



WIDE SUPPLY RANGE RS-485 TRANSCEIVER

FEATURES

- Operates With a 3-V to 5.5-V Supply
- Consumes Less Than 90 mW Quiescent Power
- Open-Circuit, Short Circuit, and Idle-Bus Failsafe Receiver
- 1/8th Unit-Load (up to 256 nodes on the bus)
- Bus-Pin ESD Protection Exceeds 16 kV HBM
- Driver Output Voltage Slew-Rate Limited for Optimum Signal Quality at 10 Mbps
- Electrically Compatible With ANSI TIA/EIA-485 Standard

APPLICATIONS

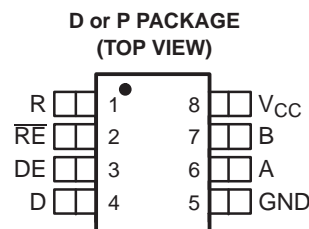
- Data Transmission With Remote Stations Powered From the Host
- Isolated Multipoint Data Buses
- Industrial Process Control Networks
- Point-of-Sale Networks
- Electric Utility Metering

DESCRIPTION

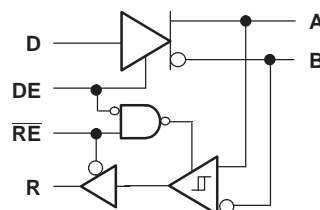
The SN65HVD08 combines a 3-state differential line driver and differential line receiver designed for balanced data transmission and interoperability with ANSI TIA/EIA-485-A and ISO-8482E standard-compliant devices.

The wide supply voltage range and low quiescent current requirements allow the SN65HVD08s to operate from a 5-V power bus in the cable with as much as a 2-V line voltage drop. Busing power in the cable can alleviate the need for isolated power to be generated at each connection of a ground-isolated bus.

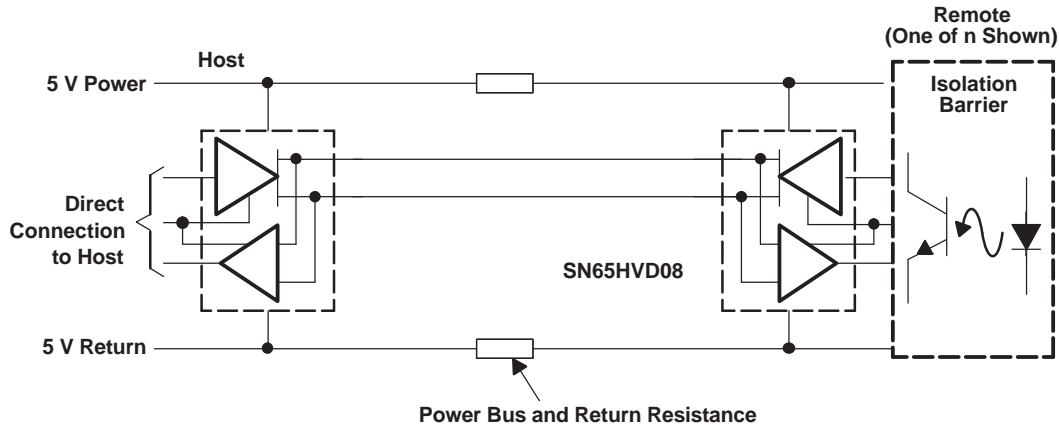
The driver differential outputs and receiver differential inputs connect internally to form a differential input/output (I/O) bus port that is designed to offer minimum loading to the bus whenever the driver is disabled or not powered. The drivers and receivers have active-high and active-low enables respectively, which can be externally connected together to function as a direction control.



LOGIC DIAGRAM (Positive Logic)



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

ORDERING INFORMATION

PART NUMBER	SPECIFIED TEMPERATURE RANGE	PACKAGE	PACKAGE MARKING
SN65HVD08D	-40°C to 85°C	SOIC	VP08
SN65HVD08P	-40°C to 85°C	PDIP	65HVD08
SN75HVD08D	0°C to 70°C	SOIC	VN08
SN75HVD08P	0°C to 70°C	PDIP	75HVD08

PACKAGE DISSIPATION RATINGS

PACKAGE	T _A ≤ 25°C POWER RATING	DERATING FACTOR ABOVE T _A = 25°C	T _A = 85°C POWER RATING
SOIC (D)	710 mW	5.7 mW/°C	369 mW
PDIP (P)	1000 mW	8 mW/°C	520 mW

ABSOLUTE MAXIMUM RATINGS

over operating free-air temperature range unless otherwise noted⁽¹⁾⁽²⁾

		UNIT	
Supply voltage, V _{CC}		-0.3 V to 6 V	
Voltage range at A or B		-9 V to 14 V	
Input voltage range at D, DE, R or \overline{RE}		-0.5 V to V _{CC} + 0.5 V	
Voltage input range, transient pulse, A and B, through 100 Ω		-25 V to 25 V	
Receiver output current, I _O		-11 mA to 11 mA	
Electrostatic discharge	Human Body Model ⁽³⁾	A, B, and GND	16 kV
		All pins	4 kV
	Charged-Device Model ⁽⁴⁾	All pins	1 kV
Continuous total power dissipation		See Dissipation Rating Table	

- (1) 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 under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) All voltage values, except differential I/O bus voltages, are with respect to network ground terminal.
- (3) Tested in accordance with JEDEC Standard 22, Test Method A114-A.
- (4) Tested in accordance with JEDEC Standard 22, Test Method C101.

RECOMMENDED OPERATING CONDITIONS

		MIN	NOM	MAX	UNIT
Supply voltage, V_{CC}		3		5.5	V
Input voltage at any bus terminal (separately or common mode), $V_I^{(1)}$		-7		12	V
High-level input voltage, V_{IH}	Driver, driver enable, and receiver enable inputs	2.25		V_{CC}	V
Low-level input voltage, V_{IL}		0		0.8	
Differential input voltage, V_{ID}		-12		12	
High-level output current, I_{OH}	Driver	-60			mA
	Receiver	-8			
Low-level output current, I_{OL}	Driver			60	mA
	Receiver			8	
Operating free-air temperature, T_A	SN75HVD08	0		70	°C
	SN65HVD08	-40		85	

(1) The algebraic convention, in which the least positive (most negative) limit is designated as minimum is used in this data sheet.

ELECTRICAL CHARACTERISTICS

over recommended operating conditions unless otherwise noted

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$ V_{OD} $ Driver differential output voltage magnitude	$R_L = 60\ \Omega$, $375\ \Omega$ on each output to -7 V to 12 V, See Figure 1	1.5		V_{CC}	V
$\Delta V_{OD} $ Change in magnitude of driver differential output voltage	$R_L = 54\ \Omega$	-0.2		0.2	V
$V_{OC(PP)}$ Peak-to-peak driver common-mode output voltage	Center of two 27- Ω load resistors, See Figure 2		0.5		V
V_{IT+} Positive-going receiver differential input voltage threshold				-10	mV
V_{IT-} Negative-going receiver differential input voltage threshold		-200			mV
V_{hys} Receiver differential input voltage threshold hysteresis ($V_{IT+} - V_{IT-}$)			35		mV
V_{OH} Receiver high-level output voltage	$I_{OH} = -8\ \text{mA}$	2.4			V
V_{OL} Receiver low-level output voltage	$I_{OL} = 8\ \text{mA}$			0.4	V
I_{IH} Driver input, driver enable, and receiver enable high-level input current		-100		100	μA
I_{IL} Driver input, driver enable, and receiver enable low-level input current		-100		100	μA
I_{OS} Driver short-circuit output current	$7\ \text{V} < V_O < 12\ \text{V}$	-265		265	mA
I_I Bus input current (disabled driver)	$V_I = 12\ \text{V}$			130	μA
	$V_I = -7\ \text{V}$	-100			
	$V_I = 12\ \text{V}$, $V_{CC} = 0\ \text{V}$			130	
	$V_I = -7\ \text{V}$, $V_{CC} = 0\ \text{V}$	-100			
I_{CC} Supply current	Receiver enabled, driver disabled, no load			10	mA
	Driver enabled, receiver disabled, no load			16	
	Both disabled			5	μA
	Both enabled, no load			16	mA

DRIVER SWITCHING CHARACTERISTICS

over recommended operating conditions unless otherwise noted

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PHL} Driver high-to-low propagation delay time	$R_L = 54 \Omega, C_L = 50 \text{ pF}$, See Figure 3	18		40	ns
t_{PLH} Driver low-to-high propagation delay time		18		40	
t_r Driver 10%-to-90% differential output rise time		10		55	
t_f Driver 90%-to-10% differential output fall time		10		55	
$t_{SK(P)}$ Driver differential output pulse skew, $ t_{PHL} - t_{PLH} $				2.5	
t_{en} Driver enable time	Receiver enabled, See Figures 4 and 5			55	ns
	Receiver disabled, See Figures 4 and 5			6	μs
t_{dis} Driver disable time	Receiver enabled, See Figures 4 and 5			90	ns

RECEIVER SWITCHING CHARACTERISTICS

over recommended operating conditions unless otherwise noted

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PHL} Receiver high-to-low propagation delay time	$C_L = 15 \text{ pF}$, See Figure 6			70	ns
t_{PLH} Receiver low-to-high propagation delay time				70	
t_r Receiver 10%-to-90% differential output rise time				5	
t_f Receiver 90%-to-10% differential output fall time				5	
$t_{SK(P)}$ Receiver differential output pulse skew, $ t_{PHL} - t_{PLH} $				4.5	
t_{en} Receiver enable time	Driver enabled, See Figure 7			15	ns
	Driver disabled, See Figure 8			6	μs
t_{dis} Receiver disable time	Driver enabled, See Figure 7			20	ns

PARAMETER MEASUREMENT INFORMATION

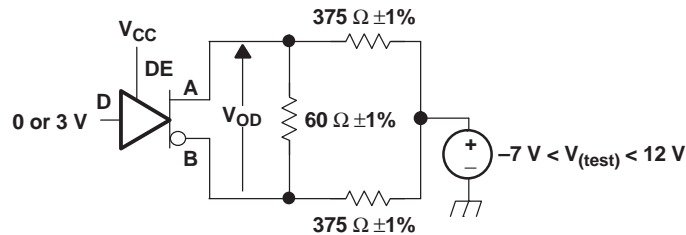
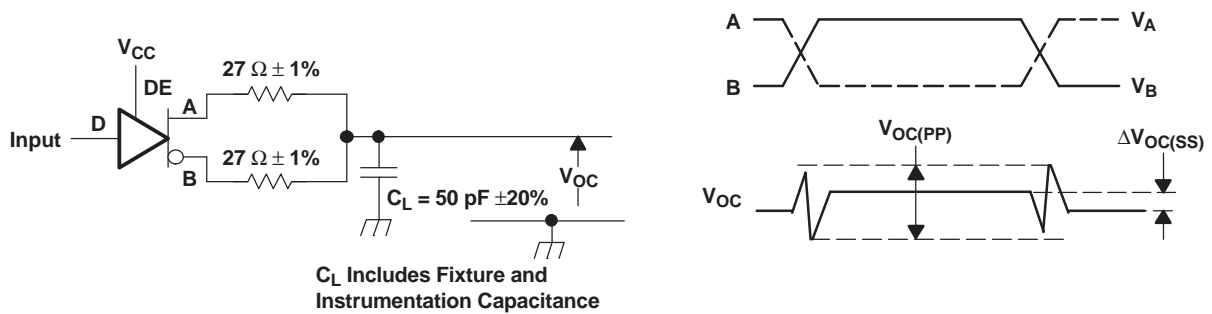


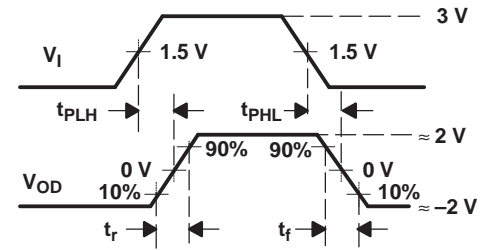
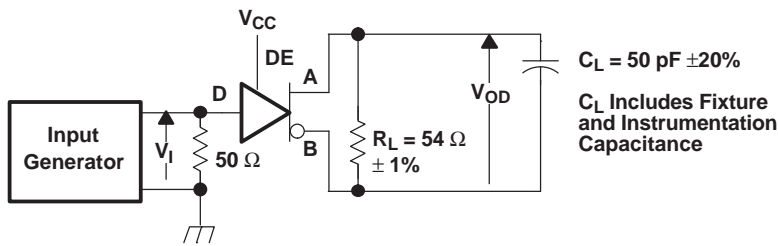
Figure 1. Driver V_{OD} With Common-Mode Loading Test Circuit



Input: PRR = 500 kHz, 50% Duty Cycle, $t_r < 6\text{ ns}$, $t_f < 6\text{ ns}$, $Z_0 = 50 \Omega$

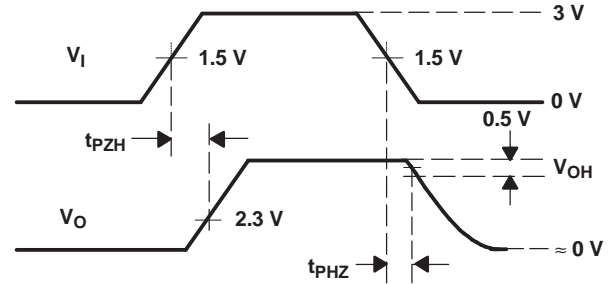
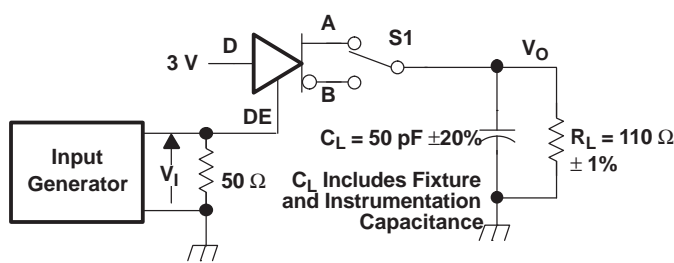
Figure 2. Test Circuit and Definitions for the Driver Common-Mode Output Voltage

PARAMETER MEASUREMENT INFORMATION (continued)



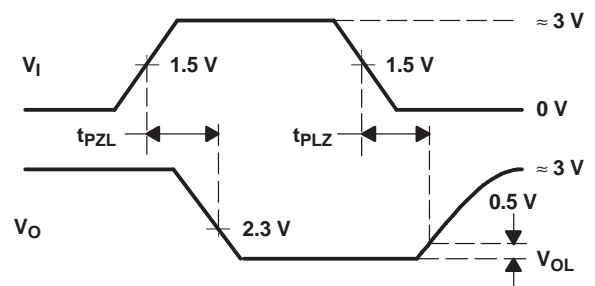
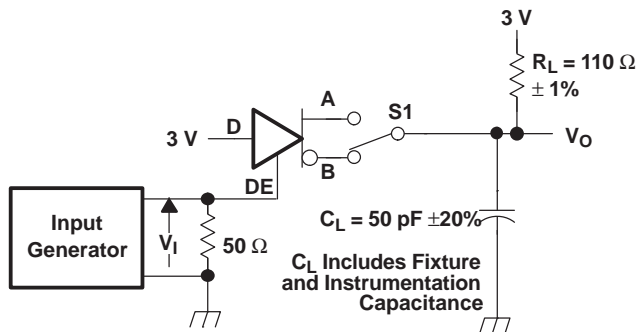
Generator: PRR = 500 kHz, 50% Duty Cycle, $t_r < 6 \text{ ns}$, $t_f < 6 \text{ ns}$, $Z_o = 50 \Omega$

Figure 3. Driver Switching Test Circuit and Voltage Waveforms



Generator: PRR = 500 kHz, 50% Duty Cycle, $t_r < 6 \text{ ns}$, $t_f < 6 \text{ ns}$, $Z_o = 50 \Omega$

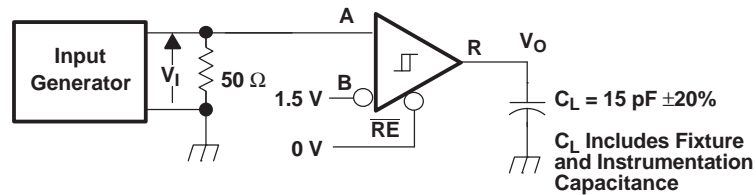
Figure 4. Driver High-Level Enable and Disable Time Test Circuit and Voltage Waveforms



Generator: PRR = 500 kHz, 50% Duty Cycle, $t_r < 6 \text{ ns}$, $t_f < 6 \text{ ns}$, $Z_o = 50 \Omega$

Figure 5. Driver Low-Level Output Enable and Disable Time Test Circuit and Voltage Waveforms

PARAMETER MEASUREMENT INFORMATION (continued)



Generator: PRR = 500 kHz, 50% Duty Cycle, $t_r < 6$ ns, $t_f < 6$ ns, $Z_o = 50 \Omega$

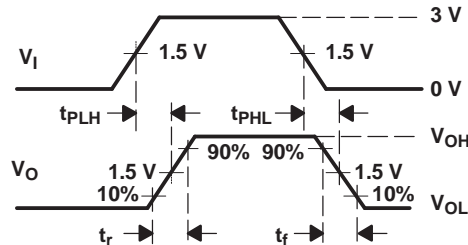
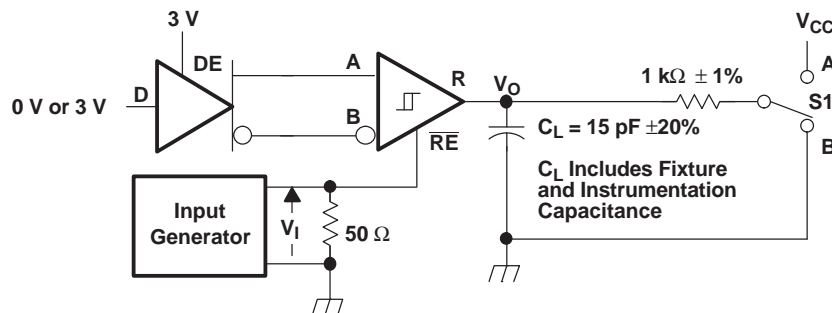


Figure 6. Receiver Switching Test Circuit and Voltage Waveforms



Generator: PRR = 500 kHz, 50% Duty Cycle, $t_r < 6$ ns, $t_f < 6$ ns, $Z_o = 50 \Omega$

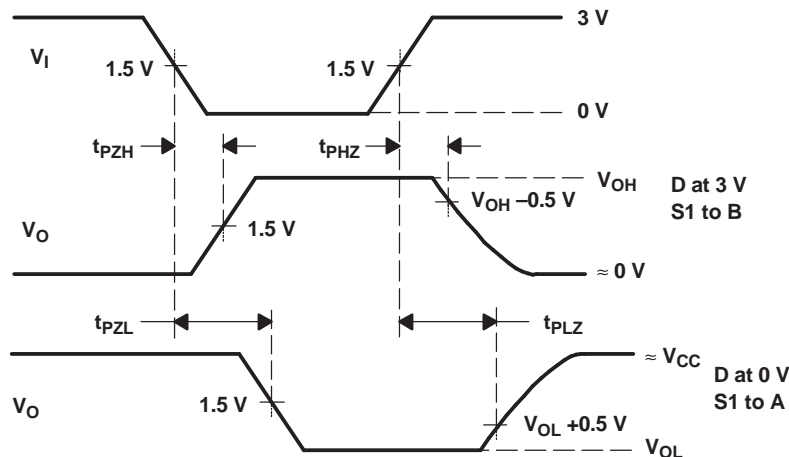


Figure 7. Receiver Enable and Disable Time Test Circuit and Voltage Waveforms With Drivers Enabled

PARAMETER MEASUREMENT INFORMATION (continued)

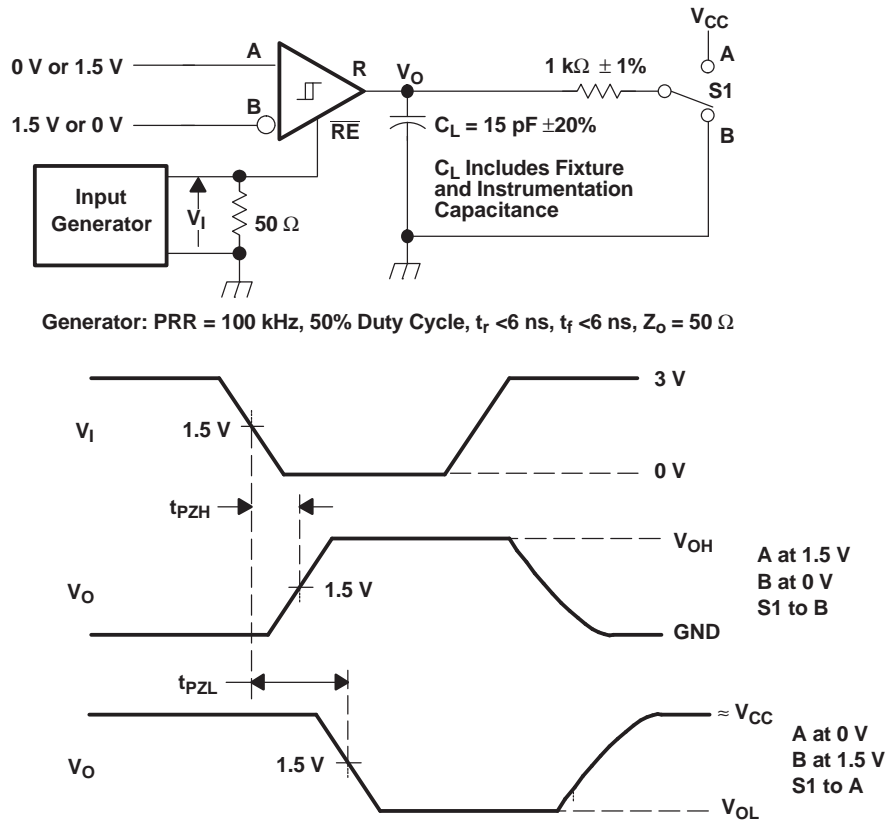


Figure 8. Receiver Enable Time From Standby (Driver Disabled)

DEVICE INFORMATION

Function Tables
DRIVER

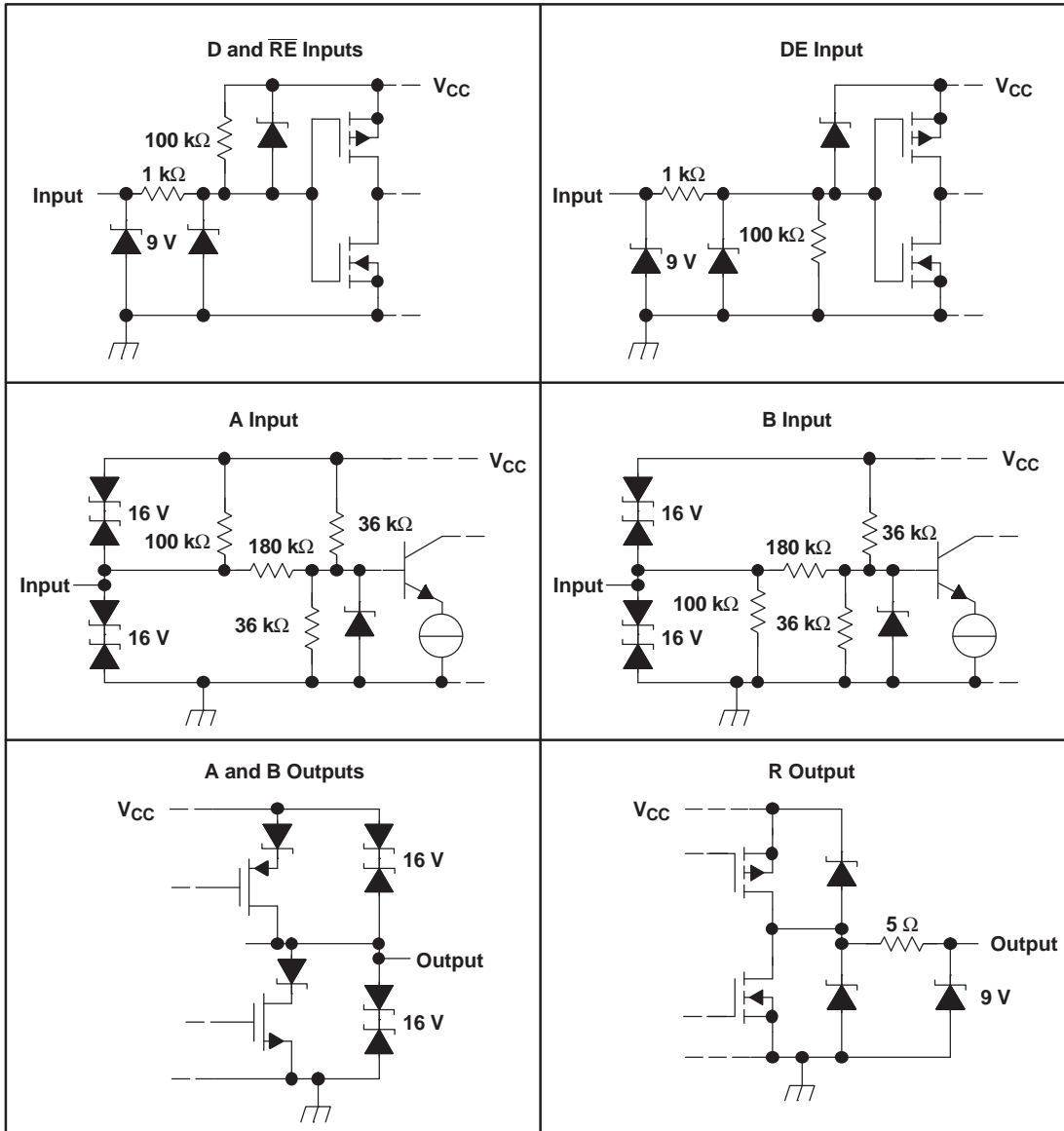
INPUT	ENABLE	OUTPUTS	
		A	B
H	H	H	L
L	H	L	H
X	L	Z	Z
Open	H	H	L

RECEIVER

DIFFERENTIAL INPUTS	ENABLE ⁽¹⁾	OUTPUT ⁽¹⁾
$V_{ID} = V_A - V_B$	RE	R
$V_{ID} \leq -0.2$ V	L	L
-0.2 V $< V_{ID} < -0.01$ V	L	?
-0.01 V $\leq V_{ID}$	L	H
X	H	Z
Open Circuit	L	H
Short Circuit	L	H

(1) H = high level; L = low level; Z = high impedance; X = irrelevant; ? = indeterminate

EQUIVALENT INPUT AND OUTPUT SCHEMATIC DIAGRAMS



TYPICAL CHARACTERISTICS

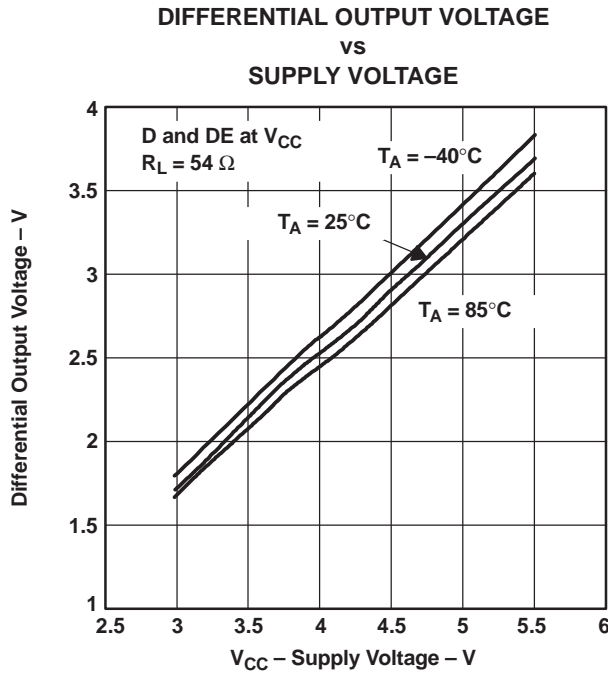


Figure 9.

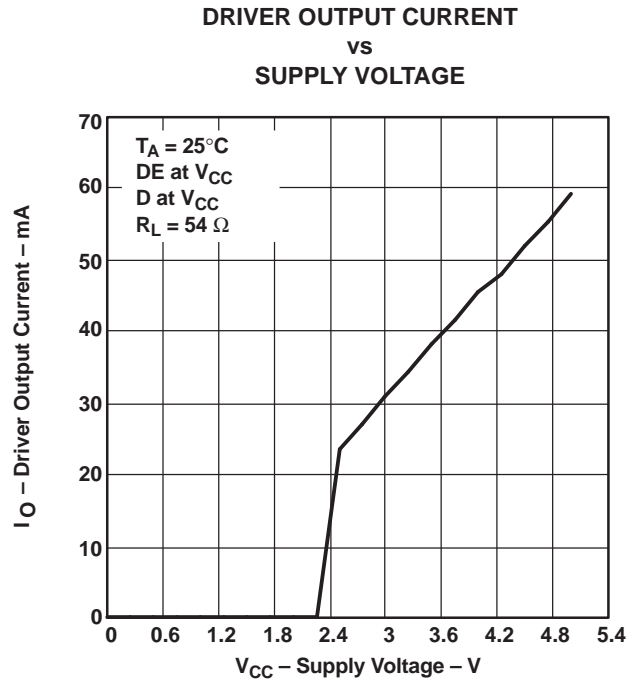


Figure 10.

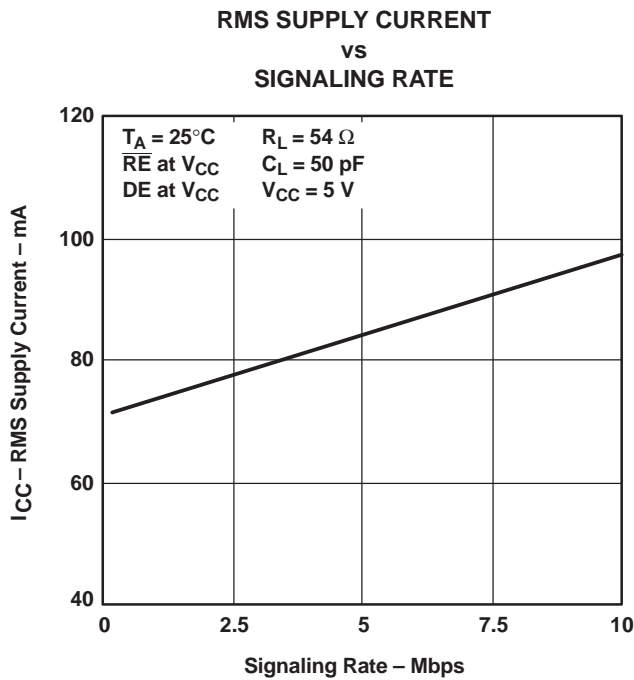


Figure 11.

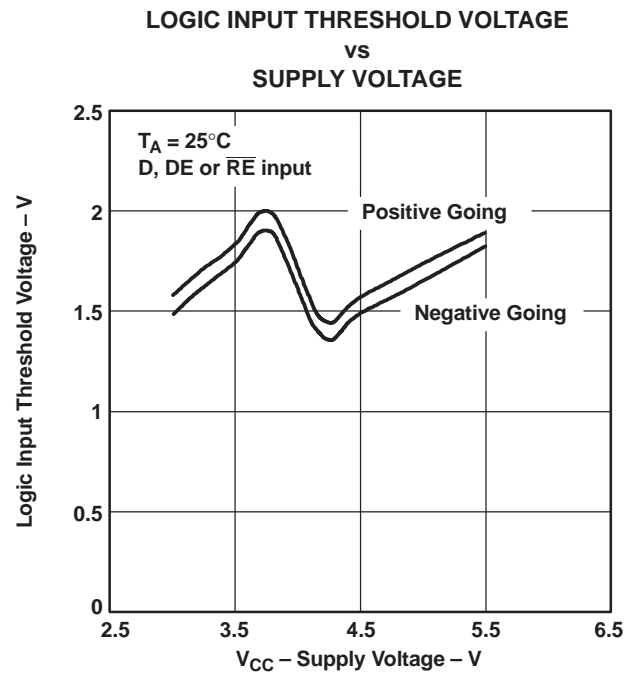


Figure 12.

TYPICAL CHARACTERISTICS (continued)

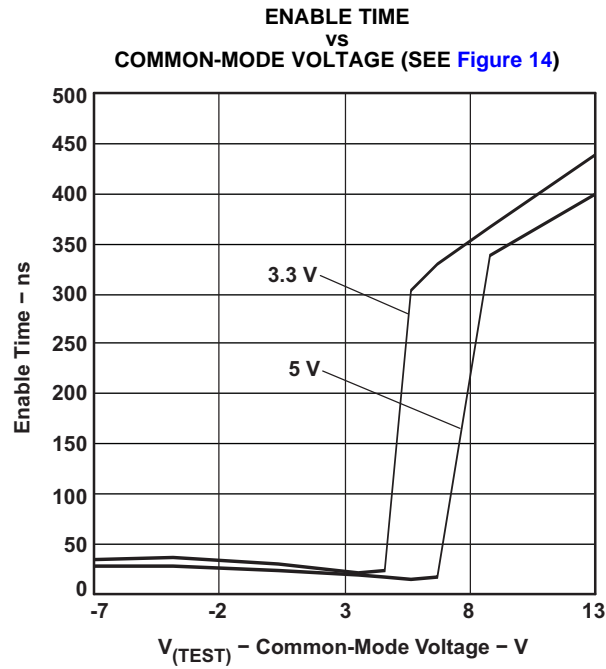


Figure 13.

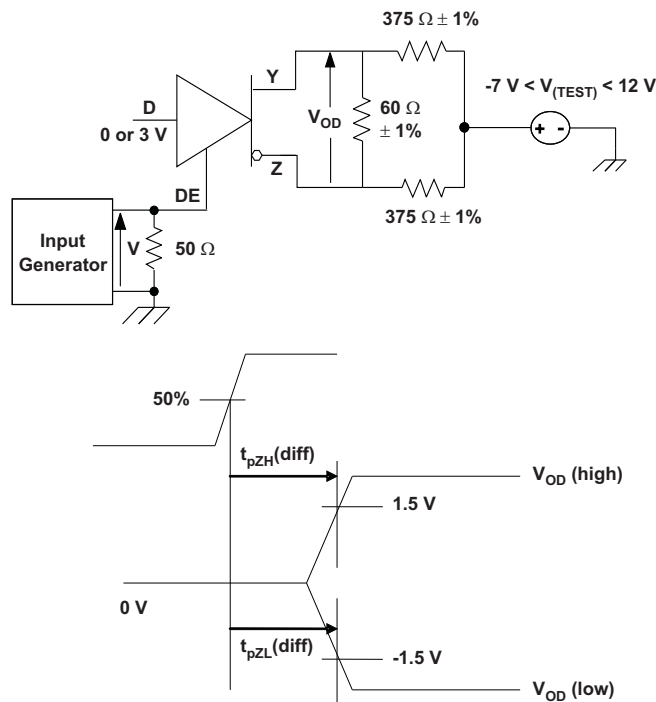


Figure 14. Driver Enable Time From DE to V_{OD}

The time $t_{pZL}(x)$ is the measure from DE to $V_{OD}(x)$. V_{OD} is valid when it is greater than 1.5 V.

APPLICATION INFORMATION

As electrical loads are physically distanced from their power source, the effects of supply and return line impedance and the resultant voltage drop must be accounted. If the supply regulation at the load cannot be maintained to the circuit requirements, it forces the use of remote sensing, additional regulation at the load, bigger or shorter cables, or a combination of these. The SN65HVD08 eases this problem by relaxing the supply requirements to allow for more variation in the supply voltage over typical RS-485 transceivers.

SUPPLY SOURCE IMPEDANCE

In the steady state, the voltage drop from the source to the load is simply the wire resistance times the load current as modeled in Figure 15.

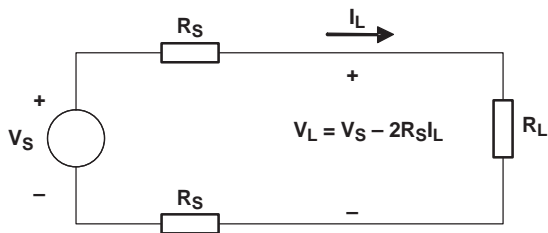


Figure 15. Steady-State Circuit Model

For example, if you were to provide 5-V \pm 5% supply power to a remote circuit with a maximum load requirement of 0.1 A (one SN65HVD08), the voltage at the load would fall below the 4.5-V minimum of most 5-V circuits with as little as 5.8 m of 28-GA conductors. Table 1 summarizes wire resistance and the length for 4.5 V and 3 V at the load with 0.1 A of load current. The maximum lengths would scale linearly for higher or lower load currents.

Table 1. Maximum Cable Lengths for Minimum Load Voltages at 0.1 A Load

WIRE SIZE	RESISTANCE	4.5 V LENGTH AT 0.1 A	3-v LENGTH AT 0.1 A
28 Gage	0.213 Ω /m	5.8 m	41.1 m
24 Gage	0.079 Ω /m	15.8 m	110.7 m
22 Gage	0.054 Ω /m	23.1 m	162.0 m
20 Gage	0.034 Ω /m	36.8 m	257.3 m
18 Gage	0.021 Ω /m	59.5 m	416.7 m

Under dynamic load requirements, the distributed inductance and capacitance of the power lines may

not be ignored and decoupling capacitance at the load is required. The amount depends upon the magnitude and frequency of the load current change but, if only powering the SN65HVD08, a 0.1 μ F ceramic capacitor is usually sufficient.

OPTO-ISOLATED DATA BUSES

Long RS-485 circuits can create large ground loops and pick up common-mode noise voltages in excess of the range tolerated by standard RS-485 circuits. A common remedy is to provide galvanic isolation of the data circuit from earth or local grounds.

Transformers, capacitors, or phototransistors most often provide isolation of the bus and the local node. Transformers and capacitors require changing signals to transfer the information over the isolation barrier and phototransistors (opto-isolators) can pass steady-state signals. Each of these methods incurs additional costs and complexity, the former in clock encoding and decoding of the data stream and the latter in requiring an isolated power supply.

Quite often, the cost of isolated power is repeated at each node connected to the bus as shown in Figure 16. The possibly lower-cost solution is to generate this supply once within the system and then distribute it along with the data line(s) as shown in Figure 17.

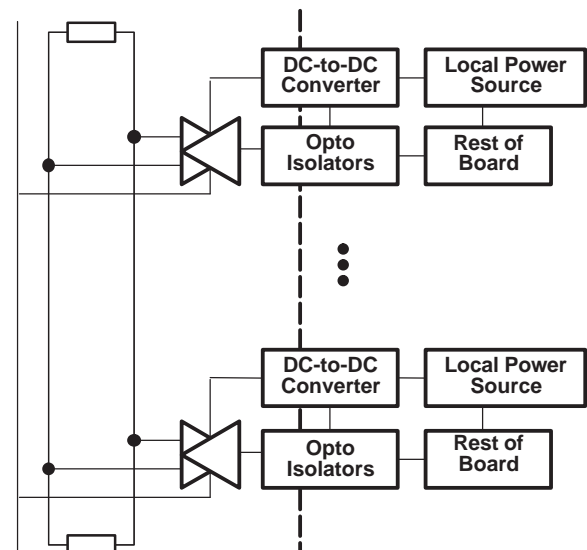


Figure 16. Isolated Power at Each Node

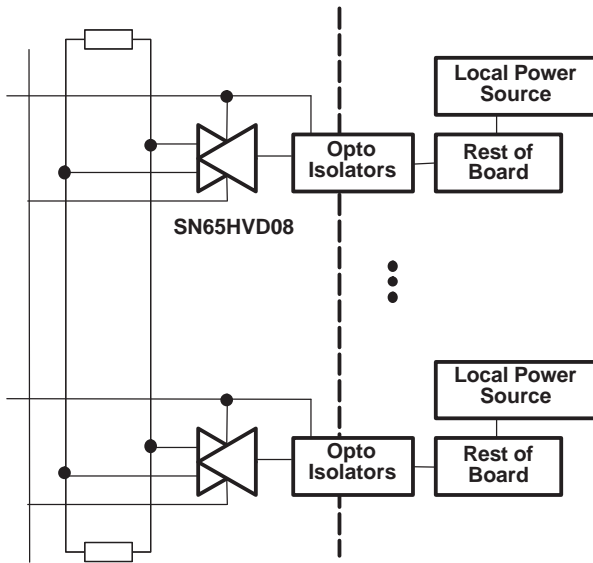


Figure 17. Distribution of Isolated Power

The features of the SN65HVD08 are particularly good for the application of Figure 17. Due to added supply source impedance, the low quiescent current requirements and wide supply voltage tolerance allow for the poorer load regulation.

AN OPTO ALTERNATIVE

The ISO150 is a two-channel, galvanically isolated data coupler capable of data rates of 80 Mbps. Each channel can be individually programmed to transmit data in either direction.

Data is transmitted across the isolation barrier by coupling complementary pulses through high-voltage 0.4-pF capacitors. Receiver circuitry restores the pulses to standard logic levels. Differential signal transmission rejects isolation-mode voltage transients up to 1.6 kV/ms.

ISO150 avoids the problems commonly associated with opto-couplers. Optically-isolated couplers require high current pulses and allowance must be made for LED aging. The ISO150's Bi-CMOS circuitry operates at 25 mW per channel with supply voltage range matching that of the SN65HVD08 of 3 V to 5.5 V.

Figure 18 shows a typical circuit.

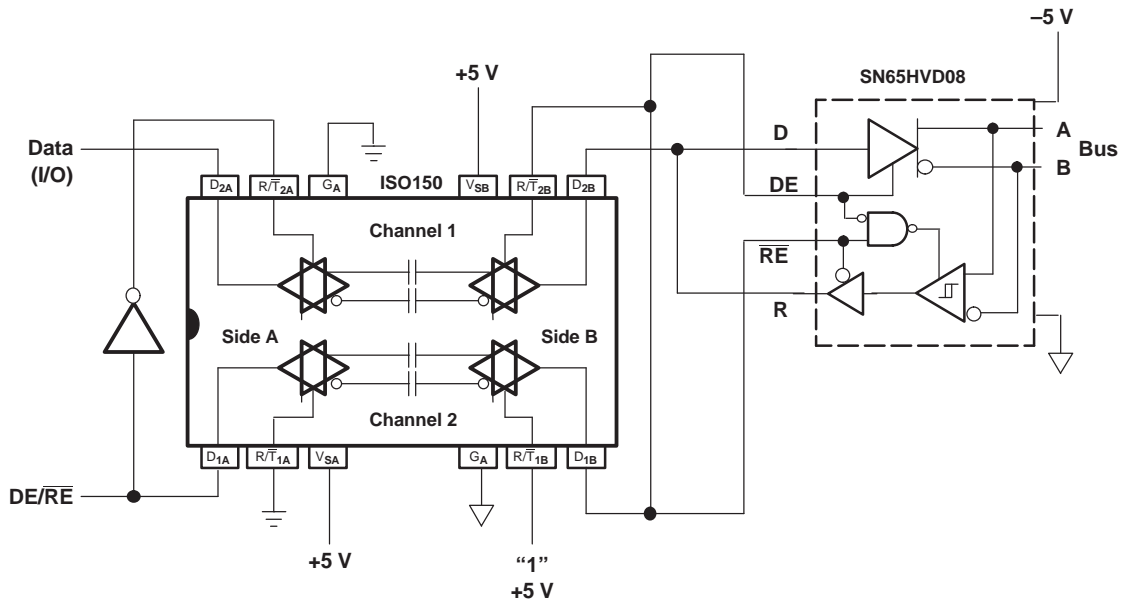


Figure 18. Isolated RS-485 Interface

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
SN65HVD08D	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65HVD08DG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65HVD08DR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65HVD08DRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65HVD08P	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN65HVD08PE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN75HVD08D	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75HVD08DG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75HVD08DR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75HVD08DRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75HVD08P	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN75HVD08PE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN65HVD08DR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
SN75HVD08DR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS

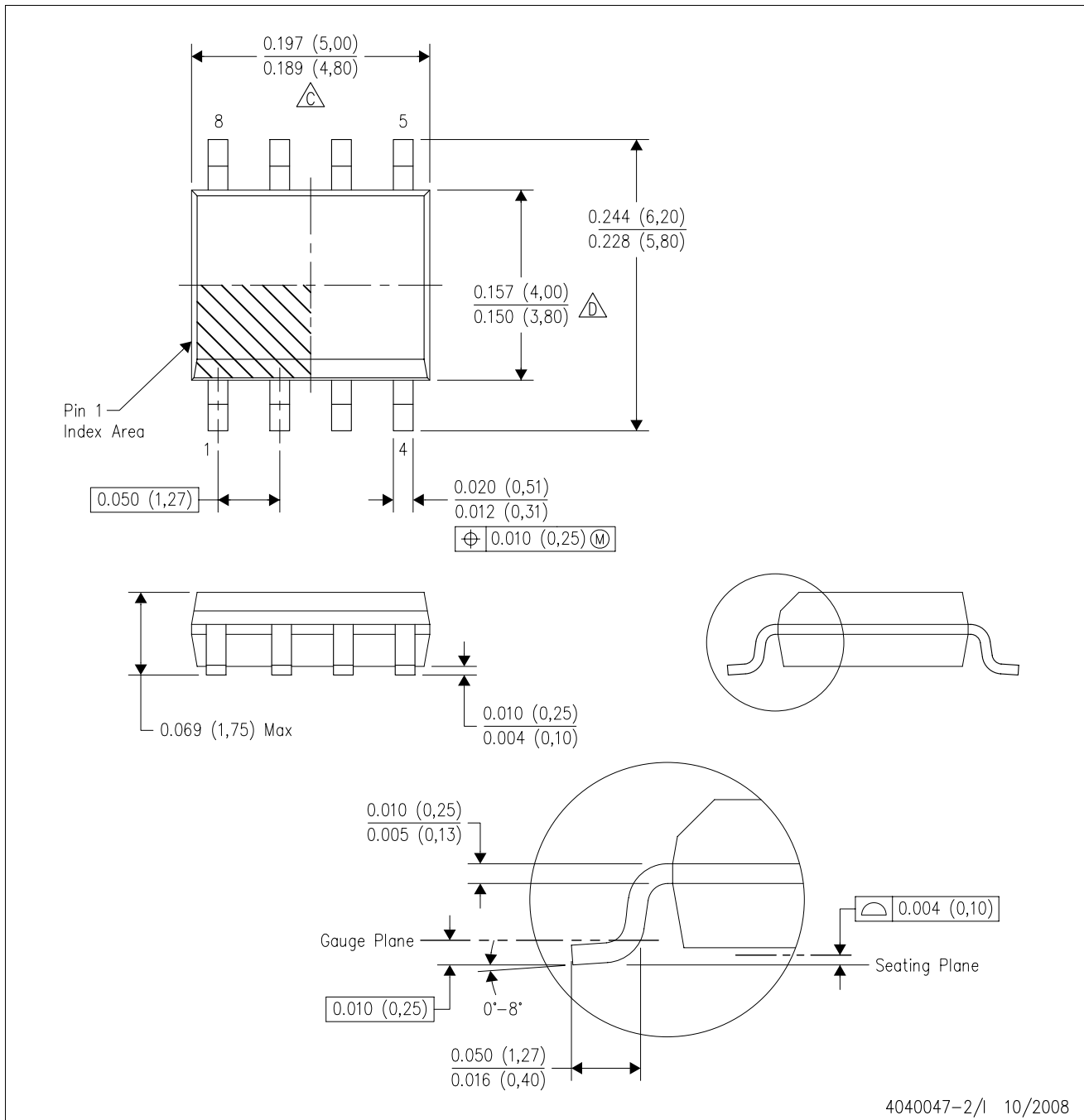


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN65HVD08DR	SOIC	D	8	2500	340.5	338.1	20.6
SN75HVD08DR	SOIC	D	8	2500	340.5	338.1	20.6

D (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - ΔC Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 (0,15) per end.
 - ΔD Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
 - E. Reference JEDEC MS-012 variation AA.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products

Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
RF/IF and ZigBee® Solutions	www.ti.com/lprf

Applications

Audio	www.ti.com/audio
Automotive	www.ti.com/automotive
Broadband	www.ti.com/broadband
Digital Control	www.ti.com/digitalcontrol
Medical	www.ti.com/medical
Military	www.ti.com/military
Optical Networking	www.ti.com/opticalnetwork
Security	www.ti.com/security
Telephony	www.ti.com/telephony
Video & Imaging	www.ti.com/video
Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2008, Texas Instruments Incorporated