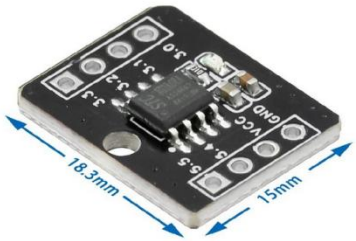
#nB51 manual

(very draft version)

The project repository (i.e. binaries, manual, and examples) are available at: https://github.com/bgolab/nB51/tree/main

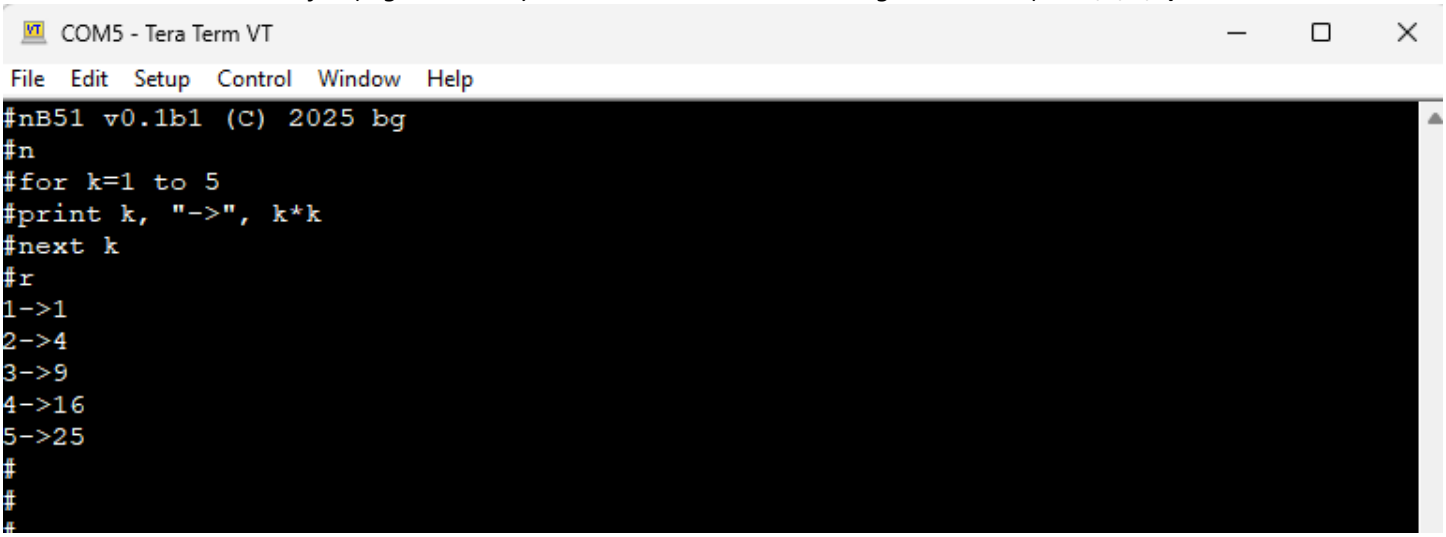
Wiring

Original breadboard wiring: STC8G1K08A



Getting started

Flash the latest BASIC hex file (e.g. nB51.hex). Start a terminal emulator e.g. ***TeraTerm*** *(**9600,8,N,1**). The 8051 will boot.*



Enter an example BASIC program (you can use Copy & Paste)

```
for k=1 to 5
  print k, ",", k*k
next k
end
```

*Use '**c**' to see the code, '**r**' to run the code. The '**n**' clears the program memory.*
*You can use **@N** (e.g. @0) to delete Nth line or **@N <code>** (@0 print 1) to insert the line of code.*
Capital and small letters accepted for keywords (i.e. 'CLS' equals 'cls'). For the names small and capital letters are NOT recognized (i.e. 'as' is the same name as 'AS')

NOTE: If you use TeraTerm and some characters are lost during Copy & Paste operation consider increasing the 'Paste delay per line' in Setup->Additional Settings->Copy and Paste

Limits

-VAR / LABEL NAME: 4 chars
-program size: 1024 chars (shared memory with tokens and name!)

MEMORY MAP

[SOURCE_CODE][OS CMD BUFFER][TOKENS][HEAP]……[NAMES]

Program structure

Program Structure	***Description/Comments***	***Example***
gosub sub1 ***end*** *subr: [sub1 <code> return*	*Command 'end' has to be the last line of the main code.* *Subroutines have to follow the 'end'.*	*gosub callme* ***end*** *callme: print "Hi!" return*

System commands

Command	***Description/Comments***	***Example***
ESC	*Stop the running program ~~or skip loading auto.bas when booting~~*	
c	*Show code*	
r	*run code*	
n	*New – clear VM memory and code*	
t	*Show Tech Info (tokens, names, mem info)*	
g	*Compile to tokens (might be disabled to save memory)*	
u	*Upload tokens from UART* *The protocol (T sets token, A sets address, R runs:* *w/o addr set(print 7): 140T 130T 7T R;* *w/ addr set to 0(print -7): '0A 140T 181T 130T 7T R'*	
l	*List tests*	
0-…	*Load N-th tests*	
~~l, s~~	*~~Load/Save program from/to EEPROM (auto.bas)~~*	
~~ee, ed~~	*~~EEPROM erase/dump~~*	
@N, @N <code>	*@N - delete N-th line; @N <code> - insert <code> before N-th line*	*@3 – removes 3rd line* *@4 cls – insert 'cls' before line 4*

The BASIC language

VARIABLES & EXPRESSIONS

-variable name: letter&digits starting w/ a letter

*-expr(arithmetic expression): combination of INT, ops/brackets(+, -, *, /, %,(,)) and INT vars;*

-hex integer format supported, e.g. 0xAA

Command	***Description/Comments***	***Example***
var=expr	*INT var, name=expr, 1st-reference creates var(value=0);*	*sy=2 + a*20*

PROGRAM FLOW CONTROL

NOTE: The FOR-loop STEP/TO values are evaluated only once, before entering the FOR-loop.

NOTE: The relop operations include: >, <, >=, <=, <>, = (Since nB51 v0.3b1: use '==')

Command	***Description/Comments***	***Example***
FOR v=expr TO expr [STEP expr] [code] NEXT var	*If STEP[default=1]; INT supported; loop nesting supported*	*FOR k = 5 TO 1 STEP -1 NEXT k END*
IF expr relop expr THEN [code] [ELSE] [code] ENDIF	*INT supported; nesting supported;*	*if a>1 then print "ok" else print "bad" endif*
label: *GOTO label/var*	*Label starts with a letter, terminated by colon; up to 8 letter & digits(plus '_');*	*k=1 again: print k k=k+1* *if k<5 then goto again: endif*
GOSUB label/var	*NOTE :Label must be located after END*	*gosub task0 end*
label: RETURN	*label: [code] RETURN*	*task0: print "done" return*
END	*Last command. GOSUB labels follows END* *NOTE: END is obligatory if you use GOSUB*	*End*

INPUT, OUTPUT, DATA, MEMORY

Command	***Description/Comments***	***Example***
PRINT expr[, "txt"],	*Prints expr, sexpr separated by ',' ';' - skips NEW*	*PRINT "6/3=", 6/3 (with NEW LINE)*

[;]?	*LINE?*	*PRINT 1; (w/o NEW LINE because of ';')*
INPUT var,…	*Assign int values to (array) var*	*INPUT "num?", name*
DATA const, const *READ var, var* *RESTORE*	*DATA - INT constants supported* *READ - assign DATA specified input to vars* *RESTORE - Reset data pointer*	*DATA 1, 2* *READ v, y*
Since nB51 v0.3b1: *-SPOKE / SPEEK for SFR* *-XSPOKE / XPEEK for XDATA / XSFR* *The following variables provide HEAP addresses:* *HS – starting memory address of the HEAP* *HE – end memory address of the HEAP*	*Memory write/read; hex supported;*	*Since nB51 v0.3b1:* *Use physical addresses as per 8051 datasheet*

TIME (two independent timers: for PAUSE and for GETTICK() settable byGETTICK(N))

Command	***Description/Comments***	***Example***
Since nB51 v0.3b1: *SETTICK msec*	*Sets msec for the GETTICK timer*	*SETTICK 0 (resets the timer)*
GETTICK()	*Ticks; MAX 32767 msec*	*a=gettick()*
PAUSE msec	*Delay (blocking) in msec*	*PAUSE 2*500*

LOGICAL

Command	***Description/Comments***	***Example***
AND(expr,expr)		*PRINT AND(0x3,0xF)*
OR(expr,expr)		*PRINT OR(0x3,0xF)*
NOT(expr)		*PRINT HEX$(NOT(0x0F))*

~~***GPIO***~~

~~***Command***~~	~~***Description/Comments***~~	~~***Example***~~
~~*PMODE pin,mode*~~	~~*const: IN,OUT,PUP,PDOWN, ADC, PWM*~~	~~*pmode 100, tsensor temp= aread(100)*~~
~~*AREAD(pin)*~~	~~*Read analog pin; pins=?;*~~	~~*pmode 26, adc voltage=aread(26)*~~
~~*AWRITE pin,cycle*~~	~~*PWM duty=cycle/65535,cycle<65535*~~	~~*pmode 22, pwm awrite 22, 16000*~~
~~*DREAD(pin)*~~	~~*Read digital pin*~~	~~*y=15 pmode y,in pmode y,pullup*~~ ~~*for k=1 to 2 step 0 pause 50 print dread(y) next k*~~
~~*DWRITE pin,value*~~	~~*Write digital pin*~~	~~*pmode 25,out dwrite 25,high pause 3000 dwrite 25,low*~~

~~***OLED*** *(OLED 0.91" supported)*~~

~~*NOTE: use 'lref' to refresh the screen as ALL the lxxx command update only the memory buffer*~~

~~***Command***~~	~~***Description/Comments***~~	~~***Example***~~
~~*LPLOT X, Y*~~	~~*Draw point at X, Y*~~	~~*for x=0 to 127 lplot x,fix(15+15*sin(6.28*x/128)) next x lref*~~
~~*LDRAW X0, Y0, X1, Y1*~~	~~*Draw line from X0, Y0 to X1, Y1*~~	~~*ldraw 10, 10, 20,20 lref*~~
~~*LCIRCLE x, y, r*~~	~~*Draw circle at x, y, r*~~	~~*lcircle 15, 15, 10*~~
~~*LPRINT expr, sexpr [AT x,y]*~~	~~*Print expr, sexpr separated by ',' [AT x, y] (default 0,0)*~~	~~*lprint "2+2=", 2+2 AT 10,10 lref*~~
~~*LCLS*~~	~~*Clear Screen*~~	~~*lcls lref*~~

LREF	Refresh LCD (copy mem to LCD)	lref

TONE_SUPPORT (tested on piezo)

Command	Description/Comments	Example
TONE pin, freq	Start PWM square signal at freq, duty 50% on a pin; freq>10Hz; non-blocking;	TONE 18, 440
NOTONE pin	Stop generating the signal on a pin	NOTONE 18

SERVO SUPPORT (tested on Tower Pro Sg90 where the pulse is between 500-2400 usec) - EXPERIMENTAL

Command	Description/Comments	Example
SERVO pin, angle [pulsemin, pulsemax]	Enable servo on a pin, set the angle (0…180 deg); optional: min/max pulse in usec(default: 500/2000usec, allowed min/max values: 500-2400usec)	SERVO 19, 90 SERVO 19, 9, 500, 2400
NOSERVO pin	Disable servo on a pin	NOSERVO 19

I2C/UART SUPPORT

-xREAD/xWRITE are blocking (waits for the data forever); non-blocking by checking if the fifo(xREADABLE/xWRITEABLE)