

LCD Module Technical Specification

First Edition
Oct, 04, 2010

Final Revision
Jan. 13, 2011

Type No. **T-55522GD020JU-MLW-A-AAN**

Customer :

Customer's Product No :

OPTREX CORPORATION

Approved : *Yasuo Kawasaki*
QUALITY ASSURANCE DIVISION

Checked : *Toshiaki Ochi*
Product Realization Div.

Prepared : *Noboru Wada*
Product Realization Div.

APPROVED

By _____

Signature :

Date :

Please return this specification within two month with your signature.
If not returned within two month ,specification will be considered
as having been accepted.

CONTENTS

No.	Item	Page
--	CONTENTS	2
1	APPLICATION	3
2	OVERVIEW	4
3	ABSOLUTE MAXIMUM RATINGS	5
4	ELECTRICAL CHARACTERISTICS	5
5	INTERFACE PIN CONNECTION	7
6	RECOMMENDED SEQUENCE	8
7	DISPLAY POSITION AND SCAN DIRECTION	14
8	MECHANICAL SPECIFICATION	15
9	OPTICAL CHARACTERISTICS	17
10	RELIABILITY TEST CONDITION	20
11	INSPECTION STANDARDS	21
12	OTHER FEATURE	22
13	HANDLING PRECAUTIONS FOR TFT-LCD MODULE	23
--	PACKAGING SPECIFICATION	26
--	PRODUCTS NUMBER LABELING FORMS	29

Revision History

Rev.	Date	Comment
1	Jan.13, 2011	Revise: TECHNICAL SPECIFICATION

1. APPLICATION

This specification applies to color TFT-LCD module, T-55522GD020JU-MLW-A-AAN.

These specification papers are the proprietary product of OPTREX CORPORATION (“OPTREX”) and include materials protected under copyright of OPTREX. No part of this document may be reproduced in any form or by any means without the express written permission of OPTREX.

OPTREX does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from use of a product specified in this document. No license, express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of OPTREX or of others.

OPTREX 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. OPTREX should make a contract that stipulate apportionment of responsibilities between OPTREX 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 OPTREX sales representative for it's intended use in writing.

OPTREX 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.

OPTREX 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 OPTREX sales representative for any questions regarding this product.

2. OVERVIEW

T-55522GD020JU-MLW-A-AAN is 2.0" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs, control circuit, backlight unit.

320 × 240, 65k-color images are displayed on the 2.0" diagonal screen. Input power voltages are 3.0V for LCD and 1.8V for interface.

Driver circuit for LED backlight is not included in this module. General specifications are summarized in the following table:

ITEM	SPECIFICATION
Display Area (mm)	40.32(H) × 30.24(V) (2.0-inch diagonal)
Number of Dots	320 × 3 (H) × 240 (V)
Pixel Pitch (mm)	0.126 (H) × 0.126 (V)
Color Pixel Arrangement	RGB vertical stripe
Display Mode	ECB Transflective
Number of Color	65k
Luminance (cd/m ²)	350
Viewing Angle (CR ≥ 10)	-60~60° (H), -45~80° (V)
Surface Treatment	Anti-reflection and hard-coating 2H
Electrical Interface	CMOS
Viewing Direction	Higher Contrast ratio: 12 o'clock Less gray scale reversal: 6 o'clock
Module Size (mm)	47.0(W) × 42.0(H) × 2.1(D) *)
Module Mass (g)	8.1
Backlight Unit	Edge-light, LED

*) W/O FPC

Characteristic value without any note is typical value.

3. ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	MIN.	MAX.	UNIT
Power Supply Voltage for LCD	VCC	-0.3	7.0	V
Power Supply Voltage for Interface	VCCIO	-0.3	7.0	V
Logic Input Voltage	VI	-0.5	VCCIO+0.5	V
Backlight (LED) Current	IF	--	35	mA
Operation Temperature (Panel) <small>Note 1,2)</small>	T _{op(Panel)}	-20	70	°C
Operation Temperature (Ambient) <small>Note 2)</small>	T _{op(Ambient)}	-20	70	°C
Storage Temperature <small>Note 2)</small>	T _{stg}	-20	80	°C

[Note]

1) Measured at the center of active area and at the center of panel back surface

2) Top, Tstg ≤ 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°C

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	Remarks
Power Supply Voltage for LCD	VCC	2.7	3.0	3.3	V	
Power Supply Voltage for Interface	VCCIO	2.7	3.0	3.3	V	
Power Supply Current for LCD	ICC	--	7.5	9.4	mA	*1)
Power Supply Current for Interface	ICCIO	--	--	220	μA	*1, *2)
Logic Input Voltage	High	VIH	0.7×VCCIO	--	VCCIO	V
	Low	VIL	0	---	0.3×VCCIO	V

*1) Display image at typical power supply current value is at VCC = +3.0V, VCCIO = +1.8 V, f_H=19 kHz, f_V=60 Hz CPU I/F, and 64-gray-bar pattern (6 bit). No access.

*2) XWR frequency: 10MHz

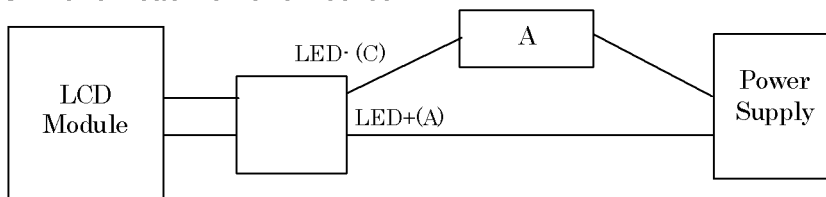
(2) Backlight

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	Remarks
LED Voltage	VF	--	(16.0)	17.5	V	IF = 15 mA, Ta = 25°C
		--	--	18.6	V	IF = 15 mA, Ta = 0°C
		--	--	19.1	V	IF = 15 mA, Ta = -20°C
LED Current	IF	--	15.0	20.0	mA	Ta = 25°C *1), *2)

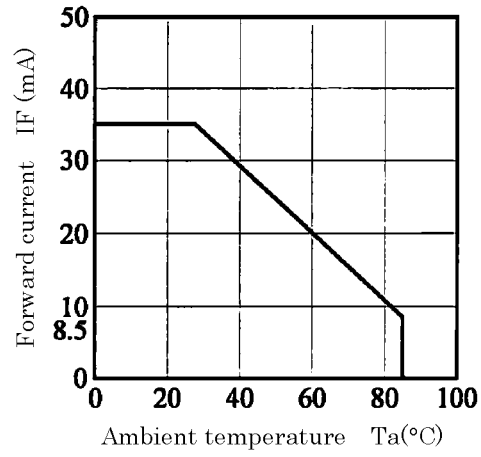
[Note]

*1) Constant Current Drive

*2) Lamp Current measurement method



Diode IF-Ta CHARACTERISTICS DIAGRAM



5. INTERFACE PIN CONNECTION

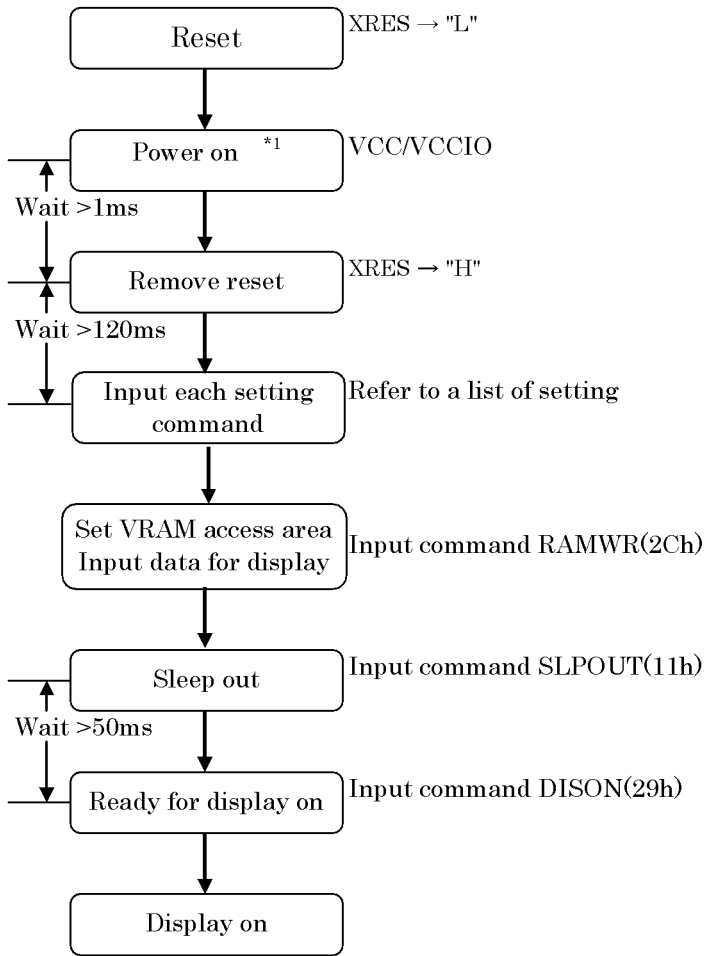
TER2 (Interface Signal)

Corresponding connector: FH27-40S-0.4SH(05) (HRS)

Pin No.	Pin Name
1	GND
2	VDD
3	VDD
4	P/S
5	MPUSEL
6	XRES
7	GND(D17)
8	GND(D16)
9	D15
10	D14
11	D13
12	D12
13	D11
14	D10
15	D9
16	D8
17	D7
18	D6
19	D5
20	D4
21	D3
22	D2
23	D1
24	D0
25	SD
26	XWR
27	XRD
28	A0
29	XCS
30	ENA
31	GND
32	DCK
33	GND
34	HSYNC
35	VSYNC
36	TE
37	VDDI
38	GND
39	LED_C
40	LED_A

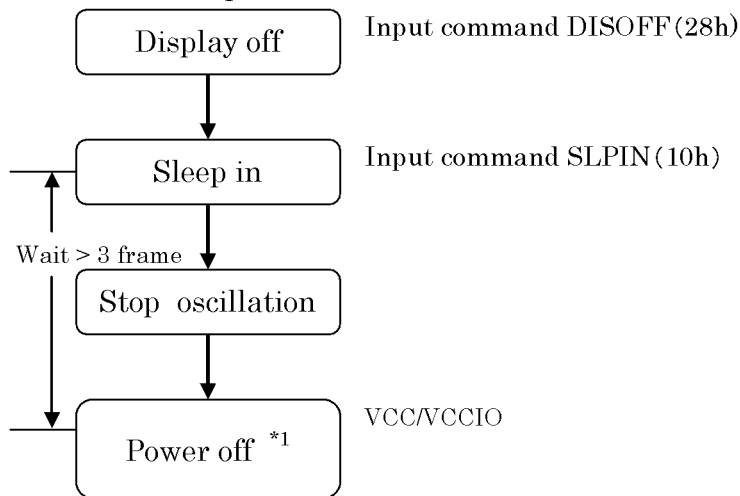
6. RECOMMENDED SEQUENCE

(1) Power ON Sequence



*1) Order to turn on of VCC and VCCIO is no object, but please turn on both of them within 1ms.

(2) Power OFF Sequence



*1) Order to turn on of VCC and VCCIO is no object, but please turn on both of them within 1ms.

(3) Register setting (S1D19122(EPSON))

Command	D7	D6	D5	D4	D3	D2	D1	D0	Hex	Description
RGBSET	0	0	1	0	1	1	0	1	2D	65k Color
P1	0	0	0	0	0	0	0	0	00	R0
P2	0	0	0	0	0	0	1	0	02	R1
P3	0	0	0	0	0	1	0	0	04	R2
P4	0	0	0	0	0	1	1	0	06	R3
P5	0	0	0	0	1	0	0	0	08	R4
P6	0	0	0	0	1	0	1	0	0A	R5
P7	0	0	0	0	1	1	0	0	0C	R6
P8	0	0	0	0	1	1	1	0	0E	R7
P9	0	0	0	1	0	0	0	0	10	R8
P10	0	0	0	1	0	0	1	0	12	R9
P11	0	0	0	1	0	1	0	0	14	R10
P12	0	0	0	1	0	1	1	0	16	R11
P13	0	0	0	1	1	0	0	0	18	R12
P14	0	0	0	1	1	0	1	0	1A	R13
P15	0	0	0	1	1	1	0	0	1C	R14
P16	0	0	0	1	1	1	1	0	1E	R15
P17	0	0	1	0	0	0	0	1	21	R16
P18	0	0	1	0	0	0	1	1	23	R17
P19	0	0	1	0	0	1	0	1	25	R18
P20	0	0	1	0	0	1	1	1	27	R19
P21	0	0	1	0	1	0	0	1	29	R20
P22	0	0	1	0	1	0	1	1	2B	R21
P23	0	0	1	0	1	1	0	1	2D	R22
P24	0	0	1	0	1	1	1	1	2F	R23
P25	0	0	1	1	0	0	0	1	31	R24
P26	0	0	1	1	0	0	1	1	33	R25
P27	0	0	1	1	0	1	0	1	35	R26
P28	0	0	1	1	0	1	1	1	37	R27
P29	0	0	1	1	1	0	0	1	39	R28
P30	0	0	1	1	1	0	1	1	3B	R29
P31	0	0	1	1	1	1	0	1	3D	R30
P32	0	0	1	1	1	1	1	1	3F	R31
P33	0	0	0	0	0	0	0	0	00	G0
P34	0	0	0	0	0	0	0	1	01	G1
P35	0	0	0	0	0	0	1	0	02	G2
P36	0	0	0	0	0	0	1	1	03	G3
P37	0	0	0	0	0	1	0	0	04	G4
P38	0	0	0	0	0	1	0	1	05	G5
P39	0	0	0	0	0	1	1	0	06	G6
P40	0	0	0	0	0	1	1	1	07	G7
P41	0	0	0	0	1	0	0	0	08	G8
P42	0	0	0	0	1	0	0	1	09	G9
P43	0	0	0	0	1	0	1	0	0A	G10
P44	0	0	0	0	1	0	1	1	0B	G11
P45	0	0	0	0	1	1	0	0	0C	G12
P46	0	0	0	0	1	1	0	1	0D	G13
P47	0	0	0	0	1	1	1	0	0E	G14
P48	0	0	0	0	1	1	1	1	0F	G15
P49	0	0	0	1	0	0	0	0	10	G16
P50	0	0	0	1	0	0	0	1	11	G17
P51	0	0	0	1	0	0	1	0	12	G18
P52	0	0	0	1	0	0	1	1	13	G19
P53	0	0	0	1	0	1	0	0	14	G20
P54	0	0	0	1	0	1	0	1	15	G21
P55	0	0	0	1	0	1	1	0	16	G22
P56	0	0	0	1	0	1	1	1	17	G23
P57	0	0	0	1	1	0	0	0	18	G24
P58	0	0	0	1	1	0	0	1	19	G25
P59	0	0	0	1	1	0	1	0	1A	G26
P60	0	0	0	1	1	0	1	1	1B	G27
P61	0	0	0	1	1	1	0	0	1C	G28
P62	0	0	0	1	1	1	0	1	1D	G29
P63	0	0	0	1	1	1	1	0	1E	G30
P64	0	0	0	1	1	1	1	1	1F	G31
P65	0	0	1	0	0	0	0	0	20	G32
P66	0	0	1	0	0	0	0	1	21	G33
P67	0	0	1	0	0	0	1	0	22	G34
P68	0	0	1	0	0	0	1	1	23	G35
P69	0	0	1	0	0	1	0	0	24	G36
P70	0	0	1	0	0	1	0	1	25	G37
P71	0	0	1	0	0	1	1	0	26	G38
P72	0	0	1	0	0	1	1	1	27	G39
P73	0	0	1	0	1	0	0	0	28	G40
P74	0	0	1	0	1	0	0	1	29	G41
P75	0	0	1	0	1	0	1	0	2A	G42
P76	0	0	1	0	1	0	1	1	2B	G43
P77	0	0	1	0	1	1	0	0	2C	G44
P78	0	0	1	0	1	1	0	1	2D	G45
P79	0	0	1	0	1	1	1	0	2E	G46
P80	0	0	1	0	1	1	1	1	2F	G47

P81	0	0	1	1	0	0	0	0	30	G48
P82	0	0	1	1	0	0	0	1	31	G49
P83	0	0	1	1	0	0	1	0	32	G50
P84	0	0	1	1	0	0	1	1	33	G51
P85	0	0	1	1	0	1	0	0	34	G52
P86	0	0	1	1	0	1	0	1	35	G53
P87	0	0	1	1	0	1	1	0	36	G54
P88	0	0	1	1	0	1	1	1	37	G55
P89	0	0	1	1	1	0	0	0	38	G56
P90	0	0	1	1	1	0	0	1	39	G57
P91	0	0	1	1	1	0	1	0	3A	G58
P92	0	0	1	1	1	0	1	1	3B	G59
P93	0	0	1	1	1	1	0	0	3C	G60
P94	0	0	1	1	1	1	0	1	3D	G61
P95	0	0	1	1	1	1	1	0	3E	G62
P96	0	0	1	1	1	1	1	1	3F	G63
P97	0	0	0	0	0	0	0	0	00	B0
P98	0	0	0	0	0	0	1	0	02	B1
P99	0	0	0	0	0	1	0	0	04	B2
P100	0	0	0	0	0	1	1	0	06	B3
P101	0	0	0	0	1	0	0	0	08	B4
P102	0	0	0	0	1	0	1	0	0A	B5
P103	0	0	0	0	1	1	0	0	0C	B6
P104	0	0	0	0	1	1	1	0	0E	B7
P105	0	0	0	1	0	0	0	0	10	B8
P106	0	0	0	1	0	0	1	0	12	B9
P107	0	0	0	1	0	1	0	0	14	B10
P108	0	0	0	1	0	1	1	0	16	B11
P109	0	0	0	1	1	0	0	0	18	B12
P110	0	0	0	1	1	0	1	0	1A	B13
P111	0	0	0	1	1	1	0	0	1C	B14
P112	0	0	0	1	1	1	1	0	1E	B15
P113	0	0	1	0	0	0	0	1	21	B16
P114	0	0	1	0	0	0	1	1	23	B17
P115	0	0	1	0	0	1	0	1	25	B18
P116	0	0	1	0	0	1	1	1	27	B19
P117	0	0	1	0	1	0	0	1	29	B20
P118	0	0	1	0	1	0	1	1	2B	B21
P119	0	0	1	0	1	1	0	1	2D	B22
P120	0	0	1	0	1	1	1	1	2F	B23
P121	0	0	1	1	0	0	0	1	31	B24
P122	0	0	1	1	0	0	1	1	33	B25
P123	0	0	1	1	0	1	0	1	35	B26
P124	0	0	1	1	0	1	1	1	37	B27
P125	0	0	1	1	1	0	0	1	39	B28
P126	0	0	1	1	1	0	1	1	3B	B29
P127	0	0	1	1	1	1	0	1	3D	B30
P128	0	0	1	1	1	1	1	1	3F	B31
TEON	0	0	1	1	0	1	0	1	35	Tearing effect line off
P1	0	0	0	0	0	0	0	0	00	Tearing effect mode
COLMOD	0	0	1	1	1	0	1	0	3A	Interface pixel format
P1						1	0	1	05	Color
DISCTL	1	0	1	1	0	0	0	0	B0	Display control
P1	0	0	0	0	1	0	1	0	0A	Vertical Back Porch
P2	0	0	0	0	0	0	0	0	00	Display Line (U)
P3	1	1	1	1	0	0	0	0	F0	Display Line (L)
P4	0	0	0	0	1	0	1	0	0A	Vertical Front Porch
P5	0	1	0	0	0	0	0	0	40	1H period
P6	0	0	0	0	1	0	1	0	0A	Drive Mode
P7	0	0	0	0	0	1	1	1	07	PreBuffer On Timing
P8	0	0	1	0	0	1	1	1	27	PreBuffer Off Timing
P9	0	0	0	0	0	0	0	0	00	Revise On Timing
P10	0	0	0	0	0	0	0	0	00	Revise Off Timing
P11	0	0	1	0	0	1	1	1	27	DAC On Timing
P12	0	0	1	1	1	1	1	0	3E	DAC Off Timing
P13	0	0	0	0	1	0	0	0	08	Gate On Timing
P14	0	0	1	1	1	0	1	1	3B	Gate Off Timing
P15	0	0	0	0	0	0	0	0	00	Gamma Off Timing
P16	0	0	0	0	1	0	1	0	0A	Inversion Mode
P17	1	1	0	0	0	0	0	0	C0	SDR Drive Mode
P18	0	0	0	0	0	0	0	0	00	Idle Refresh Mode
P19	0	0	1	0	0	0	0	0	20	Idle Drive Mode
P20	0	0	0	0	1	0	1	0	0A	Idle VFP Line
GCPSETOP R	1	1	1	1	0	0	0	0	F0	Gamma curve set 0
P1	1	1	1	0	0	1	0	0	E4	
P2	1	0	0	0	1	0	0	0	88	
P3	0	1	0	0	0	0	1	0	42	
P4	0	0	0	1	0	0	0	0	10	
P5	1	0	0	0	1	0	0	0	88	
P6	0	1	0	0	0	0	1	0	42	
P7	0	0	1	0	0	0	1	0	22	
P8	0	0	1	0	0	0	1	0	22	
P9	0	1	0	0	1	0	0	0	48	
P10	1	0	0	1	0	0	1	0	92	

P11	1	0	0	1	0	0	1	0	92	
P12	1	0	0	1	0	1	0	1	95	
P13	0	0	1	0	1	0	1	0	2A	
P14	1	0	1	0	1	0	1	0	AA	
P15	1	1	0	1	0	1	0	1	D5	
P16	0	1	0	1	1	0	1	0	5A	
P17	1	0	1	0	1	0	1	0	AA	
P18	1	0	1	0	1	0	1	0	AA	
P19	1	0	1	0	0	1	0	1	A5	
P20	0	0	1	0	0	0	1	0	22	
P21	0	1	0	0	0	0	1	0	42	
P22	0	0	0	1	0	0	0	0	10	
P23	0	0	0	0	1	0	0	0	08	
P24	0	0	0	0	0	0	0	0	00	
P25	0	0	0	0	0	0	0	0	00	
P26	0	0	0	0	0	0	0	0	00	
P27	0	0	0	0	0	0	1	0	02	
P28	0	0	0	0	0	0	0	0	00	
P29	0	0	0	0	0	0	0	0	00	
P30	0	0	0	0	0	0	0	0	00	
P31	0	0	0	0	0	0	0	0	00	
P32	0	0	0	0	0	0	0	1	01	
GCPSETON R	1	1	1	1	0	0	0	1	F1	Gamma curve set 0
P1	0	0	0	0	0	0	0	0	00	
P2	0	0	0	0	0	0	0	0	00	
P3	0	0	0	0	0	0	0	0	00	
P4	0	0	0	0	0	0	0	0	00	
P5	0	0	0	1	1	1	0	1	1D	
P6	0	0	0	1	0	0	0	1	11	
P7	0	0	0	0	1	0	0	0	08	
P8	1	0	0	0	0	1	0	0	84	
P9	0	0	1	0	0	0	0	1	21	
P10	0	0	0	0	1	0	0	0	08	
P11	1	0	0	0	0	1	0	0	84	
P12	0	1	0	0	0	1	0	0	44	
P13	1	0	0	0	1	0	0	1	89	
P14	0	0	1	0	0	0	1	0	22	
P15	1	0	0	1	0	0	1	0	92	
P16	0	1	0	1	0	1	0	0	54	
P17	1	0	1	0	1	0	1	0	AA	
P18	0	1	0	1	0	1	0	1	55	
P19	1	0	1	0	1	0	1	0	AA	
P20	1	0	1	0	1	1	0	1	AD	
P21	0	1	0	1	0	1	0	1	55	
P22	1	0	1	0	1	0	1	0	AA	
P23	0	1	0	1	0	1	0	0	54	
P24	1	0	1	0	0	1	0	0	A4	
P25	1	0	0	0	1	0	0	0	88	
P26	1	0	0	0	0	0	1	0	82	
P27	0	0	0	0	0	0	0	1	01	
P28	0	0	0	0	0	0	0	0	00	
P29	0	0	0	0	0	0	0	0	00	
P30	0	0	0	0	0	0	0	0	00	
P31	0	0	0	0	0	0	0	0	00	
P32	0	1	0	0	0	0	0	1	41	
GCPSETOP GB	1	1	1	1	0	0	1	0	F2	Gamma curve set 0
P1	1	1	1	0	0	1	0	0	E4	
P2	1	0	0	0	1	0	0	0	88	
P3	0	1	0	0	0	0	1	0	42	
P4	0	0	0	1	0	0	0	0	10	
P5	1	0	0	0	1	0	0	0	88	
P6	0	1	0	0	0	0	1	0	42	
P7	0	0	1	0	0	0	1	0	22	
P8	0	0	1	0	0	0	1	0	22	
P9	0	1	0	0	1	0	0	0	48	
P10	1	0	0	1	0	0	1	0	92	
P11	1	0	0	1	0	0	1	0	92	
P12	1	0	0	1	0	1	0	1	95	
P13	0	0	1	0	1	0	1	0	2A	
P14	1	0	1	0	1	0	1	0	AA	
P15	1	1	0	1	0	1	0	1	D5	
P16	0	1	0	1	1	0	1	0	5A	
P17	1	0	1	0	1	0	1	0	AA	
P18	1	0	1	0	1	0	1	0	AA	
P19	1	0	1	0	0	1	0	1	A5	
P20	0	0	1	0	0	0	1	0	22	

P21	0	1	0	0	0	0	1	0	42	
P22	0	0	0	1	0	0	0	0	10	
P23	0	0	0	0	1	0	0	0	08	
P24	0	0	0	0	0	0	0	0	00	
P25	0	0	0	0	0	0	0	0	00	
P26	0	0	0	0	0	0	0	0	00	
P27	0	0	0	0	0	0	1	0	02	
P28	0	0	0	0	0	0	0	0	00	
P29	0	0	0	0	0	0	0	0	00	
P30	0	0	0	0	0	0	0	0	00	
P31	0	0	0	0	0	0	0	0	00	
P32	0	0	0	0	0	0	0	1	01	
GCPSETON GB	1	1	1	1	0	0	1	1	F3	Gamma curve set 0
P1	0	0	0	0	0	0	0	0	00	
P2	0	0	0	0	0	0	0	0	00	
P3	0	0	0	0	0	0	0	0	00	
P4	0	0	0	0	0	0	0	0	00	
P5	0	0	0	1	1	1	0	1	1D	
P6	0	0	0	1	0	0	0	1	11	
P7	0	0	0	0	1	0	0	0	08	
P8	1	0	0	0	0	1	0	0	84	
P9	0	0	1	0	0	0	0	1	21	
P10	0	0	0	0	1	0	0	0	08	
P11	1	0	0	0	0	1	0	0	84	
P12	0	1	0	0	0	1	0	0	44	
P13	1	0	0	0	1	0	0	1	89	
P14	0	0	1	0	0	0	1	0	22	
P15	1	0	0	1	0	0	1	0	92	
P16	0	1	0	1	0	1	0	0	54	
P17	1	0	1	0	1	0	1	0	AA	
P18	0	1	0	1	0	1	0	1	55	
P19	1	0	1	0	1	0	1	0	AA	
P20	1	0	1	0	1	1	0	1	AD	
P21	0	1	0	1	0	1	0	1	55	
P22	1	0	1	0	1	0	1	0	AA	
P23	0	1	0	1	0	1	0	0	54	
P24	1	0	1	0	0	1	0	0	A4	
P25	1	0	0	0	1	0	0	0	88	
P26	1	0	0	0	0	0	1	0	82	
P27	0	0	0	0	0	0	0	1	01	
P28	0	0	0	0	0	0	0	0	00	
P29	0	0	0	0	0	0	0	0	00	
P30	0	0	0	0	0	0	0	0	00	
P31	0	0	0	0	0	0	0	0	00	
P32	0	1	0	0	0	0	0	1	41	
EVRSSET	1	0	1	1	1	1	1	0	BE	EVR set
P1	0	0	0	0	0	0	1	1	03	VLDO
P2	1	0	0	0	0	0	0	0	80	VDDHS
P3	0	1	1	0	0	1	0	0	64	VCOMH
P4	0	0	0	1	0	0	0	0	10	VCOMW
P5	0	0	0	1	0	1	0	0	14	VDDRH
P6	0	0	0	1	1	0	1	1	1B	VONREG
P7	0	0	0	0	1	0	1	0	0A	VOFREG
P8	0	0	0	0	0	0	0	0	00	Not defined
P9	0	0	0	0	0	0	0	0	00	Not defined
P10	0	0	0	0	0	0	0	0	00	Not defined
MDLDEF	1	1	0	0	0	0	0	0	C0	LCD Module definition
P1	0	0	0	0	1	1	1	0	0E	
P2	0	0	0	0	0	0	0	1	01	
P3	0	0	0	0	0	0	0	0	00	
P4	0	0	0	0	0	0	0	0	00	
P5	0	0	0	0	0	0	0	0	00	
PWRDEF	1	1	0	0	0	0	0	1	C1	Power definition
P1	0	0	1	0	1	1	1	1	2F	C.P Movement
P2	0	0	1	1	0	0	1	1	33	C.P Clock
P3	1	1	1	1	0	1	0	0	F4	Basic Voltage
P4	1	1	1	1	1	1	1	1	FF	Regulator ON/OFF
P5	0	0	0	1	0	0	1	0	12	Regulator Set 1 (FBH,VCOM)
P6	0	0	0	0	0	0	0	0	00	Regulator Set 2 (REG)
P7	0	0	0	0	0	0	0	1	01	Regulator Set 3 (VOFREG BST)
P8	0	0	0	0	0	0	0	1	01	Regulator Set 4 (VCOMH CU)
P9	0	0	0	0	0	0	0	1	01	Regulator Set 5 (VCOML CU)
P10	0	0	0	0	0	1	0	0	04	ONseq wait 1
P11	0	0	0	0	0	1	0	0	04	ONseq wait 2
P12	0	0	0	0	0	1	0	0	04	ONseq wait 3
P13	0	0	0	0	0	0	0	0	00	Not defined
IFMOD	1	1	0	0	0	0	1	0	C2	Interface mode select
P1	0	0	0	0	0	0	1	1	03	Interface mode

(4) Timing Specification

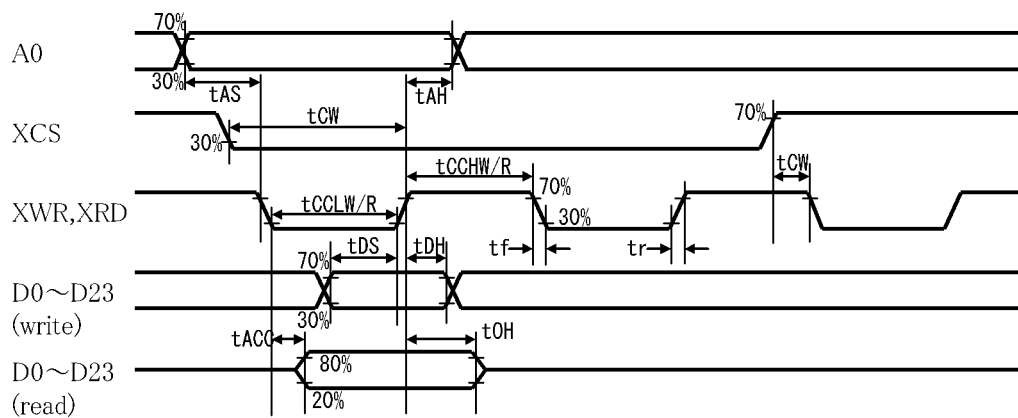
See: Data sheet of Driver IC (S1D19122 (EPSON))

Ta = 25°C

ITEM		SYMBOL	MIN.	TYP.	MAX.	UNIT
XCS-XWR,XRD time		tCW8	7	-	-	ns
Address	Set up Time	tAS	7	-	-	ns
	Hold Time	tAH	7	-	-	ns
XWR	System Cycle Time (Writing)	tCYCW	80	-	-	ns
	High Width	tCCHW	22	-	-	ns
	Low Width	tCCLW	28	-	-	ns
XRD	System Cycle Time (Reading)	tCYCR	200	-	-	ns
	High Width	tCCHR	45	-	-	ns
	Low Width	tCCLR	135	-	-	ns
Data (D0~ D23)	Set up Time	tDS	7	-	-	ns
	Hold Time	tDH	7	-	-	ns
	Access Time *)	tACC	-	-	130	ns
	Output Disable Time *)	tOH	15	-	70	ns

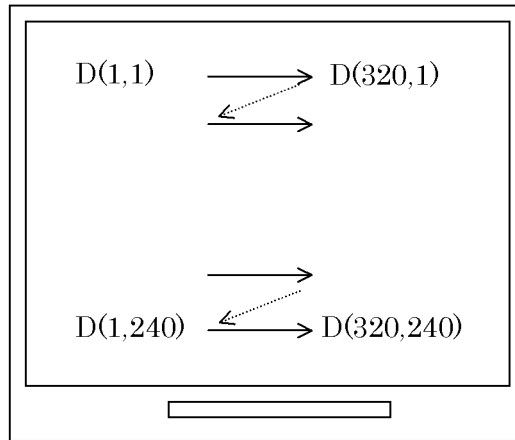
It prescribes the rising / falling time for input signal in less than 15ns.

*) Condition : CL = 8pF(min), 30pF(max)



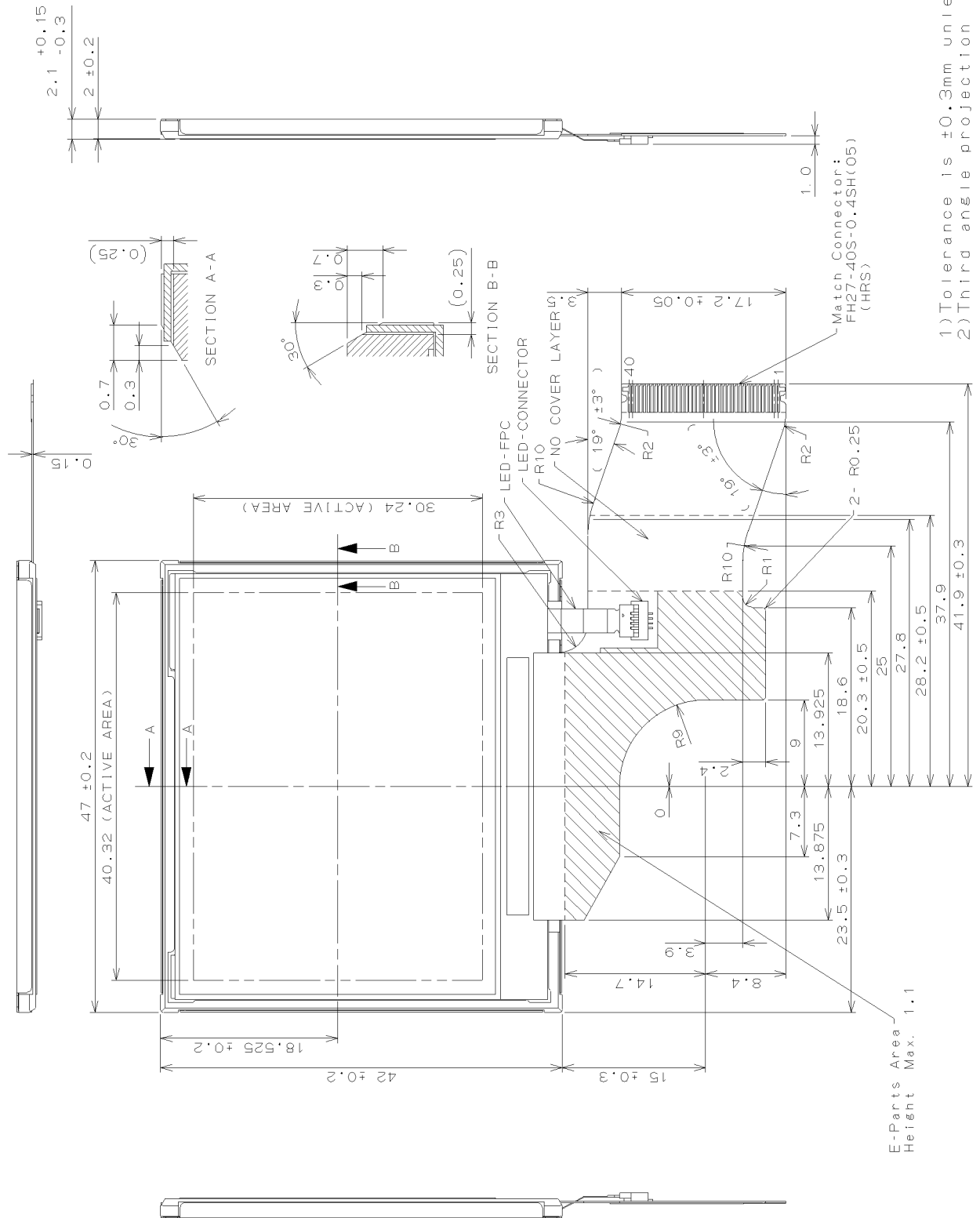
7. DISPLAY POSITION AND SCAN DIRECTION

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



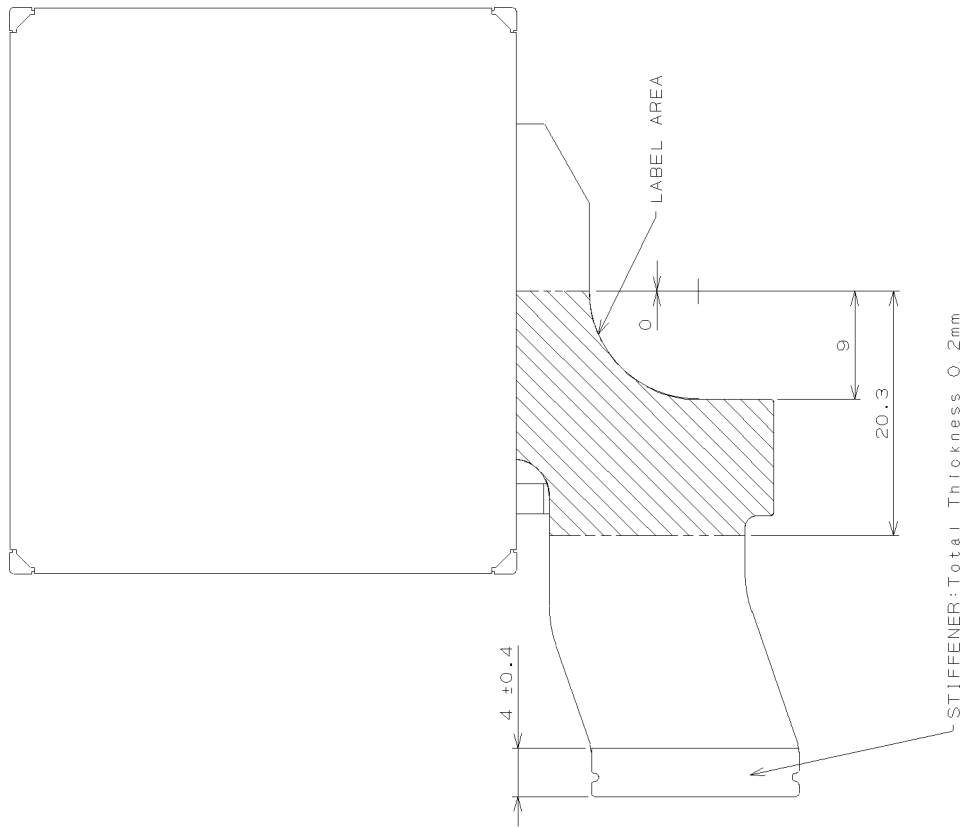
8. MECHANICAL SPECIFICATIONS

(1) Front Side



(Unit:mm)

(2) Rear Side



- 1) Tolerance is ±0.3mm unless noted.
- 2) Third angle projection

(Unit:mm)

9. OPTICAL CHARACTERISTICS

Ta=25°C, VCC=VCCIO=3.0V, VF=16V, Input Signals: Typ. values shown in Section 6

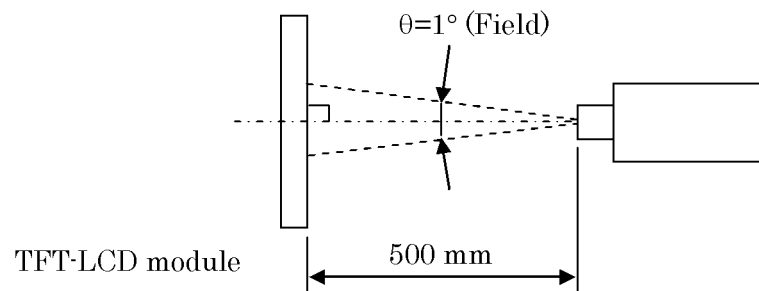
ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	Remarks
Contrast Ratio		CR	$\theta_V=0^\circ, \theta_H=0^\circ$	80	150	--	--	*1)*2)*5)
Luminance		Lw	$\theta_V=0^\circ, \theta_H=0^\circ$	230	350	--	cd/m ²	*1)*5)
Response Time		tr	$\theta_V=0^\circ, \theta_H=0^\circ$	--	24	--	ms	*1)*4)*5)
		tf	$\theta_V=0^\circ, \theta_H=0^\circ$	--	11	--	ms	*1)*4)*5)
Viewing Angle	Horizontal	θ_H	CR \geq 10	--	-60~60	--	--	*1)*5)
	Vertical	θ_V		--	-45~80	--	--	*1)*5)
Image Sticking		tis	2 h	--	--	2	s	*6)
Color Coordinates	Red	Rx	$\theta_V=0^\circ, \theta_H=0^\circ$	0.500	0.550	0.600	--	*1)*5)
		Ry		0.301	0.351	0.401		
	Green	Gx		0.288	0.338	0.388		
		Gy		0.496	0.546	0.596		
	Blue	Bx		0.113	0.163	0.213		
		By		0.097	0.147	0.197		
White	Wx	0.259	0.309	0.359				
	Wy	0.282	0.332	0.382				

[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=15.0 mA

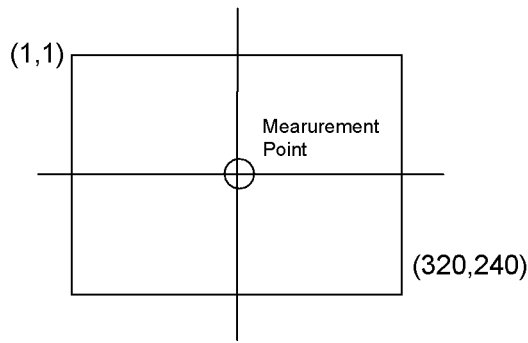
Measurement method for luminance and color coordinates is as follows.



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



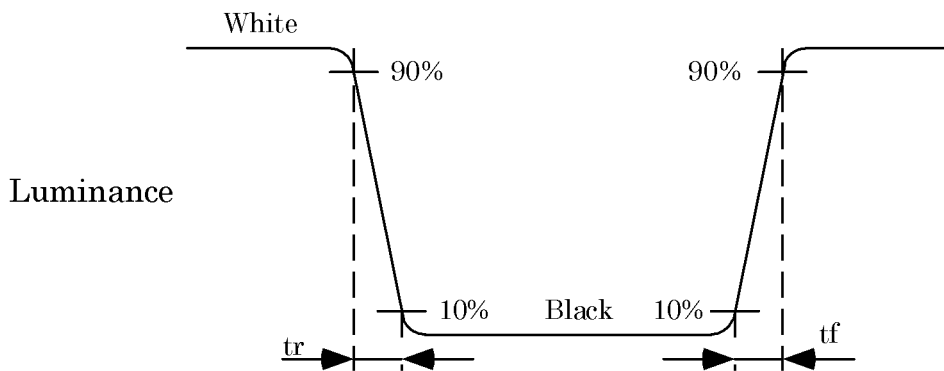
*2) Definition of Contrast Ratio

$CR = \text{Luminance with all white pixels} / \text{Luminance with all black pixels}$

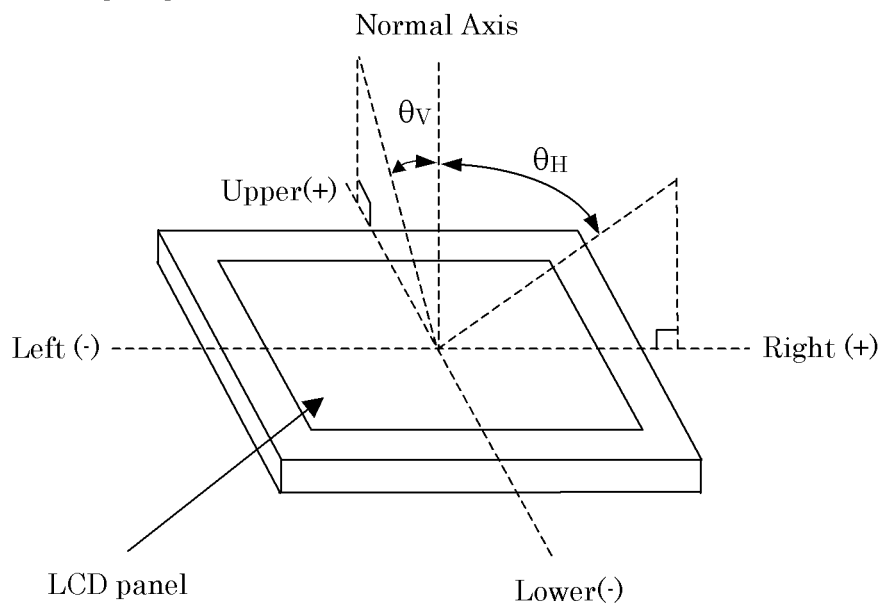
*3) Definition of Luminance Uniformity

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

*4) Definition of Response Time

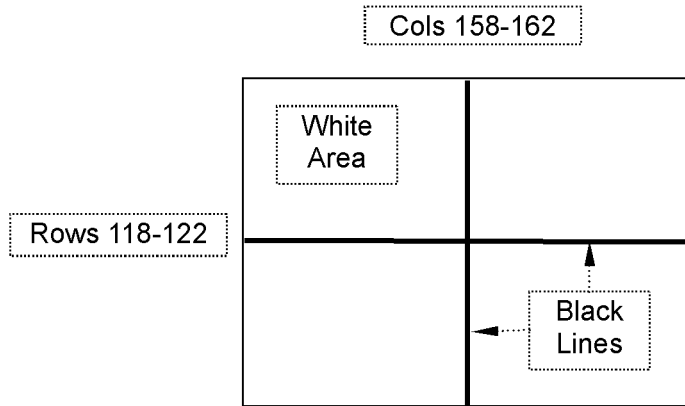


*5) Definition of Viewing Angle (θ_V , θ_H)



*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	-20°C, 240 h
THERMAL SHOCK (NON-OPERATION)	-20°C (1h) ~ 80°C(1h), 100 cycles

(2) Shock & Vibration

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

(3) 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. INSPECTION STANDARDS

Inspection condition is as follows:

- Inspection Area: active area
- Viewing distance: approximately 35 cm.
- Viewing angle: normal to the LCD panel $\pm 10^\circ$ horizontal and vertical.
- Ambient temperature: approximately 25°C.
- Ambient light: 300 - 500 lx.

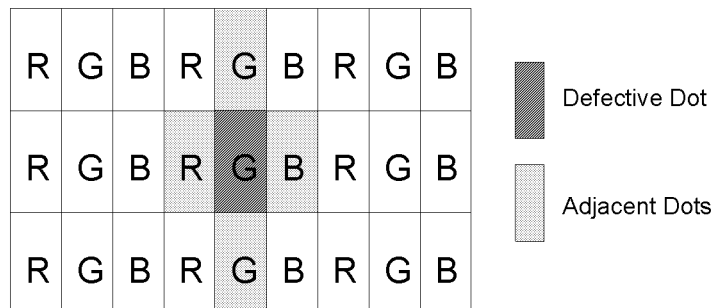
Bright Dot is defined as follows:

Visible through 5% transmission ND filter under the condition that black image (color 0) is on the display.

DEFECT TYPE		LIMIT	
VISUAL DEFECT	SCRATCH	$0.01 \text{ mm} < W \leq 0.05 \text{ mm}$ $L \leq 10 \text{ mm}$	$N \leq 4$
		$0.01 \text{ mm} < W$ $10 \text{ mm} < L$	$N = 0$
		$0.05 \text{ mm} < W$	$N = 0$
	DENT	$0.2 \text{ mm} < \phi \leq 0.4 \text{ mm}$	$N \leq 4$
		$0.4 \text{ mm} < \phi$	$N = 0$
	BLACK SPOT BUBBLE	$0.2 \text{ mm} < \phi \leq 0.4 \text{ mm}$	$N \leq 5$
		$0.4 \text{ mm} < \phi$	$N = 0$
	LINT	$L \leq 3 \text{ mm}$ $W \leq 0.1 \text{ mm}$	$N \leq 4$
		$3 \text{ mm} < L$ $W \leq 0.1 \text{ mm}$	$N = 0$
$0.1 \text{ mm} < W$		ACCORDING TO BLACK SPOT	
ELECTRICAL DEFECT	BRIGHT DOT	$N \leq 0$	
	DARK DOT	$N \leq 2$	
	TOTAL DOT	$N \leq 2$	
	TWO ADJACENT DOT BRIGHT DOT DARK DOT	NOT ALLOWED $\leq 1 \text{ PAIR}$	
	THREE OR MORE ADJACENT DOT	NOT ALLOWED	
	LINE DEFECT	NOT ALLOWED	

*1) W: width, L: length, ϕ : diameter, N: number

*2) DEFINITION OF ADJACENT



The defects that are not defined above and considered to be problem shall be reviewed and discussed by both parties.

12. OTHER FEATURE

This LCD module complies with RoHS*) directive.

*) RoHS: Restriction of the use of certain hazardous substances in electrical and electronic equipment

13. HANDLING PRECAUTIONS FOR TFT-LCD MODULE

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

(1) ASSEMBLY PRECAUTION

- a. 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.
 - (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 LCD panel surface with anything hard. And do not soil LCD panel surface by touching with bare hands. (Polarizer film, surface of LCD panel is easy to be flawed.)
- d. Please wipe off LCD panel surface with absorbent cotton or soft cloth in case of it being soiled.
- e. Please wipe off drops of adhesives like saliva and water on LCD panel surface immediately. They might damage to cause panel surface variation and color change.
- f. Please do not take a LCD module to pieces and reconstruct it. Resolving and reconstructing modules may cause them not to work well.
- g. 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.

T-55522GD020JU-MLW-A-AAN Rev.1	OPTREX CORPORATION	Page 23/29
--------------------------------	--------------------	------------

- h. Please handle metal frame carefully because edge of metal frame is very sharp.
- i. Please connect the metal frame of LCD module to GND in order to minimize the effect of external noise and EMI.
- j. Be sure to connect the cables and the connectors 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. Please take care so as not to cause any damage mentioned on (1)-d.
- 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 LCD module 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.
- 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 polarizer film, color filter, and other materials, which will degrade the quality of display characteristics. Please do not expose LCD module under strong Ultraviolet rays for a long time.
- b. Please pay attention to a panel side of LCD module not to contact with other materials in preserving it alone.
- c. For the packaging box handling, please see and obey with the packaging specification datasheet.

PACKING SPECIFICATION

PACKAGING BOX

material: cardboard, polyethylene, polypropylene
construction: See Fig.1
max. packaging number: 400 pcs.
dimension: 491 (W) × 344 (D) × 280 (H)[mm] (Tolerance is ±15mm)
mass(including 400 modules): 8.0 kg
label: Labels are put on the box.(See Fig. 2.3)

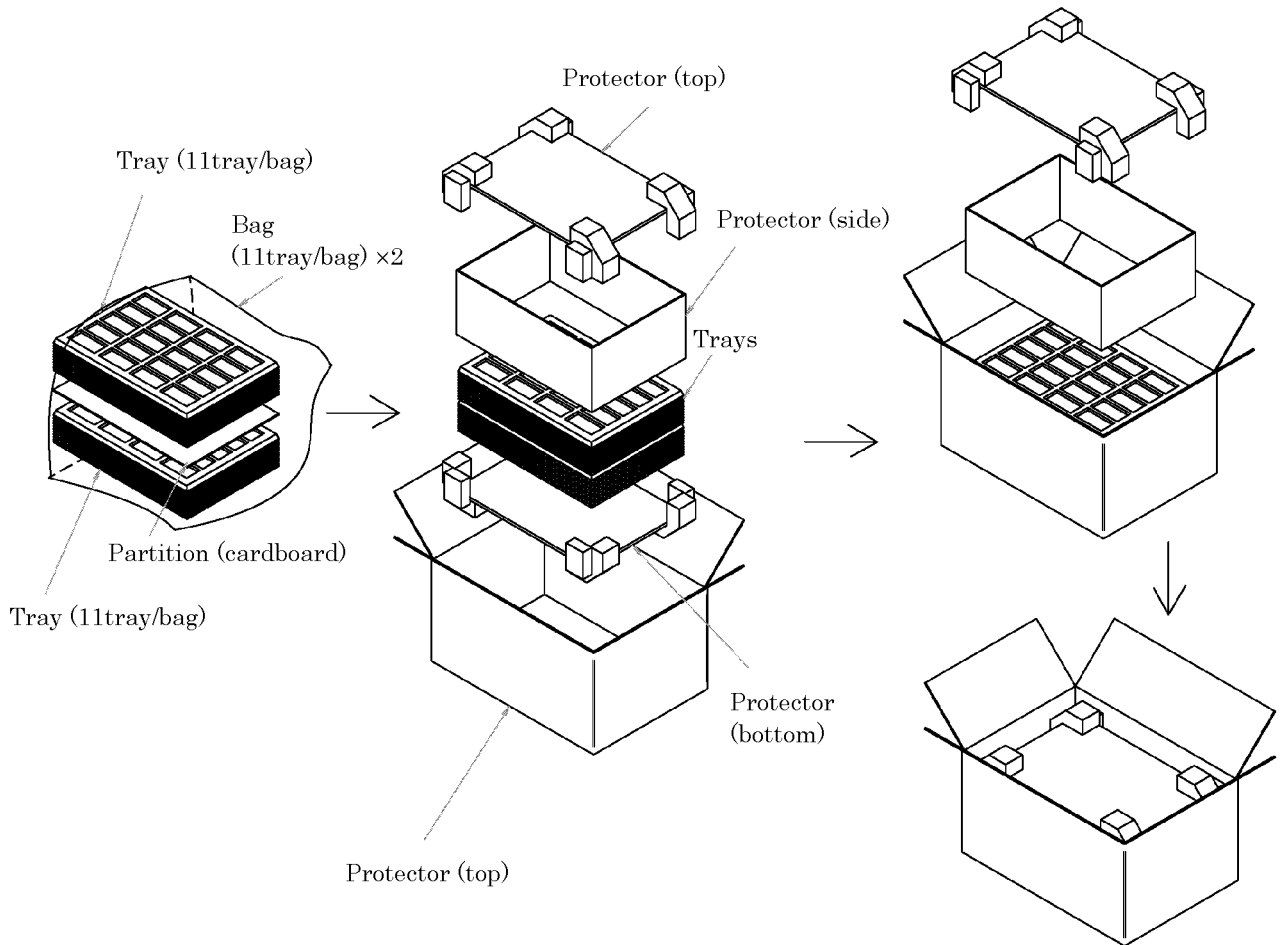


Fig.1: Illustration of packaging box structure

	Box No.
	Mass
PKG ID Bar-code	
Special Bar-code	
Quantity Bar-code	
Trans ID Bar-code	
Special Bar-code	

Fig.2: Label 1

Consignee
Product name of consignee
Product name
Order No.
Box No.
Place of production
Bar-code
Shipping date

Fig.3: Label 2



OPTREX
TFT-LCD: T-55522GD020JU-MLW-A-AAN AA020QF**
P/O NO. XXX XXXXXXXX
C/S NO. 001 OF 032
MADE IN JAPAN
 001 1999/01/14
 JA91E4001

Fig.4: Sample of Label 2

LOCATION OF LABEL ON THE PACKAGING BOX

Labels are put on the box.(See. Fig.5)

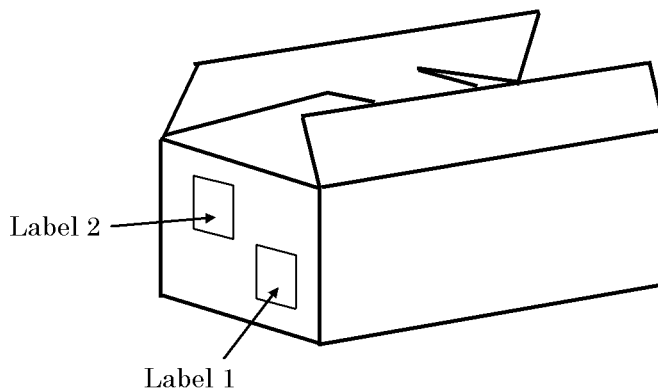


Fig.5: Location of Label

CAUTIONS OF SHIPPING & STORAGE

- (1) Do not turn the packaging upside down while storage and transportation. The boxes should not be piled up more than 8.
- (2) Packaging box and inner case for LCDs are made of cardboard. So please pay attention not to get them wet. (Such like keeping them in high humidity or wet place can occur getting them wet.)
- (3) Keep off from direct sunlight exposure. Please store under room temperature & low humidity in original packaging condition when they were shipped.
- (4) Packaging box and inner case for LCD are designed to protect the LCDs from the damage or scratching during transportation. Please do not open except picking LCDs up from the box.
- (5) Please handle packaging box with care not to give them sudden shock and vibrations. And also please do not throw them up.
- (6) Keep other cautions described in handling manual.

PRODUCTS NUMBER LABELING FORMS

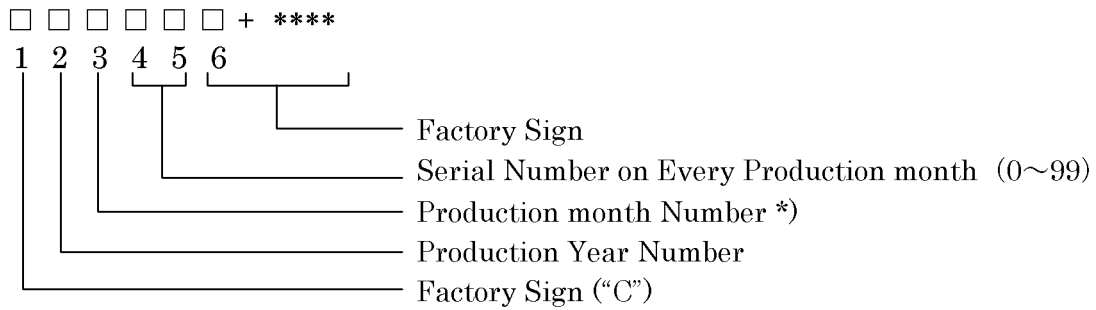
Products number label is constructed as below:

①	MITSUBISHI
②	AA020QF01
③	C99120 P000
④	MADE IN JAPAN

① Brand Name

② Products Name

③ Date Code (Serial Number, Factory Sign)



*) X: October
 Y: November
 Z: December

④ Production Country