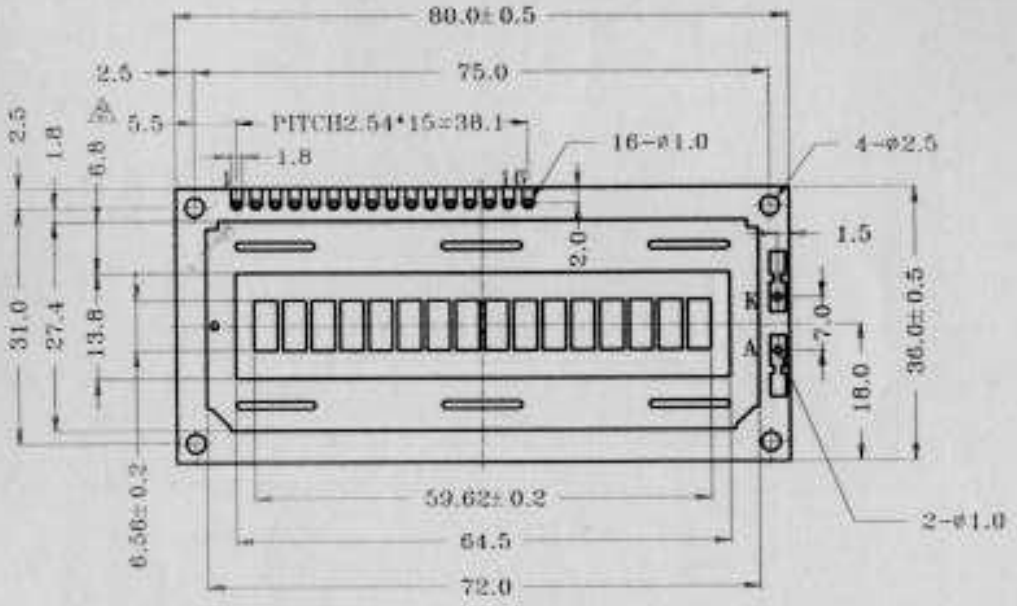
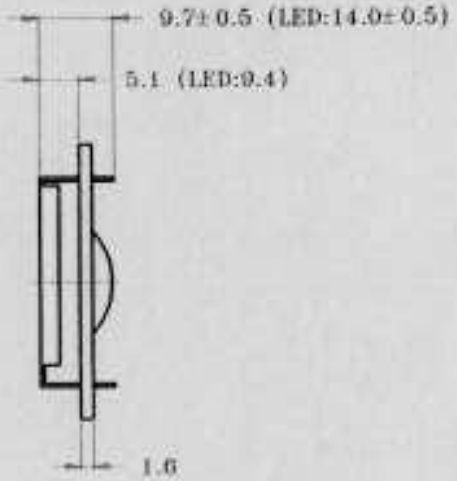
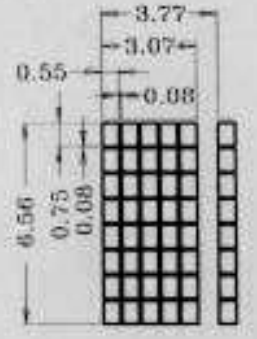
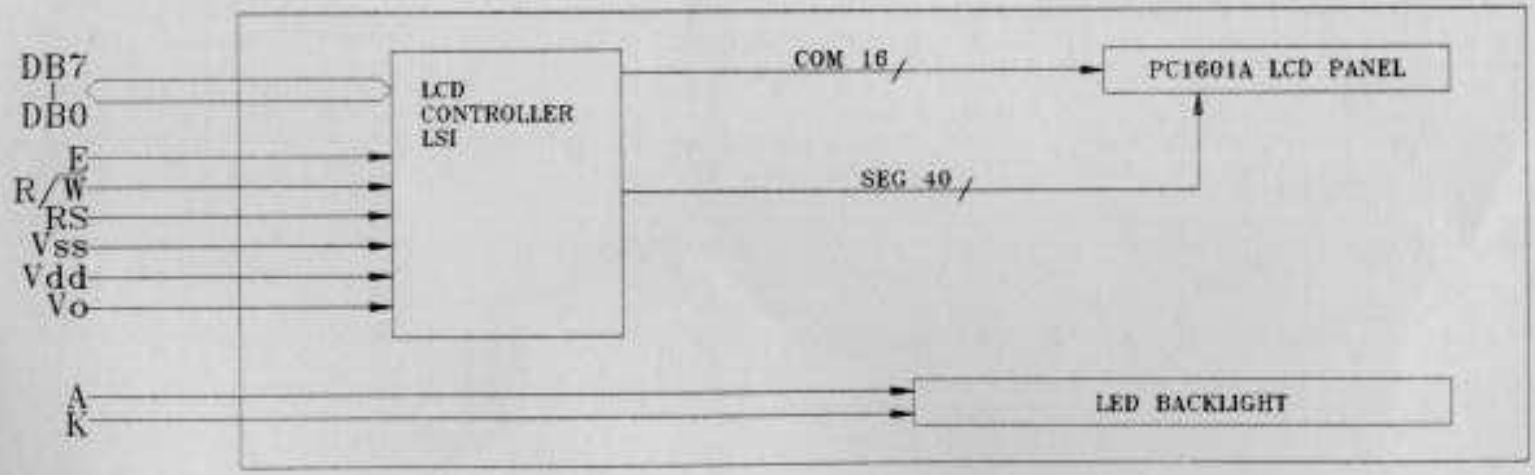






SCALE:4/1

PIN NO.	SIGNAL
1	Vss
2	Vdd
3	Vo
4	RS
5	R/W
6	E
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	A
16	K



The tolerance unless classified ±0.3mm

UNIT:mm

■ Absolute Maximum Rating

ITEM	Symbol	Value	Unit
Power Supply Voltage	Vdd -Vss	-0.3～+7.0	V
Driver Supply Voltage	Vlcd	Vdd-13.5～Vdd+0.3	
Input Voltage	Vin	-0.3～Vdd+0.3	
Operating temperature range	Top	0～+50	℃
Storage temperature range	Tst	-20～+60	

■ Description of Terminals

Symbol	Input/ Output	External Connection	Function
RS	Input	MPU	Register selection input High: Data register (for read and write) Low: Instruction register (for write) Busy flag, address counter (for read)
R/W	Input	MPU	R/W signal input is used to select the read/write mode High: Read mode Low: Write mode
E	Input	MPU	Start enable signal to read or write the data
DB4 | DB7	Input/ Output	MPU	Four high order bidirectional three-state data bus lines. Used for data transfer between the MPU and the LCD module. DB7 can be used as a busy flag.
DB0 | DB3	Input/ Output	MPU	Four low order bidirectional three-state date bus lines. Used for data transfer between the MPU and the LCD module. These four are not used during 4-bit operation.
Vdd Vss		Power Supply	Vdd: +5V Vss: GND
Vo		Power Supply	Contrast adjustment voltage

ELECTRAL CHARACTERISTICS

Dc Characteristics (Vdd=+5V±10%, Vss=0V, Ta=25℃)

Parameter	Symbol	Condition	Applicable PIN	Min	Typ	Max.	Unit
H leve input voltage(1)	Vih1	—	DB0 ~DB7	2.2	—	Vdd	V
L leve input voltage(1)	Vil1	—	RS.R/W.E	-0.3	—	0.6	V
H leve input voltage(2)	Vih2	—	OSC1	Vdd-1.0	—	Vdd	V
L leve input voltage(2)	Vil2	—		-0.2	—	1.0	V
H leve output voltage(1)	Voh1	Ioh=-0.205mA	DB0 ~DB7	2.4	—	—	V
L leve output voltage(1)	Vol1	Iol=1.2mA		—	—	0.4	V
H leve output voltage(2)	Voh2	Ioh=-40uA	XSC LP DO	0.9Vdd	—	—	V
L leve output voltage(2)	Vol2	Iol=40uA		—	—	0.1Vdd	V
I/o leakage current	Iil	Vin=0 to Vdd		-1	—	1	uA
Pull-UP Mos Current	-Ip	Vdd=5V		50	125	250	uA
Supply current	Iop	Rf oscillation ,from external clock Vdd=5v fosc=270kHz	Vdd	—	0.35	0.6	mA

Internal clock operation (Rf oscillation)

Oscillation frequency	fosc	Rf=91kΩ ±2%	OSC1 | OSC2	190	270	350	kHz
Oscillation frequency	fosc	Ceramic filter	OSC1 | OSC2	245	250	255	kHz
LCD driving voltage	Vlcd	Vdd-V5	V1~V5	3.0	—	11.0	V

AC Characteristics (Vdd=5V±10%, Vss=0V, Ta=25℃)

Read Cycle

Parameter	Symbol	Min	Typ	Max	Unit	TEST PIN
Enable cycle time	tc	500	—	—	ns	E
Enable "H" leve pulse width	tw	220	—	—	ns	E
Enable rise/fall time	tr,tf	—	—	25	ns	E
RS,R/W setup time	tsu	40	—	—	ns	R/W,RS
RS,R/W address hold time	th	10	—	—	ns	R/W,RS
Read data output delay	td	60	—	120	ns	DB0~DB7
Read data hold time	tdh	20	—	—	ns	DB0~DB7

Write Cycle

Parameter	Symbol	Min	Typ	Max	Unit	TEST PIN
Enable Cycle time	tc	500	—	—	ns	E
Enable H leve pulse width	tw	220	—	—	ns	E
Enable rise/fall time	tr,tf	—	—	25	ns	E
RS,R/W setup time	tsu1	40	—	—	ns	R/W,RS
RS,R/W address hold time	th1	10	—	—	ns	R/W,RS
Date setup time	tsu2	60	—	—	ns	DB0~DB7
Write data hold time	th2	10	—	—	ns	DB0~DB7

■ Optical Characteristics

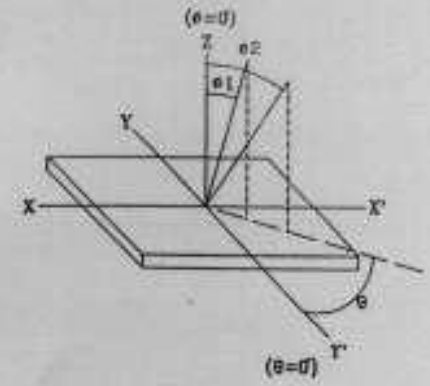
1 . STN TYPE

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Viewing Angle	$\phi 2-\phi 1$	K=1.4	40	—	—	deg.	*1,*2
Contrast Ratio	K	ϕ =10℃ θ = 0℃	—	3	—	—	*3
Response Time(Rise)	tr	ϕ =10℃ θ = 0℃	—	150	250	ms	*4
Response Time(Fall)	tf	ϕ =10℃ θ = 0℃	—	200	300	ms	*4

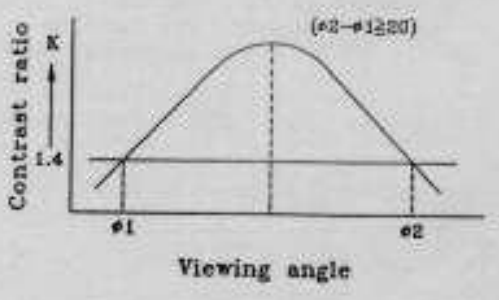
2 . TN TYPE

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Viewing Angle	$\phi 2-\phi 1$	K=1.4	60	—	—	deg.	*1,*2
Contrast Ratio	K	ϕ =25℃ θ = 0℃	—	3	—	—	*3
Response Time(Rise)	tr	ϕ =25℃ θ = 0℃	—	80	120	ms	*4
Response Time(Fall)	tf	ϕ =25℃ θ = 0℃	—	60	90	ms	*4

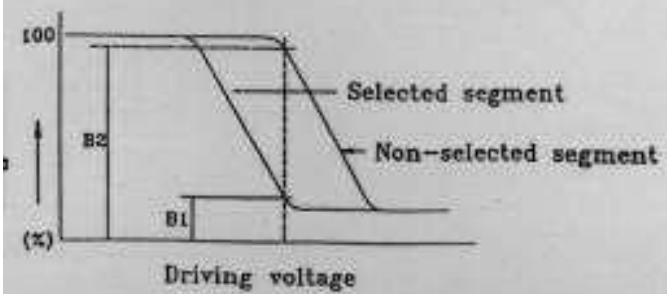
*1. Definition of Q AND ϕ



*2. Contrast vs viewing angle

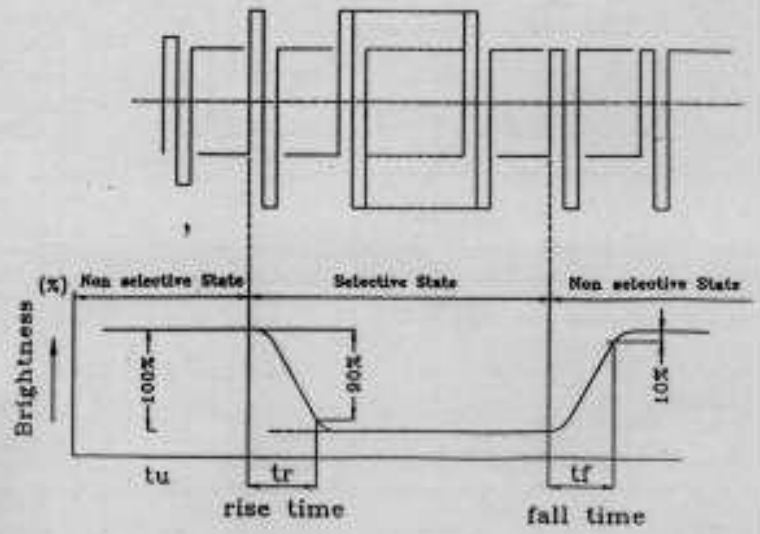


*3. definition of contrast ratio



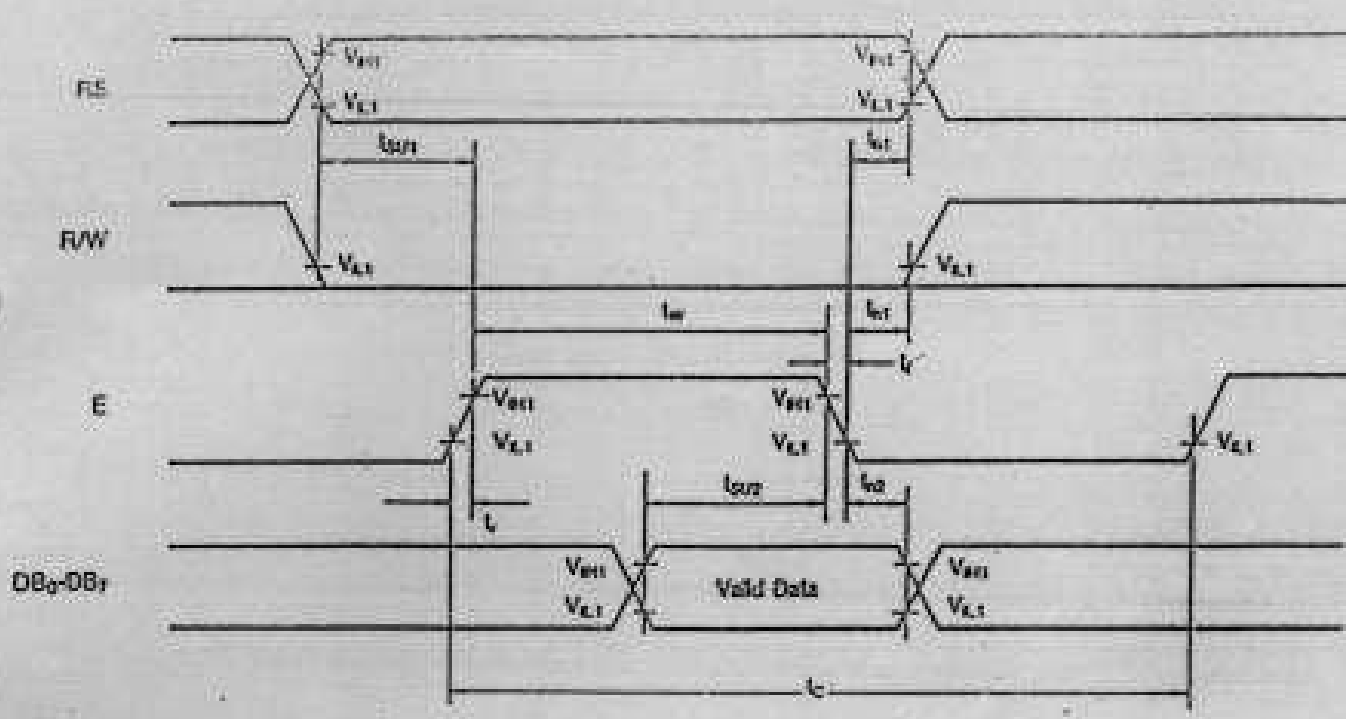
$$K=\frac{\text{Brightness of non-selected segment(B2)}}{\text{Brightness of selected segment(B1)}}$$

*4. Definition of optical response

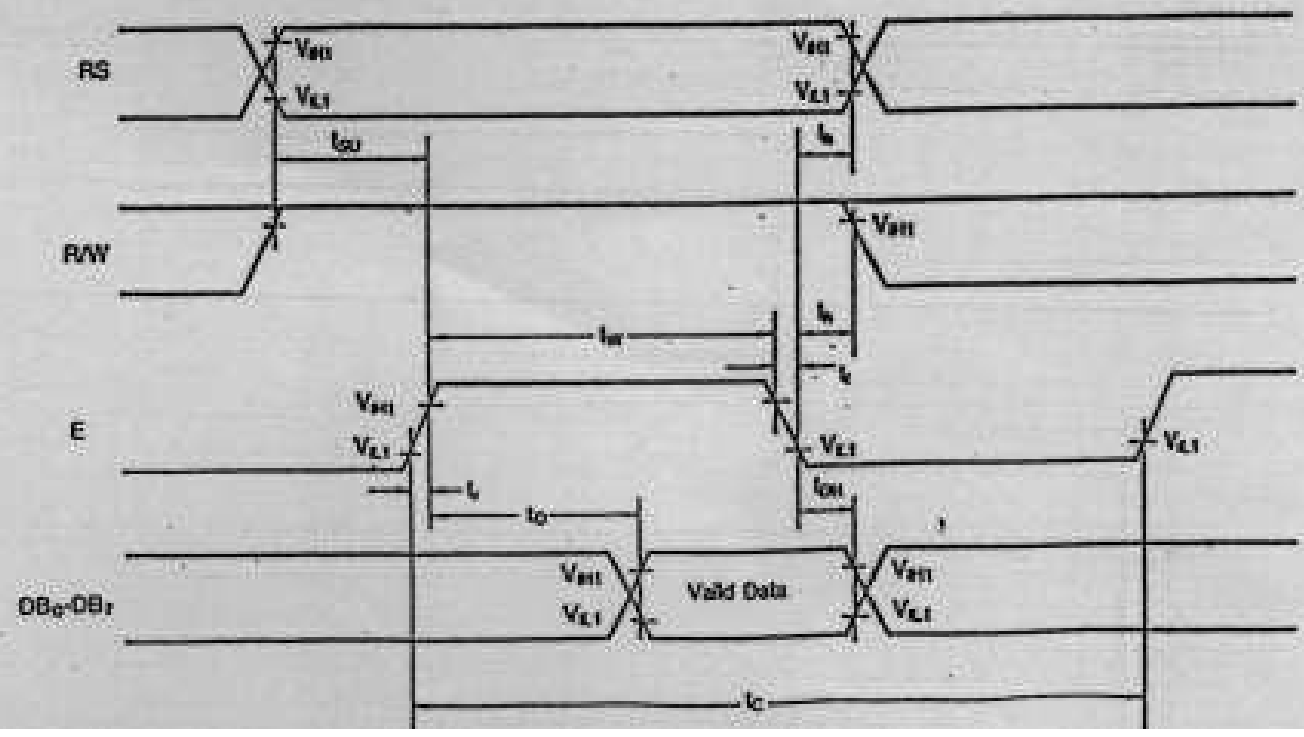


Timing Characteristics

(1) Write mode



(2) Read mode



■ DISPLAY COMMAND

Parameter	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	DESCRIPTION
CLEAR DISPLAY	0	0	0	0	0	0	0	0	0	1	
CURSOR HOME	0	0	0	0	0	0	0	0	1	*	
ENTRY MODE SET	0	0	0	0	0	0	0	1	I/D	SH	DB1=1:Increment DB1=0:Decrement DB0=1:The display is shifted DB0=0:The display is not shifted
DISPLAY ON/OFF	0	0	0	0	0	0	1	D	C	B	DB2=1:Display on DB2=0:Display off DB1=1:Cursor on DB1=0:Cursor off DB0=1:Brinking on DB0=0:Brinking off
CURSOR/ DISPLAY SHIFT	0	0	0	0	0	1	S/C	R/L	*	*	DB3=1:Shifts display one character DB2=1:Right shift DB2=0:Left shift
FUNCTION SET	0	0	0	0	1	DL	N	F	*	*	DB4=1:8 bits DB4=0:4 bits DB3=1:2 lines display (1/16 duty) DB3=0:1 line display (DB2=1:5×10 dots,1/11 duty DB2=0:5×7 dots,1/8 duty)
SET CGRAM ADDRESS	0	0	0	1	ACG						The address length that can be set is 64 addresses
SET DDRAM ADDRESS	0	0	1	ADD							The address length that can be set is 80 addresses
READ BUSY FLUG/ ADDRESS COUNTER	0	1	BF	AC							DB7=1:Bus(instruction not accepted) DB7=0:Read(instruction accepted)
WRITE DATA	1	0	Write Data								
READ DATA	1	1	Read Data								

NOTE: * Don't care.