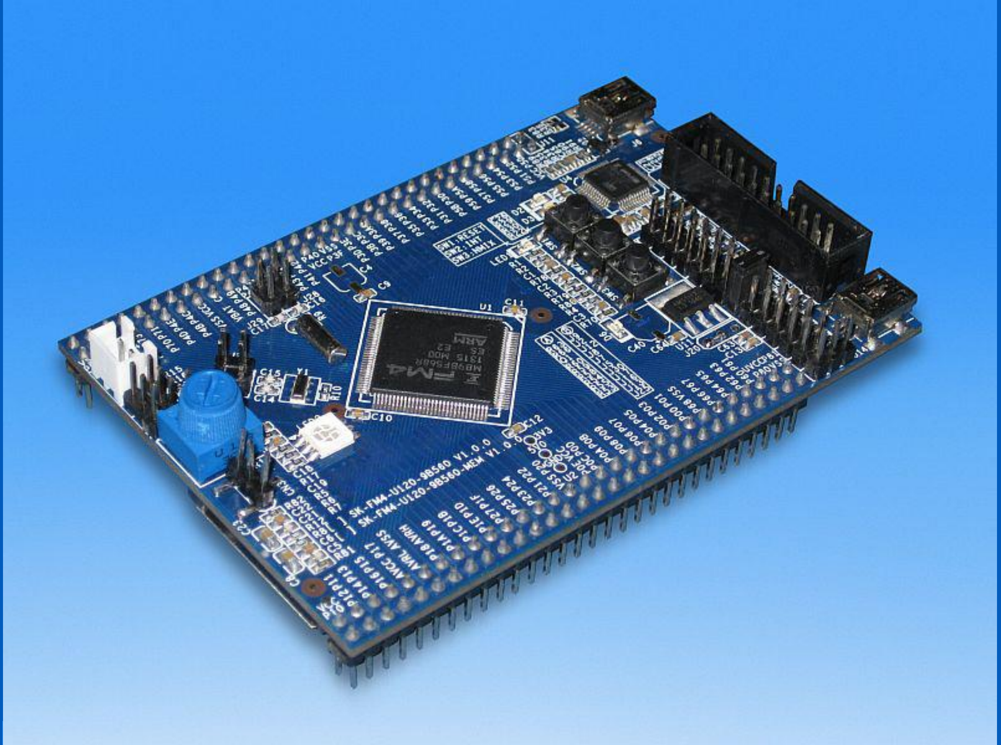

Starter Kit User Guide
FM4-U120-9B560
FM4-U120-9B560-MEM

Hardware V1.1 / Documentation V1.8

Document Number: 002-09878 Rev. *B

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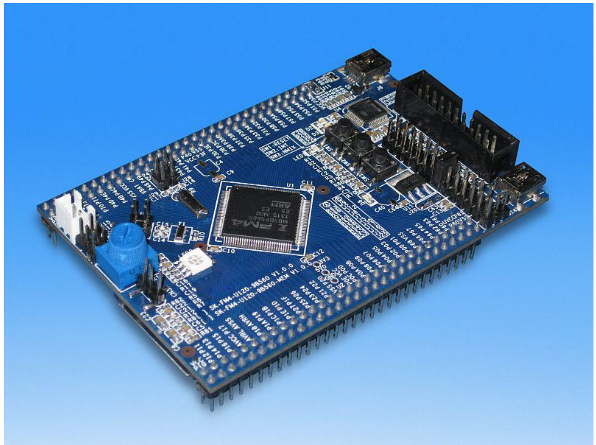
Information about this PDF Document

- 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.

Overview

- 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

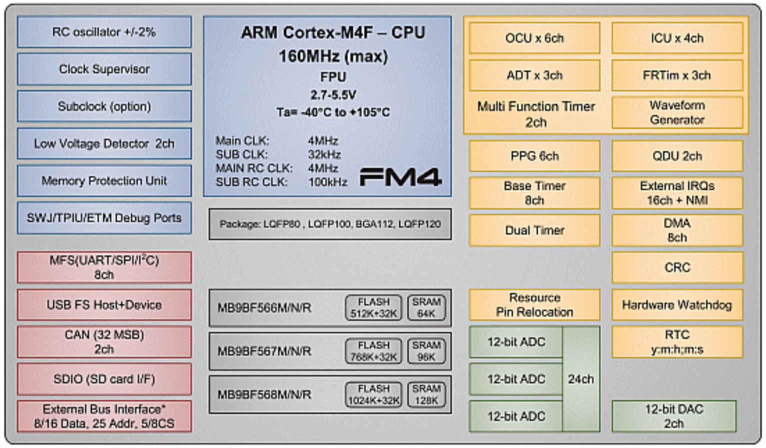


- **Additional documents**
  - Schematic
  - Factsheet
  - Data sheet MB9B560R Series
  - Peripheral Manual
  - Peripheral Manual (Timer Part)
  - Peripheral Manual (Analog Part)
  - Peripheral Manual (Communication Part)
  - Flash Programming Manual and Errata

Please visit www.cypress.com to find latest releases of the above mentioned documents.

Features of the Microcontroller

- The FM4-U120-9B560 and FM4-U120-9B560-MEM are based on the Cypress Arm® Cortex®-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 / I²C 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)


RC oscillator +/-2%
Clock Supervisor
Subclock (option)
Low Voltage Detector 2ch
Memory Protection Unit
SWJ/TPIU/ETM Debug Ports
MFS(UART/SPI/I²C) 8ch
USB FS Host+Device
CAN (32 MSB) 2ch
SDIO (SD card I/F)
External Bus Interface* 8/16 Data, 25 Addr, 5/8CS
ARM Cortex-M4F – CPU
160MHz (max)
FPU
2.7-5.5V
Ta= -40°C to +105°C
Main CLK: 4MHz
SUB CLK: 32kHz
MAIN RC CLK: 4MHz
SUB RC CLK: 100kHz
FM4
Package: LQFP80 , LQFP100, BGA112, LQFP120
MB9BF566M/N/R FLASH 512K+32K SRAM 64K
MB9BF567M/N/R FLASH 768K+32K SRAM 96K
MB9BF568M/N/R FLASH 1024K+32K SRAM 128K
OCU x 6ch
ICU x 4ch
ADT x 3ch
FRTim x 3ch
Multi Function Timer 2ch
Waveform Generator
PPG 6ch
QDU 2ch
Base Timer 8ch
External IRQs 16ch + NMI
Dual Timer
DMA 8ch
CRC
Resource Pin Relocation
Hardware Watchdog
12-bit ADC
12-bit ADC
12-bit ADC
24ch
RTC y:m:h;m:s
12-bit DAC 2ch

* >=100pin devices only

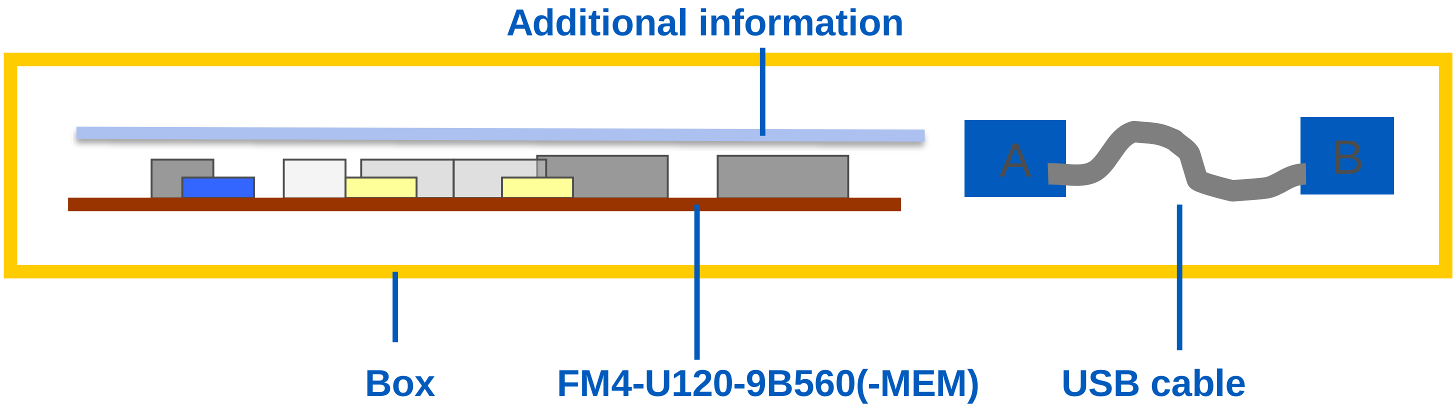
Features of the Board

- 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

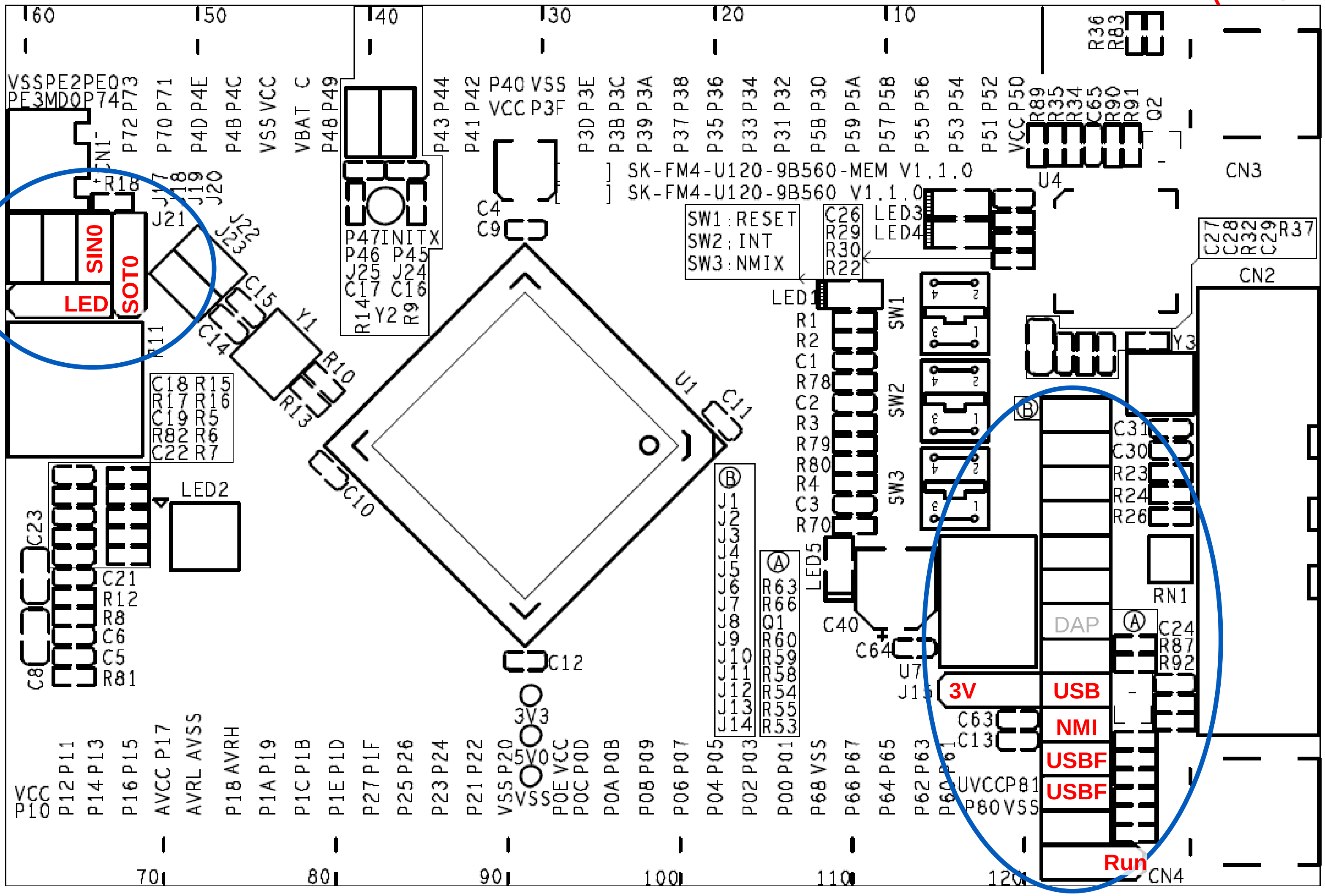

Additional information
A
B
Box
FM4-U120-9B560(-MEM)
USB cable

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

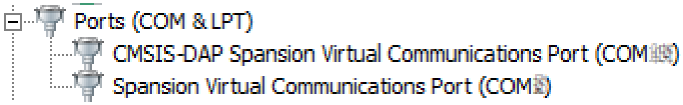
Note:

Please set J9 (USB) instead of J7 (CMSIS-DAP)
Please set J19 and J20:1-2 (SIN0/SOT0)


SINO
SOT0
LED
3V
DAP
USB
NMI
USBF
USBF
Run
SK-FM4-U120-9B560-MEM V1.1.0
SK-FM4-U120-9B560 V1.1.0
SW1:RESET
SW2:INT
SW3:NMIX
CN1
CN2
CN3
CN4
U1
U4
U7
J15
J17
J18
J19
J20
J21
J22
J23
J24
J25
Y1
Y2
Y3
LED1
LED2
LED3
LED4
LED5
3V3
5V0
VSS

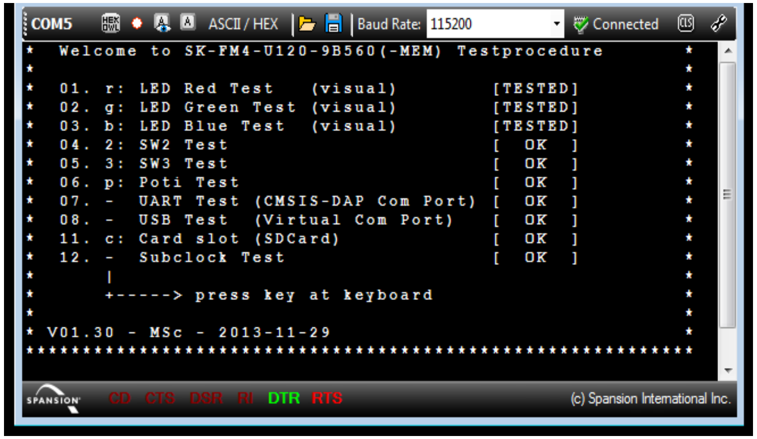
Test it by Terminal using USB

- 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



Ports (COM & LPT)
CMSIS-DAP Spansion Virtual Communications Port (COM[illegible])
Spansion Virtual Communications Port (COM[illegible])

  - 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

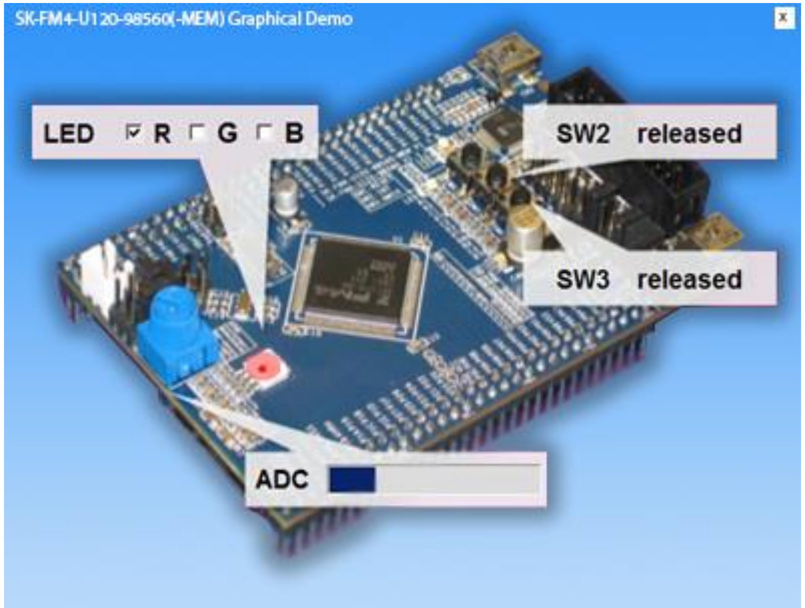


COM5
Baud Rate: 115200
Connected

```
*  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: 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                               *
***********************************************************
```

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



SK-FM4-U120-9B560(-MEM) Graphical Demo

LED ☑ R ☐ G ☐ B

SW2 released

SW3 released

ADC

Test it

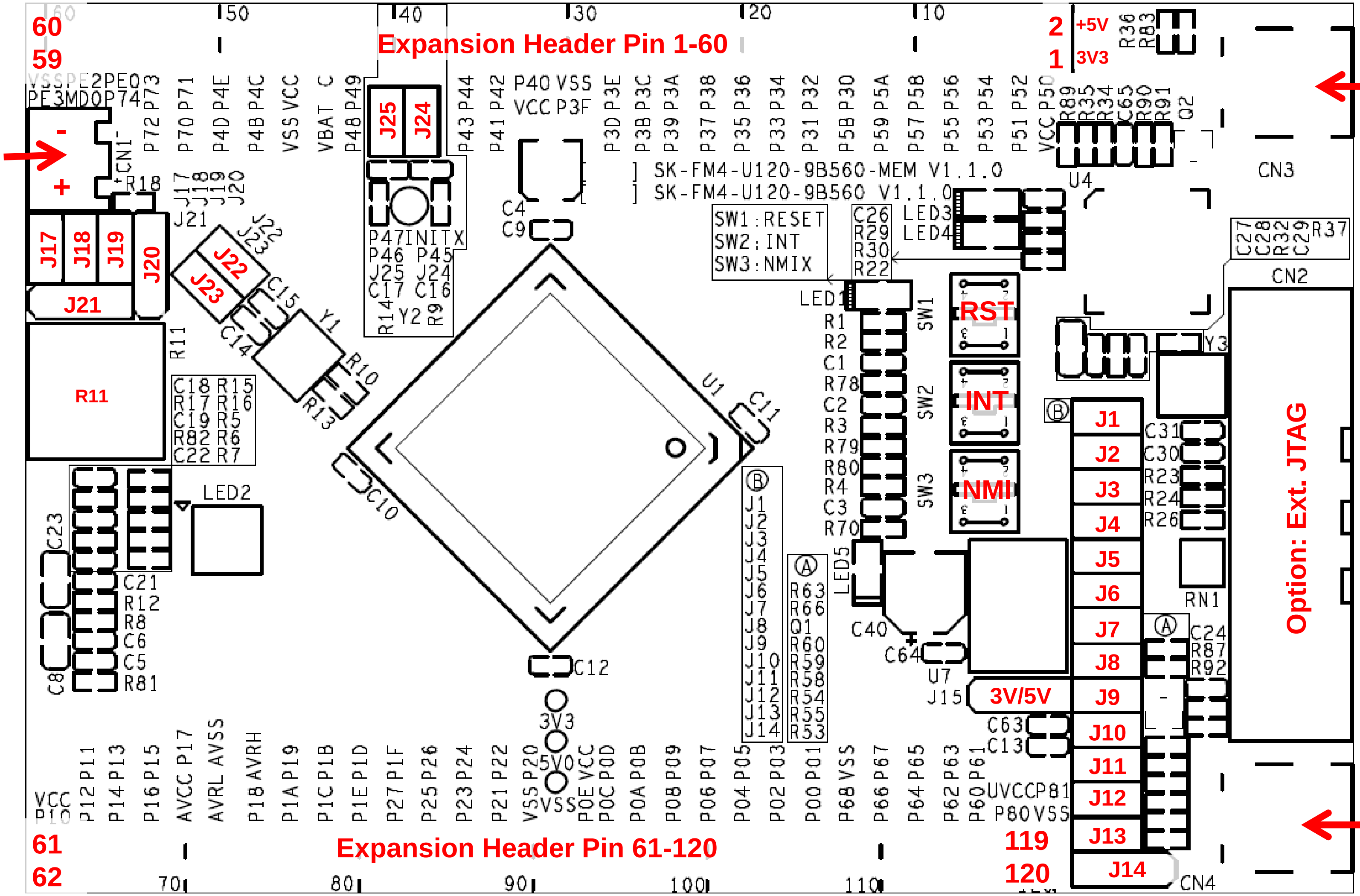
- You finished successfully the first test.

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 µVision

Hardware

The Hardware (Top Side) – Jumper Overview


60
59
Expansion Header Pin 1-60
2
1
+5V
3V3
J25
J24
-
+
J17
J18
J19
J20
J21
J22
J23
R11
SK-FM4-U120-9B560-MEM V1.1.0
SK-FM4-U120-9B560 V1.1.0
SW1:RESET
SW2:INT
SW3:NMIX
RST
INT
NMI
J1
J2
J3
J4
J5
J6
J7
J8
J9
J10
J11
J12
J13
J14
3V/5V
Option: Ext. JTAG
CN2
CN3
CN4
U1
U4
U7
LED2
3V3
5V0
VSS
61
62
Expansion Header Pin 61-120
119
120

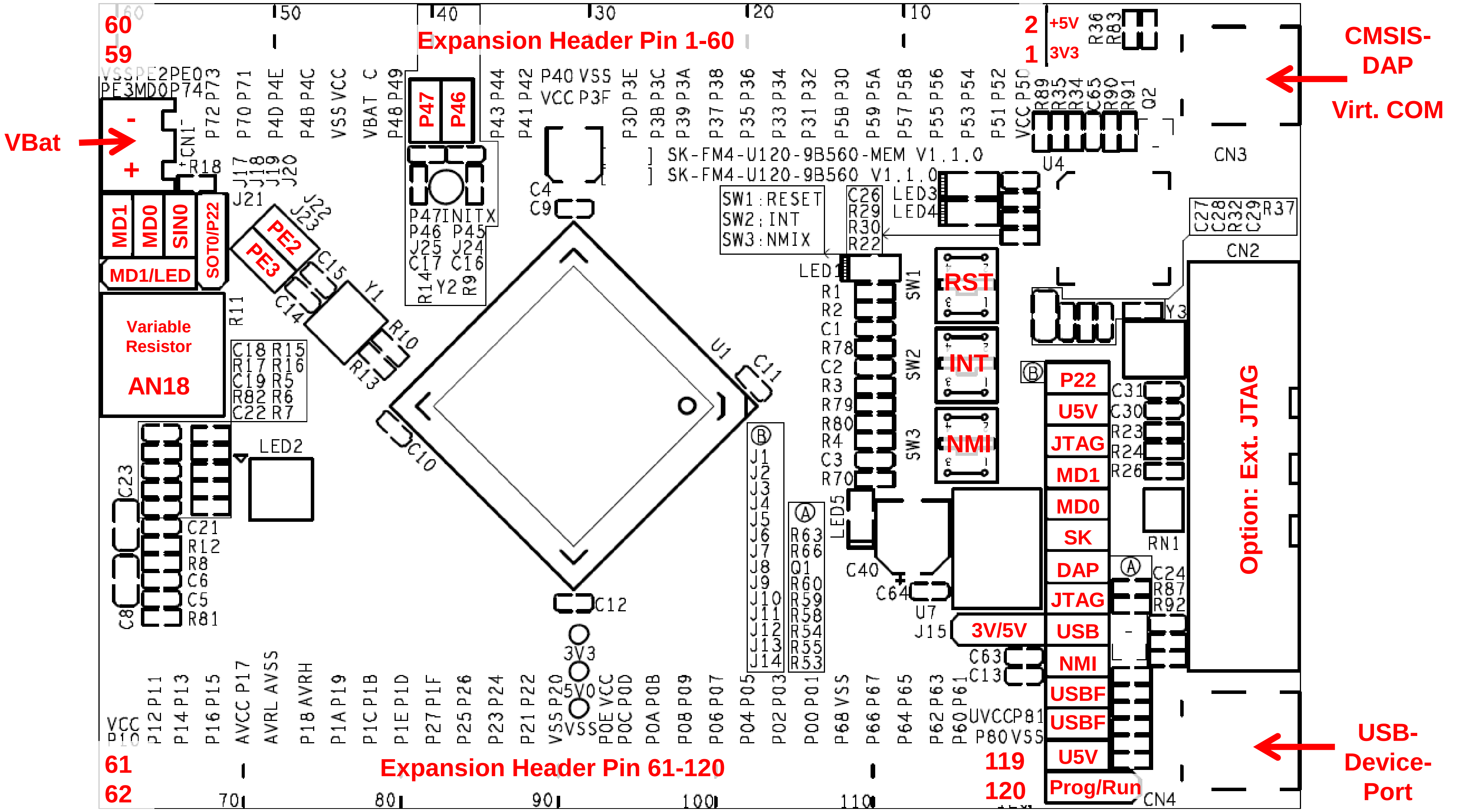
VBat

CMSIS-DAP

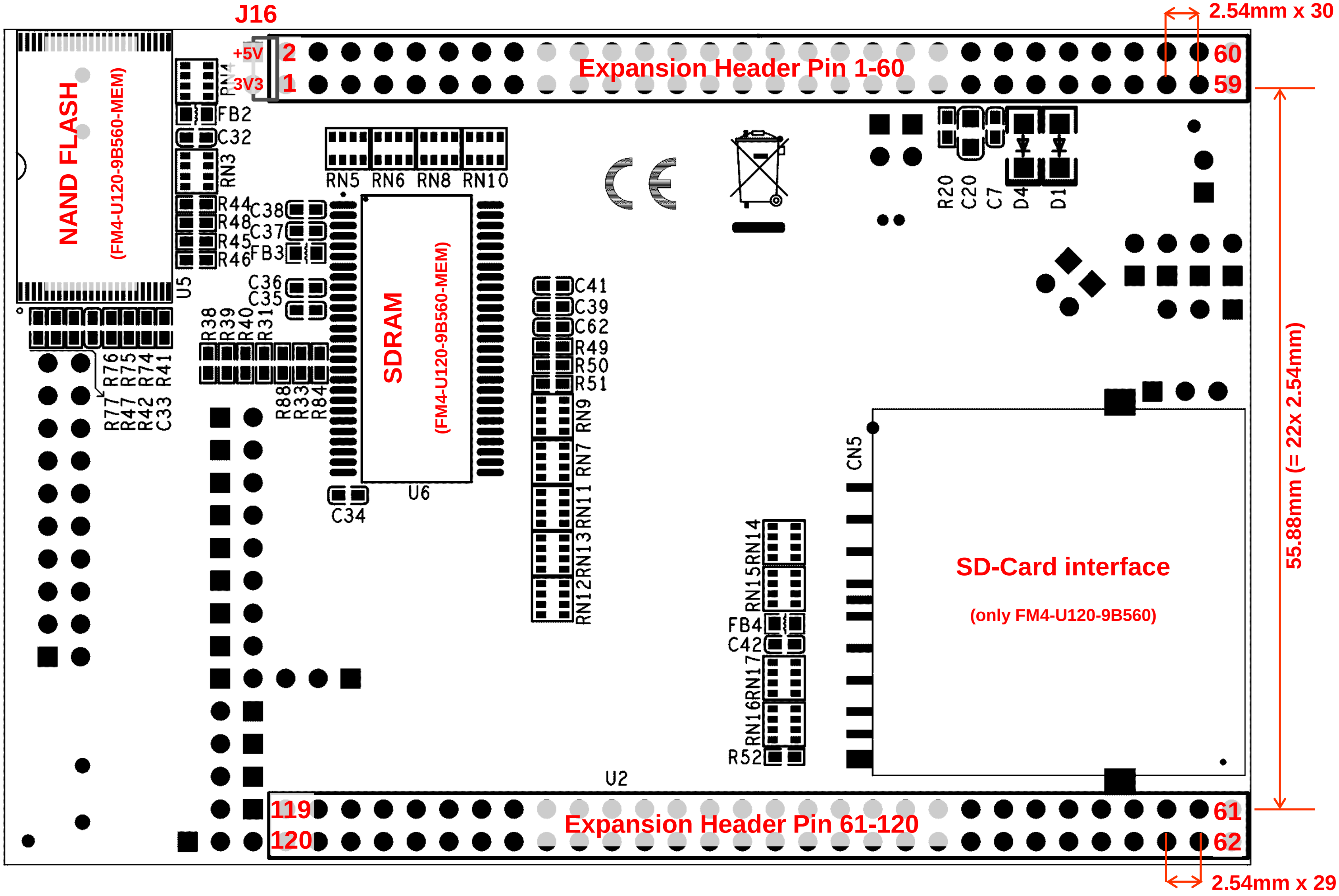
Virt. COM

USB-Device-Port

The Hardware (Top Side) – Jumper Function Overview


60
59
Expansion Header Pin 1-60
2
1
+5V
3V3
CMSIS-DAP
Virt. COM
VBat
-
+
P47
P46
MD1
MD0
SIN0
SOT0/P22
MD1/LED
PE2
PE3
Variable Resistor
AN18
SK-FM4-U120-9B560-MEM V1.1.0
SK-FM4-U120-9B560 V1.1.0
SW1:RESET
SW2:INT
SW3:NMIX
RST
INT
NMI
P22
U5V
JTAG
MD1
MD0
SK
DAP
JTAG
USB
NMI
USBF
USBF
U5V
Prog/Run
3V/5V
Option: Ext. JTAG
CN2
CN3
CN4
U1
U4
U7
USB-Device-Port
61
62
Expansion Header Pin 61-120
119
120

The Hardware (Bottom Side)


J16
+5V
3V3
2
1
Expansion Header Pin 1-60
60
59
2.54mm x 30
NAND FLASH
(FM4-U120-9B560-MEM)
SDRAM
(FM4-U120-9B560-MEM)
55.88mm (= 22x 2.54mm)
SD-Card interface
(only FM4-U120-9B560)
119
120
Expansion Header Pin 61-120
61
62
2.54mm x 29
RN4
FB2
C32
RN3
R44
R48
R45
R46
C38
C37
FB3
C36
C35
U5
RN5
RN6
RN8
RN10
U6
C34
R38
R39
R40
R31
R88
R33
R84
R77
R47
R42
C33
R76
R75
R74
R41
C41
C39
C62
R49
R50
R51
RN9
RN7
RN11
RN13
RN12
R20
C20
C7
D4
D1
CN5
RN14
RN15
FB4
C42
RN17
RN16
R52
U2

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/DTTI1X_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

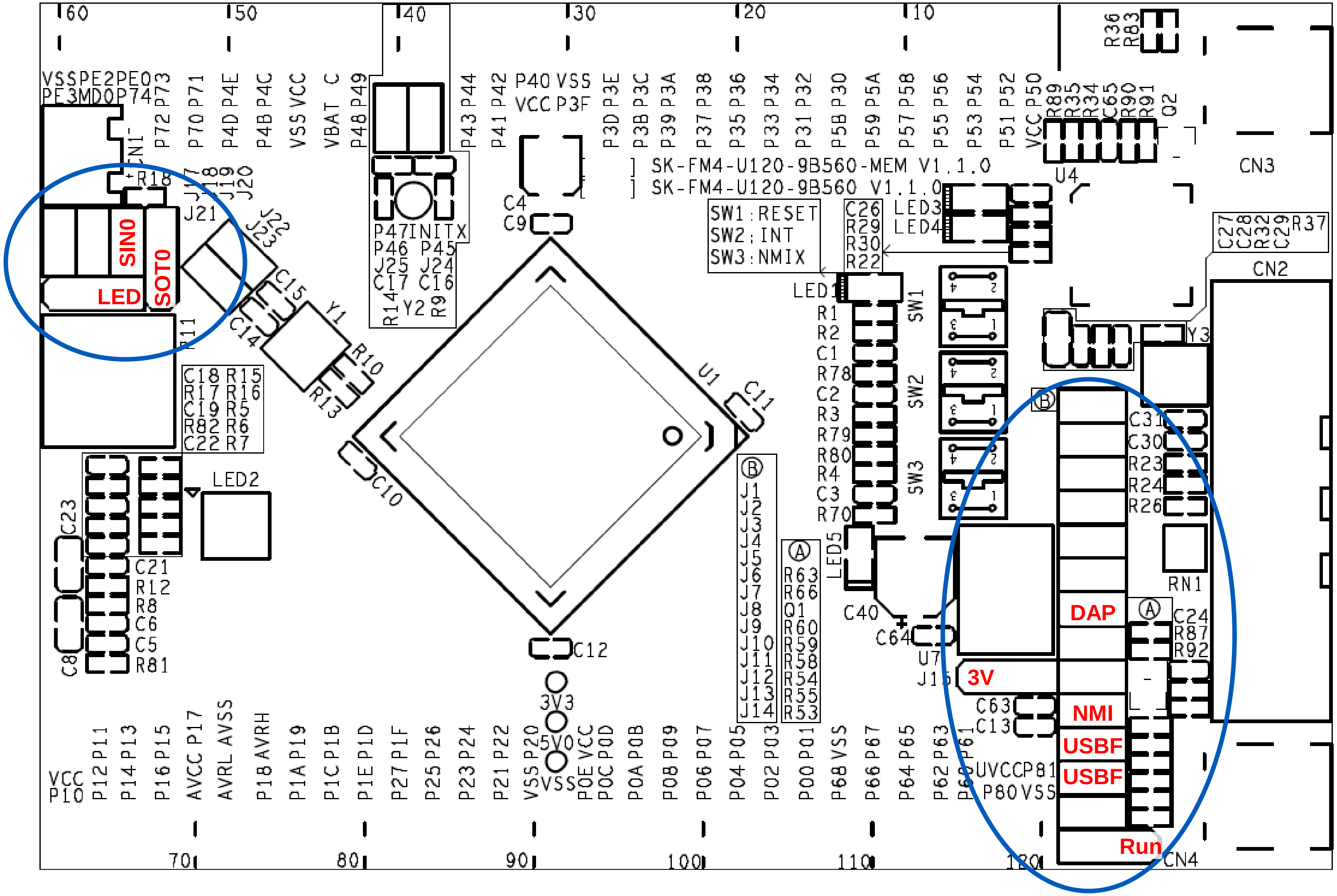
Jumper	Function	FM4-U120-9B560(-MEM) (Default setting marked **bold**)
J1 (2 pin)	CMSIS-DAP Crystal (P22) (Do not change!)	**Open: 4MHz** Closed: 48MHz
J2 (2 pin)	VBUS detection of CMSIS-DAP	**Open: 3V3** Closed: 5V (only for FM4-U120-9B560)
J3 (2 pin)	CMSIS-DAP reset	**Open: CMSIS-DAP normal operation**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

Jumper Table (continued)

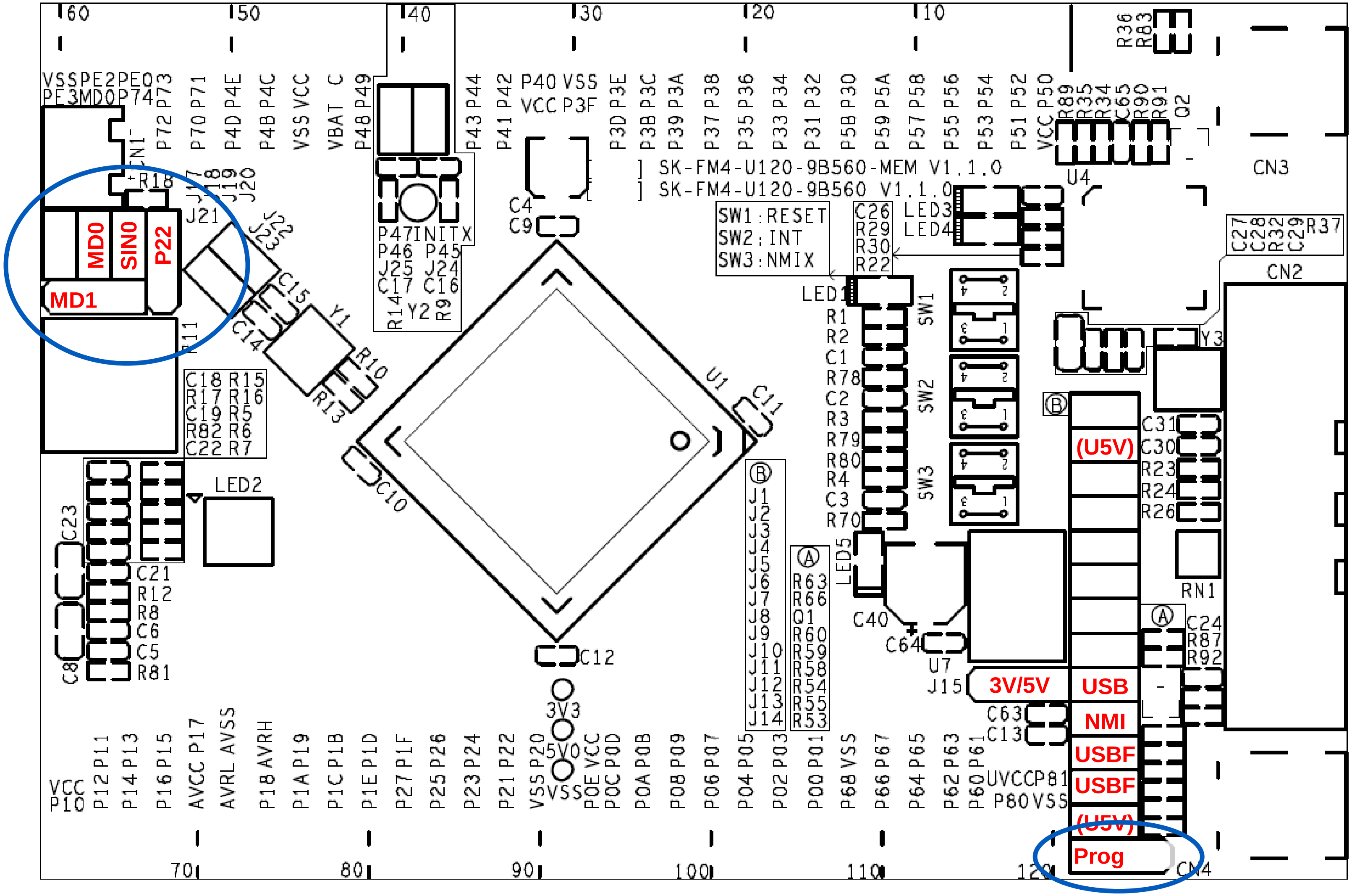
Jumper	Function	FM4-U120-9B560(-MEM) (Default setting marked **bold**)
J14 (3 pin)	USB VBUS detection See also J10	**1-2: VBUS is connected to INT03_2 (Run-Mode)** 2-3: VBUS is connected to NMIX (Programming Mode)
J15 (3 pin)	MCU voltage selection FM4-U120-9B560-MEM can be used with 3V3 only	**1-2: MCU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

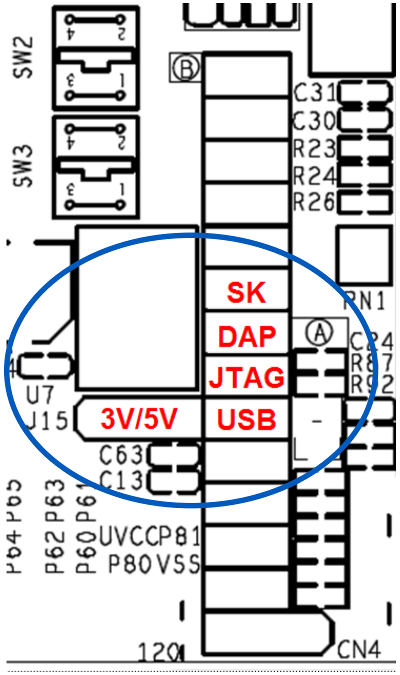

SIN0
SOT0
LED
DAP
3V
NMI
USBF
USBF
Run
SK-FM4-U120-9B560-MEM V1.1.0
SK-FM4-U120-9B560 V1.1.0
SW1:RESET
SW2:INT
SW3:NMIX
U1
U4
U7
CN1
CN2
CN3
CN4
J15
3V3
5V0
LED1
LED2
LED3
LED4
LED5
Y1
Y2
Y3
RN1

Jumper – Programming Mode (USB Direct Mode)

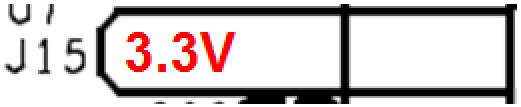

SK-FM4-U120-9B560-MEM V1.1.0
SK-FM4-U120-9B560 V1.1.0
SW1:RESET
SW2:INT
SW3:NMIX
MD0
SIN0
P22
MD1
(U5V)
3V/5V
USB
NMI
USBF
USBF
(U5V)
Prog
J15
CN2
CN3
CN4
U1

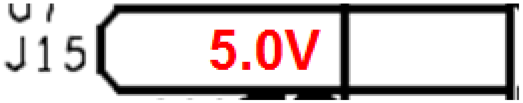
Jumper – Power the Starter Kit

- 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


SW2
SW3
B
C31
C30
R23
R24
R26
RN1
SK
DAP
JTAG
USB
A
C24
R87
R92
U7
J15
3V/5V
C63
C13
P64 P65
P62 P63
P60 P61
UVCC P81
P80 VSS
120
CN4

- 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 µVision:

  See <drive:>\sw-examples\ or 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 µVision:

  See <drive:>\sw-examples\ or www.cypress.com

  - mb9bf56xr_pdl
    - ✓ The Peripheral Drivel 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, ...)

Software Tools

- 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-spansion-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

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-spansion-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

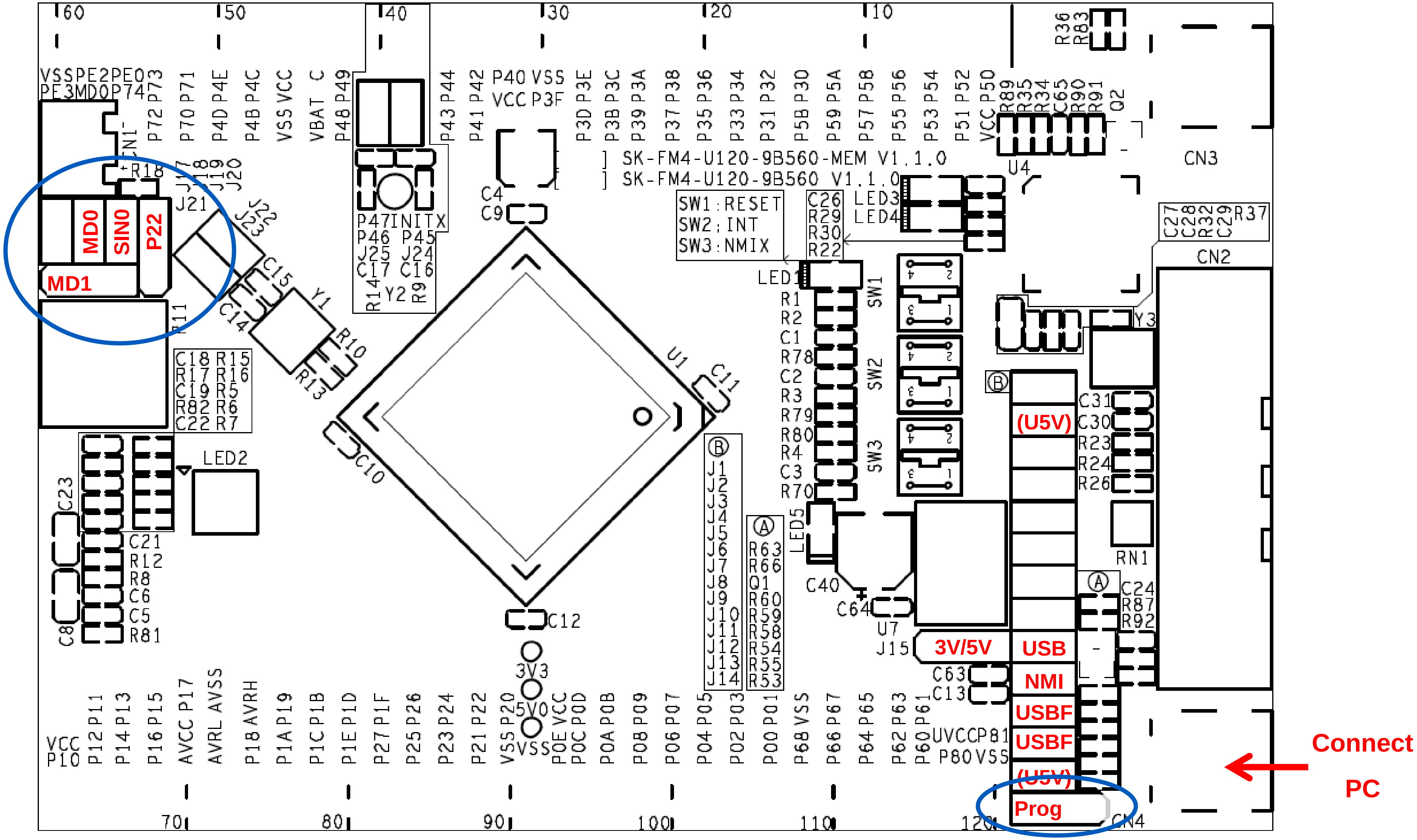
Flash Programming via CN4 (USB Direct)

- 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



MD0
SIN0
P22
MD1
SK-FM4-U120-9B560-MEM V1.1.0
SK-FM4-U120-9B560 V1.1.0
SW1:RESET
SW2:INT
SW3:NMIX
CN3
CN2
CN4
U1
U4
U7
J15
(U5V)
3V/5V
USB
NMI
USBF
USBF
(U5V)
Prog
Connect
PC

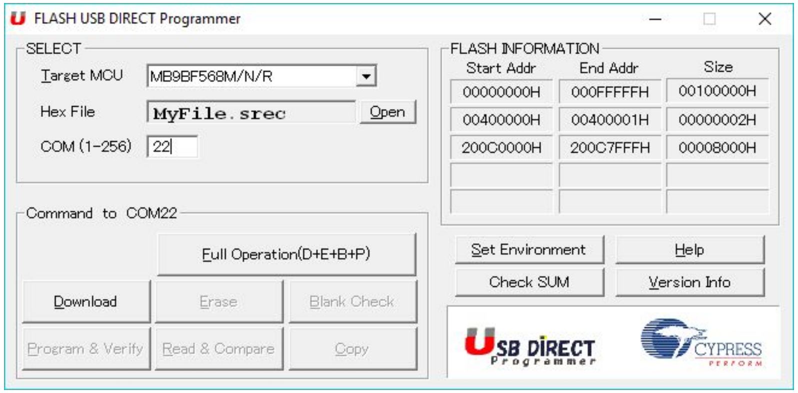
Flash Programming via CN4 (USB Direct)

- 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


FLASH USB DIRECT Programmer
SELECT
Open
Command to COM22
Full Operation(D+E+B+P)
Download
Erase
Blank Check
Program & Verify
Read & Compare
Copy
Set Environment
Help
Check SUM
Version Info
USB DIRECT Programmer
CYPRESS

Target MCU: MB9BF568M/N/R

Hex File: MyFile.srec

COM (1-256): 22

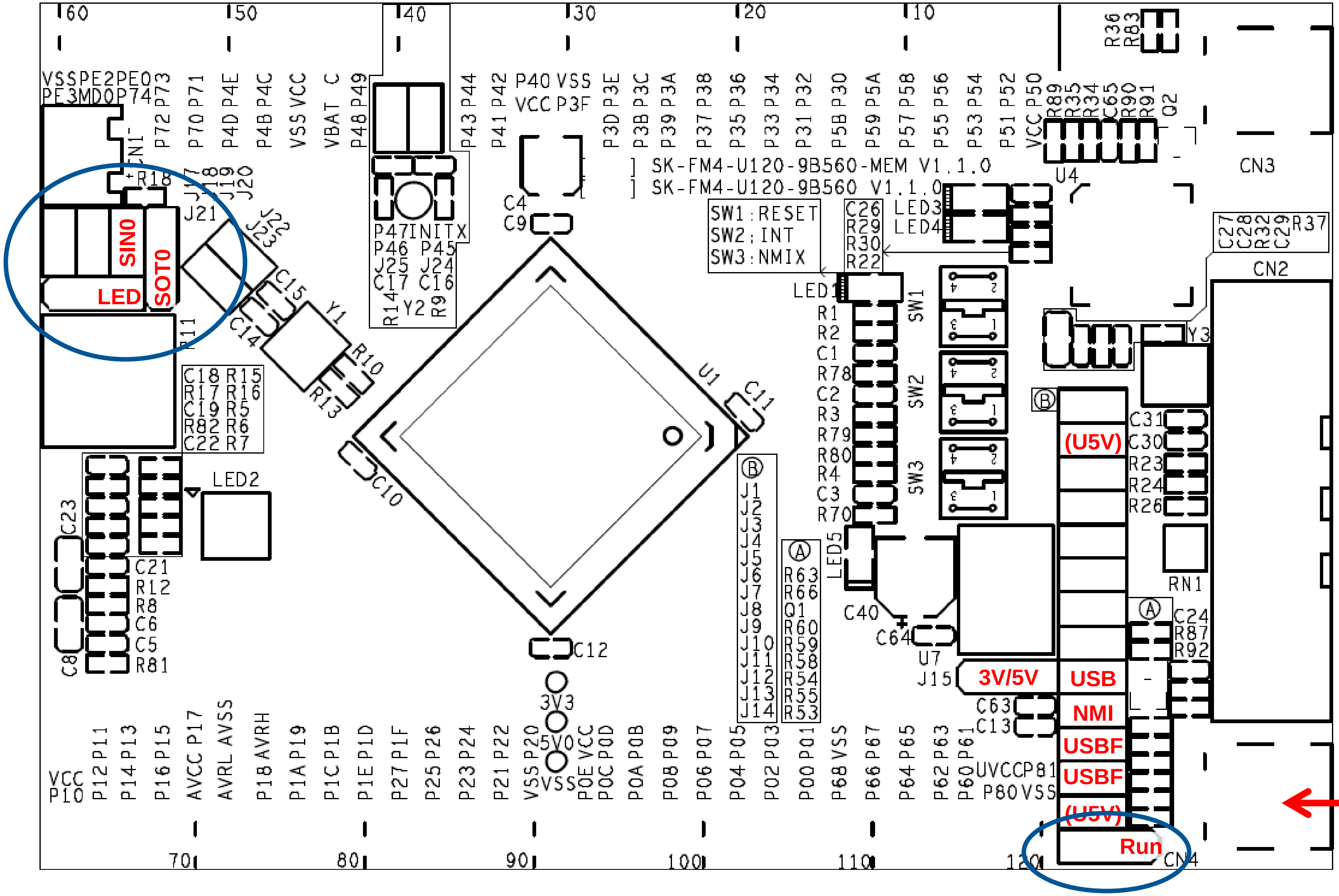
FLASH INFORMATION

Start Addr	End Addr	Size
00000000H	000FFFFFH	00100000H
00400000H	00400001H	00000002H
200C0000H	200C7FFFH	00008000H

- 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


SIN0
SOT0
LED
(U5V)
3V/5V
USB
NMI
USBF
USBF
(U5V)
Run
J15
CN4
CN3
CN2
SK-FM4-U120-9B560-MEM V1.1.0
SK-FM4-U120-9B560 V1.1.0
SW1:RESET
SW2:INT
SW3:NMIX
SW1
SW2
SW3
U1
U4
U7
LED1
LED2
LED3
LED4
LED5
Y1
Y2
Y3
RN1
3V3
5V0
VSS
60
50
40
30
20
10
70
80
90
100
110
120

Connect PC

Flash Programming via CN3 (Serial)

- 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)

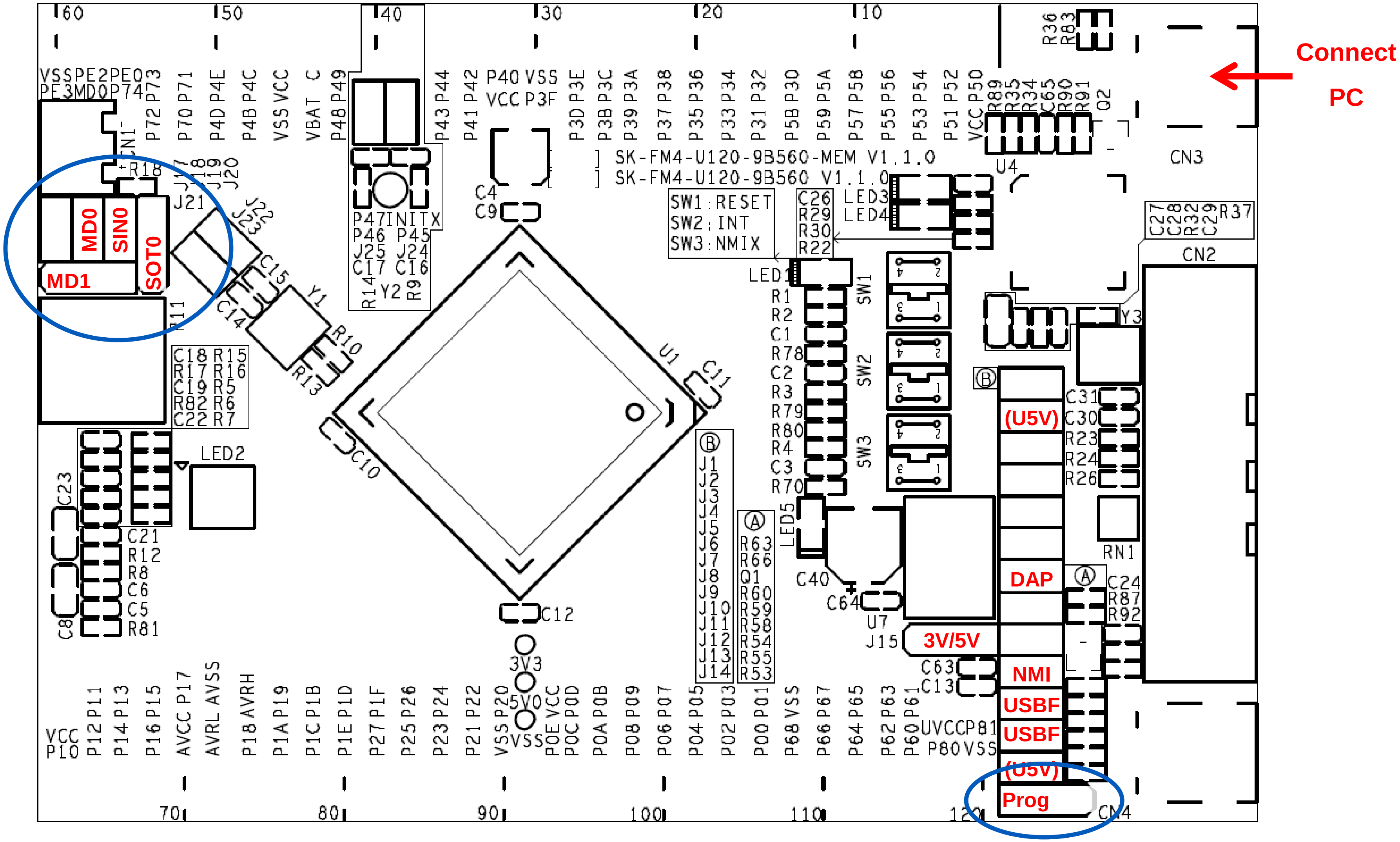
      Do not set J9 (USB Host powered)!
    - ✓ Set J20 to position 1-2 (SOT0)
    - ✓ Set J21 to position 1-2 (MD1)
    - ✓ Check jumper setting: J14:2-3 (P60)
  - Connect the board via USB CMSIS-DAP (CN3) to the USB-Port of the PC
    - ✓ When connected for first time Windows OS may ask for ‚spansionusbvcomm.inf‘

      <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)


Connect
PC
CN3
MD0
SIN0
SOT0
MD1
J21
(U5V)
DAP
3V/5V
J15
NMI
USBF
USBF
(U5V)
Prog
CN4
CN2
SK-FM4-U120-9B560-MEM V1.1.0
SK-FM4-U120-9B560 V1.1.0
SW1:RESET
SW2:INT
SW3:NMIX
U1
U4
U7

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

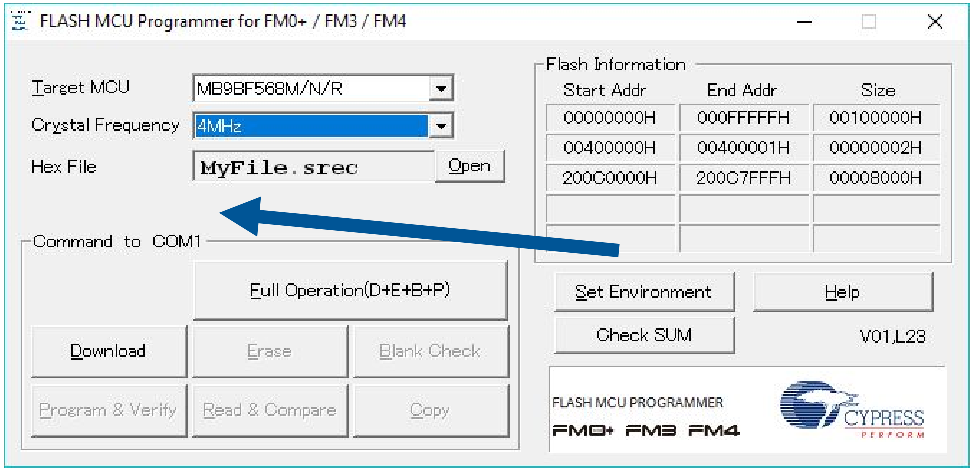
Select file (*.srec / *.hex)

Select Virtual COM-port

Execute ‚Full Operation‘

incl. stand-alone operations

- **Download**
- **Erase**
- **Blank Check**
- **Program&Verify**



FLASH MCU Programmer for FM0+ / FM3 / FM4

Target MCU: MB9BF568M/N/R

Crystal Frequency: 4MHz

Hex File: MyFile.srec

Command to COM1

Flash Information

Start Addr	End Addr	Size
00000000H	000FFFFFH	00100000H
00400000H	00400001H	00000002H
200C0000H	200C7FFFH	00008000H

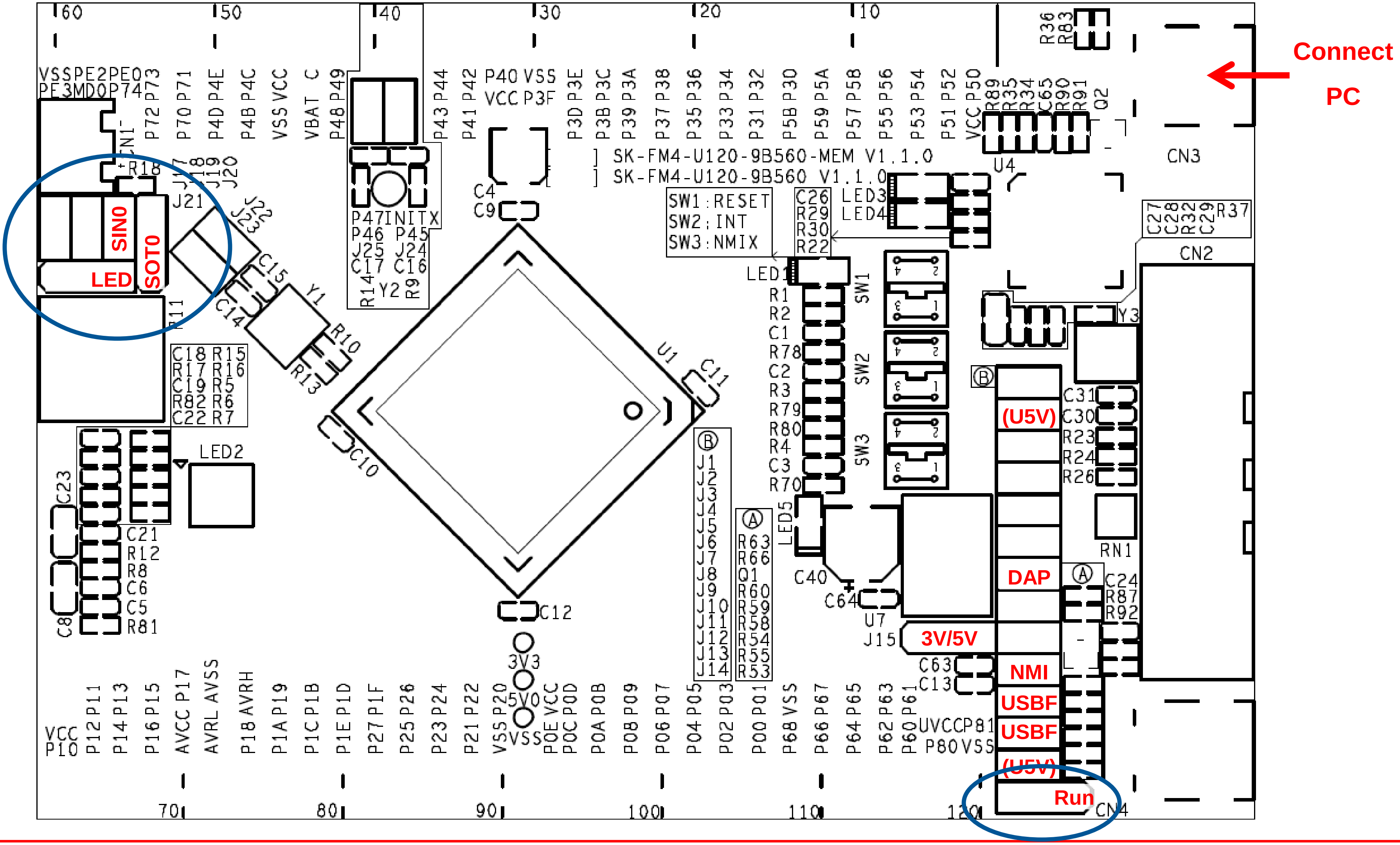
V01.L23

Open
Full Operation(D+E+B+P)
Download
Erase
Blank Check
Program & Verify
Read & Compare
Copy
Set Environment
Help
Check SUM
FLASH MCU PROGRAMMER
FM0+ FM3 FM4
CYPRESS

- Reset jumpers and return to Run-mode jumper setting

Flash Programming via CN3 (Serial)

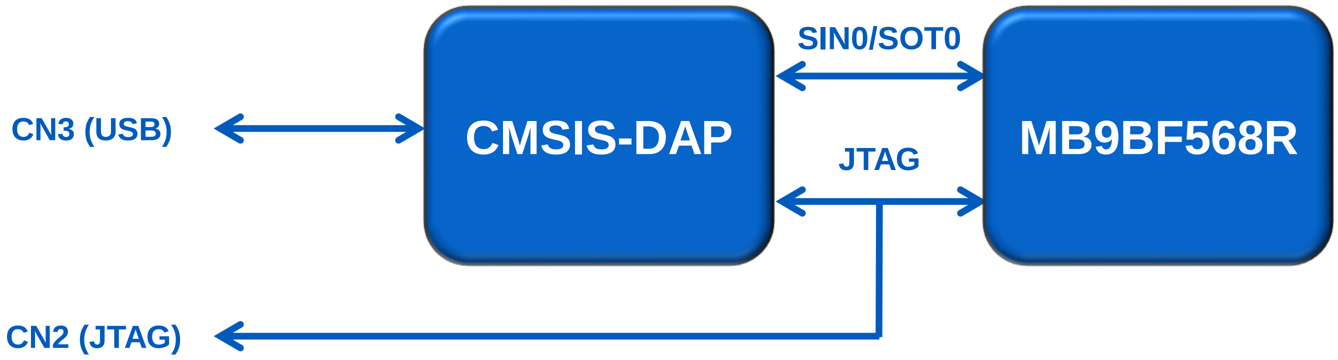
Jumper setting RUN-mode using CMSIS-DAP (serial communication)


Connect
PC
CN3
SIN0
SOT0
LED
J21
SK-FM4-U120-9B560-MEM V1.1.0
SK-FM4-U120-9B560 V1.1.0
SW1 : RESET
SW2 : INT
SW3 : NMIX
CN2
U1
U4
U7
(U5V)
DAP
3V/5V
J15
NMI
USBF
USBF
(U5V)
Run
CN4

JTAG Debugger

JTAG Adapter CMSIS-DAP

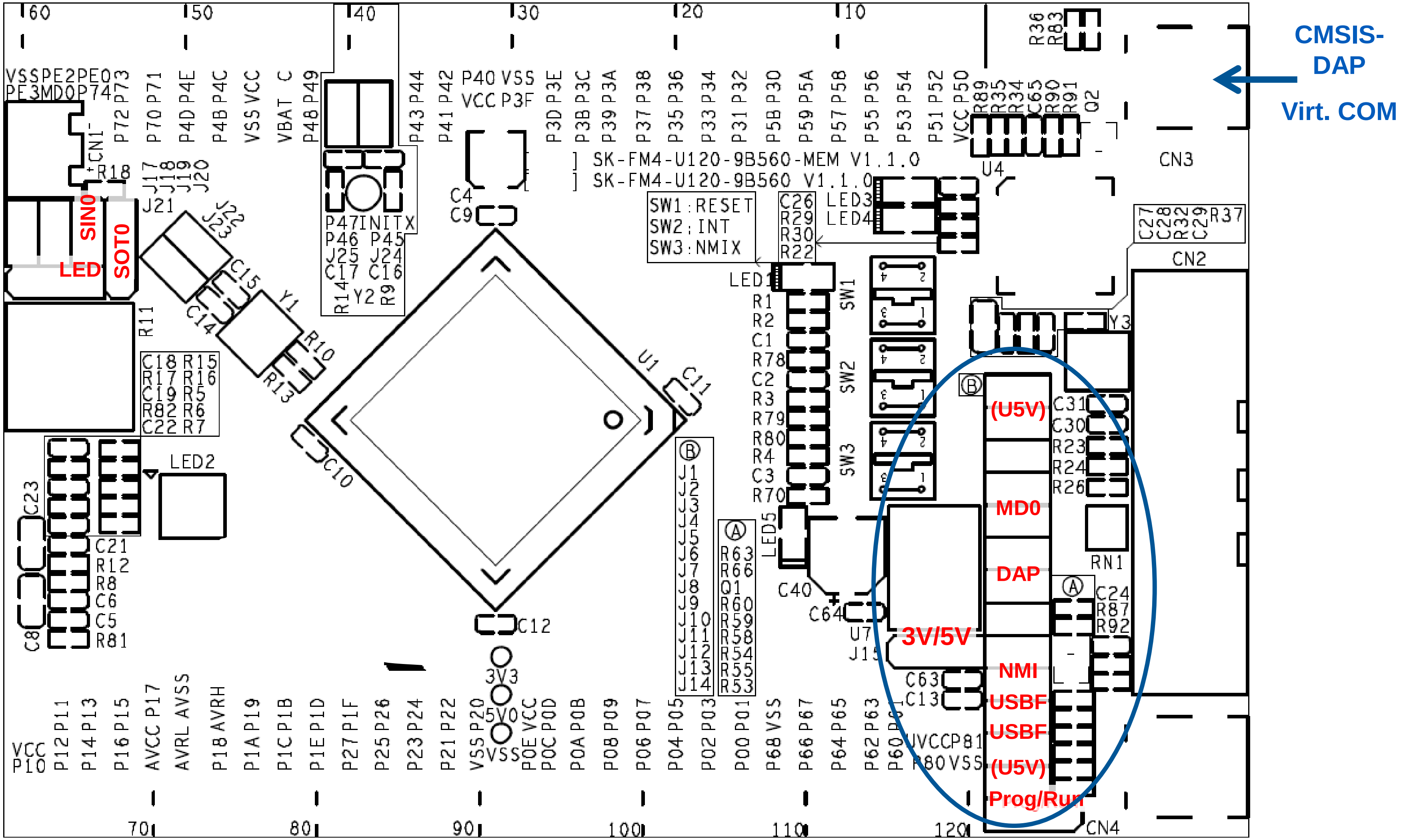
- This starter kit includes an onboard JTAG adapter
  - Compatible to CMSIS-DAP http://www.keil.com/support/man/docs/dapdebug/dapdebug_introduction.htm
  - Please update the onboard CMSIS-DAP with latest firmware
  - Select debugger CMSIS-DAP in your tool chain
- Any other JTAG-adapter can be connected 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-spansion-cypress-fm-link
  - ✓ Please set jumper J19 and J20 accordingly



CMSIS-DAP Firmware Update

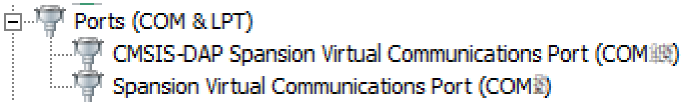
Please see instructions coming with Firmware update package!

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

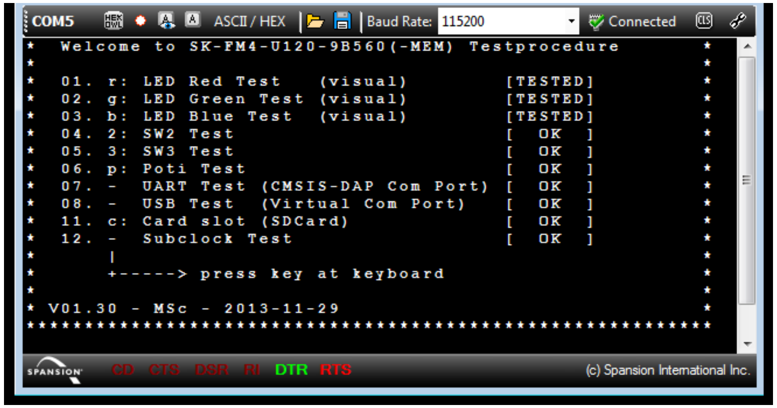

CMSIS-DAP
Virt. COM
SIN0
SOT0
LED
(U5V)
MD0
DAP
3V/5V
NMI
USBF
USBF
(U5V)
Prog/Run
SK-FM4-U120-9B560-MEM V1.1.0
SK-FM4-U120-9B560 V1.1.0
SW1:RESET
SW2:INT
SW3:NMIX
CN1
CN2
CN3
CN4
U1
U4
U7
LED1
LED2
LED3
LED4
LED5
SW1
SW2
SW3
Y1
Y2
Y3
3V3
5V0
60
50
40
30
20
10
70
80
90
100
110
120

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-spansion-cypress-fm-link](http://www.cypress.com/documentation/software-and-drivers/cmsis-dap-spansion-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



Ports (COM & LPT)
CMSIS-DAP Spansion Virtual Communications Port (COM[redacted])
Spansion Virtual Communications Port (COM[redacted])



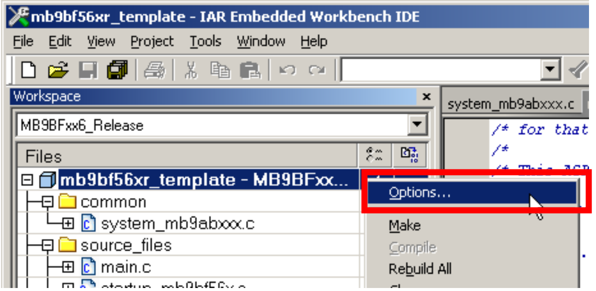
```
*  Welcome to SK-FM4-U120-9B560(-MEM) Testprocedure                 *
*                                                                   *
*  01. r: LED Red Test   (visual)                [TESTED]           *
*  02. g: LED Green Test (visual)                [TESTED]           *
*  03. b: LED Blue 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                                         *
*********************************************************************
```

JTAG Adapter CMSIS-DAP – Using IAR

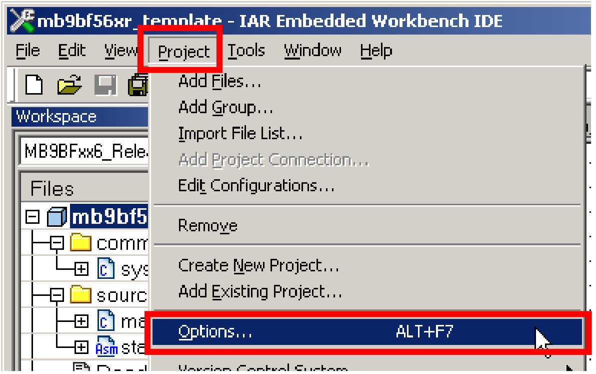
Setup in IAR EWARM (1)

Navigate to project options:

- Via Files-List
  - Right-click at the project
  - Select [Options...]


mb9bf56xr_template - IAR Embedded Workbench IDE
File Edit View Project Tools Window Help
Workspace
MB9BFxx6_Release
Files
mb9bf56xr_template - MB9BFxx...
common
system_mb9abxxx.c
source_files
main.c
system_mb9abxxx.c
Options...
Make
Compile
Rebuild All

- Or via menu tab [Project]
  - Select [Options...]


mb9bf56xr_template - IAR Embedded Workbench IDE
File Edit View Project Tools Window Help
Workspace
MB9BFxx6_Rele
Files
mb9bf5
comm
sys
sourc
ma
sta
Add Files...
Add Group...
Import File List...
Add Project Connection...
Edit Configurations...
Remove
Create New Project...
Add Existing Project...
Options... ALT+F7
Version Control System

JTAG Adapter CMSIS-DAP – Using IAR

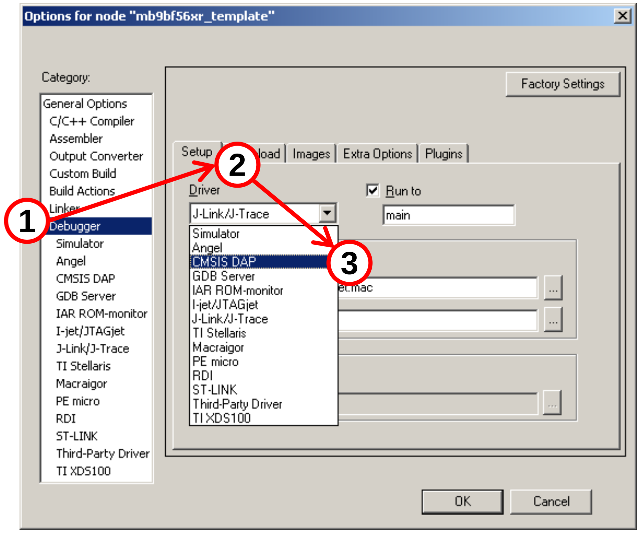
Setup in IAR EWARM (2)

Setup Project Debbuger Options

(1) Navigate to [Debugger]

(2) Select tab [Setup]

(3) Select driver [CMSIS-DAP]



Options for node "mb9bf56xr_template"

Driver: J-Link/J-Trace

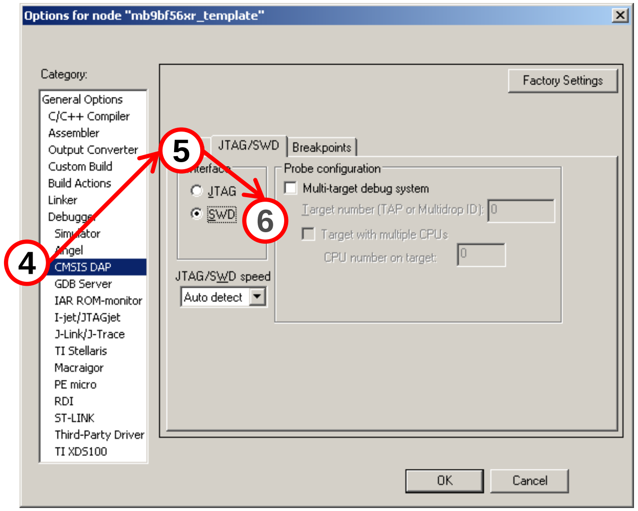
☑ Run to: main

Category:
General Options
C/C++ Compiler
Assembler
Output Converter
Custom Build
Build Actions
Linker
Debugger
Simulator
Angel
CMSIS DAP
GDB Server
IAR ROM-monitor
I-jet/JTAGjet
J-Link/J-Trace
TI Stellaris
Macraigor
PE micro
RDI
ST-LINK
Third-Party Driver
TI XDS100
Factory Settings
Setup
load
Images
Extra Options
Plugins
Simulator
Angel
CMSIS DAP
GDB Server
IAR ROM-monitor
I-jet/JTAGjet
J-Link/J-Trace
TI Stellaris
Macraigor
PE micro
RDI
ST-LINK
Third-Party Driver
TI XDS100
et.mac
OK
Cancel
1
2
3

(4) Select in [CMSIS-DAP]

(5) Select tab [JTAG/SWD]

(6) Select [SWD]



Options for node "mb9bf56xr_template"

Interface: ○ JTAG ● SWD

Probe configuration

☐ Multi-target debug system

Target number (TAP or Multidrop ID): 0

☐ Target with multiple CPUs

CPU number on target: 0

JTAG/SWD speed: Auto detect

Category:
General Options
C/C++ Compiler
Assembler
Output Converter
Custom Build
Build Actions
Linker
Debugger
Simulator
Angel
CMSIS DAP
GDB Server
IAR ROM-monitor
I-jet/JTAGjet
J-Link/J-Trace
TI Stellaris
Macraigor
PE micro
RDI
ST-LINK
Third-Party Driver
TI XDS100
Factory Settings
JTAG/SWD
Breakpoints
OK
Cancel
4
5
6

JTAG Adapter CMSIS-DAP – Using Keil

Setup in Keil µVision (1)

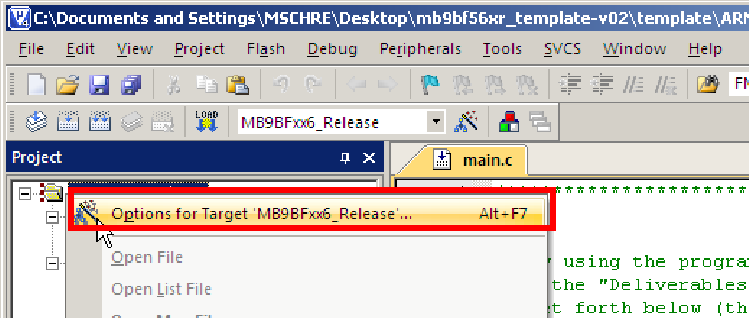
Navigate to project options:

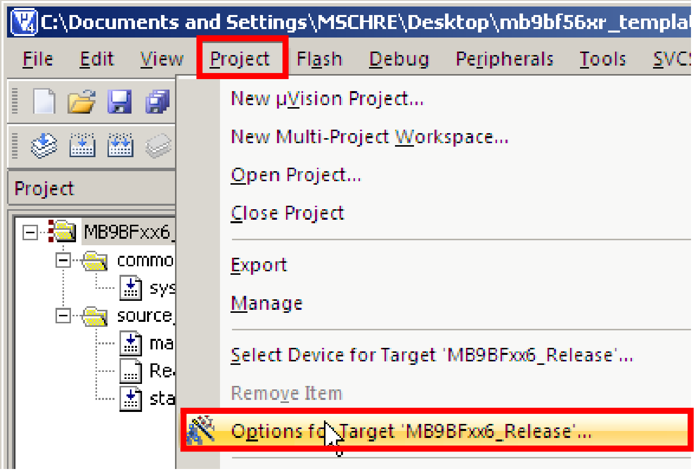
Via Project

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

Or via menu tab [Project]

- Select [Options...]


C:\Documents and Settings\MSCHRE\Desktop\mb9bf56xr_template-v02\template\ARM
File Edit View Project Flash Debug Peripherals Tools SVCS Window Help
MB9BFxx6_Release
Project
main.c
Options for Target 'MB9BFxx6_Release'... Alt+F7
Open File
Open List File
using the progra
the "Deliverables
t forth below (th


C:\Documents and Settings\MSCHRE\Desktop\mb9bf56xr_templat
File Edit View Project Flash Debug Peripherals Tools SVC
Project
MB9BFxx6_
commo
sys
source
ma
Re
sta
New µVision Project...
New Multi-Project Workspace...
Open Project...
Close Project
Export
Manage
Select Device for Target 'MB9BFxx6_Release'...
Remove Item
Options for Target 'MB9BFxx6_Release'...

JTAG Adapter CMSIS-DAP – Using Keil

Setup in Keil µVision (2)

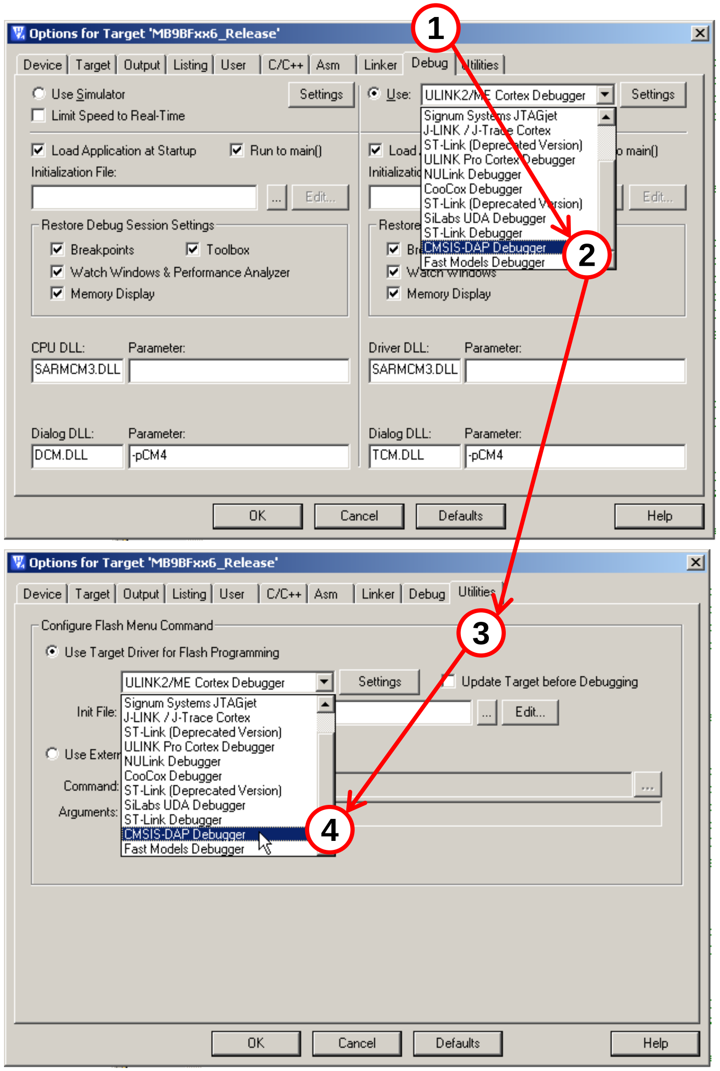
Setup Debug & Utilities

(1) Select tab [Debug]

(2) Select [CMSIS-DAP Debugger]

(3) Select tab [Utilities]

(4) Select [CMSIS-DAP Debugger]



Options for Target 'MB9BFxx6_Release'

○ Use Simulator
☐ Limit Speed to Real-Time
☑ Load Application at Startup
☑ Run to main()
Initialization File:

Restore Debug Session Settings
☑ Breakpoints
☑ Toolbox
☑ Watch Windows & Performance Analyzer
☑ Memory Display

CPU DLL: SARMCM3.DLL
Parameter:
Dialog DLL: DCM.DLL
Parameter: -pCM4

● Use: ULINK2/ME Cortex Debugger
Signum Systems JTAGjet
J-LINK / J-Trace Cortex
ST-Link (Deprecated Version)
ULINK Pro Cortex Debugger
NULink Debugger
CooCox Debugger
ST-Link (Deprecated Version)
SiLabs UDA Debugger
ST-Link Debugger
CMSIS-DAP Debugger
Fast Models Debugger

☑ Load
☑ Breakpoints
☑ Watch Windows
☑ Memory Display

Driver DLL: SARMCM3.DLL
Parameter:
Dialog DLL: TCM.DLL
Parameter: -pCM4

Options for Target 'MB9BFxx6_Release'

Configure Flash Menu Command
● Use Target Driver for Flash Programming
ULINK2/ME Cortex Debugger
Signum Systems JTAGjet
J-LINK / J-Trace Cortex
ST-Link (Deprecated Version)
ULINK Pro Cortex Debugger
NULink Debugger
CooCox Debugger
ST-Link (Deprecated Version)
SiLabs UDA Debugger
ST-Link Debugger
CMSIS-DAP Debugger
Fast Models Debugger
☐ Update Target before Debugging
Init File:
○ Use External
Command:
Arguments:

IAR Embedded Workbench

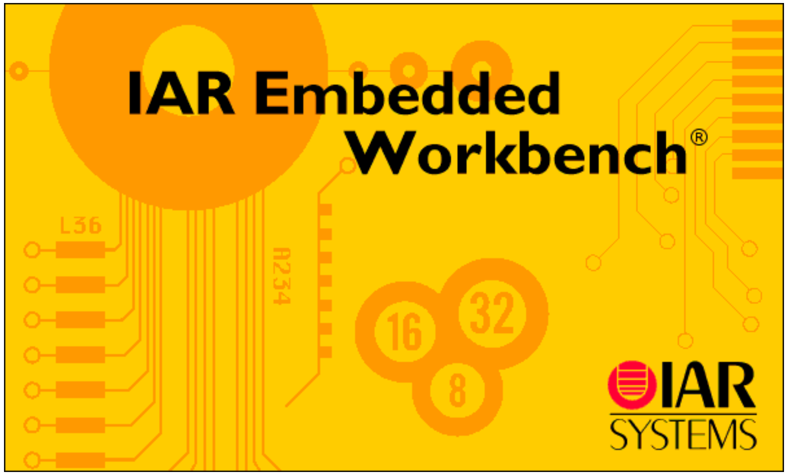
Installation

Getting Started

Open Project

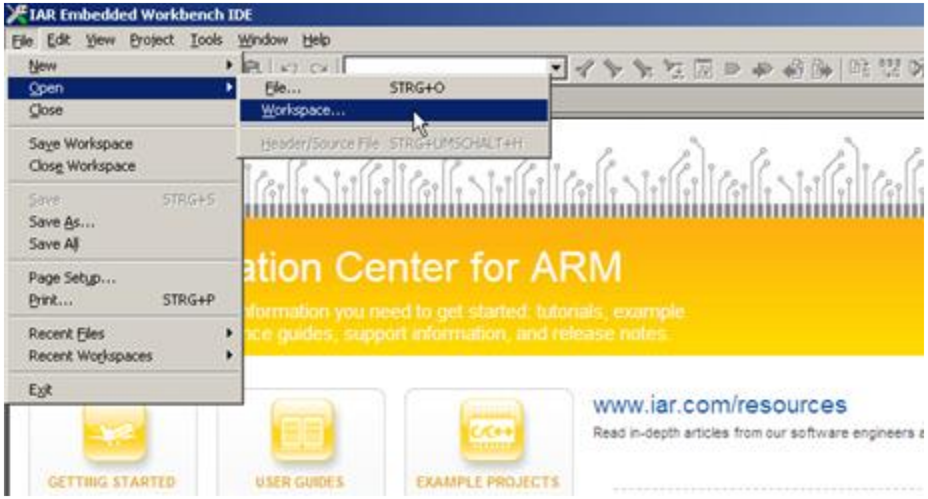
Build Project

Debug Project


IAR Embedded Workbench®
L36
A234
16
32
8
IAR SYSTEMS

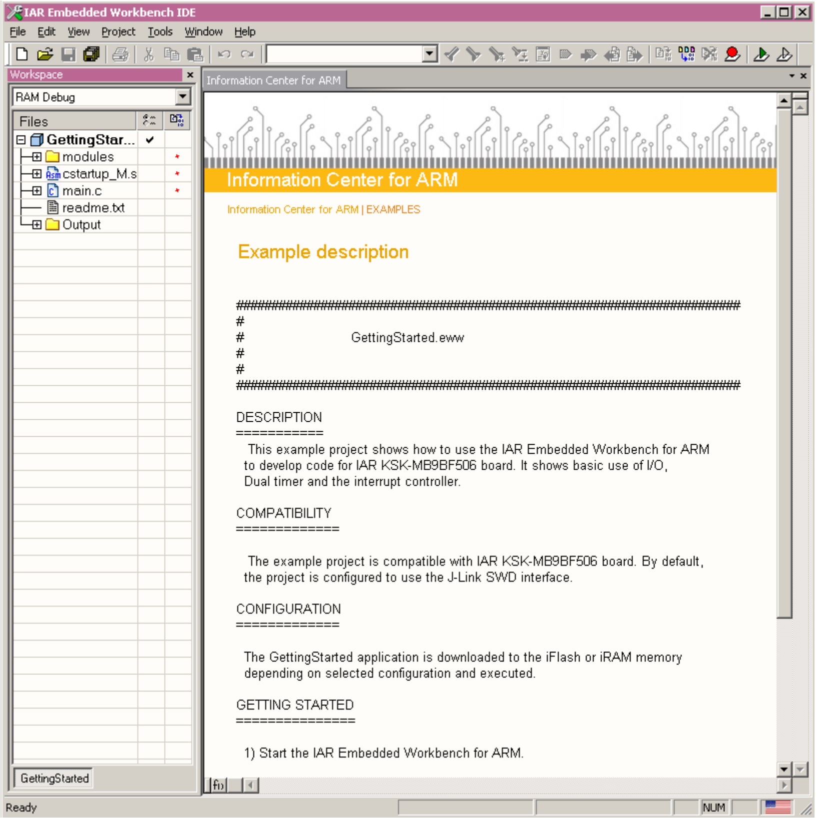
IAR Workbench Getting Started

- 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 Embedded Workbench IDE
File Edit View Project Tools Window Help
New
Open
Close
Save Workspace
Close Workspace
Save STRG+S
Save As...
Save All
Page Setup...
Print... STRG+P
Recent Files
Recent Workspaces
Exit
File... STRG+O
Workspace...
Header/Source File STRG+UMSCHALT+H
ation Center for ARM
formation you need to get started: tutorials, example
ce guides, support information, and release notes
www.iar.com/resources
Read in-depth articles from our software engineers
GETTING STARTED
USER GUIDES
EXAMPLE PROJECTS

IAR Workbench – Main Window

- 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 Embedded Workbench IDE
File
Edit
View
Project
Tools
Window
Help
Workspace
RAM Debug
Files
GettingStar...
modules
cstartup_M.s
main.c
readme.txt
Output
GettingStarted
Information Center for ARM
Ready
NUM

Information Center for ARM

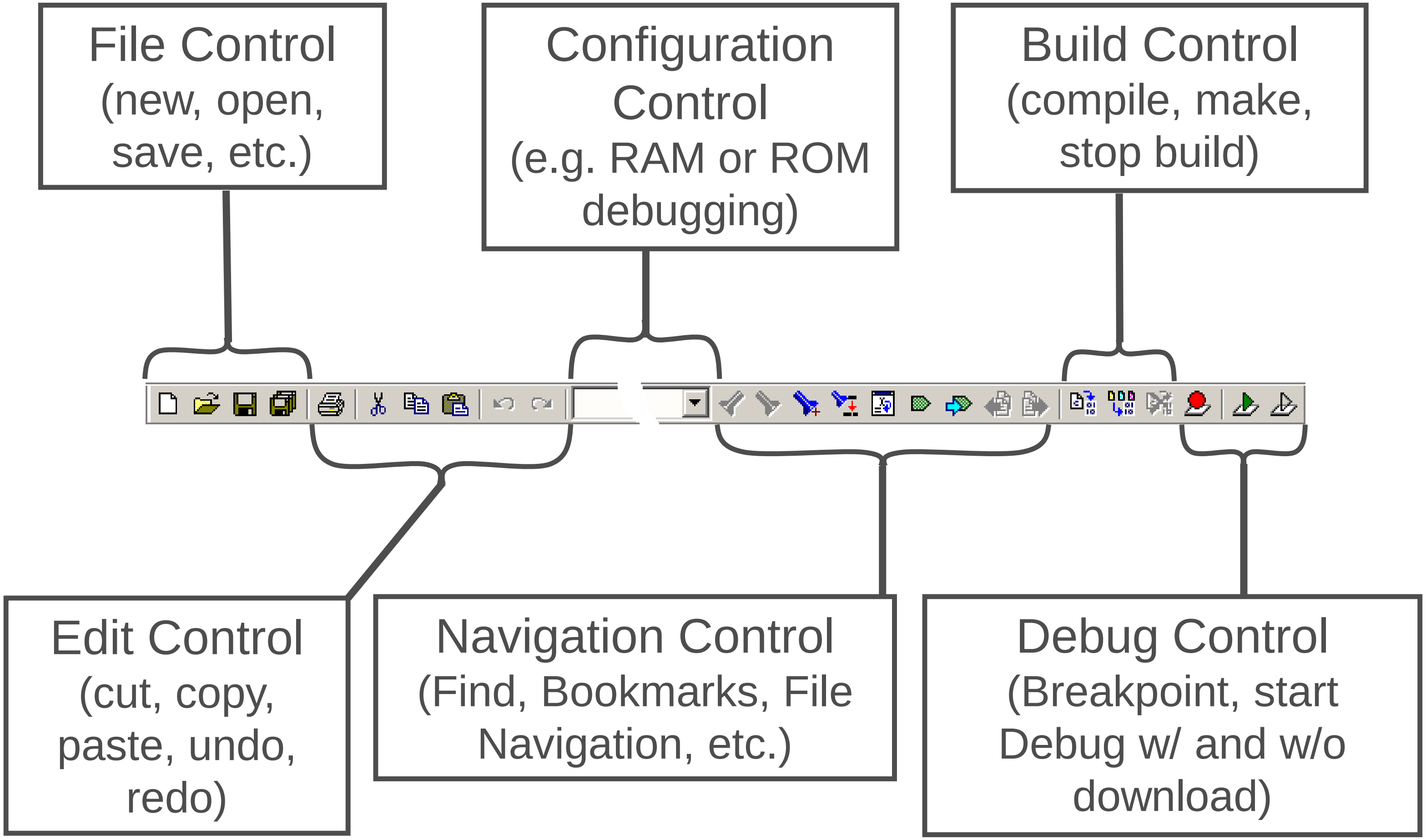
Information Center for ARM | EXAMPLES

Example description

```
#################################################################################
#
#                    GettingStarted.eww
#
#
#################################################################################

DESCRIPTION
===========
  This example project shows how to use the IAR Embedded Workbench for ARM
 to develop code for IAR KSK-MB9BF506 board. It shows basic use of I/O,
 Dual timer and the interrupt controller.

COMPATIBILITY
=============

  The example project is compatible with IAR KSK-MB9BF506 board. By default,
 the project is configured to use the J-Link SWD interface.

CONFIGURATION
=============

 The GettingStarted application is downloaded to the iFlash or iRAM memory
 depending on selected configuration and executed.

GETTING STARTED
===============

 1) Start the IAR Embedded Workbench for ARM.
```

IAR Workbench – Menu Bar

- IAR Menu Bar



File Control (new, open, save, etc.)

Configuration Control (e.g. RAM or ROM debugging)

Build Control (compile, make, stop build)

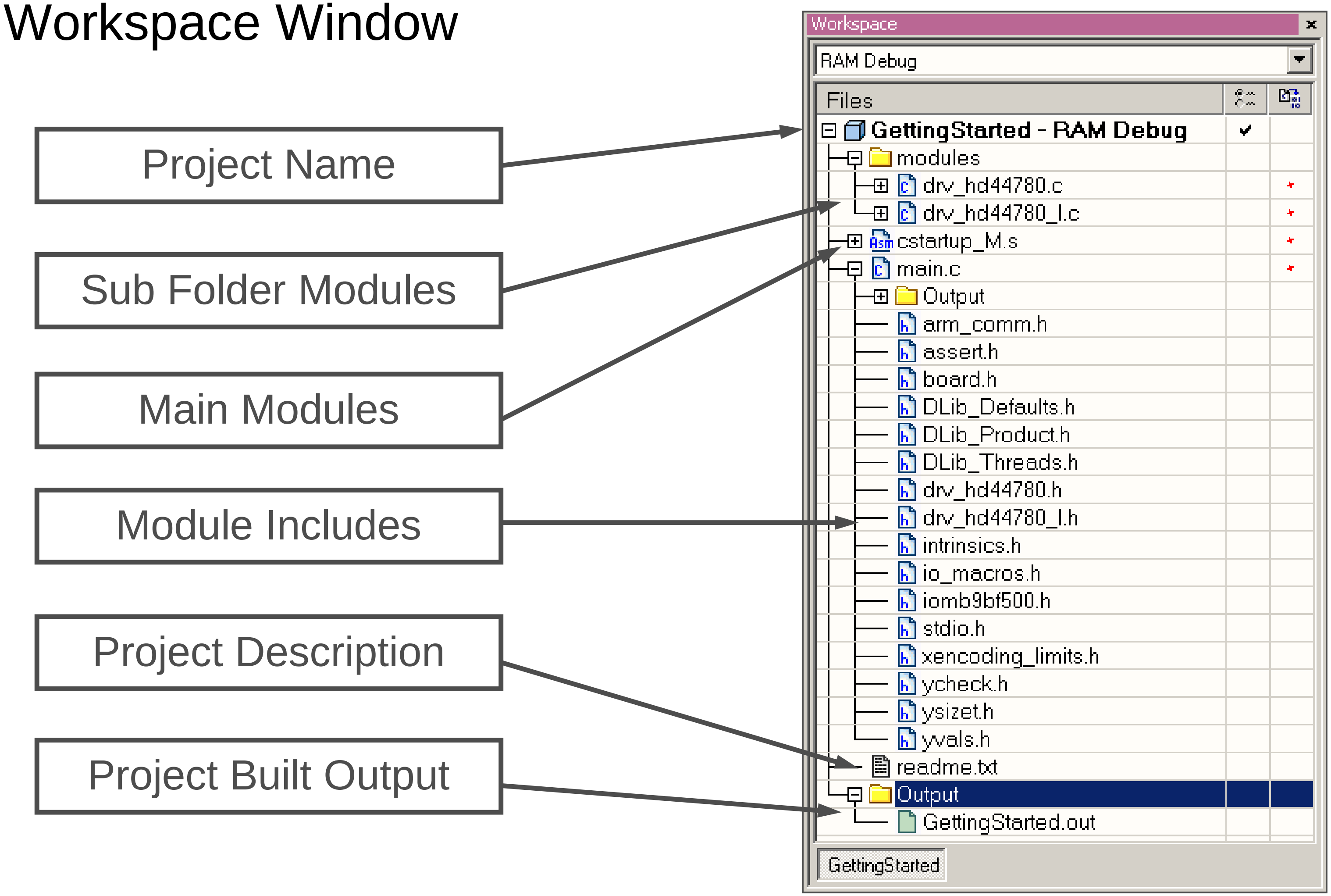
Edit Control (cut, copy, paste, undo, redo)

Navigation Control (Find, Bookmarks, File Navigation, etc.)

Debug Control (Breakpoint, start Debug w/ and w/o download)

IAR Workbench – Workspace

- IAR Workspace Window



Project Name

Sub Folder Modules

Main Modules

Module Includes

Project Description

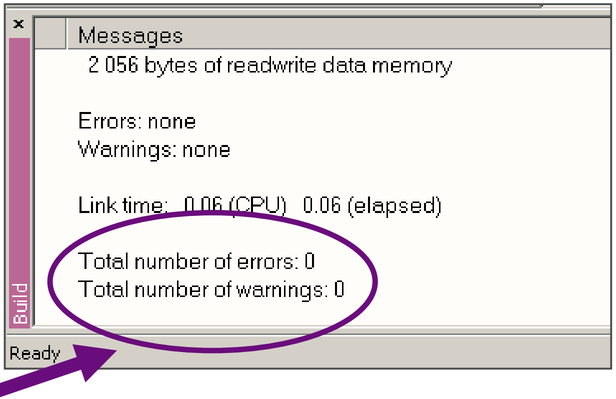
Project Built Output

RAM Debug

```
⊟ GettingStarted - RAM Debug                ✔
  ├⊟ modules
  │  ├⊞ drv_hd44780.c                            *
  │  └⊞ drv_hd44780_l.c                          *
  ├⊞ cstartup_M.s                                *
  ├⊟ main.c                                      *
  │  ├⊞ Output
  │  ├── arm_comm.h
  │  ├── assert.h
  │  ├── board.h
  │  ├── DLib_Defaults.h
  │  ├── DLib_Product.h
  │  ├── DLib_Threads.h
  │  ├── drv_hd44780.h
  │  ├── drv_hd44780_l.h
  │  ├── intrinsics.h
  │  ├── io_macros.h
  │  ├── iomb9bf500.h
  │  ├── stdio.h
  │  ├── xencoding_limits.h
  │  ├── ycheck.h
  │  ├── ysizet.h
  │  └── yvals.h
  ├── readme.txt
  └⊟ Output
     └── GettingStarted.out
```

IAR Workbench – Making Project

- 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



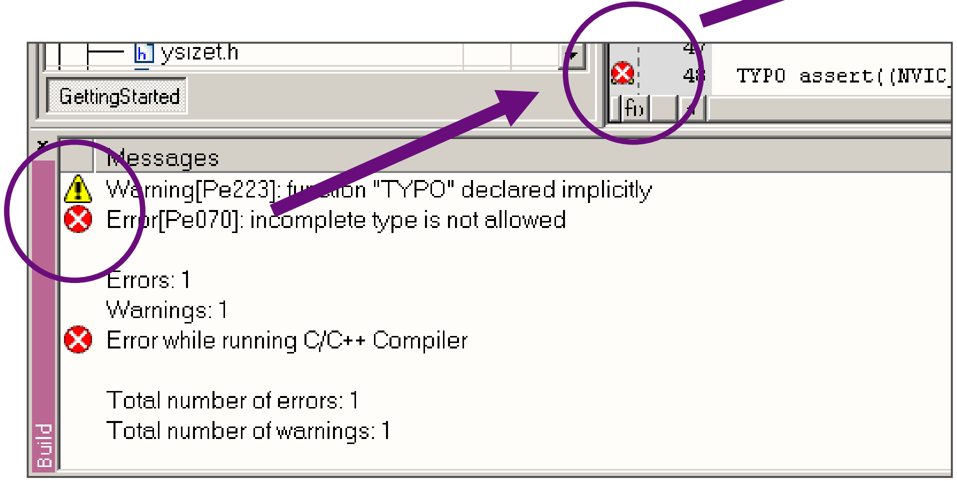
Messages

2 056 bytes of readwrite data memory

Errors: none
Warnings: none

Link time: 0.06 (CPU) 0.06 (elapsed)

Total number of errors: 0
Total number of warnings: 0



```
48 TYPO assert((NVIC_
```

Messages

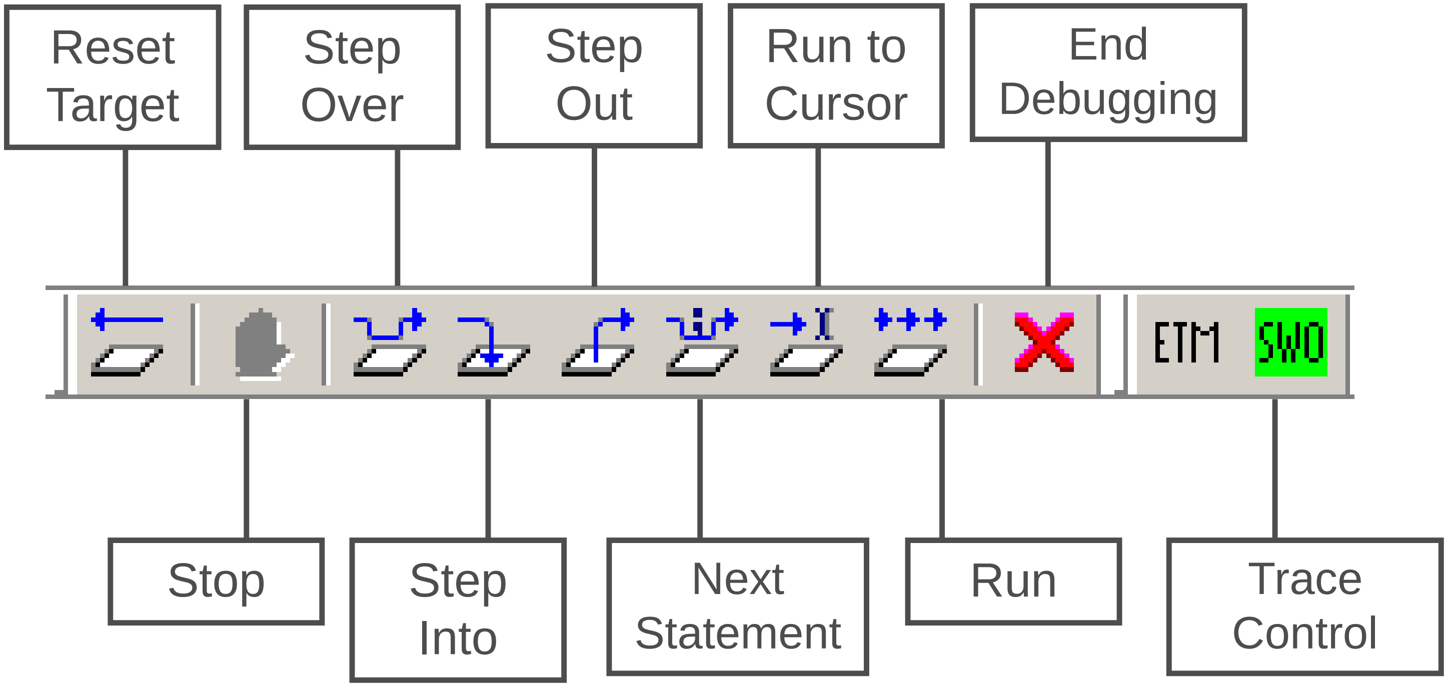
⚠ Warning[Pe223]: function "TYPO" declared implicitly
❌ Error[Pe070]: incomplete type is not allowed

Errors: 1
Warnings: 1
❌ Error while running C/C++ Compiler

Total number of errors: 1
Total number of warnings: 1

IAR Workbench – Download to Target

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


Reset Target

Step Over

Step Out

Run to Cursor

End Debugging

Stop

Step Into

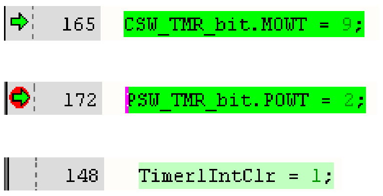
Next Statement

Run

Trace Control

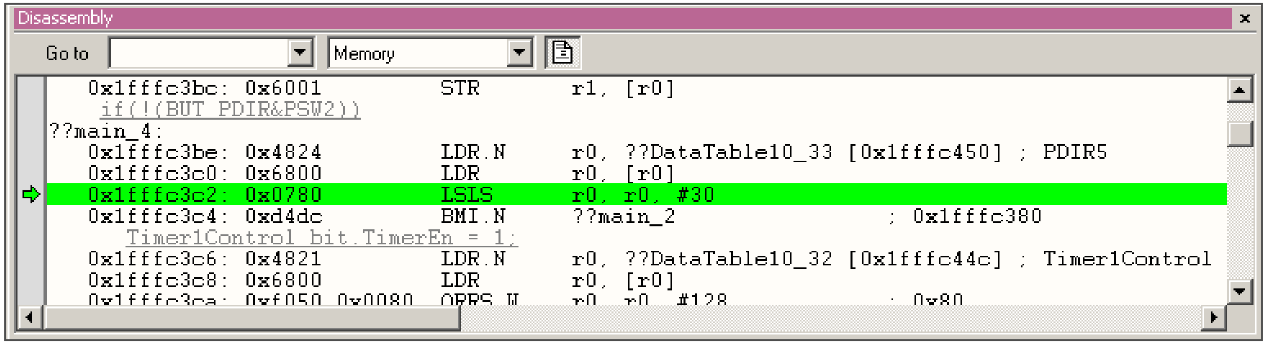
IAR Workbench – Debug (1)

- 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 = 9;
172   PSW_TMR_bit.POWT = 2;
148   Timer1IntClr = 1;
```

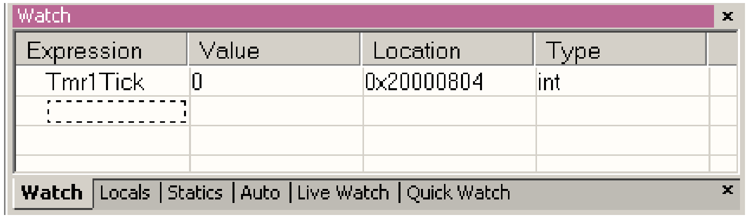
- Disassembly Window
  - Shows ‘pure‘ disassebly view
  - Shows mixed mode view



```
    0x1fffc3bc: 0x6001         STR       r1, [r0]
     if(!(BUT_PDIR&PSW2))
??main_4:
    0x1fffc3be: 0x4824         LDR.N     r0, ??DataTable10_33 [0x1fffc450] ; PDIR5
    0x1fffc3c0: 0x6800         LDR       r0, [r0]
    0x1fffc3c2: 0x0780         LSLS      r0, r0, #30
    0x1fffc3c4: 0xd4dc         BMI.N     ??main_2                         ; 0x1fffc380
       Timer1Control_bit.TimerEn = 1;
    0x1fffc3c6: 0x4821         LDR.N     r0, ??DataTable10_32 [0x1fffc44c] ; Timer1Control
    0x1fffc3c8: 0x6800         LDR       r0, [r0]
    0x1fffc3ca: 0xf050 0x0080  ORRS.W    r0, r0, #128                     ; 0x80
```

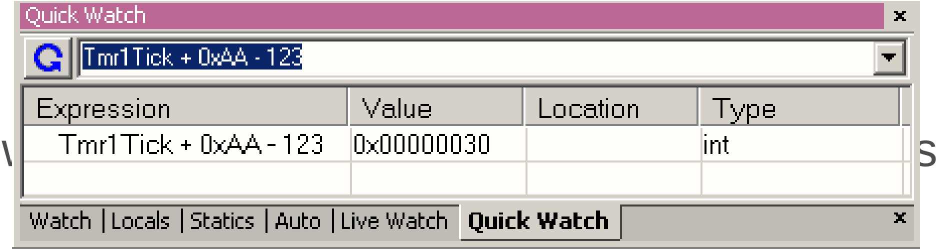
IAR Workbench – Debug (2)

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


Watch
Watch | Locals | Statics | Auto | Live Watch | Quick Watch

Expression	Value	Location	Type
Tmr1Tick	0	0x20000804	int

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

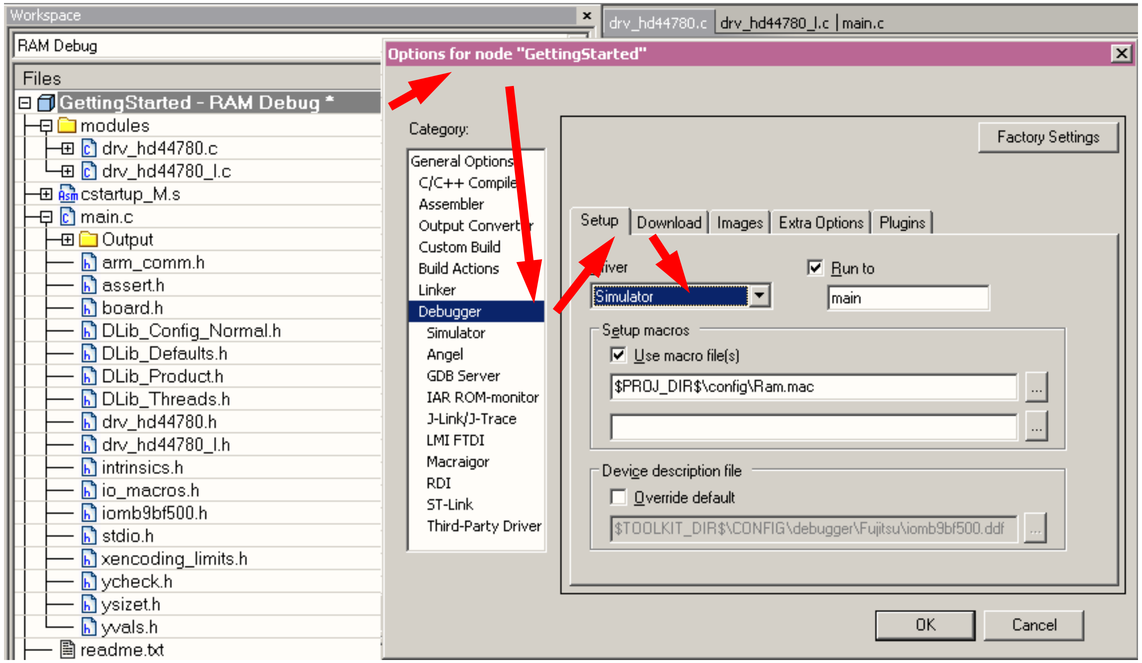

Quick Watch
Watch | Locals | Statics | Auto | Live Watch | Quick Watch

Tmr1Tick + 0xAA - 123

Expression	Value	Location	Type
Tmr1Tick + 0xAA - 123	0x00000030		int

IAR Workbench – Simulator

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


Workspace
drv_hd44780.c
drv_hd44780_l.c
main.c
RAM Debug
Files
GettingStarted - RAM Debug *
modules
drv_hd44780.c
drv_hd44780_l.c
cstartup_M.s
main.c
Output
arm_comm.h
assert.h
board.h
DLib_Config_Normal.h
DLib_Defaults.h
DLib_Product.h
DLib_Threads.h
drv_hd44780.h
drv_hd44780_l.h
intrinsics.h
io_macros.h
iomb9bf500.h
stdio.h
xencoding_limits.h
ycheck.h
ysizet.h
yvals.h
readme.txt
Options for node "GettingStarted"
Category:
General Options
C/C++ Compiler
Assembler
Output Converter
Custom Build
Build Actions
Linker
Debugger
Simulator
Angel
GDB Server
IAR ROM-monitor
J-Link/J-Trace
LMI FTDI
Macraigor
RDI
ST-Link
Third-Party Driver
Factory Settings
Setup
Download
Images
Extra Options
Plugins
OK
Cancel

Driver: Simulator

☑ Run to: main

Setup macros

☑ Use macro file(s): $PROJ_DIR$\config\Ram.mac

Device description file

☐ Override default: $TOOLKIT_DIR$\CONFIG\debugger\Fujitsu\iomb9bf500.ddf

KEIL µVision

Installation

Getting Started

Open Project

Build Project

Debug Project

KEIL™
Tools by ARM
µVision®4
Integrated Development Environment

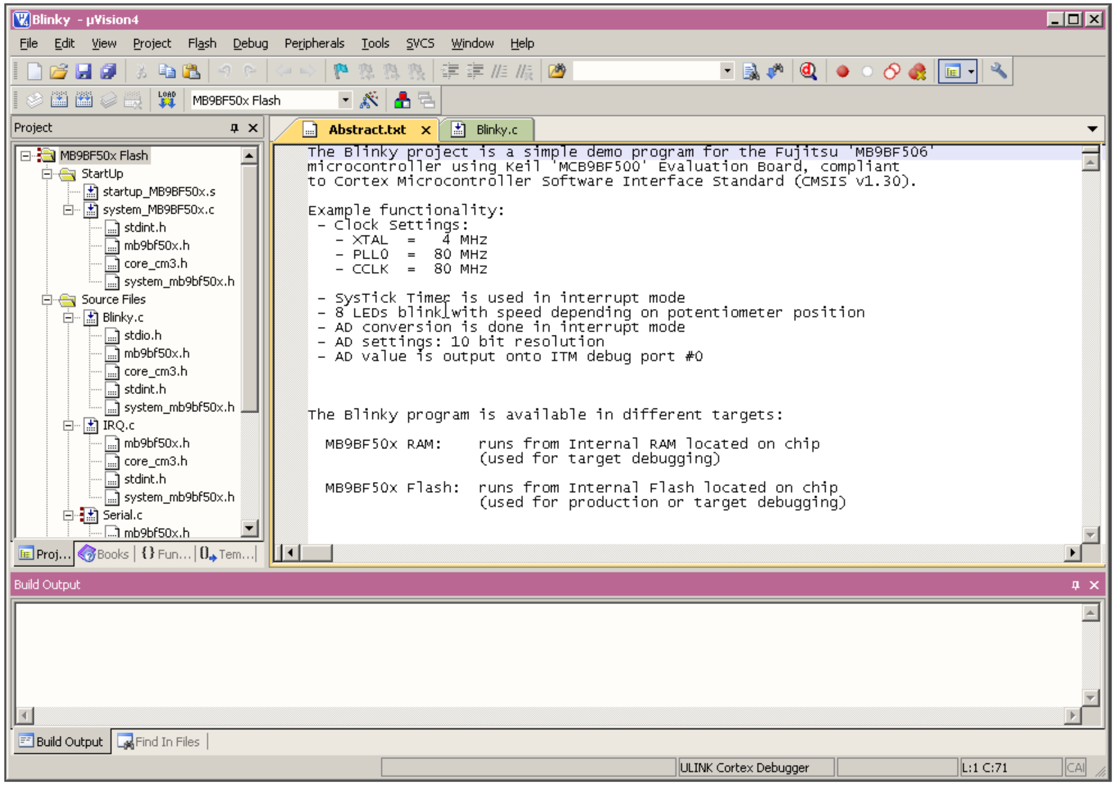
Copyright © 1997 - 2005 Keil Software, 2005 - 2009 ARM Ltd. All rights reserved.
This product is protected by US and international laws.

KEIL µVision IDE and Debugger
Getting Started

- Install µVision 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 µVision

KEIL µVision – Getting Started

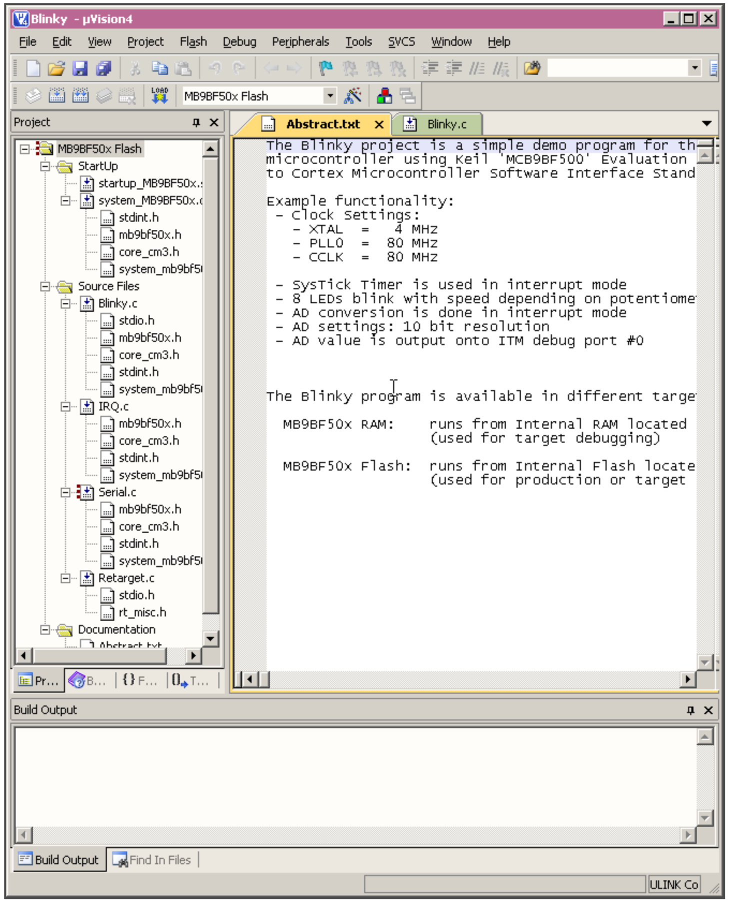
- Choose Menu: Project→Open Project...
  - Browse to: <drive:>\sw-examples\mb9bf56xr_gpio-v11\example\ARM\
  - Choose mb9bf56xr_gpio.uvproj


Blinky - µVision4
File Edit View Project Flash Debug Peripherals Tools SVCS Window Help
MB9BF50x Flash
Project
MB9BF50x Flash
StartUp
startup_MB9BF50x.s
system_MB9BF50x.c
stdint.h
mb9bf50x.h
core_cm3.h
system_mb9bf50x.h
Source Files
Blinky.c
stdio.h
mb9bf50x.h
core_cm3.h
stdint.h
system_mb9bf50x.h
IRQ.c
mb9bf50x.h
core_cm3.h
stdint.h
system_mb9bf50x.h
Serial.c
mb9bf50x.h
Proj... Books {} Fun... 0→ Tem...
Abstract.txt
Blinky.c
Build Output
Build Output Find In Files
ULINK Cortex Debugger
L:1 C:71
CAP

```
The Blinky project is a simple demo program for the Fujitsu 'MB9BF506'
microcontroller using Keil 'MCB9BF500' Evaluation Board, compliant
to Cortex Microcontroller Software Interface Standard (CMSIS v1.30).

Example functionality:
 - Clock Settings:
   - XTAL   =    4 MHz
   - PLL0   =   80 MHz
   - CCLK   =   80 MHz

 - SysTick Timer is used in interrupt mode
 - 8 LEDs blink with speed depending on potentiometer position
 - AD conversion is done in interrupt mode
 - AD settings: 10 bit resolution
 - AD value is output onto ITM debug port #0


The Blinky program is available in different targets:

  MB9BF50x RAM:    runs from Internal RAM located on chip
                   (used for target debugging)

  MB9BF50x Flash:  runs from Internal Flash located on chip
                   (used for production or target debugging)
```

KEIL µVision – Main Window

- KEIL µVision
  - 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



Blinky - µVision4
File Edit View Project Flash Debug Peripherals Tools SVCS Window Help
MB9BF50x Flash
Project
MB9BF50x Flash
StartUp
startup_MB9BF50x.s
system_MB9BF50x.c
stdint.h
mb9bf50x.h
core_cm3.h
system_mb9bf5
Source Files
Blinky.c
stdio.h
mb9bf50x.h
core_cm3.h
stdint.h
system_mb9bf5
IRQ.c
mb9bf50x.h
core_cm3.h
stdint.h
system_mb9bf5
Serial.c
mb9bf50x.h
core_cm3.h
stdint.h
system_mb9bf5
Retarget.c
stdio.h
rt_misc.h
Documentation
Abstract.txt
Pr... B... {} F... 0→ T...
Abstract.txt
Blinky.c
Build Output
Build Output
Find In Files
ULINK Co

```
The Blinky project is a simple demo program for th
microcontroller using Keil 'MCB9BF500' Evaluation
to Cortex Microcontroller Software Interface Stand

Example functionality:
 - Clock Settings:
   - XTAL   =   4 MHz
   - PLL0   =  80 MHz
   - CCLK   =  80 MHz

 - SysTick Timer is used in interrupt mode
 - 8 LEDs blink with speed depending on potentiome
 - AD conversion is done in interrupt mode
 - AD settings: 10 bit resolution
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  MB9BF50x RAM:    runs from Internal RAM located
                   (used for target debugging)

  MB9BF50x Flash:  runs from Internal Flash locate
                   (used for production or target
```
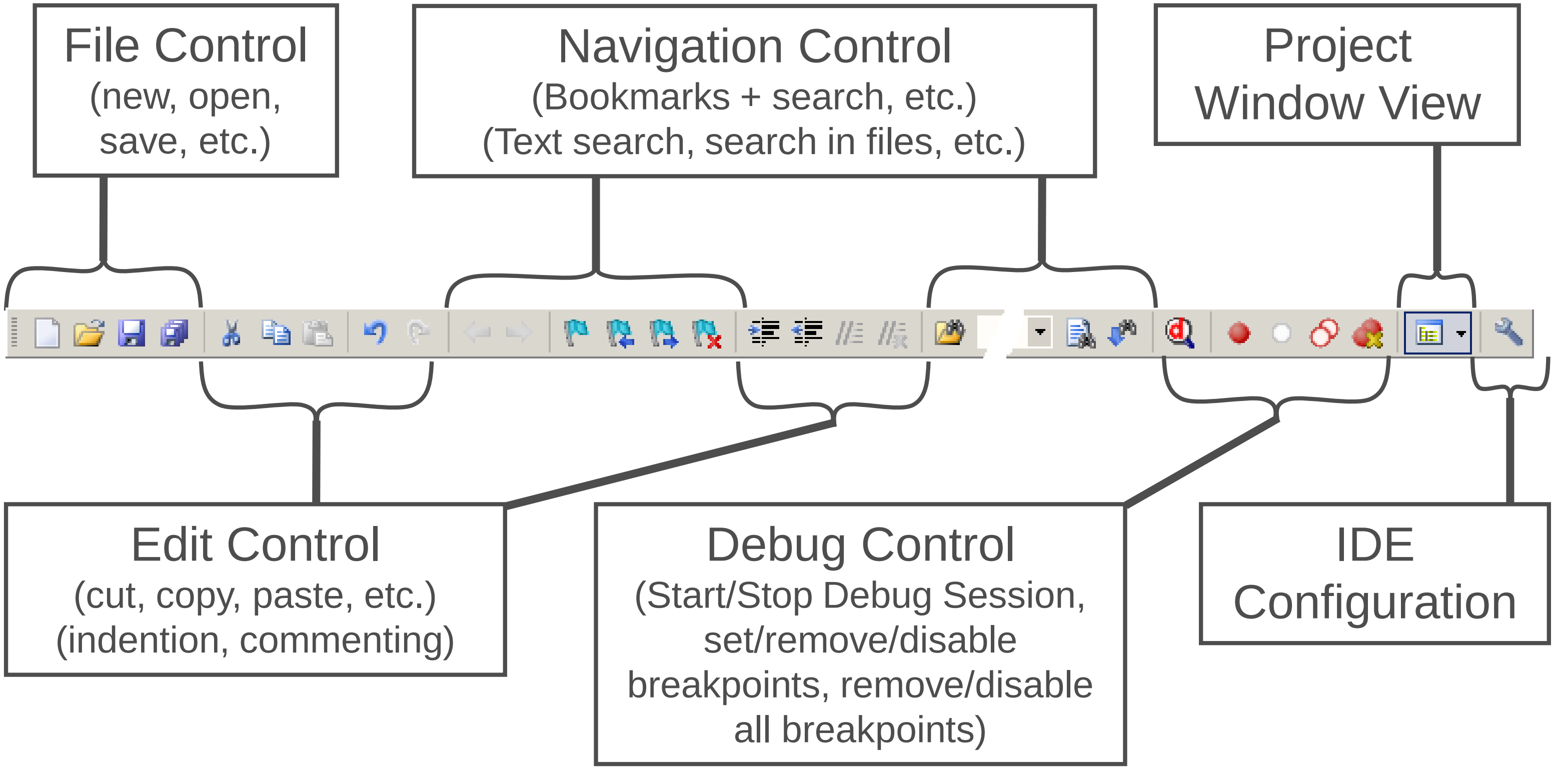

KEIL µVision – Menu Bars (1)

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



File Control
(new, open, save, etc.)

Navigation Control
(Bookmarks + search, etc.)
(Text search, search in files, etc.)

Project Window View

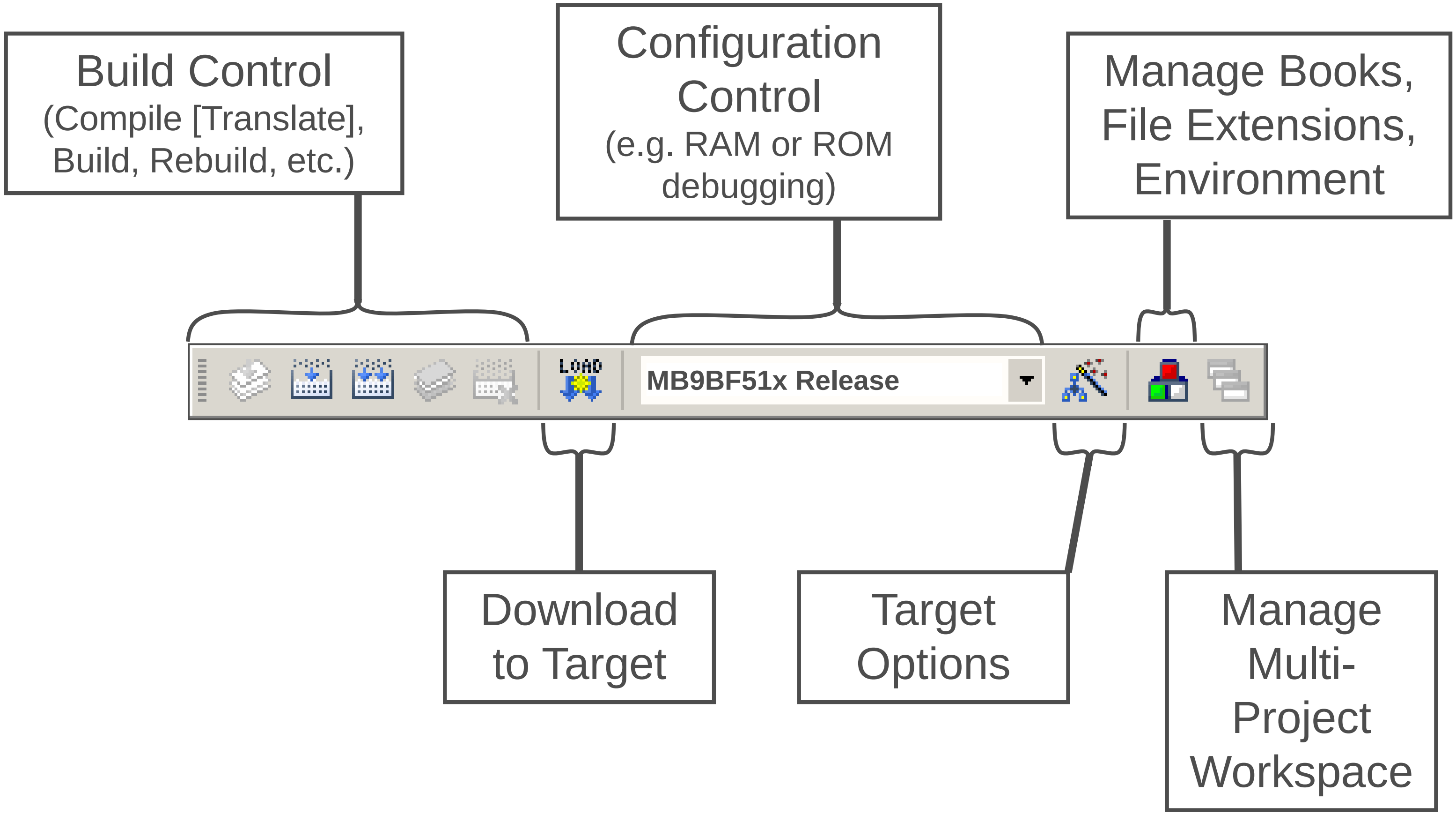
Edit Control
(cut, copy, paste, etc.)
(indention, commenting)

Debug Control
(Start/Stop Debug Session, set/remove/disable breakpoints, remove/disable all breakpoints)

IDE Configuration

KEIL µVision – Menu Bars (2)

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



Build Control
(Compile [Translate], Build, Rebuild, etc.)

Configuration Control
(e.g. RAM or ROM debugging)

Manage Books, File Extensions, Environment

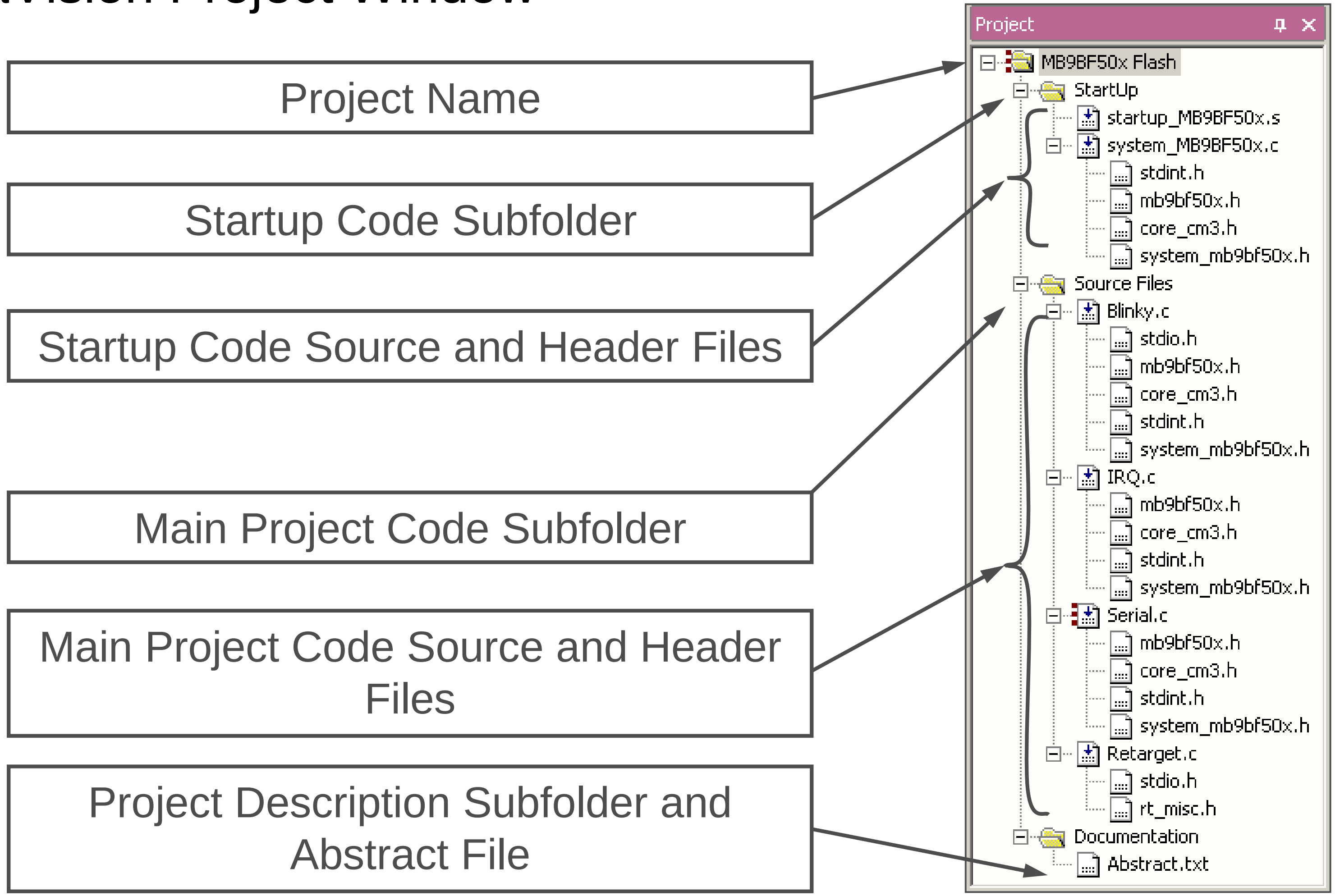
Download to Target

Target Options

Manage Multi-Project Workspace

KEIL µVision – Project Window

- µVision Project Window

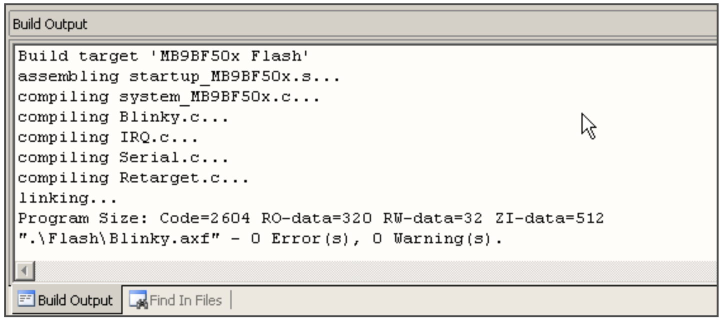


Project Name
Startup Code Subfolder
Startup Code Source and Header Files
Main Project Code Subfolder
Main Project Code Source and Header Files
Project Description Subfolder and Abstract File
Project

```
MB9BF50x Flash
  StartUp
    startup_MB9BF50x.s
    system_MB9BF50x.c
      stdint.h
      mb9bf50x.h
      core_cm3.h
      system_mb9bf50x.h
  Source Files
    Blinky.c
      stdio.h
      mb9bf50x.h
      core_cm3.h
      stdint.h
      system_mb9bf50x.h
    IRQ.c
      mb9bf50x.h
      core_cm3.h
      stdint.h
      system_mb9bf50x.h
    Serial.c
      mb9bf50x.h
      core_cm3.h
      stdint.h
      system_mb9bf50x.h
    Retarget.c
      stdio.h
      rt_misc.h
  Documentation
    Abstract.txt
```

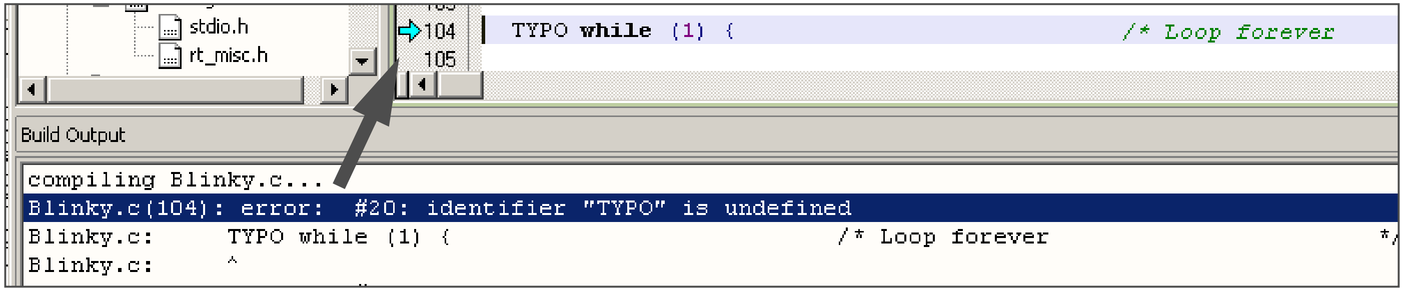
KEIL µVision – Making Project

- Making the Project
  - Use Rebuild Icon ( ) or Project→Rebuild all target files
  - Check for no errors in Output window below



```
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



```
104   TYPO while (1) {                                  /* Loop forever
105
```

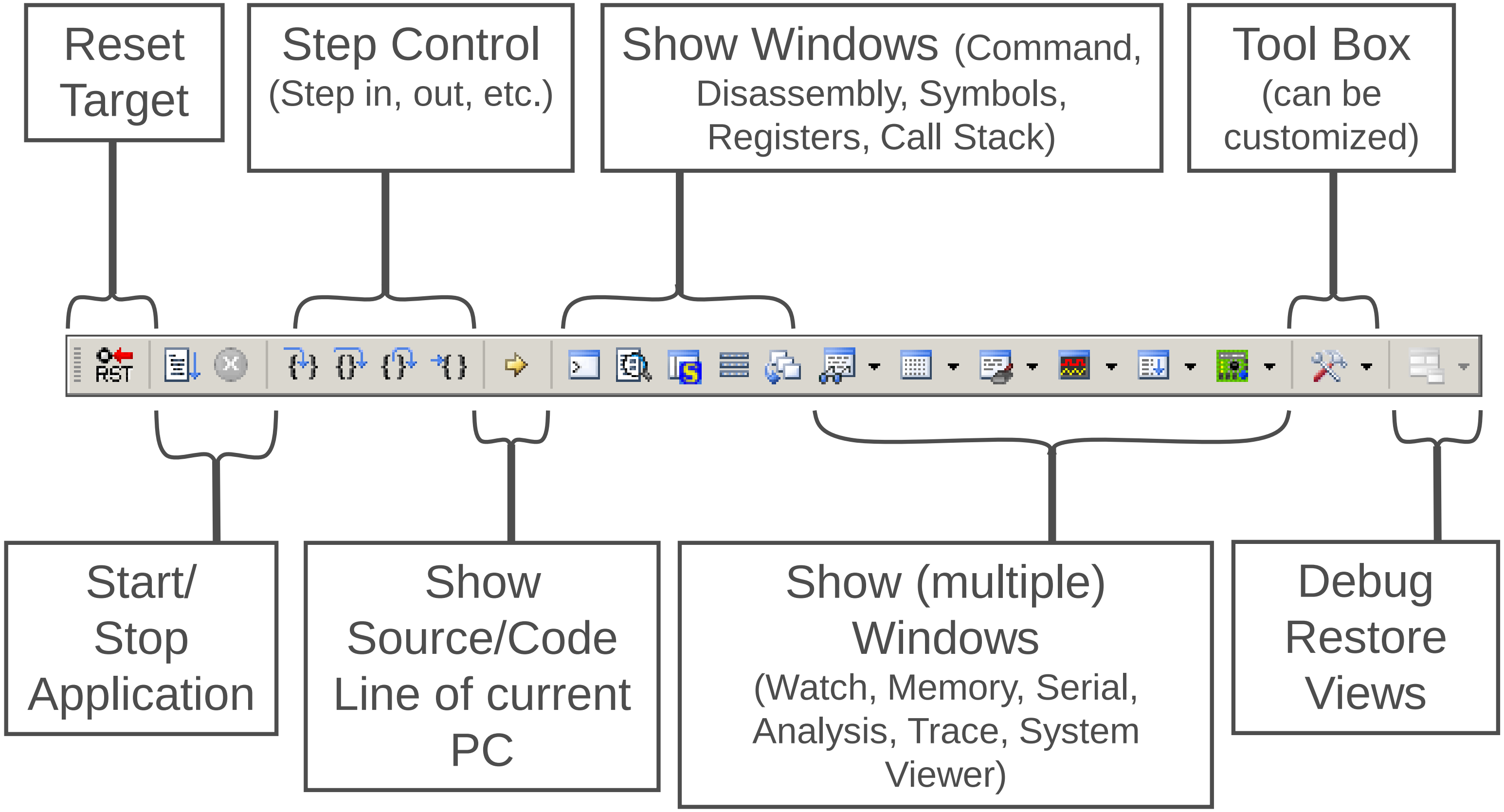
```
compiling Blinky.c...
Blinky.c(104): error:  #20: identifier "TYPO" is undefined
Blinky.c:      TYPO while (1) {                    /* Loop forever               */
Blinky.c:      ^
```

KEIL µVision – Debug (1)

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

KEIL µVision – Debug (2)

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



Reset Target

Step Control (Step in, out, etc.)

Show Windows (Command, Disassembly, Symbols, Registers, Call Stack)

Tool Box (can be customized)

Start/ Stop Application

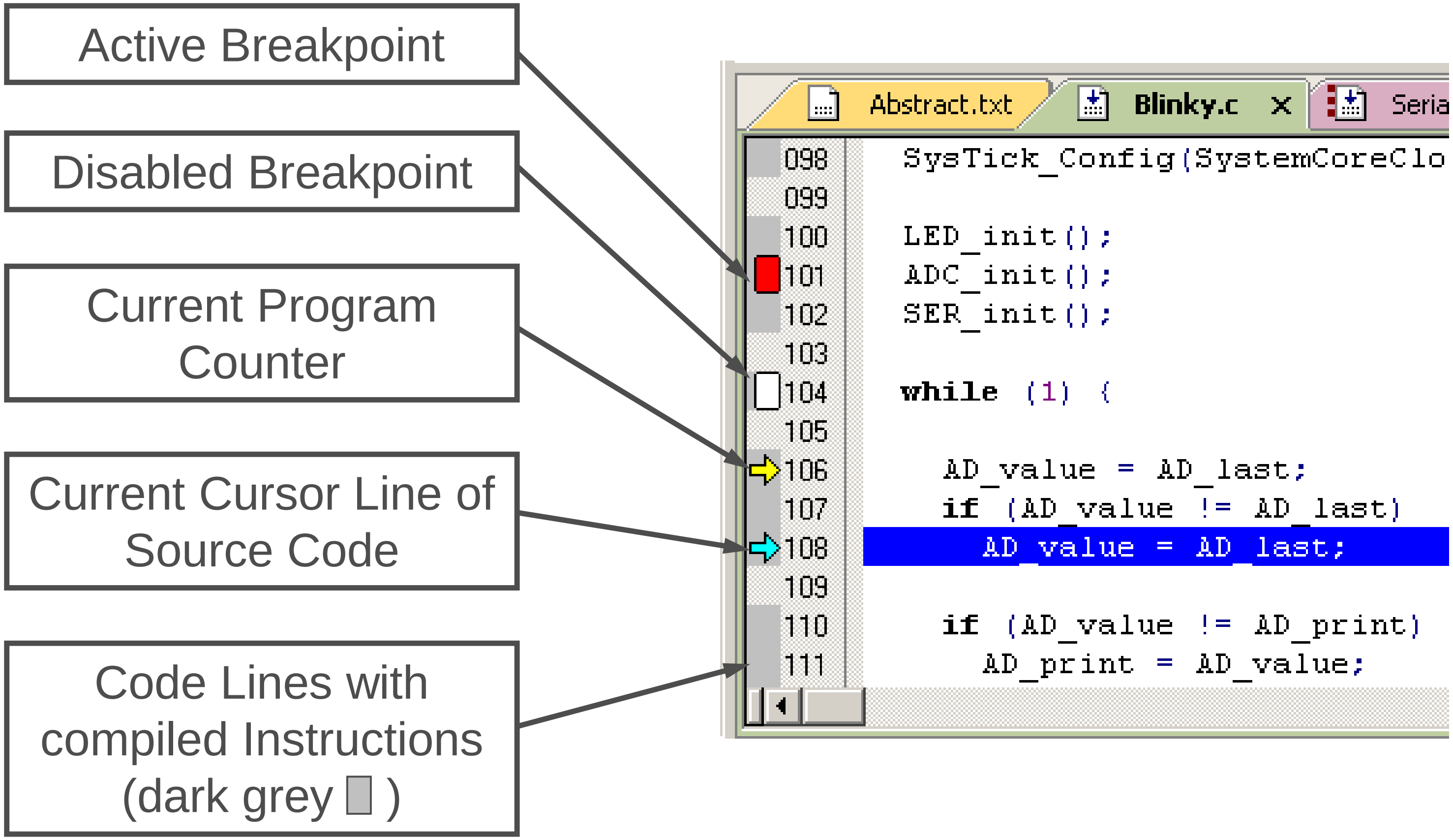
Show Source/Code Line of current PC

Show (multiple) Windows (Watch, Memory, Serial, Analysis, Trace, System Viewer)

Debug Restore Views

KEIL µVision – Debug (3)

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



Active Breakpoint

Disabled Breakpoint

Current Program Counter

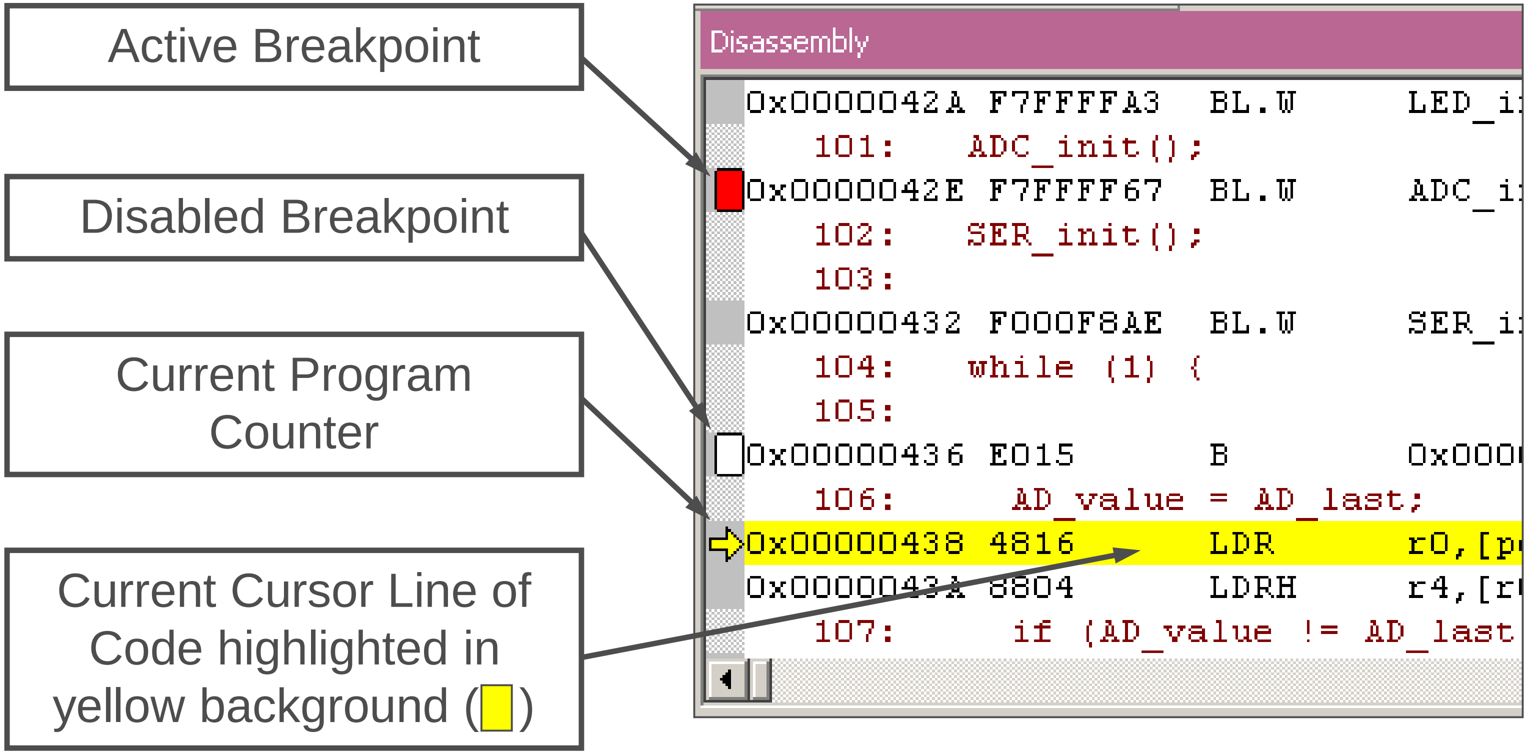
Current Cursor Line of Source Code

Code Lines with compiled Instructions (dark grey ▮)

```
  SysTick_Config(SystemCoreClo

  LED_init();
  ADC_init();
  SER_init();

  while (1) {

    AD_value = AD_last;
    if (AD_value != AD_last)
      AD_value = AD_last;

    if (AD_value != AD_print)
      AD_print = AD_value;
```

KEIL µVision – Debug (4)

- Disassembly View
  - Mixed mode is selectable and deselectable



Active Breakpoint

Disabled Breakpoint

Current Program Counter

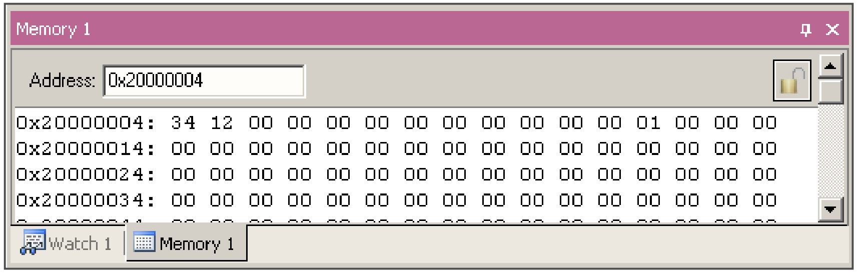
Current Cursor Line of Code highlighted in yellow background (🟨)

Disassembly

```
0x0000042A F7FFFFA3   BL.W       LED_i
    101:    ADC_init();
0x0000042E F7FFFF67   BL.W       ADC_i
    102:    SER_init();
    103:
0x00000432 F000F8AE   BL.W       SER_i
    104:    while (1) {
    105:
0x00000436 E015       B          0x000
    106:        AD_value = AD_last;
0x00000438 4816       LDR        r0,[p
0x0000043A 8804       LDRH       r4,[r
    107:        if (AD_value != AD_last
```

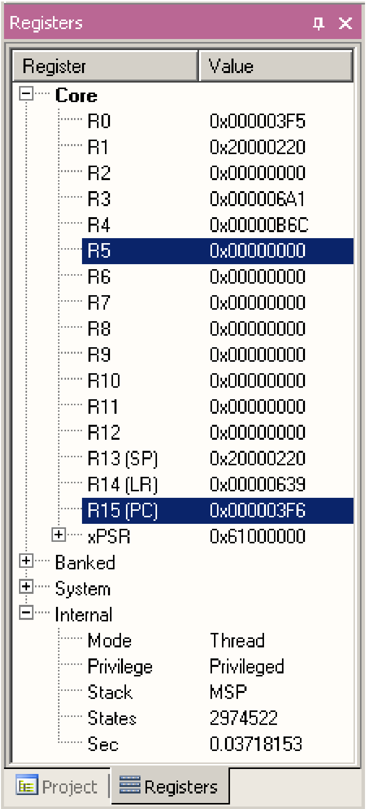
KEIL µVision – Debug (5)

- 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



```
0x20000004: 34 12 00 00 00 00 00 00 00 00 00 00 01 00 00 00
0x20000014: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x20000024: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x20000034: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
```

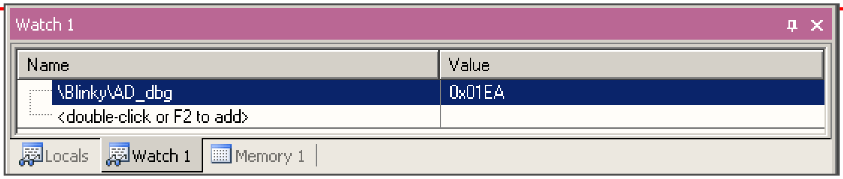
- Register View
  - Register view is a tab of the Project window
  - Changes are highlighted in dark blue text background
  - Register tree knots can be expanded



Register	Value
Core	
R0	0x000003F5
R1	0x20000220
R2	0x00000000
R3	0x000006A1
R4	0x00000B6C
R5	0x00000000
R6	0x00000000
R7	0x00000000
R8	0x00000000
R9	0x00000000
R10	0x00000000
R11	0x00000000
R12	0x00000000
R13 (SP)	0x20000220
R14 (LR)	0x00000639
R15 (PC)	0x000003F6
xPSR	0x61000000
Banked	
System	
Internal	
Mode	Thread
Privilege	Privileged
Stack	MSP
States	2974522
Sec	0.03718153

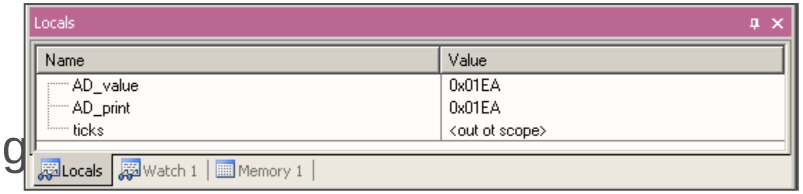
KEIL µVision – Debug (6)

- 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 backround color
    - ✓ Displayed values can be changed by user during break


Watch 1
Locals
Watch 1
Memory 1

Name	Value
\Blinky\AD_dbg	0x01EA
<double-click or F2 to add>	

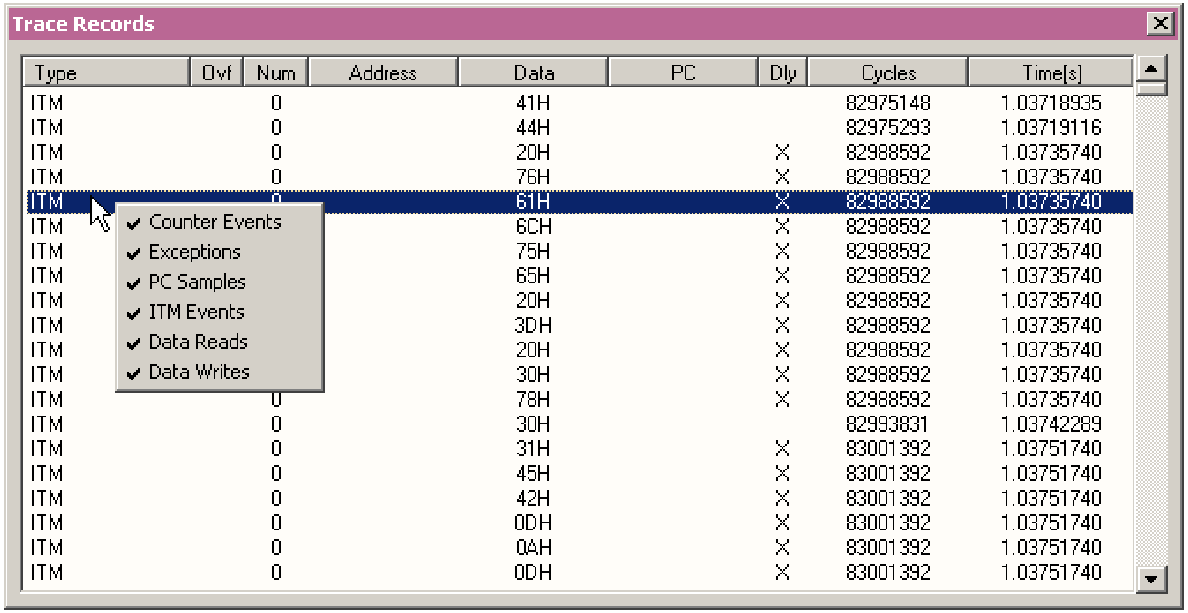
  - Local View
    - ✓ The local view shares the tab with e.g
    - ✓ Any changes are highlighted in dark blue text backround color
    - ✓ Displayed values can be changed by user during break


Locals
Locals
Watch 1
Memory 1

Name	Value
AD_value	0x01EA
AD_print	0x01EA
ticks	<out of scope>

KEIL µVision – Trace (ULINK ME)

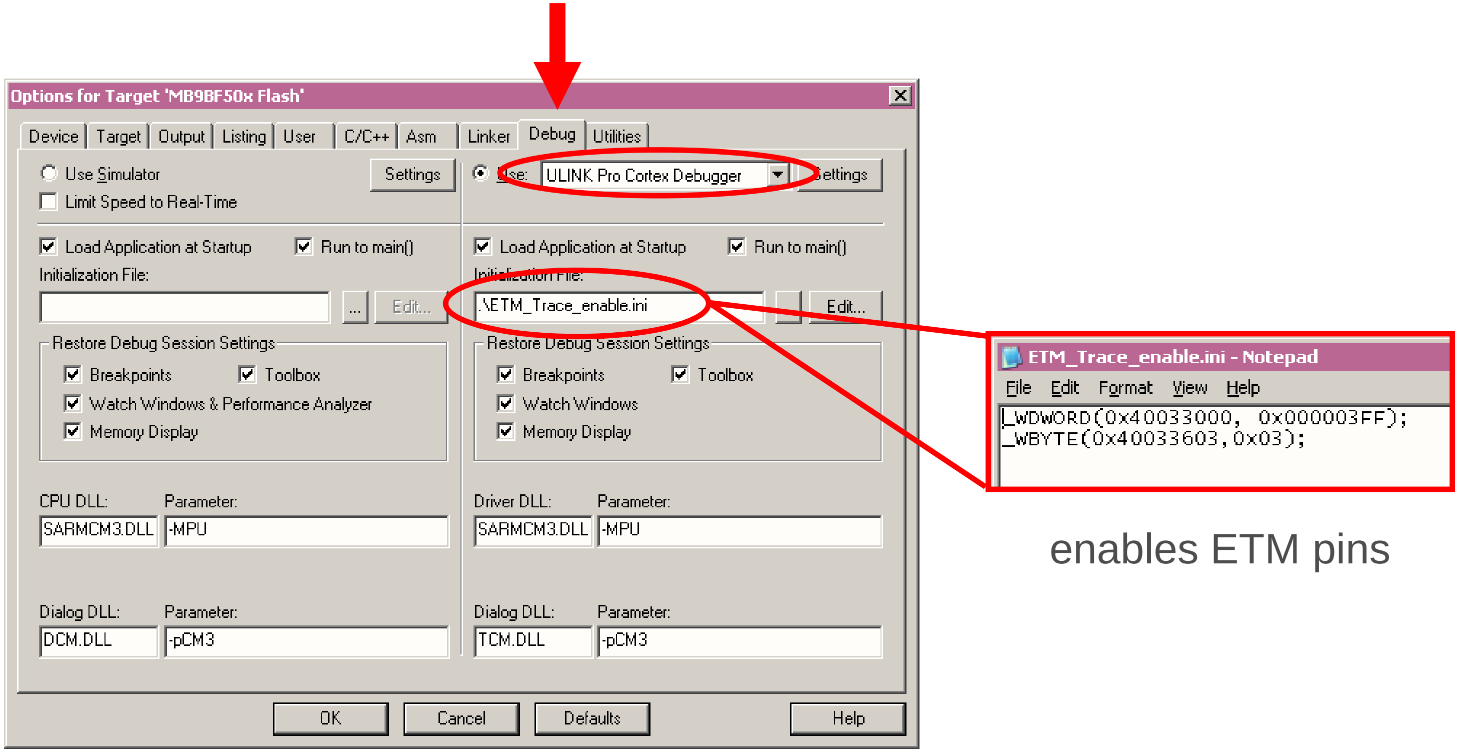
- Trace via ITM
  - Simple Trace views via Instrumentation Trace Macro is supported by µLINK ME
    - ✓ Records
    - ✓ Exceptions
    - ✓ Counters



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

KEIL µVision – Trace (ULINK Pro) (1)

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



Options for Target 'MB9BF50x Flash'

Device
Target
Output
Listing
User
C/C++
Asm
Linker
Debug
Utilities
Settings
Settings
OK
Cancel
Defaults
Help
Edit...
Edit...
...

○ Use Simulator
☐ Limit Speed to Real-Time
☑ Load Application at Startup ☑ Run to main()
Initialization File:
Restore Debug Session Settings
☑ Breakpoints ☑ Toolbox
☑ Watch Windows & Performance Analyzer
☑ Memory Display
CPU DLL: SARMCM3.DLL Parameter: -MPU
Dialog DLL: DCM.DLL Parameter: -pCM3

● Use: ULINK Pro Cortex Debugger
☑ Load Application at Startup ☑ Run to main()
Initialization File: .\ETM_Trace_enable.ini
Restore Debug Session Settings
☑ Breakpoints ☑ Toolbox
☑ Watch Windows
☑ Memory Display
Driver DLL: SARMCM3.DLL Parameter: -MPU
Dialog DLL: TCM.DLL Parameter: -pCM3

ETM_Trace_enable.ini - Notepad

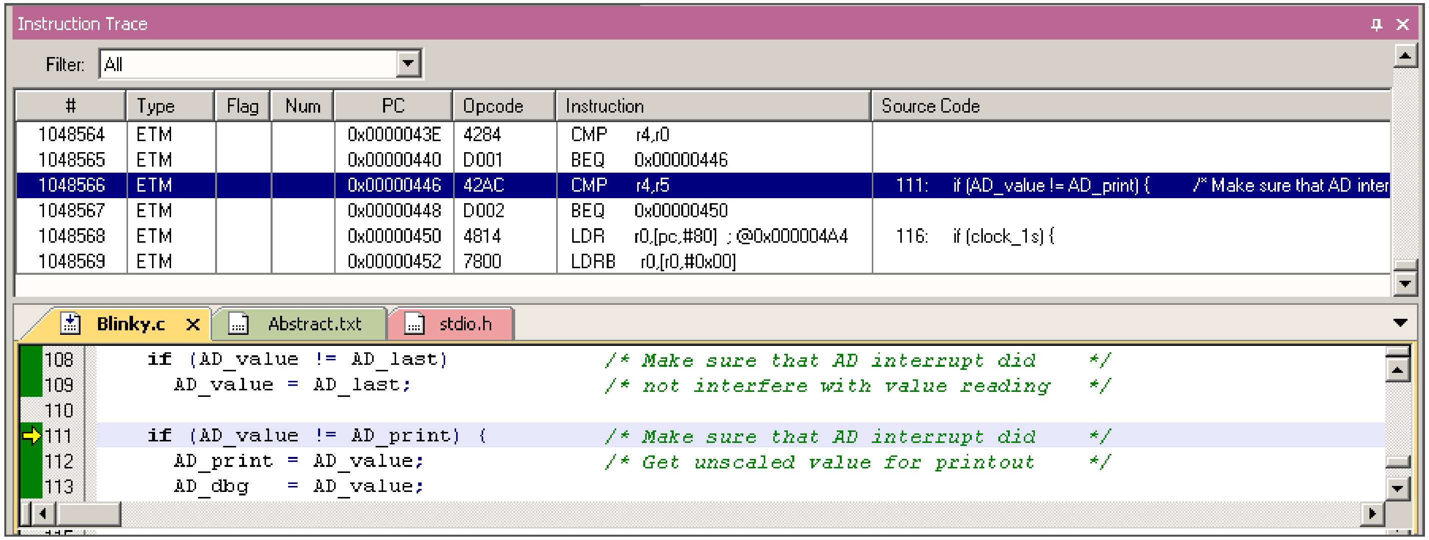
File
Edit
Format
View
Help

```
_WDWORD(0x40033000, 0x000003FF);
_WBYTE(0x40033603,0x03);
```

enables ETM pins

KEIL µVision – Trace (ULINK Pro) (2)

- Instruction Trace
  - Real Time Trace recording
  - Output can be filtered by several ETM and ITM events
  - Trace buffer is held in PC memory and transfered to µVision on break



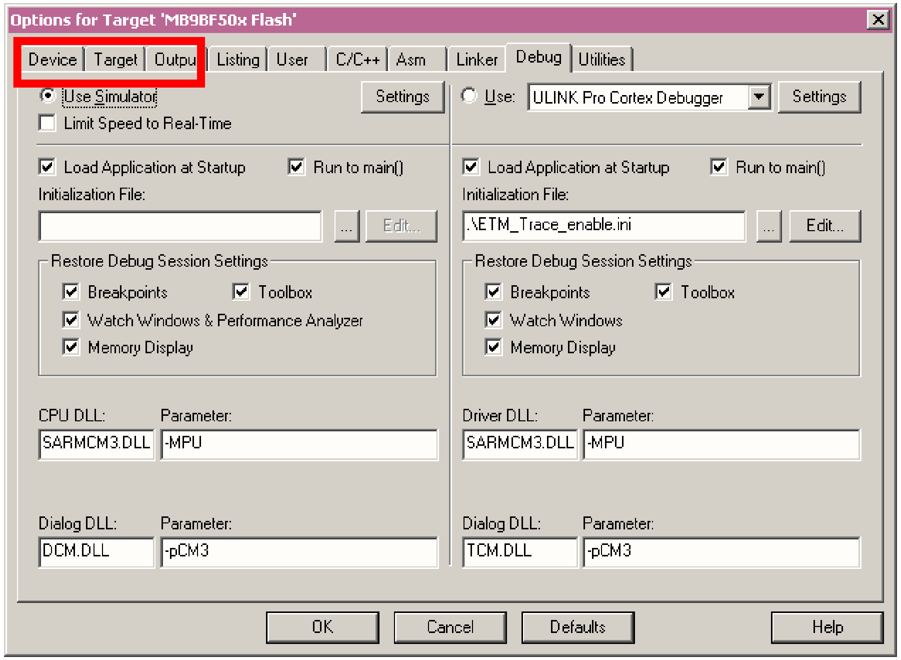
Filter: All

#	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;
```

KEIL µVision – Simulator

- 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



Options for Target 'MB9BF50x Flash'

● Use Simulator
☐ Limit Speed to Real-Time
☑ Load Application at Startup
☑ Run to main()
Initialization File:
Restore Debug Session Settings
☑ Breakpoints
☑ Toolbox
☑ Watch Windows & Performance Analyzer
☑ Memory Display
CPU DLL: SARMCM3.DLL
Parameter: -MPU
Dialog DLL: DCM.DLL
Parameter: -pCM3

○ Use: ULINK Pro Cortex Debugger
☑ Load Application at Startup
☑ Run to main()
Initialization File: .\ETM_Trace_enable.ini
Restore Debug Session Settings
☑ Breakpoints
☑ Toolbox
☑ Watch Windows
☑ Memory Display
Driver DLL: SARMCM3.DLL
Parameter: -MPU
Dialog DLL: TCM.DLL
Parameter: -pCM3

Device
Target
Outpu
Listing
User
C/C++
Asm
Linker
Debug
Utilities
Settings
Settings
...
Edit...
...
Edit...
OK
Cancel
Defaults
Help

Finally

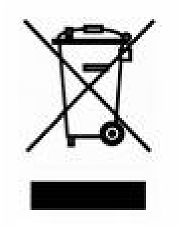
Cypress Support

- Please check the following website, for any available updates

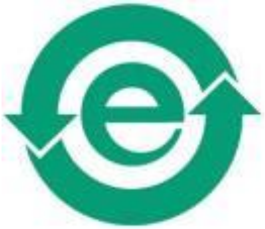
www.cypress.com

Recycling

- 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