



## DESCRIPTION

The HSN65LBC184DRG4 is a half-duplex RS-485 transceiver with  $\pm 15\text{kV}$  IEC 61000-4-2 contact discharge protection. The HSN65LBC184DRG4 contains 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 logic high even if all transmitters on a terminated bus are disabled. The HSN65LBC184DRG4 features reduced slew-rate driver that minimizes EMI and reduces reflections caused by improperly terminated cables, allowing error-free data transmission up to 500kbps. The HSN65LBC184DRG4 has a 1/8-unit load receiver input impedance that allows up to 256 transceivers on the bus.

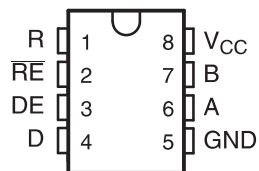
## FEATURES

TIA/EIA RS-485/RS-422 compliant ESD protection  
Integrated Transient Voltage Suppression  
Contact discharge  $\pm 15\text{KV}$   
Data rates: 500 kbps  
Half-duplex Reduced slew rates for low EMI  
Common-mode input range:  $-7\text{V}$  to  $+12\text{V}$

## APPLICATIONS

RS-485 Communications  
Level Translators  
Transceivers for EMI-Sensitive Applications  
Industrial Control Local Area Networks  
Energy Meter Networks  
Lighting Systems

## PIN CONFIGURATION



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### Pin Functions

PIN		I/O	DESCRIPTION
NAME	NO.		
A	6	Bus input/output	Driver output or receiver input (complementary to B)
B	7	Bus input/output	Driver output or receiver input (complementary to A)
D	4	Digital input	Driver data input
DE	3	Digital input	Active-HIGH driver enable
GND	5	Reference potential	Local device ground
R	1	Digital output	Receiver data output
$\overline{\text{RE}}$	2	Digital input	Active-LOW receiver enable
V <sub>CC</sub>	8	Supply	4.75-V to 5.25-V supply



## FEATUER DESCRIPTION

Transmitting				
Inputs			Outputs	
/RE	DE	DI	B	A
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	$\geq -0.05V$	1
0	X	$\leq -0.2V$	0
0	X	Open/shorted	1
1	1	X	High-Z
1	0	X	Shutdown

## ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating	Units
Power Supply	V <sub>CC</sub>	+7	V
Control Input Voltage	/RE, DE	-0.3 to V <sub>CC</sub> +0.3	V
Transmitter Input Voltage	DI	-0.3 to V <sub>CC</sub> +0.3	V
Transmitter Output Voltage	A, B	-8 to +13	V
Receiver Input Voltage	A, B	-8 to +13	V
Receiver Output Voltage	RO	-0.3 to V <sub>CC</sub> +0.3	V
Operating Temperature	--	-25 to +85	°C



## RECOMMENDED OPERATING CONDITIONS

( $V_{CC}=+5V\pm 5\%$ ,  $T_A=-40^{\circ}C\sim +85^{\circ}C$ , Typical Values are  $V_{CC}=+5V$  and  $T_A=25^{\circ}C$ ) (Note 1)

Parameter	Symbol	Conditions	MIN	TYP	MAX	UNITS	
Power Supply	$V_{CC}$		4.5		5.5	V	
<b>Driver</b>							
Differential Driver Output (no load)	$V_{OD1}$	Figure 1			5	V	
Differential Driver Output	$V_{OD2}$	Figure 1, $R = 27\ \Omega$	1.5			V	
Change in Magnitude of Differential Output Voltage (Note 2)	$\Delta V_{OD}$	Figure 1, $R = 27\ \Omega$			0.2	V	
Driver Common-mode Output Voltage	$V_{OC}$	Figure 1, $R = 27\ \Omega$			3	V	
Change in Magnitude of Common-Mode	$\Delta V_{OC}$	Figure 1, $R = 27\ \Omega$			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	$V_{HYS}$			100		mV	
Input Current (A and B)	$I_{IN4}$	DE = GND, $V_{CC} =$	$V_{IN} = 12\ V$		125	$\mu A$	
		GND or 5.25V	$V_{IN} = -7\ V$		-75		
Driver Short-Circuit Output Current	$I_{OSD}$	$-7V \leq V_{OUT} \leq V_{CC}$	-100			mA	
		$0V \leq V_{OUT} \leq 12V$			100		
<b>Receiver</b>							
Receiver Differential Threshold Voltage	$V_{TH}$	$-7V \leq V_{CM} \leq 12V$	-200	-125	-50	mV	
Receive Input Hysteresis	$\Delta V_{TH}$			40		mV	
Receiver Output High Voltage	$V_{OH}$	$I_O = -4\ mA, V_{ID} = -50\ mV$	$V_{CC}-1.5$			V	
Receiver Output Low Voltage	$V_{OL}$	$I_O = 4\ mA, V_{ID} = -200\ mV$			0.4	V	
Three-State Output Current at Receiver	$I_{OZR}$	$0.4V \leq V_O \leq 2.4V$			$\pm 1$	$\mu A$	
Receive Input Resistance	$R_{IN}$	$-7V \leq V_{CM} \leq 12V$	96			k $\Omega$	
Receiver Output Short-Circuit Current	$I_{OSR}$	$0V \leq V_{RO} \leq V_{CC}$	$\pm 7$		$\pm 95$	mA	
<b>Supply Current</b>							
Supply Current	$I_{CC}$	No load; /RE = DI = GND or $V_{CC}$	DE = $V_{CC}$		150	600	$\mu A$
			DE = GND		185	600	$\mu A$
Supply Current in Shutdown Mode	$I_{SHDN}$	DE = GND, /RE = $V_{CC}$ , DI = $V_{CC}$ or GND			10	$\mu A$	

Note 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.

Note 2:  $\Delta V_{OD}$  and  $\Delta V_{OC}$  are the changes in  $V_{OD}$  and  $V_{OC}$ , respectively, when the DI input changes state.



### SWITCHING CHARACTERISTICS

( $V_{CC}=+5V\pm 5\%$ ,  $T_A=-40^{\circ}C\sim +85^{\circ}C$ , Typical Values are  $V_{CC}=+5V$  and  $T_A=25^{\circ}C$ )

Parameter	Symbol	Conditions	MIN	TYP	MAX	UNITS
Driver Input to Output	$T_{DPLH}$	Figure 3 and 5, $R_{DIFF} = 54 \Omega$ $C_{L1} = C_{L2} = 100 \text{ pF}$		450	800	ns
	$T_{DPHL}$			450	800	
Driver Output Skew $ T_{DPLH} - T_{DPHL} $	$T_{DSKEW}$	Figure 3 and 5, $R_{DIFF} = 54 \Omega$ $C_{L1} = C_{L2} = 100 \text{ pF}$			100	ns
Driver Rise or Fall Time	$T_{DR}, T_{DF}$	Figure 3 and 5, $R_{DIFF} = 54 \Omega$ $C_{L1} = C_{L2} = 100 \text{ pF}$		150	500	ns
Maximum Data Rate	$F_{MAX}$		500			kbps
Driver Enable to Output High	$T_{DZH}$	Figure 4 and 6, $C_L = 100 \text{ pF}$ , S2			200	ns
Driver Enable to Output Low	$T_{DZL}$	Figure 4 and 6, $C_L = 100 \text{ pF}$ , S1			200	ns
Driver Disable Time from Low	$T_{DLZ}$	Figure 4 and 6, $C_L = 15 \text{ pF}$ , S1			300	ns
Driver Disable Time from High	$T_{DHZ}$	Figure 4 and 6, $C_L = 15 \text{ pF}$ , S2			300	ns
Receiver Input to Output	$T_{RPLH}$	Figure 7 and 9, $ V_{ID}  \geq 2.0V$ , rise and fall time of $V_{ID} \leq 15\text{ns}$		450	800	ns
	$T_{RPHL}$			450	800	
$ T_{RPLH} - T_{RPHL} $ Differential Receiver Skew	$T_{RSKD}$	Figure 7 and 9, $ V_{ID}  \geq 2.0V$ , rise and fall time of $V_{ID} \leq 15\text{ns}$		30		ns
Receiver Enable to Output Low	$T_{RZL}$	Figure 2 and 8, $C_L = 100 \text{ pF}$ , S1		20	50	ns
Receiver Enable to Output High	$T_{RZH}$	Figure 2 and 8, $C_L = 100 \text{ pF}$ , S2 Closed		20	50	ns
Receiver Disable Time from Low	$T_{RLZ}$	Figure 2 and 8, $C_L = 100 \text{ pF}$ , S1 Closed		80	150	ns
Receiver Disable Time from High	$T_{RHZ}$	Figure 2 and 8, $C_L = 100 \text{ pF}$ , S2 Closed		80	150	ns
Time to Shutdown	$T_{SHDN}$			50	300	ns
Driver Enable from Shutdown to Output High	$T_{DZH(SHDN)}$	Figure 4 and 6, $C_L = 15 \text{ pF}$ , S2 Closed			200	ns
Driver Enable from Shutdown to Output Low	$T_{DZL(SHDN)}$	Figure 4 and 6, $C_L = 15 \text{ pF}$ , S1 Closed			200	ns
Receiver Enable from Shutdown to Output High	$T_{RZH(SHDN)}$	Figure 2 and 8, $C_L = 100 \text{ pF}$ , S2 Closed			300	ns
Receiver Enable from Shutdown to Output Low	$T_{RZL(SHDN)}$	Figure 2 and 8, $C_L = 100 \text{ pF}$ , S1 Closed			300	ns



### TEST CIRCUITS AND TIMING DIAGRAMS

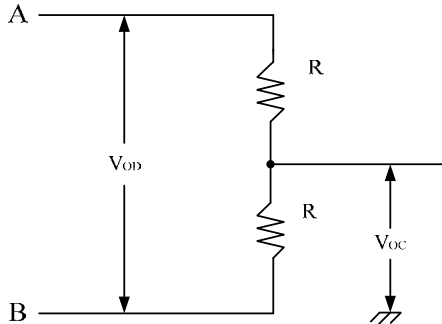


Figure 1: Driver DC Test Load

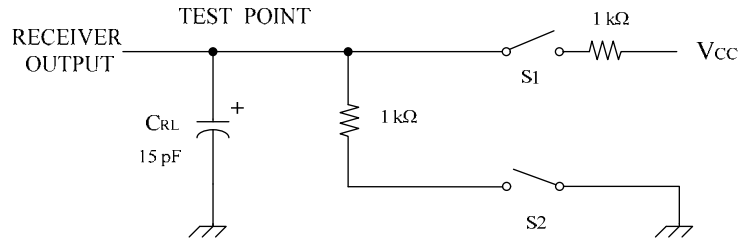


Figure 2: Receiver Enable/Disable Timing Test Load

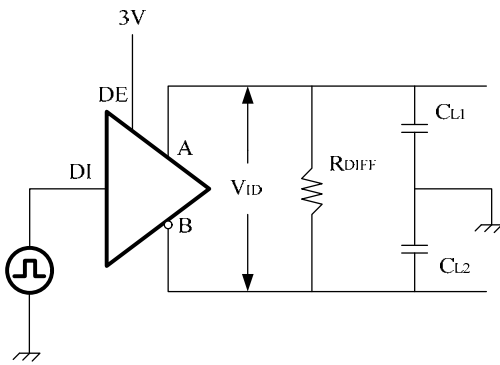


Figure 3: Driver Timing Test Circuit

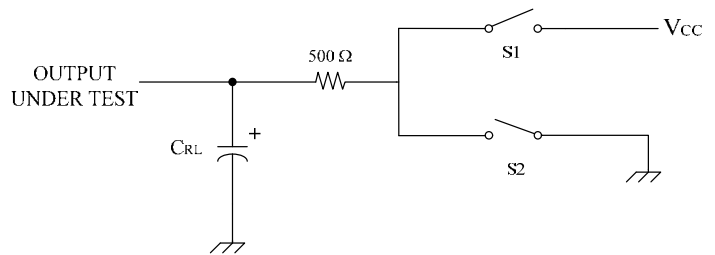


Figure 4: Driver Enable/Disable Timing test Load

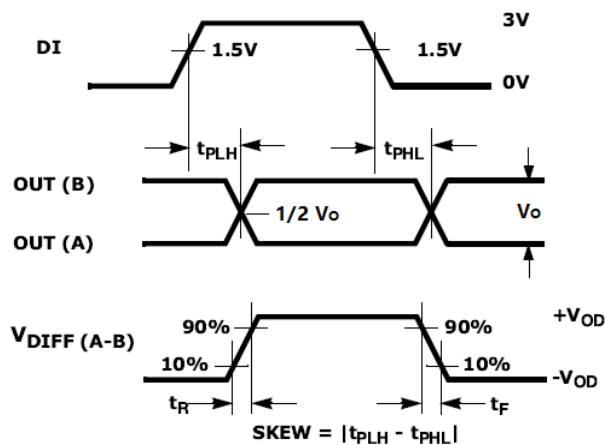


Figure 5: Driver Propagation Delays

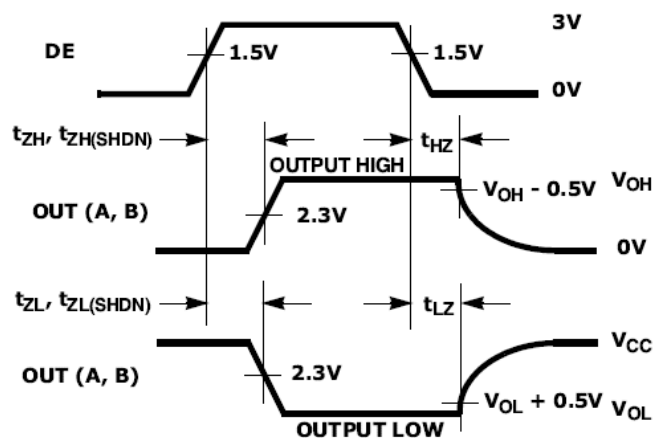


Figure 6: Driver Enable and Disable Times

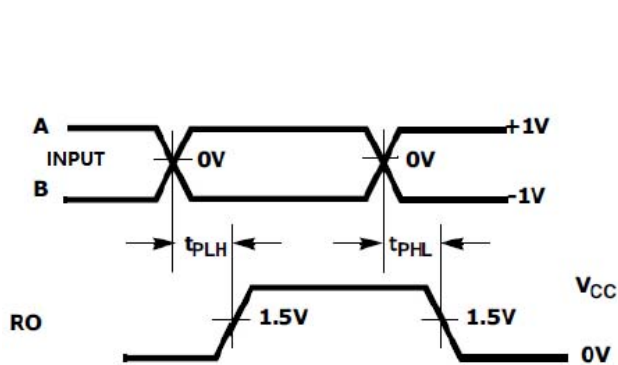


Figure 7: Receiver Propagation Delays

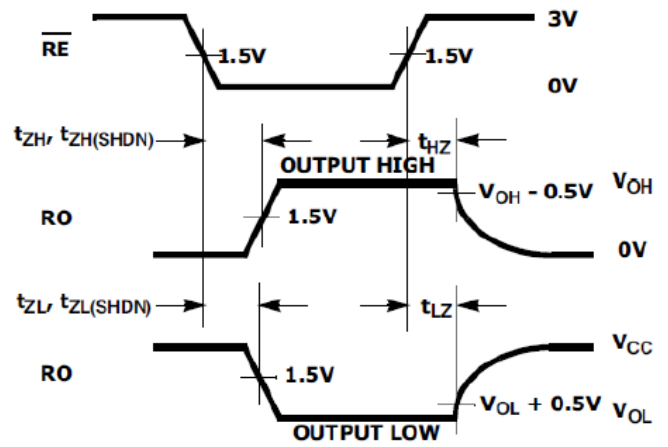


Figure 8: Receiver Enable and Disable Times

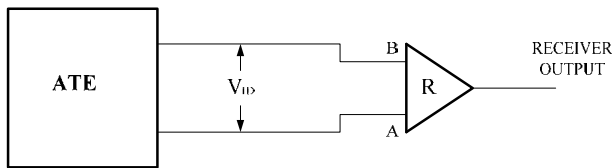
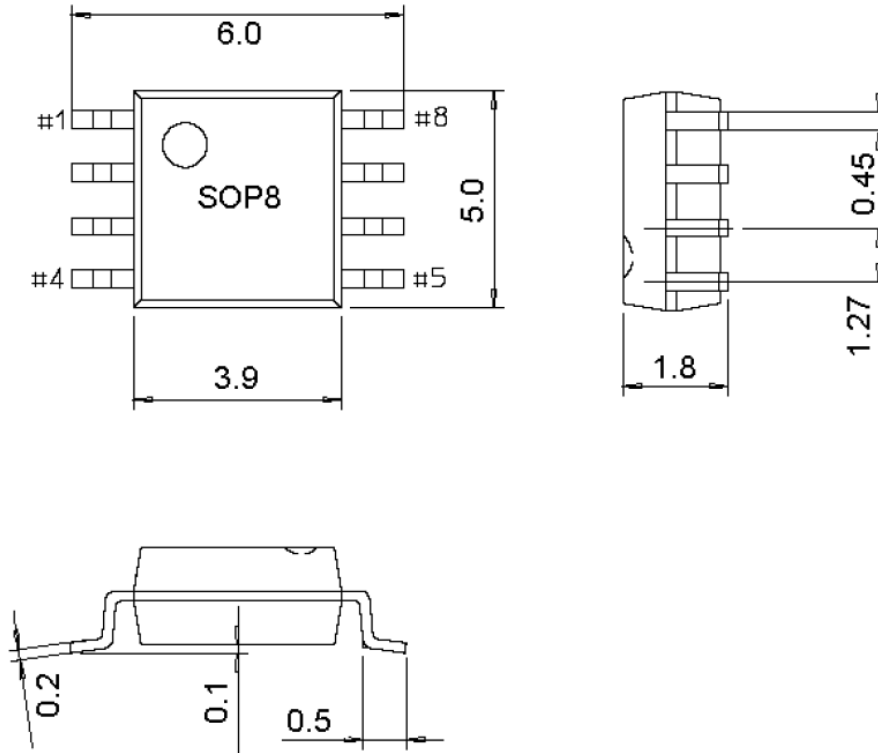


Figure 9: Receiver Propagation Delay Test Circuit



## PACKAGE OUTLINE DIMENSIONS

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