晶采光電科技股份有限公司
AMPIRE CO., LTD.

SPECIFICATIONS FOR LCD MODULE

CUSTOMER	
CUSTOMER PART NO.	
AMPIRE PART NO.	**AG-320240A4FIQW-TV6(N)(R)**
APPROVED BY	
DATE	

☐ **Approved For Specifications**
☐ **Approved For Specifications & Sample**

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RECORD OF REVISION

Revision Date	Page	Contents	Editor
2009/8/3	--	New Release	Edward

1 FEATURES

(1) Display format : 320 × 240 dot-matrix, 1/240 duty.

(2) Construction : FSTN LCD, Bezel, Heat Seal, Zebra, White Edge LED back-light, Touch Panel and PCB.

(3) Display type : FSTN LCD, Transflective, 6 o'clock view.

(4) Controller :RA8835 or Equivalent.

(5) Power : +5V for logic circuit, -20V is needed for LCD driving.

(6) Extended temperature type.

(7) ROHS compliant.

2 MECHANICAL DATA

Parameter	Stand Value	Unit
Dot size	0.345(W) × 0.345(H)	mm
Dot pitch	0.36(W) × 0.36(H)	mm
Viewing area	122.0(W) × 92.0(H)	mm
Module size (with Touch Panel)	173.1(W) × 109.0(H) × 14.5 max (T)	mm

3 ABSOLUTE MAXIMUM RATINGS

Parameter		Symbol	Min	Max	Unit
Logic Circuit Supply Voltage		VDD-VSS	-0.3	7.0	V
LCD Driving Voltage		VDD-VO	-0.3	26.0	V
Input Voltage		VI	-0.3	VDD+0.3	V
Extended temp. type	Operating Temp.	TOP	-20	70	°C
	Storage Temp.	TSTG	-30	80	°C

4 ELECTRO-OPTICAL CHARACTERISTICS

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Note
----- Electronic Characteristics -----							
Logic Circuit Supply Voltage	VDD-VSS	--	--	5.0	--	V	
LCD Driving Voltage	VDD-VO	0 °C	21.2	22.4	23.5	V	
		25 °C	20.5	21.6	22.7		
		50 °C	19.6	20.8	21.9		
Input Voltage	VIH	--	0.7 VDD	--	VDD	V	
	VIL	--	VSS	--	0.3 VDD	V	
Logic Supply Current	IDD	VDD = 5V	--	30	--	mA	
----- Optical Characteristics -----							
Contrast	CR	FSTN type	3.0	4.5	6.0		Note 1
Rise Time	tr	25°C	200	250	375	ms	Note 2
Fall Time	tf	25°C	120	150	225	ms	
Viewing Angle Range	θ f	25°C & CR≥2	--	35	--	Deg.	Note 3
	θ b		--	30	--		
	θ l		--	30	--		
	θ r		--	30	--		
Frame Frequency	FF	25°C	--	70	--	Hz	

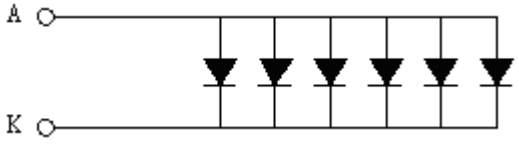
----- White LED Back-light Characteristics -----							
Parameter	**Symbol**	**Condition**	**Min**	**Typ**	**Max**	**Unit**	**Note**
Forward Current	IF	--	--	90	120	mA	Note 4
LCM Luminous intensity		IF=90mA	--	18	--	cd/m^2	Note 4
Forward Voltage	VF	IF=90mA	--	3.2	3.5	V	Note 5
LED C.I.E	X	IF=90mA	0.26	0.30	0.34		Note 6
	Y	IF=90mA	0.27	0.31	0.35		

Note 4: Luminous intensity is decided by forward current of White LED.

Note 5: White LEDs are with voltage tolerance under the same current.

Note 6: White LEDs are with color tolerance under the same current.

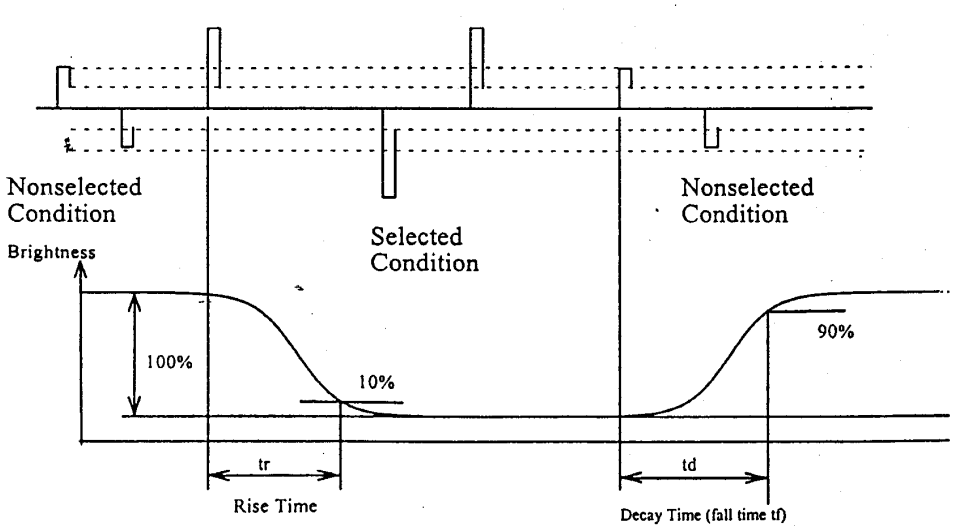
* LED Dice number = 6



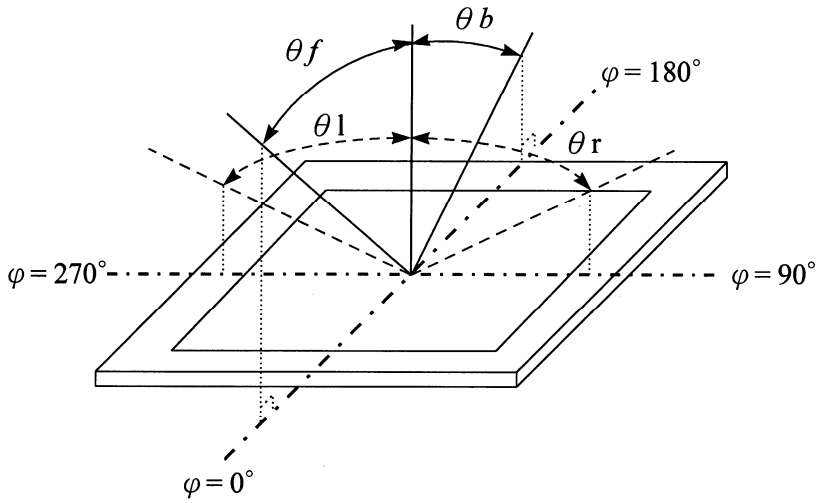
(NOTE 1) Contrast ratio :

CR = (Brightness in OFF state) / (Brightness in ON state)

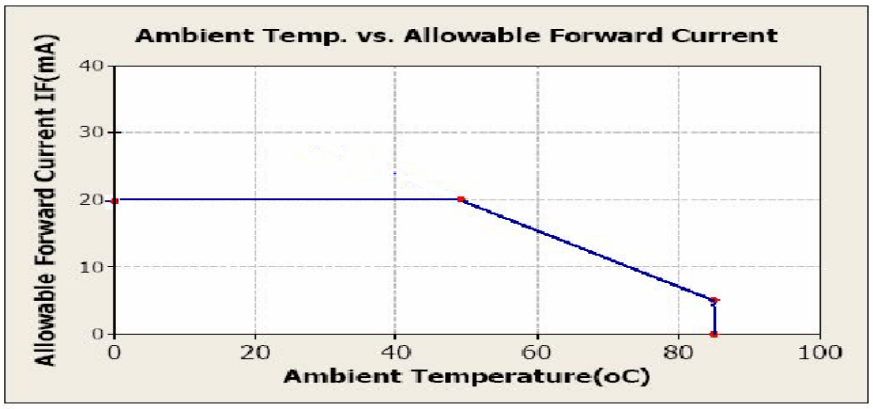
(NOTE 2) Response time :



(NOTE 3) Viewing angle



One LED dice curve diagram



4.1 Touch Panel Electrical Specification

Parameter	Condition	Standard Value
Terminal Resistance	X Axis	400 ~ 900 Ω
	Y Axis	200 ~ 500 Ω
Insulating Resistance	DC 25 V	More than 10MΩ
Linearity	--	±1.5 %
Notes life by Pen	Note a	100,000 times(min)
Input life by finger	Note b	1,000,000 times (min)

Note A .

Notes area for pen notes life test is 10 x 9 mm.

Size of word is 7.5 x 6.72

Shape of pen end : R0.8

Load : 250 g

Note B

By Silicon rubber tapping at same point

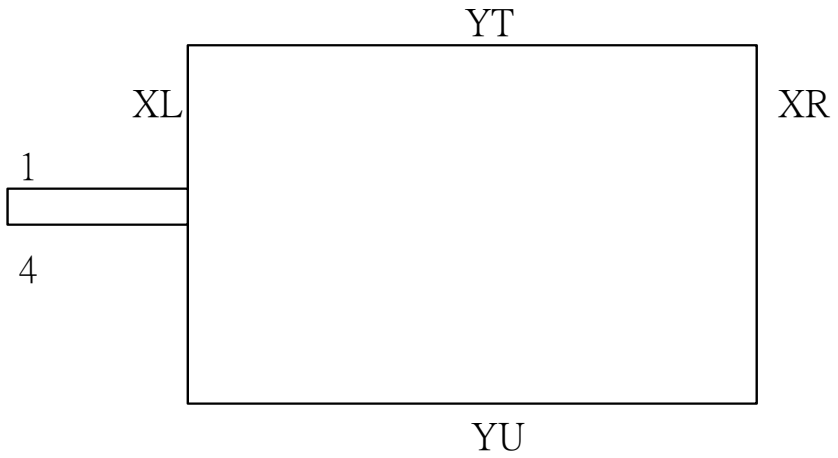
Shape of rubber end : R8

Load : 200g

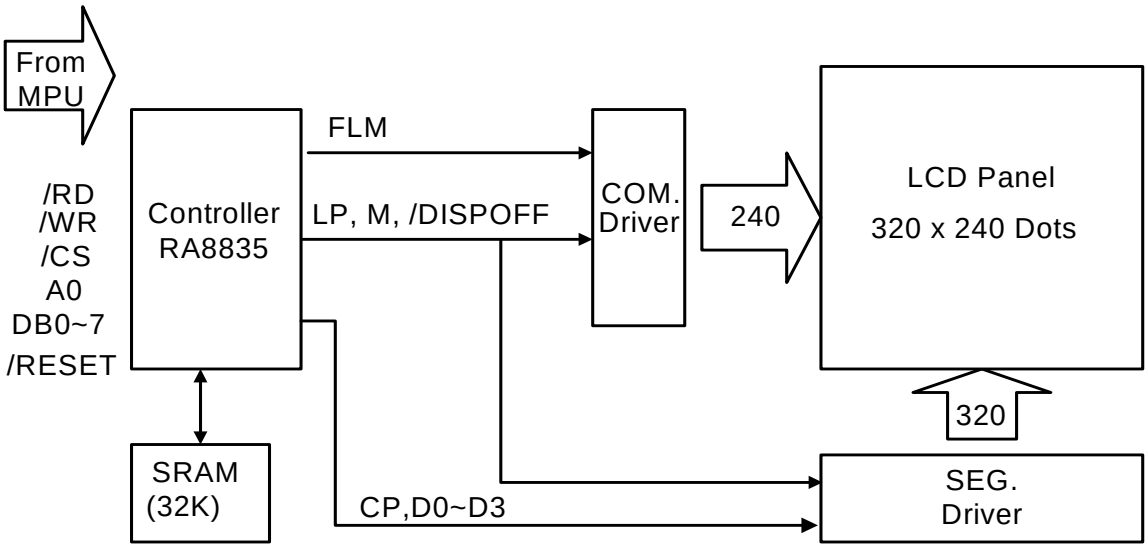
Frequency : 5 Hz

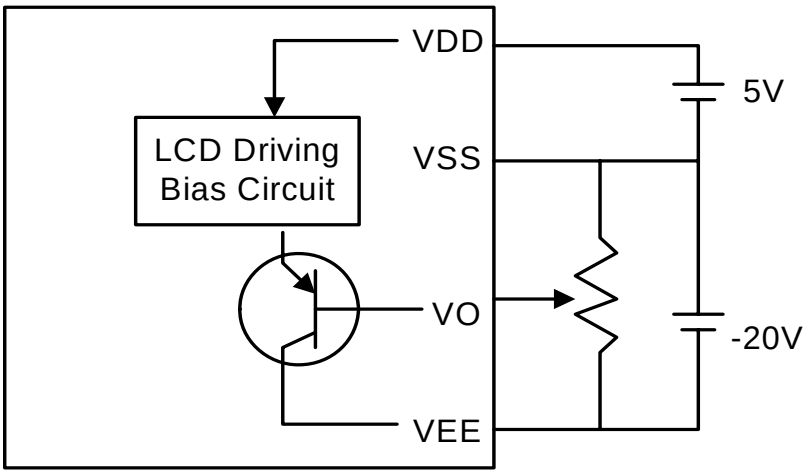
Interface

No.	Symbol	Function
1	XR	Touch Panel Right Signal in X Axis
2	YT	Touch Panel Top Signal in Y Axis
3	XL	Touch Panel Left Signal in X Axis
4	YB	Touch Panel Bottom Signal in Y Axis



5 BLOCK DIAGRAM & POWER SUPPLY





6 PIN CONNECTIONS

CN2 : RA8835 Controller

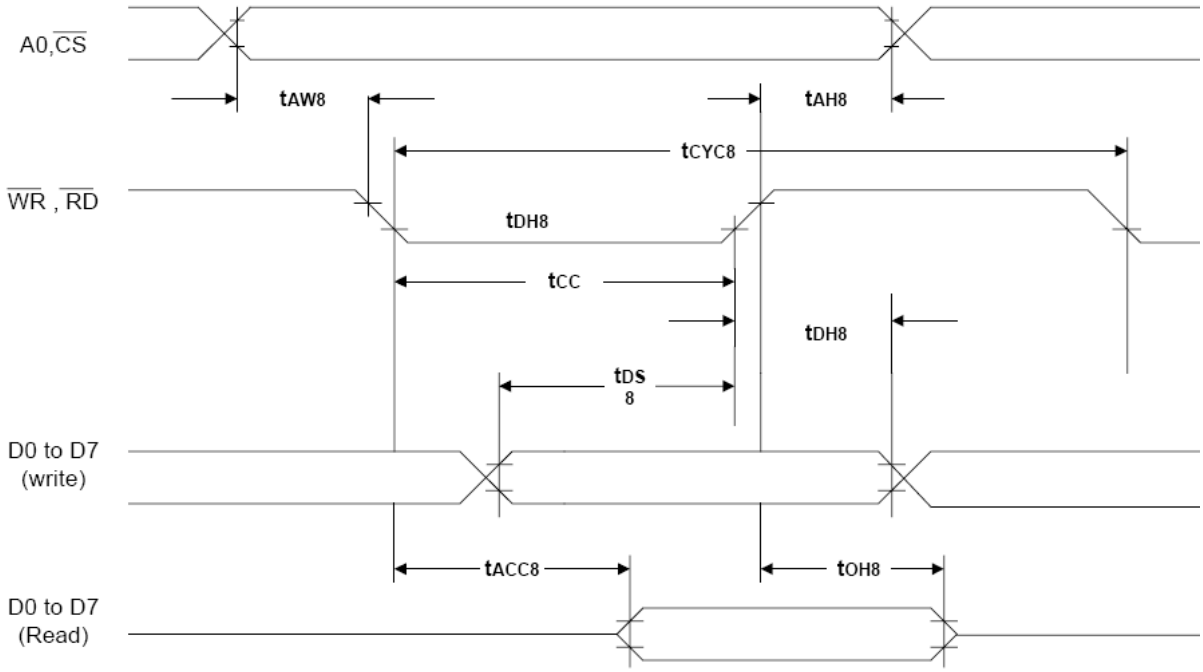
PIN NO.	SIGNAL	LEVEL	FUNCTION
1	/RESET	H/L	Reset Signal
2	/RD	H/L	80 Series: Read Signal 68 Series: Enable Signal(E)
3	/WR	H/L	80 Series: Write Signal 68 Series: R/W Signal
4	/CS	H/L	Chip Select Signal
5	A0	H/L	Data Type Selection
6 ~ 13	DB0~DB7	H/L	Data Input(8 bits)
14	VDD	-	Power Supply for Logic(+5.0V)
15	VSS	-	Power Supply(Ground : 0V)
16	VEE	-	With DC/DC Negative voltage output (-20V)
17	VO	-	Contrast Adjustment Input
18*	SK / X1	-	Serial Clock Touch Panel Left Signal in X Axis
19*	DO / X2	-	Data Output Touch Panel Right Signal in X Axis
20*	DI / Y1	-	Data In Touch Panel Upper Signal in Y Axis
21*	CS / Y2	-	T/P controller Chip Select. Active Low Touch Panel Lower Signal in X Axis
22*	INT	-	Interrupt
23	NC	-	No connection
24	NC	-	No connection

* 18~22 : SK, DO, DI, CS, INT for Touch Panel controller TSC2046

/ X1, X2, Y1, Y2 for Touch Panel (without TSC2046)

7 TIMING CHARACTERISTICS

7.1 8080 Family Interface Timing



Ta = –20 to 75°C

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

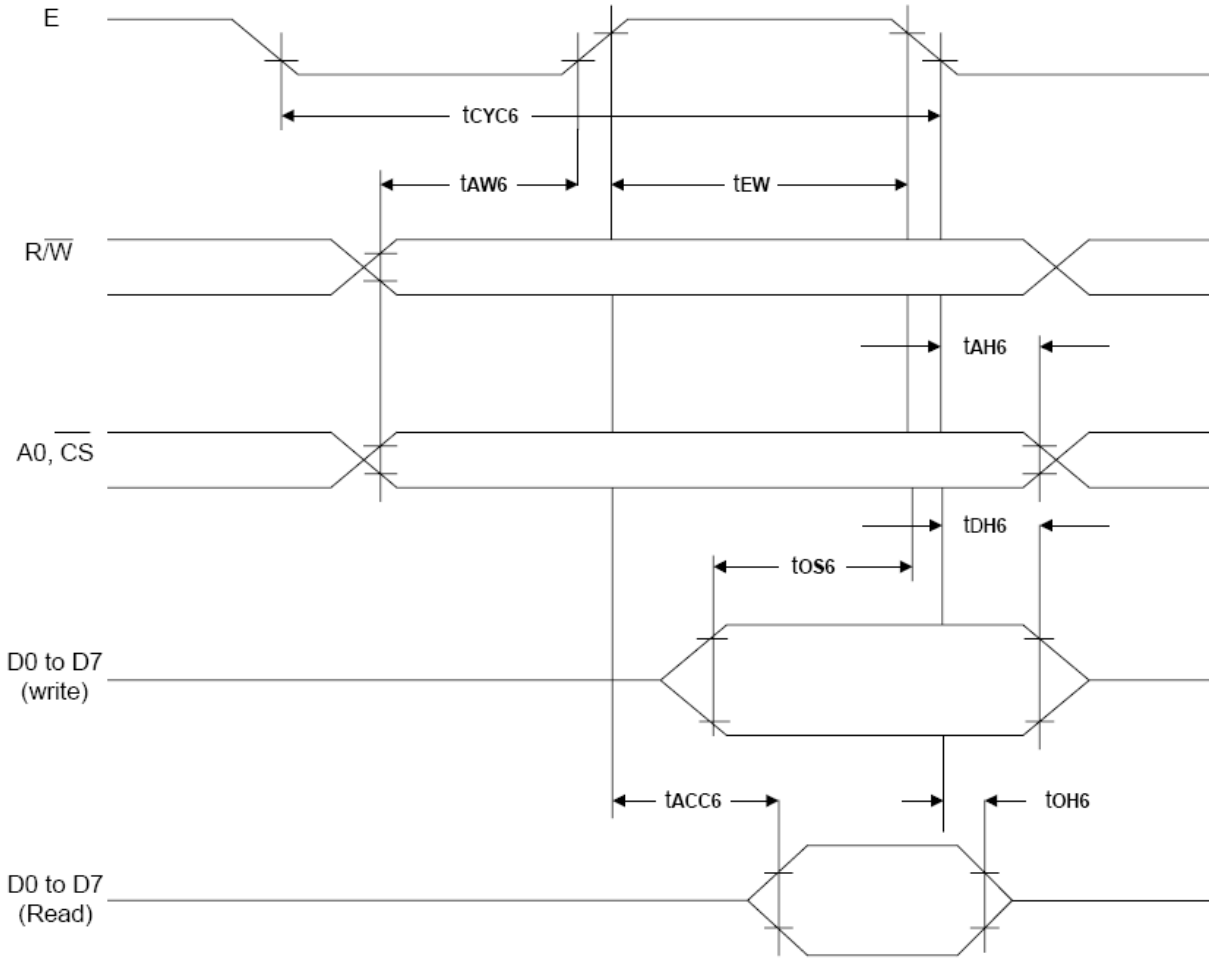
Note: For memory control and system control commands:

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

For all other commands:

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

7.2 6800 Family Interface Timing



Ta = –20 to 75°C

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

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

8 INSTRUCTION SET

Class	Command	Code											Hex	Command Description	Command read parameters	
		/RD	/WR	A0	D7	D6	D5	D4	D3	D2	D1	D0			Number of byters	Section
System Control	SYSTEM SET	1	0	1	0	1	0	0	0	0	0	0	40	Initialized Device and display	8	8.2.1
	SLEEP IN	1	0	1	0	1	0	1	0	0	1	1	53	Enter Standby mode	0	8.2.2
Display Control	DISP ON/OFF	1	0	1	0	1	0	1	1	0	0	D	58, 59	Enable and disable display and display flashing	1	8.3.1
	SCROLL	1	0	1	0	1	0	0	0	1	0	0	44	set Display start address and display regions	10	8.3.2
	CSRFORM	1	0	1	0	1	0	1	1	1	0	1	5D	Set cursor byte	2	8.3.3
	CGRAM ADDR.	1	0	1	0	1	0	1	1	1	0	0	5C	Set start address of character generator RAM	2	8.3.6
	CSRDIR	1	0	1	0	1	0	0	1	1	CD 1	CD 0	4C to 4F	Set direction of cursor movement	0	8.3.4
	HDOT SCR	1	0	1	0	1	0	1	1		1	0	5A	set horizontal scroll position	1	8.3.7
	OVLAY	1	0	1	0	1	0	1	1	0	1	1	5B	set display overlay format	1	8.3.5
Drawing Control	CSRW	1	0	1	0	1	0	0	0	1	1	0	46	set cursor address	2	8.4.1
	CSRR	1	0	1	0	1	0	0	0	1	1	1	47	read cursor address	2	8.4.2
Memory Control	MWRITE	1	0	1	0	1	0	0	0	0	1	0	42	write to display memory	-	8.5.1
	MREAD	1	0	1	0	1	0	0	0	0	1	1	43	read from display memory	-	8.5.2

Note:

1. In general, the internal registers of the RA8835 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 bytes parameters(where two bytes are treated as 1 data item) are handled as following:

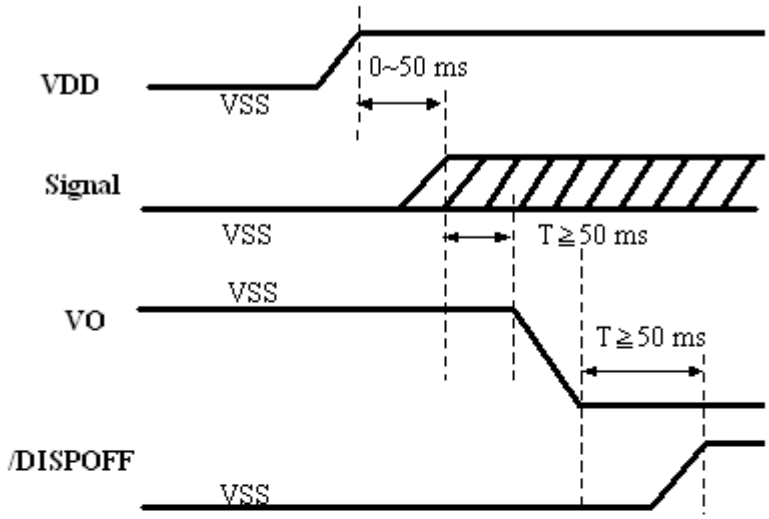
   a. CSRW, CSRR: Each byte is processed individually. The microprocessor may read or write just the low byte of the cursor address.

   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.
3. Please refer to RA8835 LCD Controller Data Book for detail.

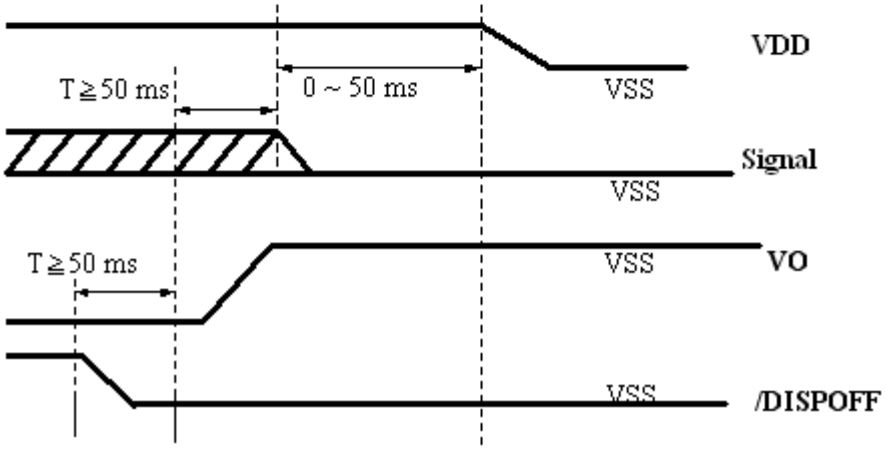
8.1 Power ON/OFF Sequence

Please maintain the blow sequence when turning on and off the power supply of the module. If /DISPOFF is supplied to the module while internal alter signal for LCD driving (M) is unstable, DC component will be supplied to the LCD panel. This may cause damage the LCD module.

POWER ON SEQUENCE



POWER OFF SEQUENCE



9 JUMPER SETTING

Item	Option	Jumper Setting	Remark
MPU	80 family (default)	Pin 1,2 short on JP6	
	68 family	Pin 2,3 short on JP6	

10 QUALITY AND RELIABILITY

10.1 TEST CONDITIONS

Tests should be conducted under the following conditions :

Ambient temperature : 25 ± 5°C

Humidity : 60 ± 25% RH.

10.2 SAMPLING PLAN

Sampling method shall be in accordance with MIL-STD-105E , level II, normal single sampling plan .

10.3 ACCEPTABLE QUALITY LEVEL

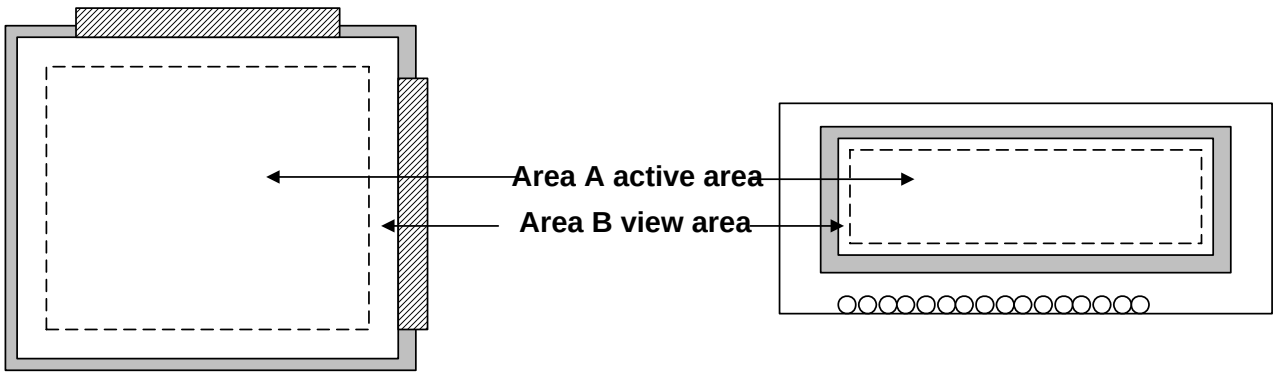
A major defect is defined as one that could cause failure to or materially reduce the usability of the unit for its intended purpose. A minor defect is one that does not materially reduce the usability of the unit for its intended purpose or is an infringement from established standards and has no significant bearing on its effective use or operation.

10.4 APPEARANCE

An appearance test should be conducted by human sight at approximately 30 cm distance from the LCD module under flourescent light. The inspection area of LCD panel shall be within the range of following limits.

10.5 INSPECTION QUALITY CRITERIA

Item	Description of defects			Class of Defects	Acceptable level (%)
Function	Short circuit or Pattern cut			Major	0.65
Dimension	Deviation from drawings			Major	1.5
Black spots	Ave . dia . D	area A	area B	Minor	2.5
	D≤0.2	Disregard			
	0.2<D≤0.3	3	4		
	0.3<D≤0.4	2	3		
	0.4<D	0	1		
Black lines	Width W, Length L	A	B	Minor	2.5
	W≤0.03	disregard			
	0.03<W≤0.05	3	4		
	0.05<W≤0.07 , L≤3.0	1	1		
	See line criteria				
Bubbles in polarizer	Average diameter D 0.2 < D < 0.5 mm for N = 4 , D > 0.5 for N = 1			Minor	2.5
Color uniformity	Rainbow color or newton ring.			Minor	2.5
Glass Scratches	Obvious visible damage.			Minor	2.5
Contrast ratio	See note 1			Minor	2.5
Response time	See note 2			Minor	2.5
Viewing angle	See note 3			Minor	2.5



10.6 RELIABILITY

Test Item	Test Conditions	Note
	Extended Temp. type	
High Temperature Operation	70±3°C , t=96 hrs	
Low Temperature Operation	-20±3°C , t=96 hrs	
High Temperature Storage	80±3°C , t=96 hrs	1,2
Low Temperature Storage	-30±3°C , t=96 hrs	1,2
Temperature Cycle	-30°C ~ 25°C ~ 80°C 30 min. 5 min. 30 min. (1 cycle) Total 5 cycle	1,2
Humidity Test	40 °C, Humidity 90%, 96 hrs	1,2
Vibration Test (Packing)	Sweep frequency : 10 ~ 55 ~ 10 Hz/1min Amplitude : 0.75mm Test direction : X.Y.Z/3 axis Duration : 30min/each axis	2

Note 1 : Condensation of water is not permitted on the module.

Note 2 : The module should be inspected after 1 hour storage in normal conditions (15-35°C , 45-65%RH).

Definitions of life end point :

- Current drain should be smaller than the specific value.
- Function of the module should be maintained.
- Appearance and display quality should not have degraded noticeably.
- Contrast ratio should be greater than 50% of the initial value.

11 HANDLING PRECAUTIONS

(1) A LCD module is a fragile item and should not be subjected to strong mechanical shocks.

(2) Avoid applying pressure to the module surface. This will distort the glass and cause a change in color.

(3) Under no circumstances should the position of the bezel tabs or their shape be modified.

(4) Do not modify the display PCB in either shape or positioning of components.

(5) Do not modify or move location of the zebra or heat seal connectors.

(6) The device should only be soldered to during interfacing. Modification to other areas of the board should not be carried out.

(7) In the event of LCD breakage and resultant leakage of fluid do not inhale, ingest or make contact with the skin. If contact is made rinse immediately.

(8) When cleaning the module use a soft damp cloth with a mild solvent, such as Isopropyl or Ethyl alcohol. The use of water, ketone or aromatic is not permitted.

(9) Prior to initial power up input signals should not be applied.

(10) Protect the module against static electricity and observe appropriate anti-static precautions.

(11) AMIPRE will provide one year warrantee for all products and three months warrantee for all repairing products.

12 OUTLINE DIMENSION