



MULTI-INNO TECHNOLOGY CO., LTD.

LCD MODULE SPECIFICATION

Model : MI4002E

Revision	1.0
Engineering	
Date	
Our Reference	

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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

Driving method : 1/16 duty , 1/5 bias

Driver IC : ST7066U,ST7065C or equivalent

For the detailed information, please refer to the IC specifications.

MECHANICAL DIMENSIONS

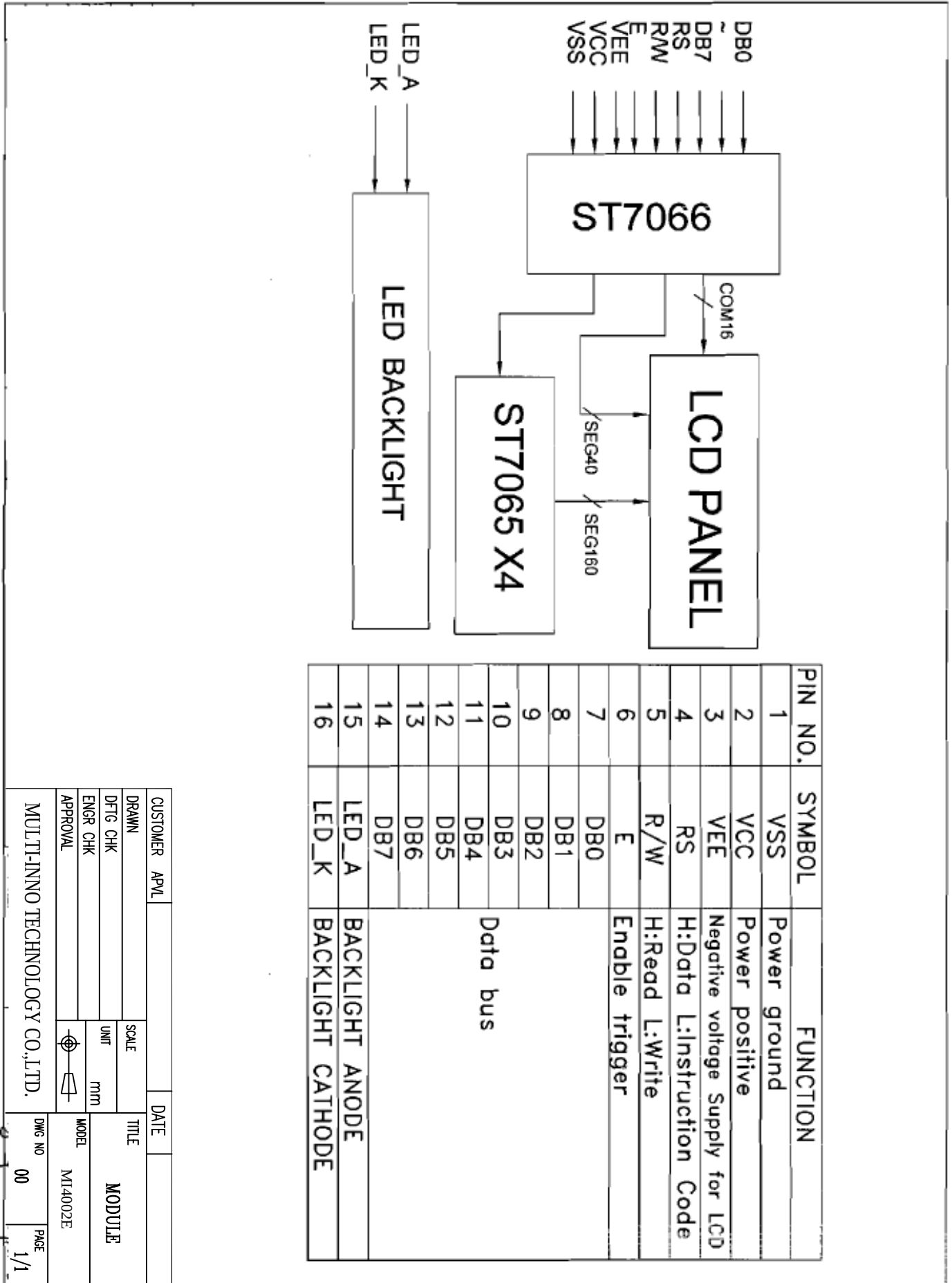
Item	Dimension	Unit	Item	Dimension	Unit
Outline Dimension	182.0(L)x33.5(W)x 11.0(Max)	mm	Dot Size	0.6(L)x0.65(W)	mm
Viewing Area	154.4(L)x15.8(W)	mm	Dot Pitch	0.65(L)x0.7(W)	mm

CONNECTOR PIN ASSIGNMENT

Pin No.	Symbol	Function
1	VSS	Ground (0V)
2	VCC	Power supply voltage for logic
3	VEE	Power supply voltage for LCD drive
4	RS	Register select signal
5	R/W	Read / Write
6	E	Enable signal
7	DB0	Data bus
8	DB1	
9	DB2	
10	DB3	
11	DB4	
12	DB5	
13	DB6	
14	DB7	
15	LED_A	Power supply for LED backlight(VBL+)
16	LED_K	Power supply for LED backlight(VBL-)

[illegible]

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)	: 5.0V		
3.Mechanical specification			
Dot size[mm]	: 0.6(L)x0.65(W)		
Dot pitch[mm]	: 0.65(L)x0.7(W)		
Viewing area[mm]	: 154.4(L)x15.8(W)		
Module dimension[mm]	: 182.0(L)x33.5(W)x11.0MAX.(H)		
4.Backlight specification			
Backlight type	: Side-lited LED backlight		
Backlight color	: YELLOW GREEN/WHITE/BLUE		
Backlight voltage	: 5.0V@151mA		

CUSTOMER	APVL	DATE	
DRAWN		SCALE	TITLE
DFIG CHK		UNIT	MODULE
ENGR CHK		mm	
APPROVAL			MODEL
MULTI-INNO TECHNOLOGY CO.,LTD.		DWG NO	MT14002E
		00	PAGE 1/1

CUSTOMER	APVL	DATE	
DRAWN		SCALE	TITLE
DFTG CHK		UNIT	mm
ENGR CHK		MODEL	MI4002E
APPROVAL			
MULTI-INNO TECHNOLOGY CO.,LTD.		DWG NO	00
		PAGE	1/1

**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	4.8	5.0	5.2	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	—	5.0	—	V	Yellow green	IBL	—	151	—	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 ST7066U.

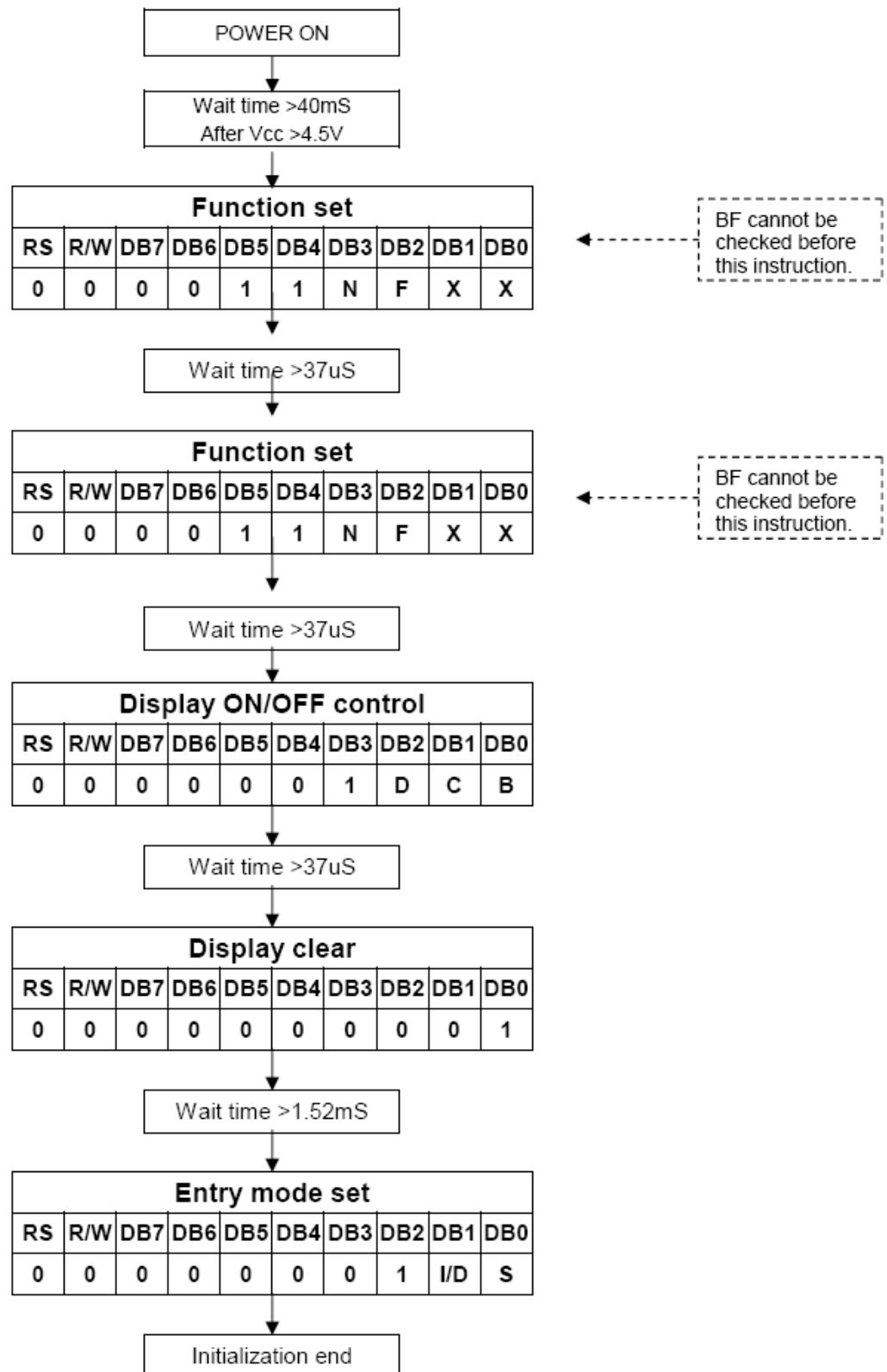
Instruction	Instruction Code										Description	Description Time (270KHz)
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM. and set DDRAM address to "00H" from AC	1.52 ms
Return Home	0	0	0	0	0	0	0	0	1	x	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.52 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.	37 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	37 us
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	x	x	Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.	37 us
Function Set	0	0	0	0	1	DL	N	F	x	x	DL:interface data is 8/4 bits N:number of line is 2/1 F:font size is 5x11/5x8	37 us
Set CGRAM address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter	37 us
Set DDRAM address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter	37 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 us
Write data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM)	37 us
Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM)	37 us

Note:

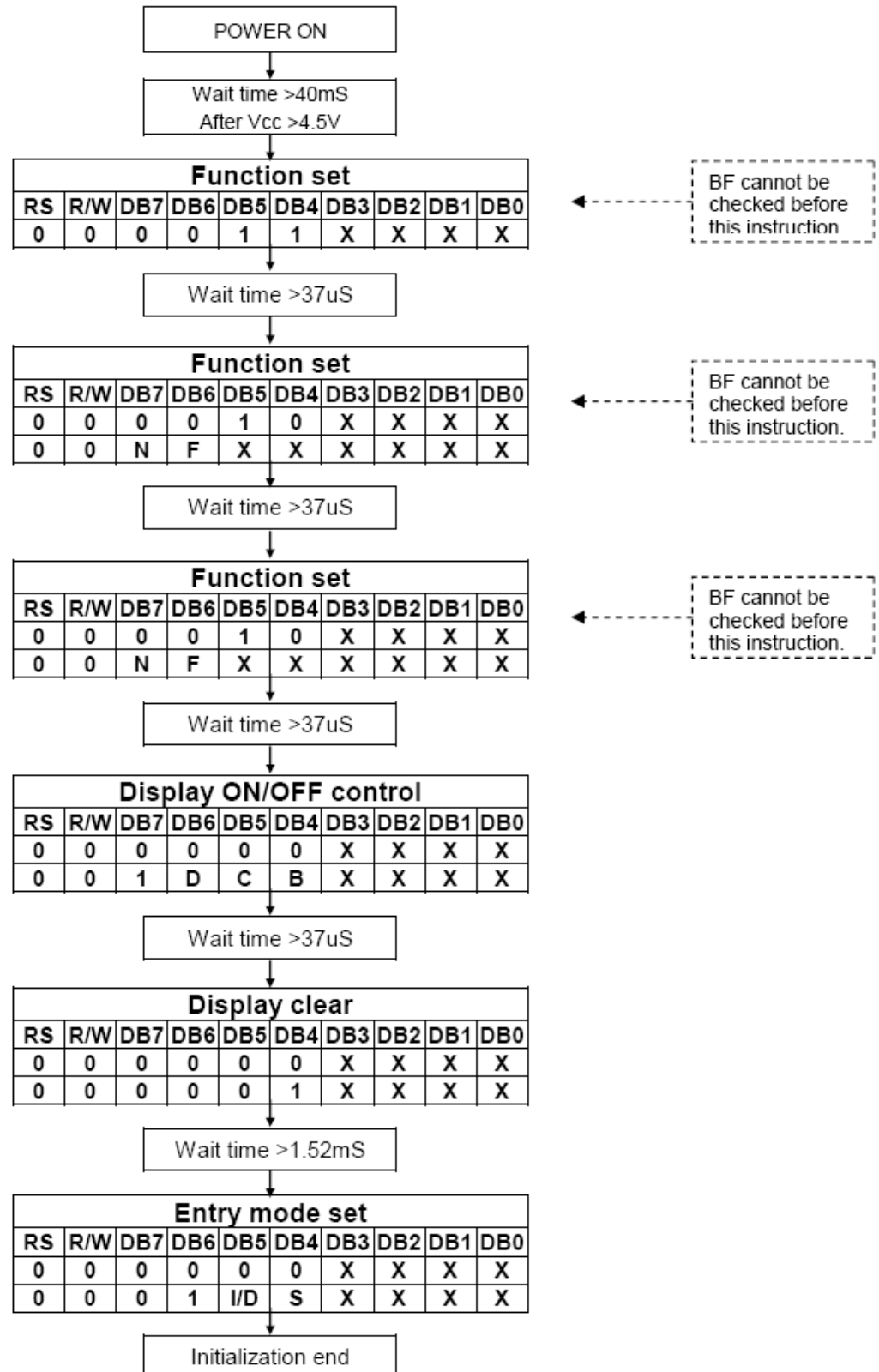
Be sure the ST7066U is not in the busy state (BF = 0) before sending an instruction from the MPU to the ST7066U. If an instruction is sent without checking the busy flag, the time between the first instruction and next instruction will take much longer than the instruction time itself. Refer to Instruction Table for the list of each instruction execution time.

Initializing by Instruction

- 8-bit Interface (fosc=270KHz)



● 4-bit Interface (fosc=270KHz)

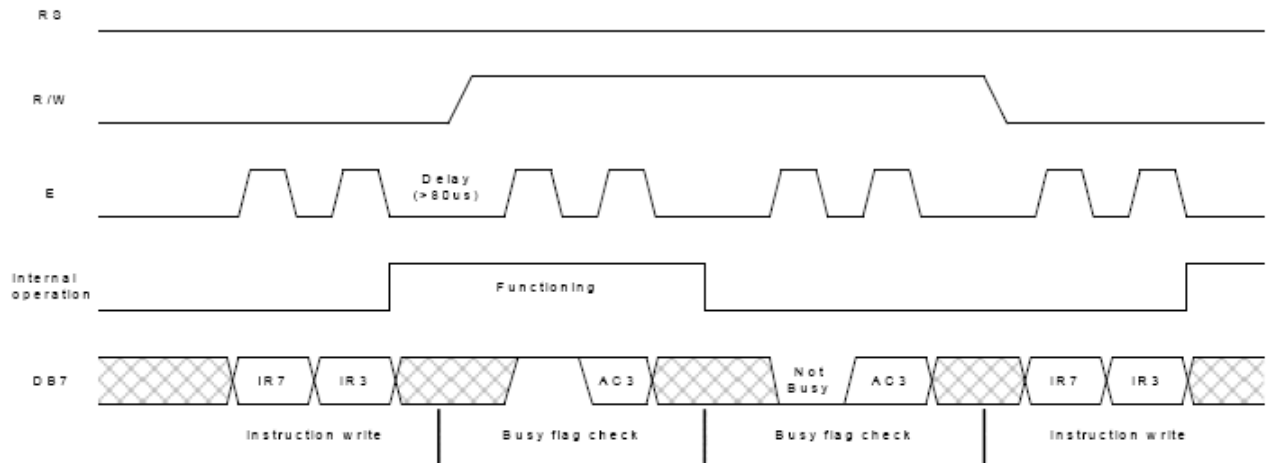


Interfacing to the MPU

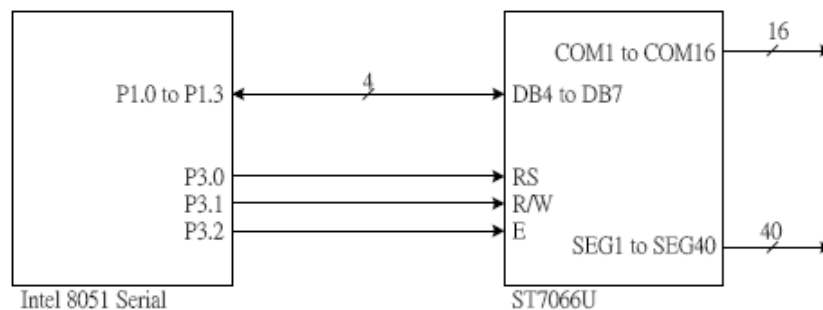
The ST7066U can send data in either two 4-bit operations or one 8-bit operation, thus allowing interfacing with 4- or 8-bit MPU.

- **For 4-bit interface data, only four bus lines (DB4 to DB7) are used for transfer.** Bus lines DB0 to DB3 are disabled. The data transfer between the ST7066U and the MPU is completed after the 4-bit data has been transferred twice. As for the order of data transfer, the four high order bits (for 8-bit operation, DB4 to DB7) are transferred before the four low order bits (for 8-bit operation, DB0 to DB3). The busy flag must be checked (one instruction) after the 4-bit data has been transferred twice. Two more 4-bit operations then transfer the busy flag and address counter data.

➤ Example of busy flag check timing sequence

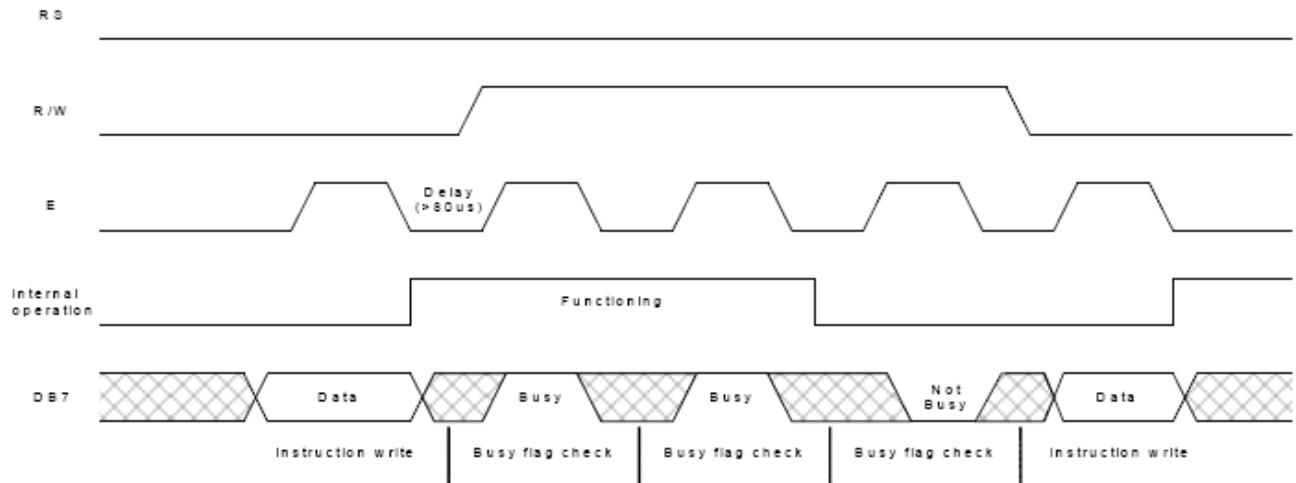


➤ Intel 8051 interface

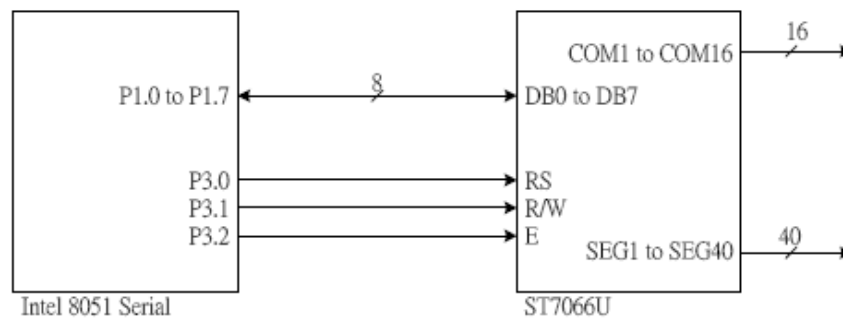


- For 8-bit interface data, all eight bus lines (DB0 to DB7) are used.

➤ Example of busy flag check timing sequence

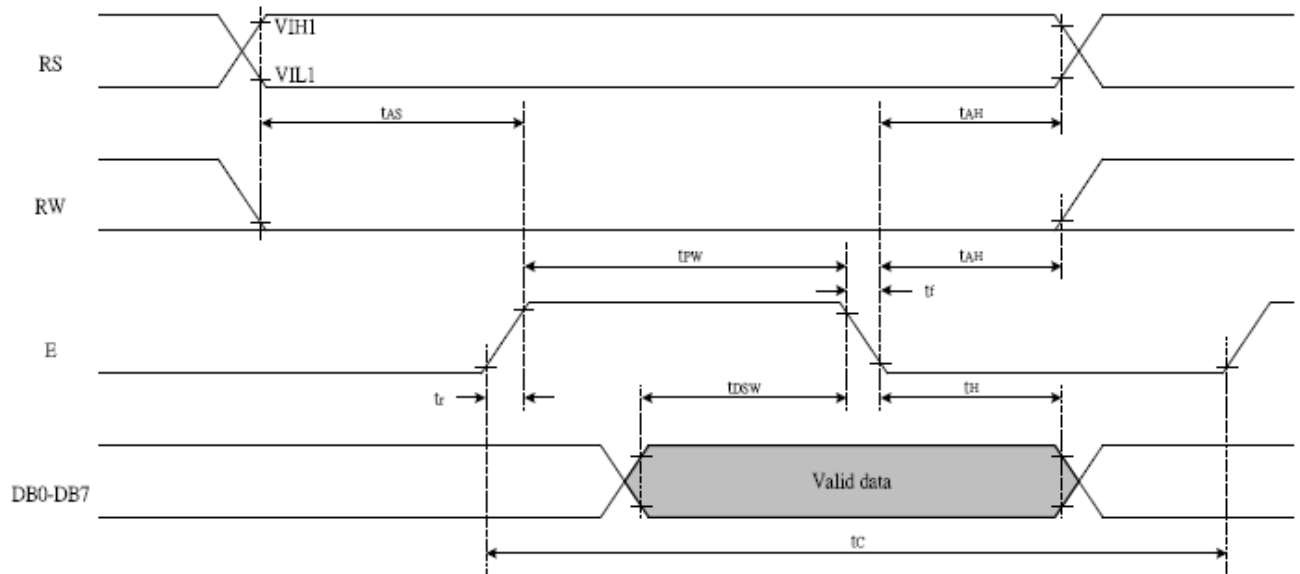


➤ Intel 8051 interface

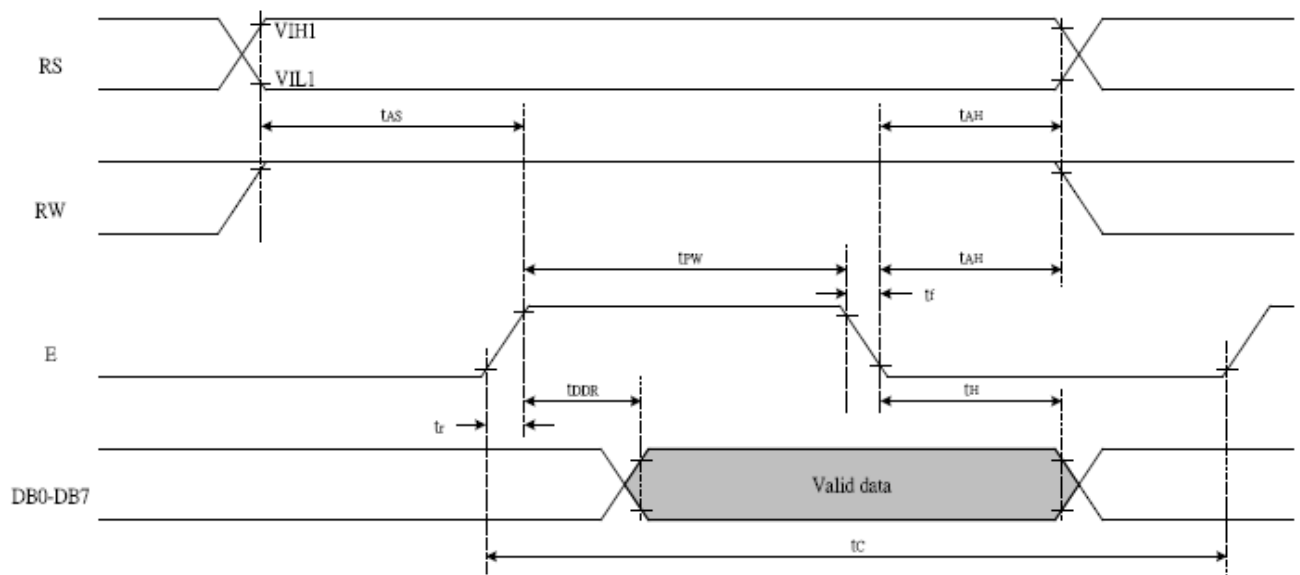


TIMING CHARACTERISTICS

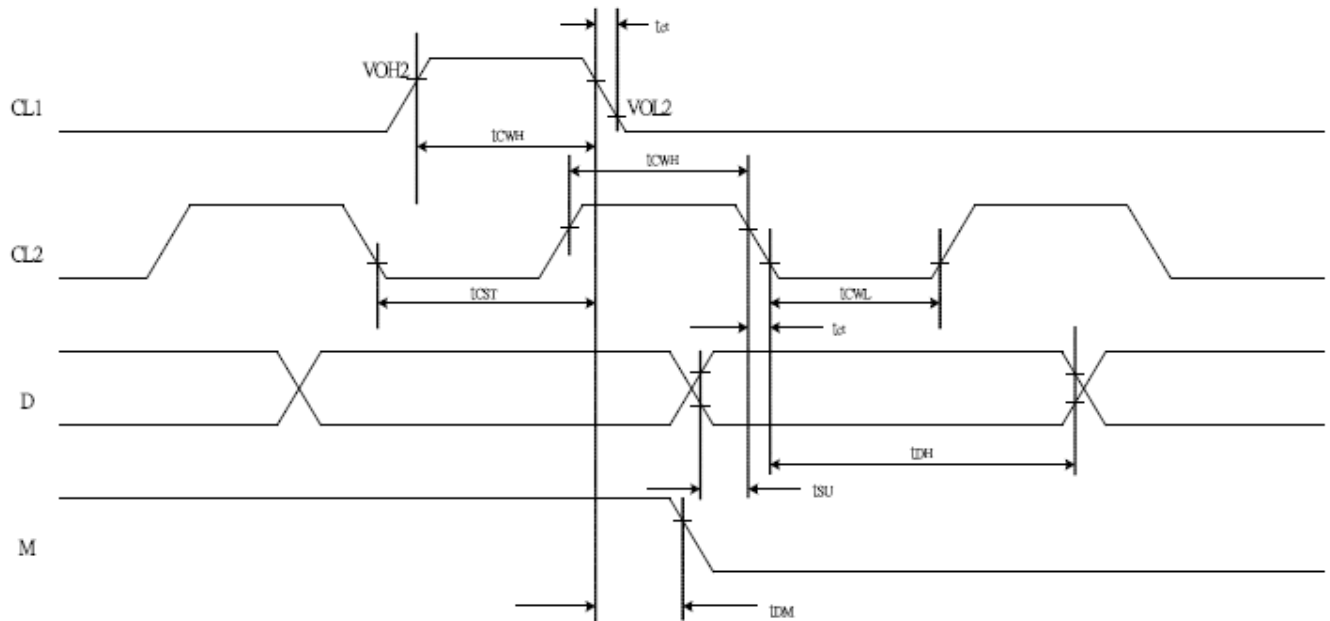
● Writing data from MPU to ST7066U



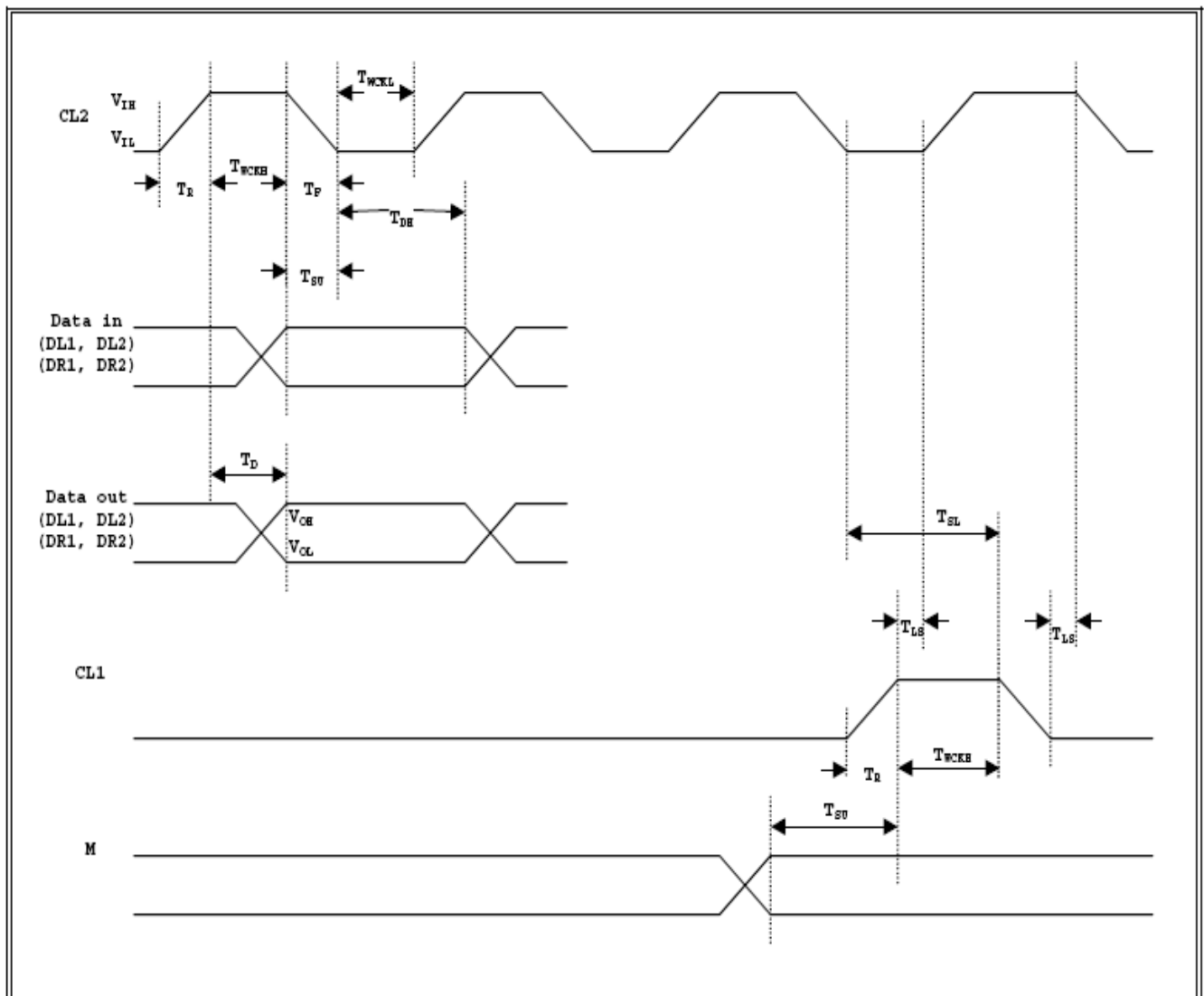
● Reading data from ST7066U to MPU



● Interface Timing with External Driver



The timing of ST7065C.



DC Characteristics

The DC Characteristics of ST7066U

Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
V_{CC}	Operating Voltage	-	4.5	-	5.5	V
V_{LCD}	LCD Voltage	$V_{CC}-V_5$	3.0	-	10.0	V
I_{CC}	Power Supply Current	$f_{OSC} = 270KHz$ $V_{CC}=5.0V$	-	0.2	0.5	mA
V_{IH1}	Input High Voltage (Except OSC1)	-	$0.7V_{CC}$	-	V_{CC}	V
V_{IL1}	Input Low Voltage (Except OSC1)	-	-0.3	-	0.6	V
V_{IH2}	Input High Voltage (OSC1)	-	$V_{CC}-1$	-	V_{CC}	V
V_{IL2}	Input Low Voltage (OSC1)	-	-	-	1.0	V
V_{OH1}	Output High Voltage (DB0 - DB7)	$I_{OH} = -0.1mA$	3.9	-	V_{CC}	V
V_{OL1}	Output Low Voltage (DB0 - DB7)	$I_{OL} = 0.1mA$	-	-	0.4	V
V_{OH2}	Output High Voltage (Except DB0 - DB7)	$I_{OH} = -0.04mA$	$0.9V_{CC}$	-	V_{CC}	V
V_{OL2}	Output Low Voltage (Except DB0 - DB7)	$I_{OL} = 0.04mA$	-	-	$0.1V_{CC}$	V
R_{COM}	Common Resistance	$V_{LCD} = 4V, I_d = 0.05mA$	-	2	20	$K\Omega$
R_{SEG}	Segment Resistance	$V_{LCD} = 4V, I_d = 0.05mA$	-	2	30	$K\Omega$
I_{LEAK}	Input Leakage Current	$V_{IN} = 0V \text{ to } V_{CC}$	-1	-	1	μA
I_{PUP}	Pull Up MOS Current	$V_{CC} = 5V$	-50	-110	-180	μA

The DC Characteristics of ST7065C

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit	Applicable pin
VDD	Operating Voltage	-	2.7	-	5.5	V	-
VLCD	Driver Supply Voltage	VDD-VEE	3	-	11	V	-
VIH	Input High Voltage	-	0.7 VDD	-	VDD	V	CL1,CL2,M,SHL1,S HL2 DL1,DL2,DR1,DR2
VIL	Input Low Voltage	-	0	-	0.3 VDD	V	
ILKG	Input Leakage Current	VIN = 0 ~ VDD	-5	-	5	uA	
VOH	Output High Voltage	IOH = -0.4mA	VDD -0.4	-	-	V	DL1,DL2,DR1,DR2 V1~V6, S[1]~S[40]
VOL	Output Low Voltage	IOL = +0.4mA	-	-	0.4	V	
IDD	Operating Current	FCL2 = 400KHZ	-	100	300	uA	VDD,VEE
IV	Leakage Current	VIN = VDD ~ VEE	-10	-	10	uA	V1 ~ V6

**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

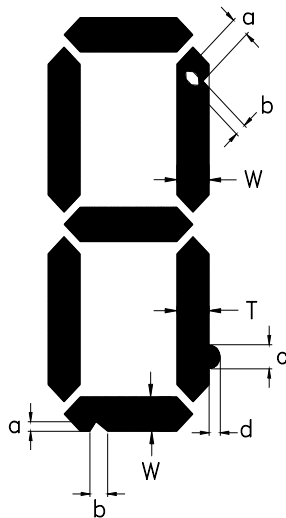
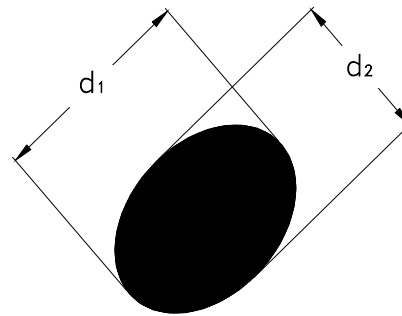
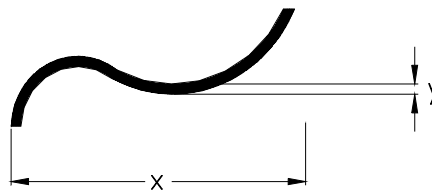


fig . 1



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

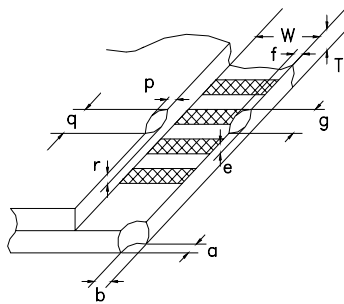


fig . 4

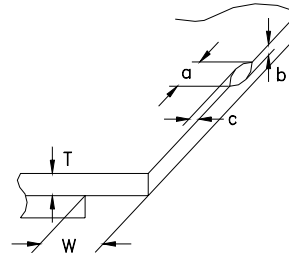


fig . 5

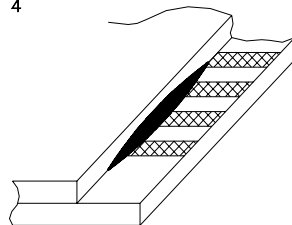


fig . 6



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.