

# HITACHI

Hitachi Displays, Ltd.

Date: July 9, 2003

For Messrs. DBTEL Incorporated  
CUSTOMER'S ACCEPTANCE SPECIFICATIONS

TX05D99VM1AAA

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Please return 1 copy with your signature on this page for approval.

Accepted by : \_\_\_\_\_

Proposed by : Isamu Aoki

Date : \_\_\_\_\_

CAS-S03-114

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## RECORD OF REVISIONS

Date	Sheet No.	Summary
July 9, 2003	3284PS 2604- TX05D99VM1AAA-2 Page 4-1/1	4.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS OF LCD Power Supply for Analog -Added : MIN -0.3, MAX 3.0, Note 4
	3284PS 2605- TX05D99VM1AAA-2 Page 5-1/1	5.1 ELECTRICAL CHARACTERISTICS OF LCD -Changed (Note 4) : 64Line → 32Line -Changed Power Supply Current Partial : 430 → 530 Stand by : 10 → 50
	3284PS 2606- TX05D99VM1AAA-2 Page 6-1/5	6.1 MAIN LCD (BACKLIGHT ON) -Changed ILED : 18mA → 15mA -Changed Brightness : TYP 120 → 130 -Changed Color tone Red x : - → 0.67 Green y : - → 0.61 Blue x : - → 0.06 Blue y : - → 0.04
	3284PS 2606- TX05D99VM1AAA-2 Page 6-2/5	6.2 SUB LCD (BACKLIGHT ON) -Changed ILED : 18mA → 15mA -Changed Brightness : TYP 50 → 60 -Changed Color tone Red x : - → 0.59 Green y : - → 0.56 Blue x : - → 0.07 Blue y : - → 0.06
	3284PS 2608- TX05D99VM1AAA-2 Page 8-1/8	8.1 INTERNAL PIN CONNECTION -Changed CONNECTOR Name DF30C-40DP-0.4V → DF30FC-40DP-0.4V(51) -Changed SUITABLE CONNECTOR Name DF30C-40DS-0.4V → DF30FC-40DS-0.4(51)
	3284PS 2608- TX05D99VM1AAA-2 Page 8-6/8 - 8-7/8	8.5 REGISTER SETTING FLOW -Changed (1)STATE CHART -Changed (2)REGISTER SETTING SEQUENCE
	3284PS 2609- TX05D99VM1AAA-2 Page 9-1/1	9. DIMENSIONAL OUTLINE -Changed CONNECTOR Name DF30C-40DP-0.4V/Hirose → DF30FC-40DP-0.4V(51)/Hirose -Changed (18.25) → 18.25 ±0.5 (16.09) → 16.09 ±0.5 -Added : Label, Note 1, Note 2
	3284PS 2610- TX05D99VM1AAA-2 Page 10-2/4, 10-3/4	10.3 COSMETIC SPECIFICATION (MAIN LCD, SUB LCD) -Deleted : 7 Uneven Anti Reflection -Added : 7,8 Scratch of Polarizer 9 Polarizer bubble

## RECORD OF REVISIONS

Date	Sheet No.	Summary
July 9, 2003	3284PS 2610- TX05D99VM1AAA-2 Page 10-4/4	No.10 Glass crack -Changed C : - → ○ -Changed (1) Electrode and (3) Corner
	3284PS 2611- TX05D99VM1AAA-2 Page 11-2/3	11.3 HANDLING PRECAUTIONS -Added (12)(13)
	3284PS 2612- TX05D99VM1AAA-2 Page 12-1/1	12. DESIGNATION OF LOT MARK -Changed Production base and Figure in lot mark -Changed Rev. : Blank → A
	3284PS 2613- TX05D99VM1AAA-2 Page 13-1/7 - 13-7/7	-Added PACKING

### 3. GENERAL DATA

(1) Part Name		TX05D99VM1AAA
(2) Module Dimensions		36.5(W) mm x 50.29(H) mm x 4.55 (t) mm
(3) Active Area Dimensions	Main LCD	28.416(W) mm x 35.52(H) mm
	Sub LCD	23.04(W) mm x 15.36(H) mm
(4) Pixel Pitch	Main LCD	0.222(W) mm x 0.222(H) mm
	Sub LCD	0.240(W) mm x 0.240(H) mm
(5) Resolution	Main LCD	128 x 3 (R,G,B)(W) x 160 (H) dots
	Sub LCD	96 x 3 (R,G,B)(W) x 64(H) dots
(6) Color Pixel Arrangement		RGB Vertical Stripe
(7) Display Mode	Main LCD	Transmissive Mode, Normally White Mode
	Sub LCD	Transflective Mode, Normally White Mode
(8) Color Number		260k Colors
(9) View ing Direction		6 O'clock
(10) Back Light		Light Emitting Diode (LED)
(11) Weight		12g typ
(12) LCD Driver IC		HD66772(Drain)
		HD66774S(Gate)
(13) Interface		8/9/16/18bit CPU bus (80 CPU series)

## 4. ABSOLUTE MAXIMUM RATINGS

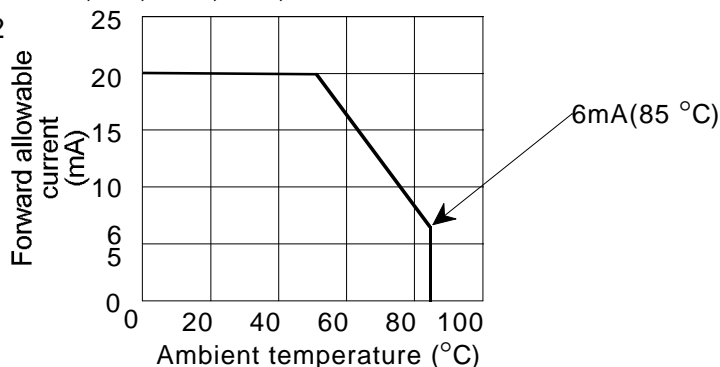
### 4. 1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS OF LCD

VSS=0V

ITEM	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VCC	-0.3	4.6	V	
Power Supply for Analog	Vci	-0.3	3.0	V	
		-0.3	4.6	V	Note 4
Input Voltage	Vi	-0.3	VCC+0.3	V	Note 1
Input Current	Ii	0	100	mA	
LED Reverse Voltage	VR	-	5	V	
LED Forward Current	ILED	-	Note 2	mA	
Static Electricity	-	-	(±2)	kV	Note 3

Note 1 CS\*, RS, WR\*, RD\*, DB0-17

Note 2



Note 3 150pF-1.5kohm/200pF-0 ohm, 25 °C-70%RH.

The Surface of LCD center are subjected.

Note 4 No display(STAGE (a)) or Standby mode(STAGE (e)). (To refer to Page 8-6/7)

### 4. 2 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	OPERATING		STORAGE		COMMENT
	MIN	MAX	MIN	MAX	
Ambient Temperature	-20 °C	70 °C	-30 °C	80 °C	Note 2
Humidity	Note 1		Note 1		Without condensation
Corrosive Gas	Not Acceptable		Not Acceptable		

Note 1  $T_a \leq 40$  °C : 85%RH max.

$T_a > 40$  °C : Absolute humidity must be lower than the humidity of 85%RH at 40 °C.

Note 2 Background color changes slightly depending on ambient temperature.  
This phenomenon is reversible.

## 5. ELECTRICAL CHARACTERISTICS

### 5. 1 ELECTRICAL CHARACTERISTICS OF LCD

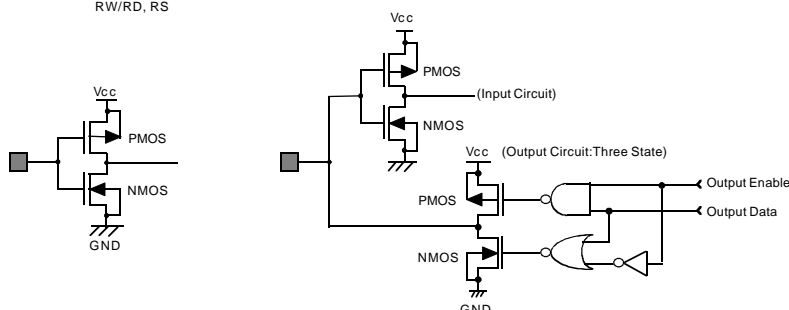
Ta=25 °C, VSS=0V

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Power Supply Voltage for Logic	VCC	-	2.76	2.85	2.91	V
Power Supply Voltage for Analog	Vci	-	2.76	2.85	2.91	V
Input Voltage for Logic Circuits (Note 1)	Vi	"H" level	0.7VCC	-	VCC	V
		"L" level	-0.3	-	0.15VCC	
Output Voltage for Logic Circuits (Note 1)	Vo	"H" level (IoH=0.1mA)	0.75VCC	-	-	V
		"L" level (IoL=0.1mA)	-	-	0.15VCC	
Input/Output Leak current (Note 2)	ILi	-	-1.0	-	1.0	uA
Power Supply Current (Note 3)(Note 4) (Note 5)(Note 6)	Icc+ Ici	Main/Sub LCD (Note 8)	-	5450	7200	uA
		All Black (Note 9)	-	1900	2500	
		Partial	-	330	530	
		standby	-	3	50	
LED Forward Voltage	VLED	-	-	3.6	-	V
LED Forward Current	ILED	-	-	18.0	(Note 7)	mA/LED
Frame Frequency	fFLM	-	55	75	81	Hz

(Note 1) RESET,CS\*,RS,WR\*,RD\*,DB0-17

Application Terminal : RESET\*, CS\*, E/WR\*/SCL,  
RW/RD, RS

Application Terminal : DB17 - DB2, DB1/SDO,DB0/SDI

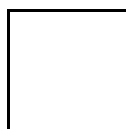


(Note 2) Excepted the current of out driving MOS.

(Note 3) VCC-VSS=2.85V, Ta=25 °C.

(Note 4) Partial Pattern

Main LCD



All White (8 color mode)

Sub LCD



32 Line : Black (8 color mode)

32 Line : White (8 color mode)

(Note 5) Still picture is displayed using internal RAM.

(Note 6) Power Supply Current values are for still picture.(Except moving picture)

(Note 7) To refer to item 4.1

(Note 8) Transmissive Mode (Line Inversion)

(Note 9) Slightly Reflective Mode (Frame Inversion)

## 6. OPTICAL CHARACTERISTICS

### 6.1 MAIN LCD (BACKLIGHT ON)

Ta=25 °C ILED=15mA

ITEM		SYMBOL	CONDITION	MIN	TYP	MAX	UNIT	NOTE
Brightness		B	$\phi=0^\circ, \theta=0^\circ$	100	130	-	cd/m <sup>2</sup>	panel center
Uniformity		-	$\phi=0^\circ, \theta=0^\circ$	-	-	+/-30	%	2),3)
View ing angle		$\phi 2-\phi 1$	$\theta=0^\circ, K \geq 2.0$	-	60	-	deg	4),5) 6)
			$\theta=90^\circ, K \geq 2.0$	-	60	-		
Contrast ratio		K	$\phi=0^\circ, \theta=0^\circ$	100	200	-	-	5)
Response time		tr+tf	$\phi=0^\circ, \theta=0^\circ$	-	35	70	ms	7)
Color tone (Primary Color)	Red	x	$\phi=0^\circ, \theta=0^\circ$	0.51	0.60	0.67	-	8)
		y		0.28	0.35	0.40	-	
	Green	x		0.25	0.32	0.37	-	
		y		0.47	0.54	0.61	-	
	Blue	x		0.06	0.14	0.21	-	
		y		0.04	0.12	0.20	-	
	White	x		0.23	0.31	0.37	-	
		y		0.22	0.32	0.40	-	

(Measurement condition : Hitachi standard).

## 6.2 SUB LCD (BACKLIGHT ON)

Ta=25 °C ILED=15mA

ITEM		SYMBOL	CONDITION	MIN	TYP	MAX	UNIT	NOTE
Brightness		B	$\phi=0^\circ, \theta=0^\circ$	40	60	-	cd/m <sup>2</sup>	panel center
Uniformity		-	$\phi=0^\circ, \theta=0^\circ$	-	-	+/-30	%	2),3)
Viewing angle		$\phi_2-\phi_1$	$\theta=0^\circ, K \geq 2.0$	-	60	-	deg	4),5) 6)
			$\theta=90^\circ, K \geq 2.0$	-	60	-		
Contrast ratio		K	$\phi=0^\circ, \theta=0^\circ$	-	25	-	-	5)
Response time		tr+tf	$\phi=0^\circ, \theta=0^\circ$	-	35	70	ms	7)
Color tone (Primary Color)	Red	x	$\phi=0^\circ, \theta=0^\circ$	0.44	0.52	0.59	-	8)
		y		0.22	0.32	0.39	-	
	Green	x		0.23	0.31	0.37	-	
		y		0.38	0.49	0.56	-	
	Blue	x		0.07	0.15	0.22	-	
		y		0.06	0.14	0.23	-	
	White	x		0.22	0.30	0.36	-	
		y		0.22	0.31	0.38	-	

(Measurement condition : Hitachi standard).



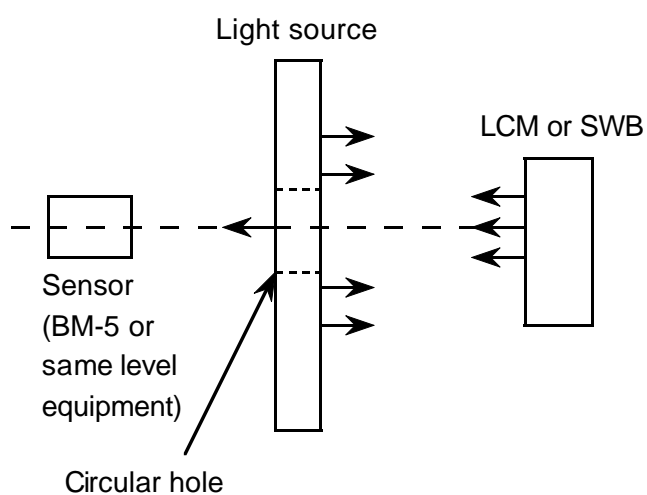
## 6.2 OPTICAL CHARACTERISTICS OF LCD (BACKLIGHT OFF)

Ta=25 °C

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT	NOTE
Reflectance	R	$\phi=0^\circ, \theta=0^\circ$	10	20	-	%	1)
Contrast ratio	K	$\phi=0^\circ, \theta=0^\circ$	5	8	-		5)
Response time (rise+fall)	tr+tf	$\phi=0^\circ, \theta=0^\circ$	-	25	50	ms	7)

(Measurement condition : Hitachi standard)

Note 1. Definition of Reflectance R



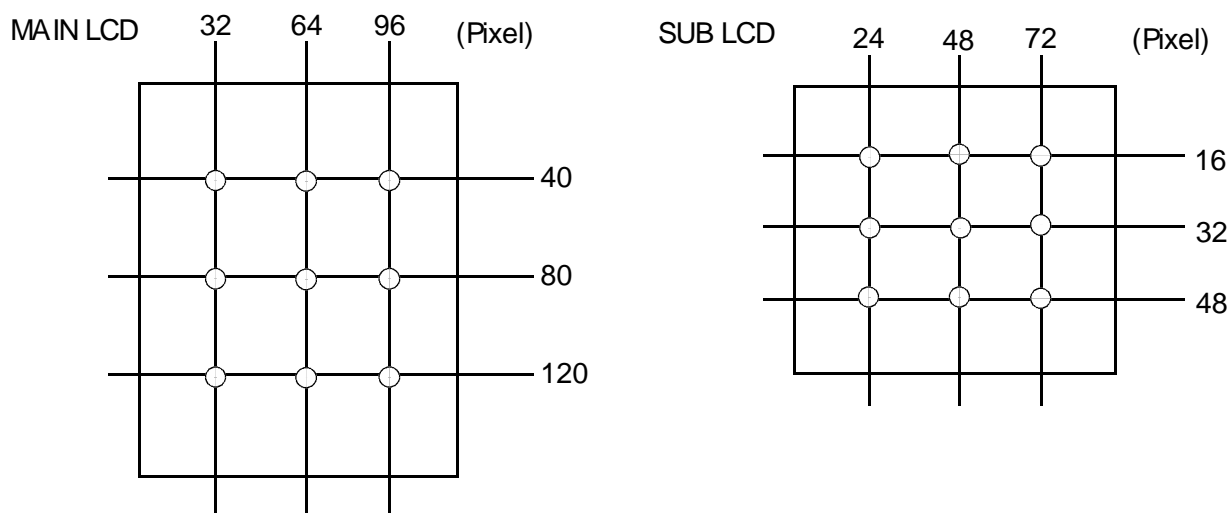
$$R = \frac{BLCM}{BSWB}$$

BLCM : Brightness of LCM at optimum voltage.  
(displaying white pattern)

BSWB : Brightness of SWB.

SWB : Standard white board.

Note 2.



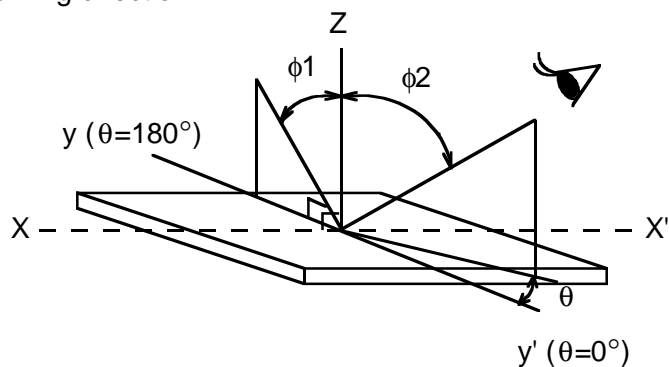
Note 3. Definition of the brightness uniformity

$$\frac{(\text{Max brightness or Min brightness}) - (\text{Average brightness})}{(\text{Average brightness})}$$

Note 4. Definition of q and f

(Normal)

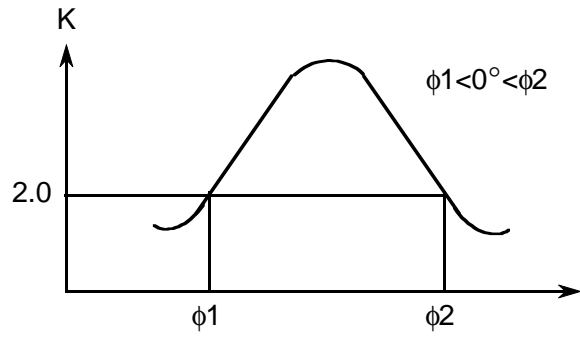
View ing direction



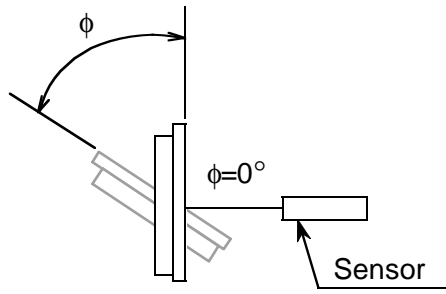
Note 5. Definition of Contrast "K"

$$K = \frac{\text{Brightness w hen displaying White raster}}{\text{Brightness w hen displaying Black raster}}$$

Note 6. Definition of view ing angle  $\phi 1$  and  $\phi 2$

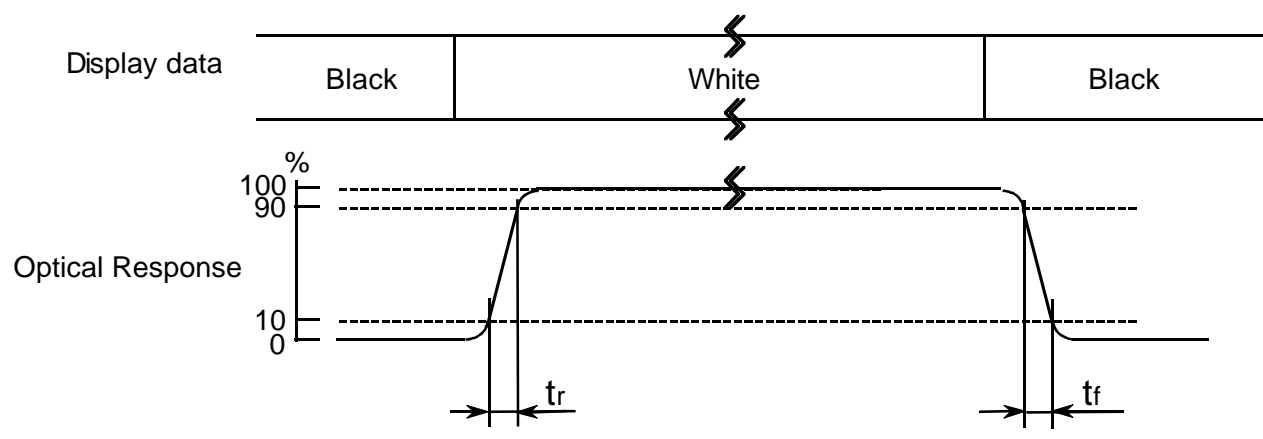


Contrast ratio  $K$  vs view ing angle  $f$



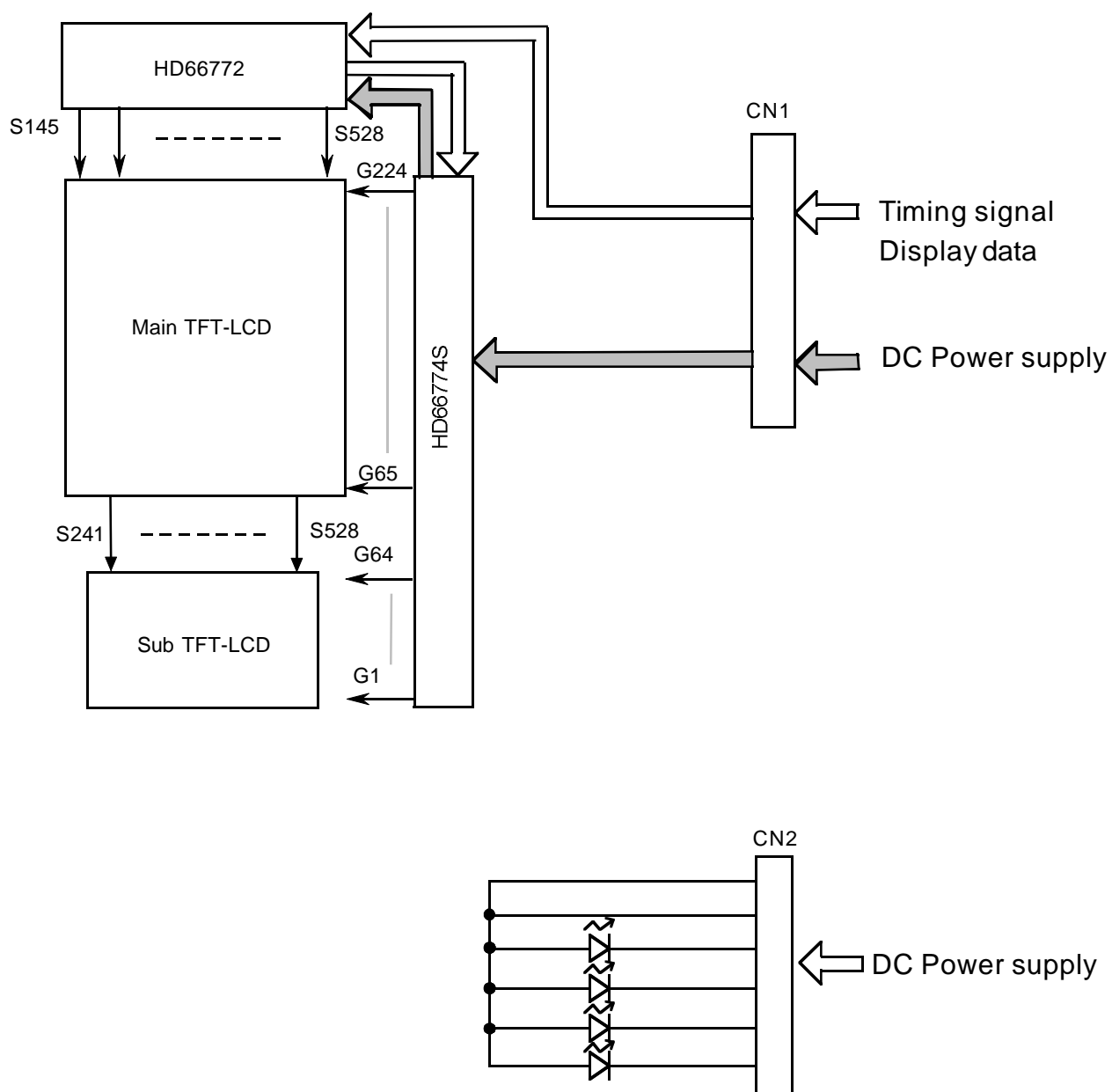
Sensor : BM-5 or similar equipment

Note 7. Definition of optical response time



Note 8. The LCD driving voltage should be adjusted so as to obtain maximum contrast.

## 7. BLOCK DIAGRAM



## 8. INTERFACE

### 8.1 INTERNAL PIN CONNECTION (8 / 9 / 16/ 18bit CPU bus correspondence)

PIN No.	SIGNAL	I / O	FUNCTION
1	IM0	I	Interface mode Select
2	AN	I	Power Supply for LED
3	IM3	I	Interface mode Select
4	AN	I	Power Supply for LED
5	DB17	I / O	Data Bus (Instruction & Display Data)
6	CA1	-	GND for LED1
7	DB16	I / O	Data Bus (Instruction & Display Data)
8	CA2	-	GND for LED2
9	DB15	I / O	Data Bus (Instruction & Display Data)
10	CA3	-	GND for LED3
11	DB14	I / O	Data Bus (Instruction & Display Data)
12	CA4	-	GND for LED4
13	DB13	I / O	Data Bus (Instruction & Display Data)
14	GND	-	GND
15	DB12	I / O	Data Bus (Instruction & Display Data)
16	RESET*	I	Reset
17	DB11	I / O	Data Bus (Instruction & Display Data)
18	GND	-	GND
19	DB10	I / O	Data Bus (Instruction & Display Data)
20	Vci	I	Power Supply for Analog circuit
21	DB9	I / O	Data Bus (Instruction & Display Data)
22	Vci	I	Power Supply for Analog circuit
23	DB8	I / O	Data Bus (Instruction & Display Data)
24	GND	-	GND
25	DB7	I / O	Data Bus (Instruction & Display Data)
26	GND	-	GND
27	DB6	I / O	Data Bus (Instruction & Display Data)
28	Vcc	-	Power Supply for Logic circuit
29	DB5	I / O	Data Bus (Instruction & Display Data)
30	Vcc	-	Power Supply for Logic circuit
31	DB4	I / O	Data Bus (Instruction & Display Data)
32	GND	-	GND
33	DB3	I / O	Data Bus (Instruction & Display Data)
34	RD*	I	Read Strobe
35	DB2	I / O	Data Bus (Instruction & Display Data)
36	WR*	I	Write Strobe
37	DB1	I / O	Data Bus (Instruction & Display Data)
38	RS	I	Resister Select
39	DB0	I / O	Data Bus (Instruction & Display Data)
40	CS*	I	Chip Select

CONNECTOR : HIROSE DF30FC-40DP-0.4V(51)

SUITABLE CONNECTOR : HIROSE DF30FC-40DS-0.4V(51)

## 8.2 CPU INTERFACE MODE SETTING

### SELECTS THE CPU INTERFACE MODE

PIN No.	SIGNAL	80-System Bus Interface			
		18-bit	16-bit	9-bit	8-bit
		260k Colors	65k Colors	260k Colors	65k Colors
1	IM0	GND	GND	Vcc	Vcc
3	IM3	Vcc	GND	Vcc	GND

Select the interface mode and colors by setting bits of IM0 and IM3.

### UNUSED DATA BUS CONNECTION

Bus Interface		18-bit	16-bit	9-bit	8-bit
Data Bus Pins		DB17-0	DB17-10,DB8-1	DB17-9	DB17-10
Unused Data Bus Pins		——	DB9,DB0	DB8-0	DB9-0
Pin No.	Signal	——	——	——	——
5	DB17				
7	DB16				
9	DB15				
11	DB14				
13	DB13				
15	DB12				
17	DB11				
19	DB10				
21	DB9		GND		GND
23	DB8			GND	GND
25	DB7			GND	GND
27	DB6			GND	GND
29	DB5			GND	GND
31	DB4			GND	GND
33	DB3			GND	GND
35	DB2			GND	GND
37	DB1			GND	GND
39	DB0		GND	GND	GND

Fix unused data bus pins to the GND level in accordance with the selected interface mode.

### INPUT THE DISPLAY DATA

Data Bus		17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
18-bit		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
16-bit		R5,R0	R4	R3	R2	R1	G5	G4	G3	-	G2	G1	G0	B5,B0	B4	B3	B2	B1	-
9-bit	1st transfer	R5	R4	R3	R2	R1	R0	G5	G4	G3	-	-	-	-	-	-	-	-	-
	2nd transfer	G2	G1	G0	B5	B4	B3	B2	B1	B0	-	-	-	-	-	-	-	-	-
8-bit	1st transfer	R5,R0	R4	R3	R2	R1	G5	G4	G3	-	-	-	-	-	-	-	-	-	-
	2nd transfer	G2	G1	G0	B5,B0	B4	B3	B2	B1	-	-	-	-	-	-	-	-	-	-

### 8.3 INTERFACE TIMING

#### Bus Timing Characteristics

<<Normal Write Mode (HWM=0), Vcc=2.76V-2.91V>>

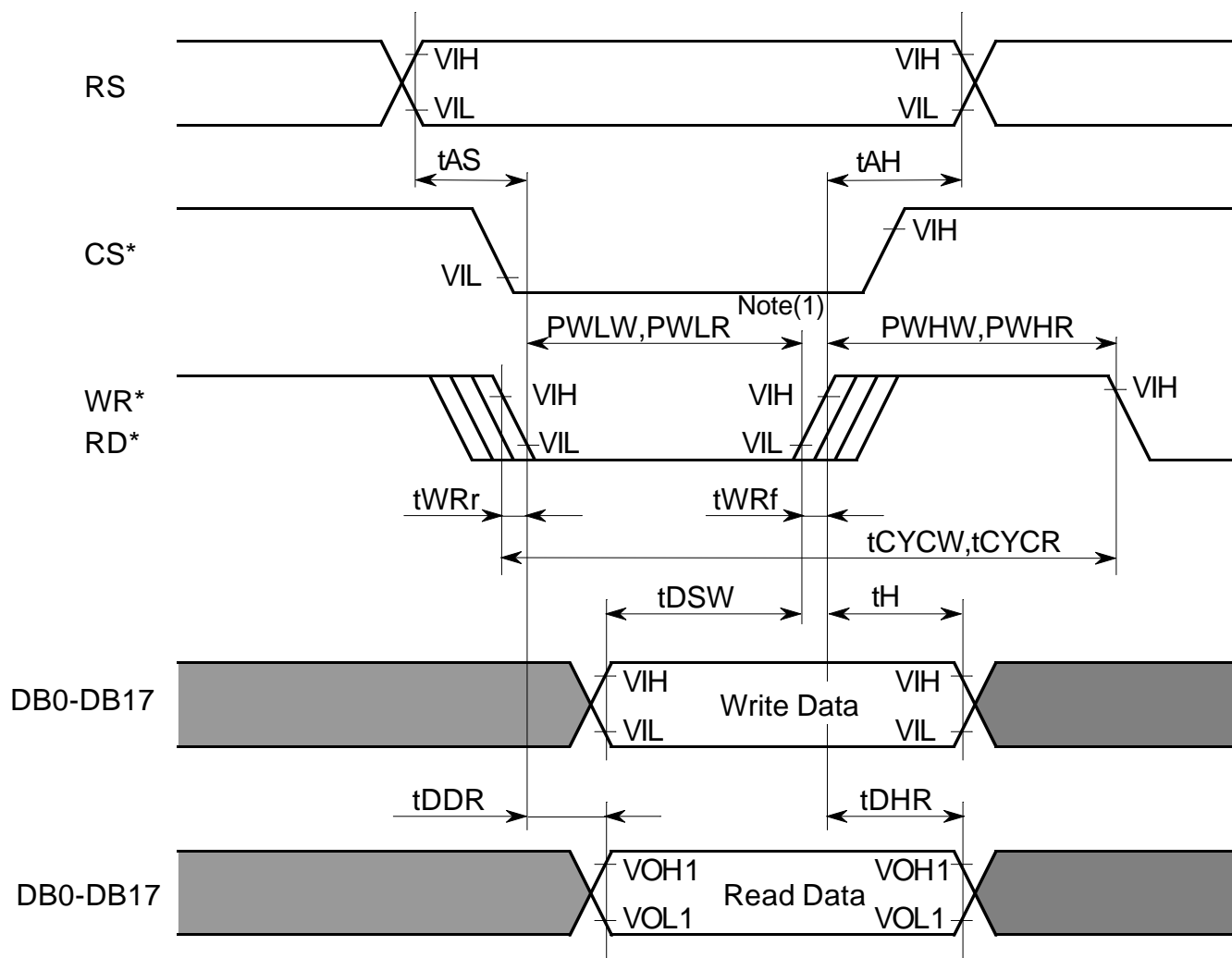
Item		Symbol	Unit	Min	Typ	Max
Bus cycle time	Write	tCYCW	ns	250	-	-
	Read	tCYCR	ns	500	-	-
Write low-level pulse width		PWLW	ns	40	-	-
Read low-level pulse width		PWLR	ns	250	-	-
Write high-level pulse width		PWHW	ns	70	-	-
Read high-level pulse width		PWHR	ns	200	-	-
Write / Read rise / fall time		tWRr, WRf	ns	-	-	25
Set up time	(RS to CS*, WR*)	tAS	ns	0	-	-
	(RS to RD*)			10	-	-
Address hold time		tAH	ns	2	-	-
Write data set up time		tDSW	ns	25	-	-
Write data hold time		tH	ns	2	-	-
Read data delay time		tDDR	ns	-	-	200
Read data hold time		tDHR	ns	5	-	-

<<High-Speed Write Mode (HWM=1), Vcc2.76V-2.91V>>

Item		Symbol	Unit	Min	Typ	Max
Bus cycle time	Write	tCYCW	ns	100	-	-
	Read	tCYCR	ns	500	-	-
Write low-level pulse width		PWLW	ns	40	-	-
Read low-level pulse width		PWLR	ns	250	-	-
Write high-level pulse width		PWHW	ns	40	-	-
Read high-level pulse width		PWHR	ns	200	-	-
Write / Read rise / fall time		tWRr, WRf	ns	-	-	25
Set up time	(RS to CS*, WR*)	tAS	ns	0	-	-
	(RS to RD*)			10	-	-
Address hold time		tAH	ns	2	-	-
Write data set up time		tDSW	ns	25	-	-
Write data hold time		tH	ns	2	-	-
Read data delay time		tDDR	ns	-	-	200
Read data hold time		tDHR	ns	5	-	-

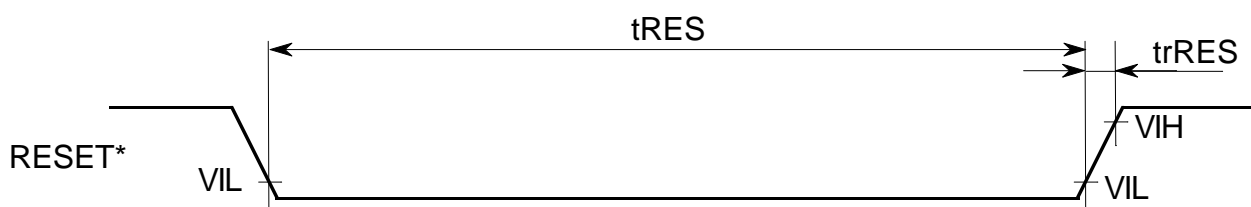
#### Reset Timing Characteristics

Item	Symbol	Unit	Min	Typ	Max
Reset "low" level width	tRES	ms	1	-	-
Reset rise time	trRES	us	-	-	10



### Bus Timing

Note(1) PWLW and PWLR is specified in the overlapped period when  $CS^*$  is low and  $WR^*$  or  $RD^*$  is low.

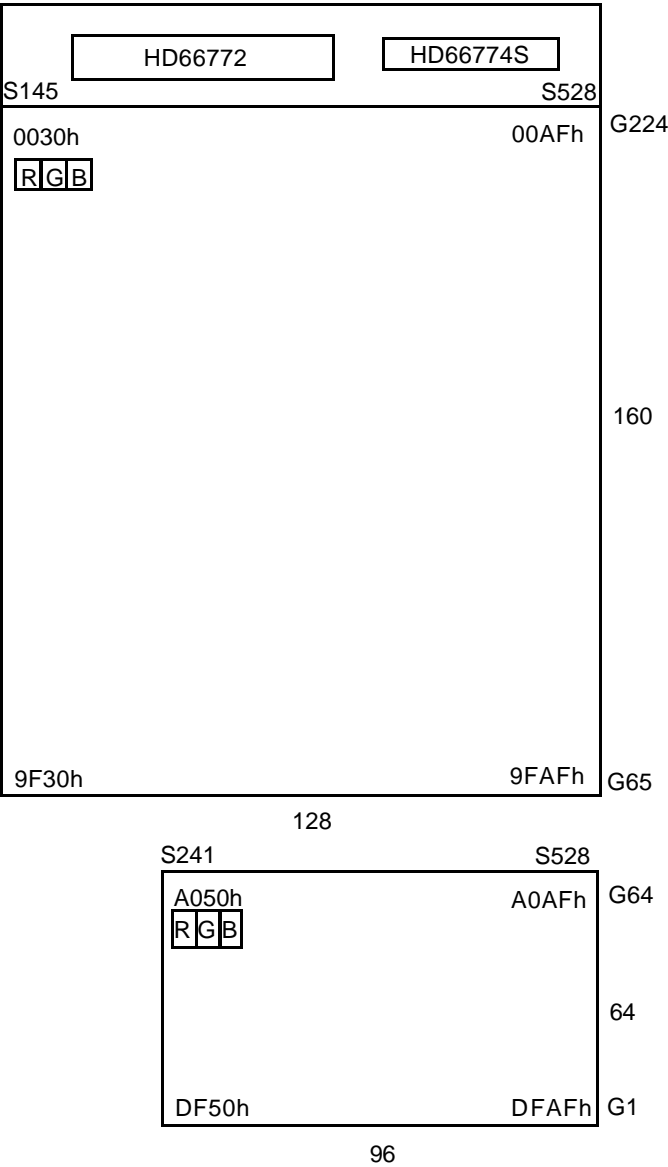


### Reset Timing



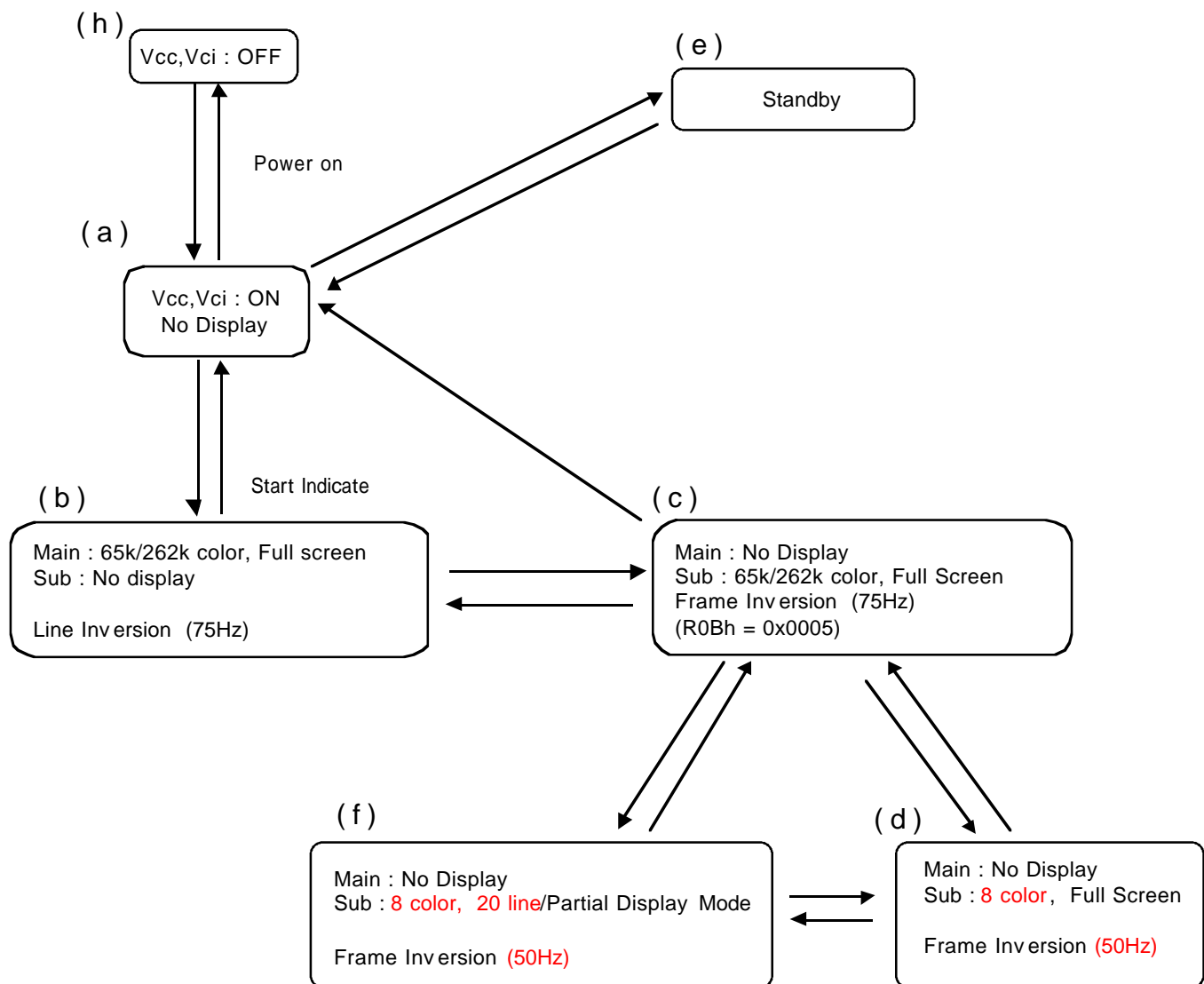
8.4 GRAM ADDRESS MAP

GS=1,SS=0,BGR=0



## 8.5 REGISTER SETTING FLOW

### (1) STATE CHART



## (2) REGISTER SETTING SEQUENCE

### Switching (h) → (a)

1	Power on	Vcc, Vci : on
2	Reset	reset* = "L"
3		wait 1 ms
4		reset* = "H"
5	Start Oscillation	R00h 0x0001
6		wait 10 ms

### Switching (a) → (b)

1	Power on setting	R14h 0x381F
2		R0Ah 0x0102
3		wait 100 μs
4		R07h 0x0001
5		R10h 0x0000
6		R11h 0x0000
7		R12h 0x0000
8		R13h 0x0608
9		R14h 0x300F
10		R0Ah 0x0100
11		wait 100 μs
12		R0Ah 0x0101
13		wait 100 μs
14		R0Ah 0x0102
15		wait 100 μs
16	Start Power on(1)	R10h 0x0808
17		R0Ah 0x0100
18		wait 20 ms
19	Start Power on(2)	R13h 0x0619
20		R0Ah 0x0101
21		wait 20 ms
22	Dr. output control	R01h 0x021B
23	LCD-Driving-Waveform Control	R02h 0x0700
24	Entry mode	R03h 0x0030
25	Compare Register(1)	R04h 0x0000
26	Compare Register(2)	R05h 0x0000
27	Display Control(2)	R08h 0x0808
28	RAM Write Data Mask(1)	R23h 0x0000
29	RAM Write Data Mask(2)	R24h 0x0000
30	Frame Cycle Control	R0Bh 0x0005
31	External Display I/f Control	R0Ch 0x0000
32	Gate Scan Start Position	R40h 0x0000
33	Vertical Scroll Control	R41h 0x0000
34	1st Screen Driving position	R42h 0x9F00
35	2nd Screen Driving position	R43h 0xEEFE
36		R0A 0x0106
37		wait 100 μs
38		R0A 0x0107
39		wait 100 μs
40	control	R30h 0x0100
41		R31h 0x0707
42		R32h 0x0102
43		R33h 0x0000
44		R34h 0x0506
45		R35h 0x0000
46		R36h 0x0706
47		R37h 0x0000
48		R3Fh 0x0000
49	Clear GRAM	Write Picture Data
50		R07h 0x0021
51		R0Ah 0x0100
52		wait 150 μs
53	Display on	R07h 0x0027
54		wait 150 μs
55		R07 0x0037
56		R12h 0x0004
57		R0A 0x0101
58		wait 100 μs

### Switching (b) → (c)

1	Power on setting	R12h 0x0000
2		R0Ah 0x0101
3		wait 5ms
4	Display off	R07h 0x0036
5	Frame Inversion	R02h 0x0500
6		wait 40ms
7	Display area (Line) setting	R42h 0xDFA0
8		Write Picture Data
9	Display on	R07h 0x0037
10		R12h 0x0004
11		R0Ah 0x0101
12		wait 40ms

### Switching (c) → (b)

1	Power on setting	R12h 0x0000
2		R0Ah 0x0101
3		wait 5ms
4	Display off	R07h 0x0036
5	Frame Inversion	R02h 0x0700
6		wait 40ms
7	Display area (Line) setting	R42h 0x9F00
8		Write Picture Data
9	Display on	R07h 0x0037
10		R12h 0x0004
11		R0Ah 0x0101
12		wait 40ms

### Switching (a) → (e)

1	Standby	R10h 0x0001
2		wait 1ms

### Switching (e) → (a)

1	Clear Standby	R10h 0x0000
2		wait 10 ms

### Switching (c) → (d)

1		R12h 0x0000
2		R0Ah 0x0101
3		wait 5 ms
4	Data output Mask	R07h 0x003A
5	Power control	R10h 0x0A68
6		R0Ah 0x0100
7		wait 100 μs
8	Frame Cycle Control	R0Bh 0x0100
9	Display area (Line) setting	R42h 0xDFA0
10		Write Picture Data
11	Display on	R07h 0x003F

(\*1)

Switching (c) → (f)

1		R12h	0x0000	
2		R0Ah	0x0101	
3		wait	5 ms	
4	Data output Mask	R07h	0x003A	
5		R10h	0x0A68	
6		R0Ah	0x0100	
7		wait	100 μs	
8	Frame Cycle Control	R0Bh	0x0100	(*1)
9	Display area (Line) setting	R42h	0xB4A0	(*2)
10		Write Picture Data		
11	Display on	R07h	0x003F	

Switching (d) or (f) → (c)

1	Data output Mask	R07h	0x0032	
2		wait	40ms	
3		R10h	0x0808	
4		R0Ah	0x0100	
5		wait	100 μs	
6	Frame Cycle Control	R0Bh	0x0005	(*1)
7	Data output Mask	R42h	0x9F00	
8	Display on	R07h	0x0037	
9		R12h	0x0004	
10		R0A	0x0101	
11		wait	100 μs	

Switching (d) → (f)

1	Display area (Line) setting	R42h	0xB4A0
---	-----------------------------	------	--------

Switching (f) → (d)

1	Display area (Line) setting	R42h	0xDFA0
---	-----------------------------	------	--------

(\*1)

R0Bh	fFLM(Hz)
0x0000	98
0x0005	75
0x000E	53
0x0100	50
0x0103	40

(\*2)

R42h = 0xB4A0  
only Sub Display  
Partial Indication



Switching (b),(c) → (a)

1	Display off	R12h	0x0000
2		R0Ah	0x0101
3		wait	5 ms
4		R07h	0x0036
5		wait	35ms
6		R07h	0x0026
7		wait	35ms
8		R07h	0x0020
9		wait	5 ms
10		R10h	0x0000
11		R0Ah	0x0100
12		wait	5 ms
13		R07h	0x0000
14		R0Ah	0x0100
15		wait	100 μs

Switching (a) → (h)

1	Power off	Vcc, Vci : off
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Note

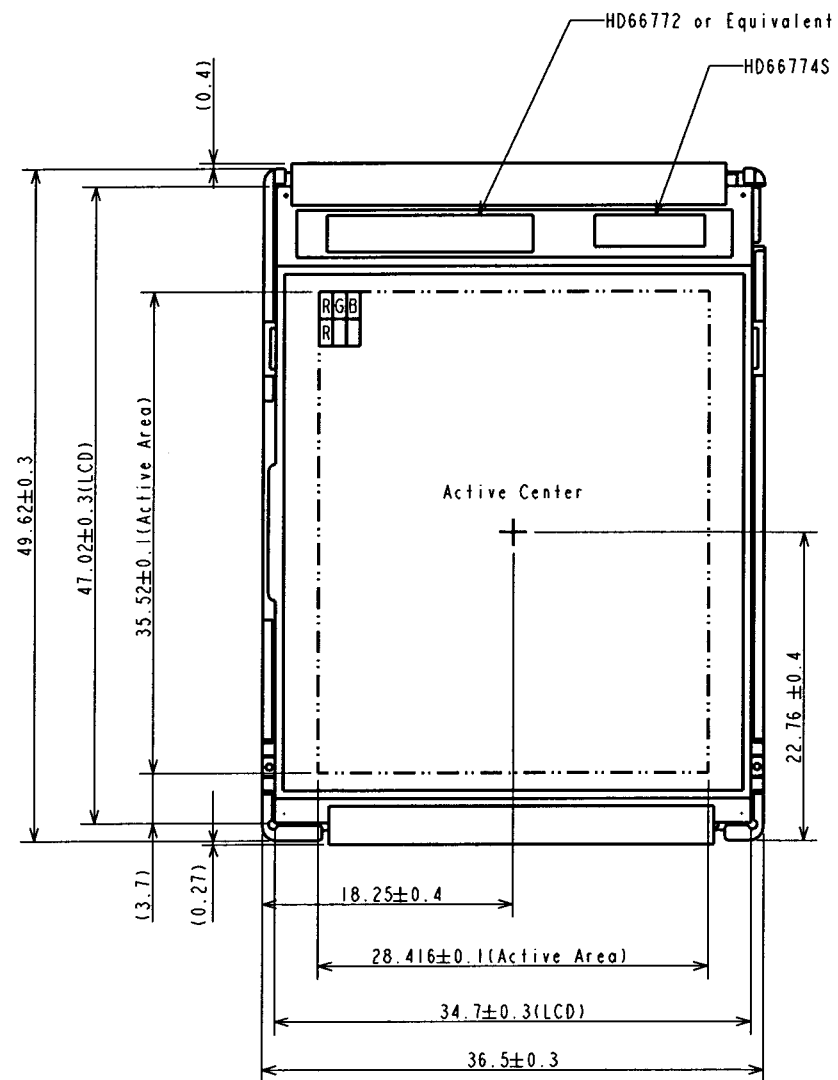
Need following register setting before Write picture data.

R21h : RAM address set

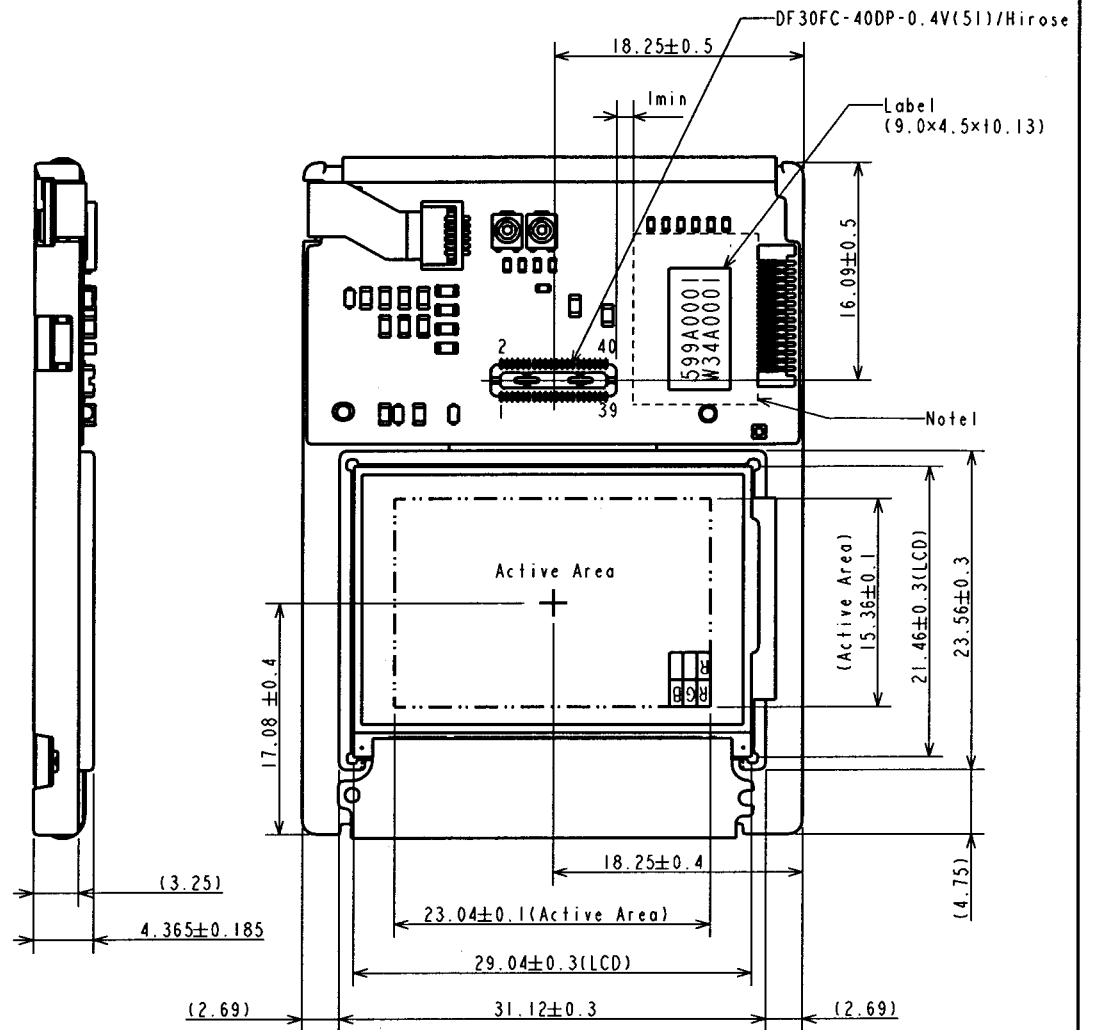
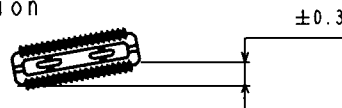
R44h : Horizontal RAM address position

R45h : Vertical RAM address position

# 9. DIMENSIONAL OUTLINE



Note1 Label is being attached on this area.  
 Note2 Connector rotation  $\pm 0.3$



10. VISUAL INSPECTION

10.1 INSPECTION CONDITION

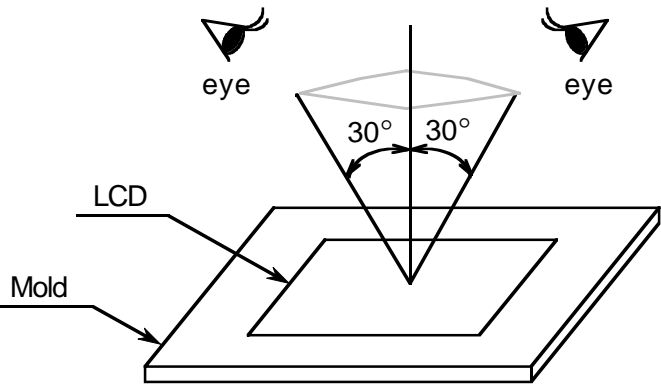
- 1) Ambient illumination:

2) Distance between eyes of an inspector and the LCD Module:

3) Viewing angle:
- 1000 - 1500 [lx]

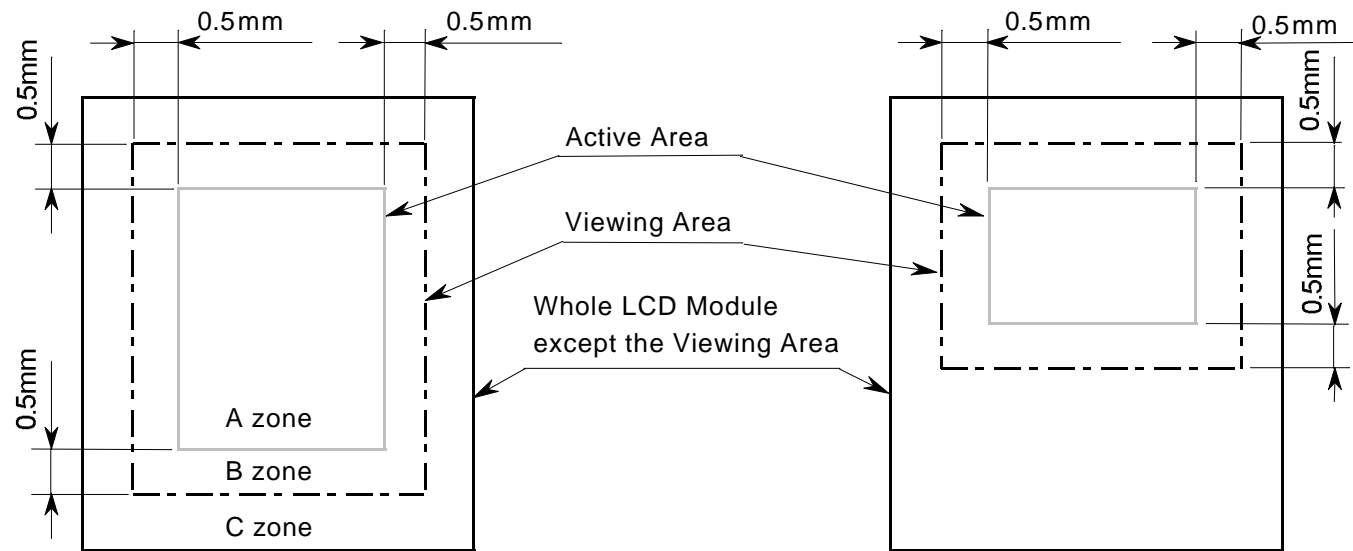
Approximately 20 [cm]

$\leq 30^\circ$



10.2 DEFINITION OF ZONE

- A zone : Active Area (Vide Page 9-1/1)
- B zone : Viewing Area
- C zone :Whole LCD Module except the Viewing Area (Including FPC & Plastic Mold)



### 10.3 COSMETIC SPECIFICATION

#### (MAIN LCD)

No.	ITEM			Maximum Acceptable number	Unit	Applied Zone	Inspection Mode	Remarks
1	Dot defect	Sparkle Mode	1 dot	0	pcs	A	Light-On	1),2),4)
			Adjacent dots	0	unit	A		
		Black Mode	1 dot	2	pcs	A		
			Adjacent dots	0	unit	A		
	The Total number			2	pcs	A		
2	Line defects			None	—	A	Light-On	—
3	Uneven Brightness: Line shape			Serious one is not allowed	—	A	Light-On	6)
4	Uneven Brightness: Dot shape							
5	Stain Inclusion : Line shape [mm]  W : Width L : Length	W ≤ 0.01	L:Ignored	Ignored	pcs	A,B	Light-On Light-Off	5),6),7)
		0.01 < W ≤ 0.05	L ≤ 2.0	2				
			L > 2.0	0				
		0.05 < W	—	see Dot shape				
6	Stain Inclusion : Dot shape [mm] D:Average diameter	D ≤ 0.1		Ignored	pcs	A,B	Light-On Light-Off	5),6),7)
		0.1 < D ≤ 0.2		2				
		0.2 < D		0				
7	Scratch of Polarizer : Line shape [mm] W : Width L : Length	W ≤ 0.015	L:Ignored	Ignored	pcs	A,B	Light-On Light-Off	5),6)
		W ≤ 0.04	L ≤ 5	2				
			L > 5	0				
8	Scratch of Polarizer : Dot shape [mm] D:Average diameter	D ≤ 0.2		Ignored	pcs	A,B	Light-On Light-Off	5),6)
		D ≤ 0.4		2				
		D > 0.4		0				
9	Polarizer bubble [mm] D:Average diameter	D ≤ 0.15		Ignored	pcs	A,B	Light-On Light-Off	5),6)
		0.15 < D ≤ 0.2		2				
		0.2 < D ≤ 0.4		1				
		0.4 < D		0				
10	Scratch, Dent of Plastic Mold			Serious one is not allowed	—	C	Light-Off	6)
11	Scratch of FPC			By Limited sample	—	C	Light-Off	6)

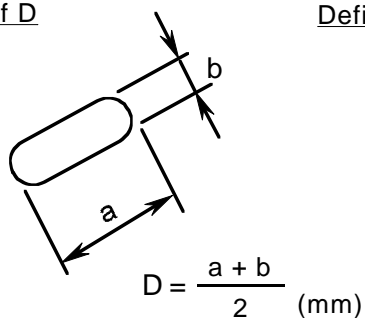
Note:

- 1) Defect whose area per each dot is over 50 % is regarded as Dot defect.
- 2) Defect whose brightness at all black screen is more than 30% is regarded as Bright Dot defect.
- 3) Defect whose brightness at all white screen is less than 70% is regarded as Dark Dot defect.
- 4) Defect dots which are not adjacent are regarded as single Dot defect each.
- 5) Defect which can be easily wiped off is disregarded
- 6) In case any problems would be brought out, both parties should discuss needed items such as limited samples.
- 7) In case of gray scale pattern, obvious defect is to be rejected.

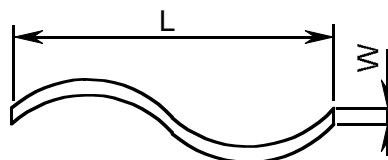
## (SUB LCD)

No.	ITEM			Maximum Acceptable number	Unit	Applied Zone	Inspection Mode	Remarks
1	Dot defect	Sparkle Mode	1 dot	0	pcs	A	Light-On	1),2),4)
			Adjacent dots	0	unit	A		
		Black Mode	1 dot	2	pcs	A		
			Adjacent dots	0	unit	A		
	The Total number			2	pcs	A		
2	Line defects			None	—	A	Light-On	—
3	Uneven Brightness: Line shape			Serious one is not allowed	—	A	Light-On	6)
4	Uneven Brightness: Dot shape							
5	Stain Inclusion : Line shape [mm]  W : Width L : Length	W ≤ 0.01	L:Ignored	Ignored	pcs	A,B	Light-On Light-Off	5),6),7)
		0.01 < W ≤ 0.05	L ≤ 2.0	2				
			L > 2.0	0				
		0.05 < W	—	see Dot shape				
6	Stain Inclusion : Dot shape [mm] D:Average diameter	D ≤ 0.1		Ignored	pcs	A,B	Light-On Light-Off	5),6),7)
		0.1 < D ≤ 0.2		2				
		0.2 < D		0				
7	Scratch of Polarizer : Line shape [mm] W : Width L : Length	W ≤ 0.015	L:Ignored	Ignored	pcs	A,B	Light-On Light-Off	5),6)
		W ≤ 0.04	L ≤ 5	2				
			L > 5	0				
8	Scratch of Polarizer : Dot shape [mm] D:Average diameter	D ≤ 0.2		Ignored	pcs	A,B	Light-On Light-Off	5),6)
		D ≤ 0.4		2				
		D > 0.4		0				
9	Polarizer bubble [mm] D:Average diameter	D ≤ 0.15		Ignored	pcs	A,B	Light-On Light-Off	5),6)
		0.15 < D ≤ 0.2		2				
		0.2 < D ≤ 0.4		1				
		0.4 < D		0				
10	Scratch, Dent of Plastic Mold			Serious one is not allowed	—	C	Light-Off	6)
11	Scratch of FPC			By Limited sample	—	C	Light-Off	6)

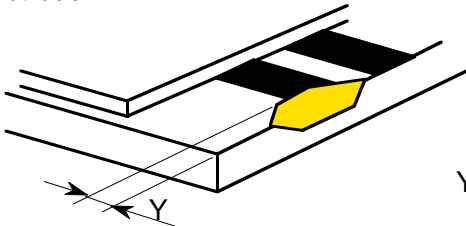
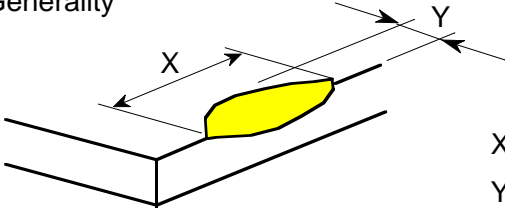
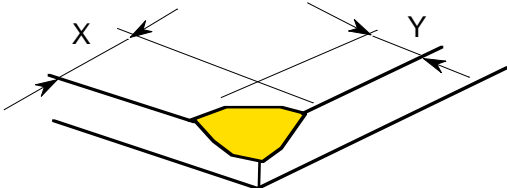
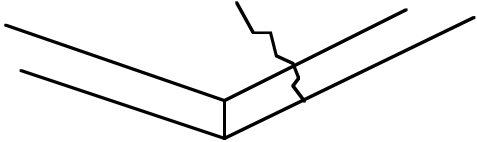
Definition of D



Definition of W and L





No.	ITEM	CRITERIA	A	B	C
10	Glass crack	(1)Electrode  $Y \leq 0.45$	—	—	○
		(2)Generality  $X \leq 5.0 \text{ [mm]}$ $Y \leq 1.5 \text{ [mm]}$ * No crack allowed to reach seal area. $Y \leq 1$ , in case of two cracks found.			
		(3)Corner  $X \leq 5.0$ $Y \leq 1.5$ * No crack allowed to reach seal area. $Y \leq 1$ , in case of two cracks found.			
		(4) The crack that has potential to enlarge  None			

## 11. PRECAUTION IN DESIGN

### 11.1 GENERAL ATTENTION

- (1) The LCD module is designed as display for mobile phone. When it is used for other purposes, we do not guarantee these specifications at all about the contents, quality, safety etc.. Moreover, this module is not particularly developed as an object for equipment in connection with a human life such as medical apparatus of life support relation.
- (2) Please do not decompose this LCD module. There is danger such as a burn, electric shock, and an injury. Moreover, when module is decomposed, we do not guarantee these specifications at all about the contents, quality, safety etc..

### 11.2 PRECAUTIONS AGAINST ELECTROSTATIC DISCHARGE

As this module contains C-MOS LSIs, it is not strong against electrostatic discharge. Make certain that the operator's body is connected to the ground through a wrist band etc. And don't touch I/F pins directly.

### 11.3 HANDLING PRECAUTIONS

- (1) Please do not leave on a humid environment for a long time. In storage, when the ambient temperature is over 35°C, please avoid high humidity.  
The polarizers degradation is easily caused in high temperature and high humidity. Moreover, It is also the cause of bubble and peeling of polarizer. Please store/operate the LCD module within the relative temperature and normal humidity.
- (2) Since the polarizer on the top tend to be easily scratched, 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 3H.
- (3) Maximum pressure to the surface must be less than 1.96Pa.  
And if the pressure area is less than 1cm<sup>2</sup>, maximum pressure must be less than 1.96N.
- (4) As the adhesives used for adhering upper/lower polarizers which will be deteriorated by a chemical reaction with such chemicals as acetone, toluene, ethanol and isopropyl alcohol. 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.
- (5) Lightly wipe to clean the dirty surface with absorbent cotton or other soft material like chamois, soaked in the recommended chemicals without scrubbing it hard.  
Always wipe the surface horizontally or vertically. Never give a wipe in a circle. 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.
- (6) Immediately wipe off saliva or water drop attached on the display area because it may cause deformation or faded color.

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- (7) Foggy dew deposited on the surface may cause a damage, stain or dirt to the polarizer.  
When you need to take out the LCD module from some place at low temperature for test, etc.  
It is required to be warmed them up to be temperature higher than room temperature before taking them out.
- (8) Touching the display area or I/F pins with bare hands or contaminating them are prohibited, because the stain on the display area and poor insulation between terminals are often caused by being touched with bare hands.  
(Some cosmetics are detrimental to polarizers.)
- (9) In general, the glass is fragile so that it, especially on its periphery, tends to be cracked or chipped in handling. Please do not give the LCD module sharp shocks caused by falling etc.
- (10) The LCD is a product made from glass. It is possible to be damaged by the strong shock.  
Please be careful and prevent to drop it.
- (11) It doesn't bend and scratch the I/F part. These are cause of no good contact.  
Please be careful.
- (12) Since the top and bottom area of bended FPC tend to be easily damaged.  
Please be fully careful not to push or have that area.
- (13) Please do not apply local stress to a LCM back side. It has potential to add a scratch to the backlight guide, or to become un-uniformity issue. Be careful of especially an interface connector portion at the time of connector installation.

#### 11.4 OPERATION PRECAUTION

- (1) The spike noise causes the mis-operation of circuits. Recommended condition of spike noise level is as follows :  $V_{cc} = \pm 200\text{mV}$  (Over and under shoot voltage)
- (2) Response time depends on the temperature. (In lower temperature, it becomes longer).  
And also brightness and color depend on the temperature.
- (3) Be careful for condensation at sudden temperature change.  
Condensation make damage to polarizer or electrical contact part.  
And after fading condensation, smear or spot will occur.
- (4) When fixed patterns are displayed at long times, afterimage is likely to occur.
- (5) Module has high frequency circuit. If you need to shield the electromagnetic noise, please do in yours.
- (6) Do not connect or remove the module from main system with power applied.
- (7) Strong light exposure causes mis-operation of driver.

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## 11.5 STORAGE

When storing LCD module as spare parts for a long time, the following precautions are necessary.

- (1) Store the LCD modules in a dark place ; do not expose them to sunlight or fluorescent light.  
Keep the temperature between 10 °C and 30 °C, and the humidity between 55% and 75%.
- (2) The polarizer surface should not come in contact with any other object.  
It is recommended that they be stored in the container in which they were shipped.

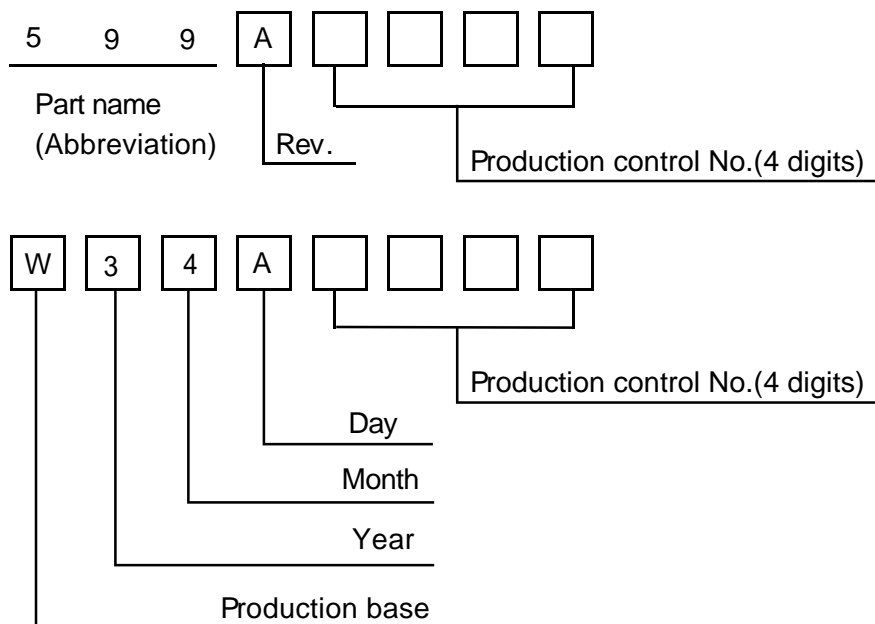
## 11.6 SAFETY

- (1) This liquid crystal display module is using glass. When it damages, please wear a protection glove to deal it. Moreover, when any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water.
- (2) Solder is used for mounting of internal electronic component at print circuit board. Since the Lead(Pb) is contained in solder. When you want to discard this LCD module, please follow local ordinances or regulations for disposal.

## 12. DESIGNATION OF LOT MARK

### 12.1 LOT MARK

Lot mark is consisted of 8 digits × 2 line



Revision	Contents of change
A	

Year	Figure in lot mark
2003	3
2004	4
2005	5
2006	6

Month	Figure in lot mark	Month	Figure in lot mark
Jan.	1	July	7
Feb.	2	Aug.	8
Mar.	3	Sep.	9
Apr.	4	Oct.	A
May	5	Nov.	B
June	6	Dec.	C

Day	1	2	3	4	5	6	7	8	9
Figure in lot mark	1	2	3	4	5	6	7	8	9

Day	10	11	12	13	14	15	16	17	18	19
Figure in lot mark	A	B	C	D	E	F	G	H	J	K
Day	20	21	22	23	24	25	26	27	28	29
Figure in lot mark	L	M	N	P	Q	R	S	T	U	V

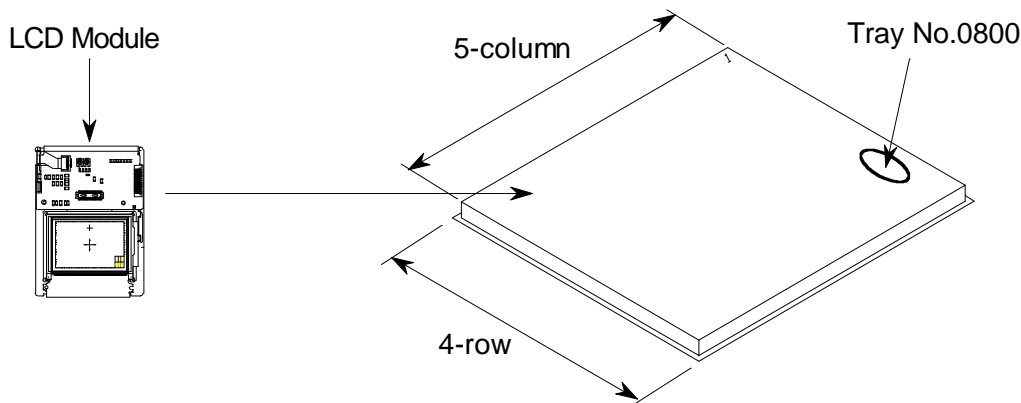
Day	30	31
Figure in lot mark	W	X

Production base	Figure in lot mark
Hitachi Displays	H
Hitachi Display Device (Suzhou)	S
WINTEK (Sub contract company in China)	W

Location of the lot mark : On the SUB LCD side.

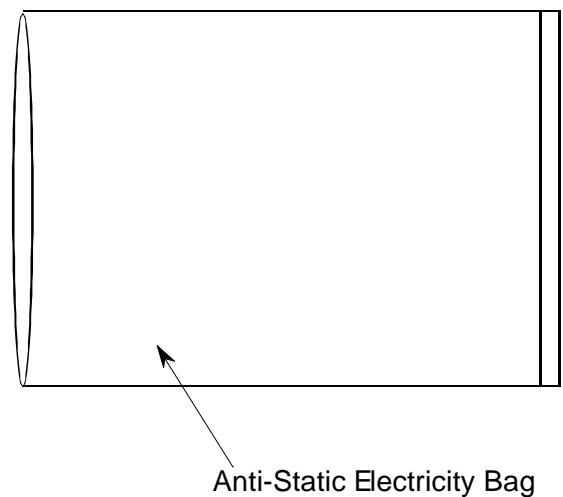
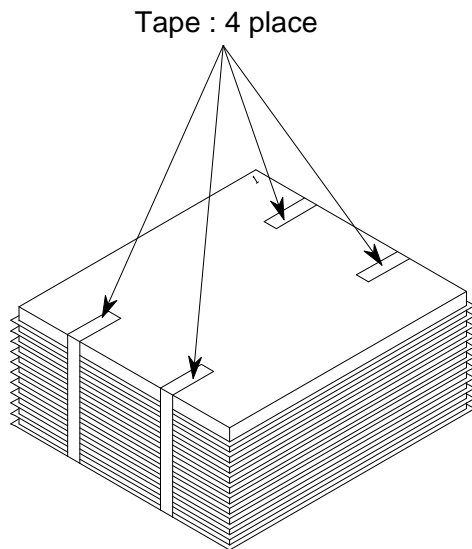
13. PACKING

(1) Plastic tray



Tray No. is rightward and LCD modules are contained making a FPC into right-hand side.

- \*Products are not runs aground on the tray.
- \*Have the circumference part of the product.
- \*Number of LCD module per tray: 20 pcs(5x4)



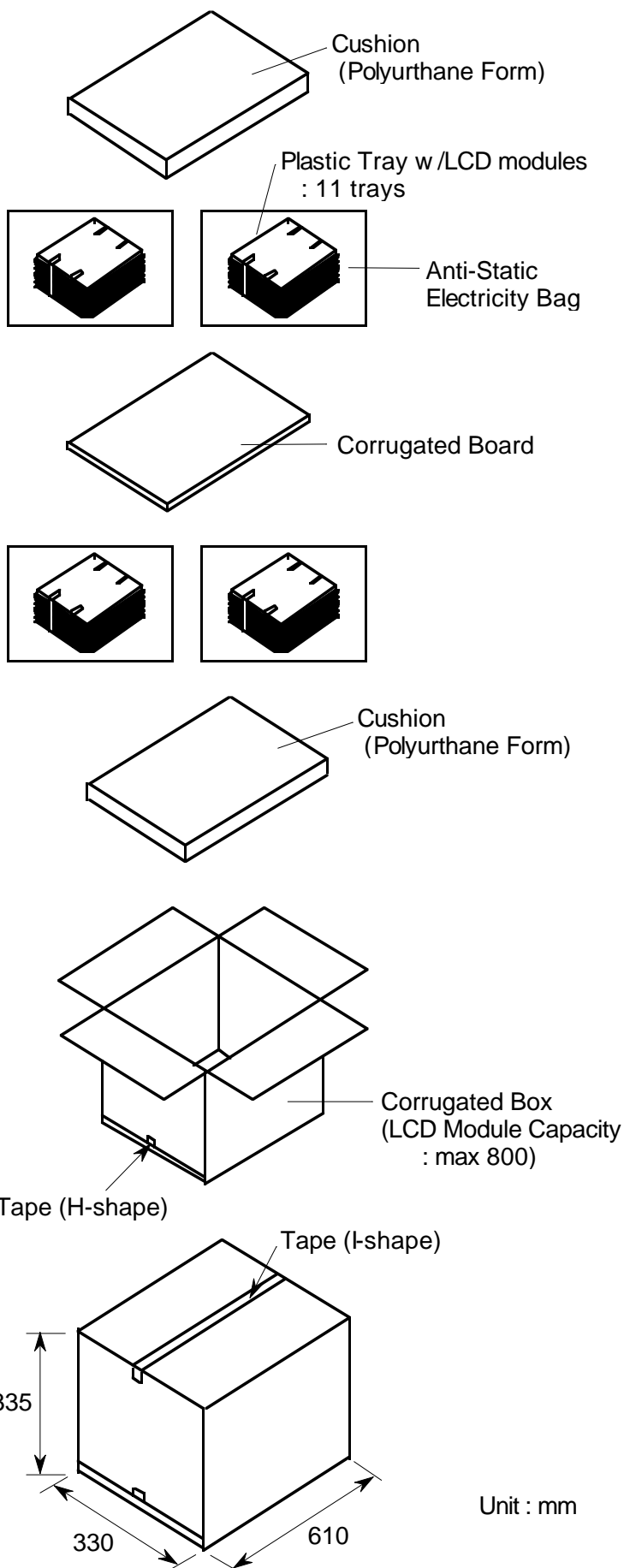
Tray: 11pcs stacked at same directions  
Top tray: No LCD Module, for Top cover purpose

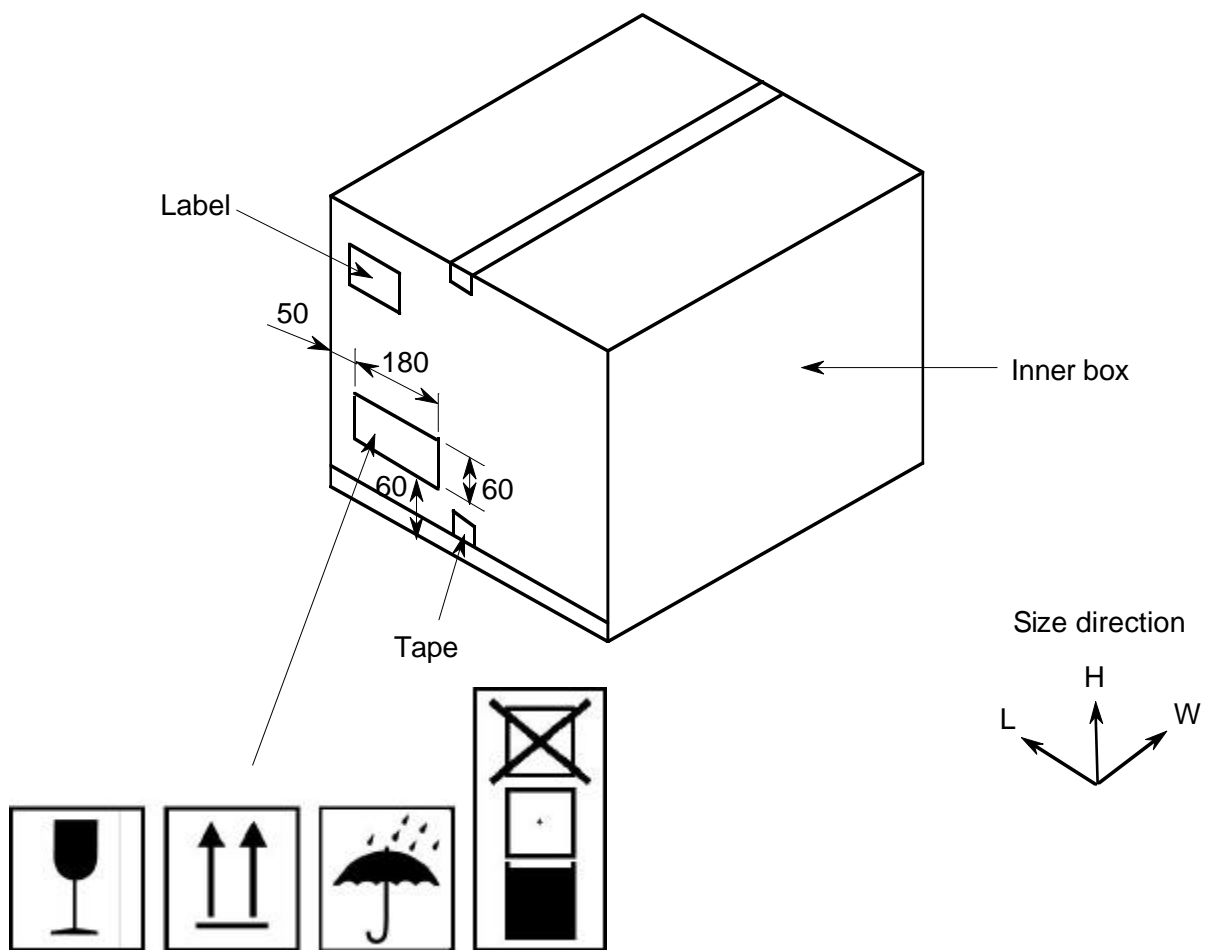
- 11pcs stacked tray is put in the anti-static electricity bag.
- \*Folded part of the bag is inserted under the tray.
  - \*Don't damage a bag.

## (2) Inner Box Specifications

Specification of storage to the inner box.

1. Polyurthaneform is put in the warehousing box.
2. 11pcs stacked tray stored in the anti-static electricity bag is stored in the inner box.
3. A corrugated cardboard is put on the stored tray.
4. 11pcs stacked tray stored in the anti-static electricity bag is stored in the box.
5. A polyurthaneform board is put on the stored tray.
6. Inner box are sealed by tape (I-shape).
7. A gap is filled up with the air bubble in case of a fraction.

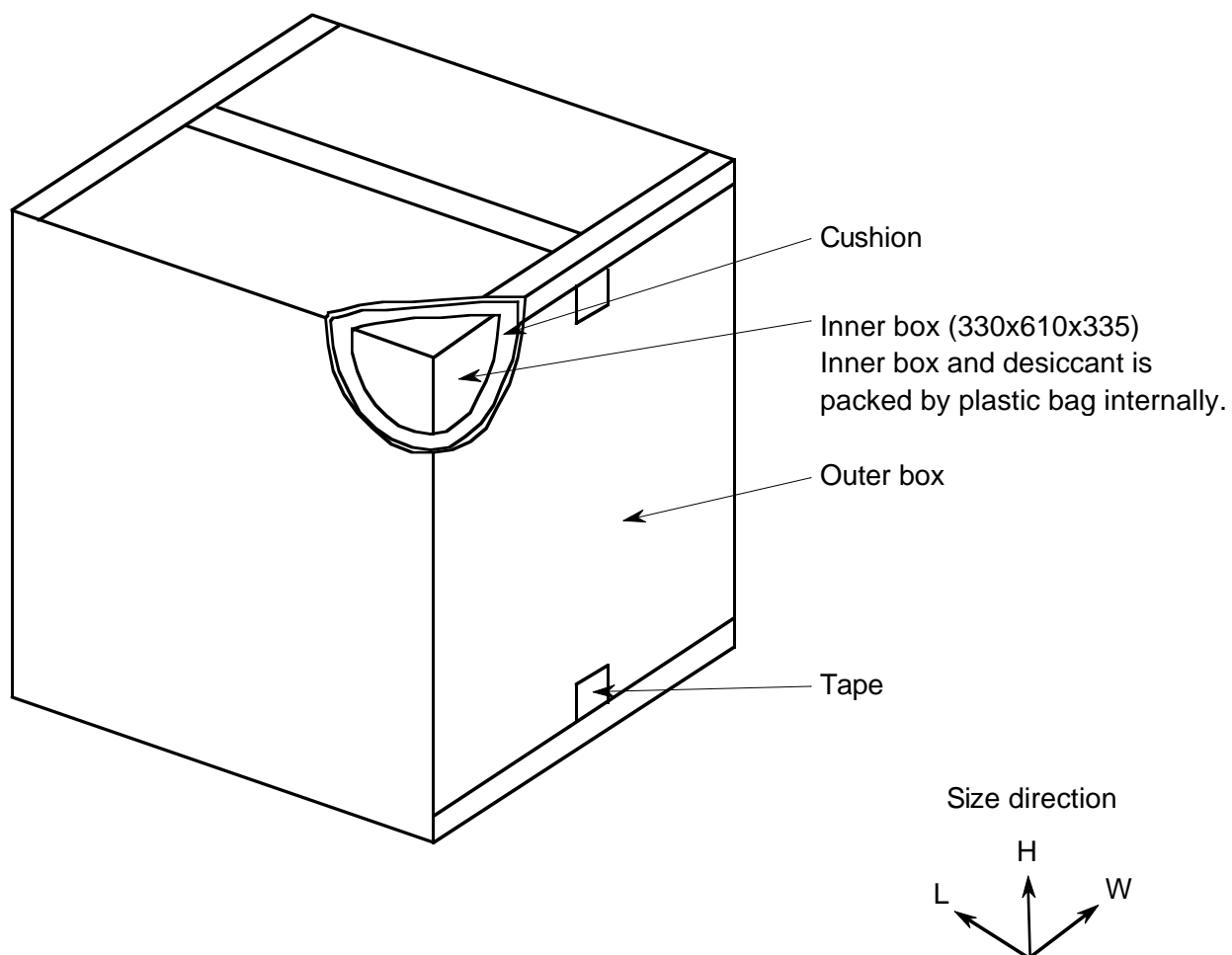




Weight	14kg in case of the quantity is 800pcs
Size(L,W,H)	330x610x335mm
Capacity	1~800pcs

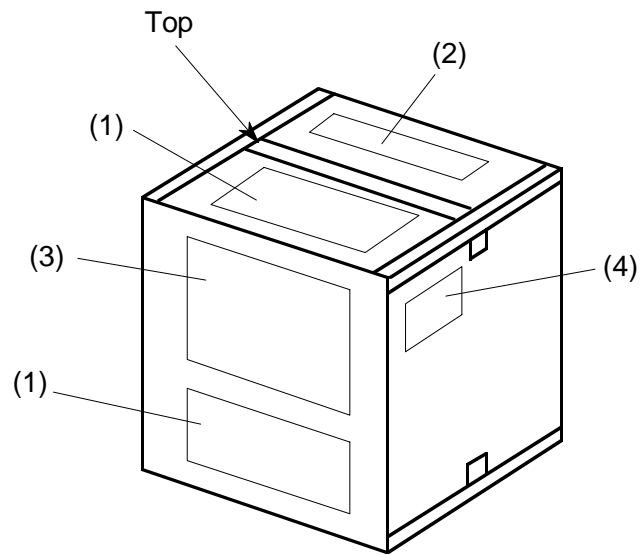


### (3) Outer Box Specifications




Weight	16kg in case of the quantity is 800pcs
Size(L,W,H)	450x730x470mm
Capacity	1~800pcs(Two packages if the quantity is 801~1600pcs)

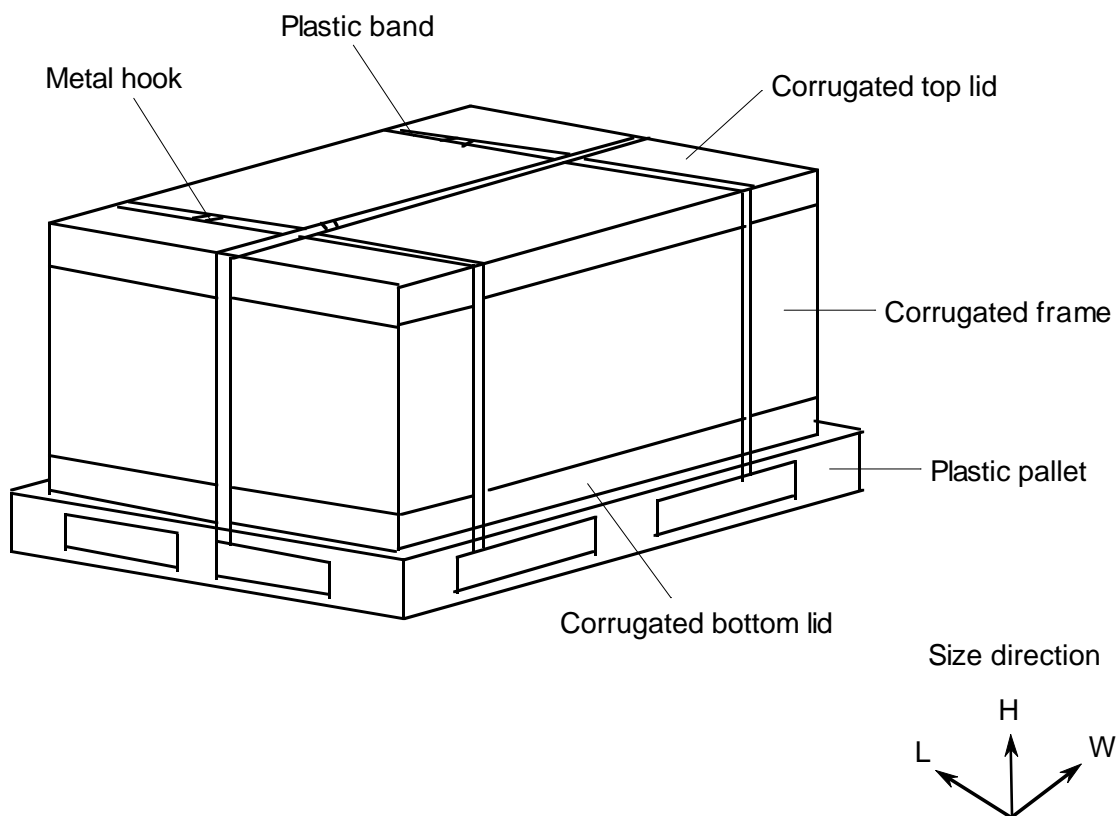
## Marking of Outer Box



Mark in Red letter, except for Case Mark

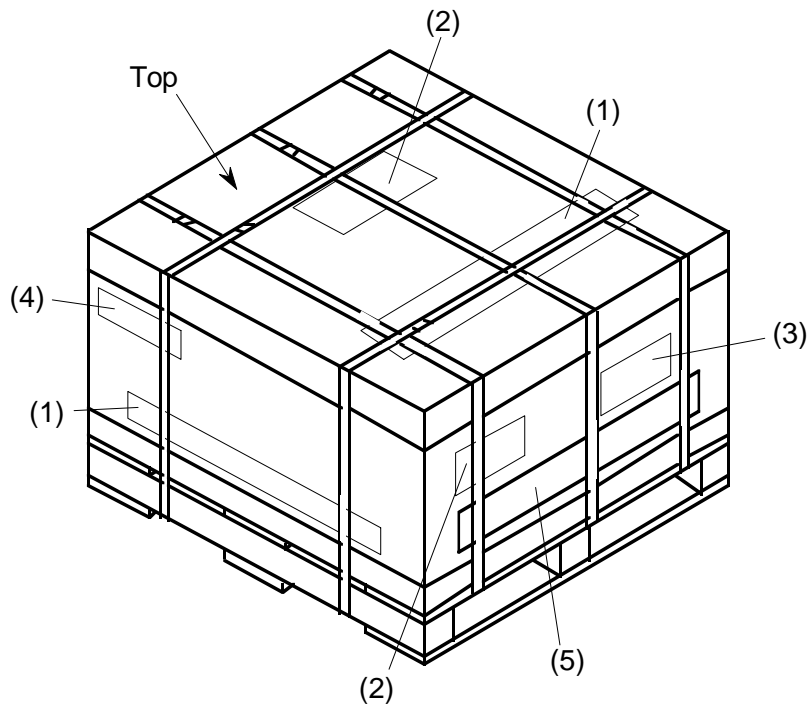
	Mark	Position
(1)	FRAGILE HANDLE WITH CARE (O.K for both one line or two lines)	Top & Both sides
(2)	GLASS	Top
(3)	Case Mark	Single side
(4)		Both sides

#### (4) Pallet Specifications

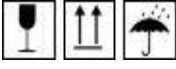


Weight	Approx.108kg in v\case of the quantity is 4800pcs
Size(L,W,H)	800x1100x880mm
Capacity	1601~4800pcs

## Marking of Outer Box



Mark in Red letter, except for Case Mark

	Mark	Position
(1)	FRAGILE HANDLE WITH CARE (O.K for both one line or two lines)	Top & Both sides
(2)	GLASS	Top
(3)	Case Mark	Single side
(4)		Both sides
(5)	HANDLE WITH FORKLIFT TRUCK ONLY	Both sides

#### 14. PRECAUTION FOR USE

- (1) A limit sample should be provided by the both parties on an occasion when the both parties agree to its necessity.  
Judgment by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.
- (2) On the following occasions, the handling of the problem should be decided through discussion and agreement between responsible 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 the specifications.
  - (3) When an inspection specification change or operating condition change by customer is reported to HITACHI, and some problem is arisen in the specification due to the change.
  - (4) When a new problem is arisen at the customer's operating set for sample evaluation
- (3) Regarding the treatment for maintenance and repairing, both parties will discuss it in six month 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.