BOCEN Bocen Display Technology Co., Ltd.

Tel: +86-0755-23145782 **E-mail**: info@bocentech.com **Website**: www.bocentech.com
Address: 808 Esun Tech Building, No.22 Jia'an South Road, Bao'an District, 518101 Shenzhen, China.

SPECIFICATION
FOR
LCM MODULE

MODULE NO.: BB320240-10A

REVISION NO.: V0

Customer Approval:

	SIGNATURE
PREPARED BY	Sylar
VERIFIED BY	William
APPROVED BY	Rio

Tel: +86-0755-23145782 **E-mail**: info@bocentech.com **Website**: www.bocentech.com
Address: 808 Esun Tech Building, No.22 Jia'an South Road, Bao'an District, 518101 Shenzhen, China.

Tel: +86-0755-23145782 **E-mail**: info@bocentech.com **Website**: www.bocentech.com
Address: 808 Esun Tech Building, No.22 Jia'an South Road, Bao'an District, 518101 Shenzhen, China.

1 . REVISION RECORD

REV	DATA	PAGES	DESCRIPTION
A	2024/08/05	15	

Tel: +86-0755-23145782 **E-mail**: info@bocentech.com **Website**: www.bocentech.com
Address: 808 Esun Tech Building, No.22 Jia'an South Road, Bao'an District, 518101 Shenzhen, China.

2. GENERAL SPECIFICATION

320×240 dots display

Epson LCD controller: RA8835A or EQV.

PCB assembly: SMT

MPU BUS Interface with 8-bit :6800 / 8080

Super-wide working voltage: 3.0V~5.5V

Optional backlight voltage: 3.0V / 5.0V

Display dot: 320×240

Display type: STN, BLUE/YELLOW-GREEN/GREY/BLACK

Polarizer mode: Positive/Negative

Viewing angle: 6:00

Display duty: 1/240

Display bias: 1/17

Memory and External Memory:

160, 5x 7 pixel characters in internal maskprogrammed character generator ROM

Up to 256, 8x16 pixel characters in external character generator ROM

32KB external display RAM (static RAM)

Mechanical characteristics (Unit: mm)

External dimension: 148×120.2×15.1

View area：120.1×92.1

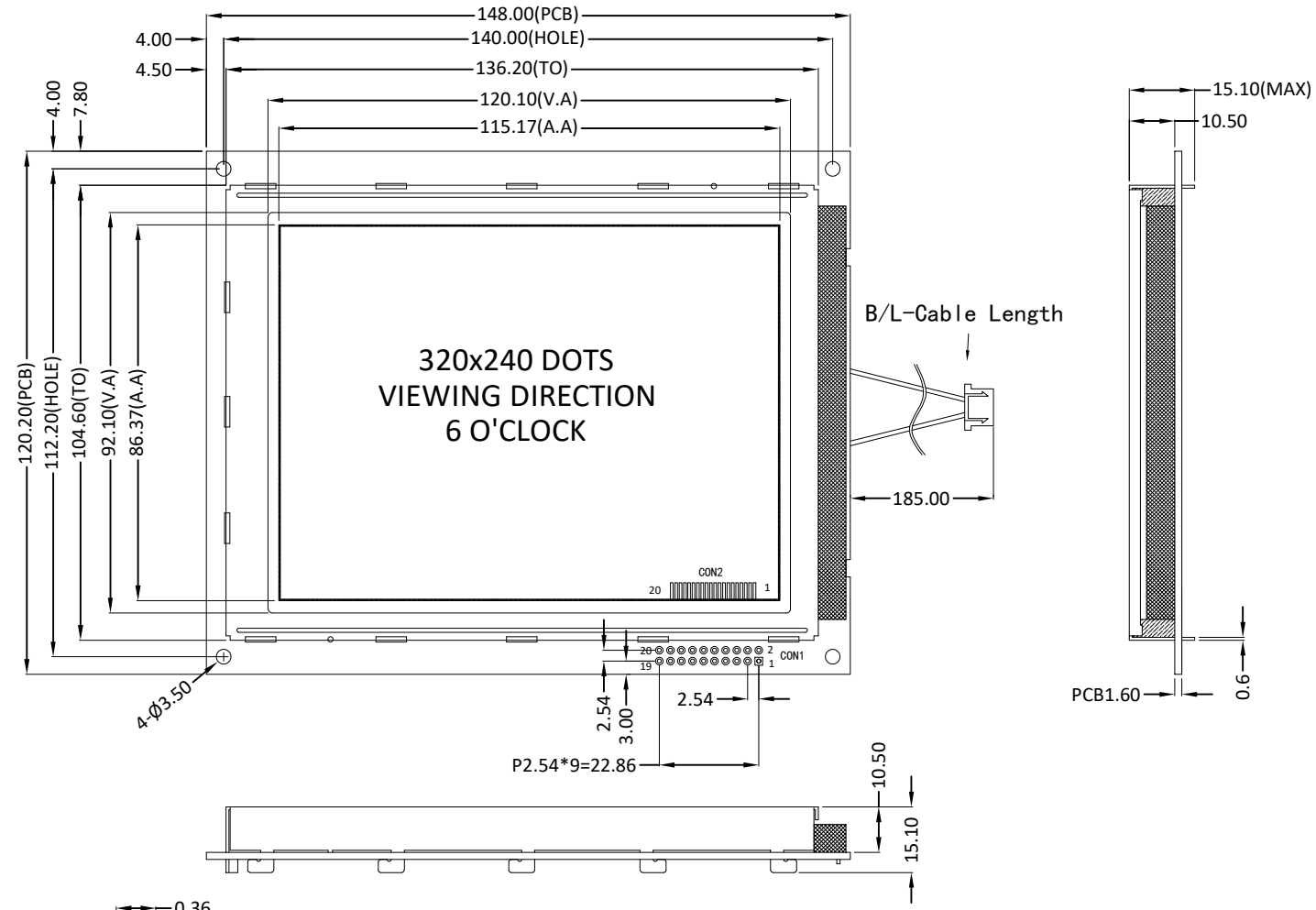
Dot size：0.33×0.33

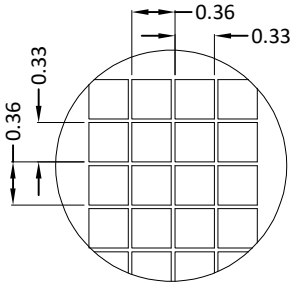
Dot pitch：0.36×0.36

POWER： +5V

Tel: +86-0755-23145782 **E-mail**: info@bocentech.com **Website**: www.bocentech.com
Address: 808 Esun Tech Building, No.22 Jia'an South Road, Bao'an District, 518101 Shenzhen, China.

3. OUTLINE DEMENSION:





SPECIFICATIONS:

1. DISPLAY TYPE:	STN / NEGATIVE (BLUE) / TRANSMISSIVE
2. DRIVE IC:	RA8835A or EQV.
3. OPERATING VOLTAGE:	VDD=5.0V, VLCD = 23.0V
4. OPERATING TEMPERATURE:	-20 ~ 70°C
5. STORAGE TEMPERATURE:	-30 ~ 80°C
6. DRIVE MODE:	1/240 DUTY, 1/17 BIAS
7. VIEWING ANGLE:	6 O'CLOCK
8. BACKLIGHT:	WHITE LED
9. CUSTOMER PART NO.:	BOCEN STANDARD PRODUCT

CON1

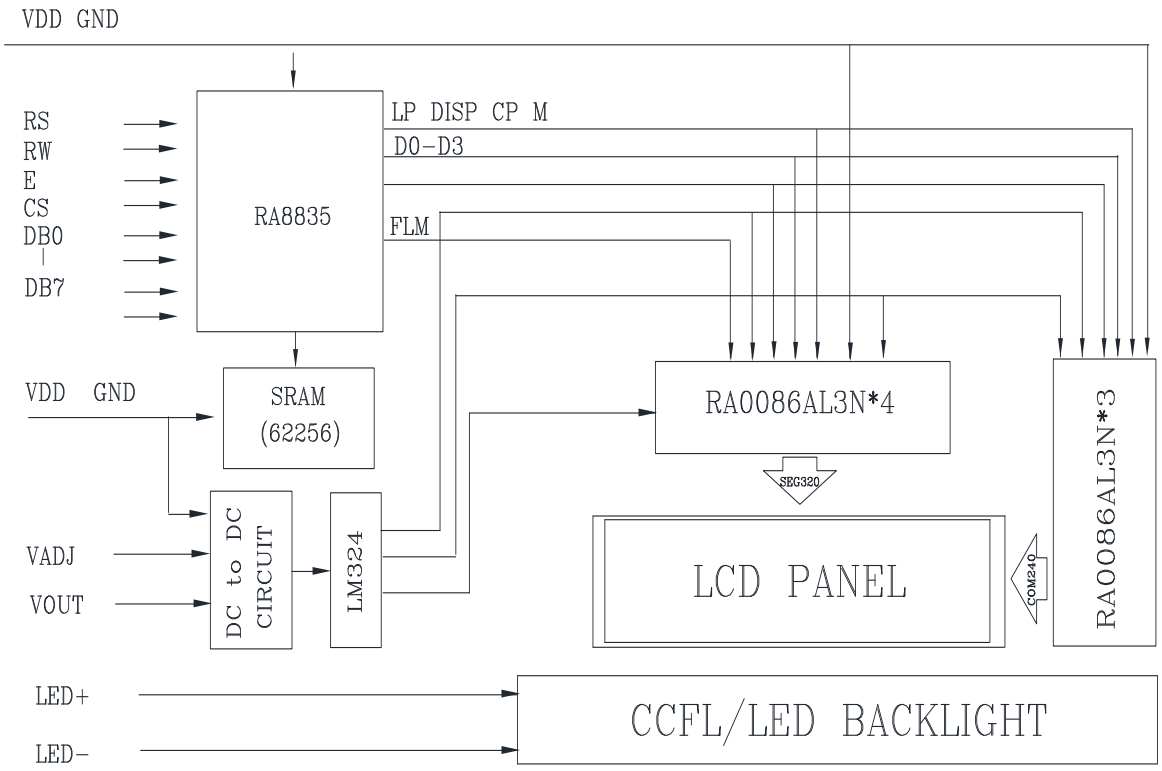
PIN	SYMBOL
1	VSS
2	VDD
3	VO
4	RD
5	WR
6	A0
7-14	D0~D7
15	CS
16	RET
17	VEE
18	FG
19	LED+
20	LED-

CON2

PIN	SYMBOL
1	VSS
2	VDD
3	VO
4	RD
5	WR
6	A0
7-14	D0~D7
15	CS
16	RET
17	VEE
18	FG
19	LED+
20	LED-

Tel: +86-0755-23145782 **E-mail**: info@bocentech.com **Website**: www.bocentech.com
Address: 808 Esun Tech Building, No.22 Jia'an South Road, Bao'an District, 518101 Shenzhen, China.

4. BLOCK DIAGRAM:



5. Absolute Maximum Ratings

Item	Symbol	Condition	Standard Value		Unit
			Min	Max	
Supply voltage for logic	Vdd	Ta=25^{0}C	-0.3	7.0	V
Supply voltage for LCD	Vo		Vdd-20	Vdd+0.3	V
Input Voltage	Vi		-0.3	Vdd+0.3	V
Operating Temp(T)	Top	-	-20	70	^{0}C
Storage Temp(T)	Tstg	-	-30	80	^{0}C

6. ELECTRICAL SPECIFICATIONS(Ta=25^{0}C,Vdd=5.0V)

ltem	Symbol	Condition	Standard Value			Unit
			Min	Type	Max	
Supply voltage for logic	Vdd-Vss	-	4.5	5.0	5.5	V
Supply Current for logic	ldd	Vdd=5.0	-	-	<50	mA
Driving Current for LCD	lee	Vee=-7.8	-	4.6	-	mA
Driving Voltage for LCD	Top	25^{0}C -	-	-	30	V
Input Voltage "H" level	Tstg	H	0.7Vdd	-	Vdd	V
Input Voltage "L" level	HTop	L	0	-	0.8	V

Tel: +86-0755-23145782 **E-mail**: info@bocentech.com **Website**: www.bocentech.com
Address: 808 Esun Tech Building, No.22 Jia'an South Road, Bao'an District, 518101 Shenzhen, China.

7. Absolute Maximum Ratings For Side LED Backlight

Parameter	Symbol	Test condition	Min	Type	Max	Unit
LED Forward Consumption Current	I_f	Ta=25^{0}C Vf=5.0V	-	150	180	mA
LED Allowable Dissipation	P_d		-	450	600	mW

8. Pin assignment

	CON1	CON2	Pin Description
1	VSS	VSS	Power Ground
2	VDD	VDD	Power supply for Logic
3	V0	V0	Contrast Adjustment
4	RD	RD	Data Read Signal
5	WR	WR	Data Write Signal
6	A0	A0	Data/ Instruction select signal
7	D0	D0	Data Bus
8	D1	D1	Data Bus
9	D2	D2	Data Bus
10	D3	D3	Data Bus
11	D4	D4	Data Bus
12	D5	D5	Data Bus
13	D6	D6	Data Bus
14	D7	D7	Data Bus
15	CS	CS	Chip selection
16	RST	RST	Controller reset signal
17	VEE	VEE	Negative voltage output
18	FG	FG	Frame Ground
19	LED+	LED+	Backlight Anode(5V)
20	LED-	LED-	Backlight Cathode(0V)

9. MPU Interface

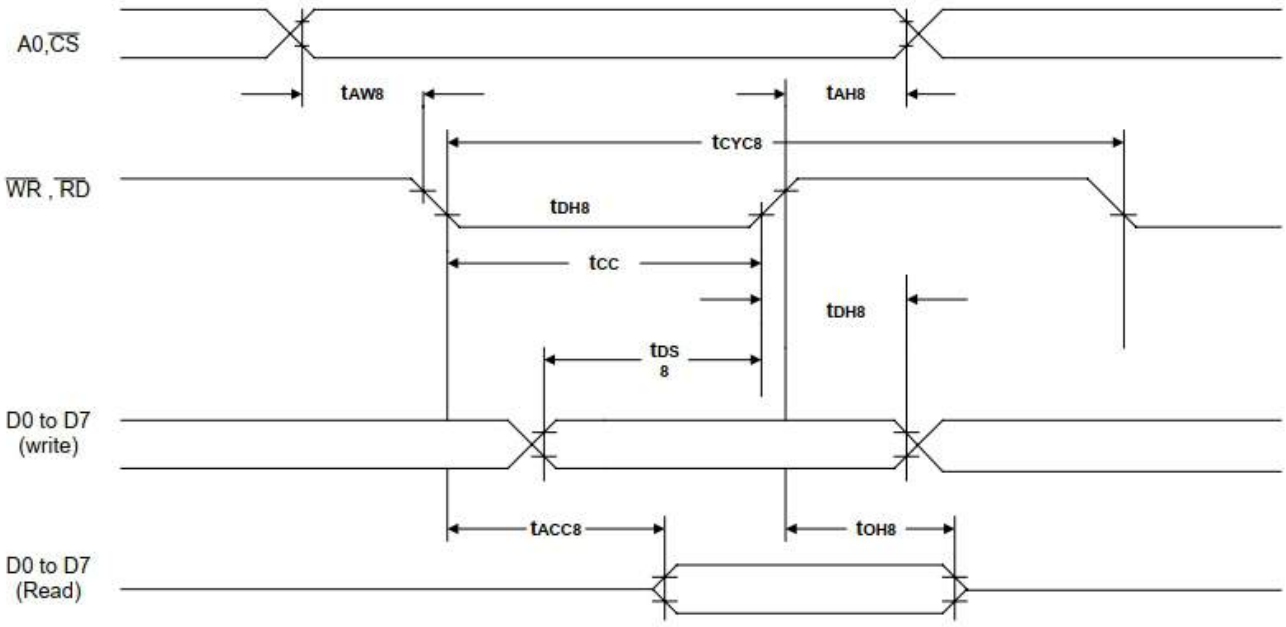
ITEM	SYMBOL	MIN	MAX	UNIT
C/D Set-up Time	t_{CDS}	100	-	ns
C/D Hold Time	t_{CDH}	10	-	ns
$\overline{CE}$,$\overline{RD}$,$\overline{WR}$ Pulse Width	t_{CE},t_{RD},t_{WR}	80	-	ns
Data Set-up Time	t_{DS}	80	-	ns
Data Hold Time	t_{DH}	40	-	ns
Access,Time	t_{ACC}	-	150	ns
Output Hold Time	t_{OH}	10	50	ns

THST CONDITIONS(Unless otherwise noted,Vdd=5.0V±10%,Vss=0V,Ta=-20 to 75℃)

Tel: +86-0755-23145782 **E-mail**: info@bocentech.com **Website**: www.bocentech.com
Address: 808 Esun Tech Building, No.22 Jia'an South Road, Bao'an District, 518101 Shenzhen, China.

10.Flowchart of communications with MPU

8080 Family Interface Timing



Ta = –20 to 75°C

Signal	Symbol	Parameter	V_{DD} = 4.5 to 5.5V		V_{DD} = 2.7 to 4.5V		Unit	Condition
			Min.	Max.	Min.	Max.		
A0, $\overline{CS}$	t_{AH8}	Address hold time	10	—	10	—	ns	CL = 100pF
	t_{AW8}	Address setup time	0	—	0	—	ns	
$\overline{WR}$, $\overline{RD}$	t_{CYC8}	System cycle time	note.	—	note.	—	ns	
	t_{CC}	Strobe pulse width	120	—	150	—	ns	
D0 to D7	t_{DS8}	Data setup time	120	—	120	—	ns	
	t_{DH8}	Data hold time	5	—	5	—	ns	
	t_{ACC8}	$\overline{RD}$ access time	—	50	—	80	ns	
	t_{OH8}	Output disable time	10	50	10	55	ns	

Note: For memory control and system control commands:

$t_{CYC8} = 2t_C + t_{CC} + t_{CEA} + 75 > t_{ACV} + 245$

For all other commands:

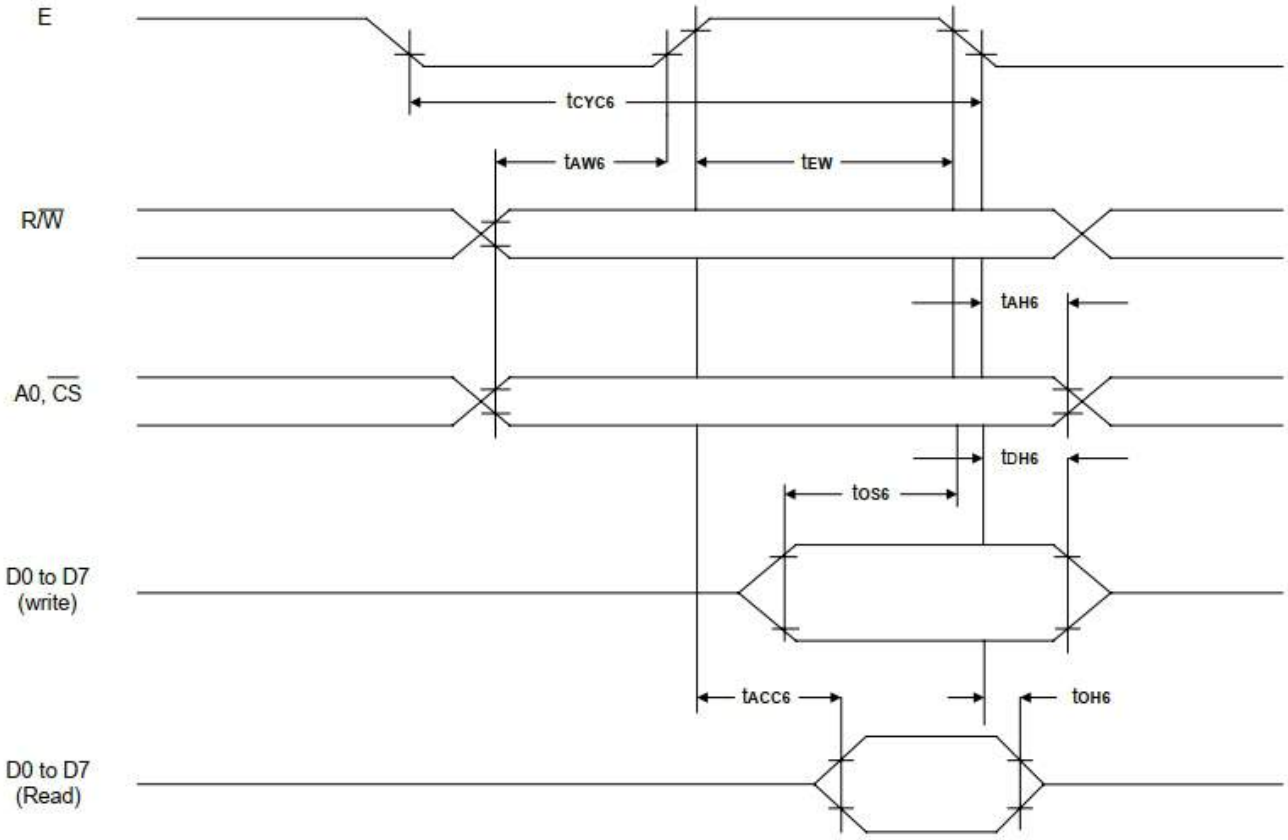
$t_{CYC8} = 4t_C + t_{CC} + 30$

Table-19: 8080 Series Interface Signals

A0	$\overline{RD}$	$\overline{WR}$	Function
0	0	1	Status flag read
1	0	1	Display data and cursor address read
0	1	0	Display data and parameter write
1	1	0	Command write

Tel: +86-0755-23145782 **E-mail**: info@bocentech.com **Website**: www.bocentech.com
Address: 808 Esun Tech Building, No.22 Jia'an South Road, Bao'an District, 518101 Shenzhen, China.

6800 Family Interface Timing



Ta = –20 to 75°C

Signal	Symbol	Parameter	V_{DD} = 4.5 to 5.5V		V_{DD} = 2.7 to 4.5V		Unit	Condition
			Min.	Max.	Min.	Max.		
A0, CS, R/(/W)	t_{CYC6}	System cycle time	note.	—	note.	—	ns	CL = 100 pF
	t_{AW6}	Address setup time	0	—	10	—	ns	
	t_{AH6}	Address hold time	0	—	0	—	ns	
D0 to D7	t_{DS6}	Data setup time	100	—	120	—	ns	
	t_{DH6}	Data hold time	0	—	0	—	ns	
	t_{OH6}	Output disable time	10	50	10	75	ns	
	t_{ACC6}	Access time	—	85	—	130	ns	
E	t_{EW}	Enable pulse width	120	—	150	—	ns	

Note: For memory control and system control commands:

$t_{CYC6} = 2t_C + t_{EW} + t_{CEA} + 75 > t_{ACV} + 245$

For all other commands:

$t_{CYC6} = 4t_C + t_{EW} + 30$

Table-20A: 6800 Series Interface Signals

A0	R/W	E	Function
0	1	1	Status flag read
1	1	1	Display data and cursor address read
0	0	1	Display data and parameter write
1	0	1	Command write

Tel: +86-0755-23145782 **E-mail**: info@bocentech.com **Website**: www.bocentech.com
Address: 808 Esun Tech Building, No.22 Jia'an South Road, Bao'an District, 518101 Shenzhen, China.

11.COMMAND SET

Table-1: Command Set

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	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

Notes:

1. In general, the internal registers of the RA8835 series are modified as each command parameter is input. However, the microprocessor does not have to set all the parameters of a command and may send a new command before all parameters have been input. The internal registers for the parameters that have been input will have been changed but the remaining parameter registers are unchanged. 2-byte parameters (where two bytes are treated as 1 data item) are handled as follows:

   a. CSRW, CSRR: Each byte is processed individually. The microprocessor may read or write just the low byte of the cursor address.

   b. SYSTEM SET, SCROLL, CGRAM ADR: Both parameter bytes are processed together. If the command is changed after half of the parameter has been input, the single byte is ignored.

2. APL and APH are 2-byte parameters, but are treated as two 1-byte parameters.

Tel: +86-0755-23145782 **E-mail**: info@bocentech.com **Website**: www.bocentech.com
Address: 808 Esun Tech Building, No.22 Jia'an South Road, Bao'an District, 518101 Shenzhen, China.

Internal Character Generator Font

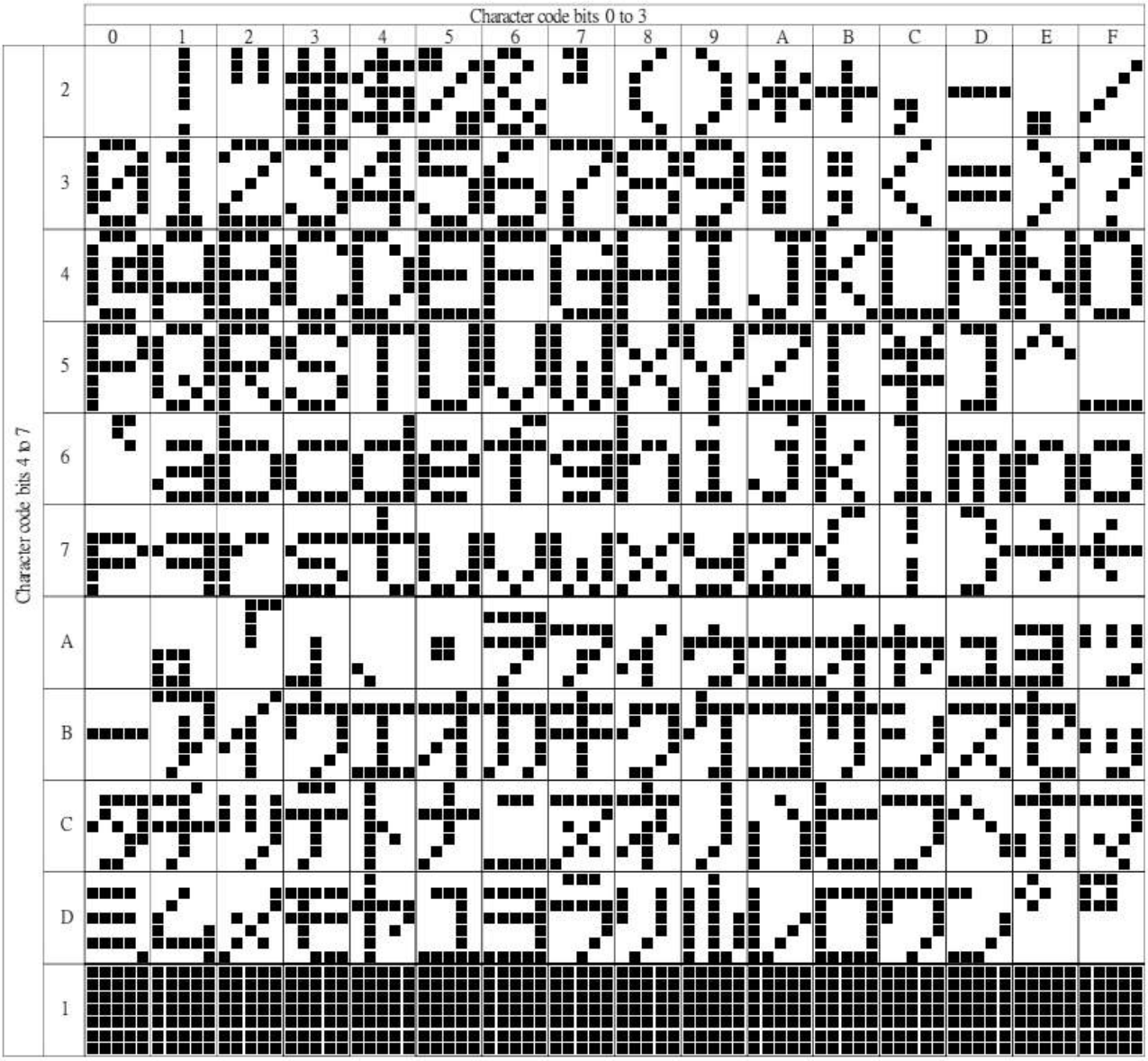


Figure 8-14: On-chip Character Set

Note: The shaded positions indicate characters that have the whole 6 x 8 bitmap blackened.

Tel: +86-0755-23145782 **E-mail**: info@bocentech.com **Website**: www.bocentech.com
Address: 808 Esun Tech Building, No.22 Jia'an South Road, Bao'an District, 518101 Shenzhen, China.

Initializes command set

Initializes the device, sets the window sizes, and selects the LCD interface format. Since this command sets the basic operating parameters of the RA8835 series, an incorrect SYSTEM SET command may cause other commands to operate incorrectly.

	MSB D7	D6	D5	D4	D3	D2	D1	D0 LSB	A0	WR	RD
C	0	1	0	0	0	0	0	0	1	0	1
P1	0	0	IV	1	W/S	M2	M1	M0	0	0	1
P2	WF	0	0	0	0	← FX →			0	0	1
P3	0	0	0	0	← FY →				0	0	1
P4	← C/R →								0	0	1
P5	← TC/R →								0	0	1
P6	← L/F →								0	0	1
P7	← APL →								0	0	1
P8	← APH →								0	0	1

12.OPTICAL CHARACTERISTICS

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REF.
Contrast	CR	25℃， Vdd=5V, θ =0, Ø=0	--	12	--		(2)
Rise Time	Tr	25℃， Vdd=5V, θ =0, Ø=0	--	160	240	ms	(3)
Fall Time	Tf	25℃， Vdd=5V, θ =0, Ø=0	--	100	150	ms	(3)
Viewing Angle	θ 1- θ 2	25℃	--	--	60	DEG	(1)
	Ø1, Ø2		-40	--	40		

(1)Definition of viewing Angle:

Tel: +86-0755-23145782 **E-mail**: info@bocentech.com **Website**: www.bocentech.com
Address: 808 Esun Tech Building, No.22 Jia'an South Road, Bao'an District, 518101 Shenzhen, China.

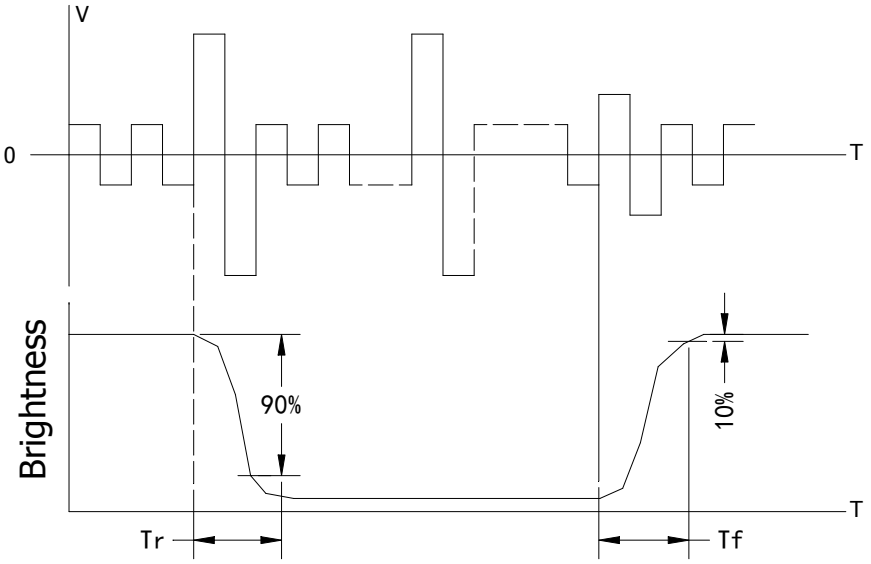
(2)Definition of Contrast Ratio:

$$\text{Contrast Ratio} = \frac{\text{Brightness of non-selected condition}}{\text{Brightness of selected condition}}$$

Test condition: standard A light source

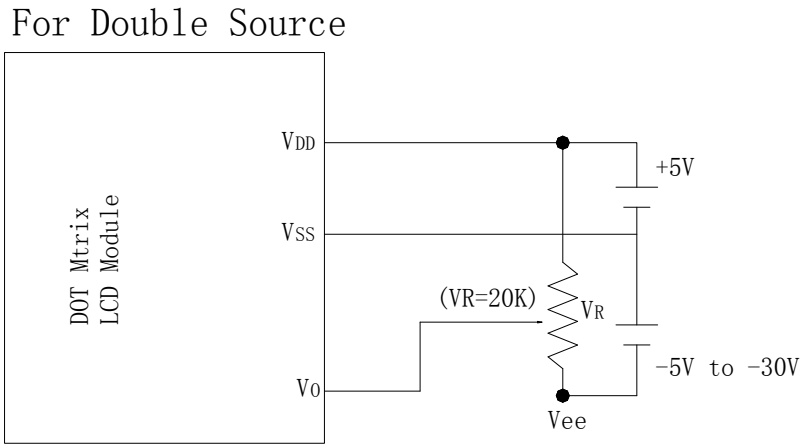
(3)Response Time:

Response time is measured as the shortest period of possible between the change in state of an LCD segments as demonstrated below:



Tel: +86-0755-23145782 **E-mail**: info@bocentech.com **Website**: www.bocentech.com
Address: 808 Esun Tech Building, No.22 Jia'an South Road, Bao'an District, 518101 Shenzhen, China.

13. POWER SUPPLY SCHEMATICS



14.PRECAUTION FOR USING LCM

1. LIQUID CRYSTAL DISPLAY (LCD)

LCD is made up of glass, organic sealant, organic fluid, and polymer-based polarizers. The following precautions should be taken when handing,

(1). Keep the temperature within range of use and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel off or bubble.

(2). Do not contact the exposed polarizers with anything harder than an HB pencil lead. To clean dust off the display surface. Wipe gently with cotton. Chamois or other soft material soaked in petroleum benzine.

(3). Wipe off saliva or water drops immediately. Contact with water over a long period of time may cause polarizer deformation or color fading, while an active LCD with water condensation on its surface will cause corrosion of ITO electrodes.

(4). Glass can be easily chipped or cracked from rough handing. especially at corners and edges.

(5). Do not drive LCD with DC voltage.

2. Liquid Crystal Display Modules

2.1 Mechanical Considerations

LCM are assembled and adjusted with a high degree of precision. Avoid excessive shocks and do not make any alterations or modifications. The following should be noted.

(1). Do not tamper in any way with the tabs on the tabs on the metal frame.

(2). Do not modify the PCB by drilling extra holes, changing its outline, moving its components or modifying its pattern.

(3). Do not touch the elastomer connector, especially insert an backlight panel (for example, EL).

(4). When mounting a LCM make sure that the PCB is not under any tress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.

(5). Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pie ls.

2.2. Static Electricity

LCM contains CMOS LSI's and the same precaution for such devices should apply, namely

(1). The operator should be grounded whenever he/she comes into contact with the module. Never

Tel: +86-0755-23145782 **E-mail**: info@bocentech.com **Website**: www.bocentech.com
Address: 808 Esun Tech Building, No.22 Jia'an South Road, Bao'an District, 518101 Shenzhen, China.

touch any of the conductive parts such as the LSI pads, the copper leads on the PCB and the interface terminals with any parts of the human body.
(2). The modules should be kept in antistatic bags or other containers resistant to static for storage.
(3). Only properly grounded soldering irons should be used.
(4). If an electric screwdriver is used, it should be well grounded and shielded from commutator sparks.
(5). The normal static prevention measures should be observed for work clothes and working benches; for the latter conductive (rubber) mat is recommended.
(6). Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

2.3. Soldering
(1). Solder only to the I/O terminals.
(2). Use only soldering irons with proper grounding and no leakage.
(3). Soldering temperature: 280 ℃±10℃
(4). Soldering time: 3 to 4 sec.
(5). Use eutectic solder with resin flux fill.
(6). If flux is used, the LCD surface should be covered to avoid flux spatters. Flux residue should be removed after wards.

2.4. Operation
(1). The viewing angle can be adjusted by varying the LCD driving voltage V0.
(2). Driving voltage should be kept within specified range; excess voltage shortens display life.
(3). Response time increases with decrease in temperature.
(4). Display may turn black or dark blue at temperatures above its operational range; this is (however not pressing on the viewing area) may cause the segments to appear "fractured".
(5). Mechanical disturbance during operation (such as pressing on the viewing area) nay cause the segments to appear "fractured".

2.5. Storage
If any fluid leaks out of a damaged glass cell, wash off any human part that comes into contact with soap and water. Never swallow the fluid. The toxicity is extremely low but caution should be exercised at all the time.