To : e-CarX

Date : Jan., 12, 2018

SPECIFICATIONS	
Product Name	**LPM102G224B**

Approval Signature

Accepted by : _____

Date : _____

Japan Display Inc.

Proposed by : _____

Revision History (1/1)

Issued No.	
Revision	01
Product Name	LPM102G224B
Customer Part No.	-

Date/Rev.	Contents of change			Reasons	Remarks
Jan. 12, 2018 Rev.01			- Initial release for trial sample		Rev.01

(C): Changed (A): Appended (D): Deleted (F): Filled in

This specification is preliminary. The official information is described in the LCD module specification after evaluation. The some value might vary for improvement the performance, quality and so on.

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1. BASIC SPECIFICATIONS

This document gives the characteristics of the active matrix 10.2inch color LTPS LCD which is designed for automotive use.

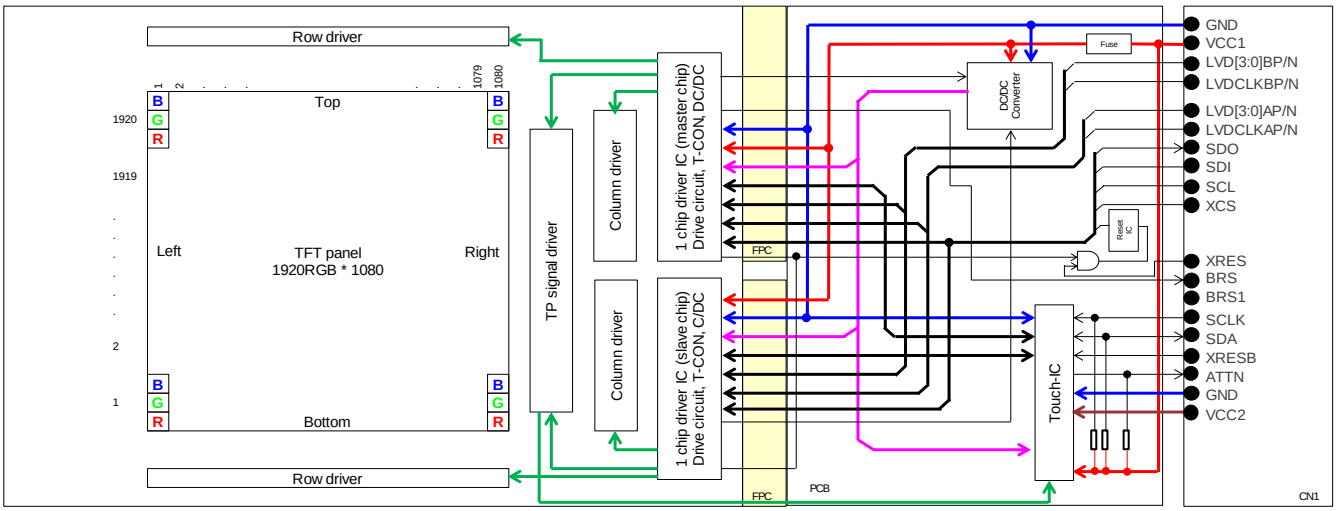
1.1 STRUCTURES

No.	FACTOR	SPECIFICATIONS	UNIT
1	LCD structure	LTPS LCD	-
2	Number of dots	1920 x RGB (W) x 1080(H)	-
3	Operating Temperature (glass surface)	- 40 to +85	deg. C

This specification is preliminary. The official information is described in the LCD module specification after evaluation. The some value might vary for improvement the performance, quality and so on.

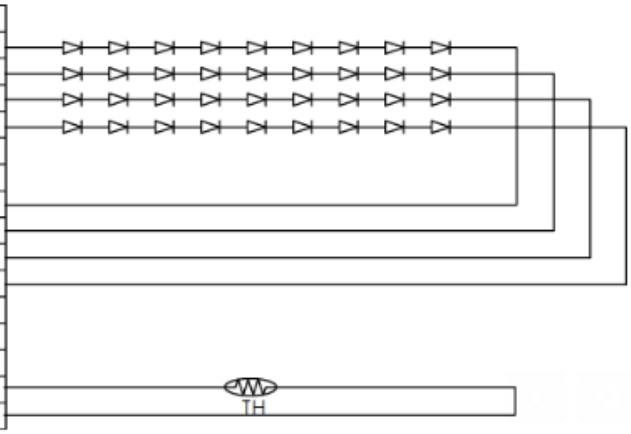
1.2 BLOCK DIAGRAM

<LCD>



<Back light>

Pin No.	Symbol	Function
1	Anode 1	LED Anode Terminal 1
2	Anode 2	LED Anode Terminal 2
3	Anode 3	LED Anode Terminal 3
4	Anode 4	LED Anode Terminal 4
5	NC	–
6	NC	–
7	Cathode 1	LED Cathode Terminal 1
8	Cathode 2	LED Cathode Terminal 2
9	Cathode 3	LED Cathode Terminal 3
10	Cathode 4	LED Cathode Terminal 4
11	NC	–
12	NC	–
13	NC	–
14	RTh 1	Thermistor
15	RTh 2	Thermistor



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1.3 I/O TERMINALS

IF-Terminals

Connector : Hirose FH28 60pin

PIN	SYMBOL	FUNCTION	I/O/P	REMARKS
1	GND	Ground	P	
2	GND	Ground	P	
3	GND	Ground	P	
4	GND	Ground	P	
5	VCC1	Power supply for LCD	P	Typ. 3.3V
6	VCC1	Power supply for LCD	P	Typ. 3.3V
7	VCC1	Power supply for LCD	P	Typ. 3.3V
8	VCC2	Power supply for Touch-IC	P	Typ. 3.3V
9	GND	Ground	P	
10	ATTN	Attention output pin from Touch IC	O	H: Processing L: New data available
11	GND	Ground	P	
12	XRESB	Reset signal for Touch IC	I	H: Release reset L: Activate reset
13	GND	Ground	P	
14	SDA	I2C data pin for Touch IC	I/O	
15	GND	Ground	P	
16	SCLK	I2C clock for Touch IC	I	
17	GND	Ground	P	
18	LVD0BN	(LVDS) B-port LVDS data0 (negative)	I	
19	LVD0BP	(LVDS) B-port LVDS data0 (positive)	I	
20	GND	Ground	P	
21	LVD1BN	(LVDS) B-port LVDS data1 (negative)	I	
22	LVD1BP	(LVDS) B-port LVDS data1 (positive)	I	
23	GND	Ground	P	
24	LVD2BN	(LVDS) B-port LVDS data2 (negative)	I	
25	LVD2BP	(LVDS) B-port LVDS data2 (positive)	I	
26	GND	Ground	P	
27	LVDCLKBN	(LVDS) B-port LVDS clock (negative)	I	
28	LVDCLKBP	(LVDS) B-port LVDS clock (positive)	I	
29	GND	Ground	P	
30	LVD3BN	(LVDS) B-port LVDS data3 (negative)	I	
31	LVD3BP	(LVDS) B-port LVDS data3 (positive)	I	
32	GND	Ground	P	
33	LVD3AP	(LVDS) A-port LVDS data3 (positive)	I	
34	LVD3AN	(LVDS) A-port LVDS data3 (negative)	I	
35	GND	Ground	P	

P: power supply, I: input O: output

This specification is preliminary. The official information is described in the LCD module specification after evaluation. The some value might vary for improvement the performance, quality and so on.

PIN	SYMBOL	FUNCTION	I/O/P	REMARKS
36	LVDCLKAP	(LVDS) A-port LVDS clock (positive)	I	
37	LVDCLKAN	(LVDS) A-port LVDS clock (negative)	I	
38	GND	Ground	P	
39	LVD2AP	(LVDS) A-port LVDS data2 (positive)	I	
40	LVD2AN	(LVDS) A-port LVDS data2 (negative)	I	
41	GND	Ground	P	
42	LVD1AP	(LVDS) A-port LVDS data1 (positive)	I	
43	LVD1AN	(LVDS) A-port LVDS data1 (negative)	I	
44	GND	Ground	P	
45	LVD0AP	(LVDS) A-port LVDS data0 (positive)	I	
46	LVD0AN	(LVDS) A-port LVDS data0 (negative)	I	
47	GND	Ground	P	
48	SCL	(Serial I/F for LCD Driver-IC) Serial clock	I	Data latched by rising edge.
49	DIN	(Serial I/F for LCD Driver-IC) Serial data input	I	
50	DOUT	(Serial I/F for LCD Driver-IC) Serial data output	O	
51	GND	Ground	P	
52	XCS	(Serial I/F for LCD Driver-IC) Chip select	I	H: Disable serial I/F L: Enable serial I/F
53	GND	Ground	P	
54	XRES	(Serial I/F for LCD Driver-IC) Device reset	I	H: Release reset L: Activate reset
55	NC	No Connect	-	
56	BRS	Feedback signal from driver-IC	O	
57	TEST2	Test pin for JDI. High level is applied when JDI's inspection program is performed. This pin is pulled down on PCB with 10kOhm resistor. Therefore, leave this pin opened.	-	
58	TEST1	Test pin for JDI. High level is applied when JDI's inspection program is performed. This pin is pulled down on PCB with 10kOhm resistor. Therefore, leave this pin opened.	-	
59	GND	Ground	P	
60	GND	Ground	P	

P: power supply, I: input O: output

1.4 THERMAL SENSOR

<Thermistor on Backlight>

Thermistor on Backlight Type : NCU18XH103F6SRB / MURATA

Resistance - Temperature Characteristics : 10kΩ

Items	Symbol	Condition	Specification	Unit	Remarks
Resistance	R_{NTC}	25 degC	10 +/- 1%	kΩ	
B-Constant	B_{NTC}	25 / 50 degC	3380 +/- 1%	K	Reference Value
Rated Electric Power	P_{NTC}	25 degC	100	mW	

1.5 BACKLIGHT TERMINALS

Suitable connector : Hirose FH28-15S-0.5SH (HIROSE FH28 15pin)

PIN	SYMBOL	FUNCTION	I/O/P	REMARKS
1	Anode 1	LED Anode Terminal 1	P	
2	Anode 2	LED Anode Terminal 2	P	
3	Anode 3	LED Anode Terminal 3	P	
4	Anode 4	LED Anode Terminal 4	P	
5	NC	Not connect	-	
6	NC	Not connect	-	
7	Cathode 1	LED Cathode Terminal 1	P	
8	Cathode 2	LED Cathode Terminal 2	P	
9	Cathode 3	LED Cathode Terminal 3	P	
10	Cathode 4	LED Cathode Terminal 4	P	
11	NC	Not connect	-	
12	NC	Not connect	-	
13	NC	Not connect	-	
14	RTh 1	Thermistor terminal 1	O	
15	RTh 2	Thermistor terminal 2	O	

2. FUNCTIONS

2.1 OVERVIEW

This LCD module is equipped with three kind of Interfaces used for transferring of command data, pixel data for LCD Driver-IC and controlling of Touch-IC.

1) Serial interface for LCD Driver-IC
- 5 wires of control signal (XRES, XCS, SCL, DIN and DOUT)

2) LVDS
- 8 pairs for transferring of pixel data (LVDA3P/N ~ LVDA0P/N, LVDB3P/N~LVDB0P/N)
- 2 pairs of clock (LVDCLKAP/N and LVDCLKBP/N)

3) Serial Interface for Touch-IC
- 3 wires of control signal (XRESB, SCLK and SDA)
- 1 wires of Attention output (ATTN)

2.2 SERIAL INTERFACE FOR LCD DRIVER-IC

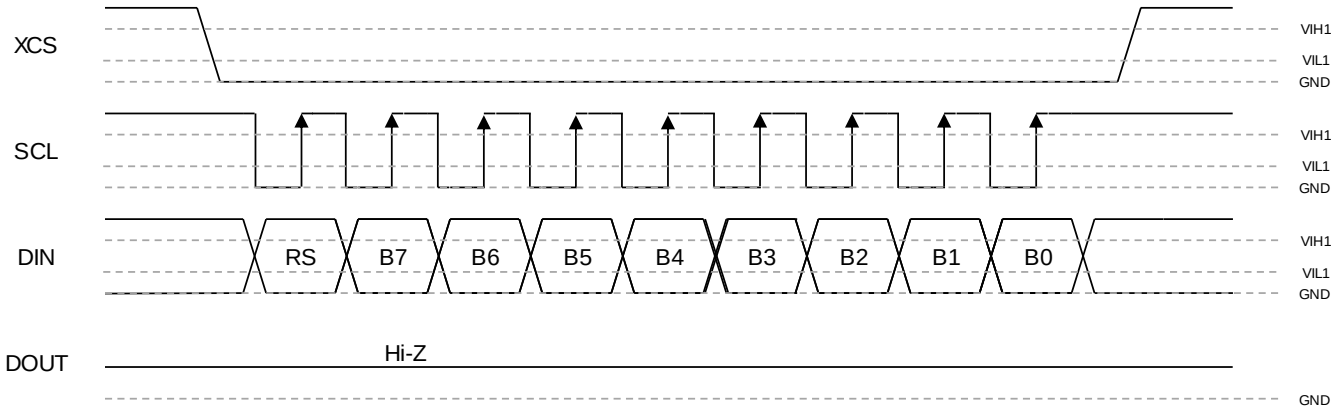
2.2.1 Signal Definition

Serial interface is performed by 5 signals.

Signal	Description
XRES	Device reset signal (Low active)
XCS	Chip select signal
SCL	Serial clock signal
DIN	Serial data input signal (Data latched at SCL rising edge)
DOUT	Serial data output signal (Data output during SCL Low period)

2.2.2 Data Write Method

Command data and parameter data are transferred by using the following four pins: XCS, SCL, DIN and DOUT.
The input format of data is RS bit + 8 bits.
It is necessary to keep XCS = L during data transferring operation. After 9bit data transferred, then XCS need pull high.

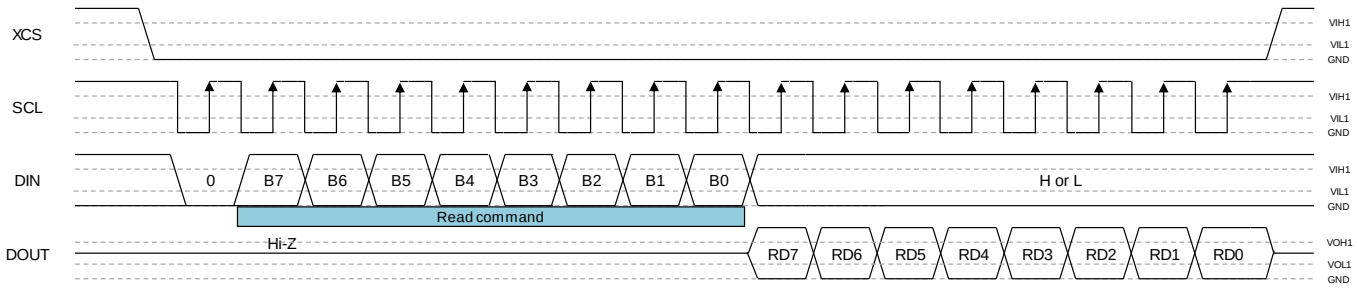


Note. refer to "4.1 DC CHARACTERISTICS OF GENERAL " for the definition of VIH1 and VIL1

RS	B[7:0]
0	Command data
1	Parameter data

2.2.3 Data Read Method

It is necessary to keep XCS = L during data reading operation. After all data received, then XCS need pull high.



2.3 LVDS

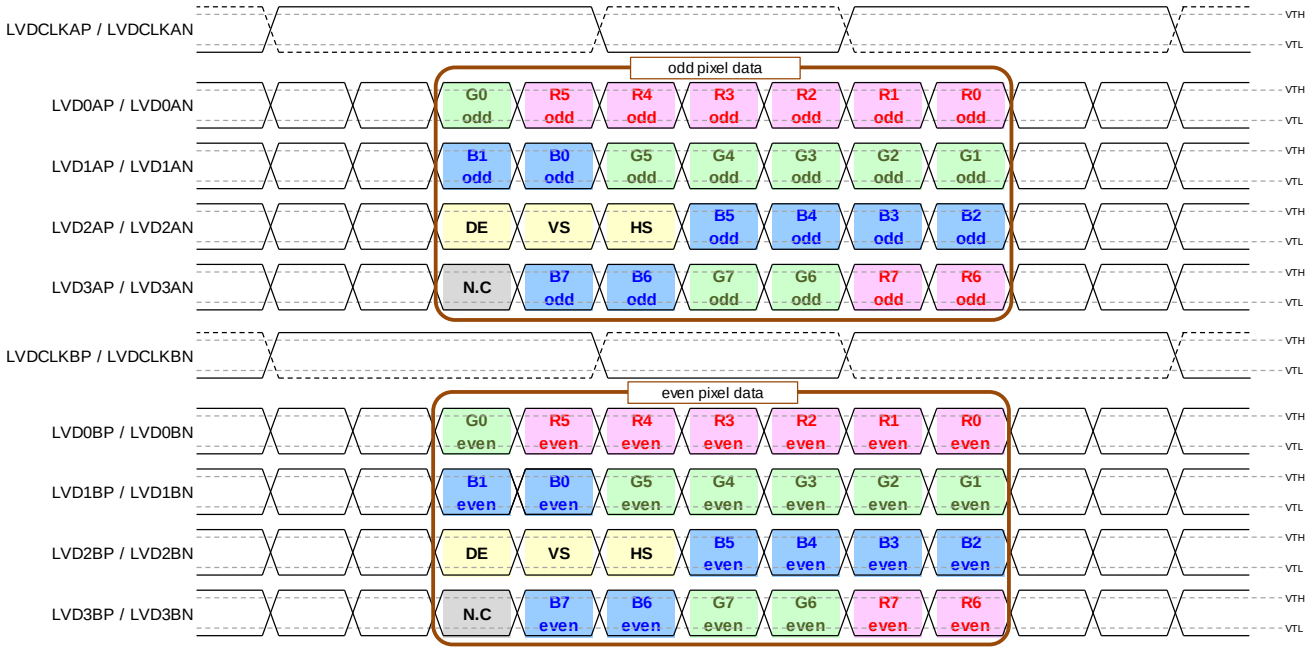
2.3.1 Signal Definition

LVDS is performed by the following signals.

Signal	Description
LVDA[3:0]P/N	A-port (for odd data), LVDS data signal
LVDCLKAP/N	A-port (for odd data), LVDS clock signal
LVDB[3:0]P/N	B-port (for even data), LVDS data signal
LVDCLKBP/N	B-port (for even data), LVDS clock signal;

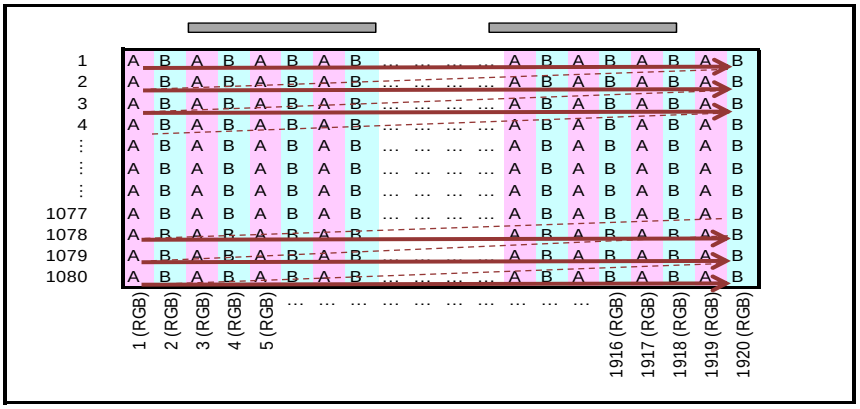
2.3.2 LVDS Data format

LVDS data format is according to the VESA format.



Note. refer to "4.2 DC CHARACTERISTICS OF LVDS " for the definition of VTH and VTL

< Data send direction >



A : Send by Port-A (LVD[3:0]AP/N, LVDCLKAP/N
B : Send by Port-B (LVD[3:0]BP/N, LVDCLKBP/N

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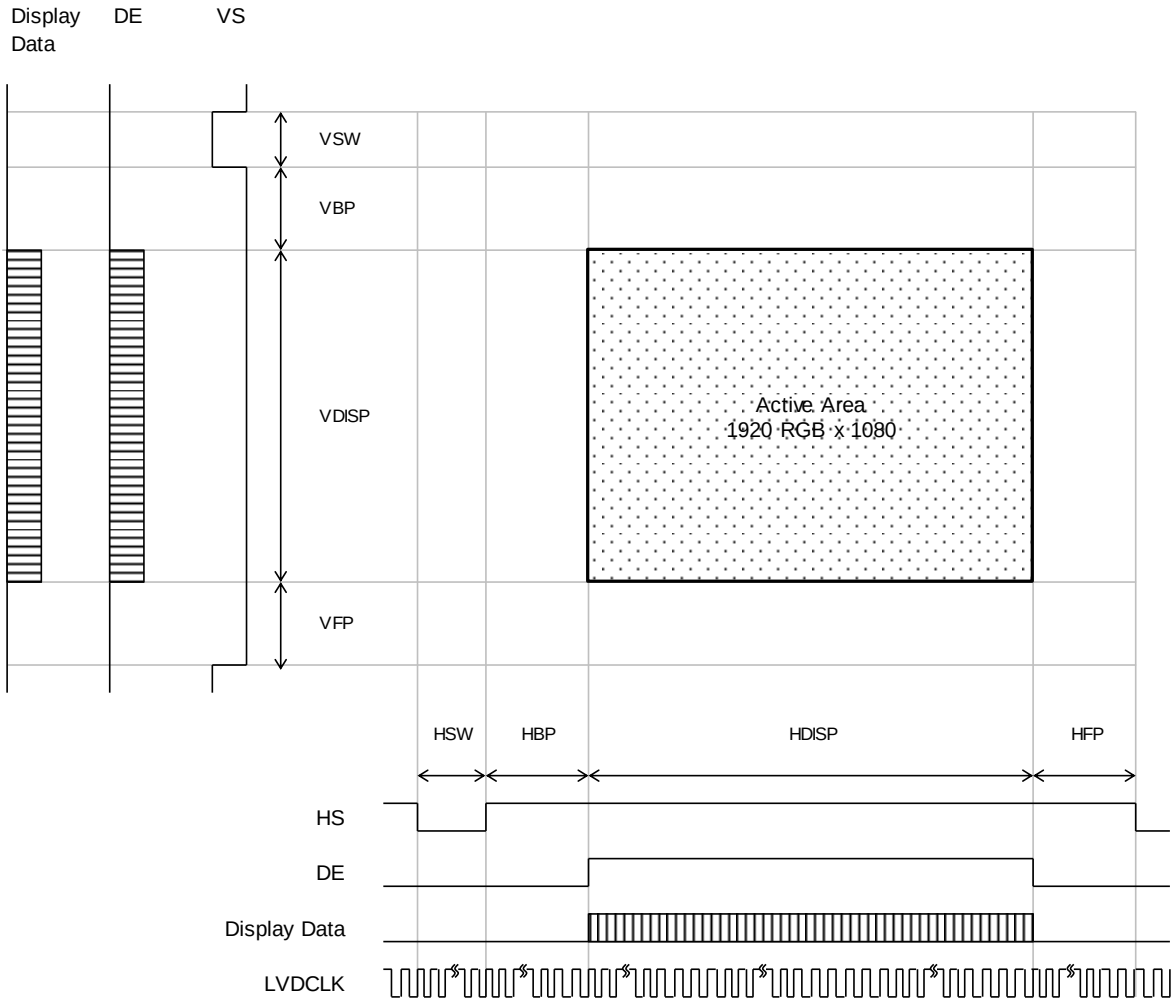
2.3.3 LVDS General Timing Diagram



Condition	Description
VSW	Vertical Sync time (VS=L)
VBP	Vertical Back Porch
VDISP	Vertical Display Active Area
VFP	Vertical Front Porch
HSW	Horizontal Sync time (HS=L)
HBP	Horizontal Back Porch
HDISP	Horizontal Display Active Area
HFP	Horizontal Front Porch

2.4 I2C INTERFACE FOR TOUCH-IC

Please refer to
S3385 Touch Controller Datasheet. (PN: 505-000628-01 Rev B)
RMI4 Specification (PN: 511-000405-03 Rev A)

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2.5 COMMANDS FOR LCD DRIVER-IC

2.5.1 Command List for LCD Driver-IC

No.	COMMAND	Hex	B7	B6	B5	B4	B3	B2	B1	B0	Function	Parameter
1	NOP	00h	0	0	0	0	0	0	0	0	No operation	No
2	DISSET	01h	0	0	0	0	0	0	0	1	Display status control	Yes (1Byte)

Parameter: It is the number of the parameters of each command.
The command which has a parameter must not enter a data more than necessity.
As for the necessary number of parameters, refer to above table and 2.5.2 Command Details for LCD Driver-IC.

2.5.2 Command Details for LCD Driver-IC

(1) NOP

This command makes no change to the other status of the LCD module (visual).

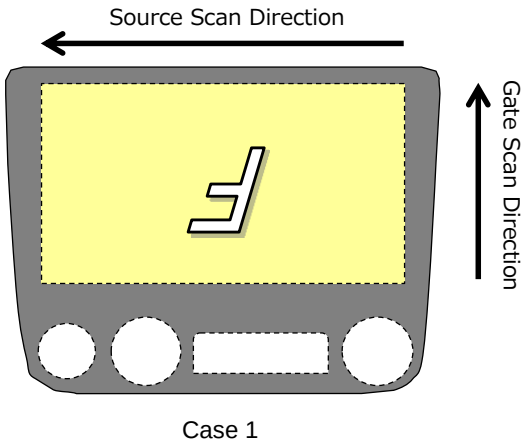
Command	Hex	B7	B6	B5	B4	B3	B2	B1	B0	Description
NOP	00h	0	0	0	0	0	0	0	0	No operation

(2) DISSET

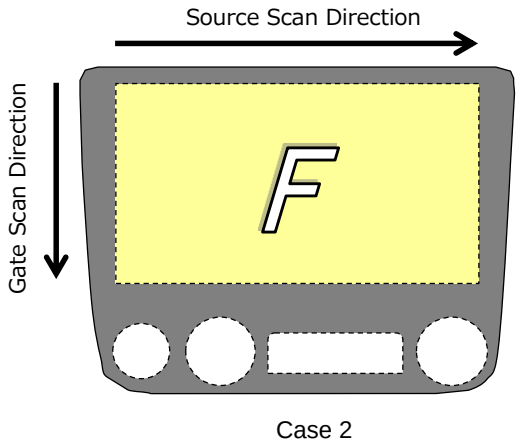
This command and the subsequent parameter are used to set the display state control.

Command	Hex	B7	B6	B5	B4	B3	B2	B1	B0	Description
DISSET	01h	0	0	0	0	0	0	0	1	Display status control
P1		P17	P16	0	0	0	0	0	P10	

P17	P16	Display Direction
0	0	Case 1
1	1	Case 2



Case 1



Case 2

P10	Display ON / OFF control
0	Display OFF
1	Display ON

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2.6 COMMANDS FOR TOUCH-IC

2.6.1 Command List for Touch-IC

Please refer to
S3385 Touch Controller Datasheet. (PN: 505-000628-01 Rev B)
RMI4 Specification (PN: 511-000405-03 Rev A)

2.6.2 Command Details for Touch-IC

Please refer to
S3385 Touch Controller Datasheet. (PN: 505-000628-01 Rev B)
RMI4 Specification (PN: 511-000405-03 Rev A)

2.7 TOUCH PANEL FUNCTION

Please refer to
S3385 Touch Controller Datasheet. (PN: 505-000628-01 Rev B)
RMI4 Specification (PN: 511-000405-03 Rev A)

3. ABSOLUTE MAXIMUM RATINGS

Stress beyond those listed under "ABSOLUTE MAXIMUM RATINGS" may cause permanent damage to the device.

3.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating	Unit
Power supply voltage	VCC1	-0.2V ~ +4.0V	V
Power supply voltage	VCC2	-0.2V ~ +4.0V	V
Logic signal input voltage (Note1)	VI1	-0.2V ~ VCC1+0.3V	V
Logic signal input voltage (Note2)	VI2	-0.2V ~ 4.0V	V
Logic signal input voltage (LVDS)	VI3	-0.2V ~ VCC1	V

Note 1: Applied Pin {XRES, DIN, SCL}

Note 2: Applied Pin {SCLK, SDA, XRESB}

3.2 ENVIROMENTAL ABSOLUTE MAXIMUM RATINGS

Parameter	Condition	Symbol	Rating		Unit	Remarks
			Min.	Max.		
Ambient temperature	Operation Storage	TOP	-40	85	deg.C	No dew condition Note 1, 2

Note 1: Care should be taken so that the LCD module may not be subjected to the temperature beyond this specification.

Note2: Ambient temperature means the temperature at LCD surface. Module temperature is apt to increase while it's driving due to the heat of backlight etc. Design carefully not to exceed +85 deg.C at every point of LCD surface that should come to contact with any other equipment. In operation temperature range, only LCD operation is assured. Contrast, response time, or other LCD characteristics are specified in the condition of Ta = + 25 deg.C.

4. ELECTRICAL SPECIFICATION

4.1 DC CHARACTERISTICS OF GENERAL

GND = 0V

Parameter	Symbol	Condition	Rating			Unit	Remarks
			Min.	Typ.	Max.		
Power Supply voltage	VCC1	Note1	3.0	3.3	3.6	V	
Power Supply voltage	VCC2	Note1	3.0	3.3	3.6	V	
Power Supply current	ICC1+ ICC2	Note2, Note3	-	(220)	(400)	mA	
Input voltage 1	VIH1	-	0.7 x VCC1	-	VCC1	V	Note4
	VIL1	-	0	-	0.3 x VCC1	V	Note4
Input voltage 2	VIH2	-	(2.2)	-	(3.6)	V	Note5
	VIL2	-	(0.0)	-	(1.0)	V	Note5
Output voltage 1	VOH1	IOH1 = -0.1mA	0.8 x VCC1	-	VCC1	V	Note6
	VOL1	IOH1 = 0.1mA	0	-	0.2 x VCC1	V	Note6
Output voltage 2	VOH2	(IOH2 = 7.1mA)	-	-	VCC1	V	Note7
	VOL2	(IOL2 = 6.8mA)	0	-	0.2 x VCC1	V	Note7
Output voltage 3	VOH3	IOH3 = Open drain	-	-	VCC1	V	Note8
	VOL3	IOL3 = 7.1mA	0	-	0.2 x VCC1	V	Note8
Input leak current 1	ILI1	VIN = VCC1	-	-	30	µA	Note4
		VIN = GND	-30	-	-	µA	Note4
Input leak current 2	ILI2	VIN = VCC1	-	(0.015)	(1)	µA	Note9
		VIN = GND	(-900)	-	(-600)	µA	Note9
Input leak current 3	ILI3	VIN = VCC1	-	(0.015)	(1)	µA	Note10
		VIN = GND	(-380)	-	(-280)	µA	Note10
Permissive ripple	PRV1	Note 9	-	-	50	mVpp	Note11
	PRV2	Note 10	-	-	50	mVpp	Note12

Note1: Rated values indicate operating range of electrical functions.
Note2: Typ. values are at the condition of power supply voltage is Typ., the ambient temperature is 25deg. C, white pattern which was written according to the timing of 4.3.1 Data Input Timing.
Max. values are at the condition of power supply voltage is in a range of 4.1 DC CHARACTERISTICS OF GENERAL, ambient temperature is in a range of operating temperature, checker pattern which was written according to the timing of 4.3.1 Data Input Timing.
Note3: In-rush current is excluded.
Note4: Applied pin {XRES, SCL, XCS and DIN}
Note5: Applied pin {XRESB, SDA and SCLK}
Note6: Applied pin {DOUT and BRS}
Note7: Applied pin {ATTN}
Note8: Applied pin {SDA}
Note9: Applied pin {XRESB}
Note10: Applied pin {SDA and SCLK}
Note11: Applied pin {VCC1}
Note12: Applied pin {VCC2}

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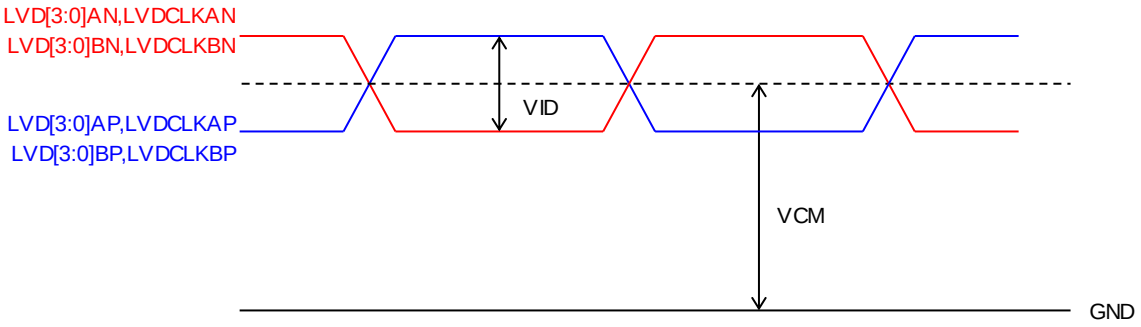
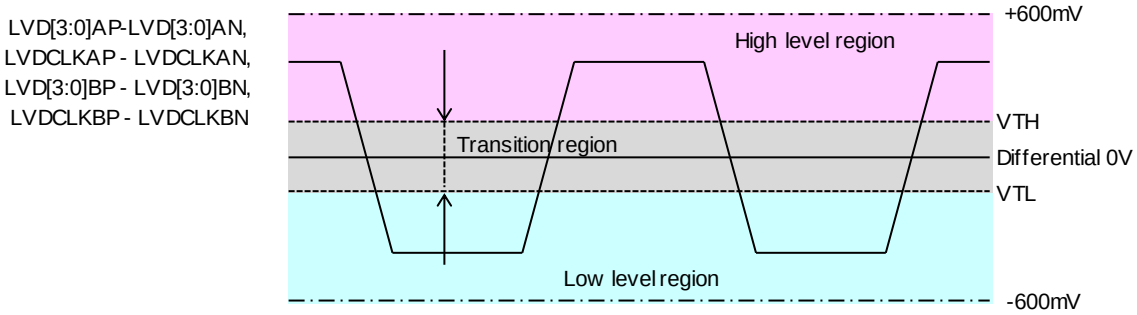
4.2 DC CHARACTERISTICS OF LVDS

GND = 0V

Parameter	Symbol	Condition	Rating			Unit	Remarks
			Min.	Typ.	Max.		
Differential threshold high voltage	VTH	-	-	-	+100	mV	
Differential threshold low voltage	VTL	-	-100	-	-	mV	
Input differential voltage	VID	-	350	450	600	mV	
Common voltage	VCM	-	1.0	1.25	1.5	V	
Termination resistor	RTRM	-	95	100	105	ohm	





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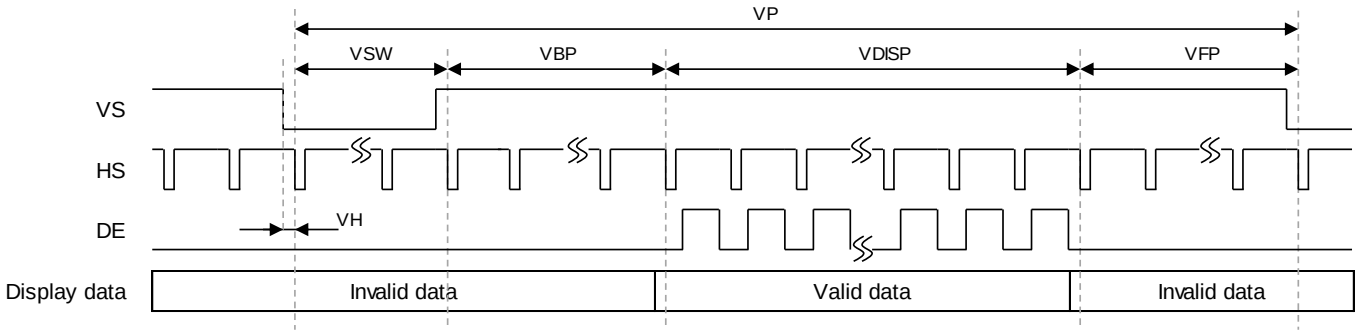
4.3 AC CHARACTERISTICS

4.3.1 Data Input Timing

(1) Vertical timing



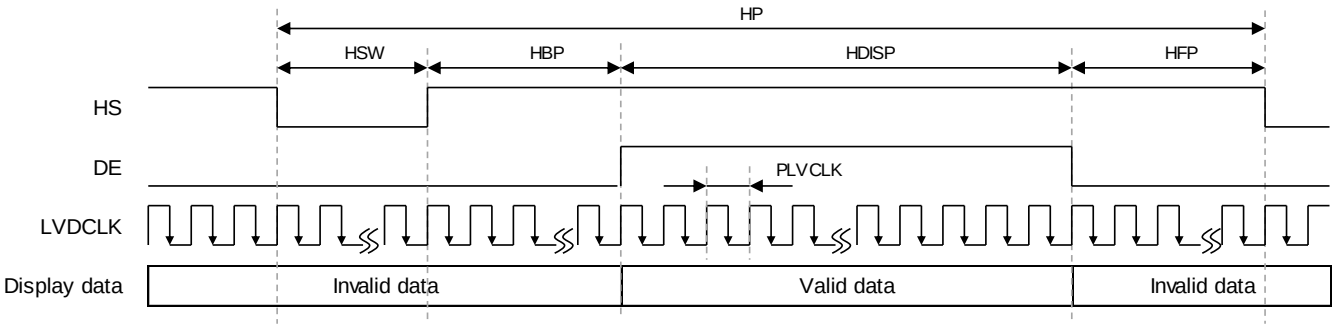
Symbol	Parameter	Min.	Typ.	Max.	Unit	Description
VP	Vertical cycle	1095	1095	1095	Line	
VSW	Vertical “L” period	1	5	10	Line	
VBP	Vertical back porch	1	5	10	Line	
VFP	Vertical front porch	4	5	10	Line	
VSW+VBP	Vertical “L” period + back porch	5	10	11	Line	
VSW+VBP +VFP	Vertical total porch	15	15	15	Line	
VDISP	Vertical active area	1080	1080	1080	Line	
VRR	Frame rate	59.41	60.01	60.61	Hz	*1

Voltage of VCC1 is in ranges of 4.1 DC CHARACTERISTICS OF GENERAL, ambient temperature is in a range of operating temperature.

*1. In case of (2) Horizontal timing

Note In case of changing the vertical and horizontal timing, the display should be turned off.

(2) Horizontal timing

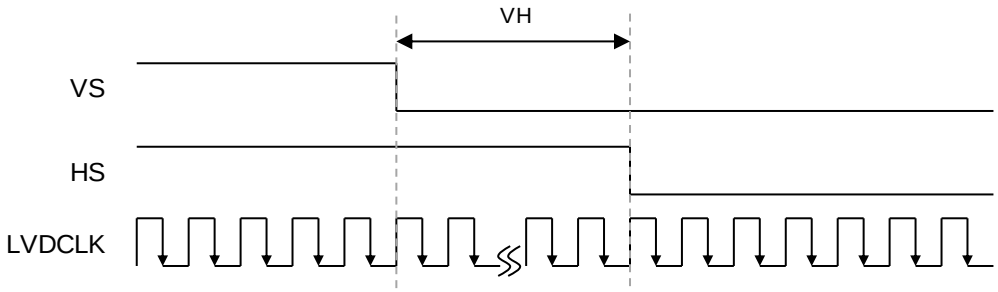


Symbol	Parameter	Min.	Typ.	Max.	Unit	Description
HP	Horizontal cycle	1130	1130	1130	LVCLK	
HSW	Horizontal “L” width	10	40	140	LVCLK	
HBP	Horizontal back porch	10	50	140	LVCLK	
HFP	Horizontal front porch	20	80	130	LVCLK	
HSW+HBP	Horizontal "L" width + back porch	40	90	150	LVCLK	
HSW+HBP +HFP	Horizontal total porch	170	170	170	LVCLK	
HDISP	Horizontal active area	960	960	960	LVCLK	
f_{LVCLK}	Pixel clock frequency	73.51	74.25	74.99	MHz	
PLVCLK		13.33	13.47	13.60	ns	

Voltage of VCC1 is in ranges of 4.1 DC CHARACTERISTICS OF GENERAL, ambient temperature is in a range of operating temperature.

Note In case of changing the vertical and horizontal timing, the display should be turned off.

(3) VS – HS timing

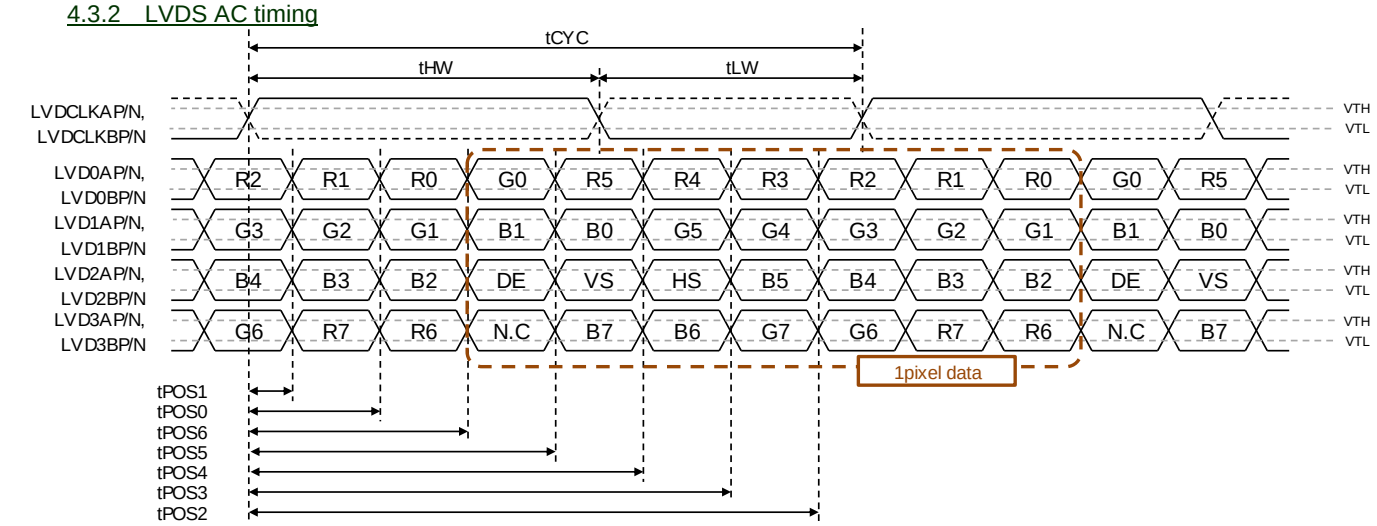


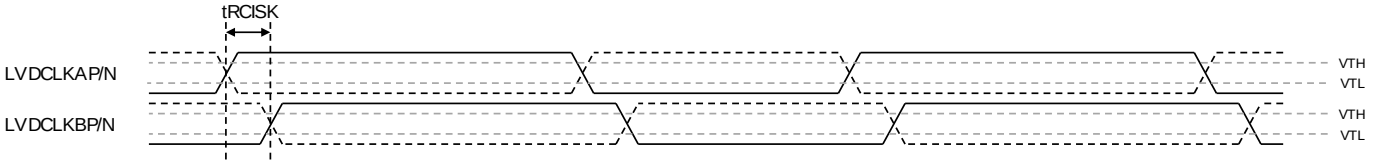
Symbol	Parameter	Min.	Typ.	Max.	Unit	Description
VH	Phase difference of VS-HS	0	0	0	LVCLK	

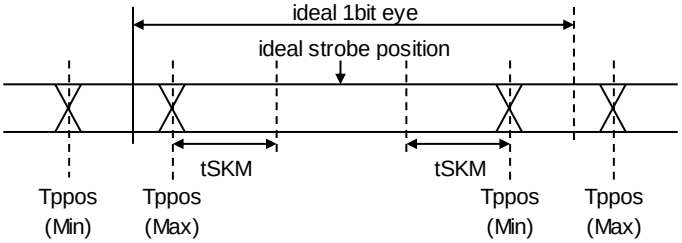
Voltage of VCC1 is in ranges of 4.1 DC CHARACTERISTICS OF GENERAL, ambient temperature is in a range of operating temperature.

This specification is preliminary. The official information is described in the LCD module specification after evaluation. The some value might vary for improvement the performance, quality and so on.

4.3.2 LVDS AC timing







Signal	Symbol	Parameter	Min.	Typ.	Max.	Unit
LVDCLKAP/N, LVDCLKBP/N	tCYC	clock cycle time	13.33	13.47	13.60	ns
	tHW	clock "H" pulse width	0.4 x tCYC	0.5 x tCYC	0.6 x tCYC	ns
	tLW	clock "L" pulse width	0.4 x tCYC	0.5 x tCYC	0.6 x tCYC	ns
	tRCISK	Port A – Port B skew	(-4/7)	0	(4/7)	tCYC
LVD[3:0]AP/N, LVD[3:0]BP/N	tPOS1	tPOS1 position	- tSKM	0	+ tSKM	ns
	tPOS0	tPOS0 position	(1/7)x tCYC - tSKM	(1/7)x tCYC	(1/7)x tCYC + tSKM	ns
	tPOS6	tPOS6 position	(2/7)x tCYC - tSKM	(2/7)x tCYC	(2/7)x tCYC + tSKM	ns
	tPOS5	tPOS5 position	(3/7)x tCYC - tSKM	(3/7)x tCYC	(3/7)x tCYC + tSKM	ns
	tPOS4	tPOS4 position	(4/7)x tCYC - tSKM	(4/7)x tCYC	(4/7)x tCYC + tSKM	ns
	tPOS3	tPOS3 position	(5/7)x tCYC - tSKM	(5/7)x tCYC	(5/7)x tCYC + tSKM	ns
	tPOS2	tPOS2 position	(6/7)x tCYC - tSKM	(6/7)x tCYC	(6/7)x tCYC + tSKM	ns
	tSKM	Skew margin	-	-	(300)	ps

Voltage of VCC1 is in ranges of 4.1 DC CHARACTERISTICS OF GENERAL, ambient temperature is in a range of operating temperature.
VTH and VTL are in ranges of 4.2 DC CHARACTERISTICS OF LVDS.

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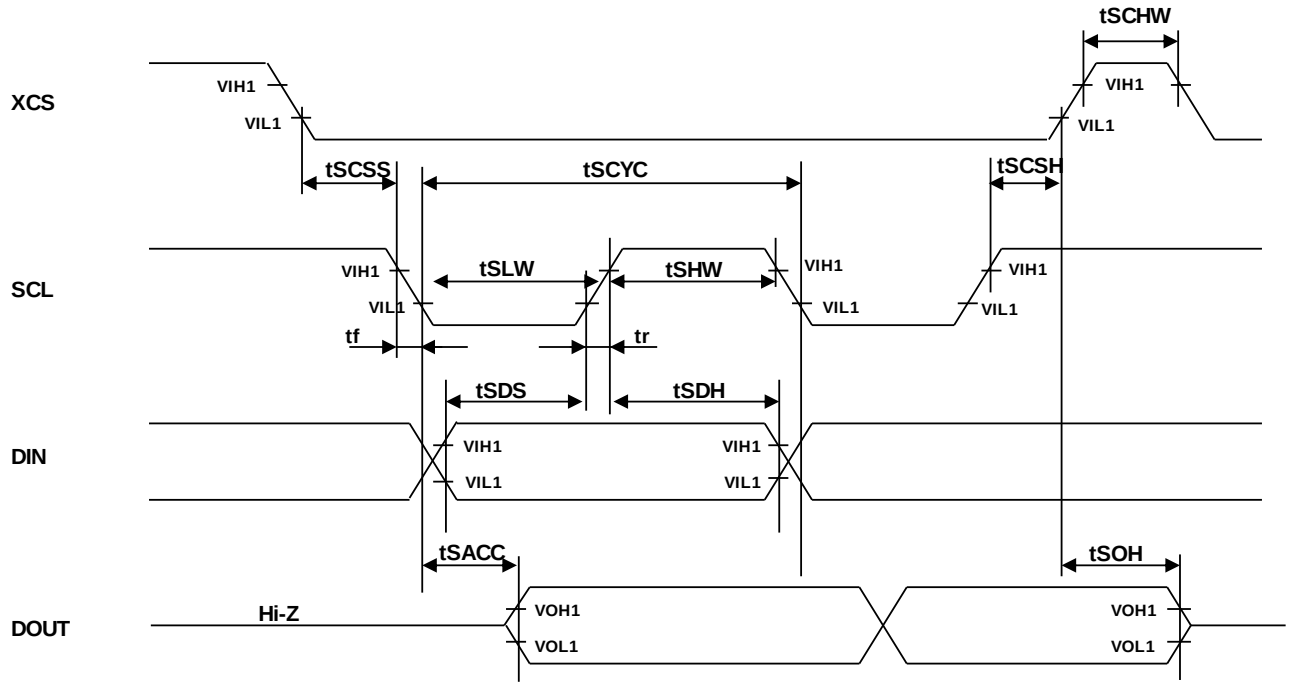
4.3.3 Serial Interface AC Timing for LCD Driver-IC



Signal	Symbol	Parameter	Min.	Max.	Unit	Description
XCS	tSCSS	Chip select signal set up time	(0)	-	ns	*1, *2
	tSCSH	Chip select signal hold time	(80)	-	ns	
	tSCHW	Chip select signal high pulse width	(80)	-	ns	
SCL	tSCYC	Serial clock cycle time	(400)	-	ns	
	tSHW	Serial clock high pulse width	(185)	-	ns	
	tSLW	Serial clock low pulse width	(185)	-	ns	
DIN	tSDS	Data set up time	(60)	-	ns	
	tSDH	Data Hold time	(60)	-	ns	
DOUT	tSACC	Read data access time	-	(160)	ns	*2, *3
	tSOH	Read data disable time	0	-	ns	

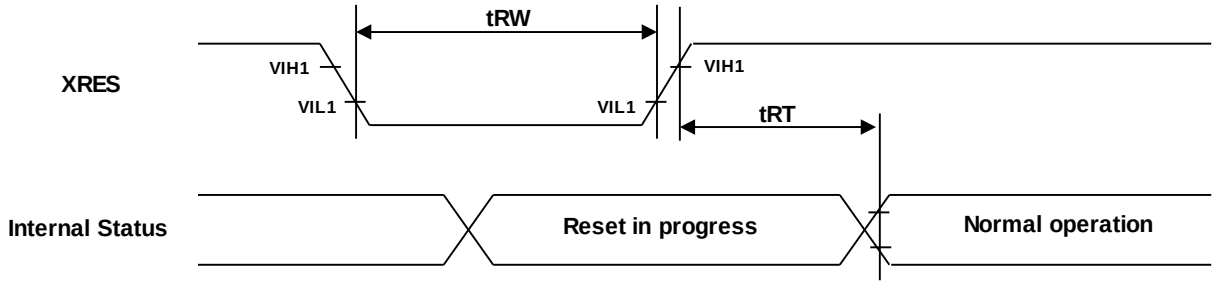
Voltage of VCC1 is in ranges of 4.1 DC CHARACTERISTICS OF GENERAL, ambient temperature is in a range of operating temperature.

*1: The rise and fall times of all input signals (tr, tf) are equal or less than 15ns

*2: VIH1, VIL1, VOH1 and VOL1 are in ranges of 4.1 DC CHARACTERISTICS OF GENERAL.

*3: Measurement condition CL = 8pF (min), 30pF (max)

4.3.4 Reset Timing for LCD Driver-IC



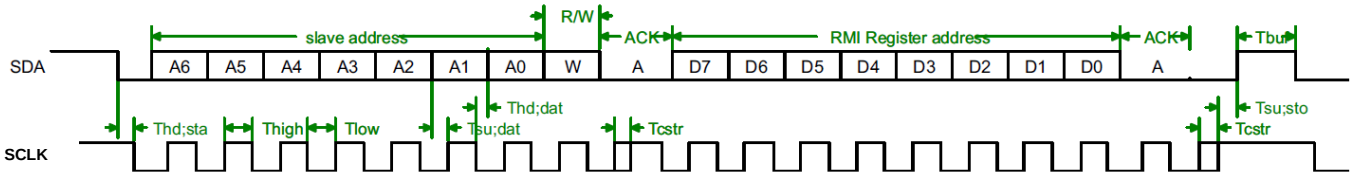
Signal	Symbol	Parameter	Min.	Max.	Unit	Description
XRES	tRW	Reset low pulse width	50	-	µs	
	tRT	Reset complete time	-	5	ms	

Voltage of VCC is in ranges of 4.1 DC CHARACTERISTICS OF GENERAL, ambient temperature is in a range of operating temperature.

VIH1 and VIL1 are in ranges of 4.1 DC CHARACTERISTICS OF GENERAL.

Follow it about regulations of 4.4.1 Power ON / OFF Sequence about reset "L" pulse width when Start to supply system power.

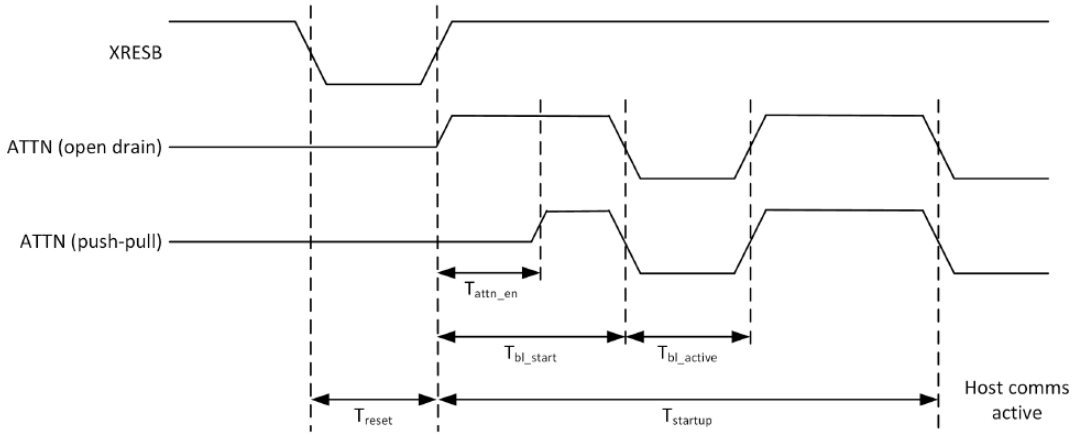
4.3.5 I2C AC Timing for Touch-IC



Parameter	Symbol	Min.	Max.	Unit
SCLK clock frequency	f_{SCL}	-	400	kHz
Stretch time	f_{CSTR}	-	25	µs
Hold time (repeated) START condition. After this period, the first clock pulse is generated.	$t_{HD:STA}$	0.6	-	µs
LOW period of the SCLK clock	t_{LOW}	1.3	-	µs
HIGH period of the SCLK clock	t_{HIGH}	0.6	-	µs
Set-up time for a repeated START condition	$t_{SU:STA}$	0.6	-	µs
Data hold time	$t_{HD:DAT}$	0	-	µs
Data out valid time	$t_{HD:DATO}$	-	0.9	µs
Data setup time	$t_{SU:DAT}$	100-	-	ns
Rise time of both SDA and SCLK signals	t_r	20+0.1C_b	300	ns
Fall time of both SDA and SCLK signals	t_f	20+0.1C_b	300	ns
Set-up time for STOP condition	$t_{SU:STO}$	0.6	-	µs
Bus free time between a STOP and START condition	t_{BUF}	1.3	-	µs
Capacitive load for each bus line	C_b	-	400	pF

4.3.6 Reset Timing for Touch-IC

Power supply	Min	Max	Unit
T_{attn_en}	5	12	ms
$T_{powerup}$	-	30	ms
$T_{startup}$	-	45	ms
T_{bl_start} (bootloader start)	-	14	ms
T_{bl_active} (bootloader active)	-	13	ms
T_{reset}	100	-	ns



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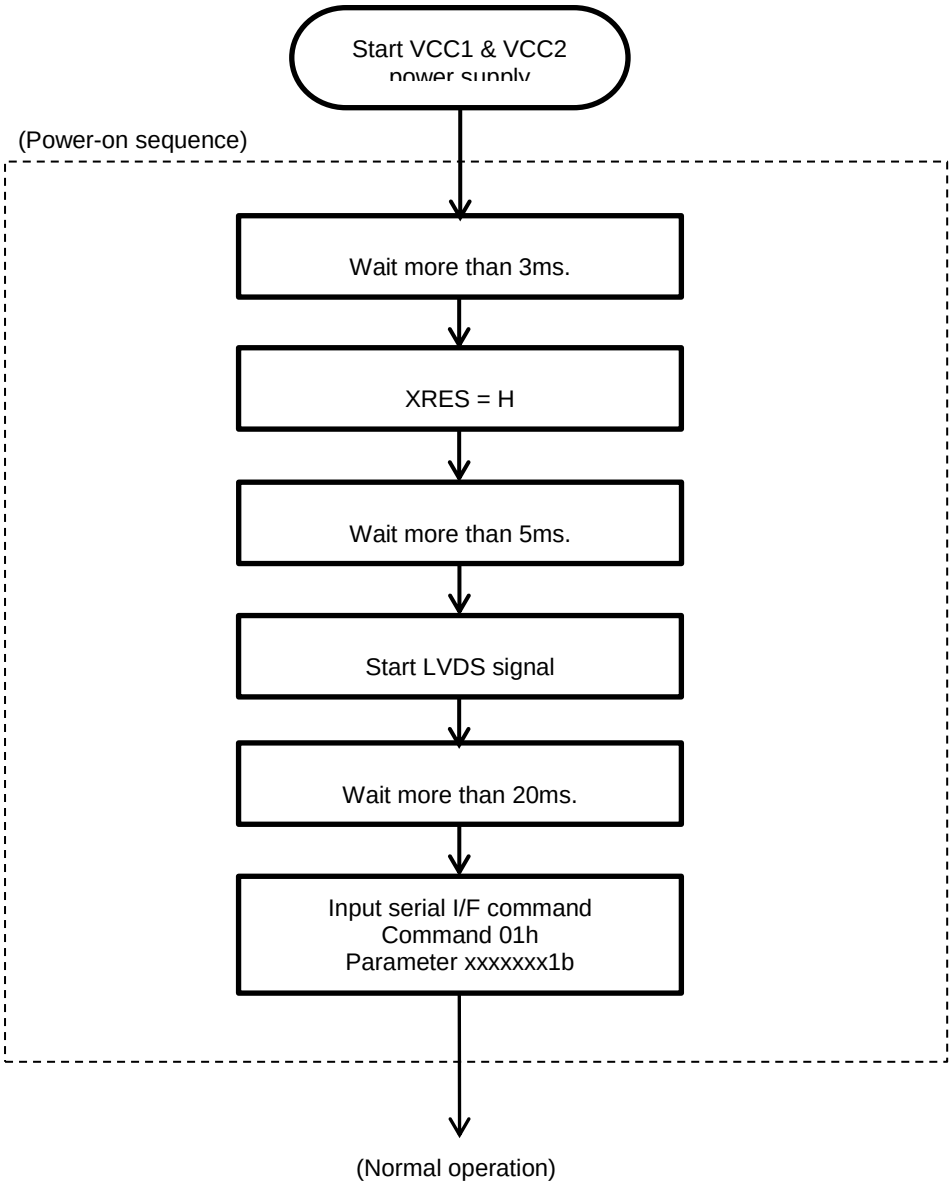
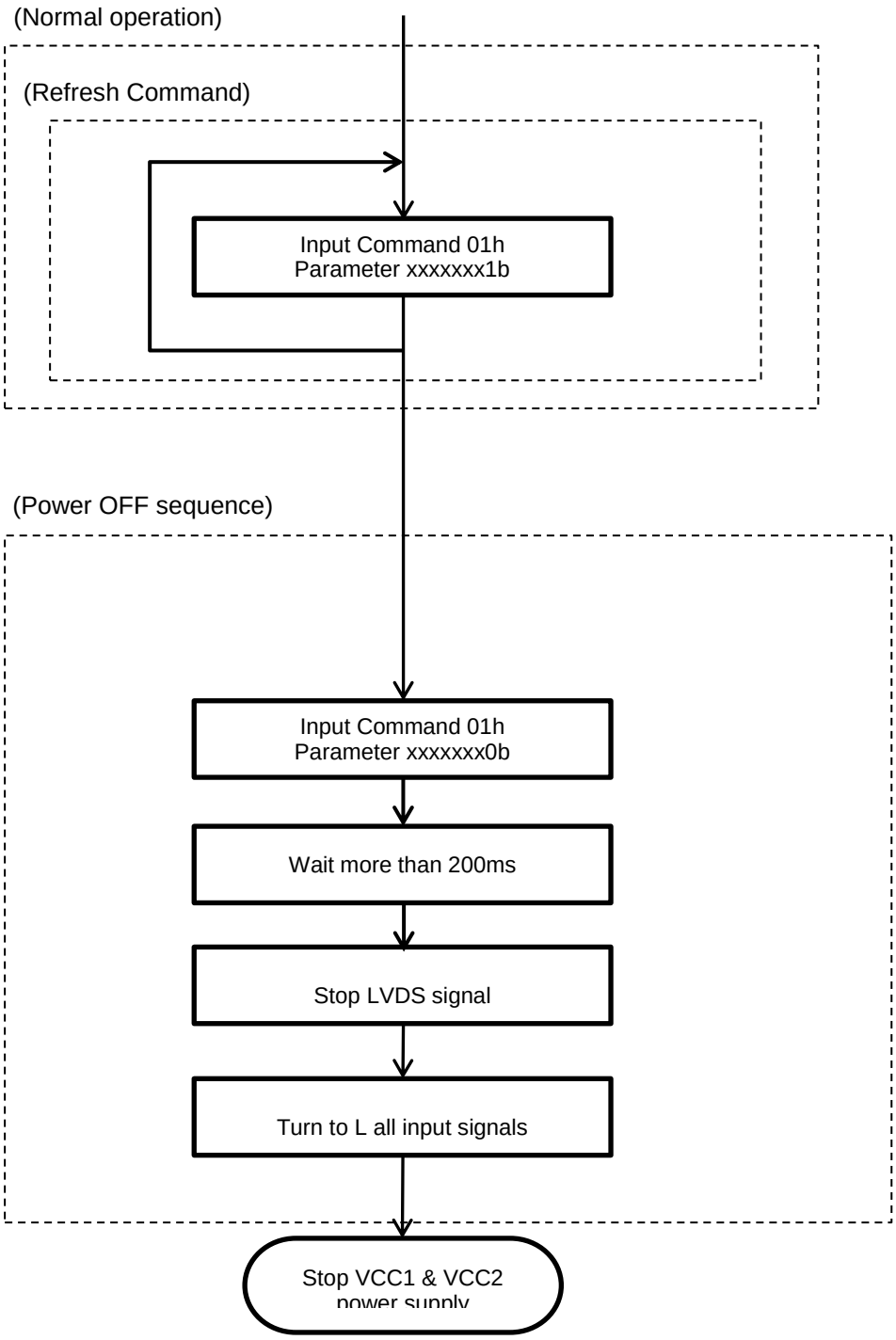
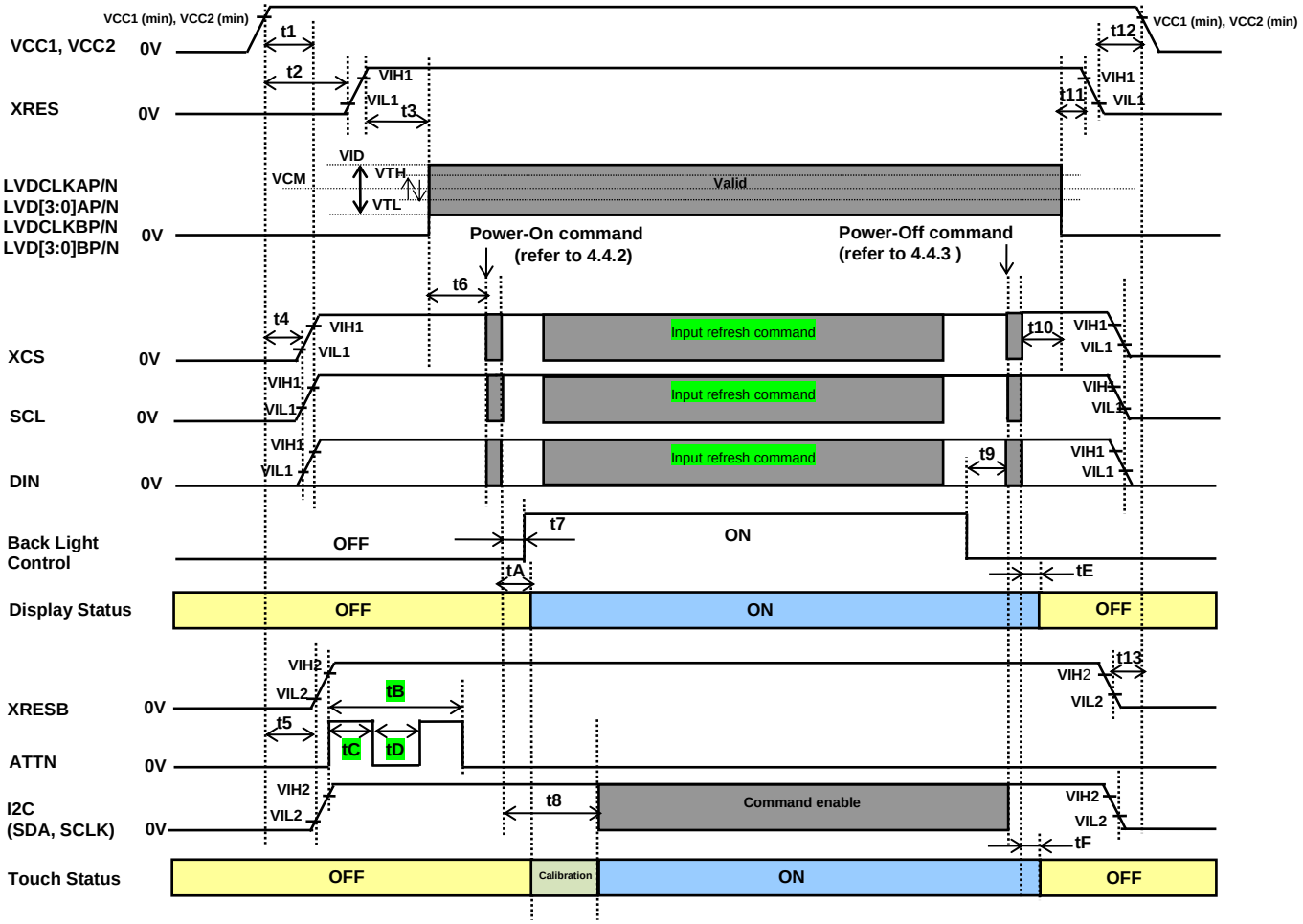
4.4 RECOMMENDED SEQUENCE

4.4.1 Power ON / OFF Sequence




(Normal operation)
(Refresh Command)
Input Command 01h
Parameter xxxxxxx1b
(Power OFF sequence)
Input Command 01h
Parameter xxxxxxx0b
Wait more than 200ms
Stop LVDS signal
Turn to L all input signals
Stop VCC1 & VCC2
power supply



<Wait time>

Please design the circuit which is able to adjust the interval of following table.

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13
Min.	(0ms)	(3ms)	(5ms)	(0ms)	(0ms)	(20ms)	(135ms)	(-)	(0ms)	(200ms)	(0ms)	(0ms)	(0ms)
Max.	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(217ms)	(-)	(-)	(-)	(-)	(-)

<Latency of LCD module operation >

	tA	tB	tC	tD	tE
Min.	-	(-)	(-)	(-)	-
Max.	(150ms)	(30ms)	(14ms)	(13ms)	(200ms)

Notes)

Note1: XRES must be maintained to “LOW” more than (3) ms after turning on the system power (VCC1 and VCC2)

Note2: XRESB must be maintained to “LOW” more than (TBD) ms after turning on the system power (VCC1 and VCC2)

Note3: LCDS signals should be start more than (5)ms after XRES signal is released.

Note4: VCC (min.) is minimum voltage of VCC. Please refer to 4.1 DC CHARACTERISTICS OF GENERAL.

Note5: The rising speed of VCC1 and VCC2 should be less than 2V/500us.
If VCC1 rising speed regulation is not satisfy, there is risk of burnout VCC1 fuse

Note6: Above regulation should be satisfied in order to ensure the normal operation of this product.

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4.4.2 Power-On Command of Serial Intrerface for LCD Driver-IC

Command		Hex Data	Remarks
DISSET	CMD	01h	
	P1	01h	In case of following condition. - Scan direction: Case 1 - Display: ON

4.4.3 Power-Off Command of Serial Intrerface for LCD Driver-IC

Command		Hex Data	Remarks
DISSET	CMD	01h	
	P1	00h	Display : Off

4.4.4 Refresh Command of Serial Intrerface for LCD Driver-IC

Command		Hex Data	Remarks
DISSET	CMD	01h	
	P1	01h	In case of following condition. - Scan direction: Case 1 - Display: ON

5. BACKLIGHT CHARACTERISTICS

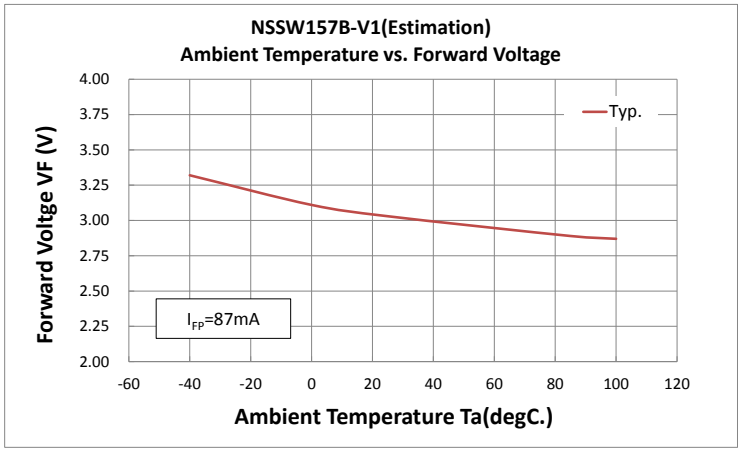
5.1 BACKLIGHT CHARACTERISTICS

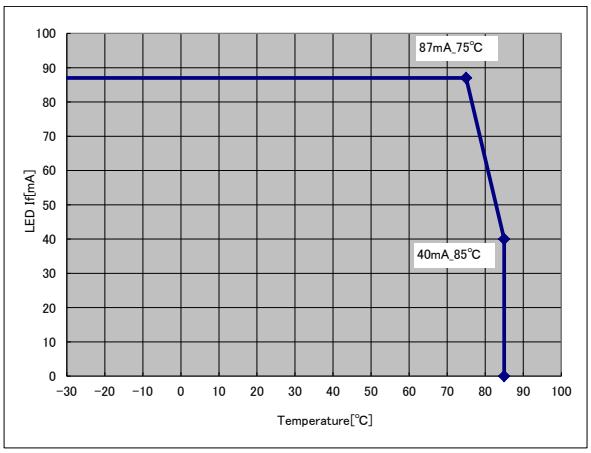
Item	Symbol	Condition		Specification MIN	Specification TYP	Specification MAX	Unit	Remark
LED Forward Voltage	V_F	I_F=87mA	T_A=25°C	2.66	3.03	3.5	V	Per one LED
				23.9	27.3	31.5	V	Per one Line
			-30°C<T_A<85°C	Note 1			V	
LED Forward Current	I_F	Each LED		-	87	-	mA	Note 2

Note
LED Type : NSSW157B-V1 (Nichia Corporation)
Total Number of LED : 36pcs (9 LED × 4 Line)

Note 1
Refer to following a representative characteristic figure from LED manufacturer.
Treat this data as reference value.

Note 2
Derating control of LED forward current is required according to temperature condition.
Even if use the PWM control, same derating curve as analog current control can be applied.





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5.1.1 Thermal Sensor

Item	Symbol	Condition	Specification	Unit	Remarks
Resistance	R_{NTC}	TA= 25°C	10	kΩ	NOTE
B- Constant	B_{NTC}	T_A= 25/ 50°C	3380	K	
Rated Electric Power	P_{NTC}	T_A= 25°C	100	mW	

NOTE
Thermistor Model: NCU18XH103F6SRB (MURATA Manufacturing Co., Ltd.)
Resistance Tolerance: ±1%
B- Constant Tolerance: ±1%
Resistance- Temperature Characteristics: Refer to following URL link.

http://www.murata.com/ja-jp/products/productdetail?partno=NCU18XH103F6SRB

6. OPTICAL SPECIFICATIONS

6.1 OPTICAL SPECIFICATION

VIN = 3.3V, IF = 87mA, f_V = 60Hz, Ta = 25 deg. C

Parameter		Symbol	Condition	Rating			Unit	Remarks
				MIN	TYP	MAX		
White Luminance		L	Perpendicular	800	-	-	cd/m2	Note 1,4)
		L_θ	x:31.5°, y:26.9°	360	-	-	cd/m2	Note 1,4)
Contrast Ratio		CR	Perpendicular	800	-	-		Note 1,3,4)
		CR_θ	x:31.5°, y:26.9°	-	655	-		Note 1,3,4)
Response Time (Bk→W→Bk)	25 deg. C	Tr＋Tf	Perpendicular T_A=+25℃	-	-	25	ms	Note 1,2,4)
	-20 deg. C		Perpendicular TA=-20℃	-	-	200		
	-30 deg. C		Perpendicular TA=-30℃	-	-	420		
Chromaticity	White	Wx	Perpendicular	-	0.313	-	-	Note 1,4)
		Wy		-	0.329	-		
	Red	Rx	Perpendicular	-	0.643	-		
		Ry		-	0.332	-		
	Green	Gx	Perpendicular	-	0.298	-		
		Gy		-	0.604	-		
	Blue	Bx	Perpendicular	-	0.152	-		
		By		-	0.062	-		
Color Gamut				-	72	-	%	
Gamma		γ	Perpendicular VESA 16	2.0	2.2	2.4	-	Note 1,4)
Uniformity	White		Perpendicular VESA 9 points	80	-	-	%	Note 1,5)
	Black		Perpendicular VESA 9 points	60	-	-	%	Note 1,5)
Reflectivity			SCI	-	-	2.2	%	

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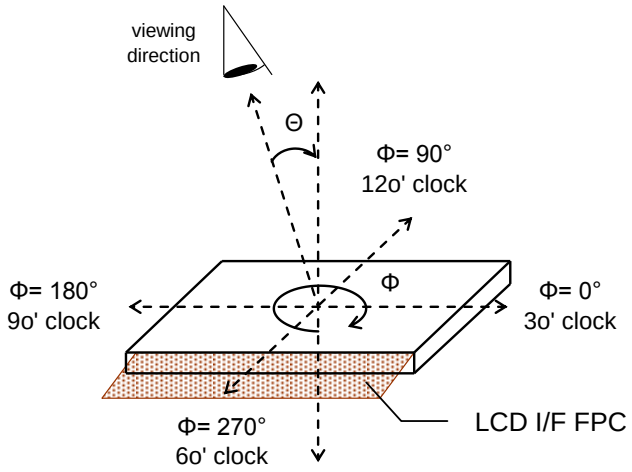
6.2 DEFINITION AND CONDITION OF OPTICAL CHARACTERISTICS

Note1) Measuring conditions

(1) Instrument: DMS 803(autronic-MELCHERS GmbH), or equivalent.
(2) Ambient temperature: unless otherwise specified,Ta=25 degree C
(3) Measure after 15 minutes of LED backlight warm up
(4) LED forward current: IF=87mA
(5) Definitions of measurement direction : Refer to following figure.



"x" and "y" are transformed to following formula.

$$\theta = \tan^{-1}\left(\sqrt{\tan^2 x + \tan^2 y}\right)$$

$$\varphi = \tan^{-1}\left(\frac{\tan y}{\tan x}\right)$$

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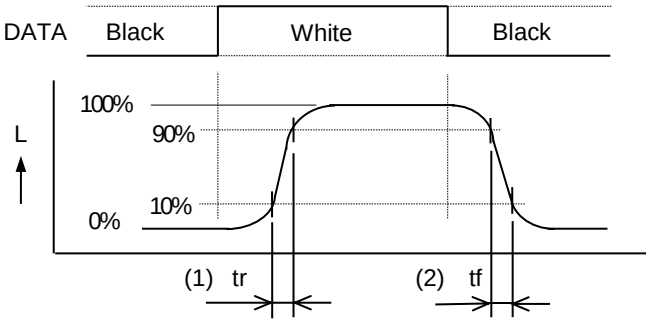
Note2) Response time



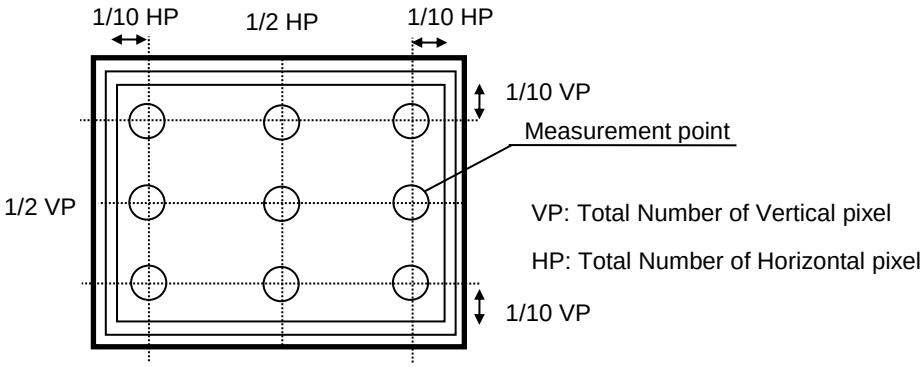
Note3) Contrast ratio "CR" :

$$CR = \frac{\text{White brightness}}{\text{Black brightness}}$$

Note4) Measured at the center of active display area

Note5) Brightness uniformity: Measured at 9 points in the active area

$$\Delta B = \frac{\text{Min. Brightness}}{\text{Max. Brightness}} \times 100$$



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7. TOUCH SPECIFICATION

7.1 TOUCH CHARACTERISTICS

		Specifications	Remarks
Multi Touch		max 10 Fingers	*1)
Report rate		120Hz +/- 6Hz	*1)
Accuracy @8mmΦ Finger	Core	max + / - 1.2mm	
	Edge	max + / - 2.0mm	
Linearity @8mmΦ Finger	H/V	max + / - 0.5mm	
	Diagonal	max + / - 1.0mm	
Jitter @8mmΦ Finger	Core	max + / - 0.5mm	
	Edge	max + / - 1.0mm	
Finger separation		14mm	8mmΦ

*1) As touched by 5 fingers or more, report rate might be unstable.

8. INSPECTION

8.1 QUALITY STANDARD

8.1.1 LOT AND STANDARDS

Lot means the unit includes all products delivered to your company at one time.

Each lot should satisfy the quality standards as shown below.

a) Major defects AQL: 0.4 %

b) Minor defects AQL: 1.0 %

8.1.2 CLASSIFICATION OF DEFECTS

Defects are classified as “major defect” and “minor defect” according to the degree of defect as following.

For details, refer to 8.2, 8.3 and 8.4.

a) Major defect

A major defect is likely to result in function failure, or to reduce materially the usability of the product for its intended purpose.

b) Minor defect

A minor defect is not likely to result in function failure, or to reduce materially the usability of the product for its intended purpose.

8.1.3 INSPECTION CONDITION

(1) Environmental condition

Under 20 to 30 deg. C.

Operating : Dark room (50 to 150lx)

Non-operating : Illuminated environment (800 to 2000lx)

(2) Inspection method

Inspect the screen by naked eye from a distance of 35cm or more on a vertical direction front on.

(3) Driving condition

According to the specification

8.2 DISPLAY APPEARANCE STANDARDS (OPERATION)

The inspection scope under LCD operating is within CG print-opening area.

Any defect outside CG print-opening area can be judged by 8.3(NON OPERATION).

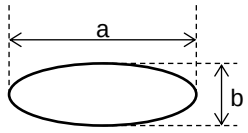
If any item is defined with a boundary sample, the boundary sample takes precedence.

No.	ITEM		CRITERION		CLASS
1	Display problems		Must not include any nonfunctioning or failure to display the correct pattern corresponding to input signal.		Major defect
2	Missing lines		No missing lines permitted.		Major defect
3	Bright dot defects Dark dot defects		Refer to allowable dot defects *1). Bright and dark dot defects are defined as following. Bright dot defects : Always bright at black raster, and larger than 50% of sub-pixel. Smaller than 50% of sub-pixel are allowed. Dark dot defects : Always dark at white raster, and larger than sub-pixel. Smaller than sub-pixel are allowed.		Minor defect
4	Mura		No mura visible through ND5% filter permitted.		Minor defect
5	Other defects e.g. particles, bubbles, stains, bright spot, dark spot	Spots	D ≤ 0.15 0.15 < D ≤ 0.40 0.40 < D	Not counted N ≤ 2 N = 0	Minor defect
		Linear	w ≤ 0.05 and L ≤ 1 w ≤ 0.05 and 1 < L ≤ 5 0.05 < w ≤ 0.15 and L ≤ 1 0.15 < w	Not counted N ≤ 2 N ≤ 2 N = 0	Minor defect

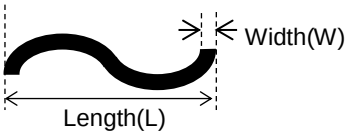
Note) Definition of defect size

Spot shape

D=(a+b)/2



Line shape



- If the trouble which is not predicted, it will be struck up with consultation between both companies.

*1: allowable dot defects

ITEM	CONDITION	DOT DEFECT		REMARKS
		DESCRIPTION	AMOUNT	
Bright dot defects	By human eye	Red	0	
		Green		
		Blue		
Dark dot defects	By human eye	Red, Green, Blue	4	
Joint dark dot defects		2 joint dots	Not allowed	
		3 joint dots	Not allowed	
Defect distance	By using a scale	Distance from defect to defect	10mm (min.)	

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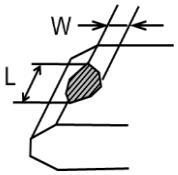
8.3 DISPLAY AND CG APPEARANCE STANDARDS (NON OPERATION)

If any item is defined with a boundary sample, the boundary sample takes precedence.

No.	ITEM		CRITERION			CLASS
1	LCD and CG defects e.g. particles, bubbles, stains, scratches,	Spot *2	D ≤ 0.15 0.15 < D ≤ 0.40 0.40 < D		Not counted N ≤ 7 N = 0	Minor defect
		Linear *2	w ≤ 0.05 0.05 < w ≤ 0.15 and L ≤ 5 0.15 < w		Not counted N ≤ 5 N = 0	Minor defect
2	Edge of CG printing	Ink stray *3	w ≤ 0.2 0.2 < w		Not counted N = 0	Minor defect
		Ink chipping *3	w ≤ 0.2 0.2 < w		Not counted N = 0	Minor defect
3	Color difference of CG printing		Should not be remarkable. If necessary, boundary samples should be provided.			Minor defect
4	Other CG Mura e.g. AR mura, AG mura		Should not be remarkable. If necessary, boundary samples should be provided.			Minor defect
5	Ink adhesions of CG side *4		Ink adhesions to the CG side are permitted.			Minor defect
6	CG chipping and crack *1		w ≤ 0.1	-	Not counted	Minor defect
			0.1 < w ≤ 0.2	L ≤ 0.1	Not counted	
				0.1 < L ≤ 0.3	N ≤ 4	
			0.2 < w	-	N = 0	

Note)

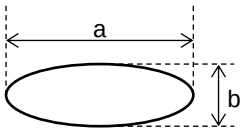
*1 : Definition of CG chipping and crack size



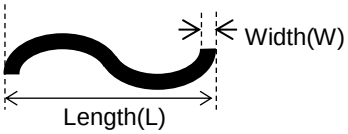
*2 : Definition of defect size

Spot shape

D=(a+b)/2

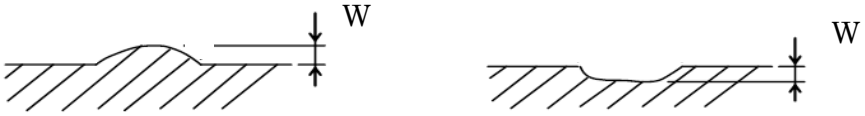


Line shape

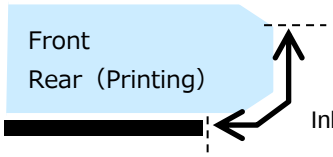


- If the trouble which is not predicted, it will be struck up with consultation between both companies.

*3 : Definition of ink stray and ink chipping at printing edge

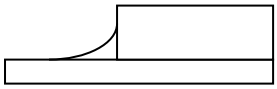


4* : Ink adhesions to CG side



Ink adhesions to the CG side are permitted

8.4 OTHER EXTERNAL APPEARANCE STANDARDS

No.	ITEM	**CRITERION**	CLASS
1	Different specifications	Not permitted.	Major defect
2	Missing parts	All parts must be complete.	Major defect
3	Damaged resist on FPC	Copper patterns on FPC must not be visible.	Minor defect
4	Circuit pattern	Must not be peeled or separated from FPC.	Major defect
5	Conductive refuses	No solder refuses or solder balls easily moving. Fixed conductive refuses over 0.2mmφ are not permitted. Should not be crowded. (crowded: means gathering more than 5 pcs within φ=5mm)	Minor defect
6	Dirt	Should not be prominent. Dirt on backside is permitted.	Minor defect
7	Soldering	Solder omissions are not permitted at any solder point.	Major defect
		Solder bridges are not permitted.	Major defect
		Cold soldering are not permitted.	Minor defect
8	Parts soldering	There must be fillet. 	Minor defect
9	Rust	Rust and discoloration of metal frame are permitted.	Minor defect

9. DURABILITY

9.1 RELIABILITY TEST ITEM AND TEST CONDITION / METHOD

Test item	Test condition	Confirm method / Judgment
Dry heat Operating	85deg.C (surface temperature of polarizer), 504Hr	After 504hours, product will be left in normal temperature and normal humidity for 2hours. It should work without fail mechanically and electrically and standard in 8.2 has to be met.
Low temperature Operating	-30deg.C, 504Hr	After 504hours, product will be left in normal temperature and normal humidity for 2hours. It should work without fail mechanically and electrically and standard in 8.2 has to be met.
Dry heat Storage	90deg.C, 504Hr	After 504hours, product will be left in normal temperature and normal humidity for 2hours. It should work without fail mechanically and electrically and standard in 8.2 has to be met.
Low temperature Storage	-40deg.C, 504Hr	After 504hours, product will be left in normal temperature and normal humidity for 2hours. It should work without fail mechanically and electrically and standard in 8.2 has to be met.
High temperature High humidity Operating	60deg.C, 90%RH, 240Hr	After 240hours, product will be left in normal temperature and normal humidity for 2hours. It should work without fail mechanically and electrically and standard in 8.2 has to be met.
High temperature High humidity Storage	60deg.C, 90%RH, 240Hr	After 240hours, product will be left in normal temperature and normal humidity for 2hours. It should work without fail mechanically and electrically and standard in 8.2 has to be met.
Light stability	Sunshine xenon weather meter BPT=63deg.C, 65W/m^2, 50%RH, Non-shower, 72Hr	After 72hours, product will be left in normal temperature and normal humidity for 2hours. It should work without fail mechanically and electrically and standard in 8.2 has to be met.
Thermal shock	-40 deg.C(30min.) +85 deg.C(30min.), 100 cycles	After 100cycles, product will be left in normal temperature and normal humidity for 2hours. It should work without fail mechanically and electrically and standard in 8.2 has to be met.
Vibration (Non-operating)	Vibration frequency: 8~33.3Hz, Amplitude 2.0mm Vibration frequency: 33.3~400Hz, Acceleration:5G, Cycle 15min. Direction of XZ: 2Hr, Direction of Y: 4Hr	Product should work without fail mechanically and electrically.
Impact (Non-operating)	100G,6ms, half sin wave,±XYZ 3 times for every direction.	Product should work without fail mechanically and electrically.
ESD -1 (Non-operating)	150pF, 330ohm, ±1kV Electrical discharge point: Between power supply terminal and another terminal 3 times for each, Non-operating	No abnormality like abnormal display.
ESD -2 (Non-operating)	150pF, 330ohm, ±8kV Electrical discharge point: Panel center 3 times Non-operating	No abnormality like abnormal display.

Note) All reliability tests are done with no condensation.

9.2 FAILURE CRITERION

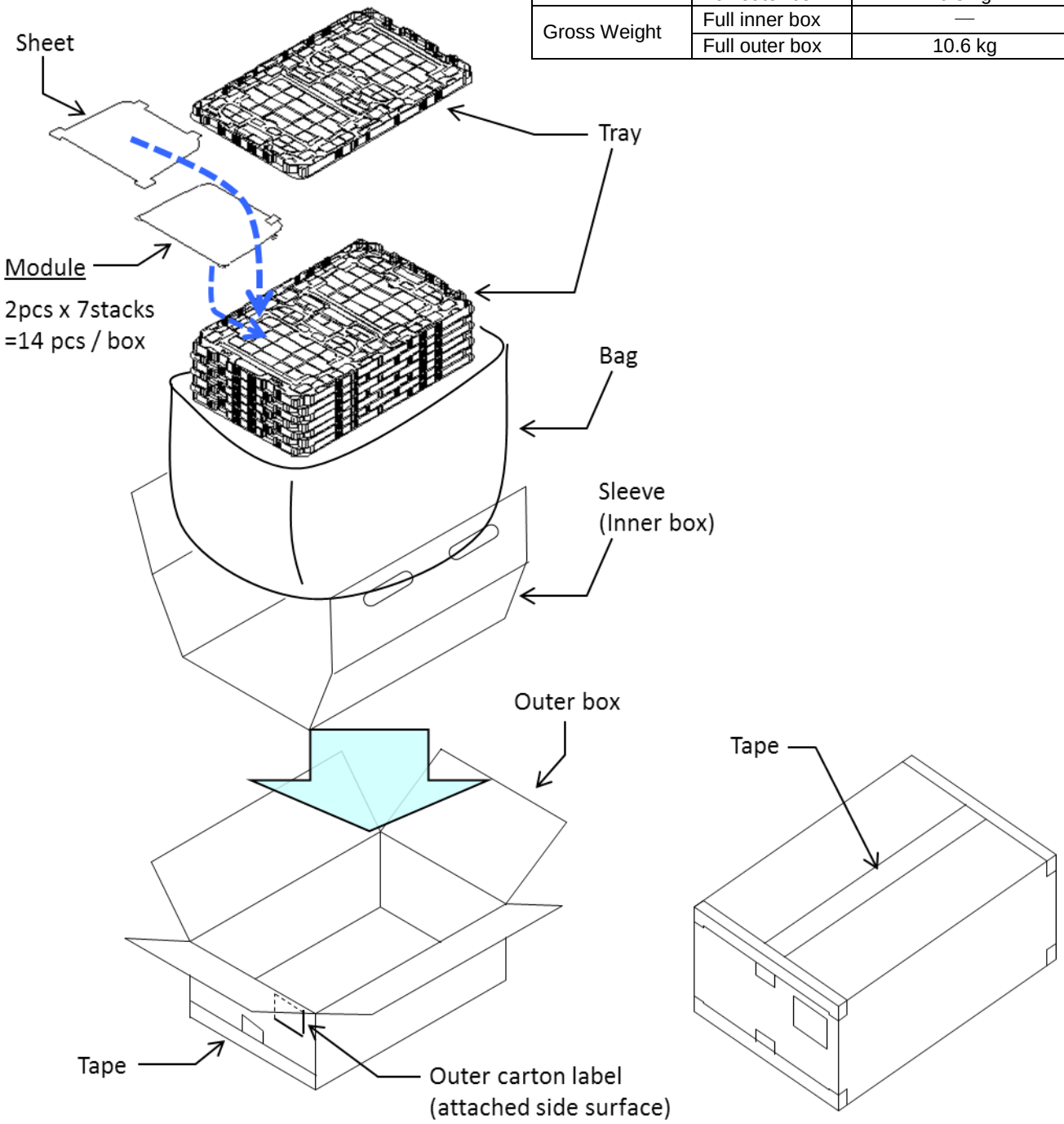
After reliability test, inspection is executed in the normal temperature / humidity environment

1) There should be severe deterioration in display quality in terms of product function.
2) There should be no abnormal function.

10. PACKING SPECIFICATIONS

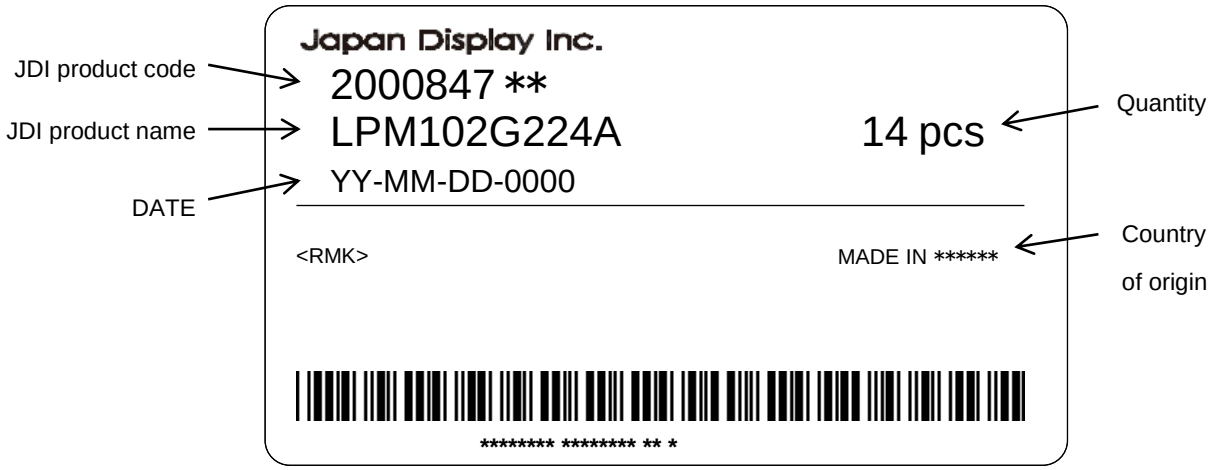
10.1 MASTER CARTON

Size	Tray	577 x 367 x 32 mm
	Inner box	577 x 374 x 191 mm
	Outer box	598 x 397 x 227 mm
Parts per Outer box		14 pcs
Parts per Inner box		14 pcs
Inner box per Outer box		1 pcs
Tray per Inner box		7+1(empty tray) pcs
Parts per Tray		2 pcs
NET Weight	Full inner box	—
	Full outer box	6.8 kg
Gross Weight	Full inner box	—
	Full outer box	10.6 kg

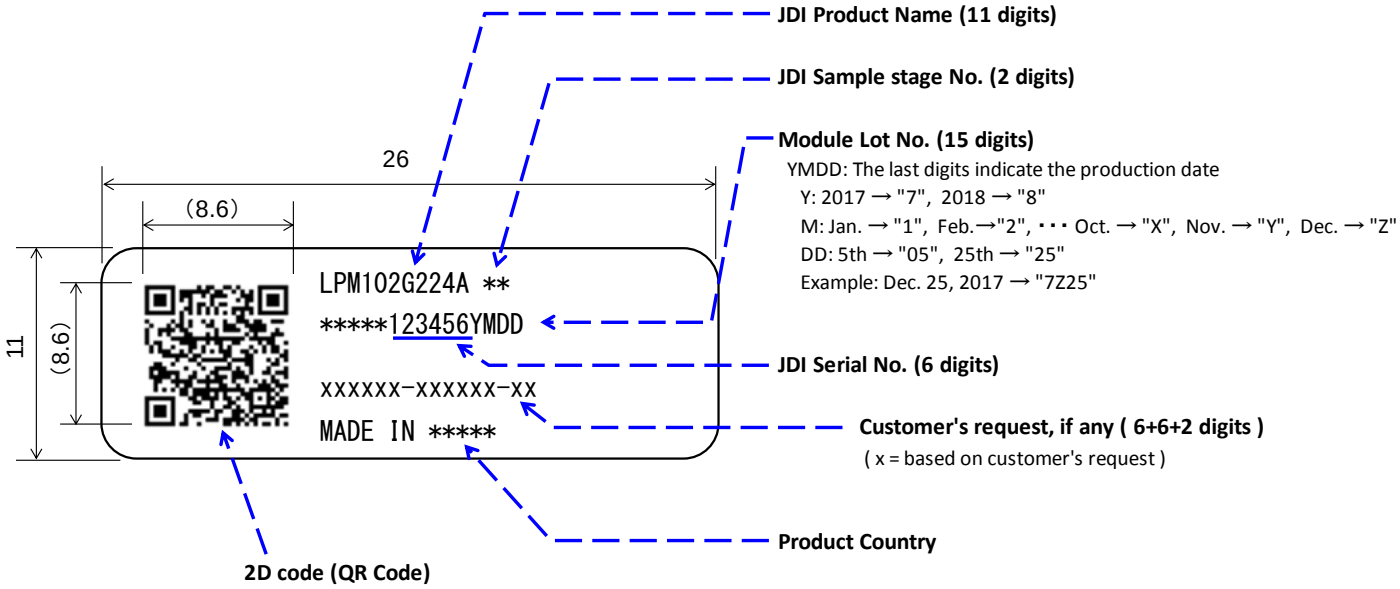


This specification is preliminary. The official information is described in the LCD module specification after evaluation. The some value might vary for improvement the performance, quality and so on.

10.1.1 MASTER CARTON LABEL



10.2 LOT LABEL



Contents of 2D barcode : xxxxxx-xxxxxx_xx_123456_YMDD_*

- 1-13 digits : "xxxxxx-xxxxxx" (x = first 6 digits x 2 based on customer's request)
- 14 digits : "_" (Under bar)
- 15-16 digits : "xx" (x = last 2 digits based on customer's request)
- 17 digits : "_" (Under bar)
- 18-23 digits : "123456" (JDI serial number)
- 24 digits : "_" (Under bar)
- 25-28 digits : "YMDD" (JDI Production date)
- 29 digits : "_" (Under bar)
- 30 digits : "*" (Manufacturing location) F (Japan)

Month : Code	Month : Code
Jan. : 1	Jul. : 7
Feb. : 2	Aug. : 8
Mar. : 3	Sep. : 9
Apr. : 4	Oct. : X
May. : 5	Nov. : Y
Jun. : 6	Dec. : Z

This specification is preliminary. The official information is described in the LCD module specification after evaluation. The some value might vary for improvement the performance, quality and so on.

11. LCD MODULE USAGE AND PRECAUTIONS

11.1 HANDLING

1) Broken glass:
Be careful to broken glass of display face. When display face is damaged, be careful enough not to cut hands by a piece of glass. The surface of product (LCD with CG module) is covered by plastic film, and glass is hard to be scattered, but there can be the hurt when touching a broken portion.

2) Broken panel:
Do not touch the liquid which flowed out of a panel. When a panel is damaged and liquid flow, do not breathe in the liquid, drink it or touch it. When liquid stuck to a hand or clothes, wipe it off in soap or alcohol immediately, then wash in water. When liquid touched to eyes, wash eyes with washing water more than 15 minutes, and undergo a medical treatment of a doctor.

3) Preventing of stain and dust:
Handle a LCD module as much as possible in a room with a few dusts. In addition, when in acceptance inspection or installing process, wear a finger case or the soft gloves which do not make a dust to prevent stain of display face of a module.

4) Handling of protection film on CG surface:
In order to protect CG surface from dust, scratches, stains etc., please remove the protection film in the final process of your assembly.

5) Wiping off stains on CG surface:
When the CG surface of LCD module was stained, please wipe it off softly by clean cloth with ethanol.

6) Water drops on CG surface:
When the the water drops on the CG surface, please wipe if off softly by clean cloth immediately.

7) Disassemble or modify of LCD module:
Do not attempt to disassemble, rework or modify the LCD module by any means. There is the possibility of electric shock, destruction of electronic parts, scratch on a display face, or dust passing into a LCD module. And if using disassembled, reworked or modified LCD module, electronic parts might emit smoke or outbreak a fire by dust or malfunction of electronic parts. A product guarantee becomes not available for a LCD module which disassembled, reworked or modified by the user.

8) Countermeasures to static electricity:
C-MOS LSI and an electronic part of the LCD module inside can be destroyed by static electricity. In order not to apply static electricity to a LCD module, spread a conductive mat to a floor and a work desk. In addition, worker should mount a ground band. Make consideration to prevent of static electricity while at work.

9) Power supply in connecting operation:
Switch off the power supply of the parent application at the time of installing process by all means. When inserting or pulling off a connector of a LCD module with having switched on the parent application, it can be damaged in an electric circuit of a LCD module. When power supply have to be turned on by testing or inspection process, use a driving circuit which satisfies an ON/OFF sequence for power supply and input signals.

10) Care of FPC/PCB at handling
Please handle with great caution no to apply stress to FPC. Grabbing the module or at Panel-PCB FPC may cause a damage of FPC or bonding connection between panel and FPC.
Be careful not to touch the mounted parts on FPC/PCB. The parts might be destroyed by static electricity and mechanical stress.

11.2 DESIGN

1) Absolute maximum ratings:
Follow the absolute maximum ratings specified in this document by all means. The absolute maximum rating is the rating which LCD module must not be violated. When using a LCD module at the condition beyond those, a burning / destruction of electronic parts or a permanent damage of characteristics may be caused. Therefore, make appropriate design not to violate the absolute maximum ratings with consideration of environmental temperature, deviation of input signals, and electronic parts tolerances.

2) Torsion and bending while in the process of installing:
Make attention that no torsion or bending stress is applied on a LCD module in the installing process to a target frame. Even if the stresses are temporarily, they might be the cause of trouble of a LCD module.

3) Preventing of a mechanical shock:
Be careful not to give a strong mechanical shock such as drops or shocks. There can be a cause of trouble such as a scratch of display face or a malfunction of LCD module.

4) Preventing of a pressure onto display face:
Make attention that no strong external force such as pushing strongly onto face of a LCD module. Because there can be a scratch on CG surface or a cause of trouble of a LCD module.

5) Preventing of a scratch on display face:
Make attention not to rub or push a display face of a LCD module by a rigid thing such as tools. In addition, be sure not to put a heavy thing such as a tool on display face and not to pile up LCD modules each other. AF coating used for display face is easy to get a scratch or traces and it might be damaged.

6) Installation of LCD module
Installation portions of a LCD module should be designed not to be applied excess torsion or bending on the LCD.

7) Spike noise of power supply
Spike noise of power supply may cause error of driver IC and abnormal display, therefore please do not apply the power supply including the noise that exceeds the range of ratings.

8) Power supply sequence:
The power supply and the input signals of the users' product unit and the inspection circuit, etc., connecting to LCD module, which satisfy the power supply sequence of the recommended operating condition, must be used.

9) Power supply circuit protection device:
Please examine and apply the power supply circuit protection device if necessary when the LCD module breaks down in accordance with the use condition.

10) Temperature dependence of display:
The response (optical response) of display varies with temperature. The response becomes slow at low temperature. In addition, brightness and chromaticity vary with temperature, too.

11) Dew condensation:
In an environment of sudden temperature change, there might be a dew condensation on surface or inside of a LCD module. Because it causes a degradation of display or malfunction, be sure to make consideration for design that dew condensation does not occur.

12) Image sticking
It is recommended to avoid display same image for long term in order to prevent causing image sticking. Also even at displaying moving image, displaying in trimmed image such as pillar-box or letterbox for long term, or repeated frequently, could cause image sticking due to the characteristics of LCD. Displaying in full screen is recommended. Interlace driving will cause image sticking on the display. Please apply non-interlace driving. In case a image sticking occurred, applying full gray image may work for recovery of sticking image for some, however if severe image sticking occurred by stationary image for more long stretch of time, this recovery measure does not work Please pay attention on these notes at designing.

13) To prevent the occurrence of erroneous operation caused by noise, special attention on satisfying VIL, VIH specified values is required. This includes taking the precautionary measures of using short cables for signal transferring.

14) An inherent characteristic of liquid crystal display is its temperature dependency. Be sure to use the LCD modules within the specified operating temperature range, as recognition of the display becomes difficult when the LCD module is used outside its range. Also, keep in mind that the voltage levels necessary for clear display images will vary according to temperature.

15) To avoid EMI, preventive measures should be implemented in the final product.

16) Similar to general electronic components, ESD may cause LCD IC to malfunction. ESD preventive measures should be considered around the LCD module, especially Driver IC.

17) As a circuit design precaution, during power-on phase, VDD shall not exceed rising rate of 2Volt/500usec. Above this rate, due to excessive current surge, system level performance of the device maybe affected.

18) While display data may be kept, data can be easily changed by external noise. Noise shall be minimized at device or system level.

19) As unexpected noise may occur, periodic refresh operation such as resend the command and display data is highly recommended as part of the software routine.

20) When logic circuit power is off, do not apply any signals to the input terminals.

21) When installing the LCD module, connect the metal frame of LCD module to the GND of the target article in order to prevent deterioration of performance by electrostatic damage.

22) Preventing of a polarizer crack:
Do not use the resin material and solvent which is containing low-molecular hydrocarbon for both lamination and cleaning at your production process at all. Crack of retarder film of the polarizer might occur when using it.

11.3 STORAGE

1) Storage and transport

Keep a LCD module with a packing form of shipment in a dark room which direct rays of the sun does not irradiate with low temperature, with low humidity, and with no dew condensation. In addition, keep it in an environment with little temperature change because there is the possibility that dew condensation occurs by a sudden temperature change. When dew condensation occurs, it may be a cause of operation abnormality or trouble.

2) Transport:

Because the master carton may be damaged or shape transformed by an excessive load applied, store and transport with piled up in lower than the number which recorded in a master carton box.

3) Handling:

Because a LCD module is a product having precision electronic parts and glass products, it might be damaged by an excessive shock or a dropping. Although a LCD module does protected with master carton, handle it carefully to reduce a shock in transshipping, transporting and loading.

11.4 DISPOSAL

Disposing LCD modules, consult a company specialized in industrial waste treatment which is permitted by the government or the local authority.

11.5 OTHER PRECAUTIONS

1) This product is developed and manufactured for the usage of general electronic equipments (office automation equipments, communication peripherals, electric appliance products, game machines, etc.) and is not suitable for devices that require high reliability and safety (aircraft / space use equipments, nuclear control apparatus, life maintenance equipments, etc).

2) Use this product correctly according to the operating conditions and precautions that are stated in this specification. Design carefully to prevent accidents, fire hazards, and social damage because of this product.

3) Radiation proof design is not applied to this product.

4) Contents in this specification shall not guarantee any third party's intellectual property right or concession of other rights. Japan Display Inc. will not take responsibility for the industrial property issue arising between the user and a third party.

5) This specification includes copyright-related contents. It is strictly prohibited to make partial/ full reprints or duplicate copies of this specification without the approval of Japan Display Inc..

6) Damages caused by the using beyond conditions or notices or precautions as mentions in this specifications, are responsible for the users.

7) If there is unknowns or need more details, please contact sales representative.

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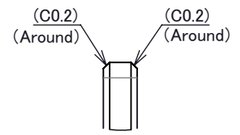

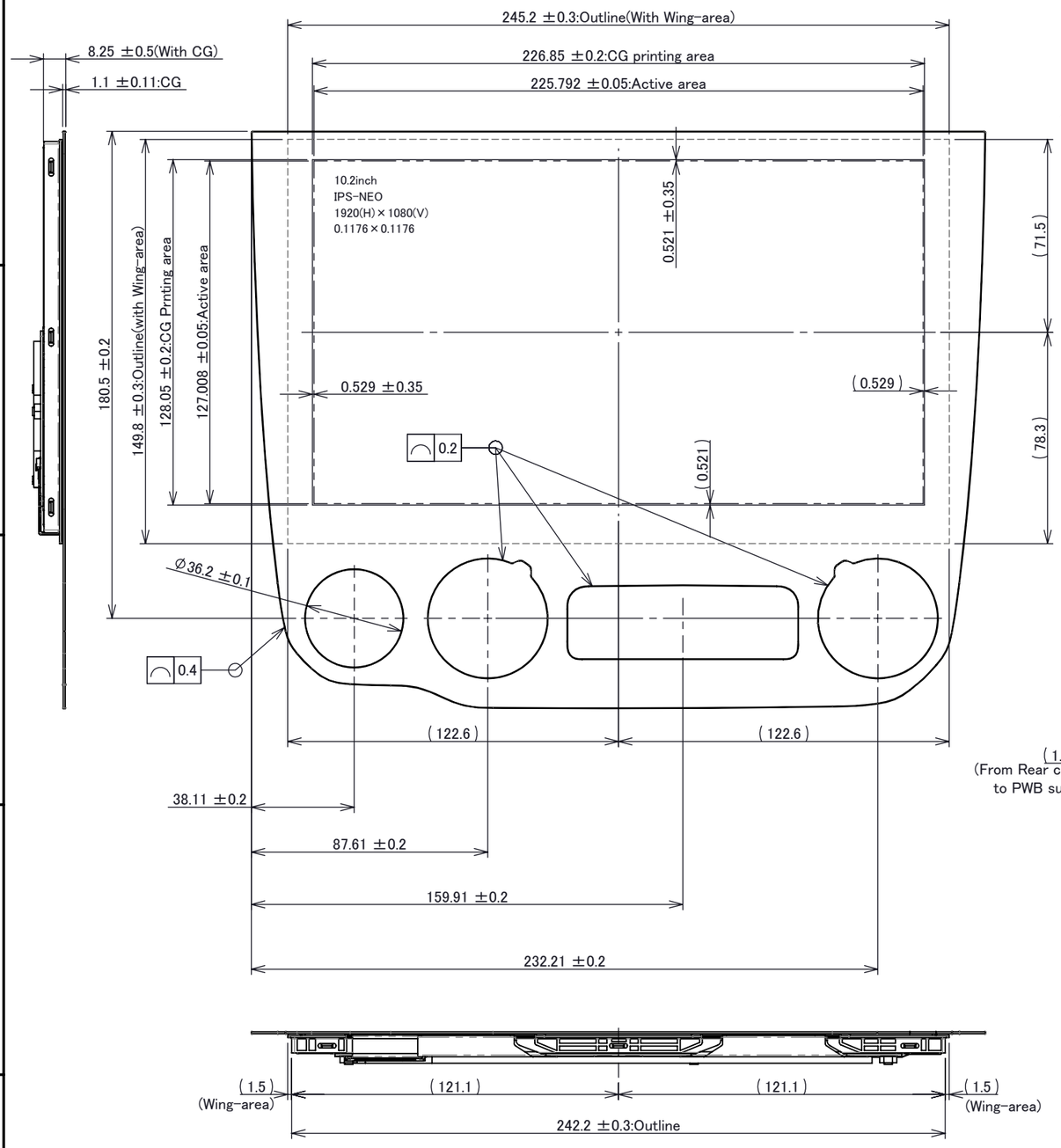

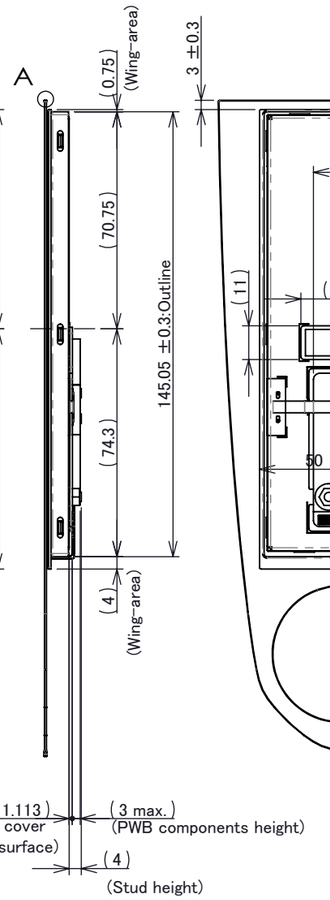

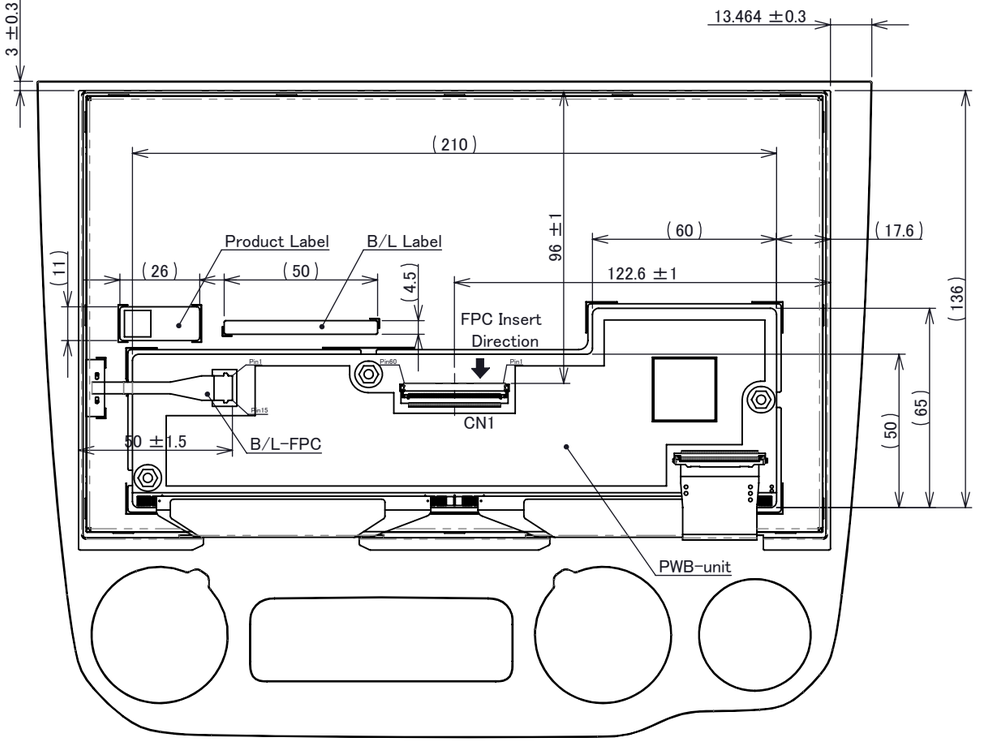

Note1:CN1:FH28-60S-0.5SH(HIROSE)
Note2:B/L-FPC suitable CN:FH28-15S-0.5SH(HIROSE)
Note3:Chamfer of CG edge and CG hole edge:(C0.2)

HISTORY X COUNT	SUFFIX / VER	DATE	REVISION	SIGN.
5 x		/ /		
4 x		/ /		
3 x		/ /		
2 x		/ /		
1 x		/ /		

DRAWN BY	PLANNED BY	CHECKED BY	APPROVED BY
S.Yamaguchi	S.Yamaguchi	M.Watanabe	M.Kitagawa

UNIT: mm
TOLERANCE: ±0.5
PROJECTION
SCALE: 1:2
TENTATIVE
MODEL: -
DOCUMENT NO: -
MODEL: LPM102G224B
DOCUMENT TEXT: OUTLINE_DWG_G224B
DOCUMENT NO: _
SHEET: 1/1

JDIグループのグリーン調達ガイドラインを厳守すること。
Requirements concerning the environment-related substances for general parts/materials Suppliers must comply with Japan Display Inc.Group's "Green Procurement Guidelines"

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ISSUED 2018/01/12

JDF01-C3-01-P1