General Description

The HG3085M +5V, half-duplex, ±15kV ESD-protected RS-485/RS-422-compatible transceivers feature one driver and one receiver. The HG3085M include a hot-swap capability to eliminate false transitions on the bus during power-up or live insertion.

The HG3085M features reduced slew-rate drivers that minimize EMI and reduce reflections caused by improperly terminated cables, allowing error-free transmission up to 500kbps.

The HG3085M feature a 1/8-unit load receiver input impedance, allowing up to 256 transceivers on the bus. These devices are intended for half-duplex communications. All driver outputs are protected to ±15kV ESD using the Human Body Model.

The HG3085M is available in an 8-pin SO package. The devices operate over the extended -40 ℃ to +85 ℃ temperature range.

Features

- +5V Operation
- Hot-Swappable for Telecom Applications
- Enhanced Slew-Rate Limiting Facilitates Error-Free Data Transmission
- Extended ESD Protection for RS-485 I/O Pins ±15kV Human Body Model
- 1/8Unit Load , Allowing Up to 256Transceivers on the Bus
- 8 Pin-SOP/DIP Package

Applications

- Isolated RS-485 Interfaces
- Utility Meters
- Industrial Controls
- Industrial Motor Drives
- Automated HVAC Systems

ABSOLUTE MAXIMUM RATINGS

(All voltages referenced to GND.)

Supply Voltage VCC..+6V

DE, RE, DI..-0.3V to +6

A, B.. -8V to +13V

Short-Circuit Duration (RO, A, B) to GND ....Continuous

Continuous Power Dissipation (TA = +70°C)

8-Pin SO (derate 5.9mW/°C above +70°C).................471mW

Operating Temperature Range ....-40°C to +85°C

Junction Temperature..+150°C

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

Lead Temperature (soldering 10s) ....+300°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 in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Ordering Information

PART	TEMP. RANGE	PIN-PACKAGE
HG3085E	-40℃～+85℃	DIP8
HG3085M	-40℃～+85℃	SOP8

DC ELECTRICAL CHARACTERICS

(VCC = +5V ±5%, TA = TMIN to TMAX, unless otherwise noted. Typical values are at VCC = +5V and TA = +25 ℃.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DRIVER						
Differential Driver Output (no load)	V_{OD1}	Figure1			5	V
Differential Driver Output	V_{OD2}	Figure1,R = 50Ω (RS-422)		2.0		V
		Figure1,R = 27Ω (RS-485)		1.5		
Change in Magnitude of Differential Output Voltage (Note 2)	ΔV_{OD}	Figure1,R =50Ωor R= 27Ω		0.2		V
Driver Common-Mode Output Voltage	V_{OC}	Figure1,R=50Ωor R = 27Ω		3		V
Change In Magnitude of Common-Mode Voltage (Note 2)	ΔV_{OC}	Figure1,R=50Ωor R = 27Ω		0.2		V
Input High Voltage	V_{IH1}	DE, DI, RE,		2.0		V
Input Low Voltage	V_{IL1}	DE, DI, RE,		0.8		V
DI Input Hysteresis	V_{HYS}	WS3085		100		mV
Input Current	I_{IN1}	DE, DI, RE		±2		µA
Input Current (A and B)	I_{IN4}	DE = GND, V_{CC}=GND or 5.25V; V_{IN}=12V		125		µA
		DE = GND, V_{CC}=GND or 5.25V; V_{IN} = -7V		-75		
Driver Short-Circuit Output Current (Note 3)	V_{OD1}	-7V ≤ V_{OUT} ≤ V_{CC}		-250		mV
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} = -200mV;		Vcc-1.5		V
Receiver Output Low Voltage	V_{OL}	I_O = -4mA, V_{ID} = -50mV		0.4		V
Three-State Output Current at Receiver	I_{OZR}	0.4V ≤ V_O ≤ 2.4V		±1		µA
Receiver Input Resistance	R_{IN}	-7V ≤ V_{CM} ≤ +12V		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, RE =DI=GND or V_{CC}; DE = V_{CC}		530	900	µA
		No load, RE =DI=GND or V_{CC}; DE = GND		500	600	

SWITCHING CHARACTERISTICS

(VCC = +5V ±5%, TA = TMIN to TMAX, unless otherwise noted. Typical values are at VCC = +5V and TA = +25 ℃.)

PARAMETER	SYMBOL	CONDITIONS	MIN TYP MAX	UNITS
Driver Input to Output	t_{DPLH}	Figures3 and 5, R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF	250 720 1000	ns
	t_{DPHL}		250 720 1000	
Driver Output Skew | t_{DPLH} - t_{DPHL} |	t_{DSKEW}	Figures 3 and 5, R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF	-3 ±100	ns
Driver Rise or Fall Time	t_{DR}, t_{DF}	Figures 3 and 5, R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF	200 530 750	ns
Maximum Data Rate	f_{MAX}		500	kbps
Driver Enable to Output High	t_{DZH}	Figures4 and 6, C_L = 100pF, S2 closed	2500	ns
Driver Enable to Output Low	t_{DZL}	Figures4 and 6,C_L= 100pF, S1 closed	2500	ns
Driver Disable Time from Low	t_{DLZ}	Figures 4 and 6, C_L = 15pF, S1 closed	100	ns
Driver Disable Time from High	t_{DHZ}	Figures 4 and 6, C_L = 15pF, S2 closed	100	ns
Receiver Input to Output	t_{RPLH}, t_{RPHL}	Figures 7 and 9; | V_{ID} | ≥ 2.0V;rise and fall time of V_{ID} ≤ 15ns	127 200	ns
| t_{RPLH} - t_{RPHL} | Differential Receiver Skew	t_{RSKD}	Figures 7 and 9; | V_{ID} | ≥ 2.0V;rise and fall time of V_{ID} ≤ 15ns	3 ±30	ns
Receiver Enable to Output Low	t_{RZL}	Figures 2 and 8, C_L = 100pF, S1 closed	20 50	ns
Receiver Enable to Output High	t_{RZH}	Figures 2 and 8, C_L = 100pF, S2 closed	20 50	ns
Receiver Disable Time from Low	t_{RLZ}	Figures 2 and 8 , C_L = 100pF, S1 closed	20 50	ns
Receiver Disable Time from High	t_{RHZ}	Figures 2 and 8, C_L = 100pF, S2 closed	20 50	ns
Time to Shutdown	t_{SHDN}	(Note 4)	50 200 600	ns
Driver Enable from Shutdown to Output High	$t_{DZH(SHDN)}$	Figures 4 and 6, C_L = 15pF, S2 closed	4500	ns
Driver Enable from Shutdown to Output Low	$t_{DZL(SHDN)}$	Figures 4 and 6, C_L = 15pF, S1 closed	4500	ns
Receiver Enable from Shutdown to Output High	$t_{RZH(SHDN)}$	Figures 2 and 8, C_L = 100pF, S2 closed	3500	ns
Receiver Enable from Shutdown to Output Low	$t_{RZL(SHDN)}$	Figures 2 and 8, C_L = 100pF, S1 closed	3500	ns

Note 4: The device is put into shutdown by bringing 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

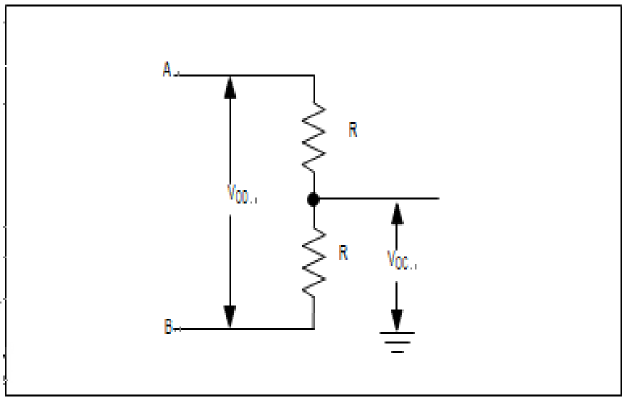


Figure 1. Driver DC Test Load

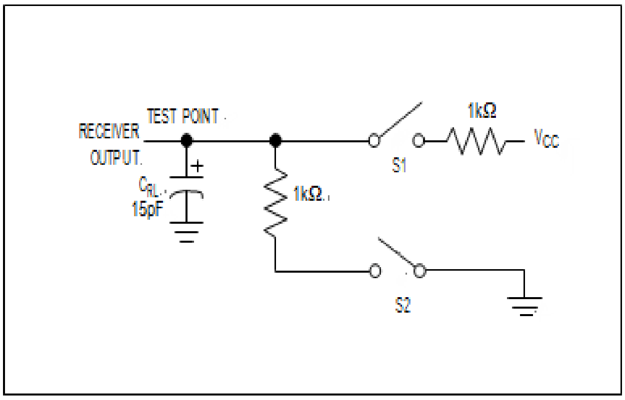


Figure 2. Receiver Enable/Disable Timing Test Load

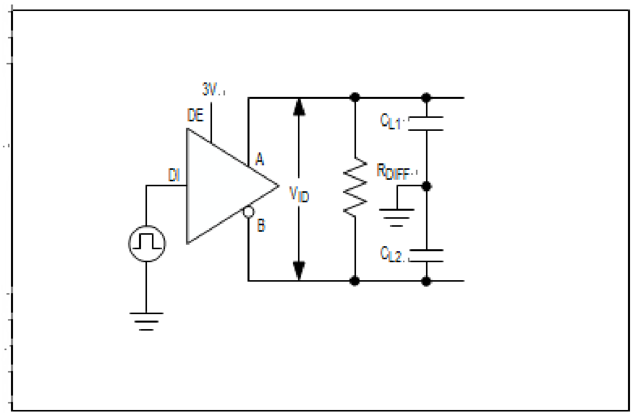


Figure 3 Driver Timing Test Circuit

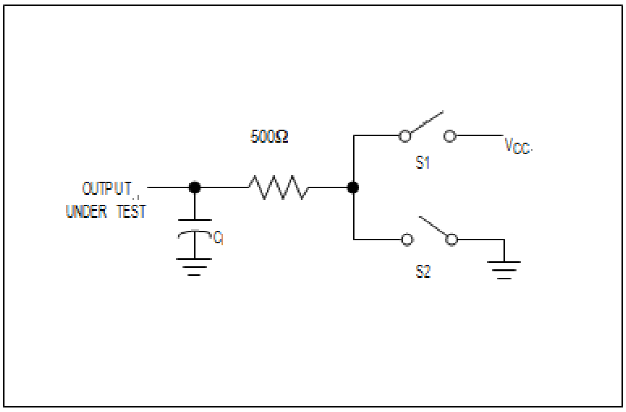
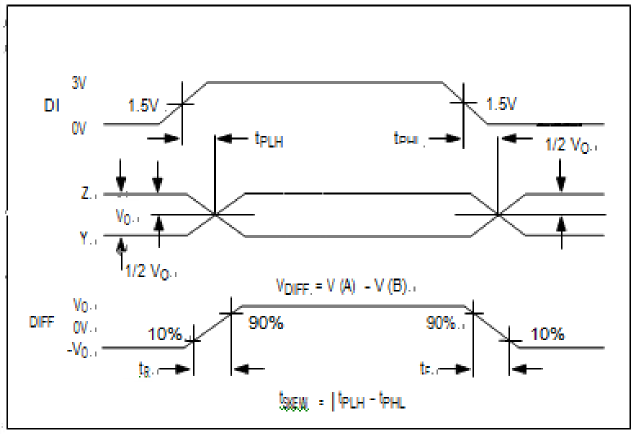


Figure 4 Driver Enable/Disable Timing Test Load



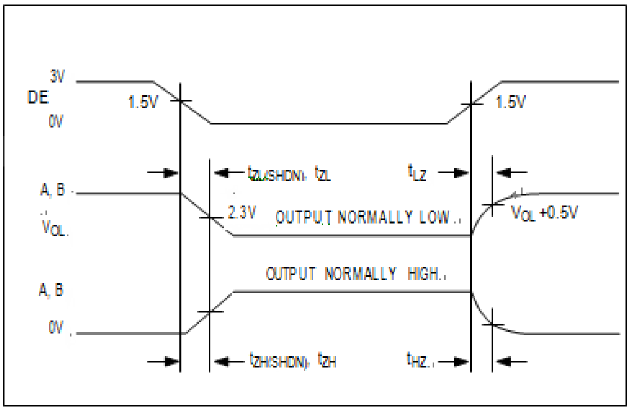


Figure 5 Driver Propagation Delays

Figure 6. Driver Enable and Disable Times

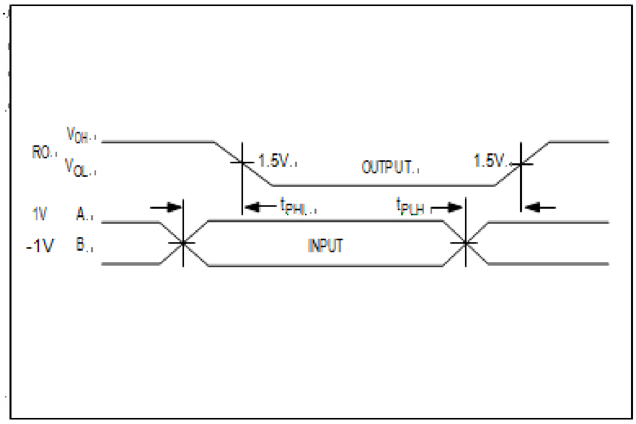


Figure 7. Receiver Propagation Delays

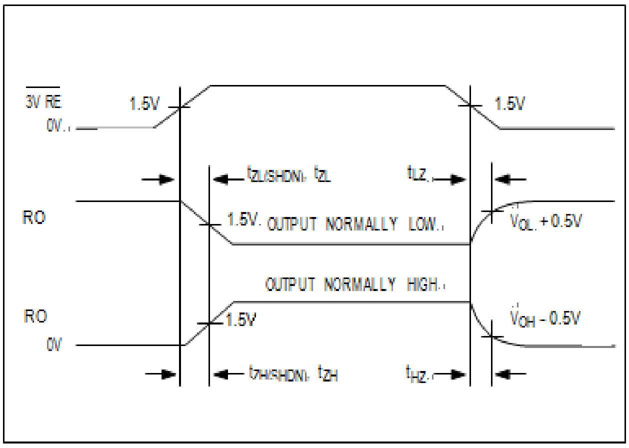


Figure 8. Receiver Enable and Disable Times

Pin Description

PIN	NAME	FUNCTION
1	RO	Receiver Output. When RE is low and if A - B ≥ -50mV, RO will be high; if A - B ≤ -200mV, RO will be low.
2	RE	Receiver Output Enable. Drive RE low to enable RO; RO is high impedance when RE is high. Drive RE high and DE low to enter low-power shutdown mode. RE is a hot-swap input (see the *Hot-Swap Capability* section for more details).
3	DE	Driver Output Enable. Drive DE high to enable driver outputs. These outputs are high impedance when DE is low. Drive RE high and DE low to enter low-power shutdown mode. DE is a hot-swap input (see the *Hot-Swap Capability* section for more details).
4	DI	Driver Input. With DE high, a low on DI forces non-inverting output low and inverting output high. Similarly, a high on DI forces non-inverting output high and inverting output low.
5	GND	Ground
6	A	Non-inverting Receiver Input and Non-inverting Driver Output
7	B	Inverting Receiver Input and Inverting Driver Output
8	Vcc	Positive Supply, V_{CC} = +5V ±5%. Bypass V_{CC} to GND with a 0.1µF capacitor.

Function Table

TRANSMITTING				
INPUTS			OUTPUTS	
RE	DE	DI	B/Z	A/Y
X	1	1	0	1
X	1	0	1	0
0	0	X	High-Z	High-Z
1	0	X	Shutdown	

RECEIVING			
INPUTS			OUTPUTS
RE	DE	A-B	RO
0	X	≥ -0.05V	1
0	X	≤ -0.2V	0
0	X	Open/shorted	1
1	1	X	High-Z
1	0	X	Shutdown

Applications Information

256 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 HG3085M family of transceivers have a 1/8-unit-load receiver input impedance (96kΩ), allowing up to 256 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.

Low-Power Shutdown Mode

Low-power shutdown mode is initiated by bringing both RE high and DE low. In shutdown, the devices typically draw only 2uA of supply current.

RE and DE may be driven simultaneously; the parts are guaranteed not to enter shutdown if RE is high and DE is low for less than 50ns. If the inputs are in this state for at least 600ns, the parts are guaranteed to enter shutdown.

Reduced EMI and Reflections

HG3085M isslew-rate limited, minimizing EMI and reducing reflections caused by improperly terminated cables.

Driver Output Protection

Two mechanisms prevent excessive output current and power dissipation caused by faults or by bus contention. The first, a fold-back current limit on the output stage, provides immediate protection against short circuits over the whole common-mode voltage range (see Typical Operating Characteristics). The second, a thermal shutdown circuit, forces the driver outputs into a high-impedance state if the die temperature becomes excessive.

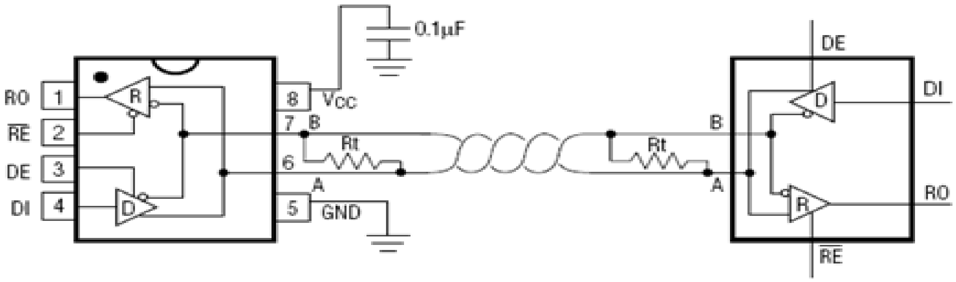


Figure 9 *Pin Configuration and Typical Half-Duplex Operating Circuit*

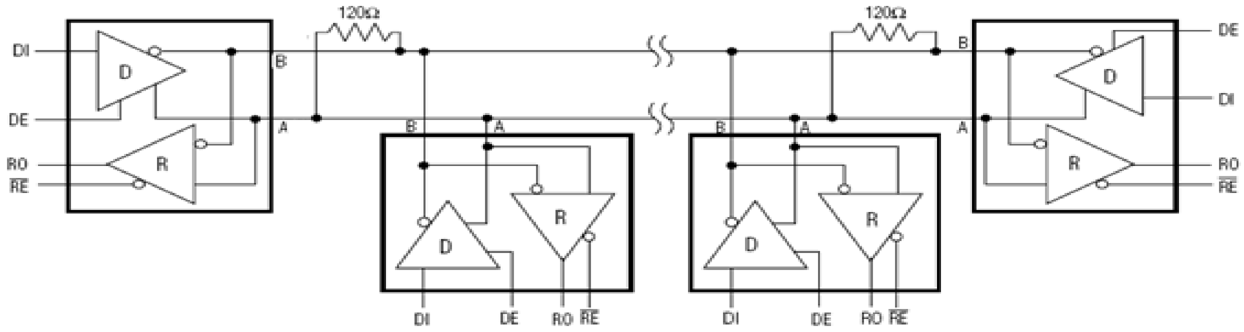


Figure 10 *Typical Half-Duplex RS-485 Network*

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