SPECIFICATIONS FOR
LCD MODULE

CUSTOMER	
CUSTOMER PART NO.	
AMPIRE PART NO.	**12864ESTQW-00H-A(R)**
APPROVED BY	
DATE	

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

APPROVED BY	CHECKED BY	ORGANIZED BY

RECORD OF REVISION

Revision Date	Page	Contents	Editor
2006/5/30	-	New Release	Kokai
2007/6/5	4-6	Modify White LED Back-light Characteristics	Edward

1 FEATURES

(1)   Display format : 128 × 64 dot-matrix ; 1/ 64 duty.

(2)   Construction : LCD, Bezel, Zebra, White Edge LED back-light, connector and PCB.

(3)   Display type : STN, Negative 6 o'clock view.

(4)   Controller : S6B0108 or equivalent..

(5)   +5V single power input. Built-in DC/DC converter for LCD driving.

(6)   Extended temperature type.

(7)   ROHS compliant.

2 MECHANICAL DATA

Parameter	Standard Value	Unit
Dot size	0.40(W) × 0.40(H)	mm
Dot pitch	0.43(W) × 0.43(H)	mm
Viewing area	60.0(W) × 32.5(H)	mm
Module size (with LED back-light)	75.0(W) × 52.7(H) × 9.0 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	16.0	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	--	4.5	5.0	5.5	V	
LCD Driving Voltage	VDD-VO	-20 °C	7.9	8.3	8.7	V	-20 ~ 70 °C for Extended Temp. type
		0 °C	7.8	8.2	8.6		
		25 °C	7.7	8.1	8.5		
		50 °C	7.6	8.0	8.4		
		70 °C	7.5	7.9	8.3		
Input Voltage	VIH	--	0.7 VDD	--	VDD	V	
	VIL	--	VSS	--	0.3 VDD	V	
Supply Current	IDD	VDD = 5V	--	18	24	mA	
----- Optical Characteristics -----							
Contrast	CR	STN type	--	5	--		Note 1
Rise Time	tr	25°C	--	140	--	ms	Note 2
Fall Time	tf	25°C	--	240	--	ms	
Viewing Angle Range	θ f	25°C & CR≥2	--	40	--	Deg.	Note 3
	θ b		--	35	--		
	θ l		--	35	--		
	θ r		--	35	--		
Frame Frequency	fF	25°C	--	64	--	Hz	
----- White LED Back-light Characteristics -----							
Parameter	Symbol	Condition	Min	Typ	Max	Unit	Note
Forward Current	IF	--	--	45	60	mA	Note 4 & 7
LCM Luminous intensity (Full White pattern)		IF=45mA	--	15	--	cd/m^2	Note 4
Forward Voltage	VF	IF=45mA	--	3.2	3.5	V	Note 5
LED C.I.E	X	IF=45mA	0.26	0.30	0.34		Note 6
	Y	IF=45mA	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
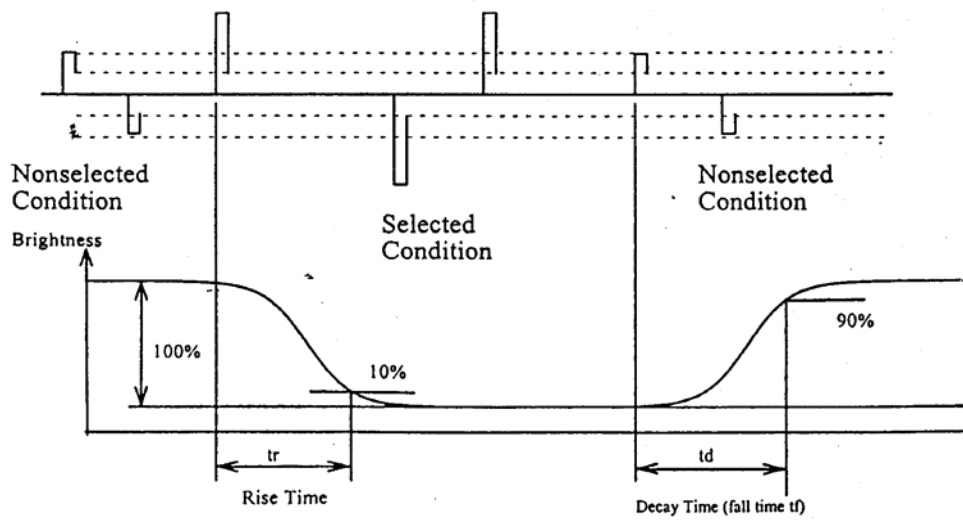
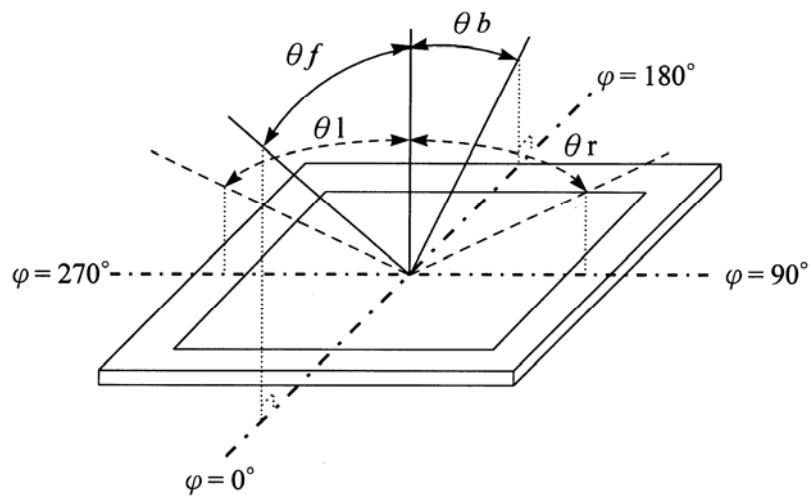Note 6: White LEDs are with color tolerance

* LED Dice number =3
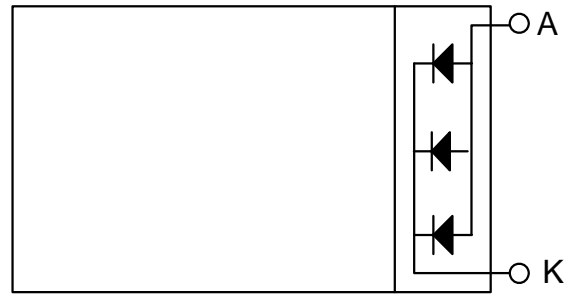
(NOTE 1) Contrast ratio :
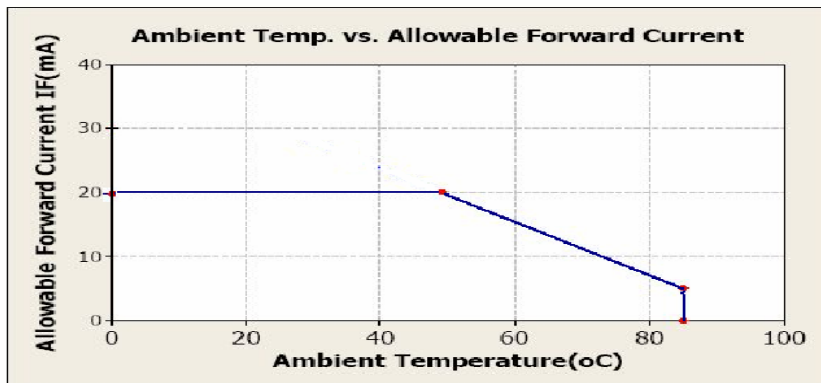
CR = (Brightness in OFF state) / (Brightness in ON state)

(NOTE 2) Response time :

Nonselected
Condition

Selected
Condition

Nonselected
Condition

Brightness

100%

10%

90%

tr

Rise Time

td

Decay Time (fall time tf)

(NOTE 3) Viewing angle

θb

θf

$\varphi = 180°$

$\theta 1$

θr

$\varphi = 270°$

$\varphi = 90°$

$\varphi = 0°$

(Note 7) One LED

5   BLOCK DIAGRAM & POWER SUPPLY
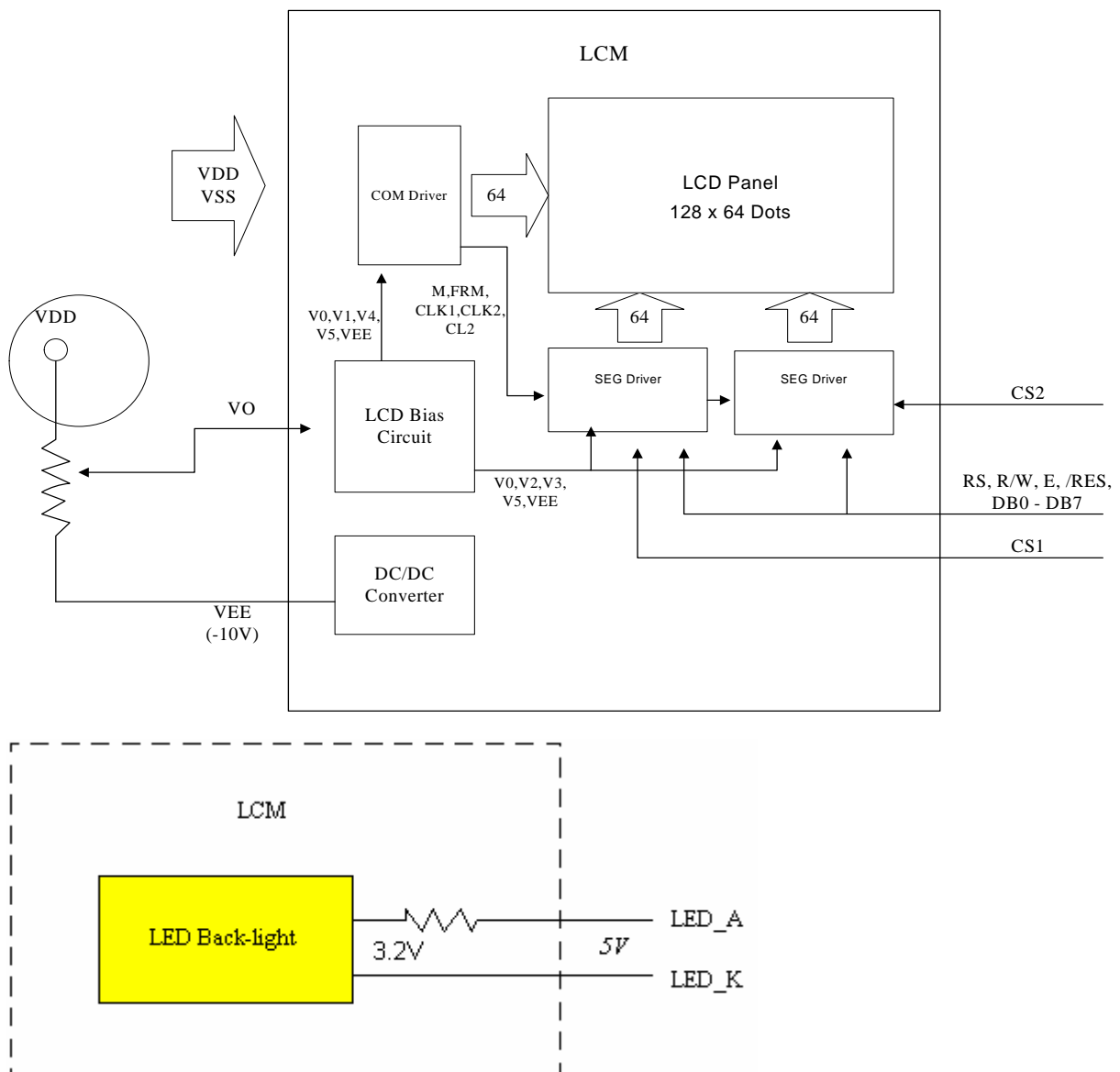
6 PIN CONNECTIONS

Pin No.	Symbol	Function
1	VDD	Power Supply (+5V)
2	VSS	Ground (0V)
3	VO	Power Supply For LCD (VDD-VO=LCD Driving Voltage)
4-10	DB0-DB7	Data Bus
12	/CS1	Chip Selection For Segment IC1
13	/CS2	Chip Selection For Segment IC2
14	/RST	Reset
15	R/W	H: Data Read L: Data Write
16	D/I	Data or Instruction
17	E	Enable Signal
18	VEE	Negative Voltage Output
19,20	LEDA,K	LED Supply Voltage (5V)

7 TIMING CHARACTERISTICS

7.1 WRITING OPERATION

ITEM		SYMBOL	MIN	TYP	MAX	UNIT
ENABLE CYCLE TIME		tCYCLE	1.0	-	-	us
ENABLE PULSE WIDTH	HIGH LEVEL	PWEH	450	-	-	ns
	LOW LEVEL	PWEL	450	-	-	ns
ENABLE RISE & FALL TIME		tER,tEF	-	-	25	ns
ADDRESS SET-UP TIME		tAs	140	-	-	ns
ADDRESS HOLD TIME		tAH	10	-	-	ns
DATA SET-UP TIME		tDSW	200	-	-	ns
DATA HOLD TIME		tDHW	10	-	-	ns
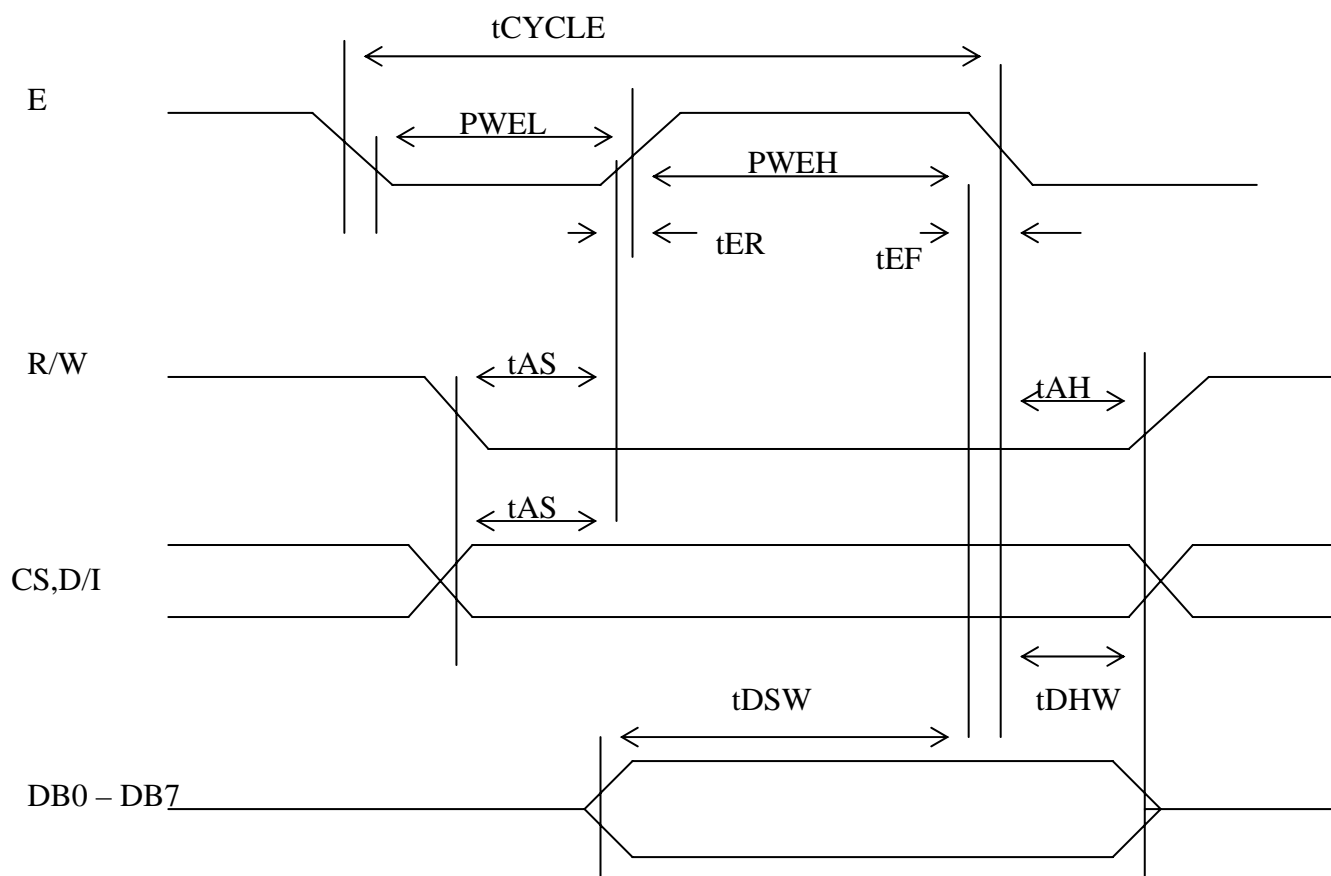
7.2 READ OPERATION

ITEM		SYMBOL	MIN	TYP	MAX	UNIT
ENABLE CYCLE TIME		tCYCLE	1.0	-	-	us
ENABLE PULSE WIDTH	HIGH LEVEL	PWEH	450	-	-	ns
	LOW LEVEL	PWEL	450	-	-	ns
ENABLE RISE & FALL TIME		tER,tEF	-	-	25	ns
ADDRESS SET-UP TIME		tAs	140	-	-	ns
ADDRESS HOLD TIME		tAH	10	-	-	ns
DATA SET-UP TIME		tDDR	-	-	320	ns
DATA HOLD TIME		tDHW	20	-	-	ns

7.3 Power ON/OFF Sequence

POWER ON SEQUENCE

VDD

VSS

0~50 ms

Signal

VSS

T≥20 ms

VO

VSS

VSS

POWER OFF SEQUENCE

VDD

VSS

0 ~ 50 ms

T≥20 ms

Signal

VSS

VSS

VO
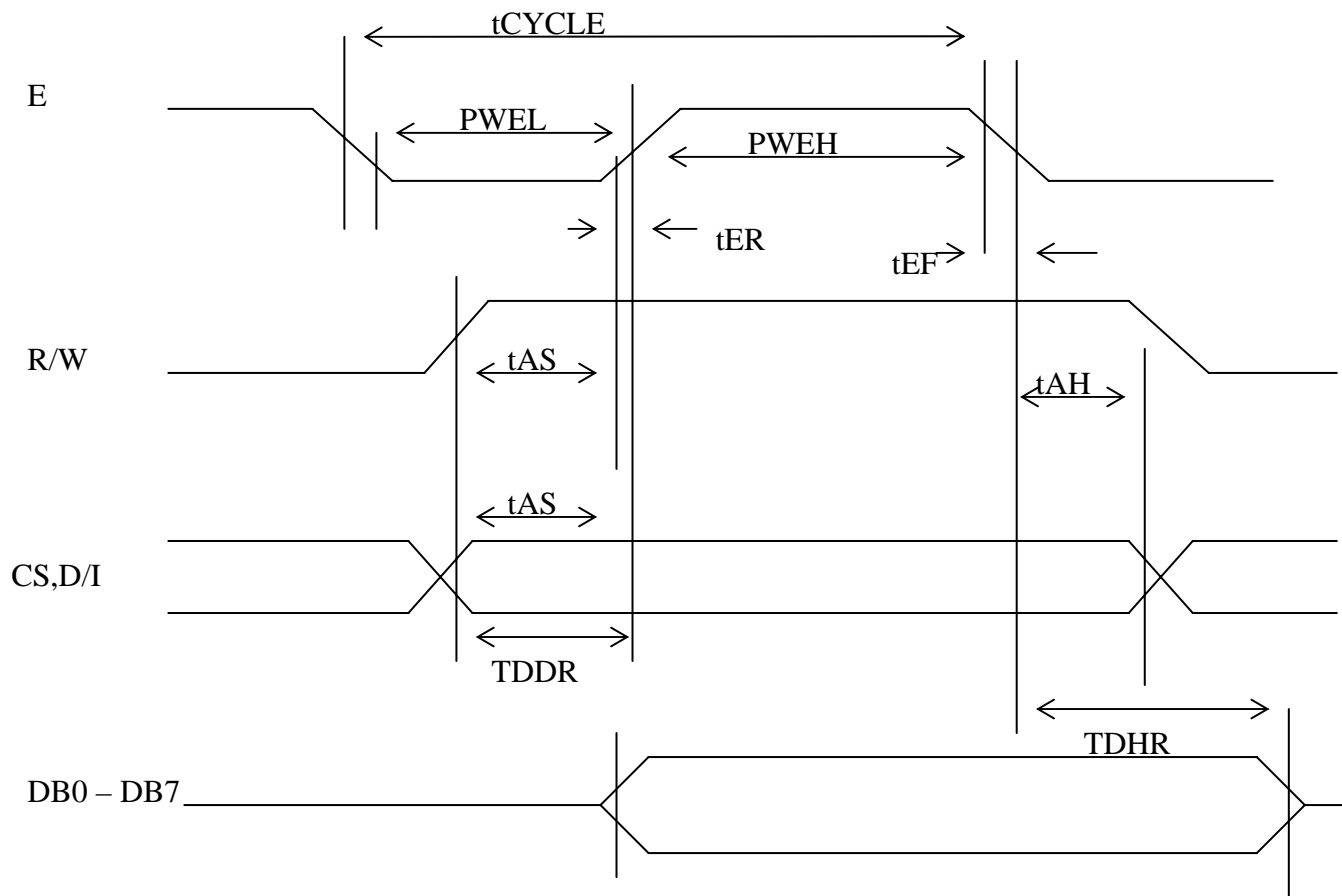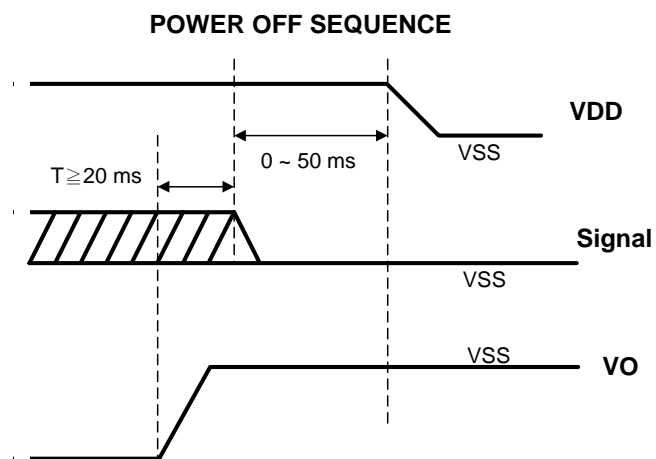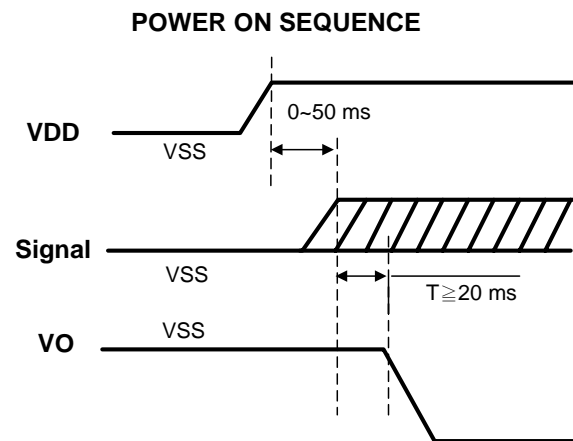
8 INSTRUNTION SET

The display control instructions control the internal state of the KS0108B. Instruction is received from MPU to KS0108B for the display control. The following table shows various instructions.

Instruction	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Function
Display ON/OFF	L	L	L	L	H	H	H	H	H	L/H	Controls the display on or off. Internal status and display RAM data is not affected. L:OFF, H:ON
Set Address (Y address)	L	L	L	H	Y address (0–63)						Sets the Y address in the Y address counter.
Set Page (X address)	L	L	H	L	H	H	H	Page (0–7)			Sets the X address at the X address register.
Display Start Line (Z address)	L	L	H	H	Display start line (0–63)						Indicates the display data RAM displayed at the top of the screen.
Status Read	L	H	BUSY	L	ON/OFF	RESET	L	L	L	L	Read status. BUSY L: Ready H: In operation ON/OFF L: Display ON H: Display OFF RESET L: Normal H: Reset
Write Display Data	H	L	Write Data								Writes data (DB0:7) into display data RAM. After writing instruction, Y address is increased by 1 automatically.
Read Display Data	H	H	Read Data								Reads data (DB0:7) from display data RAM to the data bus.

9   QUALITY AND RELIABILITY

9.1   TEST CONDITIONS

Tests should be conducted under the following conditions :

Ambient temperature   : $25 \pm 5°C$

Humidity   : $60 \pm 25\%$ 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

ZONE A active area

ZONE B viewing area
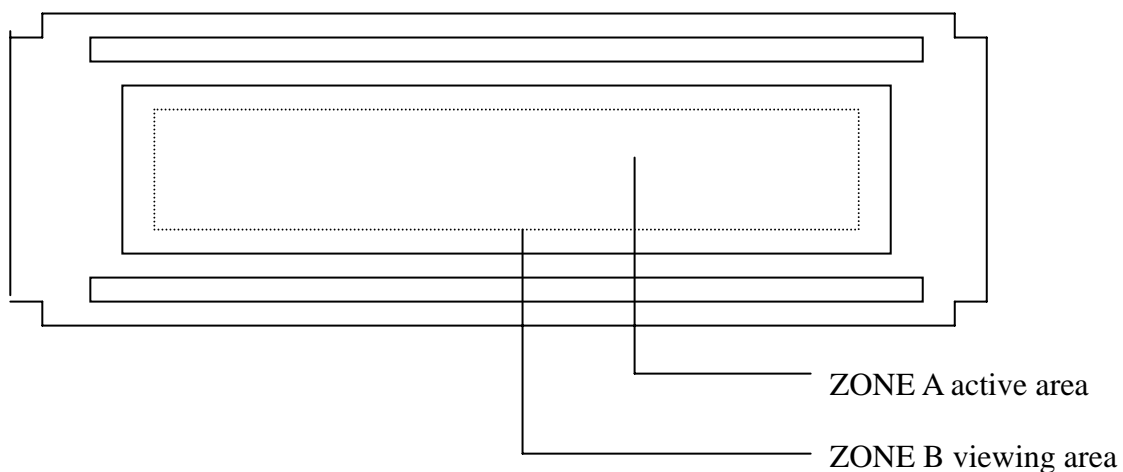
9.6 RELIABILITY

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
ESD Test	Cp=200pF, R=100Ω Air-discharge ±10KV Shot times : every step 10 times total 60 times.	2
Vibration Test (Without Packing)	Sweep frequency :10 ~ 55 ~ 10 Hz/1min Amplitude : 1.5mm Test direction : X.Y.Z/3 axis Duration : 30min/each axis	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) 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 OUTLINE DIMENSION

A Block

LED H=2.5

9.0Max.

5.5±0.3

1.0

0.4
0.43
0.4
0.43

3.5

Note:
1. Unless indicated, Tolerance Grade "B" is adopted.

1	VDD	11 DB7
2	VSS	12 /CS1
3	VO	13 /CS2
4	DB0	14 /RST
5	DB1	15 R/W
6	DB2	16 D/I
7	DB3	17 E
8	DB4	18 VEE
9	DB5	19 LEDA
10	DB6	20 LEDK

P2.54x19=48.26
20-φ1.0
2-φ2.5
2-R1.25
71.1±0.3
70.0±0.3
55.01 |A,A|
60.0±0.2 |V,A|
70.0±0.3
75.0±0.5
52.7±0.5
49.7±0.3
9.995
13.37
2.5
0.4
2.5
7.5
2.5
44.7±0.3
32.5±0.2 |V,A|
27.49 |A,A|
13.605
111
5.0

A	B	DIM.	DWN.	DATE	MIN.	TITLE	
			EMILY	06-03-03			
		IE NO.	CHK.	DATE			12864E-Q
		PARTS NO. LCM	APPD.	DATE	12864E-Q		
					12864E-Q		

TOLERANCE GRADE(±)

		A	B		
1	T12864-52-0				7
2	~6	0.05	0.1		8
3	6~18	0.08	0.18		9
4	18~50	0.1	0.25		10
5	50~180	0.2	0.4		11
6	180~	0.3	0.5		12

DWG. NO. *O30605MA
SHEET 1 OF 1