



冀诚电子
GEM-TECH ELECTRONICS

LCD MODULE SPECIFICATIONS

Customer:	
Customer Part No.:	
Gem-tech Model Name:	GTG-192646V35-BT6L2C
Release Date:	2012-3-14
Customer Approval:	
Date:	
The above signature represents that the product specifications, testing regulation, and warranty in the specifications are accepted.	

HEBEI GEM-TECH ELECTRONICS CO., LTD.

No.368 North Xinshi Road, FL.8 Chuangxin BLD P.C.: 050091

Tel.: +86 311 8381 5999, 8381 6999 Fax.: +86 311 8383 1999

<http://www.gemtech-hb.com>

Confidential

This information contained herein is the exclusive property of Gem-tech and shall not be distributed, reproduced, or disclosed in whole or in part without prior written permission of Gem-tech. Subject to change without notice.

Contents

1. BASIC SPECIFICATION
2. ABSOLUTE MAXIMUM RATINGS
3. ELECTRICAL & OPTICAL CHARACTERISTICS
4. BUS TIMING CHARACTERISTICS
5. OPERATING PRINCIPLES & METHODS
6. DISPLAY CONTROL INSTRUCTION
7. DISPLAY DATA RAM ADDRESS MAP
8. DIMENSIONAL OUTLINE
9. QUALITY SPECIFICATION
10. RELIABILITY
11. HANDLING PRECAUTION
12. PRECAUTION FOR USE
13. REVISIONS HISTORY

1. BASIC SPECIFICATION

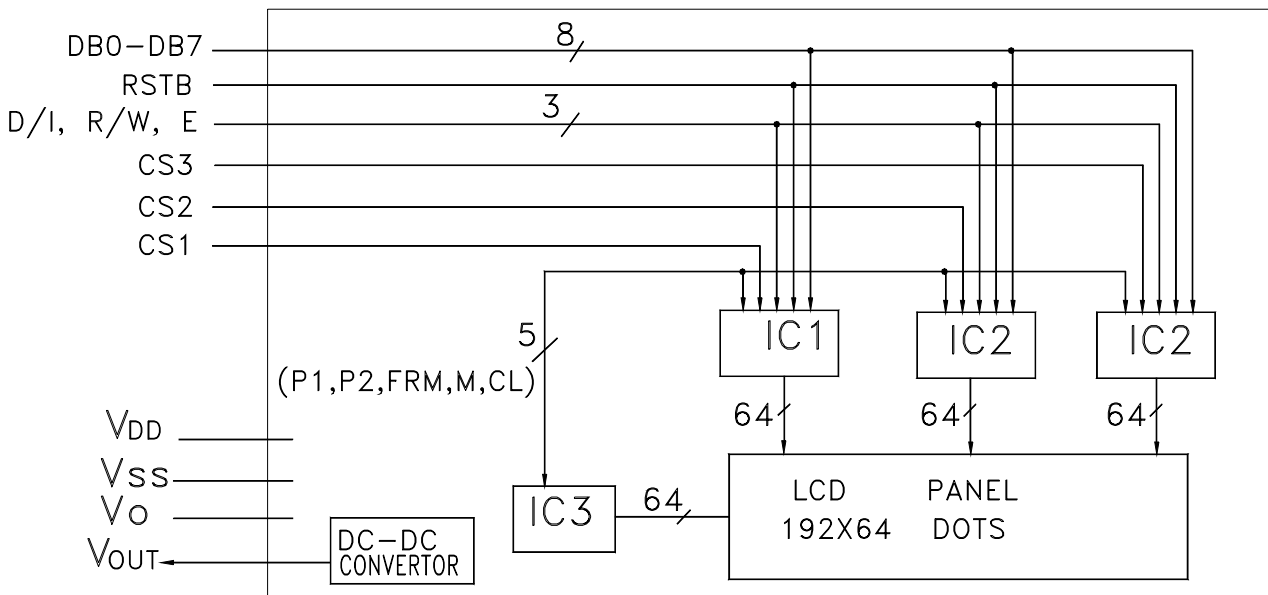
1.1 THE FEATURE OF LCD MODULE ARE AS FOLLOWS.

- . DISPLAY MODE : STN-BLUE-TRANSMISSIVER-NEGATIVE
- . DISPLAY FORMAT : 192×64 DOTS
- . INPUT DATA : 8-BITS PARALLEL DATA INPUT FROM A MPU
- . MULTIPLEXING : 1/64 DUTY
- . VIEWING DIRECTION : 6 O'CLOCK
- . DRIVED IC : KS0107B (OR EQV), KS0108B(OR EQV)
- . BUILT IN DC-DC : BIULD IN
- . BEZEL : 0.6T
- . BACKLIGHT : LED, WHITE

1.2 MECHANICAL SPECIFICATION

ITEM	SPECIFICATIONS	UNIT	REMARK
DIMENSIONAL OUTLINE	128.0(W)×63.0(H)×13.5MAX.(T)	mm	*REFERENCE DIMENSIONAL OUTLINE
VIEW AREA	103.5(W)×39.0(H)		
EFFECTIVE V/AREA	95.96(W)×31.96(H)		
NUMBER OF DOTS	192 DOTS×64 DOTS	--	
DOT PITCH	0.50(W)×0.50(H)	mm	
DOT SIZE	0.46(W)×0.46(H)	mm	

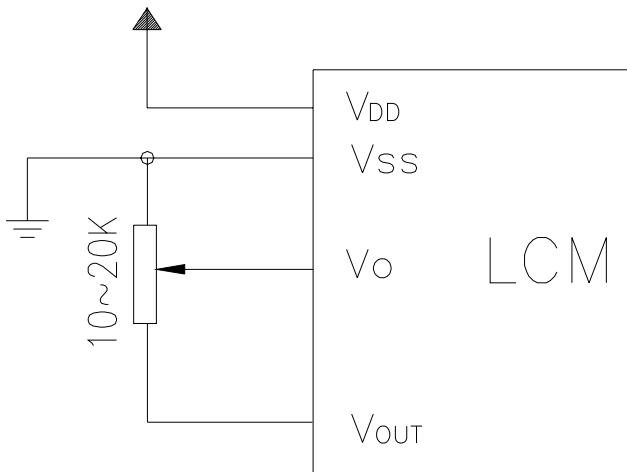
1.3 BLOCK DIAGRAM



1.4 TERMINAL FUNCTIONS

PIN NO.	SYMBOL	LEVEL	FUNCTION
1	V _{SS}	0V	Power supply(GND)
2	V _{DD}	5.0V	Power supply
3	V _o	—	Contrast Adjust
4	D/I(RS)	H/L	H: Display data L: Instruction code
5	R/W	H/L	H: Data/status read L: Data/instruction write
6	E	H, H/L	Chip enable signal
7~14	DB0-DB7	H/L	Data bus line
15	/CS1	L	Chip selection for IC1
16	/Reset	L	Reset Signal
17	/CS2	L	Chip selection for IC2
18	/CS3	L	Chip selection for IC3
19	V _{OUT}	-	Negative Voltage Output
20	BL+	-	Backlight power (+)

1-5 POWER SUPPLY CIRCUIT AND CONTRAST ADJUST



Recommended voltage: $V_{DD}-V_o = 9.1V$

2. ABSOLUTE MAXIMUM RATINGS ($T_a=25^{\circ}C$, $V_{SS}=0V$)

PARAMETER	SYMBOL	RATINGS	UNITS
Power Supply Voltage For Logic	V _{DD}	-0.3~7.0	V
Power Supply Voltage For LCD	V _{DD} -V _o	0~15.0	V
Input Voltage	V _{IN}	0~V _{DD}	V
Operating Temperature	T _{opr}	-20~+70	°C
Storage Temperature	T _{stg}	-30~+80	°C

3. ELECTRICAL CHARACTERISTICS

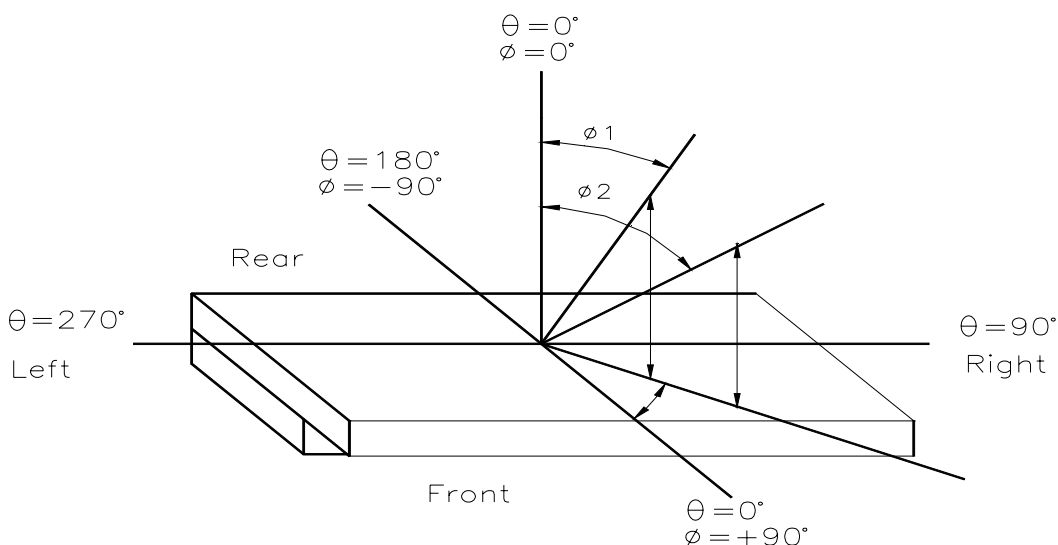
3.1 ELECTRICAL CHARACTERISTICS (Ta=25°C)

ITEM	SYMBOL	CONDITION	MIN	TYPE	MAX.	UNIT	NOTE
LOGIC CIRCUIT POWER SUPPLY VOLTAGE	V _{DD-VSS}	————	4.75	5.0	5.25	V	
INPUT VOLTAGE	V _{IH}	————	0.8V _{DD}	—	V _{DD}	V	
INPUT VOLTAGE	V _{IL}	————	GND	—	0.2V _{DD}	V	
LOGIC CIRCUIT POWER SUPPLY CURRENT	I _{DD}	V _{DD-VSS} =5.0	————	4.0	9.0	mA	
RECOMMENDED LCD DRIVING VOLTAGE	V _{OP} φ=0 θ=0	Ta=25 °C	8.2	8.5	8.8	V	

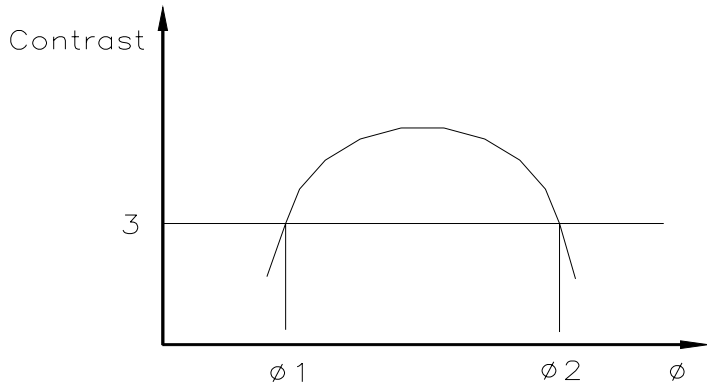
3.2 ELECTRO—OPTICAL CHARACTERISTICS (Ta=25 °C V_{DD}=5.0±0.25V)

ITEM	SYMBOL	CONDITION	MIN	TYPE	MAX	UNIT	NOTE
VIEW ANGLE	φ2-φ1	K≥3	—	50	—	DEG	NOTE1,NOTE2
CONTRAST	K	φ=0° ,θ=0°	3	5	—	—	NOTE3
FRAME FREQUENCY				128		Hz	
RESPONSE TIME	Tr(rise)	φ=0° ,θ=0°	—	250	300	ms	
	Tf(fall)	φ=0° ,θ=0°	—	300	350	ms	NOTE4

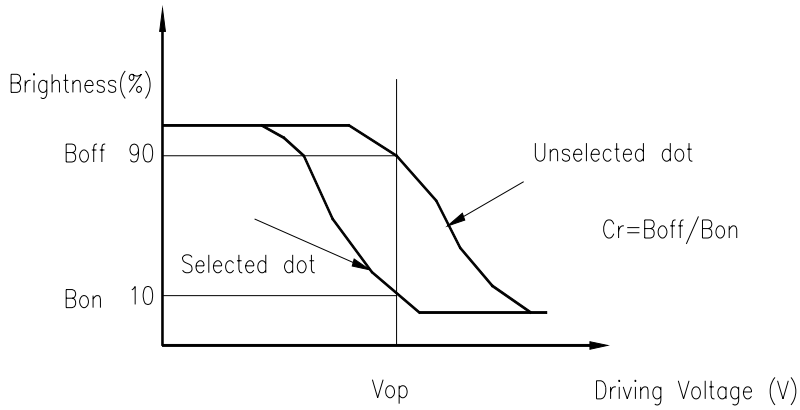
NOTE1: Definition of Viewing Angle θ, φ



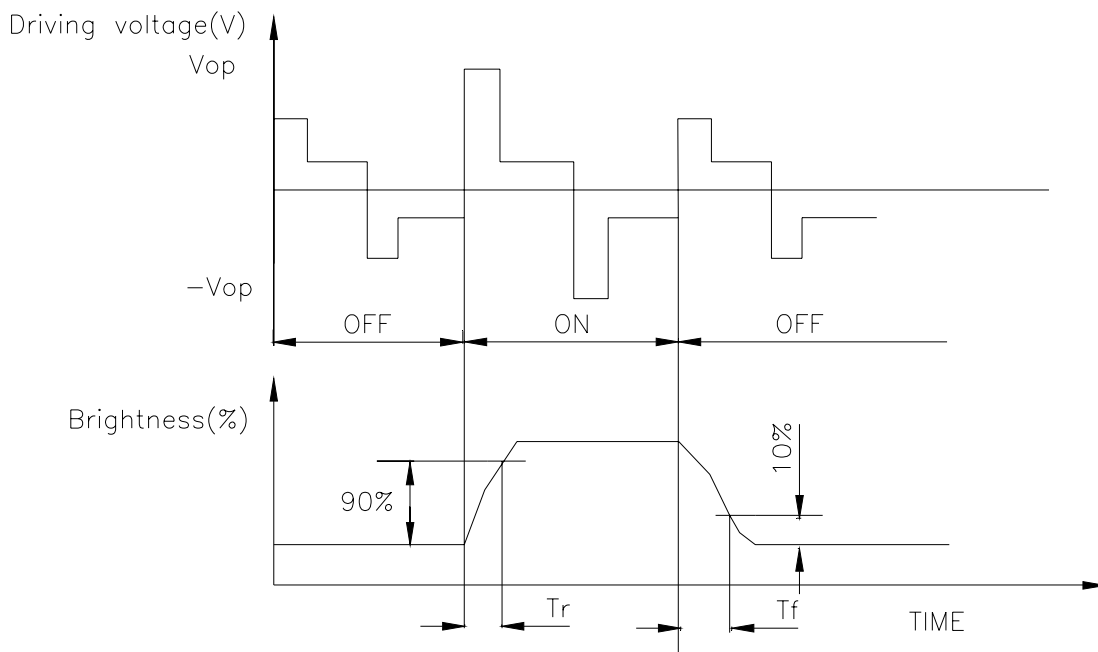
NOTE2: Definition of viewing Angle Range: $\Delta\phi = |\phi_2 - \phi_1|$



NOTE3: Definition of Contrast



NOTE4: Definition of Response Time



3-3. LED BACK-LIGHT SPECIFICATION

3-3-1.ABSOLUTE MAXIMUM RATINGS(Ta=25 °C)

ITEM	SYMBOL	RATINGS	UNIT
PEAK FORWARD CURRENT	IF	60	mA
REVERSE VOLTAGE	VR	4	V
POWER DISSIPATION	Po	0.3	W
SOLDER TEMPERATURE: 3 SEC. AT 2mm FROM THE REFLECTOR EDGE		260	°C

3-3-2. ELECTRICAL/OPTICAL SPECIFICATIONS:

ITEM	SYMBOL	STANDARD VALUE			UNIT	CONDITIONS
		MIN.	TYP.	MAX.		
FORWARD CURRENT	IF		45	54	mA	VF =5.0V Ta=25 °C Luminous is not through the LCD
LUMINOUS INTENSITY	IV	300		-	cd/m2	
COLOR		WHITE				
RANGE		X=0.26-0.32, Y=0.26-0.32				
BRIGHTNESS UNIFORMITY	△%	75%				
REVERSE CURRENT	IR	-	-	0.15	mA	VR=4V

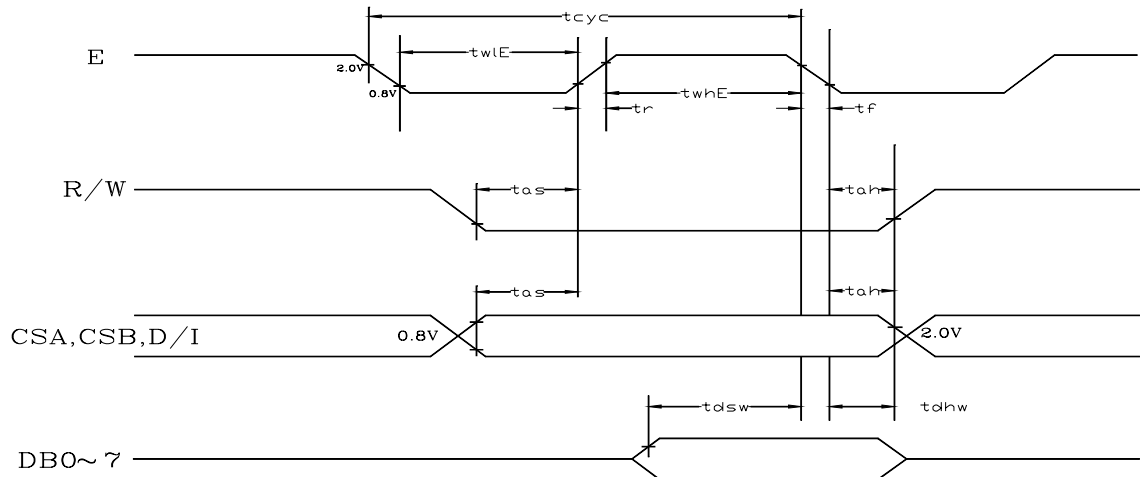
3-3-3 The LED backlight has connected to the interface Pin1 and Pin20, Add a +5.0V to Pin20 and a 0V to Pin1, the LED would be lighted.

4 BUS TIMING CHARACTERISTICS

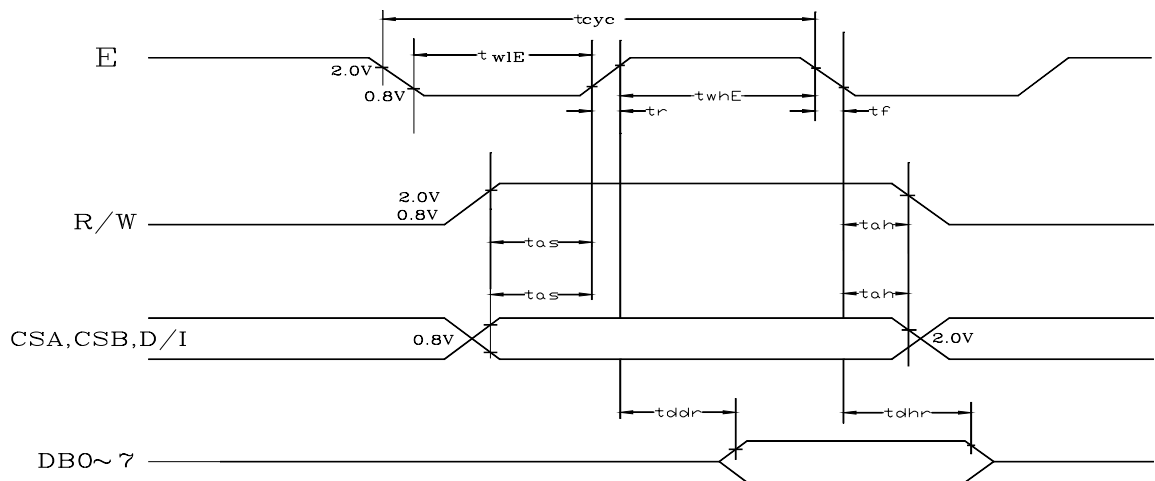
4.1 SIGNAL TIMING DAIGRAM

Characteristic	Symbol	Min.	Typ.	Max.	Unit
E cycle	t_{cyc}	1000	---	---	ns
E high level width	t_{whE}	450	---	---	ns
E low level width	t_{wlE}	450	---	---	ns
E rise time	t_r	---	---	25	ns
E fall time	t_f	---	---	25	ns
Address set-up time	t_{as}	140	---	---	ns
Address hold time	t_{ah}	10	---	---	ns
Data set-up time	t_{dsw}	200	---	---	ns
Data delay time	t_{ddr}	----	---	320	ns
Data hold time(write)	t_{dhw}	10	---	---	ns
Data hold time(read)	t_{dhr}	20	---	---	ns

MPU Write Timong



MPU Read Timong



5. OPERATING PRINCIPLES & METHODES

5.1 I/O Buffer

Input buffer controls the status between the enable and display of chip. Unless the CSA or CSB is in active mode, input or output of data and instruction do not execute. Therefore internal state is not change.

5.2 Input Register

Input register is provided to interface with MPU which is different operating frequency. Input register store the data temporarily before writing it into display data RAM.

When CSA or CSB is in the active mode, R/W and D/I select the input register. The data from MPU is written into input register and then write it into display data RAM. Data is latched when falling of the E signal and written automatically into the display data RAM by internal operation.

5.3 Output Register

Output register stores the data temporarily from display data RAM when CSA or CSB is in active mode and R/W and D/I=H. Store data in display data RAM is latched in output register. When CSA or CSB is in active mode and R/W=H, D/I=L, status data (busy check) can be read out.

To read the contents of display data RAM, twice access of read instruction is needed. In first access, data in display data RAM is latched into output register. In second access, MPU can read data which is latched. That is, to read the data in display data RAM, it needs dummy read. But status read does not need dummy read.

RS	RW	Function
0	0	Instruction
	1	Status read (busy check)
1	0	Data write (from input register to display data RAM)
	1	Data read (from display data RAM to output register)

5.4 Reset

System reset can be initialized by setting RSTB terminal at low level when turning power on, receiving instruction from MPU. When RSTB becomes low, following procedure is occurred.

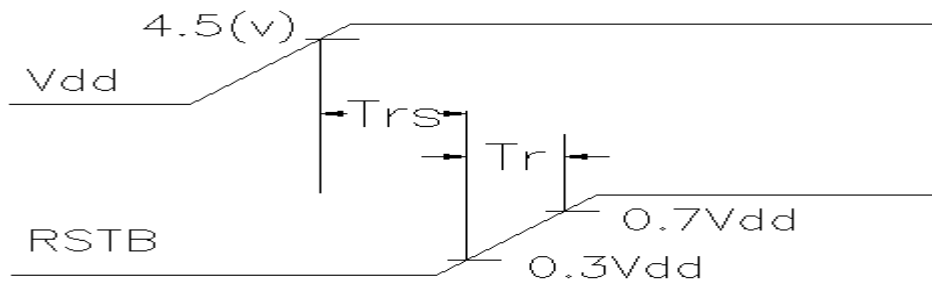
1. Display off
2. Display start line register become set by 0.(Z-address 0)

While RSTB is low level, no instruction except status read can be accepted. Reset status appears at DB4. After DB4 is low, any instruction can be accepted.

The Conditions of power supply at initial power up are shown in table 1.

Table 1. Power Supply Initial Conditions

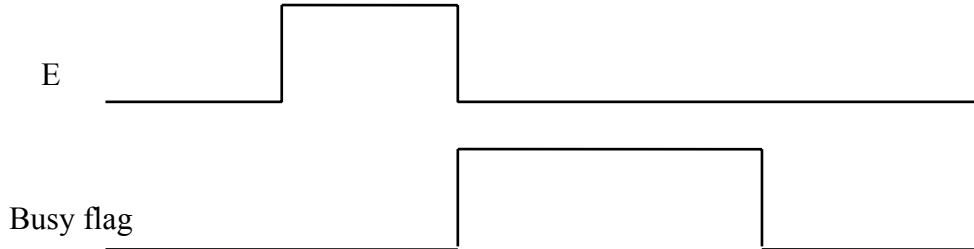
Item	Symbol	Min.	Typ.	Max.	Unit
Reset time	tRSTB	1.0	---	---	us
Rise time	tr	---	---	200	us



5.5 Busy Flag

Busy flag indicates that KS0108 is operating or not operating. When busy flag is high, KS0108 is in internal operating. When busy flag is low, KS0108 can accept the data or instruction.

DB7 indicates busy flag of the KS0108.



5.6 Display On/Off Flip-Flop

The display on/off flip-flop makes on/off the liquid crystal display. When flip-flop is reset (logical low), selective voltage or non selective voltage appears on segment output terminals. When flip-flop is set (logical high), non selective voltage appears on segment output terminals regardless of display RAM data.

The display on/off flip-flop can change status by instruction. The display data at all segments disappear while RSTB is low. The status of the flip-flop is output to DB5 by status read instruction.

5.7 X Page Register

X page register designates page of the internal display data RAM. It has not count function. An address is set by instruction.

5.8 Y Address Counter

Y address counter designates address of the internal display data RAM. An address is set by instruction and is increased by 1 automatically by read or write operations of display data.

5.9 Display Data RAM

Display data RAM stores a display data for liquid crystal display. To express on state of dot matrix of liquid crystal display, write data 1. The other way, off state write 0.

5.10 Display Start Line Register

The display start line register indicates address of display data RAM to display top line of liquid crystal display. Bit data (DB<0:5>) of the display start line set instruction is latched in display start line register. It is used for scrolling of the liquid crystal display screen.

6. DISPLAY CONTROL INSTRUCTION

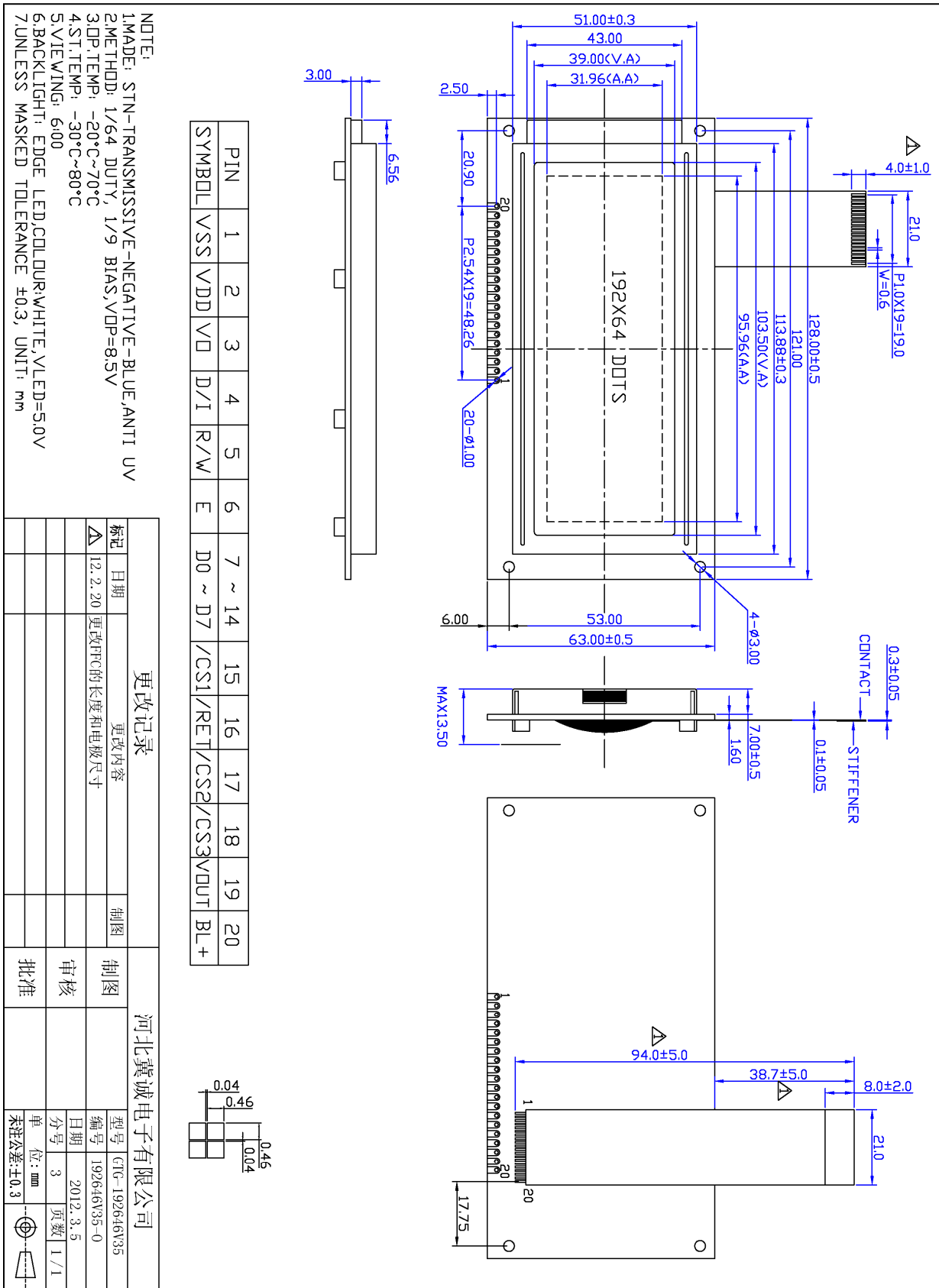
The display control instructions control the internal state of the KS0108. Instruction is received from MPU to KS0108 for the display control. The following table shows various instructions.

Instruction	D/I	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Function
Display ON/OFF	0	0	0	0	1	1	1	1	1	0/1	Controls the display on or off. Inter status and display RAM data are not affected.
Set Address	0	0	0	1	Y address (0-63)					Sets the Y address in the Y address counter.	
Set Page (X address)	0	0	1	0	1	1	1	Page (0-7)		Sets the X address at the X address register.	
Display Start Line	0	0	1	1	Display start line (0-63)					Indicates the display data RAM displayed at the top of the screen.	
Status Read	0	1	B U S Y	0	O N / O F F	R E S E T	0	0	0	0	Read status. BUSY 0: Ready 1: In operation ON/OFF 0: Display ON 1: Display OFF RESET 0: Normal 1: Reset
Write Display Data	1	0	Display Data								Writes data (DB0:7) into display data RAM. After writing instruction , Y address is increased by 1 automatically.
Read Display Data	1	1	Display Data								Read data (DB0:7) from display data RAM to the data bus.

7 DISPLAY DATA RAM ADDRESS MAP

PAGE ADDRESS	DISPLAY DATA	1ST KS0108				2ND KS0108				3TH KS0108				LINE ADDRESS	COMMON		
B8	D0													C0	COM0		
	D1													C1	COM1		
	D2													C2	COM2		
	D3													C3	COM3		
	D4													C4	COM4		
	D5													C5	COM5		
	D6													C6	COM6		
B9	D7													C7	COM7		
	D0													C8	COM8		
	D1													C9	COM9		
	D2													CA	COM10		
	D3													CB	COM11		
	D4													CC	COM12		
	D5													CD	COM13		
BA	D6													CE	COM14		
	D7													CF	COM15		
	D0													D0	COM16		
	D1													D1	COM17		
	D2													D2	COM18		
	D3													D3	COM19		
	D4													D4	COM20		
BB	D5													D5	COM21		
	D6													D6	COM22		
	D7													D7	COM23		
	D0													D8	COM24		
	D1													D9	COM25		
	D2													DA	COM26		
	D3													DB	COM27		
BC	D4													DC	COM28		
	D5													DD	COM29		
	D6													DE	COM30		
	D7													DF	COM31		
	D0													E0	COM32		
	D1													E1	COM33		
	BD	D2													E2	COM34	
D3														E3	COM35		
D4														E4	COM36		
D5														E5	COM37		
D6														E6	COM38		
D7														E7	COM39		
BE		D0													E8	COM40	
	D1													E9	COM41		
	D2													EA	COM42		
	D3													EB	COM43		
	D4													EC	COM44		
	D5													ED	COM45		
	D6													EE	COM46		
BF	D7													EF	COM47		
	D0													F0	COM48		
	D1													F1	COM49		
	D2													F2	COM50		
	D3													F3	COM51		
	D4													F4	COM52		
	D5													F5	COM53		
...	D6													F6	COM54		
	D7													F7	COM55		
	D0													F8	COM56		
	D1													F9	COM57		
	D2													FA	COM58		
	D3													FB	COM59		
	D4													FC	COM60		
...	D5													FD	COM61		
	D6													FE	COM62		
	D7													FF	COM63		
	COLUMN ADDRESS	40	41	42	---	7F	40	41	42	---	7F	40	41	42	...	7F	
	SEGMENT	SEG 1	SEG 2	SEG 3	---	SEG 64	SEG 65	SEG 66	SEG 67	---	SEG 128	SEG 129	SEG 130	SEG 131	...	SEG 192	

8. DIMENSIONAL OUTLINE



The tolerance unless specified: ±0.3mm

9.QUALITY SPECIFICATION

9-1.ACCEPTABLE QUALITY LEVEL

Inspection items	Sampling procedures	AQL
Visual-operating (Electro-optical)	ISO2859-1999 Inspection level II Normal inspection Single sample inspection	0.65
Visual-not operating	ISO2859-1999 Inspection level II Normal inspection Single sample inspection	1.5
Dimension measurement	ISO2859-1999 Inspection level II Normal inspection Single sample inspection	1.5

9-2. INSPECTION CONDITIONS

9-2-1. THE ENVIRONMENTAL

-Room temperature: 25 ± 3 °C

-Humidity: $65 \pm 20\%$ RH

9-3. INSPECTION STANDARDS

9-3-1. VISUAL WHILE OPERATING

Items to be inspected	Inspection standard
. No display	. If any pattern is not active at all, they can be rejected.
. Irregular operating	. No irregular operating are allowed . Appeared different display, which they should be chosen in the pattern, or appeared in different position where they should be chosen.
.Irregular display	. Any segment doesn't active, they can be rejected.
. Over current	. The total current required to activate the module should not be exceed the MAX current in specification.
.View angles	. Valves that don't meet the minimum value noted in the specification. they can be rejected.
.Contrast	. Valves that don't meet the minimum value noted in the specification, they can be reject.
.LCD operate voltage	. Meet the specification.

9-3-2. Visual while not operating

Module dimension	. Meet the module outline drawing, not exceed the tolerance.
LCD panel scratch	.Following scratches inside the effective viewing area considered as the defects when their width & length are larger than the following combinations. Number: one or more Width: 0.1 length: 3.0 three or more Width: 0.05 length: 2.0 three or more Width: 0.03 length: 3.0 When the defects exceed this, it can be rejected.

10.RELIABILITY

Standard Specification for Reliability of General-purpose LCM

Test Item	Test Condition	Note
High Temperature Store	80 °C,12hr.	2
Low Temperature Store	-30 °C,4hr	2
Humidity Store	40 °C,90%RH,96hr	1,2
High Temperature Operation	70°C,typical operating conditions,48hr	
Low Temperature Operation	-20°C,typical operating conditions,48hr	
Shock	Acceleration: 100m/s ² , Pulse time: 11ms, 6 times in each direction of XYZ	
Mechanical Vibration	10~55Hz sweep, 3G, ampl.=0.75mm(max) XYZ for 20 min, each.	

Note 1: Condensation of water is not permitted on the module.

Note 2: The module should be inspected after 4 hour storage in normal conditions (15~35 °C, 45~65%RH)

11. HANDLING PRECAUTION

11-1. MOUNTING METHOD

The panel of the LCD module consists of two thin glass plates with polarizes which easily get damaged since the module is fixed by utilizing fitting holes in the printed circuit board. Extreme care should be taken when handling the LCD modules.

11-2. CAUTION OF LCD HANDLING & CLEANING

When cleaning the display surface. Use soft cloth with solvent (recommended below) and wipe lightly.

- Isopropyl alcohol
- Ethyl alcohol
- Tri chlorotri fluoroethane

Do not wipe the display surface with dry or hard materials that will damage the polarizes surface.

Do not use the following solvent:

- Water
- Ketone
- Aromatics

11-3.CAUTION AGAINST STATIC CHARGE

The LCD modules use COMS LSI drivers. So we recommend that you connect any unused input terminal to Vdd or Vss, do not input any signals before power is turned on and ground your body. work/assembly table. And assembly equipment to protect against static electricity.

11-4.PACKAGING

-Modules use LCD elements, and must be treated as such avoid intense shock and falls from a height

-To prevent modules from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity.

11-5.CAUTION FOR OPERATION

-It is indispensable to drive LCM within the specified voltage limit since the higher voltage than the limit shortens LCM life.

-Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD show dark color in them.

However those phenomena do not mean malfunction or out of order with LCD, which will come

back in the specified operating temperature range.

-If the display area is pushed hard during operation. Some font will be abnormally displayed but it resumes normal condition after turning off once.

-A slight dew depositing on terminals is a cause for Electro-chemical reaction resulting in terminal open circuit.

Under the maximum operating temperature, 50%RH or less is required

11-6 STORAGE

In the case of storing for a long period of time (for instance, for years) for the purpose or replacement use. the following ways are recommended

-Storage in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it, and with no desiccant.

-Placing in a dark place where neither exposure to direct sunlight nor light is, keeping temperature in the specified storage temperature range.

-Storing with no touch on polarizes surface by the anythingelse.

(it is recommended to store them as they have been contained in the inner container at the time of delivery from us.

11-7.SAFETY

-It is recommendable to crash damaged or unnecessary LCD into pieces and wash off liquid crystal by using solvents such as acetone and ethanol, which should be burned up later.

-When any liquid crystal leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water.

12.PRECAUTION FOR USE

12-1.A limit sample should be provided by the both parties on an occasion when the both parties agree its necessity.

Judgement by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

12-2.On the following occasions, the handling of problem should be decided through discussion and agreement between representative of the both parties

-When a question is arisen in this specification.

-When a new problem is arisen which is not specified in this specifications.

-When an inspection specification change or operating condition change in customer is reported to GEM-TECH, and some problem is arisen in this specification due to the change.

-When a new problem is arisen at the customer's operating set for sample evaluation in the customer size.

13.REVISIONS HISTORY

REVISION	DATE	DESCRIPTION
1.0	2012-1-13	First release
1.1	2012-2-14	Modify the LED current and brightness.
1.2	2012-3-14	Modify the FFC.