

DISPLAYTRONIC

XIAMEN ZETTLER ELECTRONICS CO., LTD.

SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

CUSTOMER APPROVAL			
※ PART NO.: <u>ACM1602Y-FL-YBW(DISPLAYTRONIC) VER1.0</u>			
APPROVAL		COMPANY CHOP	
CUSTOMER COMMENTS			

DISPLAYTRONIC ENGINEERING APPROVAL		
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REVISION RECORD

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1.0 GENERAL SPECS

1. Display Format	16*2 Character
2. Power Supply	5.0V(Single power supply without DC-DC,adjustable Vop)
3. Module Outline Dimension	71.5mm(W) x 36.0mm(H) x max 13.5mm(D)
4. Viewing Area(W*H)	64.5mm(W) x 16.4mm(H)
5. Dot Size (W*H)	0.56mm(W) x 0.61mm(H)
6. Dot Pitch (W*H)	0.61mm(W) x 0.66mm(H)
7. Character Size (W*H)	3.00mm(W) x 5.23mm(H)
8. Character Pitch (W*H)	3.51mm(W) x 5.75mm(H)
9. Viewing Direction	6:00 O'Clock
10. Driving Method	1/16Duty,1/5Bias
11. Control IC	ST7066U-0A or Compatible
12. Display Mode	STN(Y-G) /Positive/Transflective
13. Backlight	Yellow-Green LED/Bottom
14. Operating Temperature	-20°C ~ 70°C
15. Storage Temperature	-30°C ~ 80°C
16. RoHS	RoHS compliant

2.0 ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min	Typ	Max	Unit
Operating temperature	Top	-20	--	70	°C
Storage temperature	Tst	-30	--	80	°C
Input voltage	Vin	Vss-0.3	--	Vdd+0.3	V
Supply voltage for logic	Vdd- Vss	2.7	--	5.5	V
Supply voltage for LCD driving	Vdd- V0	3.0	--	8.0	V

3.0 ELECTRICAL CHARACTERISTICS

3.1 Electrical Characteristics Of LCM

Item	Symbol	Condition	Min	Typ	Max	Unit
Power Supply Voltage	Vdd	25°C	4.8	5.0	5.2	V
Power Supply Current	Idd	Vdd=5.0V, fosc=270kHz	--	1.5	2.0	mA
Input voltage (high)	Vih	Pins:(E,RS,R/W,DB0-DB7) VDD=5V	2.5	--	Vdd	V
Input voltage (low)	Vil		-0.3	--	0.6	V
Recommended Driving Voltage LC	Vdd -V0	-20°C	4.6	4.8	5.0	V
		25°C	4.3	4.5	4.7	
		70°C	4.0	4.2	4.4	

3.2 The Characteristics Of LED Backlight

3.2.1 Electrical-Optical Characteristics Of LED Backlight (Ta=25°C)

Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage ⁽¹⁾	Vf	If=120mA ⁽⁵⁾	3.9	4.1	4.3	V
Reverse Voltage	Vr	-	--	--	8	V
Luminance ^(2,3)	Lv	If=120mA	100	160	--	cd/m ²
Uniformity	Δ	(Lvmin/Lvmax)%	70%	--	--	-
Peak wave length	λ p	If=120mA	570	--	575	nm
Lifetime ⁽⁴⁾	-	If=120mA	-	20000	-	Hours

NOTE:

(1) Forward voltage means voltage applied directly to the LED, please refer to the backlight diagram.

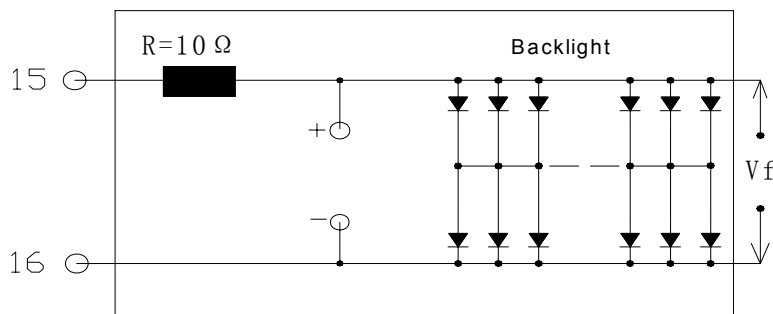
(2) Luminance means the backlight brightness without LCD.

(3) The luminance is the average value of 5 points, The measurement instrument is BM-7 luminance colorimeter. The diameter of aperture is Φ5mm,

(4) Backlight lifetime means luminance value larger than half of the original after 20000 hours' continuous working.

(5) Please apply the backlight current as the table recommend. If LCM surface luminance is acceptable, please apply the driving current as lower as possible. Any time, do not apply the driving current higher than 160mA.

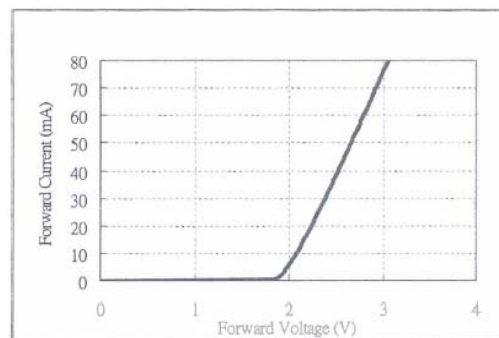
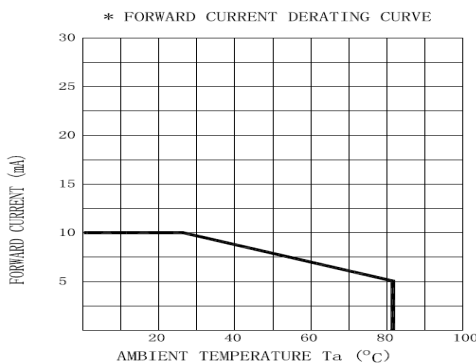
3.2.2 Backlight Control Circuit for LCM (2x12=24 pcs LED)



3.2.3 LED Typical Electro-Optical Characteristics Curve (for single led)

1. Forward current vs. Ambient temperature

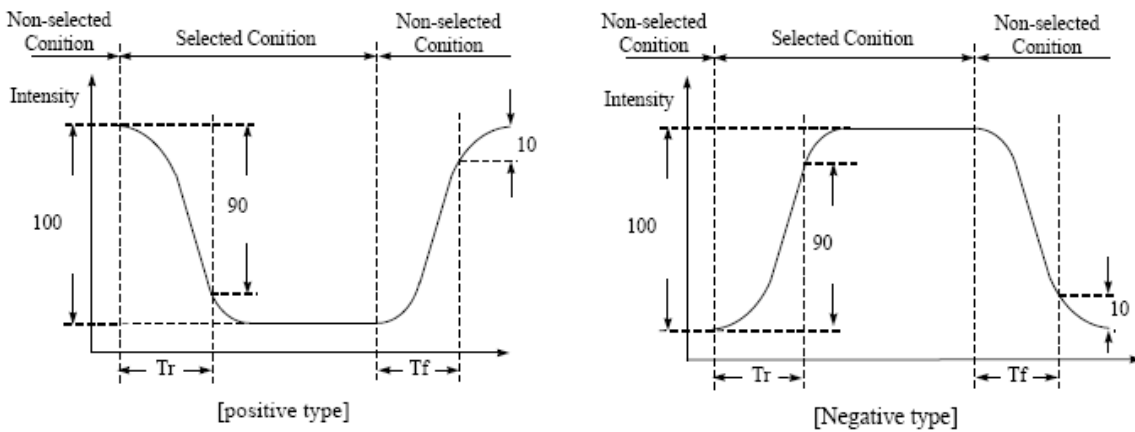
2. Forward current vs. Forward voltage



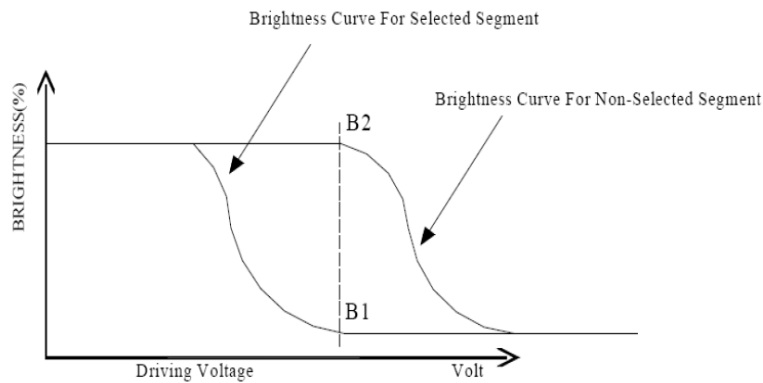
4.0 OPTICAL CHARACTERISTICS (Ta=25°C)

Item	Symbol	Condition	Min	Typ	Max	Unit
Viewing angle (Left - right)	θ_2	$Cr \geq 2.0$	-35	-	35	deg
Viewing angle (Up-down)	θ_1	$Cr \geq 2.0$	-25	-	40	deg
Contrast Ratio	Cr	$\theta_1=0^\circ, \theta_2=0^\circ$	-	5.5	-	
Response time (rise)	Tr	$\theta_1=0^\circ, \theta_2=0^\circ$	-	180	300	ms
Response time (fall)	Tf	$\theta_1=0^\circ, \theta_2=0^\circ$	-	150	250	ms

(1). Definition of Optical Response Time

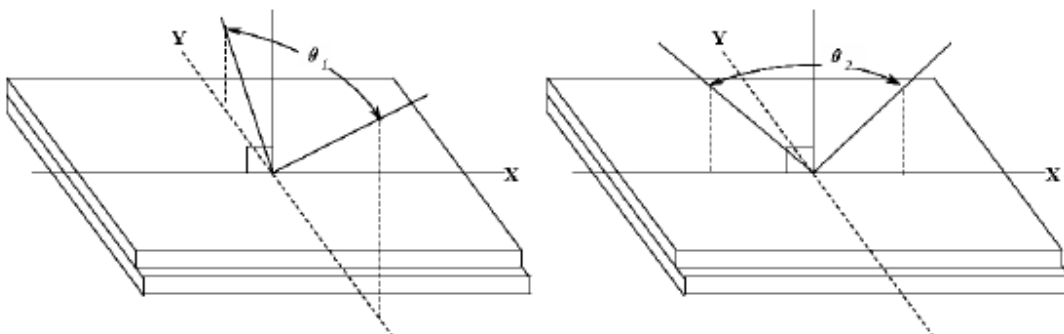


(2). Definition of Contrast Ratio

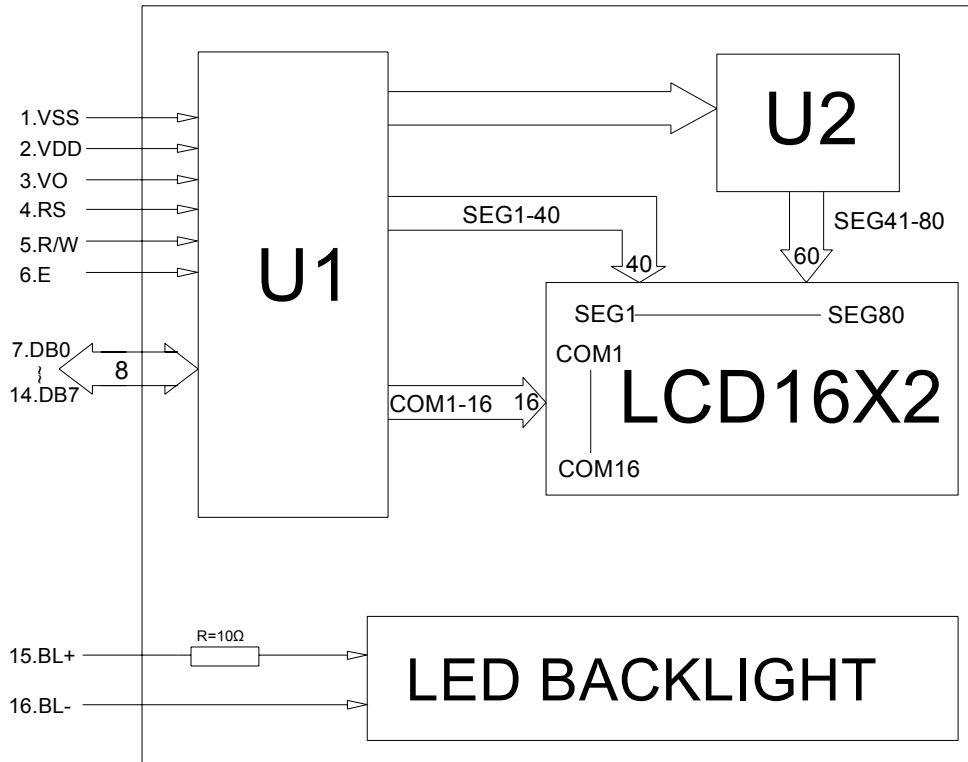


$$Cr = \frac{\text{Brightness of Non-selected Segment}(B2)}{\text{Brightness of selected Segment}(B1)}$$

(3). Definition of Viewing Angle θ_2 and θ_1



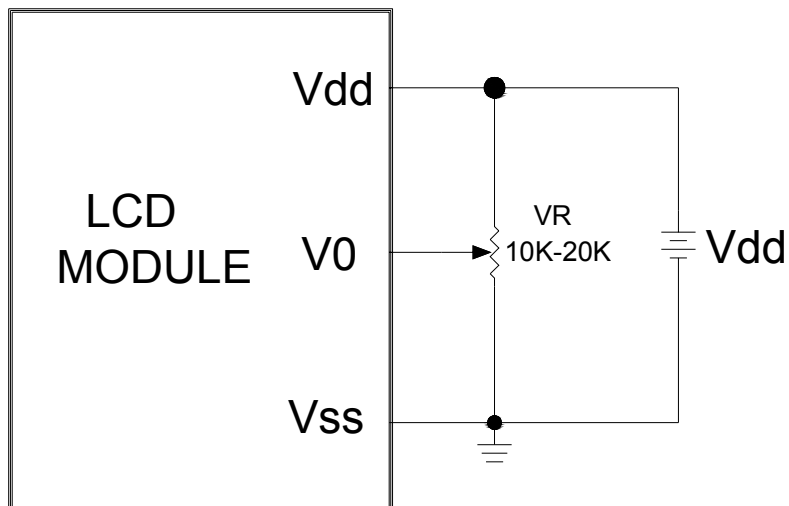
5.0 BLOCK DIAGRAM



6.0 PIN ASSIGNMENT

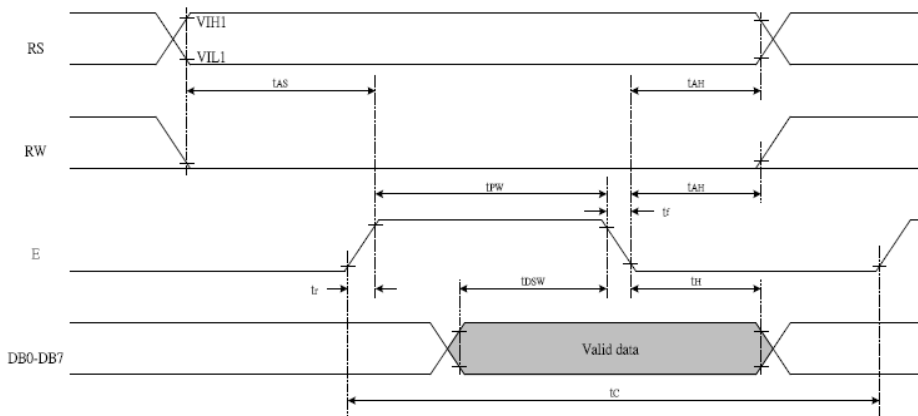
Pin No.	Symbol	Function
1	V _{ss}	Ground
2	V _{dd}	+5.0V
3	V ₀	LCD contrast adjust
4	RS	Register select
5	R/W	Read / Write Signal
6	E	Enable Signal
7	DB0	Data bit 0
8	DB1	Data bit 1
9	DB2	Data bit 2
10	DB3	Data bit 3
11	DB4	Data bit 4
12	DB5	Data bit 5
13	DB6	Data bit 6
14	DB7	Data bit 7
15	BL+	Power Supply for BL+
16	BL-	Power Supply for BL-

7.0 POWER SUPPLY

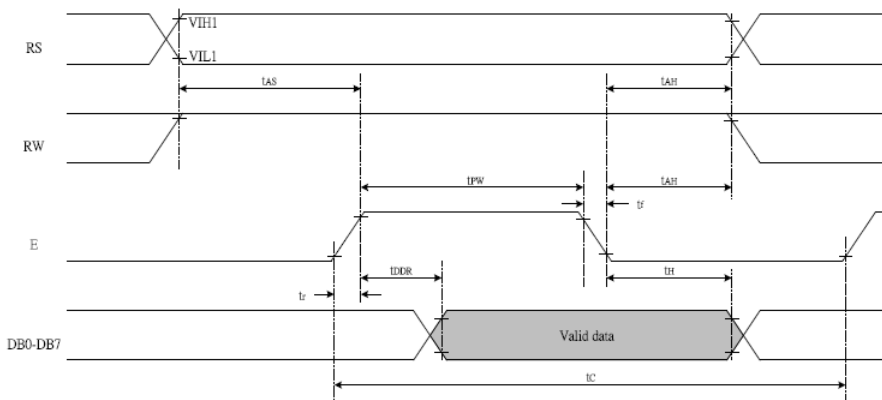


8.0 TIMING CHARACTERISTICS

Write mode (Writing Data from MPU to ST7066U)



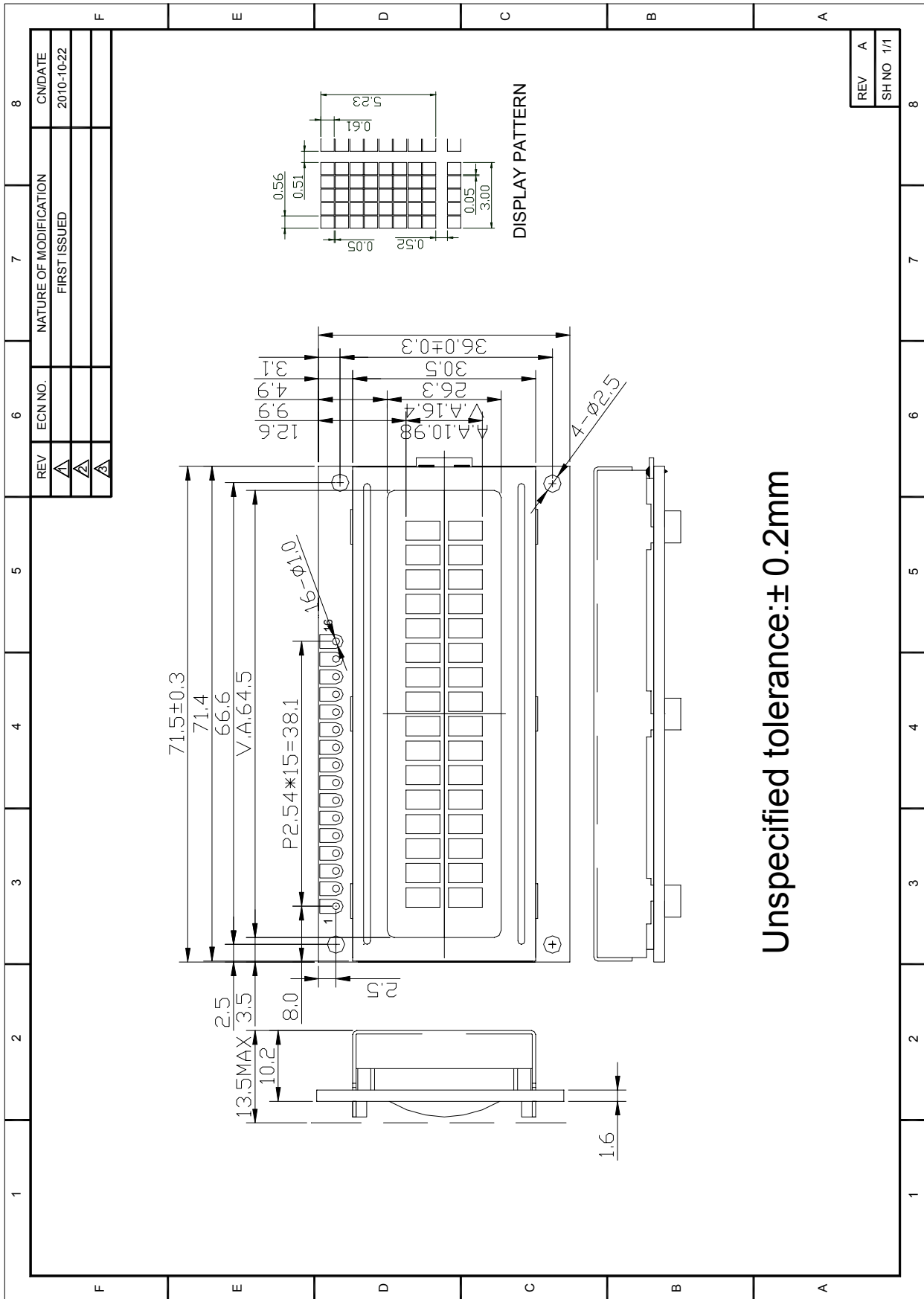
Read mode (Reading Data from ST7066U to MPU)



Write Mode (Writing data from MPU to ST7066U)						
T _C	Enable Cycle Time	Pin E	1200	-	-	ns
T _{PW}	Enable Pulse Width	Pin E	140	-	-	ns
T _R , T _F	Enable Rise/Fall Time	Pin E	-	-	25	ns
T _{AS}	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
T _{AH}	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T _{DSW}	Data Setup Time	Pins: DB0 - DB7	40	-	-	ns
T _H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns
Read Mode (Reading Data from ST7066U to MPU)						
T _C	Enable Cycle Time	Pin E	1200	-	-	ns
T _{PW}	Enable Pulse Width	Pin E	140	-	-	ns
T _R , T _F	Enable Rise/Fall Time	Pin E	-	-	25	ns
T _{AS}	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
T _{AH}	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T _{DDR}	Data Setup Time	Pins: DB0 - DB7	-	-	100	ns
T _H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns

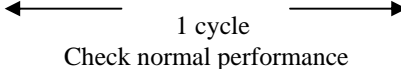
For more details, please refer to IC specification.

9.0 MECHANICAL DIAGRAM



Unspecified tolerance: ± 0.2 mm

10.0 RELIABILITY TEST

NO	Test Item	Description	Test Condition	Remark	
1	Environmental Test	High temperature storage	Applying the high storage temperature Under normal humidity for a long time Check normal performance	80 °C 96hrs	
2		Low temperature storage	Applying the low storage temperature Under normal humidity for a long time Check normal performance	-30°C 96hrs	
3		High temperature Operation	Apply the electric stress(Voltage and current) Under high temperature for a long time	70 °C 96hrs	Note1
4		Low temperature Operation	Apply the electric stress Under low temperature for a long time	-20°C 96hrs	Note1 Note2
5		High temperature/High Humidity Storage	Apply high temperature and high humidity storage for a long time	90% RH 40°C 96hrs	Note2
6		Temperature Cycle	Apply the low and high temperature cycle -30°C <-> 25°C <-> 80°C <-> 25°C 30min 10min 30min 10min 	-30°C/80°C 10 cycle	
7	Mechanical Test	Vibration test(Package state)	Applying vibration to product check normal performance	Freq:10~55~10Hz Amplitude:0.75mm 1cycle time:1min X.Y.Z every direction for 15 cycles	
8		Shock test(package state)	Applying shock to product check normal performance	Drop them through 70cm height to strike horizontal plane	
9	Other				

Remark

Note1:Normal operations condition (25°C±5°C).

Note2:Pay attention to keep dewdrops from the module during this test.

11.0 DISPLAY INSTRUCTION TABLE

Instruction	Instruction Code										Description	Execution time (Temp = 25°C)			
	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		Fosc= 190KHz	Fosc= 270KHz	Fosc= 350KHz	
Clear Display	0	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM and set DDRAM address to "00H" from AC	2.16ms	1.52ms	1.18ms
Return Home	0	0	0	0	0	0	0	0	0	1	-	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	2.16ms	1.52ms	1.18ms
Entry Mode Set	0	0	0	0	0	0	0	0	1	I/D	S	Assign cursor moving direction and enable the shift of entire display	53μs	38μs	29μs
Display ON/OFF Control	0	0	0	0	0	0	0	1	D	C	B	Set display (D), cursor(C), and blinking of cursor(B) on/off control bit.	53μs	38μs	29μs
Cursor or Display Shift	0	0	0	0	0	0	1	S/C	R/L	-	-	Set cursor moving and display shift control bit, and the direction, without changing of DDRAM data.	53μs	38μs	29μs
Function Set	0	0	0	0	0	1	DL	N	F	-	-	Set interface data length (DL: 8-bit/4-bit), numbers of display line (N: 2-line/1-line) and, display font type (F:5x10 dots/5x8 dots)	53μs	38μs	29μs
Set CGRAM Address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0		Set CGRAM address in address counter.	53μs	38μs	29μs
Set DDRAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0		Set DDRAM address in address counter	53μs	38μs	29μs
Read Busy Flag and Address Counter	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.			
Write Data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0		Write data into internal RAM (DDRAM/CGRAM).	53μs	38μs	29μs
Read Data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0		Read data from internal RAM (DDRAM/CGRAM).	53μs	38μs	29μs

