Am7995

IEEE 802.3/Ethernet/Cheapernet Transceiver

ADVANCED INFORMATION

DISTINCTIVE CHARACTERISTICS

- Compatible with Ethernet version 2 and IEEE 802.3 Rev D (10 Base 5 Type A and 10 Base 2 Type B)
- Signal Quality Error (SQE) test generated after each transmission
- Internal Jabber Controller prevents excessive transmission time
- Noise rejection filter ensures only valid data is transmitted onto network
- Collision detection on both transmit and receive data

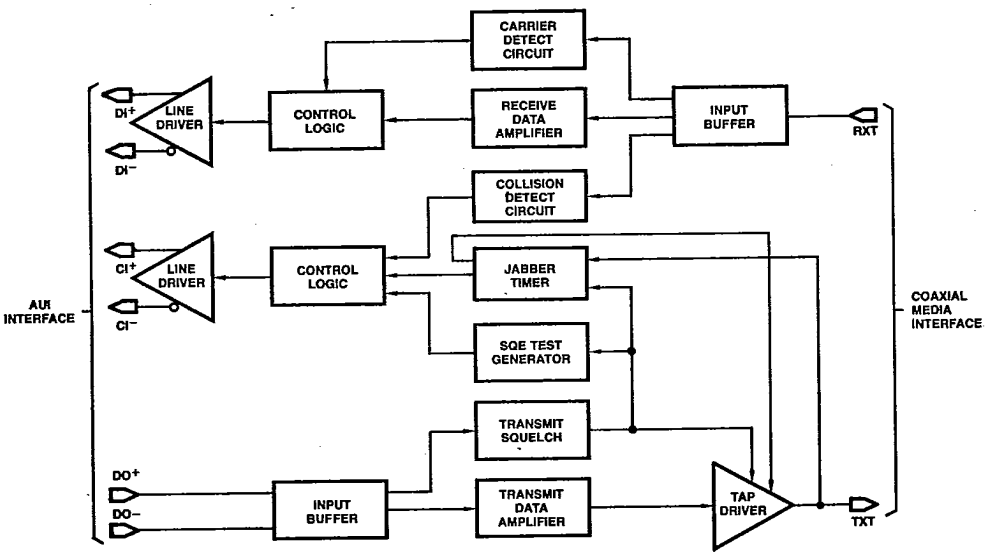
GENERAL DESCRIPTION

The Am7995 IEEE 802.3/Ethernet/Cheapernet Transceiver supports Ethernet Version 2, IEEE 802.3 (Type A), and IEEE 802.3 (Type B – "Cheapernet") transceiver applications. Transmit, receive, and collision detect functions at the coaxial media interface to the Data Terminal Equipment (DTE) are all performed by this single device.

In an IEEE 802.3 (Type A)/Ethernet application, the Am7995 interfaces the coaxial (0.4" diameter) media to the DTE through an isolating pulse transformer and the 78 ohm Attachment Unit Interface (AUI) cable. In IEEE 802.3 (Type B – "Cheapernet") applications, the Am7995 typically resides inside the DTE with its signals to the DTE isolated and the coaxial (0.2" diameter) media directly connected to the DTE. Transceiver power and ground in both applications are isolated from that of the DTE.

The Am7995's tap driver provides controlled skew and current drive for data signaling onto the media. The Jabber Controller prevents the node from transmitting excessively. While transmitting, collisions on the media are detected if one or more additional stations are transmitting. The Am7995 indicates operational status of its CI pair to the DTE by sending a signal on the CI pair at the end of every transmission at the node (SQE test).

BLOCK DIAGRAM



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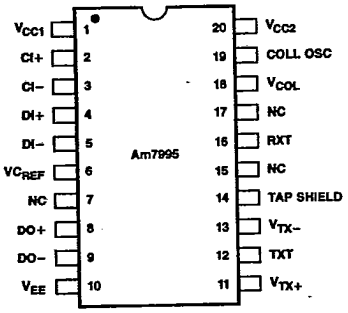
Order # 05998A

Advanced Micro Devices

February 1985

CONNECTION DIAGRAM
Top View



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RELATED PRODUCTS

Part No.	Description
Am7992A	Serial Interface Adapter (SIA)
Am7990	Local Area Network Controller for Ethernet (LANCE)

ORDERING INFORMATION

AMD products are available in several packages and operating ranges. The order number is formed by a combination of the following: device number, speed option (if applicable), package type, operating range and screening option (if desired).

Am7995 D C B

Screening Option
Blank = Standard Processing
B = Burn-In

Temperature (see Operating Range)
C = Commercial (0 to +70°C)

Package
D = (20-Pin CERDIP)
P = (20-Pin Plastic Dip)
X = Dice

IEEE 802.3/Ethernet/Cheapernet Transceiver

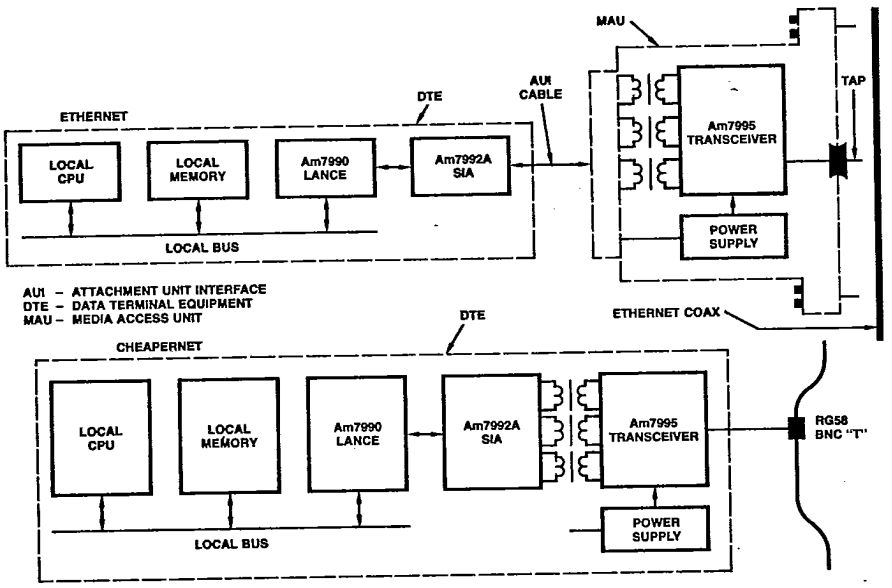
Valid Combinations

Am7995	D, C
Am7995	D, C, B

Valid Combinations

Consult the AMD sales office in your area to determine if a device is currently available in the combination you wish.

TYPICAL ETHERNET NODE



PIN DESCRIPTION

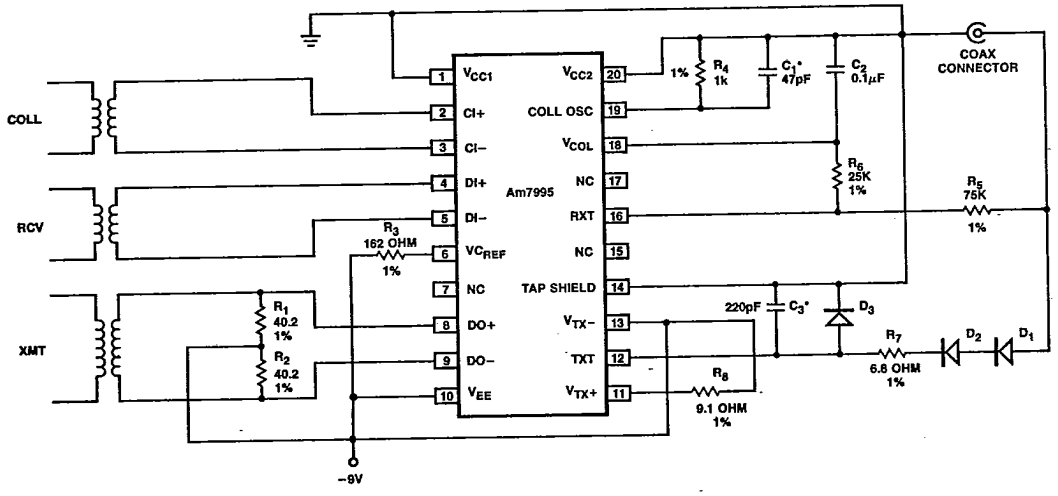
Pin No.	Name	I/O	Description
1	V_{CC1}		Positive Logic Supply
2 3	CI+, CI−	O	**Collision (Output). A Differential Line Output.** This pair is intended to operate into terminated 78 ohm transmission lines. Signal Quality Error (SQE), detected at DO± inputs (excessive transmissions) or RXT input (during a collision), outputs the 10MHz internal oscillator signal to the AUI interface. For proper component values at COLL OSC, signaling at CI± meets requirements of IEEE 802.3 Rev. D.
4 5	DI+, DI−	O	**Receive (Output). A Differential Line Output.** This pair is intended to operate into terminated 78 ohm transmission lines. Signals at RXT meeting bandwidth requirements and carrier sense levels are outputted at DI±. Signaling at DI± meet requirements of IEEE 802.3 Rev. D.
6	VC_{REF}	I	**Timing Reference Set (Input).** VC_{REF} is a compensated voltage reference input with respect to V_{EE}. When a resistor is connected between VC_{REF} and V_{EE}, then internal transmit and receive squelch timing, SQE oscillator frequency, and receive and SQE output drive levels are set. SQE frequency set is also determined by components connected between V_{CC1} and COLL OSC.
7	N.C.		**No Connection**
8 9	DO+, DO−	I	**Transmit (Input). A Differential Input.** A pair of internally biased line receivers consisting of a squelch detect receiver with offset and noise filtering, and a data receiver with zero offset for data signal processing. Signals meeting squelch requirements are waveshaped and output at TXT.
10	V_{EE}		Negative Logic Supply and IC Substrate
11 13	V_{TX+}, V_{TX-}	I	**Tap Node Driver Current Set (Inputs).** A reference input for transmission level and external redundant jabber. Transmit level is set by an external resistor between V_{TX+} and V_{TX-}. For an 80mA peak level, R is 9.1 ohm. V_{TX-} may be operated between V_{EE} and V_{EE} + 1 volts. When the voltage at V_{TX-} goes more positive than V_{EE} + 2 volts, TXT is disabled and SQE message is output at the CI pair.
12	TXT	O	**Tap Node Driver (Input/Output).** A controlled bandwidth current source and sense amplifier. This I/O port is to be connected to the media through an isolation network and a low pass filter. Signals meeting DO± squelch and jabber timing requirements are output at TXT as a controlled rise and fall time current pulse. When operated into a double terminated 50 ohms transmission line, signaling meets IEEE 802.3 Rev. D. recommendations for amplitude, pulse width distortion, rise and fall times, and harmonic content. The sense amplifier monitors TXT faults and inhibits trans-

mission if jabber time is exceeded and enables SQE message to CI± for the fault duration. TXT peak output current is set by a resistor between V_{TX+} and V_{TX-}.

14	TAP SHIELD	I	**Low Noise Media Cable Return (Input).** This input is the return for V_{COL} reference and the receive signal from the Media. External connection is to positive power supply.
15	N.C.		**No Connection**
16	RXT	I	**Media Receive (Input). Media Signal Receiver Input.** RXT connects to the Media through a 4 : 1 attenuator of 100K ohms total resistance (25K ohms and 75K ohms in series). Return for the attenuator is V_{COL}. RXT is an analog input with internal AC coupling for Manchester data signals and direct coupling for carrier detect and SQE average level detection. Signals at RXT meeting carrier squelch, enable data to the DI± outputs. Data signals are AC coupled to DI± with an 150ns time constant high pass filter. Signals meeting SQE levels enable COLL OSC frequency to CI± outputs.
17	N.C.		**No Connection**
18	V_{COL}	I	**SQE Reference Voltage (Bias Supply).** SQE sense voltage and RXT input amplifier reference. An internally set analog reference for SQE level and data signal set at −1.600V nominal with a source resistance of 150 ohms nominal. This reference should be filtered with respect to tap shield.
19	COLL OSC	I	**SQE Timing Set (Input).** Timing input for SQE oscillator. For a properly set input at VC_{REF}, SQE oscillator period is set at 2.1RC. For a 10MHz SQE oscillator frequency, R should be 1K ohms and C, 47pF including interconnect and device capacitance.
20	V_{CC2}		**SQE Timing Reference (Positive Supply Voltage).** Timing reference return for SQE oscillator and analog signal ground.

RXT and N.C. (pins 15 and 17) provide a low capacitance input for media attachment. Input capacitance at RXT is approximately 1.3pF. Receive path node capacitance is compensated by placing one third 'C' in total across the 75K ohms portion of the input attenuator.

Am7995 EXTERNAL COMPONENT DIAGRAM



*Includes parasitic capacitances at the node.

05998A-3

FUNCTIONAL DESCRIPTION

The Am7995 IEEE 802.3/Ethernet/Cheapernet Transceiver consists of four sections: a) Transmit – receives signals from DTE and sends it to the coaxial medium, b) Receive – obtains data from media and sends it to DTE, c) Jabber – guards medium from node transmissions that are excessive in length, d) Collision detect – indicates to DTE any collision on the media.

TRANSMIT

The Am7995 receives differential signals from the DTE (in the case of Am7990 Family applications from the Am7992A – Serial Interface Adapter – SIA). For IEEE 802.3 (Type A)/Ethernet applications, this signal is received through the AUI cable and isolation transformer. In IEEE 802.3 Type B "Cheapernet" applications, the AUI cable is optional.

Data is received through a noise rejection filter that rejects signals with pulse widths less than 7ns (negative going), or greater than 160ns (positive going), or with levels less than −175mV peak. Only signals greater than −275mV peak from the DTE are enabled. This minimizes false starts due to noise and ensures no valid packets are missed.

The Am7995's Tap Driver provides the driving capability to ensure adequate signal level at the end of the maximum length network segment (500m) under the worst case number of connections (100). Required rise and fall times of data transmitted on the network is maintained by the Am7995 driver. The tap driver's output is connected to the media through external isolating diodes. To safeguard network integrity, the driver is disabled whenever power falls below the minimum operation voltage.

During transmission, the Am7995's Jabber Controller counts the duration that the transmit tap driver is active and disables the driver if the jabber time is exceeded. This prevents network tie-up due to a "babbling" transceiver. Once disabled, the driver is reset 400ms after the DO pair is idle and there is no fault on TXT. During the disable time, an SQE signal is sent on the CI pair to the DTE.

At the end of every transmission on the network the Am7995 generates an SQE test. This signal is a self test indication to the DTE that the MAU collision pair is operational.

RECEIVE AND CARRIER DETECT

Signal is acquired from the tap through a high impedance (100K ohms) resistive divider. A high input impedance (low capacitance, high bandwidth, low noise) DC coupled input amplifier in the Am7995 receives the signal. The received signal passes through a high pass filter to minimize inter-symbol distortion, and then through a data slicer.

The Am7995's carrier detect compares received signals to a reference. Signals meeting carrier squelch enable data to the differential line driver within 5 bit times from the start of packet.

Received data is transmitted from the DI pair through an isolation transformer to the AUI cable (Ethernet/IEEE Type A – in IEEE 802.3 Type B "Cheapernet" the AUI cable is optional). Following the last transition of the packet, the DI pair is held high for 2 bit times and then decreases to idle level within 20 bit times.

COLLISION DETECT

The Am7995 detects collisions on transmit if one or more additional stations are transmitting on the network.

Received signals are compared against the collision threshold reference. If the level is more negative than the reference, an enable signal is generated to the collision pair. The collision threshold can be modified by external components to suit other applications.

The Collision Oscillator is a 10MHz oscillator which drives the differential CI pair to the DTE through an isolation transformer. This signal is gated to the CI pair whenever there is a collision, the SQE test is in progress, or the Jabber Controller is activated. The oscillator is also utilized in counting time for the Jabber timer and SQE test.

The CI ± output meets the drive requirements for the AUI interface. The output stays high for 2 bit times at end of packet decreasing to the idle level within 20 bit times.

JABBER FUNCTION

The Am7995's Jabber timer monitors the activity on the DO pair and senses TXT faults. It inhibits transmission if the tap driver is active for longer than the jabber time (26ms). An SQE message is enabled on the CI pair for the fault duration.

After the fault is removed, the Jabber timer counts the unjab time of 400ms before it enables the driver.

If desired, a redundant Jabber function can be implemented externally, and the output driver disabled by removing the driver supply at V_{TX-}. The Am7995 senses this condition and forces an SQE message on the CI pair, during the disable time.

SQE TEST

At the end of every transmission, the Am7995 generates an SQE test which gates a 10MHz signal to the CI pair. The SQE test ensures that the twisted pair assigned for collision notification to the DTE is intact and operational. The SQE test starts 8 bit times after the last transition of the transmitted signal and lasts for a duration of 8 bit times.

ABSOLUTE MAXIMUM RATINGS

Supply Voltages V_{EE}, V_{TX-} ..... −12 to +0.5V
Input Voltage DO+, DO−, TXT, RXT ..... −12 to 0.5V
Storage Temperature Range ..... −65 to 150°C

DC CHARACTERISTICS

The following conditions apply unless otherwise specified: Commercial T_A = 0 to +70°C
V_{EE} = −9V ±5%

Parameter	Description	Test Condition		Min	Typ	Max	Units
I_{IT}	Input Current (DO+, DO−)	V_{IN} = 0 to V_{EE}				TBA	mA
V_{CAT}	Carrier Sense Threshold (Note 1)			TBA	−500	TBA	mV
V_{COT}	Collision-Sense Threshold (Note 1)			TBA	−1600	TBA	mV
V_{TXTL}	Transmit Output LOW Voltage (Note 1)	R_L = 25 ohms			−2.05		V
V_{TXTH}	Transmit Output HIGH Voltage (Note 1)	R_L = 25 ohms			−0.05		V
V_{TXT}	Transmit Average DC Voltage with 50% Duty-Cycle into DO+, DO− (Note 1)	R_L = 25 ohms			−1.025		V
V_{OD}	Differential Output Voltage (DI+, DI−, CI+, CI−)	R_L = 78 ohms	V_{OD}+	TBA	670	TBA	mV
			V_{OD}−	TBA	670	TBA	
V_{CMT}	Common Mode Output (DI+, DI−, CI+, CI−)	R_L = 78 ohms		TBA	2.5	TBA	V
R_{IDF}	Differential Input Resistance (DO+, DO−)	V_{IN} = 0 to V_{EE}		TBA	8		K ohms
R_{ICM}	Common Mode Input Resistance (DO+, DO−)	V_{IN} = 0 to V_{EE}		TBA	2		K ohms
C_{RXT}	RXT Input Capacitance	Pin 5, 17, NC V_{EE} = 0 to Max	Ceramic		1.7		pF
			Plastic		1.1		
I_{RXT}	RXT Input Current	V_{IN} = −1 to −2.5V			±0.01	TBA	μA
V_{ICM}	DO+, DO− Common Mode Bias Voltage	I_{IN} = 0		TBA	V_{EE}+1.5	TBA	V
V_{ODI}	Differential Output Voltage Imbalance (DI+, DI−, CI+, CI−)	R_L = 78 ohms			±5	TBA	mV
V_{OD} OFF	Differential Output Idle Voltage (DI+, DI−, CI+, CI−)				±0.5	TBA	mV
I_{OD} OFF	Differential Output Idle Current (DI+, DI−, CI+, CI−)	R_L = 0			±0.01	TBA	mA
V_{IDC}	Differential Input Squelch Threshold (DO+, DO−)			TBA	−225	TBA	mV
I_{CC}	Supply Current − Non-Transmitting	R_L = 25 ohms		TBA	88.0	TBA	mA
	Supply Current − Transmitting	R_L = 25 ohms		TBA	128.0	TBA	

AC CHARACTERISTICS Over Operating Range

TRANSMIT SPECIFICATIONS

Number	Parameter	Description	Test Conditions	Min	Typ	Max	Units
1	t_{PWREJ}	DO± Input Pulse Width to Reject (DO± > $V_{IDC, Min}$)			15	TBA	ns
2	t_{PWTON}	DO± Input Pulse Width to Turn On (DO± > $V_{IDC, Max}$)		TBA	15		ns
3	t_{PWSON}	DO± Input Pulse Width to Stay On (DO± < $V_{IDC, Max}$)				105	ns
4	t_{PWOFF}	DO± Input Pulse Width to Turn Off (DO± < $V_{IDC, Min}$)		TBA	180		ns
5	t_{TON}	Transmit Driver Turn-On Delay				TBA	ns
6	t_{TOFF}	Transmit Driver Turn-Off Delay				TBA	ns
7	t_{TSD}	Transmit Static Delay (Zero Crossing to 50% Point to Coax)			30	TBA	ns
8	t_{TXTR}	Transmit Driver Rise Time			25		ns
9	t_{TXTF}	Transmit Driver Fall Time			25		ns
10	t_{DRF}	Difference in Driver Rise and Fall Times $t_{TXTR} - t_{TXTF}$			±0.5		ns
11	t_{SKEW}	Output Driver Skew – Transmit Data Symmetry			±1.0		ns
12	t_{JCT}	Jabber Control Time		20	26	35	ms
13	t_{JRT}	Jabber Reset Time		340	419	500	ms
14	t_{JREC}	Jabber Recovery Time				TBA	ns

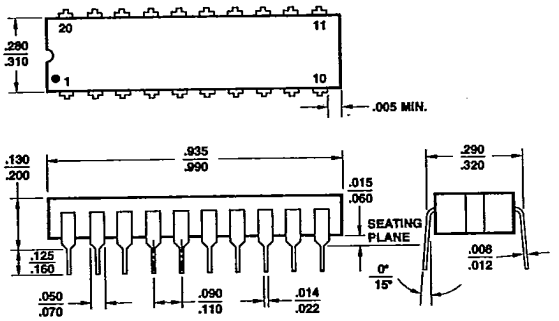
RECEIVE/COLLISION SPECIFICATIONS

Number	Parameter	Description	Test Conditions (Note 2)	Min	Typ	Max	Units
15	t_{RON}	Receiver Turn-On Delay (Note 3)	V_{CM} = 600mV		250	TBA	ns
16	t_{ROFF}	Receiver Turn-Off Delay (Note 3)	V_{CM} = 400mV	TBA		TBA	ns
17	t_{RSD}	Receiver Static Delay	50% Point at RXT to Zero Crossing at DI± Outputs		30	TBA	ns
18	t_{RS}	Receive Data Symmetry (Note 3)		48		52	%
19	t_{RR}	DI± and CI± Rise Time	.20–80%, R_L = 78 ohms	TBA		TBA	ns
20	t_{RF}	DI± and CI± Fall Time	80–20%, R_L = 78 ohms	TBA		TBA	ns
21	t_{CON}	CI± Turn-On Delay (Note 4)				TBA	ns
22	t_{COFF}	CI± Turn-Off Delay (Note 4)				TBA	ns
23	t_{CL}	CI± LOW Time				70.5	ns
24	t_{CH}	CI± HIGH Time		35			ns
25	f_{CI}	Collision Frequency		8.5	10.0	11.5	MHz
26	t_{STD}	SQE Test Delay Time (Note 4)	F_{CI} = 10.0MHz	600		1000	ns
27	t_{STL}	SQE Test Length (Note 4)	F_{CI} = 10.0MHz	600		1000	ns

Notes: 1. Parameters are measured at coax tap.
2. Inputs are applied at the coax tap for all receive/collision specifications.
3. Inputs are applied at the coax tap, outputs are measured at the DI ± pins.
4. Inputs are applied at the coax tap, outputs are measured at the CI ± pins.

PHYSICAL DIMENSIONS

CD 020



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