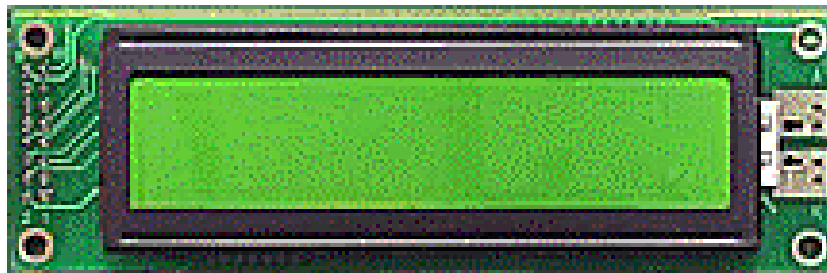


L C D - D I S P L A Y (1).

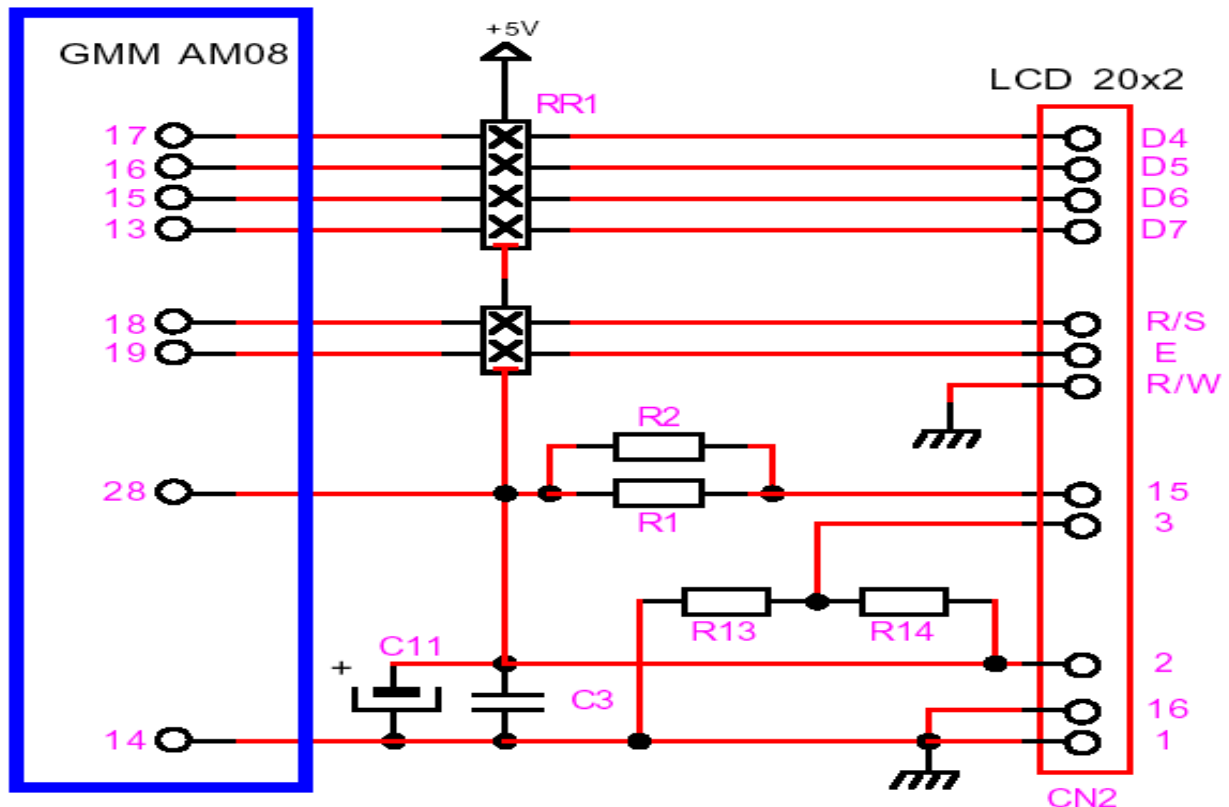
In this chapter we start the knowledge of an electronic component really important and widely used. Whenever you want to display a message or when you need a comfortable device for user interface, normally a **Display** is used.



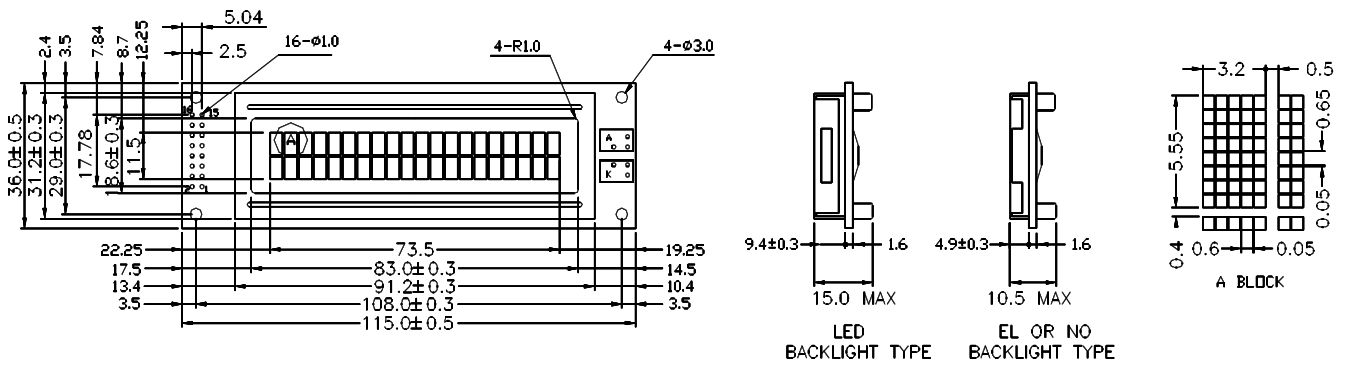
LCD Display with 20x2 Characters.

Among the available displays, one of the most frequently used is the **LCD** type, that surely has a optimum **Price/Performance** ratio.

In this chapter we'll describe and manage an **alphanumeric LCD** display with 2 rows of **20** characters.



Electric Diagram for Connection of LCD Display with 20x2 Characters.



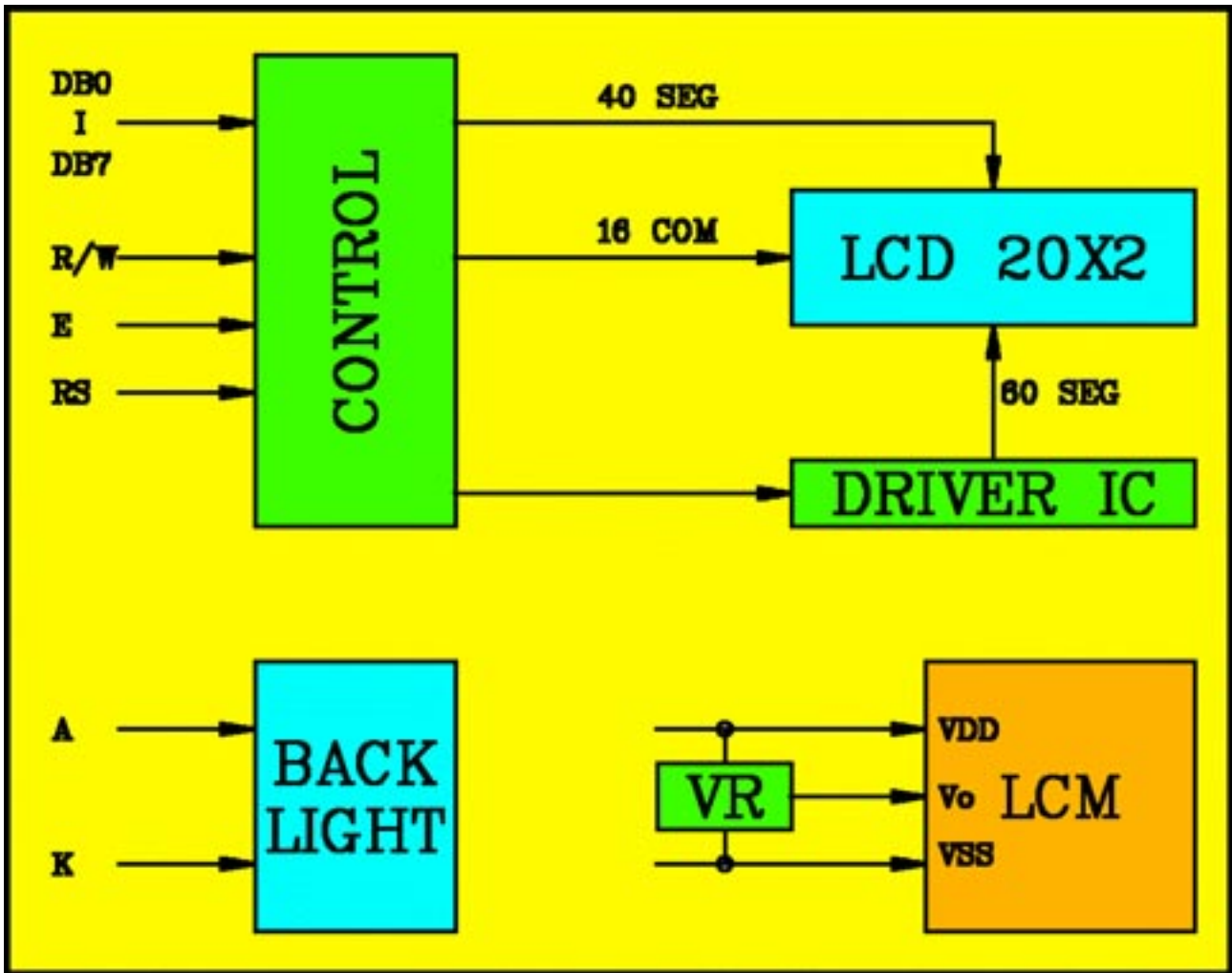
Dimensions of LCD display with 20x2 characters.

For those readers who want further information about this component we remind that the full **Data Sheet** is included in evaluation and experimentation board **GMM TST3** or between the links to documentation of the BASCOM course. For this reason we don't detail the argument, but we supply only the fundamental basic information.

NO	SYMBOL	LEVEL	FUNCTION
1	VSS	--	GND (0V)
2	VDD	H/L	DC +5V
3	VO	H/L	Contrast Adjust
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	A(+)	DC+5V	LED Backlight +
16	K(-)	0V	LED Backlight -

Display Pin Out Description.

The display connection can be performed through a standard strip header, with **8+8** pins at **2,54 mm** pitch, by following the previous description table. The display can be driven through a management **BUS** either with **8** and **4 bits**. On **GMM TST3** has been selected the last connection modality in order to reduce the number of lines required for management. This choice has a reverse side back: a lower operational speed caused by the **4 bits** management. On the contrary, the obtained advantage is the **4 I/O** lines saved. So the user has more free lines that can be used for any purpose.



Block Diagram of LCD Display with 20x2 Characters.

Each **Alphanumeric LCD** display can manage up to **256** characters. On the LCD display normally used in Italy, these characters are divided in two groups of **128**. The first **128** characters contain the standard **ASCII** codes and the seconds contain an alternative set. The model used on **GMM TST3** has an alternative set that includes special characters used in other languages (i.e. letters with accent) or symbols useful for technical visualization (i.e. arrows, mathematical symbols, etc.).

It is really interesting the possibility to create, autonomously, **8** special characters that can be used when they are not available in the described sets.

When an **LCD** display is used in your application you must check the characters set and verify if it contains the required not ASCII codes. This check can be extremely important especially when you must replace a display already installed.

In following page there is a table that shows all the **256** characters available in the display mounted on **GMM TST3**.

		Higher 4-bit (D4 to D7) of Character Code (Hexadecimal)																
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
Lower 4-bit (D0 to D3) of Character Code (Hexadecimal)	0	User chr 0	!	"	#	\$	%	&	'	()	*	+	,	-	.	:	
	1	User chr 1	;	<	=	>	?	@	A	B	C	D	E	F	G	H	I	J
	2	User chr 2	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
	3	User chr 3	[\]	^	_	`	{		}	~						
	4	User chr 4																
	5	User chr 5																
	6	User chr 6																
	7	User chr 7																
	8	User chr 0																
	9	User chr 1																
	A	User chr 2																
	B	User chr 3																
	C	User chr 4																
	D	User chr 5																
	E	User chr 6																
	F	User chr 7																

Characters Set of LCD Display 20x2.

Example.020. LCD Display. Shows the Typed Characters.

Added Definitions:

None

Added Declarations:

None

Added Instructions:

CONFIG LCDPIN ; CONFIG LCD ; CONFIG LCDMODE ; CONFIG LCDBUS ; CLS ; LCD ; LOCATE

Added Operators:

None

Example.020 of **BASCOM AVR** course.

It manages an alphanumeric display with **2 x 20** characters.

The program shows each characters received by console serial line on the **GMM TST3** display. This display is **LCD** type back lighted by **LED**, it is provided of controller and it has **2** rows of **20** characters. The program completely manages it through the high level instructions dedicated to display, available in **BASCOM AVR**.

The character to show are received from a serial console provided of monitor and it must communicate with a fixed physical protocol at **19.200 Baud, 8 Bit x chr, 1 Stop bit, No parity**.

This console can be another system capable to support a serial **RS 232** communication. In order to simplify the use it can be used a **PC** provided of one **COMx** line, that execute a terminal emulation program as **HYPERTERMINAL** or the homonym modality provided by **BASCOM AVR** (see **IDE** Configuration).

The program works only when the **GMM AM08** is mounted on **Z1** socket of **GMM TST3!!**