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SPECIFICATIONS
FOR LCD MODULE

CUSTOMER	
CUSTOMER PART NO.	
ORIENT DISPLAY (N.A.) NO	AMG20232A
DESCRIPTION	
APPROVED BY	
DATE	

PREPARED BY	CHECKED BY	APPROVED BY

DOCUMENT REVISION HISTORY:

DATE	PAGE	DESCRIPTION
2007/04/26.	-	First release

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1. Module Classification Information

A	M	C	1	6	0	2	A	R	-	B	-	B	6	W	T	D	W	-	S	P
1		2	3				4	5		6		7	8	9	10	11	12		13	

1	Brand：Orient Display (N.A.) Ltd.	
2	Display Type：C→ Character Type, G→ Graphic Type, NONE→ Custom-made	
3	Display Font：Characters X Lines / Rows X Columns /Others	
4	Model serials no.	
5	RoHS compliant: R→YES NONE→ NO	
6	IC Package Type：	M→ SMT Type B→ COB Type T→ TAB Type G→ COG Type F→ COF Type S→ Special
7	LCD Mode：	P→TN Positive N→TN Negative Y→ STN Positive, Yellow Green B→ STN Negative, Blue G→ STN Positive, Gray W→ FSTN Positive T→ FSTN Negative F→ FFSTN Negative S→ Special
8	Viewing direction	6→ 6:00,12→12:00, S→Special
9	Temperature range	N → Normal Temperature W→ Wide Temperature S→ Special
10	LCD Polarizer Type	R→ Reflective T→ Transmissive F→ Transflective S→ Special
11	Backlight Type	N→ None D→ LED E→ EL F→ CCFL S→ Special
12	Backlight Color	Y→ Yellow-green B→ Blue A→ Amber W→ White G→ Green R→ Red S→ Special
13	Internal Code	

2.Precautions in use of LCD Modules

(1)Avoid applying excessive shocks to the module or making any alterations or modifications to it.
(2)Don't make extra holes on the printed circuit board, modify its shape or change the components of LCD module.
(3)Don't disassemble the LCM.
(4)Don't operate it above the absolute maximum rating.
(5)Don't drop, bend or twist LCM.
(6)Soldering: only to the I/O terminals.
(7)Storage: please storage in anti-static electricity container and clean environment.

3.General Specification

Item	Dimension	Unit
Number of Characters	202 x 32	—
Module dimension	150.0 x 45.8 x 12.0（MAX）	mm
View area	123.0 x 24.0	mm
Active area	119.14 x 21.08	mm
Dot size	0.55 x 0.62	mm
Dot pitch	0.59 x 0.66	mm
LCD type	STN,Positive	
Duty	1/32	
View direction	6 o'clock	
Backlight Type	WHITE LED BACKLIGHT	

4.Absolute Maximum Ratings

Item	Symbol	Min	Typ	Max	Unit
Operating Temperature	T_{OP}	-0	—	+50	℃
Storage Temperature	T_{ST}	-10	—	+60	℃
Input Voltage	V_I	-0.3	—	VDD+0.3	V
Supply Voltage For Logic	V_{DD}-V_{SS}	-0.3	—	7.0	V
Supply Voltage For LCD	V_{DD}-V_0	Vdd-13.5	—	0	V

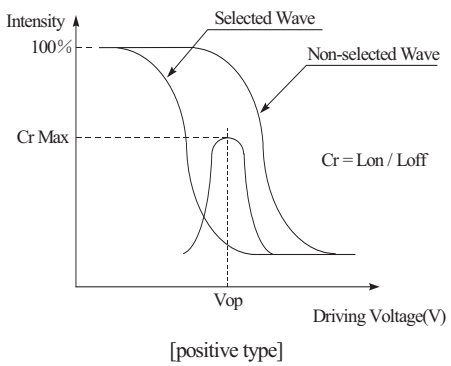
5. Electrical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage For Logic	V_{DD}-V_{SS}	—	4.5	5.0	5.5	V
Supply Voltage For LCD	V_{DD}-V_0	Ta=25℃	-	5.0	-	V
Input High Volt.	V_{IH}	—	0.7 V_{DD}	—	V_{DD}	V
Input Low Volt.	V_{IL}	—	V_{SS}	—	0.3 V_{DD}	V
Supply Current	I_{DD}	V_{DD}=5V	-	0.8	1.2	mA
Supply Voltage of White backlight	V_{LED}	Forward current =45 mA Number of LED dice 3	2.9	3.1	3.3	V

6.Optical Characteristics

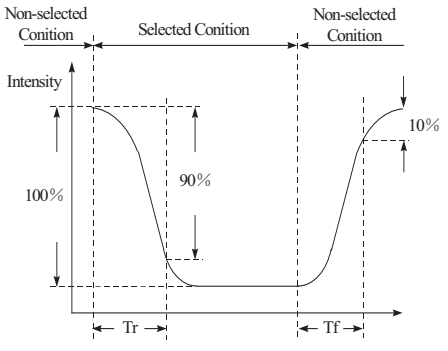
Item	Symbol	Condition	Min	Typ	Max	Unit
View Angle	(V) θ	CR≧2	20	—	35	deg
	(H) φ	CR≧2	-30	—	30	deg
Contrast Ratio	CR	—	—	3	—	—
Response Time	T rise	—	—	—	250	ms
	T fall	—	—	—	250	ms

Definition of Operation Voltage (Vop)



[positive type]

Definition of Response Time (Tr , Tf)



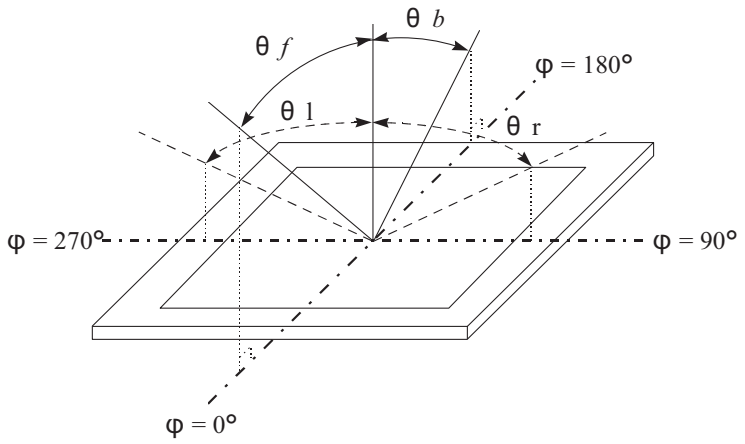
[positive type]

Conditions :

Operating Voltage : Vop Viewing Angle(θ ， φ) : 0°， 0°

Frame Frequency : 64 HZ Driving Waveform : 1/N duty , 1/a bias

Definition of viewing angle(CR≧2)

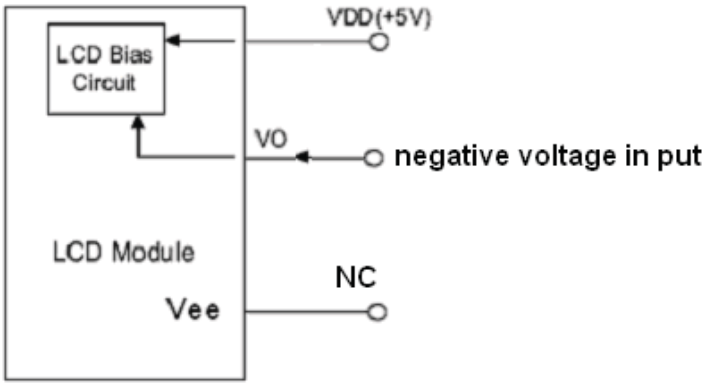


7.Interface Pin Function

Pin No.	Symbol	Level	Description
1	Vss	0V	GND
2	VDD	5.0V	Power supply for LOGIC
3	V0		Operating voltage for LCD
4	A0	H/L	Register Select
5	R/W	H/L	Read/Write
6	CS1	H/L	Chip Select Signal
7~14	DB0~DB7	H/L	Data Bus
15	Vee		Negative Voltage for LCD
16	/RES	H/L	Set Chip Initialized
17	A	3.1V	Anode of Backlight
18	K	0V	Cathode of Backlight
19	CS2	H/L	Chip Select Signal
20	CS3	H/L	Chip Select Signal

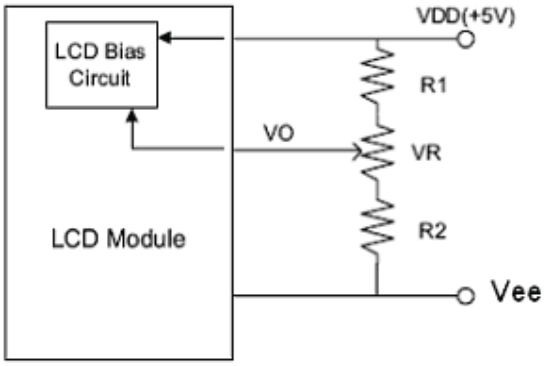
8. POWER SUPPLY

Without Negative Power on PCB



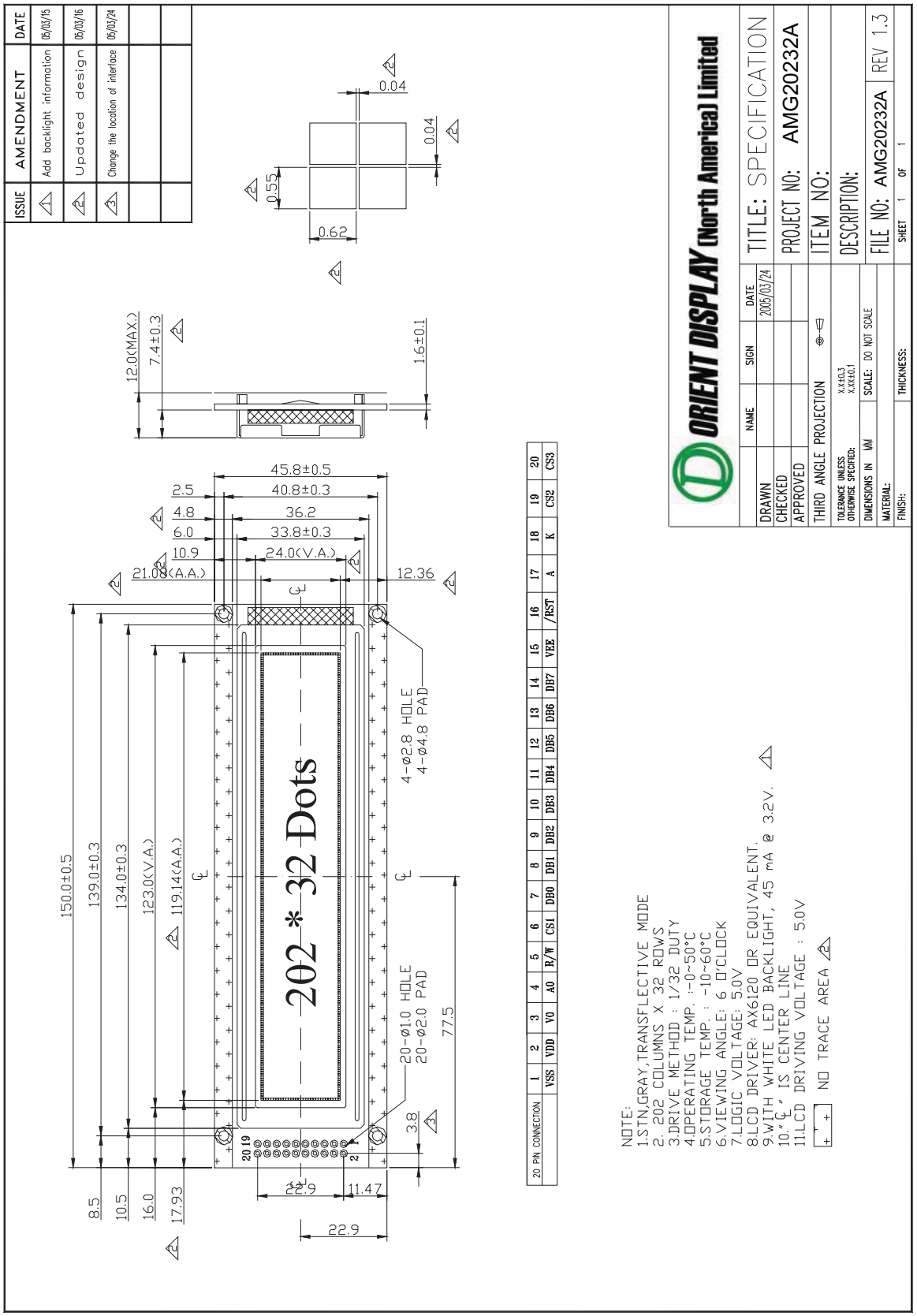
without DC-DC converter

With Negative Power on PCB



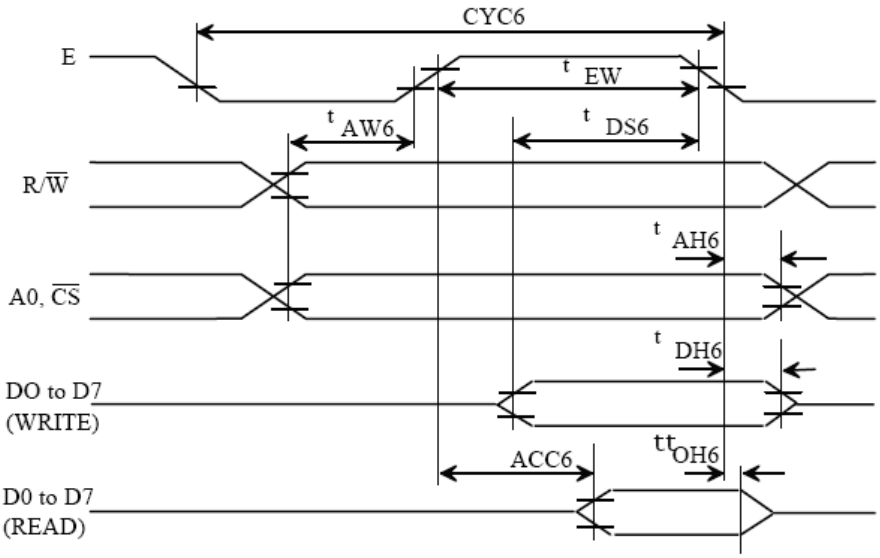
with DC-DC converter
VR:10K-20K

9.Contour Drawing



10.Timing Characteristics

• **MPU Bus Read/Write II (68-family MPU)**



Ta= -20 to 75 deg. C. Vss= -5.0V ± 10% unless stated otherwise

Parameter		Symbol	Condition	Rating		Unit	Signal
				min	max		
System cycle time		tCYC6		1,000	--	ns	A0, CS, R/W
Address setup time		tAW6		20	--	ns	
Address hold time		tAH6		10	--	ns	
Data setup time		tDS6		80	--	ns	D0 to D7
Data hold time		tDH6		10	--	ns	
Output disable time		tOH6	CL= 100pF	10	60	ns	
Access time		tACC6		--	90	ns	
Enable pulsewidth	Read	tEW		100	--	ns	E
	Write			80	--	ns	

Notes : 1. tCYC6 is the cycle time of CS. E=H. not the cycle time of E.
2. Increase parameter values by 200% when Vss= -3.0V.
3. all inputs must have a rise and fall time of less than 15 ns.

11.Instruction Table

COMMANDS

Summary

Command	Code											Function
	A0	$\overline{RD}$	$\overline{WR}$	D7	D6	D5	D4	D3	D2	D1	D0	
Display On/Off	0	1	0	1	0	1	0	1	1	1	0/1	Turns display on or off. 1 : ON, 0 : OFF
Display start line	0	1	0	1	1	0	Display start address (0 to 31)					Specifies RAM line corresponding to top line of display.
Set page address	0	1	0	1	0	1	1	1	0	Page (0 to 3)		Sets display RAM page in page address register.
Set column (segment) address	0	1	0	0	Column address (0 to 79)							Sets display RAM column address in column address registser.
Read status	0	0	1	Busy	ADC	ON/OFF	Reset	0	0	0	0	Reads the following status : BUSY 1 : Busy 0 : Ready ADC 1 : CW output 0 : CCW output ON/OFF 1 : Display off 0 : Display on RESET 1 : Being reset 0 : Normal
Write display data	1	1	0	Write data								Writes data from data bus into display RAM.
Read display data	1	0	1	Read data								Reads data from display RAM onto data bus.
Select ADC	0	1	0	1	0	1	0	0	0	0	0/1	0 : CW output, 1 : CCW output
Statis drive ON/OFF	0	1	0	1	0	1	0	0	1	0	0/1	Selects static driving operation. 1 : Static drive, 0 : Normal driving
Select duty	0	1	0	1	0	1	0	1	0	0	0/1	Selects LCD duty cycle 1 : 1/32, 0 : 1/16
Read-Modify -Write	0	1	0	1	1	1	0	0	0	0	0	Read-modify-write ON
End	0	1	0	1	1	1	0	1	1	1	0	Read-modify-write OFF
Reset	0	1	0	1	1	1	0	0	0	1	0	Software reset

12.Quality Assurance

Screen Cosmetic Criteria

Item	Defect	Judgment Criterion	Partition
1	Spots	A)Clear Size: d mm — Acceptable Qty in active area d ≦ 0.1 — Disregard 0.1<d≦0.2 — 6 0.2<d≦0.3 — 2 0.3<d — 0 Note: Including pin holes and defective dots which must be within one pixel size. B)Unclear Size: d mm — Acceptable Qty in active area d ≦ 0.2 — Disregard 0.2<d≦0.5 — 6 0.5<d≦0.7 — 2 0.7<d — 0	Minor
2	Bubbles in Polarizer	Size: d mm — Acceptable Qty in active area d≦0.3 — Disregard 0.3<d≦1.0 — 3 1.0<d≦1.5 — 1 1.5<d — 0	Minor
3	Scratch	In accordance with spots cosmetic criteria. When the light reflects on the panel surface, the scratches are not to be remarkable.	Minor
4	Allowable Density	Above defects should be separated more than 30mm each other.	Minor
5	Coloration	Not to be noticeable coloration in the viewing area of the LCD panels. Back-light type should be judged with back-light on state only.	Minor

13.Reliability

Content of Reliability Test

Environmental Test			
Test Item	**Content of Test**	**Test Condition**	**Applicable Standard**
High Temperature storage	Endurance test applying the high storage temperature for a long time.	60℃ 96hrs	——
Low Temperature storage	Endurance test applying the high storage temperature for a long time.	-10℃ 96hrs	——
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	50℃ 96hrs	——
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	0℃ 96hrs	——
High Temperature/ Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time.	60℃,90%RH 96hrs	——
High Temperature/ Humidity Operation	Endurance test applying the electric stress (Voltage & Current) and temperature / humidity stress to the element for a long time.	50℃,90%RH 96hrs	——
Temperature Cycle	Endurance test applying the low and high temperature cycle. -10℃ 25℃ 60℃ 30min 5min 30min 1 cycle	-10℃/60℃ 10 cycles	——
Mechanical Test			
Vibration test	Endurance test applying the vibration during transportation and using.	10~22Hz→1.5mmp-p 22~500Hz→1.5G Total 0.5hrs	——
Shock test	Constructional and mechanical endurance test applying the shock during transportation.	50G Half sign wave 11 msedc 3 times of each direction	——

***Supply voltage for logic system=5V. Supply voltage for LCD system =Operating voltage at 25℃