

20 μ A, 1/8-Unit-Load, Slew-Rate-Limited RS-485 Transceivers

■ Description

The TK1482 and TK1483 are low-power transceivers for RS-485 and RS-422 communication. Both feature slew-rate-limited drivers that minimize EMI and reduce reflections caused by improperly terminated cables. Data rates are guaranteed up to 250kbps.

The TK1482 is full duplex and the TK1483 is half duplex. Both parts have a 1/8-unit-load input impedance that guarantees up to 256 transceivers on the bus.

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

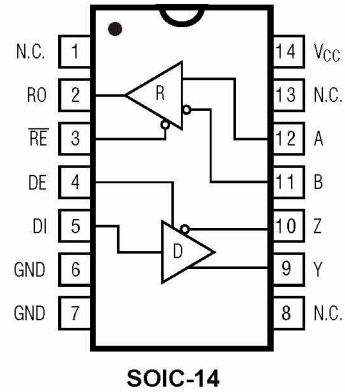
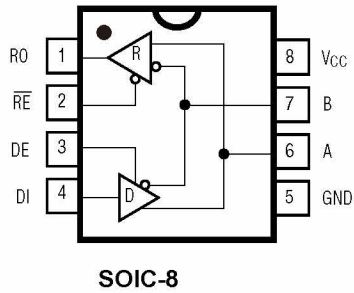
- Low Quiescent Current: 230 μ A
- -8V to +12.5V Common-Mode Input Voltage Range
- Three-State Outputs
- 3 μ s Propagation Delays, 800ns Skew
- The TK1482 is full duplex and the TK1483 is half duplex.
- Operate from a Single 5V Supply
- Allows up to 256 transceivers on the Bus
- Data rate: 250kbps
- Current-Limiting for Driver Overload Protection
- Enhanced ESD Specifications:
 - ±15kV IEC61000-4-2 Air Discharge
 - ±8kV IEC61000-4-2 Contact Discharge

■ Ordering Information

Part Number	Package	Packing	Temperature(TA)	Package Qty
TK1482CSD	SOIC-14	Reel	0°C ~ 70°C	2500
TK1482ESD	SOIC-14	Reel	-40°C ~ 85°C	2500
TK1483CSA	SOIC-8	Reel	0°C ~ 70°C	2500
TK1483ESA	SOIC-8	Reel	-40°C ~ 85°C	2500

Note: Please contact us to customize DIP packaging device.

■ Pin Assignment



■ Pin Description

PIN		NAME	FUNCTION
TK1482 DIP/SO	TK1483 DIP/SO		
2	1	RO	Receiver Output. With the receiver output enabled (RE low), RO is high if $A > B$ by 200mV or when A and B are not connected, and RO is low if $A < B$ by 200mV.
3	2	RE	Receiver Output Enable. When RE is low, RO is enabled. When RE is high, RO is high impedance. If RE is high and DE is low, the TK1482/TK1483 enter a low-power (0.1μA) shutdown state.
4	3	DE	Driver Output Enable. The driver outputs, A and B, (Y and Z for the TK1482) are enabled by bringing DE high. When DE is low, the driver outputs are high impedance, and the devices can function as line receivers if RE is low. If RE is high and DE is low, the parts will enter a low-power (0.1μA) shutdown state. If the driver outputs are enabled, the devices function as line drivers.
5	4	DI	Driver Input. With DE high, a low on DI forces output Y low and output Z high, and a high on DI forces output Y high and output Z low.
6, 7	5	GND	Ground
9	—	Y	Noninverting Driver Output
10	—	Z	Inverting Driver Output
—	6	A	Noninverting Receiver Input and Noninverting Driver Output
12	—	A	Noninverting Receiver Input
—	7	B	Inverting Receiver Input and Inverting Driver Output
11	—	B	Inverting Receiver Input
14	8	VCC	Positive Supply: 4.75V to 5.25V
1, 8, 13	—	N.C.	No Connect—not internally connected

■ ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_{CC}) 12V	Continuous Power Dissipation ($T_A = +70^\circ\text{C}$)
Control Input Voltage -0.5V to ($V_{CC} + 0.5\text{V}$)	8-Pin SOIC 2 m 14-Pin SOIC 800m (derate 9.09mW/ $^\circ\text{C}$ above $+70^\circ\text{C}$)
Driver Input Voltage (DI) -0.5V to ($V_{CC} + 0.5\text{V}$)	8-Pin SOIC 4 1m 14-Pin SOIC 668m (derate 5.88mW/ $^\circ\text{C}$ above $+70^\circ\text{C}$)
Driver Output Voltage (A, B) -8V to +12.5V	Operating Temperature Ranges -40°C to $+105^\circ\text{C}$
Receiver Input Voltage (A, B) -8V to +12.5V	Storage Temperature Range -65°C to $+160^\circ\text{C}$
Receiver Output Voltage (RO) -0.5V to ($V_{CC} + 0.5\text{V}$)	Lead Temperature (soldering, 10sec) $+300^\circ\text{C}$

* 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 under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

■ DC ELECTRICAL CHARACTERISTICS

($V_{CC} = 5\text{V} \pm 5\%$, $T_A = T_{MIN}$ to T_{MAX} , unless otherwise noted.) (Notes 1, 2)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Differential Driver Output (no load)	V_{OD1}				5	V
Differential Driver Output (with load)	V_{OD2}	$R = 50\Omega$ (RS-422)	2			V
		$R = 27\Omega$ (RS-485), Figure 1	1.5		5	
Change in Magnitude of Driver Differential Output Voltage for Complementary Output States	ΔV_{OD}	$R = 27\Omega$ or 50Ω , Figure 1			0.2	V
Driver Common-Mode Output Voltage	V_{OC}	$R = 27\Omega$ or 50Ω , Figure 1			3	V
Change in Magnitude of Driver Common-Mode Output Voltage for Complementary Output States	ΔV_{OC}	$R = 27\Omega$ or 50Ω , Figure 1			0.2	V
Input High Voltage	V_{IH}	DE, DI, \overline{RE}	2.0			V
Input Low Voltage	V_{IL}	DE, DI, \overline{RE}			0.8	V
Input Current	I_{IN1}	DE, DI, \overline{RE}			± 2	μA
Input Current (A, B)	I_{IN2}	DE = 0V; $V_{CC} = 0\text{V}$ or 5.25V	$V_{IN} = 12\text{V}$		1.0	mA
			$V_{IN} = -7\text{V}$		-0.8	
Receiver Differential Threshold Voltage	V_{TH}	$-7\text{V} \leq V_{CM} \leq 12\text{V}$	-0.2		0.2	V
Receiver Input Hysteresis	ΔV_{TH}	$V_{CM} = 0\text{V}$		70		mV
Receiver Output High Voltage	V_{OH}	$I_O = -4\text{mA}$, $V_{ID} = 200\text{mV}$	3.5			V
Receiver Output Low Voltage	V_{OL}	$I_O = 4\text{mA}$, $V_{ID} = -200\text{mV}$			0.4	V
Three-State (high impedance) Output Current at Receiver	I_{OZR}	$0.4\text{V} \leq V_O \leq 2.4\text{V}$			± 1	μA
Receiver Input Resistance	R_{IN}	$-7\text{V} \leq V_{CM} \leq 12\text{V}$	96			k Ω

■ DC ELECTRICAL CHARACTERISTICS (continue)

 (V_{CC} = 5V ±5%, T_A = T_{MIN} to T_{MAX}, unless otherwise noted.) (Notes 1, 2)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
No-Load Supply Current (Note 3)	I _{CC}	DE = V _{CC}		300	700	
		$\overline{RE} = 0V$ or V _{CC}		230	400	μA
		DE = 0V				
Driver Short-Circuit Current	I _{OSD1}	-7V ≤ V _O ≤ 12V (Note 4)	35		250	mA
VO = High Driver Short-Circuit Current	I _{OSD2}	-7V ≤ V _O ≤ 12V (Note 4)	35		250	mA
VO = Low Receiver Short-Circuit Current	I _{OSR}	0V ≤ V _O ≤ V _{CC}	7		95	mA
ESD Protection		A, B, Y and Z pins, tested using Human Body Model		±15		kV

■ SWITCHING CHARACTERISTICS

 (V_{CC} = 5V ±5%, T_A = T_{MIN} to T_{MAX}, unless otherwise noted.) (Notes 1, 2)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Driver Input to Output	t _{PLH}	R _{DIFF} = 54Ω			2	s
	t _{PHL}	C _{L1} = C _{L2} = 100pF			2	
Driver Output Skew to Output	t _{SKEW}	R _{DIFF} = 54Ω, C _{L1} = C _{L2} = 100pF			800	ns
Driver Enable to Output High	t _{ZH}	C _L = 100pF, S2 closed	250		2000	ns
Driver Enable to Output Low	t _{ZL}	C _L = 100pF, S1 closed	200		2000	ns
Driver Disable Time from Low	t _{LZ}	C _L = 15pF, S1 closed	100		3000	ns
Driver Disable Time from High	t _{HZ}	C _L = 15pF, S2 closed	300		3000	ns
Receiver Input to Output	t _{PLH}	R _{DIFF} = 54Ω	250		2250	ns
	t _{PHL}	C _{L1} = C _{L2} = 100pF	250		2250	
t _{PLH} - t _{PHL} Differential Receiver Skew	t _{SKD}	R _{DIFF} = 54Ω C _{L1} = C _{L2} = 100pF		160		ns
Receiver Enable to Output Low	t _{ZL}	C _{RL} = 15pF, S1 closed		45	90	ns
Receiver Enable to Output High	t _{ZH}	C _{RL} = 15pF, S2 closed		45	90	ns
Receiver Disable Time from Low	t _{LZ}	C _{RL} = 15pF, S1 closed		45	90	ns
Receiver Disable Time from High	t _{HZ}	C _{RL} = 15pF, S2 closed		45	90	ns
Maximum Data Rate	f _{MAX}			0.25		Mbps

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

 Note 2: All typical specifications are given for V_{CC}=5V and T_A=+25°C.

Note 3: Supply current specification is valid for loaded transmitters when DE=0V.

Note 4: Applies to peak current.

■ TEST CIRCUITS

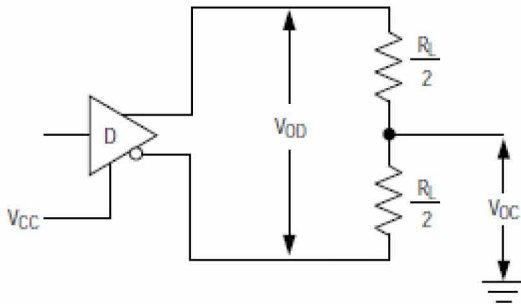


Figure 1. Driver V_{OD} and V_{OC}

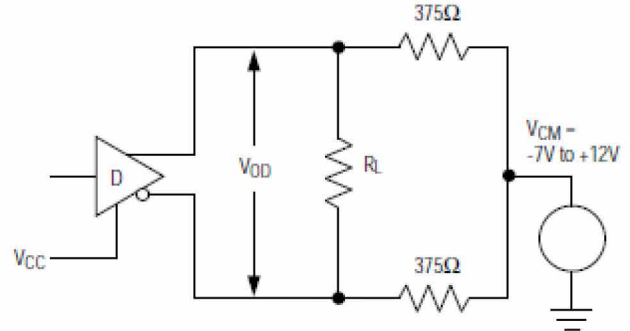


Figure 2. Driver V_{OD} with Varying Common-Mode Voltage

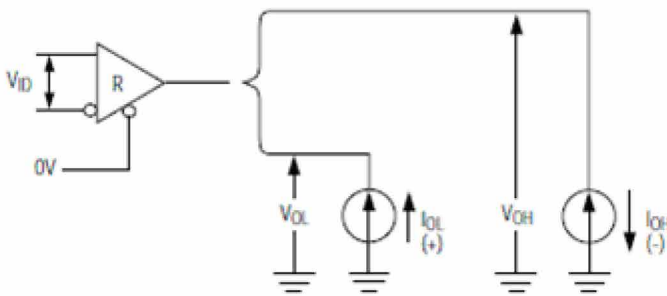


Figure 3. Receiver V_{OH} and V_{OL}

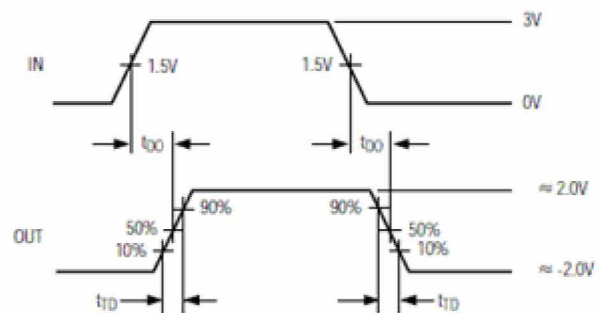
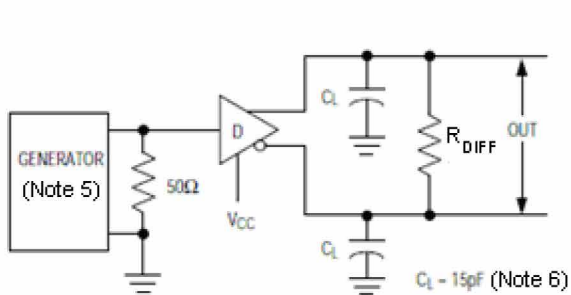
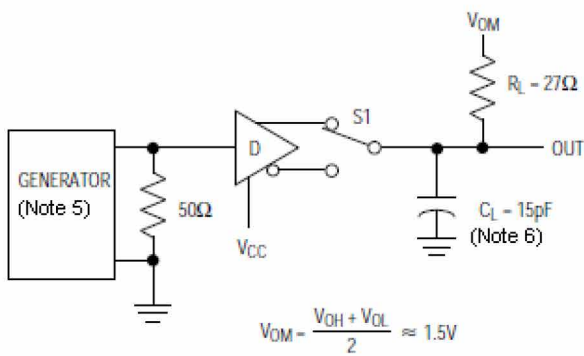
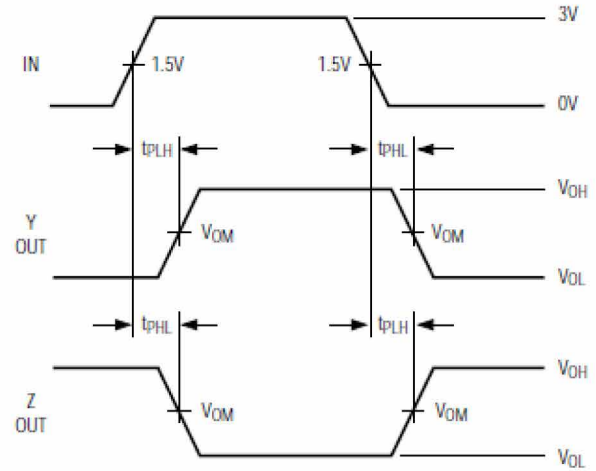
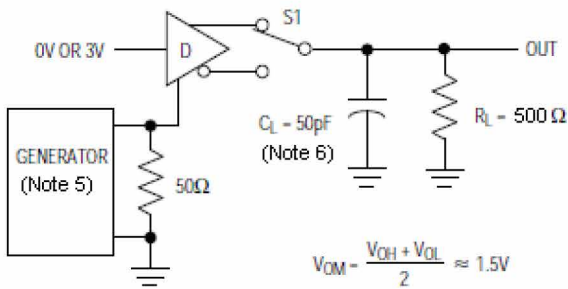


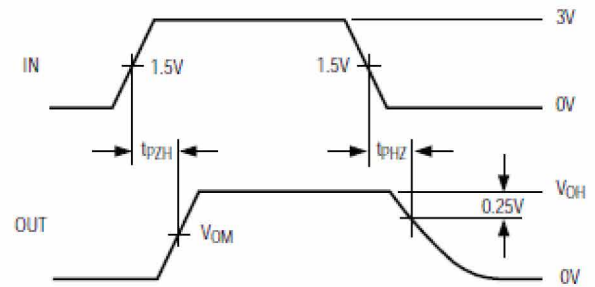
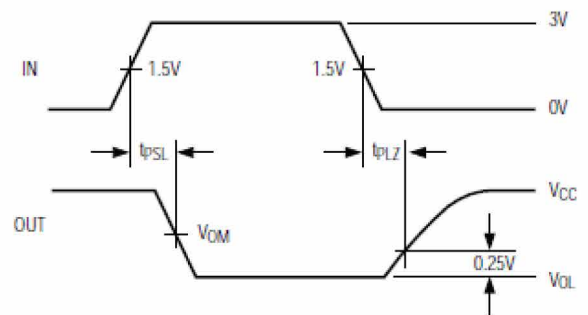
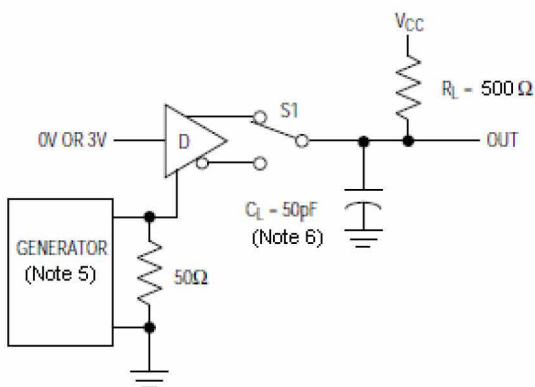
Figure 4. Driver Differential Output Delay and Transition Times

■ TEST CIRCUITS (continue)


$$V_{OM} = \frac{V_{OH} + V_{OL}}{2} \approx 1.5V$$


Figure 5. Driver Propagation Times


$$V_{OM} = \frac{V_{OH} + V_{OL}}{2} \approx 1.5V$$


Figure 6. Driver Enable and Disable Times (t_{PZH} , t_{PSH} , t_{PHZ})

Figure 7. Driver Enable and Disable Times (t_{PZL} , t_{PSL} , t_{PLZ})

■ TEST CIRCUITS (continue)

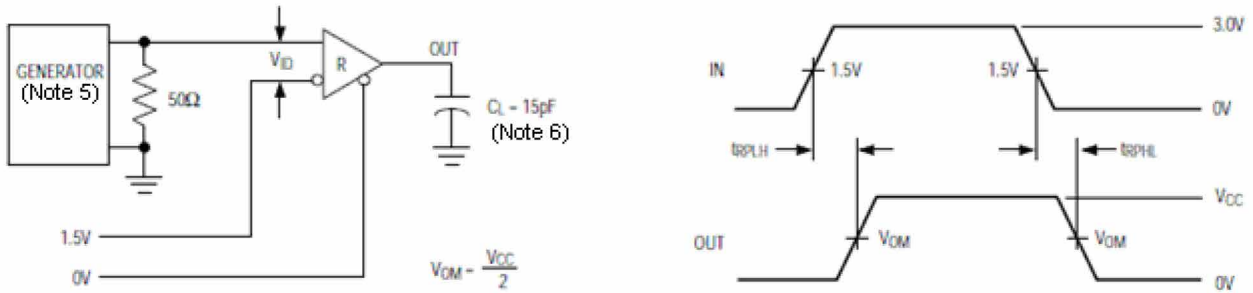


Figure 8. Receiver Propagation Delay

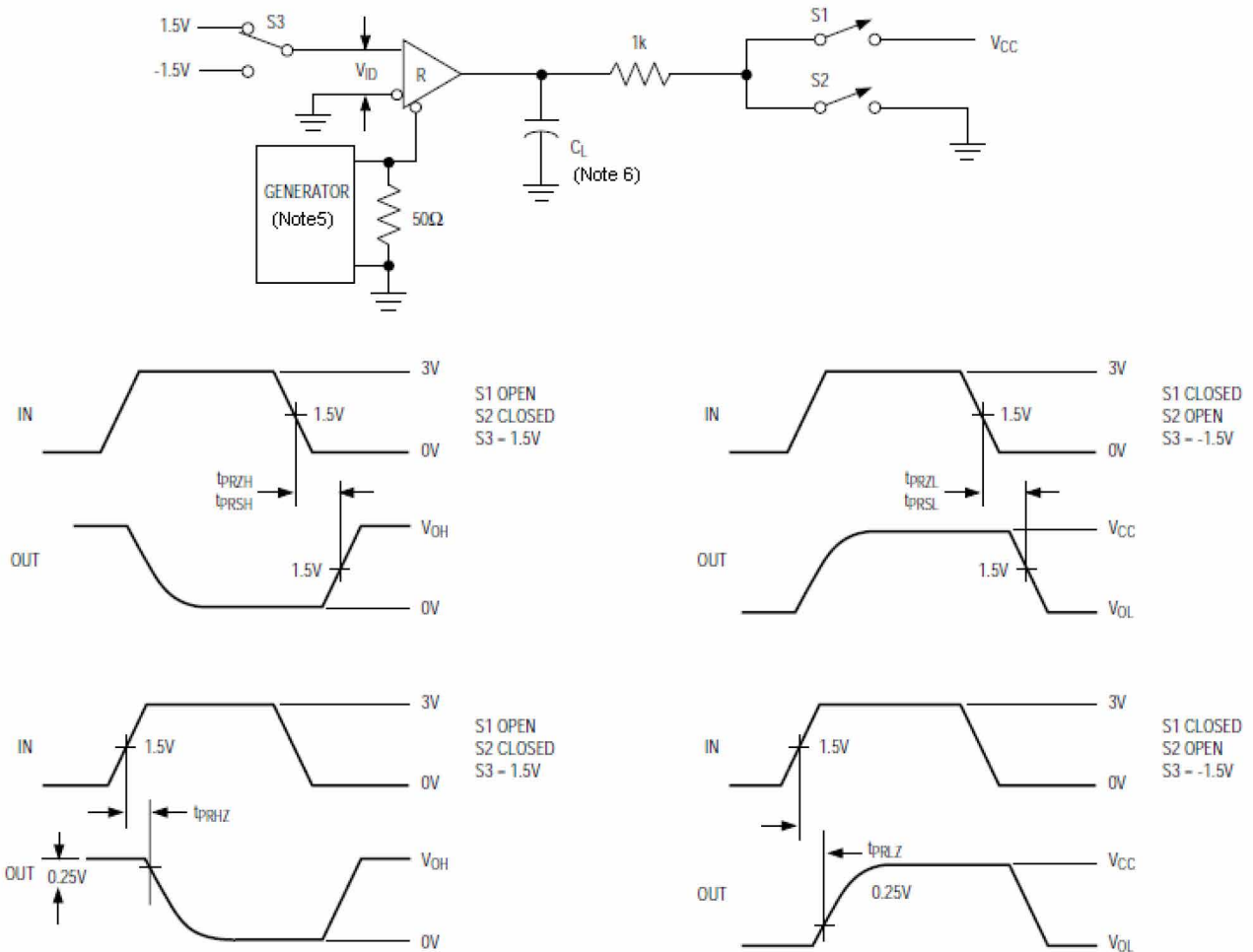


Figure 9. Receiver Enable and Disable Times

Note 5: The input pulse is supplied by a generator with the following characteristics: PRR = 250kHz, 50% duty cycle, $t_r \leq 6.0\text{ns}$, $Z_o = 50\Omega$.

Note 6: C_L includes probe and stray capacitance.

Function Tables

Transmitting				
INPUTS			OUTPUTS X	
RE	DE	DI	Z	Y
X	1	1	0	1
X	1	0	1	0
0	0	X	Z	Z
1	0	X	Z	Z

Receiving			
INPUTS			OUTPUTS
RE	DE	A-B	RO
0	0	+0.2V	1
0	0	-0.2V	0
0	0	open	1
1	0	X	Z

X-don't care
 Z-high impedance

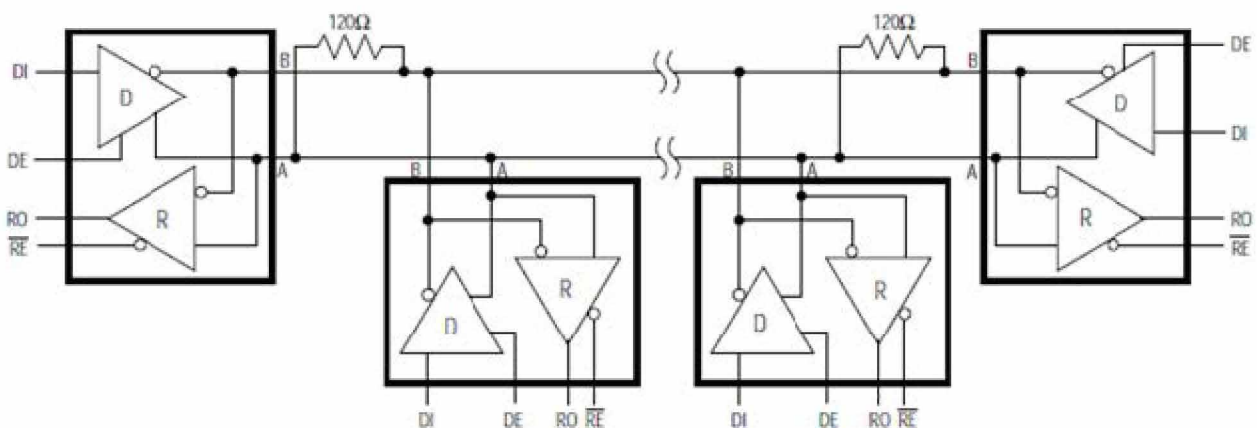
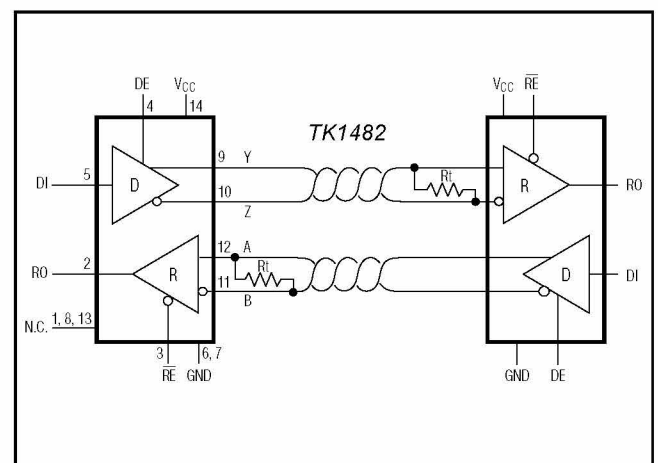
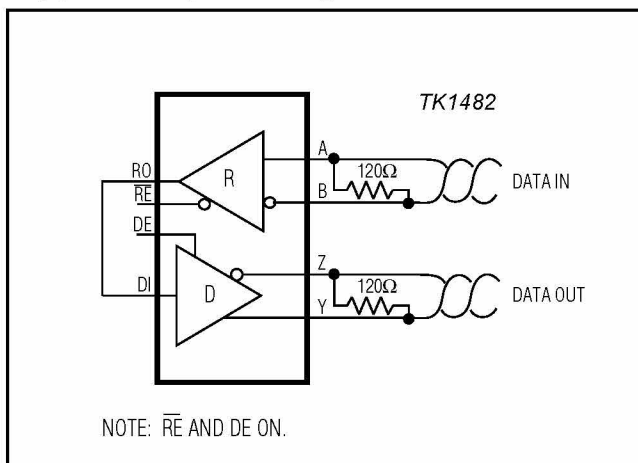
Typical Information
Typical Operating Circuits


Figure 10. TK1483 Typical RS-485 Network

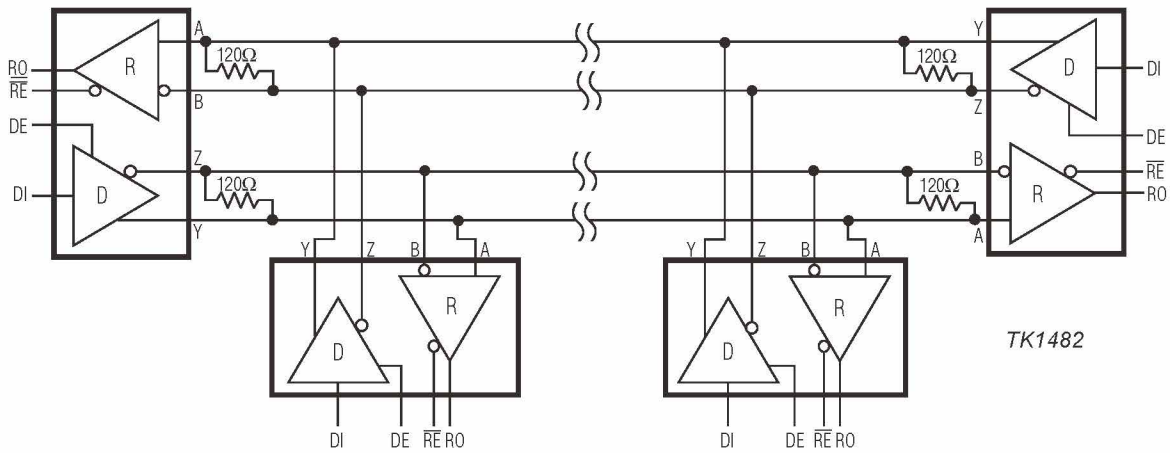


Figure 11. TK1483 Typical RS-485 Network

Driver Output Protection

Excessive output current and power dissipation caused by faults or by bus contention are prevented by two mechanisms. A foldback current limit on the output stage provides immediate protection against short circuits over the whole common-mode voltage range.

Propagation Delay

Skew time is simply the difference between the low-to-high and high-to-low propagation delay. Small driver/receiver skew times help maintain a symmetrical mark-space ratio (50% duty cycle).

The receiver skew time, $|t_{\text{PRLH}} - t_{\text{PRHL}}|$, is under 13ns. The driver skew times are 5ns for the TK1482.

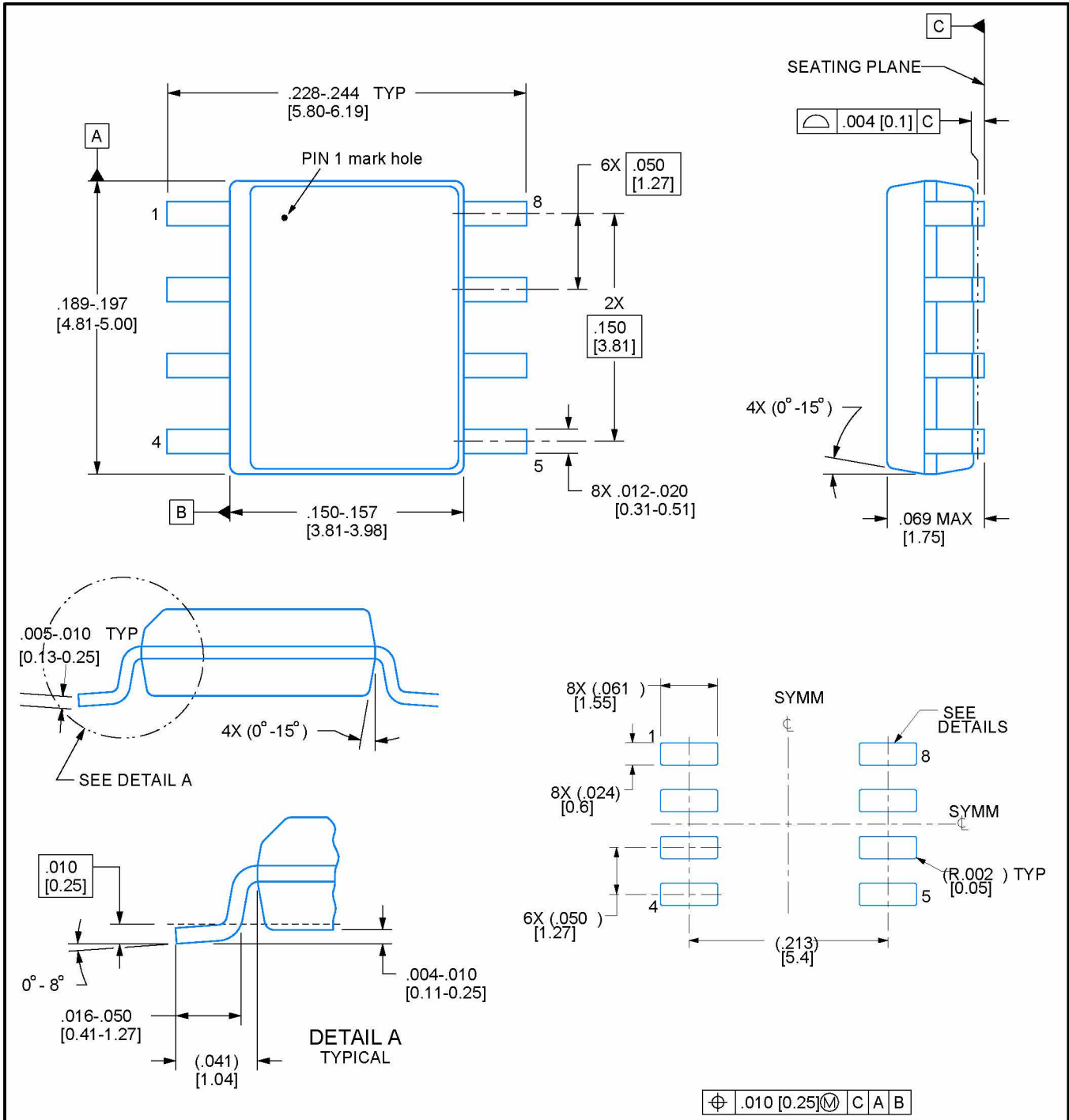
Typical Applications

TK1482 transceivers are designed for bidirectional data communications on multipoint bus transmission lines.

Figure 10 shows typical network applications circuits. These parts can also be used as line repeaters, with cable lengths longer than 4000 feet.

To minimize reflections, the line should be terminated at both ends in its characteristic impedance, and stub lengths off the main line should be kept as short as possible.

PACKAGE OUTLINE SOIC - 8, 1.75 mm max height



NOTES: Linear dimensions are in inches [millimeters]. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 [0.15] per side.

Package diagram

SOIC14: plastic small outline package; 14 leads; body width 3.9 mm

