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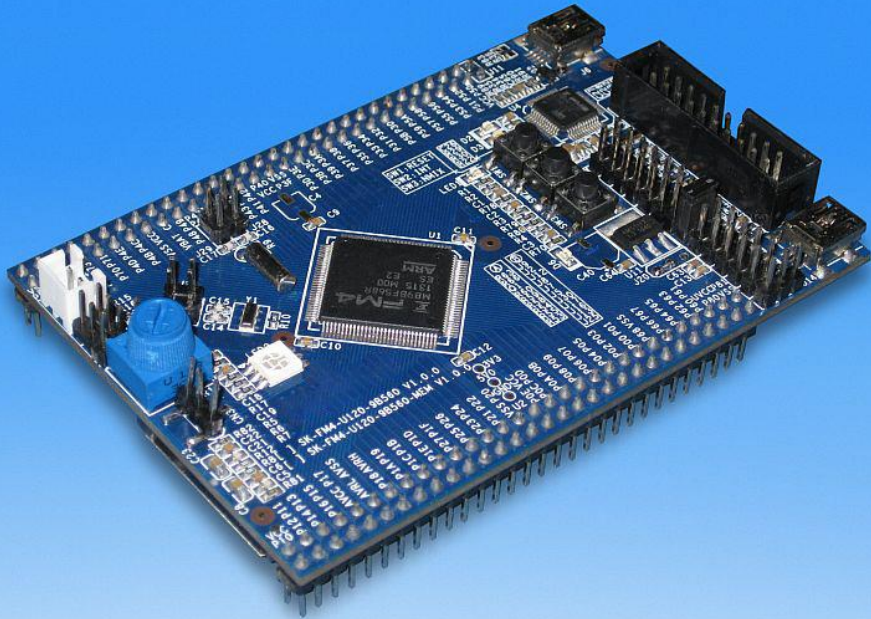
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# Starter Kit User Guide

## FM4-U120-9B560

## FM4-U120-9B560-MEM

Hardware V1.1 / Documentation V1.8



Document Number: 002-09878 Rev. \*B

# Warranty and Disclaimer



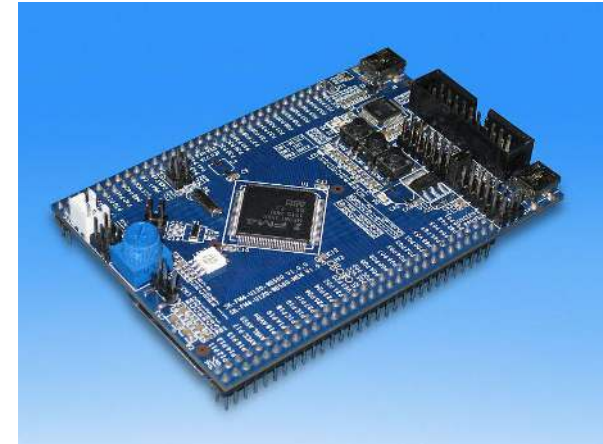
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- For your convenience this user guide includes external links that simplify installing of drivers, software utilities, and quick jumps to documentation.
- Some PDF viewer do not allow access to external content by links because of security reasons.
- A viewer called “PDF XChange” is provided in the software package of this starter kit. It’s use is free of charge and no additional installation is required.
- Launching “start.bat” opens this user guide in the PDF XChange viewer.
- Please ensure you have copied the complete software package related to this starter kit to use and run the links and examples given on the next pages.
- Please contact the [Cypress Support](#) for any question.

- [MCU Features](#), [Board Features](#), and [Contents](#)
- [Please check jumper setting](#) / [Test it by a GUI](#)
- [The Hardware](#) / [Pin Overview](#)
- [The Jumper Table](#) / [Jumper Default](#)
- [Board Power](#)
- [Software Examples & Tools](#)
- [Flash Programming](#)
- [JTAG / CMSIS-DAP](#)
- [IAR-Embedded Workbench](#)
- [KEIL μVision](#)
- [Contacts](#) and [More](#)



## ■ [Additional documents](#)

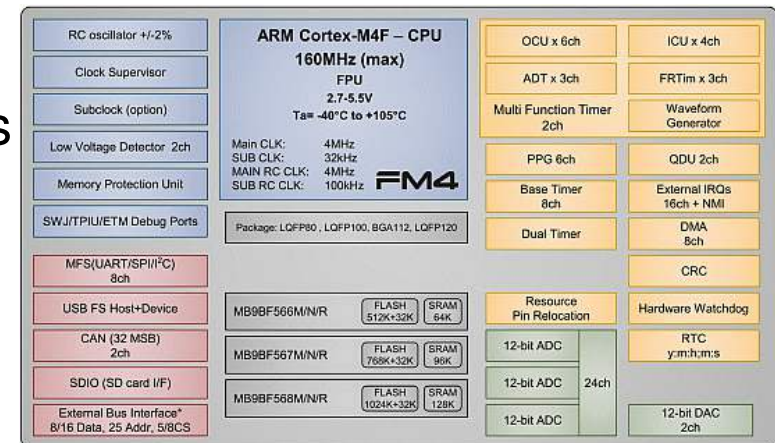
- [Schematic](#)
- [Factsheet](#)
- [Data sheet MB9B560R Series](#)
- [Peripheral Manual](#)
- [Peripheral Manual \(Timer Part\)](#)
- [Peripheral Manual \(Analog Part\)](#)
- [Peripheral Manual \(Communication Part\)](#)
- [Flash Programming Manual](#) and [Errata](#)

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# Features of the Microcontroller



- The FM4-U120-9B560 and FM4-U120-9B560-MEM are based on the Cypress Arm<sup>®</sup> Cortex<sup>®</sup>-M4 device MB9BF568R
- The MB9B560R Series includes the following features:
  - Up to 1 MByte Flash Memory and 32 KByte Work Flash Memory
  - Up to 128 KByte RAM
  - Up to 160 MHz clock
  - Up to 2 CAN controller 2.0A/B
  - Up to 8 UART / LIN / SPI / I<sup>2</sup>C interfaces
  - USB-Host/-Device interface
  - SD-Card interface
  - Three 12 bit ADCs, up to 24 channels
  - Two 12 bit DACs
  - Up to 16 channel external interrupts
  - Two Multifunction timer with waveform generator, e.g. Motor control
  - Timers (ICUs, OCUs, PPGs, others)



# Features of the Board

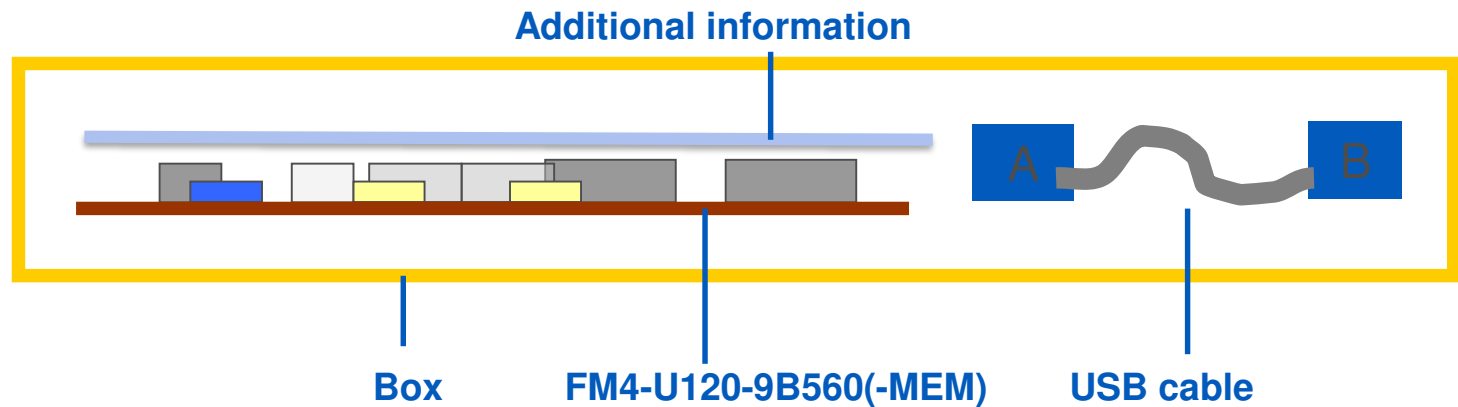


- The FM4-U120-9B560(-MEM) is available in two versions:

Feature	FM4-U120-9B560	FM4-U120-9B560-MEM
External Power Supply	USB, DAP, JTAG or from FM4-U-PERIPHERAL	
On-board Voltage	3.3 V or 5 V	3.3 V
User-LEDs, Reset-LED	3x User-LEDs (R,G,B) + Reset	
Buttons	3x buttons: Reset + External Interrupt + NMI	
Potentiometer	AN18 (0V .. Onboard voltage 3.3V/5V)	
Debug interface	Onboard CMSIS-DAP incl. Status LEDs (connected, running) (optional 20 pin JTAG-IF to be used with external JTAG adapter)	
Virtual COM port (USB-2-UART bridge)	Yes	
USB interface	USB Function (Mini-USB Type B)	
SD-Card interface	Yes	No
External Memory	No	NAND-Flash: 32 MByte SDRAM: 16 MByte

# Contents FM4-U120-9B560

- The FM4-U120-9B560(-MEM) contents
  - The FM4-U120-9B560 or FM4-U120-9B560-MEM evaluation board
  - One USB mini cable
  - 1-page flyer



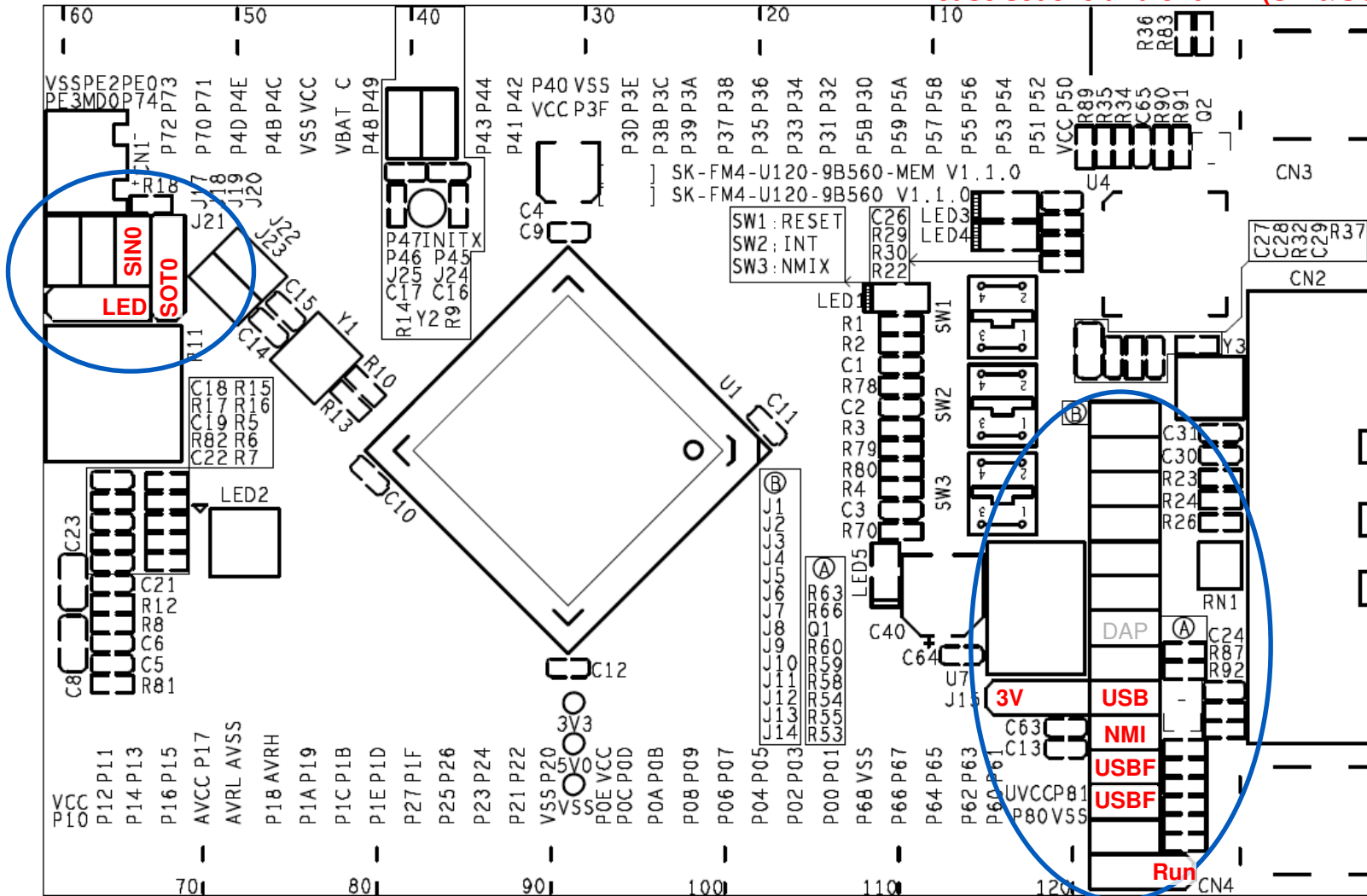


# Please Check Jumper Setting

FM4-U120-9B560 supports 5 V and 3.3 V operation  
FM4-U120-9B560-MEM supports only 3.3 V operation

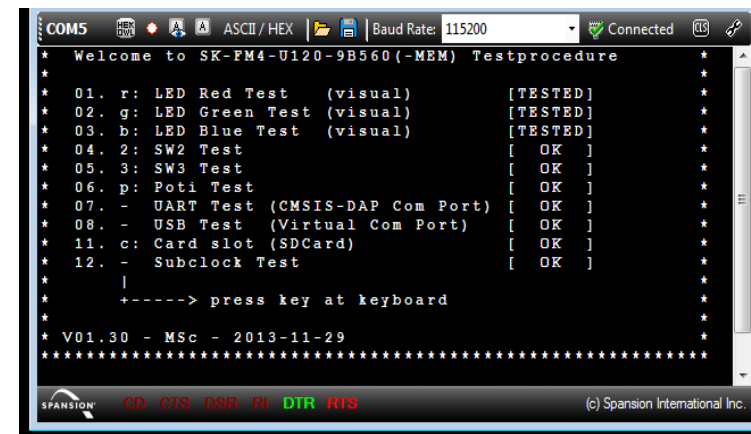
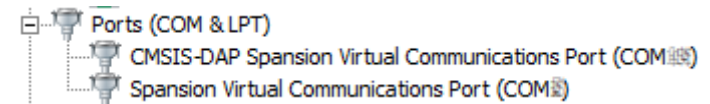
## Note:

Please set **J9 (USB)** instead of **J7 (CMSIS-DAP)**  
Please set **J19 and J20:1-2 (SINO/SOTO)**



# Test it by Terminal using USB

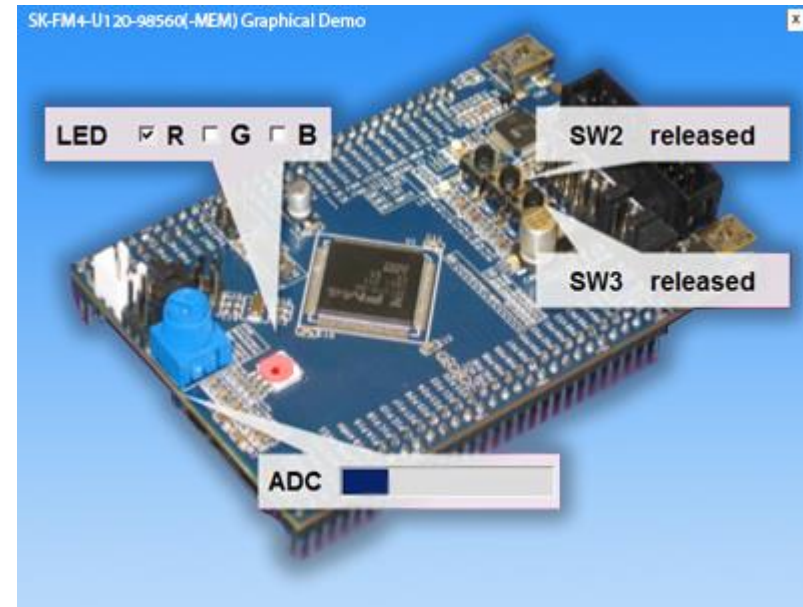
- The microcontroller on the FM4-U120-9B560(-MEM) is already preprogrammed with a test application (<drive:>\sw-examples\testsoftware)
  - Install the USB driver first <drive:>\drivers\driverinstaller.exe
  - Connect the starter kit to CN4 (USB) with your PC
    - ✓ Ensure jumper J9 (USB) is set for correct power supply
    - ✓ Ensure jumper J19 and J20:1-2 are set correctly for use of SIN0/SOT0
  - Press the ,Reset'- Button
  - Check the availability for virtual COM port
    - ✓ e.g. Windows Device Manager
  - Open a serial terminal tool
    - ✓ e.g. Cypress Serial Port Viewer
    - <drive:>\tools\serialportviewer\setup.exe
    - ✓ Settings 115200 baud, 8N1
  - Press <space> to show welcome menu
  - Please select any function to test the on-board features



```
COM5  HEX  ASCII / HEX  Baud Rate: 115200  Connected  [15]  [?]
* Welcome to SK-FM4-U120-9B560 (-MEM) Testprocedure *
* 01. r: LED Red Test (visual) [TESTED] *
* 02. g: LED Green Test (visual) [TESTED] *
* 03. b: LED Blue Test (visual) [TESTED] *
* 04. 2: SW2 Test [ OK ] *
* 05. 3: SW3 Test [ OK ] *
* 06. p: Poti Test [ OK ] *
* 07. - UART Test (CMSIS-DAP Com Port) [ OK ] *
* 08. - USB Test (Virtual Com Port) [ OK ] *
* 11. c: Card slot (SDCard) [ OK ] *
* 12. - Subclock Test [ OK ] *
* | *
* +-----> press key at keyboard *
* *
* V01.30 - MSc - 2013-11-29 *
*****
SPANSTON  CD  Q1S  DSR  RI  DTR  RTS  (c) Spansion International Inc.
```

# Test it by a GUI

- The microcontroller on the FM4-U120-9B560(-MEM) is already preprogrammed with a test application (<drive:>\sw-examples\testsoftware)
  - Install the USB driver first <drive:>\drivers\driverinstaller.exe
  - Connect the starter kit to CN4 (USB) with your PC
  - Open the PC software <drive:>\sw-examples\testsoftware\SK-FM4-U120-9B560\_demo.exe
  - The picture of the board will be shown with current status of on-board features
  - LED allows control of the RGB-LED
    - ✓ Just click to the checkboxes
  - Status of user-buttons SW2 and SW3 are shown interactively
  - ADC represents the potentiometer R11



- You finished successfully the first test.

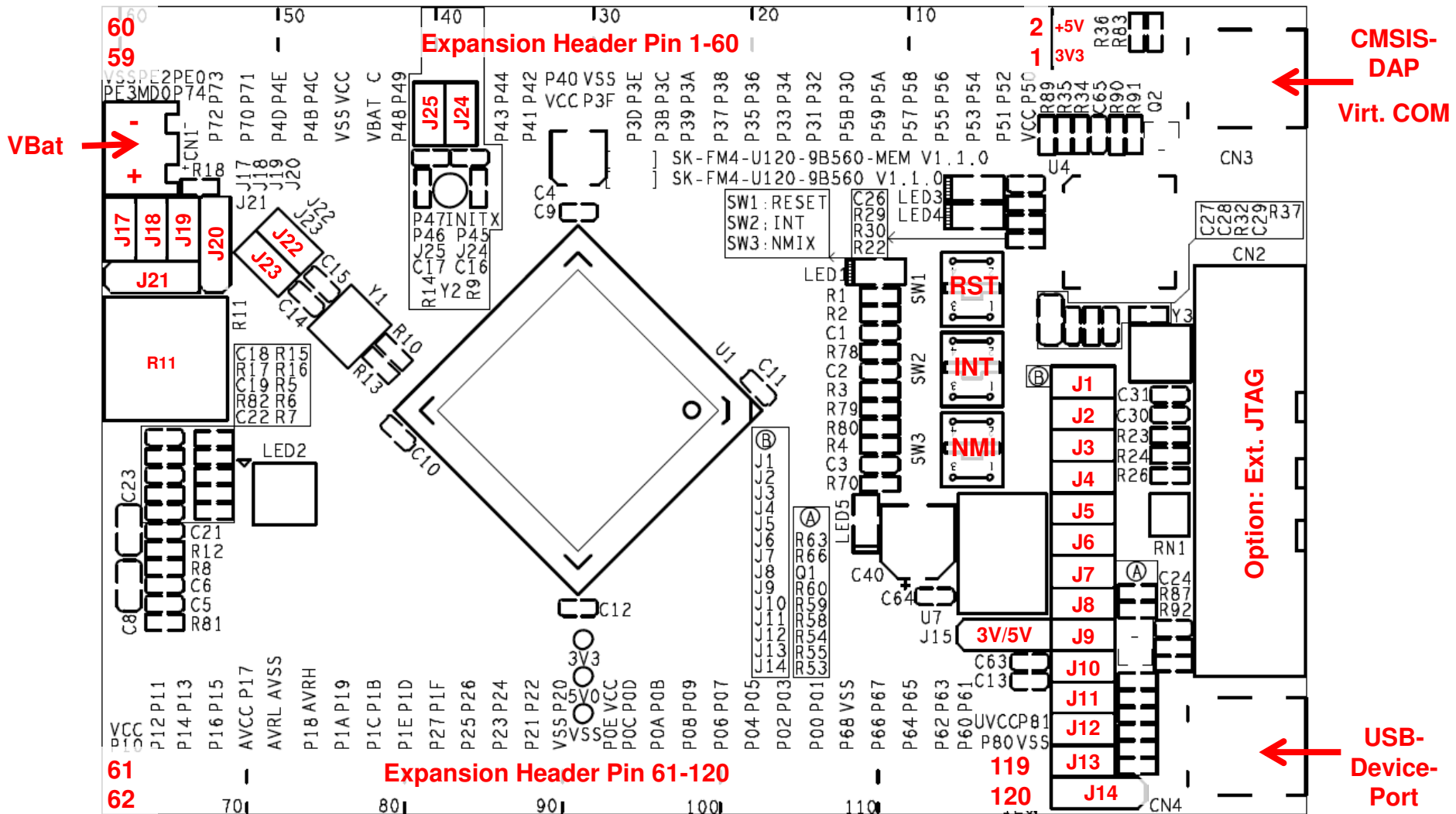
# Congratulations!

- Next section covers:
  - The onboard features
  - How to program the Flash
    - ✓ Serial ROM Boot loader
      - USB Direct
      - UART0
    - ✓ On-board CMSIS-DAP
    - ✓ JTAG with optional emulator
  - How to start with IAR-Embedded-Workbench and KEIL  $\mu$ Vision

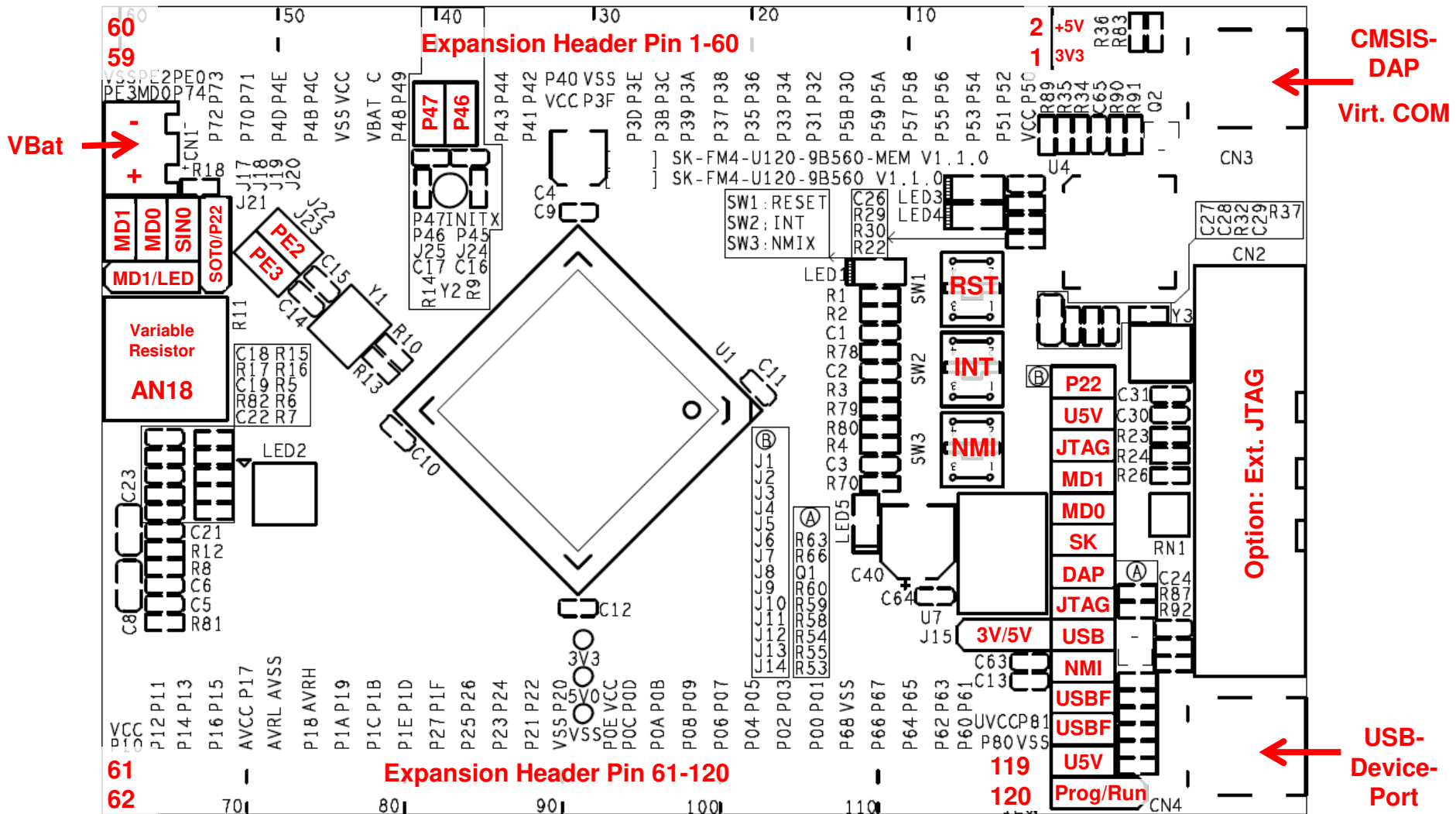


# Hardware

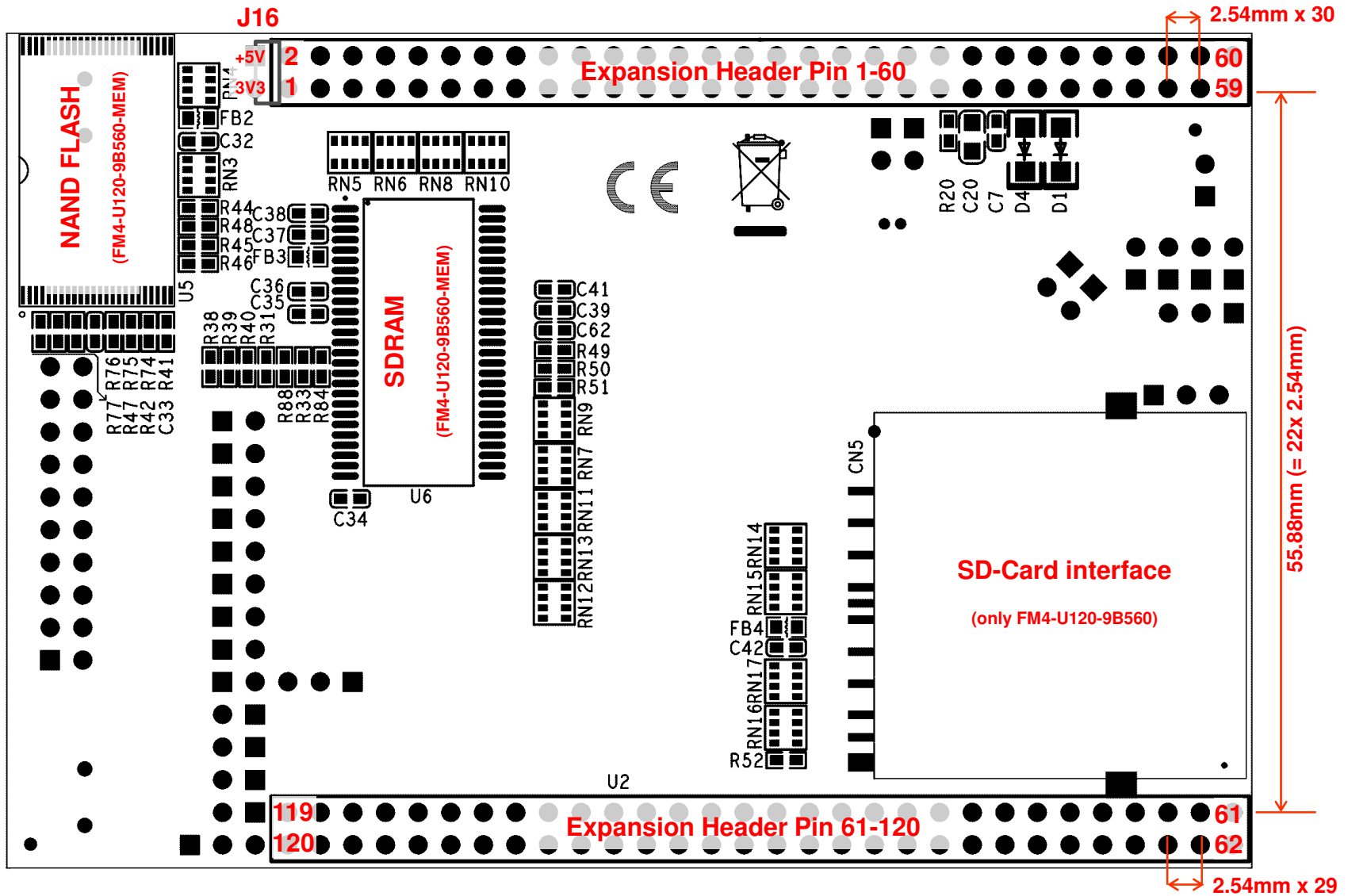
# The Hardware (Top Side) – Jumper Overview



# The Hardware (Top Side) – Jumper Function Overview



# The Hardware (Bottom Side)





# The Hardware – Pin Overview 1 - 20



Pin	Microcontroller-Function	FM4-U120-9B560	FM4-U120-9B560-MEM
1	VCC	VCC_MCU 3V3 or 5V0	VCC_MCU 3V3 or 5V0
2	P50/CTS4_0/AIN0_2/RTO10_0/INT00_0/MADATA00_0		SDRAM, NAND FLASH
3	P51/RTS4_0/BIN0_2/RTO11_0/INT01_0/MADATA01_0		SDRAM, NAND FLASH
4	P52/SCK4_0/ZIN0_2/RTO12_0/MADATA02_0		SDRAM, NAND FLASH
5	P53/TIOA1_2/SOT4_0/RTO13_0/MADATA03_0		SDRAM, NAND FLASH
6	P54/TIOB1_2/SIN4_0/RTO14_0/INT02_0/MADATA04_0		SDRAM, NAND FLASH
7	P55/ADTG_1/SIN6_0/RTO15_0/INT07_2/MADATA05_0		SDRAM, NAND FLASH
8	P56/SOT6_0/DTTI1X_0/INT08_2/MADATA06_0		SDRAM, NAND FLASH
9	P57/SCK6_0/MADATA07_0		SDRAM, NAND FLASH
10	P58/SIN4_2/AIN1_0/INT04_2/MADATA08_0		SDRAM
11	P59/RX1_1/SOT4_2/BIN1_0/INT07_1/MADATA09_0		SDRAM
12	P5A/TX1_1/SCK4_2/ZIN1_0/MADATA10_0		SDRAM
13	P5B/CTS4_2/MADATA11_0		SDRAM
14	P30/TIOB0_1/RTS4_2/INT15_2/WKUP1/MADATA12_0		SDRAM
15	P31/TIOB1_1/SIN3_1/INT09_2/MADATA13_0		SDRAM
16	P32/TIOB2_1/SOT3_1/INT10_1/MADATA14_0		SDRAM
17	P33/ADTG_6/TIOB3_1/SCK3_1/INT04_0/MADATA15_0		SDRAM
18	P34/TX0_1/TIOB4_1/FRCK0_0/MNALE_0		NAND FLASH
19	P35/RX0_1/TIOB5_1/IC03_0/INT08_1/MNCLE_0		NAND FLASH
20	P36/SIN5_2/IC02_0/INT09_1/MNWEX_0		NAND FLASH

# The Hardware – Pin Overview 21 - 40



Pin	Microcontroller-Function	FM4-U120-9B560	FM4-U120-9B560-MEM
21	P37/SOT5_2/IC01_0/INT05_2/MNREX_0		NAND FLASH
22	P38/SCK5_2/IC00_0/INT06_2	LED_G	LED_G
23	P39/ADTG_2/DTTI0X_0/RTCCO_2/SUBOUT_2/MSDCLK_0		SDRAM
24	P3A/TIOA0_1/AIN0_0/RTO00_0/MSDCKE_0		SDRAM
25	P3B/TIOA1_1/BIN0_0/RTO01_0/MRASX_0		SDRAM
26	P3C/TIOA2_1/ZIN0_0/RTO02_0/MCASX_0		SDRAM
27	P3D/TIOA3_1/RTO03_0/MAD00_0		SDRAM
28	P3E/TIOA4_1/RTO04_0/MAD01_0		SDRAM
29	P3F/TIOA5_1/RTO05_0/MAD02_0		SDRAM
30	VSS	GND	GND
31	VCC	VCC_MCU 3V3 or 5V0	VCC_MCU 3V3 or 5V0
32	P40/TIOA0_0/RTO10_1/INT12_1		
33	P41/TIOA1_0/RTO11_1/INT13_1		
34	P42/TIOA2_0/RTO12_1/MSDWEX_0		SDRAM
35	P43/ADTG_7/TIOA3_0/RTO13_1/MCSX8_0		SDRAM
36	P44/TIOA4_0/RTO14_1/DA0		
37	P45/TIOB0_0/RTO15_1/DA1		
38	INITX	Button Reset / JTAG	Button Reset / JTAG
39	P46/X0A	Sub-Crystal 32.768 kHz	Sub-Crystal 32.768 kHz
40	P47/X1A	Sub-Crystal 32.768 kHz	Sub-Crystal 32.768 kHz

# The Hardware – Pin Overview 41 - 60



Pin	Microcontroller-Function	FM4-U120-9B560	FM4-U120-9B560-MEM
41	P48/VREGCTL		
42	P49/VWAKEUP	Pull-Down resistor	Pull-Down resistor
43	VBAT	Battery (CN1)	Battery (CN1)
44	C	Capacitor 4u7	Capacitor 4u7
45	VSS	GND	GND
46	VCC	VCC_MCU 3V3 or 5V0	VCC_MCU 3V3 or 5V0
47	P4B/TIOB1_0/SCS7_1/MAD03_0		SDRAM
48	P4C/TIOB2_0/SCK7_1/AIN1_2/MAD04_0		SDRAM
49	P4D/TIOB3_0/SOT7_1/BIN1_2/INT13_2/MAD05_0		SDRAM
50	P4E/TIOB4_0/SIN7_1/ZIN1_2/FRCK1_1/INT11_1/WKUP2/MAD06_0		SDRAM
51	P70/TX0_0/TIOA4_2/AIN0_1/IC13_1		
52	P71/RX0_0/TIOB4_2/BIN0_1/IC12_1/INT15_1		
53	P72/TIOA6_0/SIN2_0/ZIN0_1/IC11_1/INT14_2		
54	P73/TIOB6_0/SOT2_0/IC10_1/INT03_2	USB	USB
55	P74/SCK2_0/DTT11X_1		
56	PE0/MD1	LED_B / MD1	LED_B / MD1
57	MD0	MD0	MD0
58	PE2/X0	Main-Crystal 4 MHz	Main-Crystal 4 MHz
59	PE3/X1	Main-Crystal 4 MHz	Main-Crystal 4 MHz
60	VSS	GND	GND

# The Hardware – Pin Overview 61 - 80



Pin	Microcontroller-Function	FM4-U120-9B560	FM4-U120-9B560-MEM
61	VCC	VCC_MCU 3V3 or 5V0	VCC_MCU 3V3 or 5V0
62	P10/AN00/RX1_2/SIN1_1/FRCK0_2/INT02_1/MAD07_0		SDRAM
63	P11/AN01/TX1_2/SOT1_1/IC00_2/MAD08_0		SDRAM
64	P12/AN02/SCK1_1/IC01_2/RTCCO_1/SUBOUT_1/MAD09_0		SDRAM
65	P13/AN03/SIN0_1/IC02_2/INT03_1/MAD10_0		SDRAM
66	P14/AN04/SOT0_1/IC03_2/MAD11_0		SDRAM
67	P15/AN05/SCK0_1/MAD12_0		
68	P16/AN06/SIN2_2/INT14_1/MAD13_0		
69	P17/AN07/SOT2_2/WKUP3/MAD14_0		SDRAM
70	AVCC	VCC_MCU	VCC_MCU
71	AVSS	GND	GND
72	AVRL	GND	GND
73	AVRH	VCC_MCU	VCC_MCU
74	P18/AN08/SCK2_2/MAD15_0		SDRAM
75	P19/AN09/SIN4_1/IC00_1/INT05_1/MAD16_0		
76	P1A/AN10/SOT4_1/IC01_1/MAD17_0		
77	P1B/AN11/SCK4_1/IC02_1/MAD18_0		
78	P1C/AN12/CTS4_1/IC03_1/MAD19_0		
79	P1D/AN13/RTS4_1/DTTI0X_1/MAD20_0		
80	P1E/AN14/ADTG_5/FRCK0_1/MAD21_0		

# The Hardware – Pin Overview 81 - 100



Pin	Microcontroller-Function	FM4-U120-9B560	FM4-U120-9B560-MEM
81	P1F/ADTG_4/TIOB6_2/RTO05_1		
82	P27/TIOA6_2/RTO04_1/INT02_2	LED_R	LED_R
83	P26/TIOB5_0/SCK2_1/RTO03_1		
84	P25/TX1_0/TIOA5_0/SOT2_1/RTO02_1		
85	P24/RX1_0/SIN2_1/RTO01_1/INT01_2		
86	P23/AN15/TIOA7_1/SCK0_0/RTO00_1/MAD22_0		
87	P22/CROUT_0/AN16/TIOB7_1/SOT0_0/ZIN1_1	JTAG	JTAG
88	P21/AN17/SIN0_0/BIN1_1/INT06_1/MAD23_0	JTAG	JTAG
89	P20/AN18/AIN1_1/INT05_0/MAD24_0	Potentiometer R11	Potentiometer R11
90	VSS	GND	GND
91	VCC	VCC_MCU 3V3 or 5V0	VCC_MCU 3V3 or 5V0
92	P0E/TIOB5_2/SCS6_1/IC13_0/S_CLK_0/MDQM1_0	SD-Card	SDRAM
93	P0D/TIOA5_2/SCK6_1/IC12_0/S_CMD_0/MDQM0_0	SD-Card	SDRAM
94	P0C/TIOA6_1/SOT6_1/IC11_0/S_DATA1_0/MALE_0	SD-Card	
95	P0B/TIOB6_1/SIN6_1/IC10_0/INT00_1/S_DATA0_0/MCSX0_0	SD-Card	NAND FLASH
96	P0A/SIN1_0/FRCK1_0/INT12_2/S_DATA3_0/MCSX1_0	SD-Card	
97	P09/AN19/TRACED0/TIOA3_2/SOT1_0/S_DATA2_0/MCSX5_0	SD-Card	
98	P08/AN20/TRACED1/TIOB3_2/SCK1_0/MCSX4_0		
99	P07/AN21/TRACED2/TIOA0_2/SCK7_0/MCLKOUT_0		
100	P06/AN22/TRACED3/TIOB0_2/SOT7_0/MCSX3_0		

# The Hardware – Pin Overview 101 - 120



Pin	Microcontroller-Function	FM4-U120-9B560	FM4-U120-9B560-MEM
101	P05/AN23/ADTG_0/TRACECLK/SIN7_0/INT01_1/MCSX2_0		
102	P04/TDO/SWO	JTAG	JTAG
103	P03/TMS/SWDIO	JTAG	JTAG
104	P02/TDI/MCSX6_0	JTAG	JTAG
105	P01/TCK/SWCLK	JTAG	JTAG
106	P00/TRSTX/MCSX7_0	JTAG	JTAG
107	VSS	GND	GND
108	P68/TIOB7_2/SCK3_0/INT00_2	Button INT	Button INT
109	P67/TIOA7_2/SOT3_0		
110	P66/ADTG_8/SIN3_0/INT11_2		
111	P65/TIOB7_0/SCK5_1		
112	P64/TIOA7_0/SOT5_1/INT10_2		
113	P63/CROUT_1/RX0_2/SIN5_1/INT03_0/S_CD_0/MWEX_0	SD-Card	
114	P62/ADTG_3/TX0_2/SIN5_0/INT04_1/S_WP_0/MOEX_0	SD-Card	
115	P61/UHCONX0/TIOB2_2/SOT5_0/RTCCO_0/SUBOUT_0	USB	USB
116	P60/TIOA2_2/SCK5_0/NMIX/WKUP0/MRDY_0	Button NMIX	Button NMIX
117	USBVCC	3V3	3V3
118	P80/UDM0	USB	USB
119	P81/UDP0	USB	USB
120	VSS	GND	GND

# Jumper Table



Jumper	Function	FM4-U120-9B560(-MEM) (Default setting marked <b>bold</b> )
J1 (2 pin)	CMSIS-DAP Crystal (P22) (Do not change!)	<b>Open: 4MHz</b> Closed: 48MHz
J2 (2 pin)	VBUS detection of CMSIS-DAP	<b>Open: 3V3</b> Closed: 5V (only for FM4-U120-9B560)
J3 (2 pin)	CMSIS-DAP reset	<b>Open: CMSIS-DAP normal operation</b> Closed: CMSIS-DAP reset assert
J4 (2 pin)	Operation of MD1 (CMSIS-DAP)	<b>Open: Run-Mode</b> Closed: Test-Mode
J5 (2 pin)	Operation of MD0 (CMSIS-DAP)	<b>Open: Run-Mode (CMSIS-DAP)</b> Closed: Firmware update of CMSIS-DAP
J6-J9	Power Supply Source Please select just one power source!	<b>J9: USB Host powered (CN4)</b> J8: JTAG powered (CN2) J7: CMSIS-DAP powered (CN3) J6: Powered by FM4-U-PERIPHERAL (J16)
J10 (2 pin)	SW3 NMI Jumper J10 needs to be open for programming	Open: Button SW3 disconnected / Programming mode <b>Closed: Button SW3 (NMI) is connected</b>
J11 (2 pin)	USB D+	Open: USB is disconnected <b>Closed: USB is connected</b>
J12 (2 pin)	USB D-	Open: USB is disconnected <b>Closed: USB is connected</b>
J13 (2 pin)	VBUS detection	<b>Open: 3V3</b> Closed: 5V (only for FM4-U120-9B560)

# Jumper Table (continued)

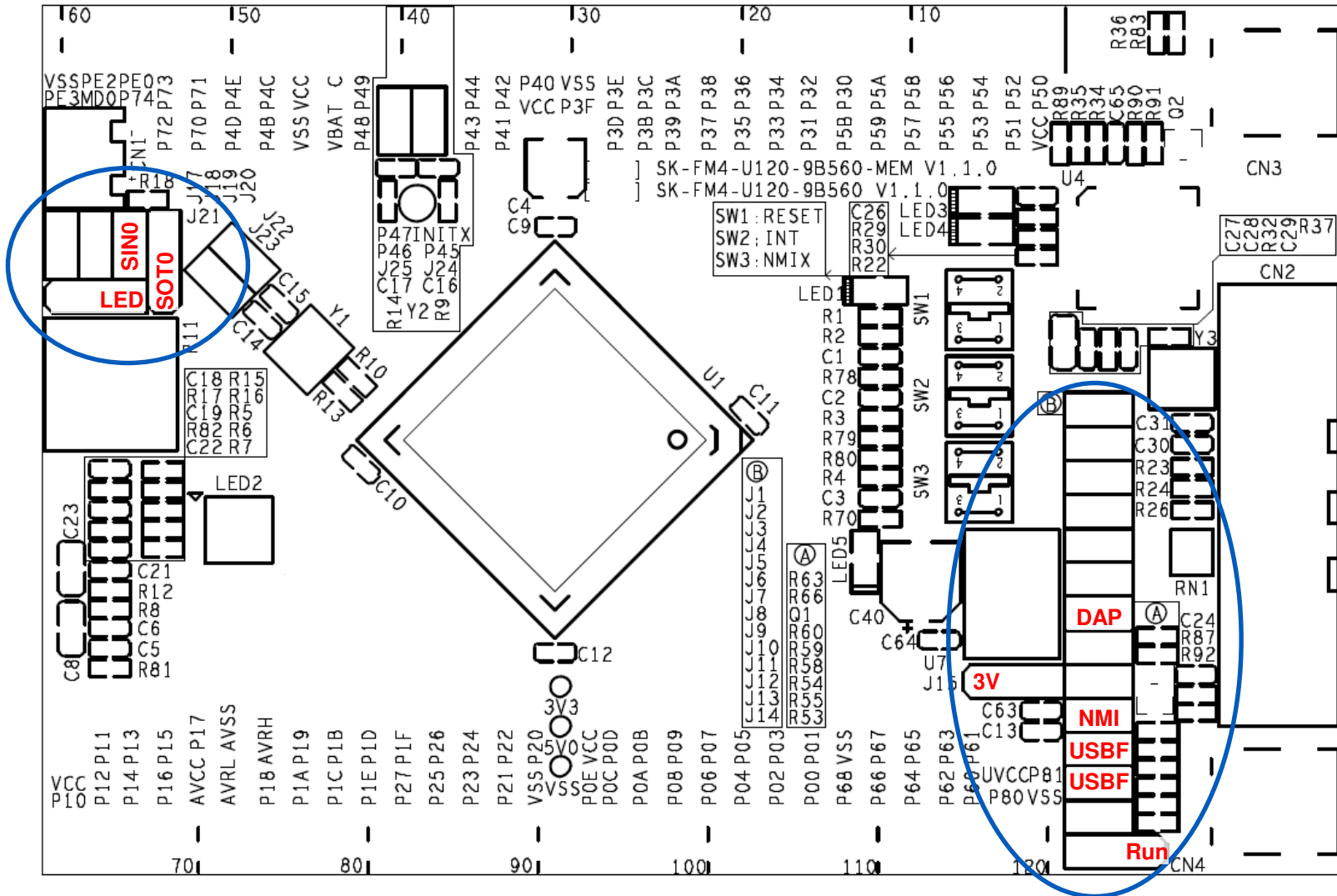


Jumper	Function	FM4-U120-9B560(-MEM) (Default setting marked <b>bold</b> )
J14 (3 pin)	USB VBUS detection See also J10	<b>1-2: VBUS is connected to INT03_2 (Run-Mode)</b> 2-3: VBUS is connected to NMIX (Programming Mode)
J15 (3 pin)	MCU voltage selection FM4-U120-9B560-MEM can be used with 3V3 only	<b>1-2: MCU is powered from 3V3</b> 2-3: MCU is powered from 5V (not FM4-U120-9B560-MEM)
J17 (2 pin)	Operation of MD1 (Do not change!)	<b>Open: Run-Mode and Programming-Mode</b> Closed: Test-Mode
J18 (2 pin)	Operation of MD0	<b>Open: Run-Mode</b> Closed: Programming-Mode
J19 (2 pin)	CMSIS-DAP Virtual COM port (SIN0_0)	Open: SIN0 is disconnected from CMSIS-DAP <b>Closed: CMSIS-DAP's virtual COM port is connected</b>
J20 (3 pin)	CMSIS-DAP Virtual COM port (SOT0_0)	2-3: SOT0/P22 is used for USB programming <b>1-2: CMSIS-DAP's virtual COM port is connected</b>
J21 (3 pin)	MD1/PE0 See also J17	1-2: MD1 (Programming-Mode) <b>2-3: PE0 (LED Blue)</b>
J22 (2 pin)	X0/PE2 Do not close J22 if crystal Y1 is assembled.	<b>Open: PE2 is disconnected</b> Closed: PE2 is connected to pin header U2
J23 (2 pin)	X1/PE3 Do not close J23 if crystal Y1 is assembled.	<b>Open: PE3 is disconnected</b> Closed: PE3 is connected to pin header U2
J24 (2 pin)	X0A/P46 Do not close J24 if crystal Y2 is assembled.	<b>Open: P46 is disconnected</b> Closed: PE2 is connected to pin header U2
J25 (2 pin)	X1A/P47 Do not close J25 if crystal Y2 is assembled.	<b>Open: P47 is disconnected</b> Closed: PE2 is connected to pin header U2

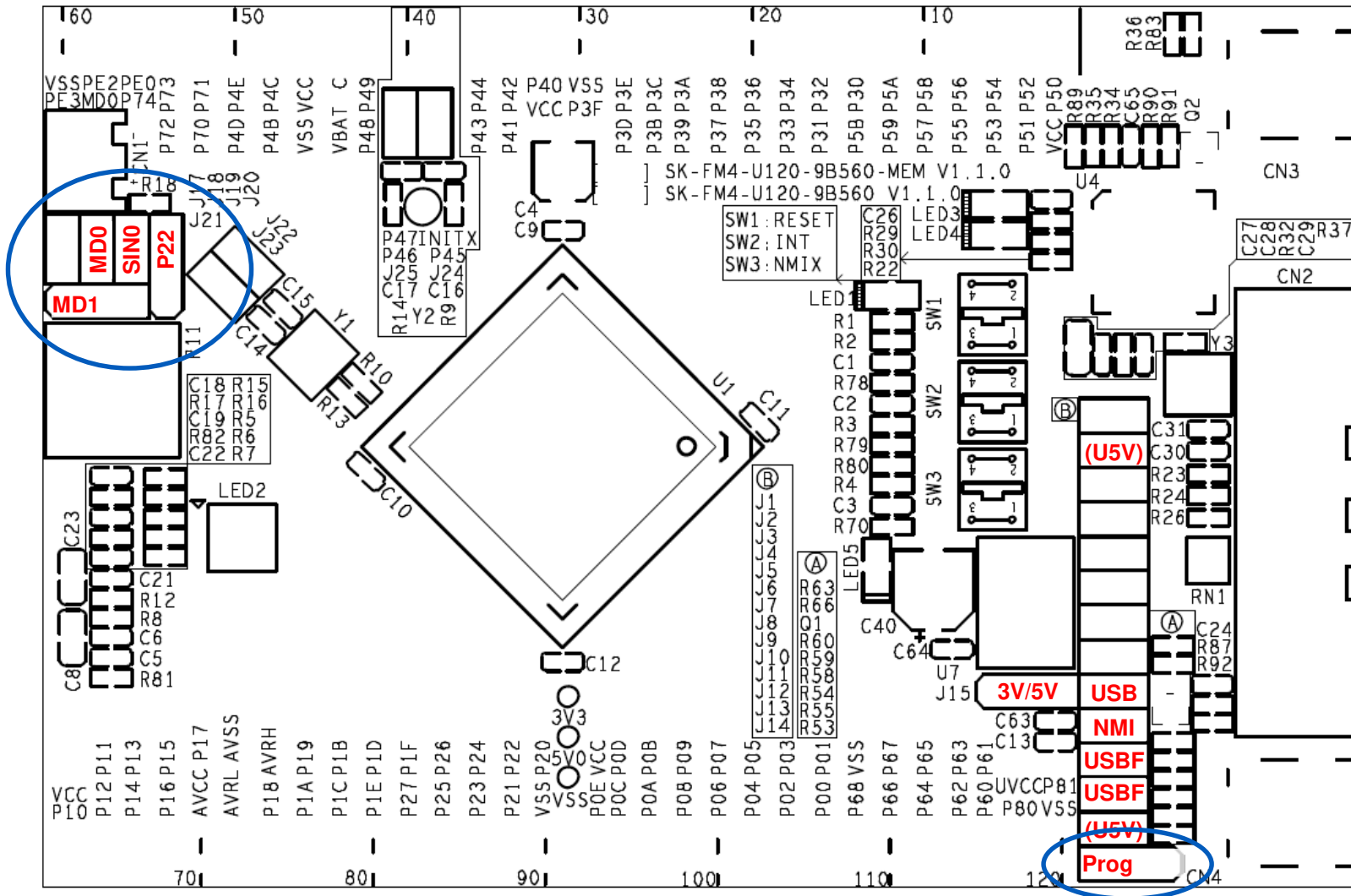


# Jumper – Default (Run mode, CMSIS-DAP)

FM4-U120-9B560 supports 5V and 3.3V operation  
 FM4-U120-9B560-MEM supports only 3.3V operation

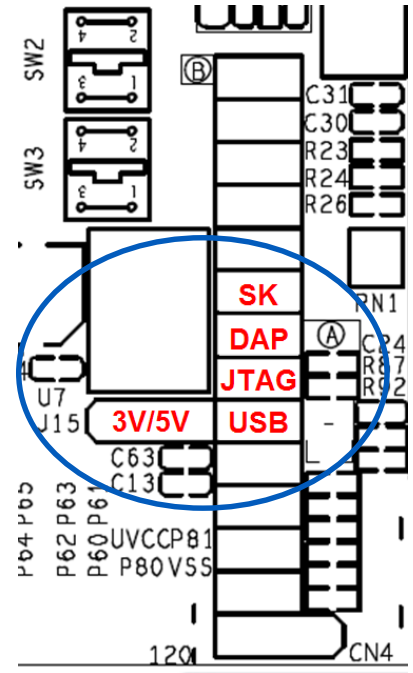


# Jumper – Programming Mode (USB Direct Mode)



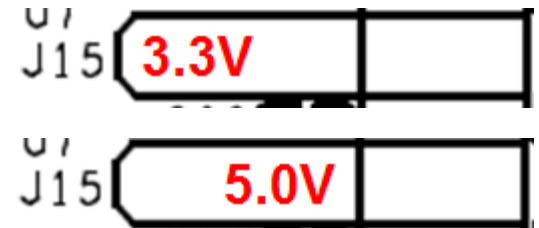
# Jumper – Power the Starter Kit

- The starter kit can be powered
  - by peripheral base-board (J16): Close jumper J6
  - by CMSIS-DAP (CN3): Close jumper J7 (default)
  - by external JTAG (CN2): Close jumper J8
  - by USB-host (CN4): Close jumper J9



- 3.3V or 5V

- Jumper J15 selects the target voltage
  - ✓ FM4-U120-9B560 can operate 3.3V or 5V
  - ✓ FM4-U120-9B560-MEM can operate 3.3V only
- Default: J15: 1-2 (3.3V)





Software

# Software Examples (1/2)

## Simple Software



- Simple example that demonstrates the usage of some peripherals

- Available for IAR EWARM or KEIL  $\mu$ Vision:

See <drive:>[\sw-examples\](#) or [www.cypress.com](http://www.cypress.com)

- [mb9bf56xr template](#)

- ✓ ,Empty' project as base for user applications

- [mb9bf56xr adc dvm](#)

- ✓ Digital Voltage Meter based on the A/D-Converter and UART

- [mb9bf56xr gpio](#)

- ✓ I/O example to control LEDs and readout the user buttons

- [mb9bf56xr mfs](#)

- ✓ An UART example allows serial communication

# Software Examples (2/2)

## Peripheral Driver Library (PDL)



- Example projects that are built with PDL (Peripheral Driver Library)

- Available for IAR EWARM or KEIL  $\mu$ Vision:

See <drive:>[\sw-examples\](#) or [www.cypress.com](http://www.cypress.com)

- [mb9bf56xr\\_pdl](#)

- ✓ The Peripheral Driver Library (PDL) includes an API for all peripherals

mb9bf56xr\_pdl\_adc\_dvm : Example for ADC

mb9bf56xr\_pdl\_gpio : Example for simple IO access

mb9bf56xr\_pdl\_mfs : Example for serial communication (UART)

mb9bf56xr\_pdl\_template : Project frame for user applications based on PDL

- Functional test

- [tp\\_sk-fm4-u120-9b560](#)

- ✓ Program for [Please check the jumper setting](#) the board features (LEDs, buttons, ADC, USB, ...)

- The following software utility tools are available:
  - USB Virtual-COM port
    - ✓ Allows UART communication via the PC's USB connection
    - ✓ Onboard UART-2-USB converter (via CN3, CMSIS-DAP)
    - ✓ Install the latest version from here:  
<http://www.cypress.com/documentation/software-and-drivers/cmsis-dap-spanion-cypress-fm-link>
  - FLASH USB DIRECT Programmer
    - ✓ Microcontroller Flash programming (via CN4, USB-Device-Port)
    - ✓ Install the latest version from here:  
<http://www.cypress.com/documentation/software-and-drivers/flash-usb-direct-programmer-1>
  - Terminal program, Serial Port Viewer
    - ✓ Install the latest version from here:  
<http://www.cypress.com/documentation/software-and-drivers/serial-port-viewer-and-terminal>



# Flash Programming



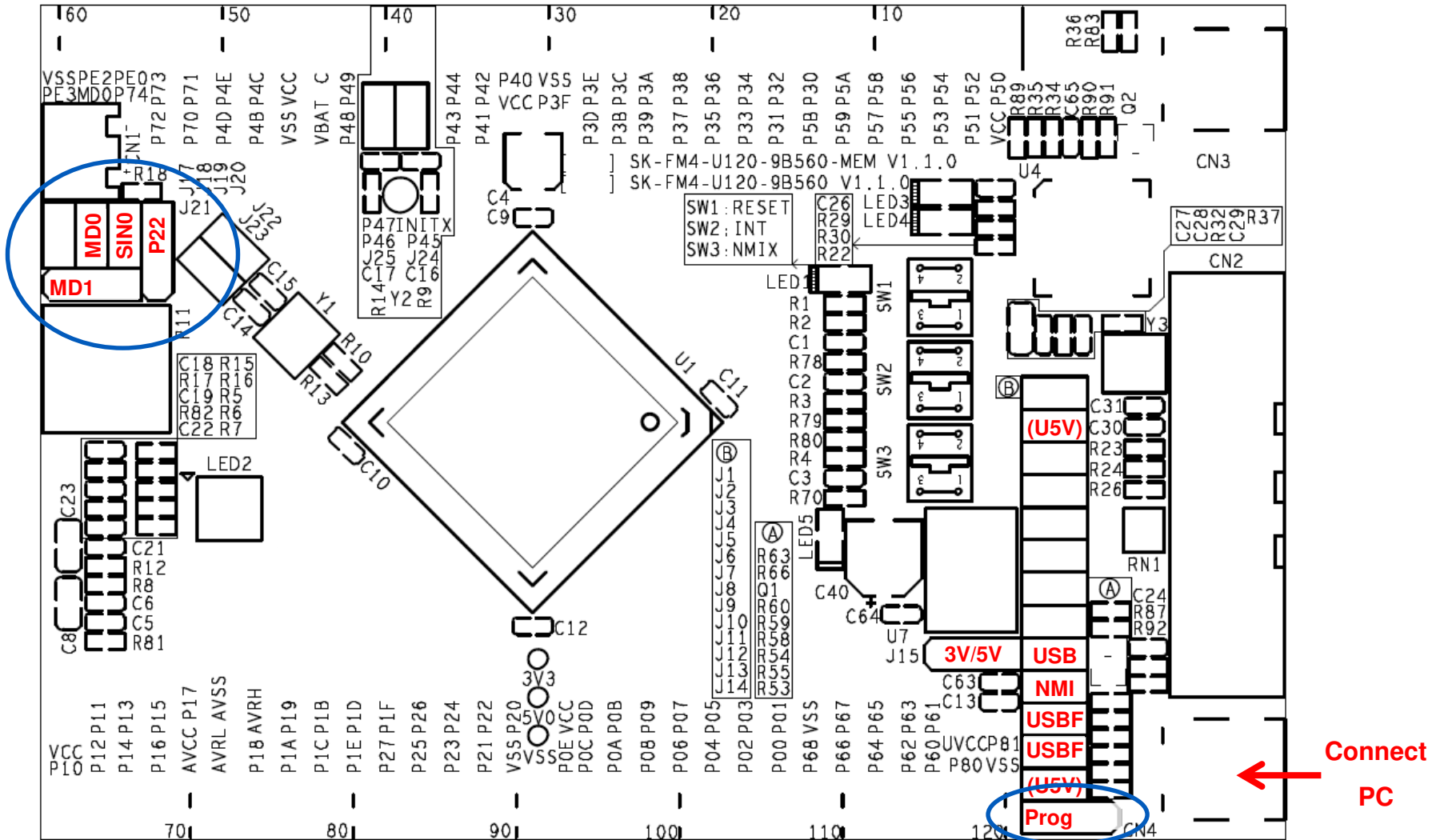
- There are several options to program the microcontroller's flash:
  - [FLASH USB DIRECT Programmer via CN4 \(USB\)](#)
  - ✓ Install the latest version from here:  
<http://www.cypress.com/documentation/software-and-drivers/flash-usb-direct-programmer-1>
  - ✓ USB driver is located in subdirectory of FLASH USB DIRECT Programmer
  - [FLASH MCU Programmer via CN3 \(Serial by use of virtual COM-port\)](#)
  - ✓ Install the latest version from here:  
<http://www.cypress.com/documentation/software-and-drivers/flash-mcu-programmer-1>
  - ✓ Install the latest driver of USB/Virtual-COM port from here:  
<http://www.cypress.com/documentation/software-and-drivers/cmsis-dap-expansion-cypress-fm-link>
  - JTAG Programming via CN3 (CMSIS-DAP)
    - ✓ Example is given for [IAR](#) and [KEIL](#)
    - ✓ See documentation of your development suite, how to setup CMSIS-DAP
  - JTAG Programming via CN2 (optional JTAG adapter)
    - ✓ The correct JTAG-adapter must be selected in the IDE toolchain
    - ✓ No dedicated jumper setting is required

- FLASH USB DIRECT Programming via CN4 (USB)
  - Jumper Setting
    - ✓ Close J9 (Power:USB), J11 (USB D+), J12 (USB D-) and J18 (MD0)
    - ✓ Set J14 to position 2-3 (P60, USB\_VCC\_DETECT)
    - ✓ Set J20 to position 2-3 (P22)
    - ✓ Set J21 to position 1-2 (MD1)
    - ✓ For 5V operation set J15 to 2-3, close J2 and J13
    - ✓ For 3.3V operation set J15 to 1-2, open J2 and J13
  - Connect the board via USB-Device (CN4) to the USB-Port of the PC
    - ✓ If connected for first time Windows OS may ask for a driver  
See subfolder ,driver' of USBdirect installation path  
or <drive:>[\tools\USBDIRECT\driver](#)
  - Start the FLASH USB DIRECT Programmer
    - ✓ Install from here: <http://www.cypress.com/documentation/software-and-drivers/flash-usb-direct-programmer-1>

# Flash Programming via CN4 (USB Direct)



## Jumper setting PRG-mode using USB direct



- Choose the right target MCU MB9BF568M/N/R
- Browse for the programming file (\*.srec or \*.hex)
  - IAR: see subfolder <project>\example\IAR\output\release\exe
  - ARM/KEIL: see subfolder <project>\example\ARM\output\release
- Adjust the corresponding virtual COM-port

Select MCU: MB9BF568M/N/R

Select file (\*.srec; \*.hex)

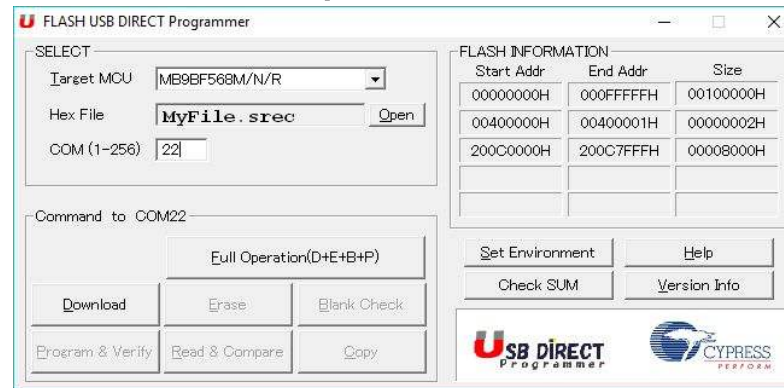
Select Virtual COM-port



- Use Full Operation

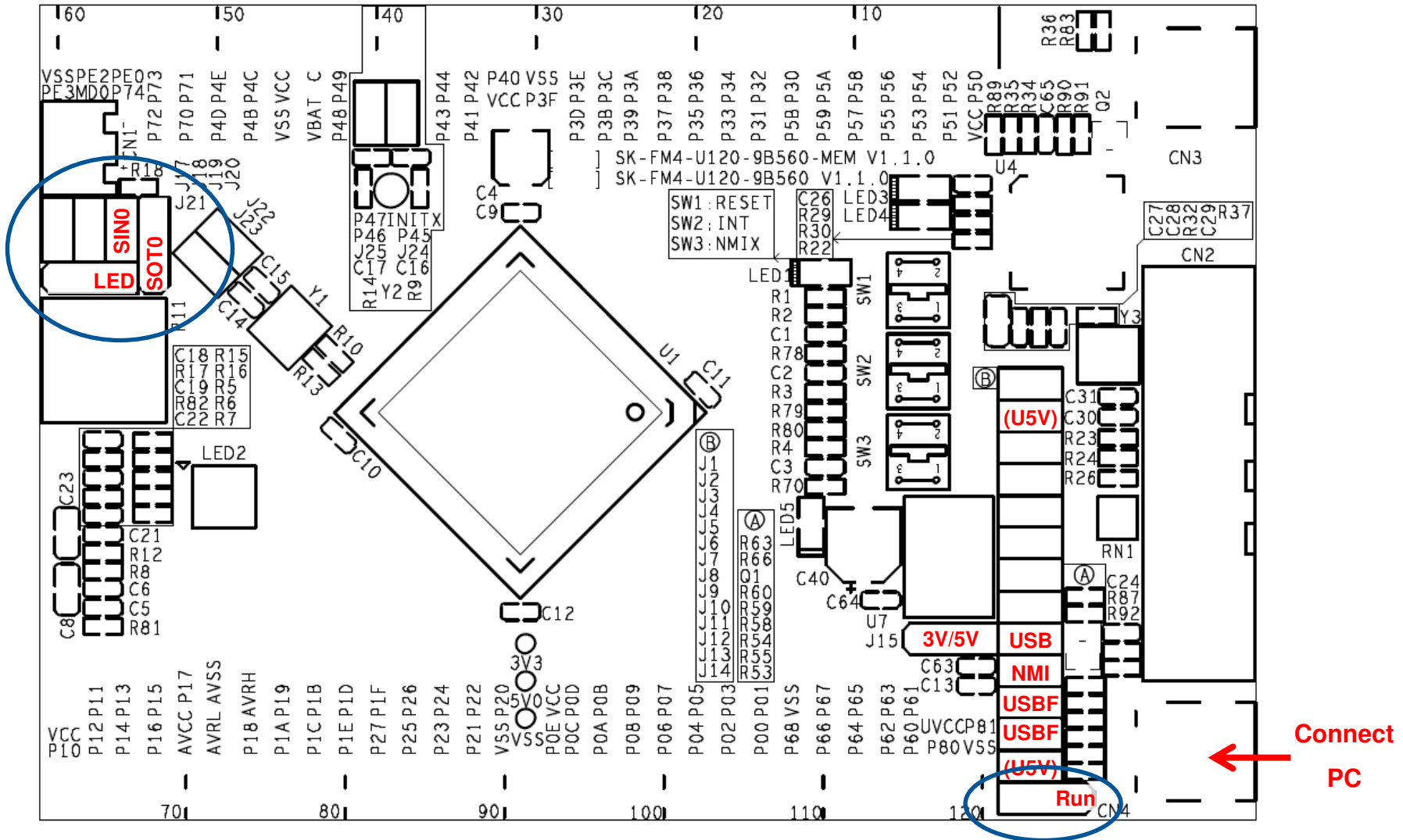
- Download
- Erase / Blank check
- Program & Verify

- Reset jumpers and return to [Run-mode](#) jumper setting



# Flash Programming via CN4 (USB Direct)

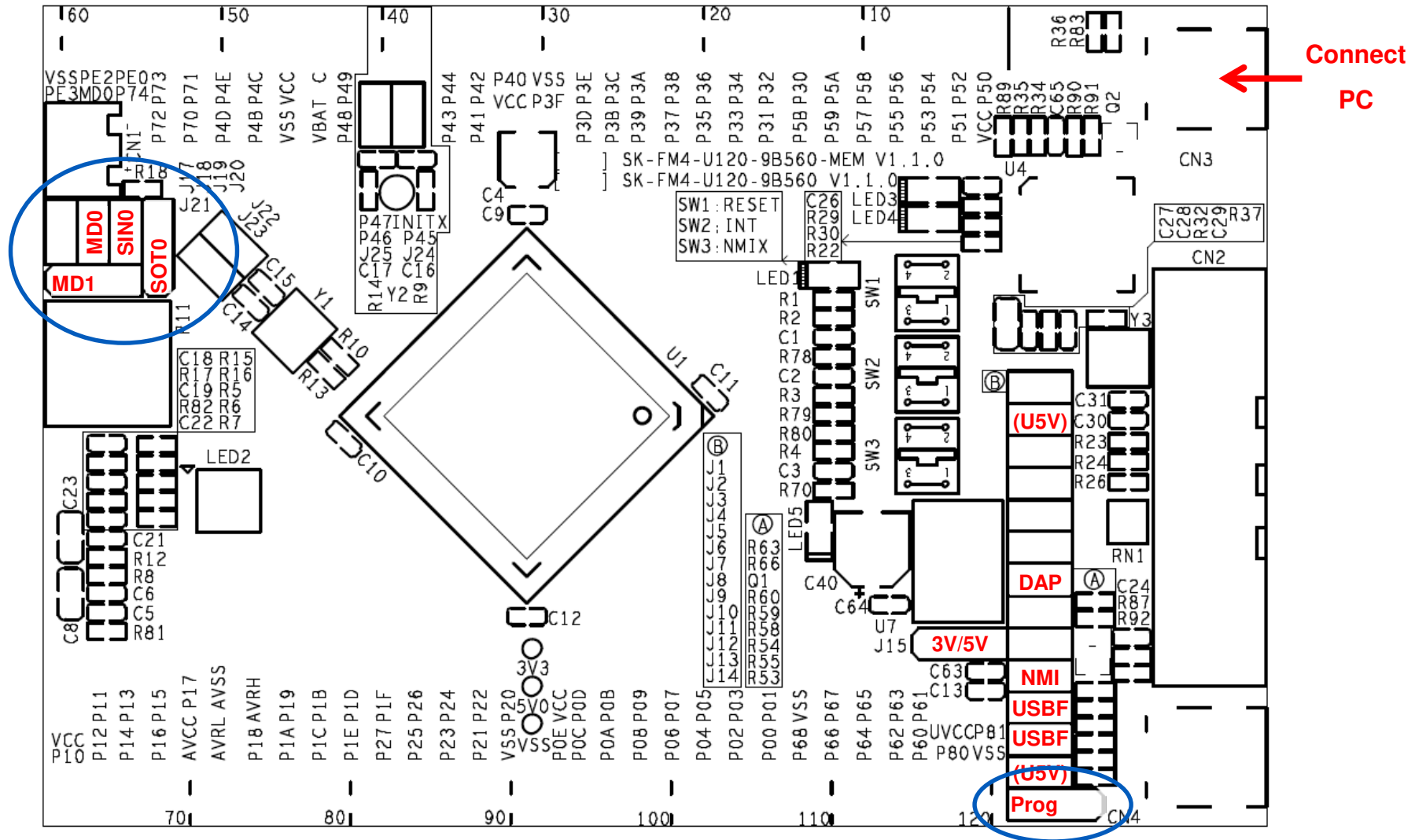
## Jumper setting RUN-mode using USB direct



- FLASH MCU Programming via CN3 (Serial)\*
  - Jumper setting
    - ✓ Open jumpers J3 (JTAG) and J10 (NMIX)
    - ✓ Close jumpers J7 (Power: DAP), J18 (MD0) and J19 (SIN0)  
Do not set J9 (USB Host powered)!
    - ✓ Set J20 to position 1-2 (SOT0)
    - ✓ Set J21 to position 1-2 (MD1)
    - ✓ Check jumper setting: J14:2-3 (P60)
  - Connect the board via USB CMSIS-DAP (CN3) to the USB-Port of the PC
    - ✓ When connected for first time Windows OS may ask for  
,spanionusbvcomm.inf  
<drive:>\drivers\cmsis-dap
  - Use the FLASH MCU Programmer for FM3/FM4
    - ✓ Install the latest version from here:  
<http://www.cypress.com/documentation/software-and-drivers/flash-mcu-programmer-1>
- \*Note: Do not connect CN4 to PC/USB while using serial programming

# Flash Programming via CN3 (Serial)

## Jumper setting PRG-mode using CMSIS-DAP (serial communication)



# Flash Programming via CN3 (Serial)

- Choose the right target MCU MB9BF568M/N/R
- Select 4MHz Crystal Frequency
- Browse for the programming file (\*.srec or \*.hex)
  - IAR: see subfolder <project>\example\IAR\output\release\exe
  - ARM/KEIL: see subfolder <project>\example\ARM\output\release
- Adjust the corresponding virtual COM-port

Select MCU: MB9BF568M/N/R

Select 4MHz Crystal Frequency

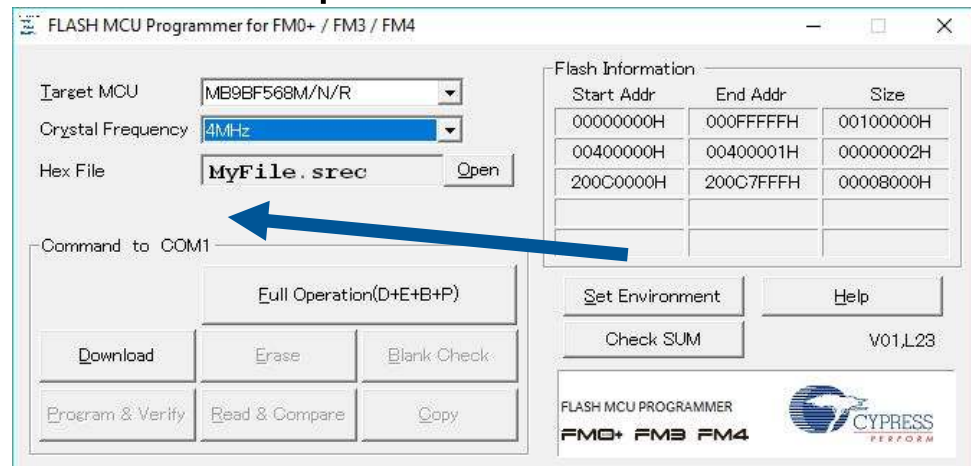
Select file (\*.srec / \*.hex)

Select Virtual COM-port

Execute ,Full Operation'

incl. stand-alone operations

- Download
- Erase
- Blank Check
- Program&Verify

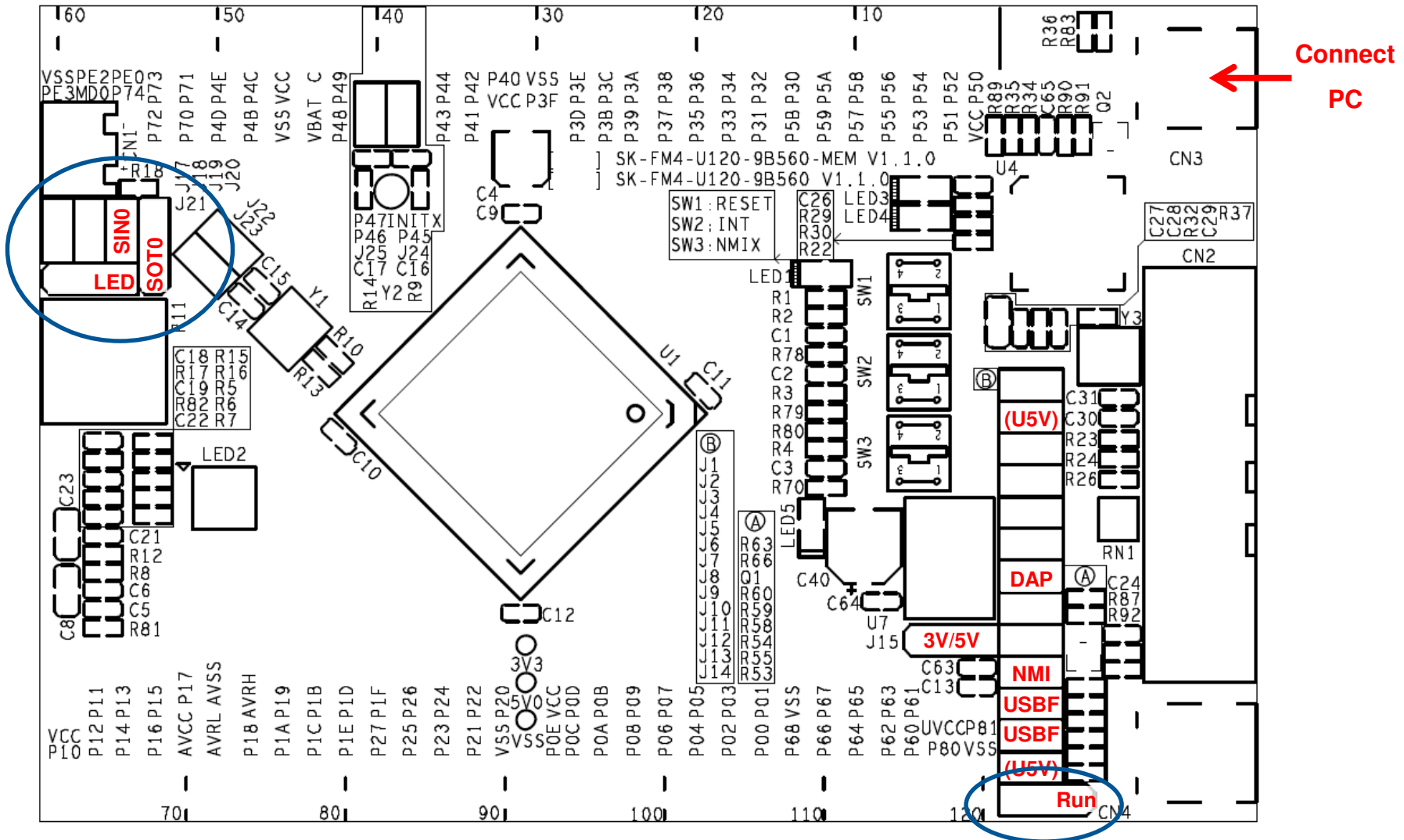


- Reset jumpers and return to Run-mode jumper setting



# Flash Programming via CN3 (Serial)

## Jumper setting RUN-mode using CMSIS-DAP (serial communication)

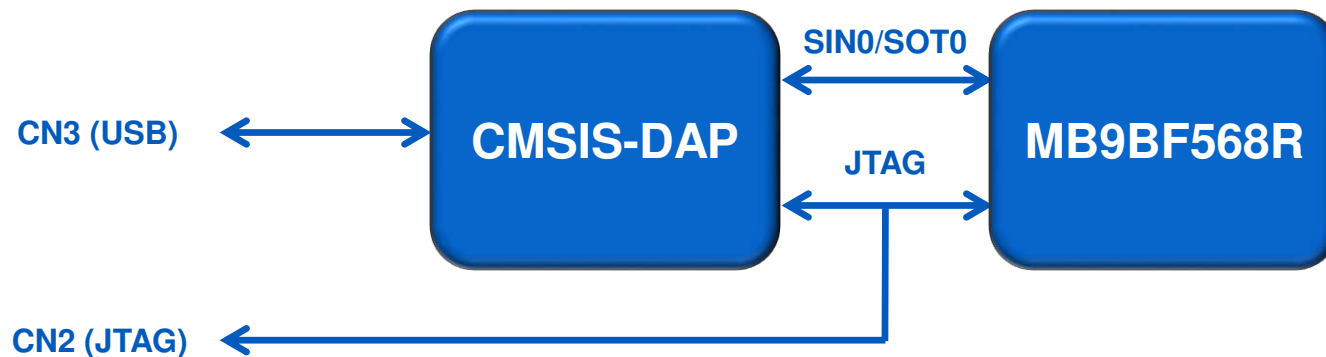




# JTAG Debugger

# JTAG Adapter CMSIS-DAP

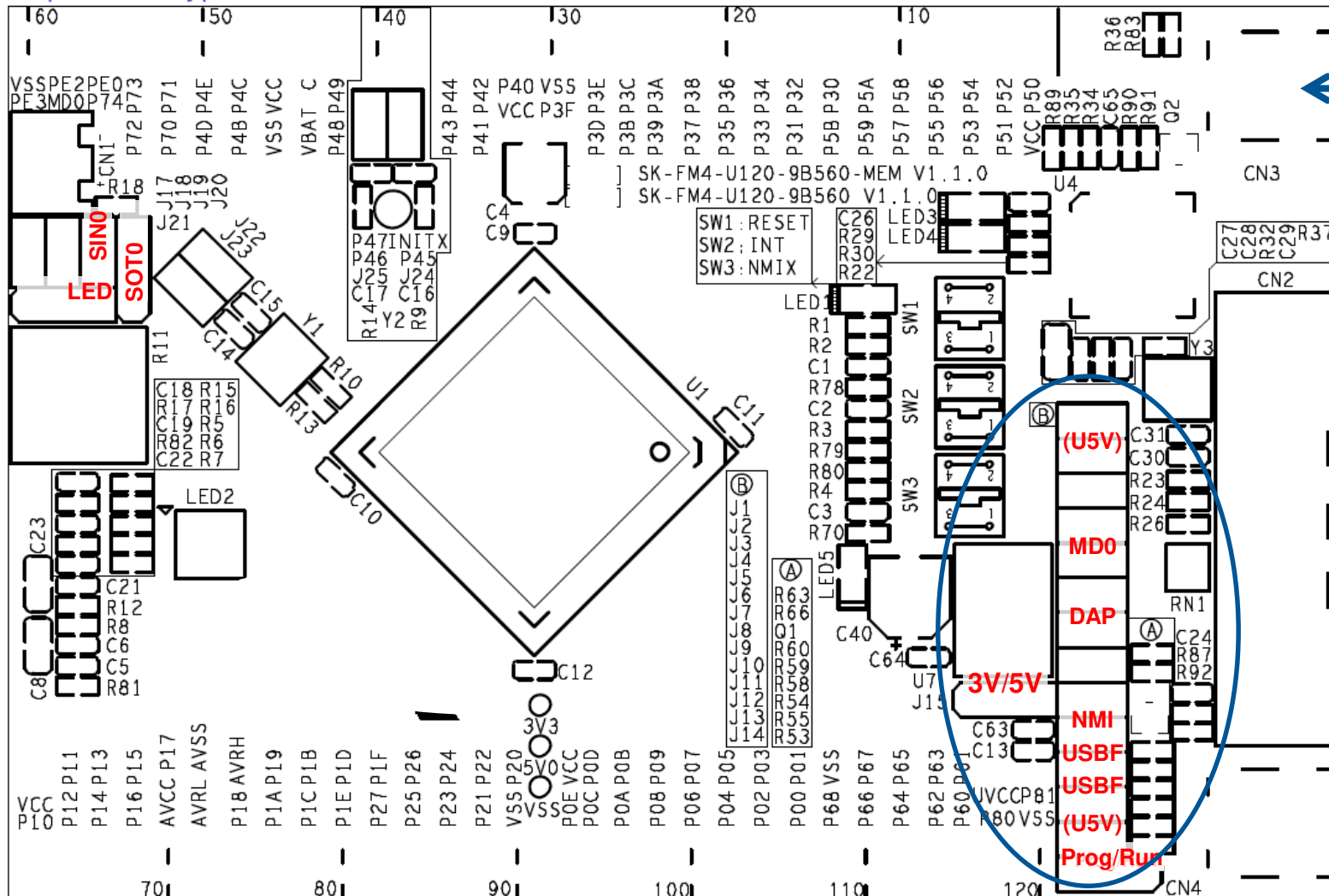
- This starter kit includes an onboard JTAG adapter
  - Compatible to CMSIS-DAP  
[http://www.keil.com/support/man/docs/dapdebug/dapdebug\\_introduction.htm](http://www.keil.com/support/man/docs/dapdebug/dapdebug_introduction.htm)
  - Please update the onboard CMSIS-DAP with [latest firmware](#)
  - Select debugger CMSIS-DAP in your tool chain
- Any other JTAG-adapter can be connected to CN2, too.
  - Select used JTAG-adapter within IDE tool chain (No jumper setting is required)
- Additional virtual COM port is provided by CN3
  - ✓ Install the latest version from here:  
<http://www.cypress.com/documentation/software-and-drivers/cmsis-dap-spanion-cypress-fm-link>
  - ✓ Please set jumper J19 and J20 accordingly



# CMSIS-DAP Firmware Update

Please see instructions coming with Firmware update package!

Install latest version from here: <http://www.cypress.com/documentation/software-and-drivers/cmsis-dap-expansion-cypress-fm-link>

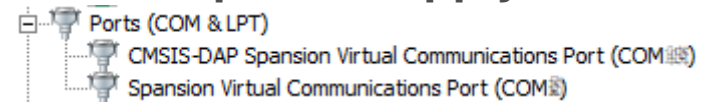


CMSIS-DAP  
Virt.COM

# Test it by Terminal using CMSIS - DAP



- The microcontroller on the FM4-U120-9B560(-MEM) is already preprogrammed with a test application (<drive:>\sw-examples\testsoftware)
  - Install latest version from here: [Install latest version from here: http://www.cypress.com/documentation/software-and-drivers/cmsis-dap-spanion-cypress-fm-link](http://www.cypress.com/documentation/software-and-drivers/cmsis-dap-spanion-cypress-fm-link)
  - Connect the starter kit to CN3 (CMSIS-DAP) with your PC
    - ✓ Ensure jumper J7 (CMSIS-DAP) is set for correct power supply
  - Press the ,Reset'- Button
  - Check the availability for virtual COM port
    - ✓ e.g. Windows Device Manager
  - Open a serial terminal tool
    - ✓ e.g. [Cypress Serial Port Viewer](#)
    - ✓ Settings 115200 baud, 8N1
  - Press <space> to show welcome menu
  - Please select any function to test the on-board features



```
COM5  Baud Rate: 115200  Connected
* Welcome to SK-FM4-U120-9B560 (-MEM) Testprocedure *
* 01. r: LED Red Test (visual) [TESTED] *
* 02. g: LED Green Test (visual) [TESTED] *
* 03. b: LED Blue Test (visual) [TESTED] *
* 04. 2: SW2 Test [ OK ] *
* 05. 3: SW3 Test [ OK ] *
* 06. p: Pot1 Test [ OK ] *
* 07. - UART Test (CMSIS-DAP Com Port) [ OK ] *
* 08. - USB Test (Virtual Com Port) [ OK ] *
* 11. c: Card slot (SDCard) [ OK ] *
* 12. - Subclock Test [ OK ] *
* | *
* +----> press key at keyboard *
* *
* V01.30 - MSc - 2013-11-29 *
*****
SPANION  GD GTS DSR IN DTR RTS  (c) Spanion International Inc.
```

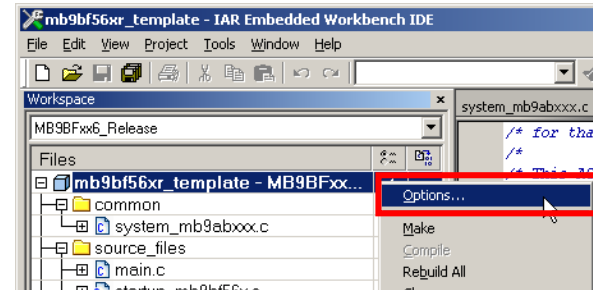
## Setup in IAR EWARM (1)

### Navigate to project options:

#### Via Files-List

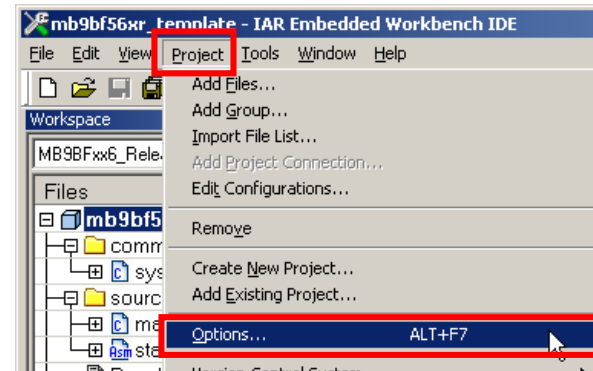
Right-click at the project

Select [Options...]



#### Or via menu tab [Project]

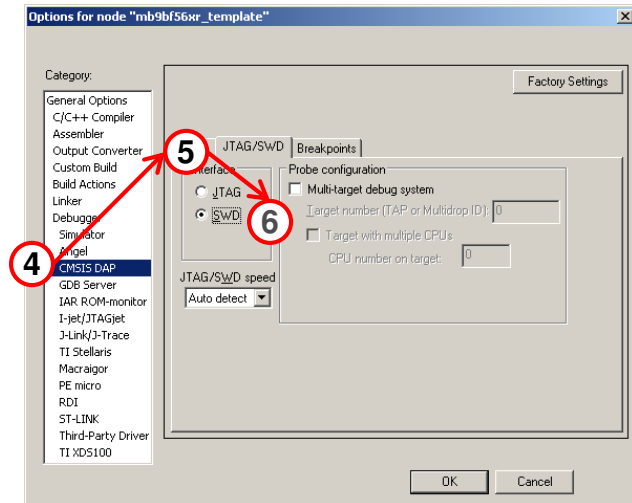
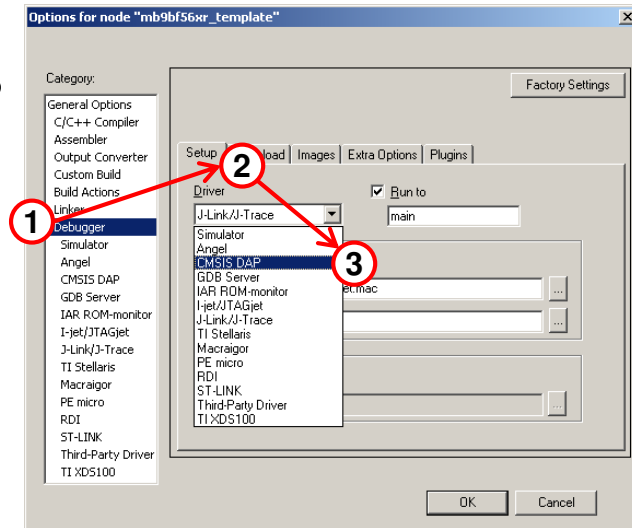
Select [Options...]



## Setup in IAR EWARM (2)

### Setup Project Debbuger Options

- (1) Navigate to [Debugger]
- (2) Select tab [Setup]
- (3) Select driver [CMSIS-DAP]
- (4) Select in [CMSIS-DAP]
- (5) Select tab [JTAG/SWD]
- (6) Select [SWD]



## Setup in Keil $\mu$ Vision (1)

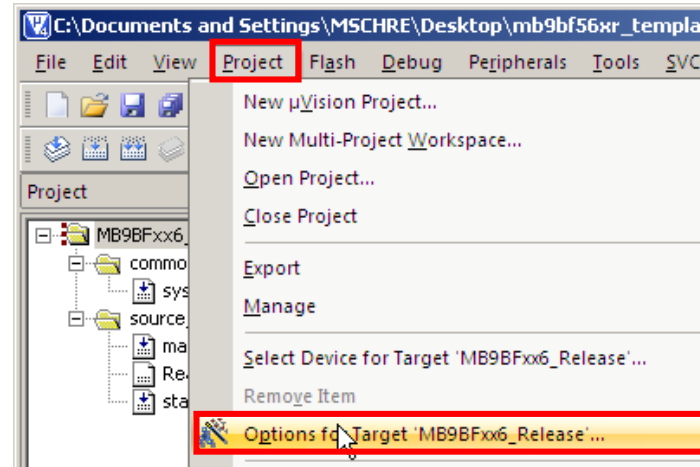
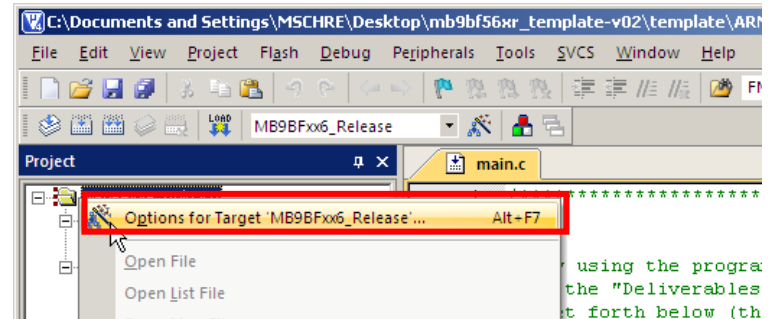
### Navigate to project options:

#### Via Project

- Right-click at the project
- Select [Options...]

#### Or via menu tab [Project]

- Select [Options...]

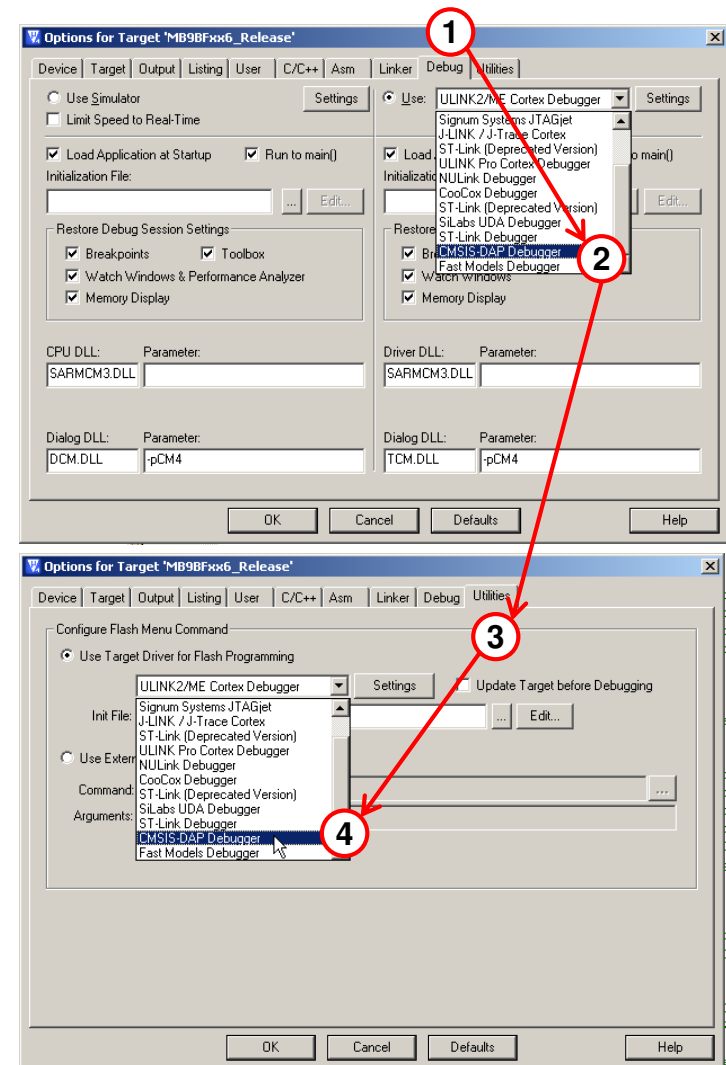




## Setup in Keil $\mu$ Vision (2)

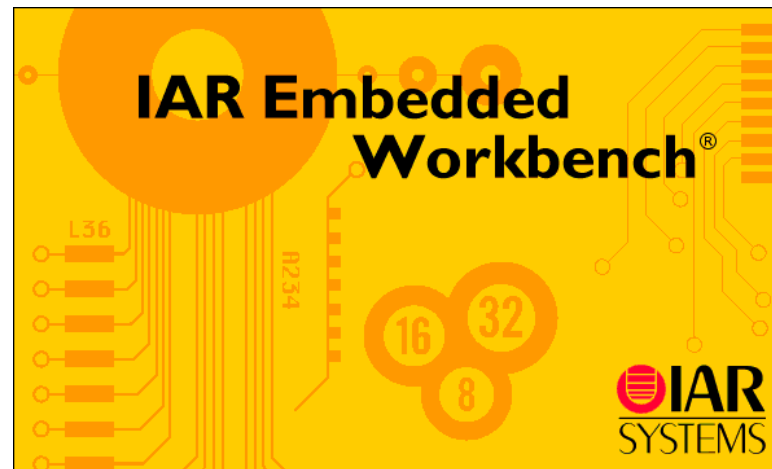
### Setup Debug & Utilities

- (1) Select tab [Debug]
- (2) Select [CMSIS-DAP Debugger]
- (3) Select tab [Utilities]
- (4) Select [CMSIS-DAP Debugger]



# IAR Embedded Workbench

**Installation**  
**Getting Started**  
**Open Project**  
**Build Project**  
**Debug Project**



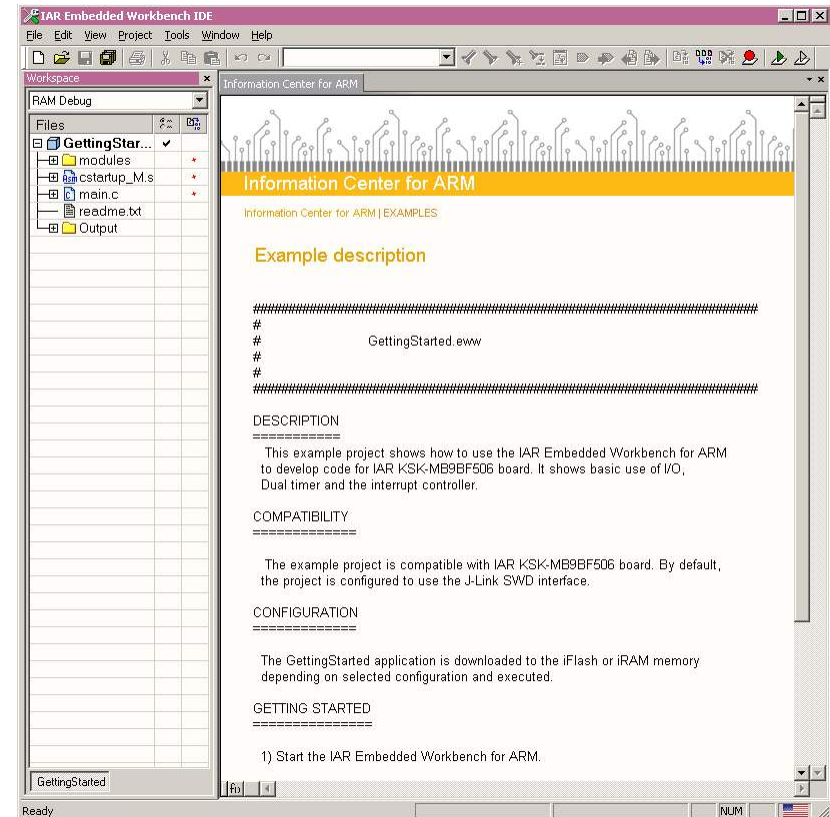
# IAR Workbench Getting Started



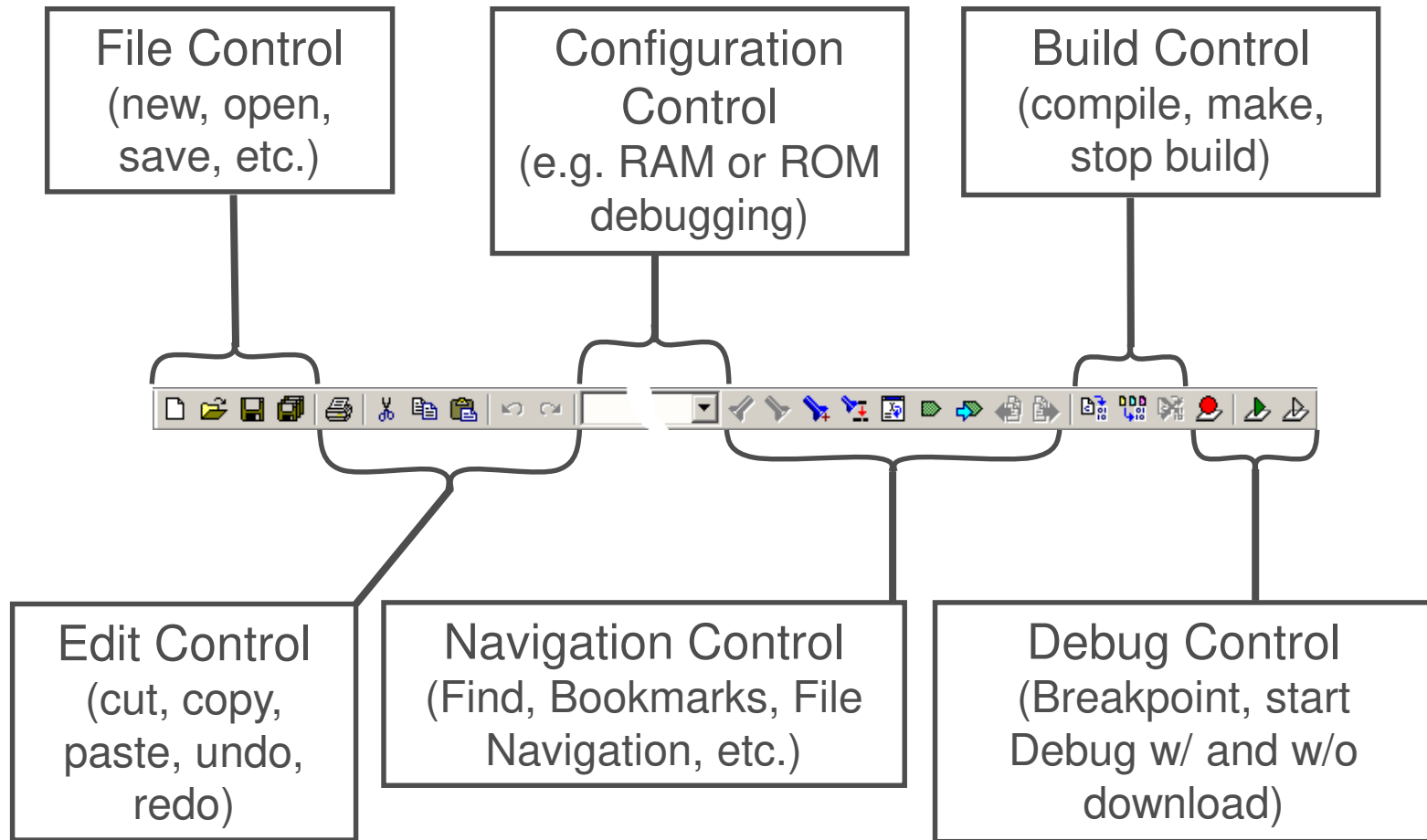
- Install EWARM from IAR-CD or download latest version from IAR Website
  - EWARM size-limited (32k) or time-limited (full) Evaluation Version
    - ✓ <http://supp.iar.com/Download/SW/?item=EWARM-EVAL>
- Start EWARM Workbench
- Choose File → Open → Workspace
  - e.g.: <drive>:\sw-examples\mb9bf56xr\_gpio-v11\example\IAR\mb9bf56xr\_io.eww



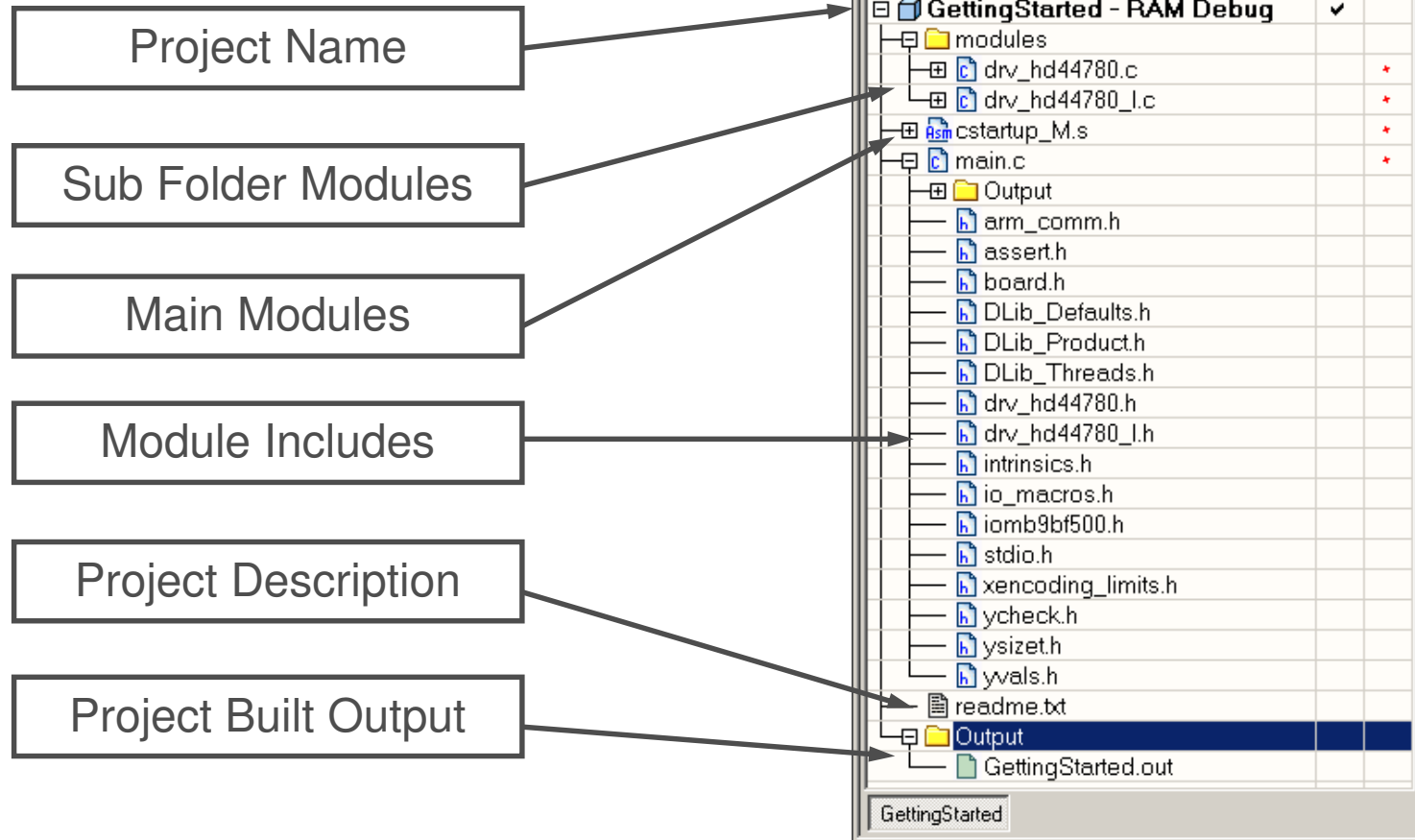
- IAR Workbench
  - Workspace on left side of Workbench window
    - ✓ If hidden then View→Workspace
  - Source files on right side of Workbench window as tabbed windows
  - Project open  
File → Open → Workspace → \*.eww
  - For new projects start with 'mb9bf56xr\_template'






- IAR Menu Bar

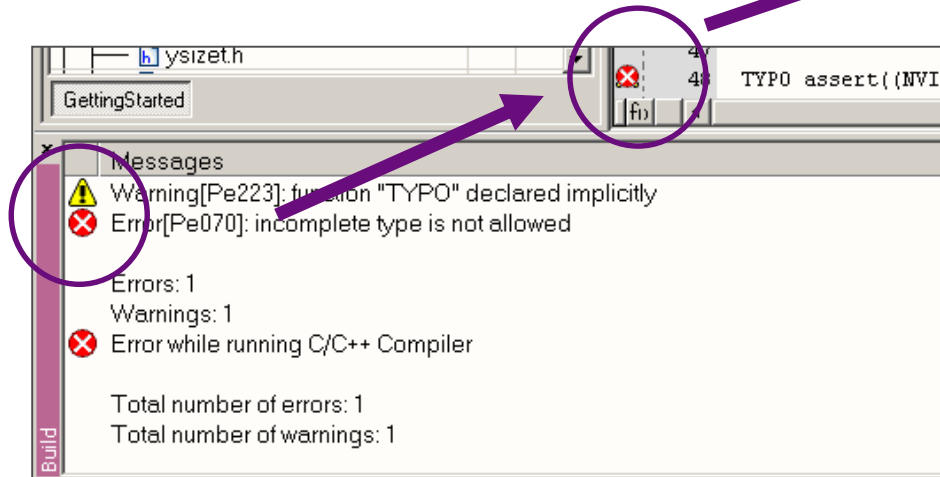
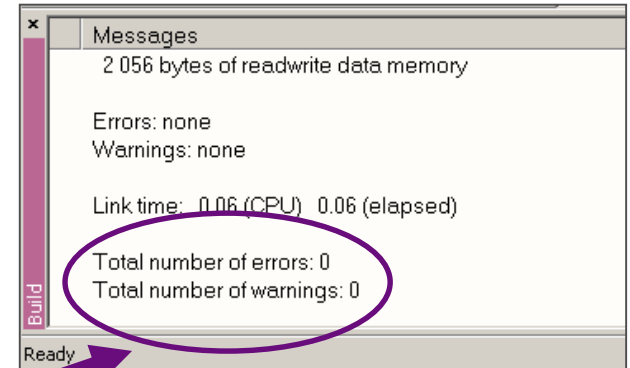



- IAR Workspace Window

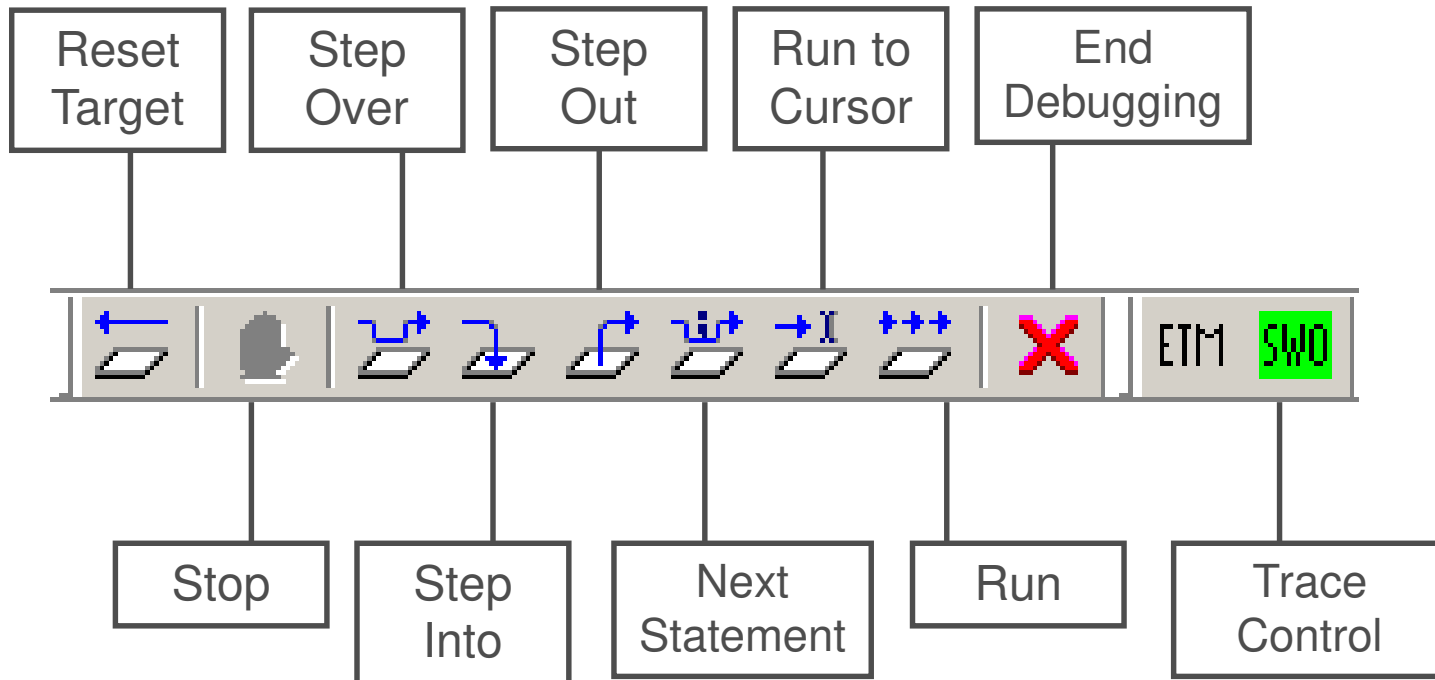


## ■ Making the Project

- Use Make-Icon (  ), <F7> or Menu: Project→Make
- Check for no errors in Output window below
- Build errors are indicated by  or   
In Output window and Source view



- Download to Target and Start Debugging
  - Use  icon, <Ctrl>-D, or Project→Download and Debug
  - A new menu bar will occur on successful connection to target





- Source Window

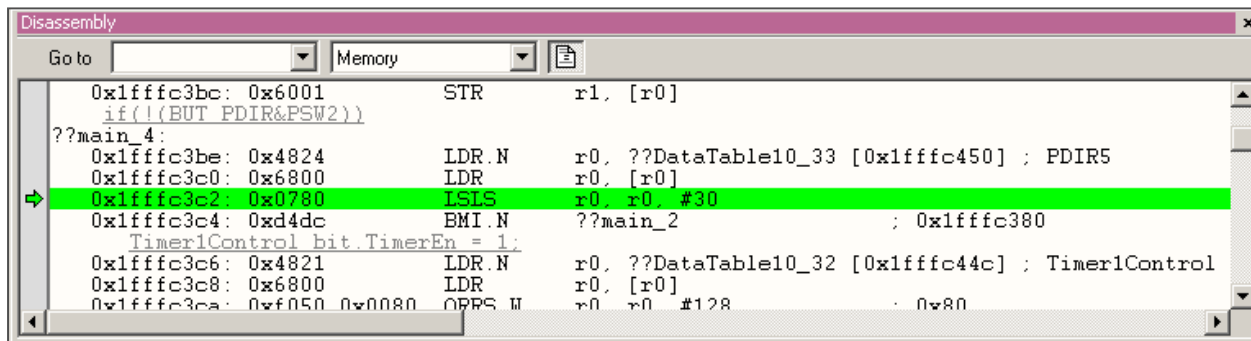
- The Source windows do not change contents but get additional information

- ✓ Current line (PC):
- ✓ Halted on Breakpoint:
- ✓ Halted on Data break (example):

```
165 CSW_TMR_bit.MOWT = 0;
172 PSW_TMR_bit.POWT = 2;
148 Timer1IntClr = 1;
```

- Disassembly Window

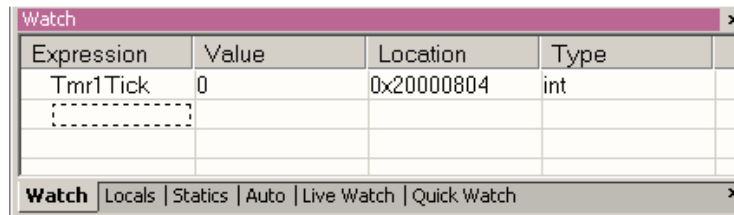
- Shows 'pure' disassembly view
- Shows mixed mode view



- Watch Window

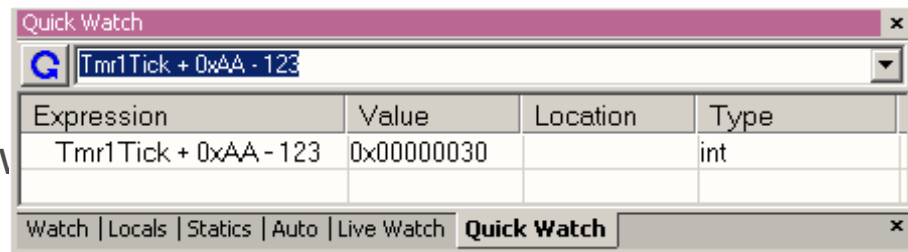
- Watch

- ✓ Expressions/Variables have to be added by user and are updated by Halt/Breakpoint




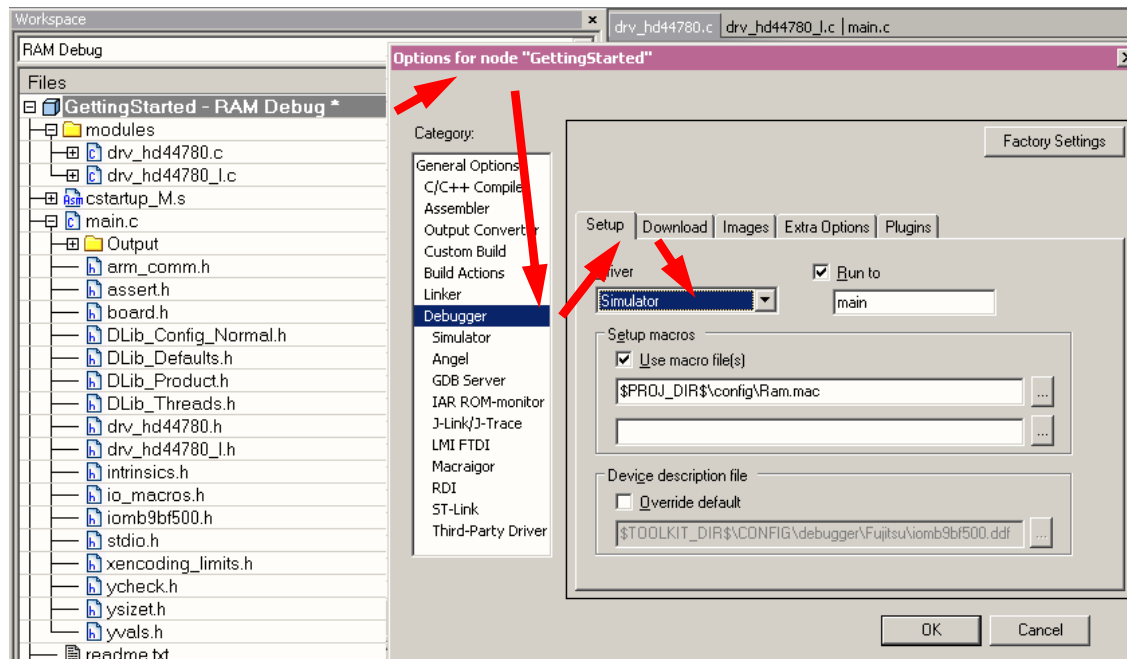
- Quick Watch

- ✓ The Quick watch allows the user to calculate and recalculate expressions even with variables



- ✓ The drop down

- Simulator
  - Mark Project File in Workspace
  - Choose Project→Options
  - Choose Simulator in Debugger Setup
  - Start Simulator with usual  Icon



# KEIL $\mu$ Vision

**Installation**  
**Getting Started**  
**Open Project**  
**Build Project**  
**Debug Project**



# KEIL $\mu$ Vision IDE and Debugger

## Getting Started

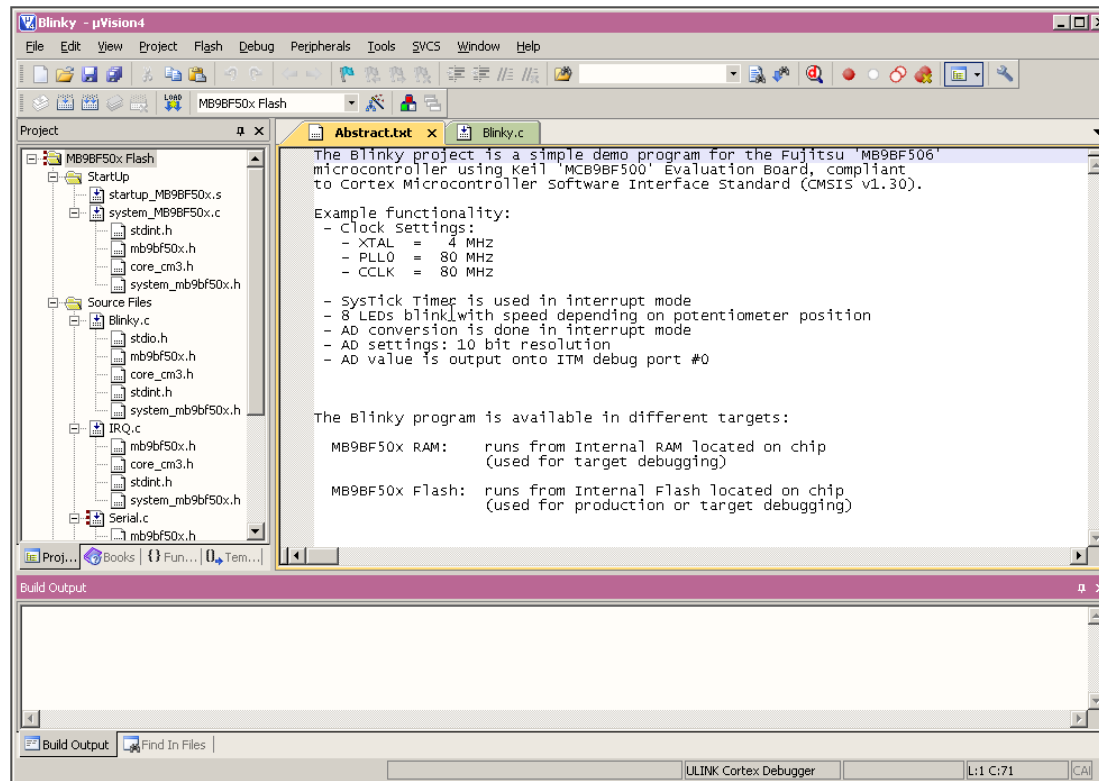


- Install  $\mu$ Vision from KEIL-CD or download latest version from KEIL Website
  - Evaluation Version
    - ✓ <https://www.keil.com/demo/eval/arm.htm>
    - ✓ Registration required
- Install ULINK-ME
  - Special installation is not needed, because ULINK-ME acts as a USB Human Interface Device (HID) and thus needs no extra USB driver
- Install ULINK Pro (optional)
  - ULINK Pro needs an own dedicated USB driver located in:  
<Installation Path>\KEIL\ARM\ULINK
- Start  $\mu$ Vision

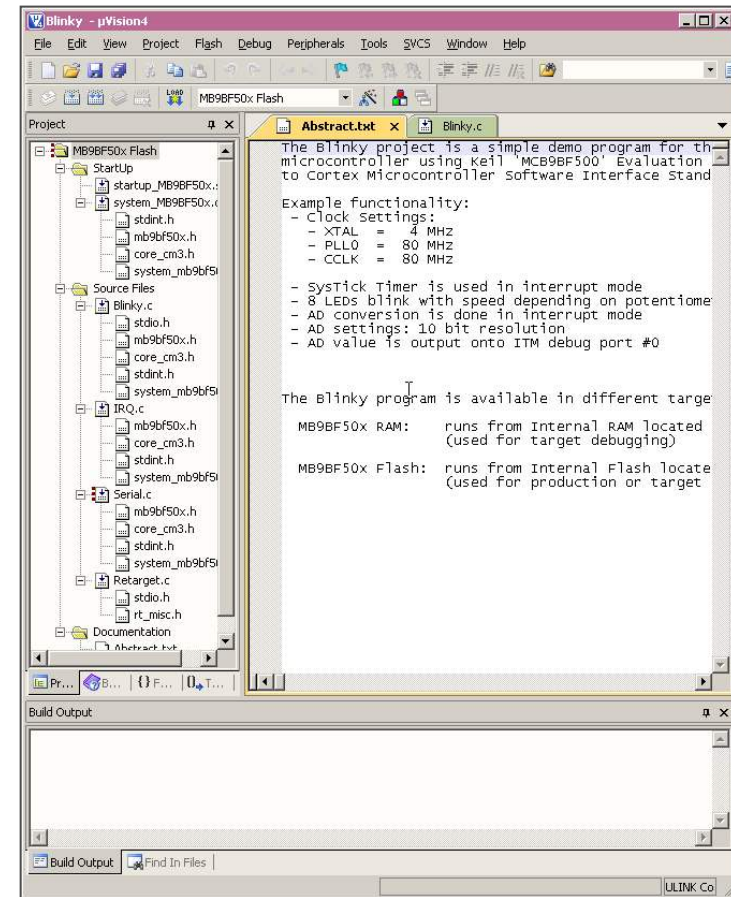
# KEIL $\mu$ Vision – Getting Started



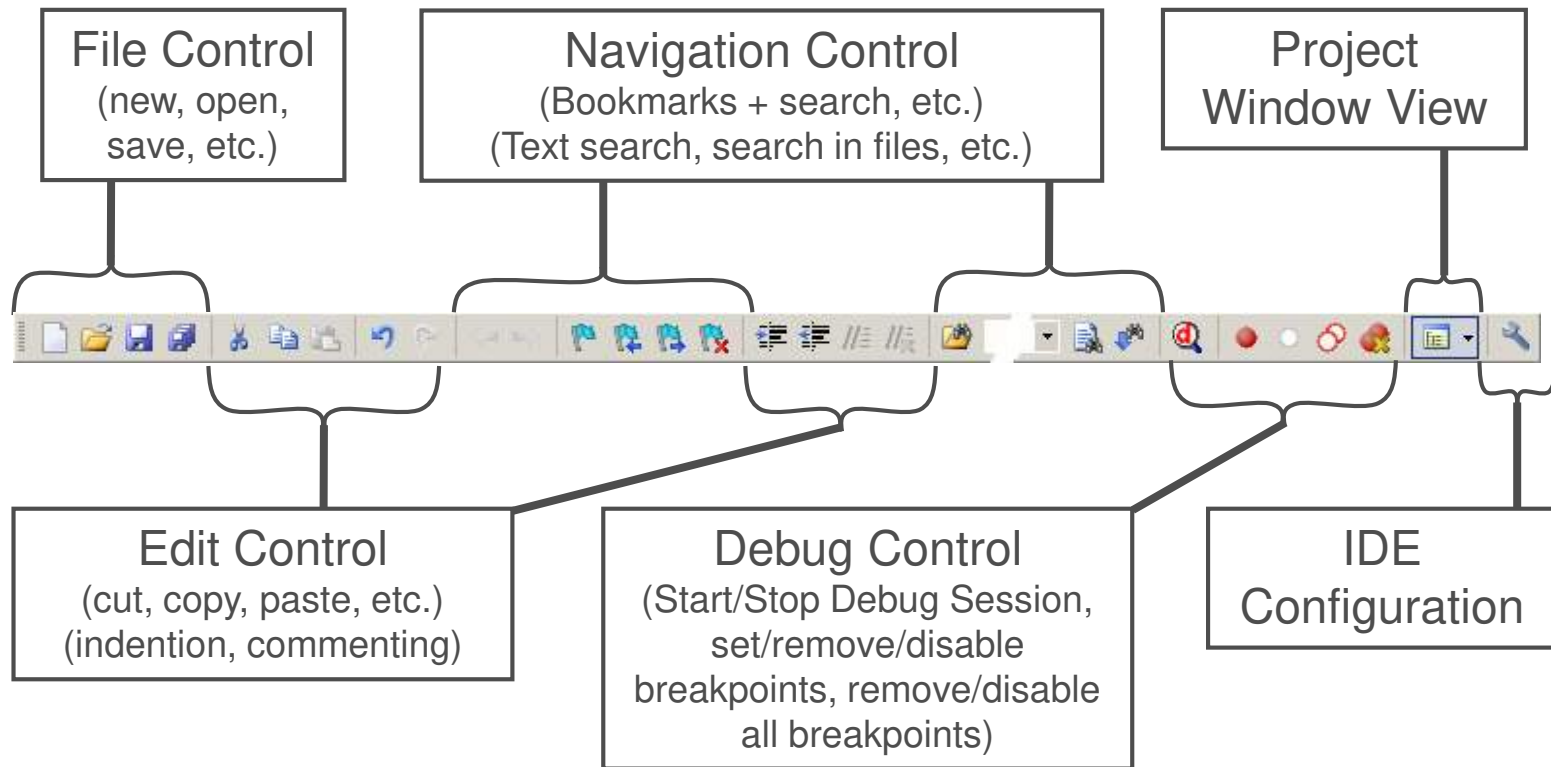
- Choose Menu: Project→Open Project...
  - Browse to: <drive:>\sw-examples\mb9bf56xr\_gpio-v1.1\example\ARM\
  - Choose mb9bf56xr\_gpio.uvproj



- KEIL  $\mu$ Vision
  - Project window on left side of IDE window
    - ✓ Choose:  
View→Project Window  
if hidden
  - Source files on right side of IDE window as tabbed windows
  - Output window on bottom side of IDE window

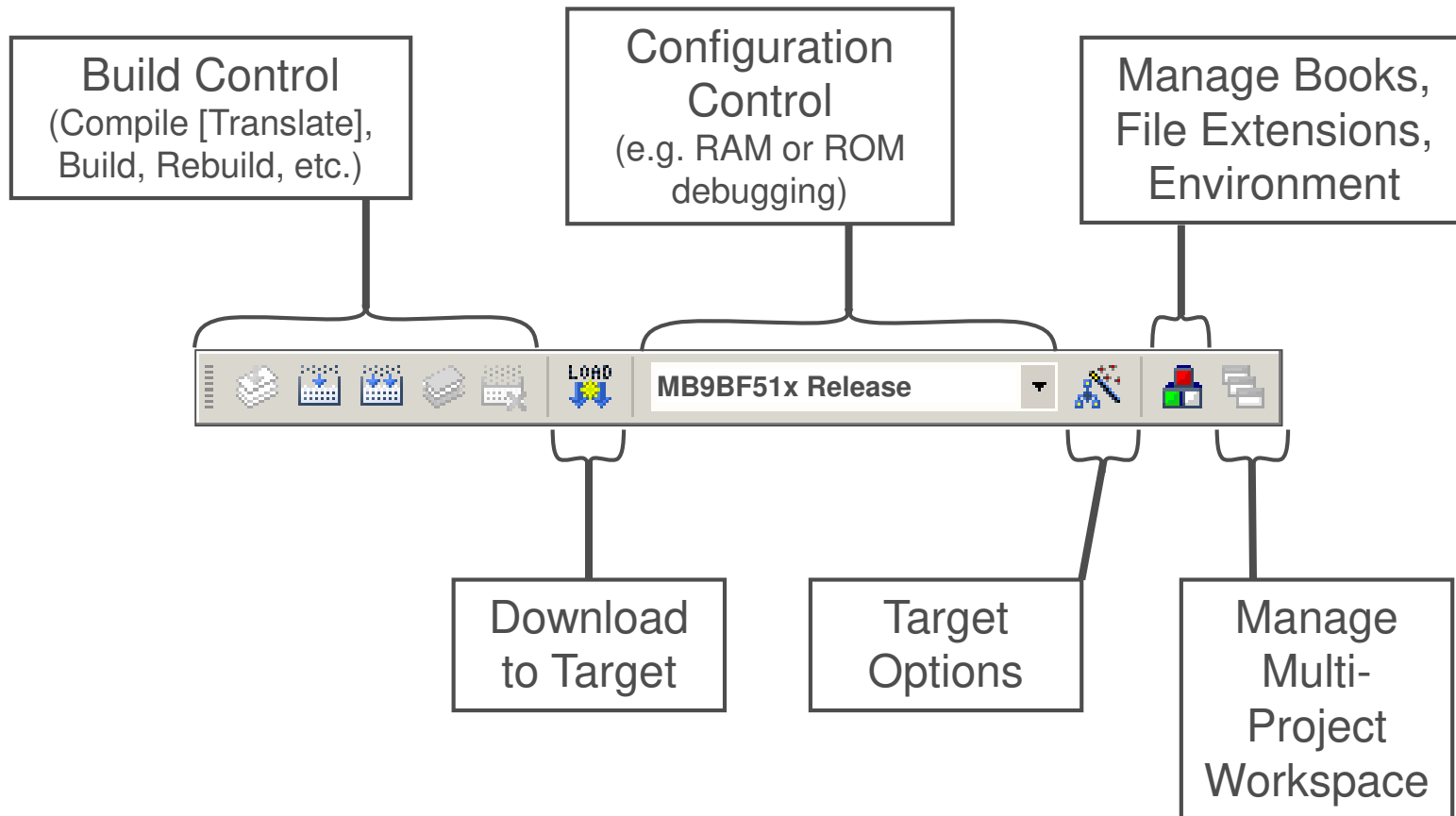


- Menu Bar 1
  - Can be moved in bar window area or set floating

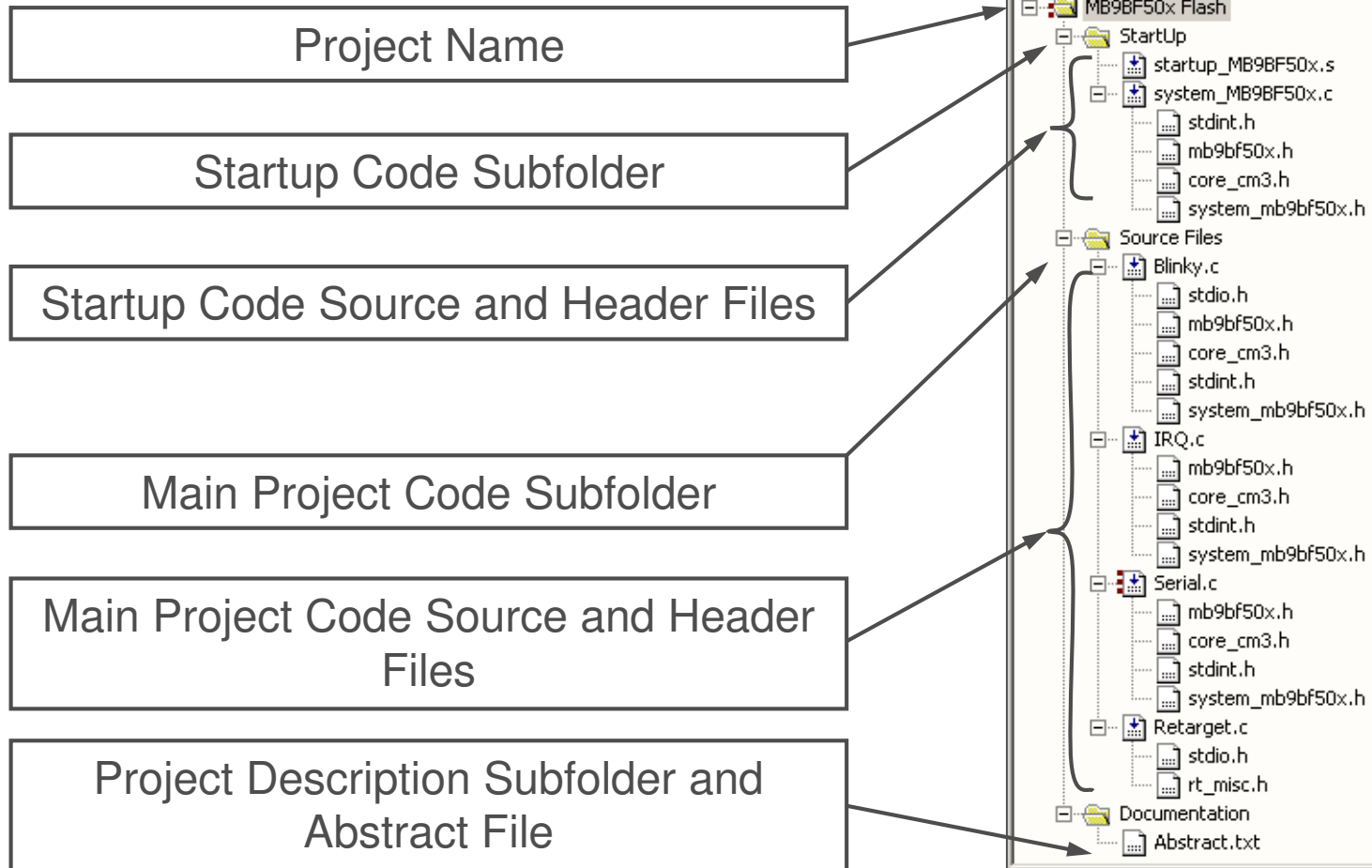




- Menu Bar 2
  - Can be moved in bar window area or set floating



- $\mu$ Vision Project Window



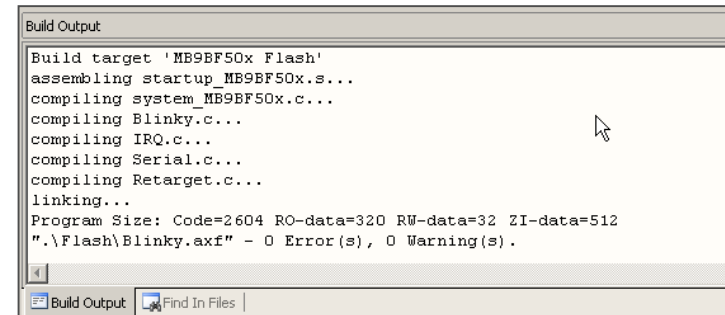
## ■ Making the Project

- Use Rebuild Icon



Project → Rebuild all target files

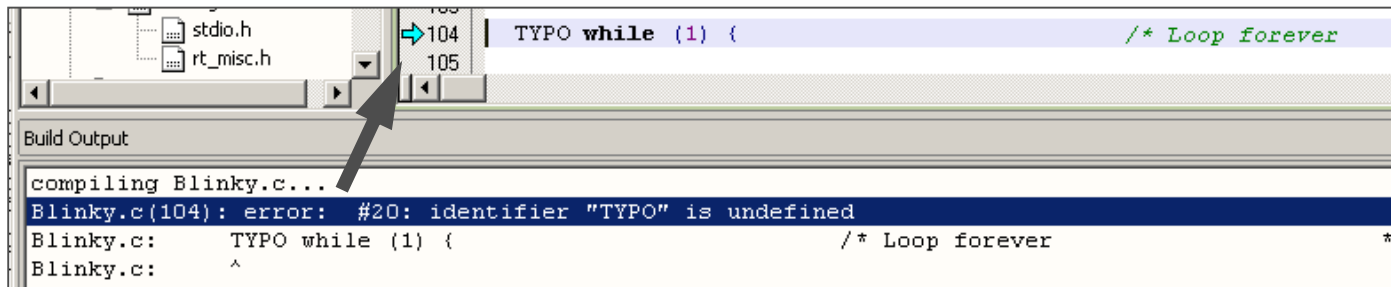
- Check for no errors in Output window below



```
Build Output
Build target 'MB9BF50x Flash'
assembling startup_MB9BF50x.s...
compiling system_MB9BF50x.c...
compiling Blinky.c...
compiling IRQ.c...
compiling Serial.c...
compiling Retarget.c...
linking...
Program Size: Code=2604 RO-data=320 RW-data=32 ZI-data=512
".\Flash\Blinky.axf" - 0 Error(s), 0 Warning(s).
```

- Build errors are shown in Output window.



✓ Can be double-clicked by showing the source line with a blue arrow



```
Build Output
compiling Blinky.c...
Blinky.c(104): error: #20: identifier "TYPO" is undefined
Blinky.c:      TYPO while (1) {
Blinky.c:      ^
```

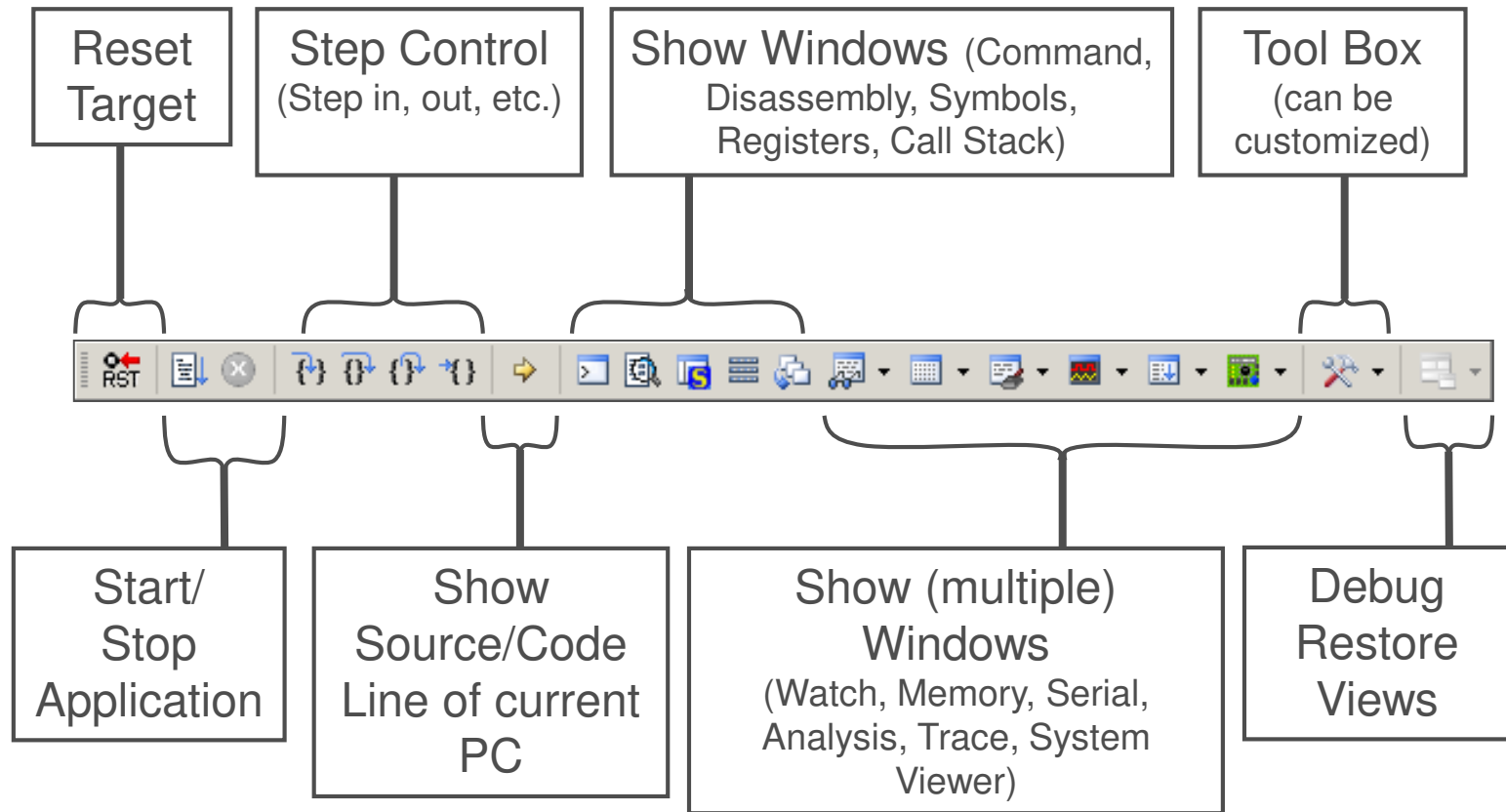
```
stdio.h
rt_misc.h
104 | TYPO while (1) { /* Loop forever
105 |
```

## ■ Start Debugging

- Download to target first, when MCU Flash does not contain the current application openend and built in the IDE
  - ✓ Use Download Icon (  ) or Menu: Flash→Download
- Start Debug Session
  - ✓ Use Start/Stop Debug Icon (  ) or Menu: Debug→Start/Stop Debug Session
- Ending Debug Session
  - ✓ Use same way as for starting debug session

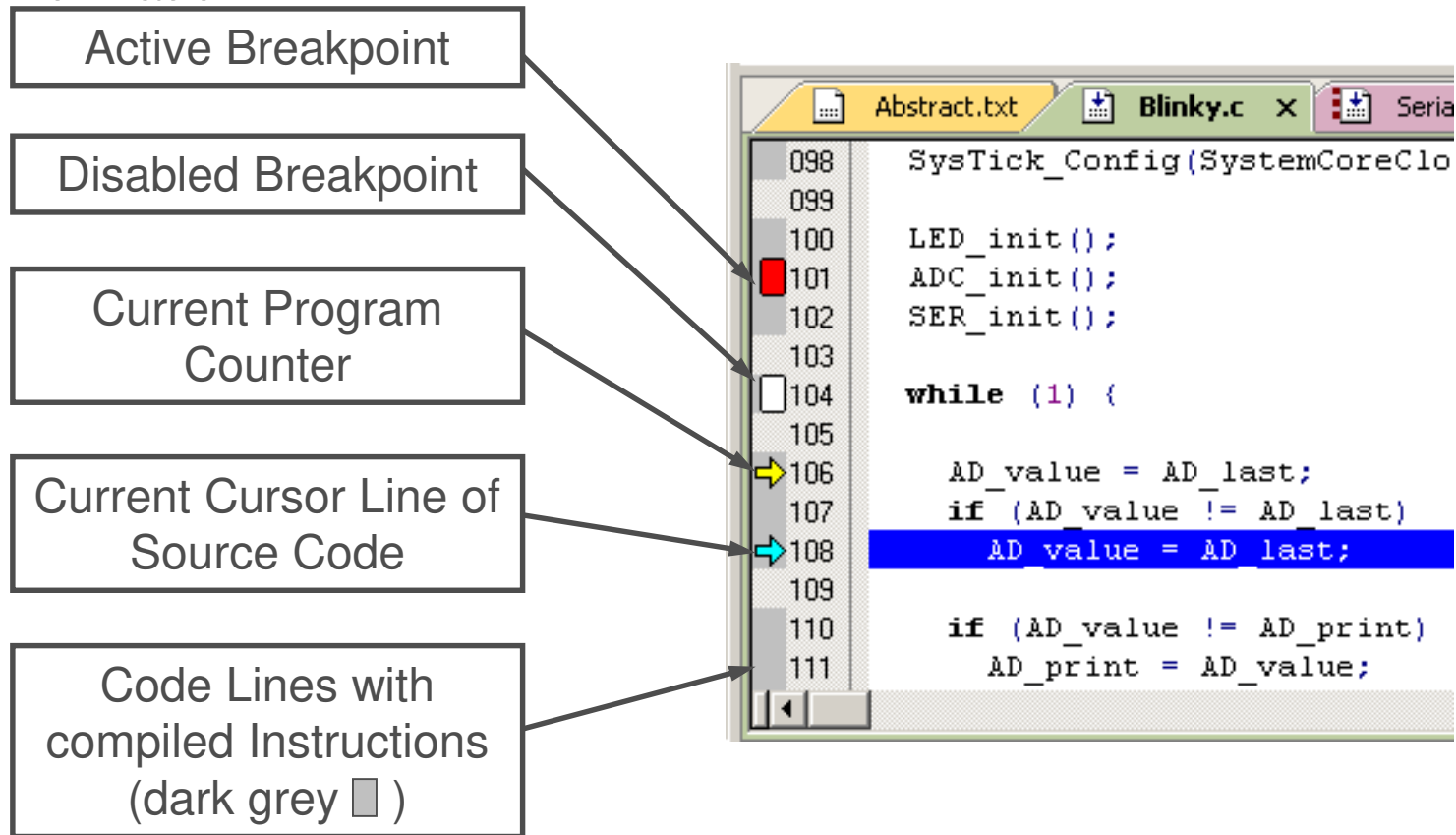
- Debugging Icon Bar

- During a Debug Session there will be visible a new icon bar



## ■ Source View

- The Source windows do not change contents but get additional information



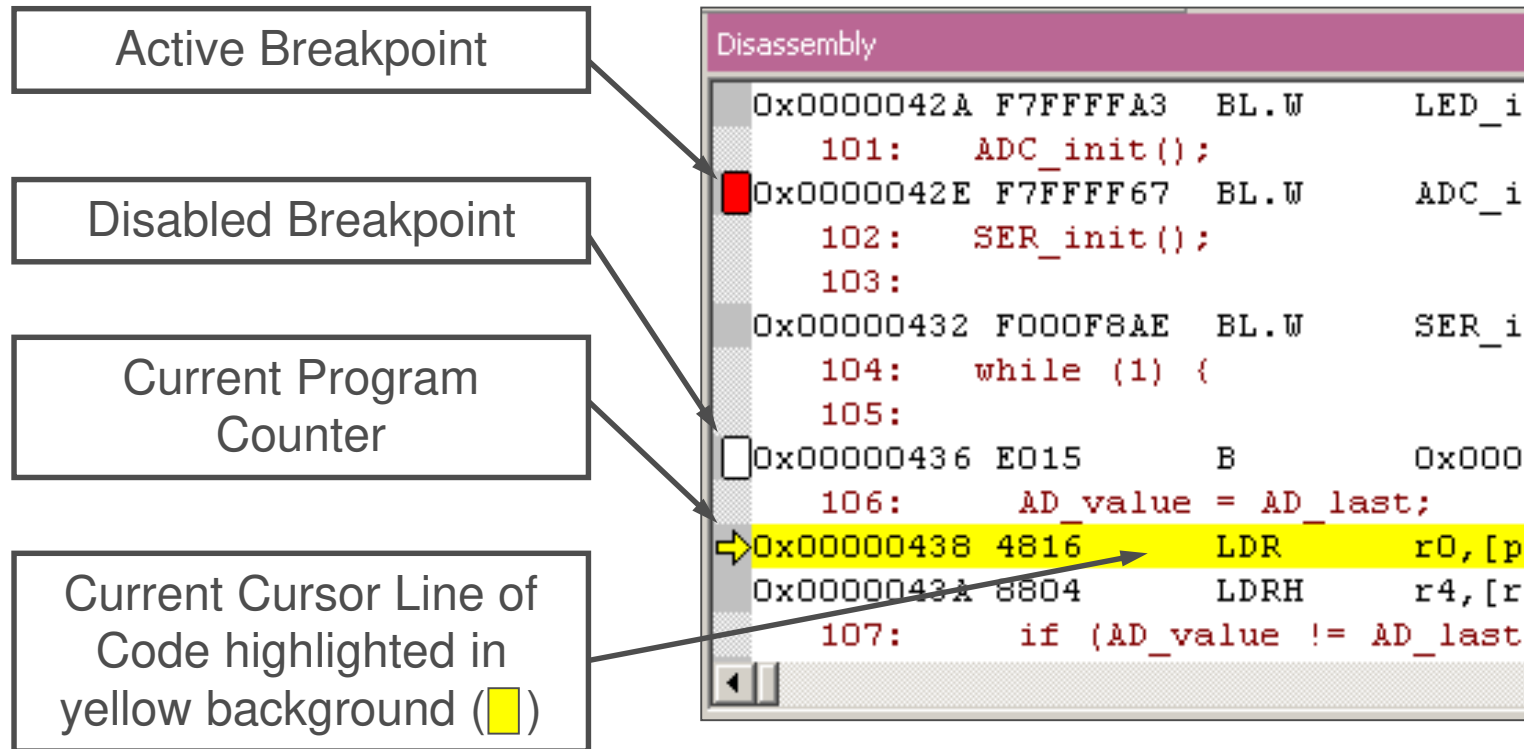
The diagram illustrates the Source View in KEIL  $\mu$ Vision. It shows a window titled 'Blinky.c' with the following code:

```
098 SysTick_Config(SystemCoreClo
099
100 LED_init();
101 ADC_init();
102 SER_init();
103
104 while (1) {
105
106     AD_value = AD_last;
107     if (AD_value != AD_last)
108         AD_value = AD_last;
109
110     if (AD_value != AD_print)
111         AD_print = AD_value;
```

Callouts from the left point to specific features in the code window:

- Active Breakpoint:** Points to a red square on line 101.
- Disabled Breakpoint:** Points to an empty square on line 104.
- Current Program Counter:** Points to a yellow arrow on line 106.
- Current Cursor Line of Source Code:** Points to a cyan arrow on line 108.
- Code Lines with compiled Instructions (dark grey):** Points to the dark grey background of lines 101, 102, 103, 106, 107, 108, 109, 110, and 111.

- Disassembly View
  - Mixed mode is selectable and deselectable



The screenshot shows the Disassembly window with the following code:

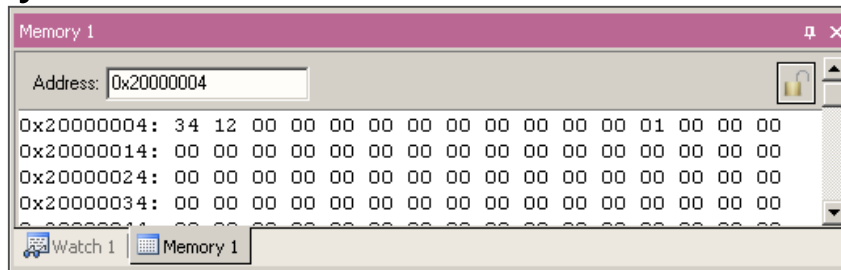
```
Disassembly
Ox0000042A F7FFFA3 BL.W LED_i
101: ADC_init();
Ox0000042E F7FFF67 BL.W ADC_i
102: SER_init();
103:
Ox00000432 F000F8AE BL.W SER_i
104: while (1) {
105:
Ox00000436 E015 B Ox0000
106: AD_value = AD_last;
Ox00000438 4816 LDR r0, [p
Ox0000043A 8804 LDRH r4, [r
107: if (AD_value != AD_last
```

Callouts from the left:

- Active Breakpoint: Points to the red square on the left of the second line of code.
- Disabled Breakpoint: Points to the white square on the left of the fifth line of code.
- Current Program Counter: Points to the address Ox00000438 on the left of the sixth line of code.
- Current Cursor Line of Code highlighted in yellow background (■): Points to the sixth line of code, which is highlighted in yellow.

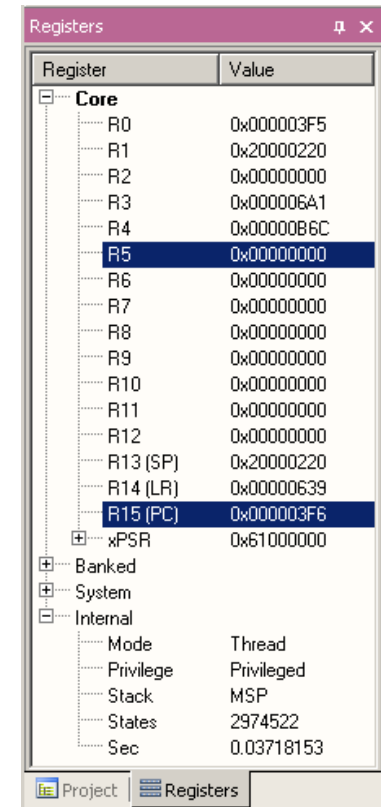
## Memory Window

- Up to 4 Memory windows can be displayed in tabs
- Memory is updated during runtime
- Memory window tabs are shared with Watch windows



## Register View

- Register view is a tab of the Project window
- Changes are highlighted in dark blue text background
- Register tree knots can be expanded

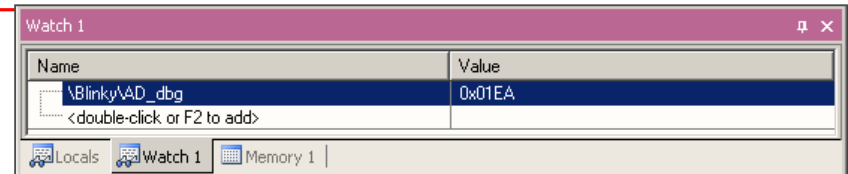




## ■ Variable Windows

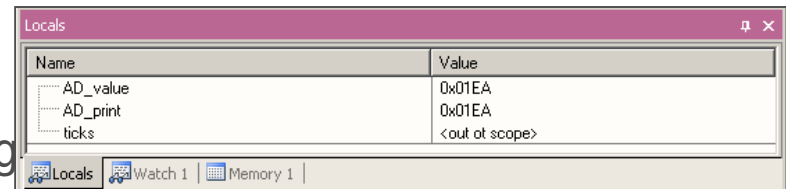
### • Watch Windows

- ✓ Up to 2 Watch windows are sharing their tabs with e.g. Memory and Local views
- ✓ Updated during runtime
- ✓ Any changes are highlighted in dark blue text background color
- ✓ Displayed values can be changed by user during break



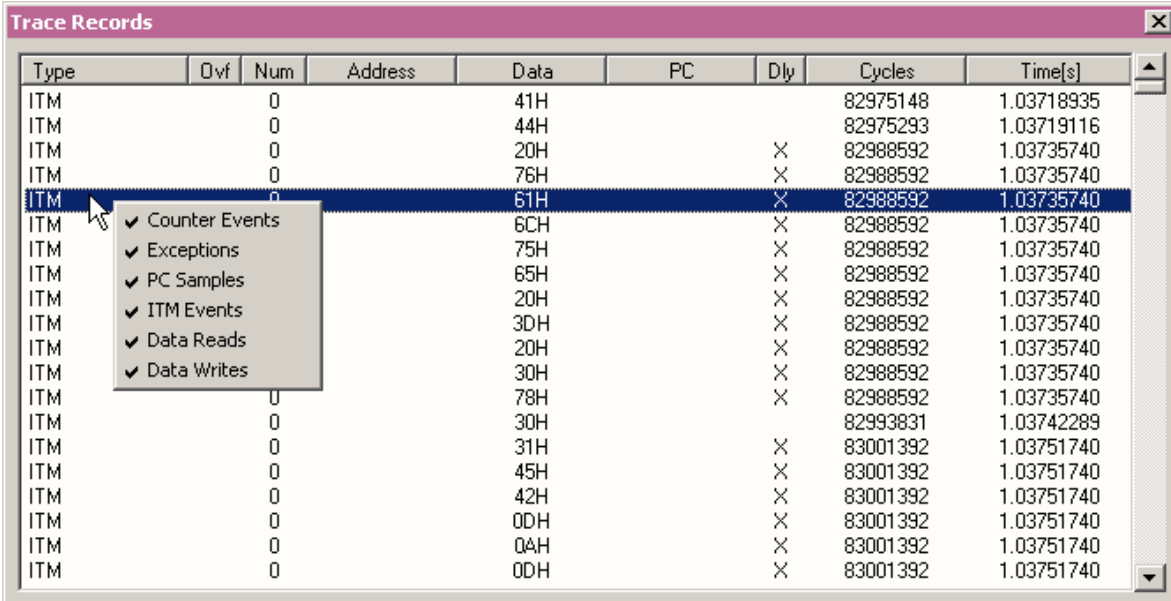
### • Local View

- ✓ The local view shares the tab with e.g. Watch and Memory windows
- ✓ Any changes are highlighted in dark blue text background color
- ✓ Displayed values can be changed by user during break



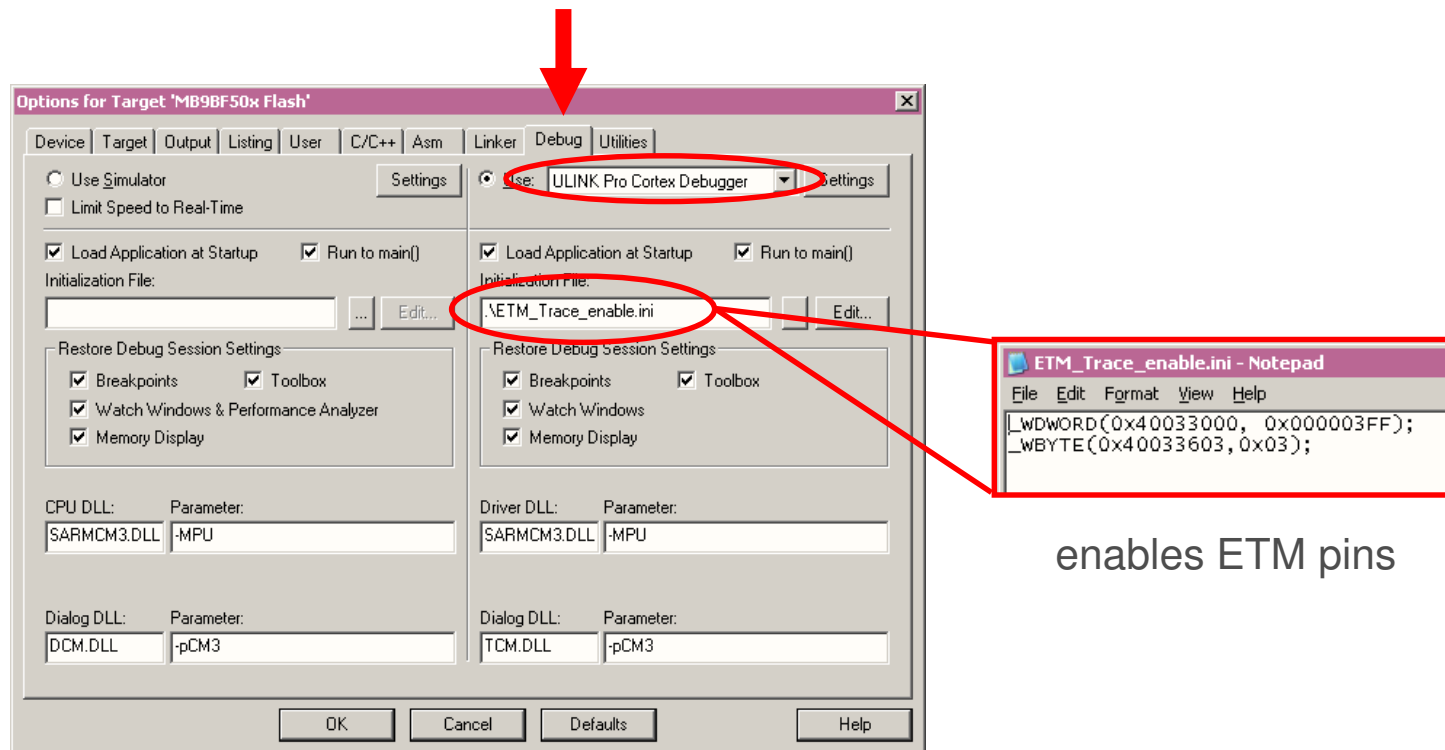
## Trace via ITM

- Simple Trace views via Instrumentation Trace Macro is supported by  $\mu$ LINK ME
  - ✓ Records
  - ✓ Exceptions
  - ✓ Counters

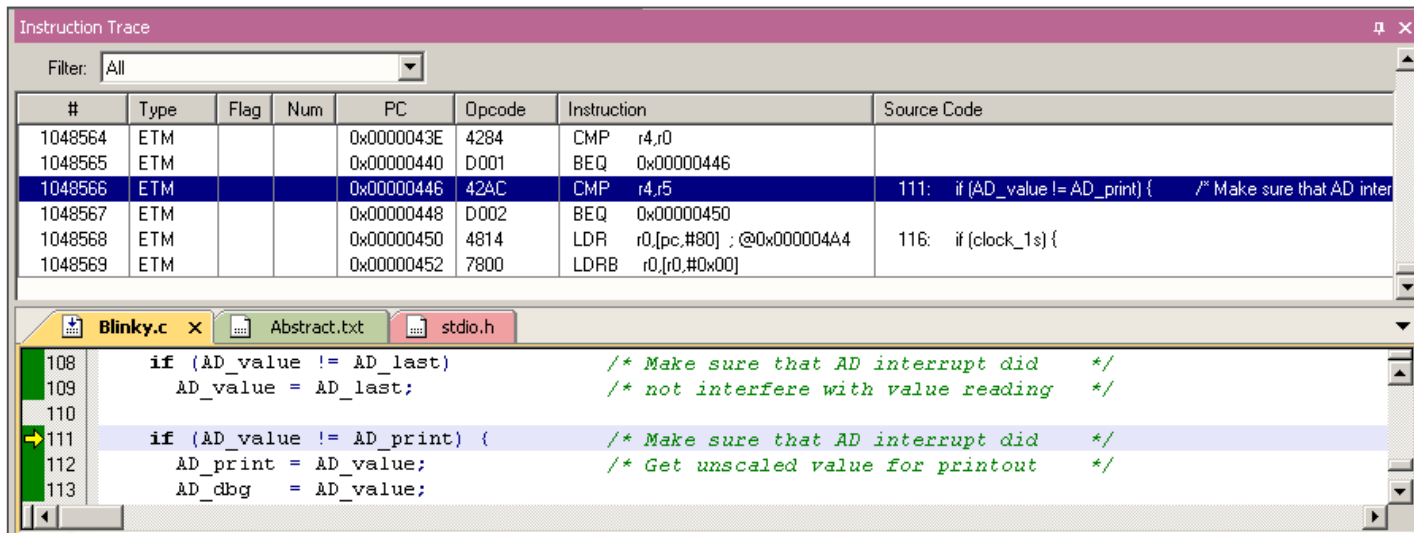


Type	Dly	Num	Address	Data	PC	Dly	Cycles	Time[s]
ITM		0	41H	41H			82975148	1.03718935
ITM		0	44H	44H			82975293	1.03719116
ITM		0	20H	20H		X	82988592	1.03735740
ITM		0	76H	76H		X	82988592	1.03735740
ITM		0	61H	61H		X	82988592	1.03735740
ITM		0	6CH	6CH		X	82988592	1.03735740
ITM		0	75H	75H		X	82988592	1.03735740
ITM		0	65H	65H		X	82988592	1.03735740
ITM		0	20H	20H		X	82988592	1.03735740
ITM		0	3DH	3DH		X	82988592	1.03735740
ITM		0	20H	20H		X	82988592	1.03735740
ITM		0	30H	30H		X	82988592	1.03735740
ITM		0	78H	78H		X	82988592	1.03735740
ITM		0	30H	30H			82993831	1.03742289
ITM		0	31H	31H		X	83001392	1.03751740
ITM		0	45H	45H		X	83001392	1.03751740
ITM		0	42H	42H		X	83001392	1.03751740
ITM		0	0DH	0DH		X	83001392	1.03751740
ITM		0	04H	04H		X	83001392	1.03751740
ITM		0	0DH	0DH		X	83001392	1.03751740

- Trace via ETM
  - Check settings in menu:  
Flash→Configure Flash Tools... Tab:Debug



- Instruction Trace
  - Real Time Trace recording
  - Output can be filtered by several ETM and ITM events
  - Trace buffer is held in PC memory and transferred to  $\mu$ Vision on break



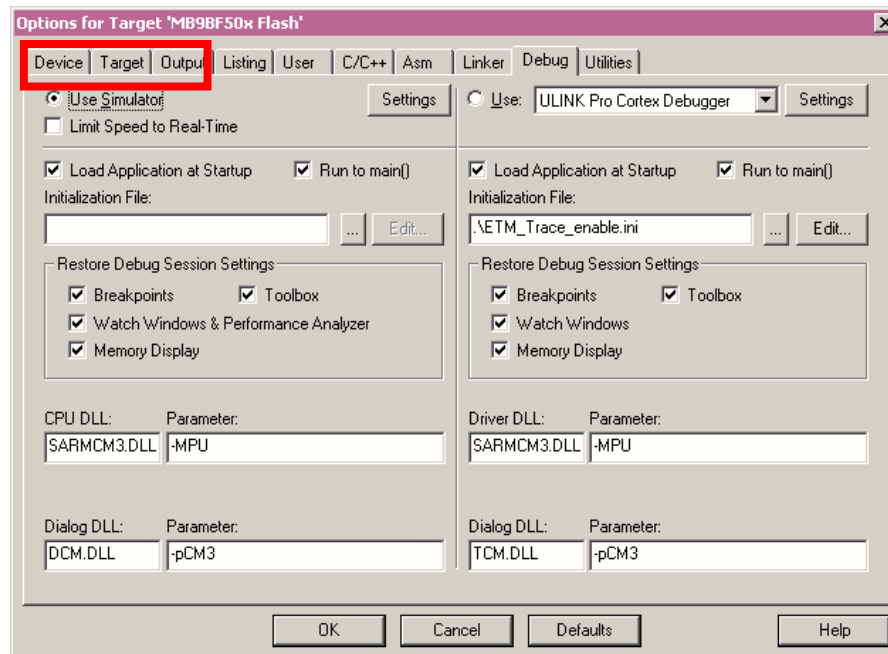
The screenshot displays the 'Instruction Trace' window in KEIL  $\mu$ Vision. The window is divided into two main sections. The top section is a table with the following columns: #, Type, Flag, Num, PC, Opcode, Instruction, and Source Code. The bottom section shows the source code for the file 'Blinky.c', with the current instruction highlighted in blue.

#	Type	Flag	Num	PC	Opcode	Instruction	Source Code
1048564	ETM			0x0000043E	4284	CMP r4,r0	
1048565	ETM			0x00000440	D001	BEQ 0x00000446	
1048566	ETM			0x00000446	42AC	CMP r4,r5	111: if (AD_value != AD_print) { /* Make sure that AD inter
1048567	ETM			0x00000448	D002	BEQ 0x00000450	
1048568	ETM			0x00000450	4814	LDR r0,[pc,#80] ;@0x000004A4	116: if (clock_1s) {
1048569	ETM			0x00000452	7800	LDRB r0,[r0,#0x00]	

```
108     if (AD_value != AD_last)           /* Make sure that AD interrupt did */
109         AD_value = AD_last;           /* not interfere with value reading */
110
111     if (AD_value != AD_print) {        /* Make sure that AD interrupt did */
112         AD_print = AD_value;           /* Get unscaled value for printout */
113         AD_dbg   = AD_value;
```

## ■ Simulator

- The Core Simulator can be selected by the menu: [Flash] → [Configure Flash Tools...] → [Debug] and then choosing [Use Simulator]
- Look & feel is like using ULINK debugger
- Controlable also with \*.ini files





Finally

- Please check the following website, for any available updates

[www.cypress.com](http://www.cypress.com)

- Gültig für EU-Länder:
  - Gemäß der Europäischen WEEE-Richtlinie und deren Umsetzung in landesspezifische Gesetze nehmen wir dieses Gerät wieder zurück.
  - Zur Entsorgung schicken Sie das Gerät bitte an die folgende Adresse:
- Valid for European Union Countries:
  - According to the European WEEE-Directive and its implementation into national laws we take this device back.
  - For disposal please send the device to the following address:



**Cypress Semiconductor**  
**198 Champion Court**  
**San Jose, CA 95134 USA**  
**Tel: +1-408-943-2600**



- This board is compliant with China RoHS