ZETTLER DISPLAYS

SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

CUSTOMER APPROVAL			
※ **PART NO. :** ATM0784L1(ZETTLER DISPLAYS) PRELIMINARY			
APPROVAL		**COMPANY CHOP**	
CUSTOMER COMMENTS			

ZETTLER DISPLAYS ENGINEERING APPROVAL		
DESIGNED BY	**CHECKED BY**	**APPROVED BY**
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REVISION RECORD

REVISION	REVISION DATE	PAGE	CONTENTS
	2019-07-04		**PRELIMINARY**
	2019-07-09	**4/5**	**ADD PIXEL INFORMATION**
			ADD CONNECTOR INFORMATION

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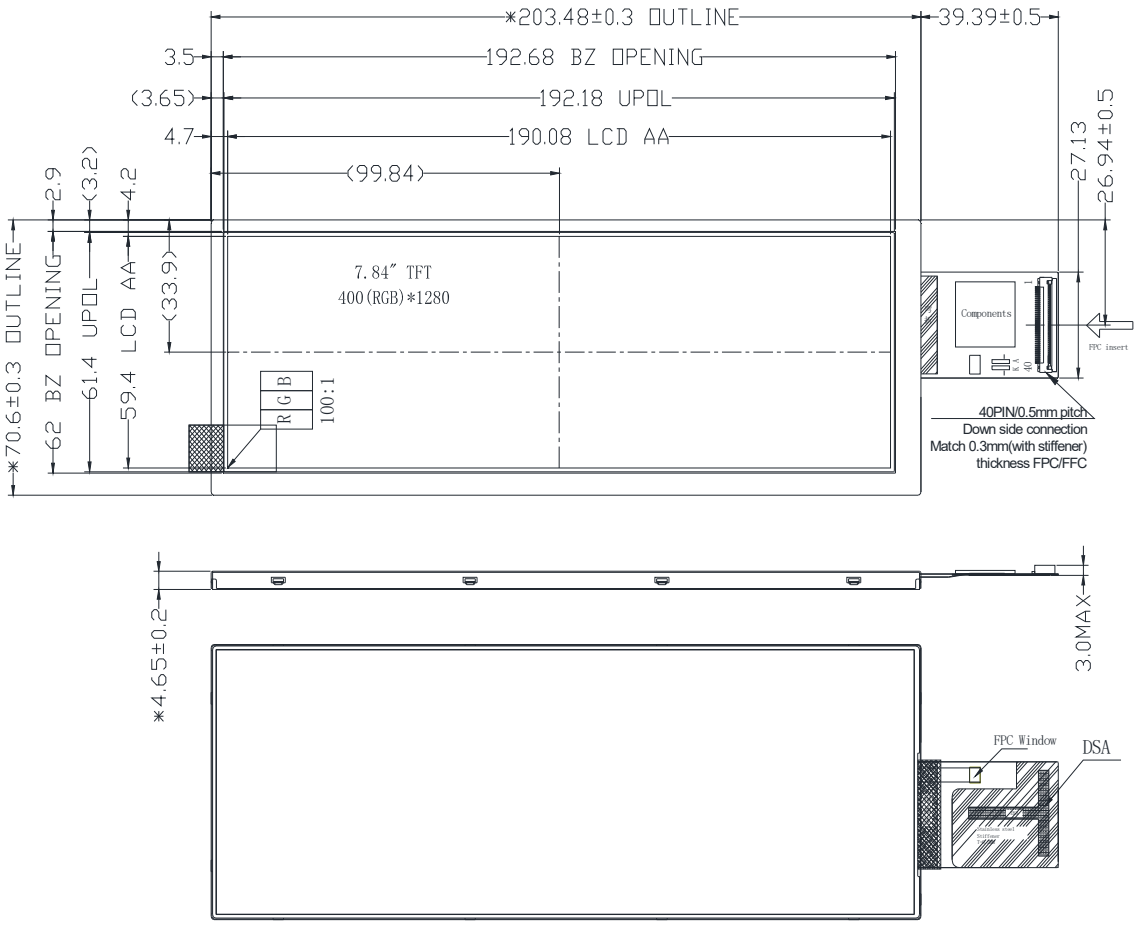
1. General Specifications

ATM0784L1 is a TFT-LCD module. It is composed of a TFT-LCD panel, driver IC, FPC, a back light unit. The 7.84″ display area contains 400(RGB) x 1280 pixels and can display up to 16.7M colors. This product accords with RoHS environmental criterion.

Item	Contents	Unit	Note
LCD Type	TFT	-	
Display color	16.7M		
Viewing Direction	ALL	O'Clock	
Operating temperature	-20~+70	℃	
Storage temperature	-30~+80	℃	
Module size	203.48x70.6x4.65	mm	
Active Area(W×H)	190.08x59.4	mm	
Number of Dots	400×RGB×1280	dots	
Dot pitch	0.0495x0.1485	mm	
Pixel pitch	0.1485x0.1485	mm	
Backlight	24-LEDs (white)	pcs	
Brightness(LCM)	550	cd/m^2	TYP.
Data Transfer	MIPI	-	

2.Outline.Drawing



3 Interface signals

Pin No.	Symbol	Function
1	GND	Ground
2	D0P	MIPI Data lane0 input （positive）
3	D0N	MIPI Data lane0 input (negative)
4	GND	Ground
5	D1P	MIPI Data lane1 input（positive）
6	D1N	MIPI Data lane1 input(negative)
7	GND	Ground
8	CLKP	MIPI CLK input （positive）
9	CLKN	MIPI CLK input (negative)
10	GND	Ground
11	D2P	MIPI Data lane2 input（positive）
12	D2N	MIPI Data lane2 input (negative)
13	GND	Ground
14	D3P	MIPI Data lane3 input（positive）
15	D3N	MIPI Data lane3 input (negative)
16-17	GND	Ground
18-19	IOVCC	IO Power Supply(1.8V)
20-23	NC	NC
24	RSTB	global reset pin. Active low to enter reset state. suggest to connecting with an RC reset circuit for stability. Normally pull high.
25	NC	NC
26	NC	NC
27	GND	Ground
28-29	K	Backlight LED Ground
30	GND	Ground
31	NC	NC
32-33	GND	Ground
34	NC	NC
35-36	A	Backlight LED Power
37	GND	Ground
38-39	VCI	Power Supply(3.3V)
40	NC	NC

4. Absolute Maximum Ratings(Ta=25℃)

4.1 Electrical Absolute Maximum Ratings.(Vss=0V ,Ta=25℃)

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Note
Power supply	VCI	Ta=25℃	2.5	-	6	V	
I/O and interface power supply	IOVCC	Ta=25℃	1.8	-	5.5	V	

Notes:

1. If the module is above these absolute maximum ratings. It may become permanently damaged. Using the module within the following electrical characteristic conditions are also exceeded, the module will malfunction and cause poor reliability.
2. $V_{CI} > V_{SS}$ must be maintained.
3. Please be sure users are grounded when handing LCD Module

4.2 Environmental Absolute Maximum Ratings.

Item	Storage		Operating		Note
	MIN.	MAX.	MIN.	MAX.	
Ambient Temperature	-30℃	80℃	-20℃	70℃	1,2

1. The response time will become lower when operated at low temperature.
2. Background color changes slightly depending on ambient temperature.
   The phenomenon is reversible.

5. Electrical Specifications and Input Timing Table

5.1 Electrical characteristics(Vss=0V ,Ta=25℃)

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Note
Power supply		VCI	Ta=25℃	-	3.3	3.6	V	
Power supply		IOVCC	Ta=25℃	-	1.8	3.3	V	
Input voltage	'H'	V_{IH}	V_{IOVCC}=1.8V	$0.8V_{IOVCC}$	-	V_{IOVCC}	V	
	'L'	V_{IL}	V_{IOVCC}=1.8V	0	-	$0.2V_{IOVCC}$	V	

Note:

1:When an optimum contrast is obtained in transmissive mode.

2: Tested in 1×1 chessboard pattern.

5.2 Input Timing Table

For 400RGBx1280

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
MIPI (4 Lane) @Frame rate=60Hz			349		Mbps
MIPI (3 Lane) @Frame rate=60Hz			465		Mbps
DCLK frequency @Frame rate=60Hz	F_{DCLK}		58.2		MHz
HSYNC period time	T_H		744		DCLK
Horizontal display area	T_{HD}		400		DCLK
HSYNC pulse width	T_{HPW}		24	-	DCLK
HSYNC back porch	T_{HBP}		160	-	DCLK
HSYNC front porch	T_{FBP}		160	-	DCLK
VSYNC period time	T_V		1304		H
Vertical display area	T_{VD}		1280		H
VSYNC pulse width	T_{VPW}		2	-	H
VSYNC back porch	T_{VBP}		10	-	H
VSYNC front porch	T_{VFP}		12	-	H

5.3 LED backlight specification(VSS=0V ,Ta=25℃)

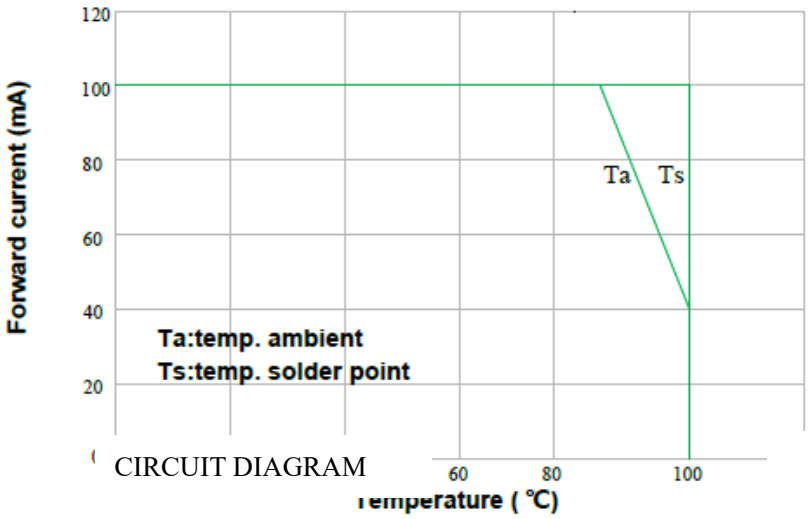
Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Supply voltage	V_f	-	-	24	-	V	1
Supply current	I_f	-	-	120	-	mA	2
Number of LED	-	8Sx3P	-	24	-	Piece	
LED life time	-		20000	-	-	Hr	

Note:

1: $V_{LED}=V_{LED}(+)-V_{LED}(-)$.

2:The current of LED is 40mA.

A LED drive in constant current mode is recommended.



CIRCUIT DIAGRAM

6. Optical Characteristics

Item	Symbol		Condition	Min.	Typ.	Max.	Unit	Note
Brightness	Bp		θ=0° Φ=0°	500	550	-	cd/m^2	1
Uniformity	⊿Bp			75	80	-	%	1,2
Viewing Angle	3:00		Cr≥10	-	80	-	Deg	3
	6:00			-	80	-		
	9:00			-	80	-		
	12:00			-	80	-		
Contrast Ratio	Cr		θ=0° Φ=0°	700	900		-	4
Response Time	T_r+T_f				25	40	ms	5
Color of CIE Coordinate	W	x	θ=0° Φ=0°	0.250	0.280	0.310	-	1,6
		y		0.260	0.290	0.320	-	
	R	x		0.562	0.592	0.622	-	
		y		0.289	0.319	0.349	-	
	G	x		0.279	0.309	0.339	-	
		y		0.537	0.567	0.597	-	
	B	x		0.117	0.147	0.177	-	
		y		0.120	0.150	0.180	-	
NTSC Ratio	S			60	70	-	%	

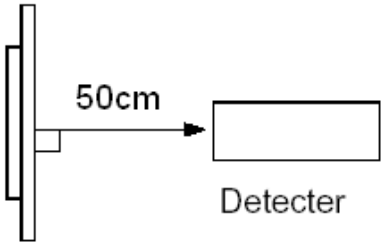
Note：The parameter is slightly changed by temperature, driving voltage and materiel

Note 1: The data are measured after LEDs are turned on for 5 minutes. LCM displays full white. The brightness is the average value of 9 measured spots. Measurement equipment BM-7 (Φ7.5mm)

Measuring condition:

- Measuring surroundings: Dark room.
- Measuring temperature: Ta=25℃.
- Adjust operating voltage to get optimum contrast at the center of the display.

Measured value at the center point of LCD panel after more than 5 minutes while backlight turning on.

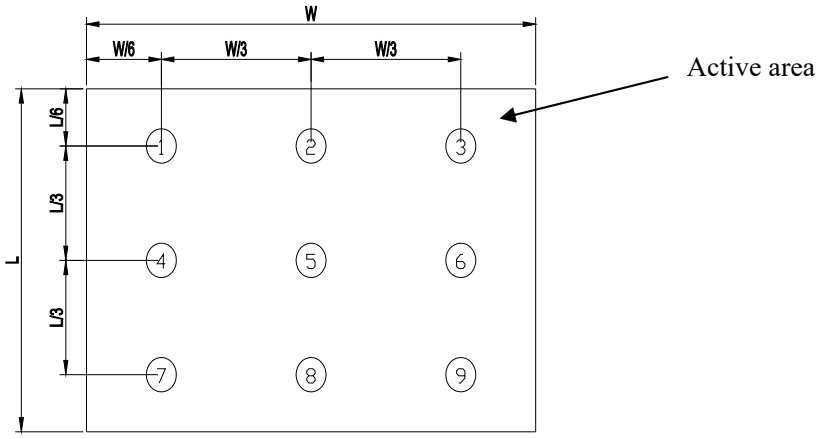


Note 2: The luminance uniformity is calculated by using following formula.

⊿Bp = Bp (Min.) / Bp (Max.)×100 (%)

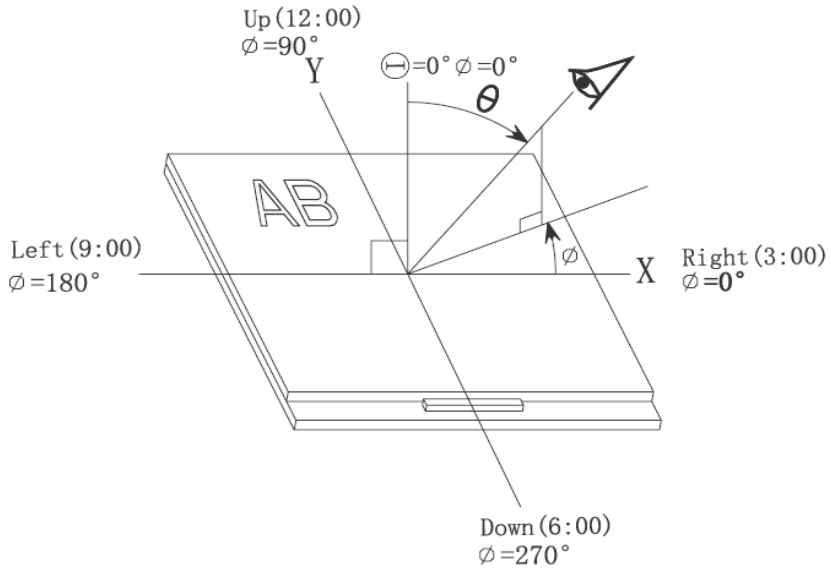
Bp (Max.) = Maximum brightness in 9 measured spots

Bp (Min.) = Minimum brightness in 9 measured spots.

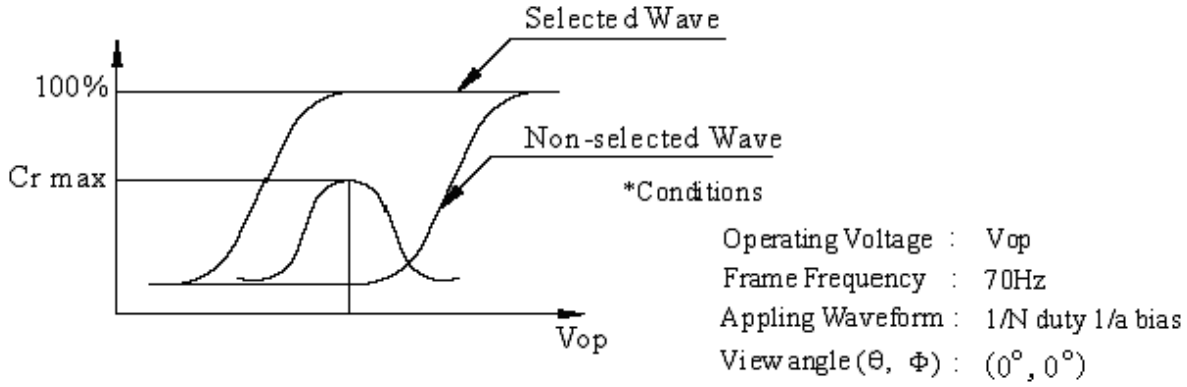


Note 3: The definition of viewing angle:

Refer to the graph below marked by θ and Φ



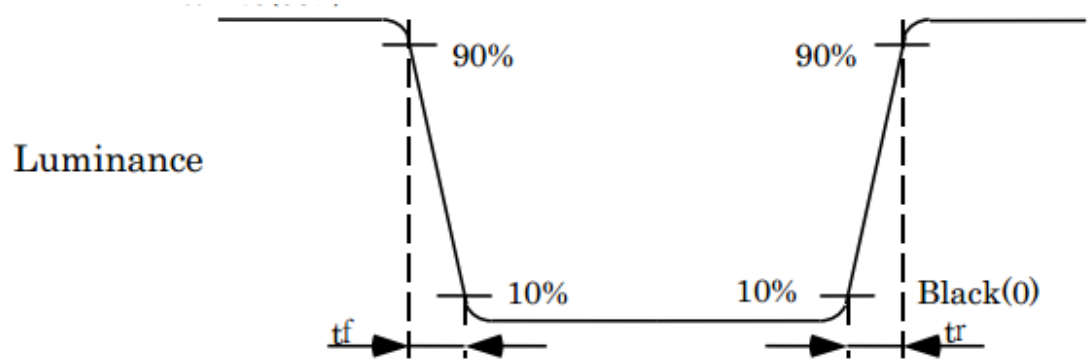
Note 4: Definition of contrast ratio.(Test LCD using DMS501)



$$Contrast\ ratio(Cr) = \frac{Brightness\ of\ selected\ dots}{Brightness\ of\ non-selected\ dots}$$

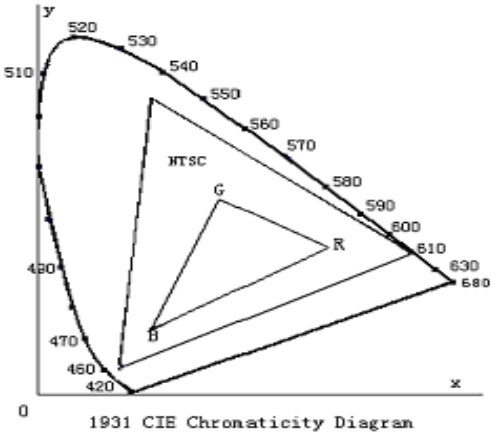
Note 5: Definition of Response time. (Test LCD using DMS501):

The output signals of photo detector are measured when the input signals are changed from “black” to “white”(Tf) and from “white” to “black”(Tr), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes.Refer to figure as below.



The definition of response time

Note 6: Definition of Color of CIE Coordinate and NTSC Ratio.

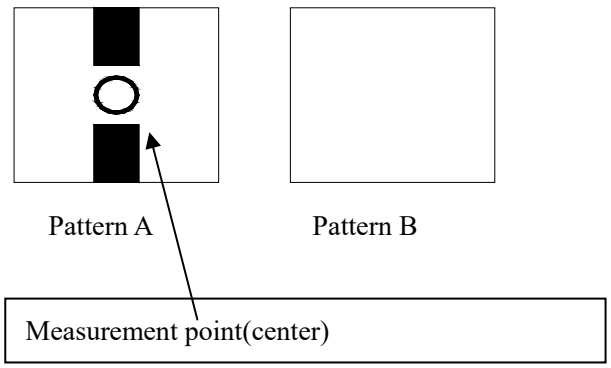


Color gamut:

$$S = \frac{\text{area of RGB triangle}}{\text{area of NTSC triangle}} \times 100\%$$

Note 7: Definition of cross talk.

Cross talk ratio(%)=|pattern A Brightness-pattern B Brightness|/pattern A Brightness*100



Electric volume value=3F+/-3Hex

7. Reliability Test Items and Criteria

No	Test Item	Test condition	Criterion
1	High Temperature Storage	80℃ 96H Restore 2H at 25℃ Power off	1. After testing, cosmetic and electrical defects should not happen. 2. Total current consumption should not be more than twice of initial value.
2	Low Temperature Storage	-30℃ 96H Restore 2H at 25℃ Power off	
3	High Temperature Operation	70℃ 96H Restore 2H at 25℃ Power on	
4	Low Temperature Operation	-20℃ 96H Restore 4H at 25℃ Power on	
5	High Temperature/Humidity Operation	60℃ 90%RH 96H Power on	
6	Temperature Cycle	-30℃ ←→ 80℃ 30min 5min 30min After 20 cycle, Restore 2H at 25℃ Power off	
7	Package Vibration Test	Random Vibration : 0.015G*G/Hz from 5-200HZ, -6dB/Octave from 200-500HZ 2 hours for each direction of X. Y. Z. (6 hours for total)	Not allowed cosmetic and electrical defects.
8	Mechanical Shock	100G, 6ms,±X, ±Y, ±Z 3 times for each direction	
9	Electro Static Discharge	Air :±8KV,(150PF,330Ω) Contact:±4KV(150PF,330Ω) Class B(EN 61000-4-2)	

Note: Operation: Supply 3.3V for logic system.

The inspection terms after reliability test, as below

ITEM	Inspection
Contrast	CR>50%
IDD	IDD<200%
Brightness	Brightness>60%
Color Tone	Color Tone+/-0,05

8 Quality level

As Quality department <<Product Cosmetic SPEC>>.

9. Precautions for Use of LCD Modules

9.1 Handling Precautions

9.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

9.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

9.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

9.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

9.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

— Isopropyl alcohol

— Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

— Water

— Ketone

— Aromatic solvents

9.1.6 Do not attempt to disassemble the LCD Module.

9.1.7 If the logic circuit power is off, do not apply the input signals.

9.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

a. Be sure to ground the body when handling the LCD Modules.

b. Tools required for assembly, such as soldering irons, must be properly

ground.

c. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

d. The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

9.2 Storage precautions

9.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

9.2.2 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

Temperature : 0℃ ～ 40℃

Relatively humidity: ≤80%

9.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

9.3 The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.