october 2015, .. march 2016

noForth

MSP430F149 Minim Core board with noForth 149

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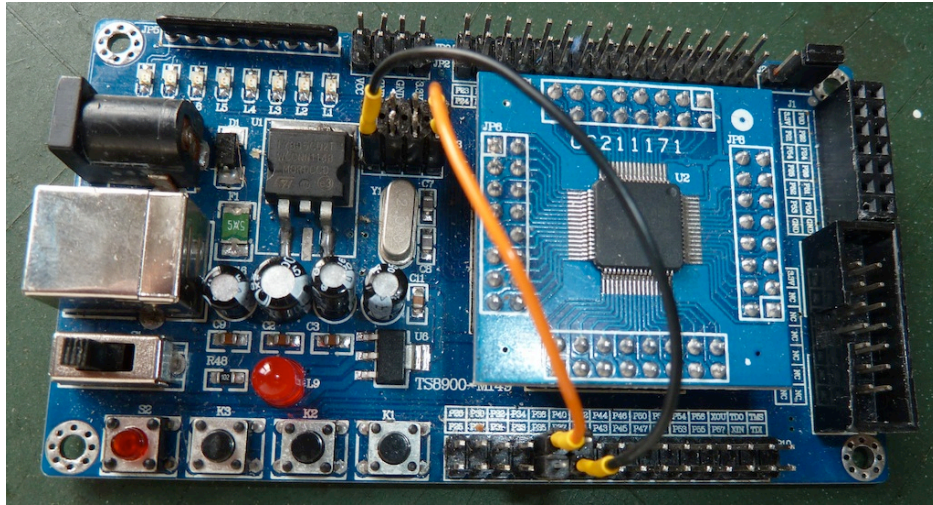   - PxSel
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In this text we refer to these two documents:

- SLAS272F.PDF "MSP430x13x, MSP430x14x, MSP430x14x1 mixed signal microcontroller"
- SLAU049F.PDF "MSP430x1xx Family User's Guide"

1. MSP430F149 Minim core board with noForth 149

Dimensions: 4.06 in x 2.24 in x 0.55 in (10.3 cm x 5.7 cm x 1.4 cm)
Weight: 1.87 oz (53 g) - Price: ca. $20.-
top seller store - China (Mainland) (Guangdong)

- Aliexpress - Product ID: 597172877
  MSP430F149 development board MSP430 Minim core board USB download
- bij DX - Model: I072606
  MSP430F149/430 Minimum SCM Development Board w/ USB Cable - Blue

RS232/USB driver

The USB chip on the minim core board is the PL2303hx. It needs a specific driver under Windows. Unzip this file and execute "PL2303_Prolific_DriverInstaller_v1.11.0.exe". Windows 8 and higher do no longer support the PL2303hx USB-chip. If you have a modern Windows a communication module with an PL2303TA chip could be a solution.

We will use UART1 for communication, because the UART0 connections on the print coincide with the push buttons on the print. Therefore UART1 must be linked with the USB chip:
connect P3.6 to JP3 pin-2 and P3.7 to JP3 pin-8 using wire jumpers.

i/o port connections on Minim core board

Port 1
Digital i/o, TimerA i/o

```
P1.0   ...
P1.1   Bootloader TX
P1.2   ...
P1.3   ...
P1.4   ...
P1.5   ...
P1.6   ...
P1.7   ...
```

Port 2
Digital i/o, TimerA i/o

```
P2.0   Led
P2.1   Led
P2.2   Led/Bootloader RX
P2.3   Led
P2.4   Led
P2.5   Led
P2.6   Led
P2.7   Led
```

Port 3
Digital i/o, UART0, UART1

```
P3.0   ...
P3.1   ...
P3.2   SW K1
P3.3   SW K2
P3.4   SW K3/TX0/USB
P3.5   RX0/USB
P3.6   TX1
P3.7   RX1
```

Port 4
Digital i/o, TimerB i/o

```
P4.0   NRF905
P4.1   NRF905
P4.2   NRF905
P4.3   ...
P4.4   ...
P4.5   NRF905
P4.6   NRF905
P4.7   ...
```

Port 5
Digital i/o, UART1 SPI mode

```
P5.0   NRF905
P5.1   NRF905
P5.2   NRF905
P5.3   NRF905
P5.4   ...
P5.5   ...
P5.6   ...
P5.7   ...
```

Port 6
Digital i/o, analog inputs

```
P6.0   ...
P6.1   ...
P6.2   ...
P6.3   ...
P6.4   ...
P6.5   ...
P6.6   ...
P6.7   ...
```

Connectors on Minim core board

```
P1    = Power 8V to 12V
USB1  = USB power annex pseudo RS232
S1    = 5 Volt via USB or P1/7805
J1    = NRF905: P2.0, P2.1, P2.2, P2.4, P2.5, P2.6,
                P5.0, P5.1, P5.2 and P5.3
J2    = Vref
JP2   = Power select
JP3   = Bootloader P1.1 and P2.2
JP9   = P1, P2.0 to P2.4, P6, Vref, Xtal, 3V3, GND and Reset
JP10  = P2.5 to P2.7, P3, P4, P5, Xtal and JTAG pins
JP11  = JTAG
```

Hardware on Minim core board

- 8 leds on P2
- 3 switches on P1.2 .. P1.4
- Reset switch S2
- Connection for NRF905 on P4 and P5

2. MSP430F149 i/o ports

Addresses

The MSP430F149 port registers are memory mapped. An overview:

	P1	P2	P3	P4	P5	P6	Function
PxIN	20	28	18	1C	30	34	In
PxOUT	21	29	19	1D	31	35	Out
PxDIR	22	2A	1A	1E	32	36	Direction
PxIFG	23	2B	–	–	–	–	Interrupt flag
PxIES	24	2C	–	–	–	–	Interrupt edge on
PxIE	25	2D	–	–	–	–	Interrupt on
PxSEL	26	2E	1B	1F	33	37	Select

See: SLAS272F.PDF under "peripheral file map", page 20-23.

PxDir

```
PxDIR = 0          Floating input
PxDIR = 1          Output
```

The port register functions are documented in SLAU049F.PDF page 9.2.3.
Texas Instruments recommends to configure unconnected i/o pins as Output.

PxSEL

The PxSEL register is used to assign a special function to an i/o pin. In this way, for example,
the ADC can be activated. See SLAU272F.PDF page 40.

```
PxSEL = 0          Normal i/o
PxSEL = 1          Special function
```

UART

Registers ME1 and ME2 are used to link the UART's to the fysical i/o bits, see
SLAU049F.PDF page "13-27".

3. MSP430F149 RAM & ROM

```
RAM        0200 - 09FF
FlashROM   1100 - FFFF
```

4. MSP430F149 interrupt vectors

```
FFDE    End of free Flash

FFE0    ...
FFE2    P2
FFE4    USART1 TX
FFE6    USART1 RX
FFE8    P1
FFEA    TIMER A3 CCR1 CCR2
FFEC    TIMER A3 CCR0
FFEE    ADC12

FFF0    USART0 TX
FFF2    USART0 RX
FFF4    WATCHDOG
FFF6    COMPARATOR
FFF8    TIMER B7 CCR1 CCR2 CCR3 ...
FFFA    TIMER B7 CCR0
FFFC    NMI
FFFE    RESET
```

See SLAS272F.PDF page 13 for details.

5. Processor registers in noForth

All processor registers (R0..R15) have their own name in noForth assembler:

`PC  RP (SP in TI texts!) SR CG`	MSP430 system registers
`SP  IP  TOS  DOX  NXT`	noForth system registers
`W   DAY SUN  MOON`	Registers, locally used by noForth
`XX  YY  ZZ`	Unused (free) registers