



## OCTAL-PORT 10/100/1000BASE-T GIGABIT ETHERNET TRANSCEIVER

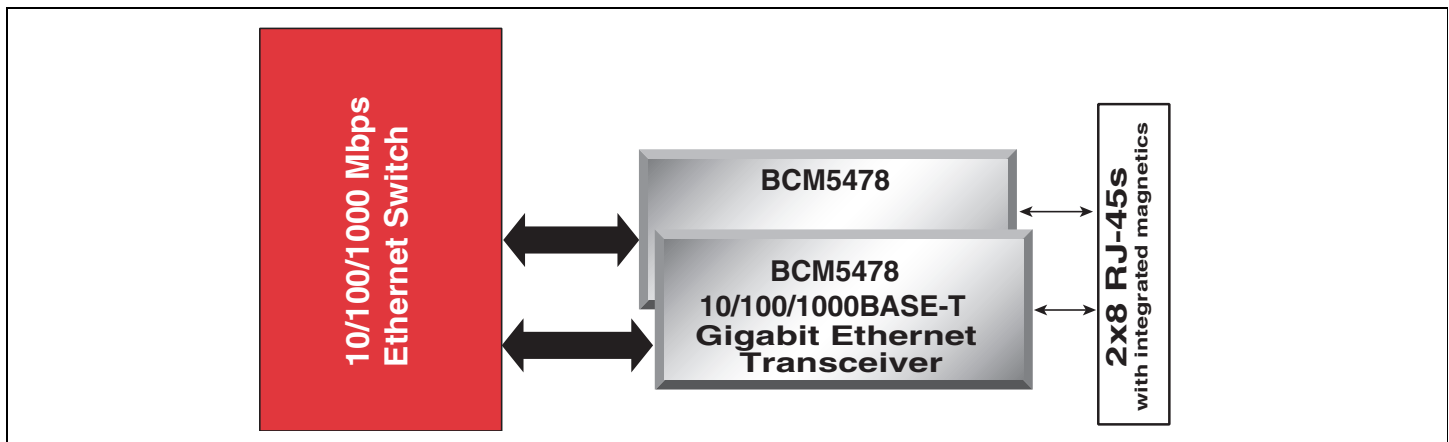
### FEATURES

- Eight fully integrated 10BASE-T/100BASE-TX/1000BASE-T Gigabit Ethernet transceivers
- RGMII, SGMII, and SerDes MAC interface options
- 1-Gbps lineside SerDes with RGMII MAC interface
- Fully compliant with IEEE 802.3, IEEE 802.3u, and IEEE 802.3ab standards
- 0.13-micron CMOS—low power and cost
- Supports copper or fiber in RGMII mode
- Low power
  - <600 mW per port
  - Advanced power management
- Trace-matched output impedance
- Lineside loopback
- Low EMI emissions
- Cable plant diagnostics
  - 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: 484-pin PBGA

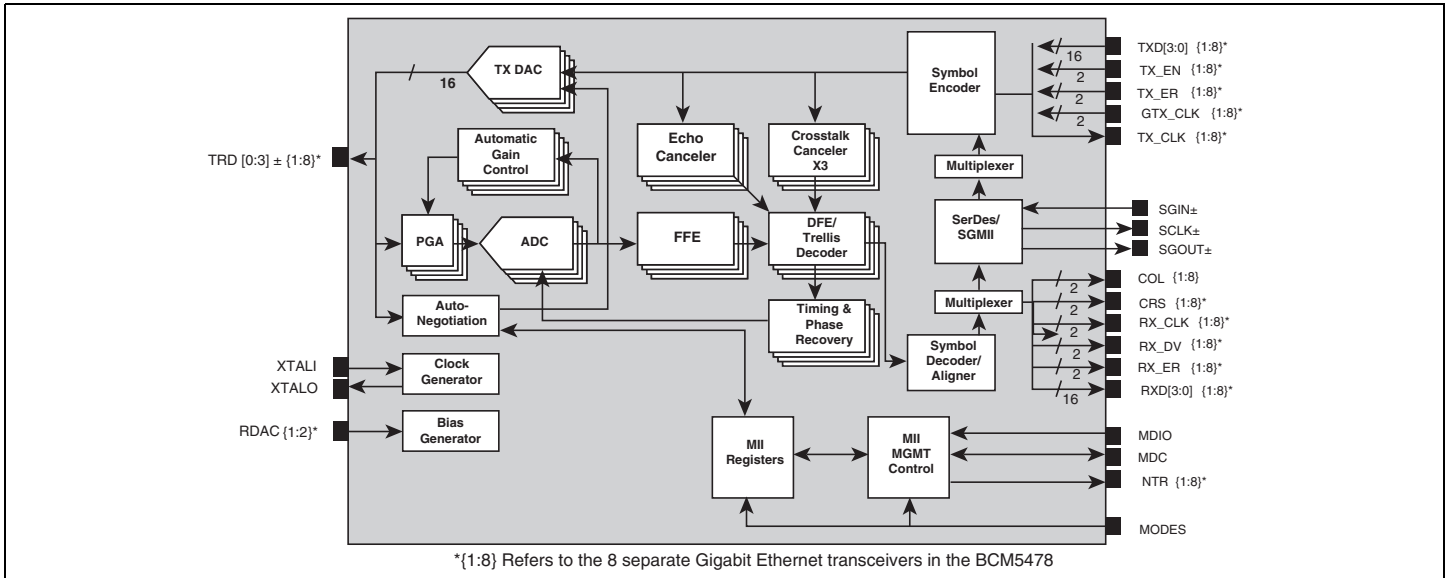
### SUMMARY OF BENEFITS

- Low-power, octal-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 with the PHY.
- Provides compatibility with IEEE standard devices operating at 10, 100, and 1000 Mbps at half-duplex and full-duplex.
- 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 fallout due to bad cable plants.
- Over 3 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.

### BCM5478 System Diagram



# OVERVIEW



The **BCM5478** consists of eight complete 10/100/1000BASE-T Gigabit Ethernet transceivers integrated on a single monolithic CMOS chip. The **BCM5478** is optimized for low power and small footprint size to enable high-port-density applications. The **BCM5478** enables a new class of cost-effective Gigabit Ethernet equipment by lowering system cost and reducing power dissipation by nearly 30 percent, driving the delivery of Gigabit Ethernet bandwidth to the desktop.

The **BCM5478** DSP-based architecture and advanced power management techniques combine to achieve robust and low-power operation over existing Category 5 twisted-pair wiring. The **BCM5478** architecture not only meets the requirements of IEEE 802.3, IEEE 802.3u, and IEEE 802.3ab, but also maintains the industry's highest level of margin over IEEE requirements for echo, near-end crosstalk (NEXT), and far-end crosstalk (FEXT). Low power is the key to implementing high-density Gigabit Ethernet switches, and the **BCM5478** has the lowest power in the industry at less than 600 mW per port. In addition, the **BCM5478** has extremely low EMI emissions, which reduces the design constraints required to meet EMI radiation specifications.

The **BCM5478** supports the RGMII, SGMII, and SerDes MAC interfaces. The RGMII, SGMII, and serial SerDes interfaces 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- $\mu$ m Gigabit Ethernet copper PHY family, joining more than a dozen other quad and single products. The 0.13- $\mu$ m process is the optimal process that offers the best performance, lowest cost, and lowest power for Gigabit Ethernet copper solutions. Devices based on the 0.13- $\mu$ m process offer an excellent long-term cost curve, enabling better cost reduction over time (compared to older technologies) without having to redesign or requalify a new part.

Each **BCM5478** 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 **BCM5478** 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 **BCM5478** has the industry's highest tolerance to ESD. This prevents ESD damage not only during manufacturing, but also during CESD events in the field. CESD is an ESD event that occurs when an electrically charged network cable is plugged into a network port. This is an issue that has become more prevalent with contemporary cable installations, and the **BCM5478** can tolerate well over 2kV of CESD.

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