

A Brighter Solution

AMP DISPLAY INC.

SPECIFICATIONS

GRAPHIC LCD MODULE

CUSTOMER:	
CUSTOMER PART NO.	
AMP DISPLAY PART NO.	A G - 1 2 8 6 4 E
APPROVED BY:	
DATE:	

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APPROVED FOR SPECIFICATIONS

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APPROVED FOR SPECIFICATION AND PROTOTYPES

AMP DISPLAY INC

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RECORD OF REVISION

Revision Date	Contents	Editor	Checked by
1999/11/25	New Release		
2000/7/16	Add the 3.3V-version option		
2000/10/6	Add power on / off sequence		
	Modify sampling plan		
2001/12/12	Modify LED characteristic		
2003/6/18	Add EL characteristic		
2003/12/19	Modify the outline dimension & Interface.	Spencer	
2007/1/30	Modify EL Back-light Characteristics	Edward	

1 FEATURES

- (1) Display format : 128 × 64 dot-matrix ; 1/ 64 duty.
- (2) Construction : STN / FSTN LCD, Bezel, Zebra, Heat Seal and PCB.
- (3) Optional Edge type LED back-light / EL Back-light.
- (4) Controller : KS0108B.
- (5) +5V* single power input. Built-in DC/DC converter for LCD driving.
- (6) Normal / Extended temperature type.

*3.3V version is also available, the controller has to be changed to AX6108. Please indicate while ordering. But the LED back-light still needs 5V.

2 NUMBERING SYSTEM

AG-12864E _ _ _ _ - _
1 2 3 4 5

No	Code Value	Description	Remark
1	G	STN gray type LCD	LCD Type
	Y	STN yellow green type LCD	
	S	STN negative type LCD	
	F	FSTN type LCD	
2	A	Reflective type / 6:00 view	Polarizer / Viewing Angel
	B	Reflective type / 12:00 view	
	I	Transflective type / 6:00 view	
	J T	ransflective type / 12:00 view	
	T	Negative type / 6:00 view	
	U	Negative type / 12:00 view	
3	None W	ithout backlight	Backlight type
	Q	Edge light LED	
	E EL	Back-light	
4	None W	ithout backlight	Backlight color
	Y	Yellow-green (LED only)	
	W	Blue (EL only)	
	B	White (EL only)	
5	None	Normal temperature type	LCM temperature type
	H Extended	temperature type	

3 MECHANICAL DATA

Parameter	Stand 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	75.0(W) × 52.7(H) × 6.8 max (T)	mm
Module size (w/ LED back-light)	75.0(W) × 52.7(H) × 9.0 max (T)	mm

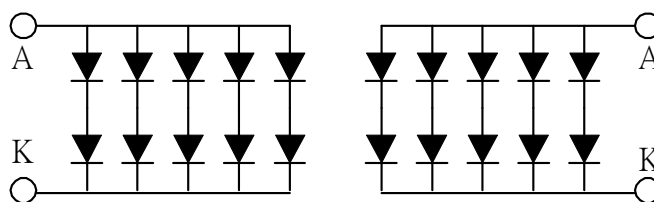
4 ABSOLUTE MAXIMUM RATINGS

Parameter		Symbol	Min	Max	Unit
Logic Circuit Supply Voltage		VDD-VSS	0 7.0		V
LCD Driving Voltage		VDD-VO	0 16		V
Input Voltage		VI	VSS VDD		V
Normal temp. type	Operating Temp.	TOP 0		50	°C
	Storage Temp.	TSTG -20		70	°C
Extended temp. type	Operating Temp.	TOP -20		70	°C
	Storage Temp.	TSTG -30		80	°C

5 ELECTRO-OPTICAL CHARACTERISTICS

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Note
----- Electronic Characteristics -----							
Logic Circuit Supply Voltage	VDD-VSS	--	2.7	5.0	5.5	V	
LCD Driving Voltage	VDD-VO	-20 °C	7.9	8.3	8.7	V	0 ~ 50 °C for Normal Temp. type -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	
Logic Supply Current	IDD	VDD = 5V	--	3.0	4.0	mA	
----- Optical Characteristics -----							
Contrast	CR	STN type	-- 5 --			Note	1
		FSTN type	7				
Rise Time	tr	25°C	-- 150		225	ms	Note 2
Fall Time	tf	25°C	-- 200		300	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	-- 70 --			Hz	
----- LED Back-light Characteristics -----							
Forward Voltage	VF	--	--	4.05	4.3	V	Supply Voltage between A&K
Forward Current	IF	VF=4.05V	-- 100 --			mA	
LCM Luminous intensity		VF=4.05V	--	8	--	cd/m ²	

* LED Dice number = 2x10=20

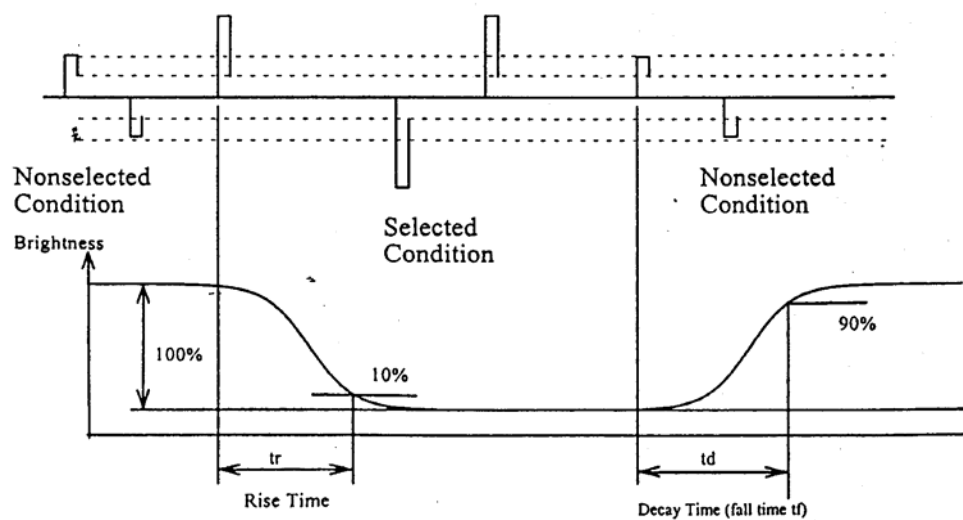


Parameter	Min	Typ	Max	Unit	Note
----- EL Back-light Characteristics -----					
Driving Voltage	--	110	--	Vrms	
Frequency	-- 400	--		Hz	
Bare EL Luminous intensity	--	50	--	cd/m ²	
LCM Luminous intensity	--	5	--	cd/m ²	

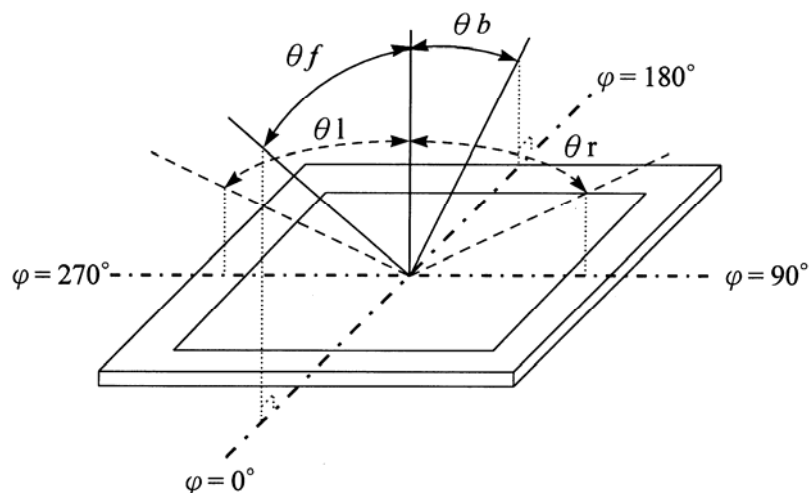
(NOTE 1) Contrast ratio :

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

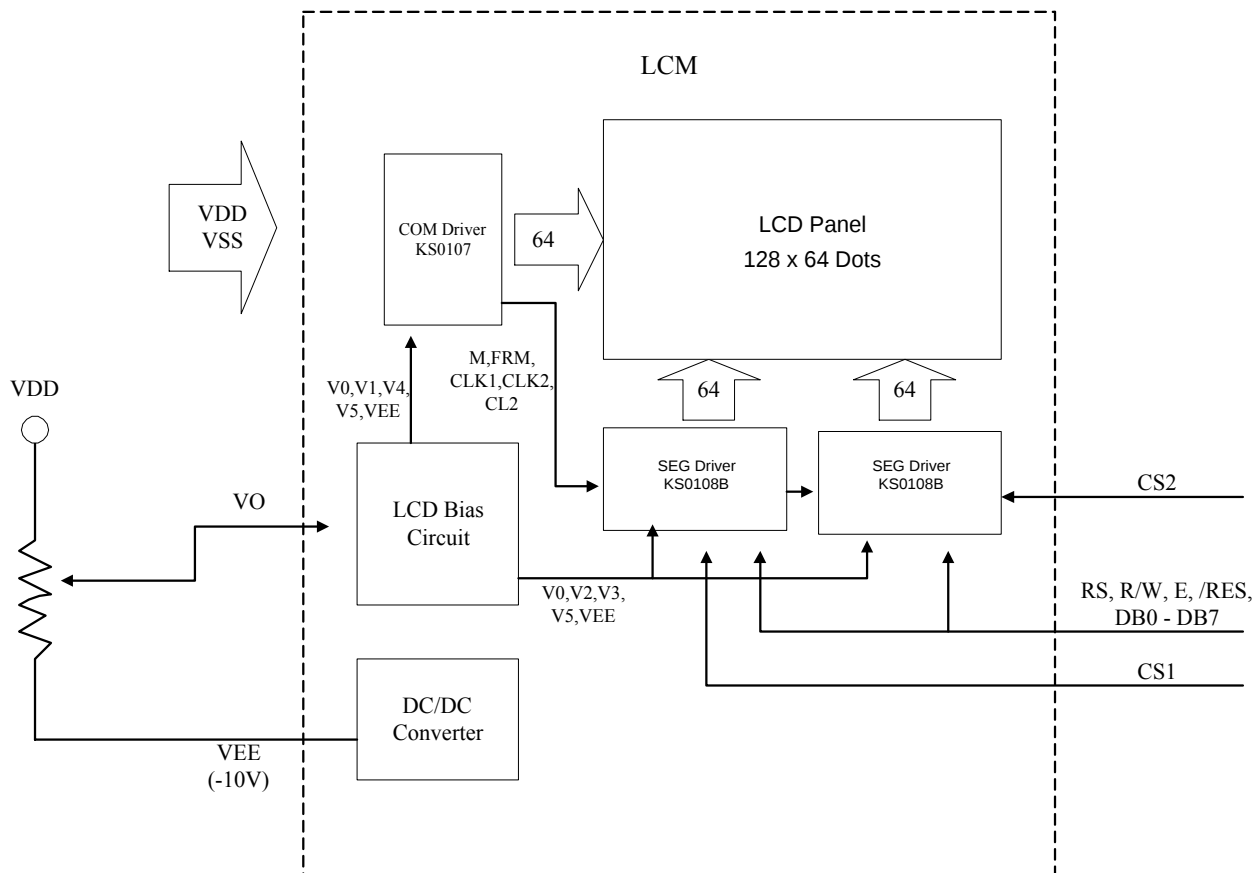
(NOTE 2) Response time :



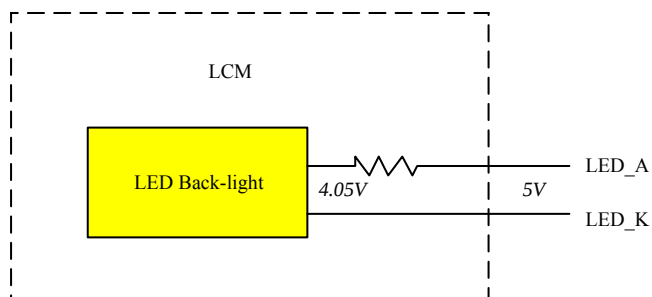
(NOTE 3) Viewing angle



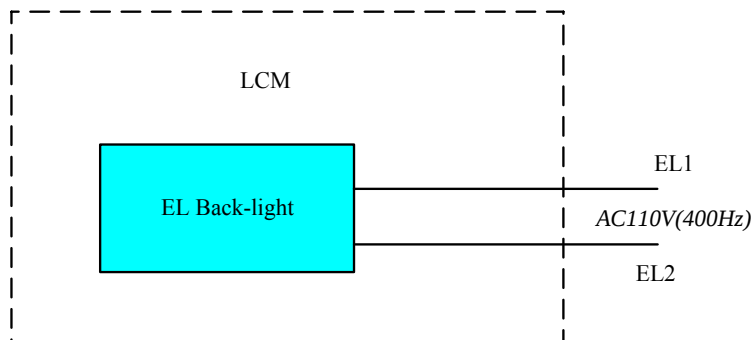
6 BLOCK DIAGRAM & POWER SUPPLY



Using LED Back-light



Using EL Back-light



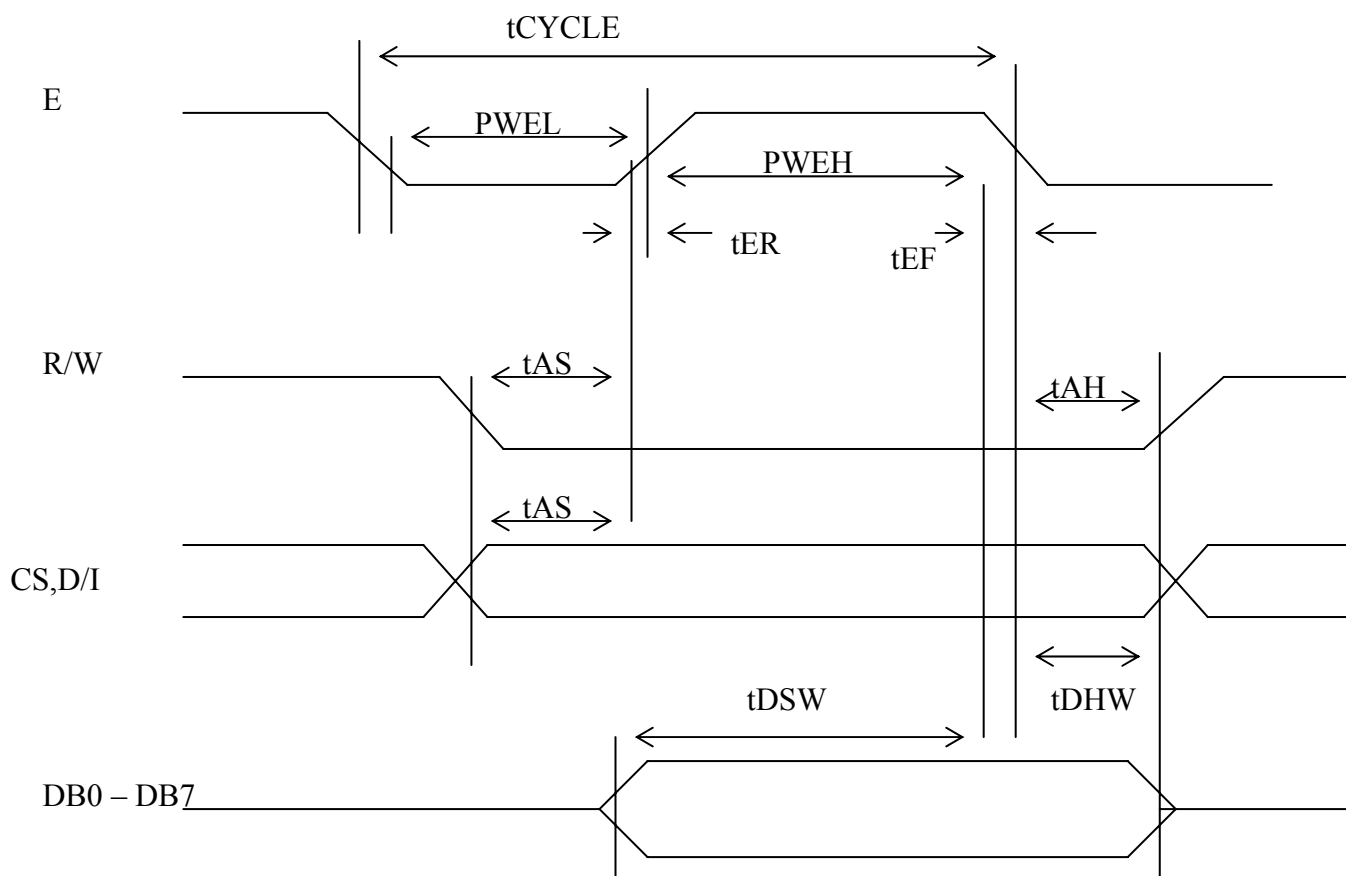
7 PIN CONNECTIONS

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	LEDA, EL_1	LED Supply Voltage (5V), EL driving input
20	LEDK, EL_2	LED Supply Voltage (0V), EL driving input

8 TIMING CHARACTERISTICS

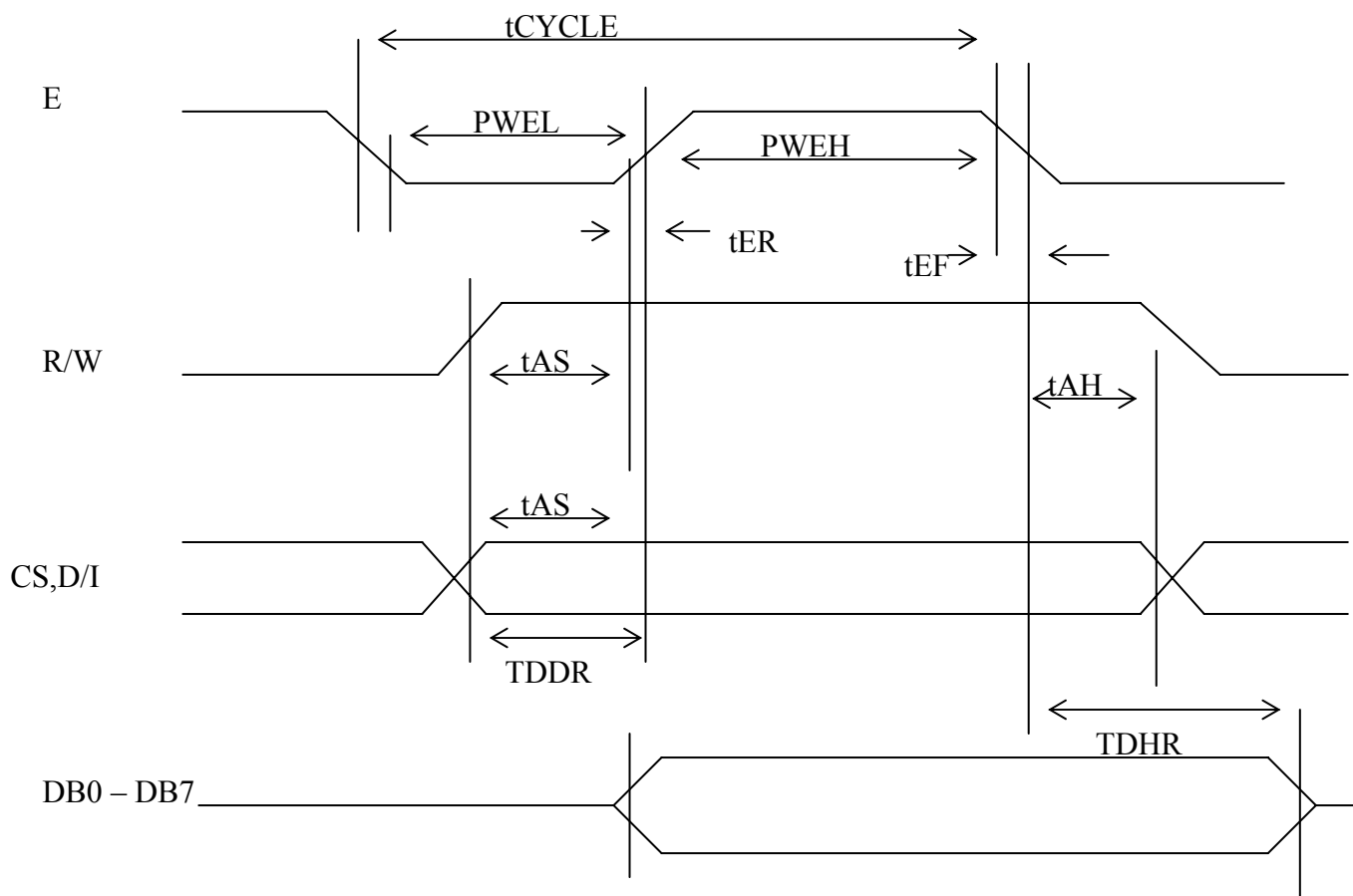
8.1 WRITING OPERATION

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

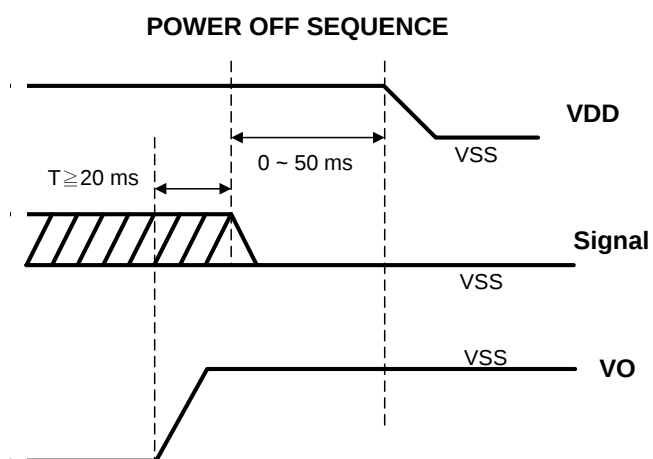
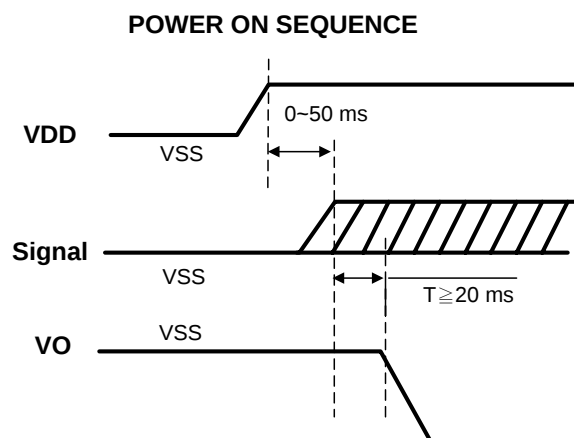


8.2 READ OPERATION

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



8.3 Power ON/OFF Sequence



9 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	B U S Y	L	O N / O F F	R E S E T	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.

10 QUALITY AND RELIABILITY

10.1 TEST CONDITIONS

Tests should be conducted under the following conditions :

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

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

10.2 SAMPLING PLAN

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

10.3 ACCEPTABLE QUALITY LEVEL

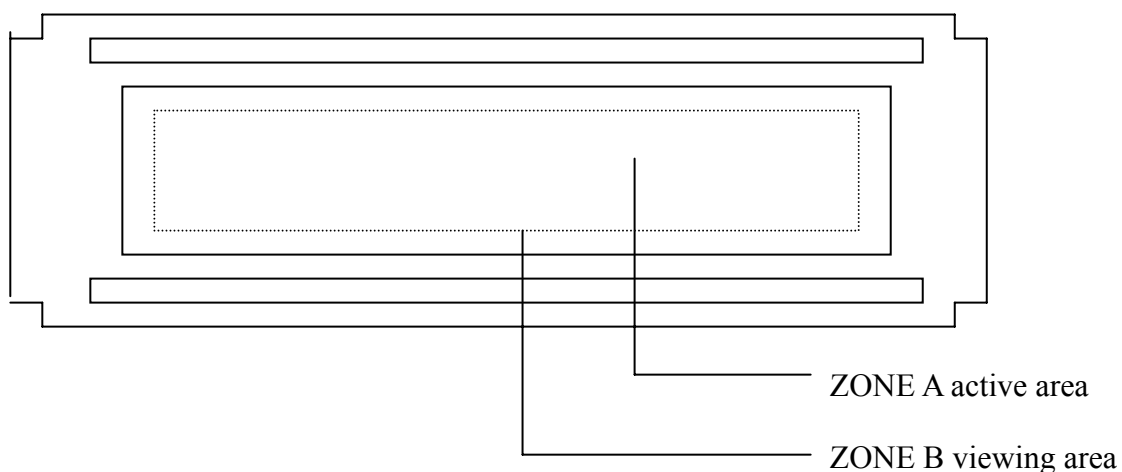
A major defect is defined as one that could cause failure to or materially reduce the usability of the unit for its intended purpose. A minor defect is one that does not materially reduce the usability of the unit for its intended purpose or is an infringement from established standards and has no significant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

10.4 APPEARANCE

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.

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
	Normal Temp. type	Extended Temp. type	
High Temperature Operation	50±3°C , t=96 hrs	70±3°C , t=96 hrs	
Low Temperature Operation	0±3°C , t=96 hrs	-20±3°C , t=96 hrs	
High Temperature Storage	70±3°C , t=96 hrs	80±3°C , t=96 hrs	1,2
Low Temperature Storage	-20±3°C , t=96 hrs	-30±3°C , t=96 hrs	1,2
Temperature Cycle	-20 °C ~ 25 °C ~ 70 °C 30 min. 5 min. 30 min. (1 cycle) Total 5 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
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.

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.

12 OUTLINE DIMENSION

