



LCD MODULE SPECIFICATION

MODEL NO.

BP240160BFPEHn87a\$

FOR MESSRS:

ON DATE OF:

APPROVED BY:



RECORD OF REVISION

Revision Date	Version	Contents
2003/3/7	0	New Release



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1. **Numbering System**

<u>B</u>	<u>P</u>	<u>240160</u>	<u>B</u>	<u>F</u>	<u>P</u>	<u>E</u>		<u>H</u>	<u>87a\$</u>
0	1	2	3	4	5	6	7	8	9

0	Brand	Bolymin	
1	Module Type	C= character type G= graphic type P= TAB/TCP type	O= COG type F= COF type
2	Format	2002=20 characters, 4 lines 12232= 122 x 32 dots	
3	Version No.	A type	
4	LCD Color	G=STN/gray Y=STN/yellow-green C=color STN	B=STN/blue F=FSTN T=TN
5	LCD Type	R=positive/reflective P=positive/transflective	M=positive/transmissive N=negative/transmissive
6	Backlight type/color	L=LED array/ yellow-green H=LED edge/white R=LED array/red G=LED edge/yellow-green	D=LED edge/blue E=EL/white B=EL/blue C=CCFL/white
7	CGRAM Font (applied only on character type)	J=English/Japanese Font E=English/European Font	C=English/Cyrillic Font H=English/Hebrew Font
8	View Angle/ Operating Temperature	B=Bottom/Normal Temperature H=Bottom/Wide Temperature U=Bottom/Ultra wide Temperature	T=Top/Normal Temperature W=Top/Wide Temperature C=9H/Normal Temperature
9	Special Code	3=3 volt logic power supply n=negative voltage for LCD c=cable/connector xxx=to be assigned on data sheet	t=temperature compensation for LCD p=touch panel \$=RoHS



2. General Specification

(1) Mechanical Dimension

Item	Dimension	Unit
Number of Dots	240 x 160	dots
Module dimension (W*H*T)	74.6*54.9*7.0 (max)-EL B/L	mm
View area	67.6 x 47.5	mm
Dot size	0.225x 0.225	mm
Dot pitch	0.24 x 0.24	mm

(2) Controller IC: **RAIO 8835** controller

(3) Temperature Range

	Wide
Operating	-20 ~+70℃
Storage	-30 ~+80℃

3. Absolute Maximum Ratings

Item	Symbol	Min	Typ	Max	Unit
Operating Temperature	T _{OP}	0	—	+50	℃
Storage Temperature	T _{ST}	-20	—	+70	℃
Input Voltage	V _I	-0.3	—	V _{DD} +0.3	V
Supply Voltage For Logic	V _{DD} -V _{SS}	-0.3	—	7.0	V
Supply Voltage For LCD	V _{ADJ} -V _{SS}	-0.3	—	22	V

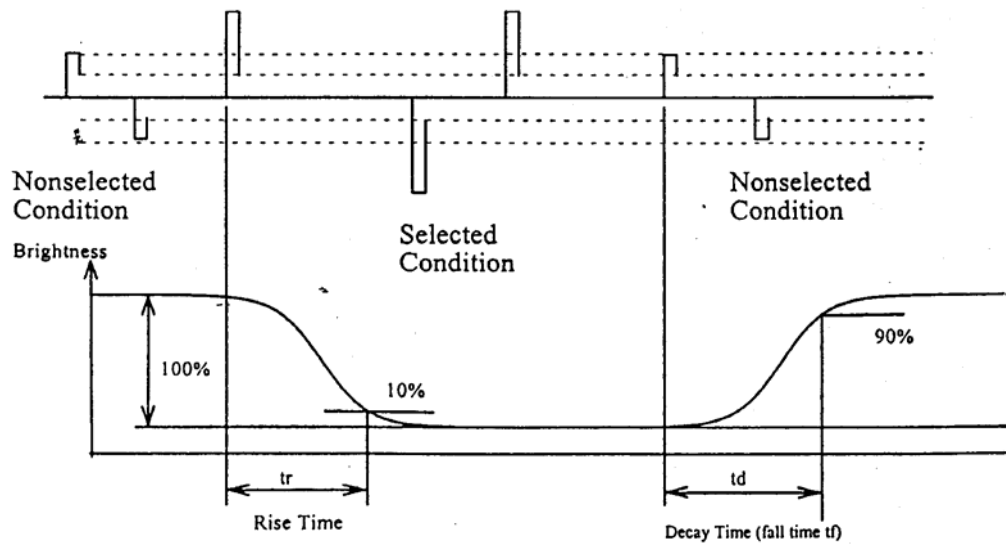


4. Electro-optical Characteristics

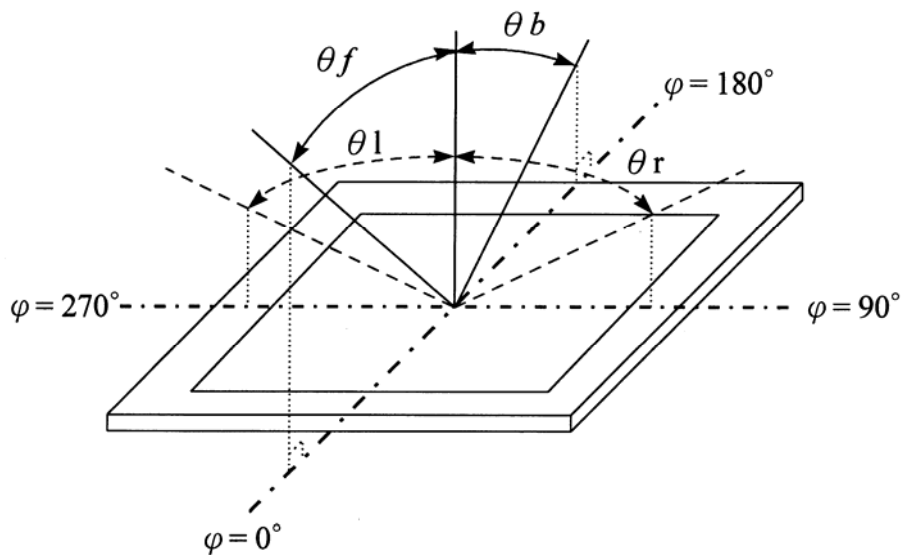
Parameter	Symbol	Condition	Min	Typ	Max	Unit	Note
----- Electronic Characteristics -----							
Logic Circuit Supply Voltage	VDD-VSS	--	2.7	--	5.5	V	
LCD Driving Voltage	VADJ-VSS	0°C	--	19.0	--	V	
		25°C	--	19.5	--	V	
		50°C	--	19.7	--	V	
Input Voltage	VIH	--	0.8 VDD	--	VDD	V	
	VIL	--	VSS	--	0.2 VDD	V	
Logic Supply Current	IDD	VDD = 5V	--	40	--	mA	
Supply Current for EL driver	IDD	VDD = 5V	--	30	--	mA	
Supply Current for LED B/L	IDD	VDD = 5V		100		mA	
----- Optical Characteristics -----							
Contrast	CR	25°C	4.19	4.28	4.33		Note 1
Rise Time	Tr	25°C	216	242	269	ms	Note 2
Fall Time	Tf	25°C	95	113	125	ms	
Viewing Angle Range	θ1	25°C & CR≥2	37	37	38	Deg.	Note 3
	θ2		30	30	30		
	φ1		37	38	40		
	φ2		35	37	39		
Frame Frequency	fF	25°C	--	64	--	Hz	

$$\text{CR} = (\text{Brightness in OFF state}) / (\text{Brightness in ON state})$$

Note 2 Response time :



Note3 Viewing angle





5. Interface Description

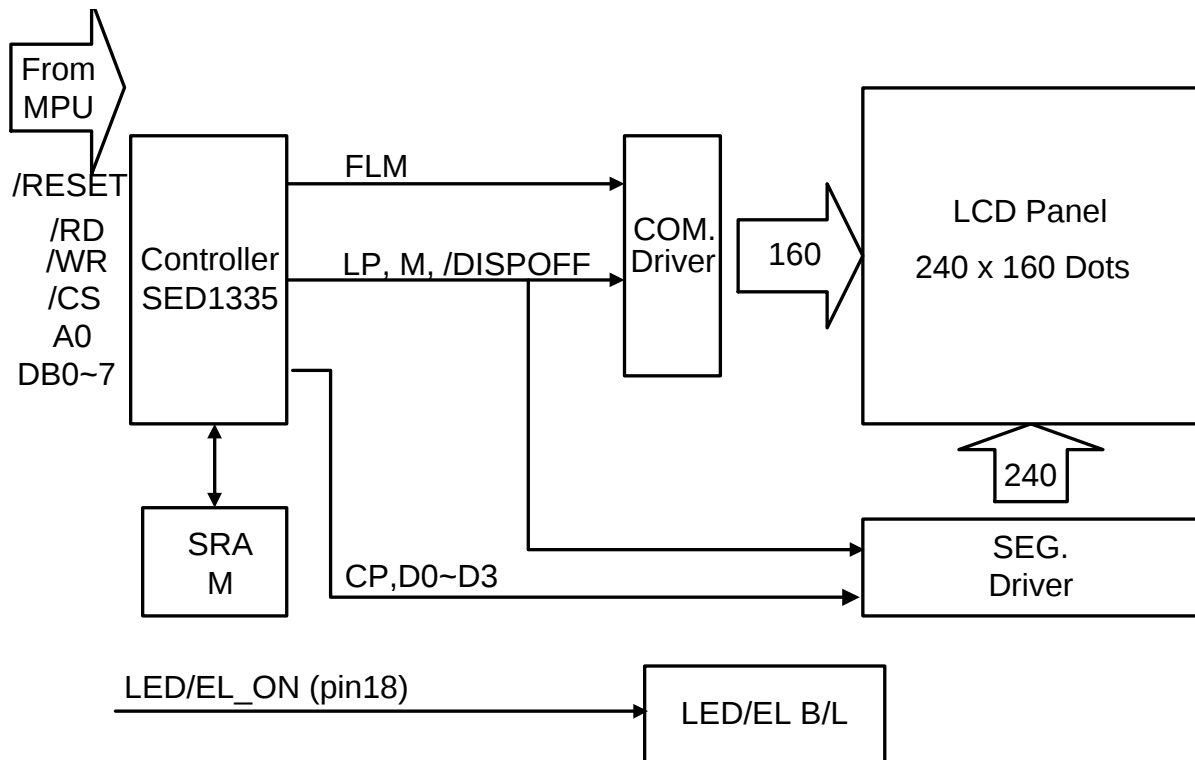
Pin No.	Signal	Level	Function
1	/RESET	H/L	Reset Signal
2	/RD	H/L	80 Series: Read Signal 68 Series: Enable Signal (E)
3	/WR	H/L	80 Series: Write Signal 68 Series: R/W Signal
4	/CS	H/L	Chip Select Signal
5	Ao	H/L	Data Type Selection
6 ~ 13	DB0~DB7	H/L	Data Input(8 bits)
14	VDD	-	Power Supply for Logic (+3V ~ +5V)
15	VSS	-	Power Supply (GND)
16	VLCD	-	Positive voltage output +21.3V
17	VADJ		Contrast Adjustment Input (VADJ-VSS = LCD driving voltage)
18	BL_ON	H/L	BL on/off signal ; H: on L: off
19	LED_A (EL1)	--	Power Supply for LED Backlight (+5V) / EL1(EL inverter non built In)
20	LED_K (EL2)	--	Power Supply for LED Backlight (0V) / EL2(EL inverter non built In)
21	Y1	-	Touch Panel Upper Signal in Y Axis
22	X1	-	Touch Panel Right Signal in X Axis
23	Y2	-	Touch Panel Lower Signal in Y Axis
24	X2	-	Touch Panel Left Signal in X Axis

6. Jumper setting

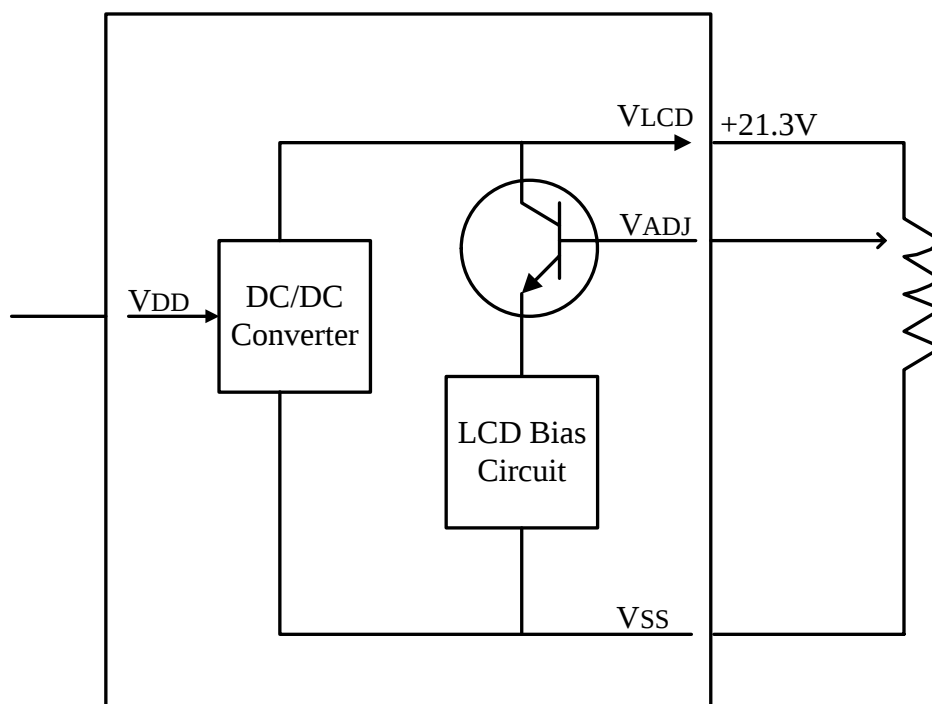
Item	Option	Jumper Setting	Remark
Display Type	Landscape (default)	Pin 1,2 short on JP1&JP2	
	Portrait	Pin 2,3 short on JP1&JP2	
MPU	80 family (default)	Pin 1,2 short on JP3	
	68 family	Pin 2,3 short on JP3	
EL driver	Built-in (default)	Pin 1,2 short on EL-JP1 & EL-JP2	Pin 19,20 are NC on CN2



7. Block Diagram



8. Power Supply for LCD Module and LCD Operating Voltage a Adjustment





9. Backlight Information

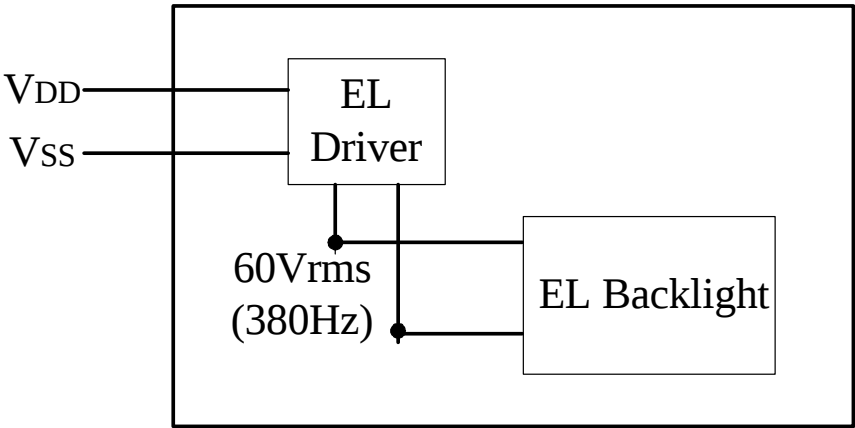
9.1 Specification

(1) EL / white

Parameter	Specification	Unit
Color	White	-
Voltage	Vrms = 60	V(AC)
Frequency	Sine Wave = 380	Hz
Current Density	0.12	mA / cm ²
Bare EL Initial Brightness	15	cd / m ²
LCM Initial Brightness	5	cd / m ²

9.2 Backlight driving methods

a. EL B/L driven





10. Timing Characteristics

(a) 8080 Family Interface Timing

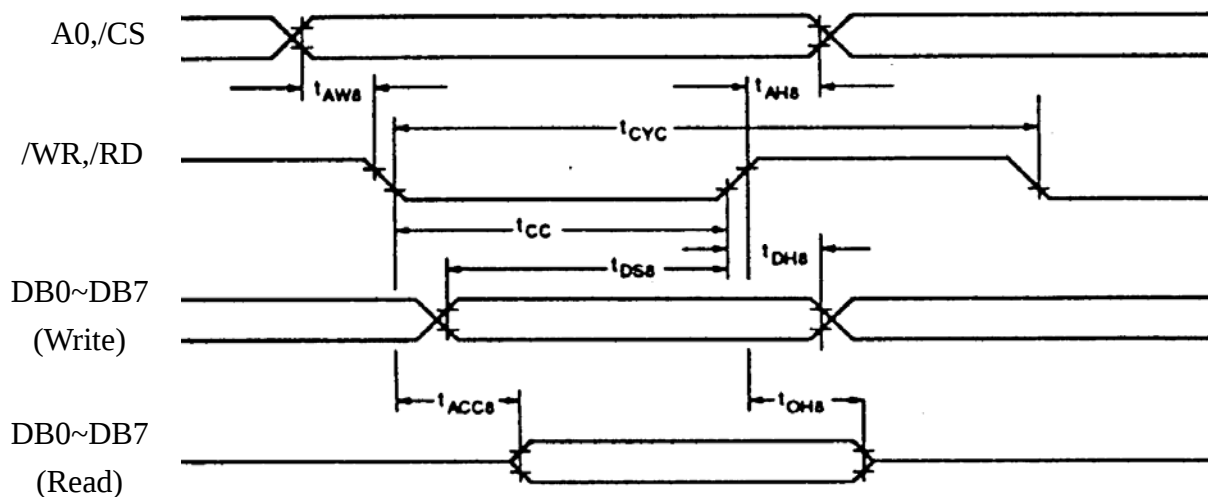
Parameter	Condition	Symbol	Min	Max	Unit	Remark
Address Hold Time	CL=100 pF VDD=2.7~4.5	tAH8	10		ns	A0,/CS
Address Setup Time		tAW8	0		ns	
System Cycle Time		tCYC	Note		ns	/WR,/RD
Strobe Pulse Width		tOC	150		ns	
Data Setup Time		tDS8	120		ns	DB0~DB7
Data Hold Time		tDH8	5		ns	
/RD Access Time		tACC8	-	80	ns	
Output Disable Time		tOH8	10	55	ns	

Note: For memory control and system control commands:

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

For all other commands:

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





(b) 6800 Family Interface Timing

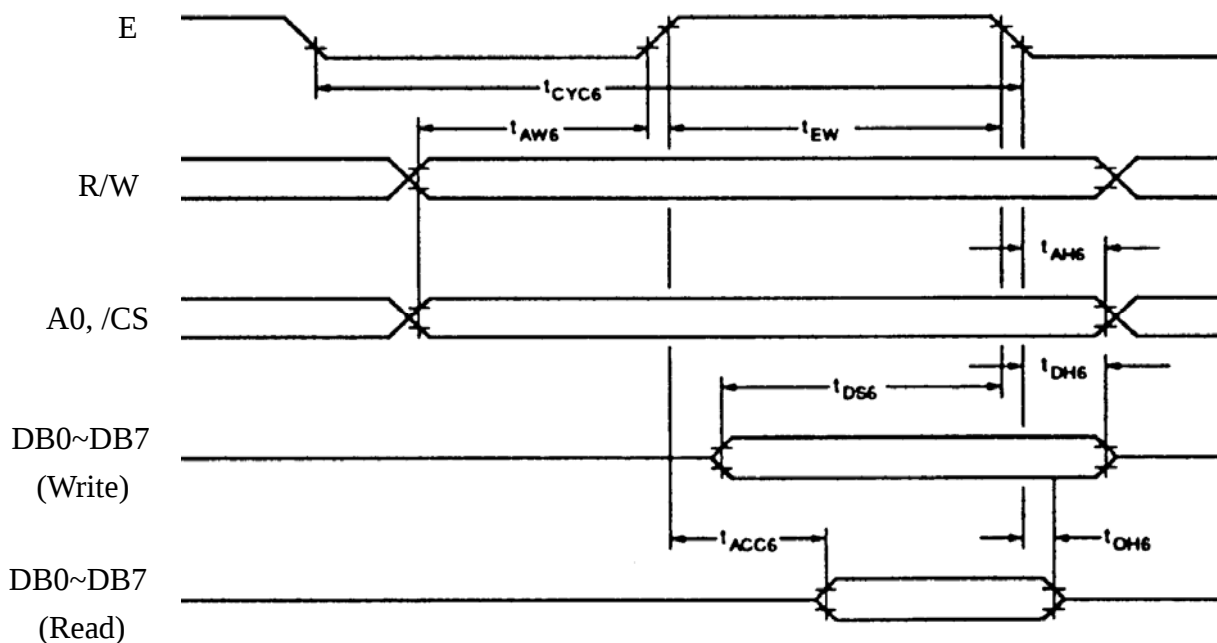
Parameter	Condition	Symbol	Min	Max	Unit	Remark
System Cycle Time	CL=100 pF VDD=2.7 ~4.5	tCYC6	Note		ns	A0,/CS, R/W
Address Setup Time		tAW6	10		ns	
Address Hold Time		tAH6	0		ns	
Data Setup Time		tDS6	120		ns	DB0~D B7
Data Hold Time		tDH6	0		ns	
Output Disable Time		tOH6	10	75	ns	
Access Time		tACC6	-	130	ns	
Enable Pulsewidth		tEW	150	-	ns	E

Note: For memory control and system control commands:

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

For all other commands:

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



AC Electrical Characteristics



11. Quality

11-1. Test Conditions

Tests should be conducted under the following conditions :

Ambient temperature : $25 \pm 5^{\circ}\text{C}$

Humidity : $60 \pm 25\% \text{ RH}$.

11-2. Sampling Plan

Sampling method shall be in accordance with MIL-STD-105E, inspection level II, normal inspection, and single sampling plan tables for normal, tightened, and reduced inspection.

11-3. 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.

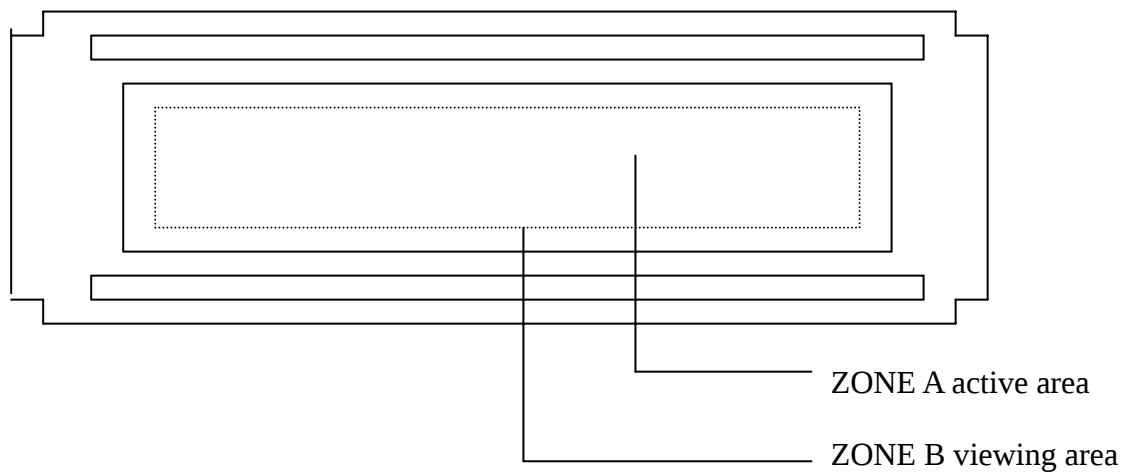
11-4. Appearance

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



11-5. 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	
	$D \leq 0.2$	Disregard				
	$0.2 < D \leq 0.3$	3	4			
	$0.3 < D \leq 0.4$	2	3			
	$0.4 < D$	0	1			
Black lines	Width W, Length L		A	B	Minor	2.5
	$W \leq 0.03$		disregard			
	$0.03 < W \leq 0.05$		3	4		
	$0.05 < W \leq 0.07$, $L \leq 3.0$		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	
Viewing angle	See note 3			Minor	2.5	
Contrast ratio	See note 1			Minor	2.5	
Response time	See note 2			Minor	2.5	





12. Reliability

Test Item	Test Conditions	Note
High Temperature Operation	50±3°C , t=96 hrs	
Low Temperature Operation	0±3°C , t=96 hrs	
High Temperature Storage	70±3°C , t=96 hrs	1,2
Low Temperature Storage	-20±3°C , t=96 hrs	1,2
Humidity Test	40 °C, Humidity 90%, 96 hrs	1,2
Thermal Shock Test	-20°C (30 min.) ~ 25°C (5 min.) ~ 70°C (30 min.) (1 cycle) Total 5 cycle	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.



13. Handling Precautions

- (1) An 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 colour.
- (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.



14. Touch panel Information , RAIO 8835F controller

14-1 Touch panel Information

Parameter	Specification	Condition
ON Resistance	351 Ω ~ 702 Ω	X Axis
	154 Ω ~ 893 Ω	Y Axis
Insulating Resistance	More than 20M Ω	DC 25 V
Chattering	Less Than 10 ms	DC 5V, Load of resistance(1mA), switching Time 2m/sec
Endurable Voltage	25 V for 1 min	

14-2 RAIO 8835 controller

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	SYSTEM	1	0	1	0	1	0	0	0	0	0	0	40	Initialized Device and display	8	8.2.1
Control	SLEEP IN	1	0	1	0	1	0	1	0	0	1	1	53	Enter Standby mode	0	8.2.2
Display Control	DISP	1	0	1	0	1	0	1	1	0	0	D	58	Enable and disable display and	1	8.3.1
	SCROLL	1	0	1	0	1	0	0	0	1	0	0	44	set Display start address and	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	1	0	1	0	1	0	1	1	1	0	0	5C	Set start address of character	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	CSRW	1	0	1	0	1	0	0	0	1	1	0	46	set cursor address	2	8.4.1
Control	CSRR	1	0	1	0	1	0	0	0	1	1	1	47	read cursor address	2	8.4.2
Memory	MWRITE	1	0	1	0	1	0	0	0	0	1	0	42	write to display memory	-	8.5.1
Control	MREAD	1	0	1	0	1	0	0	0	0	1	1	43	read from display memory	-	8.5.2

*Details reference to RAIO 8835 SPEC.



15 Outline dimension
EL or No backlight

