

NHD-1.45-160128G

Graphic Color OLED Display

NHD-	Newhaven Display
1.45-	1.45" Diagonal Size
160128-	160 x 128 Pixels
G-	OLED Glass

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Document Revision History

Revision	Date	Description	Changed by
-	01/25/19	Initial Release	PB

Functions and Features

- 160 x 128 pixel resolution
- Built-in SEPS525 controller
- Parallel, Serial, RGB interface
- RoHS compliant

A

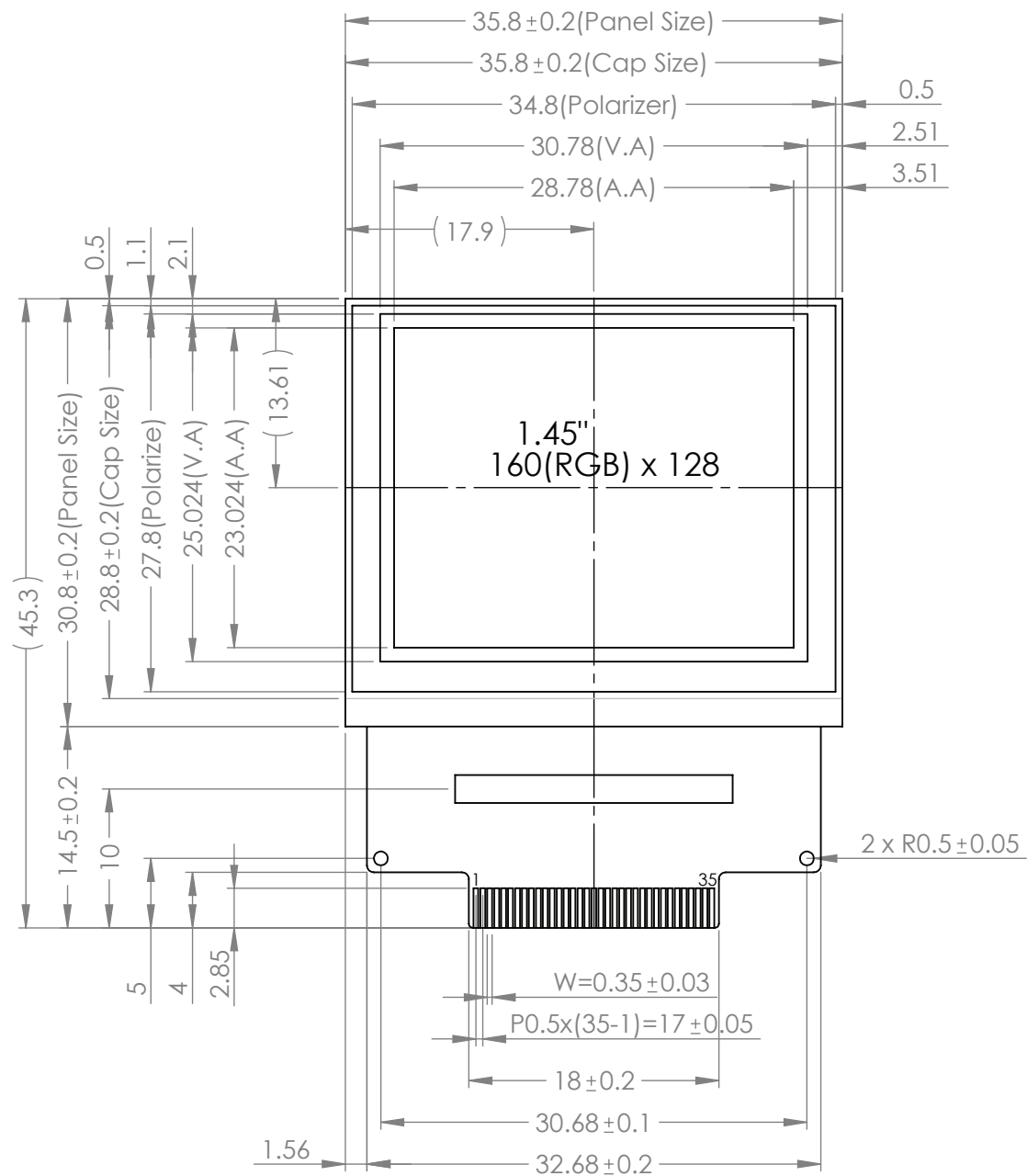
B

C

D

E

F



Notes:

1. Display Type: 1.45" Color OLED Glass, FFC Connection
2. Driver IC: SEPS525
3. Supply Voltage:
 - Logic (V_{DD}) = 3.3V
 - Display (V_{CC}) = 13V
4. Interface: 8/9-Bit 68XX/80XX Parallel, 4-wire SPI, 6-Bit RGB
5. Operating Temp: $-40^{\circ}\text{C} - +70^{\circ}\text{C}$
6. Storage Temp: $-40^{\circ}\text{C} - +85^{\circ}\text{C}$

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Interface Description

Pin No.	Symbol	External Connection	Function Description
1	GND	Power Supply	Ground
2	V _{SDH}	Power Supply	Ground
3	V _{DDH}	Power Supply	Supply Voltage for OLED glass
4	V _{SSH}	Power Supply	Ground
5	I _{REF}	Power Supply	OLED brightness current. Connect a 68kΩ resistor between this pin and VSS
6-7	OSCA1-OSCA2	-	Oscillation adjustment. Connect a 5.1kΩ resistor between these two pins
8	V _{DDIO}	Power Supply	Supply Voltage for Logic
9	NC	-	No Connect
10	V _{SYNC}	MPU	Vertical Sync signal
11	H _{SYNC}	MPU	Horizontal Sync signal
12	DOTCLK	MPU	Dot Clock signal
13	ENABLE	MPU	Data Enable signal
14	CPU	MPU	Interface select. HIGH: 6800 interface. LOW: 8080 interface
15	PS	MPU	Parallel/Serial select. HIGH: Parallel. LOW: Serial
16-24	D17-D9	MPU	<p>Parallel interface: 9-bit Bi-directional data bus (D17~D9) 8-bit Bi-directional data bus (D17~D10)</p> <p>Serial Interface: D17: Synchronous Clock signal (SCL) D16: Serial Data Input signal (SDI) D15: Serial Data Output signal (SDO)</p> <p>RGB interface: 6-bit RGB color signals (D17~D12)</p>
25	RS	MPU	Register Select signal. LOW: Command. HIGH: Data
26	CSB	MPU	Active LOW Chip Select signal
27	E RDB	MPU	<p>6800 mode: Enable signal. Falling edge triggered</p> <p>8080 mode: Active LOW Read signal</p>
28	R/W WRB	MPU	<p>6800 mode: Read/Write signal. LOW: Read. HIGH: Write</p> <p>8080 mode: Active LOW Write signal</p>
29	RESETB	MPU	Active LOW Reset signal
30	V _{SS}	Power Supply	Ground
31	V _{DD}	Power Supply	Supply Voltage for Logic
32	V _{SSH}	Power Supply	Ground
33	V _{DDH}	Power Supply	Supply Voltage for OLED glass
34	V _{SDH}	Power Supply	Ground
35	GND	Power Supply	Ground

Recommended display connector: 35pin 0.5mm pitch top contact FFC connector (Molex 54104-3531 or equivalent)

MPU Interface Pin Assignment Summary

EIM=1 (Default)

Bus Interface	PS	CPU	DFM1	DFM0	D17	D16	D15	D14	D13	D12	D11	D10	D9	RS	CSB	RDB	WRB	RESETB
4-wire SPI	0	X	X	X	SCL	SDI	NC	0	0	0	0	0	0	RS	CSB	0	0	RESETB
9-bit 8080	1	0	1	0	D8	D7	D6	D5	D4	D3	D2	D1	D0	RS	CSB	RDB	WRB	RESETB
8-bit 8080	1	0	1	1	D7	D6	D5	D4	D3	D2	D1	D0	0	RS	CSB	RDB	WRB	RESETB
9-bit 6800	1	1	1	0	D8	D7	D6	D5	D4	D3	D2	D1	D0	RS	CSB	E	R/W	RESETB
8-bit 6800	1	1	1	1	D7	D6	D5	D4	D3	D2	D1	D0	0	RS	CSB	E	R/W	RESETB

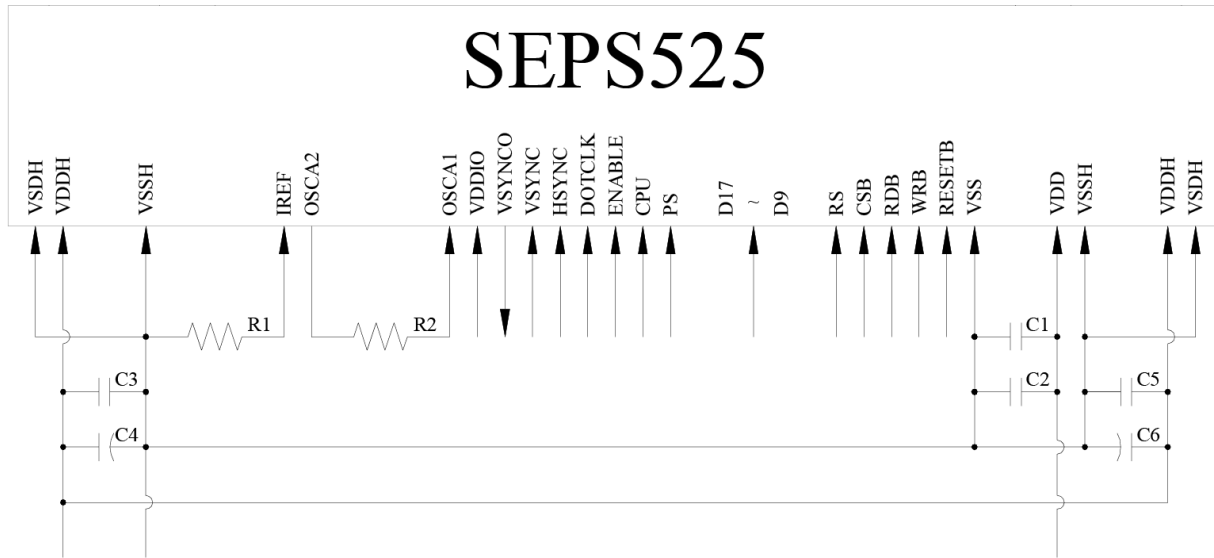
EIM=0

Bus Interface	RIM1	RIM0	D17	D16	D15	D14	D13	D12	D11	D10	D9	VSYNC	HSYNC	DOTCLK	ENABLE
6-bit RGB	1	0	D5	D4	D3	D2	D1	D0	0	0	0	VSYNC	HSYNC	DOTCLK	ENABLE

Note:

- DFM1, DFM0 register setting 16h
- EIM, RIM1, RIM0 register setting 14h
- "X" : Don't care
"NC" : No Connect
"1" : VDD
"0" : VSS

Wiring Diagram



C1, C3, C5: 0.1 μ F

C2: 4.7 μ F

C4, C6: 4.7 μ F / 25V Tantalum Capacitor

R1: 68k Ω

R2: 5.1k Ω

Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	T _{OP}	Absolute Max	-40	-	+70	°C
Storage Temperature Range	T _{ST}	Absolute Max	-40	-	+85	°C
Supply Voltage for Logic	V _{DD}	-	2.4	2.8	3.3	V
Supply Voltage for I/O pins	V _{DDIO}	-	1.6	2.8	3.3	V
Supply Voltage for Display	V _{DDH}	-	12.5	13.0	13.5	V
Supply Current (Logic)	I _{DD}	V _{DD} =2.8V	-	2.5	3.5	mA
Supply Current (Display)	I _{DDH}	V _{DDH} =13.0V, 50% ON	-	16	19	mA
		V _{DDH} =13.5V, 100% ON	-	27	32	mA
Sleep mode Current	I _{DD, SLEEP}	-	-	4	10	μA
"H" Level input	V _{IH}	-	0.8*V _{DDIO}	-	V _{DDIO}	V
"L" Level input	V _{IL}	-	V _{SS}	-	0.4	V
"H" Level output	V _{OH}	-	V _{DDIO} -0.4	-	V _{DDIO}	V
"L" Level output	V _{OL}	-	V _{SS}	-	0.4	V

Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	
Optimal Viewing Angles	Top	φY+	-	80	-	-	°
	Bottom	φY-		80	-	-	°
	Left	θX-		80	-	-	°
	Right	θX+		80	-	-	°
Contrast Ratio	CR	-	-	>10,000:1	-	-	
Response Time	Rise	T _R	-	10	-	us	
	Fall	T _F	-	10	-	us	
Brightness	L _V	50% Checkerboard	75	100	-	cd/m ²	
Lifetime	-	100 cd/m ² , T _{OP} =25°C 50% Checkerboard	10,000	-	-	Hrs	
		75 cd/m ² , T _{OP} =25°C 50% Checkerboard	15,000	-	-	Hrs	

Note: Lifetime at typical temperature is based on accelerated high-temperature operation. Lifetime is tested at average 50% pixels on and is rated as Hours until **Half-Brightness**. The Display OFF command can be used to extend the lifetime of the display.

Luminance of active pixels will degrade faster than inactive pixels. Residual (burn-in) images may occur. To avoid this, every pixel should be illuminated uniformly.

Controller information

Built-in SEPS525 controller.

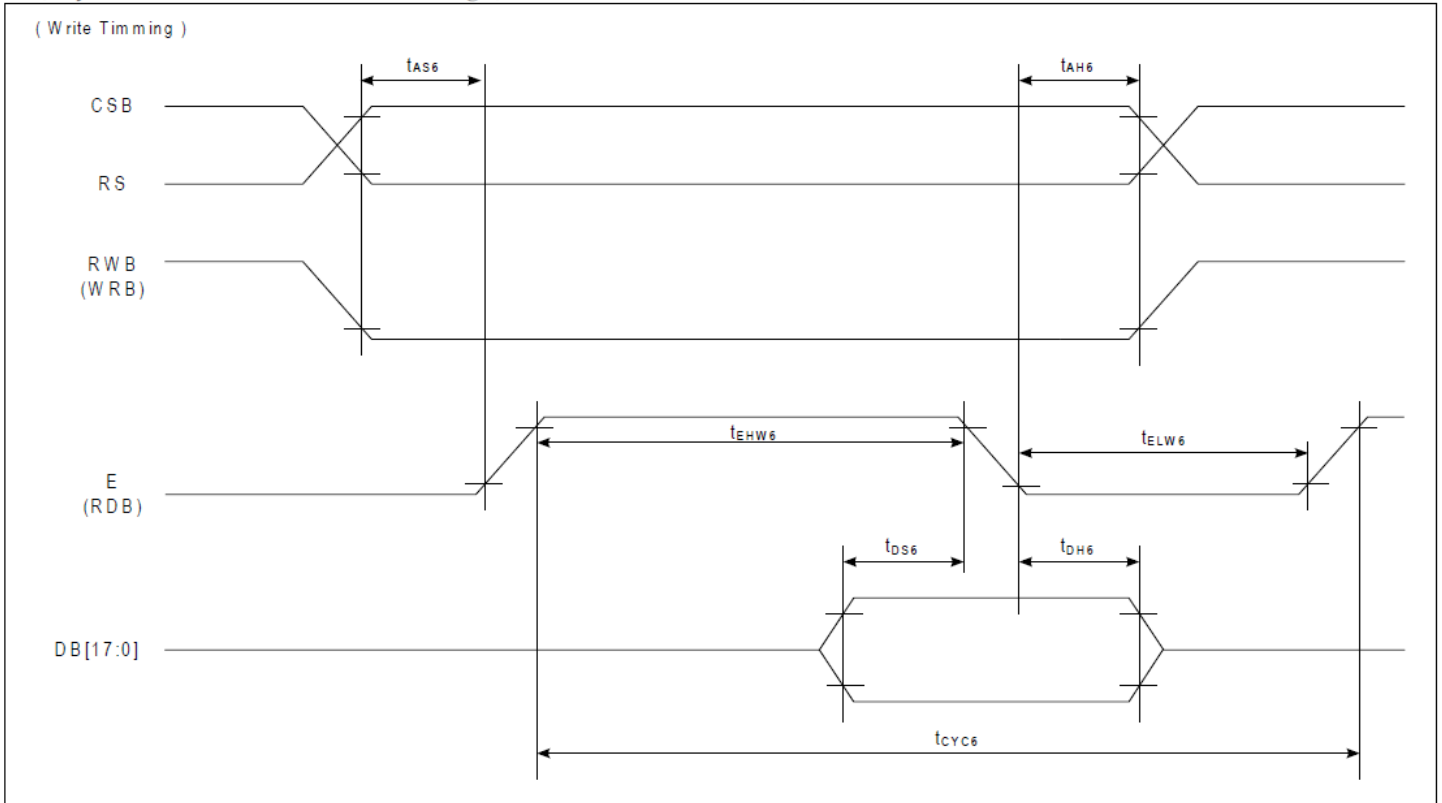
Please download specification at <http://www.newhavendisplay.com/apnotes/datasheets/OLEDs/SEPS525.pdf>

Table of Commands

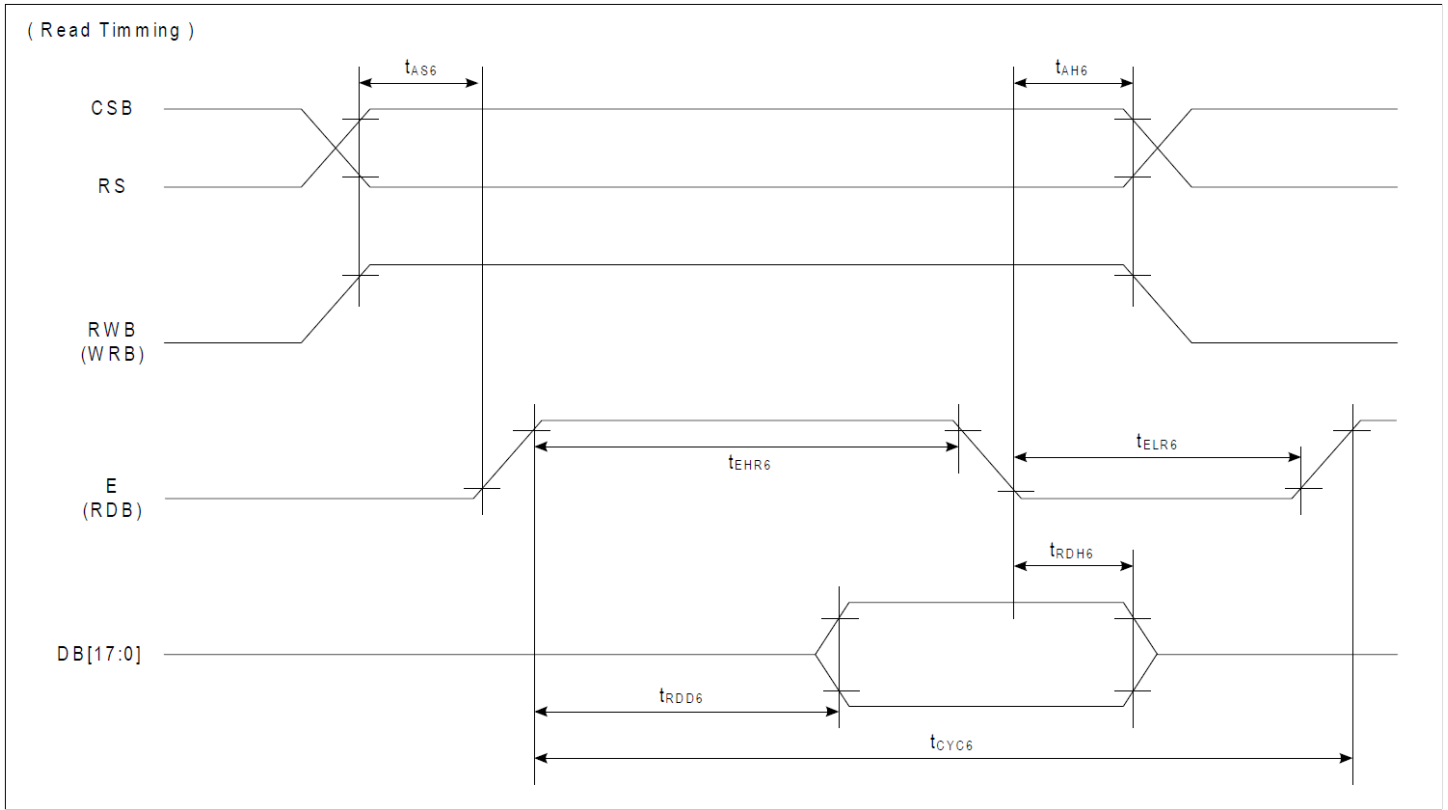
ADDR	RW	IB7	IB6	IB5	IB4	IB3	IB2	IB1	IB0	Description	Default
00h	R	IDX7	IDX6	IDX5	IDX4	IDX3	IDX2	IDX1	IDX0	INDEX	00h
01h	R	HC	VC	HV	SWAP	RD	CD	DC1	DC0	STATUS_RD	C0h
02h	R/W	SELEXP	SELRES	-	-	-	-	SELCLK	OSCD5B	OSC_CTL	C0h
80h	R/W	-	-	-	-	-	-	-	IREF	IREF	00h
03h	R/W	FR3	FR2	FR1	FR0	DFR3	DFR2	DFR1	DFR0	CLOCK_DIV	30h
04h	R/W	-	-	-	-	-	RC	OSCPS	PS	REDUCE_CURRENT	00h
05h	R/W	-	-	-	-	-	-	-	SRN	SOFT_RST	00h
06h	R/W	PREM	-	-	-	-	-	-	DON	DISP_ON_OFF	00h
08h	R/W	-	-	-	-	PTR3	PTR2	PTR1	PTR0	PRECHARGE_TIME_R	00h
09h	R/W	-	-	-	-	PTG3	PTG2	PTG1	PTG0	PRECHARGE_TIME_G	00h
0Ah	R/W	-	-	-	0	PTB3	PTB2	PTB1	PTB0	PRECHARGE_TIME_B	00h
0Bh	R/W	PCR7	PCR6	PCR5	PCR4	PCR3	PCR2	PCR1	PCR0	PRECHARGE_CURRENT_R	00h
0Ch	R/W	PCG7	PCC6	PCG5	PCC4	PCG3	PCG2	PCG1	PCG0	PRECHARGE_CURRENT_G	00h
0Dh	R/W	PCB7	PCB6	PCB5	PCB4	PCB3	PCB2	PCB1	PCB0	PRECHARGE_CURRENT_B	00h
10h	R/W	DCR7	DCR6	DCR5	DCR4	DCR3	DCR2	DCR1	DCR0	DRIVING_CURRENT_R	00h
11h	R/W	DCG7	DCG6	DCG5	DCG4	DCG3	DCG2	DCG1	DCG0	DRIVING_CURRENT_G	00h
12h	R/W	DCB7	DCB6	DCB5	DCB4	DCB3	DCB2	DCB1	DCB0	DRIVING_CURRENT_B	00h
13h	R/W	SWAP	SM	RD	CD	-	SPT	DC1	DC0	DISPLAY_MODE_SET	00h
14h	R/W	-	-	RIM1	RIM0	-	-	-	EDM	RGB_IF	11h
15h	R/W	RES	RES	ENP	DOP	VSYOEN	RES	RES	RES	RGB_POL	00h
16h	R/W	-	DFM1	DFM0	TRI	-	HC	VC	HV	MEMORY_WRITE_MODE	06h
17h	R/W	MX1_7	MX1_6	MX1_5	MX1_4	MX1_3	MX1_2	MX1_1	MX1_0	MX1_ADDR	00h
18h	R/W	MX2_7	MX2_6	MX2_5	MX2_4	MX2_3	MX2_2	MX2_1	MX2_0	MX2_ADDR	9Fh
19h	R/W	MY1_7	MY1_6	MY1_5	MY1_4	MY1_3	MY1_2	MY1_1	MY1_0	MY1_ADDR	00h
1Ah	R/W	MY2_7	MY2_6	MY2_5	MY2_4	MY2_3	MY2_2	MY2_1	MY2_0	MY2_ADDR	7Fh
20h	R/W	MAC7	MAC6	MAC5	MAC4	MAC3	MAC2	MAC1	MAC0	MEMORY_ACCESS_POINTER X	00h
21h	R/W	MAR7	MAR6	MAR5	MAR4	MAR3	MAR2	MAR1	MAR0	MEMORY_ACCESS_POINTER Y	00h
22h		DDRAM[17:0]								DDRAM_DATA_ACCESS_PORT	
50h	R/W	IGAMMA7	IGAMMA6	IGAMMA5	IGAMMA4	IGAMMA3	IGAMMA2	IGAMMA1	IGAMMA0	GRAY_SCALE_TABLE_INDEX	00h
51h	R/W	DGAMMA7	DGAMMA6	DGAMMA5	DGAMMA4	DGAMMA3	DGAMMA2	DGAMMA1	DGAMMA0	GRAY_SCALE_TABLE_DATA	
28h	R/W	DUTY7	DUTY6	DUTY5	DUTY4	DUTY3	DUTY2	DUTY1	DUTY0	DUTY	7Fh
29h	R/W	DSL7	DSL6	DSL5	DSL4	DSL3	DSL2	DSL1	DSL0	DSL	00h
2Eh	R/W	FAC7	FAC6	FAC5	FAC4	FAC3	FAC2	FAC1	FAC0	D1_DDRAM_FAC	00h
2Fh	R/W	FAR7	FAR6	FAR5	FAR4	FAR3	FAR2	FAR1	FAR0	D1_DDRAM_FAR	00h
31h	R/W	SAC7	SAC6	SAC5	SAC4	SAC3	SAC2	SAC1	SAC0	D2_DDRAM_SAC	00h
32h	R/W	SAR7	SAR6	SAR5	SAR4	SAR3	SAR2	SAR1	SAR0	D2_DDRAM_SAR	00h
33h	R/W	FX1_7	FX1_6	FX1_5	FX1_4	FX1_3	FX1_2	FX1_1	FX1_0	SCR1_FX1	00h
34h	R/W	FX2_7	FX2_6	FX2_5	FX2_4	FX2_3	FX2_2	FX2_1	FX2_0	SCR1_FX2	9Fh
35h	R/W	FY1_7	FY1_6	FY1_5	FY1_4	FY1_3	FY1_2	FY1_1	FY1_0	SCR1_FY1	00h
36h	R/W	FY2_7	FY2_6	FY2_5	FY2_4	FY2_3	FY2_2	FY2_1	FY2_0	SCR1_FY2	7Fh
37h	R/W	SX1_7	SX1_6	SX1_5	SX1_4	SX1_3	SX1_2	SX1_1	SX1_0	SCR2_SX1	00h
38h	R/W	SX2_7	SX2_6	SX2_5	SX2_4	SX2_3	SX2_2	SX2_1	SX2_0	SCR2_SX2	9Fh
39h	R/W	SY1_7	SY1_6	SY1_5	SY1_4	SY1_3	SY1_2	SY1_1	SY1_0	SCR2_SY1	00h
3Ah	R/W	SY2_7	SY2_6	SY2_5	SY2_4	SY2_3	SY2_2	SY2_1	SY2_0	SCR2_SY2	7Fh
3Bh	R/W	-	SSA1	SSA0	-	SSC1	SSC0	-	SSM	SCREEN_SAVER_CONTEROL	00h
3Ch	R/W	SST7	SST6	SST5	SST4	SST3	SST2	SST1	SST0	SS_SLEEP_TIMER	00h
3Dh	R/W	-	-	SMS1	SMS0	-	-	SMP1	SMP0	SCREEN_SAVER_MODE	00h
3Eh	R/W	FSUT7	FSUT6	FSUT5	FSUT4	FSUT3	FSUT2	FSUT1	FSUT0	SS_SCR1_FU	00h
3Fh	R/W	-	-	-	-	FSMS3	FSMS2	FSMS1	FSMS0	SS_SCR1_MXY	00h
40h	R/W	SSUT7	SSUT6	SSUT5	SSUT4	SSUT3	SSUT2	SSUT1	SSUT0	SS_SCR2_FU	00h
41h	R/W	SSMS7	SSMS6	SSMS5	SSMS4	SSMS3	SSMS2	SSMS1	SSMS0	SS_SCR2_MXY	00h
42h	R/W	-	-	SSMD1	SSMD0	-	-	-	-	MOVING_DIRECTION	00h
47h	R/W	ISX1_7	ISX1_6	ISX1_5	ISX1_4	ISX1_3	ISX1_2	ISX1_1	ISX1_0	SS_SCR2_SX1	00h
48h	R/W	ISX2_7	ISX2_6	ISX2_5	ISX2_4	ISX2_3	ISX2_2	ISX2_1	ISX2_0	SS_SCR2_SX2	00h
49h	R/W	ISY1_7	ISY1_6	ISY1_5	ISY1_4	ISY1_3	ISY1_2	ISY1_1	ISY1_0	SS_SCR2_SY1	00h
4Ah	R/W	ISY2_7	ISY2_6	ISY2_5	ISY2_4	ISY2_3	ISY2_2	ISY2_1	ISY2_0	SS_SCR2_SY2	00h

Timing Characteristics

6800-Series MCU Parallel Interface:

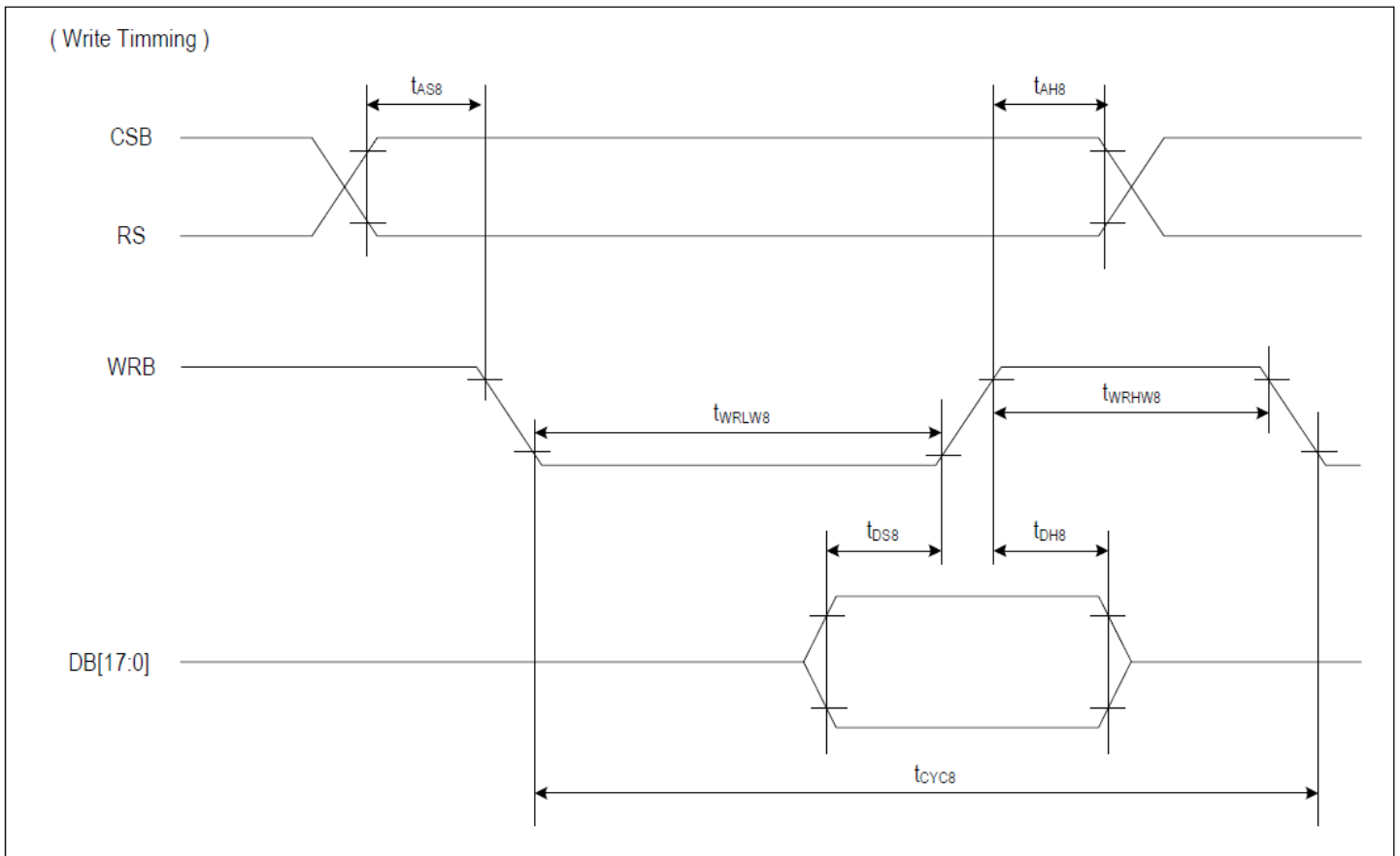


ITEM	SYMBOL	CONDITION	MIN	MAX	UNIT	PORT
Address hold timing	t_{AH6}	-	5	-	ns	CSB
Address setup timing	t_{AS6}	-	5	-	ns	RS
System cycle timing	t_{CYC6}	-	100	-	ns	
Write "L" pulse width	t_{ELW6}	-	45	-	ns	E
Write "H" pulse width	t_{EHW6}	-	45	-	ns	
Data setup timing	t_{DS6}	-	40	-	ns	DB[17:0]
Data hold timing	t_{DH6}	-	10	-	ns	

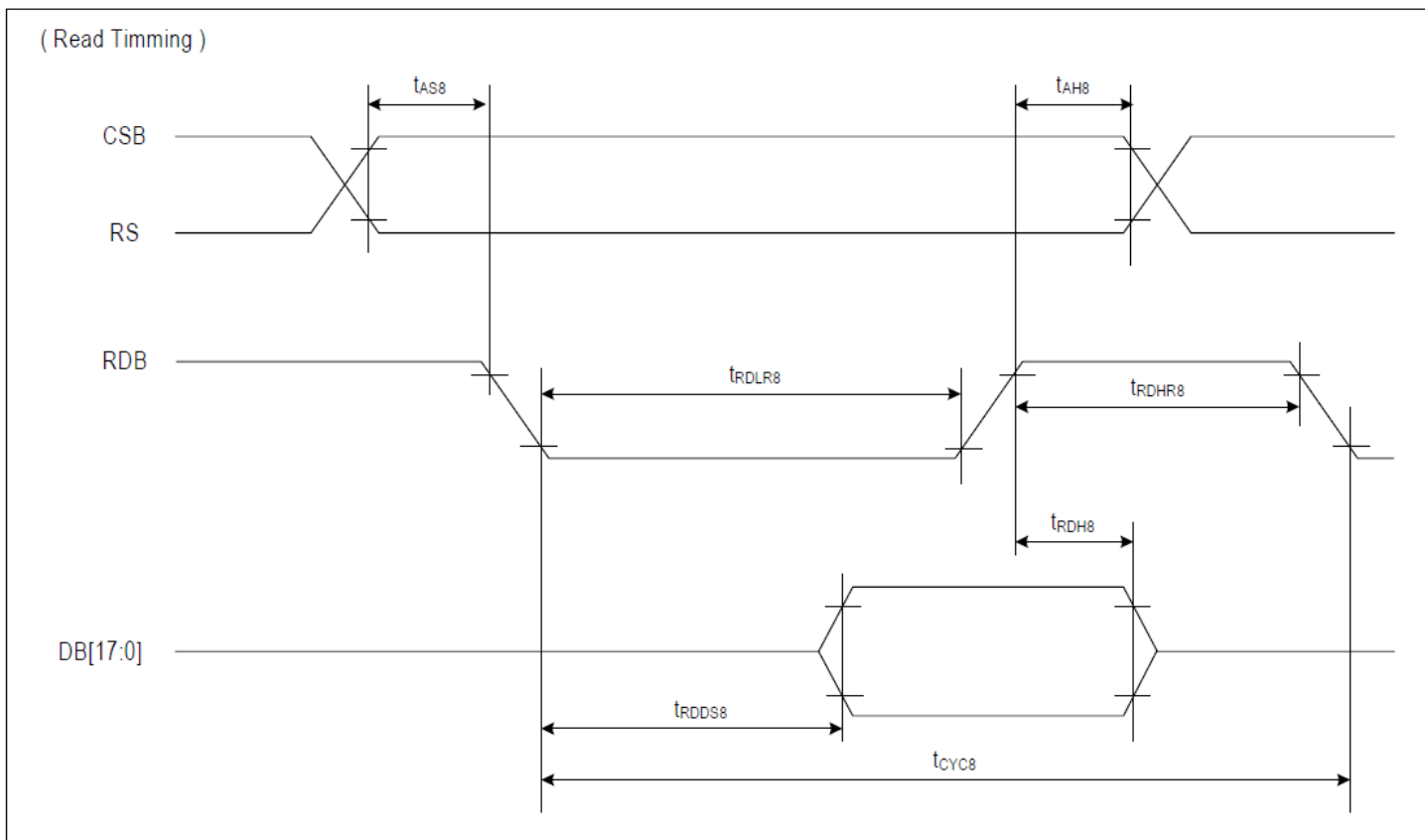


ITEM	SYMBOL	CONDITION	MIN	MAX	UNIT	PORT
Address hold timing	t_{AH6}	-	10	-	ns	CSB
Address setup timing	t_{AS6}	-	10	-	ns	RS
System cycle timing	t_{CYC6}	-	200	-	ns	
Read "L" pulse width	t_{ELR6}	-	90	-	ns	E
Read "H" pulse width	t_{EHR6}	-	90	-	ns	
Read data output delay time	t_{RDB6}	CL = 15 pF	0	70	ns	DB[17:0]
Data hold timing	t_{RDH6}	CL = 15 pF	0	70	ns	DB[17:0]

8080-Series MCU Parallel Interface:

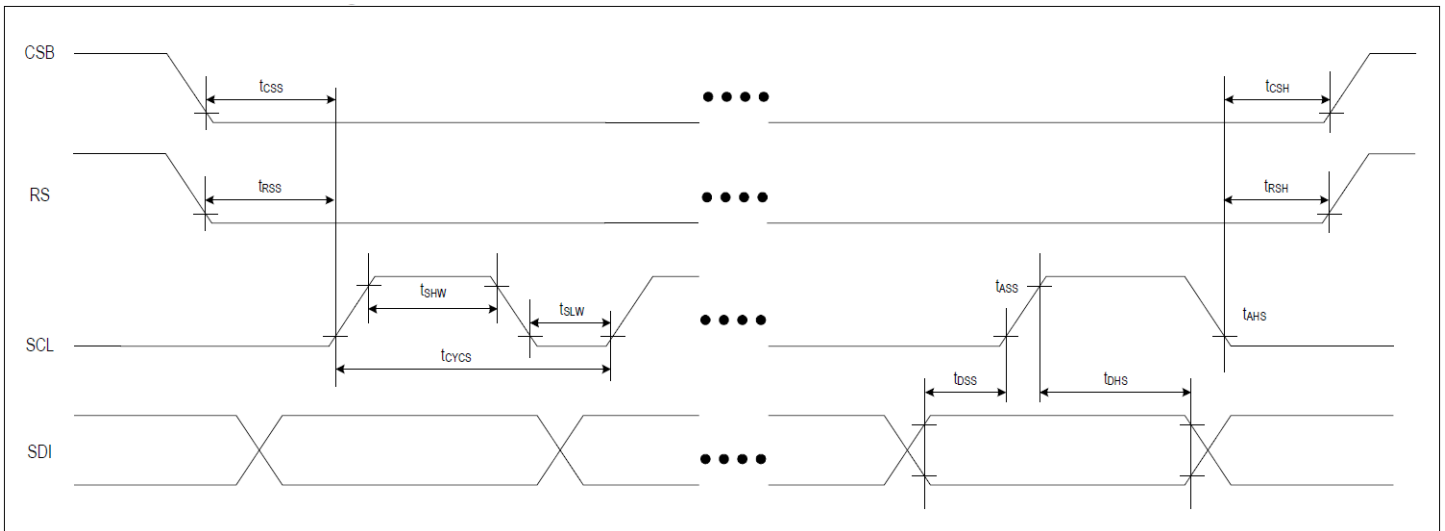


ITEM	SYMBOL	CONDITION	MIN	MAX	UNIT	PORT
Address hold timing	t_{AH8}	-	5	-	ns	CSB
Address setup timing	t_{AS8}	-	5	-	ns	RS
System cycle timing	t_{CYC8}	-	100	-	ns	
Write "L" pulse width	t_{WRLW8}	-	45	-	ns	WRB
Write "H" pulse width	t_{WRHW8}	-	45	-	ns	
Data setup timing	t_{DS8}	-	30	-	ns	DB[17:0]
Data hold timing	t_{DH8}	-	10	-	ns	



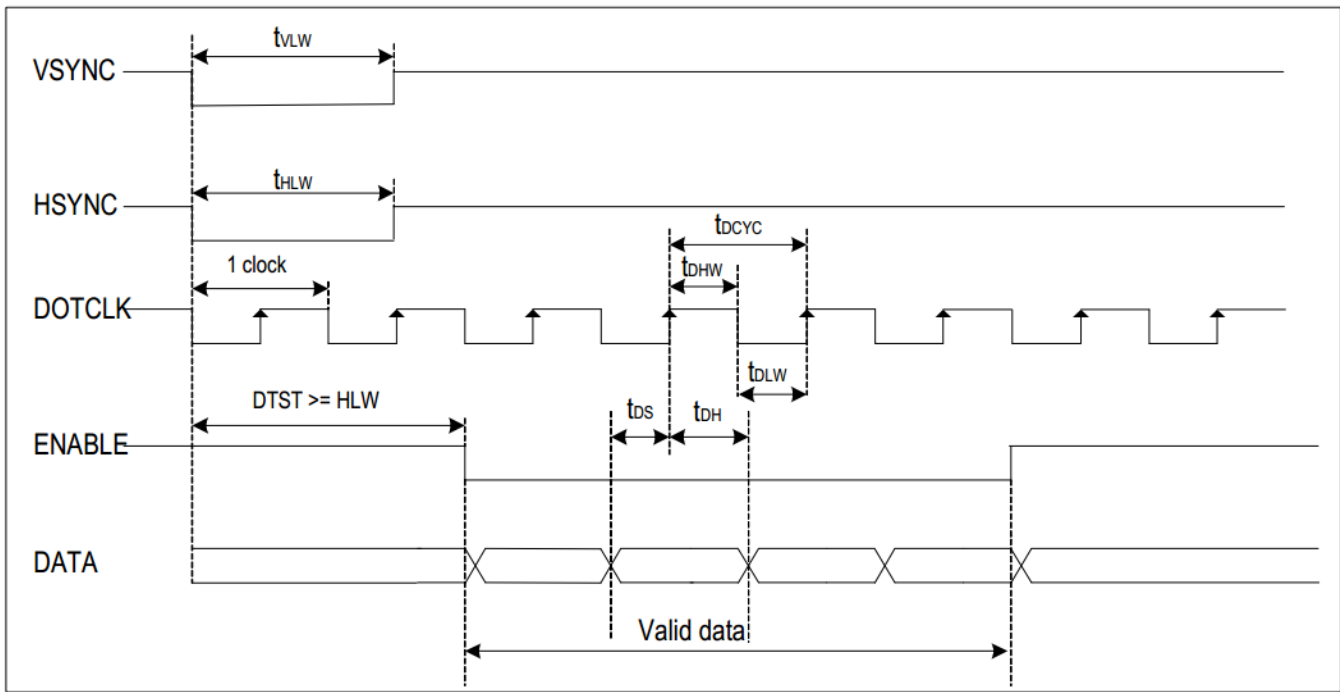
ITEM	SYMBOL	CONDITION	MIN	MAX	UNIT	PORT
Address hold timing	t_{AH8}	-	5	-	ns	CSB
Address setup timing	t_{AS8}	-	5	-	ns	RS
System cycle timing	t_{CYC8}	-	200	-	ns	
Read "L" pulse width	t_{RDLR8}	-	90	-	ns	RDB
Read "H" pulse width	t_{RDHR8}	-	90	-	ns	
Read data output delay time	t_{RDDS8}	CL = 15 pF	-	60	ns	DB[17:0]
Data hold timing	t_{RDH8}	CL = 15 pF	0	-	ns	

4-wire SPI:



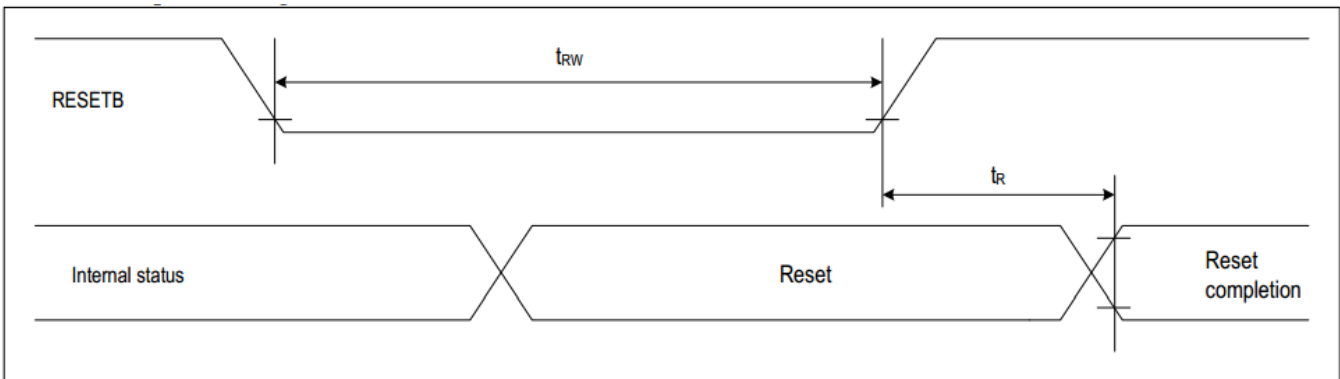
ITEM	SYMBOL	CONDITION	MIN	MAX	UNIT	PORT
Serial clock cycle	t_{CYCS}		100		ns	
SCL "H" pulse width	t_{SHW}	-	45	-	ns	SCL
SCL "L" pulse width	t_{SLW}		45		ns	
Data setup timing	t_{DSS}	-	5	-	ns	SDI
Data hold timing	t_{DHS}		5		ns	
CSB-SCL timing	t_{CSS}	-	5	-	ns	CSB
CSB-hold timing	t_{CSH}		5		ns	
RS-SCL timing	T_{RSS}	-	5	-	ns	RS
RS-hold timing	T_{RSH}		5		ns	

6-bit RGB:



ITEM	SYMBOL	CONDITION	MIN	MAX	UNIT	PORT
Dot clock cycle	t_{DCYC}		100		ns	
Dot "H" pulse width	t_{DHW}	-	50	-	ns	DOTCLK
Dot "L" pulse width	t_{DLW}		50		ns	
Data setup timing	t_{DS}	-	5	-	ns	DATA
Data hold timing	t_{DH}		5		ns	
Vsync pulse width	t_{VLW}	-	1		DOTCLK	VSYNC
Hsync pulse width	t_{HLW}		1		DOTCLK	HSYNC

Reset:



ITEM	SYMBOL	CONDITION	MIN	MAX	UNIT	PORT
Reset time	t_r			1.5	us	
RESETB "L" pulse width	t_{rw}		5		us	RESETB

Example Initialization Sequence:

```
void OLED_Init_160128RGB(void)
{
  GPIO_ResetBits(RES_pin);
  delay_ms(10);
  GPIO_SetBits(RES_pin);
  delay_ms(10);

  oled_Command_160128RGB(0x04);    //Set REDUCE_CURRENT
  oled_Data_160128RGB(0x01);

  delay_ms(2);

  oled_Command_160128RGB(0x04);    //Set REDUCE_CURRENT
  oled_Data_160128RGB(0x00);

  delay_ms(2);

  oled_Command_160128RGB(0x05);    //Set SOFT_RST
  oled_Data_160128RGB(0x00);

  oled_Command_160128RGB(0x06);    //Set DISP_ON_OFF
  oled_Data_160128RGB(0x00);

  oled_Command_160128RGB(0x02);    //Set OSC_CTL
  oled_Data_160128RGB(0x01);

  oled_Command_160128RGB(0x03);    //Set CLOCK_DIV
  oled_Data_160128RGB(0x30);

  oled_Command_160128RGB(0x28);    //Set DUTY
  oled_Data_160128RGB(0x7F);

  oled_Command_160128RGB(0x29);    //Set DSL
  oled_Data_160128RGB(0x00);

  oled_Command_160128RGB(0x20);    //Set MEMORY_ACCESSPOINTER_X
  oled_Data_160128RGB(0x00);

  oled_Command_160128RGB(0x21);    //Set MEMORY_ACCESSPOINTER_Y
  oled_Data_160128RGB(0x00);

  oled_Command_160128RGB(0x14);    //Set RGB_IF
  oled_Data_160128RGB(0x31);

  oled_Command_160128RGB(0x15);    //Set RGB_POL
  oled_Data_160128RGB(0x00);

  oled_Command_160128RGB(0x13);    //Set DISPLAY_MODE_SET
  oled_Data_160128RGB(0x00);

  oled_Command_160128RGB(0x16);    //Set MEMORY_WRITE_MODE
  oled_Data_160128RGB(0x76);
}
```

```

oled_Command_160128RGB(0x10); //Set DRIVING_CURRENT_R
oled_Data_160128RGB(0x32);

oled_Command_160128RGB(0x11); //Set DRIVING_CURRENT_G
oled_Data_160128RGB(0x27);

oled_Command_160128RGB(0x12); //Set DRIVING_CURRENT_B
oled_Data_160128RGB(0x2B);

oled_Command_160128RGB(0x08); //Set PRECHARGE_TIME_R
oled_Data_160128RGB(0x01);

oled_Command_160128RGB(0x09); //Set PRECHARGE_TIME_G
oled_Data_160128RGB(0x01);

oled_Command_160128RGB(0x0A); //Set PRECHARGE_TIME_B
oled_Data_160128RGB(0x02);

oled_Command_160128RGB(0x0B); //Set PRECHARGE_CURRENT_R
oled_Data_160128RGB(0x0C);

oled_Command_160128RGB(0x0C); //Set PRECHARGE_CURRENT_R
oled_Data_160128RGB(0x19);

oled_Command_160128RGB(0x0D); //Set PRECHARGE_CURRENT_R
oled_Data_160128RGB(0x15);

oled_Command_160128RGB(0x80); //Set IREF
oled_Data_160128RGB(0x00);

oled_Clear_Screen(); //Clear Display (write all 0x00's to display RAM)

oled_Command_160128RGB(0x17); //Set MX1_ADDR
oled_Data_160128RGB(0x00);

oled_Command_160128RGB(0x18); //Set MX2_ADDR
oled_Data_160128RGB(0x9F);

oled_Command_160128RGB(0x19); //Set MY1_ADDR
oled_Data_160128RGB(0x00);

oled_Command_160128RGB(0x1A); //Set MY2_ADDR
oled_Data_160128RGB(0x7F);

oled_Command_160128RGB(0x06); //Set DISP_ON_OFF
oled_Data_160128RGB(0x01);

delay_ms(100);

oled_Command_160128RGB(0x22); //Enable write to display RAM
}

```


Quality Information

Test Item	Content of Test	Test Condition	Note
High Temperature storage	Test the endurance of the display at high storage temperature.	+85°C, 96hrs	2
Low Temperature storage	Test the endurance of the display at low storage temperature.	-40°C, 96hrs	1,2
High Temperature Operation	Test the endurance of the display by applying electric stress (voltage & current) at high temperature.	+70°C, 96hrs	2
Low Temperature Operation	Test the endurance of the display by applying electric stress (voltage & current) at low temperature.	-40°C, 96hrs	1,2
High Temperature / Humidity Operation	Test the endurance of the display by applying electric stress (voltage & current) at high temperature with high humidity.	+60°C, 90% RH, 96hrs	1,2
Thermal Shock resistance	Test the endurance of the display by applying electric stress (voltage & current) during a cycle of low and high temperatures.	-30°C,30min -> 25°C,5min -> 70°C,30min = 1 cycle 100 cycles	
Vibration test	Test the endurance of the display by applying vibration to simulate transportation and use.	10-22Hz , 15mm amplitude. 22-500Hz, 1.5G 30min in each of 3 directions X,Y,Z	3
Atmospheric Pressure test	Test the endurance of the display by applying atmospheric pressure to simulate transportation by air.	115mbar, 40hrs	3
Static electricity test	Test the endurance of the display by applying electric static discharge.	VS=800V, RS=1.5kΩ, CS=100pF One time	

Note 1: No condensation to be observed.

Note 2: Conducted after 2 hours of storage at 25°C, 0%RH.

Note 3: Test performed on product itself, not inside a container.

Evaluation Criteria:

- 1: Display is fully functional during operational tests and after all tests, at room temperature.
- 2: No observable defects.
- 3: Luminance >50% of initial value.
- 4: Current consumption within 50% of initial value

Precautions for using OLEDs/LCDs/LCMs

See Precautions at www.newhavendisplay.com/specs/precautions.pdf

Warranty Information

See Terms & Conditions at http://www.newhavendisplay.com/index.php?main_page=terms

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