

**QUAD-PORT GIGABIT COPPER TRANSCEIVER WITH RGMII AND RTBI INTERFACE**

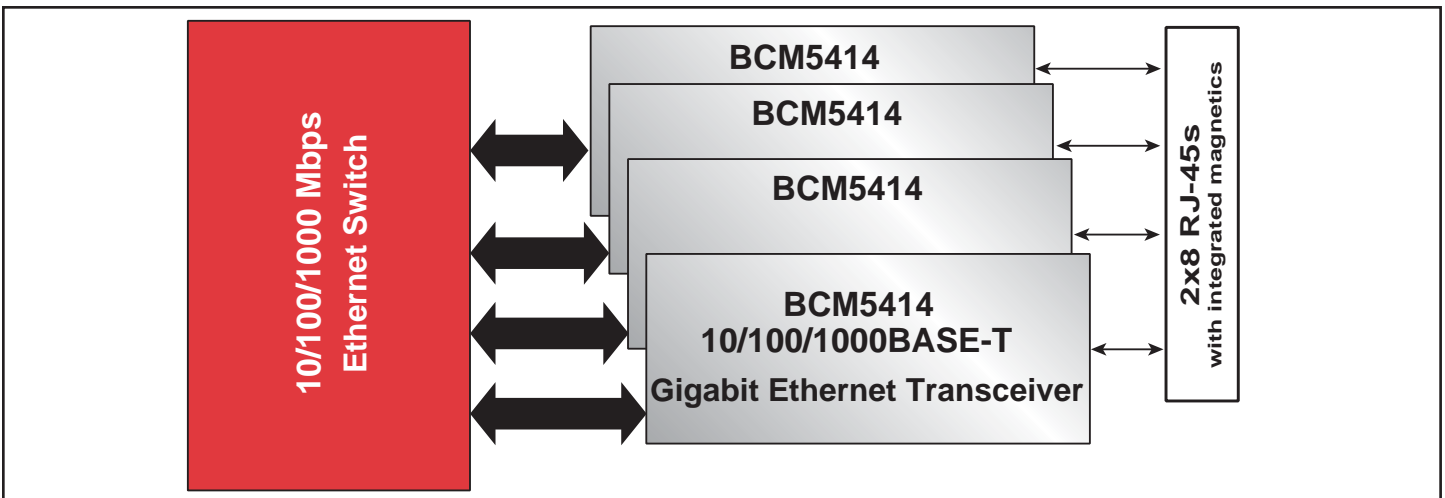
**BCM5414 FEATURES**

- Four fully integrated 10BASE-T/100BASE-TX/1000BASE-T Gigabit Ethernet transceivers
- RTBI and HSTL level RGMII interface options
- Fully compliant with IEEE 802.3, 802.3u, and 802.3ab standards
- 0.13μ CMOS — low power and cost
- Low power
  - 1W per port
  - Advanced power management
- Low EMI emissions
- Ethernet@WireSpeed™ logic automatically selects the maximum speed based on channel conditions
- Cable plant diagnostic
  - Cable plant analyzer function detects cable plant impairments
  - Link quality indication LED
  - Automatic detection and correction of wiring pair swaps, pair skew, and pair polarity
  - Automatic MDI/MDIX crossover at all speeds
- Robust CESD tolerance
- Support for jumbo packets up to 9 KB
- IEEE 1149.1 (JTAG) boundary scan

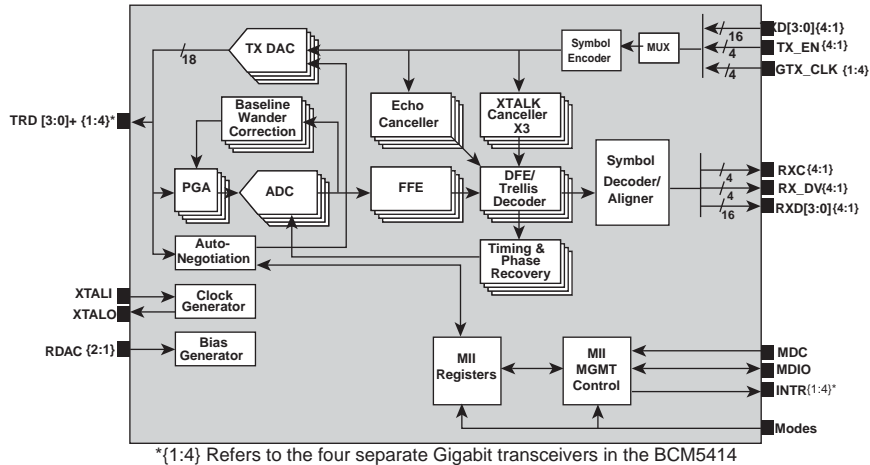
**SUMMARY OF BENEFITS**

- Low-power, quad-port integration enables single-row, high port density switches.
  - Lowers system costs by eliminating PCB layers required for routing high density solutions
  - 1.5V or 1.8V HSTL signal levels eliminate the need for 3.3V power supply, lowering system cost and simplifying design
  - Clock timing can be adjusted to eliminate board trace delays required by the RGMII specification.
  - Lowers MAC/switch costs by reducing the number of pins required to interface to the PHY.
- Provides compatibility with IEEE standard devices operating at 10, 100, and 1000 Mbps at half- and full-duplex.
- Reduces design constraints in high-density applications that have higher EMI emissions.
- Automatically configures the link to support the highest possible speed based on link partner capability and characteristics of the channel.
- Cable diagnostic function characterizes cable plant condition and immediately indicates cabling issues.
  - Prevents erroneous equipment return due to bad cable plants.
  - Prevents manufacturing fall-out due to bad cable plants.
- High CESD tolerance prevents equipment damage and return.
- Supports jumbo packets for wider range of packet protocol compatibility.
- Ease of manufacturing with JTAG support and simplified power supply.

**BCM5414 System Diagram**



BCM5414 Block Diagram



The **BCM5414** consists of four complete 10/100/1000BASE-T Gigabit Ethernet transceivers integrated on a single monolithic CMOS chip. The **BCM5414** is optimized for low power and small footprint size to enable high port-density applications. By doubling transceiver port density, lowering system cost, and reducing power dissipation by nearly 50%, the **BCM5414** enables a new class of cost-effective Gigabit Ethernet equipment, driving the delivery of Gigabit bandwidth to the desktop.

The **BCM5414**'s Digital Signal Processor based architecture and advanced power management techniques combine to achieve robust and low-power operation over the existing CAT 5 twisted pair wiring. The **BCM5414** architecture not only meets the requirements of 802.3, 802.3u, and 802.3ab, but maintains the industry's highest level of margin over IEEE requirements for Echo, NEXT, and FEXT. Low power is key to implementing high-density Gigabit switches, and at 1W per port, the **BCM5414** enables twice the density of previous Gigabit PHY transceivers. In addition, the **BCM5414** has extremely low EMI emissions, which reduces the design constraints required to meet EMI radiation specifications.

The **BCM5414** supports the RTBI and HSTL level RGMII interfaces. The RGMII is a reduced pin-count (12 versus 25) version of the GMII and RTBI is a reduced pin-count version of TBI utilizing standard ASIC technology. HSTL level signalling is supported at 1.5V or at 1.8V. Using HSTL level signalling for the RGMII interface eliminates the need to supply 3.3V to the design, which removes a power supply, lowers cost, and simplifies the design. The RGMII clock timing can be adjusted to eliminate the board trace delays required by the RGMII specification. These reduced pin-count interfaces simplify design and lower system cost by reducing the number of layers required to route high density solutions. In addition, these interfaces allow fewer pins at the MAC/switch, which reduces the MAC/switch cost by enabling smaller die sizes than would be possible with full GMII or TBI

interfaces.

This device is another member of Broadcom's 0.13µm Gigabit copper PHY family, joining the BCM5404, BCM5421, BCM5421S, BCM5424 and BCM5434. The 0.13µm process is an aggressive process that offers the best performance, lowest cost, and lowest power for Gigabit copper solutions. In addition, devices based on this process offer an excellent long-term cost curve, enabling cost reductions as the price of the 0.13µm wafers come down, without having to redesign or requalify a new part.

Each port of the **BCM5414** is fully independent and has individual interface, control and status registers and incorporates a number of advanced features. A link quality indicator LED gives installers an instant visual indication if there are any problems with the wiring plant supporting operation at the desired speed. This includes physical wiring defects that the **BCM5414** cannot automatically correct for and channel conditions such as excessive cable length, and return loss, crosstalk, echo, and noise. Broadcom's cable analyzer software can be used with the device to provide remote management of the cable and a first level of diagnostics and fault isolation. The **BCM5414** is fully compatible with the IEEE 802.3 standard for auto-negotiation of speed, but additionally supports Ethernet@WireSpeed™. Ethernet@WireSpeed™ allows the **BCM5414** to force auto-negotiation to be automatically limited by the speed that the channel can reliably support, rather than the performance of the end equipment.

The **BCM5414** also has ESD tolerance well above typical industry standards. This prevents ESD damage not only during manufacturing but during CESD events in the field. Cable-sourced electrostatic discharge (CESD) is an ESD event that occurs when an electrically charged network cable is plugged into a network port, an issue becoming more prevalent with recent cable installations.

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