

**SPECIFICATIONS FOR  
LIQUID CRYSTAL DISPLAY MODULE**

**MODEL NO : SO1602AWGB-UC-WB-U**

**CUSTOMER : AKZUKI**

**APPROVED SIGNATURE**

**DSGD :**

**CHKD : Gili Wang**

**APPD : Chuan-Lin Hsu**

**DATE : Sep.12.2014**

**SUNLIKE DISPLAY TECHNOLOGY CO .  
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Revision Record

No.	Date	Model No.	Version	Remarks
1	Mar.31.2014	SO1602AWGB-UC-WB-U	REV.0	Smapple RoHS-Compliant
2	Aug.11.2014	SO1602AWGB-UC-WB-U	REV.1	SPE Change P7 SDA_in /SDA_out
3	Aug.18.2014	SO1602AWGB-UC-WB-U	REV.2	SPE Change P7 SDA_in/SDA_out are tied together.
4	Sep.12.2014	SO1602AWGB-UC-WB-U	REV.3	SPE Change P12 Serial Interface Timing IO = SCL / SDA = 2.4-3.6V

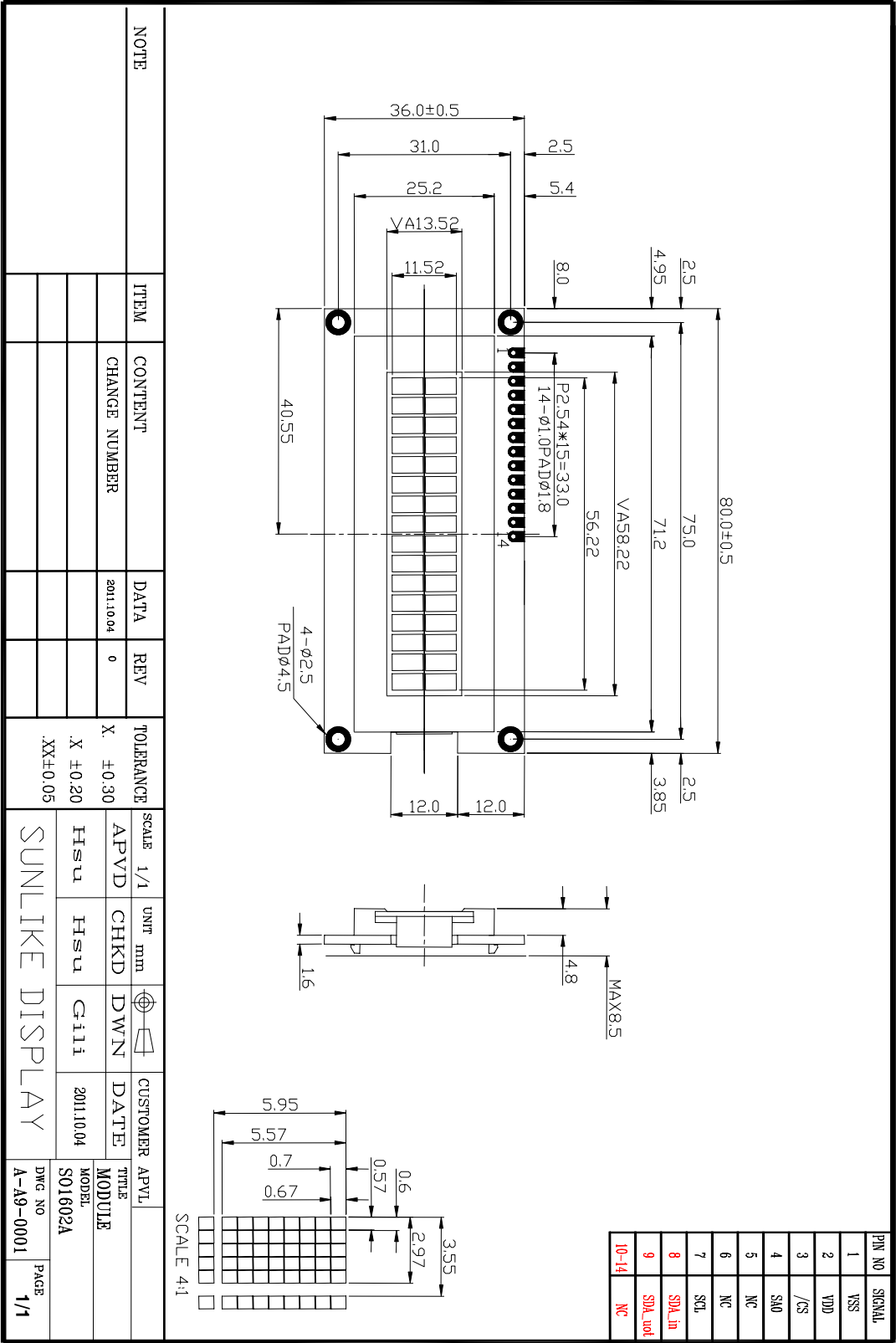
**GENERAL SPECIFICATION**

<b>ITEM</b>	<b>DESCRIPTION</b>				
Product No	SO1602AWGB-UC-WB-U				
OLED Type	OLED White & Black				
Rear Polarizer	Reflective / Positive				
Backlight Type	OLED				
OLED Color	<input type="checkbox"/> Yellow	Green	<input type="checkbox"/> Amber	<input type="checkbox"/> White	<input type="checkbox"/>
Temperature Range	Wide Temp., 3.3V, Single Supply Voltage				
Frame	Black				

**TO BE VERY CAREFUL !**

The OLED driver ICs are made by CMOS process, which are very easy to be damaged by static charge, make sure the user is grounded when handling the LCM.

**This parts comply with RoHs**



**ABSOLUTE MAXIMUM RATING**

## (1) Electrical Absolute Ratings

Item	Symbol	Min.	Max.	Unit	Note
Power Supply for Logic	$V_{DD}-V_{SS}$	-0.3	5.5	Volt	
Power Supply for OLED	$V_{DD}-V_{CC}$	-0.3	13.0	Volt	
Input Voltage	$V_I$	-0.3	$V_{DD}$	Volt	
Life Time (100 cd/m <sup>2</sup> )	$V_{CC} = 7.25V$ $T_a = 25^{\circ}C$ 50% RH	50,000	---	Hour	

## (2) Environmental Absolute Maximum Ratings

Item	Wide Temperature			
	Operating		Storage	
	Min,	Max.	Min,	Max.
Ambient Temperature	-40	+70	-40	+85
Humidity(without condensation)	Note 4,5		Note 4,6	

Note 2  $T_a = 50$  : 80% RH max

$T_a > 50$  : Absolute humidity must be lower than the humidity of 85%RH at 50

Note 3  $T_a$  at -20 will be <48hrs at 70 will be <120hrs when humidity is higher than 70%.

Note 4 Background color changes slightly depending on ambient temperature. This phenomenon is reversible.

Note 5  $T_a = 70$  : 75RH max

$T_a > 70$  : absolute humidity must be lower than the humidity of 75%RH at 70

Note 6  $T_a$  at -30 will be <48hrs, at 80 will be <120hrs when humidity is higher than 70%.

**ELECTRICAL CHARACTERISTICS**

Item	Symbol	Condition	Min.	Typ	Max.	Unit	note
Power Supply for Logic	$V_{DD}-V_{SS}$	-	2.4	3.3	3.6	Volt	
Power Supply for OLED	$V_{CC}-V_{SS}$	-	11.5	12.0	12.5	Volt	
Input Voltage	$V_{IL}$	L level	0	-	$0.2 V_{DD}$	Volt	
	$V_{IH}$	H level	$0.8 V_{DD}$	-	$V_{DD}$	Volt	
Onput Voltage	$V_{OL}$	L level	0	-	$0.1 V_{DD}$		
	$V_{OH}$	H level	$0.9 V_{DD}$	-	$V_{DD}$		
LCM Recommend OLED Module Driving Voltage	$V_O - V_{SS}$	Ta = 0	-	-	-	Volt	
		Ta = 25	9.0	10.0	11.5		
		Ta = 50	-	-	-		
Power Supply Current for OLED	$I_{DD}$	$V_{DD}=3.3V$ $V_O-V_{SS}=10.0V$	-	50.0	80.0	mA	

**OPTICAL CHARACTERISTICS**

Item	Symbol	Condition	Min.	Typ	Max.	Unit	note
Viewing angle range	f(12 o'clock)	When Cr 20	-	75	-	Degree	9,10
	b(6 o'clock)		-	75	-		
	l(9 o'clock)		-	65	-		
	r(3 o'clock)		-	65	-		
Rise Time	Tr	$V_O-V_{SS}=10.0V$ Ta=25	-	40		mS	
Fall Time	Tf		-	40			
Frame frequency	Frm		-	64	-	Hz	8,10
Dark Room Contrast	Cr		-	2000:1	-		7
Brightness	L		120	150	-	cd/m <sup>2</sup>	
Peak Emission Wavelength	C.I.E (Green)	CIE1931	X=0.27 Y=0.58	X=0.31 Y=0.62	X=0.35 Y=0.66	nm	

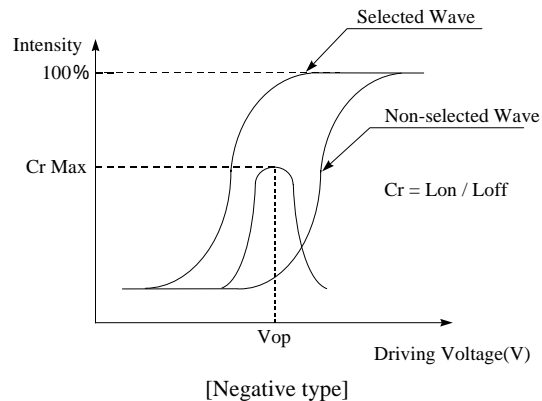
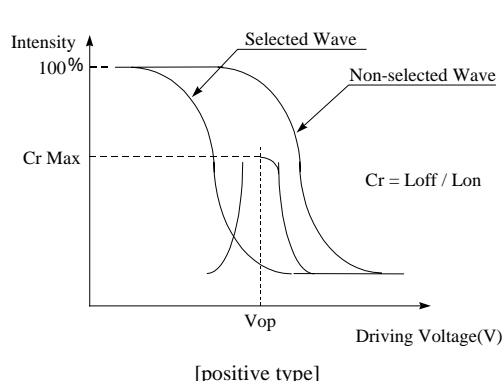
**MECHANICAL SPECIFICATION**

ITEM	DESCRIPTION
Product No.	SO1602A
Viewing Area	58.22(W)mm×13.52(H)mm
Module Size	80.0(W)×36.0(H)×8.5 max(D)
Dot Size	0.57(W)mm×0.67(H)mm
Dot Pitch	0.60(W)mm×0.70(H)mm
Display Format	16 characters (W)×2 lines (H)
Duty Ratio	1/16 Duty
Interface	I <sup>2</sup> C Serial
Controller	US2066 or Equivalent

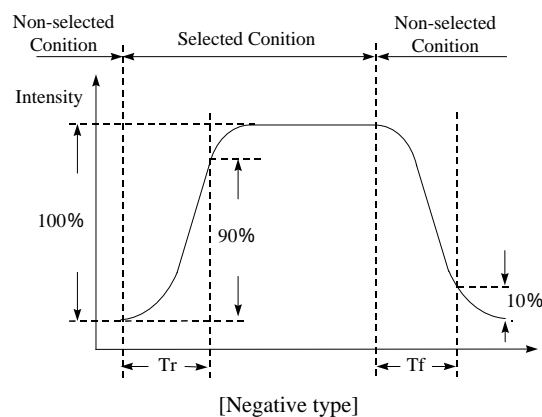
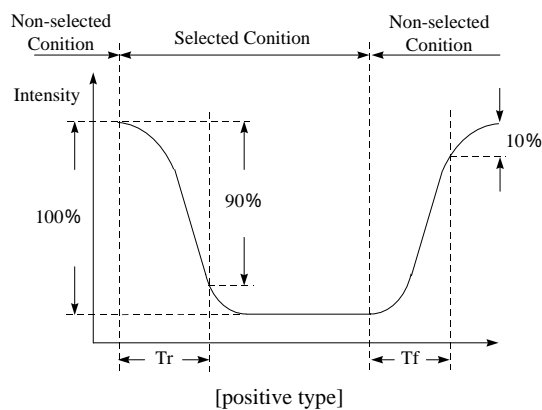
**INTERFACE PIN ASSIGNMENT**

Pin No.	Pin Out	Level	Description
1	VSS	0V	Power Supply Ground
2	VDD	3.3V	Power Supply Voltage
3	/CS	L	Chip Select Signal
4	SA0	-	Slave address
5	NC	---	No Connection
6	NC	---	No Connection
7	SCL	H/L	IIC Bus Serial Clock Input
8	SDA_in	H/L	IIC Bus Serial Data “SDA in” and “SDA out” are tied together and serve as SDA.
9	SDA_out	H/L	
10 14	NC	---	No Connection

## [Note 7] Definition of Operation Voltage ( $V_{op}$ )



## [Note 8] Definition of Response Time ( $T_r$ , $T_f$ )



### Conditions:

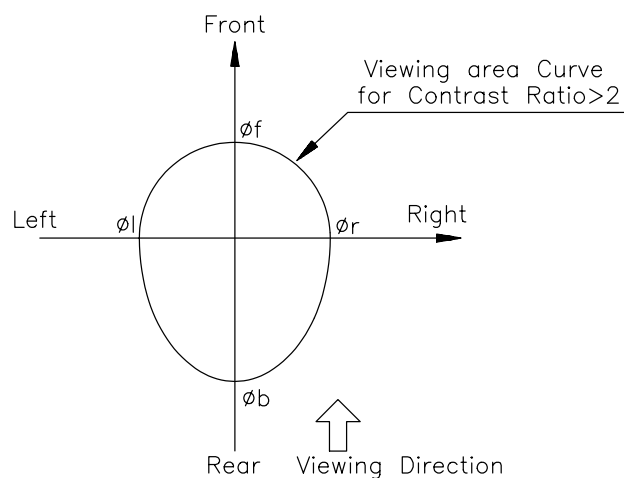
Operating Voltage :  $V_{op}$

Frame Frequency : 64 Hz

Viewing Angle( , ):  $0^\circ$ ,  $0^\circ$

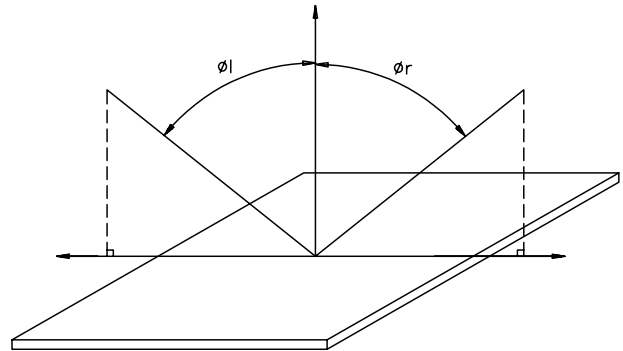
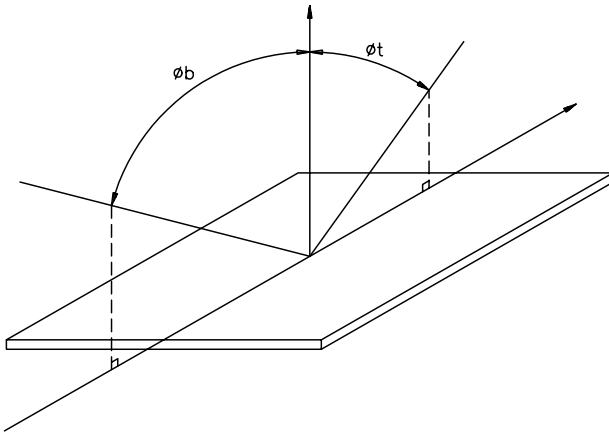
Driving Wave form : 1/N duty, 1/a bias

## [Note 9] Definition of Viewing Direction

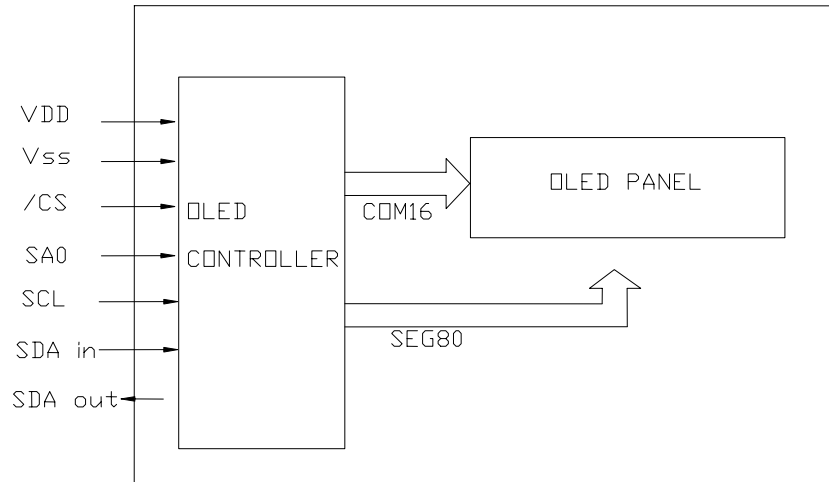




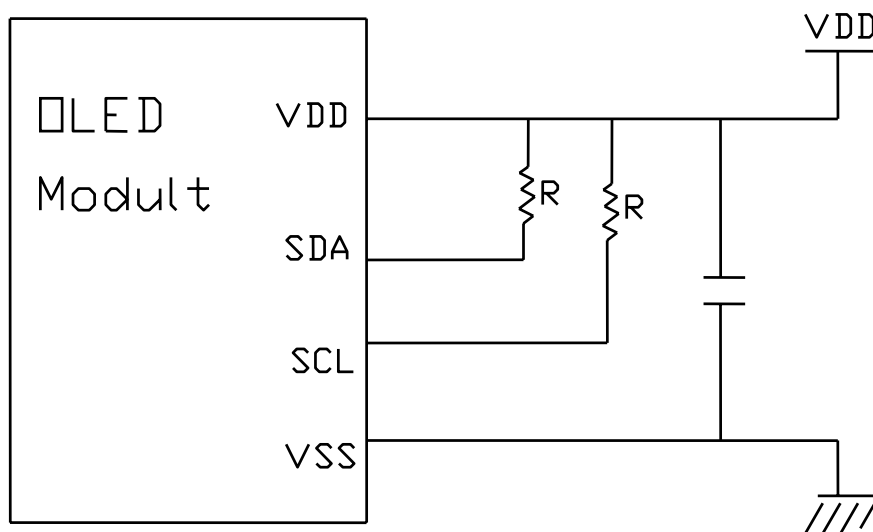
**[Note 10] Definition of viewing angle**



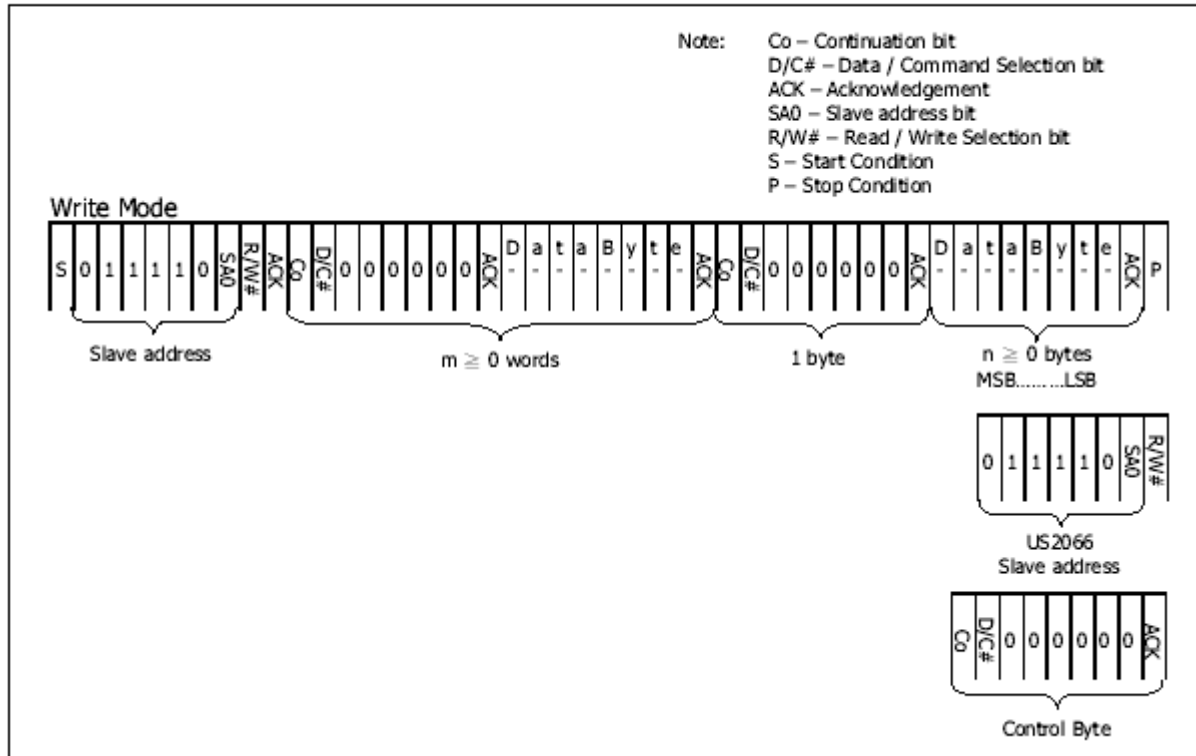
## BLOCK DIAGRAM



## POWER SUPPLY

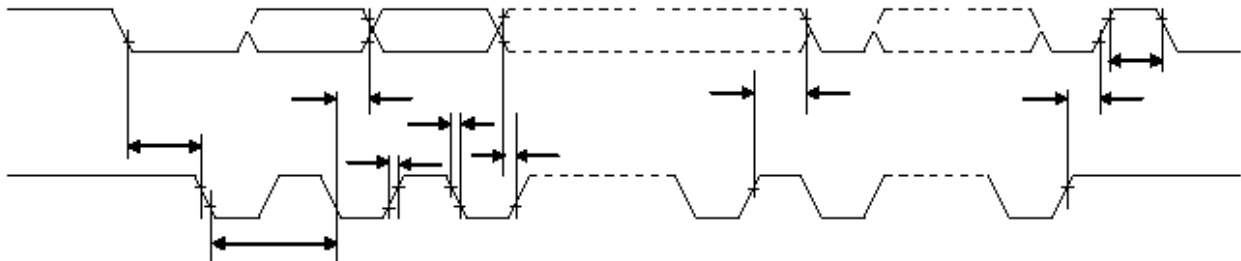


## I<sup>2</sup>C-bus data format



**I<sup>2</sup>C Timing Characteristics****I<sup>2</sup>C Timing Characteristics**(T<sub>A</sub> = 25°C, V<sub>DDIO</sub> = 2.4-3.6V, V<sub>SS</sub> = 0V)

Symbol	Parameter	Min	Typ	Max	Unit
t <sub>cycle</sub>	Clock Cycle Time	2.5	-	-	μs
t <sub>HSTART</sub>	Start condition Hold Time	0.6	-	-	μs
t <sub>HD</sub>	Data Hold Time (for "SDA <sub>OUT</sub> " pin)	5	-	-	ns
	Data Hold Time (for "SDA <sub>IN</sub> " pin)	300	-	-	ns
t <sub>SD</sub>	Data Setup Time	100	-	-	ns
t <sub>SSTART</sub>	Start condition Setup Time (Only relevant for a repeated Start condition)	0.6	-	-	μs
t <sub>SSTOP</sub>	Stop condition Setup Time	0.6	-	-	μs
t <sub>R</sub>	Rise Time for data and clock pin	-	-	300	ns
t <sub>F</sub>	Fall Time for data and clock pin	-	-	300	ns
t <sub>IDLE</sub>	Idle Time before a new transmission can start	1.3	-	-	μs

Note: All timings are based on 20% to 80% of V<sub>DDIO</sub>-V<sub>SS</sub>**I<sup>2</sup>C Timing Characteristics**

## FUNCTIONAL SPECIFICATION

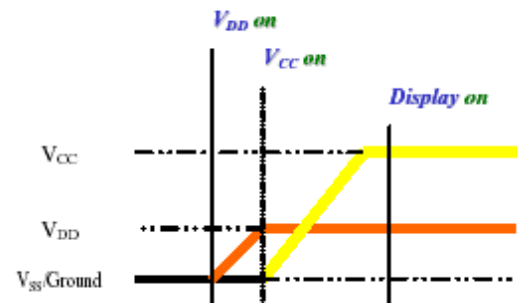
### Commands

### Power down and Power up Sequence

To protect OEL panel and extend the panel life time, the driver IC power up/down routine should include a delay period between high voltage and low voltage power sources during turn on/off. It gives the OEL panel enough time to complete the action of charge and discharge before/after the operation.

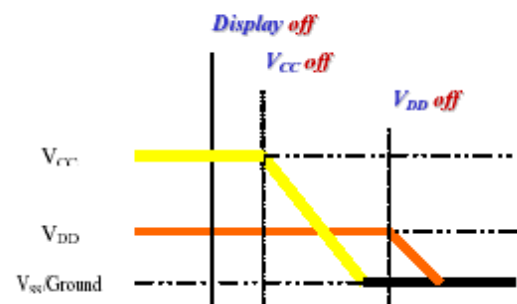
Power up Sequence:

1. Power up  $V_{DD}$
2. Send Display off command
3. Initialization
4. Clear Screen
5. Power up  $V_{CC}$
6. Delay 100ms  
(When  $V_{CC}$  is stable)
7. Send Display on command



Power down Sequence:

1. Send Display off command
2. Power down  $V_{CC}$
3. Delay 100ms  
(When  $V_{CC}$  is reach 0 and panel is completely discharges)
4. Power down  $V_{DD}$



Note :

- 1) Since an ESD protection circuit is connected between  $V_{DD}$  and  $V_{CC}$  inside the driver IC,  $V_{CC}$  becomes lower than  $V_{DD}$  whenever  $V_{DD}$  is ON and  $V_{CC}$  is OFF.
- 2)  $V_{CC}$  should be kept float (disable) when it is OFF.
- 3) Power Pins ( $V_{DD}$ ,  $V_{CC}$ ) can never be pulled to ground under any circumstance.
- 4)  $V_{DD}$  should not be power down before  $V_{CC}$  power down.

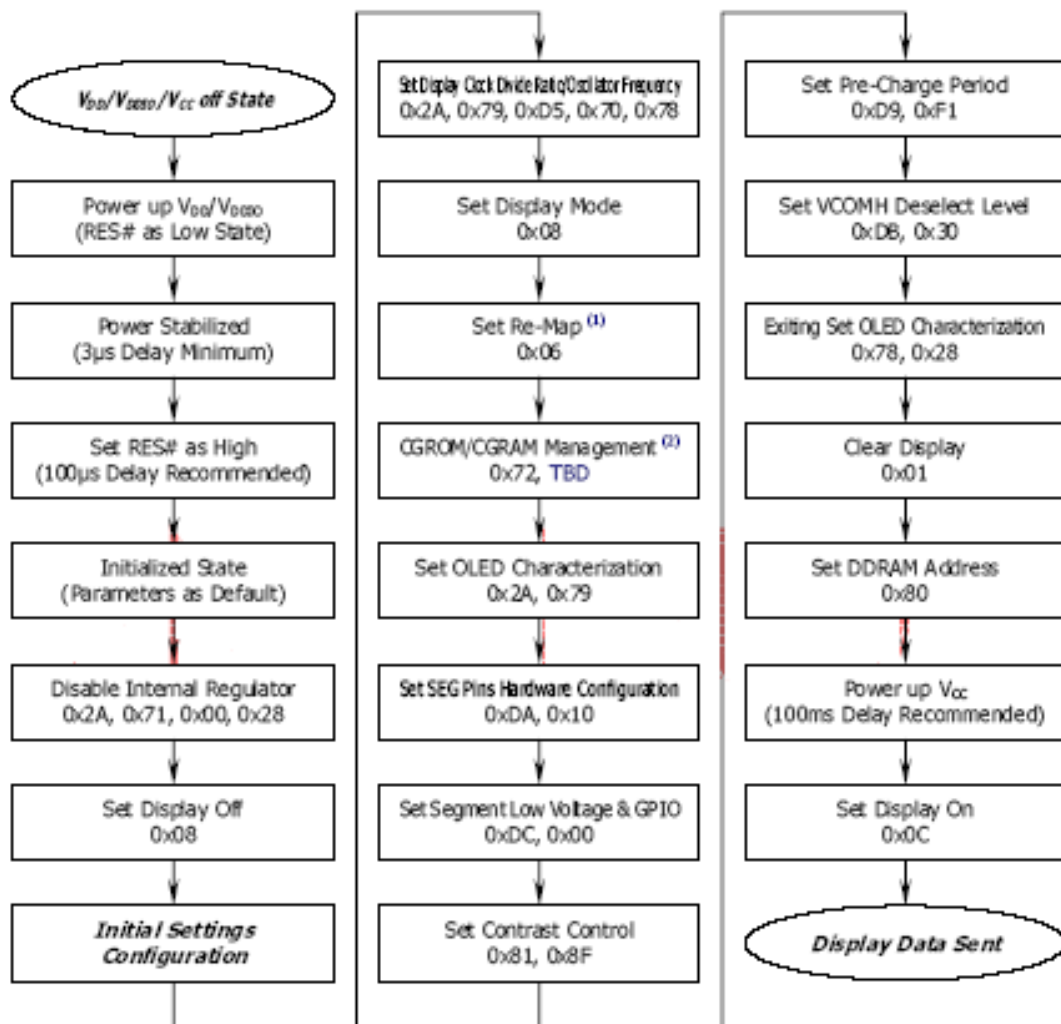
## RESET CIRCUIT

When RES# input is low, the chip is initialized with the following status:

1. Display off, Cursor off, Blink off.
2. Power Down off.
3. 5-dot font is default.
4. Display Shift Disable.
5. CGRAM address is 00h. SEGRAM address is 00h.
6. DDRAM address is 00h.
7. Display start line is set at display RAM address 0
8. Column address counter is set at 0
9. Normal scan direction of the COM outputs
10. Contrast control register is set at 7Fh

## ACTUAL APPLICATION EXAMPLE

## &lt;Power up Sequence&gt;



## US2066 CGROM CHARACTER CODE

ROM A (ROM[1:0] = [0:0])

k7-n k3-o	0000	0001	0002	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000																
0001																
0010																
0011																
0100																
0101																
0110																
0111																
1000																
1001																
1010																
1011																
1100																
1101																
1110																
1111																



ROM B (ROM[1:0] = [0:1])

0000	0001	0002	0003	0004	0005	0006	0007	0008	0009	000A	000B	000C	000D	000E	000F
0000	0001	0002	0003	0004	0005	0006	0007	0008	0009	000A	000B	000C	000D	000E	000F
0010	0011	0012	0013	0014	0015	0016	0017	0018	0019	001A	001B	001C	001D	001E	001F
0020	0021	0022	0023	0024	0025	0026	0027	0028	0029	002A	002B	002C	002D	002E	002F
0030	0031	0032	0033	0034	0035	0036	0037	0038	0039	003A	003B	003C	003D	003E	003F
0040	0041	0042	0043	0044	0045	0046	0047	0048	0049	004A	004B	004C	004D	004E	004F
0050	0051	0052	0053	0054	0055	0056	0057	0058	0059	005A	005B	005C	005D	005E	005F
0060	0061	0062	0063	0064	0065	0066	0067	0068	0069	006A	006B	006C	006D	006E	006F
0070	0071	0072	0073	0074	0075	0076	0077	0078	0079	007A	007B	007C	007D	007E	007F
0080	0081	0082	0083	0084	0085	0086	0087	0088	0089	008A	008B	008C	008D	008E	008F
0090	0091	0092	0093	0094	0095	0096	0097	0098	0099	009A	009B	009C	009D	009E	009F
00A0	00A1	00A2	00A3	00A4	00A5	00A6	00A7	00A8	00A9	00AA	00AB	00AC	00AD	00AE	00AF
00B0	00B1	00B2	00B3	00B4	00B5	00B6	00B7	00B8	00B9	00BA	00BB	00BC	00BD	00BE	00BF
00C0	00C1	00C2	00C3	00C4	00C5	00C6	00C7	00C8	00C9	00CA	00CB	00CC	00CD	00CE	00CF
00D0	00D1	00D2	00D3	00D4	00D5	00D6	00D7	00D8	00D9	00DA	00DB	00DC	00DD	00DE	00DF
00E0	00E1	00E2	00E3	00E4	00E5	00E6	00E7	00E8	00E9	00EA	00EB	00EC	00ED	00EE	00EF
00F0	00F1	00F2	00F3	00F4	00F5	00F6	00F7	00F8	00F9	00FA	00FB	00FC	00FD	00FE	00FF
0100	0101	0102	0103	0104	0105	0106	0107	0108	0109	010A	010B	010C	010D	010E	010F
0110	0111	0112	0113	0114	0115	0116	0117	0118	0119	011A	011B	011C	011D	011E	011F
0120	0121	0122	0123	0124	0125	0126	0127	0128	0129	012A	012B	012C	012D	012E	012F
0130	0131	0132	0133	0134	0135	0136	0137	0138	0139	013A	013B	013C	013D	013E	013F
0140	0141	0142	0143	0144	0145	0146	0147	0148	0149	014A	014B	014C	014D	014E	014F
0150	0151	0152	0153	0154	0155	0156	0157	0158	0159	015A	015B	015C	015D	015E	015F
0160	0161	0162	0163	0164	0165	0166	0167	0168	0169	016A	016B	016C	016D	016E	016F
0170	0171	0172	0173	0174	0175	0176	0177	0178	0179	017A	017B	017C	017D	017E	017F
0180	0181	0182	0183	0184	0185	0186	0187	0188	0189	018A	018B	018C	018D	018E	018F
0190	0191	0192	0193	0194	0195	0196	0197	0198	0199	019A	019B	019C	019D	019E	019F
01A0	01A1	01A2	01A3	01A4	01A5	01A6	01A7	01A8	01A9	01AA	01AB	01AC	01AD	01AE	01AF
01B0	01B1	01B2	01B3	01B4	01B5	01B6	01B7	01B8	01B9	01BA	01BB	01BC	01BD	01BE	01BF
01C0	01C1	01C2	01C3	01C4	01C5	01C6	01C7	01C8	01C9	01CA	01CB	01CC	01CD	01CE	01CF
01D0	01D1	01D2	01D3	01D4	01D5	01D6	01D7	01D8	01D9	01DA	01DB	01DC	01DD	01DE	01DF
01E0	01E1	01E2	01E3	01E4	01E5	01E6	01E7	01E8	01E9	01EA	01EB	01EC	01ED	01EE	01EF
01F0	01F1	01F2	01F3	01F4	01F5	01F6	01F7	01F8	01F9	01FA	01FB	01FC	01FD	01FE	01FF
0200	0201	0202	0203	0204	0205	0206	0207	0208	0209	020A	020B	020C	020D	020E	020F
0210	0211	0212	0213	0214	0215	0216	0217	0218	0219	021A	021B	021C	021D	021E	021F
0220	0221	0222	0223	0224	0225	0226	0227	0228	0229	022A	022B	022C	022D	022E	022F
0230	0231	0232	0233	0234	0235	0236	0237	0238	0239	023A	023B	023C	023D	023E	023F
0240	0241	0242	0243	0244	0245	0246	0247	0248	0249	024A	024B	024C	024D	024E	024F
0250	0251	0252	0253	0254	0255	0256	0257	0258	0259	025A	025B	025C	025D	025E	025F
0260	0261	0262	0263	0264	0265	0266	0267	0268	0269	026A	026B	026C	026D	026E	026F
0270	0271	0272	0273	0274	0275	0276	0277	0278	0279	027A	027B	027C	027D	027E	027F
0280	0281	0282	0283	0284	0285	0286	0287	0288	0289	028A	028B	028C	028D	028E	028F
0290	0291	0292	0293	0294	0295	0296	0297	0298	0299	029A	029B	029C	029D	029E	029F
02A0	02A1	02A2	02A3	02A4	02A5	02A6	02A7	02A8	02A9	02AA	02AB	02AC	02AD	02AE	02AF
02B0	02B1	02B2	02B3	02B4	02B5	02B6	02B7	02B8	02B9	02BA	02BB	02BC	02BD	02BE	02BF
02C0	02C1	02C2	02C3	02C4	02C5	02C6	02C7	02C8	02C9	02CA	02CB	02CC	02CD	02CE	02CF
02D0	02D1	02D2	02D3	02D4	02D5	02D6	02D7	02D8	02D9	02DA	02DB	02DC	02DD	02DE	02DF
02E0	02E1	02E2	02E3	02E4	02E5	02E6	02E7	02E8	02E9	02EA	02EB	02EC	02ED	02EE	02EF
02F0	02F1	02F2	02F3	02F4	02F5	02F6	02F7	02F8	02F9	02FA	02FB	02FC	02FD	02FE	02FF
0300	0301	0302	0303	0304	0305	0306	0307	0308	0309	030A	030B	030C	030D	030E	030F
0310	0311	0312	0313	0314	0315	0316	0317	0318	0319	031A	031B	031C	031D	031E	031F
0320	0321	0322	0323	0324	0325	0326	0327	0328	0329	032A	032B	032C	032D	032E	032F
0330	0331	0332	0333	0334	0335	0336	0337	0338	0339	033A	033B	033C	033D	033E	033F
0340	0341	0342	0343	0344	0345	0346	0347	0348	0349	034A	034B	034C	034D	034E	034F
0350	0351	0352	0353	0354	0355	0356	0357	0358	0359	035A	035B	035C	035D	035E	035F
0360	0361	0362	0363	0364	0365	0366	0367	0368	0369	036A	036B	036C	036D	036E	036F
0370	0371	0372	0373	0374	0375	0376	0377	0378	0379	037A	037B	037C	037D	037E	037F
0380	0381	0382	0383	0384	0385	0386	0387	0388	0389	038A	038B	038C	038D	038E	038F
0390	0391	0392	0393	0394	0395	0396	0397	0398	0399	039A	039B	039C	039D	039E	039F
03A0	03A1	03A2	03A3	03A4	03A5	03A6	03A7	03A8	03A9	03AA	03AB	03AC	03AD	03AE	03AF
03B0	03B1	03B2	03B3	03B4	03B5	03B6	03B7	03B8	03B9	03BA	03BB	03BC	03BD	03BE	03BF
03C0	03C1	03C2	03C3	03C4	03C5	03C6	03C7	03C8	03C9	03CA	03CB	03CC	03CD	03CE	03CF
03D0	03D1	03D2	03D3	03D4	03D5	03D6	03D7	03D8	03D9	03DA	03DB	03DC	03DD	03DE	03DF
03E0	03E1	03E2	03E3	03E4	03E5	03E6	03E7	03E8	03E9	03EA	03EB	03EC	03ED	03EE	03EF
03F0	03F1	03F2	03F3	03F4	03F5	03F6	03F7	03F8	03F9	03FA	03FB	03FC	03FD	03FE	03FF
0400	0401	0402	0403	0404	0405	0406	0407	0408	0409	040A	040B	040C	040D	040E	040F
0410	0411	0412	0413	0414	0415	0416	0417	0418	0419	041A	041B	041C	041D	041E	041F
0420	0421	0422	0423	0424	0425	0426	0427	0428	0429	042A	042B	042C	042D	042E	042F
0430	0431	0432	0433	0434	0435	0436	0437	0438	0439	043A	043B	043C	043D	043E	043F
0440	0441	0442	0443	0444	0445	0446	0447	0448	0449	044A	044B	044C	044D	044E	044F
0450	0451	0452	0453	0454	0455	0456	0457	0458	0459	045A	045B	045C	045D	045E	045F
0460	0461	0462	0463	0464	0465	0466	0467	0468	0469	046A	046B	046C	046D	046E	046F
0470	0471	0472	0473	0474	0475	0476	0477	0478	0479	047A	047B	047C	047D	047E	047F
0480	0481	0482	0483	0484	0485	0486	0487	0488	0489	048A	048B	048C	048D	048E	048F
0490	0491	0492	0493	0494	0495	0496	0497	0498	0499	049A	049B	049C	049D	049E	049F
04A0	04A1	04A2	04A3	04A4	04A5	04A6	04A7	04A8	04A9	04AA	04AB	04AC	04AD	04AE	04AF
04B0	04B1	04B2	04B3	04B4	04B5	04B6	04B7	04B8	04B9	04BA	04BB	04BC	04BD	04BE	04BF
04C0	04C1	04C2	04C3	04C4	04C5	04C6	04C7	04C8	04C9	04CA	04CB	04CC	04CD	04CE	04CF
04D0	04D1	04D2	04D3	04D4	04D5	04D6	04D7	04D8	04D9	04DA	04DB	04DC	04DD	04DE	04DF
04E0	04E1	04E2	04E3	04E4	04E5	04E6	04E7	04E8	04E9	04EA	04EB	04EC	04ED	04EE	04EF
04F0	04F1	04F2	04F3	04F4	04F5	04F6	04F7	04F8	04F9	04FA	04FB	04FC	04FD	04FE	04FF
0500	0501	0502	0503	0504	0505	0506	0507	0508	0509	050A	050B	050C	050D	050E	050F
0510	0511	0512	0513	0514	0515	0516	0517	0518	0519	051A	051B	051C	051D	051E	051F
0520	0521	0522	0523	0524	0525	0526	0527	0528	0529	052A	052B	052C	052D	052E	052F
05															



4:3	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111	
4:2	0000																
0001																	
0010																	
0011																	
0100																	
0101																	
0110																	
0111																	
1000																	
1001																	
1010																	
1011																	
1100																	
1101																	
1110																	
1111																	

## Commands

Instruction	Instruction code										Description	Execution Time(Fosc is 540 kHz)	POR Hex
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0			
IS=X , RE=X , SD=0													
Clear Display	0	0	0	0	0	0	0	0	0	1	Write"20H"toDDRAM.and set DDRAM address to"00H" from AC	1.52 mS	
IS=X , RE=0 , SD=0													
Return Home	0	0	0	0	0	0	0	0	1	*	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.52 mS	
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction and specifies display shift. These operations are performed during data write and read.	37 μS	06H
Display ON/OFF	0	0	0	0	0	0	1	D	C	B	D=1 : entire display on C=1 : cursor on B=1 : blink on	37 μS	08H
Function Set	0	0	0	0	1	*	N	DH	RE (0)	IS	N : number of line is 2/1 DH : Double height font control for 2-line mode enable/disable Extension register RE Extension register IS	37 μS	20H
IS=0 , RE=0 , SD=0													
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	*	*	Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.	37 μS	10H
Set CG RAM Address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter.	37 μS	
IS=0 , RE=X , SD=0													
Set DDRAM RAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter.	37 μS	
Read Busy Flag and Address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.	0 μS	
Write Data	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM)	37 μS	
Read Data	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM)	37 μS	

Instruction	Instruction code										Description	Execution Time(Fosc is 540 kHz)	POR Hex
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0			
IS=0 , RE=1 , SD=0													
Function Set	0	0	0	0	1	*	N	BE	RE (1)	REV	N : Number of line is 2/1 BE : CGRAM blink enable RE(1) : Extension register REV : Reverse bit	37 μS	20H
Entry Mode Set	0	0	0	0	0	0	0	1	BDC	BDS	Common bi-direction function BDC= "0" : COM31->COM0 BDC= "1" : COM0-> COM31 Segment bi-direction function BDS= "0" : SEG99-> SEG0 BDS= "1" : SEG0-> SEG99	37 μS	06H
Set Scroll Quantity	0	0	1	*	SQ5	SQ4	SQ3	SQ2	SQ1	SQ0	Set the quantity of horizontal dot scroll. Scroll Quantity (0 - 48)	37 μS	80H
OLED Characterization	0	0	0	1	1	1	1	0	0	SD	SD=0 : Normal register SD=1 : Extension register	37 μS	78H
Double Height (4-line)/ Display-dot shift	0	0	0	0	0	1	UD2	UD1	*	DH'	UD2, UD1: Assign different double height formats, DH' : Display shift enable selection bit.	37 μS	1CH
IS=1 , RE=1 , SD=0													
Shift / Scroll Enable	0	0	0	0	0	1	DS4/ HS4	DS3/ HS3	DS2/ HS2	DS1/ HS1	When DH'=1 Shift Enable DS : Display shift per line enable When DH'=0 Scroll Enable HS : Horizontal scroll per line enable	37 μS	1FH

Instruction	Instruction code										Description	Execution Time(Fosc is 540 kHz)	POR Hex																									
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0																												
IS=X , RE=1 , SD=0																																						
Extended Function Set	0	0	0	0	0	0	1	FW	B/W	NW	FW : Font Width control B/W : Black/White Inversion enable bit NW : 4 Line mode enable bit	37 μS	08H																									
Function Selection A	0 1	0 0	0 A7	1 A6	1 A5	1 A4	0 A3	0 A2	0 A1	1 A0	This double byte command enable or disable the internal VDD	37 μS	71H [5CH]																									
Function Selection B	0 1	0 0	0 *	1 *	1 *	1 *	0 RO1	0 RO0	1 OP1	0 OP0	Beside using CGROM <table><tr><td>OP[1:0]</td><td>CGROM</td><td>CGRAM</td></tr><tr><td>00b</td><td>240</td><td>8</td></tr><tr><td>01b</td><td>248</td><td>8</td></tr><tr><td>10b</td><td>250</td><td>6</td></tr><tr><td>11b</td><td>256</td><td>0</td></tr></table> Select character ROM <table><tr><td>RO[1:0]</td><td>ROM</td></tr><tr><td>00b</td><td>A</td></tr><tr><td>01b</td><td>B</td></tr><tr><td>10b</td><td>C</td></tr><tr><td>11b</td><td>Invalid</td></tr></table>	OP[1:0]	CGROM	CGRAM	00b	240	8	01b	248	8	10b	250	6	11b	256	0	RO[1:0]	ROM	00b	A	01b	B	10b	C	11b	Invalid	37 μS	72H [0FH]
OP[1:0]	CGROM	CGRAM																																				
00b	240	8																																				
01b	248	8																																				
10b	250	6																																				
11b	256	0																																				
RO[1:0]	ROM																																					
00b	A																																					
01b	B																																					
10b	C																																					
11b	Invalid																																					
Set Contrast Control	0 0	0 0	1 A7	0 A6	0 A5	0 A4	0 A3	0 A2	0 A1	1 A0	This command sets the Contrast Setting of the display.	37 μS	81H [7FH]																									
Set Display Clock Divide Ratio/Oscillator Frequency	0 0	0 0	1 A7	1 A6	0 A5	1 A4	0 A3	1 A2	0 A1	1 A0	Display Clock Divide Ratio (A[3:0]) Oscillator Frequency (A[7:4])	37 μS	D5H [70H]																									
Set Phase Length	0 0	0 0	1 A7	1 A6	0 A5	1 A4	1 A3	0 A2	0 A1	1 A0	This double byte command sets the length of phase 1 and 2 of segment waveform of the driver.	37 μS	D9H [78H]																									
Set SEG Pins Hardware Configuration	0 0	0 0	1 0	1 0	0 A5	1 A4	1 0	0 0	1 0	0 0	This double byte command changes the mapping between the display	37 μS	DAH [10H]																									
Set VCOMH Deselect Level	0 0	0 0	1 0	1 A6	0 A5	1 A4	1 0	0 0	1 0	1 0	<table><tr><td>A [6:4]</td><td>Hex</td><td>VCOMH deselect code</td><td>level</td></tr><tr><td>000b</td><td>00h</td><td colspan="2">0.65xVcc</td></tr><tr><td>001b</td><td>10h</td><td colspan="2">0.71xVcc</td></tr><tr><td>010b</td><td>20h</td><td colspan="2">0.77xVcc</td></tr><tr><td>011b</td><td>30h</td><td colspan="2">0.83xVcc</td></tr><tr><td>100b</td><td>40h</td><td colspan="2">1xVcc</td></tr></table>	A [6:4]	Hex	VCOMH deselect code	level	000b	00h	0.65xVcc		001b	10h	0.71xVcc		010b	20h	0.77xVcc		011b	30h	0.83xVcc		100b	40h	1xVcc		37 μS	DBH [40H]	
A [6:4]	Hex	VCOMH deselect code	level																																			
000b	00h	0.65xVcc																																				
001b	10h	0.71xVcc																																				
010b	20h	0.77xVcc																																				
011b	30h	0.83xVcc																																				
100b	40h	1xVcc																																				
Function Selection C	0 0	0 0	1 0	1 A7	0 0	1 0	1 0	1 0	0 A1	0 A0	This double byte command consists of two functions	37 μS	DCH [00H]																									
Crosstalk Compensation	0	0	1	1	0	1	1	1	1	1	TBD	37 μS	DFH																									
Note (1) POR stands for Power On Reset Values (2) “*”and ”x” stand for ”Don’t care” (3) The locked OLED driver IC MCU interface prohibits all commands access except logic bit SD is set to 1b (4) Refer to Table 0-1 and (5) Table 0-2 for the details of logic bits IS , RE and SD. (6) Cursor & Blink is ON, that performs alternate between all the high data and display character at the cursor position. If fosc has 540kHz frequency, blinking has 370 ms interval.																																						

## HANDLING PRECAUTION

### 1. Mounting Method

The panel of the OLED Module consists of two thin glass plates with polarizers which easily get damaged since the Module is fixed by utilizing fitting holes in the printed circuit board. Extreme care should be taken when handling the OLED Modules.

### 2. Caution of OLED handling & cleaning

When cleaning the display surface, use soft cloth with solvent (recommended below) and Wipe lightly.

- Isopropyl alcohol
- Ethyl alcohol
- Trichlorotrifluoroethane

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent :

- Water
- Kettle
- Aromatics

### 3. Caution against static charge

The OLED Module uses CMOS drivers, so we recommend that you connect any unused input terminal to VDD or VSS, do not input any signals before power is turned on. And ground your body, Work/assembly table. And assembly equipment to protect against static electricity.

### 4. Packaging

- Modules use OLED elements, and must be treated as such. Avoid intense shock and falls from a height.
- To prevent modules from degradation. Do not operate or store them exposed directly to sunshine or high temperature/humidity.

## 5. Caution for operation

-It is indispensable to drive LCD's within the specified voltage limit since the higher voltage than the limit shortens LCD life.

An electrochemical reaction due to direct current causes LCD deterioration. Avoid the use of direct current drive.

-Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's. Which will come back in the specified operating temperature range.

- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.

- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Usage under the relative condition of 40%RH or less is required.

## 6. Storage

In the case of storing for a long period of time (for instance. For years) for the purpose or replacement use, The following ways are recommended.

- Storage in a polyethylene bag with sealed so as not to enter fresh air outside in it, And with no desiccant.

- Placing in a dark place where neither exposure to direct sunlight nor light is. Keeping temperature in the specified storage temperature range.

-Storing with no touch on polarizer surface by anything else. (It is recommended to store them as they have been contained in the inner container at the time of delivery)

## 7. Safety

- It is recommendable to crash damaged or unnecessary LCD into pieces and wash off liquid crystal by using solvents such as acetone and ethanol. Which should be burned up later.

- When any liquid crystal leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water.