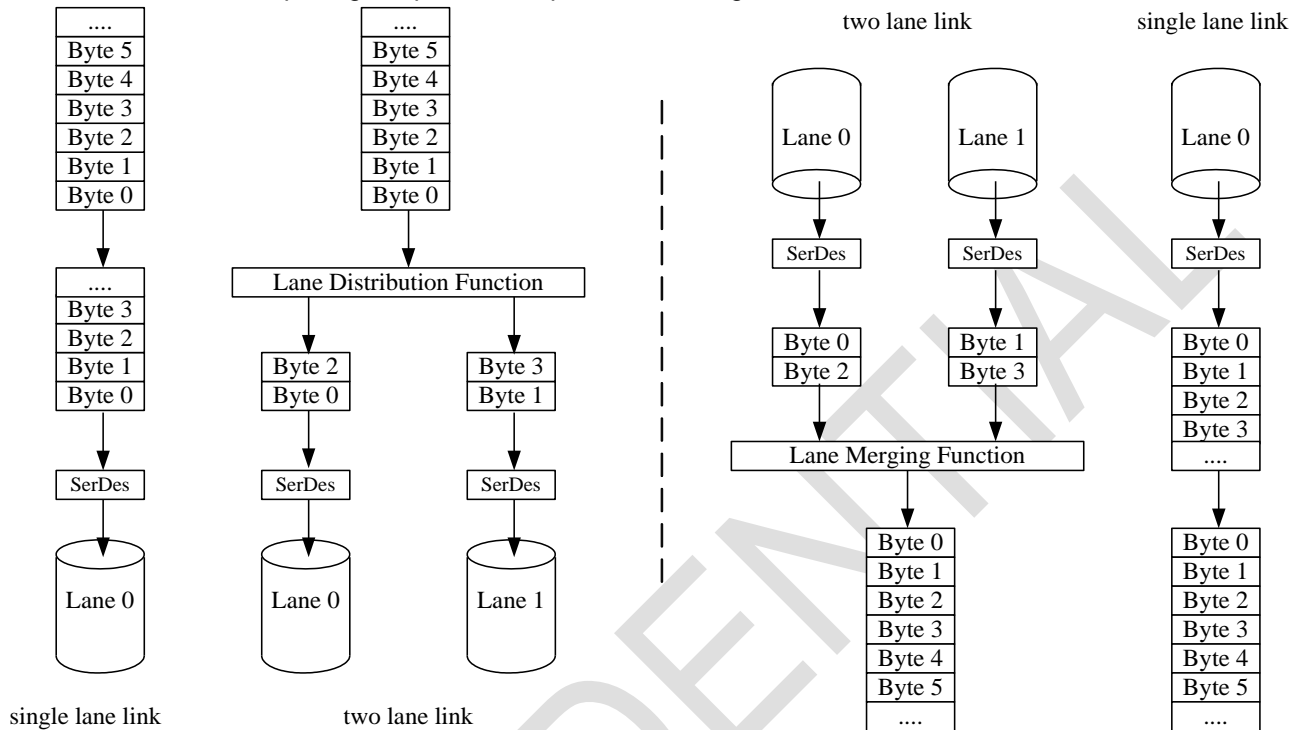
RM67199 Video Mode architectures also include a simple timing controller and partial frame buffer, used to maintain a partial-screen or lower-resolution image in standby or Low Power Mode. This permits the interface to reduce power consumption.

RM67199 Configuration:

Lane Pair	MCU(Master) RM67199(Slave)
Clock Lane	Unidirectional Lane Clock only
Data Lane 0	Bi-directional Lane Forward High-speed Bi-directional Escape Mode Bi-directional LPDT
Data Lane 1	Unidirectional Lane Forward High-Speed Escape Mode No LPDT
Data Lane 2	Unidirectional Lane Forward High-speed Escape Mode No LPDT
Data Lane 3	Unidirectional Lane Forward High-speed Escape Mode No LPDT

## 4.3.1 DSI Protocol

On the transmitter side of a DSI Link, parallel data, signal events, and commands are converted to packets. These packets are sent across the serial Link. The receiver side of a DSI Link performs the converse of the transmitter side, decomposing the packet into parallel data, signal events and commands.



There are two kinds of packets, **short packet and long packet**.

Short packet structure:

LP-11: low power mode

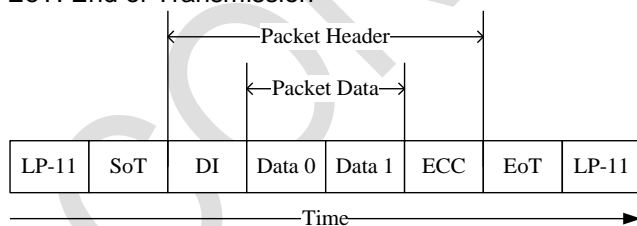
SoT: start of transmission

DI: data identification

Data 0, Data1: packet data

ECC: error correction code

EoT: End of Transmission



DI structure:

Virtual Channel: these two bits identify the data as directed to one of four virtual channels

Data Type: It specifies the packet structure and packet format

Virtual Channel (VC)		Data Type (DT)					
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Long packet structure:

LP-11: low power mode

SoT: start of transmission

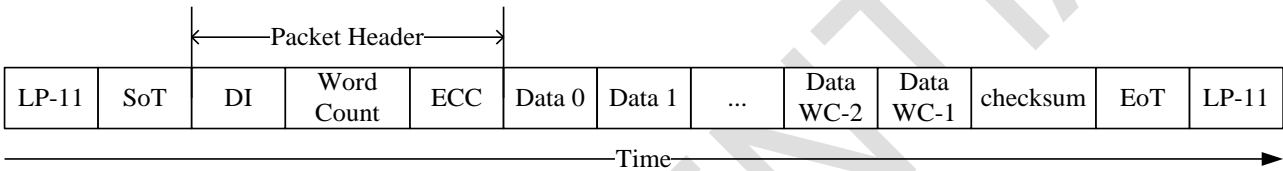
DI: data identification

Word Count: the number of data bytes of packet data

ECC: error correction code

Checksum: The 16-bit CRC generator to check packet data. If the calculated checksum of receiver are equal to the packet data, the packet data is correct. If the calculated checksum of receiver are not equal, the packet data are not correct.

EoT: end of transmission



### 4.3.2 Processor to Peripheral Transactions

#### Processor to Peripheral Direction Packet Data Types

Data Type	Data Type binary	Description	Packet Size
01h	00 0001	Sync Event, V Sync Start	Short
11h	01 0001	Sync Event, V Sync End	Short
21h	10 0001	Sync Event, H Sync Start	Short
31h	11 0001	Sync Event, H Sync End	Short
08h	00 1000	End of Transmission packet (EoTp)	Short
02h	00 0010	Color Mode (CM) Off Command	Short
12h	01 0010	Color Mode (CM) On Command	Short
22h	10 0010	reserved	Short
32h	11 0010	reserved	Short
03h	00 0011	reserved	Short
13h	01 0011	Generic Short WRITE, 1 parameter	Short
23h	10 0011	Generic Short WRITE, 2 parameters	Short
04h	00 0100	reserved	Short
14h	01 0100	Generic READ, 1 parameter	Short
24h	10 0100	Generic READ, 2 parameters	Short
05h	00 0101	DCS Short WRITE, no parameters	Short
15h	01 0101	DCS Short WRITE, 1 parameter	Short
06h	00 0110	DCS READ, no parameters	Short
37h	11 0111	Set Maximum Return Packet Size	Short
09h	00 1001	Null Packet, no data	Long
19h	01 1001	Blanking Packet, no data	Long
29h	10 1001	Generic Long Write	Long
39h	11 1001	DCS Long Write/write_LUT Command Packet	Long
0Eh	00 1110	Packed Pixel Stream, 16-bit RGB, 5-6-5 Format	Long
1Eh	01 1110	Packed Pixel Stream, 18-bit RGB, 6-6-6 Format	Long
2Eh	10 1110	Loosely Packed Pixel Stream, 18-bit RGB, 6-6-6 Format	Long
3Eh	11 1110	Packed Pixel Stream, 24-bit RGB, 8-8-8 Format	Long

## Sync Event, Data Type = xx 0001

Sync Events are all short packets and time-accurately. They can perform like the start and end of sync pulses. To represent timing information as accurately as possible, a V Sync Start event represents the start of the VSA and also implies an H Sync Start event for the first line of the VSA. Hence, a V Sync End event implies an H Sync Start event for the last line of the VSA. Sync events may be concatenated with blanking packets to convey inter-line timing accurately and avoid the overhead of switching between LPS and HS for every event. Note there is a power penalty for keeping the data line in HS mode.

## EoT packet

This short packet is used to indicate the end of a high speed (HS) transmission. This packet will enhance overall system reliability. Although the main objective of the EoTp is to enhance robustness during HS transmission mode, RM67199 can detect and interpret arriving EoTps regardless of transmission mode (HS or LP modes)

## Color Mode Off / On Command

They are short packet commands to switch video display module between normal display mode and low-color mode for power saving.

## Generic short write / read packet

Generic Short WRITE command is a Short packet type for sending generic data to the peripheral. Generic READ request is a Short packet requesting data from the peripheral.

## DCS commands

### DCS short write command

DCS short write command is used to write a single data byte command to display module. If there is a valid parameter byte, data type bit 4 shall be set to 1. If there is no valid parameter byte, data type bit 4 shall be set to 0 and the parameter byte shall be 00h.

### DCS read commands

The commands are used to request data from s display module.

### DCS Long Write / write\_LUT command

The commands are used to send larger blocks of data to a display module.

### Maximum return packet size

This command specifies the maximum size of the payload in a long packet transmission from a display module to host processor.

## Null Packet

This is a mechanism for keeping the data lane(s) in high speed mode while sending dummy data.

## Blanking Packet

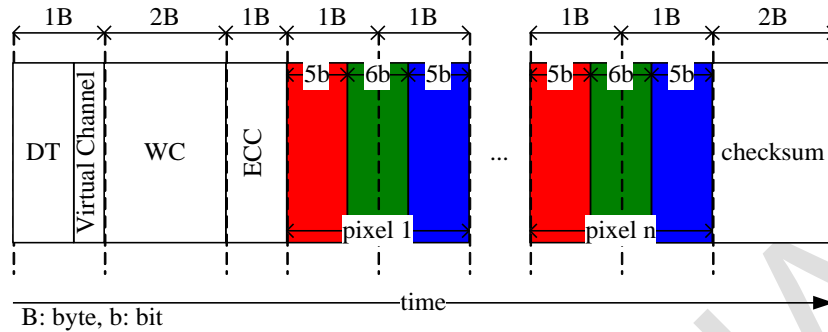
A Blanking packet is used to convey blanking timing information in a Long packet. The packet represents a period between active scan lines of a Video Mode display, where traditional display timing is provided from the host processor to the display module. The blanking period may have Sync Event packets interspersed between blanking segments. Blanking packets may contain arbitrary data as payload.

## Generic Long Write

This is used to transmit arbitrary blocks of data from a host processor to a peripheral.

Packed Pixel Stream, 16-bit Format, Data Type: 00 1110

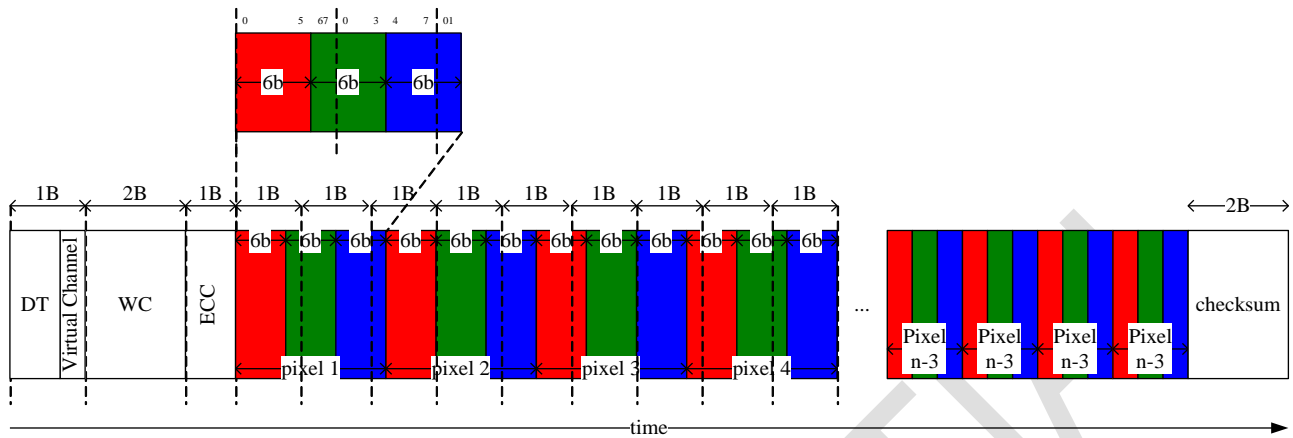
The pixel format is five bits red, six bits green and five bits blue. The green component is split across two bytes. Within a color component, the LSB is sent first, the MSB last.



CONFIDENTIAL

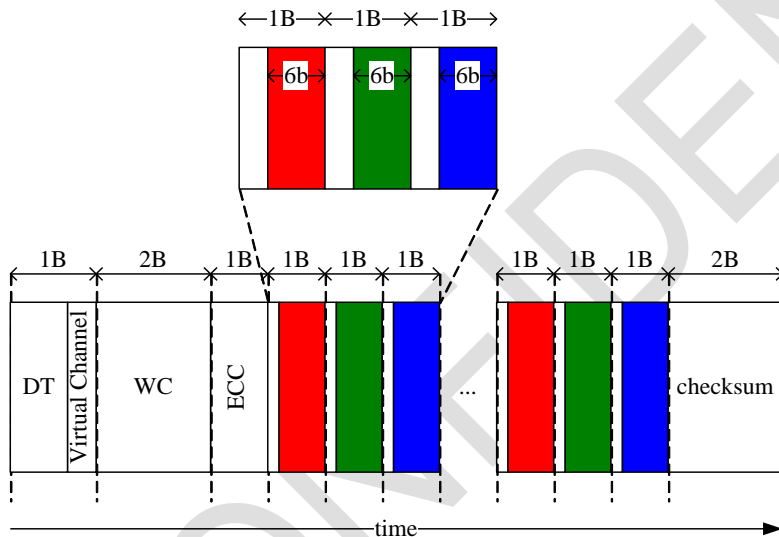
Packet pixel stream, 18-bit format, Data Type: 01 1110

The pixel format is six bits red, six bits green and six bits blue. Within a color component, the LSB is sent first, the MSB last.

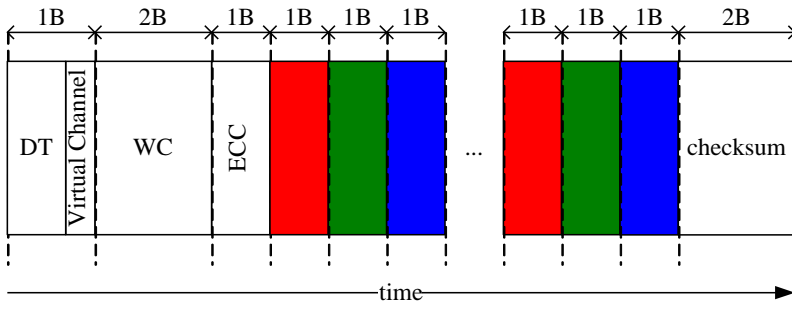


Packet pixel stream, 18-bit format in three bytes, Data Type: 10 1110

This is 18-bit pixel loosely packed format, each R, G or B color component is six bits but shifted to the upper bits of byte.



Packet pixel stream, 24-bit format, Data Type: 11 1110  
The pixel format is eight bits red, eight bits green and eight bits blue.



### 4.3.3 Peripheral-to-Processor LP Transmission

All Command Mode systems require bidirectional capability for returning READ data, acknowledge, or error information to the host processor. Multi-Lane systems shall use Lane 0 for all peripheral-to-processor transmissions. Reverse-direction signaling shall only use low power mode transmission.

Packet structure for peripheral-to-processor transaction is the same as for the processor-to-peripheral direction. For the processor-to-peripheral direction, two basic packet formats are the same as the peripheral-to-processor direction: Short and Long packet structure. BTA shall take place after every peripheral-to-processor transaction. This returns bus control to the host processor following the completion of the LP transmission from the peripheral.

There are four basic types of peripheral-to-processor transactions.

**Tearing Effect:** It is a Trigger message sent to convey display timing information to the host processor.

**Acknowledge:** It is a Trigger Message sent when the current transmission, as well as all preceding transmissions since the last peripheral to host communication.

**Acknowledge and Error Report:** It is a Short packet sent if any errors were detected in preceding transmissions from the host processor.

**Response to Read Request:** It may be a Short or Long packet that returns data requested by the preceding READ command from the processor.

Interpretation of processor-to-peripheral transactions with BTA asserted, and the expected responses, are as follows:

Following a non-Read command: If no errors were detected, the peripheral shall respond with Acknowledge.

Following a Read request: The peripheral shall send the requested READ data if no errors were detected and stored since the last peripheral to host communication.

Following a Read request: If only a single-bit ECC error was detected and corrected, the peripheral shall send the requested READ data in a Long or Short packet and a 4-byte Acknowledge and Error Report packet in the same LP transmission.

Following a non-Read command: If only a single-bit ECC error was detected and corrected, the peripheral shall respond to BTA by sending a 4-byte Acknowledge and Error Report packet.

Following a Read request: If multi-bit ECC errors were detected and not corrected, the peripheral shall send a 4-byte Acknowledge and Error Report packet without sending Read data.

Following a non-Read command: If multi-bit ECC errors were detected and not corrected, the peripheral shall not execute the command, and shall send a 4-byte Acknowledge and Error Report packet.

Following any command: If SoT Error, SoT Sync Error, the VC of DSI or the ID of DSI Invalid or DSI protocol violation was detected, or the DSI command was not recognized, the peripheral shall send a 4-byte Acknowledge and Error Report response.

Following any command: If EoT Sync Error or LP Transmit Sync Error is detected, or a checksum error is detected in the payload, the peripheral shall send a 4-byte Acknowledge and Error Report packet.

## Error Report Format

The following table shows the bit assignment for all 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	HS Receive Timeout Error
6	False Control Error
7	Reserved
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 Not Recognized
12	DSI VC ID Invalid
13	reserved
14	reserved
15	reserved

## Peripheral-to-Processor Transaction – Detail Format Description

The following list is the complete set of peripheral-to-processor data types.

Data type, hex	Data type binary	Description	Packet size
02h	00 0010	Acknowledge and error report	short
08h	00 1000	reserved	short
11h	01 0001	GEN short read response, 1byte returned	short
12h	01 0010	GEN short read response, 2bytes returned	short
1Ah	01 1010	Generic long read response	long
1Ch	01 1100	DCS long read response	long
21h	10 0001	DCS short read response, 1byte returned	short
22h	10 0010	DCS short read response, 2bytes returned	short

**Acknowledge and error report:** It is sent with BTA asserted when a reportable error is detected in the preceding, or earlier, transmission from the host processor.

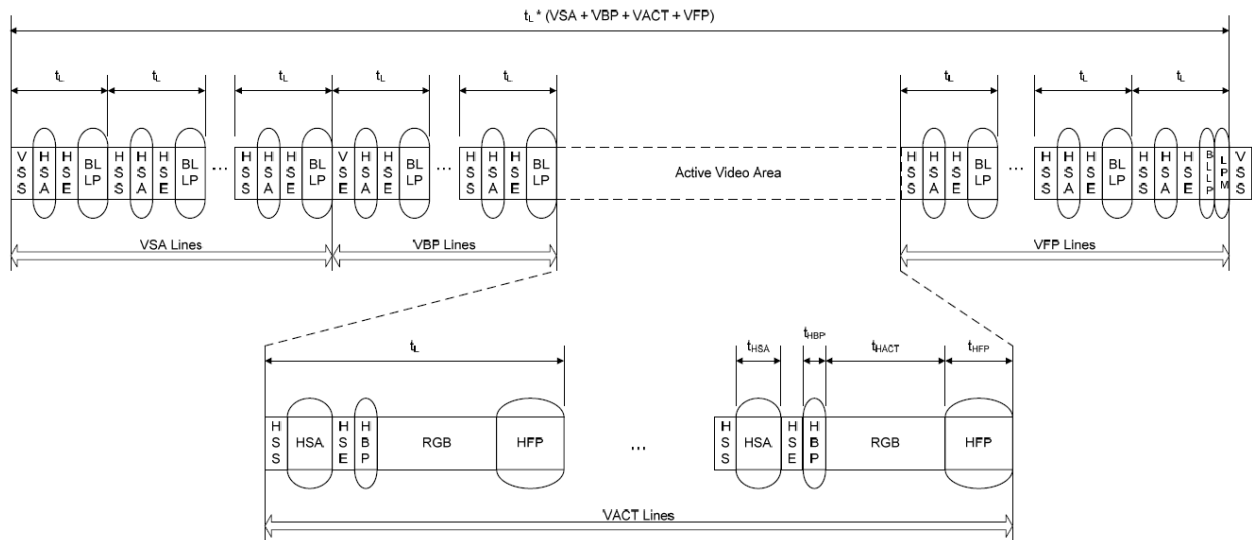
**Generic Short Read Response:** This is the short-packet response to Generic READ Request. Packet composition is the Data Identifier (DI) byte, two bytes of payload data and an ECC byte. If the command itself is possibly corrupt, due to an uncorrectable ECC error, SoT or SoT Sync error, the requested READ data packet shall not be sent and only the Acknowledge and Error Report packet shall be sent.

**Generic long read response:** This is the long-packet response to Generic READ Request. Packet composition is DI followed by a two-byte Word Count, an ECC byte, N bytes of payload, and a two-byte Checksum. If the command itself is possibly corrupt, due to an uncorrectable ECC error, SoT or SoT Sync error, the requested READ data packet shall not be sent and only the Acknowledge and Error Report packet shall be sent.

**DCS long read response:** This is a Long packet response to DCS Read Request. Packet composition is DI followed by a two-byte Word Count, an ECC byte, N bytes of payload, and a two-byte Checksum. If the DCS command itself is possibly corrupt, due to uncorrectable ECC error, SoT or SoT Sync error, the requested READ data packet shall not be sent and only the Acknowledge and Error Report packet shall be sent.

**DCS short read response:** This is the short-packet response to DCS Read Request. Packet composition is DI, two bytes of payload data and an ECC byte. If the command itself is possibly corrupt, due to an uncorrectable ECC error, SoT or SoT Sync error, the requested READ data packet shall not be sent and only the Acknowledge and Error Report packet shall be sent.

## 4.3.4 DSI Video Mode Interface Timing



CONFIDENTIAL

### 4.3.5 Error Correction Code (ECC)

ECC shall always be generated and appended in the Packet Header from the host processor. Peripherals with Bidirectional Links shall also generate and send ECC.

The number of parity or error check bits required is given by the Hamming rule, which uses parity to correct a single-bit error or detect a two-bit error, but are not capable of doing both simultaneously. DSI uses Hamming-modified codes where an extra parity bit is used to support both single error correction as well as two-bit error detection.

Since Packet Headers are fixed at four bytes (twenty-four data bits and eight ECC bits), P6 and P7 of the ECC byte are unused and shall be set to zero by the transmitter. The receiver shall ignore P6 and P7 and set both bits to zero before processing ECC.

The parity bits of ECC are defined as below:

$$P7 = 0$$

$$P6 = 0$$

$$P5 = D10 \wedge D11 \wedge D12 \wedge D13 \wedge D14 \wedge D15 \wedge D16 \wedge D17 \wedge D18 \wedge D19 \wedge D21 \wedge D22 \wedge D23$$

$$P4 = D4 \wedge D5 \wedge D6 \wedge D7 \wedge D8 \wedge D9 \wedge D16 \wedge D17 \wedge D18 \wedge D19 \wedge D20 \wedge D22 \wedge D23$$

$$P3 = D1 \wedge D2 \wedge D3 \wedge D7 \wedge D8 \wedge D9 \wedge D13 \wedge D14 \wedge D15 \wedge D19 \wedge D20 \wedge D21 \wedge D23$$

$$P2 = D0 \wedge D2 \wedge D3 \wedge D5 \wedge D6 \wedge D9 \wedge D11 \wedge D12 \wedge D15 \wedge D18 \wedge D20 \wedge D21 \wedge D22$$

$$P1 = D0 \wedge D1 \wedge D3 \wedge D4 \wedge D6 \wedge D8 \wedge D10 \wedge D12 \wedge D14 \wedge D17 \wedge D20 \wedge D21 \wedge D22 \wedge D23$$

$$P0 = D0 \wedge D1 \wedge D2 \wedge D4 \wedge D5 \wedge D7 \wedge D10 \wedge D11 \wedge D13 \wedge D16 \wedge D20 \wedge D21 \wedge D22 \wedge D23$$

The table below shows a compact way to specify the encoding of parity and decoding of syndromes.

ECC Parity Generation Rules:

Data Bit	P7	P6	P5	P4	P3	P2	P1	P0	Hex
0	0	0	0	0	0	1	1	1	0x07
1	0	0	0	0	1	0	1	1	0x0B
2	0	0	0	0	1	1	0	1	0x0D
3	0	0	0	0	1	1	1	0	0x0E
4	0	0	0	1	0	0	1	1	0x13
5	0	0	0	1	0	1	0	1	0x15
6	0	0	0	1	0	1	1	0	0x16
7	0	0	0	1	1	0	0	1	0x19
8	0	0	0	1	1	0	1	0	0x1A
9	0	0	0	1	1	1	0	0	0x1C
10	0	0	1	0	0	0	1	1	0x23
11	0	0	1	0	0	1	0	1	0x25
12	0	0	1	0	0	1	1	0	0x26
13	0	0	1	0	1	0	0	1	0x29
14	0	0	1	0	1	0	1	0	0x2A
15	0	0	1	0	1	1	0	0	0x2C
16	0	0	1	1	0	0	0	1	0x31
17	0	0	1	1	0	0	1	0	0x32
18	0	0	1	1	0	1	0	0	0x34
19	0	0	1	1	1	0	0	0	0x38
20	0	0	0	1	1	1	1	1	0x1F
21	0	0	1	0	1	1	1	1	0x2F
22	0	0	1	1	0	1	1	1	0x37
23	0	0	1	1	1	0	1	1	0x3B

#### 4.3.6 Notice

1. We recommend users to stay in STOP state for 500ns when switching from LPDT to HSDT.
2. We recommend users to adopt EoTp to enhance overall robustness of the system during HSDT.

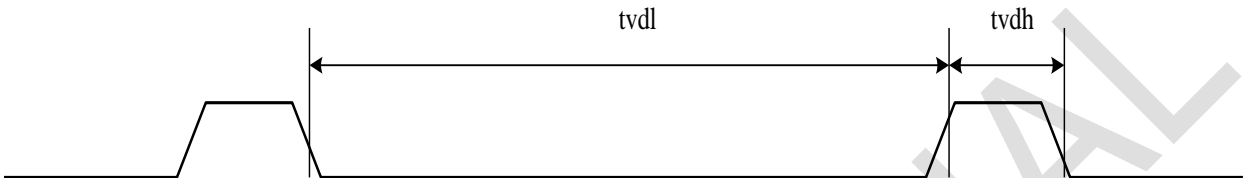
CONFIDENTIAL

**4.4 Tearing Effect Output**

The tearing effect output line supplies to the HOST a panel synchronization signal. This signal can be enabled or disabled by the set\_tear\_off (34h) and set\_tear\_on (35h) commands. The mode of the tearing effect signal is defined by the parameter of the set\_tear\_on (35h) and set\_tear\_scanline(44h) commands. The signal can be used by the HOST to synchronize internal VSYNC when displaying video images.

**4.4.1 Tearing Effect Line Mode**

Mode 1, the tearing effect output signal consist of V-sync information only:



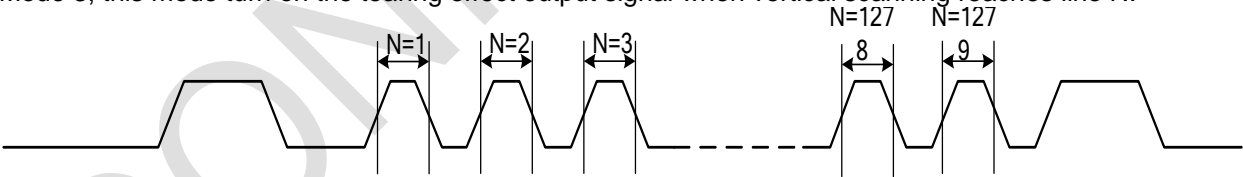
tvdh = The LCD display is not updated from the frame memory.  
tvdl = The LCD display is updated from the frame memory.

Mode 2, the tearing effect output signal consist of V-sync and H-sync information:

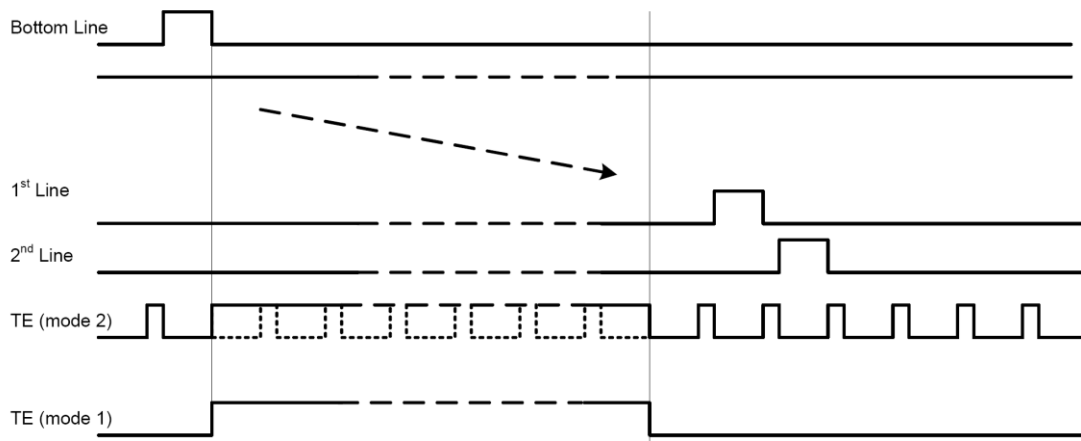


thdh = The LCD display is not updated from the frame memory.  
thdl = The LCD display is updated from the frame memory.

Mode 3, this mode turn on the tearing effect output signal when vertical scanning reaches line N.



N = The N-th scanning line which set by register N[15:0] of command STESL(44h).

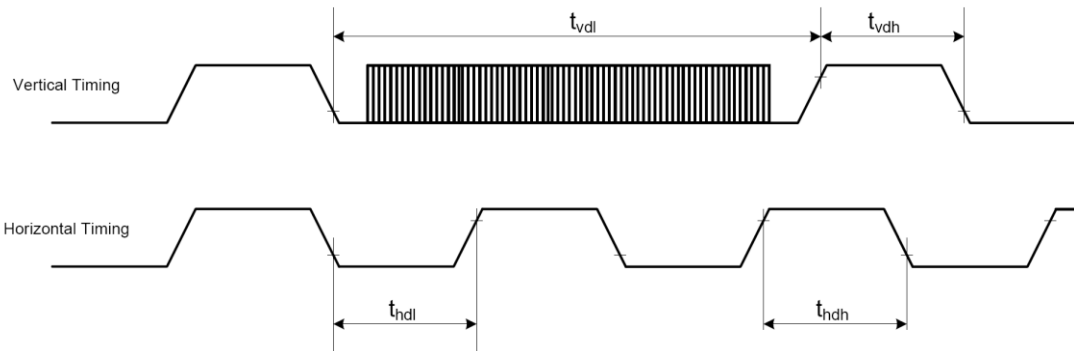


Note. During Sleep In mode, the tearing effect output signal is active low.

CONFIDENTIAL

## 4.4.2 Tearing Effect Line Timing

The tearing effect signal is described as below:

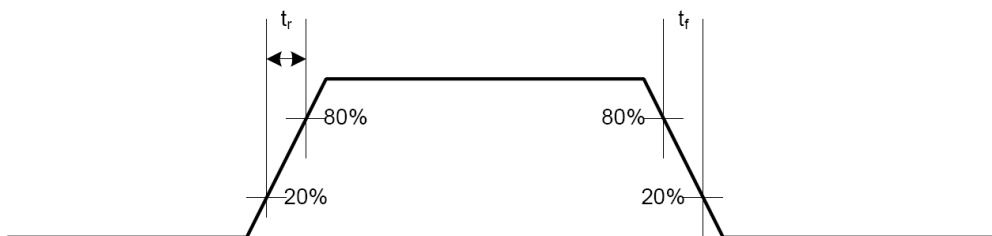


AC characteristics of Tearing Effect Signal (Frame Rate = 60.5Hz)

Symbol	Parameter	Min.	Max.	Unit	Description
tvdl	Vertical timing low duration	TBD		ms	
tvdh	Vertical timing high duration	TBD		us	
thdl	Horizontal timing low duration	TBD		us	
thdh	Horizontal timing high duration	TBD		us	

Notes:

1. The timings apply when MADCTL B4=0 and B4=1
2. The signal's rise and fall times ( $t_f$ ,  $t_r$ ) are stipulated to be equal to or less than 15ns.



The Tearing Effect Output Line is fed back to the HOST and should be used as shown below to avoid tearing effect:

The Tearing Effect output line supplies to the HOST a panel synchronization signal. This signal can be enabled or disabled by the `set_tear_off(34h)`, `set_tear_on(35h)` commands. The mode of the Tearing Effect Signal is defined by the Parameter of the Tearing Effect Line On command. The signal can be used by the HOST to synchronize internal VSYNC when displaying video images.

TEON (35h)	TELOM (35h, 1 <sup>st</sup> bit)	TE signal Output
0	*	GND
1	0	TE (Mode 1)
1	1	TE (Mode 2)

## 5. Command

### 5.1. Command List

Table of User Command Set (Command 1)

CMD1	Para	Instruction	D7	D6	D5	D4	D3	D2	D1	D0	Default	
00h	-	NOP	No argument								-	
01h	-	Soft reset	No argument								-	
04h	00h	Get display ID	ID1[7:0]								00h	
	01h		ID2[7:0]								00h	
	02h		ID3[7:0]								00h	
05h	-	Get number of errors on DSI	D[7:0]								00h	
0Ah	00h	Get power mode	BSTON	IDMON	-	SLPOUT	-	DISPON	-	-	-	
0Bh	00h	Get address mode	-	-	-	-	RGB	-	RSMX	-	00h	
0Ch	00h	Get pixel format	-	VIPF2	VIPF1	VIPF0	-	IFPF2	IFPF1	IFPF0	77h	
0Dh	00h	Get display mode	-	-	INVON	ALLPON	ALLPOFF	-	-	-	00h	
0Eh	00h	Get signal mode	TEON	M	-	-	-	-	-	ERR	00h	
0Fh	00h	Get diagnostic result	register loading detection				-	-	-	-	-	00h
10h	-	Enter sleep mode	No argument								-	
11h	-	Exit sleep mode	No argument								-	
20h	-	Exit invert mode	No argument								-	
21h	-	Enter invert mode	No argument								-	
22h	-	Set all pixels off	No argument								-	
23h	-	Set all pixels on	No argument								-	
28h	-	Set display off	No argument								-	
29h	-	Set display on	No argument								-	
2Ch	-	Write memory start	D7	D6	D5	D4	D3	D2	D1	D0	-	
34h	-	Set tear off	No argument								-	
35h	00h	Set tear on	-	-	-	-	-	-	-	TELOM	00h	
36h	00h	Set address mode	-	-	-	-	RGB	-	RSMX	-	00h	
38h	-	Exit idle mode	No argument								-	
39h	-	Enter idle mode	No argument								-	
3Ah	00h	Set pixel format	-	VIPF2	VIPF1	VIPF0	-	IFPF2	IFPF1	IFPF0	77h	
3Ch	-	Write memory continuous	D7	D6	D5	D4	D3	D2	D1	D0	-	
44h	00h	Set tear scan line	N[15:8]								00h	
	01h		N[7:0]								00h	
45h	00h	Get scan line	N[15:8]								00h	
	01h		N[7:0]								00h	
4Fh	00h	Set deep standby mode	-	-	-	-	-	-	-	DSTB	00h	
51h	00h	Write display brightness	DBV[7:0] (input)								FFh	
52h	00h	Read display brightness	DBV[7:0] (output)								FFh	
53h	00h	Write control display	HBM[1:0]		BCTRL	-	DD	-	-	-	20h	
54h	00h	Read control display	HBM[1:0]		BCTRL	-	DD	-	-	-	20h	
55h	00h	Write RAD-ACL control	-	-	-	-	-	-	RAD_ACL[1:0]		00h	
56h	00h	Read RAD-ACL control	-	-	-	-	-	-	RAD_ACL[1:0]		00h	
58h	00h	Write CE	CTE_EN		CTE_LEVEL[3:0]			-	-	-	48h	
59h	00h	Read CE	CTE_EN		CTE_LEVEL[3:0]			-	-	-	48h	
5Ah	00h	Write CE1	SKIN_EN	-	SKIN_LEVEL[1:0]		EN_VIVID_ENH	-	CE_LEVEL[1:0]		11h	
5Bh	00h	Read CE1	SKIN_EN	-	SKIN_LEVEL[1:0]		EN_VIVID_ENH	-	CE_LEVEL[1:0]		11h	
5Ch	00h	Write CE2	SLR_EN	-	SLR_LEVEL[1:0]		EN_EDGE	EDGE_LEVEL[2:0]		14h		
5Dh	00h	Read CE2	SLR_EN	-	SLR_LEVEL[1:0]		EN_EDGE	EDGE_LEVEL[2:0]		14h		

						E				
62h	00h	Write CE3 (temper)	TEMPER_EN	TEMPER_LEVEL[6:0]						00h
63h	00h	Read CE3 (temper)	TEMPER_EN	TEMPER_LEVEL[6:0]						00h
64h	00h	Write CE4 (paper)	PAPER_EN	PAPER_LEVEL[6:0]						00h
65h	00h	Read CE4 (paper)	PAPER_EN	PAPER_LEVEL[6:0]						00h
66h	00h	Write CE5 (WB)	WB_EN	-	-	-	-	-	-	00h
67h	00h	Read CE5 (WB)	WB_EN	-	-	-	-	-	-	00h
6Ah	00h	Write CE6 (HDR)	hdr_en	hdr_level[6:0]						00h
6Bh	00h	Read CE6 (HDR)	hdr_en	hdr_level[6:0]						00h
A1h	00h	Read DDB start	SID[15:8]						00h	
	01h		SID[7:0]						00h	
	02h		MID[15:8]						00h	
	03h		MID[7:0]						00h	
	04h		1	1	1	1	1	1	1	1
A8h	00h	Read DDB continue	SID[15:8]						00h	
	01h		SID[7:0]						00h	
	02h		MID[15:8]						00h	
	03h		MID[7:0]						00h	
	04h		1	1	1	1	1	1	1	1
AAh	00h	Read first checksum	FCS[7:0]						00h	
AFh	00h	Read continue checksum	CCS[7:0]						00h	
C2h	00h	Set DSI mode	-	-	-	-	RM	-	DM[1:0]	08h
DAh	00h	Read ID1	ID1[7:0]						00h	
DBh	00h	Read ID2	ID2[7:0]						00h	
DCh	00h	Read ID3	ID3[7:0]						00h	
FEh	00h	Write CMD page switch	CMD_PG_SEL[7:0]						00h	
FFh	00h	Read CMD page	CMD_PG_SEL[7:0]						00h	

**Table of User Command Set (Command 1) (continued)**

CMD1	Para.	Instruction	Status Availability			
			command(C) / read (R) / write (W)	Normal mode on, idle mode off, sleep out	Normal mode on, idle mode on, sleep out	sleep in
00h	-	NOP	C	Yes	Yes	Yes
01h	-	Soft reset	C	Yes	Yes	Yes
04h	00h	Get display ID	R	Yes	Yes	Yes
	01h		R	Yes	Yes	Yes
	02h		R	Yes	Yes	Yes
05h	-	Get number of errors on DSI	R	Yes	Yes	Yes
0Ah	00h	Get power mode	R	Yes	Yes	Yes
0Bh	00h	Get address mode	R	Yes	Yes	Yes
0Ch	00h	Get pixel format	R	Yes	Yes	Yes
0Dh	00h	Get display mode	R	Yes	Yes	Yes
0Eh	00h	Get signal mode	R	Yes	Yes	Yes
0Fh	00h	Get diagnostic result	R	Yes	Yes	Yes
10h	-	Enter sleep mode	C	Yes	Yes	Yes
11h	-	Exit sleep mode	C	Yes	Yes	Yes
20h	-	Exit invert mode	C	Yes	Yes	Yes
21h	-	Enter invert mode	C	Yes	Yes	Yes
22h	-	Set all pixels off	C	Yes	Yes	Yes
23h	-	Set all pixels on	C	Yes	Yes	Yes
28h	-	Set display off	C	Yes	Yes	Yes
29h	-	Set display on	C	Yes	Yes	Yes
2Ch	-	Write memory start	C	Yes	Yes	Yes
34h	-	Set tear off	C	Yes	Yes	Yes
35h	00h	Set tear on	W	Yes	Yes	Yes
36h	00h	Set address mode	W	Yes	Yes	Yes
38h	-	Exit idle mode	C	Yes	Yes	Yes
39h	-	Enter idle mode	C	Yes	Yes	Yes
3Ah	00h	Set pixel format	W	Yes	Yes	Yes
3Ch	-	Write memory continuous	C	Yes	Yes	Yes
44h	00h	Set tear scan line	W	Yes	Yes	Yes
	01h		W	Yes	Yes	Yes
45h	00h	Get scan line	R	Yes	Yes	Yes
	01h		R	Yes	Yes	Yes
4Fh	00h	Set deep standby mode	W	Yes	Yes	Yes
51h	00h	Write display brightness	W	Yes	Yes	Yes
52h	00h	Read display brightness	R	Yes	Yes	Yes
53h	00h	Write control display	W	Yes	Yes	Yes
54h	00h	Read control display	R	Yes	Yes	Yes
58h	00h	Write CE	W	Yes	Yes	Yes
59h	00h	Read CE	R	Yes	Yes	Yes
5Ah	00h	Write CE1	W	Yes	Yes	Yes
5Bh	00h	Read CE1	R	Yes	Yes	Yes
5Ch	00h	Write CE2	W	Yes	Yes	Yes
5Dh	00h	Read CE2	R	Yes	Yes	Yes
62h	00h	Write CE3 (temper)	W	Yes	Yes	Yes
63h	00h	Read CE3 (temper)	R	Yes	Yes	Yes
64h	00h	Write CE4 (paper)	W	Yes	Yes	Yes
65h	00h	Read CE4 (paper)	R	Yes	Yes	Yes
66h	00h	Write CE5 (WB)	W	Yes	Yes	Yes
67h	00h	Read CE5 (WB)	R	Yes	Yes	Yes

6Ah	00h	Write CE6 (HDR)	W	Yes	Yes	Yes
6Bh	00h	Read CE6 (HDR)	R	Yes	Yes	Yes
A1h	00h	Read DDB start	R	Yes	Yes	Yes
	01h		R	Yes	Yes	Yes
	02h		R	Yes	Yes	Yes
	03h		R	Yes	Yes	Yes
	04h		R	Yes	Yes	Yes
A8h	00h	Read DDB continue	R	Yes	Yes	Yes
	01h		R	Yes	Yes	Yes
	02h		R	Yes	Yes	Yes
	03h		R	Yes	Yes	Yes
	04h		R	Yes	Yes	Yes
AAh	00h	Read first checksum	R	Yes	Yes	Yes
AFh	00h	Read continue checksum	R	Yes	Yes	Yes
C2h	00h	Set DSI mode	W	Yes	Yes	Yes
DAh	00h	Read ID1	R	Yes	Yes	Yes
DBh	00h	Read ID2	R	Yes	Yes	Yes
DCh	00h	Read ID3	R	Yes	Yes	Yes
FEh	00h	Write CMD page switch	W	Yes	Yes	Yes
FFh	00h	Read CMD page	R	Yes	Yes	Yes

CONFIDENTIAL

## 5.2. Command Description

### (0000h) NOP

NOP (No Operation)																					
Inst/Para	R/W	Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0	HEX								
		MIPI	Other																		
NOP	W	00h	0000h	No Argument																	
Description	This command is an empty command; it does not have any effect on the display module. X = Don't care.																				
Restriction	None																				
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>SW Reset</td> <td>N/A</td> </tr> <tr> <td>HW Reset</td> <td>N/A</td> </tr> </tbody> </table>													Status	Default Value	Power On Sequence	N/A	SW Reset	N/A	HW Reset	N/A
Status	Default Value																				
Power On Sequence	N/A																				
SW Reset	N/A																				
HW Reset	N/A																				
Flow Chart	None																				

## (0100h) SWRESET : Software Reset

SWRESET(Software Reset)																				
Inst/Para	R/W	Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0	HEX							
		MIPI	Other																	
SWRESET	W	01h	0100h	No Argument																
Description	When the Software Reset command is written, it causes software reset. It resets the commands and parameters to their S/W Reset default values. (See default tables in each command description.)																			
Restriction	Software Reset Command cannot be sent during Sleep Out sequence. Any new command is cannot be sent for 10-frame period until the RM67199 enters Sleep-In mode. Do not send any command.																			
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>SW Reset</td> <td>N/A</td> </tr> <tr> <td>HW Reset</td> <td>N/A</td> </tr> </tbody> </table>												Status	Default Value	Power On Sequence	N/A	SW Reset	N/A	HW Reset	N/A
Status	Default Value																			
Power On Sequence	N/A																			
SW Reset	N/A																			
HW Reset	N/A																			
Flow Chart	<pre> graph TD     A[SWRESET (01h)] --&gt; B[/Display whole blank screen/]     B --&gt; C[/Set Commands to S/W Default Value/]     C --&gt; D([Sleep In Mode])     </pre> <p>Legend</p> <ul style="list-style-type: none"> <li>Command: Rectangle</li> <li>Parameter: Parallelogram</li> <li>Display: Rounded rectangle</li> <li>Action: Pointed rectangle</li> <li>Mode: Oval</li> <li>Sequential transfer: Oval with tail</li> </ul>																			

## (0400h~0402h) RDDID : Get Display ID

Inst/Para	R/W	RDDID																								
		Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0	HEX													
		MIPI	Other																							
RDDID	R	04h	0400h	x	ID17	ID16	ID15	ID14	ID13	ID12	ID11	ID10	00													
			0401h	x	ID27	ID26	ID25	ID24	ID23	ID22	ID21	ID20	00													
			0402h	x	ID37	ID36	ID35	ID34	ID33	ID32	ID31	ID30	00													
Description	The 1 <sup>st</sup> parameter (ID1): the Module's manufacture ID The 2 <sup>nd</sup> parameter (ID2): the Module/driver version ID The 3 <sup>rd</sup> parameter (ID3): the Module/driver ID Note: Commands RDID1/2/3 (DAh/DBh/DCh) read data correspond to the parameter 1, 2, 3 of command 04h, respectively.																									
Restriction	-																									
Default	<table border="1"> <thead> <tr> <th rowspan="2">Status</th> <th colspan="2">Default Value</th> </tr> <tr> <th>After MTP</th> <th>Before MTP</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>MTP value</td> <td>ID1=00h / ID2=00h / ID3=00h</td> </tr> <tr> <td>SW Reset</td> <td>MTP value</td> <td>ID1=00h / ID2=00h / ID3=00h</td> </tr> <tr> <td>HW Reset</td> <td>MTP value</td> <td>ID1=00h / ID2=00h / ID3=00h</td> </tr> </tbody> </table>												Status	Default Value		After MTP	Before MTP	Power On Sequence	MTP value	ID1=00h / ID2=00h / ID3=00h	SW Reset	MTP value	ID1=00h / ID2=00h / ID3=00h	HW Reset	MTP value	ID1=00h / ID2=00h / ID3=00h
Status	Default Value																									
	After MTP	Before MTP																								
Power On Sequence	MTP value	ID1=00h / ID2=00h / ID3=00h																								
SW Reset	MTP value	ID1=00h / ID2=00h / ID3=00h																								
HW Reset	MTP value	ID1=00h / ID2=00h / ID3=00h																								
Flow Chart	<pre> graph TD     A[RDDID 04h] --&gt; B[/Send 1st parameter ID1[7:0]/]     B --&gt; C[/Send 2nd parameter ID2[7:0]/]     C --&gt; D[/Send 3rd parameter ID3[7:0]/]     </pre>																									

## (0500h) RDNUMED : Get Number of Errors on DSI

Inst/Para	R/W	RDNUMED											HEX								
		Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0									
		MIPI	Other																		
RDNUMED	R	05h	0500h	x	D7	D6	D5	D4	D3	D2	D1	D0	00								
Description	<p>The first parameter is telling a number of the parity errors on DSI. The more detailed description of the bits is below.                      D[6:0] bits are telling a number of the parity errors.                      D[7] is set to "1" if there is overflow with D[6..0] bits.                      D[7:0] bits are set to "0"s (as well as RDDSM(0Eh)'s D0 are set "0" at the same time) after there is sent the first parameter information (= The read function is completed).                      This command is used for MIPI DSI only. It is no function for others interface operation.</p>																				
Restriction	-																				
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>SW Reset</td> <td>00h</td> </tr> <tr> <td>HW Reset</td> <td>00h</td> </tr> </tbody> </table>													Status	Default Value	Power On Sequence	00h	SW Reset	00h	HW Reset	00h
Status	Default Value																				
Power On Sequence	00h																				
SW Reset	00h																				
HW Reset	00h																				
Flow Chart	<pre> graph TD     A[RDNUMED (05h)] --&gt; B[/Send 1st parameter/]     B --&gt; C[/P[7:0]=00h RDDSM(0Eh)'s D0 = '0'/]     </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>																				

## (0A00h) RDDPM : Get Power Mode

RDDPM (Read Display Power Mode)																				
Inst/Para	R/W	Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0	HEX							
		MIPI	Other																	
RDDPM	R	0Ah	0A00h	x	D7	D6	D5	D4	D3	D2	D1	D0	08							
Description	This command indicates the current status of the display as described in the table below:																			
	Bit	Symbol	Description	Comment																
	D7	BSTON	Booster Voltage Status	'1'=Booster on, '0'=Booster off																
	D6	IDMON	Idle Mode On/Off	'1' = Idle Mode On, '0' = Idle Mode Off																
	D5	Reserved																		
	D4	SLPOUT	Sleep In/Out	'1' = Sleep Out, '0' = Sleep In																
	D3	Reserved																		
	D2	DISPON	Display On/Off	'1' = Display On, '0' = Display Off																
	D1	Reserved		0																
	D0	Reserved		0																
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>08h</td> </tr> <tr> <td>SW Reset</td> <td>08h</td> </tr> <tr> <td>HW Reset</td> <td>08h</td> </tr> </tbody> </table>												Status	Default Value	Power On Sequence	08h	SW Reset	08h	HW Reset	08h
	Status	Default Value																		
	Power On Sequence	08h																		
	SW Reset	08h																		
HW Reset	08h																			
Flow Chart	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Serial I/F Mode</p> </div> <div style="text-align: center;"> <p>Parallel I/F Mode</p> </div> </div> <p style="text-align: center; margin-top: 10px;">Host Driver</p> <div style="border: 1px dashed black; padding: 5px; margin-top: 10px;"> <p style="text-align: center;">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> </div>																			

## (0B00h) RDDMADCTR : Get Address Mode

RDDMADCTR (Read Display MADCTR)																																																	
Inst/Para	R/W	Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0	HEX																																				
		MIPI	Other																																														
RDDMADCTR	R	0Bh	0B00h	x	D7	D6	D5	D4	D3	D2	D1	D0	00																																				
Description	This command indicates the current status of the display as described in the table below:																																																
	<table border="1"> <thead> <tr> <th>Bit</th> <th>Symbol</th> <th>Description</th> <th>Comment</th> </tr> </thead> <tbody> <tr> <td>D7</td> <td>Reserved</td> <td></td> <td>0</td> </tr> <tr> <td>D6</td> <td>Reserved</td> <td></td> <td>0</td> </tr> <tr> <td>D5</td> <td>Reserved</td> <td></td> <td>0</td> </tr> <tr> <td>D4</td> <td>Reserved</td> <td></td> <td>0</td> </tr> <tr> <td>D3</td> <td>RGB</td> <td>RGB/BGR Order</td> <td>'1' =BGR, (36H-D3 = "1") '0'=RGB, (36H-D3 = "0") It shall not be applied while resolution is FHD <b>SPR</b>.</td> </tr> <tr> <td>D2</td> <td>Reserved</td> <td></td> <td>0</td> </tr> <tr> <td>D1</td> <td>RSMX</td> <td>Horizontal Flip</td> <td>'0' = Normal display(36H-D1='0') '1' = Flipped display(36H-D1='1')</td> </tr> <tr> <td>D0</td> <td>Reserved</td> <td></td> <td></td> </tr> </tbody> </table>													Bit	Symbol	Description	Comment	D7	Reserved		0	D6	Reserved		0	D5	Reserved		0	D4	Reserved		0	D3	RGB	RGB/BGR Order	'1' =BGR, (36H-D3 = "1") '0'=RGB, (36H-D3 = "0") It shall not be applied while resolution is FHD <b>SPR</b> .	D2	Reserved		0	D1	RSMX	Horizontal Flip	'0' = Normal display(36H-D1='0') '1' = Flipped display(36H-D1='1')	D0	Reserved		
	Bit	Symbol	Description	Comment																																													
	D7	Reserved		0																																													
	D6	Reserved		0																																													
	D5	Reserved		0																																													
	D4	Reserved		0																																													
	D3	RGB	RGB/BGR Order	'1' =BGR, (36H-D3 = "1") '0'=RGB, (36H-D3 = "0") It shall not be applied while resolution is FHD <b>SPR</b> .																																													
	D2	Reserved		0																																													
D1	RSMX	Horizontal Flip	'0' = Normal display(36H-D1='0') '1' = Flipped display(36H-D1='1')																																														
D0	Reserved																																																
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>SW Reset</td> <td>No Change</td> </tr> <tr> <td>HW Reset</td> <td>00h</td> </tr> </tbody> </table>													Status	Default Value	Power On Sequence	00h	SW Reset	No Change	HW Reset	00h																												
	Status	Default Value																																															
	Power On Sequence	00h																																															
	SW Reset	No Change																																															
HW Reset	00h																																																
Flow Chart	<pre> graph TD     subgraph Serial_I_F_Mode [Serial I/F Mode]         C1[RDDMADCTR (0Bh)] --&gt; P1[/Send D[7:0]/]     end     subgraph Parallel_I_F_Mode [Parallel I/F Mode]         C2[RDDMADCTR (0Bh)] --&gt; P2[/Dummy Read/]         P2 --&gt; P3[/Send D[7:0]/]     end     C1 -.-&gt; C2     P1 -.-&gt; P2     P3 -.-&gt; P2     </pre> <p>Host Driver</p> <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>																																																

## (0C00h) RDDCOLMOD : Get Pixel Format

RDDCOLMOD (Read Display Pixel Format)																																							
Inst/Para	R/W	Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0	HEX																										
		MIPI	Other																																				
RDDCOLMOD	R	0Ch	0C00h	x	D7	D6	D5	D4	D3	D2	D1	D0	77																										
Description	This command indicates the current status of the display as described in the table below:																																						
	<table border="1"> <thead> <tr> <th>Bit</th> <th>Symbol</th> <th>Description</th> <th>Comment</th> </tr> </thead> <tbody> <tr> <td>D7</td> <td>-</td> <td></td> <td>'0'</td> </tr> <tr> <td>D6</td> <td>VIPF[2]</td> <td rowspan="3">DPI Pixel Format (RGB Interface Color Format)</td> <td rowspan="3">'101' = 16-bits / pixel, '110' = 18-bits / pixel, '111' = 24-bits / pixel, others = not defined</td> </tr> <tr> <td>D5</td> <td>VIPF[1]</td> </tr> <tr> <td>D4</td> <td>VIPF[0]</td> </tr> <tr> <td>D3</td> <td>-</td> <td></td> <td>0</td> </tr> <tr> <td>D2</td> <td>IFPF[2]</td> <td rowspan="3">DBI Pixel Format (Control Interface Color Format)</td> <td rowspan="3">'101' = 16-bits / pixel, '110' = 18-bits / pixel, '111' = 24-bits / pixel, others = not defined</td> </tr> <tr> <td>D1</td> <td>IFPF[1]</td> </tr> <tr> <td>D0</td> <td>IFPF[0]</td> </tr> </tbody> </table>				Bit	Symbol	Description	Comment	D7	-		'0'	D6	VIPF[2]	DPI Pixel Format (RGB Interface Color Format)	'101' = 16-bits / pixel, '110' = 18-bits / pixel, '111' = 24-bits / pixel, others = not defined	D5	VIPF[1]	D4	VIPF[0]	D3	-		0	D2	IFPF[2]	DBI Pixel Format (Control Interface Color Format)	'101' = 16-bits / pixel, '110' = 18-bits / pixel, '111' = 24-bits / pixel, others = not defined	D1	IFPF[1]	D0	IFPF[0]							
Bit	Symbol	Description	Comment																																				
D7	-		'0'																																				
D6	VIPF[2]	DPI Pixel Format (RGB Interface Color Format)	'101' = 16-bits / pixel, '110' = 18-bits / pixel, '111' = 24-bits / pixel, others = not defined																																				
D5	VIPF[1]																																						
D4	VIPF[0]																																						
D3	-		0																																				
D2	IFPF[2]	DBI Pixel Format (Control Interface Color Format)	'101' = 16-bits / pixel, '110' = 18-bits / pixel, '111' = 24-bits / pixel, others = not defined																																				
D1	IFPF[1]																																						
D0	IFPF[0]																																						
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>77h</td> </tr> <tr> <td>SW Reset</td> <td>No Change</td> </tr> <tr> <td>HW Reset</td> <td>77h</td> </tr> </tbody> </table>												Status	Default Value	Power On Sequence	77h	SW Reset	No Change	HW Reset	77h																			
	Status	Default Value																																					
Power On Sequence	77h																																						
SW Reset	No Change																																						
HW Reset	77h																																						
Flow Chart	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Serial I/F Mode</p> <pre> graph TD     A[RDDCOLMOD (0Ch)] --&gt; B[/Send D[7:0]/]             </pre> </div> <div style="text-align: center;"> <p>Parallel I/F Mode</p> <pre> graph TD     A[RDDCOLMOD (0Ch)] --&gt; B[/Dummy Read/]     B --&gt; C[/Send D[7:0]/]             </pre> </div> </div> <p style="text-align: center; margin-top: 10px;">Host Driver</p> <div style="border: 1px dashed black; padding: 5px; margin-top: 10px;"> <p>Legend</p> <ul style="list-style-type: none"> <li>Command: [Rectangle]</li> <li>Parameter: [Parallelogram]</li> <li>Display: [Oval]</li> <li>Action: [Arrow]</li> <li>Mode: [Rounded Rectangle]</li> <li>Sequential transfer: [Speech bubble]</li> </ul> </div>																																						

## (0D00h) RDDIM : Get Display Mode

Inst/Para	R/W	RDDIM (Read Display Image Mode)											HEX							
		Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0								
		MIPI	Other																	
RDDIM	R	0Dh	0D00h	x	D7	D6	D5	D4	D3	D2	D1	D0	00							
Description	The display module returns the display image mode status.																			
	Bit	Symbol	Description	Comment																
	D7	Reserved		'0'																
	D6	Reserved		'0'																
	D5	INVON	Inversion On/Off	"0" = Inversion is Off "1" = Inversion is On,																
	D4	ALLPON	All Pixel On	'0' = Normal display '1' = White display																
	D3	ALLPOFF	All Pixel Off	'0' = Normal display '1' = Black display																
D2~D0	Reserved		'000'																	
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>SW Reset</td> <td>00h</td> </tr> <tr> <td>HW Reset</td> <td>00h</td> </tr> </tbody> </table>												Status	Default Value	Power On Sequence	00h	SW Reset	00h	HW Reset	00h
	Status	Default Value																		
	Power On Sequence	00h																		
	SW Reset	00h																		
HW Reset	00h																			
Flow Chart	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Serial I/F Mode</p> </div> <div style="text-align: center;"> <p>Parallel I/F Mode</p> </div> </div> <div style="margin-top: 20px;"> <p>Legend</p> <ul style="list-style-type: none"> <li>Command (Rectangle)</li> <li>Parameter (Parallelogram)</li> <li>Display (Oval)</li> <li>Action (Arrowhead)</li> <li>Mode (Oval)</li> <li>Sequential transfer (Speech bubble)</li> </ul> </div>																			

## (0E00h) RDDSM : Get Signal Mode

RDDSM (Read Display Signal Mode)																																																	
Inst/Para	R/W	Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0	HEX																																				
		MIPI	Other																																														
RDDSM	R	0Eh	0E00h	x	D7	D6	D5	D4	D3	D2	D1	D0	00																																				
Description	The display module returns the Display Signal Mode.																																																
	<table border="1"> <thead> <tr> <th>Bit</th> <th>Symbol</th> <th>Description</th> <th>Comment</th> </tr> </thead> <tbody> <tr> <td>D7</td> <td>TEON</td> <td>Tearing Effect Line On/Off</td> <td>"0" = Off "1" = On</td> </tr> <tr> <td>D6</td> <td>TELOM</td> <td>Tearing Effect Line mode</td> <td>"0" = mode1 "1" = mode2</td> </tr> <tr> <td>D5</td> <td>Reserved</td> <td></td> <td>'0'</td> </tr> <tr> <td>D4</td> <td>Reserved</td> <td></td> <td>'0'</td> </tr> <tr> <td>D3</td> <td>Reserved</td> <td></td> <td>'0'</td> </tr> <tr> <td>D2</td> <td>Reserved</td> <td></td> <td>'0'</td> </tr> <tr> <td>D1</td> <td>Reserved</td> <td></td> <td>'0'</td> </tr> <tr> <td>D0</td> <td>Error on DSI</td> <td>Error on DSI</td> <td>'0' = No Error '1' = Error</td> </tr> </tbody> </table>													Bit	Symbol	Description	Comment	D7	TEON	Tearing Effect Line On/Off	"0" = Off "1" = On	D6	TELOM	Tearing Effect Line mode	"0" = mode1 "1" = mode2	D5	Reserved		'0'	D4	Reserved		'0'	D3	Reserved		'0'	D2	Reserved		'0'	D1	Reserved		'0'	D0	Error on DSI	Error on DSI	'0' = No Error '1' = Error
	Bit	Symbol	Description	Comment																																													
	D7	TEON	Tearing Effect Line On/Off	"0" = Off "1" = On																																													
	D6	TELOM	Tearing Effect Line mode	"0" = mode1 "1" = mode2																																													
	D5	Reserved		'0'																																													
	D4	Reserved		'0'																																													
	D3	Reserved		'0'																																													
	D2	Reserved		'0'																																													
	D1	Reserved		'0'																																													
D0	Error on DSI	Error on DSI	'0' = No Error '1' = Error																																														
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>SW Reset</td> <td>00h</td> </tr> <tr> <td>HW Reset</td> <td>00h</td> </tr> </tbody> </table>													Status	Default Value	Power On Sequence	00h	SW Reset	00h	HW Reset	00h																												
	Status	Default Value																																															
	Power On Sequence	00h																																															
	SW Reset	00h																																															
HW Reset	00h																																																
Flow Chart	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Serial I/F Mode</p> </div> <div style="text-align: center;"> <p>Parallel I/F Mode</p> </div> </div> <p style="text-align: center;">Host Driver</p> <div style="border: 1px dashed black; padding: 5px; margin-top: 10px;"> <p>Legend</p> <ul style="list-style-type: none"> <li><span style="border: 1px solid black; padding: 2px;">Command</span></li> <li><span style="border: 1px solid black; padding: 2px;">Parameter</span></li> <li><span style="border: 1px solid black; padding: 2px;">Display</span></li> <li><span style="border: 1px solid black; padding: 2px;">Action</span></li> <li><span style="border: 1px solid black; padding: 2px;">Mode</span></li> <li><span style="border: 1px solid black; padding: 2px;">Sequential transfer</span></li> </ul> </div>																																																

## (0F00h) RDDSDR : Get Diagnostic Result

RDDSDR (Read Display Self-Diagnostic Result)																																				
Inst/Para	R/W	Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0	HEX																							
		MIPI	Other																																	
RDDSDR	R	0Fh	0F00h	x	Register Loading Detection			D3	D2	D1	D0	00																								
Description	The display module returns the self-diagnostic results following a Sleep Out command.																																			
	<table border="1"> <thead> <tr> <th>Bit</th> <th>Symbol</th> <th>Description</th> <th>Comment</th> </tr> </thead> <tbody> <tr> <td>D7~D4</td> <td>RELD</td> <td>Register Loading Detection</td> <td></td> </tr> <tr> <td>D3</td> <td>Reserved</td> <td></td> <td>'0'</td> </tr> <tr> <td>D2</td> <td>Reserved</td> <td></td> <td>'0'</td> </tr> <tr> <td>D1</td> <td>Reserved</td> <td></td> <td>'0'</td> </tr> <tr> <td>D0</td> <td>Reserved</td> <td></td> <td>'0'</td> </tr> </tbody> </table>												Bit	Symbol	Description	Comment	D7~D4	RELD	Register Loading Detection		D3	Reserved		'0'	D2	Reserved		'0'	D1	Reserved		'0'	D0	Reserved		'0'
	Bit	Symbol	Description	Comment																																
	D7~D4	RELD	Register Loading Detection																																	
	D3	Reserved		'0'																																
	D2	Reserved		'0'																																
D1	Reserved		'0'																																	
D0	Reserved		'0'																																	
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>SW Reset</td> <td>00h</td> </tr> <tr> <td>HW Reset</td> <td>00h</td> </tr> </tbody> </table>												Status	Default Value	Power On Sequence	00h	SW Reset	00h	HW Reset	00h																
	Status	Default Value																																		
	Power On Sequence	00h																																		
	SW Reset	00h																																		
HW Reset	00h																																			
Flow Chart	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Serial I/F Mode</p> <pre> graph TD     A[RDDSR (0Fh)] --&gt; B[/Send D[7:0]/]             </pre> </div> <div style="text-align: center;"> <p>Parallel I/F Mode</p> <pre> graph TD     A[RDDSR (0Fh)] --&gt; B[/Dummy Read/]     B --&gt; C[/Send D[7:0]/]             </pre> </div> <div style="border: 1px dashed black; padding: 5px;"> <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> </div> </div> <p style="text-align: center; margin-top: 10px;">Host Driver</p>																																			

## (1000h) SLPIN : Enter Sleep mode

Inst/Para	R/W	SLPIN (Sleep In)											HEX							
		Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0								
		MIPI	Other																	
SLPIN	W	10h	1000h	No Argument																
Description	<p>This command causes the display module to enter the minimum power consumption mode.</p> <p>In this mode the DC/DC converter is stopped, Internal display oscillator is stopped, and panel scanning is stopped. The control Interface such as registers is still working and keeps its values.</p> <p>After Sleep in command, user can send PCLK, HS and VS information on RGB I/F for blank display and this information is valid during 2 frames if there is used Normal Mode On in Sleep Out-mode.</p> <p>There is used an internal oscillator for blank display.</p>																			
Restriction	<p>This command has no effect when the display module is already in Sleep mode.</p> <p>Sleep In Mode can only be exit by the Sleep Out Command (11h).</p> <p>It must wait 5msec before sending next command for the supply voltages and clock circuits to stabilize.</p> <p>It must wait 120msec after sending Sleep Out command (when in Sleep In Mode) before Sleep In command can be sent.</p>																			
Default	<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>SW Reset</td> <td>Sleep In Mode</td> </tr> <tr> <td>HW Reset</td> <td>Sleep In Mode</td> </tr> </tbody> </table>												Status	Default Value	Power On Sequence	Sleep In Mode	SW Reset	Sleep In Mode	HW Reset	Sleep In Mode
Status	Default Value																			
Power On Sequence	Sleep In Mode																			
SW Reset	Sleep In Mode																			
HW Reset	Sleep In Mode																			
Flow Chart	<pre> graph TD     A[SPLIN 10h] --&gt; B[Display whole blank screen (Automatic No effect to DISPON/OFF command)]     B --&gt; C[/Drain charge from panel/]     C --&gt; D[Stop DC/DC Converte]     C --&gt; E[Stop Internal Oscillator]     D --&gt; F([Sleep In])     E --&gt; F     </pre>																			

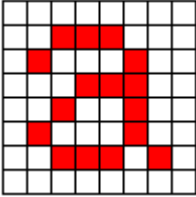
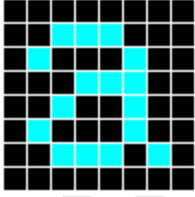
## (1100h) SLPOUT : Exit Sleep Mode

		SLPOUT (Sleep Out)																			
Inst/Para	R/W	Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0	HEX								
		MIPI	Other																		
SLPOUT	W	11h	1100h	No Argument																	
Description	<p>This command causes the display module to exit Sleep mode. All blocks inside the display module are enabled. The host processor sends PCLK, HS and VS information to display modules two frames before this command is sent when the display module is in Normal Mode.</p>																				
Restriction	<p>This command shall not cause any visible effect on the display device when the display module is not in Sleep mode. The host processor must wait five milliseconds after sending this command before sending another command. This delay allows the supply voltages and clock circuits to stabilize.</p> <p>The host processor must wait 120 milliseconds after sending a Sleep Out command before sending a Sleep-In command. The display module loads the display module's default values to the registers when exiting the Sleep mode. There shall not be any abnormal visual effect on the display device when loading the registers if the factory default and register values are the same or when the display module is not in Sleep mode. The display module runs the self-diagnostic functions after this command is received.</p>																				
Default	<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>SW Reset</td> <td>Sleep In Mode</td> </tr> <tr> <td>HW Reset</td> <td>Sleep In Mode</td> </tr> </tbody> </table>													Status	Default Value	Power On Sequence	Sleep In Mode	SW Reset	Sleep In Mode	HW Reset	Sleep In Mode
Status	Default Value																				
Power On Sequence	Sleep In Mode																				
SW Reset	Sleep In Mode																				
HW Reset	Sleep In Mode																				
Flow chart	<pre> graph TD     Start[SLPOUT (11h)] --&gt; A1{{Start Internal Oscillator}}     A1 --&gt; A2{{Start DC-DC Converter}}     A2 --&gt; A3{{Charge Offset voltage for LCD Panel}}     A3 --&gt; A4{{Display whole blank screen for 2 frames (Automatic No effect to DISPON/OFF Commands)}}     A4 --&gt; A5{{Display Image contents in accordance with the current command table settings}}     A5 --&gt; End([Sleep Out])     </pre>																				

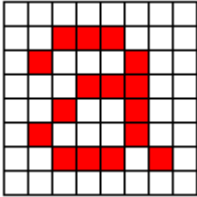
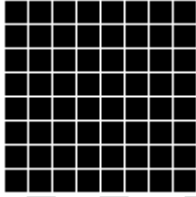
## (2000h) INVOFF : Exit Invert Mode

INVOFF (Display Inversion Off)																				
Inst/Para	R/W	Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0	HEX							
		MIPI	Other																	
INVOFF	W	20h	2000h	No Argument																
Description	<p>This command causes the display module to stop inverting the image data on the display device. No status bits are changed.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p><b>Input Image</b></p> </div> <div style="font-size: 2em;">→</div> <div style="text-align: center;"> <p><b>Display Panel</b></p> </div> </div>																			
Restriction	This command has no effect when the display module is not inverting the display image.																			
Default	<table border="1" style="margin-left: auto; margin-right: auto;"> <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>SW Reset</td> <td>Display Inversion off</td> </tr> <tr> <td>HW Reset</td> <td>Display Inversion off</td> </tr> </tbody> </table>												Status	Default Value	Power On Sequence	Display Inversion off	SW Reset	Display Inversion off	HW Reset	Display Inversion off
Status	Default Value																			
Power On Sequence	Display Inversion off																			
SW Reset	Display Inversion off																			
HW Reset	Display Inversion off																			
Flow Chart	<div style="display: flex; align-items: center;"> <div style="flex: 1;"> <pre> graph TD     A([Display Inversion On Mode]) --&gt; B[INVOFF (20h)]     B --&gt; C([Display Inversion OFF Mode])                     </pre> </div> <div style="flex: 1; border: 1px dashed black; padding: 5px;"> <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> </div> </div>																			

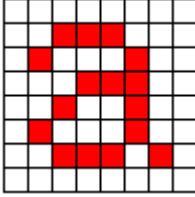
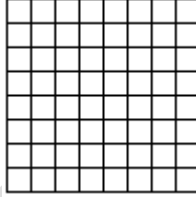
## (2100h) INVON : Enter Invert Mode

INVON (Display Inversion On)																				
Inst/Para	R/W	Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0	HEX							
		MIPI	Other																	
INVON	W	21h	2100h	No Argument																
Description	<p>This command causes the display module to invert the image data only on the display device. No status bits are changed.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p><b>Input Image</b></p>  </div> <div style="font-size: 2em;">→</div> <div style="text-align: center;"> <p><b>Display Panel</b></p>  </div> </div>																			
Restriction	This command has no effect when module is already in inversion on mode.																			
Default	<table border="1" style="width: 100%; border-collapse: collapse;"> <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>SW Reset</td> <td>Display Inversion off</td> </tr> <tr> <td>HW Reset</td> <td>Display Inversion off</td> </tr> </tbody> </table>												Status	Default Value	Power On Sequence	Display Inversion off	SW Reset	Display Inversion off	HW Reset	Display Inversion off
Status	Default Value																			
Power On Sequence	Display Inversion off																			
SW Reset	Display Inversion off																			
HW Reset	Display Inversion off																			
Flow Chart	<div style="display: flex; align-items: center;"> <div style="flex: 1;"> <pre> graph TD     A([Display Inversion OFF Mode]) --&gt; B[INVON (21h)]     B --&gt; C([Display Inversion ON Mode])                     </pre> </div> <div style="flex: 1; border: 1px dashed black; padding: 5px;"> <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> </div> </div>																			

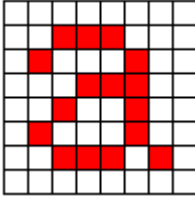
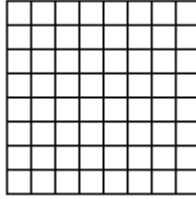
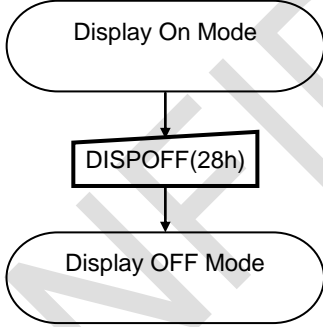
## (2200h) ALLPOFF : Set All Pixel Off

Inst/Para	R/W	ALLPOFF											HEX							
		Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0								
		MIPI	Other																	
ALLPOFF	W	22h	2200h	No Argument																
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. This command does not change any other status.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p><b>Input Image</b></p>  </div> <div style="font-size: 2em;">→</div> <div style="text-align: center;"> <p><b>Display Panel</b></p>  </div> </div> <p>“All Pixels On” or “Normal Display On” commands are used to leave this mode. The display panel is showing the content of the Input Image after “Normal Display On” command.</p>																			
Restriction	-																			
Default	<table border="1" style="margin-left: auto; margin-right: auto;"> <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>SW Reset</td> <td>Display Inversion off</td> </tr> <tr> <td>HW Reset</td> <td>Display Inversion off</td> </tr> </tbody> </table>												Status	Default Value	Power On Sequence	Display Inversion off	SW Reset	Display Inversion off	HW Reset	Display Inversion off
Status	Default Value																			
Power On Sequence	Display Inversion off																			
SW Reset	Display Inversion off																			
HW Reset	Display Inversion off																			
Flow Chart	<div style="display: flex; align-items: center;"> <div style="flex: 1;"> <pre> graph TD     A([Normal Display ON Mode]) --&gt; B[ALLPOFF (22h)]     B --&gt; C([Black Display])             </pre> </div> <div style="flex: 1; border: 1px dashed black; padding: 5px;"> <p>Legend</p> <ul style="list-style-type: none"> <li><span style="border: 1px solid black; display: inline-block; width: 20px; height: 10px; margin-right: 5px;"></span> Command</li> <li><span style="border: 1px solid black; transform: rotate(-30deg); display: inline-block; width: 20px; height: 10px; margin-right: 5px;"></span> Parameter</li> <li><span style="border: 1px solid black; border-radius: 10px; display: inline-block; width: 20px; height: 10px; margin-right: 5px;"></span> Display</li> <li><span style="border: 1px solid black; border-radius: 10px; transform: rotate(180deg); display: inline-block; width: 20px; height: 10px; margin-right: 5px;"></span> Action</li> <li><span style="border: 1px solid black; border-radius: 10px; display: inline-block; width: 20px; height: 10px; margin-right: 5px;"></span> Mode</li> <li><span style="border: 1px solid black; border-radius: 10px; display: inline-block; width: 20px; height: 10px; margin-right: 5px;"></span> Sequential transfer</li> </ul> </div> </div>																			

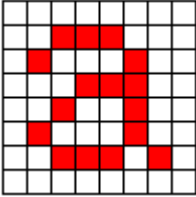
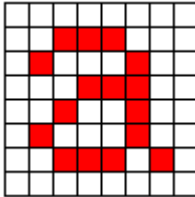
## (2300h) ALLPON : Set All Pixel On

Inst/Para	R/W	ALLPON											HEX							
		Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0								
		MIPI	Other																	
ALLPON	W	23h	2300h	No Argument																
Description	<p>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.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p><b>Input Image</b></p>  </div> <div style="font-size: 2em;">→</div> <div style="text-align: center;"> <p><b>Display Panel</b></p>  </div> </div> <p>“All Pixels Off”, “Normal Display Mode On” commands are used to leave this mode. The display panel is showing the content of the Input Image after “Normal Display On” command.</p>																			
Restriction	-																			
Default	<table border="1" style="width: 100%; border-collapse: collapse;"> <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>SW Reset</td> <td>Display Inversion off</td> </tr> <tr> <td>HW Reset</td> <td>Display Inversion off</td> </tr> </tbody> </table>												Status	Default Value	Power On Sequence	Display Inversion off	SW Reset	Display Inversion off	HW Reset	Display Inversion off
Status	Default Value																			
Power On Sequence	Display Inversion off																			
SW Reset	Display Inversion off																			
HW Reset	Display Inversion off																			
Flow Chart	<div style="display: flex; align-items: center;"> <div style="flex: 1;"> <pre> graph TD     A([Normal Display ON Mode]) --&gt; B[ALLPON (23h)]     B --&gt; C([White Display])                     </pre> </div> <div style="flex: 1; border: 1px dashed black; padding: 5px;"> <p>Legend</p> <ul style="list-style-type: none"> <li><span style="border: 1px solid black; display: inline-block; width: 20px; height: 10px; margin-right: 5px;"></span> Command</li> <li><span style="border: 1px solid black; width: 20px; height: 10px; transform: rotate(-45deg); margin-right: 5px;"></span> Parameter</li> <li><span style="border: 1px solid black; width: 20px; height: 10px; border-radius: 5px; margin-right: 5px;"></span> Display</li> <li><span style="border: 1px solid black; width: 20px; height: 10px; border-radius: 5px; margin-right: 5px;"></span> Action</li> <li><span style="border: 1px solid black; width: 20px; height: 10px; border-radius: 5px; margin-right: 5px;"></span> Mode</li> <li><span style="border: 1px solid black; width: 20px; height: 10px; border-radius: 5px; margin-right: 5px;"></span> Sequential transfer</li> </ul> </div> </div>																			

## (2800h) DISPOFF : Set Display Off

		DISPOFF (Display Off)																			
Inst/Para	R/W	Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0	HEX								
		MIPI	Other																		
DISPOFF	W	28h	2800h	No Argument																	
Description	<p>This command causes the display module to stop displaying the image data on the display device. No status bits are changed.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p><b>Input Image</b></p>  </div> <div style="text-align: center;"> <p>→</p> <p>(example)</p> </div> <div style="text-align: center;"> <p><b>Display Panel</b></p>  </div> </div>																				
	Restriction	This command has no effect when module is already in display off mode.																			
Default	<table border="1" style="margin-left: auto; margin-right: auto;"> <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>SW Reset</td> <td>Display Off</td> </tr> <tr> <td>HW Reset</td> <td>Display Off</td> </tr> </tbody> </table>													Status	Default Value	Power On Sequence	Display Off	SW Reset	Display Off	HW Reset	Display Off
	Status	Default Value																			
Power On Sequence	Display Off																				
SW Reset	Display Off																				
HW Reset	Display Off																				
Flow Chart	<div style="display: flex; align-items: center;"> <div style="flex: 1;">  <pre> graph TD     A([Display On Mode]) --&gt; B[DISPOFF(28h)]     B --&gt; C([Display OFF Mode])             </pre> </div> <div style="flex: 1; border: 1px dashed black; padding: 5px;"> <p>Legend</p> <ul style="list-style-type: none"> <li><span style="border: 1px solid black; display: inline-block; width: 20px; height: 10px; margin-right: 5px;"></span> Command</li> <li><span style="border: 1px solid black; display: inline-block; width: 20px; height: 10px; transform: rotate(-45deg); margin-right: 5px;"></span> Parameter</li> <li><span style="border: 1px solid black; display: inline-block; width: 20px; height: 10px; border-radius: 5px; margin-right: 5px;"></span> Display</li> <li><span style="border: 1px solid black; display: inline-block; width: 20px; height: 10px; border-left: none; border-right: none; border-top: none; border-bottom: none; margin-right: 5px;"></span> Action</li> <li><span style="border: 1px solid black; display: inline-block; width: 20px; height: 10px; border-radius: 5px; margin-right: 5px;"></span> Mode</li> <li><span style="border: 1px solid black; display: inline-block; width: 20px; height: 10px; border-radius: 5px; margin-right: 5px;"></span> Sequential transfer</li> </ul> </div> </div>																				

## (2900h) DISPON : Set Display On

Inst/Para	R/W	DISPON (Display On)											HEX							
		Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0								
		MIPI	Other																	
DISPON	W	29h	2900h	No Argument																
Description	<p>This command causes the display module to start displaying the image data on the display device. No status bits are changed.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p><b>Input Image</b></p>  </div> <div style="font-size: 2em;">→</div> <div style="text-align: center;"> <p><b>Display Panel</b></p>  </div> </div> <p>(example)</p>																			
Restriction	This command has no effect when module is already in display on mode.																			
Default	<table border="1" style="margin-left: auto; margin-right: auto;"> <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>SW Reset</td> <td>Display Off</td> </tr> <tr> <td>HW Reset</td> <td>Display Off</td> </tr> </tbody> </table>												Status	Default Value	Power On Sequence	Display Off	SW Reset	Display Off	HW Reset	Display Off
Status	Default Value																			
Power On Sequence	Display Off																			
SW Reset	Display Off																			
HW Reset	Display Off																			
Flow Chart	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>Display OFF Mode</p> <p>↓</p> <p>DISPON (29h)</p> <p>↓</p> <p>Display ON Mode</p> </div> <div style="border: 1px dashed black; padding: 5px;"> <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> </div> </div>																			

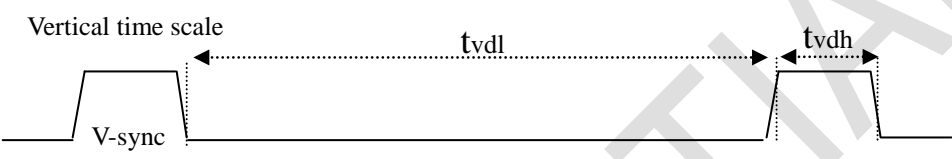
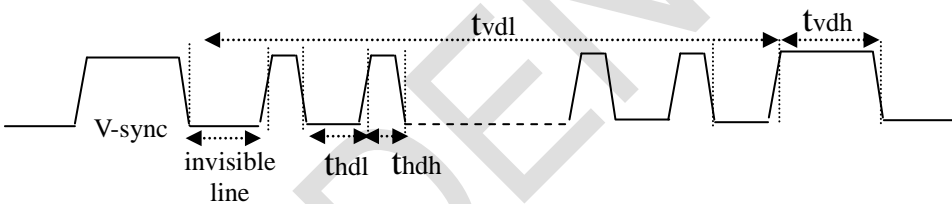
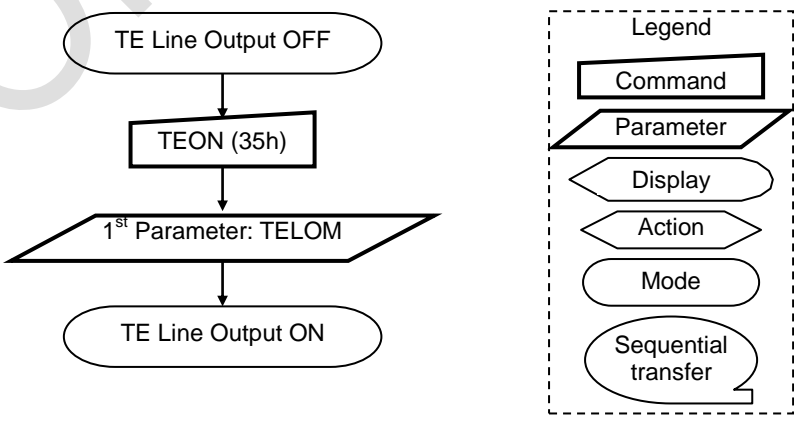
## (2C00h) RAMWR : Write Memory Start

Inst/Para	R/W	RAMWR																		
		Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0	HEX							
		MIPI	Other																	
RAMWR	R/W	2Ch	2C00h	X	0	0	1	0	1	1	0	0	2C							
			1 <sup>st</sup> Pixel	X	D <sub>17</sub>	D <sub>16</sub>	D <sub>15</sub>	D <sub>14</sub>	D <sub>13</sub>	D <sub>12</sub>	D <sub>11</sub>	D <sub>10</sub>								
			:	X	:	:	:	:	:	:	:	:	:							
			N <sup>th</sup> Pixel	X	D <sub>N7</sub>	D <sub>N6</sub>	D <sub>N5</sub>	D <sub>N4</sub>	D <sub>N3</sub>	D <sub>N2</sub>	D <sub>N1</sub>	D <sub>N0</sub>								
Description	<p>This command transfers image data from the host processor to the display module's frame memory. It initializes the memory address pointer to the start of the memory.</p> <p>Please refer to TE (Tearing Effect signal) to synchronize Frame Memory Writing when displaying video images.</p>																			
Restriction	<p>The pixel data of one line must be transmitting by one packet.</p> <p>EX: 8-8-8 pixel format with 1080x1920 resolution → packet size = 1080x3 = 3240 bytes</p> <p>EX: 6-6-6 pixel format with 1080x1920 resolution → packet size = 1080x3 = 3240 bytes</p> <p>EX: 5-6-5 pixel format with 1080x1920 resolution → packet size = 1080x2 = 2160 bytes</p>																			
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>SW Reset</td> <td>Contents of memory is not cleared</td> </tr> <tr> <td>HW Reset</td> <td>Contents of memory is not cleared</td> </tr> </tbody> </table>												Status	Default Value	Power On Sequence	Contents of memory is set randomly	SW Reset	Contents of memory is not cleared	HW Reset	Contents of memory is not cleared
Status	Default Value																			
Power On Sequence	Contents of memory is set randomly																			
SW Reset	Contents of memory is not cleared																			
HW Reset	Contents of memory is not cleared																			
Flow chart																				

## (3400h) TEOFF : Set Tear OFF

TEOFF (Tearing Effect Line OFF)																				
Inst/Para	R/W	Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0	HEX							
		MIPI	Other																	
TEOFF	W	34h	3400h	No Argument																
Description	This command turns off the display module's Tearing Effect output signal from the TE signal line.																			
Restriction	This command has no effect when the Tearing Effect output is already off.																			
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>SW Reset</td> <td>OFF</td> </tr> <tr> <td>HW Reset</td> <td>OFF</td> </tr> </tbody> </table>												Status	Default Value	Power On Sequence	OFF	SW Reset	OFF	HW Reset	OFF
Status	Default Value																			
Power On Sequence	OFF																			
SW Reset	OFF																			
HW Reset	OFF																			
Flow Chart	<pre> graph TD     A([TE Line Output ON]) --&gt; B[TEOFF (34h)]     B --&gt; C([TE Line Output OFF])     </pre> <p><b>Legend</b></p> <ul style="list-style-type: none"> <li>Command: Rectangle</li> <li>Parameter: Parallelogram</li> <li>Display: Oval</li> <li>Action: Arrowhead</li> <li>Mode: Capsule</li> <li>Sequential transfer: Oval with tail</li> </ul>																			

## (3500h) TEON : Set Tear ON

Inst/Para	R/W	TEON (Tearing Effect Line ON)											HEX							
		Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0								
		MIPI	Other																	
TEON	R/W	35h	3500h	x	0	0	0	0	0	0	0	TELOM	00							
Description	<p>This command turns on the tearing Effect output signal on the TE signal line. The TE signal is not affected by changing MADCTR (36h-D4) (Line Address Order). The Tearing Effect Line On has one parameter that describes the Tearing Effect Output Line mode.</p> <p>If TELOM = 0 The Tearing Effect Output line consists of V-Blanking information only.</p>  <p>If TELOM = 1 The Tearing Effect Output line consists of both V-Blanking and H-Blanking information.</p>  <p><b>The Tearing Effect Output line shall be active low when the display module is in Sleep mode.</b></p>																			
Restriction	This command has no effect when Tearing Effect output is already ON.																			
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>SW Reset</td> <td>OFF</td> </tr> <tr> <td>HW Reset</td> <td>OFF</td> </tr> </tbody> </table>												Status	Default Value	Power On Sequence	OFF	SW Reset	OFF	HW Reset	OFF
Status	Default Value																			
Power On Sequence	OFF																			
SW Reset	OFF																			
HW Reset	OFF																			
Flow Chart																				

## (3600h) MADCTR : Set Address Mode

Inst/Para	R/W	MADCTR (Scan Direction Control)																																															
		Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0	HEX																																				
		MIPI	Other																																														
MADCTR	W	36h	3600h	x	D7	D6	D5	D4	D3	D2	D1	D0	00																																				
Description	<p>This command defines the scan direction of Source and Gate Driver. This command makes no change on the other driver status.</p> <table border="1"> <thead> <tr> <th>Bit</th> <th>Symbol</th> <th>Description</th> <th>Comment</th> </tr> </thead> <tbody> <tr> <td>D7</td> <td>Reserved</td> <td></td> <td>0</td> </tr> <tr> <td>D6</td> <td>Reserved</td> <td></td> <td>0</td> </tr> <tr> <td>D5</td> <td>Reserved</td> <td></td> <td>0</td> </tr> <tr> <td>D4</td> <td>Reserved</td> <td></td> <td>0</td> </tr> <tr> <td>D3</td> <td>RGB</td> <td>RGB/BGR Order</td> <td>"0"=RGB '1' =BGR It shall not be applied while resolution is FHD <b>SPR</b>.</td> </tr> <tr> <td>D2</td> <td>Reserved</td> <td></td> <td>0</td> </tr> <tr> <td>D1</td> <td>RSMX</td> <td>Horizontal Flip</td> <td>'0' = Normal display '1' = Flipped display</td> </tr> <tr> <td>D0</td> <td>Reserved</td> <td></td> <td></td> </tr> </tbody> </table>													Bit	Symbol	Description	Comment	D7	Reserved		0	D6	Reserved		0	D5	Reserved		0	D4	Reserved		0	D3	RGB	RGB/BGR Order	"0"=RGB '1' =BGR It shall not be applied while resolution is FHD <b>SPR</b> .	D2	Reserved		0	D1	RSMX	Horizontal Flip	'0' = Normal display '1' = Flipped display	D0	Reserved		
	Bit	Symbol	Description	Comment																																													
D7	Reserved		0																																														
D6	Reserved		0																																														
D5	Reserved		0																																														
D4	Reserved		0																																														
D3	RGB	RGB/BGR Order	"0"=RGB '1' =BGR It shall not be applied while resolution is FHD <b>SPR</b> .																																														
D2	Reserved		0																																														
D1	RSMX	Horizontal Flip	'0' = Normal display '1' = Flipped display																																														
D0	Reserved																																																
	<p>• Bit D1 – Horizontal Flip</p> <table border="1"> <thead> <tr> <th>D1</th> <th>D0</th> <th>Display Panel</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td></td> </tr> <tr> <td>1</td> <td>0</td> <td></td> </tr> </tbody> </table>													D1	D0	Display Panel	0	0		1	0																												
D1	D0	Display Panel																																															
0	0																																																
1	0																																																
	<p>• Bit D3 – RGB/BGR order</p> <table border="0"> <tr> <td>Input Image</td> <td></td> <td>Display Panel</td> </tr> <tr> <td></td> <td><math>\xrightarrow[\text{Sent RGB}]{D3 = 0}</math></td> <td></td> </tr> <tr> <td>Input Image</td> <td></td> <td>Display Panel</td> </tr> <tr> <td></td> <td><math>\xrightarrow[\text{Sent BGR}]{D3 = 1}</math></td> <td></td> </tr> </table>													Input Image		Display Panel		$\xrightarrow[\text{Sent RGB}]{D3 = 0}$		Input Image		Display Panel		$\xrightarrow[\text{Sent BGR}]{D3 = 1}$																									
Input Image		Display Panel																																															
	$\xrightarrow[\text{Sent RGB}]{D3 = 0}$																																																
Input Image		Display Panel																																															
	$\xrightarrow[\text{Sent BGR}]{D3 = 1}$																																																
Restriction	Bit D3 is not applicable while resolution is FHD SPR.																																																
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>SW Reset</td> <td>No Change</td> </tr> <tr> <td>HW Reset</td> <td>00h</td> </tr> </tbody> </table>	Status	Default Value	Power On Sequence	00h	SW Reset	No Change	HW Reset	00h
Status	Default Value								
Power On Sequence	00h								
SW Reset	No Change								
HW Reset	00h								
Flow chart	<p>The flow chart shows a rectangular box labeled 'MADCTR (36h)' with a downward arrow pointing to a parallelogram labeled '1st Parameter'. To the right is a legend box containing six symbols: a rectangle for 'Command', a parallelogram for 'Parameter', a pointed oval for 'Display', an arrowhead for 'Action', a rounded rectangle for 'Mode', and an oval with a tail for 'Sequential transfer'.</p>								

CONFIDENTIAL

## (3800h) IDMOFF : Exit Idle Mode

Inst/Para	R/W	IDMOFF (Idle Mode Off)											HEX							
		Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0								
		MIPI	Other																	
IDMOFF	W	38h	3800h	No Argument																
Description	This command causes the display module to exit Idle mode.																			
Restriction	This command has no effect when the display module is not in Idle mode.																			
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>SW Reset</td> <td>Idle Mode Off</td> </tr> <tr> <td>HW Reset</td> <td>Idle Mode Off</td> </tr> </tbody> </table>												Status	Default Value	Power On Sequence	Idle Mode Off	SW Reset	Idle Mode Off	HW Reset	Idle Mode Off
Status	Default Value																			
Power On Sequence	Idle Mode Off																			
SW Reset	Idle Mode Off																			
HW Reset	Idle Mode Off																			
Flow Chart	<pre> graph TD     A([Idle mode ON]) --&gt; B[IDMOFF (38h)]     B --&gt; C([Idle mode OFF])     </pre> <p>Legend:</p> <ul style="list-style-type: none"> <li>Command: Rectangle</li> <li>Parameter: Parallelogram</li> <li>Display: Oval</li> <li>Action: Diamond</li> <li>Mode: Rounded rectangle</li> <li>Sequential transfer: Oval with tail</li> </ul>																			

## (3900h) IDMON : Enter\_idle\_mode

Inst/Para	R/W	IDMON										HEX																																		
		Address		D15-8	D7	D6	D5	D4	D3	D2	D1		D0																																	
		MIPI	Other																																											
IDMON	W	39h	3900h	No Argument																																										
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> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p><b>Input Image</b></p> </div> <div style="font-size: 2em; margin: 0 20px;">→</div> <div style="text-align: center;"> <p><b>Display Panel</b></p> </div> </div>																																													
	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>Color</th> <th>R7 R6 R5 R4 R3 R2 R1</th> <th>G7 G6 G5 G4 G3 G2 G1</th> <th>B7 B6 B5 B4 B3 B2</th> </tr> </thead> <tbody> <tr> <td>Black</td> <td>0XXXXXXX</td> <td>0XXXXXXX</td> <td>0XXXXXXX</td> </tr> <tr> <td>Blue</td> <td>0XXXXXXX</td> <td>0XXXXXXX</td> <td>1XXXXXXX</td> </tr> <tr> <td>Red</td> <td>1XXXXXXX</td> <td>0XXXXXXX</td> <td>0XXXXXXX</td> </tr> <tr> <td>Mage</td> <td>1XXXXXXX</td> <td>0XXXXXXX</td> <td>1XXXXXXX</td> </tr> <tr> <td>Green</td> <td>0XXXXXXX</td> <td>1XXXXXXX</td> <td>0XXXXXXX</td> </tr> <tr> <td>Cyan</td> <td>0XXXXXXX</td> <td>1XXXXXXX</td> <td>1XXXXXXX</td> </tr> <tr> <td>Yellow</td> <td>1XXXXXXX</td> <td>1XXXXXXX</td> <td>0XXXXXXX</td> </tr> <tr> <td>White</td> <td>1XXXXXXX</td> <td>1XXXXXXX</td> <td>1XXXXXXX</td> </tr> </tbody> </table>											Color	R7 R6 R5 R4 R3 R2 R1	G7 G6 G5 G4 G3 G2 G1	B7 B6 B5 B4 B3 B2	Black	0XXXXXXX	0XXXXXXX	0XXXXXXX	Blue	0XXXXXXX	0XXXXXXX	1XXXXXXX	Red	1XXXXXXX	0XXXXXXX	0XXXXXXX	Mage	1XXXXXXX	0XXXXXXX	1XXXXXXX	Green	0XXXXXXX	1XXXXXXX	0XXXXXXX	Cyan	0XXXXXXX	1XXXXXXX	1XXXXXXX	Yellow	1XXXXXXX	1XXXXXXX	0XXXXXXX	White	1XXXXXXX	1XXXXXXX
Color	R7 R6 R5 R4 R3 R2 R1	G7 G6 G5 G4 G3 G2 G1	B7 B6 B5 B4 B3 B2																																											
Black	0XXXXXXX	0XXXXXXX	0XXXXXXX																																											
Blue	0XXXXXXX	0XXXXXXX	1XXXXXXX																																											
Red	1XXXXXXX	0XXXXXXX	0XXXXXXX																																											
Mage	1XXXXXXX	0XXXXXXX	1XXXXXXX																																											
Green	0XXXXXXX	1XXXXXXX	0XXXXXXX																																											
Cyan	0XXXXXXX	1XXXXXXX	1XXXXXXX																																											
Yellow	1XXXXXXX	1XXXXXXX	0XXXXXXX																																											
White	1XXXXXXX	1XXXXXXX	1XXXXXXX																																											
Restriction	This command has no effect when module is already in idle on mode.																																													
Default	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <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>SW Reset</td> <td>Idle Mode Off</td> </tr> <tr> <td>HW Reset</td> <td>Idle Mode Off</td> </tr> </tbody> </table>											Status	Default Value	Power On Sequence	Idle Mode Off	SW Reset	Idle Mode Off	HW Reset	Idle Mode Off																											
Status	Default Value																																													
Power On Sequence	Idle Mode Off																																													
SW Reset	Idle Mode Off																																													
HW Reset	Idle Mode Off																																													
Flow Chart	<div style="display: flex; align-items: center;"> <div style="flex: 1;"> <pre> graph TD     A{{Idle mode OFF}} --&gt; B[IDMON (39h)]     B --&gt; C{{Idle mode ON}}             </pre> </div> <div style="flex: 1; border: 1px dashed black; padding: 5px;"> <p style="text-align: center;">Legend</p> <ul style="list-style-type: none"> <li>Command: [ ]</li> <li>Parameter: / /</li> <li>Dislav: &lt;&gt;</li> <li>Action: &lt;&gt;</li> <li>Mode: ( )</li> <li>Sequential transfer: ( )</li> </ul> </div> </div>																																													

## (3A00h) COLMOD : Set Pixel Format

COLMOD (Interface Pixel Format)																													
Inst/Para	R/W	Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0	HEX																
		MIPI	Other																										
COLMOD	W	3Ah	3A00h	x	-	VIPF[2]	VIPF[1]	VIPF[0]	-	IFPF[2]	IFPF[1]	IFPF[0]	77																
Description	<p>This command sets the pixel format for the RGB image data used by the interface.</p> <p>VIPF[2:0] : DPI Pixel Format Definition. IFPF[2:0] : MCU Pixel Format Definition.</p> <p>If not used DPI interface, then the corresponding bits in the parameter are ignored.</p> <table border="1"> <thead> <tr> <th colspan="4">Control Interface Color Format</th> </tr> </thead> <tbody> <tr> <td>16bit/pixel (65,536 colors)</td> <td>1</td> <td>0</td> <td>1</td> </tr> <tr> <td>18bit/pixel (262,144 colors)</td> <td>1</td> <td>1</td> <td>0</td> </tr> <tr> <td>24bit/pixel (16.7M colors)</td> <td>1</td> <td>1</td> <td>1</td> </tr> </tbody> </table>													Control Interface Color Format				16bit/pixel (65,536 colors)	1	0	1	18bit/pixel (262,144 colors)	1	1	0	24bit/pixel (16.7M colors)	1	1	1
Control Interface Color Format																													
16bit/pixel (65,536 colors)	1	0	1																										
18bit/pixel (262,144 colors)	1	1	0																										
24bit/pixel (16.7M colors)	1	1	1																										
Restriction	-																												
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>77h</td> </tr> <tr> <td>SW Reset</td> <td>No Change</td> </tr> <tr> <td>HW Reset</td> <td>77h</td> </tr> </tbody> </table>													Status	Default Value	Power On Sequence	77h	SW Reset	No Change	HW Reset	77h								
Status	Default Value																												
Power On Sequence	77h																												
SW Reset	No Change																												
HW Reset	77h																												
Flow chart	<p>Example :</p> <pre> graph TD     A([16-bits / Pixel Mode]) --&gt; B[COLMOD (3Ah)]     B --&gt; C[/1st Parameter (06h)/]     C --&gt; D([18-bits / Pixel Mode])     </pre> <p>Legend</p> <ul style="list-style-type: none"> <li>Command: Rectangle</li> <li>Parameter: Parallelogram</li> <li>Display: Oval</li> <li>Action: Arrow</li> <li>Mode: Oval</li> <li>Sequential transfer: Oval with arrow</li> </ul>																												

## (3C00h) RAMWRC : Write Memory Continuous

Inst/Para	R/W	RAMWRC																		
		Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0	HEX							
		MIPI	Other																	
RAMWR	R/W	3Ch	3C00h	X	0	0	1	1	1	1	0	0	3C							
			1 <sup>st</sup> Pixel	X	D <sub>17</sub>	D <sub>16</sub>	D <sub>15</sub>	D <sub>14</sub>	D <sub>13</sub>	D <sub>12</sub>	D <sub>11</sub>	D <sub>10</sub>								
			:	X	:	:	:	:	:	:	:	:	:							
			N <sup>th</sup> Pixel	X	D <sub>N7</sub>	D <sub>N6</sub>	D <sub>N5</sub>	D <sub>N4</sub>	D <sub>N3</sub>	D <sub>N2</sub>	D <sub>N1</sub>	D <sub>N0</sub>								
Description	This command transfers image data from the host processor to the display module's frame memory continuing from the pixel location following the previous Write_Memory_Continue or Write_Memory_Start command.																			
Restriction	The pixel data of one line must be transmitting by one packet. EX: 8-8-8 pixel format with 1080x1920 resolution → packet size = 1080x3 = 3240 bytes EX: 6-6-6 pixel format with 1080x1920 resolution → packet size = 1080x3 = 3240 bytes EX: 5-6-5 pixel format with 1080x1920 resolution → packet size = 1080x2 = 2160 bytes																			
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>SW Reset</td> <td>Contents of memory is not cleared</td> </tr> <tr> <td>HW Reset</td> <td>Contents of memory is not cleared</td> </tr> </tbody> </table>												Status	Default Value	Power On Sequence	Contents of memory is set randomly	SW Reset	Contents of memory is not cleared	HW Reset	Contents of memory is not cleared
Status	Default Value																			
Power On Sequence	Contents of memory is set randomly																			
SW Reset	Contents of memory is not cleared																			
HW Reset	Contents of memory is not cleared																			
Flow chart	<pre> graph TD     A[RAMWRC (3Ch)] --&gt; B([Image Data D1[B:0], D2[B:0].....Dn[B:0]])     B --&gt; C[Any Command]     </pre> <p>Legend</p> <ul style="list-style-type: none"> <li>Command: Rectangle</li> <li>Parameter: Parallelogram</li> <li>Display: Pointed oval</li> <li>Action: Pointed oval</li> <li>Mode: Rounded rectangle</li> <li>Sequential transfer: Oval with tail</li> </ul>																			

## (4400h) STESL : Set Tear Scanline

Inst/Para	R/W	STESL (Set Tear Scanline)																		
		Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0	HEX							
		MIPI	Other																	
STESL	W	44h	4400h	x	N[15]	N[14]	N[13]	N[12]	N[11]	N[10]	N[9]	N[8]	00							
			4401h	x	N[7]	N[6]	N[5]	N[4]	N[3]	N[2]	N[1]	N[0]	00							
Description	<p>This command turns on the display Tearing Effect output signal on the TE signal line when the display module reaches line N[15:0]. The TE signal is not affected by changing “Set_Address_Mode” bit D4. The Tearing Effect Line On has one parameter that describes the Tearing Effect Output Line mode.</p> <p>See figure in Mode 3 of “Tearing Effect Output”</p> <p>The Tearing Effect Output line shall be active low when the display module is in Sleep mode.</p>																			
Restriction																				
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>N[15:0]=16'h0000</td> </tr> <tr> <td>SW Reset</td> <td>No change</td> </tr> <tr> <td>HW Reset</td> <td>N[15:0]=16'h0000</td> </tr> </tbody> </table>												Status	Default Value	Power On Sequence	N[15:0]=16'h0000	SW Reset	No change	HW Reset	N[15:0]=16'h0000
Status	Default Value																			
Power On Sequence	N[15:0]=16'h0000																			
SW Reset	No change																			
HW Reset	N[15:0]=16'h0000																			
Flow Chart	<pre> graph TD     Start([TE output ON or OFF]) --&gt; Command[Set_Tear_Scanline (44h)]     Command --&gt; Param1[/Send 1st parameter/]     Param1 --&gt; Param2[/Send 2nd parameter/]     Param2 --&gt; End([TE output on the Nth line])     </pre> <p><b>Legend</b></p> <ul style="list-style-type: none"> <li>Command: Rectangle</li> <li>Parameter: Parallelogram</li> <li>Display: Oval</li> <li>Action: Arrow</li> <li>Mode: Rounded Rectangle</li> <li>Sequential transfer: Curved Arrow</li> </ul>																			

## (4500h) GSL : Get Scanline

Inst/Para	R/W	GSL (Get Scanline)											HEX
		Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0	
		MIPI	Other										
GSL	R	45h	4500h	x	N[15]	N[14]	N[13]	N[12]	N[11]	N[10]	N[9]	N[8]	0x
			4501h	x	N[7]	N[6]	N[5]	N[4]	N[3]	N[2]	N[1]	N[0]	xx
Description	<p>The display returns the current scan line, N, used to update the display device. The total number of scan lines on a display device is defined as VSYNC + VBP + VACT + VFP. The first scan line is defined as the first line of V-Sync and is denoted as Line 0. When in Sleep Mode, the value returned by “get scanline” is undefined.</p>												
Restriction	-												
Flow Chart	<pre> graph TD     A[Get_Scanline (45h)] --&gt; B{Wait 3us}     B --&gt; C[/Dummy Read/]     C --&gt; D[/Send 1st parameter/]     D --&gt; E[/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>												

## (4F00h) DSTBON : Set Deep Standby Mode

Inst/Para	R/W	DSTBON(Deep Standby Mode On)											HEX							
		Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0								
		MIPI	Other																	
DSTBON	W	4Fh	4F00h	x	0	0	0	0	0	0	0	DSTB	00							
Description	<p>This command is used to enter deep standby mode. DSTB="1", enter deep standby mode.</p> <p>Notes:</p> <ol style="list-style-type: none"> <li>To exit Deep Standby Mode, set RESX low pulse more than 3 msec to pin RESX.</li> <li>If user wants to enter DSTB mode from Normal Display directly, it shall enter sleep-in &amp; 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.</li> </ol>																			
Restriction	-																			
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>SW Reset</td> <td>00h</td> </tr> <tr> <td>HW Reset</td> <td>00h</td> </tr> </tbody> </table>												Status	Default Value	Power On Sequence	00h	SW Reset	00h	HW Reset	00h
Status	Default Value																			
Power On Sequence	00h																			
SW Reset	00h																			
HW Reset	00h																			
Flow chart	<pre> graph TD     A[DSTBON (4Fh)] --&gt; B[/Parameter DSTB=1/]     B --&gt; C([Deep Standby Mode])     </pre> <p>Legend</p> <ul style="list-style-type: none"> <li>Command: Rectangle</li> <li>Parameter: Parallelogram</li> <li>Display: Oval with horizontal lines</li> <li>Action: Oval with horizontal lines</li> <li>Mode: Oval with horizontal lines</li> <li>Sequential transfer: Oval with a tail</li> </ul>																			

## (5100h) WRDISBV : Write Display Brightness

Inst/Para	R/ W	Address		D15 -D8	D7	D6	D5	D4	D3	D2	D1	D0	HEX																
		MIPI	Other																										
parameter 1	W	51h	5100h	x	DBV7	DBV6	DBV5	DBV4	DBV3	DBV2	DBV1	DBV0	FF																
Description	<p>This command is used to adjust the brightness value of the display. In principle relationship is that 00h value means the lowest brightness and FFh value means the highest brightness.</p> <table border="1"> <thead> <tr> <th colspan="2">8-bit mode</th> </tr> <tr> <th>DBV[15:8]</th> <th>Amount of light</th> </tr> </thead> <tbody> <tr> <td>00h</td> <td>OFF (0%)</td> </tr> <tr> <td>01h</td> <td>2/256</td> </tr> <tr> <td>02h</td> <td>3/256</td> </tr> <tr> <td>03h</td> <td>4/256</td> </tr> <tr> <td>...</td> <td>...</td> </tr> <tr> <td>FFh</td> <td>256/256</td> </tr> </tbody> </table>													8-bit mode		DBV[15:8]	Amount of light	00h	OFF (0%)	01h	2/256	02h	3/256	03h	4/256	...	...	FFh	256/256
8-bit mode																													
DBV[15:8]	Amount of light																												
00h	OFF (0%)																												
01h	2/256																												
02h	3/256																												
03h	4/256																												
...	...																												
FFh	256/256																												
Restriction	The display supplier cannot use this command for tuning																												
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>FFh</td> </tr> <tr> <td>SW Reset</td> <td>FFh</td> </tr> <tr> <td>HW Reset</td> <td>FFh</td> </tr> </tbody> </table>													Status	Default Value	Power On Sequence	FFh	SW Reset	FFh	HW Reset	FFh								
Status	Default Value																												
Power On Sequence	FFh																												
SW Reset	FFh																												
HW Reset	FFh																												
Flow chart	<pre> graph TD     A[WRDISBV (51h)] --&gt; B[/Parameter DBV/]     B --&gt; C([New Brightness Loaded])     </pre> <p>Legend</p> <ul style="list-style-type: none"> <li>Command: Rectangle</li> <li>Parameter: Parallelogram</li> <li>Display: Oval</li> <li>Action: Arrowhead</li> <li>Mode: Rounded rectangle</li> <li>Sequential transfer: Dashed box</li> </ul>																												

## (5200h) RDDISBV : Read Display Brightness

Inst/Para	R/ W	Address		D15 -D8	D7	D6	D5	D4	D3	D2	D1	D0	HEX								
		MIPI	Other																		
parameter 1	R	52h	5200h	x	DBV7	DBV6	DBV5	DBV4	DBV3	DBV2	DBV1	DBV0	FF								
Description	<p>This command is used to returns the brightness value of the display. In principle relationship is that 00h value means the lowest brightness and FFh value means the highest brightness. Please refer the register "WRDISBV (51h)" for detailed.</p>																				
Restriction	-																				
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value Parameter 1</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>FFh</td> </tr> <tr> <td>SW Reset</td> <td>FFh</td> </tr> <tr> <td>HW Reset</td> <td>FFh</td> </tr> </tbody> </table>													Status	Default Value Parameter 1	Power On Sequence	FFh	SW Reset	FFh	HW Reset	FFh
Status	Default Value Parameter 1																				
Power On Sequence	FFh																				
SW Reset	FFh																				
HW Reset	FFh																				
Flow Chart	<pre> graph TD     subgraph Host_Driver [Host Driver]         RDDISBV[RDDISBV (52h)]     end     subgraph Display         Send[Send parameter DBV]     end     RDDISBV --&gt; Send     </pre> <p>Legend</p> <ul style="list-style-type: none"> <li>Command: Rectangle</li> <li>Parameter: Parallelogram</li> <li>Display: Oval</li> <li>Action: Arrow</li> <li>Mode: Rounded Rectangle</li> <li>Sequential transfer: Speech Bubble</li> </ul>																				

## (5300h) WRCTRLD : Write Control Display

Inst/Para	R/ W	Address		D15 -D8	D7	D6	D5	D4	D3	D2	D1	D0	HEX																				
		MIPI	Other																														
WRCTRLD	W	53h	5300h	x	HBM[1:0]		BCTRL	0	DD	0	0	0	20																				
Description	<p>This command is used to control OLED brightness.</p> <p><b>HBM[1:0]:</b> Turn on/off the high brightness mode</p> <table border="1"> <thead> <tr> <th>HBM[1:0]</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>2'h0</td> <td>HBM mode off</td> </tr> <tr> <td>2'h3</td> <td>HBM mode on</td> </tr> <tr> <td>others</td> <td>Reserved</td> </tr> </tbody> </table> <p><b>BCTRL:</b> Brightness control</p> <table border="1"> <thead> <tr> <th>BCTRL</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>OFF, DBV[7:0] = 00h.</td> </tr> <tr> <td>1</td> <td>ON, DBV[7:0] are active.</td> </tr> </tbody> </table> <p><b>DD:</b> Brightness control with dimming effect</p> <table border="1"> <thead> <tr> <th>DD</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Dimming effect is OFF.</td> </tr> <tr> <td>1</td> <td>Dimming effect is ON.</td> </tr> </tbody> </table>													HBM[1:0]	Description	2'h0	HBM mode off	2'h3	HBM mode on	others	Reserved	BCTRL	Description	0	OFF, DBV[7:0] = 00h.	1	ON, DBV[7:0] are active.	DD	Description	0	Dimming effect is OFF.	1	Dimming effect is ON.
	HBM[1:0]	Description																															
	2'h0	HBM mode off																															
	2'h3	HBM mode on																															
others	Reserved																																
BCTRL	Description																																
0	OFF, DBV[7:0] = 00h.																																
1	ON, DBV[7:0] are active.																																
DD	Description																																
0	Dimming effect is OFF.																																
1	Dimming effect is ON.																																
Restriction	The display supplier cannot use this command for tuning																																
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>20h</td> </tr> <tr> <td>SW Reset</td> <td>20h</td> </tr> <tr> <td>HW Reset</td> <td>20h</td> </tr> </tbody> </table>													Status	Default Value	Power On Sequence	20h	SW Reset	20h	HW Reset	20h												
Status	Default Value																																
Power On Sequence	20h																																
SW Reset	20h																																
HW Reset	20h																																
Flow chart	<pre> graph TD     A[WRDISBV (53h)] --&gt; B[/HBM, BCTRL, DD/]     B --&gt; C([New Control Value])     </pre> <p>Legend</p> <ul style="list-style-type: none"> <li>Command: Rectangle</li> <li>Parameter: Parallelogram</li> <li>Display: Oval</li> <li>Action: Arrowhead</li> <li>Mode: Rounded rectangle</li> <li>Sequential transfer: Dashed box</li> </ul>																																

## (5400h) RDCTRLD : Read Control Display

Inst/Para	R/W	Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0	HEX																				
		MIPI	Other																														
RDCTRLD	R	54h	5400h	x	HBM[1:0]	BCTRL	0	DD	0	0	0	0	20																				
Description	<p>This command is used to “read” the setting status of OLED brightness control.</p> <p><b>HBM[1:0]:</b> Turn on/off the high brightness mode</p> <table border="1"> <thead> <tr> <th>HBM[1:0]</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>2'h0</td> <td>HBM mode off</td> </tr> <tr> <td>2'h3</td> <td>HBM mode on</td> </tr> <tr> <td>others</td> <td>Reserved</td> </tr> </tbody> </table> <p><b>BCTRL:</b> Brightness control</p> <table border="1"> <thead> <tr> <th>BCTRL</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>OFF, DBV[7:0] = 00h.</td> </tr> <tr> <td>1</td> <td>ON, DBV[7:0] are active.</td> </tr> </tbody> </table> <p><b>DD:</b> Brightness control with dimming effect</p> <table border="1"> <thead> <tr> <th>DD</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Dimming effect is OFF.</td> </tr> <tr> <td>1</td> <td>Dimming effect is ON.</td> </tr> </tbody> </table>													HBM[1:0]	Description	2'h0	HBM mode off	2'h3	HBM mode on	others	Reserved	BCTRL	Description	0	OFF, DBV[7:0] = 00h.	1	ON, DBV[7:0] are active.	DD	Description	0	Dimming effect is OFF.	1	Dimming effect is ON.
	HBM[1:0]	Description																															
	2'h0	HBM mode off																															
	2'h3	HBM mode on																															
others	Reserved																																
BCTRL	Description																																
0	OFF, DBV[7:0] = 00h.																																
1	ON, DBV[7:0] are active.																																
DD	Description																																
0	Dimming effect is OFF.																																
1	Dimming effect is ON.																																
Restriction	-																																
Default	<table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>20h</td> </tr> <tr> <td>SW Reset</td> <td>20h</td> </tr> <tr> <td>HW Reset</td> <td>20h</td> </tr> </tbody> </table>													Status	Default Value	Power On Sequence	20h	SW Reset	20h	HW Reset	20h												
Status	Default Value																																
Power On Sequence	20h																																
SW Reset	20h																																
HW Reset	20h																																
Flow Chart	<p>The flow chart shows a box labeled 'RDCTRLD (54h)' with a downward arrow pointing to a parallelogram labeled 'Send parameter HBM, BCTRL, DD'. A dotted line labeled 'Host Driver' connects the two.</p> <div style="border: 1px dashed black; padding: 5px; margin-top: 10px;"> <p>Legend</p> <ul style="list-style-type: none"> <li><span style="border: 1px solid black; padding: 2px;">Command</span></li> <li><span style="border: 1px solid black; padding: 2px; transform: rotate(-15deg);">Parameter</span></li> <li><span style="border: 1px solid black; padding: 2px; border-radius: 15px;">Display</span></li> <li><span style="border: 1px solid black; padding: 2px; border-radius: 15px;">Action</span></li> <li><span style="border: 1px solid black; padding: 2px; border-radius: 15px;">Mode</span></li> <li><span style="border: 1px solid black; padding: 2px; border-radius: 15px;">Sequential transfer</span></li> </ul> </div>																																

**(5800h) WRCE : Write CE**

Inst/Para	R/W	Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0	HEX
		MIPI	Other										
WRCE	W	58h	5800h	x	CTE_EN	CTE_LEVEL 3	CTE_LEVEL 2	CTE_LEVEL 1	CTE_LEVEL 0	-	-	-	48
Description	This command is used to set the parameters for CE (color enhance)												
	<b>Bit</b>		<b>Description</b>		<b>Value</b>								
	CTE_EN		Contrast enhancement Enable		'0' : disable; '1': enable								
CTE_LEVEL [3:0]		Contrast enhancement Level		0~2, low to high , Manual Mode0 4~6, low to high , Manual Mode1 8~10, low to high , Auto Mode									
Restriction	-												
Flow Chart	<div style="border: 1px dashed black; padding: 10px; width: fit-content; margin: auto;"> <p style="text-align: center;">Legend</p> <div style="display: flex; flex-direction: column; align-items: center; gap: 5px;"> <div style="border: 1px solid black; padding: 2px 10px; margin: 2px;">Command</div> <div style="border: 1px solid black; padding: 2px 10px; transform: rotate(-15deg); margin: 2px;">Parameter</div> <div style="border: 1px solid black; padding: 2px 10px; border-radius: 15px; margin: 2px;">Display</div> <div style="border: 1px solid black; padding: 2px 10px; border-radius: 15px; margin: 2px;">Action</div> <div style="border: 1px solid black; padding: 2px 10px; border-radius: 15px; margin: 2px;">Mode</div> <div style="border: 1px solid black; padding: 2px 10px; border-radius: 15px; margin: 2px;">Sequential transfer</div> </div> </div>												

**(5900h) RDCE : Read CE**

RDCE (Read_Color_Enhancement)																					
Inst/Para	R/W	Address		D15 -D8	D7	D6	D5	D4	D3	D2	D1	D0	HEX								
		MIPI	Other																		
RDCE	R	59h	5900h	x	CTE_ EN	CTE_ LEVEL3	CTE_ LEVEL2	CTE_ LEVEL1	CTE_ LEVEL0	-	-	-	48								
Description	<p>This command is used to read the parameters for CE (color enhance)</p> <table border="1"> <thead> <tr> <th>Bit</th> <th>Description</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>CTE_EN</td> <td>Contrast enhancement Enable</td> <td>'0' : disable; '1': enable</td> </tr> <tr> <td>CTE_LEVEL [3:0]</td> <td>Contrast enhancement Level</td> <td>0~2, low to high , Manual Mode0 4~6, low to high , Manual Mode1 8~10 low to high, Auto Mode</td> </tr> </tbody> </table>												Bit	Description	Value	CTE_EN	Contrast enhancement Enable	'0' : disable; '1': enable	CTE_LEVEL [3:0]	Contrast enhancement Level	0~2, low to high , Manual Mode0 4~6, low to high , Manual Mode1 8~10 low to high, Auto Mode
Bit	Description	Value																			
CTE_EN	Contrast enhancement Enable	'0' : disable; '1': enable																			
CTE_LEVEL [3:0]	Contrast enhancement Level	0~2, low to high , Manual Mode0 4~6, low to high , Manual Mode1 8~10 low to high, Auto Mode																			
Restriction	-																				
Flow Chart	<div style="border: 1px dashed black; padding: 10px; width: fit-content; margin: auto;"> <p>Legend</p> <ul style="list-style-type: none"> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; margin-right: 5px;"></span> Command</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; transform: rotate(-30deg); margin-right: 5px;"></span> Parameter</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Display</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Action</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Mode</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Sequential transfer</li> </ul> </div>																				

## (5A00h) WRCE1 : Write CE1

Inst/Para	R/W	Address		D15 -D8	D7	D6	D5	D4	D3	D2	D1	D0	HEX
		MIPI	Other										
WRCE1	W	5Ah	5A00h	X	SKIN_EN	X	SKIN_LEVEL[1]	SKIN_LEVEL[0]	EN_VIVID_ENH	X	CE_LEVEL[1]	CE_LEVEL[0]	11
Description	This command is used to set the parameters for CE (color enhance)												
	<b>Bit</b>		<b>Description</b>		<b>Value</b>								
	SKIN_EN		Skin Color enable		'0' : disable; '1': enable								
	SKIN_LEVEL[1:0]		Skin Color level		0~2, low to high								
	EN_VIVID_ENH		Vivid Color enable		'0' : disable; '1': enable								
CE_LEVEL[1:0]		Vivid Color Level		0~2, low to high									
Restriction	-												
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>												
	<p>COMBINED</p>												

## (5B00h) RDCE1 : Read CE1

RDCE1 (Read_Color_Enhancement_1)													
Inst/Para	R/W	Address		D15-D8	D7	D6	D5	D4	D3	D2	D1	D0	HEX
		MIPI	Other										
RDCE1	R	5Ah	5A00h	x	SKIN_EN	X	SKIN_LEVEL [1]	SKIN_LEVEL [0]	EN_VIVID_ENH	X	CE_LEVEL [1]	CE_LEVEL [0]	11
Description	This command is used to read the parameters for CE (color enhance)												
	Bit			Description				Value					
	SKIN_EN			Skin Color enable				'0' : disable; '1' : enable					
	SKIN_LEVEL[1:0]			Skin Color level				0~2, low to high					
	EN_VIVID_ENH			Vivid Color enable				'0' : disable; '1' : enable					
CE_LEVEL[1:0]			Vivid Color Level				0~2, low to high						
Restriction	-												
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>												

## (5C00h) WRCE2 : Write CE2

Inst/Para	R/W	Address		D15 -D8	D7	D6	D5	D4	D3	D2	D1	D0	HEX
		MIPI	Other										
WRCE2	W	5Ch	5C00h	x	SLR_EN	-	SLR_LEVEL [1]	SLR_LEVEL [0]	EN_EDGE_ENH	EN_EDGE_LEVEL [2]	EN_EDGE_LEVEL [1]	EN_EDGE_LEVEL [0]	14
Description	This command is used to set the parameters for CE (color enhance)												
	Bit		Description					Value					
	SLR_EN		Sunlight Readable Enhancement enable					0 : disable 1 : enable					
	SLR_LEVEL[1:0]		Sunlight Readable Enhancement level					0~2, low to high					
	EN_EDGE_ENH		Edge enhancement enable					0 : disable 1 : enable					
EDGE_LEVEL[2:0]		Edge enhancement Level					0~2, low to high						
Restriction	-												
Flow Chart	<div style="border: 1px dashed black; padding: 10px; width: fit-content; margin: auto;"> <p style="text-align: center;">Legend</p> <div style="display: flex; flex-direction: column; align-items: center; gap: 5px;"> <div style="border: 1px solid black; padding: 2px 10px; margin: 2px;">Command</div> <div style="border: 1px solid black; padding: 2px 10px; transform: rotate(-15deg); margin: 2px;">Parameter</div> <div style="border: 1px solid black; padding: 2px 10px; transform: rotate(-30deg); margin: 2px;">Display</div> <div style="border: 1px solid black; padding: 2px 10px; transform: rotate(-15deg); margin: 2px;">Action</div> <div style="border: 1px solid black; padding: 2px 10px; border-radius: 15px; margin: 2px;">Mode</div> <div style="border: 1px solid black; padding: 2px 10px; border-radius: 50%; margin: 2px;">Sequential transfer</div> </div> </div>												

## (5D00h) RDCE2 : Read CE2

Inst/Para	R/W	Address		D15 -D8	D7	D6	D5	D4	D3	D2	D1	D0	HEX
		MIPI	Other										
RDCE2	R	5Dh	5D00h	x	SLR_EN	-	SLR_LEVEL [1]	SLR_LEVEL [0]	EN_EDGE_ENH	EN_EDGE_LEVEL [2]	EN_EDGE_LEVEL [1]	EN_EDGE_LEVEL [0]	14
Description	This command is used to read the parameters for CE (color enhance)												
	Bit		Description					Value					
	SLR_EN		Sunlight Readable Enhancement enable					0 : disable 1 : enable					
	SLR_LEVEL[1:0]		Sunlight Readable Enhancement level					0~2, low to high					
	EN_EDGE_ENH		Edge enhancement enable					0 : disable 1 : enable					
EDGE_LEVEL[2:0]		Edge enhancement Level					0~2, low to high						
Restriction	-												
Flow Chart	<div style="border: 1px dashed black; padding: 10px; width: fit-content; margin: auto;"> <p>Legend</p> <ul style="list-style-type: none"> <li><span style="border: 1px solid black; padding: 2px 10px;">Command</span></li> <li><span style="border: 1px solid black; padding: 2px 10px; transform: rotate(-15deg); display: inline-block;">Parameter</span></li> <li><span style="border: 1px solid black; padding: 2px 10px; border-radius: 15px; display: inline-block;">Display</span></li> <li><span style="border: 1px solid black; padding: 2px 10px; border-radius: 15px; display: inline-block;">Action</span></li> <li><span style="border: 1px solid black; padding: 2px 10px; border-radius: 15px; display: inline-block;">Mode</span></li> <li><span style="border: 1px solid black; padding: 2px 10px; border-radius: 15px; display: inline-block;">Sequential transfer</span></li> </ul> </div>												

## (6200h) WRTMR : Write CE3 (temper)

Inst/Para	R/W	Address		D15-D8	D7	D6	D5	D4	D3	D2	D1	D0	HEX									
		MIPI	Other																			
WRTMR	W	62h	6200h	x	TEMPER_EN	TEMPER_LEVEL[6]	TEMPER_LEVEL[5]	TEMPER_LEVEL[4]	TEMPER_LEVEL[3]	TEMPER_LEVEL[2]	TEMPER_LEVEL[1]	TEMPER_LEVEL[0]	00									
Description	<p>This command is used to set the parameters for CE (color enhance)</p> <table border="1"> <thead> <tr> <th>Bit</th> <th>Description</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>TEMPER_EN</td> <td>Temperature enable</td> <td>0 : disable 1 : enable</td> </tr> <tr> <td>TEMPER_LEVEL[6:0]</td> <td>Temperature Set</td> <td>0~64 setting</td> </tr> </tbody> </table>													Bit	Description	Value	TEMPER_EN	Temperature enable	0 : disable 1 : enable	TEMPER_LEVEL[6:0]	Temperature Set	0~64 setting
Bit	Description	Value																				
TEMPER_EN	Temperature enable	0 : disable 1 : enable																				
TEMPER_LEVEL[6:0]	Temperature Set	0~64 setting																				
Restriction	-																					
Flow Chart	<div style="border: 1px dashed black; padding: 10px; width: fit-content; margin: auto;"> <p>Legend</p> <ul style="list-style-type: none"> <li><span style="border: 1px solid black; display: inline-block; width: 50px; height: 15px; margin-right: 5px;"></span> Command</li> <li><span style="border: 1px solid black; display: inline-block; width: 50px; height: 15px; transform: rotate(-15deg); margin-right: 5px;"></span> Parameter</li> <li><span style="border: 1px solid black; display: inline-block; width: 50px; height: 15px; border-radius: 5px; margin-right: 5px;"></span> Display</li> <li><span style="border: 1px solid black; display: inline-block; width: 50px; height: 15px; border-radius: 5px; margin-right: 5px;"></span> Action</li> <li><span style="border: 1px solid black; display: inline-block; width: 50px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Mode</li> <li><span style="border: 1px solid black; display: inline-block; width: 50px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Sequential transfer</li> </ul> </div>																					

**(6300h) RDTMR : Read CE3 (temper)**

Inst/Para	R/W	Address		D15 -D8	D7	D6	D5	D4	D3	D2	D1	D0	HEX									
		MIPI	Other																			
RDTMR	R	63h	6300h	x	TEMPER _EN	TEMPER _LEVEL [6]	TEMPER _LEVEL [5]	TEMPER _LEVEL [4]	TEMPER _LEVEL [3]	TEMPER _LEVEL [2]	TEMPER _LEVEL [1]	TEMPER _LEVEL [0]	00									
Description	<p>This command is used to read the parameters for CE (color enhance)</p> <table border="1"> <thead> <tr> <th>Bit</th> <th>Description</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>TEMPER_EN</td> <td>Temperature enable</td> <td>0 : disable 1 : enable</td> </tr> <tr> <td>TEMPER_LEVEL[6:0]</td> <td>Temperature Set</td> <td>0~64 setting</td> </tr> </tbody> </table>													Bit	Description	Value	TEMPER_EN	Temperature enable	0 : disable 1 : enable	TEMPER_LEVEL[6:0]	Temperature Set	0~64 setting
Bit	Description	Value																				
TEMPER_EN	Temperature enable	0 : disable 1 : enable																				
TEMPER_LEVEL[6:0]	Temperature Set	0~64 setting																				
Restriction	-																					
Flow Chart	<div style="border: 1px dashed black; padding: 10px; width: fit-content; margin: auto;"> <p>Legend</p> <ul style="list-style-type: none"> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; margin-right: 5px;"></span> Command</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; transform: rotate(-30deg); margin-right: 5px;"></span> Parameter</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Display</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Action</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Mode</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Sequential transfer</li> </ul> </div>																					

## (6400h) WRPA : Write CE4 (Paper)

Inst/Para	R/W	Address		D15 -D8	D7	D6	D5	D4	D3	D2	D1	D0	HEX									
		MIPI	Other																			
WRPA	W	64h	6400h	x	PAPER_EN	PAPER_LEVEL [6]	PAPER_LEVEL [5]	PAPER_LEVEL [4]	PAPER_LEVEL [3]	PAPER_LEVEL [2]	PAPER_LEVEL [1]	PAPER_LEVEL [0]	00									
Description	<p>This command is used to set the parameters for CE (color enhance)</p> <table border="1"> <thead> <tr> <th>Bit</th> <th>Description</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>PAPER_EN</td> <td>Paper Mode enable</td> <td>0 : disable 1 : enable</td> </tr> <tr> <td>PAPER_LEVEL[6:0]</td> <td>Paper Mode Set</td> <td>0~64 setting</td> </tr> </tbody> </table>													Bit	Description	Value	PAPER_EN	Paper Mode enable	0 : disable 1 : enable	PAPER_LEVEL[6:0]	Paper Mode Set	0~64 setting
Bit	Description	Value																				
PAPER_EN	Paper Mode enable	0 : disable 1 : enable																				
PAPER_LEVEL[6:0]	Paper Mode Set	0~64 setting																				
Restriction	-																					
Flow Chart	<div style="border: 1px dashed black; padding: 10px; width: fit-content; margin: 0 auto;"> <p>Legend</p> <ul style="list-style-type: none"> <li><span style="border: 1px solid black; display: inline-block; width: 50px; height: 15px; margin-right: 5px;"></span> Command</li> <li><span style="border: 1px solid black; display: inline-block; width: 50px; height: 15px; transform: rotate(-15deg); margin-right: 5px;"></span> Parameter</li> <li><span style="border: 1px solid black; display: inline-block; width: 50px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Display</li> <li><span style="border: 1px solid black; display: inline-block; width: 50px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Action</li> <li><span style="border: 1px solid black; display: inline-block; width: 50px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Mode</li> <li><span style="border: 1px solid black; display: inline-block; width: 50px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Sequential transfer</li> </ul> </div>																					

**(6500h) RDPA : Read CE4 (Paper)**

Inst/Para	R/W	Address		D15 -D8	D7	D6	D5	D4	D3	D2	D1	D0	HEX									
		MIPI	Other																			
RDPA	R	65h	6500h	x	PAPER_EN	PAPER_LEVEL [6]	PAPER_LEVEL [5]	PAPER_LEVEL [4]	PAPER_LEVEL [3]	PAPER_LEVEL [2]	PAPER_LEVEL [1]	PAPER_LEVEL [0]	00									
Description	<p>This command is used to read the parameters for CE (color enhance)</p> <table border="1"> <thead> <tr> <th>Bit</th> <th>Description</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>PAPER_EN</td> <td>Paper Mode enable</td> <td>0 : disable 1 : enable</td> </tr> <tr> <td>PAPER_LEVEL[6:0]</td> <td>Paper Mode Set</td> <td>0~64 setting</td> </tr> </tbody> </table>													Bit	Description	Value	PAPER_EN	Paper Mode enable	0 : disable 1 : enable	PAPER_LEVEL[6:0]	Paper Mode Set	0~64 setting
Bit	Description	Value																				
PAPER_EN	Paper Mode enable	0 : disable 1 : enable																				
PAPER_LEVEL[6:0]	Paper Mode Set	0~64 setting																				
Restriction	-																					
Flow Chart	<div style="border: 1px dashed black; padding: 10px; width: fit-content; margin: auto;"> <p>Legend</p> <ul style="list-style-type: none"> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; margin-right: 5px;"></span> Command</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; transform: rotate(-30deg); margin-right: 5px;"></span> Parameter</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Display</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Action</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Mode</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Sequential transfer</li> </ul> </div>																					

## (6600h) WRWB : Write CE5 (WB)

Inst/Para	R/W	Address		D15 -D8	D7	D6	D5	D4	D3	D2	D1	D0	HEX					
		MIPI	Other															
WRWB	W	66h	6600h	x	WB_EN	-	-	-	-	-	-	-	00					
Description	This command is used to set the parameters for CE (color enhance)																	
	<table border="1"> <thead> <tr> <th>Bit</th> <th>Description</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>WB_EN</td> <td>White Balance enable</td> <td>0 : disable 1 : enable</td> </tr> </tbody> </table>			Bit	Description	Value	WB_EN	White Balance enable	0 : disable 1 : enable									
Bit	Description	Value																
WB_EN	White Balance enable	0 : disable 1 : enable																
Restriction	-																	
Flow Chart	<div style="border: 1px dashed black; padding: 10px;"> <p>Legend</p> <ul style="list-style-type: none"> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; margin-right: 5px;"></span> Command</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; transform: rotate(-30deg); margin-right: 5px;"></span> Parameter</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Display</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Action</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Mode</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Sequential transfer</li> </ul> </div>																	

**(6700h) RDWB : Read CE5 (WB)**

Inst/Para	R/W	Address		D15 -D8	D7	D6	D5	D4	D3	D2	D1	D0	HEX						
		MIPI	Other																
RDWB	R	67h	6700h	x	WB_EN	-	-	-	-	-	-	-	00						
Description	<p>This command is used to read the parameters for CE (color enhance)</p> <table border="1"> <thead> <tr> <th>Bit</th> <th>Description</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>WB_EN</td> <td>White Balance enable</td> <td>0 : disable 1 : enable</td> </tr> </tbody> </table>													Bit	Description	Value	WB_EN	White Balance enable	0 : disable 1 : enable
Bit	Description	Value																	
WB_EN	White Balance enable	0 : disable 1 : enable																	
Restriction	-																		
Flow Chart	<div style="border: 1px dashed black; padding: 10px; width: fit-content; margin: auto;"> <p>Legend</p> <ul style="list-style-type: none"> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; margin-right: 5px;"></span> Command</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; transform: rotate(-30deg); margin-right: 5px;"></span> Parameter</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Display</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Action</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Mode</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Sequential transfer</li> </ul> </div>																		

## (6A00h) WRHDR : Write CE6 (HDR)

Inst/Para	R/W	Address		D15 -D8	D7	D6	D5	D4	D3	D2	D1	D0	HEX									
		MIPI	Other																			
WRHDR	W	6Ah	6A00h	x	hdr_en	hdr_level[6:0]						00										
Description	<p>This command is used to set the parameters for CE (color enhance)</p> <table border="1"> <thead> <tr> <th>Bit</th> <th>Description</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>hdr_en</td> <td>HDR enable</td> <td>0 : disable 1 : enable</td> </tr> <tr> <td>hdr_level[6:0]</td> <td>HDR level set</td> <td>0~64 setting</td> </tr> </tbody> </table>													Bit	Description	Value	hdr_en	HDR enable	0 : disable 1 : enable	hdr_level[6:0]	HDR level set	0~64 setting
Bit	Description	Value																				
hdr_en	HDR enable	0 : disable 1 : enable																				
hdr_level[6:0]	HDR level set	0~64 setting																				
Restriction	-																					
Flow Chart	<div style="border: 1px dashed black; padding: 10px; width: fit-content; margin: auto;"> <p>Legend</p> <ul style="list-style-type: none"> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; margin-right: 5px;"></span> Command</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; transform: rotate(-30deg); margin-right: 5px;"></span> Parameter</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Display</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Action</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Mode</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Sequential transfer</li> </ul> </div>																					

**(6B00h) RDHDR : Read CE6 (HDR)**

RDHDR (Read HDR)																					
Inst/Para	R/W	Address		D15 -D8	D7	D6	D5	D4	D3	D2	D1	D0	HEX								
		MIPI	Other																		
RDHDR	R	6Bh	6B00h	x	hdr_en	hdr_level[6:0]						00									
Description	<p>This command is used to read the parameters for CE (color enhance)</p> <table border="1"> <thead> <tr> <th>Bit</th> <th>Description</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>hdr_en</td> <td>HDR enable</td> <td>0: disable 1: enable</td> </tr> <tr> <td>hdr_level[6:0]</td> <td>HDR level set</td> <td>0~64 setting</td> </tr> </tbody> </table>												Bit	Description	Value	hdr_en	HDR enable	0: disable 1: enable	hdr_level[6:0]	HDR level set	0~64 setting
Bit	Description	Value																			
hdr_en	HDR enable	0: disable 1: enable																			
hdr_level[6:0]	HDR level set	0~64 setting																			
Restriction	-																				
Flow Chart	<div style="border: 1px dashed black; padding: 10px; width: fit-content; margin: auto;"> <p>Legend</p> <ul style="list-style-type: none"> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; margin-right: 5px;"></span> Command</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; transform: rotate(-30deg); margin-right: 5px;"></span> Parameter</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Display</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Action</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Mode</li> <li><span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px; border-radius: 10px; margin-right: 5px;"></span> Sequential transfer</li> </ul> </div>																				

**(A100h ~ A104h) RDDDBS : Read DDB Start**

RDDDBS (Read_DDB_Start)																										
Inst/Para	R/W	Address		D15-D8	D7	D6	D5	D4	D3	D2	D1	D0	HEX													
		MIPI	Other																							
RDDDBS	R	A1h	A100h	x	SID[15]	SID[14]	SID[13]	SID[12]	SID[11]	SID[10]	SID[9]	SID[8]	00													
			A101h	x	SID[7]	SID[6]	SID[5]	SID[4]	SID[3]	SID[2]	SID[1]	SID[0]	00													
			A102h	x	MID[15]	MID[14]	MID[13]	MID[12]	MID[11]	MID[10]	MID[9]	MID[8]	00													
			A103h	x	MID[7]	MID[6]	MID[5]	MID[4]	MID[3]	MID[2]	MID[1]	MID[0]	00													
			A104h	x	1	1	1	1	1	1	1	1	1	FF												
Description	1st parameter : Supplier ID code 2nd parameter : Supplier ID code 3rd parameter : Module ID 4th parameter : Module ID 5th Exit code (FFh).																									
Restriction																										
Default	<table border="1"> <thead> <tr> <th rowspan="2">Status</th> <th colspan="2">Default Value</th> </tr> <tr> <th>After MTP</th> <th>Before MTP</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>MTP Value</td> <td>00h, 00h, 00h, 00h, FFh</td> </tr> <tr> <td>SW Reset</td> <td>MTP Value</td> <td>00h, 00h, 00h, 00h, FFh</td> </tr> <tr> <td>HW Reset</td> <td>MTP Value</td> <td>00h, 00h, 00h, 00h, FFh</td> </tr> </tbody> </table>												Status	Default Value		After MTP	Before MTP	Power On Sequence	MTP Value	00h, 00h, 00h, 00h, FFh	SW Reset	MTP Value	00h, 00h, 00h, 00h, FFh	HW Reset	MTP Value	00h, 00h, 00h, 00h, FFh
Status	Default Value																									
	After MTP	Before MTP																								
Power On Sequence	MTP Value	00h, 00h, 00h, 00h, FFh																								
SW Reset	MTP Value	00h, 00h, 00h, 00h, FFh																								
HW Reset	MTP Value	00h, 00h, 00h, 00h, FFh																								
Flow Chart	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Serial I/F Mode</p> </div> <div style="text-align: center;"> <p>Parallel I/F Mode</p> </div> <div style="border: 1px dashed black; padding: 5px;"> <p>Legend</p> <ul style="list-style-type: none"> <li>Command (rectangle)</li> <li>Parameter (parallelogram)</li> <li>Display (rounded rectangle)</li> <li>Action (arrowhead)</li> <li>Mode (oval)</li> <li>Sequential transfer (curved arrow)</li> </ul> </div> </div> <p style="text-align: center; margin-top: 10px;">Host Driver</p>																									

**(A800h ~ A804h) RDDDBC : Read DDB Continue**

Inst/Para	R/W	RDDDBC																								
		Address		D15-D8	D7	D6	D5	D4	D3	D2	D1	D0	HEX													
		MIPI	Other																							
RDDDBC	R	A8h	A800h	x	SID[15]	SID[14]	SID[13]	SID[12]	SID[11]	SID[10]	SID[9]	SID[8]	00													
			A801h	x	SID[7]	SID[6]	SID[5]	SID[4]	SID[3]	SID[2]	SID[1]	SID[0]	00													
			A802h	x	MID[15]	MID[14]	MID[13]	MID[12]	MID[11]	MID[10]	MID[9]	MID[8]	00													
			A803h	x	MID[7]	MID[6]	MID[5]	MID[4]	MID[3]	MID[2]	MID[1]	MID[0]	00													
			A804h	x	1	1	1	1	1	1	1	1	1	FF												
Description	<p>This command returns the supplier identification and display module mode/revision information from the point where RDDDBS command was interrupted by another command.</p> <p><i>Note: Parameter 0xFF is an "Exit Code", this means that there is no more data in the DDB block.</i></p> <p><i>Note: For use example,</i></p> <ol style="list-style-type: none"> <li>1. Set maximum return packet size=3</li> <li>2. Read 0xA1, return 3 bytes SID[7:0], SID[15:8], MID[7:0]</li> <li>3. Read 0xA8, return 2 bytes MID[15:8],RID[7:0], RID[15:8] and 0xFF</li> </ol>																									
Restriction	<p>A Read DDB Start command (RDDDBS) should be executed at least once before a Read DDB Continue command (RDDDBC) to define the read location. Otherwise, data read with a Read DDB Continue command is undefined.</p>																									
Default	<table border="1"> <thead> <tr> <th rowspan="2">Status</th> <th colspan="2">Default Value</th> </tr> <tr> <th>After MTP</th> <th>Before MTP</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>MTP Value</td> <td>00h, 00h, 00h, 00h, FFh</td> </tr> <tr> <td>SW Reset</td> <td>MTP Value</td> <td>00h, 00h, 00h, 00h, FFh</td> </tr> <tr> <td>HW Reset</td> <td>MTP Value</td> <td>00h, 00h, 00h, 00h, FFh</td> </tr> </tbody> </table>												Status	Default Value		After MTP	Before MTP	Power On Sequence	MTP Value	00h, 00h, 00h, 00h, FFh	SW Reset	MTP Value	00h, 00h, 00h, 00h, FFh	HW Reset	MTP Value	00h, 00h, 00h, 00h, FFh
Status	Default Value																									
	After MTP	Before MTP																								
Power On Sequence	MTP Value	00h, 00h, 00h, 00h, FFh																								
SW Reset	MTP Value	00h, 00h, 00h, 00h, FFh																								
HW Reset	MTP Value	00h, 00h, 00h, 00h, FFh																								
Flow Chart	<pre> graph TD     A[RDDDBC (A8h)] --&gt; B(RDDDBS Data D1[7:0], D2[7:0], ... Dn[7:0])     </pre> <p><b>Legend</b></p> <ul style="list-style-type: none"> <li>Command: Rectangle</li> <li>Parameter: Parallelogram</li> <li>Display: Oval</li> <li>Action: Arrow</li> <li>Mode: Rounded Rectangle</li> <li>Sequential transfer: Oval with tail</li> </ul>																									

## (AA00h) RDFCS : Read First Checksum

Inst/Para	R/W	RDFCS											HEX								
		Address		D15 -D8	D7	D6	D5	D4	D3	D2	D1	D0									
		MIPI	Other																		
RDFCS	R	AAh	AA00h	X	FCS7	FCS6	FCS5	FCS4	FCS3	FCS2	FCS1	FCS0	00								
Description	This command returns the first checksum what has been calculated from "User Command Set" area registers (not include "Manufacture Command Set") and the frame memory after the write access to those registers and/or frame memory 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.																				
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[RDFCS (AAh)] --&gt; B[/Send Parameter FCS[7:0]/]     </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>																				

## (AF00h) RDCCS : Read Continue Checksum

Inst/Para	R/W	RDCCS											HEX								
		Address		D15 -D8	D7	D6	D5	D4	D3	D2	D1	D0									
		MIPI	Other																		
RDCCS	R	AFh	AF00h	x	CCS7	CCS6	CCS5	CCS4	CCS3	CCS2	CCS1	CCS0	00								
Description	This command returns the continue checksum what has been calculated continuously after the first checksum has calculated from "User Command Set" area registers and the frame memory after the write access to those registers and/or frame memory 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 in the first time.																				
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[RDCCS (AFh)] --&gt; B[/Send Parameter CCS[7:0]/]     </pre> <p>Legend:</p> <ul style="list-style-type: none"> <li>Command: Rectangle</li> <li>Parameter: Parallelogram</li> <li>Display: Oval</li> <li>Action: Arrowhead</li> <li>Mode: Rounded Rectangle</li> <li>Sequential transfer: Oval with tail</li> </ul>																				

## (C200h) SETDSIMODE : Set DSI Mode

Inst/Para	R/W	SETDSIMODE											HEX																																											
		Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0																																												
		MIPI	Other																																																					
SETDSIMODE	W/R	C2h	C200h	x	-	-			RM	-	DM1	DM0	08																																											
Description	This command is used to select display operation mode. When RM/DM register is changed, please follow display mode change sequence.																																																							
	<table border="1"> <thead> <tr> <th rowspan="2">RM</th> <th rowspan="2">DM</th> <th rowspan="2">display operation mode</th> <th rowspan="2">input data</th> <th rowspan="2">display data path</th> <th colspan="3">display control</th> </tr> <tr> <th>VSYNC</th> <th>HSYNC</th> <th>clock</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>0</td> <td>Command RAM mode</td> <td>Command / Video</td> <td>RAM → source</td> <td>internal</td> <td>Internal</td> <td>OSC</td> </tr> <tr> <td>X</td> <td>1</td> <td>Video RAM mode</td> <td>Video</td> <td>RAM → source</td> <td>external</td> <td>external</td> <td>OSC</td> </tr> <tr> <td>0</td> <td>3</td> <td>Video through mode</td> <td>Video</td> <td>Video → source</td> <td>external</td> <td>external</td> <td>OSC</td> </tr> <tr> <td>1</td> <td>3</td> <td>Video RAM capture mode</td> <td>Video</td> <td>RAM → source</td> <td>external</td> <td>external</td> <td>OSC</td> </tr> </tbody> </table>													RM	DM	display operation mode	input data	display data path	display control			VSYNC	HSYNC	clock	X	0	Command RAM mode	Command / Video	RAM → source	internal	Internal	OSC	X	1	Video RAM mode	Video	RAM → source	external	external	OSC	0	3	Video through mode	Video	Video → source	external	external	OSC	1	3	Video RAM capture mode	Video	RAM → source	external	external	OSC
	RM	DM	display operation mode	input data	display data path	display control																																																		
						VSYNC	HSYNC	clock																																																
	X	0	Command RAM mode	Command / Video	RAM → source	internal	Internal	OSC																																																
X	1	Video RAM mode	Video	RAM → source	external	external	OSC																																																	
0	3	Video through mode	Video	Video → source	external	external	OSC																																																	
1	3	Video RAM capture mode	Video	RAM → source	external	external	OSC																																																	
Restriction	-																																																							
Flow Chart	<div style="border: 1px dashed black; padding: 10px; width: fit-content; margin: auto;"> <p>Legend</p> <ul style="list-style-type: none"> <li><span style="border: 1px solid black; display: inline-block; width: 50px; height: 15px; margin-right: 5px;"></span> Command</li> <li><span style="border: 1px solid black; display: inline-block; width: 50px; height: 15px; transform: rotate(-15deg); margin-right: 5px;"></span> Parameter</li> <li><span style="border: 1px solid black; display: inline-block; width: 50px; height: 15px; border-radius: 5px; margin-right: 5px;"></span> Display</li> <li><span style="border: 1px solid black; display: inline-block; width: 50px; height: 15px; border-radius: 5px; margin-right: 5px;"></span> Action</li> <li><span style="border: 1px solid black; display: inline-block; width: 50px; height: 15px; border-radius: 5px; margin-right: 5px;"></span> Mode</li> <li><span style="border: 1px solid black; display: inline-block; width: 50px; height: 15px; border-radius: 5px; margin-right: 5px;"></span> Sequential transfer</li> </ul> </div>																																																							

**(DA00h) RDCTRLD1 : Read Control ID1**

Inst/Para	R/W	RDCTRLD1											HEX													
		Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0														
		MIPI	Other																							
RDCTRLD1	R	DAh	DA00h	x	ID1							00														
Description	This read byte identifies Module's manufacture ID																									
Restriction	-																									
Default	<table border="1"> <thead> <tr> <th rowspan="2">Status</th> <th colspan="2">Default Value</th> </tr> <tr> <th>After MTP</th> <th>Before MTP</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>MTP Value</td> <td>00h</td> </tr> <tr> <td>SW Reset</td> <td>MTP Value</td> <td>00h</td> </tr> <tr> <td>HW Reset</td> <td>MTP Value</td> <td>00h</td> </tr> </tbody> </table>												Status	Default Value		After MTP	Before MTP	Power On Sequence	MTP Value	00h	SW Reset	MTP Value	00h	HW Reset	MTP Value	00h
Status	Default Value																									
	After MTP	Before MTP																								
Power On Sequence	MTP Value	00h																								
SW Reset	MTP Value	00h																								
HW Reset	MTP Value	00h																								
Flow Chart	<pre> graph TD     RDID1[RDID1 (DAh)] --&gt; SendParam[/Send Parameter RDCTRLD1[7:0]/]     </pre> <p>Legend</p> <ul style="list-style-type: none"> <li>Command: Rectangle</li> <li>Parameter: Parallelogram</li> <li>Display: Oval</li> <li>Action: Arrow</li> <li>Mode: Rounded Rectangle</li> <li>Sequential transfer: Oval with tail</li> </ul>																									

## (DB00h) RDCTRLD2 : Read Control ID2

Inst/Para	R/W	RDCTRLD1											HEX													
		Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0														
		MIPI	Other																							
RDCTRLD2	R	DBh	DB00h	x	ID2							00														
Description	This read byte identifies Module / driver version ID																									
Restriction	-																									
Default	<table border="1"> <thead> <tr> <th rowspan="2">Status</th> <th colspan="2">Default Value</th> </tr> <tr> <th>After MTP</th> <th>Before MTP</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>MTP Value</td> <td>00h</td> </tr> <tr> <td>SW Reset</td> <td>MTP Value</td> <td>00h</td> </tr> <tr> <td>HW Reset</td> <td>MTP Value</td> <td>00h</td> </tr> </tbody> </table>												Status	Default Value		After MTP	Before MTP	Power On Sequence	MTP Value	00h	SW Reset	MTP Value	00h	HW Reset	MTP Value	00h
Status	Default Value																									
	After MTP	Before MTP																								
Power On Sequence	MTP Value	00h																								
SW Reset	MTP Value	00h																								
HW Reset	MTP Value	00h																								
Flow Chart	<pre> graph TD     A[RDID2 (DBh)] --&gt; B[/Send Parameter RDCTRLD2[7:0]/]     </pre> <p><b>Legend</b></p> <ul style="list-style-type: none"> <li>Command: Rectangle</li> <li>Parameter: Parallelogram</li> <li>Display: Oval with tail</li> <li>Action: Arrowhead</li> <li>Mode: Oval</li> <li>Sequential transfer: Oval with tail</li> </ul>																									

## (DC00h) RDCTRLD3 : Read Control ID3

Inst/Para	R/W	Address		D15-8	D7	D6	D5	D4	D3	D2	D1	D0	HEX														
		MIPI	Other																								
RDCTRLD3	R	DCh	DC00h	x	ID3							00															
Description	This read byte identifies Module / driver ID																										
Restriction	-																										
Default	<table border="1"> <thead> <tr> <th rowspan="2">Status</th> <th colspan="2">Default Value</th> </tr> <tr> <th>After MTP</th> <th>Before MTP</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>MTP Value</td> <td>00h</td> </tr> <tr> <td>SW Reset</td> <td>MTP Value</td> <td>00h</td> </tr> <tr> <td>HW Reset</td> <td>MTP Value</td> <td>00h</td> </tr> </tbody> </table>													Status	Default Value		After MTP	Before MTP	Power On Sequence	MTP Value	00h	SW Reset	MTP Value	00h	HW Reset	MTP Value	00h
Status	Default Value																										
	After MTP	Before MTP																									
Power On Sequence	MTP Value	00h																									
SW Reset	MTP Value	00h																									
HW Reset	MTP Value	00h																									
Flow Chart	<pre> graph TD     RDID3[RDID3 (DCh)] --&gt; SendParam[/Send Parameter RDCTRLD3[7:0]/]     </pre> <p>Legend</p> <ul style="list-style-type: none"> <li>Command: Rectangle</li> <li>Parameter: Parallelogram</li> <li>Display: Oval</li> <li>Action: Arrow</li> <li>Mode: Rounded Rectangle</li> <li>Sequential transfer: Oval with tail</li> </ul>																										

## (FE00h) WRMAUCCTR : Write CMD Page Switch

WR MAUCCTR (Manufacture Command Set Control)													
Instruction	R/W	Address		Parameter									
		MIPI	Others	D15-D8	D7	D6	D5	D4	D3	D2	D1	D0	HEX
CMD Mode Switch	W/R	FEh	FE00h	00h	CMD_PG_SEL[7:0]								00
Description	This command is used to switch the Manufacture Command Pages and User Commands sets.												
	<b>CMD_PG_SEL [7:0]</b>		<b>Description</b>										
	00h (default)		User Command Set (UCS = CMD1)										
	40h		Manufacture Command Set Page0 ( CMD2 P0)										
	50h		Manufacture Command Set Page1 ( CMD2 P1)										
60h		Manufacture Command Set Page2 ( CMD2 P2)											
Restriction	-												
Default	<b>Status</b>		<b>Default Value</b>										
			FEh / FE00h										
	Power On Sequence		00h										
	S/W Reset		00h										
H/W Reset		00h											
Flow Chart	<div style="border: 1px dashed black; padding: 5px;"> <p style="text-align: center;">Legend</p> <div style="display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Command</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Parameter</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Display</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Action</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Mode</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Sequential transfer</div> </div> </div>												

**(FF00h) RDMAUCCTR : Read CMD Page**

FF00H		RD MAUCCTR (Manufacture Command Set Control)																					
Instruction	R/W	Address		Parameter										HEX									
		MIPI	Others	D15-D8	D7	D6	D5	D4	D3	D2	D1	D0											
RD CMD Status	R	FFh	FF00h	00h	CMD_PG_SEL[7:0]										00								
Description	<p>This command is used to switch the Manufacture Command Pages and User Commands sets.</p> <table border="1"> <thead> <tr> <th>CMD_PG_SEL [7:0]</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>00h</td> <td>User Command Set (UCS = CMD1)</td> </tr> <tr> <td>40h</td> <td>Manufacture Command Set Page0 ( CMD2 P0)</td> </tr> <tr> <td>50h</td> <td>Manufacture Command Set Page1 ( CMD2 P1)</td> </tr> <tr> <td>60h</td> <td>Manufacture Command Set Page2 ( CMD2 P2)</td> </tr> </tbody> </table>													CMD_PG_SEL [7:0]	Description	00h	User Command Set (UCS = CMD1)	40h	Manufacture Command Set Page0 ( CMD2 P0)	50h	Manufacture Command Set Page1 ( CMD2 P1)	60h	Manufacture Command Set Page2 ( CMD2 P2)
CMD_PG_SEL [7:0]	Description																						
00h	User Command Set (UCS = CMD1)																						
40h	Manufacture Command Set Page0 ( CMD2 P0)																						
50h	Manufacture Command Set Page1 ( CMD2 P1)																						
60h	Manufacture Command Set Page2 ( CMD2 P2)																						
Restriction	-																						
Default	<table border="1"> <thead> <tr> <th rowspan="2">Status</th> <th>Default Value</th> </tr> <tr> <th>FFh / FF00h</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	FFh / FF00h	Power On Sequence	00h	S/W Reset	00h	H/W Reset	00h	
Status	Default Value																						
	FFh / FF00h																						
Power On Sequence	00h																						
S/W Reset	00h																						
H/W Reset	00h																						
Flow Chart	<pre> graph TD     A[RD MAUCCTR (FFh)] --&gt; B[/Send Parameter CMD_PG_SEL/]     </pre> <p><b>Legend</b></p> <ul style="list-style-type: none"> <li>Command: Rectangle</li> <li>Parameter: Parallelogram</li> <li>Display: Oval</li> <li>Action: Arrowhead</li> <li>Mode: Capsule</li> <li>Sequential transfer: Oval with tail</li> </ul>																						

## 6. Electrical Characteristics

### 6.1 Absolute Maximum Ratings

The absolute maximum rating is listed on following table. When RM67199 is used out of the absolute maximum ratings, the RM67199 may be permanently damaged. To use the RM67199 within the following electrical characteristics limit is strongly recommended for normal operation. If these electrical characteristic conditions are exceeded during normal operation, the RM67199 will malfunction and cause poor reliability.

item	Symbol	Value	Unit
Power supply voltage	VDDI	-0.3 ~ 5.5	V
Power supply voltage	VDDA, VDDDB, VDDR, VDDAM VCC	-0.3 ~ 5.5	V
Supply voltage (MV)	AVDD-AVSS	-0.3 ~ 6.6	V
	AVEE-AVSS	-0.3 ~ -6.6	V
Supply voltage (HV)	VGHR - VGLR	-0.3 ~ 33	V
Input voltage	VIN	-0.3 ~ VDDI+ 0.3	V
Output voltage	VO	-0.3 ~ VDDI+ 0.3	V
Operating temperature	Topr	-40 ~ 85	°C
Storage temperature	Tstg	-55 ~ 125	°C
Notes: If one of the above items exceeds its maximum limitation momentarily, the quality of the product may be degraded. Absolute maximum limitation. Therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the recommend range.			

### 6.2 ESD Protection Level

Model	Test Condition	Level
Human Body Mode	R = 1.5 K $\Omega$ / C = 100 pF	Pass 2KV
Machine Mode	R = 0 ohm / C = 200 pF	Pass 200V

### 6.3 Latch-Up Protection Level

The device will not latch up at trigger current levels less than  $\pm 200$ mA.

## 6.4 DC Characteristics

### 6.4.1 Basic Characteristics

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Related Pins
Analog Power Supply Voltage	VDD	Operation Voltage	2.5	3.3	3.6	V	Note 1
	VCC	Operating Voltage	1.65	1.8	3.3	V	Note 1
I/O pin Power Supply Voltage	VDDI	I/O supply voltage	1.65	1.8	3.3	V	Note 1
Logic High level input voltage	VIH	VDDI = 1.65V ~ 3.3V	0.8* VDDI	-	VDDI	V	Note 2
Logic Low level input voltage	VIL	VDDI = 1.65V ~ 3.3V	0.0	-	0.2* VDDI	V	Note 2
Logic High level Output voltage	VOH	Iout = -1mA	0.8* VDDI	-	VDDI	V	Note 2
Logic Low level Output voltage	VOL	Iout = +1mA	0.0	-	0.2* VDDI	V	Note 2
Logic High level input current (Except MIPI)	IIHD	Vin=0~VDDI			1	uA	Note 2
Logic Low level input current (Except MIPI)	IILD	Vin=0~VDDI	-1			uA	Note 2
Logic High level input current (MIPI)	IIHD	Vin=0~VDDAM			1	uA	Note 2
Logic Low level input current (MIPI)	IILD	Vin=0~VDDAM	-1			uA	Note 2
AVDD booster voltage	AVDD		4.5		6.5	V	Note 2
AVEE booster voltage	AVEE		-6.5		-4.5	V	Note 2
VCL booster voltage	VCL				-VDDDB	V	Note 2
VGH booster voltage	VGH				AVDD +VDDDB	V	Note 2
VGL booster voltage	VGL				AVEE -AVDD	V	Note 2
Voltage difference between VGHR and VGLR	VGHL	VGHR-VGLR			25	V	Note 2
Gamma reference voltage	VGMP		2.0		AVDD-0.3	V	Note 2,3
	VGSP		0.0		3.3	V	Note 2,3
Channel deviation voltage	V <sub>DEV</sub>	Code 0 ~ Code 255		5	10	mV	

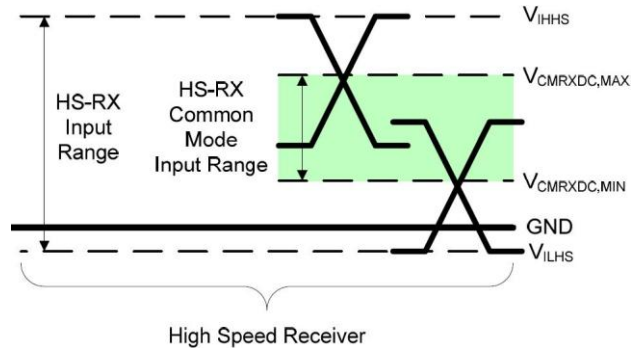
#### Notes:

- VDDI=1.65 to 3.3V, VDD=2.5 to 4.8V, VSSI=VSS=DVSS=0V, VDD means VDDA, VDDR, VDDDB. And VSS means VSSA, VSSR, VSSB, AVSS, VSSAM. VDDDB, VDDA and VDDR should be the same input voltage level and larger than VDDI voltage.
- TA = -30 to 85 °C
- AVDD-0.3V >=VGMP > VGSP >= 0V

## 6.4.2 MIPI Characteristics

### High-Speed Receiver Specification

#### DC Specifications



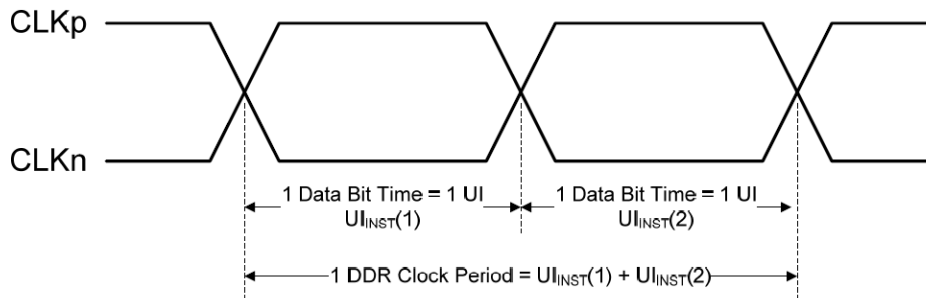
Parameter	Description	Min	Nom	Max	Units	Note
VCMRX(DC)	Common-mode voltage HS receive mode	70		330	mV	1,2
VIDTH	Differential input high threshold			70	mV	
VIDTL	Differential input low threshold	-70			mV	
VIHHS	Single-ended input high voltage			460	mV	1
VILHS	Single-ended input low voltage	-40			mV	1
ZID	Differential input impedance	80	100	125	$\Omega$	

#### Notes:

1. Excluding possible additional RF interference of 100mV peak sine wave beyond 450MHz.
2. This table value includes a ground difference of 50mV between the transmitter and the receiver, the static common-mode level tolerance and variations below 450MHz

## Forward high speed transmissions

### DDR Clock Definition



Clock Parameter	Symbol	Min	Typ	Max	Units	Notes
UI instantaneous	$UI_{INST}$	1.00		12.5	ns	1, 2

#### Notes:

1. This value corresponds to a maximum of 1Gbps and a minimum of 80 Mbps data rate.
2. The minimum UI shall not be violated for any single bit period, i.e., any DDR half cycle within a data burst.

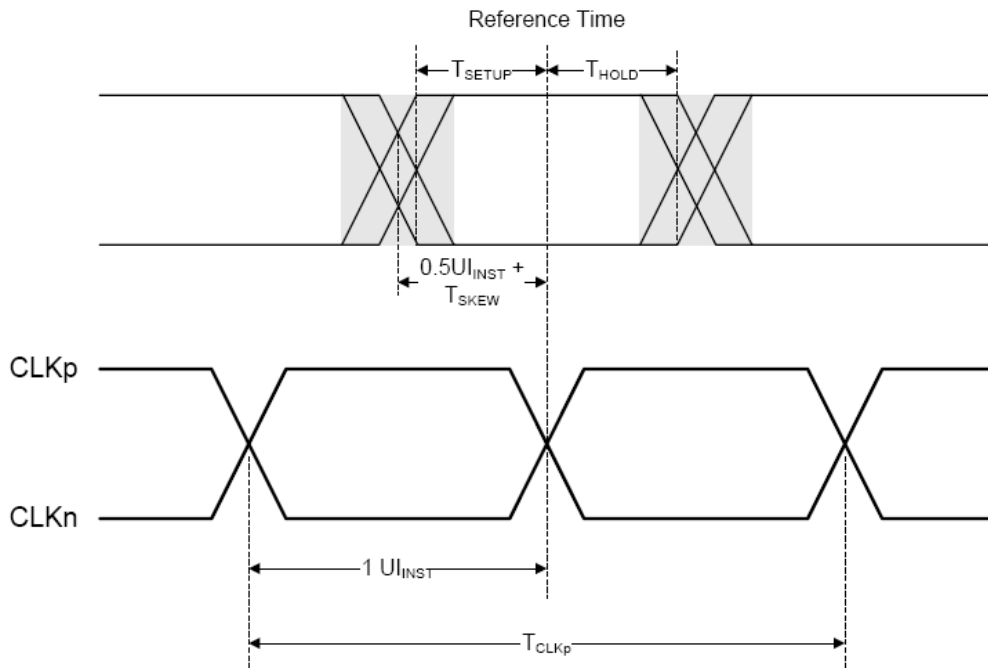
### Data-Clock Timing Specifications

Parameter	Symbol	Min	Typ	Max	Units	Notes
Data to Clock Skew [measured at transmitter]	$T_{SKEW[TX]}$	-0.15		0.15	$UI_{INST}$	1
Data to Clock Setup Time [receiver]	$T_{SETUP[RX]}$	0.15			$UI_{INST}$	2
Clock to Data Hold Time [receiver]	$T_{HOLD[RX]}$	0.15			$UI_{INST}$	2

#### Notes:

1. Total silicon and package delay budget of  $0.3 * UI_{INST}$
2. Total setup and hold window for receiver of  $0.3 * UI_{INST}$ . This value may change according to DSI transfer rate.

## Data to Clock Timing Definitions



CONFIDENTIAL

## Low power transceiver specifications

Parameters	Symbol	Condition	Min	Typ	Max	Unit
Logic high level input voltage	VIHCD	Contention Detection (Lane_D0)	450		1350	mV
Logic low level input voltage	VILCD	Contention Detection (Lane_D0)	0		200	mV
Logic high level input voltage	VIH-LPRX	LP-Rx (Lane_CK, Lane_D0, Lane_D1)	880	-	1350	mV
Logic low level input voltage	VIL-LPRX	LP-Rx (Lane_CK, Lane_D0, Lane_D1)	0		550	mV
Logic low level input voltage	VIL-ULPS	LP-Rx ULPS (Lane_CK, Lane_D0, Lane_D1)	0		300	mV
Logic high level input voltage	VOH-LPTX	Contention Detection (Lane_D0)	1.1	1.2	1.3	V
Logic low level input voltage	VOL-LPTX	Contention Detection (Lane_D0)	-50	0	50	mV
eSPIKE <sup>(1,2,3)</sup>	Fig. 2	Input pulse rejection			300	V.ps

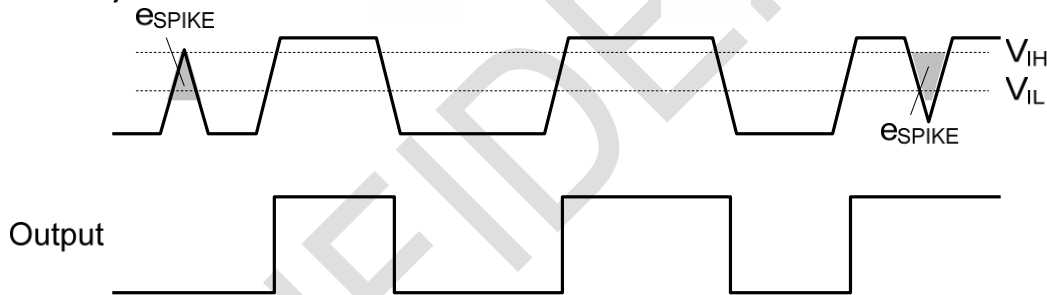
Notes:

Time-voltage integration of a spike above VIL when being in LP-0 state or below VIH when being in LP-1 State.

An impulse less than this will not change the receiver state.

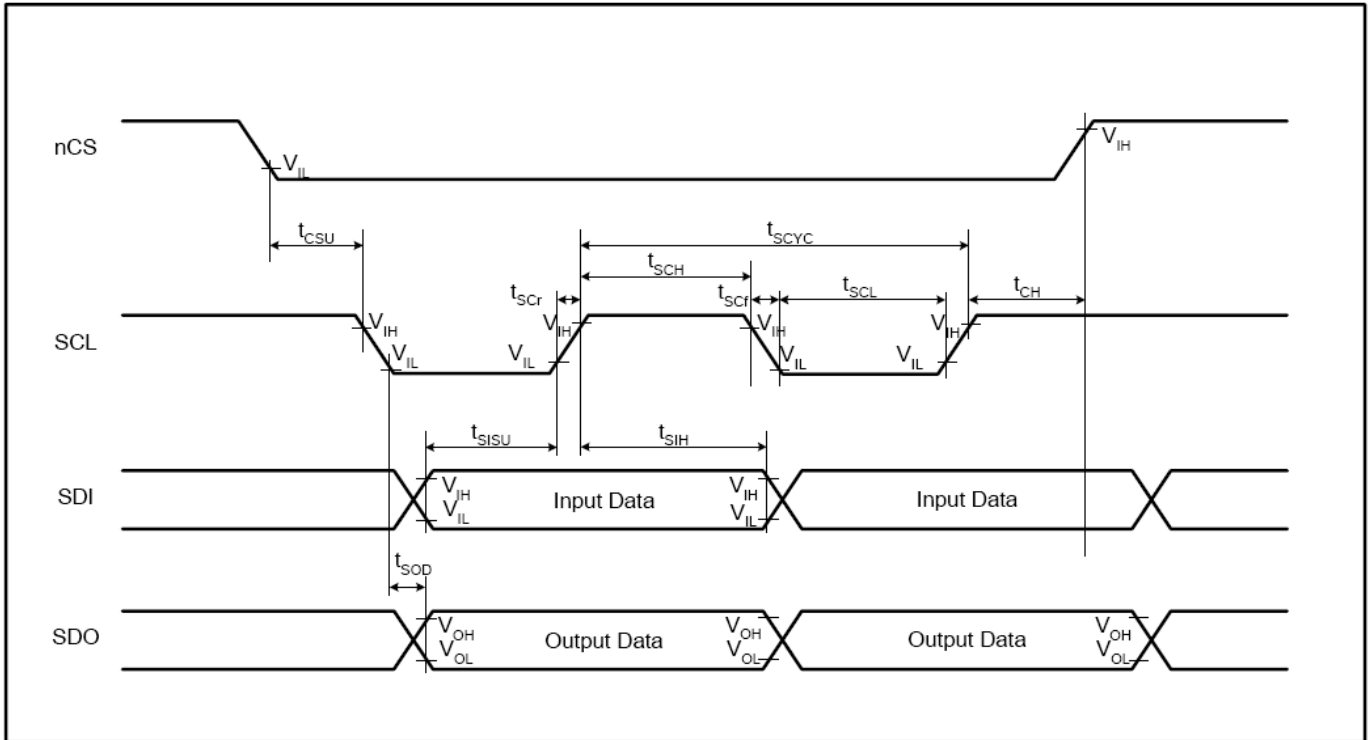
In addition to the required glitch rejection, implementers shall ensure rejection of known RF-interferers.

Input Glitch Rejection of Low Power Receivers as follow.



## 6.5 AC Characteristics

### 6.5.1 Serial Interface Characteristics



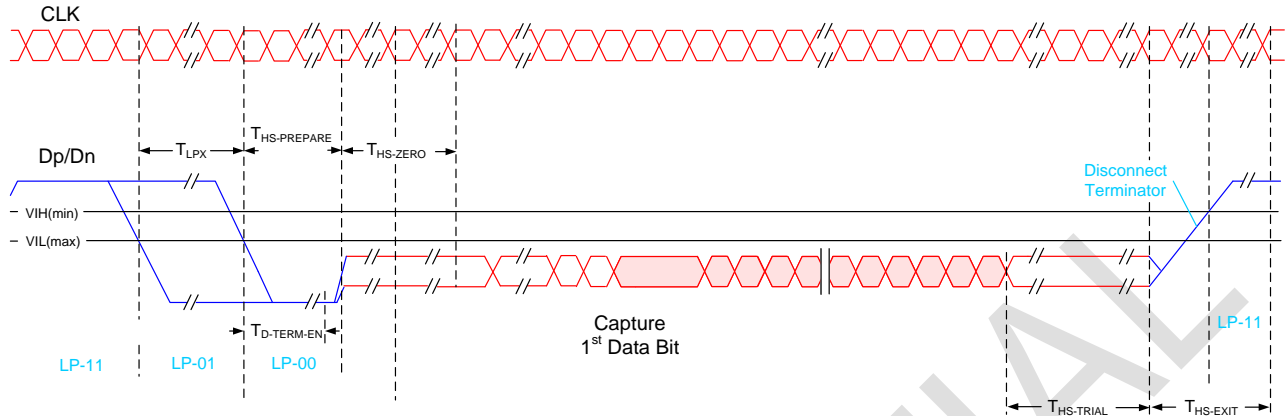
Signal	Symbol	Parameter	MIN	MAX	Unit	Description
SCL	$T_{SCYC}$	Clock cycle (Write)	100		ns	-
	$T_{SCYC}$	Clock cycle (Read)	300		ns	
	$T_{SCH}$	Clock "H" pulse width (Write)	40		ns	
	$T_{SCH}$	Clock "H" pulse width (Read)	140		ns	
	$T_{SCL}$	Clock "L" pulse width (Write)	40		ns	
	$T_{SCL}$	Clock "L" pulse width (Read)	140		ns	
	$T_{SCr}$	Clock rise time		5	ns	
	$T_{ScF}$	Clock fall time		5	ns	
nCS	$T_{CSU}$	Chip select setup time	20		ns	-
	$T_{CH}$	Chip select hold time	50		ns	
SDI	$T_{SISU}$	Data input setup time	20		ns	-
	$T_{SIH}$	Data input hold time	20		ns	
SDO	$T_{SOD}$	Data output setup time		120	ns	-
	$T_{SOH}$	Data output hold time	5		ns	

Note: Logic high and low levels are specified as 20% and 80% of IOVCC for Input signals.

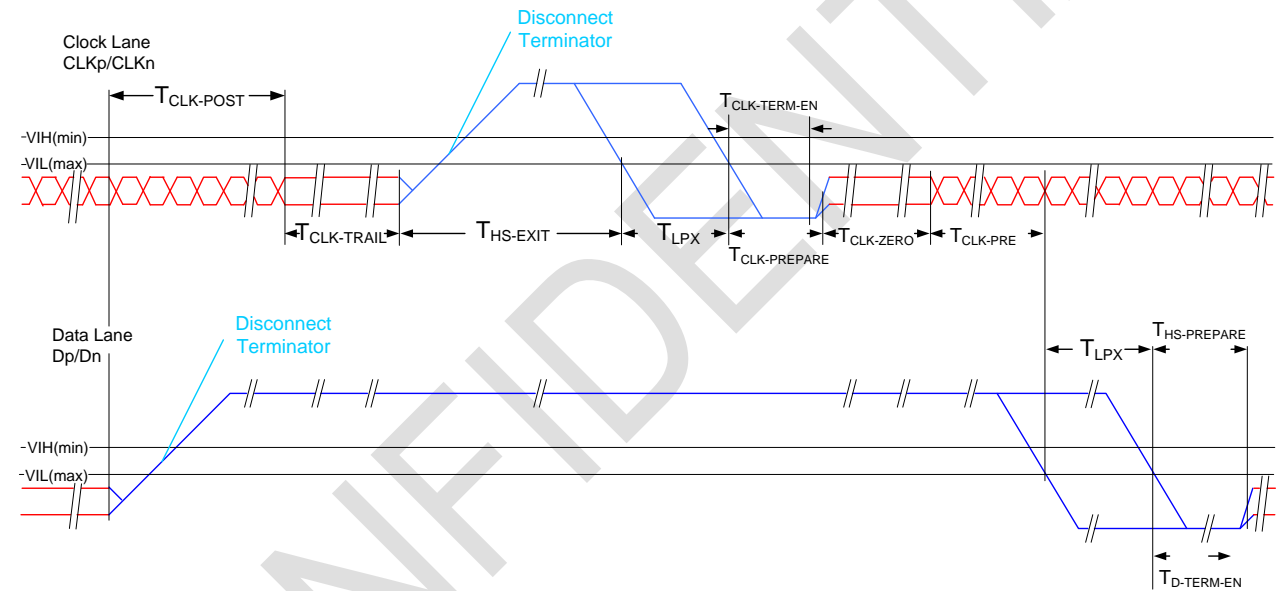
Note:  $T_a = -30$  to  $70$  °C, IOVCC=1.65V to 3.3V, VDD=2.5V to 3.6V, GND=0V

## 6.5.2 DSI Timing Characteristics

### HS Data Transmission Burst



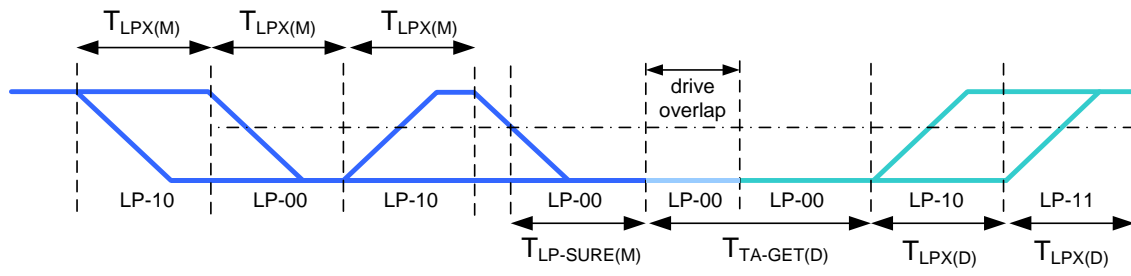
### HS clock transmission



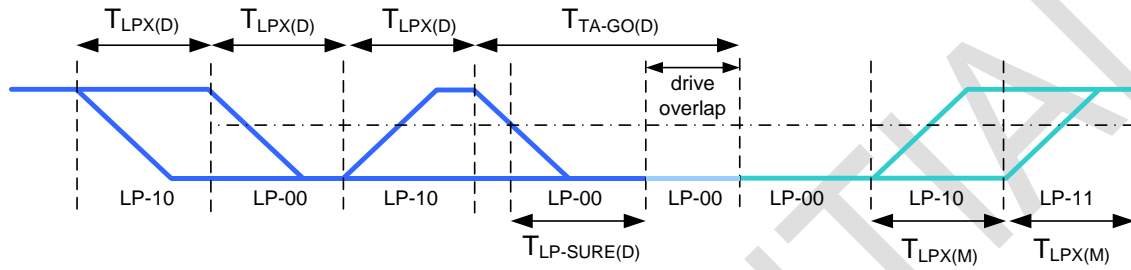
## Timing Parameters:

Parameter	Description	Min	Typ	Max	Unit
$T_{\text{CLK-POST}}$	Time that the transmitter continues to send HS clock after the last associated Data Lane has transitioned to LP Mode. Interval is defined as the period from the end of $T_{\text{HS-TRAIL}}$ to the beginning of $T_{\text{CLK-TRAIL}}$ .	$60\text{ns} + 52*UI$			ns
$T_{\text{CLK-TRAIL}}$	Time that the transmitter drives the HS-0 state after the last payload clock bit of a HS transmission burst.	60			ns
$T_{\text{HS-EXIT}}$	Time that the transmitter drives LP-11 following a HS burst.	<b>300</b>			ns
$T_{\text{CLK-TERM-EN}}$	Time for the Clock Lane receiver to enable the HS line termination, starting from the time point when Dn crosses $V_{\text{IL,MAX}}$ .	Time for Dn to reach $V_{\text{TERM-EN}}$		38	ns
$T_{\text{CLK-PREPARE}}$	Time that the transmitter drives the Clock Lane LP-00 Line state immediately before the HS-0 Line state starting the HS transmission.	38		95	ns
$T_{\text{CLK-PRE}}$	Time that the HS clock shall be driven by the transmitter prior to any associated Data Lane beginning the transition from LP to HS mode.	8			UI
$T_{\text{CLK-PREPARE}} + T_{\text{CLK-ZERO}}$	$T_{\text{CLK-PREPARE}}$ + time that the transmitter drives the HS-0 state prior to starting the Clock.	300			ns
$T_{\text{D-TERM-EN}}$	Time for the Data Lane receiver to enable the HS line termination, starting from the time point when Dn crosses $V_{\text{IL,MAX}}$ .	Time for Dn to reach $V_{\text{TERM-EN}}$		$35\text{ ns} + 4*UI$	
$T_{\text{HS-PREPARE}}$	Time that the transmitter drives the Data Lane LP-00 Line state immediately before the HS-0 Line state starting the HS transmission	$40\text{ns} + 4*UI$		$85\text{ ns} + 6*UI$	ns
$T_{\text{HS-PREPARE}} + T_{\text{HS-ZERO}}$	<b><math>T_{\text{HS-PREPARE}}</math> + time that the transmitter drives the HS-0 state prior to transmitting the Sync sequence.</b>	<b><math>145\text{ns} + 10*UI</math></b>			<b>ns</b>
$T_{\text{HS-TRAIL}}$	Time that the transmitter drives the flipped differential state after last payload data bit of a HS transmission burst	$60\text{ns} + 4*UI$			ns

## Turnaround Procedure



Bus turnaround (BAT) from MPU to display module timing



Bus turnaround (BAT) from display module to MPU timing

CONFIDENTIAL

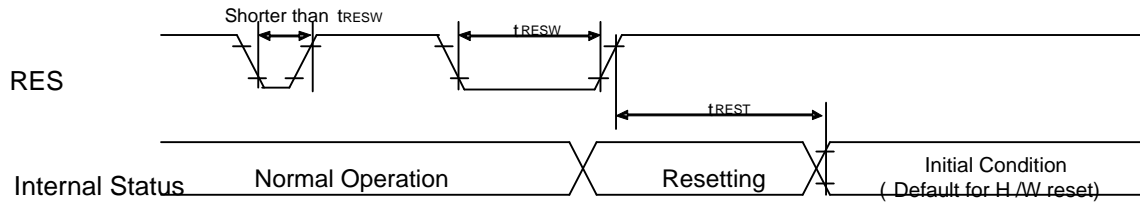
Low Power Mode :

Parameter	Description	Min	Typ	Max	Unit	Notes
$T_{LPX(M)}$	Transmitted length of any Low-Power state period of MCU to display module	50		<b>150</b>	ns	1,2
$T_{TA-SURE(M)}$	Time that the display module waits after the LP-10 state before transmitting the Bridge state (LP-00) during a Link Turnaround.	$T_{LPX(M)}$		$2 * T_{LPX(M)}$	ns	2
$T_{LPX(D)}$	Transmitted length of any Low-Power state period of display module to MCU	50		<b>150</b>	ns	1,2
$T_{TA-GET(D)}$	Time that the display module drives the Bridge state (LP-00) after accepting control during a Link Turnaround.		$5 * T_{LPX(D)}$		ns	2
$T_{TA-GO(D)}$	Time that the display module drives the Bridge state (LP-00) before releasing control during a Link Turnaround.		$4 * T_{LPX(D)}$		ns	2
$T_{TA-SURE(D)}$	Time that the MPU waits after the LP-10 state before transmitting the Bridge state (LP-00) during a Link Turnaround.	$T_{LPX(D)}$		$2 * T_{LPX(D)}$	ns	2

NOTE:

1.  $T_{LPX}$  is an internal state machine timing reference. Externally measured values may differ slightly from the specified values due to asymmetrical rise and fall times.
2. Transmitter-specific parameter

## 6.5.3 Reset Timing



Reset input timing:

IOVCC=1.65 to 3.6V, VDD=2.5 to 3.6V, AGND=DGND=0V, Ta=-40 to 85°C

Symbol	Parameter	Related Pins	MIN	TYP	MAX	Note	Unit
$t_{RESW}$	*1) Reset low pulse width	RESX	10	-	-	-	$\mu$ S
$t_{REST}$	*2) Reset complete time	-	-	-	5	When reset applied during Sleep in mode	ms
		-	-	-	120	When reset applied during Sleep out mode	ms

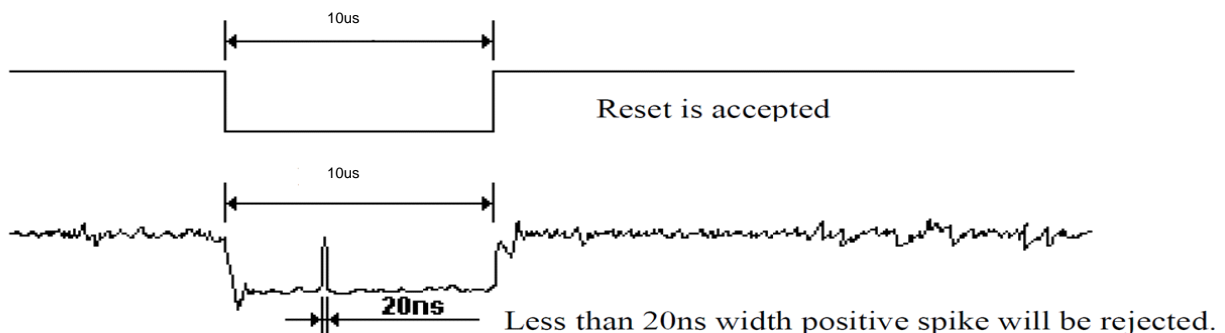
Note 1) Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below.

RESX Pulse	Action
Shorter than 5 $\mu$ s	Reset Rejected
Longer than 10 $\mu$ s	Reset
Between 5 $\mu$ s and 10 $\mu$ s	Reset starts (It depends on voltage and temperature condition.)

Note 2. During the resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, 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.

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

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



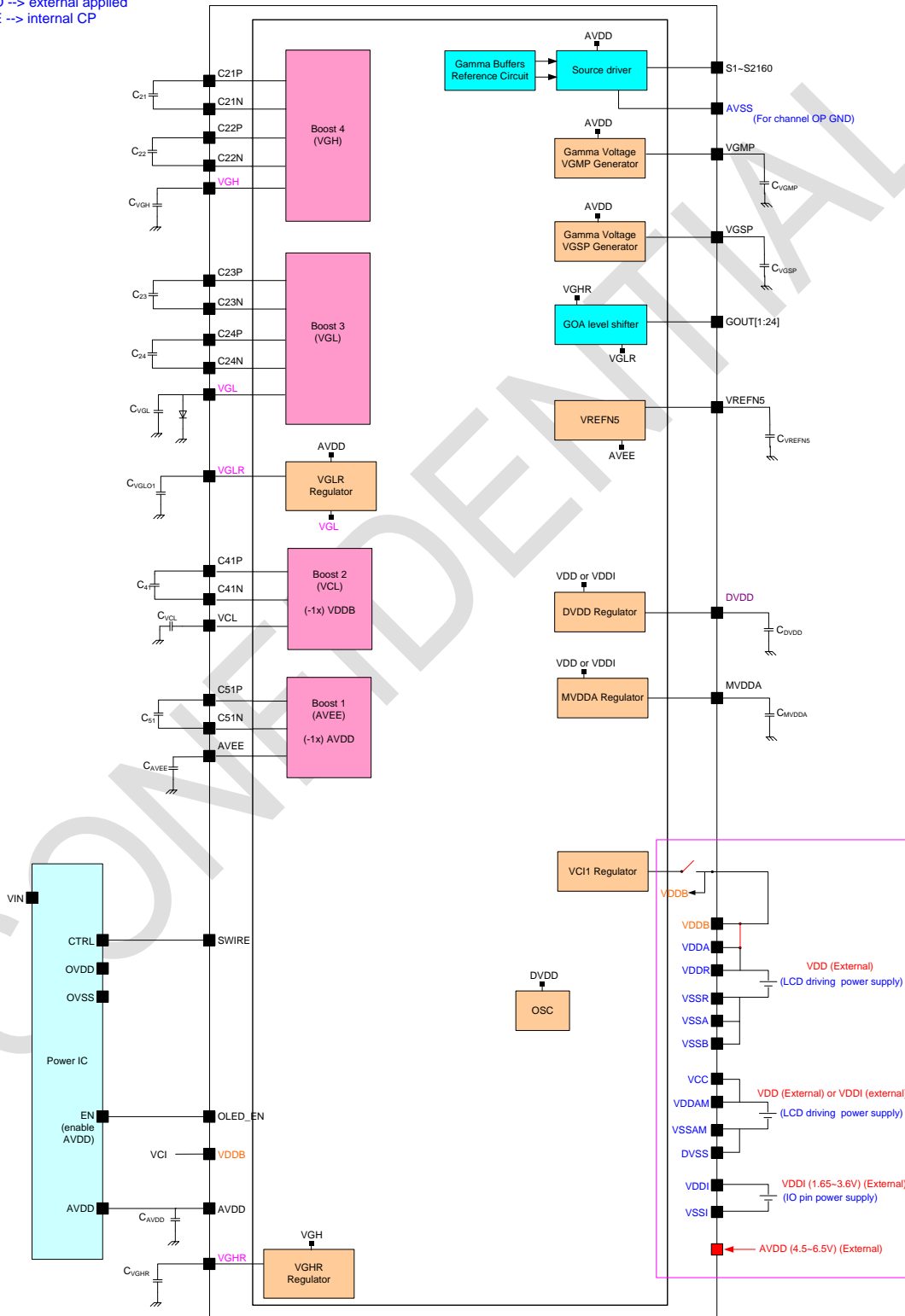
Note 5. It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

## 7. Power Generation

### 7.1 DC/DC Converter Circuit

**BSTM = 111**

3PWR(VDDI, VCI, AVDD)  
VCI=VDDA=VDDB=VDDR  
AVDD --> external applied  
AVEE --> internal CP



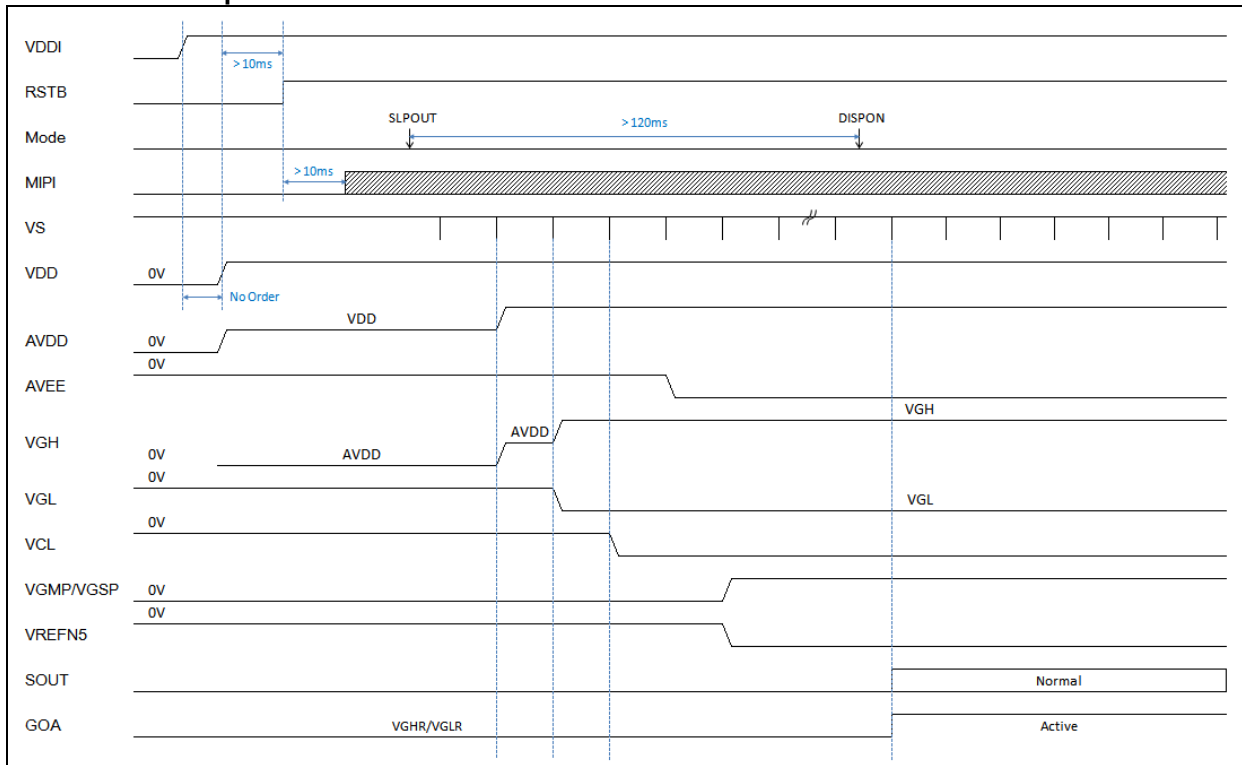
## 7.2 External Component

No.	Signal Name	Values	Max Ability	Note
1	VDDA, VDDDB, VDDR, VCC	Cap, 4.7uF	6.3V	Analog power input
2	VDDI	Cap, 2.2uF	6.3V	I/O & Digital power input
3	DVDD	Cap, 2.2uF	6.3V	Regulator output
4	MVDDA	Cap, 1uF	6.3V	Regulator output
5	VREFP5	Cap, 2.2uF	6.3V	Regulator output
6	VREFN5	Cap, 2.2uF	6.3V	Regulator output
7	VGHR	Cap, 2.2uF	16V	Regulator output
8	VGLR	Cap, 2.2uF	16V	Regulator output
9	AVDD	Cap, 4.7uF	10V	AVDD
10	AVEE	Cap, 4.7uF	10V	AVEE
11	C21P/C21N	Cap, 1uF	16V	VGH Pump
12	C22P/C22N	Cap, 1uF	16V	
13	VGH	Cap, 2.2uF	25V	
14	C23P/C23N	Cap, 1uF	16V	VGL Pump
15	C24P/C24N	Cap, 1uF	16V	
16	VGL	Cap, 2.2uF	25V	
17	C41P/C41N	Cap, 1uF	6.3V	VCL Pump
18	VCL	Cap, 2.2uF	6.3V	
19	C51P/C51N	Cap, 1uF	10V	AVEE Pump
20	VGL-GND	Schottky Diode	Vf < 0.4V @ 10mA	Prevent from Latch-Up
21	VGMP	Cap, 1uF	6.3V	Regulator output
22	VGSP	Cap, 1uF	6.3V	Regulator output

CONFIDENTIAL

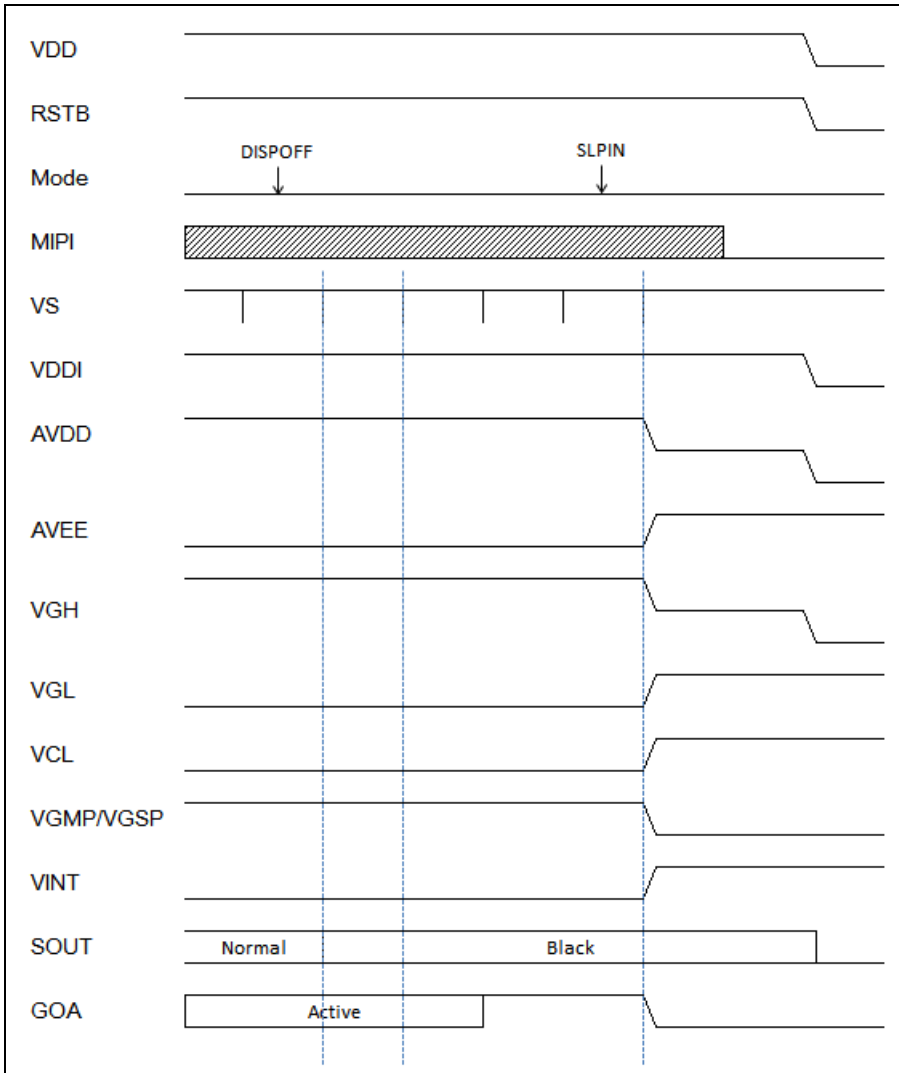
## 8. Power Sequence

### 8.1 Power On Sequence

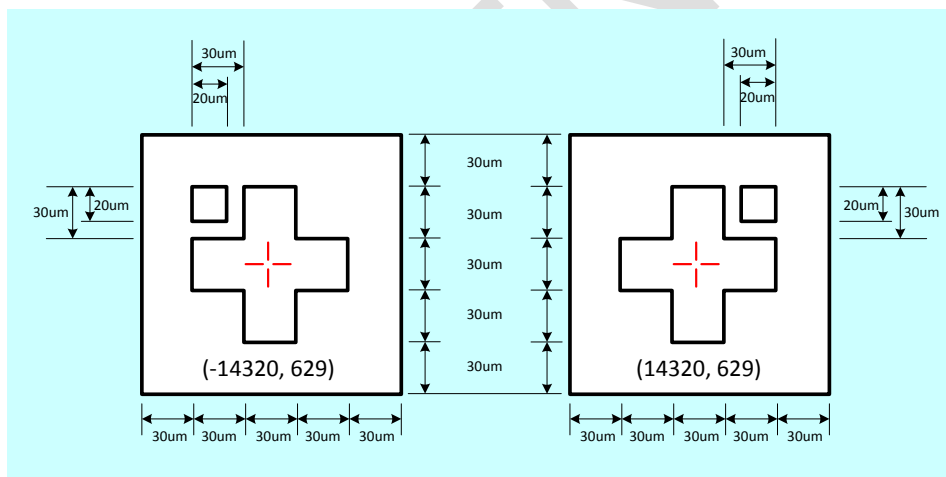
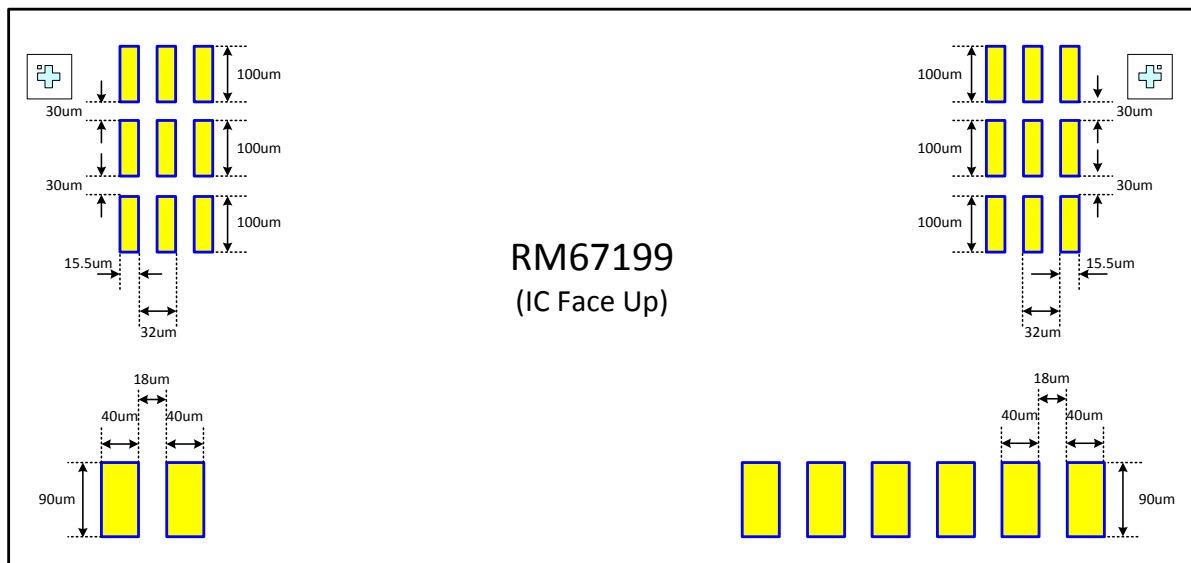


CONFIDENTIAL

## 8.2 Power Off Sequence



## 9. Chip Information



- ◆ **Chip Thickness= 200um**
- ◆ **Au Bump:**
  1. **ILB Size= 40um x 90um, Pitch= 58um**
  2. **OLB Size= 15.5um x 100um, Pitch= 32um (every 3 bumps)**
  3. **Bump Height= 12±2um (Typ.)**
- ◆ **Alignment Mark L coordinate: (-14320um, 629um)**
- ◆ **Alignment Mark R coordinate: (14320um, 629um)**