TENTATIVE

All information in this technical data sheet is tentative and subject to change without notice.

9.0" WVGA

TECHNICAL SPECIFICATION

AA090ME01--T1

MITSUBISHI ELECTRIC Corp.

Date: Jun.14,'11

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1. APPLICATION

This specification applies to color TFT-LCD module, AA090ME01--T1.

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MITSUBISHI classifies the usage of the TFT-LCD module as follows. Please confirm the usage before using the product.

(1) Standard Usage

Computers, office equipment, factory automation equipment, test and measurement equipment, communications, transportation equipment(automobiles, ships, trains, etc.), provided, however, that operation is not influenced by TFT-LCD directly.

(2) Special Usage

Medical equipment, safety equipment, transportation equipment, provided, however, that TFT-LCD is necessary to its operation.

(3) Specific Usage

Cockpit Equipment, military systems, aerospace equipment, nuclear reactor control systems, life support systems and any other equipment. MITSUBISHI should make a contract that stipulate apportionment of responsibilities between MITSUBISHI and our customer.

The product specified in this document is designed for "Standard Usage" unless otherwise specified in this document. If customers intend to use the product for applications other than those specified for "Standard Usage", they should first contact MITSUBISHI sales representative for it's intended use in writing.

MITSUBISHI has been making continuous effort to improve the reliability of its products. Customers should implement sufficient reliability design of their application equipments such as redundant system design, fail-safe functions, anti-failure features.

MITSUBISHI assumes no responsibility for any damage resulting from the use of the product that does not comply with the instructions and the precautions specified in this document.

Please contact and consult a MITSUBISHI sales representative for any questions regarding this product.

2. OVERVIEW

AA090ME01--T1 is 9.0" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs, control circuit, backlight unit, and touch panel.

By applying 6 bit or 8 bit digital data, 800×480 , 262k-color or 16.7M-color images are displayed on the 9.0" diagonal screen. Input power voltage is 3.3V for LCD driving.

The type of data and control signals are digital and transmitted via LVDS interface per Typ. 30.4 MHz clock cycle.

Driver circuit for LED backlight and controller for touch panel are not included in this module. General specifications are summarized in the following table:

ITEM	SPECIFICATION
Display Area (mm)	196.8 (H) × 118.08 (V) (9.0-inch diagonal)
Number of Dots	$800 \times 3 \text{ (H)} \times 480 \text{ (V)}$
Pixel Pitch (mm)	$0.246~(H) \times 0.246~(V)$
Color Pixel Arrangement	RGB vertical stripe
Display Mode	Normally black
Number of Color	262k(6 bit/color), 16.7M(8 bit/color)
Luminance (cd/m²)	320
Viewing Angle ($CR \ge 10$)	-85~85°(H), -85~85°(V)
Surface Treatment (Touch panel)	Anti-glare and hard-coating 3H
Electrical Interface	LVDS (6 bit/8 bit)
Module Size (mm)	219.0 (W) × 136.2 (H) × 11.1 (D)
Module Mass (g)	410
Backlight Unit	LED, edge-light, replaceable
Touch Panel	4-wire analog resistive

Characteristic value without any note is typical value.

3. ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	MIN.	MAX.	UNIT
Power Supply Voltage for LCD	VCC	0	4.0	V
Logic Input Voltage	VI	-0.3	VCC+0.3	V
Backlight (LED) Current	IF	180	mA	
Touch Panel Voltage	TPV		7.0	V
Operation Temperature (Touch Panel) Note 1,2)	$T_{op(TouchPanel)}$	-20	70	°C
Operation Temperature (Ambient) Note 2)	Top(Ambient)	-20	70	°C
Storage Temperature Note 2)	T_{stg}	-30	80	°C

[Note]

- 1) Measured at the center of active area and at the center of panel back surface
- 2) Top,Tstg \leq 40°C : 90%RH max. without condensation

Top,Tstg > 40°C : Absolute humidity shall be less than the value of 90%RH at 40°C without condensation.

4. ELECTRICAL CHARACTERISTICS

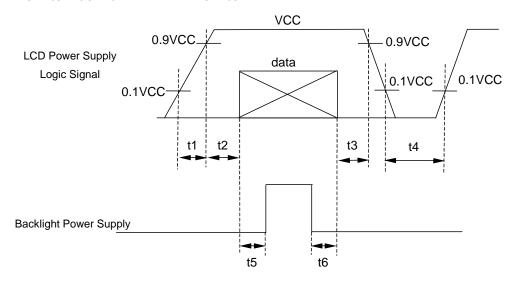
(1) TFT-LCD

Ambient temperature: $Ta = 25^{\circ}C$

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	Remarks	
Power Supply Voltages	VCC	3.0	3.3	3.6	V	*1)	
Power Supply Currents	ICC		250	410	mA	*2)	
Permissive Input Ripp	le Voltage	VRP			100	mVp-p	VCC = +3.3V
Logic Input Voltage	High	VIH 0.8×VCC VCC		VCC	V	MODE, SC	
	Low	VIL	0		0.2×VCC	V	MODE, SC

*1) Power and signals sequence:

 $\begin{array}{lll} t1 \leq 10 \ ms & 200 \ ms \leq t4 \\ 0 < t2 \leq 50 \ ms & 200 \ ms \leq t5 \\ 0 < t3 \leq 50 \ ms & 0 \leq t6 \end{array}$

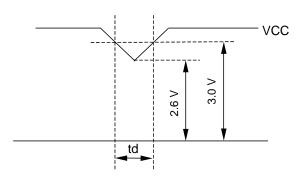


data: RGB DATA, DCLK, DENA, MODE, SC

VCC-dip conditions:

- 1) When $2.6~V \le VCC < 3.0~V$, $td \le 10~ms$
- 2) When VCC < 2.6 V

VCC-dip conditions should also follow the power and signals sequence.



*2) VCC = +3.3 V , f_H =31.7 kHz, f_V =60 Hz, f_{CLK} =30.4 MHz Display image at typical power supply current value is 256-gray-bar pattern (8 bit), 480 line mode.

*3) Fuse

Parameter	Fuse Type Name	Supplier	Remark
VCC	FCC16162AB	Kamaya Electric Co., Ltd.	*)

^{*)} The power supply capacity should be designed to be more than the fusing current.

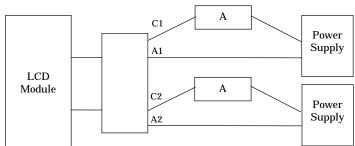
(2) Backlight

 $Ta = 25^{\circ}C$

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	Remarks
LED Voltage			(24)	30.2	V	IF = 90 mA, Ta = 25°C, *2)
	VF	VF		31.3	V	IF =90 mA, $Ta = 0$ °C
				32.2	V	IF = 90 mA, $Ta = -20$ °C
LED Current	IF		90	100	mA	$Ta = 25^{\circ}C, *1), *3)$
LED Life Time	LT	80,000	100,000		h	IF = 90 mA, Ta = 25°C *4), *5), Continuous operation

[Note]

- *1) Constant Current Drive
- *2) The Voltage deviation between strings: $|V_{f1} V_{f2}| \le 2V$
- *3) LED Current measurement method



- *4) LED life time is defined as the time when the brightness becomes 50% of the initial value.
- *5) The life time of the backlight depends on the ambient temperature. The life time will decrease under low/high temperature.

(3) Touch Panel

Electrical Characteristics

ITEM	MIN.	TYP.	MAX.	UNIT	Remarks
Linearity	-1.5		1.5	%	Analog X and Y directions
	527		1231	Ω	X
Terminal Resistance	186		434		Y
Insulation Resistance	20			ΜΩ	DC 25 V
Voltage	3.0	5.0	7.0	V	DC
Chattering			10	ms	

^{*)} Do not operate it with a thing except a polyacetal pen (tip R0.8 mm or more) or a finger, especially those with hard or sharp tips such as a ball point pen or a mechanical pencil.

5. INTERFACE PIN CONNECTION

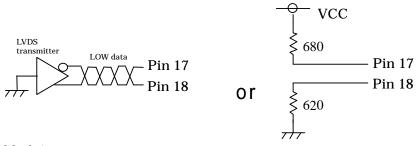
(1) CN 1(Interface Signal)

Used connector: FI-SE20P-HFE (JAE)

Corresponding connector: FI-S20S [for discrete Wire], FI-SE20ME [for FPC] (JAE)

Pin	Symbol	Function (ISP 6 bit	Function (ISP 8 bit	
No.	Syllibol	6 bit input	8 bit input	compatibility mode)
1	VCC	+3.3 V Pov	wer supply	←
2	VCC	+3.3 V Pov	wer supply	←
3	GND	GI	ND	←
4	GND	GI	ND	←
5	Link 0-	R0, R1, R2, R3, R4, R5, G0	R2, R3, R4, R5, R6, R7, G2	R0, R1, R2, R3, R4, R5, G0
6	Link 0+	R0, R1, R2, R3, R4, R5, G0	R2, R3, R4, R5, R6, R7, G2	R0, R1, R2, R3, R4, R5, G0
7	GND		ND	←
8	Link 1-	G1, G2, G3, G4, G5, B0, B1	G3, G4, G5, G6, G7, B2, B3	G1, G2, G3, G4, G5, B0, B1
9	Link 1+	G1, G2, G3, G4, G5, B0, B1	G1, G2, G3, G4, G5, B0, B1	
10	GND	Gì	ND	←
11	Link 2-	B2, B3, B4, B5, DENA	B4, B5, B6, B7, DENA	B2, B3, B4, B5, DENA
12	Link 2+	B2, B3, B4, B5, DENA	B4, B5, B6, B7, DENA	B2, B3, B4, B5, DENA
13	GND	GI	ND	←
14	CLKIN-	Clo	ck –	←
15	CLKIN+	Clo	ck +	←
16	GND	GI	ND	←
17	Link3-	See: *2)	R0, R1, G0, G1, B0, B1	R6, R7, G6, G7, B6, B7
18	Link3+	See: *2)	R6, R7, G6, G7, B6, B7	
19	MODE	Low=ISP 6 bit c	ompatibility mode	High=ISP 8 bit compatibility mode
20	SC	Scan direction control (Lo	w=Normal, High=Reverse)	

- *1) Metal frame is connected to signal GND.
- *2) Recommended wiring of Pin 17,18 (6 bit input)



(2) CN 2(Backlight)

 $Backlight\text{-}side\ connector:\ SM06B\text{-}SHLS\text{-}TF(LF)(SN)\ (JST)$

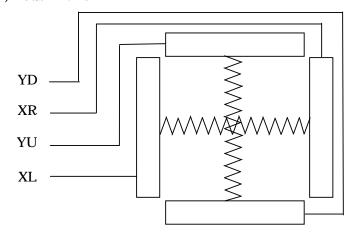
Corresponding connector: SHLP-06V-S-B (JST)

Pin No.	Symbol	Function
1	NC	This pin should be open.
2	NC	This pin should be open.
3	LED C 1	LED cathode 1
4	LED A 1	LED anode 1
5	LED A 2	LED anode 2
6	LED C 2	LED cathode 2

(3) FPC 1 (Touch Panel Interface)

Pin No.	Symbol
1	XL
2	YU
3	XR
4	YD

(4) Touch Panel



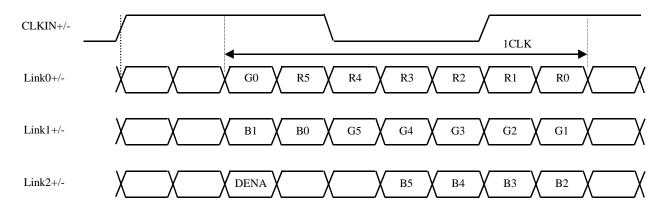
Top View

X: Upper electrode

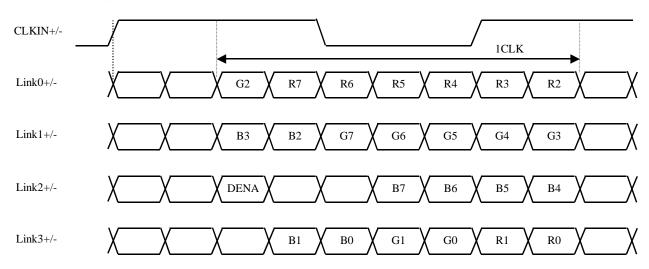
Y: Lower electrode

(5) ISP data mapping

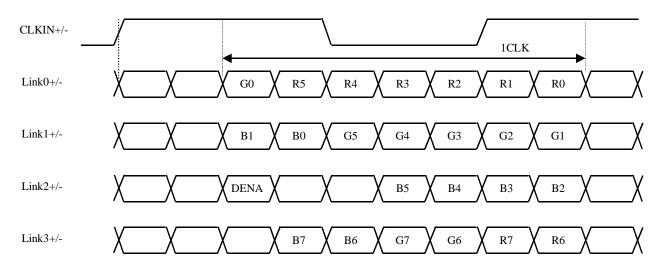
a. ISP 6 bit compatibility mode(6 bit input)



b. ISP 6 bit compatibility mode(8 bit input)



c. ISP 8 bit compatibility mode



6. INTERFACE TIMING

LVDS transmitter input signal

(1) Timing Specifications

	ITEM		SYMBOL	MIN	TYP	MAX	UNIT
DOLL	Frequency		fclk	25	30.4	45	MHz
DCLK	Period		tclk	22.2	32.9	40	ns
		Active Time	t _{HA}	800	800	800	t_{CLK}
	Horizontal	Blanking Time	tнв	20	160		tclk
	Horizontai	Frequency	f_H	26.4	31.7	45	kHz
DENIA		Period	tн	22.2	31.6	37.9	μs
DENA		Active Time	tva	480	480	480	tн
	Vertical	Blanking Time	tvB	3	48		tн
	vertical	Frequency	fv	55	60	75	Hz
		Period	t_{V}	13.3	16.7	18.2	ms

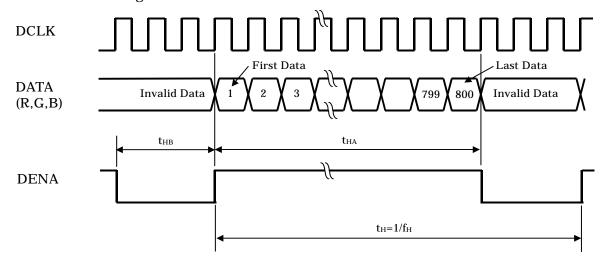
[Note]

- 1) DENA (Data Enable) should always be positive polarity as shown in the timing specification.
- 2) DCLK should appear during all invalid period.
- 3) LVDS timing follows the timing specifications of LVDS receiver IC: THC63LVDF84B(Thine).
- 4) In case of blanking time fluctuation, please satisfy following condition.

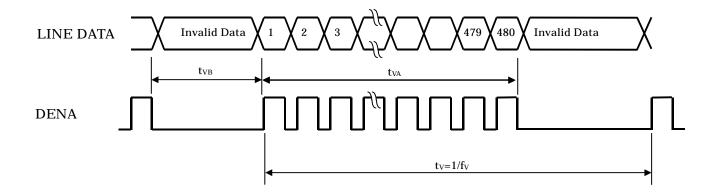
 $t_{VBn} > t_{VBn-1} - 3(t_H)$

(2) Timing Chart

a. Horizontal Timing Chart



b. Vertical Timing Chart



(3) Color Data Assignment

a. 6 bit input

	<u>input</u>								IN	NPUT	`DAT	ГА							
				R D	ATA			G DATA					B DATA						
C	OLOR	R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	В4	В3	В2	B1	В0
		MSB					LSB	MSB					LSB	MSB					LSB
	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
BASIC	BLUE(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
COLOR	CYAN	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	MAGENTA	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	RED(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	RED(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
RED																			
	RED(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	GREEN(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
GREEN																			
	GREEN(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	GREEN(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	BLUE(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	BLUE(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
BLUE																			
											E								
	BLUE(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	BLUE(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

[Note]

1) Definition of gray scale

Color (n) --- n indicates gray scale level. Higher n means brighter level.

2) Data

1:High, 0: Low

b. 8 bit input

D. O DIL												INI	PUT	'DA	TA										
COLOR				I	R DA	ATA						(G D	ATA	١]	B D	ATA	١		
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	В7	В6	В5	В4	Вз	В2	В1	В0
		MSB							LSB	MSB							LSB	MSB							LSB
	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BASIC	GREEN(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
COLOR	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	CYAN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	MAGENTA	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	RED(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RED																									
																						-			
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	GREEN(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
GREEN																						-			
							ā										ē						<u></u>		
																						-			
	GREEN(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	BLUE(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	BLUE(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
BLUE																									
																						Ī			
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

[Note]

1) Definition of gray scale

Color (n) --- n indicates gray scale level. Higher n means brighter level.

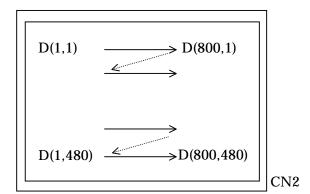
2) Data

1:High, 0: Low

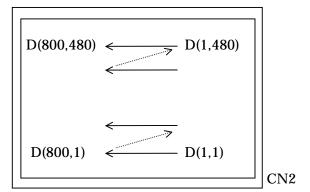
(4) Display Position and Scan Direction

D(X,Y) shows the data number of input signal.

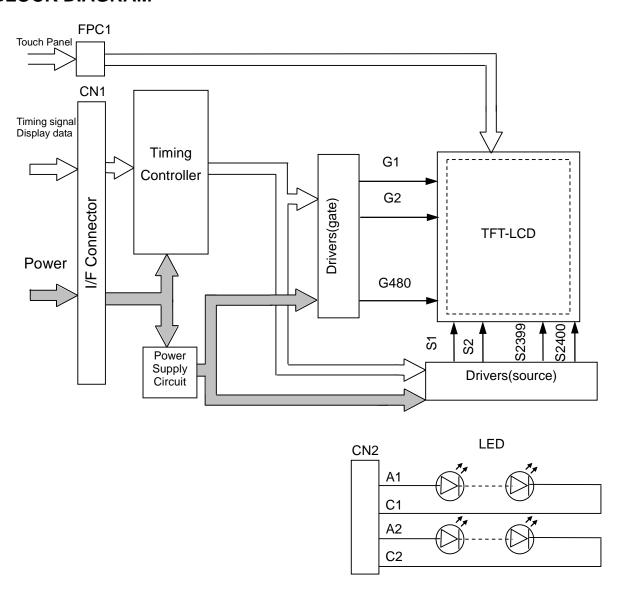
SC: Low



SC: High

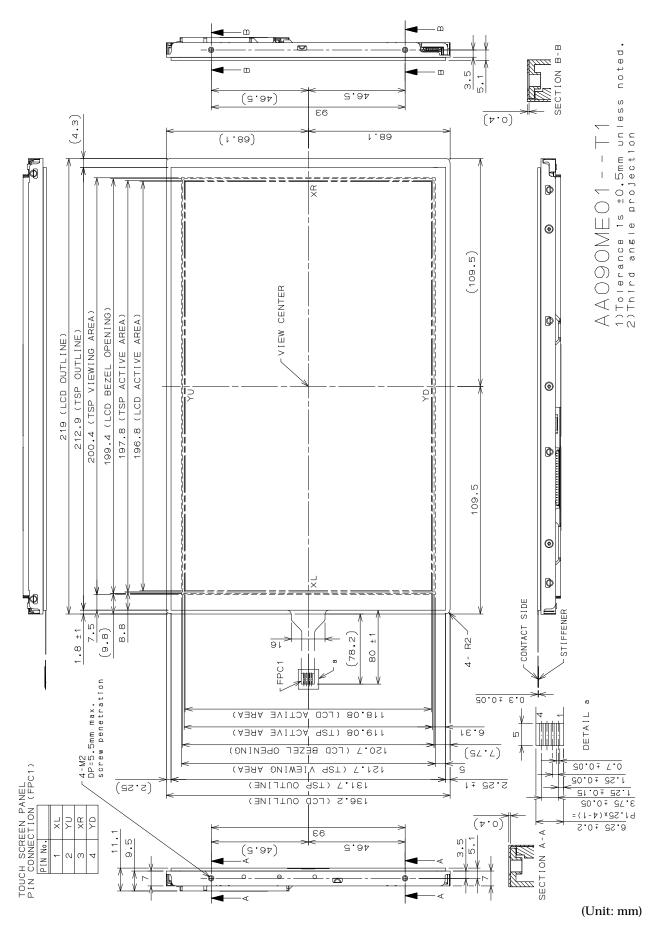


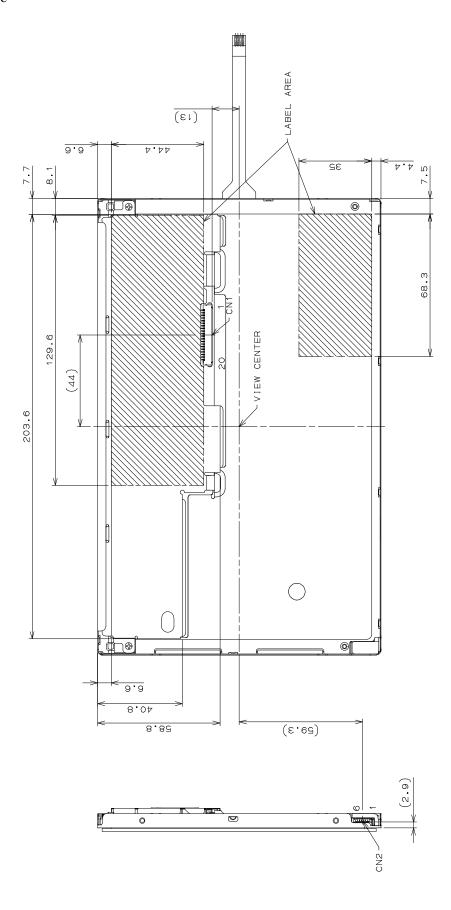
7. BLOCK DIAGRAM



8. MECHANICAL SPECIFICATIONS

(1) Front Side





CN1:FI-SE20P-HFE (JAE) CN2:SMO6B-SHLS-TF(LF)(SN) (JST)

(Unit:mm)

(3) Touch Panel

a. Mechanical Characteristics

	ITEM	MIN.	TYP.	MAX.	UNIT	Remarks	
Activation 1	Force	0.05		0.8	N	*1)	
Durability	Surface Scratching	Write 100,000			characters	*2)	
Durability	Surface Pitting	10,000,000			touches	*3)	
Surface Ha	rdnoss	2			Н	JIS K5400,	
Surface ria	runess	3			11	ASTM D3363	

*1) Stylus pen Input: R4.0 mm silicon pen

*2) Measurement for Surface area

-Input size $10 \times 10 \text{ mm}$

-Input Character A to Z /minute

-Force: 2.45 N

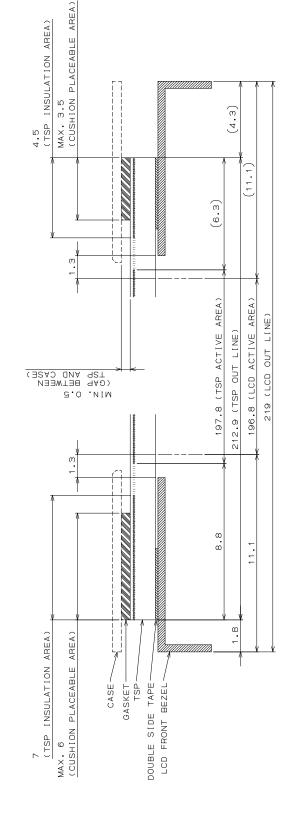
-Stylus: R0.8 mm polyacetal tip

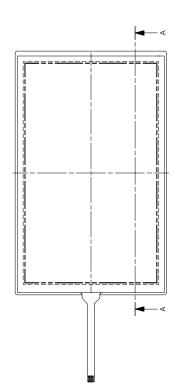
*3) Pit 10,000,000 hits on the Film with a R4.0 mm silicon pen

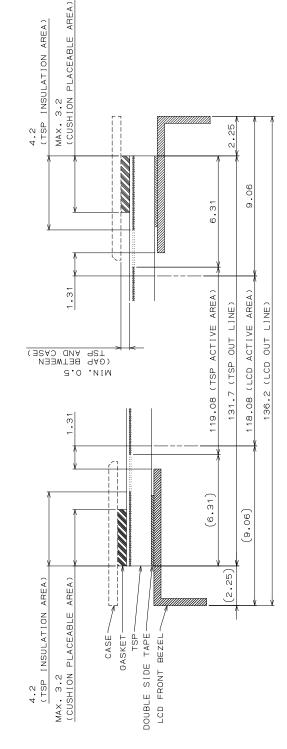
-Force: 3 N -Speed: 2 hits/sec

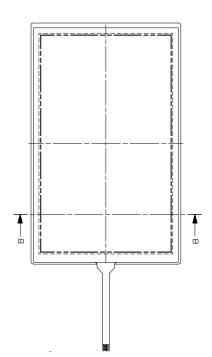
b. Design Guide

- -Avoid the design that Front-case overlap and press on the active area of the touch-panel.
- -Give enough gap (over 0.5 mm at compressed) between the front case and touch-panel to protect wrong operating.
- -Use a buffer material (Gasket) between the touch-panel and Front-case to protect damage and wrong operating.
- -Avoid the design that buffer material overlap and press on the inside of touch-panel viewing area.
- -The flexible tail section should be designed to avoid stress from the front case and/or avoid any bending stress to root of flexible tail section.
- -Please avoid any strong forces, such as pen input in the area between display area and insulated area (distance: >2mm), because it may cause damage to the film.
- -When you handle the product, hold the product by its body. Do not hold by the FPC.









9. OPTICAL CHARACTERISTICS

Ta=25°C, VCC=3.3V, Input Signals: Typ. values shown in Section 6

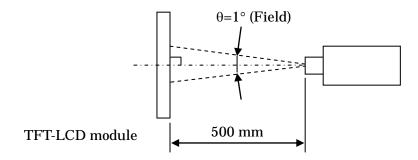
ITEM		SYMBOL	CONDITION	MIN	TYP	MAX	UNIT	Remarks	
Contrast Ratio		CR	θν=0°, θн=0°	550	850			*1)*2)*5)	
Luminance		Lw	θν=0°, θн=0°	250	320		cd/m²	*1)*5)	
Luminance U	Iniformity	ΔLw	θν=0°, θн=0°			30	%	*1)*3)*5)	
Dognanga Tin	20	tr	$\theta_V=0^\circ,\theta_H=0^\circ$		12		ms	*1)*4)*5)	
Response Tin	ne	tf	$\theta_V=0^\circ,\theta_H=0^\circ$		12		ms	*1)*4)*5)	
Viewing	Horizontal	θ_{H}	CR ≥ 10	-70~70	-85~85		0	*1)*5)	
Angle	Vertical	$\theta_{ m V}$	CR ≥ 10	-70~70	-85~85		0	*1)*5)	
Image sticking		tis	2 h			2	S	*6)	
	Red	Rx		0.597	0.637	0.677			
	Reu	Ry		0.281	0.321	0.361			
Color	Green	Gx		0.279	0.319	0.359			
Coordinates	Green	Gy	$\theta_V=0^\circ,\theta_H=0^\circ$	0.591	0.631	0.671		*1)*5)	
	Blue	Bx		0.112	0.152	0.192			
	Diue	By		0.028	0.068	0.108			
	White	Wx		0.278	0.318	0.358			
	winte	Wy		0.295	0.335	0.375			

[Note]

These items are measured using EZContrast (ELDIM) for viewing angle and CS2000 (Minolta) or equivalent equipment for others under the dark room condition (no ambient light) after more than 30 minutes from turning on the backlight unless noted.

Condition: IF = 90 mA

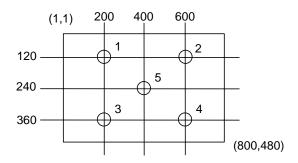
Measurement method for luminance and color coordinates is as follows.



The luminance is measured according to FLAT PANEL DISPLAY MEASUREMENTS STANDARD (VESA Standard).

*1) Measurement Point

Contrast Ratio, Luminance, Response Time, Viewing Angle, Color Coordinates: Display Center Luminance Uniformity: point 1~5 shown in a figure below



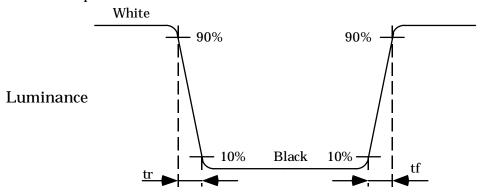
*2) Definition of Contrast Ratio

CR= Luminance with all white pixels / Luminance with all black pixels

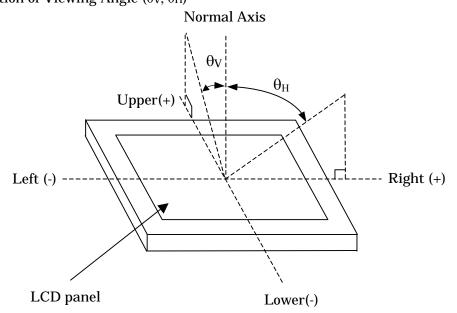
*3) Definition of Luminance Uniformity

 $\Delta Lw {=} [Lw(MAX)/Lw(MIN) {-} 1] \times 100$

*4) Definition of Response Time

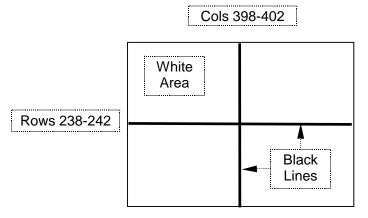


*5) Definition of Viewing Angle (θ_V , θ_H)



*6) Image sticking:

Continuously display the test pattern shown in the figure below for two-hours. Then display a completely white screen. The previous image shall not persist more than two seconds at 25°C.



TEST PATTERN FOR IMAGE STICKING TEST

10. RELIABILITY TEST CONDITION

(1) Temperature and Humidity

ITEM	CONDITIONS
HIGH TEMPERATURE HIGH HUMIDITY OPERATION	40°C, 90%RH, 240 h (No condensation)
HIGH TEMPERATURE OPERATION	70°C, 240 h
LOW TEMPERATURE OPERATION	−20°C, 240 h
HIGH TEMPERATURE STORAGE	80°C, 240 h
LOW TEMPERATURE STORAGE	−30°C, 240 h
THERMAL SHOCK (NON-OPERATION)	−30°C (1h) ~ 80°C(1h), 100 cycles

(2) Shock & Vibration

SHOCK & VIDIATION	
ITEM	CONDITIONS
	Shock level: 1470 m/s² (150G)
SHOCK	Waveform: half sinusoidal wave, 2 ms
(NON-OPERATION)	Number of shocks: one shock input in each direction of three mutually
	perpendicular axes for a total of six shock inputs
VIBRATION (NON-OPERATION)	Vibration level: 9.8 m/s² (1.0G) Waveform: sinusoidal Frequency range: 5 to 500 Hz Frequency sweep rate: 0.5 octave /min Duration: one sweep from 5 to 500 Hz in each of three mutually perpendicular axis(each x,y,z axis: 1 hour, total 3 hours)

(3) ESD Test

ITEM	CONDITIONS
CONTACT DISCHARGE (OPERATION)	150pF, 330 Ω , ± 8 kV, 10 times at 1 sec interval
SIGNAL PIN DISCHARGE (NON-OPERATION)	200pF, 0Ω , ± 200 V, 10 times at 1 sec interval

(4) Judgment standard

The judgment of the above tests should be made as follow:

 $Pass: Normal\ display\ image,\ no\ damage\ of\ the\ display\ function.\ (ex.\ no\ line\ defect)$

Partial transformation of the module parts should be ignored.

Fail: No display image, damage of the display function. (ex. line defect)

11. OTHER FEATURE

This LCD module complies with RoHS *) directive.

 $^{\ast)}$ RoHS: Restriction of the use of certain hazardous substances in electrical and electronic equipment

UL1950 certified (UL File# E158720)

12. HANDLING PRECAUTIONS FOR TFT-LCD MODULE

Please pay attention to the followings in handling TFT-LCD products;

(1) ASSEMBLY PRECAUTION

- a. Please mount the LCD module by using mounting hole with a screw clamping torque less than 0.2 Nm. Please do not bend or wrench the LCD module in assembling. Please do not drop, bend or twist the LCD module in handling.
- b. Please design display housing in accordance with the following guide lines.
 - (a) Housing case must be designed carefully so as not to put stresses on LCD and not to wrench module.
 - (b) Under high temperature environment, performance and life time of LED may heavily shorten. When you design with our LCD product, please consider radiating heat and ventilation for good heat management.
 - (c) Keep sufficient clearance between LCD module back surface and housing when the LCD module is mounted. Approximately 1.0mm of the clearance in the design is recommended taking into account the tolerance of LCD module thickness and mounting structure height on the housing.
 - (d) When some parts, such as, FPC cable and ferrite plate, are installed underneath the LCD module, still sufficient clearance is required, such as 0.5mm. This clearance is, especially, to be reconsidered when the additional parts are implemented for EMI countermeasure.
 - (e) Design the LED driver location and connector position carefully so as not to give stress to LED backlight cable and flexible tail.
 - (f) Keep sufficient clearance between LCD module and the others parts, such as inverter and speaker so as not to interfere the LCD module. Approximately 1.0 mm of the clearance in the design is recommended.
 - (g) To avoid local elevation/decrease of temperature, considering location of heating element, heat release, thermal design should be done.
- c. Please do not push or scratch touch panel surface with anything hard. And do not soil LCD panel surface by touching with bare hands.
- d. Do not use or store the product under a condition where the product will be exposed to water, organic solution or acid.
- e. Please wipe off touch panel surface with absorbent cotton or soft cloth in case of it being soiled.
- f. Touch panel glass edge is not rounded. Please take care in handling to avoid injury.
- g. Please do not take a LCD module to pieces and reconstruct it. Resolving and reconstructing modules may cause them not to work well.
- h. Please do not touch metal frames with bare hands and soiled gloves. A color change of the metal frames can happen during a long preservation of soiled LCD modules.
- i. Please handle metal frame carefully because edge of metal frame is very sharp.

- j. Please connect the metal frame of LCD module to GND in order to minimize the effect of external noise and EMI.
- k. Be sure to connect the cables and the connecters correctly.

(2) OPERATING PRECAUTIONS

- a. Please be sure to turn off the power supply before connecting and disconnecting signal input cable.
- b. Please do not change variable resistance settings in LCD module. They are adjusted to the most suitable value. If they are changed, it might happen LCD does not satisfy the characteristics specification.
- c. The interface signal speed is very high. Please pay attention to transmission line design and other high speed signal precautions to satisfy signal specification.
- d. Condensation might happen on the surface and inside of LCD module in case of sudden change of ambient temperature. Do not use touch panel when there is condensation. It could cause touch panel failure.
- e. Please pay attention not to display the same pattern for very long time. Image sticking might happen on LCD. Although image sticking may disappear as the operation time proceeds, screen saver function is recommended not to cause image sticking.
- f. Please obey the same safe instructions as ones being prepared for ordinary electronic products.

(3) PRECAUTIONS WITH ELECTROSTATICS

- a. This LCD module use CMOS-IC on circuit board and TFT-LCD panel, and so it is easy to be affected by electrostatics. Please be careful with electrostatics by the way of your body connecting to the ground and so on.
- b. Please remove protection film very slowly from the surface of touch panel to prevent from electrostatics occurrence.

(4) STORAGE PRECAUTIONS

LCD should be stored in the room temperature environment with normal humidity. The LCD inventory should be processed by first-in first-out method.

(5) SAFETY PRECAUTIONS

- a. When you waste damaged or unnecessary LCDs, it is recommended to crush LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.
- b. If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.
- c. Be sure to turn off the power supply when inserting or disconnecting the LED backlight cable.

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d. LED driver should be designed carefully to limit or stop its function when over current is detected on the LED.

(6) OTHERS

- a. A strong incident light into LCD panel may cause deterioration to touch panel, polarizer film, color filter, and other materials, which will degrade the quality and performance of display. Please do not expose LCD module under strong Ultraviolet rays for a long time. If using under direct sunlight condition, please test the reliability and performance completely.
- b. For the packaging box handling, please see and obey with the packaging specification datasheet.
- c. Please do not reuse the LED unit which is once removed.