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.	**AO-09648BFI-00H**
APPROVED BY	
DATE	

AMPIRE CO., LTD.
TOWER A, 4F, No.114, Sec. 1, HSIN-TAI 5th RD., HIS-CHIH,
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APPROVED BY	CHECKED BY	ORGANIZED BY
	Jelly 10/17	Johnny 10/7

RECORD OF REVISION

Revision Date	Contents	Editor
2004/6/18	New Release	Johnny
2004/11/1	Revise Mechanical Data	Johnny

1 FEATURES

(1) Display format : 96×48 dots, 1/49 duty, 1/8 bias.

(2) Construction : LCD panel, FPC and COG technology.

(3) Display type : FSTN, Transflective, Positive , 6 o'clock view

(4) Controller : ST7565V

(5) Interface for 80 series family MPU

(6) Extend temperature type.

2 MECHANICAL DATA

Parameter	Stand Value	Unit
Dot size	0.185(W) × 0.26(H)	mm
Dot pitch	0.2(W) × 0.275(H)	mm
Active area	19.185(W) × 13.185 (H)	mm
Viewing area	21.5(W) × 16 (H)	mm
Module size	25.3(W) ×38.5(H) × 1.8 Max. (T)	mm
Weight	2.0	mg

3 ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit
Logic Circuit Supply Voltage	VDD-VSS	-0.3	7.0	V
LCD Driving Voltage	VDD-VO	0	16.0	V
Input Voltage	VI	-0.3	VDD+0.3	V
Operating Temp.	TOP	-20	70	°C
Storage Temp.	TSTG	-30	80	°C

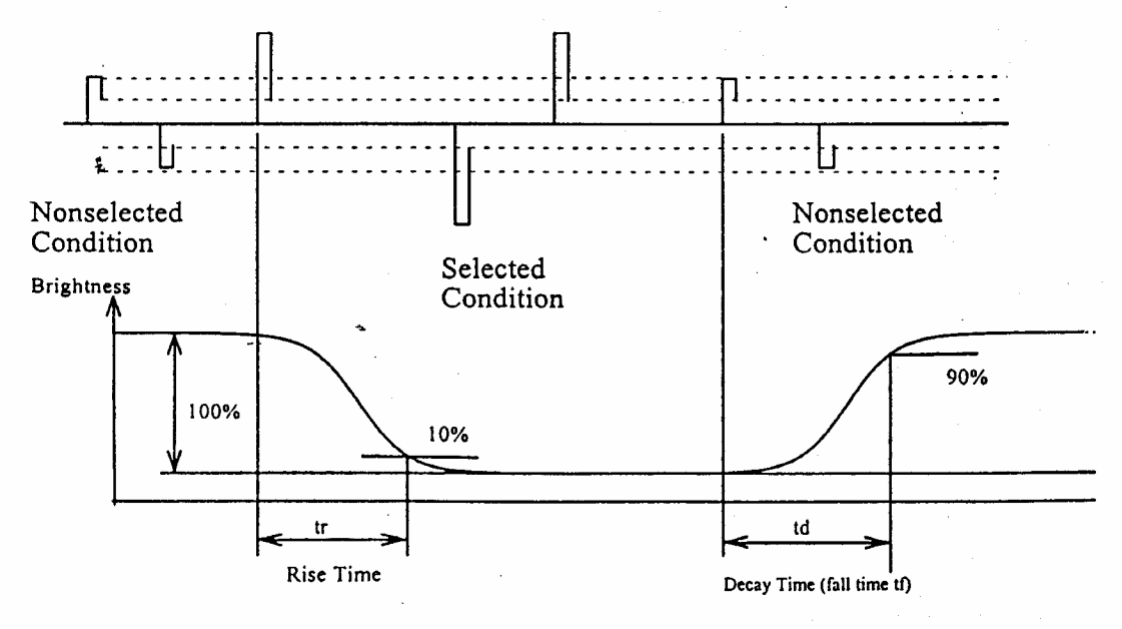
4 ELECTRO-OPTICAL CHARACTERISTICS

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Note
----- Electronic Characteristics -----							
Logic Circuit Supply Voltage	VDD-VSS	--	2.4	3.0	3.6	V	
LCD Driving Voltage (FSTN)	VLCD	-20 °C	--	--	--	V	
		25 °C	8.5	9.0	9.5		
		70 °C					
Input Voltage	VIH	--	0.7VDD	--	VDD	V	
	VIL	--	-0.3	--	0.15 VDD	V	
Logic Supply Current	IDD	VDD=3.0V	--	0.05	0.15	mA	
----- Optical Characteristics (FSTN) -----							
Contrast	CR	25°C	--	13.8	--		Note 1
Rise Time	tr	25°C	--	250	750	ms	Note 2
Fall Time	tf	25°C	--	300	900	ms	
Viewing Angle Range	θ f	25°C & CR≥2	--	45	--	Deg.	Note 3
	θ b		--	45	--		
	θ l		--	45	--		
	θ r		--	45	--		
Frame Frequency	fF	25°C	--	64	--	Hz	

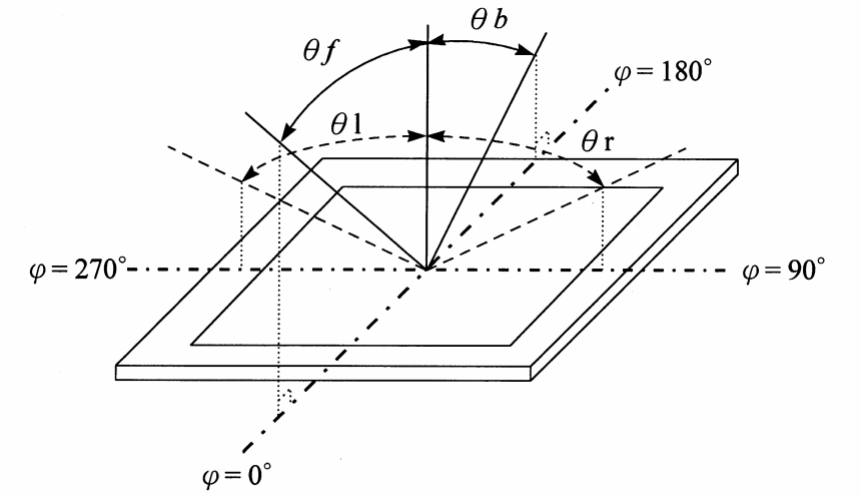
(NOTE 1) Contrast ratio :

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

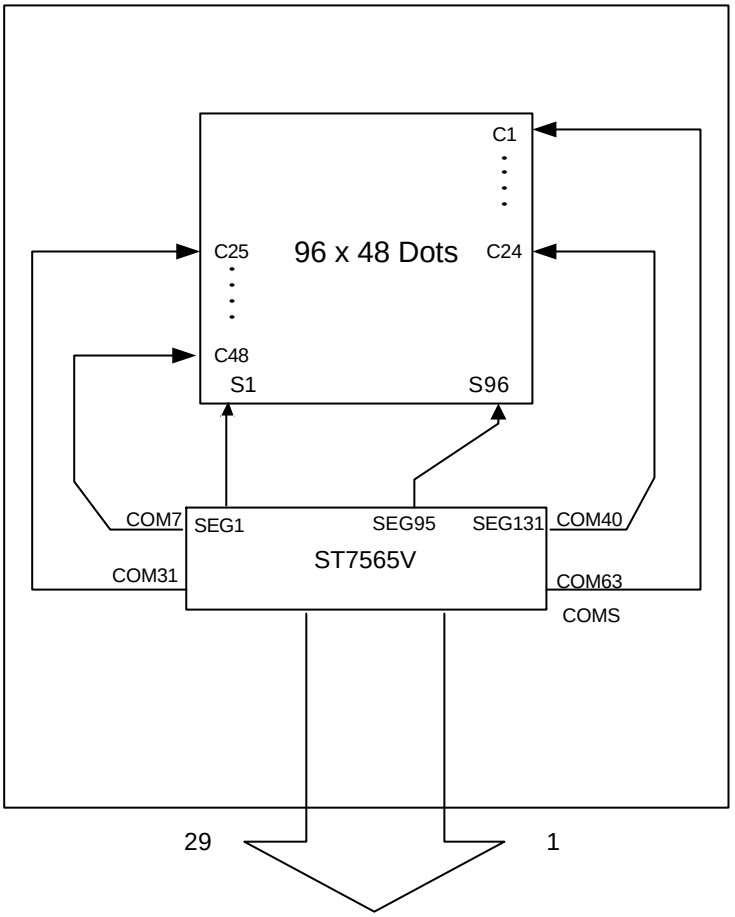
(NOTE 2) Response time :



(NOTE 3) Viewing angle



5 BLOCK DIAGRAM & POWER SUPPLY



Default Setting:

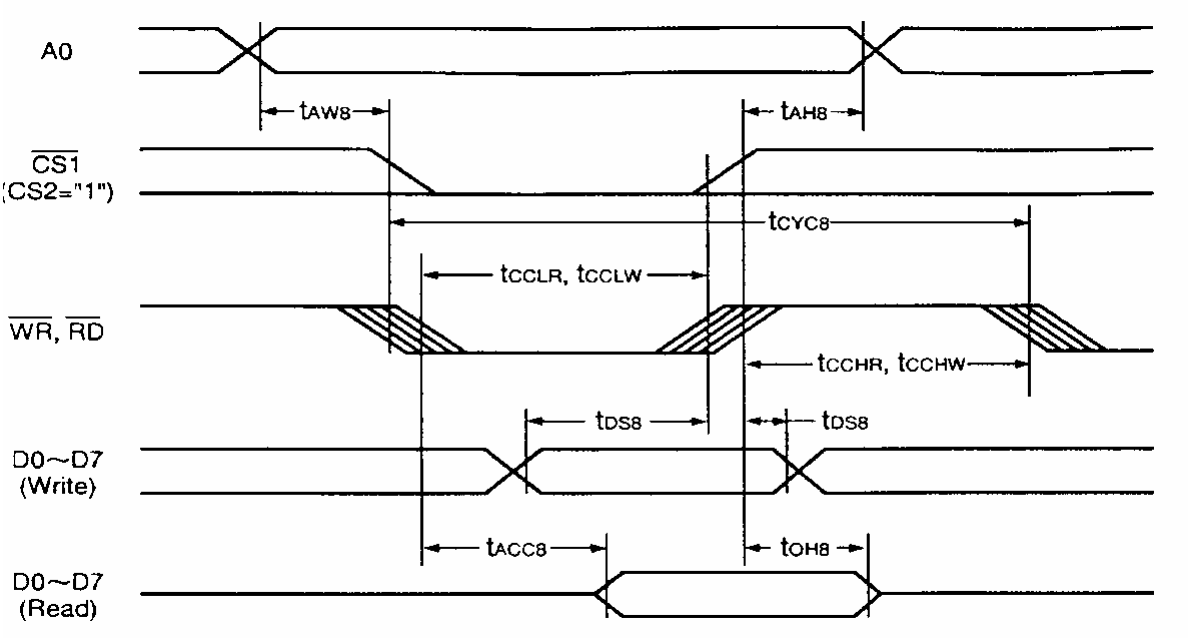
Symbol	H/L	Description
FR, FRS, M, CL, /DOF	NC	Single chip; No used
TEST[5:0]	NC	Test pin; no used
/CS1	H	When /CS1=" L" , then the Chip select become active.
SEL[3:1]	LLH	1/49 Duty
VRS	NC	Internal voltage regulator
IRS	L	External resistor
M/S	H	Master mode
CLS	H	Internal clock is enable
C68	L	8080 Series MPU interface
P/S	H	Parallel data input
/HPM	L	High power current mode

6 INTERFACE

No.	Signal	Level	Function
1	NC	H/L	No connection
2	/CS1	H/L	Chip Select Signal
3	/RES	H/L	Reset Signal
4	AO	H/L	Data/Instruction Selection Signal
5	/WR	H/L	Write enable clock input pin. The data on D0 to D7 are latched at the rising edge of the /WR signal.
6	/RD	H/L	Read enable clock input pin. When /RD is "L" D0 to D7 are in an output status
7	D0	H/L	8 bits Data Bus for 8080 Series MPU
8	D1	H/L	
9	D2	H/L	
10	D3	H/L	
11	D4	H/L	
12	D5	H/L	
13	D6	H/L	
14	D7	H/L	
15	VDD		Power Supply
16	VSS	-	Ground
17	VOUT	-	Voltage converter output pin. Connect this pin to VSS through capacitor.
18	CAP3-	-	Boost capacitor
19	CAP1+	-	Boost capacitor (quadruple)
20	CAP1-	-	Boost capacitor
21	CAP2-	-	Boost capacitor
22	CAP2+	-	Boost capacitor (triple or more)
23	V1	-	LCD driver supply voltages The voltage determined by LCD pixel is impedance-converted by an operational amplifier for application. Voltages should have the following relationship: VDD=(V0) ≧V1 ≧ V2 ≧ V3 ≧ V4 ≧ V5
24	V2	-	
25	V3	-	
26	V4	-	
27	V5	-	
28	VR	-	Contrast adjustment
29	NC	-	No connection

7 TIMING CHARACTERISTICS

80-SYSTEM



(V_{DD}=3.3V, Ta=25°C)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	t_{AH8}		0	-	ns
Address setup time		t_{AW8}		0	-	
System cycle time		t_{CYC8}		240	-	
Enable L pulse width (WRITE)	WR	t_{CCLW}		80	-	
Enable H pulse width (WRITE)		t_{CCHW}		80	-	
Enable L pulse width (READ)	RD	t_{CCLR}		80	-	
Enable H pulse width (READ)		t_{CCHR}		140		
WRITE Data setup time	D0 to D7	t_{DS8}		40	-	
WRITE Address hold time		t_{DH8}		0	-	
READ access time		t_{ACC8}	C_L=100pF	-	70	
Read Output disable time		t_{OH8}	C_L=100pF	5	50	

8 INSTRUCTION SET

Command	Command Code											Function
	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	
(1) Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0 1	LCD display ON/OFF 0:OFF, 1:ON
(2) Display start line set	0	1	0	0	1	Display start address						Sets the display RAM display start line address
(3) Page address set	0	1	0	1	0	1	1	Page address				Sets the display RAM page address
(4) Column address set upper bit Column address set lower bit	0	1	0	0 0	0 0	0 0	1 0	Most significant column address Least significant column address				Sets the most significant 4 bits of the display RAM column address. Sets the least significant 4 bits of the display RAM column address.
(5) Status read	0	0	1	Status				0	0	0	0	Reads the status data
(6) Display data write	1	1	0	Write data								Writes to the display RAM
(7) Display data read	1	0	1	Read data								Reads from the display RAM
(8) ADC select	0	1	0	1	0	1	0	0	0	0	0 1	Sets the display RAM address SEG output correspondence 0: normal, 1:reverse
(9) Display normal/reverse	0	1	0	1	0	1	0	0	1	1	0 1	Sets the LCD display normal/reverse 0: normal, 1:reverse
(10) Display all points ON/OFF	0	1	0	1	0	1	0	0	1	0	0 1	Display all points 0: normal display 1: all points ON
(11) LCD bias set	0	1	0	1	0	1	0	0	0	1	0 1	Sets the LCD drive voltage bias ratio 0: 1/9bias, 1:1/7bias
(12) Read/modify/write	0	1	0	1	1	1	0	0	0	0	0	Column address increment At write: +1 At read: 0
(13) End	0	1	0	1	1	1	0	1	1	1	0	Clear read/modify/write
(14) Reset	0	1	0	1	1	1	0	0	0	1	0	Internal reset
(15) Common output modify select	0	1	0	1	1	0	0	0 1	*	*	*	Select COM output scan direction 0: normal direction 1: reverse direction
(16) Power control set	0	1	0	0	0	1	0	1	Operating mode			Select internal power supply operating mode
(17) V5 voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			Select internal resistor ratio (Rb/Ra) mode
(18) Electronic volume mode set Electronic volume register set	0	1	0	1 0	0 0	0 Electronic volume value	0	0	0	0	1	Set the V5 output voltage electronic volume register
(19) static indicator ON/OFF static indicator register set	0	1	0	1 0	1 0	1 0	1 0	1 0	0 0	0 0	0 1 mode	0: OFF, 1:ON Set the flashing mode
(20) Booster ratio set	0	1	0	1 0	1 0	1 0	1 0	1 0	0 0	0 Step-up Value	0	Select booster ratio 00: 2x, 3x, 4x 01: 5x 11: 6x
(21) Power saver												Display OFF and display all point ON compound command
(22) NOP	0	1	0	1	1	1	0	0	0	1	1	Command for non-operation

Command	Command Code											Function
	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	
(23) Test	0	1	0	1	1	1	1	*	*	*	*	Command for IC test. Do not use this command

9 QUALITY AND RELIABILITY

9.1 TEST CONDITIONS

Tests should be conducted under the following conditions :

Ambient temperature : 25 ± 5°C

Humidity : 60 ± 25% RH.

9.2 SAMPLING PLAN

Sampling method shall be in accordance with MIL-STD-105E , level II, normal single sampling plan .

9.3 ACCEPTABLE QUALITY LEVEL

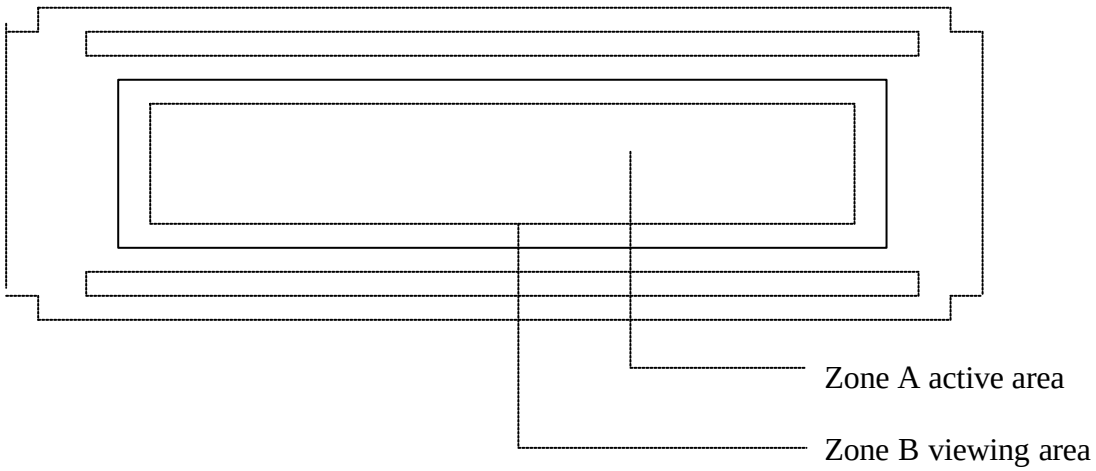
A major defect is defined as one that could cause failure to or materially reduce the usability of the unit for its intended purpose. A minor defect is one that does not materially reduce the usability of the unit for its intended purpose or is an infringement from established standards and has no significant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

9.4 APPEARANCE

An appearance test should be conducted by human sight at approximately 30 cm distance from the LCD module under flourescent light. The inspection area of LCD panel shall be within the range of following limits.

9.5 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



9.6 RELIABILITY

Test Item	Test Conditions	Note
	Extend Temp. type	
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
Thermal Shock Test	-30°C ~ 25°C ~ 80°C 30 m in. 5 min. 30 min. (1 cycle) Total 5 cycle	1,2
Humidity Test	40 °C, Humidity 90%, 96 hrs	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.

10 HANDLING PRECAUTIONS

(1) A 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.

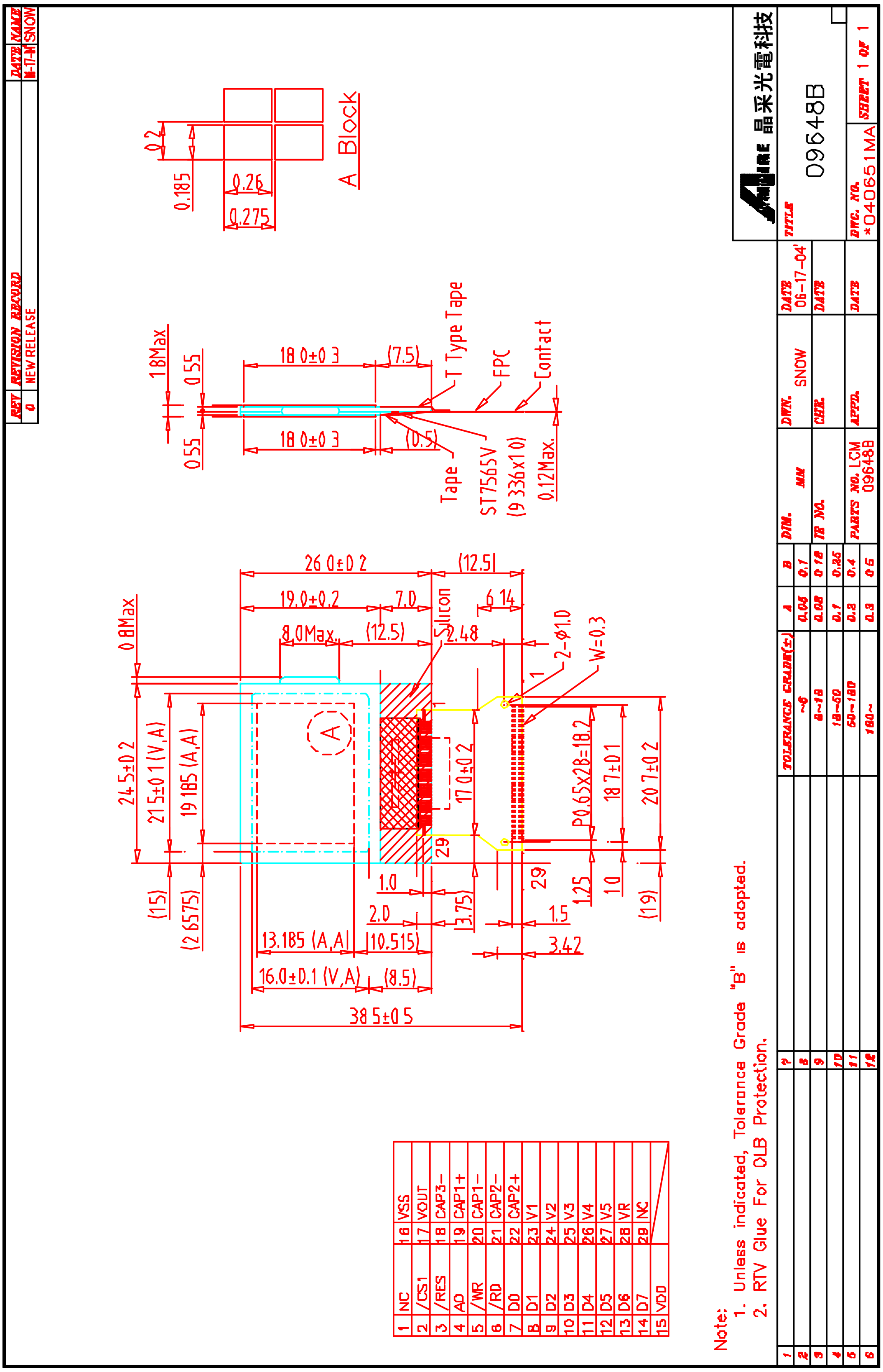
(7) In the event of LCD breakage and resultant leakage of fluid do not inhale, ingest or make contact with the skin. If contact is made rinse immediately.

(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.

11 OUTLINE DIMENSION



12 PACKING STANDARDS SPECIFICATIONS

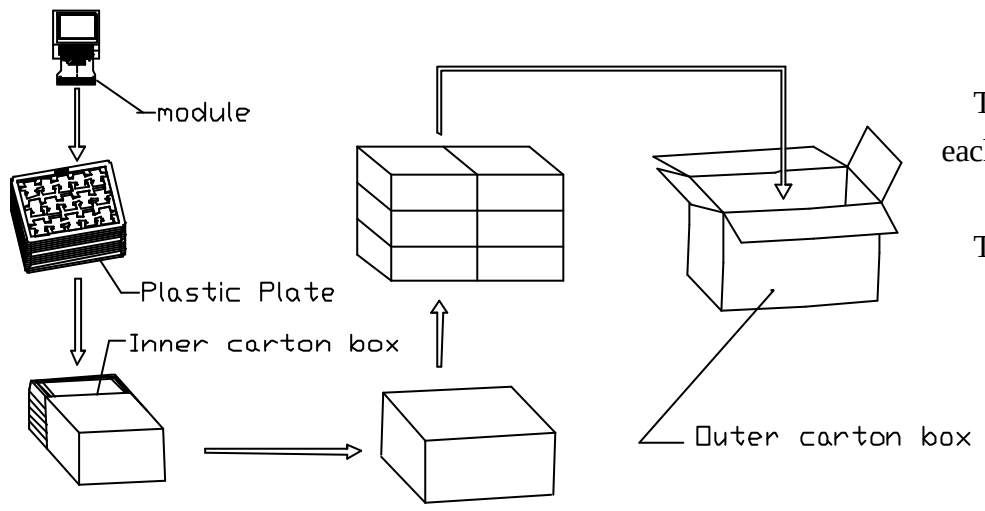
Product No.	TSD2164	Release date		October 8, 2004	
Product name	LIQUID CRYSTAL DISPLAY	Releaser		WS.LI	
Supplier	TRULY SEMI CONDUCTORS LTD	Recycle		( )YES (√)NO	
Ouantity/ each box	1350pcs	Material for box		(√) paper ( ) plastic	
Outer carton box size	435mm*290mm*310mm	Box type		(√)new ( )update	
Ouantity / inner box * Quantity / outer box	225*6=1350pcs	Weigh t	g / pcs Kg / outer box	BOX=TYPE Record of SRF Dept.	12Kg(Max)

Packing Standards:

There are 15 modules each plastic plate.

There are 225 modules each inner carton box.

There are 6 inner carton



Requirements of outer carton box :

1. Weight(Max): 12Kg
2. Height (Max): 1.2M
3. Prohibition: Box made by log

confirmation for customer

material	technology	product Dept.	input of product Dept.

path of disposal