FUJITSU

ETHERNET ENCODER / DECODER

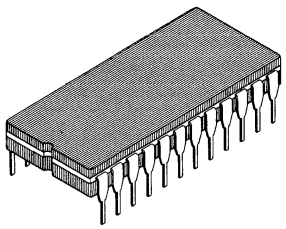
MB 502A

October 1983
Edition 2.0

ETHERNET ENCODER/DECODER

The Fujitsu MB 502A is an Ethernet* Encoder/Decoder designed to meet all the requirements of the Ethernet Blue Book specification and fabricated with high-speed ECL and Schottky TTL technology.

The encoder converts serial binary data into complementary Manchester code. The decoder converts Manchester code into binary data and synchronous clock signals. The decoding method is a digital phase locked loop with dual bandwidth which allows both fast lock-on and a small amount of jitter. Typical acquisition is eight bits or better. A key feature of the decoder design is its capability to recover distorted input signals. The MB 502A is packaged in a 24-pin ceramic standard DIP.

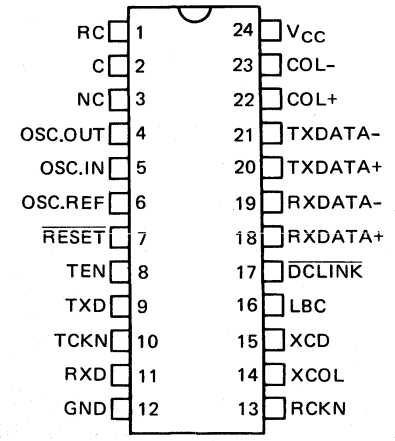


CERAMIC PACKAGE
DIP-24C-C01

FEATURES

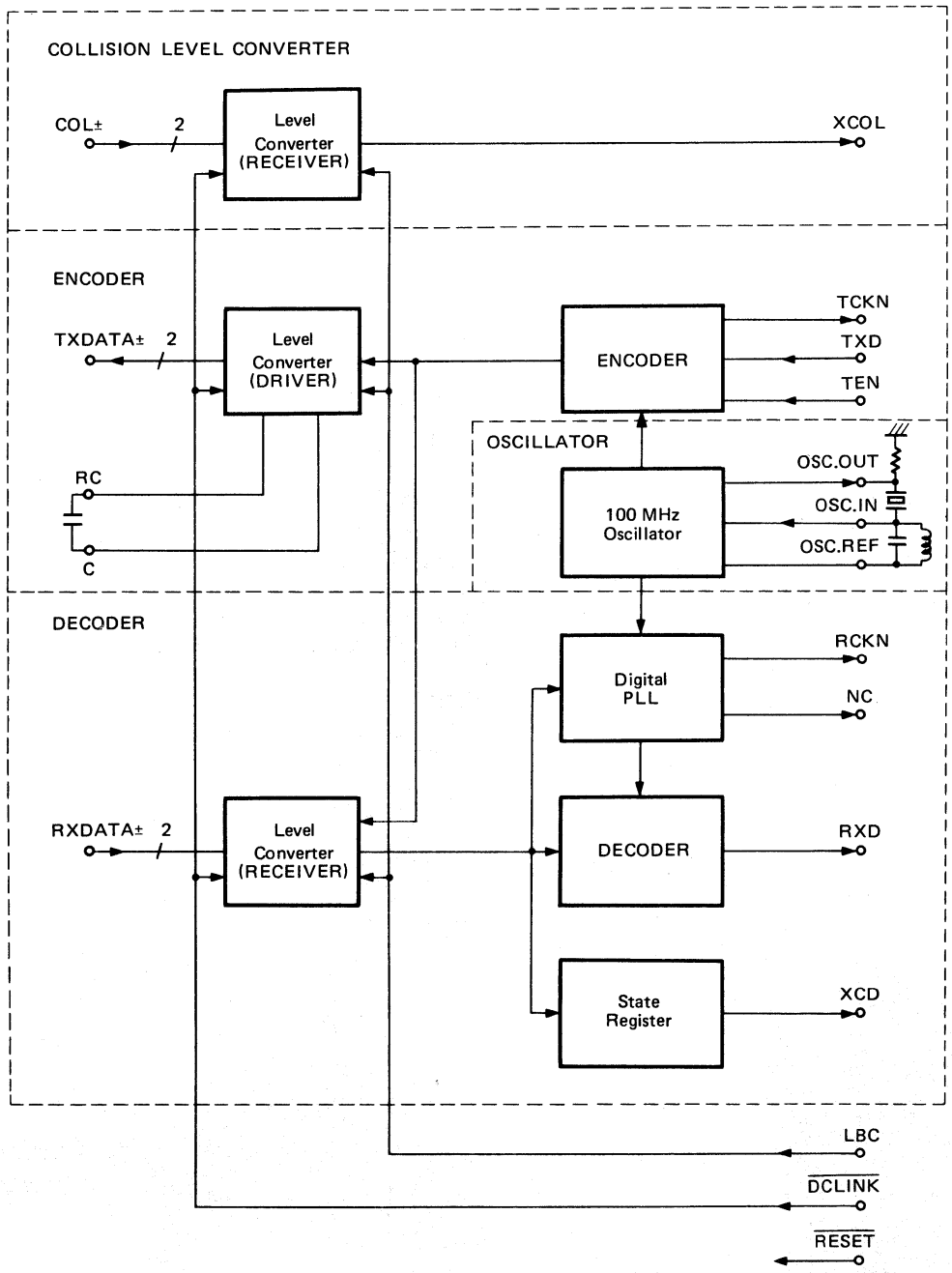
- Full Ethernet compatibility
- Manchester encode and decode
- Level conversion: transceiver level to/from TTL level
- Carrier detection
- Large distortion recovery: ±20 ns
- Dual bandwidth phase locked loop: allows fast acquisition
- Loopback "CONFIDENCE" test feature
- Built-in clock generator
- Small external parts count: all passive external components
- High-speed ECL and Schottky TTL technology
- Single power supply: +5V
- Low power dissipation: 750mW typ.
- 24-pin standard Dual In-line Ceramic Package

PIN ASSIGNMENT



*Ethernet is a trade mark of Xerox Corp. U.S.A.

Fig. 1 BLOCK DIAGRAM



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PIN ASSIGNMENT TABLE

Group	Pin Number	Symbol	Pin Name	I/O	Level	Function
Power Group	12	GND	Power supply	I		Ground
	24	V_{CC}		I		+5V DC power supply
Cable Group	18 19	RXDATA+ RXDATA-	Receive data pair	I I	ECL differential	Interfacing to receive pair of the transceiver cable.
	20 21	TXDATA+ TXDATA-	Transmit data pair	O O	ECL differential	Interfacing to transmit pair of the transceiver cable.
	22 23	COL+ COL-	Collision presence pair	I I	ECL differential	Interfacing to collision presence pair of the transceiver cable.
EDLC Group	8	TEN	Transmit encode enable	I	TTL	Input for encoding and TXDATA± enable.
	9	TXD	Transmit serial data	I	TTL	Input for transmit data to be encoded onto the Ethernet coax.
	10	TCKN	Transmit data clock	O	TTL	Stable 10MHz clock output for transmit bit stream.
	11	RXD	Receive serial data	O	TTL	Output of received and decoded bit stream.
	13	RCKN	Receive data clock	O	TTL	Clock output to strobe RXD.
	14	XCOL	Collision presence	O	TTL	Duplication of the collision presence pair (COL±).
	15	XCD	Receive carrier detect	O	TTL	Carrier detect function of the decoder.
	16	LBC	Loopback command	I	TTL	Input to command the MB502A to operate in loopback mode.
Oscillator Group	4 5 6	OSC. OUT OSC. IN OSC. REF	Oscillator pins	O I O	ECL	Pins for direct connection of discrete oscillator components.
Others	1 2	RC C	Capacitor pins	– –	ECL –	Pins for direct connection of a capacitor.
	3	NC	Non-connection (PLL test)	O	ECL	Output pin for PLL testing purpose only.
	7	$\overline{\text{RESET}}$	FF test	I	TTL	Input pin to initialize flip-flops for testing purpose only.
	17	$\overline{\text{DCLINK}}$	DC/AC coupling select for transceiver pairs	I	TTL	Input to select DC/AC coupling of transceiver cable pairs.

FUNCTIONAL DESCRIPTION

The MB 502A has five major functions; encode, decode, collision, master clock generation and loopback.

ENCODE

The encoder section of the MB 502A is a simple circuit which performs an appropriate exclusive-OR between the transmit clock and transmit data using latches to reduce the skew of TXDATA± outputs. The encoder sends the transmit clock (TCKN) to the Data Link controller. Then an encode enable signal (TEN) and data (TXD) are returned from the Data Link controller.

DECODE

The decoder performs three functions. First, it decodes data using the differential receive inputs (RXDATA+ and RXDATA-) of the transceiver cable. Next is the carrier detect function. The carrier is derived from the receive inputs and passed to the Data Link controller from the XCD output. The last function is the stripping of the first several bits (eight bits maximum) of the packet. This is not a part of the Ethernet Physical Layer specification. The receive clock (RCKN) is actually inhibited for 6 or 7 clock cycles to allow the PLL (phase locked loop) to gain acquisition. This function was designed into the Encoder/Decoder because the EDLC (Ethernet Data Link Controller, MB 8795B) is a byte oriented device, and the function is more appropriately provided in the Encoder/Decoder which is bit oriented.

The decoder PLL has excellent distortion handling capability. It is designed to recover ± 20ns exercised.

COLLISION

The collision detect inputs (COL+ and COL-) are simply converted to a TTL level signal (XCOL). The latching and timing functions for this signal are provided in the EDLC (MB 8795B).

MASTER CLOCK GENERATION

The oscillator generates and supplies a 100MHz master clock signal to the encoder and decoder.
Discrete oscillator components such as a crystal may be directly connected to the provided oscillator pins.
The oscillation frequency must be 100MHz with a tolerance of less than ±0.01% to meet the Ethernet specification because one tenth of the oscillation frequency is the transmit bit rate.

LOOPBACK

A loopback input is provided to allow all encoding and decoding functions to be exercised without using the transceiver cable. During loopback operation, the encoded data is routed internally to the decoder, the transmit outputs are idle, and the receive and collision inputs are ignored.

SIGNAL PIN DESCRIPTION

CABLE GROUP

RXDATA± (receive serial data pair, inputs)

These are the inputs to the decoder. They receive Manchester coded signals which the transceiver encounters on the Ethernet coax.
The input circuit is a differential receiver and can receive voltages of 0 to V_{CC}. The differential receiver has two operation modes; DC coupled operation and AC coupled operation, which are selected by $\overline{\text{DCLINK}}$ input.
In DC coupled operation ($\overline{\text{DCLINK}}$ is low), the differential threshold is typically 0V. The differential input voltage of more than 0.2V is regarded as high level and the differential input voltage of less than -0.2V is regarded as low level.
In AC coupled operation ($\overline{\text{DCLINK}}$ is high), the differential threshold is typically -0.2V. A differential input voltage of more than -0.05V is regarded as high level and a differential input voltage of less than -0.4V is regarded as low level.
The receiver circuit is designed to supply a high level to the decoder when RXDATA+ and RXDATA- are not receiving data but are just short-circuited through a transformer coil or left unconnected. However, when RXDATA± are receiving data, the differential threshold is typically 0V to minimize receiving distortion.

TXDATA± (transmit data pair, outputs)

These are the outputs of the encoder. They transmit Manchester coded signals to the transceiver.
The driver output circuit is an emitter-follower and requires a pull-down resistor (270Ω typ.). It can drive a transceiver cable differential impedance of 78Ω.

The differential transmitter outputs (TXDATA+ and TXDATA-) also have the ability to emulate a transformer drive. This is actually implemented to reduce the current involved in a transformer termination of the transmit outputs in the transceiver which has a DC resistance of zero ohms. After the encoding function stops, the transmitter outputs gradually return to a 0V differential between the two output wires. The returning time is determined by an external capacitor connected between the RC and C pins.

COL± (collision presence pair, inputs)

This pair of signals indicates the presence of a collision generated by the transceiver.
The input circuit is a differential receiver and can receive voltages of 0V to V_{CC}. The differential receiver has two operation modes; DC coupled operation and AC coupled operation, which are selected by $\overline{\text{DCLINK}}$ input.
In DC coupled operation ($\overline{\text{DCLINK}}$ is low), the differential threshold is typically 0V. A differential input voltage of more than 0.2V is regarded as high level and a differential input voltage of less than -0.2V is regarded as low level.
In AC coupled operation ($\overline{\text{DCLINK}}$ is high), the differential threshold is typically -0.2V. A differential input voltage of more than -0.05V is regarded as high

level and a differential input voltage of less than -0.4V is regarded as low level.
The receiver circuit is designed to supply a high level to the level converter when COL+ and COL- are not receiving data but are just short-circuited through a transformer coil or left unconnected.
Unlike RXDATA±, the differential threshold is set to -0.2V even when COL± are receiving data.

EDLC GROUP

TEN (transmit encode enable, input)
This is an input to the on-chip Manchester encoder and enables TXDATA pair. Input high enables TXDATA pair; input low makes TXDATA pair idle (high).

TXD (transmit serial data, input)
This is an input to the on-chip Manchester encoder and provides data to be encoded.
Serial binary data must be supplied to this input synchronously with the falling edge of TCKN (transmit data clock).
This input is enabled when TEN (transmit encode enable) is high.

TCKN (transmit data clock, output)
10MHz clock output for the transmit serial binary data. This is stable one-tenth of the master clock frequency. See TXD (transmit serial data) description.

RXD (receive serial data, output)
This is an output of the on-chip Manchester decoder and provides decoded data from Ethernet coax to a Data Link controller.
This output is synchronous with the falling edge of RCKN (receive data clock).

RCKN (receive data clock, output)
Clock output to strobe RXD (receive serial data). See RXD (receive serial data) description.
At the beginning of a packet, RCKN is inhibited for 6 or 7 clock cycles to allow the PLL to gain acquisition. And at the end of a packet, RCKN is inhibited for 1 clock cycle.
During idle state, this output generates a 10MHz clock signal.

XCOL (collision presence, output)
This is a TTL duplication of the collision presence pair (COL±). The transceiver connected to Ethernet coax supplies a high level or differential voltage of 0V to COL ± when collision is not seen on the coax. It supplies a 10MHz square wave signal to COL ± when collision is detected. Accordingly, XCOL outputs high level when collision is not seen and outputs a 10MHz square wave signal during collision presence.

XCD (receive carrier detect, output)
This output provides carrier detect function of the Manchester decoder. This signal is used by a Data Link controller receiver as a data acquisition enable signal and by a Data Link controller transmitter as transmition permission information.
Output is low when the Ethernet coax is idle.

LBC (loopback command, input)
High level input to this pin dictates loopback mode operation. During the loopback mode operation,
XCOL output is high level,
TXDATA+ output is high level,
RXDATA± inputs are ignored
and the data supplied to TXD (transmit serial data) when TEN (transmit encode enable) is high is encoded, supplied to the Manchester decoder through the internal route and output from RXD (receive serial data), RCKN (receive data clock) and XCD (receive carrier detect).

OSCILLATOR GROUP

OSC.OUT, OSC.IN AND OSC.REF (oscillator pins)
A 100MHz crystal is to be placed between OSC.IN and OSC.OUT.
An LC tank circuit is to be placed between OSC.IN and OSC.REF to assure start-up in the proper harmonic of the crystal.
OSC.OUT is an emitter-follower output and requires a pull-down resistor (330Ω typ.). A phase adjusting capacitor is to be placed in parallel with the pull-down resistor to make the delay through the oscillator close to 10ns to increase the efficiency of the crystal.

As a design recommendation, connection wires should be as short as possible.

OTHERS

RC and C (capacitor pins)
A capacitor placed between these pins provides the timing for the transformer emulation of the transmit pair.
In AC coupled operation ($\overline{\text{DCLINK}}$ is high), after data transmission, TXDATA- goes high with rise time determined by the time-constant of the internal resistor and the connected capacitor. When a 470pF capacitor is connected, the rise time of TXDATA- is typically 0.8μs (20% to 80%).

Because pin C is connected to V_{CC} on chip, DC voltage must never be supplied to this pin.

$\overline{\text{DCLINK}}$ (DC/AC coupling select for transceiver pair)
This input is to select DC/AC coupling of transceiver cable pairs. Low level selects DC coupling. High level selects AC coupling and makes both TXDATA+ and TXDATA- high during idle state to prevent the transformer from saturation.
See CABLE GROUP description.

This pin must be stuck at high or low level. It may be connected directly to V_{CC} or ground.

$\overline{\text{RESET}}$ (FF testing purpose only)
This input pin is to initialize flip-flops for testing purposes only and must be connected to V_{CC} or stuck at high level in a normal operation.

NC (non-connection)
This output pin is for testing purposes only and must be left open in a normal operation.

ABSOLUTE MAXIMUM RATINGS*

Rating	Symbol	Value	Unit
Supply Voltage	V_{CC}	-0.3 to 7.0	V
TTL Level Input Voltage	V_{ITTL}	-0.3 to 7.0	V
Receiver Input Voltage	V_{IR}	-0.3 to V_{CC} + 0.3	V
Driver Output Voltage	V_{ODV}	V_{CC} (max)	V
Driver Output Current	I_{ODV}	-40.0 to 0	mA
Oscillator Input Voltage	V_{IOSC}	V_{CC}-4 to V_{CC}, and more than -0.3	V
Oscillator Output Current	I_{OOSC}	-20.0 to 0	mA
Operating Temperature	T_{OP}	-25 to 100	°C
Storage Temperature	T_{STG}	-65 to 125	°C

* Permanent device damage may occur if ABSOLUTE MAXIMUM RATINGS are exceeded. Functional operation should be restricted to the conditions as destailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING CONDITIONS

Parameter		Symbol	Value	Operating Temperature
Supply Voltage		V_{CC}	5.0V ± 5%	0°C to +70°C
TTL High Level Output Current		I_{OH}	-0.4 mA to 0 mA	
TTL Low Level Output Current		I_{OL}	0 mA to 8 mA	
Receiver Input Voltage		V_{IR}	0V to V_{CC}	
Driver Terminator		R_{LD}	270Ω	
Differential Load		R_{DLD}	78Ω	
Oscillator Terminator		R_{LOSC}	330Ω and 33pF parallel*	
Crystal for Oscillator		f_{XTAL}	100 MHz ± 0.01%**	
Capacitor placed between C and RC pins		C_{TX}	470pF	
LC Tank Constant	Inductance	L_{OSC}	0.15 μH	
	Capacitance	C_{OSC}	33pF*	

* The values of the oscillator capacitors may have to be tuned for a particular components layout. Both capacitors should be adjusted for maximum voltage at OSC.IN.
However, once the correct values are determined for that layout, any more tuning will not be necessary for each board.
** 5th overtone series resonant.

DC CHARACTERISTICS

(Recommended operating conditions unless otherwise noted.)

Parameter	Symbol	Condition	Value				Unit
			V_{CC} (V)	min.	typ.	max.	
High Level Input Voltage *1	V_{IH}			2.0			V
Low Level Input Voltage *1	V_{IL}					0.8	V
Input Clamp Voltage *1	V_{IC}	I_{IL} = -18mA	4.75	-1.5			V
High Level Output Voltage *2	V_{OH}	I_{OH} = -0.4mA	4.75	2.7			V
Low Level Output Voltage *2	V_{OL}	I_{OL} = 8mA	4.75			0.5	V
High Level Input Current *1	I_{IH}	V_{IH} = 2.7V	5.25			20	μA
Low Level Input Current *1	I_{IL}	V_{IL} = 0.4V	5.25	-100			μA
Output Short Current *2	I_{OS}	V_O = 0V	5.25	-100		-20	mA
High Level Differential Input Voltage *3	V_{IHD}	$V_{IR+} - V_{IR-}$, $\overline{DCLINK}$ = 0V		0.2			V
Low Level Differential Input Voltage *3	V_{ILD}	$V_{IR+} - V_{IR-}$, $\overline{DCLINK}$ = 0V				-0.2	V
High Level Differential Input Voltage *4	V_{IHD}	$V_{IR+} - V_{IR-}$, $\overline{DCLINK}$ = 4.5V		-0.05			V
Low Level Differential Input Voltage *4	V_{ILD}	$V_{IR+} - V_{IR-}$, $\overline{DCLINK}$ = 4.5V				-0.4	V
High Level Differential Input Voltage *5	V_{IHD}	$V_{IR+} - V_{IR-}$, $\overline{DCLINK}$ = 4.5V		0.2			V
Low Level Differential Input Voltage *5	V_{ILD}	$V_{IR+} - V_{IR-}$, $\overline{DCLINK}$ = 4.5V				-0.2	V
High Level Input Current *3	I_{IHR}	V_{IR} = 5.25V, $\overline{DCLINK}$ = 0V	5.25			0.7	mA
Low Level Input Current *3	I_{iLR}	V_{IR} = 0V, $\overline{DCLINK}$ = 0V	5.25	-1.5			mA

Note: 1: Applicable to TTL input pins. (TEN, TXD, LBC, $\overline{DCLINK}$ and $\overline{RESET}$)
2: Applicable to TTL output pins. (TCKN, RXD, RCKN, XCOL and XCD)
3: Applicable to COL± and RXDATA±.
4: Applicable to RXDATA± while XCD output is low (idle state) and COL±.
5: Applicable to RXDATA± while XCD output is high.

DC CHARACTERISTICS (Cont'd)

(Recommended operating conditions unless otherwise noted.)

Parameter	Symbol	Condition	Value				Unit
			V_{CC}(V)	min.	typ.	max.	
High Level Output Voltage *1	V_{OHTX}		5.0		4.1		V
Low Level Output Voltage *1	V_{OLTX}		5.0		3.3		V
High Level Differential Output Voltage *1	V_{OHD}	$V_{O+} - V_{O-}$ / $\overline{DCLINK}$ = 0V		0.55		1.0	V
Low Level Differential Output Voltage *1	V_{OLD}	$V_{O+} - V_{O-}$ / $\overline{DCLINK}$ = 0V		-1.0		-0.55	V
Oscillator Reference Voltage *2	V_{BB}		5.0		3.7		V
High Level Input Current *3	I_{IHO}	V_{IH} = 4.1V	5.0			150	μA
High Level Output Voltage *4	V_{OHO}	OSC.IN is open	5.0		4.15		V
Low Level Output Voltage *4	V_{OLO}	V_{IOSC} = 4.1V	5.0		3.3		V
RC Internal Resistor	R_{RC}	V_{RC} = 0.5V	0.5	25	50	100	kΩ
Power Supply Current	I_{CC}	All signal pins are open.	5.25			220	mA

Note: 1: Applicable to TXDATA±.
These pins are connected to ground through 270Ω resistor. And 78Ω resistor is placed between these pins.
2: Applicable to OSC.REF.
3: Applicable to OSC.IN.
4: Applicable to OSC.OUT.
This pin is connected to ground through a 330Ω resistor.

5

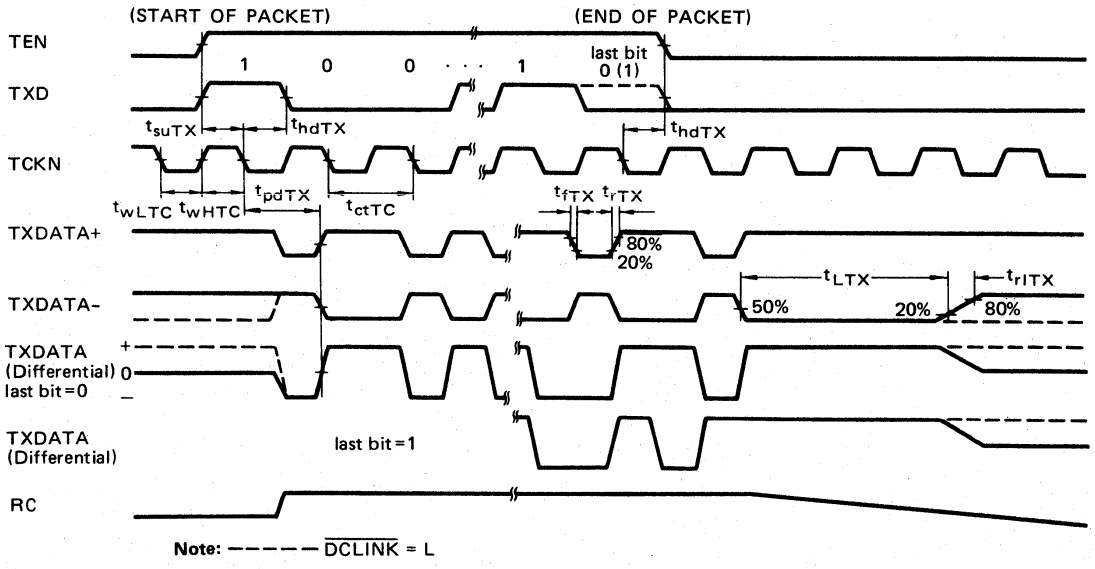
AC CHARACTERISTICS

TRANSMIT TIMING

(Recommended operating conditions unless otherwise noted. V_{CC}=5.0V)

Parameter	Symbol	Condition	Value				Unit
			Fig.	min.	typ.	max.	
TCKN Cycle Time	t_{ctTC}		2, 3	99.99	100.00	100.01	ns
TCKN Low Time	t_{wLTC}		2, 3	40	50		ns
TCKN High Time	t_{wHTC}		2, 3	40	50		ns
TXDATA± Encode Time	t_{pdTX}		2, 3 5, 6		95		ns
TXDATA± Output Rise Time	t_{rTX}		5, 6		2.0		ns
TADATA± Output Fall Time	t_{fTX}		5, 6		2.0		ns
TXDATA- Low Level Hold Time	t_{LTX}	C_{TX} = 470pF $\overline{DCLINK}$ = V_{CC}	5, 6		3		μs
TXDATA- Idling Rise Time	t_{rlTX}	C_{TX} = 470pF (20% ~ 80%) $\overline{DCLINK}$ = V_{CC}	5, 6		0.8		μs
TXD, TEN Setup Time	t_{suTX}		4	20			ns
TXD, TEN Hold Time	t_{hdTX}		4	0			ns

TRANSMIT TIMING DIAGRAM



Note: – – – – $\overline{DCLINK}$ = L

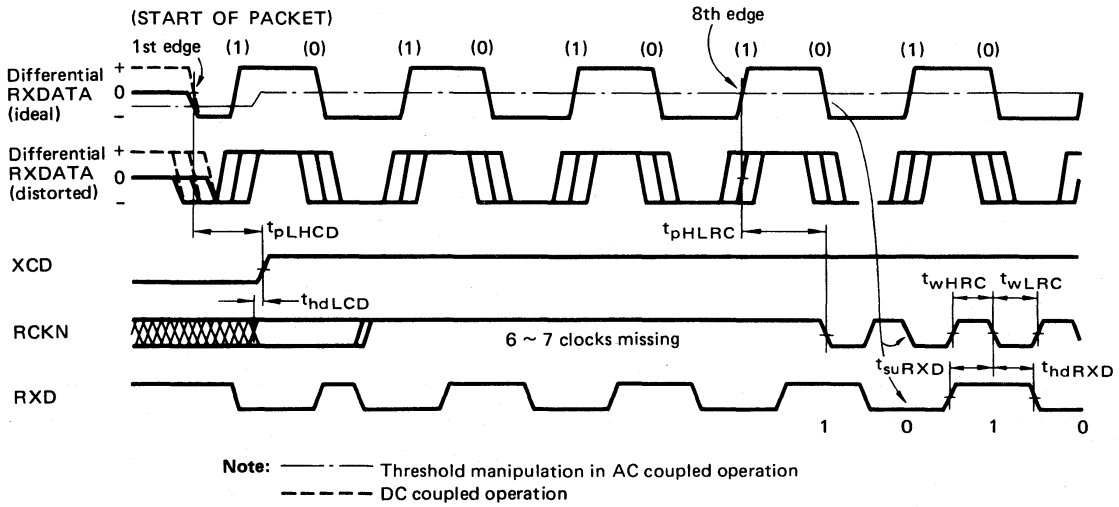
AC CHARACTERISTICS (Cont'd)

RECEIVE TIMING

(Recommended operating conditions unless otherwise noted. V_{CC}=5.0V)

Parameter	Symbol	Condition	Value			Unit
			Fig.	min.	typ.	max.	
RCKN Cycle Time in Idle	t_{ctRC}		2, 3	99.99	100.00	100.01	ns
RCKN Low Time	t_{wLRC}		2, 3	35	50		ns
RCKN High Time	t_{wHRC}		2, 3	35	50		ns
RCKN Delay Time	t_{pHLRC}		2, 3, 7		120		ns
XCD ON Delay Time	t_{pLHCD}		2, 3, 7		80	110	ns
XCD OFF Delay Time	t_{pHLCD}		2, 3, 7		230		ns
XCD Low Hold Time	t_{hdLCD}		2, 3	0	10		ns
XCD High Hold Time	t_{hdHCD}		2, 3		120		ns
XCD Low Setup Time	t_{suLCD}		2, 3		80		ns
RXD Setup Time	t_{suRXD}		2, 3	20	60		ns
RXD Hold Time	t_{hdRXD}		2, 3	10	20		ns

RECEIVE TIMING DIAGRAM



Note: ——·—— Threshold manipulation in AC coupled operation
– – – – – DC coupled operation

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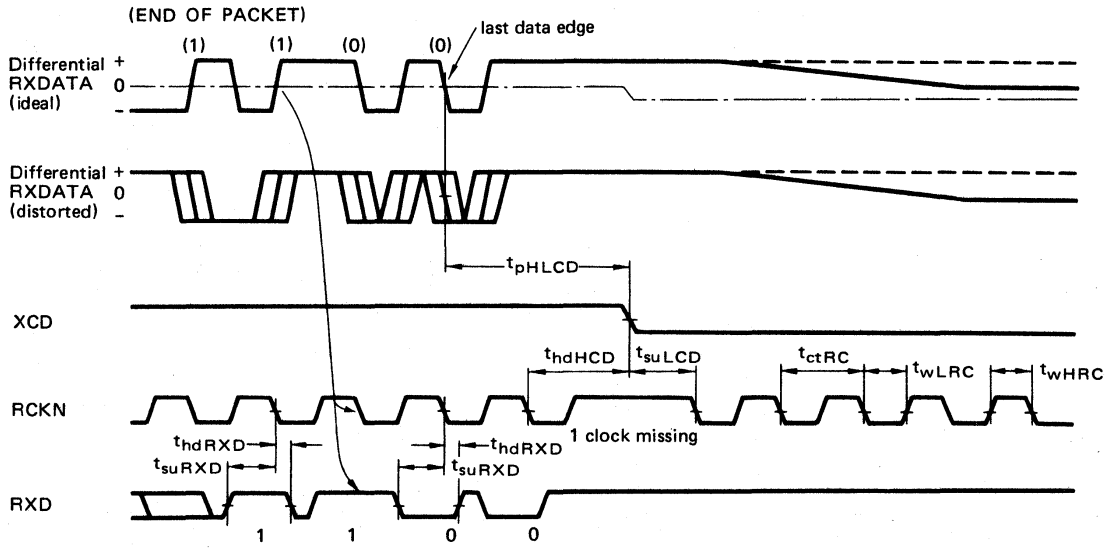
AC CHARACTERISTICS (Cont'd)

RECEIVE TIMING DIAGRAM (Cont'd)



Note: —·— Threshold manipulation in AC coupled operation

– – – – – DC coupled operation

AC CHARACTERISTICS (Cont'd)

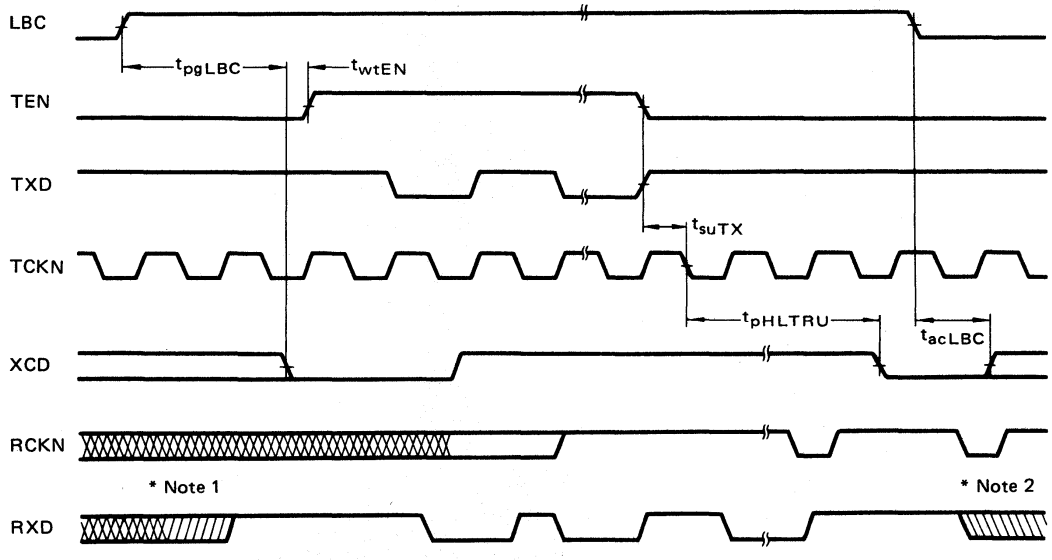
LOOPBACK TIMING

(Recommended operating conditions unless otherwise noted. V_{CC}=5.0V)

Parameter	Symbol	Condition	Value			Unit
			Fig.	min.	typ.	max.	
LBC Receiving Data Purge Time	t_{pgLBC}		2, 3, 4		230		ns
LBC Receiving Data Accept Time	t_{acLBC}		2, 3, 4		80		ns
DATA Through Time	t_{pHLTRU}		2, 3, 4		280		ns
TEN Wait Time	t_{wtEN}		2, 3, 4	0			ns

In Loopback mode operation, COL± and RXDATA± inputs are ignored, TXDATA+ and XCOL are high level and XCD, RCKN and RXD functions are in the same manner as a normal receive operation.

LOOPBACK TIMING DIAGRAM



Note 1: When RXDATA± are receiving a packet at LBC rising, the received data is not complete.
Note 2: When RXDATA± are receiving a packet at LBC falling, the packet may not be decoded correctly.

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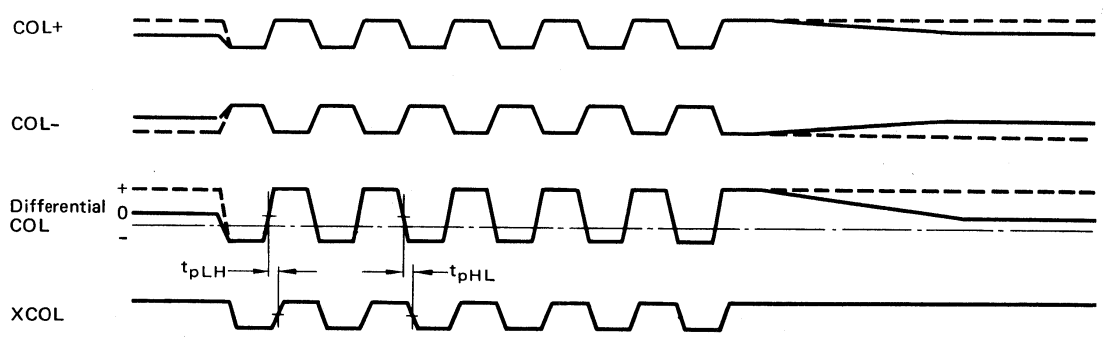
AC CHARACTERISTICS (Cont'd)

COLLISION TIMING

(Recommended operating conditions unless otherwise noted. V_{CC}=5.0V)

Parameter	Symbol	Condition	Value			Unit
			Fig.	min.	typ.	max.	
COL to XCOL Propagation Delay Time	t_{pLH}	$\overline{DCLINK}$ = 0V	2, 3, 7		9	30	ns
COL to XCOL Propagation Delay Time	t_{pHL}	$\overline{DCLINK}$ = 0V	2, 3, 7		11	30	ns

COLLISION TIMING DIAGRAM



Note: —·— Threshold manipulation in AC coupled operation

– – – – DC coupled operation

AC CHARACTERISTICS (Cont'd)

AC TEST CONDITIONS

Fig. 2 TTL OUTPUT LOAD CIRCUIT

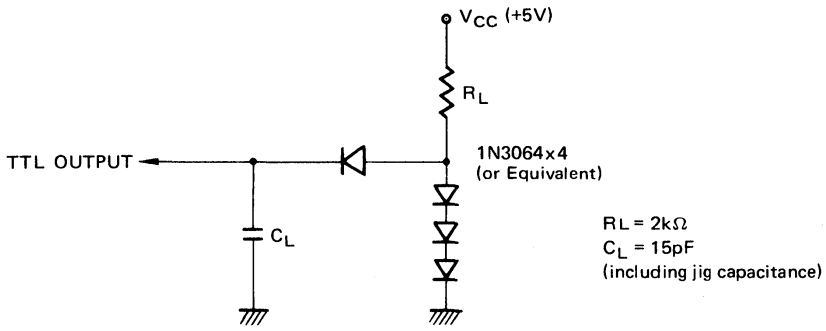
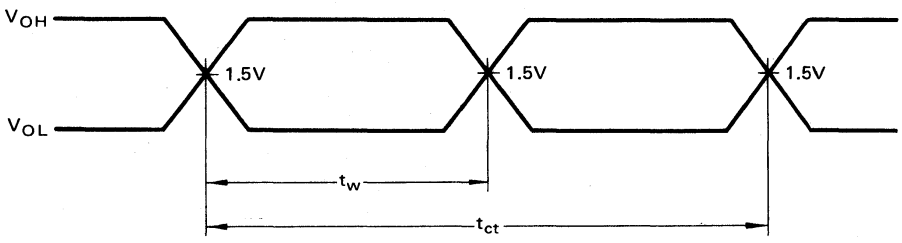
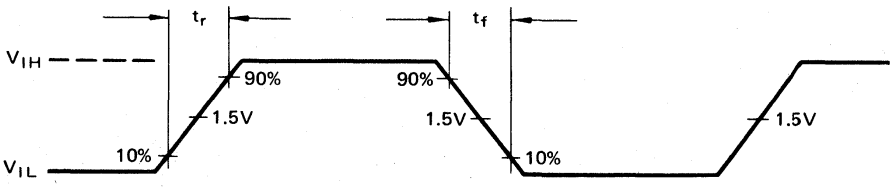


Fig. 3 TTL OUTPUT WAVEFORM



Threshold voltage = 1.5V

Fig. 4 TTL INPUT WAVEFORM



V_{IH} = 3V, V_{IL} = 0V
$t_r = t_f$ = 10ns
Threshold voltage = 1.5V

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AC CHARACTERISTICS (Cont'd)

AC TEST CONDITIONS (Cont'd)

Fig. 5 TXDATA± OUTPUT LOAD CIRCUIT

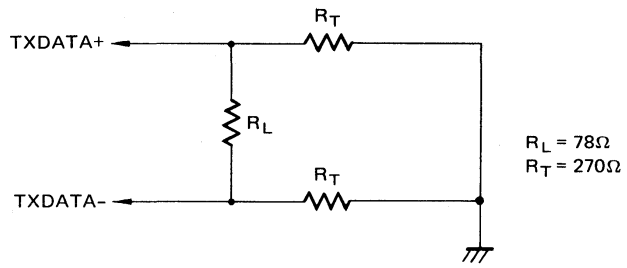


Fig. 6 TXDATA± OUTPUT WAVEFORM

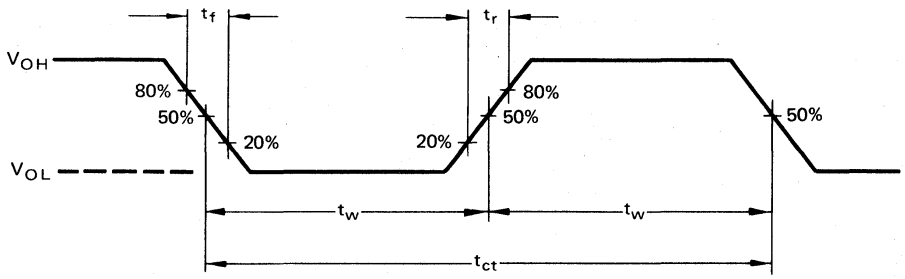
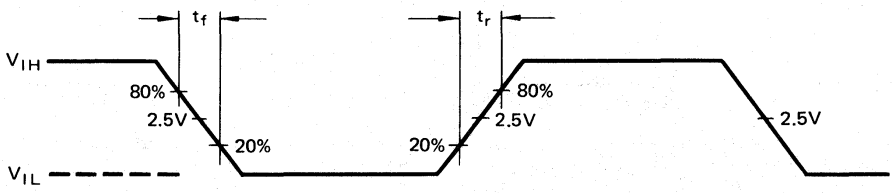


Fig. 7 RXDATA+, COL+ INPUT WAVEFORM



V_{IH} = 3.5V, V_{IL} = 1.5V
t_r= t_f = 2.0ns

RXDATA-, COL- Input voltage = 2.5V (DC)
$\overline{\text{DCLINK}}$ = 0V (DC coupling)

TYPICAL CHARACTERISTICS CURVES

Fig. 8
TXDATA±
Output Voltage vs. Output Current

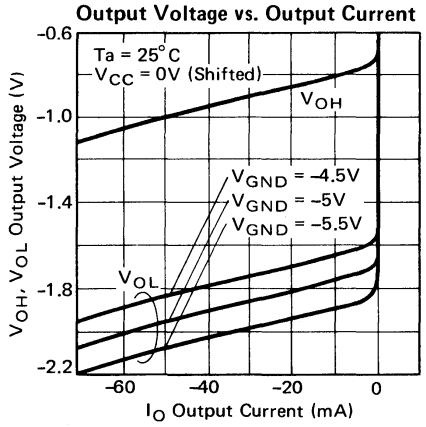


Fig. 9
RXDATA±, COL±
Input Current vs. Input Voltage

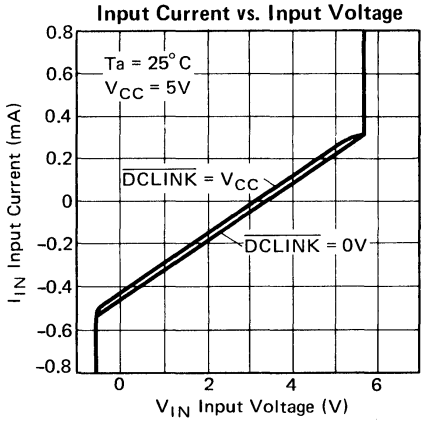


Fig. 10
TTL-OUTPUT
High Level Output Current vs.
High Level Output Voltage

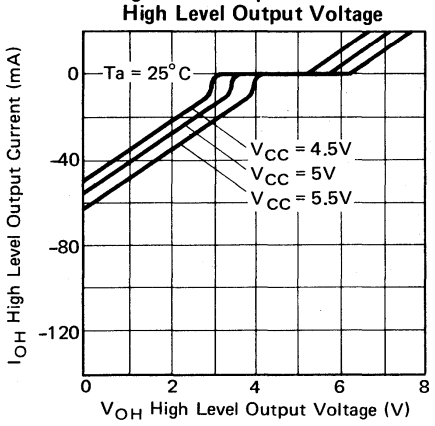


Fig. 11
TTL-OUTPUT
Low Level Output Current vs.
Low Level Output Voltage

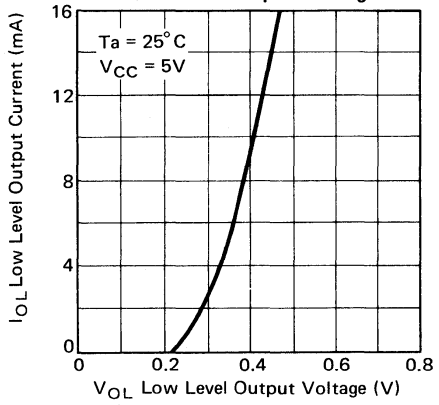


Fig. 12
TTL-INPUT
Input Current vs. Input Voltage

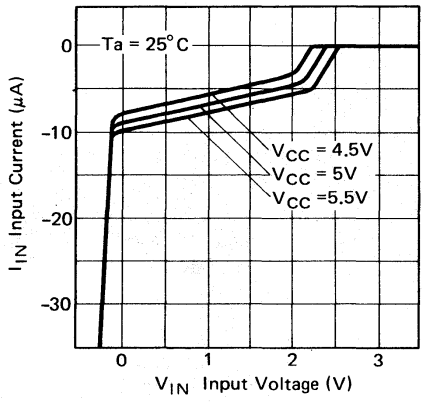


Fig. 13
OSC.IN
Input Current vs. Input Voltage

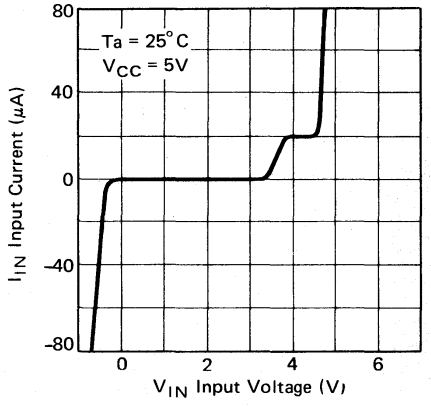


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Fig. 14
COL± to XCOL TRANSFER (Receiver Threshold)
Output Voltage vs. Differential Input Voltage

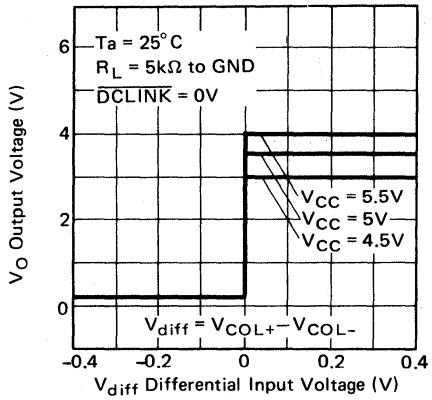


Fig. 15
COL± to XCOL TRANSFER (Receiver Threshold)
Output Voltage vs. Differential Input Voltage

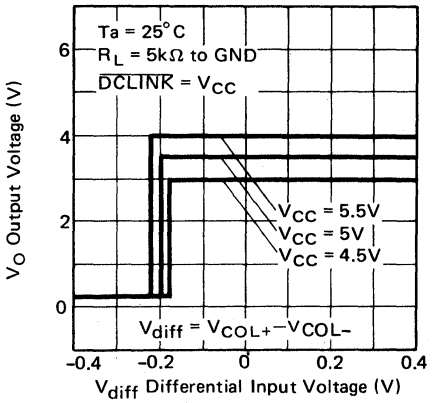


Fig. 16
TTL-INPUT THRESHOLD
TTL Input Threshold vs. Power Supply Voltage

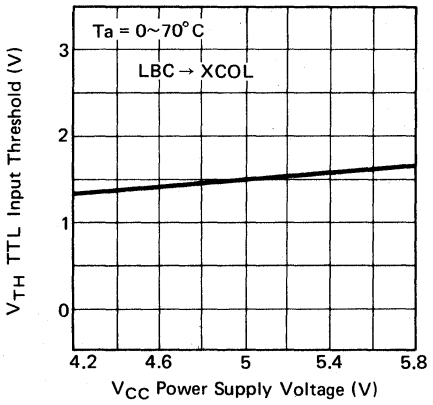


Fig. 17
RC to TXDATA- TRANSFER
Output Voltage vs. RC Input Voltage

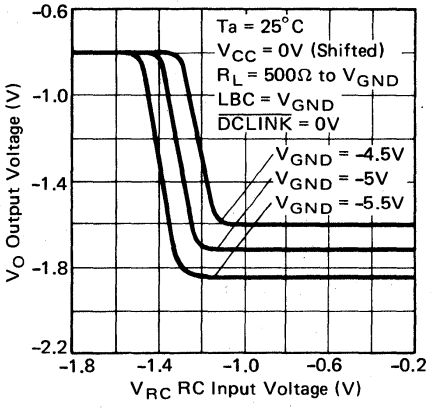


Fig. 18
TXDATA- LOW LEVEL HOLD TIME
TXDATA- Low Level Hold Time vs. RC Capacitance
TXDATA- Idling Rise Time

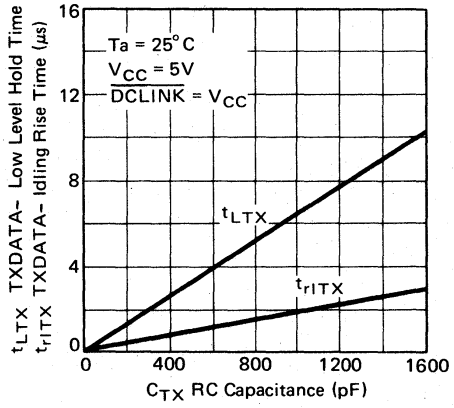
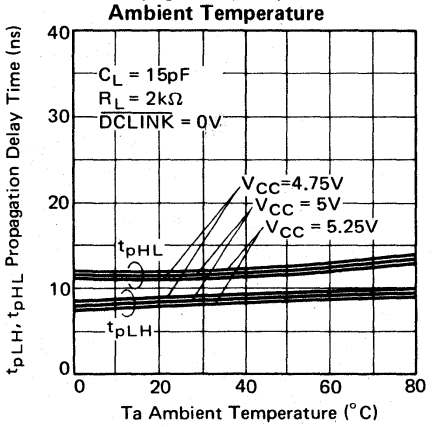
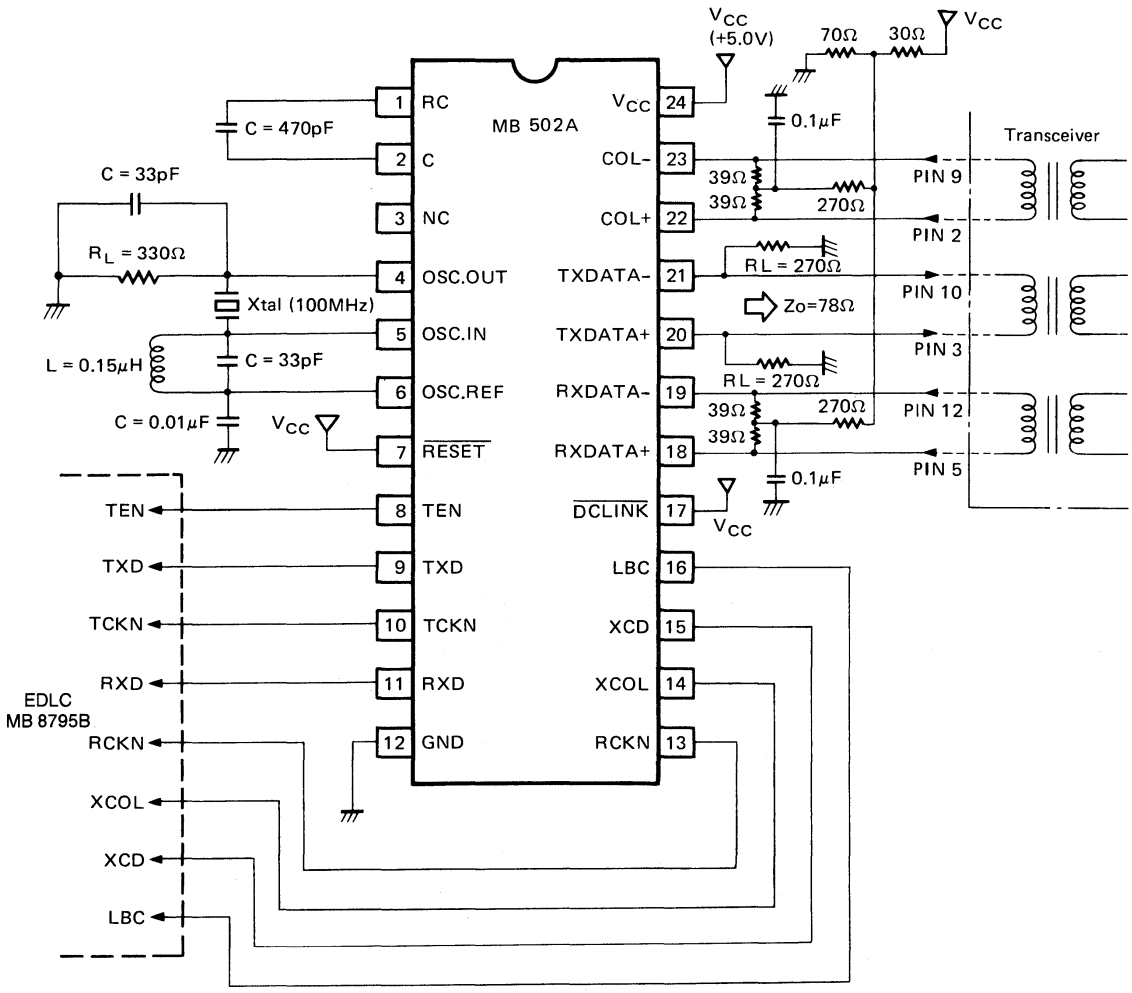


Fig. 19
COL± to XCOL PROPAGATION DELAY TIME
Propagation Delay Time vs. Ambient Temperature



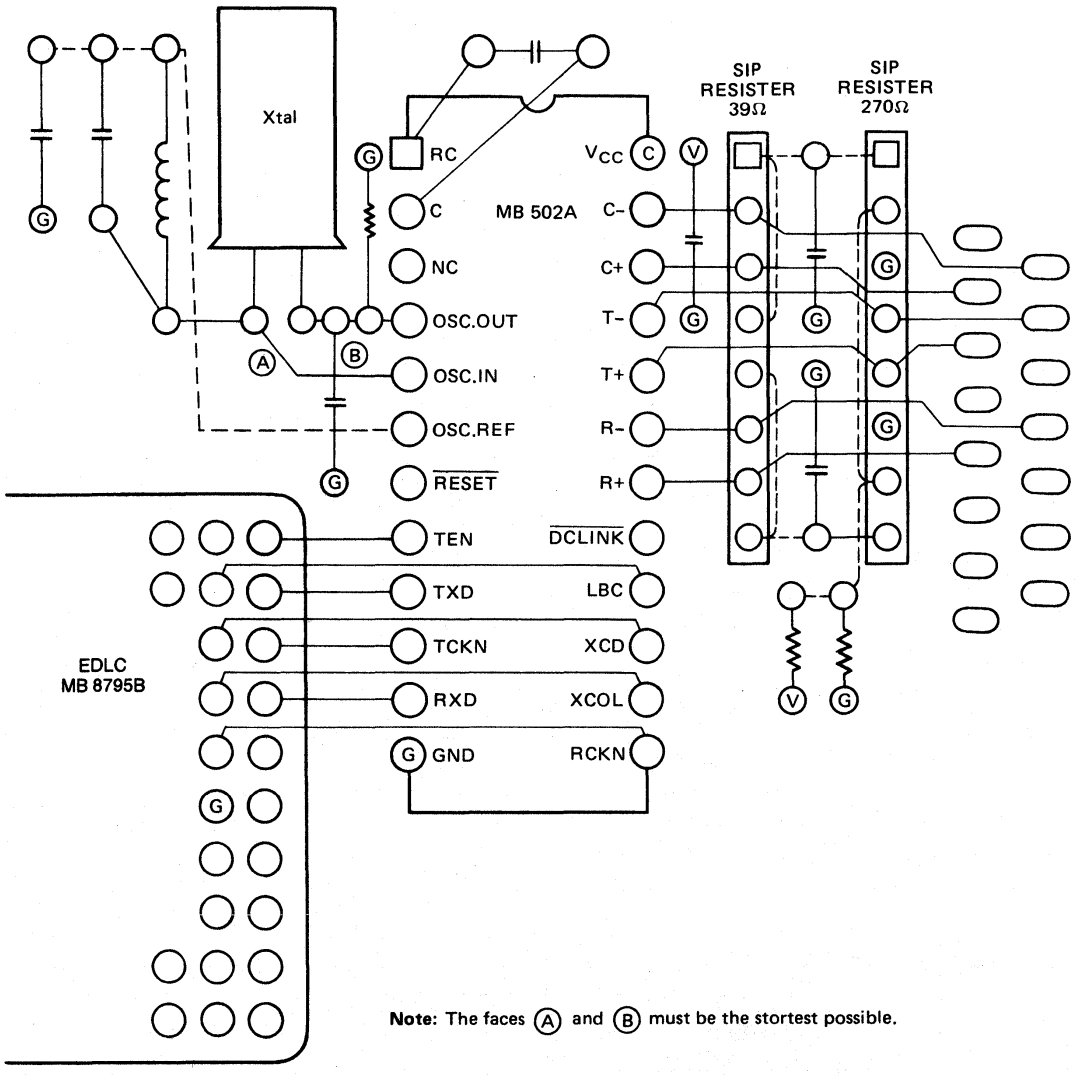
APPLICATION INFORMATION

Fig. 20 TYPICAL APPLICATION CIRCUIT



Note: 39Ω resistors must be balanced less than 1%.

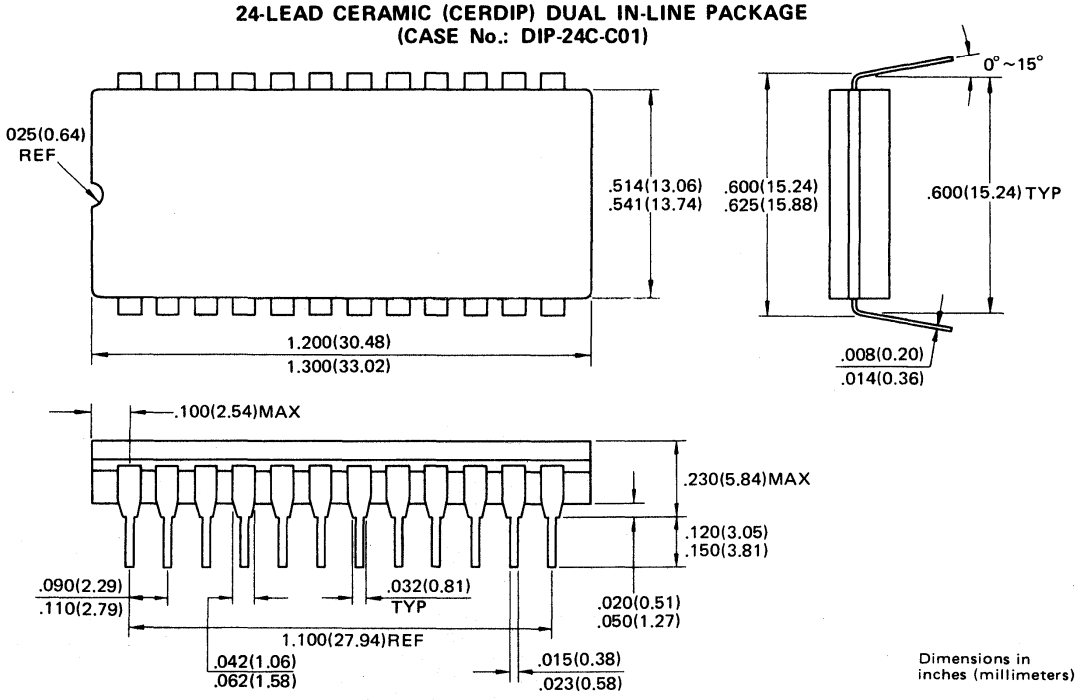
Fig. 21 TYPICAL COMPONENT LAYOUT



Note: The faces (A) and (B) must be the stortest possible.

PACKAGE DIMENSIONS

24-LEAD CERAMIC (CERDIP) DUAL IN-LINE PACKAGE
(CASE No.: DIP-24C-C01)



Dimensions in inches (millimeters)

5

Preliminary

Advanced Products

FUJITSU

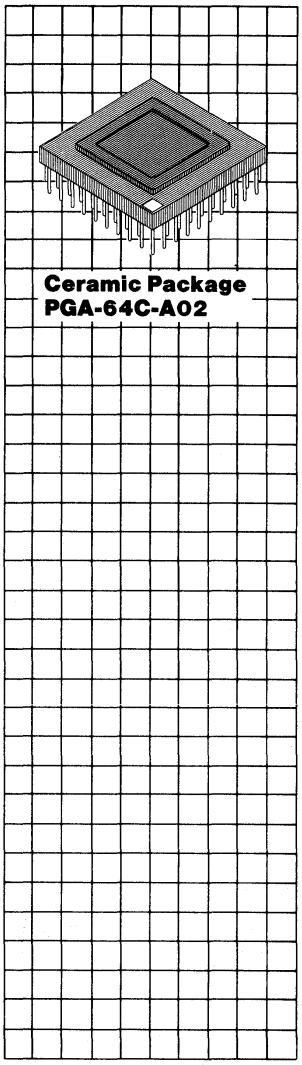
■ MB8795B
Ethernet Data Link Controller

Description

The Fujitsu MB8795B Ethernet Data Link Controller (EDLC) manufactured with Fujitsu's Advanced CMOS Technology, is designed for Ethernet* Local Area Network Systems and to be used with Fujitsu's MB502A Ethernet Encoder/Decoder (EED).

The MB8795B EDLC provides the user with a low power implementation of the Data Link Layer of the Ethernet Blue Book Specification. High throughput is possible via the separate data ports, while low cost implementations are also possible by tying the ports together.

The host system communicates with the MB8795B EDLC using the command and status registers accessed through the control port. Functions provided include complete transmit and receive control, and interrupt masking.



Ceramic Package
PGA-64C-A02

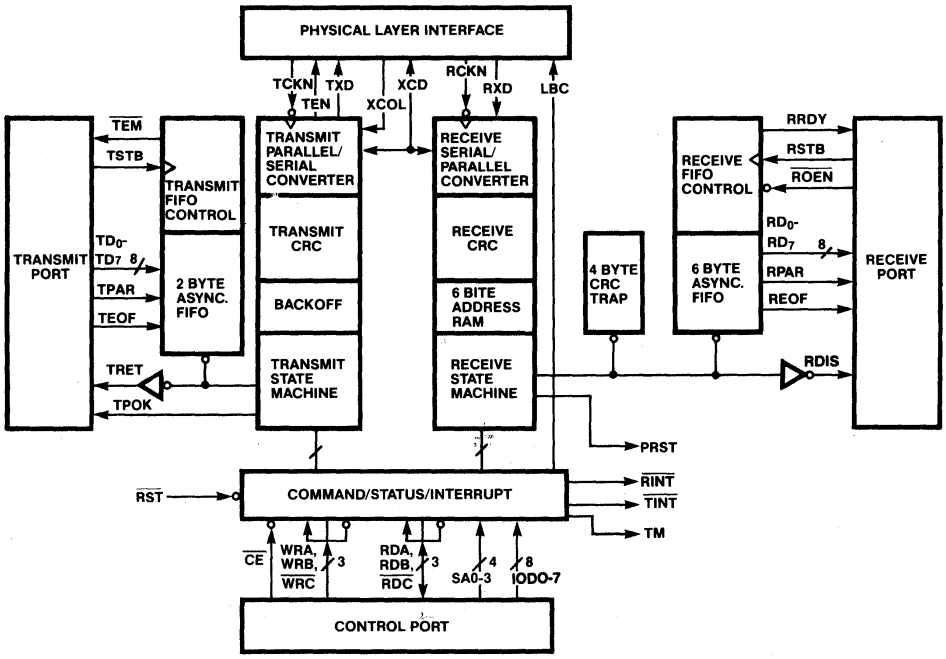
Features

- **Implementing Ethernet Blue Book Specification**
- **Function to generate and remove preamble and CRC**
- **Conversion between serial and parallel Data**
- **Four modes of address recognition**

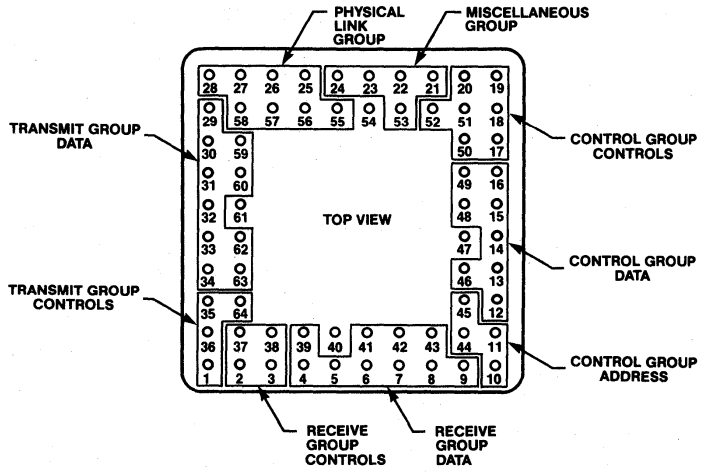
  Accept no packet, Physical Address/Multicast-group Address/Broadcast Address, Physical Address/Multicast Address, Accept all packets
- **Random exponential backoff to recover from collisions**
- **Three separate data ports providing flexible interface; Transmit, Receive, Control Ports**
- **Optional parity check on transmit byte stream**
- **Odd parity generated for receive byte stream**
- **Low power, advanced silicon gate CMOS technology**
- **Space saving 64-pin pin grid array package**

Note: *Ethernet is a trademark of Xerox Corp.

Block Diagram



Pin Assignment



5

Pin Assignment
(Continued)

PIN No.	I/O	Pin Name	PIN No.	I/O	Pin Name	PIN No.	I/O	Pin Name	PIN No.	I/O	Pin Name
1	O	$\overline{TEM}$	17	I	$\overline{WRC}$	33	I	TD2	49	I/O	IOD6
2	O	RRDY	18	I	WRB	34	I	TD0	50	I	RDA
3	I	RSTB	19	I	$\overline{CE}$	35	O	TPOK	51	I	RDB
4	O	RD0	20	I	WRA	36	I	TSTB	52	I	$\overline{RDC}$
5	O	RD2	21	O	$\overline{TINT}$	37	O	RDIS	53	I	$\overline{RST}$
6	O	RD3	22	O	$\overline{RINT}$	38	I	$\overline{ROEN}$	54	V_{SS}	GND
7	O	RD5	23	O	PRST	39	O	RD1	55	I	RCKN
8	O	RD7	24	O	TM	40	V_{SS}	GND	56	I	XCOL
9	O	RPAR	25	I	RXD	41	O	RD4	57	I	XCD
10	I	SA1	26	I	TCKN	42	O	RD6	58	O	LBC
11	I	SA3	27	O	TXD	43	O	REOF	59	I	TEOF
12	I/O	IOD0	28	O	TEN	44	I	SA0	60	I	TD6
13	I/O	IOD2	29	I	TPAR	45	I	SA2	61	V_{DD}	V_{CC}
14	I/O	IOD3	30	I	TD7	46	I/O	IOD1	62	I	TD3
15	I/O	IOD5	31	I	TD5	47	V_{DD}	V_{CC}	63	I	TD1
16	I/O	IOD7	32	I	TD4	48	I/O	IOD4	64	O	TRET

Absolute Maximum Ratings

Rating	Symbol	Value Min.	Value Max.	Unit
Supply Voltage	V_{CC}	GND - 0.3*	7.0	V
Input and Output Voltage	V_I, V_{OUT}	GND - 0.3*	V_{CC} + 0.3*	V
Storage Temperature	T_{STG}	-55	150	°C
Operating Temperature	T_{OP}	0	70	°C

Note: *0.3 V is for stable state. For transit state, 0.5 V is allowed. (20 to 30 nsec.)

Note: Permanent device damage may occur if ABSOLUTE MAXIMUM RATINGS are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet.

Capacitance
(T_A = 25°C, V_{CC} = V_I = GND = 0V, f = 1 MHZ

Parameter	Symbol	Value Min.	Value Typ.	Value Max.	Unit
Input Capacitance	C_{IN}			8	pF
Output Capacitance	C_{OUT}			8	pF
Bus Capacitance	$C_{I/O}$			12	pF

Recommended Operating Conditions

Parameter	Symbol	Value Min.	Value Typ.	Value Max.	Unit
Supply Voltage	V_{CC}	4.5	5.0	5.5	V
Operating Temperature	T_{OP}	0		70	°C

DC Characteristics

Parameter	Symbol	Value Min.	Typ.	Max.	Unit
Power Supply Current (For Stable State; $V_{IH} = V_{CC}$, V_{IL} = GND)	I_{CC}	0		0.1	mA
Output High Voltage (I_{OH} = -0.4mA)	V_{OH}	4.0		V_{CC}	V
Output Low Voltage (I_{OL} = 2mA)	V_{OL}	GND		0.4	V
Input High Voltage	V_{IH}	2.2			V
Input Low Voltage	V_{IL}			0.8	V
Input Leakage Current (V_I = 0V to V_{CC})	I_{LI}	-10		10	μA
Input Leakage Current for Bus Pins (V_I = 0V to V_{CC})	I_{LZ}	-40		40	μA

AC Characteristics

Control Register Read Timing

Parameter	Symbol	Value Min.	Typ.	Max.	Unit
Read Pulse Width	t_{RW}	35			ns
Read Address Pulse Width	t_{RAW}	35			ns
Read Access Time (C_L = 80 pF)	t_{RA}			110	ns
Read Address Access Time (C_L = 80 pF)	t_{RAA}			150	ns
Read Turn-off Delay Time (C_L = 80 pF)	t_{RZ}	10			ns
Read Address Turn-off Delay Time (C_L = 80 pF)	t_{RAZ}	20			ns
Address Register Read Access Time (C_L = 80 pF)	t_{ARRA}			300	ns
Address Register Read Address Turn-off Delay Time (C_L = 80 pF)	t_{ARRAZ}	20			ns
Address Register Read Address Setup Time	t_{ARRAS}	15			ns
Address Register Read Address Hold Time	t_{ARRAH}	90			ns

Control Register Write Timing

Parameter	Symbol	Value Min.	Typ.	Max.	Unit
Write Pulse Width	t_{WW}	35			ns
Write Address Set-up Time	t_{WAS}	30			ns
Write Data Set-up Time	t_{WDS}	15			ns
Write Address Hold Time	t_{WAH}	40			ns
Write Data Hold Time	t_{WDH}	80			ns
Test Pin Delay Time (C_L = 50 pF)	t_T			150	ns
Transmit Status Register Reset Delay Time (C_L = 50 pF)	t_{TS}			150	ns
Receive Status Register Reset Delay Time (C_L = 50 pF)	t_{RS}			150	ns
Reset Register Reset Delay Time (C_L = 50 pF)	t_R			220	ns

5

AC Characteristics
(Continued)

Transmit Timing

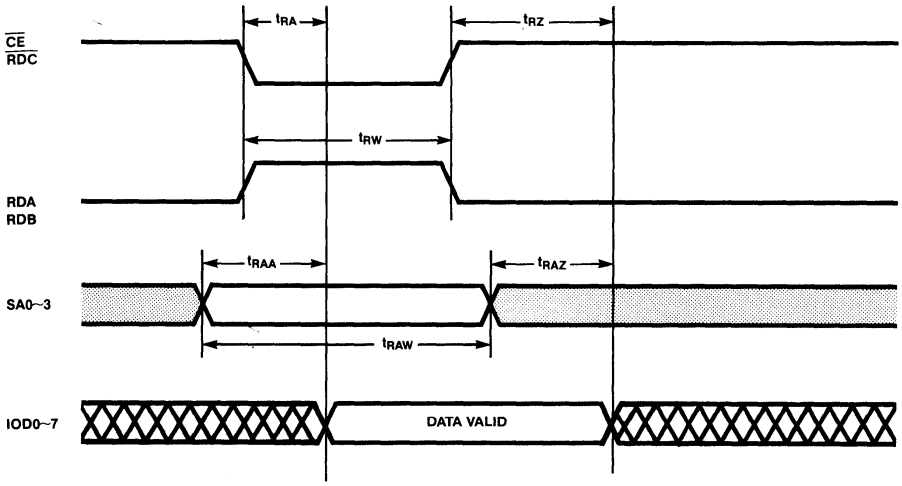
Parameter	Symbol	Value Min.	Typ.	Max.	Unit
TSTB Pulse Width	t_{TSTBW}	35			ns
TCKN Pulse Width	t_{TCKNW}	35			ns
TCKN Frequency	f_{TCKN}			10.2	MHz
Transmit Data Set-up Time	t_{TDS}	20			ns
Transmit Data Hold Time	t_{TDH}	25			ns
$\overline{TEM}$ Delay Time High (C_L = 50 pF)	t_{TEMH}			100	ns
$\overline{TEM}$ Delay Time Low (C_L = 50 pF)	t_{TEML}			150	ns
$\overline{TEM}$ Delay Time Low (Sync.) (C_L = 50 pF)	t_{TEMLS}			170	ns
TEN Delay Time (C_L = 50 pF)	t_{TEN}			55	ns
TXD Delay Time (C_L = 50 pF)	t_{TXD}			70	ns
TPOK Delay Time (C_L = 50 pF)	t_{TPOK}			150	ns
$\overline{TRET}$ Delay Time (C_L = 50 pF)	t_{TRET}			140	ns
$\overline{TINT}$ Delay Time (Transmit) (C_L = 50 pF)	t_{TINTT}			160	ns

Receive Timing

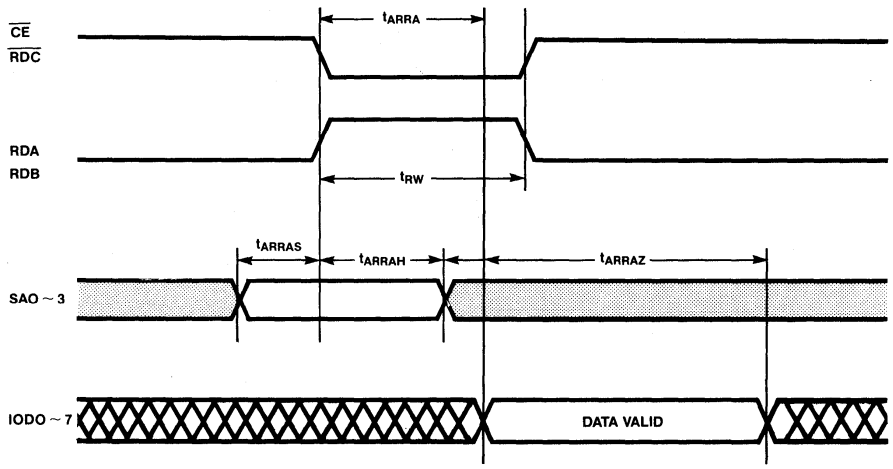
Parameter	Symbol	Value Min.	Typ.	Max.	Unit
RCKN Pulse Width	t_{RCKNW}	35			ns
RCKN Frequency	f_{RCKN}			10.2	MHz
$\overline{RSTB}$ Pulse Width	t_{RSTBW}	35			ns
$\overline{ROEN}$ Pulse Width	t_{ROENW}	35			ns
Receive Data Set-up Time	t_{RDS}	20			ns
Receive Data Hold Time	t_{RDH}	10			ns
$\overline{RRDY}$ Delay Time High (Sync.) (C_L = 50 pF)	t_{RRDYHS}			650	ns
Receive Data Delay Time (Sync.) (C_L = 50 pF)	t_{RDDS}			650	ns
$\overline{RRDY}$ Delay Time High (C_L = 50 pF)	t_{RRDYH}			100	ns
$\overline{RRDY}$ Delay Time Low (C_L = 50 pF)	t_{RRDYL}			65	ns
Receive Data Delay Time (C_L = 50 pF)	t_{RD}	10		100	ns
$\overline{ROEN}$ Access Time (C_L = 50 pF)	t_{ROENA}			80	ns
$\overline{ROEN}$ Turn-off Delay Time (C_L = 50 pF)	t_{ROENZ}	10			ns
RDIS Delay Time (C_L = 50 pF)	t_{RDIS}			120	ns
$\overline{PRST}$ Delay Time (C_L = 50 pF)	t_{PRST}			120	ns
$\overline{RINT}$ Delay Time (C_L = 50 pF)	t_{RINT}			160	ns
$\overline{TINT}$ Delay Time (Rcv) (C_L = 50 pF)	t_{TINTR}			190	ns

Timing Diagram

Control Register Read
Registers 0~7, F



Address Registers 8~D



WHEN RESET OR WHEN IN LOOPBACK AND ACCEPT NO PACKET MODE.

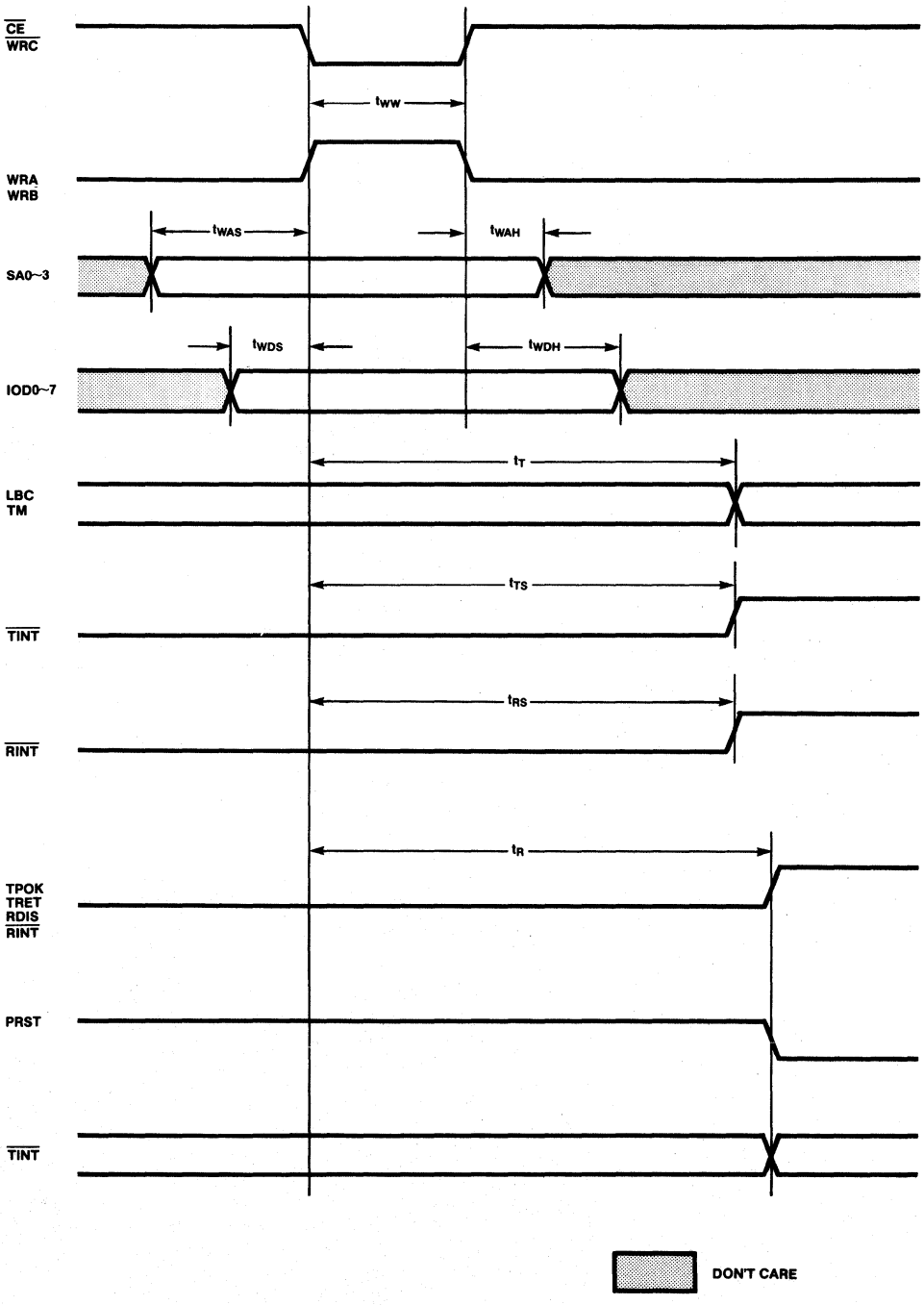
DON'T CARE

DATA UNDEFINED

5

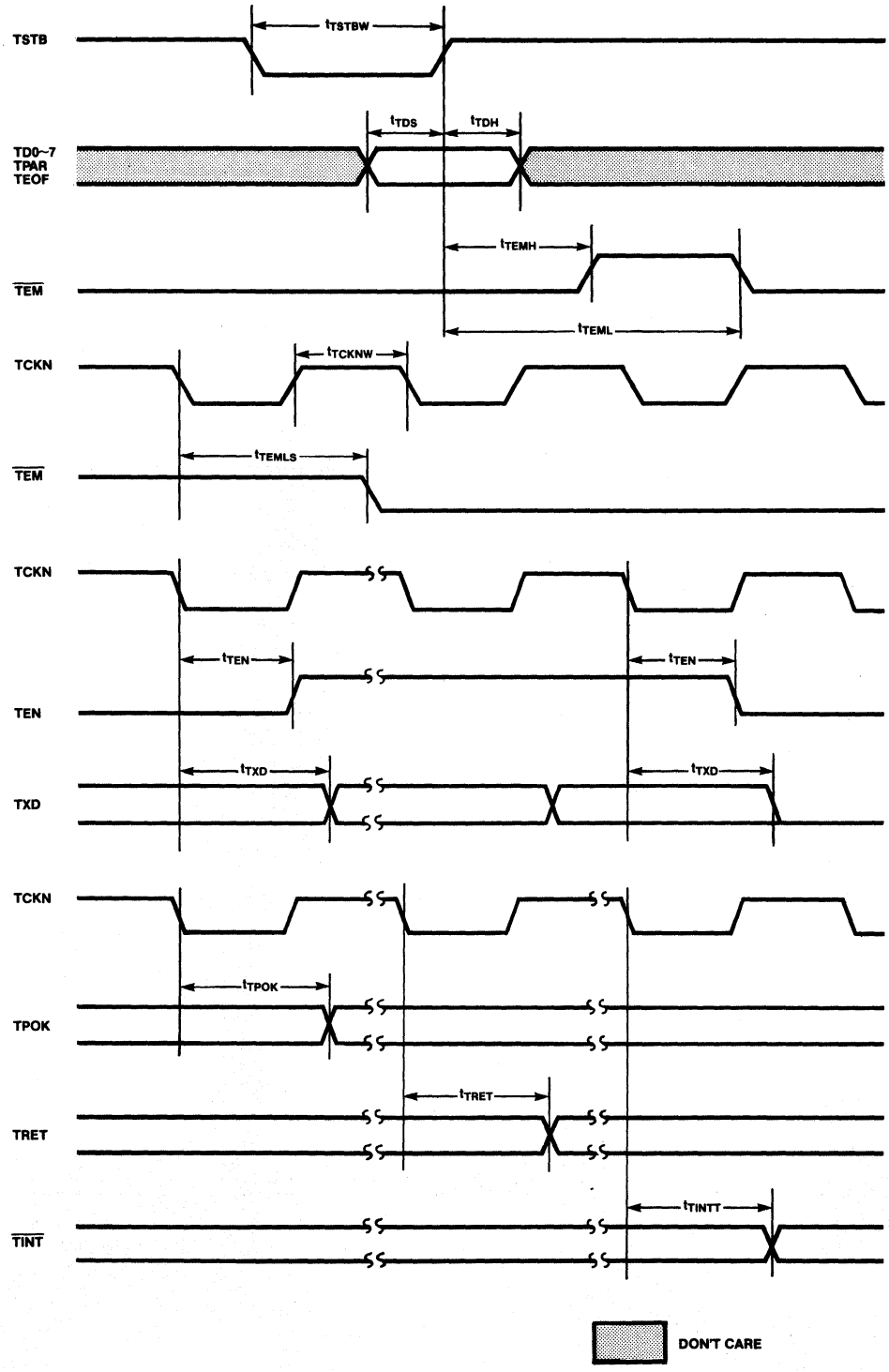
Timing Diagram
(Continued)

Control Register Write



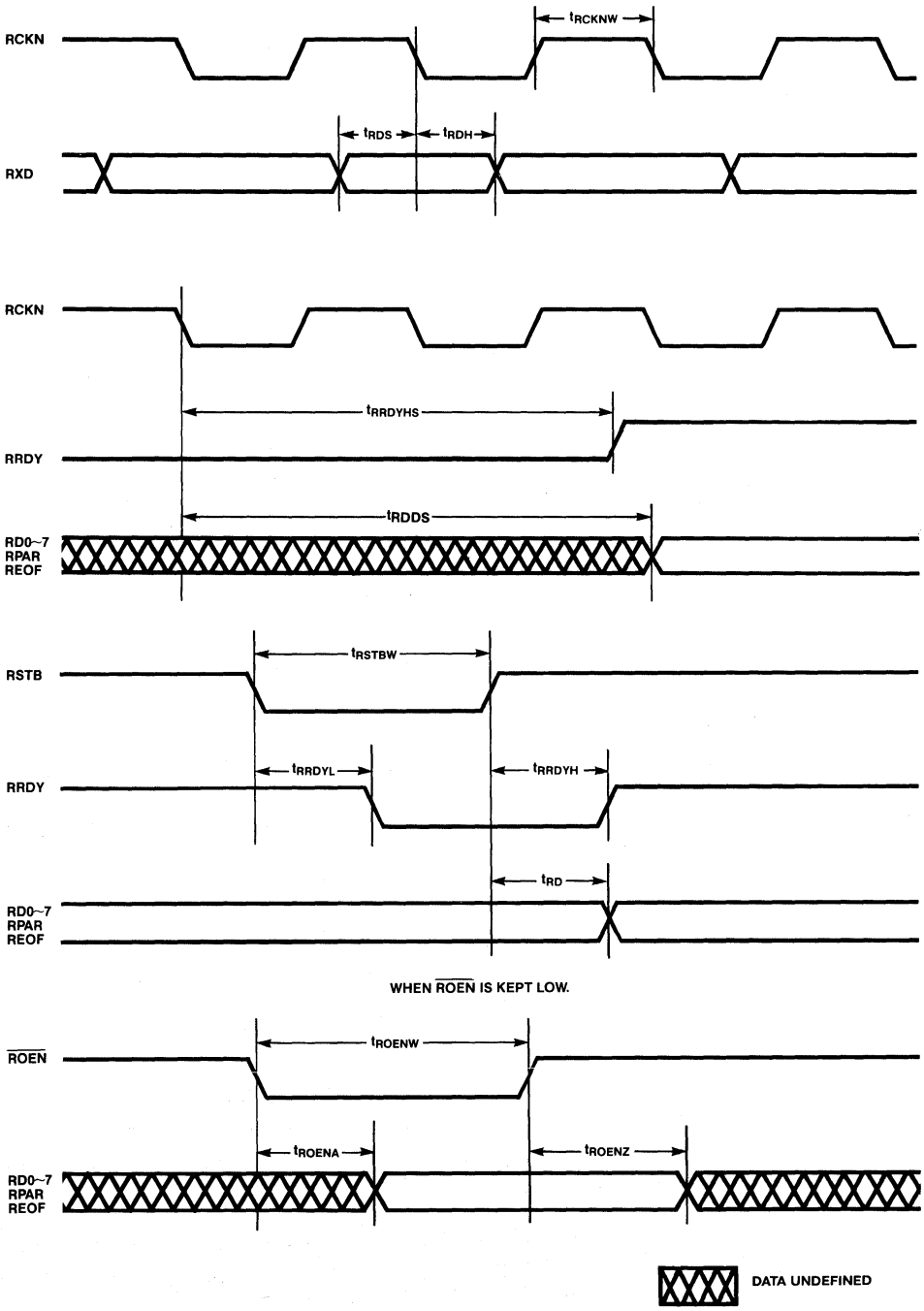
Timing Diagram
(Continued)

Transmit



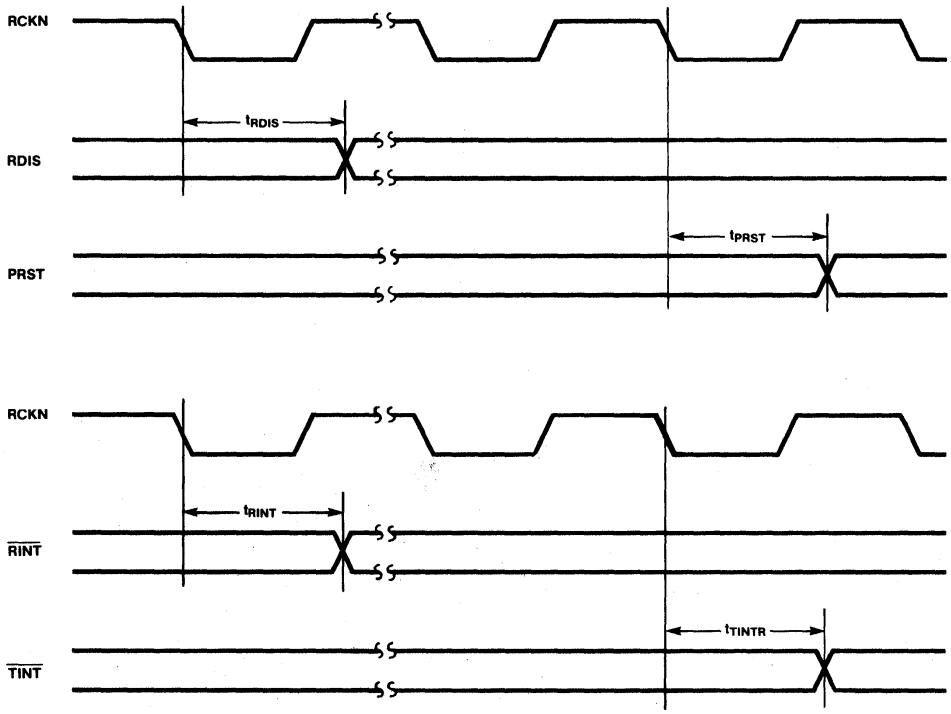
Timing Diagram
(Continued)

Receive



Timing Diagram
(Continued)

Receive (Continued)



Functional Description

The MB8795B EDLC is designed as two distinct sections, a transmitter and a receiver. Each section provides a small amount of asynchronous buffering, provisions for byte parity (which can be ignored), preamble generation/stripping, CRC generation/checking, and conversion between serial and parallel data. In addition, the transmitter provides contention resolution by means of binary exponential backoff. Finally, the receiver provides various modes of address recognition.

Transmitter

The block diagram on page 2 shows the various functions the transmitter performs.

Asynchronous FIFO

A two-byte FIFO provides a minimum amount of elastic buffering for the transmit byte data. Two signals are used for the byte controls. The first signal, TEM, indicates that the input register is full. The second signal, TSTB, is the input register data strobe. On the rising edge of this strobe input, the eight data bits, the parity bit and the 'end of frame' (TEOF) bit are latched into the input register. Strobes are ignored while the register is full.

The TRET signal indicates that a collision has occurred and that the packet in progress should be restarted. The buffer management would typically flush any buffers and reset its pointers to the beginning of the packet. Note that on the block diagram the asynchronous FIFO is cleared by this signal.

The TPOK signal indicates that successful transmission of the packet has been completed and the transmitter is ready for the next packet. This signal goes high when transmission of the packet is complete.

Note: The TPOK signal remains low long enough after the last byte is strobed into the FIFO, so the FIFO can be emptied and the CRC appended. Therefore the buffer management must remain prepared to reset its pointers in the case of a late collision.

Transmit Parallel/Serial Conversion

This section has a shift register for parallel to serial data conversion, a preamble generator, and a sychronization circuit for the collision and carrier detect signals. Also included is the optional 'ODD' parity check that is performed on the byte data supplied to the CRC generator. The parity check provides added security against internal chip failures due to undetected bad data transmissions.

Transmit CRC

The 32-bit CRC generator as defined in the Ethernet Specification.

Backoff

A pseudo-random number generator (17-bits), clocked at the bit rate so that distances between stations becomes part of the randomizing function, is sampled at the time of collision and counted down at the slot-time rate (512-bits) defined in the Ethernet specification, which provides a binary exponential backoff from collisions.

Transmitter State Machine

The state machine provides the major sequencing of events for the transmitter including idle, preamble, data, CRC, interframe gap, jam, and backoff. It also provides indicators for various error conditions.

Receiver

Refer to the block diagram for the relation of the sections. (See page 2).

Asynchronous FIFO

A six byte FIFO is provided so that when in diagnostic mode a minimum size packet (6 byte destination address and 4 byte CRC) can be received even in systems where the buffer management is half duplex. The data, parity and 'end of frame' bit are tri-stated with signal ROEN, a low true enable. The 'receive byte ready' (RRDY) indicates a byte is available to the host system. RSTB is a low true clock whose falling edge causes RRDY to be false and whose rising edge causes the data in the register to be removed. See the timing charts for further clarification.

CRC Trap

All received bytes are delayed by four bytes so that the last bytes of the received packet (CRC) can be removed. After four bytes are received the trap will put one byte into the asynchronous FIFO for each subsequent byte received, thereby always maintaining four bytes in the trap. At the 'end of frame' the four bytes in the trap are the CRC and they are never put into the asynchronous FIFO.

Receive Serial/Parallel Conversion

This section has a shift register for data serial to parallel conversion, a circuit to recognize the end of preamble, and an odd parity check circuit.

Receive CRC

The 32-bit CRC checking register and comparison logic as described in the Ethernet specification.

6 Byte Address RAM

A 48-bit storage RAM used for comparing with the Destination Address Field of the incoming packets (the first 48 bits after the preamble).

Receiver State Machine

The state machine provides the major sequencing through the receiver states including idle, address recognition, data, and holding as a discarded packet completes. It also provides indicators of various error conditions.

Functional Description
(Continued)

Command/Status/Interrupt

This section has fifteen registers, a register address decoder, and gating for interrupt conditions. Each register is one byte length. The host system communicates with the MB8795B EDLC using these registers accessed through the control port.

Interrupt conditions are defined by setting the registers of Transmit Marks and Receive Masks.

Register Description

The Register in the MB8795B EDLC can be accessed via the control port with their address assigned by the signals SA0-3. (SA0 represents the LSB of the address.) The address signals SA0-3 are activated by both the chip enable signal CE and, write signals WRA, WRB, WRC, or, read signals RDA, RDB, RDC. A brief description of each register is given in the table below.

Register Description

			7	6	5	4	3	2	1	0
0	XMIT STATUS	RD	RDY For PKT	NET BUSY	XMIT RECVD	SHORT-ED	UNDER-FLOW	COLL	16 COLL	PAR ERR
		WR	—	—	—	—	CLR UNDER-FLOW	CLR COLL	CLR 16 COLL	CLR PAR ERR
1	XMIT MASKS	RD/WR	MASK STATUS 7	—	MASK STATUS 5	—	MASK STATUS 3	MASK STATUS 2	MASK STATUS 1	MASK STATUS 0
2	REC STATUS	RD	PKT OK	—	—	RESET PKT	SHORT PKT	ALIGN ERR	CRC ERR	OVER-FLOW ERR
		WR	CLR PKT	—	—	—	CLR ERR	CLR ERR	CLR ERR	CLR ERR
3	REC MASKS	RD/WR	MASK STATUS 7	—	—	MASK STATUS 4	MASK STATUS 3	MASK STATUS 2	MASK STATUS 1	MASK STATUS 0
4	TMODE + COLL ATTEMPT	RD/WR	3	2	1	0	IGNORE PARITY	TM	LBC	DIS-ABLE CONTNT
			Collision Attempts, Read Only							
5	RMODE	RD/WR	TST CRC	—	—	ADD SIZE	ENA SHORT PKT	ENA RST	ADD ENA1	ADD ENA0
6	RESET	Write Only	RESET	—	—	—	—	—	—	—
7	TDR1	Read Only	TDR7	TDR6	TDR5	TDR4	TDR3	TDR2	TDR1	TDR0

5

Register Description
(Continued)

				7	6	5	4	3	2	1	0
48-Bit Ethernet Address	8	NODE IDO	RD/WR	8th BIT A.P.	7th BIT A.P.	6th BIT A.P.	5th BIT A.P.	4th BIT A.P.	3rd BIT A.P.	2nd BIT A.P.	1st BIT A.P.*
				First Byte After Preamble							
	9	NODE ID1	RD/WR	16th BIT A.P.	15th BIT A.P.	14th BIT A.P.	13th BIT A.P.	12th BIT A.P.	11th BIT A.P.	10th BIT A.P.	9th BIT A.P.
				Second Byte After Preamble							
	A	NODE ID2	RD/WR	24th BIT A.P.	23rd BIT A.P.	22nd BIT A.P.	21st BIT A.P.	20th BIT A.P.	19th BIT A.P.	18th BIT A.P.	17th BIT A.P.
				Third Byte After Preamble							
	B	NODE ID3	RD/WR	32nd BIT A.P.	31st BIT A.P.	30th BIT A.P.	29th BIT A.P.	28th BIT A.P.	27th BIT A.P.	26th BIT A.P.	25th BIT A.P.
				Fourth Byte After Preamble							
	C	NODE ID4	RD/WR	40th BIT A.P.	39th BIT A.P.	38th BIT A.P.	37th BIT A.P.	36th BIT A.P.	35th BIT A.P.	34th BIT A.P.	33rd BIT A.P.
				Fifth Byte After Preamble							
	D	NODE ID5	RD/WR	48th BIT A.P.	47th BIT A.P.	46th BIT A.P.	45th BIT A.P.	44th BIT A.P.	43rd BIT A.P.	42nd BIT A.P.	41st BIT A.P.
				Sixth Byte After Preamble							
	E	(RESERVED)		—	—	—	—	—	—	—	—
	F	TDR2	Read Only	—	—	TDR13	TDR12	TDR11	TDR10	TDR9	TDR8

*Multicast bit

Register Description
(Continued)

Transmit Status—Address 00H

This register indicates the status of the transmitter.

Bit 7

Read—Ready for Packet—A copy of the Transmit Packet Successful (TPOK) signal pin. For use in systems where the processor handles the transmit buffer management.

Write—no effect.

Bit 6

Read—Net Busy—A copy of the Receive Carrier Detect (XCD) input.

Write—no effect.

Bit 5

Read—Transmitted Packet was Received—Indicates that shortly after transmission was completed a good packet was received by the receiver. This is used to indicate self-reception of the packet, which allows the software to take advantage of the hardware address matching even in systems which are designed for half duplex operation. This bit is cleared as each transmission begins.

Write—no effect.

Bit 4

Read—Shorted—Set if the Receive Carrier Detect (XCD) stops during packet transmission. Either a collision or shorted coax can cause the bit to be set. This bit is cleared as each transmission begins.
—Write—no effect.

Bit 3

Read—Underflow—Set when data to be transmitted is not available to the parallel to serial converter before the converter is empty. Transmission is aborted immediately while bytes will be accepted from the FIFO until an EOF is encountered.

Write—0, no effect; 1, clear the error condition.

Bit 2

Read—Collision—Set when a collision terminates transmission of a packet.

Write—0, no effect; 1, clear the error condition.

Bit 1

Read—16 Collisions—Set when the 16th collision for a single packet aborts transmission. Bytes are strobed through FIFO normally to discard the packet.

Write—0, no effect; 1, clear the error condition.

Bit 0

Read—Parity Error—Set when the parallel to serial converter detects a parity error in the data. If parity check is enabled transmission is aborted while the bytes continue to be strobed from the FIFO, until EOF.

Write—0, no effect; 1, clear the error condition.

Transmit Masks—Address 01H

The interrupt conditions which define the signal at $\overline{\text{TINT}}$ are defined by setting the bits of this register.

Bit 7—Rd/Wr—Gates 'Ready For Packet'
Bit 6—no bit, read as 0
Bit 5—Rd/Wr—Gates 'Transmit Received'
Bit 4—no bit, read as 0.
Bit 3—Rd/Wr—Gates 'Underflow'
Bit 2—Rd/Wr—Gates 'Collision'
Bit 1—Rd/Wr—Gates '16 Collisions'
Bit 0—Rd/Wr—Gates 'Parity Error'

Receive Status—Address 02H

This register indicates the status of the receiver.

Bit 7

Read—Packet OK—Set when CRC of a legal length packet received is correct.

Write—0, no effect; 1, clear the error condition.

Bit 6

not used

Bit 5

not used

Bit 4

Read—Reset Packet—Set when a packet is received successfully and the field type is 0900H. The bit is cleared at the beginning of the next packet reception. The bit is set only if the Node ID matches, not multicast or broadcast. Reset packets are recognized in any Address Match mode from NONE to PROMISCUOUS.

Write—no effect

Bit 3

Read—Short Packet—Set if a packet does not meet the minimum length requirements of the Ethernet specification.

Write—0, no effect; 1, clear condition.

Bit 2

Read—Alignment Error—Set if a packet has bad CRC at the last octet boundary and the number of bits are not divisible by eight.

Write—0, no effect; 1, clear condition.

Bit 1

Read—CRC Error—Set if the CRC does not verify at the end of the packet.

Write—0, no effect; 1, clear the error condition.

Bit 0

Read—Overflow—Set if the internal asynchronous FIFO is full when a byte is available from the serial to parallel converter.

Write—0, no effect; 1, clear error condition.

5

Register Description
(Continued)

Receive Masks—Address 03H

The interrupt conditions which define the signal at RINT are defined by setting the bits of this register.

Bit 7—Rd/Wr—Gates 'Packet OK'
Bit 6—no bit, read as 0.
Bit 5—no bit, read as 0.
Bit 4—Rd/Wr—Gates 'Reset Packet'
Bit 3—Rd/Wr—Gates 'Short Packet'
Bit 2—Rd/Wr—Gates 'Alignment Error'
Bit 1—Rd/Wr—Gates 'CRC Error'
Bit 0—Rd/Wr—Gates 'Overflow'

Transmit Mode—Address 04H

Bits 7-4

Read Only—Collision Attempts—Indicates the number of collisions occured before the last packet was sent (or aborted). This is a testing aid as the number is cleared at the beginning of a subsequent transmission.

Bit 3

Rd/Wr—Ignore Parity—if set this bit prevents the setting of the Parity Error condition.

Bit 2

Rd/Wr—TM—A bit whose complement is available as signal pin TM. Intended to control the power to the transceiver or any other function external to the chip.

Bit 1

Rd/Wr—LBC—A bit whose complement is available as signal pin LBC. Intended to control the loopback function of the Encoder/Decoder or any other function external to the chip.

Bit 0

Rd/Wr—Disable Contention—When this bit is set the transmitter disregards Receive Carrier Detect. This special function would only be used if the MB8795B EDLC were used in a two wire point to point link, in true full duplex operation. In this case the Collision Detect signal (a low level will inhibit the start of transmission) acts as carrier sense for the transmitter while collisions during transmissions are ignored.

Receive Mode—Address 05H

Bit 7

Rd/Wr—Test Mode—For chip testing this bit:

1) Inhibits the receiver from accumulating CRC. The last four bytes of a packet are shifted into the CRC register and checked without being modified.

2) Changes the backoff algorithm so that the pseudo-random number generator is disabled and the number to backoff becomes $2^{n-1}+1$, where n is the number of collisions. Also, the slot time is reduced to one (1) byte.

Bit 6

not used.

Bit 5

not used.

Bit 4

Rd/Wr—Address Size—When set this bit reduces the Node ID address match to 5 bytes instead of the normal 6. This is used where the node is performing some multiplex function on the least significant byte of the destination address.

Bit 3

Rd/Wr—Short Packet Enable—For testing, when this bit is set the receiver will successfully receive any packet of ten (10) bytes or more. This function is used in half duplex systems for the loopback check and can be used by all testing programs to reduce testing time.

Bit 2

Rd/Wr—Reset Enable—When this bit is zero, the checking done for the special type field is disabled.

Bit 1-0

Rd/Wr—Address Match Mode—

- Mode 0—accept no packets
- Mode 1—accept Node ID packets, multicasts which match the first three bytes of the Node ID packets, and broadcast packets.
- Mode 2—accept Node ID packets, and all multicasts including broadcast of course
- Mode 3—promiscuous, accept all packets.

Reset—Address 06H

Bit 7

Write Only—Reset—This latch is writeable and will hold the device in the reset state while set. It is set by the external reset pin RST being low. After power up the software should first initialize all the modes and masks, and then clear the reset.

Bit 6-0

not used

TDR LSB—Address 07H

Bits 7-0

Read Only—contains the least significant 8 bits of the TDR register which counts how many bits were successfully transmitted. Counting stops on collision or drop of carrier. Count is reset with each transmission.

Node ID—Addresses 10-15H

These 6 bytes are Rd/Wr and represent the address against which th frame addresses are matched during Address Match Modes 1 and 2. Bit 0 of address 10H is equivalent to the multicast bit.

TDR MSB—Address 17H

Bits 7-6

not used

Bits 5-0

Read Only—Contains the most significant six bits of the TDR register which was described above.

Register Description
(Continued)

Interface Signal Description

Power Group

V_{CC}—+5V power supply (two pins)

GND—ground (two pins)

Control Group

$\overline{CE}$ (Chip enable, low active input)

This active low signal gates all control port reads and writes.

RDA,RDB,$\overline{RDC}$ (Control read, inputs)

These two active high and one active low signals are ANDed with $\overline{CE}$ to form read signals inside the MB8795B EDLC.

WRA,WRB,$\overline{WRC}$ (Control write, inputs)

These two active high and one active low signals are ANDed with $\overline{CE}$ to form write strobes inside the MB8795B EDLC. One of the signals is intended to be a clock so that address, data, and other controls will be stable when the internal write is active.

SA0-3 (Control port address, input)

These four signals address the 16 possible registers of the MB8795B EDLC. SA0 is the least significant bit of the address.

IOD0-7 (Control port data, 3-state outputs and inputs)

These eight signals are the bi-directional data used to read and write the 16 possible internal registers of the MB8795B EDLC.

Transmit Group

TD0-7 (Transmit data bytes, inputs)

Eight bits of data to be transmitted.

TPAR (Transmit data parity, input)

Optional parity accompanying the transmit byte data.

TEOF (Transmit data end of frame, input)

Required data bit which signals the last byte of the frame. After the byte having this bit is sent, CRC transmission will start.

$\overline{TEM}$ (Transmit byte register not empty, output)

Indicates that the asynchronous FIFO has no room for a byte.

TSTB (Transmit byte register strobe, positive edge-trigger input)

Strobes the transmit data into the asynchronous FIFO.

TRET (Transmit packet - retransmit packet, output)

Indicates that a collision or underflow has occurred. Buffer management logic should discard any remaining bytes of the current packet and then restart transmission of the packet.

TPOK (Transmit packet successful, output)

Indicates to the buffer management that it will not be required to retransmit the current packet again and thus can proceed to the next packet.

Receive Group

RD0-7 (Receive data bytes, 3-state outputs)

Eight bits of data being received.

RPAR (Receive data parity, 3-state output)

Odd parity computed on the incoming data stream.

REOF (Receive data end of frame, 3-state output)

A tenth data bit which accompanies the last byte of the frame, which is only present if reception was successful. Successful reception means that a packet had good CRC, appropriate length and an address match in the current mode.

$\overline{ROEN}$ (Receive byte output enable, low active input)

3-state enable for the ten data bits above. This allows multiplexing the receive data port with the transmit and control ports in low cost systems.

RRDY (Receive byte ready, output)

Indicates that a byte is available at the output of the async FIFO.

RSTB (Receive byte strobe, positive edge trigger input)

Strobes the receive data out of the async FIFO to the host system.

RDIS (Receive packet discard, output)

Indicates that the bytes received so far should be discarded because of bad address, bad length or bad CRC. This signal and the REOF output are mutually exclusive.

Physical Link Group

RCKN (Receive data clock, negative edge trigger input)

This signal is generated by the Ethernet Encoder/Decoder (EED) MB502A. It is a strobe frequency source for the receive bit clock and is used to strobe RXD.

RXD (Receive serial data, input)

Decoded data from the MB502A EED.

TCKN (Transmit data clock, negative edge trigger input)

Generated by the MB502A EED as a strobe frequency source for the transmit bit clock.

TEN (Transmit encode enable, output)

High true enable for Manchester encoding. This signal is strobed and stable at the same time as TXD.

TXD (Transmit serial data, output)

Serial data to be encoded onto the Ethernet Coax. Gated by TEN

XCD (Receive carrier detect, input)

Carrier detect signal of the decoder. Used by the receiver as data gate and by the transmitter as contention information.

5

Register Description
(Continued)

XCOL (Collision presence, input)

A TTL copy of the Collision presence pair of the transceiver cable. The idle state is indicated by a logic "1" and the collision is indicated by a 10 MHz square wave.

LBC (Loopback Control, output)

A copy of a software setable latch used to command the MB502A EED to operate in Loopback mode.

Misc. Group

PRST (Packet reset, output)

Indicates that a complete and legal packet of type 0900H was received. This is intended to be used as a remote reset function.

$\overline{\text{RINT}}$ (Receive interrupt, output)

A logic "0" indicates the receiver interrupt condition coincides with its corresponding mask bit.

$\overline{\text{TINT}}$ (Transmitter interrupt, output)

Same as $\overline{\text{RINT}}$ for transmitter interrupt.

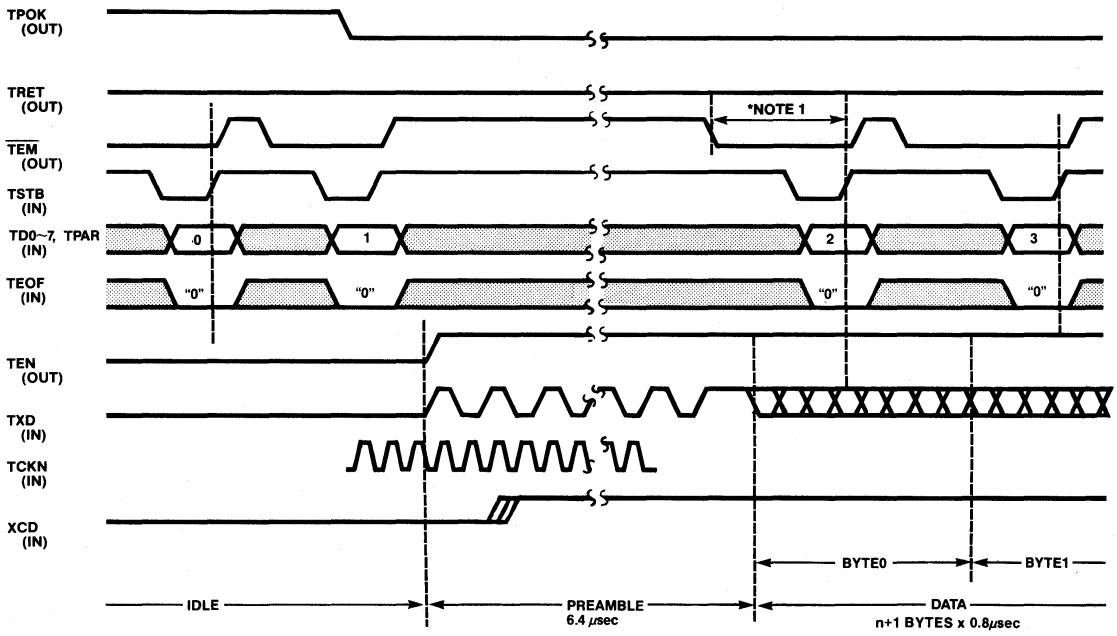
$\overline{\text{RST}}$ (Reset, low active input)

TM (Test mode, output)

A copy of a software loadable latch. Intended to control a circuit to turn the Transceiver power on and off.

Timing Diagram

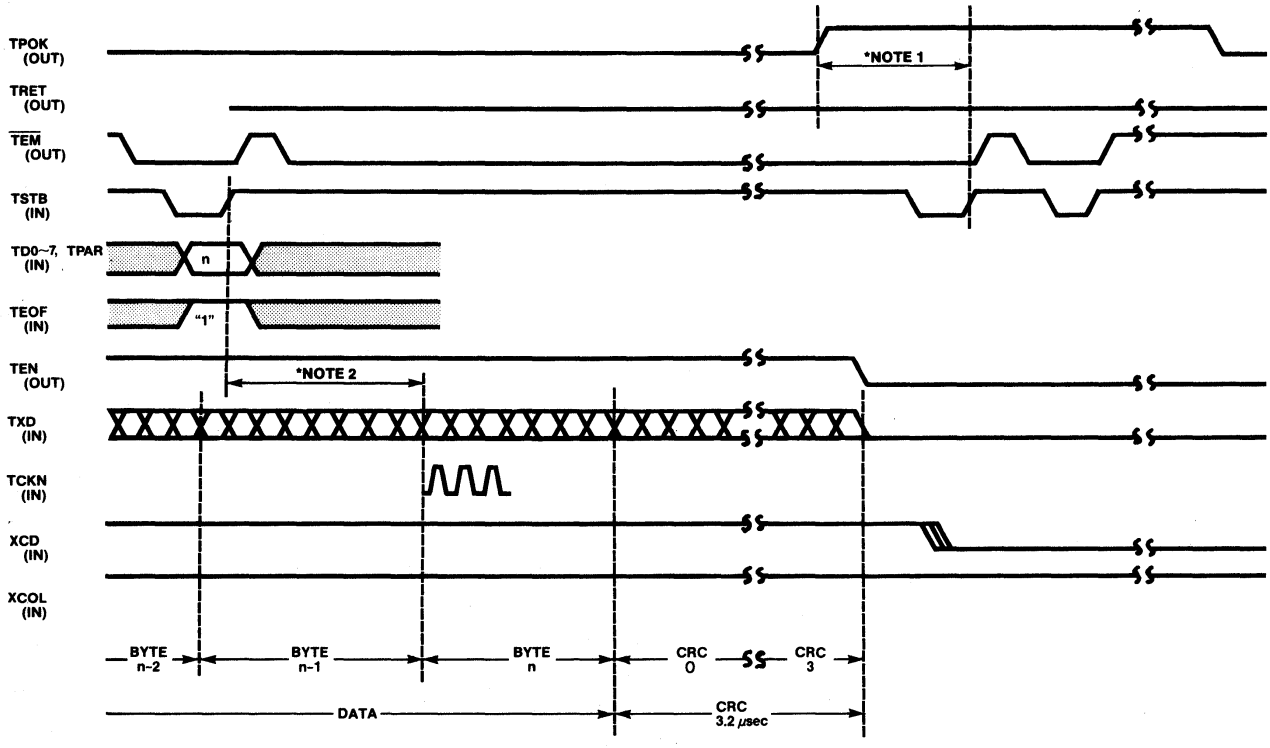
Transmit Good Packet (1)



***Note 1:** This period could be as great as 1½ byte times.

Timing Diagram
(Continued)

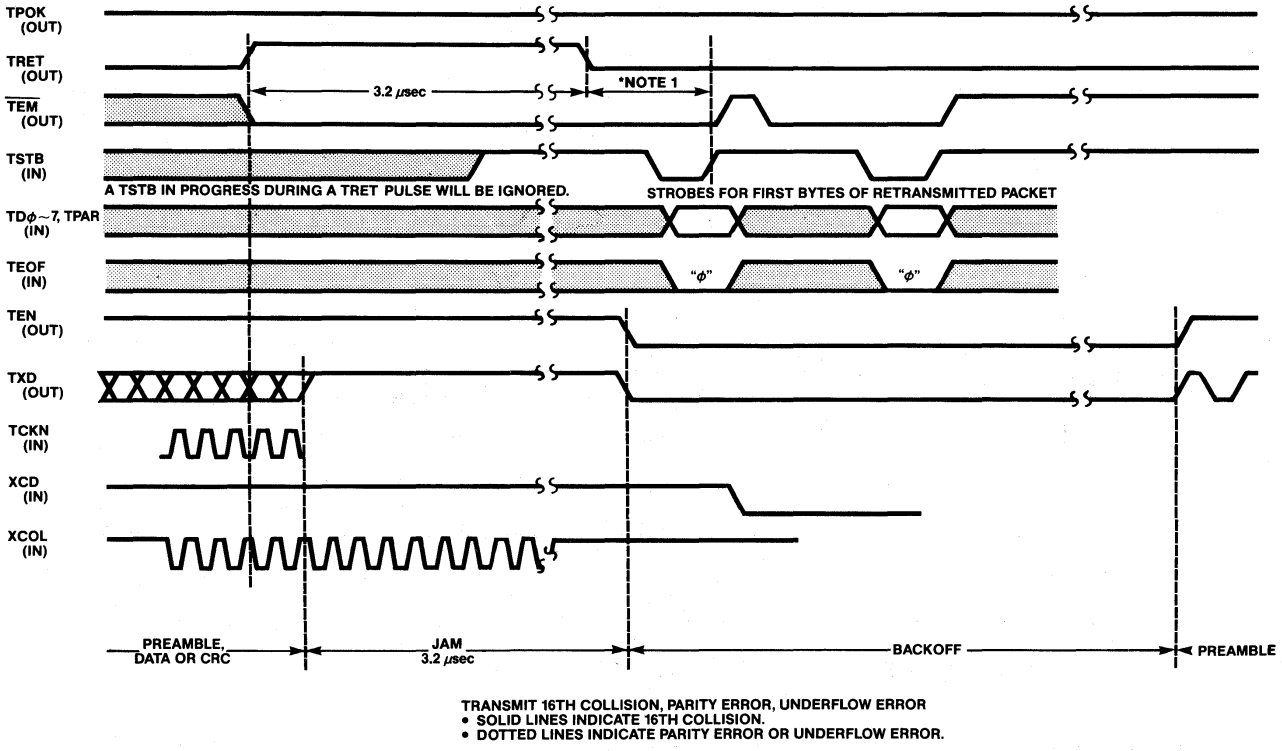
Transmit Good Packet (2)



***Note 1:** Must be less than ≈ 5.0 μ sec. to guarantee minimum packet spacing.
***Note 2:** This could be ½-2½ byte times.

Timing Diagram
(Continued)

Transmit Collision—First Fifteen Collisions only

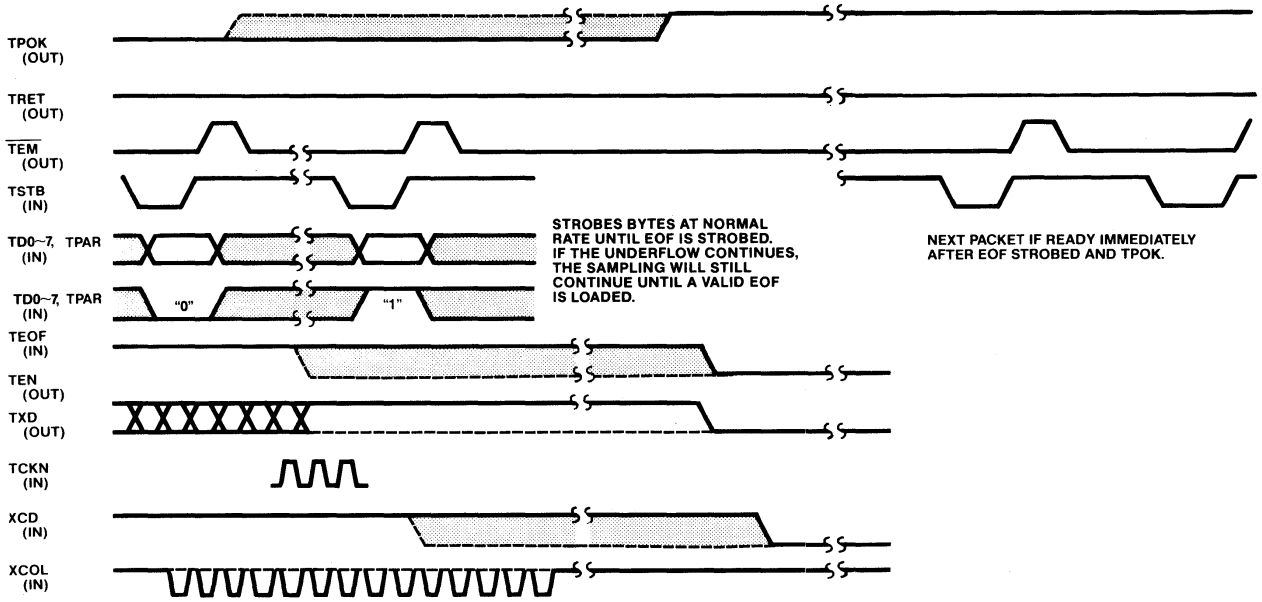


***Note 1:** Must be less than ≈ 5.0 μ sec. to guarantee minimum backoff time.

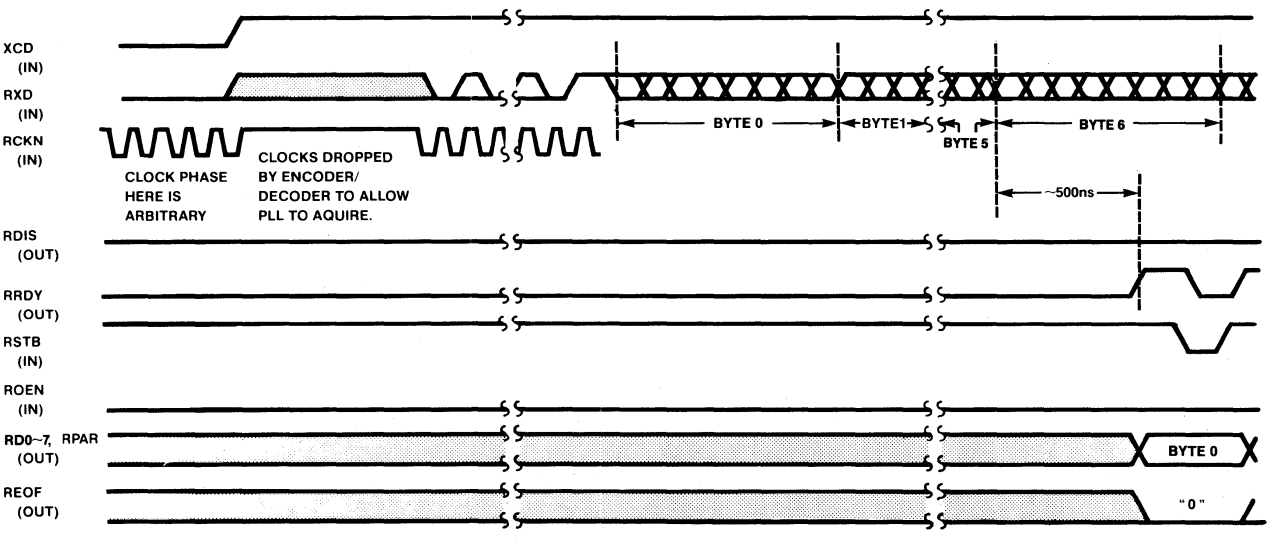
Timing Diagram
(Continued)

Transmit 16th Collision, Parity Error, Underflow Error

- **Solid lines indicate 16th collision.**
- **Dotted lines indicate parity error or underflow error.**



Receive



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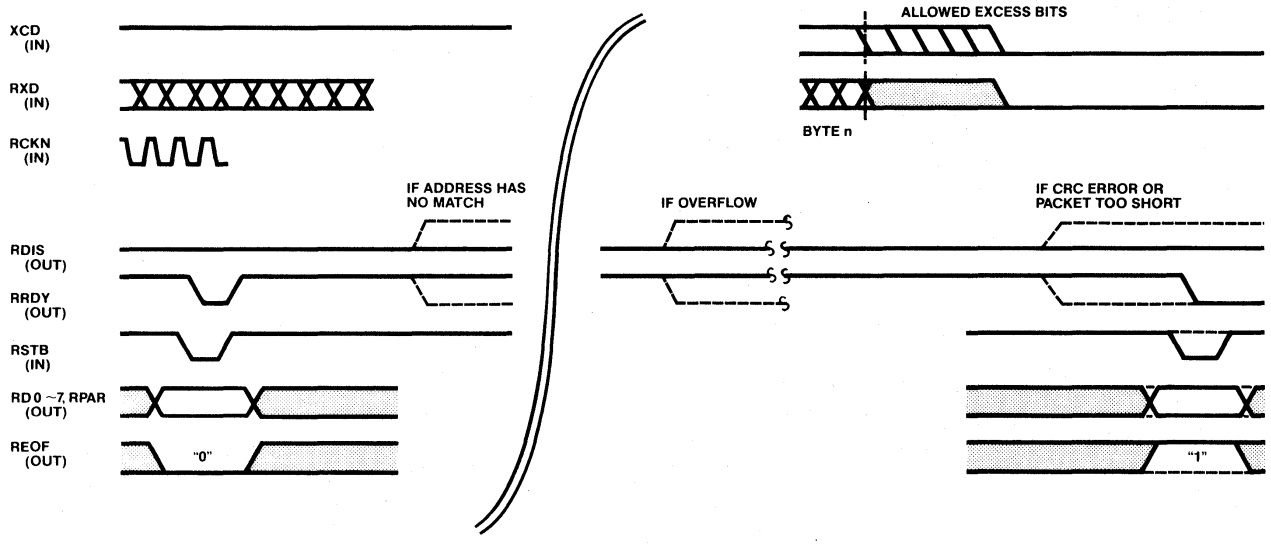
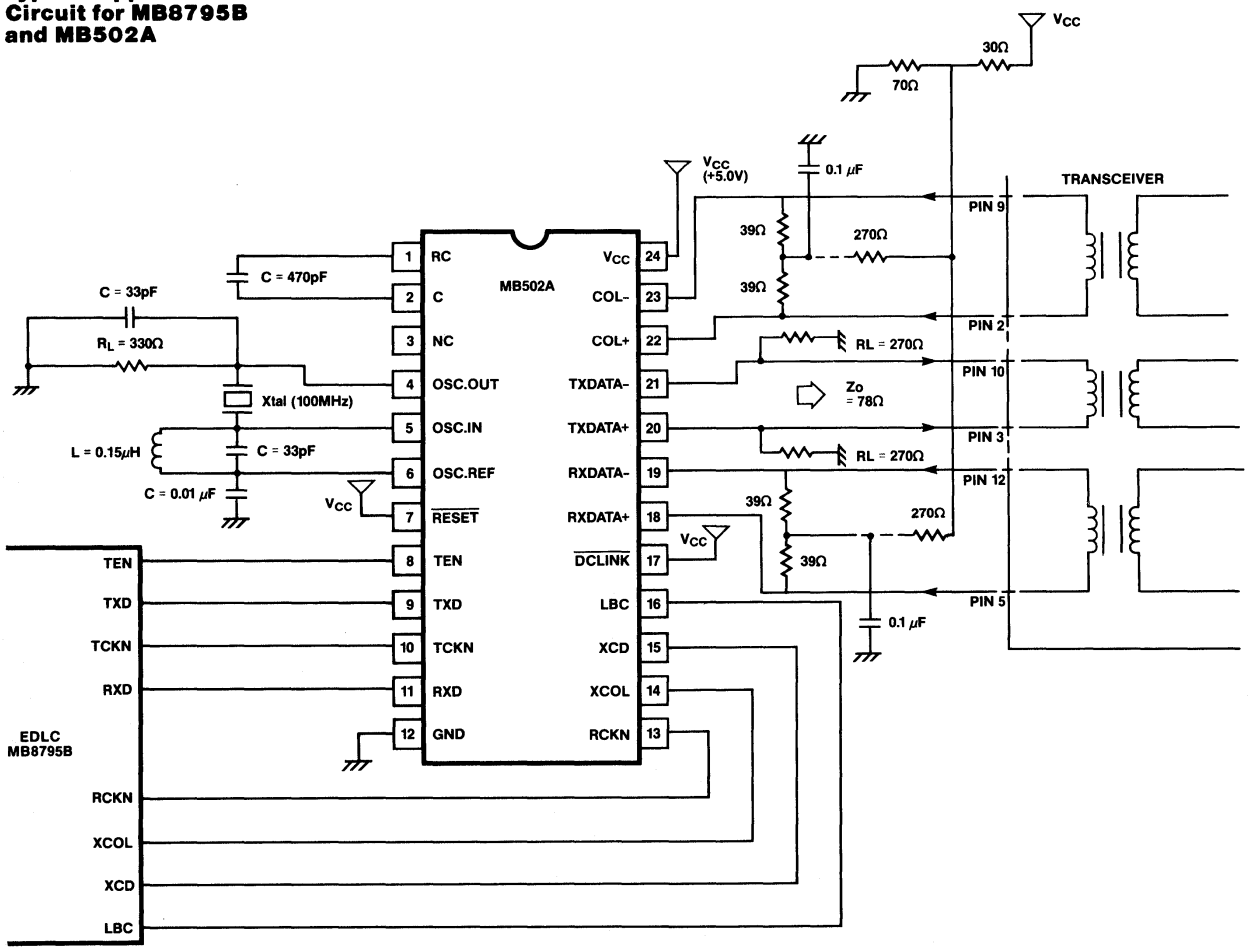
Timing Diagram
(Continued)

Receive—Address Mismatch, Overflow Error, CRC Error, Packet Length Error



Typical Application Circuit for MB8795B and MB502A



Package Dimensions
Dimensions in inches
(millimeters)

64-LEAD CERAMIC (METAL SEAL) PIN GRID ARRAY PACKAGE
(CASE No.: PGA-64C-A02)