

# 35054-OP

## 4 Line X 20 Character Serial LCD

### Serial LCD for Arduino

LCM2004 LCD using Serial I2C/SPI communication with microcontroller.

Installed Backpack board with the PCF8574 chip uses simple 4 wire connection.

LCD features: 20 character by 4 line LCD module, White characters on dark blue background with White LED backlighting.

Power: +5 volts (supplied by Arduino)

Current: ~<300mA (Includes LED B/L)

Character size: 4.75 mm X 2.95mm

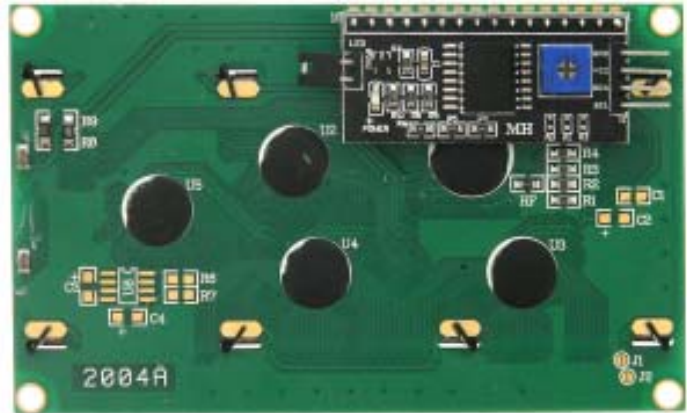
Dot Size: 0.55mm x 0.55mm

Pitch: 0.60 x 0.60mm

I/O: 4 pin header 0.1in Pitch

**L:** 3-7/8" **W:** 2-5/8" **T:** 7/8 O/A **WT:** .2

NOTE: Most use the I2C address of 0x27 but These unit May use 0x3F So check code you download or write



### USEFULL LINKS FOR INFORMATION, DOWNLOADS, SKETCHES AND SETUP

<https://arduino-info.wikispaces.com/lcd-blue-i2c#v1>

<http://www.instructables.com/id/quick-setup-guide-to-arduino-lcd-2004-with-pcf8574>

<https://www.brainy-bits.com/connect-a-character-lcd-using-the-i2c-bus/>

<https://bitbucket.org/fmalpartida/new-liquidcrystal/downloads>

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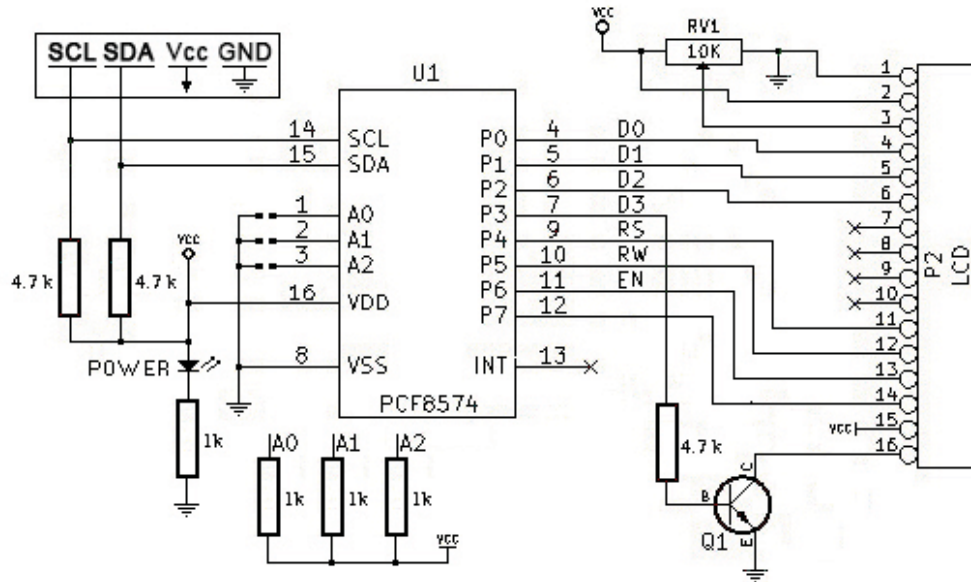
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# 35054-OP

4 Line X 20 Character Serial LCD

## PCF8574 SERIAL INTERFACE BOARD



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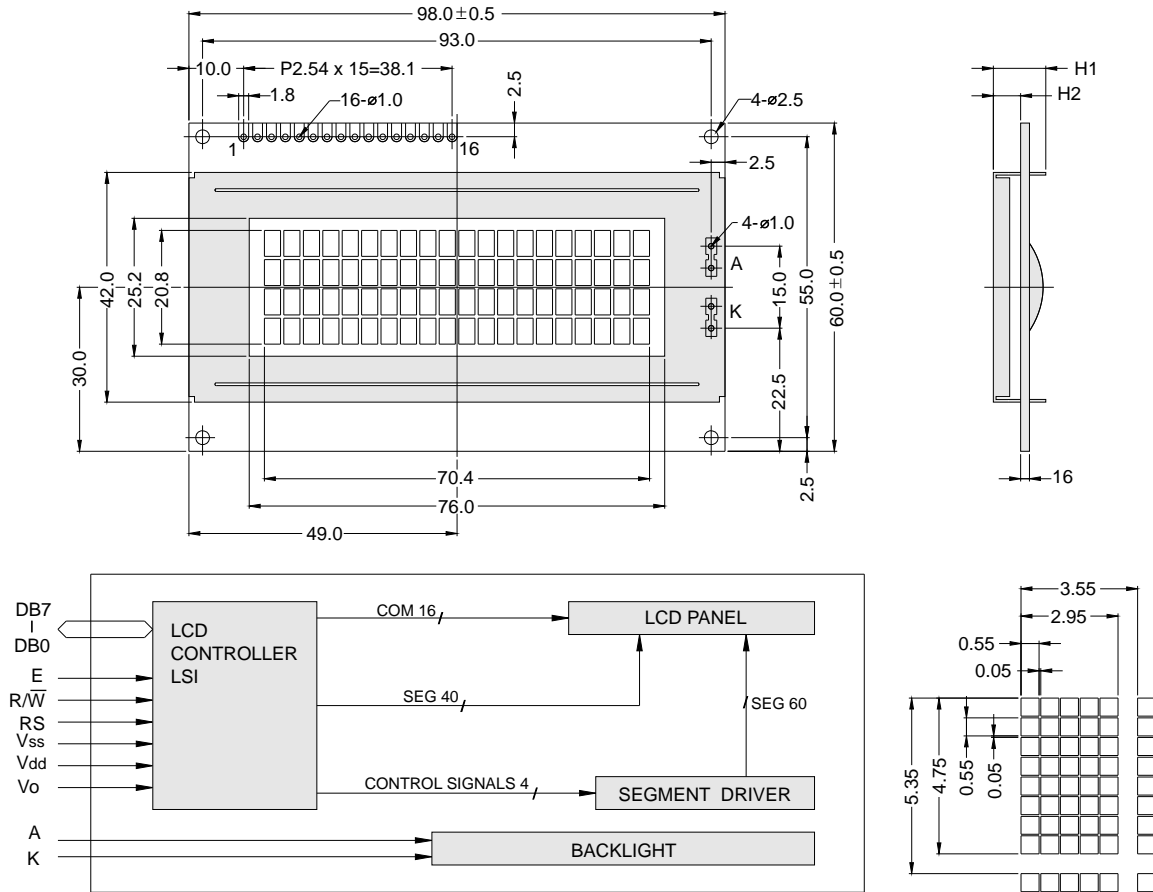


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# LCD 2004-A

## OUTLINE DIMENSION & BLOCK DIAGRAM



The tolerance unless classified ± 0.3mm

MECHANICAL SPECIFICATION			
Overall Size	98.0 x 60.0	Module	H2 / H1
View Area	76.0 x 25.2	W/O B/L	5.0 / 9.6
Dot Size	0.55 x 0.55	EL B/L	5.0 / 9.6
Dot Pitch	0.60 x 0.60	LED B/L	8.7 / 13.3

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.1	-	7.5	-	V	
		0°C	5.1	-	5.4	-	6.1	-	V
		25°C	5	6.1	5.3	6.4	5.8	6.7	V
		50°C	4.4	-	4.7	-	5.5	-	V
70°C	-	5.7	-	6	-	6.3	V		
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2.5	4	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	260	-	mA			

### REMARK

LCD option: STN, TN, FSTN

Backlight Option: LED, EL Backlight feature, other Specs not available on catalog is under request.





## Typical/Electrical Characteristics of LCD Modules

- Optical Characteristics Of LCD Modules
- Electrical Characteristics Of LCD Modules

### Optical Characteristics Of LCD Modules

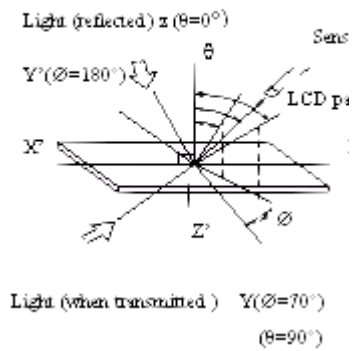
STN Type,  $T_a=25^\circ\text{C}$

Item	Symbol	Conditions	Min.	Typ.	Max	Note
Viewing angle	$\theta 2-\theta 1$	$C \geq 2.0, \varnothing=0^\circ\text{C}$	$60^\circ$	-	-	Note 1,2
Contrast Ratio	C	$\theta=5^\circ, \varnothing=0^\circ$	-	5	-	Note 3
Response time(rise)	ton	$\theta=5^\circ, \varnothing=0^\circ$	-	150ms	250ms	Note 4
Response time(fall)	toff	$\theta=5^\circ, \varnothing=0^\circ$	-	200ms	300ms	Note 4

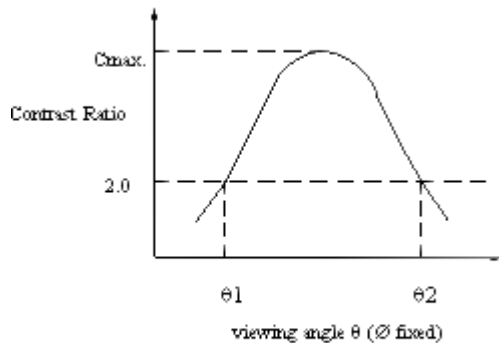
TN Type,  $T_a=25^\circ\text{C}$

Item	Symbol	Conditions	Min.	Typ.	Max	Note
Viewing angle	$\theta 2-\theta 1$	$C \geq 2.0, \varnothing=0^\circ\text{C}$	-	$40^\circ$	-	Note 1,2
Contrast Ratio	C	$\theta=25^\circ, \varnothing=0^\circ$	-	5	-	Note 3
Response time(rise)	ton	$\theta=25^\circ, \varnothing=0^\circ$	-	80ms	120ms	Note 4
Response time(fall)	toff	$\theta=25^\circ, \varnothing=0^\circ$	-	60ms	90ms	Note 4

#### Note 1: Definition of angles $\theta$ and $\varnothing$

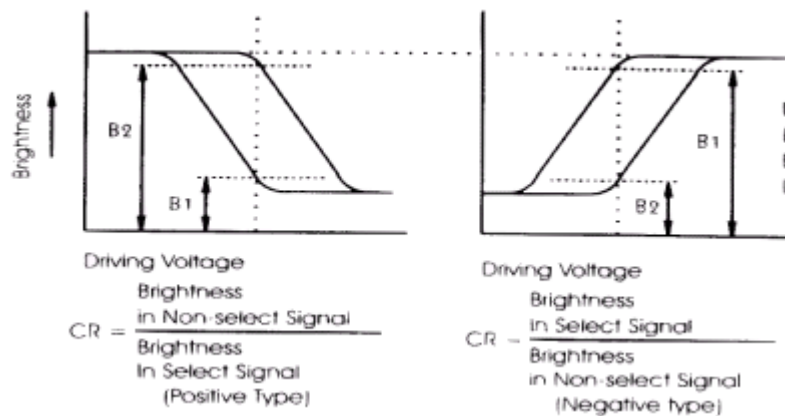


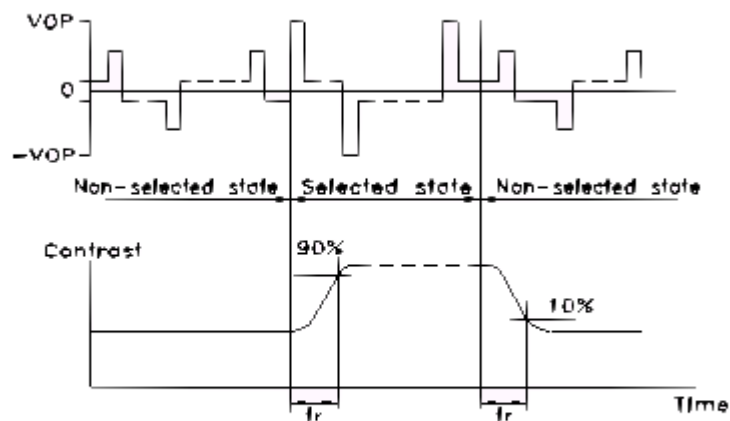
#### Note 2: Definition of viewing angles $\theta 1$ and $\theta 2$



Remark: Optimum viewing angle with the naked eye and viewing angle  $\theta$  at  $C_{max}$

#### Note 3: Definition of contrast Ratio



**Note 4: Definition of response time**

Note: Measured with a transmissive LCD panel which is displayed 1 cm<sup>2</sup>

Vopr : Operating voltage    fFRM : Frame frequency  
 ton : Response time (rise)    toff : Response time (fall)

**Electrical Characteristics Of LCD Modules**

**Character Type:** VDD=+5V±10%,VSS=0V,TA=25°C

Item	Symbol	Condition	Standard Value			Unit
			Min.	Typ.	Max.	
Logic Supply voltage	VDD	-	4.5	5	5.5	V
"H" input voltage	VIH	-	2.2	-	VDD	V
"L" input voltage	VL	-	0	-	0.6	V
"H" output voltage	VOH	-	VDD-0.3	-	-	V
"L" output voltage	VOL	-	-	-	0.4	V
Supply current	IOP	VDD=5V	-	0.4	-	mA
LCD driving voltage	VLCD	VDD-Vo	3.0	8.1	11.0	V

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# Technical



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## Backlight for LCD modules

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- LED Backlight

### LED Backlight

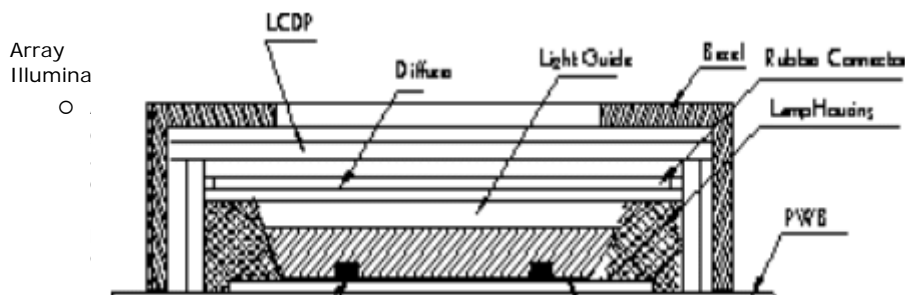
**Long life, low power consumption and requires a simple power supply. Available colors are red, green and orange, available in array type illumination or edge illumination.**

#### Features:

- Low driving voltage ( DC ) and does not require an inverter.
- Long life of 100,000 hours ( average )
- No noise occurrence.

Various colors available in red, green and orange etc. (multi-color by alternative switch is also available)

- Operating characteristics of PC2002-A series is 4.2V, 210mA, 250cd/m



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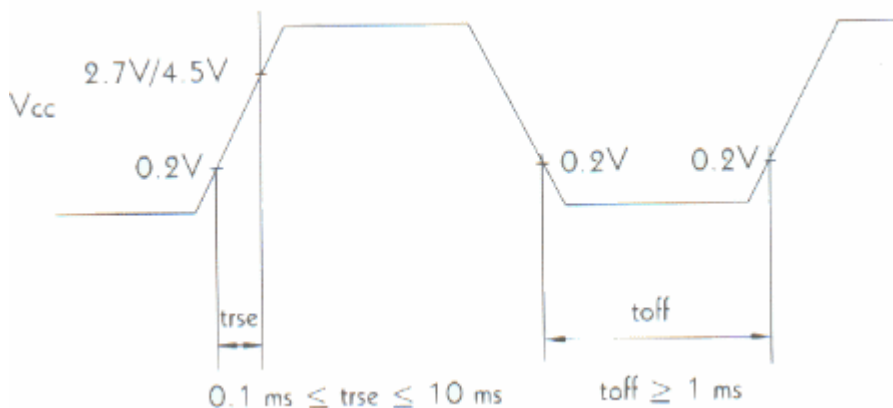
# Technical



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## Power Supply Reset

The internal reset circuit will be operating properly when the following power supply conditions are satisfied. If it is not operating properly, please perform the initial setting along with the instruction.



Item	Symbol	Measuring Condition	Standard Value			Unit
			Min.	Typ.	Max.	
Power Supply RISE Time	trse	-----	0.1	-----	10	mS
Power Supply OFF Time	toff	-----	1	-----	-----	mS

## Reset function

Initialization made by internal reset circuit

- The HD44780 automatically initializes (resets) when power is supplied (builtin internal reset circuit).
- The following instructions are executed during initialization.
  - The busy flag (BF) is kept in busy state until initialization ends. (BF=1) The busy state is 10ms after Vdd reaches 4.5V.
    1. Display clear
    2. Function set
  - DL=1: 8 bit long interface data
  - DL=0: 4 bit F=0: 5 \* 7 dots character font
  - N=1: 2 lines
  - N=0: 1 line
    3. Display ON/OFF control
  - D=0: Display OFF C=0: Cursor OFF
  - B=0: Blink OFF
    4. Entry mode set
  - 1/D= 1: +1(increment) S=0: No shift

Note: When the power supply conditions, using internal reset circuit is not satisfied, the internal reset circuit will not function properly and initialization will not be performed. Please initialize using the MPU along with the instruction set.



### Initialization along with instruction

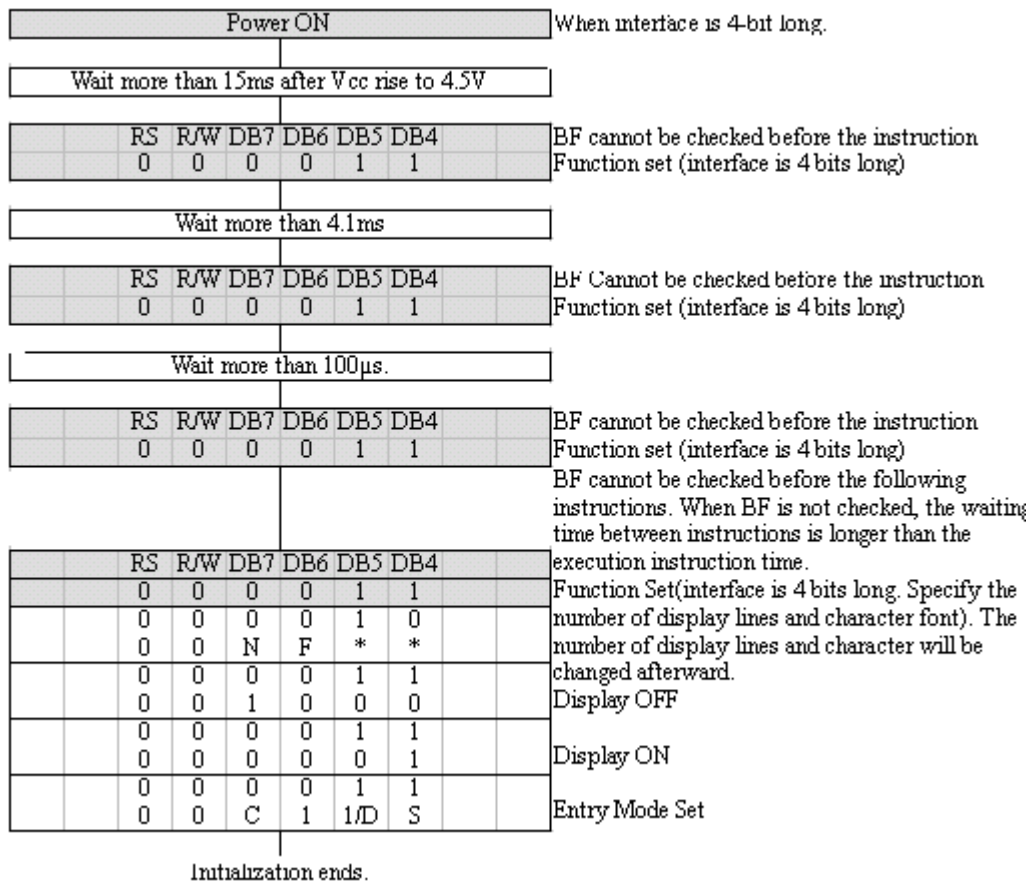
If power supply conditions are not satisfied, for the proper operation of the internal reset circuit, it is necessary to initialize using the instructions.

Please use the following procedures.

Power ON										When interface is 8-bit long.
Wait more than 15ms after V <sub>cc</sub> rise to 4.5V										
RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	BF cannot be checked before the instruction Function set (interface is 8 bits long)
0	0	0	0	1	1	*	*	*	*	
Wait more than 4.1ms										
RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	BF Cannot be checked before the instruction Function set (interface is 8 bits long)
0	0	0	0	1	1	*	*	*	*	
Wait more than 100µs										
RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	BF cannot be checked before the instruction Function set (interface is 8 bits long)
0	0	0	0	1	1	*	*	*	*	
										BF cannot be checked before the following instructions. When BF is not checked. The waiting time between instructions is longer than the execution instruction time Function Set(interface is 8 bit long. Specify the number of display line and character font) The number of display line and character will be changed afterward.
RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Display OFF
0	0	0	0	0	0	1	0	0	0	Display ON
0	0	0	0	0	0	0	0	0	1	Entry Mode Set
0	0	0	0	0	0	0	1	1/D	S	
Initialization ends.										

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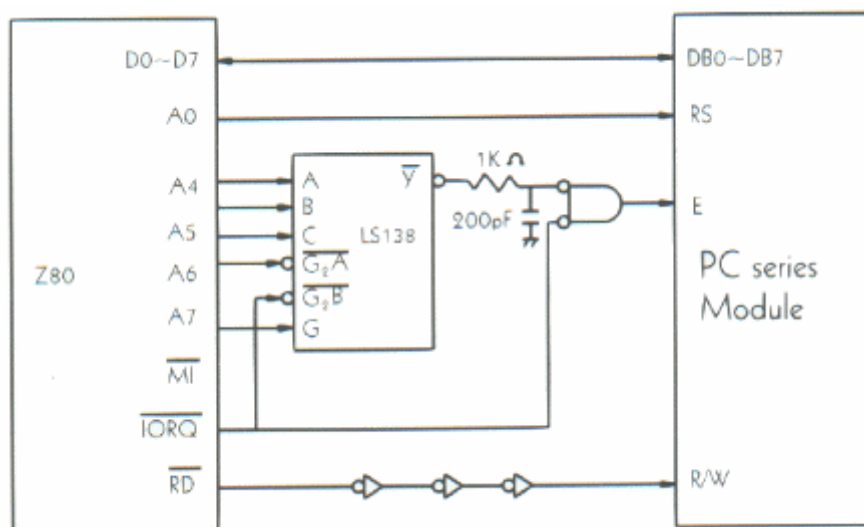
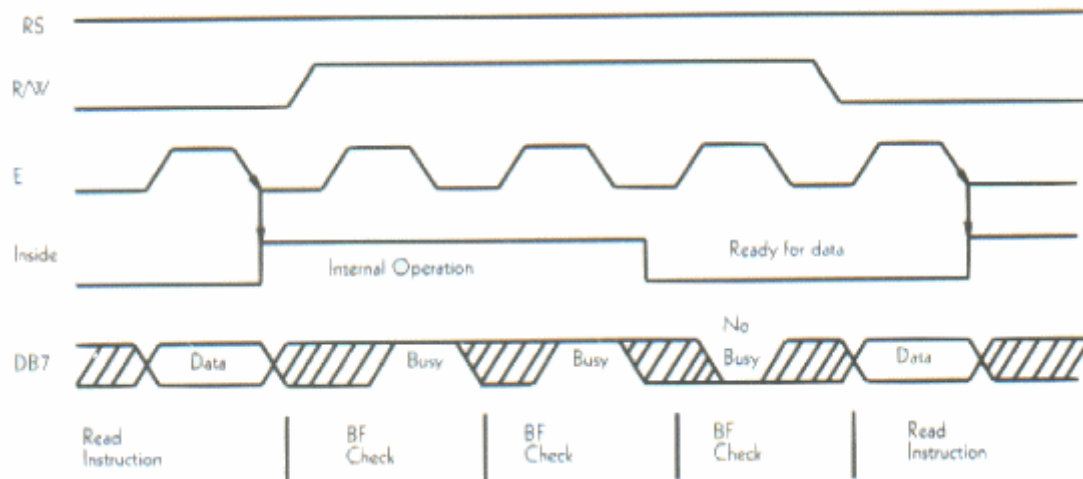


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## Interface With MPU

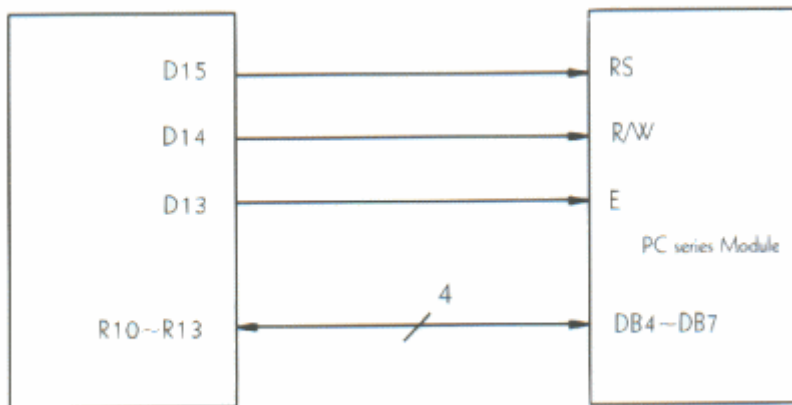
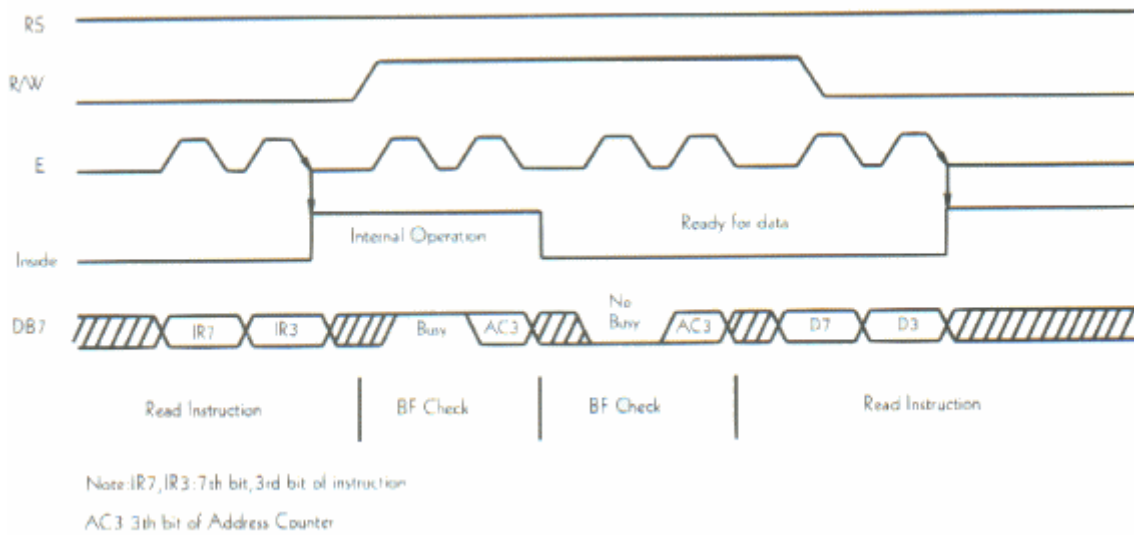
- Example of interfacing to an 8-bit MPU(Z80)
- Example of interfacing to a 4-bit MPU
- If interface data is 4-bits long
- If interface data is 8-bits long

### Example of interfacing to an 8-bit MPU(Z80)



### Example of interface to a 4-bit MPU

Interface to a 4-bit MPU can be made through the I/O port of the 4-bit MPU. If there are sufficient I/O ports, data can be transferred at 8-bit cycles, however, if there are not, data transfer can be accomplished by two cycles of 4-bit transfers (select interface as 4-bits long). Please take into account that 2 cycles of the BF check will be necessary and the timing sequence will prove to be complicated.



#### Features:

1. Interface to an 8-bit or 4-bit MPU is available.
2. 192 types of alphanumeric, symbols and special characters can be displayed with the multi built-in character generator(ROM).
3. Other preferred characters can be displayed by character generator(RAM)
4. Various instructions may be programmed.
  - Clear display
  - Cursor at home
  - On/Off cursor
  - Blink character
  - Shift display
  - Shift cursor
  - Read/write display data, etc.
5. Compact and light weight design which can easily be integrated into end products.
6. single power supply +5V drive(except for extended temp. type).
7. Low power consumption.
  - Interface between data bus line and 4-bit or 8-bit MPU is available.
  - Data transfer requires two cycles in case of a 4-bit MPU, and once in case of an 8-bit MPU.

#### If Interface Data Is 4-bit long

- Data transfer is accomplished through 4 bus lines from DB4 to DB7.(while the rest of 4 bus lines from DB0 to DB3 are not used.)
- Data transfer is completed when 4-bits of data is transferred twice.(upper 4-bits of data, then lower 4-bits of data.)

#### If Interface Data Is 8-bits Long

- Data transfer is made through all 8 bus lines from DB0 to DB7.



**Technical**



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**Standard Character Pattern**

- Character Pattern (WB)
- Character Pattern (HC)
- Character Pattern (NI)
- Character Pattern (JA)
- Character Pattern (SO,WA)
- Character Pattern
- Character Pattern (N5)
- Character Pattern
- Character Pattern (N4)
- Character Pattern (TA)
- Character Pattern (NH)
- Character Pattern (YA)

		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	CG RAM (1)	±	!	0	P	'	P	G	E	A	'	0	M	P	T			
	1	CG RAM (2)	≡	!	1	A	Q	a	r	u	a	e	i	"	J	T	y	o	
	2	CG RAM (3)	7	"	2	B	R	b	r	e	r	E	6	'	°	9	8	z	
	3	CG RAM (4)	2	#	3	O	S	c	s	a	a	o	u	'	P	7	e	q	
	4	CG RAM (5)	7	\$	4	D	T	d	t	a	a	6	4	'	4	7	z	o	
	5	CG RAM (6)	2	5	E	U	e	u	a	b	6	E	2	'	2	1	4	n	7
	6	CG RAM (7)	7	6	F	U	f	u	a	6	4	W	U	'	8	8	8	8	
	7	CG RAM (8)	7	'	7	G	w	a	w	S	U	R	X	'	A	L	L	4	
	8	CG RAM (1)	7	(	C	H	X	h	x	E	9	4	'	÷	÷	E	K	8	
	9	CG RAM (2)	7	)	9	I	Y	y	9	a	b	1	'	Δ	Γ	W	X	4	
	A	CG RAM (3)	8	*	#	J	Z	j	z	e	0	2	'	2	7	2	U	7	
	B	CG RAM (4)	7	+	#	K	I	k	C	I	R	3	'	*	L	7	v	4	
	C	CG RAM (5)	≡	.	<	L	V	l	v	i	N	8	'	*	U	8	5	0	
	D	CG RAM (6)	8	:	-	M	J	m	j	i	3	4	'	.	ψ	π	-	-	
	E	CG RAM (7)	7	.	>	N	^	n	^	2	9	9	'	7	0	0	p	8	
	F	CG RAM (8)	8	/	?	O	_	O	_	Δ	Δ	6	'	7	0	0	0	8	

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