september 2018, february 2020

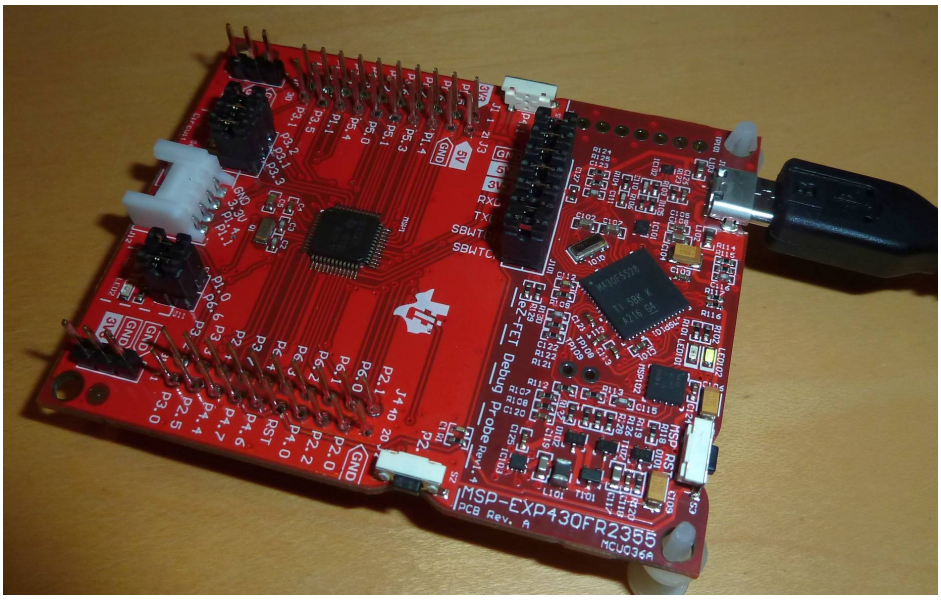
noForth website

MSP-EXP430FR2355 with noForth 2x55

In this text we refer to these two documents:

- MSP430FR2355.PDF "MSP430FR2355 Mixed-Signal Microcontroller"
- SLAU445I.PDF "MSP430FR4xx and MSP430FR2xx Family User's Guide"

1. MSP-EXP430FR2355 with noForth 2x55



MSP430FR2355 Development kit
Core Sub-Architecture: MSP430X
No. of Bits: 16 bit
Kit Contents: LaunchPad Emulator, Mini USB-B Cable, Quick Start Guide

- Farnell - Ordercode: Unknown, TEXAS INSTRUMENTS - MSP-EXP430FR2355
- Texas Instruments - https://store.ti.com/MSP-EXP430FR2355

The Windows USB-driver for this board is: ezFET-Lite-Driver1.zip

i/o port connections on MSP-EXP430FR2355

Port 1

```
P1.0    - Led 1
P1.1    - ...
P1.2    - ...
P1.3    - ...
P1.4    - ...
P1.5    - ...
P1.6    - ...
P1.7    - ...
```

Port 2

```
P2.0    - ...
P2.1    - ...
P2.2    - ...
P2.3    - S2
P2.4    - ...
P2.5    - ...
P2.6    - Xout
P2.7    - Xin
```

Port 3

```
P3.0    - ...
P3.1    - Light sensor
P3.2    - Light sensor
P3.3    - Light sensor
P3.4    - ...
P3.5    - ...
P3.6    - ...
P3.7    - ...
```

Port 4

```
P4.0    - ...
P4.1    - S1
P4.2    - RXD<<
P4.3    - TXD>>
P4.4    - ...
P4.5    - ...
P4.6    - ...
P4.7    - ...
```

Port 5

```
P5.0    - ...
P5.1    - ...
P5.2    - ...
P5.3    - ...
P5.4    - ...
```

Port 6

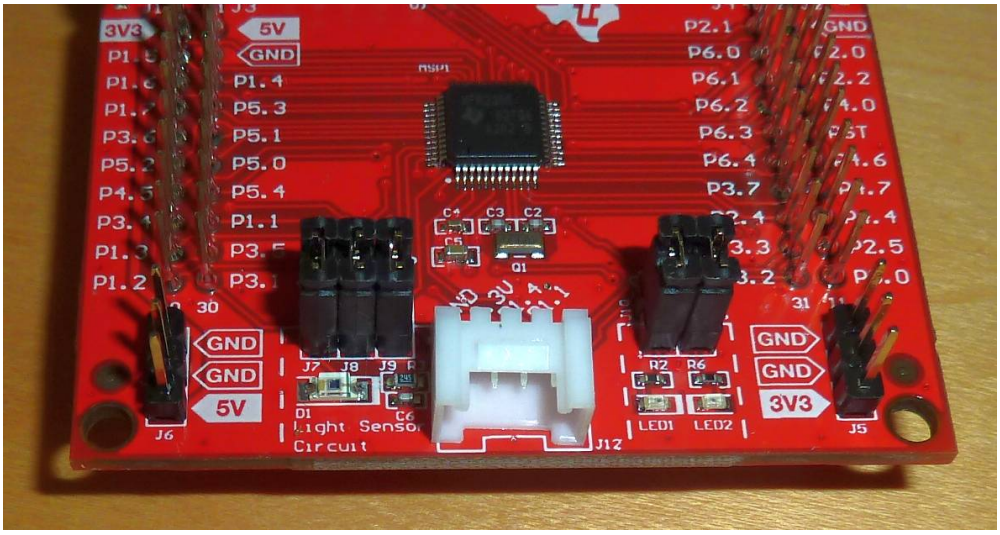
```
P6.0    - ...
P6.1    - ...
P6.2    - ...
P6.3    - ...
P6.4    - ...
P6.5    - ...
P6.6    - Led 2
```

Connectors on MSP-EXP430FR2355

```
J1     = i/o P1, P3, P5 and 3V3
J2     = i/o P2, P3, P4, Reset and GND
J3     = i/o P1, P3, P5, +5V and GND
J4     = i/o P2, P3, P6
J5     = (External) power (2,5V tot 3,6V)
J6     = (External) power (5V)
J7     = Light sensor
J8     = Light sensor
J9     = Light sensor
J10    = Led 1 connect
J11    = Led 2 connect
J12    = Grove connector, Analog and Digital modules (Seeed Studio)
J101   = Programmer connection and USB RS232
J102   = Micro USB programming/RS232/Power supply
TP101  = Seven test points
```

Hardware on MSP-EXP430FR2355

- Two leds on P1.0 and P6.6
- Switch S1 on P4.1
- Switch S2 on P2.3
- Reset switch S3
- 32KHz xtal
- Photo diode (Light sensor circuit)



2. MSP430FR2355 i/o ports

Addresses

The MSP430FR2355 port registers are memory mapped. An overview:

Label	P1	P2	P3	P4	P5	P6	Function
PxIN	200	201	220	221	240	241	Input
PxOUT	202	203	222	223	242	243	Output
PxDIR	204	205	224	225	244	245	Direction
PxREN	206	207	226	227	246	247	Resistor enable
PxSEL0	20A	20B	22A	22B	24A	24B	Select 0
PxSEL1	20C	20D	22C	22D	24C	24D	Select 1
PxIV	20E	21E	22E	22F			Interrupt vector word
PxSELC	210	211	230	231			Complement selection
PxIES	218	219	238	239			Interrupt edge select
PxIE	21A	21B	23A	23B			Interrupt on
PxIFG	21C	21D	23C	23D			Interrupt flag

PxDir, PxREN and PxOUT

The three registers PxDIR, PxREN and PxOUT are used to configure an i/o pin:

PxDIR	PxREN	PxOUT	Pin configuration
0	0	x	Floating input
0	1	0	Input with resistor to GND
0	1	1	Input with resistor to VCC
1	x	x	Output

More info in SLAU445I.PDF page 313.
Texas Instruments recommends to configure unconnected i/o pins as Output.

PxSEL0 and PxSEL1

The registers PxSEL0 and PxSEL1 are used to assign a special function to an i/o pin. In this way, for example, the ADC of UART can be activated. More info: MSP430FR2355.PDF from page 95, etc: P1-functions.

PxSEL1	PxSEL0	i/o-function
0	0	Normal i/o
0	1	Basic extra function
1	0	Controller specific!
1	1	Second extra function

UART

The eUSCI A1 is used as UART the default baudrate is 115200 baud. Pins P4.3 (TXD>>) and P4.2 (RXD<<) are used.

3. RAM and ROM

```
RAM 2000 - 2FFF,  ROM 8000 - FFFF
```

4. Interrupt vectors MSP430FR2355

```
FF7E    - End of free flash
FF80    - 4 Bytes JTAG/BSL signature
FF84    - 4 Bytes BSL signature
FF88    - BSL Config Signature
FF8A    - BSL Config
FFA0    - BSL I2C Address
FFA2    - Reserved space

FFCE    - P4
FFD0    - P3
FFD2    - P2
FFD4    - P1
FFD6    - SAC1-sAC3
FFD8    - SAC0_SAC2
FFDA    - eCOMP0_eCOMP1
FFDC    - ADC
FFDE    - eUSCI B1 tx/rx
FFE0    - eUSCI B0 tx/rx
FFE2    - eUSCI A1 tx/rx
FFE4    - eUSCI A0 tx/rx
FFE6    - WATCHDOG
FFE8    - RTC
FFEA    - TIMER3 B7 CCR1
FFEC    - TIMER3 B7 CCR0
FFEE    - TIMER2 B3 CCR1
FFF0    - TIMER2 B3 CCR0
FFF2    - TIMER1 B3 CCR1  CCR2
FFF4    - TIMER1 B3 CCR0
FFF6    - TIMER0 B3 CCR1  CCR2
FFF8    - TIMER0 B3 CCR0
FFFA    - NMI USER
FFFC    - NMI SYSTEM
FFFE    - RESET from many sources
```

See MSP430FR2355.PDF page 63 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

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