

## Общие характеристики модуля

Тип модуля	знакосинтезирующий (текстовый) ЖКИ
Формат модуля	16 x 2
Тип поляризатора	полупрозрачный (transflective)
Подсветка	желто-зеленая светодиодная
Тип стекла	STN серый
Угол обзора	6:00 часов (bottom view)
Температурный диапазон	Расширенный, -20..+70 °C
Контроллер	KS0066U (аналог HD44780)
Кодировка	английская + <b>русская</b>
Габариты модуля	80.0 (W) x 36.0 (H) x 13.5 (D) мм
Размер точки (пикселя)	0.56 (W) x 0.61 (H) мм



## Питание модуля

Напряжение питания модуля	4.75 – 5.25 В
Потребляемый ток (модуль)	1.5 – 2.5 мА
Потребляемый ток (подсветка)	160 мА (при 5.0 В)



## Описание выводов модуля

№ вывода	Название вывода	Описание
1	Vss	Питание модуля (-), «земля»
2	Vdd	Питание модуля (+)
3	Vo	Напряжение смещения (управление контрастностью)
4	RS	Регистр управления (1 – данные, 0 – команды)
5	R/W	1 – чтение, 0 – запись
6	E	Строб
7	DB0	Шина команды / данные
8	DB1	
9	DB2	
10	DB3	
11	DB4	
12	DB5	
13	DB6	
14	DB7	
+	BL+	Питание подсветки (+) +5.0 В
-	BL-	Питание подсветки (-) 0 В

## Пример работы с индикатором на микроконтроллере PIC (компилятор MikroC v.6.x.x, <http://mikroe.com>)

Подключение ЖКИ к порту PORTB микроконтроллера PIC:

D7 – RB7  
D6 – RB6  
D5 – RB5  
D4 – RB4  
E – RB3  
RS – RB2  
RW – RB0

### // Строки символов, которые будут выведены на ЖКИ

```
static char txt1[] = {163,75,45,184,189,227,184,186,97,191,111,112,0}; // 'ЖК-индикатор'
static char txt2[] = {65,67,77,49,54,48,50,75,32,32,171,165,168,45,72,72,0}; // 'АСМ1602К ЧИП-НН'
```

```
void main() {
    TRISB = 0; // Инициализация PORTB
    PORTB = 0xFF;
    TRISB = 0xFF;

    Lcd_Init(&PORTB); // Инициализация ЖКИ
    Lcd_Cmd(LCD_CLEAR); // Очистить дисплей
    Lcd_Cmd(LCD_CURSOR_OFF); // Выключить отображение курсора

    Lcd_Out(1,1,txt1); // Вывести первую строку
    Lcd_Out(2,1,txt2); // Вывести вторую строку

    while(1);
}
```

Техническое описание на английском языке (с сайта <http://displaytronic.com> )

## ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min	Typ	Max	Unit
Operating temperature (Standard)	Top	0	-	50	°C
Storage temperature (Standard)	Tst	-10	-	60	°C
Operating temperature (Wide temperature)	Top	-20	-	70	°C
Storage temperature (Wide temperature)	Tst	-30	-	80	°C
Input voltage	Vin	Vss		Vdd	V
Supply voltage for logic	Vdd- Vss	2.7	-	5.5	V
Supply voltage for LCD drive	Vdd- Vo	3.0	-	13.0	V

## ELECTRICAL CHARACTERISTICS

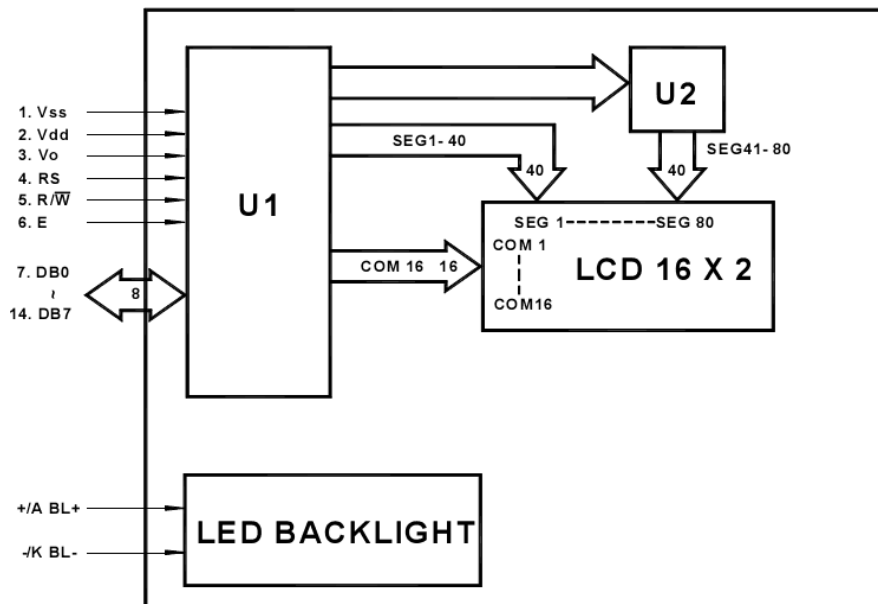
Item	Symbol	Condition	Min	Typ	Max	Unit
Input voltage (high)	Vih	H level	2.2	-	Vdd	V
Input voltage (low)	Vil	L level	0	-	0.55	V
Recommended LC Driving Voltage(Standard Temp)	Vdd -Vo R11=0Ω	0°C	4.0	4.3	4.6	V
		25°C	3.7	3.9	4.1	V
		50°C	3.2	3.5	3.9	V
Recommended LC Driving Voltage(Wide Temp)	Vdd -Vo R11=0Ω	-20°C	4.3	4.6	5.0	V
		0°C	4.0	4.3	4.6	V
		25°C	3.6	3.8	4.1	V
		50°C	3.2	3.5	3.9	V
		70°C	3.0	3.2	3.5	V
Power Supply Voltage	Vdd	25°C	4.75	5.0	5.25	V
Power Supply Current	Idd	Vdd=5.0V, fosc=270kHz	-	1.5	2.5	mA
LED Power Supply Voltage	Vf	If=120 mA	3.9-	4.1	4.3	V
LED Power Supply Current	IBL	VOP=5.0V R7=5.1Ω	130	160	190	mA

NOTE: Vf=The voltage of between backlight 'A'and 'K'

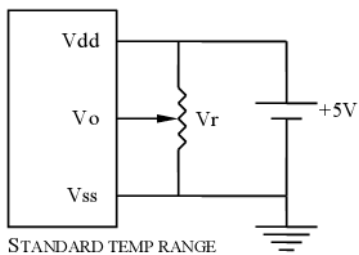
## OPTICAL CHARACTERISTICS (Ta=25°C, Vdd= 5.0V±0.25V, STN LC fluid)

Item	Symbol	Condition	Min	Typ	Max	Unit
Viewing angle (horizontal)	θ	Cr ≥ 2.0	-60	-	35	deg
Viewing angle (vertical)	φ	Cr ≥ 2.0	-40	-	40	deg
Contrast Ratio	Cr	φ=0°, θ=0°	-	6	-	
Response time (rise)	Tr	φ=0°, θ=0°	-	150	250	ms
Response time (fall)	Tf	φ=0°, θ=0°	-	150	250	ms

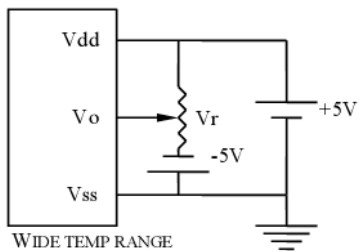
## BLOCK DIAGRAM



## POWER SUPPLY



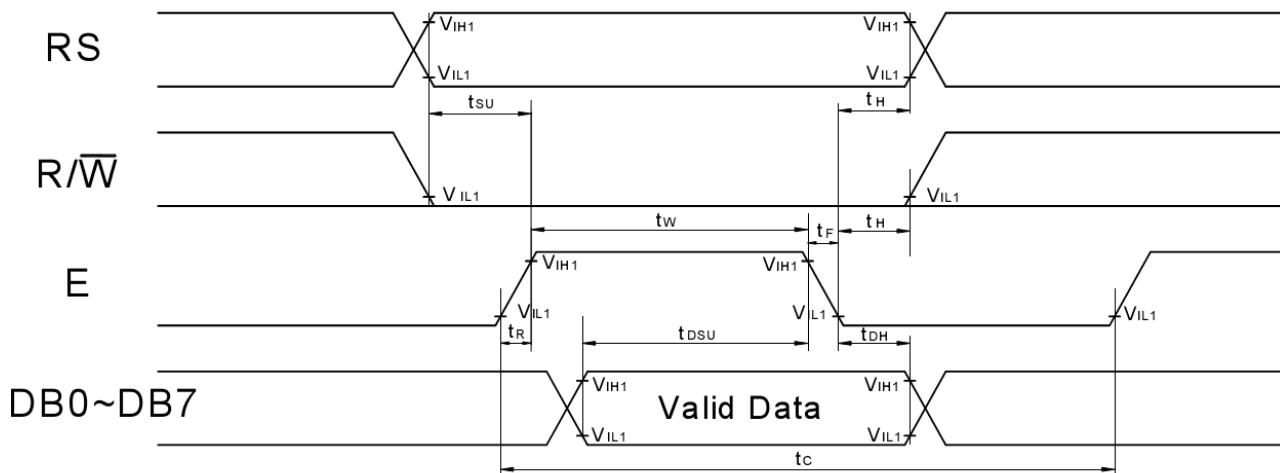
$$V_r = 10K\Omega \sim 20K\Omega$$



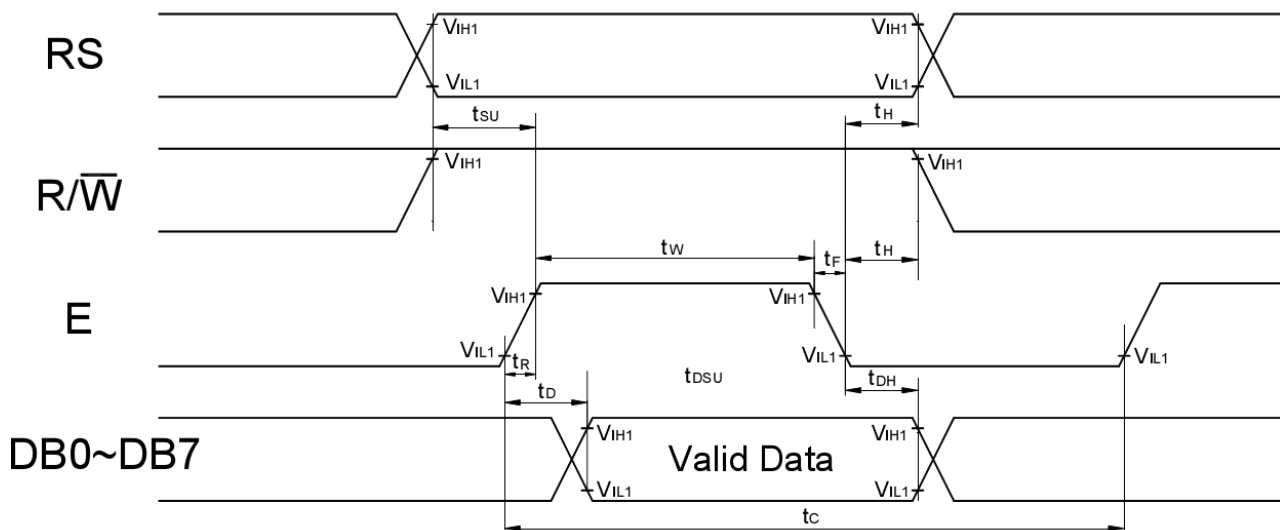
## TIMING CHARACTERISTICS

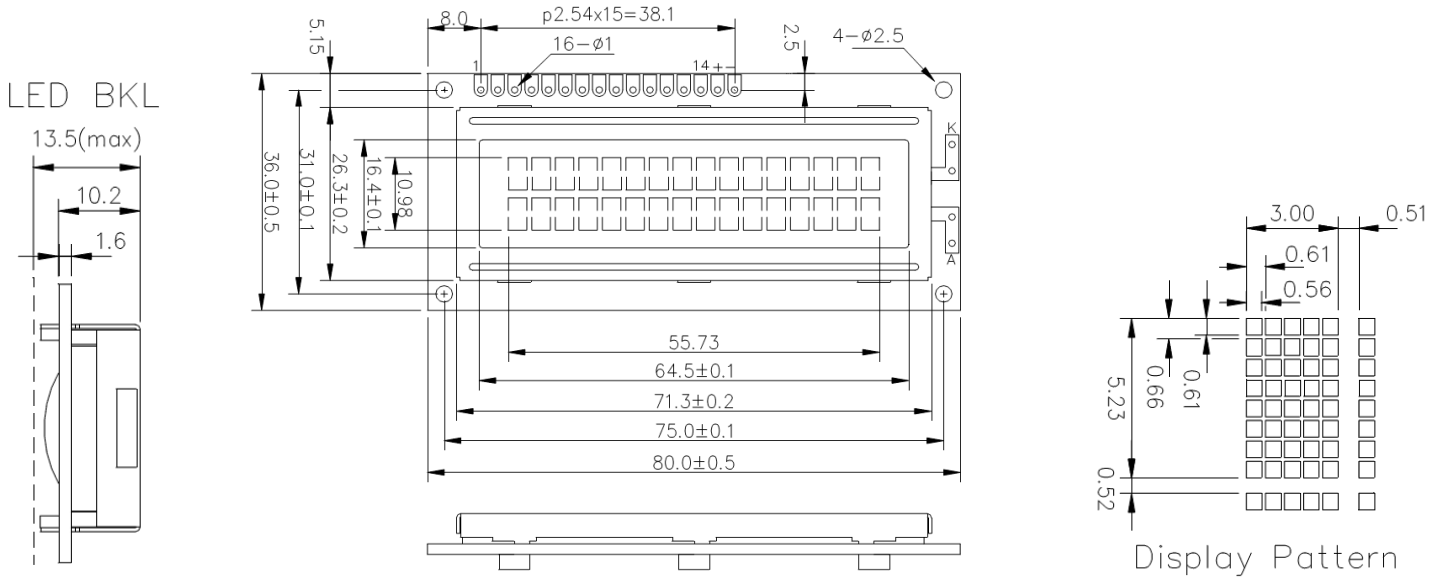
Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Enable cycle time	$t_c$	Fig. a, Fig. b	500	-	-	ns
Enable pulse width	$t_w$	Fig. a, Fig. b	230	-	-	ns
Enable rise/fall time	$t_r, t_f$	Fig. a, Fig. b	-	-	20	ns
RS, R/W set up time	$t_{su}$	Fig. a, Fig. b	40	-	-	ns
RS, R/W hold time	$t_h$	Fig. a, Fig. b	10	-	-	ns
Data delay time	$t_d$	Fig. b	-	-	120	ns
Data set up time	$t_{dsu}$	Fig. a	80	-	-	ns
Data hold time	$t_{dh}$	Fig. a, Fig. b	10	-	-	ns

Interface timing (data write)



Interface timing (data read)





## RELIABILITY TEST

Storage Condition	Content	Evaluations and Assessment*			
		Current Consumption	Oozing	Contrast	Other Appearances
Operation at high temperature and humidity	40°C, 90% RH, 240hrs	Twice initial value or less	none	More than 80% of initial value	No abnormality
High temperature storage	60°C, 240hrs	Twice initial value or less	none	More than 80% of initial value	No abnormality
Low temperature storage	-20°C, 240hrs	Twice initial value or less		More than 80% of initial value	No abnormality

\*Evaluations and assessment to be made two hours after returning to room temperature (25°C±5°C).

\*The LCDs subjected to the test must not have dew condensation.

## DISPLAY INSTRUCTION TABLE

COMMAND	R S	R/ W	DB 7	DB 6	DB 5	DB 4	DB 3	DB 2	DB 1	DB 0	DESCRIPTION	Executing time fosc=250khz	
Clear Display	0	0	0	0	0	0	0	0	0	1	Clears Display & Returns to Address 0.	1.64ms	
Cursor at Home	0	0	0	0	0	0	0	0	1	x	Returns Cursor to Address 0. Also returns the display being shifted to the original position. DDRAM contents remain unchanged.	1.64ms	
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	I/D: Set Cursor Moving Direction I/D=1: Increment I/D=0: Decrement  S: Specify Shift of Display S=1: The display is shifted S=0: The display is not shifted	40µs	
Display ON/OFF Control	0	0	0	0	0	0	1	D	C	B	Display D=1: Display on D=0: Display off Cursor C=1: Cursor on C=0: Cursor off Brink B=1: Brink on B=0: Brink off	40µs	
Cursor / Display Shift	0	0	0	0	0	1	S/C	R/L	x	x	Moves cursor or shifts the display w/o changing DD RAM contents S/C=0: Cursor Shift (RAM unchanged) S/C=1: Display Shift (RAM unchanged) R/L=1: Shift to the Right R/L=0: Shift to the Left	40µs	
Function Set	0	0	0	0	1	DL	N	F	x	x	Sets data bus length (DL), # of display lines (N), and character fonts (F). DL=1: 8 bits F=0: 5x7 dots DL=0: 4 bits F=1: 5x10 dots N=0: 1 line display N=1: 2 lines display	40µs	
Set CG RAM Address	0	0	0	1	Character Generator (CG) RAM Address					Sets CG RAM address. CG RAM data is sent and received after this instruction.		40µs	
Set DD RAM Address	0	0	1	Display Data (DD) RAM Address / Cursor Address					Sets DD RAM address. DD Ram data is sent and received after this instruction.		40µs		
Busy Flag / Address Read	0	1	B F	Address counter used for both DD & CG RAM address					Reads Busy Flag (BF) and address counter contents.		40µs		
Write Data	1	0	Write Data								Writes data into DDRAM or CGRAM.		46µs
Read Data	1	1	Read Data								Reads data from DDRAM or CGRAM.		46µs

X: Don't Care