Product Specification

Model No.:	**97G084S5N6F-2**
Description:	**8.4" TFT-LCD Panel** **with Touch Sensor**
Document No.:	**DOC-50-110284**
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	Name	**Date**	**Department**
Prepared By	Peggy Chen	2012/07/26	■PM □R&D
Checked By	Eva Yang	2012/07/26	□PM ■R&D
Approved By	Davis Weng	2012/07/26	□PM ■R&D

Record of Revision

Version	Revise Date	Page Affected	Content
Preliminary	2011/10/06	-	First Draft
V0.2	2012/1/31	5	2.1 Display Characteristics – typical power consumption: 4.5W→2.94W
		6	2.2 Optical Characteristics update
		10	5.2.1 Parameter guideline for LED backlight
		23	13 Mechanical Drawing update
V1.0	2012/02/20	-	First Release
V1.1	2012/07/26	-	Modify Operating Temperature

Contents

1. Operating Precautions

1) Since front touch panel is easily damaged, please be cautious not to scratch it.

2) Be sure to turn off power supply when inserting or disconnecting from input connector.

3) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.

4) When the touch panel surface is soiled, wipe it with absorbent cotton or soft cloth.

5) Since the touch panel is made of glass, it may be broken or cracked if dropped or bumped on hard surface.

6) To avoid ESD (Electro Static Discharge) damage, be sure to ground yourself before handling TFT-LCD module.

7) Do not open nor modify the module assembly.

8) Do not press the reflector sheet at the back of the module to any direction.

9) In case if a module has to be put back into the packing container slot after it was taken out from the container, do not press the center of the LED Reflector edge. Instead, press at the far ends of the LED Reflector edge softly. Otherwise the TFT Module may be damaged.

10) At the insertion or removal of the Signal Interface Connector, be sure not to rotate nor tilt the Interface Connector of the TFT Module.

11) After installation of the TFT Module into an enclosure (Notebook PC Bezel, for example), do not twist nor bend the TFT Module even momentary. At designing the enclosure, it should be taken into consideration that no bending/twisting forces are applied to the TFT Module from outside. Otherwise the TFT Module may be damaged.

12) Small amount of materials having no flammability grade is used in the LCD module. The LCD module should be supplied by power complied with requirements of Limited Power Source (IEC60950 or UL1950), or be applied exemption.

13) Severe temperature condition may result in different luminance, response time.

14) Continuous operating TFT-LCD Module under high temperature environment may accelerate LED light bar exhaustion and reduce luminance dramatically.

15) The data on this specification sheet is applicable when LCD module is placed in landscape position.

16) Continuous displaying fixed pattern may induce image sticking. It is recommended to use screen saver or shuffle content periodically if fixed pattern is displayed on the screen.

2. General Description

- This specification applies to the 8.4 inch color TFT LCD module with 4-wires resistive touch sensor.
- The screen format is intended to support the SVGA (800(H) x 600(V)) screen and 16.2M (RGB 8-bits) or 262k colors (RGB 6-bits).
- LED driving board for backlight unit is included, and the structure of the LED unit is replaceable.
- Timing controller is built in.
- Input signals is LVDS

2.1 Display Characteristics

The following items are characteristics summary of the table under 25ºC condition:

Items	Unit	Specifications
Screen Diagonal	inch	8.4 (213.4mm)
Active Area	mm	170.4(H) x 127.8 (V)
Pixels H x V	-	800x3(RGB) x 600
Pixel Pitch	mm	0.213 x 0.213
Pixel Arrangement	-	R.G.B. Vertical Stripe
Display Mode	-	TN, Normally White
Nominal Input Voltage VDD	Volt	3.3 (typ)
Typical Power Consumption	Watt	2.94 (typ)
Weight	Grams	325+/- 10
Physical Size	mm	203.0(H) x 142.5(H) x 9.8(D) (typ.)
Electrical Interface	-	1 channel LVDS
Surface Treatment	-	Hardness 3H
Support Color	-	262K(6-bit) / 16.2M(8-bit)
Temperature Range	-	
Operating	ºC	-20 to +70 (panel surface temperature)
Storage (Non-Operating)	ºC	-20 to +70
RoHS Compliance	-	RoHS Compliance

2.2 Optical Characteristics

The optical characteristics are measured under stable conditions at 25ºC (Room Temperature):

| Item	Unit	Conditions		Min.	Typ.	Max.	Note
White Luminance	cd/m^2	I_F = 50mA (center point)		280	360	-	1
Uniformity	%	9 Points		70	75	-	1, 2, 3
Contrast Ratio				400	600	-	4
Response Time	msec	Rising		-	20	30	5
		Falling		-	10	20	
		Raising + Falling		-	30	50	
Viewing Angle	degree	Horizontal	(Right)	70	80	-	6
		CR = 10	(Left)	70	80	-	
		Vertical	(Upper)	65	80	-	
		CR = 10	(Lower)	50	60	-	
Color/ Chromaticity Coordinates (CIE 1931)	-	Red x		-	0.609	-	1
		Red y		-	0.333	-	
		Green x		-	0.365	-	
		Green y		-	0.570	-	
		Blue x		-	0.151	-	
		Blue y		-	0.106	-	
		White x		-	0.31	-	
		White y		-	0.33	-	
Color Gamut	%				45	-	1

Note 1: Measurement method

Equipment: Pattern Generator, Power Supply, Digital Voltmeter, Luminance meter (SR_3 or equivalent)
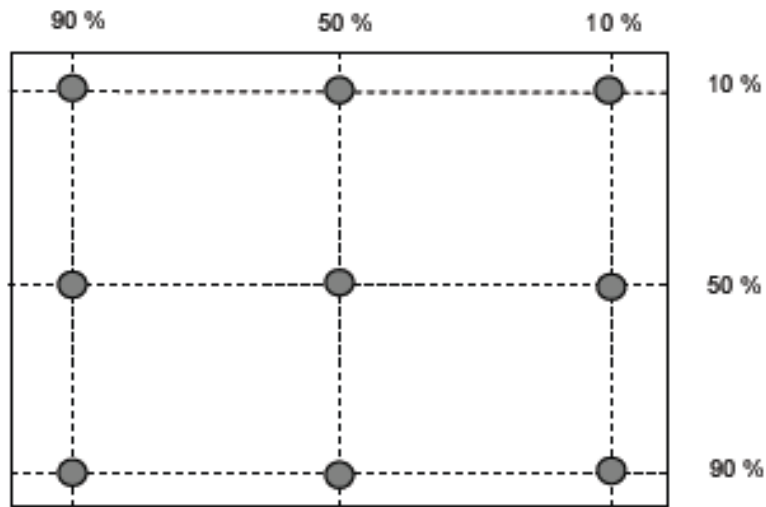
Aperture   1º with 50cm viewing distance

Test Point   Center

Environment   < 1 lux
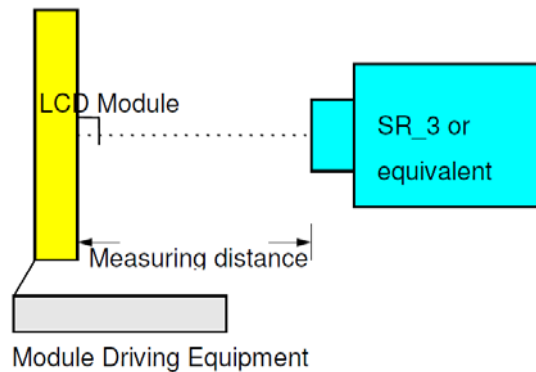
Note 2: Definition of 9 points position (Display active area: 170.4 (H) x 127.8 (V))

Note 3: The luminance uniformity of 9 points is defined by dividing the minimum luminance value by the maximum test point luminance.

$$\delta_{W9} = \frac{\text{Minimum brightness of nine points}}{\text{Maximum brightness of nine points}}$$

Note 4: Definition of contrast ratio (CR):

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "White" state}}{\text{Brightness on the "Black" state}}$$

Note 5: Definition of response time:

The output signals of photo detector are measured when the input signals are changed from "White" to "Black" (falling time) and from "Black" to "White" (rising time), respectively. The response time interval is between 10% and 90% of amplitudes. Please refer to the figure as below.
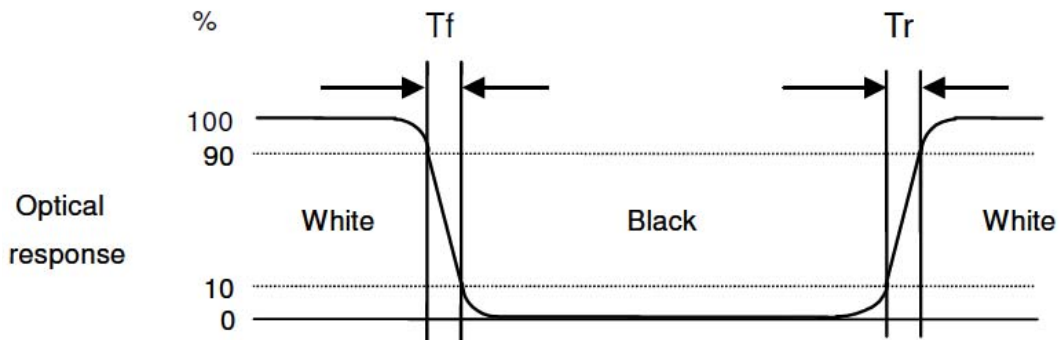
Note 6: Definition of viewing angle

Viewing angle is the measurement of contrast ratio ≥ 10, at the screen center, over a 180º horizontal and 180º vertical range (off-normal viewing angles). The 180º viewing angle range is broken down as below: 90º (θ) horizontal left and right, and 90º (Φ) vertical high (up) and low (down). The measurement direction is typically perpendicular to the display surface with the screen rotated to its center to develop the desired measurement viewing angle.
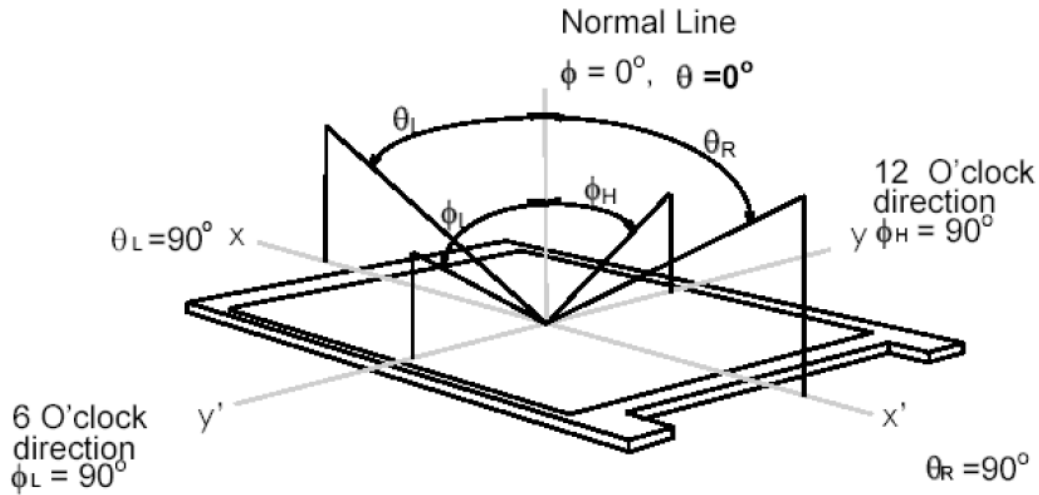
3. Functional Block Diagram

The following diagram shows the functional block of the 8.4 inch color TFT/LCD module:
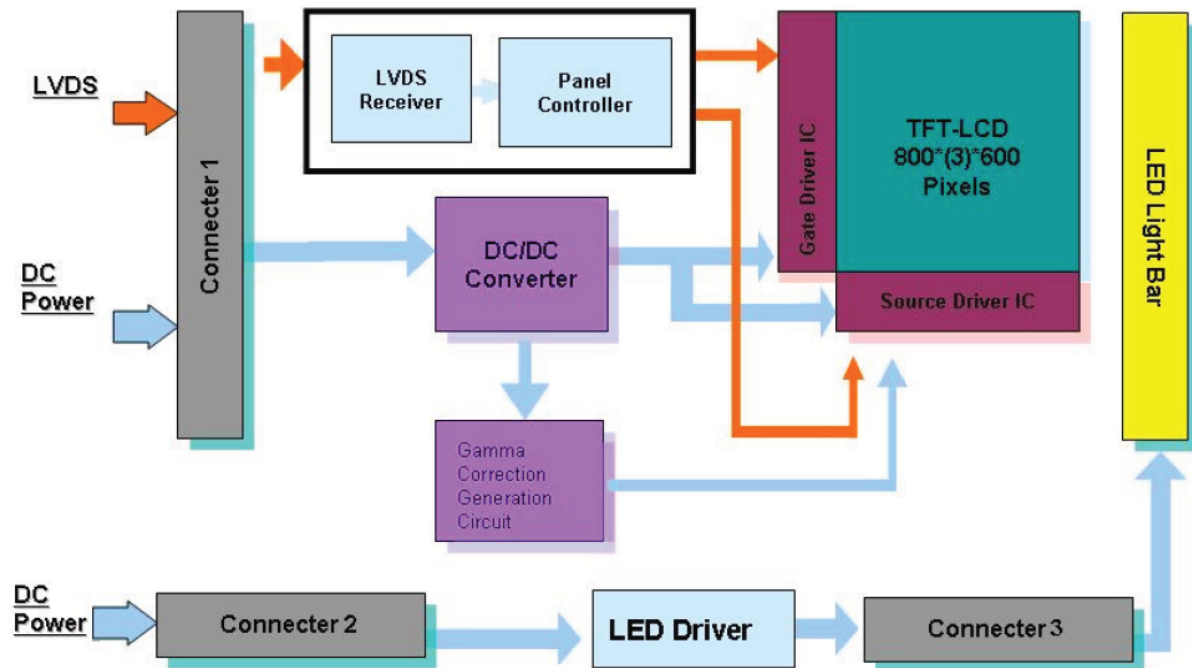
4. Absolute Maximum Ratings

4.1 Absolute Ratings of TFT LCD Module

Item	Symbol	Min	Max	Unit
Logic/LCD Drive Voltage	VDD	-0.3	+3.6	Volt

4.2 Absolute Ratings of Environment

Item	Symbol	Min	Max	Unit
Operating Temperature	TOP	-20	+70	ºC
Operation Humidity	HOP	20	90	%RH
Storage Temperature	TST	-20	+70	ºC
Storage Humidity	HST	10	90	%RH

Note: Maximum Wet-Bulb should be 39ºC and no condensation.

5. Electrical Characteristics

5.1 TFT LCD Module

5.1.1 Power Specification

Symbol	Parameter	Min	Typ	Max	Unit	Remark
VDD	Logic/LCD Drive Voltage	3.0	3.3	3.6	Volt	±10%
I_{VDD}	VDD Current	-	270	330	mA	64 Gray Bar Pattern (VDD=3.3V, at 60Hz)
P_{VDD}	VDD Power	-	0.9	1.2	Watt	64 Gray Bar Pattern (VDD=3.3V, at 60Hz)

Note 1: Measurement condition

VDD rising time

64 Gray pattern
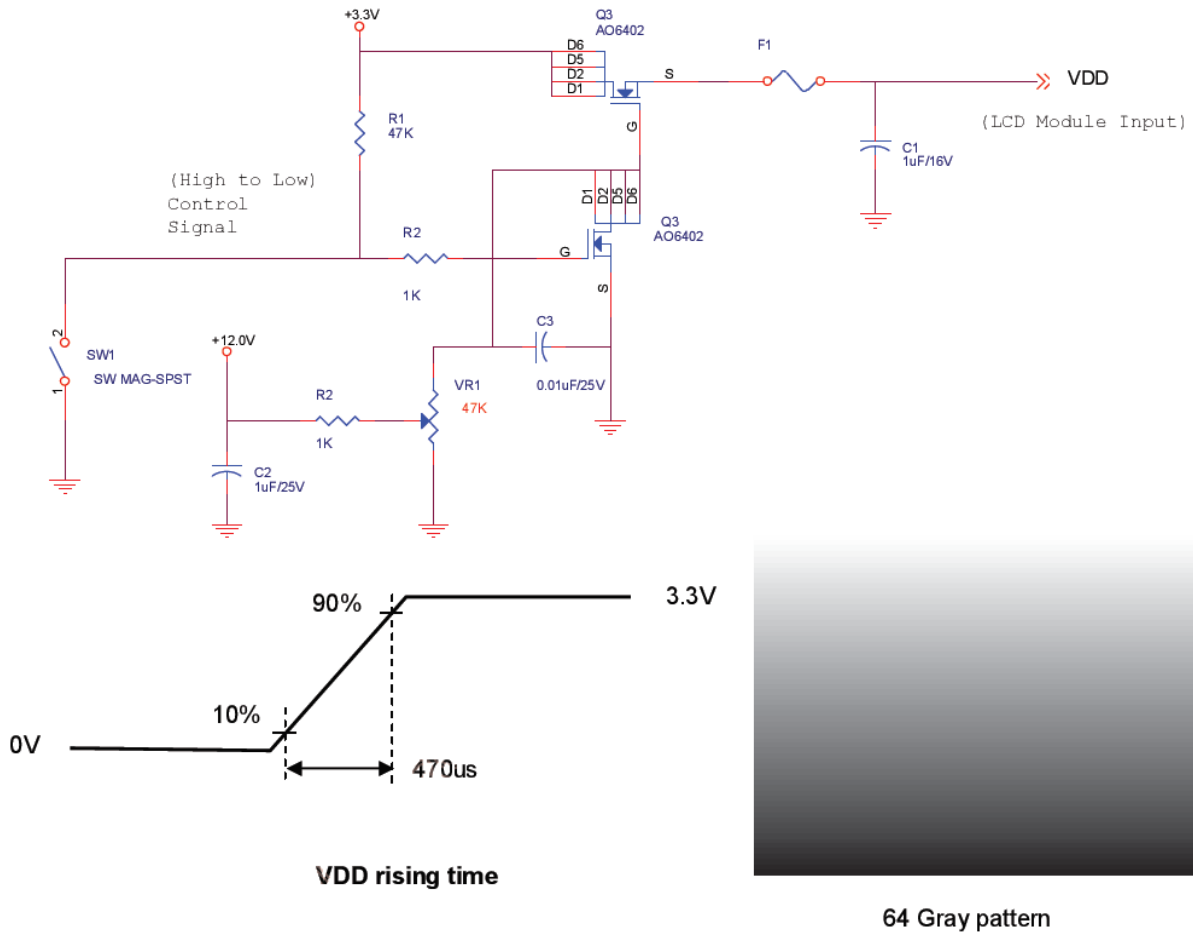
5.1.2 Signal Electrical Characteristics

Input signals shall be low or Hi-Z state when VDD is off.

Symbol	Parameter	Min	Typ	Max	Unit	Remark
VTH	Differential Input High Threshold	-	-	100	mV	VICM=1.2V
VTL	Differential Input Low Threshold	-100	-	-	mV	VICM=1.2V
| VID |	Input Differential Voltage	100	400	600	mV	-
VICM	Differential Input Common Mode Voltage	1.1		1.6	V	VTH/VTL=±100mV

Note: LVDS Signal Waveform
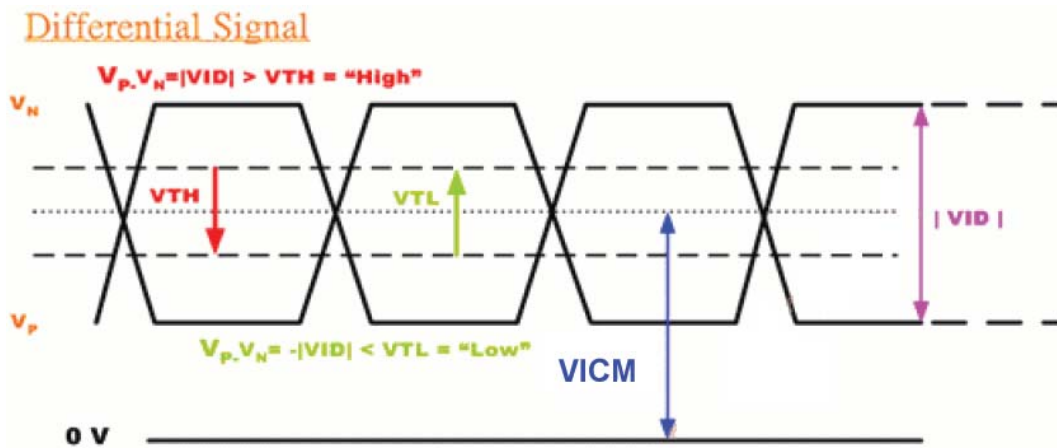
5.2 Backlight Unit

5.2.1 Parameter guideline for LED backlight

Following characteristics are measured under a stable condition using an inverter at 25ºC. (Room Temperature):

Symbol	Parameter	Min	Typ	Max	Unit	Remark
VCC	Input Voltage	10.8	12	12.6	Volt	
I_{VCC}	Input Current	-	0.17	-	A	100% PWM Duty
P_{VCC}	Power Consumption	-	2.04	2.14	Watt	100% PWM Duty
F_{PWM}	Dimming Frequency	200	-	20K	Hz	
	Swing Voltage	3	3.3	5.5	V	
	Dimming Duty Cycle	5	-	100	%	
I_F	LED Forward Current	-	50	52.5	mA	Ta=25ºC
V_F	LED Forward Voltage	-	21		Volt	I_F = 50mA, Ta =-30ºC
			19.2	21.9	Volt	I_F = 50mA, Ta =25ºC
			18.3			I_F = 50mA, Ta =85ºC
P_{LED}	LED Power Consumption	-	1.92	-	Watt	I_F = 50mA, Ta = 25ºC (total power)
Operation Life	-	50,000		-	Hrs	I_F = 50mA, Ta = 25ºC

Note 1: Ta means ambient temperature of TFT-LCD module

Note 2: VCC, I_{VCC}, P_{VCC}, are defined for LED backlight. (100% duty of PWM dimming)

Note 3: I_F, V_F are defined for each channel of LED Light Bar. There are two LED channels (AN1-CA1-CA2) in back light unit

Note 4: If this module is driven by high current or at high ambient temperature & humidity condition, the operating life will be reduced.

Note 5: Operating life means brightness goes down to 50% initial brightness. Minimum operating life time is estimated data.

6. Signal Characteristic

6.1 Pixel Format Image

Following figure shows the relationship between input signal and LCD pixel format.

6.2 Signal Description

LVDS is a differential signal technology for LCD interface and high speed data transfer device. The connector pin definition is as below:

Pin No.	Symbol	Description
1	VDD	Power Supply , 3.3V (typical)
2	VDD	Power Supply , 3.3V (typical)
3	UD	Vertical Reverse Scan Control, When UD=Low or NC → Normal Mode. When UD=High → Vertical Reverse Scan *Note
4	LR	Horizontal Reverse Scan Control, When LR=Low or NC → Normal Mode. When LR=High → Horizontal Reverse Scan *Note
5	RxIN1-	LVDS differential data input Pair 0
6	RxIN1+	
7	GND	Ground
8	RxIN2-	LVDS differential data input Pair 1
9	RxIN2+	
10	GND	Ground
11	RxIN3-	LVDS differential data input Pair 2
12	RxIN3+	
13	GND	Ground
14	RxCLKIN-	LVDS differential clock input Pair
15	RxCLKIN+	
16	GND	Ground
17	SEL 68	LVDS 6/8 bits select function control, Low or NC → 6 bit Input Mode. High → 8 bit Input Mode *Note
18	NC	NC
19	RxIN4-	LVDS differential data input Pair 3. Must be set to NC in 6 bit input mode.
20	RxIN4+	

Note: "Low" stands for 0V. "High" stands for 3.3V. "NC" stands for "No Connected".

6.3 Scanning Direction

The following figures show the image seen from the front view. The arrow indicates the direction of scan.
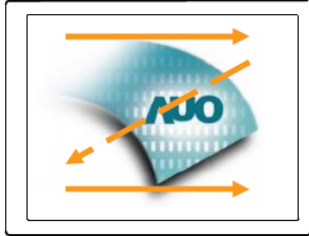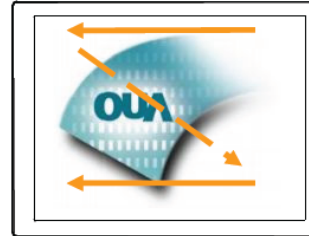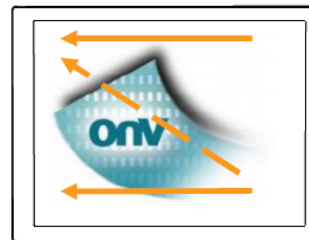

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig 1 Normal scan (Pin3, UD=Low or NC; Pin 4, RL=Low or NC)
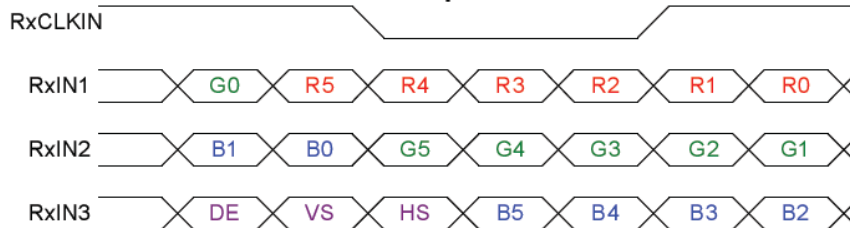
Fig 2 Reverse scan (Pin3, UD=Low or NC; Pin 4, RL=High)

Fig 3 Reverse scan (Pin 3, UD=High; Pin 4, RL=Low or NC)

Fig 4 Reverse scan (Pin 3, UD=High; Pin 4, RL=High)

6.4 The Input Data Format

6.4.1 SEL68

SEL68 = "Low" or "NC" for 6 bits LVDS Input

RxCLKIN							
RxIN1	G0	R5	R4	R3	R2	R1	R0
RxIN2	B1	B0	G5	G4	G3	G2	G1
RxIN3	DE	VS	HS	B5	B4	B3	B2

SEL68 = "High" for 8 bits LVDS Input

RxCLKIN							
RxIN1	G0	R5	R4	R3	R2	R1	R0
RxIN2	B1	B0	G5	G4	G3	G2	G1
RxIN3	DE	VS	HS	B5	B4	B3	B2
RxIN4	RSV	B7	B6	G7	G6	R7	R6
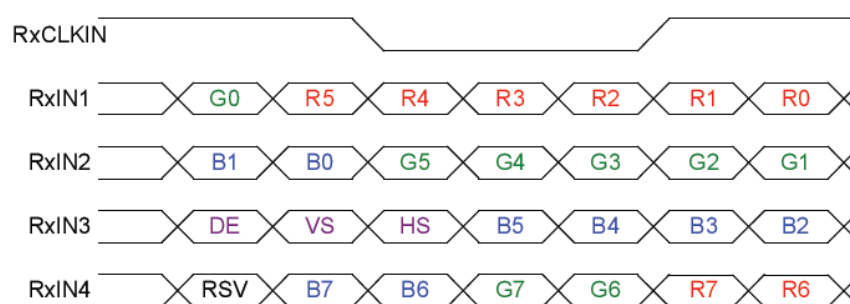
Note1: Please follow PSWG.
Note2: R/G/B data 7:MSB, R/G/B data 0:LSB

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Signal Name	Description	Remark
R7	Red Data 7 (MSB)	Red-pixel Data
R6	Red Data 6	Each red pixel's brightness data consists of these 8bits pixel
R5	Red Data 5	data.
R4	Red Data 4	
R3	Red Data 3	
R2	Red Data 2	
R1	Red Data 1	
R0	Red Data 0 (LSB)	
G7	Green Data 7 (MSB)	Green-pixel Data
G6	Green Data 6	Each green pixel's brightness data consists of these 8bits
G5	Green Data 5	pixel data.
G4	Green Data 4	
G3	Green Data 3	
G2	Green Data 2	
G1	Green Data 1	
G0	Green Data 0 (LSB)	
B7	Blue Data 7 (MSB)	Blue-pixel Data
B6	Blue Data 6	Each blue pixel's brightness data consists of these 8bits
B5	Blue Data 5	pixel data.
B4	Blue Data 4	
B3	Blue Data 3	
B2	Blue Data 2	
B1	Blue Data 1	
B0	Blue Data 0 (LSB)	
RxCLKIN+ RxCLKIN-	LVDS Clock Input	
DE	Display Enable	
VS	Vertical Sync	
HS	Horizontal Sync	

Note: Output signals from any system shall be low or Hi-Z state when VDD is off.
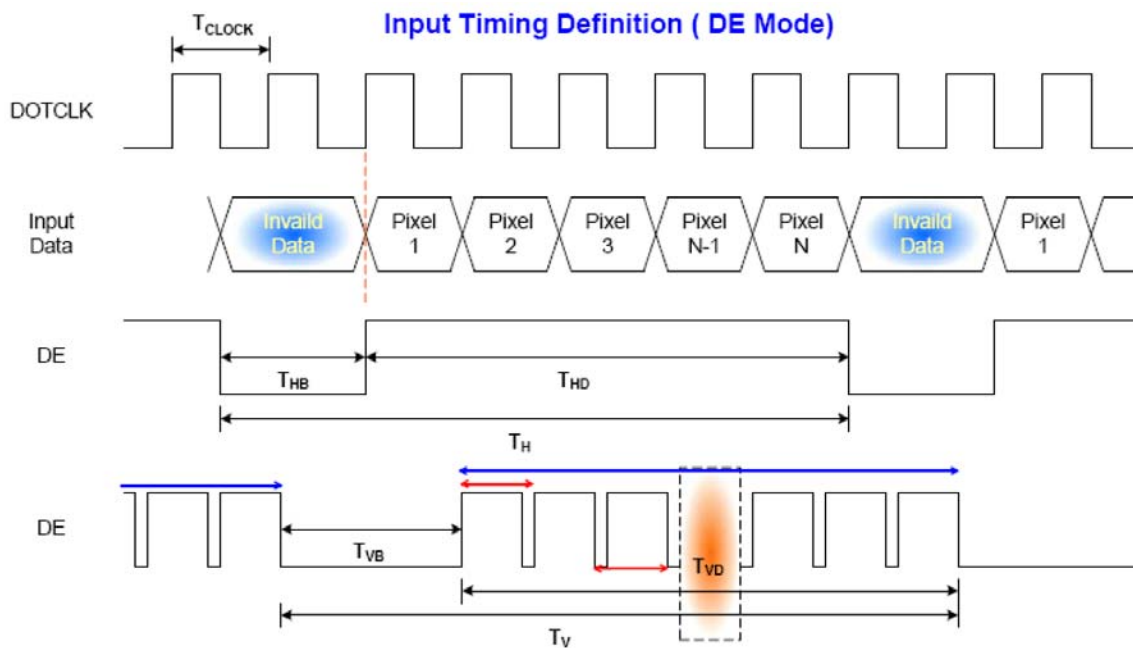
6.5 Interface Timing

6.5.1 Timing Characteristics

DE mode only

| Parameter		Symbol	Min.	Typ.	Max.	Unit
Clock frequency		1/T$_{Clock}$	33.6	39.8	48.3	MHz
Vertical Section	Period	T$_V$	608	628	650	T$_H$
	Active	T$_{VD}$	600	600	600	
	Blanking	T$_{VB}$	8	28	50	
Horizontal Section	Period	T$_H$	920	1056	1240	T$_{Clock}$
	Active	T$_{HD}$	800	800	800	
	Blanking	T$_{HB}$	120	256	440	

Note: Frame rate is 60 Hz.

Note: DE mode.

6.5.2 Input Timing Diagram

6.6 Power ON/OFF Sequence

VDD power and lamp on/off sequence is as below. Interface signals are also shown in the chart.

Signals from any system shall be Hi-Z state or low level when VDD is off.
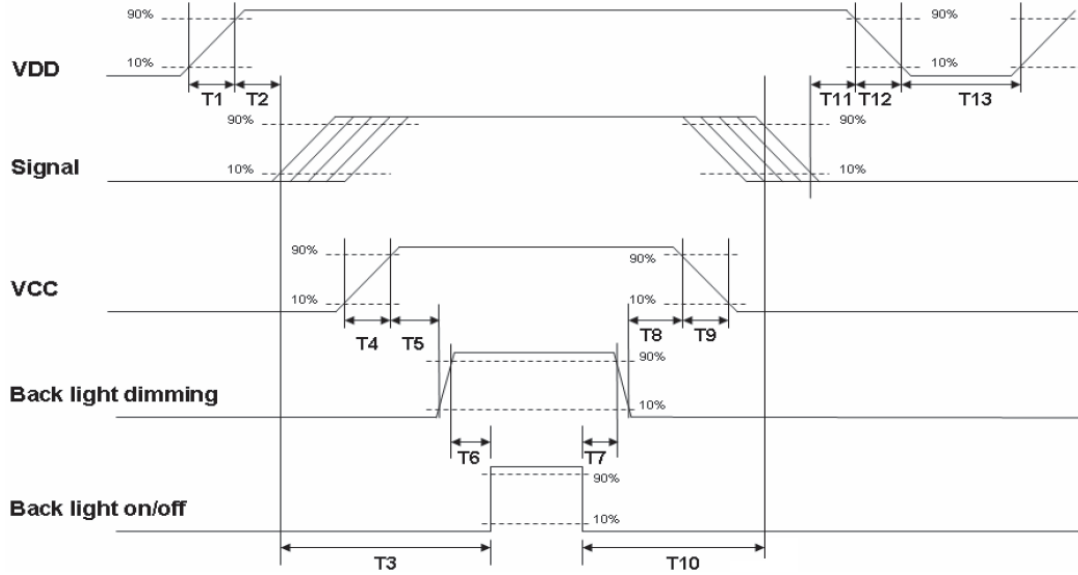
Power ON/OFF sequence timing

Parameter	Value			Units
	Min.	Typ.	Max.	
T1	0.5	-	10	ms
T2	30	40	50	ms
T3	200	-	-	ms
T4	0.5	-	10	ms
T5	10	-	-	ms
T6	10	-	-	ms
T7	0	-	-	ms
T8	10	-	-	ms
T9	-	-	10	ms
T10	110	-	-	ms
T11	0	16	50	ms
T12	-	-	10	ms
T13	1000	-	-	ms

The above on/off sequence should be applied to avoid abnormal function in the display. Please make sure to turn off the power when you plug the cable into the input connector or pull the cable out of the connector.

7. Connector & Pin Assignment

Physical interface is described as for the connector on module. These connectors are capable of accommodating the following signals and will be following components.

7.1 TFT LCD Signal (CN1): LVDS Connector

Connector Name / Designation	Signal Connector
Manufacturer	STM, Hirose or compatible
Connector Model Number	STM-MSB24013P20HA, Hirose-DF19LA-20P-1H or compatible
Adaptable Plug	STM-P24013P20, Hirose-DF19-20S-1C or compatible

Pin No.	Symbol	Pin No.	Symbol
1	VDD	2	VDD
3	UD	4	LR
5	RxIN1-	6	RxIN1+
7	GND	8	RxIN2-
9	RxIN2+	10	GND
11	RxIN3-	12	RxIN3+
13	GND	14	RxCKIN-
15	RxCKIN+	16	GND
17	SEL68	18	NC
19	RxIN4-	20	RxIN4+

7.2 LED Backlight Unit (CN2): LED Driver Connector

Connector Name / Designation	Lamp Connector
Manufacturer	ENTERY
Connector Model Number	ENTERY 3808K-F04N-02R or compatible
Mating Model Number	ENTERY H208K-P04N-02B or compatible

Pin No.	Symbol	Description
1	VCC	12V input
2	GND	GND
3	Display_ON/OFF	+5V or +3.3V: ON, 0V: OFF
4	Dimming	PWM

7.3 LED Light Bar Input Connector (CN3):

Manufacturer	ENTERY
Connector Model Number	ENTERY 3800K-F03N-03 or compatible
Mating Model Number	ENTERY H203K-D03N-04B or compatible

Pin No.	Symbol	Description	Color
1	AN1	LED anode	Red
2	CA1	LED cathode	Black
3	CA2	LED cathode	Black

8. Touch Panel Specification

8.1 Operating condition

Item	Min.	Typ.	Max.	Unit	Remark
Rated voltage		5	7	V	DC

8.2 Electrical characteristic

Item		Min.	Typ.	Max.	Unit	Remark
Resistance	X	300	-	1000	Ω	At connector
	Y	100	-	600	Ω	
Insulation resistance		20	-	-	MΩ	DC 25V
Linearity	X	-	-	1.5	%	-
	Y	-	-	1.5	%	-

8.3 Mechanical characteristic

| Item	Min.	Typ.	Max.	Unit	Remark
Pen/Finger input pressure	5	-	50	g	
Surface hardness	-	3	-	H	JIS K-5600-5-4
Notes life	10^5				Within "guaranteed active area"
Input Life	10^6				Within "guaranteed active area"

9. Assembly Notes

Please pay attention stated below when mounting design of touch panel & enclosure

- Enclosure support to fix touch panel must be out of view (transparent) area. Do not design your enclosure pressing the view area, to prevent from mis-touch

- The enclosure edge must be between view area and guaranteed active area. (Enclosure edge must not touch the view area.)

- Elastic materials are recommended as a support to fix touch panel.

- Do not use an adhesive tape to bond the top surface (film side) of touch panel with enclosure.

- The corners and edges of touch panel may be conductive. Do not touch it with metallic components after mounting.

- Special design is required for water resistance.

- If using an air gun to clean the touch panel, the setting for pressure is suggested to be below 2kg/cm2. To prevent FPC peeled off, do not blow the air toward the FPC.
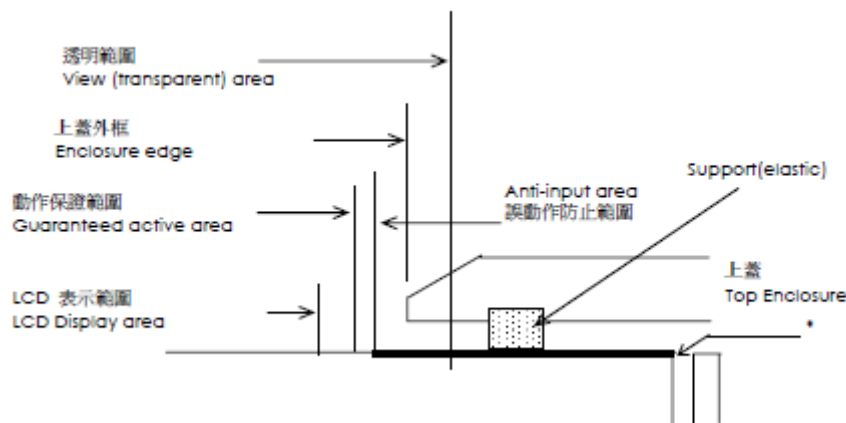
- The mounting structure must reserve space for the FPC tail and not to touch or squeeze the FPC with the enclosure or other components, for preventing the FPC to peel off.
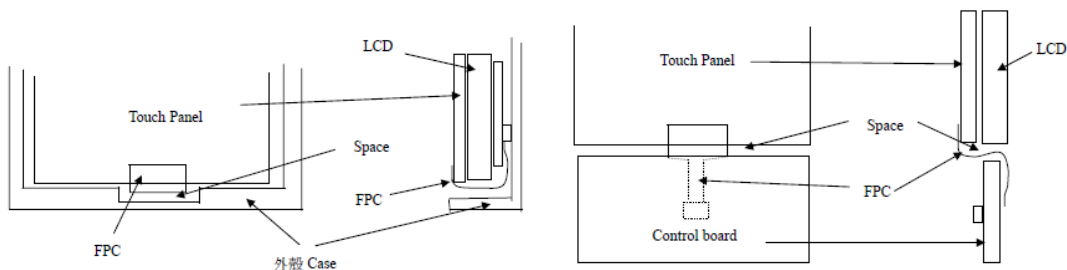
10. Reliability Test

Environment test conditions are listed as following table.

Items	Required Condition
High Temperature Operation	70ºC, 8Hrs
Low Temperature Operation	-20ºC, 8Hrs
High Temperature Storage	70ºC, 8Hrs
Low Temperature Storage	-20ºC, 8Hrs

11. Display quality

The display quality of the color TFT-LCD module should be in compliance with the Promate's OQC inspection standard.
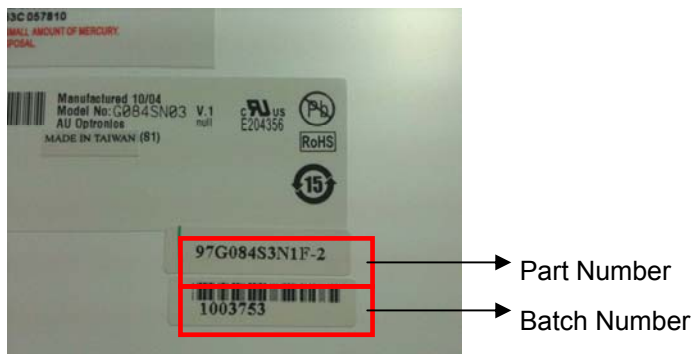
12. Label and Packaging
12.1 Shipping label

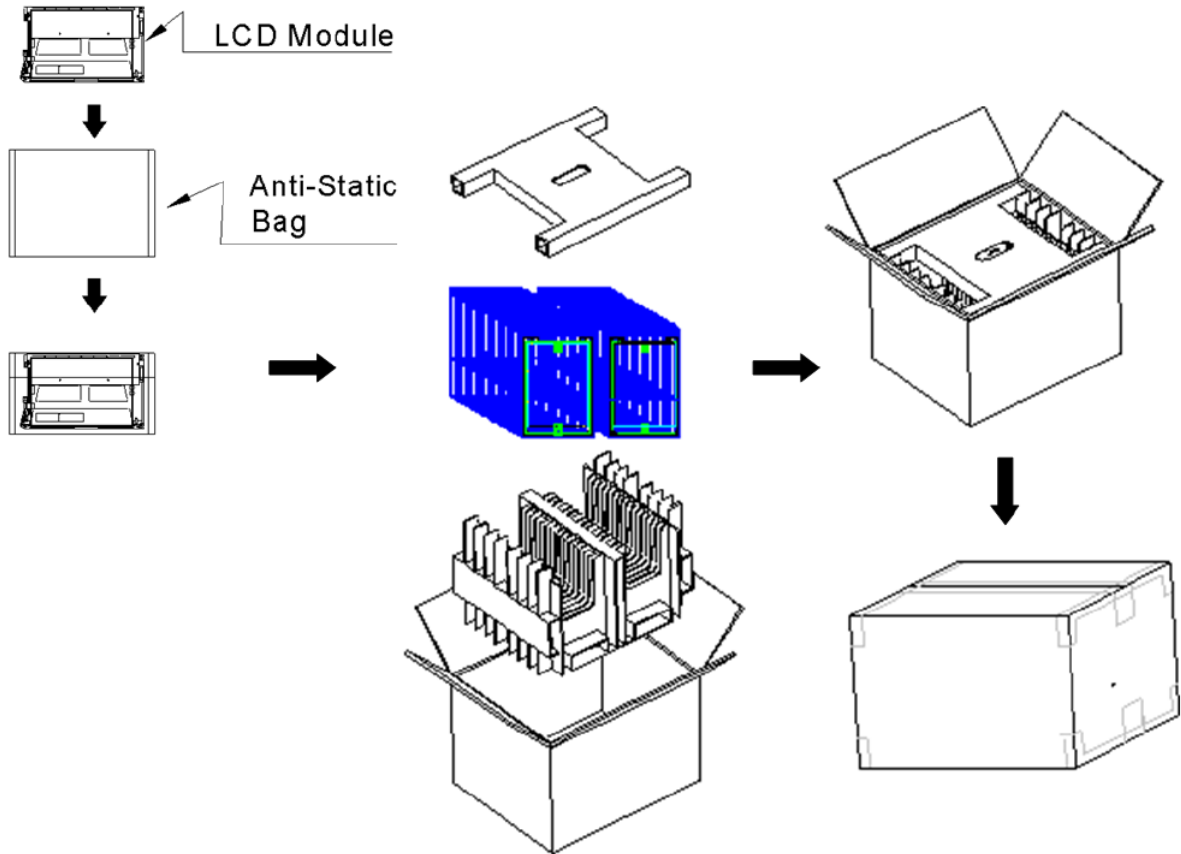Location: on the rear side of TFT-LCD display

The shipping label format is shown as below.

Sample:

Part Number

Batch Number

12.2 Carton Package

1) Max. Capacity: 30pcs LCD Modules / per carton

2) Max. Weight: 11.6kg / per carton

3) The outside dimension of carton is 405(L) mm x 328(W) mm x 301(H) mm

13. Mechanical Drawing

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2.1 Delivery will be made Free Carrier (Incoterms 1990), Promate's designated warehouse to a carrier designated in writing by Buyer, or if Buyer fails to designate a carrier, to a carrier designated by Promate.

2.2 Title to the goods and the entire risk will pass to Buyer upon delivery to carrier.

2.3 Shipments are subject to availability. Promate shall make every reasonable effort to meet the date(s) quoted or acknowledged; and if Promate makes such effort, PROMATE WILL NOT BE LIABLE FOR ANY DELAYS.

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4.1 Promate warrants that the goods sold will be free from defects in material and workmanship and comply with Promate's applicable published specifications for a period of twelve (12) months from the date of Promate's shipment.

4.2 Goods or parts which have been subject to abuse (including without limitation repeated or extended exposure to conditions at or near the limits of applicable absolute ratings) misuse, accident, alteration, neglect, or unauthorized repair or improper application are not covered by any warranty. No warranty is made with respect to custom products or goods produced to Buyer's specifications (unless specifically stated in writing signed by Promate). Promate shall not be responsible for defects or claims caused by acts not performed by Promate; or by combination of goods with other things.

4.3 No warranty is made with respect to goods used in devices intended for use in applications where failure to perform when properly used can reasonably be expected to result in significant injury (including, without limitation, navigation, aviation, weaponry or nuclear equipment, or for surgical implant or to support or sustain life) and Buyer agrees to indemnify, defend, and hold harmless Promate from all claims, damages and liabilities arising out of any such uses.

4.4 This Article 4 is the only warranty by Promate with respect to goods and may not be modified or amended except in writing signed by an authorized officer of Promate.

4.5 Buyer acknowledges and agrees that it is not relying on any applications, diagrams or circuits contained in any literature, and Buyer will test all parts and applications under extended field and laboratory conditions. Notwithstanding any cross-reference or any statements of compatibility, functionality, interchangeability, and the like, the goods may differ from similar goods from other vendors in performance, function or operation, and in areas not contained in the written specifications, or as to ranges and conditions outside such specifications; and Buyer agrees that there are no warranties and that Promate is not responsible for such things.

4.6 REGARDLESS OF CAUSE OR REASON FOR DAMAGE (WHETHER ACCIDENT, NEGLIGENCE, OR OTHERWISE) PROMATE SHALL HAVE NO LIABILITY (DIRECT, CONSEQUENTIAL OR OTHER) FOR, IN CONNECTION WITH OR ARISING FROM PROPERTY FURNISHED FOR USE AT OR LEFT AT PROMATE: and by delivering or entrusting property to Promate, Buyer expressly confirms this limitation. Notwithstanding this limitation, Promate will replace, or pay the reasonable retooling costs to replace, masks damaged or destroyed as a result of Promate's gross negligence or fault.

4.7 EXCEPT AS PROVIDED ABOVE, PROMATE MAKES NO WARRANTIES OR CONDITIONS, EXPRESS, IMPLIED, OR STATUTORY: AND PROMATE EXPRESSLY EXCLUDES AND DISCLAIMS ANY WARRANTY OR CONDITION OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE OR APPLICATION.

5 LIMITATION OF LIABILITY

5.1 Promate will not be liable for any loss, damage or penalty resulting from causes beyond its reasonable control, including but not limited to delay by others, force majeure, acts of God, material shortage or labor conditions. In any such event, the date(s) for Promate's performance will be deemed extended for a period equal to any delay resulting.

5.2 THE LIABILITY OF PROMATE ARISING OUT OF THIS AGREEMENT OR ANY GOODS SOLD WILL BE LIMITED TO REFUND OF THE PURCHASE PRICE OR (WITH PROMATE'S PRIOR WRITTEN CONSENT) REPAIR OR REPLACEMENT OF PURCHASED GOODS (RETURNED TO PROMATE FREIGHT PRE-PAID): OR IN THE EVENT OF A FAILURE OR BREACH BY PROMATE REGARDING DELIVERY, AN AMOUNT EQUAL TO THE TOTAL PURCHASE PRICE OF THE GOODS THAT HAVE NOT BEEN DELIVERED DUE TO SUCH FAILURE.

5.3 Buyer will not return any goods without first obtaining a customer return order number.

5.4 AS A SEPARATE LIMITATION, IN NO EVENT WILL PROMATE BE LIABLE (i) FOR COSTS OF SUBSTITUTE GOODS, (ii) FOR ANY SPECIAL, CONSEQUENTIAL, INCIDENTAL, RELIANCE OR INDIRECT DAMAGES, OR (iii) FOR LOSS OF USE, OPPORTUNITY, MARKET POTENTIAL, GOODWILL AND/OR PROFIT ON ANY THEORY (CONTRACT, TORT, FROM THIRD PARTY CLAIMS OR OTHERWISE). THESE LIMITATIONS SHALL APPLY NOTWITHSTANDING ANY FAILURE OF ESSENTIAL PURPOSE OR OF ANY FAILURE OR INADEQUACY OF ANY REMEDY. THIS AGREEMENT STATES THE ONLY AND EXCLUSIVE REMEDY FOR ANY AND ALL CLAIMS MADE AGAINST PROMATE UNDER ANY AGREEMENT AND/OR WITH RESPECT TO PANELS, COMPONENTS, SERVICES AND/OR GOODS.

5.5 No action or proceeding may be commenced by either party against the other (other than to collect money due for goods delivered or services rendered), whether for breach, indemnification, contribution or otherwise, more than one year after delivery of the goods to the carrier: and no claim may be brought unless the non-claiming party has first been given commercially reasonable notice, a full written explanation of all pertinent details (including copies of all materials), and a good faith opportunity to resolve the matter.

5.6 BUYER EXPRESSLY AGREES TO THE LIMITATIONS OF ARTICLES 5, 8 AND 9 AND TO THEIR REASONABLENESS.

5.7 The exclusions and limitations of Articles 5, 8 and 9 will survive the termination of the applicable Agreements, and shall apply notwithstanding any claim of a failure of any one or more remedies to accomplish their purpose, and THE PARTIES EXPRESSLY WAIVE AND RELINQUISH ANY CONTRARY RIGHTS UNDER ANY AGREEMENT, AND/OR LAW, DECISION, CUSTOM OR PRACTICE.

6 SUBSTITUTIONS AND MODIFICATIONS

Promate may at any time make substitutions for product ordered which do not materially and adversely affect overall performance with the then current specifications in the typical and intended use. Promate reserves the right to halt deliveries and shipments and alter specifications and prices without notice. Buyer shall verify that the literature and information is current before purchasing. Other changes to process and/or specifications by Promate shall be pursuant to Promate's standard ECN procedures.

7 CANCELLATION

7.1 This Agreement may not be canceled by Buyer except with written consent by Promate and Buyer's payment of reasonable cancellation charges (including but not limited to expenses already incurred for labor and material, overhead, commitments made by Promate, and a reasonable profit).

7.2 In no event will Buyer have rights in partially completed goods.

8 INDEMNIFICATION

8.1 Promate will, at its own expense, assist Buyer with technical support and information in connection with any claim that any parts as shipped by Promate under this purchase order infringe any valid, enforceable, unexpired R.O.C. patent, copyright, or trademark, provided however, that Buyer (i) gives immediate written notice to Promate, (ii) permits Promate to participate and to defend if Promate requests to do so, and (iii) gives Promate all needed information, assistance and authority. However, Promate will not be responsible for infringements resulting from anything not entirely manufactured by Promate, or from any combination with products, equipment, or materials not furnished by Promate. Promate will have no liability with respect to intellectual property matters arising out of products made to Buyer's specifications, code, or designs.

8.2 Except as expressly stated in this Article 8 or in another writing signed by an authorized officer, Promate makes no representations and/or warranties with respect to intellectual and/or industrial property and/or with respect to claims of infringement.

8.3 Except as to claims Promate agrees in writing to defend, BUYER WILL INDEMNIFY, DEFEND AND HOLD HARMLESS PROMATE FROM ALL CLAIMS, COSTS, LOSSES, AND DAMAGES (INCLUDING ATTORNEYS FEES) AGAINST AND/OR ARISING OUT OF GOODS SOLD AND/OR SHIPPED HEREUNDER.

9 NO CONFIDENTIAL INFORMATION

Promate shall have no obligation to hold any information in confidence except as provided in a separate non-disclosure agreement signed by both parties.

10 ENTIRE AGREEMENT

These terms and conditions are the entire agreement between Promate and Buyer, and no addition, deletion or modification shall be binding on Promate unless expressly agreed to in a writing signed by an officer of Promate. Buyer is not relying upon any warranty or representation except for those specifically stated here.

11 APPLICABLE LAW

This Agreement and all performance and disputes arising out of or relating to goods involved will be governed by the laws of Taiwan, Republic of China, without reference to conflict of laws principles and excluding the U.N. Convention on Contracts for the International Sale of Goods. Buyer agrees at its sole expense to comply with all applicable laws in connection with the purchase, use or sale of the goods provided hereunder.

12 DISPUTE RESOLUTIONS

12.1 Buyer and Promate shall cooperate and attempt in good faith to resolve any and all disputes arising out of and/or relating to this Agreement and/or goods furnished pursuant to this Agreement.

12.2 Any disputes relating to and/or arising out of any Agreement and/or goods furnished pursuant to this Agreement that cannot be so resolved will be decided exclusively by binding arbitration. Such arbitration shall take place in Taipei, Taiwan pursuant to the Rules for International Arbitration under the American Arbitration Association.

12.3 Notwithstanding anything to the contrary, any party may apply to any court of competent jurisdiction for interim injunctive relief with respect to irreparable harm which cannot be avoided and/or compensated by such arbitration proceedings, without breach of this Article 12 and without any abridgment of the powers of the arbitrators.

13 ATTORNEYS' FEES

Reasonable attorneys' fees and costs will be awarded to the prevailing party in the event of litigation involving the enforcement or interpretation of this Agreement.