



Universal Serial Bus (USB) is an emerging standard for interconnecting PCs with peripherals. The primary goal of USB is to dramatically simplify the use of the PC with its "Plug-and-Play" features and standard connector and cable. This will not only lower costs for installing and upgrading PCs in today's business environment, but will also allow the PC to emerge as a true consumer product. Other goals are to enable the PC to provide new and enhanced capabilities like Computer Telephone Integration (CTI) and to also enable development of new and creative audio and video products for enhanced multimedia applications. USB is revolutionizing the PC market.

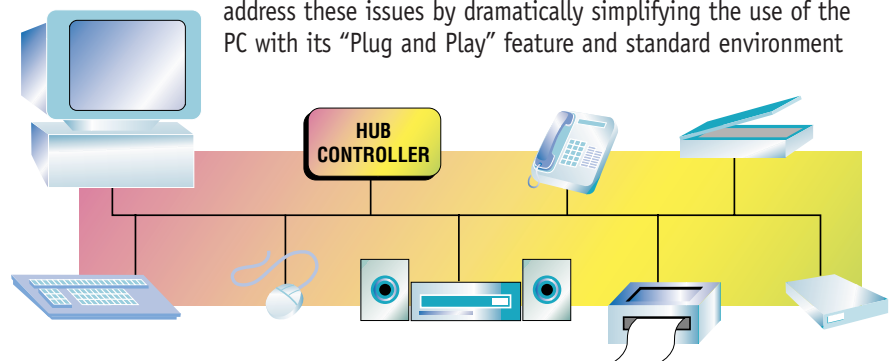
UNIVERSAL SERIAL BUS

POWER MANAGEMENT PRODUCTS



Making "Plug and Play" Universal

Universal Serial Bus (USB) is an emerging standard for interconnecting PCs with peripherals. It was initially drafted by a consortium of companies including Intel, DEC, Microsoft, IBM, Compaq, NEC and Northern Telecom. Major initiatives are changing the landscape of how the PC will be used in the future. New business requirements dictate a lower cost of ownership. Consumers demand simplicity as well as expanded multimedia capabilities to support entertainment. The primary goal of USB is to address these issues by dramatically simplifying the use of the PC with its "Plug and Play" feature and standard environment

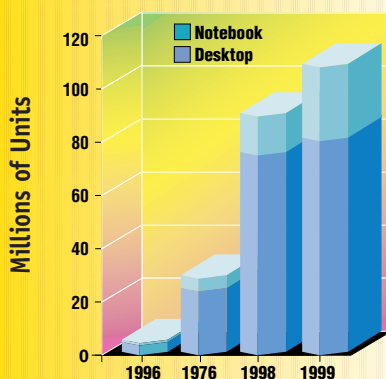


and will also enable the PC to emerge as true consumer product. In addition, USB is designed to support real-time audio and compressed video transfers that will provide the PC with new and enhanced capabilities such as Computer Telephony Integration (CTI), video conferencing, and to enable the development of new and creative audio and video products.

The Plug-and-Play capabilities of USB will go a long way toward mitigating some of the problems currently plaguing the PC. Plug-and-Play USB peripherals will automatically configure themselves and be ready for immediate use when attached to the system by the user. USB provides a serial, bidirectional 12Mbit/sec interface. USB peripheral data as well as power are distributed by devices called hubs via a universally compatible four wire cable.

Meeting requirements to support USB's Plug-and-Play and other power distribution specifications requires satisfying stringent criteria. Micrel leverages off expertise in PCMCIA and other power management device technology to solve USB's power distribution requirements.

USB PC Shipments



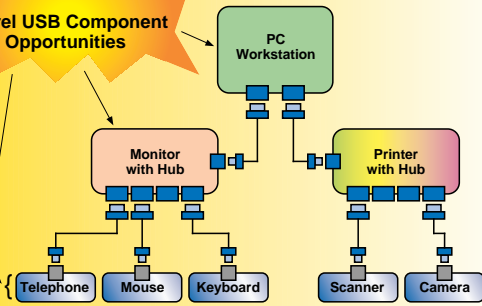
Source: Dataquest



MICREL SEMICONDUCTOR:

YOUR CUSTOM AND STANDARD ANALOG IC MANUFACTURER

Micrel USB Component Opportunities



Micrel ICs Beat Polyfuse Solutions

For expediency, some designers choose polyfuse thermally-activated switches to try and meet USB requirements. Unfortunately, passive polyfuse designs:

- cannot be switched off by USB controllers
- cannot report overcurrent conditions to the system software.
- Exceed on-resistance specifications while satisfying the 25VA current-limit requirement.
- Have long trip times at rated current relative to Micrel's analog switches.

The MIC2525 and MIC2526 plug-and-play protected FET power switches are high-performance replacements for passive polyfuse parts. Optimized for USB power distribution, these single and dual high-side switches, respectively, are available with both active-high and active-low enable logic for maximum design flexibility in interfacing to any USB controller.

To meet the very stringent requirements for USB power distribution, the MIC2525 and MIC2526 are designed to solve all of the issues concerning USB power distribution. For example, they feature an integrated 100 milliohm switch that meets USB requirements for voltage drop and regulation. The MIC2525 and MIC2526 also feature a soft-start circuit for slow and controlled power turn-on. This feature limits the in-rush current that occurs when charging the bulk capacitance on a downstream port. By limiting the current, this ensures that downstream peripherals operate correctly by meeting the USB transient-droop specification for the bus voltage.

Micrel's USB Switch Features:

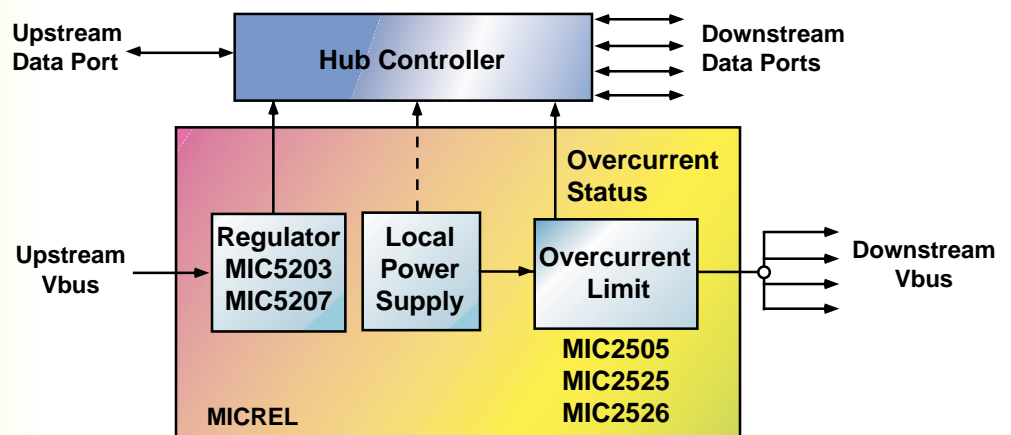
- Low on-resistance meets USB voltage regulation requirements
- Slow turn-on time controls transients and helps meet USB requirements
- Logic-compatible enable and flag signals work with any USB controller
- Full thermal protection for switch and downstream device
- Undervoltage lockout ensures switch is off until supply voltage is stable
- IEC-1000-4-2 ESD compliant to 15kV
- DIP and surface-mount packages available

Micrel: Committed to Our USB Customers

Micrel leads in USB power management products:

- Leads with price and performance
- Offers the most comprehensive line of USB power management devices in the industry
- As a member of the USB Implementers Forum, Micrel monitors and contributes to changes in USB specifications.

USB SELF-POWERED HUB



BUS-POWERED

MIC2526

MIC5207

HUBS

SELF-POWERED

Furthermore, these devices will automatically limit current to very safe levels, typically 750mA, well under the USB ceiling of 5A. Limiting current is important because it also helps preserve battery capacity in mobile and portable systems, such as laptop, notebook and palmtop PCs. Upon detecting a current limit condition, the MIC2525 and MIC2526 provide a logic-compatible flag output to the local USB controller for action by the host software.

These devices also are fully protected against shorts or other fault conditions by a thermal shutdown circuit that monitors the IC's temperature. When the specified temperature limit is reached, the switch will shut down the device to prevent damage to itself and downstream devices.

In USB monitor applications where only an unregulated dc supply voltage is available, Micrel offers the MIC29151 and MIC29301 high-current low-dropout (LDO) voltage regulators with comparable USB specifications. These 5V regulators also have overcurrent flag, logic-compatible enable and current-limiting features.

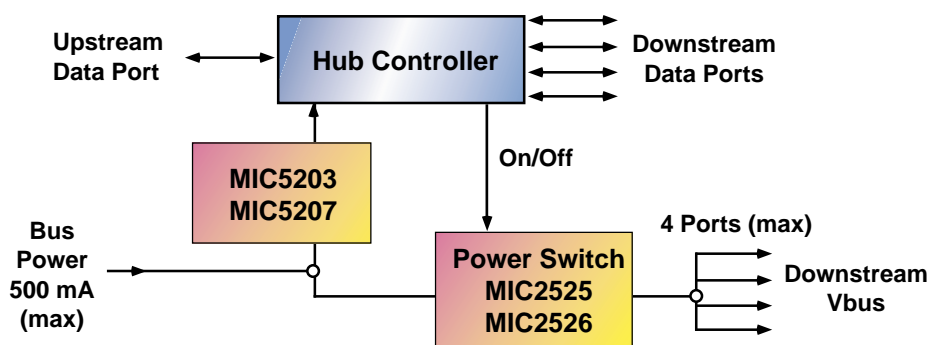
And for USB microcontrollers, Micrel provides the MIC5203/7 LDO voltage regulators, to support lower-voltage microcontrollers. These regulators consume very low quiescent current, making them ideal when the USB controller is powered directly from the bus to support enumeration when the device itself is powered down.

The MIC2525 and MIC2526 also bring the same high-spec performance to bus-powered hubs as well.

USB SELECTION GUIDE

Mobile PCs (Laptop, Palmtop)	Desktop PCs	USB Hubs (Printer, Monitor, etc.)
MIC2525	MIC2526	MIC2525 (Bus-Powered) MIC2505 MIC2526

USB BUS-POWERED HUB



MIC2505

SWITCHES

MIC5203

POWER

MICREL

COMMITTED TO OUR USB CUSTOMERS

"Micrel's USB power switches offer fully-compliant and robust protection for USB products, such as keyboards, printers, and desktop and portable PCs. Furthermore, our devices work with any USB controller."

— Larry Mazer, Product Marketing Manager

MICREL LEADS INDUSTRY

WITH VERSATILE USB POWER MANAGEMENT DEVICES

We offer a proven portfolio of power management ICs for USB peripherals that gives PC system designers the higher integration, better specifications, more versatility and lower overall cost they need.

Furthermore, our devices build on Micrel's already established strength in plug-and-play technologies, such as our PCMCIA or PC Card leadership.

Micrel's USB Device Portfolio:

- **MIC2505**
High-performance switch optimized for global self-powered hub overcurrent protection
- **MIC2525 and MIC2526**
High-performance switches for self-powered and bus-powered hub applications
- **MIC29151 and MIC29301**
High-current voltage regulators with enable and overcurrent flag provide USB port power from a loosely regulated supply voltage
- **MIC5203 and MIC5207**
Low-dropout (LDO) voltage regulators that are ideal to power any USB controller

ABOUT MICREL

Micrel provides customers with total solutions in analog ICs. By "total solutions," we mean the best possible design, development and delivery of products that meet our customers' needs, and the requirements of their applications markets. Custom and semicustom analog ICs are a major part of our total-solutions strategy. Often, a ground-up or tailored design provides the leading-edge differentiation needed for success.

"By meeting our customers' needs, we've been profitable and growing for more than 19 years—something few IC manufacturers can say. This stellar performance reflects our successful dedication in offering customers the right custom, semicustom and standard products at the right time".

—Ray Zinn,

President, CEO and Chairman

Micrel will continue to invest in expanding its portfolio of USB power management products.

- Maintain lead with price and performance for a variety of USB devices and peripherals
- Continue to maintain the most comprehensive line of USB power management devices in the industry
- As a member of the USB Implementers Forum, Micrel monitors and contributes to any modifications to USB specifications

Micrel's Technology

Micrel—the *total-solutions power-analog company*—provides more than 900 standard devices, as well as customer-specific custom products, design services and foundry manufacturing for its customers. Founded in 1978, the company has been profitable in every quarter for more than 19 years.

We successfully serve applications in the following markets:

- Portable battery-powered computing equipment
- Networking, telecommunications
- Desktop computers
- Cellular telephones
- PC (PCMCIA) Cards and sockets
- OEM power supplies
- Medical electronics
- Industrial
- Automotive
- Avionics

These growing markets attest to Micrel's versatility as a technology-rich analog IC manufacturer providing total solutions for customers like you.

We constantly strive for industry-leading design engineering, technology-rich manufacturing processes (CMOS, BiCMOS and bipolar) and ISO 9001-level quality assurance through statistical process control, for example. Our experienced management team provides exceptional depth and breadth to our technology business.

Need Information

Order our USB evaluation switch and samples, or check out our data sheets directly from Micrel's Web Site:

<http://www.micrel.com>

MICREL
SEMICONDUCTOR

TEL: **1-800-401-9572** FAX: **408-944-0970**

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MIC5207

POWER

MIC2526

SWITCHES