

FTDI Chip Microcontrollers

BRIDGING TECHNOLOGIES

Ultimate Bridging Solutions with new 8-bit and 32-bit MCUs



Bridging technologies is the FTDI Chip company mission, and our range of products and services are designed and manufactured to facilitate this. Our series of microcontrollers (MCUs) have been developed with key functionality to enable enhanced system performance and operational efficiency. Based upon FTDI Chip's new FT32, high performance 32-bit RISC core, the FT90X series provides a plethora of connectivity options, making it the ideal choice for advanced technology bridging solutions. By executing instructions from shadow RAM, rather than flash memory, the FT90X can operate at true Zero Wait States (0WS) up to 100MHz and 310 DMIPS (at 100MHz) performance.

Using the industry standard GCC compiler, together with the Eclipse IDE, allows the FT90X to utilise a wide variety of third-party and open source software.

For applications with lower performance requirements, the FT51A, based on an 8-bit core gives 48MIPS processing performance. The FT51A integrates a Low/Full Speed USB hub and provides a downstream port, allowing multiple devices to be cascaded or combined with other USB devices. In addition to standard 8051 functions, the FT51A includes multiple ADC/ DACs facilitating analog measurement applications along with a fully configurable USB Device Controller, analogous to the FTDI Chip FT12 series.

The toolchain for the FT51A comprises SDCC compiler integrated together with Eclipse IDE, thus providing a tried and tested development solution for a proven CPU architecture.

FT90X Series

The FT90X series has been developed for high speed, interface bridging tasks. With a parallel camera input, 10/100 Base-TX Ethernet interface, CAN bus, and USB2.0 Hi-Speed peripheral and host ports, this device offers excellent interconnect capabilities and fast data rates.

Enhanced features:

- 32-bit RISC architecture
- 256kB program/shadow memory
- High speed operation – 3.1 DMIPS per MHz
- 64kB data memory
- True Zero Wait State operation up to 100MHz
- USB DFU Bootloader

Standard features:

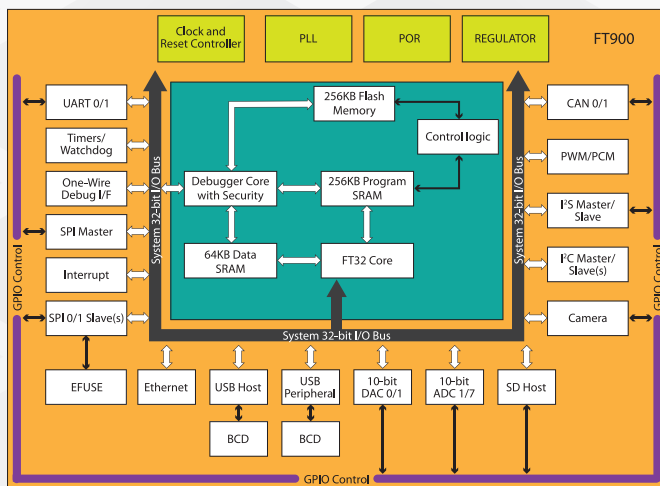
- User programmable EFUSE for memory and security configuration
- Integrated Phase-Locked Loop (PLL) supports external crystal and clock source input
- 32.768kHz RTC clock support
- Four user timers with prescale and watchdog function
- 3.3V single supply operation
- Internal voltage regulator + 1.2V to the digital core for lower power consumption
- Supports Battery Charging Specification, for USB2.0 Hi-Speed peripheral port
- Integrated power-on-reset circuit
- Pb-free, RoHS packaging, 100QFN, 100LQFP, 76QFN and 80LQFP options

Digital connectivity:

- Direct camera input via a parallel data interface
- USB2.0 Hi-Speed (480Mbps) device controller with Battery Charge Detection (BCD)
- USB2.0 Hi-Speed (480Mbps) host controller with BCD emulation
- 10/100 BASE-TX Ethernet MAC and PHY; compliant with the IEEE 802.3/802.3u standards
- Two CAN 2.0 controllers for data transfer up to 1M bit/s
- I²S master/slave interface supporting up to 24b/192MHz
- Host SD controller compliant with standard specification V3.0, which supports UHS50 and UHS104 cards
- SPI master supports single/dual/quad modes
- Two SPI slaves support single data transfer with 25MHz clock
- UART interface configured as 1 Full UART or 2 basic UARTs (TX/RX/CTS/RTS)
- Two I²C bus interfaces can be configured as master or slave, with data transfers up to 3.4Mbps
- Supports eight separate PWM channel outputs with support for PCM 8-bit/16-bit stereo audio output

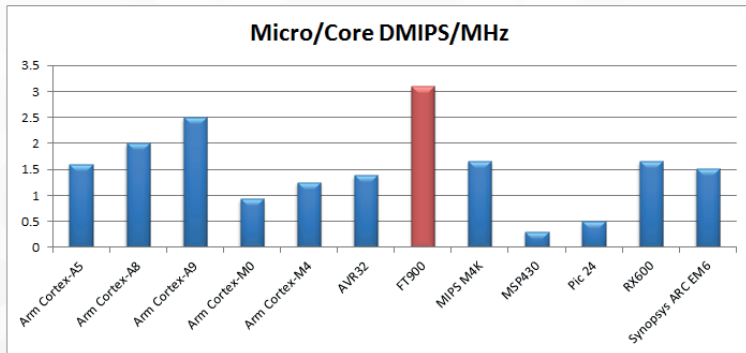
Analog connectivity:

- 7 input channel muxed to a single internal ADC
- Two 10 bit DACs



FT90X Series CPU Performance

The FT90X's FT32 processor core operates at 3.1DMIPs/MHz, and with a Zero Wait State program memory clocking up to 100MHz. The FT90X MCU's unique data streaming domain eliminates the need for complex direct memory access (DMA) interfacing to transfer data internally providing a highly deterministic processing model. The comparison of CPU performance is shown below:



FT90X Series Device Solutions

Part Number	Package	CAN2.0	Ethernet 10/100M	Camera VGA	SD3.0	I ² S Master and Slave	Others*
FT900Q	100QFN	Y	Y	Y	Y	Y	Y
FT900L	100LQFP	Y	Y	Y	Y	Y	Y
FT901Q	100QFN	-	Y	Y	Y	Y	Y
FT901L	100LQFP	-	Y	Y	Y	Y	Y
FT902Q	100QFN	Y	-	Y	Y	Y	Y
FT902L	100LQFP	Y	-	Y	Y	Y	Y
FT903Q	100QFN	-	-	Y	Y	Y	Y
FT903L	100LQFP	-	-	Y	Y	Y	Y
FT905Q	76QFN	Y	Y	-	-	-	Y
FT905L	80LQFP	Y	Y	-	-	-	Y
FT906Q	76QFN	-	Y	-	-	-	Y
FT906L	80LQFP	-	Y	-	-	-	Y
FT907Q	76QFN	Y	-	-	-	-	Y
FT907L	80LQFP	Y	-	-	-	-	Y
FT908Q	76QFN	-	-	-	-	-	Y
FT908L	80LQFP	-	-	-	-	-	Y

*others include all other functions

FT90X Series Development Modules

MM900EV1A/2A/3A

FT90X Development Hardware

The MM900EV development modules provide full hardware feature support for the FT90X processor in a variety of form factors. The modules also provide a connector for accessing external plug-in hardware over an SPI interface. There are three module types available: MM900EV1A, which comes without a camera, MM900EV2A, with an inbuilt front facing CMOS camera, and MM900EV3A, with a back facing camera.

Key features:

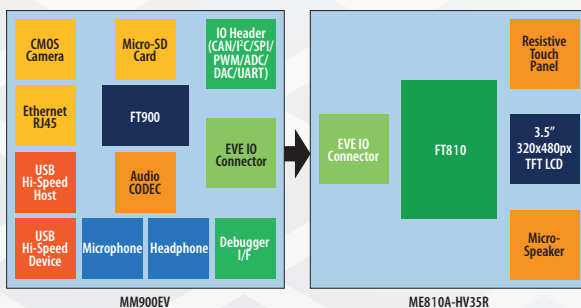
- Ethernet 10/100Base-T interface, RJ45 MAGJACK connector with 2 LED status indication
- Independent USB Hi-speed device and host port
- Built in small and low noise microphone module
- 3.5mm audio jack for stereo audio output with a mono microphone input
- Debugger interface for FT900 flash programming and EFUSE configuration
- RGB LED with 24 bit colour
- Micro SD card socket supporting SD3.0 specification
- SPI/QSPI interface exposed over a 16-pin header connector to connect with accessory cards such as the ME800A-HV35R 3.5" resistive touch HVGA display daughter board
- 40 pins double row header for extending IOs
- 5V power jack source
- Built in high quality CMOS Camera module (MM900EV2A and MM900EV3A only)

ME810A-HV35R

3.5" HVGA Display Adaptor

The ME810A-HV35R provides a display, audio and touch HMI companion for the MM900EV. The module includes FTDI Chip's FT810 Embedded Video Engine with a 3.5" 320 x 480 HVGA display and resistive touch. An integrated audio micro-speaker and LCD backlight control are also included. The 16-pin header connector provides the SPI interface to the MM900EV.

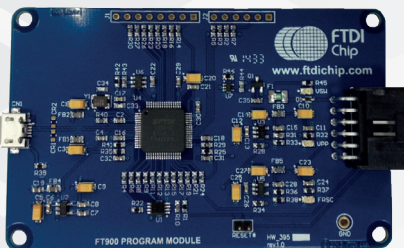
The 16-pin header connector provides the SPI interface to the MM900EV.



UMFTPD2A

FT90X series debugger/ programmer module

The UMFTPD2A debugger/programmer module provides a USB bridge between the FT90X Eclipse IDE development tools running on a PC and the FT900 1-wire debug pin. This module can be used to program, configure the EFUSE and debug firmware running on the FT900 device.



FT90X Series Development Tools and Software Support

A complete set of tools, from hardware development modules to software code editors, libraries, compilers and debuggers, are available now.

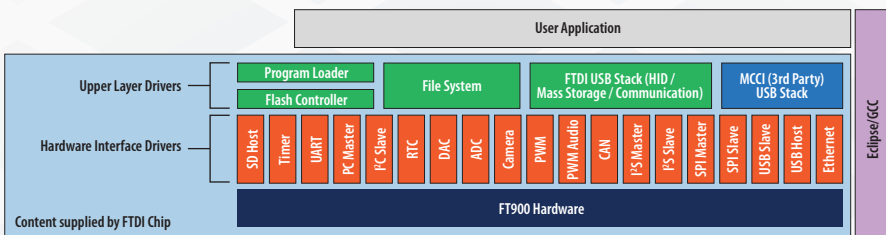
FT90X Series Firmware Development

FTDI Chip provides a development toolchain based on GNU C/C++ and assembly compiler for the FT90X series. It is fully integrated with the open source Eclipse IDE with C/C++ Development Tooling (CDT). The FT90X Eclipse integrated toolset includes FT90X sample applications to enable the ability to start a new project design quickly. An open source real time OS FreeRTOS is ported to the FT90X and comes together with the toolchain.



Interface Driver Support

The toolchain is supported with a suite of free libraries to control each function block in addition to a collection of USB libraries to enable a range of USB host or device solutions. All drivers will be provided as source code for easy adaptation and modification.



Firmware Download and Debug

With the plug in developed by FTDI Chip, the functionality of Eclipse is extended to support loading of compiled firmware into the target device via a dedicated 1-wire debug pin on the ICs. Running and debugging the firmware is also supported via the debugger pin with up to 3 breakpoints supported to assist debug. A dedicated debugger/programmer module is available to support these devices and interface with the Eclipse IDE.

3rd Party Tools

FTDI Chip have been working closely with 3rd party partners in order to offer additional design aids. A collaboration with MCCI® Corporation, a leading developer of USB drivers and firmware for embedded SoC has resulted in the availability of TrueTask® USB, an embedded USB host stack designed for use with the FT90X MCU product family, and a partnership with MikroE has culminated to provide a comprehensive development environment for the FT90X including compilers, development boards, useful examples for click boards and Visual TFT software support. For more information on MCCI please visit www.mcci.com and visit www.mikroe.com for details on MikroE.

FT90X Series Applications

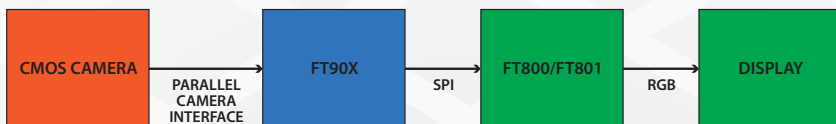
FT90X series is a range of general purpose microcontrollers targeted at high performance systems and as application controllers that can be used in conjunction with EVE display controllers.

Target Applications include:

- Closed Circuit Monitoring
- Security Network Systems
- Traffic Control
- Audio Players
- Access/Entry Systems
- Industrial Control and Monitoring
- Security Digital Video Recording
- Remote Cameras
- Home Networks
- Back-up Cameras
- IO Interface Bridges
- ... and many more

FT90X and Eve Based Video

The FT90X will accept video input from a CMOS camera sensor over the parallel camera interface or from a networked camera over Ethernet. Processing of the image can then be performed within the FT90X to create an FT800 compatible bit-map for output on a QVGA or QCIF display, with a target frame rate of up to 30fps (QCIF).



FT90X Based Audio

By making use of the SD CARD interface and the I²S interface to an external codec the FT90X may be used to implement a full feature MP3 player for streaming music and audio file playback.



FT90X Low Cost IP Camera

Easily interface video from a camera sensor via the FT900 to remote location via Ethernet connectivity.



FT51A Series

The FT51A series provides an 8051-compatible core with best in class performance and unique features including multiple ADCs/DACs, USB 2.0 Full Speed Device, and USB hub function targeted at cascading multiple FT51A systems, or to connect an additional USB peripheral like a mouse or keyboard.

Enhanced Digital features:

- 8051-compatible core running at a maximum frequency of 48MHz
- High speed operation 48MIPs@48MHz
- 16kB program/shadow memory
- 8kB data memory
- True Zero Wait States operation up to 48MHz
- FT12 series compatible USB2.0 Full-Speed/ Low-Speed peripheral controller with Battery Charger Detection (BCD)
- USB downstream port
- Enhanced UART with transfer rates from 300 baud to 3M baud
- Integrated hardware debugger
- PWM Controller
- I²C master/slave controller
- SPI master/slave controller
- 4 extra timers plus watchdog function

- 8-bit parallel FIFO

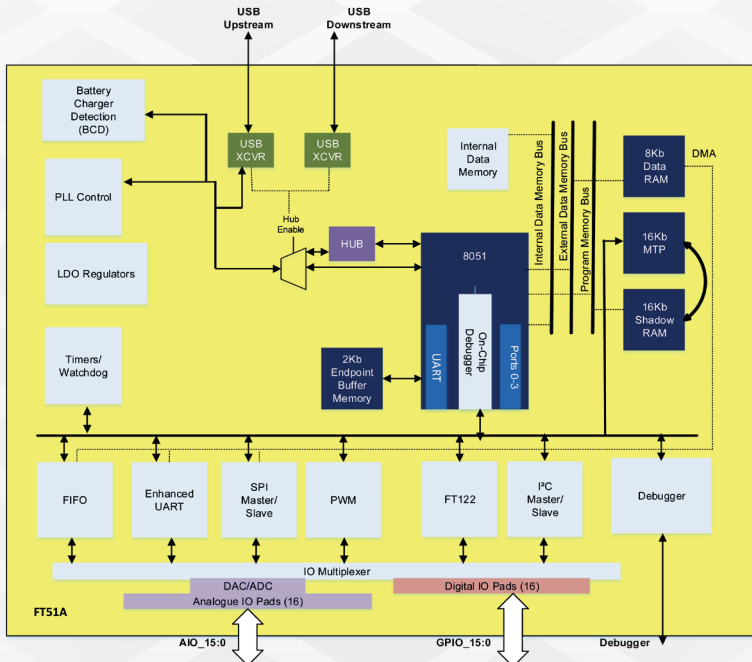
- USART/SPI/FIFO, all with DMA options
- Integrated clock generation, no external crystal required

Enhanced Analog features:

- 16 Analog IO Cells for ADC/DAC functions
- Up to 4 simultaneous ADC/DACs

Standard features:

- Standard 8051 peripheral set
- Up to 16 GPIO
- USB DFU Bootloader
- Integrated power-on-reset circuit
- +5V single supply operation
- Internal 3.3V/1.8V LDO regulators
- Range of compact packaging options available: 48-pin WQFN, 44-pin LQFP, 32-pin WQFN and 28-pin SSOP



FT51A Series Development Modules

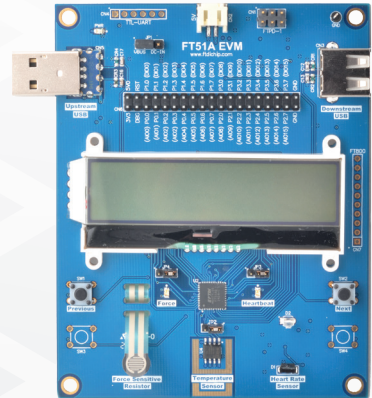
FT51A EVM

FT51A Evaluation Module

The FT51A EVM evaluation module provides full hardware feature support for the FT51A processor and includes several ready to go DAQ circuits allowing almost instant bringup and delivering a simple environment to evaluate/modify and add peripherals to the FT51A at a low cost.

Key features:

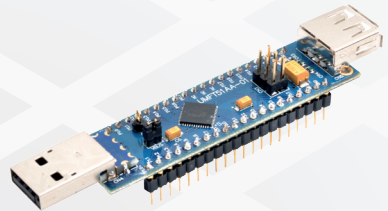
- FT51A at 48MHz
- Built in USB Hub with downstream device support for cascaded devices
- Tri-colour backlight 2x20LCD
- Temperature, force and heart rate detection sensors
- 4 tactile buttons
- 2 controllable LEDs
- Debugger interface for FT51A flash programming
- 2x20 pin IO header allowing easy customisation and addition of extra peripherals



UMFT51AA

8051 Compatibility Module

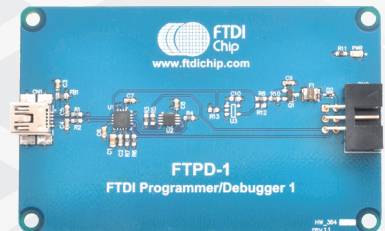
The FT51AA module is pin compatible with the DIP40 MCS-51 range of MCUs. The form factor of the module makes it easy to cascade up to four of them together and leverage upon the USB hub feature.



UMFTPD1

FT51A series debugger/programmer module

The UMFTPD1 debugger/programmer module provides a USB bridge between the FT51A Eclipse IDE development tools running on a PC and the FT51A 1-wire debug pin. This module can be used to program, configure and debug firmware running on the FT51A device (such as the FT51A EVM evaluation module or the FT51AA 8051 compatibility module).



FT51A Series Development Tools and Software Support

FT51A Series Firmware Development

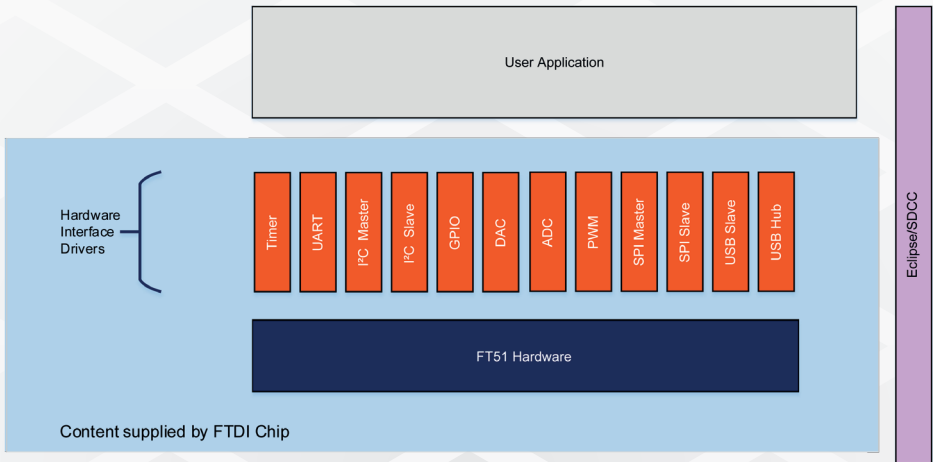
The FTDI Chip FT51A development tool chain is based on SDCC and is fully integrated in to the open source Eclipse IDE with C/C++ Development Tooling (CDT).

The FT51A Eclipse integrated tool set includes several FT51A sample applications to enable the ability to start a new project design quickly.



Interface Driver Support

The toolchain is supported with a suite of free libraries to control each function block in addition to a collection of USB libraries to enable a range of USB host or device solutions. Source code is provided for all drivers allowing for easy adaptation and modification.



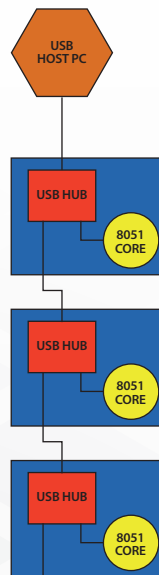
FT51A Series Applications

The FT51A series offers outstanding performance with an extensive range of interfaces including DAC, ADC, SPI, PWM and USB and is ideally suited for control of a distributed network array of sensors/actuators.

A unique USB hub feature of the chip allows multiple devices to be cascaded over USB, back to the main host controller. As a result, the FT51A can be seen as a microcontroller for a single unit, or as a link in a chain of sub-systems that can easily pass data to a USB host system for analysis.

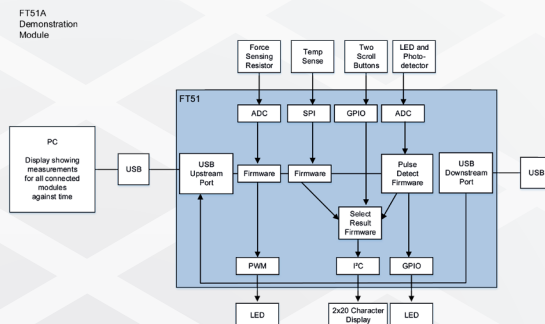
Target Applications include:

- Cascadable USB DAQ
 - Industrial Control
 - Multi-room Thermostat
 - Window Monitor System
 - Security Systems
 - ... and many more
- Fitness Equipment
 - Smart Home Control
 - Weather Station
 - Keyboard with USB mouse port



FT51A Series Sensor Application

The sensor application example uses the ADC, I²C, PWM, GPIO and USB interfaces to create a sensor controller as detailed in the table below.



Module Feature	Implementation	FT51A Input	FT51A Output	Display	Logged data / PC display
Pressure sense and display	Potential divider with force sensing resistor.	ADC	PWM, I ² C	LED brightness intensity Numerical Display of force	Pressure vs time
Heartbeat monitor and display	LED and photo-detector	ADC	GPIO, I ² C	LED pulses as heart beats Numerical Display of pulse rate	Pulse rate vs time
Body temperature	Temp sensor	SPI	I ² C	Numerical display of temp	Temp. vs time
Display control feature	Push buttons and 2x20 character display	GPIO	I ² C	Selected result (pressure, heart rate, temp)	-

Readings are made from each of the sensor inputs and an output is displayed locally on the demonstration PCB as well as being reported back to the PC. Up to 4 boards may be cascaded to increase the amount of data that can be collected and reported back to the PC for storage and analysis. Full source code for this example firmware (targeted to the FT51A EVM module) is available for download.

About FTDI Chip



FTDI Chip develops innovative silicon solutions that enhance interaction with the latest in global technology. The major objective from the company is to 'bridge technologies' in order to support engineers with highly sophisticated, feature-rich, robust and simple-to-use product platforms. These platforms enable creation of electronic designs with high performance, few peripheral component requirements, low power budgets and minimal board real estate.

FTDI Chip's long-established, continuously expanding Universal Serial Bus (USB) product line boasts such universally recognized product brands as the ubiquitous R-Chip, X-Chip, Hi-Speed and SuperSpeed USB 3.0 series. In addition to both host and bridge chips, it includes highly-integrated system solutions with built-in microcontroller functionality. The company's Embedded Video Engine (EVE) graphic controllers each pack display, audio and touch functionality onto a single chip. The unique, streamlined approach utilised by these ICs allow dramatic reductions in the

development time and bill-of-materials costs involved in next generation Human Machine Interface (HMI) implementation. FTDI Chip also provides families of highly-differentiated, speed-optimised microcontroller units (MCUs) with augmented connectivity features, specifically designed with compatibility to its USB and Display product lines in mind. These MCUs are targeted at key applications where they can add value with their superior processing performance and high levels of operational efficiency.

FTDI Chip is a fab-less semiconductor company, partnered with the world's leading foundries. The headquarter is located in Glasgow, UK and is supported with research and development facilities in Glasgow, Singapore and Taipei (Taiwan) plus regional sales and technical support sites in Glasgow, Taipei, Tigard (Oregon, USA) and Shanghai (China).

For more information go to: www.ftdichip.com



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