1 FEATURES

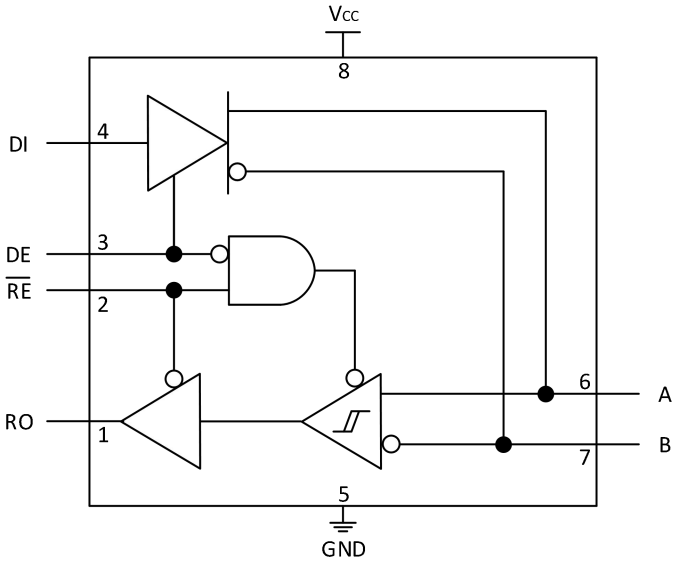
- 4.5V to 5.5V input voltage
- A low-current shutdown mode is provided
- Industry standard SOP8 package available
- Guaranteed 10Mbps Data Rate
- True Fail-Safe Receiver While Maintaining EIA/TIA-485 Compatibility
- Enhanced Slew-Rate Limiting Facilitates Error-Free Data Transmission
- Enhanced ESD protection is provided for RS-485/RS-422 A/B pins
- Overtemperature protection(OTP)

2 APPLICATIONS

- Industrial control
- Electricity meter, water meter, gas meter
- EMI sensitive transceiver applications
- Security system
- Lighting system
- Instrument and meter

3 DESCRIPTION

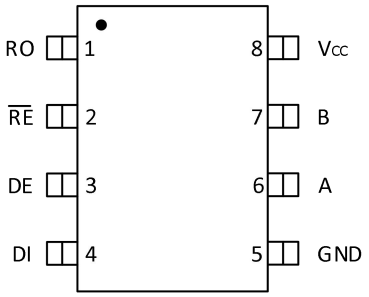
The GM75176E is ±15kV electrostatic discharge (ESD)-protected, high-speed transceiver for RS-485/RS-422 communication that contain one driver and one receiver. The device features fail-safe circuitry, which guarantees a logic-high receiver output when the receiver inputs are open or shorted. This means that the receiver output will be a logic high if all transmitters on a terminated bus are disabled (high impedance).The GM75176E is equipped with reduced slew-rate drivers. These drivers can minimize EMI and reduce reflections caused by improperly terminated cables, enabling error - free data transmission at speeds of up to 10Mbps.In addition, the receivers of the GM75176E have a 1-unit-load input impedance, which allows up to 32 transceivers to be connected to the bus.The GM75176E is intended for half-duplex communications,it also features a overtemperature protection (OTP)to prevent damage under high temperature conditions.



BLOCK DIAGRAM

4 Pin Configuration and Functions

GM75176E
SOP8
(Top View)



Pin	Name	Description
1	RO	Receiver output. When $\overline{RE}$ is at low level, if A-B≥-50mV, RO outputs a high level; if A-B≤-200mV, RO outputs a low level
2	$\overline{RE}$	Receiver output enable. When $\overline{RE}$ is connected to low level, the RO output is valid. When $\overline{RE}$ is connected to high level, RO is in a high - impedance state. When $\overline{RE}$ is connected to high level and DE is connected to low level, the device enters the low-power shutdown mode
3	DE	Driver output enable. When DE is connected to a high level, the driver output is active. When DE is at a low level, the output is in a high - impedance state. When $\overline{RE}$ is connected to a high level and DE is connected to a low level, the device enters the low-power shutdown mode
4	DI	Driver input. When DE is at a high level, a low level on DI forces the in-phase output to be low and the anti-phase output to be high. Similarly, a high level on DI will force the in-phase output to be high and the anti-phase output to be low
5	GND	Ground
6	A	Receiver in-phase input and driver in-phase output
7	B	Receiver inverse-phase input and driver inverse-phase output
8	V_{CC}	Positive supply terminal: 4.5 ≤ V_{CC} ≤ 5.5V

5 ABSOLUTE MAXIMUM RATINGS

Parameter	Parameter	Rating	UNIT
V_{CC}	Supply Voltage	+7	V
$\overline{RE}$,DE	Control Input Voltage	-0.3 to V_{CC}+0.3	V
DI	Driver Input Voltage	-0.3 to V_{CC}+0.3	V
A,B	Driver Output Voltage	±13	V
A,B	Receiver Input Voltage	±13	V
RO	Receiver Output Voltage	-0.3 to V_{CC}+0.3	V
P	Continuous Power Dissipation	471	mW
T_O	Operating Temperature Ranges	-40 to +85	℃
T_{st}	Storage Temperature Range	-65 to +150	℃
T_L	Lead Temperature(Soldering time <10s)	300	℃

6 DC ELECTRICAL CHARACTERISTICS

(V_{CC} = +5V ±5%, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at V_{CC} = +5V and T_A = +25°C.)(1)

Symbol	Parameter	Condition		MIN	TYP	MAX	UNIT
DRIVER							
V_{CC}	Supply Voltage			4.5		5.5	
V_{OD1}	Differential Driver Output	Figure 2, (No Load)		1.5		5	V
V_{OD2}	Differential Driver Output	Figure 2, R=50Ω (RS-422)		2.0		5	V
		Figure 2, R=27Ω (RS-485)		1.5		5	V
ΔV_{OD}	Change-in-Magnitude of Differential Output Voltage (2)	Figure 2, R=50Ω or R=27Ω				0.2	V
V_{OC}	Driver Common-Mode Output Voltage	Figure 2, R=50Ω or R=27Ω		1		3	V
ΔV_{OC}	Change-in-Magnitude of Common-Mode Voltage (2)	Figure 2, R=50Ω or R=27Ω				0.2	V
V_{IH1}	Input High Voltage	DE,DI,$\overline{RE}$		2.0			V
V_{IL1}	Input Low Voltage	DE,DI,$\overline{RE}$				0.8	V
V_{HYS}	DI Input Hysteresis	DE,DI,$\overline{RE}$			100		mV
I_{IN4}	Input Current (A and B) Half-Duplex	DE = GND, V_{CC} = GND or 5.25V	V_{IN}=12V			500	μA
			V_{IN}=-7V	-500			
I_{OSD}	Driver Short-Circuit Output Current(3)	-7V≤V_{OUT}≤V_{CC}		-250			mA
		0V≤V_{OUT}≤12V				250	
		0V≤V_{OUT}≤V_{CC}		±25			
RECEIVER							
V_{TH}	Receiver Differential Threshold Voltage	-7V ≤ V_{CM} ≤ 12V		-200	-110	-50	mV
ΔV_{TH}	Receiver Input Hysteresis				30		mV
V_{OH}	Receiver Output High Voltage	I_O=-4mA, V_{ID}=-50mV		V_{CC}-0.4			V
V_{OL}	Receiver Output Low Voltage	I_O=4mA, V_{ID}=-200mV				0.4	V
I_{OZR}	Three-State Output Current at Receiver	0.4V≤V_O≤2.4V				±1	μA
R_{IN}	Receiver Input Resistance	-7V≤V_{CM}≤12V		12			kΩ
I_{OSR}	Receiver Output Short-Circuit Current	0V≤V_{RO}≤V_{CC}		±7		±95	mA
SUPPLY CURRENT							
I_{CC}	Supply Current	No load, $\overline{RE}$=DI=V_{CC}, DE=V_{CC}			500	900	μA
		No load, $\overline{RE}$=DI=GND, DE=GND			400	600	μA
I_{SHDN}	Supply Current in Shutdown Mode	DE=GND, $V_{\overline{RE}}$=V_{CC},DI=V_{CC} or GND			20	30	μA
ESD ELECTROSTATIC PROTECTION							
ESD	Electrostatic Protection (A/B pin)	Human Body Model		±15			kV
		Machine Mode		±800			V
		Contact Discharge IEC 61000-4-2		±12			kV
		Air Discharge IEC 61000-4-2		±15			kV

7 SWITCHING CHARACTERISTICS

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

Symbol	Parameter	Condition	MIN	TYP	MAX	UNIT
T_{DPLH}	Driver Input-to-Output	Figures 4 and 6, R_{DIFF}=54Ω, C_{L1}=C_{L2}=100pF		20	40	ns
T_{DPHL}				20	40	
T_{DSKEW}	Driver Output Skew | t_{DPLH} - t_{DPHL} |	Figures 4 and 6, R_{DIFF}=54Ω, C_{L1}=C_{L2}=100pF		-3	±10	ns
T_{DR}, T_{DF}	Driver Rise or Fall Time	Figures 4 and 6, R_{DIFF}=54Ω, C_{L1}=C_{L2}=100pF		14	25	ns
F_{MAX}	Maximum Data Rate		10			Mbps
T_{DZH}	Driver Enable to Output High	Figures 5 and 7, C_L=100pF, S2 closed			150	ns
T_{DZL}	Driver Enable to Output Low	Figures 5 and 7, C_L=100pF, S1 closed			150	ns
T_{DLZ}	Driver Disable Time from Low	Figures 5 and 7, C_L=15pF, S1 closed			100	ns
T_{DHZ}	Driver Disable Time from High	Figures 5 and 7, C_L=15pF, S2 closed			100	ns
T_{RPLH}, T_{RPHL}	Receiver Input to Output	Figures 8 and 10; | V_{ID} | ≥ 2.0V; rise and fall time of V_{ID} ≤ 15ns		50		ns
T_{RSKD}	| t_{RPLH} - t_{RPHL} | Differential Receiver Skew	Figures 8 and 10; | V_{ID} | ≥ 2.0V; rise and fall time of V_{ID} ≤ 15ns		0	±10	ns
T_{RZL}	Receiver Enable to Output Low	Figures 3 and 9, C_L=100pF, S1 closed		20	50	ns
T_{RZH}	Receiver Enable to Output High	Figures 3 and 9, C_L=100pF, S2 closed		20	50	ns
T_{RLZ}	Receiver Disable Time from Low	Figures 3 and 9, C_L=100pF, S1 closed		20	50	ns
T_{RHZ}	Receiver Disable Time from High	Figures 3 and 9, C_L=100pF, S2 closed		20	50	ns
T_{SHDN}	Time to Shutdown	(4)	50	200	600	ns
$T_{DZH(SHDN)}$	Driver Enable from Shutdown to Output High	Figures 5 and 7, C_L=15pF, S2 closed			250	ns
$T_{DZL(SHDN)}$	Driver Enable from Shutdown to Output Low	Figures 5 and 7, C_L=15pF, S1 closed			250	ns
$T_{RZH(SHDN)}$	Receiver Enable from Shutdown to-Output High	Figures 3 and 9, C_L=100pF, S2 closed			3500	ns
$T_{RZL(SHDN)}$	Receiver Enable from Shutdown to-Output Low	Figures 3 and 9, C_L=100pF, S1 closed			3500	ns

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

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

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

4：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.

8 FUNCTION TABLES

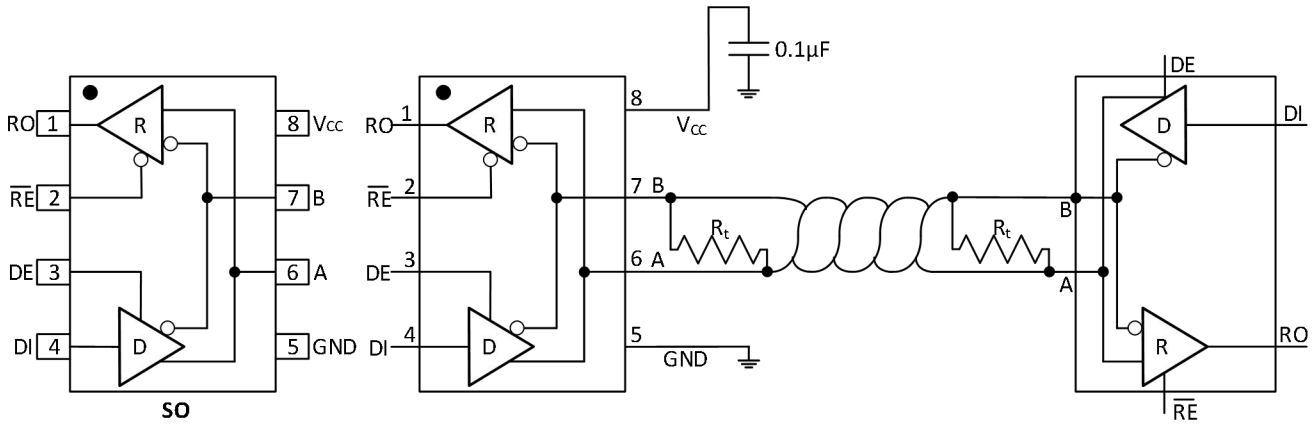


Figure 1.GM75176E typical half-duplex operating circuit

TRANSMITTING				
CONTROL		INPUTS	OUTPUTS	
$\overline{RE}$	DE	DI	B	A
X	1	1	0	1
X	1	0	1	0
0	0	X	Z	Z
1	0	X	Shutdown	
RECEIVING				
CONTROL		**INPUTS**	**OUTPUTS**	
$\overline{RE}$	DE	A - B	RO	
0	X	≥ -50mV	1	
0	X	≤ -200mV	0	
0	X	Open/Shorted	1	
1	1	X	Z	
1	0	X	Shutdown	

9 Detailed Description

9.1 Detailed Description

The GM75176E high - speed transceiver for RS-485/RS-422 communication contains a driver and a receiver. It has a fail-safe circuit that ensures the receiver outputs a logic high level when the receiver inputs are open - circuited or short-circuited. If all transmitters connected to the terminated bus are disabled (in a high-impedance state), the receiver will output a logic high level. The GM75176E is equipped with a low-slew-rate driver, which can reduce EMI and reflections caused by improper cable termination, enabling error-free data transmission at speeds of up to 10Mbps. The GM75176E is a half-duplex transceiver.

9.2 Receiver Input Filtering

The receivers of the GM75176E when operating in more than 10Mbps mode, incorporate input filtering in addition to input hysteresis. This filtering enhances noise immunity with differential signals that have very slow rise and fall times. Receiver propagation delay increases by 25% due to this filtering.

9.3 Thermal Down Protection

Thermal shutdown prevents thermal runaway. When the silicon die temperature exceeds 120°C, the entire chip shuts down. When the temperature drops below 100°C, the chip is enabled again automatically.

9.4 Fail-Safe

The GM75176E guarantees a logic-high receiver output when the receiver inputs are shorted or open, or when they are connected to a terminated transmission line with all drivers disabled. This is done by setting the receiver threshold between -50mV and -200mV. If the differential receiver input voltage (A - B) is greater than or equal to -50mV, RO is logic high. If A - B is less than or equal to -200mV, RO is logic low. In the case of a terminated bus with all transmitters disabled, the receiver's differential input voltage is pulled to 0V by the termination. With the receiver thresholds of the GM75176E , this results in a logic high with a 50mV minimum noise margin. Unlike previous fail-safe devices, the -50mV to -200mV threshold complies with the ±200mV EIA/TIA-485 standard.

9.5 32 Transceivers on the Bus

The standard RS-485 receiver input impedance is 12kΩ(one-unit load), and the standard driver can drive up to 32 unit loads. The GM75176E of transceivers have a 1-unit-load receiver input impedance (12kΩ), allowing up to 32 transceivers to be connected in parallel on one communication line. Any combination of these devices and/or other RS-485 transceivers with a total of 32 unit loads or less can be connected to the line.

9.6 Reduced EMI and Reflections

The low slew rate driver of GM75176E can reduce EMI and decrease reflections caused by improper cable termination. The rise time of the driver is related to the length of the terminal, and the following equation represents their relationship: Length = $T_{RISE}/(10\times1.5ns/F_t)$, where T_{RISE} is the rise time of the driver.

10 TEST CIRCUITS AND WAVEFORMS

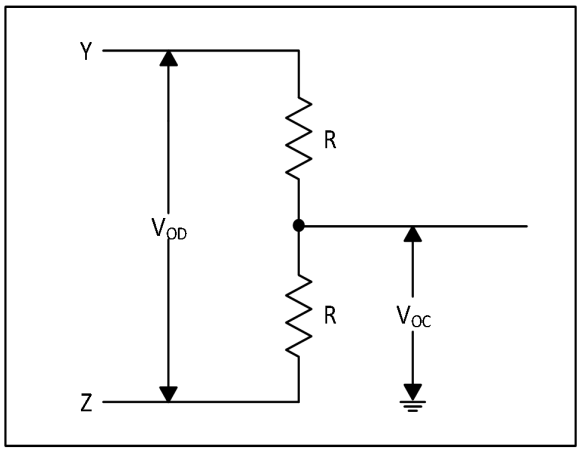


Figure 2.Driver DC test load

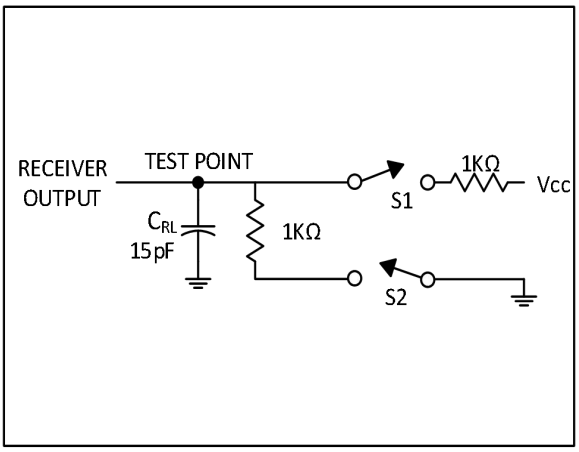


Figure 3. Receiver enable and disable timing test load

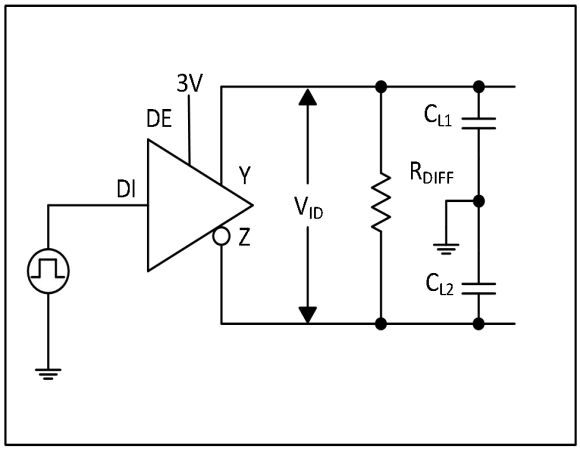


Figure 4. Driver timing test load

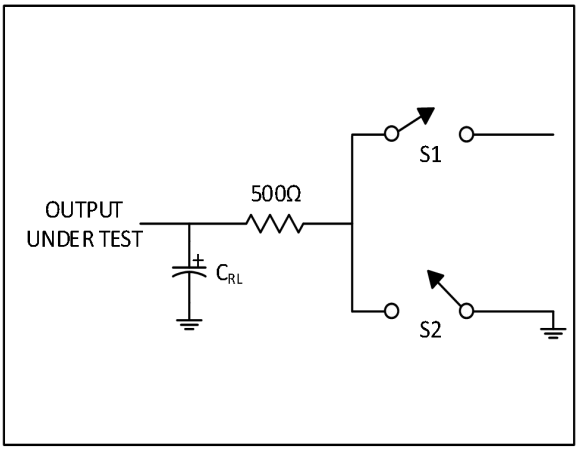


Figure 5. Driver enable and disable timing test load

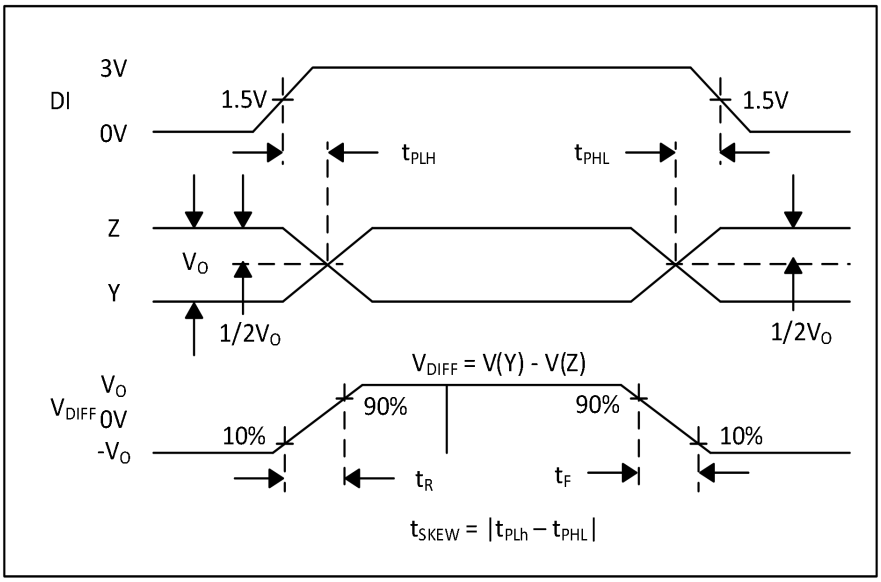


Figure 6. Driver propagation delays

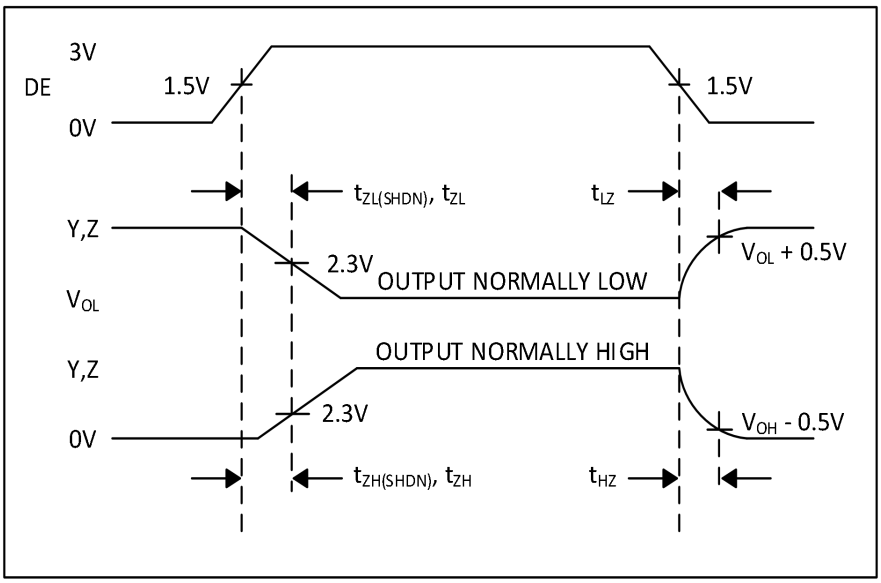


Figure 7. Driver enable and disable time

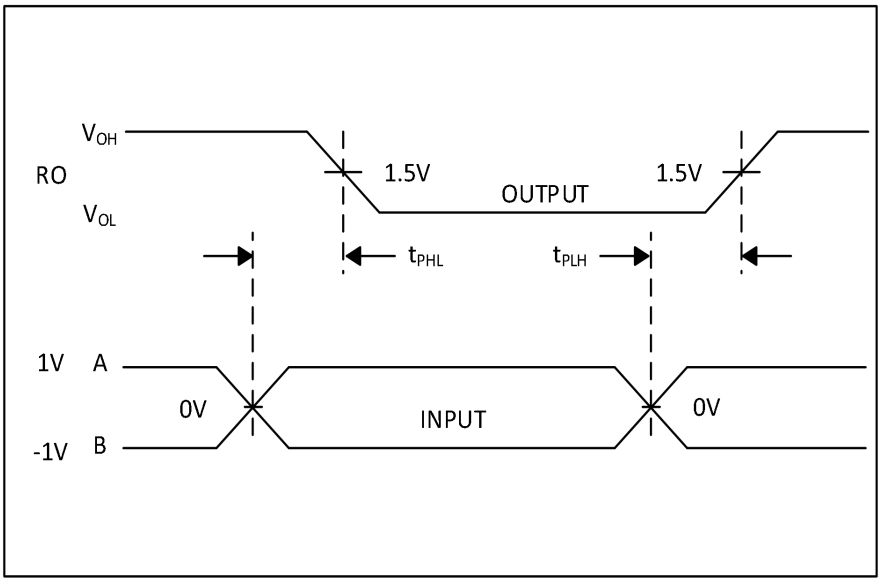


Figure 8. Receiver propagation delays

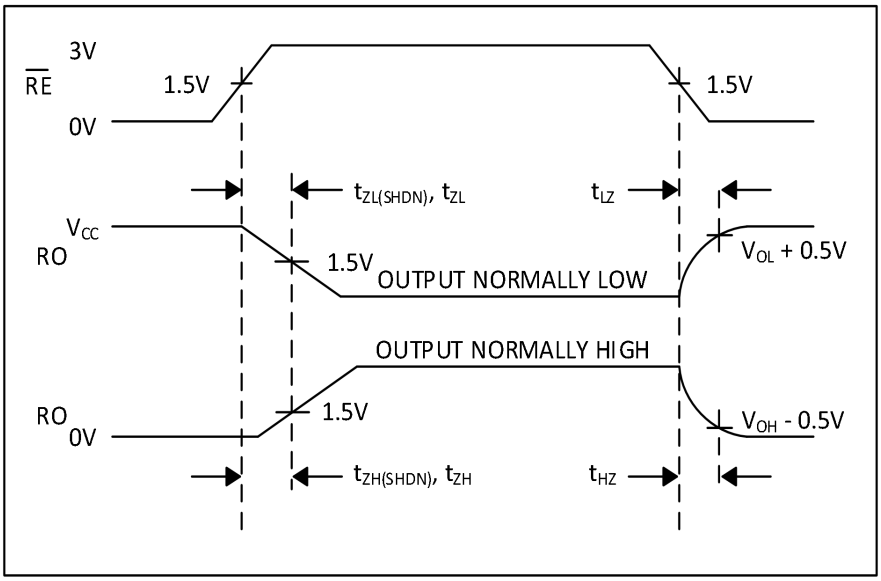


Figure 9. Receiver enable and disable time

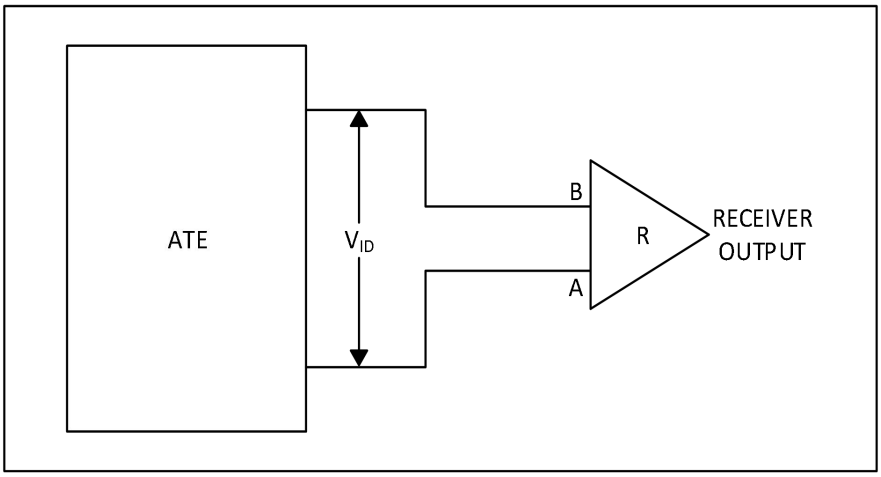


Figure 10. Receiver propagation delay test circuit

11 Typical Application

The GM75176E transceiver is designed for bidirectional data messages on multipoint bus transmission lines. Figure 11 shows a typical network application circuit. Under low-speed conditions, these devices can operate as linear repeaters for cable lengths exceeding 4000 feet. However, at high-speed rates (e.g., 10Mbps), the transmission line length must be limited to within 100 feet.To minimize reflection, the terminal matching should be performed at both ends of the transmission line with their characteristic impedance, and the length of the branch line outside the main trunk should be as short as possible.

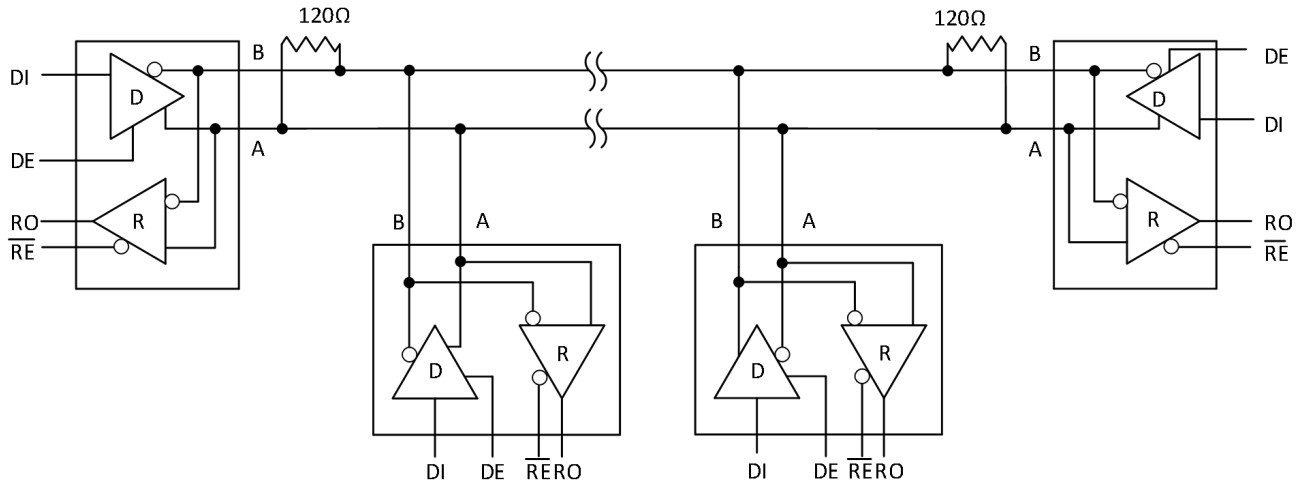
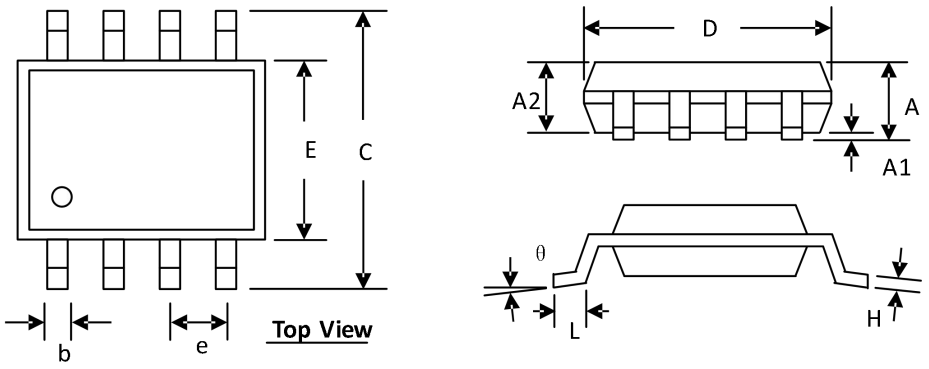


Figure11.Typical polarity-adaptive RS-485 network application diagram

Tel: (+86) 13135660803
Email: sales@gmmicro.com

PACKAGE DIMENSION SOP8



SYMBOLS	DIMENSION (MM)		DIMENSION (INCH)	
	MIN	MAX	MIN	MAX
A	1.300	1.752	0.051	0.069
A1	0.000	0.203	0.000	0.008
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
C	5.790	6.200	0.228	0.244
D	4.700	5.110	0.185	0.201
E	3.800	4.000	0.150	0.157
e	1.270 BSC		0.050 BSC	
H	0.170	0.254	0.007	0.010
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

Order Information

Order number	Package	Marking information	Operation Temperature Range	MSL Grade	Ship, Quantity	Green
GM75176E	SOP8	GM75176E	-40 to 85°C	3	T&R,2500	Rohs