Crystalfontz America, Inc.

SPECIFICATION

CUSTOMER : _____

MODULE NO.: __CFAG12864A-TMI-V__

SALES BY	APPROVED BY	CHECKED BY	PREPARED BY

ISSUED DATE:

Contents

1.Module Classification Information

CFA G 1 2 8 6 4 A T M I   V
① ② ③ ④ ⑤⑥⑦ ⑧

①	Brand: **CRYSTALFONTZ AMERICA, INC**		
②	Display Type: H→Character Type, **G→Graphic Type**		
③	Displays Logical Dimensions: **128 pixels by 64 pixels**		
④	Model PCB Variant: **A**		
⑤	Backlight Type:	N→Without backlight	**T→LED, White**
		B→EL, Blue green	A→LED, Amber
		D→EL, Green	R→LED, Red
		W→EL, White	O→LED, Orange
		F→CCFL, White	G→LED, Green
		Y→LED, Yellow Green	
⑥	LCD Mode:	B→TN Positive, Gray T→FSTN Negative	
		N→TN Negative,	
		G→STN Positive, Gray	
		Y→STN Positive, Yellow Green	
		M→STN Negative, Blue	
		F→FSTN Positive	
⑦	LCD Polarizer Type/ Temperature range/ View direction	A→Reflective, N.T, 6:00	H→Transflective, W.T,6:00
		D→Reflective, N.T, 12:00	K→Transflective, W.T,12:00
		G→Reflective, W. T, 6:00	C→Transmissive, N.T,6:00
		J→Reflective, W. T, 12:00	F→Transmissive, N.T,12:00
		B→Transflective, N.T,6:00	**I→Transmissive, W. T, 6:00**
		E→Transflective, N.T.12:00	L→Transmissive, W.T,12:00
⑧	Special Code	**V→Built in Negative voltage generator;**	

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	128 x 64 dots	
Module dimension	93 x 70.0 x 13.6(MAX)	mm
View area	72.0 x 40.0	mm
Active area	66.52 x 33.24	mm
Dot size	0.48 x 0.48	mm
Dot pitch	0.52 x 0.52	mm
LCD type	STN, Negative, Transmissive ,Blue	
Duty	1/64	
View direction	6 o'clock	
Backlight Type	LED White	

4.Absolute Maximum Ratings

Item	Symbol	Min	Typ	Max	Unit
Operating Temperature	T_{OP}	-20		+70	°C
Storage Temperature	T_{ST}	-30		+80	°C
Input Voltage	V_I	0		V_{DD}	V
Supply Voltage For Logic	V_{DD}	0		67	V
Supply Voltage For LCD	V_{DD}-V_{LCD}	0		16.7	V
Supply Voltage For LCD	VDD-V_{OUT}			-10	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=-20°C			10.6	V
		Ta=25°C		9.1		V
		Ta=+70°C	7.6			V
Input High Volt.	V_{IH}		2.0		V_{DD}	V
Input Low Volt.	V_{IL}		0		0.8	V
Output High Volt.	V_{OH}		2.4		V_{DD}	V
Output Low Volt.	V_{OL}				0.4	V
Supply Current	I_{DD}			18		mA

6.Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
View Angle	(V)θ	CR≥2	20	☐	40	deg
	(H)φ	CR≥2	-30	☐	30	deg
Contrast Ratio	CR	☐	☐	3	☐	☐
Response Time	T rise	☐	☐	200	300	ms
	T fall	☐	☐	200	300	ms

Definition of Operation Voltage (Vop)   **Definition of Response Time (Tr , Tf)**
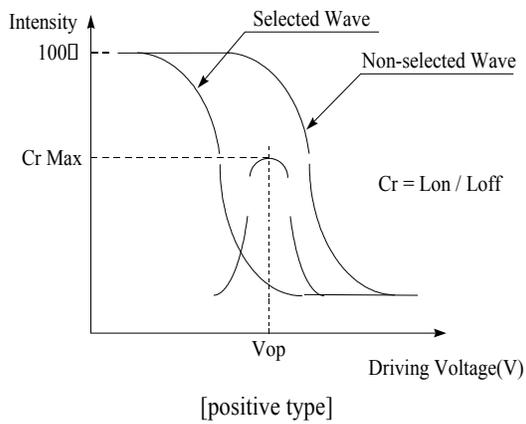
Intensity
100☐ ··· Selected Wave
                Non-selected Wave
Cr Max ···
                Cr = Lon / Loff
                Vop
                Driving Voltage(V)
[positive type]

Non-selected Conition | Selected Conition | Non-selected Conition
Intensity
10☐
100☐   90☐
        Tr   Tf
[positive type]
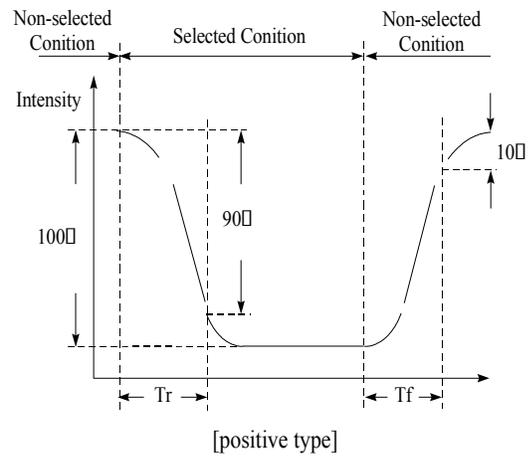
Conditions :

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)

Θb
Θf
Φ= 180°
Θl   Θr
Φ= 270°   Φ= 90°
Φ= 0°
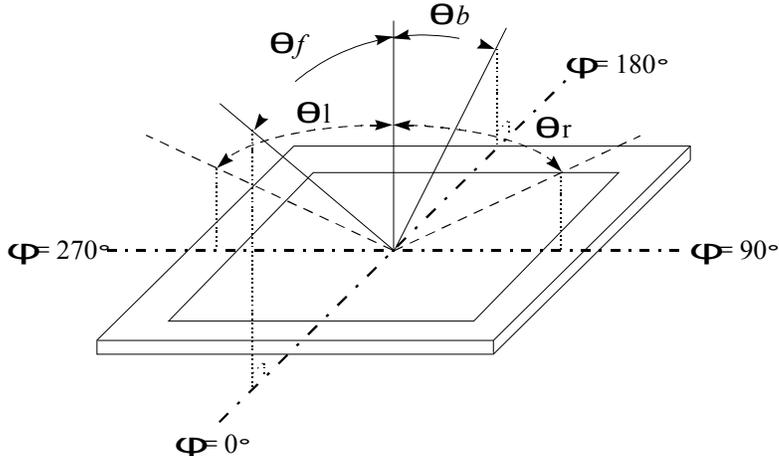
7.Interface Description

Pin No.	Symbol	Level	Description
1	**GND**	**0V**	**Ground**
2	**V_{DD}**	**5.0V**	**Supply voltage for logic**
3	**V_o**	**(Variable)**	**Operating voltage for LCD**
4	**D/I**	**H/L**	**H: Data , L : Instruction**
5	**R/W**	**H/L**	**H: Read (MPU←Module) , L: Write (MPU→Module)**
6	**E**	**H**	**Enable signal**
7	**DB0**	**H/L**	**Data bus line**
8	**DB1**	**H/L**	**Data bus line**
9	**DB2**	**H/L**	**Data bus line**
10	**DB3**	**H/L**	**Data bus line**
11	**DB4**	**H/L**	**Data bus line**
12	**DB5**	**H/L**	**Data bus line**
13	**DB6**	**H/L**	**Data bus line**
14	**DB7**	**H/L**	**Data bus line**
15	**CS1**	**H**	**Select Column 1~ Column 64**
16	**CS2**	**H**	**Select Column 65~ Column 128**
17	**RST**	**L**	**Reset signal**
18	**Vout**	**□**	**Negative Voltage**
19	**A**	**□**	**Power Supply for LED backlight (+)**
20	**K**	**□**	**Power Supply for LED backlight (-)**

8.Contour Drawing &Block Diagram
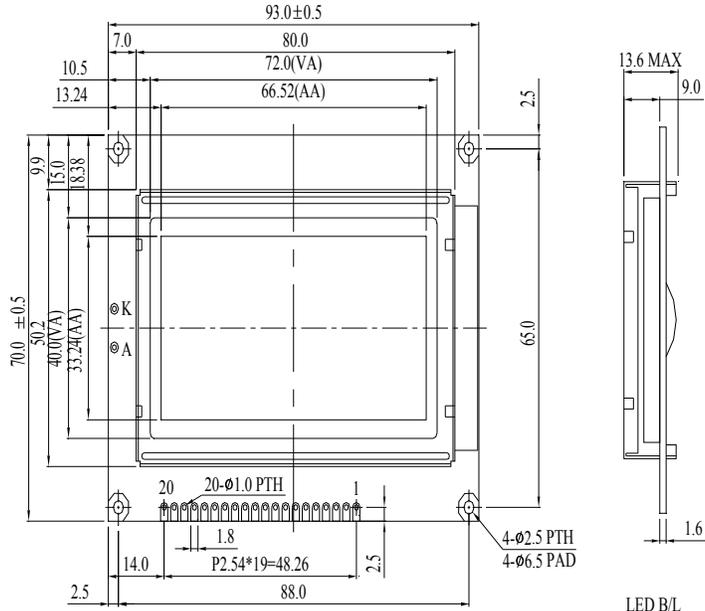
PIN NO.	SYMBOL
1	Vss
2	Vdd
3	Vo
4	D/I
5	R/$\overline{W}$
6	E
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	CS1
16	CS2
17	$\overline{RES}$
18	Vout
19	A
20	K

DOT SIZE
SCALE 10/1

LED B/L
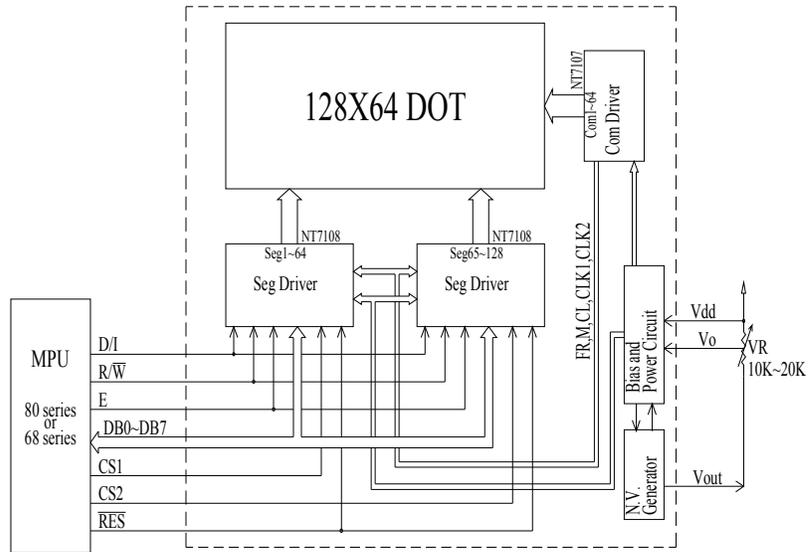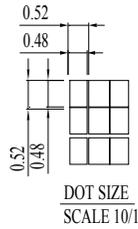
External contrast adjustment.

9.Timing Characteristics

☐ MPU Interface   (T=25°C, VDD=+5.0V±0.5)

Characteristic	Symbol	Min	Typ	Max	Unit
E cycle	tcyc	1000	☐	☐	ns
E high level width	twhE	450	☐	☐	ns
E low level width	twlE	450	☐	☐	ns
E rise time	tr	☐	☐	25	ns
E tall time	tf	☐	☐	25	ns
Address set-up time	tas	140	☐	☐	ns
Address hold time	tah	10	☐	☐	ns
Data set-up time	tdsw	200	☐	☐	ns
Data delay time	tddr	☐	☐	320	ns
Data hold time (write)	tdhw	10	☐	☐	ns
Data hold time (read)	tdhr	20	☐	☐	ns
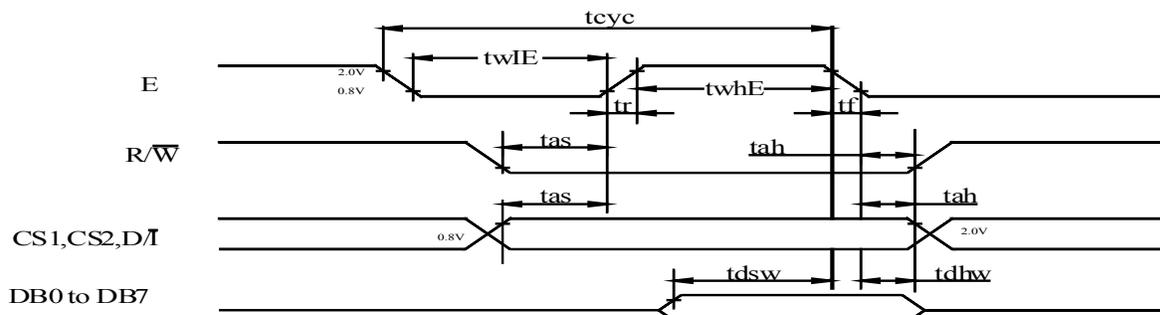
MPU Write Timing
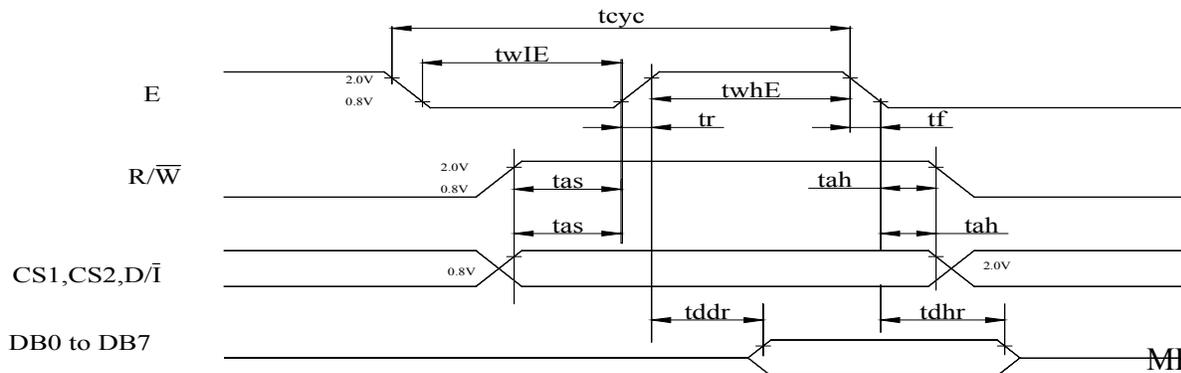
MPU Read Timing

10.Display Control Instruction

   The display control instructions control the internal state of the NT7108. Instruction is received from MPU to NT7108 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.

11.Detailed Explanation

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	1	1	1	1	D

The display data appears when D is 1 and disappears when D is 0. Though the data is not on the

screen with D=0, it remains in the display data RAM. Therefore, you can make it appear by changing D=0 into D=1.

SET ADDRESS (Y ADDRESS)

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0

Y address (AC0-AC5) of the display data RAM is set in the Y address counter. An address is set by instruction and increased by 1 automatically by read or write operations of display data.

SET PAGE (X ADDRESS)

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	1	0	1	1	1	AC2	AC1	AC0

X address (AC0-AC2) of the display data RAM is set in the X address register. Writing or reading to or from MPU is executed in this specified page until the next page is set.

DISPLAY START LINE (Z ADDRESS)

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	1	1	AC5	AC4	AC3	AC2	AC1	AC0

Z address (AC0-AC5) of the display data RAM is set in the display start line register and displayed at the top of the screen. When the display duty cycle is 1/64 or others (1/32-1/64), the data of total line number of LCD screen, from the line specified by display start line instruction, is displayed.

STATUS READ

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	1	BUSY	0	ON/OFF	RESET	0	0	0	0

▯BUSY

When BUSY is 1, the Chip is executing internal operation and no instructions are accepted.

When BUSY is 0, the Chip is ready to accept any instructions.

▯ON/OFF

When ON/OFF is 1, the display is OFF.

When ON/OFF is 0, the display is ON.

▯RESET

When RESET is 1, the system is being initialized.

In this condition, no instructions except status read can be accepted.

When RESET is 0, initializing has finished and the system is in usual operation condition.

WRITE DISPLAY DATA

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
1	0	D7	D6	D5	D4	D3	D2	D1	D0

Writes data (D0-D7) into the display data RAM. After writing instruction, Y address is increased by 1automatically.

READ DISPLAY DATA

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
1	1	D7	D6	D5	D4	D3	D2	D1	D0

Reads data (D0-D7) from the display data RAM. After reading instruction, Y address is increased by 1 automatically.

12.Reliability

Content of Reliability Test (wide temperature, -20□~70□)

Environmental Test			
Test Item	**Content of Test**	**Test Condition**	**Note**
High Temperature storage	Endurance test applying the high storage temperature for a long time.	80°C 200hrs	2
Low Temperature storage	Endurance test applying the high storage temperature for a long time.	-30°C 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70°C 200hrs	——
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-20°C 200hrs	1
High Temperature/ Humidity Operation	The module should be allowed to stand at 60°C,90%RH max For 96hrs under no-load condition excluding the polarizer, Then taking it out and drying it at normal temperature.	60°C,90%RH 96hrs	1,2
Thermal shock resistance	The sample should be allowed stand the following 10 cycles of operation -20°C 25°C 70°C 30min 5min 30min 1 cycle	-20°C/70°C 10 cycles	——
Vibration test	Endurance test applying the vibration during transportation and using.	Total fixed amplitude : 1.5mm Vibration Frequency : 10~55Hz One cycle 60 seconds to 3 directions of X,Y,Z for Each 15 minutes	3
Static electricity test	Endurance test applying the electric stress to the terminal.	VS=800V,RS=1.5kΩ CS=100pF 1 time	——

Note1: No dew condensation to be observed.

Note2: The function test shall be conducted after 4 hours storage at the normal

   Temperature and humidity after remove from the test chamber.

**Note3: Vibration test will be conducted to the product itself without putting it in a container.**

13.Backlight Information

Specification

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	TEST□CONDITION
Supply Current	ILED	65	80	100	mA	V=3.5V
Supply Voltage	V	3.4	3.5	3.6	V	□
Reverse Voltage	VR	□	□	5	V	□
Luminous Intensity	IV	200	250	□	cd/m²	ILED=80mA
Life Time	□	□	10K	□	Hr.	ILED=80mA
Color	White					

Note: The LED of B/L is drive by current only, drive voltage is for reference only.
   drive voltage can make driving current under safety area (current between
   minimum and maximum).

2.Drive from pin19,pin20
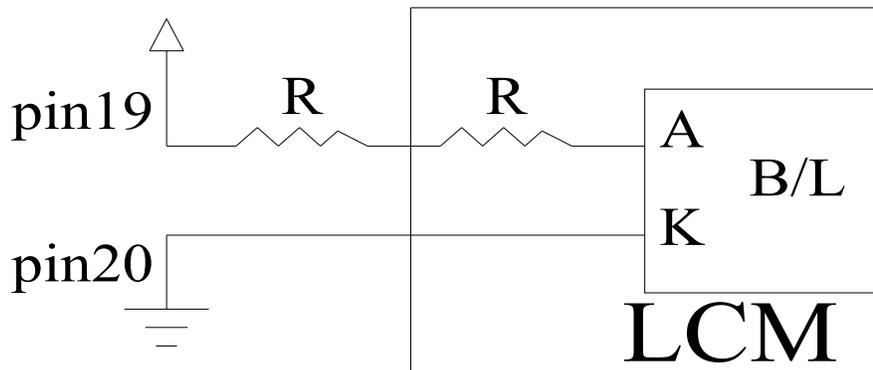
(Will never get Vee output from pin19)

14. Material List of Components for RoHS

1. Crystalfontz America, Inc. hereby declares that all of or part of products (with the mark "#"in code), including, but not limited to, the LCM, accessories or packages, manufactured and/or delivered to your company (including your subsidiaries and affiliated company) directly or indirectly by our company (including our subsidiaries or affiliated companies) do not intentionally contain any of the substances listed in all applicable EU directives and regulations, including the following substances.

Exhibit A: The Harmful Material List

Material	(Cd)	(Pb)	(Hg)	(Cr6+)	PBBs	PBDEs
Limited Value	100 ppm	1000 ppm	1000 ppm	1000 ppm	1000 ppm	1000 ppm
Above limited value is set up according to RoHS.						

2.Process for RoHS requirement:
   (1) Use the Sn/Ag/Cu soldering surface: the surface of Pb-free solder is rougher than we used before.
   (2) Heat-resistance temp.:
      Reflow: 250°C,30 seconds Max.
      Connector soldering wave or hand soldering: 320°C, 10 seconds max.
   (3) Temp. curve of reflow, max. Temp.: 235±5°C
      Recommended customer's soldering temp. of connector: 280°C, 3 seconds.