

## BCM5411 10/100/1000BASE-T TRANSCEIVER

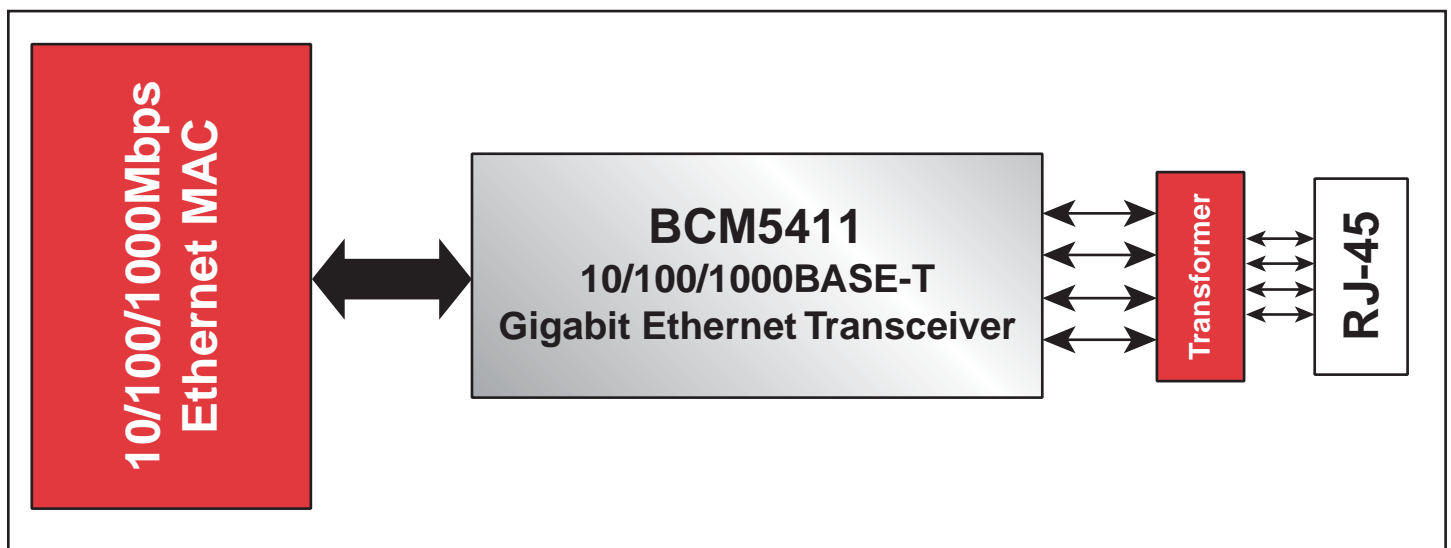
### BCM5411 FEATURES

- Fully integrated 10BASE-T/100BASE-TX/1000BASE-T Gigabit Ethernet transceiver compliant with IEEE 802.3, 802.3u, and 802.3ab standards
- Low power
  - Less than 2W per port
  - Advanced power management
  - Wake on LAN support—less than 600 mW
  - Standby power mode with energy detect
- MII, GMII, RGMII, TBI and RTBI interface options
- Ethernet@WireSpeed™ automatically selects maximum speed based on channel conditions
- Cable plant diagnostic
  - Cable plant analyzer capability to detect 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
- Internal 125-MHz low-jitter clock generation
- Support for jumbo packets up to 9 KB
- IEEE 1149.1 (JTAG) boundary scan
- 128-pin MQFP package or 117-pin BGA package

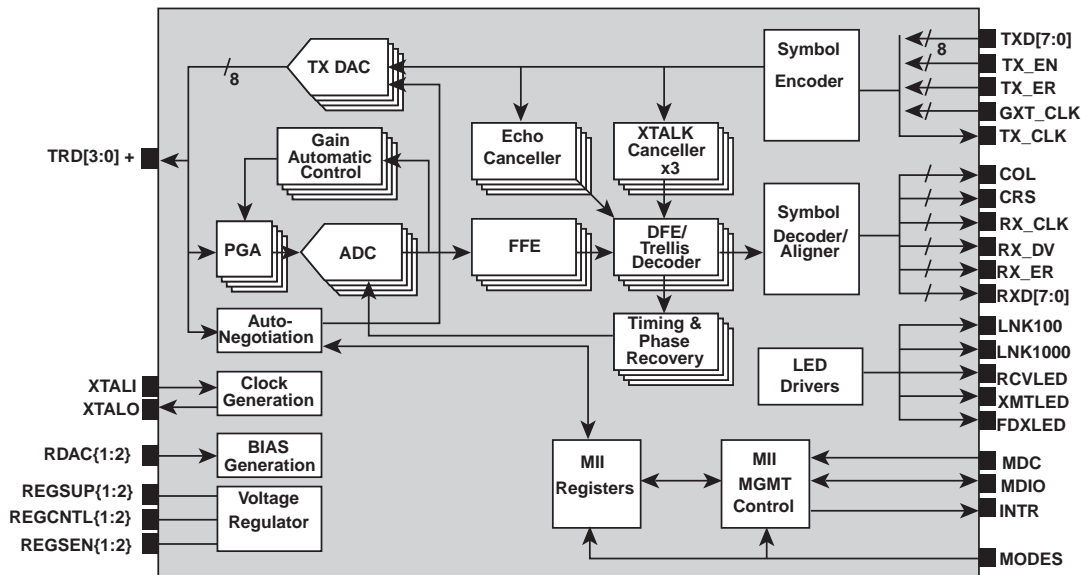
### SUMMARY OF BENEFITS

- Compatible with IEEE standard operation at 10, 100, and 1000 Mbps at half- and full-duplex.
- No airflow or heatsink required.
- Wake on LAN mode for low-power, PC'99-compliant adapters (less than 600 mW).
- Auto-Network detection places unconnected ports into low power state.
- Automatically configures the link to support the highest possible speed based on link partner capability and characteristics of the channel.
- RGMII/RTBI reduces I/O pin requirement over GMII and TBI by more than 50%.
- 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.
- 125-MHz clock eliminates costly external clocking circuitry for the MAC/ASIC.
- Operates with larger packets for wider range of packet protocol support and for improved efficiency.
- High density package options without heatsink requirement provides improved testability.

### BCM5411 System Diagram



BCM5411 Block Diagram



The **BCM5411** is a fully integrated 10/100/1000BASE-T Gigabit Ethernet transceiver solution. An advanced Digital Signal Processor based architecture, 0.18u CMOS process, and power management techniques are used to create a design optimized for low power operation and minimal board space.

This device represents the third generation of Gigabit Ethernet transceivers based on the same field-proven architecture as in the BCM5400 and BCM5401 transceivers, which demonstrate robust operation over the installed base of CAT 5 twisted pair wiring. The **BCM5411** is fully software and register compatible with the BCM5400 and BCM5401.

In addition to low power operation, several modes are included to further reduce power in special conditions. The **BCM5411** can detect when the user disconnects the port from a network and subsequently enters into low power modes. When energy is detected on the line, the part re-enters normal mode of operation. The energy detection mode is especially valuable for mobile applications to conserve battery life when the Ethernet port is not used.

Dissipating less than 600 mW, the **BCM5411**'s Wake-on-LAN mode allows PC adapters and LAN-on-motherboard (LOM) to meet stringent standby power requirements for PC'99 compliance. In the wake-on-LAN mode, the transceiver keeps

the link active at 10 Mbps or 100 Mbps while powering down all of the internal circuitry needed for operation at Gigabit Ethernet. Power is less than 400 mW in wake-on-LAN mode.

In addition to supporting IEEE 802.3 Standard Gigabit Media Independent Interface (GMII), and industry standard Ten Bit Interface (TBI), **BCM5411** also supports RGMII, a reduced pin-count (12 versus 25) version of the GMII. In a 24-port system, using RGMII instead of GMII results in savings of 312 pins for MAC ASICS, thus saving systems cost significantly.

The **BCM5411** is fully compatible with the IEEE 802.3 standard for auto-negotiation of speed. Additionally, several Plug and Play enhancements are added to make the device even more user friendly. 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 **BCM5411** cannot automatically correct for and channel conditions such as excessive cable length, 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 **BCM5411** continually monitors various channel conditions. The optional Ethernet@WireSpeed™ capability allows the **BCM5411** to auto-negotiate to the maximum data rate allowed by the cable plant. This feature prevents failure to establish link because of cable plant impairment at higher data rates.

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