

HITACHI

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FOR MESSRS. ALCATEL

DATE. Jan 28.'00

CUSTOMER'S ACCEPTANCE SPECIFICATIONS

SX19V001-ZZA
C O N T E N T S

No.	ITEM	SHEET No.	PAGE
1	COVER	7B64PS 2701-SX19V001-ZZA-8	1-1/1
2	RECORD OF REVISION	7B64PS 2702-SX19V001-ZZA-8	2-1/3~3/3
3	MECHANICAL DATA	7B64PS 2703-SX19V001-ZZA-8	3-1/1
4	ABSOLUTE MAXIMUM RATINGS	7B64PS 2704-SX19V001-ZZA-8	4-1/1
5	ELECTRICAL CHARACTERISTICS	7B64PS 2705-SX19V001-ZZA-8	5-1/2~2/2
6	OPTICAL CHARACTERISTICS	7B64PS 2706-SX19V001-ZZA-8	6-1/3~3/3
7	BLOCK DIAGRAM	7B64PS 2707-SX19V001-ZZA-8	7-1/1
8	INTERFACE TIMING CHART	7B64PS 2708-SX19V001-ZZA-8	8-1/4~4/4
9	DIMENSIONAL OUTLINE	7B63PS 2709-SX19V001-ZZA-8	9-1/2
		7B64PS 2709-SX19V001-ZZA-8	9-2/2
10	APPEARANCE STANDARD	7B64PS 2710-SX19V001-ZZA-8	10-1/7~7/7
11	PRECAUTION IN DESIGN	7B64PS 2711-SX19V001-ZZA-8	11-1/3~3/3
12	DESIGNATION OF LOT MARK	7B64PS 2712-SX19V001-ZZA-8	12-1/1
13	PRECAUTION FOR USE	7B64PS 2713-SX19V001-ZZA-8	13-1/1

*WHEN PRODUCT WILL BE DISCONTINUED, CUSTOMER WILL BE INFORMED
BY HITACHI WITH TWELVE MONTHS PRIOR ANNOUNCEMENT.

ACCEPTED BY; _____

PROPOSED BY; _____

J. M. Tsai

KAOHSIUNG HITACHI ELECTRONICS CO.,LTD.	Sh. No.	7B64PS 2701-SX19V001-ZZA-8	PAGE	1-1/1
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RECORD OF REVISION

DATE	SHEET No.	SUMMARY
Mar.04.'98	7B64PS 2703-SX19V001-ZZA-2	3.MECMANICAL DATA ADD : (13) :TOUCH SCREEN
	7B64PS 2704-SX19V001-ZZA-2	4.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS ADD :TOUCH SCREEN SPEC.
	7B64PS 2705-SX19V001-ZZA-2	5.ELECTRICAL CHARACTERISTICS CHANGE :RECOMMENDED LC DRIVING VOLTAGE ADD :TOUCH SCREEN SPEC.
	7B64PS 2707-SX19V001-ZZA-2	ADD :NOTE 2 :INPUT CAPACITANCE.
	7B64PS 2710-SX19V001-ZZA-2	10.APPEARANCE STANDARD ADD ;TOUCH SCREEN APPEARANCE.
May 20.'98	7B64PS 2705-SX19V001-ZZA-3	5.1 DD & LCD M N . TYP . MAX M N . TYP . MAX LCD - 30 50 → 10 20 30 DD - 16 25 → 8 16 25
	7B64PS 2707-SX19V001-ZZA-3	ADD :NOTE 2 :NOUT CAPACITANCE CL2-GND=(220PF) (D0~D7)-GND=(5PF) DISP OFF-GND=(5PF) FLM -GND=(0.22μF)
	7B64PS 2708-SX19V001-ZZA-3	8.3 POWER ON/OFF SEQUENCE M N M N DLCS 20 → 100
	7B64PS 2709-SX19V001-ZZA-3	ADD NOTE THE PROTECTIVE FILM WOULD BE COVERED ON THE TOUCH PANEL.
Aug 31.'98	7B64PS 2703-SX19V001-ZZA-4	(13) TOUCH SCREEN MAKER : (DYNAPRO) → (SMK)
	7B64PS 2705-SX19V001-ZZA-4	5.ELECTRIC CHARACTER 5.1-1 TOUCH SCREEN SPECIFICATION UPDATE
	7B64PS 2706-SX19V001-ZZA-4	6.1 OPTICAL CHARACTERICS OF LCD CONTRAST : (-)M N . → (15)M N .
	7B64PS 2706-SX19V001-ZZA-4	PAGE 6-2/3 CONTRAST : PRICHARD 1980A-PL APERTURE : 0.2° DISTANCE : 0.4m } → CONTRAST &

RECORD OF REVISION

DATE	SHEET No.	SUMMARY
May 20.'98	7B64PS 2709-SX19V001-ZZA-4	NOTE : TOUCH PANEL TYPE 9442 → MTX0100-5601R (MADE BY DYNAPRO) (MADE BY SMK)
	7B64PS 2709-SX19V001-ZZA-4	TOUCH PANEL I/F PIN NO. SIGNAL SIGNAL 1 Y (+) Y (-) 2 X (+) X (-) 3 Y (-) Y (+) 4 X (-) X (+)
	7B64PS 2710-SX19V001-ZZA-4	UPDATE 10.2 (1) LCD ZONE (2) TOUCH PANEL ZONE (3) TOUCH PANEL APPEARANCE
Oct 22.'98	7B64PS 2709-SX19V001-ZZA-5 PAGE 9-1/2	9.1 DIMENSIONAL OUTLINE CHANGE CFL CONNECTOR NUMBER 11.0max → 10.6+/-0.8 ADD STIFFNER SIZE : - → 40
	7B64PS 2709-SX19V001-ZZA-5 PAGE 9-2/2	9.2 INTERNAL PIN CONNECTOR REVISE CFL CONNECTOR PIN NO : 1 ST PIN GND → H.V 4 TH PIN GND → GND
	7B64PS 2710-SX19V001-ZZA-5 PAGE 10-2/7	UPDATE ALL PAGE
Jun. 04.'99	7B64PS 2706-SX19V001-ZZA-6 PAGE 6-1/3	6. OPTICAL CHARACTERISTICS OF LCD CHANGE COLOR TONE VALUE
Jun. 17.'99	7B64PS 2706-SX19V001-ZZA-7 PAGE 6-1/3	6. OPTICAL CHARACTERISTICS GREEN Y : (0.55)typ → (0.52)typ BLUE Y : (0.14)typ → (0.18)typ WHITE Y : (0.30)typ → (0.31)typ
Jun. 23.'99	7B64PS 2712-SX19V001-ZZA-7 PAGE 12-1/1	ADD 12.2 Revision
Jan. 28.'00	7B64PS 2703-SX19V001-ZZA-8 PAGE 3-1/1	(13) ADD TOUCH SCREEN MAKER : Fujitsu (PART No N010-0555-T941)
	7B64PS 2705-SX19V001-ZZA-8 PAGE 5-1/2	5. ELECTRIC CHARACTER 5.1-1 ADD TOUCH SCREEN SPECIFICATION Rev8.X : 250Ω~750Ω Y : 100Ω~500Ω

RECORD OF REVISION

DATE	SHEET No.	SUMMARY
Jan 28.'00	7B64PS 2709-SX19V001-ZZA-8 PAGE 9-1/2	NOTE :ADD TOUCH PANEL MADE BY SMKOR Fuiitsu.
	7B64PS 2712-SX19V001-ZZA-8 PAGE 12-1/1	12.DESIGNATION OF LOT MARK 12.1 LOT MARK OF YEAR UPDATE 12.2 ADD Rev8 REVISION Fuiitsu T/P 12.3 LOCATION OF LOT MARK TO WADITY.

3. MECHANICAL DATA

(1) NUMBER OF DOTS	640 * 3 (R,G,B) (W) * 480 (H) DOTS
(2) DOT SIZE	0.056 (W) mm * 0.214 (H) mm
(3) DOT PITCH	0.079 (W) mm * 0.237 (H) mm
(4) MODULE SIZE	197.0 (W) mm * 145.0 (H) mm * 11.0 max. (D) mm
(5) DUTY	1/480
(6) VIEWING DIRECTION	6 O'CLOCK
(7) DRIVING VOLTAGE	36.6 TYP. (AT25°C)
(8) CONTRAST	25 TYP. (AT25°C) (INCLUDING TOUCH PANEL)
(9) RESPONSE TIME (Tr+Tf)	550 ms (AT25°C)
(10) BRIGHTNESS	60 cd/m ² TYP. (CFL=4.0mA)
(11) BACKLIGHT POWER	1.0 w (EXCEPT INVERTER) • 12FILM TYPE COLOR (NEGATIVE TYPE) • THE UPPER POLARIZER IS GLARE TYPE. THE BUTTOM POLARIZER IS TRANSMISSIVE TYPE. • MAKER :SMK (PART NO NTX0100-5601R) Fujitsu (PART NO NO10-0555-T941)
(12) LCD	• SIZE :181.0 (W) mm * 143.0 (H) mm • SURFACE :ANTI GLARE HARD COAT,(3H) OPERATING • WITH PEN :0.05~0.3N :PON;SR 0.8mm • WITH FINGER :0.05~0.5N :SILCON RUBBER; φ12,SR 0.8mm
(13) TOUCH SCREEN	

4. ABSOLUTE MAXIMUM RATINGS

4.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS. VSS=0V STANDARD

ITEM		SYMBOL	MIN.	MAX.	UNIT	COMMENT
POWER SUPPLY FOR LOGIC		VDD-VSS	0	7.0	V	
POWER SUPPLY FOR LCD DRIVE		VLDD-VSS	0	42.0	V	
INPUT VOLTAGE		V_i	-0.3	VDD+0.3	V	NOTE 1
INPUT CURRENT		I_i	0	1	A	
STATIC ELECTRICITY		VESD0	-	+/-100	V	NOTE 2,3,4
		VESD1	-	+/-10	KV	NOTE 2,3,5
TOUCH SCREEN	VOLTAGE	-	-	7	V	DC
	CURRENT	-	-	25	mA	
	OPERATING TEMP	-	0	50	-	HUMIDITY 20-90% RH
	STORAGE TEMP	-	-25	70	-	HUMIDITY 20-95% RH

NOTE (1) DISPLAY, FLM, CL1, CL2, D0~D7.

NOTE (2): MAKE CERTAIN YOU ARE GROUNDED WHEN HANDLING LCM.

NOTE (3) ENERGY STORAGE CAPACITANCE 200PF, DISCHARGE RESISTANCE 250Ω
Ta=25°C, 60% RH.

NOTE (4) CONTACT DISCHARGE TO I/F CONNECTOR PINS.

NOTE (5) CONTACT DISCHARGE TO FRONT METAL BEZEL.

4.2 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS.

ITEM	OPERATING		STORAGE		COMMENT
	MIN.	MAX.	MIN.	MAX.	
AMBIENT TEMPERATURE	5°C	50°C	-20°C	60°C	NOTE 2,3,7
HUMIDITY	NOTE 1		NOTE 1		WITHOUT CONDENSATION
VIBRATION	-	2.45m/s ² (0.25G)	-	11.76m/s ² (1.2G) NOTE 5	NOTE 4 1 HOUR MAX.
SHOCK	-	29.4m/s ² (3G)	-	490.0m/s ² (50G) NOTE 5	XYZ DIRECTIONS
CORROSIVE GAS	NOT ACCEPTABLE		NOT ACCEPTABLE		

NOTE (1) Ta≤40°C 85% RH max.

Ta>40°C ABSOLUTE HUMIDITY MUST BE LOWER
THAN THE HUMIDITY OF 85% RH AT 40°C.

NOTE (2) Ta AT -20°C ——< 48HRS AT 60°C ——< 168HRS.

NOTE (3) BACKGROUND COLOR CHANGES SLIGHTLY DEPENDING ON AMBIENT
TEMPERATURE. THIS PHENOMENON IS REVERSIBLE.

NOTE (4) 5Hz~100Hz (EXCEPT RESONANCE FREQUENCY)

NOTE (5) THIS MODULE SHOULD BE OPERATED NORMALLY AFTER FINISH
THE TEST.

NOTE (6) WHEN LCM WILL BE OPERATED AT 5°C, THE LIFE TIME OF CFL
WILL BE REDUCED. NEED TO MAKE SURE OF VALUE OF IL AND
CHARACTERISTICS OF INVERTER. ALSO THE RESPONSE TIME AT
5°C WILL BE SLOWER.

NOTE (7) THERE ARE POSSIBILITY THAT COLOR UN-UNIFORMITY HAPPENED
WHILE OPERATION AT 50°C.

5. ELECTRICAL CHARACTERISTICS

5.1 ELECTRICAL CHARACTERISTICS OF LCD

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
POWER SUPPLY VOLTAGE FOR LOGIC	VDD-VSS	-	3.15	3.3	5.15	V
POWER SUPPLY VOLTAGE FOR LC DRIVING	VLCD-VSS	-	-	-	40	V
INPUT VOLTAGE NOTE 1	VI	H LEVEL	0.8VDD	-	VDD	V
		L LEVEL	0	-	0.2VDD	V
INPUT LEAK CURRENT NOTE 2	I _{ih}	V _{IN} =VCC or GND Ta=25°C	-	-	+/-0.1	μA
POWER SUPPLY CIRCUIT FOR LC DRIVING NOTE 2	I _{LCD}	VDD-VSS=3.3V VLCD-VSS=36.6V	10	20	30	mA
POWER SUPPLY CIRCUIT FOR LOGIC CURRENT NOTE 2	I _{DD}	VDD-VSS=3.3V VLCD-VSS=36.6V	8	16	25	mA
RECOMMENDED LC DRIVING VOLTAGE NOTE 3	VLCD-VSS	Ta= 5°C ,φ=0°	-	37.6	-	V
		Ta=25°C ,φ=0°	-	36.6	-	V
		Ta=40°C ,φ=0°	-	35.6	-	V
FRAME FREQUENCY NOTE 4	f _{FLM}	VDD>3.15V	70	120	(140)	Hz

NOTE 1 DISPOFF ,FLM ,CL1 ,CL2 ,D0~D7.

NOTE 2 f_{FLM}=75HZ ,TEST PATTERN IS ALL "Q" .
VLCD-VSS=36.6V,Ta=25°C .

NOTE 3 RECOMMENDED LC DRIVING VOLTAGE FLUCTUATE ABOUT +/-1.0V BY EACH MODULE..
TEST PATTERN IS ALL "Q" .

NOTE 4 NEED TO MAKE SURE OF FLICKERING AND RIPPLING OF DISPLAY WHEN SETTING THE FRAME FREQUENCY IN YOUR SET.

5.1-1TOUCH SCREEN

ITEM		SPECIFICATIONS	REMARKS
VOLTAGE		5VDC	
CURRENT		<10 mA	
LEAD TO LEAD RESISTANCE	Rev.7	X :400Ω~900Ω Y :250Ω~700Ω	
	Rev.8	X :250Ω~750Ω Y :100Ω~500Ω	
INSULATION RESISTANCE		>25M Ω@ 25VDC	
CONTACT BOUNCE		<10 m s	NOTE (1)

NOTE (1) :HIT ANY POINT WITHIN THE EFFECTIVE AREA IN A NORMAL MANNER (2 TO 3 HITS A SECOND WITH A FORCE OF ABOUT 2N)

5.2 ELECTRICAL CHARACTERISTICS OF BACKLIGHT

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
LAMP VOLTAGE	VL	-	(450)	-	Vrms	Ta=25°C
FREQUENCY	fL	(60)	(70)	(85)	KHz	
LAMP CURRENT	IL	(3.5)	(4.0)	(5.0)	mA	Ta=25°C
STARTING DISCHARGE VOLTAGE	VS NOTE 2	(1400)	-	-	Vrms	Ta=5°C

NOTE 1 PLEASE DESIGN YOUR LAMP DRIVING CIRCUIT (INVERTER) ACCORDING TO THE ABOVE SPECIFICATIONS AND INFORM HITACHI OF IT.

NOTE 2 STARTING DISCHARGE VOLTAGE IS INCREASED WHEN LCM IS OPERATING AT LOWER TEMPERATURE.
PLEASE CHECK THE CHARACTERISTICS OF YOUR INVERTER BEFORE APPLYING TO YOUR SET.

NOTE 3 AVERAGE LIFE TIME OF CFL WILL BE DECREASED WHEN LCM IS OPERATING AT LOWER TEMPERATURE.

NOTE 4 UNDER LOWER DRIVING FREQUENCY OF AN INVERTER, A CERTAIN BACKLIGHT SYSTEM (CFL & CFL REFLECTION SHEET) MAY GENERATE A SOUND NOISE BEFORE DESIGNING THE INVERTER.

NOTE 5 WHEN CFL IS USED OVER 5.0mA, IT MAY CAUSE UNEVEN CONTRAST NEAR CFL LOCATION, DUE TO HEAT DISPERSION FROM CFL.

NOTE 6 SUITABLE INVERTER INVC445.

6. OPTICAL CHARACTERISTICS

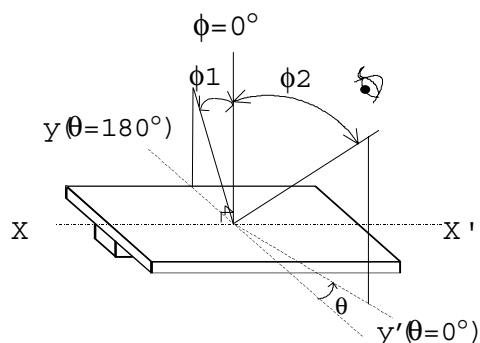
6.1 OPTICAL CHARACTERISTICS OF LCD

Ta=25°C (BACKLIGHT ON)

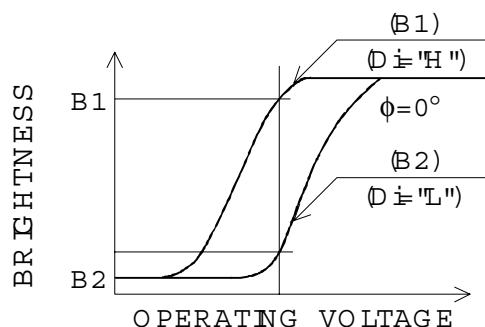
ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
VIEWING AREA		$\phi 2-\phi 1$	$\theta=0^\circ, K \geq 2.0$	-	40	-	deg	1,2
CONTRAST RATIO		K	$\phi=0^\circ \theta=0^\circ$	-	25	-	-	3,5,6
RESPONSE TIME (RISE)		tr	$\phi=0^\circ \theta=0^\circ$	-	350	-	ms	4
RESPONSE TIME (FALL)		tf	$\phi=0^\circ \theta=0^\circ$	-	200	-	ms	4
COLOR TONE (PRIMARY COLOR)	RED	x	$\phi=0^\circ \theta=0^\circ$	(0.52)	(0.57)	(0.62)	-	7
		y		(0.28)	(0.33)	(0.38)	-	
	GREEN	x		(0.27)	(0.32)	(0.37)	-	
		y		(0.47)	(0.52)	(0.57)	-	
	BLUE	x		(0.12)	(0.17)	(0.22)	-	
		y		(0.13)	(0.18)	(0.23)	-	
	WHITE	x		(0.26)	(0.31)	(0.36)	-	
		y		(0.26)	(0.31)	(0.36)	-	

(MEASUREMENT CONDITION ; HITACHI STANDARD)

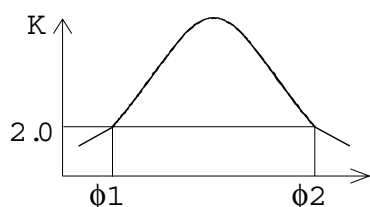
NOTE 1 DEFINITION OF θ AND ϕ
(NORMAL)
VIEWING DIRECTION θ



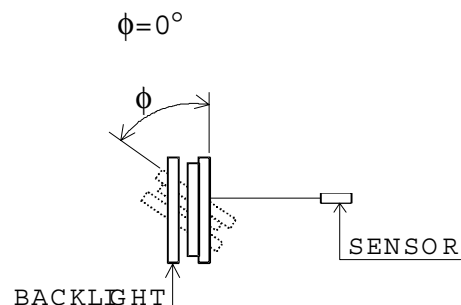
NOTE 3 DEFINITION OF CONTRAST "K"
$$K = \frac{\text{BRIGHTNESS ON SELECTED DOT (B1)}}{\text{BRIGHTNESS ON NON-SELECTED DOT (B2)}}$$



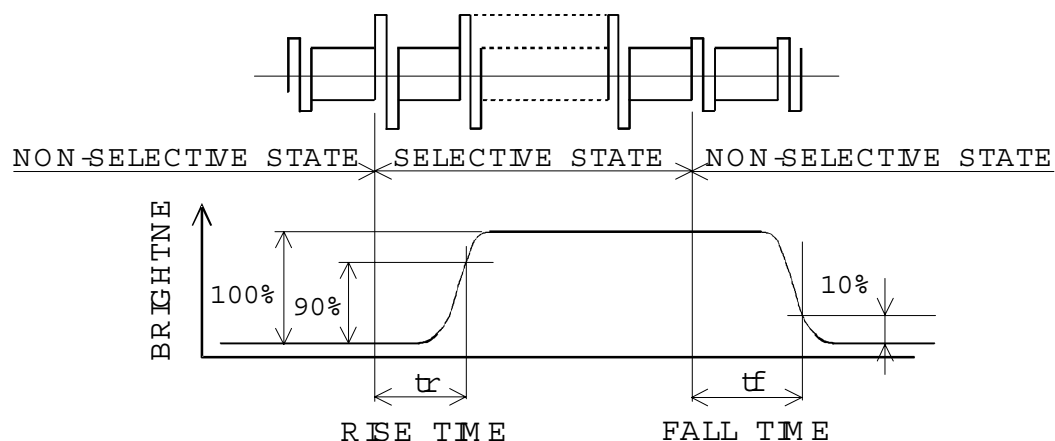
NOTE 2 DEFINITION OF VIEWING ANGLE
 ϕ_1 AND ϕ_2
 $(-40^\circ) < \phi_1 < 0^\circ < \phi_2 < (40^\circ)$



CONTRAST RATIO K VS
VIEWING ANGLE ϕ .



NOTE 4 DEFINITION OF OPTICAL RESPONSE TIME



CONTRAST : BM -7
APERTURE : 1°
DISTANCE : 0.4m
BRIGHTNESS BM -7
APERTURE : 1°
DISTANCE : 0.4m

NOTE 5. HITACHI WILL NOT DO 100% INSPECTION FOR MINIMUM VALUE.
MINIMUM VALUE IS FOR REFERENCE.
NOTE 6. HITACHI WILL DO SAMPLING INSPECTION FOR MINIMUM VALUE.
NOTE 7. THE LCD DRIVING VOLTAGE SHOULD BE ADJUSTED AT THE
VOLTAGE WHERE THE PEAK CONTRAST IS OBTAINED.

6.2 OPTICAL CHARACTERISTICS OF BACKLIGHT

ITEM	M N .	TYP .	MAX .	UNIT	NOTE
BRIGHTNESS	45	65	-	cd/m ²	IL=4.0mA NOTE 1,2
RISE TIME	-	3	-	MINUTE	IL=4.0mA BRIGHTNESS 80%
BRIGHTNESS UNIFORMITY	-	-	+/-30	%	UNDERMENTIONED NOTE 1,3

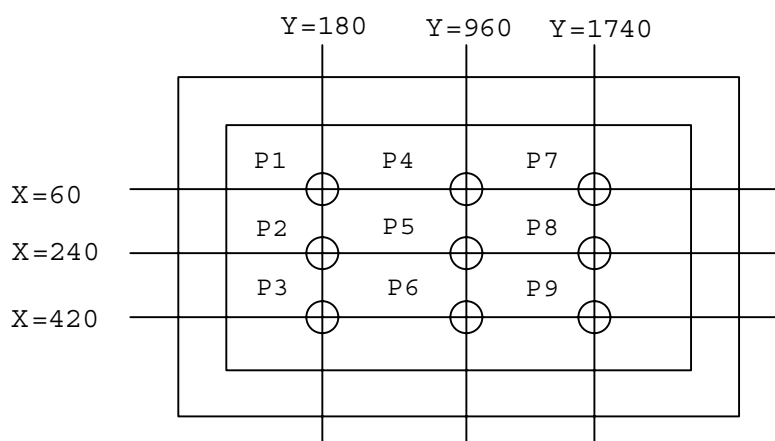
(MEASUREMENT CONDITION HITACHI STANDARD)

CFL : INITIAL, Ta=25°C, THE LCD DRIVING SHOULD BE ADJUSTED AT VOLTAGE WHERE THE PEAK CONTRAST IS OBTAINED, WHEN SET PATTERN IS ALL "Q" DISPLAY DATA SHOULD BE ALL "ON".

NOTE 1 MEASUREMENT AFTER 10 MINUTES OF CFL OPERATING.
MEASUREMENT CONDITION : SEE NOTE 3 ON PAGE 6-1/2.

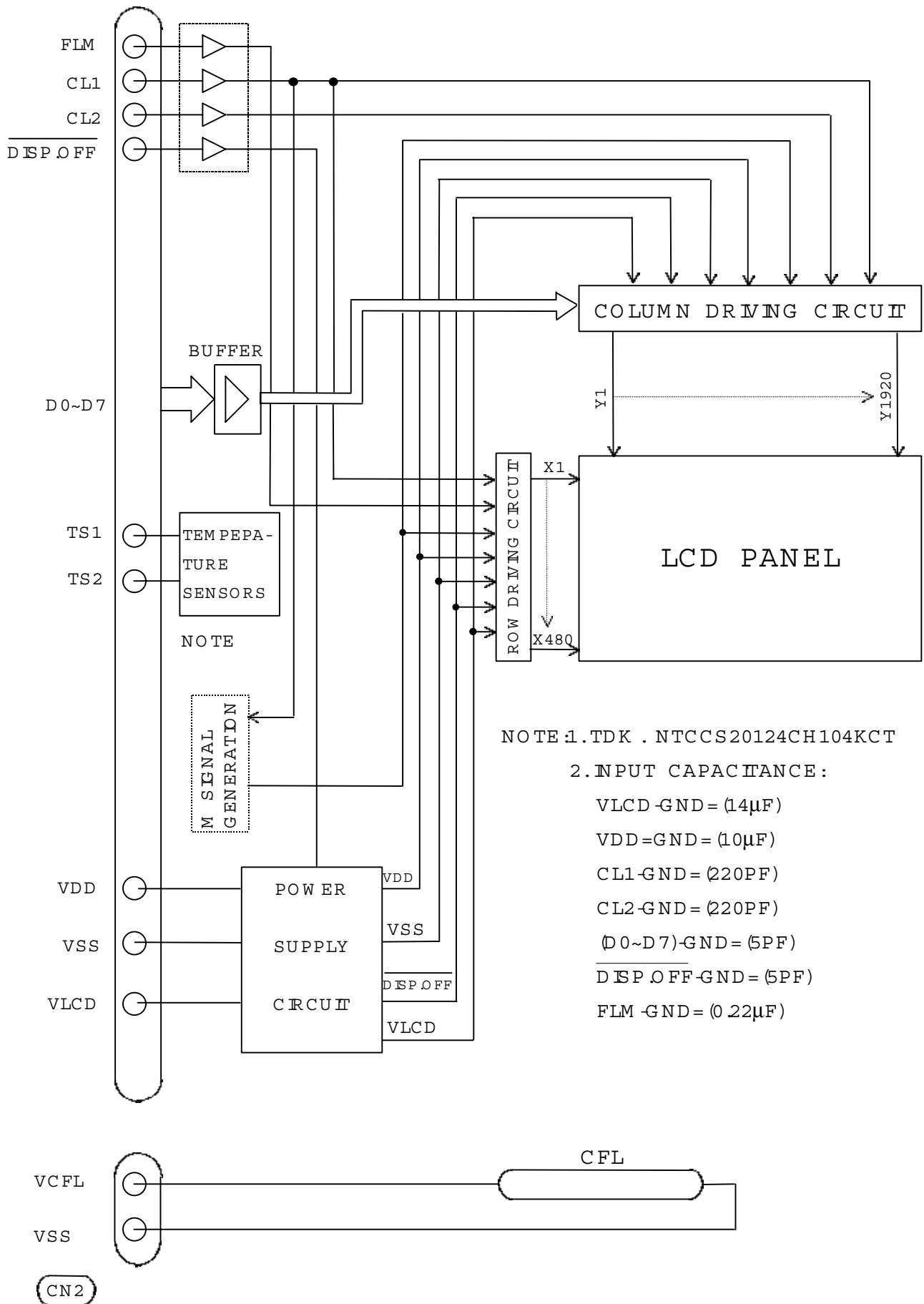
NOTE 2 BRIGHTNESS CONTROL : 100% .

NOTE 3 MEASUREMENT OF THE FOLLOWING 9 PLACES ON THE DISPLAY.
DEFINITION OF THE BRIGHTNESS TOLERANCE.



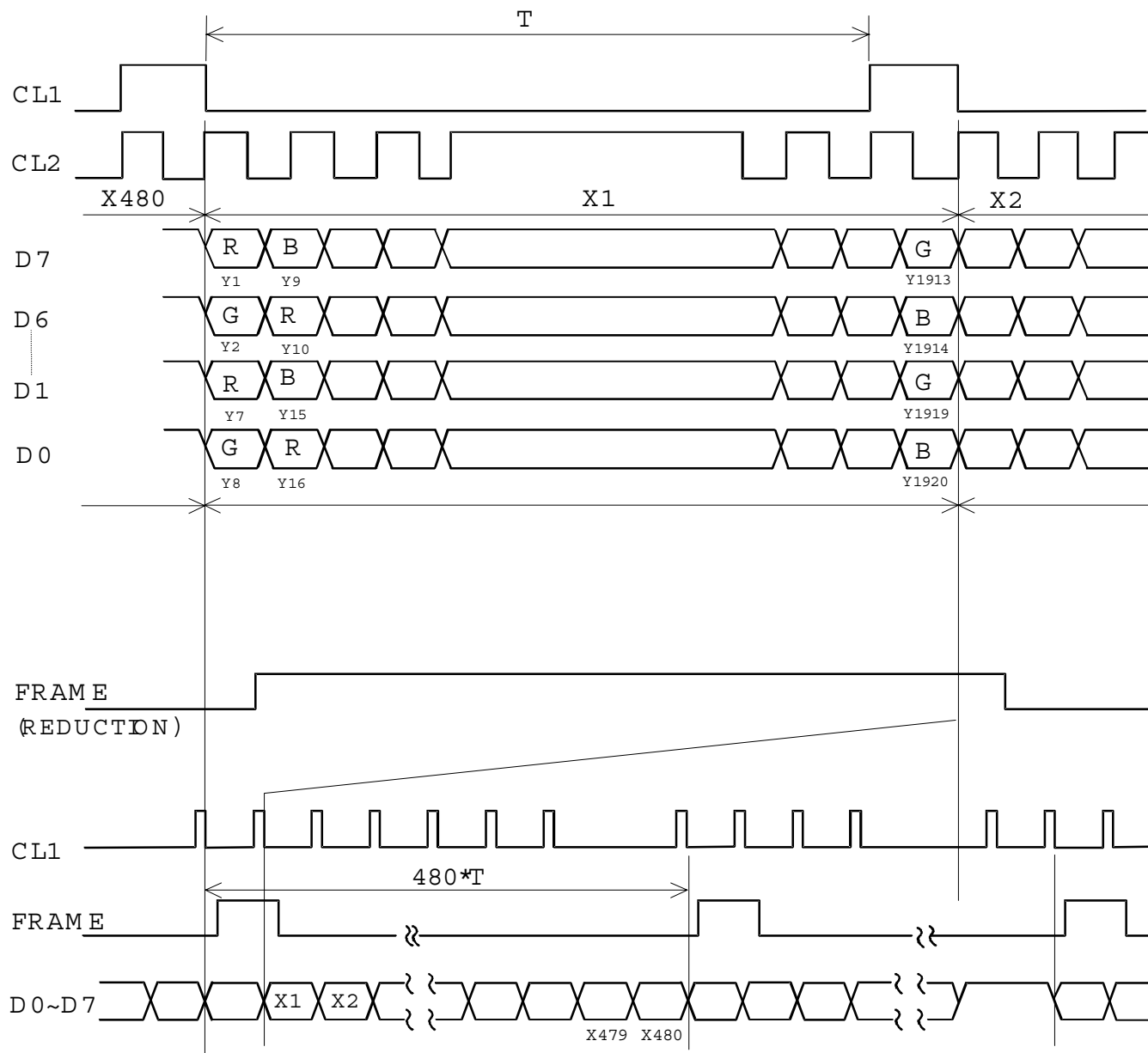
$$\left(\frac{\text{MAX BRIGHTNESS OR MIN BRIGHTNESS} - \text{AVERAGE BRIGHTNESS}}{\text{AVERAGE BRIGHTNESS}} \right) \times 100$$

7. BLOCK DIAGRAM



8. INTERFACE TIMING CHART

8.1 TMING CHART

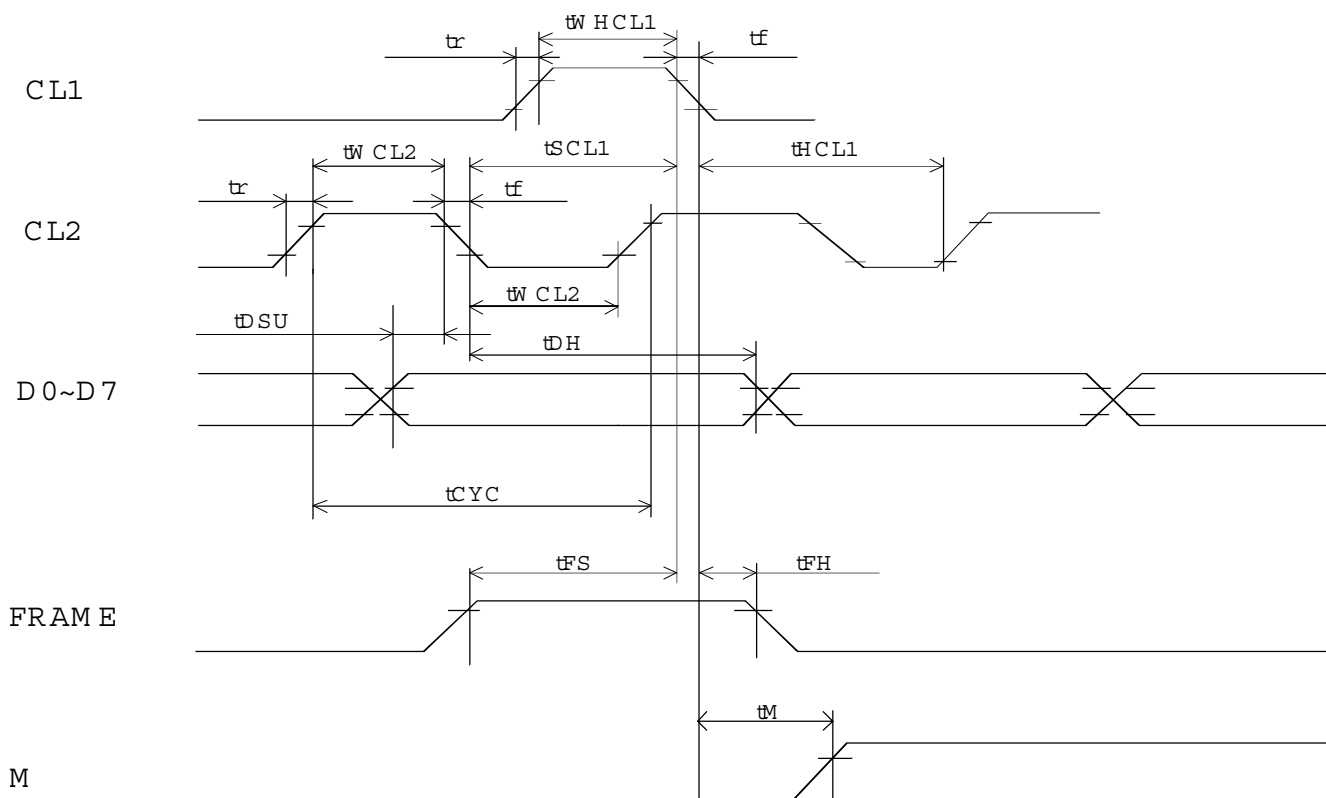


8.2 INTERFACE TIMING SPECIFICATION

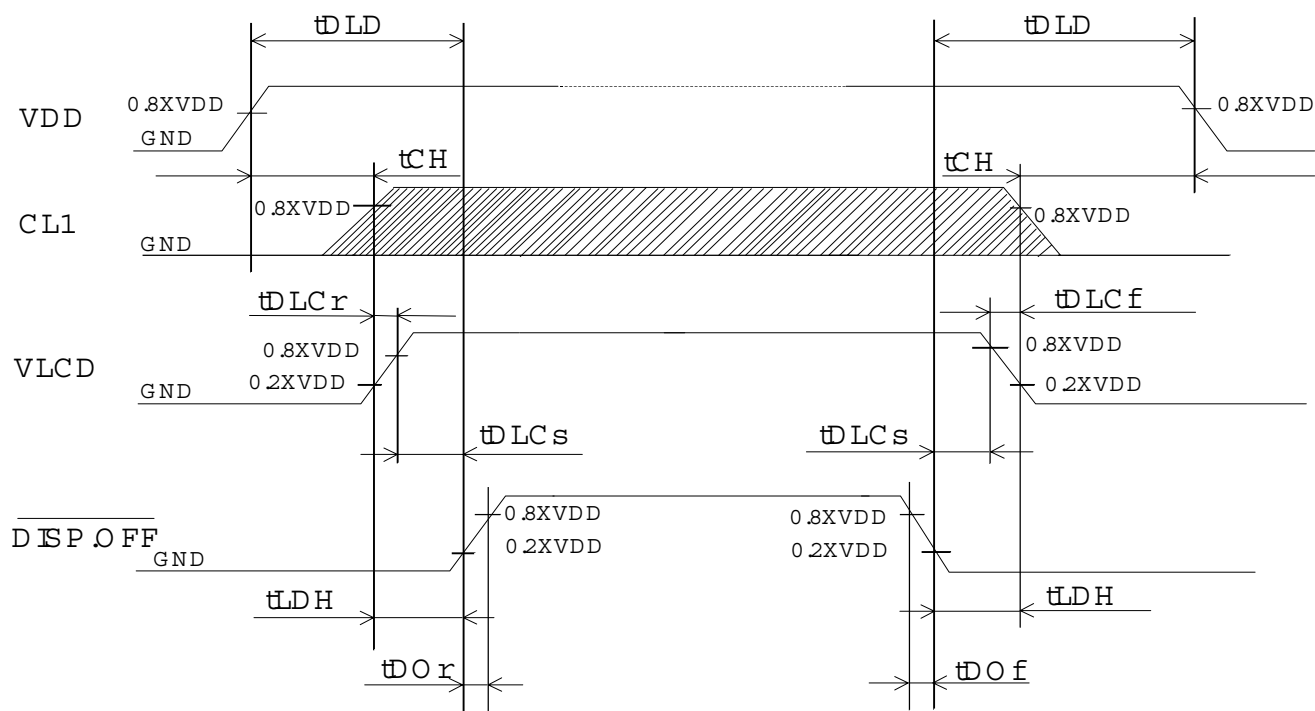
(VDD=3.15~5.5V)

ITEM	SYMBOL		MIN.	TYP.	MAX.	UNIT
CL1 PULSE WIDTH "H"	$\overline{t_{WHCL1}}$		30	-	-	ns
CLOCK FREQUENCY	f_{cp}	VDD=3.15~5.5V	-	-	16.6	MHz
CL2 PULSE WIDTH	$\overline{t_{WCL2}}$		25	-	-	ns
CLOCK SET UP TIME	$\overline{t_{SCL1}}$		100	-	-	ns
CLOCK HOLD TIME	$\overline{t_{HCL1}}$		100	-	-	ns
CLOCK RISE UP TIME	t_r, t_f		-	-	50 NOTE (1)	ns
DATA SET UP TIME	$\overline{t_{DSU}}$		20	-	-	ns
DATA HOLD TIME	$\overline{t_{DH}}$		25	-	-	ns
"FRAME" SET UP TIME	$\overline{t_{FS}}$		100	-	-	ns
"FRAME" HOLD TIME	$\overline{t_{FH}}$		30	-	-	ns
"M" DELAY TIME	$\overline{t_M}$		-	-	300	ns

NOTE 1 : (1) $t_r, t_f = \frac{1/f_{cp} - 2\overline{t_{WCL2}}}{2}$ (2) $t_r, t_f \leq 50\text{ns}$



8.3 POWER ON/OFF SEQUENCE

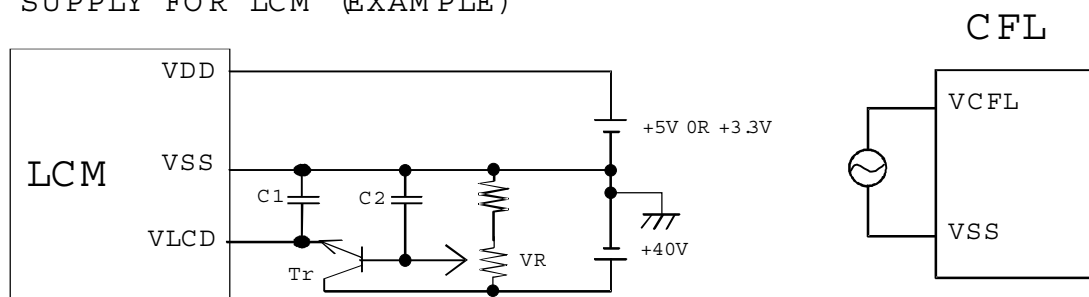


SYMBOL	MIN	MAX	UNIT	COMMENT
t_{LD}	200	-	ms	(NOTE 1)
t_{CH}	0	200	ms	
t_{LCH}	0	-	ms	
$t_{O r}$	-	100	ns	(NOTE 2)
$t_{O f}$	-	100	ns	
t_{LDCr}	0	-	ms	
t_{LDCf}	0	-	ms	
t_{LDCs}	100	-	ms	

(NOTE 1) PLEASE KEEP THE SPECIFIED SEQUENCE BECAUSE WRONG SEQUENCE MAY CAUSE PERMANENT DAMAGE TO THE LCD PANEL.

(NOTE 2) HITACHI RECOMMENDS YOU TO USE DISP OFF FUNCTION. DISPLAY QUALITY MAY DETERIORATE IF YOU DON'T USE DISP OFF FUNCTION.

8.4 POWER SUPPLY FOR LCM (EXAMPLE)



NOTE 1 VR : 10k Ω

C1 : 10 μ μ F

C2 : 3.3 μ F

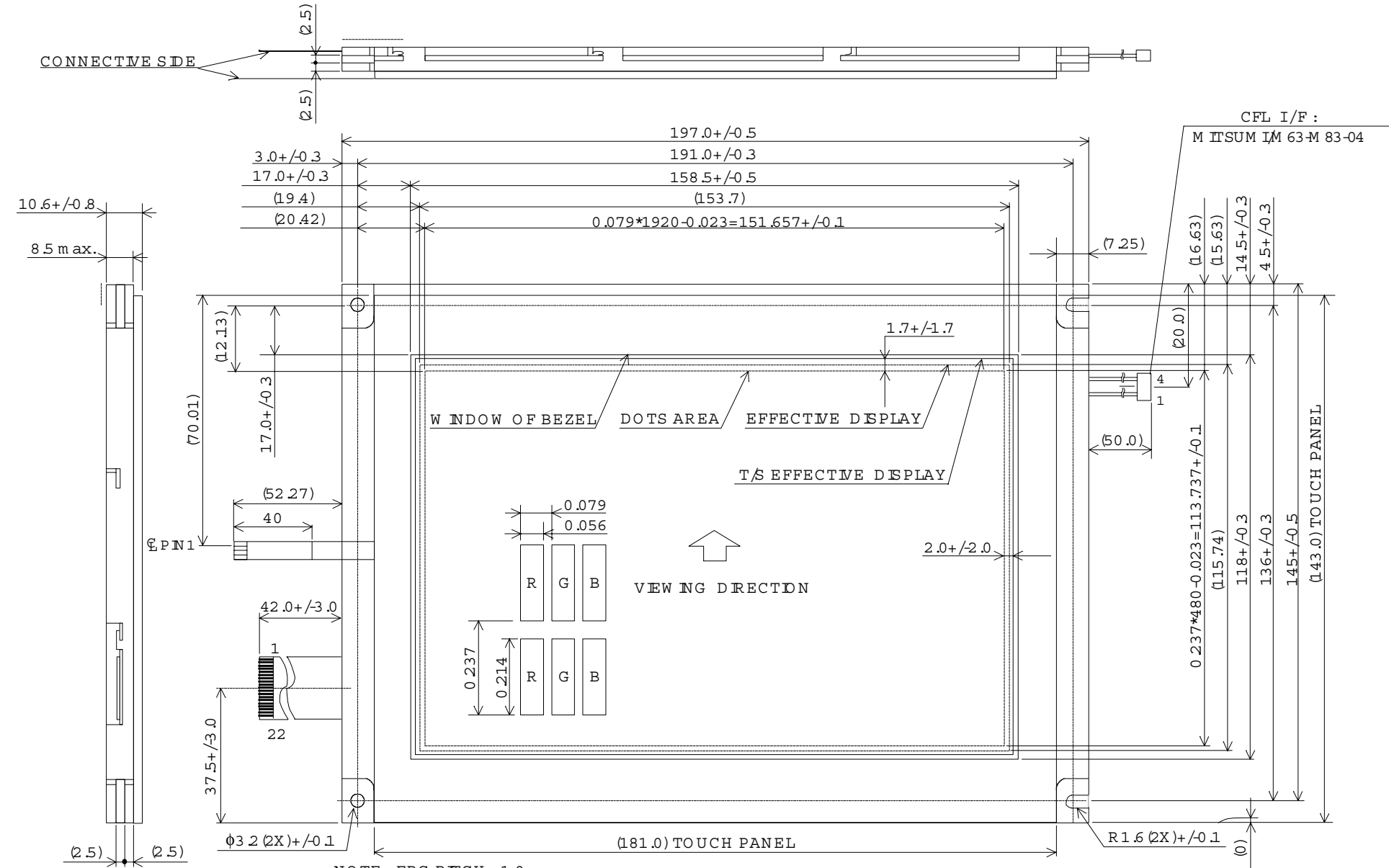
Tr: I_c (PEEK) SHOULD BE LARGER THAN 1A (PEEK) x 25ms

8.5 DATA RESPOND

DATA SIGNAL	D 7	D 6	D 5	D 4	D 3	D 2	D 1	D 0	D 7	D 6	D 5	D 4	-----	D 4	D 3	D 2	D 1	D 0
Y	1	2	3	4	5	6	7	8	9	10	11	12	-----	1 9 1 6	1 9 1 7	1 9 1 8	1 9 1 9	1 9 2 0
X																		
1	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
2	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
3	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
4	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
5	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
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238	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
239	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
240	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
241	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
242	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
243	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
244	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
245	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
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.	.	.	.	.	.	.	.	.	.	.	.	.		.	.	.	.	.
478	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
479	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
480	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B

R :RED
G :GREEN
B :BLUE

9.1 DIMENSIONAL OUTLINE



NOTE : FPC PITCH : 1.0mm .
SUTABLE CONNECTOR : IL-402-22S-S1L-SA (MAKER JAE)
TOUCH PANEL MADE BY SMK OR SMK,Fujitsu.
THE PROTECTIVE FILM WOULD BE COVERED ON THE TOUCH PANEL

9.2 INTERNAL PN CONNECTION

FPC : PITCH 1.0mm

SUITABLE CONNECTOR : IL-402-22S-S1L-SA (MAKER : JAE)

PN No.	SIGNAL	LEVEL	FUNCTION
1	FLM	H	FIRST LINE MARKER
2	VSS	-	GND
3	CL1	H→L	DATA LATCH
4	VSS	-	GND
5	CL2	H→L	DATA SHIFT
6	VSS	-	GND
7	D0	H/L	DISPLAY DATA
8	D1		
9	D2		
10	D3		
11	D4		
12	D5		
13	D6		
14	D7		
15	DISP OFF	H/L	H ON / L OFF
16	VDD	-	POWER SUPPLY FOR LOGIC
17	VDD	-	POWER SUPPLY FOR LOGIC
18	VSS	-	GND
19	VLCD	-	POWER SUPPLY FOR LC
20	VSS	-	GND
21	TS1	-	TEMPERATURE SENSOR PN1
22	TS2	-	TEMPERATURE SENSOR PN2

CFL I/F : MITSUMI M63-M83-04

SUITABLE CONNECTOR : MITSUMI M61M73-04

MITSUMI M60-04-30-114P (STRAIGHT)

MITSUMI M60-04-30-134P (ANGLE)

PN No.	SIGNAL	LEVEL	FUNCTION
1	HV	-	POWER SUPPLY FOR CFL
2	N.C	-	-
3	N.C	-	-
4	GND	-	CFL GND

TOUCH PANEL I/F

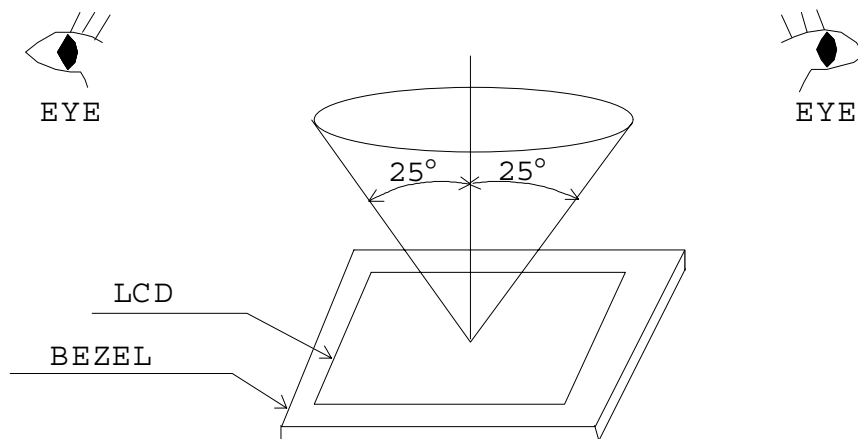
PN No.	SIGNAL	LEVEL	FUNCTION
1	Y (-)	-	TOP
2	X (-)	-	LEFT
3	Y (+)	-	BOTTOM
4	X (+)	-	RIGHT

10. APPEARANCE STANDARD

10.1 APPEARANCE INSPECTION CONDITION

VISUAL INSPECTION SHOULD BE DONE UNDER THE FOLLOWING CONDITION.

- (1) THE INSPECTION SHOULD BE DONE IN A DARK ROOM.
- (2) THE CFL SHOULD BE LIGHTED WITH THE PRESCRIBED INVERTER.
- (3) THE DISTANCE BETWEEN EYES OF AN INSPECTOR AND THE LCD MODULE IS 25cm.
- (4) THE VIEWING ZONE IS SHOWN THE FIGURE.
VIEWING ANGLE $\leq 25^\circ$.

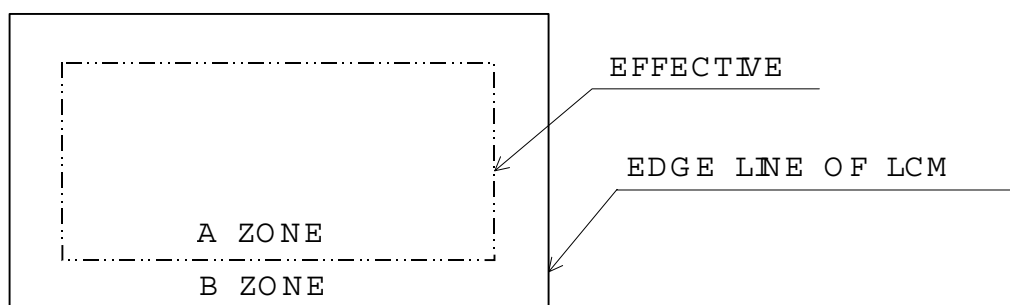


10.2 DEFINITION OF ZONE

(1) LCD ZONE

A ZONE : WITHIN THE EFFECTIVE AREA SPECIFIED AT PAGE 9-1/1 OF THIS DOCUMENT.

B ZONE : AREA BETWEEN THE EDGE LINE OF LCD CELL AND THE EFFECTIVE DISPLAY AREA (A ZONE) LINE SPECIFIED AT PAGE 9-1/1 OF THIS DOCUMENT.



(2) TOUCH PANEL ZONE

(2-1) X ZONE (ACTIVE AREA):

(1) AREA TO BE GUARANTEED ALL CHARACTERISTICS STATED ON THIS SPEC.

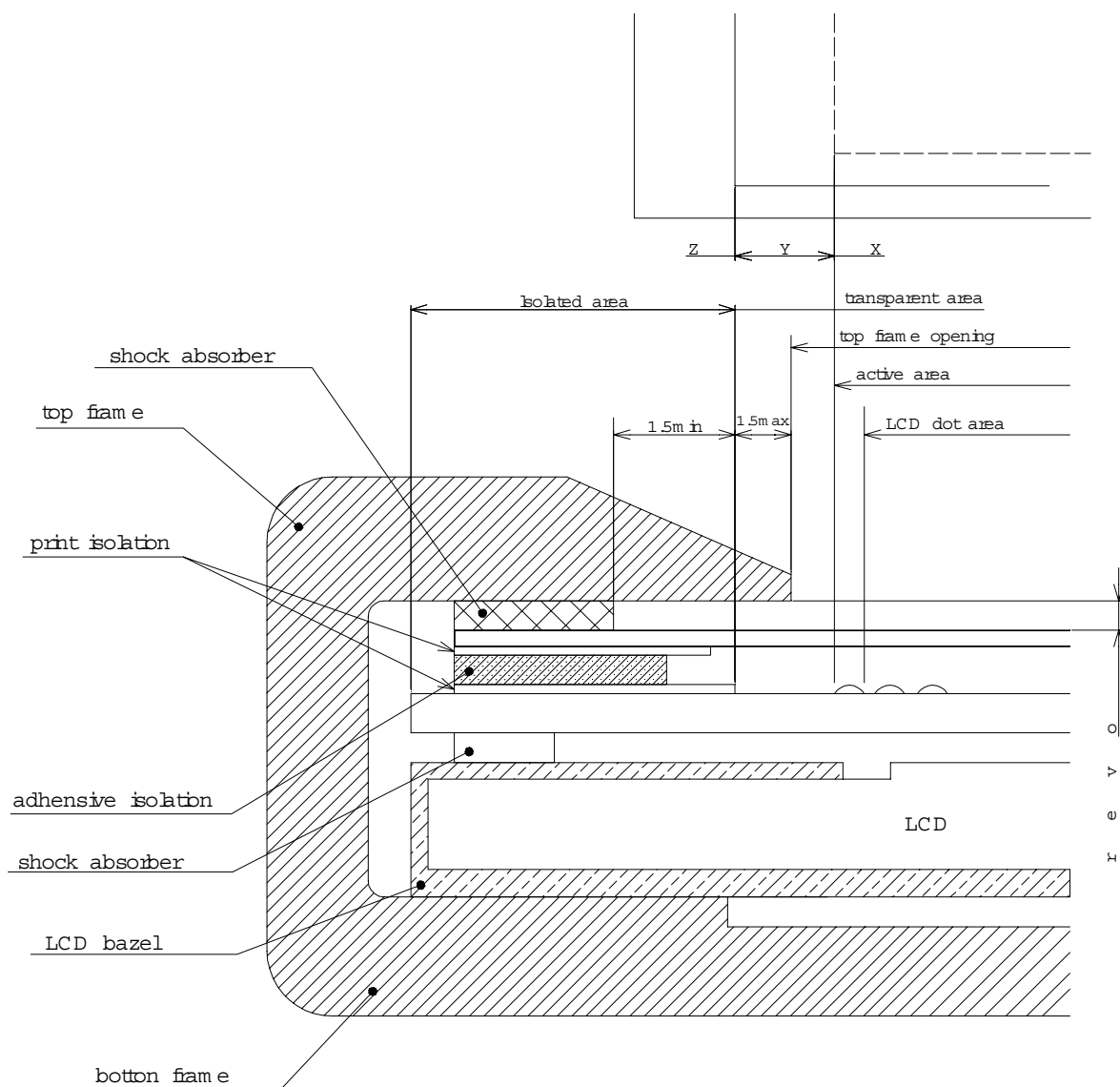
(2) LCD DOT AREA MUST BE DESIGNED NOT TO EXCEED THESE DIMENSION. (1.5mm OR GREATER PER SIDE IS DESIRABLE)

(2-2) Y ZONE (VIEWING AREA)

IT'S ELECTRICITY CONDUCTIVE, BUT NOT TO QUARANTELL LINEARITY.

(2-3) Z ZONE (ISOLATED AREA)

AN AREA PROVIDED FOR LAYING ELECTRODES AND PATTEN ACCEPTS RESIST PRINTING AND ADHENSIVE.



10.3 APPEARENCE SPECIFICATION

(1) LCD APPEARANCE

* IF THE PROBLEM OCCURESS ABOUT THIS ITEM THE RESPONSIBLE PERSON OF BOTH PARTY (CUSTOMER AND HITACHI) WILL DISCUSS MORE DETAIL.

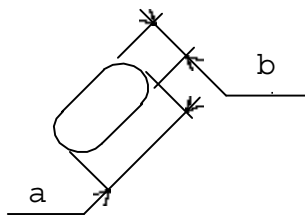
No.	ITEM	CRITERIA		APPLIED ZONE	
LCD & TOUCH PANEL	SCRATCHES	DISTINGUISHED ONE IS NOT ACCEPTABLE (TO BE JUDGE BY HITACHI LMT SAMPLE)		A	
	DENT	SAME AS ABOVE		A	
	WRINKLES IN POLARIZER	SAME AS ABOVE		A	
	BUBBLES	AVERAGE DIAMETER D (mm)	MAXIMUM ACCEPTABLE NUMBER	A	
		D ≤ 0.2	IGNORE		
		0.2 < D ≤ 0.3	12		
		0.3 < D ≤ 0.5	3		
		0.5 < D	NONE		
	STAINS, FOREIGN MATERIALS DARK SPOT	FILAMENTOUS			A,B
		LENGTH L (mm)	WIDTH W (mm)	MAXIMUM ACCEPTABLE NUMBER	
		L ≤ 2.0	W ≤ 0.03	IGNORE	
		L ≤ 3.0	0.03 < W ≤ 0.05	6	
		L ≤ 2.5	0.05 < W ≤ 0.1	1	
		ROUND (DOT SHAPE)			A,B
		AVERAGE DIAMETER D (mm)	MAXIMUM ACCEPTABLE NUMBER	MINIMUM SPACE	
		D < 0.2	IGNORE	-	
		0.2 ≤ D < 0.3	10	10 mm	
0.3 ≤ D < 0.4		5	30 mm		
0.4 ≤ D		NONE	-		
THE TOTAL NUMBER		FILAMENTOUS + ROUND = 10			
THOSE WIPED OUT EASILY ARE ACCEPTABLE			A,B		
COLOR TONE	TO BE JUDGE BY HITACHI STANDARD		A		
COLOR UNIFORMITY	SAME AS ABOVE		A		

No.	ITEM	CRITERIA				APPLIED ZONE
L C D & T O U C H P A N E L	CONTRAST IRREGULARITY (SPOT)	AVERAGE DIAMETER D (mm)	CONTRAST	MAXMUM ACCEPTABLE NUMBER	M N MUM SPACE	A
		D <= 0.25	TO BE	IGNORE	-	
		0.25 < D <= 0.35	JUDGED	10	20mm	
		0.35 < D <= 0.5	BY HITACHI	4	20mm	
		0.5 < D <= 0.7	STANDARD	3	50mm	
		0.7 < D		NONE	-	
	CONTRAST IRREGULARITY (LINE) (A PAIR OF SCRATCH)	WIDTH W (mm)	LENGTH L (mm)	MAXMUM ACCEPTABLE NUMBER	M N MUM SPACE	A
		W <= 0.25	L <= 1.2	2	20mm	
		W <= 0.2	L <= 1.5	3	20mm	
		W <= 0.15	L <= 2.0	3	20mm	
		W <= 0.1	L <= 3.0	4	20mm	
		NOTE (3)	THE WHOLE NUMBER		6	
	RUBBNG SCRATCH	TO BE JUDGED BY HITACHI ILM STANDARD				

(2) CFL BACKLIGHT APPEARANCE

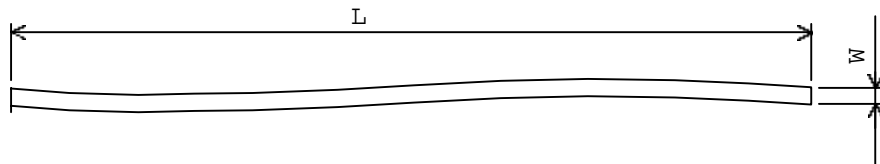
No.	ITEM	CRITERIA			APPLIED ZONE
C F L	DARK SPOTS WHITE SPOTS FOREIGN MATERIALS (SPOT)	AVERAGE DIAMETER D (mm)		MAXMUM ACCEPTABLE NUMBER	A
	D <= 0.4		IGNORED		
	0.4 < D		NONE		
B A C K L I G H T	FOREIGN MATERIALS (LINE)	WIDTH W (mm)	LENGTH L (mm)	MAXMUM ACCEPTABLE NUMBER	A
		W <= 0.2	L <= 25	1	
			2.5 < L	NONE	
		0.2 < W	-	NONE	
S C R A T C H E S	SCRATCHES	WIDTH W (mm)	LENGTH L (mm)	MAXMUM ACCEPTABLE NUMBER	A
		W <= 0.1	-	IGNORED	
		0.1 < W <= 0.2	L <= 11	1	
			11 < L	NONE	
		0.2 < W	-	NONE	

NOTE 1 DEFINITION OF AVERAGE DIAMETER (D)



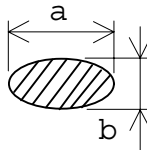
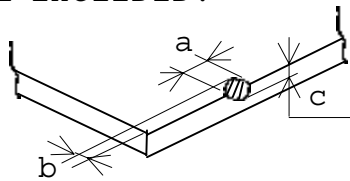
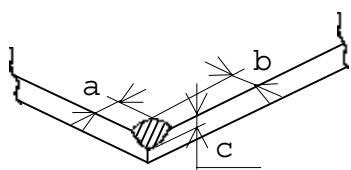
$$D = \frac{a+b}{2}$$

2 DEFINITION OF LENGTH L AND WIDTH (W)



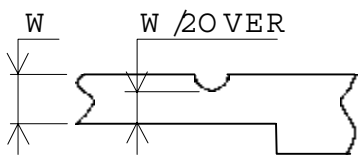
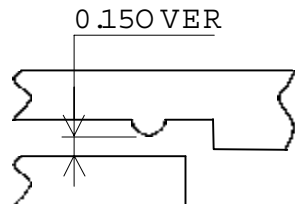
(3) TOUCH PANEL APPEARANCE

(1) EXTERNAL APPEARANCE

ITEM		RATNGS	
1	DOT FOREIGN PARTICLES	AVERAGE DIAMETER (D)	SPECIFICATION
		D <= 0.2mm	NOT COUNTED
		0.2mm < D <= 0.3mm	2 OR LESS (WITHIN Ø50mm)
		0.3mm < D	0
		 $D = \frac{a+b}{2}$	
2	LINEAR FOREIGN PARTICLES , SCRATCHES	BREADTH (W)	SPECIFICATION
		W < 0.05mm	NOT COUNTED
		0.05mm <= W < 0.1mm	L >= 5mm :NG
			L < 5mm :2 OR LESS (WITHIN Ø50mm)
		0.1mm <= W	DOT
3	UNCLEANNES	NO CONSPICUOUS DIRT	
4	GLASS CHIPPING	a <= 5 , b <= 2 , c <= t (t= GLASS THICKNESS) NONE OF THE ABOVE FIGURES MAY BE EXCEEDED. THE NUMBER OF CHIPPED AREAS DOES NOT NEED TO BE CONSIDERED. (SAME AS CORNER)	
			
5	CORNER CHIPPING	a <= 5 , b <= 2 , c <= t (t=GLASS THICKNESS)	
			
6	GLASS CRACK	NO CRACKS ARE ALLOWED .NO CHIPPING TO TOUCH WITH CIRCUIT.	
7	WAVINESS OF TOP SHEET SURFACE	FLUORESCENT LAMPS MUST NOT APPEAR DISTORTED.	
8	NEWTON RING	NO UNUSUAL INTERFERENCE FRINGE MUST SHOW WHEN SEEN THROUGH THE TOP SURFACE SHEET.	

THE SPECIFICATIONS MENTIONED ABOVE APPLY TO TRANSPARENT AREA ONLY.
 APPLICATION TO OTHER AREAS ARE WAIVED UNLESS CONCERN FOR MECHANICAL
 OR ELECTRICAL PERFORMANCE DEVELOPS. (GLASS CHIPPING IS EXCEPTED)

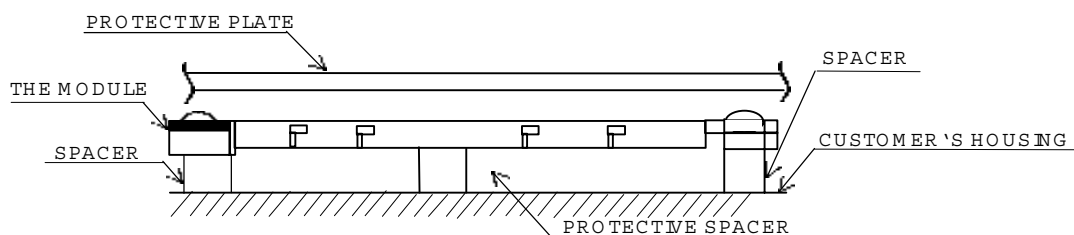
2)CIRCUIT PATTERN

ITEM	RATINGS
M N M U M C R C U I T P A T T E R N W I D T H	
M N M U M C R C U I T P A T T E R N G A P	

11. PRECAUTION IN DESIGN

11.1 MOUNTING METHOD

SINCE THE MODULE IS SO CONSTRUCTED AS TO BE FIXED BY UTILIZING FITTING HOLES IN THE PRINTED CIRCUIT BOARD AS SHOWN BELOW, IT IS NECESSARY TO TAKE CONSIDERATION THE FOLLOWING ITEMS ON ATTACHMENT TO A FRAME.



- (1) USE OF PROTECTIVE PLATE MADE OF AN ACRYLIC PLATE, ETC, IN ORDER TO PROTECT A POLARIZER AND LC CELL.
- (2) TO PREVENT THE MODULE COVER FROM BEING PRESSED, THE SPACERS BETWEEN THE MODULE AND THE FITTING PLATES SHOULD BE LONGER THAN 0.5mm.
- (3) WE RECOMMEND YOU TO USE PROTECTIVE SPACER AS FIGURE FOR PROTECTING LCD MODULE FROM ANY KIND OF SHOCK TO YOUR SET.

11.2 LC DRIVING VOLTAGE (VEE) AND VIEWING ANGLE RANGE.

SETTING V0 OUT OF THE RECOMMENDED CONDITION WILL BE A CAUSE FOR A CHANGE OF VIEWING ANGLE RANGE.

11.3 CAUTION AGAINST STATIC CHARGE

AS THIS MODULE IS PROVIDED WITH CMOS LSI, THE CARE TO TAKE SUCH A PRECAUTION AS TO GROUNDING THE OPERATOR'S BODY IS REQUIRED WHEN HANDLING IT.

11.4 POWER ON SEQUENCE

INPUT SIGNALS SHOULD NOT BE APPLIED TO LCD MODULE BEFORE POWER SUPPLY VOLTAGE IS APPLIED AND REACHES TO SPECIFIED VOLTAGE (VDD).

IF ABOVE SEQUENCE IS NOT KEPT, CMOS LSIS OF LCD MODULES MAY BE DAMAGED DUE TO LATCH UP PROBLEM.

11.5 PACKAGING

- (1) NO. LEAVING PRODUCTS IS PREFERABLE IN THE PLACE OF HIGH HUMIDITY FOR A LONG PERIOD OF TIME. FOR THEIR STORAGE IN THE PLACE WHERE TEMPERATURE IS 35° OF HIGHER, SPECIAL CARE TO PREVENT THEM FROM HIGH HUMIDITY IS REQUIRED. A COMBINATION OF HIGH TEMPERATURE AND HIGH HUMIDITY MAY CAUSE THEM POLARIZATION DEGRADATION AS WELL AS BUBBLE GENERATION AND POLARIZER PEEL-OFF. PLEASE KEEP THE TEMPERATURE AND HUMIDITY WITHIN THE SPECIFIED RANGE FOR USE AND STORING.

- (2) SINCE UPPER POLARIZERS AND LOWER ALUMINUM PLATES TEND TO BE EASILY DAMAGED, THEY SHOULD BE HANDLED WITH FULL CARE SO AS NOT TO GET THEM TOUCHED, PUSHED OR RUBBED BY A PIECE OF GLASS. TWEEZERS AND ANYTHING ELSE WHICH ARE HARDER THAN A PENCIL LEAD SH.
- (3) AS THE ADHESIVES USED FOR ADHERING UPPER/LOWER POLARIZERS AND ALUMINUM PLATES ARE MADE OF ORGANIC SUBSTANCES WHICH WILL BE DETERIORATED BY A CHEMICAL REACTION WITH SUCH CHEMICALS AS ACETONE, TOLUENE ETHANOL AND ISOPROPYLALCOHOL. THE FOLLOWING SOLVENTS ARE RECOMMENDED FOR USE:
NORMAL HEXANE
PLEASE CONTACT US WHEN IT IS NECESSARY FOR YOU TO USE CHEMICALS OTHER THAN THE ABOVE.
- (4) LIGHTLY WIPE TO CLEAN THE DIRTY SURFACE WITH ABSORBENT COTTON WASTE OR OTHER SOFT MATERIAL LIKE CHAMOIS, SOAKED IN THE CHEMICALS RECOMMENDED WITHOUT SCRUBBING IT HARDLY TO PREVENT THE DISPLAY SURFACE FROM DAMAGE AND KEEP THE APPEARANCE IN GOOD STATE, IT IS SUFFICIENT, IN GENERAL, TO WIPE IT WITH ABSORBENT COTTON.
- (5) IMMEDIATELY WIPE OFF SALIVA OR WATER DROP ATTACHED ON THE DISPLAY AREA BECAUSE ITS LONG PERIOD ADHERENCE MAY CAUSE DEFORMATION OR FADED COLOR ON THE SPOT.
- (6) FOGY DEW DEPOSITED ON THE SURFACE AND CONTACT TERMINALS DUE TO COLDNESS WILL BE A CAUSE FOR POLARIZER, DAMAGE STAIN AND DIRT ON PRODUCT WHEN NECESSARY TO TAKE OUT THE PRODUCTS FROM SOME PLACE AT LOW TEMPERATURE FOR TEST, ETC. IT IS REQUIRED FOR THEM TO BE WARMED UP IN A CONTAINER ONCE AT THE TEMPERATURE HIGHER THAN THAT OF ROOM.
- (7) TOUCHING THE DISPLAY AREA AND CONTACT TERMINALS WITH BARE HANDS AND CONTAMINATING THEM ARE PROHIBITED, BECAUSE THE STAIN ON THE DISPLAY AREA AND POOR INSULATION BETWEEN TERMINALS ARE OFTEN CAUSED BY BEING TOUCHED BY BARE HANDS. (THERE ARE SOME COSMETICS DETRIMENTAL TO POLARIZERS.)
- (8) IN GENERAL THE QUALITY OF GLASS IS FRAGILE SO THAT IT TENDS TO BE CRACKED OR CHIPPED IN HANDLING, SPECIALLY ON ITS PERIPHERY PLEASE BE CAREFUL NOT TO GIVE IT SHARP SHOCK CAUSED BY DROPPING DOWN, ETC.

11.6 CAUTION FOR OPERATION

- (1) IT IS AN INDISPENSABLE CONDITION TO DRIVE LCD'S WITHIN THE SPECIFIED VOLTAGE LIMIT SINCE THE HIGHER VOLTAGE THAN THE LIMIT CAUSES THE SHORTER LCD LIFE AND AN ELECTROCHEMICAL REACTION DUE TO DIRECT CURRENT CAUSES LCD'S UNDESIRABLE DETERIORATION, SO THAT THE USE OF DIRECT CURRENT DRIVER SHOULD BE AVOIDED.
- (2) RESPONSE TIME WILL BE EXTREMELY DELAYED AT LOWER TEMPERATURE THAN THE OPERATING TEMPERATURE RANGE AND ON THE OTHER HAND AT HIGHER TEMPERATURE LCD'S SHOW DARK BLUE COLOR IN THEM HOWEVER THOSE PHENOMENA DO NOT MEAN MALFUNCTION OR OUT OF ORDER WITH LCD'S WHICH WILL COME BACK IN THE SPECIFIED OPERATING TEMPERATURE RANGE.
- (3) IF THE DISPLAY AREA IS PUSHED HARD DURING OPERATION, SOME FONT WILL BE ABNORMALLY DISPLAY BUT IT RESUMES NORMAL CONDITION AFTER TURNING OFF ONCE.
- (4) A SLIGHT DEW DEPOSITING ON TERMINALS IS A CAUSE FOR ELECTROCHEMICAL REACTION RESULTING IN TERMINAL OPEN CIRCUIT. USAGE UNDER THE RELATIVE CONDITION OF 40°C 50% RH OR LESS IS REQUIRED.
- (5) SINCE STN-LCD IS SENSITIVE FOR HEAT PLEASE CONSIDER THE HEAT PROTECTION FROM ANY HEAT SOURCES LIKE INVERTER, DC/DC CONVERTER, CPU AND SO ON.

11.7 STORAGE

IN CASE OF STORING FOR A LONG PERIOD OF TIME (FOR INSTANCE, FOR YEARS) FOR THE PURPOSE OF REPLACEMENT USE, THE FOLLOWING WAYS ARE RECOMMENDED.

- (1) STORAGE IN A POLYETHYLENE BAG WITH THE OPENING SEALED SO AS NOT TO ENTER FRESH AIR OUTSIDE IN IT AND WITH NO DESICCANT.
- (2) PLACING IN A DARK PLACE WHERE NEITHER EXPOSURE TO DIRECT SUNLIGHT NOR LIGHT IS, KEEPING TEMPERATURE IN THE RANGE FROM 0°C TO 35°C.
- (3) STORING WITH NO TOUCH ON POLARIZER SURFACE BY ANYTHING ELSE. (IT IS RECOMMENDED TO STORE THEM AS THEY HAVE BEEN CONTAINED IN THE INNER CONTAINER AT THE TIME OF DELIVERY FROM US.)

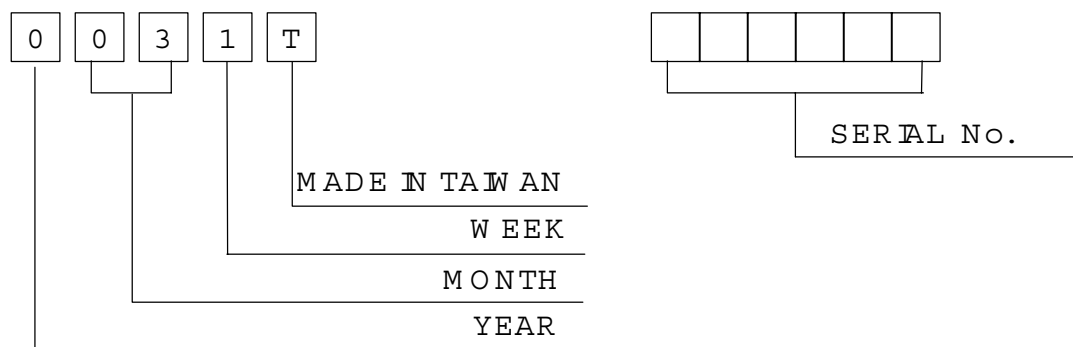
11.8 SAFETY

- (1) IT IS RECOMMENDABLE TO CRASH DAMAGED OR UNNECESSARY LCD'S INTO PIECES AND WASH OFF LIQUID CRYSTAL BY EITHER OF SOLVENTS SUCH AS ACETONE AND ETHANOL, WHICH SHOULD BE BURNED UP LATER.
- (2) WHEN ANY LIQUID LEAKED OUT OF A DAMAGED GLASS GELL COMES IN CONTACT WITH YOUR HANDS, PLEASE WASH IT OFF WELL WITH SOAP AND WATER.

12.DESIGNATION OF LOT MARK

12.1 LOT MARK

LOT MARK IS CONSISTED OF 4 LIGHT FOR PRODUCTION LOT 6 OR 7 DIGITS FOR PRODUCTION CONTROL.



YEAR	FIGURE IN LOT MARK
1999	9
2000	0
2001	1
2002	2
2003	3

MONTH	FIGURE IN LOT MARK	MONTH	FIGURE IN LOT MARK
JAN.	01	JULY.	07
FEB.	02	AUG.	08
MAR.	03	SEPT.	09
APR.	04	OCT.	10
MAY.	05	NOV.	11
JUNE.	06	DEC.	12

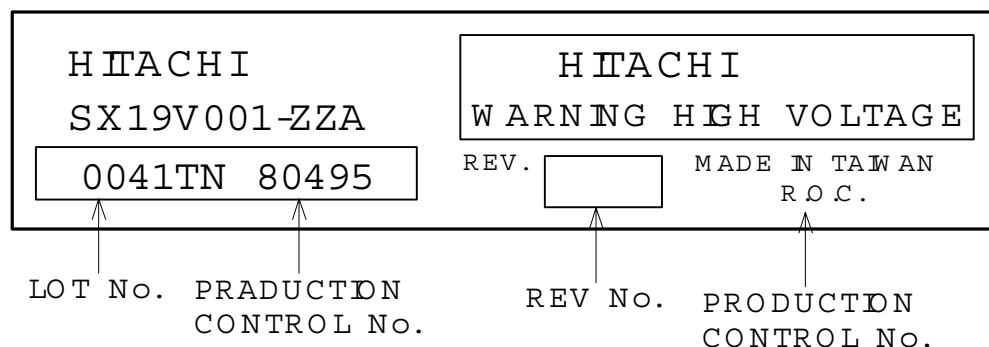
WEEK (DAY IN CALENDAR)	FIGURE IN LOT MARK
01~07	1
08~14	2
15~21	3
22~28	4
29~31	5

12.2 Revision

REV. No.	ITEM	LOT No.
-		
7	CHANGE T/P AND CFL, SMK T/P	
8	Fuji T/P	

12.3 LOCATION OF LOT MARK :ON THE LABEL ATTACHED ON THE BACK SIDE OF LCM

EXAMPLE :



13.PRECIPTIN FOR USE

- (1) A LMIT SAMPLE SHOULD BE PROVIDED BY THE BOTH PARTIES ON AN OCCASION WHEN THE BOTH PARTIES AGREED ITS NECESSITY. JUDGMENT BY A LMIT SAMPLE SHALL TAKE EFFECT AFTER THE LMIT SAMPLE HAS BEEN ESTABLISHED AND CONFIRMED BY THE BOTH PARTIES.
- (2) ON THE FOLLOWING OCCASIONS, THE HANDLING OF THE PROBLEM SHOULD BE DECDED THROUGH DISCUSSION AND AGREEMENT BETWEEN RESPONSBLE PERSONS OF THE BOTH PARTIES.
 - (1) WHEN A QUESTION IS ARISEN IN THE SPECIFICATIONS.
 - (2) WHEN A NEW PROBLEM IS ARISEN WHICH IS NOT SPECIFIED IN THIS SPECIFICATIONS.
 - (3) WHEN AN INSPECTION SPECIFICATIONS CHANGE OR OPERATING CONDITION CHANGE IN CUSTOMER IS REPORTED TO HITACHI, AND SOME PROBLEM IS ARISEN IN THIS SPECIFICATION DUE TO THE CHANGE.
 - (4) WHEN A NEW PROBLEM IS ARISEN AT THE CUSTOMER'S OPERATING SET FOR SAMPLE EVALUATION IN THE CUSTOMER SITE.
- (3) REGARDING THE TREATMENT FOR MAINTENANCE AND REPAIRING, BOTH PARTIES WILL DISCUSS IT IN SIX MONTHS LATER AFTER LATEST DELIVERY OF THIS PRODUCT.

THE PRECAUTION THAT SHOULD BE OBSERVED WHEN HANDLING LCM HAVE BEEN EXPLAINED ABOVE. IF ANY POINTS ARE UNCLEAR OR IF YOU HAVE ANY REQUESTS, PLEASE CONTACT HITACHI.