

## EMC OPTIMIZED CAN TRANSCEIVER

## FEATURES

- Improved Replacement for the TJA1050
- High Electromagnetic Immunity (EMI)
- Very Low Electromagnetic Emissions (EME)
- Meets or Exceeds the Requirements of ISO 11898-2
- Bus-Fault Protection of  $-27\text{ V}$  to  $40\text{ V}$
- Dominant Time-Out Function
- Power-Up/Down Glitch-Free Bus Inputs and Outputs
  - High Input Impedance with Low  $V_{CC}$
  - Monotonic Outputs During Power Cycling

## APPLICATIONS

- **Industrial Automation**
  - **DeviceNet™ Data Buses (Vendor ID #806)**
- **SAE J2284 High Speed CAN for Automotive Applications**
- **SAE J1939 Standard Data Bus Interface**
- **ISO 11783 Standard Data Bus Interface**
- **NMEA 2000 Standard Data Bus Interface**

## DESCRIPTION

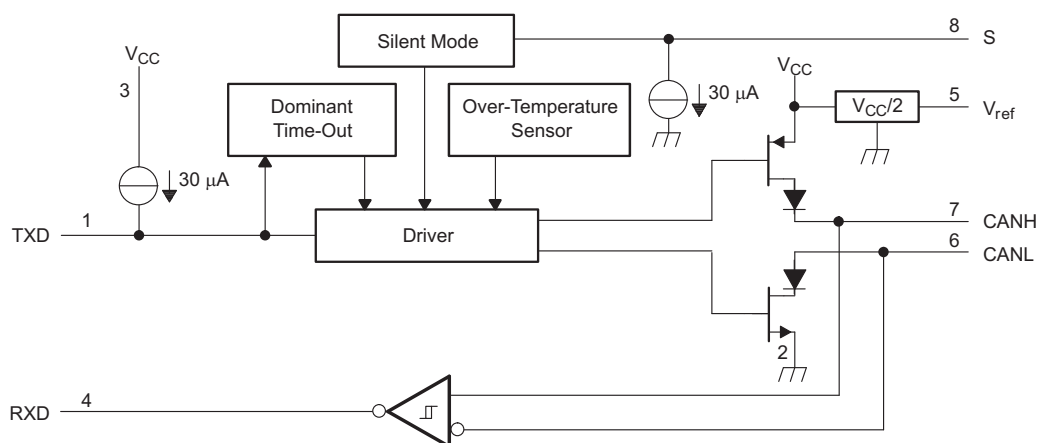
The SN65HVD1050 meets or exceeds the specifications of the ISO 11898 standard for use in applications employing a Controller Area Network (CAN). The device is also qualified for use in automotive applications in accordance with AEC-Q100.<sup>(1)</sup>

As a CAN transceiver, this device provides differential transmit capability to the bus and differential receive capability to a CAN controller at signaling rates up to 1 megabit per second (Mbps)<sup>(2)</sup>.

Designed for operation in especially harsh environments, the HVD1050 features cross-wire, over-voltage and loss of ground protection from -27 V to 40V, over-temperature shut down, a -12 V to 12 V common-mode range, and will withstand voltage transients from -200 V to 200 V according to ISO 7637.

- (1) The device is available with Q100 qualification as the SN65HVD1050Q (PRODUCT PREVIEW).
- (2) The signaling rate of a line is the number of voltage transitions that are made per second expressed in the units bps (bits per second).

## FUNCTION BLOCK DIAGRAM



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.

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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.

## DESCRIPTION (CONTINUED)

Pin 8 provides for two different modes of operation: high-speed or silent mode. The high-speed mode of operation is selected by connecting S (pin 8) to ground.

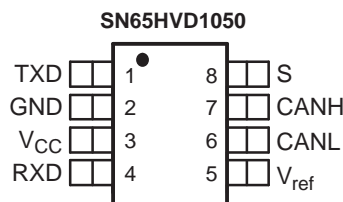
If a high logic level is applied to the S pin of the SN65HVD1050, the device enters a listen-only silent mode during which the driver is switched off while the receiver remains fully functional.

In silent mode, all bus activity is passed by the receiver output to the local protocol controller. When data transmission is required, the local protocol controller reverses this low-current silent mode by placing a logic-low on the S pin to resume full operation.

A dominant-time-out circuit in the SN65HVD1050 prevents the driver from blocking network communication with a hardware or software failure. The time-out circuit is triggered by a falling edge on TXD (pin 1). If no rising edge is seen before the time-out constant of the circuit expires, the driver is disabled. The circuit is then reset by the next rising edge on TXD.

$V_{ref}$  (pin 5) is available as a  $V_{CC}/2$  voltage reference.

The SN65HVD1050 is characterized for operation from  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ .



## ORDERING INFORMATION

PART NUMBER	PACKAGE	MARKED AS	ORDERING NUMBER
SN65HVD1050	SOIC-8	VP1050	SN65HVD1050D (rail)
			SN65HVD1050DR (reel)

## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

	UNIT
$V_{CC}$ Supply voltage <sup>(2)</sup>	$-0.3\text{ V to }7\text{ V}$
Voltage range at any bus terminal (CANH, CANL, $V_{ref}$ )	$-27\text{ V to }40\text{ V}$
$I_O$ Receiver output current	20 mA
$V_I$ Voltage input, transient pulse <sup>(3)</sup> (CANH, CANL)	$-200\text{ V to }200\text{ V}$
$V_I$ Voltage input range (TXD, S)	$-0.5\text{ V to }6\text{ V}$
$T_J$ Junction temperature	$-55^{\circ}\text{C to }170^{\circ}\text{C}$

- (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 ISO 7637, test pulses 1, 2, 3a, 3b, 5, 6, and 7.

## ELECTROSTATIC DISCHARGE PROTECTION<sup>(1)</sup>

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

PARAMETER	TEST CONDITIONS		VALUE
IEC Contact Discharge	IEC 61000-4-2	Bus terminals vs GND	±6 kV
Human Body Model	JEDEC Standard 22, Test Method A114-C.01	Bus terminals vs GND	±8 kV
		All pins	±4 kV
Field-Induced-Charged Device Model	JEDEC Standard 22, Test Method C101	All pins	±1.5 kV
Machine Model	ANSI/ESDS5.2-1996		±200 V

(1) All typical values at 25°C.

## RECOMMENDED OPERATING CONDITIONS

			MIN	NOM	MAX	UNIT
V <sub>CC</sub>	Supply voltage		4.75		5.25	V
V <sub>I</sub> or V <sub>IC</sub>	Voltage at any bus terminal (separately or common mode)		–12		12	V
V <sub>IH</sub>	High-level input voltage	TXD, S	2		5.25	V
V <sub>IL</sub>	Low-level input voltage		0		0.8	V
V <sub>ID</sub>	Differential input voltage		–7		7	V
I <sub>OH</sub>	High-level output current	Driver	–70			mA
		Receiver	–2			
I <sub>OL</sub>	Low-level output current	Driver			70	mA
		Receiver			2	
T <sub>J</sub>	Junction temperature	See <i>Thermal Characteristics</i> table, 1 Mbps minimum signaling rate with R <sub>L</sub> = 54Ω		–40	150	°C

## SUPPLY CURRENT

over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
I <sub>CC</sub>	5-V Supply current	Silent mode		6	10	mA
		Dominant		50	70	
		Recessive		6	10	

## DEVICE SWITCHING CHARACTERISTICS

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t <sub>d(LOOP1)</sub>	Total loop delay, driver input to receiver output, recessive to dominant	Figure 9, S at 0V	90	190	ns
t <sub>d(LOOP2)</sub>	Total loop delay, driver input to receiver output, dominant to recessive		90	190	

## DRIVER ELECTRICAL CHARACTERISTICS

over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP <sup>(1)</sup>	MAX	UNIT
V <sub>O(D)</sub>	Bus output voltage (Dominant)	V <sub>I</sub> = 0 V, S at 0 V, R <sub>L</sub> = 60 Ω, See <a href="#">Figure 1</a> and <a href="#">Figure 2</a>	2.9	3.4	4.5	V
	CANH		0.8	1.5		
V <sub>O(R)</sub>	Bus output voltage (Recessive)	V <sub>I</sub> = 3 V, S at 0 V, R <sub>L</sub> = 60 Ω, See <a href="#">Figure 1</a> and <a href="#">Figure 2</a>	2	2.3	3	V

(1) All typical values are at 25°C with a 5-V supply.

**DRIVER ELECTRICAL CHARACTERISTICS (continued)**

over recommended operating conditions (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP <sup>(1)</sup>	MAX	UNIT
V <sub>OD(D)</sub> Differential output voltage (Dominant)	V <sub>I</sub> = 0 V, R <sub>L</sub> = 60 Ω, S at 0 V, See <a href="#">Figure 1</a> , <a href="#">Figure 2</a> , and <a href="#">Figure 3</a>	1.5		3	V
	V <sub>I</sub> = 0 V, R <sub>L</sub> = 45 Ω, S at 0 V, See <a href="#">Figure 1</a> , <a href="#">Figure 2</a> , and <a href="#">Figure 3</a>	1.4		3	V
V <sub>OD(R)</sub> Differential output voltage (Recessive)	V <sub>I</sub> = 3 V, S at 0 V, See <a href="#">Figure 1</a> and <a href="#">Figure 2</a>	–0.012		0.012	V
	V <sub>I</sub> = 3 V, S at 0 V, No Load	–0.5		0.05	V
V <sub>OC(ss)</sub> Steady state common-mode output voltage	S at 0 V, <a href="#">Figure 8</a>	2	2.3	3	V
ΔV <sub>OC(ss)</sub> Change in steady-state common-mode output voltage			30		mV
I <sub>IH</sub> High-level input current, TXD input	V <sub>I</sub> at V <sub>CC</sub>	–2		2	μA
I <sub>IL</sub> Low-level input current, TXD input	V <sub>I</sub> at 0 V	–50		–10	
I <sub>O(off)</sub> Power-off TXD output current	V <sub>CC</sub> at 0 V, TXD at 5 V			1	
I <sub>OS(ss)</sub> Short-circuit steady-state output current	V <sub>CANH</sub> = –12 V, CANL Open, See <a href="#">Figure 11</a>	–105	–72		mA
	V <sub>CANH</sub> = 12 V, CANL Open, See <a href="#">Figure 11</a>		0.36	1	
	V <sub>CANL</sub> = –12 V, CANH Open, See <a href="#">Figure 11</a>	–1	–0.5		
	V <sub>CANL</sub> = 12 V, CANH Open, See <a href="#">Figure 11</a>		71	105	
C <sub>O</sub> Output capacitance	See receiver input capacitance				

**DRIVER SWITCHING CHARACTERISTICS**

over recommended operating conditions (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t <sub>PLH</sub> Propagation delay time, low-to-high-level output	S at 0 V, See <a href="#">Figure 4</a>	25	65	120	ns
t <sub>PHL</sub> Propagation delay time, high-to-low-level output		25	45	90	
t <sub>r</sub> Differential output signal rise time			25		
t <sub>f</sub> Differential output signal fall time			50		
t <sub>en</sub> Enable time from silent mode to dominant	See <a href="#">Figure 7</a>			1	μs
t <sub>(dom)</sub> Dominant time-out	↓V <sub>I</sub> , See <a href="#">Figure 10</a>	300	450	700	μs

**RECEIVER ELECTRICAL CHARACTERISTICS**

over recommended operating conditions (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP <sup>(1)</sup>	MAX	UNIT
V <sub>IT+</sub> Positive-going input threshold voltage	S at 0 V, See <a href="#">Table 1</a>		800	900	mV
V <sub>IT–</sub> Negative-going input threshold voltage		500	650		
V <sub>hys</sub> Hysteresis voltage (V <sub>IT+</sub> – V <sub>IT–</sub> )		100	125		
V <sub>OH</sub> High-level output voltage	I <sub>O</sub> = –2 mA, See <a href="#">Figure 6</a>	4	4.6		V
V <sub>OL</sub> Low-level output voltage	I <sub>O</sub> = 2 mA, See <a href="#">Figure 6</a>		0.2	0.4	V
I <sub>I(off)</sub> Power-off bus input current	CANH or CANL = 5 V, Other pin at 0 V, V <sub>CC</sub> at 0 V, TXD at 0 V		165	250	μA
I <sub>O(off)</sub> Power-off RXD leakage current	V <sub>CC</sub> at 0 V, RXD at 5 V			20	μA
C <sub>I</sub> Input capacitance to ground, (CANH or CANL)	TXD at 3 V, V <sub>I</sub> = 0.4 sin (4E6πt) + 2.5 V		13		pF
C <sub>ID</sub> Differential input capacitance	TXD at 3 V, V <sub>I</sub> = 0.4 sin (4E6πt)		5		
R <sub>ID</sub> Differential input resistance	TXD at 3 V, S at 0 V	30		80	kΩ
R <sub>IN</sub> Input resistance, (CANH or CANL)		15	30	40	

(1) All typical values are at 25°C with a 5-V supply.

## RECEIVER ELECTRICAL CHARACTERISTICS (continued)

over recommended operating conditions (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP <sup>(1)</sup>	MAX	UNIT
$R_{I(m)}$ Input resistance matching [1 – ( $R_{IN(CANH)} / R_{IN(CANL)}$ )] × 100%	$V_{(CANH)} = V_{(CANL)}$	–3%	0%	3%	

## RECEIVER SWITCHING CHARACTERISTICS

over recommended operating conditions (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$ Propagation delay time, low-to-high-level output	S at 0 V or $V_{CC}$ , See <a href="#">Figure 6</a>	60	100	130	ns
$t_{PHL}$ Propagation delay time, high-to-low-level output		45	70	90	ns
$t_r$ Output signal rise time			8		ns
$t_f$ Output signal fall time			8		ns

## S-PIN CHARACTERISTICS

over recommended operating conditions (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$I_{IH}$ High level input current	S at 2 V	20	40	70	$\mu A$
$I_{IL}$ Low level input current	S at 0.8 V	5	20	30	

## VREF-PIN CHARACTERISTICS

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$V_O$ Reference output voltage	$-50 \mu A < I_O < 50 \mu A$	0.4 $V_{CC}$	0.5 $V_{CC}$	0.6 $V_{CC}$	V

## THERMAL CHARACTERISTICS

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$\theta_{JA}$ Junction-to-Air	Low-K thermal resistance <sup>(1)</sup>		211		$^{\circ}C/W$
	High-K thermal resistance		131		
$\theta_{JB}$ Junction-to-Board Thermal Resistance			53		
$\theta_{JC}$ Junction-to-Case Thermal Resistance			79		
$P_D$ Average power dissipation	$V_{CC} = 5.0 V$ , $T_j = 27^{\circ}C$ , $R_L = 60 \Omega$ , S at 0 V, Input to TXD a 500 kHz, 50% duty cycle square wave. CL at RXD = 15 pF		112		mW
	$V_{CC} = 5.5 V$ , $T_j = 130^{\circ}C$ , $R_L = 45 \Omega$ , S at 0 V, Input to TXD a 500 kHz, 50% duty cycle square wave. CL at RXD = 15 pF			170	
$T_{J\_shutdown}$ Junction temperature, thermal shutdown <sup>(2)</sup>			190		$^{\circ}C$

(1) Tested in accordance with the Low-K or High-K thermal metric definitions of EIA/JESD51-3 for leaded surface-mount packages.

(2) Extended operation in thermal shutdown may affect device reliability, see APPLICATIONS INFORMATION.

## FUNCTION TABLES

## DRIVER

INPUTS		OUTPUTS		BUS STATE
TXD <sup>(1)</sup>	S <sup>(1)</sup>	CANH <sup>(1)</sup>	CANL <sup>(1)</sup>	
L	L or Open	H	L	DOMINANT
H	X	Z	Z	RECESSIVE
Open	X	Z	Z	RECESSIVE
X	H	Z	Z	RECESSIVE

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

## RECEIVER

DIFFERENTIAL INPUTS $V_{ID} = V(CANH) - V(CANL)$	OUTPUT RXD <sup>(1)</sup>	BUS STATE
$V_{ID} \geq 0.9 \text{ V}$	L	DOMINANT
$0.5 \text{ V} < V_{ID} < 0.9 \text{ V}$	?	?
$V_{ID} \leq 0.5 \text{ V}$	H	RECESSIVE
Open	H	RECESSIVE

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

## PARAMETER MEASUREMENT INFORMATION

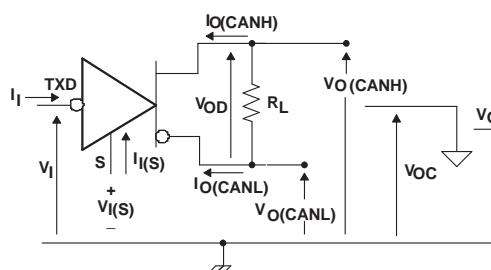


Figure 1. Driver Voltage, Current, and Test Definition

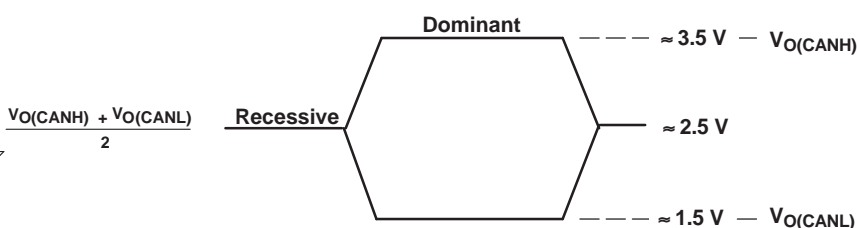
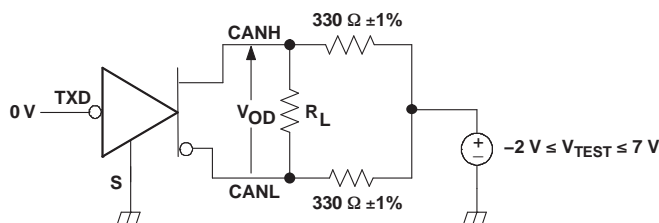


Figure 2. Bus Logic State Voltage Definitions

Figure 3. Driver  $V_{OD}$  Test Circuit

## PARAMETER MEASUREMENT INFORMATION (continued)

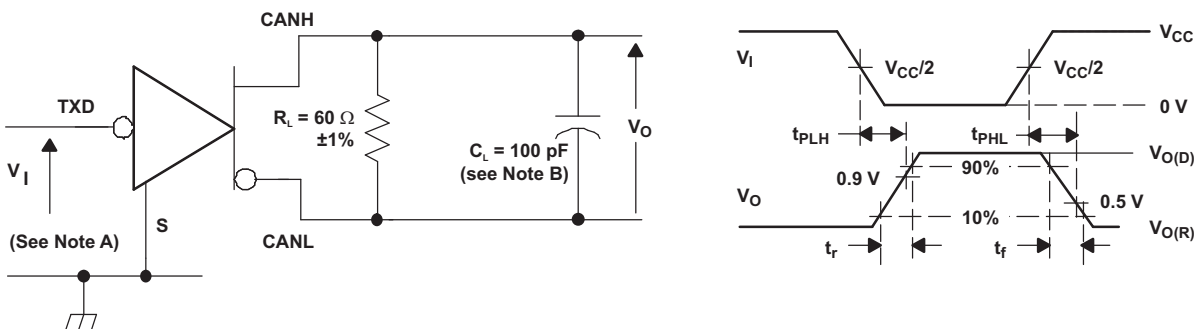


Figure 4. Driver Test Circuit and Voltage Waveforms

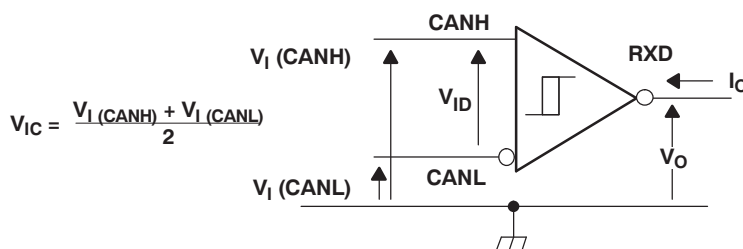
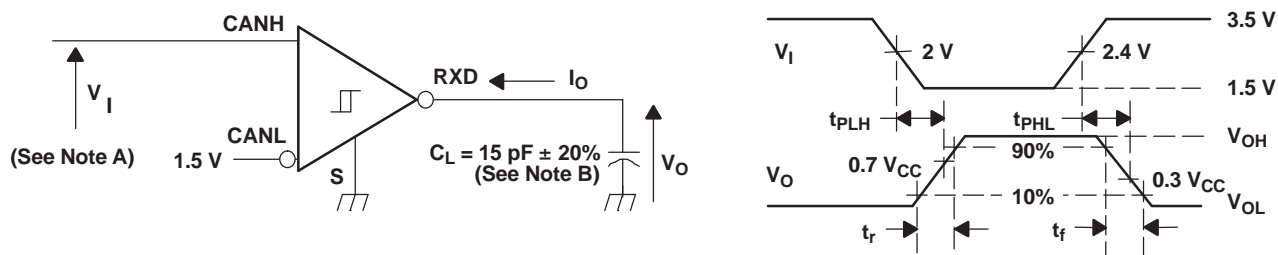


Figure 5. Receiver Voltage and Current Definitions

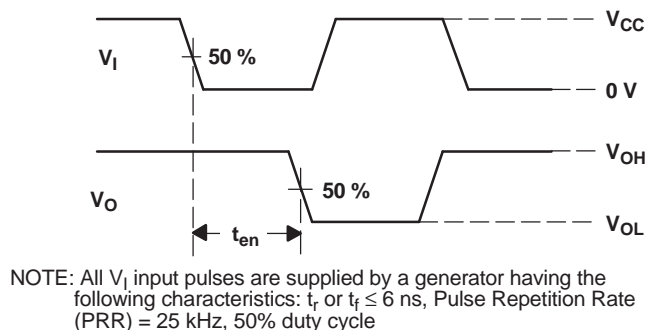
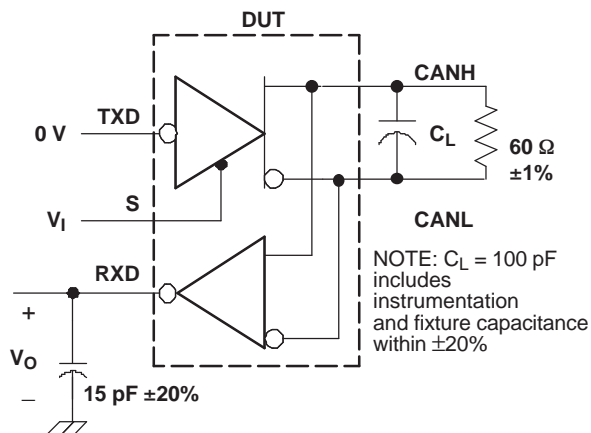
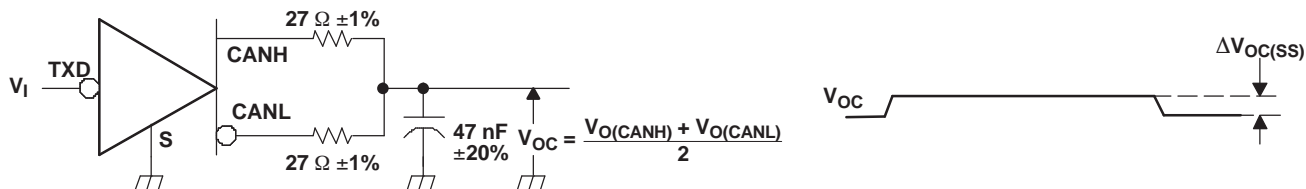
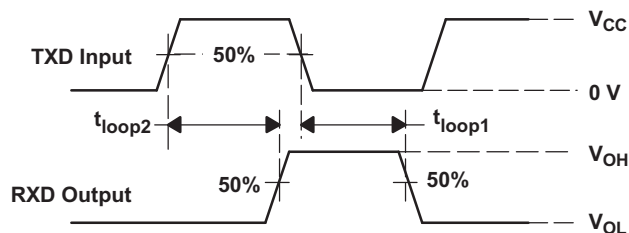
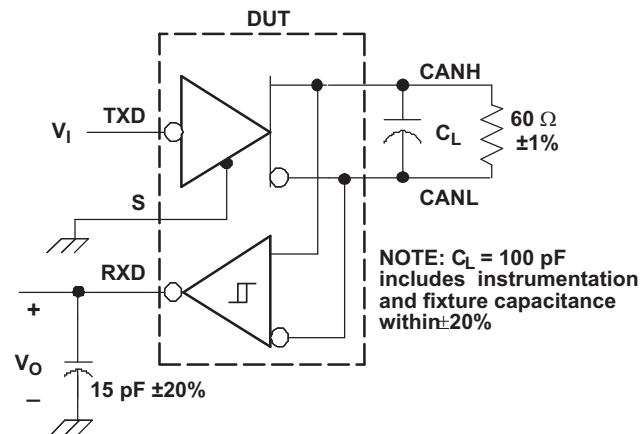


- A. The input pulse is supplied by a generator having the following characteristics: PRR ≤ 125 kHz, 50% duty cycle,  $t_r \leq 6$  ns,  $t_f \leq 6$  ns,  $Z_O = 50 \Omega$ .
- B.  $C_L$  includes instrumentation and fixture capacitance within 20%.

Figure 6. Receiver Test Circuit and Voltage Waveforms

Table 1. Differential Input Voltage Threshold Test

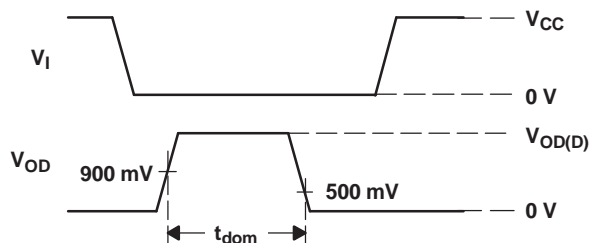
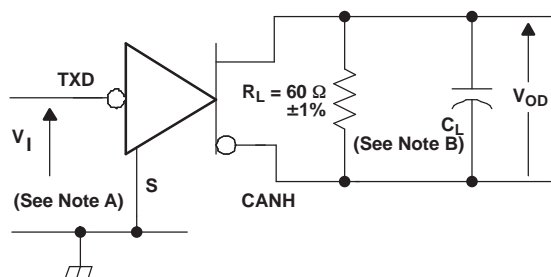
INPUT			OUTPUT	
$V_{CANH}$	$V_{CANL}$	$ V_{ID} $	R	
-11.1 V	-12 V	900 mV	L	$V_{OL}$
12 V	11.1 V	900 mV	L	
-6 V	-12 V	6 V	L	
12 V	6 V	6 V	L	
-11.5 V	-12 V	500 mV	H	$V_{OH}$
12 V	11.5 V	500 mV	H	
-12 V	-6 V	6 V	H	
6 V	12 V	6 V	H	
Open	Open	X	H	


**Figure 7.  $t_{en}$  Test Circuit and Waveform**

**Figure 8. Common Mode Output Voltage Test and Waveforms**


- A. All  $V_I$  input pulses are from 0 V to  $V_{CC}$  and supplied by a generator having the following characteristics:  $t_r$  or  $t_f \leq 6$  ns, Pulse Repetition Rate (PRR) = 125 kHz, 50% duty cycle.

**Figure 9.  $t_{(LOOP)}$  Test Circuit and Waveform**





- A. All  $V_I$  input pulses are from 0 V to  $V_{CC}$  and supplied by a generator having the following characteristics:  $t_r$  or  $t_f \leq 6$  ns. Pulse Repetition Rate (PRR) = 500 Hz, 50% duty cycle.
- B.  $C_L = 100$  pF includes instrumentation and fixture capacitance within  $\pm 20\%$ .

Figure 10. Dominant Time-Out Test Circuit and Waveforms

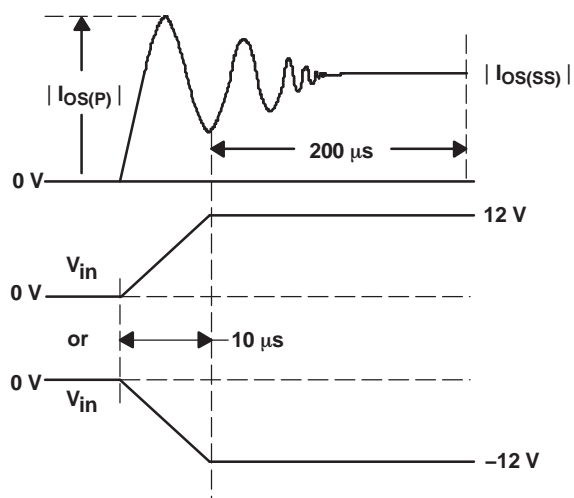
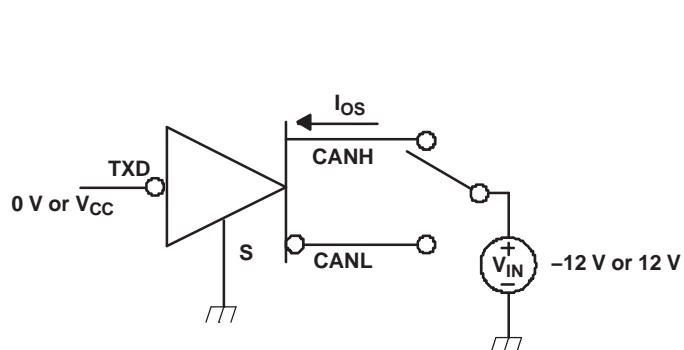


Figure 11. Driver Short-Circuit Current Test and Waveform

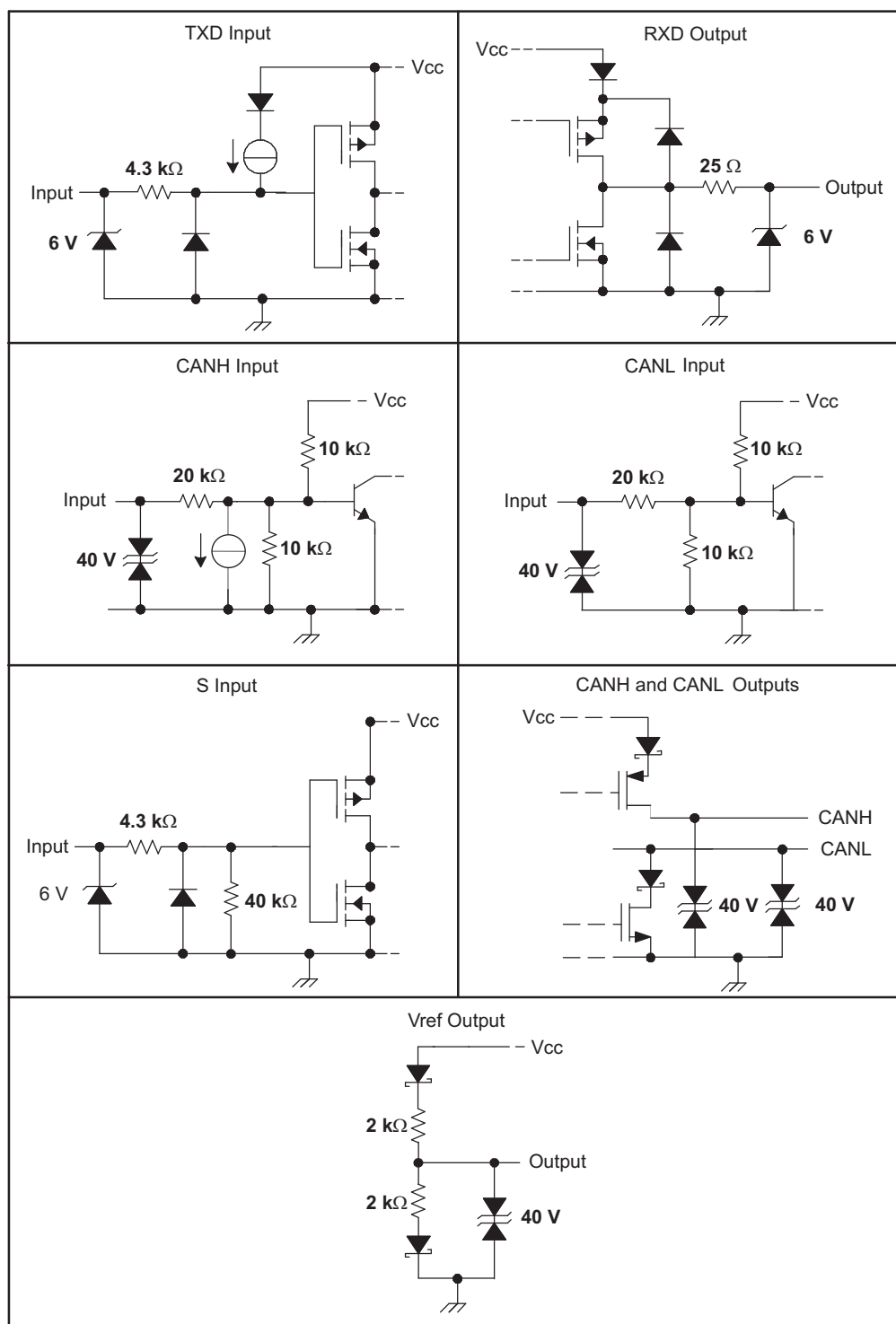
## DEVICE INFORMATION

**Table 2. Parametric Cross Reference With the TJA1050**

TJA1050 <sup>(1)</sup>	PARAMETER	HVD1050
<b>TRANSMITTER SECTION</b>		
V <sub>IH</sub>	High-level input voltage	Recommended V <sub>IH</sub>
V <sub>IL</sub>	Low-level input voltage	Recommended V <sub>IL</sub>
I <sub>IH</sub>	High-level input current	Driver I <sub>IH</sub>
I <sub>IL</sub>	Low-level input current	Driver I <sub>IL</sub>
<b>BUS SECTION</b>		
I <sub>LI</sub>	Power-off bus input current	Receiver I <sub>I(off)</sub>
I <sub>O(SC)</sub>	Short-circuit output current	Driver I <sub>OS(SS)</sub>
V <sub>O(dom)</sub>	Dominant output voltage	Driver V <sub>O(D)</sub>
V <sub>i(dif)(th)</sub>	Differential input voltage	Receiver V <sub>IT</sub> and recommended V <sub>ID</sub>
V <sub>i(dif)(hys)</sub>	Differential input hysteresis	Receiver V <sub>hys</sub>
V <sub>O(reces)</sub>	Recessive output voltage	Driver V <sub>O(R)</sub>
V <sub>O(dif)(bus)</sub>	Differential bus voltage	Driver V <sub>OD(D)</sub> and V <sub>OD(R)</sub>
R <sub>i(cm)</sub>	CANH, CANL input resistance	Receiver R <sub>IN</sub>
R <sub>i(dif)</sub>	Differential input resistance	Receiver R <sub>ID</sub>
R <sub>i(cm)(m)</sub>	Input resistance matching	Receiver R <sub>I (m)</sub>
C <sub>i</sub>	Input capacitance to ground	Receiver C <sub>I</sub>
C <sub>i(dif)</sub>	Differential input capacitance	Receiver C <sub>ID</sub>
<b>RECEIVER SECTION</b>		
I <sub>OH</sub>	High-level output current	Recommended I <sub>OH</sub>
I <sub>OL</sub>	Low-level output current	Recommended I <sub>OL</sub>
<b>Vref PIN SECTION</b>		
V <sub>ref</sub>	Reference output voltage	V <sub>O</sub>
<b>TIMING SECTION</b>		
t <sub>d(TXD-BUSon)</sub>	Delay TXD to bus active	Driver t <sub>PLH</sub>
t <sub>d(TXD-BUSoff)</sub>	Delay TXD to bus inactive	Driver t <sub>PHL</sub>
t <sub>d(BUSon-RXD)</sub>	Delay bus active to RXD	Receiver t <sub>PHL</sub>
t <sub>d(BUSoff-RXD)</sub>	Delay bus inactive to RXD	Receiver t <sub>PLH</sub>
	t <sub>d(TXD-BUSon)</sub> + t <sub>d(BUSon-RXD)</sub>	Device t <sub>LOOP1</sub>
	t <sub>d(TXD-BUSoff)</sub> + t <sub>d(BUSoff-RXD)</sub>	Device t <sub>LOOP2</sub>
t <sub>dom(TXD)</sub>	Dominant time out	Driver t <sub>(dom)</sub>
<b>S PIN SECTION</b>		
V <sub>IH</sub>	High-level input voltage	Recommended V <sub>IH</sub>
V <sub>IL</sub>	Low-level input voltage	Recommended V <sub>IL</sub>
I <sub>IH</sub>	High-level input current	I <sub>IH</sub>
I <sub>IL</sub>	Low-level input current	I <sub>IL</sub>

(1) From TJA1050 Product Specification, Philips Semiconductors, 2002 May 16.

## Equivalent Input and Output Schematic Diagrams



## TYPICAL CHARACTERISTICS

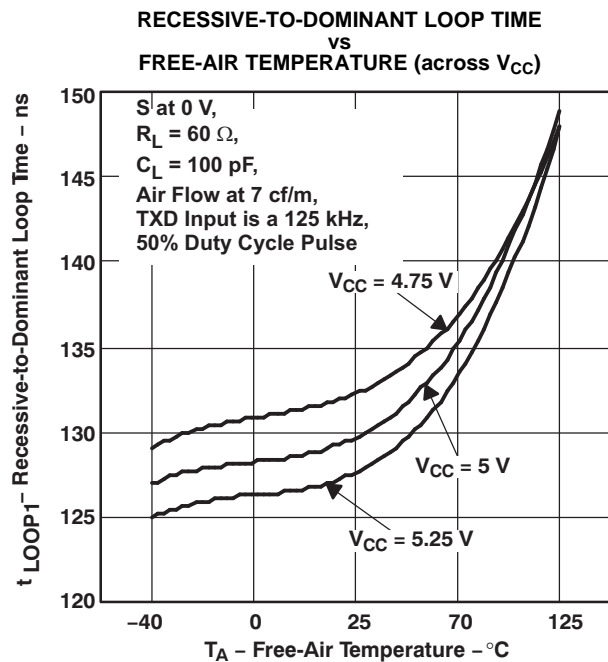


Figure 12.

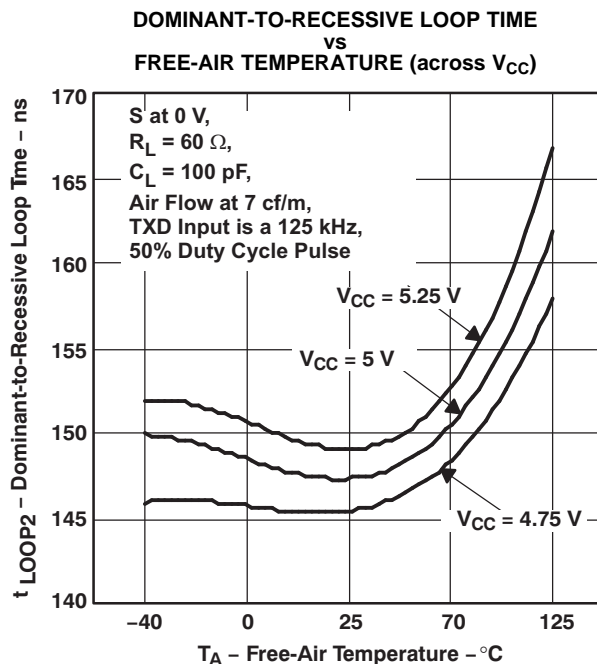


Figure 13.

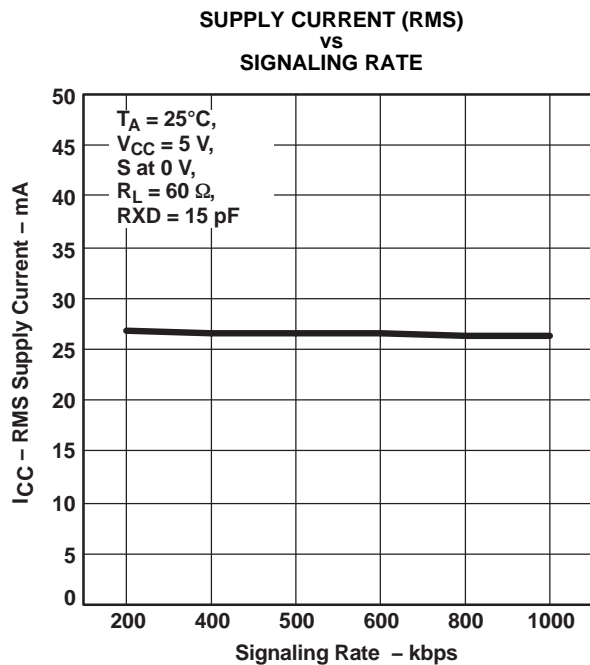


Figure 14.

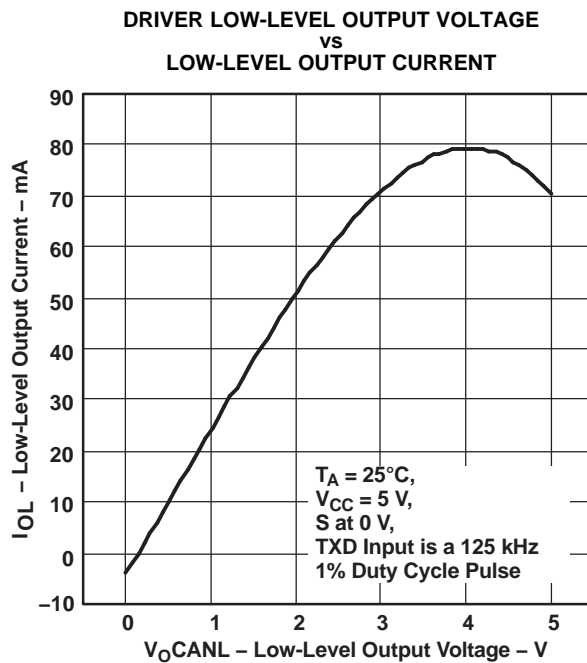


Figure 15.

## TYPICAL CHARACTERISTICS (continued)

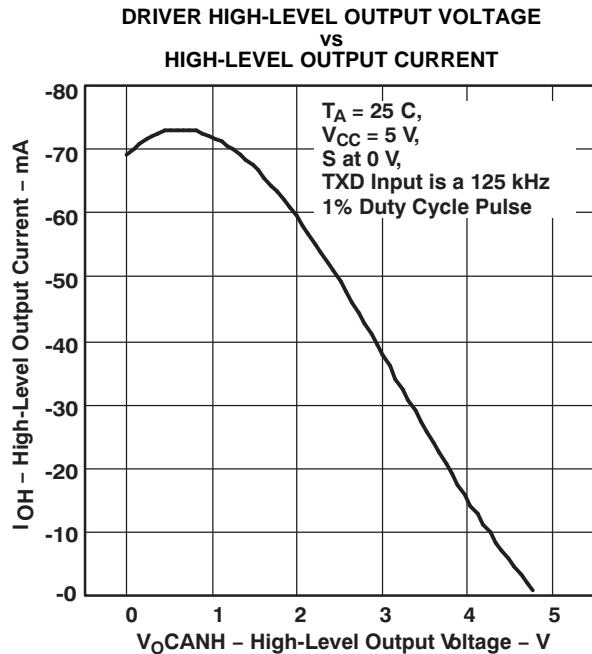


Figure 16.

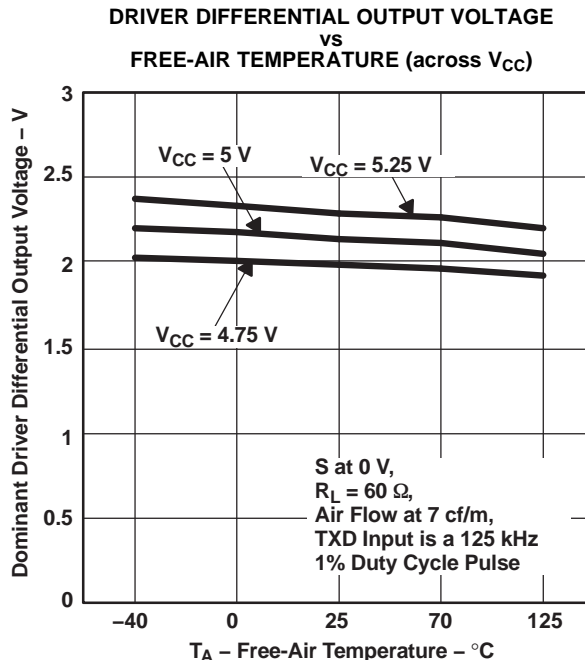


Figure 17.

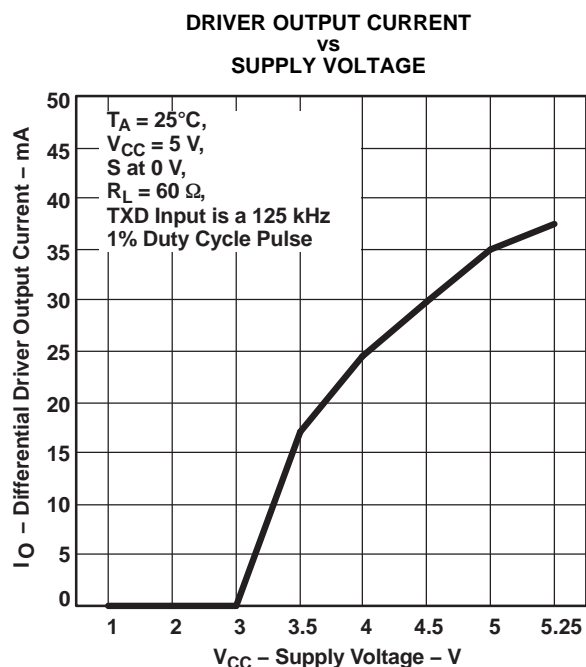


Figure 18.

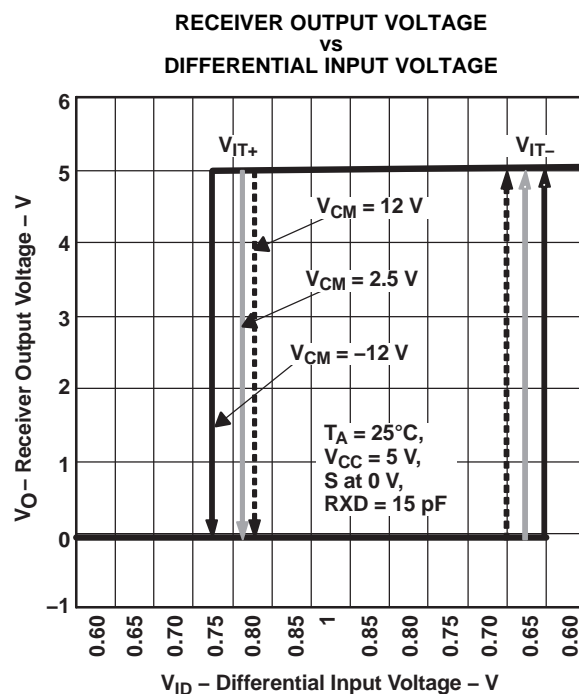
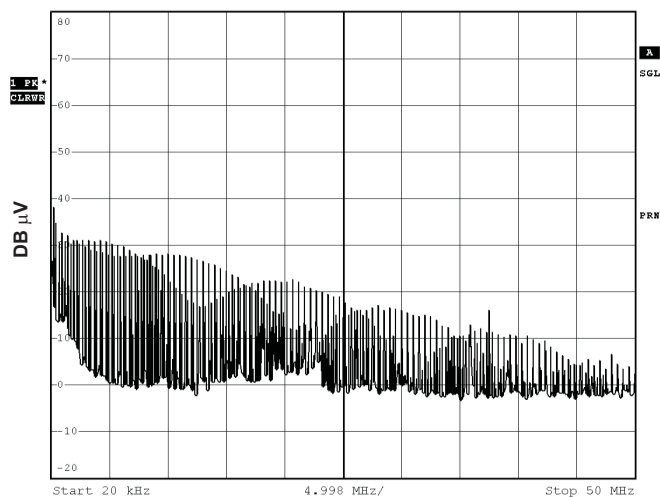


Figure 19.

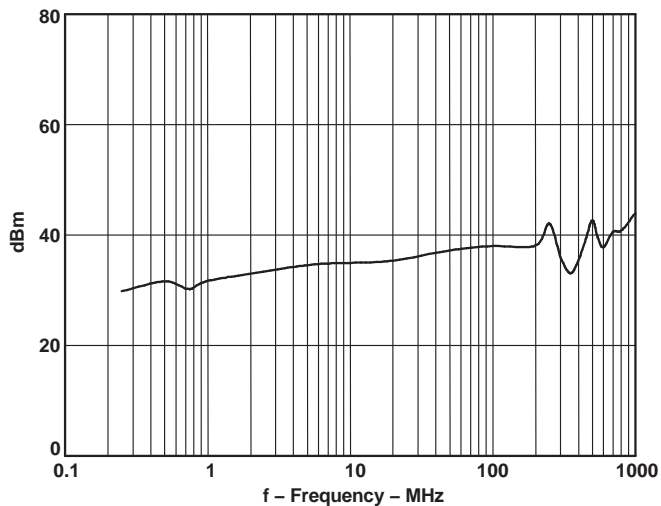
## TYPICAL CHARACTERISTICS (continued)

**TYPICAL ELECTROMAGNETIC EMISSIONS  
UP TO 50 MHz (Peak Amplitude)**



**Figure 20. Frequency Spectrum of Common-Mode Emissions**

**TYPICAL ELECTROMAGNETIC  
IMMUNITY PERFORMANCE**



**Figure 21. Direct Power Injection (DPI) Response vs Frequency**

## APPLICATION INFORMATION

### THERMAL SHUTDOWN

The SN65HVD1050 has a thermal shutdown feature that turns off the driver outputs when the junction temperature nears 190°C. This shutdown prevents catastrophic failure from bus shorts, but does not protect the circuit from possible damage. The user should strive to maintain recommended operating conditions and not exceed absolute-maximum ratings at all times. If an SN65HVD1050 is subjected to many, or long-duration faults that can put the device into thermal shutdown, it should be replaced.

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
SN65HVD1050D	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65HVD1050DG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65HVD1050DR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65HVD1050DRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

<sup>(1)</sup> 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.

<sup>(2)</sup> 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)

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

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**OTHER QUALIFIED VERSIONS OF SN65HVD1050 :**

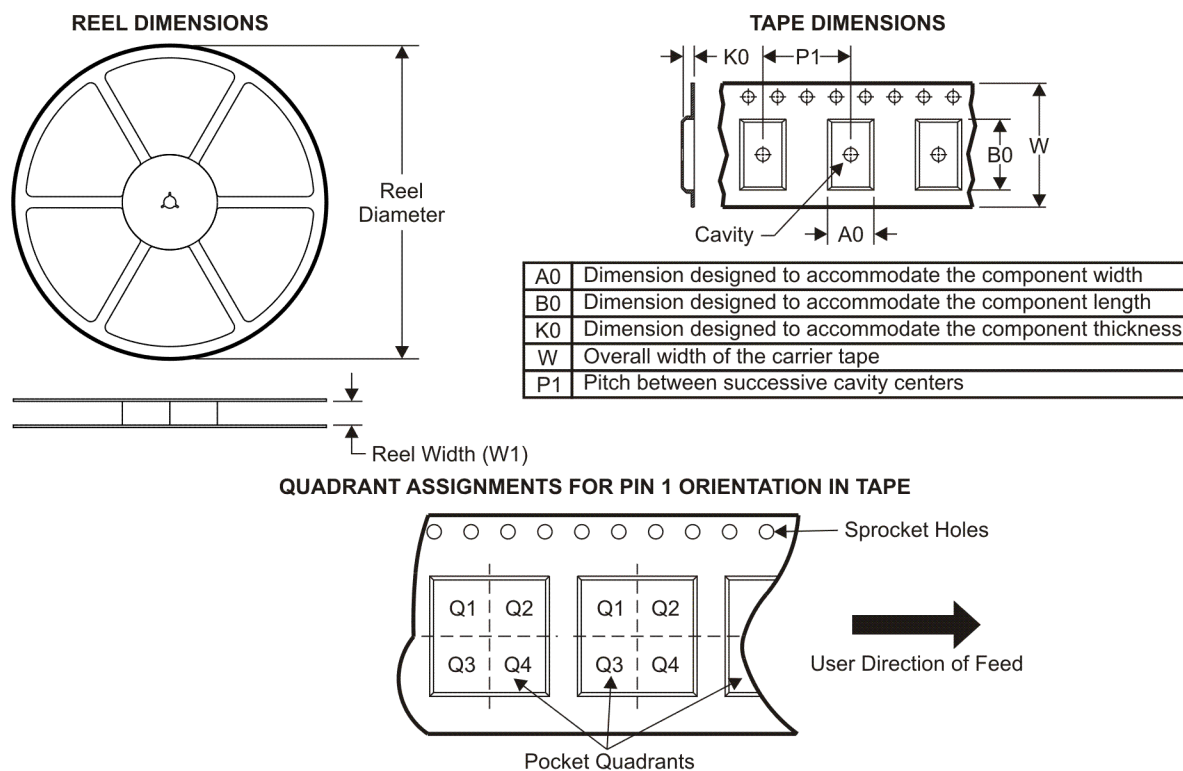
- Automotive: [SN65HVD1050-Q1](#)
- Enhanced Product: [SN65HVD1050-EP](#)

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Enhanced Product - Supports Defense, Aerospace and Medical Applications



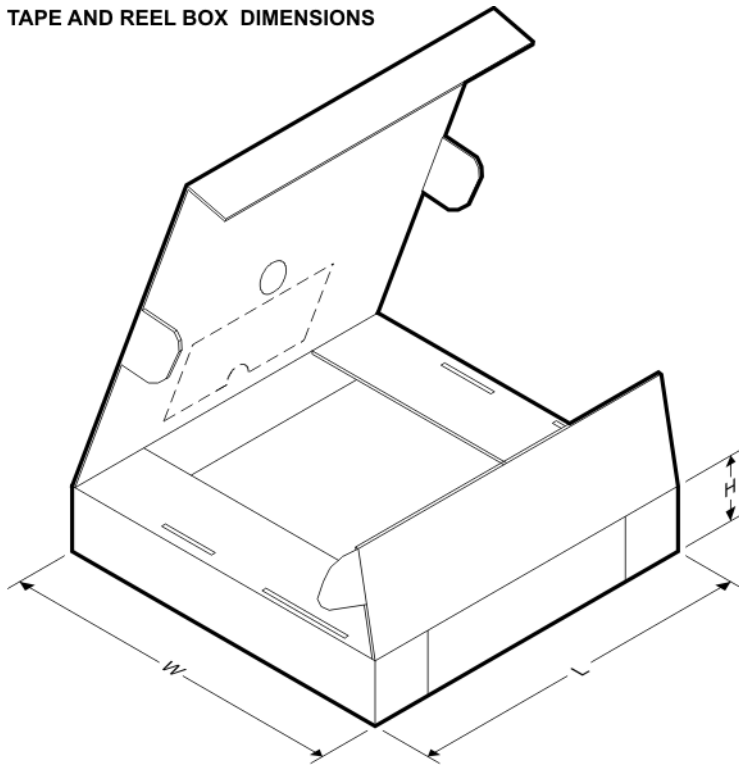
## TAPE AND REEL INFORMATION



\*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
SN65HVD1050DR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1

## TAPE AND REEL BOX DIMENSIONS

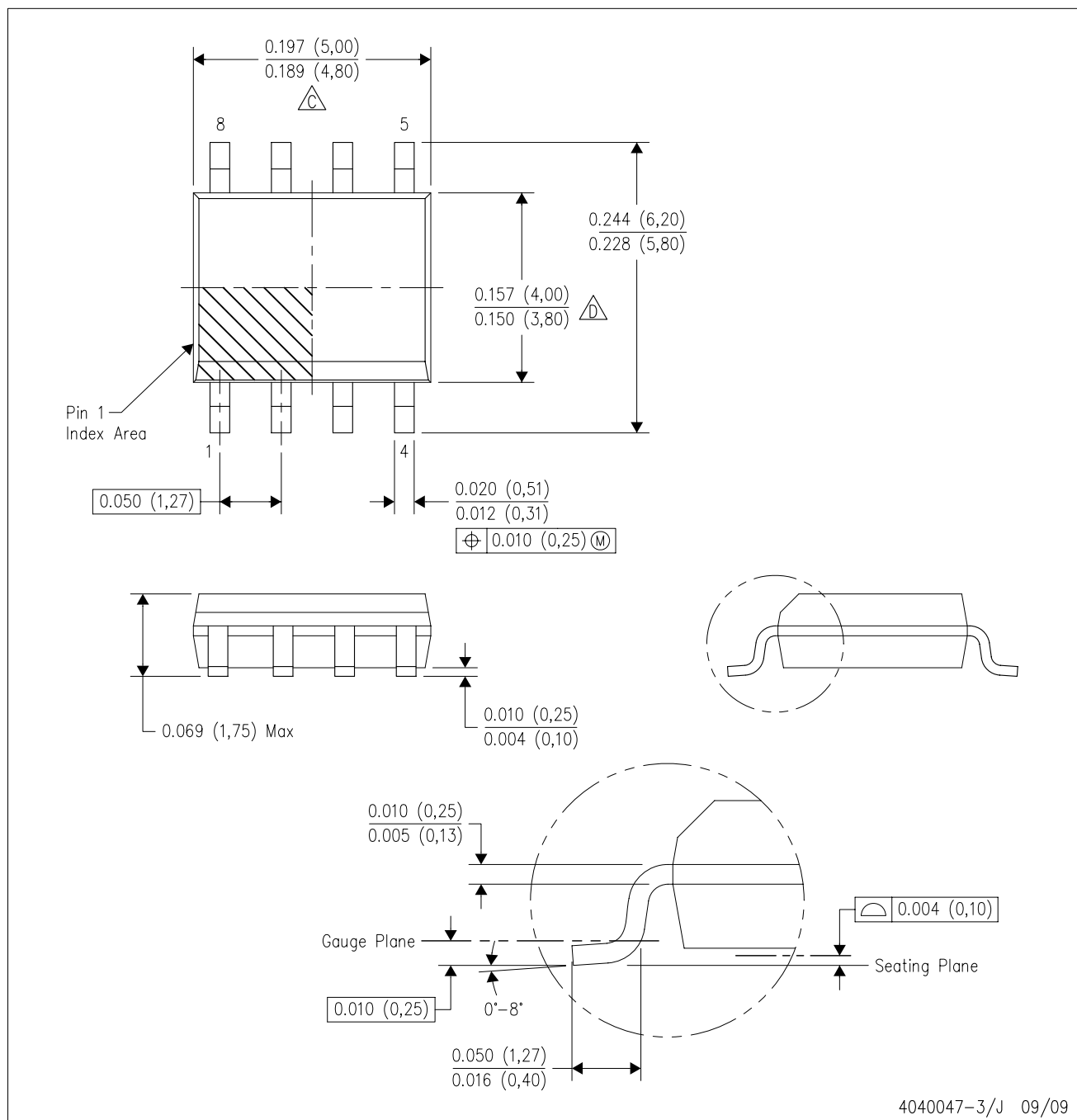




\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN65HVD1050DR	SOIC	D	8	2500	346.0	346.0	29.0

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.
  -  C. 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.
  -  D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
  - E. Reference JEDEC MS-012 variation AA.

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