



One Stop Displays  
310 Genius Drive  
Winter Park, FL 32789  
407-629-0500  
[sales@onestopdisplays.net](mailto:sales@onestopdisplays.net)

## **OSD2002-2**

---

### **PLED 20x2 Character Module Specifications**

# PLED 20x2 Character Module OSD2002-2 Specification

## 1. Features

1. 2 lines of 20 characters of 5x8 (dots)
2. Low power consumption
3. High contrast ratio and wide viewing angle
4. Compatible with LCD 20x2 type
5. Controller is compatible with HD44780
6. 4-bits or 8-bit MPU interface
7. High speed MPU interface:2 MHz(VDD=5V)
8. 80x8 bit Display RAM(80 characters max.)

## 2. Absolute maximum ratings

<b>Symbol</b>	<b>Parameter</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>	<b>Unit</b>
VDD	Supply voltage for Logic	4.5	5.0	5.5	V
Topr	Operating temperature	-20	25	60	°C
Tstg	Storage temperature	-30		70	°C
Vbt	Brightness control voltage		3		V
Tsolder	Soldering Temperature	260□ for 5 seconds			
Pd	Module power consumption @Vbt=3V VDD=5V	50	80	130	mW

<b>Item</b>	<b>Operating</b>		<b>Storage</b>	
	<b>Min.</b>	<b>Max.</b>	<b>Min.</b>	<b>Max.</b>
Ambient Temperature	-20°C	60°C	-30°C	70°C
Humidity	40°C 90%RH		40°C 90%RH	
Corrosive gas	Not Acceptable		Not Acceptable	

### 3 Electrical Characteristics

#### 3.1 DC Electrical Characteristics

(Ta= -20C to 50C)

<i>Item</i>	<i>Symbol</i>	<i>Condition</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
Power supply voltage	VDD		4.5		5.5	V
Brightness control voltage	VBT			3		V
Power supply current	Icc	VDD=5V, (Logical only)		0.35	0.6	mA
High level input voltage	Vih		0.7VDD		VDD	V
Low level input voltage	Vil		-0.3		0.55	V
Leakage current	II		-1		1	uA

#### 3.2 AC Electrical Characteristics

(Ta= -20C to 50C)

Write operation

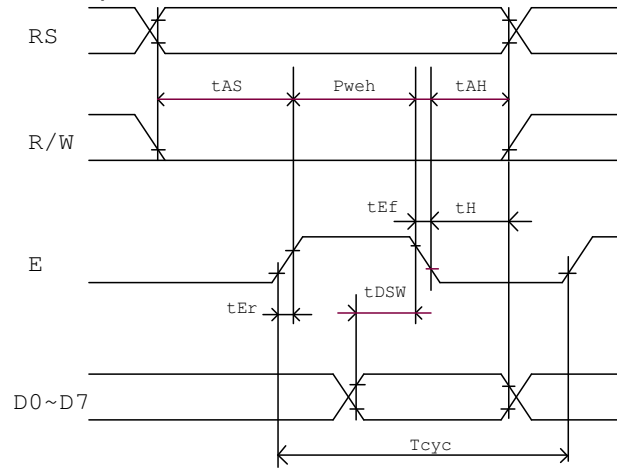
<i>Item</i>	<i>Symbol</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
Enable Cycle Time	Tcyc	500			ns
Enable Pulse Width (High level)	Pweh	230			ns
Enable Rise/ Fall Time	tEf, tEr			20	ns
Address Set-up Time	tAS	40			ns
Address Hold Time	tAH	10			ns
Data Set-up Time	tDSW	80			ns
Data Hold Time	tH	10			ns

Read operation

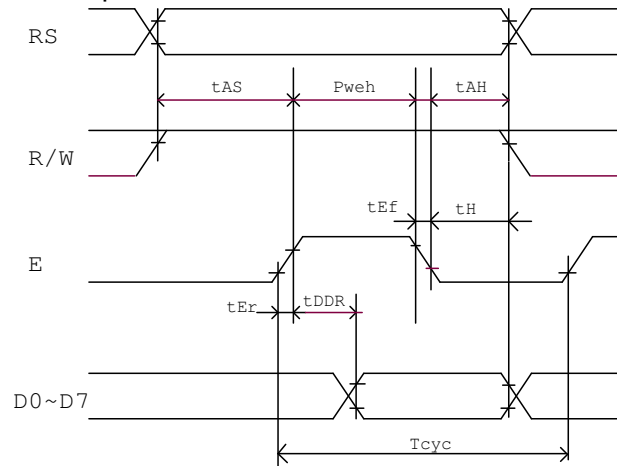
<i>Item</i>	<i>Symbol</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
Enable Cycle Time	Tcyc	500			ns
Enable Pulse Width (High level)	Pweh	230			ns
Enable Rise/ Fall Time	tEf, tEr			20	ns
Address Set-up Time	tAS	40			ns
Address Hold Time	tAH	10			ns
Data Delay Time	tDDR			160	ns
Data Hold Time	tH	5			ns

### 3.3 Timing Chart

#### Write operation



#### Read operation



### 3.4 Display Data RAM (DDRAM)

The Display Data RAM (DDRAM) is used to store the Display Data that is represented as 8-bit character code. The Display Data RAM supports an extended capacity of 80 x 8-bits or 80 characters.

DDRAM	00	01	02	03	04	05	.....	22	23	24	25	26	27
Address (Hex)	40	41	42	43	44	45	.....	62	63	64	65	66	67

To illustrate, for 2-line x 20 characters display, the relationship between the DDRAM address and position of the PLED panel is shown below.

Display Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
DDRAM	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13
Address	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	50	51	52	53

For shift left

DDRAM	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13	14
Address	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	50	51	52	53	54

For shift right

DDRAM	27	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	50	51	52
Address	67	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	50	51	52	53

### 3.5 Correspondence between character codes and char patterns Standard Font Table

CODE POINT HEX	CODE POINT DEC	CODE POINT HEX	CODE POINT DEC	CODE POINT HEX	CODE POINT DEC	CODE POINT HEX	CODE POINT DEC	CODE POINT HEX	CODE POINT DEC	CODE POINT HEX	CODE POINT DEC	CODE POINT HEX	CODE POINT DEC	CODE POINT HEX	CODE POINT DEC	CODE POINT HEX	CODE POINT DEC
0000	0	0001	1	0010	2	0011	3	0014	4	0015	5	0016	6	0017	7	0018	8
0001	1	0002	2	0003	3	0004	4	0005	5	0006	6	0007	7	0008	8	0009	9
000A	10	000B	11	000C	12	000D	13	000E	14	000F	15	0010	16	0011	17	0012	18
0013	19	0014	20	0015	21	0016	22	0017	23	0018	24	0019	25	001A	26	001B	27
001C	28	001D	29	001E	30	001F	31	0020	32	0021	33	0022	34	0023	35	0024	36
0025	37	0026	38	0027	39	0028	40	0029	41	002A	42	002B	43	002C	44	002D	45
002E	46	002F	47	0030	48	0031	49	0032	50	0033	51	0034	52	0035	53	0036	54
0037	55	0038	56	0039	57	003A	58	003B	59	003C	60	003D	61	003E	62	003F	63
0040	64	0041	65	0042	66	0043	67	0044	68	0045	69	0046	70	0047	71	0048	72
0049	73	004A	74	004B	75	004C	76	004D	77	004E	78	004F	79	0050	80	0051	81
0052	82	0053	83	0054	84	0055	85	0056	86	0057	87	0058	88	0059	89	005A	90
005B	91	005C	92	005D	93	005E	94	005F	95	0060	96	0061	97	0062	98	0063	99
0064	100	0065	101	0066	102	0067	103	0068	104	0069	105	006A	106	006B	107	006C	108
006D	109	006E	110	006F	111	0070	112	0071	113	0072	114	0073	115	0074	116	0075	117
0076	118	0077	119	0078	120	0079	121	007A	122	007B	123	007C	124	007D	125	007E	126
007F	127	0080	128	0081	129	0082	130	0083	131	0084	132	0085	133	0086	134	0087	135
0088	136	0089	137	008A	138	008B	139	008C	140	008D	141	008E	142	008F	143	0090	144
0091	145	0092	146	0093	147	0094	148	0095	149	0096	150	0097	151	0098	152	0099	153
009A	154	009B	155	009C	156	009D	157	009E	158	009F	159	00A0	160	00A1	161	00A2	162
00A3	163	00A4	164	00A5	165	00A6	166	00A7	167	00A8	168	00A9	169	00AA	170	00AB	171
00AC	172	00AD	173	00AE	174	00AF	175	00B0	176	00B1	177	00B2	178	00B3	179	00B4	180
00B5	181	00B6	182	00B7	183	00B8	184	00B9	185	00BA	186	00BB	187	00BC	188	00BD	189
00BE	190	00BF	191	00C0	192	00C1	193	00C2	194	00C3	195	00C4	196	00C5	197	00C6	198
00C7	199	00C8	200	00C9	201	00CA	202	00CB	203	00CC	204	00CD	205	00CE	206	00CF	207
00D0	208	00D1	209	00D2	210	00D3	211	00D4	212	00D5	213	00D6	214	00D7	215	00D8	216
00D9	217	00DA	218	00DB	219	00DC	220	00DD	221	00DE	222	00DF	223	00E0	224	00E1	225
00E2	226	00E3	227	00E4	228	00E5	229	00E6	230	00E7	231	00E8	232	00E9	233	00EA	234
00EB	235	00EC	236	00ED	237	00EE	238	00EF	239	00F0	240	00F1	241	00F2	242	00F3	243
00F4	244	00F5	245	00F6	246	00F7	247	00F8	248	00F9	249	00FA	250	00FB	251	00FC	252
00FD	253	00FE	254	00FF	255	0100	256	0101	257	0102	258	0103	259	0104	260	0105	261
0106	262	0107	263	0108	264	0109	265	010A	266	010B	267	010C	268	010D	269	010E	270
010F	271	0110	272	0111	273	0112	274	0113	275	0114	276	0115	277	0116	278	0117	279
0118	280	0119	281	011A	282	011B	283	011C	284	011D	285	011E	286	011F	287	0120	288
0121	289	0122	290	0123	291	0124	292	0125	293	0126	294	0127	295	0128	296	0129	297
012A	298	012B	299	012C	300	012D	301	012E	302	012F	303	0130	304	0131	305	0132	306
0133	307	0134	308	0135	309	0136	310	0137	311	0138	312	0139	313	013A	314	013B	315
013C	316	013D	317	013E	318	013F	319	0140	320	0141	321	0142	322	0143	323	0144	324
0145	325	0146	326	0147	327	0148	328	0149	329	014A	330	014B	331	014C	332	014D	333
014E	334	014F	335	0150	336	0151	337	0152	338	0153	339	0154	340	0155	341	0156	342
0157	343	0158	344	0159	345	015A	346	015B	347	015C	348	015D	349	015E	350	015F	351
0160	352	0161	353	0162	354	0163	355	0164	356	0165	357	0166	358	0167	359	0168	360
0169	361	016A	362	016B	363	016C	364	016D	365	016E	366	016F	367	0170	368	0171	369
0172	370	0173	371	0174	372	0175	373	0176	374	0177	375	0178	376	0179	377	017A	378
017B	379	017C	380	017D	381	017E	382	017F	383	0180	384	0181	385	0182	386	0183	387
0184	388	0185	389	0186	390	0187	391	0188	392	0189	393	018A	394	018B	395	018C	396
018D	397	018E	398	018F	399	0190	400	0191	401	0192	402	0193	403	0194	404	0195	405
0196	406	0197	407	0198	408	0199	409	019A	410	019B	411	019C	412	019D	413	019E	414
019F	415	01A0	416	01A1	417	01A2	418	01A3	419	01A4	420	01A5	421	01A6	422	01A7	423
01A8	424	01A9	425	01AA	426	01AB	427	01AC	428	01AD	429	01AE	430	01AF	431	01B0	432
01B1	433	01B2	434	01B3	435	01B4	436	01B5	437	01B6	438	01B7	439	01B8	440	01B9	441
01BA	442	01BB	443	01BC	444	01BD	445	01BE	446	01BF	447	01C0	448	01C1	449	01C2	450
01C3	451	01C4	452	01C5	453	01C6	454	01C7	455	01C8	456	01C9	457	01CA	458	01CB	459
01CC	460	01CD	461	01CE	462	01CF	463	01D0	464	01D1	465	01D2	466	01D3	467	01D4	468
01D5	469	01D6	470	01D7	471	01D8	472	01D9	473	01DA	474	01DB	475	01DC	476	01DD	477
01DE	478	01DF	479	01E0	480	01E1	481	01E2	482	01E3	483	01E4	484	01E5	485	01E6	486
01E7	487	01E8	488	01E9	489	01EA	490	01EB	491	01EC	492	01ED	493	01EE	494	01EF	495
01F0	496	01F1	497	01F2	498	01F3	499	01F4	500	01F5	501	01F6	502	01F7	503	01F8	504
01F9	505	01FA	506	01FB	507	01FC	508	01FD	509	01FE	510	01FF	511	0200	512	0201	513
0202	514	0203	515	0204	516	0205	517	0206	518	0207	519	0208	520	0209	521	020A	522
020B	523	020C	524	020D	525	020E	526	020F	527	0210	528	0211	529	0212	530	0213	531
0214	532	0215	533	0216	534	0217	535	0218	536	0219	537	021A	538	021B	539	021C	540
021D	541	021E	542	021F	543	0220	544	0221	545	0222	546	0223	547	0224	548	0225	549
0226	550	0227	551	0228	552	0229	553	022A	554	022B	555	022C	556	022D	557	022E	558
022F	559	0230	560	0231	561	0232	562	0233	563	0234	564	0235	565	0236	566	0237	567
0238	568	0239	569	023A	570	023B	571	023C	572	023D	573	023E	574	023F	575	0240	576
0241	577	0242	578	0243	579	0244	580	0245	581	0246	582	0247	583	0248	584	0249	585
024A	586	024B	587	024C	588	024D	589	024E	590	024F	591	0250	592	0251	593	0252	594
0253	595	0254	596	0255	597	0256	598	0257	599	0258	600	0259	601	025A	602	025B	603
025C	604	025D	605	025E	606	025F	607	0260	608	0261	609	0262</					

Optional Cyrillic Font Table

Upper 4 bit Lower 4 bit	LLLL	LLHH	LLHL	LLHH	LHLL	LHHH	LHHL	LHHH	HLLL	HLLH	HLLH	HLLH	HLLH	HLLH	HLLH	HLLH
LLLL	CG RAM (1)			00P' P								00P' P				
LLHH	CG RAM (2)		!	1A0a a								1A0a a				
LLHL	CG RAM (3)		"	2B Rb r								2B Rb r				
LLHH	CG RAM (4)		#	3C Sc s								3C Sc s				
LHLL	CG RAM (5)		\$	4D Td t								4D Td t				
LHLH	CG RAM (6)		%	5E Ue u								5E Ue u				
LHHL	CG RAM (7)		&	6F Vv v								6F Vv v				
LHHH	CG RAM (8)		'	7G Ww w								7G Ww w				
HLLL	CG RAM (9)		(	8H Xh x								8H Xh x				
HLLH	CG RAM (2)		)	9I Yy y								9I Yy y				
HLHL	CG RAM (3)		*	# J Zz z								# J Zz z				
HLHH	CG RAM (4)		+	# K K k								# K K k				
HHLL	CG RAM (5)		,	< L l l								< L l l				
HHLH	CG RAM (6)		-	= M m m								= M m m				
HHHL	CG RAM (7)		.	> N n n								> N n n				
HHHH	CG RAM (8)		/	? O o o								? O o o				

### 3.6 Instruction set

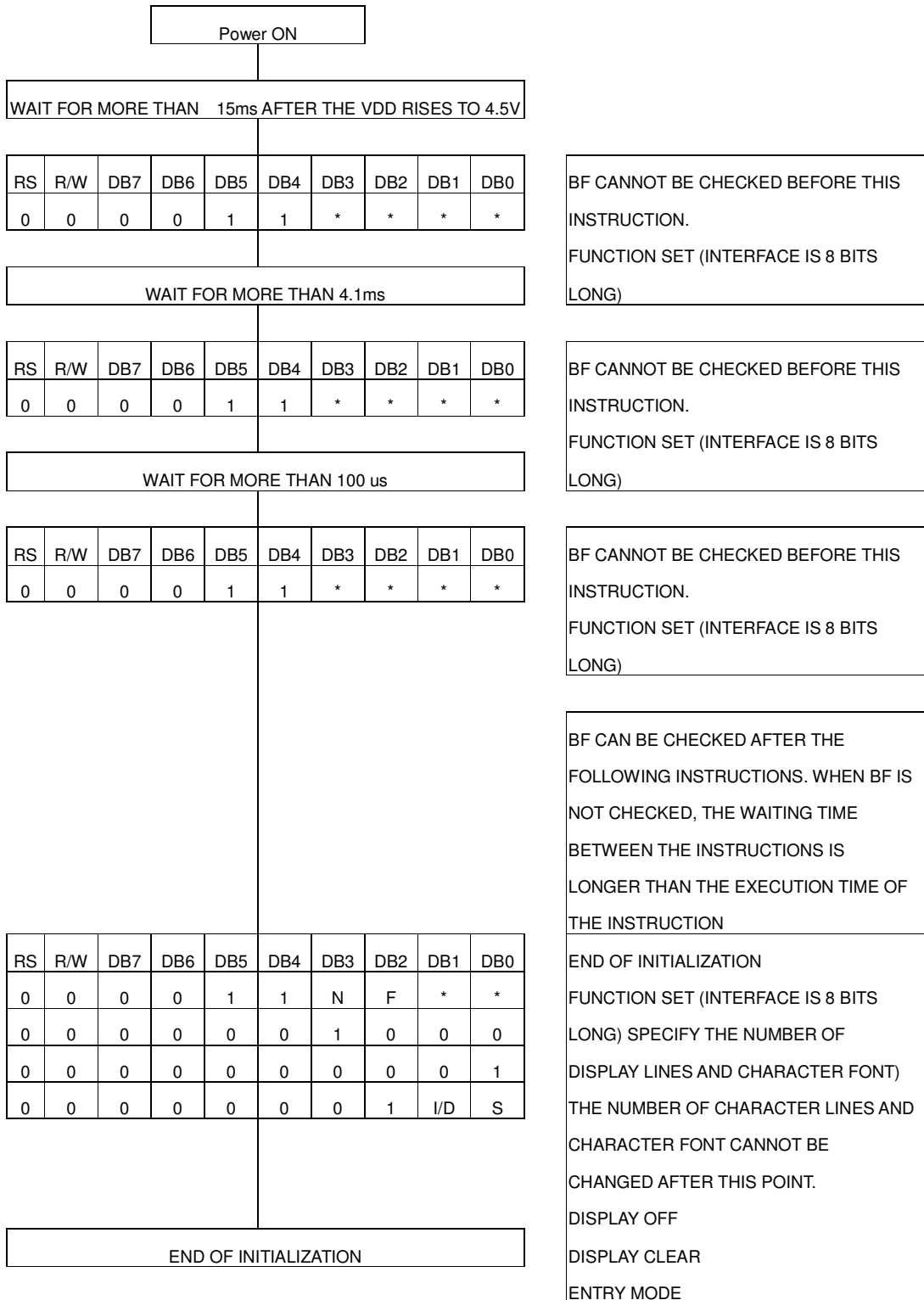
Instruction	Code										Description	Execution time
	RS	R/W	D7	D6	D5	D4	D3	D2	D1	D0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Clear entire display. Sets DDRAM address 0 into address counter	1.52ms
Entry mode set	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction and specifies display shift	37us
Display On/Off control	0	0	0	0	0	0	1	D	C	B	Sets entire display (D) On/Off Sets cursor (C) On/Off Sets Blinking (B) of cursor position character	37us
Cursor/display shift	0	0	0	0	0	1	S/C	R/L	X	X	Moves cursor & shifts display without changing DDRAM contents	37us
Function set	0	0	0	0	1	DL	N	F	X	X	Sets interface data length (DL) Sets number of display lines (N) Sets character font (F)	37us
Set CGRAM address	0	0	0	1	ACG	ACG	ACG	ACG	ACG	ACG	Sets CGRAM address. CGRAM data is sent and received after this setting.	37us
Set DDRAM address	0	0	1	ADD	ADD	ADD	ADD	ADD	ADD	ADD	Sets DDRAM address. The DDRAM data bus sent and received after this setting	37us
Read busy flag & address	0	1	BF	AC	AC	AC	AC	AC	AC	AC	Reads busy flag (BF) indicating that internal operation is being performed Reads address counter contents	0us
Write data into the CGRAM or DDRAM	1	0	Write data							Write data into the CGRAM or DDRAM		37us
Read data into the CGRAM or DDRAM	1	1	Read data							Read data from the CGRAM or DDRAM		37us
	I/D = 1: Increment                      I/F=0:Decrement S = 1: Display shift on D = 1: Display on C = 1: Cursor display on B = 1: Cursor blink on S/C = 1: Shift display                  S/C=0: Move cursor R/L = 1: Shift right                    R/L=0:Shift left DL = 1: 8-bit                              DL=0:4-bit N = 1: Dual line                          N =0:Single line F = 1:5x10 dots                          F =0:5x8 dots BF = 1:Internal operation BF =0:Ready for instruction										DDRAM: Display Data RAM CGRAM: Character Generator RAM ACG: Character Generator RAM Address ADD: Display Data RAM Address AC: Address Counter	



### 3.7 Initialization via Instruction

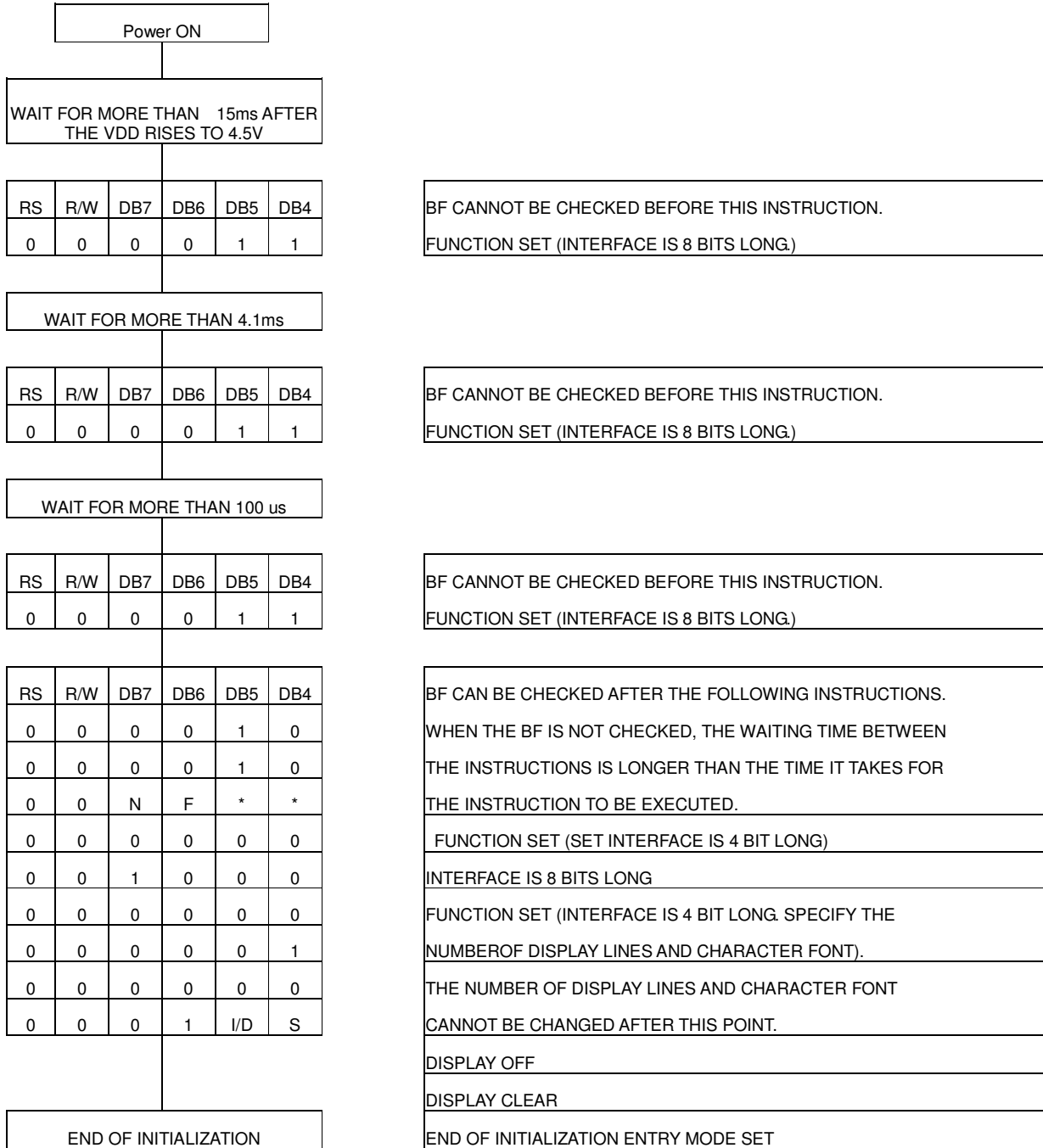
#### 8-BIT INTERFACE

The following procedures are followed during the initialization of an 8-bit MPU

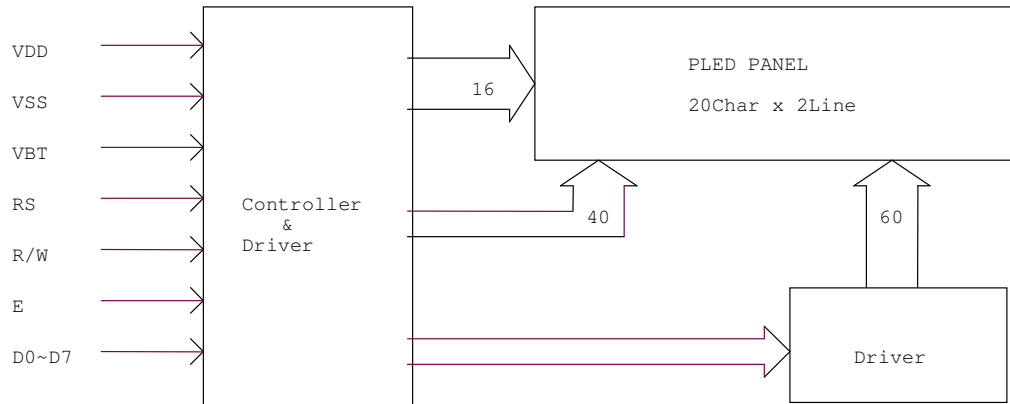


## 4-BIT INTERFACE

The following procedures are followed during the initialization of a 4-bit MPU



### 3.8 Block Diagram



### 4 Interface Pin Function

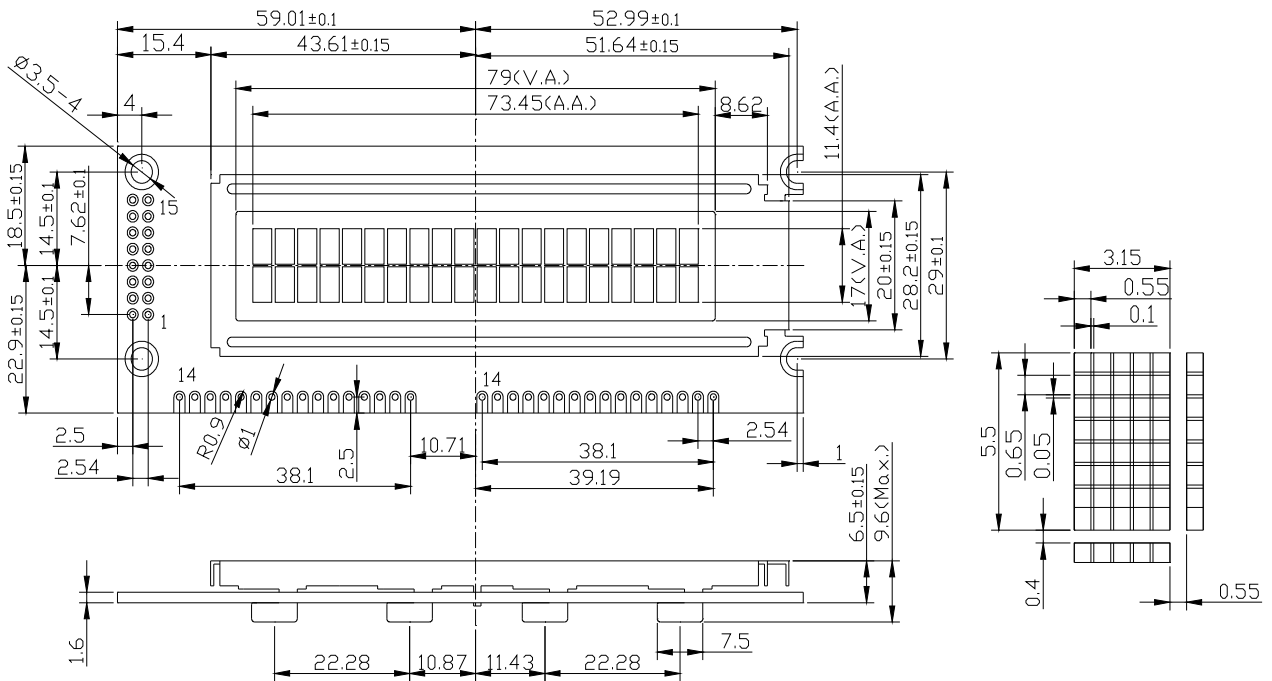
Pin No.	Symbol	I/O	Function
1	VSS	I	Ground
2	VDD	I	Power supply for logic
3	VBT	I	Brightness adjustment
4	RS	I	H: Data L: Instruction code
5	R/W	I	H: Read L: Write
6	E	I	H→L: Enable
7	D0	I	Data bus
8	D1	I	
9	D2	I	
10	D3	I	
11	D4	I	
12	D5	I	
13	D6	I	
14	D7	I	

## 6 Physical specifications

### 6.1 Mechanical specifications

NO.	Item	Specification	Unit
1	Active display area	73.45x11.4	mm
2	Viewing area	79.0x17.0	mm
3	Module dimension	113.0x41.4x9.6	mm
4	Dot size	0.5x0.65	mm
5	Weight	34	g

### 6.2 Drawing



## 7 Optical specifications

Item	Condition	Min.	Typ.	Max.	Unit
Response time	Rise	-	-	10	us
	Fall	-	-	10	us
Contrast ratio	100 lux	100	-	-	
Viewing angle	Top	-	80	-	deg
	Bottom	-	80	-	deg
	Left	-	80	-	deg
	right	-	80	-	deg
Brightness	With polarizer	30	40	50	nits
Color		-	YG <sup>1</sup>	-	

Note 1. YG.= yellow green



## (2) Ref. Programming

```
-----
'It is an OSD2002-2 pattern program and shows A,B,C....on module.
'Here use BASCOM-AVR compile.
-----
' Project name   : 20x2 character module
' file name      : demo2002.bas
' MCU           : AVR AT90S8515
' Xtal          : 8MHz
' Panel I/F     : RS, RW, Enable, BTV
' Writer        : Cheng-Nan Yeh
' Date          : Dec.26, 2002 rev:A
-----
' DB0=PA0: DB1=PA1: DB2=PA2: DB3=PA3
' DB4=PA4: DB5=PA5: DB6=PA6: DB7=PA7
' RS=PB2: RW=PB1: Enable=PB0
-----
'-----initial setting
$regfile = "8515DEF.DAT"
Config Porta = Output
Config Portb = Output
Dim J As Integer , Cara As Byte , I As Byte
Dim Command_diable As Byte, Command_enable As Byte
Dim Command_write_data As Byte , Command_clear_display As Byte
Dim Command_move_right As Byte , Command_display_on As Byte
Dim Command_line2_char5x7 As Byte , Command_ddram_&H00 As Byte
Dim Command_ddram_&H40 As Byte , Write_char As Byte
'-----
Command_diable = &H00
Command_enable = &H01
Command_clear_display = &H01
Command_move_right = &H1D
Command_display_on = &H0C
Command_line2_char5x7 = &H38
Command_ddram_&H00 = &H80
Command_ddram_&H40 = &HC0
Command_write_data = &H05
Write_char = &H40
'-----
C = 1
I = 0
'-----clear module display and cursor back home
Portb = Command_enable           'RS=0, RW=0, Enable=1
Porta = Command_clear_display
Waitus 500                       'wait 500uS for MCU internal delay time
Portb = Command_diable           'You need to set PB0=0 after PB0=1 for MCU.
'-----setting S/C, R/L, I/D, S
Portb = Command_enable
Porta = Command_move_right       'S/C=1 ,R/L=1 ,I/D=0, S=1
Waitus 500
Portb = Command_diable
'-----display on / off
Portb = Command_enable
Porta = Command_display_on       'D=1, C=0, B=0
Waitus 500
Portb = Command_diable
'-----setting 5x7 Char. 2-Line
Portb = Command_enable
Porta = Command_line2_char5x7    'DL=1, N=1, F=0
Waitus 500
Portb = Command_diable
```

```

'-----
"-----fill in any data to module
"-----setting DDRAM address &H00
For J = 1 To 20 Step 1
Portb = Command_enable
Porta = Command_ddram_&H00 + I           'set address is &H00
Waitms 10                               'and next one
Portb = Command_diabale
'-----write data up
Portb = Command_write_data
Porta = Write_char + C                   'write Char. is "A" and next one.
Waitms 10
Portb = Command_diabale
Cara = Cara + 1
'-----setting DDRAM address &H40
Portb = Command_enable
Porta = Command_ddram_&H40 + I         'set address is &H40
Waitms 10                               'and next one
Portb = Command_diabale
'-----write data down
Portb = Command_write_data
Porta = Write_char + C                   'write Char. is "B" and next one.
Waitms 10
Portb = Command_diabale
'-----
C = C + 1
I = I + 1
If I = 20 Then I = 0                       'if DDRAM address is end then come back &H00.
If C = 40 Then C = 0
Next J
'-----end program
End

```

**Download free BASCOM-AVR DEMO compiler from <http://www.mcselec.com/>**

## **10 Precaution in Design**

- (1) Please do not put mechanical stress on the module. Mechanical stress will cause damage to the metal, plastic, and PLED panel.
- (2) The polarizer is easily scratched and should be carefully handled. Please do not touch the polarizer with hard materials, such as tweezers, pencil lead and glass. Please do not touch it by.
- (3) This module is easily damaged by static discharge, please be cautious of static electricity and insure human body grounding.
- (4) The Half-Brightness Decay Life will be longer than 10K hours when the module is operated at room temp.