Interface Transceiver of the Serial Data of the Standard RS-485/RS-422

■ Description

The TK3080 is interface transceiver of serial data under RS-485 standard with low power consumption. The TK3080 features reduced slew-rate drivers that minimize EMI and reduce reflections caused by improperly terminated cables, allowing error-free data transmission up to 115kbps.It intended for full-duplex communications

The TK3080 is purposed for application in telecom systems under RS485/RS422 standards with low power dissipation, translators of the level, transceiving devices sensitive to electromagnetic radiation, industrial control systems.

■ Features

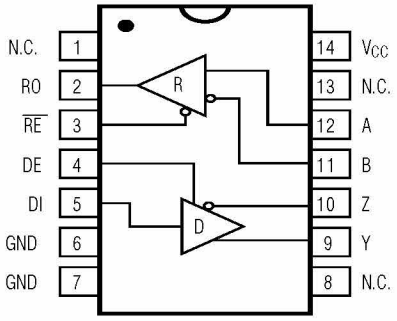
- 1 transmitter and 1 receivers of the serial data of the standard RS-485
- Auto Shutdown function provide low power consumption
- Supply voltage range: 5.0V ± 5%
- Data rate: 115Kbps
- ESD protection up to 2000V for transmitter input and receiver output (TTL/CMOS levels) and up to 15000V for transmitter output and receiver input (RS-485 levels)
- Latch current, min – 300mA at normal climatic condition
- Enhanced ESD Specifications(EC and EE_ only):
  ±15kV IEC61000-4-2 Air Discharge
  ±8kV IEC61000-4-2 Contact Discharge

■ Ordering Information

Part Number	Package	Packing	Temperature(TA)	Package Qty	ESD
TK3080CSD	SOIC-14	Reel	0°C ~ 70°C	2500	
TK3080ESD	SOIC-14	Reel	-40°C ~ 85°C	2500	
TK3080ECSD	SOIC-14	Reel	0°C ~ 70°C	2500	±15KV
TK3080EESD	SOIC-14	Reel	-40°C ~ 85°C	2500	±15KV

Note: Please contact us to customize DIP packaging device.

■ Pin Description



SOIC14

Table 1. **Pin Description**

Pin Num	Symbol	Pin Description
01	N.C.	No Connect. Not internally connected, can be connected to GND.
02	RO	Receiver Output. When $\overline{RE}$ is low and if A - B ≥ -50mV, RO will be high; if A - B ≤ -200mV, RO will be low.
03	$\overline{RE}$	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.
04	DE	Driver Output Enable. Drive DE high to enable driver outputs. These outputs are high impedance when DE is low. Drive $\overline{RE}$ high and DE low to enter low-power shutdown mode.
05	DI	Driver Input. With DE high, a low on DI forces noninverting output low and inverting output high. Similarly, a high on DI forces noninverting output high and inverting output low.
06	GND	Ground
07	GND	Ground
08	N.C.	No Connect. Not internally connected, can be connected to GND.
09	Y	Noninverting Driver Output
10	Z	Inverting Driver Output
11	B	Inverting Receiver Input
12	A	Noninverting Receiver Input
13	N.C.	No Connect. Not internally connected, can be connected to GND.
14	V_{CC}	Positive Supply; 4.75V ≤ V_{CC} ≤ 5.25V

Typical Full-Duplex RS-485 Network Application Diagram

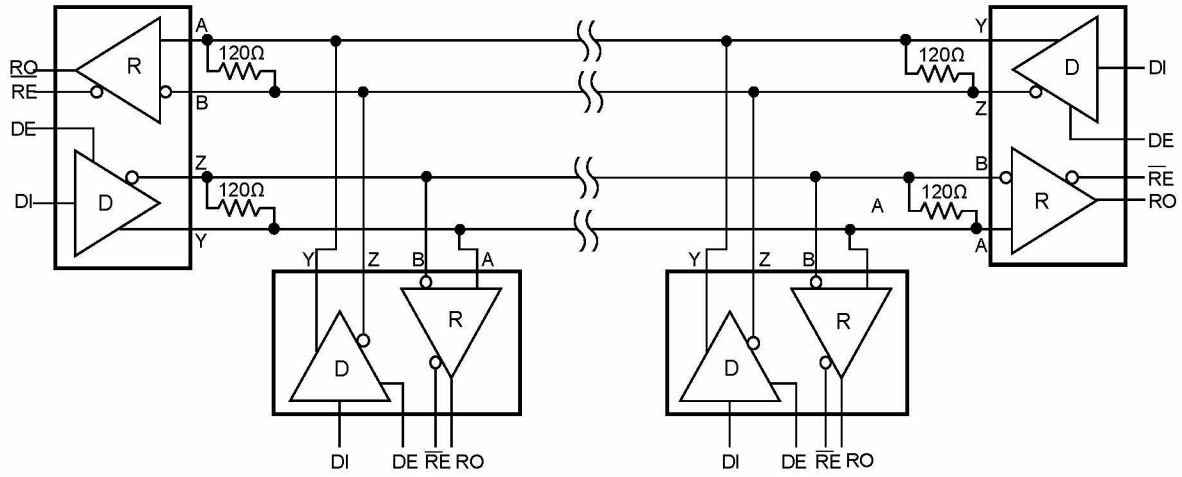


Table 2. **Transmitter Truth Table**

TRANSMITTING				
INPUTS			OUTPUTS	
$\overline{RE}$	DE	DI	Z	Y
X	H	H	L	H
X	H	L	H	L
L	L	X	High-Z	High-Z
H	L	X	Shutdown	

Note : H – high level, L – low level , X –don't care, Z – third state

Table 3. **Receiver Truth Table**

RECEIVING			
INPUTS			OUTPUT
$\overline{RE}$	DE	A-B	RO
L	X	≥ -0.05V	H
L	X	≤ -0.2V	L
L	X	Open/shorted	H
H	H	X	High-Z
H	L	X	Shutdown

Note : H – high level, L – low level , BH – inputs not used, X –don't care, Z – third state, ZZ – inputs and outputs are in the third state

Table 4. **Maximum Ratings**

Parameter	Limit		Unit
	min	max	
Supply Voltage (V_{CC})		7.0	V
Control Input Voltage ($\overline{RE}$, DE)	-0.3	V_{CC} + 0.3	V
(H/$\overline{F}$, SRL, TXP, RXP)	0.3	V_{CC} + 0.3	V
Driver Input Voltage (DI)	0.3	V_{CC} + 0.3	V
Driver Output Voltage (A, B, Y, Z)	-13	13	V
Receiver Input Voltage, Full Duplex (A, B)	-25	25	V
Receiver Output Voltage (RO)	0.3	V_{CC} + 0.3	V
Continuous Power Dissipation (T_A = +70°C)		667	mW

Table 5. **Electrical Parameters**

(Vcc = 5V ± 5%)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
DRIVER							
Differential Driver Output (no load)	V_{OD1}	Fig 1				5	V
Differential Driver Output	V_{OD2}	Fig 1, R = 50Ω (RS-422)		2.0			V
		Fig 1, R = 27Ω (RS-485)		1.5			
Change in Magnitude of Differential Output Voltage	ΔV_{OD}	Fig 1, R = 50Ω or R = 27Ω				0.2	V
Driver Common-Mode Output Voltage	V_{OC}	Fig 1, R = 50Ω or R = 27Ω				3	V
Change In Magnitude of Common-Mode Voltage)	ΔV_{OC}	Fig 1, R = 50Ω or R = 27Ω				0.2	V
Input High Voltage	V_{IH1}	DE, DI, $\overline{RE}$, H/$\overline{F}$, TXP, RXP		2.0			V
Input Low Voltage	V_{IL1}	DE, DI, $\overline{RE}$, H/$\overline{F}$, TXP, RXP				0.8	V
DI Input Hysteresis	V_{HYS}	MAX3080–MAX3085, and MAX3089 with SRL = V_{CC} or unconnected			100		mV
SRL Input Current	I_{IN1}	DE, DI, $\overline{RE}$				±2	µA
	I_{IN2}	H/$\overline{F}$, TXP, RXP, internal pulldown		10		40	
Input High Voltage	V_{IH2}	SRL		V_{CC} - 0.8			V
Input Middle Voltage	V_{IM2}	SRL		0.4V_{CC}		0.6V_{CC}	V
Input Low Voltage	V_{IL2}	SRL				0.8	V
SRL Input Current	I_{IN3}	SRL = V_{CC}				75	µA
		SRL = GND		-75			
Input Current (A and B) Full Duplex	I_{IN4}	DE = GND, V_{CC} = GND or 5.25V	V_{IN} = 12V			125	µA
			V_{IN} = -7V			-75	
Output Leakage (Y and Z) Full Duplex	I_O	DE = GND, V_{CC} = GND or 5.25V	V_{IN} = 12V			125	µA
			V_{IN} = -7V	-100			
Driver Short-Circuit Output Current	V_{OD1}	-7V ≤ V_{OUT} ≤ V_{CC}		-250			mA
		0V ≤ V_{OUT} ≤ 12V				250	
		0V ≤ V_{OUT} ≤ V_{CC}		±25			
RECEIVER							
Receiver Differential Threshold Voltage	V_{TH}	-7V ≤ V_{CM} ≤ +12V		-200	-125	-50	mV
Receiver Input Hysteresis	ΔV_{TH}				25		mV
Receiver Output High Voltage	V_{OH}	I_O = -4mA, V_{ID} = -50mV		V_{CC} -1.5			V
Receiver Output Low Voltage	V_{OL}	I_O = 4mA, V_{ID} = -200mV				0.4	V
Three-State Output Current at Receiver	I_{OZR}	0.4V ≤ V_O ≤ 2.4V				±1	µA
	R_{IN}			96			kΩ
Receiver Output Short-Circuit Current	I_{OSR}	0V ≤ V_{RO} ≤ V_{CC}		±7		±95	mA
SUPPLY CURRENT							
Supply Current	I_{CC}	No load, $\overline{RE}$ = DI = GND or V_{CC}, SRL = V_{CC}	DE = V_{CC}		430	900	µA
			DE = GND		375	600	
		No load, $\overline{RE}$ = DI = GND or V_{CC}, SRL = GND	DE = V_{CC}		475	1000	µA
			DE = GND		420	800	
Supply Current in Shutdown Mode	I_{SHDN}	DE = GND, $V_{\overline{RE}}$ = V_{CC}			0.001	10	µA
ESD Protection for Y, Z, A, B		Human Body Model (TK3080E_)			±15		kV

Table 6. SWITCHING CHARACTERISTICS

(V_{CC} = +5V ±5%, T_A = T_{MIN} to T_{MAX}, Typical values are at V_{CC} = +5V and T_A = +25°C.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Driver Input to Output	t_{DPLH}	Fig 3 and 5, R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF	500	2030	2600	ns
	t_{DPHL}		500	2030	2600	
Driver Output Skew | t_{DPLH} - t_{DPHL} |	t_{DSKEW}	Fig 3 and 5, R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF		-3	±200	ns
Driver Rise or Fall Time	t_{DR}, t_{DF}	Fig 3 and 5, R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF	667	1320	2500	ns
Maximum Data Rate	f_{MAX}		115			kbps
Driver Enable to Output High	t_{DZH}	Fig 4 and 6, C_L = 100pF, S2 closed			3500	ns
Driver Enable to Output Low	t_{DZL}	Fig 4 and 6, C_L = 100pF, S1 closed			3500	ns
Driver Disable Time from Low	t_{DLZ}	Fig 4 and 6, C_L = 15pF, S1 closed			100	ns
Driver Disable Time from High	t_{DHZ}	Fig 4 and 6, C_L = 15pF, S2 closed			100	ns
Receiver Input to Output	t_{RPLH}, t_{RPHL}	Fig 7; | V_{ID} | ≥ 2.0V; rise and fall time of V_{ID} ≤ 15ns		127	200	ns
| t_{RPLH} - t_{RPHL} | Differential Receiver Skew	t_{RSKD}	Fig 7; | V_{ID} | ≥ 2.0V; rise and fall time of V_{ID} ≤ 15ns		3	±30	ns
Receiver Enable to Output Low	t_{RZL}	Fig 2 and 8 , C_L = 100pF, S1 closed		20	50	ns
Receiver Enable to Output High	t_{RZH}	Fig 2 and 8, C_L = 100pF, S2 closed		20	50	ns
Receiver Disable Time from Low	t_{RLZ}	Fig 2 and 8, C_L = 100pF, S1 closed		20	50	ns
Receiver Disable Time from High	t_{RHZ}	C_L = 100pF, S2 closed		20	50	ns
Time to Shutdown	t_{SHDN}	(Note 1)	50	200	600	ns
Driver Enable from Shutdown to Output High	$t_{DZH(SHDN)}$	Fig 4 and 6, C_L = 15pF, S2 closed			6000	ns
Driver Enable from Shutdown to Output Low	$t_{DZL(SHDN)}$	Fig 4 and 6, C_L = 15pF, S1 closed			6000	ns
Receiver Enable from Shutdown to Output High	$t_{RZH(SHDN)}$	Fig 2 and 8, C_L = 100pF, S2 closed			3500	ns
Receiver Enable from Shutdown to Output Low	$t_{RZL(SHDN)}$	Fig 2 and 8, C_L = 100pF, S1 closed			3500	ns

Note 1: The device is put into shutdown 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 600ns, the device is guaranteed to have entered shutdown.

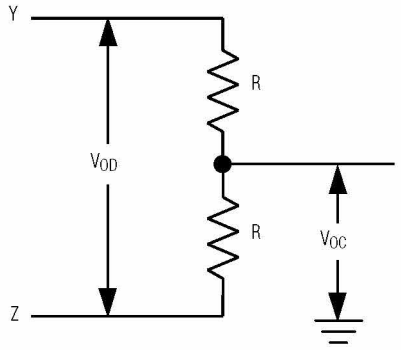


Fig 1. Driver DC Test Load

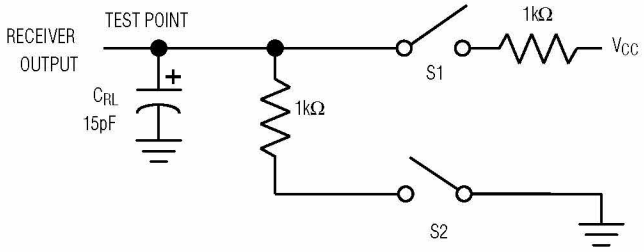


Fig 2. Receiver Enable/Disable Timing Test Load

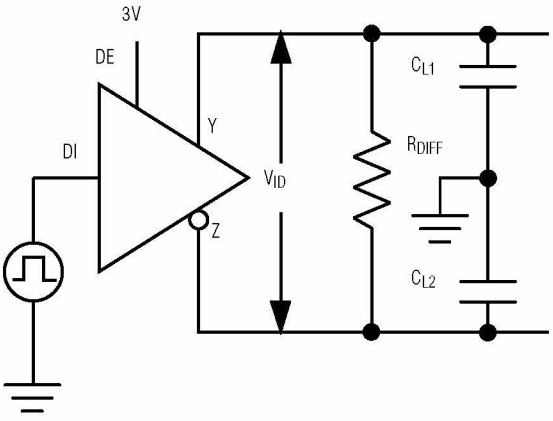


Fig 3. Driver Timing Test Circuit

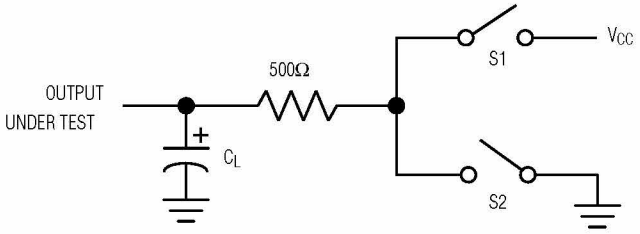


Fig 4 Driver Enable/Disable Timing Test Load

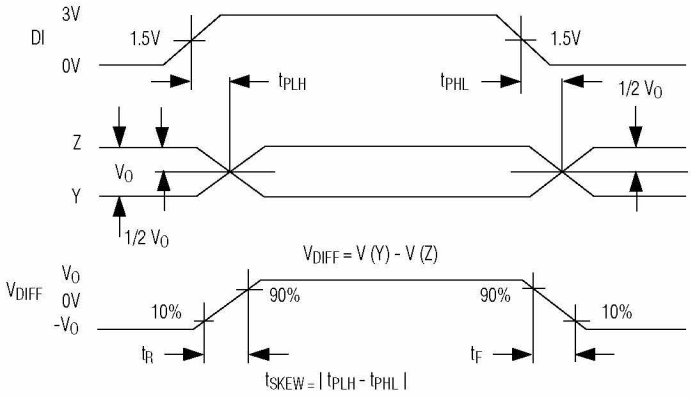


Fig 5. Driver Propagation Delays

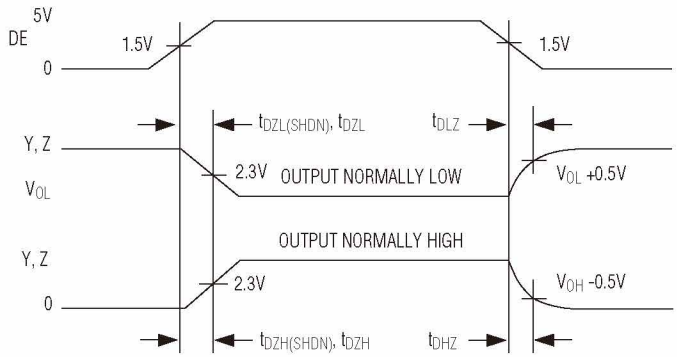


Fig 6. Driver Enable and Disable Times

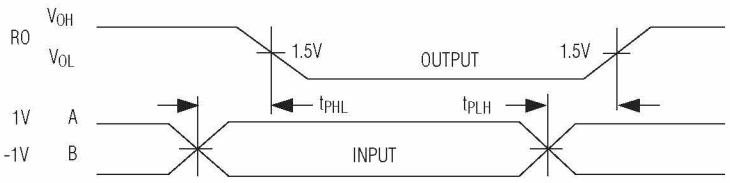


Fig 7. Receiver Propagation Delays

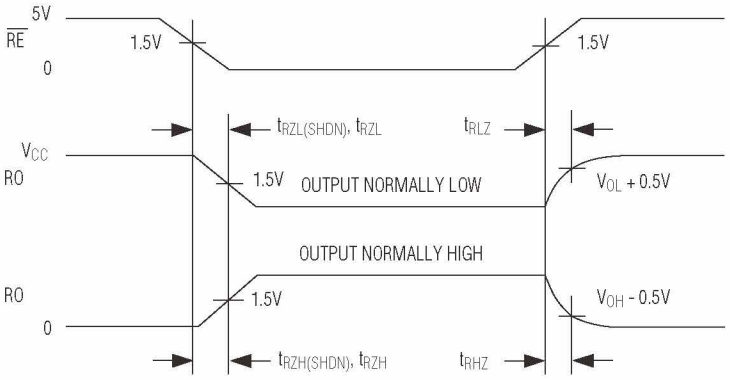


Fig 8. Receiver Enable and Disable Times

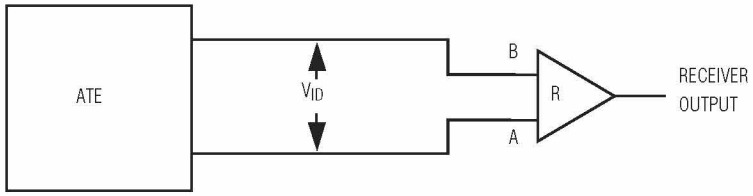


Fig 9. Receiver Propagation Delay Test Circuit

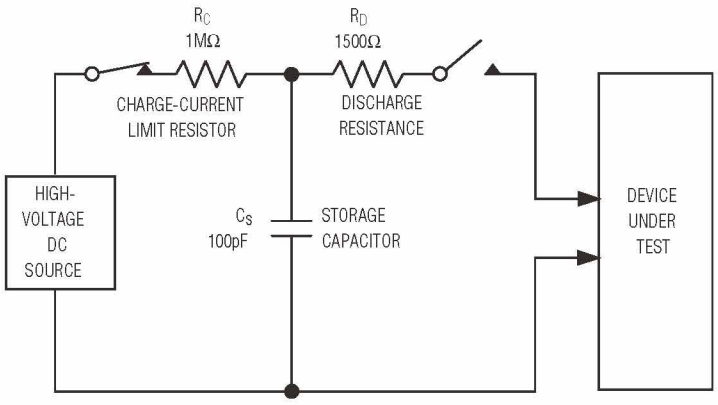
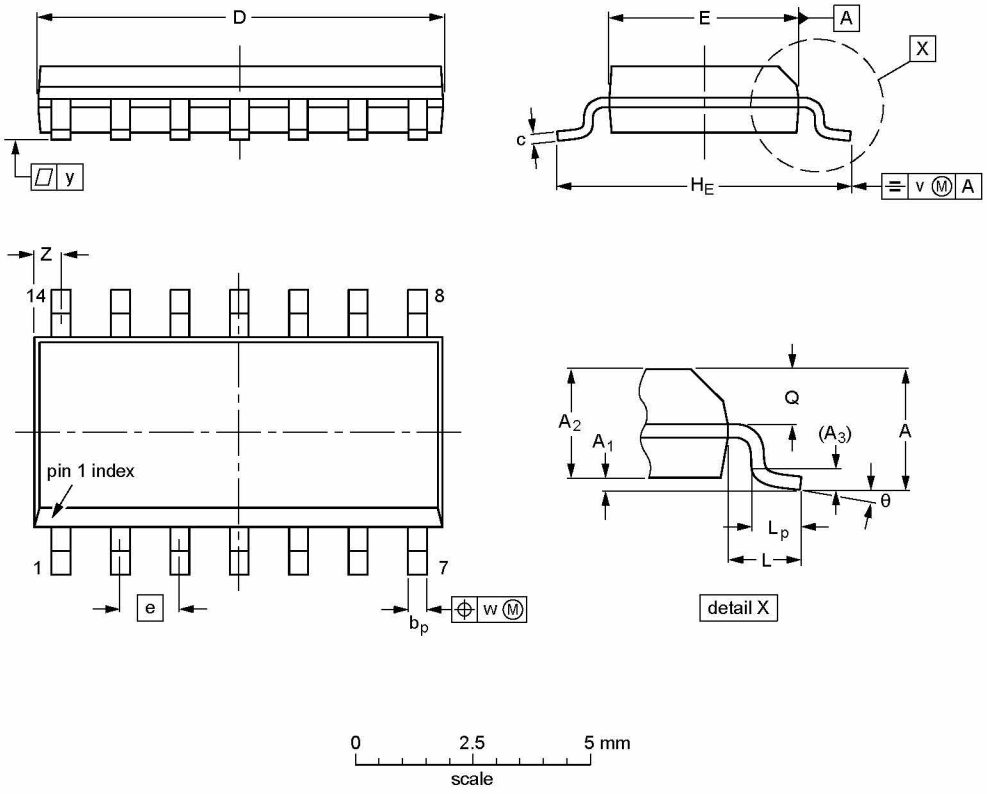


Fig 10. Human Body ESD Test Model

Package diagram

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



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	8.75 8.55	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8° 0°

Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
TKSOIC14						05-06-19