

**BOLYMIN**

**SPECIFICATIONS FOR  
LCD MODULE**

MODEL NO.  
BL12864KERNH\$



**ROHS**  
COMPLIANT

FOR MESSRS:

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ON DATE OF:

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APPROVED BY:

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# 1. Numbering System

<u>B</u>	<u>L</u>	<u>12864</u>	<u>K</u>	<u>E</u>	<u>R</u>	<u>N</u>	<u>:</u>	<u>H</u>	<u>\$</u>
0	1	2	3	4	5	6	7	8	9

<b>0</b>	Brand	Bolymin	
<b>1</b>	Module Type	C= character type G= graphic type P= TAB/TCP type	O= COG type F= COF type L=PLED/OLED
<b>2</b>	Format	2002=20 characters, 2 lines 12232= 122 x 32 dots	
<b>3</b>	Version No.	A type	
<b>4</b>	LCD Color	G=STN/gray Y=STN/yellow-green PLED/yellow-green C=color STN,OLED/RGB E=OLED/yellow	B=STN/blue,OLED/blue F=FSTN T=TN D=OLED/blue+yellow A=OLED/blue+yellow+green
<b>5</b>	LCD Type	R=positive/reflective P=positive/transflective	M=positive/transmissive N=negative/transmissive
<b>6</b>	Backlight type/color	L=LED array/ yellow-green H=LED edge/white R=LED array/red G=LED edge/yellow-green F=RGB array I=RGB edge Q=LED edge/red N=No backlight	D=LED edge/blue E=EL/white B=EL/blue C=CCFL/white Y=LED Bottom/yellow O=LED array/orange K=LED edge/green A=LED edge/amber
<b>7</b>	CGRAM Font (applied only on character type)	J=English/Japanese Font E=English/European Font G=Chinese(simple) F=Chinese(traditional)	C=English/Cyrillic Font H=English/Hebrew Font A=English/Arabic Font
<b>8</b>	View Angle/ Operating Temperature	B=Bottom/Normal Temperature H=Bottom/Wide Temperature U=Bottom/Ultra wide Temperature	T=Top/Normal Temperature W=Top/Wide Temperature C=9H/Normal Temperature E=Top/ultra wide temperature
<b>9</b>	Special Code	3=3 volt logic power supply n=negative voltage for LCD c=cable/connector xxx=to be assigned on datasheet	t=temperature compensation for LCD p=touch panel \$=RoHS

## 2. General Specification

### (1) Mechanical Dimension

Item	Standard Value	Unit
Number of dots	128×64	dots
Module dimension (L*W*H)	70.9*41.86*2.01(MAX)	mm
View area	63.41*32.69	mm
Active area	61.41*30.69	mm
Dot size	0.45(W)×0.45(H)	mm
Dot pitch	0.48(W)×0.48 (H)	mm
Color	Yellow	

### (2) Controller IC: SSD1305 Controller

### (3) Temperature Range

Operating	-40 ~ +70
Storage	-40 ~ +85

## 3. Absolute Maximum Ratings

Item	Symbol	Min	Typ	Max	Unit
Operating Temperature	TOP	-40	-	+70	
Storage Temperature	TST	-40	-	+85	
Input Voltage (VDD)	VDD	-0.3	-	3.5	V
Supply Voltage (Vcc)	Vcc	8	-	16	V
Humidity	-	-	-	85	%
Operating lift time	-	-	30000(*)	-	Hrs

\*:80cd/m<sup>2</sup> light on

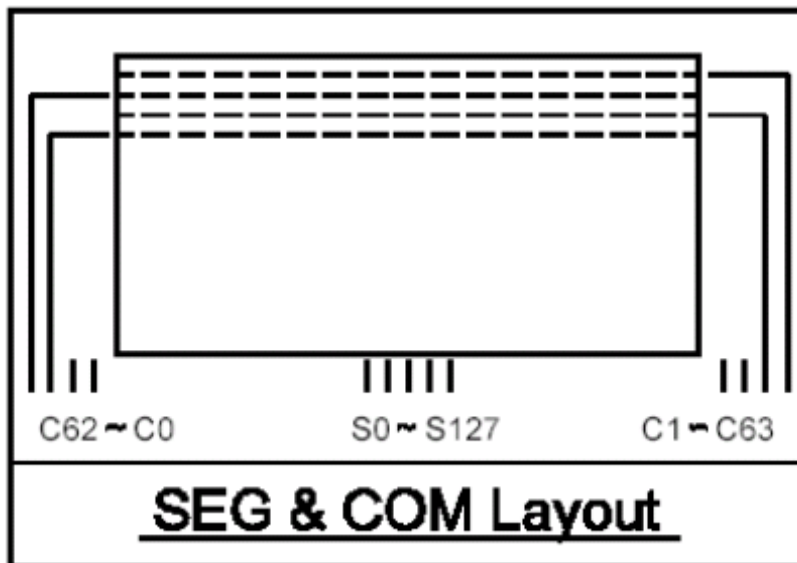
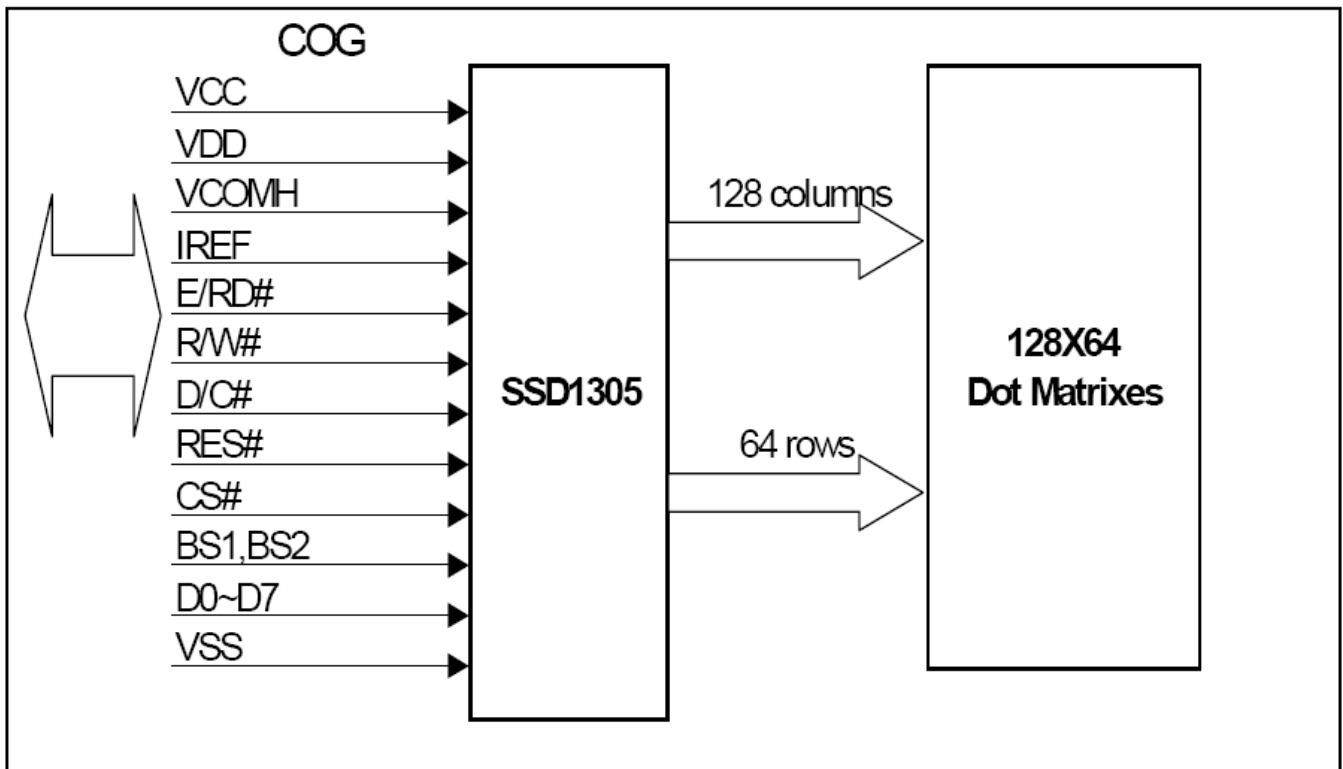
## 4. Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage For Logic	V <sub>DD</sub> -V <sub>SS</sub>	-	2.4	2.7	3.5	V
Supply Voltage For Panel	V <sub>CC</sub> -V <sub>SS</sub>	-	14.5	15	15.5	V
Input High Vol	V <sub>IH</sub>	-	0.8V <sub>DD</sub>	-	V <sub>DD</sub>	V
Input Low Vol	V <sub>IL</sub>	-	0	-	0.2V <sub>DD</sub>	V
Output High Vol	V <sub>OH</sub>	-	0.9V <sub>DD</sub>	-	V <sub>DD</sub>	V
Output Low Vol.	V <sub>OL</sub>	-	0	-	0.1V <sub>DD</sub>	V
Supply Current	I <sub>DD</sub>	-	-	28	30	mA

## 5. Optical Characteristics

Item	Min.	Typ.	Max.	Unit
View Angle	160	-	-	deg
Dark Room contrast	2000:1	-	-	-
Response Time	-	10	-	us

## 6. Block Diagram



## 7. Interface Pin Function

Pin No.	Symbol	Level	Description
1	Vcc		Positive OLED high voltage power supply
2	VCOMH		The COM voltage reference pin, this pin should be connected to ground through a capacitor
3	IREF		The current reference input pin, this pin should be connected to ground through a resistor.
4	DB7	H/L	Data bus line
5	DB6	H/L	Data bus line
6	DB5	H/L	Data bus line
7	DB4	H/L	Data bus line
8	DB3	H/L	Data bus line
9	DB2	H/L	Data bus line
10	DB1	H/L	Data bus line
11	DB0	H/L	Data bus line
12	E(RD)	H/L	Data read operation is initiated when it's pull low
13	R/W#	H/L	Data write operation is initiated when it's pull low
14	D/C#	H/L	This is data/command control pin, H: Data input ,L: Command input .
15	RES#	H/L	Hardware reset signal
16	CS#	H/L	Chip select pin. The driver IC will be selected When CS pin is active low.
17	BS2	H/L	Interface select pin
18	BS1	H/L	Interface select pin
19	VDD	H/L	Voltage power supply for logic
20	NC		No connection
21	Vss		This is ground pin
22	Vss		This is ground pin



## 8. Graphic Display Data RAM Address MAP

The GDDRAM is a bit mapped static RAM holding the bit pattern to be display.

The size of the RAM is 132X64=8448bits.

For mechanical flexibility, re-mapping on both Segment and Common outputs can be selected by software.

OUT	Row Address			OUT	Column Address								...	Column Address						
	Direction='1'	Direction='0'			Remap='0'	Remap='1'	SEG0	SEG1	SEG2	SEG3	SEG4	SEG5		SEG6	SEG7	SEG 128	SEG 129	SEG 130	SEG 131	
COM0	0x3Fh	0x00h	PAGE 0	D0																
COM1	0x3Eh	0x01h		D1																
COM2	0x3Dh	0x02h		D2																
COM3	0x3Ch	0x03h		D3																
COM4	0x3Bh	0x04h		D4																
COM5	0x3Ah	0x05h		D5																
COM6	0x39h	0x06h		D6																
COM7	0x38h	0x07h		D7																
COM8	0x37h	0x08h	PAGE 1	D0																
COM9	0x36h	0x09h		D1																
COM10	0x35h	0x0Ah		D2																
COM11	0x34h	0x0Bh		D3																
COM12	0x33h	0x0Ch		D4																
COM13	0x32h	0x0Dh		D5																
COM14	0x31h	0x0Eh		D6																
COM15	0x30h	0x0Fh		D7																
COM16	0x2Fh	0x10h	PAGE 2	D0																
COM17	0x2Eh	0x11h		D1																
COM18	0x2Dh	0x12h		D2																
COM19	0x2Ch	0x13h		D3																
COM20	0x2Bh	0x14h		D4																
COM21	0x2Ah	0x15h		D5																
COM22	0x29h	0x16h		D6																
COM23	0x28h	0x17h		D7																
COM48	0x0Fh	0x30h	PAGE 6	D0																
COM49	0x0Eh	0x31h		D1																
COM50	0x0Dh	0x32h		D2																
COM51	0x0Ch	0x33h		D3																
COM52	0x0Bh	0x34h		D4																
COM53	0x0Ah	0x35h		D5																
COM54	0x09h	0x36h		D6																
COM55	0x08h	0x37h		D7																
COM56	0x07h	0x38h	PAGE 7	D0																
COM57	0x06h	0x39h		D1																
COM58	0x05h	0x3Ah		D2																
COM59	0x04h	0x3Bh		D3																
COM60	0x03h	0x3Ch		D4																
COM61	0x02h	0x3Dh		D5																
COM62	0x01h	0x3Fh		D6																
COM63	0x00h	0x3Fh		D7																

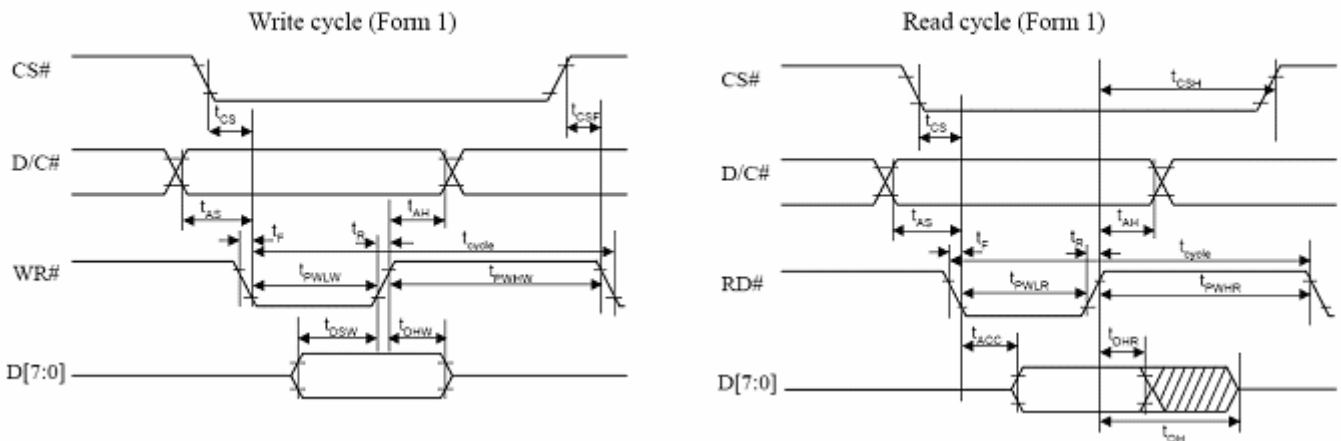
## 9. Timing Characteristics

### 9-1.8080 MPU Interface

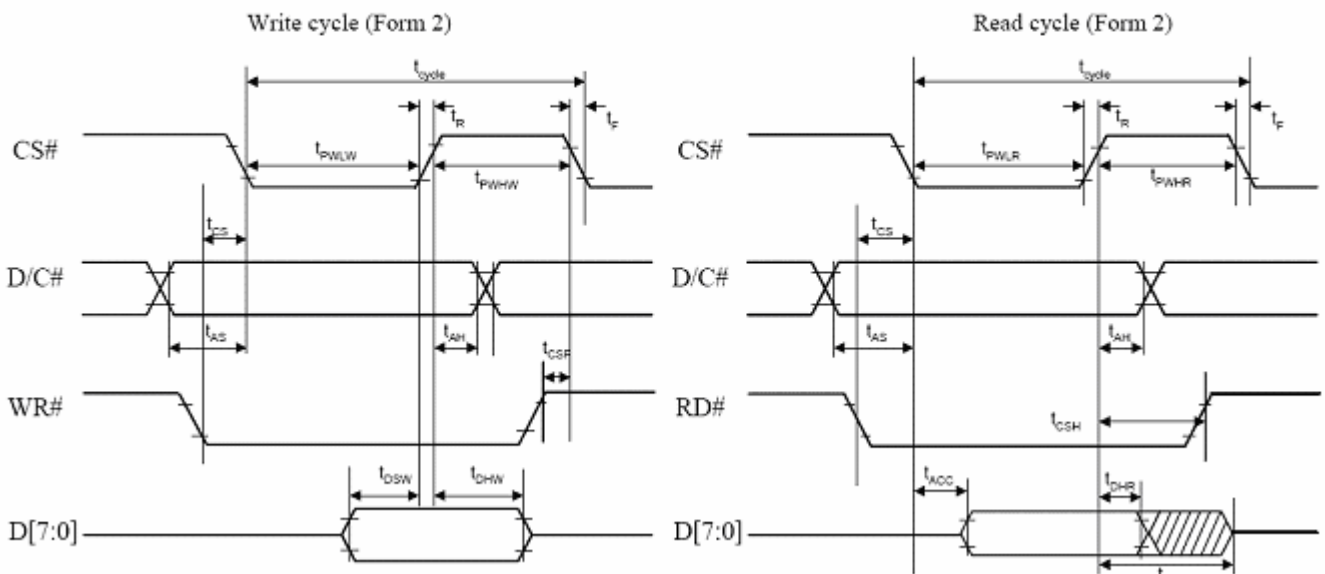
( $V_{DD} - V_{SS} = 2.4V$  to  $3.5V$ ,  $V_{DDIO} = V_{DD}$ ,  $T_A = 25^\circ C$ )

Symbol	Parameter	Min	Typ	Max	Unit
$t_{cycle}$	Clock Cycle Time	300	-	-	ns
$t_{AS}$	Address Setup Time	10	-	-	ns
$t_{AH}$	Address Hold Time	0	-	-	ns
$t_{DSW}$	Write Data Setup Time	40	-	-	ns
$t_{DHW}$	Write Data Hold Time	7	-	-	ns
$t_{DHR}$	Read Data Hold Time	20	-	-	ns
$t_{OH}$	Output Disable Time	-	-	70	ns
$t_{ACC}$	Access Time	-	-	140	ns
$t_{PWL R}$	Read Low Time	120	-	-	ns
$t_{PWL W}$	Write Low Time	60	-	-	ns
$t_{PWH R}$	Read High Time	60	-	-	ns
$t_{PWH W}$	Write High Time	60	-	-	ns
$t_R$	Rise Time	-	-	40	ns
$t_F$	Fall Time	-	-	40	ns
$t_{CS}$	Chip select setup time	0	-	-	ns
$t_{CSH}$	Chip select hold time to read signal	0	-	-	ns
$t_{CSF}$	Chip select hold time	20	-	-	ns

8080-series parallel interface characteristics (Form 1)



8080-series parallel interface characteristics (Form 2)

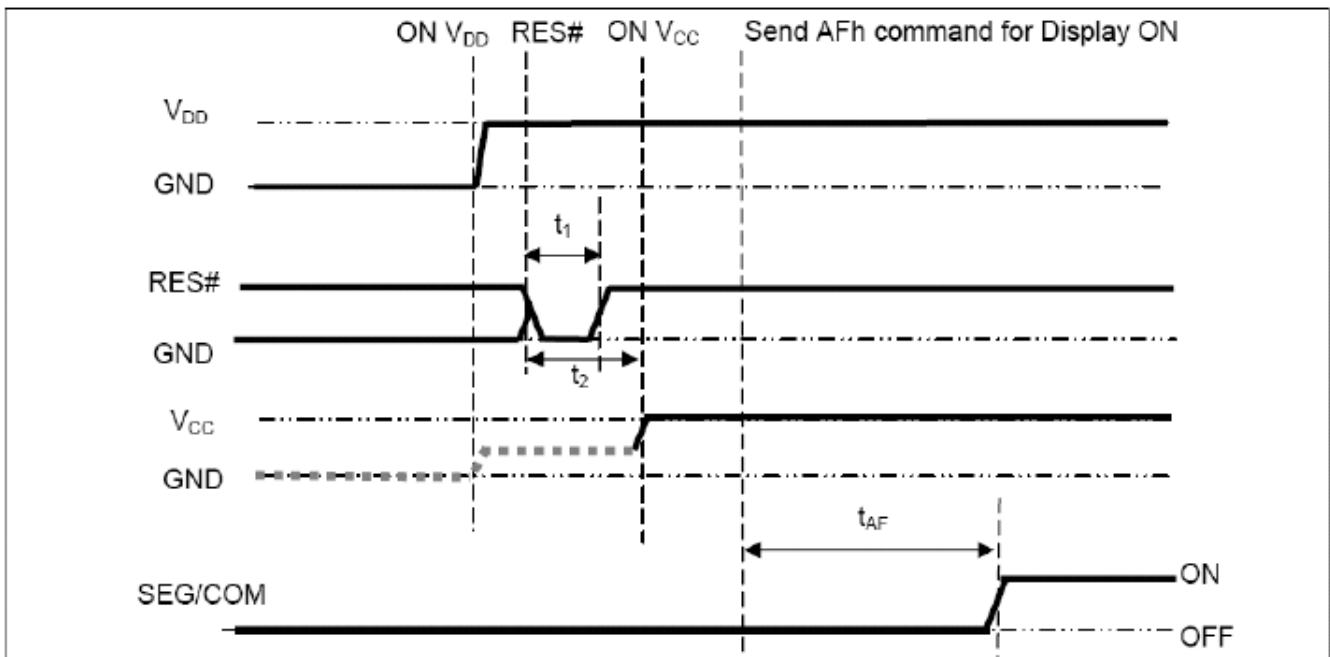


## 10. Power ON / OFF Sequence & Application Circuit

### 10.1 POWER ON / OFF SEQUENCE

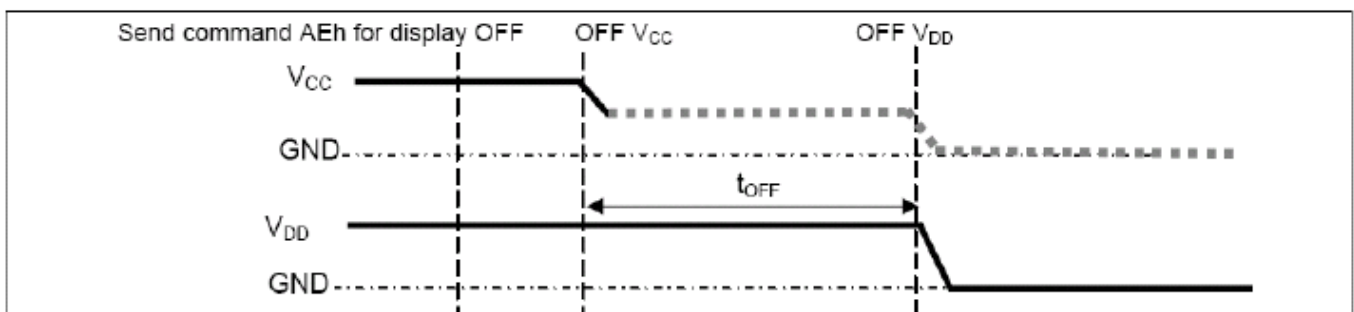
#### Power ON sequence:

1. Power ON  $V_{DD}$ .
2. After  $V_{DD}$  become stable, set RES# pin LOW (logic low) for at least  $3\mu s$  ( $t_1$ ) and then HIGH (logic high).
3. After set RES# pin LOW (logic low), wait for at least  $3\mu s$  ( $t_2$ ). Then Power ON  $V_{CC}$ . (1)
4. After  $V_{CC}$  become stable, send command AFh for display ON. SEG/COM will be ON after  $100ms$  ( $t_{AF}$ ).



#### Power OFF sequence:

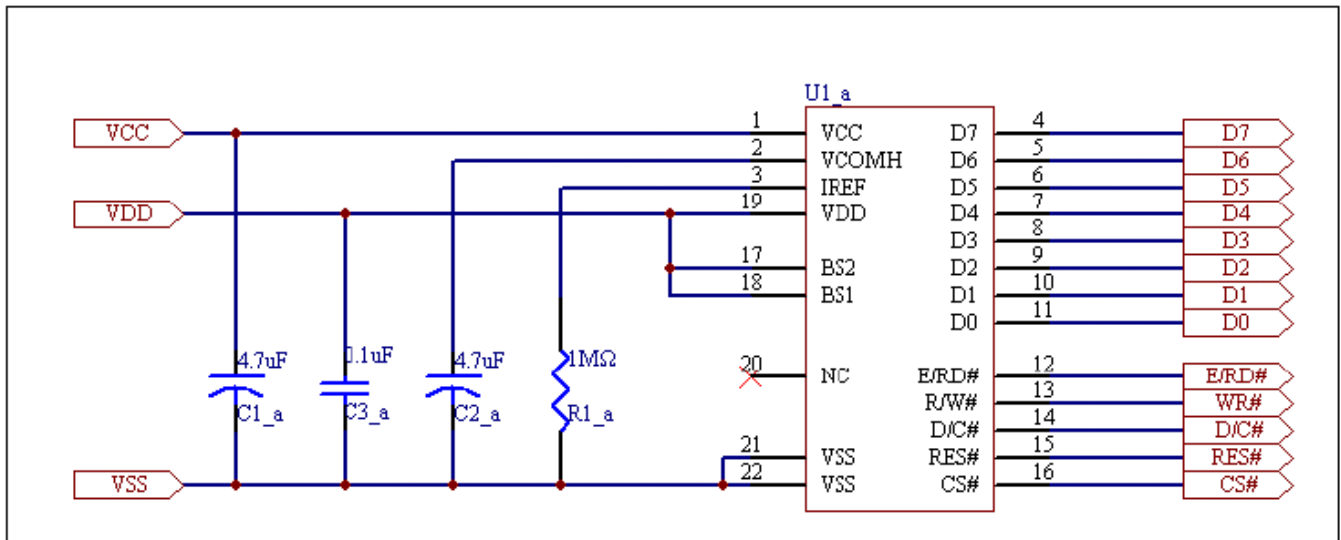
1. Send command AEh for display OFF.
2. Power OFF  $V_{CC}$ . (1), (2)
3. Wait for  $t_{OFF}$ . Power OFF  $V_{DD}$ . (where Minimum  $t_{OFF}=80ms$ , Typical  $t_{OFF}=100ms$ )



#### Note:

- (1) Since an ESD protection circuit is connected between  $V_{DD}$  and  $V_{CC}$ ,  $V_{CC}$  becomes lower than  $V_{DD}$  whenever  $V_{DD}$  is ON and  $V_{CC}$  is OFF as shown in the dotted line of  $V_{CC}$  in above figures.
- (2)  $V_{CC}$  should be disabled when it is OFF.

## 10.2 Application circuit



## 11. Display Control Instruction

Command Table

(D/C#=0, R/W#(WR#) = 0, E(RD#)=1) unless specific setting is stated)

Fundamental Command Table											
D/C#	Hex	D7	D6	D5	D4	D3	D2	D1	D0	Command	Description
0	00~0F	0	0	0	0	X <sub>3</sub>	X <sub>2</sub>	X <sub>1</sub>	X <sub>0</sub>	Set Lower Column Start Address for Page Addressing Mode	Set the lower nibble of the column start address register for Page Addressing Mode using X[3:0] as data bits. The initial display line register is reset to 0000b after RESET.
0	10~1F	0	0	0	1	X <sub>3</sub>	X <sub>2</sub>	X <sub>1</sub>	X <sub>0</sub>	Set Higher Column Start Address for Page Addressing Mode	Set the higher nibble of the column start address register for Page Addressing Mode using X[3:0] as data bits. The initial display line register is reset to 0000b after RESET.
0 0	20 A[1:0]	0 *	0 *	1 *	0 *	0 *	0 *	0 A <sub>1</sub>	0 A <sub>0</sub>	Set Memory Addressing Mode	A[1:0] = 00b, Horizontal Addressing Mode A[1:0] = 01b, Vertical Addressing Mode A[1:0] = 10b, Page Addressing Mode (RESET) A[1:0] = 11b, Invalid
0 0 0	21 A[7:0] B[7:0]	0 A <sub>7</sub> B <sub>7</sub>	0 A <sub>6</sub> B <sub>6</sub>	1 A <sub>5</sub> B <sub>5</sub>	0 A <sub>4</sub> B <sub>4</sub>	0 A <sub>3</sub> B <sub>3</sub>	0 A <sub>2</sub> B <sub>2</sub>	0 A <sub>1</sub> B <sub>1</sub>	0 A <sub>0</sub> B <sub>0</sub>	Set Column Address	Setup column start and end address A[7:0] : Column start address, range : 0-131d, (RESET=0d)  B[7:0]: Column end address, range : 0-131d, (RESET =131d)
0 0 0	22 A[2:0] B[2:0]	0 * *	0 * *	1 * *	0 * *	0 * *	0 A <sub>2</sub> B <sub>2</sub>	1 A <sub>1</sub> B <sub>1</sub>	0 A <sub>0</sub> B <sub>0</sub>	Set Page Address	Setup page start and end address A[2:0] : Page start Address, range : 0-7d, (RESET = 0d) B[2:0] : Page end Address, range : 0-7d, (RESET = 7d)
0	40~7F	0	1	X <sub>5</sub>	X <sub>4</sub>	X <sub>3</sub>	X <sub>2</sub>	X <sub>1</sub>	X <sub>0</sub>	Set Display Start Line	Set display RAM display start line register from 0-63 using X <sub>5</sub> X <sub>3</sub> X <sub>2</sub> X <sub>1</sub> X <sub>0</sub> . Display start line register is reset to 000000b during RESET.
0 0	81 A[7:0]	1 A <sub>7</sub>	0 A <sub>6</sub>	0 A <sub>5</sub>	0 A <sub>4</sub>	0 A <sub>3</sub>	0 A <sub>2</sub>	0 A <sub>1</sub>	1 A <sub>0</sub>	Set Contrast Control For BANK0	Double byte command to select 1 out of 256 contrast steps. Contrast increases as the value increases. (RESET = 80h)
0 0	82 A[7:0]	1 A <sub>7</sub>	0 A <sub>6</sub>	0 A <sub>5</sub>	0 A <sub>4</sub>	0 A <sub>3</sub>	0 A <sub>2</sub>	1 A <sub>1</sub>	0 A <sub>0</sub>	Set Brightness For Area Color Banks	Double byte command to select 1 out of 256 brightness steps. Brightness increases as the value increases. (RESET = 80h)
0 0 0 0 0	91 X[5:0] A[5:0] B[5:0] C[5:0]	1 * * * *	0 * * * *	0 X <sub>5</sub> A <sub>5</sub> B <sub>5</sub> C <sub>5</sub>	1 X <sub>4</sub> A <sub>4</sub> B <sub>4</sub> C <sub>4</sub>	0 X <sub>3</sub> A <sub>3</sub> B <sub>3</sub> C <sub>3</sub>	0 X <sub>2</sub> A <sub>2</sub> B <sub>2</sub> C <sub>2</sub>	0 X <sub>1</sub> A <sub>1</sub> B <sub>1</sub> C <sub>1</sub>	1 X <sub>0</sub> A <sub>0</sub> B <sub>0</sub> C <sub>0</sub>	Set Look Up Table (LUT)	Set current drive pulse width of BANK0, Color A, B and C. BANK0: X[5:0] = 31... 63; for pulse width set to 32 ~ 64 clocks (RESET = 110001b) Color A: A[5:0] same as above (RESET = 111111b) Color B: B[5:0] same as above (RESET = 111111b) Color C: C[5:0] same as above (RESET = 111111b)  <b>Note</b> <sup>(1)</sup> Color D pulse width is fixed at 64 clocks pulse.

Fundamental Command Table											
D/C#	Hex	D7	D6	D5	D4	D3	D2	D1	D0	Command	Description
0 0 0 0	92 A[7:0] B[7:0] C[7:0] D[7:0]	1 A <sub>7</sub> B <sub>7</sub> C <sub>7</sub> D <sub>7</sub>	0 A <sub>6</sub> B <sub>6</sub> C <sub>6</sub> D <sub>6</sub>	0 A <sub>5</sub> B <sub>5</sub> C <sub>5</sub> D <sub>5</sub>	1 A <sub>4</sub> B <sub>4</sub> C <sub>4</sub> D <sub>4</sub>	0 A <sub>3</sub> B <sub>3</sub> C <sub>3</sub> D <sub>3</sub>	0 A <sub>2</sub> B <sub>2</sub> C <sub>2</sub> D <sub>2</sub>	1 A <sub>1</sub> B <sub>1</sub> C <sub>1</sub> D <sub>1</sub>	0 A <sub>0</sub> B <sub>0</sub> C <sub>0</sub> D <sub>0</sub>	Set Bank Color of BANK1 to BANK16 (PAGE0)	Set the bank color of BANK1~BANK16 to any one of the 4 colors : A, B, C and D .  A[1:0] : 00b, 01b, 10b, or 11b for Color = A, B, C or D of BANK1 A[3:2] : 00b, 01b, 10b, or 11b for Color = A, B, C or D of BANK2 : : D[5:4] : 00b, 01b, 10b, or 11b for Color = A, B, C or D of BANK15 D[7:6] : 00b, 01b, 10b, or 11b for Color = A, B, C or D of BANK16
0 0 0 0	93 A[7:0] B[7:0] C[7:0] D[7:0]	1 A <sub>7</sub> B <sub>7</sub> C <sub>7</sub> D <sub>7</sub>	0 A <sub>6</sub> B <sub>6</sub> C <sub>6</sub> D <sub>6</sub>	0 A <sub>5</sub> B <sub>5</sub> C <sub>5</sub> D <sub>5</sub>	1 A <sub>4</sub> B <sub>4</sub> C <sub>4</sub> D <sub>4</sub>	0 A <sub>3</sub> B <sub>3</sub> C <sub>3</sub> D <sub>3</sub>	0 A <sub>2</sub> B <sub>2</sub> C <sub>2</sub> D <sub>2</sub>	1 A <sub>1</sub> B <sub>1</sub> C <sub>1</sub> D <sub>1</sub>	1 A <sub>0</sub> B <sub>0</sub> C <sub>0</sub> D <sub>0</sub>	Set Bank Color of BANK17~BANK32 (PAGE1)	Set the bank color of BANK17~BANK32 to any one of the 4 colors: A, B, C and D.  A[1:0] : 00b, 01b, 10b, or 11b for Color = A, B, C or D of BANK17 A[3:2] : 00b, 01b, 10b, or 1b1 for Color = A, B, C or D of BANK18 : : D[5:4] : 00b, 01b, 10b, or 11b for Color = A, B, C or D of BANK31 D[7:6] : 00b, 01b, 10b, or 11b for Color = A, B, C or D of BANK32
0	A0/A1	1	0	1	0	0	0	0	X <sub>0</sub>	Set Segment Re-map	X[0]=0b: column address 0 is mapped to SEG0 (RESET) X[0]=1b: column address 131 is mapped to SEG0
0	A4/A5	1	0	1	0	0	1	0	X <sub>0</sub>	Entire Display ON	X <sub>0</sub> =0b: Resume to RAM content display (RESET) Output follows RAM content X <sub>0</sub> =1b: Entire display ON Output ignores RAM content
0	A6/A7	1	0	1	0	0	1	1	X <sub>0</sub>	Set Normal/Inverse Display	X[0]=0b: Normal display (RESET) 0 in RAM: OFF in display panel 1 in RAM: ON in display panel  X[0]=1b: inverse display 0 in RAM: ON in display panel 1 in RAM: OFF in display panel
0 0	A8 A[5:0]	1 *	0 *	1 A <sub>5</sub>	0 A <sub>4</sub>	1 A <sub>3</sub>	0 A <sub>2</sub>	0 A <sub>1</sub>	0 A <sub>0</sub>	Set Multiplex Ratio	Set MUX ratio to N+1 MUX N=A[5:0] : from 16MUX to 64MUX, RESET= 111111b (i.e. 64MUX) A[5:0] from 0 to 14 are invalid entry.
0	AA	1	0	1	0	1	0	1	0	Reserved	Reserved
0 0 0 0	AB A[3:0] B[7:0] C[7:0]	1 * B <sub>7</sub> C <sub>7</sub>	0 * B <sub>6</sub> C <sub>6</sub>	1 * B <sub>5</sub> C <sub>5</sub>	0 * B <sub>4</sub> C <sub>4</sub>	1 A <sub>3</sub>	0 A <sub>2</sub>	1 A <sub>1</sub>	1 A <sub>0</sub> B <sub>0</sub> C <sub>0</sub>	Dim mode setting	A[3:0] : Reserved (set as 0000b) B [7:0] : Set contrast for BANK0, valid range 0-255d, please refer to command 81h C [7:0] : Set brightness for color bank, valid range 0-255d, please refer to command 82h

Fundamental Command Table											
D/C#	Hex	D7	D6	D5	D4	D3	D2	D1	D0	Command	Description
0 0	AD A[7:0]	1 1	0 0	1 0	0 0	1 1	1 1	0 1	1 A <sub>0</sub>	Master Configuration	A[0]=0b, Select external V <sub>CC</sub> supply (RESET) A[0]=1b, Select internal DC-DC voltage converter  <b>Note</b> <sup>(1)</sup> Refer to Section 8.11 for DC-DC converter details <sup>(2)</sup> The DC-DC converter must be enabled by the following command: ADh ; Master Configuration 8Fh ; Enable internal DC-DC AFh or ACh ; Display ON
0	AC AE AF	1	0	1	0	1	1	A <sub>1</sub>	A <sub>0</sub>	Set Display ON/OFF	ACh = Display ON in dim mode  AEh = Display OFF (sleep mode) (RESET)  AFh = Display ON in normal mode
0	B0-B7	1	0	1	1	0	X <sub>2</sub>	X <sub>1</sub>	X <sub>0</sub>	Set Page Start Address for Page Addressing Mode	Set GDDRAM Page Start Address (PAGE0~PAGE7) for Page Addressing Mode using X[2:0].
0	C0/C8	1	1	0	0	X <sub>3</sub>	0	0	0	Set COM Output Scan Direction	X[3]=0b: normal mode (RESET) Scan from COM0 to COM[N-1] X[3]=1b: remapped mode. Scan from COM[N-1] to COM0  Where N is the Multiplex ratio.
0 0	D3 A[5:0]	1 *	1 *	0 A <sub>5</sub>	1 A <sub>4</sub>	0 A <sub>3</sub>	0 A <sub>2</sub>	1 A <sub>1</sub>	1 A <sub>0</sub>	Set Display Offset	Set vertical shift by COM from 0~63. The value is reset to 00h after RESET.
0	D5 A[7:0]	1 A <sub>7</sub>	1 A <sub>6</sub>	0 A <sub>5</sub>	1 A <sub>4</sub>	0 A <sub>3</sub>	1 A <sub>2</sub>	0 A <sub>1</sub>	1 A <sub>0</sub>	Set Display Clock Divide Ratio/Oscillator Frequency	A[3:0] : Define the divide ratio (D) of the display clocks (DCLK): Divide ratio= A[3:0] + 1, RESET is 0000b (divide ratio = 1)  A[7:4] : Set the Oscillator Frequency, F <sub>OSC</sub> . Oscillator Frequency increases with the value of A[7:4] and vice versa. RESET is 0111b Range:0000b~1111b Frequency increases as setting value increases. Refer to section 10.1.23 for details.
0 0	D8	1 0	1 0	0 X <sub>5</sub>	1 X <sub>4</sub>	1 0	0 X <sub>2</sub>	0 0	0 X <sub>0</sub>	Set Area Color Mode ON/OFF & Low Power Display Mode	X[5:4]= 00b (RESET) : monochrome mode X[5:4]= 11b Area Color enable  X[2]=0b and X[0]=0b: Normal power mode(RESET) X[2]=1b and X[0]=1b: Set low power display mode
0 0	D9 A[7:0]	1 A <sub>7</sub>	1 A <sub>6</sub>	0 A <sub>5</sub>	1 A <sub>4</sub>	1 A <sub>3</sub>	0 A <sub>2</sub>	0 A <sub>1</sub>	1 A <sub>0</sub>	Set Pre-charge Period	A[3:0] : Phase 1 period of up to 15 DCLK clocks (RESET=2h); 0 is invalid entry  A[7:4] : Phase 2 period of up to 15 DCLK clocks (RESET=2h); 0 is invalid entry

Fundamental Command Table																							
D/C#	Hex	D7	D6	D5	D4	D3	D2	D1	D0	Command	Description												
0 0	DA	1 0	1 0	0 X <sub>5</sub>	1 X <sub>4</sub>	1 0	0 0	1 1	0 0	Set COM Pins Hardware Configuration	X[4]=0b, Sequential COM pin configuration X[4]=1b(RESET), Alternative COM pin configuration  X[5]=0b(RESET), Disable COM Left/Right remap X[5]=1b, Enable COM Left/Right remap  Please refer to Table 10-3 for details.												
0 0	DB A[5:2]	1 0	1 0	0 A <sub>5</sub>	1 A <sub>4</sub>	1 A <sub>3</sub>	0 A <sub>2</sub>	1 0	1 0	Set V <sub>COMH</sub> Deselect Level	<table border="1"> <thead> <tr> <th>A[5:2]</th> <th>Hex code</th> <th>V<sub>COMH</sub> deselect level</th> </tr> </thead> <tbody> <tr> <td>000b</td> <td>00h</td> <td>~ 0.43 x V<sub>CC</sub></td> </tr> <tr> <td>1101b</td> <td>34h</td> <td>~ 0.77 x V<sub>CC</sub> (RESET)</td> </tr> <tr> <td>1111b</td> <td>3Ch</td> <td>~ 0.83 x V<sub>CC</sub></td> </tr> </tbody> </table>	A[5:2]	Hex code	V <sub>COMH</sub> deselect level	000b	00h	~ 0.43 x V <sub>CC</sub>	1101b	34h	~ 0.77 x V <sub>CC</sub> (RESET)	1111b	3Ch	~ 0.83 x V <sub>CC</sub>
A[5:2]	Hex code	V <sub>COMH</sub> deselect level																					
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1111b	3Ch	~ 0.83 x V <sub>CC</sub>																					
0	E0	1	1	1	0	0	0	0	0	Enter Read Modify Write	Enter the Read Modify Write mode.  Details please refer to section 10.1.28.												
0	E3	1	1	1	0	0	0	1	1	NOP	Command for no operation												
0	EE	1	1	1	0	1	1	1	0	Exit Read Modify Write	Exit the Read Modify Write mode (Please refer to command E0h)												



**Graphic Acceleration Command Table**

D/C#	Hex	D7	D6	D5	D4	D3	D2	D1	D0	Command	Description																										
0	26/27	0	0	1	0	0	1	1	X <sub>0</sub>	Horizontal Scroll Setup	X[0]=0, Right Horizontal Scroll X[0]=1, Left Horizontal Scroll  A[2:0] : Set number of column scroll offset 000b No horizontal scroll 001b Horizontal scroll by 1 column 010b Horizontal scroll by 2 columns 011b Horizontal scroll by 3 columns 100b Horizontal scroll by 4 columns Other values are invalid. B[2:0] : Define start page address <table border="1"> <tr> <td>000b – PAGE0</td> <td>011b – PAGE3</td> <td>110b – PAGE6</td> </tr> <tr> <td>001b – PAGE1</td> <td>100b – PAGE4</td> <td>111b – PAGE7</td> </tr> <tr> <td>010b – PAGE2</td> <td>101b – PAGE5</td> <td></td> </tr> </table> C[2:0] : Set time interval between each scroll step in terms of frame frequency <table border="1"> <tr> <td>000b – 6 frames</td> <td>100b – 3 frames</td> </tr> <tr> <td>001b – 32 frames</td> <td>101b – 4 frames</td> </tr> <tr> <td>010b – 64 frames</td> <td>110b – 2 frame</td> </tr> <tr> <td>011b – 128 frames</td> <td>111b – Invalid</td> </tr> </table> D[2:0] : Define end page address <table border="1"> <tr> <td>000b – PAGE0</td> <td>011b – PAGE3</td> <td>110b – PAGE6</td> </tr> <tr> <td>001b – PAGE1</td> <td>100b – PAGE4</td> <td>111b – PAGE7</td> </tr> <tr> <td>010b – PAGE2</td> <td>101b – PAGE5</td> <td></td> </tr> </table> The value of D[2:0] must be larger or equal to B[2:0]	000b – PAGE0	011b – PAGE3	110b – PAGE6	001b – PAGE1	100b – PAGE4	111b – PAGE7	010b – PAGE2	101b – PAGE5		000b – 6 frames	100b – 3 frames	001b – 32 frames	101b – 4 frames	010b – 64 frames	110b – 2 frame	011b – 128 frames	111b – Invalid	000b – PAGE0	011b – PAGE3	110b – PAGE6	001b – PAGE1	100b – PAGE4	111b – PAGE7	010b – PAGE2	101b – PAGE5	
000b – PAGE0	011b – PAGE3	110b – PAGE6																																			
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001b – 32 frames	101b – 4 frames																																				
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011b – 128 frames	111b – Invalid																																				
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001b – PAGE1	100b – PAGE4	111b – PAGE7																																			
010b – PAGE2	101b – PAGE5																																				
0	A[2:0]	*	*	*	*	*	A <sub>2</sub>	A <sub>1</sub>	A <sub>0</sub>																												
0	B[2:0]	*	*	*	*	*	B <sub>2</sub>	B <sub>1</sub>	B <sub>0</sub>																												
0	C[2:0]	*	*	*	*	*	C <sub>2</sub>	C <sub>1</sub>	C <sub>0</sub>																												
0	D[2:0]	*	*	*	*	*	D <sub>2</sub>	D <sub>1</sub>	D <sub>0</sub>																												
0	29/2A	0	0	1	0	1	0	X <sub>1</sub>	X <sub>0</sub>	Continuous Vertical and Horizontal Scroll Setup	X <sub>1</sub> X <sub>0</sub> =01b : Vertical and Right Horizontal Scroll X <sub>1</sub> X <sub>0</sub> =10b : Vertical and Left Horizontal Scroll  A[2:0] : Set number of column scroll offset 000b No horizontal scroll 001b Horizontal scroll by 1 column 010b Horizontal scroll by 2 columns 011b Horizontal scroll by 3 columns 100b Horizontal scroll by 4 columns Other values are invalid. B[2:0] : Define start page address <table border="1"> <tr> <td>000b – PAGE0</td> <td>011b – PAGE3</td> <td>110b – PAGE6</td> </tr> <tr> <td>001b – PAGE1</td> <td>100b – PAGE4</td> <td>111b – PAGE7</td> </tr> <tr> <td>010b – PAGE2</td> <td>101b – PAGE5</td> <td></td> </tr> </table> C[2:0] : Set time interval between each scroll step in terms of frame frequency <table border="1"> <tr> <td>000b – 6 frames</td> <td>100b – 3 frames</td> </tr> <tr> <td>001b – 32 frames</td> <td>101b – 4 frames</td> </tr> <tr> <td>010b – 64 frames</td> <td>110b – 2 frame</td> </tr> <tr> <td>011b – 128 frames</td> <td>111b – Invalid</td> </tr> </table> D[2:0] : Define end page address <table border="1"> <tr> <td>000b – PAGE0</td> <td>011b – PAGE3</td> <td>110b – PAGE6</td> </tr> <tr> <td>001b – PAGE1</td> <td>100b – PAGE4</td> <td>111b – PAGE7</td> </tr> <tr> <td>010b – PAGE2</td> <td>101b – PAGE5</td> <td></td> </tr> </table> The value of D[2:0] must be larger or equal to B[2:0] E[5:0] : Vertical scrolling offset e.g. E[5:0]= 01h refer to offset =1 row E[5:0] =3Fh refer to offset =63 rows	000b – PAGE0	011b – PAGE3	110b – PAGE6	001b – PAGE1	100b – PAGE4	111b – PAGE7	010b – PAGE2	101b – PAGE5		000b – 6 frames	100b – 3 frames	001b – 32 frames	101b – 4 frames	010b – 64 frames	110b – 2 frame	011b – 128 frames	111b – Invalid	000b – PAGE0	011b – PAGE3	110b – PAGE6	001b – PAGE1	100b – PAGE4	111b – PAGE7	010b – PAGE2	101b – PAGE5	
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0	A[2:0]	*	*	*	*	*	A <sub>2</sub>	A <sub>1</sub>	A <sub>0</sub>																												
0	B[2:0]	*	*	*	*	*	B <sub>2</sub>	B <sub>1</sub>	B <sub>0</sub>																												
0	C[2:0]	*	*	*	*	*	C <sub>2</sub>	C <sub>1</sub>	C <sub>0</sub>																												
0	D[2:0]	*	*	*	*	*	D <sub>2</sub>	D <sub>1</sub>	D <sub>0</sub>																												
0	E[5:0]	*	*	E <sub>5</sub>	E <sub>4</sub>	E <sub>3</sub>	E <sub>2</sub>	E <sub>1</sub>	E <sub>0</sub>																												

**Graphic Acceleration Command Table**

D/C#	Hex	D7	D6	D5	D4	D3	D2	D1	D0	Command	Description
0	2E	0	0	1	0	1	1	1	0	Deactivate scroll	<p>Stop scrolling that is configured by command 26h/27h/29h/2Ah.</p> <p><b>Note</b>  <sup>(1)</sup> After sending 2Eh command to deactivate the scrolling action, the ram data needs to be rewritten.</p>
0	2F	0	0	1	0	1	1	1	1	Activate scroll	<p>Start scrolling that is configured by the scrolling setup commands :26h/27h/29h/2Ah with the following valid sequences:            Valid command sequence 1: 26h ;2Fh.            Valid command sequence 2: 27h ;2Fh.            Valid command sequence 3: 29h ;2Fh.            Valid command sequence 4: 2Ah ;2Fh.</p> <p>For example, if “26h; 2Ah; 2Fh.” commands are issued, the setting in the last scrolling setup command, i.e. 2Ah in this case, will be executed. In other words, setting in the last scrolling setup command overwrites the setting in the previous scrolling setup commands.</p>
0 0 0	A3 A[5:0] B[6:0]	1 * *	0 * B <sub>6</sub>	1 A <sub>5</sub> B <sub>5</sub>	0 A <sub>4</sub> B <sub>4</sub>	0 A <sub>3</sub> B <sub>3</sub>	0 A <sub>2</sub> B <sub>2</sub>	1 A <sub>1</sub> B <sub>1</sub>	1 A <sub>0</sub> B <sub>0</sub>	Set Vertical Scroll Area	<p>A[5:0] : Set No. of rows in top fixed area. The No. of rows in top fixed area is referenced to the top of the GDDRAM (i.e. row 0). [RESET = 0]</p> <p>B[6:0] : Set No. of rows in scroll area. This is the number of rows to be used for vertical scrolling. The scroll area starts in the first row below the top fixed area. [RESET = 64]</p> <p><b>Note</b>  <sup>(1)</sup> A[5:0]+B[6:0] &lt;= MUX ratio  <sup>(2)</sup> B[6:0] &lt;= MUX ratio  <sup>(3a)</sup> Vertical scrolling offset (E[5:0] in 29h/2Ah) &lt; B[6:0]  <sup>(3b)</sup> Set Display Start Line (X5X4X3X2X1X0 of 40h~7Fh) &lt; B[6:0]  <sup>(4)</sup> The last row of the scroll area shifts to the first row of the scroll area.  <sup>(5)</sup> For 64d MUX display            A[5:0] = 0, B[6:0]=64 : whole area scrolls            A[5:0]= 0, B[6:0] &lt; 64 : top area scrolls            A[5:0] + B[6:0] &lt; 64 : central area scrolls            A[5:0] + B[6:0] = 64 : bottom area scrolls            Please refer to Figure 10-14 for details.</p>

**Read Command Table**

Bit Pattern	Command	Description
D <sub>7</sub> D <sub>6</sub> D <sub>5</sub> D <sub>4</sub> D <sub>3</sub> D <sub>2</sub> D <sub>1</sub> D <sub>0</sub>	Status Register Read	D[7] : Reserve D[6] : “1” for display OFF / “0” for display ON D[5] : Reserve D[4] : Reserve D[3] : Reserve D[2] : Reserve D[1] : Reserve D[0] : Reserve

**Note**

<sup>(1)</sup> Patterns other than those given in the Command Table are prohibited to enter the chip as a command; as unexpected results can occur.

## 12. Reliability

### Content of Reliability Test

NO.	Items.	Specification	Applicable Standard
1	High temp. (Non-operation)	85°C, 240hrs	—
2	High temp. (Operation)	70°C, 120hrs	—
3	Low temp. (Operation)	-40°C, 120hrs	—
4	High temp. / High. humidity (Operation)	65°C, 90%RH, 120hrs	—
5	Thermal shock(Non-operation)	-40°C ~85°C (-40°C /30min; transit /3min; 85°C /30min; transit /3min) 1cycle: 66min, 100 cycles.	—
6	Vibration	Frequency : 5~50HZ, 0.5G Scan rate : 1 oct/min Time : 2 hrs/axis Test axis : X, Y, Z	—
7	Drop	Height: 120cm Sequence : 1 angle、 3 edges and faces Cycles: 1	—
8	ESD (Non-operation)	Air discharge model, ±8kV, 10 times	—

