Data International Co., Ltd.

DATAVISION

APPROVAL SHEET

Customer	**:**	
Part Name	**:**	**LCD MODULE**
Model No.	**:**	**DG-24064-2-S2FBLY-H**
Drawing No.	**:**	
Approved by	**:**	
Date	**:**	

Approved	Checked	Prepared	Sheet Code:
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CONTENTS

1. SCOPE

This specification covers the engineering requirements for the DG-24064-2-S2FBLY-H liquid crystal module.

2. PRODUCT SPECIFICATIONS

2.1 General

- 240 × 64 dot matrix LCD
- STN(Gray) , Transflective , Wide temperature type
- 6 o'clock
- Back-light: LED , Yellow-green
- Multiplexing driving : 1/64duty, 1/8bias

2.2 Mechanical Characteristics

Item	Characteristic
Dot configuration	240 × 64
Dot dimensions(mm)	0.49 × 0.49
Dot spacing (mm)	0.04
Module dimensions (Horizontal × Vertical × Thickness, mm)	180.0 × 65.0 × 16.0 max.
Viewing area (Horizontal × Vertical, mm)	132.0 × 39.0
Active area (Horizontal × Vertical, mm)	127.16 × 33.88

2.3 Absolute Maximum Ratings (Without LED back-light)

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

ITEM	SYMBOL	RATING	UNIT
Supply Voltage	V_{DD} (Note)	−0.3 to 7.0	V
Input Voltage	V_{IN} (Note)	−0.3 to V_{DD} + 0.3	V
Operating Temperature	T_{opr}	−20 to 70	°C
Storage Temperature	T_{stg}	−55 to 125	°C

(Note) Referenced to V_{SS} = 0V.

2.4 Electrical Characteristics (Without LED back-light)

ELECTRICAL CHARACTERISTICS
DC CHARACTERISTICS
TEST CONDITIONS (Unless otherwise noted, V_{SS} = 0V, V_{DD} = 5.0V ± 10%, Ta = −20 to 75°C)

ITEM		SYMBOL	TEST CIR-CUIT	TEST CONDITIONS	MIN	TYP.	MAX	UNIT	PIN NAME
Operating Voltage		V_{DD}	—	—	4.5	5.0	5.5	V	V_{DD}
Input	H Level	V_{IH}	—	—	V_{DD} − 2.2	—	V_{DD}	V	Input pins
	L Level	V_{IL}	—	—	0	—	0.8	V	Input pins
Output Voltage	H Level	V_{OH}	—	—	V_{DD} − 0.3	—	V_{DD}	V	Output pins
	L Level	V_{OL}	—	—	0	—	0.3	V	Output pins
Output Resistance	H Level	R_{OH}	—	V_{OUT} = V_{DD} − 0.5V	—	—	400	Ω	Output pins
	L Level	R_{OL}	—	V_{OUT} = 0.5V	—	—	400	Ω	Output pins
Input Pull-up Resistance		RPU	—	—	50	100	200	kΩ	(Note 1)
Operating Frequency		f_{OSC}	—	—	0.4	—	5.5	MHz	
Current Consumption (Operating)		I_{DD} (1)	—	V_{DD} = 5.0V (Note 2) f_{OSC} = 3.0MHz	—	3.3	6	mA	V_{DD}
Current Consumption (Halt)		I_{DD} (2)	—	V_{DD} = 5.0V	—	—	3	μA	V_{DD}

(Note 1) Applied $\overline{T1}$, $\overline{T2}$, $\overline{RESET}$
(Note 2) MDS = L, MD0 = L, MD1 = L, MD2 = H, MD3 = H, FS0 = L, FS1 = L, $\overline{SDSEL}$ = L, $\overline{DUAL}$ = H, D7 to D0 = LHLHLHLH

2.5 Optical Characteristics Absolute maximum ratings

Item	Symbol	Rating	Unit
Applied voltage AC	VAC	16	V
Operating temperature range	Top	-20~70	°C
Storage temperature range	Tst	-30~80	°C

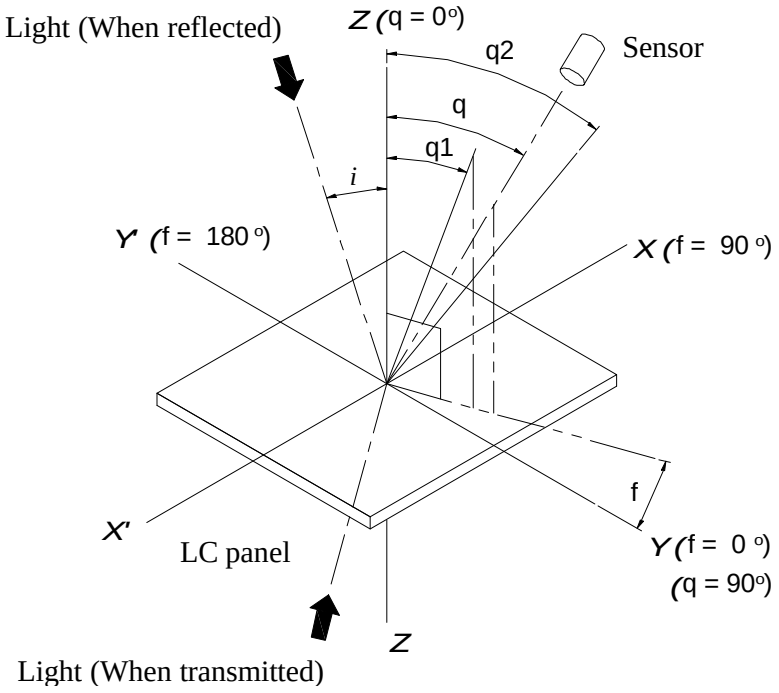
2.6 Optical Characteristics

1/64 duty, 1/8 bias, Vopr=12.4V

Item	Symbol	Temp.	Min.	Typ.	Max.	Unit
Driving voltage	Vop	-20°C	--	14.0	--	V
		25°C	--	12.4	--	
		70°C	--	10.7	--	
Contrast	K	25°C	--	3.0	--	--
Frame freq.	fF	--	--	64	--	Hz
Viewing angle*	θ_1	25°C CR≥1.5	--	30	--	deg.
	θ_2		--	25	--	
Response time	t_{on}	25°C	--	130	--	ms
	t_{off}		--	220	--	

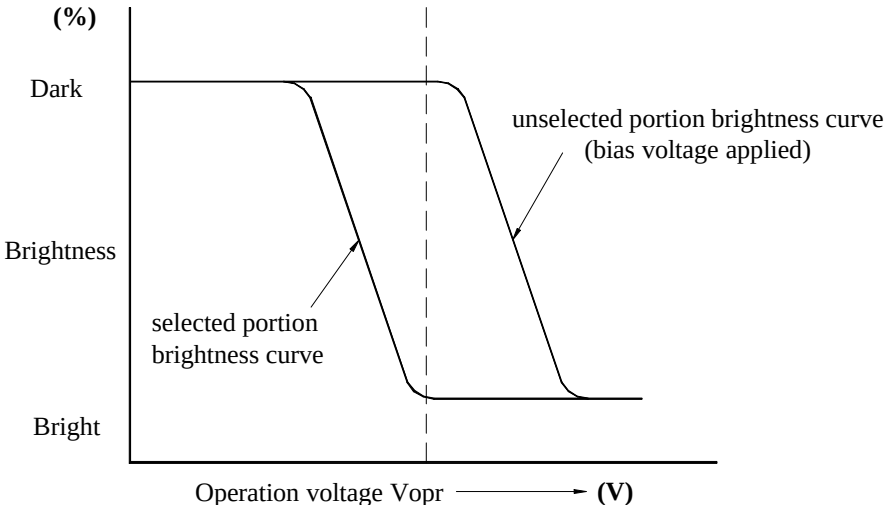
2.6.1 Definition of optical characteristics

* Definition of angles ϕ and θ

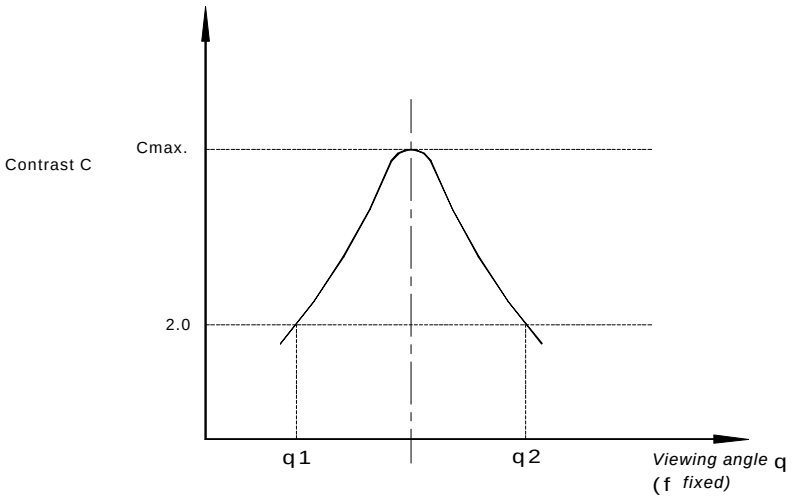


*Definition of contrast C

$$C = \frac{B1}{B2} = \frac{\text{Brightness of selected portion}}{\text{Brightness of unselected portion}}$$

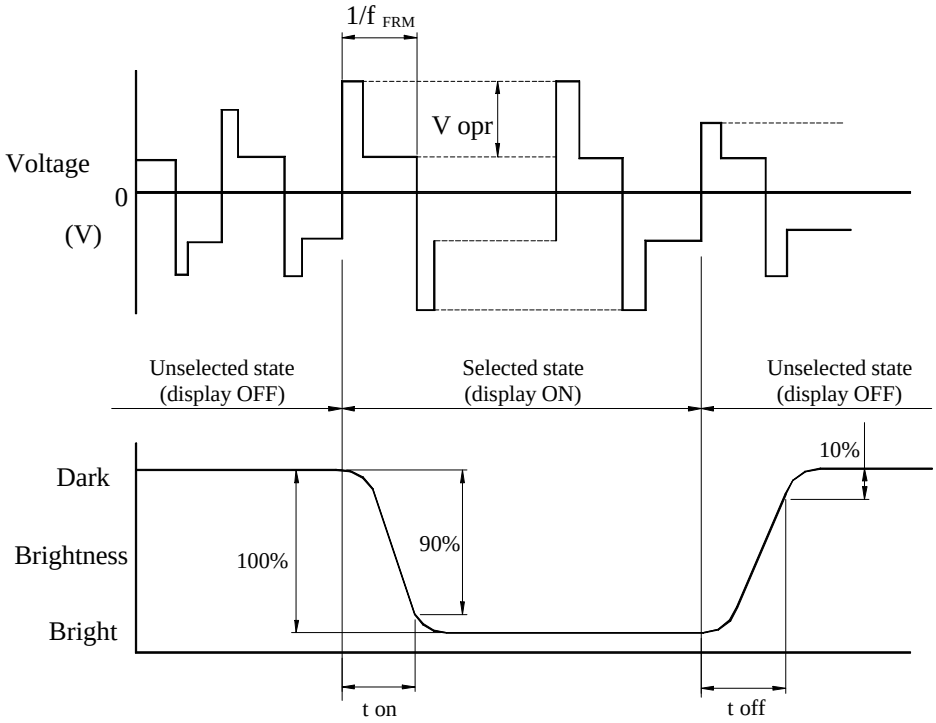


* Definition of viewing angles θ1 and θ2



Note : Optimum vision with the naked eye and viewing angle θ at Cmax above are not always the same.

* Definition of response time



Vop : Operating voltage (V)
fFRM : Frame frequency (Hz)
ton : Response time (rise) (ms)
toff : Response time (fall) (ms)

2.7 LED Back-light Characteristics

2.7.1 Absolute maximum ratings

Ta = 25°C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward voltage	V_f	If=660mA, Yellow Green	3.9	4.1	4.3	V
*****Luminous Intensity	I_V	If=220A, Yellow Green	120	160	--	cd/m^2
Peak Emission Wavelength	λP	If=20mA, Yellow Green	--	570	--	nm
Spectrum Radiation Bandwidth	Δλ	If=20mA, Yellow Green	--	30	--	nm
Reverse Current	I_R	VR=8V, Yellow Green	--	--	6.6	mA

Note: * Measured at the bare LED backlight unit.

2.7.2 LED Maximum Operating Range

Item	Symbol	Yellow Green	Unit
Power Dissipation	P_{AD}	5.68	W
Forward Current	I_F	1.32	A
Reverse Voltage	V_R	8	V

3. RELIABILITY

3.1 Reliability

Test item	Test condition	Evaluation and assessment
Operation at high temperature and humidity	40 °C±2 °C 90%RH for 500hours	No abnormalities in functions* and appearance**
Operation at high temperature	60 °C±2 °C for 500 hours	No abnormalities in functions* and appearance**
Heat shock	-20± ~ +60 °C Left for 1 hour at each temperature, transition time 5 min, repeated 10times	No abnormalities in functions* and appearance**
Low temperature	-20±2 °C for 500 hours	No abnormalities in functions* and appearance**
Vibration	Sweep for 1 min at 10 Hz, 55Hz, 10Hz, amplitude 1.5mm 2 hrs each in the X,Y and Z directions	No abnormalities in functions* and appearance**
Drop shock	Dropped onto a board from a height of 10cm	No abnormalities in functions* and appearance**

* Dissipation current, contrast and display functions

** Polarizing filter deterioration, other appearance defects

3.2 Liquid crystal panel service life

100,000 hours minimum at 25 °C±10 °C

3.3 Definition of panel service life

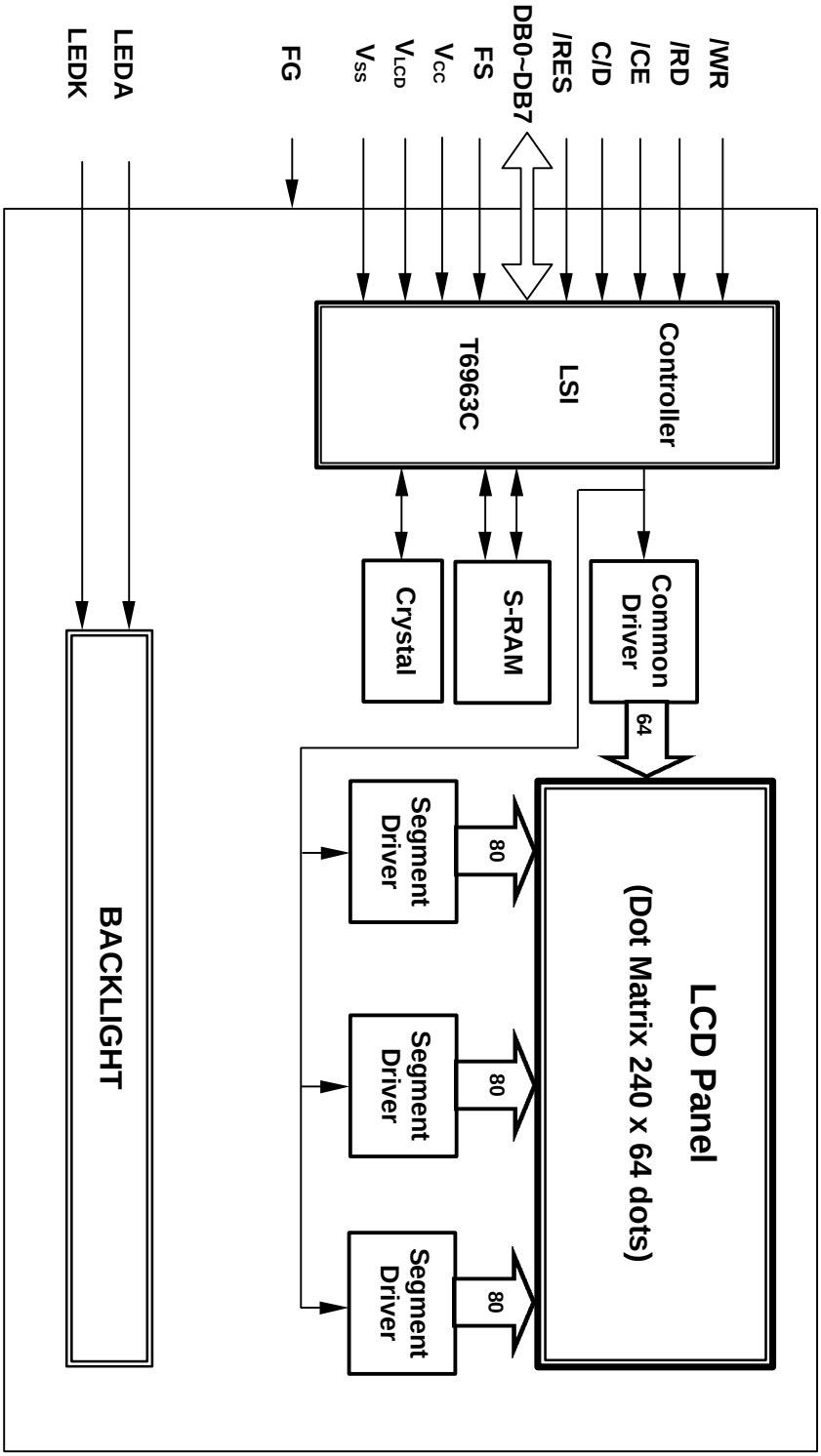
- Contrast becomes 30% of initial value
- Current consumption becomes three times higher than initial value
- Remarkable alignment deterioration occurs in LCD cell layer
- Unusual operation occurs in display functions

4. OPERATING INSTRUCTIONS

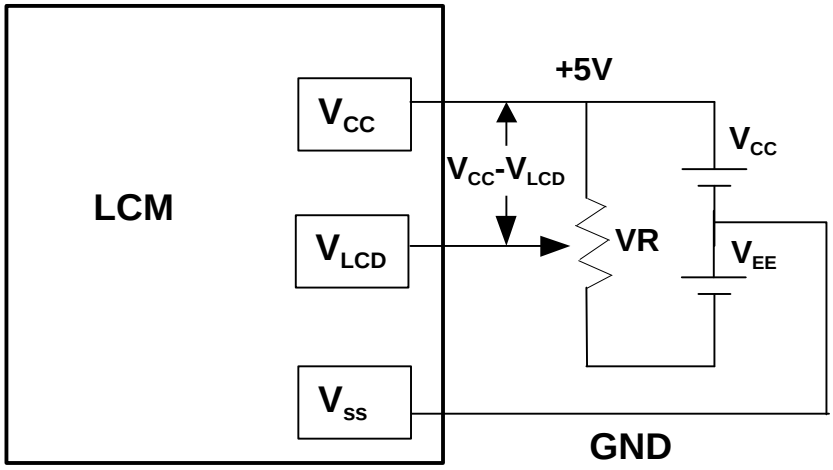
4.1 Input signal Function

NO.	Symbol	Function
1	FG	Frame ground
2	VSS	Ground (0V)
3	VCC	Power supply for Logic circuit (+)
4	VLCD	Power supply for LCD
5	/WR	Write Data
6	/RD	Read Data
7	/CE	Chip Enable
8	C/D	Code/Data
9	NC	No connection
10	/RES	Reset Active “L”
11-18	DB0-DB7	Data Bus Line
19	FS	Font select
20	NC	No connection

4.2 Circuit Block Diagram



4.3 Voltage Generator Circuit

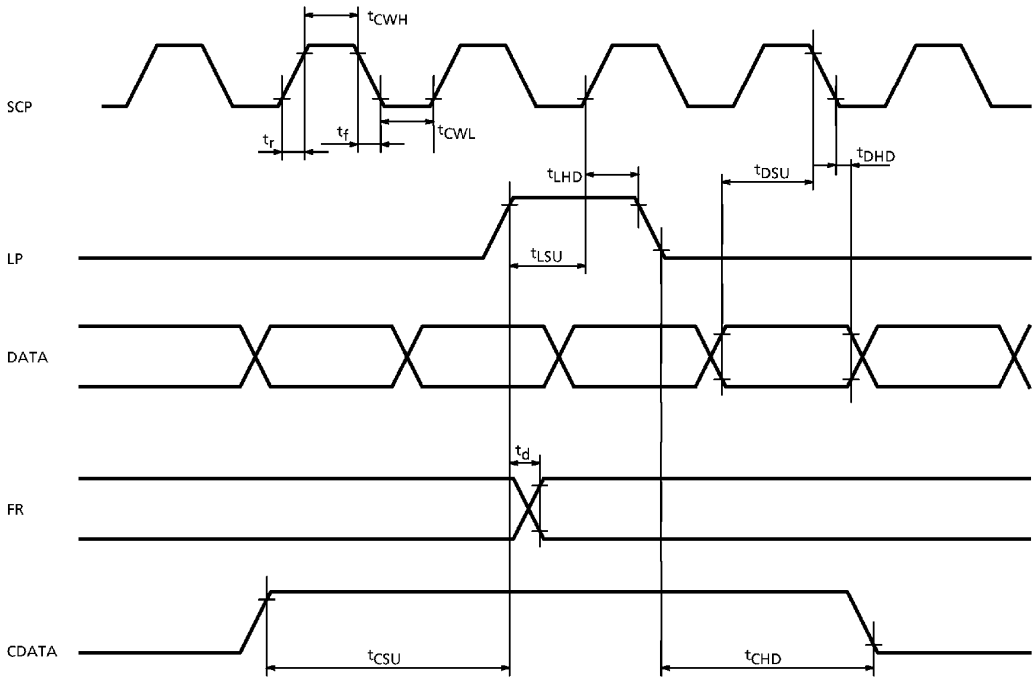


V_{CC} – V_{LCD} : LCD Driving Voltage
VR : 10K~20K

4.4 Timing Characteristics

AC CHARACTERISTICS

- Switching Characteristics (1)

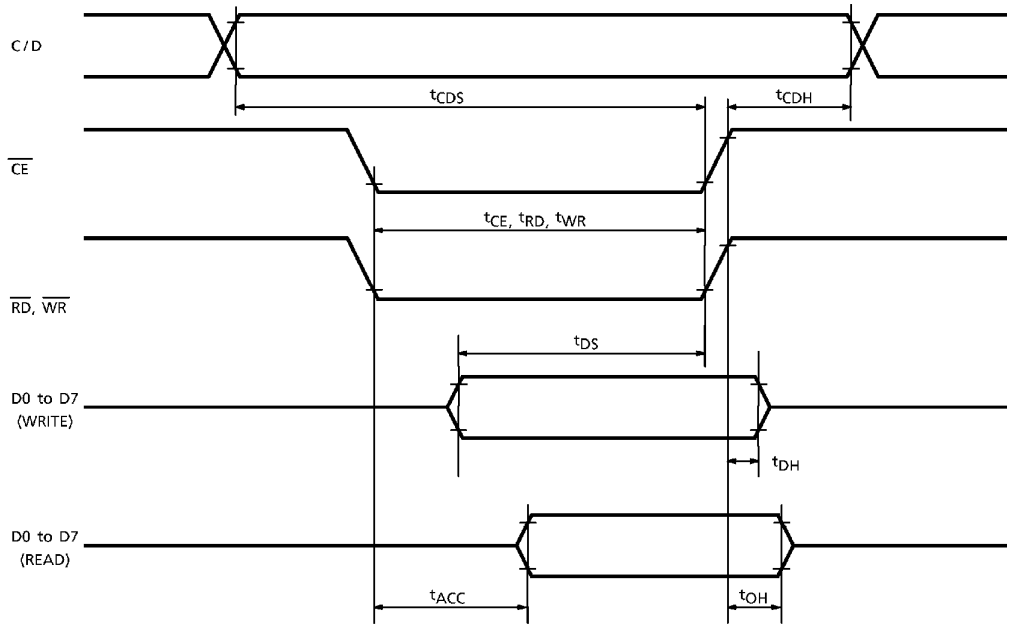


TEST CONDITIONS (Unless otherwise noted, V_{DD} = 5.0V ± 10%, V_{SS} = 0V, Ta = −20 to 70°C)

ITEM	SYMBOL	TEST CONDITIONS	MIN	MAX	UNIT
Operating Frequency	f_{scp}	Ta = −10~70°C	—	2.75	MHz
SCP Pulse Width	t_{CWH}, t_{CWL}	—	150	—	ns
SCP Rise / Fall Time	t_r, t_f	—	—	30	ns
LP Set-up Time	t_{LSU}	—	150	290	ns
LP Hold Time	t_{LHD}	—	5	40	ns
Data Set-up Time	t_{DSU}	—	170	—	ns
Data Hold Time	t_{DHD}	—	80	—	ns
FR Delay Time	t_d	—	0	90	ns
CDATA Set-up Time	t_{CSU}	—	450	850	ns
CDATA Hold Time	t_{CHD}	—	450	950	ns

- Switching Characteristics (2)

  Bus Timing

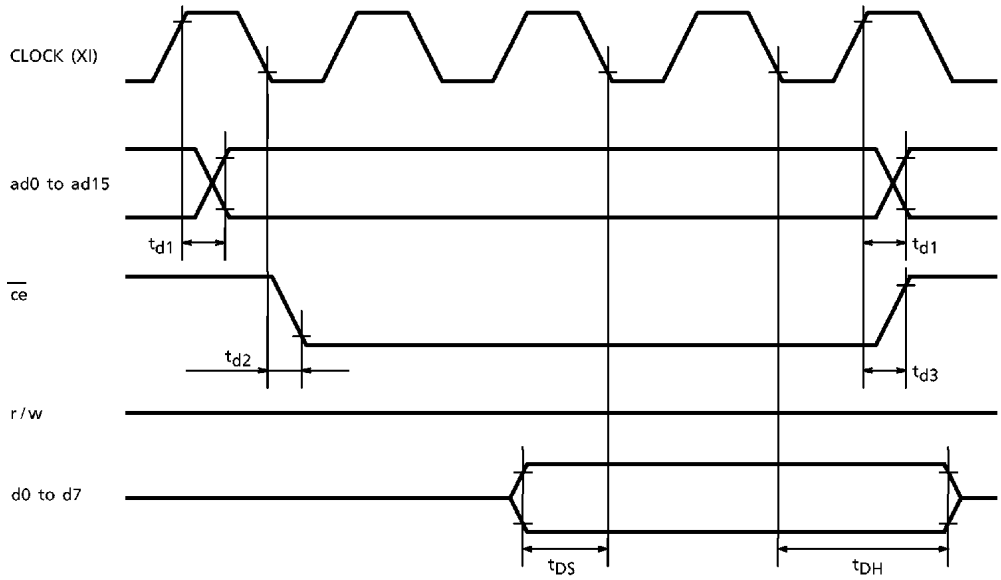


TEST CONDITIONS (Unless otherwise noted, V_{DD} = 5.0V ± 10%, V_{SS} = 0V, Ta = −20 to 75°C)

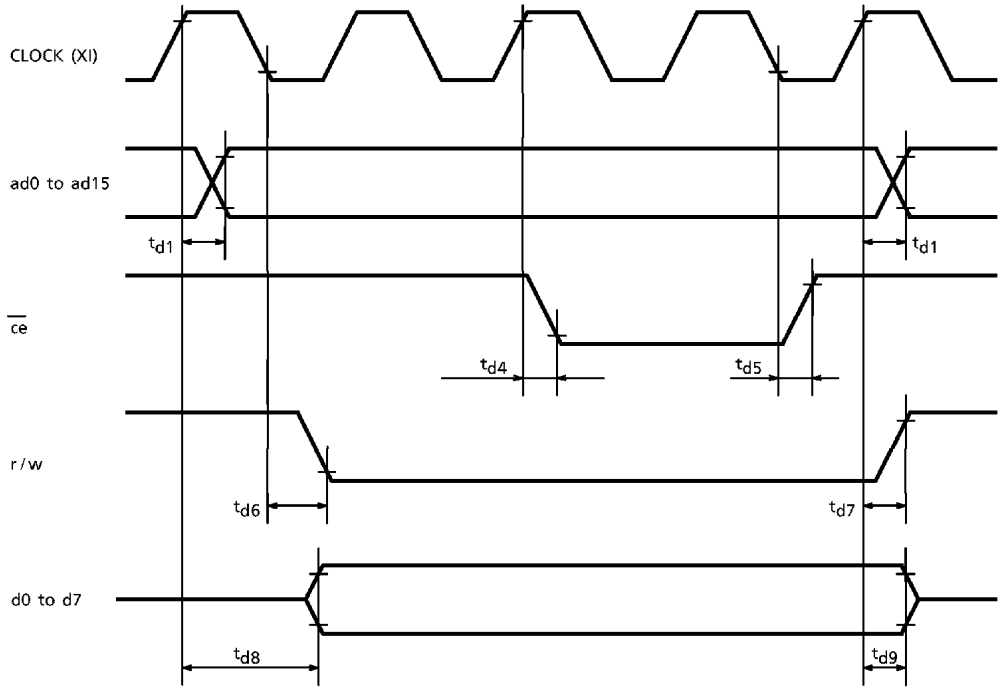
ITEM	SYMBOL	TEST CONDITIONS	MIN	MAX	UNIT
C/D Set-up Time	t_{CDS}	—	100	—	ns
C/D Hold Time	t_{CDH}	—	10	—	ns
$\overline{CE}$, $\overline{RD}$, $\overline{WR}$ Pulse Width	t_{CE}, t_{RD}, t_{WR}	—	80	—	ns
Data Set-up Time	t_{DS}	—	80	—	ns
Data Hold Time	t_{DH}	—	40	—	ns
Access Time	t_{ACC}	—	—	150	ns
Output Hold Time	t_{OH}	—	10	50	ns

- Switching Characteristics (3)

(1) External RAM Read mode



(2) External RAM Write mode



TEST CONDITIONS (Unless otherwise noted, V_{DD} = 5.0V ± 10%, V_{SS} = 0V, Ta = – 20 to 70°C)

ITEM	SYMBOL	TEST CONDITIONS	MIN	MAX	UNIT
Address Delay Time	t_{d1}	—	—	250	ns
ce Fall Delay Time (Read)	t_{d2}	—	—	180	ns
ce Rise Delay Time (Read)	t_{d3}	—	—	180	ns
Data Set-up Time	t_{DS}	—	0	—	ns
Data Hold Time	t_{DH}	—	30	—	ns
ce Fall Delay Time (Write)	t_{d4}	—	—	200	ns
ce Rise Delay Time (Write)	t_{d5}	—	—	200	ns
r/w Fall Delay Time	t_{d6}	—	—	180	ns
r/w Rise Delay Time	t_{d7}	—	—	180	ns
Data Stable Time	t_{d8}	—	—	450	ns
Data Hold Time	t_{d9}	—	—	200	ns

4.5 Character Code Map

CHARACTER CODE MAP
ROM code 0101

LSB / MSB	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0																
1																
2																
3																
4																
5																
6																
7																

4.6 Command Definitions

COMMAND DEFINITIONS

COMMAND	CODE	D1	D2	FUNCTION
REGISTERS SETTING	00100001	X address	Y address	Set Cursor Pointer
	00100010	Data	00H	Set Offset Register
	00100100	Low address	High address	Set Address Pointer
SET CONTROL WORD	01000000	Low address	High address	Set Text Home Address
	01000001	Columns	00H	Set Text Area
	01000010	Low address	High address	Set Graphic Home Address
	01000011	Columns	00H	Set Graphic Area
MODE SET	1000X000	—	—	OR mode
	1000X001	—	—	EXOR mode
	1000X011	—	—	AND mode
	1000X100	—	—	Text Attribute mode
	10000XXX	—	—	Internal CG ROM mode
	10001XXX	—	—	External CG RAM mode
DISPLAY MODE	10010000	—	—	Display off
	1001XX10	—	—	Cursor on, blink off
	1001XX11	—	—	Cursor on, blink on
	100101XX	—	—	Text on, graphic off
	100110XX	—	—	Text off, graphic on
	100111XX	—	—	Text on, graphic on
CURSOR PATTERN SELECT	10100000	—	—	1-line cursor
	10100001	—	—	2-line cursor
	10100010	—	—	3-line cursor
	10100011	—	—	4-line cursor
	10100100	—	—	5-line cursor
	10100101	—	—	6-line cursor
	10100110	—	—	7-line cursor
	10100111	—	—	8-line cursor
DATA AUTO READ / WRITE	10110000	—	—	Set Data Auto Write
	10110001	—	—	Set Data Auto Read
	10110010	—	—	Auto Reset
DATA READ / WRITE	11000000	Data	—	Data Write and Increment ADP
	11000001	—	—	Data Read and Increment ADP
	11000010	Data	—	Data Write and Decrement ADP
	11000011	—	—	Data Read and Decrement ADP
	11000100	Data	—	Data Write and Nonvariable ADP
	11000101	—	—	Data Read and Nonvariable ADP
SCREEN PEEK	11100000	—	—	Screen Peek
SCREEN COPY	11101000			Screen Copy

X : invalid

COMMAND	CODE	D1	D2	FUNCTION
BIT SET / RESET	11110XXX	—	—	Bit Reset
	11111XXX	—	—	Bit Set
	1111X000	—	—	Bit 0 (LSB)
	1111X001	—	—	Bit 1
	1111X010	—	—	Bit 2
	1111X011	—	—	Bit 3
	1111X100	—	—	Bit 4
	1111X101	—	—	Bit 5
	1111X110	—	—	Bit 6
	1111X111	—	—	Bit 7 (MSB)

X : invalid

5. NOTES

Safety

- If the LCD panel breaks, be careful not to get the liquid crystal in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and plenty of water.

Handling

- Avoid static electricity as this can damage the CMOS LSI.
- The LCD panel is plate glass; do not hit or crush it.
- Do not remove the panel or frame from the module.
- The polarizing plate of the display is very fragile; handle it very carefully

Mounting and Design

- Mount the module by using the specified mounting part and holes.
- To protect the module from external pressure, leave a small gap by placing transparent plates (e.g. acrylic or glass) on the display surface, frame, and polarizing plate
- Design the system so that no input signal is given unless the power-supply voltage is applied.
- Keep the module dry. Avoid condensation, otherwise the transparent electrodes may break.

Storage

- Store the module in a dark place where the temperature is 25°C±10°C and the humidity below 65% RH.
- Do not store the module near organic solvents or corrosive gases.
- Do not crush, shake, or jolt the module (including accessories).

Cleaning

- Do not wipe the polarizing plate with a dry cloth, as it may scratch the surface.
- Wipe the module gently with soft cloth soaked with a petroleum benzine.
- Do not use ketonic solvents (ketone and acetoe) or aromatic solvents (toluene and xylene), as they may damage the polarizing plate.

6. OPERATION PRECAUTIONS

Any changes that need to be made in this specification or any problems arising from it will be dealt with quickly by discussion between both companies.

7. LCM Dimension