



CLOVER DISPLAY LTD.

LCD MODULE SPECIFICATION

Model: CG9162G - _ _ - _ _ - _ _ - _

Revision	00
Engineering	Kemp Huang
Date	25 August 2016
Our Reference	X9061

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MODE OF DISPLAY**Display mode**

- TN positive
 TN negative
 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

LCD MODULE NUMBER NOTATION:

CG9162G - N N - S R - N 6 - T

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

*(1)---Model number of standard LCD Modules

*(2)---Backlight type

- N – No backlight
 E – EL backlight
 L – Side-lited LED backlight
 M – Array LED backlight
 C – CCFL

*(3)---Backlight color

- N – No backlight
 A – Amber
 B – Blue
 O – Orange
 W – White
 Y – Yellow green

*(4)---Display mode

- T – TN
 V – TN (Negative)
 S – STN Yellow green
 G – STN Grey
 B – STN Blue (Negative)
 F – FSTN
 N – FSTN (Negative)
 E – EBTN (Negative)

*(5)---Rear polarizer type

- R – Reflective
 F – Transflective
 T – Transmissive

*(6)---Temperature range

- N – Normal
 W – Extended

*(7)---Viewing direction

- 6 – 6 O'clock
 2 – 12 O'clock
 3 – 3 O'clock
 9 – 9 O'clock

*(8)---Special code for other requirements
(Can be omitted if not used)

GENERAL DESCRIPTION

Display mode	:	16 characters x 2 lines LCD module
Interface	:	4-bit / 8-bit parallel
Driving method	:	1/16 duty, 1/5 bias
Controller IC	:	NT7603 or equivalent For the detailed information, please refer to the IC specifications

MECHANICAL DIMENSIONS

Item		Unit	Item	Dimension	Unit
Outline Dimension		mm	Viewing Area	79.0(L)x16.1(W)	mm
No backlight	83.0(L)x27.4(W)x2.9MAX.(H)	mm	Character Size	4.20(L)x6.75(W)	mm
Yellow-Green backlight	83.0(L)x27.4(W)x7.2MAX.(H)	mm	Character Pitch	4.75(L)x7.50(W)	mm
White and Blue	88.5(L)x27.4(W)x7.2MAX.(H)	mm	Dot Size	0.8(L)x0.8(W)	mm

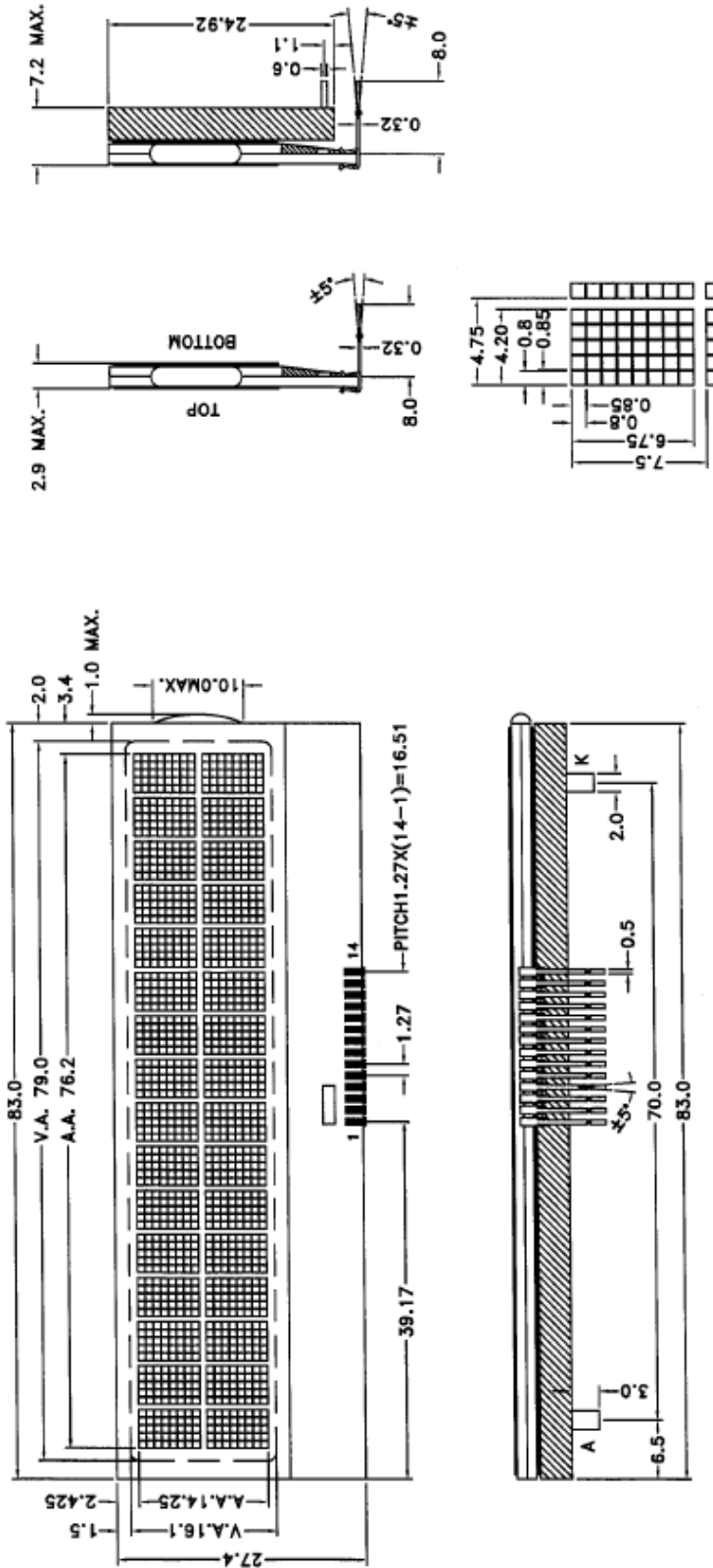
CONNECTOR PIN ASSIGNMENT

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	GND	Power supply (0V,ground)	9	DB2	Data bus line
2	V0	Supply voltage for LCD	10	DB3	Data bus line
3	VDD	Logic power supply	11	DB4	Data bus line
4	RS	Register select input	12	DB5	Data bus line
5	R/W	Read/Write select	13	DB6	Data bus line
6	E	Chip enable signal	14	DB7	Data bus line
7	DB0	Data bus line	15	(*)A	Supply voltage for backlight (+)
8	DB1	Data bus line	16	(*)K	Supply voltage for backlight (-)

Note (*): Pin A, K are used for LED backlight version.

COUNTER DRAWING OF MODULE DIMENSION

MARK	REASON	PREPARED	DATE
△			
△			
△			
△			



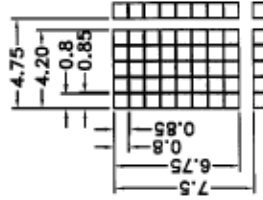
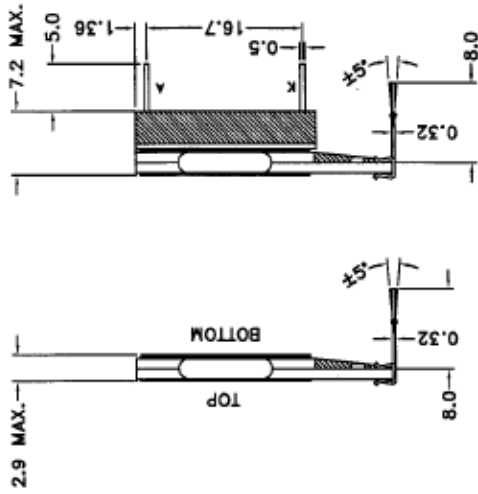
SHEET 1 OF 4

SCALE 2:1

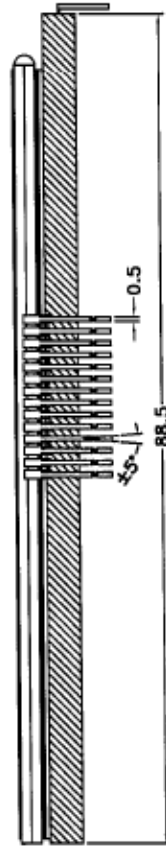
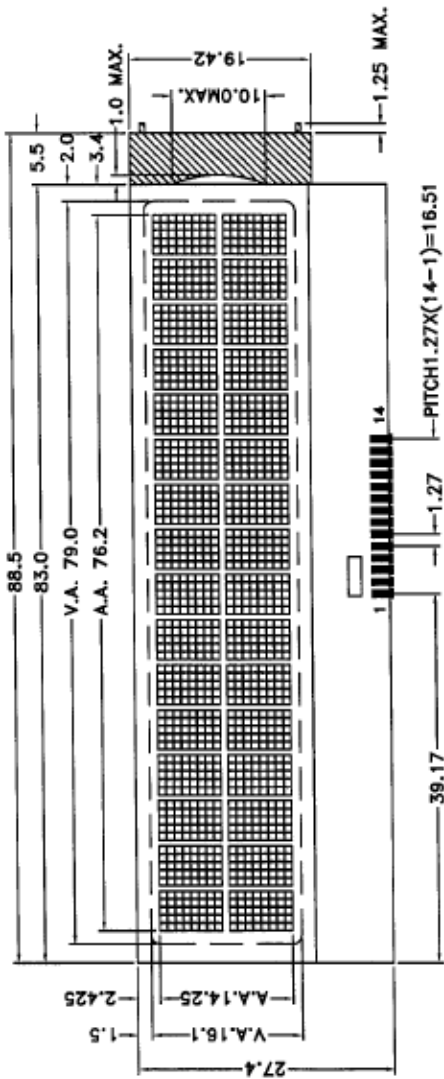
*No backlight and yellow green backlight types

TOLERANCE IF NOT SPECIFY ±0.5mm		SCALE N.T.S.	UNIT IN mm	CLOVER DISPLAY LTD. (HK)	
REV. 00	REVISION RECORD 1st ISSUE		DATE 18 JUL 16	APPROVED <i>[Signature]</i>	MODEL NO. CG9162G
				APPROVED <i>[Signature]</i>	TITLE: MODULE DIMENSION
				OUR REF. X9061	DRAWN BY: DDHAN DATE: 18 JUL 16
				CUSTOMER REF.	CHECKED BY: <i>[Signature]</i> DATE: 18 JUL 16
					APPROVED BY: <i>[Signature]</i> DATE: 18 JUL 16

COUNTER DRAWING OF MODULE DIMENSION



SCALE 2:1

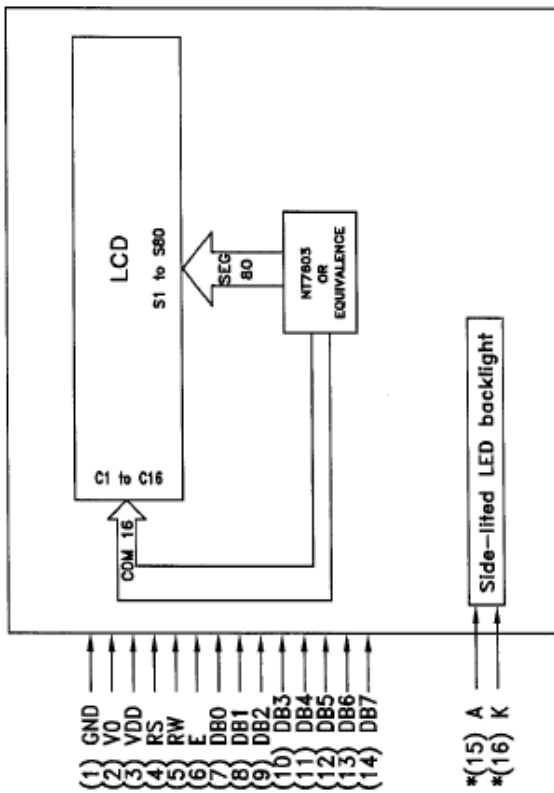


*White and blue side backlight type

TOLERANCE IF NOT SPECIFY ±0.5mm		SCALE N.T.S.	UNIT IN mm	CLOVER DISPLAY LTD. (HK)		SHEET 2 OF 4
REV.	REVISION RECORD	DATE	CUSTOMER	APPROVED	MODEL NO. CG9162G	
00	1st ISSUE	18 JUL 16	STANDARD	<i>[Signature]</i>	TITLE: MODULE DIMENSION	
			AGENT	APPROVED	DRAWN BY: DDHAN	DATE: 18 JUL 16
			CUSTOMER REF.	<i>[Signature]</i>	CHECKED BY: <i>[Signature]</i>	DATE: 18 JUL 16
				OUR REF. X9061	APPROVED BY: <i>[Signature]</i>	DATE: 18 JUL 16

COUNTER DRAWING OF PIN OUT & BLOCK DIAGRA

PIN NO.	SYMBOL	FUNCTION
1	GND	Power supply (0V,ground)
2	V0	Supply voltage for LCD
3	VDD	Logic power supply
4	RS	Register select input
5	RW	Read / write select
6	E	Chip enable signal
7	DB0	Data bus line
8	DB1	
9	DB2	
10	DB3	
11	DB4	
12	DB5	
13	DB6	
14	DB7	
15	(*)A	Supply voltage for backlight(+)
16	(*)K	Supply voltage for backlight(-)



Note (*): pinA,K are used for backlight version only

TOLERANCE IF NOT SPECIFY ±0.5mm		SCALE N.T.S.	UNIT IN mm	CLOVER DISPLAY LTD. (HK)		SHEET 3 OF 4
REV.	REVISION RECORD	DATE	CUSTOMER	APPROVED	MODEL NO. CG9162G	
00	1st ISSUE	18 JUL 16	STANDARD	<i>[Signature]</i>	TITLE: PIN OUT & BLOCK DIAGRAM	
			AGENT	APPROVED	DRAWN BY: DDHAN	DATE: 18 JUL 16
			CUSTOMER REF.	OUR REF: X9061	CHECKED BY: <i>[Signature]</i>	DATE: 18 JUL 16
					APPROVED BY: <i>[Signature]</i>	DATE: 18 JUL 16

ELECTRICAL CHARACTERISTICS

Conditions: VSS=0V, Ta=25°C

Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	VDD	4.75	5.0	5.25	V
Supply Current	IDD	—	0.9	—	mA
Input Voltage for LCD (*)	V0	0.2	0.5	0.8	V
“H”Level Input Voltage	VIH	0.8VDD	—	VDD	V
“L”Level Input Voltage	VIL	—	—	0.2VDD	V

Note (*): There is tolerance in optimum LCD driving voltage during production and it will be within the specified range. The corresponding LCD voltage = VDD -V0

Side-lited LED

Constant voltage driving:

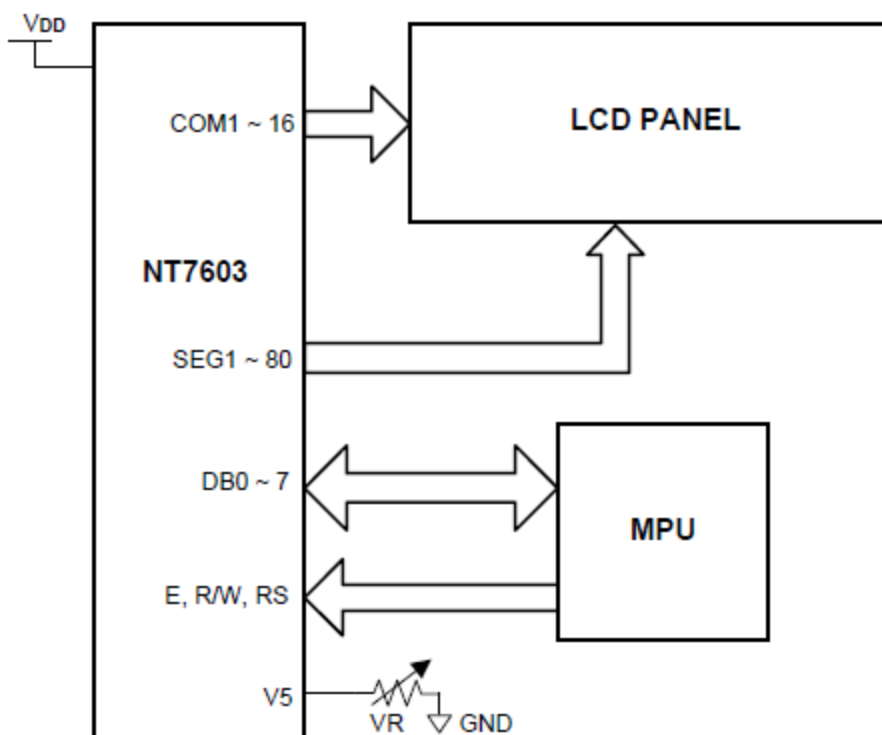
Item	Symbol	MIN.	TYP.	MAX.	Unit	Condition
White Backlight current	I _{BL}	—	35	40	mA	V _{BL} = 5.0V
Blue Backlight current	I _{BL}	—	35	40	mA	V _{BL} = 5.0V
Yellow-Green Backlight current	I _{BL}	—	50	55	mA	V _{BL} = 5.0V

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	VDD	-0.3 to 7	-0.3 to 7	V
Input Voltage	VT	-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

REFERENCE CIRCUIT EXAMPLE



INSTRUCTIONS TABLE

Instruction	Code										Function	Execution time (max) (fOSC = 540KHz)	
	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0			
Display Clear	0	0	0	0	0	0	0	0	0	1	Clear entire display area, Restore display from shift, and load address counter with DD RAM address 00H.	1.64ms	
Display/ Cursor Home	0	0	0	0	0	0	0	0	0	*	Restore display from shift and load address counter with DD RAM address 00H.	1.64ms	
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Specify direction of cursor movement and display shift mode. This operation takes place after each data transfer (read/write).	40μs	
Display ON/OFF	0	0	0	0	0	0	1	D	C	B	Specify activation of display (D) cursor (C) and blinking of character at cursor position (B).	40μs	
Display/ Cursor Shift	0	0	0	0	0	1	S/C	R/L	*	*	Shift display or move cursor.	40μs	
Function Set	0	0	0	0	1	DL	N	F	*	*	Set interface data length (DL), number of display line (N), and character font (F).	40μs	
RAM Address Set	0	0	0	1	ACG						Load the address counter with a CG RAM address. Subsequent data access is for CG RAM data.	40μs	
DD RAM Address Set	0	0	1	ADD						Load the address counter with a DD RAM address. Subsequent data access is for DD RAM data.	40μs		
Busy Flag/ Address Counter Read	0	1	BF	AC						Read Busy Flag (BF) and contents of Address Counter (AC).	1μs		
CG RAM/ DD RAM Data Write	1	0	Write data						Write data to CG RAM or DD RAM.	40μs			
CG RAM/ DD RAM Data Read	1	1	Read data						Read data from CG RAM or DD RAM.	40μs			
	I/D = 1 : Increment S = 1 : Display Shift On D = 1 : Display On C = 1 : Cursor Display On B = 1 : Cursor Blink On S/C = 1 : Shift Display R/L = 1 : Shift Right DL = 1 : 8-Bit N = 1 : Dual Line F = 1 : 5x10 dots BF = 1 : Internal Operation BF = 0 : Ready for Instruction										I/D = 0 : Decrement S/C = 0 : Move Cursor R/L = 0 : Shift Left DL = 0 : 4-Bit N = 0 : Signal Line F = 0 : 5 X 8 dots	DD RAM : Display Data RAM CG RAM : Character Generator RAM ACG : Character Generator RAM Address ADD : Display Data RAM Address AC : Address Counter	

Note 1: Symbol "*" signifies an insignificant bit (disregard).

Note 2: Correct input value for "N" is predetermined for each model.

Note 3: The variation of execution time depends on the change of oscillator frequency; for example:

$$\text{if } f_{OSC} = 380\text{KHz, then execution time} = 40\mu\text{s} \times (540\text{KHz} / 380\text{KHz}) = 57\mu\text{s}$$

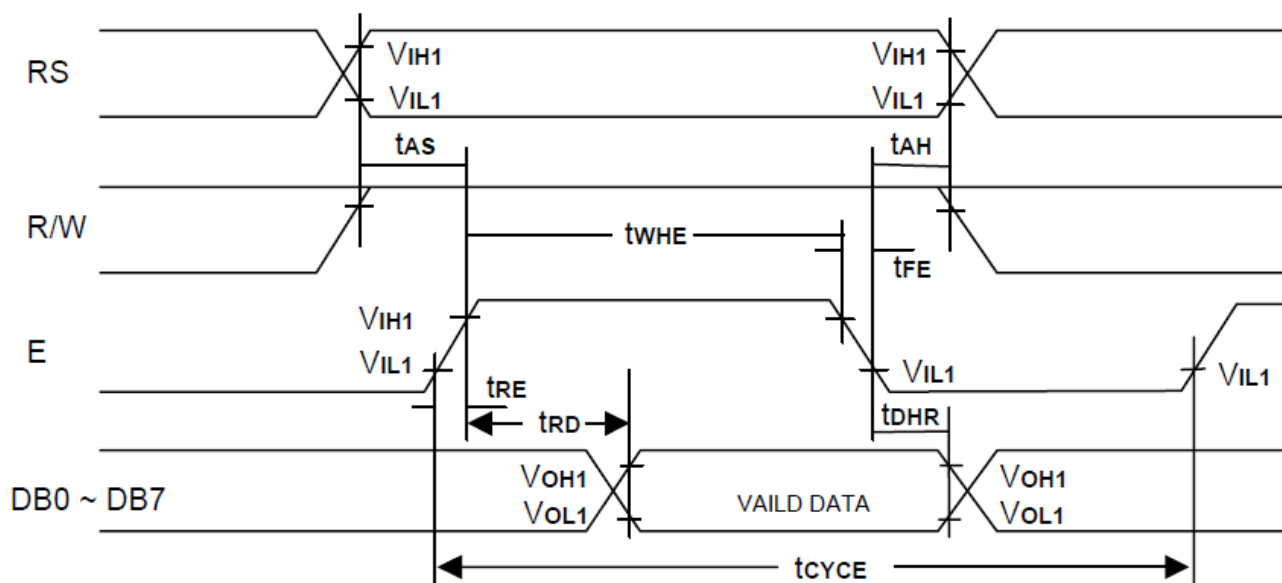
DISPLAY DATA RAM

NT7603H-BDT01 Correspondence between Character Codes and Character Patterns

		Higher 4-bit (D4 to D7) of Character Code (Hexadecimal)															
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Lower 4-bit (D0 to D3) of Character Code (Hexadecimal)	0	CG RAM (1)			0	1	2	3					4	5	6	7	
	1	CG RAM (2)		8	9	A	B	C					D	E	F		
	2	CG RAM (3)		"	z	Z	R	B	r								
	3	CG RAM (4)		*	3	C	S	c	s								
	4	CG RAM (5)		4	D	T	d	t									
	5	CG RAM (6)		5	E	U	e	u									
	6	CG RAM (7)		6	F	V	f	v									
	7	CG RAM (8)		7	G	W	g	w									
	8	CG RAM (1)		8	H	X	h	x									
	9	CG RAM (2)		9	I	Y	i	y									
	A	CG RAM (3)		A	J	Z	j	z									
	B	CG RAM (4)		+	K	X	k	x									
	C	CG RAM (5)		<	L	X	l	x									
	D	CG RAM (6)		—	M	X	m	x									
	E	CG RAM (7)		.	N	X	n	x									
	F	CG RAM (8)		/	O	X	o	x									

8-BIT INTERFACE TIMING DIAGRAM

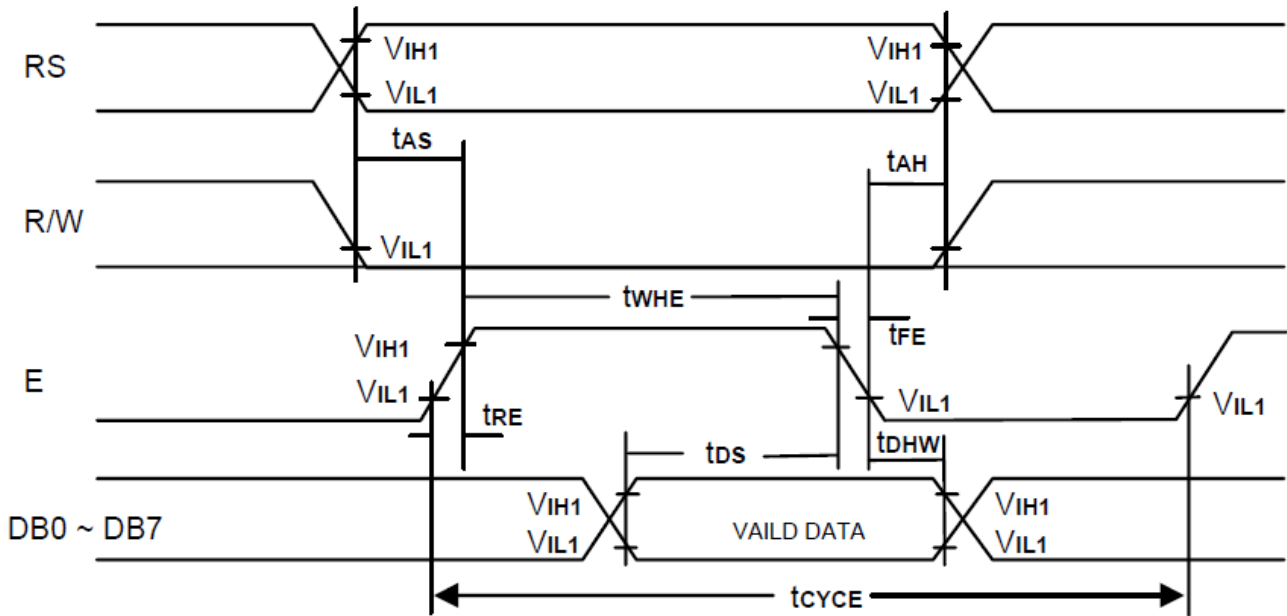
Read Mode Timing Diagram (Reading out data from NT7603 to 8-bit MPU)



Read Cycle (VDD = 5.0V, GND = 0V, TA = 25°C)

Symbol	Parameter	Min.	Typ.	Max.	Unit
tCYCE	Enable Cycle Time	500	-	-	ns
tWHE	Enable "H" Level Pulse Width	300	-	-	ns
tRE, tFE	Enable Rising/Falling Time	-	-	25	ns
tAS	RS, R/W Setup Time	60 ¹	-	-	ns
		100 ²	-	-	ns
tAH	RS, R/W Address Hold Time	10	-	-	ns
tRD	Read Data Output Delay	-	-	190	ns
tDHR	Read Data Hold Time	20	-	-	ns

Write Mode Timing Diagram (Writing data from 8-bit MPU to NT7603)



Write Cycle (VDD = 5.0V, GND = 0V, TA = 25°C)

Symbol	Parameter	Min.	Typ.	Max.	Unit
tCYCE	Enable Cycle Time	500	-	-	ns
twHE	Enable "H" Level Pulse Width	300	-	-	ns
tRE, tFE	Enable Rising/Falling Time	-	-	25	ns
tAS	RS, R/W Setup Time	60 ¹	-	-	ns
		100 ²	-	-	ns
tAH	RS, R/W Address Hold Time	10	-	-	ns
tds	Data Output Delay	100	-	-	ns
tDHW	Data Hold Time	10	-	-	ns

Notes: 1: 8-bit operation mode
 2: 4-bit operation mode

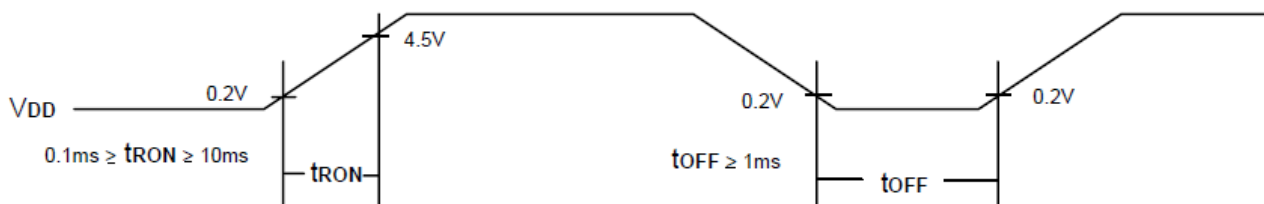
Power Supply Conditions Using Internal Reset Circuit

(VDD = 5.0V, GND = 0V, TA = 25°C)

Symbol	Parameter	Min.	Typ.	Max.	Unit
tRON	Power Supply Rising Time	0.1	-	10	ms
tOFF	Power Supply OFF Time	1	-	-	ms

Interface Signals with Segment Driver LSI

tOFF stipulates the time of power OFF for instantaneous Power supply to or when power supply repeats ON and OFF



THE RESET CIRCUIT

Low Voltage Reset

The Low voltage reset function is used to monitor the supply voltage and applies an internal reset at the time when low voltage is detected.

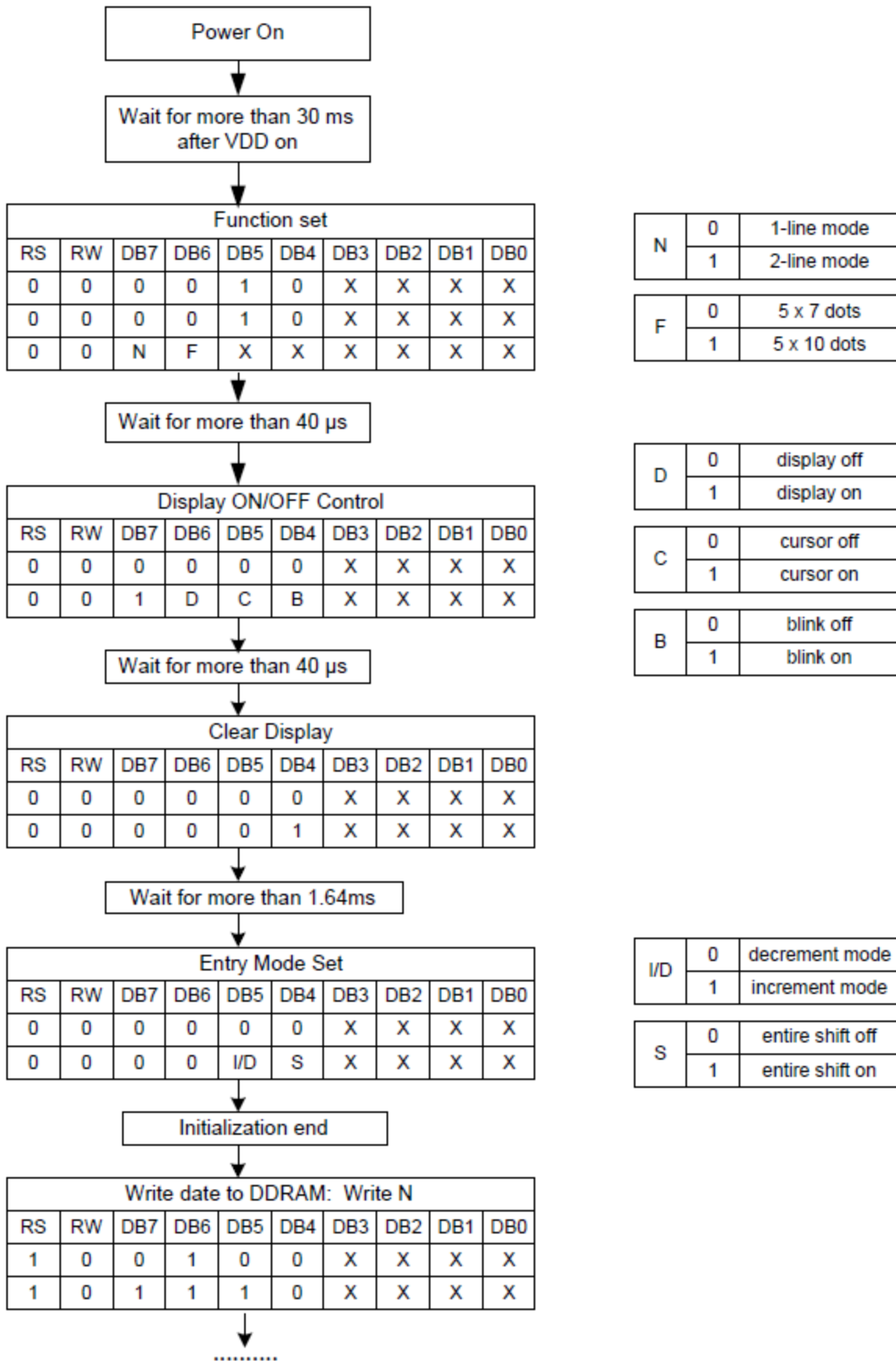
Functions of the Low Voltage Reset Circuit

The Low voltage reset circuit has the following functions:

- Generates an internal reset signal when $VDD \leq VLVR$
- Cancels the internal reset signal when $VDD > VLVR$

Here, VDD: power supply voltage, VLVR: Low voltage reset detect voltage, about 2.0V.

Initialization for 8-Bit Interface



ELECTRO-OPTICAL CHARACTERISTICS

MEASURING CONDITION: POWER SUPPLY = $V_{OP} / 64 \text{ Hz}$
 TEMPERATURE = $22 \pm 5 \text{ }^\circ\text{C}$
 RELATIVE HUMIDITY = $60 \pm 15 \%$

ITEM	SYMBOL	UNIT	TYP. STN
RESPONSE TIME	Ton	ms	150
	Toff	ms	190
CONTRAST RATIO	Cr	-	15
VIEWING ANGLE (Cr \geq 2)	V3:00	$^\circ$	45
	V6:00	$^\circ$	70
	V9:00	$^\circ$	45
	V12:00	$^\circ$	60

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

RELIABILITY OF LCD MODULE

NO.	Item	TEST CONDITION FOR NORMAL TEMPERATURE	TEST CONDITION FOR WIDE TEMPERATURE	TIME
1	High temperature operating	50 $^\circ\text{C}$	70 $^\circ\text{C}$	240 hours
2	Low temperature operating	0 $^\circ\text{C}$	-20 $^\circ\text{C}$	240 hours
3	High temperature storage	60 $^\circ\text{C}$	80 $^\circ\text{C}$	240 hours
4	Low temperature storage	-10 $^\circ\text{C}$	-30 $^\circ\text{C}$	240 hours
5	Temperature-humidity storage	40 $^\circ\text{C}$ 90% R.H.	60 $^\circ\text{C}$ 90% R.H.	96 hours
6	Temperature cycling	-10 $^\circ\text{C}$ to 60 $^\circ\text{C}$ 30 Min Dwell	-30 $^\circ\text{C}$ to 80 $^\circ\text{C}$ 30 Min Dwell	5 cycle
7	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	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	—

Inspection condition:

No. 1 ~ 6:

The samples should be placed in room temperature for 2 hours before inspection.

Acceptance criteria:

No non-conformance found in functional and cosmetic.

SAMPLING METHOD

SAMPLING PLAN: ANSI/ASQ Z1.4

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

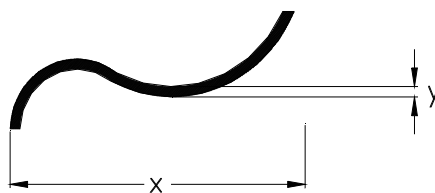
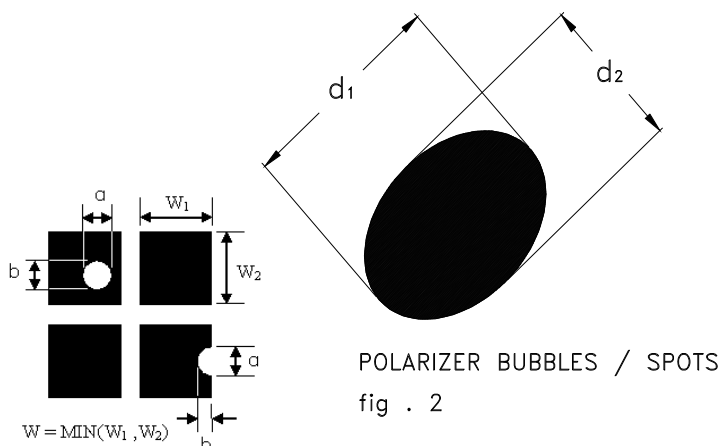
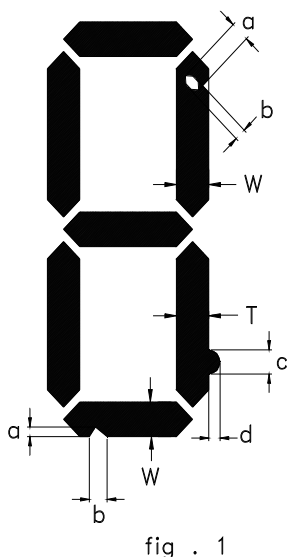
QUALITY STANDARD

DEFECT	CRITERIA	TYPE	FIGURE
SHORT CIRCUIT	-	MAJOR	-
MISSING SEGMENT	-	MAJOR	-
UNEVEN / POOR CONTRAST	-	MAJOR	-
CROSS TALK	-	MAJOR	-
PIN HOLE	MAX(a,b) ≤ 1 / 4 W MAX(a,b) < 0.3 N.A.**	MINOR	1
EXCESS SEGMENT	MAX(c,d) ≤ 1 / 4 T	MINOR	1
BUBBLES	d* ≥ 0.2 QTY=0	MINOR	2
BLACKS SPOTS	d ≤ 0.3 N.A.** 0.3 < d ≤ 0.4 QTY ≤ 1 0.4 < d QTY=0	MINOR	2
LINE SCRATCHES	x ≥ 0.7 y ≥ 0.05 QTY=0	MINOR	3
BLACK LINE	x ≥ 0.7 y ≥ 0.05 QTY=0	MINOR	3

*d = MAX (d₁,d₂)

** N. A . = NOT APPLICABLE

DEFECT TABLE : B



QUALITY STANDARD (CONT .)

DEFECT		CRITERIA	TYPE	FIGURE
CHIPS	CONTACT EDGE	$e \leq 1/2T$ $f \leq 1/3W$ $g \leq 3.5$	MINOR	4
	BOTTOM GLASS	$p \leq 1.0$ $q \leq 3.5$ $r \leq 1/2T$		4
	CORNER	$a \leq 1.5$ $b \leq W$		4
	TOP GLASS	$a \leq 3.0$ $b \leq 1/3T$ $c \leq 1/2W$		5
GLASS PROTRUSION		$a \leq 1/4 W$	MINOR	6
RAINBOW		-	MINOR	-

UNLESS STATE OTHERWISE , ALL UNIT ARE IN MILLIMETER .

DEFECT TABLE : B

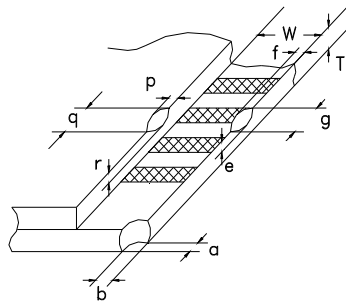


fig . 4

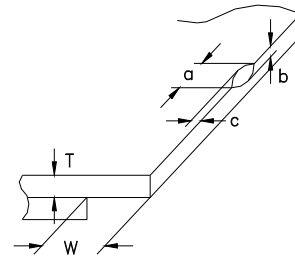


fig . 5

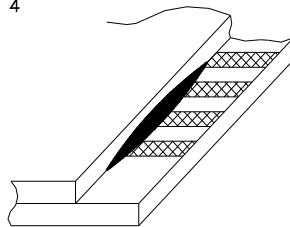


fig . 6

HANDLING PRECAUTIONS

(1) CAUTION OF LCD HANDLING & CLEANING

Use soft cloth with solvent (recommended below) to clean the display surface and wipe lightly.
- Isopropyl alcohol, ethyl alcohol, trichlorotrifluoroethane

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface. Do not use the following solvent;
-water, ketone, aromatics

(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.

Remove the protective film slowly and, if possible, under ESD control device like ion blower and humidity of working room should be kept over 50%RH to reduce risk of static charge.

(3) PACKAGING

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

(4) CAUTION FOR OPERATION

It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage than the limit causes the shorter LCD life. The use of direct current drive should be avoided because an electrochemical reaction due to direct current causes LCD's undesirable deterioration.

Response time will be extremely delayed at low temperature, and LCD's show dark color at high temperature. However those phenomena do not mean malfunction or out of order with LCD's.

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

(5) SOLDERING (for Pin type)

It is recommended to complete dip soldering at 270 °C or hand soldering at 280 °C within 3 seconds. The soldering position is at least 3mm apart from the pin head. Wave or reflow soldering are not recommended. Metal pins should not be soldered for more than 3 times and each soldering should be done after cool down of metal pins

(6) SAFETY

For crash damaged or unnecessary LCD's, it is recommended to wash off liquid crystal by either of solvents such as acetone and ethanol and should be burned up later.

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

WARRANTY

CLOVER 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 Clover is limited to repair and/or replacement. Clover will not be responsible for any subsequent or consequential event.