DATA MODUL

SPECIFICATION

BATRON

BTFT030M-02

3“ - Mono– MCU

Version: 1.2
Date: 25.07.2016

Note: This specification is subject to change without prior notice

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Revision History (1/1)

Issued No.	
Revision	13
Product Name	
Customer Part No.	

Date/Rev.	Contents of change			Reasons	Remarks
Ari. 28, 2016 Rev.01			- Initial release		
Jul. 25,2016 Rev.02	(C)	Hist.,37	Update customer P.N	Customer request	
	(D)	4	2.1.1 Parallel interface Dummy read is deleted	Error correction	
	(C)	9	2.2 COMMANDS The descriptions of parameters are modified.	Customer request	
	(C)	28	4.5 POWER OFF SEQUENCE IN EMERGENCY MODE The sentences of emergency mode are modified.	Customer request	

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

CONTENTS

1. BASIC SPECIFICATIONS

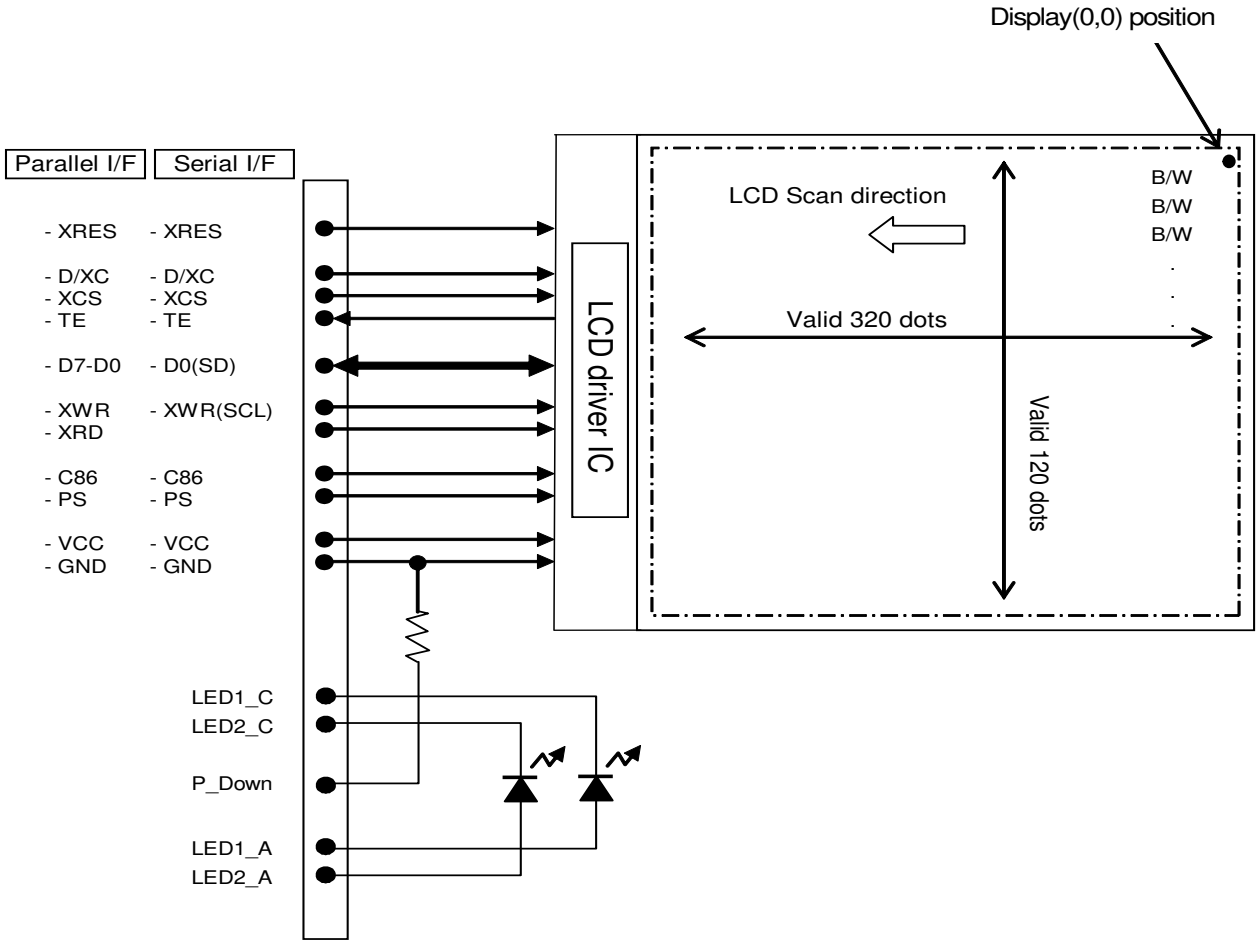
This document gives the characteristics of the active matrix 3.0 inch monochrome TFT LCD.

1.1 STRUCTURES

No.	FACTOR	SPECIFICATIONS	UNIT
1	LCD structure	a-TFT LCD	-
2	Module size	87.15(W) x 36.7(H) x 10.5(D) (Max)	mm
3	Weight	36(without protection film)	g
4	Active Area [Screen Dimension]	72(W)×27(H) 〔3.0 inch〕	mm
5	Viewing Area	74.9(W)×29.9(H)	mm
6	Number of dots	320 X 120 dots	-
7	Dot pitch	0.225(W) × 0.225(H)	mm
8	Dot layout	Square	-
9	Viewing direction	all-round view	-
10	Liquid crystal mode	IPS, normally black, transmissive type	-
11	Polarization plate	Anti glare	-

*1) See attached drawing for details.

1.2 BLOCK DIAGRAM



1.3 I/O TERMINALS

Pin No.	Name	I/O	Remarks
1	GND	P	Ground
2	GND	P	Ground
3	XRES	I	Display is initialized when XRES is set to "L".
4	D/XC	I	Data command select signal. This pin is used for 8bit parallel and 4wire 8bit serial interface. " L " = Command, " H " = Parameter
5	XCS	I	Chip select signal. Active low. When XCS is "H", D7-D0 outputs are set to the high impedance.
6	TE	O	V sync signal output pin for LCD display timing. When TEOFF command is entered, it changes to "L".
7	D7	I/O	Parallel interface : data bus D1-D7 Serial interface : unused
8	D6	I/O	
9	D5	I/O	
10	D4	I/O	
11	D3	I/O	
12	D2	I/O	
13	D1	I/O	
14	D0(SD)	I/O	Parallel interface : Data bus D0 Serial interface : Serial data input / output
15	XWR (SCL)	I	Parallel interface: I80 parallel interface : connecting XWR signal M68 parallel interface : connecting R/W signal Serial interface : connecting the SCL signal
16	GND	P	Ground
17	XRD	I	Parallel interface: I80 parallel interface : connecting XRD signal M68 parallel interface : connecting E signal Serial interface : unused
18	C86	I	Interface selection pin. Parallel interface: "H" M68 8bit parallel interface "L" I80 8bit parallel interface Serial interface: "H" 4wire 8bit serial interface "L" 3wire 9bit serial interface Please do not change input level for this terminal while operating.
19	PS	I	Interface selection pin. "H" parallel interface "L" serial interface Please do not change input level for this terminal while operating.
20	VCC	P	Power supply
21	VCC	P	Power supply
22	GND	P	Ground
23	NC	-	Non connection
24	LED1_C	P	LED cathode 1
25	LED2_C	P	LED cathode 2
26	P_Down	P	10K ohm (typ) resistor connected to GND
27	NC	-	Non connection
28	LED1_A	P	LED anode 1
29	LED2_A	P	LED anode 2
30	NC	-	Non connection

P: power supply, I: input O: output

2. FUNCTIONS

2.1 OVERVIEW

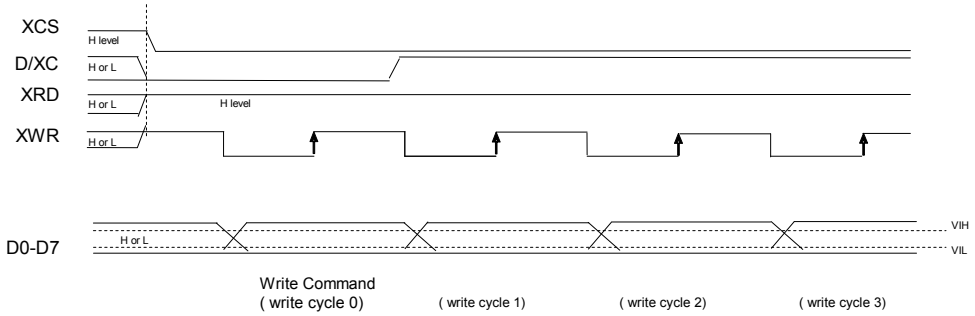
This LCD module has four types of MPU Interface used for transferring of command and pixel data.

1) Parallel interface
   - I80 8bit parallel bus for transferring of commands and pixel data.
   - M68 8bit parallel bus for transferring of commands and pixel data.
2) Serial interface
   - 4 wire serial bus for transferring of commands and pixel data.
   - 3 wire Serial bus for transferring of commands and pixel data.

2.1.1 Parallel interface

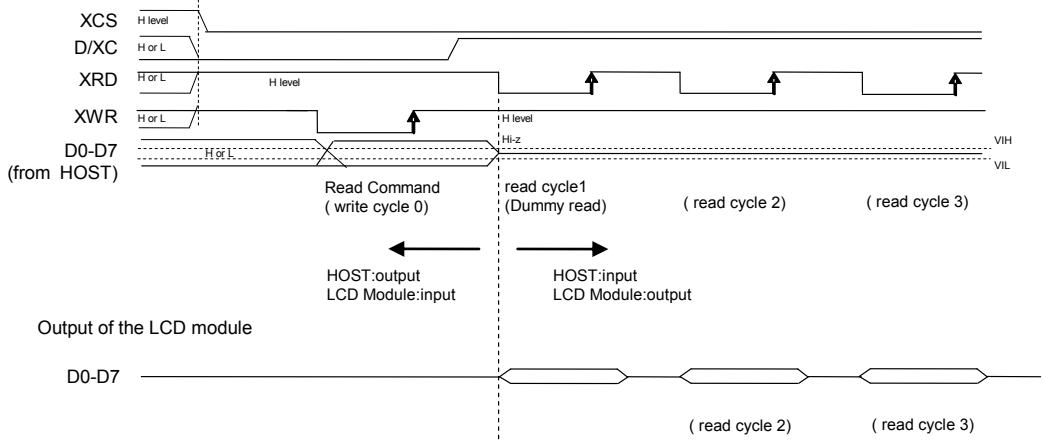
1) I80 8bit parallel interface

Write data mode(Access at XWR **a**nd XRD when XCS is "L".)



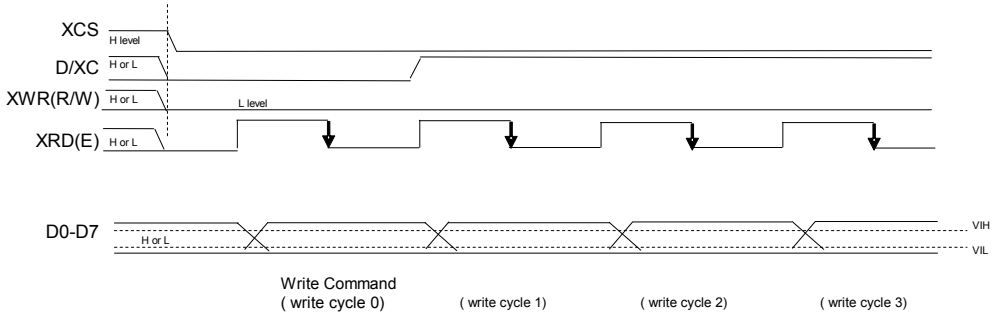
Read data mode(Access at XWR and XRD when XCS is "L".)

States, RAM contents and ID read commands (0Fh, 2Eh, DAh, DBh, DCh) are used this mode.



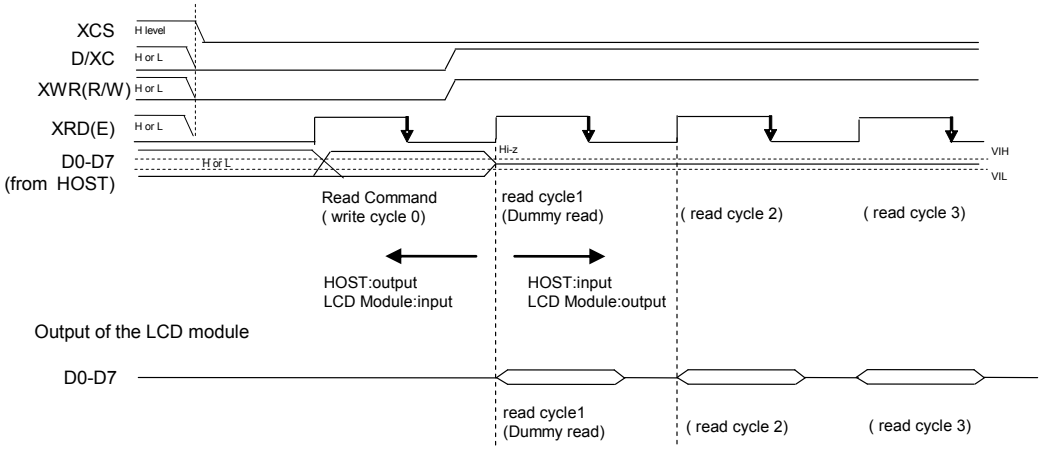
2) M68 8bit parallel interface

Write data mode (Access at E when XCS is "L")



Read data mode (Access at E when XCS is "L")

States, RAM contents and ID read commands (0Fh, 2Eh, DAh, DBh, DCh) are used this mode.



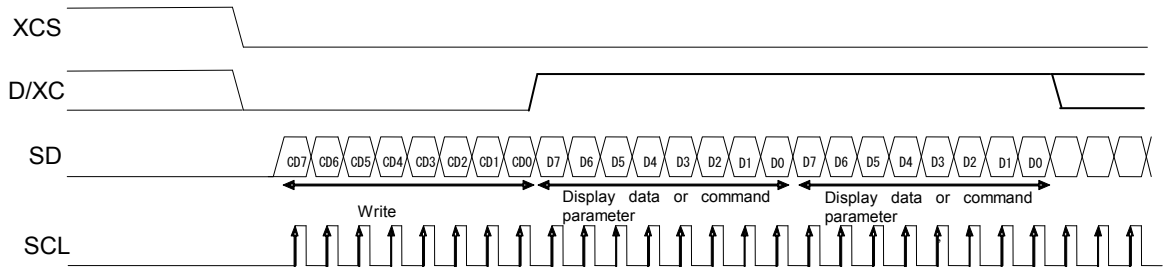
2.1.2 Serial interface

1) 4 wire 8bit Serial interface

Command input and data input are possible by using the following 4 pins: XCS, SCL, D/XC and SD. However, RAM data cannot be read.

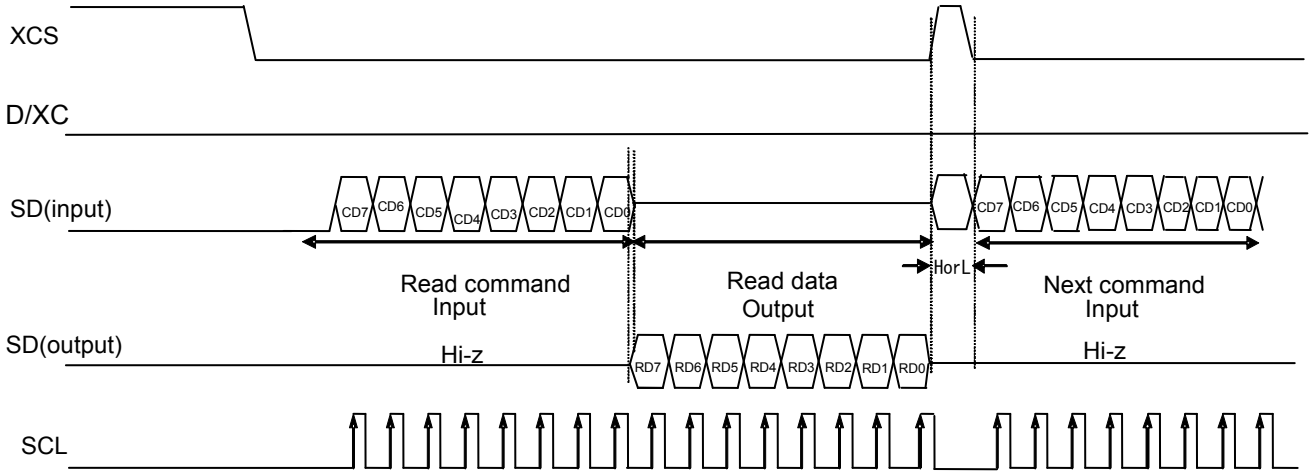
The input format of data is 8 bits data. When it is inputting command and parameters, as well as display, use the following methods.

Write data mode



Read data mode

Status and ID read commands (0Fh, DAh, DBh, DCh) are used this mode.

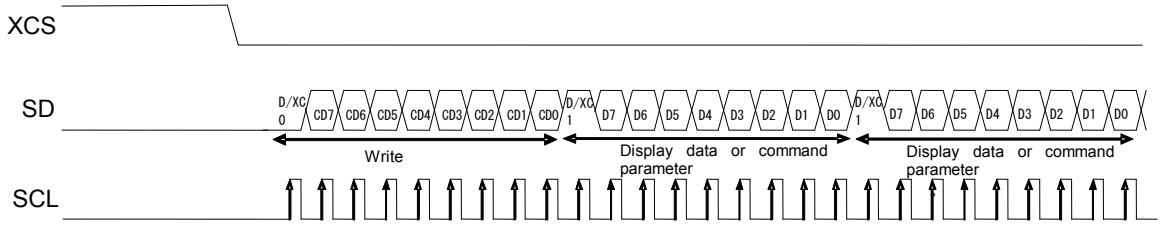


2) 3 wire 9bit Serial interface

Command input and data input are possible by using the following three pins: XCS, SCL, and SD. However, RAM data cannot be read.

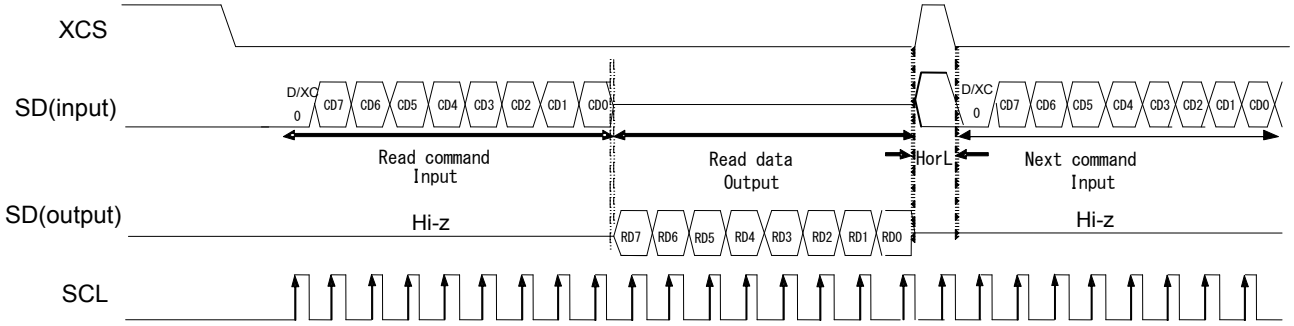
The input format of data is D/XC + 8 bits. When it is inputting command and parameters, as well as display data, use the following methods.

Write data mode



Read data mode

Status and ID read commands (0Fh, DAh, DBh, DCh) are used this mode.



2.1.3 Display data format

320x120 dots, 16 gray scale

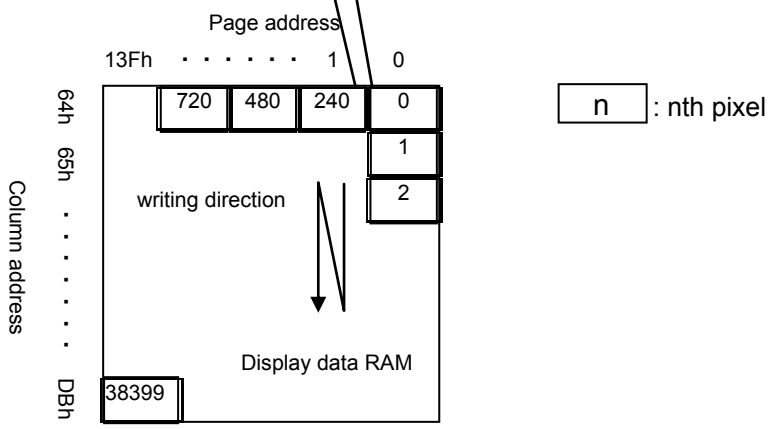
Write cycle	0	1	2	…	19200
D/XC	0	1	1	1	1
D7	CD7	0D3	2D3	…	38398D3
D6	CD6	0D2	2D2	…	38398D2
D5	CD5	0D1	2D1	…	38398D1
D4	CD4	0D0	2D0	…	38398D0
D3	CD3	1D3	3D3	…	38399D3
D2	CD2	1D2	3D2	…	38399D2
D1	CD1	1D1	3D1	…	38399D1
D0	CD0	1D0	3D0	…	38399D0

CD：Memory write command: 2Ch

nD3: MSB of nth dot

nD0: LSB of nth dot

4 bit / dot



2.2 COMMANDS

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

No.	Comand	D7	D6	D5	D4	D3	D2	D1	D0	HEX	Function	Number of parameter	Note
1	NOP	0	0	0	0	0	0	0	0	00	No operation	none	-
2	SWRESET	0	0	0	0	0	0	0	1	01	Software reset	none	-
3	RDDSDR	0	0	0	0	1	1	1	1	0F	Read display self diagnostic results	2	*1
4	SLPIN	0	0	0	1	0	0	0	0	10	Sleep in	none	-
5	SLPOUT	0	0	0	1	0	0	0	1	11	Sleep out	none	-
6	NORON	0	0	0	1	0	0	1	1	13	Normal display mode on	none	-
7	DISINOFF	0	0	1	0	0	0	0	0	20	Display inversion off	none	-
8	DISINV	0	0	1	0	0	0	0	1	21	Display inversion on	none	-
9	DISPOFF	0	0	1	0	1	0	0	0	28	Display off	none	-
10	DISPON	0	0	1	0	1	0	0	1	29	Display on	none	-
11	CASET	0	0	1	0	1	0	1	0	2A	Column address set	4	-
12	PASET	0	0	1	0	1	0	1	1	2B	Page address set	4	-
13	RAMWR	0	0	1	0	1	1	0	0	2C	RAM write	write data count	-
14	RAMRD	0	0	1	0	1	1	1	0	2E	RAM read	read data count	-
15	TEOFF	0	0	1	1	0	1	0	0	34	TE signal output off	none	-
16	TEON	0	0	1	1	0	1	0	1	35	TE signal output on	1	-
17	MADCTL	0	0	1	1	0	1	1	0	36	RAM address control	1	-
18	COLMOD	0	0	1	1	1	0	1	0	3A	Display data format	1	-
19	RDID1	1	1	0	1	1	0	1	0	DA	Read ID1	2	*1
20	RDID2	1	1	0	1	1	0	1	1	DB	Read ID2	2	*1
21	RDID3	1	1	0	1	1	1	0	0	DC	Read ID3	2	*1

***1 : Dummy Read + Read Data (parallel I/F only)**

(1) NOP **Command: 1** **Parameter: 0**

This command does not affect the operation or other effect to the LCD module (visual).

Command	D7	D6	D5	D4	D3	D2	D1	D0	Hex	Description
NOP	0	0	0	0	0	0	0	0	00	No operation

(2) SWRESET **Command: 1** **Parameter: 0**

This command resets LCD module by software.

Command	D7	D6	D5	D4	D3	D2	D1	D0	Hex	Description
SWRESET	0	0	0	0	0	0	0	1	01	Soft ware reset

(3) RDDSDR **Command: 1** **Parameter: 2**

This command indicates the current status of the display.
However this diagnostic function doesn't ensure to detect all of fault.
It is necessary to wait for 150ms to obtain a correct diagnostic outcome after the SLPOUT command is executed.

Command/ Parameter	D7	D6	D5	D4	D3	D2	D1	D0	Hex	Description
RDDSDR	0	0	0	0	1	1	1	1	0F	Read Display self diagnostic result
DD	DD	DD	DD	DD	DD	DD	DD	DD	xx	Dummy Read (Parallel I/F only)
P1	B7	B6	B5	X	0	0	0	0	xx	Read Data

Refer to the following tables for the meaning of each bit.

No.	Function
B7	OK : Set to 0 after RESET. It is inverted by each SLPOUT command.
B6	NG : Set to 0 after RESET. It is NOT inverted by each SLPOUT command.
B5	
B4	X (1 or 0)
B3	0
B2	0
B1	0
B0	0

(4) SLPIN **Command: 1** **Parameter: 0**

This command sets the sleep state of the LCD module.
Please maintain the power supply to 150ms after SLPIN command executed.
See 4.4 RECOMMENDED SEQUENCE to design a command sequence and intervals.

Command	D7	D6	D5	D4	D3	D2	D1	D0	Hex	Description
SLPIN	0	0	0	1	0	0	0	0	10	Sleep in

(5) SLPOUT **Command: 1** **Parameter: 0**

This command releases the sleep state of the LCD module. It is necessary to wait for 10msec for stabilizing internal power circuit
See 4.4 RECOMMENDED SEQUENCE to design a command sequence and intervals.

Command	D7	D6	D5	D4	D3	D2	D1	D0	Hex	Description
SLPOUT	0	0	0	1	0	0	0	1	11	Sleep out

(6) NORON **Command: 1 Parameter: 0**

This command sets the normal display.

Command	D7	D6	D5	D4	D3	D2	D1	D0	Hex	Description
NORON	0	0	0	1	0	0	1	1	13	Normal display mode on

(7) DISINOFF **Command: 1 Parameter: 0**

This command sets the display to show a non-inverted image.

Command	D7	D6	D5	D4	D3	D2	D1	D0	Hex	Description
DISINOFF	0	0	1	0	0	0	0	0	20	Display inversion off

(8) DISINV **Command: 1 Parameter: 0**

This command allows the display to invert the image without having to update the content of the display data RAM.

Command	D7	D6	D5	D4	D3	D2	D1	D0	Hex	Description
DISINV	0	0	1	0	0	0	0	1	21	Display inversion on

(9) DISPOFF **Command: 1 Parameter: 0**

This command sets all dots to black.

Command	D7	D6	D5	D4	D3	D2	D1	D0	Hex	Description
DISPOFF	0	0	1	0	1	0	0	0	28	Display off

(10) DISPON **Command: 1 Parameter: 0**

This command turns on the display.

Command	D7	D6	D5	D4	D3	D2	D1	D0	Hex	Description
DISPON	0	0	1	0	1	0	0	1	29	Display on

(11) CASET **Command: 1 Parameter: 4**

This command sets the column address region when display data RAM is accessed from the MPU. Refer to the following formula, in case of the address changing.

CASET(End) – CASET(Start) +1 = 8 x N (N=1~40 *N is an integer)

Command/ Parameter	D7	D6	D5	D4	D3	D2	D1	D0	Hex	Description
CASET	0	0	1	0	1	0	1	0	2A	Column address set
P1	*	*	*	*	*	*	*	SC8	xx	Start (Upper data byte)
P2	SC7	SC6	SC5	SC4	SC3	SC2	SC1	SC0	xx	Start (Lower data byte)
P3	*	*	*	*	*	*	*	EC8	xx	End (Upper data byte)
P4	EC7	EC6	EC5	EC4	EC3	EC2	EC1	EC0	xx	End (Lower data byte)

***don’ t care (H or L)**

(12) PASET **Command: 1 Parameter: 4**

This command sets the page address region when display data RAM is accessed from the MPU.

Command/ Parameter	D7	D6	D5	D4	D3	D2	D1	D0	Hex	Description
PASET	0	0	1	0	1	0	1	1	2B	Page address set
P1	*	*	*	*	*	*	*	SP8	xx	Start (Upper data byte)
P2	SP7	SP6	SP5	SP4	SP3	SP2	SP1	SP0	xx	Start (Lower data byte)
P3	*	*	*	*	*	*	*	EP8	xx	End (Upper data byte)
P4	EP7	EP6	EP5	EP4	EP3	EP2	EP1	EP0	xx	End (Lower data byte)

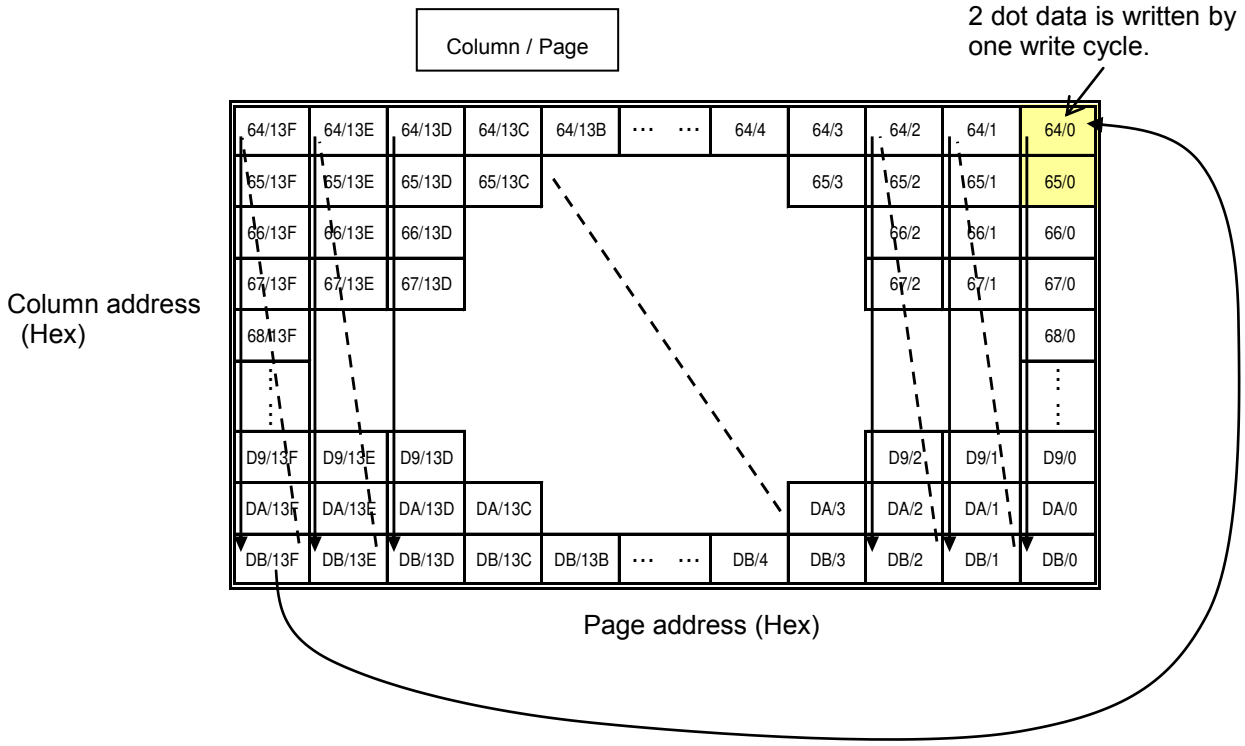
*don’ t care (H or L)

(13) RAMWR **Command: 1 Parameter: write data count**

This command enables writing the data MPU to the display memory.

Command/ Parameter	D7	D6	D5	D4	D3	D2	D1	D0	Hex	Description
RAMWR	0	0	1	0	1	1	0	0	2C	RAM write
P1	B17	B16	B15	B14	B13	B12	B11	B10	xx	Write data
There is no limitation in the number of data.										
Px	Bx7	Bx6	Bx5	Bx4	Bx3	Bx2	Bx1	Bx0	xx	Write data

Display RAM access order according to 4.4 RECOMMENDED SEQUENCE.



Setting value for memory mapping

MADCTL command : 00h
Page address : 00h to 13Fh
Column address : 64h to DBh

(14) RAMRD **Command: 1 Parameter: read data count**

This command enables the data read state when the MPU reads data from the display memory.
This command can not be used for serial interface mode.

Command/ Parameter	D7	D6	D5	D4	D3	D2	D1	D0	Hex	Description
RAMRD	0	0	1	0	1	1	1	0	2E	RAM read
P1	DD	DD	DD	DD	DD	DD	DD	DD	DD	Dummy Read
P2	Read data									
There is no limitation in the number of data.										
Px	Read data									

(15) TEOFF **Command: 1 Parameter: 0**

This command disables timing signal output for avoiding tearing effect.
This function is executed next frame, after this command is entered.
TE terminal becomes low.

Command	D7	D6	D5	D4	D3	D2	D1	D0	Hex	Description
TEOFF	0	0	1	1	0	1	0	0	34	TE signal output off

(16) TEON **Command: 1 Parameter: 1**

This command enables timing signal output for avoiding tearing effect.
This function is executed next frame, after this command is entered.

Command/ Parameter	D7	D6	D5	D4	D3	D2	D1	D0	Hex	Description
TEON	0	0	1	1	0	1	0	1	35	TE signal output on
P1	0	0	0	0	0	0	0	0	0	TE signal output mode

Refer to 4.3 USAGE OF TE OUTPUT.

(17) MADCTL **Command: 1 Parameter: 1**

This command sets the access-direction of RAM and the scan-direction of gate output port.

Command/ Parameter	D7	D6	D5	D4	D3	D2	D1	D0	Hex	Description
MADCTL	0	0	1	1	0	1	1	0	36	RAM address control
P1	B7	B6	0	B4	*	*	*	0	xx	

*don’ t care (H or L).

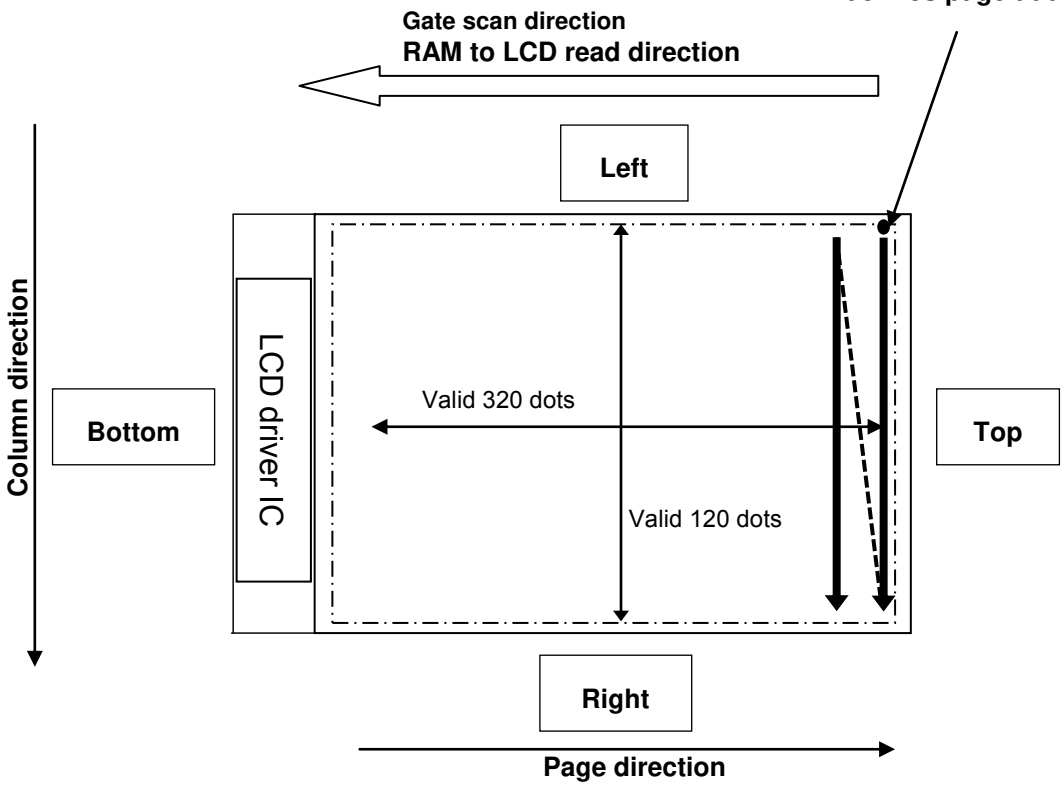
LCD MODULE DEFAULT SETTING

B4	RAM to LCD read direction	Gate scan direction
0	Top to Bottom	Top to Bottom

B6: Column address origin **0: Left side**

B7: Page address origin **0: Top side**

B6: defines column address origin.
B7: defines page address origin.



Note: The figure shows the case of portrait configuration with the driver IC left.

(18) COLMOD **Command: 1 Parameter: 1**

This command sets the gray scale mode.

Command/ Parameter	D7	D6	D5	D4	D3	D2	D1	D0	Hex	Description
COLMOD	0	0	1	1	1	0	1	0	3A	Display data format
P1	*	*	*	*	*	0	B1	B0	xx	I/F

*don’ t care (H or L)

Function	B1	B0
2G/S Mode (Not used)	0	0
4G/S Mode (Not used)	0	1
Not defined	1	0
16G/S Mode	1	1

(19) RDID1 **Command: 1 Parameter: 2**

This command read the ID1 of LCD module.

Command/ Parameter	D7	D6	D5	D4	D3	D2	D1	D0	Hex	Description
RDID1	1	1	0	1	1	0	1	0	DA	Read ID1
DD	DD	DD	DD	DD	DD	DD	DD	DD	xx	Dummy Read (Parallel I/F only)
P1	0	0	0	0	0	0	0	0	00	

(20) RDID2 **Command: 1 Parameter: 2**

This command read the ID2 of LCD module.

Command/ Parameter	D7	D6	D5	D4	D3	D2	D1	D0	Hex	Description
RDID2	1	1	0	1	1	0	1	1	DB	Read ID2
DD	DD	DD	DD	DD	DD	DD	DD	DD	xx	Dummy Read (Parallel I/F only)
P1	0	0	0	0	0	0	0	0	00	

(21) RDID3 **Command: 1 Parameter: 2**

This command read the ID3 of LCD module.

Command/ Parameter	D7	D6	D5	D4	D3	D2	D1	D0	Hex	Description
RDID3	1	1	0	1	1	1	0	0	DC	Read ID3
DD	DD	DD	DD	DD	DD	DD	DD	DD	xx	Dummy Read (Parallel I/F only)
P1	0	0	0	0	0	0	0	0	00	

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

Item	Symbol	Rating	Unit
Power supply voltage	VCC	-0.3 to +4.0	V
Signal input voltage	VIN	-0.3 to VCC+0.3	V

3.2 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	STMBOL	CONDITION	RATING		UNIT	REMARKS
			Min	Max		
Ambient temperature	TOP	Operation	- 20	70	℃	No dew condition
	TST	Storage	- 20	80		

The absolute maximum ratings represent the rated values which LCD module can not exceed. When LCD modules are used beyond this rated value, the operating characteristics may be adversely affected.

4. ELECTRICAL SPECIFICATIONS

4.1 DC CHARACTERISTICS

4.1.1 DC specifications of general pins

GND=0V

PARAMETER	Symbol	Rating			Unit	Remarks
		Min.	Typ.	Max.		
Power Supply voltage	VCC	3.0	3.3	3.6	V	
Power Supply current	ICC	-	-	10	mA	Image: All pixels White *2
		-	-	400	uA	Sleep in mode*3
Input voltage	High	0.7VCC	-	VCC	V	IIH = 10[uA](Max)
	Low	0	-	0.3VCC	V	IIL = -10[uA](Max)
Output voltage	High	0.8VCC	-	VCC	V	IOH=-0.5mA
	Low	0	-	0.2VCC	V	IOL=0.5mA
Input leak current	I_L	-10	-	10	uA	Except VCC PIN

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

*2: At the condition of input pins of D0～D7, D/XC, XWR, and XRD are fixed to "H" or "L". In-rush current is excluded.

*3: At the condition of input pins of D0～D7, D/XC, XWR, and XRD are fixed to "H" or "L", backlight is turned off.

4.1.2 Characteristics of LED and LED driving

PARAMETER	Symbol	Value			Unit	Remarks
		Min.	Typ.	Max.		
LED forward voltage	Vf	-	2.8	3.4	V	Per LED *1
LED forward current	If	-	25	280	mA	*2

*1: If=25mA, Ta=25℃(from Nichia's only one LED specification)

*2: LED allowable forward current is decremented by the ambient temperature. (Refer to Fig.1)

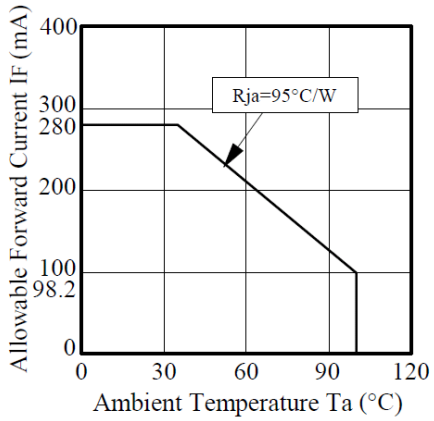
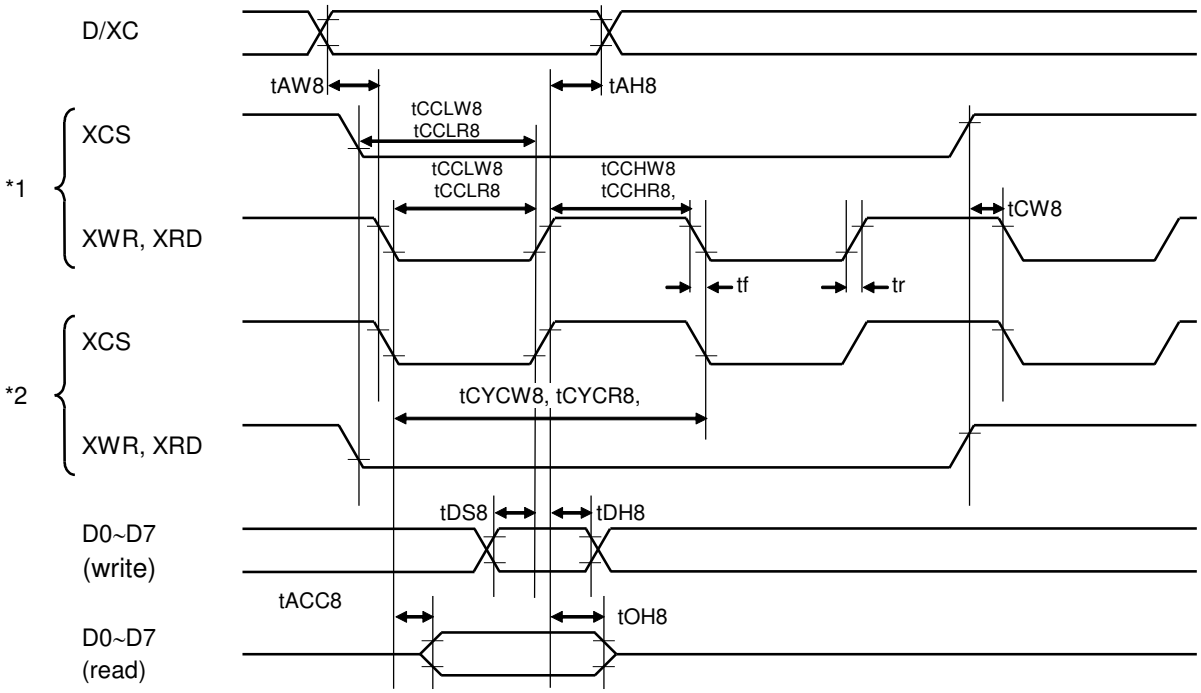


Fig.1: Ambient Temperature vs. Allowable Forward Current (from Nichia's specification)

4.2 AC CHARACTERISTICS

4.2.1 Parallel interface timing

(1) I80 8bit parallel interface



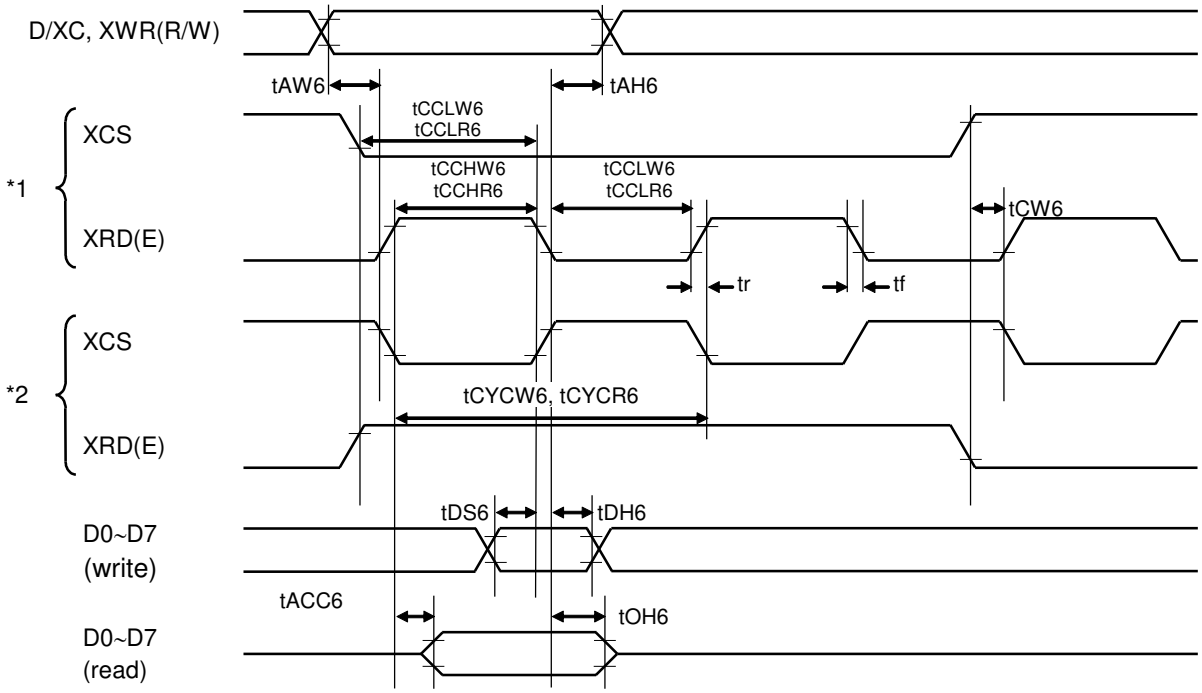
*1 Access at XWR and XRD when XCS is "L".*2 Access at XCS when XWR and XRD are "L".

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
XCS	tCW8	XCS/set up time	20	-	ns	*1, *2, *3
D/XC	tAH8	address hold time	20	-	ns	
	tAW8	address set up time	20	-	ns	
XWR	tCYCW8	Write cycle	150	-	ns	
	tCCHW8	Control pulse H width (WR)	35	-	ns	
	tCCLW8	Control pulse L width (WR)	35	-	ns	
XRD	tCYCR8	Read cycle	440	-	ns	
	tCCHR8	Control pulse H width (RD)	90	-	ns	
	tCCLR8	Control pulse L width (RD)	150	-	ns	
D0 ~ D7	tDS8	data set time	20	-	ns	
	tDH8	data hold time	20	-	ns	
	tACC8	read access time	-	145	ns	*4 *5
	tOH8	output disable time	15	80	ns	

Voltage of VCC is in ranges of 4.1 DC CHARACTERISTICS, 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 40ns.
*2 Input signal timings are specified based on 30% and 70% of VCC.
*3 tCCLW8 is set to the overlapping period when XCS is "L" and XWR is "L".
tCCLR8 is set to the overlapping period when XCS is "L" and XRD is "L" .
*4 tACC8 and tOH8 specified based on 20% and 80% of VCC.
*5 Measurement condition For maximum value : C_L = 30pF, For minimum value : C_L = 8pF

(2) M68 8bit parallel interface



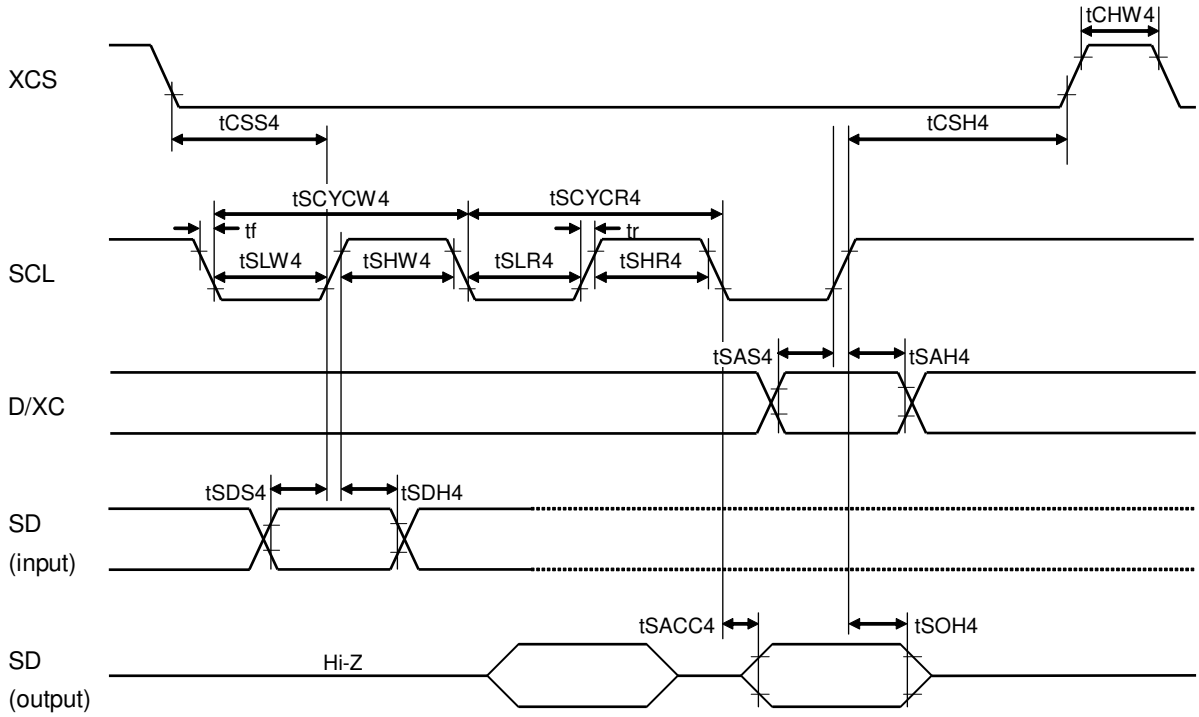
*1 Access at E when XCS is "L". *2 Access at XCS when E is “H”.

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
XCS	tCW6	XCS/set up time	20	-	ns	*1, *2, *3
D/XC	tAH6	address hold time	20	-	ns	
R/W	tAW6	address set up time	20	-	ns	
E	tCYCW6	Write cycle	150	-	ns	
	tCCHW6	Control pulse H width (WR)	35	-	ns	
	tCCLW6	Control pulse L width (WR)	35	-	ns	
E	tCYCR6	Read cycle	440	-	ns	
	tCCHR6	Control pulse H width (RD)	90	-	ns	
	tCCLR6	Control pulse L width (RD)	150	-	ns	
D0 ~ D7	tDS6	data set time	20	-	ns	
	tDH6	data hold time	20	-	ns	
	tACC6	read access time	-	145	ns	*4 *5
	tOH6	output disable time	15	80	ns	

Voltage of VCC is in ranges of 4.1 DC CHARACTERISTICS, 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 40ns.
*2 Input signal timings are specified based on 30% and 70% of VCC.
*3 tCCLW6 is set to the overlapping period when XCS is "L" and XRD(E) is "L".
tCCLR6 is set to the overlapping period when XCS is "L" and XRD(E) is "L" .
*4 tACC6 and tOH6 specified based on 20% and 80% of VCC.
*5 Measurement condition For maximum value : C_L = 30pF, For minimum value : C_L = 8pF

4.2.2 4wire 8bit serial interface timing

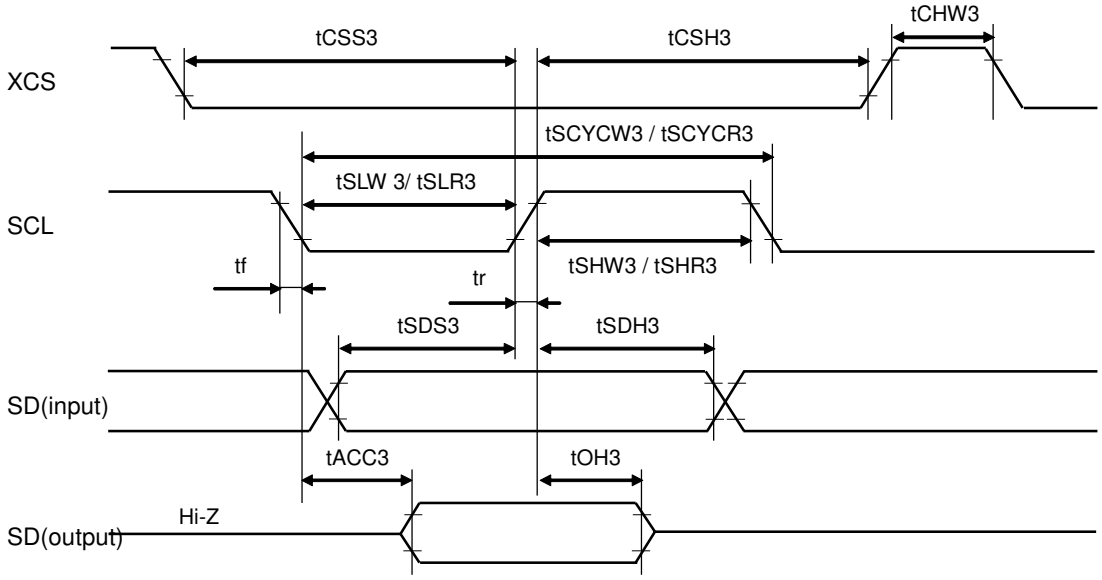


Signal	Symbol	Parameter	MIN	MAX	Unit	Description
XCS	tCSS4	XCS/set up time	60	-	ns	*1, *2
	tCSH4	XCS/hold time	65	-	ns	
	tCHW4	XCS"H" pulse width	45	-	ns	
SCL (Write)	tSCYCW4	clock cycle	150	-	ns	
	tSLW4	"L" pulse width	35	-	ns	
	tSHW4	"H" pulse width	35	-	ns	
SCL (Read)	tSCYCR4	clock cycle	470	-	ns	
	tSLR4	"L" pulse width	135	-	ns	
	tSHR4	"H" pulse width	135	-	ns	
D/XC	tSAS4	Address setup time	30	-	ns	
	tSAH4	Address hold time	30	-	ns	
SD(input)	tSDS4	data set time	30	-	ns	
	tSDH4	data hold time	30	-	ns	
SD(output)	tACC4	data delay time(Hi-z-data)	5	130	ns	*3, *4
	tOH4	data delay time(data-Hi-z)	15	130	ns	

Voltage of VCC is in ranges of 4.1 DC CHARACTERISTICS, 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 40ns.
*2 All input signal timings are specified based on 30% and 70% of VCC.
*3 All output signal timings are specified based on 20% and 80% of VCC.
*4 Measurement condition For maximum C_L = 30pF , For minimum C_L = 8pF

4.2.3 3 wire 9bit serial interface timing

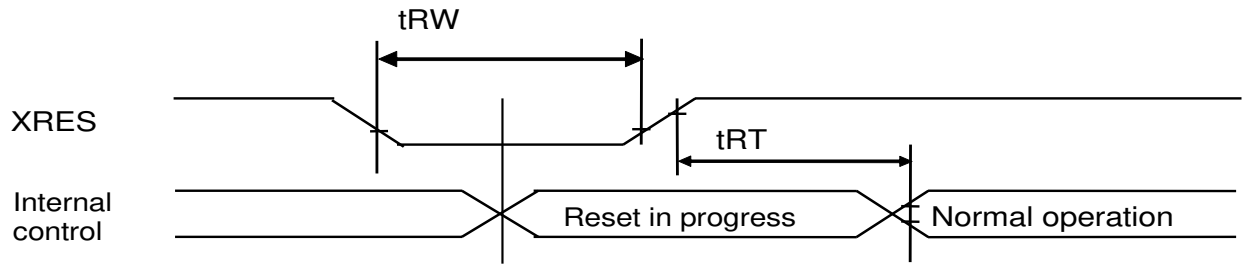


Signal	Symbol	Parameter	MIN	MAX	Unit	Description
XCS	tCSS3	XCS/set up time	60	-	ns	*1, *2
	tCSH3	XCS/hold time	65	-	ns	
	tCHW3	XCS"H" pulse width	45	-	ns	
SCL (Write)	tSCYCW3	clock cycle	150	-	ns	
	tSLW3	"L" pulse width	35	-	ns	
	tSHW3	"H" pulse width	35	-	ns	
SCL (Read)	tSCYCR3	clock cycle	470	-	ns	
	tSLR3	"L" pulse width	135	-	ns	
	tSHR3	"H" pulse width	135	-	ns	
SD(input)	tSDS3	data set time	30	-	ns	
	tSDH3	data hold time	30	-	ns	
SD(output)	tACC3	data delay time(Hi-z-data)	5	130	ns	*3, *4
	tOH3	data delay time(data-Hi-z)	15	130	ns	

Voltage of VCC is in ranges of 4.1 DC CHARACTERISTICS, 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 40ns
*2 All input signal timings are specified based on 30% and 70% of VCC.
*3 All output signal timings are specified based on 20% and 80% of VCC.
*4 Measurement condition For maximum value : C_L = 30pF , For minimum value : C_L = 8pF

4.2.4 Reset timing



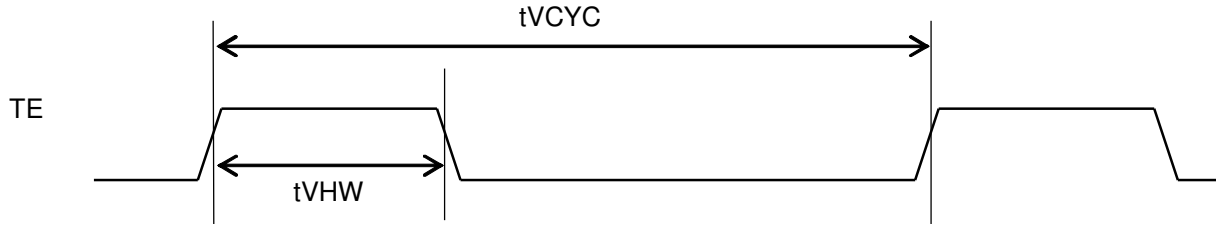
Signal	Symbol	Parameter	MIN	MAX	Unit	Measurement Condition and Others
XRES	tRW	reset pulse width	50	-	us	*1
	tRT	clear reset	-	10	ms	*1, *2

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

*1 The rise and fall times of the input signal (tr, tf) are equal or less than 100ns.
Input signal timings are specified based on 30% and 70% of VCC.
*2 The driver IC initializes logic circuit for this period.

4.3 USAGE OF TE OUTPUT

4.3.1 TE output characteristics

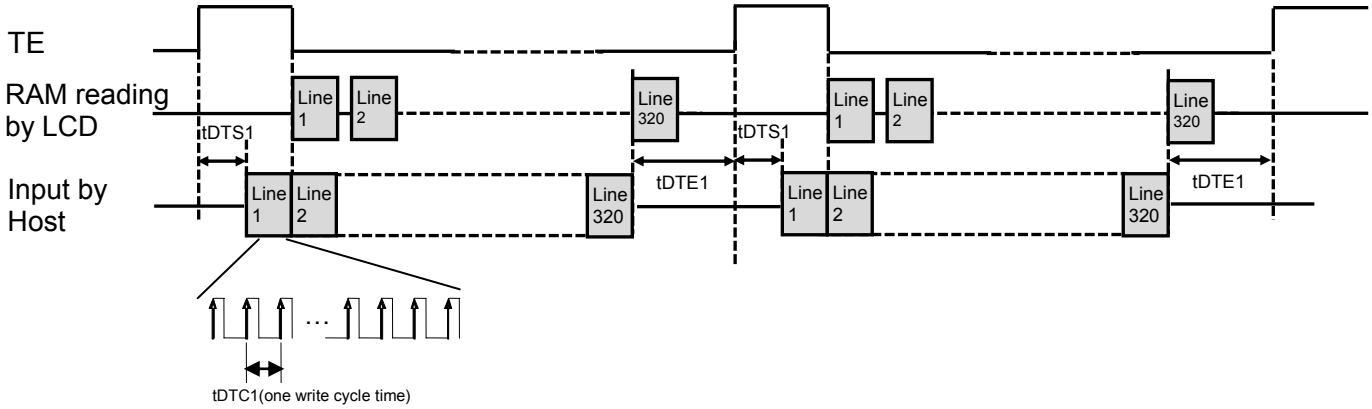


Signal	Symbol	Parameter	Min.	Typ.	Max.	Unit	Conditions
TE	tVHW	TE pulse H width	133	153	181	us	
	tVCYC	TE period	14.4	16.6	19.6	ms	

*: At the condition of power supply voltage is in a range of 4.1 DC CHARCTERISTCS.

4.3.2 TE Output and RAM Writing by Host

Timings are mentioned in order to prevent a tearing of display that is caused by running over of writing.



Data transmission start timing : tDTS1

It is necessary to start the data transmission within tDTS1(MAX).

Data transmission end timing : tDTE1

It is necessary to end the data transmission up to tDTE1(MIN).

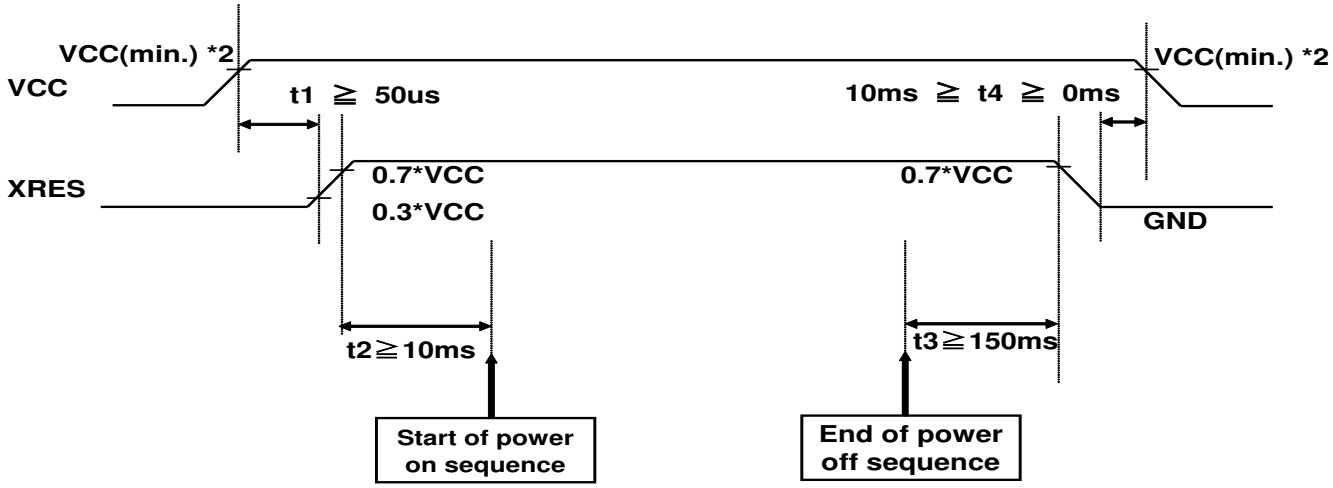
16G/S Mode

Parameter	MIN	MAX	Unit	Remarks
tDTS1	-	89	us	
tDTE1	121	-	us	
tDTC1 (Tr,Tf<=15ns)	0.1 (*1)	0.37 (*2)	us	*1 : refer to 4.2 AC CHARACTERISTICS
tDTC1 (Tr,Tf<=100ns)	0.27 (*1)	0.37 (*2)	us	*2 : tDTS1=89us,tDTE1=121us

4.4 RECOMMENDED SEQUENCE

-1) Start to supply system power (VCC).
-2) Make a device reset after starting to supply the system power.
(XRES must be kept "L" for more than 50us.)
-3) Input control signal.
-4) Wait more than 10ms 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)
* 1 XRES must be maintained to “LOW” more than 50us after turning on the system power (VCC).
* 2 VCC(min) is minimum voltage of VCC. Please refer to 4.1. DC CHARACTERISTICS
* 3 The rising speed of VCC should be less than 2V/100us.

4.4.1 Power on sequence

Command	Hex	Remarks
Power-ON (VDD)		
XRES = "L" more than 50us		
XRES = "H" (reset release)		
More than 10 [ms]		
SLPOUT	11h	
More than 10 [ms]		
CASET	2Ah	
P1	00h	
P2	64h	
P3	00h	
P4	DBh	
PASET	2Bh	
P1	00h	
P2	00h	
P3	01h	
P4	3Fh	
COLMOD	3Ah	
P1	03h	16 gray scale
TEON	35h	
P1	00h	
NORON	13h	
DISINOFF	20h	
MADCTL	36h	
P1	00h	
RAMWR	2Ch	
dot #0 - #1		Send display data 2 dot / cycle (4 bit / dot)
dot #2 - #3		
. . .		
dot #38396 - #38397		
dot #38398 - #38399		
DISPON	29h	

4.4.2 Power off sequence

Command	Hex	Remarks
Display on state		
DISPOFF	28h	
Wait more than [50ms]		
SLPIN	10h	
More than 150 [ms]		
Power - OFF		

4.4.3 Refresh sequence

This sequence should be implemented continuously in order to recover the display error due to noise etc.

Command	Hex	Remarks
SLPOUT	11h	
More than 10 [ms]		
CASET	2Ah	
P1	00h	
P2	64h	
P3	00h	
P4	DBh	
PASET	2Bh	
P1	00h	
P2	00h	
P3	01h	
P4	3Fh	
COLMOD	3Ah	
P1	03h	16 gray scale
TEON	35h	
P1	00h	
NORON	13h	
DISINOFF	20h	
MADCTL	36h	
P1	00h	
RAMWR	2Ch	
dot #0 - #1		Send picture data 2 dot / cycle (4 bit / dot)
dot #2 - #3		
. . .		
dot #38396 - #38397		
dot #38398 - #38399		
DISPON	29h	

4.4.4 Sleep out sequence

This sequence should be input in order to return from the sleep mode.

Command	Hex	Remarks
SLPOUT	11h	
More than 10 [ms]		
CASET	2Ah	
P1	00h	
P2	64h	
P3	00h	
P4	DBh	
PASET	2Bh	
P1	00h	
P2	00h	
P3	01h	
P4	3Fh	
COLMOD	3Ah	
P1	03h	16 gray scale
TEON	35h	
P1	00h	
NORON	13h	
DISINOFF	20h	
MADCTL	36h	
P1	00h	
RAMWR	2Ch	
dot #0 - #1		Send picture data 2 dot / cycle (4 bit / dot)
dot #2 - #3		
. . .		
dot #38396 - #38397		
dot #38398 - #38399		
DISPON	29h	

4.4.5 Sleep in sequence

This sequence should be input in order to enter the sleep mode.

Command	Hex	Remarks
Display on state		
DISPOFF	28h	
More than 50 [ms]		
SLPIN	10h	
More than 150 [ms]		
Sleep in state		

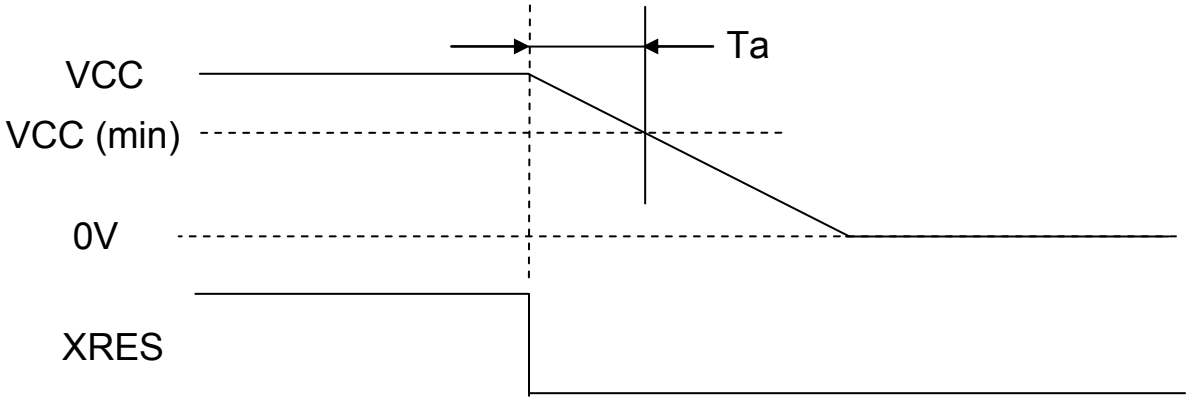
4.5 POWER OFF SEQUENCE IN EMERGENCY MODE

(ABNORMAL POWER OFF SEQUENCE)

This power off sequence must be used only in emergency mode.

Please use 4.4 RECOMMENDED SEQUENCE for normal operation because this sequence may cause flicker and image sticking.

This sequence is applied only H/W reset.



Symbol	Min	Typ	Max	unit
Ta	50	-	-	[us]

Notes)

(1) This sequence will not cause any permanent failure to the LCD module.
But flicker screen may occur temporally at next display on.

(2) Current consumption after XRES =”L” is same as sleep in state.

(3) Other signals (XCS, XWR, XRD, D/XC, D0-D7) can be set to low at same time as XRES.
But there is possibility of short time data bus contention between display and controller when XRD and XRES are turned "L".

5. OPTICAL SPECIFICATIONS

5.1 OPTICAL SPECIFICATION

Item			Symbol	Rating			Unit	Definition (Condition)	Remark
				Min.	Typ.	Max.			
Contrast Ratio			*CR*	500	1000	-	-	1,2	-
Response	tr+tf		*trf*	-	40	-	ms	1,3	-
Color coordinates	W-x		*Wx*	0.275	0.315	0.355	-	1,4	-
	W-y		*Wy*	0.292	0.332	0.372			
Brightness			*B*	350	600	-	cd/m^2	1,6	-
Brightness homogeneity			-	75	-	-	%	1,7	-
Contrast ratio (Viewing angle)	ϕ =0° 90° 180° 270°	θ =70°	CR	10	-	-	-	1,5	-
		θ =55°	CR	40	-	-			
		θ =40°	CR	150	-	-			

5.2 DEFINITIONS AND CONDITIONS

5.2.1 Definitions of optical characteristics

Definition 1

Measuring conditions

(1) Instrument: DMS 803(301) (autronic-MELCHERS GmbH.),or equivalent.
(2) Ambient temperature: Ta=25 °C
(3) Display: white or black display on all screen,VCC=3.3V
(4) Measure after 15 minutes of LED warm up.
(5) Vf=2.8V, If=25mA per LED

Definition 2

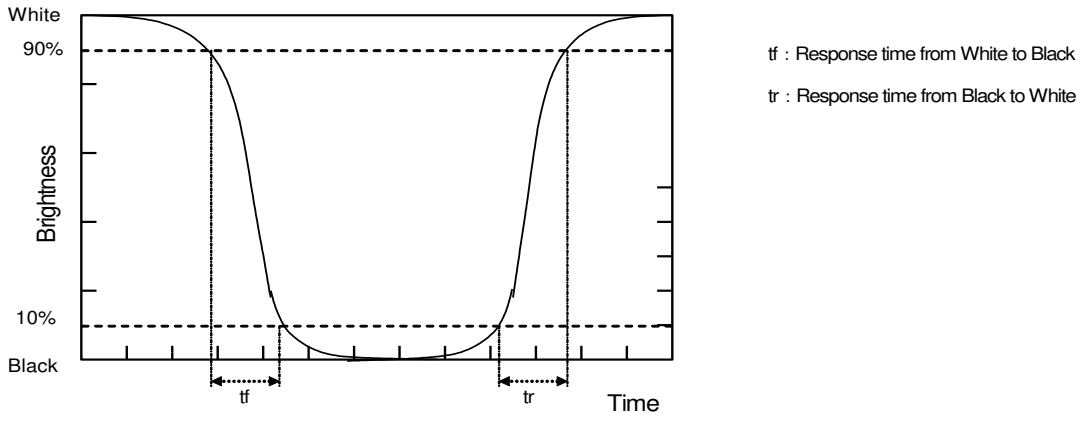
This is a ratio between the screen surface reflectance or brightness of the white raster and the black raster.

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

Definition 3

tf: This is a time that decreases to 10% of total change of the screen surface brightness from the point of 90%, after data signal is switched from white-raster to black-raster.

tr: This is a time that increases to 90% of total change of the screen surface brightness from the point of 10%, after data signal is switched from black-raster to white-raster.



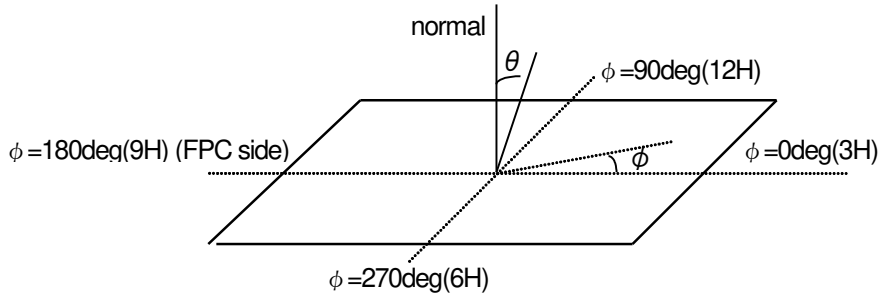
Definition 4

This is the x-y coordinate of White colors specified on the CIE1931 chromaticity diagram.

Definition 5

This is a maximum angle θ from the normal direction that keeps having the contrast ratio more than 10:1,40:1 and 150:1.

The angle on surface ϕ is defined respectively.

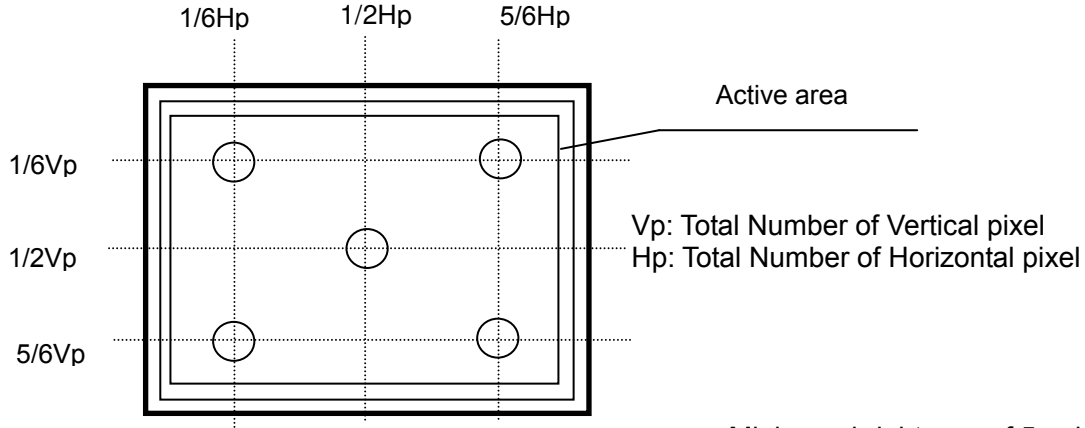


Definition 6

Measured at the center of active display area

Definition 7

Measurement point



$$\text{Luminance homogeneity} = \frac{\text{Minimum brightness of 5 points}}{\text{Maximum brightness of 5 points}} \times 100$$

Characteristics is measured at 5 points in the active area.

6. INSPECTION

6.1 STANDARDS

*ppm targets

Major defects 100ppm

Minor defects 1000ppm

Note) This figure is a target. It is not guaranteed.

6.2 LOTS

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

6.3 INSPECTION CONDITION

1) Emviromental conditions :

1. Temperature/humidity condtion : Normal temprature (25+- 5 degrees)

Normal humidity （60+-20%RH）

2. Iluminance environment : Not lighted appearance : 800～2000Lx

Lighted appearance : 100～ 400Lx

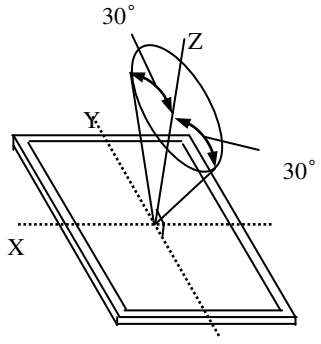
* Some specified patterns : 50Lx or the less

2) Inspection method : Inspection by naked eye

Inspect the screen by naked eye from a distance of about 30 cm and the angle shall be 30 degrees

from the vertical direction to the product.

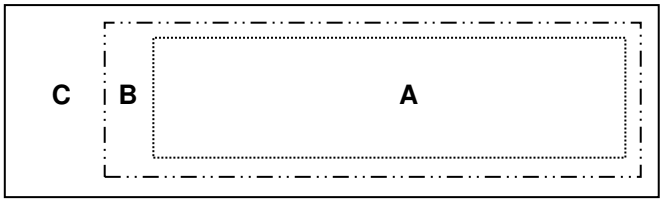
Veiwing angle is 30 degrees from the vertical direction as shown in the picture below.



3) Drive condition : It is done pursuant to product specification.

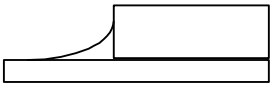
6.4 APPEARANCE STANDARD

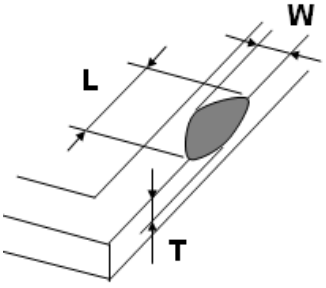
6.4.1 Application scope



zone	definition
A	Active Area.
B	Area from outside of “A zone” to insight edge of metal frame.
C	Black painting Area.

6.4.3 General Appearance Specifications

<table>
<tr><th>No.</th><th>Items</th><th>Judgment criteria</th><th>Class</th></tr>
<tr><td>1</td><td>different specifications</td><td>Not permitted.</td><td>Major</td></tr>
<tr><td>2</td><td>Damaged resist on FPC</td><td>Copper patterns on FPC must not be visible.</td><td>Minor</td></tr>
<tr><td>3</td><td>Circuit pattern</td><td>Must not be peeled or separated from FPC.</td><td>Major</td></tr>
<tr><td>4</td><td>Conductive refuses</td><td>No solder refuses or solder balls easily moving.
Fixed particle which has no functional affect can be ignored.</td><td>Minor</td></tr>
<tr><td>5</td><td>Dirt</td><td>Should not be prominent.
Dirt on backside is permitted.</td><td>Minor</td></tr>
<tr><td>6</td><td>I/F terminal scratch / dirt</td><td>Should not be prominent.</td><td>Minor</td></tr>
<tr><td>7</td><td>Plating</td><td>Must not be peeled, no rust and no discoloration.</td><td>Minor</td></tr>
<tr><td>8</td><td>Soldering defect</td><td>Solder omissions is not permitted at any solder point.
Solder bridges is not permitted.
Cold soldering is not permitted.</td><td>Major
Major
Minor</td></tr>
<tr><td>9</td><td>Parts soldering</td><td>There must be fillet.
  </td><td>Minor</td></tr>
<tr><td>10</td><td>Metal frame Scratch / discoloration</td><td>Scratch out of viewing area and discoloration shall be ignored.</td><td>Minor</td></tr>
<tr><td>11</td><td>Metal frame black painting area (zone C) dent / dirt / scratch</td><td>Repair of black paint is not permitted.

There must not be dents, dirt and scratches that influences product characteristic and the process of the customer.
If any problems arise on this specification , they shall be solved through consultation between both parties.</td><td>Minor</td></tr>
<tr><td>12</td><td>Cushion</td><td>Breakage on cushion
〈Breakage on inner edge〉
not permitted
〈Breakage on outer edge〉
<table><tr><th>Size(mm)</th><th>Tolerance (Note)</th></tr><tr><td>L≦3.0
W≦2/3*w
T≦2/3*t</td><td>3</td></tr></table> 
w: cushion width
t : cushion thickness
Note : Number of cushion breakage in circumference.
minimum cushion breakage will be checked by appearance inspection</td><td>Minor</td></tr>
</table>

7. WARRANTY

Please contact Data Modul for further information.

8. RELIABILITY

8.1 RELIABILITY TESTING CONDITION

No.	Parameter	Condition	Ratings	Evaluation Criteria
1	High-temperature storage	80 ºC ± 2 ºC	500 h	After the test, and 2 hours elapsed at room temperature, it should not be changed in external appearance and/or display appearance that could impair use.
2	Low-temperature storage	-30 ºC ± 2 ºC	500 h	
3	Temperature cycling	-30 ºC <-> 80 ºC (0.5h) (0.5h)	100 cycles	
4	High-temperature operation	70 ºC ± 2 ºC	500 h	
5	Low-temperature operation	-20 ºC ± 2 ºC	500 h	
6	High-temperature, high-humidity operation	50 ºC 90%RH	500 h	

8.2 MECHANICAL PERFORMANCE

1	Vibration (Non-operating)	5-10 Hz, +10dB/octave 10 - 50Hz 5.58m2/s3 (0.0558g2 / Hz) 50 - 500Hz, -10db/octave X, Y, Z / 30 minutes each	There must be no abnormalities of function or display.
2	Shock (Non-operating)	100G 6ms Sinusoidal half wave ±X, ±Y, ±Z / 1 cycles each	
3	Package vibration	5 - 55 Hz variable / 1 cycle (15 min.) ・5Hz～20Hz 2.0mmp-p ・20Hz～55Hz 1.5G 2 cycles for each in X, Y, Z direction	
4	Package drop	According to JIS-Z0202 Height for plane drop: 50 cm Height for corner and ridge drop: 50 cm	
5	ESD (Non-operating)	Contact Discharge 100pF, 1500ohm, ±8kV Panel center 3 times (intervals of 1s) Non-operating	There must be no abnormalities of function or display. Current consumption should be less than maximum current.
6	ESD (Non-operating)	Air Discharge 100pF, 1500ohm, ±8kV 4 points to metal frame 3 times for each (intervals of 1s) Non-operating	

9. LCD MODULE USAGE AND PRECAUTIONS

9.1 DESIGN OF APPLICATION

1) To prevent damage to the module, design applications in consideration of the following:
   - The absolute maximum ratings represent the rated values which the LCD module must not exceed. When modules are used beyond this rating, the operating characteristics may be irreversibly affected.
   - It is recommended that power supply lines [VCC] include current surge protection (fuses, etc.). Without such protection, foreign material or isolated circuit failures can cause overheating or smoke emission, resulting in injury.
   - When logic circuit power is off, do not apply any signals to the input terminals.
   - Potentially irreversible abnormality may occur with forcible disconnection of LCD module power supply, such as removing the device battery.
   - Employ designs that avoid direct contact with the IC.
     In the event there is a chance of contact, please contact Data Modul. regarding precautions.
2) To prevent erroneous operation, design applications in consideration of the following:
   - To prevent the occurrence of erroneous operation caused by noise, pay special attention to satisfying specified operating conditions.
     This includes precautionary measures, like using short signal cables.
   - Note that peripheral devices can cause mutual noise interference with LCD modules.
     In particular, input devices such as touch panels may emit operational level noise as radiation, even when these devices are not in operation.
     Provisions for, and evaluation of, performance under actual usage conditions with the system are highly recommended.
   - The driver IC used by the LCD module is easily affected by light exposure because it is mounted as a bare chip on the module.
     To avoid increased current consumption and accompanied shut-down of power supply, give consideration to taking light-shielding countermeasures, and evaluating performance in the system.
   - Just as with general electronic components, ESD may cause LCD modules to malfunction.
     ESD countermeasures should be considered around components surrounding the LCD module, especially the driver IC and power IC.
     When an LCD module is mounted near the outer surface of a product, take extra care that components such as these cannot act as conductive paths for ESD.
   - By command, LCD module operation status and display data is saved, but that data can easily be altered by external noise.
     Noise should be minimized, or its effect avoided, at the device or system level.
   - As unexpected noise may occur, periodic refresh operations, such as resetting commands or resending display data, are highly recommended as part of the software routine.
   - As display problems can occur when signals are fed to the input/output cable NC terminals, system

designs should keep them open.

3) System designs should consider the following:
   - Design applications so that excessive force will not be applied to the surface, perimeter or adjoining areas of LCD modules, as this may cause display panel color tone to vary.
   - Be sure that the LCD module is free from twisting, warping, or distortion as any stress can have great influence on the display quality.
     Ensure sufficient stiffness of the system's outer case or frame.
     Also, exercise caution when handling.
   - Use the backlight frame section or metal frame section to set and fix the LCD module position inside the system.
     Using other components to fix the LCD module position may sever circuits on the FPC.
   - As part of the construction of the LCD module, the FPC board with on-board electronic components is only partly fixed to the case, in consideration of reworking. Potentially, the FPC may curve under the weight of individual components, and they may protrude beyond the outline of the case. As such, preventive measures should be taken to prevent any electrical contact between the LCD module components and other circuits inside the system.
   - The viewing angle of the LCD module and that of the system should match.
   - If a display frame or printed frame is provided, place it inside the viewing area and outside the active area for a good appearance.
4) Liquid crystal display elements are temperature dependent.
   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.
5) To avoid EMI, preventive measures should be implemented in the system.
6) Note that sudden powering-up sends excessive inrush current to the LCD module, and can affect the entire system.

9.2 ASSEMBLY PRECAUTIONS

1) Static electricity can destroy LCD module elements, so carefully observe the following during assembly:
   - Be sure to ground your body when handling the LCD module.
   - Make sure that solder guns and all other tools required for assembly have been grounded.
   - The use of anti-static mats (0.5k – 1MΩ) on the workbench for grounding is recommended.
   - To reduce occurrence of static electricity, avoid using this product in dry environments, (less than 50%RH).
   - To eliminate static electricity, the use of an ionizer (anti-static air blower) is recommended.
   - A protective film has been attached to the surface of the LCD panel.
     When peeling off the protective film, do so carefully near an ionizer.
   - To guard against performance degradation of the LCD module caused by destructive forces such as static electricity, etc., avoid direct contact to the terminal electrodes of connectors and FPC circuit pattern when handling.

2) The LCD Panel surface is protected by a protective film, which must be removed before system installation. Units having been in prolonged storage may have some adhesive residue left on the display panel. In such cases, please remove the contaminant according to the procedure in item 5) under "10.3 Handling Precautions" below.
3) As removing the LCD module's protective film makes the polarizer susceptible to the adhesion of foreign material, do so immediately prior to assembly.
4) Exercise caution when applying adhesive to the LCD module as it is difficult to remove.
5) Do not touch or handle the LCD module directly with bare hands as residue of dirt, oil or water can cause corrosion.
Be sure to wear finger stalls or gloves when handling LCD modules.
(CAUTION: The following applies to bare panel modules)
When holding an LCD module, carefully hold the panel by the edges of the glass plate.
6) Handle LCD modules by their edges.
Handling the screen directly can cause display problems or cracks in the panel.
7) When installing the LCD module, don't forcibly bend or stretch the input/output cable.
Bending or twisting the FPC section may damage circuit patterns.
Applying any excessive stress to the LCD module can damage it.
8) Do not apply pressure to the LSI chip or surrounding mold area as it can cause damage.
9) Do not use sharp, pointy or rigid tools when handing LCD panels.
These objects can scratch or nick the glass panel, which can cause it to crack.
10) Perform the LCD module power on/off of the system assembly inspection according to the procedure in the specification document.
11) Do not allow non-atmospheric, specialty gases to contact with the LCD module.
Check plastic or rubber materials to be used in the system beforehand as gas they produce can cause functional degradation of internal components like the LCD panel polarizer.

9.3 HANDLING PRECAUTIONS

1) The display panel is made of glass. Do not subject it to mechanical shock such as dropping it from a high position, etc.
2) If the display panel is damaged and internal liquid crystal substance leaks out, be sure not to inhale or consume it.
Direct contact with skin should also be avoided.
Should contact with the internal liquid crystal substance occur, promptly apply the following responses:
- Contact with clothing: Remove affected items
- Contact with skin: Wash off using soap and running water
- Contact with eyes: Wash out for 15 min. or longer with clean water then consult a physician
- Ingestion: Induce vomiting with water and consult a physician

3) Take precautions in handling the LCD module because the glass plate has very keen edges. Should it break, take extra care to avoid injury from chips, shards and flying glass.
4) The polarizer covering the display panel surface of the LCD module is soft and can be easily scratched. Handle this polarizer carefully, avoiding contact with sharp, pointy instruments or stiff cloth.
5) If the polarizer surface becomes contaminated, use the following recommended or equivalent adhesive tape for contaminants removal:
   - Scotch-brand mending tape (No. 810) or an equal similar product.
6) Do not breathe on the display surface or use ethyl alcohol solvent for contaminant removal. This can cause cloudiness in the polarizer surface.
   Furthermore, do not use the following as they can damage the polarizer:
   - Water
   - Ketones
   - Aromatic solvents
7) Avoid using the LCD module under condensation or high-humidity environments as this may cause polarizer or other functional degradation.
8) After being in a high-humidity or condensation environment, keep the LCD module at room temperature more than 30 minutes before using.
9) Current flow in a condensation or high-humidity environment can cause corrosion of electrodes. Also, take precautions against water getting inside the LCD module as it can cause damage.
10) Liquid crystal freezes when stored below the storage temperature range and such freezing may cause orientation defects or bubbles (black or white) to appear in the LCD panel.
    Bubbles may also occur if the panel receives an impact in a low-temperature environment.
11) If the LCD module is left operating for a long time with the same display showing, the displayed pattern may leave traces on the screen or the contrast may become inconsistent.
12) As optimal operating voltage of the LCD module depends on the surrounding temperature, operation in a high-temperature environment may cause slight flickering.

9.4 DISASSEMBLY AND MODIFICATION

1) Do not attempt to disassemble or modify the LCD module. The internal construction of the LCD module is susceptible to shock, and foreign material or damage can cause screen loss. Data Modul shall not be responsible in the event that a customer attempts to disassemble or modify the LCD module.

9.5 STORAGE

1) When storing LCD modules, avoid the following conditions or environments:
   • Exposure to direct sunlight or fluorescent lighting.
   • High-temperature/high-humidity or very low-temperature (below 0°C) environments.
   • Exposure to water droplets, condensation, etc.
   Furthermore, keep LCD modules in anti-static bags to prevent static electricity charge ups. Whenever possible, LCD modules should be stored in the same conditions in which they were shipped

from Data Modul. When doing so, ensure there are no water droplets, or condensation.

2) Take precaution to minimize corrosion of electrodes.
   Corrosion of electrodes is accelerated by moisture, condensation or a current flow in a high-humidity environment.
3) Recommended storage conditions:
   • Storage environment : +15 ºC to 35 ºC, less than 65%RH
   • Duration: up to 12 months after shipping date
4) The shipping cartons must not be stacked up over 1.8m in height.

9.6 DISPOSAL

1) When disposing of LCD modules, consult companies authorized to handle industrial waste treatment. When incineration is the method of LCD module disposal, relevant environmental legislation must be observed.

9.7 OTHERS

1) This product is designed to be used in general electronic devices (such as office equipment, telecommunications equipment, home electronics, or video game devices). Do not use this product in applications that require an extremely high level of reliability and safety, especially in devices that may cause direct bodily damage to end users (such as equipment for aerospace, traffic control, nuclear, medical, life-support, or safety use).
2) Data Modul shall not be responsible for defects that occur in this product or in equipment connected to this product if the product is used in an environment that exceeds the ranges specified in this document, or in an environment not described in this document.
3) Use this product within the scope of conditions and precautions set forth in this document.
   Even when used according to guidelines ensure sufficient safety at a system and design level to avoid the operation of this product becoming the cause of personal injury, fire or wider damage.

Materials		
1	Front metal frame	Stainless (t=0.3)
2	PL frame	Polycarbonate (white)
3	Back metal frame	Aluminum (t=0.5)

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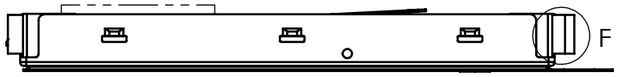
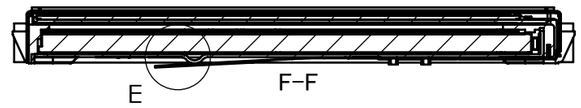
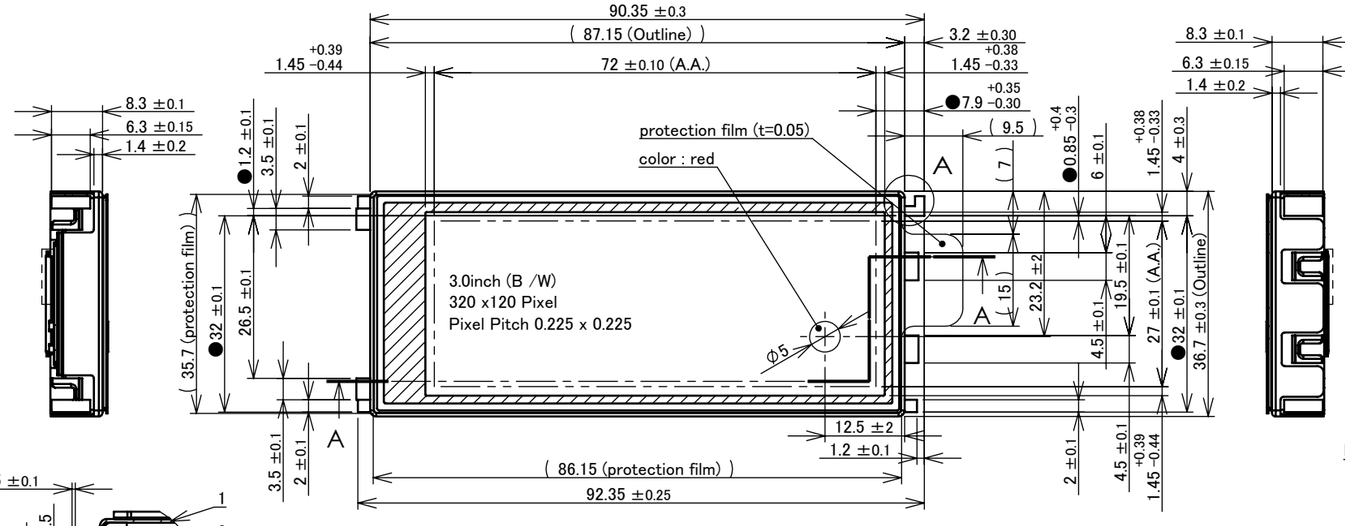
—	—	New Issue	2015/09/24	—

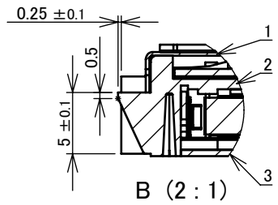






Pin No.	I/F Terminal
01	GND
02	GND
03	XRES
04	D/XC
05	XCS
06	TE
07	D7
08	D6
09	D5
10	D4
11	D3
12	D2
13	D1
14	D0(SD)
15	XWR(SCL)
16	GND
17	XRD
18	C86
19	PS
20	VCC
21	VCC
22	GND
23	N.C.
24	LED1_C
25	LED2_C
* 26	P_Down
27	N.C.
28	LED1_A
29	LED2_A
30	N.C.

*10K resistor
connect to GND for ID.



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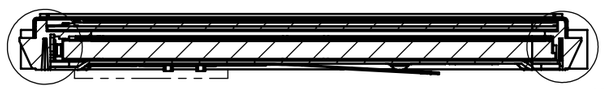
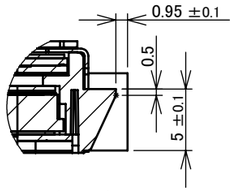


A-A



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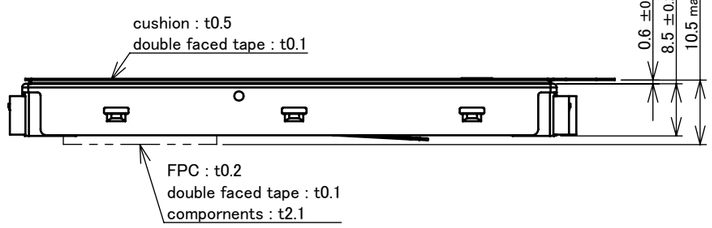

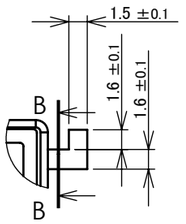

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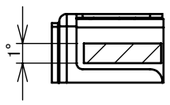
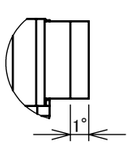


B-B



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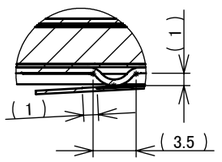

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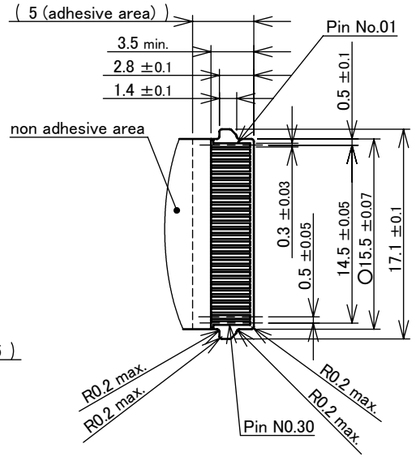
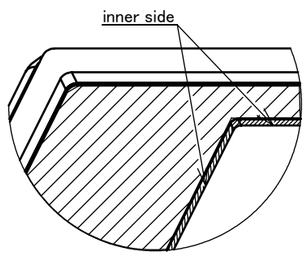
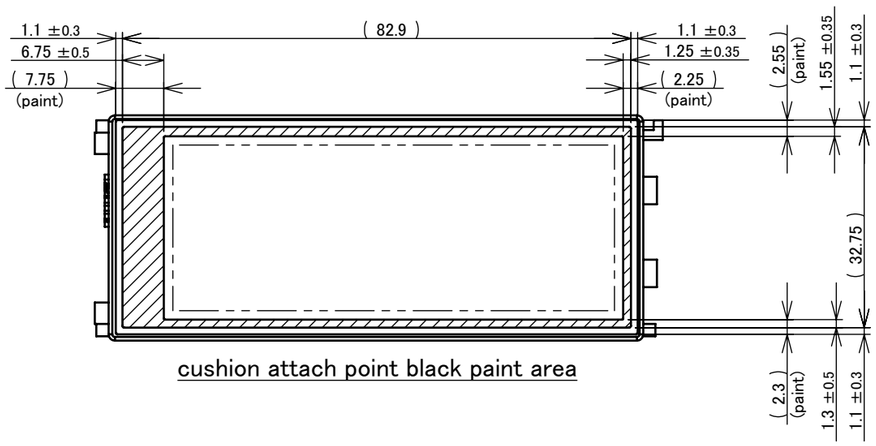


Detail of I/F FPC terminal
S = 2 : 1



Detail black paint area
S= 5 : 1



cushion attach point black paint area

3) Critical dimensions are indicated in white circle (○) Cmk≧1.67
2) Critical dimensions are indicated in black circle (●) Cpk≧1.33
Note 1) Connecter for I/F Terminal : FH28D-30S-0.5SH(05) (HIROSE)

ANGLE	TOLERANCE	MATERIAL (COLOR)
	±0.5	

株	名称	図番	尺度・単位	頁
	OUTLINE_DWG_U134D	AM-U134D-0PD	1 : 1 ・ mm	1/1

DATA MODUL

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