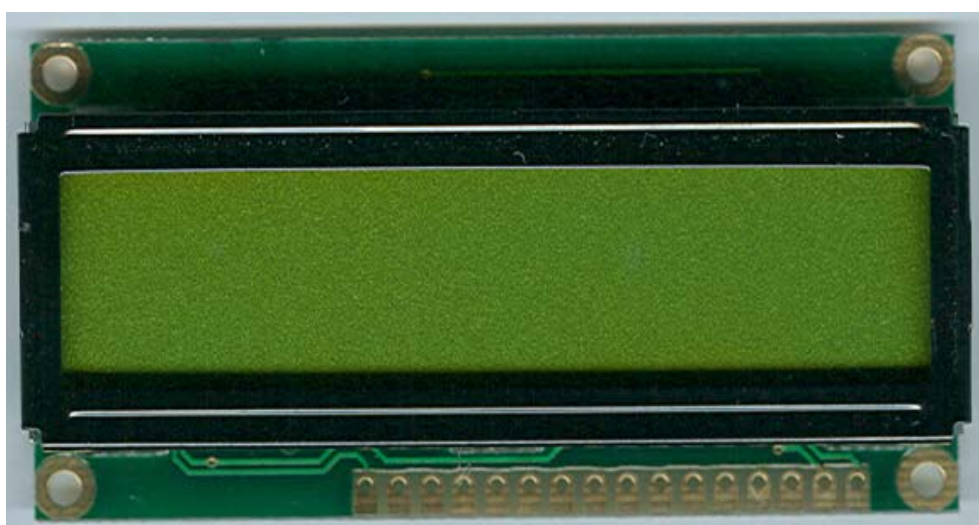


LCD CHARACTER MODULE

PRODUCT SPECIFICATIONS	
CUSTOMER	
CUSTOMER PART NO.	
ANDI® PART NO. (# = RoHS)	YL#162-A5SY4TYH6ASX
LEHNER DABITROS ITEM NO.	5601522
APPROVED BY CUSTOMER	
DATE	



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In view of technical development, we reserve to carry out constructional technical improvements at our products without announcement.

Each responsibility for consequences resulting from printing or unintentional description is excluded.

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2. Basic specification

Font color / Background color	dark blue / yellow green
Backlight type / Backlight color	LED / yellow green
Polarizer:	transflective
LCD type:	STN
View direction:	12°
Operating temperature:	-20°C ~ 70°C
Storage temperature:	-30°C ~ 80°C
Controller / Driver:	6A
Character set:	English / Japanese
Technology:	COB
Power supply:	single +5.0V

2.1 General

The YL#162-A5SY4TYH6ASX, dot-matrix LCD unit consists of 5 x 8 dot 16-character 2-line dot-matrix LCD panel, LCD driver, controller LSI on a single PCB. Incorporating mask ROM-based character generator and display data RAM in the controller LSI, the unit can efficiently display the desired characters under microprocessor control.

2.2 Features

- Construction: STN LCD, Bezel, Conductive rubber, LED backlight and PCB.
- LED serial resistor: R8 = 0Ω
- RoHS compliant

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3. Mechanical data

PARAMETER	STANDARD VALUE	UNIT
Display resolution	16 x 2 character 1/16 duty	--
Character size (H x W)	5.56 x 2.96	mm
Dot / Character (H x W)	8 x 5	--
Viewing area (W x H)	65.0 x 16.0	mm
Module size (W x H x T)	72.0 x 36.0 x 12.8	mm
Module outline dimensions	See page 12	--

4. Absolute maximum ratings

4.1 Electrical absolute maximum ratings

Ta = 25°C

PARAMETER	SYMBOL	MIN	MAX	UNIT
Logic circuit supply voltage	V _{DD} -V _{SS}	-0.3	7.0	V
LCD driving voltage	V _{LCD}	-0.3	10.0	V
Input voltage	V _I	-0.3	V _{DD} +0.3	V
Operating temperature *	T _{OP}	-20	70	°C
Storage temperature *	T _{STG}	-30	80	°C

* Note: Please refer to section 11

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5. Electrical characteristics

Ta = 25°C

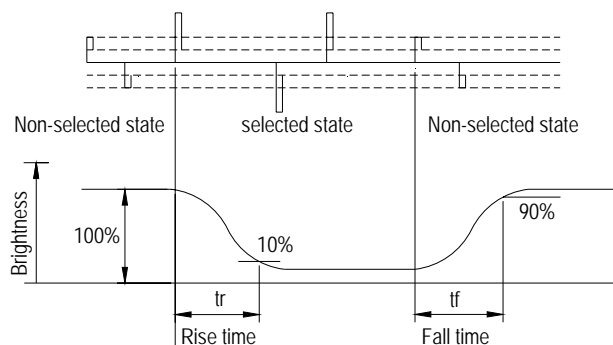
PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Logic circuit supply voltage	V _{DD} -V _{SS}	--	4.5	5.0	5.5	V
LCD driving voltage	V _{LCD}	25°C	4.2	4.5	4.8	V
Input voltage	V _{IH}	--	0.7V _{DD}	--	V _{DD}	V
	V _{IL}	--	-0.3	--	0.6	
Output voltage (DB0 – DB7)	V _{OH1}	I _{OH} = -0.1mA	3.9	--	V _{DD}	V
	V _{OL1}	I _{OL} = 0.1mA	--	--	0.4	
Output voltage (Except DB0 – DB7)	V _{OH2}	I _{OH} = -0.04mA	0.9V _{DD}	--	V _{DD}	V
	V _{OL2}	I _{OL} = 0.04mA	--	--	0.1V _{DD}	
Logic supply current	I _{DD}	V _{DD} = 5V V _{LCD} = 4.5V	--	2.0	3.0	mA

6. Optical characteristics

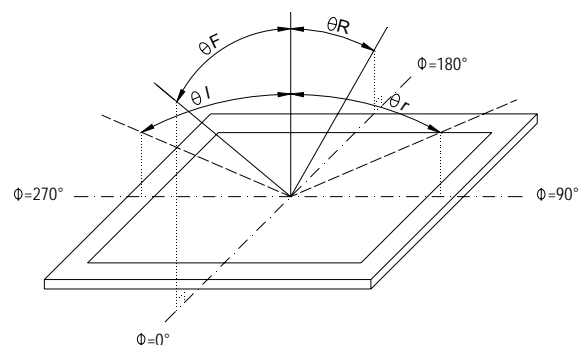
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response time	Tr	V _{LCD} = 4.5V Ta = 25°C	--	200	--	ms	1
	Tf		--	250	--		
Contrast ratio	CR		--	3.0	--	--	3, 4
Frame frequency	F _{rm}		--	64	--	Hz	--
Viewing angle	Left	When CR ≥ 1.4	--	30	--	deg.	2, 4
	Right		--	30	--		
	Rear		--	40	--		
	Front		--	20	--		

6.1 Notes

NOTE1: DEFINITION OF RESPONSE TIME

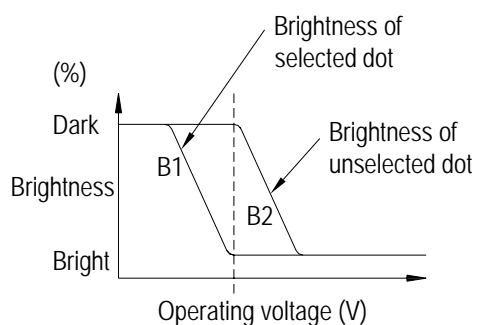


NOTE2: DEFINITION OF ANGLES ϕ AND θ

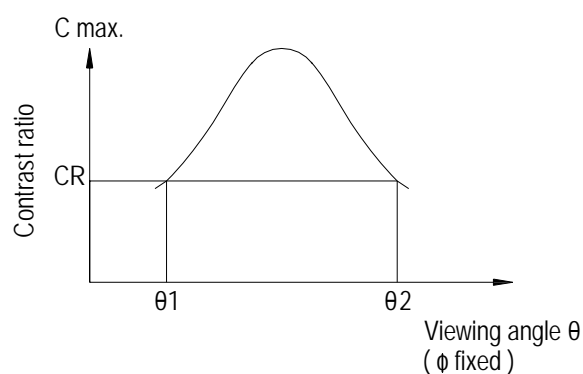


NOTE3: DEFINITION OF CONTRAST RATIO CR

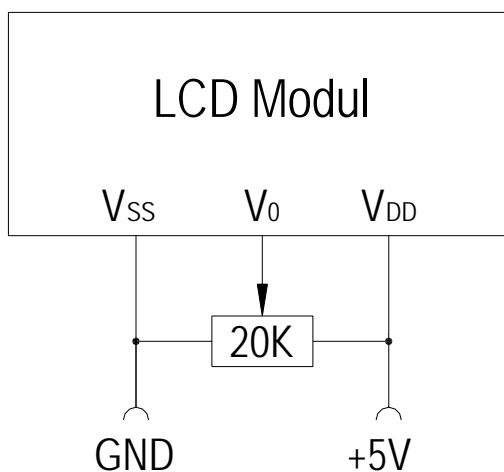
$$CR = \frac{\text{Brightness of selected dot (B1)}}{\text{Brightness of unselected dot (B2)}}$$



NOTE4: DEFINITION OF VIEWING ANGLES θ_1 AND θ_2



7. Power supply



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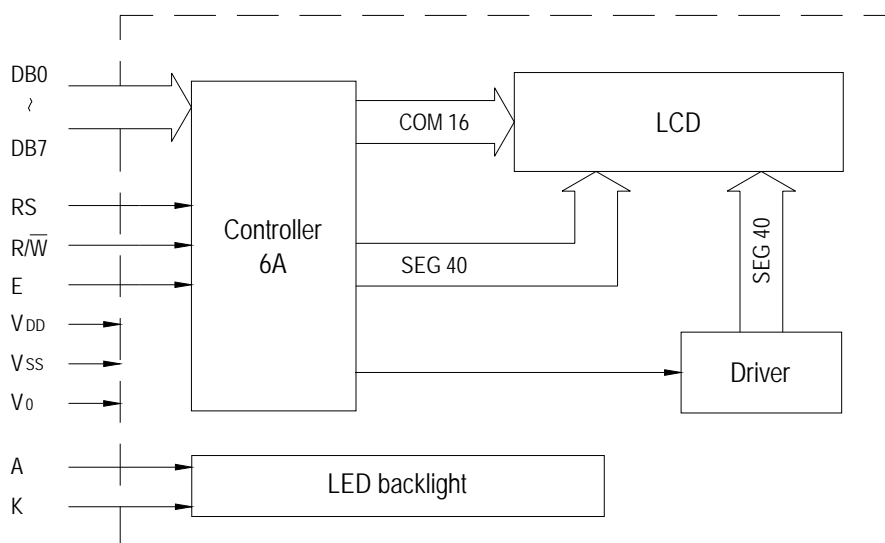
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8. Pin connections

PIN No.	FUNCTION	LEVEL	DESCRIPTION
1	V _{SS}	0V	Power supply ground
2	V _{DD}	5V	Power supply voltage
3	V ₀	--	Contrast adjustment
4	RS	H/L	Register select
5	R / \overline{W}	H/L	Read/Write
6	E	H, H→L	Enable signal
7	DB0	H/L	Data bit 0
8	DB1	H/L	Data bit 1
9	DB2	H/L	Data bit 2
10	DB3	H/L	Data bit 3
11	DB4	H/L	Data bit 4
12	DB5	H/L	Data bit 5
13	DB6	H/L	Data bit 6
14	DB7	H/L	Data bit 7
15	LED A	--	LED power supply (+4.2V)
16	LED K	--	LED power supply (0V)

9. Block diagram



10. LED back-light characteristics

10.1 Electrical / optical specifications

Ta = 25°C

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Forward voltage	V_f	If = 130mA	--	4.1	4.6	V
Forward current	I_F	--	--	130	--	mA
Brightness of backlight	L	If = 130mA	120	190		cd/m ²
Peak emission wavelength	λ_P		565	570	575	nm
Reverse current	I_R	VR = 8V	--	--	0.2	mA
LED serial resistor	R8 = 0Ω					
Color	yellow green					

10.2 LED maximum operating range

ITEM	SYMBOL	YELLOW GREEN	UNIT
Power dissipation	P_{AD}	0.9	W
Forward current	I_F	195	mA
Reverse voltage	V_R	8	V

11. Environmental tests

ITEM	EXTENDED TEMPERATURE			
	Operating		Storage	
	Min.	Max.	Min.	Max.
Ambient temperature	-20°C	+70°C	-30°C	+80°C
Humidity (without condensation)	Note 1, 2		Note 1, 3	

Note 1: Background color changes slightly depending on ambient temperature. This phenomenon is reversible.

Note 2: Ta ≤ 70°C: 75% RH max.

Ta > 70°C absolute humidity must be lower than the humidity of 75% RH at 70°C.

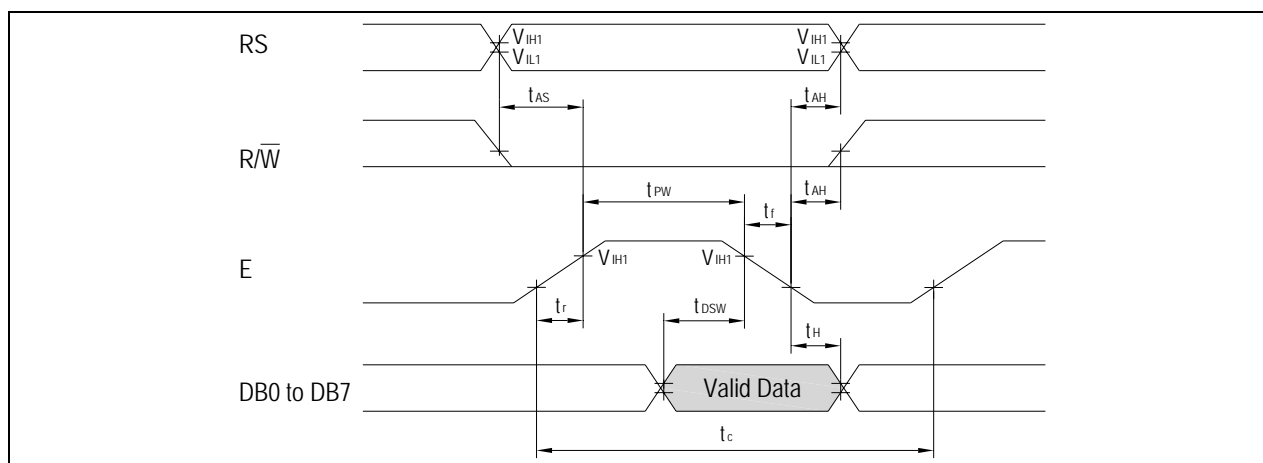
Note 3: Ta at -30°C will be < 48hrs, at 80°C will be < 120hrs when humidity is higher than 70%.

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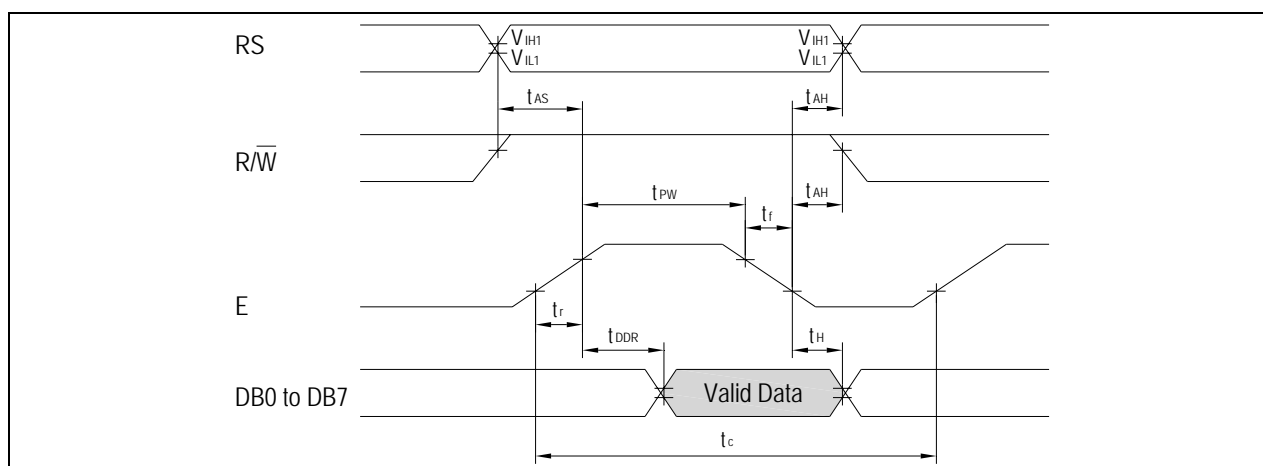
12. Timing characteristics

$V_{DD} = 5.0V$, $T_a = +25^\circ C$

MODE	CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT
Write mode	E cycle time (Pin E)	t_c	1200	--	--	ns
	E pulse width (Pin E)	t_{PW}	140	--	--	
	Enable rise / fall time (Pin E)	t_r / t_f	--	--	25	
	Address set-up time (Pin RS, R/\overline{W} , E)	t_{AS}	0	--	--	
	Address hold time (Pin RS, R/\overline{W} , E)	t_{AH}	10	--	--	
	Data setup time (Pin DB0~DB7)	t_{DSW}	40	--	--	
	Data hold time (Pin DB0~DB7)	t_H	10	--	--	



MODE	CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT
Read mode	E cycle time (Pin E)	t_c	1200	--	--	ns
	E pulse width (Pin E)	t_{PW}	140	--	--	
	Enable rise / fall time (Pin E)	t_r / t_f	--	--	25	
	Address set-up time (Pin RS, R/\overline{W} , E)	t_{AS}	0	--	--	
	Address hold time (Pin RS, R/\overline{W} , E)	t_{AH}	10	--	--	
	Data setup time (Pin DB0~DB7)	t_{DDR}	--	--	100	
	Data hold time (Pin DB0~DB7)	t_H	10	--	--	



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13. Commands

INSTRUCTION	CODE										DESCRIPTION	EXECUTION TIME (WHEN FASC IS 270 kHz)	
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0			
Clear display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM and set DDRAM address to "00H" from AC	1.52ms	
Return home	0	0	0	0	0	0	0	0	0	1	x	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.52ms
Entry mode set	0	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
Display ON/OFF control	0	0	0	0	0	0	0	1	D	C	B	D = 1: entire display on C = 1: cursor on B = 1: cursor position on	37 μs
Cursor or display shift	0	0	0	0	0	0	1	S/C	R/L	x	x	Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.	37 μs
Function set	0	0	0	0	0	1	DL	N	F	x	x	DL: interface data is 8/4 bits NL: number of lines is 2/1 F: font size is 5x11 / 5x8	37 μs
Set CG RAM address.	0	0	0	1	AC 5	AC 4	AC 3	AC 2	AC 1	AC 0		Set CGRAM address in address counter.	37 μs
Set DD RAM address	0	0	1	AC 6	AC 5	AC 4	AC 3	AC 2	AC 1	AC 0		Set DD RAM address in address counter.	37 μs
Read busy flag & address	0	1	BF	AC 6	AC 5	AC 4	AC 3	AC 2	AC 1	AC 0		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 to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0		Write data into internal RAM (DDRAM / CGRAM)	37 μs
Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0		Read data from internal RAM (DDRAM / CGRAM)	37 μs

Note:

Be sure the Controller is not in the busy state (BF = 0) before sending an instruction from the MPU to the Controller. If an instruction is sent without checking the busy flag, the time between the first instruction and next instruction will take much longer than the instruction time itself. Refer to instruction table for the list of each instruction execution time.

14. Interface to MPU

The Controller can send data in either two 4-bit operations or one 8-bit operation, thus allowing interfacing with 4- or 8-bit MPU.

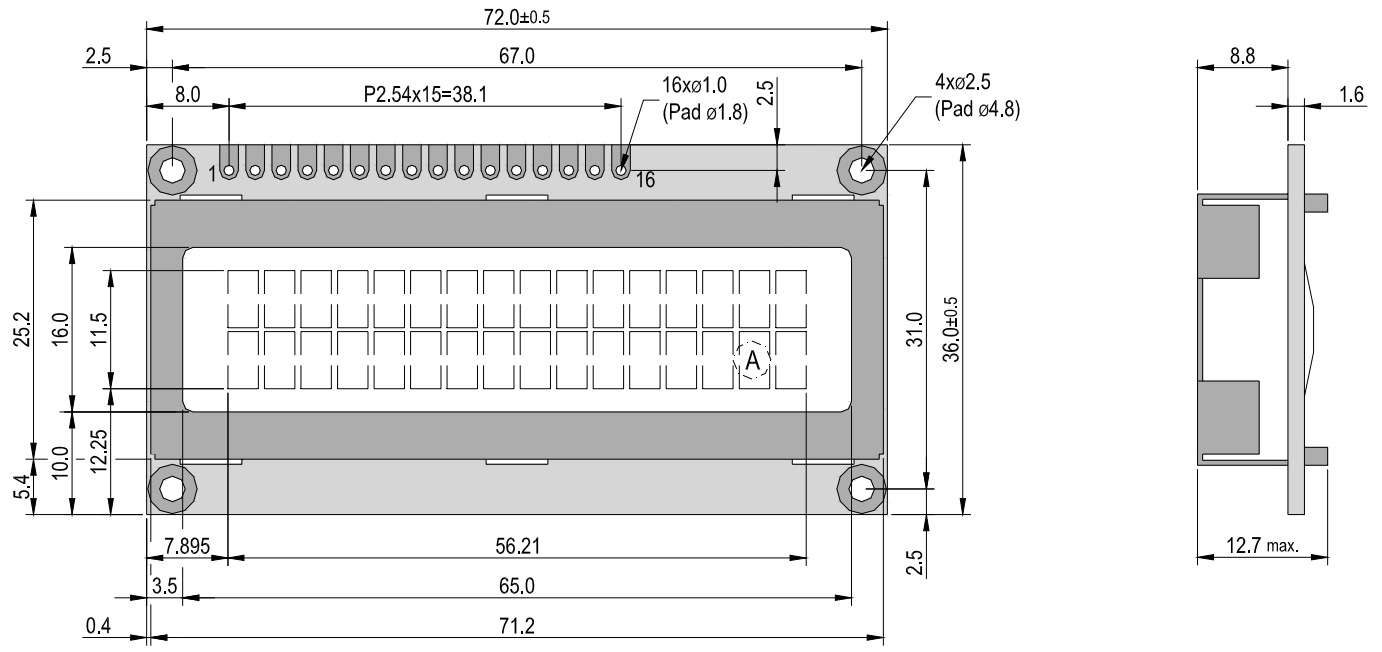
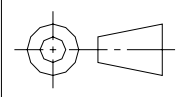
- For 4-bit interface data, only four bus lines (DB4 to DB7) are used for transfer. Bus lines DB0 to DB3 are disabled. The data transfer between the Controller and the MPU is completed after the 4-bit data has been transferred twice. As for the order of data transfer, the four high order bits (for 8-bit operation, DB4 to DB7) are transferred before the four low order bits (for 8-bit operation, DB0 to DB3). The busy flag must be checked (one instruction) after the 4-bit data has been transferred twice. Two more 4-bit operations then transfer the busy flag and address counter data.
- For 8-bit interface data, all eight bus lines (DB0 to DB7) are used.

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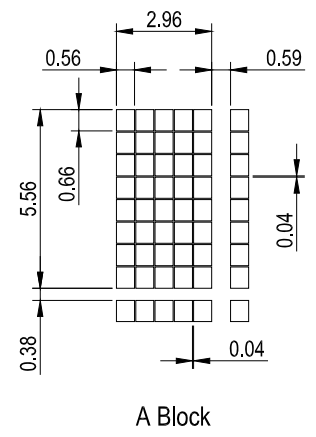
15. Character code map

Upper 4 Bits Lower 4 Bits	LLLL	LLLH	LLHL	LLHH	LHLL	LHLH	LHHL	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL	HHHH
LLLL	CG RAM (1)			0	1	2	3	4				一	二	三	四	五
LLLH	CG RAM (2)		!	1	2	3	4	5			。	ア	イ	ウ	エ	オ
LLHL	CG RAM (3)		"	2	3	4	5	6			”	イ	ロ	ハ	ニ	ホ
LLHH	CG RAM (4)		#	3	4	5	6	7			レ	ウ	エ	オ	カ	キ
LHLL	CG RAM (5)		\$	4	5	6	7	8			人	正	下	中	上	下
LHLH	CG RAM (6)		%	5	6	7	8	9			。	来	大	正	大	大
LHHL	CG RAM (7)		&	6	7	8	9	0			取	力	二	目	大	大
LHHH	CG RAM (8)		'	7	8	9	0	1			マ	キ	又	大	大	大
HLLL	CG RAM (1)		(8	9	0	1	2			イ	ウ	来	大	大	大
HLLH	CG RAM (2))	9	0	1	2	3			古	力	大	大	大	大
HLHL	CG RAM (3)		*	:	J	Z	j	z			正	口	大	大	大	大
HLHH	CG RAM (4)		+	:	K	C	k	c			来	大	大	大	大	大
HHLL	CG RAM (5)		,	<	L	キ	l	キ			カ	大	大	大	大	大
HHLH	CG RAM (6)		!	=	N	J	B	Y			ト	又	大	大	大	大
HHHL	CG RAM (7)		.	>	N	>	n	大			目	大	大	大	大	大
HHHH	CG RAM (8)		/	?	0	1	0	大			大	大	大	大	大	大

16. Drawing



Pin Assignment			
Pin No.	Function	Level	Description
1	V _{SS}	0V	Power supply ground
2	V _{OD}	5V	Power supply voltage
3	V ₀	-	Contrast adjustment
4	RS	H/L	Register select
5	R/W	H/L	Read/Write
6	E	H, H/L	Enable signal
7	DB0	H/L	Data bit 0
8	DB1	H/L	Data bit 1
9	DB2	H/L	Data bit 2
10	DB3	H/L	Data bit 3
11	DB4	H/L	Data bit 4
12	DB5	H/L	Data bit 5
13	DB6	H/L	Data bit 6
14	DB7	H/L	Data bit 7
15	LED A	-	LED power supply (+4.2V)
16	LED K	-	LED power supply (0V)



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Tolerance grade (±)	Dim: mm	Date	Name	Title:
X.	0.3	27.10.11	T. Ferch	YL#162-A5SY4TYH6ASX
.X	0.2			
.XX	0.05			Device no. / File name:
		1/1	00	5601522



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17. Instructions for handling liquid crystal displays (LCD)

17.1 General recommendations

1. Work with the LCD within the prescribed temperature and operating voltage ranges. Prevent the LCD from operating under high atmospheric humidity and for long periods under direct sunlight.
2. Avoid mechanical shocks (collisions) and pressure on the LCD glass. During assembly, make sure that no torques or compressive forces are applied on the LCD. If any liquid escapes, avoid any contact. Pay special attention to not inadvertently swallowing any liquid. Should the liquid come into contact with body or clothing, please wash the affected parts thoroughly with water and soap.
3. The LCD's reflector and polarizer are made of soft material. Prevent any scratching! Use a soft cloth for cleaning the display. Do not use any organic solvents or water. If the dirt can not be removed this way, use a little bit of benzine on a soft cloth.

As the LCD is made with CMOS LSI technology, following precautions must be taken:

4. Connect all non-allocated inputs with V_{DD} or V_{SS} . When connecting, take care that the inputs fulfill the desired logical functions.
5. Do not apply any input signals when the supply voltage is not applied.
6. Connect a 10 μ F capacitor to the power terminal to prevent ignition voltages when switched on.
7. In order to avoid static electrification
 - a) work with bare hands or with cotton gloves. Make sure you are grounded when working with the LCD.
 - b) use antistatic work clothes if necessary.
 - c) install ground cables on the ground, on doors, workbenches etc.
 - d) ground tools and accessories.
8. Do not turn on the LCD unit's operating current while the input signal terminals are open. It is advisable to turn on input signal and LCD operating voltage simultaneously.
9. The LCD unit must be stored in its original packing at a temperature between +15°C and +35°C and a relative humidity of 65% or less. Keep the LCD unit in a dark place not exposed to direct sunlight or fluorescent light.

The following precautions should be observed when mounting the LCD units

10. The LCD unit can be mounted at the inner or outer side of a casing. In order to ensure an optimal mounting angle, please stand within the viewing angle ranges indicated in the respective specifications.
11. Acrylic glass (or the like) can be used to protect the LCD panels. In this case, there must be a gap of 0,5 up to 1,0 mm between the protecting plate and the LCD panel. In order to avoid pressure on the LCD panel, the unit should be mounted with a vertical tolerance of $\pm 0,1$ mm.
12. An anti-reflex glass can be used instead of an acrylic protecting glass. The mounting process remains the same.

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