钍地半导体
Tudi Semiconductor

Product Specification

TUDI-MAX3291/MAX3292

RS-485/RS-422 Transceivers with Preemphasis for High-Speed, Long-Distance Communication

网址 www.sztdbdt.com

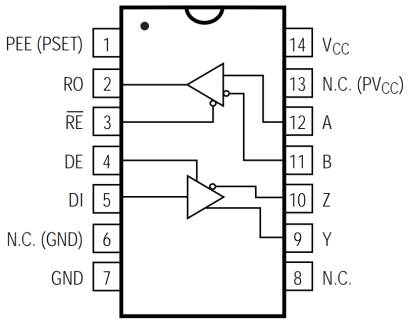
用芯智造·卓越品质

semiconductor device manufacturer

- Design
- research and development
- production
- and sales

Features

TOP VIEW



MAX3291
MAX3292

SO/DIP

●Preemphasis Increases the Distance and Data Rate of Reliable RS-485/RS-422 Communication
● Data Rate
Optimized for 5Mbps to 10Mbps (MAX3291)
Programmable up to 10Mbps (MAX3292)
● 100nA Low-Current Shutdown Mode
● Allow Up to 128 Transceivers on the Bus
● -7V to +12V Common-Mode Input Voltage Range
● Pin-Compatible with ’75180, MAX489, MAX491 MAX3080, MAX3083, MAX3086, MAX1482

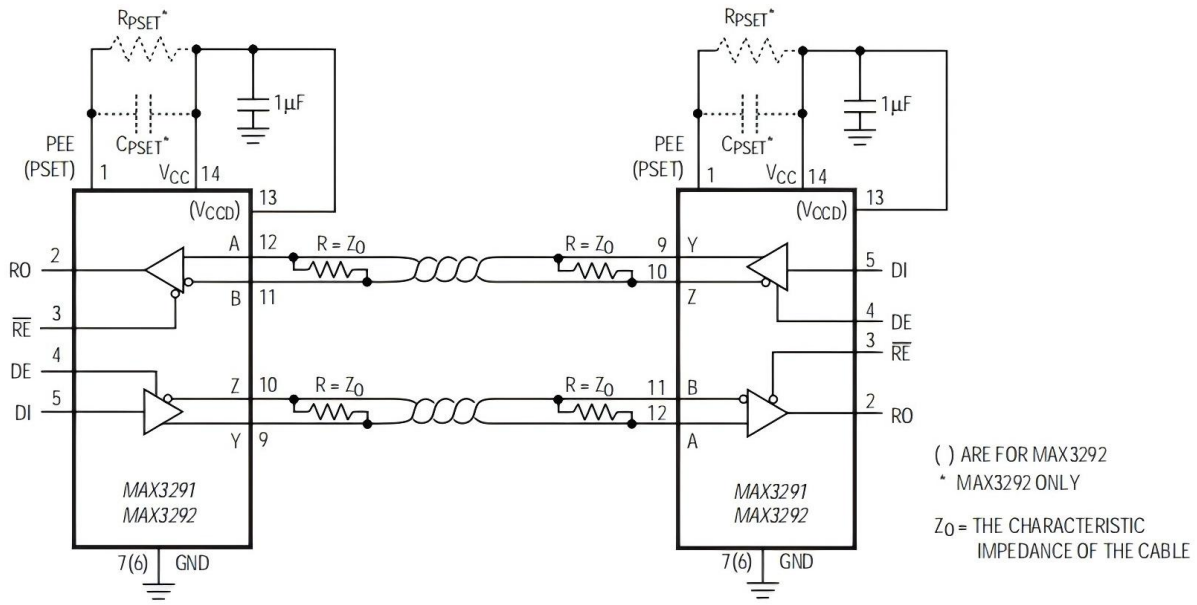
Applications

Long-Distance, High-Speed RS-485/RS-422 Communications
Telecommunications
Industrial-Control Local Area Networks

General Description

The MAX3291/MAX3292 high-speed RS-485/RS-422 transceivers feature driver preemphasis circuitry, which extends the distance and increases the data rate of reli-able communication by reducing intersymbol interfer-ence (ISI) caused by long cables. The MAX3291 is programmable for data rates of 5Mbps to 10Mbps, while the MAX3292 is programmable for data rates up to 10Mbps by using a single external resistor.
The MAX3291/MAX3292 are full-duplex devices that operate from a single +5V supply and offer a low-cur-rent shutdown mode that reduces supply current to 100nA. They feature driver output short-circuit current limiting and a fail-safe receiver input that guarantees a logic-high output if the input is open circuit. A 1/4-unit-load receiver input impedance allows up to 128 trans-ceivers on the bus

Typical Operating Circuit and Functional Diagram



Pin Configuration appears at end of data sheet.

ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_{CC}, V_{CCD}) .....+6V
Control Input Voltage ($\overline{RE}$, DE, PEE, PSET, DI) .....-0.3V to (V_{CC} + 0.3V)
Driver Output Voltage (Y, Z).....-7.5V to +12.5V
Receiver Input Voltage (A, B).....-7.5V to +12.5V
Receiver Output Voltage (RO).....-0.3V to (V_{CC} + 0.3V)
Continuous Power Dissipation (T_A = +70°C)
14-Pin SO (derate 8.7mW/°C above +70°C).....695mW
14-Pin Plastic DIP (derate 10.0mW/°C above +70°C) ..800mW

Operating Temperature Ranges
MAX329_C_ D.....0°C to +70°C
MAX329_E_ D.....-40°C to +85°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.

DC ELECTRICAL CHARACTERISTICS

(Typical Operating Circuit, V_{CC} = +5V ±5%, R_{PSET} = 0 (MAX3292), V_{CC} = V_{CCD} (MAX3292), T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at V_{CC} = +5V and T_A = +25°C.) (Note 1)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
DRIVER							
Differential Driver Output	V_{OD}	Figure 1	R = 27Ω	1.5		5.0	V
			No load (Note 2)			5.25	
Differential Driver Output with Preemphasis	V_{ODP}	R = 27Ω		2.4			V
Differential Driver Preemphasis Ratio	DPER	Figure 1, R = 27Ω (Note 3)		1.65	2.0	2.35	V
Change in Magnitude of Differential Output Voltage (Normal and Preemphasis)	ΔV_{OD}, ΔV_{ODP}	Figure 1, R = 27Ω (Note 4)				0.2	V
Driver Common-Mode Output Voltage (Normal and Preemphasis)	V_{OC}	Figure 1, R = 27Ω			V_{CC} / 2	3	V
Change in Magnitude of Common-Mode Voltage (Normal and Preemphasis)	ΔV_{OC}	Figure 1, R = 27Ω (Note 5)				0.3	V
Change in Magnitude of Common-Mode Output Voltage (Normal to Preemphasis)	ΔV_{NP}	Figure 1, R = 27Ω			50		mV
Input High Voltage	V_{IH}	DE, DI, $\overline{RE}$		2.4			V
		PEE		3.75			
Input Low Voltage	V_{IL}	DE, DI, $\overline{RE}$, PEE				0.8	V
Input Current	I_{IN}	DE, DI, $\overline{RE}$				±2	µA
PEE Input Current (MAX3291)	I_{PEE}			-15	-30	-45	µA
PSET Input Current (MAX3292)	I_{PSET}	V_{PSET} = V_{CC}			70	110	µA
Output Leakage (Y and Z)	I_O	DE = GND, V_{CC} = GND or 5.25V	V_Y = V_Z = +12V			25	µA
			V_Y = V_Z = -7V			-25	
Driver Short-Circuit Output Current	I_{OSD}	-7V ≤ V_{OUT} ≤ +12V (Note 6)		±30		±250	mA

DC ELECTRICAL CHARACTERISTICS (continued)

(Typical Operating Circuit, V_{CC} = +5V ±5%, R_{PSET} = 0 (MAX3292), V_{CC} = V_{CCD} (MAX3292), T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at V_{CC} = +5V and T_A = +25°C.) (Note 1)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
RECEIVER							
Input Current (A and B)	$I_{A, B}$	DE = GND, V_{CC} = GND or 5.25V	V_{IN} = +12V			250	µA
			V_{IN} = -7V			-150	
Receiver Differential Threshold Voltage	V_{TH}	-7V ≤ V_{CM} ≤ +12V		-200		200	mV
Receiver Input Hysteresis	ΔV_{TH}	V_A = V_B = 0			35		mV
Receiver Output High Voltage	V_{OH}	I_O = -4mA, V_A - V_B = V_{TH}		3.5			V
Receiver Output Low Voltage	V_{OL}	I_O = 4mA, V_A - V_B = -V_{TH}				0.4	V
Three-State Output Current at Receiver	I_{OZR}	0 ≤ V_O ≤ V_{CC}			0.1	±1	µA
Receiver Input Resistance	R_{IN}	-7V ≤ V_{CM} ≤ +12V		48			kΩ
Receiver Output Short-Circuit Current	I_{OSR}	0 ≤ V_{RO} ≤ V_{CC}		±15		±95	mA
SUPPLY CURRENT							
No-Load Supply Current	I_{CC} + I_{CCD}	$\overline{RE}$ = GND, DE = V_{CC}			2.0	3.0	mA
Supply Current in Shutdown Mode	I_{SHDN}	$\overline{RE}$ = V_{CC}, DE = GND, V_Y = V_Z = 0 to V_{CC} or floating			0.1	1	µA

SWITCHING CHARACTERISTICS

(Typical Operating Circuit, V_{CC} = +5V ±5%, R_{PSET} = 0 (MAX3292), V_{CC} = V_{CCD} (MAX3292), T_A = +25°C, unless otherwise noted. Typical values are at V_{CC} = +5V and T_A = +25°C.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Driver Propagation Delay	t_{DPLH}	Figures 3 and 5, R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 50pF			41	65	ns
	t_{DPHL}				44	65	
Driver Differential Output Rise or Fall Time	t_{HL}	Figures 3 and 5, R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 50pF			12		ns
	t_{LH}						
Driver Preemphasis Interval	t_{PRE}	Figures 3 and 10, R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 50pF	MAX3291/MAX3292, R_{PSET} = 0	80	100	120	ns
			MAX3292, R_{PSET} = 523kΩ	0.75	1	1.25	µs
Preemphasis Voltage Level to Normal Voltage Level Delay	t_{PTND}	Figures 3 and 10, R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 50pF			30		ns
Differential Driver Output Skew | t_{DPLH} - t_{DPHL} |	t_{DSKEW}	Figures 3 and 5, R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 50pF			3	8	ns
Maximum Data Rate	f_{MAX}			10			Mbps

SWITCHING CHARACTERISTICS (continued)

(Typical Operating Circuit, V_{CC} = +5V ±5%, R_{PSET} = 0 (MAX3292), V_{CC} = V_{CCD} (MAX3292), T_A = +25°C, unless otherwise noted. Typical values are at V_{CC} = +5V and T_A = +25°C.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Driver Enable to Output High	t_{DZH}	Figures 2 and 6, S2 closed, R_L = 500Ω, C_L = 100pF		72	105	ns
Driver Enable to Output Low	t_{DZL}	Figures 2 and 6, S1 closed, R_L = 500Ω, C_L = 100pF		55	105	ns
Driver Disable Time from Low	t_{DLZ}	Figures 2 and 6, S1 closed, R_L = 500Ω, C_L = 15pF		53	100	ns
Driver Disable Time from High	t_{DHZ}	Figures 2 and 6, S2 closed, R_L = 500Ω, C_L = 15pF		71	100	ns
Receiver Propagation Delay	t_{RPLH}	Figures 7 and 9, C_L = 50pF, V_{ID} = 2V, V_{CM} = 0		49	85	ns
	t_{RPHL}			52	85	
Receiver Output Skew $\lvert t_{RPLH} - t_{RPHL} \rvert$	t_{RSKEW}	Figures 7 and 9, C_L = 100pF		3		ns
Receiver Enable to Output Low	t_{RZL}	Figures 2 and 8, R_L = 1kΩ, C_L = 100pF, S1 closed	3	43	55	ns
Receiver Enable to Output High	t_{RZH}	Figures 2 and 8, R_L = 1kΩ, C_L = 100pF, S2 closed	3	43	55	ns
Receiver Disable Time from Low	t_{RLZ}	Figures 2 and 8, R_L = 1kΩ, C_L = 15pF, S1 closed		25	45	ns
Receiver Disable Time from High	t_{RHZ}	Figures 2 and 8, R_L = 1kΩ, C_L = 15pF, S2 closed		25	45	ns
Time to Shutdown	t_{SHDN}	Figures 4 and 11 (Note 7)	50	160	500	ns
Driver Enable from Shutdown to Output High	$t_{DZH(SHDN)}$	Figures 2 and 6, R_L = 500Ω, C_L = 100pF, S2 closed		6000	8750	ns
Driver Enable from Shutdown to Output Low	$t_{DZL(SHDN)}$	Figures 2 and 6, R_L = 500Ω, C_L = 100pF, S1 closed		6000	8750	ns
Receiver Enable from Shutdown to Output High	$t_{RZH(SHDN)}$	Figures 2 and 8, R_L = 1kΩ, C_L = 100pF, S2 closed		850	1500	ns
Receiver Enable from Shutdown to Output Low	$t_{RZL(SHDN)}$	Figures 2 and 8, R_L = 1kΩ, C_L = 100pF, S1 closed		30	1500	ns

Note 1: All currents into the device are positive; all currents out of the device are negative. All voltages are referenced to device ground unless otherwise noted.

Note 2: Guaranteed by design.

Note 3: DPER is defined as (V_{ODP} / V_{OD}).

Note 4: ΔV_{ODP} and ΔV_{OC} are the changes in V_{DD} and V_{OC}, respectively, when the DI input changes. This specification reflects constant operating conditions. When operating conditions shift, the maximum value may be momentarily exceeded.

Note 5: ΔV_{ODP} and ΔV_{OC} are the changes in V_{OD} and V_{OC}, respectively, when the DI input changes state.

Note 6: Maximum current level applies to peak current just prior to foldback-current limiting; minimum current level applies during current limiting.

Note 7: Shutdown is enabled by bringing $\overline{RE}$ high and DE low. If the enable inputs are in this state for less than 50ns, the device is guaranteed not to enter shutdown. If the enable inputs are in this state for at least 500ns, the device is guaranteed to have entered shutdown. Time to shutdown for the device (t_{SHDN}) is measured by monitoring R0 as in Figure 4.

Pin Description

PIN		NAME	FUNCTION
MAX3291	MAX3292		
1	—	PEE	Preemphasis Enable Input. To enable preemphasis, leave PEE unconnected, connect to V_{CC}, or drive high. To enable strong-level-drive only mode, connect PEE to GND or drive low.
—	1	PSET	Preemphasis Set Input. Sets the preemphasis interval. Connect a resistor (R_{PSET}) in parallel with a capacitor (C_{PSET}) from PSET to V_{CC} to set the preemphasis interval. See *Typical Operating Circuit*.
2	2	RO	Receiver Output. When $\overline{RE}$ is low and if A - B ≥ 200mV, RO is high; if A - B ≤ -200mV, RO is low.
3	3	$\overline{RE}$	Receiver Output Enable. Drive $\overline{RE}$ low to enable RO; RO is high impedance when $\overline{RE}$ is high. Drive $\overline{RE}$ high and DE low to enter low-power shutdown mode.
4	4	DE	Driver Output Enable. Drive DE high to enable the driver outputs. These outputs are high impedance when DE is low. Drive $\overline{RE}$ high and DE low to enter low-power shutdown mode.
5	5	DI	Driver Input. With DE high, a low on DI forces the noninverting output low and the inverting output high. Similarly, a high on DI forces the noninverting output high and the inverting output low.
6, 8, 13	8	N.C.	No Connection. Not internally connected.
7	6, 7	GND	Ground
9	9	Y	Noninverting Driver Output
10	10	Z	Inverting Driver Output
11	11	B	Inverting Receiver Input
12	12	A	Noninverting Receiver Input
—	13	V_{CCD}	Connect to V_{CC}
14	14	V_{CC}	Positive Supply: +4.75V ≤ V_{CC} ≤ +5.25V

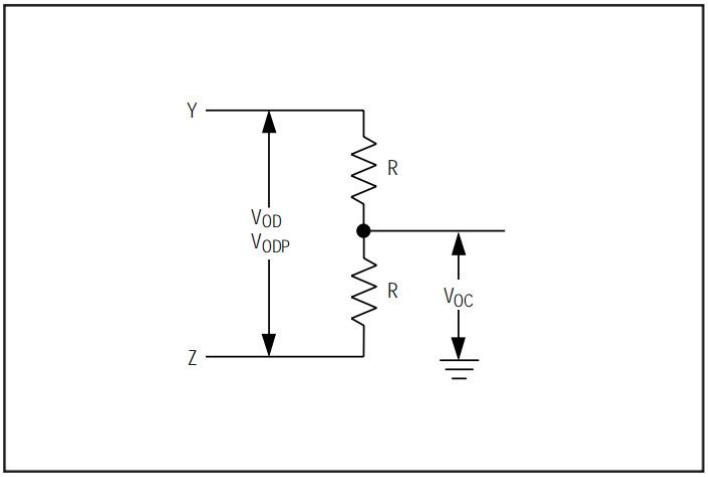


Figure 1. Driver DC Test Load

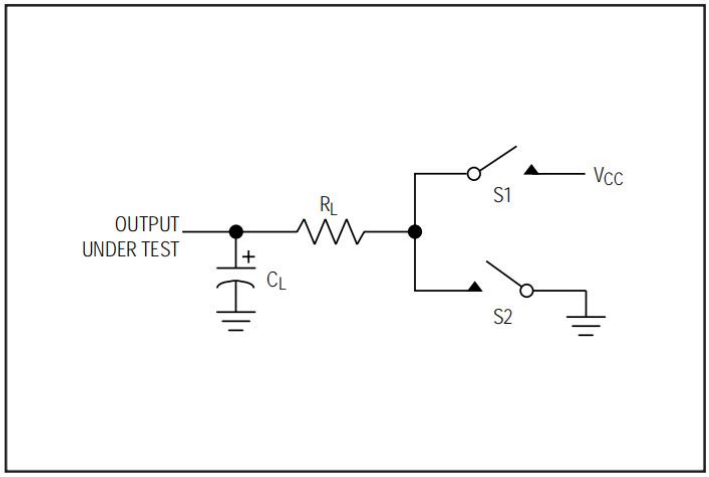


Figure 2. Driver or Receiver Enable/Disable Timing Test Load

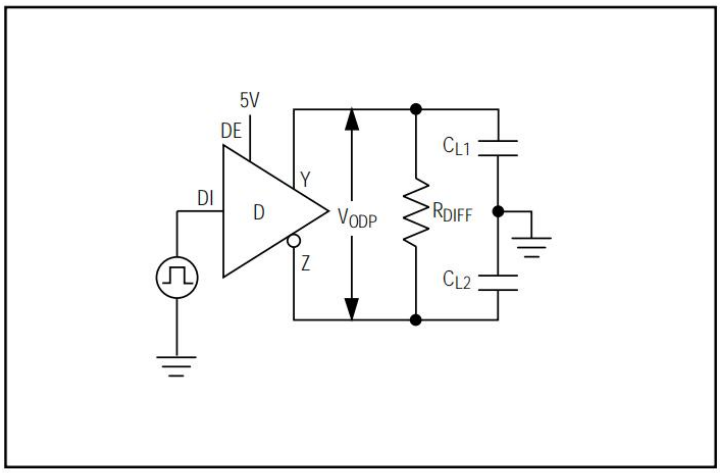


Figure 3. Driver Timing Test Circuit

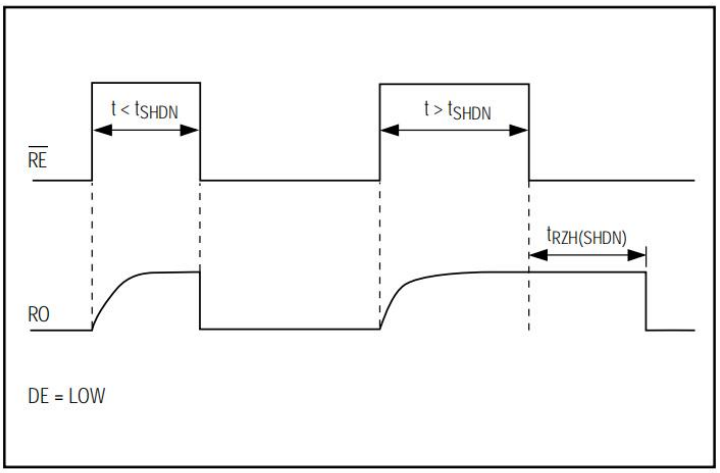


Figure 4. Shutdown Timing Diagram

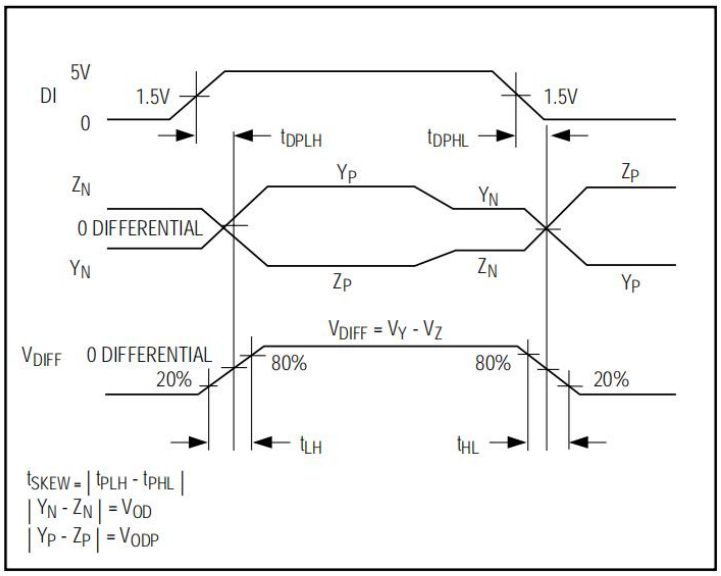


Figure 5. Driver Propagation Delays

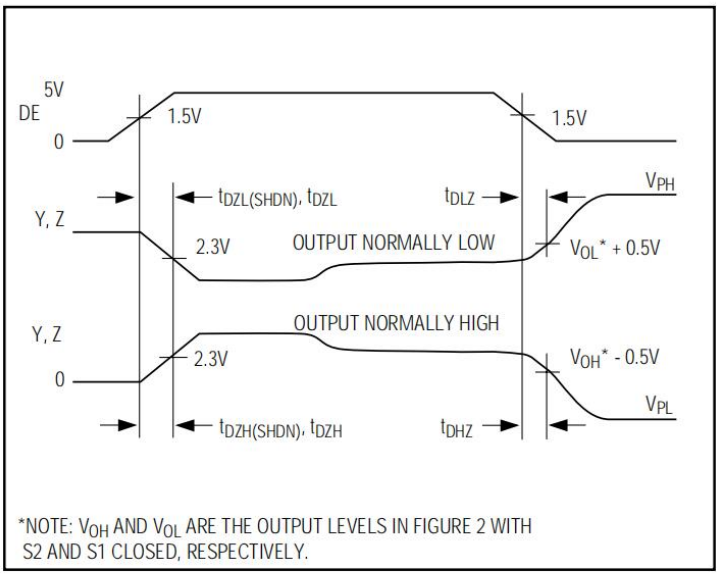


Figure 6. Driver Enable and Disable Times

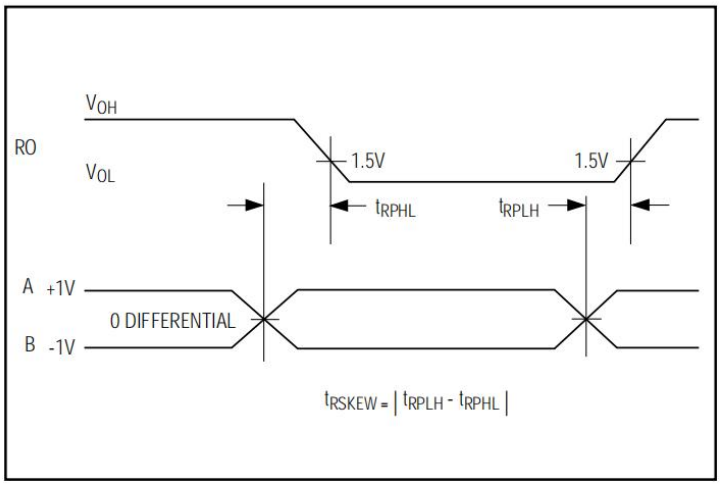


Figure 7. Receiver Propagation Delays

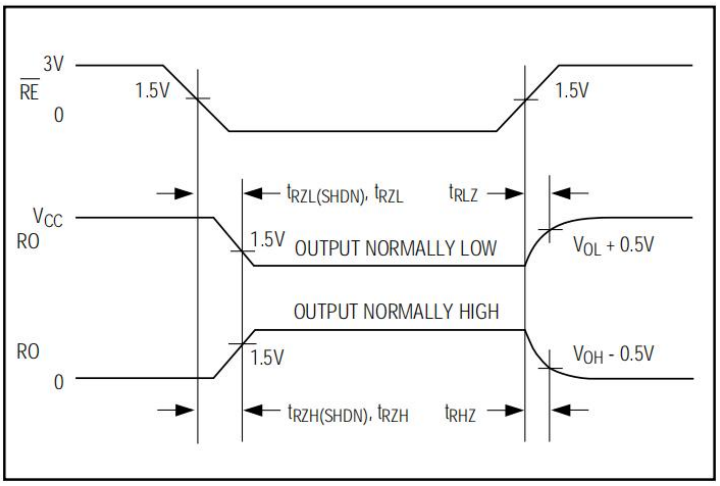


Figure 8. Receiver Enable and Disable Times

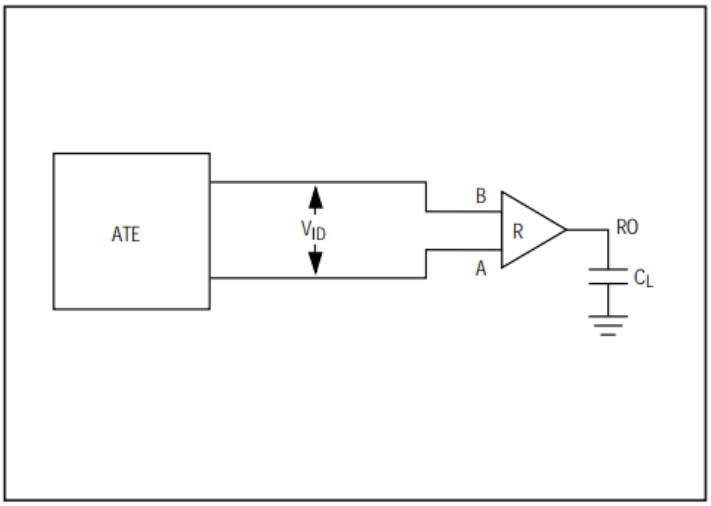


Figure 9. Receiver Propagation Delay Test Circuit

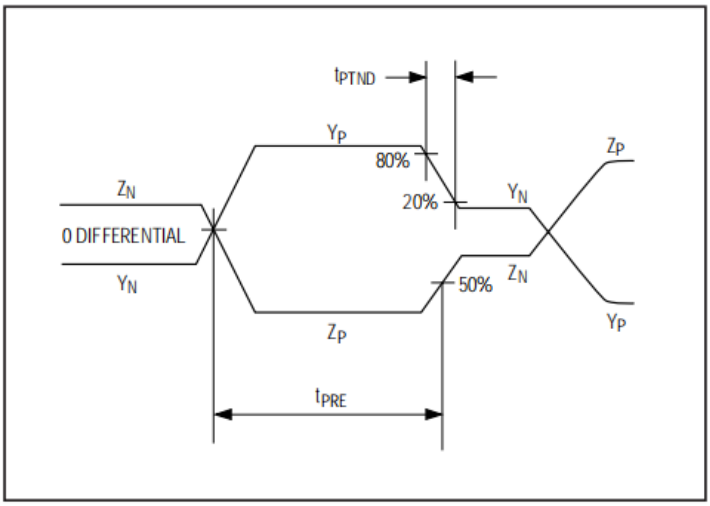


Figure 10. Preemphasis Timing

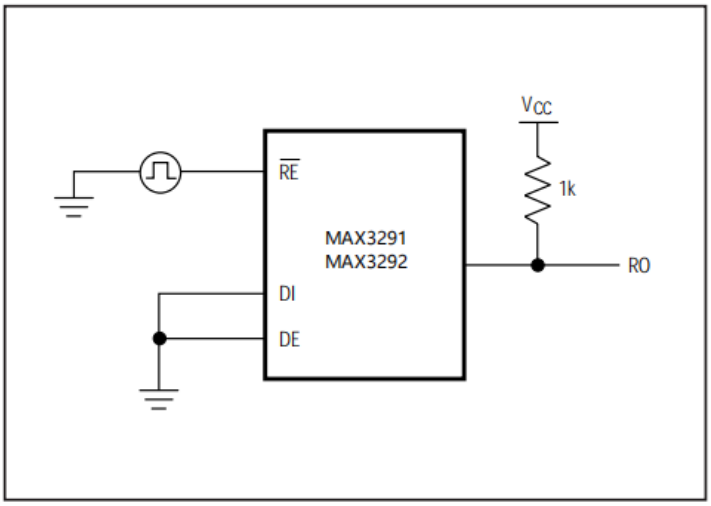


Figure 11. Time-to-Shutdown Test Circuit

Function Tables

TRANSMITTING				
INPUTS			OUTPUTS	
$\overline{RE}$	DE	DI	Z	Y
X	1	1	0	1
X	1	0	1	0
0	0	X	High-Z	High-Z
1	0	X	High-Z and SHUTDOWN	

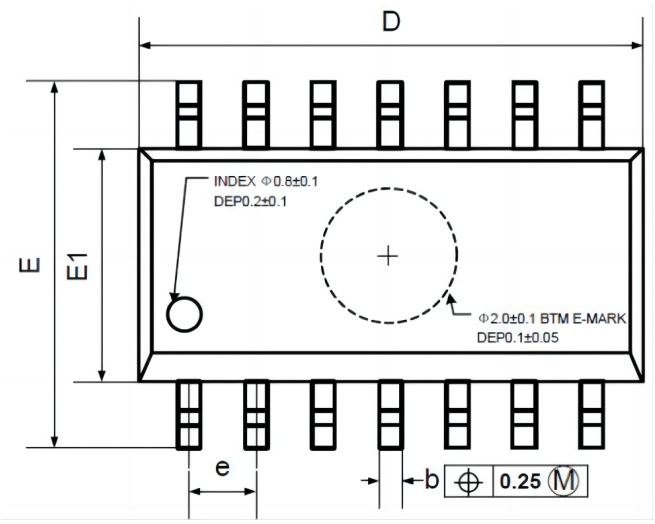
RECEIVING			
INPUTS			OUTPUT
$\overline{RE}$	DE	A-B	RO
0	X	≥ 0.2V	1
0	X	≤ -0.2V	0
0	X	Open	1
1	1	X	High-Z
1	0	X	High-Z and SHUTDOWN

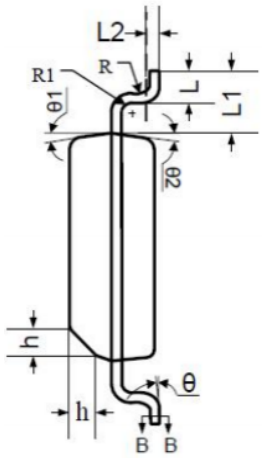
X = Don't care
Z = High impedance
SHUTDOWN = Low-power shutdown; driver and receiver outputs are high impedance.

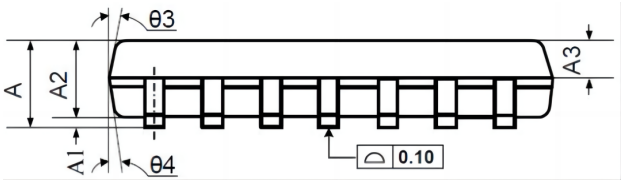
ORDERING INFORMATION

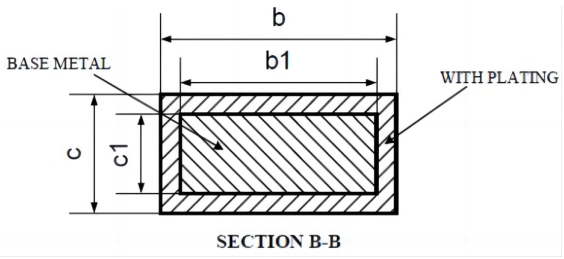
Order Number	Package	Package Quantity	Marking On The park
MAX3291CSD-TUDI	SOP14	Tape,Reel,2500	MAX3291CSD
MAX3291EPD-TUDI	DIP14	Tube,25,A box of 1000	MAX3291EPD
MAX3291ESD-TUDI	SOP14	Tape,Reel,2500	MAX3291ESD
MAX3292CSD-TUDI	SOP14	Tape,Reel,2500	MAX3292CSD
MAX3292EPD-TUDI	DIP14	Tube,25,A box of 1000	MAX3292EPD
MAX3292ESD-TUDI	SOP14	Tape,Reel,2500	MAX3292ESD

Package SOP14



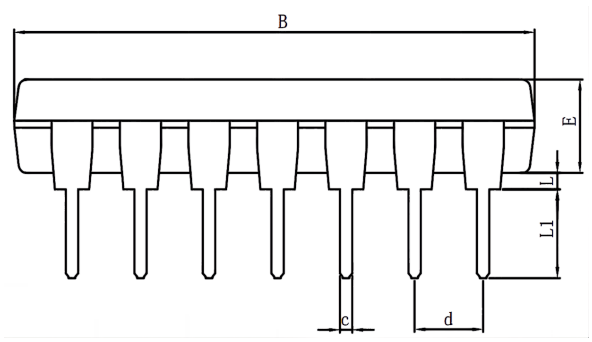


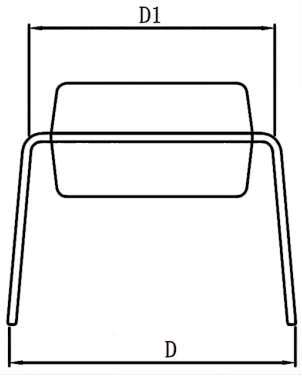


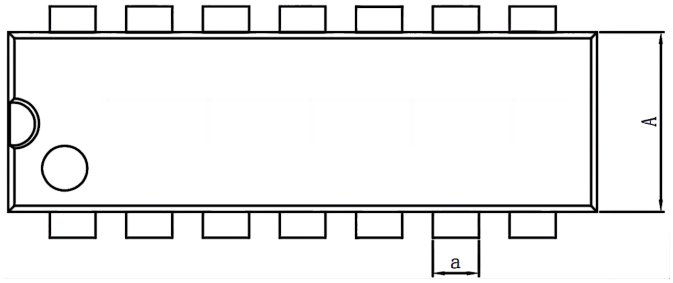


Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	1.35	1.60	1.75
A1	0.10	0.15	0.25
A2	1.25	1.45	1.65
A3	0.55	0.65	0.75
b	0.36		0.49
b1	0.35	0.40	0.45
C	0.16		0.25
c1	0.15	0.20	0.25
D	8.53	8.63	8.73
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27 BSC		
L	0.45	0.60	0.80
L1	1.04 REF		
L2	0.25 BSC		
R	0.07		
R1	0.07		
h	0.30	0.40	0.50
θ	0°		8°
θ1	6°	8°	10°
θ2	6°	8°	10°
θ3	5°	7°	9°
θ4	5°	7°	9°

Package DIP14







DIM.	MIN	TYP	MAX	DIM.	MIN	TYP	MAX
A	6.100	6.300	6.680	a	1.504	1.524	1.544
B	18.940	19.200	19.560	C	0.437	0.457	0.477
D	8.200	8.700	9.200	d	2.530	2.540	2.550
D1	7.42	7.62	7.82	L	0.500	—	0.800
E	3.100	3.300	3.550	L1	3.000	3.200	3.600

Important statement:

●TUDI Semiconductor reserves the right to modify the product manual without prior notice! Before placing an order, customers need to confirm whether the obtained information is the latest version and verify the completeness of the relevant information.

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