



MULTI-INNO TECHNOLOGY CO., LTD.

www.multi-inno.com

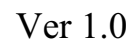
LCD MODULE SPECIFICATION

Model : MI4002G

For Customer's Acceptance:

Customer	
Approved	
Comment	

Revision	1.0
Engineering	
Date	2012-05-18
Our Reference	

[illegible]



MODE OF DISPLAY**Display mode**

- STN : ☐ Yellow green
☐ Grey
☐ Blue (negative)
☐ FSTN positive
☐ FSTN negative

Display condition

- ☐ Reflective type
☐ Transflective type
☐ Transmissive type
☐ Others

Viewing direction

- ☐ 6 O' clock
☐ 12 O' clock
☐ 3 O' clock
☐ 9 O' clock

**GENERAL DESCRIPTION**

Display mode : 40 characters x 2 lines COB LCD module
Interface : 8-bit or 4-bit parallel or serial
Driving method : 1/16 duty , 1/5 bias
Driver IC : AIP31066 ,AIP31065 or equivalent
For the detailed information, please refer to the IC specifications.

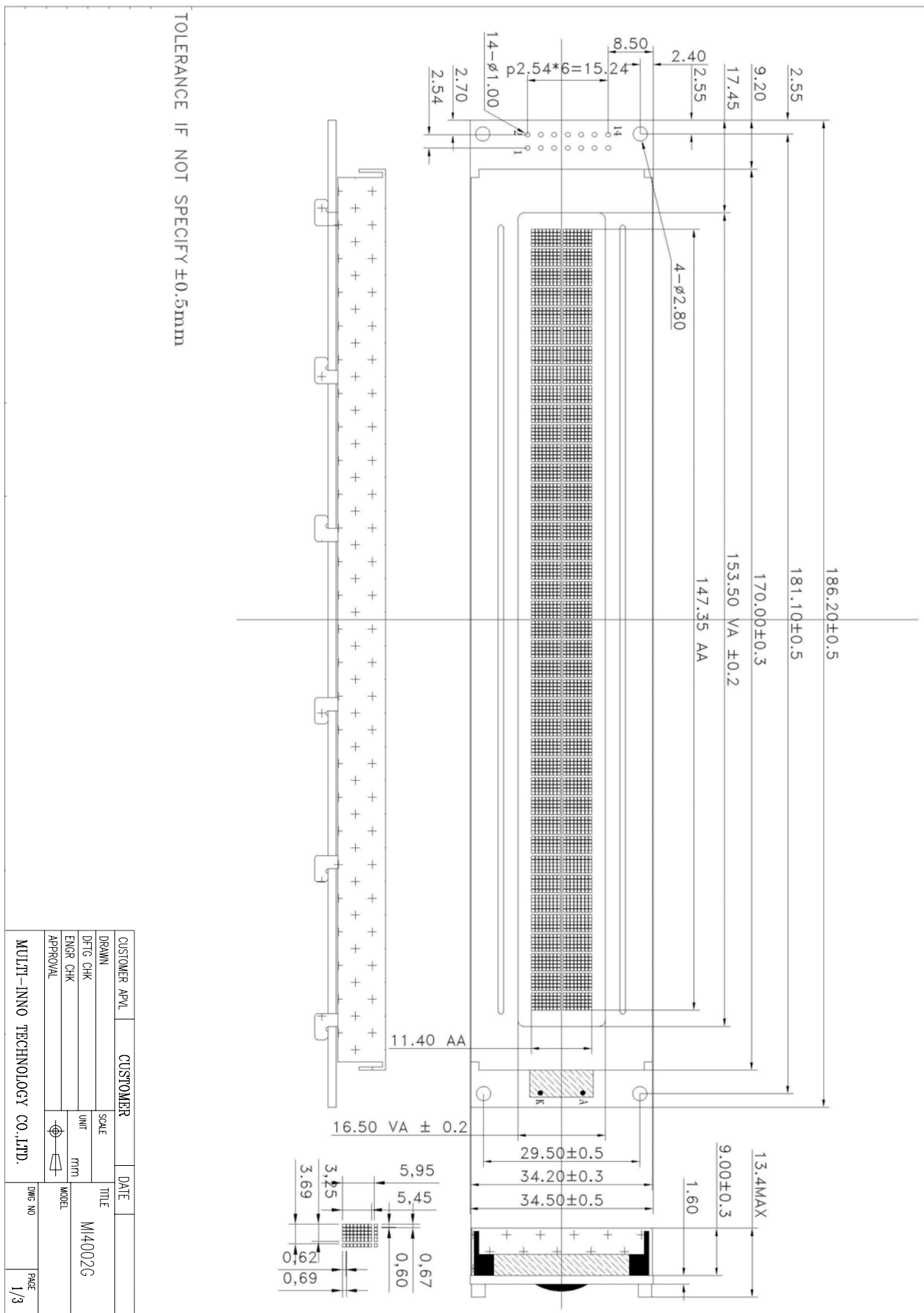
MECHANICAL DIMENSIONS

Item	Dimension	Unit	Item	Dimension	Unit
Outline Dimension	186.2(L)x34.5(W)x 13.4(Max)	mm	Dot Size	0.6(L)x0.62(W)	mm
Viewing Area	147.35(L)x16.5(W)	mm	Dot Pitch	0.67(L)x0.69(W)	mm

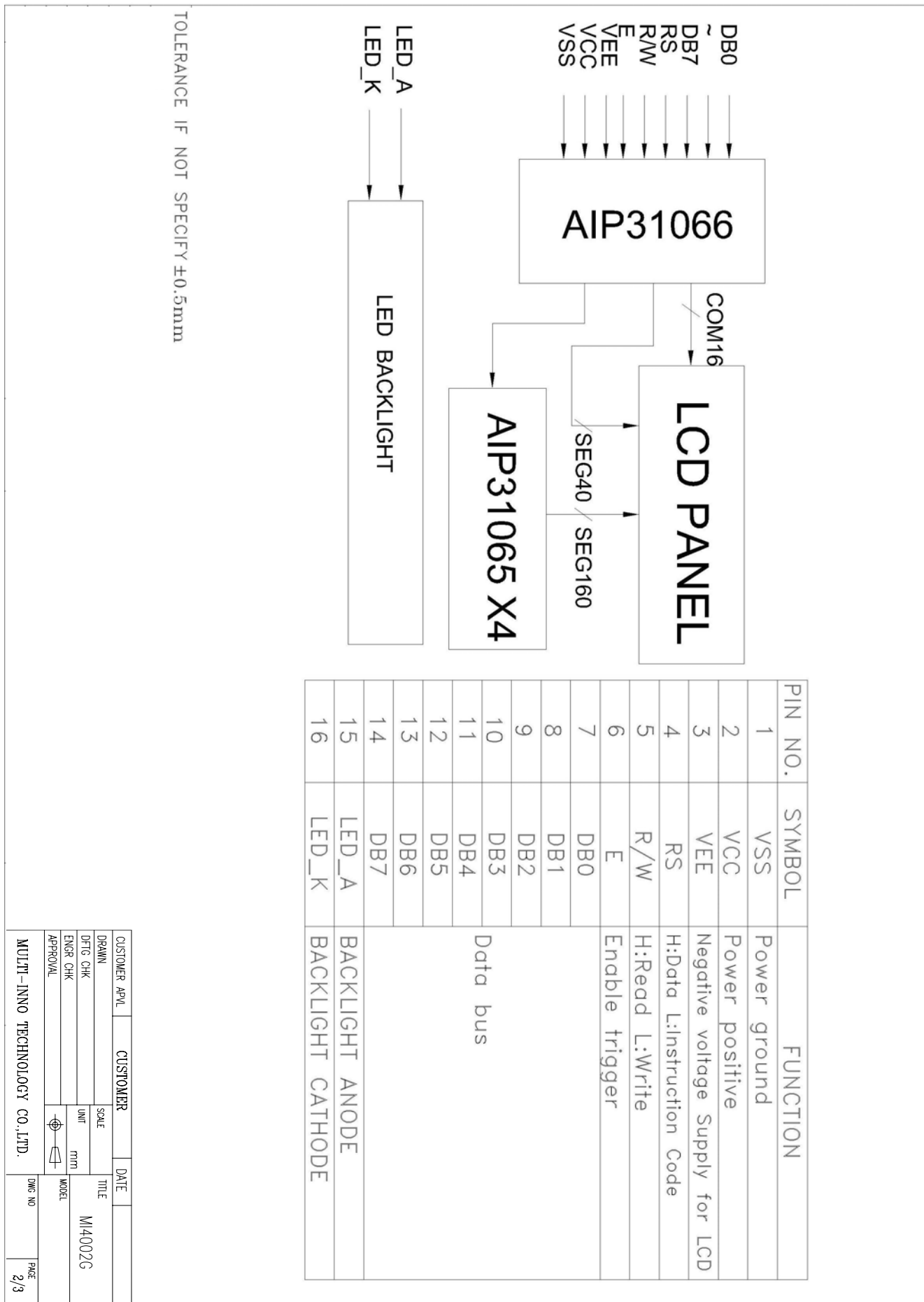
CONNECTOR PIN ASSIGNMENT

Pin No.	Symbol	Function
1	VSS	Power ground
2	VCC	Power positive
3	VEE	Negetive voltage supply for LCD
4	RS	H:Data L:Instruction Code
5	R/W	H:Read L:Write
6	E	Enable trigger
7	DB0	Data bus
8	DB1	
9	DB2	
10	DB3	
11	DB4	
12	DB5	
13	DB6	
14	DB7	
15	LED_A	BACKLIGHT ANODE
16	LED_K	BACKLIGHT CATHODE

COUNTER DRAWING OF MODULE DIMENSION



COUNTER DRAWING OF PIN OUT & BLOCK DIAGRAM



COUNTER DRAWING OF SPECIFICATION

1.General specification

Display mode : 40 Characters x 2 lines COB LCD Module
Interface : 4-bit or 8-bit parallel or serial
Driving method : 1/16 duty , 1/5 bias

2.Electrical specification

Supply voltage for logic(VDD) : 5.0V
Input voltage for LCD (VLCD) : 4.5V

3.Mechanical specification

Dot size[mm] : 0.6(L)x0.62(W)
Dot pitch[mm] : 0.67(L)x0.69(W)
Viewing area[mm] : 153.5(L)x16.5(W)
Module dimension[mm] : 186.2(L)x34.5(W)x13.4MAX.(H)

4.Backlight specification

Backlight type : Array/side-lited LED backlight
Backlight color : YELLOW GREEN
Backlight voltage : 4.2V 340mA

TOLERANCE IF NOT SPECIFY $\pm 0.5\text{mm}$

CUSTOMER APPL	CUSTOMER	DATE	TITLE
DRAWN	SCALE		
DRG CHK	UNIT	mm	MI4002G
ENGR CHK			
APPROVAL			
MULTI-INNO TECHNOLOGY CO.,LTD.			DWG NO
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**ELECTRICAL CHARACTERISTICS**

Conditions: VSS=0V, Ta=25°C

Item	Symbol	MIN.	TYP.	MAX.	Unit	Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage for Logic	VDD	4.9	5.0	5.1	V	Supply Voltage for LCD	VEE	—	—	—	V
Supply Current for Logic	IDD	—	1.2	2.5	mA	“H”Level Input Voltage	VIH	0.7VDD	—	VDD	V
Voltage Adjust for LCD	VLCD	4.3	4.5	4.7	V	“L”Level Input Voltage	VIL	-0.3	—	0.6	V
Side-lited LED Backlight Forward Voltage (VF)						Side-lited LED Backlight Forward Current (IF)					
Yellow green	VBL	—	4.2	—	V	Yellow green	IBL	—	340	—	mA

ABSOLUTE MAXIMUM RATINGS

Please make sure not to exceed the following maximum rating values under the worst application conditions.

Item	Symbol	Rating (for normal temperature)	Rating (for wide temperature)	Unit
Supply Voltage for Logic	VDD	-0.3 to 7.0	-0.3 to 7.0	V
Input Voltage for Logic	VIN	-0.3 to VDD+0.3	-0.3 to VDD+0.3	V
Operating Temperature	T _{opr}	0 to 50	-20 to 70	°C
Storage Temperature	T _{stg}	-10 to 60	-30 to 80	°C

Instructions

The instructions of AIP31066.

指令	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	执行时间 fosc=270KHZ	描述
清除显示	0	0	0	0	0	0	0	0	0	1	1.53ms	将 20H 写入 DDRAM, 将地址计数器中的地址 00H 设置为 DDRAM 地址
返回	0	0	0	0	0	0	0	0	1	-	1.53ms	将地址计数器中的地址 00H 设置为 DDRAM 地址, 并将光标恢复至初始位置, DDRAM 的内容保持不变。
输入模式设置	0	0	0	0	0	0	0	1	I/D	SH	39us	设置光标移方向, 并允许整个显示移动
显示开/关	0	0	0	0	0	0	1	D	C	B	39us	设置显示、光标, 光标的闪烁控制位。
移位	0	0	0	0	0	1	S/C	R/L	-	-	39us	设置光标移动, 显示移动方向的控制位, DDRAM 数据保持不变。
功能设置	0	0	0	0	1	DL	N	F	-	-	39us	设置接口数据长度 (DL: 8 位/4 位), 显示行数 (N: 2 行/1 行), 显示字体 (F: 5×11 点阵/5×8 点阵)

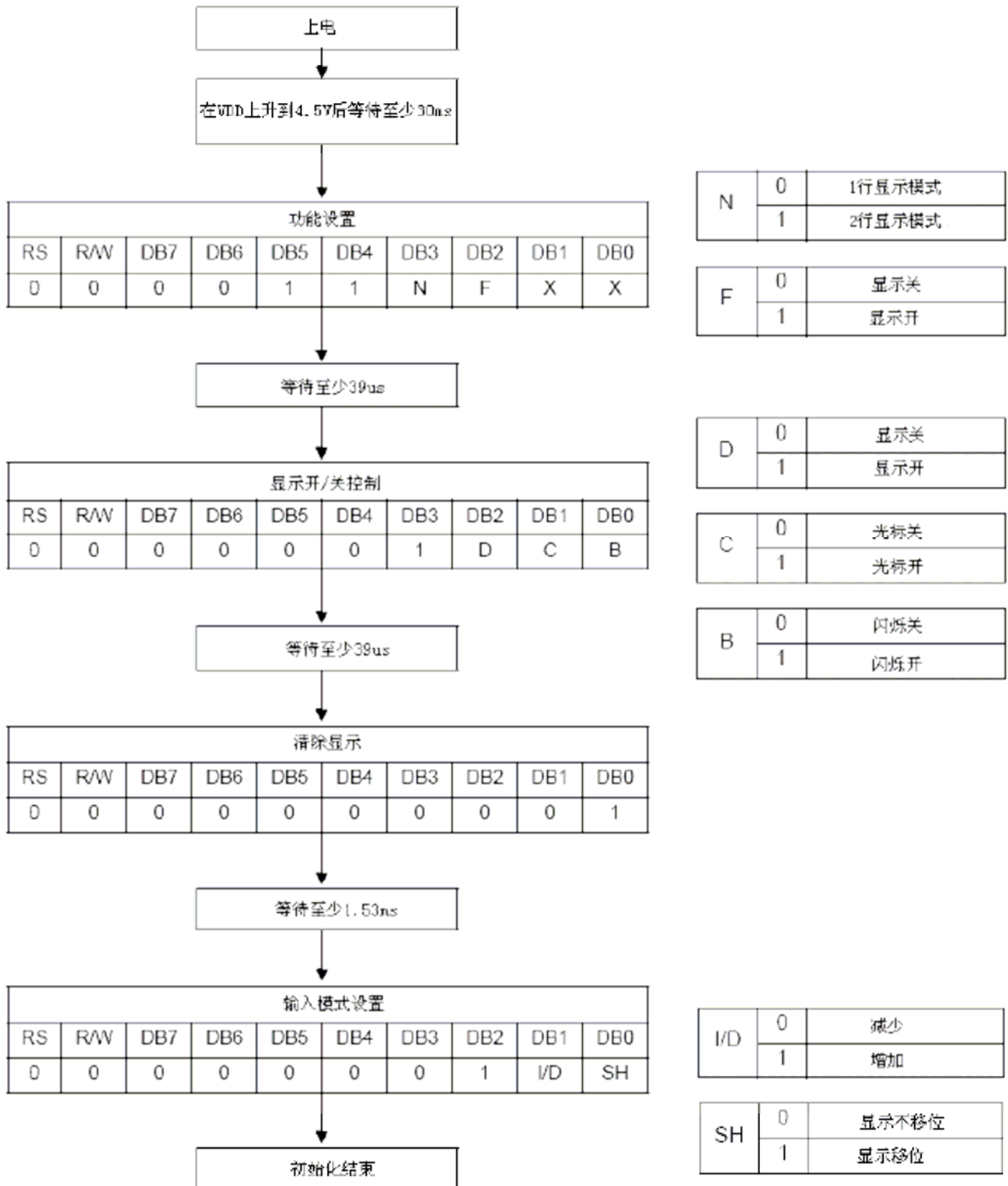


指令	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	执行时间 fosc=250KHZ	备注
设置 CG RAM 地址	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	39us	在地址计数器内设置 CGRAM 地址
设置 DD RAM 地址	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	39us	在地址计数器内设置 DDRAM 地址
读忙标志 & 地址	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	0us	通过读取 BF 观察是否内部工作正在进行中，地址计数器中的内容同时被读取
写数据	1	0	D7	D6	D5	D4	D3	D2	D1	D0	43s	写数据至内部 RAM (DDRAM/CGRAM)
读数据	1	1	D7	D6	D5	D4	D3	D2	D1	D0	43s	从内部 RAM (DDRAM/CGRAM)中读取数据

注：“-”不考虑

Initializing by Instruction

•8-bit Interface(fosc=270KHz)



4-bit Interface(fosc=270KHz)



N	0	1行显示模式
	1	2行显示模式

F	0	显示关
	1	显示开

D	0	显示关
	1	显示开

C	0	光标关
	1	光标开

B	0	闪烁关
	1	闪烁开

I/D	0	减少
	1	增加

SH	0	显示不移位
	1	显示移位

Interfacing to the MPU

1) 8位MPU接口

当接口数据长度被设置为8位，数据从8位端口（DB0~DB7）同时读出。时序图实例如下图所示：

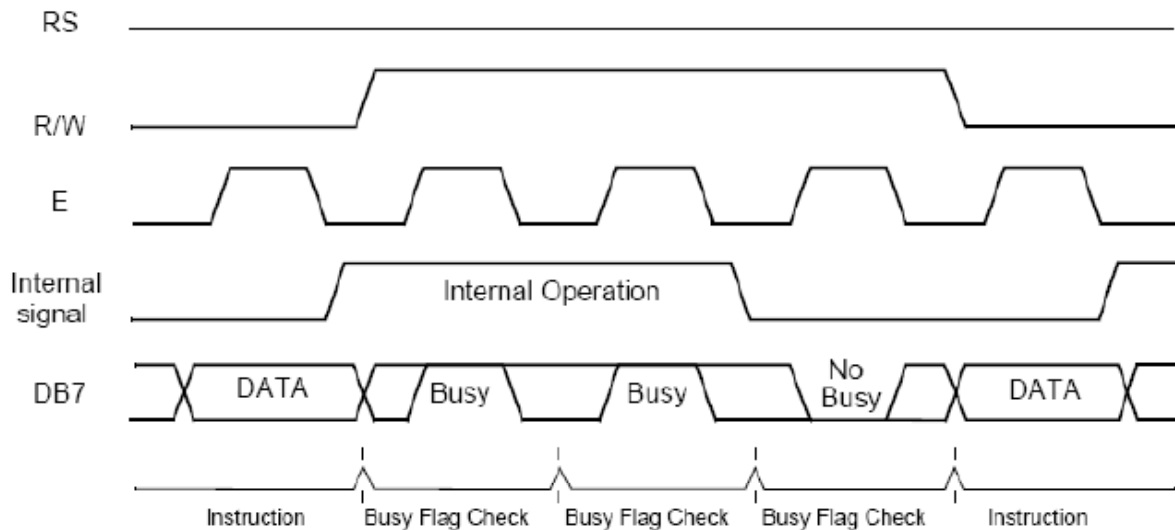


图7 .

2) 4位MPU接口

当接口数据长度被设置为4位，仅有4个端口（DB4~DB7）作为数据传输总线。高4位先传（8位数据总线模式时，DB4~DB7的内容），低4位后传（8位数据总线模式时，DB0~DB3的内容），所以第二次传输结束时，经历了两次忙标志位输出高。时序图实例如下图所示：

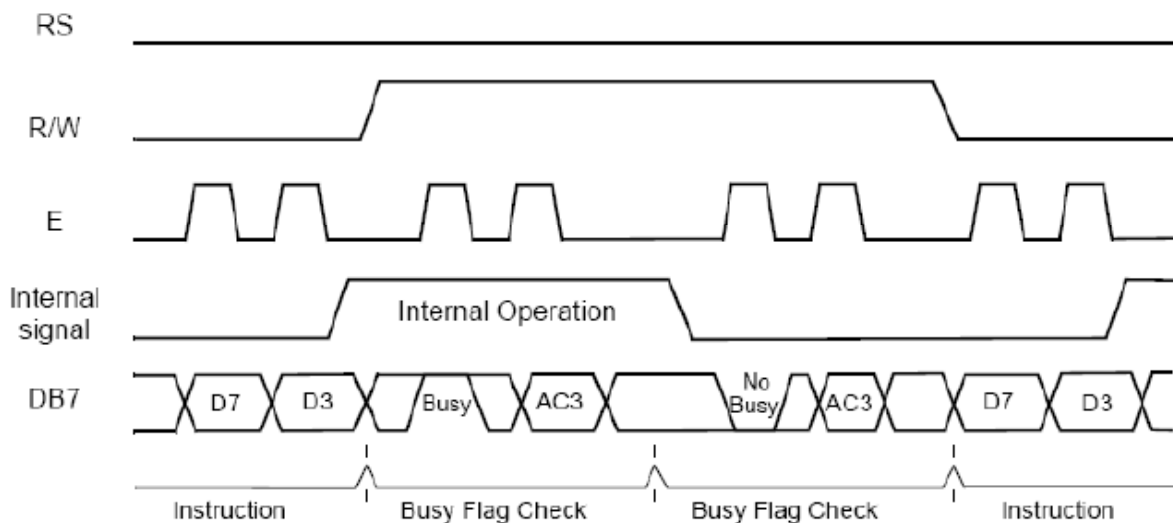


图8 .

TIMING CHARACTERISTICS

- Writing or Reading data from MPU to AIP31066.

交流特性($V_{DD} = 4.5V \sim 5.5V$, $T_a = -30 \sim +85^\circ C$)

模式	参 数	符号	最小	典型	最大	单 位
写模式 (参考图1)	E周期	t_c	500	-	-	ns
	E上升/下降时间	t_{R,t_F}	-	-	20	
	E脉冲宽度(1,0)	t_w	230	-	-	
	R/W和RS建立时间	t_{su1}	40	-	-	
	R/W和RS保持时间	t_{H1}	10	-	-	
	数据建立时间	t_{su2}	80	-	-	
	数据保持时间	t_{H2}	10	-	-	
读模式 (参考图2)	E周期	t_c	500	-	-	ns
	E上升/下降时间	t_{R,t_F}	-	-	20	
	E脉冲宽度(1,0)	t_w	230	-	-	
	R/W和RS建立时间	t_{su}	40	-	-	
	R/W和RS保持时间	t_H	10	-	-	
	数据输出延迟时间	t_D	-	-	120	
	数据保持时间	t_{DH}	5	-	-	

交流特性($V_{DD} = 2.7V \sim 4.5V$, $T_a = -30 \sim +85^\circ C$)

模式	参 数	符号	最小	典型	最大	单 位
写模式 (参考图1)	E周期	t_c	1000	-	-	ns
	E上升/下降时间	t_{R,t_F}	-	-	25	
	E脉冲宽度(1,0)	t_w	450	-	-	
	R/W和RS建立时间	t_{su1}	60	-	-	
	R/W和RS保持时间	t_{H1}	20	-	-	
	数据建立时间	t_{su2}	195	-	-	
	数据保持时间	t_{H2}	10	-	-	
读模式 (参考图2)	E周期	t_c	1000	-	-	ns
	E上升/下降时间	t_{R,t_F}	-	-	25	
	E脉冲宽度(1,0)	t_w	450	-	-	
	R/W和RS建立时间	t_{su}	60	-	-	
	R/W和RS保持时间	t_H	20	-	-	
	数据输出延迟时间	t_D	-	-	360	
	数据保持时间	t_{DH}	5	-	-	

交流特性($V_{DD}=2.7V \sim 4.5V$, $T_a = -30 \sim +85^\circ C$)

模式	参 数	符号	最小	典型	最大	单 位
接口模式 (参考图3)	时钟高/低电平脉冲宽度 (1, 0)	t_{CWH}	800	-	-	ns
	时钟上升/下降时间	t_R, t_F	-	-	25	
	时钟建立时间	t_{su1}	500	-	-	
	数据建立时间	t_{su2}	300	-	-	
	数据保持时间	t_{DH}	300	-	-	
	M延迟时间	t_{DM}	-1000	-	1000	

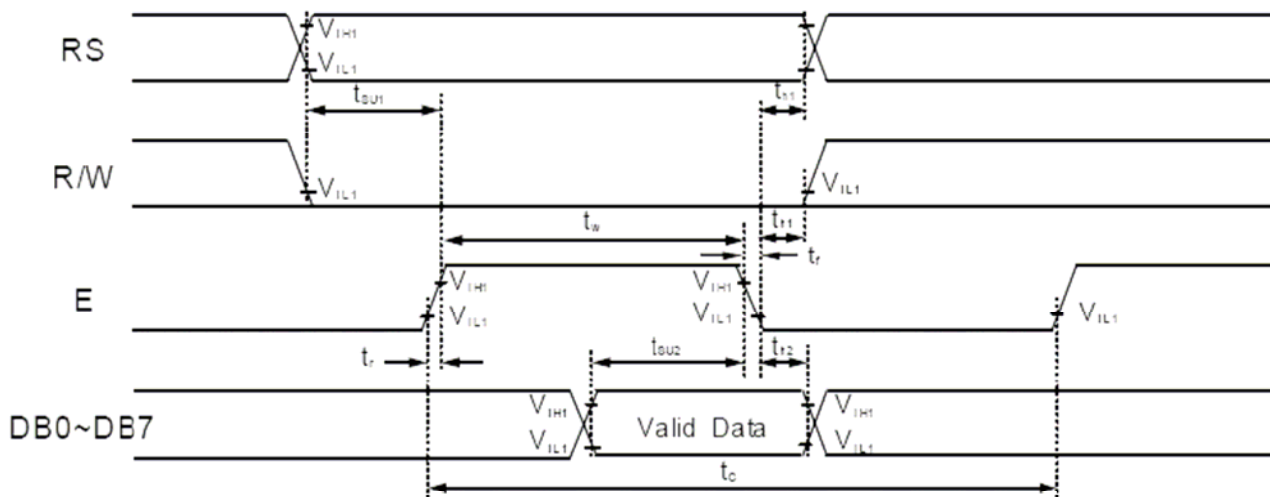


图1.

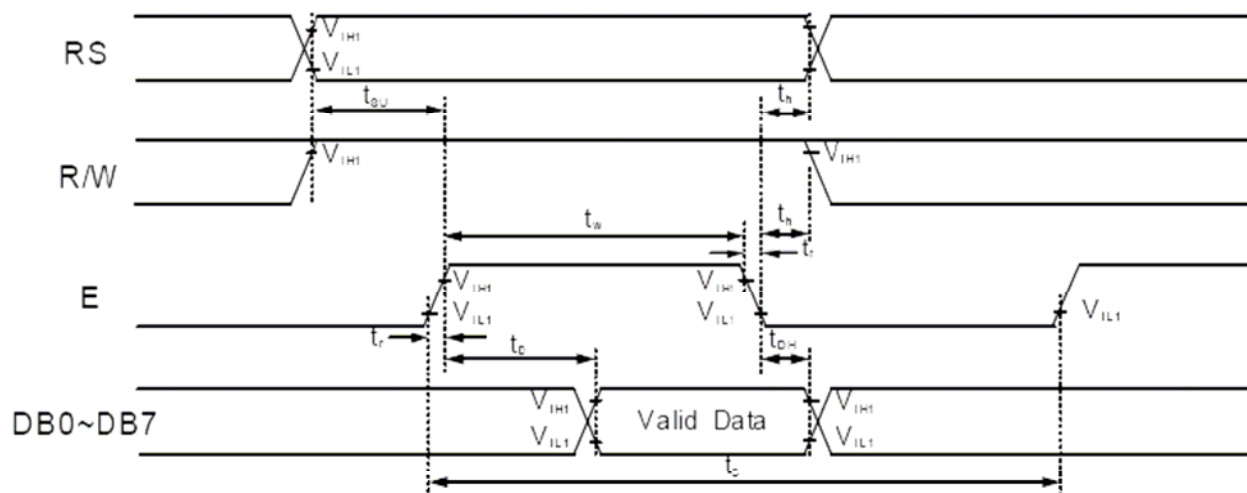


图2.

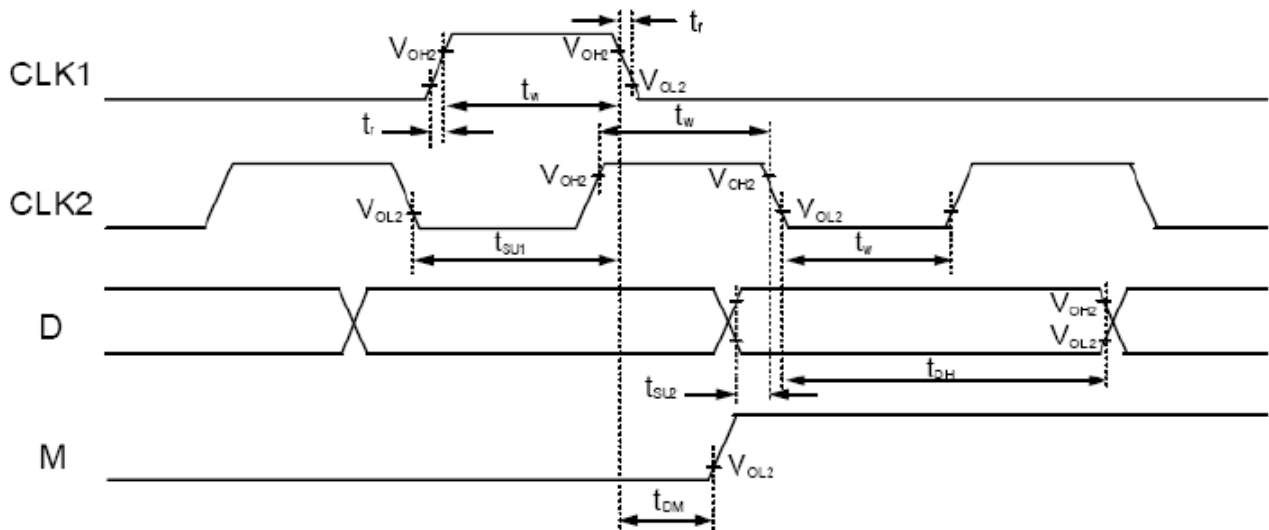


图 3.

The timing of AIP31065.

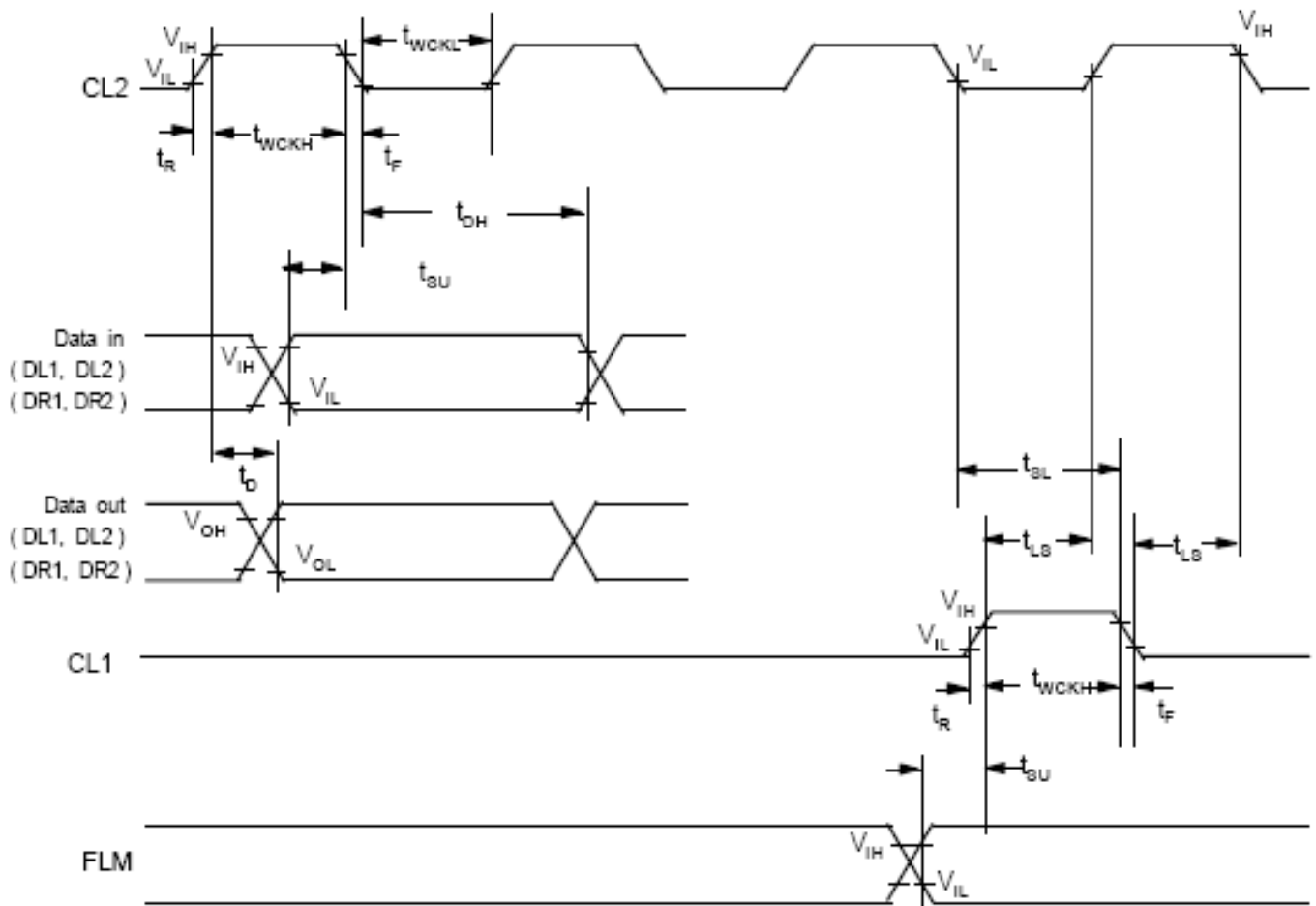


Fig 3. AC characteristics

DC Characteristics

The DC Characteristics of AIP31066.

直流特性 ($V_{DD} = 2.7V \sim 4.5V, T_a = -30 \sim +85^{\circ}C$)

参数	符号	测试条件		最小	典型	最大	单位
工作电压	V_{DD}	—		2.7	—	4.5	V
电源电流	I_{DD}	内部振荡或者外部时钟($V_{DD}=3V$ $f_{osc}=270KHz$)		—	0.15	0.3	mA
输入电压 1	V_{IH1}	—		$0.7V_{DD}$	—	V_{DD}	V
	V_{IL1}	—		-0.3	—	0.55	
输入电压 2	V_{IH2}	—		$0.7V_{DD}$	—	V_{DD}	
	V_{IL2}	—		—	—	$0.2V_{DD}$	
输出电压 1	V_{OH1}	$I_{OH} = -0.1mA$		$0.75V_{DD}$	—	—	
	V_{OL1}	$I_{OL} = 0.1mA$		—	—	$0.2V_{DD}$	
输出电压 2	V_{OH2}	$I_O = -40uA$		$0.8V_{DD}$	—	—	
	V_{OL2}	$I_O = 40uA$		—	—	$0.2V_{DD}$	
电压降	V_{dCOM}	$I_O = \pm 0.1mA$		—	—	1	
	V_{dSEG}			—	—	1	
输入漏电流	I_{IKG}	$V_{IN} = 0V \sim V_{DD}$		-1	—	1	uA
低输入电流	I_{IL}	$V_{IN} = 0V$ $V_{DD} = 3V$ (上拉)		-10	-50	-120	
内部时钟频率	f_{OSC1}	$R_f = 75K\Omega \pm 2\%$ $V_{DD} = 3V$		190	270	350	KHz
外部时钟频率	f_{OSC2}	—		125	270	410	KHz
	duty			45	50	55	%
	t_R, t_F			—	—	0.2	us
LCD 驱动电压	V_{LCD1}	$V_{DD} - V_5$	1/5 偏置	3.0	—	13.0	V
	V_{LCD2}		1/4 偏置	3.0	—	13.0	

The DC Characteristics of AIP31065.

1. 静态参数(若无其它规定, $T_a = -30 \sim +85^\circ\text{C}$, $V_{DD} = 2.7\text{V} \sim 5.5\text{V}$, $V_{DD} - V_{EE} = 3\text{V} \sim 13\text{V}$, $V_{SS} = 0\text{V}$)

参 数	符号	测试条件	最小	最大	单位	适用管脚
电源电流	I_{DD}	$f_{CL2} = 400\text{KHz}$	—	1	mA	—
	I_{EE}	$f_{CL1} = 1\text{KHz}$	—	10	uA	
输入电压	V_{IH}		$0.7 V_{DD}$	V_{DD}	V	CL1, CL2, DL1 DL2, DR1, DR2 SHL1, SHL2, M FCS
	V_{IL}		0	$0.3 V_{DD}$	V	
输入漏电流	I_{Ik_g}	$V_{IN} = 0 - V_{DD}$	-5	5	uA	
输出电压	V_{OH}	$I_{OH} = -0.4\text{mA}$	$V_{DD} - 0.4$	—	V	DL1, DL2, DR1, DR2
	V_{OL}	$I_{OL} = +0.4\text{mA}$	—	0.4	V	
电压下降	V_{D1}	$I_{ON} = 0.1\text{mA}$, SC1~SC40	—	1.1	V	V (V1~V6) —V(SC1~SC40)
	V_{D2}	$I_{ON} = 0.05\text{mA}$, SC1~SC40	—	1.5	V	
漏电流	I_{V1}	$V_{IN} = V_{DD} \sim V_{EE}$ SC1~SC40 悬空	-10	10	uA	V1~V6

2. 动态参数(若无其它规定, $T_a = -30 \sim +85^\circ\text{C}$, $V_{DD} = 2.7\text{V} \sim 5.5\text{V}$, $V_{DD} - V_{EE} = 3\text{V} \sim 13\text{V}$, $V_{SS} = 0\text{V}$)

参 数	符 号	测试条件	最小	最大	单位	适用管脚
数据移位频率	f_{CL}	—	—	400	KHz	CL2
时钟高电平脉宽	t_{WCKH}	—	800	—	Ns	CL1, CL2
时钟低电平脉宽	t_{WCKL}	—	800	—	Ns	CL2
时钟建立时间	t_{SL}	从 CL2 到 CL1	500	—	Ns	CL1, CL2
	t_{LS}	从 CL1 到 CL2	500	—	Ns	
时钟上升/下降时间	$T_{R/F}$	—	—	200	Ns	
数据建立时间	t_{SU}	—	300	—	Ns	DL1, DL2, DR1 DR2, FLM
数据保持时间	t_{DH}	—	300	—	Ns	
数据延迟时间	t_D	CL=15pF	—	500	Ns	DL1, DL2 DR1, DR2

**ELECTRO-OPTICAL CHARACTERISTICS**

MEASURING CONDITION: POWER SUPPLY = V_{OP} / 64 Hz
 TEMPERATURE = 23 ± 5 °C
 RELATIVE HUMIDITY = 60 ± 20 %

ITEM	SYMBOL	UNIT	TYP	DEFINITION
RESPONSE TIME	T_{on}	ms	150	APPEND 2
	T_{off}	ms	190	APPEND 2
D.C. RESISTANCE	R_{LC}	MΩ	100	APPEND 3
CURRENT CONSUMPTION	I_{op}	μA	100	APPEND 3
CONTRAST RATIO	C_r	-	15	-
VIEWING ANGLE ($C_r \geq 2$)	$V_{3:00}$	°	45	APPEND 4
	$V_{6:00}$	°	70	APPEND 4
	$V_{9:00}$	°	45	APPEND 4
	$V_{12:00}$	°	60	APPEND 4

THE ELECTRO-OPTICAL CHARACTERISTICS ARE MEASURED VALUE BUT NOT GUARANTEED ONES.

RELIABILITY OF LCD MODULE

ITEM	TEST CONDITION	TIME
High temperature operating	70°C	240 hours
Low temperature operating	-20°C	240 hours
High temperature storage	80°C	240 hours
Low temperature storage	-30°C	240 hours
Temperature-humidity storage	60°C 90% R.H.	96 hours
Temperature cycling	-30°C <=> 80°C 30 MIN DWELL	5 cycles
Vibration Test at LCM Level	Freq 10-55 Hz Sweep rate: 10-55-10 at 1 min Sweep mode Linear Displacement: 2 mm p-p 1 Hour each for X, Y, Z	—

SAMPLING METHOD

SAMPLING PLAN: MIL-STD 105E

CLASS OF AQL: LEVEL II/ SINGLE SAMPLING
MAJOR-0.65% MINOR – 1.5%

QUALITY STANDARD

DEFECT	CRITERIA	TYPE	FIGURE
SHORT CIRCUIT	-	MAJOR	-
MISSING SEGMENT	-	MAJOR	-
UNEVEN / POOR CONTRAST	-	MAJOR	-
CROSS TALK	-	MAJOR	-
PIN HOLE	$\text{MAX}(a,b) \leq 1/4 W$	MINOR	1
EXCESS SEGMENT	$\text{MAX}(c,d) \leq 1/4 T$	MINOR	1
BUBBLES	$d^* \leq 0.2$ QTY=2	MINOR	2
BLACKS SPOTS	$d \leq 0.2$ QTY ≤ 2 $0.2 < d \leq 0.3$ QTY ≤ 1 $d > 0.3$ QTY=0	MINOR	2
LINE SCRATCHES	$x \leq 0.5$ $y \leq 0.05$ QTY=1	MINOR	3
BLACK LINE	$x \leq 0.5$ $y \leq 0.05$ QTY=1	MINOR	3

*d = MAX (d₁,d₂)

** N. A . = NOT APPLICABLE

DEFECT TABLE : B

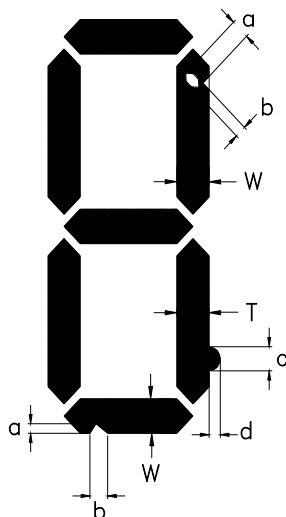
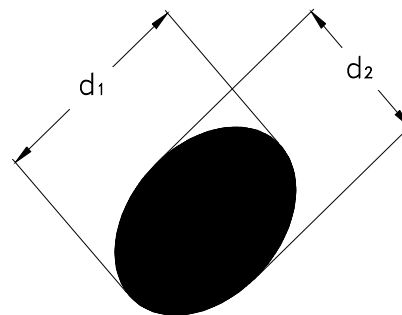
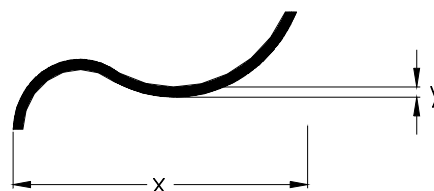


fig . 1



POLARIZER BUBBLES / SPOTS

fig . 2



LINE SCRATCHES / BLACK LINE

fig . 3

QUALITY STANDARD (CONT .)

DEFECT		CRITERIA	TYPE	FIGURE
CHIPS	CONTACT EDGE	$e \leq 1/2T$ $f < 1/4W$ $g < 2.0$	MINOR	4
	BOTTOM GLASS	$P < 0.5$ $q < 2.0$ $r < 1/2T$		4
	CORNER	$a \leq 1.5$ $b \leq 1/2W$		4
	TOP GLASS	$a < 2.5$ $b < 1/2T$ $c < 1/3W$		5
GLASS PROTRUSION		$a < 1/5 W$	MINOR	6
RAINBOW		-	MINOR	-

UNLESS STATE OTHERWISE ,

ALL UNIT ARE IN MILLIMETER .

DEFECT TABLE : B

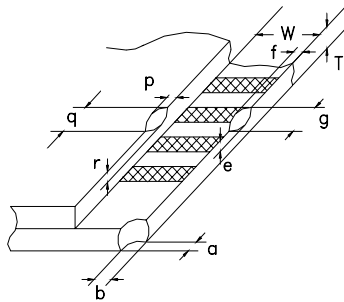


fig . 4

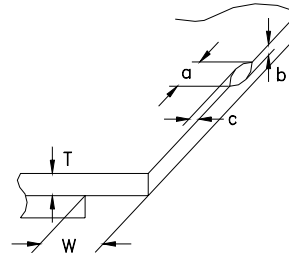


fig . 5

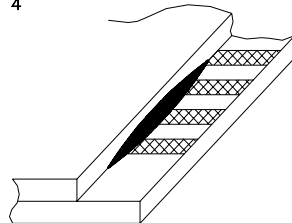


fig . 6

HANDLING PRECAUTIONS

(1) CAUTION OF LCD HANDLING & CLEANING

The polarizing plate on the surface of the panel is made from organic substances. Be very careful for chemicals not to touch the plate or it leads the polarizing plate to deteriorate.

If the use of a chemical is unavoidable, wipe the panel lightly with soft materials, such as gauze and absorbent cotton, soaked in a solvent.

*Usable solvent: Alcohol (ethanol, IPA and the like)

*Appropriate solvent: Ketones, ethyl alcohol

Avoid wiping with a dry cloth, since it could damage the surface of the polarizing plate and others.

(2) CAUTION AGAINST STATIC CHARGE

The LCD modules use CMOS LSI drivers, so customers are recommended that any unused input terminal would be connected to V_{DD} or V_{SS} , do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

(3) PACKAGING

Avoid intense shock and falls from a height and do not operate or store them exposed to direct sunshine or high temperature/humidity for long periods.

(4) CAUTION FOR OPERATION

Driving voltage should be kept within specified range, excess voltage shortens display life.

Response time increases with decrease in temperature.

Display may turn black or dark Blue at temperature above its operational range; this is however not destructive and the display will return to normal once the temperature falls back to range.

Mechanical disturbance during operation (such as pressing on the viewing area) may cause the segments to appear “fractured”. They will recover once the display is turned off.

Condensation at terminals will cause malfunction and possible electrochemical reaction. Relative humidity of the environment should therefore be kept below 60%.

(5) SAFETY

Liquid crystal may leak out of a damaged LCD, it is recommended to wash off the liquid crystal by using solvents such as acetone or ethanol and should be burned up later.

If any liquid leaks out of a damaged glass cell comes in contact with your hands, wash it off with soap and water immediately.

WARRANTY

MULTI-INNO will replace or repair any of her LCD module in accordance with her LCD specification for a period of one year from date of shipment. The warranty liability of MULTI-INNO is limited to repair and/or replacement. MULTI-INNO will not be responsible for any subsequent or consequential event.