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SPECIFICATIONS FOR LCD MODULE

MODULE NO. : AMG128128P1-G

REV: B00

ISSUED DATE 2009-12-12

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1 GENERAL SPECIFICATION

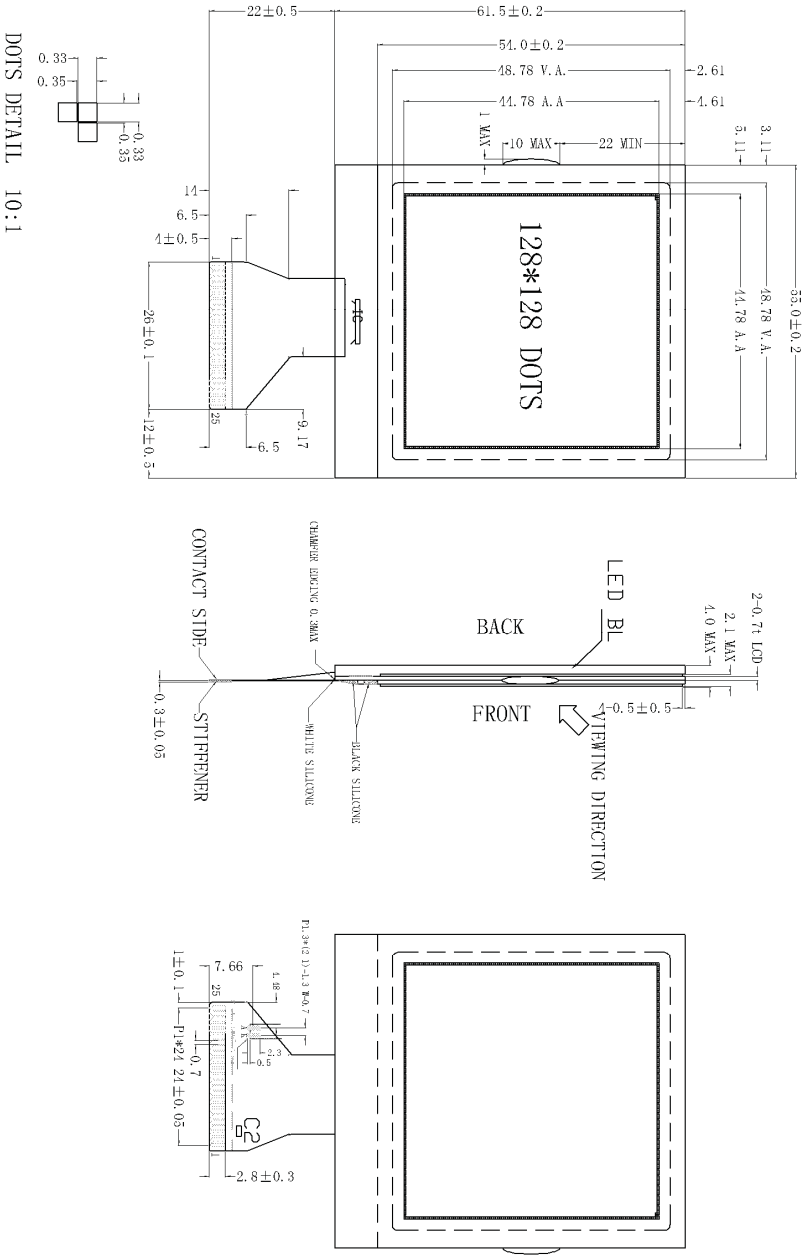
ITEM	CONTENTS
Display Format	FSTN , Transflective, Positive, View Direction: 12 H 128X128 Dots
General Dimensions	55.0W x 83.5H x 4.0 D max
LCD Driver IC	ST7571
Backlight	LED Backlight
Backlight Driver type	
Backlight Color	White

2 MECHANICAL SPECIFICATIONS

2.0 MECHANICAL SPECIFICATIONS

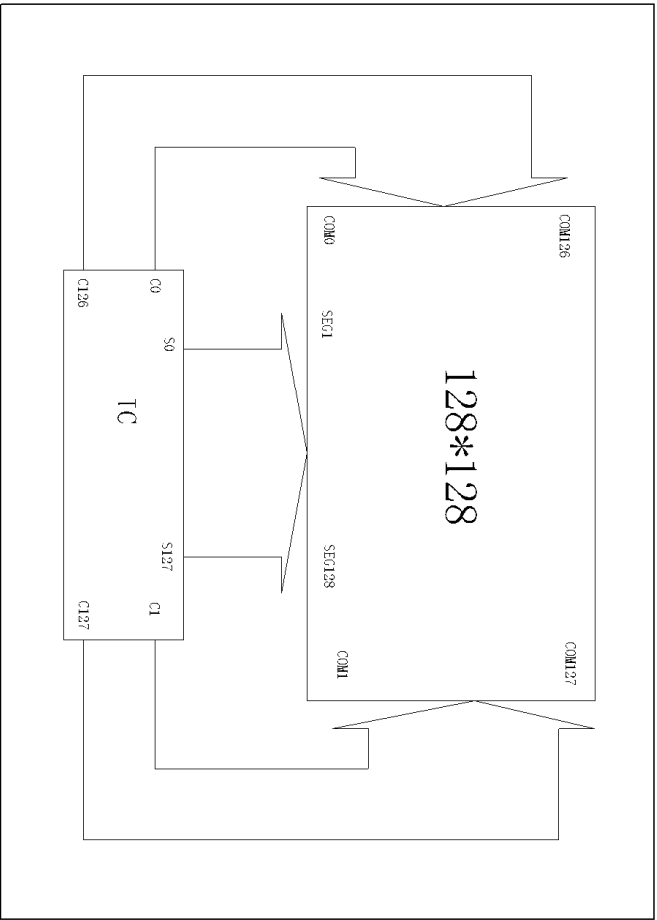
ITEM	STANDARD VALUE	UNIT
MODULE DIMENSION	55.0 (W)×83.5 (H)×4.0 (D Max)	mm
VIEW AREA	48.78 (W)×48.78 (H) Min	mm

2.1 DIMENSIONAL DIAGRAM



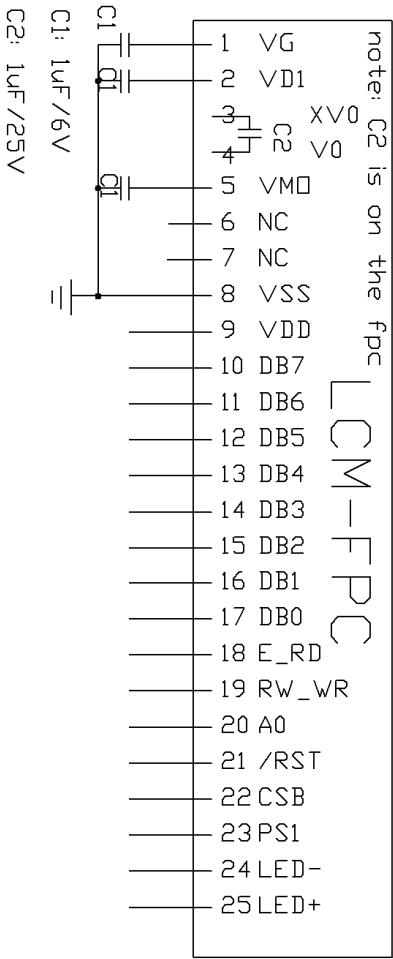
3 BLOCK DIAGRAM

Block Diagram:



Pin Description:

Pin	Symbol	Function Description
1	VG	LCD driver supply voltages
2	VD1	LCD driver supply voltages
3	XV0	NC
4	VO	NC
5	VMO	LCD driver supply voltages
6	NC	
7	NC	
8	VSS	Ground
9	VDD	Power supply
10	DB7	8 bit bi directional data bus
11	DB6	8 bit bi directional data bus
12	DB5	8 bit bi directional data bus
13	DB4	8 bit bi directional data bus
14	DB3	8 bit bi directional data bus
15	DB2	8 bit bi directional data bus
16	DB1	8 bit bi directional data bus
17	DB0	8 bit bi directional data bus
18	E_RD	E signal or Read control pin
19	RW_WR	RW signal or Write control pin
20	A0	Register select input pin
21	/RST	Reset input pin
22	CSB	Chip select input pins
23	PS1	6800/8080 Select
24	LED-	LED back light cathode
25	LED+	LED back light anode



4 MAX STANDARD VALUE

ITEM	SYMBOL	MIN.	MAX.	UNIT
SUPPLY VOLTAGE FOR LOGIC	VDD1	-0.3	3.3	V
SUPPLY VOLTAGE FOR LCD	VLCD	-0.3	15	V
INPUT VOLTAGE	VI	-0.3	VDD+0.3	V
OPERATING TEMPERATURE	Top	-10	60	°C
STORAGE TEMPERATURE	Tst	-20	70	°C

5 ELECTRICAL CHARACTERISTICS

ITEM	SYMBOL	TEST CONDITION	MIN.	TYPE	MAX.	UNIT
SUPPLY VOLTAGE FOR LOGIC	VDD-VSS	Ta=25°C	2.7	3.0	3.3	V
SUPPLY VOLTAGE FOR LCD DRIVER	VLCD	Ta=25°C	10.0	10.5	11.0	V
INPUT VOLTAGE	VI	H LEVEL	0.7VDD1	/	VDD1	V
		L LEVEL	VSS	/	0.3VDD1	V
POWER SUPPLY FOR LOGIC CURRENT	IDD	VDD=5.0V	/	1.0	3.0	mA

LED BACKLIGHT ELECTRICAL/OPTICAL CHARACTERISTICS

Ta=25°C, Unless specified, The Ambient temperature Ta=25°C)

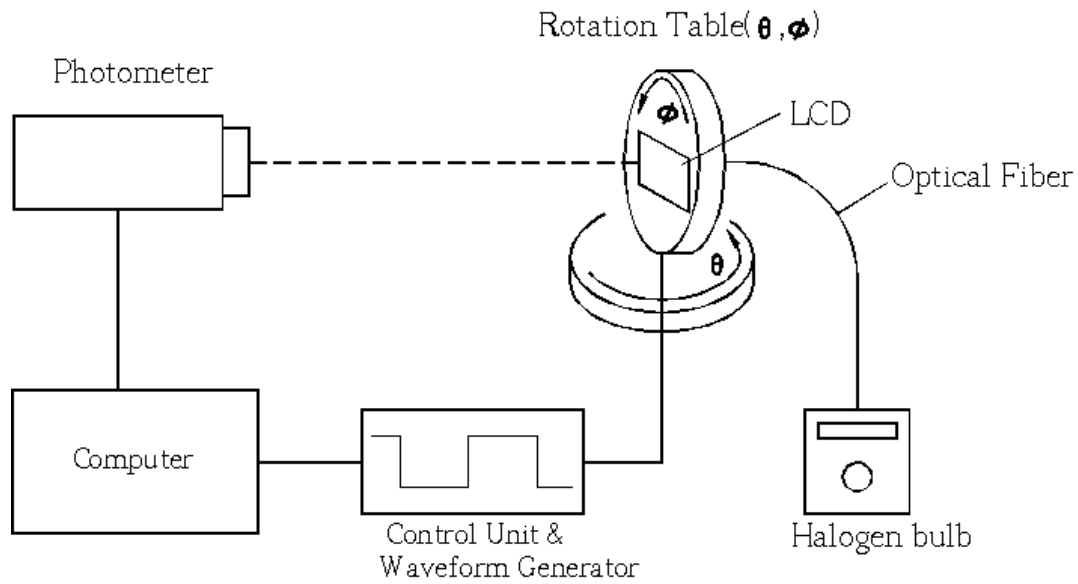
Item	Symbol	min	typ	max	Unit	Condition
Forward Voltage	Vf	2.9	3.1	3.3	V	If=30mA
Reverse Current	Ir		10		uA	Vr=5 V
Luminance	Lv	170	220		cd/m²	If= 15 mA

6 OPTICAL CHARACTERISTICS

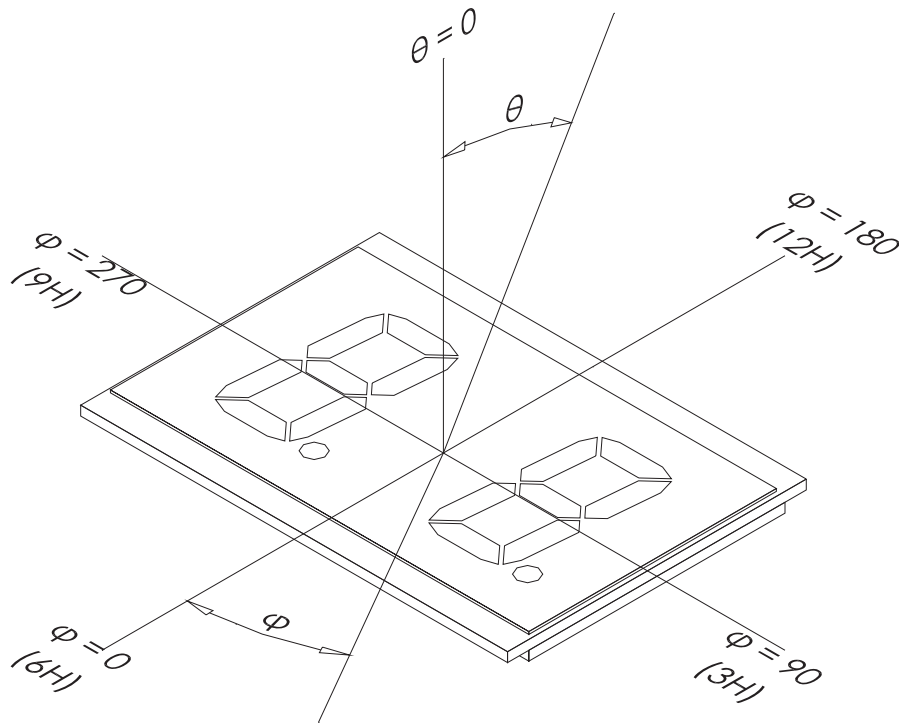
6.0 Optical Characteristics

ITEM	SYMBOL	CONDITION	MIN.	TYPE	MAX.	UNIT
Viewing Angle	θ (BK-FT) ϕ (R-L)	Cr>2.0 Ta=25 °C	-20	-	40	DEG
			-40	-	40	
Contrast Ratio	Cr	$\theta = 0, \phi = 0$ Ta=25 °C VLCD=10.5V	3	6	-	
Response Time(Rise) $\square$	Ton		-	150	200	mS
Response Time(Fall)	Toff		-	150	200	mS

6.1 Optical Measurement System



6.2 Definition Of θ and Φ



6.3 DEFINITION OF CONTRAST RATIO Cr

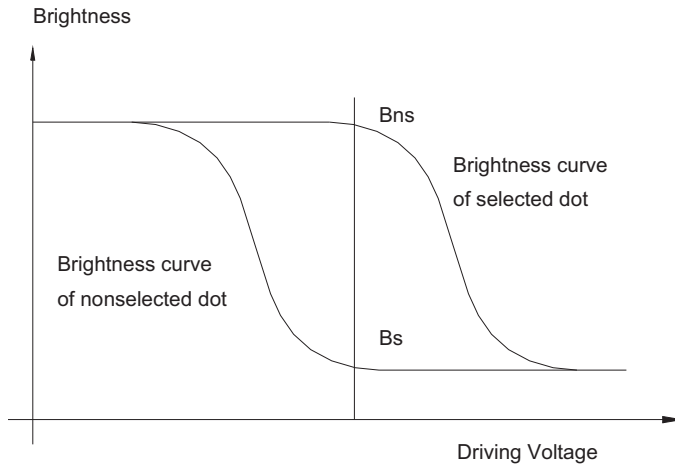
Contrast ratio is calculated by the following formula when the output voltage is obtained from the optical measurement system

Conditions of Testing: Accord to the LCD's driving method and operating voltage (V_{op})

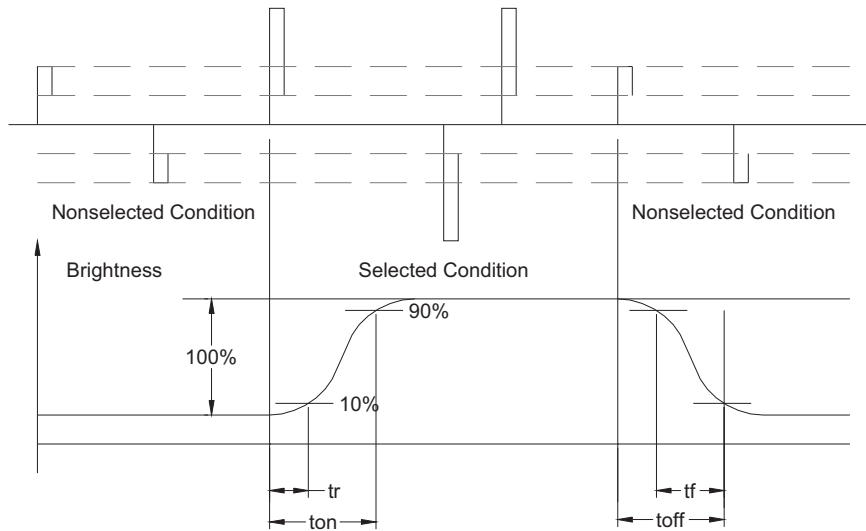
The formula:

$$Cr = \frac{\text{Brightness at nonselected segments}}{\text{Brightness at selected segments}}$$

$$= \frac{\text{Photometer output voltage when nonselect waveform is applying}}{\text{Photometer output voltage when select waveform is applying}}$$



6.4 DEFINITION OF OPTICAL RESPONSE TIME



- Rise time (t_r):** time required for the transmission to change from 10% to 90%.
Fall time (t_f): time required for the transmission to change from 90% to 10%.
On time (t_{on}): time required for the transmission to change from 0% to 90%.
Off time (t_{off}): time required for the transmission to change from 100% to 10%.

7 INTERFACE

PIN NO.	SYMBOL	LEVEL	I/O	FUNCTION
1	VG			LCD driver supply voltage
2	VD1			LCD driver supply voltage
3	NC			No Connect
4	NC			No Connect
5	VM0			LCD driver supply voltage
6	NC			No Connect
7	NC			No Connect
8	VSS	0 V	/	GND
9	VDD	+3 V	/	Power Supply for logical
10	D7	H/L	I/O	DATA SIGNALS
11	D6	H/L	I/O	DATA SIGNALS
12	D5	H/L	I/O	DATA SIGNALS
13	D4	H/L	I/O	DATA SIGNALS
14	D3	H/L	I/O	DATA SIGNALS
15	D2	H/L	I/O	DATA SIGNALS
16	D1	H/L	I/O	DATA SIGNALS
17	D0	H/L	I/O	DATA SIGNALS
18	E_RD	H/L	I	E signal or Read control pin
19	RW_WR	H/L	I	RW signal or Write control pin
20	A0	H/L	I	Register select input pin
21	/RST	H/L	I	Reset input pin
22	CSB	H/L	I	Chip select input pin
23	PS1	H/L	I	6800/8080 select
24	LED-		I	LED back light cathode
25	LED+		I	LED back light anode

8 APPLICATION OF LCD MODULE

8.0 COMMANDS

INSTRUCTIONS

Instruction	A0	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description	
Mode Set	0	0	0	0	1	1	1	0	0	0	2-byte instruction to set Mode and	9.1.1
	0	0	FR3	FR2	FR1	FR0	BE1	BE0	x'	0	FR(Frame frequency control) BE(Booster efficiency control)	
Write display data	1	0	Write data							Write data into DDRAM		9.1.2
ICON control register ON/OFF	0	0	1	0	1	0	0	0	1	ICON	ICON=0: ICON disable(default) ICON=1: ICON enable & set the page address to 16	9.1.3
Set page address	0	0	1	0	1	1	P3	P2	P1	P0	Set page address	9.1.4
Set column address MSB	0	0	0	0	0	1	0	Y7	Y6	Y5	Set column address MSB	9.1.5
Set column address LSB	0	0	0	0	0	0	Y4	Y3	Y2	Y1	Set column address LSB	9.1.6
Display ON/OFF	0	0	1	0	1	0	1	1	1	D	D=0: Display OFF D=1: Display ON	9.1.7
Set initial display line register	0	0	0	1	0	0	0	0	x'	x'	2-byte instruction to specify the initial display line to realize vertical scrolling	9.1.8
	0	0	x'	S6	S5	S4	S3	S2	S1	S0		
Set initial COM0 register	0	0	0	1	0	0	0	1	x'	x'	2-byte instruction to specify the initial COM0 to realize window scrolling	9.1.9
	0	0	x'	C6	C5	C4	C3	C2	C1	C0		
Set partial display duty ration	0	0	0	1	0	0	1	0	x'	x'	2-byte instruction to set partial display duty ratio	9.1.10
	0	0	D7	D6	D5	D4	D3	D2	D1	D0		
Set N-line inversion	0	0	0	1	0	0	1	1	x'	x'	2-byte instruction to set N-line inversion register	9.1.11
	0	0	x'	x'	x'	N4	N3	N2	N1	N0		
Release N-line inversion	0	0	1	1	1	0	0	1	0	0	Release N-line inversion mode	9.1.12
Reverse display ON/OFF	0	0	1	0	1	0	0	1	1	REV	REV=0: normal display REV=1: reverse display	9.1.13
Entire display ON/OFF	0	0	1	0	1	0	0	1	0	EON	EON=0: normal display EON=1: entire display ON	9.1.14

Instruction	A0	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description	
Power control	0	0	0	0	1	0	1	VC	VR	VF	Control power circuit operation	9.1.15
Select regulator register	0	0	0	0	1	0	0	R2	R1	R0	Select the internal resistance ratio of the regulator resistor	9.1.16
Select electronic volume register	0	0	1	0	0	0	0	0	0	1	2-byte instruction to specify the reference voltage	9.1.17
	0	0	x'	x'	EV5	EV4	EV3	EV2	EV1	EV0		
Select LCD bias	0	0	0	1	0	1	0	B2	B1	B0	Select LCD bias	9.1.18
SHL select	0	0	1	1	0	0	SHL	x'	x'	x'	COM bi-directional selection SHL=0: normal direction SHL=1: reverse direction	9.1.19
ADC select	0	0	1	0	1	0	0	0	0	ADC	SEG bi-direction selection ADC=0: normal direction ADC=1: reverse direction	9.1.20
Oscillator on start	0	0	1	0	1	0	1	0	1	1	Start the built-in oscillator	9.1.21
Set power save mode	0	0	1	0	1	0	1	0	0	P	P=0: normal mode P=1: sleep mode	9.1.22
Release power save mode	0	0	1	1	1	0	0	0	0	1	release power save mode	9.1.23
Reset	0	0	1	1	1	0	0	0	1	0	initial the internal function	9.1.24
Display data length	x'	x'	1	1	1	0	1	0	0	0	2-byte instruction to specify the number of data bytes. (SPI mode)	9.1.25
	x'	x'	D7	D6	D5	D4	D3	D2	D1	D0		
NOP	0	0	1	1	1	0	0	0	1	1	No operation	9.1.26
Test Command set 1	0	0	1	1	1	1	x'	x'	x'	x'	Enter test command set 1 Use for Burning EE	9.1.27
Test Command set 2	0	0	1	1	0	1	0	0	0	1	Enter test command set 2 Use for Burning EE	9.1.28
Test Command set 3	0	0	0	1	1	1	1	0	1	1	Don't use this instruction	9.1.29

Instruction	A0	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
COMMAND SET 1											
Disable autoread	0	0	1	0	1	0	1	0	1	0	Disable autoread
Enter EEPROM mode	0	0	0	0	0	1	0	0	1	1	Enter EEPROM mode
Enable read mode	0	0	0	0	1	0	0	0	0	0	Enable read mode
Set read pulse	0	0	0	1	1	1	0	0	0	1	Set read pulse width (Do not modify this value)
Exit EEPROM mode	0	0	1	0	0	0	0	0	1	1	Exit EEPROM mode
Enable erase mode	0	0	0	1	0	0	1	0	1	0	Enable erase mode
Set erase pulse	0	0	0	1	0	1	0	1	0	1	Set erase pulse width (Do not modify this value)
Enable write mode	0	0	0	0	1	1	0	1	0	1	Enable write mode
Set write pulse	0	0	0	1	1	0	1	0	1	0	Set write pulse width (Do not modify this value)
Return normal mode	0	0	0	0	0	0	0	0	0	0	Return normal mode
COMMAND SET 2											
Increase vop offset	0	0	0	1	0	1	0	0	0	1	Increase vop offset 1 level
Decrease vop offset	0	0	0	1	0	1	0	0	1	0	Decrease vop offset 1 level
Return normal mode	0	0	0	0	0	0	0	0	0	0	Return normal mode

8.1 TIMING CHARACTERISTICS

DC CHARACTERISTICS

Item	Symbol	Condition	Rating			Units	Applicable Pin
			Min.	Typ.	Max.		
Digital Operating Voltage	VDD1		1.8	—	3.3	V	VDD1
Analog Operating Voltage	VDD2		2.4	—	3.3	V	*2
Analog Operating Voltage	VDD3		2.4	—	3.3	V	*2
High-level Input Voltage	VIHC		0.7 x VDD1	—	VDD1	V	*1
Low-level Input Voltage	VILC		VSS	—	0.3 x VDD1	V	*1
Input leakage current	ILI	VIN = VDD1 or VSS	−1.0	—	1.0	μA	*3
Output leakage current	ILO	VIN = VDD1 or VSS	−3.0	—	3.0	μA	*4
LCD Driver ON Resistance	R _{ON}	Ta = 25°C	Vop=12V ΔV=1.2V	—	0.7	KΩ	SEgN COMn *5
			VG=2V ΔV=0.2V	—	0.7		
Frame Frequency	f _{FR}	1/129 duty, Ta = 25°C FR[3:0]=0000(77Hz)	70	77	84	Hz	

* VSS1 = VSS2 = VSS3 = 0 V unless otherwise specified.

Bare Dice Current Consumption

Using Internal Power Circuits and applying external operating voltage (VDD1, VDD2 & VDD3).

Item	Symbol	Condition	Rating			Units	Notes
			Min.	Typ.	Max.		
Display ON Pattern: SNOW	ISS	VDD1=1.8V, VDD2=VDD3=2.8V Ta = 25°C, Vop=10.5V, 8X booster, 1/9 Bias, N-Line=0x01, 1/129 duty, FR[3:0]=0000(77Hz)	—	450	600	μA	*6
Power Save	ISS	VDD1=1.8V, VDD2=VDD3=2.8V , Ta = 25°C	—	5	10	μA	*6

Note:

1. The A0, D0 to D5, D6 (SI), D7 (SCL), /RD (E), /WR (RW), CSB, IMS, OSC, P/S, /DOF, RESB, and MODE terminals.
2. Used by internal analog circuits.
3. The A0, /RD (E), /WR, /R(W), CSB, IMS, OSC, P/S, /DOF, RESB and MODE terminals.
4. Applies when the D0 to D5, D6 (SI), D7 (SCL) terminals are in a high impedance state.
5. These are the resistance values for when a specified voltage difference is applied between the output terminals (SEgN/COMn) and the various power supply terminals (V0, XV0, VG & VM).
 $R_{ON} = \Delta V / \Delta I_{.....}$ (ΔV is the specified voltage difference; ΔI is the current when applying ΔV between output and power)
6. It indicates the current consumed by Bare Chip alone.

9 RELIABILITY

ITEM OF RELIABILITY TEST:

NO.	ITEM	CONDITION	CRITERION
1	HIGH TEMPERATURE OPERATING	60±2 °C, Operation for 48 hrs.	No defects in cosmetic and operational function are allowable.
2	LOW TEMPERATURE OPERATING	-10±2 °C, Operation for 48 hrs.	

3	HIGH TEMPERATURE STORAGE	70 ± 2 °C, storage for 96 hrs, then measure after 4 hrs. (Normal condition)	Total current consumption should be below double of initial value. The contrast ratio must be larger than half of initiated test. Normal condition: 20 ± 5 °C, 60%RH
4	LOW TEMPERATURE STORAGE	-20 ± 2 °C, storage for 96 hrs, then measure after 4 hrs. (Normal condition)	
5	DAMP PROOF TEST	40 ± 2 °C, 90%RH, 48 hrs, then measure after 4 hrs. (Normal condition)	

REVISION HISTORY

Rev	Content	<i>Date</i>
A00	Initial Version	2009-03-12
B00	LED BL without house	2009-12-12