



Powertip alphanumeric dot matrix liquid crystal displays

Reflective types - RS stock numbers 214-3238, 214-3244, 214-3250, 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, 214-3395, 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 transreflective 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
- ASCII 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 = 0V, 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 1	-	RS, R/W, E	-0.3	-	0.6	V
H level output voltage (1)	Voh 1	Ioh = -0.205mA	DB0 ~ DB7	2.4	-	-	V
L level output voltage (1)	Vol 1	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	-	-	0.6	mA
				1.3	-	2.5	

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)

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

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

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

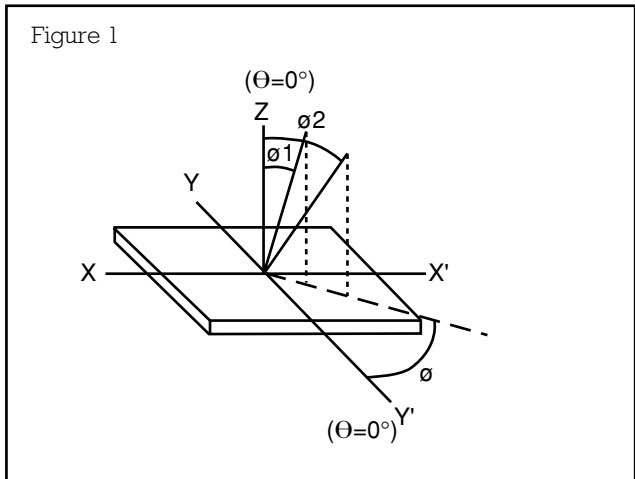
1. STN type

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Viewing angle	$\phi 2 - \phi 1$	$K = 1.4$	60	-	-	deg.	*1, *2
Contrast ratio	K	$\phi = 10^{\circ}\text{C}$ $\theta = 0^{\circ}\text{C}$	5	-	-	-	*3
Response time (rise)	tr	$\phi = 10^{\circ}\text{C}$ $\theta = 0^{\circ}\text{C}$	-	150	250	ms	*4
Response time (fall)	tf	$\phi = 10^{\circ}\text{C}$ $\theta = 0^{\circ}\text{C}$	-	200	300	ms	*4

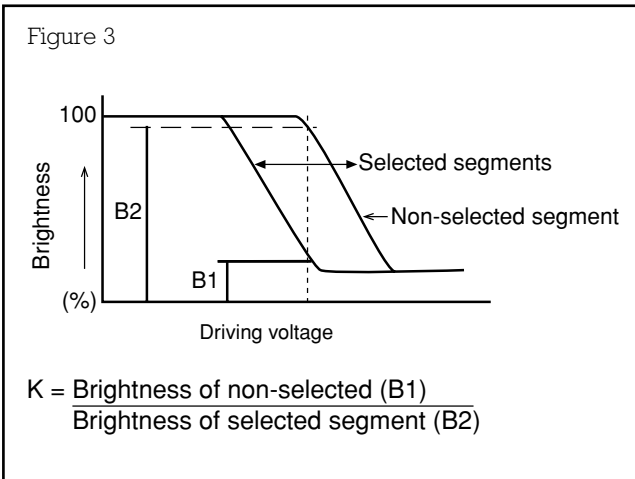
2. TN type

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Viewing angle	$\phi 2 - \phi 1$	$K = 1.4$	40	-	-	deg.	*1, *2
Contrast ratio	K	$\phi = 25^{\circ}\text{C}$ $\theta = 0^{\circ}\text{C}$	-	5	-	-	*3
Response time (rise)	tr	$\phi = 25^{\circ}\text{C}$ $\theta = 0^{\circ}\text{C}$	-	80	120	ms	*4
Response time (fall)	tf	$\phi = 25^{\circ}\text{C}$ $\theta = 0^{\circ}\text{C}$	-	60	90	ms	*4

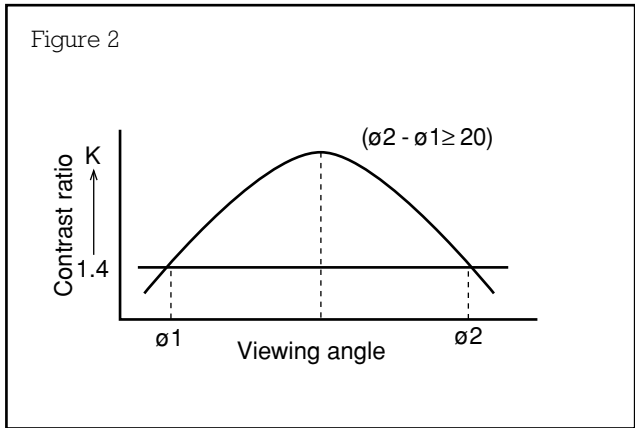
*1. Definition of U and ϕ



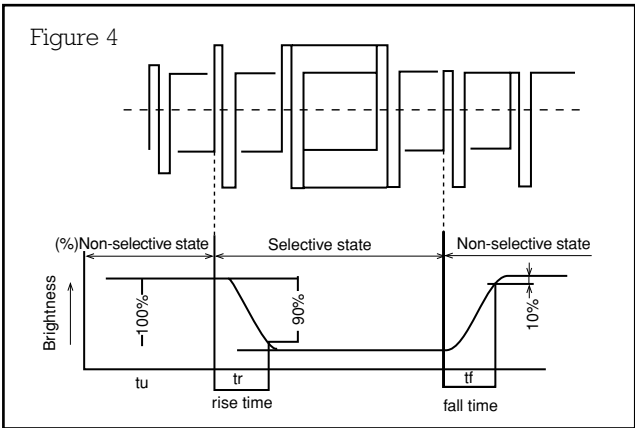
*3. Definition of contrast ratio



*2. Contrast vs viewing angle



*4 Definition of optical response



Timing characteristics

Figure 5 Write operation

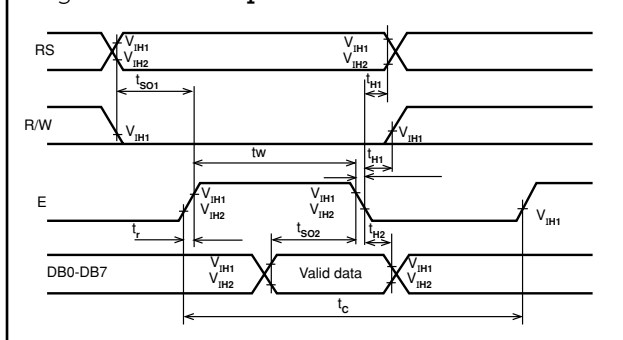
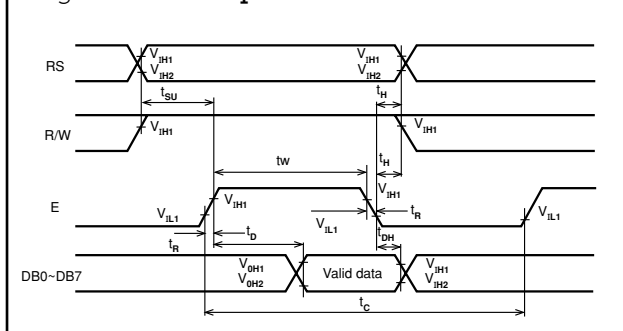


Figure 6 Read operation



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

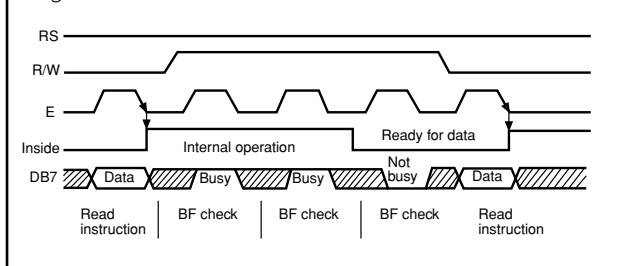
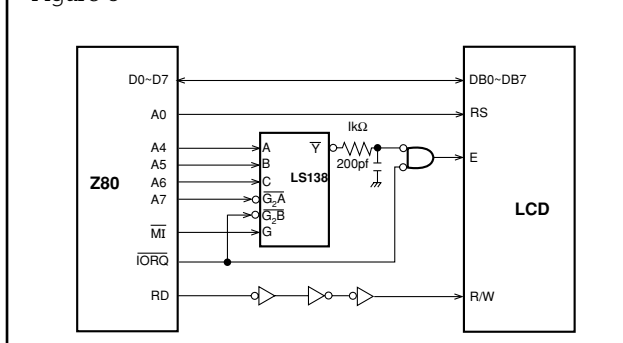


Figure 8



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

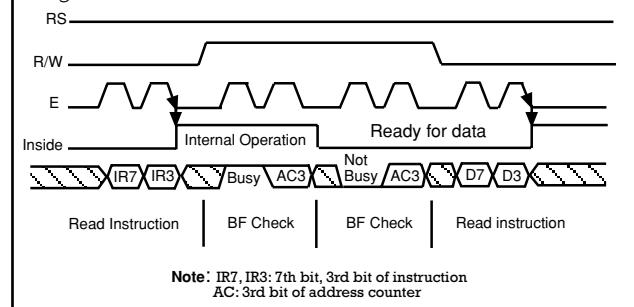
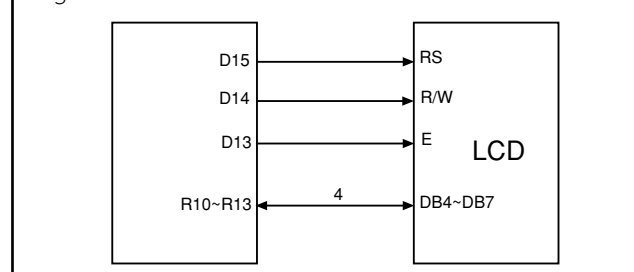


Figure 10

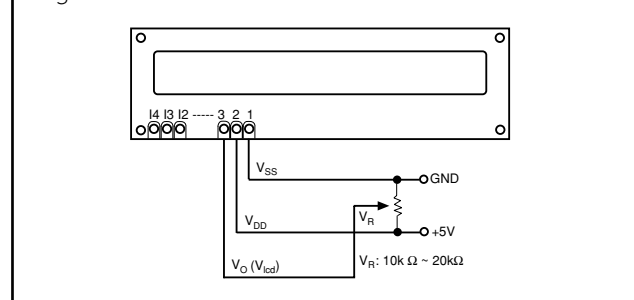


Features

- Interface with 8-bit or 4-bit MPU is available.
- 192 kind of alphabets, numerals, symbols and special characters can be displayed by built-in character generator (ROM).
- Other preferred characters can be displayed by character preferred generator (RAM).
- 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.
- Compact and light design which can be easily assembled in devices.
- Single power supply +5 drive (at ambient temperature).
- 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.	
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 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	DL=0: 4-bit N=1: 2 lines N=0: 1 line F=1: 5 x 10 dots F=0: 5 x 7 dots BF=1: Internal operation is being performed BF=0: Instruction acceptable	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	fcp or fosc=250kHz However, when frequency changes, execution time also changes Ex If fcp or fosc is 270kHz, 40μS x 250/270 = 37μS *Don't care

Figure 12

Standard character pattern

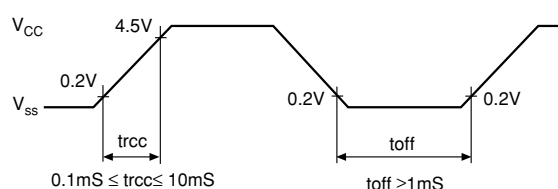
		Higher 4-bit (D4 to D7) of Character Code (Hexadecimal)																
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
Lower 4-bit (D0 to D3) of Character Code (Hexadecimal)	0	CG RAM (1)			0	0	P`	P						-	9	≡	o	p
	1	CG RAM (2)			!	1	Q	a	q				u	7	7	4	ä	q
	2	CG RAM (3)			"	2	B	r	b	r				「	「	「	「	「
	3	CG RAM (4)			#	3	C	s	c	s				」	」	」	」	」
	4	CG RAM (5)			\$	4	D	t	d	t				、	、	、	、	、
	5	CG RAM (6)			%	5	E	u	e	u				・	・	・	・	・
	6	CG RAM (7)			&	6	F	v	f	v				ヲ	ヲ	ヲ	ヲ	ヲ
	7	CG RAM (8)			'	7	G	w	g	w				ヲ	ヲ	ヲ	ヲ	ヲ
	8	CG RAM (1)			(8	H	x	h	x				イ	イ	イ	イ	イ
	9	CG RAM (2))	9	I	y	i	y				ウ	ウ	ウ	ウ	ウ
	A	CG RAM (3)			*	A	J	z	j	z				エ	エ	エ	エ	エ
	B	CG RAM (4)			+	B	K	k						ヲ	ヲ	ヲ	ヲ	ヲ
	C	CG RAM (5)			,	C	L	l						ヲ	ヲ	ヲ	ヲ	ヲ
	D	CG RAM (6)			-	D	M	m						ヲ	ヲ	ヲ	ヲ	ヲ
	E	CG RAM (7)			.	E	N	n						ヲ	ヲ	ヲ	ヲ	ヲ
	F	CG RAM (8)			/	F	O	o						ヲ	ヲ	ヲ	ヲ	ヲ

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



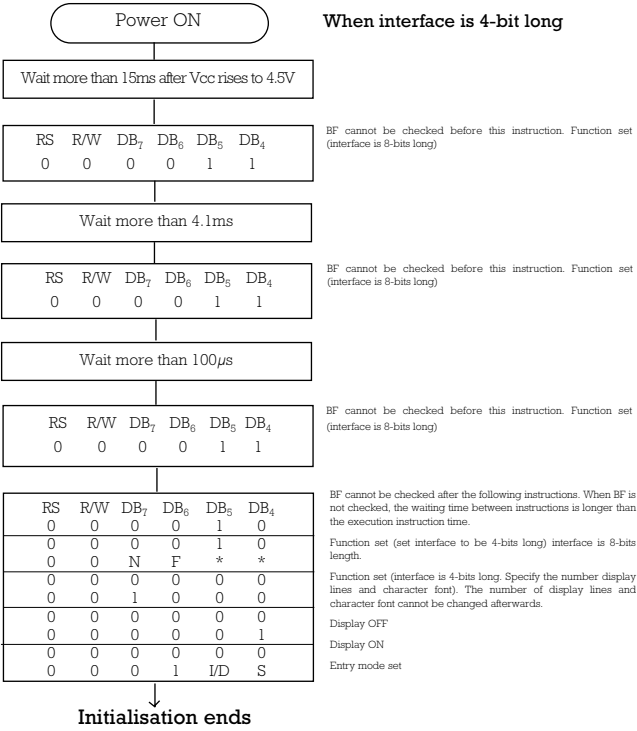
Note: toff defines period that power supply is off when power shuts down momentarily or repeats on/off state

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.

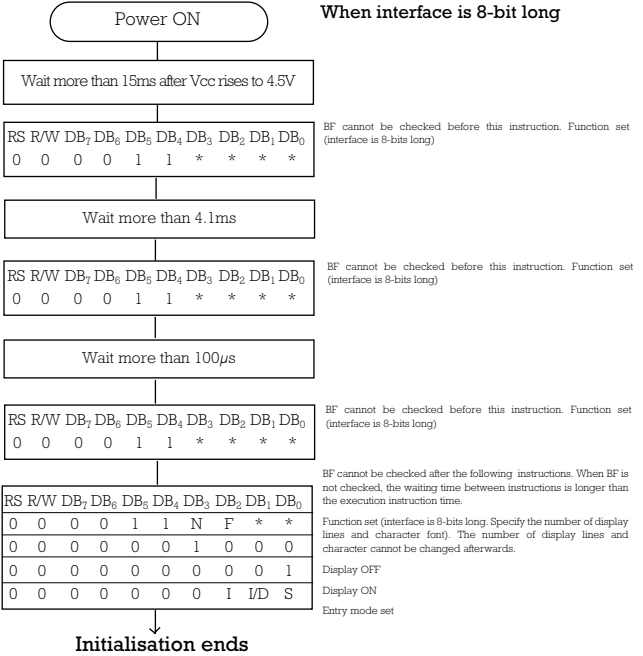
1. Display clear
2. Function set
DL = 1:8bit long interface data
DL = 0:4bit F=0:5 x dot character font
N =1: 2lines
N =0: 1line
3. Display ON/OFF control
D=0:display OFF C=0:cursor OFF B=0:blink OFF
4. Entry mode set
I/D=1: + 1 (increment) S=0:No shift

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



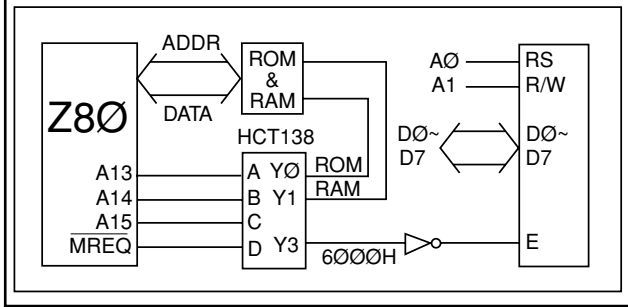
Initialisation along with instructions

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 Z80 MPU running at 2 Mhz

A0 is connected to **RS** of module

where A0 = 1: Instruction register is selected

where A0 = 0: Data register is selected

A1 is connected to R/W of module

where A1 = 0: Module in write mode

where A1 = 1: Module in read mode

WRINST EQU 6000H ;write instruction

WRDATA EQU 6001H ;write data

RDBUSY EQU 6002H ;read busy

Initialisation

```
LD      B,0           ;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,00001111B   ;display on, cursor
LD      (WRINST),A    ;blink
;set DDRAM address to 00H
LD      A,10000000B   ;set to 00H
CALL    MMSG          ;o/p message
;set DDRAM address to 40H
```

```
LD      A,11000000B   ;set to 40H
CALL    MMSG          ;o/p message
HALT                    ;program stop here.....
```

;subroutine to set DDRAM addr and o/p message

MMSG: 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 00110000B ;set DL to high

DEFB 00111000B ;8-bit, 2 lines, 5X7 dots

DEFB 00001000B ;display off

DEFB 00000001B ;clear display, return cursor

DEFB 00000110B ;set shift mode (entry mode set)

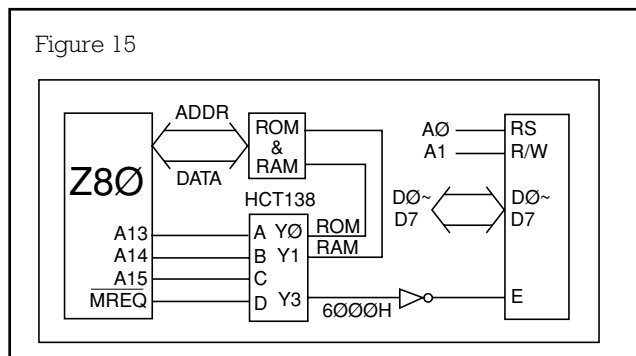
; message

MSGGE: DEFB 'DISPLAY MODULES'

END

Application example for 20 x 4 and 40 x 4 displays

Figure 15



Example of interfacing to Z80 MPU running at 2 Mhz

A0 is connected to RS of module

where A0 = 1: Instruction register is selected

where A0 = 0: Data register is selected

A1 is connected to R/W of module

where A1 = 0: Module in read mode

where A1 = 1: Module in write mode

```
WRINST EQU 6000H ;write instruction
WRDATA EQU 6001H ;write data
RDBUSY EQU 6002H ;read busy
```

Initialisation

```
LD B,0 ;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,00001111B ;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 message 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 00110000B ;set DL to high
DEFB 00111000B ;8 bit, 2 lines, 5x7 dots
DEFB 00001000B ;display off
DEFB 00000001B ;clear display, return
; cursor
DEFB 00000110B ;set shift mode
```

; message

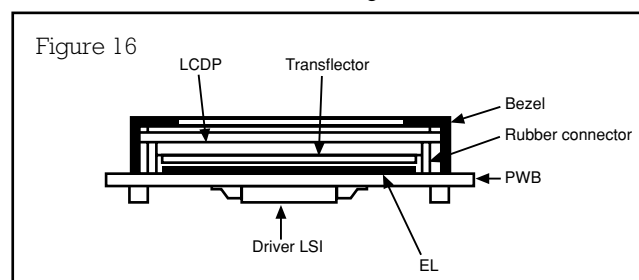
MESSAGE: DEFB 18 ;no. of character to be sent
 DEFB 00H ;ADDR OF DDRAM
 DEFB 'This is first line'
 DEFB 19 ;no. of character to be sent
 DEFB 40H ;addr of DDRAM
 DEFB 'This is second line'
 DEFB 18 ;no. of character to be sent
 DEFB 14H ;addr of DDRAM
 DEFB 'This is third line'
 DEFB 19 ;no. of character 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

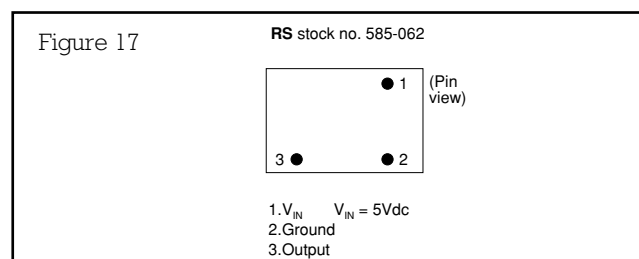


Inverter for EL back light drive

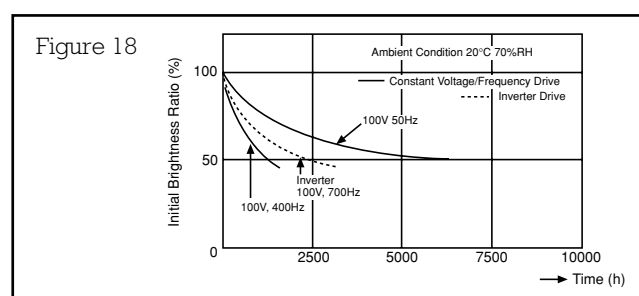
It is necessary to use inverter an when you need to operate EL with battery or a dc power supply.

- 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

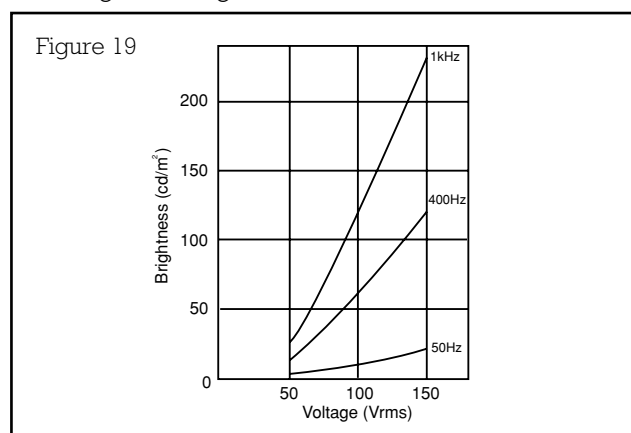


Life characteristics

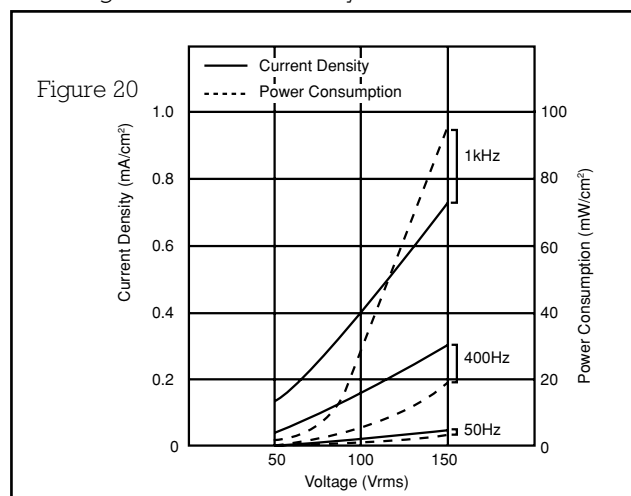


Electrical characteristics (reference data)

● Voltage VS. brightness



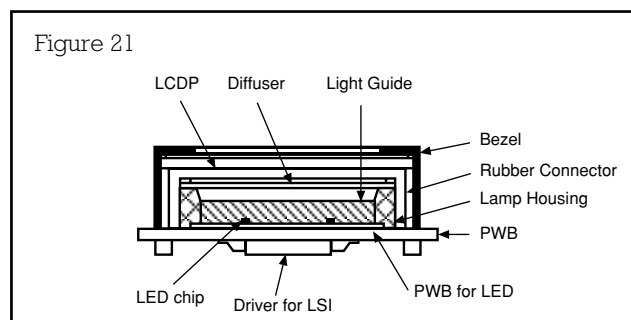
● Voltage VS. current density



LED backlight types

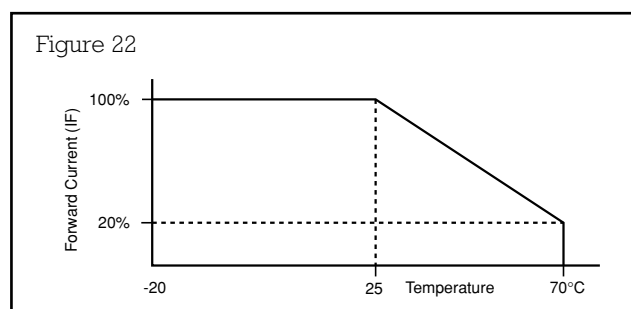
Features

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

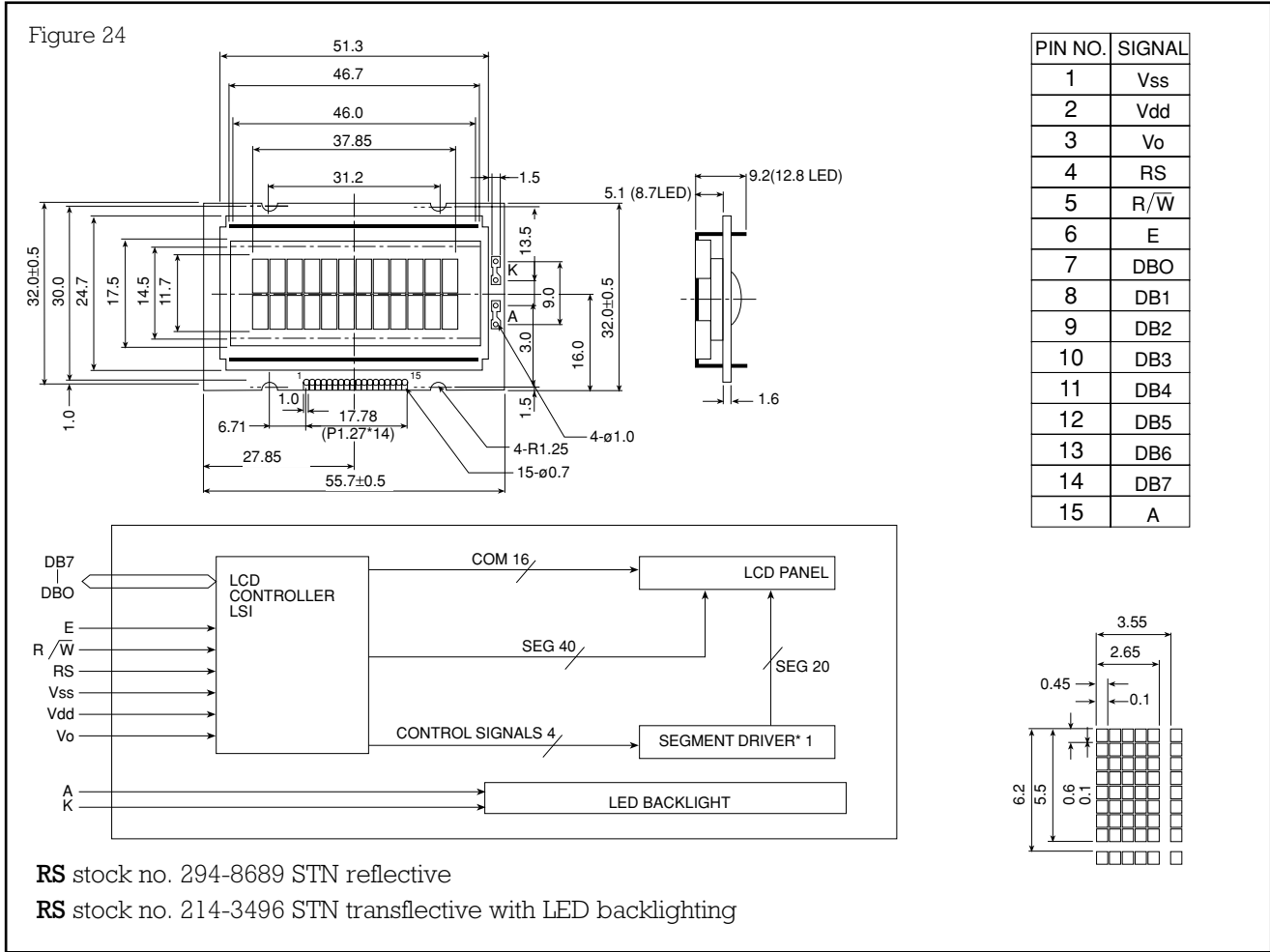


Electrical characteristics (reference data)

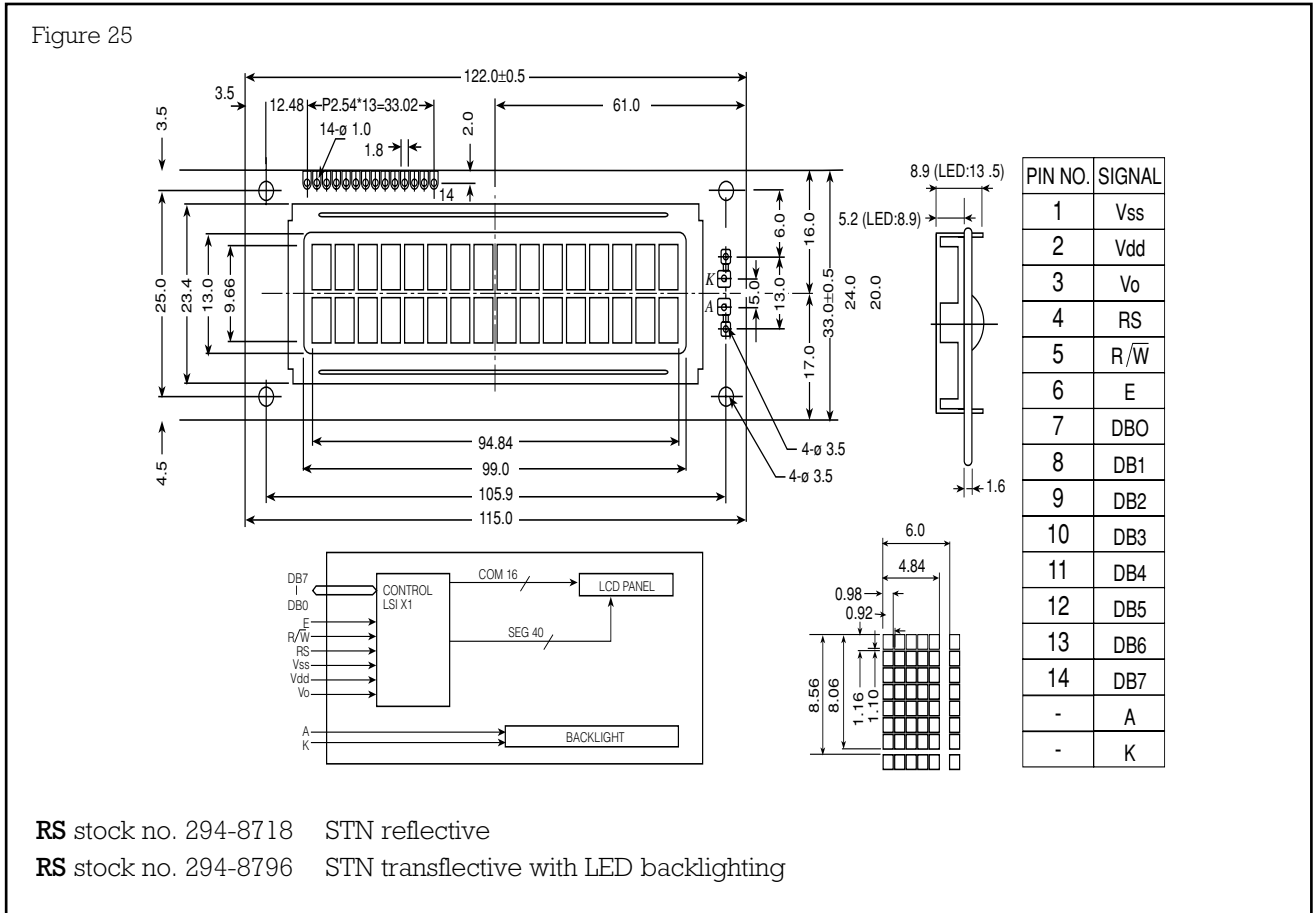
● Forward current derating curve



12 x 2 LCD module

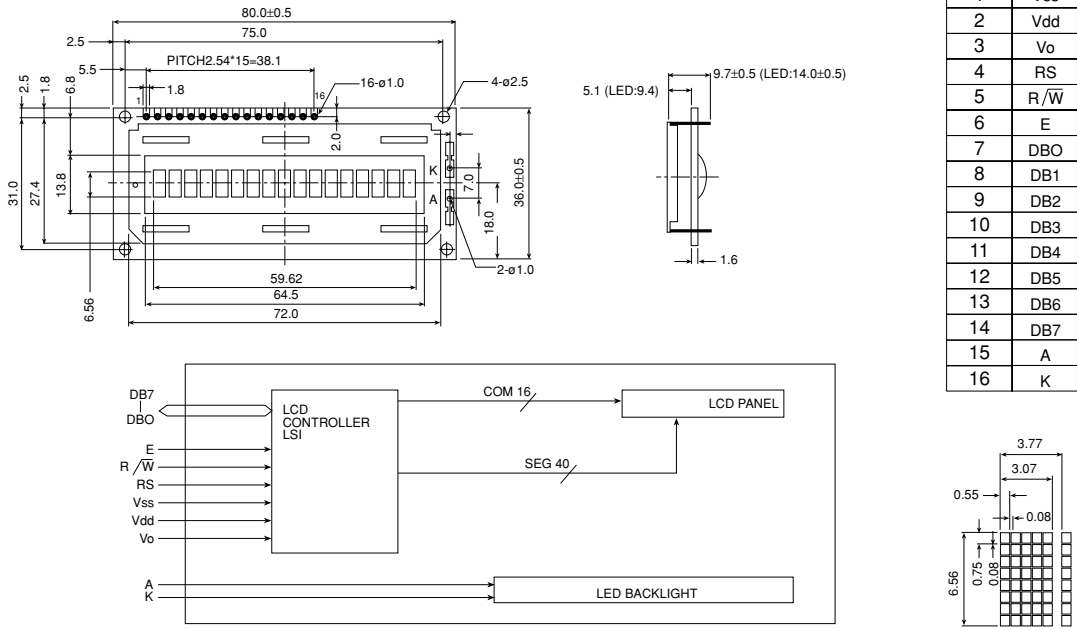


16 x 1 Large Character LCD modules



16 x 1 LCD modules

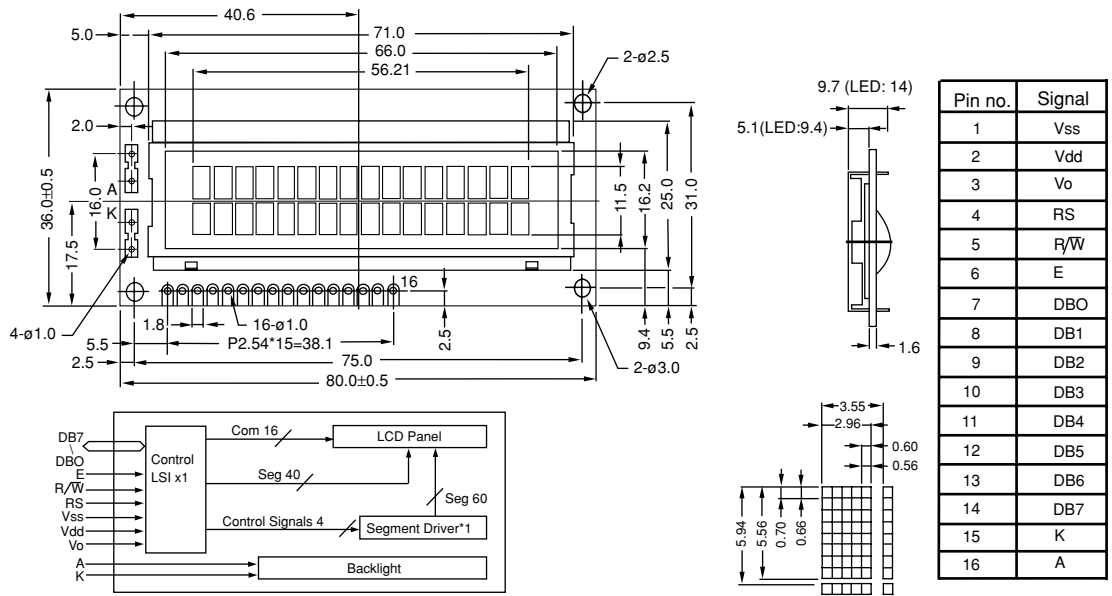
Figure 26



- RS stock no. 214-3238 TN reflective
- RS stock no. 214-3294 STN reflective
- RS stock no. 214-3519 STN transfective with LED backlighting.

16 x 2 Small PCB LCD modules

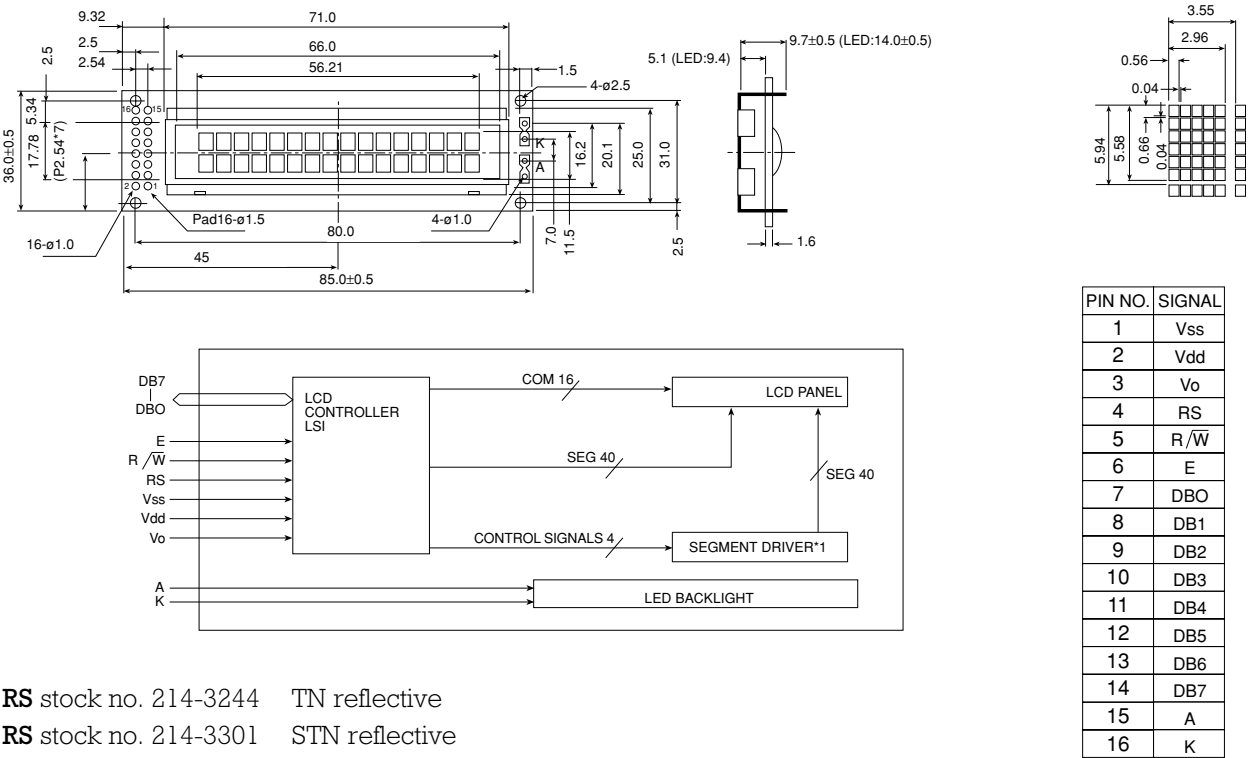
Figure 27



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

16 x 2 LCD modules

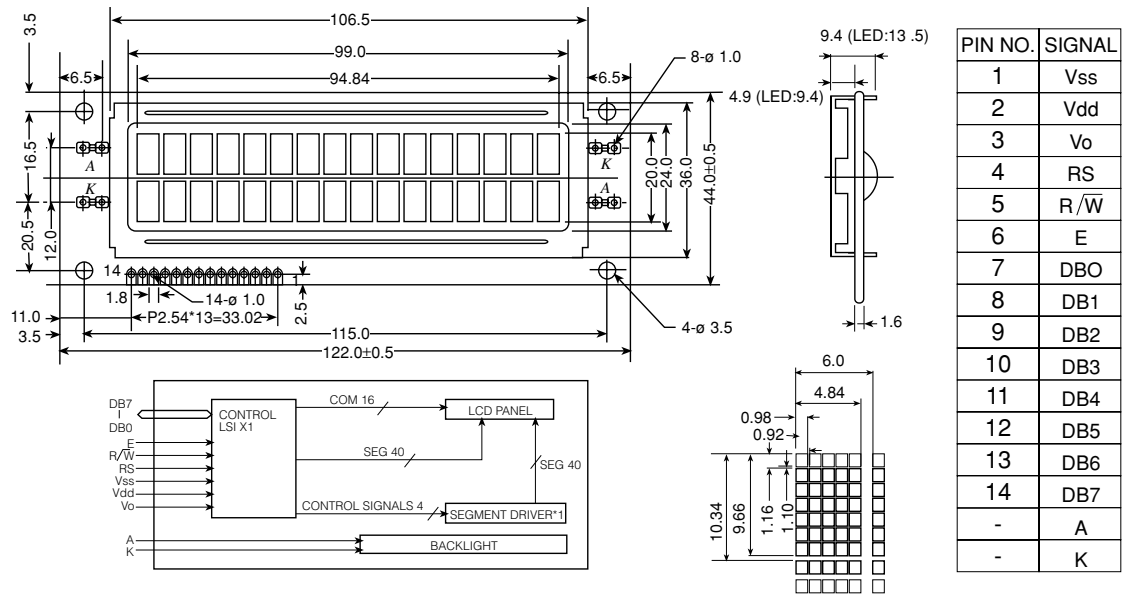
Figure 28



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 transfective with LED backlighting.

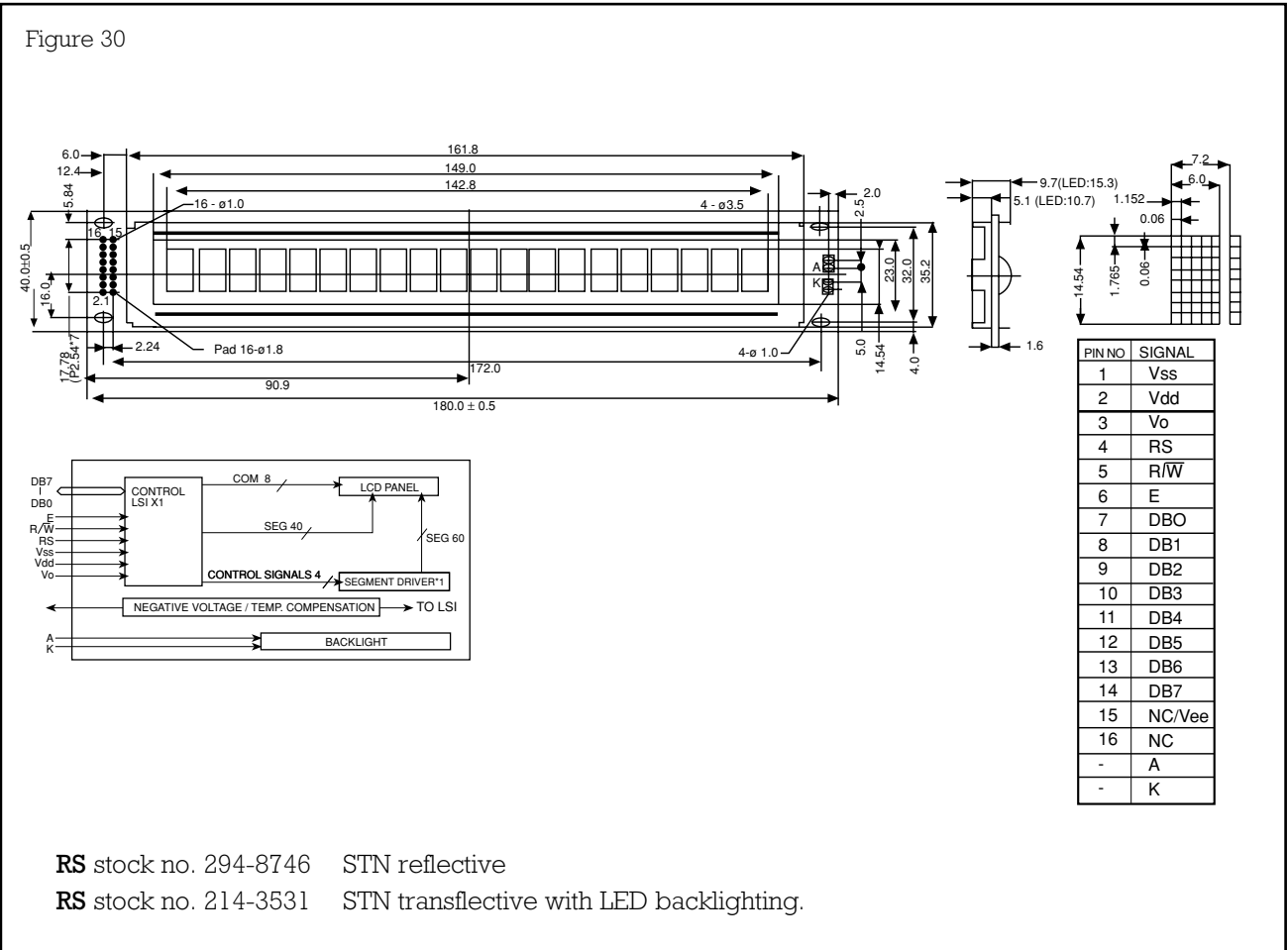
16x 2 Large Character LCD modules

Figure 29



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

20 x 1 Large Character LCD modules



16 x 4 LCD modules

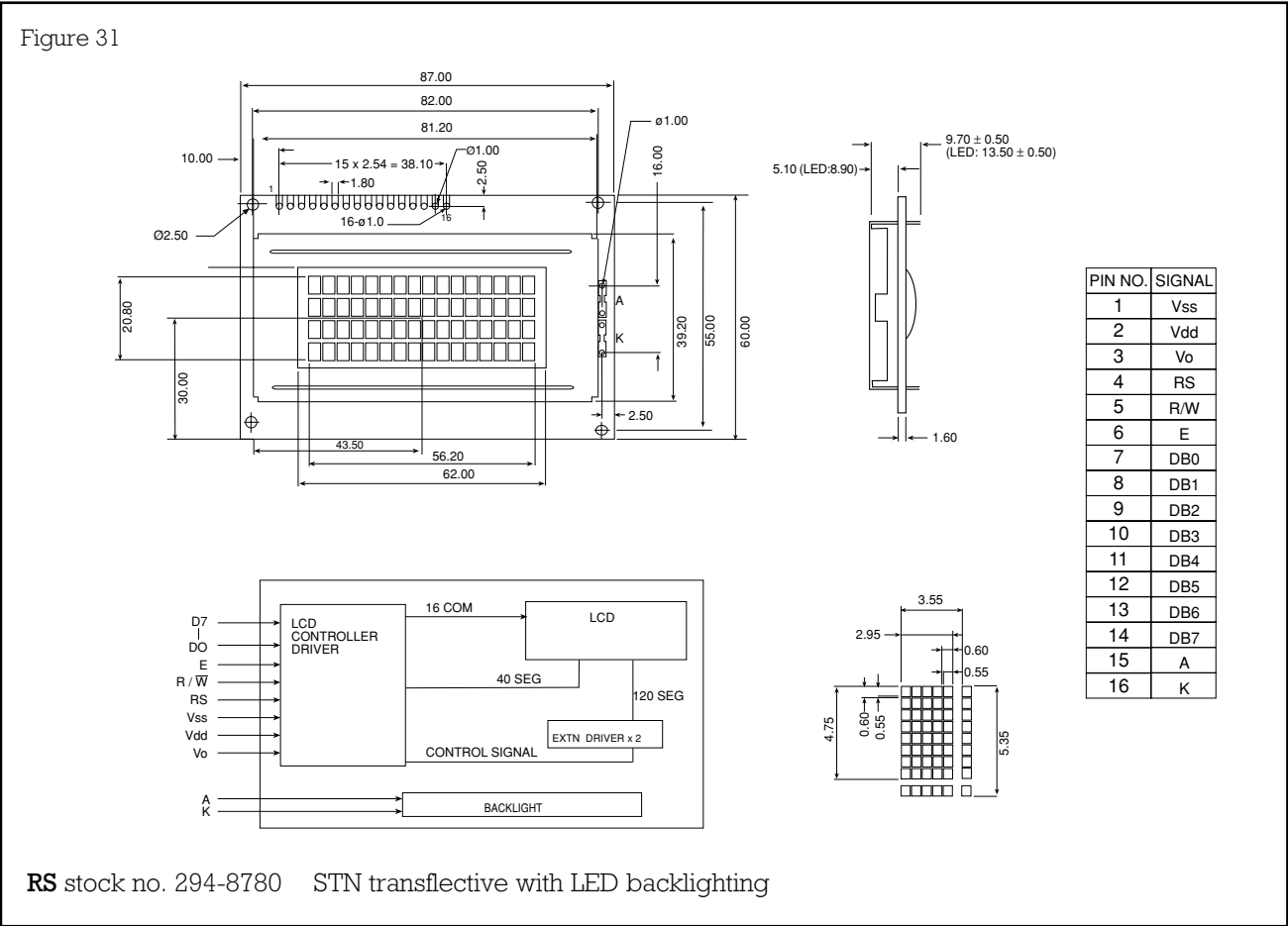
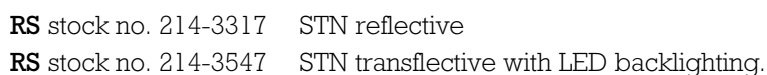
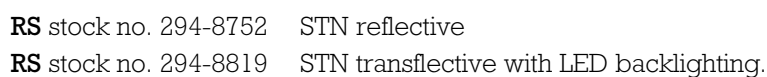


Figure 32

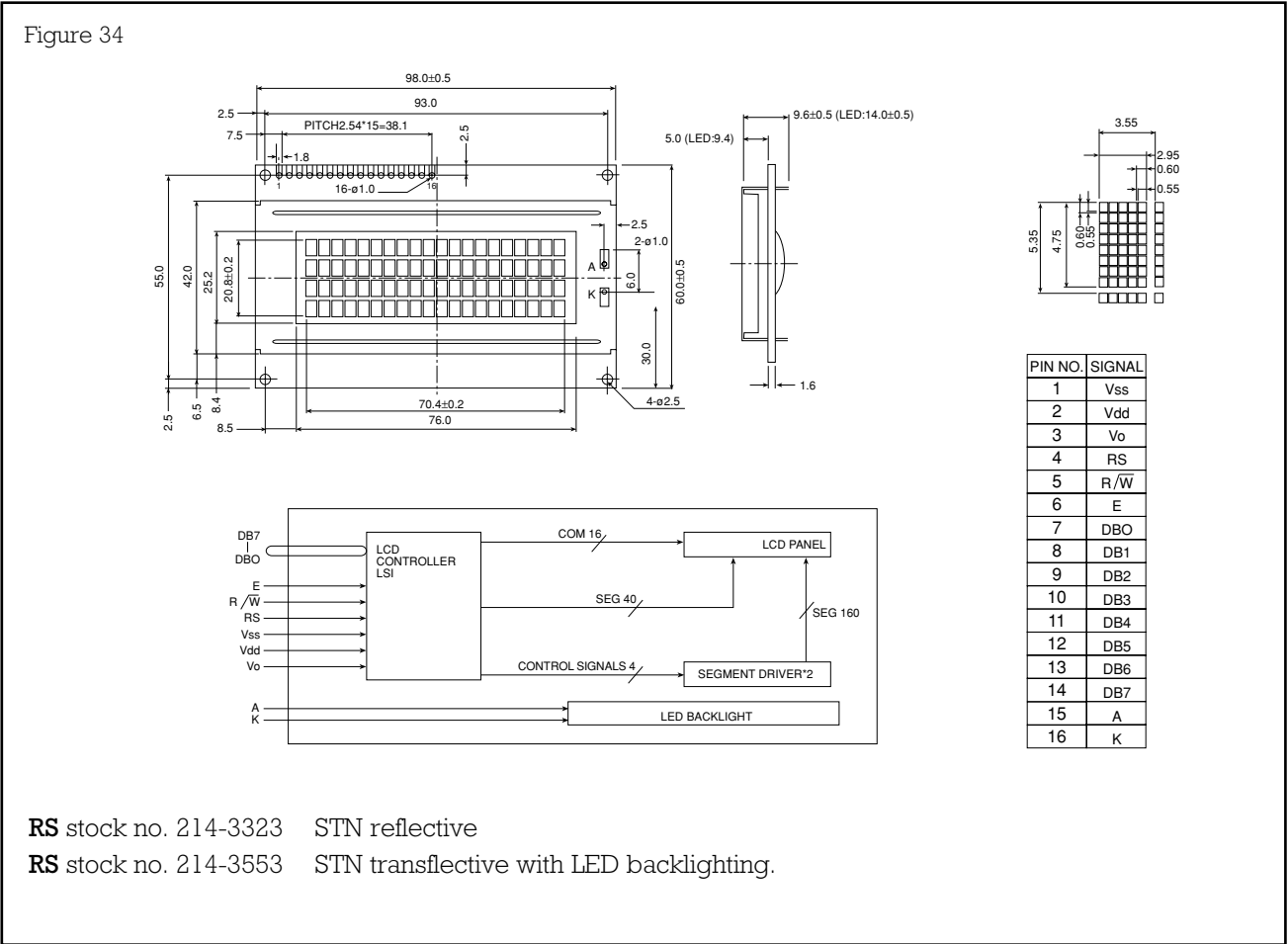


20 x 2 Large Character LCD modules

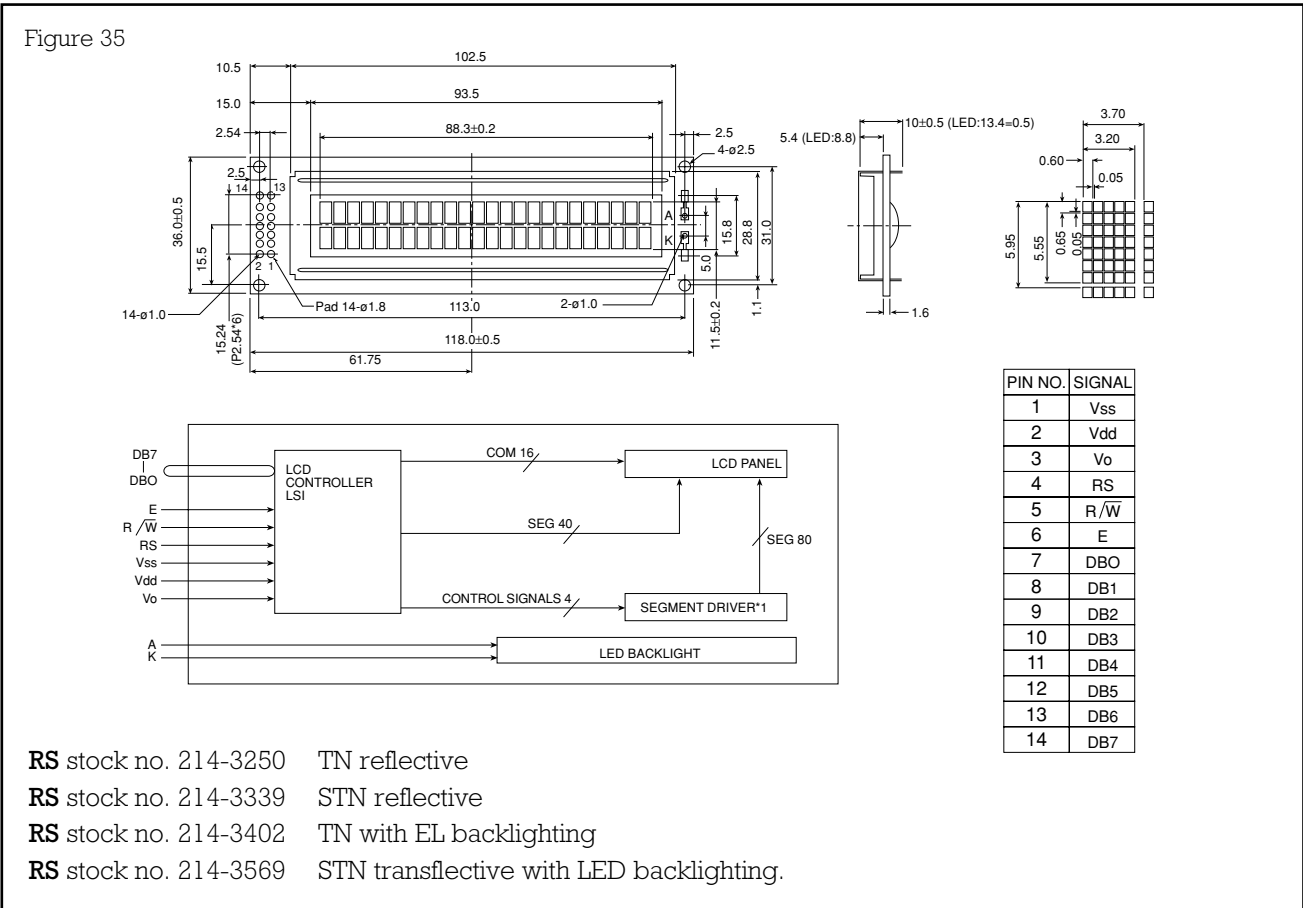
Figure 33



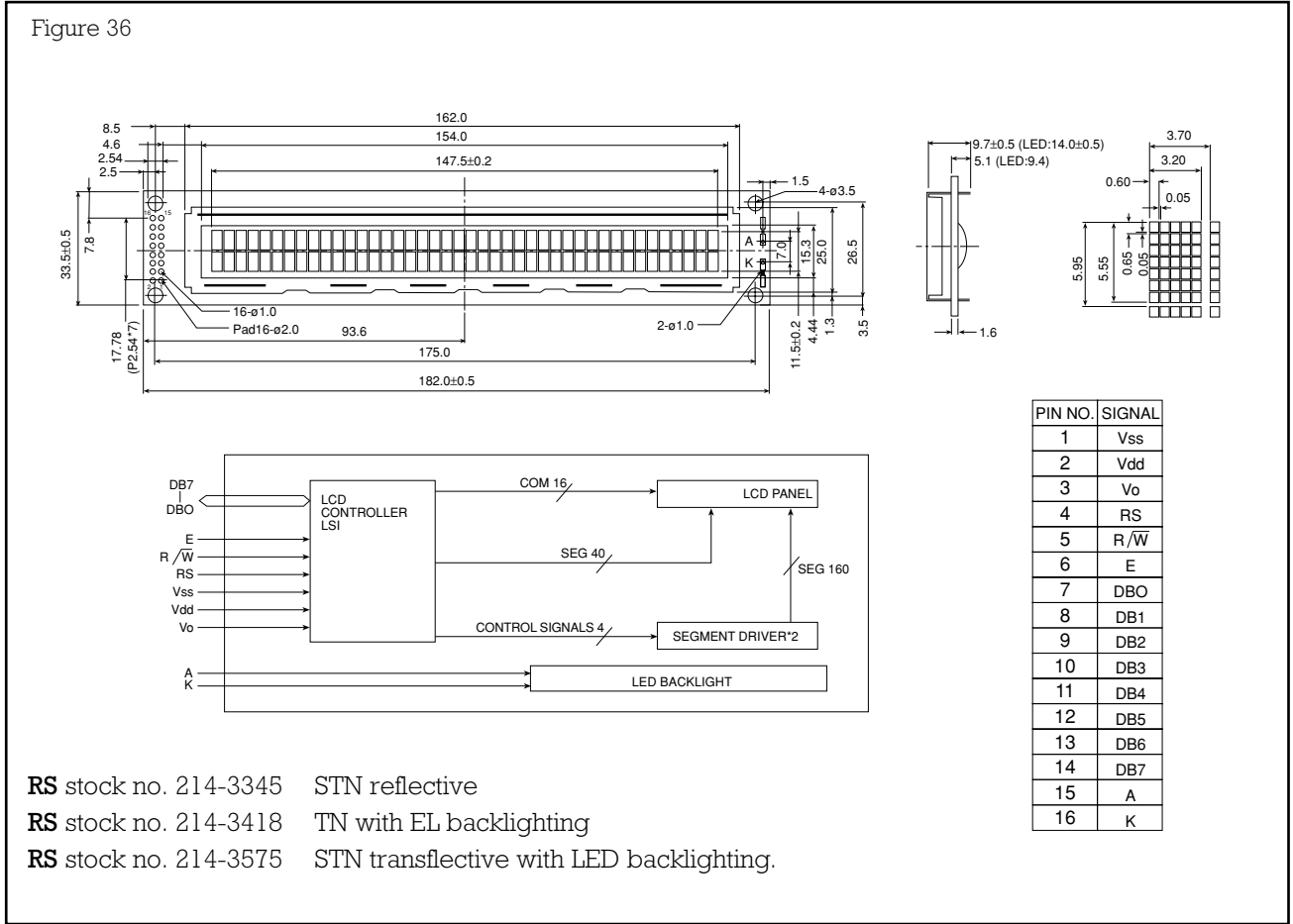
20 x 4 LCD modules



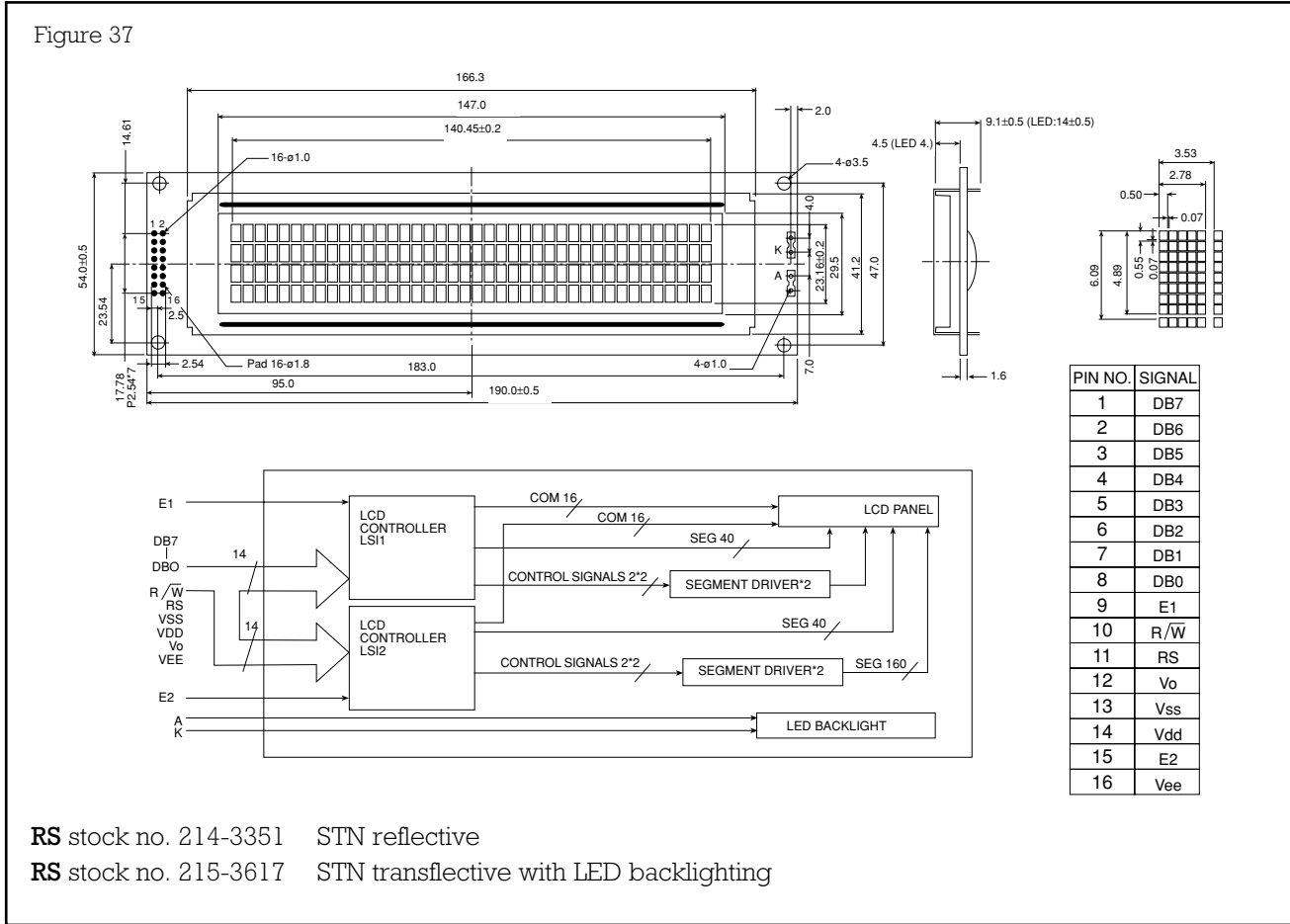
24 x 2 LCD modules



40 x 2 LCD modules



40 x 4 LCD modules



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 polariser 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.

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