



晶采光電科技股份有限公司  
AMPIRE CO., LTD.

## SPECIFICATIONS FOR LCD MODULE

<b>CUSTOMER</b>	
<b>CUSTOMER PART NO.</b>	
<b>AMPIRE PART NO.</b>	<b>AT-09632K3FIEB50-(R)</b>
<b>APPROVED BY</b>	
<b>DATE</b>	

Approved For Specifications

Approved For Specifications & Sample

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## RECORD OF REVISION

Revision Date	Page	Contents	Editor
2005/9/7	--	New Release	Tony
2005/11/23	3,17	Modify Electro-Optical characteristics and Outline dimension	Tony

## 1 FEATURES

- (1) Display format : 96 × 32 dot-matrix, 1/33 duty, 1/6 Bias.
- (2) Construction : LCD panel, Blue EL backlight and TAB IC
- (3) Display type : FSTN, Transflective, Positive, 6 o'clock view
- (4) LCD Controller :NT7534
- (5) Interface for 8-bits 80 or 6800 series MPU.
- (6) Normal temperature type.
- (7) ROHS compliable.

## 2 MECHANICAL DATA

Parameter	Stand Value	Unit
Dot size	0.235(W) × 0.235(H)	mm
Dot pitch	0.25(W) × 0.25(H)	mm
Viewing area	25.985(W) × 11.0(H)	mm
Module size	33.0(W) × 35.9(H) × 2.25 max (T)	mm

## 3 ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit	
Logic Circuit Supply Voltage	VDD	2.7	3.5	V	
LCD Driving Voltage	VLCD	--	6.0	V	
Input Voltage	VI	VSS	VDD	V	
Normal temp. type	Operating Temp.	TOP	0	50	°C
	Storage Temp.	TSTG	-20	70	°C

## 4 ELECTRO-OPTICAL CHARACTERISTICS

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Note
----- Electronic Characteristics -----							
Logic Circuit Supply Voltage	VDD-VSS	--	2.7	--	3.5	V	
LCD Driving Voltage	V0-VSS	-20 °C	--	--	--	V	Best contrast 1/6 bias
		25 °C	5.2	5.5	5.8		
		70 °C	--	--	--		
Input Voltage	VIH	--	2.2	--	VDD	V	
	VIL	--	VSS	--	0.6	V	
Logic Supply Current	IDD	VDD = 3.0V	--	--	0.3	mA	
----- Optical Characteristics -----							
Contrast	CR	FSTN type	--	7	--		Note 1
Rise Time	tr	25°C	--	200	--	ms	Note 2
Fall Time	tf	25°C	--	200	--	ms	
Viewing Angle Range	θ f	25°C & CR≥2	--	40	--	Deg.	Note 3
	θ b		--	35	--		
	θ l		--	40	--		
	θ r		--	40	--		
Frame Frequency	fF	25°C	--	33	--	Hz	

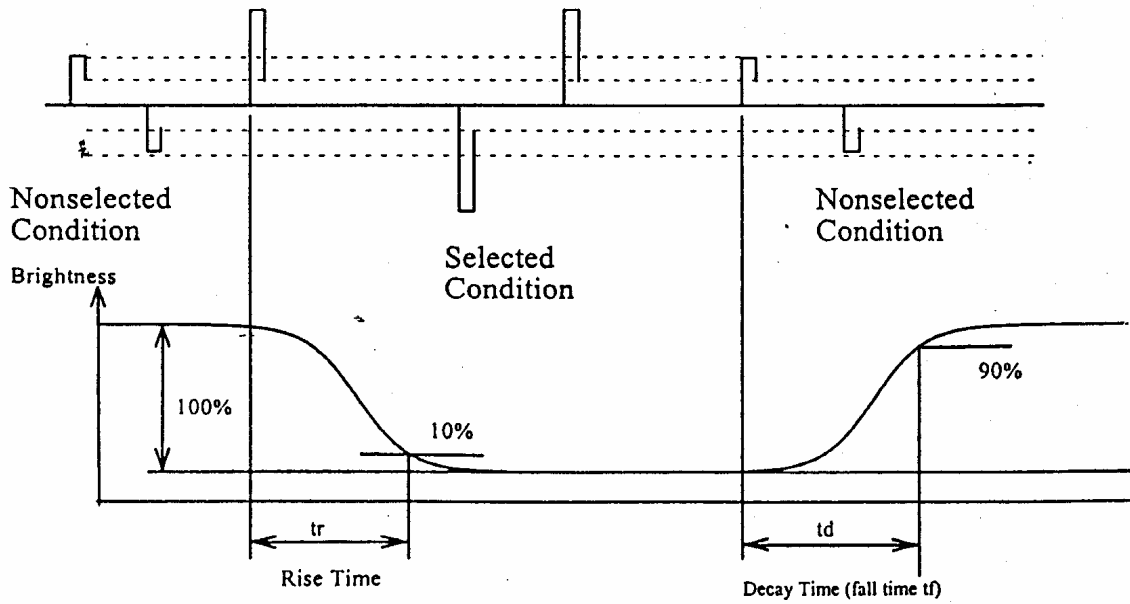
### EL Back-light Electrical Specification

Parameter	Specification	Unit
Color	Blue	-
Voltage	Vrms = 100	V(AC)
Frequency	Sine Wave = 400	Hz
Current Density	0.2	mA / cm <sup>2</sup>
Bare EL Initial Brightness	47	cd / m <sup>2</sup>
LCM Initial Brightness	6	cd / m <sup>2</sup>

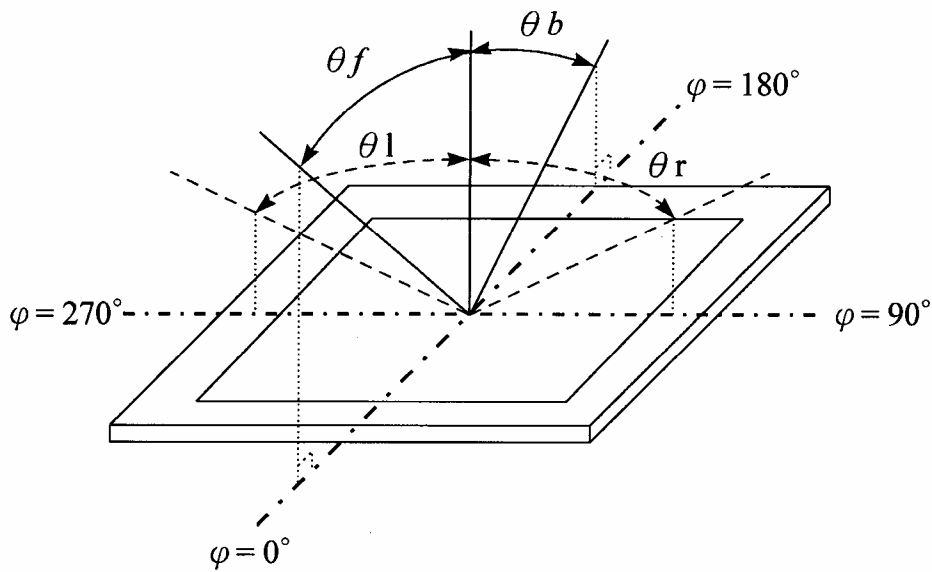
(NOTE 1) Contrast ratio :

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

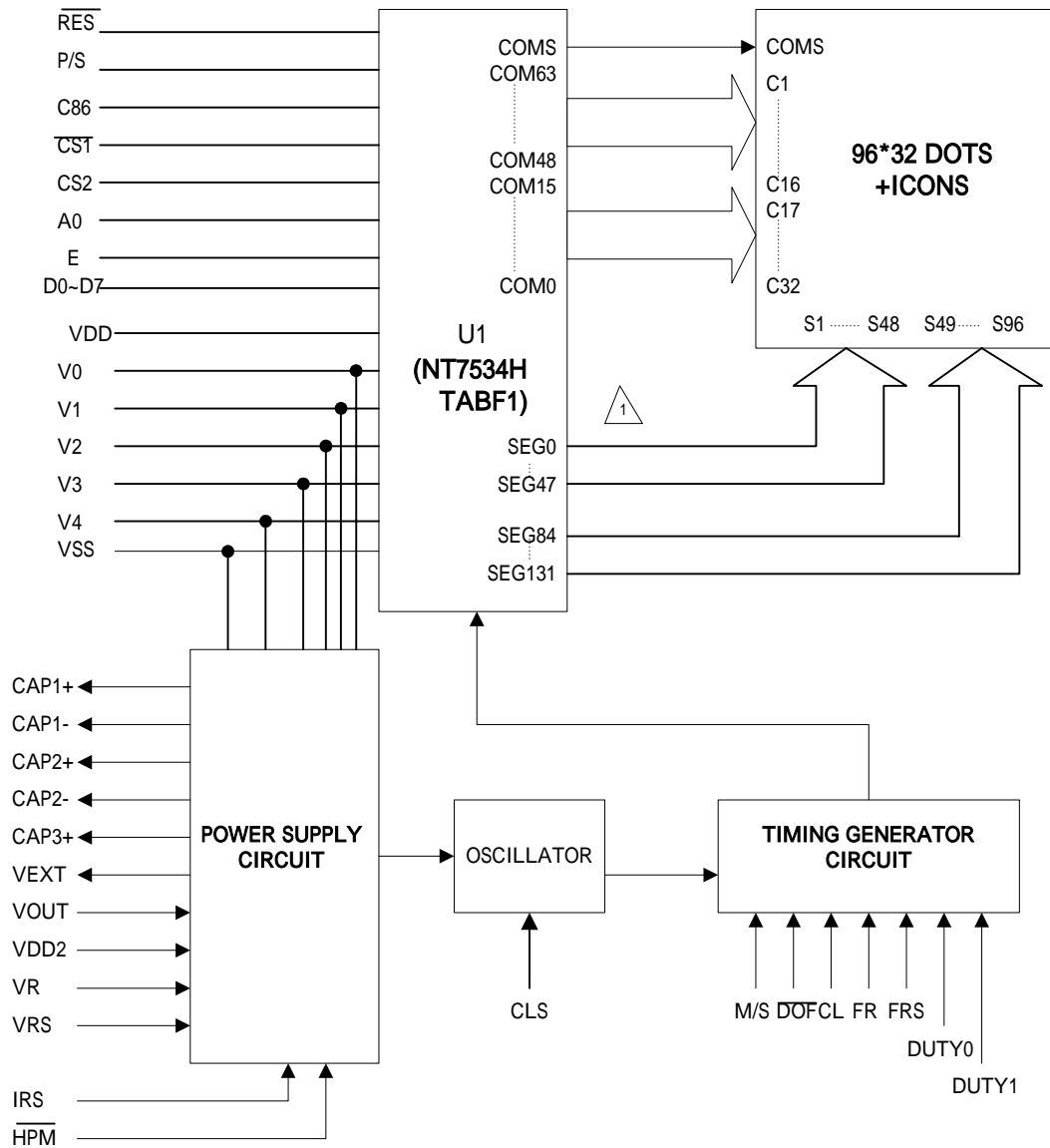
(NOTE 2) Response time :



(NOTE 3) Viewing angle



## 5 BLOCK DIAGRAM



## 6 INTERFACE

No.	Symbol	Function
1~4	NC	No connection
5	FR	M/S="H" Output; M/S="L" Input.
6	CL	This is the display clock input terminal.
7	DOF	M/S="H" Output; M/S="L" Input.
8	NC	No connection
9	CS1	Chip select
10	CS2	Chip select
11	RES	Set="L" Settings are initialized.
12	A0	"H" D0-D7 are display data; "L" D0-D7 are control data.
13	WR	8080 MPU It's active"L"; 6800 MPU "H"Read, "L"Write.
14	RD	8080 MPU It's active"L"; 6800 MPU It's active"H".
15~22	D0~D7	8-bit data bus for 80 series MPU
23	DUTY0	Select the LCD driver duty.
24	DUTY1	Select the LCD driver duty.
25	VDD	Power supply 2.4-3.5V
26	VDD2	This is the reference power supply.
27	VSS	Ground
28	VOUT	DC/DC Voltage Converter.
29	NC	No connection
30	CAP3+	Capacitor3+ pad for internal DC/DC Voltage Converter.
31	CAP1-	Capacitor1- pad for internal DC/DC Voltage Converter.
32	CAP1+	Capacitor1+ pad for internal DC/DC Voltage Converter.
33	CAP2+	Capacitor2+ pad for internal DC/DC Voltage Converter.
34	CAP2-	Capacitor2- pad for internal DC/DC Voltage Converter.
35	VEXT	Vext must be > 2.4V and < Vdd2.
36	VRS	"0" using the external Vref; "1" using the internal Vref.
37	V1	LCD driver supply voltage:
38	V2	Voltage should have the following relationship; $V0 \geq V1 \geq V2 \geq V3 \geq V4 \geq Vss$
39	V3	
40	V4	
41	V0	
42	VR	Voltage adjustment pad.
43	M/S	Select the Master/Slave operation.
44	CLS	"H" internal oscillator circuit is enabled. "L" internal oscillator circuit is disabled.

45	C86	"H" 6800 Series MPU interface; "L" 8080 MPU interface.
46	P/S	This is parallel data.
47	HPM	"H" Normal mode; "L" Hight power mode.
48	IRS	"H" use the internal resistors "L" Don't use the internal resistors
49	NC	No connection



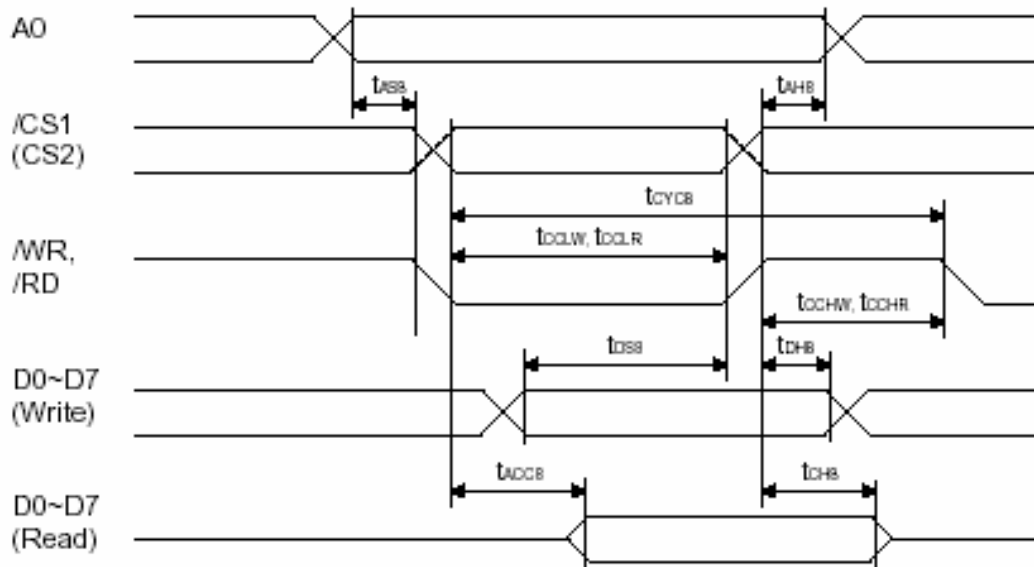
## 7 INSTRUCTION SET

Command	A0	/RD	/WR	Code								Hex	Function	
				D7	D6	D5	D4	D3	D2	D1	D0			
(1) Display OFF	0	1	0	1	0	1	0	1	1	1	0	1	AEh AFh	Turn on LCD panel when high, and turn off when low
(2) Display Start Line Set	0	1	0	0	1	Display Start Address					40h to 7Fh	Specifies RAM display line for COM0		
(3) Page Address Set	0	1	0	1	0	1	1	Page Address				B0h to B8h	Set the display data RAM page in Page Address register	
(4) Column Address Set	0	1	0	0	0	0	1	Higher Column Address				00h to 18h	Set 4 higher bits and 4 lower bits of column address of display data RAM in register	
	0	1	0	0	0	0	0	Lower Column Address						
(5) Read Status	0	0	1	Status				0	0	0	0	XX	Reads the status information	
(6) Write Display Data	1	1	0	Write Data								XX	Write data in display data RAM	
(7) Read Display Data	1	0	1	Read Data								XX	Read data from display data RAM	
(8) ADC Select	0	1	0	1	0	1	0	0	0	0	0	1	A0h A1h	Set the display data RAM address SEG output correspondence
(9) Normal/Reverse Display	0	1	0	1	0	1	0	0	1	1	0	1	A6h A7h	Normal indication when low, but full indication when high
(10) Entire Display ON/OFF	0	1	0	1	0	1	0	0	1	0	0	1	A4h A5h	Select normal display (0) or entire display on
(11) LCD Bias Set	0	1	0	1	0	1	0	0	0	1	0	1	A2h A3h	Sets LCD driving voltage bias ratio
(12) Read-Modify-Write	0	1	0	1	1	1	0	0	0	0	0	0	E0h	Increments column address counter during each write
(13) End	0	1	0	1	1	1	0	1	1	1	0	0	EEh	Releases the Read-Modify-Write
(14) Reset	0	1	0	1	1	1	0	0	0	1	0	0	E2h	Resets internal functions
(15) Common Output Mode Select	0	1	0	1	1	0	0	0	1	*	*	*	C0h to CFh	Select COM output scan direction *: invalid data
(16) Power Control Set	0	1	0	0	0	1	0	1	Operation Status			28h to 2Fh	Select the power circuit operation mode	
(17) V0 Voltage Regulator Internal Resistor ratio Set	0	1	0	0	0	1	0	0	Resistor Ratio			20h to 27h	Select internal resistor ratio Rb/Ra mode	
(18) Electronic Volume mode Set Electronic Volume Register Set	0	1	0	1	0	0	0	0	0	0	0	1	81h	
	0	1	0	*	*	Electronic Control Value					XX	Sets the V0 output voltage electronic volume register		
(19) Set Static indicator ON/OFF Set Static Indicator Register	0	1	0	1	0	1	0	1	1	0	0	1	ACh ADh	Sets static indicator ON/OFF 0: OFF, 1: ON
	0	1	0	*	*	*	*	*	*	Mode		XX	Sets the flash mode	
(20) Power Save	0	1	0	-	-	-	-	-	-	-	-	-	-	Compound command of Display OFF and Entire Display ON
(21) NOP	0	1	0	1	1	1	0	0	0	1	1	1	E3h	Command for non-operation

Command	A0	/RD	/WR	Code								Hex	Function	
				D7	D6	D5	D4	D3	D2	D1	D0			
(22)Oscillation Frequency Select	0	1	0	1	1	1	0	0	1	0	0	1	E4h E5h	Select the oscillation frequency
(23)Partial Display mode Set	0	1	0	1	0	0	0	0	0	1	0	1	82h 83h	Enter/Release the partial display mode
(24)Partial Display Duty Set	0	1	0	0	0	1	1	0	Duty Ratio			30h 37h	Sets the LCD duty ratio for partial display mode	
(25)Partial Display Bias Set	0	1	0	0	0	1	1	1	Bias Ratio			38h 3Fh	Sets the LCD bias ratio for partial display mode	
(26)Partial Start Line Set	0	1	0	1	1	0	1	0	0	1	1	D3h	Enter Partial Start Line Set	
Partial Start Line Set	0	1	0	1	1	Partial Start Line					XX	Sets the LCD Number of partial display start line		
(27)N-Line Inversion Set	0	1	0	1	0	0	0	0	1	0	1	85h	Enter N-Line inversion	
Number of Line Set	0	1	0	*	*	*	Number of Line				XX	Sets the number of line used for N-Line inversion		
(28)N-Line Inversion Release	0	1	0	1	0	0	0	0	1	0	0	84h	Exit N-Line Inversion	
(29)DC/DC Clock Set	0	1	0	1	1	1	0	0	1	1	0	E6h	Set DC/DC Clock Frequency	
DC/DC Clock Division Set	0	1	0	1	1	0	0	Clock Division			XX	Set the Division of DC/DC Clock Frequency		
(30)Test Command	0	1	0	1	1	1	1	*	*	*	*	F1h to FFh	IC test command. Do not use!	
(31)Test Mode Reset	0	1	0	1	1	1	1	0	0	0	0	F0h	Command of test mode reset	

## 8 TIMING CHARACTERISTICS

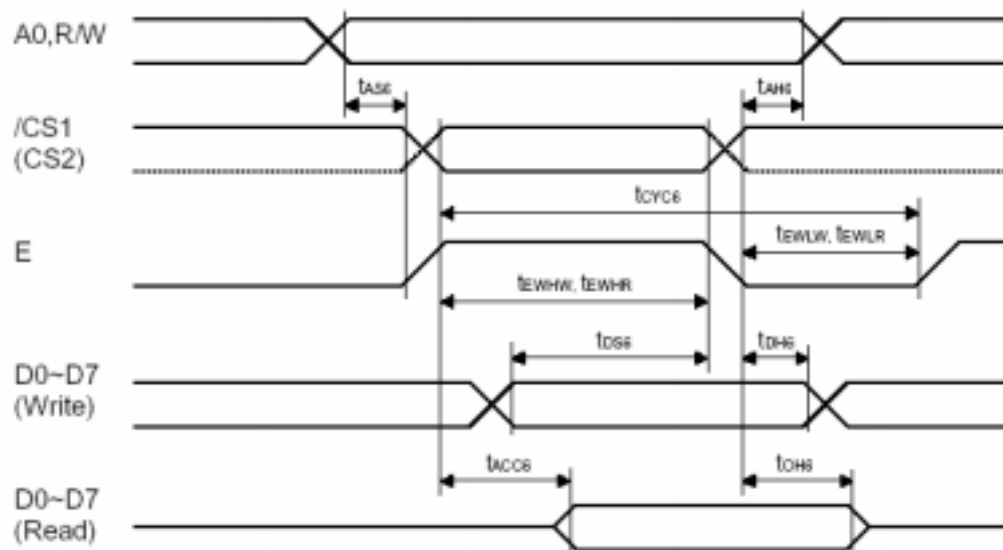
### 1. System Buses Read/Write Characteristics (for 8080 Series MPU)



(VDD = 2.7 ~ 3.6V, Ta = -40 ~ +85°C)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
tAHS	Address hold time	0	-	-	ns	A0
tAss	Address setup time	0	-	-	ns	
tCYCS	System cycle time	240	-	-	ns	
tCCLW	Control low pulse width (write)	120	-	-	ns	/WR
tCCLR	Control low pulse width (read)	120	-	-	ns	/RD
tCCHW	Control high pulse width (write)	100	-	-	ns	/WR
tCCHR	Control high pulse width (read)	100	-	-	ns	/RD
tDSS	Data setup time	40	-	-	ns	D0~D7
tDHS	Data hold time	10	-	-	ns	
tACCs	/RD access time	-	-	140	ns	D0~D7, CL = 100pF
tCHS	Output disable time	5	-	50	ns	

## 2. System Buses Read/Write Characteristics (for 6800 Series MPU)



(VDD = 2.7 ~ 3.6V, Ta = -40 ~ +85°C)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
$t_{AHS}$	Address hold time	0	-	-	ns	A0, R/W
$t_{Ass}$	Address setup time	0	-	-	ns	
$t_{CYCS}$	System cycle time	240	-	-	ns	
$t_{EWHW}$	Control low pulse width (write)	120	-	-	ns	E
$t_{EWHR}$	Control low pulse width (read)	120	-	-	ns	E
$t_{EWLW}$	Control high pulse width (write)	100	-	-	ns	E
$t_{EWLR}$	Control high pulse width (read)	100	-	-	ns	E
$t_{DSS}$	Data setup time	40	-	-	ns	D0~D7
$t_{DHS}$	Data hold time	10	-	-	ns	
$t_{ACCs}$	/RD access time	-	-	140	ns	D0~D7 CL = 100pF
$t_{OHS}$	Output disable time	5	-	50	ns	

## **9 QUALITY AND RELIABILITY**

### **9.1 TEST CONDITIONS**

Tests should be conducted under the following conditions :

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

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

### **9.2 SAMPLING PLAN**

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

### **9.3 ACCEPTABLE QUALITY LEVEL**

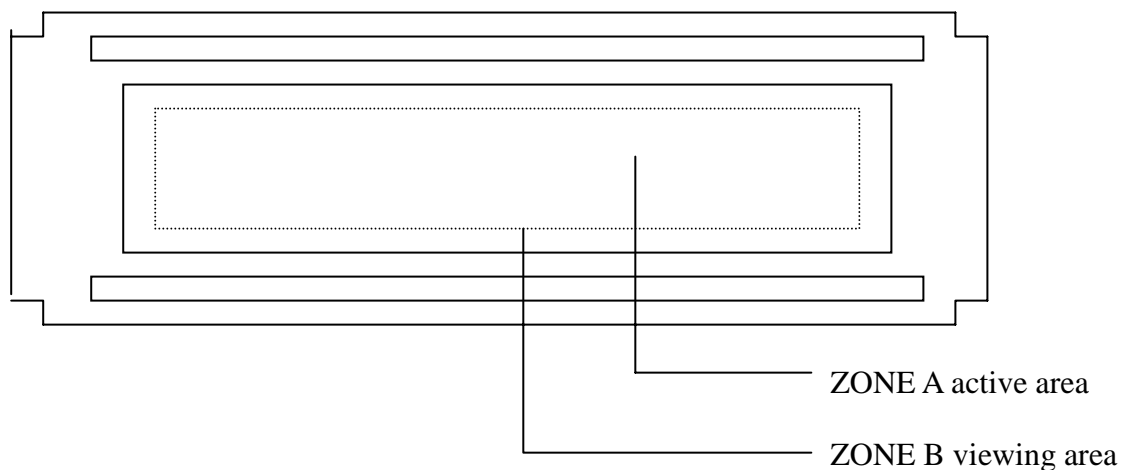
A major defect is defined as one that could cause failure to or materially reduce the usability of the unit for its intended purpose. A minor defect is one that does not materially reduce the usability of the unit for its intended purpose or is an infringement from established standards and has no significant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

### **9.4 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.

## 9.5 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



## 9.6 RELIABILITY

Test Item	Test Conditions	Note
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
Thermal Shock Test	-30°C ~ 25°C ~ 80°C 30 min. 5 min. 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.

## **10 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 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.



