

XIAMEN OCULAR OPTICS CO.,LTD

**SPECIFICATIONS OF
LCD MODULE**

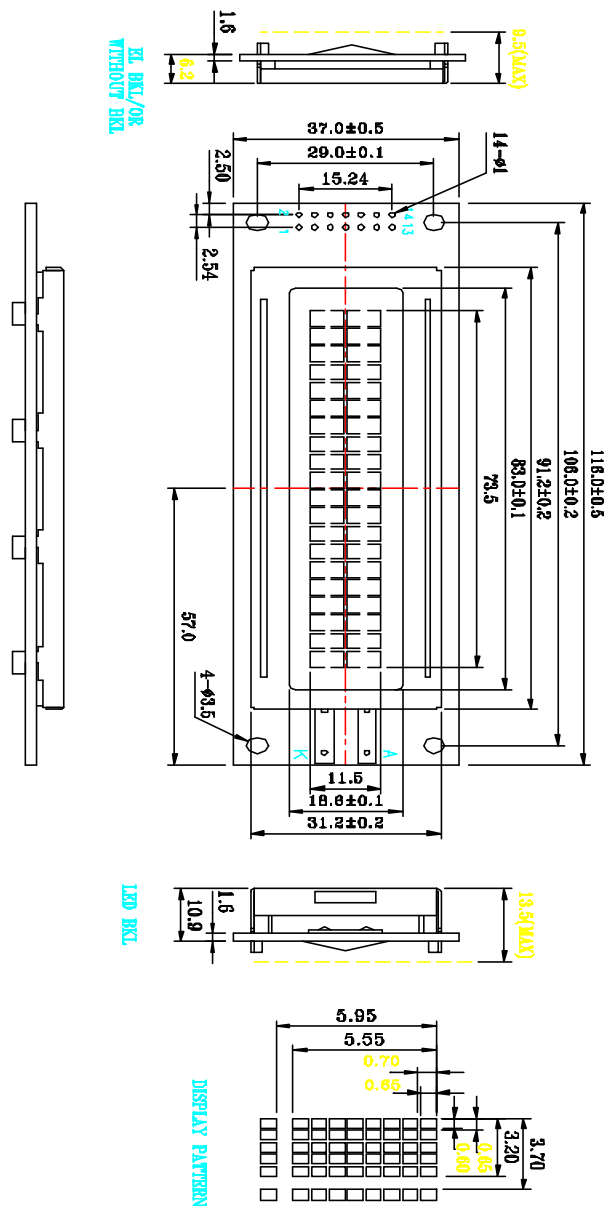
**PART NUMBER
DATE**

**GDM2002D SERIES
APRIL 20, 1999**

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Mechanical Diagram



PERFORMANCE FEATURES	
LC FLUID: TN, STN	
POLARIZER: REFLECTIVE, TRANSPARENT	
TRANSMISSIVE	
COLOR: GRAY, YELLOW, BLUE	
BACKLIGHT: LED, YELLOW-GREEN	
TEMPERATURE RANGE: STANDARD, WIDE	
CONTROLLER: KS0066	

PIN	SIGNAL/PIN	SIGNAL
1	VSS	9 DB2
2	VDD	10 DB3
3	V0	11 DB4
4	RS	12 DB5
5	R/W	13 DB6
6	R	14 DB7
7	DB0	A
8	DB1	K
		LED+
		LED-

Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit
Power Voltage	V _{DD} -V _{SS}	0	7.0	V
Input Voltage	V _{in}	V _{SS}	V _{DD}	
Operating Temperature Range	T _{OP}	0	+50	°C
Storage Temperature Range	T _{ST}	-20	+60	

*Wide Temperature range is available

(operating/storage temperature as wide as -20.+70/-30.+80.).

Description Of Terminals

Pin No.	Pin Name	Input/Output	External Connection	Function
1	VSS	—	Power Supply	VSS: GND
2	VDD	—		VDD: +5V
3	VO	—		V _{LCD} adjustment
4	RS	INPUT	MPU	Register select signal “0”:Instruction register (when writing) Busy flag & address counter (When reading) “1”:Data register (when writing & reading)
5	R/W	Input	MPU	Read/write select signal “0” for writing , “1” for reading
6	E	Input	MPU	Operation (data read/write) enable signal
7 / 10	DB0-DB3	Input	MPU	Low-order lines of data bus with 3-state, bi-directional function for use in data transaction with the MPU. These lines are not used when interfacing with a 4-bit microprocessor.
11 / 14	DB4-DB7	Input	MPU	High-order lines of data bus with 3-state, bi-directional function for use in data transactions with the MPU. DB7 may also be used to check the busy flag.
15 / 16	LED ..+.. LED ..-..	Input	LED BACKLIGHT POWER SUPPLY	LED..+..:VOLTAGE TYPE:4.2V MAX : 4.5V LED..-..: GND

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Optical Characteristics

for TN Type Display Module ($T_a=25.$, $V_{DD}=5.0V\pm0.25V$)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing angle	.	$C_r.4$	-25	.	—	deg
	.		-30	.	30	
Contrast ratio	C_r	.	.	2	.	.
Response time(rise)	T_r	.	.	120	150	ms
Response time(fall)	T_r	.	.	120	150	ms

for STN Type Display Module ($T_a=25.$, $V_{DD}=5.0V\pm0.25V$)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing angle	.	$C_r.2$	-60	.	35	deg
	.		-40	.	40	
Contrast ratio	C_r	.	.	6	.	.
Response time(rise)	T_r	.	.	150	250	ms
Response time(fall)	T_r	.	.	150	250	ms

Electrical Characteristics

DC Characteristics

Parameter	Symbol	Conditions	Min.	Type	Max.	Unit
Supply voltage for LCD	V_{DD}, V_O	$T_A=25.$	—	4.6	—	V
Input voltage	V_{DD}		4.7	—	5.5	V
Supply current	I_{DD}	$V_{DD}=5.0V; T_A=25.$	—	1.5	2.5	mA
Input leakage current	I_{LKG}		—	—	1.0	μA
“H” level input voltage	V_{IH}		2.2	—	V_{DD}	V
“L” level input voltage	V_{IL}	Twice initial value or less	0	—	0.6	V
“H” level output voltage	V_{OH}	LOH= -0.25MA	2.4	—	—	V
“L” level output voltage	V_{OL}	LOL=1.6MA	—	—	0.4	V
Backlight supply voltage	V_F		—	4.2	4.5	V

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AC Characteristics

Read Cycle ($V_{DD}=5.0V+10\%$, $V_{SS}=0V$, $T_a=25.$)

Parameter	Symbol	Test pin	Min.	Type	Max.	Unit
Enable cycle time	t_c	E	500	.	.	ns
Enable pulse width	t_w	E	300	.	.	
Enable rise/fall time	t_r, t_f	E	.	.	25	
RS,R/W setup time	t_{su}	RS; R/W	100	.	.	
RS,R/W address hold time	t_h	RS; R/W	10	.	.	
Read data output delay	t_D	DB0-DB7	60	.	190	
Read data hold time	t_{DH}	DB0-DB7	20	.	.	

Write Cycle

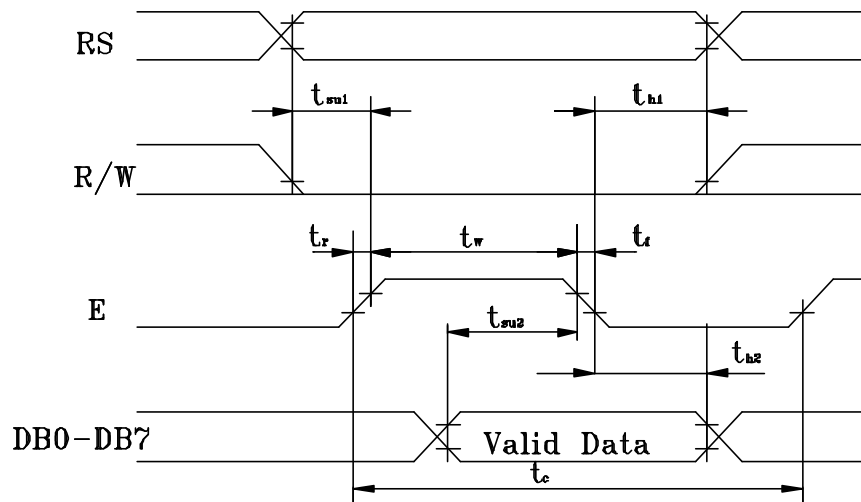
Parameter	Symbol	Test pin	Min.	Type	Max.	Unit
Enable cycle time	t_c	E	500	.	.	ns
Enable pulse width	t_w	E	300	.	.	
Enable rise/fall time	t_r, t_f	E	.	.	25	
RS,R/W setup time	t_{su1}	RS; R/W	100	.	.	
RS,R/W address hold time	t_{h1}	RS; R/W	10	.	.	
Data setup time	t_{su2}	DB0-DB7	60	.	.	
Data hold time	t_{h2}	DB0-DB7	10	.	.	

Timing Characteristics

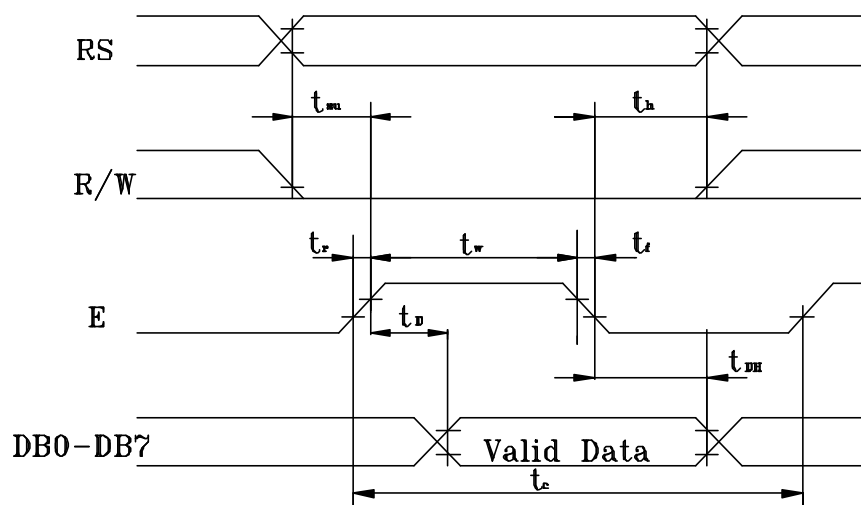
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Write Timing



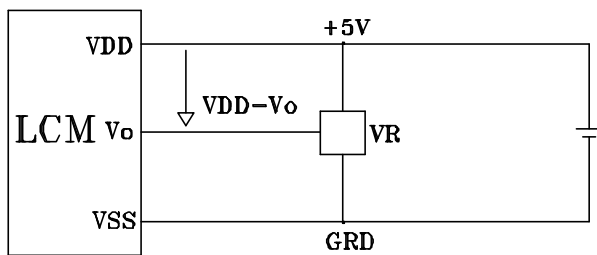
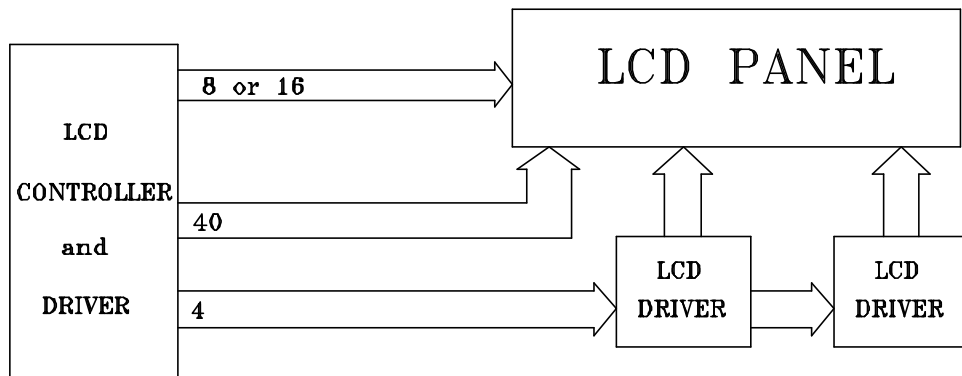
Read Timing



Block Diagram

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VDD-V_o: LCD DRIVING VOLTAGE

VR: 10K-20K.

Display command

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Parameter	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Note	Executing time fosc=250k hz	
Clear Display	0	0	0	0	0	0	0	0	0	1		1.64ms	
Cursor home	0	0	0	0	0	0	0	0	1	*		1.64ms	
Entry Mode Set	0	0	0	0	0	0	0	1	1/D	S	DB1=1:Increment DB1=0:Decrement DB0=1:The display is shifted DB0=0:The display is not shifted	40.s	
Display on/off	0	0	0	0	0	0	1	D	C	B	DB2=1:Display on DB2=0: Display off DB1=1:Cursor on DB1=0: Cursor off DB0=1:Brinking on DB0=0:Brinking off	40.s	
Cursor / Display Shift	0	0	0	0	0	1	S/C	R/L	*	*	DB3=1:Shifts display one character DB2=1:Right shift DB2=0:Left shift	40.s	
System Set	0	0	0	0	1	DL	N	F	*	*	DB4=1:8 bits DB4=0:4 bits DB3=1:2 lines display (1/16 duty) DB3=0:1 line display DB2=1:5.10 dots , 1/11 duty DB2=1:5.7 dots , 1/8 duty	40.s	
Set CG RAM Address	0	0	0	1	CG RAM address corresponds to cursor address						The address length that can be set is 64 address		40.s
Set DD RAM Address	0	0	1	DD RAM address							The address length that can be set is 80 address		40.s
Read Busy Flag/Address Counter	0	1	BF	Address counter used for both DD&CG RAM address							DB7=1:Busy (instruction not accepted) DB7=0:Ready(for instruction)		40.s
Write Data	1	0	Write data										46.s
Read Data	1	1	Read data										46.s

DD RAM Address:

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Address for line 1	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13
Address for line 2	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	50	51	52	53

Reliability and Life Time

1. Reliability Test

		Evaluations and Assessment*
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Storage Condition	Content	Current consumption	Oozing	Contrast	Other appearances
Operation at high temperature and humidity	40.,90% RH,240hrs	Twice initial value or less	none	More than 80% of initial value	No abnormality
High temperature storage	60., 240hrs	Twice initial value or less	none	More than 80% of initial value	No abnormality
Low temperature storage	-20., 240hrs	Twice initial value or less		More than 80% of initial value	No abnormality

*Evaluations and assessment to be made two hours after returning to room temperature (25.±5.).

*The LCDs subjected to the test must not have dew condensation.

2. Liquid crystal panel service life

50,000 hours minimum at 25±10.,45±20%RH.

Standard Character Pattern

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Lower 4 Bits	Upper 4 Bits	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
xxxx0000	CG RAM (1)			0	a	P	`	P				-	タ	ミ	α	p	
xxxx0001	(2)			!	1	A	Q	a	q			。	ア	チ	△	ä	q
xxxx0010	(3)			"	2	B	R	b	r			「	イ	ツ	×	ß	θ
xxxx0011	(4)			#	3	C	S	c	s			」	ウ	テ	モ	ε	∞
xxxx0100	(5)			\$	4	D	T	d	t			、	エ	ト	ト	μ	Ω
xxxx0101	(6)			%	5	E	U	e	u			・	オ	ナ	1	℃	ü
xxxx0110	(7)			&	6	F	V	f	v			ヲ	カ	ニ	ヨ	ρ	Σ
xxxx0111	(8)			'	7	G	W	g	w			ア	キ	ヌ	ラ	g	π
xxxx1000	(1)			(	8	H	X	h	x			イ	ク	ネ	リ	フ	Σ
xxxx1001	(2)			)	9	I	Y	i	y			ウ	ケ	ル	ル	'	γ
xxxx1010	(3)			*	:	J	Z	j	z			エ	コ	ハ	レ	j	¢
xxxx1011	(4)			+	;	K	[	k	{			オ	サ	ヒ	ロ	×	π
xxxx1100	(5)			,	<	L	¥	l	l			ヤ	シ	フ	ワ	¢	円
xxxx1101	(6)			-	=	M	]	m	}			ユ	ズ	ハ	ン	¢	÷
xxxx1110	(7)			.	>	N	^	n	+			ヨ	セ	ホ	°	°	
xxxx1111	(8)			/	?	O	_	o	+			ッ	ソ	マ	°	°	■

Note: The user can specify any pattern for character-generator RAM.

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