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OLED-DISPLAYS
INCL. CONTROLLER 8-BIT AND 4-BIT

OLED										
Part-Number	Row x Column	Char height	Module size			Viewing Area		Accessories (Frames)	Hints	Drawing page
			B	H	T	B	H			
EA W082-XLG	2x8	5.5	58.0	32.0	10.0	38.0	16.0	---	yellow/green	7
EA W162-X3LW	2x16	5.5	80.0	36.0	10.0	66.0	16.0	EA 017-2U	icewhite	7
EA W162-X3LG	2x16	5.5						EA 017-2U	yellow/green	7
EA W162-X9LG	2x16	5.5	85.0	36.0	10.0	66.0	16.0	EA 017-2U	yellow/green	8
EA W162-XLG	2x16	5.5	84.0	44.0	10.0	66.0	16.0	EA 017-2U	yellow/green	8
EA W162-XBLW	2x16	8.9	122.0	55.0	10.0	99.0	24.0	EA 017-12U	icewhite	9
EA W162-XBLG	2x16	8.9						EA 017-12U	yellow/green	9
EA W202-XLG	2x20	5.5	116.0	37.0	9.8	85.0	18.6	EA 017-7U	yellow/green	9
EA W204-XLG	4x20	5.5	98.0	60.0	10.0	70.0	25.2	EA 017-9U	yellow/green	10

TECHNICAL DATA

* INTEGRATED CONTROLLER (HD44780-LIKE)
* INPUT 4- OR 8-BIT DATA-BUS, 3 CONTROL-WIRES(R/W, E, RS)
* ASCII-CHAR SET AND SPECIAL SYMBOLS STORED IN CHARACTER-ROM
* UP TO 8 CHARACTERS (ASCII-CODE 0..7) CAN BE DEFINIED BY USER
* DIFFERENT FUNCTIONS WITH ONE INSTRUCTION:
  - CLEAR DISPLAY, CURSOR HOME, CURSOR ON/OFF, BLINKING CURSOR
  - SHIFT DISPLAY, SHIFT CURSOR, READ/WRITE DISPLAY DATA, ETC.
* SIMPLE SUPPLY (3.3..5V).
* LOW POWER CONSUMPTION (15..50 mA)
* OPERATING TEMPERATURE -40..+80°C
* 3 INTEGRATED FONTS

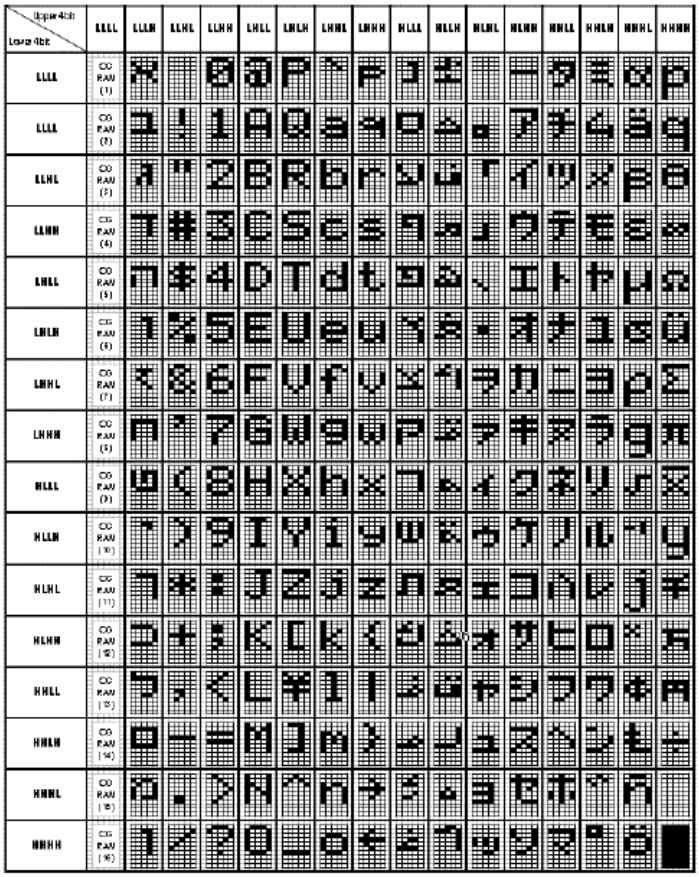
ACCESSORIES

* FRAMES (SEE TABLE)

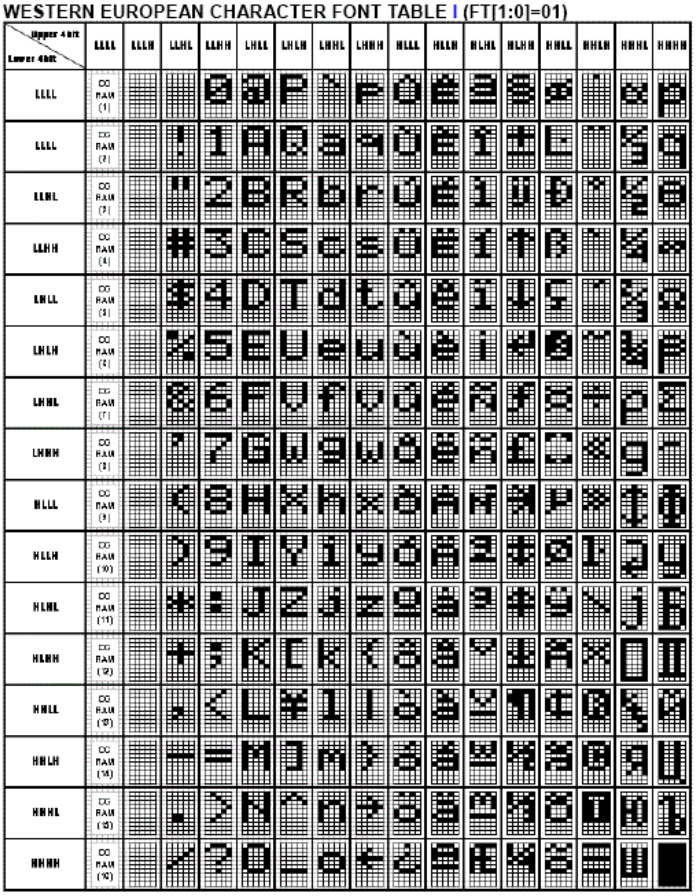
Specifications may be changed without prior notice. Printing error reserverd

CHARACTER SET

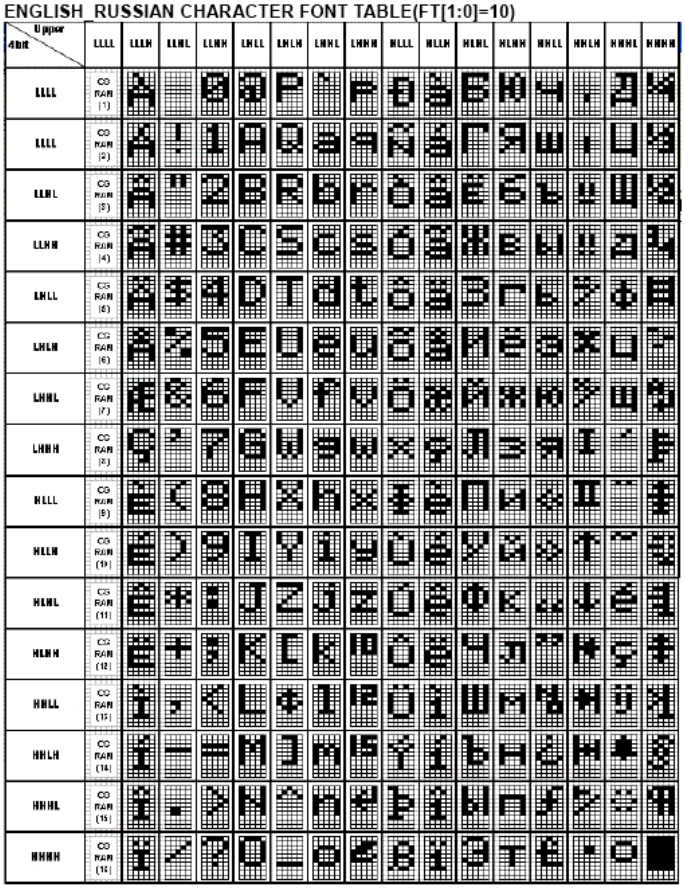
ENGLISH_JAPANESE CHARACTER FONT TABLE(default FT[1:0]= 00)



WESTERN EUROPEAN CHARACTER FONT TABLE I (FT[1:0]=01)



ENGLISH_RUSSIAN CHARACTER FONT TABLE(FT[1:0]=10)



It is possible to choose one of the shown char sets. The English/Japanese char set is setted by default . You have to set the bits FT1/FT0 of function set register:

FT 1	FT 0	Description
0	0	Englisch Japanese character font table
0	1	Western European character font table
1	0	English Russian character font table
1	1	not available

It must be noted that the character font setting must be performed at the head of the program before executing any instructions other than the Busy Flag and Address Instruction. Otherwise, the Function Set Instruction cannot be executed unless the interface data length is changed.

SELF DEFINIED CHARACTER

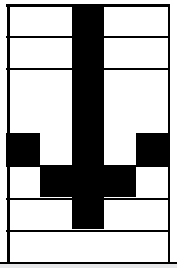
All these character display modules got the feature to create 8 own characters (ASCII Codes 0..7) in addition to the ROM fixed codes.

1.) The command „CG RAM Address Set“ defines the ASCII code (Bit 3,4,5) and the dot line (Bit 0,1,2) of the new character. Example demonstrates creating ASCII code $00.

2.) Doing 8 times the write command „Data Write“ defines line by line the new character. 8th. byte stands for the cursor line.

3.) The new defined character can be used as a „normal“ ASCII code (0..7); use with „DD RAM Address Set“ and „Data Write“.

Adresse im CG RAM setzen				Daten des Zeichens								
Adresse			Hex	Bit								Hex
				7	6	5	4	3	2	1	0	
0 1	0 0 0	0 0 0	$40	X	X	X	0	0	1	0	0	$04
		0 0 1	$41				0	0	1	0	0	$04
		0 1 0	$42				0	0	1	0	0	$04
		0 1 1	$43				0	0	1	0	0	$04
		1 0 0	$44				1	0	1	0	1	$15
		1 0 1	$45				0	1	1	1	0	$0E
		1 1 0	$46				0	0	1	0	0	$04
		1 1 1	$47				0	0	0	0	0	$00



PINOUT

PIN	SYMBOL	Level	DESCRIPTION	
			8 BIT-Mode	4 BIT-Mode
1	GND	L (0V)	Ground	Ground
2	VCC	H (5V)	Supply Voltage	Supply Voltage
3	N.C.	---	not connected	not connected
4	RS	H/L	H: Data, L: Instruction code	H: Data, L: Instruction code
5	R/W	H/L	H: Read, L: Write	H: Read, L: Write
6	E	H, H->L	Enable	Enable
7	DB0	H/L	Data bit 0 (LSB)	Do not connect
8	DB1	H/L	Data bit 1	Do not connect
9	DB2	H/L	Data bit 2	Do not connect
10	DB3	H/L	Data bit 3	Do not connect
11	DB4	H/L	Data bit 4	Data bit 0 (LSB)
12	DB5	H/L	Data bit 5	Data bit 1
13	DB6	H/L	Data bit 6	Data bit 2
14	DB7	H/L	Data bit 7 (MSB)	Data bit 3 (MSB)
15	N.C.	---	not connected	not connected
16	N.C.	---	not connected	not connected

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INSTRUCTION SET

Instruction	Code										Description	Max. execution time when fsp or fosc=250KHz
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Clears entire Display, Sets DDRAM-address 0 into addresscounter	6.2ms
Return Home	0	0	0	0	0	0	0	0	1	0	Sets DDRAM-address 0 into addresscounter. Returns shifted display to original position. DDRAM contents remain unchanged.	0ms
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.)	0ms
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.	0ms
Cursor/Display Shift/Mode/Pwr	0	0	0	0	0	1	S/C	R/L	0	0	Moves cursor and shifts display without changing DDRAMcontents.	0ms
							G/C (0)	PWR	1	1	Sets Graphic/Character Mode Sets internal power on/off	0ms
Function Set	0	0	0	0	1	DL	N	F	FT1	FT0	Sets interface data length (DL). Sets number of display lines (N). Sets Character Font (F). Sets Font Table (FT).	0ms
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.	0ms
Set DDRAM Address	0	0	1	ADD	ADD	ADD	ADD	ADD	ADD	ADD	Sets DDRAM Address. The DDRAM data Is sent and received after this setting.	0ms
Read Busy Flag and 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.	0ms
Write data into the CGRAM or DDRAM	1	0	Write Data								Writes data into the CGRAM or DDRAM	0ms
Read data from the CGRAM or DDRAM	1	1	Read Data								Reads data from the CGRAM or DDRAM	0ms

Notes on the instruction set:

1. After the CGRAM/DDRAM Read or Write Instruction has been executed, the RAM Address Counter is incremented or decremented by 1. After the Busy Flag is turned OFF, the RAM Address is updated.
2. **I/D**=Increment/Decrement Bit
   - I/D="1": Increment
   - I/D="0": Decrement
3. **S**=Shift Entire Display Control Bit.
   - S="0", shift function disable.
   - S="1", shift function enable.
4. **BF**=Busy Flag
   - BF="1": Internal Operating in Progress
   - BF="0": No Internal Operation is being executed, next instruction can be accepted.
5. **R/L**=Shift Right/Left
   - R/L="1": Shift to the Right
   - R/L="0": Shift to the Left
6. **S/C**=Display Shift/Cursor Move
   - S/C="1": Display Shift
   - S/C="0": Cursor Move
7. **G/C**=Graphic/Character mode selection.
   - G/C="0", Character mode is selected.
   - G/C="1", Graphic mode is selected.
8. **PWR**=Internal DCDC on/of control.
   - PWR="1", DCDC on.
   - PWR="0", DCDC off.
9. **DDRAM**=Display Data RAM
10. **CGRAM**=Character Generator RAM
11. **ACG**=CGRAM Address
12. **ADD**=Address Counter Address (corresponds to cursor address)
13. **AC**=Address Counter (used for DDRAM and CGRAM Addresses)
14. **F**=Character Pattern Mode
    - F="1": 5 x 10 dots
    - F="0": 5 x 8 dots
15. **N**=Number of Lines Displayed
    - N="1": 2- and 4-Line Display
    - N="0": 1-Line Display

INITIALISATION EXAMPLES

Initialisation example: 8-Bit

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	HEX	Description
0	0	0	0	1	1	1	0	0	1	$39	Function Set, western european character set, 8-Bit
0	0	0	0	0	0	1	0	0	0	$08	Display off
0	0	0	0	0	0	0	1	1	0	$06	Entry mode set, increment cursor by 1 not shifting display
0	0	0	0	0	1	0	1	1	1	$17	Character mode and internel power on (have to turn on internel power to get the best brightness)
0	0	0	0	0	0	0	0	0	1	$01	Clear display
0	0	0	0	0	0	0	0	1	0	$02	Return home
0	0	0	0	0	0	1	1	0	0	$0C	Display on

```
void initDisplay (void)
{       RS_DD=1;      //RS Pin as output
        RW_DD=1;      //RW Pin as output
        EN_DD=1;      //EN Pin as output
        WriteIns(0x39); //function set european chararacter set
        WriteIns(0x08); //display off
        WriteIns(0x06); //entry mode set increment cursor by 1 not shifting display
        WriteIns(0x17); //Character mode and internel power on
        WriteIns(0x01); //clear display
        WriteIns(0x02); //return home
        WriteIns(0x0C); //display on
}
```

```
void WriteIns(char instruction)
{       DATA_PORT_DD=0xFF; //Dataport as Output
        RS = 0;
        RW = 0;
        DATA_PORT = instruction; //set Data on Outputport
        EN = 1;         //set Enable to high
        Wait(10);       //wait 1us (stabilize Outputport)
        EN = 0;         //reset Enable to low
        CheckBusy();
}
```

Initialisation example: 4-Bit

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	HEX	Description
0	0	0	0	1	0	1	0	0	0	$28	Function Set, English/Japanese char set, 4-Bit
0	0	0	0	0	0	1	0	0	0	$08	Display off
0	0	0	0	0	0	0	1	1	0	$06	Entry mode set, increment cursor by 1 not shifting display
0	0	0	0	0	1	0	1	1	1	$17	Character mode and internel power on (have to turn on internel power to get the best brightness)
0	0	0	0	0	0	0	0	0	1	$01	Clear display
0	0	0	0	0	0	0	0	1	0	$02	Return home
0	0	0	0	0	0	1	1	0	0	$0C	Display on

```
void initDisplay(void)
{       RS_DD=1; //RS-Pin as Output
        EN_DD=1; //EN-Pin as Output
        RW_DD=1; //RW-Pin as Output
        RS = 0;  //RS-Pin to low
        RW = 0; //RW-Pin to low
        EN = 0; //EN-Pin to low
        send_nibble(0x03); //Be sure to
        send_nibble(0x03); //be in
        send_nibble(0x03); //8-Bit-Mode
        send_nibble(0x02); //Switch to 4 Bit
        Wait(50); //Wait 5us
        WriteIns(0x28);//4-Bit-Mode
        WriteIns(0x08);//display off
        WriteIns(0x06);//entry mode set increment cursor by 1 not shifting display
        WriteIns(0x17);//Character mode and internel power on
        WriteIns(0x01);//clear display
        WriteIns(0x02);//return home
        WriteIns(0x0C); //display on
```

```
void send_nibble (char data)
{       DATA_PORT = data; //output data
        EN=1;
        Wait(10); //wait 1us (stabilize outupt)
        EN=0;
        Wait(10); //wait 1us (stabilize outupt)
}
```

```
void WriteIns(char instruction)
{       DATA_PORT_DD=0x0F; //Dataport as Output
        RS = 0;
        RW = 0;
        send_nibble((instruction&0xF0)>>4);//Highbyte
        send_nibble(instruction&0x0F); //Lowbyte
        CheckBusy();
}
```

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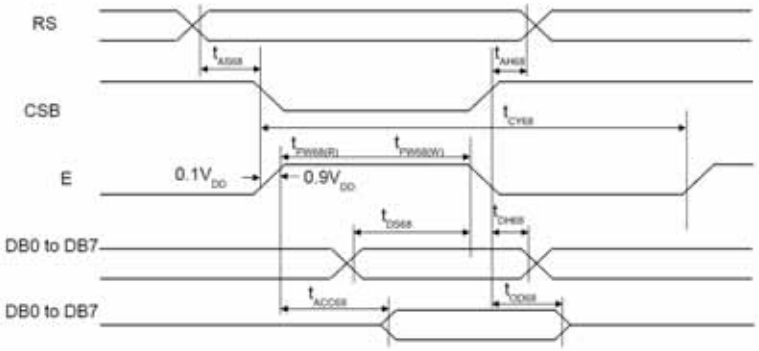
TIMING 8-BIT INTERFACE



(VDD = 3.0 to 5.3V, Ta = 25°C)

Item	Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Address setup time Address hold time	RS	tAS68 tAH68	20 0	-	-	ns	
System cycle time		tCY68	500	-	-	ns	
Pulse width (E)	E_RDB	tPW68(W)	250	-	-	ns	
Pulse width (E)	E_RDB	tPW68(R)	250	-	-	ns	
Data setup time Data hold time	DB7 to DB0	tDS68 tDH68	40 20	-	-	ns	
Read access time Output disable time		tACC68 tOD68	- 10	-	180 -	ns	CL = 100pF

ELECTRICAL CHARACTERISTICS

Item	Symbol	Test Condition	Standard Value			Unit
			min.	typ.	max	
Input "high" voltage	VIH	-	0.9 VDD	-	VDD	V
Input "low" voltage	VIL	-	GND	-	0.1 VDD	V
Output "high" voltage	VOH	IOH=-0.5mA	0.8 VDD	-	VDD	V
Output "low" voltage	VOL	IOL=0.5mA	GND	-	0.2 VDD	V
Power supply current	ICC	VDD=5V		15..50mA		A

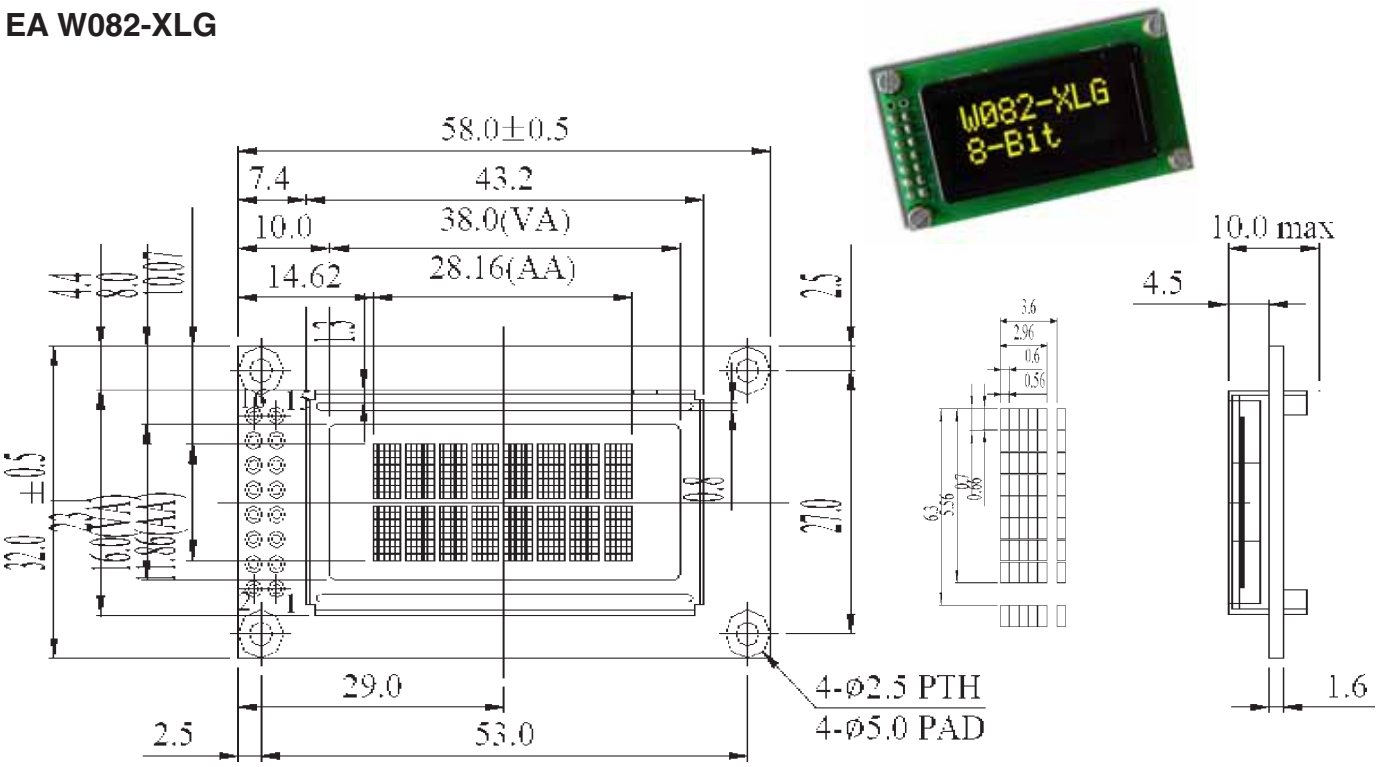
ABSOLUTE MAXIMUM RATINGS

VCC=5,0V , Ta=25°C

Item	Symbol	Standard Value		Unit
		min.	max	
Power supply voltage for logic	VDD-GND	-0.3	5.3	V
Input Voltage	VI	-0.3	VDD	V
Operating temperature	TOP	-40	80	°C
Storage Temperature	TST	-40	80	°C

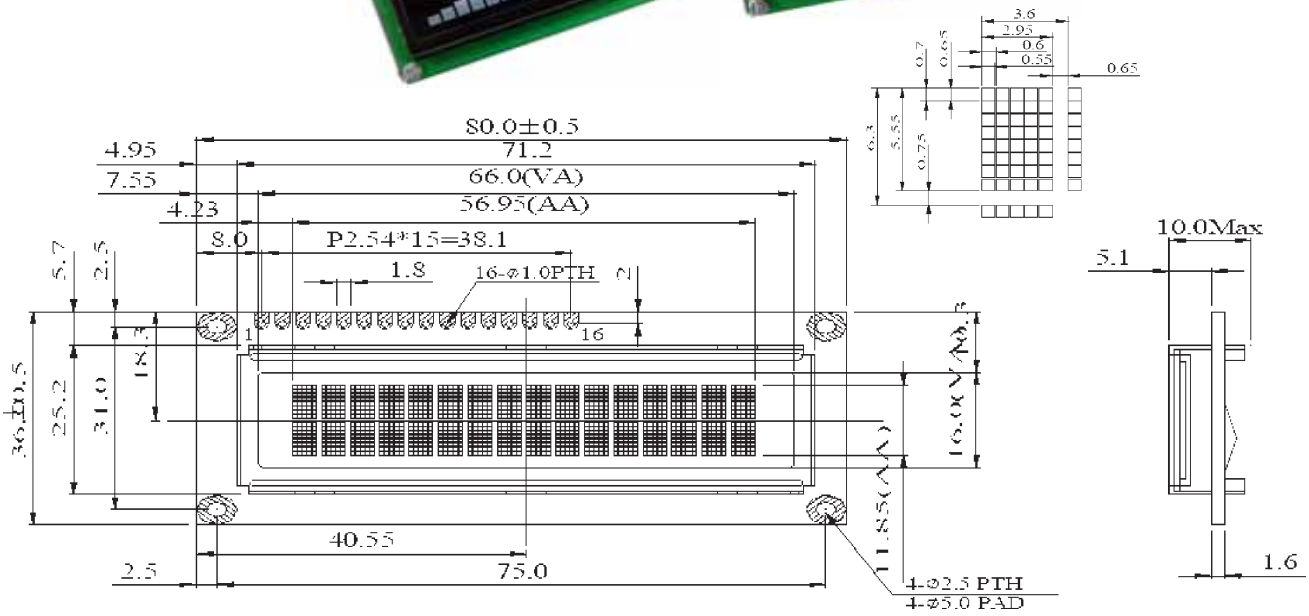
It must be noted:
Supplied with 3.3V reduces brightness compered to 5V

EA W082-XLG



EA W162-X3LW (ICEWHITE)
EA W162-X3LG (YELLOW/GREEN)

FRAME
EA 017-2U



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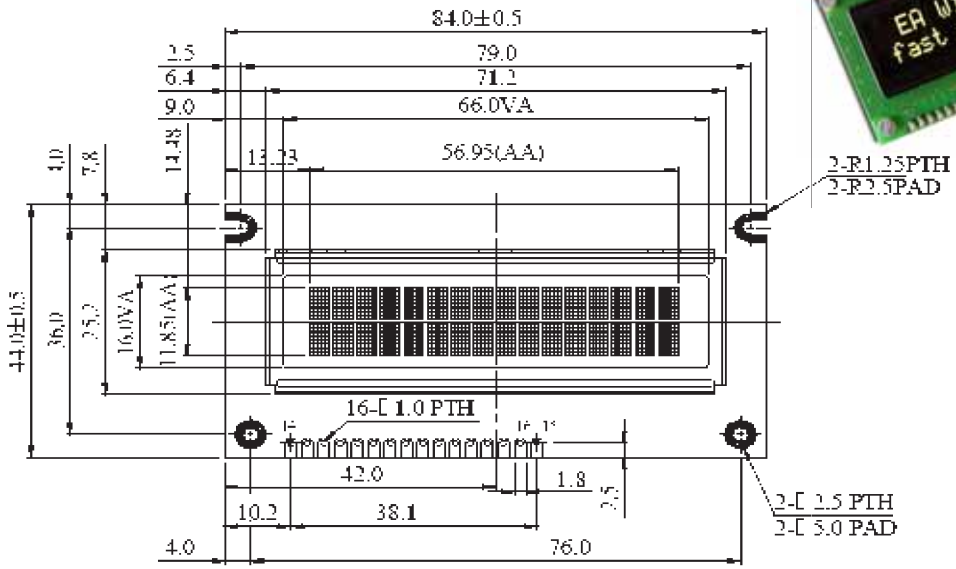
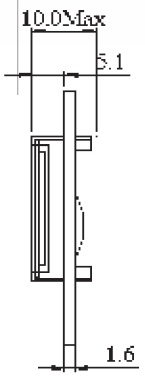
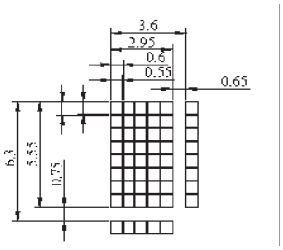
EA W162-XLW (ICEWHITE)
EA W162-XLG (YELLOW/GREEN)

FRAME
EA 017-2U

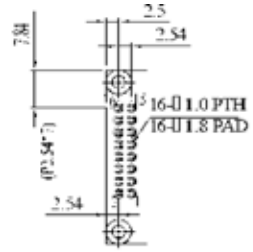


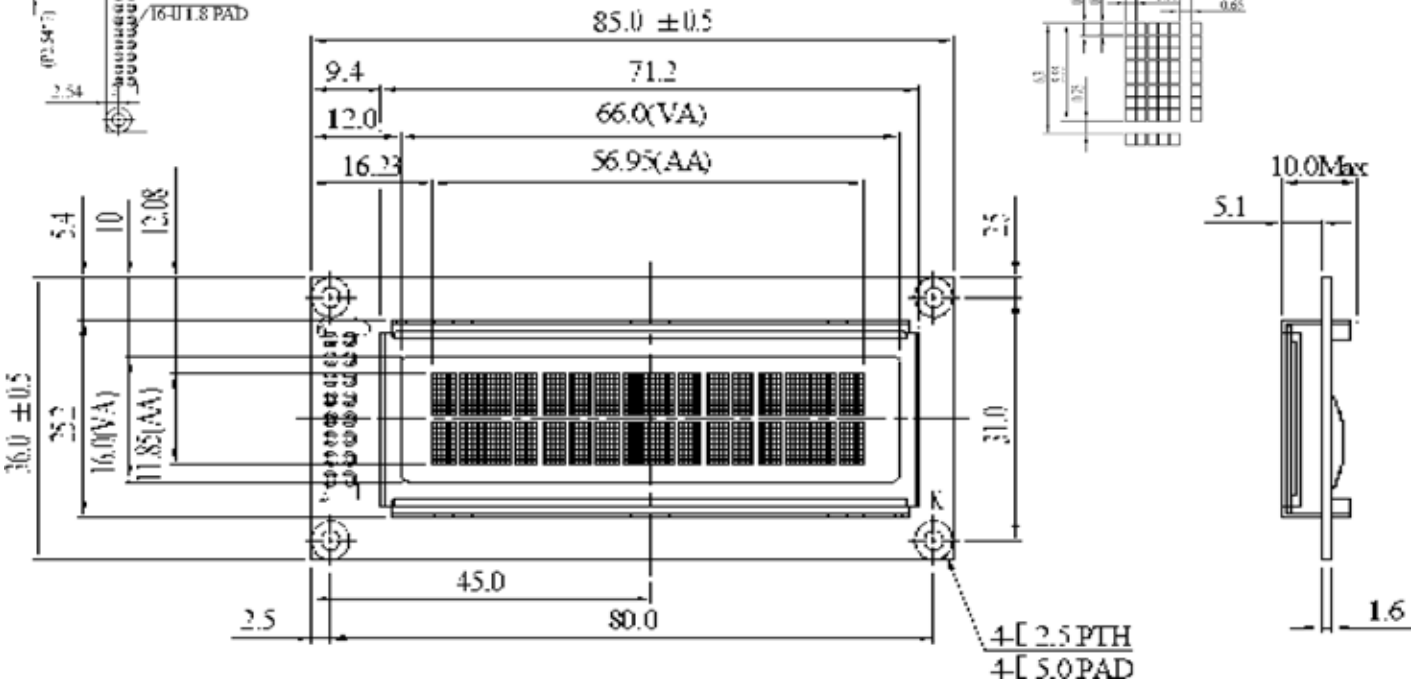


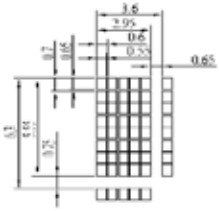


EA W162-X9LG

FRAME
EA 017-2U

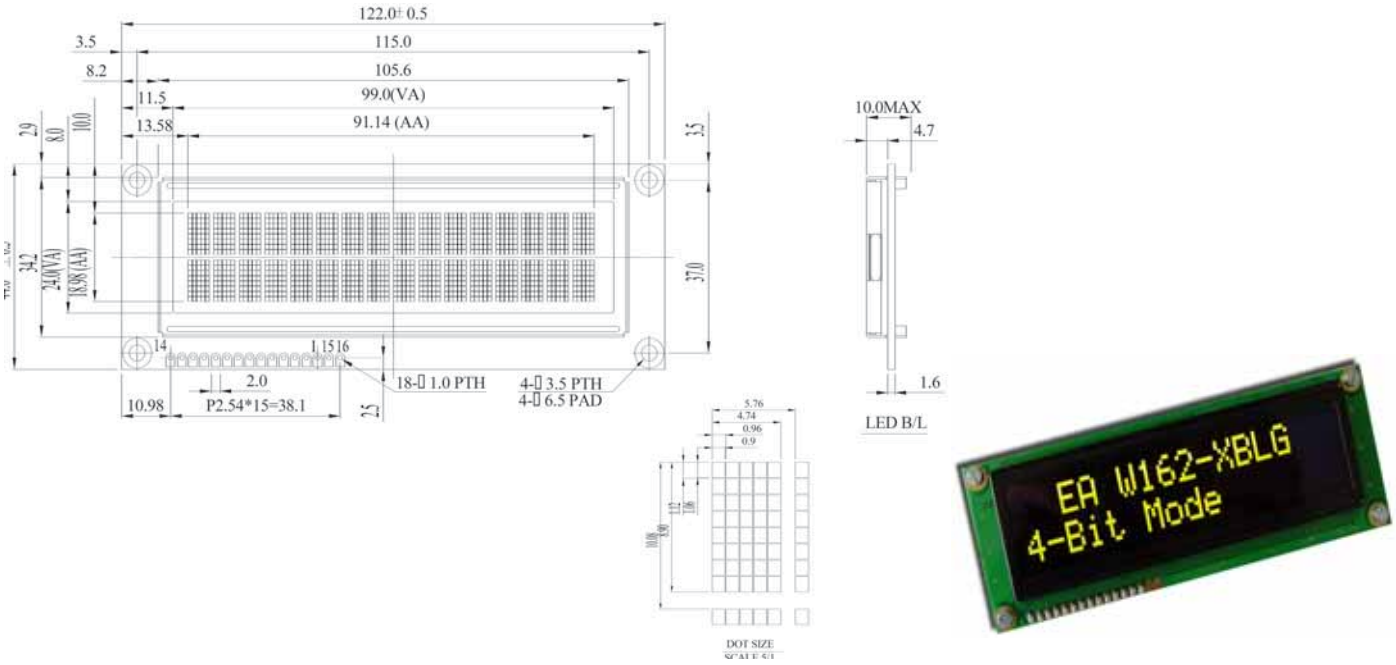






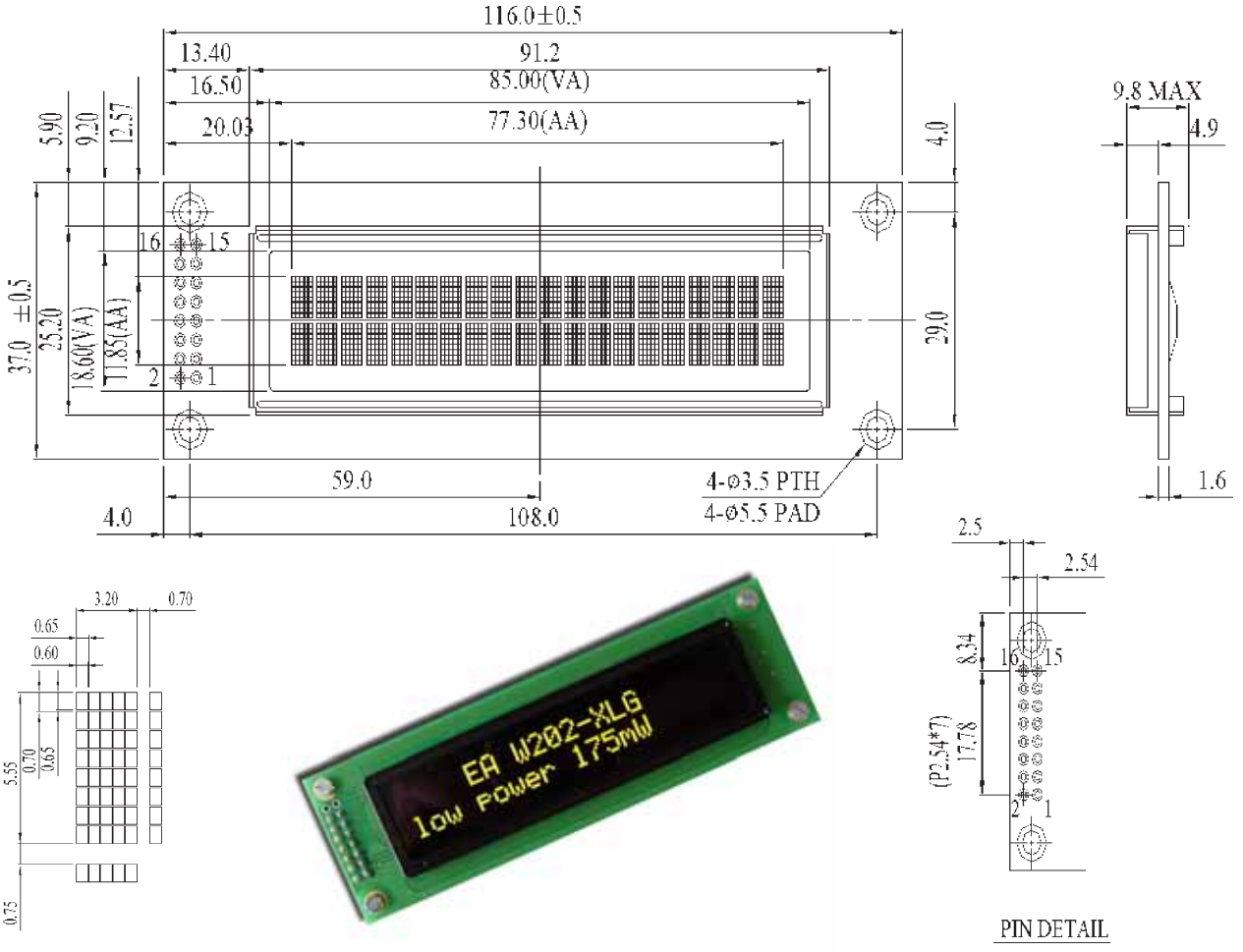
EA W162-XBLW (ICEWHITE)
EA W162-XBLW (YELLOW/GREEN)

FRAME
EA 017-12U



EA W202-XLG

FRAME
EA 017-7U



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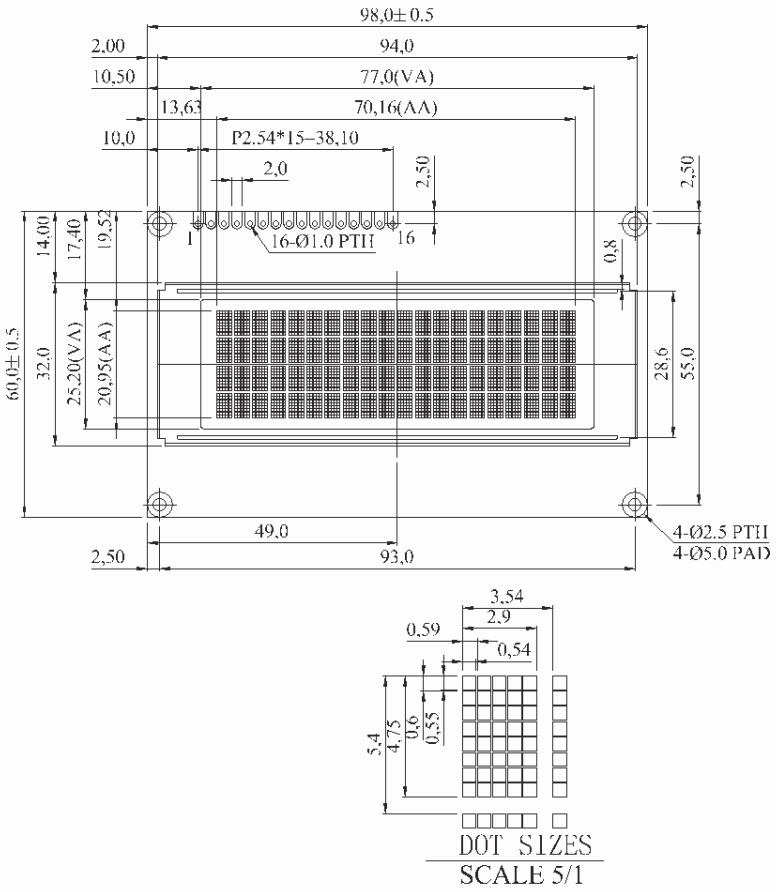
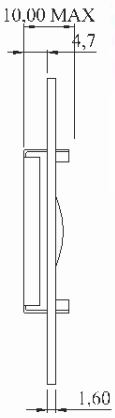
EA W204-XLG

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EA 017-9U