

1 FEATURES

- Enhanced ESD protection for A/B pins:
±15kV HBM protection
±12kV IEC 6100-4-2, Contact Discharge
±15kV IEC 6100-4-2, Air-Gap Discharge
- True Fail-Safe Receiver While Maintaining EIA/TIA-485 Compatibility
- Enhanced Slew-Rate Limiting Facilitates Error-Free Data Transmission
- 1/8-Unit Load, Allowing Up to 256 Transceivers on the Bus
- 8-Pin SO Package
- Bus polarity auto-adaptation feature

2 APPLICATIONS

- Industrial Controls
- Utility Meters
- EMI-sensitive transceiver application
- Security System
- Lighting System

3 DESCRIPTION

The GM3085N is a high-speed transceiver designed for half-duplex communication in RS-485/RS-422 applications. It integrates one driver and one receiver. The GM3085N features a polarity adaptive control circuit, which allows the receiver to automatically detect and match the polarity of the driver in a communication system composed of RS-485 chips. This feature enables the polarity adaptive chip GM3085N to establish network connections without the need to distinguish between A/B bus polarities, unlike traditional RS-485 chips that require polarity matching for network connections.

The GM3085N features ±15kV human body mode ESD protection as well as fail-safe circuitry, and it features reduced slew-rate drivers that minimize EMI and reduce reflections caused by improperly terminated cables, allowing error-free transmission up to 1Mbps. In addition, the GM3085N is designed 1/8 unit load receiver input impedance, which can connect 256 devices on a bus at least.

Block Diagram

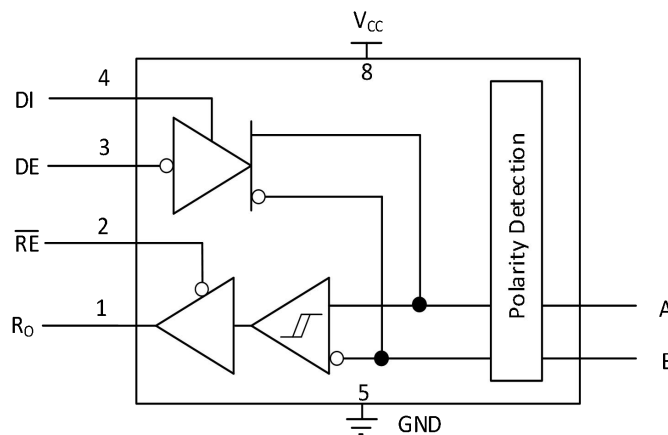


Figure1. Block Diagram

4 Pin Configuration and Functions

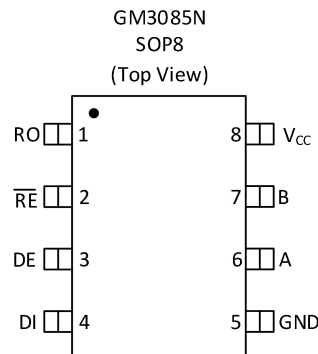


Figure2.pin-out

No.	Pin	Description
1	RO	Receiver Output. When \overline{RE} is low and if $(A-B) \geq -50\text{mV}$, RO is high; if $(A-B) \leq -200\text{mV}$, RO is low.
2	\overline{RE}	Receiver Output Enable. Drive \overline{RE} low to enable the RO; Drive \overline{RE} high to let the RO in high-impedance; Drive \overline{RE} high and DE low to put the part in shutdown.
3	DE	Driver Output Enable. Drive DE high to enable the output; Drive DE low to let the RO in high-impedance; Drive \overline{RE} high and DE low to put the part in shutdown.
4	DI	Driver Input. Drive DI low to force non-inverting output low and inverting output high. Drive DI high to force non-inverting output high and inverting output low.
5	GND	Ground
6	A	Receiver input and driver output (polarity adaptive)
7	B	Receiver input and driver output (polarity adaptive)
8	V _{CC}	Supply voltage: $3.0\text{V} \leq V_{CC} \leq 5.5\text{V}$

5 Absolute Maximum Ratings

Parameter	Parameter	Rating	UNIT
V _{CC}	Supply Voltage	+7	V
/RE, DE	Control Input Voltage	-0.3 to (V _{CC} +0.3)	V
DI	Transmitter Input	-0.3 to (V _{CC} +0.3)	V
A, B	Receiver Input Voltage	±13	V
A, B	Transmitter Output Voltage	±13	V
RO	Receiver Output Voltage	-0.3 to (V _{CC} +0.3)	V
T _{OP}	Operating Temperature	-40 to +85	°C
T _{STO}	Storage Temperature	-65 to +150	°C
T _{WE}	Weld Temperature	300	°C

6 DC Electrical Characteristics

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

Symbol	Parameter	Test Conditions	MIN	TYP	MAX	UNIT
Transmitter						
V _{CC}	Supply voltage		3.0		5.5	V
V _{OD1}	Differential Transmitter Output	No load, Fig.3 (No load)	1.5		5	V
V _{OD2}	Differential Transmitter Output	Fig.3, R=50Ω(RS-422)	2.0		5	V
		Fig.3, R=27Ω(RS-485)	1.5		5	V
ΔV _{OD}	Change in Magnitude of Differential Output Voltage ⁽²⁾	Fig.3, R=50Ω or R=27Ω			0.2	V
V _{OC}	Transmitter Common- Mode Output Voltage	Fig.3, R=50Ω or R=27Ω	1		3	V
ΔV _{OC}	Change in Magnitude of Common- Mode Voltage ⁽²⁾	Fig.3, 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			100		mV
I _{IN4}	Input Current for A and B (half-duplex)	DE=GND, V _{CC} =GND or 5.25V	V _{IN} =12V		125	μA
			V _{IN} =-7V	-75		
I _{OSD}	Transmitter Short-Circuit Output Current	\overline{RE} =DE=DI=V _{CC} , A pin short to B pin	-150		150	mV
Receiver						
V _{TH}	Receiver Differential Threshold Voltage	-7V ≤ V _{CM} ≤ 12V	-100		+100	mV
ΔV _{TH}	Receiver Input Hysteresis			30		mV
V _{OH}	Receiver Output High Voltage	I _O =-4mA, V _{ID} =-50mV	V _{CC} -1.5			V
V _{OL}	Receiver Output Low Voltage	I _O =4mA, V _{ID} =-200mV			0.4	V
I _{OZR}	Three- State Output Current	0.4V ≤ V _O ≤ 2.4V			±1	μA
R _{IN}	Receiver Input Resistance	-7V ≤ V _{CM} ≤ 12V	96			kΩ
I _{OSR}	Receiver Output Short-Circuit Current	0V ≤ V _{RO} ≤ V _{CC}	±7		±95	mV
Supply Current						
I _{CC}	Supply current	No load, \overline{RE} =DI=V _{CC} , DE=V _{CC}		268	800	μA
		No load, \overline{RE} =DI=GND, DE=GND		245	800	μA
Polarity adaptive discrimination time						
T _{DPF}	Polarity adaptive discrimination time	\overline{RE} =DE=GND		72		ms
ESD Protection						
ESD	ESD Protection (A, B)	Human Body Mode	±15			kV
		Machine Mode	±800			V
		Contact Discharge IEC 61000-4-2	±12			kV
		Air-Gap Discharge IEC 61000-4-2	±15			kV
ESD	All Other Pins	Human Body Mode	±6			kV
		Machine Mode	±400			V

1.All currents into the device are positive, and all currents out of the device are negative; all voltages, unless otherwise specified, are referenced to ground.

2.When the DI input changes state, ΔV_{OD} and ΔV_{OC} change for V_{OD} and V_{OC} respectively.

3.Maximum current is used only for peak current before feedback current limiting and minimum current is used during current limiting.

7 Switching Characteristics

($V_{CC}=+5V\pm 5\%$, $T_A=T_{MIN}\sim T_{MAX}$, Typical values are at $V_{CC}=+5V$, $T_A=25^\circ C$; unless otherwise specified)

Symbol	Parameter	Conditions	MIN	TYP	MAX	UNITS
T_{DPLH}, T_{DPHL}	Transmitter Input to Output	Fig.5 and Fig.8, $R_{DIFF}=54\Omega$ $C_{L1}=C_{L2}=100pF$	250	720	900	ns
			250	720	900	
T_{DHKEW}	Transmitter Output Skew $ t_{DPLH} - t_{DPHL} $	Fig.5 and Fig.8, $R_{DIFF}=54\Omega$ $C_{L1}=C_{L2}=100pF$		-3	± 100	ns
t_{DR}, t_{DF}	Transmitter Rise or Fall Time	Fig.5 and Fig.8, $R_{DIFF}=54\Omega$ $C_{L1}=C_{L2}=100pF$	200	530	750	ns
F_{MAX}	Data Rate				1000	kbps
T_{DZH}	Transmitter Enable to Output High	Fig.6 and Fig.9, $C_L=100pF$ S2 closed			2500	ns
T_{DZL}	Transmitter Enable to Output Low	Fig.6 and Fig.9, $C_L=100pF$ S1 closed			2500	ns
T_{DLZ}	Transmitter Disable Time from Low	Fig.6 and Fig.9, $C_L=15pF$ S1 closed			100	ns
T_{DHZ}	Transmitter Disable Time from High	Fig.6 and Fig.9, $C_L=15pF$ S2 closed			100	ns
T_{RPLH}	Receiver Input to Output	Fig.9 and Fig.12, $ VID \geq 2.0V$ rise and fall time of $VID\leq 15ns$		127	200	ns
T_{RPHL}						
T_{RSKD}	Different Receiver Skew $ t_{DPLH} - t_{DPHL} $	Fig.9 and Fig.12, $ VID \geq 2.0V$ rise and fall time of $VID\leq 15ns$		3	± 30	ns
T_{RZL}	Receiver Enable to Output Low	Fig.4 and Fig.11, $C_L=100pF$ S1 closed		20	50	ns
T_{RZH}	Receiver Enable to Output High	Fig.4 and Fig.11, $C_L=100pF$ S2 closed		20	50	ns
T_{RLZ}	Receiver Disable from Output Low	Fig.4 and Fig.11, $C_L=100pF$ S1 closed		20	50	ns
T_{RHZ}	Receiver Disable from Output High	Fig.4 and Fig.11, $C_L=100pF$ S2 closed		20	50	ns
T_{SHDN}	Time to Shutdown		50	200	600	ns
$T_{DZH(SHDN)}$	Driver Enable from Shutdown to Output High	Fig.6 and Fig.9, $C_L=15pF$ S2 closed			4500	ns
$T_{DZL(SHDN)}$	Driver Enable from Shutdown to Output Low	Fig.6 and Fig.9, $C_L=15pF$ S1 closed			4500	ns
$T_{RZH(SHDN)}$	Receiver Enable from Shutdown to Output High	Fig.4 and Fig.11, $C_L=100pF$ S2 closed			3500	ns
$T_{RZL(SHDN)}$	Receiver Enable from Shutdown to Output Low	Fig.4 and Fig.11, $C_L=100pF$ S1 closed			3500	ns

8 Test Circuits and Waveforms

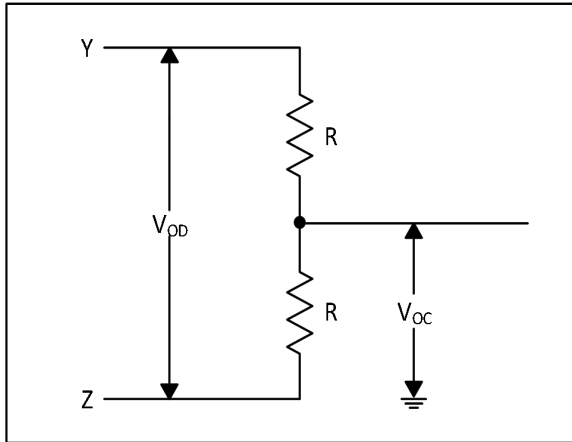


Figure 3. Driver DC Test Load

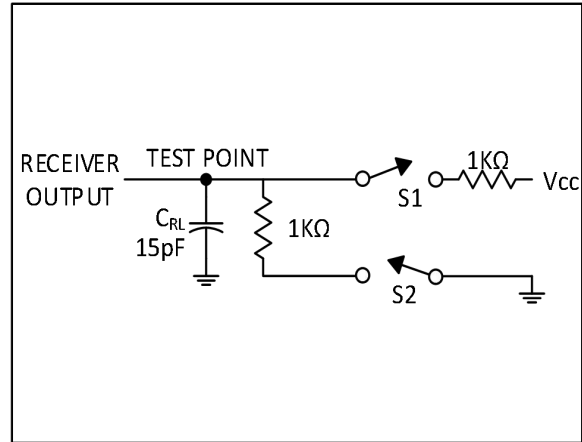


Figure 4. Receiver enable/disable timing test load

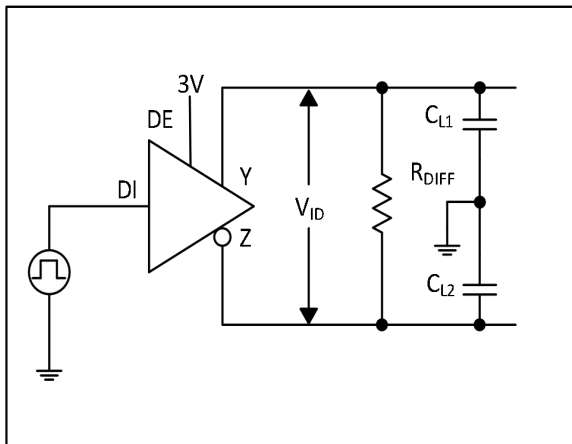


Figure 5. Transmitter timing test load

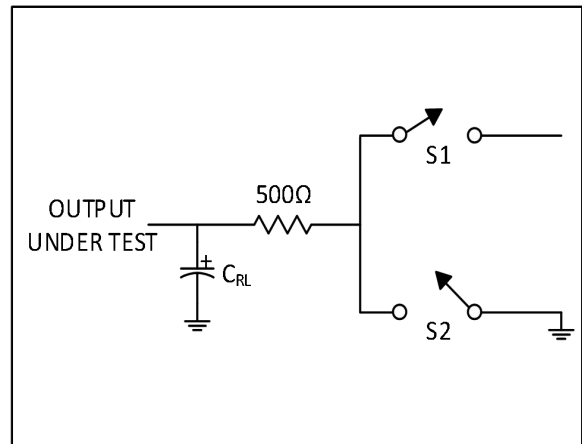


Figure 6. Transmitter enable/disable timing test load

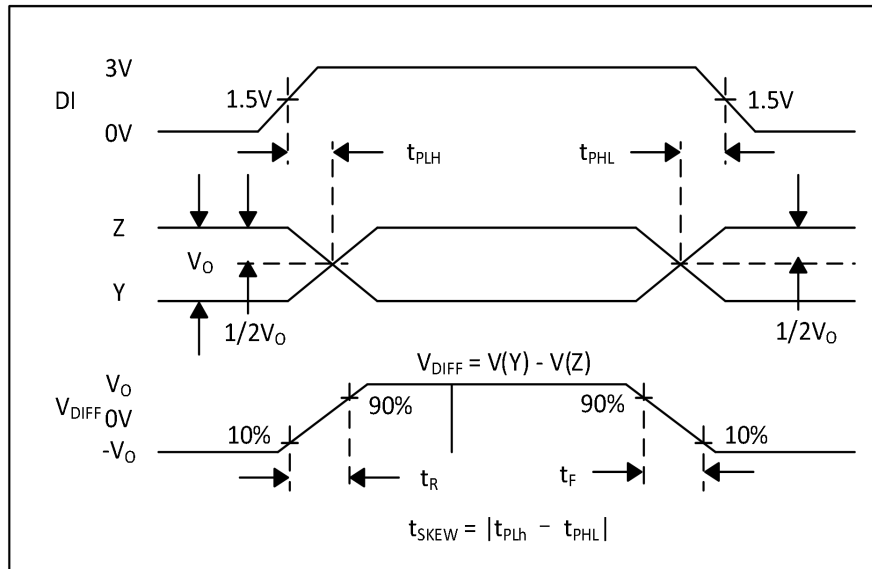


Figure 7. Transmitter propagation delays

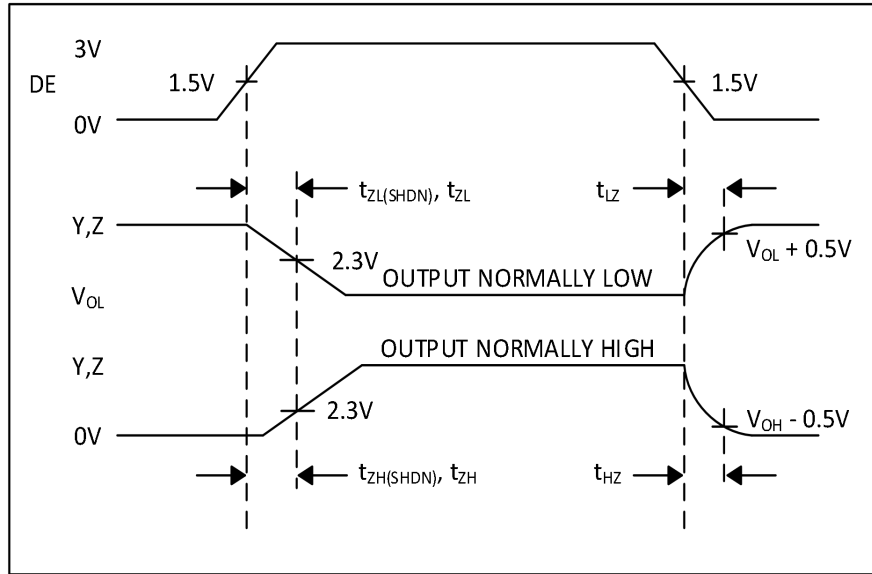


Figure 8. Transmitter enable and disable time

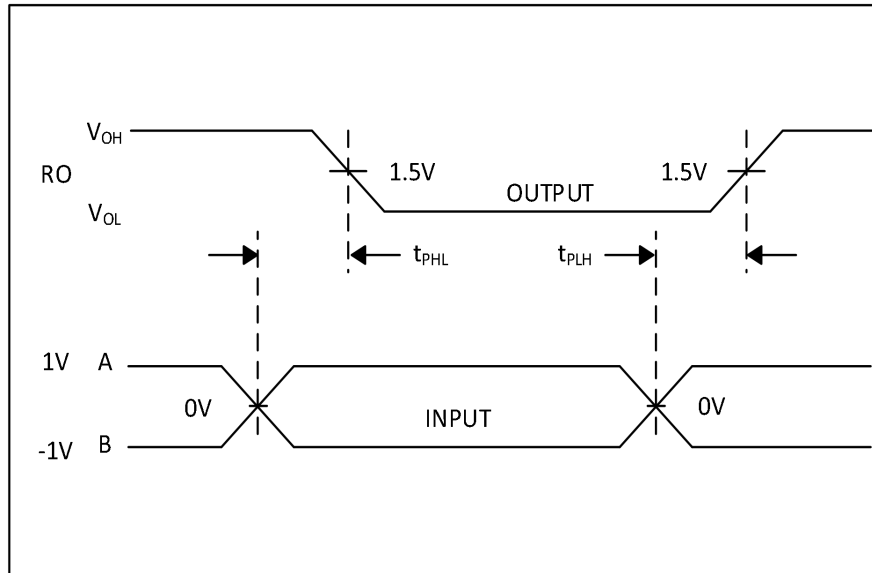


Figure 9. Receiver propagation delays

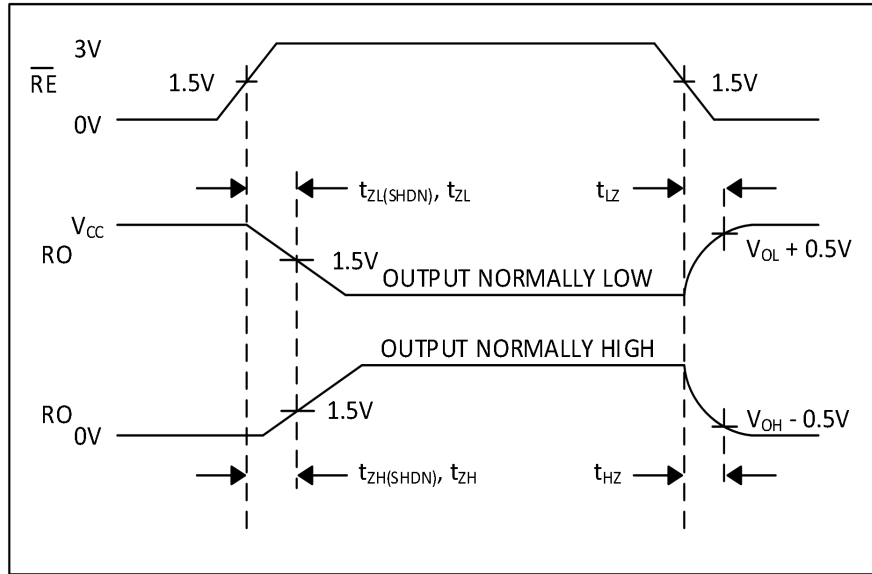


Figure 10. Receiver enable and disable time

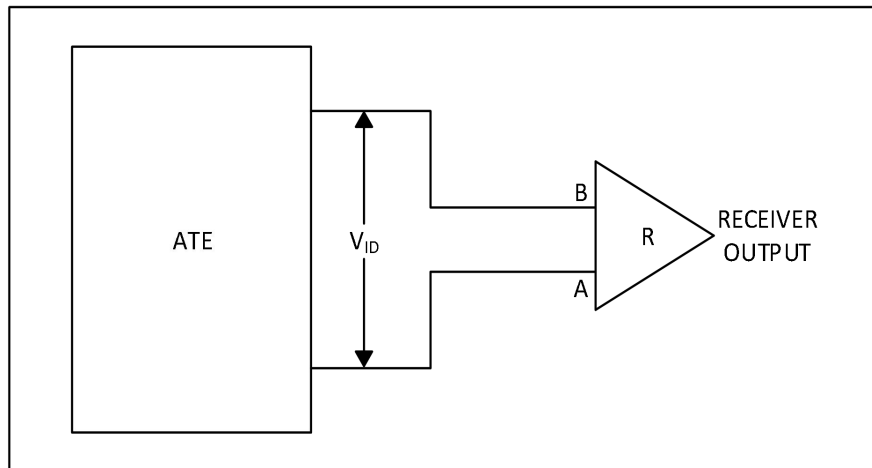


Figure 11. Receiver-Propagation-Delay Test Circuit

9 Function Tables

TRANSMITTING			
CONTROL	INPUT	OUTPUT	
DE	DI	A	B
NORMAL MODE			
H	H	H	L
H	L	L	H
L	X	Z	Z
POLARITY-CORRECTING MODE			
H	H	L	H
H	L	H	L
L	X	Z	Z

RECEIVING			
CONTROL		INPUTS	OUTPUTS
$\overline{\text{RE}}$	DE	A - B	RO
L	X	$\geq +100\text{mV}$	H
L	X	$\leq -100\text{mV}$	L ⁽¹⁾ H ⁽²⁾
L	X	open	H ⁽²⁾
L	X	short	H ⁽²⁾
H	H	X	Z
H	L	X	Z

(1) Polarity judgment within time

(2) Polarity judgment out of time

10 Detailed Description

The GM3085N high speed transceiver for RS-485/RS-422 communications contains a driver and receiver. A fail-safe circuit is provided to ensure that the receiver outputs a logic high level when the receiver input is open or shorted. If all transmitters connected to the bus are disabled (high resistance), the receiver will output a logic high. The GM3085N has a low-swing driver that reduces EMI and reflections due to improper cable termination, enabling error-free data transmission up to 1Mbps. The GM3085N is a half-duplex transceiver.

Receiver Input Filtering

When operating the GM3085N in high-speed mode, its receiver includes an input filter function in addition to input hysteresis. This filtering feature improves noise rejection of slow rising and falling differential signals. The filter increases the receiver transmission delay by 25%.

256 Transceivers on the Bus

The standard RS-485 receiver input impedance is 12k Ω (1-unit load), and the standard driver can drive up to 32-unit loads. The GM13487E/GM13488E have a 1/8-unit load receiver input impedance (96k Ω), allowing up to 256 transceivers to be connected in parallel on one communication line. Any combination of these devices, as well as other RS-485 transceivers with a total of 32-unit loads or fewer, can be connected to the line.

Reduced EMI and Reflections

The low slew rate driver of GM3085N 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: $Length = t_{RISE} / (10 \times 1.5ns/ft)$.

Driver output Protection

The output stage uses a foldback current limiting method to prevent excessive output current and high power consumption caused by faults or bus conflicts. The foldback current limiting at the output stage can provide fast short-circuit protection across the entire common-mode voltage range (refer to typical operating characteristics).

Bus Polarity Adaptive Function

In the RS-485 networking system application, the RS-485 chip as the host (driver) is generally connected to the RS-485 chip as the slave (receiver) through two buses. In traditional RS-485 systems, the polarity of these two buses needs to be differentiated, and the polarity of all RS-485 chip bus ports in the system needs to be matched.

The GM3085N has a built-in polarity adaptive circuit, and the RS-485 system composed of this chip does not need to differentiate and match the buses. After the system is powered on, the built-in chip's polarity adaptive circuit can automatically detect the bus polarity of the driver in the system, and after 72ms the receiver in the system automatically adjusts the polarity of the bus port to match with the driver's bus polarity.

The GM3085N transceiver is designed for bi-directional data communication over a multi-point bus transmission line. [Figure 13](#) shows its typical network application circuit. In this system, the driver's A and B ports need to be hooked up to the appropriate pull-up and pull-down resistors as appropriate (thus determining the bus polarity), while the receiver automatically recognizes and matches them without hooking up pull-up and pull-down resistors to the bus.

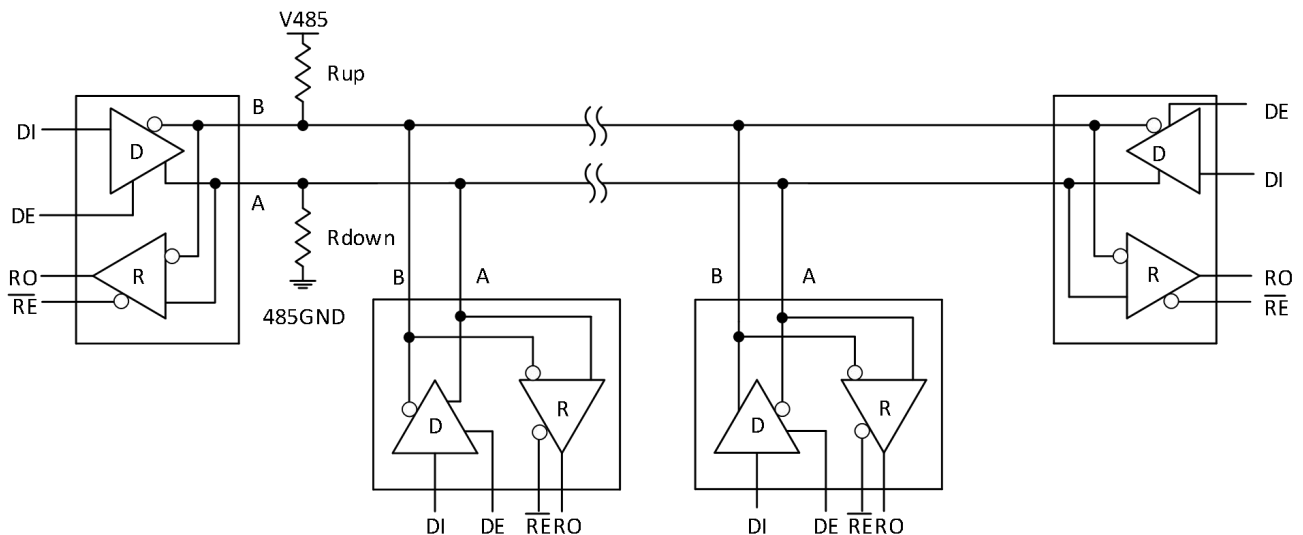
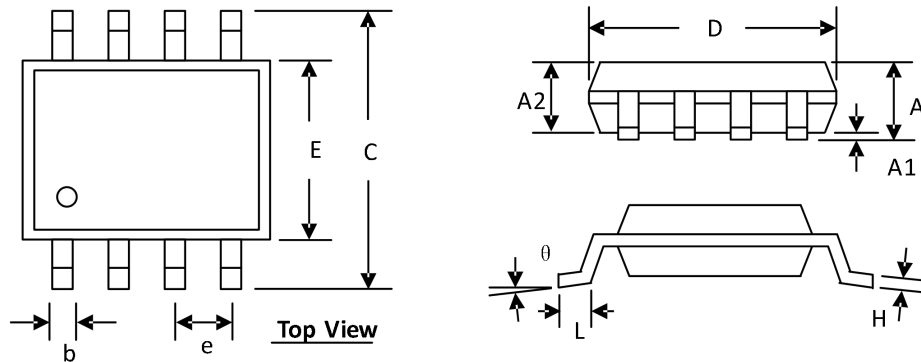


Figure12. Typical Polarity-Adaptive RS-485 Network Application Diagram

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
GM3085N	SOP8	GM3085N	-40 to 85°C	3	T&R, 2500	Rohs