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Texas Instruments™

Technical Specifications

This document contains technical information on the Texas Instruments™ microprocessor variants, feature and limitations supported by Proteus. For information on what is included in a particular Proteus product please click the link in the table of contents below

Contents

Proteus Platinum Edition

Summary

Proteus Platinum is the ultimate Proteus product and contains all of the product modules that we sell. This includes:

- All of our PCB Design features - top of the range PCB module.
- High Speed design and differential pairs support
- Shape based Autorouter
- Built-in access to millions of ready-made library parts and footprints.
- ProSPICE professional simulation engine
- All of our Proteus VSM microcotroller families (over 750 processor models).
- All of our Visual Designer and IoT Builder product modules.

PCB Features

PCB Design in Proteus Platinum has unlimited design capacity and includes all available PCB features.

- True Hierarchical Schematic Design.
- Fully Customisable Bill of Materials Reporting Module.
- Interactive Design Explorer with Cross Probing.
- Support for product Assembly Variants.
- Dedicated Reporting Module (Project Notes).
- Formal Design Re-use with Project Clips/Design Snippets.
- Integrated Library Part Import Tools.
- 3D Board Visualisation.
- Gerber X2, ODB++, IDF, PDF, STEP and IGES Output Formats.
- Adaptive Shape Based Autorouter in scriptable or interactive mode.

- Hardware Accelerated Display with Layer Transparency.
- Comprehensive Design Rule Configuration.
- Design Rule Aware Interactive Routing.
- Adaptive Shape Based Autorouter.
- Automatic Power Plane Generation.
- Differential Pair Routing Support
- Gerber Export.
- Automatic Length Matching / Net tuning of routes.
- Multiple Power Planes per Layer (e.g. an Analog Ground and Digital Ground).
- User drawn Power Planes of specific dimensions.
- Dynamic Teardrops.

VSM Families

The Platinum Version includes all the microcontroller variants that we support, across every family, architecture and silicon vendor. This includes :

- Proteus VSM for Microchip Technologies™ PIC10, 12, 16, 18, 24 and dsPIC33.

- Proteus VSM for Atmel® AVR® and Arduino™ AVR®.

- Proteus VSM for Texas Instruments™ MSP430® and PICCOLO®.

- Proteus VSM for NXP 8051 variants.

- Proteus VSM for all ARM® LPC2000, ARM® Cortex™-M0, ARM® Cortex™-M3 and Cortex™-M4 variants.

Other Modules

In addition to the unlimited PCB Layout and VSM Simulation software the Platinum Version also includes all of our supporting modules as standard, including:

- Visual Designer for Arduino™ AVR®.

- Visual Designer for Raspberry Pi®.

- Proteus IoT Builder.

- Advanced Simulation Features.

- USB Simulation Support.

- All Embedded Peripherals Libraries.

Proteus Enterprise Edition

Summary

Proteus Enterprise Version contains everything you need for professional PCB product design. It supports the complete product design lifecycle from schematic capture to simulation test/debug to PCB Layout and export for manufacture.

- Professional Schematic Capture module
- Unlimited Professional PCB Layout module
- High Speed design and differential pairs support
- Shape based Autorouter
- Built-in access to millions of ready-made library parts and footprints.
- ProSPICE professional simulation engine
- All Proteus VSM microcontroller families (over 750 processor models).

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PCB Features

PCB Design in the Enterprise Version has unlimited design capacity and includes all available PCB features.

- True Hierarchical Schematic Design.
- Fully Customisable Bill of Materials Reporting Module.
- Interactive Design Explorer with Cross Probing.
- Support for product Assembly Variants.
- Dedicated Reporting Module (Project Notes).
- Formal Design Re-use with Project Clips/Design Snippets.
- Integrated Library Part Import Tools.
- 3D Board Visualisation.
- Gerber X2, ODB++, IDF, PDF, STEP and IGES Output Formats.
- Adaptive Shape Based Autorouter in scriptable or interactive mode.
- Hardware Accelerated Display with Layer Transparency.
- Comprehensive Design Rule Configuration.
- Design Rule Aware Interactive Routing.
- Adaptive Shape Based Autorouter.
- Automatic Power Plane Generation.
- Differential Pair Routing Support
- Gerber Export.
- Automatic Length Matching / Net tuning of routes.
- Multiple Power Planes per Layer (e.g. an Analog Ground and Digital Ground).
- User drawn Power Planes of specific dimensions.
- Dynamic Teardrops.

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VSM Families

The Enterprise Version includes all the microcontroller variants that we support, across every family, architecture and silicon vendor. This includes :

- Proteus VSM for Microchip Technologies™ PIC10, 12, 16, 18, 24 and dsPIC33.

- Proteus VSM for Atmel® AVR® and Arduino™ AVR®.

- Proteus VSM for Texas Instruments™ MSP430® and PICCOLO®.

- Proteus VSM for NXP 8051 variants.

- Proteus VSM for all ARM® LPC2000, ARM® Cortex™-M0, ARM® Cortex™-M3 and Cortex™-M4 variants.

Other Modules

In addition to the unlimited PCB Layout and VSM Simulation software the Enterprise Version also includes the following supporting modules:

- Advanced Simulation Features.

- USB Simulation Support.

- All Embedded Peripherals Libraries.

Proteus VSM for MSP430

Summary

Proteus Virtual System Modelling (VSM) combines mixed mode SPICE circuit simulation, animated components and microprocessor models to facilitate co-simulation of complete microcontroller based designs.The 'Proteus VSM for MSP430' product includes the following main software modules:

- Professional Schematic Capture module

- ProSPICE professional Simulation Engine

- All supported VSM microcotroller variants in the MSP430® Family.

- All of the Proteus Embedded Simulation Peripheral Libraries.

- VSM Studio IDE with automatic compiler configuration.

- Over 10,000 standard simulation models.

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Variants

The following is a current list of supported variants in the MSP430® family:

- MSP430C1101, MSP430C1111, MSP430C1121, MSP430F233
- MSP430F235, MSP430F247, MSP430F248, MSP430F249
- MSP430F1101, MSP430F1111, MSP430F1121, MSP430F2001
- MSP430F2011, MSP430F2101, MSP430F2111, MSP430F2112
- MSP430F2121, MSP430F2122, MSP430F2131, MSP430F2132
- MSP430F2232, MSP430F2252, MSP430F2272, MSP430F2330
- MSP430F2350, MSP430F2370, MSP430F2410, MSP430F2416
- MSP430F2417, MSP430F2418, MSP430F2419, MSP430F2471
- MSP430F2481, MSP430F2491, MSP430G2001, MSP430G2101
- MSP430G2102, MSP430G2111, MSP430G2112, MSP430G2121
- MSP430G2131, MSP430G2132, MSP430G2152, MSP430G2153

- MSP430G2201, MSP430G2202, MSP430G2203, MSP430G2210
- MSP430G2211, MSP430G2212, MSP430G2213, MSP430G2221
- MSP430G2230, MSP430G2231, MSP430G2232, MSP430G2233
- MSP430G2252, MSP430G2253, MSP430G2302, MSP430G2303
- MSP430G2312, MSP430G2313, MSP430G2332, MSP430G2333
- MSP430G2352. MSP430G2353, MSP430G2402, MSP430G2403
- MSP430G2412, MSP430G2413, MSP430G2432, MSP430G2433
- MSP430G2444, MSP430G2452, MSP430G2453, MSP430G2513
- MSP430G2533, MSP430G2544, MSP430G2553, MSP430G2744
- MSP430G2755, MSP430G2855, MSP430G2955

Features

We believe our simulation models are the most accurate and the most complete on the market today. A summary of model capabilities is listed below:

- The entire instruction set.
- Supports all port and other I/O pin operations.
- Supports all counter/timers including seperate prescalers, capture compare and PWM modes.
- Supports watchdog timer.
- Supports serial U(S)ART.
- Supports Analogue-to-Digital Conversion (ADC) and analogue comparator modules in all modes.
- Supports all internal and external interrupt modes.
- Supports internal and external code, data and EEPROM memory inc. code protection and data persistence.
- Internally generated processor clock for performance. Event timing accurate to one clock period.
- Allows disassembly of code when no or limited debug information available.
- Provides internal consistency checks on code (e.g. execution of invalid op-codes, illegal memory accesses, stack overflow checking, etc.).
- Fully integrated in to the VSM source level debugging system.
- Fully integrated into the Proteus Diagnostic Control System.

Limitations

The following is a listing of known limitations in the current version of the MSP430®:

x No significant functional limitations.

Compilers

Supported Third Party Compilers

Proteus VSM models will fundamentally work with the exact same HEX file as you would program the physical device with. However, far more debugging information is available when using a compiler to write the firmware and providing these object files to Proteus in place of the HEX file provides a much richer working environment.

We recommend you use the free Labcenter VSM Studio IDE. This will greatly simplify the task as it will automatically configure supported compilers to work with a Proteus VSM simulation.

If you prefer to work inside your own IDE then you will need to set your compiler options manually. After compiling for debug, all you need to do is specify the debug file from the compiler as the program property of the microcontroller on the schematic.

VSM Studio supported toolchains

- Code Composer
- GCC

Proteus VSM for PICCOLO

Summary

Proteus Virtual System Modelling (VSM) combines mixed mode SPICE circuit simulation, animated components and microprocessor models to facilitate co-simulation of complete microcontroller based designs.The 'Proteus VSM for PICCOLO®' product includes the following main software modules:

- Professional Schematic Capture module
- ProSPICE professional Simulation Engine
- All supported VSM microcotroller variants in the PICCOLO® Family.

- All of the Proteus Embedded Simulation Peripheral Libraries.
- VSM Studio IDE with automatic compiler configuration.
- Over 10,000 standard simulation models.

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Variants

The following is a current list of supported variants in the PICCOLO® family:

- TMS320F280200, TMS320F28020, TMS320F28021
- TMS320F28022,TMS320F28023, TMS320F28026
- TMS320F28027

Features

We believe our simulation models are the most accurate and the most complete on the market today. A summary of model capabilities is listed below:

- Fully simulates the entire instruction set.
- Supports all port and other I/O pin operations.
- Supports all timers including watchdog timer.
- Supports both Enhanced and High-Resolution Pulse Width Modulator (EPWM and HRPWM) modules in all modes.
- Supports communication interfaces: I2C, SCI and SPI modules.
- Supports Analogue-to-Digital Conversion (ADC) module including support for voltage reference pins and internal temperature sensor.
- Supports Enhanced Capture (ECAP) module.
- Supports Analogue Comparator modules including support for internal and external voltage references.
- Supports all interrupt and power-safe modes.
- Internally generated processor clock for performance. Event timing accurate to one clock period.
- Provides internal consistency checks on code (e.g. execution of invalid op-codes and illegal memory accesses)
- Fully integrated in to the VSM source level debugging system.
- Fully integrated into the Proteus Diagnostic Control System.

Limitations

The following is a listing of known limitations in the current version of the PICCOLO®:

x The Device_cal() routine is programmed into TI reserved memory by the factory. It is used to calibrate the internal oscillators and ADC with device specific calibration data. In the model the procedure contains a single instruction - Return from Routine

x The nominal frequency of both INTOSC1 and INTOSC2 is 10 MHz. Two 16-bit registers are provided for trimming each oscillator at manufacturing time (called coarse trim) and also provide you with a way to trim the oscillator using software (called fine trim).This is not implemented in the model.

x It is possible for the clock source (internal or external) of the DSP to fail. When the PLL is not disabled, the main oscillator fail logic allows the device to detect this condition. This behaviour is not implemented in the model.

x There are two CPU-Timer emulation modes in the hardware device.CPU-Timer Emulation Modes: These bits are special emulation bits that determine the state of the timer when a breakpoint is encountered in the high-level language debugger. These bits are not modelled.

x SPI Emulation mode is not modelled. This means that SPIPRI register behaviour is not implemented and that SPIRXEMU Register is not used (SPIRXBUF is used for normal operation and fully supported in the model)

x Digital loopback bit (I2CMDR.DLB) of the I2C model and the ECAP Emulation control bits are not supported by the model. All other I2C modes are fully modelled.

x MEP calibration logic (MRPWR.MEPOFF) is initially disabled in the hrPWM module.

x Code Security is not implemented.

Compilers

Supported Third Party Compilers

Proteus VSM models will fundamentally work with the exact same HEX file as you would program the physical device with. However, far more debugging information is available when using a compiler to write the firmware and providing these object files to Proteus in place of the HEX file provides a much richer working environment.

We recommend you use the free Labcenter VSM Studio IDE. This will greatly simplify the task as it will automatically configure supported compilers to work with a Proteus VSM simulation.

If you prefer to work inside your own IDE then you will need to set your compiler options manually. After compiling for debug, all you need to do is specify the debug file from the compiler as the program property of the microcontroller on the schematic.

VSM Studio supported toolchains

- Code Composer

Proteus VSM for ARM Cortex-M3

Summary

Proteus Virtual System Modelling (VSM) combines mixed mode SPICE circuit simulation, animated components and microprocessor models to facilitate co-simulation of complete microcontroller based designs.The 'Proteus VSM for ARM® Cortex™-M3' product includes the following main software modules:

- Professional Schematic Capture module
- ProSPICE professional Simulation Engine
- All supported VSM microcotroller variants in the ARM® Cortex™-M3 Family.

- All of the Proteus Embedded Simulation Peripheral Libraries.
- VSM Studio IDE with automatic compiler configuration.
- Over 10,000 standard simulation models.

⚠ *Proteus VSM for ARM Bundle products are ideal if you need to simulate more than one family of ARM micro-controllers.*

Variants

The following is a current list of supported variants in the ARM® Cortex™-M3 family:

- STM32F103C4, STM32F103R4, STM32F103T4, STM32F103C6
- LM3S300, LM3S301, LM3S308, LM3S310
- LM3S315, LM3S316, LM3S317, LM3S328
- ATSAM3N00A, ATSAM3N00B, ATSAM3N0A, ATSAM3N0B
- ATSAM3N0C, ATSAM3N1A, ATSAM3N1B, ATSAM3N1C
- ATSAM3N2A, ATSAM3N2B, ATSAM3N2C, ATSAM3N4A

- STM32F103R6, STM32F103T6, ATSAM3N4B, ATSAM3N4C
- LPC1311FHN33, LPC1313FHN33, LPC1313FBD48
- LPC1342FHN33, LPC1311FHN33, LPC1313FHN33
- LPC1313FBD48, LPC1342FHN33, LPC1342FBD48
- LPC1343FHN33, LPC1343FBD48

Features

We believe our simulation models are the most accurate and the most complete on the market today. A summary of model capabilities is listed below:

- Fully simulates the entire instruction set (excluding operations for multiprocessor support).
- Supports all port and other I/O pin operations.
- Supports sleep and deep sleep modes.
- Supports Watchdog Timer.
- Supports General Purpose Timers in all modes.
- Supports Universal Asynchronous Receiver/Transmitter (UART) with FIFO mode.
- Supports Synchronous Serial Interface (SSI) with following frame types: Freescale, MICROWIRE, or Texas Instruments.
- Supports Inter-Integrated Circuit (I2C) in all modes on appropriate devices.
- Supports Analog Comparators in all configurations of signal sources.
- Supports Analog-to-digital 10-bit converter (ADC) with several input channels plus internal temperature sensor.
- Supports internal code and data FLASH memory including Cortex-M3 memory region protection.
- Supports all interrupt modes.
- Internally generated processor clock for performance. Event timing accurate to one clock period.
- Provides internal consistency checks on code (e.g. execution of invalid op-codes, illegal memory accesses, stack integrity checking, etc.).
- Fully integrated in to the VSM source level debugging system.
- Fully integrated into the Proteus Diagnostic Control System.

Limitations

The following is a listing of known limitations in the current version of the ARM® Cortex™-M3:

x Bitband alias regions are of type XN (Execute Never).

x Cache information is not used.

x Systick calibration value register (SYST_CALIB) is ignored.

x Data Barrier instructions (DMB,DSB) are treated as NOP.

x Register PLLCFG is not modelled.

x Clock Verification Timers and Internal brown-out detector not modelled.

x Registers DR2R,DR4R,DR8R,SLR are not modelled.

x Loopback feature of the I2C Module is not documented and therefore not modelled.

Compilers

Supported Third Party Compilers

Proteus VSM models will fundamentally work with the exact same HEX file as you would program the physical device with. However, far more debugging information is available when using a compiler to write the firmware and providing these object files to Proteus in place of the HEX file provides a much richer working environment.

We recommend you use the free Labcenter VSM Studio IDE. This will greatly simplify the task as it will automatically configure supported compilers to work with a Proteus VSM simulation.

If you prefer to work inside your own IDE then you will need to set your compiler options manually. After compiling for debug, all you need to do is specify the debug file from the compiler as the program property of the microcontroller on the schematic.

VSM Studio supported toolchains

- IAR
- GCC
- KEIL

Proteus VSM for ARM Bundle

Summary

Proteus Virtual System Modelling (VSM) combines mixed mode SPICE circuit simulation, animated components and microprocessor models to facilitate co-simulation of complete microcontroller based designs.The Proteus VSM Bundles include the following main software modules:

- Professional Schematic Capture module

- ProSPICE professional Simulation Engine

- All supported VSM microcotroller variants in the ARM Families.

- All of the Proteus Embedded Simulation Peripheral Libraries.

- VSM Studio IDE with automatic compiler configuration.

- Over 10,000 standard simulation models.

⚠ *Proteus VSM for ARM® Bundle products are ideal if you need to simulate more than one family of ARM micro-controllers.*

Variants

The following is a current list of supported variants in the ARM7 family:

- LPC2104, LPC2105, LPC2106.
- LPC2114, LPC2124
- LPC2131, LPC2132, LPC2134, LPC2136, LPC2138.
- LPC2101, LPC2102, LPC2103.
- ARM7TDMI and ARM7TDMI-S core models.

The following is a current list of supported variants in the ARM® Cortex™-M3 family:

- STM32F103C4, STM32F103R4, STM32F103T4, STM32F103C6
- STM32F103R6, STM32F103T6, ATSAM3N4B, ATSAM3N4C
- LM3S300, LM3S301, LM3S308, LM3S310
- LPC1311FHN33, LPC1313FHN33, LPC1313FBD48
- LM3S315, LM3S316, LM3S317, LM3S328
- LPC1342FHN33, LPC1311FHN33, LPC1313FHN33
- ATSAM3N00A, ATSAM3N00B, ATSAM3N0A, ATSAM3N0B
- LPC1313FBD48, LPC1342FHN33, LPC1342FBD48
- ATSAM3N0C, ATSAM3N1A, ATSAM3N1B, ATSAM3N1C
- LPC1343FHN33, LPC1343FBD48
- ATSAM3N2A, ATSAM3N2B, ATSAM3N2C, ATSAM3N4A

The following is a current list of supported variants in the ARM® Cortex™-M0/M0+ family:

- LPC1110FD20, LPC1111FDH20/002
- LPC1111FHN33/101, LPC1111FHN33/102
- LPC1111FHN33/103, LPC1111FHN33/201
- LPC1111FHN33/202, LPC1111FHN33/203
- LPC1112FD20/102, LPC1112FDH20/102
- LPC1112FDH28/102, LPC1112FHN24/202
- LPC1112FHN33/101, LPC1112FHN33/102
- LPC1112FHN33/103, LPC1112FHN33/201
- LPC1112FHN33/202, LPC1112FHN33/203
- LPC1113FBD48/301, LPC1113FBD48/302
- LPC1113FBD48/303, LPC1113FHN33/201
- LPC1113FHN33/202, LPC1113FHN33/203
- LPC1113FHN33/301, LPC1113FHN33/302
- LPC1113FHN33/303, LPC1114FBD48/301

- LPC1114FBD48/302, LPC1114FBD48/303
- LPC1114FBD48/323, LPC1114FBD48/333
- LPC1114FDH28/102, LPC1114FHN33/201
- LPC1114FHN33/202, LPC1114FHN33/203
- LPC1114FHN33/301, LPC1114FHN33/302
- LPC1114FHN33/303, LPC1114FHN33/333
- LPC1114FN28/102, LPC1115FBD48/303
- LPC1115FET48/303, ATSAMD21E15A
- ATSAMD21E16A, ATSAMD21E17A
- ATSAMD21E18A, ATSAMD21G15A
- ATSAMD21G16A, ATSAMD21G17A
- ATSAMD21G18A, ATSAMD21J15A
- ATSAMD21J16A, ATSAMD21J17A
- ATSAMD21J18A

The following is a current list of supported variants in the ARM® Cortex™-M4 family:

- STM32F401CB, STM32F401CC, STM32F401CD, STM32F401CE
- STM32F401VB, STM32F401VC, STM32F401VD, STM32F401VE

- STM32F401RB, STM32F401RC, STM32F401RD, STM32F401RE

Features

Please see individual product families for features and information on model details.

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Limitations

Please see individual product families for information on model limitations of variants in that family.

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Compilers

Supported Third Party Compilers

Proteus VSM models will fundamentally work with the exact same HEX file as you would program the physical device with. However, far more debugging information is available when using a compiler to write the firmware and providing these object files to Proteus in place of the HEX file provides a much richer working environment.

We recommend you use the free Labcenter VSM Studio IDE. This will greatly simplify the task as it will automatically configure supported compilers to work with a Proteus VSM simulation.

If you prefer to work inside your own IDE then you will need to set your compiler options manually. After compiling for debug, all you need to do is specify the debug file from the compiler as the program property of the microcontroller on the schematic.

VSM Studio supported toolchains

- IAR
- GCC
- Keil