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AN204432

FM3, FM4 Trace with µVision and ULINK Pro

Target Product: All FM3, FM4 series with trace ports

This application notes describes how setup the trace functionality with KEIL's µVision tool chain using the ULINK Pro JTAG/TRACE adapter.

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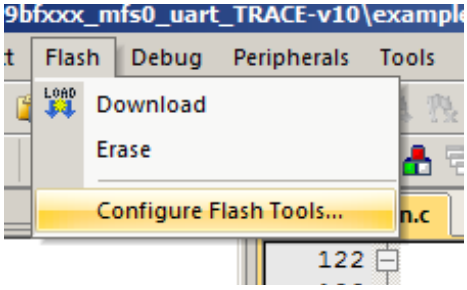
1 Introduction

This application notes describes how setup the trace functionality with KEIL's µVision tool chain using the ULINK Pro JTAG/TRACE adapter.

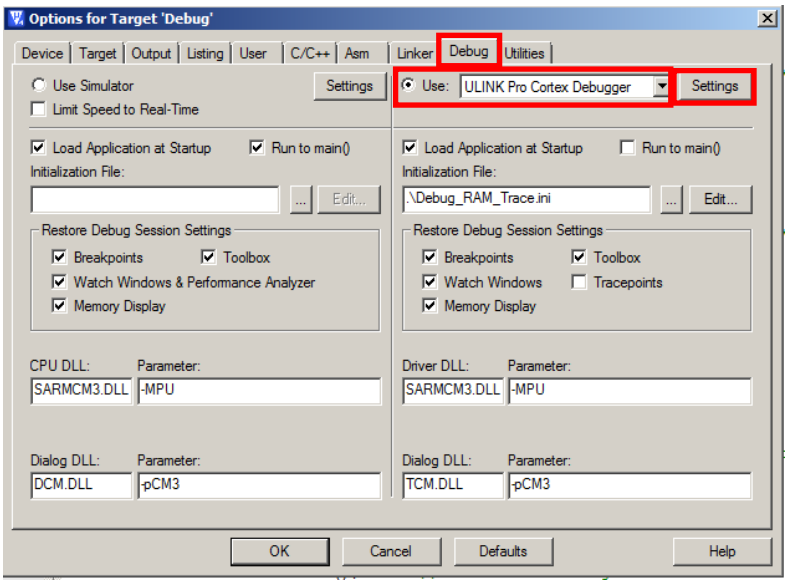
2 µVision Configuration

2.1 Configure Flash Tools…

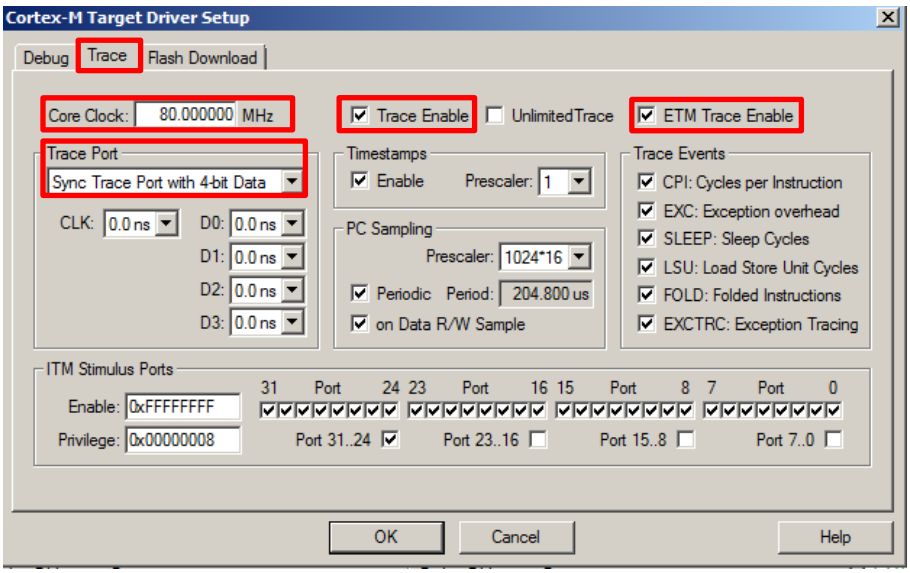
Follow the menu path **Flash → Configure Flash Tools**… The Options for Target <*Name*> window opens.



In the Options for Target <*Name*> dialog, go to the **Debug** tab. Select the **ULINK Pro Cortex Debugger** option, and then click **Settings**.



The Cortex-M Target Driver Setup window opens. Go to the **Trace** tab.



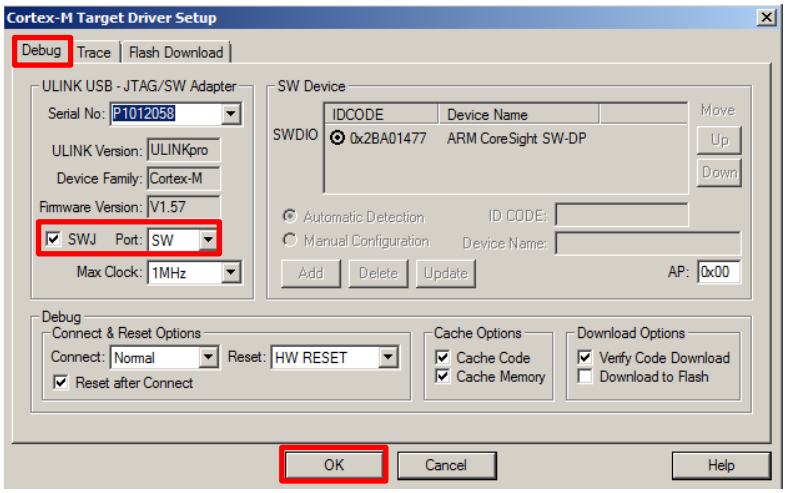
In this configuration window, adjust the following mandatory settings:

- **Core Clock** (for example, FM3: 80 MHz, FM4: 160 MHz)
- **Trace Port**: Sync Trace Port with 4-bit Data
- **Trace Enable**
- **ETM Trace Enable**

The remaining settings depend on your requirements.

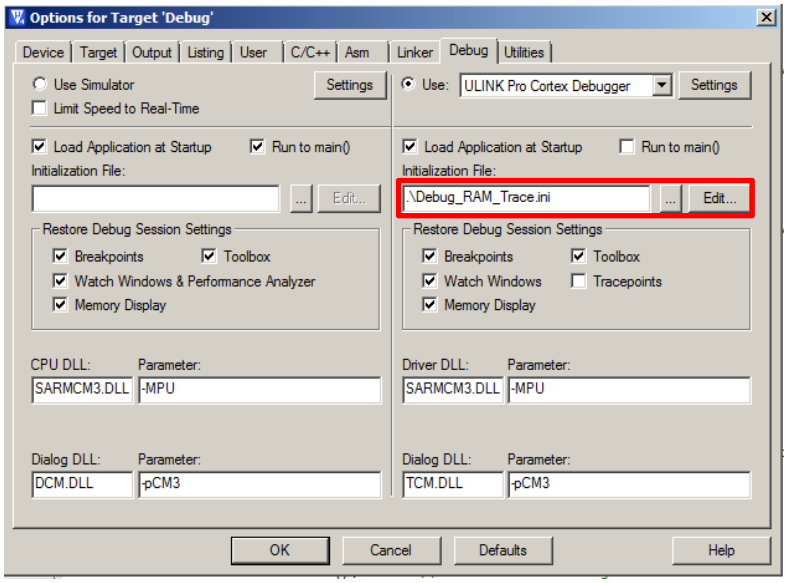
2.2 Debugger Configuration

In the Cortex-M Target Driver Setup dialog, go to the **Debug** tab. Select the **SWJ** option, and select **SW** from the **Port** drop-down list to adjust the ULINK Pro to serial wire debug. Confirm the settings and click **OK**.



2.3 Trace Port Enable

Adjust the debug *ini* script for trace usage.



A typical debug initialization script may look like the following code. The necessary trace ports and pins enable is highlighted in dark red bold characters. These lines enable the port pins for trace. Note that at Port 0 also the JTAG pins have to be kept (write `0x000003FF`).

Example for FM4 (MBF568R):

```
/* Initialization Script for Debug RAM */

FUNC void Setup (void) {
  SP = _RDWORD(0x1FFF8000);           // Setup Stack Pointer
  PC = _RDWORD(0x1FFF8004);           // Setup Program Counter
  _WDWORD(0xE000ED08, 0x1FFF8000);    // Setup Vector Table Offset Register

  _WDWORD(0x4006F500, 0xF07FFFFF);    // ADE.AN19...23 = 0
  _WDWORD(0x40063000, 0x000003FF);    // PFRs for Port P00 to P09
  _WBYTE(0x40063603, 0x03);           // TRC0E, TRC1E of EPFR00
}

load %L incremental

Setup();                              // Setup for Running

g, main
```

Example for FM3 (MBF506N):

```
/* Initialization Script for Debug RAM */

FUNC void Setup (void) {
  SP = _RDWORD(0x1FFF8000);           // Setup Stack Pointer
  PC = _RDWORD(0x1FFF8004);           // Setup Program Counter
  _WDWORD(0xE000ED08, 0x1FFF8000);    // Setup Vector Table Offset Register

  _WDWORD(0x40033000, 0x000003FF);    // PFRs for Port P00 to P09
  _WBYTE(0x40033603, 0x03);           // TRC0E, TRC1E of EPFR00
}

load %L incremental

Setup();                              // Setup for Running

g, main
```

Note: FM3 and FM4 have different GPIO base addresses. Table 1 lists the differences.

Table 1. Differences between GPIO Base Addresses

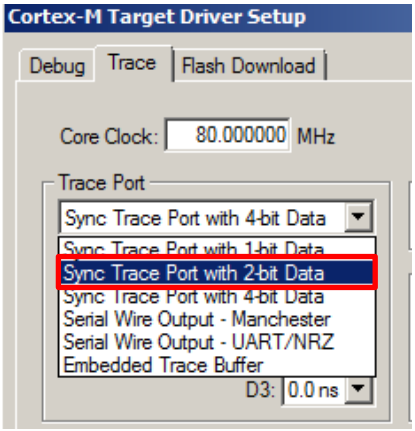
Register	FM3 address	FM4 address
EPFR0	0x40033600	0x40063600
PFR0	0x40033000	0x40063000
ADE	0x4003F000	0x4006F000

Note, that the JTAG port pins must be preserved, so that the access to EPFR00 should be done for the upper byte where the trace enable bits are located. Thus, the offset for the EPFR00 base address is 3.

Note: If the trace pins share analog inputs, these analog inputs must be switched OFF using the GPIO's ADE register. Check the pin layout to identify the analog inputs that your device share with these trace pins.

2.3.1 Trace Port with 2-Bit Data

If only TRACECLK, TRACED0, TRACED1 should be used by writing `0x01` to `0x40033603`, **Sync Trace Port with 2-bit Data** must be selected in the Cortex-M Target Driver Setup dialog.

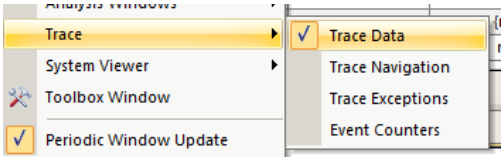


3 Debug Session with µVision

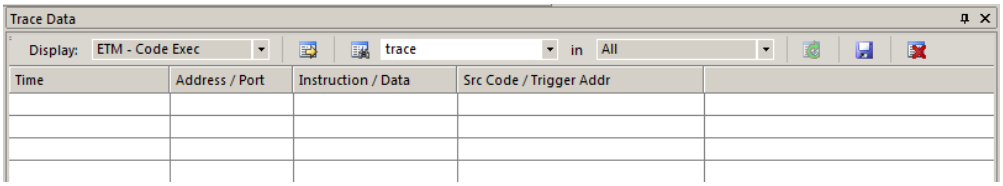
3.1 Trace Window

Now the IDE and the MCU are prepared for trace usage.

Start the debug session with the µVision IDE. Follow the menu path **View → Trace → Trace Data**.

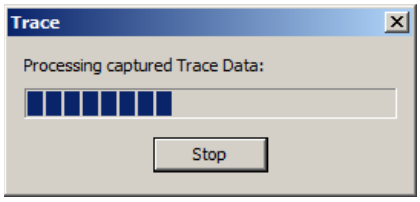


The Trace Data window opens.

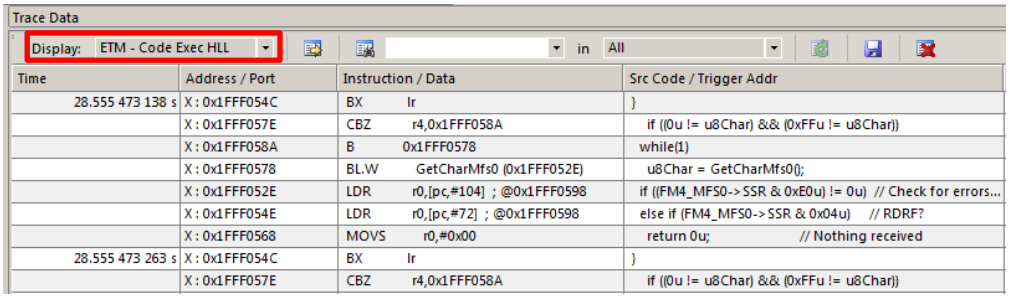


Select **ETM – Code Exec HLL** from the **Display** drop-down list. The ITM items use a reduced trace functionality via the JTAG port.

A pop up window will occur after stopping the application.



After code execution and the application is stopped, the trace window will look like the following example.

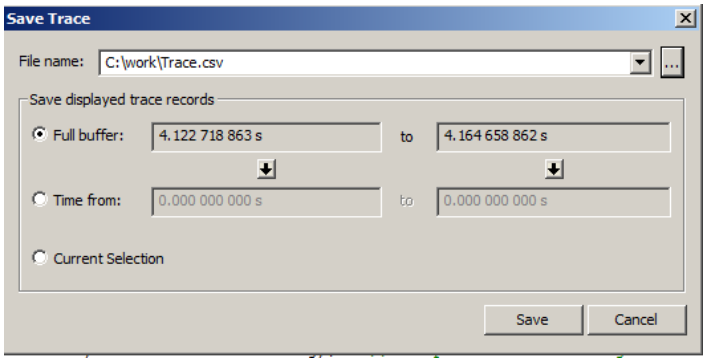


Time	Address / Port	Instruction / Data	Src Code / Trigger Addr
28.555 473 138 s	X:0x1FFF054C	BX lr	}
	X:0x1FFF057E	CBZ r4,0x1FFF058A	if ((0u != u8Char) && (0xFFu != u8Char))
	X:0x1FFF058A	B 0x1FFF0578	while(1)
	X:0x1FFF0578	BL.W GetCharMfs0 (0x1FFF052E)	u8Char = GetCharMfs0();
	X:0x1FFF052E	LDR r0,[pc,#104] ; @0x1FFF0598	if ((FM4_MFS0->SSR & 0xE0u) != 0u) // Check for errors...
	X:0x1FFF054E	LDR r0,[pc,#72] ; @0x1FFF0598	else if (FM4_MFS0->SSR & 0x04u) // RDRF?
	X:0x1FFF0568	MOVS r0,#0x00	return 0u; // Nothing received
28.555 473 263 s	X:0x1FFF054C	BX lr	}
	X:0x1FFF057E	CBZ r4,0x1FFF058A	if ((0u != u8Char) && (0xFFu != u8Char))

3.2 Saving Trace Data

You can explore the trace data to a CSV file using the save icon .

You can either save the full buffer for a time interval or a selection of the trace window. Note that the save process may take longer, depending of the size of the trace data.



The CSV file looks like the following excerpt.

```
# C:/work/Trace.csv : uVision Trace Data Export - CSV
#
#
Index,Time (in s),Address / Port,Instruction / Data,Src Code / Trigger Addr,Function
"0","0.736783500",X : 0x1FFF058A," B           0x1FFF0578","   while(1)","main"
"1","0.736783500",X : 0x1FFF0578," BL.W        GetCharMfs0 (0x1FFF052E)","     u8Char = GetCharMfs0();","main"
"2","0.736783500",X :  0x1FFF052E," LDR         r0,[pc,#104]  ; @0x1FFF0598","   if ((FM4_MFS0->SSR & 0xE0u) != 0u)  // Check for
errors PE, ORE, FRE","GetCharMfs0"
"3","0.736783500",X : 0x1FFF054E," LDR         r0,[pc,#72]  ; @0x1FFF0598","   else if (FM4_MFS0->SSR & 0x04u)     //
RDRF?","GetCharMfs0"
"4","0.736783500",X : 0x1FFF0568," MOVS        r0,#0x00","     return 0u;                      // Nothing received","GetCharMfs0"
"5","0.736783500",X : 0x1FFF054C," BX          lr"," }","GetCharMfs0"
"6","0.736783625",X : 0x1FFF057E," CBZ         r4,0x1FFF058A","     if ((0u != u8Char) && (0xFFu != u8Char))","main"
```

Document History

Document Title: AN204432 - FM3, FM4 Trace with µVision and ULINK Pro

Document Number: 002-04432

Revision	ECN	Submission Date	Description of Change
**	_	03/06/2014	Initial Release
*A	5034126	12/02/2015	Converted Spansion Application Note “FM3_FM4_AN706-00082-1v0-E” to Cypress format
*B	5874553	09/06/2017	Updated logo and copyright.
*C	6469227	01/31/2019	Sunset Review Updated Template Minor Text Edits
*D	6835006	03/20/2020	Adjusted the width of the tables containing examples FM4 (MBF568R) and FM3 (MBF506N).

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