Philips TinyARM PHIL40 Module

1. Introduction
The purpose of this document is to specify mechanical dimensions and
electrical behavior of TinyARM LPC2103 PHIL40 module.

2. Reason for development
Philips introduced LPC2103 processor housed in LQFP 48 pin package.
It features 32kbyte Flash memory and 8kbyte SRAM. This chip can be
used as a replacement for 8/16 microcontrollers.
There are following problems when using this chip:
A. Price of development tools, both software and hardware.
B. Unusual package which is not convenient for development.
C. The chip requires 2 different voltages.
D. Battery voltage (for RTC and RAM backup) range is not sufficient.

3. Solution
PHIL40 module intends to solve all problems:
A. The module is housed in DIP40 package which has pin out similar
   to 8751 microcontroller.
B. The module requires just one convenient 5V supply. All the
   voltages
   for Philips LPC2103 processor are generated on-board. The module
   can supply 1.8V and 3.3V supply to external (low power) circuitry.
C. The module features built-in 10 MHz oscillator.
D. The module includes Reset generator.
E. The module includes 32768Hz quartz and backup voltage generation
   for real time clock section of the processor.
F. The module is re-usable. It can be used in several designs, the
   only
   additional investment is DIL40 socket for each design.
F. Software tools are either IAR or free GNU .

4. List of required signals for development version
All the signals required for standard ARM Test/Debug JTAG interface
are
generated on PHIL40 board. This includes standard JTAG TRSTN,TCLK,
TMS,TDI and TDO signals and handling of RTCK and DBGSEL signals.
Reset signal for all circuitry is generated on board.

5. Voltage levels and electrical behaviour

PHIL40 module runs from 5V supply applied to DIL40 pin 40.
The supply voltage for this version can be from 4.5V to 5.5V.
The estimated current consumption is 100mA from 5V supply.

PHIL40 module can supply 1.8 and 3.3V voltage from pins located in
the middle of the board. Do not draw more than 20mA from any supply !

Voltage levels for ARM I/O pins are 3.3V compliant. The specs says
that
I/O pins are 5V tolerant.

6. Method of programming internal Flash
There are 2 methods to program Flash – either JTAG or ISP (using
UART0 of Philips LPC210x chip). Please, refer to the relevant Philips
LPC210x
manual.
Note: P0.14 must be logic low for LPC2103 processor to enter boot
      loader mode. For normal operation, use pull up resistor to 3.3V

so that PHIL40 does not enter boot loader mode.

7. Mechanical dimensions
The module should fit into the standard 600 mils DIL40 socket.

8. Tips and tricks for development
None

9. Preliminary drawing
None

10. PHIL40 board control signals
RSTN – input for external reset signal, active low. Leave unconnected
if not used. PHIL40 board generates proper internal Reset signal upon
power-up. An external push button can be connected to RSTN to
generate
reset signal. No debounce is needed for the push button.
Note: If driving RSTN pin by external circuitry, then it must be open
collector (open drain) with pull-up resistor. Do NOT use push-pull
to drive RSTN !

RST_OUTN – output of PHIL40 internal reset generator, active low,
open
drain output.

PWRENN – input controlling PHIL40 voltage regulators. Default is low
when the voltage regulators are enabled and generate 3.3V and 1.8V
respectively. This signal is pulled down on PHIL40 board. Normally
leave this pin unconnected (N.C.). Driving this pin high will disable
voltage regulators.

DBGSEL – this is Debug Select input. Default is low when the part
operates normally, executing code in internal Flash or SRAM.
Leave this pin unconnected for normal operation as it is pulled down
by 10k resistor on the module. Drive this pin high if there is a need
to enter Debug Mode.

RTCK – leave this pin unconnected for normal operation.

BATT – connect an external battery for RTC section backup.

11. Interfacing PHIL40 board to various voltage levels
PHIL40 board runs from 5V supply and generates 3.3V voltage for I/O
pins logic levels reference. All PHIL40 I/Os are 3.3V compliant,
meaning they can directly interface with 3.3V logic. They can also
interface directly 5V LV TTL and HCT MOS logic.
PHIL40 I/Os are 5V resistant so they can receive 5V TTL/HC/HCT logic
levels. However, I/O cannot drive 5V HC MOS inputs directly, some
level
conversion is necessary. The simplest method for slow signals is
using
pull up resistor to 5V supply.

12. Simple test / First use of TinyARM
It is easy to start with PHIL40 module. All what you need is and
experimental board, DIL40 socket, RS232 interface circuit like MAX232
and 5V power supply. Philips supplies LPC210x ISP utility for Windows
which can talk to PHIL40 UART0 serial interface.
Make the connections like the following:
- connect ground to DIL40 pin 20
- connect +5V to DIL40 pin 40
- connect logic low (pull down 3k9 to ground) to DIL40 pin 16 which
  corresponds to PHIL40 Port0.14. This pin is samples during reset
  or
  power-up to indicate whether to start ISP utility.
- connect DIL40 pin 1 which corresponds to PHIL40 Port00/TxD0 to the
  input of MAX232 driver, e.g. to T1in (MAX232 pin 11). The output
  of MAX232 driver, e.g. T1out (MAX232 pin 14) is connected to DB9
  or DB25 connector as TxD signal.
- connect DIL40 pin 2 which corresponds to PHIL40 Port01/RxD0 to the
  output of MAX232 receiver, e.g. to R1out (MAX232 pin 12). The
  input of MAX232 driver, e.g. R1in (MAX232 pin 13) is connected to
  DB9 or DB25 connector as RxD signal.
- Connect a push-button between DIL40 pin 9 RSTN and ground.
- Insert PHIL40 board into DIL40 socket.
- Connect RS232 cable to the PC on one side and to your board on the
  other side.
- Apply power from 5V supply.
- Start Philips LPC210x utility
- Press push button to connect PHIL40 to the PC, if necessary.
- ENJOY !

13. Connecting Macraigor Systems WIGGLER to TinyARM board
The easiest way is to use extra DIL40 socket and connect DIL40 pins
to the male dual-row 20 pin header as follows:

DIL40 pin	Header pin	Signal name
20	4,6,8,10,12,14 16,18,20	GND
22	3	TRSTN
23	7	TMS
24	9	TCK
25	5	TDI
26	13	TDO
9	15	RESETN
30	11	RTCK
42	1,2	VCC (3.3V)

Some additional resistors are strongly recommended to apply correct
default voltage levels on JTAG pins.
Notes:
a. DBGSEL pin should be driven high, i.e. pull up resistor 1k to Vcc
   for the part to enter debug mode when debugging is possible.
b. PHIL40 module can supply 1.8V and 3.3V voltage to other (low
power)
   peripherals.

14. TinyARM board pinout

Pin Nr.	Pin Name	Altern.		Pin Nr.	Pin Name	Altern.
1	P0.0	TxD0/PWM1		40	VCC	5V
2	P0.1	RxD0/PWM3		39	P0.31	EXTIN0/*
3	P0.2	SCL/CAP0.0		38	P0.30	TRACEPKT3/*
4	P0.3	SDA/MAT0.0		37	P0.29	TRACEPKT2/*
5	P0.4	SCK/CAP0.1		36	P0.28	TRACEPKT1/*
6	P0.5	MISO/MAT0.1		35	P0.27	TRACEPKT0/*
7	P0.6	MOSI/CAP0.2		34	P0.26	TRACESYNC
8	P0.7	SSEL/PWM		33	P0.25	PIPESTAT2
9	RSTN			32	P0.24	PIPESTAT1
10	P0.8	TxD1/PWM4		31	RSTN_OUT	
11	P0.9	RxD1/PWM6		30	RTCK	
12	P0.10	RTS1/CAP1.0		29	DBGSEL	
13	P0.11	CTS1/CAP1.1		28	P0.23	PIPESTAT0
14	P0.12	DSR1/MAT1.1		27	P0.22	TRACECLK
15	P0.13	DTR1/MAT1.1		26	P0.21	PWM5/**TDO**
16 *Note	P0.14	DCD1/EINT1		25	P0.20	MAT1.3/**TDI**
17	P0.15	RI1/EINT2		24	P0.19	MAT1.2/**TCK**
18	PWRENN			23	P0.18	CAP1.3/**TMS**
19	VBAT			22	P0.17	CAP1.2/**TRST**
20	GND			21	P0.16	EINT0/MAT0.2

Note: P0.14 must be logic low for PHIL40 to enter boot loader mode.

15. Known problems of Philips LPC2106 processor
(Check if this applies to LPC2103 **!!!!)**
a. External interrupts 0 to 2 (EINT0 to EINT2) are level sensitive.
   It is not possible to set them to edge sensitive mode.
b. SPI interface requires to use pull up resistor on SSEL pin even
   if it is set to Master mode. That results in pin wasting, pin SSEL
   cannot be used as GPIO P0.7 when SPI is used.