

Full-Duplex RS-485 Transceivers

■ Description

The TK490 is a low power differential line driver/receiver meeting RS-485 and RS-422 standards up to 2.5Mbps. The TK491 is identical to the TK490 with the addition of driver and receiver tri-state enable lines. Both products feature $\pm 200\text{mV}$ receiver input sensitivity, over wide common mode range. The TK490 is available in SOIC-8 packages for operation over the commercial temperature range. The TK491 is available in 14-pin NSOIC packages for operation over the commercial and industrial temperature ranges.

Drivers are short-circuit current limited and are protected against excessive power dissipation by thermal shutdown circuitry that places the driver outputs into a high-impedance state. The receiver input has a fail-safe feature that guarantees a logic-high output if the input is open circuit.

■ Features

5V only

Low power BiCMOS

Driver/receiver enable (TK491)

RS-485 and RS-422 drivers/receivers

Enhanced ESD Specifications ("D" and "F" only):

$\pm 15\text{kV}$ IEC61000-4-2 Air Discharge

$\pm 8\text{kV}$ IEC61000-4-2 Contact Discharge

■ Applications

Low-Power RS-485 Transceivers

Low-Power RS-422 Transceivers

Level Translators

Transceivers for EMI-Sensitive Applications

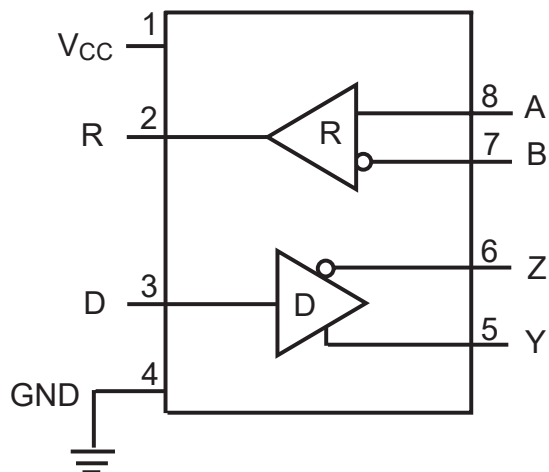
Industrial-Control Local Area Networks

■ Ordering Information

Part Number	Package	Packaging	Temperature(TA)	Package Qty	Remark
TK490ESR	SOIC8	Reel	-40°C ~ 85°C	2500	
TK490ETR	TSSOP8	Reel	-40°C ~ 85°C	2500	
TK490FSR	SOIC8	Reel	-40°C ~ 85°C	2500	$\pm 15\text{KV}$
TK490FTR	TSSOP8	Reel	-40°C ~ 85°C	2500	$\pm 15\text{KV}$

Note: Please contact us to customize DIP or other packaging device.

■ **Pin Functions**



TK490
Pinout (Top View)

Pin Description

Pin Number	Pin Name	Description
1	V _{CC}	Positive supply
2	R	Receiver output
3	D	Driver Input
4	GND	Ground connection
5	Y	Non-inverting driver output
6	Z	Inverting driver output
7	B	Inverting receiver Input
8	A	Non-inverting receiver input

■ Absolute Maximum Ratings (TK490)

These are stress ratings only and functional operation of the device at these ratings or any other above those indicated in the operation sections of the specifications below is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

V_{CC}7.0V

Input Voltages

Drivers.....-0.5V to ($V_{CC}+0.5V$)

Receivers..... $\pm 14V$

Output Voltages

Drivers..... $\pm 14V$

Receivers.....-0.5V to ($V_{CC}+0.5V$)

Storage Temperature.....-65°C to +150°C

Power Dissipation.....1000mW

ESD Rating Human Body Model (HBM)..... $\pm 15kV$

■ Electrical Characteristics

$T_{AMB} = T_{MIN}$ to T_{MAX} and $V_{CC} = 5V \pm 5\%$ unless otherwise noted.

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
TK490 Driver DC Characteristics					
Differential output voltage			V_{CC}	V	Unloaded; $R = \infty\Omega$; Figure 1
Differential output voltage	2		V_{CC}	V	With load; $R = 50\Omega$ (RS-422); Figure 1
Differential output voltage	1.5		V_{CC}	V	With load; $R = 27\Omega$ (RS-485); Figure 1
Change in magnitude of driver differential output voltage for complimentary states			0.2	V	$R = 27\Omega$ or $R = 50\Omega$; Figure 1
Driver common-mode output voltage			3	V	$R = 27\Omega$ or $R = 50\Omega$; Figure 1
Input high voltage	2.0			V	Applies to D
Input low voltage			0.8	V	Applies to D
Input current			± 10	μA	Applies to D
Driver short circuit current $V_{OUT} = HIGH$			± 250	mA	$-7V \leq V_O \leq 12V$
Driver short circuit current $V_{OUT} = LOW$			± 250	mA	$-7V \leq V_O \leq 12V$
TK490 Driver AC Characteristics					
Maximum data rate	2.5			Mbps	
Driver input to output, t_{PLH}		30	60	ns	$R_{DIFF} = 54\Omega$, $C_{L1} = C_{L2} = 100pF$; Figures 3 & 5
Driver input to output, t_{PHL}		30	60	ns	$R_{DIFF} = 54\Omega$, $C_{L1} = C_{L2} = 100pF$; Figures 3 & 5
Driver skew		5		ns	$t_{SKEW} = t_{DPLH} - t_{DPHL} $; Figures 3 & 5
Driver rise or fall time		15	40	ns	From 10% to 90%; $R_{DIFF} = 54\Omega$, $C_{L1} = C_{L2} = 100pF$; Figures 3 & 5

Electrical Characteristics (Continued)

$T_{AMB} = T_{MIN}$ to T_{MAX} and $V_{CC} = 5V \pm 5\%$ unless otherwise noted.

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
TK490 Receiver DC Characteristics					
Differential input threshol	-0.2		0.2	V	$-7V \leq V_{CM} \leq 12V$
Input hysteresis		70		mV	$V_{CM} = 0V$
Output voltage HIGH	3.5			V	$V_{ID} = 200mV, I_O = -4mA$
Output voltage LOW			0.4	V	$V_{ID} = -200mV, I_O = 4mA$
Input resistance	12	15		k Ω	$-7V \leq V_{CM} \leq 12V$
Input current (A, B); $V_{IN} = 12V$			± 1.0	mA	$V_{IN} = 12V$
Input current (A, B); $V_{IN} = -7V$			-0.8	mA	$V_{IN} = -7V$
Short circuit current			85	mA	$0V \leq V_O \leq V_{CC}$
TK490 Receiver AC Characteristics					
Maximum data rate	2.5			Mbps	
Receiver input to output, t_{PLH}		45	150	ns	$R_{DIFF} = 54\Omega, C_{L1} = C_{L2} = 100pF$; Figures 3 and 7
Receiver input to output, t_{PHL}		45	150	ns	$R_{DIFF} = 54\Omega, C_{L1} = C_{L2} = 100pF$; Figures 3 and 7
Differential receiver ske , $ t_{PLH} - t_{PHL} $		13		ns	$R_{DIFF} = 54\Omega, C_{L1} = C_{L2} = 100pF$; Figures 3 and 7
Power Requirements					
Supply Voltage	4.75		5.25	V	
Supply Current		900		μA	
TK490 Environmental and Mechanical					
Operating Temperture					
Commercial (_C_)	0		70	$^{\circ}C$	
Storage Temperature	-65		150	$^{\circ}C$	
Package					
SOIC (_N)					

■ Test Circuits

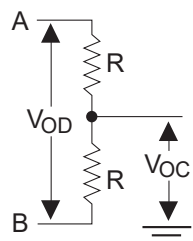


Figure 1: Driver DC Test Load Circuit

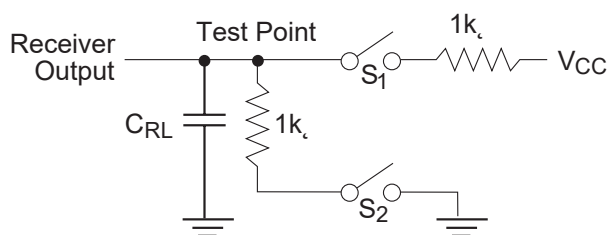


Figure 2: Receiver Timing Test Load Circuit

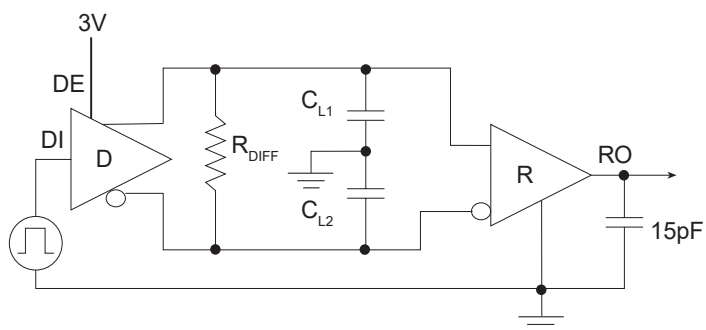


Figure 3: Driver/Receiver Timing Test Circuit

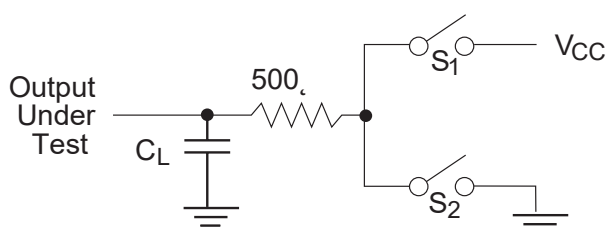


Figure 4: Driver Timing Test Load #2 Circuit

■ **Switching Waveforms**

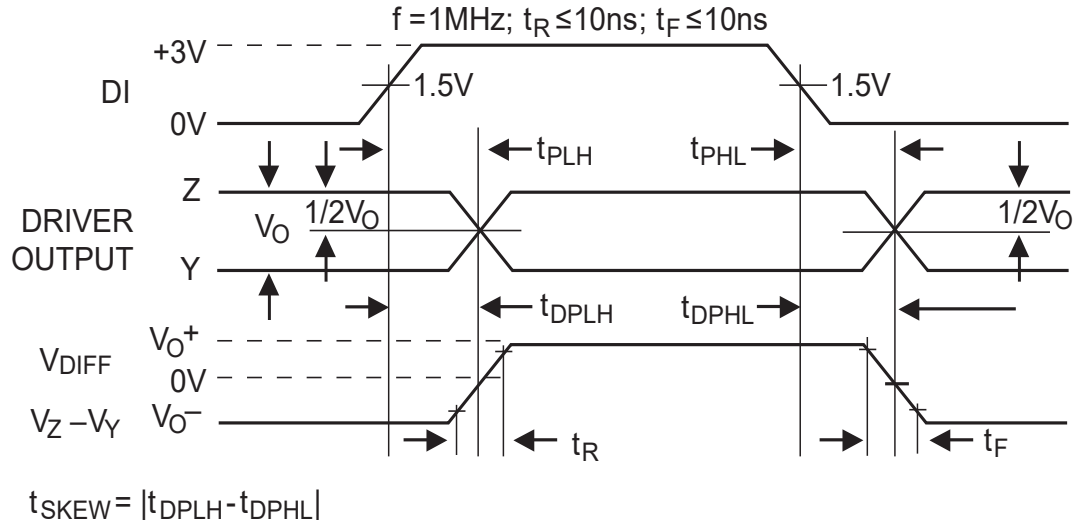


Figure 5: Driver Propagation Delays

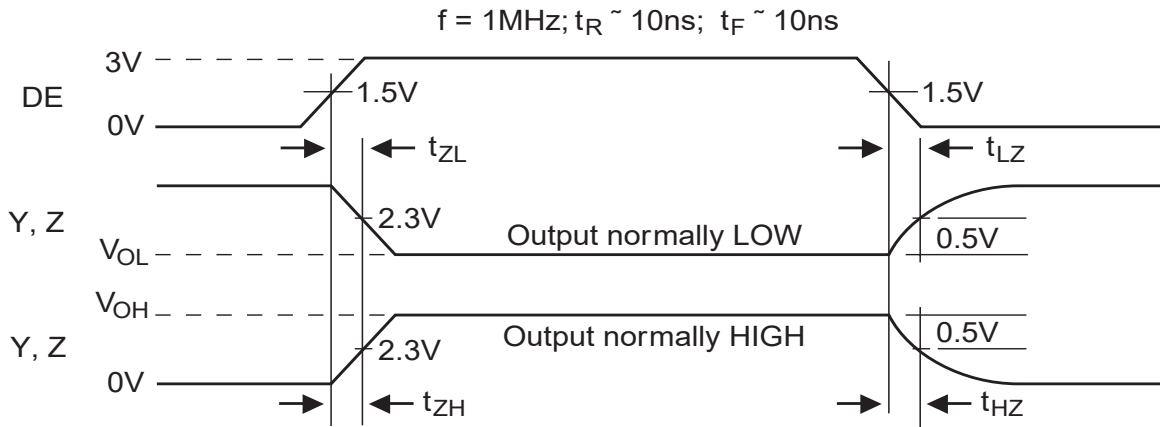


Figure 6: Driver Enable and Disable Times

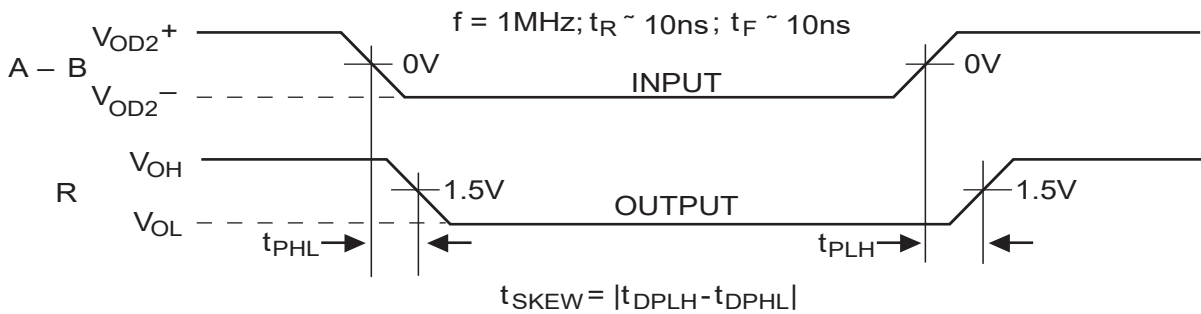


Figure 7: Receiver Propagation Delays

■ **Switching Waveforms**

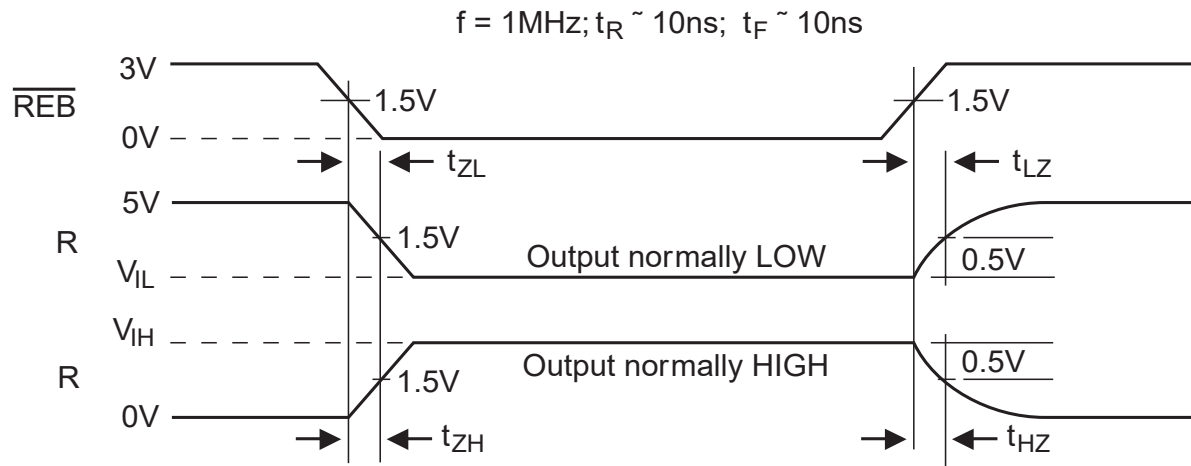


Figure 8: Receiver Enable and Disable Times

■ Description

The TK490 and TK491 are full-duplex differential transceivers that meet the requirements of RS-485 and RS-422. Both products require a fraction of the power of older bipolar designs.

The RS-485 standard is ideal for multi-drop applications or for long-distance interfaces. RS-485 allows up to 32 drivers and 32 receivers to be connected to a data bus, making it an ideal choice for multi-drop applications. Since the cabling can be as long as 4,000 feet, RS-485 transceivers are equipped with a wide (-7V to 12V) common mode range to accommodate ground potential differences. Because RS-485 is a differential interface, data is virtually immune to noise in the transmission line.

Drivers

The drivers for both the TK490 and TK491 have differential outputs. The typical voltage output swing with no load will be 0 volts to +5 volts. With worst case loading of 54Ω across the differential outputs, the driver can maintain greater than 1.5V voltage levels.

The driver of the TK491 has a driver enable control line which is active high. A logic high on DE (pin 4) of the TK491 will enable the differential driver outputs. A logic low on DE (pin 4) of the TK491 will tri-state the driver outputs. The TK490 does not have a driver enable.

Receivers

The receivers for both the TK490 and TK491 have differential inputs with an input sensitivity as low as $\pm 200\text{mV}$. Input impedance of the receivers is typically $15\text{k}\Omega$ ($12\text{k}\Omega$ minimum). A wide common mode range of -7V to 12V allows for large ground potential differences between systems. The receivers for both the TK490 and TK491 are equipped with the fail-safe feature. Fail-safe guarantees that the receiver output will be in a high state when the input is left unconnected.

The receiver of the TK491 has a receiver enable control line which is active low. A logic low on $\overline{\text{REB}}$ (pin 3) of the TK491 will enable the differential receiver. A logic high on $\overline{\text{REB}}$ (pin 3) of the TK491 will tri-state the receiver.

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