TECHNOLOGY BRIEF

RF Front End Interface (RFFE)

Cost-Efficient, Adaptable Front-End Control of Mobile Devices

MIPI® RFFE defines a compact, cost-efficient, flexible two-wire control bus interface for RF front-end master and slave devices. Increasingly complex RF front-end designs that utilize multiple power amplifiers, low-noise amplifiers, switches, tuners and other components benefit from using this standard interface. The RFFE control bus specification strives to satisfy both current and the foreseen future needs of mobile wireless devices. To facilitate synchronized events, RFFE defines broadcast capabilities and trigger events. Multi-master configurations, a broad range of bus frequencies, and interrupt-capable slave functionality are also supported. A full complement of reserved registers is available for efficient software and hardware development. The RFFE specification facilitates flexibility, scalability, interoperability, low RF EMI, efficient power control and compact designs.

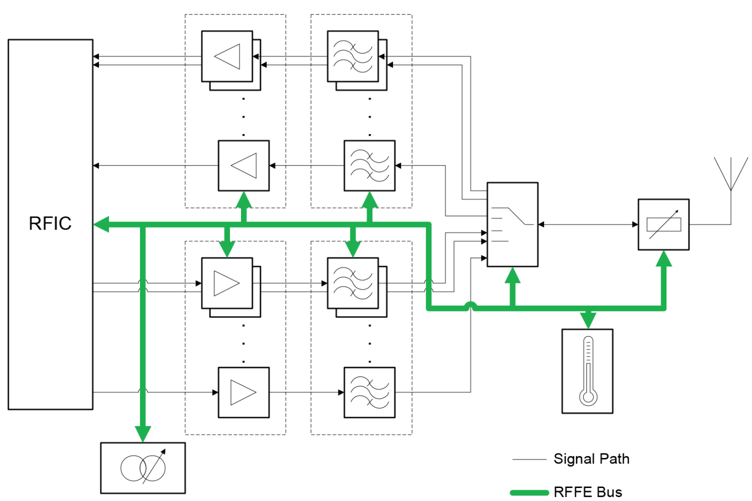

Figure 1: Example of RFFE Configuration

HIGHLIGHTS

Target Applications

- Mobile phones and tablets
- Internet of Things (IOT)
- Laptops
- Advanced automotive applications
- Medical

Key Features

- Two-wire bus
- Point to multi-point topology
- Optional multi-master configurations
- Flexible command structure including support for broadcast, triggers and interrupts

Key Benefits

- Interoperability
- Cost efficiency
- Low pin count
- Real-time control

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Technical Summary

The current RFFE interface specification is RFFE v2.0, which is backward compatible with v1.x. Based on internal working group discussions and consultation with the entire design community, several new features were introduced in v2.0, including multi-master support, interrupt-capable slave functionality, extended bus frequencies, synchronous reads, and definitions for additional reserved registers.

The specification defines interactions between a master device and up to 15 slave devices on a single RFFE bus. A single IC may host more than one RFFE bus, which means there is no practical limit on the number of slave devices. There are two signal lines: a clock signal (SCLK) controlled by the master; and, a bidirectional data signal (SDATA). The specification also defines an I/O supply/reference voltage (VIO). Slave devices can be configured as write-only to simplify design or with read/write capability. Interrupt Capable Slaves (ICS) enable quick polling to the master to signal action is needed.

Synchronous Reads allow for practical performance requirements at extended frequencies of v2.0 and relaxation of timing parameters at lower frequencies. System architects can choose between a single-master or multi-master configurations as needed by the application. Single-master systems provide a means of keeping RFFE bus timing predictive; multi-master systems provide support for multiple transceivers that can be used to implement different radio access techniques. RFFE command sequences (protocol messages) implement read and write accesses to slaves on the bus; the primary differences between command sequences is the amount of addressable space available and the size of the payload. Slave manufacturers can select the number of sequences implemented to accommodate the needs of a specific front-end device.

FEATURES

Design

- Practical, high-performance solution for multi-radio, multi-frequency systems
- Common triggers for time-critical control
- Single or multi-master configurations
- Interrupt-capable slave functionality
- Scalability topologies
- Flexible command sequence architecture
- Synchronous read functionality
- Reduced EMI to protect RF

Device Manufacturer

- Solution for mitigating variations in analog device performance
- Provides common control mechanisms for multiple configurations
- Increases intrinsic value of device

Handset OEM

- Reduces PCB complexity
- Promotes interoperability
- Common software structure
- Timing accurate programming
- Promotes IP reuse

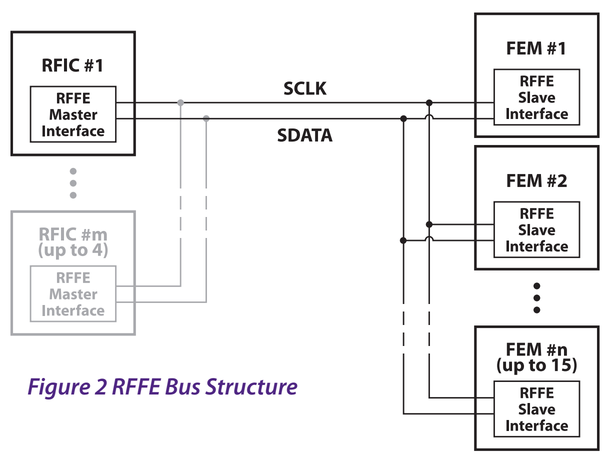

Figure 2 RFFE Bus Structure

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Device Management Entity Overview

The Device Management Entity controls the layers in the MIPI UniPro stack. It provides access to control and status parameters in all layers, manages the power mode transitions of the Link and handles the boot-up, hibernate and reset of the stack.

Application Specific Protocols

Different Application specific protocols can be used to connect with the MIPI UniPro Layers. These application specific applications include: JEDEC UFS and MIPI CSI-3.

MIPI UniPro Work Group Overview

The MIPI UniPro Work Group was chartered in 2004 to develop a high-speed interface technology for interconnecting integrated circuits in mobile devices. The Work Group coordinates requests from different application groups such as JEDEC UFS Work Group, MIPI Camera Work Group, and MIPI PHY work group to align latest development with protocol demand.

MIPI Alliance Overview

MIPI Alliance (MIPI) develops interface specifications for mobile and mobile-influenced industries. Founded in 2003, the organization has more than 250 member companies worldwide, more than a dozen active working groups, and has delivered more than 45 specifications within the mobile ecosystem in the last decade. Members of the organization include handset manufacturers, device OEMs, software providers, semiconductor companies, application processor developers, IP tool providers, test and test equipment companies, as well as camera, tablet and laptop manufacturers. For more information, please visit www.mipi.org.