
320240A

LCD MODULE USER MANUAL

1. FUNCTIONS & FEATURES

Features

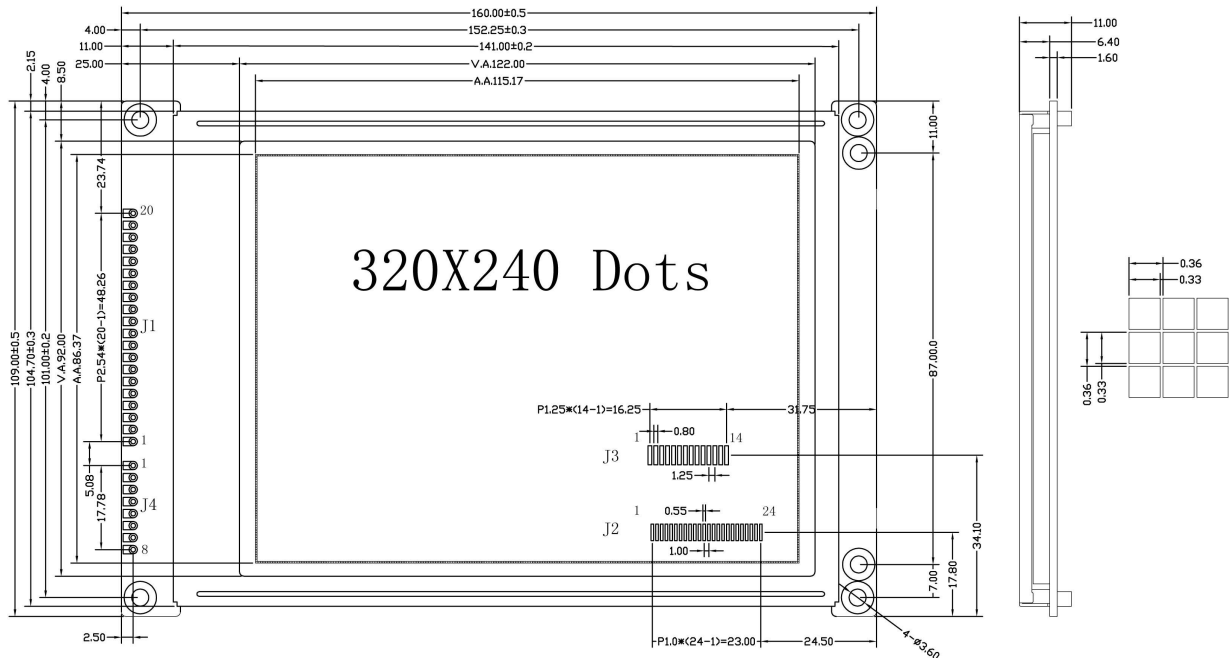
- Dot Matrix: 320×240 Dots
- LCD Mode: STN
- Controller IC: RA8835 or Equivalent
- Driving Method: 1/240 Duty; 1/17 Bias
- Viewing Angle: 6 O'clock direction
- 6800 or 8080 serial 8-Bit MPU Interface
- Backlight: LED
- Operating Temperature Range: -20 to 70°C;
- Storage Temperature Range : -30 to 80°C;

Note: Color tone is slightly changed by temperature and driving voltage.

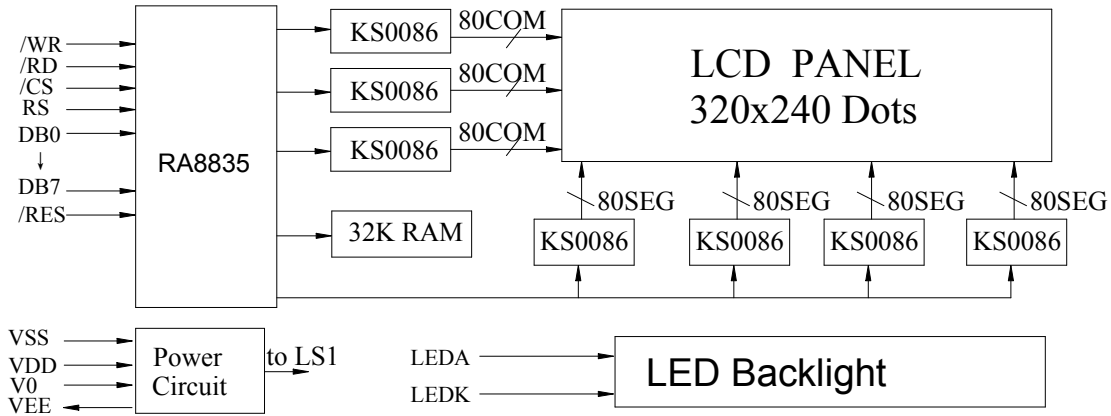
2. MECHANICAL SPECIFICATIONS

ITEM	SPECIFICATIONS	UNIT
Module Size	160.0L×109.0W×11.0 (max) H	mm
View Area	122.0×92.0	mm
Effective Area	320×240	dots
Dot Size	0.33×0.33	mm
Dot Pitch	0.36×0.36	mm

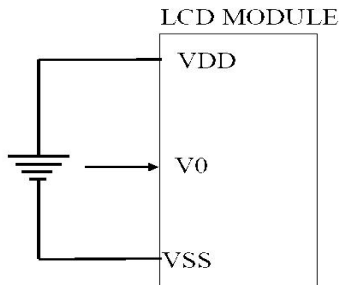
3. EXTERNAL DIMENSIONS



4. BLOCK DIAGRAM



5. POWER SUPPLY



6. PIN DESCRIPTION

J1 PIN DESCRIPTION

Pin No.	SYMBOL	LEVEL	FUNCTION
1	VSS	0V	Power Ground
2	VDD	5.0V	Power Supply For Logic
3	V0	—	Contrast Adjust
4	/WR*	L	Write Signal for 8080 family interface
5	/RD*	L	Read Signal for 8080 family interface
6	/CS	L	Chip Enable Signal
7	A0(=RS)	H/L	H: Command L: Data
8	/RESET	L	Reset Signal
9	DB0	H/L	Data Bus
~	~		
16	DB7		
17,19	LEDA	5.0V	LED Backlight Anode
18	VEE	—	Negative Power output For LCD Driving
20	LEDK	0V	LED Backlight Cathode

J2 WITH TOUCH PIN DESCRIPTION

Pin No.	SYMBOL	LEVEL	FUNCTION
1	/RESET	L	Reset Signal
2	/RD*	L	Read Signal for 8080 family interface
3	/WR*	L	Write Signal for 8080 family interface
4	/CS	L	Chip Enable Signal
5	A0(=RS)	H/L	H: Command L: Data
6 ~ 13	DB0 ~ DB7	H/L	Data Bus
14	VDD	5.0V	Power Supply For Logic
15	VSS	0V	Power Ground
16	VEE	—	Negative Power output For LCD Driving
17	V0	—	Contrast Adjust
18	DCLK	H/L	ADS7843 Serial Clock
19	DOUT	H/L	ADS7843 Serial Data Out
20	DIN	H/L	ADS7843 Serial Data input
21	T-CS	H/L	ADS7843 Chip Enable Signal
22	PEN	H/L	ADS7843 Interrupt Signal
23	LEDA	5.0V	LED Backlight Anode
24	LEDK	0V	LED Backlight Cathode

J3 NO CONTROLLER PIN DESCRIPTION

Pin No.	SYMBOL	LEVEL	FUNCTION
1~4	D0~D3	H/L	Data Bus
5	DIS.O	H/L	Display Switch H ON, L OFF
6	FRM	H/L	Frame Signal
7	M	H/L	AC Signal For LCD Driver Output
8	LP	H/L	Latch Pulse
9	CP	H/L	Data Shift Clock
10	VDD	5V	Power Supply For Logic
11	VSS	0V	Power Ground
12	VEE	—	Negative Power output For LCD Driving
13	V0	—	Contrast Adjust
14	F.G	—	Bezel Ground

J4 TOUCH PIN DESCRIPTION

Pin No.	SYMBOL	LEVEL	FUNCTION
1	DCLK	H/L	ADS7843 Serial Clock
2	T-CS	H/L	ADS7843 Chip Enable Signal
3	DIN	H/L	ADS7843 Serial Data input
4	BUSY	H/L	ADS7843 Busy Signal
5	DOUT	H/L	ADS7843 Serial Data Out
6	PEN	H/L	ADS7843 Interrupt Signal
7	IN3	H/L	ADS7843 Auxiliary Input 1
8	IN4	H/L	ADS7843 Auxiliary Input 2

7. MAXIMUM ABSOLUTE LIMIT (T=25°C)

Items	Symbol	Standard Value	Unit
Supply Voltage	Vdd	-0.3~7.0	V
Input Voltage	Vin	Vss~Vdd	V
Operating Temperature	Top	-20~70	°C
Storage Temperature	Tst	-30~80	°C

Note: Voltage greater than above may damage the module
 All voltages are specified relative to Vss=0V

8. ELECTRICAL CHARACTERISTICS

8.1 DC Characteristics (VDD=+5V, VSS=0V, Ta=-0~+50° C)

Items	Symbol	Min	TYP	Max	Unit	Condition
Operating Voltage	Vdd	4.7	5.0	5.3	V	Vdd
Supply Current	Idd	—	—	65	mA	except LED backlight
Input High Voltage	Vin	2.0	—	Vdd	V	RS,RW,E,DB0-DB7
Input Low Voltage	Vil	0	—	0.8	V	
Output High Voltage	Voh	2.4	—	—	V	Ioh=-0.1mA,DB0-DB7
Output Low Voltage	Vol	—	—	0.4	V	Iol=0.1mA,DB0-DB7
LCD Driving Voltage	Vlcd	19.5	23.0	23.3	V	Vdd-V0

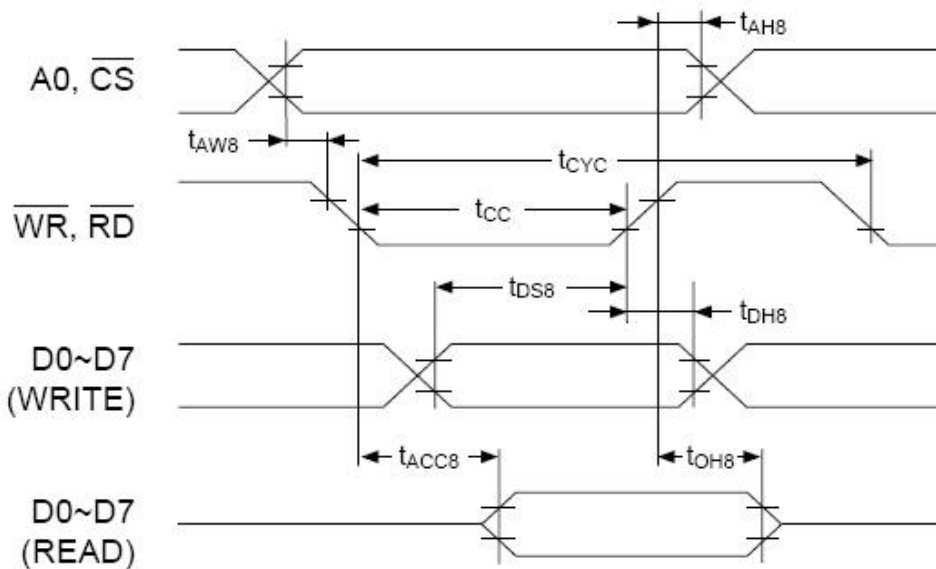
8.2a AC Characteristics For 8080 Family Interface(VDD=+5V, VSS=0V, Ta=-20~75°)

Signal	Symbol	Parameter	Min	Type	Max	Unit
RS, /CS	t _{AH8}	Address hold time	13	—	—	nS
	t _{AW8}	Address setup time	5	—	—	nS
/WR, /RD	t _{CYC}	System cycle time	(*note)	—	—	nS
	t _{CC}	Strobe pulse width	150	—	—	nS
DB0-DB7	t _{DS8}	Data setup time	150	—	—	nS
	t _{DH8}	Data hold time	7	—	—	nS
	t _{ACC8}	/RD access time	—	—	65	nS
	t _{OH8}	Output disable time	13	—	65	nS

Note:

- Input signal rise/fall time should be less than 20nS;
- For memory control and system control commands:
 $t_{CYC} = 2 t_c + t_{CC} + t_{CEA} + 75 > t_{ACV} + 245$
 For all other commands:
 $t_{CYC} = 4 t_c + t_{CC} + 30$
- Please see the RA8835 datasheet for details

8080 family interface timing



8.3b AC Characteristics For 6800 Family Interface(VDD=+5V, VSS=0V, Ta=-20~75°)

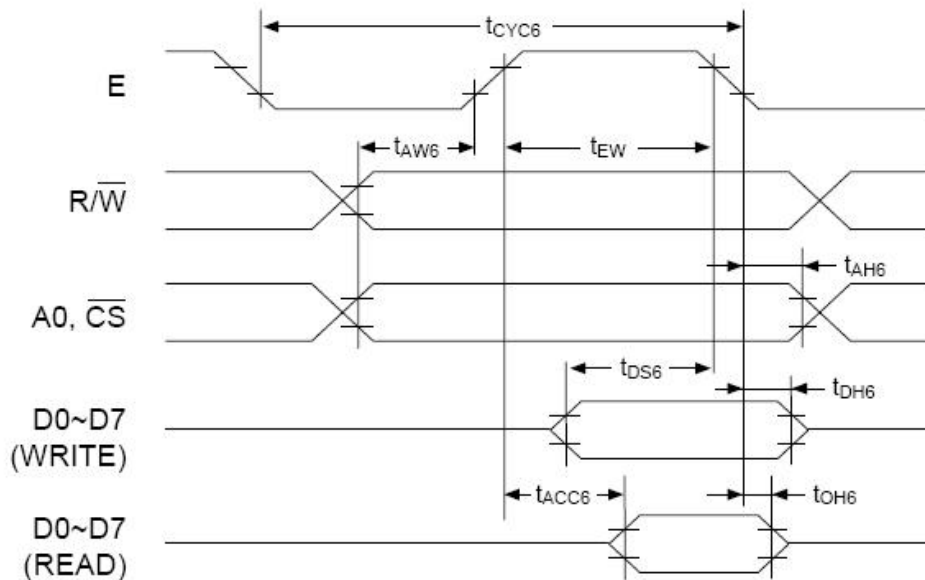
Signal	Symbol	Parameter	Min	Type	Max	Unit
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RS, /CS R/W	t_{AH6}	Address hold time	5	—	—	nS
	t_{AW6}	Address setup time	5	—	—	nS
	t_{CYC6}	System cycle time	(*note)	—	—	nS
DB0-DB7	t_{DS6}	Data setup time	125	—	—	nS
	t_{DH6}	Data hold time	5	—	—	nS
	t_{ACC6}	access time	13	—	65	nS
	t_{OH6}	Output disable time	—	—	110	nS
E	t_{EW}	Enable pulse width	150	—	—	nS

Note:

- Input signal rise/fall time should be less than 20nS;
- For memory control and system control commands: $t_{CYC} = 2 t_C + t_{EW6} + t_{CEA} + 75 > t_{ACV} + 245$
For all other commands: $t_{CYC} = 4 t_C + t_{CC} + 30$

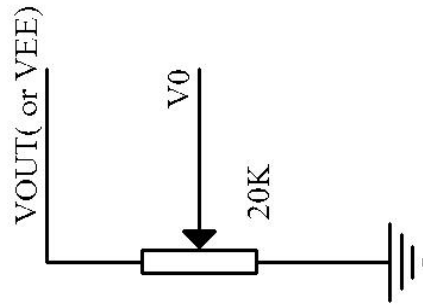
6800 family interface timing



9. FUNCTION SPECIFICATIONS

9.1. Adjusting The LCD Display Contrast

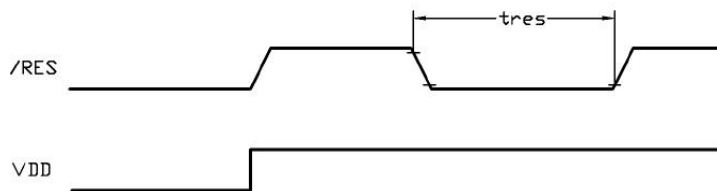
A Variable-Resistor must be connected to the LCD module for providing a reference to V0. The recommended value of the Variable-Resistor is 20K to 50K.



9.2. Resetting The LCD Module

The LCD module should be initialized by setting /RST terminal at low level when turning the power. While /RST is low, no instructions can be accepted .

Items	Symbol	Min	TYP	Max	Unit
Reset plus	t_{res}	1.0	—	—	mS



9.3. Display Memory Map

1,1 (D7)	2,1 (D6)	3,1 (D5)	4,1 (D4)	5,1 (D3)	---	---	316,1 (D4)	317,1 (D3)	318,1 (D2)	319,1 (D1)	320,1 (D0)
1,2 (D7)	2,2 (D6)	3,2 (D5)	4,2 (D4)	5,2 (D3)	---	---	316,2 (D4)	317,2 (D3)	318,2 (D2)	319,2 (D1)	320,2 (D0)
1,3 (D7)	2,3 (D6)	3,3 (D5)	4,3 (D4)	5,3 (D3)	---	---	316,3 (D4)	317,3 (D3)	318,3 (D2)	319,3 (D1)	320,3 (D0)
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
1,238 (D7)	2,238 (D6)	3,238 (D5)	4,238 (D4)	5,238 (D3)	---	---	316,238 (D4)	317,238 (D3)	318,238 (D2)	319,238 (D1)	320,238 (D0)
1,239 (D7)	2,239 (D6)	3,239 (D5)	4,239 (D4)	5,239 (D3)	---	---	316,239 (D4)	317,239 (D3)	318,239 (D2)	319,239 (D1)	320,239 (D0)
1,240 (D7)	2,240 (D6)	3,240 (D5)	4,240 (D4)	5,240 (D3)	---	---	316,240 (D4)	317,240 (D3)	318,240 (D2)	319,240 (D1)	320,240 (D0)

Note:

- Based on the top view of the LCD module, the 1,1(x,y) pixel is the upper-left pixel; the 320,240(x,y) pixel is the lower-right pixel.
- For the details of memory mapping, please refer to RA8835 datasheet.

9.4. Display Control Instructions

Command	Parameter	A0	/RD	/WR	D7	D6	D5	D4	D3	D2	D1	D0	HEX	Descriptions	
SYSTEM SET	-	1	1	0	0	1	0	0	0	0	0	0	40	Init device and display (with 8 parameters)	
	P1	0	1	0	0	0	IV	1	W/S	M2	M1	M0	**	M0=0: internal CG ROM M0=1: external CG ROM M1=0: no D6 correction M1=1: D6 correction M2=0: 8-pixel char height M2=1: 16-pixel char height W/S=0: single panel drive W/S=1: dual panel drive IV=0: Screen top-line correction IV=1: No screen top-line correction	
	P2	0	1	0	WF	0	0	0	0			FX	**	FX: define the horizontal char size WF=0: 16-line AC drive WF=1: two frame AC drive	
	P3	0	1	0	0	0	0	0				FY	**	FY: Vertical Char Size	
	P4	0	1	0									C/R	**	C/R: display line address range
	P5	0	1	0									TC/R	**	TC/R: Line length selection
	P6	0	1	0									L/F	**	L/F: Frame Height selection
	P7	0	1	0									APL	**	APL: Horizontal address range (low byte)
	P8	0	1	0									APH	**	APH: Horizontal address range (high byte)
SLEEP IN	-	1	1	0	0	1	0	1	0	0	1	1	53	Enter standby mode	
DISP ON/OFF	-	1	1	0	0	1	0	1	1	0	0	D	58 / 59	Enable and disable display and display flashing (with 1 parameter)	
SCROLL	-	1	1	0	FP5	FP4	FP3	FP2	FP1	FP0	FC1	FC0	**	Each pair of bit in FP sets the attributes of one screen block	
	P1	0	1	0	0	1	0	0	0	1	0	0	44	Set display start address and display regions (with 8 or 10 parameters)	
	P1	0	1	0	A7	A6	A5	A4	A3	A2	A1	A0	**	SAD 1L	
	P2	0	1	0	A15	A14	A13	A12	A11	A10	A9	A8	**	SAD 1H	
	P3	0	1	0	L7	L6	L5	L4	L3	L2	L1	L0	**	SL1	
	P4	0	1	0	A7	A6	A5	A4	A3	A2	A1	A0	**	SAD 2L	
	P5	0	1	0	A15	A14	A13	A12	A11	A10	A9	A8	**	SAD 2H	
	P6	0	1	0	L7	L6	L5	L4	L3	L2	L1	L0	**	SL2	
	P7	0	1	0	A7	A6	A5	A4	A3	A2	A1	A0	**	SAD3L	
	P8	0	1	0	A15	A14	A13	A12	A11	A10	A9	A8	**	SAD3H	
	P9	0	1	0	A7	A6	A5	A4	A3	A2	A1	A0	**	SAD4L (for both two-screen drive and two layer config are select)	
P10	0	1	0	A15	A14	A13	A12	A11	A10	A9	A8	**	SAD4H (for both two-screen drive and two layer config are select)		
CSRFORM	-	1	1	0	0	1	0	1	1	1	0	1	5D	Set cursor type (with 2 parameters)	
	P1	0	1	0	0	0	0	0	X3	X2	X1	X0	**	CRX	
	P2	0	1	0	CM	0	0	0	Y3	Y2	Y1	Y0	**	CRY CM=0: underscore cursor; CM=1: block cursor	
CGRAM ADR	-	1	1	0	0	1	0	1	1	1	0	0	5C	Set Start address of char generator RAM (with 2 parameters)	
	P1	0	1	0	A7	A6	A5	A4	A3	A2	A1	A0	**	SAGL	
	P2	0	1	0	A15	A14	A13	A12	A11	A10	A9	A8	**	SAGH	
CSRDIR	-	1	1	0	0	1	0	0	1	1	CD1	CD0	4C~4F	Set Direction of Cursor movement	
HDOT SCR	-	1	1	0	0	1	0	1	1	0	1	0	5A	Set horizontal scroll position (with 1 parameters)	
	P1	0	1	0	0	0	0	0	0	D2	D1	D0	**		
OVLAY	-	1	1	0	0	1	0	1	1	0	1	1	5B	Set display overlay format (with 1 parameters)	
	P1	0	1	0	0	0	0	OV	DM2	DM1	MX1	MX0	**		
CSRW	-	1	1	0	0	1	0	0	0	1	1	0	46	Set cursor address (with 2 parameters)	
	P1	0	1	0	A7	A6	A5	A4	A3	A2	A1	A0	**	CSRL	
	P2	0	1	0	A15	A14	A13	A12	A11	A10	A9	A8	**	CSRH	
CSRR	-	1	1	0	0	1	0	0	0	1	1	1	47	Read Cursor Address (with 2 parameters)	
	P1	1	0	1	A7	A6	A5	A4	A3	A2	A1	A0	**	CSRL	
	P2	1	0	1	A15	A14	A13	A12	A11	A10	A9	A8	**	CSRH	
MWRITE	-	1	1	0	0	1	0	0	0	0	1	0	42	Write to display memory (with n parameters)	
	P1	0	1	0									**	Memory Data Display memory data	
	:	:	:	:									**		
	Pn	0	1	0									**	Memory Data	
MREAD	-	1	1	0	0	1	0	0	0	0	1	1	43	Read from display memory (with n parameters)	
	P1	1	0	1									**	Memory Data Display memory data	
	:	:	:	:									**		
	Pn	1	0	1									**	Memory Data	

Note: For the details please refer to RA8835 datasheet.

9.5. Initialization Setting Example

The following setting should be issue to LCD module after hardware reset.
(It is s example only; it could be adjusted if necessary.)

Command	Parameter	A0	/RD	/WR	Value (binary)	HEX	Descriptions
SYSTEM SET	-	1	1	0	0100 0000	40	Init device and display, (with 8 parameters)
	P1	0	1	0	0011 0000	30	M0=0: internal CG ROM M0=1: external CG ROM M1=0: no D6 correction M1=1: D6 correction M2=0: 8-pixel char height M2=1: 16-pixel char height W/S=0: single panel drive W/S=1: dual panel drive IV=0: Screen top-line correction IV=1: No screen top-line correction
	P2	0	1	0	1000 0111	87	FX: define the horizontal char size WF=0: 16-line AC drive WF=1: two frame AC drive
	P3	0	1	0	0000 0000	00	FY: Vertical Char Size
	P4	0	1	0	0010 1000	28	C/R: display line address range
	P5	0	1	0	0100 0101	45	TC/R: Line length selection
	P6	0	1	0	1110 1111	EF	L/F: Frame Height selection
	P7	0	1	0	0010 1000	28	APL: Horizontal address range (low byte)
	P8	0	1	0	0000 0000	00	APH: Horizontal address range (high byte)
DISP ON/OFF	-	1	1	0	0101 1001	59	Enable
	P1	0	1	0	0000 0100	04	
SCROLL	-	1	1	0	0100 0100	44	Set cursor type (with 10 parameters)
	P1	0	1	0	0000 0000	00	SAD 1L
	P2	0	1	0	0000 0000	00	SAD 1H
	P3	0	1	0	1110 1111	EF	SL1
	P4	0	1	0	0000 0000	00	SAD 2L
	P5	0	1	0	0000 0000	00	SAD 2H
	P6	0	1	0	1110 1111	EF	SL2
	P7	0	1	0	0000 0000	00	SAD3L
	P8	0	1	0	0000 0000	00	SAD3H
CSRDIR	-	1	1	0	0100 1100	4C	Set Direction of Cursor movement
HDOT SCR	-	1	1	0	0101 1010	5A	Set horizontal scroll position (with 1 parameters)
	P1	0	1	0	0000 0000	00	
OVLAY	-	1	1	0	0101 1011	5B	Set display overlay format (with 1 parameters)
	P1	0	1	0	0000 1101	0D	
CSRW	-	1	1	0	0100 0110	46	Set cursor address (with 2 parameters)
	P1	0	1	0	0000 0000	00	CSRL
	P2	0	1	0	0000 0000	00	CSRH
MWRITE	-	1	1	0	0100 0010	42	Write to display memory (with n parameters)
	P1	0	1	0	Memory Data	**	Display memory data
	:	:	:	:	:	**	
	Pn	0	1	0	Memory Data	**	

Note:

For details please refer to RA8835 datasheet.

10. DESIGN AND HANDLING PRECAUTION

- 10.1. The LCD panel is made by glass. Any mechanical shock (eg. Dropping from high place) will damage the LCD module. Do not add excessive force on the surface of the display, which may cause the Display color change abnormally.
- 10.2. The polarizer on the LCD is easily get scratched. If possible, do not remove the LCD protective film until the last step of installation.
- 10.3. Never attempt to disassemble or rework the LCD module.
- 10.4. Only Clean the LCD with Isopropyl Alcohol or Ethyl Alcohol. Other solvents (eg. water) may damage the LCD.
- 10.5. When mounting the LCD module, make sure that it is free from twisting, warping and distortion.
- 10.6. Ensure to provide enough space (with cushion) between case and LCD panel to prevent external force adding on it, or it may cause damage to the LCD or degrade the display result

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- 10.7. Only hold the LCD module by its side. Never hold LCD module by add force on the heat seal or TAB.
 - 10.8. Never add force to component of the LCD module. It may cause invisible damage or degrade of the reliability.
 - 10.9. LCD module could be easily damaged by static electricity. Be careful to maintain an optimum anti-static work environment to protect the LCD module.
 - 10.10. When peeling of the protective film form LCD, static charge may cause abnormal display pattern. It is normal and will resume to normal in a short while.
 - 10.11. Take care and prevent get hurt by the LCD panel edge.
 - 10.12. Never operate the LCD module exceed the absolute maximum ratings.
 - 10.13. Keep the signal line as short as possible to prevent noisy signal applying to LCD module.
 - 10.14. Never apply signal to the LCD module without power supply.
 - 10.15. IC chip (eg. TAB or COG) is sensitive to the light. Strong lighting environment could possibly cause malfunction. Light sealing structure casing is recommend.
 - 10.16. LCD module reliability may be reduced by temperature shock.
 - 10.17. When storing the LCD module, avoid exposure to the direct sunlight, high humidity, high temperature or low temperature. They may damage or degrade the LCD module