LCD Module RoHS

NLC240x128BTGC

(Status: April 2010)

Specification V1.0

Approval of Specification

	Approved by	Date
Admatec	Stahl	12.04.2010
Customer		

This product complies to EU directive 2002/95/EC (RoHS) of January 27th,2003.

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REVISION RECORD

Rev.	Date	Pages	Description	PM	TM
1.0	2010-04-12		First Issue	JR	CS

1. MECHANICAL DATA

NO.	ITEM	CONTENTS	UNIT
1	Product No.	NLC240x128BTGC	
2	Module Size	170.0(W)*102.0(H)*MAX 14.0(D)	mm
3	Dot Size	0.47(W)*0.47(H)	mm
4	Dot Pitch	0.5(W)*0.5(H)	mm
5	Number of Dots	240(W)*128(H)	--
6	Duty	1/128	--
7	LCD Type	FSTN Negative	--
8	Rear Polarizer	Transmissive	--
9	Viewing Direction	6 O'clock	--
10	Backlight	CFL	--
11	Controller	T6963C	--
12	DC/DC Converter	Excluded	--
13	Touch Panel	Excluded	--
14	Weight	225 (Approx.)	g

Note:

NLC240x128 B T G C

Back Light
B: CFL Backlight

Reflective/Transmissive
T: Transmissive

Mode/View Angle
G: Negative Image, 6 o'clock

Option
C: Anti-Glare

2. ABSOLUTE MAXIMUM RATINGS

2.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS

VSS=0V

ITEM	SYMBOL	MIN.	MAX.	UNIT	COMMENT
Power Supply for Logic	V_{DD}-V_{SS}	-0.3	5.5	V	---
Input Voltage	V_I	-0.3	V_{DD}	V	---
Static Electricity	---	---	---	---	Note(1)

NOTE (1): LCM should be grounded during handling LCM.

2.2 ENVIRONMENTAL MAXIMUM RATINGS

ITEM	OPERATING		STORAGE		COMMENT
	MIN.	MAX.	MIN.	MAX.	
AMBIENT TEMPERATURE	0°C	50°C	-20°C	70°C	
HUMIDITY	Note(2,4)		Note(3,4)		NO CONDENSATION

NOTE (2): Ta≤50°C: 80%RH MAX.

NOTE (3): Please refer to item of reliability test.

NOTE (4): Background color will change slightly depending on ambient temperature. That phenomenon is reversible.

3. ELECTRICAL CHARACTERISTICS

3.1 ELECTRICAL CHARACTERISTICS OF LCM

ITEM	SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Power supply for Logic	V_{DD}-G_{ND}	Ta=25°C		4.5	5.0	5.5	V
Power supply for LCD Driving	V_{DD} - V_{EE}	V_{DD}=5.0V Duty=1/128	0°C	19.8	20.1	20.4	V
			25°C	18.2	18.5	18.8	
			50°C	16.8	17.1	17.4	
Input Voltage	V_{IH}	H level		0.8V_{DD}	--	V_{DD}	V
	V_{IL}	L level		GND	--	0.2V_{DD}	
Power Supply Current	I_{DD}	V_{DD}=5.0V V_{EE}=-13.5V Ta=25°C PATTERN : ■□■□■□■□■□ □■□■□■□■□■		--	11.5	17.3	mA
	I_{EE}			--	4.0	6.0	

3.2 ELECTRICAL CHARACTERISTICS OF BACKLIGHT

Used CFL Rating T_a = 25°C

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITION
Lamp Voltage	V_L	--	385	--	V_{rms}	---
Lamp Current	I_L	4.0	5.0	6.0	mA_{rms}	---
Lamp power consumption	P_L	--	1.93	--	W	NOTE (1)
Starting voltage	V_S	--	--	570	V_{rms}	At 25°C
		--	--	660	V_{rms}	At 0°C
Lamp Life time	L_L	50,000	--	--	hrs	I_L=5.0mA_{rms} NOTE (2)

NOTE (1): Power consumption excluded inverter loss.
NOTE (2): Lamp life time is defined as follows: The final brightness is at 50% of original brightness.

Recommended Inverter: **ADL10ALF (5V)**
ADL10LLF (12V)

4. OPTICAL CHARACTERISTICS

Cr≥2 at V_{op}

ITEM		Cr(Contrast Ratio)						θ(Viewing Angle)		φ(Viewing Angle)	
		0°C		25°C		50°C		25°C		25°C	
MODE		MIN	TYP	MIN	TYP	MIN	TYP	MIN	TYP	MIN	TYP
T	G	8	10	8	10	5.6	7		F:50 R:40		F:45 R.45
NOTE		Note 3,6						Note 3,5			

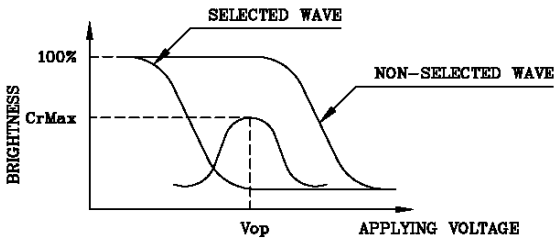
NOTE:
T: Transmissive
H: Negative Image, 06 o' clock

at φ=0°, θ =0°

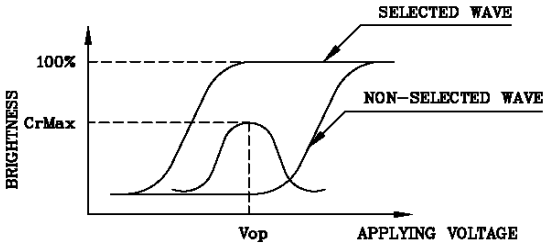
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	COMMENT
Response Time (Rise)	Tr	0°C	380	480	720	ms	Note 2
		25°C	180	230	350		
		50°C	80	100	150		
Response Time (Fall)	Tf	0°C	220	280	420	ms	Note 2
		25°C	60	80	120		
		50°C	50	60	90		
Surface Luminance of LCM	L_L	At I_{AK}=60mA	--	120	--	cd/m²	--

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



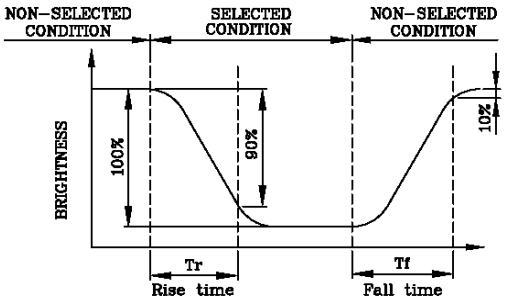
(negative type)

*Conditions

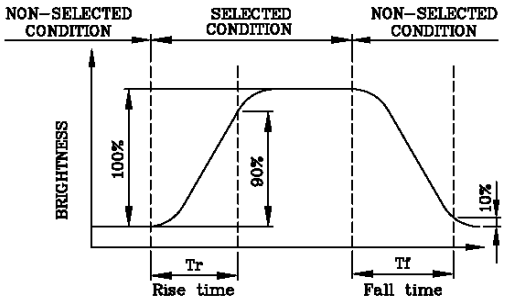
Viewing Angle : 0
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



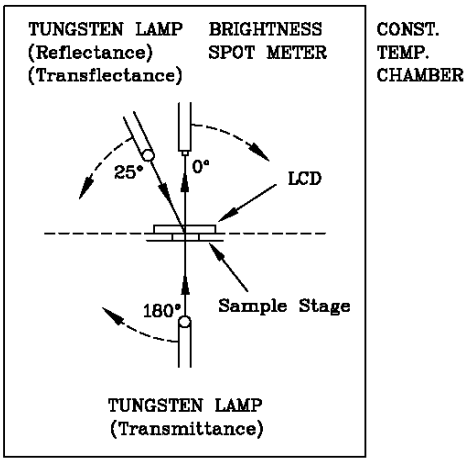
(negative type)

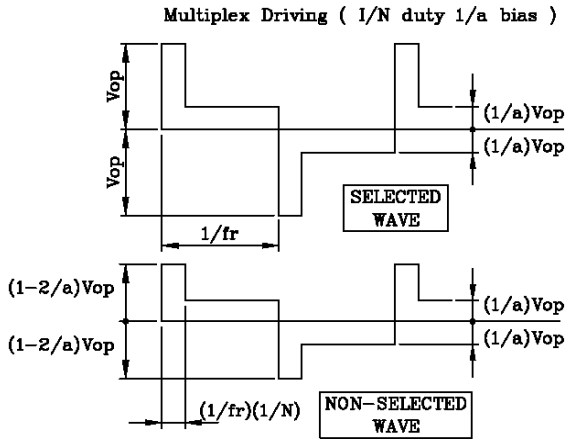
*Conditions

Operating Voltage : Vop
Viewing Angle (θ,ϕ) : (0,0)
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias

(NOTE 3)

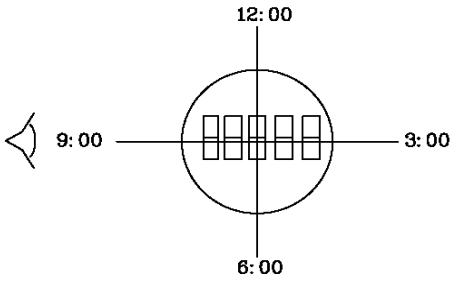
Description of Measuring Equipment and Driving Waveforms





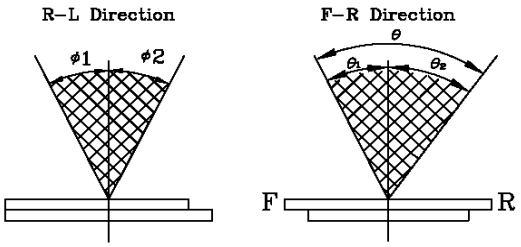
(NOTE 4)

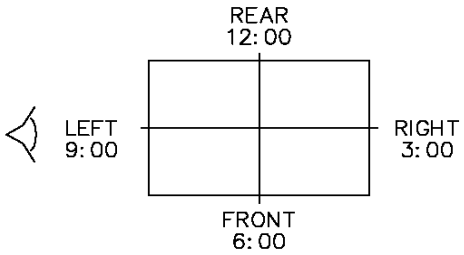
Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle





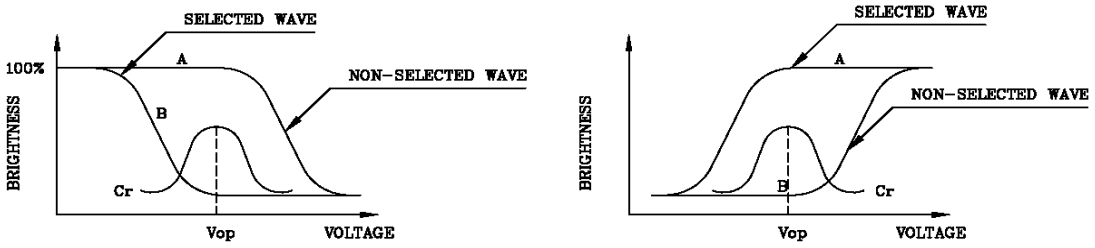
$\phi = \phi_1 + \phi_2$

*Conditions

Operating Voltage : Vop
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias
Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



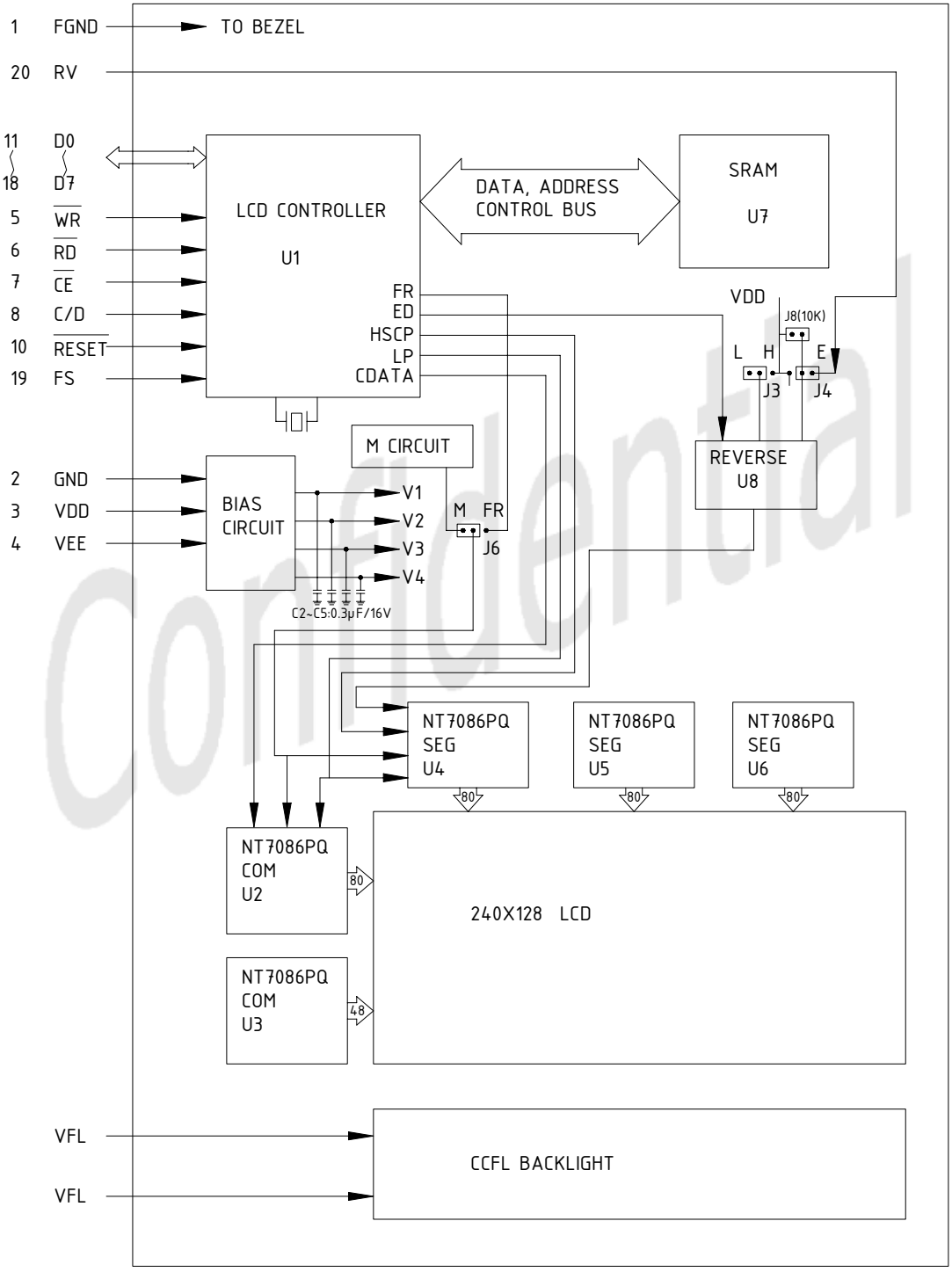
(positive type) (negative type)

Contrast Ratio : Cr=A/B

*Conditions

Viewing Angle : 0
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias

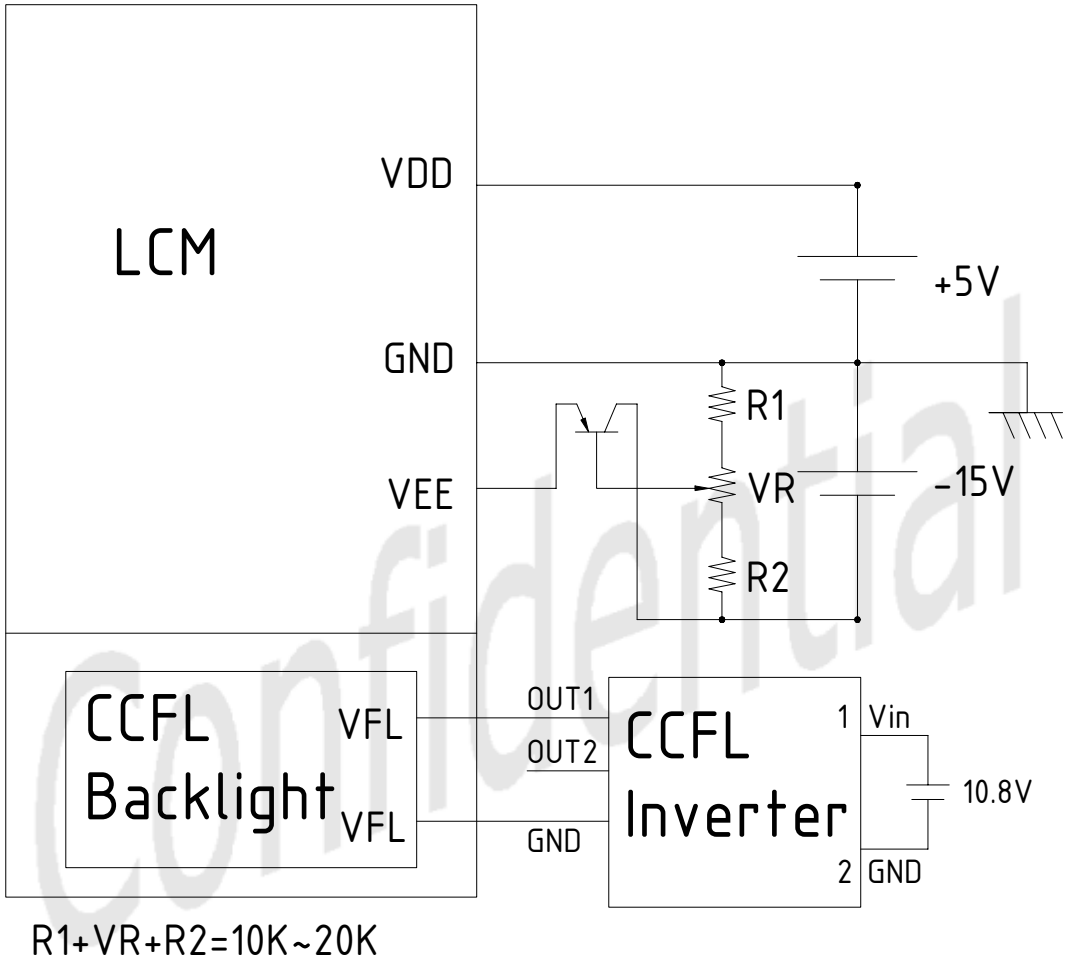
5. BLOCK DIAGRAM



6. INTERNAL PIN CONNECTION

PIN No.	SYMBOL	FUNCTION
1	FGND	Frame Ground (0V)
2	GND	Ground
3	VDD	Power supply for Logic (+5V)
4	VEE	Power supply for LC driving
5	$\overline{WR}$	Data write
6	$\overline{RD}$	Data read
7	$\overline{CE}$	Chip enable
8	C/D	$\overline{WR}$="L",C/D="H": Command Write $\overline{WR}$="L",C/D="L": Data Write $\overline{RD}$="L",C/D="H": Status Read $\overline{RD}$="L",C/D="L": Data Read
9	NC	No connection
10	$\overline{RESET}$	Controller reset
11	D0	Data input/output
12	D1	Data input/output
13	D2	Data input/output
14	D3	Data input/output
15	D4	Data input/output
16	D5	Data input/output
17	D6	Data input/output
18	D7	Data input/output
19	FS	Font select: Connect to VDD: 6x8 pixels/character Connect to GND: 8x8 pixels/character
20	RV	Display data reverse: RV=H: Reverse Display RV=L: Normal Display

7. POWER SUPPLY



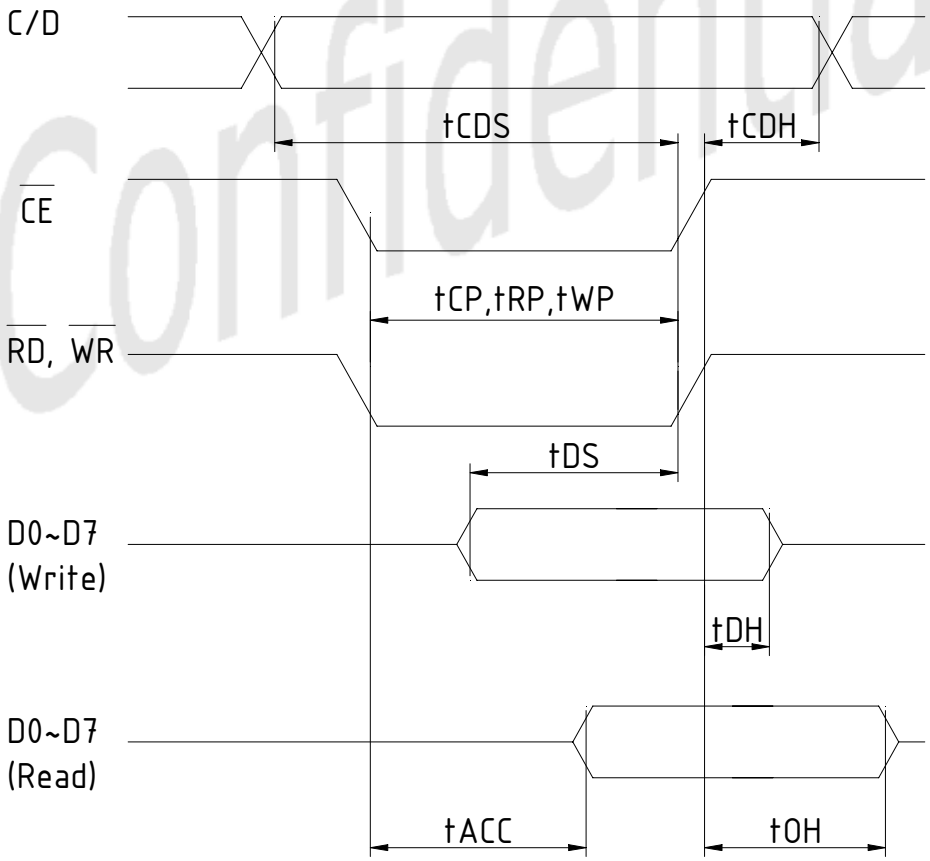
R1+VR+R2=10K~20K

8. TIMING CHARACTERISTICS

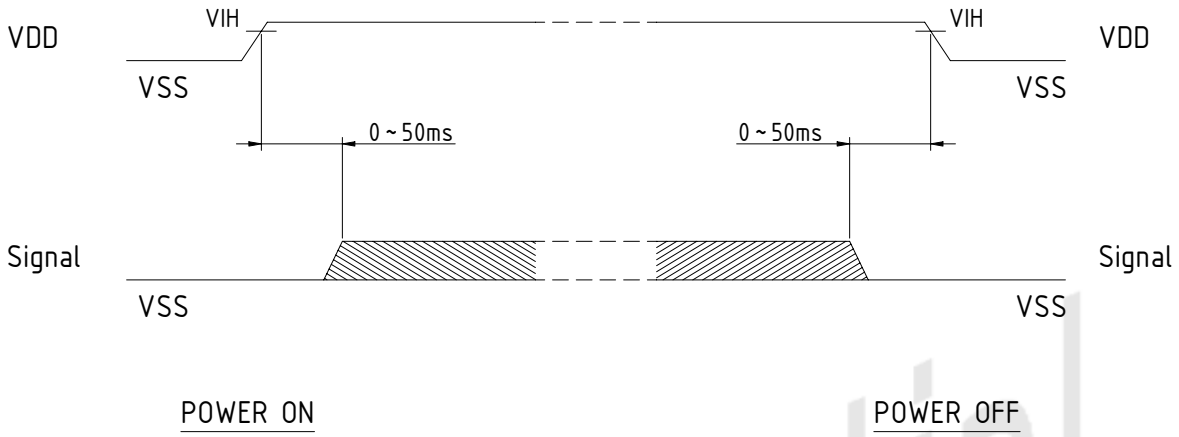
8.1 INTERFACE TIMING

At VDD=5V±10%

ITEM	SYMBOL	CONDITION	MIN.	MAX.	UNIT
C/D Set up time	t_{CDS}	Fig.	100	--	ns
C/D hold time	t_{CDH}		10	--	ns
$\overline{CE}$, $\overline{RD}$, $\overline{WR}$ Clock width	T_{CP}, t_{RP}, t_{WP}		80	--	ns
Data Set up time	t_{DS}		80	--	ns
Data hold time	t_{DH}		40	--	ns
Access time	t_{ACC}		--	150	ns
Data output time	t_{OH}		10	50	ns

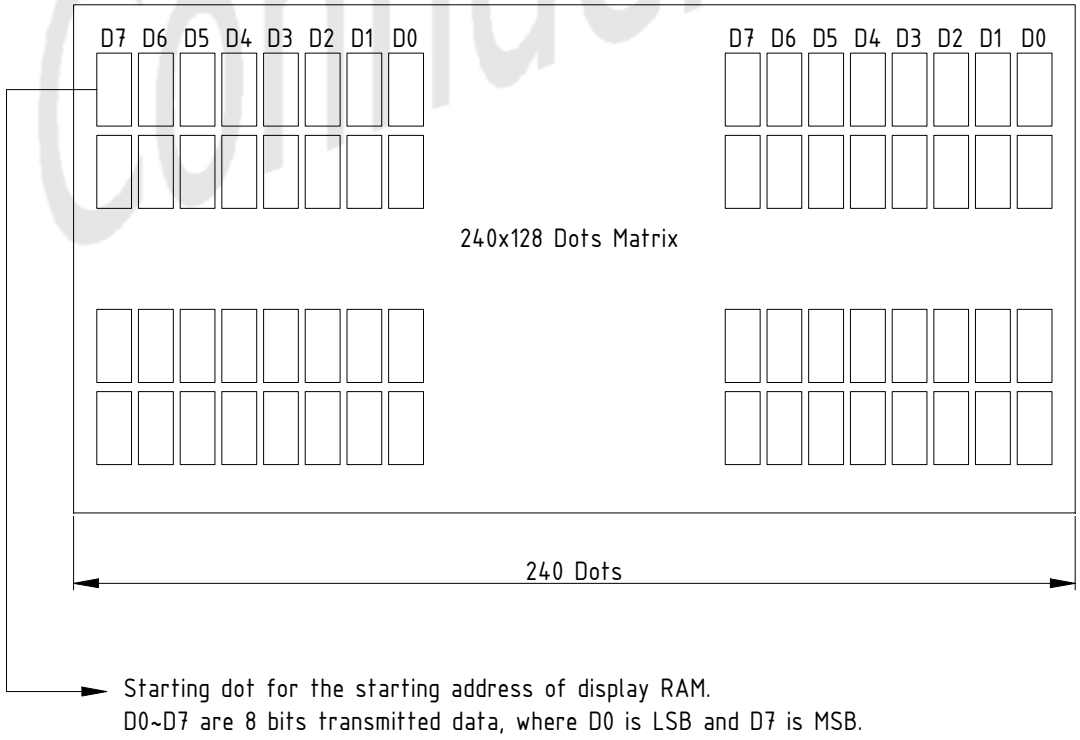


8.2 POWER ON/OFF TIMING



The missing pixels may occur when the LCM is driven beyond above power interface timing sequence

8.3 DISPLAY PATTERN



8.4 COMMAND LIST

COMMAND	CODE	D1	D2	FUNCTION
Register Set	00100001 00100010 00100100	X address Data Low address	X address OOH High address	Cursor pointer set Offset register set Address pointer set
Control Word Set	01000000 01000001 01000010 01000011	Low address Columns Low address Columns	High address OOH High address OOH	Text home address set Text area set Graphic home address set Graphic area set
Mode Set	1000X000 1000X001 1000X011 1000X100 10000XXX 10001XXX	-- -- -- -- -- --	-- -- -- -- -- --	„OR" mode „EXOR" mode „AND" mode „Text attribute" mode Internal CG ROM mode External CG ROM mode
Display Mode	10010000 1001XX10 1001XX11 100101XX 100110XX 100111XX	-- -- -- -- -- --	-- -- -- -- -- --	Display off Cursor on, blink off Cursor on, blink on Text on, graphic off Test off, graphic on Text on, graphic on
Cursor Pattern Select	10100000 10100001 10100010 10100011 10100100 10100101 10100110 10100111	-- -- -- -- -- -- -- --	-- -- -- -- -- -- -- --	1 line cursor 2 lines cursor 3 lines cursor 4 lines cursor 5 lines cursor 6 lines cursor 7 lines cursor 8 lines cursor
Data Auto Read / Write	10110000 10110001 10110010	-- -- --	-- -- --	Data auto write set Data auto read set Auto reset
Data Read Write	11000000 11000001 11000010 11000011 11000100 11000101	Data -- Data -- Data --	-- -- -- -- -- --	Data write and ADP increment Data read and ADP increment Data write and ADP decrement Data read and ADP decrement Data write and ADP non variable Data read and ADP non variable
Screen Peek	11100000	--	--	Screen peek
Screen Copy	11101000	--	--	Screen copy
Bit Set/Reset	11110XXX 11111XXX 1111X000 1111X001 1111X010 1111X011 1111X100 1111X101 1111X110 1111X111	-- -- -- -- -- -- -- -- -- --	-- -- -- -- -- -- -- -- -- --	bit reset bit set bit0(LSB) bit1 bit2 bit3 bit4 bit5 bit6 bit7(MSB)

8.5 STATUS READ

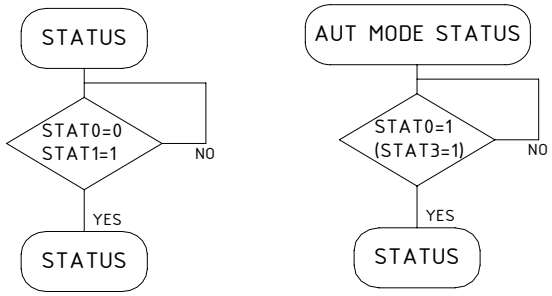
Before sending data (read/write), command it is necessary to check the status.

T6963C status word format is following:

D0 (LSB)	STA0	Check capability of command execution	0: Disable 1: Enable
D1	STA1	Check capability of data read/write	0: Disable 1: Enable
D2	STA2	Check capability of auto mode data read	0: Disable 1: Enable
D3	STA3	Check capability of auto mode data write	0: Disable 1: Enable
D4	STA4	Not use	0: Disable 1: Enable
D5	STA5	Check capability of controller operation	0: Disable 1: Enable
D6	STA6	Error flag. Using screen peek/copy command	0: Disable 1: Enable
D7 (MSB)	STA7	Check this condition blink	0: Disable 1: Enable

NOTE (1): It is necessary to check STA0 and STA1 at the same time. The error is happened by sending data at executing command.
NOTE (2): The status check will be enough to check STA0/STA1.
NOTE (3): STA2/STA3 are valid in auto mode STA0/STA1 are invalid.

Status checking flow



NOTE (4): It is impossible to save status check in the case of command of MSB0. To have the delay time cannot be save status check. The interrupt of hardware is happened at the the end of lines. If command of MSB0 is sent in this period, the command executing is waited. The state of waiting doesn't disregarded or rewrites data of waiting command.

9. RELIABILITY TEST

9.1 TEST CONDITION

No.	Item	Condition		Standard	Note
1	High temp. storage	70°C	120 hrs	Appearance without defect	
2	Low temp. storage	-20°C	120 hrs		
3	High temp. & High humi. storage	50°C 90% RH	120 hrs		
4	High temp. operating display	50°C	120 hrs		
5	Low temp. operating display	0°C	120 hrs		
7	Thermal shock	-20°C, 30min. → 70°C, 30min. (1cycle)			10 cycles

9.1 INSPECTION PROVISION

For the inspection provision please refer to the document:

„Reliability_Test_LCD“

10. DRAWING