MC68194

Technical Summary

Carrierband Modem

The bipolar LSI MC68194 carrierband modem (CBM), when combined with the MC68824 token bus controller (TBC), provides an IEEE 802.4 single-channel, phase-coherent carrierband, local area network (LAN) connection. The CBM performs the physical layer function, including symbol encoding/decoding, signal transmission and reception, and physical management.

The following features are available on the MC68194:

- Implements IEEE 802.4 Single-Channel, Phase-Coherent Frequency Shift Keying (FSK) Physical Layer, Including End-of-Transmission Receiver Blanking
- Provides Physical Layer Management, Including Local Loopback Mode, Transmitter Enable, and Reset
- Supports Data Rates up to 10 Mbps — IEEE 802.4 Standards Use 5 or 10 Mbps
- Interfaces via Standard Serial Interface to MC68824 Token Bus Controller
- Crystal-Controlled Transmit Clock
- Local Loopback Mode for Testing
- Recovery of Clocked Data through Phase-Locked Loop
- Adjustable Signal-Detection Threshold
- RC-Controlled Jabber-Inhibit Timer
- Single +5.0-V Power Supply

This document contains information on a new product. Specifications and information herein are subject to change without notice.

GENERAL DESCRIPTION

The MC68194 CBM is part of Motorola's solution for an IEEE 802.4 token bus carrierband LAN node. The CBM integrates the function of the single-channel FSK physical layer. Figure 1 illustrates the architecture of a token bus LAN node as commonly used in Manufacturing Automation Protocol (MAP) industrial communications. Based on the ISO-OSI model shown in Figure 2, the logical link control (LLC) sublayer and additional upper layers are typically supported by a local MPU subsystem, while the IEEE 802.4 token bus media access control (MAC) sublayer and physical layer are implemented by the MC68824 TBC and MC68194 CBM, respectively.

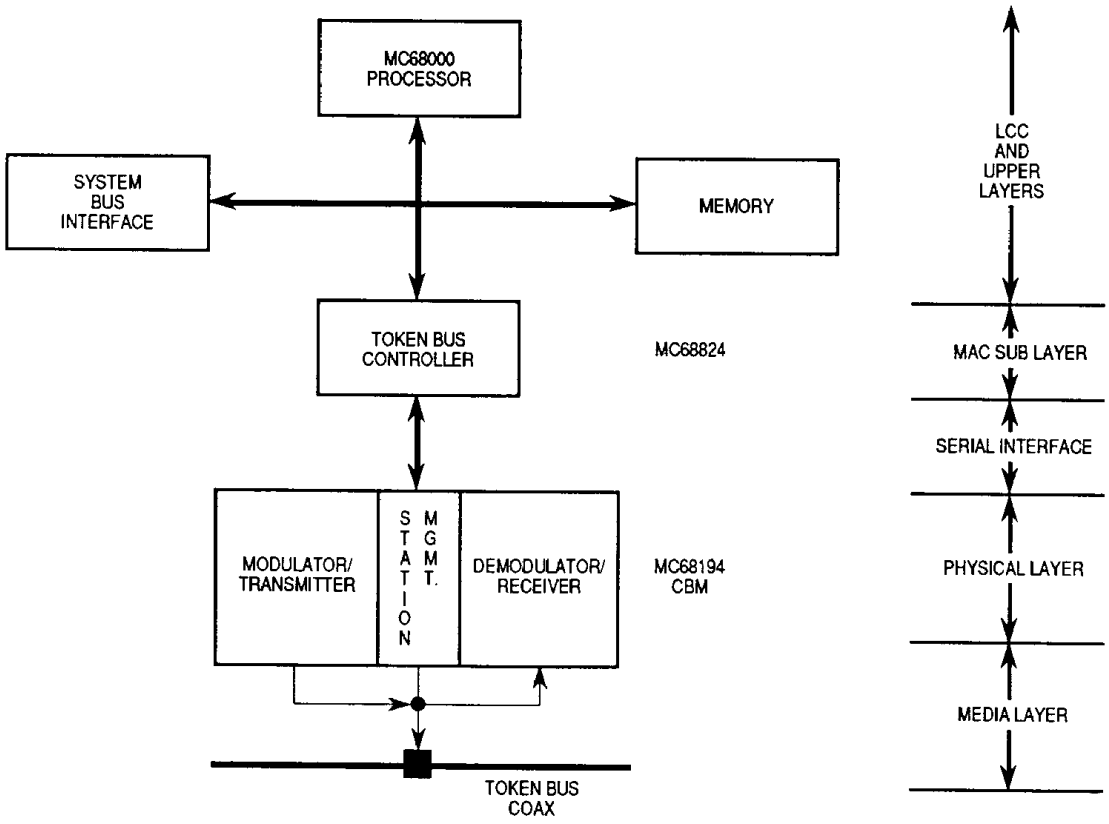

Figure 1. Token Bus LAN Node

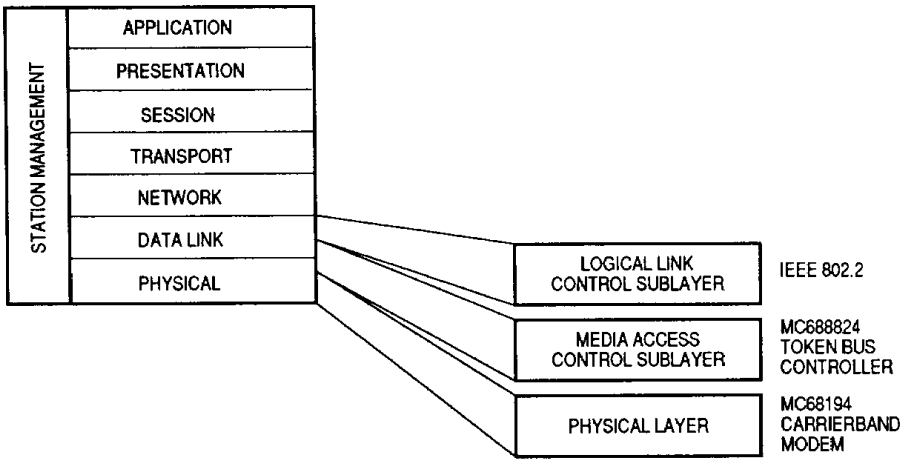

Figure 2. ISO/OSI Model

The CBM provides the three basic functions of the physical layer: data transmission to the coaxial cable, data reception from the cable, and management of the physical layer. For standard data mode (also called MAC mode), the CBM receives a serial transmit data stream from the TBC (called symbols or atomic symbols), encodes, modulates the carrier, and transmits the signal to the coaxial cable. Also in the data mode, the CBM receives a signal from the cable, demodulates the signal, recovers the data, and sends the received data symbols to the TBC. End-of-transmission receiver blanking as required by IEEE 802.4 is supported. Communication between the TBC and CBM is through a standardized serial interface consistent with the IEEE 802.4 DTE-DCE interface.

The physical layer management provides the ability to reset the CBM, control the transmitter, and do loopback testing. Also, an on-board RC timer provides a jabber-inhibit function to turn off the transmitter and report an error condition if the transmitter has been continuously on for too long. The CBM management mode uses the TBC serial interface in a similar manner as the data mode.

The CBM uses FSK modulation on a single-channel system. In this modulation technique, the two signaling frequencies are integrally related to the data rate, and transitions between the two signaling frequencies are made at zero crossings of the carrier waveform. Table 1 shows the data rate and signaling frequencies. An {L} is represented as one-half cycle of a signal, starting and ending with a nominal zero amplitude whose period is equal to the period of the data rate, with the phase of one-half cycle changing at each successive {L}. An {H} is represented as one full cycle of a signal, starting and ending with a nominal zero amplitude whose period is equal to half the period of the data rate. In a

5-Mbps implementation, the frequency of {L} is 5 MHz and {H} is 10 MHz. For a 10-Mbps implementation, the frequency of {L} is 10 MHz and {H} is 20 MHz. The other possible physical symbol is when no signal occurs for a period equal to one-half the period of the data rate. This condition is represented by {off}.

Table 1. Data Rate vs Signaling Frequencies

Data Rate Mbps	Frequency of Lower Tone MHz {L}	Frequency of Higher Tone MHz {H}
5	5.0	10.0
10	10.0	20.0

The specified physical symbols ({L}, {H}, and {off}) are combined into pairs called MAC symbols. The MAC symbols are transferred across the serial link. The encodings for the five MAC symbols are shown in Table 2. Figure 3 shows the phase-coherent modulation scheme for one, zero, and nondata. The IEEE 802.4 document does not specify the polarity used to transmit data on the physical cable. The receiver must operate without respect to polarity.

Table 2. MAC Symbol Encodings

MAC Symbol	Encoding
SILENCE	{ OFF OFF }
PAD-IDLE PAIRS	{ L L } { H H }
ZERO	{ H H }
ONE	{ L L }
NONDATA ND1 ND2	 { H L } { L H }

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Figure 4 illustrates the functional blocks of the CBM and peripheral circuitry required for an IEEE 802.4 carrierband 5-Mbps or 10-Mbps data-rate FSK physical layer. A number of passive components directly support CBM operation to set the jabber-inhibit timer and data-recovery timing. In addition, an external crystal or clock source is required (20 MHz for a 5-Mbps data rate or 40 MHz for a 10-Mbps data rate). The receive clock recovery is based on a phased-locked loop that uses an active filter with an external op amp.

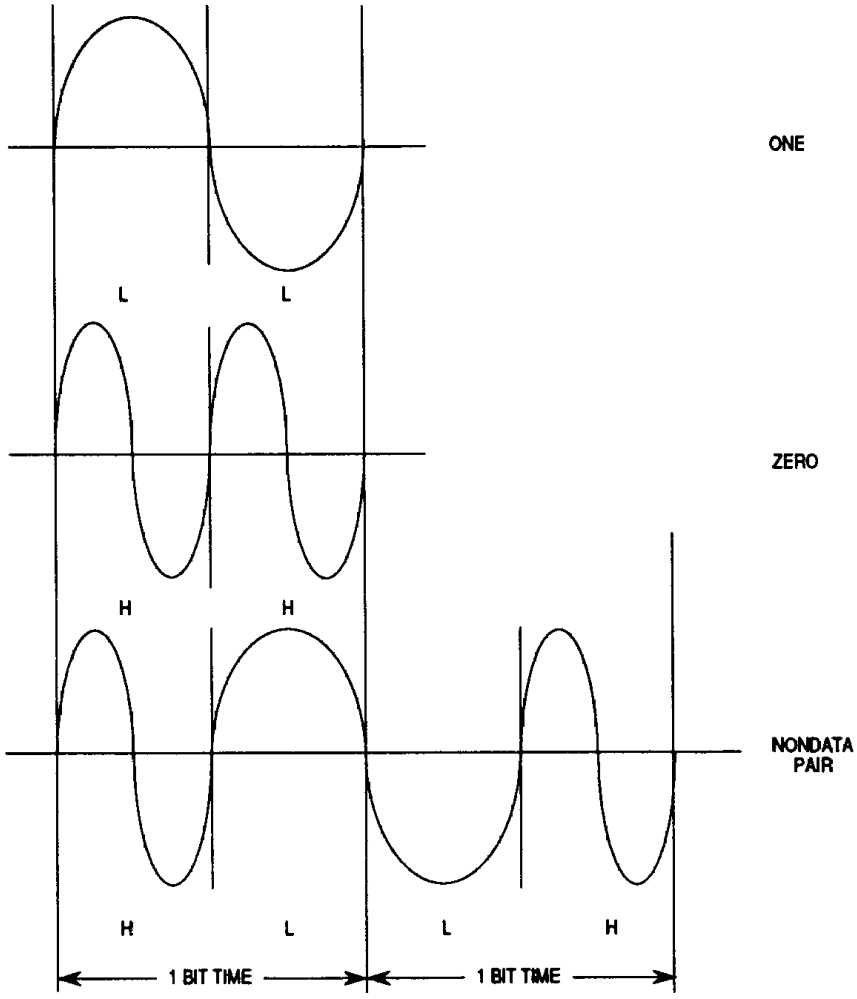


Figure 3. Phase-Coherent Modulation Scheme

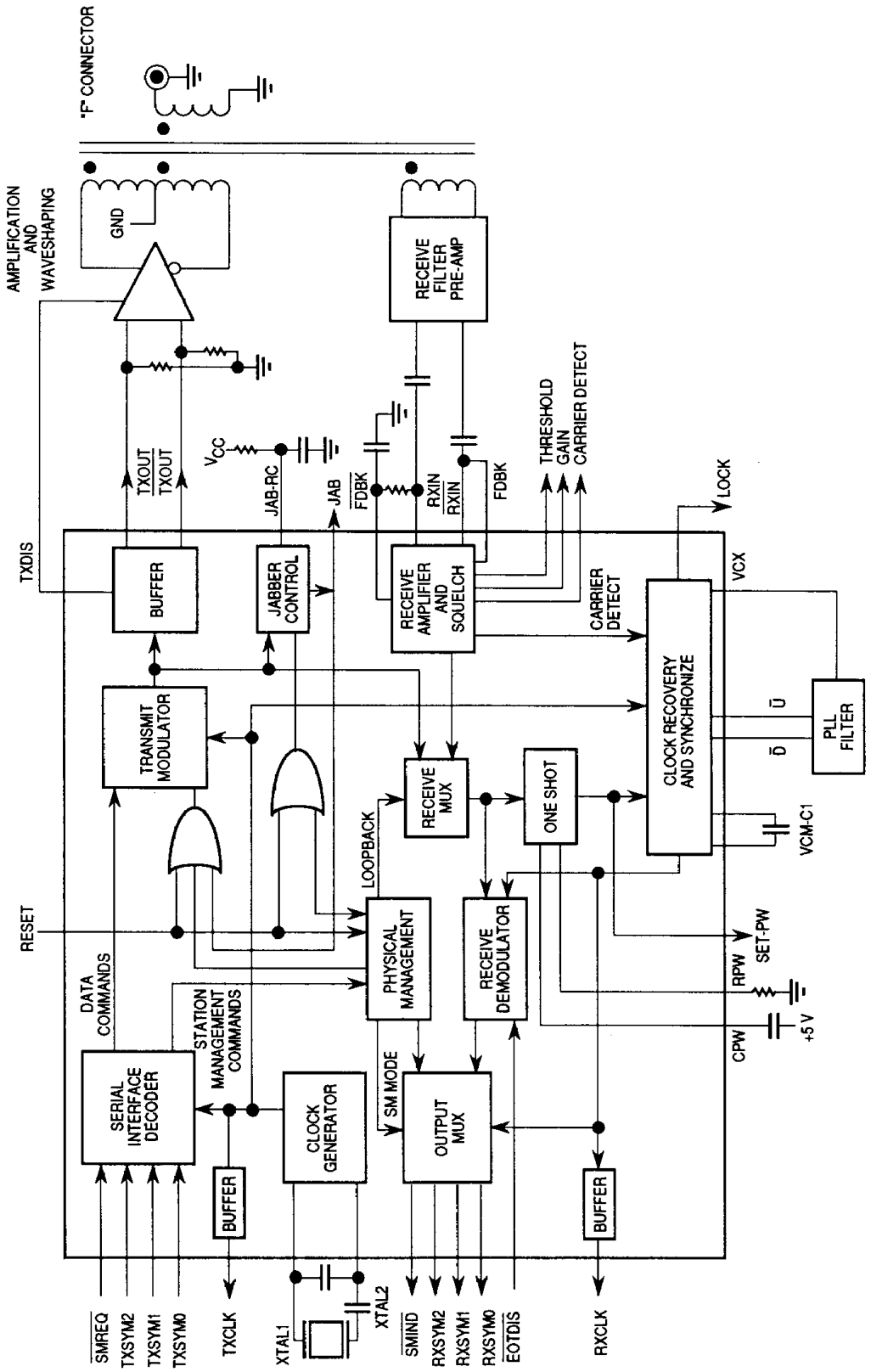


Figure 4. Functional Block Diagram

For the coaxial cable interface, the CBM can directly receive the filtered signal from the cable, meeting the IEEE 802.4 requirement of a 4 to 10 dB (1 mV, 75 Ω) [dBmV] threshold window. The receive threshold is trimmable if desired by the user. For signal transmission, the CBM provides a set of differential transmit outputs that use emitter-coupled logic (ECL) levels referenced to V_{CC} — i.e., logic high = −4.1 V and logic low = −3.3 V) and a TX disable signal. Since the IEEE 802.4 requires a +63 to +66 dBmV transmit level, an amplifier with waveshaping is required. Typically, an RF transformer is used for connection to the cable.

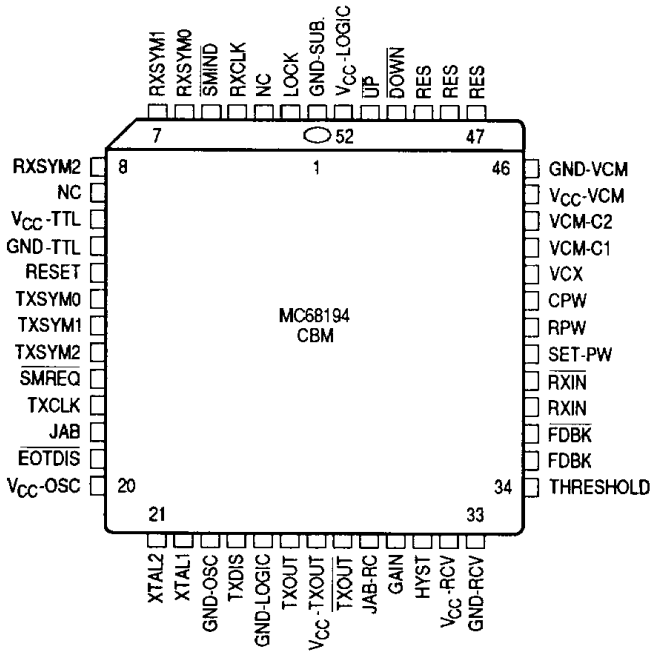
Although primarily intended for the IEEE 802.4 carrierband, the CBM is also an excellent device for point-to-point data links, fiber-optic modems, and proprietary LANs. The CBM can be used over a wide range of frequencies and interfaces easily into different kinds of media.

SERIAL INTERFACE

The serial interface is composed of the physical data request channel and the physical data indication channel. Five signals comprise the physical data request channel: TXSYM0, TXSYM1, TXSYM2, TXCLK, and $\overline{\text{SMREQ}}$. The physical data indication channel is composed of RXSYM0, RXSYM1, RXSYM2, RXCLK, and $\overline{\text{SMIND}}$. The serial interface is used to pass commands and data frames between the TBC and the CBM. This interface is based on the IEEE 802.4 DTE-DCE interface.

PIN ASSIGNMENT

52-LEAD PLASTIC LEADED CHIP CARRIER



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