HITACHI

Hitachi Displays, Ltd.

Date; December 17, 2007

For LG Electronics, Inc.

CUSTOMER'S ACCEPTANCE SPECIFICATIONS

TX05D128VM0AAA

CONTENTS

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

Accepted by : _____ Proposed by: Hiroshi Abe

Date : _____

DPATL000057700004YH

RECORD OF REVISIONS

Date	Sheet No.	Summary
Nov. 5, 2007	3284PS2608- TX05D128VM0AAA-2 Page 8-8/8	8.4.2 SEQUENCE State (b) Refresh Revised: Gamma setting R007Ch R0082h R0088h 0x5A5A -> 0x5555 R007Dh R0083h R0089h 0x3F3F -> 0x4141 R007Eh R0084h R008Ah 0x0404 -> 0x0707
	3284PS2610- TX05D128VM0AAA-2 Page 10-4/4	10.4 RELIABILITY TEST No.11 Pressure at COG Revised: Judgment: 1.0 kgf or more => 1.5kgf or more
Dec. 17, 2007	3284PS2610- TX05D128VM0AAA-3 Page 10-4/4	10.4 RELIABILITY TEST No.11 Pressure at COG Revised: Judgment: 1.5 kgf or more (Up to 1 failure of 24 pcs can be allowed.) => Judgment: 1.0 kgf or more (Up to 0 failure of 24 pcs can be allowed.)
	3284PS2613- TX05D128VM0AAA-3 Page 13-1/4, 13-2/4	13.1 INNER BOX SPECIFICATIONS Marking of Inner Box Added: Pb free label

3. GENERAL DATA

(1) Product Name	TX05D128VM0AAA
(2) Module Dimensions	37.2 (W) mm x 52.1 (H) mm x 1.5 (t) mm (Excluding FPC)
(3) Active Area Dimensions	30.6 (W) mm x 40.8 (H) mm
(4) Pixel Pitch	0.1275 (W) mm x 0.1275 (H) mm
(5) Resolution	240 x 3 (R,G,B)(W) x 320(H) dots
(6) Color Pixel Arrangement	RGB Vertical Stripe
(7) Display Mode	Transmissive Type, Normally Black Mode, In-Plane Switching Mode
(8) Number of Colors	65,536 / 262,144 / 16,777,216 Colors
(9) Viewing Direction	-
(10) Backlight	Light Emitting Diode (LED), Four LEDs are parallel connection Backlight current : 20 mA/LED (typ)
(11) Weight	5.2 g (typ)
(12) Power Supply Voltage	Vcc = 2.8 V (typ)
(13) Interface I/O power supply Note (1)	I/OVCC = 1.8 V to VCC (1.8 V ≤ I/OVCC ≤ Vcc) The same voltage as "H" level of a customer's interface signal must be supplied to I/OVcc.
(14) LCD Driver IC	uPD161707 (Source, Gate and Power IC)
(15) Interface	16-bit CPU Interface (80 systems)

Note (1) I/OVCC is reference voltage for adjusting I/O signal level of uPD161707.
I/OVCC voltage must be determined according to a customer's system.

4. ABSOLUTE MAXIMUM RATINGS

4. 1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS OF LCD

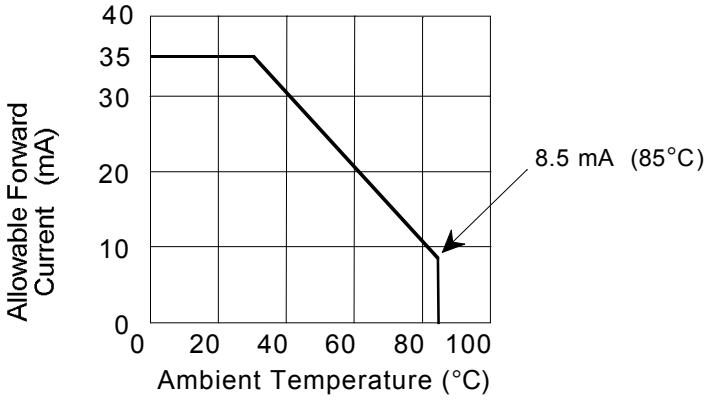
V_{SS} = 0 V, Ta = 25°C

Item	Symbol	Min	Max	Unit	Note
Power Supply for Interface	I/OVcc	-0.3	4.0	V	(1), (5)
Power Supply for Logic and Analog	Vcc	-0.3	4.0	V	(1)
Input Voltage	Vt	-0.3	I/OVcc+0.3	V	(2)
LED Reverse Voltage	VR	-	5	V	
LED Forward Current	I_{LED}	-	Note (3)	mA	per LED
Static Electricity	-	-	±2	kV	(4)

Notes (1) Keep all Voltages no lower than GND.

(2) Applies to the RESET*, CS*, RS, WR*, RD*, D0 to D15 pins, IFMODE3 and IFMODE4.

(3) Ambient Temperature vs. Allowable Forward Current



(4) 100pF-1.5 kohm, 25°C-70%RH
Static electricity discharge is to be aimed at the center of the active area.

(5) I/OVcc ≤ Vcc

4. 2 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

Item	Operating		Storage		Remarks
	Min	Max	Min	Max	
Ambient Temperature	-20°C	70°C	-30°C	80°C	Note (2)
Humidity	Note (1)		Note (1)		No condensation
Corrosive Gas	Not Acceptable		Not Acceptable		

Notes (1) Ta≤40°C 85%RH max.
Ta>40°C Absolute humidity must be lower than the humidity of 85%RH at 40°C.
The polarizer quality is not assured by the above values.

(2) Background color slightly changes depending on ambient temperature and viewing angle.

5. ELECTRICAL CHARACTERISTICS

LCD Module

VSS = 0 V, Ta = 25 °C

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Power Supply Voltage for Logic and Analog	Vcc	-	2.7	2.8	2.9	V	-
Power Supply Voltage for I/O interface	I/OVcc	-	1.8	-	Vcc	V	-
Input Voltage for Logic Circuits	Vi	"H" level	0.85xI/OVcc	-	-	V	(1),(2)
		"L" level	-	-	0.15xI/OVcc		
Output Voltage for Logic Circuits	Vo	"H" level	0.75xI/OVcc	-	-	V	(1),(2)
		"L" level	-	-	0.2xI/OVcc		
Input/Output Leak Current	ILi	-	-1.0		1.0	μA	(3)
Power Supply Current	IDD	All White	-	5.1	9.5	mA	(4),(6)
		Deep Standby	-	1	15	μA	(5),(6)
LED Forward Voltage	VLED	-	2.8	3.2	3.5	V	(7)
LED Forward Current	ILED	-	-	20	Note (8)	mA	(7)
LED Reverse Current	IR	-	-	-	50	μA	(7)

Notes (1) 1.8V ≤ I/OVcc ≤ Vcc (I/OVcc = 1.8 V to 2.8V)

(2) Input : RESET*, CS*, RS, WR*, RD*, IFMODE3, IFMODE4, D0 to D15
Output : D0 to D15, VSYNC-OUT, Maker ID

(3) Excepted the current of out driving MOS.

(4) Vcc = I/OVcc = 2.8 V, fFLM = 85 Hz, Frame inversion mode.

(5) Vcc = I/OVcc = 2.8 V, Deep standby mode,
Vcc, I/OVcc: ON, Display: OFF,
Input signals (RESET*, CS*, RS, WR*, RD*, IFMODE3, IFMODE4, D0 to D15)="H"
Internal oscillator: STOP, Power supply: OFF, Data signals:OFF.

(6) Operation Mode: Refer to Item 8.4.1, State (b).

(7) Shows the value per LED.

(8) The operating current of LED should be determined within the maximum rating of the temperature environmental condition.

6. OPTICAL CHARACTERISTICS

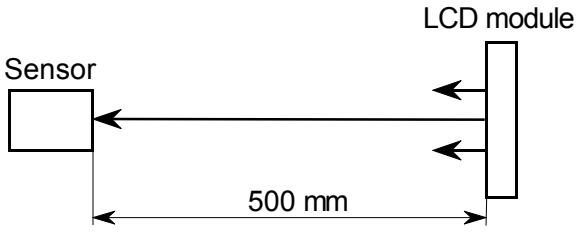
LCD (BACKLIGHT ON)

Item		Symbol	Condition	Min	Typ	Max	Unit	Note
Brightness		B	ϕ=0°, θ=0°	300	400	-	cd/m^2	(1), (2)
Brightness Uniformity		-	ϕ=0°, θ=0°	80	-	-	%	(2), (3), (5)
View ing Angle		ϕ1+ϕ2	θ=0°, K≥10	-	170	-	deg	(4), (6), (7)
			θ=90°, K≥10	-	170	-		
Contrast Ratio		K	ϕ=0°, θ=0°	300	400	-	-	(6)
Response Time		tr+tf	ϕ=0°, θ=0°	-	35	60	ms	(8)
Color Tone (Primary Color)	Red	x	ϕ=0°, θ=0°	0.60	0.65	0.70	-	-
		y		0.28	0.33	0.38		
	Green	x		0.28	0.33	0.38		
		y		0.56	0.61	0.66		
	Blue	x		0.09	0.14	0.19		
		y		0.03	0.08	0.13		
	White	x		0.27	0.32	0.37		
		y		0.28	0.33	0.38		
Color temperature		k		5500	-	9500		
NTSC Ratio		-		65	70	-	%	-

Measurement Conditions

Measurement environment : Dark room
Ambient temperature : Ta = 25°C
Sequence : Refer to Item 8.4.2.
Pow er supply voltage : Vcc = I/OVcc = 2.8 V
Backlight current : I_{LED} = 20 mA/1LED

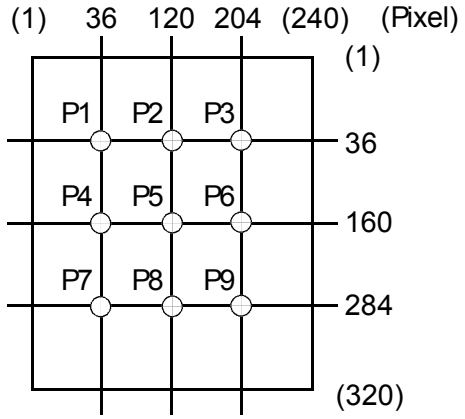
Note (1) Definition of Brightness "B"



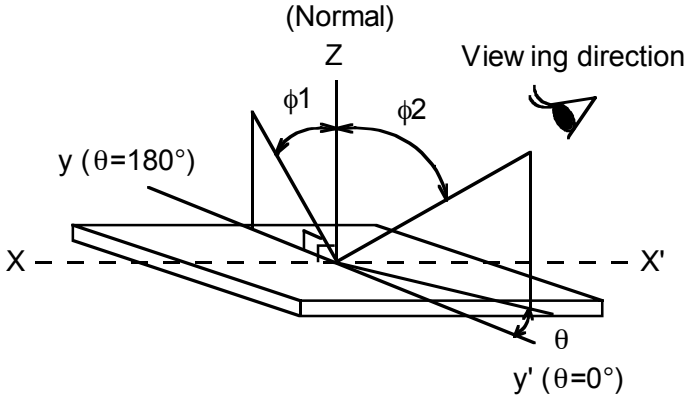
Sensor : TOPCON's BM-5A or equivalent
Measuring point : Center of LCD's active area

(2) Display image for measurement: All w hite

Notes (3) Measurement point



(4) Definitions of θ and ϕ



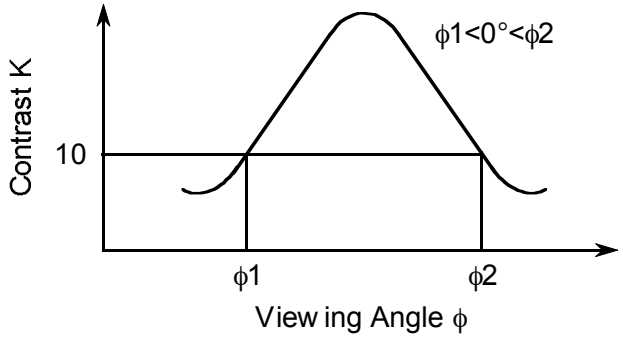
(5) Definition of Brightness Uniformity

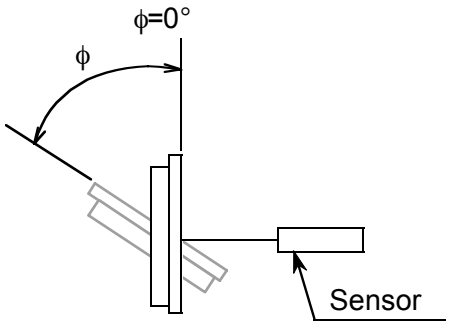
$$\text{Brightness Uniformity} = \frac{\text{Brightness (min)}}{\text{Brightness (max)}} \times 100\ (\%)$$

(6) Definition of Contrast "K"

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

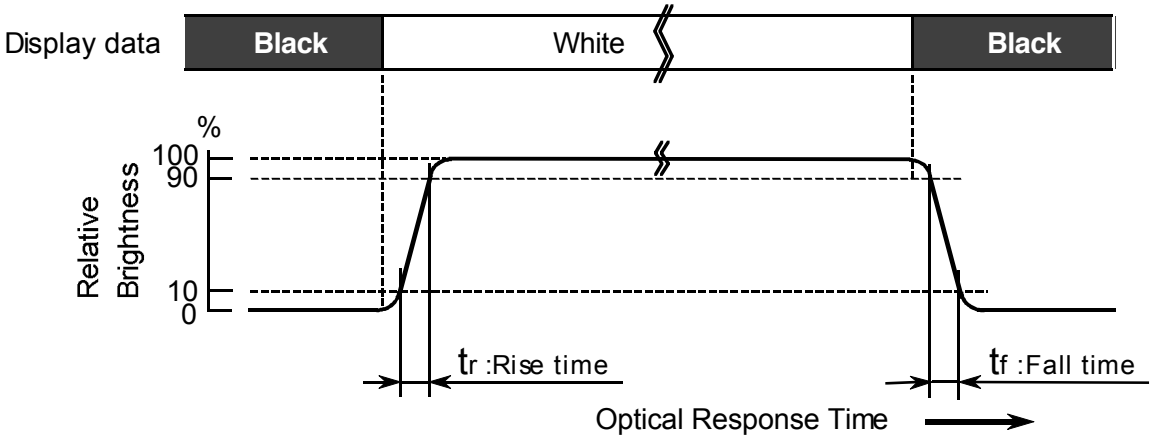
(7) Definition of View ing Angle ϕ1 and ϕ2



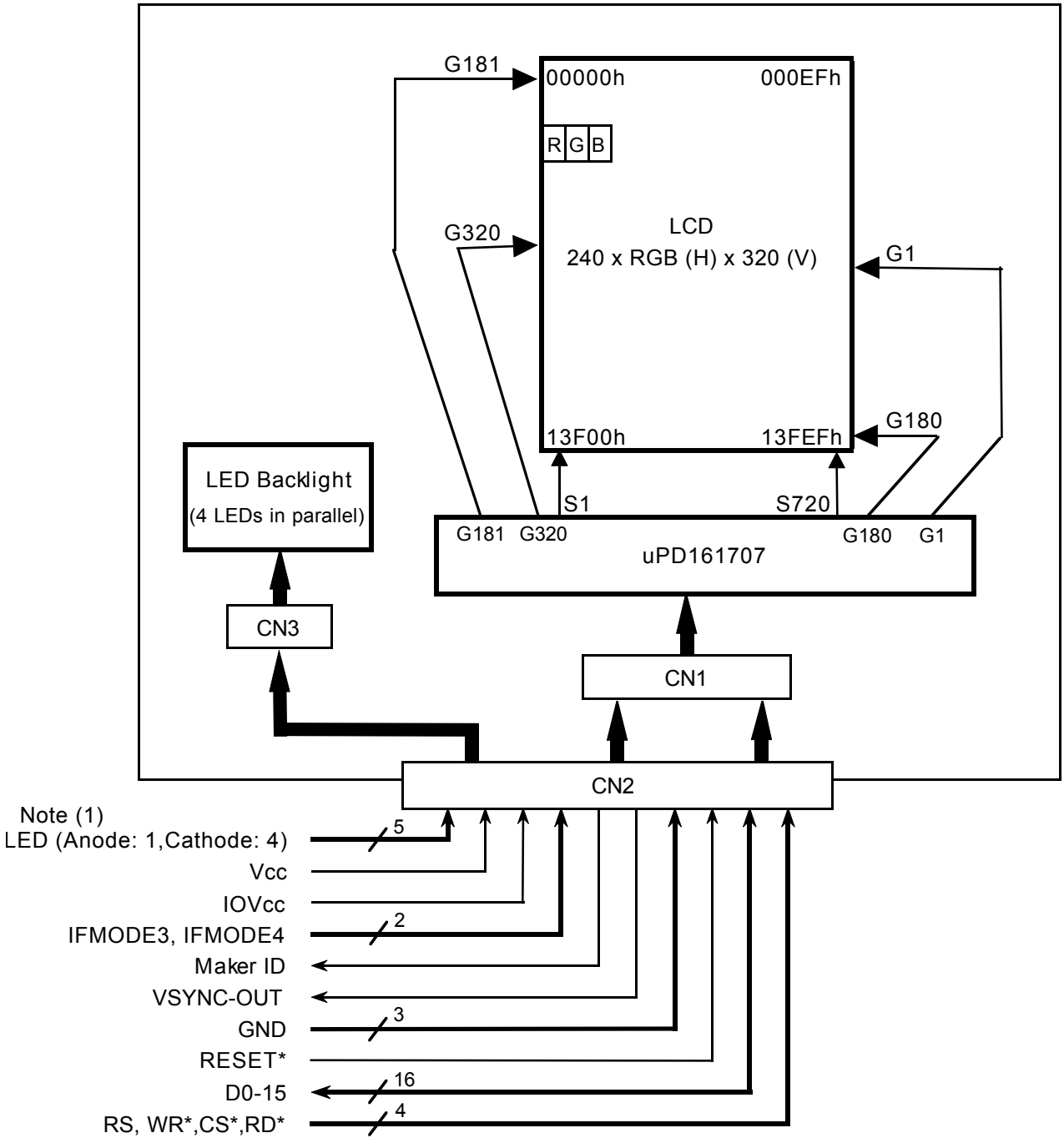


Sensor : TOPCON's BM-5A or equivalent

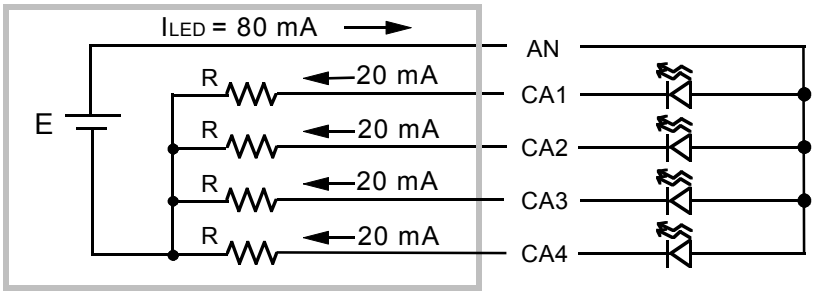
(8) Definition of Optical Response Time



7. BLOCK DIAGRAM



Note (1) Please connect the resistor (R = 200Ω) for current control between LED (cathode) and GND in the customer's system.



Hitachi Displays, Ltd.	Date	Dec. 17, 2007	Sh. No.	3284PS 2607 - TX05D128VM0AAA - 3	Page	7-1/1

8. INTERFACE

8.1 INTERNAL PIN CONNECTION

Pin No.	Signal	I/O	Function	Driver's Signal Name
1	LED (AN)	-	Power Supply for LED	-
2	LED (CA)	-	Ground for LED	-
3	LED (CA)	-	Ground for LED	-
4	LED (CA)	-	Ground for LED	-
5	LED (CA)	-	Ground for LED	-
6	IFMODE4	I	Interface mode Select	DTX3
7	GND	-	Ground	-
8	IFMODE3	I	Interface mode Select	DTX2
9	VSYNC-OUT	O	Frame Start Signal	CSTB
10	RD*	I	Read Strobe	/RD
11	WR*	I	Write Strobe	/WR
12	RS	I	Data/Command Select	RS
13	RESET*	I	Reset	/RESET
14	CS*	I	Chip Select	/CS
15	GND	-	Ground	-
16	D15	I/O	Data Bus (Instruction & Display Data)	D15
17	D14	I/O	Data Bus (Instruction & Display Data)	D14
18	D13	I/O	Data Bus (Instruction & Display Data)	D13
19	D12	I/O	Data Bus (Instruction & Display Data)	D12
20	D11	I/O	Data Bus (Instruction & Display Data)	D11
21	D10	I/O	Data Bus (Instruction & Display Data)	D10
22	D9	I/O	Data Bus (Instruction & Display Data)	D9
23	D8	I/O	Data Bus (Instruction & Display Data)	D8
24	D7	I/O	Data Bus (Instruction & Display Data)	D7
25	D6	I/O	Data Bus (Instruction & Display Data)	D6
26	D5	I/O	Data Bus (Instruction & Display Data)	D5
27	D4	I/O	Data Bus (Instruction & Display Data)	D4
28	D3	I/O	Data Bus (Instruction & Display Data)	D3
29	D2	I/O	Data Bus (Instruction & Display Data)	D2
30	D1	I/O	Data Bus (Instruction & Display Data)	D1
31	D0	I/O	Data Bus (Instruction & Display Data)	D0
32	Maker ID (Low)	O	Maker ID (Low : Ground level)	-
33	Vcc2(2.8±0.05V)	-	Interface I/O Power	VCCIO
34	Vcc1(2.8±0.05V)	-	Power Supply for Analog Circuit	VDC
35	GND	-	Ground	-

Suitable Connector: 04-6293-035-001-829+ (KYOCERA ELCO)

8.2 CPU INTERFACE MODE SETTING

8.2.1 SELECT CPU INTERFACE MODE

Mode Select		D Pin	RAM Write Data	Colors	Note
IFMODE3	IFMODE4				
0	0	D15-D0	3 transfers (1st: 16 bits, 2nd: 16 bits, 3rd: 16 bits)	16M	
1	0		2 transfers (1st: 16 bits, 2nd: 2 bits)	262k	
0	1	D8-D0	2 transfers (1st: 9 bits, 2nd: 9 bits)	262k	(1)
1	1	D15-D0	Single transfer (16 bits)	65k	

Note (1) The unused D pins must be fixed at "IOVcc" or "GND".

8.2.2 DATA FORMAT OF CPU INTERFACE MODE

< 16bit+16bit+16bit (2 pixels data) three times transfer >

Index/Command data format

Data Bus	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
Index	IB15	IB14	IB13	IB12	IB11	IB10	IB9	IB8	IB7	IB6	IB5	IB4	IB3	IB2	IB1	IB0
Command	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0

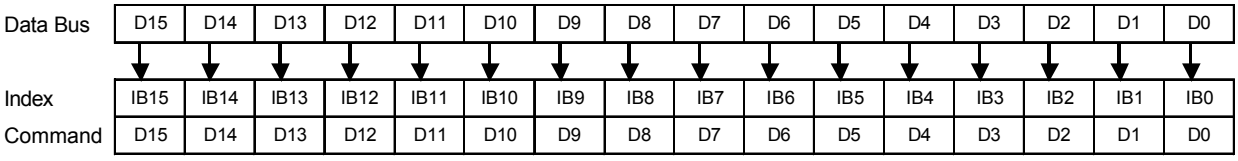
RAM write format

Data Bus	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
Pixel data																
1st Transfer	R7(n)	R6(n)	R5(n)	R4(n)	R3(n)	R2(n)	R1(n)	R0(n)	G7(n)	G6(n)	G5(n)	G4(n)	G3(n)	G2(n)	G1(n)	G0(n)
2nd Transfer	B7(n)	B6(n)	B5(n)	B4(n)	B3(n)	B2(n)	B1(n)	B0(n)	R7(n+1)	R6(n+1)	R7(n+1)	R6(n+1)	R7(n+1)	R6(n+1)	R7(n+1)	R6(n+1)
3rd Transfer	G7(n+1)	G6(n+1)	G5(n+1)	G4(n+1)	G3(n+1)	G2(n+1)	G1(n+1)	G0(n+1)	B7(n+1)	B6(n+1)	B5(n+1)	B4(n+1)	B3(n+1)	B2(n+1)	B1(n+1)	B0(n+1)

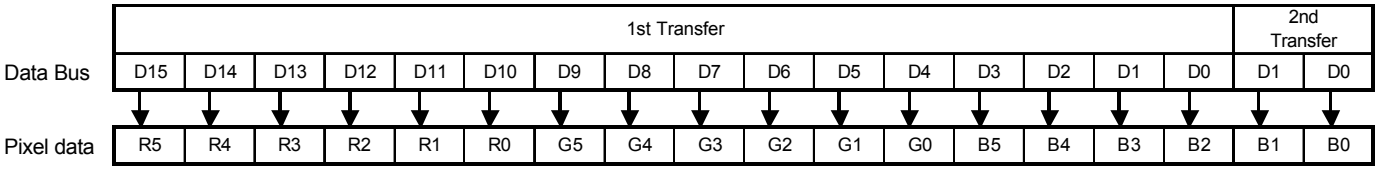
Remark n: Pixel No.

< 16bit+2bit 2 times transfer >

Index/Command data format

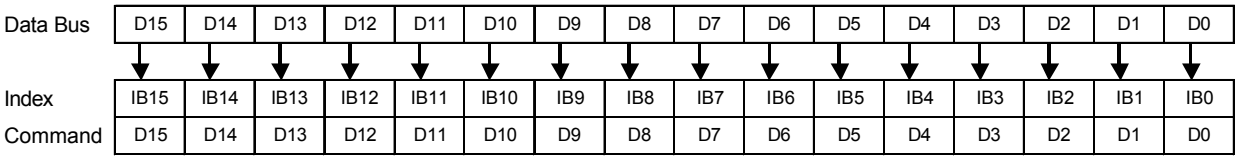


RAM write format

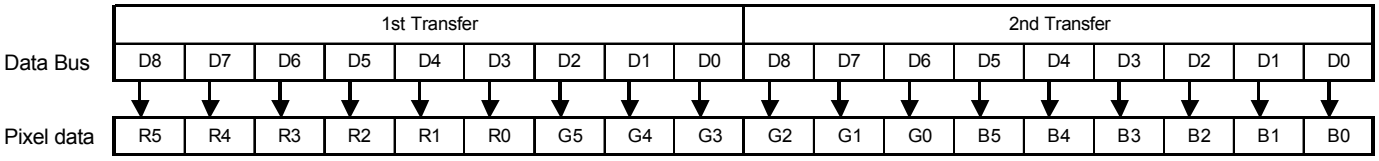


< 9bit+9bit 2 times transfer >

Index/Command data format

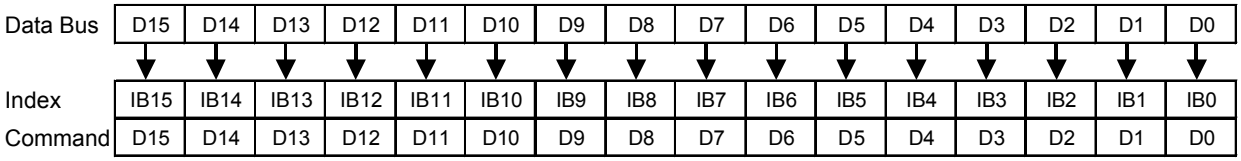


RAM write format

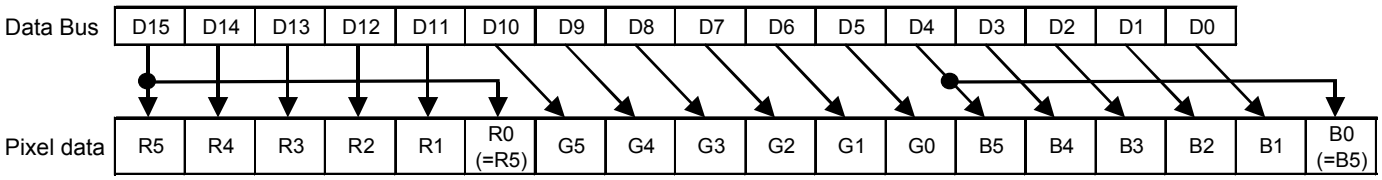


< 16bit 1 time transfer >

Index/Command data format



RAM write format



8.3 INTERFACE TIMING

8.3.1 80-system Bus interface Timing Characteristics

<<IOVCC=1.8V~Vcc>>

Timing Diagram : Fig.1

Parameter	Symbol	Condition		Min.	Typ.	Max.	Unit
Address hold time	tAH	RS		11	-	-	ns
Address set-up time	tAS	RS		0	-	-	ns
System cycle time	tCYC	Read		420	-	-	ns
		Write, horizontal writing (INC(D2 or R5) = 0)		53	-	-	ns
		Write, vertical writing (INC(D2 or R5) = 1)		53	-	-	ns
Control low level pulse width (/WR)	tCCLW	/WR		21	-	-	ns
Control low level pulse width (/RD)	tCCLR	/RD		210	-	-	ns
Control high level pulse width (/WR)	tCCHW	/WR		21	-	-	ns
Control high level pulse width (/RD)	tCCHR	/RD		84	-	-	ns
Data set-up time	tDS	D0 to D15		42	-	-	ns
Data hold time	tDH	D0 to D15		0	-	-	ns
CS set-up time	tCSS	CS	Write	37	-	-	ns
			Read	210	-	-	ns
CS hold time	tCSH	CS	Write	0	-	-	ns
			Read	21	-	-	ns
/RD access time	tACC	D0 to D15, CL= 100pF		-	-	190	ns
Output disable time	tOH	D0 to D15		-	-	95	ns

8.3.2 Reset Timing Characteristics

<<IOVCC=1.8V~Vcc>>

Timing Diagram : Fig.2

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Recovery time	tREC		11	-	-	μs
Reset pulse width	tRW		11	-	-	μs
Reset un-reacted pulse width	tET		-	-	2	μs

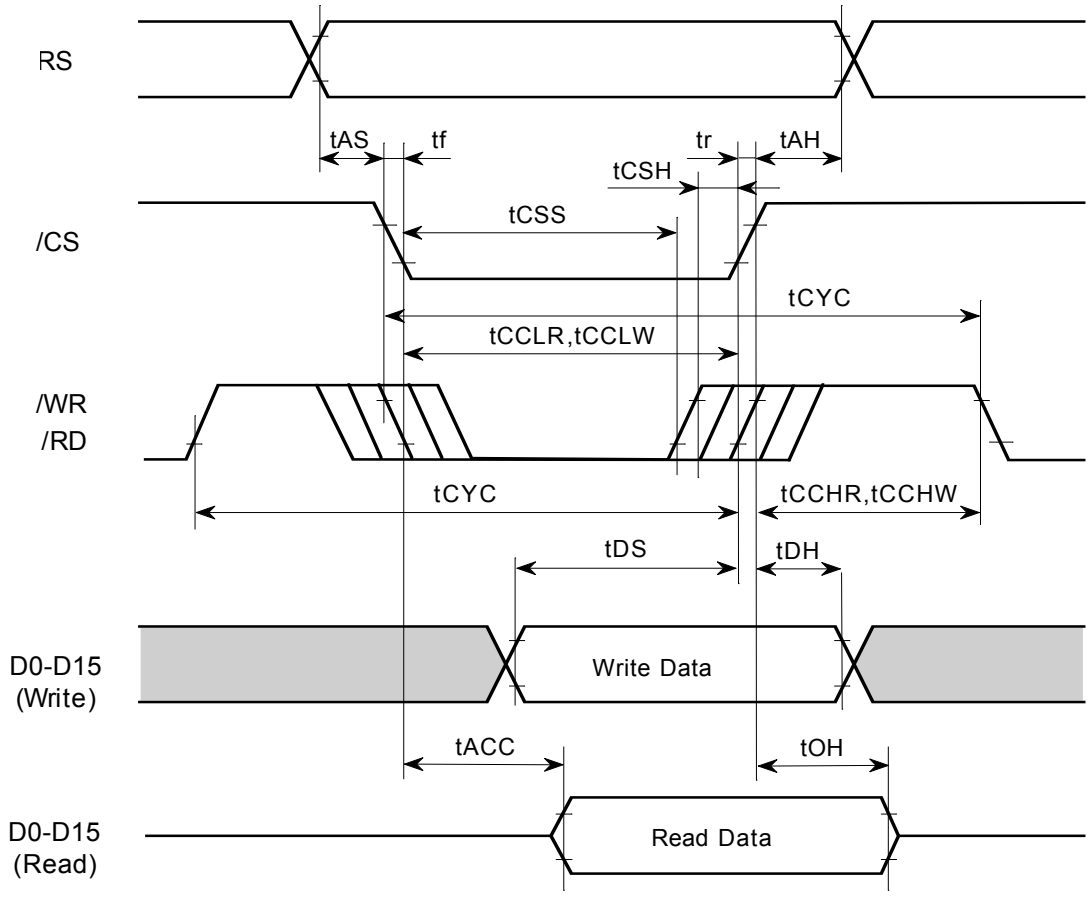


Fig.1 Bus Timing

Notes (1) The rise and fall times (tf, tr) of an input signal are specified at 15ns or less.
It is prescribed by (tr + tf) < (tCYC - tCCLW - tCCHW) or the case where system cycle time is used at high speed.
For example, when it is in tCYC=53ns, tCCLW=21ns, tCCHW=21ns, it becomes tr + tf < 11ns.
(2) All timings data is specified at 20% to 80% of IOVCC.

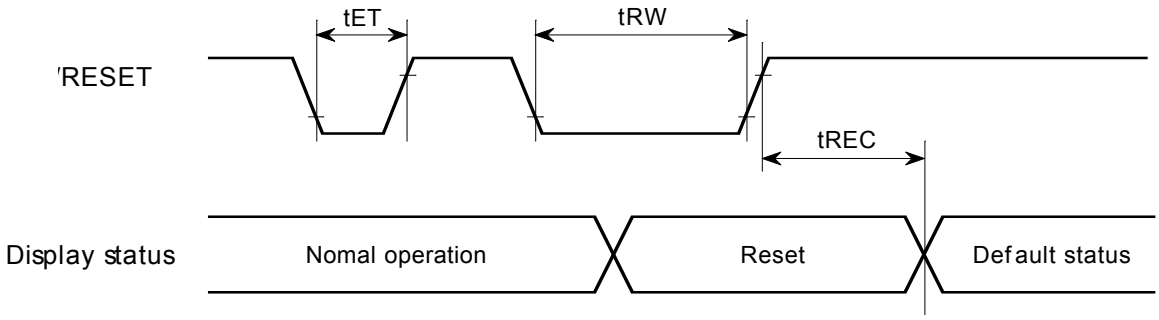
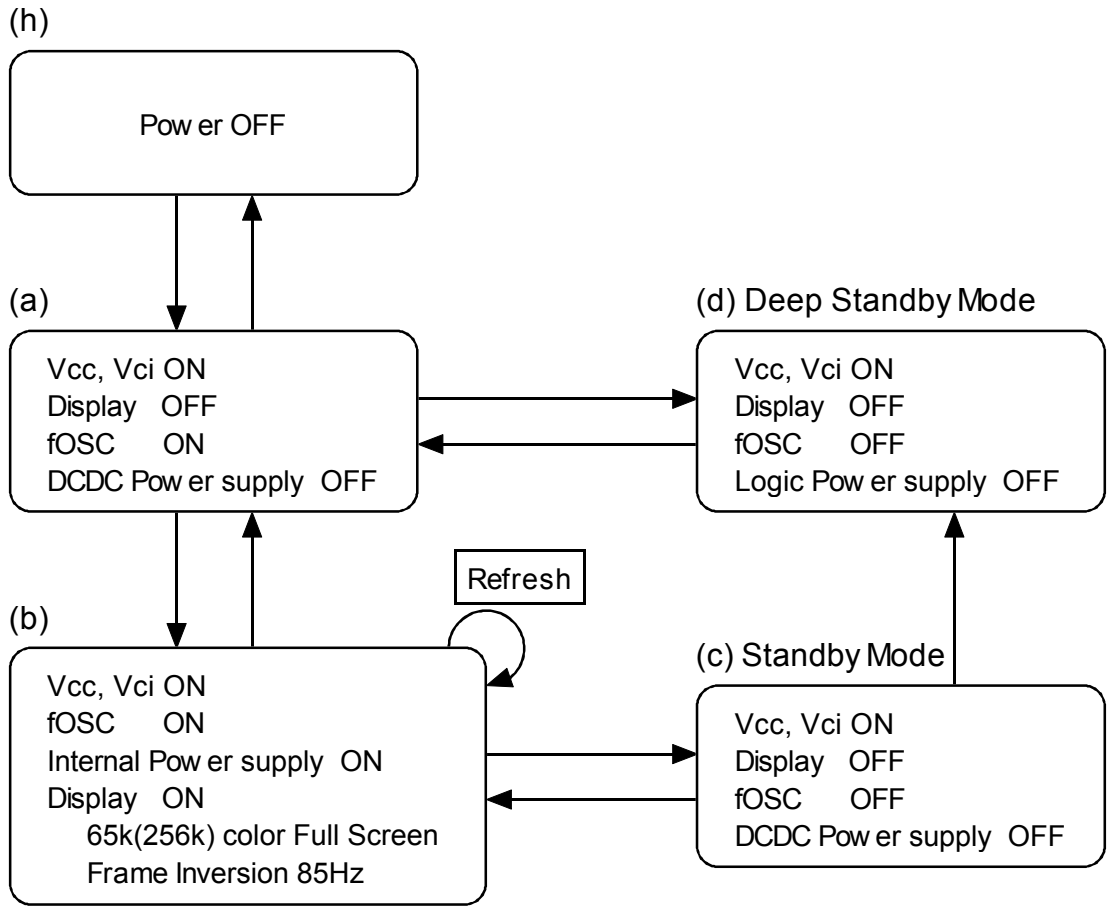


Fig.2 Reset Timing

8.4 REGISTER SETTING

8.4.1 STATE TRANSITION DIAGRAM OF OPERATION MODE



8.4.2 SEQUENCE

State (h) to (a)

1	Power ON	Vcc ON	
2		ioVcc ON	
3		Vci ON	
4		reset* = "L"	
5	Reset	wait	10µs Min.
6		reset* = "H"	
7		wait	10µs Min.

State (a) to (h)

1	Power OFF	Vci OFF	
2		ioVcc OFF	
3		Vcc OFF	

State (b) to (a)

1	Display OFF	R0000h	0x0008
2		wait	50ms
3		R0000h	0x002C
4		wait	2 frames Min.
5		R003Ah	0x0000

State (b) to (s)

1	Standby	R0000h	0x0008
2		wait	2 frames Min.
3	STBY_GOFF =1	R0000h	0x000C
4	Oscillation stop	R003Ah	0x0000

State (s) to (b)

1	Oscillation start	R003Ah	0x0001
2		wait	10ms Min.
3	STBY_GOFF =0	R0000h	0x0008
4	Standby Cancellation	R0000h	0x0000

State (s) to (d)

1	Deep Standby	R000Ch	0x0001

State (d) to (a)

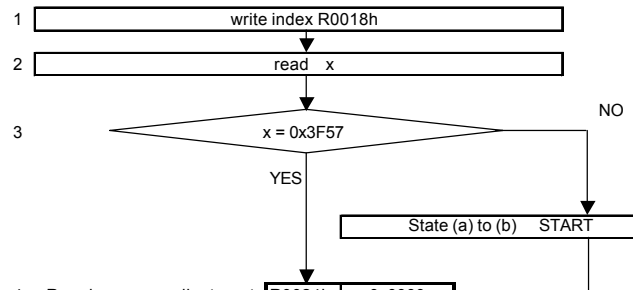
1	DSTB Mode Cancellation(1)	CS="L"	⤵⤴	Sequential control
2	DSTB Mode Cancellation(2)	CS="L"	⤵⤴	
3		wait	1ms	
4	DSTB Mode Cancellation(3)	CS="L"	⤵⤴	
5	DSTB Mode Cancellation(4)	CS="L"	⤵⤴	
6	DSTB Mode Cancellation(5)	CS="L"	⤵⤴	
7	DSTB Mode Cancellation(6)	CS="L"	⤵⤴	

State (a) to (b)

1	Command reset	R0003h	0x0001	
2	Oscillation start	R003Ah	0x0001	
3		wait	10ms	
4	Rough gamma adjustment	R0024h	0x0000	
5	Rough gamma adjustment	R0025h	0x0001	
6	Rough gamma adjustment	R0026h	0x0001	
7	Rough gamma adjustment	R0027h	0x0000	
8	Gamma middle amplifier OFF	R0052h	0x0000	
9	RGB independent gamma ON	R0078h	0x0001	
10	BR0_R	R007Bh	0x0909	
11	BR0_G	R0081h	0x0909	
12	BR0_B	R0087h	0x0909	
13	GAM0_R	R007Ch	0x5555	
14	GAM0_G	R0082h	0x5555	
15	GAM0_B	R0088h	0x5555	
16	GAM1_R	R007Dh	0x4141	
17	GAM1_G	R0083h	0x4141	
18	GAM1_B	R0089h	0x4141	
19	GAM2_R	R007Eh	0x0707	
20	GAM2_G	R0084h	0x0707	
21	GAM2_B	R008Ah	0x0707	
22	BR1_R	R007Fh	0xFAFA	
23	BR1_G	R0085h	0xFAFA	
24	BR1_B	R008Bh	0xFAFA	
25	TILT_R	R0080h	0xF9F9	
26	TILT_G	R0086h	0xF9F9	
27	TILT_B	R008Ch	0xF9F9	
28	Dot clock set	R002Eh	0x002C	85Hz
29	Back porch	R002Fh	0x0008	
30	Front porch	R0030h	0x0008	
31	X min	R0008h	0x0000	
32	X max	R0009h	0x00EF	
33	Y min	R000Ah	0x0000	
34	Y max	R000Bh	0x013F	
35		R0037h	0x0001	
36	Window mode	R0005h	0x0018	
37	RAM X address	R0006h	0x0000	
38	RAM Y address	R0007h	0x0000	
39	Gate scan mode	R0032h	0x0000	
40	262,244 of colors	R0004h	0x0000	
41	Deep STB OFF	R000Ch	0x0000	
42	Power supply (1) VGH, VGL	R0018h	0x3F57	
43	Power supply (2) DC/DC	R0019h	0x0080	
44	Power supply (3) DCDC division	R001Ah	0x00F0	
45	Power supply (4) DCDC start setting	R001Bh	0x0022	
46	Power supply (5) VGM, Vr, Vs, Vref	R001Ch	0x0FFD	
47	Vcom current amplifier set	R001Dh	0x0033	
48	Vcom output set	R001Eh	0x0015	
49	Vcom amplitude set	R001Fh	0x0014	
50	Standby ON	R0000h	0x0008	
51		wait	2 frames Min.	
52	Gate control	R003Bh	0x0001	
53	Standby OFF	R0000h	0x0000	
54	e-fuse set	R005Ch	0x0001	
55		wait	3ms Min.	
56	RAM write/read	R000Eh	-	

Notes
(1) The values for gamma set and power set are just our suggestion.
They will be optimized according to your evaluation results.

State (b) Refresh Note(2)



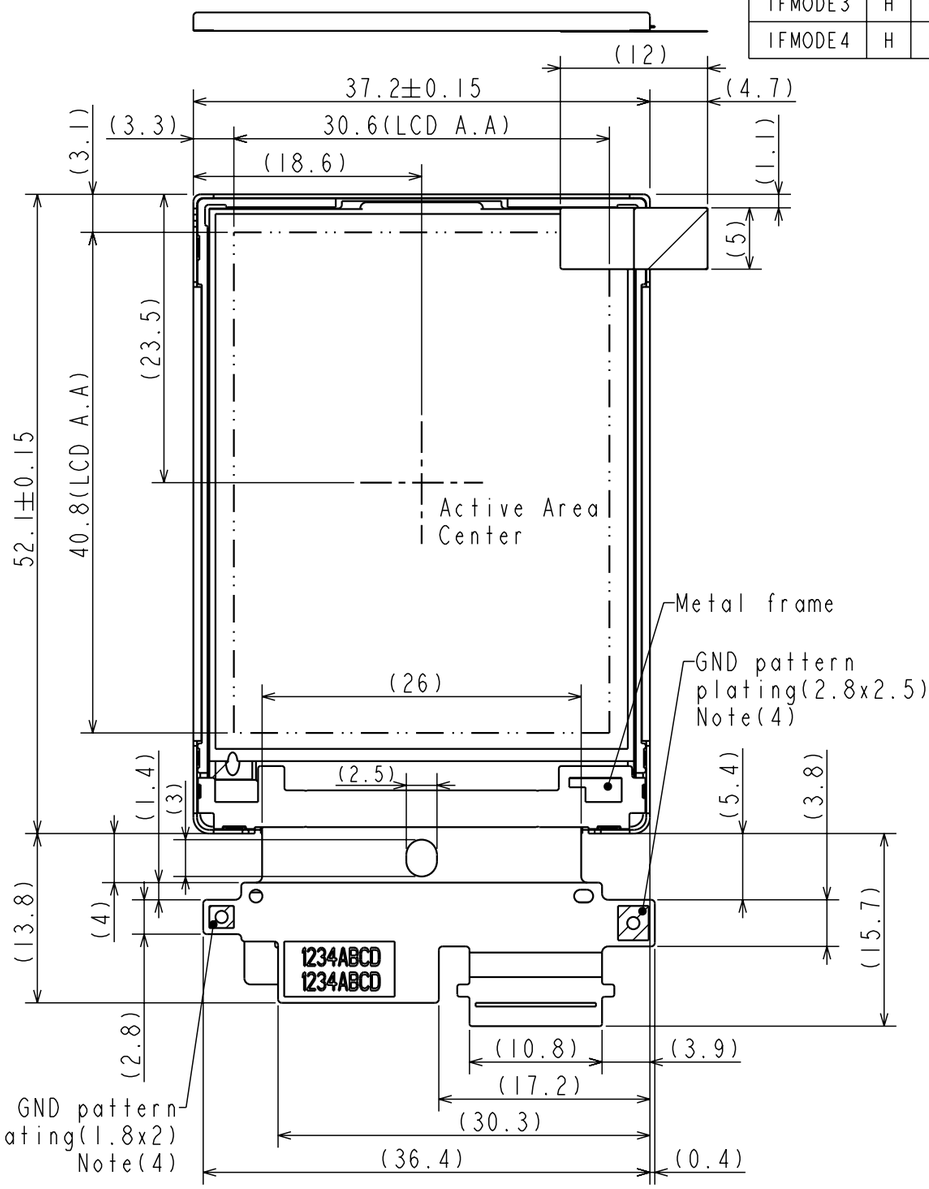
4	Rough gamma adjustment	R0024h	0x0000	
5	Rough gamma adjustment	R0025h	0x0001	
6	Rough gamma adjustment	R0026h	0x0001	
7	Rough gamma adjustment	R0027h	0x0000	
8	Gamma middle amplifier OFF	R0052h	0x0000	
9	RGB independent gamma ON	R0078h	0x0001	
10	BR0_R	R007Bh	0x0909	
11	BR0_G	R0081h	0x0909	
12	BR0_B	R0087h	0x0909	
13	GAM0_R	R007Ch	0x5555	
14	GAM0_G	R0082h	0x5555	
15	GAM0_B	R0088h	0x5555	
16	GAM1_R	R007Dh	0x4141	
17	GAM1_G	R0083h	0x4141	
18	GAM1_B	R0089h	0x4141	
19	GAM2_R	R007Eh	0x0707	
20	GAM2_G	R0084h	0x0707	
21	GAM2_B	R008Ah	0x0707	
22	BR1_R	R007Fh	0xFAFA	
23	BR1_G	R0085h	0xFAFA	
24	BR1_B	R008Bh	0xFAFA	
25	TILT_R	R0080h	0xF9F9	
26	TILT_G	R0086h	0xF9F9	
27	TILT_B	R008Ch	0xF9F9	
28	Dot clock set	R002Eh	0x002C	
29	Back porch	R002Fh	0x0008	
30	Front porch	R0030h	0x0008	
31	X min	R0008h	0x0000	
32	X max	R0009h	0x00EF	
33	Y min	R000Ah	0x0000	
34	Y max	R000Bh	0x013F	
35		R0037h	0x0001	
36	Window mode	R0005h	0x0018	
37	RAM X address	R0006h	0x0000	
38	RAM Y address	R0007h	0x0000	
39	Gate scan mode	R0032h	0x0000	
40	262,244 of colors	R0004h	0x0000	
41	Deep STB OFF	R000Ch	0x0000	
42	Power supply (2) DC/DC	R0019h	0x0080	
43	Power supply (3) DCDC division	R001Ah	0x00F0	
44	Power supply (4) DCDC start setting	R001Bh	0x0022	
45	Power supply (5) VGM, Vr, Vs, Vref	R001Ch	0x0FFD	
46	Vcom current amplifier set	R001Dh	0x0033	
47	Vcom output set	R001Eh	0x0015	
48	Vcom amplitude set	R001Fh	0x0014	
49	Gate control	R003Bh	0x0001	
50	e-fuse set	R005Ch	0x0001	
51		wait	3ms Min.	
52	RAM write/read	R000Eh	-	
53		Display Data Writing		Graphic Size 240x320

Notes
(2) The refresh sequence must be used after the LCD module normally starts up once or more when it is turned on.

9. Dimensional Outline

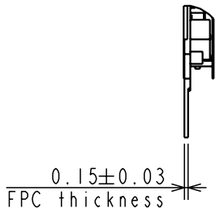
16bit Interface

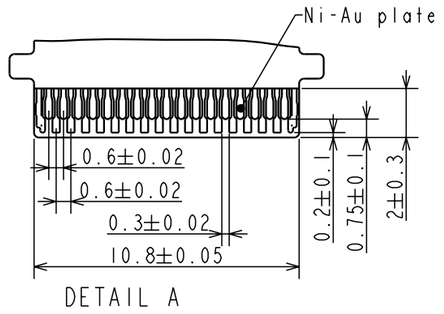
Colors	65k	262k		16M
IFMODE3	H	H	L	L
IFMODE4	H	L	H	L



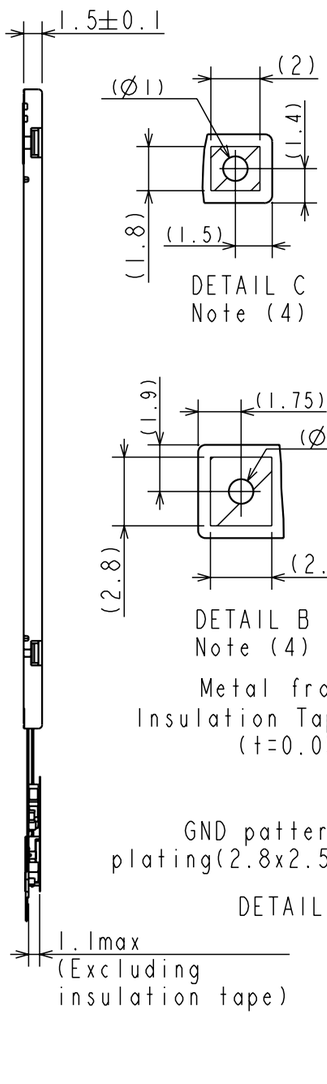
LCD DOTS DETAILS

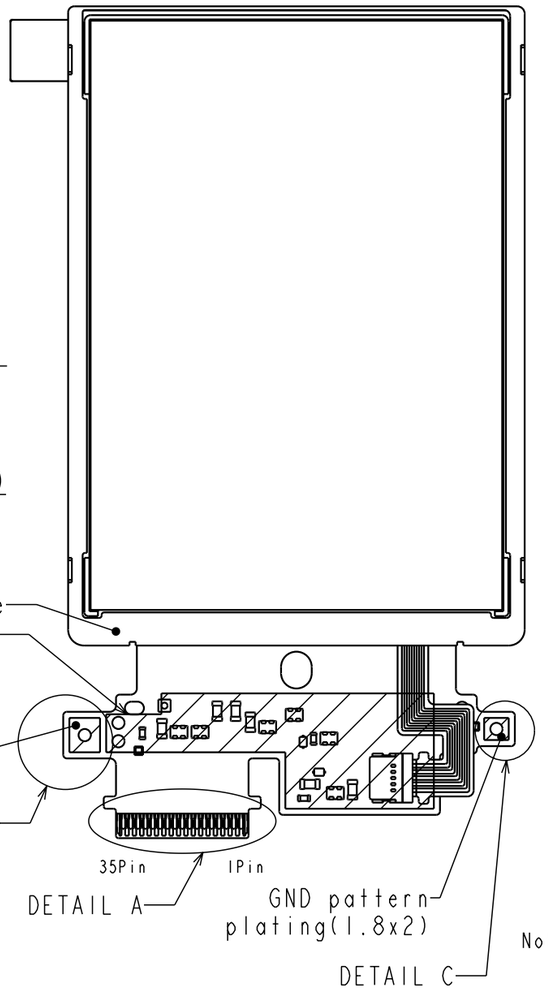
Dot Pitch (mm) : 0.0425xRGB(H)x0.1275(V)





DETAIL A





Pin Assignment

PIN No.	SIGNAL	I/O
1	LED(AN)	-
2	LED(CA)	-
3	LED(CA)	-
4	LED(CA)	-
5	LED(CA)	-
6	IFMODE4	I
7	GND	-
8	IFMODE3	I
9	VSYNC-OUT	O
10	RD*	I
11	WR*	I
12	RS	I
13	RESET*	I
14	CS*	I
15	GND	-
16	D15	I/O
17	D14	I/O
18	D13	I/O
19	D12	I/O
20	D11	I/O
21	D10	I/O
22	D9	I/O
23	D8	I/O
24	D7	I/O
25	D6	I/O
26	D5	I/O
27	D4	I/O
28	D3	I/O
29	D2	I/O
30	D1	I/O
31	D0	I/O
32	MakerID(Low)	O
33	VCC2(I/OVCC) (2.8±0.05V)	-
34	VCC1(2.8±0.05V)	-
35	GND	-

Note(3)

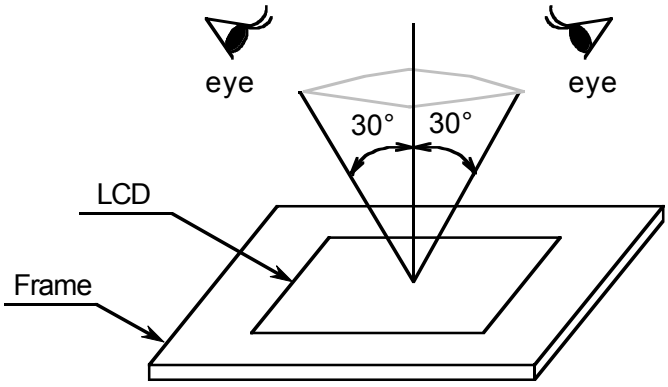
Note
(1)The unspecified tolerance : ±0.2
(2)Suitable FPC Connector : 04-6293-035-001-829+(KYOCERA ELCO)
(3)I/OVCC=1.8V to VCC1
(4)Ignore the burrs and peeling/missing copper-foil in the hole at theground pad

Scale : NTS
Unit : mm

10. VISUAL INSPECTION

10.1 INSPECTION CONDITION

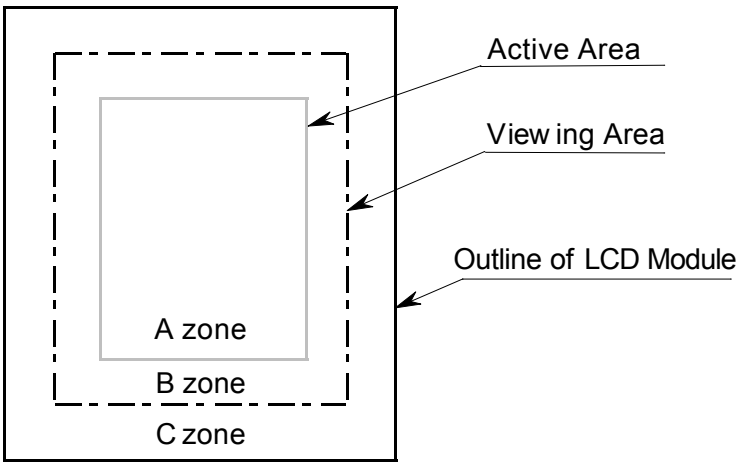
(1) Ambient illumination : 1000 - 1500 [lx]
(2) Distance betw een inspector's eyes and LCD Module : Approximately 30 [cm]
(3) View ing angle : ≤30°
(4) Refer to the Measurement Conditions described in Item 6 for the conditions other than specified here.



10.2 DEFINITION OF ZONE

The visual inspection zones of LCD Module is divided into three as follow s.

A zone : Active Area (For dimensions, see Item 9, DIMENSIONAL OUTLINE.)
B zone : View ing Area but Active Area (For dimensions, see Item 9, DIMENSIONAL OUTLINE.)
C zone : Whole LCD Module except the View ing Area (Including FPC and frame)



10.3 COSMETIC SPECIFICATION

No.	Item			Maximum Acceptable Number	Unit	Applied Zone	LCD module	Back light	Note
1	Dot Defect	Bright dot		0	pc	A	On		(1), (2), (3), (4)
		Dark dot		0	pc				
		Total Number		0	pc				
2	Line Defect			0	pc	A	On		-
3	Uneven Brightness (Linear)			Serious one is not allow ed.	-	A	On		(6)
4	Uneven Brightness (Circular)								
5	Foreign Particles, Stain (Linear) [mm] W: Width L: Length	W≤0.02	L<1.0	Ignored	pc	A, B	On		(5), (6), (7)
		0.02<W≤0.03	L≤1.0	1					
		0.03<W	-	0					
6	Foreign Particles, Stain (Circular) [mm] D: Average diameter	D≤0.1		Ignored	pc	A, B	On		(5), (6), (7)
		0.1<D≤0.2		1					
		0.2<D		0					
7	Scratch of Polarizer (Linear) [mm] W: Width, L: Length	W≤0.02	L<1.0	Ignored	pc	A, B	Off		(5), (6), (7)
		0.02<W≤0.03	L≤1.0	1					
		0.03<W	-	0					
8	Scratch of Polarizer (Circular) [mm] D: Average diameter	D≤0.1		Ignored	pc	A, B	Off		(5), (6), (7)
		0.1<D≤0.2		1					
		0.2<D		0					
9	Polarizer Bubble [mm] D: Average diameter	D≤0.1		Ignored	pc	A, B	Off		(5), (6), (7)
		0.1<D≤0.2		1					
		0.2<D		0					
10	Scratch, Dent in Frame			Serious one is not allow ed.	-	C	Off		(6)
11	Scratch of FPC				-	C	Off		(6)

Notes (1) A defect whose area is more than 50% of the dot is regarded as a Dot Defect.

(2) A dot whose brightness at all black screen is more than 30% of a normal white dot is defined as a Bright Dot Defect.

(3) A defect whose brightness in all white screen is less than 60% of a normal white dot is defined as a Dark Dot Defect.

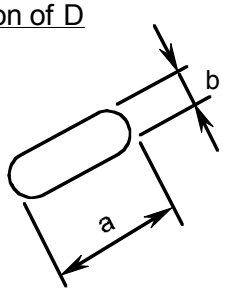
(4) Defective dots which are not adjacent are taken as a single Dot Defect each.

(5) Something which can be easily wiped off is disregarded as a defect.

(6) In case a problem arises, both parties should discuss needed items such as limit samples.

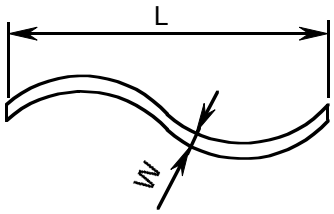
(7) Definitions for D, W and L are as follows.

Definition of D



$$D = \frac{a + b}{2} \quad (mm)$$

Definitions of W and L



10.4 RELIABILITY TEST

No.	Test Items	Test Conditions	Quantity	Note
1	High temperature, operating	70°C, 96 h	10	(1), (2)
2	Low temperature, operating	-20°C, 96 h	10	
3	High temperature & high humidity, operating	60°C, 90%RH, 96 h	10	
4	High temperature, storage	80°C, 96 h	10	(2)
5	Low temperature, storage	-30°C, 96 h	10	
6	High temperature & high humidity, storage	60°C, 90%RH, 96 h	10	
7	Thermal shock, storage	-30°C (0.5h)/+70°C (0.5h), 10 cycles	10	
8	Vibration	10-55 Hz, Vibration amplitude: 1.5 mm, Direction: X, Y, Z, 2 h/axis	5	
9	Packaging drop test	Drop height: 30 cm, 1 angle, 3 edges	1	
10	3 Point Bending	Support jigs:3.0mm diam. Distance between jigs:36mm Pressing jigs:3.0mm diam. Pressing speed:5mm/min Material:Steel(or Al) Judgment:3.5 kgf or more (Up to 1 failure of 24 pcs can be allowed.)	24	(3)
11	Pressure at COG	Distance between jigs:30mm Pressing jigs:5.0mm diam. Pressing speed:5mm/min Material:Steel(or Al) Judgment:1.0 kgf or more (Up to 0 failure of 24 pcs can be allowed.)	24	

Notes (1) Operation conditions : Vcc =IOVcc = 2.8 V, fFLM = 85 Hz.

(2) To be no defective functions related to electrical and/or optical characteristics when the tested module operates.

(3) If a nonconformance is found, both parties will have a discussion to solve it.

11. PRECAUTIONS IN DESIGN

11. 1 GENERAL ATTENTION

(1) The LCD module covered by this specification is designed as the display for mobile phone. When it is used for other purposes, we do not guarantee these specifications at all about the contents including quality and safety. Moreover, this module has not been particularly developed as an object for equipment in connection with a human life such as medical apparatus of life support relation.

(2) Never attempt to disassemble this LCD module. There is danger such as a burn, an electric shock, and an injury. Moreover, when module is disassembled, we do not guarantee these specifications including quality and safety.

11.2 PRECAUTIONS AGAINST ELECTROSTATIC DISCHARGE

As this module contains a C-MOS LSI, it is not strong against electrostatic discharge. Make certain that the operator is grounded with suitable gear such as a wrist band. Pay attention not to touch terminal pins directly.

11.3 HANDLING PRECAUTIONS

(1) Do not leave the LCD module in a humid environment for a long time. When the ambient temperature is over 35 degrees C in storage, please avoid high humidity.
The polarizer can be deteriorated in high temperatures and high humidity. Moreover, it is also the cause of bubble and peeling of polarizer. Please store/operate the LCD module within the specified temperatures and normal humidity.

(2) Since the polarizer tends to be easily scratched, the LCD module 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 is harder than a pencil lead 3H.

(3) Maximum pressure to the surface must be 1.96 Pa. If the area to be given pressure is less than 1 cm^2, the pressure must be 1.96 N or less.

(4) As the adhesives used for adhering upper and lower polarizers is an organic matter, it can be deteriorated by chemical reaction with such chemicals as acetone, toluene, ethanol and isopropyl alcohol. The following solvent is recommended for use: Normal hexane.
Please contact us when it is necessary for you to use other chemicals than the above.

(5) Lightly wipe a dirty surface with absorbent cotton or other soft material like chamois, dampened with recommended chemicals without scrubbing it hardly. 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) If spittle or a water drop comes in contact with the display area, immediately wipe it off. They can damage the display in some way including deformation and faded color.

(7) Condensation on the LCD module 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 let them stand at room temperature before taking them out.

(8) Touching the display area or the terminal pins with bare hands or contaminating them is 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) As the display is made of glass, it is possible to be broken by a shock, especially its periphery can be easily cracked or chipped in handling. Please handle it with care and prevent it from being dropped.

(10) Never bend nor scratch the interface part. Those actions can cause poor contacting.

(11) Since the top and bottom areas of bent FPC tend to be easily damaged, be fully careful not to push or hold those areas.

(12) Please do not apply local stress to the LCD module's back side. It has potential to add a scratch to the backlight guide, or to become a non-uniformity issue. Pay extra attention to the interface connector portion at the time of connector insertion.

11.4 OPERATION PRECAUTIONS

(1) Spike noise can cause malfunction of the circuit. Recommended condition of spike noise level is as follows: Vcc = ±200 mV (over and under shoot voltage).

(2) Response time depends on a temperature. (At a lower temperature, it becomes longer.)
And also brightness and color vary depending on a temperature.

(3) Be careful for condensation at a sudden temperature change. Condensation can make damage to polarizers or electrical contacts. And after fading condensation, smear or a spot may occur.

(4) When a fixed pattern is displayed at long times, afterimage is likely to occur.

(5) As the LCD module has a high frequency circuit, take sufficient measures against electromagnetic noise, such as shielding your system.

(6) Do not connect nor disconnect the module to or from main system with power applied.

(7) Strong light exposure may cause malfunction of the driver.

11.5 STORAGE

When storing the LCD modules 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 and 30 degrees C, and the humidity from 55% to 75%.

(2) The polarizer surface should not come in contact with any other object. It is recommended that the LCD modules are stored in the container in which they were shipped.

11.6 SAFETY

This LCD module is a glass product. When it got damaged, be sure to wear a pair of protective gloves to deal it. Moreover, when any liquid leaked out of a damaged glass cell comes in contact with your skin, immediately wash it off well with soap and water.

11.7 MECHANICAL DESIGN

(1) The design of the mobile phone case for this LCD module should be well studied so that any shock will not be added to the LCD module. When the case is dropped and the shock is not enough absorbed by the case, the LCD module may be broken.

(2) Providing a cushion material such as PORON in the case will help LCD driver get less shock. See the figure below for example.

(3) To prevent foreign substances from entering, please apply a piece of polyurethane foam cushion, such as PORON, around the LCD.

11.8 ENVIRONMENTAL PROTECTION

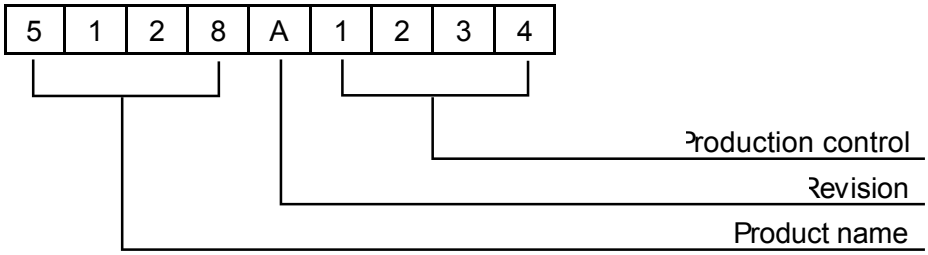
(1) Abide by the national law, legislation and local regulation when disposing of this LCD module.

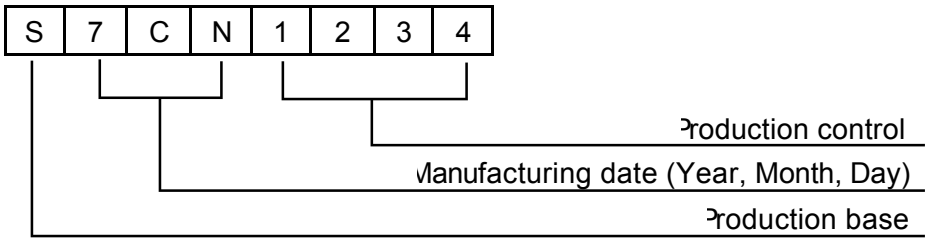
(2) This LCD module complies with RoHS Directive.

12. DESIGNATION OF LOT MARK

LOT MARK

Lot mark is consisted of 9 digits + 8 digits





Revision	Description of change
A	

Year	Figure in lot mark
2007	7
2008	8
2009	9
2010	0

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

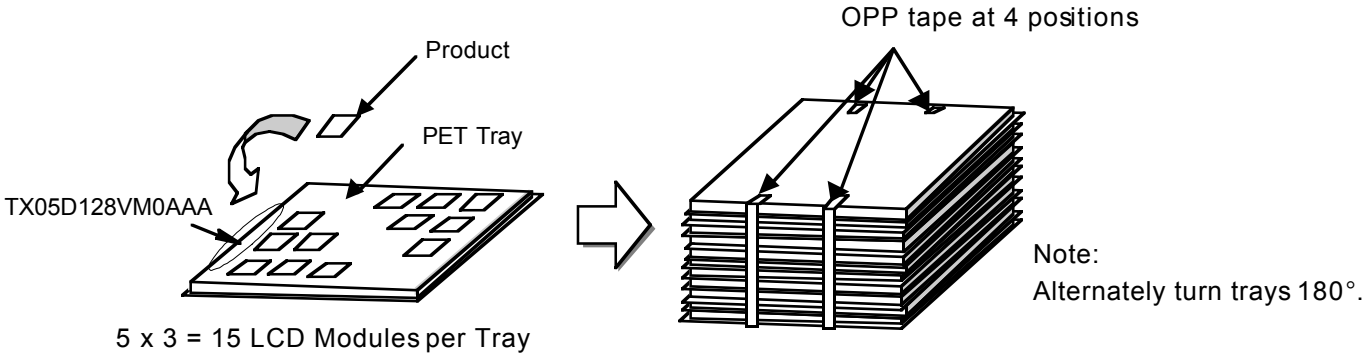
Production base	Figure in lot mark
Hitachi Displays	H
Hitachi Display Device (Suzhou)	S

Print example

5128A1234
S7CN1234

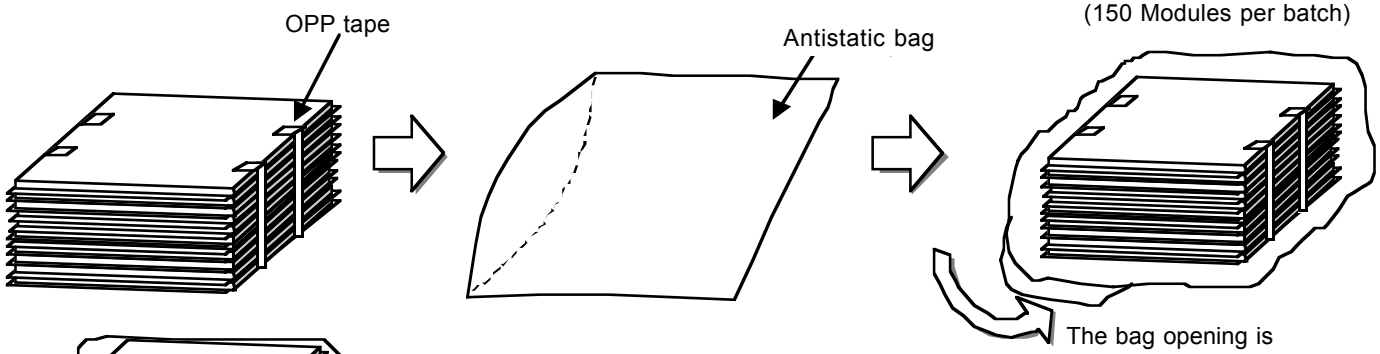
13. PACKING SPECIFICATIONS

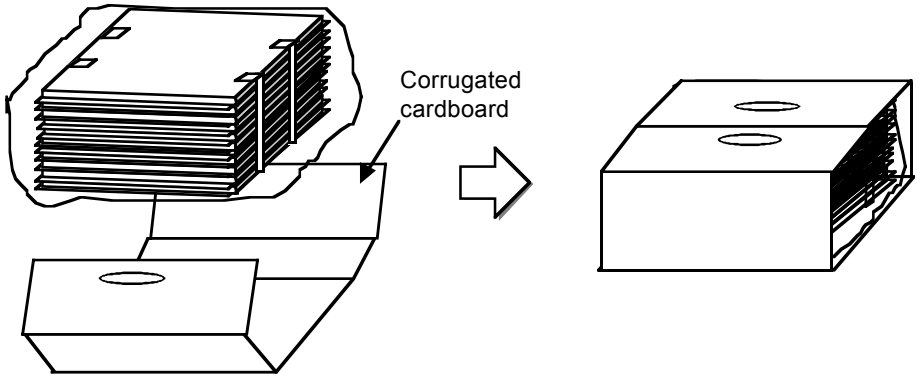
13.1 INNER BOX SPECIFICATIONS

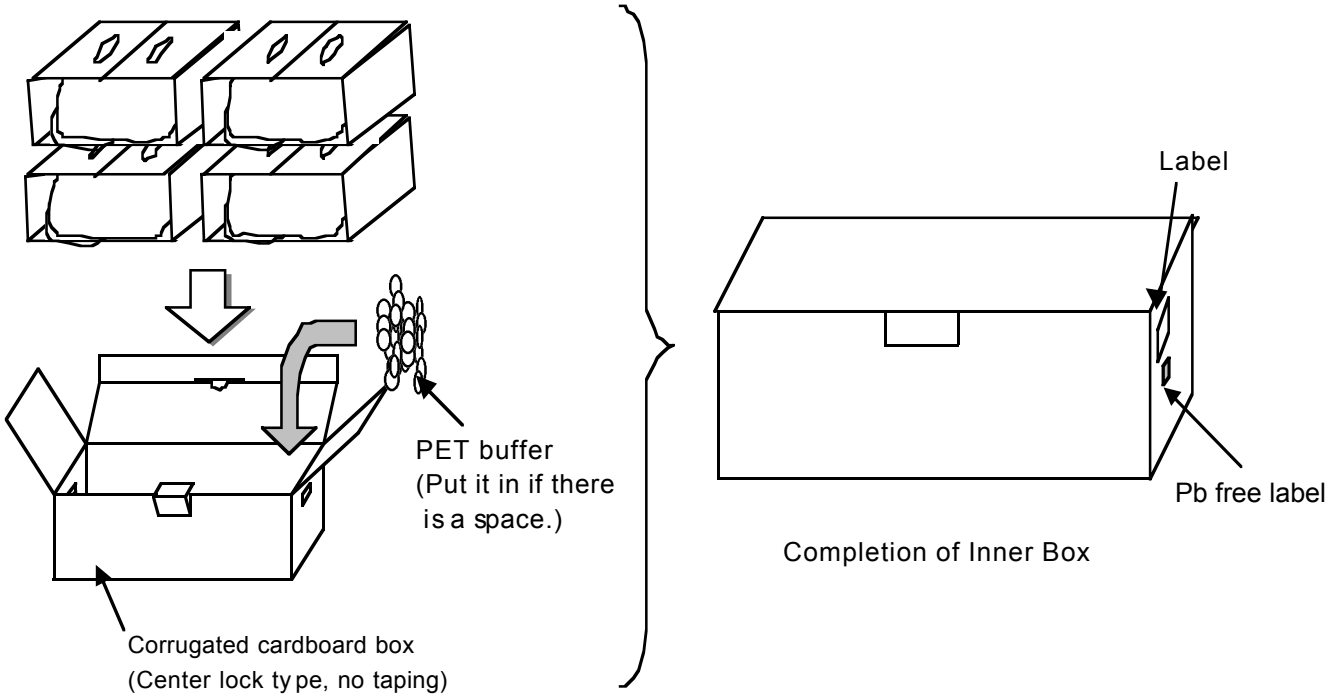


5 x 3 = 15 LCD Modules per Tray

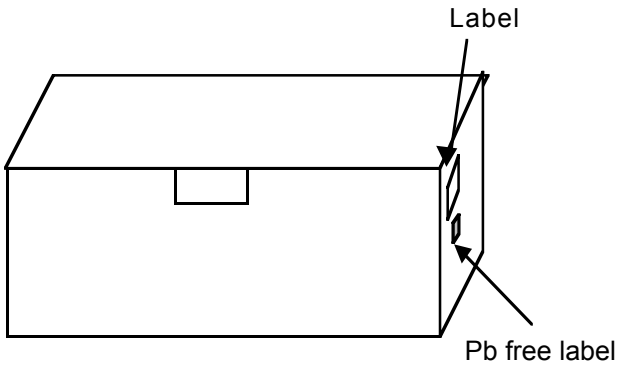
Ten (10) trays with products + empty tray as cover = Eleven (11) trays
(150 Modules per batch)

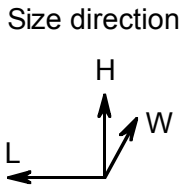






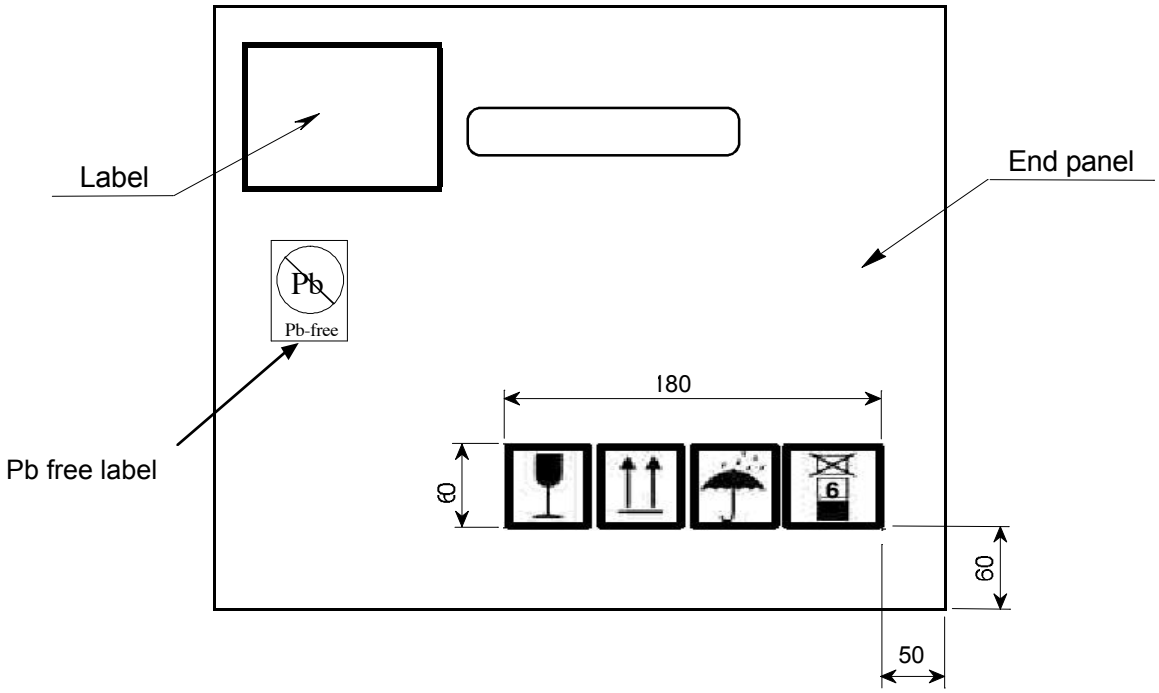
Completion of Inner Box





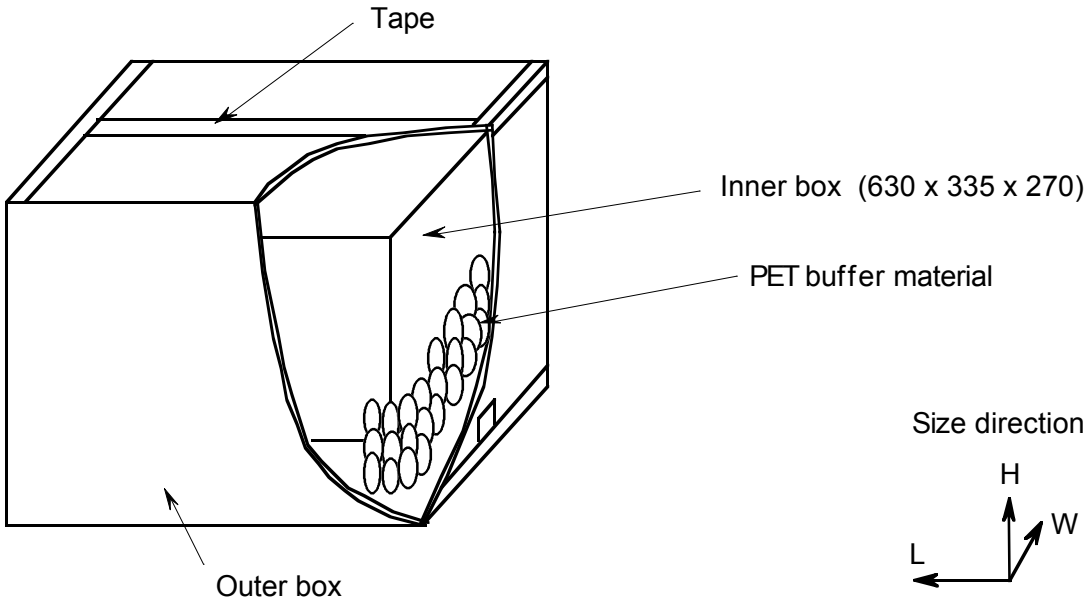
Size (L, W, H)	630 x 335 x 270 mm
Quantity	1 to 600 pcs

Marking of Inner Box



13.2 OUTER BOX SPECIFICATIONS

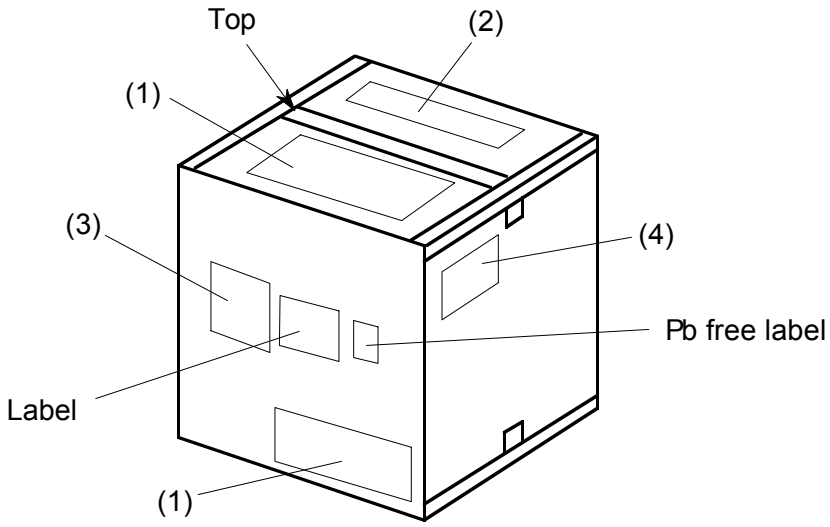
An outer box is used only when the number of products is less than the minimum quantity for pallet.

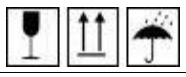


Weight (gross)	9.5 kg when the quantity is 600 pcs
Size (L, W, H)	730 x 450 x 470 mm
Quantity	1 to 600 pcs

Two outer boxes are used if the quantity is between 601 and 1200.

Marking of Outer Box

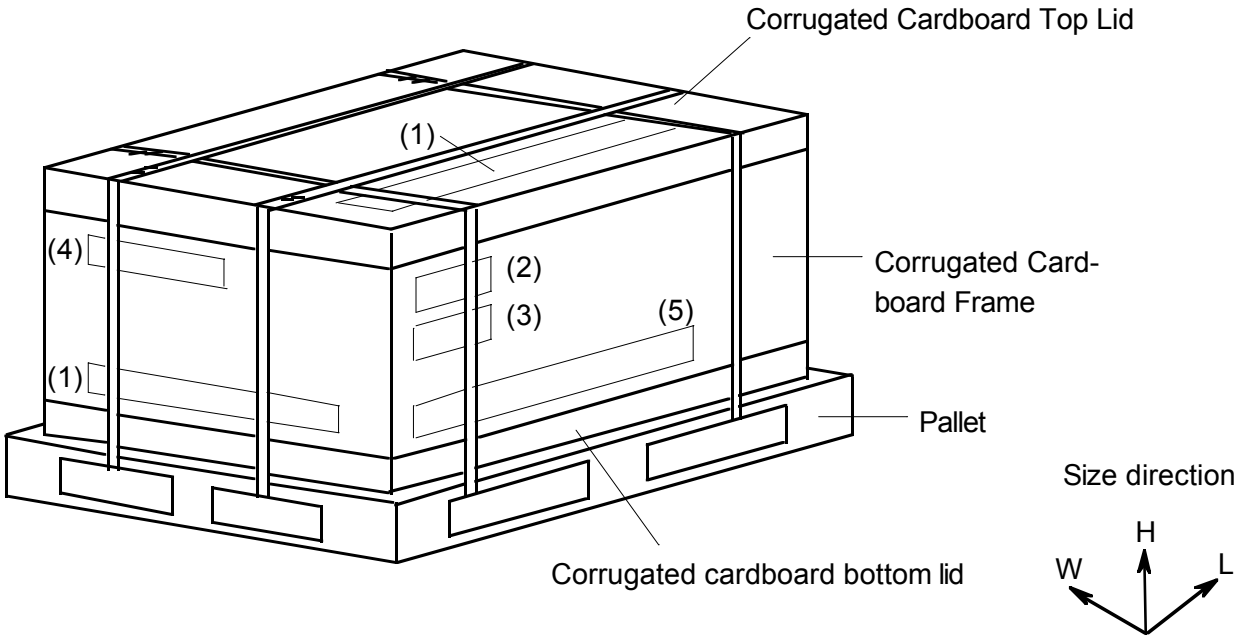


	Mark	Position
(1)	"FRAGILE HANDLE WITH CARE"	Top panel and both side panels
(2)	"GLASS"	Top panel
(3)	Case mark	One side panel
(4)		Both end panels

Markings are in red, except for the case mark.

13.3 PALLET SPECIFICATIONS

A pallet is used for shipment of three (3) to nine (9) inner boxes.



Weight (gross)	Approx. 95 kg
Size (L, W, H)	Approx. 1200 x 800 x 1030 mm
Quantity	1201 to 5400 pcs

Marking of Pallet load

	Mark	Position
(1)	" FRAGILE HANDLE WITH CARE "	Top panel and both end panels
(2)	" 精密機器 "	Both side panels
(3)	" 小心軽放 "	Both side panels
(4)		Both end panels
(5)	" HANDLE WITH FORKLIFT TRUCK ONLY "	Both side panels

All markings in red

14. PRECAUTIONS FOR USE

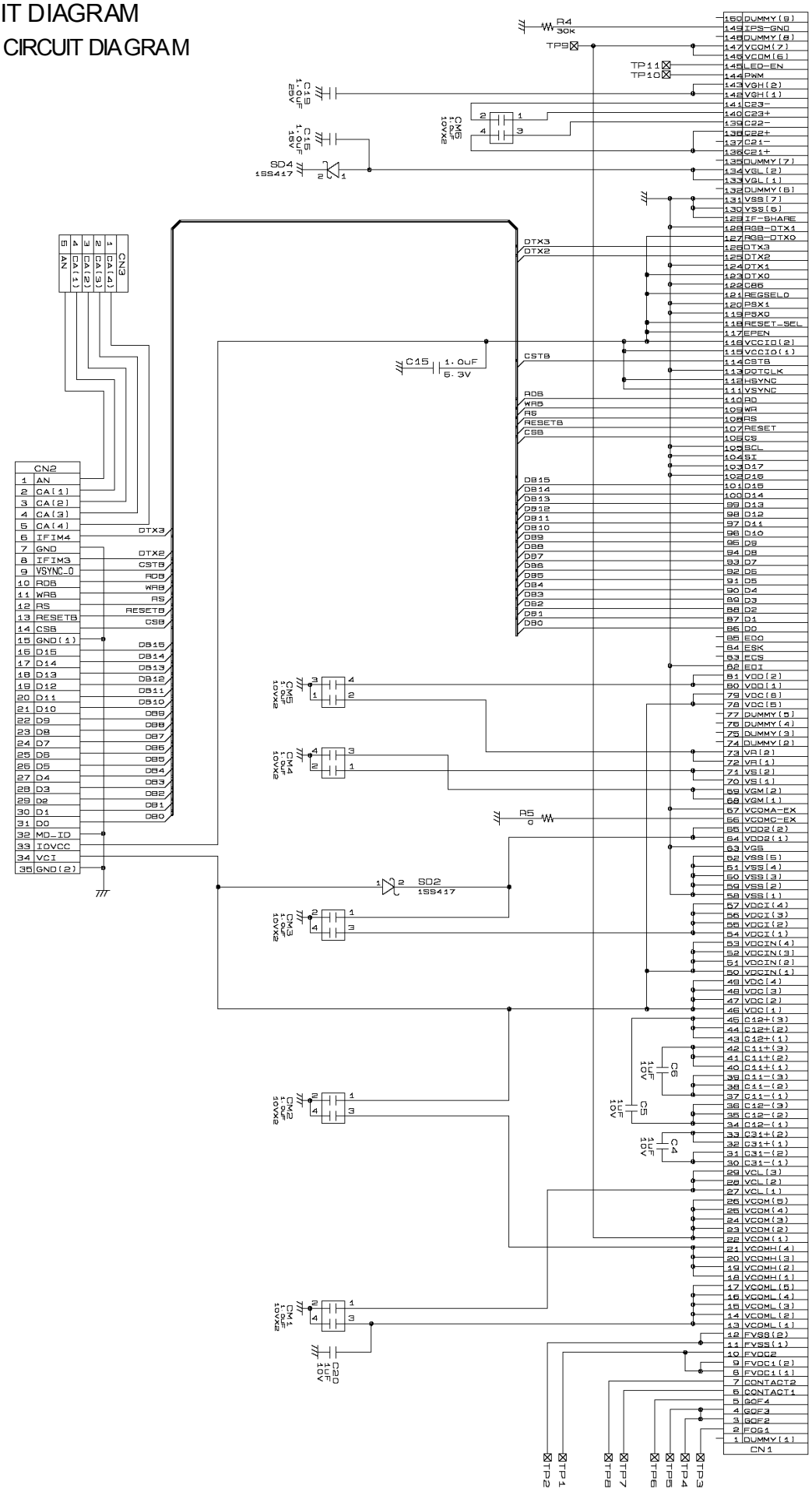
(1) A limit sample should be provided by the both parities on an occasion w hen the both parties agree to its necessity.
Judgment by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

(2) On the follow ing occasions, the handling of the problem should be decided through discussion and agreement betw een responsible people of the both parties.

a) When a question arises in the specifications.
b) When a new problem w hich is not mentioned in the specifications occurs.
c) When the customer changes any item of inspection specification or operating condition and reports it to Hitachi, and a problem in the specification arises because of the change.
d) When a new problem is found w ith the customer's operating set for sample evaluation.

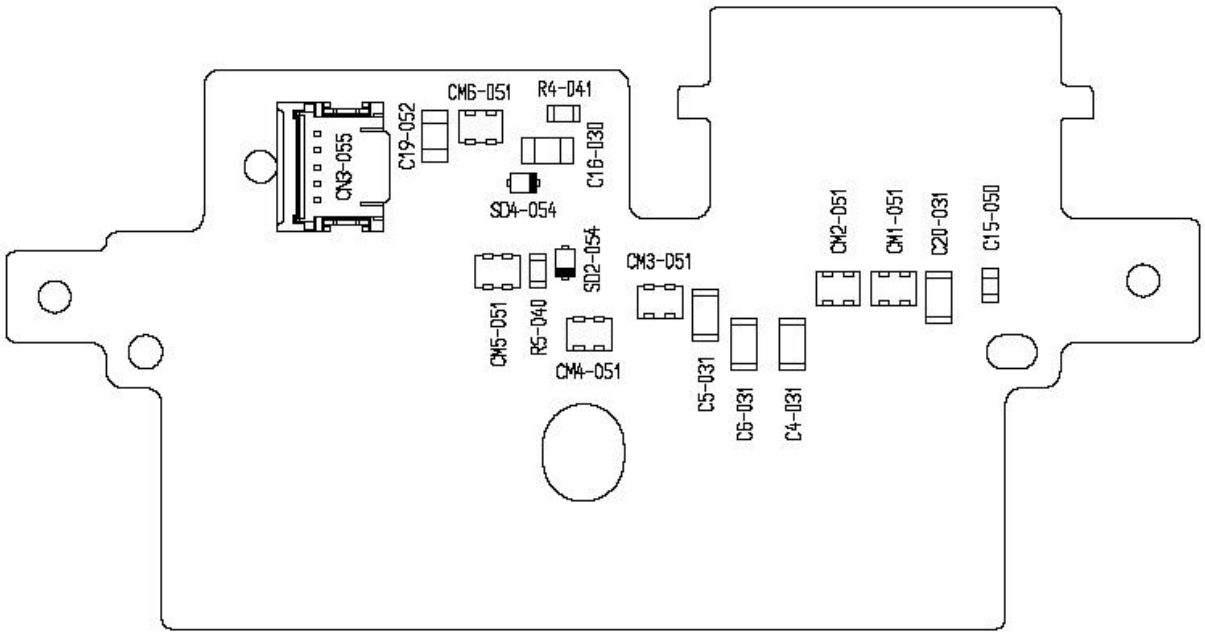
15. CIRCUIT DIAGRAM

15.1 FPC CIRCUIT DIAGRAM

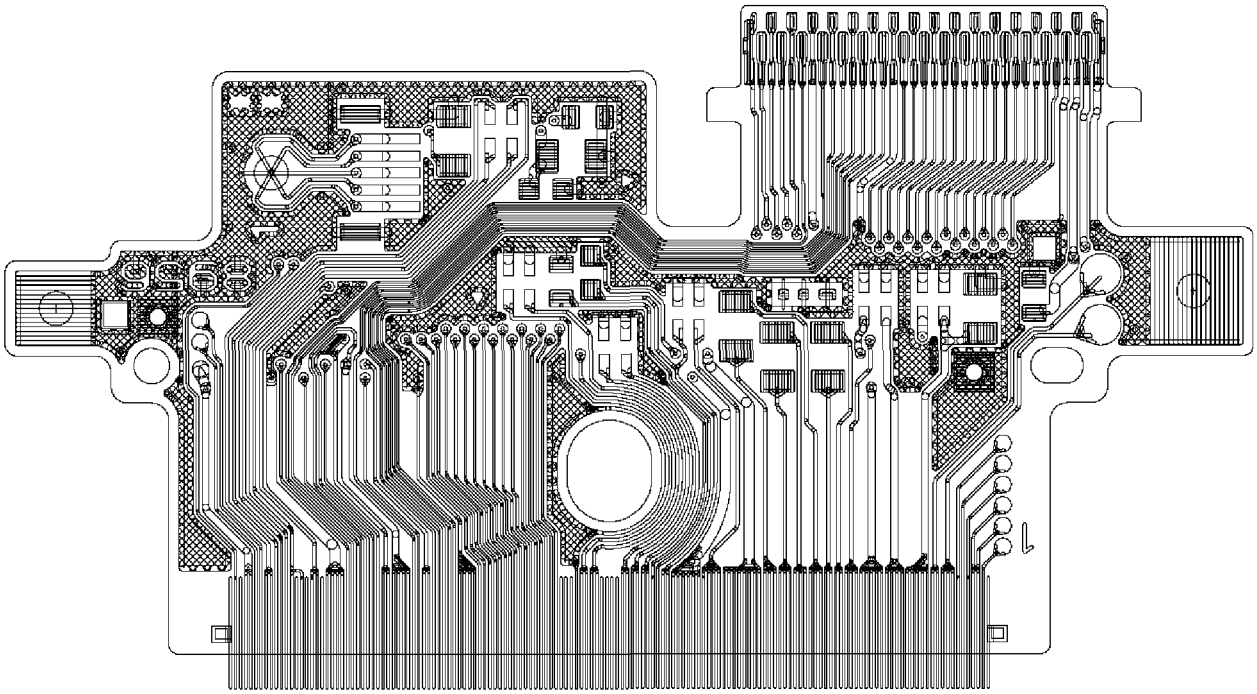


Hitachi Displays, Ltd.	Date	Dec. 17, 2007	Sh. No.	3284PS 2615 - TX05D128VM0AAA - 3	Page	15-1/4

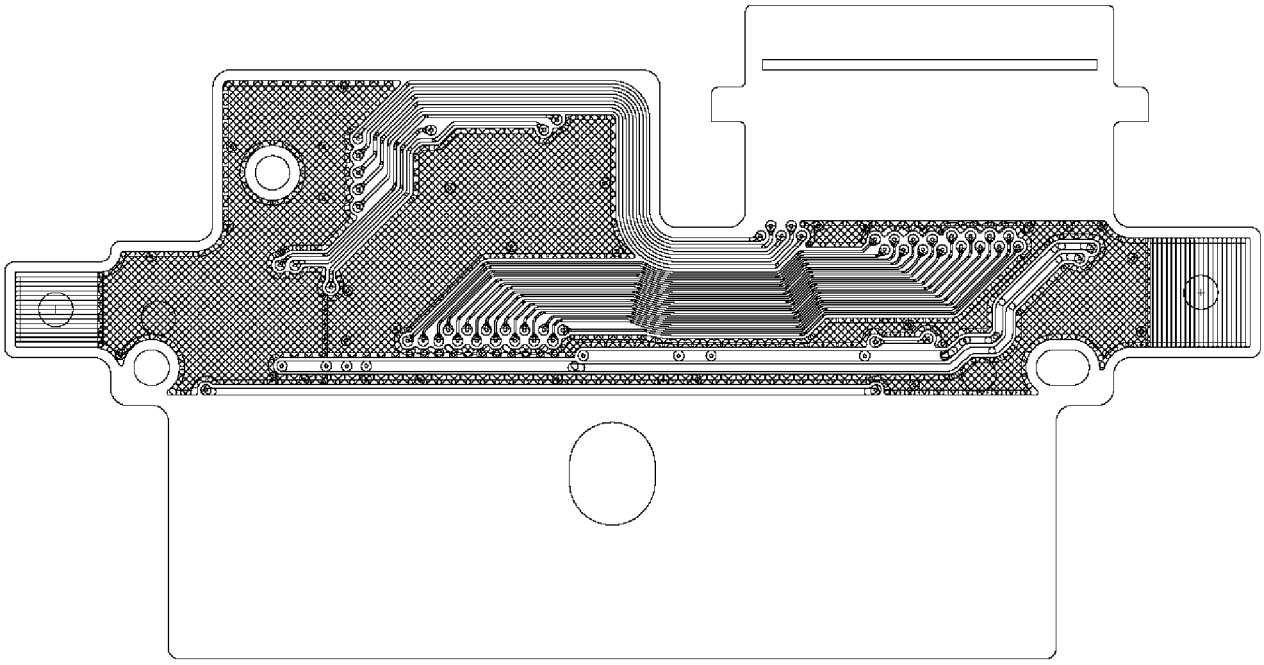
15.2 COMPONENTS LAYOUT DRAWING



15.3 FPC PATTERN LAYOUT



Electronic components mounting side (Top view)



Back side (Transparent view)

15.4 PARTS LIST

Part No.	Part Name	Supplier	Specification	Quantity	No. on the circuit
-	LCD	Hitachi Displays	-	1	-
-	LCD Driver IC	NEC	uPD161707	1	-
-	Polarizer(U)	NITTO	-	1	-
-	Polarizer(L)	NITTO	-	1	-
-	Back Light Unit	Hitachi Display Devices	-	1	-
	LED	Nichia	NSSW006T (*1)	4	-
-	FPC	NIPPON MEKTRON	Two layers	1	-
-	Lower SUS Frame	昆山偉時電子有限公司	SUS304	1	-
-	Upper SUS Frame	吉利德顕示元器件 蘇州)有限公司	SUS304	1	-
030	Capacitor	TDK, Murata, Kyocera	CM105B105K16AT etc.	1	C16
031	Capacitor	TDK, Murata, Kyocera	C1608JB1A105KT etc.	4	C4-C6, C20
040	Resistor	Matsushita, Susumu, KOA	ERJ2GE0R00X etc.	1	R5
041	Resistor	Matsushita, Susumu, KOA	ERJ2GEJ303X etc.	1	R4
050	Capacitor	TDK, Murata, Kyocera	C1005JB0J105KT etc.	1	C15
051	Capacitor	TDK, Murata, Kyocera	CKCM25X5R1A105MT etc.	6	CM1- CM6
052	Capacitor	TDK, Murata, Kyocera	GRM188B31E105KA75D etc.	1	C19
054	Diode	TOSHIBA	1SS417	2	SD2, SD4
055	Connector	KYOCERA ELCO	04-6277-005-001-883+	1	CN3

*1 LED Rank (Ta=25°C)

RANC	Symbol	Condition	Min.	Max.	Unit
A18	Iv	IF=20[mA]	1800	1900	mcd
A17	Iv	IF=20[mA]	1700	1800	mcd
A16	Iv	IF=20[mA]	1600	1700	mcd

Color Ranks

	a57			
x	0.272	0.2793	0.282	-
y	0.258	0.2755	0.272	-

	a67			
x	0.282	0.2793	0.2887	0.291
y	0.272	0.2755	0.2916	0.287

	a52			
x	0.280	0.272	0.282	0.288
y	0.248	0.258	0.272	0.262

	a62			
x	0.288	0.282	0.291	0.296
y	0.262	0.272	0.287	0.276