NXP

freescale™
Vybrid

32-bit Controller Solutions

Vybrid VF5xx Family

Single-core solution with dual Ethernet and L2 switch
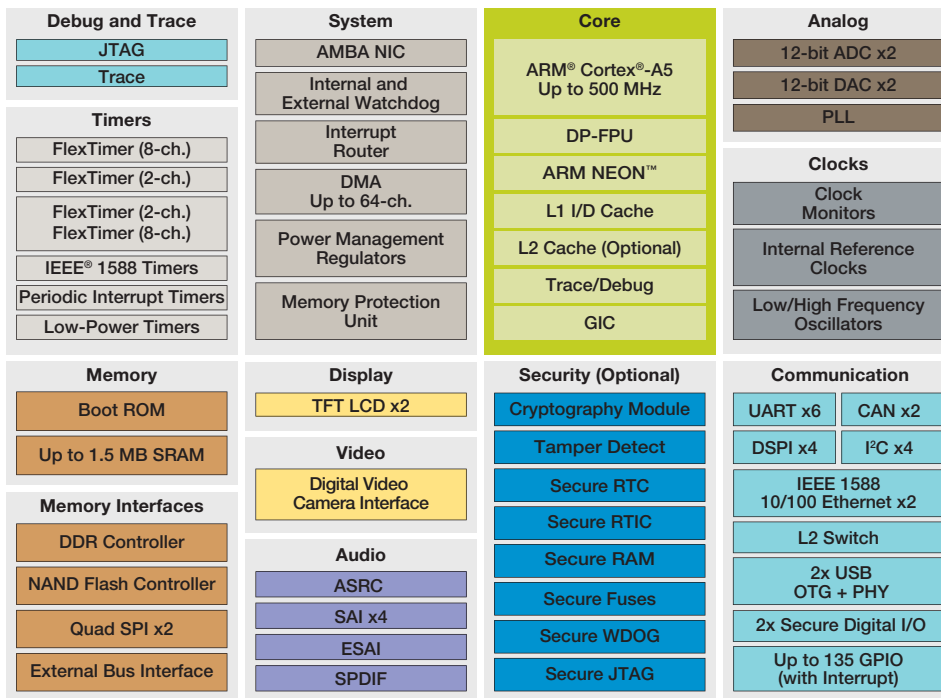
Overview

The VF5xx family features the ARM® Cortex®-A5 core with speeds up to 500 MHz. The family includes a 512 KB L2 cache, dual USB 2.0 (full- and high-speed) device/host/OTG controllers with integrated PHY, dual 10/100 Ethernet controllers with L2 switch, up to 1.5 MB of on-chip SRAM and a rich suite of communication, connectivity and human-machine interfaces (HMI). In addition, anti-clone, anti-tamper, secure boot and advanced encryption hardware deliver the highest level of security and accuracy. The VF5xx family is pin and software compatible with the VF6xx family.

Vybrid VF5xx devices feature IEEE® 1588 hardware time stamping and reduced media independent interface, as well as multiple serial interfaces, including UARTs with support for ISO 7816 SIM/smart cards, SPI and I²C and dual CAN modules.

Target Applications

- Industrial automation
  - Applications requiring simple 2D graphics (HMI)
- Industrial scanners and printers
- Industrial vehicle control with HMI
- Large or high-quality small appliances
- Metering
  - Data concentrator
- Portable patient monitors
- Simple vending machines

Vybrid VF5xx Block Diagram

Debug and Trace	System	Core	Analog
JTAG	AMBA NIC	ARM® Cortex®-A5 Up to 500 MHz	12-bit ADC x2
Trace	Internal and External Watchdog		12-bit DAC x2
Timers	Interrupt Router	DP-FPU	PLL
FlexTimer (8-ch.)		ARM NEON™	**Clocks**
FlexTimer (2-ch.)	DMA Up to 64-ch.	L1 I/D Cache	Clock Monitors
FlexTimer (2-ch.) FlexTimer (8-ch.)	Power Management Regulators	L2 Cache (Optional)	Internal Reference Clocks
IEEE® 1588 Timers		Trace/Debug	
Periodic Interrupt Timers	Memory Protection Unit	GIC	Low/High Frequency Oscillators
Low-Power Timers			

Memory	Display	Security (Optional)	Communication
Boot ROM	TFT LCD x2	Cryptography Module	UART x6 / CAN x2
Up to 1.5 MB SRAM	**Video**	Tamper Detect	DSPI x4 / I²C x4
Memory Interfaces	Digital Video Camera Interface	Secure RTC	IEEE 1588 10/100 Ethernet x2
DDR Controller		Secure RTIC	L2 Switch
NAND Flash Controller	**Audio**	Secure RAM	2x USB OTG + PHY
Quad SPI x2	ASRC	Secure Fuses	
	SAI x4	Secure WDOG	2x Secure Digital I/O
External Bus Interface	ESAI	Secure JTAG	Up to 135 GPIO (with Interrupt)
	SPDIF		

Vybrid VF5xx devices can interface to a variety of external peripherals and memories for system expansion and data storage. Dual quad SPI interfaces with execute in place (XIP), dual secure digital host controller, NAND flash and DRAM controllers with ECC support allow the connection to a wide variety of memory types for critical applications.

The Vybrid VF5xx family offers a host of multimedia options for rich applications with real-time control. Audio interfaces include synchronous audio interface for full-duplex audio transfer and enhanced serial audio interface for interfacing with the Sony/Philips Digital Interface for digital audio support. Display controller units interface with TFT LCD displays for resolutions up to XGA (1024 x 768). A video interface unit provides image and vision capture.

Vybrid VF5xx devices include a variety of data integrity and optional security hardware features for safeguarding memory, communication and system data. A cyclic redundancy check module is available for validating memory contents and communication data. An optional hardware encryption unit supports several encryption and hashing algorithms for program validation as well as authentication and securing data for transfer and storage. The optional tamper detection system has integrated sensors for voltage, frequency and temperature, and external sensing for physical attack detection.

Enablement Offering: MPU + IDE + OS

- Freescale Tower System development board platform with complimentary MQX™ RTOS and Timesys Linux® BSPs

- Complimentary bootloaders (USB, Ethernet, serial)

- ARM DS-5 Development Studio Vybrid™ Controllers Edition

Vybrid VF5xx Family

	Features	Benefits
Core and System	Cortex-A5 up to 500 MHz	Power-efficient applications processor with full Cortex application compatibility
	ARM NEON™ technology	Advanced SIMD instruction set for acceleration of media and signal processing functions
	Double precision floating point with IEEE 754 compliance	Algorithm acceleration and improved signal processing
	Level 1 and 2 caches	Increased code throughput and reduced processor stalls. 512 KB L2 cache optional.
	ARM TrustZone® technology	Ensures reliable implementation of security applications ranging from digital rights management to electronic payment
	64-bit AXI bus	Increases concurrent data transfer capabilities from several bus masters
	Up to 64-channel DMA	Peripheral and memory servicing with reduced CPU loading
	Address space controllers	Provides memory protection for all crossbar switch masters, increasing software reliability
Memory and Memory Interfaces	Up to 1.5 MB of on-chip SRAM	High reliability, fast access non-blocking RAM with ECC protection on 512 KB of SRAM (reduced to 1 MB SRAM when L2 cache enabled). Can eliminate the need for external DRAM.
	FlexBus external bus interface	Enables the connection of external memories and peripherals (e.g., graphics displays, FPGA, ASICs)
	NAND flash controller	Supports up to 32-bit ECC current and future NAND types with minimal software overhead
	SDHC controller	For in-application software upgrades, media files or adding Wi-Fi® support
	Dual quad-SPI with execute in place (XIP)	Supports up to 80 MHz external SPI flash for fast off-chip flash program or data space
	DRAM controller with 8-bit ECC	Support for DDR3 and LPDDR2 memories up to 800 MHz data rate. DDR3 memory is half the cost of DDR2 memory.
Communications Interface	Dual USB On-The-Go (High-, Full- and Low-Speed) with integrated PHY	High-speed I/O required for demanding diagnosis and monitoring tasks, including dynamic machine condition, plug-and-play ease for monitoring human-machine interfaces (HMIs) or connect to industrial compute. Lower BOM cost with integrated PHY.
	Dual 10/100 Ethernet MAC with IEEE 1588 hardware time stamping	Precision clock synchronization for real-time, networked industrial automation and control
	Serial interfaces	Multiple communication interfaces for simple and efficient data exchange, industrial network bridging and audio system interfacing. Variety of data size, format and transmission/reception settings supported for multiple industrial communication protocols.
	Dual CAN	Enable industrial network bridging by connecting to sensors, actuators and control devices
Security	Hardware encryption accelerator	Secure data transfer and storage. Faster than software implementations with minimal CPU loading. Supports a wide variety of algorithms: DES, 3DES, AES, MD5, SHA-1, SHA-256.
	Hardware tamper detection	Secure real-time clock with independent battery supply and secure key storage with internal/external tamper detect for temperature/clock/supply voltage variations and physical attack
	High assurance boot	Supports encrypted boot with code signing, peripheral access policy control and public key infrastructure RSA 2048/ECC-512
	Hardware cyclic redundancy check engine	Validates memory contents and communication data, increasing system reliability
	Independent-clocked COP, external watchdog monitor	Prevents code runaway in fail-safe applications and drives output pin to safe state external components if watchdog event occurs
HMI	Dual display controllers	Support for up to two SVGA resolution TFT displays
	Video interface unit	24-bit parallel interface for image and vision capture
Audio	Synchronous audio interface	Supports full-duplex serial interfaces with frame synchronization such as I²S, AC97 and codec/DSP interfaces
	Enhanced serial audio interface	Full-duplex serial port for communication with a variety of serial audio devices, including industry-standard codecs, SPDIF transceivers and other processors
	Sony Philips Digital Interface	Receive and transmit digital audio using the IEC60958 standard consumer format
	Asynchronous sample rate converter	Sample rate conversion between input and output audio streams
Other	Integrated power management in 364 MAPBGA package	Reduces the system cost
	Operating temperature range (–40 °C to +85 °C)	Qualified for consumer and industrial applications

Get Started Today

The Freescale Tower System development board platform provides a modular and expandable development platform for evaluating and prototyping with Vybrid controller solutions. The TWR-VF65GS10 board is a development tool for the Vybrid family of controllers that operates as a standalone debug tool or as part of an assembled Tower System development platform. With full support from MQX software solutions, Timesys Linux BSP and the DS-5 toolchain, your next application-rich design is at your fingertips. For more information, visit **freescale.com/TWR-VF65GS10** and **freescale.com/TWR-VF65GS10-DS5**.

Tower System Development Tools for Vybrid Controller Solutions

Ordering Part Number	Description	MSRP (USD)
TWR-VF65GS10	• TWR-VF65GS10 board, USB cable, Quick Start Guide • Complimentary 1-year, non-renewable license to ARM DS-5 Development Studio Starter Kit for Vybrid™ Controller Tower™ System Module (256 KB code size limitation)	$199
TWR-VF65GS10-KIT	• TWR-VF65GS10 module, USB cable, Quick Start Guide • Complimentary 1-year, non-renewable license to DS-5 Development Studio Starter Kit for Vybrid Controller Tower System Module (256 KB code size limitation) • TWR-ELEV elevator boards • TWR-SER serial board	$269
TWR-VF65GS10-PRO	• TWR-VF65GS10 board, USB cable, Quick Start Guide • Complimentary 1-year, non-renewable license to DS-5 Development Studio Starter Kit for Vybrid Controller Tower System Module (256 KB code size limitation) • TWR-ELEV elevator boards • TWR-SER2 enhanced serial board • TWR-LCD-RGB graphical LCD board	$399
TWR-VF65GS10-DS5	• Same as TWR-VF65GS10-PRO except includes 1-year, renewable license for DS-5 Development Studio Vybrid Controllers Edition (hardware platform independent, 1 MB code size limitation)	$1,500

For more information, visit freescale.com/Vybrid

Visit Freescale Solution Advisor to select the right Vybrid controller solution for your design: freescale.com/SA