19-0112; Rev. 0; 3/93

MAXIM

Low-Power AppleTalk Interface Transceiver

General Description

The MAX216 transceiver is designed specifically for communicating with AppleTalk™ interfaces. The MAX216 has one differential and one single-ended driver, plus one differential and two single-ended receivers, all of which meet the AppleTalk transceiver specifications.

The single-ended and differential drivers have a ±5V output voltage range when they are active, and have thermal shutdown protection against short circuits. The drivers remain in a high-impedance state when disabled or shut down.

One single-ended receiver is configured as an inverter, and the other is configured as a buffer. The input thresholds of the single-ended receivers are TTL-compatible, but the input voltages can vary between ±7V. The input thresholds of the differential receiver are ±200mV, and have a common-mode range of ±7V.

The MAX216 uses only 3mA max when fully operational. The drivers and receivers are disabled during shutdown mode, when the quiescent current is reduced to only 30µA.

Features

- ♦ **Differential Driver/Receiver Compatible with RS-422**
- ♦ **Single-Ended Driver/Receiver Compatible with EIA/TIA-562 and EIA/TIA-232E**
- ♦ **Low, 3mA Max Operational Supply Current**
- ♦ **Low, 30µA Shutdown-Mode Supply Current**

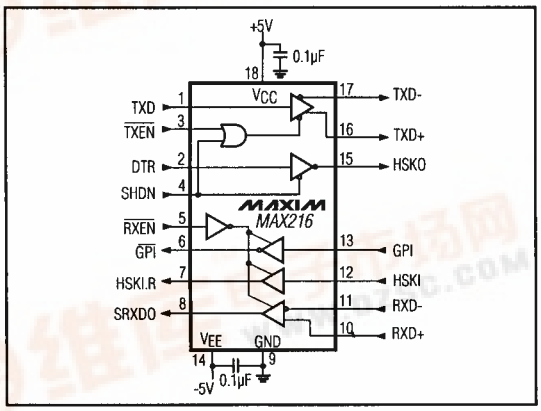
Ordering Information

PART	TEMP. RANGE	PIN-PACKAGE
MAX216CWN	0°C to +70°C	18 Wide SO

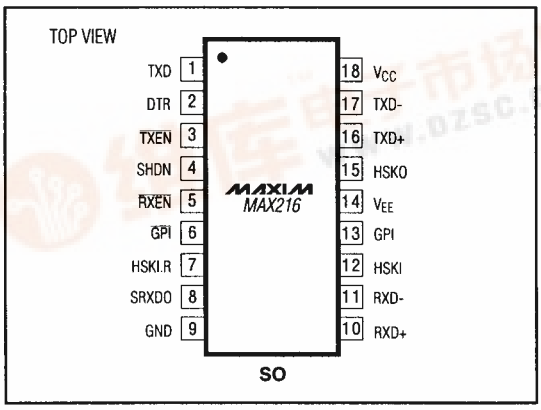
Applications

AppleTalk Interfaces
Apple Printer Interfaces
Apple Peripheral Interface
EIA/TIA-232/562 to RS-422 Conversion

Typical Operating Circuit



Pin Configuration



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Low-Power AppleTalk Interface Transceiver

ABSOLUTE MAXIMUM RATINGS

V_{CC} ..... +7V
V_{EE} ..... -7V
Input Voltages
  Driver Inputs ..... -0.5V to (V_{CC} + 0.5V)
  Receiver Inputs ..... ±15V
  Control Input Voltages ..... -0.5V to (V_{CC} + 0.5V)
Output Voltages
  Driver Outputs ..... ±15V
  Receiver Outputs ..... -0.5V to (V_{CC} + 0.5V)

Short-Circuit Duration
  Driver Outputs (to V_{CC} or V_{EE}) ..... Continuous
  Receiver Outputs (to V_{CC} or GND) ..... Continuous
Continuous Power Dissipation (T_A = +70°C)
  SO (derate 9.52mW/°C above +70°C) 762mW
Operating Temperature Range ..... 0°C to +70°C
Storage Temperature Range ..... -65°C to +160°C
Lead Temperature (soldering, 10sec) ..... +300°C

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS – DC PARAMETERS

(V_{CC} = 5V ±5%, V_{EE} = -5V ±5%, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. See Figures 1 and 5.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
POWER SUPPLY						
Positive Supply Current	I_{CC}	No load, SHDN = 0V		1.2	3	mA
		No load, SHDN = V_{CC}		30	100	µA
Negative Supply Current	I_{EE}	No load			100	µA
DIFFERENTIAL DRIVER						
TTL/CMOS Input Levels	V_{IL}	TXD, $\overline{TXEN}$, SHDN			0.8	V
	V_{IH}		2.0			
Input Current		TXD, $\overline{TXEN}$, SHDN			±20	µA
Differential Driver Output Voltage	V_{OD1}	No load, I_O = 0A, V_{D1}	8.0			V
	V_{OD2}	R = 50Ω, V_{D2}	2.0			
Change in Magnitude of Differential Output Voltage	ΔV_{OD2}	R = 50Ω, V_{D2}			0.2	V
Common-Mode Output Voltage	V_{OC}	R = 50Ω, V_{D2}			3	V
Change in Magnitude of Common-Mode Output Voltage	$\Delta\lvert V_{OC}\rvert$	R = 50Ω, V_{D2}			0.2	V
Output Common-Mode Range	V_{CMR}	SHDN > 2.0V or power off			±10	V
Short-Circuit Current		-5V ≤ V_O ≤ 5V	35		450	mA
Off-State Output Current		SHDN > 2.0V or power off, -10V < V_O < 10V			±100	µA

ELECTRICAL CHARACTERISTICS – DC PARAMETERS (continued)

(V_{CC} = 5V ±5%, V_{EE} = -5V ±5%, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. See Figures 1 and 5.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
SINGLE-ENDED DRIVER							
Input High Voltage	V_{IH}	DTR		2.0			V
Input Low Voltage	V_{IL}	DTR				0.8	V
Input Current		DTR				±20	µA
Output Voltage	V_{O1}	No load	DTR = 0.8V	4.0			V
			DTR = 2.0V	-4.0			
	V_{O2}	R_L = 400Ω	DTR = 0.8V	3.4			
			DTR = 2.0V	-3.4			
Off-State Output Current		SHDN > 2.0V or power off, -10V < V_O < 10V				±100	µA
Output Short-Circuit Current		-5V ≤ V_O ≤ 5V		35		450	mA
DIFFERENTIAL RECEIVER							
Receiver Input Current		V_{IN} = 7V				1.5	mA
		V_{IN} = -7V				-1.5	
Receiver Input Resistance		-7V ≤ V_{IN} ≤ 7V		12			kΩ
Receiver Output High Voltage	V_{OH}	I_O = -4mA		3.5			V
Receiver Output Low Voltage	V_{OL}	I_O = 4mA				0.4	V
Receiver Short-Circuit Current		0V ≤ V_O ≤ 5V		7.0		85	mA
Disabled Receiver Output Current		0V ≤ V_O ≤ 5V				±100	µA
Differential Input Threshold Voltage		-7V ≤ V_{CM} ≤ 7V		-0.2		0.2	V
SINGLE-ENDED RECEIVER							
Receiver Input Current		V_{IN} = 7V				1.5	mA
		V_{IN} = -7V				-1.5	
Receiver Input Resistance		-7V ≤ V_{IN} ≤ 7V		12			kΩ
Receiver Output High Voltage	V_{OH}	I_O = -4mA		3.5			V
Receiver Output Low Voltage	V_{OL}	I_O = 4mA				0.4	V
Receiver Short-Circuit Current		0V ≤ V_O ≤ 5V		7		85	mA
Disabled Receiver Output Current		0V ≤ V_O ≤ 5V				±100	µA
Input Low Voltage	V_{IL}					0.8	V
Input High Voltage	V_{IH}			2.0			V

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ELECTRICAL CHARACTERISTICS – AC PARAMETERS

(V_{CC} = 5V ±5%, V_{EE} = -5V ±5%, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. See Figures 2 and 5.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DIFFERENTIAL DRIVER						
Driver Input to Output	t_{PLH}	R_L = 100Ω, C_{L1} = 100pF, C_{L2} =100pF			120	ns
	t_{PHL}				120	
Driver Output to Output	t_{SKEW}	R_L = 100Ω, C_{L1} = 100pF, C_{L2} =100pF			30	ns
Driver Rise Time	t_R	R_L = 100Ω, C_{L1} = 100pF, C_{L2} =100pF			60	ns
Driver Fall Time	t_F	R_L = 100Ω, C_{L1} = 100pF, C_{L2} =100pF			60	ns
Driver Enable to Output High	t_{ZH}	C_L = 100pF, Figure 4			150	ns
Driver Enable to Output Low	t_{ZL}	C_L = 100pF, Figure 3			150	ns
Driver Disable Time from Low	t_{LZ}	C_L = 15pF, Figure 3			150	ns
Driver Disable Time from High	t_{HZ}	C_L = 15pF, Figure 4			150	ns
SINGLE-ENDED DRIVER						
Driver Input to Output	t_{PLH}	R_L = 450Ω, C_L = 100pF			120	ns
	t_{PHL}				120	
Driver Rise Time	t_R	R_L = 450Ω, C_L = 100pF			60	ns
Driver Fall Time	t_F	R_L = 450Ω, C_L = 100pF			60	ns
DIFFERENTIAL RECEIVER						
Receiver Input to Output	t_{PLH}	C_L = 15pF			160	ns
	t_{PHL}				160	
Receiver Disable Time from Low	t_{LZ}	C_L = 15pF, Figure 6			100	ns
Receiver Disable Time from High	t_{HZ}	C_L = 15pF, Figure 7			100	ns
Receiver Enable to Output High	t_{ZH}	C_L = 100pF, Figure 7			100	ns
Receiver Enable to Output Low	t_{ZL}	C_L = 100pF, Figure 6			100	ns
SINGLE-ENDED RECEIVER						
Receiver Input to Output	t_{PLH}	C_L = 15pF			160	ns
	t_{PHL}				160	
Receiver Disable Time from Low	t_{LZ}	C_L = 15pF, Figure 6			100	ns
Receiver Disable Time from High	t_{HZ}	C_L = 15pF, Figure 7			100	ns
Receiver Enable to Output High	t_{ZH}	C_L = 100pF, Figure 7			100	ns
Receiver Enable to Output Low	t_{ZL}	C_L = 100pF, Figure 6			100	ns

Pin Description

PIN	NAME	FUNCTION
1	TXD	TTL-compatible differential driver input
2	DTR	TTL-compatible single-ended inverting driver input
3	$\overline{TXEN}$	TTL-compatible differential driver output enable. A high input forces the differential driver output into a high -impedance state. A low input enables the differential driver output. This input does not affect the single-ended driver.
4	SHDN	TTL-compatible shutdown input. A high input forces the chip into shutdown, with both driver outputs forced into three-state and the supply current reduced to 20µA typ. The receivers are not functional, but their outputs remain enabled unless $\overline{RXEN}$ is pulled high. A low input forces the chip into normal operation.
5	$\overline{RXEN}$	TTL-compatible receiver enable input. A low input enables the outputs of the receivers and a high input forces the receiver outputs into a high-impedance state. To prevent unwanted noise at the output of the receivers in shutdown mode, $\overline{RXEN}$ should be pulled high along with SHDN.
6	$\overline{GPI}$	Inverting single-ended receiver output
7	HSKI.R	Noninverting single-ended receiver output
8	SRXDO	Differential receiver output
9	GND	Ground
10	RXD+	Noninverting input to the differential receiver. If RXD+ is greater than RXD- by more than 200mV, then the differential receiver output, SRXDO, will be high. If RXD+ is less than RXD- by more than 200mV, SRXDO will be low – meets RS-422 thresholds.
11	RXD-	Inverting input to the differential receiver – meets RS-422 thresholds.
12	HSKI	Noninverting receiver input – meets EIA/TIA-562 and EIA/TIA-232E thresholds.
13	GPI	Inverting receiver input – meets EIA/TIA-562 and EIA/TIA-232E thresholds.
14	V_{EE}	Negative supply
15	HSKO	Single-ended inverting driver output – meets EIA/TIA-562 and EIA/TIA-232E voltage levels.
16	TXD+	Noninverting differential driver output – meets RS-422 voltage levels.
17	TXD-	Inverting differential driver output – meets RS-422 voltage levels.
18	V_{CC}	Positive supply

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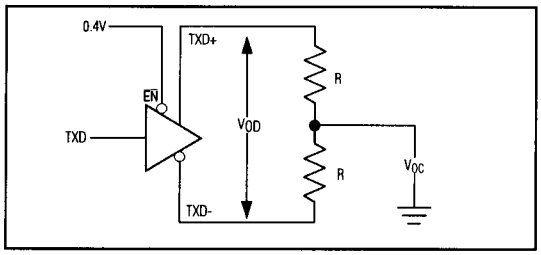

Figure 1. Differential and Common-Mode Output Voltages

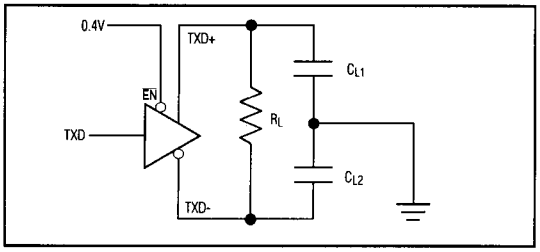

Figure 2. Differential Driver Timing Test Circuit

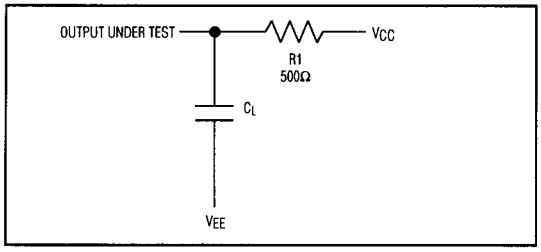

Figure 3. Driver Enable/Disable Test Circuit 1

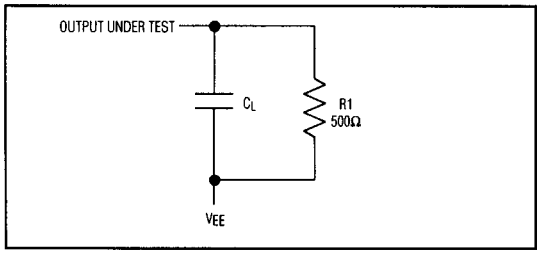

Figure 4. Driver Enable/Disable Test Circuit 2

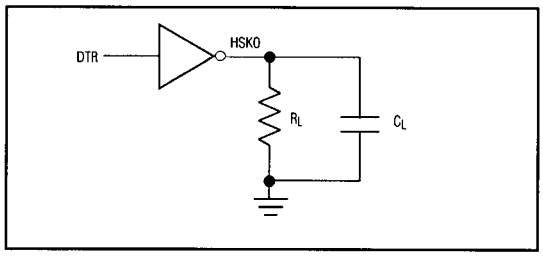

Figure 5. Single-Ended Driver Timing Test Circuit

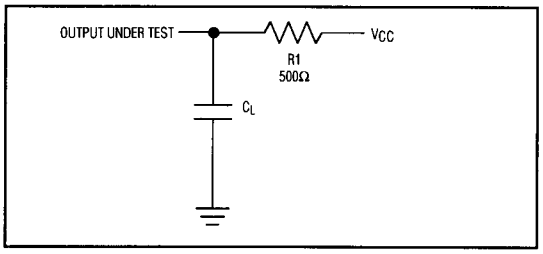

Figure 6. Receiver Enable/Disable Test Circuit 1

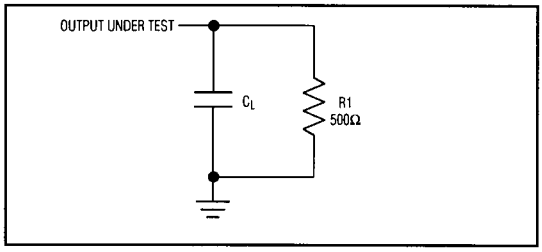

Figure 7. Receiver Enable/Disable Test Circuit 2

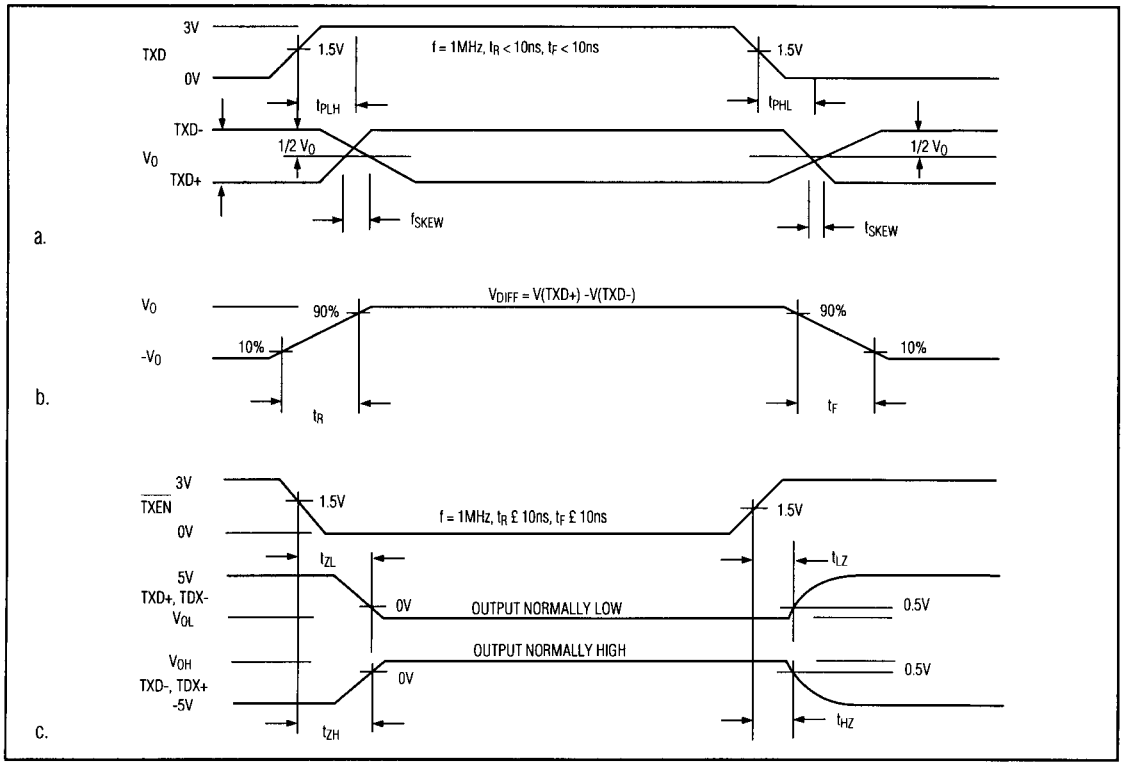

Figure 8. Differential Driver Switching Times: a) Propagation Delay and Skew; b) Rise and Fall Times; c) Enable/Disable Timing.

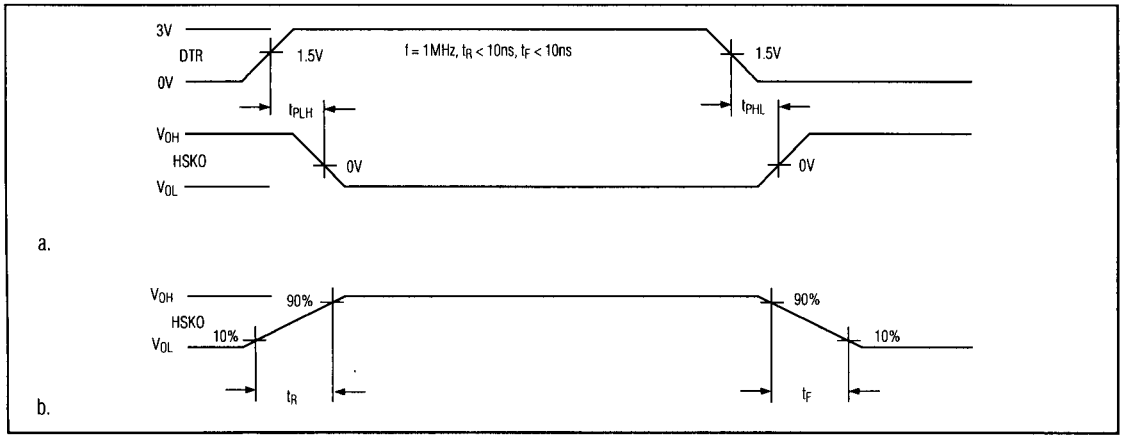

Figure 9. Single-Ended Driver Switching Times: a) Propagation Delay; b) Rise and Fall Times.

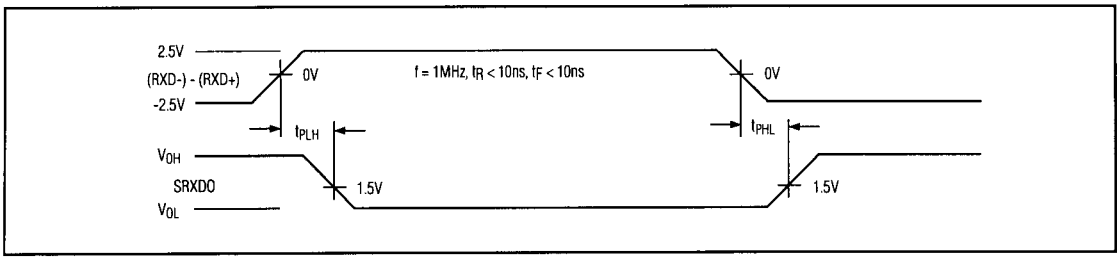

Figure 10. Differential Receiver Switching Times

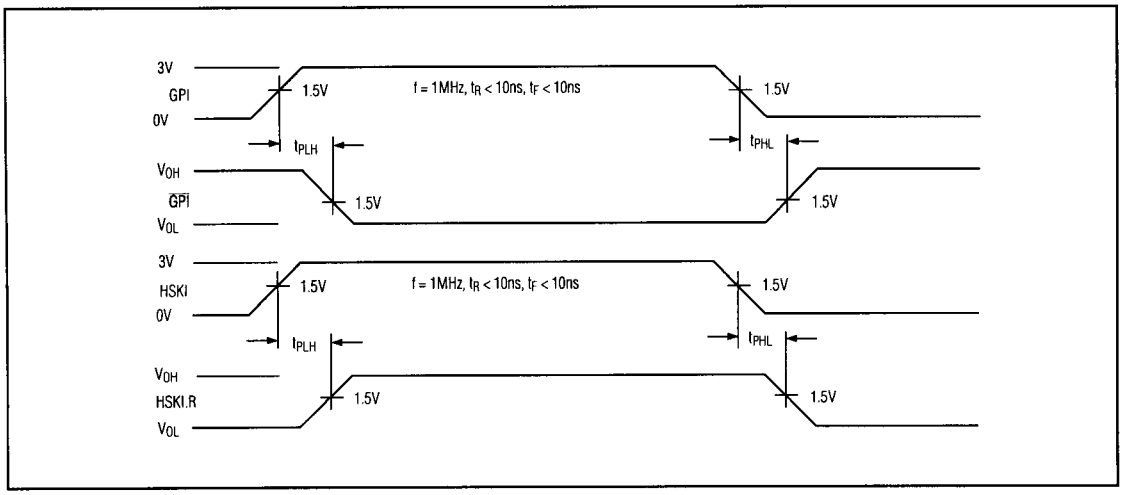

Figure 11. Single-Ended Receiver Switching Times

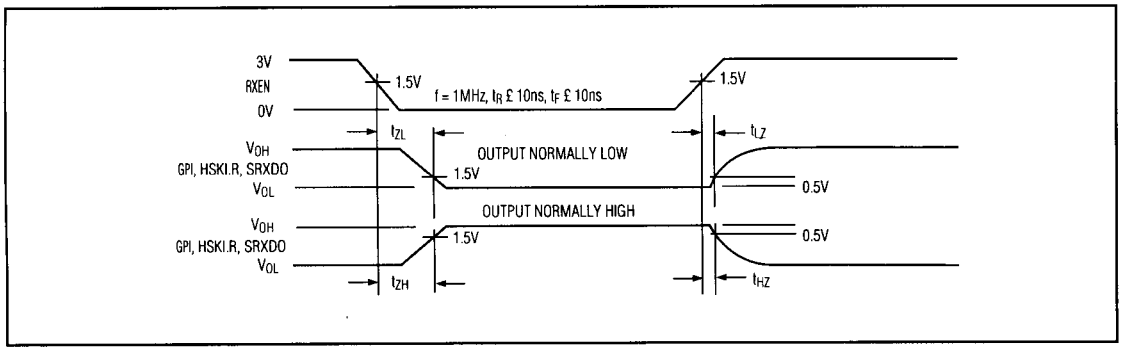

Figure 12. Receiver Enable/Disable Switching Times