SPECIFICATIONS FOR
LCD MODULE

MODEL NO.
<u>BO1602D series</u>
<u>VER.01</u>

RoHS
COMPLIANT

FOR MESSRS:

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ON DATE OF:

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APPROVED BY:

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History of Version

Version	Contents	Date	Note
01	NEW VERSION	2007/10/22	SPEC.

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1. Numbering System

B	O	1602	D	-	-	-	-	-	XXX
0	1	2	3	4	5	6	7	8	9

0	Brand	Bolymin	
1	Module Type	C= character type G= graphic type P= TAB/TCP type	O= COG type F= COF type L=PLED/OLED
2	Format	1602=16 characters, 2 lines	
3	Version No.	A type	
4	LCD Color	G=STN/gray Y=STN/yellow-green PLED/yellow-green C=color STN,OLED/RGB	B=STN/blue,OLED/blue F=FSTN T=TN D=OLED/blue+yellow A=OLED/blue+yellow+green
5	LCD Type	R=positive/reflective P=positive/transflective	M=positive/transmissive N=negative/transmissive
6	Backlight type/color	L=LED array/ yellow-green H=LED edge/white R=LED array/red G=LED edge/yellow-green F=RGB array I=RGB edge Q=LED edge/red N=No backlight	D=LED edge/blue E=EL/white B=EL/blue C=CCFL/white Y=LED Bottom/yellow O=LED array/orange K=LED edge/green A=LED edge/amber
7	CGRAM Font (applied only on character type)	J=English/Japanese Font E=English/European Font G=Chinese(simple) F=Chinese(traditional)	C=English/Cyrillic Font H=English/Hebrew Font A=English/Arabic Font
8	View Angle/ Operating Temperature	B=Bottom/Normal Temperature H=Bottom/Wide Temperature U=Bottom/Ultra wide Temperature	T=Top/Normal Temperature W=Top/Wide Temperature C=9H/Normal Temperature E=Top/ultra wide temperature
9	Special Code	3=3 volt logic power supply n=negative voltage for LCD c=cable/connector xxx=to be assigned on datasheet	t=temperature compensation for LCD p=touch panel $=RoHS

2. General Specification

(1) Mechanical Dimension

Item	Dimension	Unit
Number of Characters	16characters x 2 Lines	—
Module dimension (L x W x H)	41.2 x 27.5 x 2.1 (Max)	mm
View area	38.2 x 17.0	mm
Dot size	0.34 x 0.5	mm
Dot pitch	0.38 x 0.58	mm
Character size (L x W)	1.86 x 4.56	mm

(2) Controller IC: **ST7032i controller**

(3) Temperature Range

	Normal	Wide
Operating	0 ~+50℃	-20 ~+70℃
Storage	-10 ~+60℃	-30 ~+80℃

3. Absolute Maximum Ratings

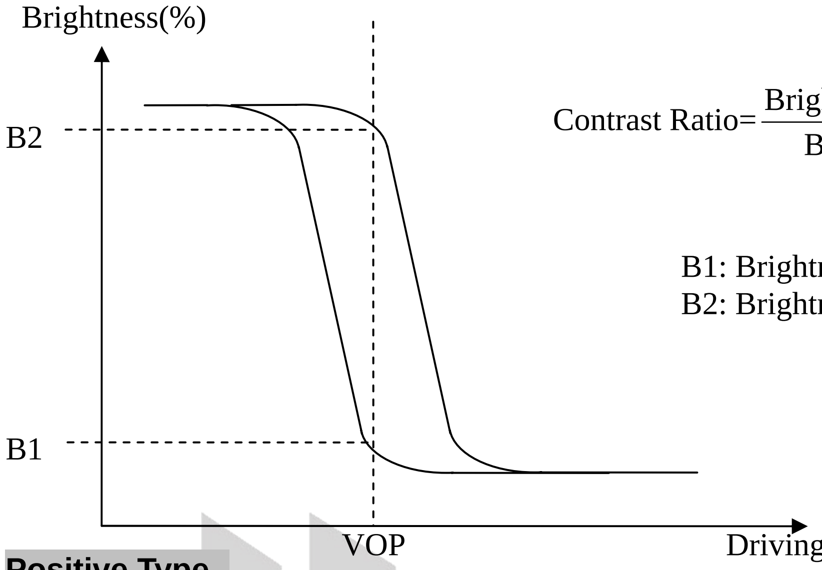
(Vss=0V, Ta=25℃)

Item	Symbol	Min	Max	Unit
Supply Voltage (Logic)	Vdd-Vss	2.6	3.4	V
Supply Voltage (LCD driver)	Vlcd	4	6.5	V
Input Voltage	VI	-0.3	Vdd+0.3	V
Normal Type	TOP	0	+50	℃
	TSTG	-10	+60	℃
Wide Temperature Type	Top	-20	+70	℃
	Tstg	-30	+80	℃

4. Electrical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Note
----- Electronic Characteristics -----							
Logic Circuit Supply Voltage	Vdd-Vss	--	2.2	3.3	3.5	V	
LCD driving voltage (STN)	Vlcd	-20 °C	--		--	V	-20 ~ 70 °C for Extended Temp. typ
		0 °C	--	--	--		
		25 °C	--	**4.8**	--		
		50 °C	--	--	--		
		70 °C	--		--		
Input Voltage	V_{IH}	--	2.1	--	Vdd	V	
	V_{IL}	--	0	--	0.9	V	
Logic Supply Current	Idd	Vdd=3.0V	--	1	--	mA	
----- Optical Characteristics (STN)-----							
Contrast	CR	STN type		8			Note 1
Rise Time	tr	25°C	--	150	300	ms	Note 2
Fall Time	tf	25°C	--	150	300	ms	
Viewing Angle Range	θ f	25°C & CR≥3	--	40	--	Deg.	Note 3
	θ b		--	35	--		
	θ l		--	35	--		
	θ r		--	35	--		
Frame Frequency	fF	25°C	--	64	--	Hz	

(Note 1) Contrast ratio :

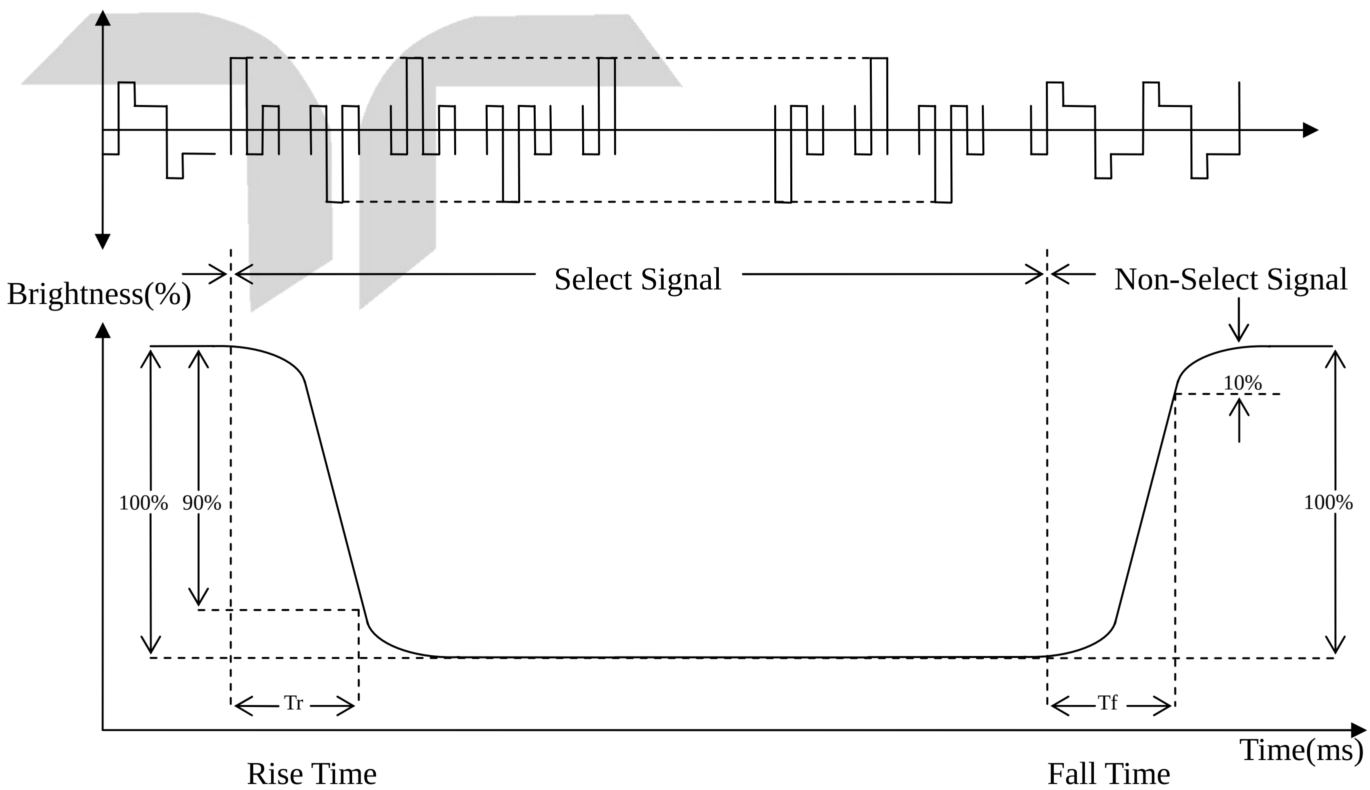


$$\text{Contrast Ratio} = \frac{\text{Brightness In Non - Select Singal}}{\text{Brightness In Select Singal}}$$

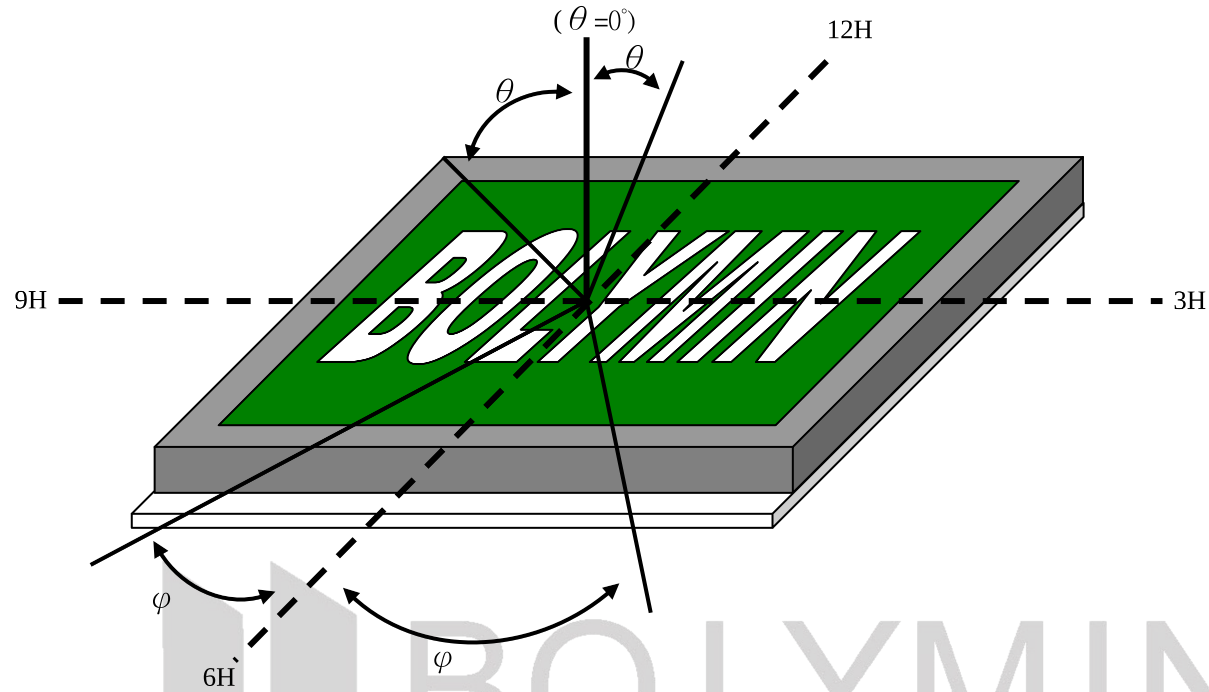
B1: Brightness In Select Signal
B2: Brightness In Non-Select Signal

Positive Type

(Note 2) Response time :



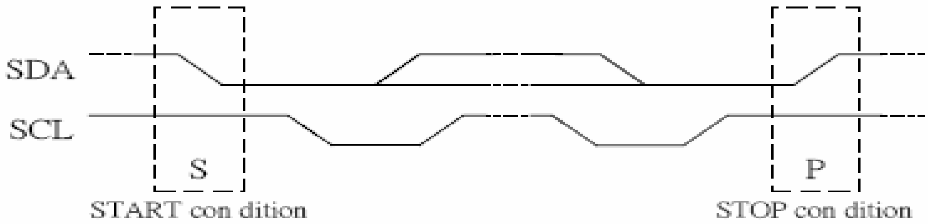
(Note 3) Viewing angle



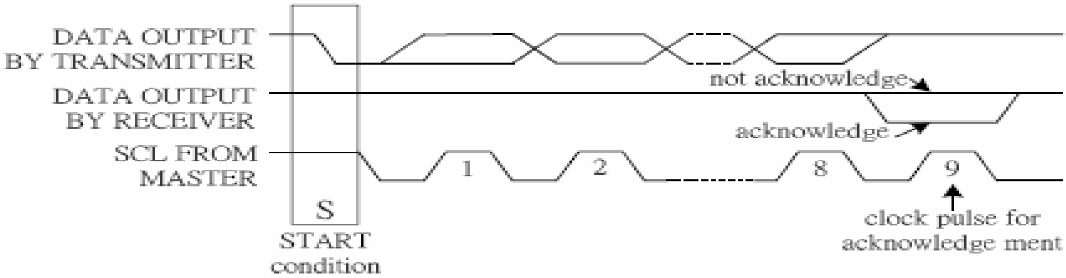
5. Interface Pin Function

Pin No.	Symbol	Level	Function
1	RST	H/L	Reset signal
2	SCL	H/L	Serial Clock Input
3	SDA	H/L	Serial Data Input/Output
4	VSS	-	Power supply GND
5	VDD	-	Power supply for logic (+3.3V)
6	CAP+	-	Voltage booster circuit External capacitor about 0.1u~4.7uf
7	CAP-	-	
8	VOUT	-	LCD driver voltage

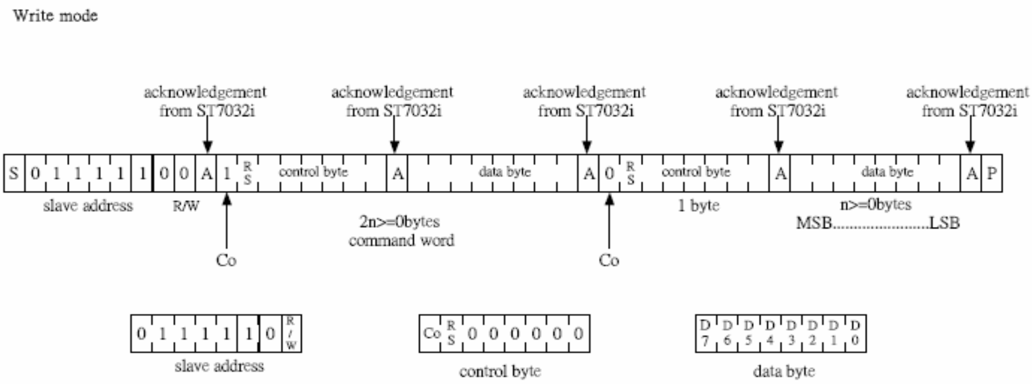
6.Timing Characteristics



Definition of START and STOP conditions



Acknowledgement on the 2-line Interface



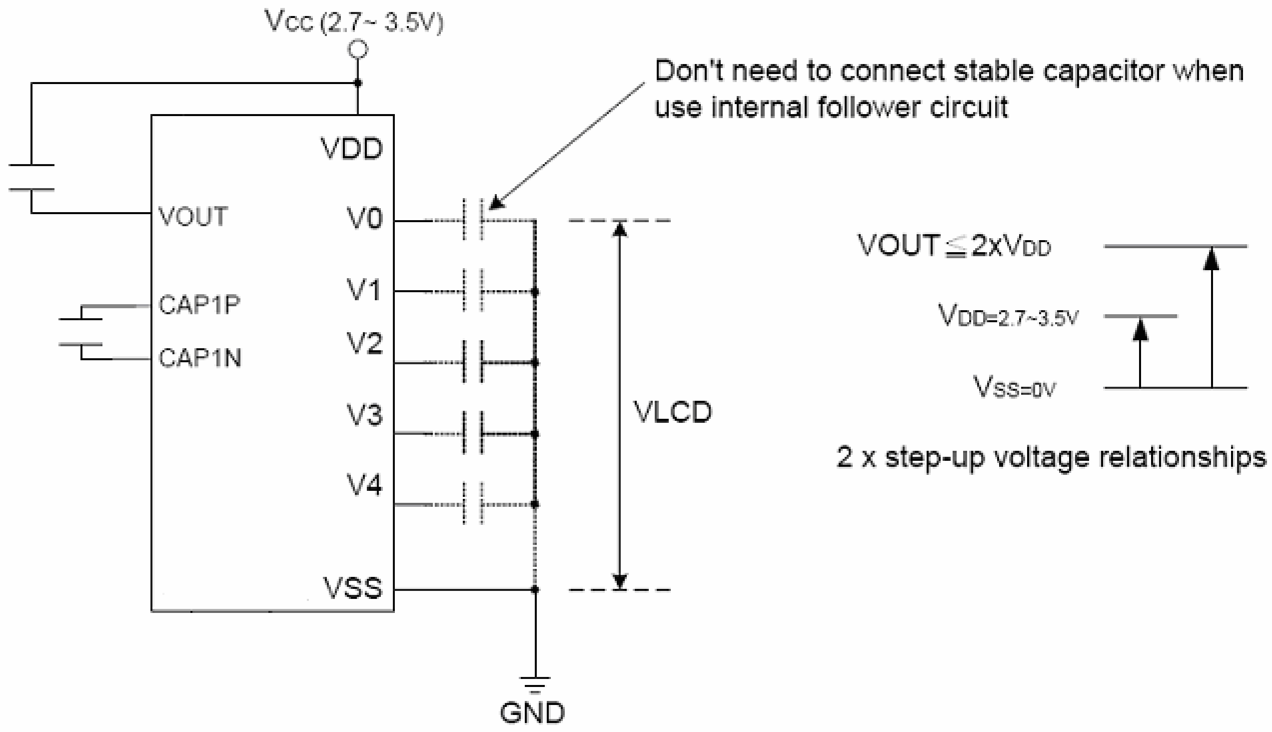
2-line Interface protocol

Co	0	Last control byte to be sent. Only a stream of data bytes is allowed to follow. This stream may only be terminated by a STOP condition.
	1	Another control byte will follow the data byte unless a STOP condition is received.

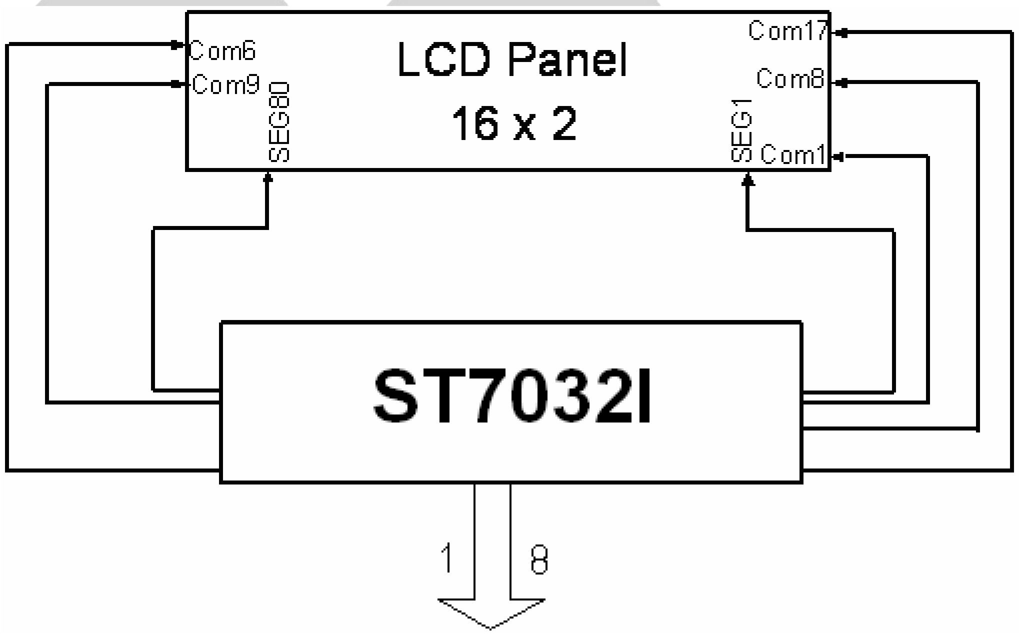
RS	R/W	Operation
L	L	Instruction Write operation (MPU writes Instruction code into IR)
H	L	Data Write operation (MPU writes data into DR)

Various kinds of operations according to RS and R/W bits.

7. Power Supply



8. Block Diagram



9. Backlight Information

9.1 Specification

(1) LED dege / yellow-green B/L

Parameter	Symbol	Min	Typ	Max	Unit	Test Condition
Supply Current	ILED	—	80		mA	V=4.2V
Supply Voltage	V	—	4.2	4.3	V	
Reverse Voltage	VR	—	—	8	V	
Luminous Intensity	IV	60	—	—	cd/ m^2	ILED=100mA
Wave Length	λ p		574		nm	ILED=100mA
Life Time		—	50000	—	Hr.	V≦4.2V
Color	Yellow Green					

(2) LED dege / white B/L

Parameter	Symbol	Min	Typ	Max	Unit	Test Condition
Supply Current	ILED	—	40		mA	ILED≦40mA
Supply Voltage	V	—	3.2	3.5	V	
Reverse Voltage	VR	—	—	8	V	
Luminous Intensity	IV	80	—	—	cd/ m^2	ILED≦40mA
Wave Length	X		0.31			ILED≦40mA
	Y		0.31			
Life Time		—	50000	—	Hr.	ILED≦40mA
Color	white					

(3) LED dege / blue B/L

Parameter	Symbol	Min	Typ	Max	Unit	Test Condition
Supply Current	ILED	—	40		mA	ILED≦40mA
Supply Voltage	V	—	3.2	3.5	V	
Reverse Voltage	VR	—	—	8	V	
Luminous Intensity	IV	80	—	—	cd/ m^2	ILED≦40mA
Wave Length						ILED≦40mA
Life Time		—	50000	—	Hr.	ILED≦40mA
Color	blue					

(4) LED dege / red B/L

Parameter	Symbol	Min	Typ	Max	Unit	Test Condition
Supply Current	ILED	—	20		mA	ILED≦20mA
Supply Voltage	V	—	4.2	4.3	V	
Reverse Voltage	VR	—	—	8	V	
Luminous Intensity	IV	80	—	—	cd/ m^2	ILED≦20mA
Wave Length			655		nm	ILED≦20mA
Life Time	λp	—	50000	—	Hr.	ILED≦20mA
Color	red					

10. Commands

Instruction	Instruction Code										Description	Instruction Execution Time		
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		OSC= 380KHz	OSC= 540kHz	OSC= 700KHz
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM. and set DDRAM address to "00H" from AC	1.08 ms	0.76 ms	0.59 ms
Return Home	0	0	0	0	0	0	0	0	1	x	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.08 ms	0.76 ms	0.59 ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction and specifies display shift. These operations are performed during data write and read.	26.3 us	18.5 us	14.3 us
Display ON/OFF	0	0	0	0	0	0	1	D	C	B	D=1:entire display on C=1:cursor on B=1:cursor position on	26.3 us	18.5 us	14.3 us
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	x	x	S/C and R/L: Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.	26.3 us	18.5 us	14.3 us
Function Set	0	0	0	0	1	DL	N	x	x	x	DL: interface data is 8/4 bits N: number of line is 2/1	26.3 us	18.5 us	14.3 us
Set CGRAM	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter	26.3 us	18.5 us	14.3 us
Set DDRAM address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter	26.3 us	18.5 us	14.3 us
Read Busy flag and address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.	0	0	0
Write data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM)	26.3 us	18.5 us	14.3 us
Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM)	26.3 us	18.5 us	14.3 us

Instruction	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description	OSC=380KHz	OSC=540kHz	OSC=700KHz
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM. and set DDRAM address to "00H" from AC	1.08 ms	0.76 ms	0.59 ms
Return Home	0	0	0	0	0	0	0	0	1	x	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.08 ms	0.76 ms	0.59 ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction and specifies display shift. These operations are performed during data write and read.	26.3 us	18.5 us	14.3 us
Display ON/OFF	0	0	0	0	0	0	1	D	C	B	D=1:entire display on C=1:cursor on B=1:cursor position on	26.3 us	18.5 us	14.3 us
Function Set	0	0	0	0	1	DL	N	DH	*0	IS	DL: interface data is 8/4 bits N: number of line is 2/1 DH: double height font IS: instruction table select	26.3 us	18.5 us	14.3 us
Set DDRAM address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter	26.3 us	18.5 us	14.3 us
Read Busy flag and address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.	0	0	0
Write data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM/ICONRAM)	26.3 us	18.5 us	14.3 us
Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM/ICONRAM)	26.3 us	18.5 us	14.3 us

Note * : this bit is for test command , and must always set to "0"

Instruction table 0(IS=0)

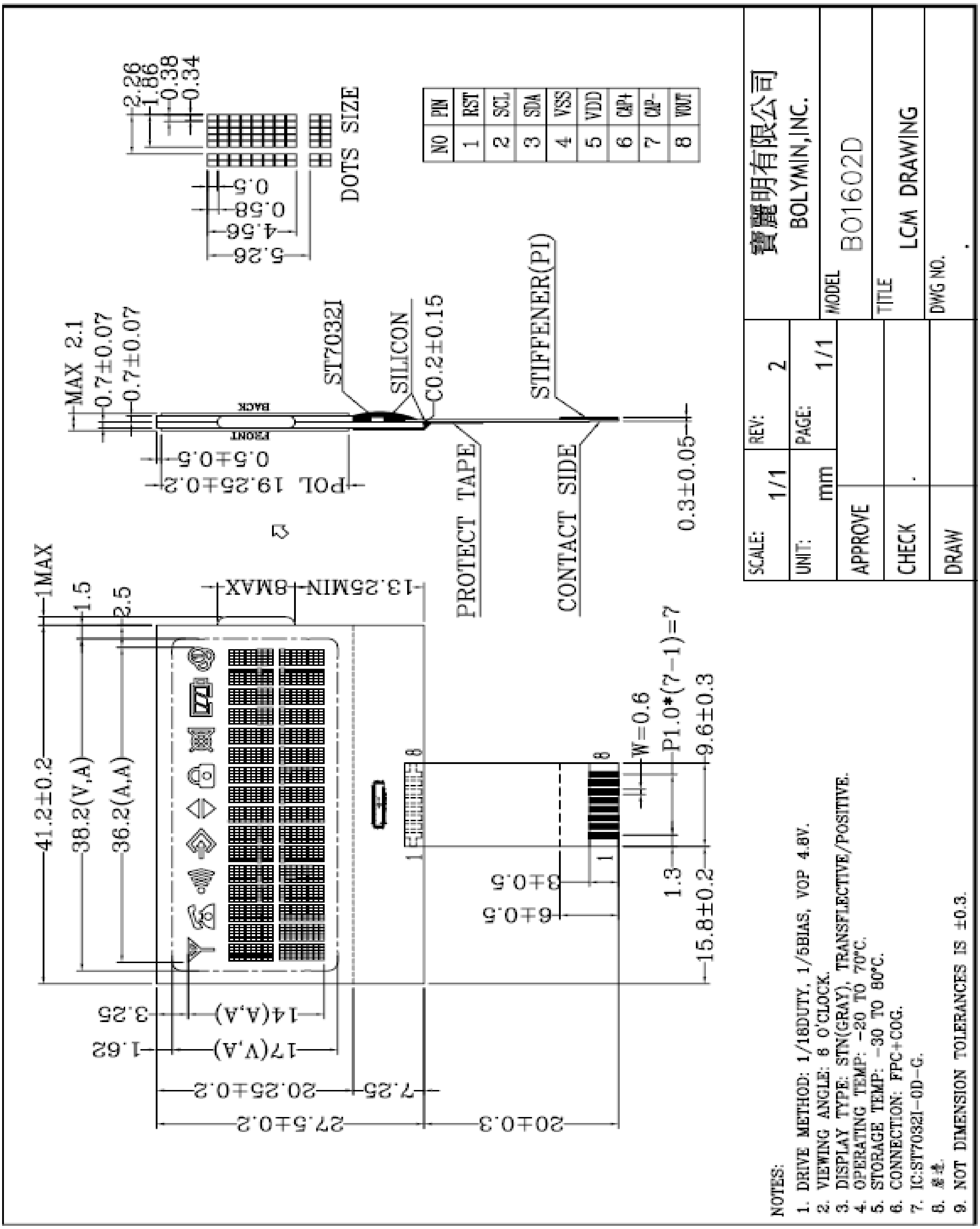
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	x	x	S/C and R/L: Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.	26.3 us	18.5 us	14.3 us
Set CGRAM	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter	26.3 us	18.5 us	14.3 us

Instruction table 1(IS=1)

Internal OSC frequency	0	0	0	0	0	1	BS	F2	F1	F0	BS=1:1/4 bias BS=0:1/5 bias F2~0: adjust internal OSC frequency for FR frequency.	26.3 us	18.5 us	14.3 us
Set ICON address	0	0	0	1	0	0	AC3	AC2	AC1	AC0	Set ICON address in address counter.	26.3 us	18.5 us	14.3 us
Power/ICON control/Contrast set	0	0	0	1	0	1	Ion	Bon	C5	C4	Ion: ICON display on/off Bon: set booster circuit on/off C5,C4: Contrast set for internal follower mode.	26.3 us	18.5 us	14.3 us
Follower control	0	0	0	1	1	0	Fon	Rab 2	Rab 1	Rab 0	Fon: set follower circuit on/off Rab2~0: select follower amplified ratio.	26.3 us	18.5 us	14.3 us
Contrast set	0	0	0	1	1	1	C3	C2	C1	C0	Contrast set for internal follower mode.	26.3 us	18.5 us	14.3 us

11. Font table

12. Drawing


寶麗明有限公司
BOLYMIN,INC.
MODEL
BO1602D
TITLE
LCM DRAWING
DWG NO.
SCALE:
1/1
REV:
2
UNIT:
mm
PAGE:
1/1
APPROVE
CHECK
DRAW
NO
PIN
1
RST
2
SCL
3
SDA
4
VSS
5
VDD
6
CAP+
7
CAP-
8
VOUT
DOTS SIZE
2.26
1.86
0.38
0.34
0.5
0.58
4.56
5.26
MAX 2.1
0.7±0.07
0.7±0.07
ST7032I
SILICON
C0.2±0.15
STIFFENER(PI)
BACK
FRONT
0.5±0.5
POL 19.25±0.2
PROTECT TAPE
CONTACT SIDE
0.3±0.05
1MAX
1.5
2.5
8MAX
13.25MIN
41.2±0.2
38.2(V,A)
36.2(A,A)
W=0.6
P1.0*(7-1)=7
9.6±0.3
1.3
15.8±0.2
8±0.5
6±0.5
3.25
14(A,A)
1.62
17(V,A)
20.25±0.2
7.25
27.5±0.2
20±0.3
NOTES:
1. DRIVE METHOD: 1/16DUTY, 1/5BIAS, VOP 4.8V.
2. VIEWING ANGLE: 6 O'CLOCK.
3. DISPLAY TYPE: STN(GRAY), TRANSFLECTIVE/POSITIVE.
4. OPERATING TEMP: -20 TO 70°C.
5. STORAGE TEMP: -30 TO 80°C.
6. CONNECTION: FPC+COG.
7. IC:ST7032I-0D-G.
9. NOT DIMENSION TOLERANCES IS ±0.3.