



Imperas Peripheral Model Guide

Model Specific Information for arm.ovpworld.org / VexpressSysRegs

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Model Release Status

This model is released as part of OVP releases and is included in OVPworld packages. Please visit OVPworld.org.

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1.0 Model Specific Information

This document provides usage information for an Imperas OVP peripheral behavioral model.

The document is split into sections providing specific information for this peripheral, including any ports for connecting into a platform, registers, other component parts, and configuration options and general information for peripheral modeling with Imperas OVP.

1.1 Description

ARM Versatile Express System Registers

1.2 Limitations

Only select registers are modeled. See user.c for details.

1.3 Reference

ARM Motherboard Express ATX V2M-P1 Technical Reference Manual(ARM DUI 0447G), Section 4.3 Register Summary

1.4 Licensing

Open Source Apache 2.0

1.5 Location

The VexpressSysRegs peripheral model is located in an Imperas/OVP installation at the VLNV: arm.ovpworld.org / peripheral / VexpressSysRegs / 1.0.

2.0 Peripheral Instance Parameters

This model accepts the following parameters:

Table 1. Peripheral Parameters

Name	Type	Description
SYS_PROCID0	uns32	Specify value returned when SYS_PROCID0 register is read (default=0x0c000191)

3.0 Net Ports

This model has the following net ports:

Table 2. Net Ports

Name	Type	Must Be Connected	Description
cardin	input	F (False)	
wprot	input	F (False)	

4.0 Bus Slave Ports

This model has the following bus slave ports:

4.1 Bus Slave Port: *bport1*

Table 3. Bus Slave Port: *bport1*

Name	Size (bytes)	Must Be Connected	Description
bport1	0x1000	F (False)	

Table 4. Bus Slave Port: *bport1* Registers:

Name	Offset	Width (bits)	Description	R/W	is Volatile
ab_ID	0x0	32	System Identifier		
ab_SW	0x4	32	Soft user switches		
ab_LED	0x8	32	User LEDs		
ab_CNT100HZ	0x24	32	100Hz counter		
ab_FLAGSSET	0x30	32	Flag Set Register		
ab_FLAGSCLR	0x34	32	Flag Clear Register		
ab_NVFLAGSSET	0x38	32	NV Flag Set Registers		
ab_NVFLAGSCLR	0x3c	32	NV Flag Clear Registers		
ab_MCI	0x48	32	MCI status and control register		
ab_FLASH	0x4c	32	Flash write protection		
ab_CFGSW	0x58	32	Soft configuration switches		
ab_CNT24MHZ	0x5c	32	32-bit counter clocked at 24MHz		
ab_MISC	0x60	32	Miscellaneous control flags		
ab_DMA	0x64	32	DMA Channel Selection Register		
ab_PROCID0	0x84	32			
ab_PROCID1	0x88	32			
ab_CFGDATA	0xa0	32	System Configuration register		
ab_CFGCTRL	0xa4	32	Configuration Control Register		
ab_CFGSTAT	0xa8	32	Configuration Status Register		

5.0 Platforms that use this peripheral component

Peripheral components can be used in many different platforms, including those developed by Imperas or by other users of OVP. You can use this peripheral in your own platforms.

Table 5. Publicly available platforms using peripheral 'VexpressSysRegs'

Platform Name	Vendor
ArmVersatileExpress	arm.ovpworld.org
ArmVersatileExpress-CA15	arm.ovpworld.org
ArmVersatileExpress-CA9	arm.ovpworld.org
ARMv8-A-FMv1	arm.ovpworld.org
ArmVersatileExpress	arm.ovpworld.org
ArmVersatileExpress-CA15	arm.ovpworld.org
ArmVersatileExpress-CA9	arm.ovpworld.org

This peripheral is used in some internal Imperas virtual platforms. Please contact Imperas for more information.

6.0 Peripheral components in the library

Table 6. Publicly available Imperas/OVP peripheral models (227 models)

Peripheral	Peripheral	Peripheral
arm.ovpworld.org/WdtSP805	atmel.ovpworld.org/AdvancedInterruptController	atmel.ovpworld.org/ParallelIOController
atmel.ovpworld.org/PowerSaving	atmel.ovpworld.org/SpecialFunction	atmel.ovpworld.org/TimerCounter
atmel.ovpworld.org/UsartInterface	atmel.ovpworld.org/WatchdogTimer	cadence.ovpworld.org/gem
cadence.ovpworld.org/uart	cirrus.ovpworld.org/GD5446	freescale.ovpworld.org/KinetisADC
freescale.ovpworld.org/KinetisAIPS	freescale.ovpworld.org/KinetisAXBBS	freescale.ovpworld.org/KinetisCAN
freescale.ovpworld.org/KinetisCMP	freescale.ovpworld.org/KinetisCMT	freescale.ovpworld.org/KinetisCRC
freescale.ovpworld.org/KinetisDAC	freescale.ovpworld.org/KinetisDDR	freescale.ovpworld.org/KinetisDMA
freescale.ovpworld.org/KinetisDMAC	freescale.ovpworld.org/KinetisDMAMUX	freescale.ovpworld.org/KinetisENET
freescale.ovpworld.org/KinetisEWM	freescale.ovpworld.org/KinetisFB	freescale.ovpworld.org/KinetisFMC
freescale.ovpworld.org/KinetisFTFE	freescale.ovpworld.org/KinetisFTM	freescale.ovpworld.org/KinetisGPIO
freescale.ovpworld.org/KinetisI2C	freescale.ovpworld.org/KinetisI2S	freescale.ovpworld.org/KinetisLLWU
freescale.ovpworld.org/KinetisLPTMR	freescale.ovpworld.org/KinetisMCG	freescale.ovpworld.org/KinetisMPU
freescale.ovpworld.org/KinetisNFC	freescale.ovpworld.org/KinetisOSC	freescale.ovpworld.org/KinetisPDB
freescale.ovpworld.org/KinetisPIT	freescale.ovpworld.org/KinetisPMC	freescale.ovpworld.org/KinetisPORT
freescale.ovpworld.org/KinetisRCM	freescale.ovpworld.org/KinetisRFSYS	freescale.ovpworld.org/KinetisRFVBAT
freescale.ovpworld.org/KinetisRNG	freescale.ovpworld.org/KinetisRTC	freescale.ovpworld.org/KinetisSDHC
freescale.ovpworld.org/KinetisSIM	freescale.ovpworld.org/KinetisSMC	freescale.ovpworld.org/KinetisSPI
freescale.ovpworld.org/KinetisTSI	freescale.ovpworld.org/KinetisUART	freescale.ovpworld.org/KinetisUSB
freescale.ovpworld.org/KinetisUSBDCD	freescale.ovpworld.org/KinetisUSBHS	freescale.ovpworld.org/KinetisVREF
freescale.ovpworld.org/KinetisWDOG	freescale.ovpworld.org/Uart	freescale.ovpworld.org/VybridADC
freescale.ovpworld.org/VybridANADIG	freescale.ovpworld.org/VybridCCM	freescale.ovpworld.org/VybridDMA
freescale.ovpworld.org/VybridGPIO	freescale.ovpworld.org/VybridI2C	freescale.ovpworld.org/VybridLCD
freescale.ovpworld.org/VybridQUADSPI	freescale.ovpworld.org/VybridSDHC	freescale.ovpworld.org/VybridSPI
freescale.ovpworld.org/VybridUART	freescale.ovpworld.org/VybridUSB	imperas.ovpworld.org/frameBuffer
imperas.ovpworld.org/uart	imperas.ovpworld.org/usecCounter	intel.ovpworld.org/82077AA
intel.ovpworld.org/82371EB	intel.ovpworld.org/8253	intel.ovpworld.org/8259A
intel.ovpworld.org/NorFlash48F4400	intel.ovpworld.org/PciIDE	intel.ovpworld.org/PciPM
intel.ovpworld.org/PciUSB	intel.ovpworld.org/Ps2Control	marvell.ovpworld.org/GT6412x
maxim.ovpworld.org/max673x	microsemi.ovpworld.org/CoreUARTapb	mips.ovpworld.org/16450C
mips.ovpworld.org/MaltaFPGA	mips.ovpworld.org/SmartLoaderLinux	motorola.ovpworld.org/MC146818
national.ovpworld.org/16450	national.ovpworld.org/16550	national.ovpworld.org/16550_4bytes
nxp.ovpworld.org/iMX6_Analog	nxp.ovpworld.org/iMX6_CCM	nxp.ovpworld.org/iMX6_GPC
nxp.ovpworld.org/iMX6_GPIO	nxp.ovpworld.org/iMX6_GPT	nxp.ovpworld.org/iMX6_MMDC
nxp.ovpworld.org/iMX6_SDHC	nxp.ovpworld.org/iMX6_SRC	nxp.ovpworld.org/iMX6_UART
nxp.ovpworld.org/iMX6_WDOG	ovpworld.org/Alpha2x16Display	ovpworld.org/DynamicBridge
ovpworld.org/FlashDevice	ovpworld.org/ledRegister	ovpworld.org/SerInt
ovpworld.org/SimpleDma	ovpworld.org/switchRegister	ovpworld.org/temperatureSensor
ovpworld.org/trap	ovpworld.org/trap4K	ovpworld.org/vEthernet_Bridge
ovpworld.org/VirtioBlkMMIO	ovpworld.org/VirtioNetMMIO	philips.ovpworld.org/ISP1761
renesas.ovpworld.org/adc	renesas.ovpworld.org/bcu	renesas.ovpworld.org/brg
renesas.ovpworld.org/can	renesas.ovpworld.org/can	renesas.ovpworld.org/clkgen
renesas.ovpworld.org/crc	renesas.ovpworld.org/csib	renesas.ovpworld.org/csie

renesas.ovpworld.org/dma	renesas.ovpworld.org/intc	renesas.ovpworld.org/memc
renesas.ovpworld.org/rng	renesas.ovpworld.org/taa	renesas.ovpworld.org/tms
renesas.ovpworld.org/tmt	renesas.ovpworld.org/uartc	renesas.ovpworld.org/UPD70F3441Logic
riscv.ovpworld.org/CLINT	riscv.ovpworld.org/PLIC	riscv.ovpworld.org/SmartLoaderRV64Linux
safepower.ovpworld.org/node	safepower.ovpworld.org/NostrumNode	safepower.ovpworld.org/ring_oscillator
safepower.ovpworld.org/TTELNode	sifive.ovpworld.org/artyIO	sifive.ovpworld.org/DDRCTL
sifive.ovpworld.org/gpio	sifive.ovpworld.org/MSEL	sifive.ovpworld.org/PLIC
sifive.ovpworld.org/PRCI	sifive.ovpworld.org/pwm	sifive.ovpworld.org/spi
sifive.ovpworld.org/teststatus	sifive.ovpworld.org/UART	smc.ovpworld.org/LAN9118
smc.ovpworld.org/LAN91C111	ti.ovpworld.org/tca6416a	ti.ovpworld.org/UartInterface
ti.ovpworld.org/ucd9012a	ti.ovpworld.org/ucd9248	vendor.com/fifo
xilinx.ovpworld.org/axi-gpio	xilinx.ovpworld.org/axi-intc	xilinx.ovpworld.org/axi-pcie
xilinx.ovpworld.org/axi-timer	xilinx.ovpworld.org/logicore-fit	xilinx.ovpworld.org/mdm
xilinx.ovpworld.org/mpmc	xilinx.ovpworld.org/xps-gpio	xilinx.ovpworld.org/xps-iic
xilinx.ovpworld.org/xps-intc	xilinx.ovpworld.org/xps-ll-temac	xilinx.ovpworld.org/xps-mch-emc
xilinx.ovpworld.org/xps-sysace	xilinx.ovpworld.org/xps-timer	xilinx.ovpworld.org/xps-uartlite
xilinx.ovpworld.org/zynq_7000-can	xilinx.ovpworld.org/zynq_7000-ddrc	xilinx.ovpworld.org/zynq_7000-devcfg
xilinx.ovpworld.org/zynq_7000-dmac	xilinx.ovpworld.org/zynq_7000-gpio	xilinx.ovpworld.org/zynq_7000-iic
xilinx.ovpworld.org/zynq_7000-ocm	xilinx.ovpworld.org/zynq_7000-qos301	xilinx.ovpworld.org/zynq_7000-qspi
xilinx.ovpworld.org/zynq_7000-sdio	xilinx.ovpworld.org/zynq_7000-slcr	xilinx.ovpworld.org/zynq_7000-spi
xilinx.ovpworld.org/zynq_7000-swdt	xilinx.ovpworld.org/zynq_7000-ttc	xilinx.ovpworld.org/zynq_7000-tz_GPVsecurity
xilinx.ovpworld.org/zynq_7000-tz_security	xilinx.ovpworld.org/zynq_7000-usb	altera.ovpworld.org/dw-apb-timer
altera.ovpworld.org/dw-apb-uart	altera.ovpworld.org/IntervalTimer32Core	altera.ovpworld.org/IntervalTimer64Core
altera.ovpworld.org/JtagUart	altera.ovpworld.org/PerformanceCounterCore	altera.ovpworld.org/RSTMGR
altera.ovpworld.org/SystemIDCore	altera.ovpworld.org/Uart	amd.ovpworld.org/79C970
andes.ovpworld.org/ATCUART100	andes.ovpworld.org/NCEPLIC100	andes.ovpworld.org/NCEPLMT100
arm.ovpworld.org/AaciPL041	arm.ovpworld.org/CompactFlashRegs	arm.ovpworld.org/CoreModule9x6
arm.ovpworld.org/DebugLedAndDipSwitch	arm.ovpworld.org/DMemCtrlPL341	arm.ovpworld.org/IcpControl
arm.ovpworld.org/IcpCounterTimer	arm.ovpworld.org/IntICP	arm.ovpworld.org/IntICP
arm.ovpworld.org/KbPL050	arm.ovpworld.org/L2CachePL310	arm.ovpworld.org/LcdPL110
arm.ovpworld.org/MmciPL181	arm.ovpworld.org/RtcPL031	arm.ovpworld.org/SerBusDviRegs
arm.ovpworld.org/SmartLoaderArm64Linux	arm.ovpworld.org/SmartLoaderArmLinux	arm.ovpworld.org/SMemCtrlPL354
arm.ovpworld.org/SysCtrlSP810	arm.ovpworld.org/TimerSP804	arm.ovpworld.org/TzpcBP147
arm.ovpworld.org/UartPL011	arm.ovpworld.org/VexpressSysRegs	

7.0 General Information on Peripheral Models

This document provides usage information for an Imperas OVP peripheral behavioral model.

The document is split into sections providing specific information for this peripheral, including any ports for connecting into a platform, registers etc. and configuration options and general information for peripheral modeling with Imperas OVP.

7.1 Background

Imperas OVP simulation technology enables very high performance simulation, debug and analysis of platforms containing multiple processors and peripheral models. The technology is designed to be extensible: you can create new models of processors, peripherals and other platform components using interfaces and libraries defined by OVP.

The peripheral models created using the OVP APIs run on the Peripheral Simulation Engine (PSE).

The model is typically written in C and compiled into an executable for the PSE processor architecture. The model is compiled for speed of execution and to protect IP. It is dynamically loaded by the simulator at run time.

8.0 Building peripherals easily with Imperas iGen

To aid with model creation, Imperas products include iGen, a model generation tool. iGen takes the laborious and error-prone task of constructing the various hardware model and software element files required for a typical model, and automates this process. iGen creates the needed C files. iGen also creates the C++ SystemC TLM2 interface files needed to run peripheral models in SystemC simulations.

iGen takes as input a simple script specification that includes device internals such as registers and memories, port information, component descriptors, and other elements. iGen then builds the C code model files and user editable templates. These include model frameworks with registers, function calls, memory map, and other items. It ensures that all component parts of the model are well-structured using best practices, and are consistent throughout the files, thus eliminating a common source of errors.

More information on iGen can be found: imperas.com/products.

9.0 Peripheral model internals

Each instance of a peripheral model runs on its own virtual machine with an address space large enough for the model. This processor (the PSE) and its memory are separate from any processors, memories and buses in the platform being simulated; they exist only to execute the code of the peripheral model.

Interception of functions defined in the peripheral model allows the use of features of the host system in the

implementation of the behavior of a peripheral. As an example, a real platform might contain a video display device. When simulating this system, it is generally more convenient not to simulate the complete video display device but to use a video package available on the host machine, such as SDL, and to use this to render to the host display. Also models of uarts, ethernet devices and USB components can make use of the host PC resources during simulation, to allow, for example, a simulation to browse the real internet, or the simulation to connect to a real USB device.

10.0 Parts of peripheral models

10.1 Configuring the Peripheral Instance with Parameters

A peripheral can include the behaviour of several configurations. These are controlled when the peripheral is instanced in the platform by setting parameters defined on the peripheral.

10.2 Net Ports

Peripherals may be connected to other peripherals or processors with signal wires (nets). These can be used to act as interrupt signals or used to control behavior between peripherals.

The wires are created in the platform as nets and this net is connected into the peripheral using a net port.

10.3 Bus master ports

A bus master port initiates (and controls the address of) a bus cycle. Bus cycles are generated by behavioral code within the peripheral model.

10.4 Bus slave ports

A peripheral can be defined as having several bus slave ports. The bus slave ports can be split into several address blocks. Each address block be either local memory or memory mapped registers. Both of these can have associated callback functions. A memory mapped register can also be defined as specific read/write access, whether it is volatile, and also whether it is associated with a reset pin and mask. A memory mapped register can also have specific bit fields defined.

10.5 Packetnets

A peripheral can be defined as being connected to packetnet ports. A packetnet is used to model packet based communication such as Ethernet, CAN bus or GSM. A packetnet is created in a platform, then connected to packetnet ports on model instances. A packetnet can have many connections, each able to send or receive packets. A packetnet is used as an efficient method of communication within OVP models.

For more information on modeling with packetnets, please see the peripheral modeling documentation: [OVP_Peripheral_Modeling_Guide.pdf](#), [OVPSim_and_CpuManager_User_Guide.pdf](#) and the example: [\\$IMPERAS_HOME/Examples/Models/Peripherals/packetnet](#).

11.0 More information (documentation) on peripheral models and modeling

More information on modeling and APIs can be found at: OVPworld.org/technology_apis.

Specifics on modeling peripherals can be found: [OVP_Peripheral_Modeling_Guide.pdf](#).

A full list of the currently available OVP documentation is available: [OVPworld.org/documentation](#).

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