DISPLAY Elektronik GmbH

DATA SHEET

LCD MODULE

DEM 40271 FGH-PW

Product Specification   *Version : 3*

16.02.2016

GENERAL SPECIFICATION

MODULE NO. :

DEM 40271 FGH-PW

CUSTOMER P/N

VERSION NO.	CHANGE DESCRIPTION	DATE
0	ORIGINAL VERSION	09.10.2015
1	UPDATE SPEC.	14.10.2015
2	UPDATE SPEC.	15.10.2015
3	UPDATE SPEC.	16.02.2016

PREPARED BY: GJ   DATE: 16.02.2016

APPROVED BY: MH   DATE: 16.02.2016

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1. FUNCTIONS & FEATURES
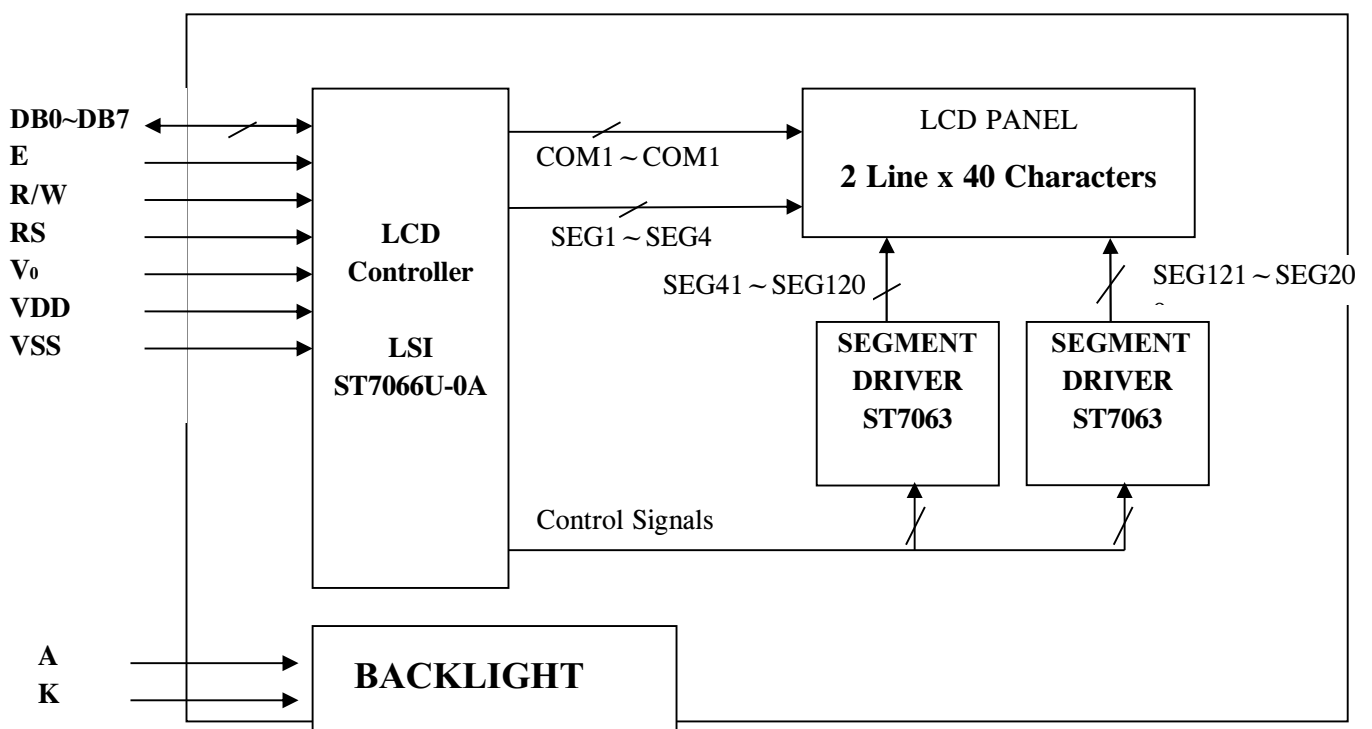
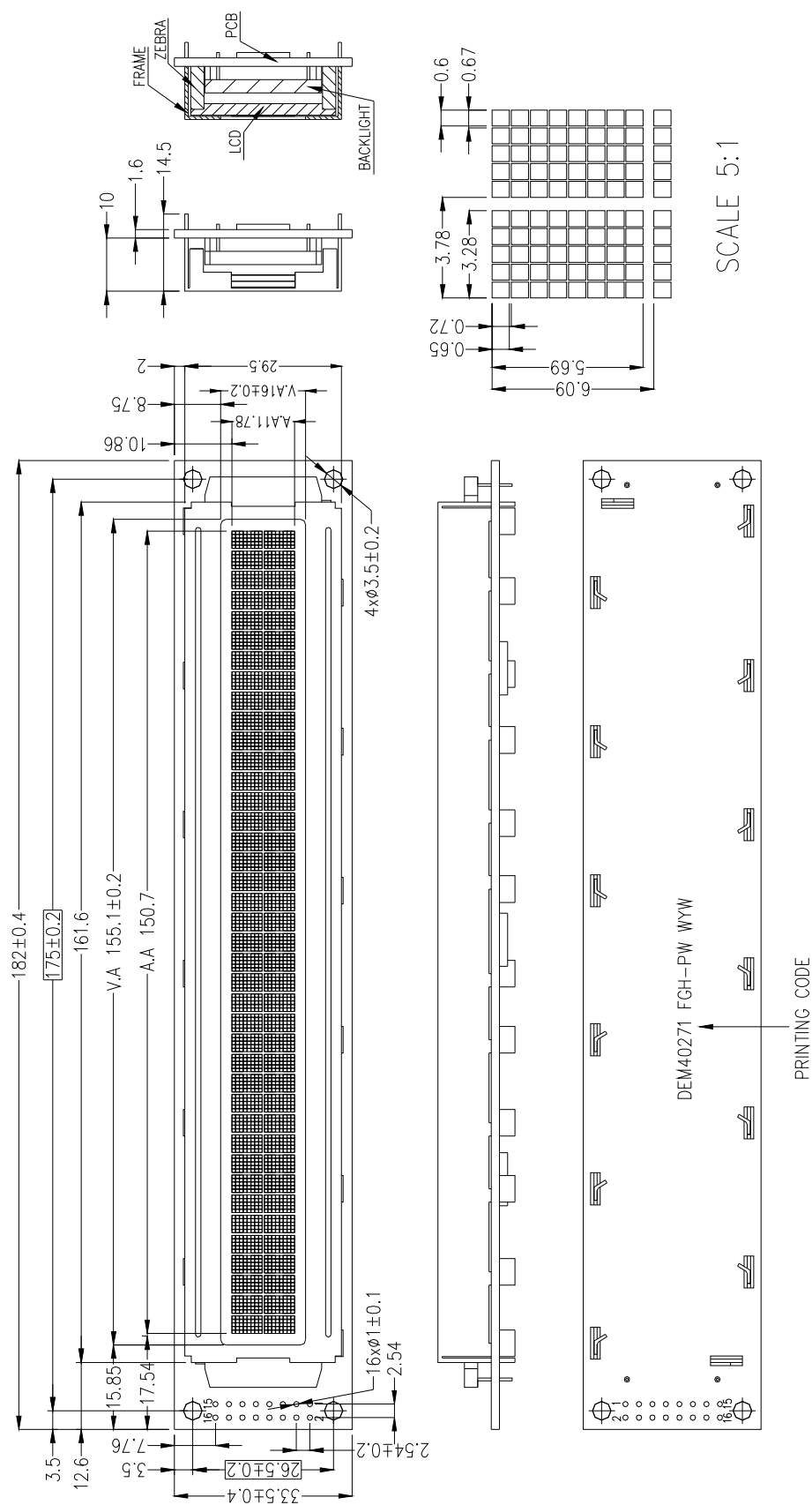| MODULE NAME	LCD TYPE
DEM 40271 FGH-PW	FSTN Transflective Positive Mode

- Viewing Direction   : 6 O'clock
- Driving Scheme   : 1/16 Duty Cycle, 1/5 Bias
- Power Supply Voltage   : 5.0 Volt (typ.)
- V_{LCD} Adjustable For Best Contrast   : 4.6 Volt (typ.)
- Display Format   : 40 x 2 Characters
- Operation Temperature   :-20°C to +70°C
- Storage Temperature   :-30°C to +80°C
- Internal Memory   : CGROM (10,080 bits)
                                              : CGRAM (64 x 8 bits)
                                              : DDRAM (80 x 8 bits)
- CGROM   : CGROM of the ST7066U-0A
- Interface   : Easy Interface with 4-bit or 8-bit MPU

2. MECHANICAL SPECIFICATIONS

- Module Size   : 182.00 x 33.50 x 14.50 mm
- Character Pitch   : 3.78 x 6.09 mm
- Character Size   : 3.28 x 5.69 mm
- Character Font   : 5 x 8 Dots
- Dot Size   : 0.60 x 0.65 mm
- Dot Pitch   : 0.07 mm

3. BLOCK DIAGRAM

4. EXTERNAL DIMENSIONS

5. PIN ASSIGNMENT

Pin No.	Symbol	Function
1	V_{SS}	Ground terminal of module.
2	V_{DD}	Power terminal of module 5.0V.
3	V_0	Power Supply for liquid crystal drive.
4	RS	Register select RS = 0 (Instruction register) RS = 1 (Data register)
5	R/W	Read /Write R/W = 1 (Read) R/W = 0 (Write)
6	E	Read/Write Enable Signal
7	DB0	Bi-directional data bus, data transfer is performed once, thru DB0 to DB7, in the case of interface data. Length is 8-bits; and twice, thru DB4 to DB7 in the case of interface data length is 4-bits. Upper four bits first then lower four bits.
8	DB1	
9	DB2	
10	DB3	
11	DB4	
12	DB5	
13	DB6	
14	DB7	
15	LED – (K)	Supply 5.0V for LED Backlight.Please also refer to 6. PCB drawing and description.
16	LED + (A)	

6. PCB DRAWING AND DESCRIPTION.
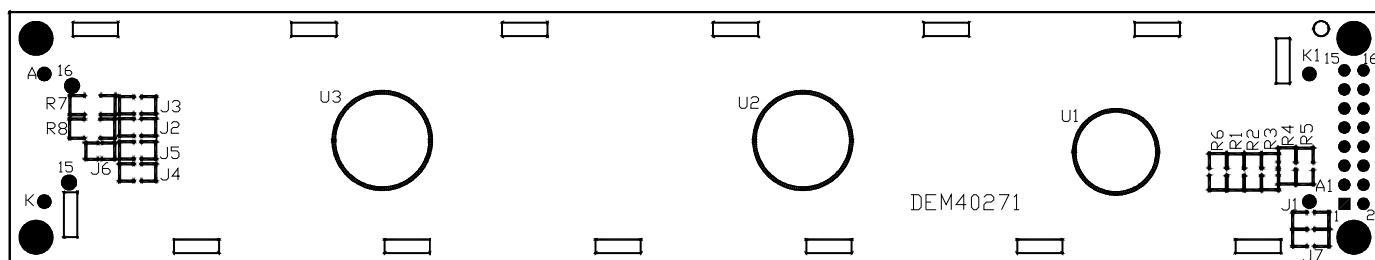
DESCRIPTION:

6-1-1. The polarity of the pin 15 and the pin 16:

J3,J5	J2,J4	LED Polarity	
		15 Pin	16 Pin
Each open	Each closed	Anode	Cathode
Each closed	Each open	Cathode	Anode

Note: In application, J3, J5 should be closed, and J2, J4 should be open.

6-1-2. The metal-bezel is set be on ground when the J1 is closed.

Note: In application, J1 should be closed.

6-1-3. The LED resistor should can be bridged when the J6 is closed.

Note: In application J6 should be opened.

**6-1-4. The R7 and the R8 are the LED resistor.**

Note: In application, R7=68 Ohm, R8=68 Ohm

**6-1-5. The mounting hole is set to ground, when J7 is closed.**

Note: In application J7 is closed.

7. BACKLIGHT VOLTAGE & CURRENT

ELECTRICAL-OPTICAL CHARACTERISTICS						
Item	Symbol	min.	typ.	max.	Unit	Condition
Forward Voltage	Vf	2.8	3.0	3.2	V	If= 60 mA
Power Dissipation	Pd	–	180	–	mW	If= 60 mA
Luminous Uniformity	ΔLv	70			%	MIN/MAX*100%
Luminance	Lv	400	600		cd/m^2	If= 60 mA T=25° C
Color Coordinate	X	0.25		0.31		
	Y	0.25		0.31		
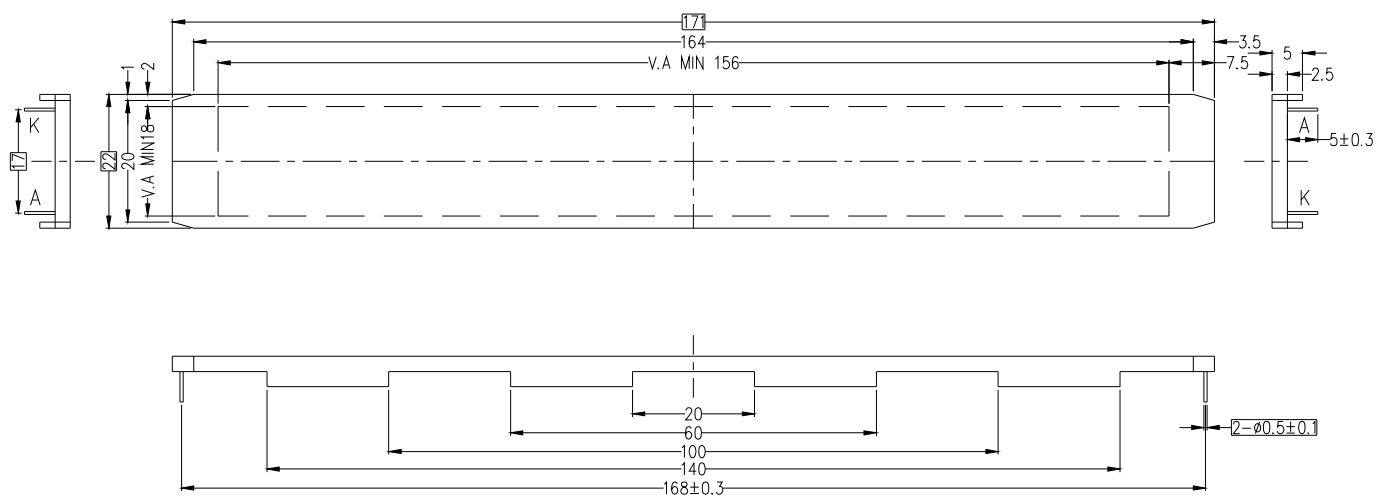
REMARKS:
1. UNMARKED TOLERANCE IS ±0.3
2. ALL MATERIAL COMPLY WITH ROHS
3. LED LIFE TIME IS 50000h

A●—▷|—●K 2 pcs LED
A●—▷|—●K 2 pcs LED

LED BRAND:JUFEI, COLOR: WHITE
INTERNAL CIRCUIT DIAGRAM
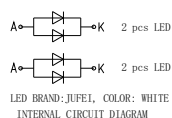
8. MAXIMUM ABSOLUTE POWER RATINGS

Item	Symbol	Standard value	Unit
Power Supply Voltage (1)	V_{DD}	-0.3~+7.0	V
Power Supply Voltage (2)	V_0	V_{DD}-15.0~V_{DD}+0.3	V
Input Voltage	V_{IN}	-0.3~V_{DD}+0.3	V
Operating Temperature	T_{opr}	-20~+70	°C
Storage Temperature	T_{stg}	-30~+80	°C

*Voltage greater than above may damage to the Circuit.

VDD＞V1＞V2＞V3＞V4＞V5

9. ELECTRICAL CHARACTERISTICS

9-1 DC Characteristics (VDD=4.5V~5.5V, Ta=-20~+70°C)

Item	Symbol	Standard Value			Test Condition	Unit
		MIN	TYP	MAX		
Operating Voltage	V_{DD}	2.7	5.0	5.5	-------	V
Supply Current	I_{DD1}	----	0.35	0.6	V_{DD}＝5V, fosc＝270kHz	mA
LCD Driving Voltage	VLCD	4.3	4.6	4.9	VDD-V5 (1/5,1/4 Bias)	V

**9-2 AC Characteristics** (V$_{DD}$=4.5V~5.5V, Ta=-20~+70°C)

9-2-1. Write mode (writing data from MPU to Module)

Characteristic	Symbol	Min	Typ	Max	Unit	Test PIN
E Cycle Time	t$_C$	1200			ns	E
E Rise Time	t$_R$			25	ns	E
E Fall Time	t$_F$			25	ns	E
E Pulse width (High, Low)	t$_W$	140			ns	E
R/W and RS Set-up Time	t$_{SU1}$	0			ns	R/W, RS
R/W and RS Hold Time	t$_{H1}$	10			ns	R/W, RS
Data Set-up Time	t$_{SU2}$	40			ns	DB0~DB7
Data Hold Time	t$_{H2}$	10			ns	DB0~DB7
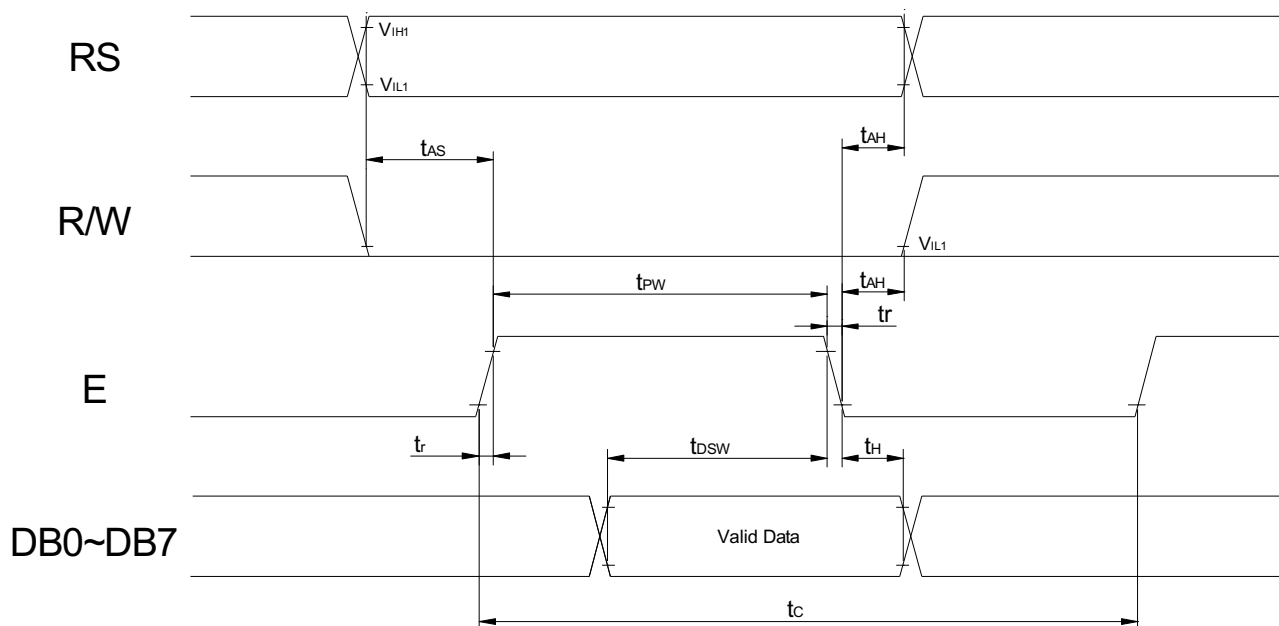
9-2-2. Read mode (Reading data from Module to MPU)

Characteristic	Symbol	Min	Typ	Max	Unit	Test PIN
E Cycle Time	t_C	1200			ns	E
E Rise Time	t_R			25	ns	E
E Fall Time	t_F			25	ns	E
E Pulse width (High, Low)	t_W	140			ns	E
R/W and RS Set-up Time	t_{SU}	0			ns	R/W, RS
R/W and RS Hold Time	t_H	10			ns	R/W, RS
Data output Delay Time	t_D			100	ns	DB0~DB7
Data Hold Time	t_{DH}	5			ns	DB0~DB7
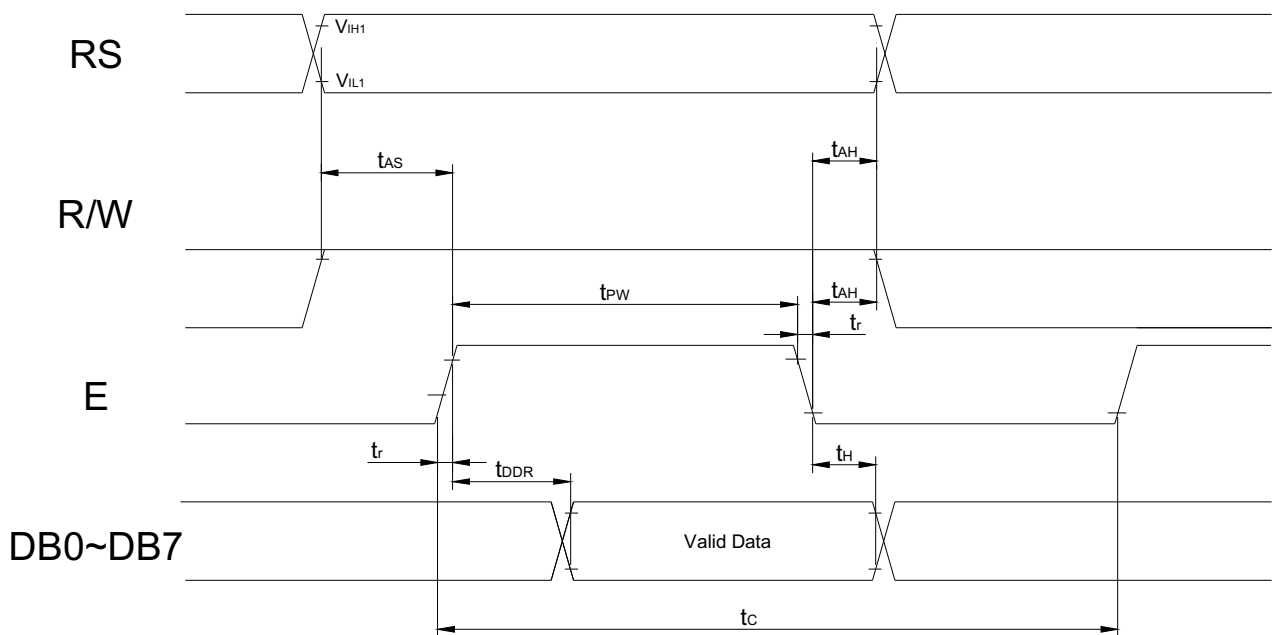
10. CONTROL AND DISPLAY COMMAND

Command	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Execution time (fosc=270KHz)	Remark
Clear Display	0	0	0	0	0	0	0	0	0	1	1.52ms	Write"20H" to DDRAM. And set DDRAM address to "00H" from AC
Return home	0	0	0	0	0	0	0	0	1	x	1.52ms	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.
Entry mode Set	0	0	0	0	0	0	0	1	I/D	S	37us	Sets cursor move direction and specifies display shift. These operations are performed during data write and read.
Display on/off control	0	0	0	0	0	0	1	D	C	B	37us	D=1: entire display on C=1: cursor on B=1: cursor position on
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	x	x	37us	Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.
function Set	0	0	0	0	1	DL	N	F	x	x	37us	DL: interface data is 8/4 bits N: number of line is 2/1 F: font size is 5x11/5x8
Set CGRAM address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	37us	Set CGRAM address in address counter
Set DDRAM address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	37us	Set DDRAM address in address counter
Read busy flag& address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	0us	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	37us	Write data into internal RAM (DDRAM/CGRAM)
Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	37us	Read data from internal RAM (DDRAM / CGRAM)

Note:

Be sure the ST7066U is not in the busy state (BF=00 before sending an instruction from the MPU to the ST7066U. If an instruction is sent without checking the busy flag, the time between the first instruction and next instruction will take much longer than the instruction time itself. Refer to instruction table for the list of each instruction execution time.

11. STANDARD CHARACTER PATTERN (ST7066U-0A)

Upper(4bit) / Lower(4bit)	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	10010	1011	1100	1101	1110	1111
0000	CG RAM (1)			0	@	P	`	p				–	タ	ミ	α	p
0001	(2)		!	1	A	Q	a	q				。	チ	ム	ä	q
0010	(3)		"	2	B	R	b	r				「	ツ	メ	β	θ
0011	(4)		#	3	C	S	c	s				」	テ	モ	ε	∞
0100	(5)		$	4	D	T	d	t				、	ト	ヤ	μ	Ω
0101	(6)		%	5	E	U	e	u				・	ナ	ユ	σ	ü
0110	(7)		&	6	F	V	f	v				ヲ	ニ	ヨ	ρ	Σ
0111	(8)		'	7	G	W	g	w				ア	ヌ	ラ	g	π
1000	(1)		(	8	H	X	h	x				イ	ネ	リ	√	x̄
1001	(2)		)	9	I	Y	i	y				ウ	ノ	ル	-1	y
1010	(3)		*	:	J	Z	j	z				エ	ハ	レ	j	千
1011	(4)		+	;	K	[	k	{				オ	ヒ	ロ	x	万
1100	(5)		,	<	L	¥	l	|				ヤ	フ	ワ	¢	円
1101	(6)		-	=	M	]	m	}				ユ	ヘ	ン	£	÷
1110	(7)		.	>	N	^	n	→				ヨ	ホ	゛	ñ	
1111	(8)		/	?	O	_	o	←				ツ	マ	゜	ö	▓

12. QUALITY DESCRIPTION

DEFECT SPECIFICATION:

Specific type-related items are covered in this sheet.

a: Table for Cosmetic defects
       (Note: nc = not counted).
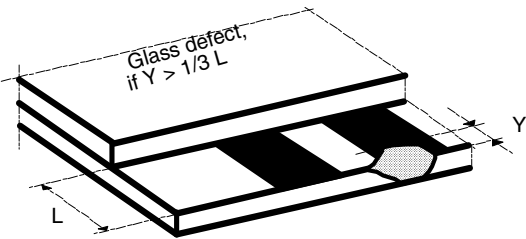   Sizes and number of defects
       (Max. Qty)
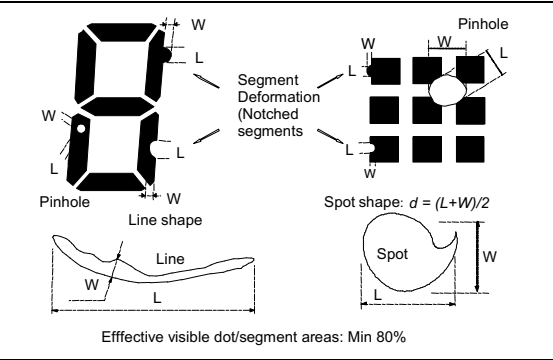
 Examples/

Shapes

b: Glass defects
b1:Glass defects at contact ledge

Defect Type	Max. defect size [μm] d or L W	Max. Quantity.
Black or White Spots	$d \leq 100$	nc
	$100 < d \leq 200$	5
Black or White Lines	-- $W \leq 10$	nc
	$L \leq 5000$ $W \leq 30$	3
	$L \leq 2000$ $W \leq 50$	2
Pinhole	$d \leq 100$ $100 < d \leq 200$	nc 1/segment
(Total defects)		(5)
Segment Deformation	$W \leq 100$	nc
Bubble (e.g. under pola)	$d \leq 150$	nc
	$200 < d \leq 400$	3
	$400 < d \leq 600$	1

b2:Glass chipping in other areas shall not be in conflict
with the product's function.

13. MODULE ACCEPT QUALITY LEVEL (AQL).

13.1 AQL Standard Value: Fatal Defect =0.1, Major Defect=0.65; Minor Defect =2.5.

13.2 Curtailed Inspection Scheme

Type	Batch Qty	inspection Qty	AQL value	pass	Reject
module product	350PCS＜1000PCS	125pcs	0.1	0	1
			0.65	2	3
			2.5	7	8
	200PCS＜350PCS	80pcs	0.1	0	1
			0.65	1	2
			2.5	5	6
	＜200PCS	32pcs	0.1	0	1
			0.65	0	1
			2.5	4	5
Module sample	＜200PCS	All inspected	/	/	The sample will be reject when the fateful defect>2pcs or main defect>5pcs.
	＞200PCS	125pcs			

Notes: 1). Batch QTY is the production amount that Production department ship to QA department.

2). All of product will be inspected if the batch QTY less than inspected QTY.

3). Each batch fixed to be 500pcs.

14. RELIABILITY TEST

Operating life time: Longer than 50000 hours (at room temperature without direct irradiation of sunlight)

Reliability characteristics shall meet following requirements.

TEMPERATURE TESTS	NORMAL GRADE
High temperature storage	+80�«ᵒ x 96hrs (Without Polarizer)
Low temperature storage	-30℃ x 4hrs
High temperature operation	+70℃ x 96hrs
Low temperature operation	-20℃ x 4hrs
High temperature, High humidity	+70�«ᵒ 95% RH 96hrs (Without Polarizer)
Thermal shock	-20◻ x 30 min 10s ↓5Cycles +70℃ x 30 min
Vibration test	Frequency x Swing x Time 40Hz x 4mm x 4hrs
Drop test	Drop height x Times 1.0m x 6 times

15. LCD MODULES HAMDLING PRECAUTIONS

■ Please remove the protection foil of polarizer before using.

■ The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

■ If the display panel is damaged and the liquid crystal substance inside it leaks out, do not get any in your mouth. If the substance come into contact with your skin or clothes promptly wash it off using soap and water.

■ Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

■ The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarize carefully.

■ To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
  -Be sure to ground the body when handling the LCD module.
  -Tools required for assembly, such as soldering irons, must be properly grounded.
  -To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
  -The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

■ Storage precautions
  When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps. Keep the modules in bags designed to prevent static electricity charging under low temperature / normal humidity conditions (avoid high temperature / high humidity and low temperatures below 0°C). Whenever possible, the LCD modules should be stored in the same conditions in which they were shipped from our company.

16 OTHERS

■ Liquid crystals solidify at low temperature (below the storage temperature range) leading to defective orientation of liquid crystal or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subjected to a strong shock at a low temperature.

■ If the LCD modules have been operating for a long time showing the same display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. Abnormal operating status can be resumed to be normal condition by suspending use for some time. It should be noted that this phenomena does not adversely affect performance reliability.

■ To minimize the performance degradation of the LCD modules resulting from caused by static electricity, etc. exercise care to avoid holding the following sections when handling the modules:
  - Exposed area of the printed circuit board
  - Terminal electrode sections