INTERFACE SPECIFICATION

LCD Module

Product number: L5F30914T00

TENTATIVE

	Date	Revision Number
Issued Date	Sep 16, 2008	00
Revised Date	Oct 2, 2008	01

EPSON IMAGING DEVICES CORPORATION

REVISION HISTORY

Product Number	Rev.	Revised item	Date
L5F30914T00	00	Initial issue	Sep.16 2008
	01	(C) Absolute Maximum ratings : LED forward current	Oct.2 2008

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

CONTENTS

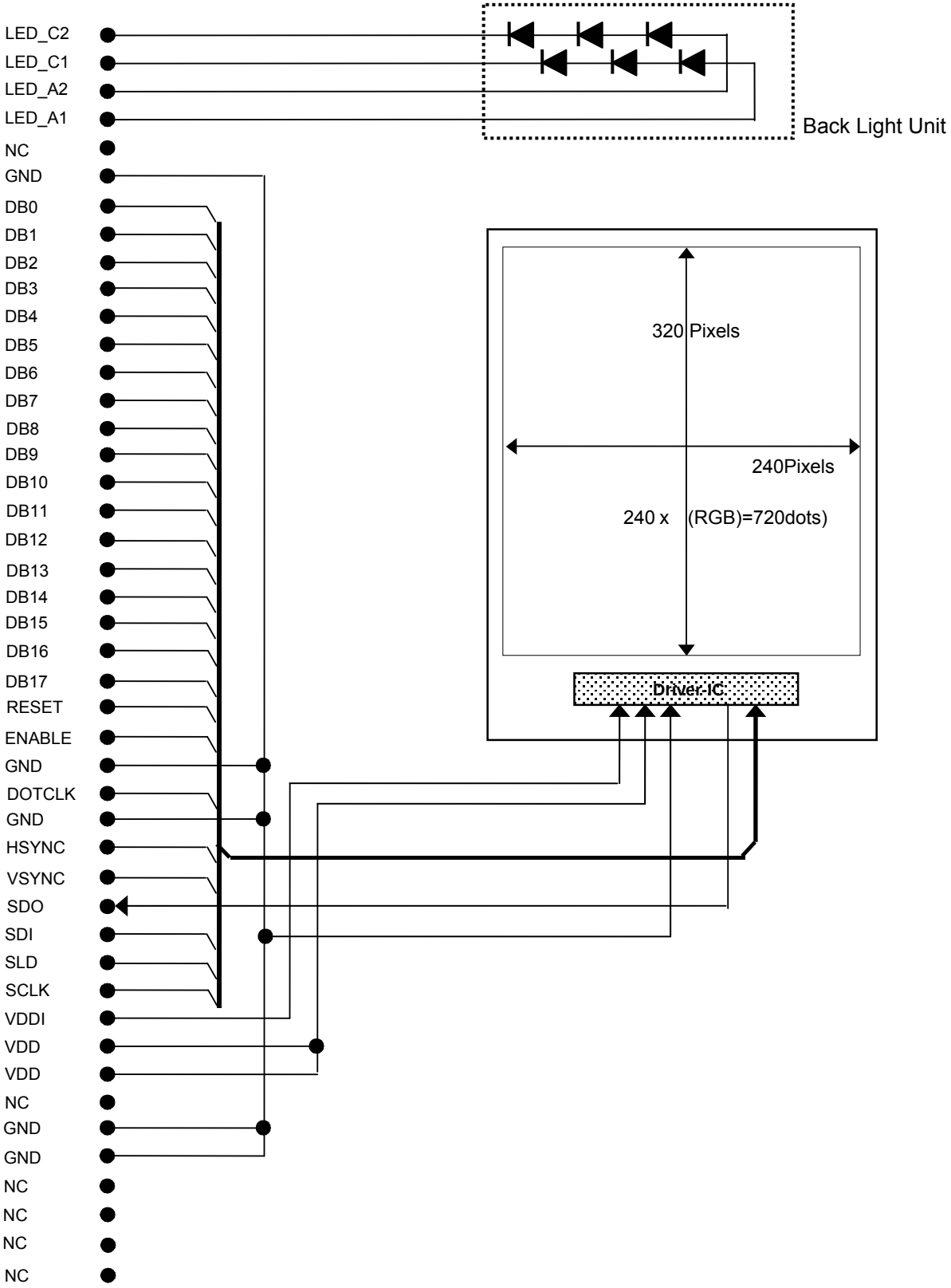
1. BASIC SPECIFICATIONS

1.1 STRUCTURES

	PARAMETER	SPECIFICATIONS
1	LCD structure	TFT LCD
2	Outward	59.8（W） x 82.8（H） x 2.57（D） mm (excluding part of protruding) *1)
3	Weight	Approx. (23.1) g (excluding protective film)
4	Screen Size	53.28(W) x 71.04(H) mm
5	Number of Dots	720(240 x RGB)(W) x 320(H)
6	Dot Pitch	0.074(W) x 0.222(H) mm
7	Color Layout	Stripe
8	Viewing Direction	1:30
9	LCD Optical Mode	Transflective with High-Reflectance display, ECB mode
10	Polarizer Type	LR type
11	Number of Colors	262k

*1) See attached drawing for details.

1.2 BLOCK DIAGRAM



1.3 I/O PINS

PIN	SYMBOL	FUNCTION	I/O	REMARKS
1	LED_C2	LED Cathode	P	
2	LED_C1	LED Cathode	P	
3	LED_A2	LED Anode	P	
4	LED_A1	LED Anode	P	
5	NC	Not connect		Leave this pin should be open
6	GND	Ground	P	
7	DB0	Digital RGB Data input	I	
8	DB1	Digital RGB Data input	I	
9	DB2	Digital RGB Data input	I	
10	DB3	Digital RGB Data input	I	
11	DB4	Digital RGB Data input	I	
12	DB5	Digital RGB Data input	I	
13	DB6	Digital RGB Data input	I	
14	DB7	Digital RGB Data input	I	
15	DB8	Digital RGB Data input	I	
16	DB9	Digital RGB Data input	I	
17	DB10	Digital RGB Data input	I	
18	DB11	Digital RGB Data input	I	
19	DB12	Digital RGB Data input	I	
20	DB13	Digital RGB Data input	I	
21	DB14	Digital RGB Data input	I	
22	DB15	Digital RGB Data input	I	
23	DB16	Digital RGB Data input	I	
24	DB17	Digital RGB Data input	I	
25	RESET	Device Reset Signal	I	"L" active
26	ENABLE	Data enable	I	"H" active
27	GND	Ground	P	
28	DOTCLK	Data clock	I	
29	GND	Ground	P	
30	HSYNC	Horizontal synchronous signal	I	"L" active
31	VSYNC	Vertical synchronous signal	I	"L" active
32	SDO	Not connect		Leave this pin should be open
33	SDI	Serial data input	I	
34	SLD(CSB)	Chip select	I	"L" active
35	SCLK(RS)	Serial clock	I	Latched at rising edge
36	VDDI	Power supply for I/O logic	P	
37	VDD	Power supply for system	P	
38	VDD	Power supply for system	P	
39	NC	Not connect		Leave this pin should be open
40	GND	Ground	P	
41	GND	Ground	P	
42	NC	Not connect		Leave this pin should be open
43	NC	Not connect		Leave this pin should be open
44	NC	Not connect		Leave this pin should be open
45	NC	Not connect		Leave this pin should be open

P :power supply I: Input O: Output

2. FUNCTIONS

2.1 OVERVIEW

This LCD module is equipped with two kind of Interface used for transferring of command data and pixel data.

1) MPU serial interface

Serial bus with MPU control for transferring of commands, parameters.

2) RGB interface

RGB data and HSYNC, VSYNC, DOTCLK ,ENABLE for transferring of display-content.

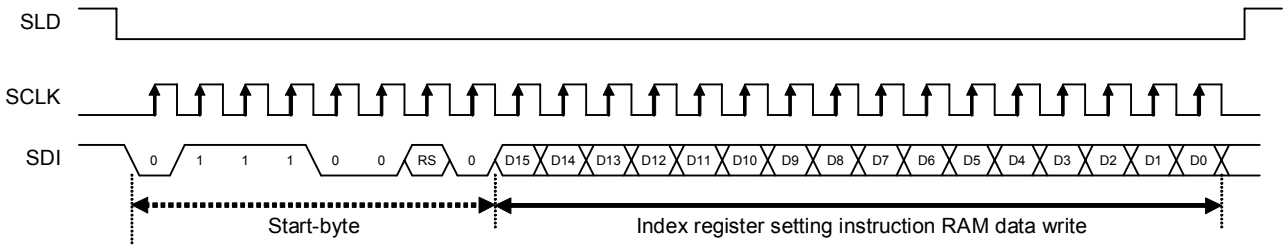
2.1.1. MPU serial interface

MPU serial interface is performed by three signal lines.

SLD	Chip select signal
SCLK	Serial transfer clock signal
SDI	Serial input data signal (latched by rising edge of SCLK)

This interface is composed of two sets of data (Start byte, Index register setting instruction RAM data write).

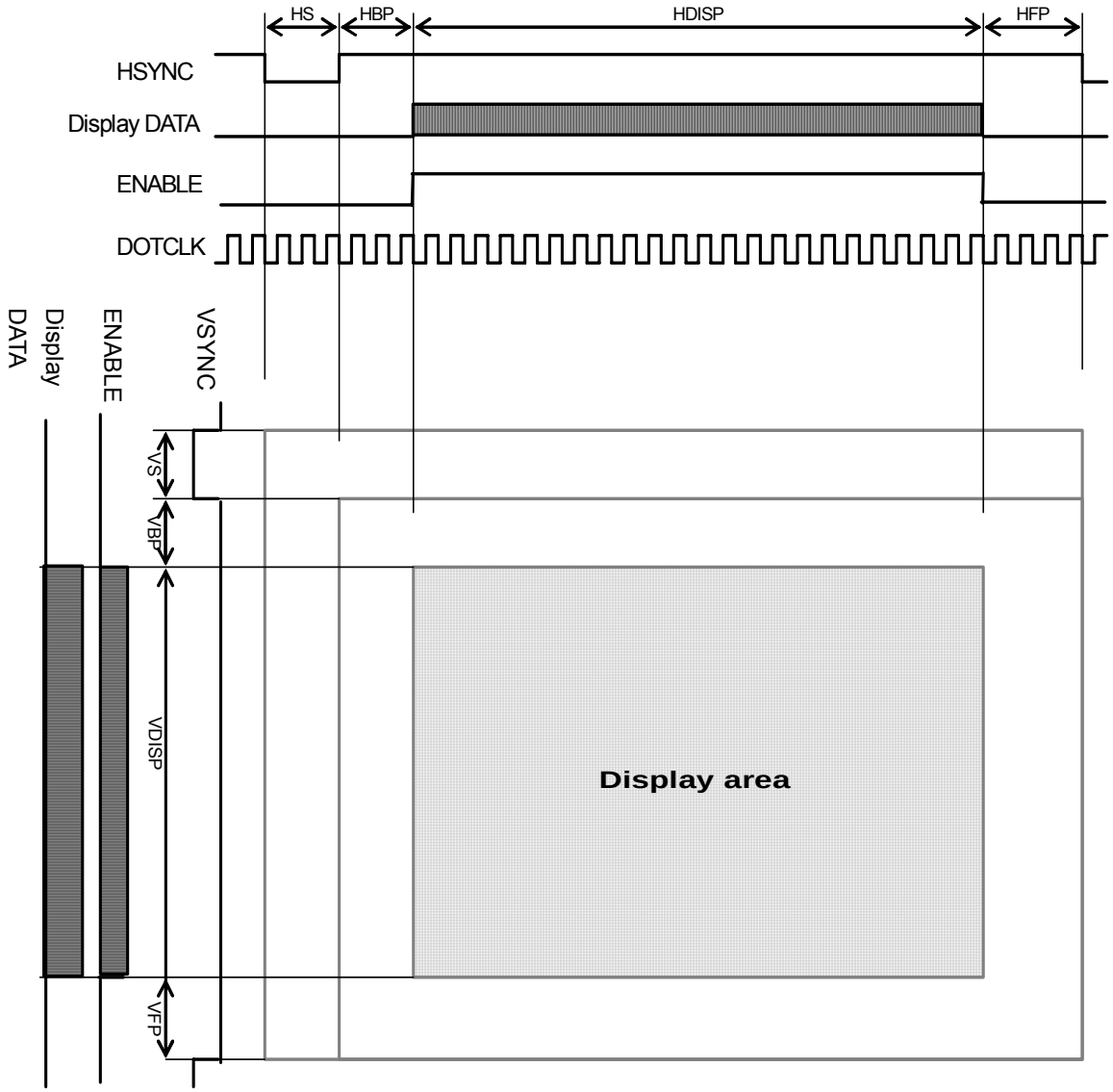
24bit data must be transferred in one time in the order of Start byte, Index register setting instruction RAM data write.



RS	
0	ID[15:0]
1	IB[15:0]

2.1.2. RGB interface

The display data is input synchronizing with HSYNC, VSYNC, ENABLE and DOTCLK.



Name	Description
VS	Vertical Sync time （VSYNC=L）
VBP	Vertical Back Porch
VDISP	Vertical Display Active time
VFP	Vertical Front Porch
HS	Horizontal Sync time (HSYNC=L)
HBP	Horizontal Back Porch
HDISP	Horizontal Display Active time
HFP	Horizontal Front Porch

2.1.3. Display format

18bit RGB interface

PIN	Cycle					
	1	2	3	…	239	240
DB17	$R1^5$	$R2^5$	$R3^5$	…	$R239^5$	$R240^5$
DB16	$R1^4$	$R2^4$	$R3^4$	…	$R239^4$	$R240^4$
DB15	$R1^3$	$R2^3$	$R3^3$	…	$R239^3$	$R240^3$
DB14	$R1^2$	$R2^2$	$R3^2$	…	$R239^2$	$R240^2$
DB13	$R1^1$	$R2^1$	$R3^1$	…	$R239^1$	$R240^1$
DB12	$R1^0$	$R2^0$	$R3^0$	…	$R239^0$	$R240^0$
DB11	$G1^5$	$G2^5$	$G3^5$	…	$G239^5$	$G240^5$
DB10	$G1^4$	$G2^4$	$G3^4$	…	$G239^4$	$G240^4$
DB9	$G1^3$	$G2^3$	$G3^3$	…	$G239^3$	$G240^3$
DB8	$G1^2$	$G2^2$	$G3^2$	…	$G239^2$	$G240^2$
DB7	$G1^1$	$G2^1$	$G3^1$	…	$G239^1$	$G240^1$
DB6	$G1^0$	$G2^0$	$G3^0$	…	$G239^0$	$G240^0$
DB5	$B1^5$	$B2^5$	$B3^5$	…	$B239^5$	$B240^5$
DB4	$B1^4$	$B2^4$	$B3^4$	…	$B239^4$	$B240^4$
DB3	$B1^3$	$B2^3$	$B3^3$	…	$B239^3$	$B240^3$
DB2	$B1^2$	$B2^2$	$B3^2$	…	$B239^2$	$B240^2$
DB1	$B1^1$	$B2^1$	$B3^1$	…	$B239^1$	$B240^1$
DB0	$B1^0$	$B2^0$	$B3^0$	…	$B239^0$	$B240^0$

2.2 COMMANDS

2.2.1 Command List

2.2.1.1 Register Settings and RAM Writing

No.	Command	ID[15:0]	IB15	IB14	IB13	IB12	IB11	IB10	IB9	IB8	IB7	IB6	IB5	IB4	IB3	IB2	IB1	IB0
1	DRVOUT	0001h	VSPL	HSPL	DPL	EPL	0	GS	SS	0	0	0	1	0	1	0	0	0
2	WAVCTL	0002h	0	0	0	0	0	0	0	INV0	0	0	0	0	0	0	0	0
3	ENTMOD	0003h	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0
4	DISCTL1	0007h	0	0	0	0	0	0	0	0	0	0	0	GON	0	REV	D1	D0
5	BLANKCTL	0008h	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0
6	FRMCTL	000Bh	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
7	INTERFACE CTL	000Ch	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0
8	STARTOSC	000Fh	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0
9	PWRCTL1	0010h	0	0	0	0	0	1	1	0	0	0	0	0	0	0	DSTB	0
10	PWRCTL2	0011h	0	0	0	APON	0	0	0	0	0	0	0	VCI1 _EN	1	0	0	1
11	PWRCTL3	0012h	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
12	PWRCTL4	0013h	0	0	0	1	0	1	1	0	0	1	0	0	0	0	1	0
13	PWRCTL5	0014h	0	1	1	0	0	0	1	0	0	1	1	1	0	0	0	1
14	VCIRECYCLE	0015h	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
15	RAMWR	0022h	Display Data															
16	HADD1	0036h	0	0	0	0	0	0	0	0	1	1	1	0	1	1	1	1
17	HADD2	0037h	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	VADD1	0038h	0	0	0	0	0	0	0	1	0	0	1	1	1	1	1	1
19	VADD2	0039h	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	VREFICTL	0091h	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0
21	GAMCTL1	0050h	TBD															
22	GAMCTL2	0051h																
23	GAMCTL3	0052h																
24	GAMCTL4	0053h																
25	GAMCTL5	0054h																
26	GAMCTL6	0055h																
27	GAMCTL7	0056h																
28	GAMCTL8	0057h																
29	GAMCTL9	0058h																
30	GAMCTL10	0059h																

2.2.2 Command Details

See 4.4 RECOMMENDED SEQUENCE to design a command sequence and intervals.

(1) DRVOUT

This command is used to control the output signals for display panel.

	Hex	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
ID[15:0]	0001h	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
IB[15:0]	-	VSPL	HSPL	DPL	EPL	0	GS	SS	0	0	0	1	0	1	0	0	0

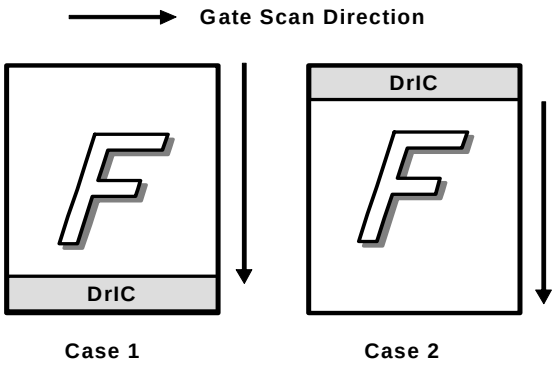
VSPL	Polarity of VSYNC
0	Low active
1	High active

HSPL	Polarity of HSYNC
0	Low active
1	High active

DPL	Polarity of DOTCLK
0	Rising edge
1	falling edge

EPL	Polarity of ENABLE
0	Low active
1	High active

GS	SS	Display Direction
0	1	Case 1
1	0	Case 2



(2) WAVCTL

This command is used to settle the driving methods of display panel.

	Hex	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
ID[15:0]	0002h	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
IB[15:0]	-	0	0	0	0	0	0	0	INV0	0	0	0	0	0	0	0	0

INV0	LCD Driving Method
0	Frame Alternation
1	1-Line Alternation

(3) ENTMOD

This command is used to settle the transferring mode and the writing direction for RAM.

	Hex	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
ID[15:0]	0003h	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
IB[15:0]	1030h	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0

All numerical values of IB[15:0] are provisional and must be presented by EPSON IMAGING DEVICES CORP. after measuring of LCD. Be sure to prepare for modification.

(4) DISCTL1

This command is used to control the display. See 4.4 RECOMMENDED SEQUENCE to design a command sequence and intervals.

	Hex	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
ID[15:0]	0007h	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
IB[15:0]	-	0	0	0	0	0	0	0	0	0	0	0	GON	0	REV	D1	D0

GON	D[1]	D[0]	Display State
0	0	0	Display OFF (Non Operating State)
1	0	1	Display OFF (Operating State)
1	1	0	Display ON (Blank)
1	1	1	Display ON

REV	Positive Image / Reversal Image
0	Positive
1	Reversal

(5) BLANKCTL

This command is used to settle the front porch and the back porch, and to settle the operation of Source driver amplifiers during porch period.

	Hex	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
ID[15:0]	0008h	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
IB[15:0]	4404h	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0

All numerical values of IB[15:0] are provisional and must be presented by EPSON IMAGING DEVICES CORP. after measuring of LCD. Be sure to prepare for modification.

(6) FRMCTL

This command is used to settle the display timings.

	Hex	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
ID[15:0]	000Bh	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
IB[15:0]	4200h	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0

All numerical values of IB[15:0] are provisional and must be presented by EPSON IMAGING DEVICES CORP. after measuring of LCD. Be sure to prepare for modification.

(7) INTERFACECTL

This command is used to settle the RGB interface mode.

	Hex	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
ID[15:0]	000Ch	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
IB[15:0]	0110h	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0

All numerical values of IB[15:0] are provisional and must be presented by EPSON IMAGING DEVICES CORP. after measuring of LCD. Be sure to prepare for modification.

(8) STARTOSC

This command is used to settle the oscillator.

	Hex	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
ID[15:0]	000Fh	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
IB[15:0]	0500h	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0

All numerical values of IB[15:0] are provisional and must be presented by EPSON IMAGING DEVICES CORP. after measuring of LCD. Be sure to prepare for modification.

(9) PWRCTL1

This command is used to control the operation of source driver amplifiers and standby state.

	Hex	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
ID[15:0]	0010h	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
IB[15:0]	-	0	0	0	0	0	1	1	0	0	0	0	0	0	0	DSTB	0

DSTB	Standby State
0	Out
1	In

All numerical values of IB[15:0] are provisional and must be presented by EPSON IMAGING DEVICES CORP. after measuring of LCD. Be sure to prepare for modification.

(10) PWRCTL2

This command is used to control the operation of output amplifiers and booster circuit.

See 4.4 RECOMMENDED SEQUENCE to design a command sequence and intervals.

	Hex	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
ID[15:0]	0011h	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
IB[15:0]	-	0	0	0	APON	0	0	0	0	0	0	0	VCI1_EN	1	0	0	1

APON	Booster Circuit
0	Stop
1	Operation

VCI1_EN	VCI1amplifier Circuit
0	Stop
1	Operation

All numerical values of IB[15:0] are provisional and must be presented by EPSON IMAGING DEVICES CORP. after measuring of LCD. Be sure to prepare for modification.

(11) PWRCTL3

This command is used to settle the multiple and clock of charge pumping circuits.

	Hex	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
ID[15:0]	0012h	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
IB[15:0]	3000h	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0

All numerical values of IB[15:0] are provisional and must be presented by EPSON IMAGING DEVICES CORP. after measuring of LCD. Be sure to prepare for modification.

(12) PWRCTL4

This command is used to settle the gamma voltage source and the reference voltage of charge pumping circuits

	Hex	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
ID[15:0]	0013h	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
IB[15:0]	1642h	0	0	0	1	0	1	1	0	0	1	0	0	0	0	1	0

All numerical values of IB[15:0] are provisional and must be presented by EPSON IMAGING DEVICES CORP. after measuring of LCD. Be sure to prepare for modification.

(13) PWRCTL5

This command is used to settle the voltage of VCOM.

	Hex	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
ID[15:0]	0014h	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
IB[15:0]	6271h	0	1	1	0	0	0	1	0	0	1	1	1	0	0	0	1

All numerical values of IB[15:0] are provisional and must be presented by EPSON IMAGING DEVICES CORP. after measuring of LCD. Be sure to prepare for modification.

(14) VCIRECYCLE

This command is used to settle the voltage of precharge timing.

	Hex	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
ID[15:0]	0015h	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1
IB[15:0]	0060h	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0

All numerical values of IB[15:0] are provisional and must be presented by EPSON IMAGING DEVICES CORP. after measuring of LCD. Be sure to prepare for modification.

(15) RAMWR

This command is used to entering to the RAM writing state by interface. Writing data subsequent to this command causes the content of RAM to be overwritten and at the same time the column address or the page address to be incremented. Inputting other commands cancels the RAM writing state automatically.

	Hex	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
ID[15:0]	0022h	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0
		Display Data															

(16) HADD1

This command is used to settle the end column address of RAM when accessing from interface.

	Hex	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
ID[15:0]	0036h	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	0
IB[15:0]	00EFh	0	0	0	0	0	0	0	0	1	1	1	0	1	1	1	1

(17) HADD2

This command is used to settle the start column address of RAM when accessing from interface.

	Hex	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
ID[15:0]	0037h	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1
IB[15:0]	0000h	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

(18) VADD1

This command is used to end page address of RAM when accessing from interface.

	Hex	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
ID[15:0]	0038h	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0
IB[15:0]	013Fh	0	0	0	0	0	0	0	1	0	0	1	1	1	1	1	1

(19) VADD2

This command is used to start page address of RAM when accessing from interface.

	Hex	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
ID[15:0]	0039h	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1
IB[15:0]	0000h	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

(20) VREFICTL

This command is used to settle the VREFI circuit.

	Hex	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
ID[15:0]	0091h	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1
IB[15:0]	1C00h	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0

(22) GAMCTL1~10

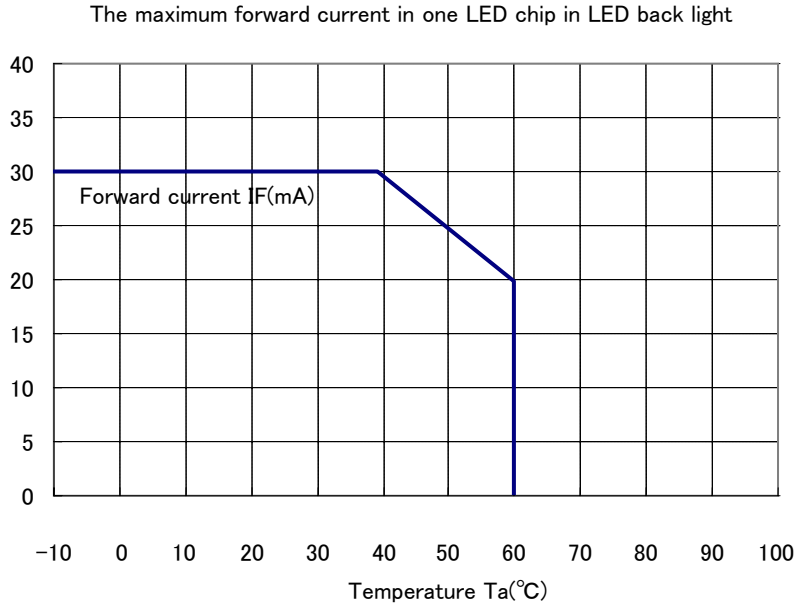
TBD

3. ABSOLUTE MAXIMUM RATINGS

GND=0V

PARAMETER	SYMBOL	RATINGS	UNIT	REMARKS
Power supply voltage	VDD	0.0 ~ 4.0	V	
	VDDI	0.0 ~ 4.0	V	
Input voltage	VIN	0.0 ~VDDI + 0.3	V	
Storage temperature range (ambient temperature)	TST	-20～70	℃	no dew condition
Operating temperature range (ambient temperature)	TOP	-10～60	℃	no dew condition
LED forward current	IF	30	mA	per chip at 25℃ *1)

*1: The rating of maximum LED forward current is decreased along the ambient temperature as the following scheme.



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

4. ELECTRICAL SPECIFICATIONS

4.1 DC SPECIFICATIONS

4.1.1 DC specifications of general pins

GND = 0 V, Ambient temperature = 25°C unless otherwise specified

Item	Symbol	Condition	Rating			Unit	Pin
			Min.	Typ.	Max.		
Power supply voltage *1)	VDD		2.8	3.0	3.3	V	Pin-37,38
	VDDI		2.8	3.0	3.3	V	Pin-36
Low-level input voltage	VIL		0	-	0.2 x VDDI	V	All input pins
High-level input voltage	VIH		0.8 x VDDI	-	VDDI	V	
Input leak current	ILI		-	-	T.B.D	µA	All input pins except power supply pins
Power supply current (RMS)	IDD	*2)	-	T.B.D	T.B.D	mA	VDD
	IDDI		-	T.B.D	T.B.D	mA	VDDI

*1: Rated values indicate operating range of electrical functions.

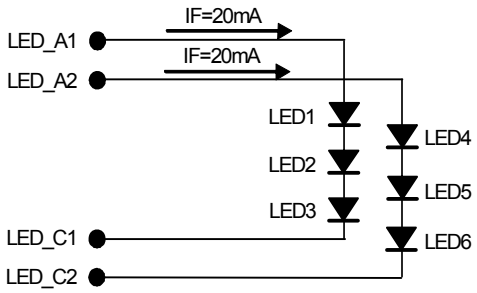
*2: Typ. values are at the condition of power supply voltage is Typ., the ambient temperature is 25°C, full screen colorbar which was written according to the timing of 4.3. DISPLAY SIGNAL INPUT TIMING.
Max. values are at the condition of power supply voltage is in a range of "DC specification", ambient temperature is in a range of operating temperature, full screen color bar which was written according to the timing of 4.3. DISPLAY SIGNAL INPUT TIMING.

< Color Bar Display >

4.1.2 DC specifications of back light

Item	Symbol	Condition	Rating			Unit	Pin
			Min.	Typ.	Max.		
forward voltage / circuit	VF	IF=20mA/chip	-	(9.6)	10.5	V	Ta=25°C

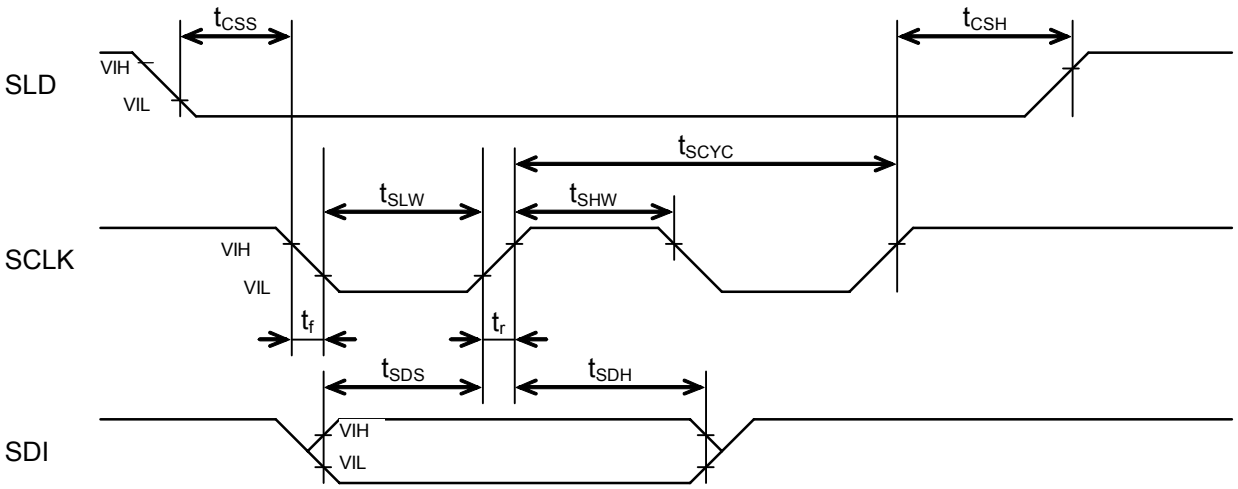
* Epson Imaging Devices Corporation doesn't specify these ratings.



LED forward voltage and current condition.

4.2 AC SPECIFICATIONS

4.2.1 Serial interface timing



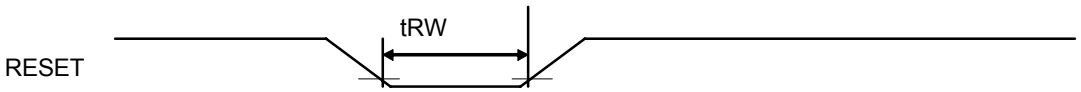
Signal	Symbol	Parameter	Min.	Max.	Unit	Remarks
SCLK	tSCYC	Serial Clock Cycle	(160)	-	ns	
	tSHW	SCL "H" Pulse Width	(70)	-	ns	
	tSLW	SCL "L" Pulse Width	(70)	-	ns	
SDI	tSDS	Data Setup Time	(50)	-	ns	
	tSDH	Data Hold Time	(50)	-	ns	
SLD	tCSS	CS Setup Time	(40)	-	ns	
	tCSH	CS Hold Time	(80)	-	ns	

Voltage of VDDI is in ranges of 4.1. DC SPECIFICATIONS, ambient temperature is in a range of operating temperature.

*: When both the rising time (tr) and the falling time (tf) of input signals are less than 10 ns.

*: Ratings are specified as intervals by at the voltage of 20% and 80% of VDDI-GND.

4.2.2 Reset timing

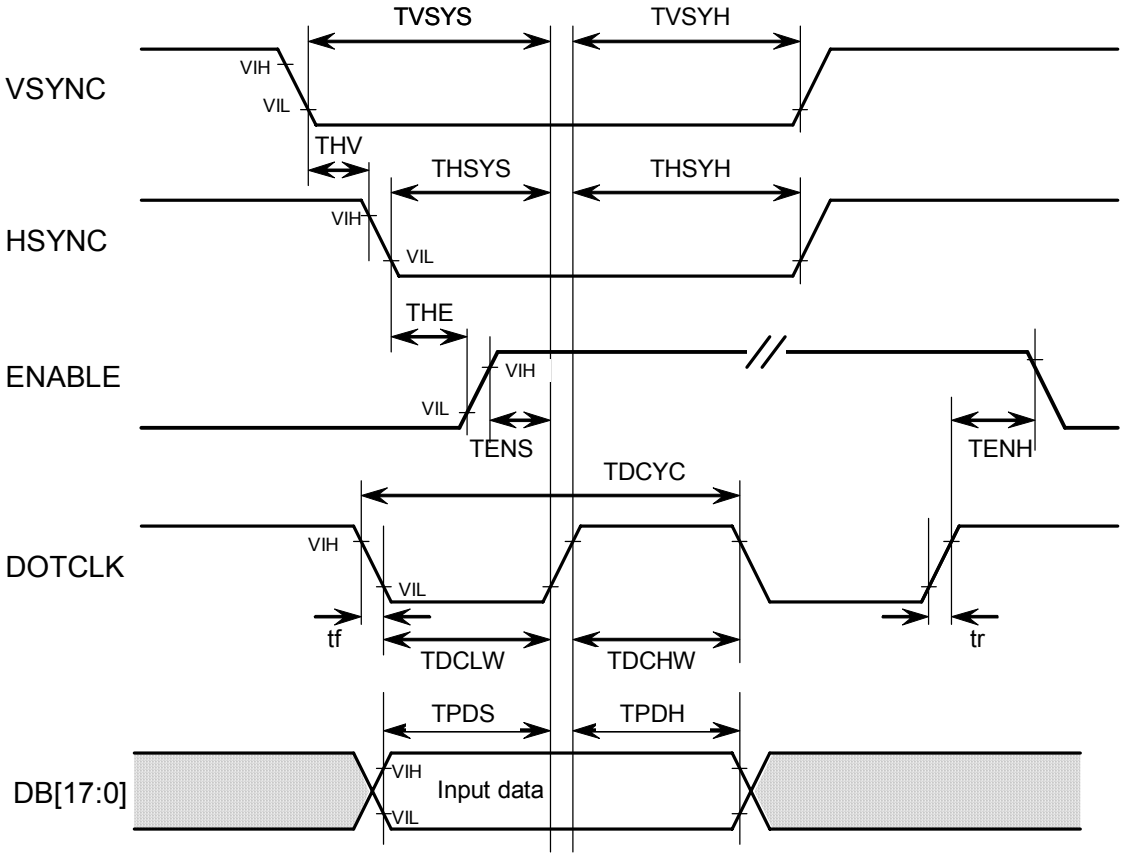


Signal	Symbol	Parameter	Min.	Max.	Unit	Remarks
RESET	tRW	Reset pulse width	(100)	-	µs	

Voltage of VDDI is in ranges of 4.1. DC SPECIFICATIONS, ambient temperature is in a range of operating temperature.

*: Ratings are specified as intervals by at the voltage of 20% and 80% of VDDI-GND.

4.2.3 RGB interface timing



Signal	Symbol	Parameter	Min.	Max.	Unit	Remarks
VSYNC	TVSYS	Vertical sync Setup time	(40)	-	ns	
	TVSYH	Vertical sync Hold time	(40)	-	ns	
HSYNC	THSYS	Horizontal sync Setup time	(40)	-	ns	
	THSYH	Horizontal sync Hold time	(40)	-	ns	
DOTCLK	TDCYC	Pixel clock cycle	(120)	-	ns	
	TDCLW	Pixel clock low time	(50)	-	ns	
	TDCHW	Pixel clock High time	(50)	-	ns	
ENABLE	TENS	Enable setup time	(40)	-	ns	
	TENH	Enable hold time	(30)	-	ns	
DB[17:0]	TPDS	Data setup time	(40)	-	ns	
	TPDH	Data hold time	(30)	-	ns	
	THV	VSYNC_N - HSYNC_N Time	(1)	(255)	CLK	
	THE	HSYNC_N - BLANK_N Time	(1)	(239)	CLK	

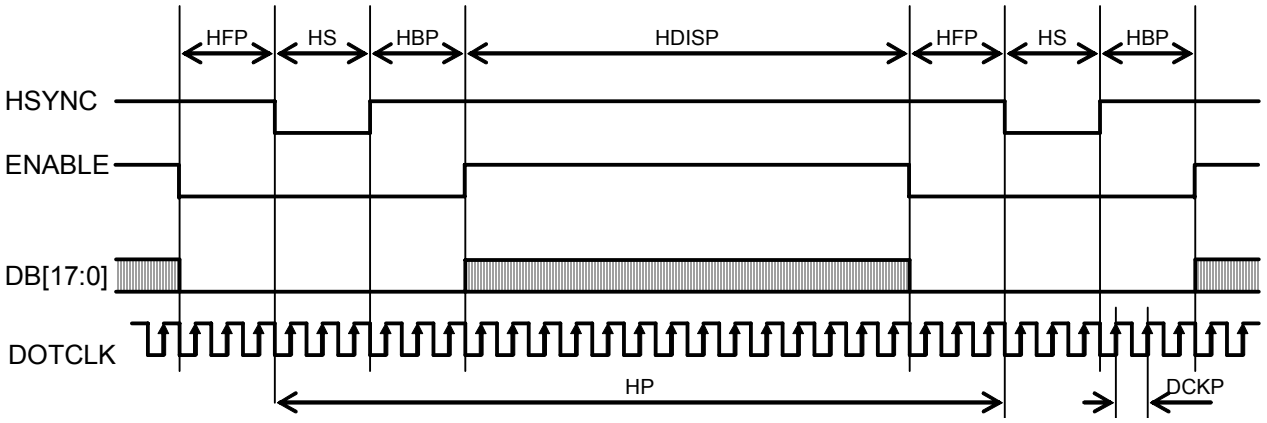
Voltage of VDDI is in ranges of 4.1. DC SPECIFICATIONS, ambient temperature is in a range of operating temperature.

*: When both the rising time (tr) and the falling time (tf) of input signals are less than 10 ns.

*: Ratings are specified as intervals by at the voltage of 20% and 80% of VDDI-GND.

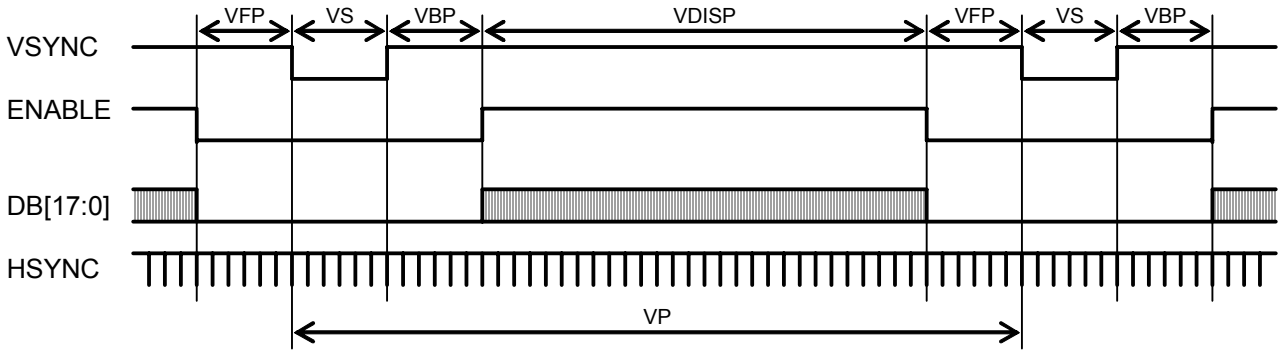
4.3 DISPLAY SIGNAL INPUT TIMING

1) Horizontal Timing



Parameter	Symbol	MIN	TYP	MAX	Unit	Remarks
HS cycle	HP		(288)		CLK	
HS low pulse width	HS		(10)		CLK	
Horizontal back porch	HBP		(10)		CLK	
Horizontal front porch	HFP		(28)		CLK	
Horizontal active area	HDISP		240		CLK	
Frame cycle	-		60		Hz	
Pixel clock Period	DCKP		(5.64)		MHz	

2) Vertical Timing

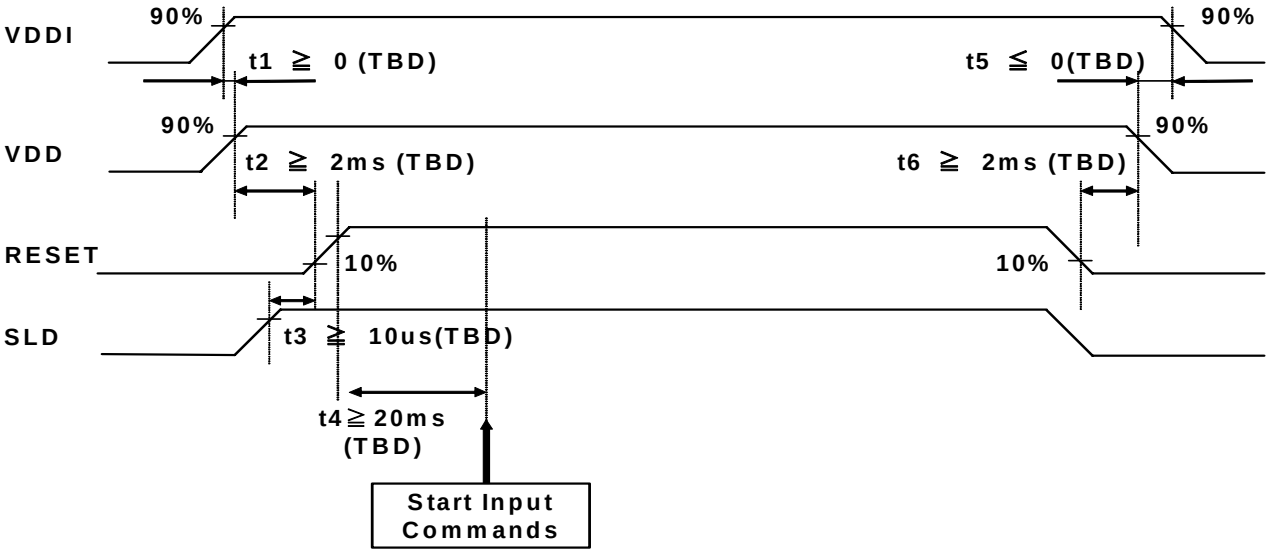


Parameter	Symbol	MIN	TYP	MAX	Unit	Remarks
Vertical cycle	VP		(326)		H	
Vertical Low pulse width	VS		(2)		H	
Vertical front porch	VFP		(2)		H	
Vertical back porch	VBP		(2)		H	
Vertical active area	VDISP		320		H	

4.4 RECOMMENDED SEQUENCE

-1) Start to supply system power.
-2) Make a device reset after starting to supply the system power.
(RESET must be kept "L" for more than 2ms.)
-3) Input video signal. (DOTCLK,HSYNC,VSYNC,ENABLE)
-4) Wait more than 20ms after releasing the system reset *1)
-5) Transfer commands for initial setting and turning on. (See 4.4.1 Power ON Sequence.)
(Display is started.)
-6) Transfer commands to turn off. (See 4.4.2 Power OFF Sequence.)
-7) Stop to supply system power.

Required intervals are described in the following chart and the table of "4.4.1" to "4.4.2".



Notes)
* RESET must be maintained to “LOW” more than 2ms after turning on the system power (VDD, VDDI).
* The rising speed of VDD or VDDI should be less than 2V/100μs.

4.4.1 Power ON Sequence

Command	Hex Data	Remarks
STARTOSC	70000Fh	
	720500h	
INTERFACECTL	70000Ch	
	720110h	
DRVOUT	700001h	
	721128h	
WAVCTL	700002h	
	720100h	
ENTMOD	700003h	
	721030h	
DISCTL1	700007h	
	720004h	
BLANKCTL	700008h	
	724404h	
FRMCTL	70000Bh	
	724200h	
VCIRECYCLE	700015h	
	720060h	
VREFICTL	700091h	
	721C00h	
GAMCTL1	700050h	
	720000h	
GAMCTL2	700051h	
	720A03h	
GAMCTL3	700052h	
	720D0Ch	
GAMCTL4	700053h	
	720200h	
GAMCTL5	700054h	
	720C0Dh	
GAMCTL6	700055h	
	72030Ah	
GAMCTL7	700056h	
	720000h	
GAMCTL8	700057h	
	720002h	

Command	Hex Data	Remarks
GAMCTL9	700058h	
	720000h	
GAMCTL10	700059h	
	720000h	
PWRCTL2	700011h	
	720019h	
PWRCTL3	700012h	
	723000h	
PWRCTL4	700013h	
	721642h	
PWRCTL5	700014h	
	726271h	
PWRCTL1	700010h	
	720600h	
Wait 80ms or more		
PWRCTL2	700011h	
	721019h	
Wait 200ms or more		
HADD1	700036h	
	7200EFh	
HADD2	700037h	
	720000h	
VADD1	700038h	
	72013Fh	
VADD2	700039h	
	720000h	
RAMWR	700022h	
Picture Data Send		
DISCTL1	700007h	
	720016h	
Wait 80ms or more		
DISCTL1	700007h	
	720017h	
RAMWR	700022h	

All numerical values of Hex Data are provisional and must be presented by EPSON after measuring of LCD. Be sure to prepare for modification.

4.4.2 Power OFF Sequence

Command	Hex Data	Remarks
Display-ON State		
DISCTL1	700007h	
	720016h	
Wait 80ms or more		
DISCTL1	700007h	
	720004h	
Wait 80ms or more		
PWRCTL1	700010h	
	720602h	
DOTCLK,HSYNC,VSYNC, ENABLE,DB[17:0] is stop		

All numerical values of Hex Data are provisional and must be presented by EPSON after measuring of LCD. Be sure to prepare for modification.

5. OPTICAL CHARACTERISTICS

Values in “OPTICAL SPECIFICATIONS“ are provided under the following conditions.

* Frame Frequency : 60Hz
* VDD : 3.0V
* VDDI : 3.0V

5.1 OPTICAL CHARACTERISTICS

5.1.1 Backlight ON (Transmissive mode)

Item		Symbol	Temp. (°C)	Rating			Unit	Remark
				Min.	Typ.	Max.		
Contrast		*CR*	25	T.B.D.	(180)	-	-	
Response	W→B	t_r	25	-	T.B.D.	T.B.D.	ms	
	B→W	t_f	25	-	T.B.D.	T.B.D.		
Color Coordinates	R-x	*Rx*	25	T.B.D.	T.B.D.	T.B.D.	-	
	R-y	*Ry*		T.B.D.	T.B.D.	T.B.D.		
	G-x	*Gx*		T.B.D.	T.B.D.	T.B.D.		
	G-y	*Gy*		T.B.D.	T.B.D.	T.B.D.		
	B-x	*Bx*		T.B.D.	T.B.D.	T.B.D.		
	B-y	*By*		T.B.D.	T.B.D.	T.B.D.		
	W-x	*Wx*		T.B.D.	T.B.D.	T.B.D.		
	W-y	*Wy*		T.B.D.	T.B.D.	T.B.D.		
NTSC ratio			25	—	(37)	—	%	
Brightness		*B*	25	T.B.D	(200)	—	cd/m^2	If = 20mA
Brightness deviation		-	25	60	—	—	%	
Viewing angle	ϕ=0	-	25	T.B.D.	T.B.D.	—	Deg.	
	ϕ=90			T.B.D.	T.B.D.			
	ϕ=180			T.B.D.	T.B.D.			
	ϕ=270			T.B.D.	T.B.D.			

5.1.2 Backlight OFF (Reflective mode)

Item		Symbol	Temp. (°C)	Rating			Unit	Remark
				Min.	Typ.	Max.		
Contrast		*CR*	25	T.B.D.	(14)	-	-	
Color Coordinates	W-x	*Wx*	25	T.B.D.	T.B.D.	T.B.D.		
	W-y	*Wy*		T.B.D.	T.B.D.	T.B.D.		
NTSC ratio			25	-	(7)	-	%	
Reflectance		*R*	25	T.B.D	(6)	-	%	