

# **SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY**

## **MGD2004B-NSW-BBS-01**

**DATE: 2009-12-11**

**DOC VER: 1.0**

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**1.0 MECHANICAL SPECS**

1. Overall Module Size	84.0mm(W) x 44.0mm(H) x max 11.5mm(D)
2. Dot Size	0.42mm(W) x 0.46mm(H)
3. Dot Pitch	0.47mm(W) x 0.51mm(H)
4. Duty	1/16
5. Controller IC	ST7066U or Equivalent
6. LC Fluid Options	STN
7. Polarizer Options	Negative Blue and Transmissive
8. Viewing Angle	6:00 o'clock
9. Backlight Options	LED(White)
10. Temperature Range Options	Standard temp.: (Operating: 0°C ~ 50°C; Storage: -20°C ~ 70°C)

**2.0 ABSOLUTE MAXIMUM RATINGS**

Item	Symbol	Min	Typ	Max	Unit
Operating temperature (Standard)	Top	0	-	50	°C
Storage temperature (Standard)	Tst	-20	-	70	°C
Input voltage	Vin	Vss		Vdd	V
Operating temperature (Wide temperature)	Top	-20	-	70	°C
Storage temperature (Wide temperature)	Tst	-30	-	80	°C
Supply voltage for logic	Vdd- Vss	2.7	-	5.5	V
Supply voltage for LCD drive	Vdd- Vo	3.0	4.6	6.5	V

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**3.0 ELECTRICAL CHARACTERISTICS**

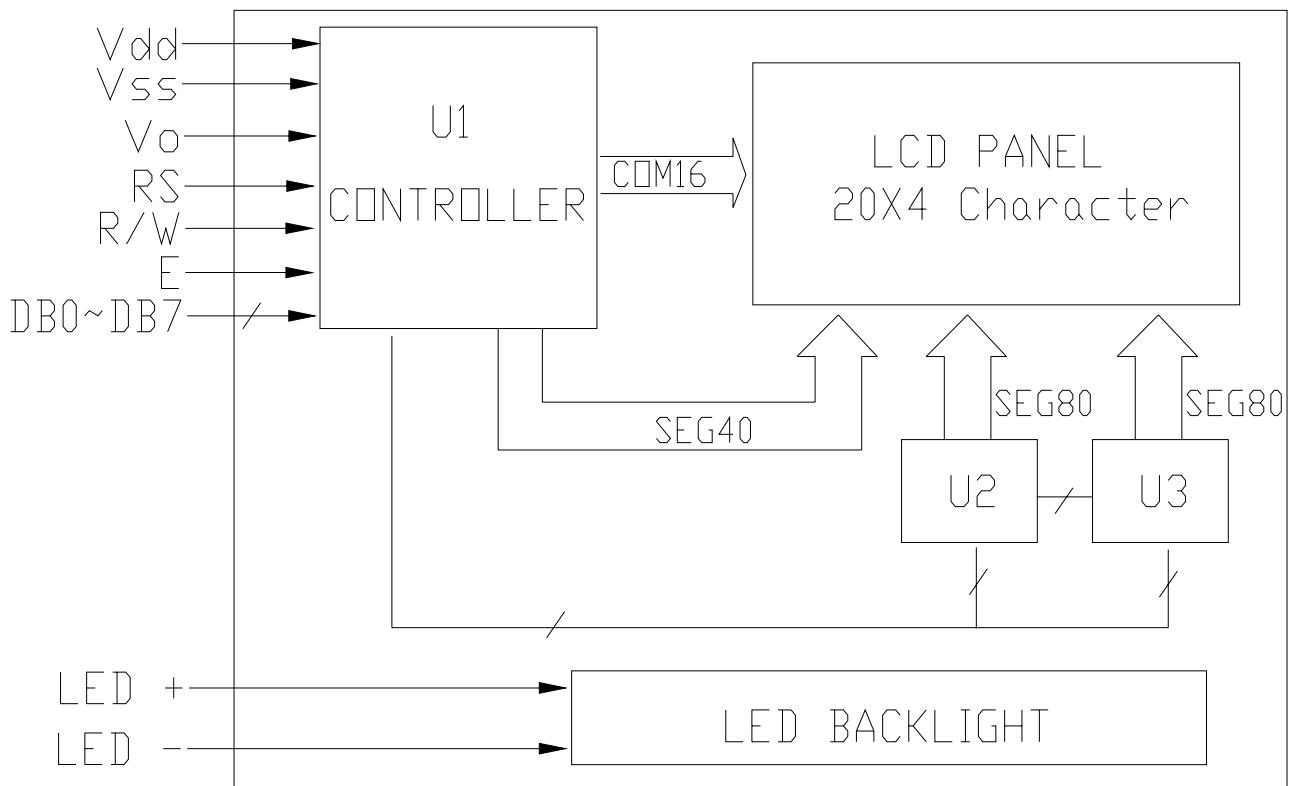
Item	Symbol	Condition	Min	Typ	Max	Unit
Power Supply Voltage	Vdd	fosc=270kHz	--	5.0	--	V
Power Supply Current	Idd	Vdd=5.0V, fosc=270kHz	-	2.0	3.0	mA
Recommended LC Driving Voltage (Standard Temp)	Vdd - Vo	0°C	-	4.8	5.4	V
		25°C	4.2	4.5	-	
		50°C	3.9	4.3	-	
Recommended LC Driving Voltage (Wide Temp)	Vdd -Vo	-20°C	-	6.4	7.2	V
		0°C	-	4.8	-	
		50°C	-	4.2	-	
		70°C	3.5	4.0	-	
BackLight Power Supply Voltage	Vf	R=0Ω	-	5.0	5.5	V
BackLight Power Supply Current	If	R=0Ω	-	40	-	mA

**4.0 OPTICAL CHARACTERISTICS (Ta=25°C, Vdd= 5.0V±0.5V, STN LC fluid)**

Item	Symbol	Condition	Min	Typ	Max	Unit
Viewing angle (horizontal)	θ	Cr ≥ 2.0	-60	-	35	deg
Viewing angle (vertical)	φ	Cr ≥ 2.0	-40	-	40	deg
Contrast Ratio	Cr	φ=0°, θ=0°	-	6	-	
Response time (rise)	Tr	φ=0°, θ=0°	-	150	250	ms
Response time (fall)	Tf	φ=0°, θ=0°	-	150	250	ms

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5.0 BLOCK DIAGRAM

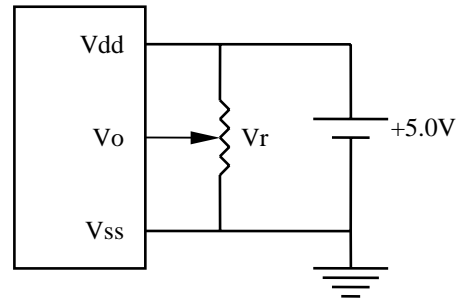


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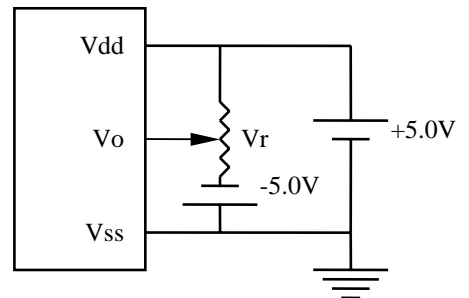
6.0 PIN ASSIGNMENT

Pin No.	Symbol	Function
1	Vss	Ground
2	Vdd	+5.0V
3	Vo	LCD contrast adjust
4	RS	Register select
5	R/W	Read / write
6	E	Enable
7	DB0	Data bit 0
8	DB1	Data bit 1
9	DB2	Data bit 2
10	DB3	Data bit 3
11	DB4	Data bit 4
12	DB5	Data bit 5
13	DB6	Data bit 6
14	DB7	Data bit 7
15	A	Power Supply for +5.0V
16	K	Power Supply for VSS

7.0 POWER SUPPLY



STANDARD TEMP RANGE



WIDE TEMP RANGE

$V_r = 10K\Omega \sim 20K\Omega$

8.0 TIMING CHARACTERISTICS

Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Enable cycle time	$t_c$	Fig. a, Fig. b	500	-	-	ns
Enable pulse width	$t_w$	Fig. a, Fig. b	220	-	-	ns
Enable rise/fall time	$t_r, t_f$	Fig. a, Fig. b	-	-	25	ns
RS, R/W set up time	$t_{su}$	Fig. a, Fig. b	40	-	-	ns
RS, R/W hold time	$t_h$	Fig. a, Fig. b	10	-	-	ns
Data delay time	$t_d$	Fig. b	-	-	120	ns
Data set up time	$t_{dsu}$	Fig. a	60	-	-	ns
Data hold time	$t_{dh}$	Fig. a, Fig. b	20	-	-	ns

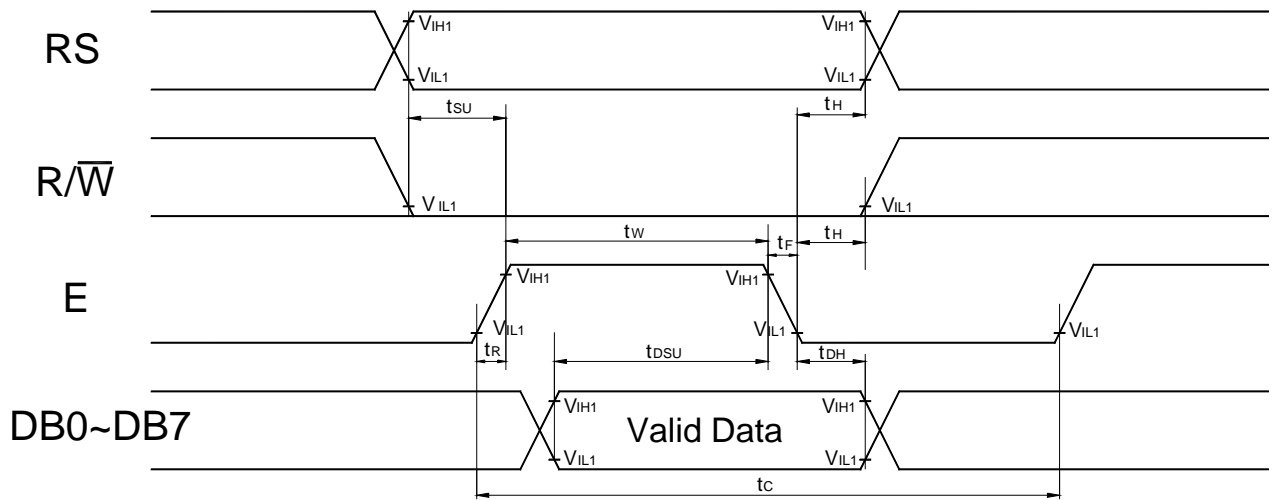


Fig. a Interface timing (data write)

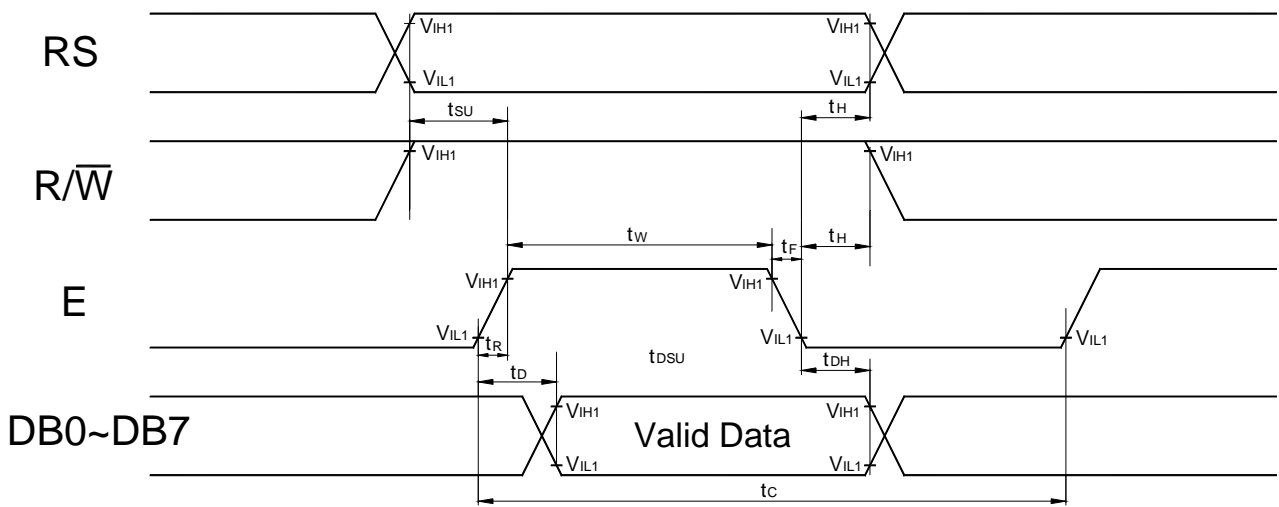
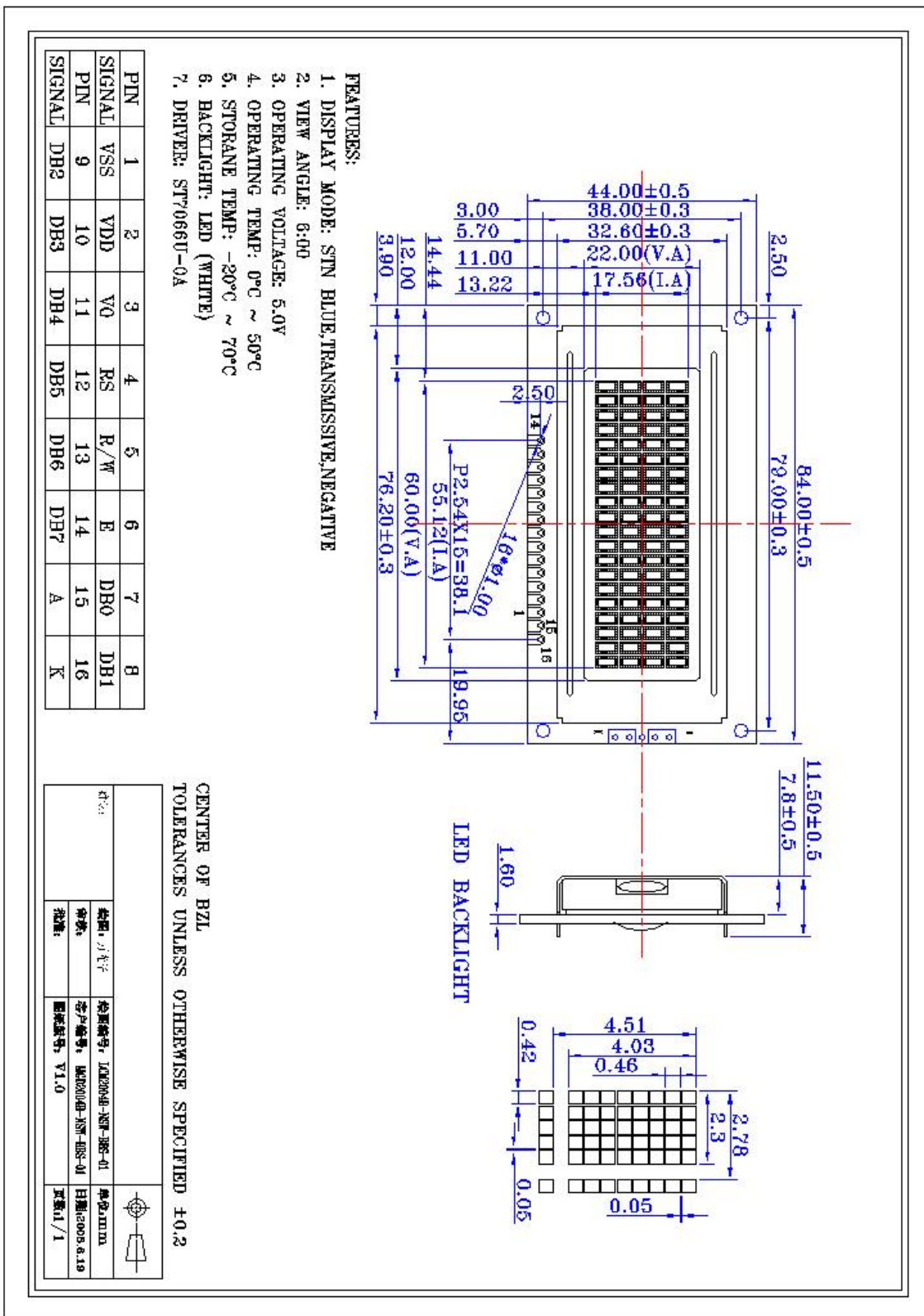


Fig. b Interface timing (data read)

9.0 MECHANICAL DIAGRAM



**10.0 RELIABILITY TEST**

Storage Condition	Content	Evaluations and Assessment*			
		Current Consumption	Oozing	Contrast	Other Appearances
Operation at high temperature and humidity	40°C,90% RH,240hrs	Twice initial value or less	none	More than 80% of initial value	No abnormality
High temperature storage	60°C, 240hrs	Twice initial value or less	none	More than 80% of initial value	No abnormality
Low temperature storage	-20°C, 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°C±5°C).

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

**11.0 DISPLAY CHARACTER ADDRESS**

**20\*4 Module DDRAM Address:**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13
40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	50	51	52	53
14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	20	21	22	23	24	25	26	27
54	55	56	56	58	59	5A	5B	5C	5D	5E	5F	60	61	62	63	64	65	66	67

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12.0 DISPLAY INSTRUCTION TABLE

COMMAND	R S	R/ W	DB 7	DB 6	DB 5	DB 4	DB 3	DB 2	DB 1	DB 0	DESCRIPTION	Executing time fosc=250khz
Clear Display	0	0	0	0	0	0	0	0	0	1	Clears Display & Returns to Address 0.	1.64ms
Cursor at Home	0	0	0	0	0	0	0	0	1	x	Returns Cursor to Address 0. Also returns the display being shifted to the original position. DDRAM contents remain unchanged.	1.64ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	I/D: Set Cursor Moving Direction I/D=1: Increment I/D=0: Decrement  S: Specify Shift of Display S=1: The display is shifted S=0: The display is not shifted	40µs
Display ON/OFF Control	0	0	0	0	0	0	1	D	C	B	Display D=1: Display on D=0: Display off Cursor C=1: Cursor on C=0: Cursor off Brink B=1: Brink on B=0: Brink off	40µs
Cursor / Display Shift	0	0	0	0	0	1	S/C	R/L	x	x	Moves cursor or shifts the display w/o changing DD RAM contents S/C=0: Cursor Shift (RAM unchanged) S/C=1: Display Shift (RAM unchanged) R/L=1: Shift to the Right R/L=0: Shift to the Left	40µs
Function Set	0	0	0	0	1	DL	N	F	x	x	Sets data bus length (DL), # of display lines (N), and character fonts (F). DL=1: 8 bits F=0: 5x7 dots DL=0: 4 bits F=1: 5x10 dots N=0: 1 line display N=1: 2 lines display	40µs
Set CG RAM Address	0	0	0	1	Character Generator (CG) RAM Address					Sets CG RAM address. CG RAM data is sent and received after this instruction.		40µs
Set DD RAM Address	0	0	1	Display Data (DD) RAM Address / Cursor Address					Sets DD RAM address. DD Ram data is sent and received after this instruction.		40µs	
Busy Flag / Address Read	0	1	B F	Address counter used for both DD & CG RAM address					Reads Busy Flag (BF) and address counter contents.		40µs	
Write Data	1	0	Write Data					Writes data into DDRAM or CGRAM.		46µs		
Read Data	1	1	Read Data					Reads data from DDRAM or CGRAM.		46µs		

X: Don't Care

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13.0 STANDARD CHARACTER PATTERNS

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	@	P	`	P				-	夕	ミ	α	P	
xxxx0001	(2)			!	1	A	Q	a	q			。	ア	チ	△	≡	q
xxxx0010	(3)			"	2	B	R	b	r			「	イ	ツ	×	β	θ
xxxx0011	(4)			#	3	C	S	c	s			」	ウ	テ	ε	∞	
xxxx0100	(5)			\$	4	D	T	d	t			、	エ	ト	†	μ	Ω
xxxx0101	(6)			%	5	E	U	e	u			・	オ	ナ	∟	ε	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	∫	∞
xxxx1001	(2)			>	9	I	Y	i	y			ウ	ケ	ル	ル	'	y
xxxx1010	(3)			*	:	J	Z	j	z			エ	コ	ン	レ	j	≠
xxxx1011	(4)			+	;	K	[	k	[			オ	サ	ヒ	ロ	*	≠
xxxx1100	(5)			,	<	L	¥	l	l			カ	シ	フ	ワ	φ	≠
xxxx1101	(6)			-	=	M	]	m	]			ユ	ズ	ハ	ン	≠	÷
xxxx1110	(7)			.	>	N	^	n	→			ヨ	セ	ホ	°	≠	
xxxx1111	(8)			/	?	O	_	o	+			ッ	リ	マ	°	○	■

Note: The character generator RAM is the RAM with which the user can rewrite character patterns by program.

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