



晶采光電科技股份有限公司
AMPIRE CO., LTD.

SPECIFICATIONS FOR LCD MODULE

CUSTOMER	
CUSTOMER PART NO.	
AMPIRE PART NO.	AF-09632FFI-H
APPROVED BY	
DATE	

AMPIRE CO., LTD.

**TOWER A, 4F, No.114, Sec. 1, HSIN-TAI 5th RD., HIS-CHIH,
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RECORD OF REVISION

Revision Date	Contents
2001/11/27	New Release

1 FEATURES

- (1) Display format : 96×32 dot-matrix; 1/33 duty.
- (2) Construction : LCD and COF.
- (3) Display type : FSTN, Transflective, Positive, 6 o'clock view
- (4) LCD driver : NT7501
- (5) Input data : Series data interface from a MPU
- (6) 3.3V power input.
- (7) Extended temperature type.
- (8) With temperature compensation circuit.

2 MECHANICAL DATA

Parameter	Stand Value	Unit
Dot size	$0.3(W) \times 0.33(H)$	mm
Dot pitch	$0.315(W) \times 0.345(H)$	mm
Viewing area	$33.0(W) \times 13.2(H)$	mm
Module size	$36.0(W) \times 50.5(H) \times 1.6 \text{ Max.}(T)$	mm

3 ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit
Logic Circuit Supply Voltage	VDD-VSS	-0.3	6.0	V
LCD Driving Voltage	V0 -VSS	-0.3	10.5	V
Input Voltage	VI	-0.3	VDD+0.3	V
Operating Temp.	TOP	-20	70	°C
Storage Temp.	TSTG	-30	80	°C

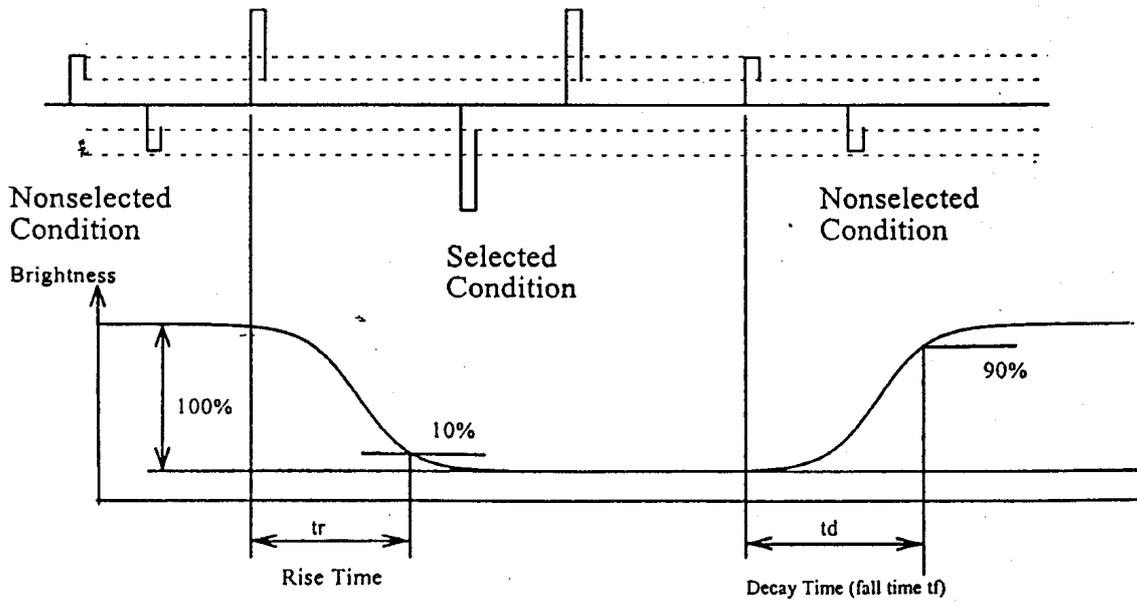
4 ELECTRO-OPTICAL CHARACTERISTICS

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Note
----- Electronic Characteristics -----							
Logic Circuit Supply Voltage	VDD-VSS	--	2.4	3.3	3.5	V	
LCD Driving Voltage.	V0-V5	-20 °C	--	7.57	--	V	
		25 °C	--	7.40	--		
		70 °C	--	7.30	--		
Input Voltage	VIH	--	0.8 VDD	--	VDD	V	
	VIL	--	VSS	--	0.2VDD	V	
Logic Supply Current	IDD	VDD = 3.3V	--	0.2	0.5	mA	
----- Optical Characteristics -----							
Contrast	CR	FSTN type	--	7	--		Note 1
Rise Time	tr	25°C	--	200	--	ms	Note 2
Fall Time	tf	25°C	--	200	--	ms	
Viewing Angle Range	θ f	25°C & CR≥2	--	40	--	Deg.	Note 3
	θ b		--	35	--		
	θ l		--	40	--		
	θ r		--	40	--		
Frame Frequency	fF	25°C	--	64	--	Hz	

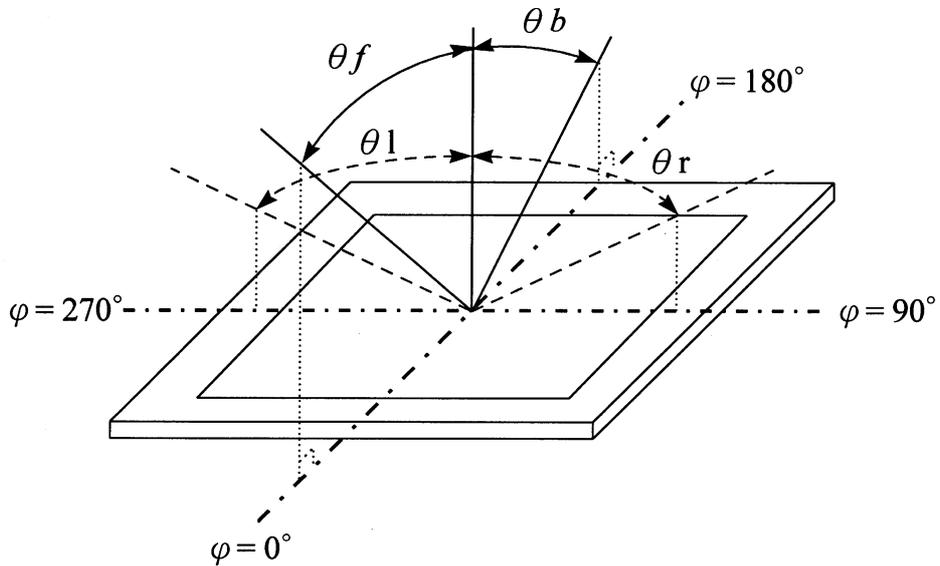
(NOTE 1) Contrast ratio :

CR = (Brightness in OFF state) / (Brightness in ON state)

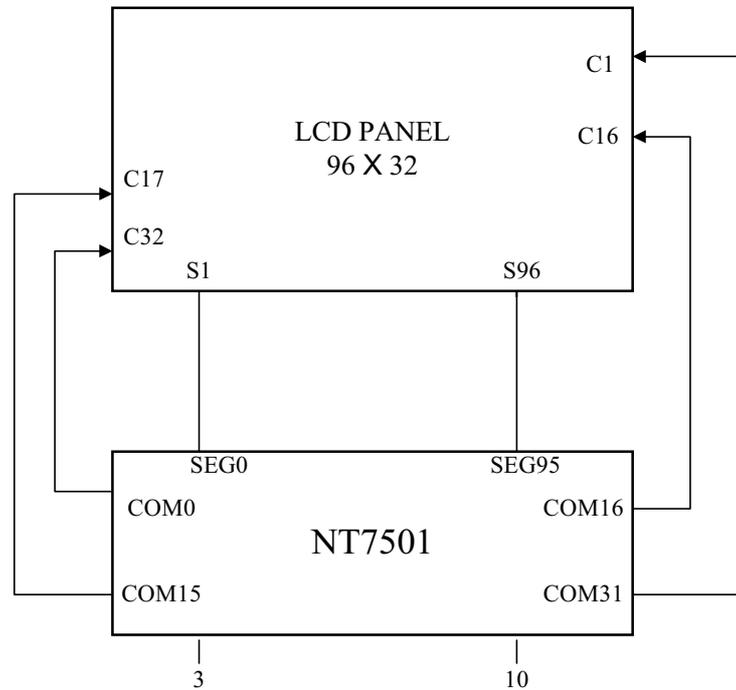
(NOTE 2) Response time :



(NOTE 3) Viewing angle



5 BLOCK DIAGRAM

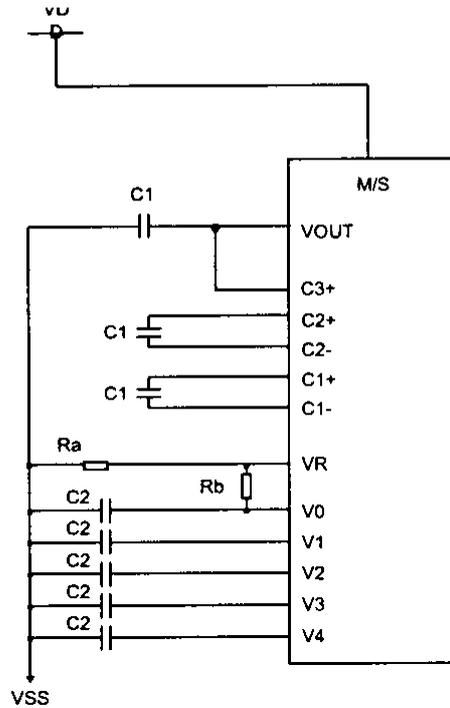


Default Setting:

Symbol	H/L	Description
M/S	H	Master
C86	H	Serial Interface, this pin pull high.
P/S	L	Serial Interface
CS2	H	When /CS1="L", then the Chip select become active.
TPS0	L	Temperature coefficient: of the reference voltage:
TPS1	L	Thermal Gradient : -0.05 % / °C

6 POWER SUPPLY

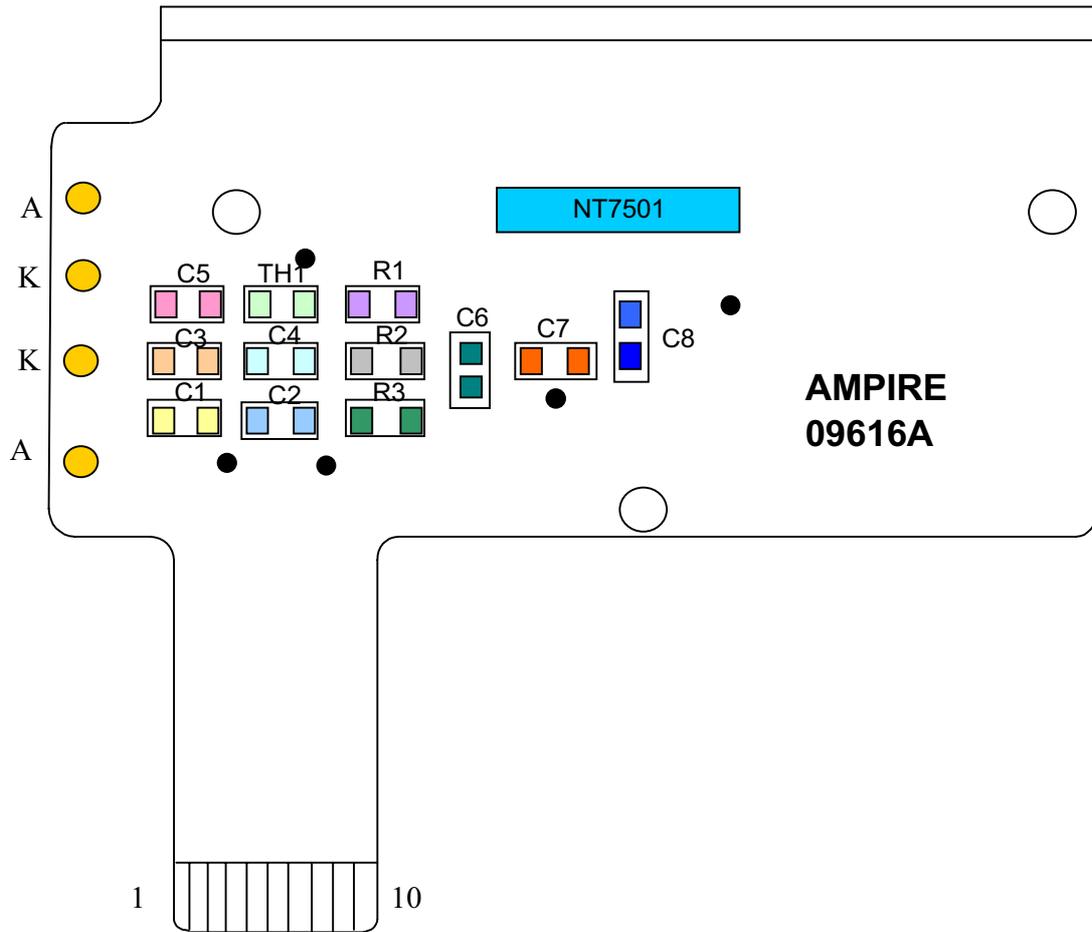
-When using all LCD power circuits
 (Voltage converter regulator and follower)
 (In case of 3X boosting circuit)



7 PIN CONNECTIONS

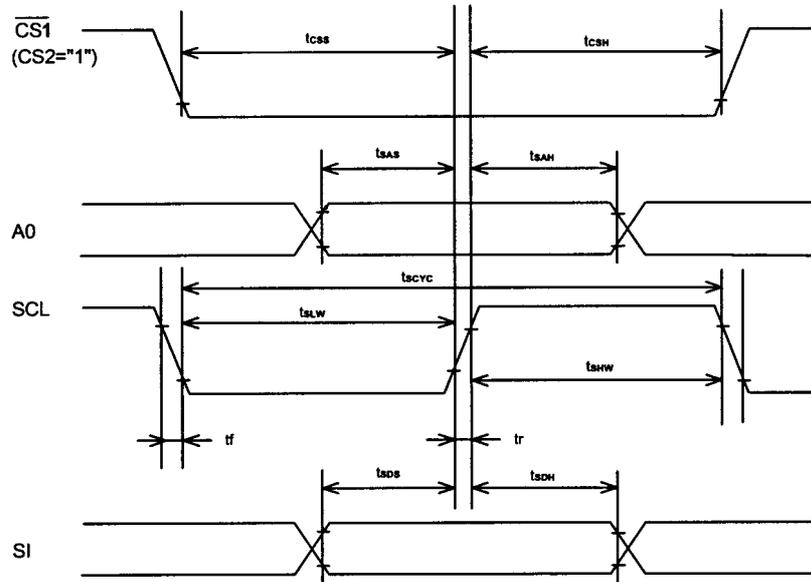
No.	Symbol	Function
1	NC	No Connection
2	NC	No Connection
3	VSS	Ground (0V)
4	SI	Input Serial Data
5	SCLK	Input Serial Clock
6	VDD	Power Supply for Logic (3.3V)
7	A0	Command/Data Selecting
8	/CS	Chip Selecting
9	/RES	Low Active Reset Signal
10	VSS	Ground (0V)

8 BOM LIST



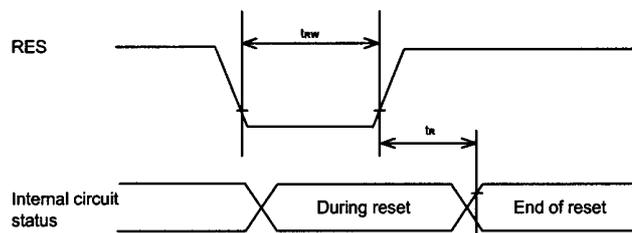
Pos	Quantity	Designator	Component	Type /Value	Case	Manufacturer
1	1		LCD	96 × 32 dot-matrix Transflective, 6 o'clock		Truly
2	1		Film	09616A		Sony
3	1	U1	Controller	NT7501		NovaTek
4	1	R1	Chip resistor	150K	0603	
5	1	R2	Chip resistor	330K	0603	
6	1	R3	Chip resistor	18K	0603	
7	1	TH1	Thermal resistor	10K	0603	
8	8	C1~C8	Chip capacitor	1uF /10V	0603	

9 TIMING CHARACTERISTICS



($V_{DD}=2.4 - 3.5V, T_A = -40 - 85^{\circ}C$)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
Tscyc	Serial clock cycle	450			nS	
Tshw	Serial clock H pulse width	180			nS	
Tslw	Serial clock L pulse width	135			nS	
Tsas	Address setup time	90			nS	
Tсах	Address hold time	360			nS	
Tsds	Data setup time	90			nS	
Tsdh	Data hold time	90			nS	
Tcss	$\overline{CS1}$ serial clock time	55			nS	
Tcsh	$\overline{CS1}$ serial clock time	180			nS	

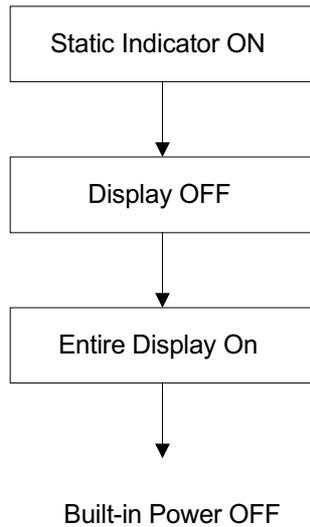


($V_{DD}=2.4 - 3.5V, T_A = -40 - 85^{\circ}C$)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
TR	Reset time	1.0			μS	
Tw	Reset low pulse width	1.0			μS	

9.1 Power OFF Software Sequence

Please maintain the below sequence when turning off the power supply of the module, turn it off after making the system into the standby mode. If not, the DC component will be supplied to the LCD panel. This may cause damage the LCD module.



RS	RW	(DB7~DB0)	HEX
0	0	(10101101)	ACh
0	0	(10101110)	Aeh
0	0	(10100101)	A5h

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-STD-105E , level II, normal single sampling plan .

10.3 ACCEPTABLE QUALITY LEVEL

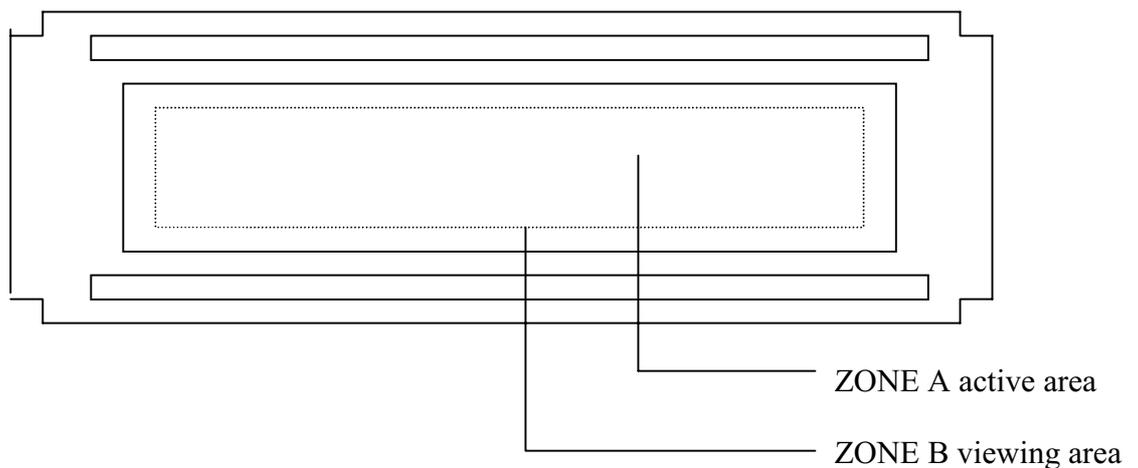
A major defect is defined as one that could cause failure to or materially reduce the usability of the unit for its intended purpose. A minor defect is one that does not materially reduce the usability of the unit for its intended purpose or is an infringement from established standards and has no significant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

10.4 APPEARANCE

An 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
High Temperature Operation	70±3°C , t=96 hrs	
Low Temperature Operation	-20±3°C , t=96 hrs	
High Temperature Storage	80±3°C , t=96 hrs	1,2
Low Temperature Storage	-30±3°C , t=96 hrs	1,2
Humidity Test	40°C , Humidity 90%, 96 hrs	1,2
Thermal Shock Test	-30°C ~ 25°C ~ 80°C 30 min. 5 min. 30 min. (1 cycle) Total 5 cycle	1,2
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) An 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.

