SHARP

DISPLAY DEVICE COMPANY

SHARP CORPORATION

APPLICABLE DIVISION

DEVELOPMENT DEPARTMENT
BUSINESS UNIT 2
BUSINESS DVISION 1
DISPLAY DEVICE COMPANY

SPECIFICATION

DEVICE SPECIFICATION for

CGS Color LCD Module
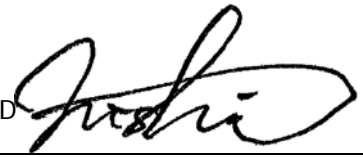
(1440 × RGB × 1440 dots)

Model No.

LS029B3SX04

PRESENTED
BY

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□ CUSTOMER'S APPROVALDATE

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BY _____

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DATE	REF.PAGE PARAGRAPH DRAWING No.	REVISED NO.	SUMMARY
7.Nov.2016		A	First Issue
28.Dec.2016	Page.7_Table.2 Page.8_Fig.2 Page.31_Fig.19	B	Pin No.37 is added ″6LED″. Pin No.38 is added ″7LED″. Pin No.39 is modified to″LED_AN2″,″positive2″ and added ″7LED″. Pin No.40 is modified to″LED_AN1″,″positive1″ and added ″6LED″ Fig.2 is modified in the same way as Pin39,Pin40. Fig.19 is modified in the same way as Pin39,Pin40,and added LED-FPC circuit.
6.Jan.2017	Page.5_Table.1 Page.8_Fig.2 Page.9 Page.18 Page.19 Page.20 Page.26	C	Table.1 : "Mass" is modified Recommended outside circuit : "Dual Port" is added Fig.2 LED Input electric current (Table.3, Fig.3) is modified Display Timing (60Hz frame /　75Hz scan) is modified Display Timing (90Hz frame / 120Hz scan) is modified Display Timing (60Hz frame / 120Hz scan) is added Optical Characteristic Table.21 is modified
12.Jan.2017	Page.26	D	Optical Characteristic Table.21 is modified （NTSC ratio specification）
9.Feb.2017	Page.31	E	The Indication of factory code in the lot number is modified.

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○ The device listed in these specification sheets was designed and manufactured for use in Telecommunication equipment (terminals)

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○ Do not use the device for equipment that requires an extreme level of reliability, such as aerospace applications, telecommunication equipment (trunk lines), nuclear power control equipment and medical or other equipment for life support.

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○ Contact and consult with a SHARP sales representative for any questions about this device.

[For handling and system design]

(1) Do not scratch the surface of the polarizer film as it is easily damaged.

(2) If the cleaning of the surface of the LCD panel is necessary, wipe it swiftly with cotton or other soft cloth. Do not use organic solvent as it damages polarizer.

(3) Water droplets on polarizer must be wiped off immediately as they may cause color changes, or other defects if remained for a long time.

(4) Since this LCD panel is made of glass, dropping the module or banging it against hard objects may cause cracks or fragmentation.

(5) Certain materials such as epoxy resin (amine's hardener) or silicone adhesive agent (de-alcohol or de-oxym) emits gas to which polarizer reacts (color change). Check carefully that gas from materials used in system housing or packaging do not hart polarizer.

(6) Liquid crystal material will freeze below specified storage temperature range and it will not get back to normal quality even after temperature comes back within specified temperature range. Liquid crystal material will become isotropic above specified temperature range and may not get back to normal quality. Keep the LCD module always within specified temperature range.

(7) Do not expose LCD module to the direct sunlight or to strong ultraviolet light for long time.

(8) If the LCD driver IC (COG) is exposed to light, normal operation may be impeded.   It is necessary to design so that the light is shut off when the LCD module is mounted.

(9) Do not disassemble the LCD module as it may cause permanent damage.

(10) As this LCD module contains components sensitive to electrostatic discharge, be sure to follow the instructions in below.

① Operators

Operators must wear anti-static wears to prevent electrostatic charge up to and discharge from human body.

② Equipment and containers

Process equipment such as conveyer, soldering iron, working bench and containers may possibly generate electrostatic charge up and discharge. Equipment must be grounded through 100Mohms resistance. Use ion blower.

③ Floor

Floor is an important part to leak static electricity which is generated from human body or equipment.

There is a possibility that the static electricity is charged to them without leakage in case of insulating floor, so the counter measure (electrostatic earth:$1\times10^8\Omega$) should be made.

④Humidity

Proper humidity of working room may reduce the risk of electrostatic charge up and discharge. Humidity should be kept over 50% all the time.

⑤Transportation/storage

Storage materials must be anti-static to prevent causing electrostatic discharge.

⑥Others

Protective film is attached on the surface of LCD panel to prevent scratches or other damages. When removing this protective film, remove it slowly under proper anti-ESD control such as ion blower.

(11) Hold LCD very carefully when placing LCD module into the system housing. Do not apply excessive stress or pressure to LCD module. Do not to use chloroprene rubber as it may affect on the reliability of the electrical interconnection.

(12) Do not hold or touch LCD panel to flex interconnection area as it may be damaged.

(13) As the binding material between LCD panel and flex connector mentioned in 12) contains an organic material, any type of organic solvents are not allowed to be used. Direct contact by fingers is also prohibited.

(14) When carrying the LCD module, place it on the tray to protect from mechanical damage. It is recommended to use the conductive trays to protect the CMOS components from electrostatic discharge. When holding the module, hold the Plastic Frame of LCD module so that the panel, COG and other electric parts are not damaged.

(15) Do not touch the COG's patterning area. Otherwise the circuit may be damaged.

(16) Do not touch LSI chips as it may cause a trouble in the inner lead connection.

(17) Place a protective cover on the LCD module to protect the glass panel from mechanical damages.

(18) LCD panel is susceptible to mechanical stress and even the slightest stress will cause a color change in background. So make sure the LCD panel is placed on flat plane without any continuous twisting, bending or pushing stress.

(19) Protective film is placed onto the surface of LCD panel when it is shipped from factory. Make sure to peel it off before assembling the LCD module into the system. Be very careful not to damage LCD module by electrostatic discharge when peeling off this protective film. Ion blower and ground strap are recommended.

(20) Make sure the mechanical design of the system in which the LCD module will be assembled matches specified viewing angle of this LCD module.

(21) This LCD module does not contain nor use any ODS (1,1,1-Trichloroethane, CCL4) in all materials used, in all production processes.

(22) Reflection sheet is exposed in the rear side of LCD module in order to make this module thinner and lighter.

Please do not laminate something on reflection sheet and push reflection sheet.

If do so, mura or blem could be occurred due to deflection of reflection sheet or breakage inside of LCD module.
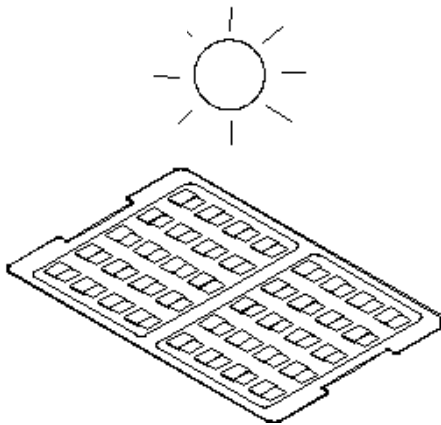
[For operating LCD module]

(1) Do not operate or store the LCD module under outside of specified environmental conditions.

(2) At the shipment, adjust the contrast of each LCD module with electric volume. LCD contrast may vary from panel to panel depending on variation of LCD power voltage from system.

(3) As opt-electrical characteristics of LCD will be changed, dependent on the temperature, the confirmation of display quality and characteristics has to be done after temperature is set at 25 °C and it becomes stable.

[Precautions for Storage]

(1) Do not expose the LCD module to direct sunlight or strong ultraviolet light for long periods. Store in a dark place.

(2) The liquid crystal material will solidify if stored below the rated storage temperature and will become an isotropic liquid if stored above the rated storage temperature, and may not retain its original properties. Only store the module at normal temperature and humidity (25±5°C,60±10%RH) in order to avoid exposing the front polarizer to chronic humidity.

(3) Keeping Method

    a. Don't keeping under the direct sunlight.   b. Keeping in the tray under the dark place.

DON'T   DO
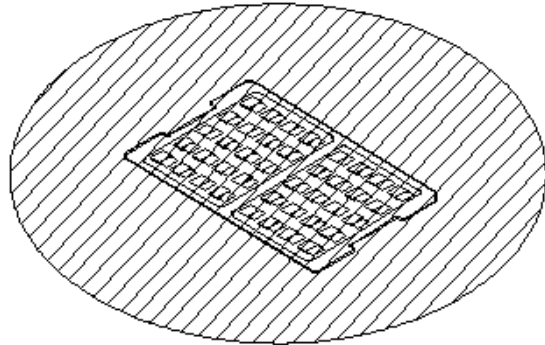
(4) Do not operate or store the LCD module under outside of specified environmental conditions.

(5) Be sure to prevent light striking the chip surface.

[Other Notice]

(1) Do not operate or store the LCD module under outside of specified environmental conditions.

(2) As electrical impedance of power supply lines (VDDI-GND) are low when LCD module is working, place the de-coupling capacitor nearby LCD module as close as possible.

(3) Reset signal must be sent after power on to initialize LSI. LSI does not function properly until initialize it by reset signal.

(4) Generally, at power on, in order not to apply DC charge directly to LCD panel, supply logic voltage first and initialize LSI logic function including polarity alternation. Then supply voltage for LCD bias. At power off, in order not to apply DC charge directly to LCD panel, execute Power OFF sequence and Discharge command.

(5) Don't touch to FPC surface, exposed IC chip, electric parts and other parts, to any electric, metallic materials.

(6) No bromide specific fire-retardant material is used in this module.

(7) Do not display still picture on the display over 2 hours as this will damage the liquid crystal.

(8) U/V glue (Liquid OCA) should not be attached on upper polarizer edge, when customer laminate cover glass

and touch panel on LCD.

[Precautions for Discarding Liquid Crystal Modules]

COG: After removing the LSI from the liquid crystal panel, dispose of it in a similar way to circuit boards from electronic devices.

LCD panel: Dispose of as glass waste. This LCD module contains no harmful substances. The liquid crystal panel contains no dangerous or harmful substances. The liquid crystal panel only contains an extremely small amount of liquid crystal (approx.100mg) and therefore it will not leak even if the panel should break.

-Its median lethal dose (LD50) is greater than 2,000 mg/kg and a mutagenetic (Aims test: negative) material is employed.

FPC: Dispose of as similar way to circuit board from electric device.

1. Application

This data sheet is to introduce the specification of active matrix 16,777,216 color LCD module.

Main color LCD module is controlled by Driver IC (R63423).

If any problem occurs concerning the items not stated in this specification, it must be solved sincerely

by both parties after deliberation.

As to basic specification of driver IC refer to the IC specification and handbook.

2. Construction and Outline

This module is a color transmissive, high contrast, wide viewing angle and active matrix LCD module incorporating

CG-Silicon TFT (Continuous Grain-Silicon Thin Film Transistor).

Construction: LCD panel, Driver (COG), FPC with electric components, LEDs, prism sheet, diffuser, light guide,

reflector and plastic frame to fix them mechanically.

Outline: See page 30   (Fig.18 Outline dimensions)

Connection: Board-to-Board Plug Connector (JAE WP7B-P040VA1)

There shall be no scratches, stains, chips, distortions and other external drawbacks that may affect the display function.

Rejection criteria shall be noted in Inspection Standard.

3. Mechanical Specification

Table 1

Item	Specifications	Unit	Remarks
Screen size	73.406 (2.89" type) Diagonal	mm	
Active area	51.84(H)X51.84(V)	mm	
Pixel format	1440(H)×1440(V)	Pixel	
	1 Pixel =R+G+B dots	-	
Pixel pitch	0.012 (H) x 0.036(V)	mm	
Pixel configuration	R,G,B vertical stripes	-	
Display mode	Normally Black	-	
LDC Driving method	DC Driving / Column	-	
Liquid Crystal Mode	SFR	-	
Number of colors	16,777,216	Colors	24 bits
Outline dimensions	54.24 X 59.02 X 1.365	mm	Note 3-1
Mass	7.2	g	

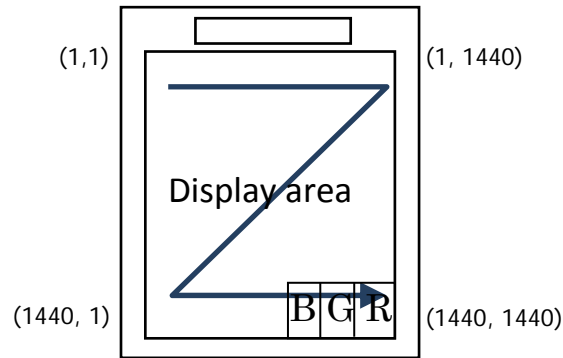Note 3-1) The above-mentioned table indicates module sizes without some projections and FPC.

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4. Pixel Configuration

Fig. 1

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5. Input Terminal Names and Functions

Table 2

Pin No	Symbol	I/O	Description	Remarks
1	DSIA_D3_N	I	MIPI data3 negative signal of MIPI Port A	
2	DSIA_D3_P	I	MIPI data3 positive signal of MIPI Port A	
3	DSIA_D0_N	I/O	MIPI data0 negative signal of MIPI Port A	
4	DSIA_D0_P	I/O	MIPI data0 positive signal of MIPI Port A	
5	DSIA_CLK_N	I	MIPI clock negative signal of MIPI Port A	
6	DSIA_CLK_P	I	MIPI clock positive signal of MIPI Port A	
7	DSIA_D1_N	I	MIPI data1 negative signal of MIPI Port A	
8	DSIA_D1_P	I	MIPI data1 positive signal of MIPI Port A	
9	DSIA_D2_N	I	MIPI data2 negative signal of MIPI Port A	
10	DSIA_D2_P	I	MIPI data2 positive signal of MIPI Port A	
11	DSIB_D2_P	I	MIPI data2 positive signal of MIPI Port B	
12	DSIB_D2_N	I	MIPI data2 negative signal of MIPI Port B	
13	DSIB_D1_P	I	MIPI data1 positive signal of MIPI Port B	
14	DSIB_D1_N	I	MIPI data1 negative signal of MIPI Port B	
15	DSIB_CLK_P	I	MIPI clock positive signal of MIPI Port B	
16	DSIB_CLK_N	I	MIPI clock negative signal of MIPI Port B	
17	DSIB_D0_P	I/O	MIPI data0 positive signal of MIPI Port B	
18	DSIB_D0_N	I/O	MIPI data0 negative signal of MIPI Port B	
19	DSIB_D3_P	I	MIPI data3 positive signal of MIPI Port B	
20	DSIB_D3_N	I	MIPI data3 negative signal of MIPI Port B	
21	EN1PORT	I	EN1PORT is used for enable or disable MIPI dual port	"H" single port
22	AVDD	-	Power supply for analog	
23	VDDI	-	Power supply for I/O	
24	VDDI	-	Power supply for I/O	
25	EXCK	I	External Clock (not used)	GND
26	GND	-	Ground	
27	GND	-	Ground	
28	GND	-	Ground	
29	RESX	I	Device reset signal	"L" Active
30	FTE	O	Frame head pulse signal (not used)	Open
31	Sync	O	Synchronizing signal (not used)	Open
32	LEDPWM	O	Backlight LED driver PWM (if not used, "floating")	
33	AGND	-	Ground	
34	AGND	-	Ground	
35	AGND	-	Ground	
36	AVEE	-	Power supply for analog	
37	LED_CA1		LED back light power negative1(6LED)	
38	LED_CA2		LED back light power negative2(7LED)	
39	LED_AN2		LED back light power positive2(7LED)	
40	LED_AN1		LED back light power positive1(6LED)	

Fitting connector: JAE   WP7B-S040VA1 (Board-to-Board Receptacle)

Pin layout: See Outline dimensions. (P.30)

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Recommended outside circuit:

<MIPI DSI (Single Port)>

BtoB Connector

Pin	Signal	Signal	Pin
21	EN1PORT	D3N_B	20
22	AVDD	D3P_B	19
23	VDDI	D0N_B	18
24	VDDI	D0P_B	17
25	EXCK	CKN_B	16
26	DGND	CKP_B	15
27	DGND	D1N_B	14
28	DGND	D1P_B	13
29	RESET	D2N_B	12
30	FTE	D2P_B	11
31	Sync	D2P_A	10
32	LEDPWM	D2N_A	9
33	AGND	D1P_A	8
34	AGND	D1N_A	7
35	AGND	CKP_A	6
36	AVEE	CKN_A	5
37	Cathode1	D0P_A	4
38	Cathode2	D0N_A	3
39	Anode2	D3P_A	2
40	Anode1	D3N_A	1

(40Pin)

Left side signals: AVDD, VDDI, RESX, FTE, Sync, LEDPWM, AVEE, Cathode_1, Cathode_2, Anode_2, Anode_1

Right side signals: DATA_2P_A, DATA_2N_A, DATA_1P_A, DATA_1N_A, CLK_P_A, CLK_N_A, DATA_0P_A, DATA_0N_A, DATA_3P_A, DATA_3N_A

<MIPI DSI (Dual Port)>

BtoB Connector

Pin	Signal	Signal	Pin
21	EN1PORT	D3N_B	20
22	AVDD	D3P_B	19
23	VDDI	D0N_B	18
24	VDDI	D0P_B	17
25	EXCK	CKN_B	16
26	DGND	CKP_B	15
27	DGND	D1N_B	14
28	DGND	D1P_B	13
29	RESET	D2N_B	12
30	FTE	D2P_B	11
31	Sync	D2P_A	10
32	LEDPWM	D2N_A	9
33	AGND	D1P_A	8
34	AGND	D1N_A	7
35	AGND	CKP_A	6
36	AVEE	CKN_A	5
37	Cathode1	D0P_A	4
38	Cathode2	D0N_A	3
39	Anode2	D3P_A	2
40	Anode1	D3N_A	1

(40Pin)

Left side signals: AVDD, VDDI, RESX, FTE, Sync, LEDPWM, AVEE, Cathode_1, Cathode_2, Anode_2, Anode_1

Right side signals (B port): DATA_3N_B, DATA_3P_B, DATA_0N_B, DATA_0P_B, CLK_N_B, CLK_P_B, DATA_1N_B, DATA_1P_B, DATA_2N_B, DATA_2P_B

Right side signals (A port): DATA_2P_A, DATA_2N_A, DATA_1P_A, DATA_1N_A, CLK_P_A, CLK_N_A, DATA_0P_A, DATA_0N_A, DATA_3P_A, DATA_3N_A
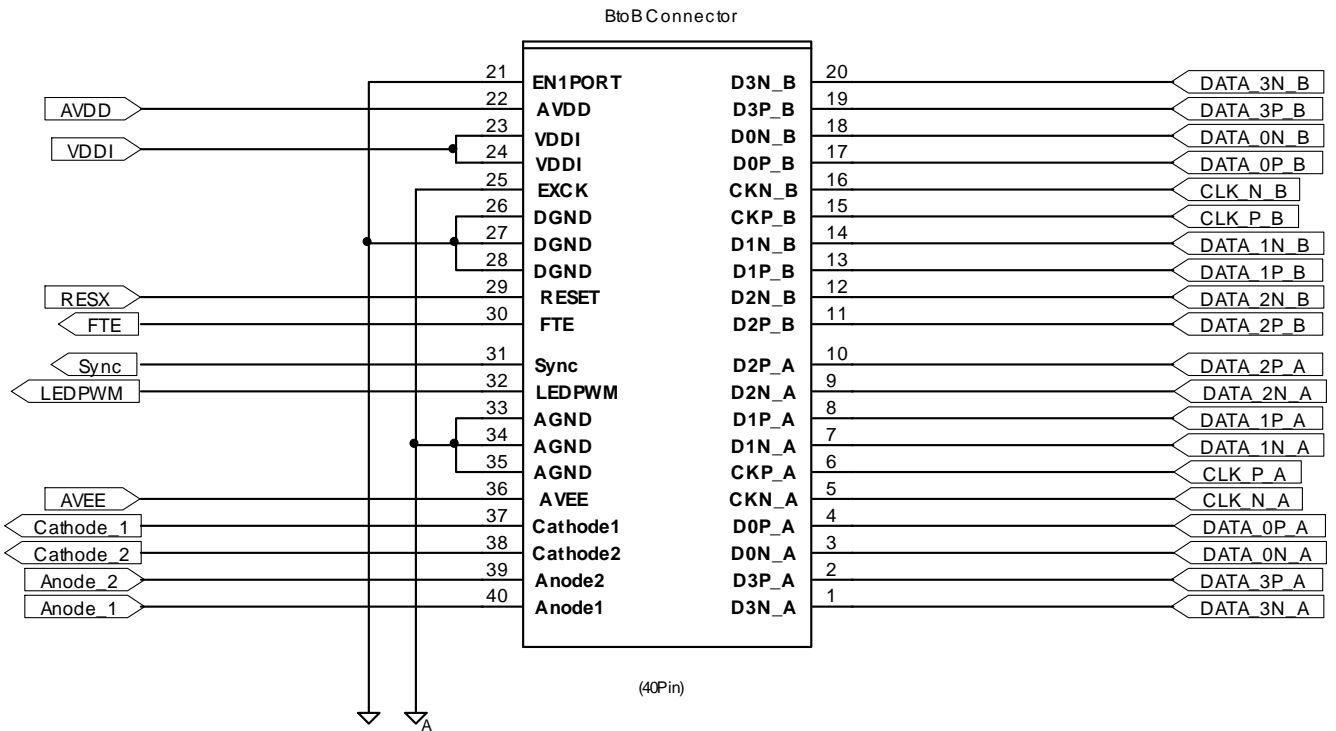
Fig. 2

6.Absolute Maximum Ratings

Table3   GND=0V

Parameter	Symbol	Conditions	Rated value	Unit	Remarks
Driver IC (Positive Analog) Power Supply Voltage	AVDD	Ta=+25°C	-0.3 to +6.5	V	Note6-1
Driver IC (Negative Analog) Power Supply Voltage	AVEE	Ta=+25°C	+0.3 to -6.5	V	Note6-1
Driver IC (Digital) Power Supply Voltage	VDDI	Ta=+25°C	-0.3 to +5.5	V	Note6-1
Temperature for storage	Tstg	-	-30 to +70	°C	Note6-2
Temperature for operation	Topr	-	-20 to +60	°C	Note6-2
LED Input electric current	ILED	Ta=+25°C	0 to 100 (Duty 10%)	mA	Note6-3

Note6-1) Voltage applied to GND pins. GND pin conditions are based on all the same voltage (0V).

Always connect all GND externally and use at the same voltage.

Note6-2)Humidity: 95%RHMax.(at Ta≤40°C). Maximum wet-bulb temperature is less than 39°C (at Ta>40°C).

Condensation of dew must be avoided.

Note6-3) Ambient temperature and the maximum input are fulfilling the following operating conditions.

デューティー比-許容順電流特性
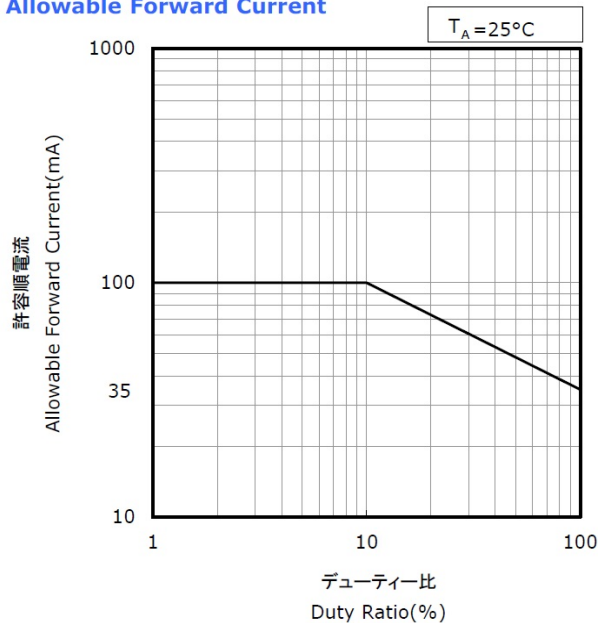Duty Ratio vs
Allowable Forward Current

$T_A=25°C$

Fig. 3

7. Electrical Specifications

7-1. TFT-LCD Panel Driving Section

Table4   Ta=+25°C, GND=0V

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remarks
Driver IC(Digital) Power Supply Voltage	VDDI	1.70	1.80	1.9	V	Note7-1
Driver IC(Positive Analog) Power Supply Voltage	AVDD	5.3	5.5	6.0	V	Note7-1
Driver IC(Negative Analog) Power Supply Voltage	AVEE	-6.0	-5.5	-5.3	V	Note7-1
Input voltage (Low)	V$_{IL}$	0	-	0.3 VDDI	V	Note7-2
Input voltage (High)	V$_{IH}$	0.7 VDDI	-	VDDI	V	Note7-2
Input current (Low)	I$_{IL}$	-10	-	-	µA	
Input current (High)	I$_{IH}$	-	-	10	µA	
Output voltage (Low)	V$_{OL}$	0	-	0.2 VDDI	V	I$_{OL}$=+0.1mA
Output voltage (High)	V$_{OH}$	0.8 VDDI	-	VDDI	V	I$_{OH}$=-0.1mA
Current consumption Video mode without RAM 2port(SDC)	I$_{VDDIO}$	-	48$_{(*1)}$	80$_{(*3)}$	mA	Note7-3
	I$_{VSP}$	-	14$_{(*1)}$	40$_{(*2)}$	mA	
	I$_{VSN}$	-40$_{(*2)}$	-14$_{(*1)}$	-	mA	

Note7-1) Include Ripple Noise

Note7-2) Applied overshoot

Note7-3) 120Hz / (*1) Gradation shift pattern, (*2) 1dot checker pattern, (*3) Random dot pattern

7-2. Back Light Driving Section

Table5   Ta=+25°C,GND=0V

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remarks
LED Voltage	V$_{LED}$	-	2.9	3.2	V	per unit
LED Current	I$_{LED}$	-	95	100	mA	Duty 10%
Power Consumption	W$_{LED}$	-	3582	-	mW	When LED on,Duty 11%
LED Quantity			13		pcs	

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8. Timing characteristics of input signals

8-1. MIPI DC/AC Characteristics

<DC characteristics>

Table6

Item		Symbol	Unit	Test condition	Min.	Typ.	Max.	Note
HS-RX	Differential input high threshold	VIDTH	mV	IOVCC=1.65V~ 1.95V DPHYVCC=1.65V~ 1.95V	-	-	70	
	Differential input low threshold	VIDTL	mV	IOVCC=1.65V~ 1.95V DPHYVCC=1.65V~ 1.95V	-70	-	-	
	Single-ended input low voltage	VILHS	mV	IOVCC=1.65V~ 1.95V DPHYVCC=1.65V~ 1.95V	-40	-	-	
	Single-ended input high voltage	VIHHS	mV	IOVCC=1.65V~ 1.95V DPHYVCC=1.65V~ 1.95V	-	-	460	
	Common-mode voltage HS receive mode	VCMRX(DC)	mV	IOVCC=1.65V~ 1.95V DPHYVCC=1.65V~ 1.95V	70	-	330	1
	Differential input impedance	ZID	Ω	IOVCC=1.65V~ 1.95V DPHYVCC=1.65V~ 1.95V	-	100	-	2
LP-RX	Logic 0 input voltage not in ULP State	VIL	mV	IOVCC=1.65V~ 1.95V DPHYVCC=1.65V~ 1.95V	-50	-	550	
	Logic 1 input voltage	VIH	mV	IOVCC=1.65V~ 1.95V	880	-	1350	
	I/O leakage current	ILEAK	µA	Vin = -50mV - 1350mV	-10	-	10	
LP-TX	Thevenin output low level	VOL	mV	IOVCC=1.65V~ 1.95V DPHYVCC=1.65V~ 1.95V	-50	-	50	
	Thevenin output high level	VOH	V	IOVCC=1.65V~ 1.95V DPHYVCC=1.65V~ 1.95V	1.1	1.2	1.3	
	Output impedance of LP transmitter	ZOLP	Ω	IOVCC=DPHYVCC= 1.80V	110	-	-	2
CD-RX	Logic 0 contention threshold	VILCD	mV	IOVCC=1.65V~ 1.95V DPHYVCC=1.65V~ 1.95V	-	-	200	
	Logic 1 contention threshold	VIHCD	mV	IOVCC=1.65V~ 1.95V DPHYVCC=1.65V~ 1.95V	450	-	-	

Notes:
1. VCMRX (DC) = (VP+VDN)/2
2. Excluding COG resistance (contact resistance and ITO wiring resistance).