

1 简介

ETM trace 是一种高速 Trace，并提供强大的调试模式，可帮助您解决最困难的问题。本文档旨在介绍如何为 i.MXRT10xx 芯片启用 ETM Trace 以及使用 uTrace 调试器的基本步骤。

2 安装软件

用户可以从 https://www.lauterbach.com/frames.html?download_overview.html 找到 TRACE32 安装软件包，将 TRACE32_201909.7z 下载到计算机上并进行安装。注意以下两点：

1. 由于安装包比较大，可以根据目标处理器安装软件组件，以节省硬盘空间；
2. 您可以在 C:\T32\bin\windows64\drivers 文件夹中找到安装的驱动程序。

3 连接硬件

TRACE32 调试器硬件包括：

- 通用调试器硬件
- 特定于处理器体系结构的调试电缆

图 1 是硬件连接示意图。

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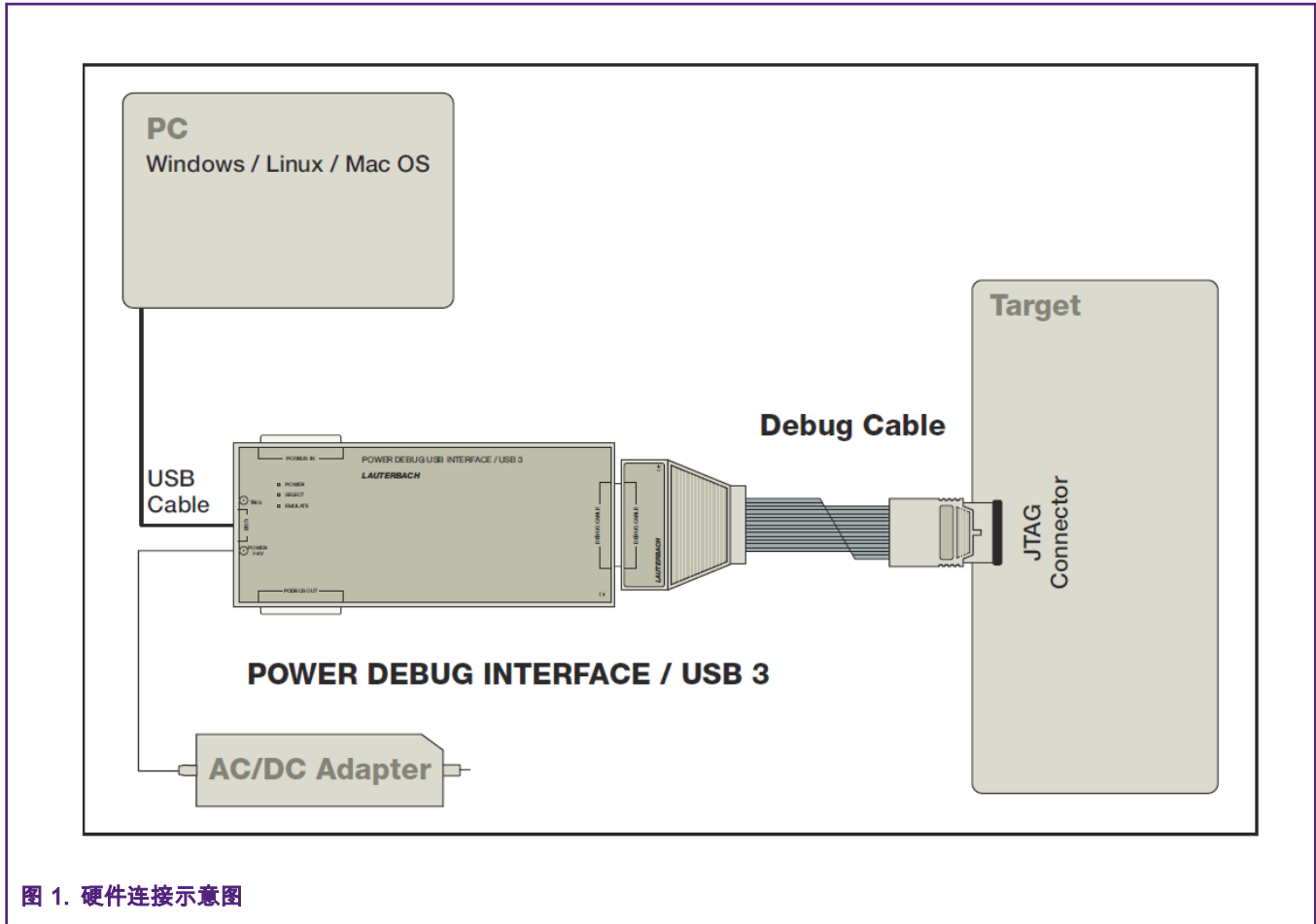


图 1. 硬件连接示意图

1. 以 i.MX RT1010 验证板 (RAM) 为例，图 2 显示了 i.MX RT1010 验证板硬件连接图。

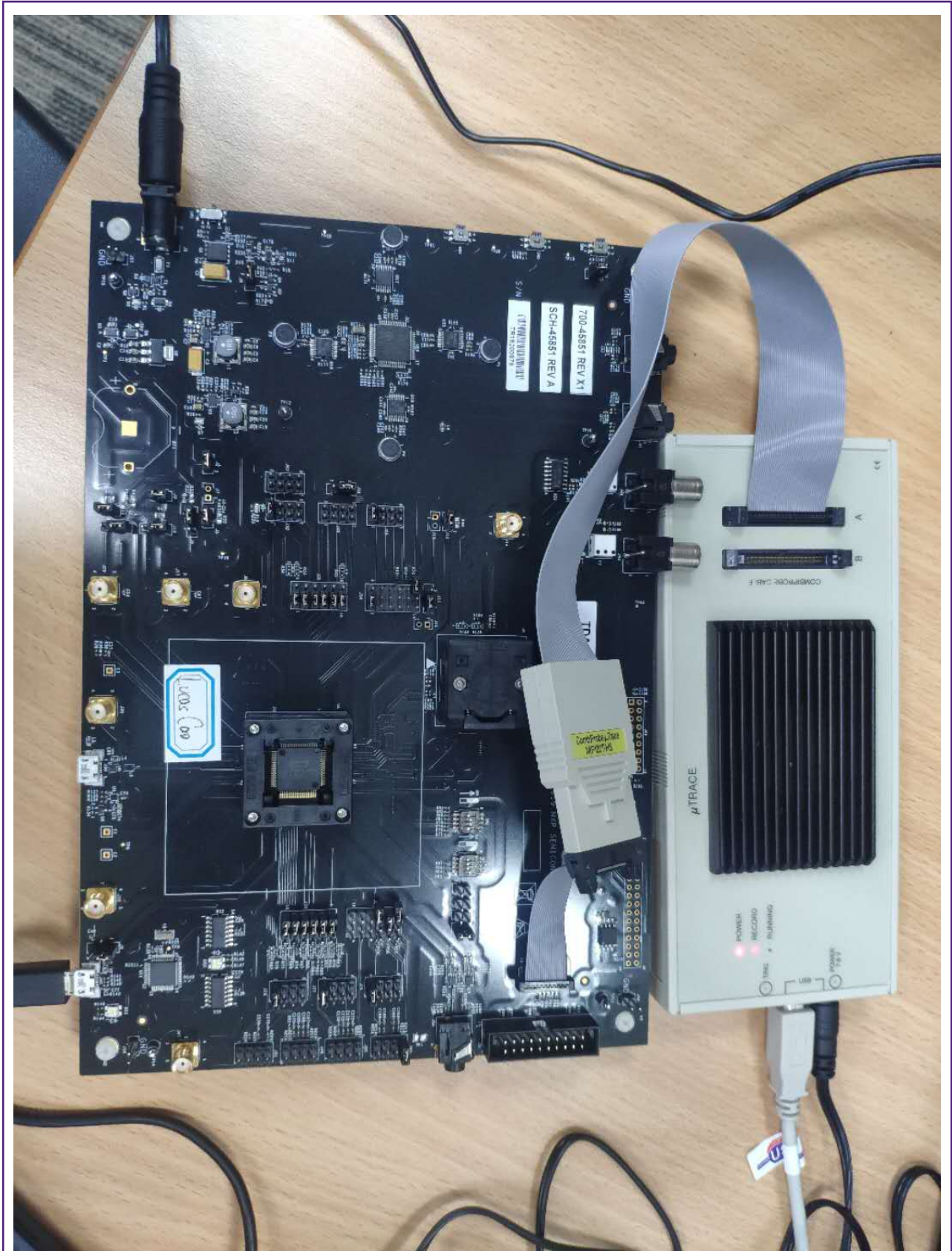
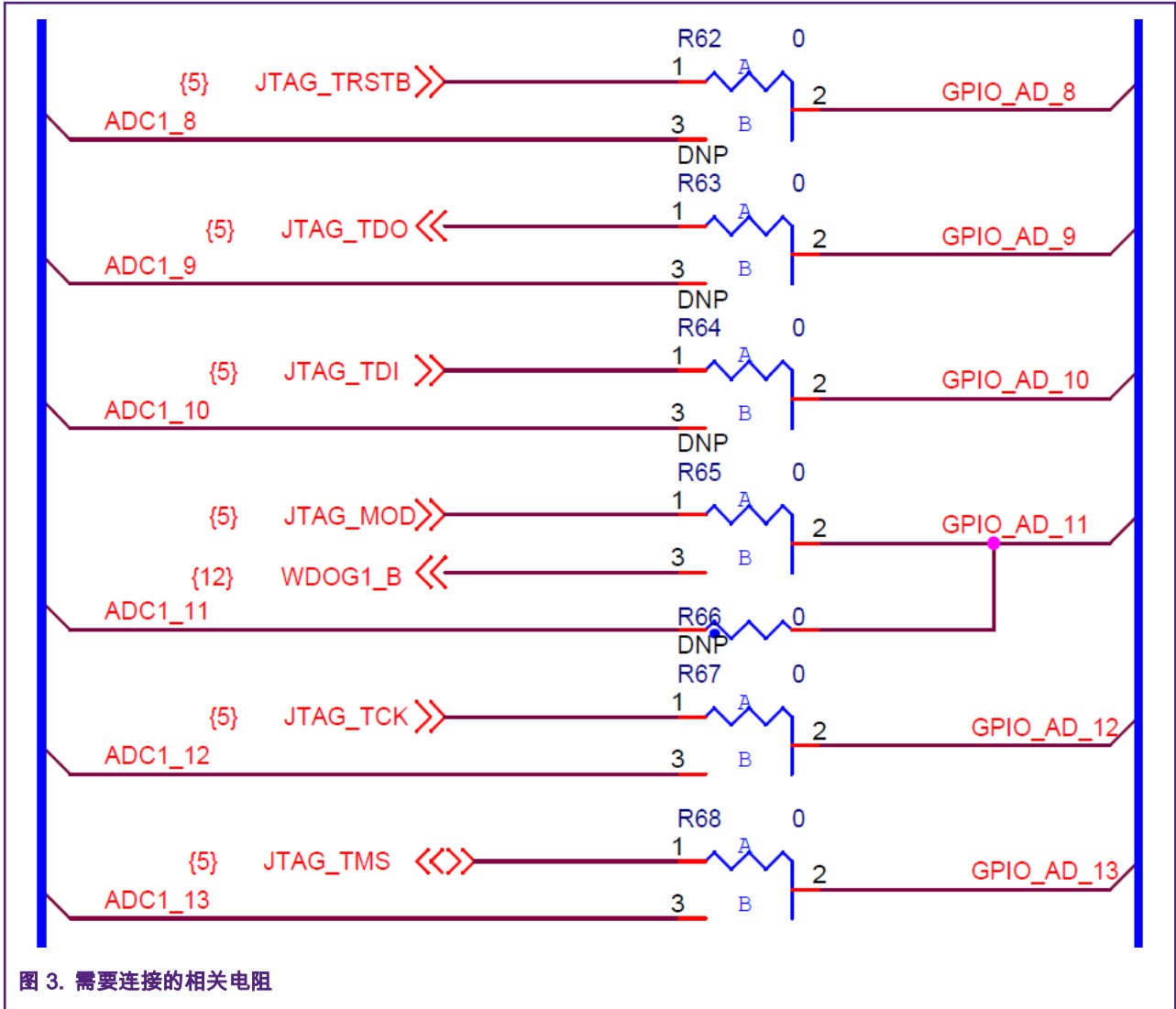
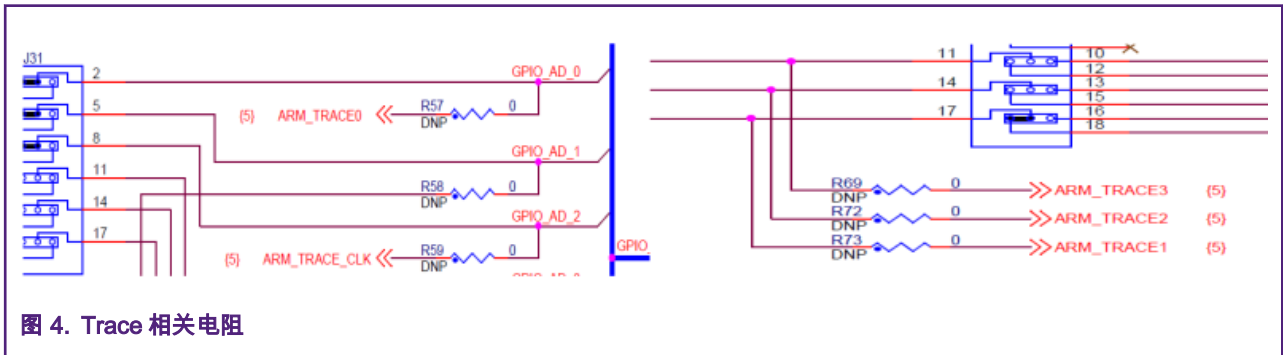


图 2. i.MX RT1010 Validation Board 硬件连接图

- 对 i.MX RT1010 烧写 efuse, 将调试模式更改为 JTAG, 然后焊接相关电阻: R62, R63, R64, R65, R67, 如图 3 所示。



- 焊接 Trace 信号线相关的电阻, TRACE_CLK (R59), TRACE0 (R57), TRACE1 (R73), TRACE2 (R72), TRACE3 (R69)。并断开信号线上的其他信号跳线, 如图 4 所示。



4 使用软件

点击 CPU->System settings, 再点击 CPU 以选择 CPU 类型, 如图 5 所示。

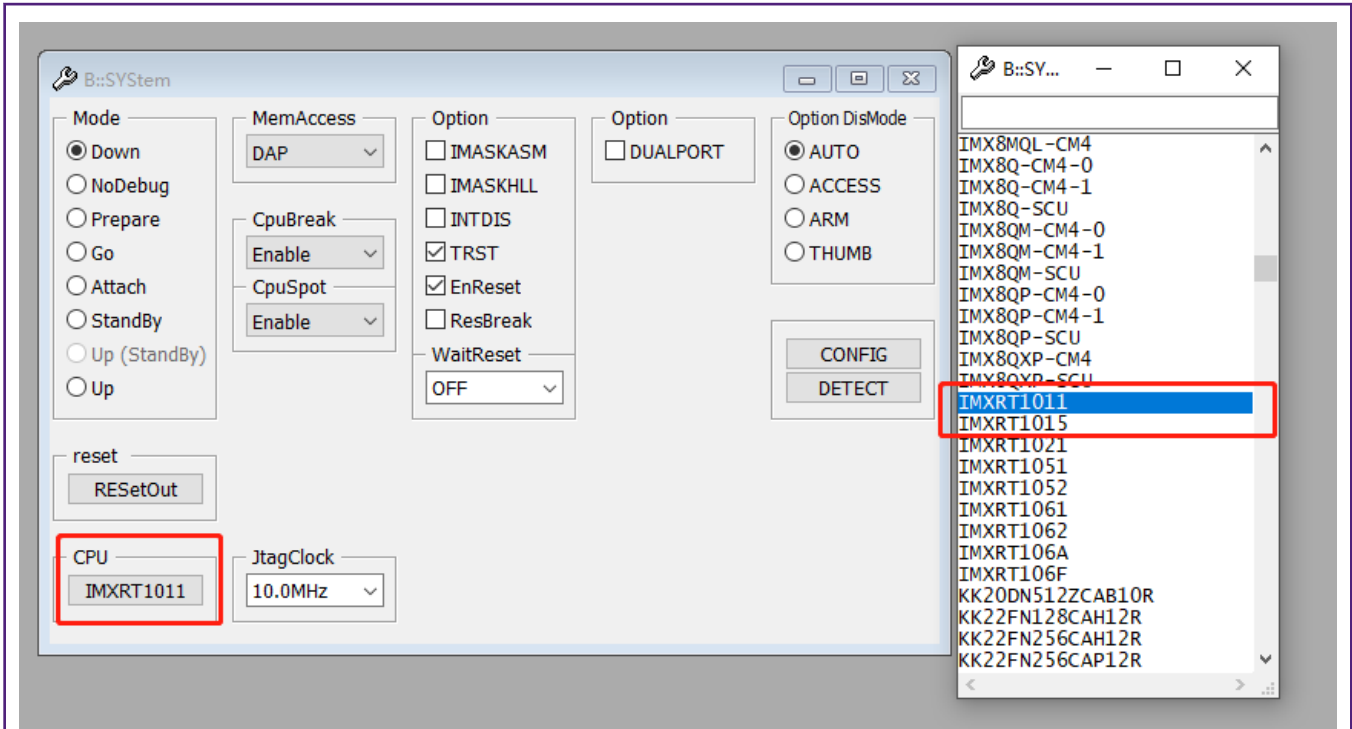


图 5. 选择 CPU 类型

并将调试端口类型设置为 JTAG，如图 6 所示

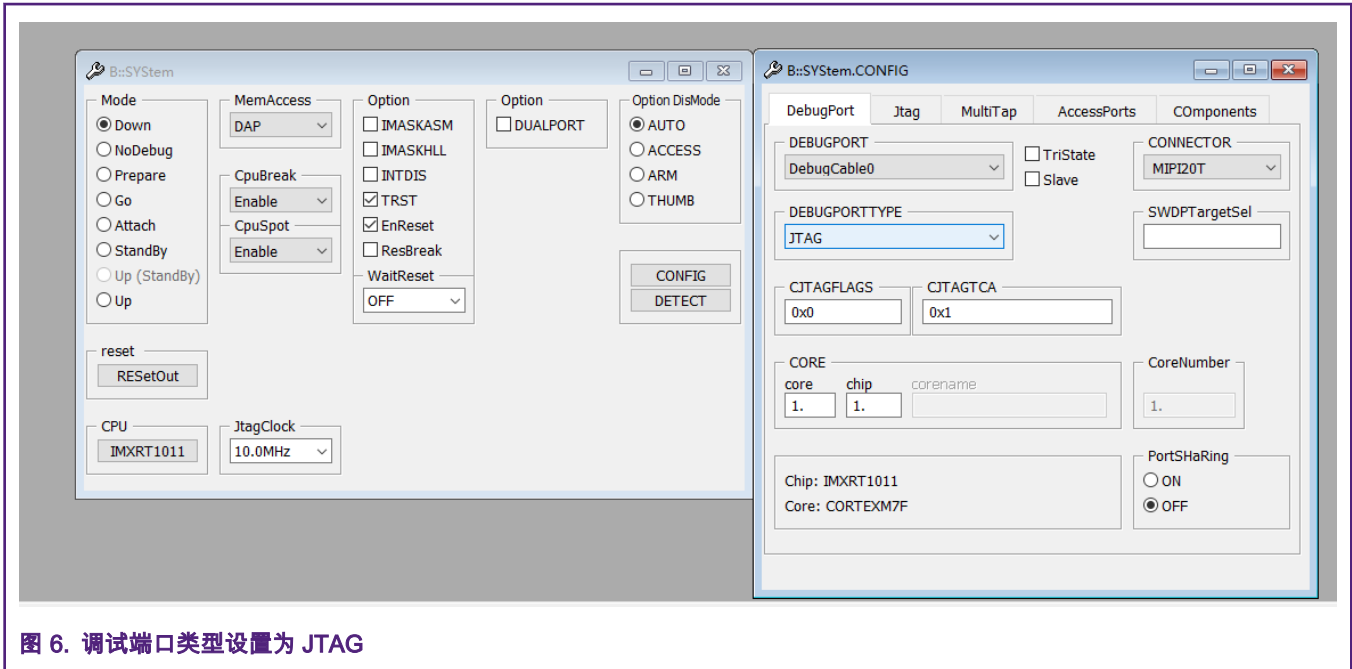


图 6. 调试端口类型设置为 JTAG

最后在 **Mode** 页面中选择 **Up** 以调试模拟重启 CPU，并在调试器和 CPU 之间建立通信。

5 加载应用

以 SDK_2.6.1_EVK-MIMX RT1010 为例，打开 IAR hello_world 项目，然后将其设置为 debug mode，然后将生成的文件后缀设置为 .elf，如图 7 所示，您可以在 debug 文件夹中找到生成的 hello_world.elf 文件。

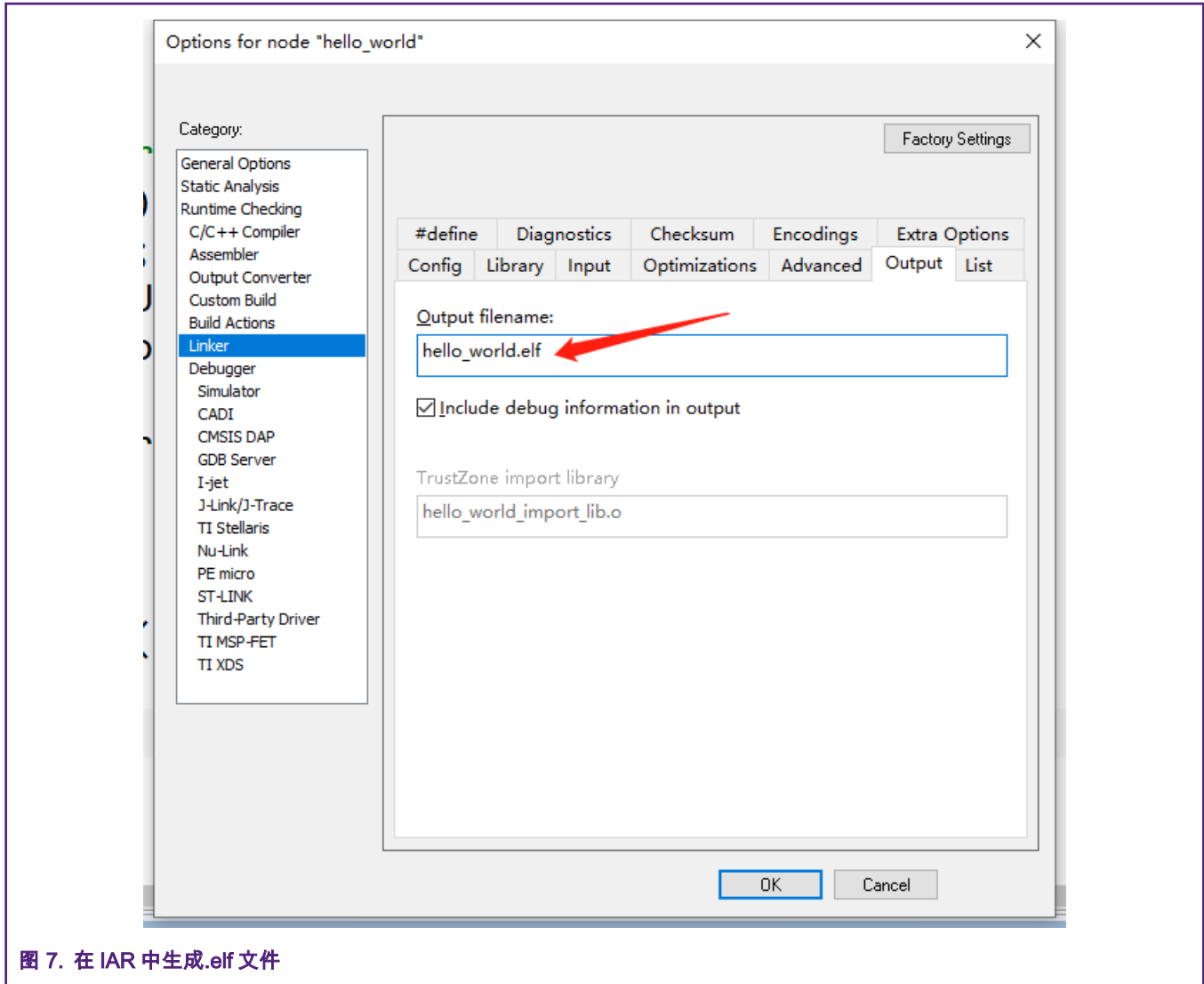


图 7. 在 IAR 中生成.elf 文件

6 创建脚本

将以下脚本命令另存为 .cmm 格式文件，并将其命名为 hello_world.cmm

```
WinCLEAR
; -----
; initialize and start the debugger
RESet
SYStem.RESet
SYStem.CPU IMXRT1010
SYStem.CONFIG.DEBUGPORTTYPE JTAG
SYStem.Option DUALPORT ON
SYStem.MemAccess DAP
SYStem.JtagClock CTKC 10MHz
Trace.DISable
SYStem.Up
; -----
; load demo program (uses internal RAM only)
```

```

Data.LOAD.Elf "~~~/hello_world.elf"

; -----
; initialize OFFCHIP trace (ETM, ITM)
IF COMBIPROBE()||UTRACE()||Analyzer()
(
; set PinMux and enable Clocks
; TRACECLK - IOMUX_GPIO_AD_02 - ALT7
; TRACEDATA0 - IOMUX_GPIO_AD_00 - ALT7
; TRACEDATA1 - IOMUX_GPIO_AD_13 - ALT7
; TRACEDATA2 - IOMUX_GPIO_AD_12 - ALT7
; TRACEDATA3 - IOMUX_GPIO_AD_11 - ALT7
Data.Set AD:0x401F8040 %Long 0x7
Data.Set AD:0x401F8048 %Long 0x7
Data.Set AD:0x401F8088 %Long 0x7
Data.Set AD:0x401F808C %Long 0x7
Data.Set AD:0x401F8090 %Long 0x7

TPIU.PortSize 1
TPIU.PortMode Continuous
ITM.DataTrace CorrelatedData
ITM.ON
ETM.Trace ON
ETM.COND ALL
ETM.ON
)
IF COMBIPROBE()||UTRACE()
(
Trace.METHOD CAnalyzer
Trace.AutoInit ON
IF VERSION.BUILD.BASE()>=74752.
(
CAnalyzer.AutoFocus
)
ELSE
(
; for uTrace & Combiprobe use manual calibration
; CAnalyzer.ClockDELAY Large
)
)
IF Analyzer()
(
Trace.METHOD Analyzer
Trace.AutoInit ON
Trace.AutoFocus
)

; -----
; start program execution
Go.direct main
WAIT !STATE.RUN()

; -----
; setup ITM based datatrace of variable ch
;Var.Break.Set ch /Write /TraceData

; -----
; open some windows
WinCLEAR
Mode.Hll

```

```

WinPOS 0. 0. 116. 26.
List.auto
WinPOS 120. 0. 100. 8.
Frame.view
WinPOS 120. 14.
Var.Watch
Var.AddWatch %SpotLight ast flags
WinPOS 120. 25.
Trace.List
;WinPOS 0. 32.
;Trace.DRAW.Var %DEfault ch

ENDDO

```

7 加载应用

打开 TRACE32 软件, 单击 File->Load File. 找到我们上面生成的 hello_world.elf 文件并运行它。

1. 单击 **View->List Source** 打开代码调试窗口。
2. 单击 **Step** 或按 **F2** 直接执行程序。
3. 单击 **Go** 或按 **F7** 直接运行程序。
4. 单击 **Break** 或按 **F8** 暂停程序。

8 Trace 调试

TRACE32 提供了一个称为 Trace.ShowFocus 的强大功能, 可以分析跟踪端口的信号完整性。

水平轴以纳秒为单位反映时间线。左侧显示了每个跟踪信号的当前延迟。红线显示采样点。每个信号可能有所不同。如果设置的值小于零或不是所有采样点都相等, 则数据线会延迟。如果值大于零, 则时钟线被延迟。

按下 **Scan** 按钮将执行 Analyzer.ShowFocus 以更新窗口。在最佳情况下, 它应类似于 图 8 所示:

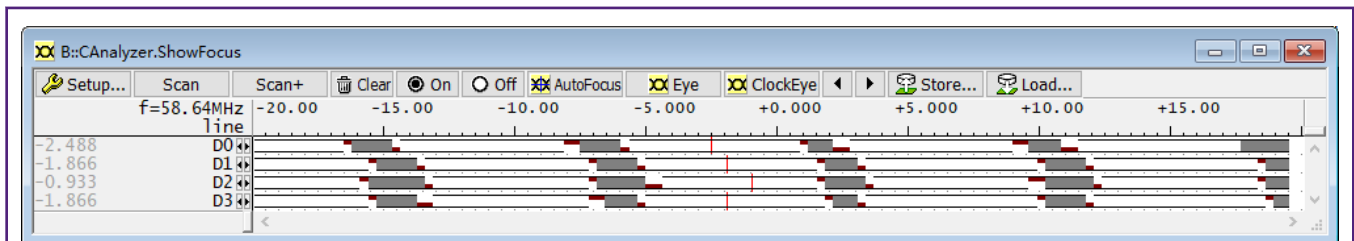


图 8. CAnalyzer. ShowFocus

TRACE32 PowerView 提供了一个时序图, 该时序显示了 program counters 何时处于哪个 function/symbol 范围内。

在 图 9 窗口中单击 **Chart** 按钮将打开 图 10 窗口。

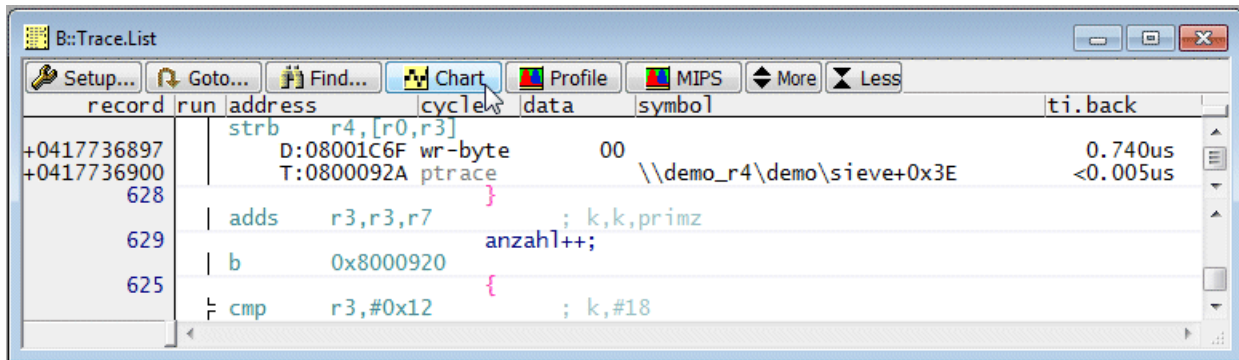


图 9. Trace.List 窗口

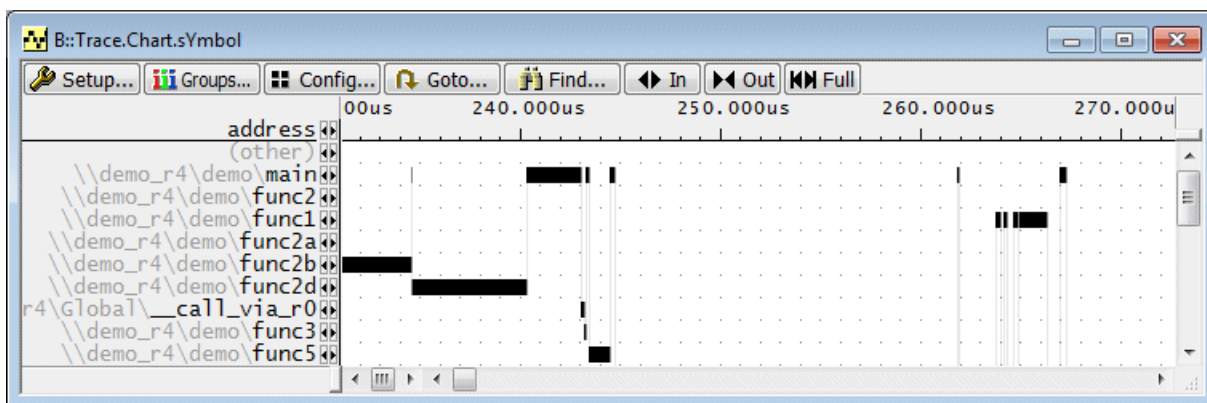


图 10. Chart.Symbol 窗口

9 其他

对于其他 i.MXRT 平台，我们应该进行以下更改。

- 对于 i.MXRT1050 验证板，请执行以下步骤：

1. 烧写 efuse 将调试模式更改为 JTAG。
2. 焊接 Trace 相关电阻 TRACE_CLK (R140 R592) ， TRACE0 (R583) ， TRACE1 (R270) ， TRACE2 (R294 R547) ， TRACE3 (R268 R688) 。
3. 在脚本中替换以下代码：

```

— Data.Set AD:0x401F816C %Long 0x2
— Data.Set AD:0x401F814C %Long 0x3
— Data.Set AD:0x401F8150 %Long 0x3
— Data.Set AD:0x401F8154 %Long 0x3
— Data.Set AD:0x401F8158 %Long 0x3

```

- 对于 i.MXRT1020 验证板，请执行以下步骤：

1. 烧写 efuse 将调试模式更改为 JTAG。
2. 焊接 Trace 相关电阻，TRACE_CLK (R140) ， TRACE0 (R815) 。
3. 在脚本中替换以下代码

```

— ; set PinMux and enable Clocks

```

— Data.Set AD:0x401F80E4 %Long 0x6

— Data.Set AD:0x401F80EC %Long 0x6

NOTE

对于 RT1020,由于 SOC 的限制只可以使能 1BIT EMT Trace。

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