



◆ Address Instruction Guide

(1) Clear Display

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	0	0	0	1

Writes space code "20H" into all DD RAM addresses. Sets DD RAM address 0 in address counter. Returns display to its original status if it was shifted. In other words, the display disappears and the cursor or blink go to the left edge of the display (the first line if 2 lines are displayed). Set I/D 1 (Increment Mode) of Entry Mode. S of Entry Mode doesn't change.

(2) Return Home

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	0	0	1	*

* Don't care

Sets the DD RAM address 0 in address counter. Returns display to its original status if it was shifted. DD RAM contents do not change. The cursor or blink go to the left edge of the display (the first line if 2 lines are displayed).

(3) Entry Mode Set

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	0	1	I/D	S

I/D: Increments (I/D=1) or decrements (I/D=0) the DD RAM address by 1 when a character code is written into or read from the DD RAM. The cursor or blink moves to the right when incremented by 1 and to the left when decremented by 1. The same applies to writing and reading of CG RAM.

S: Shifts the entire display either to the right or the left when S is 1; to the left when I/D=1 and to the right when I/D=0. Thus it looks as if the cursor stands still and the display moves. The display does not shift when reading from the DD RAM, when writing into or reading out from the CG AM does it shift when S=0.

(4) Display ON/OFF Control

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	1	D	C	B

D: The display is ON when D=1 and OFF when D=0. When off due to D=0, display data remains in the DD RAM. It can be displayed immediately by setting D=1.

C: The cursor display when C=1 and does not display when C=0. Even if the cursor disappears, the function of I/D, etc. does not change during display data write. The cursor is displayed using 5 dots in the 8th line when the 5x7 dot character font is selected, and 5 dots in the 11th line when the 5x10 dot character font is selected.

B: The character indicated by the cursor blinks when B=1. The blink is displayed by switching between all blank dots and display characters at 409.6ms interval when fcp or fosc=250kHz. The cursor and the blink can be set to display simultaneously. (The blink frequency changes according to the reciprocal of fcp or fosc. $409.6 \times 250/270 = 379.2\text{ms}$ when fcp=270kHz.)



(5) Cursor or Display Shift

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	1	S/C	R/L	*	*

*Don't care

Shifts cursor position or display to the right or left without writing or reading display data. This function is used to correct or search for the display. In a 2 line display, the cursor moves to the 2nd line when it passes the 40th digit of the 1st line. Notice that the 1st and 2nd line displays will shift at the same time. When the displayed data is shifted repeatedly each line only moves horizontally. The 2nd line display does not shift into the 1st line position.

S/C	R/L	
0	0	Shifts the cursor position to the left. (AC is decremented by one.)
0	1	Shifts the cursor position to the right. (AC is incremented by one.)
1	0	Shifts the entire display to the left. The cursor follows the display shift.
1	1	Shifts the entire display to the right. The cursor follows the display shift.

Address counter (AC) contents do not change if the only action performed is shift display.

(6) Function Set

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	DL	N	F	*	*

*Don't care

- DL: Sets interface data length. Data is sent or received in 8 bit lengths (DB7-DB0) when DL=1, and in 4 bit lengths (DB7-DB0) when DL=0.
When the 4 bit length is selected, data must be sent or received twice.
- N: Sets number of display lines.
- F: Sets character font.

(7) Set CG RAM address

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	1	A	A	A	A	A	A

Sets the CG RAM address into address counter in binary AAAAAA. Data is then written or read from the MPU for the CG RAM.

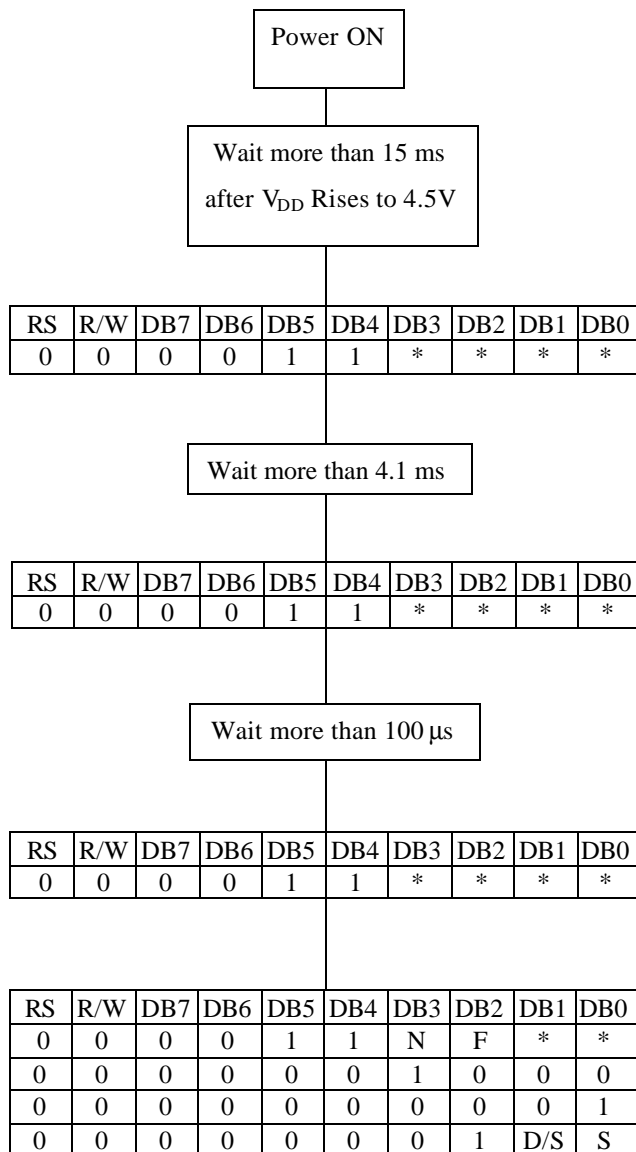
(8) Set DD RAM address

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	1	A	A	A	A	A	A	A

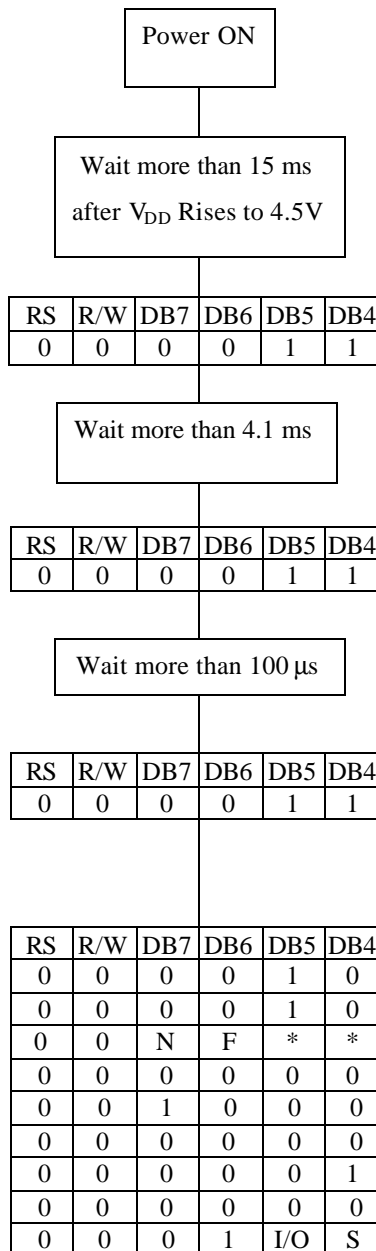
Sets the DD RAM address into address counter in binary AAAAAAA. Data is then written or read from the MPU for the DD RAM. However, when N=0 (1 line display), AAAAAAA is 0H - 4FH. When N=1 (2 line display), AAAAAAA is 0H - 27H for the first line, and 40H - 67H for the second line.

◆ INSTRUCTION

(1) 8 BITS :



(2) 4 BITS :





INSTRUCTION	CODE										DESCRIPTION	EXECUTION TIME (MAX) (when fcp or fosc is 250kHz)
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
CLEAR DISPLAY	0	0	0	0	0	0	0	0	0	1	Clear entire display and sets DD RAM 0 in address counter.	1.64ms
RETURN HOME	0	0	0	0	0	0	0	0	1	*	Sets DD RAM address 0 in address counter. Also returns display being shifted to original position. DD RAM contents remain unchanged.	1.64ms
ENTRY MODE SET	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction and specifies shift of display. These operations are performed during data write and read.	40µs
DISPLAY ON/OFF CONTROL	0	0	0	0	0	0	1	D	C	B	Sets ON/OFF of entire display (D), cursor ON/OFF (C), and blink of cursor position character (B).	40µs
CURSOR OR DISPLAY SHIFT	0	0	0	0	0	1	S/C	R/L	*	*	Moves cursor and shifts display without changing DD RAM contents.	40µs
FUNCTION SET	0	0	0	0	1	DL	N	F	*	*	Sets interface data length (DL), number of display lines (L) and character font (F).	40µs
SET CG RAM ADDRESS	0	0	0	1	AGC						Sets CG RAM address. CGRAM data is sent and received after this setting.	40µs
SET DD RAM ADDRESS	0	0	1	ADD							Sets DD RAM address. DD RAM data is sent and received after this setting.	40µs
READ BUSY FLAG & ADDRESS	0	1	BF	AC							Reads Busy flag (BF) indicating internal operation is being performed and reads address counter contents.	0µs
WRITE DATA TO CG OR DD RAM	1	0	WRITE DATA								Writes data into DDRAM or CG RAM	40µs
READ DATA FROM CG OR DD RAM	1	1	READ DATA								Reads data from DD RAM or CG RAM	40µs
	I/D: 1=Increment 0=Decrement S: 1=Accompanies display shift S/C: 1=Display shift 0=Cursor shift R/L: 1=Shift to the right. 0=Shift to the left. DL: 1=8 bits 0=4 bits N: 1=2 lines 0=1 line F: 1=5x10 dots 0=5x7 dots BF: 1=Internally operating. 0=Can accept instruction.										DD RAM: Display data RAM. CG RAM: Character generator RAM. ACG: CG RAM address. ADD: DD RAM address. Corresponds to cursor address. AC: Address counter used for both DD and CG RAM address.	Execution time changes when frequency changes, (Example) When fcp or fosc is 270kHz, 40µs(250/270) =37µs

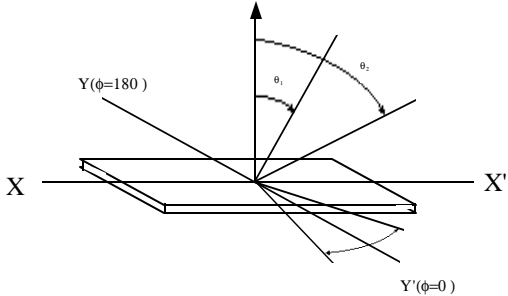
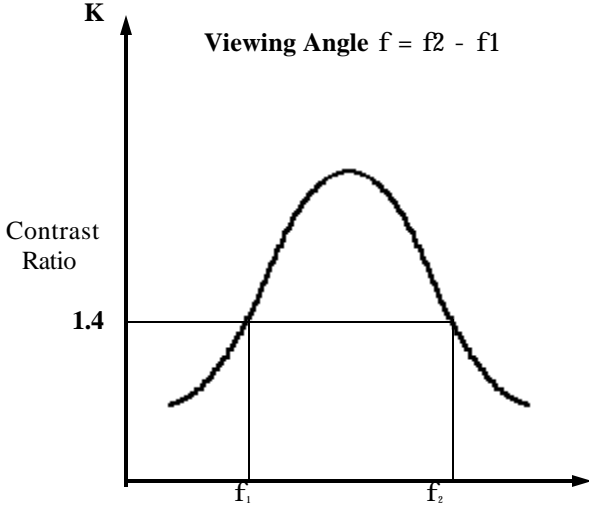
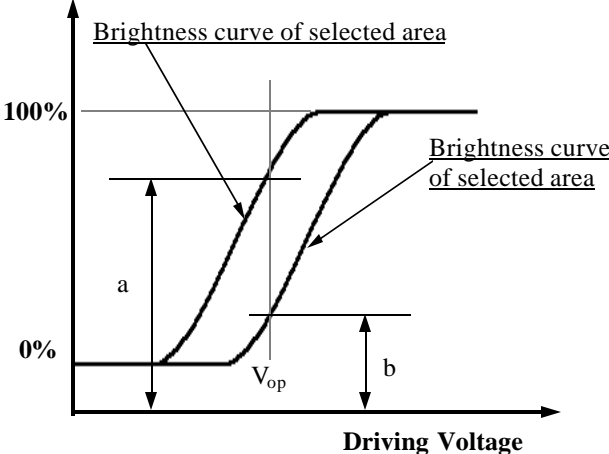
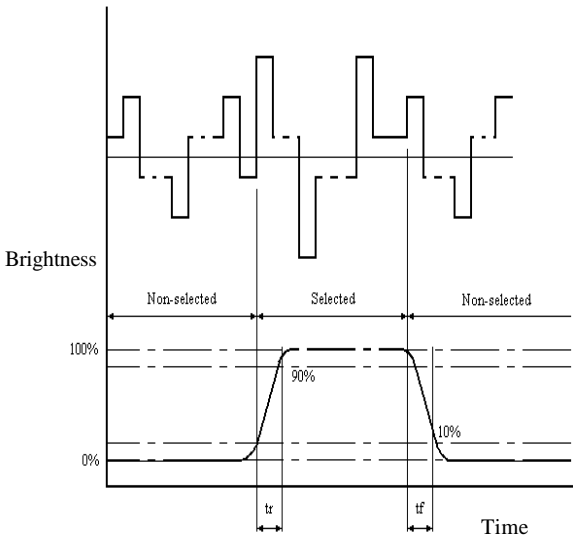
Optical Specifications

Absolute Maximum Ratings

Item	Symbol	Test Condition	Standard		Extended		Unit
			min.	max.	min.	max.	
Supply voltage for logic	Vdd - Vss	Ta = 25 °C	-0.3	7	-0.3	7	V
Supply voltage for LCD drive	Vlcd	Ta = 25 °C	Vdd - 13.5	Vdd + 0.3	Vdd - 13.5	Vdd + 0.3	V
Input voltage	Vin	Ta = 25 °C	-0.3	Vdd + 0.3	-0.3	Vdd + 0.3	V
Operating temp	Topr	-	0	50	-20	70	°C
Storage temp	Tstg	-	-20	70	-30	80	°C

TN type (STN type)

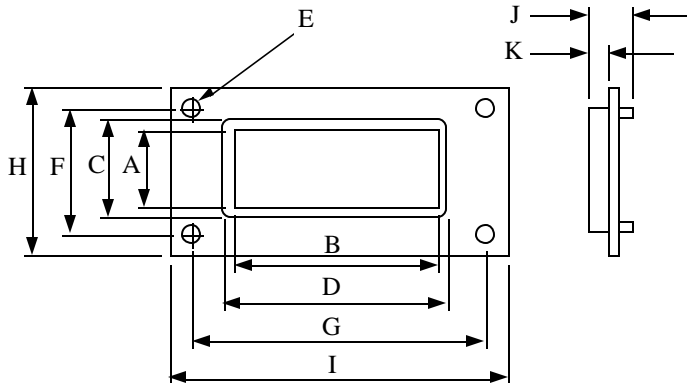
ITEM	SYMBOL	MIN	TYP	MAX	UNIT	CONDITION
Viewing Angle	$\theta_2 - \theta_1$	20 (40)	- [-]	- [-]	deg.	K = 1.4
Contrast Ratio	K	-[3]	3[-]	- [-]	-	$\theta=25$ [10], $\phi=0$
Response Time (rise)	Tr	-	200[200]	250[300]	ms	$\theta=25$ [10], $\phi=0$
Response Time (fall)	Tf	-	200[250]	300[350]	ms	$\theta=25$ [10], $\phi=0$

<p>Note A: Definition of Angle θ & ϕ</p> 	<p>Note B: Definition of Viewing Angle θ_1 & θ_2</p> 
<p>Note C: Definition of Contrast Cr</p>  <p style="text-align: center;">Driving Voltage</p> <p>Contrast ratio = $\frac{\text{Brightness of selected area}}{\text{Brightness of non-selected area}}$ ("a")</p> <p>$T_{op} = 25 \text{ deg} / V_{op} = \text{At optimum contrast ratio} / \theta X = \theta Y = 0 \text{ deg}$</p>	<p>Note D: Definition of Optical Response</p> 

◆ Custom Design Guide

Dimensional Profile (mm)

- A Display Height _____
- B Display Length _____
- C Viewing Height _____
- D Viewing Length _____
- E Diameter of Mounting Hole _____
- F Mounting Hole Height _____
- G Mounting Hole Length _____
- H Module Height _____
- I Module Length _____
- J Upper Thickness _____
- K Overall Thickness _____



Character: _____ Characters, _____ Lines

Graphic: _____ Dots (Horizontal), _____ Dots (Vertical)

Display:

Number: _____
 Alpha-Numeric: _____ } (Display Art coordination often required)
 Clock: _____

Viewing Angle: 3:00____ 6:00____ 9:00____ 12:00____

Type:

TN ____, STN ____, FSTN ____, Other ____

Reflective ____, Transflective ____, Transmissive ____

Interface:

No Pin ____, Pin ____, Heat Seal ____, Zebra ____

Back Lighting:

EL ____, LED ____, CCFL ____, Other ____, None ____