Data Sheet

Powertip alphanumeric dot matrix liquid crystal displays

Reflective types - RS **stock numbers 214-3238, 214-3244, 214-3250, 214-3266, 214-3272, 214-3288, 214-3294, 214-3301, 214-3317, 214-3323, 214-3339, 214-3345, 214-3351, 294-8667, 294-8689, 294-8695, 294-8702, 294-8718, 294-8724, 294-8746, 294-8752**

EL types - RS **stock numbers 214-3367, 214-3373, 214-3395, 214-3402, 214-3418**

LED types - RS **stock numbers 214-3480, 214-3496, 214-3519, 214-3525, 214-3531, 214-3547, 214-3553, 214-3569, 214-3575, 215-3617, 294-8774, 294-8780, 294-8796, 294-8803, 294-8819**

Intelligent, alphanumeric, dot matrix modules with integral CMOS microprocessor and LCD display drivers. The modules utilise a 5 × 7 dot matrix format with cursor, and are capable of displaying 192 different alphanumeric characters and symbols. The modules are available in twisted nematic and super twisted nematic grey mode. Reflective types are available in TN and STN, EL backlit types in TN, LED backlit transmissive types in TN LED backlit transflective types in STN. Inverters are required to drive the EL backlit types.

Applications

- Data terminals
- Medical instruments
- Hand-held instruments
- Hand-held data terminals
- Electronic typewriters
- Point of sale terminals
- Test instruments
- Word processors.

Features

- Single 5V power supply (excluding EL types)
- Wide viewing angle (STN)
- High contrast
- Interfaces to a 4 or 8-bit data bus
- ASC11 compatible
- Chip-on-board technology (COB)
- 192 different characters and symbols
- 8 user programmable characters
- Compact and lightweight
- Low power consumption
- Surface mounted components (SMT).
- Powerful instruction set

ATTENTION

OBSERVE PRECAUTIONS FOR HANDLING

ELECTROSTATIC SENSITIVE DEVICES

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	°C
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 data 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 (Vlcd)		Power Supply	Contrast adjustment voltage Vdd - 11~ Vdd + 0.3

Electrical characteristics

DC characteristics (Vdd = + 5V ± 10%, Vss = OV, Ta = 25°C)

Parameter	Symbol	Condition	Application PIN	Min.	Type	Max.	Unit
H level input voltage (1)	Vih 1	-	DB0 ~ DB7	2.2	-	Vdd	V
L level input voltage (1)	Vil l	-	RS, R/W, E	-0.3	-	0.6	V
H level output voltage (1)	Voh 1	Ioh = -0.205mA	DBO ~ DB7	2.4	-	-	V
L level output voltage (1)	Vol l	Iol = 1.2mA		-	-	0.4	V
I/o leakage current	Iil	Vin = 0 to Vdd	E	-1	-	1	uA
Pull-UP Mos current	-Ip	Vdd = 5V	RS R/W DB0-DB7	50	125	250	uA
Supply current (Depends on module size)	Iop	RF oscillation, from external clock Vdd = 5v fosc = 270kHz	Vdd	- 1.3	-	0.6 2.5	mA

Internal clock operation (Rf oscillation)

Oscillation frequency	fosc	Rf = 91k Ω ± 2%	OSC1 | OSC2	190	270	350	kHz
LCD driving voltage	Vlcd	Vdd - V5	V1 ~ V5	3.0	-	11.0	V

LED Backlight Characteristics (Vf = 4.2Vtyp , 4.8Vmax. this figure must not be exceeded)

RS Part Number	Condition	Symbol	Type	Max.	Unit
214-3480	Ta=25°C	I_f	70	140	mA
214-3496	Ta=25°C	I_f	80	160	mA
294-8796	Ta=25°C	I_f	190	380	mA
214-3519, 214-3525 294-8774	Ta=25°C	I_f	120	240	mA
294-8803, 214-3531	Ta=25°C	I_f	360	700	mA
294-8819, 214-3474, 214-3575	Ta=25°C	I_f	270	500	mA
214-3553	Ta=25°C	I_f	40	80	mA
214-3569	Ta=25°C	I_f	150	300	mA
215-3617	Ta=25°C	I_f	440	800	mA
214-3547, 294-8780	Ta=25°C	I_f	210	420	mA

AC characteristics (Vdd = 5V ± 10%, Vss = 0V, Ta = 25ºC) Read cycle (Figure 6)

Parameter	Symbol	Min.	Type	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	-	-	120	ns	DB0 ~ DB7
Read data hold time	tdh	20	-	-	ns	DB0 ~ DB7

Write cycle (Figure 5)

Parameter	Symbol	Min.	Type	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	tsul	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

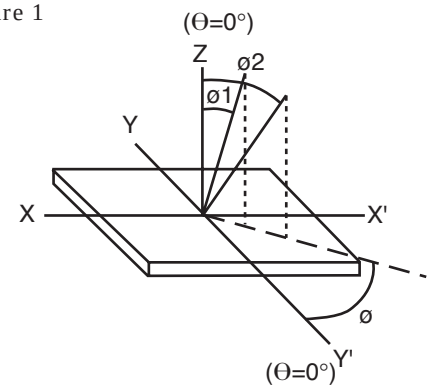
Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Viewing angle	ø2 -ø1	K = 1.4	60	-	-	deg.	*1, *2
Contrast ratio	K	ø = 10°C θ = 0°C	5	-	-	-	*3
Response time (rise)	tr	ø = 10°C θ = 0°C	-	150	250	ms	*4
Response time (fall)	tf	ø = 10°C θ = 0°C	-	200	300	ms	*4

2. TN type

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Viewing angle	ø2 -ø1	K = 1.4	40	-	-	deg.	*1, *2
Contrast ratio	K	ø = 25°C θ = 0°C	-	5	-	-	*3
Response time (rise)	tr	ø = 25°C θ = 0°C	-	80	120	ms	*4
Response time (fall)	tf	ø = 25°C θ = 0°C	-	60	90	ms	*4

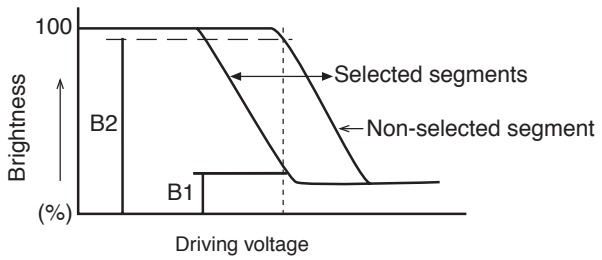
*1. Definition of Θ and ø

Figure 1



*3. Definition of contrast ratio

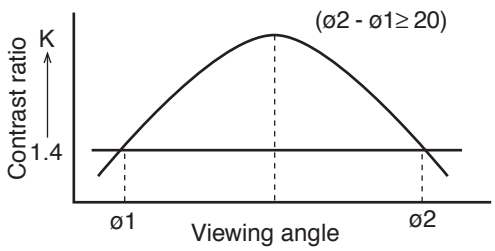
Figure 3



$$K = \frac{\text{Brightness of non-selected (B2)}}{\text{Brightness of selected segment (B 2)}}$$

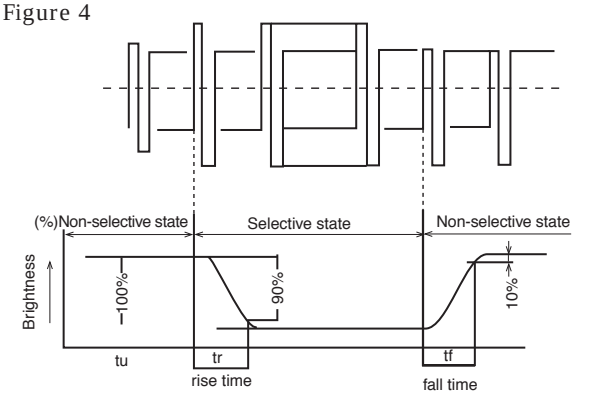
*2. Contrast vs viewing angle

Figure 2



*4 Definition of optical response

Figure 4



Timing characteristics

Figure 5 Write operation

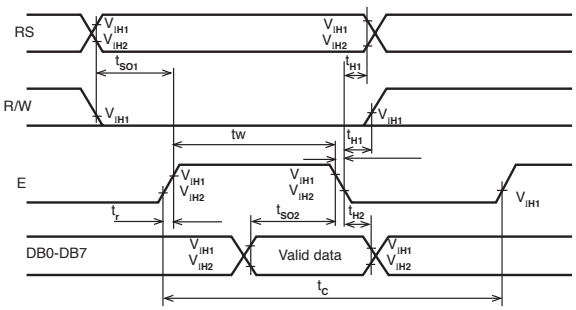
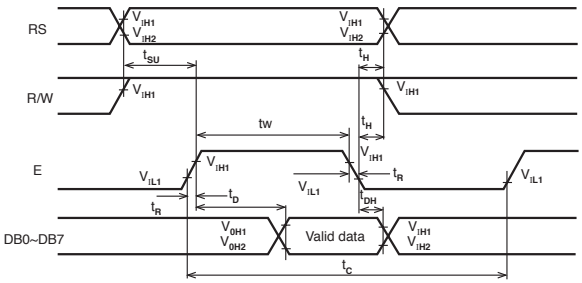


Figure 6 Read operation



The modules can be interfaced to 4 bit or 8 bit micro controllers (MPU):

4-bit interface

All data/command transfers are made through data bits DB4 to DB7. (Data bits DB0 to DB3 are not used). Each data transfer to the module requires two 4 bit write operations. The 4 high order bits (DB4 to DB7) should be transferred first, while the 4 low order bits (DB0 to DB3) should be transferred last.

8-bit interface

The 8 bit interface uses all 8 line data line (DB0 to DB7).

Example of interface with 8-bit MPU (Z80)

Figure 7

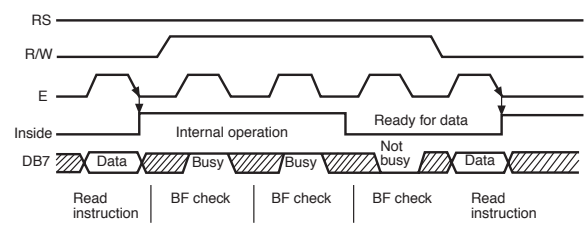
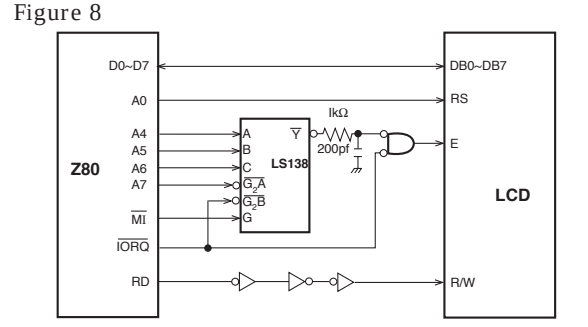


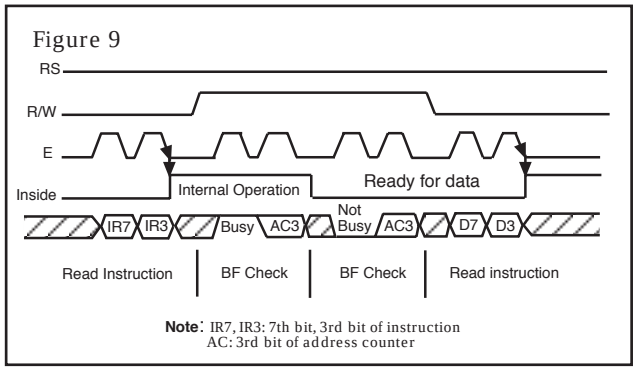
Figure 8



Example of interface with 4-bit MPU

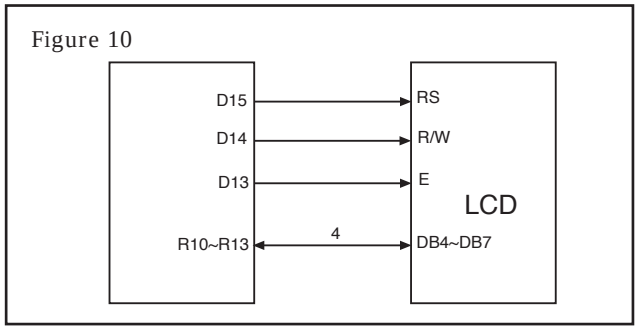
The interface with a 4 bit MPU can be made using through an I/O port. If an 8 bit I/O port is not available a 4 bit I/O port can be used. The module should be initialised to accept 4 bit data and commands. Each command/data instruction must be sent as two 4 bit nibbles, high order nibble first. The busy flag (BF) should be checked every 2 cycles. (Please note that checking the busy flag requires 2 cycles as well).

Figure 9



Note: IR7, IR3: 7th bit, 3rd bit of instruction
AC: 3rd bit of address counter

Figure 10

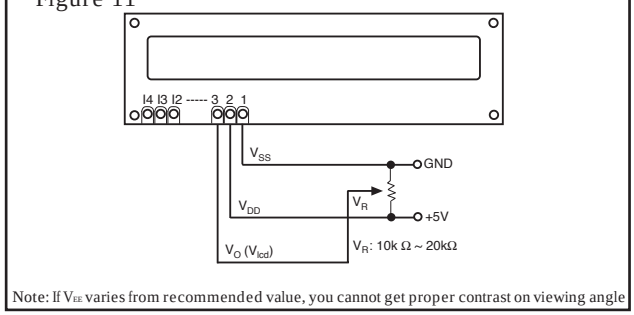


Features

1. Interface with 8-bit or 4-bit MPU is available.
2. 192 kind of alphabets, numerals, symbols and special characters can be displayed by built-in character generator (ROM).
3. Other preferred characters can be displayed by character generator (RAM).
4. Various functions of instruction are available by programming.
   - Clear display
   - Cursor at home
   - On/off cursor
   - Blink character
   - Shift display
   - Shift cursor
   - Read/write display data etc.
5. Compact and light design which can be easily assembled in devices.
6. Single power supply +5 drive (at ambient temperature).
7. Low power consumption.

Example of power supply

Figure 11



Note: If V_{EE} varies from recommended value, you cannot get proper contrast on viewing angle

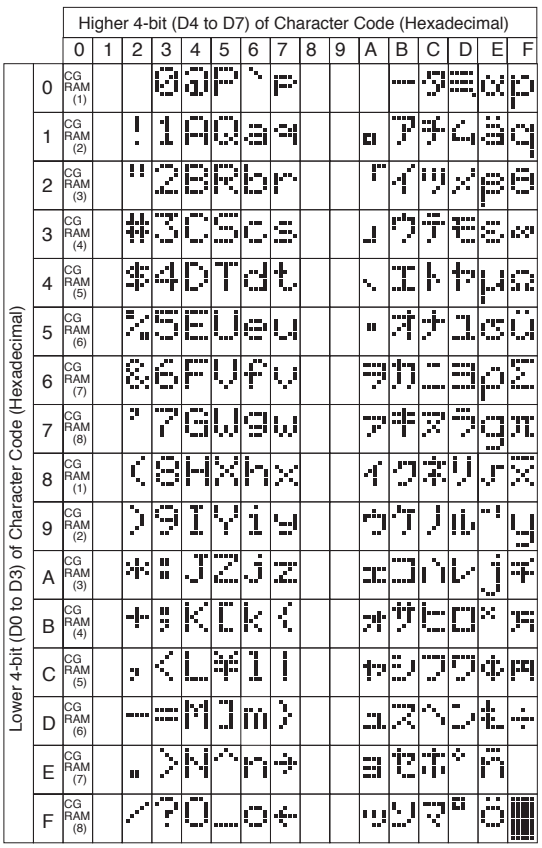
Instructions

Instructions	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 the display and returns the cursor to the 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. DDRAM contents remain unchanged.	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 to shift the display. These operations are performed during the data write and read.	40μS
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).	40μS
Cursor/display shift	0	0	0	0	0	1	S/C	R/L	*	*	Moves the cursor and shifts the display without changing DDRAM contents.	40μS
Function set	0	0	0	0	1	DL	N	F	*	*	Sets interface data length (DL) number of display lines (N) and character font (F).	40μS
CGRAM address set	0	0	0	1	ACG						Set the CGRAM address. CGRAM data is sent and received after this setting.	40μS
DDRAM address set	0	0	1	ADD							Sets the DDRAM address. DDRAM data is sent and received after this setting.	40μS
Busy flag/address read	0	1	BF	AC							Reads busy flag (BF) indicating internal operation is being performed and reads address counter contents.	0μS
CGRAM/DDRAM data write	1	0	Write data								Writes data into DDRAM or CGRAM.	46μS
CGRAM/DDRAM Data read	1	1	Read data								Reads data from DDRAM or CGRAM.	46μS

Code		Description	Executed time (max.)
I/D=1:Increment	DL=0:4-bit	DDRAM:Display data RAM	
I/D=0:Decrement	N=1:2 lines	CGRAM:Character generator RAM	
S=1:With display shift	N=0:1 line	ACG:CGRAM address	fcp or fosc=250kHz
S/C=1: Display shift	F=1:5 x 10dots	ADD:DDRAM address corresponds to cursor address.	However, when frequency changes, execution time also changes
S/C=0: Cursor movement	F=0.5 x 7dots	AC: Address counter, used for both DDRAM and CGRAM	Ex
R/L=1: Shift to the right	BF=1: Internal operation		If fcp or fosc is 270kHz,
R/L=0: Shift to the left	is being performed		40μS x 250/270 = 37μS
DL=1:8-bit	BF=0: Instruction acceptable	*Don't care	

Figure 12

Standard character pattern

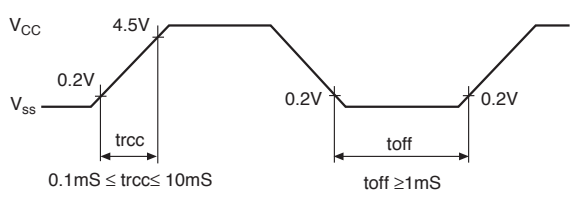


Power supply reset

The internal reset circuit 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
			min.	typ.	max.	
Power supply rise time	trcc	-	0.1	-	10	mS
Power supply OFF time	toff	-	1	-	-	mS

Figure 13



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

Reset function

- Initialisation made by Internal Rest Circuit

  KS0066 automatically initialises (resets) when power is supplied (built-in internal reset circuit). The following instructions are executed in initialisation. The busy flag (BF) is kept in a busy state until initialisation 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 x dot character font

   N =1: 2lines

   N =0: 1line
3. Display ON/OFF control

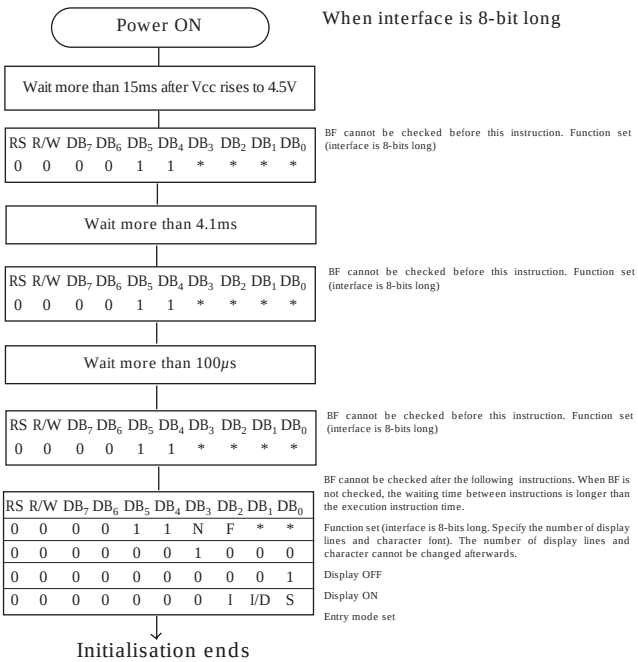
   D=0:display OFF C=0:cursor OFF B=0:blink OFF
4. Entry mode set

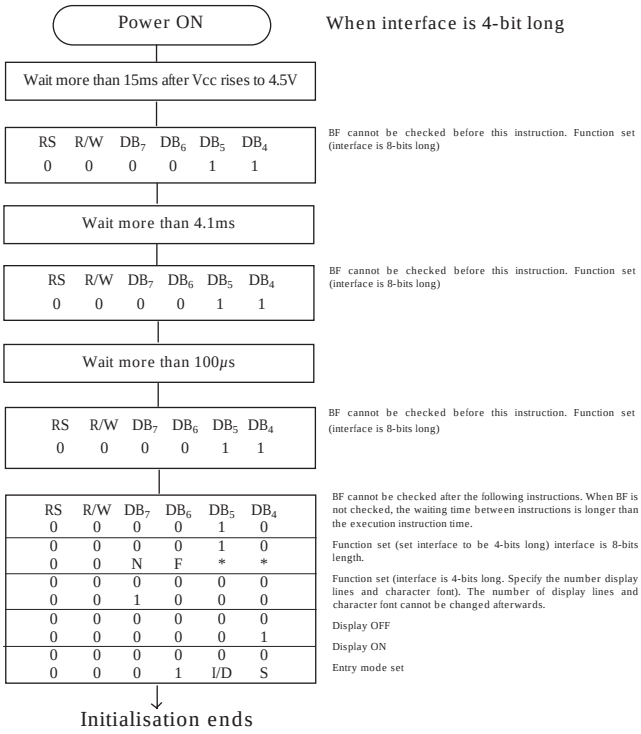
   1/D=1: + 1 (increment) S=0:No shift

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

Initialisation along with instructions

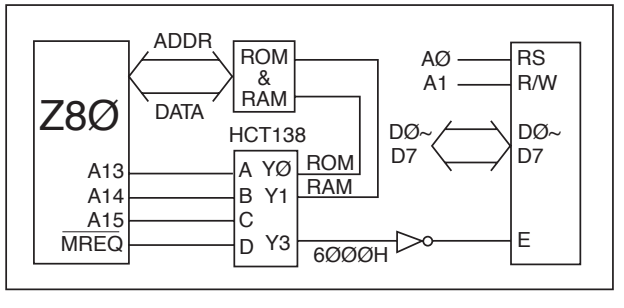
If power supply conditions are not satisfied, for proper operation of internal reset circuit, it is required to make initialisation along with instruction. Please make following procedures:-





Application example

Figure 14



All modules except 20 x 4 and 40x4
Example of interfacing to Z8Ø MPU running at 2 Mhz
AØ is connected to RS of module
where AØ = 1: Instruction register is selected
where AØ = Ø: Data register is selected
A1 is connected to R/W of module
where A1 = Ø: Module in write mode
where A1 = 1: Module in read mode

```
WRINST EQU 6ØØØH    ;write instruction
WRDATA EQU 6ØØ1H    ;write data
RDBUSY EQU 6ØØ2H    ;read busy
```

Initialisation

```
LD      B,Ø         ;power up delay
DJNZ    $
LD      SP,27FFH    ;stack pointer
LD      HL, INITBL  ;init table pointer
LD      B,15        ;15ms delay
CALL    INSTR       ;o/p instruction to  module
LD      B,5         ;5ms delay
CALL    INSTR       ;o/p instruction to module
LD      B,1         ; one ms delay
CALL    INSTR       ;o/p instruction to module
```

Function set

function set

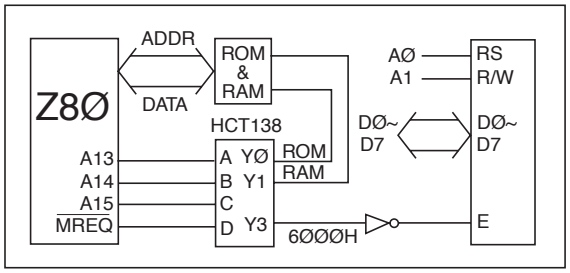
```
        LD      B,4         ;four modes
MODSET; CALL    BUSY        ;check for not busy
        INC     HL          ;inc table pointer
        LD      A,(HL)      ;get data
        LD      (WRINST),A  ;and sent to module
        DJNZ    MODSET      ;next mode
```

Write message to module

```
    LD      HL,MESSAGE      ;get message table
;turn on display, blinking cursor
    CALL    BUSY
    LD      A,ØØØØ1111B     ;display on, cursor
    LD (WRINST),A           ;blink
;set DDRAM address to ØØH
    LD      A,1ØØØØØØØB     ;set to ØØH
    CALL    MESG            ;o/p message
;set DDRAM address to 4ØH
    LD      A,11ØØØØØØB     ;set to 4ØH
    CALL    MESG            ;o/p message
    HALT                    ;program stop here.....

;subroutine to set DDRAM addr and o/p message
MESG:   CALL    BUSY
        LD      (WRINST),A
;write message to module
        LD      B,8         ;no. of byte to be sent
WRITE2: CALL    BUSY
        LD      A,(HL)      ;get character
        LD      (WRDATA),A  ;write to module
        INC     HL          ;inc pointer
        DJNZ    WRITE2      ;next byte
        RET

; subroutine : busy check
BUSY:   PUSH    AF
BUSY1:  LD      A, (RDBUSY)
        BIT     7, A
        JR      NZ, BUSY1
        POP     AF
        RET

;subroutine: o/p instruction to module
INSTR:  CALL    DELAY       ;time delay
        LD      A,(HL)      ;get data
        LD      (WRINST), A ;o/p to module
        RET

; time delay subroutine
; Total delay time = B* 1mS
; Register destroyed : DE
DELAY:  PUSH    HL
        LD      DE,-1
LOOP1:  LD      HL, 431/5
LOOP2:  ADD     HL, DE
        JR      C, LOOP2
        DJNZ    LOOP1
        POP     HL
        RET

; data table for initialisation routine
INITBL: DEFB    ØØ11ØØØØB   ;set DL to high
        DEFB    ØØ111ØØØB   ;8-bit, 2 lines, 5X7 dots
        DEFB    ØØØØ1ØØØB   ;display off
        DEFB    ØØØØØØØ1B   ;clear display, return cursor
        DEFB    ØØØØØ11ØB   ;set shift mode (entry mode set)
; message
    MESSGE:     DEFB    'DISPLAY MODULES'
```

Application example for 20 x 4 and 40 x 4 displays

Figure 15



Example of interfacing to Z8Ø MPU running at 2 Mhz

AØ is connected to RS of module

where AØ = 1: Instruction register is selected

where AØ = Ø: Data register is selected

A1 is connected to R/W of module

where A1 = Ø: Module in read mode

where A1 = Ø: Module in read mode

```
WRINST  EQU   6ØØØH   ;write instruction
WRDATA  EQU   6ØØ1H   ;write data
RDBUSY  EQU   6ØØ2H   ;read busy

Initialisation
LD      B,Ø           ;power up delay
DJNZ    $
LD      SP,27FFH      ;stack pointer
LD      HL, INITBL    ;init table pointer
LD      B,15          ;15ms delay
CALL    INSTR         ;o/p instruction to  module
LD      B,5           ;5ms delay
CALL    INSTR         ;o/p instruction to module

Function set
LD      B,1           ; one mS delay
CALL    INSTR         ;o/p instruction to module

Function set
; function set
        LD    B,4           ;four modes
MODSET; CALL  BUSY          ;check for not busy
        INC   HL            ;inc table pointer
        LD    A,(HL)        ;get data
        LD    (WRINST),A    ;and sent to module
        DJNZ  MODSET        ;next mode

Write message to module
; turn on display, blinking cursor
    CALL    BUSY
    LD      A,ØØØØ1111B     ;display on, cursor
    LD (WRINST),A           ;blink
;send message to display module
        LD   HL,MESSGE  ;get message table
OUTMSG: LD   A,(HL)     ;get data from messge
                        table
        CP   $          ;is end of message ?
;       JR   Z,ENDMSG   ;yes, it is
        LD   B,A        ;no, this is the number
                        of byte to be sent
        INC  HL         ;now, get the DDRAM
                        addr
        LD   A,(HL)
        CALL BUSY       ;check for not busy
        SET  7,A        ;set bit 7 to 1
        LD   (WRINST), A ;o/p to module
NXTCHR: INC  HL         ;get character
        LD   A,(HL)
        CALL BUSY       ;check for not busy
        LD   (WRDATA), A ;o/p to module
        DJNZ NXTCHR     ;o/p next character
        INC  HL         ;inc pointer
        JR   OUTMSG     ;go and check any
                        more message
;
ENDMSG:  HALT           ;program stop here.....

subroutine: busy check
BUSY;   PUSH  AF
BUSY1   LD    A,(RDBUSY)
        BIT   7,A
        JR    NZ,BUSY1
        POP   AF
        RET

;  SUBROUTINE : o/p instruction to module
INSTR:  CALL  DELAY     ;time delay
        LD    A,(HL)    ;get data
        LD    (WRINST),A ;o/p to module
        RET

; time delay subroutine
; Total delay time = B * 1mS
; Register destroyed : DE
DELAY:  PUSH  HL
        LD    DE, - 1
LOOP1:  LD    HL,431/5
LOOP2:  ADD   HL,DE
        JR    C,LOOP2
        DJNZ  LOOP1
        POP   HL
        RET

; data table for initialisation routine
INITBL: DEFB  ØØ11ØØØØB ;set DL to high
        DEFB  ØØ111ØØØB ;8 bit, 2 lines, 5x7 dots
        DEFB  ØØØØ1ØØØB ;display off
        DEFB  ØØØØØØØ1B ;clear display, return
                        cursor
        DEFB  ØØØØØ11ØB ;set shift mode
; message
```

```
MESSGE:  DEFB   18      ;no. of character to be sent
         DEFB   ØØH     ;ADDR OF DDRAM
         DEFB   'This is first line'
         DEFB   19      ;no. of character to be sent
         DEFB   4ØH     ;addr of DDRAM
         DEFB   'This is second line'
         DEFB   18      ;no. of character to be sent
         DEFB   14H     ;addr of DDRAM
         DEFB   'This is third line'
         DEFB   19      ;no. of character to be sent
         DEFB   54H     ;addr of DDRAM
         DEFB   'This is fourth line'
         DEFB   '$'     ;end of message
         END
```

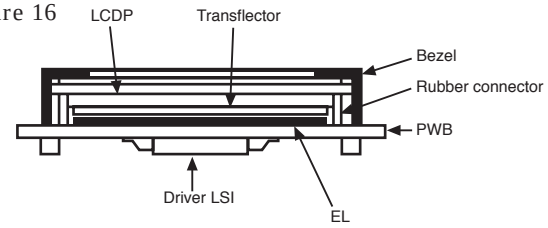
EL

Flat surface light source offers simple and even illumination over large area. It has an extremely thin structure type of illumination with little heat up.

Features

- Max. 1.3mm thickness (max. 1.5mm for lead portion)
- Wide driving condition of 60- 1,000Hz and 150Vac max., with inverter, step-up voltage from 1.5V battery is available
- Emitted colour is white
- Temperature range: operating 0°C ~ + 50°C
  Storage - 20°C ~ + 60°C

Figure 16



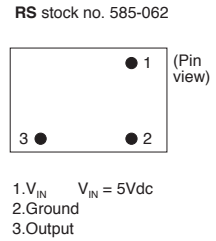
Inverter for EL back light drive

It is necessary to use inverter an when you need to operate EL with battery or a dc power supply.

- Low inverter loss and high light efficiency because it is designed as suitable for EL.
- Less change of power consumption during operation under temperature change or extended hours, which is realised by characteristics of constant supply current, minimises brightness change of EL.

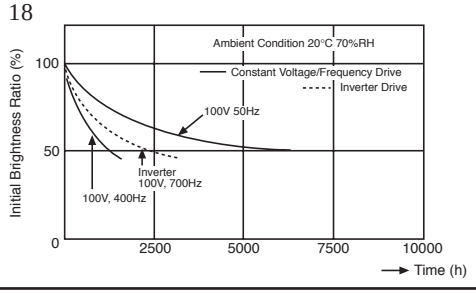
Inverter connections

Figure 17



Life characteristics

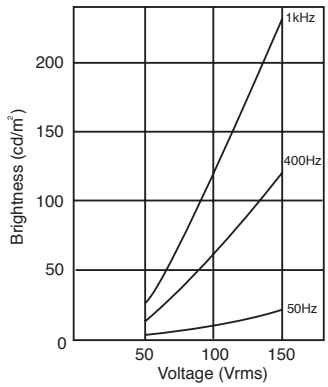
Figure 18



Electrical characteristics (reference data)

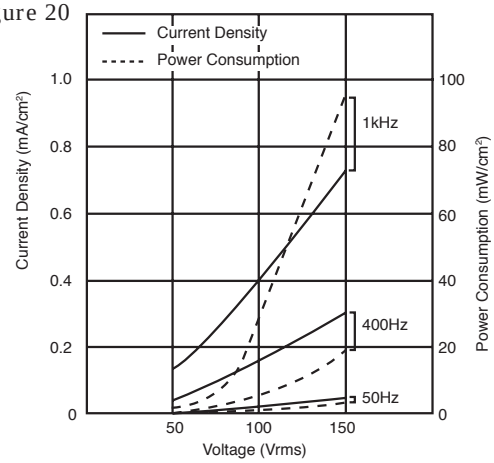
- Voltage VS. brightness

Figure 19



- Voltage VS. current density

Figure 20

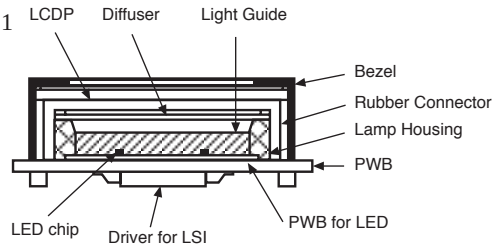


LED backlight types

Features

- Low voltage driving (dc) is available without inverter
- Long life time 100,000 hours (average)
- No noise occurrence.

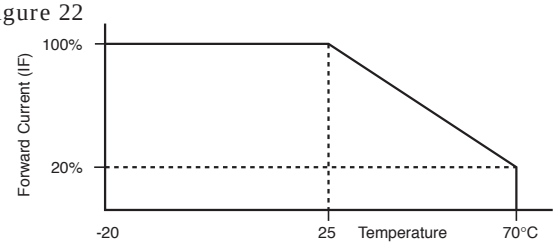
Figure 21



Electrical characteristics (reference data)

- Forward current derating curve

Figure 22



Typical Problems

Q. Why can only 1 character line be driven on a 2 character line module?
A. The module has either failed to initialise or has been initialised as a 1 line display

Q. Why are some rows and/or columns of pixels missing?
A. The module has been mounted in way which is applying pressure to the bezel supporting the LCD glass.

Q. Why does the display remain blank after initialisation and ASCII data sent?
A. V_{lcd} (V0) incorrectly set.
Timing incorrect. Check that all set up times have been followed. Check that the enable pulse width is 450nS minimum.

Q. Why can only characters 1 to 8 be addressed on a one line by sixteen character module?
A. A 1 line by 16 character module must be treated electrically as a 2 line by 8 character display module. After initialisation Line 1 will address characters 1 to 8 (RAM address 00h to 07h) and Line 2 will address characters 9 to 16 (RAM address 40h to 47h)

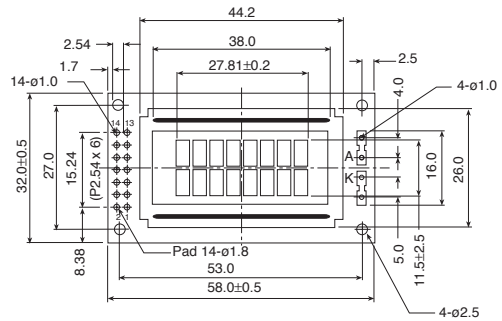
Q. Why can only lines 1 and 2 be addressed on a four line by forty character module?
A. The module contains two independent LCD controllers that must be driven as two separate 2 line by 40 character modules. The module has two enable lines allowing the top or bottom controller to be selected. If a hardware cursor is used it should be carefully controlled when moving between controllers.

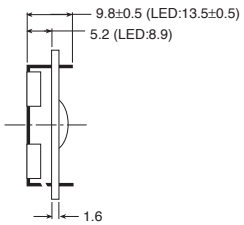
Q. When sequentially written data is sent to a 4 line by 16/20 module, why does the cursor jump from line 1 to line 3 to line 2 to line 4.
A. The module is electrically similar to a 2 line by forty module which has been folded in the middle such that line 3 follows line 1 and line 4 follows line 2.
Characters 1 to 20 are stored in RAM locations 00h to 13h
Characters 21 to 40 are stored in RAM locations 40h to 53h
Characters 41 to 60 are stored in RAM locations 14h to 27h
Characters 61 to 80 are stored in RAM locations 54h to 67h

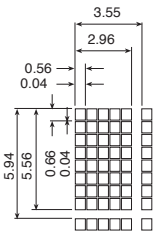
Mechanical dimensions

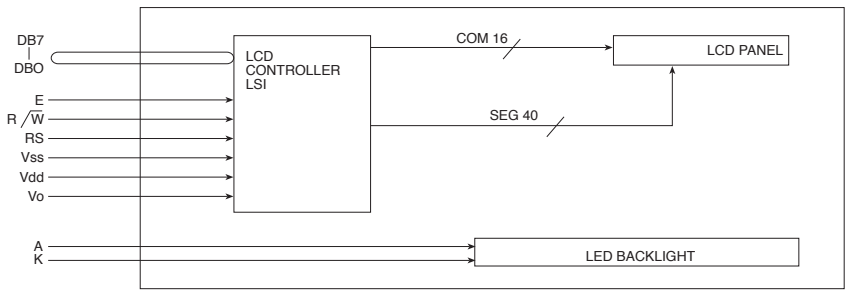
8 x 2 LCD modules

Figure 23







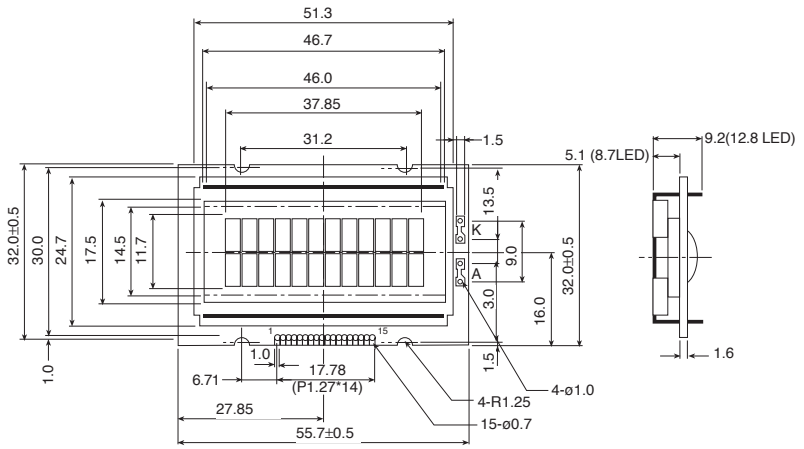


PIN NO.	SIGNAL
1	Vss
2	Vdd
3	Vo
4	RS
5	R/$\overline{W}$
6	E
7	DBO
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7

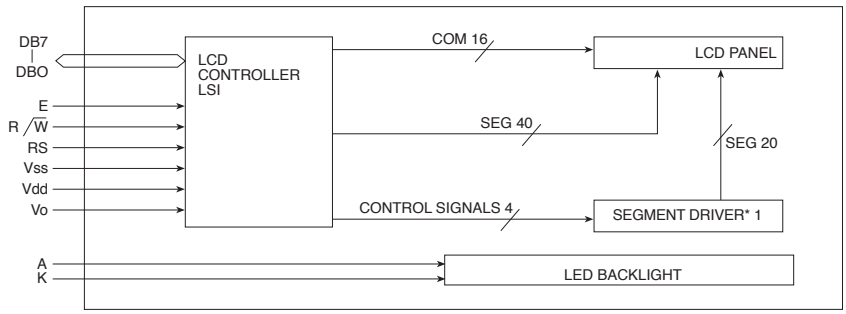
RS stock no. 214-3288 STN reflective
RS stock no. 214-3367 TN with EL backlighting
RS stock no. 214-3480 STN transflective with LED backlighting.

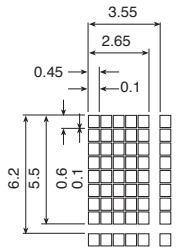
12 x 2 LCD module

Figure 24



PIN NO.	SIGNAL
1	Vss
2	Vdd
3	Vo
4	RS
5	R/$\overline{W}$
6	E
7	DBO
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	A

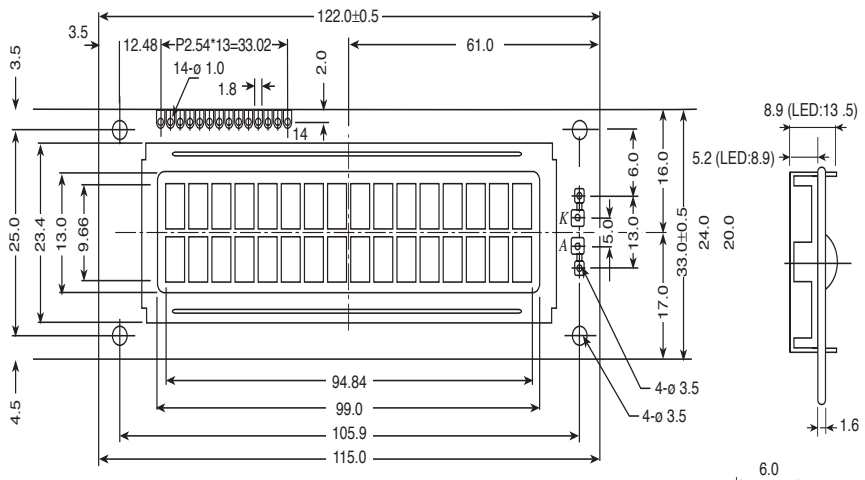


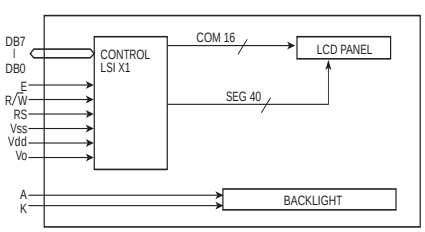


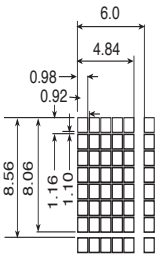
RS stock no. 294-8689 STN reflective
RS stock no. 214-3496 STN transflective with LED backlighting

16 x 1 Large Character LCD modules

Figure 25





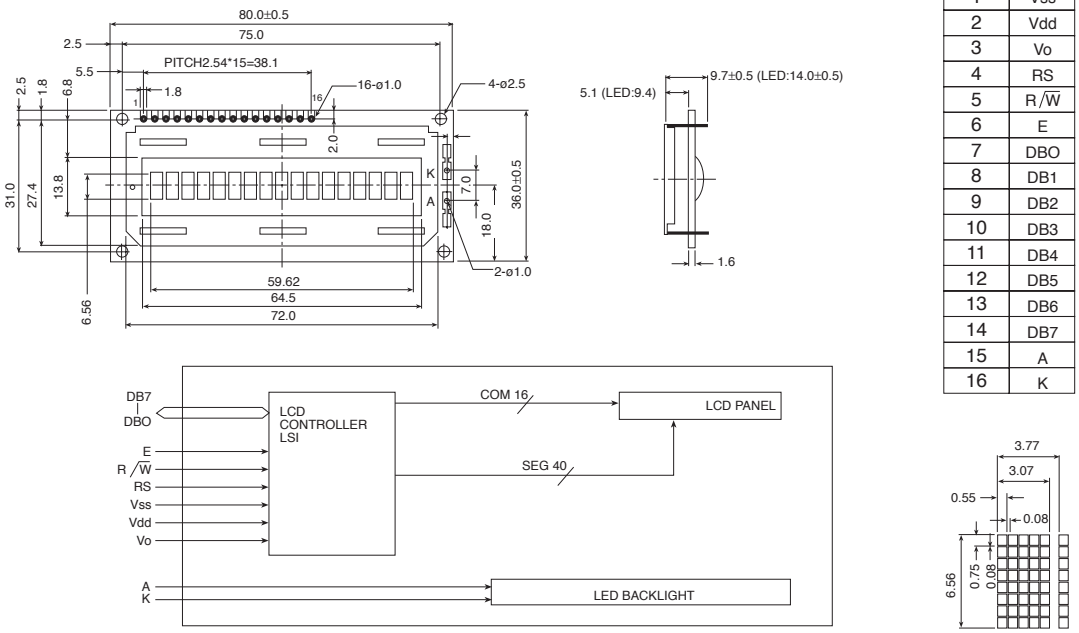


PIN NO.	SIGNAL
1	Vss
2	Vdd
3	Vo
4	RS
5	R/$\overline{W}$
6	E
7	DBO
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
-	A
-	K

RS stock no. 294-8718 STN reflective
RS stock no. 294-8796 STN transflective with LED backlighting

16 x 1 LCD modules

Figure 26

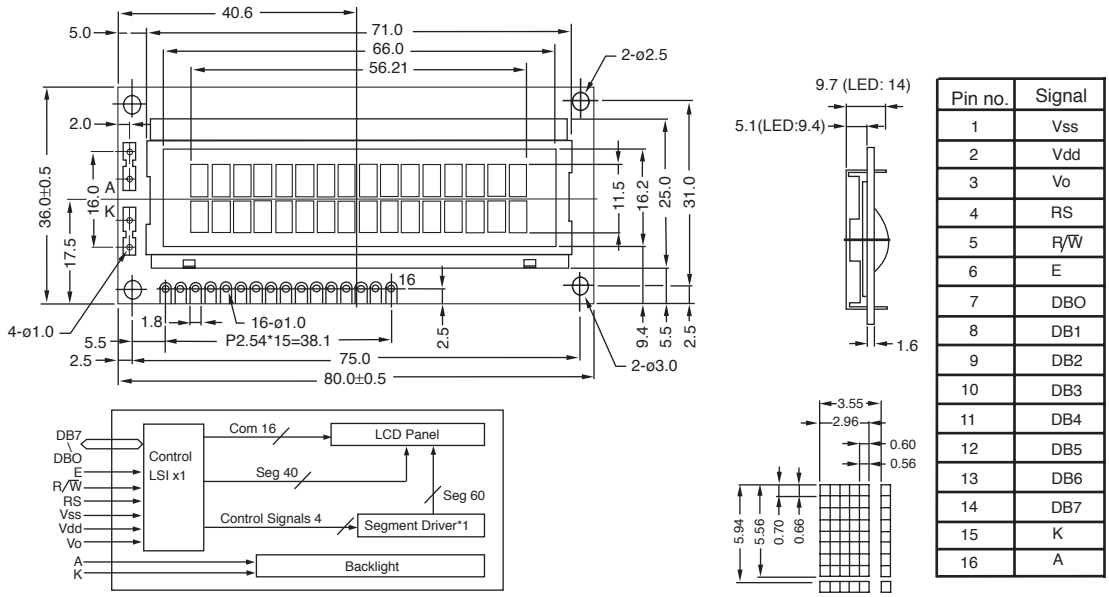


PIN NO.	SIGNAL
1	Vss
2	Vdd
3	Vo
4	RS
5	R/W
6	E
7	DBO
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	A
16	K

RS stock no. 214-3238 TN reflective
RS stock no. 214-3294 STN reflective
RS stock no. 214-3373 TN with EL backlighting
RS stock no. 214-3519 STN transflective with LED backlighting.

16 x 2 Small PCB LCD modules

Figure 27

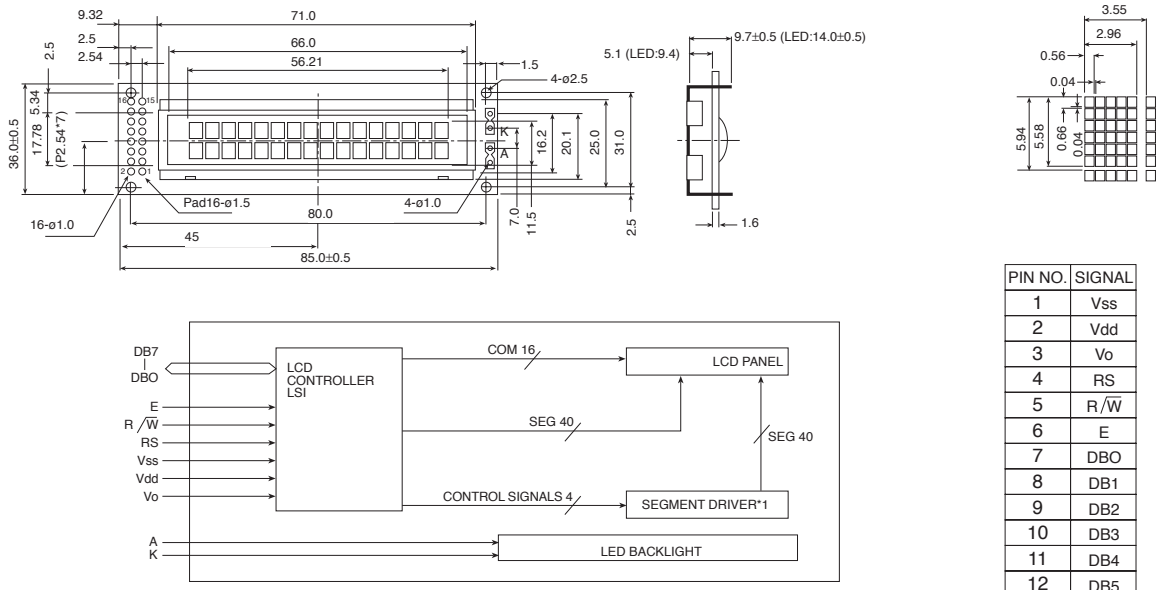


Pin no.	Signal
1	Vss
2	Vdd
3	Vo
4	RS
5	R/W
6	E
7	DBO
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	K
16	A

RS stock no. 294-8667 TN reflective
RS stock no. 294-8695 STN reflective
RS stock no. 294-8774 STN transflective with LED backlighting

16 x 2 LCD modules

Figure 28

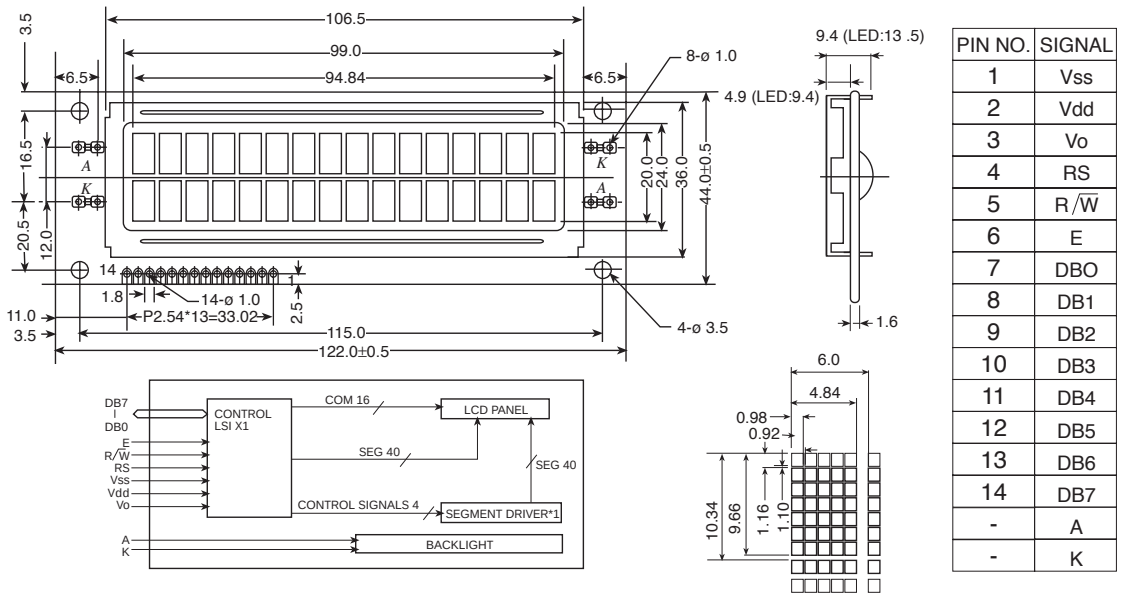


PIN NO.	SIGNAL
1	Vss
2	Vdd
3	Vo
4	RS
5	R/W
6	E
7	DBO
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	A
16	K

RS stock no. 214-3244 TN reflective
RS stock no. 214-3301 STN reflective
RS stock no. 214-3395 TN with EL backlighting
RS stock no. 214-3525 STN transflective with LED backlighting.

16x 2 Large Character LCD modules

Figure 29

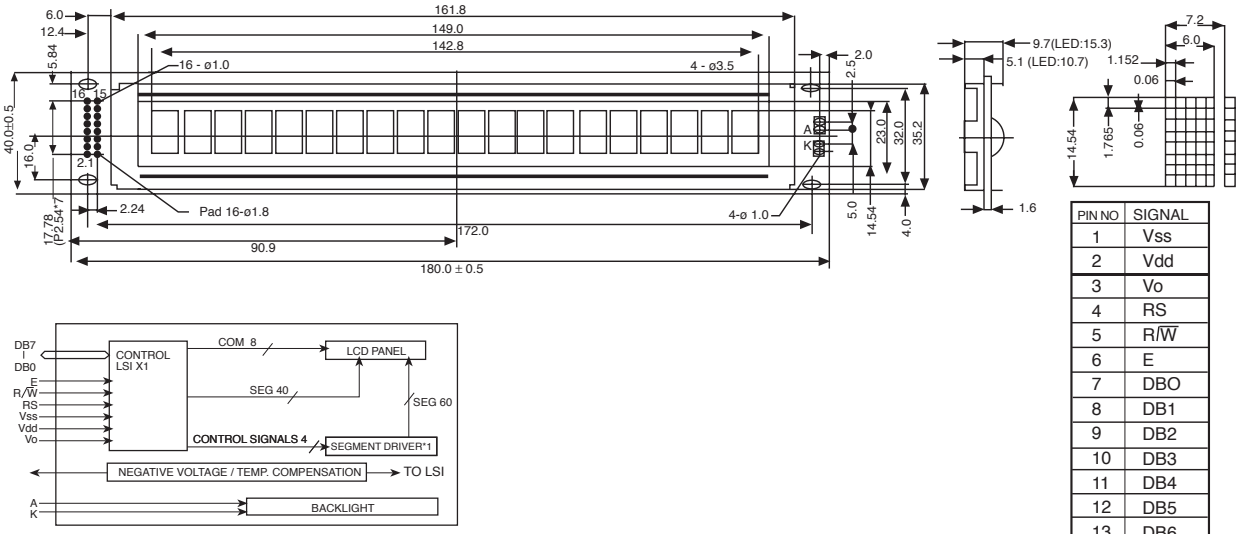


PIN NO.	SIGNAL
1	Vss
2	Vdd
3	Vo
4	RS
5	R/W
6	E
7	DBO
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
-	A
-	K

RS stock no. 294-8724 STN reflective
RS stock no. 294-8803 STN transflective with LED backlighting.

20 x 1 Large Character LCD modules

Figure 30

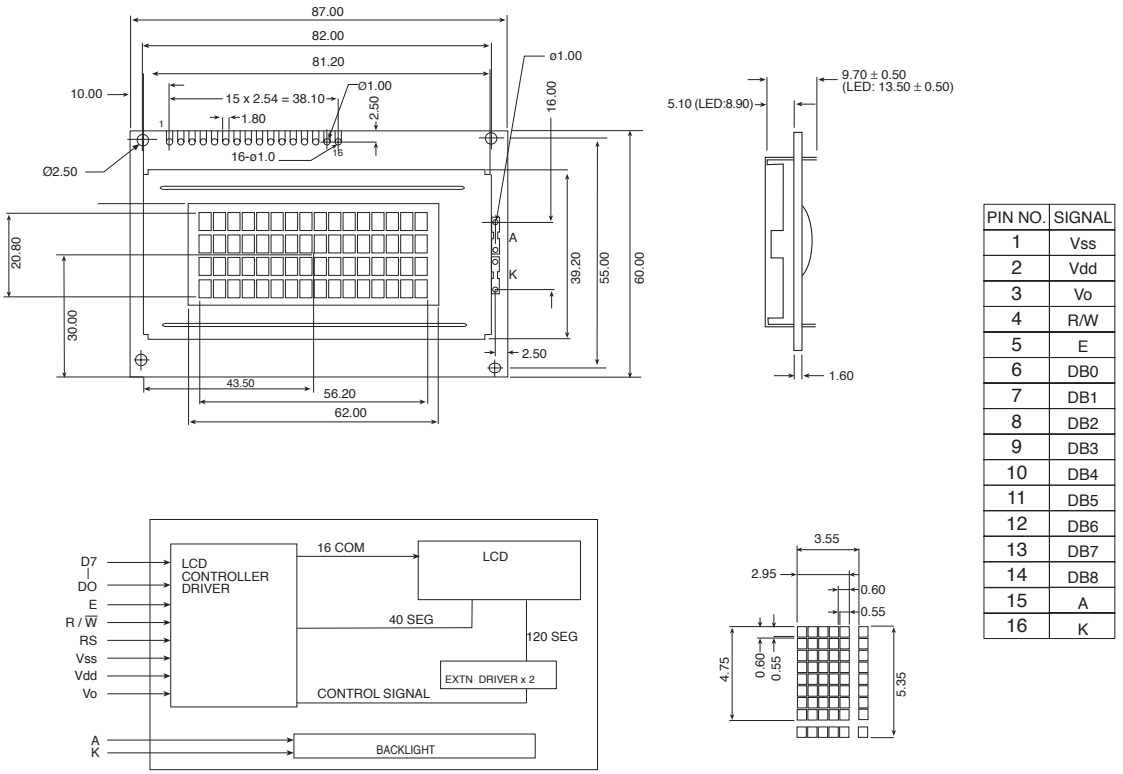


PIN NO	SIGNAL
1	Vss
2	Vdd
3	Vo
4	RS
5	R/$\overline{W}$
6	E
7	DBO
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	NC/Vee
16	NC
-	A
-	K

RS stock no. 294-8746 STN reflective
RS stock no. 214-3531 STN transflective with LED backlighting.

16 x 4 LCD modules

Figure 31

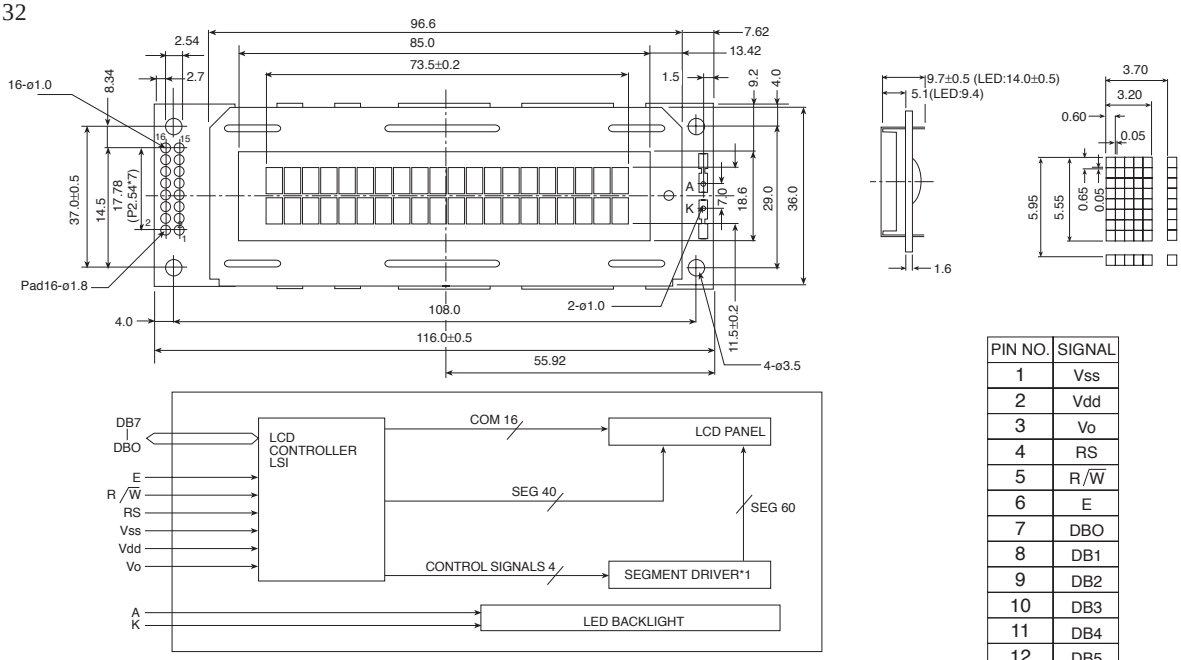


PIN NO.	SIGNAL
1	Vss
2	Vdd
3	Vo
4	R/W
5	E
6	DB0
7	DB1
8	DB2
9	DB3
10	DB4
11	DB5
12	DB6
13	DB7
14	DB8
15	A
16	K

RS stock no. 294-8780 STN transflective with LED backlighting

20 x 2 LCD modules

Figure 32

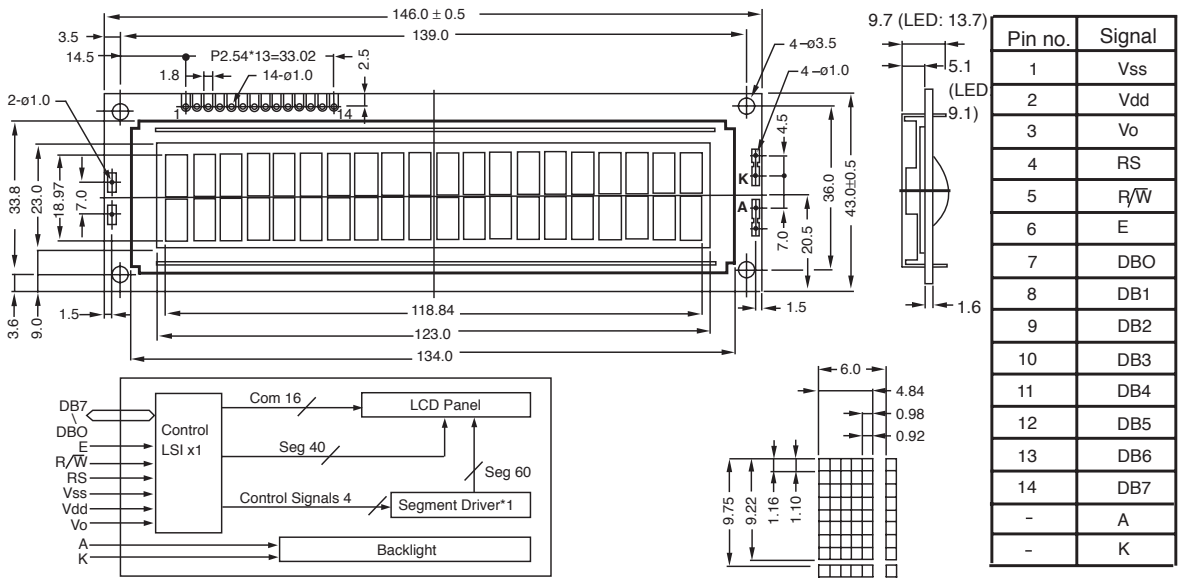


PIN NO.	SIGNAL
1	Vss
2	Vdd
3	Vo
4	RS
5	R/W
6	E
7	DBO
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	A
16	K

RS stock no. 214-3317 STN reflective
RS stock no. 214-3547 STN transflective with LED backlighting.

20 x 2 Large Character LCD modules

Figure 33

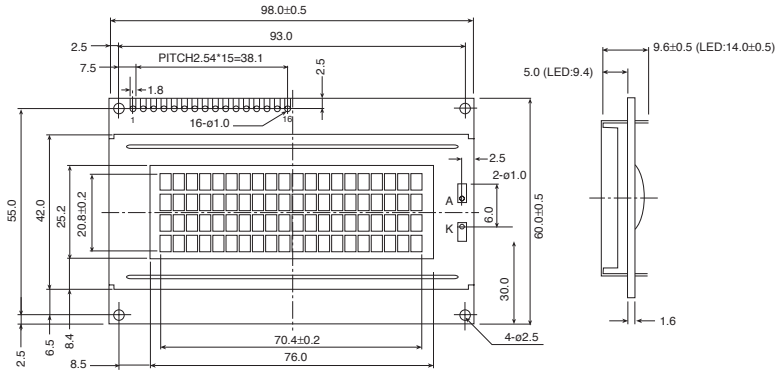


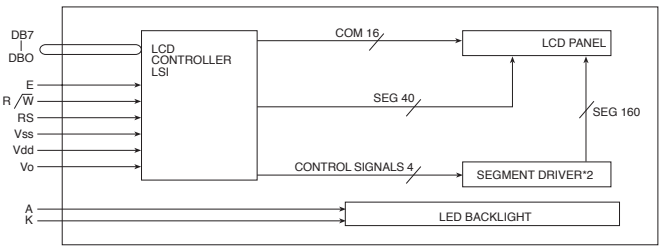
Pin no.	Signal
1	Vss
2	Vdd
3	Vo
4	RS
5	R/W
6	E
7	DBO
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
-	A
-	K

RS stock no. 294-8752 STN reflective
RS stock no. 294-8819 STN transflective with LED backlighting.

20 x 4 LCD modules

Figure 34



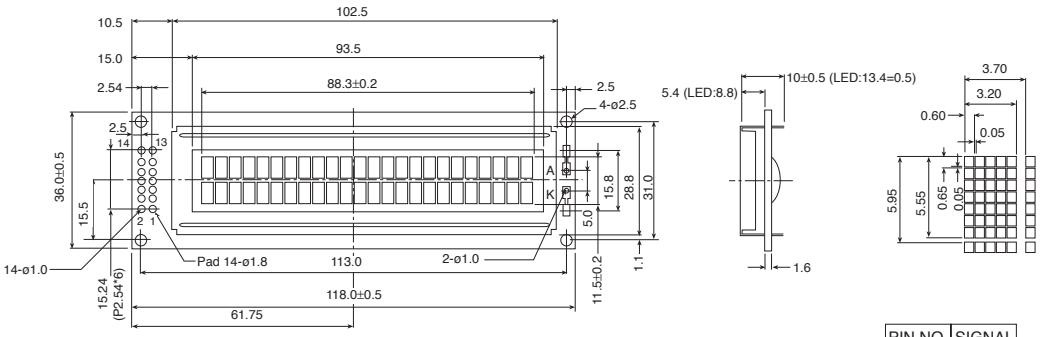


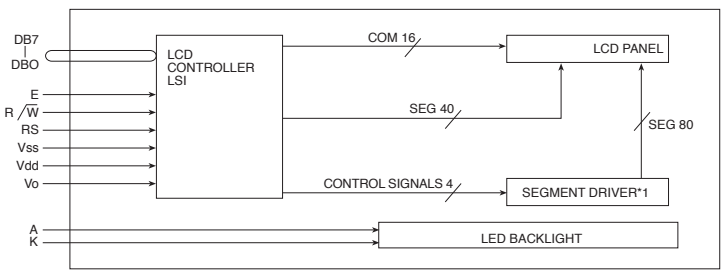
PIN NO.	SIGNAL
1	Vss
2	Vdd
3	Vo
4	RS
5	R/W
6	E
7	DBO
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	A
16	K

RS stock no. 214-3323 STN reflective
RS stock no. 214-3553 STN transflective with LED backlighting.

24 x 2 LCD modules

Figure 35



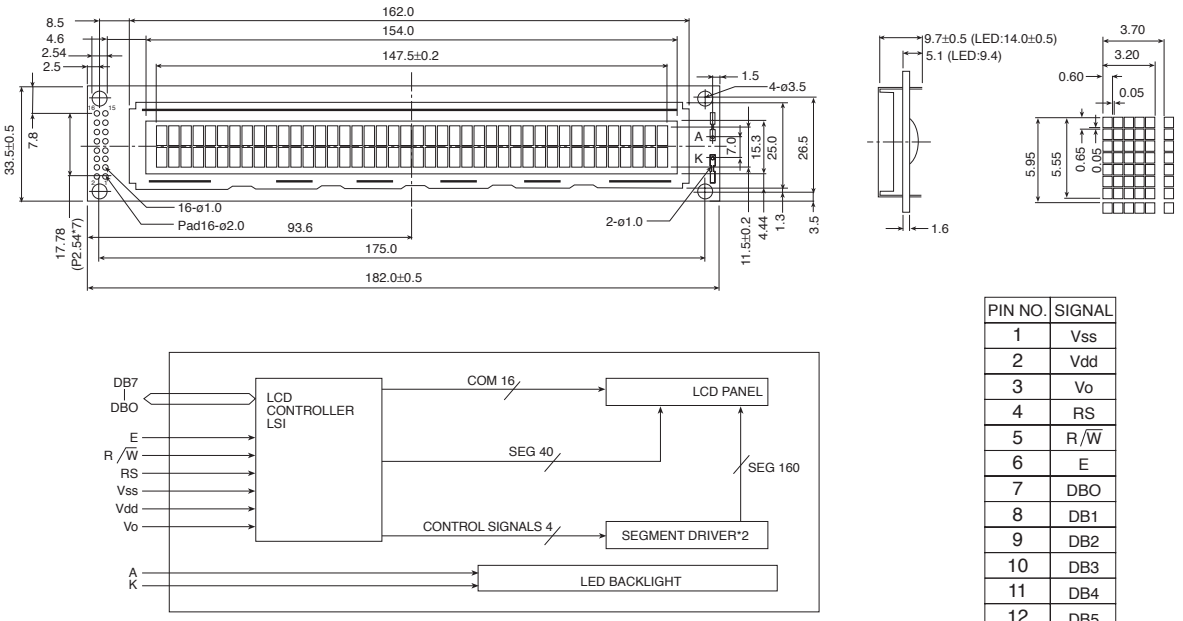


PIN NO.	SIGNAL
1	Vss
2	Vdd
3	Vo
4	RS
5	R/W
6	E
7	DBO
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7

RS stock no. 214-3250 TN reflective
RS stock no. 214-3339 STN reflective
RS stock no. 214-3402 TN with EL backlighting
RS stock no. 214-3569 STN transflective with LED backlighting.

40 x 2 LCD modules

Figure 36

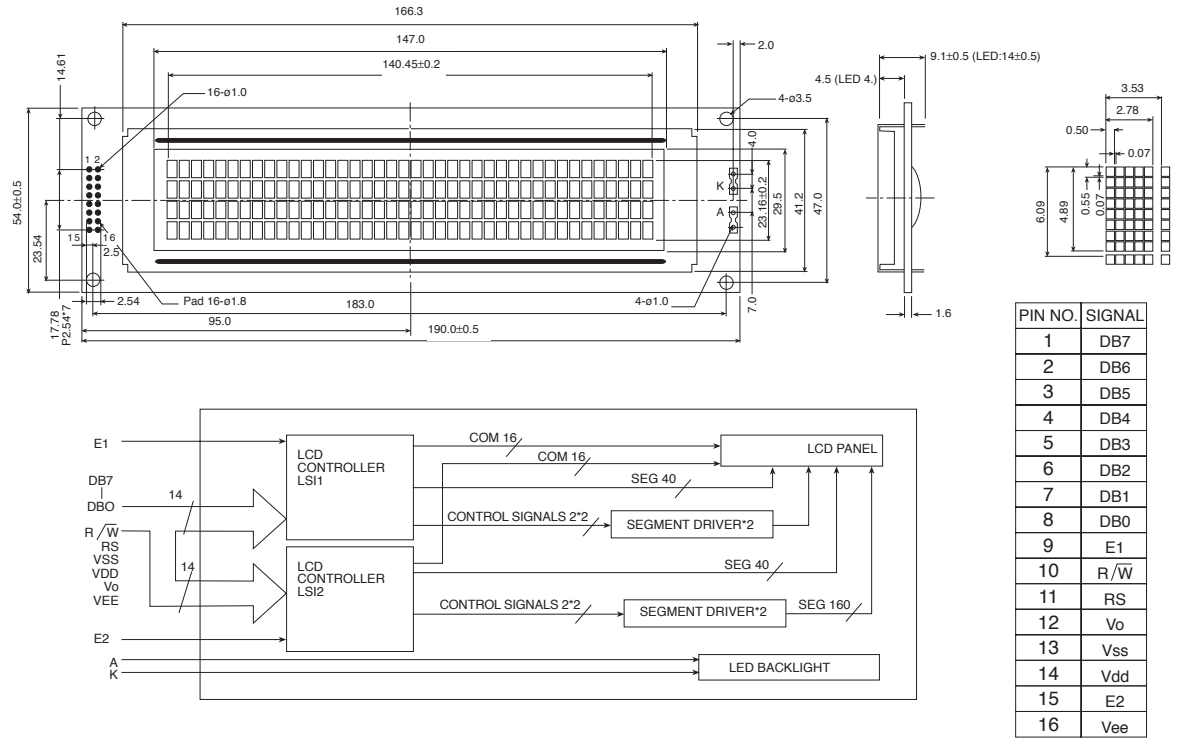


PIN NO.	SIGNAL
1	Vss
2	Vdd
3	Vo
4	RS
5	R/W
6	E
7	DBO
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	A
16	K

RS stock no. 214-3266 TN reflective
RS stock no. 214-3345 STN reflective
RS stock no. 214-3418 TN with EL backlighting
RS stock no. 214-3474 TN transmissive with LED backlighting
RS stock no. 214-3575 STN transflective with LED backlighting.

40 x 4 LCD modules

Figure 37



PIN NO.	SIGNAL
1	DB7
2	DB6
3	DB5
4	DB4
5	DB3
6	DB2
7	DB1
8	DB0
9	E1
10	R/W
11	RS
12	Vo
13	Vss
14	Vdd
15	E2
16	Vee

RS stock no. 214-3272 TN reflective
RS stock no. 214-3351 STN reflective
RS stock no. 215-3617 STN transflective with LED backlighting

Precaution for using

1. Handling
   a) Do not touch, press or rub the display panel with a hard, stiff tool or object (e.g. tweezers) as the polarises in the panel are easily scratched.
   b) Never use organic solvents to clear the display panel as these solvents may adversely affect the polariser. To clean the display panel and dampen a bit of absorbent cotton with petroleum benzine and gently wipe the panel.
   c) Never touch terminals of electrodes of PCB or LSI leads.
   d) Avoid using or storing the LCM under high temperature and high humidity conditions. When in storage it is recommended that the device is packaged in a conductive polyethylene bag and placed under the condition where the temperature is relatively lower (10 -30°C), and direct sunlight or fluorescent lamp must be cut off.
2. Operation
   a) Never connect or disconnect the LCM from the main system while power is being supplied.
   b) If the operating temperature drops below the temperature limits, the blinking speed of the display will decrease, while if it rises above the prescribed limits, the entire display will turn black. When the temperature returns to within normal limits, the display will operate normally.
3. Workmanship
   a) Never disassemble the module.
   b) Anti static precautions must be taken, as the circuit of the module contains a CMOS LSI.

RS Components, PO Box 99, Corby, Northants, NN17 9RS
Telephone: 01536 201234
An Electrocomponents Company