



# SAM S CPU Support Package Guide

**Version: 1.3**





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# SAM S Support Package

This guide describes the following features of the SAM S CPU support package:

- [How to create SAM S projects](#)
- [How to open SAM S sample projects](#)
- [SAM S specific project properties](#)
- [SAM S specific project templates](#)
- [Supported SAM S devices](#)
- [Troubleshooting](#)

# Creating SAM S Projects

## Creating an SAM S C/C++ executable project

To create a new minimal C/C++ executable project:

- Select the **File > New > New Project** menu item.
- Select the **A C/C++ executable for Microchip SAM S** project template.
- Set the required project name and location directory.
- Click **Next**.
- If required, change any of the default project settings.
- Click **Finish** to create the project.

## Creating an SAM S library project

To create a new library project:

- Select the **File > New > New Project** menu item.
- Select the **A library for Microchip SAM S** project template.
- Set the required project name and location directory.
- Click **Next**.
- If required, change any of the default project settings.
- Click **Finish** to create the project.

## Creating an SAM S externally built executable project

To create a new project that will allow you to debug an existing externally built executable file:

- Select the **File > New > New Project** menu item.
- Select the **An externally built executable for Microchip SAM S** project template.
- Set the required project name and location directory.
- Click **Next**.
- Set the **Load File** project property to point to the executable file you want to download and debug.
- If required, change any of the other default project settings.
- Click **Finish** to create the project.

## Creating an SAM S CrossWorks Tasking Library executable project

To create a new C/C++ executable project configured to use the CrossWorks Tasking Library:

- Select the **File > New > New Project** menu item.
- Select the **A CrossWorks Tasking Library executable for Microchip SAM S** project template.
- Set the required project name and location directory.
- Click **Next**.

If required, change any of the other default project settings.  
Click **Finish** to create the project.

### Creating an SAM S assembly code only executable project

*Please note, this template does not add any C/C++ startup code or libraries and is therefore not suitable for creating projects that include C/C++ code.*

To create a new assembly code only executable project without:

Select the **File > New > New Project** menu item.

Select the **An assembly code only executable for Microchip SAM S** project template.

Set the required project name and location directory.

Click **Next**.

If required, change any of the other default project settings.

Click **Finish** to create the project.

# Opening SAM S Sample Solutions

## SAM S Samples Solution

This solution contains general sample projects that run on SAM S devices. To open the SAM S Samples Solution:

- Select the **Tools > Show Installed Packages** menu item.
- Select the **Microchip SAM S CPU Support Package** link.
- Select the **Samples Solutions > SAM S Samples Solution** link.

## SAM S CMSIS-DSP Samples Solution

This solution contains sample projects that use the CMSIS-DSP library running on SAM S devices. To open the SAM S CMSIS-DSP Samples Solution:

- Select the **Tools > Show Installed Packages** menu item.
- Select the **Microchip SAM S CPU Support Package** link.
- Select the **Sample Solutions > SAM S CMSIS-DSP Samples Solution** link.



# SAM S Project Properties

Projects creating using the project templates in this support package have the following device specific project properties:

## Heap Size

The heap size is set to be 256 bytes when a project is created. The heap size can be modified using the **Heap Size** project property.

## Section Placement

You can select the memory configuration you require using the **Section Placement** project property.

For SAM S projects, the set of placements are:

**Flash** - The application runs in internal Flash memory (*default*).

**Flash Vectors In RAM** - The application runs in internal Flash memory and exception vectors are copied to RAM memory.

**Flash Copy To RAM** - The application starts in internal flash and copies itself to run internal RAM memory.

**RAM** - The application runs internal RAM memory.

## Stack Sizes

The main stack size is set to be 256 bytes when a project is created.

The process stack size is set to be 0 bytes when a project is created.

The main and process stack sizes can be modified using the **Main Stack Size** and **Process Stack Size** project properties.

To change the location of the stacks, edit the section placement file and place the `.stack` and `.stack_process` sections as required.

## Startup From Reset

By default, the application will only startup from power-on/reset in *Release* configuration. This acts as a safety net in case you accidentally download a program in FLASH during development that crashes and prevents the debugger from taking control of the target over the debug interface thus rendering the device unusable.

For SAM S projects, the **Startup From Reset** project property can be set to one of the following:

**No** - The application will not startup from reset.

**Release Only** - The application will only startup from reset when built in *Release* configuration (*default*).

**Yes** - The application will always startup from reset.

## Target Processor

Once a project has been created you can target different devices by modifying the **Target Processor** project property. See the [SAM S Devices](#) section for details on the files, preprocessor definitions and macro definitions used when a device is selected.

## Use On-Chip RC Oscillator

The **Build Options > Use On-Chip RC Oscillator** project property can be set to one of the following:

**No** - The startup code will configure the device to use an external oscillator (*default*).

**Yes** - The startup code will configure the device to use the on-chip RC oscillator.

## TCM Configuration

The **Build Options > TCM Configuration** project property can be set to one of the following:

**ITCM and DTCM Disabled** - The startup code will configure the device to have no ITCM and DTCM (*default*).

**32 Kbytes ITCM and DTCM** - The startup code will configure the device to have a 32 Kbyte ITCM and DTCM.

**64 Kbytes ITCM and DTCM** - The startup code will configure the device to have a 64 Kbyte ITCM and DTCM.

**128 Kbytes ITCM and DTCM** - The startup code will configure the device to have a 128 Kbyte ITCM and DTCM.

## SAM S Project Templates

The project template system simplifies the creation of new projects with the IDE, it also system makes it easy to create new projects with a text editor or script. All that needs to be specified is the project name, the support packages that the project is dependent on, the target processor and the source files you want to add to the project. For example, create a file called *example.hzp* with the following contents:

```
<!DOCTYPE CrossStudio_Project_File>
<solution Name="Example Solution">
  <project Name="Example Project" template_name="SAM_S_EXE">
    <configuration Name="Common" package_dependencies="SAM_S" Target="ATSAMS70J21" />
    <folder Name="Source Files">
      <file file_name="file1.c" />
      <file file_name="file2.c" />
    </folder>
  </project>
</solution>
```

You can also add any other property settings that the project requires such as preprocessor definitions or include paths using the property save name, for example:

```
<!DOCTYPE CrossStudio_Project_File>
<solution Name="Example Solution">
  <project Name="Example Project" template_name="SAM_S_EXE">
    <configuration Name="Common" package_dependencies="SAM_S" Target="ATSAMS70J21"
      c_preprocessor_definitions="MYDEF1=1;MYDEF2=TWO" c_user_include_directories="$(ProjectDir)/
      include1;$(ProjectDir)/include2" />
    <folder Name="Source Files">
      <file file_name="file1.c" />
      <file file_name="file2.c" />
    </folder>
  </project>
</solution>
```

### Available SAM S project templates

| Template Name | Template Description                |
|---------------|-------------------------------------|
| SAM S_ASM_EXE | SAM S Assembly Code Only Executable |
| SAM S_CTL_EXE | SAM S CTL Executable                |
| SAM S_EXE     | SAM S C/C++ Executable              |
| SAM S_EXT_EXE | SAM S Externally Built Executable   |
| SAM S_LIB     | SAM S Library                       |

# SAM S Devices

This package supports the following SAM S devices:

[ATSAMS70J19](#)  
[ATSAMS70J19B](#)  
[ATSAMS70J20](#)  
[ATSAMS70J20B](#)  
[ATSAMS70J21](#)  
[ATSAMS70J21B](#)  
[ATSAMS70N19](#)  
[ATSAMS70N19B](#)  
[ATSAMS70N20](#)  
[ATSAMS70N20B](#)  
[ATSAMS70N21](#)  
[ATSAMS70N21B](#)  
[ATSAMS70Q19](#)  
[ATSAMS70Q19B](#)  
[ATSAMS70Q20](#)  
[ATSAMS70Q20B](#)  
[ATSAMS70Q21](#)  
[ATSAMS70Q21B](#)

# ATSAMS70J19

## Device Details

|                          |  |
|--------------------------|--|
| CMSIS Header File        | \$(TargetsDir)/SAM_S/CMSIS/sams70a/include/sam.h       |
| CMSIS Include Path       | \$(TargetsDir)/SAM_S/CMSIS/sams70a/include             |
| CMSIS System File        | \$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c      |
| Family                   | SAM S  |
| Loader File              | \$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf          |
| Memory Map File          | \$(TargetsDir)/SAM_S/XML/<br>ATSAMS70J19_MemoryMap.xml |
| Register Definition File | \$(TargetsDir)/SAM_S/XML/<br>ATSAMS70J19_Registers.xml |
| Vectors File             | \$(TargetsDir)/SAM_S/Source/ATSAMS70J19_Vectors.s      |

## Preprocessor Definitions

```
ARM_MATH_CM7
__SAMS70J19__
__SAM_S_FAMILY
```

## Memory Segments

|       |                         |
|-------|-------------------------|
| FLASH | 0x00400000 - 0x0047FFFF |
| RAM   | 0x20400000 - 0x2043FFFF |

## Project Macros

```
DeviceIncludePath=$(TargetsDir)/SAM_S/CMSIS/sams70a/include
DeviceHeaderFile=$(TargetsDir)/SAM_S/CMSIS/sams70a/include/sam.h
DeviceLoaderFile=$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf
DeviceRegisterDefinitionFile=$(TargetsDir)/SAM_S/XML/ATSAMS70J19_Registers.xml
DeviceSystemFile=$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c
DeviceVectorsFile=$(TargetsDir)/SAM_S/Source/ATSAMS70J19_Vectors.s
DeviceFamily=SAM S
```

# ATSAMS70J19B

## Device Details

|                          |   |
|--------------------------|---|
| CMSIS Header File        | \$(TargetsDir)/SAM_S/CMSIS/sams70b/include/sam.h        |
| CMSIS Include Path       | \$(TargetsDir)/SAM_S/CMSIS/sams70b/include              |
| CMSIS System File        | \$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c       |
| Family                   | SAM S   |
| Loader File              | \$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf           |
| Memory Map File          | \$(TargetsDir)/SAM_S/XML/<br>ATSAMS70J19B_MemoryMap.xml |
| Register Definition File | \$(TargetsDir)/SAM_S/XML/<br>ATSAMS70J19B_Registers.xml |
| Vectors File             | \$(TargetsDir)/SAM_S/Source/ATSAMS70J19B_Vectors.s      |

## Preprocessor Definitions

```
ARM_MATH_CM7
__SAMS70J19B__
__SAM_S_FAMILY
```

## Memory Segments

|       |                         |
|-------|-------------------------|
| FLASH | 0x00400000 - 0x0047FFFF |
| RAM   | 0x20400000 - 0x2043FFFF |

## Project Macros

```
DeviceIncludePath=$(TargetsDir)/SAM_S/CMSIS/sams70b/include
DeviceHeaderFile=$(TargetsDir)/SAM_S/CMSIS/sams70b/include/sam.h
DeviceLoaderFile=$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf
DeviceRegisterDefinitionFile=$(TargetsDir)/SAM_S/XML/ATSAMS70J19B_Registers.xml
DeviceSystemFile=$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c
DeviceVectorsFile=$(TargetsDir)/SAM_S/Source/ATSAMS70J19B_Vectors.s
DeviceFamily=SAM S
```

# ATSAMS70J20

## Device Details

|                          |  |
|--------------------------|--|
| CMSIS Header File        | \$(TargetsDir)/SAM_S/CMSIS/sams70a/include/sam.h   |
| CMSIS Include Path       | \$(TargetsDir)/SAM_S/CMSIS/sams70a/include         |
| CMSIS System File        | \$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c  |
| Family                   | SAM S  |
| Loader File              | \$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf      |
| Memory Map File          | \$(TargetsDir)/SAM_S/XML/ATSAMS70J20_MemoryMap.xml |
| Register Definition File | \$(TargetsDir)/SAM_S/XML/ATSAMS70J20_Registers.xml |
| Vectors File             | \$(TargetsDir)/SAM_S/Source/ATSAMS70J20_Vectors.s  |

## Preprocessor Definitions

```
ARM_MATH_CM7
__SAMS70J20__
__SAM_S_FAMILY
```

## Memory Segments

|       |                         |
|-------|-------------------------|
| FLASH | 0x00400000 - 0x004FFFFF |
| RAM   | 0x20400000 - 0x2045FFFF |

## Project Macros

```
DeviceIncludePath=$(TargetsDir)/SAM_S/CMSIS/sams70a/include
DeviceHeaderFile=$(TargetsDir)/SAM_S/CMSIS/sams70a/include/sam.h
DeviceLoaderFile=$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf
DeviceRegisterDefinitionFile=$(TargetsDir)/SAM_S/XML/ATSAMS70J20_Registers.xml
DeviceSystemFile=$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c
DeviceVectorsFile=$(TargetsDir)/SAM_S/Source/ATSAMS70J20_Vectors.s
DeviceFamily=SAM S
```

# ATSAMS70J20B

## Device Details

|                          |   |
|--------------------------|---|
| CMSIS Header File        | \$(TargetsDir)/SAM_S/CMSIS/sams70b/include/sam.h        |
| CMSIS Include Path       | \$(TargetsDir)/SAM_S/CMSIS/sams70b/include              |
| CMSIS System File        | \$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c       |
| Family                   | SAM S   |
| Loader File              | \$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf           |
| Memory Map File          | \$(TargetsDir)/SAM_S/XML/<br>ATSAMS70J20B_MemoryMap.xml |
| Register Definition File | \$(TargetsDir)/SAM_S/XML/<br>ATSAMS70J20B_Registers.xml |
| Vectors File             | \$(TargetsDir)/SAM_S/Source/ATSAMS70J20B_Vectors.s      |

## Preprocessor Definitions

```
ARM_MATH_CM7
__SAMS70J20B__
__SAM_S_FAMILY
```

## Memory Segments

|       |                         |
|-------|-------------------------|
| FLASH | 0x00400000 - 0x004FFFFF |
| RAM   | 0x20400000 - 0x2045FFFF |

## Project Macros

```
DeviceIncludePath=$(TargetsDir)/SAM_S/CMSIS/sams70b/include
DeviceHeaderFile=$(TargetsDir)/SAM_S/CMSIS/sams70b/include/sam.h
DeviceLoaderFile=$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf
DeviceRegisterDefinitionFile=$(TargetsDir)/SAM_S/XML/ATSAMS70J20B_Registers.xml
DeviceSystemFile=$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c
DeviceVectorsFile=$(TargetsDir)/SAM_S/Source/ATSAMS70J20B_Vectors.s
DeviceFamily=SAM S
```



# ATSAMS70J21

## Device Details

|                          |  |
|--------------------------|--|
| CMSIS Header File        | \$(TargetsDir)/SAM_S/CMSIS/sams70a/include/sam.h   |
| CMSIS Include Path       | \$(TargetsDir)/SAM_S/CMSIS/sams70a/include         |
| CMSIS System File        | \$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c  |
| Family                   | SAM S  |
| Loader File              | \$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf      |
| Memory Map File          | \$(TargetsDir)/SAM_S/XML/ATSAMS70J21_MemoryMap.xml |
| Register Definition File | \$(TargetsDir)/SAM_S/XML/ATSAMS70J21_Registers.xml |
| Vectors File             | \$(TargetsDir)/SAM_S/Source/ATSAMS70J21_Vectors.s  |

## Preprocessor Definitions

```
ARM_MATH_CM7
__SAMS70J21__
__SAM_S_FAMILY
```

## Memory Segments

|       |                          |
|-------|--------------------------|
| FLASH | 0x00400000 - 0x005FFFFFF |
| RAM   | 0x20400000 - 0x2045FFFF  |

## Project Macros

```
DeviceIncludePath=$(TargetsDir)/SAM_S/CMSIS/sams70a/include
DeviceHeaderFile=$(TargetsDir)/SAM_S/CMSIS/sams70a/include/sam.h
DeviceLoaderFile=$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf
DeviceRegisterDefinitionFile=$(TargetsDir)/SAM_S/XML/ATSAMS70J21_Registers.xml
DeviceSystemFile=$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c
DeviceVectorsFile=$(TargetsDir)/SAM_S/Source/ATSAMS70J21_Vectors.s
DeviceFamily=SAM S
```

# ATSAMS70J21B

## Device Details

|                          |   |
|--------------------------|---|
| CMSIS Header File        | \$(TargetsDir)/SAM_S/CMSIS/sams70b/include/sam.h        |
| CMSIS Include Path       | \$(TargetsDir)/SAM_S/CMSIS/sams70b/include              |
| CMSIS System File        | \$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c       |
| Family                   | SAM S   |
| Loader File              | \$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf           |
| Memory Map File          | \$(TargetsDir)/SAM_S/XML/<br>ATSAMS70J21B_MemoryMap.xml |
| Register Definition File | \$(TargetsDir)/SAM_S/XML/<br>ATSAMS70J21B_Registers.xml |
| Vectors File             | \$(TargetsDir)/SAM_S/Source/ATSAMS70J21B_Vectors.s      |

## Preprocessor Definitions

```
ARM_MATH_CM7
__SAMS70J21B__
__SAM_S_FAMILY
```

## Memory Segments

|       |                         |
|-------|-------------------------|
| FLASH | 0x00400000 - 0x005FFFFF |
| RAM   | 0x20400000 - 0x2045FFFF |

## Project Macros

```
DeviceIncludePath=$(TargetsDir)/SAM_S/CMSIS/sams70b/include
DeviceHeaderFile=$(TargetsDir)/SAM_S/CMSIS/sams70b/include/sam.h
DeviceLoaderFile=$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf
DeviceRegisterDefinitionFile=$(TargetsDir)/SAM_S/XML/ATSAMS70J21B_Registers.xml
DeviceSystemFile=$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c
DeviceVectorsFile=$(TargetsDir)/SAM_S/Source/ATSAMS70J21B_Vectors.s
DeviceFamily=SAM S
```

# ATSAMS70N19

## Device Details

|                          |  |
|--------------------------|--|
| CMSIS Header File        | \$(TargetsDir)/SAM_S/CMSIS/sams70a/include/sam.h       |
| CMSIS Include Path       | \$(TargetsDir)/SAM_S/CMSIS/sams70a/include             |
| CMSIS System File        | \$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c      |
| Family                   | SAM S  |
| Loader File              | \$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf          |
| Memory Map File          | \$(TargetsDir)/SAM_S/XML/<br>ATSAMS70N19_MemoryMap.xml |
| Register Definition File | \$(TargetsDir)/SAM_S/XML/<br>ATSAMS70N19_Registers.xml |
| Vectors File             | \$(TargetsDir)/SAM_S/Source/ATSAMS70N19_Vectors.s      |

## Preprocessor Definitions

```
ARM_MATH_CM7
__SAMS70N19__
__SAM_S_FAMILY
```

## Memory Segments

|       |                         |
|-------|-------------------------|
| FLASH | 0x00400000 - 0x0047FFFF |
| RAM   | 0x20400000 - 0x2043FFFF |

## Project Macros

```
DeviceIncludePath=$(TargetsDir)/SAM_S/CMSIS/sams70a/include
DeviceHeaderFile=$(TargetsDir)/SAM_S/CMSIS/sams70a/include/sam.h
DeviceLoaderFile=$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf
DeviceRegisterDefinitionFile=$(TargetsDir)/SAM_S/XML/ATSAMS70N19_Registers.xml
DeviceSystemFile=$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c
DeviceVectorsFile=$(TargetsDir)/SAM_S/Source/ATSAMS70N19_Vectors.s
DeviceFamily=SAM S
```

# ATSAMS70N19B

## Device Details

|                          |   |
|--------------------------|---|
| CMSIS Header File        | \$(TargetsDir)/SAM_S/CMSIS/sams70b/include/sam.h        |
| CMSIS Include Path       | \$(TargetsDir)/SAM_S/CMSIS/sams70b/include              |
| CMSIS System File        | \$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c       |
| Family                   | SAM S   |
| Loader File              | \$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf           |
| Memory Map File          | \$(TargetsDir)/SAM_S/XML/<br>ATSAMS70N19B_MemoryMap.xml |
| Register Definition File | \$(TargetsDir)/SAM_S/XML/<br>ATSAMS70N19B_Registers.xml |
| Vectors File             | \$(TargetsDir)/SAM_S/Source/<br>ATSAMS70N19B_Vectors.s  |

## Preprocessor Definitions

```
ARM_MATH_CM7
__SAMS70N19B__
__SAM_S_FAMILY
```

## Memory Segments

|       |                         |
|-------|-------------------------|
| FLASH | 0x00400000 - 0x0047FFFF |
| RAM   | 0x20400000 - 0x2043FFFF |

## Project Macros

```
DeviceIncludePath=$(TargetsDir)/SAM_S/CMSIS/sams70b/include
DeviceHeaderFile=$(TargetsDir)/SAM_S/CMSIS/sams70b/include/sam.h
DeviceLoaderFile=$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf
DeviceRegisterDefinitionFile=$(TargetsDir)/SAM_S/XML/ATSAMS70N19B_Registers.xml
DeviceSystemFile=$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c
DeviceVectorsFile=$(TargetsDir)/SAM_S/Source/ATSAMS70N19B_Vectors.s
DeviceFamily=SAM S
```

# ATSAMS70N20

## Device Details

|                          |  |
|--------------------------|--|
| CMSIS Header File        | \$(TargetsDir)/SAM_S/CMSIS/sams70a/include/sam.h       |
| CMSIS Include Path       | \$(TargetsDir)/SAM_S/CMSIS/sams70a/include             |
| CMSIS System File        | \$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c      |
| Family                   | SAM S  |
| Loader File              | \$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf          |
| Memory Map File          | \$(TargetsDir)/SAM_S/XML/<br>ATSAMS70N20_MemoryMap.xml |
| Register Definition File | \$(TargetsDir)/SAM_S/XML/<br>ATSAMS70N20_Registers.xml |
| Vectors File             | \$(TargetsDir)/SAM_S/Source/ATSAMS70N20_Vectors.s      |

## Preprocessor Definitions

```
ARM_MATH_CM7
__SAMS70N20__
__SAM_S_FAMILY
```

## Memory Segments

|       |                         |
|-------|-------------------------|
| FLASH | 0x00400000 - 0x004FFFFF |
| RAM   | 0x20400000 - 0x2045FFFF |

## Project Macros

```
DeviceIncludePath=$(TargetsDir)/SAM_S/CMSIS/sams70a/include
DeviceHeaderFile=$(TargetsDir)/SAM_S/CMSIS/sams70a/include/sam.h
DeviceLoaderFile=$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf
DeviceRegisterDefinitionFile=$(TargetsDir)/SAM_S/XML/ATSAMS70N20_Registers.xml
DeviceSystemFile=$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c
DeviceVectorsFile=$(TargetsDir)/SAM_S/Source/ATSAMS70N20_Vectors.s
DeviceFamily=SAM S
```

# ATSAMS70N20B

## Device Details

|                          |   |
|--------------------------|---|
| CMSIS Header File        | \$(TargetsDir)/SAM_S/CMSIS/sams70b/include/sam.h        |
| CMSIS Include Path       | \$(TargetsDir)/SAM_S/CMSIS/sams70b/include              |
| CMSIS System File        | \$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c       |
| Family                   | SAM S   |
| Loader File              | \$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf           |
| Memory Map File          | \$(TargetsDir)/SAM_S/XML/<br>ATSAMS70N20B_MemoryMap.xml |
| Register Definition File | \$(TargetsDir)/SAM_S/XML/<br>ATSAMS70N20B_Registers.xml |
| Vectors File             | \$(TargetsDir)/SAM_S/Source/<br>ATSAMS70N20B_Vectors.s  |

## Preprocessor Definitions

```
ARM_MATH_CM7
__SAMS70N20B__
__SAM_S_FAMILY
```

## Memory Segments

|       |                          |
|-------|--------------------------|
| FLASH | 0x00400000 - 0x004FFFFFF |
| RAM   | 0x20400000 - 0x2045FFFF  |

## Project Macros

```
DeviceIncludePath=$(TargetsDir)/SAM_S/CMSIS/sams70b/include
DeviceHeaderFile=$(TargetsDir)/SAM_S/CMSIS/sams70b/include/sam.h
DeviceLoaderFile=$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf
DeviceRegisterDefinitionFile=$(TargetsDir)/SAM_S/XML/ATSAMS70N20B_Registers.xml
DeviceSystemFile=$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c
DeviceVectorsFile=$(TargetsDir)/SAM_S/Source/ATSAMS70N20B_Vectors.s
DeviceFamily=SAM S
```

# ATSAMS70N21

## Device Details

|                          |  |
|--------------------------|--|
| CMSIS Header File        | \$(TargetsDir)/SAM_S/CMSIS/sams70a/include/sam.h       |
| CMSIS Include Path       | \$(TargetsDir)/SAM_S/CMSIS/sams70a/include             |
| CMSIS System File        | \$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c      |
| Family                   | SAM S  |
| Loader File              | \$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf          |
| Memory Map File          | \$(TargetsDir)/SAM_S/XML/<br>ATSAMS70N21_MemoryMap.xml |
| Register Definition File | \$(TargetsDir)/SAM_S/XML/<br>ATSAMS70N21_Registers.xml |
| Vectors File             | \$(TargetsDir)/SAM_S/Source/ATSAMS70N21_Vectors.s      |

## Preprocessor Definitions

```
ARM_MATH_CM7
__SAMS70N21__
__SAM_S_FAMILY
```

## Memory Segments

|       |                         |
|-------|-------------------------|
| FLASH | 0x00400000 - 0x005FFFFF |
| RAM   | 0x20400000 - 0x2045FFFF |

## Project Macros

```
DeviceIncludePath=$(TargetsDir)/SAM_S/CMSIS/sams70a/include
DeviceHeaderFile=$(TargetsDir)/SAM_S/CMSIS/sams70a/include/sam.h
DeviceLoaderFile=$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf
DeviceRegisterDefinitionFile=$(TargetsDir)/SAM_S/XML/ATSAMS70N21_Registers.xml
DeviceSystemFile=$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c
DeviceVectorsFile=$(TargetsDir)/SAM_S/Source/ATSAMS70N21_Vectors.s
DeviceFamily=SAM S
```

# ATSAMS70N21B

| Device Details           |   |
|--------------------------|---|
| CMSIS Header File        | \$(TargetsDir)/SAM_S/CMSIS/sams70b/include/sam.h        |
| CMSIS Include Path       | \$(TargetsDir)/SAM_S/CMSIS/sams70b/include              |
| CMSIS System File        | \$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c       |
| Family                   | SAM S   |
| Loader File              | \$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf           |
| Memory Map File          | \$(TargetsDir)/SAM_S/XML/<br>ATSAMS70N21B_MemoryMap.xml |
| Register Definition File | \$(TargetsDir)/SAM_S/XML/<br>ATSAMS70N21B_Registers.xml |
| Vectors File             | \$(TargetsDir)/SAM_S/Source/<br>ATSAMS70N21B_Vectors.s  |

| Preprocessor Definitions |  |
|--------------------------|--|
| ARM_MATH_CM7             |  |
| __SAMS70N21B__           |  |
| __SAM_S_FAMILY           |  |

| Memory Segments |                          |
|-----------------|--------------------------|
| FLASH           | 0x00400000 - 0x005FFFFFF |
| RAM             | 0x20400000 - 0x2045FFFF  |

| Project Macros               |   |
|------------------------------|---|
| DeviceIncludePath            | \$(TargetsDir)/SAM_S/CMSIS/sams70b/include          |
| DeviceHeaderFile             | \$(TargetsDir)/SAM_S/CMSIS/sams70b/include/sam.h    |
| DeviceLoaderFile             | \$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf       |
| DeviceRegisterDefinitionFile | \$(TargetsDir)/SAM_S/XML/ATSAMS70N21B_Registers.xml |
| DeviceSystemFile             | \$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c   |
| DeviceVectorsFile            | \$(TargetsDir)/SAM_S/Source/ATSAMS70N21B_Vectors.s  |
| DeviceFamily                 | SAM S   |



# ATSAMS70Q19

## Device Details

|                          |  |
|--------------------------|--|
| CMSIS Header File        | \$(TargetsDir)/SAM_S/CMSIS/sams70a/include/sam.h   |
| CMSIS Include Path       | \$(TargetsDir)/SAM_S/CMSIS/sams70a/include         |
| CMSIS System File        | \$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c  |
| Family                   | SAM S  |
| Loader File              | \$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf      |
| Memory Map File          | \$(TargetsDir)/SAM_S/XML/ATSAMS70Q19_MemoryMap.xml |
| Register Definition File | \$(TargetsDir)/SAM_S/XML/ATSAMS70Q19_Registers.xml |
| Vectors File             | \$(TargetsDir)/SAM_S/Source/ATSAMS70Q19_Vectors.s  |

## Preprocessor Definitions

```
ARM_MATH_CM7
__SAMS70Q19__
__SAM_S_FAMILY
```

## Memory Segments

|       |                         |
|-------|-------------------------|
| FLASH | 0x00400000 - 0x0047FFFF |
| RAM   | 0x20400000 - 0x2043FFFF |

## Project Macros

```
DeviceIncludePath=$(TargetsDir)/SAM_S/CMSIS/sams70a/include
DeviceHeaderFile=$(TargetsDir)/SAM_S/CMSIS/sams70a/include/sam.h
DeviceLoaderFile=$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf
DeviceRegisterDefinitionFile=$(TargetsDir)/SAM_S/XML/ATSAMS70Q19_Registers.xml
DeviceSystemFile=$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c
DeviceVectorsFile=$(TargetsDir)/SAM_S/Source/ATSAMS70Q19_Vectors.s
DeviceFamily=SAM S
```

# ATSAMS70Q19B

| Device Details           |   |
|--------------------------|---|
| CMSIS Header File        | \$(TargetsDir)/SAM_S/CMSIS/sams70b/include/sam.h        |
| CMSIS Include Path       | \$(TargetsDir)/SAM_S/CMSIS/sams70b/include              |
| CMSIS System File        | \$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c       |
| Family                   | SAM S   |
| Loader File              | \$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf           |
| Memory Map File          | \$(TargetsDir)/SAM_S/XML/<br>ATSAMS70Q19B_MemoryMap.xml |
| Register Definition File | \$(TargetsDir)/SAM_S/XML/<br>ATSAMS70Q19B_Registers.xml |
| Vectors File             | \$(TargetsDir)/SAM_S/Source/<br>ATSAMS70Q19B_Vectors.s  |

| Preprocessor Definitions |  |
|--------------------------|--|
| ARM_MATH_CM7             |  |
| __SAMS70Q19B__           |  |
| __SAM_S_FAMILY           |  |

| Memory Segments |                         |
|-----------------|-------------------------|
| FLASH           | 0x00400000 - 0x0047FFFF |
| RAM             | 0x20400000 - 0x2043FFFF |

| Project Macros               |   |
|------------------------------|---|
| DeviceIncludePath            | \$(TargetsDir)/SAM_S/CMSIS/sams70b/include          |
| DeviceHeaderFile             | \$(TargetsDir)/SAM_S/CMSIS/sams70b/include/sam.h    |
| DeviceLoaderFile             | \$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf       |
| DeviceRegisterDefinitionFile | \$(TargetsDir)/SAM_S/XML/ATSAMS70Q19B_Registers.xml |
| DeviceSystemFile             | \$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c   |
| DeviceVectorsFile            | \$(TargetsDir)/SAM_S/Source/ATSAMS70Q19B_Vectors.s  |
| DeviceFamily                 | SAM S   |

# ATSAMS70Q20

## Device Details

|                          |  |
|--------------------------|--|
| CMSIS Header File        | \$(TargetsDir)/SAM_S/CMSIS/sams70a/include/sam.h   |
| CMSIS Include Path       | \$(TargetsDir)/SAM_S/CMSIS/sams70a/include         |
| CMSIS System File        | \$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c  |
| Family                   | SAM S  |
| Loader File              | \$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf      |
| Memory Map File          | \$(TargetsDir)/SAM_S/XML/ATSAMS70Q20_MemoryMap.xml |
| Register Definition File | \$(TargetsDir)/SAM_S/XML/ATSAMS70Q20_Registers.xml |
| Vectors File             | \$(TargetsDir)/SAM_S/Source/ATSAMS70Q20_Vectors.s  |

## Preprocessor Definitions

ARM\_MATH\_CM7

\_\_SAMS70Q20\_\_

\_\_SAM\_S\_FAMILY

## Memory Segments

|       |                         |
|-------|-------------------------|
| FLASH | 0x00400000 - 0x004FFFFF |
| RAM   | 0x20400000 - 0x2045FFFF |

## Project Macros

DeviceIncludePath=\$(TargetsDir)/SAM\_S/CMSIS/sams70a/include

DeviceHeaderFile=\$(TargetsDir)/SAM\_S/CMSIS/sams70a/include/sam.h

DeviceLoaderFile=\$(TargetsDir)/SAM\_S/Loader/SAMS70\_Loader.elf

DeviceRegisterDefinitionFile=\$(TargetsDir)/SAM\_S/XML/ATSAMS70Q20\_Registers.xml

DeviceSystemFile=\$(TargetsDir)/SAM\_S/CMSIS/source/system\_SAMS70.c

DeviceVectorsFile=\$(TargetsDir)/SAM\_S/Source/ATSAMS70Q20\_Vectors.s

DeviceFamily=SAM S

# ATSAMS70Q20B

## Device Details

|                          |   |
|--------------------------|---|
| CMSIS Header File        | \$(TargetsDir)/SAM_S/CMSIS/sams70b/include/sam.h        |
| CMSIS Include Path       | \$(TargetsDir)/SAM_S/CMSIS/sams70b/include              |
| CMSIS System File        | \$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c       |
| Family                   | SAM S   |
| Loader File              | \$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf           |
| Memory Map File          | \$(TargetsDir)/SAM_S/XML/<br>ATSAMS70Q20B_MemoryMap.xml |
| Register Definition File | \$(TargetsDir)/SAM_S/XML/<br>ATSAMS70Q20B_Registers.xml |
| Vectors File             | \$(TargetsDir)/SAM_S/Source/<br>ATSAMS70Q20B_Vectors.s  |

## Preprocessor Definitions

```
ARM_MATH_CM7
__SAMS70Q20B__
__SAM_S_FAMILY
```

## Memory Segments

|       |                          |
|-------|--------------------------|
| FLASH | 0x00400000 - 0x004FFFFFF |
| RAM   | 0x20400000 - 0x2045FFFF  |

## Project Macros

```
DeviceIncludePath=$(TargetsDir)/SAM_S/CMSIS/sams70b/include
DeviceHeaderFile=$(TargetsDir)/SAM_S/CMSIS/sams70b/include/sam.h
DeviceLoaderFile=$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf
DeviceRegisterDefinitionFile=$(TargetsDir)/SAM_S/XML/ATSAMS70Q20B_Registers.xml
DeviceSystemFile=$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c
DeviceVectorsFile=$(TargetsDir)/SAM_S/Source/ATSAMS70Q20B_Vectors.s
DeviceFamily=SAM S
```

# ATSAMS70Q21

## Device Details

|                          |  |
|--------------------------|--|
| CMSIS Header File        | \$(TargetsDir)/SAM_S/CMSIS/sams70a/include/sam.h   |
| CMSIS Include Path       | \$(TargetsDir)/SAM_S/CMSIS/sams70a/include         |
| CMSIS System File        | \$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c  |
| Family                   | SAM S  |
| Loader File              | \$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf      |
| Memory Map File          | \$(TargetsDir)/SAM_S/XML/ATSAMS70Q21_MemoryMap.xml |
| Register Definition File | \$(TargetsDir)/SAM_S/XML/ATSAMS70Q21_Registers.xml |
| Vectors File             | \$(TargetsDir)/SAM_S/Source/ATSAMS70Q21_Vectors.s  |

## Preprocessor Definitions

ARM\_MATH\_CM7

\_\_SAMS70Q21\_\_

\_\_SAM\_S\_FAMILY

## Memory Segments

|       |                         |
|-------|-------------------------|
| FLASH | 0x00400000 - 0x005FFFFF |
| RAM   | 0x20400000 - 0x2045FFFF |

## Project Macros

DeviceIncludePath=\$(TargetsDir)/SAM\_S/CMSIS/sams70a/include

DeviceHeaderFile=\$(TargetsDir)/SAM\_S/CMSIS/sams70a/include/sam.h

DeviceLoaderFile=\$(TargetsDir)/SAM\_S/Loader/SAMS70\_Loader.elf

DeviceRegisterDefinitionFile=\$(TargetsDir)/SAM\_S/XML/ATSAMS70Q21\_Registers.xml

DeviceSystemFile=\$(TargetsDir)/SAM\_S/CMSIS/source/system\_SAMS70.c

DeviceVectorsFile=\$(TargetsDir)/SAM\_S/Source/ATSAMS70Q21\_Vectors.s

DeviceFamily=SAM S

# ATSAMS70Q21B

## Device Details

|                          |   |
|--------------------------|---|
| CMSIS Header File        | \$(TargetsDir)/SAM_S/CMSIS/sams70b/include/sam.h        |
| CMSIS Include Path       | \$(TargetsDir)/SAM_S/CMSIS/sams70b/include              |
| CMSIS System File        | \$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c       |
| Family                   | SAM S   |
| Loader File              | \$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf           |
| Memory Map File          | \$(TargetsDir)/SAM_S/XML/<br>ATSAMS70Q21B_MemoryMap.xml |
| Register Definition File | \$(TargetsDir)/SAM_S/XML/<br>ATSAMS70Q21B_Registers.xml |
| Vectors File             | \$(TargetsDir)/SAM_S/Source/<br>ATSAMS70Q21B_Vectors.s  |

## Preprocessor Definitions

```
ARM_MATH_CM7
__SAMS70Q21B__
__SAM_S_FAMILY
```

## Memory Segments

|       |                          |
|-------|--------------------------|
| FLASH | 0x00400000 - 0x005FFFFFF |
| RAM   | 0x20400000 - 0x2045FFFF  |

## Project Macros

```
DeviceIncludePath=$(TargetsDir)/SAM_S/CMSIS/sams70b/include
DeviceHeaderFile=$(TargetsDir)/SAM_S/CMSIS/sams70b/include/sam.h
DeviceLoaderFile=$(TargetsDir)/SAM_S/Loader/SAMS70_Loader.elf
DeviceRegisterDefinitionFile=$(TargetsDir)/SAM_S/XML/ATSAMS70Q21B_Registers.xml
DeviceSystemFile=$(TargetsDir)/SAM_S/CMSIS/source/system_SAMS70.c
DeviceVectorsFile=$(TargetsDir)/SAM_S/Source/ATSAMS70Q21B_Vectors.s
DeviceFamily=SAM S
```

# Troubleshooting

## On-Chip RC Oscillator

If your program doesn't start up and you are using a board without an external oscillator, set the **Build Options > Use On-Chip RC Oscillator** project property to **Yes**.

## TCM

Code and data can be placed in TCM memory either by setting the **Section Placement** project property to one of the TCM configurations or by placing code/data in the TCM program sections (.bss\_tcm, .data\_tcm, .rodata\_tcm and .text\_tcm).

For this to work, the device must also be configured to enable TCM memory by setting the **Build Options > TCM Configuration** project property. Failure to do this will result in ITCM/DTCM memory segment overflow errors from the linker.