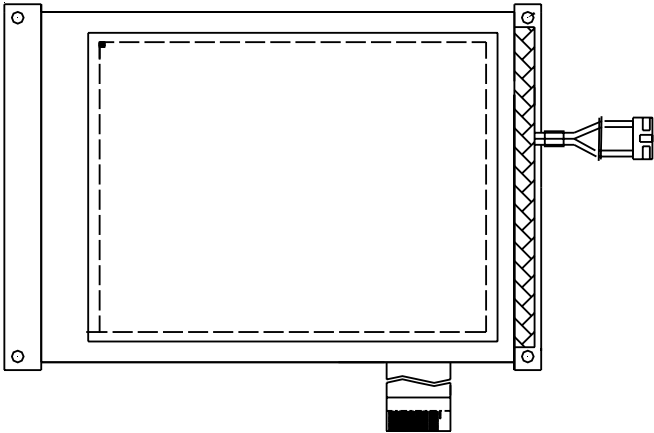




PRODUCT SPECIFICATION

# HDM3224NL-1

320 x240 MONOCHROME GRAPHICS  
LCD DISPLAY MODULE



HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.:	REV:	HDM3224NL-1	SHEET 1 OF 13
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## .General Specifications

### 1. Features

- A. Low power consumption 5.0V power supply
- B. 1/240 duty, 1/13 bias
- C. Viewing direction: 6:00
- D. Operating tempration: -20~70
- E. Storage tempration: -30~85
- F. Display mode: FSTN mode, positive type display

### 2. Mechanical Data and Conditions:

- (1) Module Size-----160.0 w \* 109.0 h mm
- (2) Viewing Area ----- 122.0 w \* 92.0 h mm
- (3) Dot Size -----0.33 w \* 0.33 h mm
- (4) Dot Pitch ----- 0.36 w \* 0.36 h mm
- (5) Number of Dots -----320 \* 240 Dots
- (6) Outline Dimensions-----See Attached Drawing

### 3. Absolute Maximum Ratings

Characteristics	Symbol	Ratings
Operating Voltage	VDD	-0.3V to +7.0V
Input Voltage Range	V <sub>IN</sub>	-0.3V to VDD+0.3V

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4.Pin Connections:

Pin No.	Symbol	Function
1	Vss	Ground(0v)
2	Vdd	Logic Supply Voltage(+5.0v)
3	V0	Regulate LCD
4	A0	Data type select
5	R/W	Write signal
6	E	Read signal
7	D0	Data Bus Line
8	D1	Data Bus Line
9	D2	Data Bus Line
10	D3	Data Bus Line
11	D4	Data Bus Line
12	D5	Data Bus Line
13	D6	Data Bus Line
14	D7	Data Bus Line
15	/CS	Chip select
16	RES	Reset signal
17	Vee	Power Supply Voltage for LCD
18	SEL1	Interface select

5. Timing Characteristics: (VDD=5V)

(1). Display memory write timing

Ta = -20 to 75°C

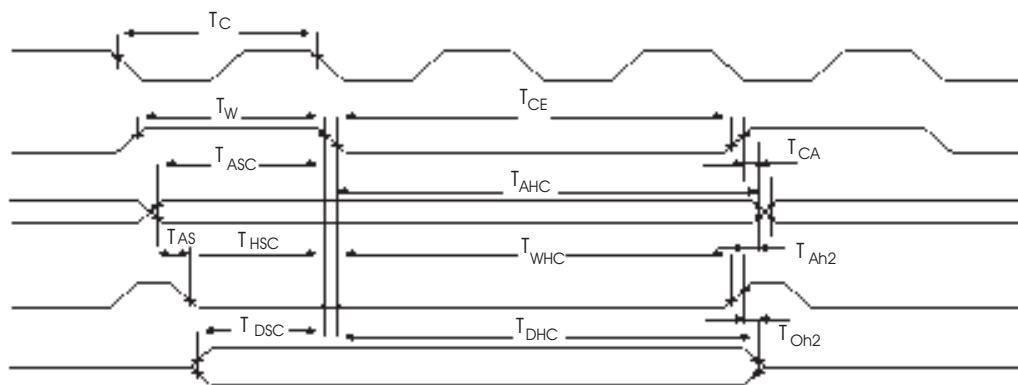
Signal	Symbol	Parameter	VDD = 4.5 to 5.5V		VDD = 2.7 to 4.5V		Unit	Condition
			Min.	Max.	Min.	Max.		
EXT $\Phi 0$	t <sub>c</sub>	Clock period	100	—	125	—	ns	CL = 100 pF
$\overline{\text{VCE}}$	t <sub>w</sub>	VCE HIGH-level pulse width	t <sub>c</sub> - 50	—	t <sub>c</sub> - 50	—	ns	
	t <sub>OE</sub>	VCE LOW-level pulse width	2t <sub>c</sub> - 30	—	2t <sub>c</sub> - 30	—	ns	
VA0 to VA15	t <sub>CYW</sub>	Write cycle time	3t <sub>c</sub>	—	3t <sub>c</sub>	—	ns	
	t <sub>AHC</sub>	Address hold time from falling edge of $\overline{\text{VCE}}$	2t <sub>c</sub> - 30	—	2t <sub>c</sub> - 40	—	ns	
	t <sub>ASC</sub>	Address setup time to falling edge of $\overline{\text{VCE}}$	t <sub>c</sub> - 70	—	t <sub>c</sub> - 110	—	ns	
	t <sub>CA</sub>	Address hold time from rising edge of $\overline{\text{VCE}}$	0	—	0	—	ns	
	t <sub>AS</sub>	Address setup time to falling edge of $\overline{\text{VWR}}$	0	—	0	—	ns	
	t <sub>AH2</sub>	Address hold time from rising edge of $\overline{\text{VWR}}$	10	—	10	—	ns	
$\overline{\text{VWR}}$	t <sub>wsc</sub>	Write setup time to falling edge of $\overline{\text{VCE}}$	t <sub>c</sub> - 80	—	t <sub>c</sub> - 115	—	ns	
	t <sub>wHC</sub>	Write hold time from falling edge of $\overline{\text{VCE}}$	2t <sub>c</sub> - 20	—	2t <sub>c</sub> - 20	—	ns	
VD0 to VD7	t <sub>DS</sub>	Data Input setup time to falling edge of $\overline{\text{VCE}}$	t <sub>c</sub> - 85	—	t <sub>c</sub> - 125	—	ns	
	t <sub>DHC</sub>	Data Input hold time from falling edge of $\overline{\text{VCE}}$	2t <sub>c</sub> - 30	—	2t <sub>c</sub> - 30	—	ns	

(2). Display memory read timing

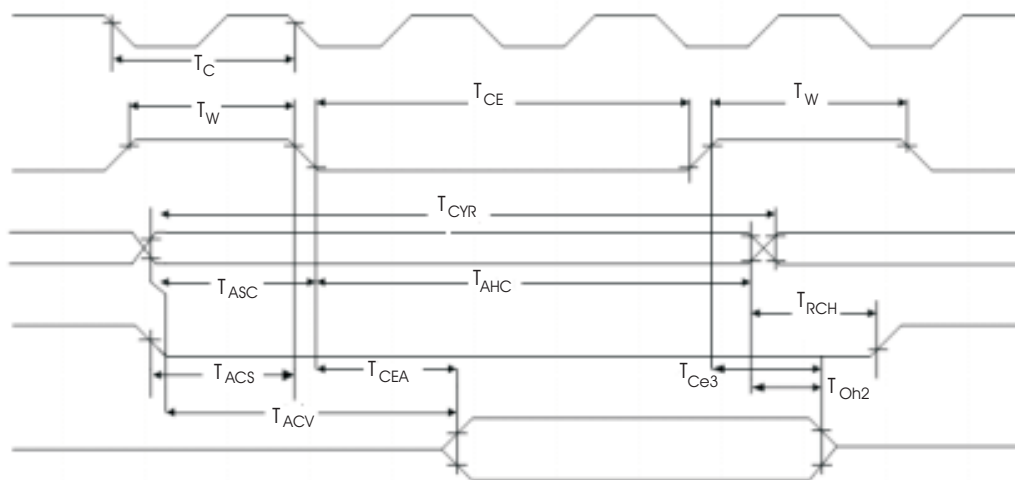
Ta = -20 to 75 C

Signal	Symbol	Parameter	V <sub>DD</sub> = 4.5 to 5.5V		V <sub>DD</sub> = 2.7 to 4.5V		Unit	Condition
			Min.	Max.	Min.	Max.		
EXT $\Phi$ D	t <sub>C</sub>	Clock period	100	—	125	—	ns	CL = 100 pF
$\overline{\text{VCE}}$	t <sub>H</sub>	VCE HIGH-level pulse width	t <sub>C</sub> - 50	—	t <sub>C</sub> - 50	—	ns	
	t <sub>CE</sub>	VCE LOW-level pulse width	2t <sub>C</sub> - 30	—	2t <sub>C</sub> - 30	—	ns	
VA0 to VA15	t <sub>CR</sub>	Read cycle time	3t <sub>C</sub>	—	3t <sub>C</sub>	—	ns	
	t <sub>ABC</sub>	Address setup time to falling edge of VCE	t <sub>C</sub> - 70	—	t <sub>C</sub> - 100	—	ns	
	t <sub>AHC</sub>	Address hold time from falling edge of VCE	2t <sub>C</sub> - 30	—	2t <sub>C</sub> - 40	—	ns	
$\overline{\text{VRD}}$	t <sub>RCs</sub>	Read cycle setup time to falling edge of VCE	t <sub>C</sub> - 45	—	t <sub>C</sub> - 60	—	ns	
	t <sub>RCH</sub>	Read cycle hold time from rising edge of VCE	0.5t <sub>C</sub>	—	0.5t <sub>C</sub>	—	ns	
VD0 to VD7	t <sub>ACV</sub>	Address access time	—	3t <sub>C</sub> - 100	—	3t <sub>C</sub> - 115	ns	
	t <sub>CEA</sub>	VCE access time	—	2t <sub>C</sub> - 80	—	2t <sub>C</sub> - 90	ns	
	t <sub>OH2</sub>	Output data hold time	0	—	0	—	ns	
	t <sub>CO</sub>	VCE to data off time	0	—	0	—	ns	

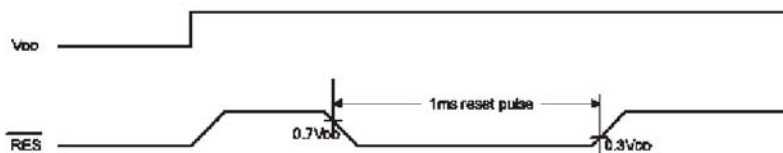
Write timing:



Read timing:



Reset:



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## .The Characteristics and Reliability Test

### 1.Electro-Optic Characteristics

Condition:TEMP=(23 ± 3) °C

NO	Item	Symbol	Min.	Typ.	Max.	Unit	Condition
1	Supply Voltage(Logic)	Vdd-Vss	4.5	5.0	5.5	V	
2	LCD Operating Voltage	Vdd-V <sub>0</sub>	21.8	22.4	23.0	V	0°C
			21.4	22.0	22.6	V	25°C
			21.0	21.6	22.2	V	70°C
3	Response Time	Ton	85	88	96	ms	
		Toff	243	248	261	ms	
4	Contrast	CR	2				
5	Viewing Angel	12H	1	56		Deg	(CR≥2.0)
		6H	2	66			
		3H	3	60			
		9H	4	60			

### 2. Characteristics of backlight (LED unit)

#### (1).Absolute Maximum Ratings:

Item	Symbol	Rating	Unit	Condition
Forward Current	IFM	200	mA	Ta=25°C
Reverse Voltage	VR	1.0	V	Ta=25°C
Power Dissipation	PD	600	mW	Ta=25°C

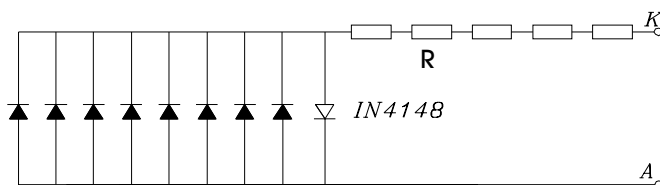
#### (2).Electrical-optical Characteristics:

Item	Symbol	Min	Typ	Max	Unit	Condition
Forward current	IF	80	120	160	mA	VF=5.0V
Reverse current	IR		50		uA	VF =5.0V
Color	WHITE					

#### WARNING:

A BACKLIGHT IS A KIND OF CURRENT DEVICE,IT MUST CONNECT A RESISTANCE FOR LIMITING CURRENT ,OR IT WILL BE DAMAGED.

### 2.Circuit diagram LED 1X8=8 DIES



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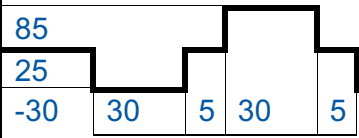
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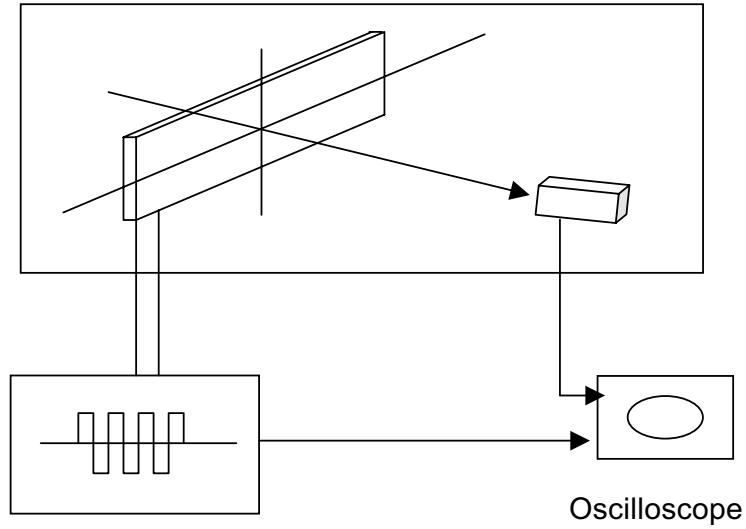
## 2. Reliability Test

No	Items	Test Condition	Equipment	Test Result
1	High Temp Storage	Temp:85 ± 2 C Time:96h Restore:24h	Tenny	Passed
2	Low Temp Storage	Temp:-30 ± 3 C Time:96h Restore:24h	Tenny	Passed
3	High Temp Static drive	Temp:70 ± 2 C Vop:5V Time:24h Restore:24h	Tenny	Passed
4	Low Temp Static drive	Temp:-20 ± 3 C Vop:5V Time:24h Restore:24h	Tenny	Passed
5	High Temp High Hum Storage	Temp:40 ± 2 C Hum:95%Rh Time:96h Restore:24h	Tenny	Passed
6	Thermal Shock	Temp: ( C )  5Cycles Restore:24h	Tenny	Passed



# The Equipment and LCD Measuring Method

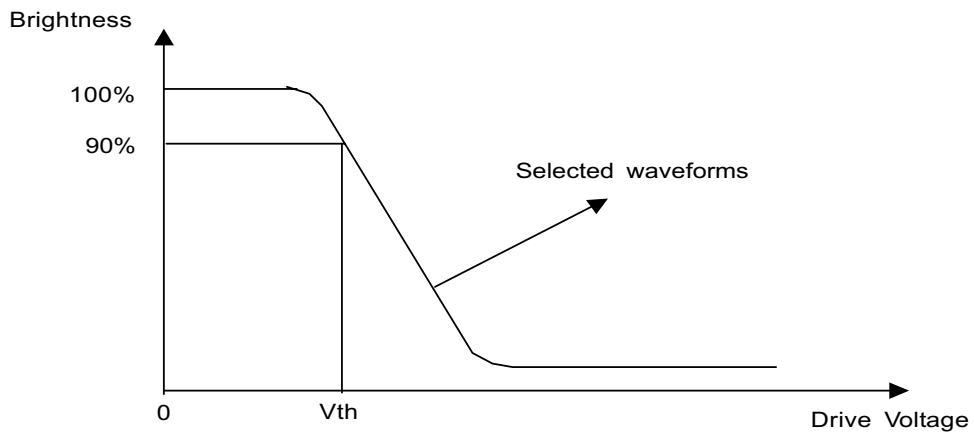
## 1. Equipment



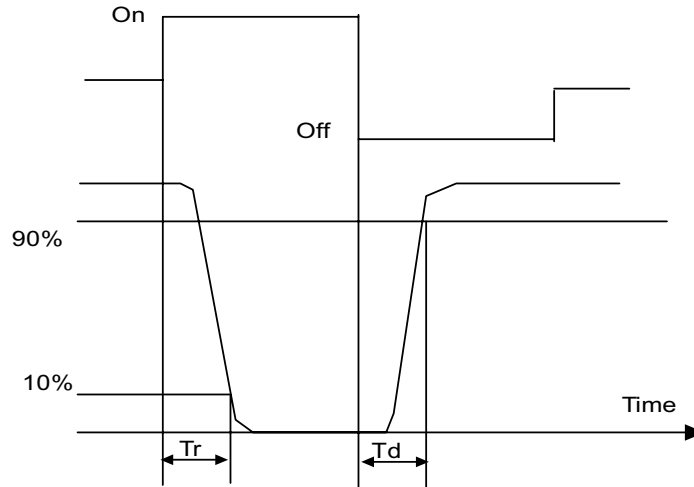
Waveform Generator

## (2) Definition

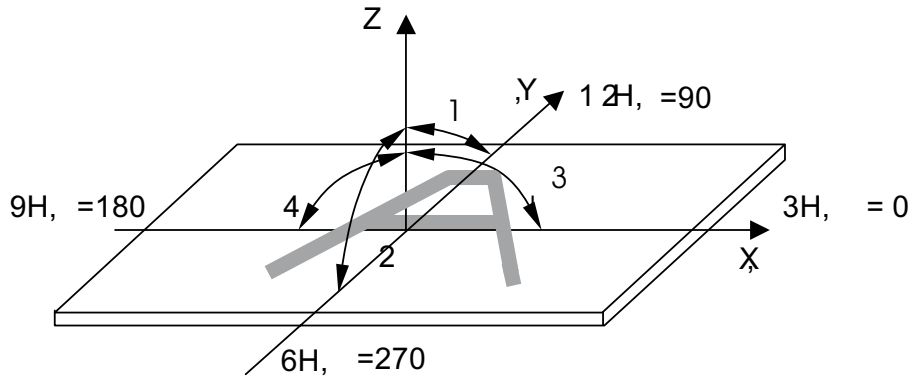
### a. Threshold Voltage ( $V_{th}$ )



b. Response Time



a. Viewing Angle:



b. Contrast Ratio (positive)

$$CR = \frac{\text{Brightness of non-selected wave-form}}{\text{Brightness of selected wave-form}}$$

4. Reliability Test:

Equipment : Tenny

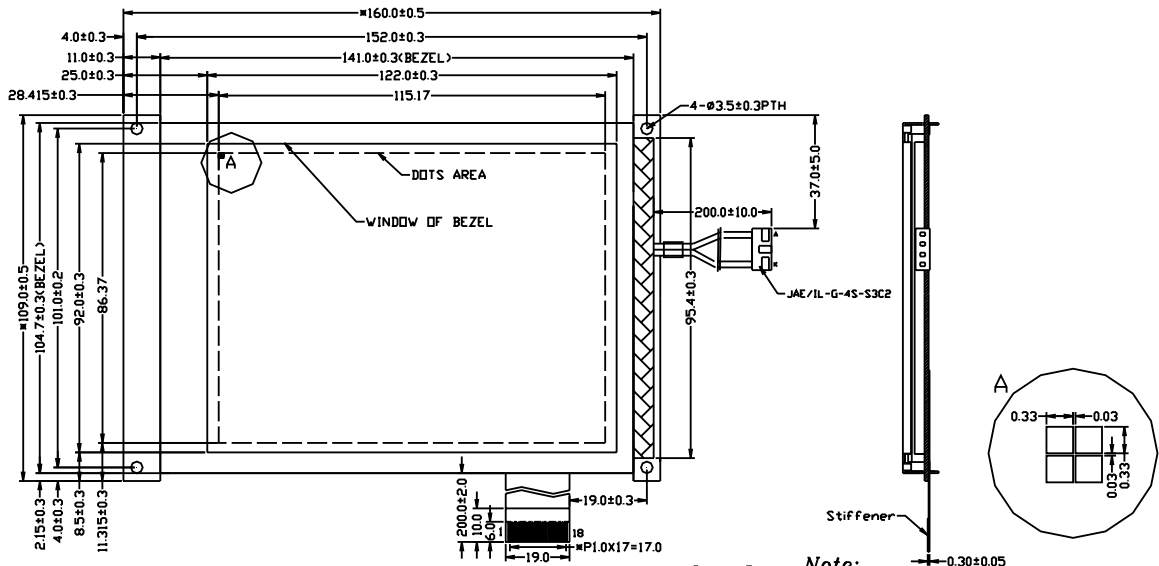
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# .Instruction Sets

## Instruction Table

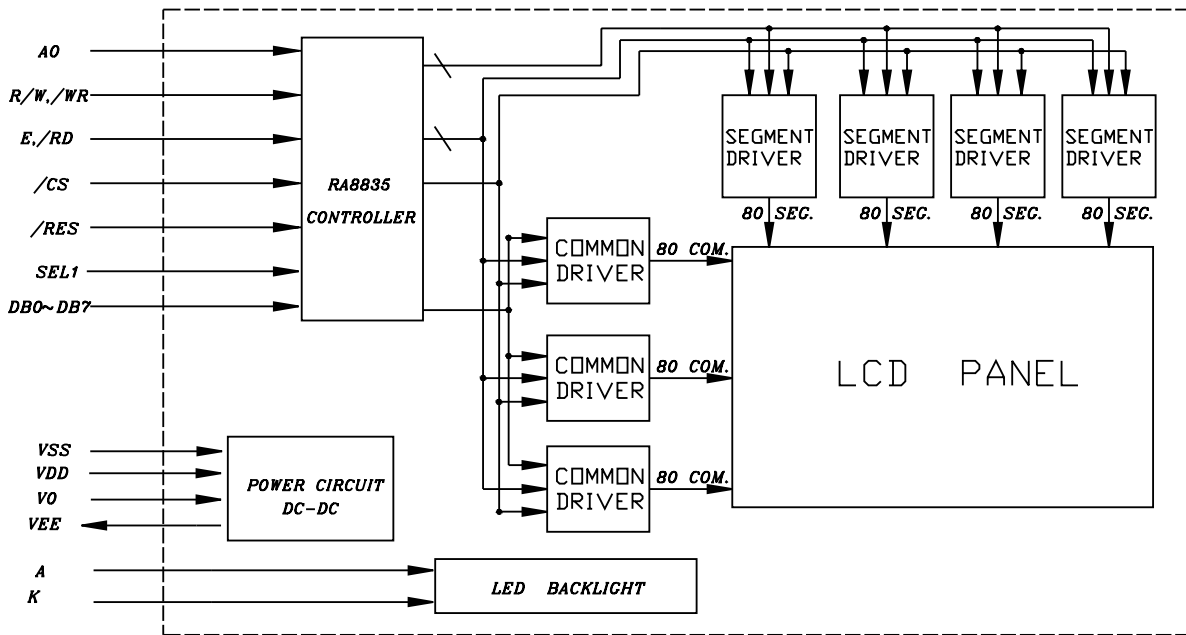
Class	Command	Code											Hex	Command Description	Command Read Parameters		
		RD	WR	A0	D7	D6	D5	D4	D3	D2	D1	D0			No. of Bytes	Section	
System Control	SYSTEM SET	1	0	1	0	1	0	0	0	0	0	0	0	40	Initialize device and display	8	9-2-1
	SLEEP IN	1	0	1	0	1	0	1	0	0	1	1	53	Enter standby mode	0	9-2-2	
Display Control	DISPLAY ON/OFF	1	0	1	0	1	0	1	1	0	0	D	58, 59	Enable and disable display and display flashing	1	9-3-1	
	SCROLL	1	0	1	0	1	0	0	0	1	0	0	44	Set display start address and display regions	10	9-3-2	
	CSRFORM	1	0	1	0	1	0	1	1	1	0	1	5D	Set cursor type	2	9-3-3	
	CGRAM ADR	1	0	1	0	1	0	1	1	1	0	0	5C	Set start address of character generator RAM	2	9-3-6	
	CSRDIR	1	0	1	0	1	0	0	1	1	CD 1	CD 0	4C to 4F	Set direction of cursor movement	0	9-3-4	
	HDOT SCR	1	0	1	0	1	0	1	1	0	1	0	5A	Set horizontal scroll position	1	9-3-7	
	OVLAY	1	0	1	0	1	0	1	1	0	1	1	5B	Set display overlay format	1	9-3-5	
Drawing Control	CSRW	1	0	1	0	1	0	0	0	1	1	0	46	Set cursor address	2	9-r1	
	CSRR	1	0	1	0	1	0	0	0	1	1	1	47	Read cursor address	2	9-4-2	
Memory Control	MWRITE	1	0	1	0	1	0	0	0	0	1	0	42	Write to display memory	—	9-5-1	
	MREAD	1	0	1	0	1	0	0	0	0	1	1	43	Read from display memory	—	9-5-2	

. Attached Drawing



Note:

1	Operating Voltage:	5.0V
2	Drive method:	1/240Duty, 1/19Bias
3	Viewing Direction:	6:00
4	Operating Temp:	-20°C~70°C
5	Storage Temp:	-30°C~85°C
6	Display type:	FSTN, Positive, T/H
7	Unspecified tolerance:	±0.2
8	LCD controller/driver:	RAB835, SDN8080C
9	Backlight:	LED/W
10	Customer No.:	
11	Dimensions with mark "*" are important	
12	RoHS compliant	



PIN NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
SYMBOL	VSS	VDD	V0	A0	R/W	E	D0	D1	D2	D3	D4	D5	D6	D7	/CS	RES	VEE	SEL1