



### QUAD-PORT 10/100/1000BASE-T GIGABIT COPPER TRANSCEIVER

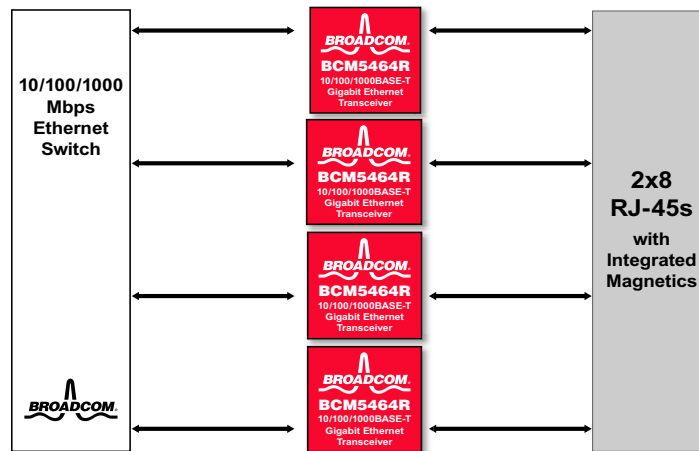
#### FEATURES

- Four fully-integrated 10BASE-T/100BASE-TX/1000BASE-T Gigabit Ethernet transceivers
- RGMII, SGMII, and SerDes MAC interface options
- 1-Gbps line-side SerDes with RGMII MAC interface
- Fully compliant with IEEE 802.3, 802.3u, and 802.3ab standards
- 0.13-micron CMOS—low power and cost
- Supports copper or fiber in RGMII mode
- Low power
  - 750 mW per port
  - Advanced power management
- Trace matched output impedance
- Line-side loopback
- Low EMI emissions
- 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 cable-sourced electrostatic discharge (CESD) tolerance
- Support for jumbo packets up to 10 KB
- IEEE 1149.1 (JTAG) boundary scan
- Package: 256-pin BGA

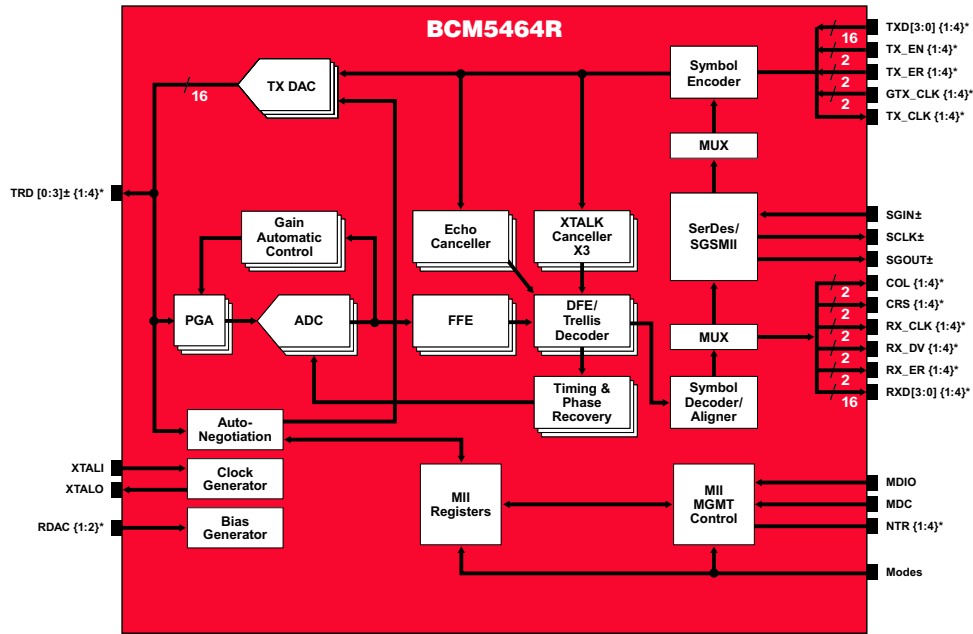
#### SUMMARY OF BENEFITS

- 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.
  - Reduced I/O pin requirements with RGMII (over 50%), SGMII (over 75%), and SerDes (over 80%).
  - 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-duplex and full-duplex.
- Requires no airflow or heatsink.
- Lowers system BOM cost and simplifies system design.
- Eases system-level debug.
- Enables use of low-cost magnetics, even in high-density (48+) designs.
- 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.
- Over 4 kV of CESD tolerance prevents equipment damage and return.
- Operates with larger packets for wider range of packet protocol support and improved efficiency.
- Ease of manufacturing with JTAG support, simplified power supply, and multiple MAC interfaces.

#### BCM5464R System Diagram



# OVERVIEW



**BCM5464R Reference Design**

The BCM5464R consists of four complete 10/100/1000BASE-T Gigabit Ethernet transceivers integrated on a single monolithic CMOS chip, and is a member of Broadcom's QuadSquad™ family of quad Gigabit Ethernet PHYs. The BCM5464R is optimized for low-power and small footprint size to enable high port density applications. The BCM5464R enables a new class of cost-effective Gigabit Ethernet equipment by lowering system cost and reducing power dissipation by nearly 25%, driving the delivery of Gigabit bandwidth to the desktop.

The BCM5464R's digital signal processor-based architecture and advanced power management techniques combine to achieve robust and low-power operation over the existing Category 5 twisted-pair wiring. The BCM5464R architecture not only meets the requirements of IEEE's 802.3, 802.3u, and 802.3ab standards, 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 the BCM5464R has the lowest power in the industry at 750 mW per port. In addition, the BCM5464R has extremely low EMI emissions, which reduces the design constraints required to meet EMI radiation specifications.

The BCM5464R supports the RGMII, SGMII, and SerDes MAC interfaces. The RGMII, SGMII, and Serial SerDes are reduced pin count (12, 6, and 4, respectively, versus 25) versions of the GMII. 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.

This device is another member of Broadcom's 0.13-µm Gigabit copper PHY family, joining more than a dozen other quad-port and single-port PHY products. The 0.13-µm process is the optimal process that offers the best performance, lowest cost, and lowest power for Gigabit copper solutions. Devices based on the 0.13-µm process offer an excellent long-term cost curve, enabling better cost reduction over time compared to older technologies without requiring the redesign or requalification of a new part.

Each BCM5464R port 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 preferred speed. This includes physical wiring defects that the BCM5464R cannot automatically correct. This includes 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 BCM5464R also has ESD tolerance well above typical industry standards. This prevents ESD damage not only during manufacturing but during CESD events in the field. The CESD is an ESD event that occurs when an electrically-charged network cable is plugged into a network port. This issue is becoming more prevalent with contemporary cable installations. The BCM5464R tolerates over 4 kV of CESD.

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