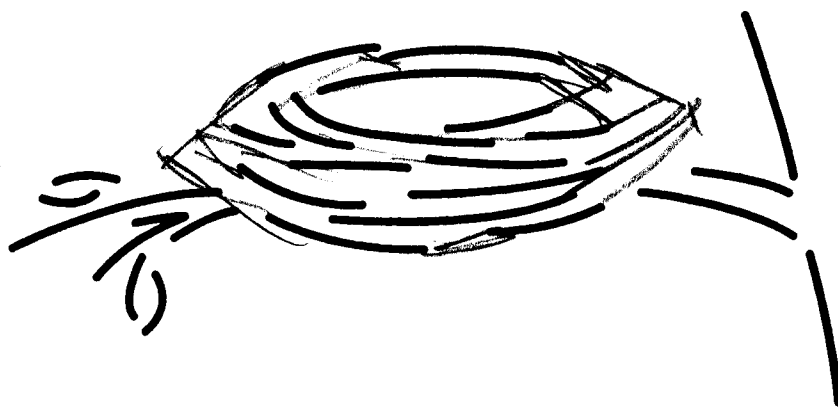


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LCM Standard Product List

Model No.	Format	Type	Back Light	Modul Size	View Area	Dot Size	Dot Pitch	Character Size
SC1601A	16*1	TN,STN	No,EL(LED)	80*36*8.8(12.7)	66*16	.55*.75	.63*.83	3.07*6.56
SC1601B	16*1	TN,STN	No,EL(LED)	85*28*8.8(12.7)	66*16	.55*.75	.63*.83	3.07*6.56
SC1601D	16*1	TN,STN	No,EL(LED)	115*23.2*8.8(12.7)	99*13	.92*1.16	.98*1.22	4.84*9.7
SC1602A	16*2	TN,STN	No,EL(LED)	80*36*8.8(12.7)	66*16	.56*.66	.60*.70	2.95*4.35
SC1602B	16*2	TN,STN	No,EL(LED)	85*30*8.8(12.7)	66*16	.56*.66	.60*.70	2.95*4.35
SC1602H	16*2	TN,STN	No,EL(LED)	84*44*8.8(12.7)	66*16	.56*.66	.60*.70	2.96*5.56
SC1602D	16*2	TN,STN	No,EL(LED)	85*36*8.8(12.7)	66*16	.56*.66	.60*.70	2.96*5.56
SC1602E	16*2	TN,STN	No,EL(LED)	122*44*8.8(12.7)	99*24	.92*1.16	.98*1.21	4.84*9.63
SC2002A	20*2	TN,STN	No,EL(LED)	116*37*8.8(12.7)	85*18.6	.60*.65	.65*.70	3.20*5.55
SC2004A	20*4	STN,TN	No,EL(LED)	98*60*8.8(12.7)	77*26.3	.55*.55	.60*.70	2.95*4.75
SC2402A	24*2	TN,STN	No,EL(LED)	118*36*8.8(12.7)	93.5*16	.60*.65	.65*.70	3.20*5.55
SC4002A	40*2	STN,TN	No,EL(LED)	182*33.5*8.8(12.7)	154*15.3	.60*.65	.65*.70	3.20*5.55
SG12232A	122*32	STN	No,EL(LED)	84*44*8.8(12.7)	60.5*18.5	.40*.45	.44*.49	
SG12864A	128*64	STN	No,EL(LED)	93*70*8.8(12.7)	72*40	.48*.48	.52*.52	
SG128128B	128*128	STN/FSTN	No,EL(CCFL)	84.4*100*14.0	62*62	.40*.40	.43*.43	
SG24064A	240*64	STN	No,EL(CCFL,LED)	180*65*10(20.1)	134*40	.49*.49	.53*.53	
SG24064B	240*64	STN/FSTN	No,EL(CCFL,LED)	180(187)*65(76) *11.5(14.0)	133*40	.49*.49	.53*.53	
SG240128A	240*128	STN	No,EL(CCFL)	170*101.1*14	132*76	.47*.47	.50*.50	
SG240128B	240*128	STN/FSTN	No,EL(CCFL)	144*104*10.3(14)	114*64	.42*.42	.45*.45	
SG320240A	320*240	STN	No,EL(CCFL)	167.1*109*10	122*92	.33*.33	.36*.36	
SG320240B	320*240	STN/FSTN	No,EL(CCFL)	160(167.1)*109*11	12*90	.33*.33	.36*.36	
SG640200B	640*200	STN	No,CCFL	264*141*20.5	232*106	.32*.46	.35*.49	
SG640480B	640*480	STN	No,CCFL	254*276.8*21.5	230*198	.32*.37	.35*.40	

● HANDLING PRECAUTIONS

- (1) The LCD module is a fragile item and should not be subjected to strong mechanical shocks.
- (2) Avoid applying pressure to the module surface. This will distort the glass and cause a change in colour.
- (3) Under no circumstance should the position of the bezel tabs or their shape be modified.
- (4) Do not modify the display PCB in either shape or positioning of components.
- (5) Do not modify or move location of the zebra or heart seal connectors.
- (6) The device should only be soldered to during interfacing. Modification to other area of the board should not be carried out.
- (7) In the event of LCD breakage and resultant leakage of fluid do not inhale, ingest or make contact with the skin. If contact is made rinse immediately.
- (8) When cleaning the module use a soft damp cloth with a mild solvent, such as Isopropyl or Ethyl alcohol. The use of water, ketone or aromatic is not permitted.
- (9) Prior to initial power up input signals should not be applied.
- (10) Protect the module against static electricity and observe appropriate anti-static precaution.

● LCD Module Classification

SC 1601A SL B -HO-00

① ② ③ ④ ⑤ ⑥ ⑦

- ① Module Types: SC=Character type, SG=Graphic type
- ② Model No.: 1601, 1602, 2002, 2004, 4002, etc.
- ③ LCD Mode: N=TN positive, M=TN negative, S=STN/Gray,
U=STN/Yellow, B=STN/Blue, F=FSTN/White, N=FSTN/Black
- ④ Back Light Mode: L=LED/Yellow, M=LED/Amber, N=LED/Red,
O=LED/Orange, E=EL/White, B=EL/Blue-Green,
G=EL/Green, C=CCFL/White/Transmissive
D=CCFL/White/Transflective
- ⑤ View Angel: B=Bottom View, T=Up View
- ⑥ Character set
SO: Samsung/English-Japanese
HO: Hitachi/English-Japanese
EH: Epson/English-Cyrillic-Russian
EB: Epson/English-European
- ⑦ ● Temperature Type
 - G: General temperature (0 ~ 50 °C)
 - H: Wide temperature (- 20 ~ 60 °C)

SC1601A (16 characters × 1 line)

■ FEATURE:

- 1.5 × 7dots with cursor
- 2.Built in Controller (KS0066 or Equivalent)
- 3.5V Power Supply
- 4.1/16 Duty Cycle
- 5.4.2V LED Forward Voltage

■ MECHANICAL DATA

ITEM	DIMENSIONS	UNIT
Module Size (W × H × T)	80 × 36.0 × 8.8(12.7LED)	mm
Viewing Area (W × H)	66.0 × 16.0	mm
Character Size (W × H)	3.07 × 6.56	mm
Character Pitch(W × H)	3.77 × 6.56	mm
Dot Size(W × H)	0.55 × 0.75	mm
Dot Pitch(W × H)	0.63 × 0.83	mm

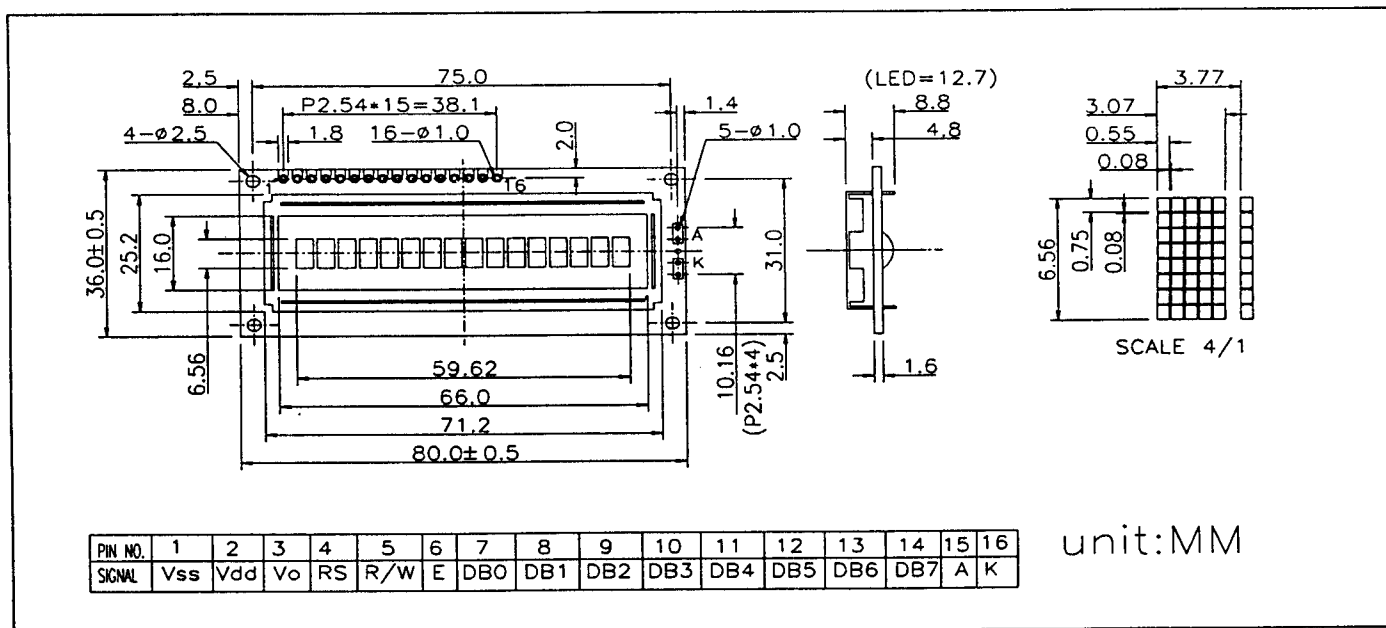
■ INTERFACE PIN CONNECTIONS:

No	Symbol	Function	No	Symbol	Function
1	V _{SS}	0V	9	DB2	DATA BIT2
2	V _{DD}	5V	10	DB3	DATA BIT3
3	V _O	CONTRAST ADJ	11	DB4	DATA BIT4
4	RS	REGISTER SELECT	12	DB5	DATA BIT5
5	R/W	READ/WRITE	13	DB6	DATA BIT6
6	E	ENABLE SIGNAL	14	DB7	DATA BIT7
7	DB0	DATA BIT0	15	A	LED POWER
8	DB1	DATA BIT1	16	K	LED POWER

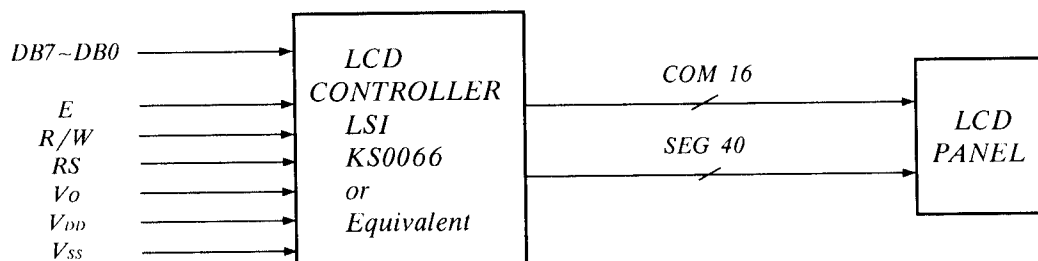
■ ELECTRICAL CHARACTERISTICS:

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD Operating Voltage	V _{DD} -V _O	Ta=0 °C	—	4.8	—	V
		Ta=25 °C	—	4.5	—	V
		Ta=50 °C	—	4.2	—	V
Supply Voltage	V _{DD} -V _{SS}	—	4.7	5	5.3	V
Input Voltage	"High" Level	V _{IH}	—	2.2	—	V _{DD} V
	"Low" Level	V _{IL}	—	0	—	0.6 V
Output Voltage	"High" Level	V _{OH}	—	2.4	—	V
	"Low" Level	V _{OL}	—	—	0.4	V

■ EXTERNAL DIMENSION



■ BLOCK DIAGRAM



SC1601B (16 characters × 1 line)

FEATURE:

- 1.5 × 7dots with cursor
- 2.Built in Controller (KS0066 or Equivalent)
- 3.5V Power Supply
- 4.1/16 Duty Cycle
- 5.4.2V LED Forward Voltage

MECHANICAL DATA

ITEM	DIMENSIONS	UNIT
Module Size (W × H × T)	85 × 28.0 × 8.8(12.7LED)	mm
Viewing Area (W × H)	66.0 × 16.0	mm
Character Size (W × H)	3.07 × 6.56	mm
Character Pitch(W × H)	3.77 × 6.56	mm
Dot Size(W × H)	0.55 × 0.75	mm
Dot Pitch(W × H)	0.63 × 0.83	mm

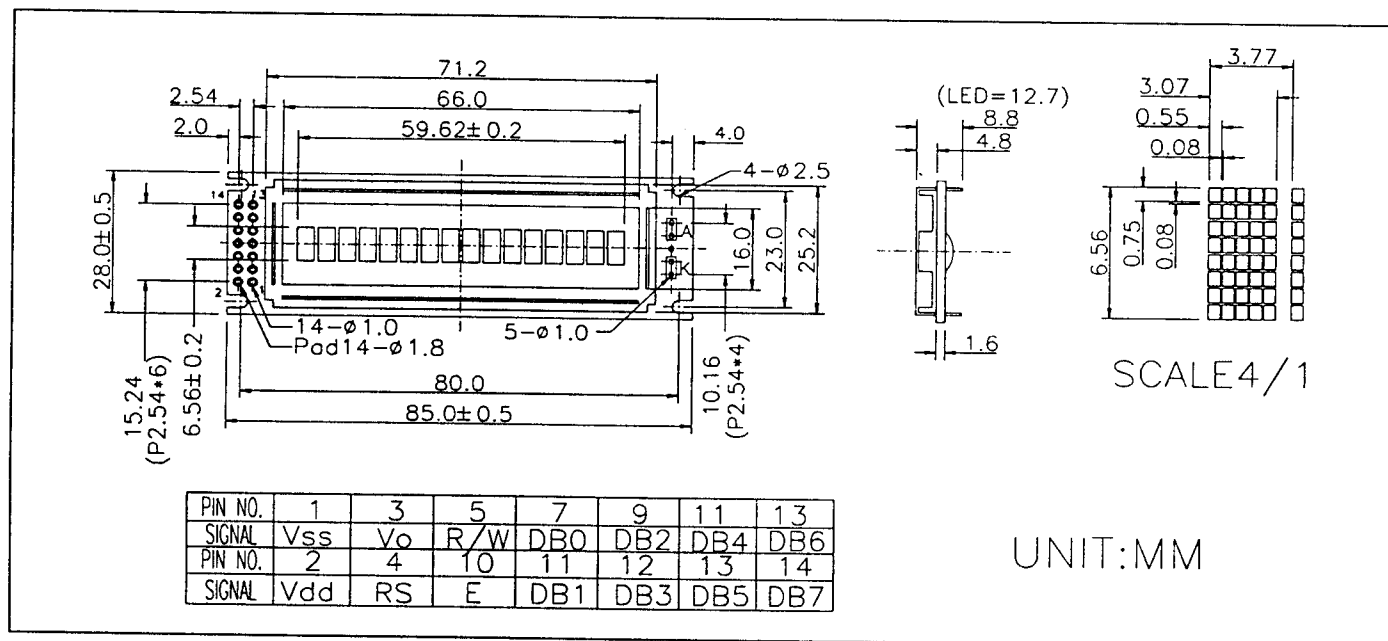
INTERFACE PIN CONNECTIONS:

No	Symbol	Function	No	Symbol	Function
1	V _{SS}	0V	9	DB2	DATA BIT2
2	V _{DD}	5V	10	DB3	DATA BIT3
3	V _O	CONTRAST ADJ.	11	DB4	DATA BIT4
4	RS	REGISTER SELECT	12	DB5	DATA BIT5
5	R/W	READ/WRITE	13	DB6	DATA BIT6
6	E	ENABLE SIGNAL	14	DB7	DATA BIT7
7	DB0	DATA BIT0			
8	DB1	DATA BIT1			

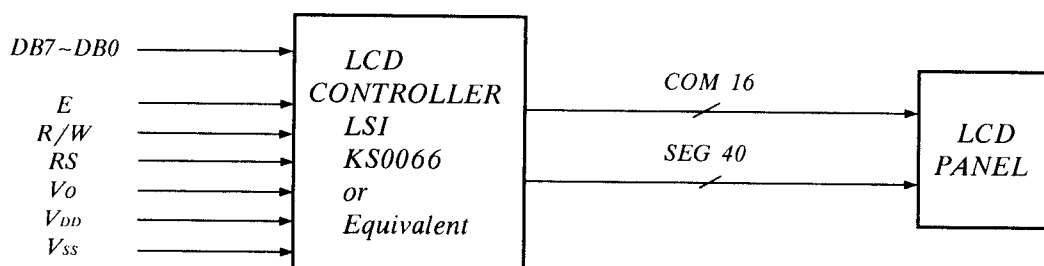
ELECTRICAL CHARACTERISTICS:

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD Operating Voltage	V _{DD} -V _O	Ta=0 °C	—	4.8	—	V
		Ta=25 °C	—	4.5	—	V
		Ta=50 °C	—	4.2	—	V
Supply Voltage	V _{DD} -V _{SS}	—	4.7	5	5.3	V
Input Voltage	"High" Level	V _{IH}	—	2.2	—	V _{DD} V
	"Low" Level	V _{IL}	—	0	—	0.6 V
Output Voltage	"High" Level	V _{OH}	—	2.4	—	V
	"Low" Level	V _{OL}	—	—	0.4	V

EXTERNAL DIMENSION



BLOCK DIAGRAM



■ FEATURE:

- 1.5 × 7dots with cursor
- 2.Built in Controller (KS0066 or Equivalent)
- 3.5V Power Supply
- 4.1/16 Duty Cycle
- 5.4.2V LED Forward Voltage

■ MECHANICAL DATA

ITEM	DIMENSIONS	UNIT
Module Size (W × H × T)	80×36.0×8.8(12.7LED)	mm
Viewing Area (W × H)	66.0 × 16.0	mm
Character Size (W × H)	2.96 × 5.56	mm
Character Pitch(W × H)	3.55 × 5.94	mm
Dot Size(W × H)	0.56 × 0.66	mm
Dot Pitch(W × H)	0.60 × 0.70	mm

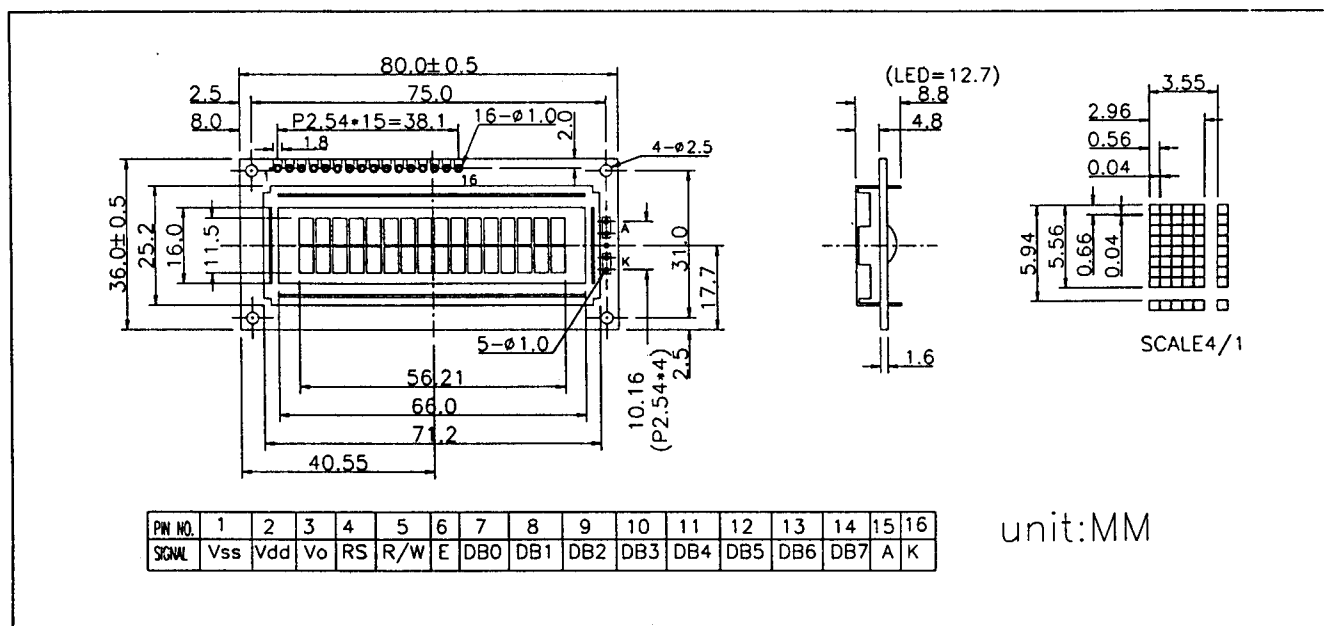
■ INTERFACE PIN CONNECTIONS:

No	Symbol	Function	No	Symbol	Function
1	V _{SS}	0V	9	DB2	DATA BIT2
2	V _{DD}	5V	10	DB3	DATA BIT3
3	V _O	CONTRAST ADJ.	11	DB4	DATA BIT4
4	RS	REGISTER SELECT	12	DB5	DATA BIT5
5	R/W	READ/WRITE	13	DB6	DATA BIT6
6	E	ENABLE SIGNAL	14	DB7	DATA BIT7
7	DB0	DATA BIT0	15	A	LED POWER
8	DB1	DATA BIT1	16	K	LED POWER

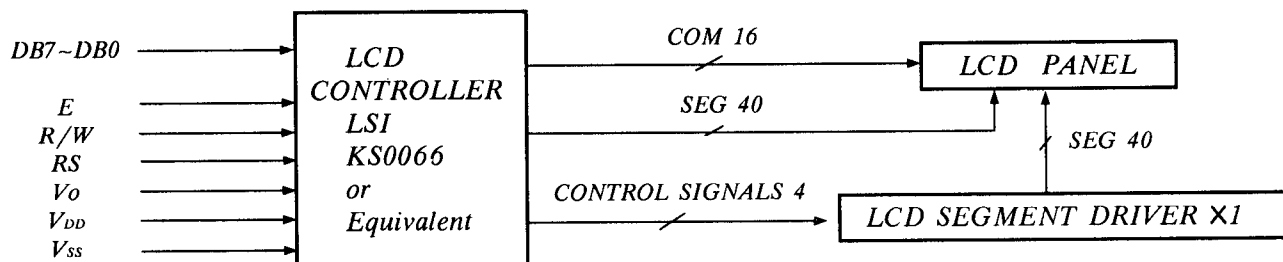
■ ELECTRICAL CHARACTERISTICS:

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD Operating Voltage	V _{DD} -V _O	Ta=0 °C	—	4.8	—	V
		Ta=25 °C	—	4.5	—	V
		Ta=50 °C	—	4.2	—	V
Supply Voltage	V _{DD} -V _{SS}	—	4.7	5	5.3	V
Input Voltage	"High" Level	V _{IH}	—	2.2	—	V _{DD} V
	"Low" Level	V _{IL}	—	0	—	0.6 V
Output Voltage	"High" Level	V _{OH}	—	2.4	—	V
	"Low" Level	V _{OL}	—	—	0.4	V

■ EXTERNAL DIMENSION



■ BLOCK DIAGRAM



SC1602B (16 characters × 2 lines)

■ FEATURE:

- 1.5 × 7dots with cursor
- 2.Built in Controller (KS0066 or Equivalent)
- 3.5V Power Supply
- 4.1/16 Duty Cycle
- 5.4.2V LED Forward Voltage

■ MECHANICAL DATA

ITEM	DIMENSIONS	UNIT
Module Size (W × H × T)	85.0×30.0×8.8(12.7LED)	mm
Viewing Area (W × H)	66.0 × 16.0	mm
Character Size (W × H)	2.96 × 5.56	mm
Character Pitch(W × H)	3.55 × 5.94	mm
Dot Size(W × H)	0.56 × 0.66	mm
Dot Pitch(W × H)	0.60 × 0.70	mm

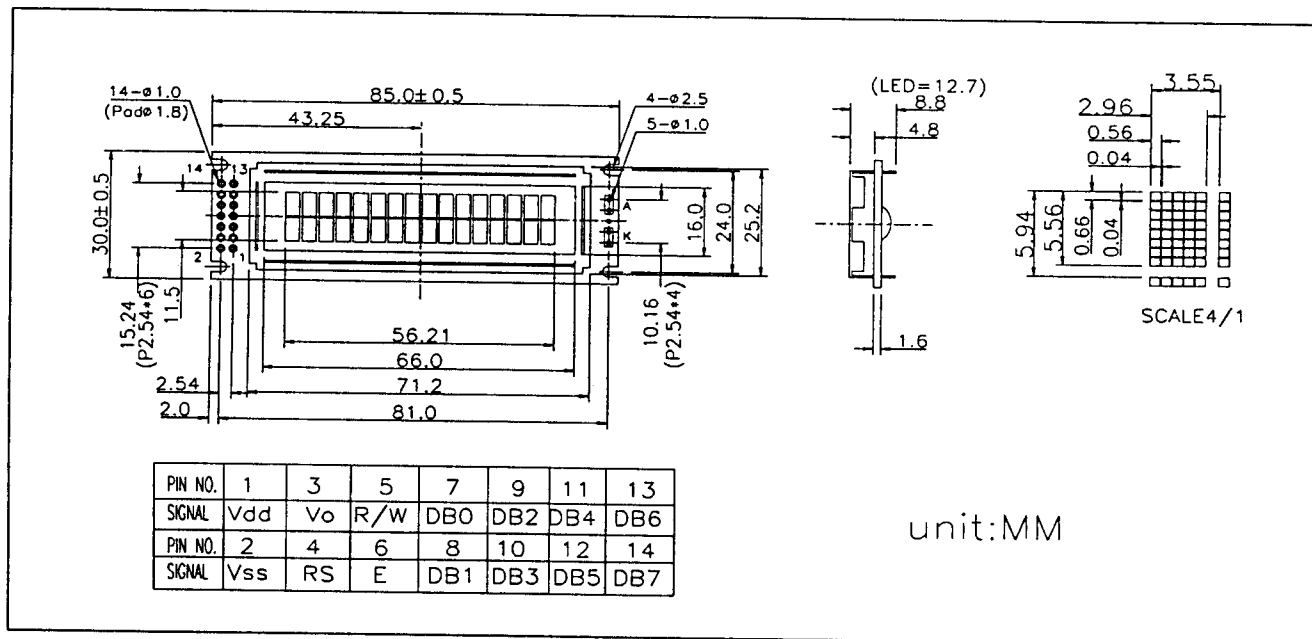
■ INTERFACE PIN CONNECTIONS:

No	Symbol	Function	No	Symbol	Function
1	V _{DD}	5V	9	DB2	DATA BIT2
2	V _{SS}	0V	10	DB3	DATA BIT3
3	V _O	CONTRAST ADJ.	11	DB4	DATA BIT4
4	RS	REGISTER SELECT	12	DB5	DATA BIT5
5	R/W	READ/WRITE	13	DB6	DATA BIT6
6	E	ENABLE SIGNAL	14	DB7	DATA BIT7
7	DB0	DATA BIT0			
8	DB1	DATA BIT1			

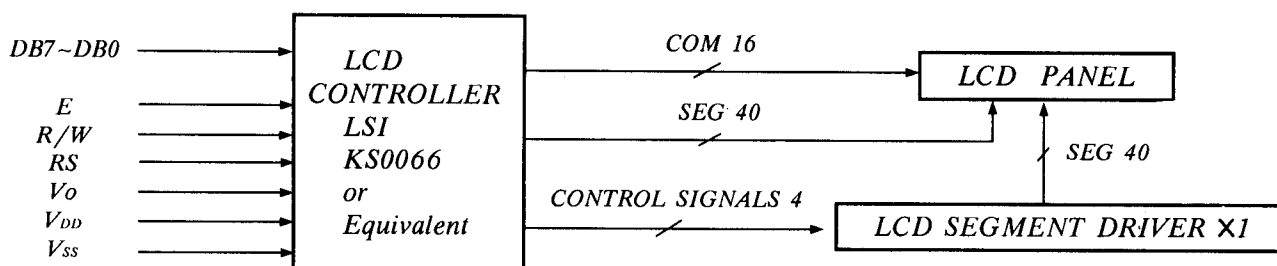
■ ELECTRICAL CHARACTERISTICS:

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD Operating Voltage	V _{DD} -V _O	Ta=0℃	—	4.8	—	V
		Ta=25℃	—	4.5	—	V
		Ta=50℃	—	4.2	—	V
Supply Voltage	V _{DD} -V _{SS}	—	4.7	5	5.3	V
Input Voltage	"High" Level	V _{IH}	—	2.2	—	V _{DD}
	"Low" Level	V _{IL}	—	0	—	0.6 V
Output Voltage	"High" Level	V _{OH}	—	2.4	—	V
	"Low" Level	V _{OL}	—	—	—	0.4 V

■ EXTERNAL DIMENSION



■ BLOCK DIAGRAM



SC1602C (16 characters × 2 lines)

■ FEATURE:

- 1.5 × 7dots with cursor
- 2.Built in Controller (KS0066 or Equivalent)
- 3.5V Power Supply
- 4.1/16 Duty Cycle
- 5.4.2V LED Forward Voltage

■ MECHANICAL DATA

ITEM	DIMENSIONS	UNIT
Module Size (W × H × T)	84.0×44.0×8.8(12.7LED)	mm
Viewing Area (W × H)	66.0 × 16.0	mm
Character Size (W × H)	2.96 × 5.56	mm
Character Pitch(W × H)	3.55 × 5.94	mm
Dot Size(W × H)	0.56 × 0.66	mm
Dot Pitch(W × H)	0.60 × 0.70	mm

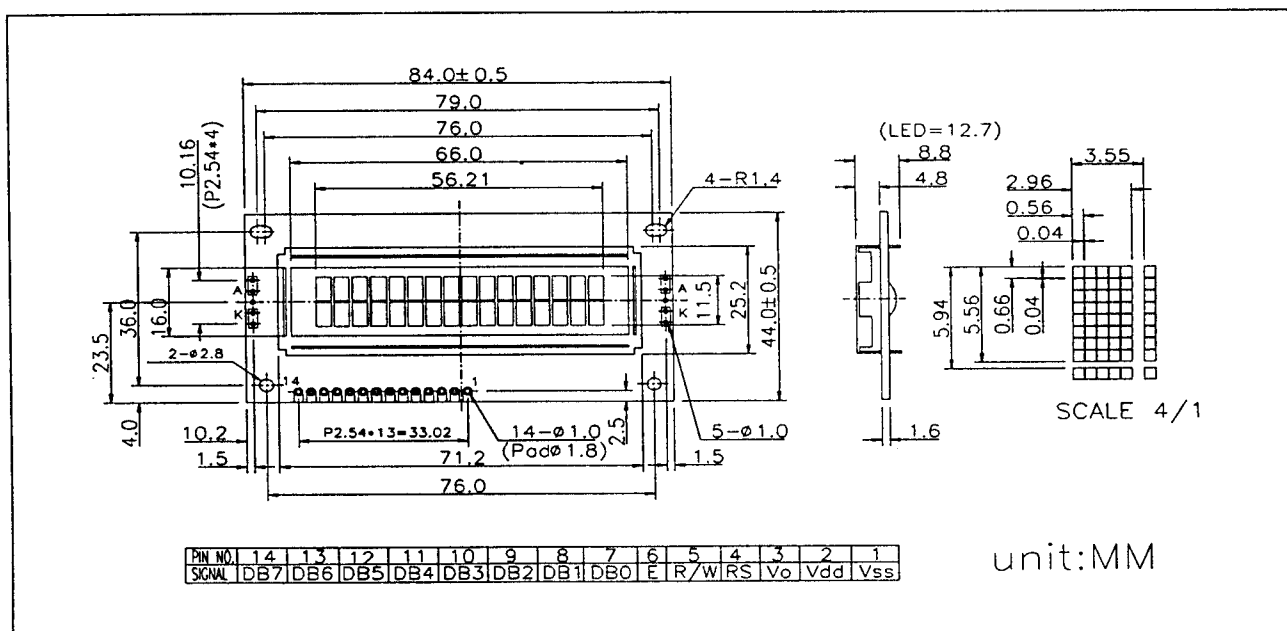
■ INTERFACE PIN CONNECTIONS:

No	Symbol	Function	No	Symbol	Function
1	V _{SS}	0V	9	DB2	DATA BIT2
2	V _{DD}	5V	10	DB3	DATA BIT3
3	V _O	CONTRAST ADJ.	11	DB4	DATA BIT4
4	RS	REGISTER SELECT	12	DB5	DATA BIT5
5	R/W	READ/WRITE	13	DB6	DATA BIT6
6	E	ENABLE SIGNAL	14	DB7	DATA BIT7
7	DB0	DATA BIT0			
8	DB1	DATA BIT1			

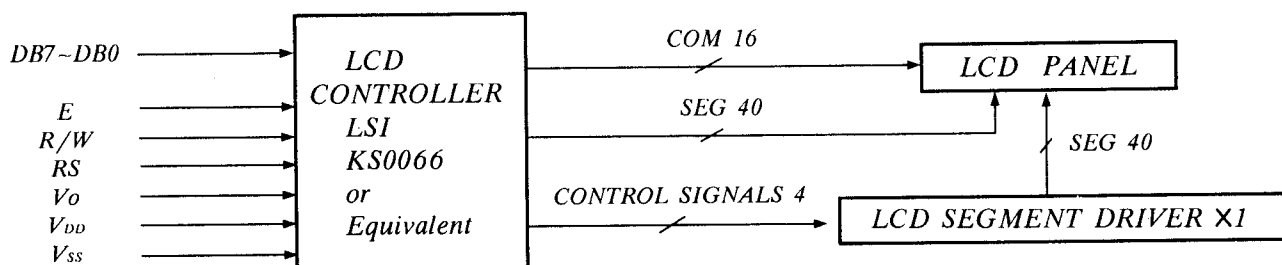
■ ELECTRICAL CHARACTERISTICS:

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD Operating Voltage	V _{DD} -V _O	Ta=0 °C	—	4.8	—	V
		Ta=25 °C	—	4.5	—	V
		Ta=50 °C	—	4.2	—	V
Supply Voltage	V _{DD} -V _{SS}	—	4.7	5	5.3	V
Input Voltage	"High" Level	V _{IH}	—	2.2	—	V _{DD}
	"Low" Level	V _{IL}	—	0	—	0.6 V
Output Voltage	"High" Level	V _{OH}	—	2.4	—	V
	"Low" Level	V _{OL}	—	—	—	0.4 V

■ EXTERNAL DIMENSION



■ BLOCK DIAGRAM



SC1602D (16 characters × 2 lines)

FEATURE:

- 1.5 × 7dots with cursor
- 2.Built in Controller (KS0066 or Equivalent)
- 3.5V Power Supply
- 4.1/16 Duty Cycle
- 5.4.2V LED Forward Voltage

MECHANICAL DATA

ITEM	DIMENSIONS	UNIT
Module Size (W × H × T)	85.0×36.0×8.8(12.7LED)	mm
Viewing Area (W × H)	66.0 × 16.0	mm
Character Size (W × H)	2.96 × 5.56	mm
Character Pitch(W × H)	3.55 × 5.94	mm
Dot Size(W × H)	0.56 × 0.66	mm
Dot Pitch(W × H)	0.60 × 0.70	mm

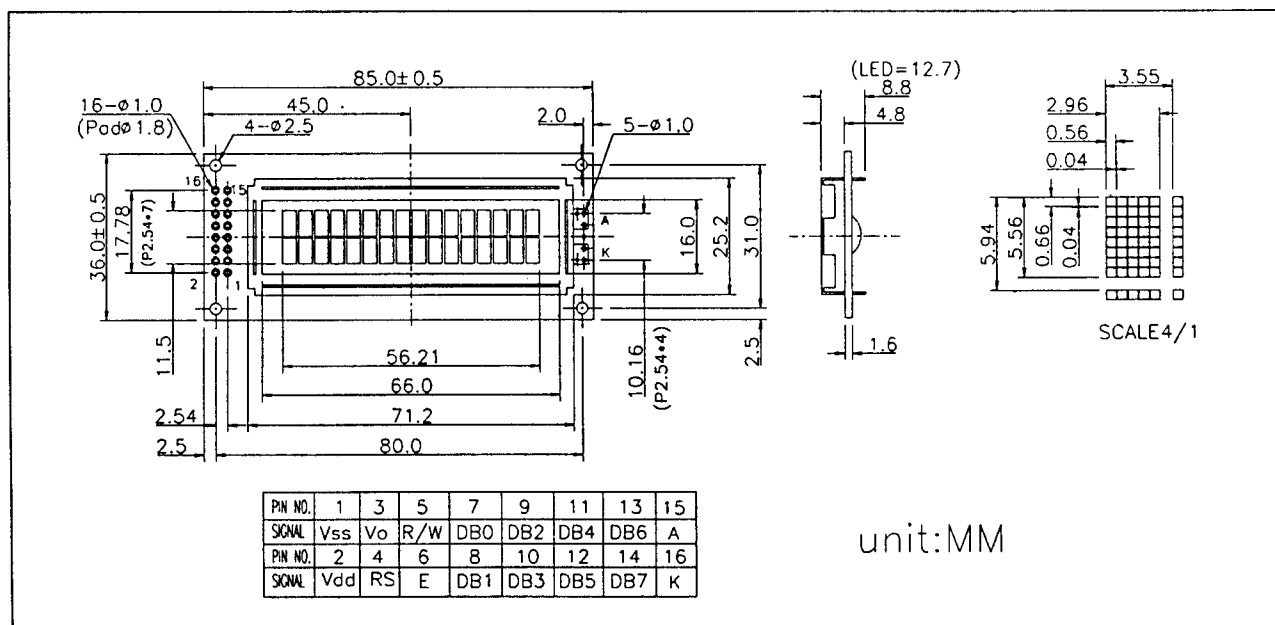
INTERFACE PIN CONNECTIONS:

No	Symbol	Function	No	Symbol	Function
1	V _{SS}	0V	9	DB2	DATA BIT2
2	V _{DD}	5V	10	DB3	DATA BIT3
3	V _O	CONTRAST ADJ.	11	DB4	DATA BIT4
4	RS	REGISTER SELECT	12	DB5	DATA BIT5
5	R/W	READ/WRITE	13	DB6	DATA BIT6
6	E	ENABLE SIGNAL	14	DB7	DATA BIT7
7	DB0	DATA BIT0	15	A	LED POWER
8	DB1	DATA BIT1	16	K	LED POWER

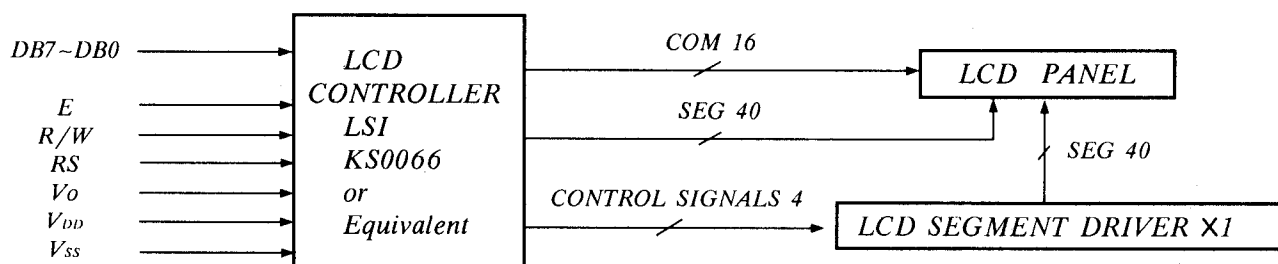
ELECTRICAL CHARACTERISTICS:

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD Operating Voltage	V _{DD} -V _O	Ta=0 °C	—	4.8	—	V
		Ta=25 °C	—	4.5	—	V
		Ta=50 °C	—	4.2	—	V
Supply Voltage	V _{DD} -V _{SS}	—	4.7	5	5.3	V
Input Voltage	"High" Level	V _{IH}	—	2.2	—	V _{DD} V
	"Low" Level	V _{IL}	—	0	—	0.6 V
Output Voltage	"High" Level	V _{OH}	—	2.4	—	V
	"Low" Level	V _{OL}	—	—	0.4	V

EXTERNAL DIMENSION



BLOCK DIAGRAM



SC1602E (16 characters × 2 lines)

FEATURE:

- 1.5 × 7dots with cursor
- 2.Built in Controller (KS0066 or Equivalent)
- 3.5V Power Supply
- 4.1/16 Duty Cycle
- 5.4.2V LED Forward Voltage

MECHANICAL DATA

ITEM	DIMENSIONS	UNIT
Module Size (W × H × T)	122.0×44.0×8.8(13.5LED)	mm
Viewing Area (W × H)	99.0 × 24.0	mm
Character Size (W × H)	4.84 × 9.63	mm
Character Pitch(W × H)	6.0 × 10.37	mm
Dot Size(W × H)	0.92 × 1.16	mm
Dot Pitch(W × H)	0.98 × 1.21	mm

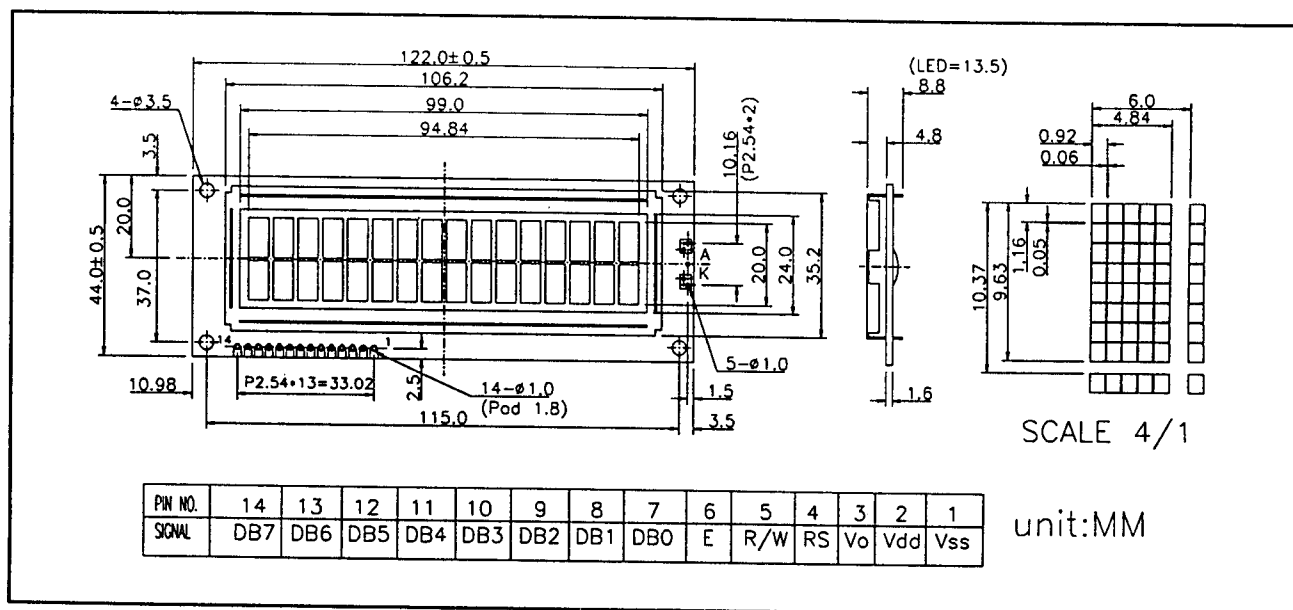
INTERFACE PIN CONNECTIONS:

No	Symbol	Function	No	Symbol	Function
1	V _{SS}	0V	9	DB2	DATA BIT2
2	V _{DD}	5V	10	DB3	DATA BIT3
3	V _O	CONTRAST ADJ.	11	DB4	DATA BIT4
4	RS	REGISTER SELECT	12	DB5	DATA BIT5
5	R/W	READ/WRITE	13	DB6	DATA BIT6
6	E	ENABLE SIGNAL	14	DB7	DATA BIT7
7	DB0	DATA BIT0			
8	DB1	DATA BIT1			

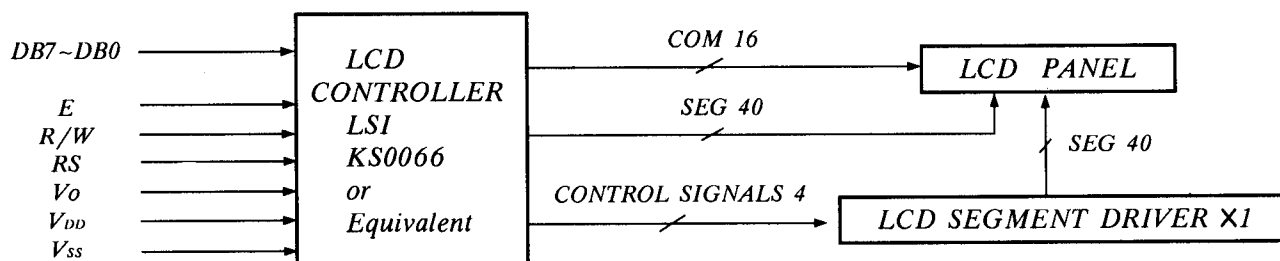
ELECTRICAL CHARACTERISTICS:

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD Operating Voltage	V _{DD} -V _O	Ta=0 °C	—	4.8	—	V
		Ta=25 °C	—	4.5	—	V
		Ta=50 °C	—	4.2	—	V
Suply Voltage	V _{DD} -V _{SS}	—	4.7	5	5.3	V
Input Voltage	"High" Level	V _{IH}	—	2.2	—	V _{DD} V
	"Low" Level	V _{IL}	—	0	—	0.6 V
Output Voltage	"High" Level	V _{OH}	—	2.4	—	V
	"Low" Level	V _{OL}	—	—	0.4	V

EXTERNAL DIMENSION



BLOCK DIAGRAM



SC2002A (20 characters × 2 lines)

FEATURE:

- 1.5 × 7dots with cursor
- 2.Built in Controller (HD44780 or Equivalent)
- 3.5V Power Supply
- 4.1/16 Duty Cycle
- 5.4.2V LED Forward Voltage

MECHANICAL DATA

ITEM	DIMENSIONS	UNIT
Module Size (W × H × T)	116.0×37.0×8.8(12.7LED)	mm
Viewing Area (W × H)	85.0 × 18.6	mm
Character Size (W × H)	3.20 × 5.55	mm
Character Pitch(W × H)	3.7 × 5.95	mm
Dot Size(W × H)	0.60 × 0.65	mm
Dot Pitch(W × H)	0.65 × 0.70	mm

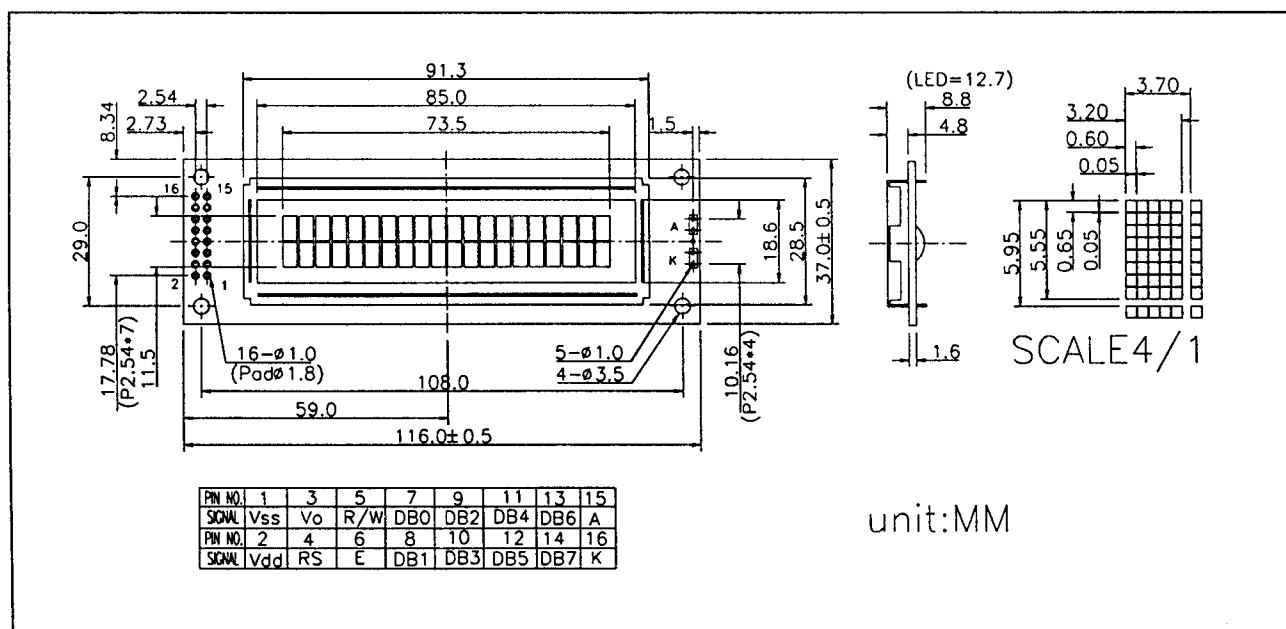
INTERFACE PIN CONNECTIONS:

No	Symbol	Function	No	Symbol	Function
1	V _{SS}	0V	9	DB2	DATA BIT2
2	V _{DD}	5V	10	DB3	DATA BIT3
3	V _O	CONTRAST ADJ.	11	DB4	DATA BIT4
4	RS	REGISTER SELECT	12	DB5	DATA BIT5
5	R/W	READ/WRITE	13	DB6	DATA BIT6
6	E	ENABLE SIGNAL	14	DB7	DATA BIT7
7	DB0	DATA BIT0	15	A	LED POWER
8	DB1	DATA BIT1	16	K	LED POWER

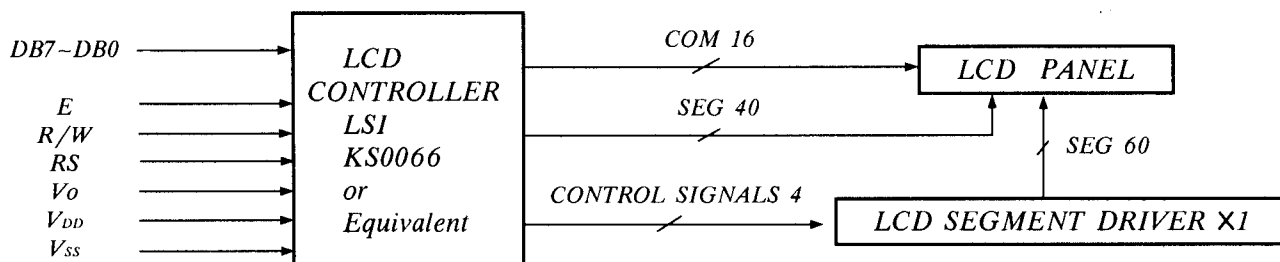
ELECTRICAL CHARACTERISTICS:

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD Operating Voltage	V _{DD} -V _O	Ta=0 °C	—	4.8	—	V
		Ta=25 °C	—	4.5	—	V
		Ta=50 °C	—	4.2	—	V
Supply Voltage	V _{DD} -V _{SS}	—	4.7	5	5.3	V
Input Voltage	"High" Level	V _{IH}	—	2.2	—	V _{DD} V
	"Low" Level	V _{IL}	—	0	—	0.6 V
Output Voltage	"High" Level	V _{OH}	—	2.4	—	V
	"Low" Level	V _{OL}	—	—	0.4	V

EXTERNAL DIMENSION



BLOCK DIAGRAM



SC2004A (20 characters × 4 lines)

■ FEATURE:

- 1.5 × 7dots with cursor
- 2.Built in Controller (HD44780 or Equivalent)
- 3.5V Power Supply
- 4.1/16 Duty Cycle
- 5.4.2V LED Forward Voltage

■ MECHANICAL DATA

ITEM	DIMENSIONS	UNIT
Module Size (W × H × T)	98.0×60.0×8.8(12.7LED)	mm
Viewing Area (W × H)	77.0 × 26.3	mm
Character Size (W × H)	2.95 × 4.75	mm
Character Pitch(W × H)	3.55 × 5.35	mm
Dot Size(W × H)	0.55 × 0.55	mm
Dot Pitch(W × H)	0.60 × 0.60	mm

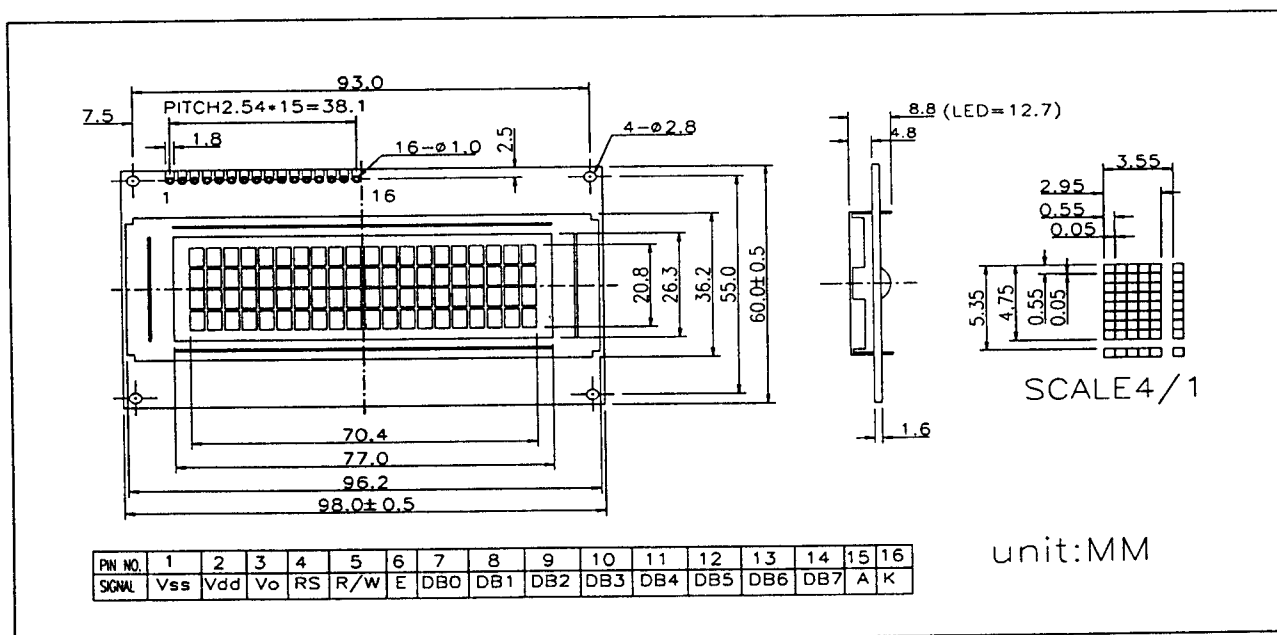
■ INTERFACE PIN CONNECTIONS:

No	Symbol	Function	No	Symbol	Function
1	V _{SS}	0V	9	DB2	DATA BIT2
2	V _{DD}	5V	10	DB3	DATA BIT3
3	V _O	CONTRAST ADJ	11	DB4	DATA BIT4
4	RS	REGISTER SELECT	12	DB5	DATA BIT5
5	R/W	READ/WRITE	13	DB6	DATA BIT6
6	E	ENABLE SIGNAL	14	DB7	DATA BIT7
7	DB0	DATA BIT0	15	A	LED POWER
8	DB1	DATA BIT1	16	K	LED POWER

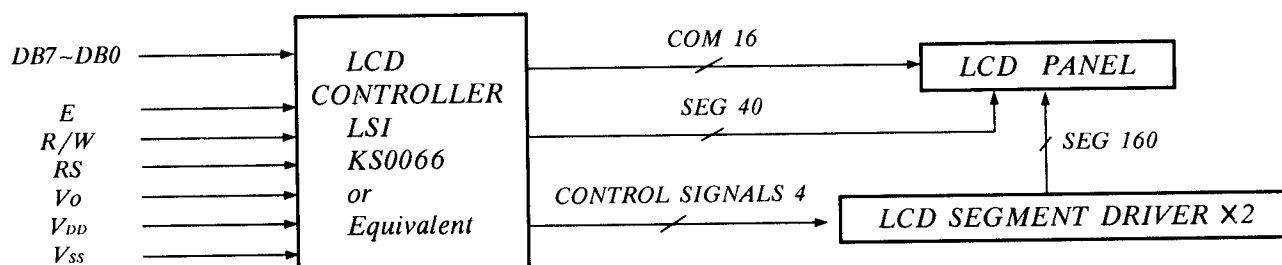
■ ELECTRICAL CHARACTERISTICS:

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD Operating Voltage	V _{DD} -V _O	Ta=0 °C	—	4.8	—	V
		Ta=25 °C	—	4.5	—	V
		Ta=50 °C	—	4.2	—	V
Suply Voltage	V _{DD} -V _{SS}	—	4.7	5	5.3	V
Input Voltage	"High" Level	V _{IH}	—	2.2	—	V _{DD} V
	"Low" Level	V _{IL}	—	0	—	0.6 V
Output Voltage	"High" Level	V _{OH}	—	2.4	—	V
	"Low" Level	V _{OL}	—	—	0.4	V

■ EXTERNAL DIMENSION



■ BLOCK DIAGRAM



SC2402A (24 characters × 2 lines)

FEATURE:

- 1.5 × 7dots with cursor
- 2.Built in Controller (HD44780 or Equivalent)
- 3.5V Power Supply
- 4.1/16 Duty Cycle
- 5.4.2V LED Forward Voltage

MECHANICAL DATA

ITEM	DIMENSIONS	UNIT
Module Size (W × H × T)	118.0×36.0×8.8(12.7LED)	mm
Viewing Area (W × H)	93.5 × 16.0	mm
Character Size (W × H)	3.20 × 5.55	mm
Character Pitch(W × H)	3.70 × 5.95	mm
Dot Size(W × H)	0.60 × 0.65	mm
Dot Pitch(W × H)	0.65 × 0.70	mm

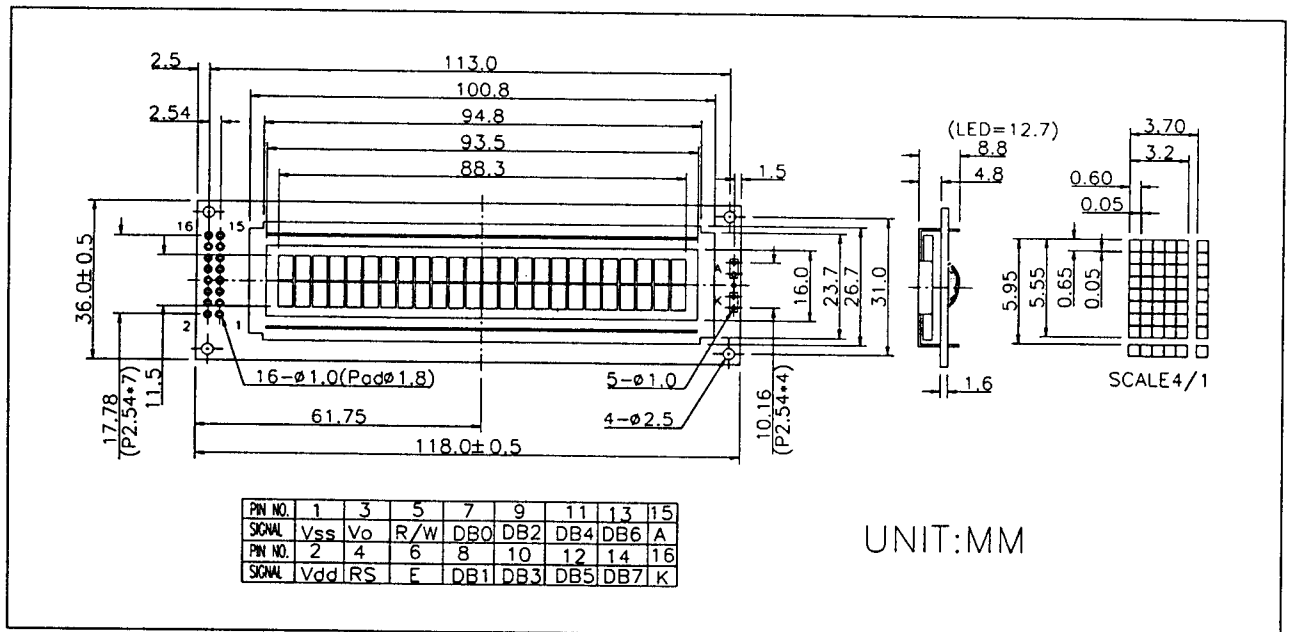
INTERFACE PIN CONNECTIONS:

No	Symbol	Function	No	Symbol	Function
1	V _{SS}	0V	9	DB2	DATA BIT2
2	V _{DD}	5V	10	DB3	DATA BIT3
3	V _O	CONTRAST ADJ.	11	DB4	DATA BIT4
4	RS	REGISTER SELECT	12	DB5	DATA BIT5
5	R/W	READ/WRITE	13	DB6	DATA BIT6
6	E	ENABLE SIGNAL	14	DB7	DATA BIT7
7	DB0	DATA BIT0	15	A	LED POWER
8	DB1	DATA BIT1	16	K	LED POWER

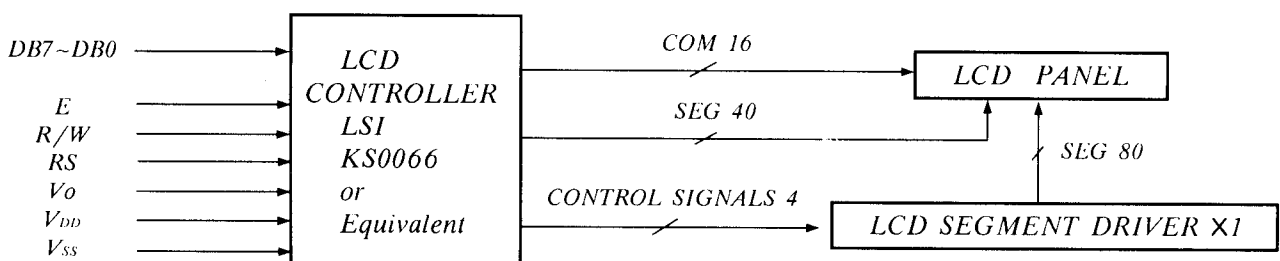
ELECTRICAL CHARACTERISTICS:

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD Operating Voltage	V _{DD} -V _O	Ta=0 °C	—	4.8	—	V
		Ta=25 °C	—	4.5	—	V
		Ta=50 °C	—	4.2	—	V
Supply Voltage	V _{DD} -V _{SS}	—	4.7	5	5.3	V
Input Voltage	"High" Level	V _{IH}	—	2.2	—	V _{DD} V
	"Low" Level	V _{IL}	—	0	—	0.6 V
Output Voltage	"High" Level	V _{OH}	—	2.4	—	V
	"Low" Level	V _{OL}	—	—	0.4	V

EXTERNAL DIMENSION



BLOCK DIAGRAM



SC4002A (40 characters × 2 lines)

■ FEATURE:

- 1.5 × 7dots with cursor
- 2.Built in Controller (HD44780 or Equivalent)
- 3.5V Power Supply
- 4.1/16 Duty Cycle
- 5.4.2V LED Forward Voltage

■ MECHANICAL DATA

ITEM	DIMENSIONS	UNIT
Module Size (W × H × T)	182.0×33.5×8.8(12.7LED)	mm
Viewing Area (W × H)	154.0 × 15.3	mm
Character Size (W × H)	3.20 × 5.55	mm
Character Pitch(W × H)	3.70 × 5.95	mm
Dot Size(W × H)	0.60 × 0.65	mm
Dot Pitch(W × H)	0.63 × 0.70	mm

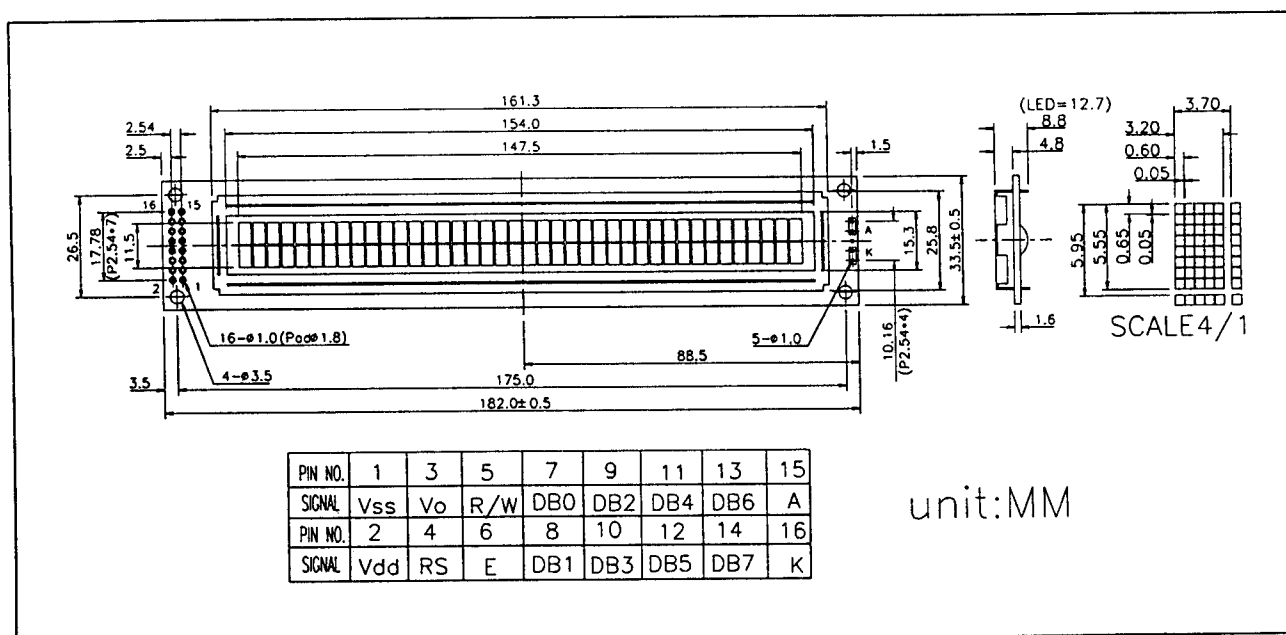
■ INTERFACE PIN CONNECTIONS:

No	Symbol	Function	No	Symbol	Function
1	V _{SS}	0V	9	DB2	DATA BIT2
2	V _{DD}	5V	10	DB3	DATA BIT3
3	V _O	CONTRAST ADJ.	11	DB4	DATA BIT4
4	RS	REGISTER SELECT	12	DB5	DATA BIT5
5	R/W	READ/WRITE	13	DB6	DATA BIT6
6	E	ENABLE SIGNAL	14	DB7	DATA BIT7
7	DB0	DATA BIT0	15	A	LED POWER
8	DB1	DATA BIT1	16	K	LED POWER

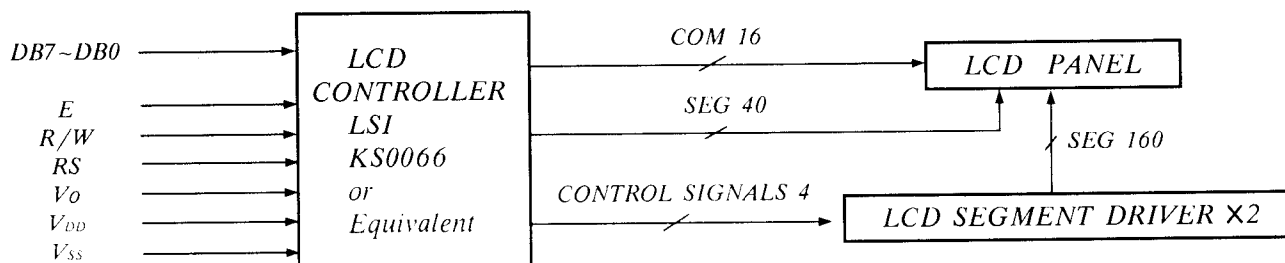
■ ELECTRICAL CHARACTERISTICS:

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD Operating Voltage	V _{DD-V_O}	Ta=0 °C	—	4.8	—	V
		Ta=25 °C	—	4.5	—	V
		Ta=50 °C	—	4.2	—	V
Supply Voltage	V _{DD-V_{SS}}	—	4.7	5	5.3	V
Input Voltage	"High" Level	V _{IH}	—	2.2	—	V _{DD} V
	"Low" Level	V _{IL}	—	0	—	0.6 V
Output Voltage	"High" Level	V _{OH}	—	2.4	—	V
	"Low" Level	V _{OL}	—	—	—	0.4 V

■ EXTERNAL DIMENSION



■ BLOCK DIAGRAM



Absolute maximum ratings

Item	Symbol	Test condition	Standard value		Unit
			min.	max.	
Supply voltage for logic	$V_{dd}-V_{ss}$	$T_a=25\text{ }^{\circ}\text{C}$	-0.3	7	V
Supply voltage for LCD drive	V_{lcd}	$T_a=25\text{ }^{\circ}\text{C}$	$V_{dd}-13.5$	$V_{dd}+0.3$	V
Input voltage	V_{in}	$T_a=25\text{ }^{\circ}\text{C}$	-0.3	$V_{dd}+0.3$	V
Operating temperature	T_{opr}	....	0	50	$^{\circ}\text{C}$
Storage temperature	$T_{stg.}$	....	-20	70	$^{\circ}\text{C}$

Reliability conditions

LCD Module (Consumer Type)		
High temperature operation	Operation 96~100Hrs at $50 \pm 2\text{ }^{\circ}\text{C}$ surrounding temp.	No visible inferiority in appearance and function.
Low temperature operation	Operation 96~100Hrs at $0 \pm 2\text{ }^{\circ}\text{C}$ surrounding temp.No dew to be found.	
High temperature storage	Storage 96~100Hrs at $60 \pm 2\text{ }^{\circ}\text{C}$ surrounding temp.then storage 4Hrs at normal condition (Power Off).	
Low temperature storage	Storage 96~100Hrs at $-20 \pm 2\text{ }^{\circ}\text{C}$ surrounding temp.then storage 4Hrs at normal condition (Power Off). No dew to be found.	
Damp proof	Storage 96~100Hrs at $40 \pm 2\text{ }^{\circ}\text{C}$ and 90~95% RH surrounding condition then storage 4Hrs at normal condition(Power Off).No dew to be found.	

Note:The above mentioned conditions are nominal ones.which may differ in special specifications.

Optical characteristics

1.STN Type

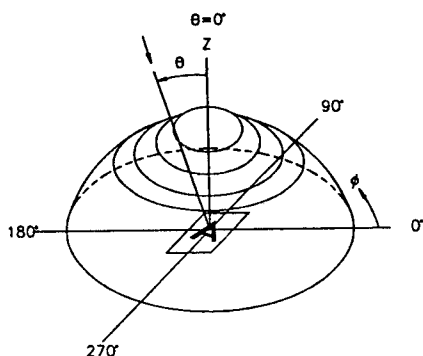
Item	Symbol	Condition	min.	typ.	max.	Unit	Note
Viewing angle	ϕ 2- ϕ 1	$K=2.0$	60	....	....	deg.	A
Contrast ratio	K	$\phi =10, \theta =0$	5	....	....	....	B
Response time (Rise)	t_r	$\phi =10, \theta =0$	....	150	250	ms	C
Response time (Fall)	t_f	$\phi =10, \theta =0$	....	200	300	ms	C

2.TN Type

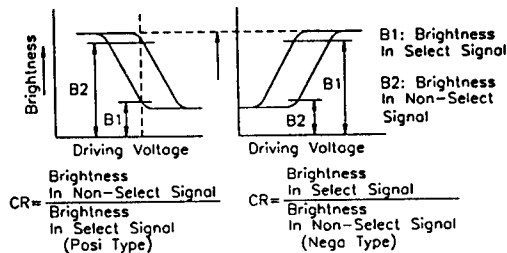
Item	Symbol	Condition	min.	typ.	max.	Unit	Note
Viewing angle	ϕ 2- ϕ 1	$K=2.0$	....	40	....	deg.	A
Contrast ratio	K	$\phi =25, \theta =0$	....	5	....	....	B
Response time (Rise)	t_r	$\phi =25, \theta =0$	....	80	120	ms	C
Response time (Fall)	t_f	$\phi =25, \theta =0$	....	60	90	ms	C

Measurement method of optical characteristics

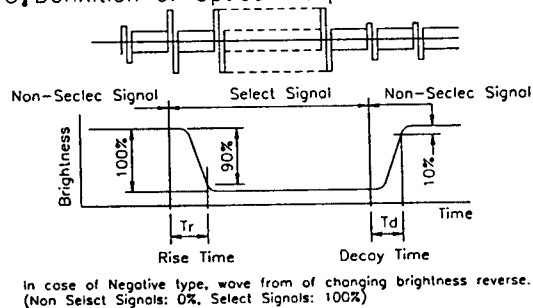
A, Definition of Viewing Angle θ and ϕ B, Definition of Contrast Ratio (CR)



Definition of the viewing direction by the inclination THETA and the azimuth, PHI (For reference axis see sub-clause 4.5 of Essential Ratings and characteristics.)



C, Definition of Optical Response Time



Electrical characteristics

$V_{DD}=5V \pm 5\%$
 $V_{SS}=0V, T_{op}=0-50^\circ C$

Item	Symbol	Condition	Standard Value			Unit	Applicable terminal
			min.	typ.	max.		
Power Voltage	V_{DD}	....	4.75	5	5.25	V	V_{DD}
Input H-level voltage	V_{IH}	....	2.2	...	V_{DD}	V	RS,R/W,E
Input L-level voltage	V_{IL}	....	-0.3	...	0.6	V	DB0~DB7
Output H-level voltage	V_{OH}	$I_{OH}=0.205mA$	2.4	...	...	V	DB0~DB7
Output L-level voltage	V_{OL}	$I_{OL}=1.2mA$	...	...	0.4	V	RS,R/W,E
I/O leakage current	I_{IL}	$V_{IN}=0 \sim V_{DD}$	-1	...	1	μA	DB0~DB7
Supply current	I_{DD}	$V_{DD}=5V$	...	0.35	0.6	mV	V_{DD}
LCD operation voltage	V_{LDC}	$V_{DD}-V_0$	3	...	11	V	V_0

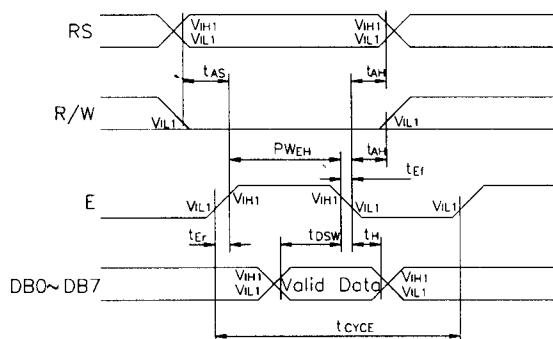
Timing chart

$V_{DD}=5V \pm 5\%$
 $V_{SS}=0V, T_{op}=0-50^\circ C$

Item	Symbol	Min.	Max.	Unit
Enable cycle time	t_{CYCE}	500	...	ns
Enable pulse width "High" Level	P_{WEH}	220	...	ns
Enable rise/fall time	t_{Er}, t_{Ef}	...	25	ns
Set-up time RS,R/W-E	t_{AS}	40	...	ns
Address hold time	t_{AH}	10	...	ns
Data set-up time	t_{DSW}	60	...	ns
Data delay time	t_{DDR}	60	120	ns
Data hold time (writing)	t_H	10	...	ns
Data hold time (reading)	t_{DHR}	20	...	ns
Colck oscillating frequency	t_{OSC}	270 (TYP)		KHZ

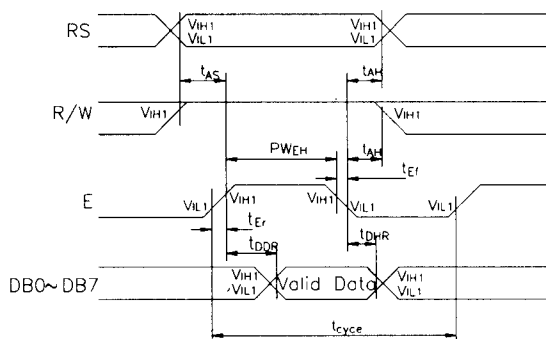
Timing Characteristics

FIG.1 WRITE OPERATION



(Write Data from MPU to MODULE)

FIG.2 READ OPERATION



(Read Data from MODULE to MPU)

Pin assignment

Pin No	Symbol	Level	Function	
1	Vss	...	Power Supply	0V(GND)
2	Vdd	...		5V
3	Vo	...		for LCD Drive
4	RS	H/L	Register select signal Register H:Data input Select L:Instruction Input	
5	R/W	H/L	H:Data read(Module → MPU) L:Data Write(Module ← MPU)	
6	E	H,H → L	Enable signal(no pull-up resistor)	
7	DB0	H/L	Data bus line	
8	DB1	H/L		
9	DB2	H/L		
10	DB3	H/L		
11	DB4	H/L		
12	DB5	H/L		
13	DB6	H/L		
14	DB7	H/L		

※ Interface between data bus line and 4-bit or 8-bit MPU is available. Data transfer are made twice in case of 4-bit MPU, and once in case of 8-bit MPU.

■ If interface data is 4-bit long

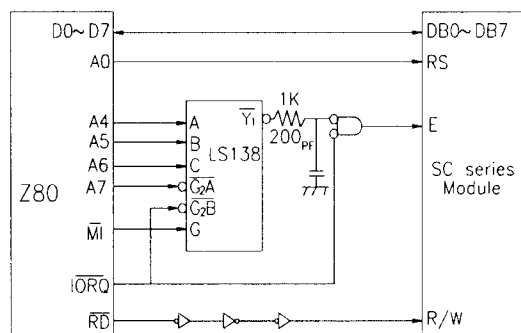
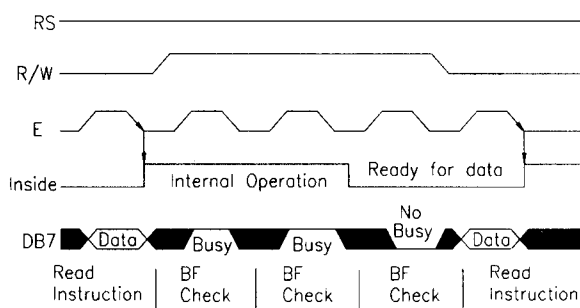
Data transfer are made through 4 bus line from DB4 to DB7. While the rest of 4 bus line from DB0 to DB3 are not used. Data transfer with MPU are completed when 4-bit data are transferred twice. First upper 4-bit data, then lower 4-bit data.

■ If interface data is 8-bit long

Data transfer are made through all of 8 bus line from DB0 to DB7.

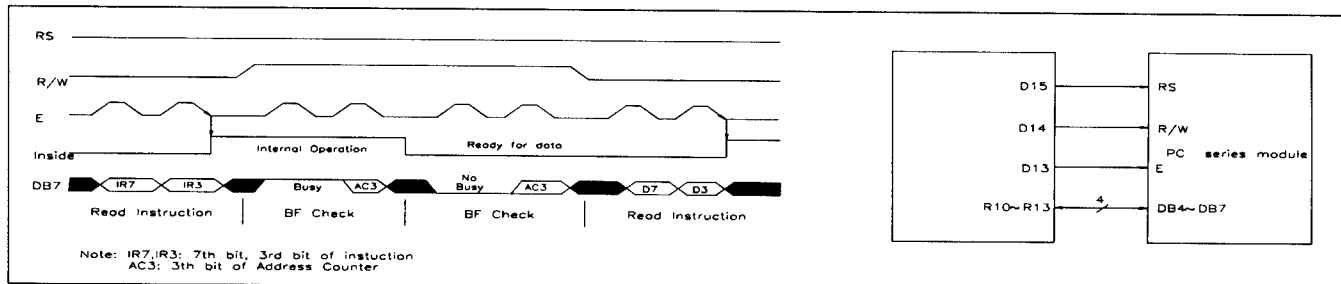
Interface with MPU

Example of Intreface with 8-bit MPU (Z80)



Example of interface with 4-bit MPU

Interface with 4-bit MPU can be made through I/O port of 4-bit MPU. If there are enough I/O port, data can be transferred by 8-bit, however, if there isn't, data transfer can be done by 4-bit twice(select interface is 4-bit long) ,and timing sequence will be complicated in this case. Please take into account that 2-cycle of BF check is necessary,while 2 cycles of data transfer are also necessary.

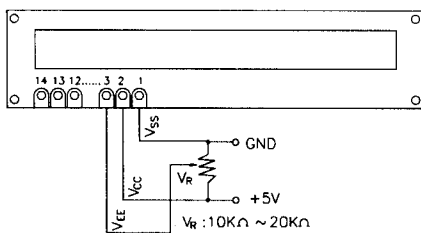


< Features >

- (1)Interface with 8-bit or 4--bit MPU is available.
- (2)192 kind of alphabets, numericals, symbols and special characters can be displayed by built-in character generator (ROM).
- (3)16 other preferred characters can be displayed by character generator (RAM).
- (4)Various functions of instruction are available by programming.
 - Clear display
 - Shift display
- (5)Compact and light weight design which can be easily assembled in your devices.
- (6)Single power consumption.
- (7)Low power consumption.

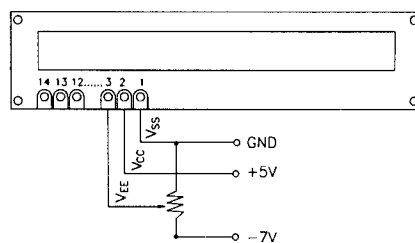
Example of power supply

FIG.1 Normal Temperature Type

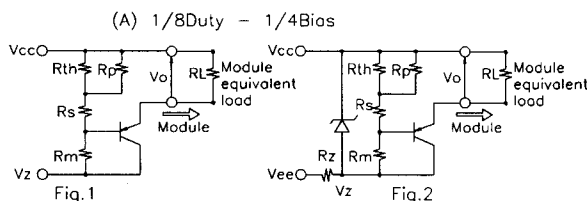


*Note:If V vary from recommended value, you cannot get proper contrast or viewing angle.

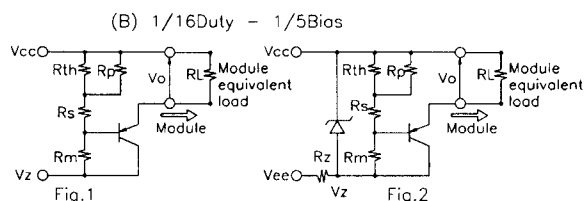
FIG.2 Extended Temperature Type



Examples of Temperature Compensation Circuits for Extended Temp Type. (Only for reference)



Thermistor:R_{th}(25°C)=15[k-ohm],B=4200[K]
Resistors:R_p=30[k-ohm],R_s=6.8[k-ohm],R_m=3.3[k-ohm]
Transistors:PNP Type
Vcc: +5V, Vss: 0V(Logic Supply)
Vz: -8V(-7.8~ -8.2V)
Vee<Vz,Rz=(Vz-Vee)/5 [k-ohm]

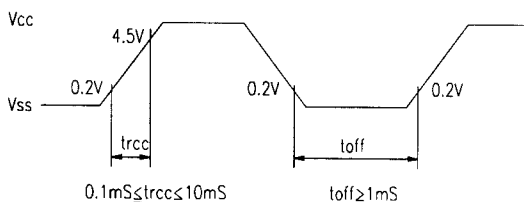


Thermistor:R_{th}(25°C)=15[k-ohm],B=4200[K]
Resistors:R_p=150[k-ohm],R_s=8.2[k-ohm],R_m=3.9[k-ohm]
Transistors:PNP Type
Vcc: +5V, Vss: 0V(Logic Supply)
Vz: -11V(-10.725~ -11.275V)
Vee<Vz,Rz=(Vz-Vee)/5 [k-ohm]

Power supply reset

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

Item	Symbol	Measuring Condition	Standard Value	Unit
Power Supply Rise Time	trcc	—	0.1 — 10	mS
Power Supply OFF Time	toff	—	1 — —	mS



Note: toff defines period that power supply is off when power supply shut down momentarily or repeats on/off state.

Reset function

Initialization mode by Internal Reset Circuit

HD44780 automatically initializes (resets) when power is supplied (built-in internal reset circuit). The following instructions are executed in initialization. The busy flag (BF) is kept in busy state until initialization ends. (BF=1)

The busy state is 10mS after Vdd reach to 4.5V.

1. Display clear

2. Function set

DL=1: 8bit long interface data

DL=0: 4bit F=0: 5 × dot character font

N=1: 2 lines

N=0: 1 lines

3. Display ON/OFF control

D=0: Display OFF C=0: Cursor OFF B=0: Blink OFF

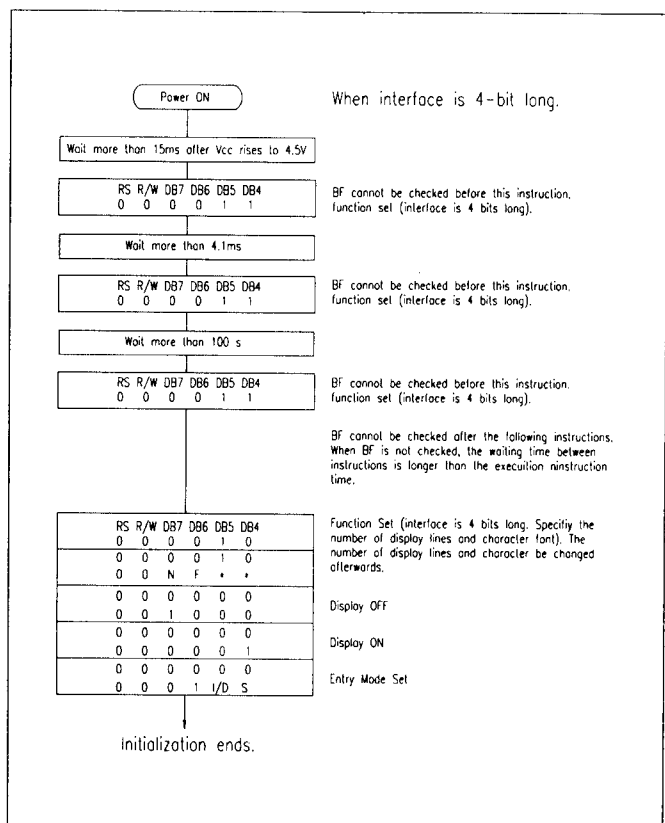
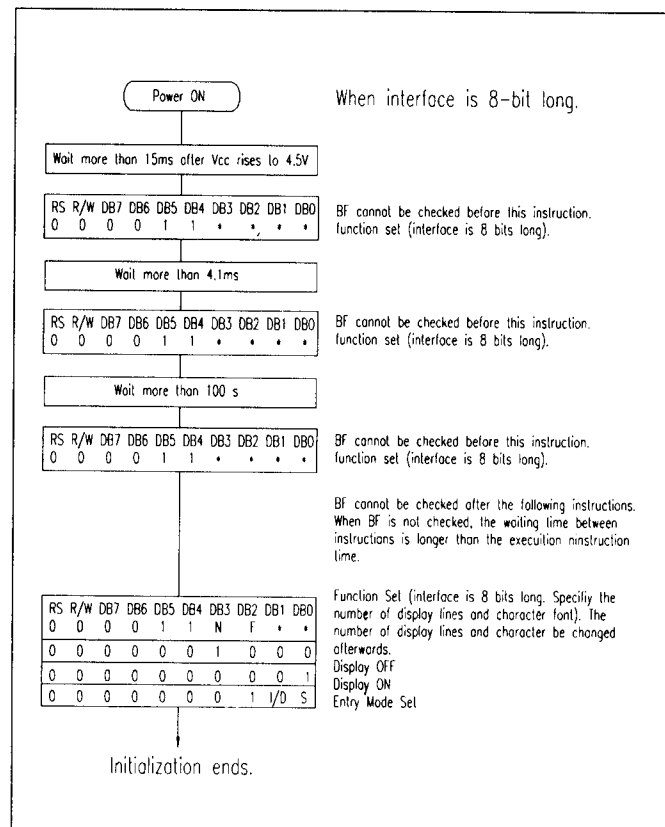
4. Entry mode set

I/D=1: +1 (increment) S=0: No shift

Note: When conditions stated in "Power Supply Conditions Using Internal Reset Circuit" are not satisfied, the internal reset circuit will not operate properly and initialization will not be performed. Please make initialization using MPU and "Initialization along with instructions."

Initialization along with instruction

If power supply conditions are not satisfied for proper operation of internal reset circuit, it is required to make initialization along with instruction. Please make following procedures:



■ Instructions

Instruction	Code										Description	Executed Time(max.)
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Clears all display and returns the cursor to home position (Address 0)	1.64ms
Cursor At Home	0	0	0	0	0	0	0	0	1	*	Returns the cursor to the home position(Address 0).Also returns the display being shifted to the original position.DDAM contents remain unchanged. (during data write and read.)	1.64ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets the cursor move direction and specifies or not shift the display.These operations are performed during data write and read.	40 μ s
Display On/Off Control	0	0	0	0	0	0	1	D	C	B	Sets ON/OFF of all display(D) cursor ON/OFF(C),and blink of cursor position character(B).	40 μ s
Couosr /Display Shift	0	0	0	0	0	1	S/C	R/L	*	*	Moves the cursor and shifts the display without changing DDRAM contents.	40 μ s
Function Set	0	0	0	0	1	DL	N	F	*	*	Sets interface data length(DL), number of display lines (N)and character font(F).	40 μ s
CGRAM Address Set	0	0	0	1	ACG						Sets the CGRAM address. CGRAM data is sent and received after this setting.	40 μ s
DDRAM Address Set	0	0	1	ADD							Sets the DDRAM address. DDRAM data is sent and received after this setting.	40 μ s
Busy Flag/ Address Read	0	1	BF	AC							Reads Busy flag (BF)indicating: Internal operation performs and reads address counter contents.	40 μ s
CGRAM/DDRAM Data Write	1	0	WRITE DATA								Writes data into DDRAM or CGRAM	40 μ s
CGRAM/DDRAM Data Read	1	1	READ DATA								Reads data into DDRAM or CGRAM	40 μ s

Code	Description	Executed Time(max)
I/D=1:Increment I/D=0:Decrement S=1:With display shift S/C=1:Display shift S/C=0:Cursor movement R/L=1:Shift to the right R/L=0:Shift to the left DL=1:8-bit	DDRAM:Display Data RAM CGRAM:Character Generator RAM ACG:CGRAM Address ADD:DDRAM Address Corresponds to cursor address. AC:Address Counter,used for both DDRAM and CGRAM *:Invalid	f_{cp} or $f_{osc}=250kHz$ However,when frequency changes, execution time also changes. Example: if f_{cp} or f_{osc} is 270kHz, $40\mu s \times 250/270=37\mu s$

ELECTRICAL CHARACTERISTICS

1.DC Characteristics (Vdd=5V+10%,Vss=0V,Ta=25C)

Parameter	Symbol	Condition	Applicable PIN	Min.	Typ.	Max.	Unit
H level input voltage(1)	Vih1	——	DB0~DB7	2.2	——	Vdd	V
L level input voltage(1)	Vil1	——	RS,R/W,E	-0.3	——	0.6	V
H level input voltage(2)	Vih2	——	OSC1	Vdd-1.0	——	Vdd	V
L level input voltage(2)	Vil2	——		-0.2	——	1	V
H level output voltage(1)	Voh1	Ioh=-0.205mA	DB0~DB7	2.4	——	——	V
L level output voltage(1)	Vol1	Iol=1.2mA		——	——	0.4	V
H level output voltage(2)	Voh2	Ioh=-40uA	XSC LP DO	0.9Vdd	——	——	V
L level output voltage(2)	Vol2	Iol=40uA		——	——	0.1 Vdd	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	uA

Internal clock operation (RF oscillation)

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

2.AC Characteristics (Vdd=5V+10%,Vss=0V,Ta=25C)

1).Read Cycle

Parameter	Symbol	Min.	Typ.	Max.	Unit.	TEST PIN
Enable cycle time	tc	500	——	——	ns	E
Enable "H" level 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

2).Write Cycle

Parameter	Symbol	Min.	Typ.	Max.	Unit.	TEST PIN
Enable cycle time	tc	500	——	——	ns	E
Enable "H" level 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
Data setup time	tsu2	60	——	——	ns	DB0~DB7
Write data hold time	th2	10	——	——	ns	DB0~DB7

Customer Design Specification Check List

LCD Module

Application					
Function					
Structure					
Display Spec	Segment Type	7-segment or ()-segment × ()characters,Flag()-segm LCD driving=(Duty=1/()Bias=1/()			
	Full dot matrix type	()L × ()H dots,Flag ()-segment LCD driving=(Duty=1/()Bias=1/()			
	Character dot matrix type	()Columns × ()Lines, Flag()-segment			
		Display Fonts ()L × ()H dots, Cursor (Yes/No)			
	Note	Please attach the drawing if all of display cannot be explained above.			
Outer Spec	Outer Dimension	1.Factory Proposal 2.Specific Requirements:()L × ()H × ()T (mm)			
	Bezel Dimension	1.Factory Proposal 2.Specific Requirements:Bezel Window()L × H Outer Dimension ()L × ()H × ()T(mm)			
	Terminal Position	1.Factory Proposal 2.Specific Requirements:Top/Bottom/Left/Right/Other			
	Note	Other specific requirements of outer dimension()			
LCD Spec	LCD outer dimension	1.Factory Proposal 2.Specific Requirements Front:()L × ()H × ()T Rear:()L × ()H × ()T			
	Display Mode	1.TN Positive 2.TN Negative 3.Super TN(Neutral) 4.Super TN(yellow) 5.Other()			
	Viewing Direction	1.6:00 2.12:00 3.3:00 4.9:00 5.Other()			
	Note				
LSI	Driver	1.Factory Proposal 2.Specific Requirements:Common × pieces Segment × Pieces			
	Control	1.Yes/No 2.Specific Requirements S-RAM memory()K			
	Note				
Back Light Spec	Back Light	1.Nil 2.EL 3.LED 4.CFL 5.Lamp 6.Other()			
	EL	1.Blue-green(EB) 2.Yellow(EY) 3.White(EW) 4.Other(Specific Product:)			
	LED	1.Yellow-green(LY) 2.Amber(LA) 3.Red(LR) 4.Other(Specific Product:)			
	CFL	()pieces, Diffusor Color() Other(Specific Product:)			
	Lamp	Standard(V/ mA), Dimension T-()or (), Lamp ()pcx Specific Material() Lamp Cap: Color(), Specific Product ()			
	Note				
Other Spec	PCB	Material:1.Fr-4 2.CEM-3 3.Other Thickness()mm,UL Standard:1.Unnecessary 2.Necessary(94HB 94V-1 94V-0)			
	Terminal	1.Pattem Only 2.Specific Connector(Type Nbr. Manufacture) 3.Other			
	Bezel	Material:1.SPECC(to be completed) 2.Steel 3.SUS 4.Black Zinc 5.Other Completion:Plating()or Printing()			
	Note				
Cost	Development charge		Unit Price	Sample:	
	Tooling charge			Series Production:	

Schedule	Item	Finalize Specifications	Start of Designing	W/S	E/S	C/S	P/P	M/P	Monthly Requirement	Total Lot
	Date									
	Quantity									
Other Conditions										

● Standard Character Pattern(S0) (H0)

		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	a	P	`	F				—	9	3	o	p
	1	CG RAM (2)		!	1	A	0	a	9			#	7	7	4	a	g
	2	CG RAM (3)		"	2	B	R	b	r			7	4	9	x	p	e
	3	CG RAM (4)		#	3	C	S	c	s			J	0	7	e	a	w
	4	CG RAM (5)		\$	4	D	T	t	t			\	I	K	h	p	o
	5	CG RAM (6)		%	5	E	U	e	u			.	*	*	1	s	U
	6	CG RAM (7)		&	6	F	V	v	v			9	0	2	a	p	Z
	7	CG RAM (8)		'	7	G	W	w	w			7	*	7	7	g	n
	8	CG RAM (1)		(	8	H	X	x	x			4	0	*	U	j	X
	9	CG RAM (2)		)	9	I	Y	y	y			6	7	J	u	r	y
	A	CG RAM (3)		*	*	J	Z	z	z			2	0	N	v	j	7
	B	CG RAM (4)		+	*	K	L	k	l			*	9	0	a	*	A
	C	CG RAM (5)		,	<	L	#	1	1			6	9	7	7	0	A
	D	CG RAM (6)		—	=	M	I	m	)			2	7	\	U	t	÷
	E	CG RAM (7)		.	>	N	^	n	+			9	0	a	*	A	
	F	CG RAM (8)		/	?	O	_	o	+			u	v	7	"	0	■

● Standard Character Pattern(EB)

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

● Standard Character Pattern(EH)

		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)			00P'				P			B00	4	.	2K		
	1	CG RAM (2)		!	1A0	a						7A					
	2	CG RAM (3)		"	2BR	b	r					E6					
	3	CG RAM (4)		#	3C5	c						8E					
	4	CG RAM (5)		\$	4DT	d	t					37					
	5	CG RAM (6)		%	5EU	e	u					4B					
	6	CG RAM (7)		&	6FV	f	v					5A					
	7	CG RAM (8)		'	7BU	u						6B					
	8	CG RAM (1)		(	8HX	h	x					7C					
	9	CG RAM (2)		)	9IV	i	v					8D					
	A	CG RAM (3)		*	AJZ	j	z					9E					
	B	CG RAM (4)		+	BKM	k	m					AF					
	C	CG RAM (5)		,	CLE	l	e					BF					
	D	CG RAM (6)		-	DNM	n						CF					
	E	CG RAM (7)		.	ENM							DF					
	F	CG RAM (8)		/	FOL	o						EF					