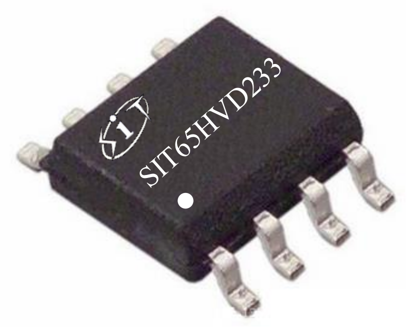
SIT65HVD233

Corel **3.3V power supply, with diagnostic loop function, high-speed CAN bus transceiver**

characteristic:

- Powered by a single power supply of 3.3V;
- Comply with ISO 11898-2 standard;
- Total lead ESD protection exceeds ±12kV human model (HBM);
- Up to 120 nodes can be connected on a single bus;
- The adjustable driver conversion time can improve the radiation performance;
- Low current standby mode: 650μA (typical value);
- Designed for data rates up to 1Mbps;
- Hot shutdown protection;
- Open circuit fault safety design;
- Non-scratch pulse power on and off protection for hot-swappable applications

Product appearance:



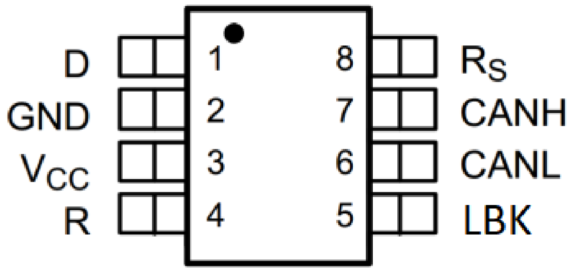
Provide green and lead-free packaging

description

SIT65HVD233 is an interface chip used between CAN protocol controllers and physical buses. It works with 3.3V microprocessors, microcontrollers (MCUs), and digital signal processors (DSPs) or equivalent protocol controllers equipped with CAN controllers. It is applied in industrial automation, control, sensor and drive systems, motor and robot control, building and temperature control, telecommunications and base station control, as well as status monitoring. It is suitable for applications that use the CAN serial communication physical layer compliant with ISO 11898 standards.

Parameter	Symbol	Test condition	Minimum	Maximum	Unit
Service voltage	V_{cc}		3	3.6	V
Peak transfer rate	$1/t_{bit}$	Non-zero code	1		Mbaud
CANH、CANL Input and output voltage	V_{can}		-36	+36	V
Total line differential voltage	V_{diff}		1.5	3.0	V
Ambient temperature	T_{amb}		-40	125	℃

Pin distribution diagram


D
GND
V_{CC}
R
1
2
3
4
8
7
6
5
R_S
CANH
CANL
LBK

absolute rating

Parameter	Symbol	Big or small	Unit
Supply voltage	V_{CC}	-0.3~+6	V
MCU side port volt-age	D，R	-0.5~VCC+0.5	V
Total input voltage on the bus	CANL，CANH	-36~36	V
6, Transient voltage at pin 7	V_{tr}	-100~+100	V
Receiver output cu-rrent, IO		-11~11	mA
Storage working te-mperature range		-40~150	℃
Ambient temperature		-40~125	℃
Welding temperature range		300	℃
Continuous power consumption	SOP8	400	mW
	DIP8	700	mW

The maximum limit parameter value is the value beyond which the device may suffer irreversible damage. Under these conditions, it is not conducive to the normal operation of the device. Continuous operation of the device at the maximum allowable rating may affect the reliability of the device. All voltage reference points are ground.

Pin definition

Pin number	Pin name	Pin function
1	D	CAN sends data input (low level in explicit bus state; high level in implicit bus state), also known as TXD, driver input
2	GND	Grounding connection
3	VCC	Transceiver 3.3V, power supply voltage
4	R	The CAN receives data output (low level in the explicit bus state; high level in the implicit bus state), also known as RXD, driver output
5	LBK	Ringback mode input pin
6	CANL	Low level CAN bus
7	CANH	High level CAN bus
8	R_S	Mode selection pin: Strong pull-down to GND= high speed mode; strong pull-up to VCC = low power mode; through 10 kΩ to 100kΩ, resistor pull-down to GND = slope control

		mode.

DC characteristics of the total signal transmitter

Symbol	Parameter		Test condition	Minimum	Typical case	Maximum	Unit
V_O (D)	Output voltage (dominance)	CANH	VI = 0V, RS = 0V, RL = 60Ω (see Figure 1 and Figure 2)	2.45		VCC	v
		CANL		0.5		1.25	
V_{OD} (D)	Differential output voltage (explicit)		VI = 0V, RS = 0V, RL = 60Ω (see Figure 1)	1.5	2	3	v
			VI=0V, RL=60Ω, RS =0V (see Figure 3)	1.2	2	3	v
V_O (R)	Output voltage (covert gender)	CANH	VI = 3V, RS = 0V, RL = 60Ω (see Figure 1)		2.3		v
		CANL			2.3		
V_{OD} (R)	Differential output voltage (hidden)		VI=3V, R_S=0V	-0.12		0.012	v
			VI=3V, R_S=0V,NO LOAD	-0.5		0.05	v
I_{IH}	High voltage input current		VI=2V	-30		30	μA
I_{IL}	Low voltage input current		VI=0.8V	-30		30	μA
I_{OS}	Short circuit output current		CANH=-7V	-250			mA
			CANH=12V			1	
			CANL=-7V	-1			
			CANL=12V			250	
C_O	Output capacitance		See receiver				
I_{CC}	Supply current		Await the opportune moment		650	950	μA
			VI=0V (dominant), no load			6	mA
			VI=VCC (heterozygous), no load			6	mA

(If not otherwise stated, VCC=3.3V±10%, Temp=TMIN~TMAX, typical value in VCC=+3.3V, Temp = 25)

Symbol	Parameter	Test condition	Minimum	Typical case	Maximum	Unit
t_{PLH}	Propagation delay (low to high)	R = 0, i.e. short circuit (see Figure 4)		35	85	ns
		R=10 kΩ		70	125	
		R=100 kΩ		500	870	
t_{PHL}	Propagation delay (high to low)	R = 0, i.e. short circuit (see Figure 4)		70	120	
		R=10 kΩ		130	180	
		R=100 kΩ		870	1200	
$t_{sk(p)}$	Propagation delay symmetry	R = 0, i.e. short circuit (see Figure 4)		35		

	(| t_{PLH} - t_{PHL} |)	R=10 kΩ		60		
		R=100 kΩ		370		
tr	Differential output rise time	R = 0, i.e. short circuit (see Figure 4)	20		80	
		R=10 kΩ	30		160	
		R=100 kΩ	300		1400	
tf	Differential output fall time	R = 0, i.e. short circuit (see Figure 4)	20		80	
		R=10 kΩ	30		160	
		R=100 kΩ	300		1400	

(If not otherwise stated, VCC=3.3V±10%, Temp=TMIN~TMAX, typical value in VCC=+3.3V, Temp = 25)

DC characteristics of the total signal receiver

Symbol	Parameter	Test condition	Minimum	Typical case	Maximum	Unit
V_{IT+}	Receiver is at threshold	See Table 1		750	900	mV
V_{IT-}	Receiver negative threshold	See Table 1	500	650		mV
V_{hys}	The lag range	VIT+- VIT-		100		mV
V_{OH}	High level output voltage	-6V<VID<500mV Io =-8mA (see Figure 5)	2.4			V
V_{OL}	Low level output voltage	900mV<VID<6V Io =8 mA (see Figure 5)			0.4	V
I_i	Total input current for the bus	VIH=12V, VCC=0V	100		600	uA
I_i		VIH=12V, VCC=3.3V	100		500	μA
I_i		VIH=-7V, VCC=0V	-450		-20	μA
I_i		VIH=-7V, VCC=3.3V	-610		-30	μA
R_i	Total input resistance of the bus	ISO 11898-2 corresponding standard	20	35	50	KΩ
R_{diff}	Differential input resistance	ISO 11898-2 corresponding standard	40		100	KΩ
C_i	Total input capacitance of the bus	ISO 11898-2 corresponding standard		40		pF

C_{diff}	Differential-input capacitance	ISO 11898-2 corresponding standard		20		pF

I_{CC}	Supply current	See the driver				

(If not otherwise stated, VCC=3.3V±10%, Temp=TMIN~TMAX, typical value in VCC=+3.3V, Temp = 25)

Total line receiver switch characteristics

Symbol	Parameter	Test condition	Minimum	Typical case	Maximum	Unit
t_{PLH}	Receiver propagation delay (low-high)	See Figure 6		35	60	ns
t_{PHL}	Receiver propagation delay (high-low)	See Figure 6		35	60	ns
t_{sk}	Pulse shift	$\|t_{PHL} - t_{PLH}\|$			10	ns
t_r	Output signal rise time	See Figure 6		1.5		ns
t_f	Output signal fall time	See Figure 6		1.5		ns

(If not otherwise stated, VCC=3.3V±10%, Temp=TMIN~TMAX, typical value in VCC=+3.3V, Temp = 25)

Device switching characteristics

Symbol	Parameter	Test condition	Minimum	Typical case	Maximum	Unit
$t_{(LOOP1)}$	Loop delay 1, driver input to receiver output, implicit to explicit	R = 0, i.e. short circuit (see Figure 8)		70	135	ns
		R=10 kΩ		105	190	ns
		R=100 kΩ		535	1000	ns
$t_{(LOOP2)}$	Loop delay 2, driver input to receiver output, explicit to implicit	R = 0, i.e. short circuit (see Figure 8)		70	165	ns
		R=10 kΩ		105	190	ns
		R=100 kΩ		535	1000	ns
$t_{(LBK)}$	The loopback delay drives the input of the receiver	(See figure 9)		7.5	12	ns

	to the output					

(If not otherwise stated, VCC=3.3V±10%, Temp=TMIN~TMAX, typical value in VCC=+3.3V, Temp = 25)

Over temperature protection

Symbol	Parameter	Test condition	Minimum	Typical case	Maximum	Unit
Overtemperature shutdown	Tj(sd)		155	165	180	℃

(If not otherwise stated, VCC=3.3V±10%, Temp=TMIN~TMAX, typical value in VCC=+3.3V, Temp = 25)

Control pin characteristics

Symbol	Parameter	Test condition	Minimum	Typical case	Maximum	Unit
T_{WAKE}	Wait until the wake time	RS Joining square wave (see Figure 7)		0.55	1.5	μs
I_{RS}	High speed mode input current	V_{RS}<1V	-450		0	μA
V_{RS}	Standby/sleep input voltage	0<V_{RS}<V_{CC}	0.75V_{CC}		V_{CC}	V
I_{off}	Dropping leakage current	Vcc=0V , V_{CANH}=V_{CANL}=5V	-250		250	μA

(If not otherwise stated, VCC=3.3V±10%, Temp=TMIN~TMAX, typical value in VCC=+3.3V, Temp = 25)

supply current

Parameter	Symbol	Test condition	Minimum	Typical case	Maximum	Unit
Standby power consumption	I_{CC}	R_S=VCC, V_I=VCC		650	950	μA
Visible power consumption		V_I=0V, R_S=0V, LOAD=60Ω		50	70	mA
Hidden power consumption		V_I=VCC, R_S=0V, NO LOAD			6	mA

(If not otherwise stated, VCC=3.3V±10%, Temp=TMIN~TMAX, typical value VCC=+3.3V, Temp = 25)

Function table

Table 1 Receiver characteristics in common mode mode (V(RS)=1.2V)

V_{ID}	V_{CANH}	V_{CANL}	R OUTPUT	
900mV	-6.1V	-7V	L	VOL
900mV	12V	11.1V	L	
6V	-1V	-7V	L	
6V	12V	6V	L	
500mV	-6.5V	-7V	H	VOH
500mV	12V	11.5V	H	
-6V	-7V	-1V	H	
-6V	6V	12V	H	
X	Open	Open	H	

(1) H= high level; L= low level; X= not related

Table 2 Driver functions

INPUTS			OUTPUTS		
D	**LBK**	**R_S**	**CANH**	**CANL**	**General vehicle status**
X	X	>0.75V_{CC}	Z	Z	Covert gender
L	L or open	<0.33V_{CC}	H	L	Dominance
H or open	X		Z	Z	Covert gender
X	H	0.33V_{CC}	Z	Z	Covert gender

(1) H= high level; L= low level; Z= high resistance state

Table 3 Receiver functions

INPUTS				OUTPUT
General vehicle status	**V_{ID}=CANH-CANL**	**LBK**	**D**	**R**
Dominance	V_{ID}≥0.9V	L or open	X	L
Covert gender	V_{ID}≤0.5V or open	L or open	H or open	H
?	0.5< V_{ID}<0.9V	L or open	H or open	?
X	X	H	L	L
X	X	H	H	H

(2) H= high level; L= low level;? = uncertain; X= not related

test circuit

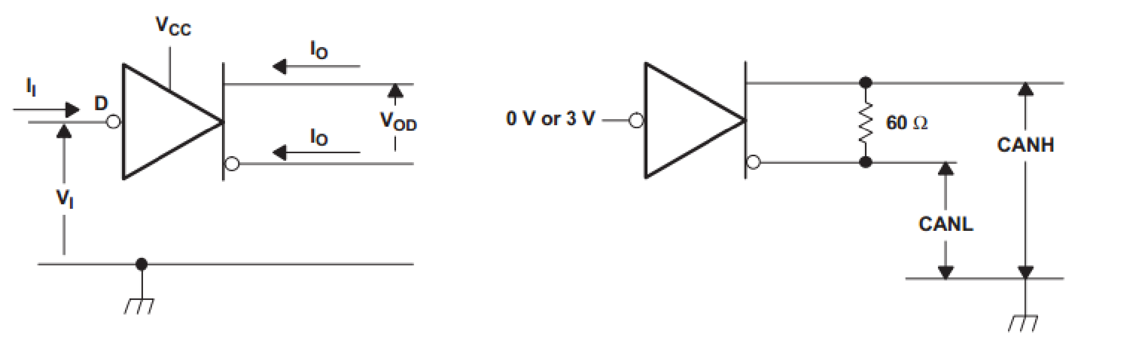


Figure 1 Definition of driver voltage and current test

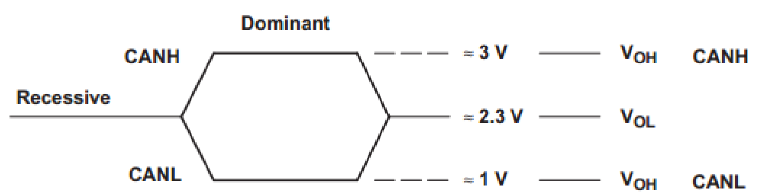


Figure 2 Bus logic voltage definition

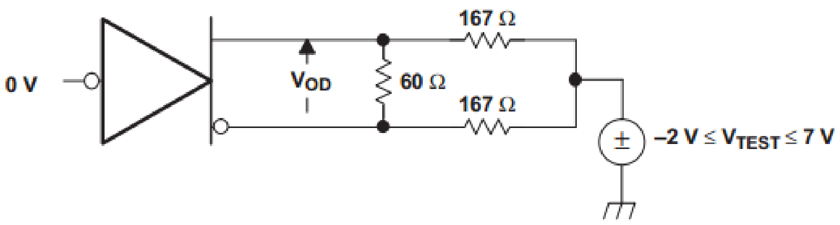
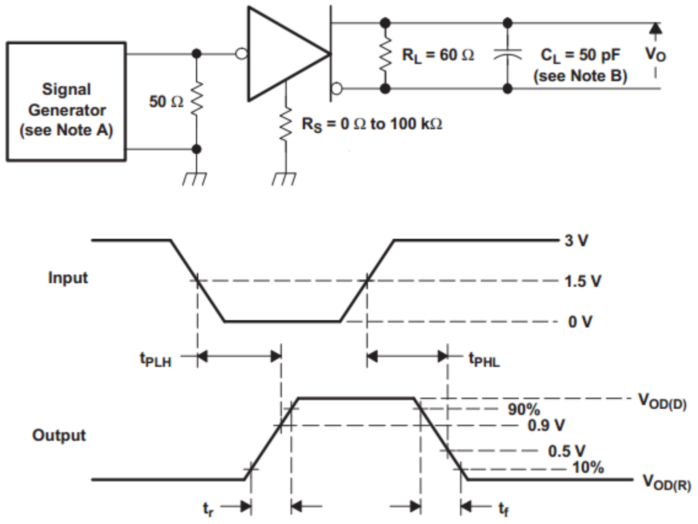


Figure 3 Driver VOD test circuit



A. Characteristics of input pulse generator: PRR is less than or equal to 500KHz, duty cycle is 50%, tr is less than 6ns, tf is less than 6ns, Zo is 50Ω

B and CL include instruments and fixed capacitors with an error of less than 20%.

Figure 4 Driver test circuit and voltage waveform

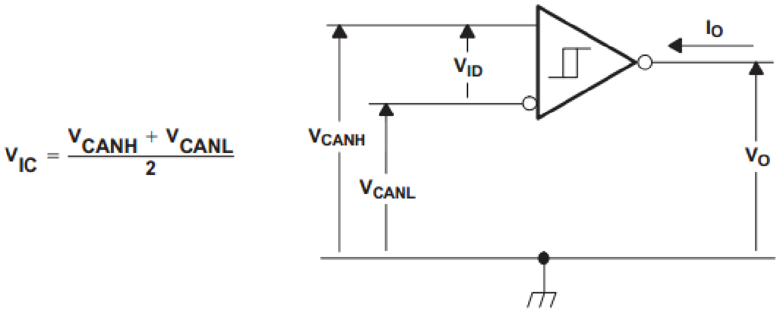
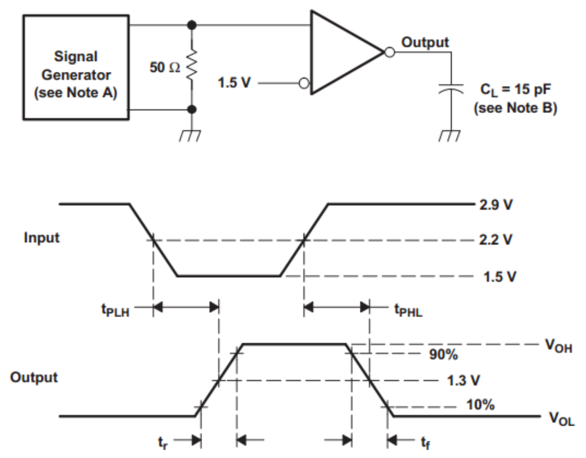


Figure 5 Receiver voltage and current definition



A. Characteristics of input pulse generator: PRR is less than or equal to 500KHz, duty cycle is 50%, tr is less than 6ns, tf is less than 6ns, Zo is 50Ω

B and CL include instruments and fixed capacitors with an error of less than 20%.

Figure 6 Receiver test circuit and voltage waveform

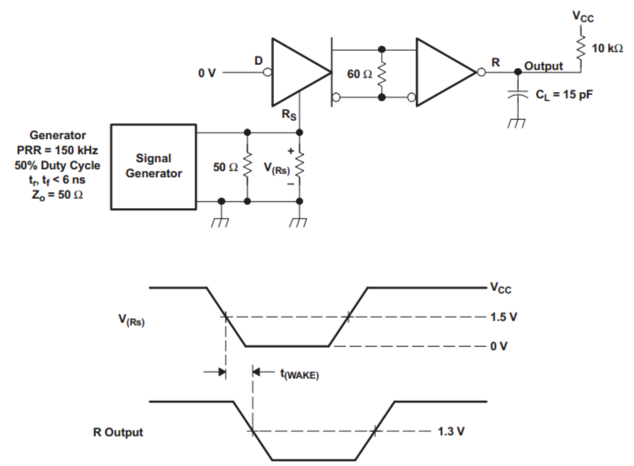
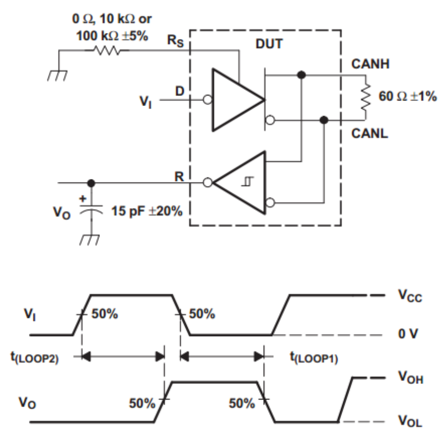
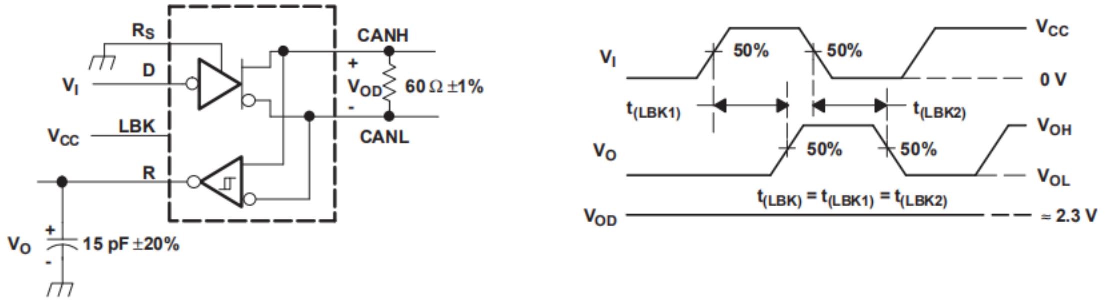


Figure 7 t (WAKE) test circuit and voltage waveform



A. Characteristics of input pulse generator: PRR is less than or equal to 125KHz, 50% duty cycle, tr <6ns, tf <6ns, Zo = 50Ω

Figure 8 t (LOOP) test circuit and voltage waveform



A. Characteristics of the input pulse generator: PRR = 125KHz, 50% duty cycle, tr <6ns, tf <6ns

Figure 9 t (LBK) test circuit and voltage waveform

explain

1 resume

SIT65HVD233 is an interface chip used between CAN protocol controllers and physical buses. When combined with 3.3V microprocessors, microcontrollers (MCUs), and digital signal processors (DSPs) or equivalent protocol controllers equipped with CAN controllers, it can be applied in industrial automation, control, sensor and drive systems, motor and robot control, building and temperature control, telecommunicati-ons and base station control, as well as status monitoring. It supports speeds up to 1Mbps and fully complies with the "ISO 11898" standard.

2 short-circuit protection

The drive level of SIT65HVD233 has a current limiting protection function to prevent the drive circuit from short-circuiting to the positive and negative power supply voltage. When a short circuit occurs, the power consumption will increase. The short circuit protection function can protect the drive level from damage.

3 Over temperature protection

SIT65HVD233 It has overtemperature protection function. When the junction tempe-rature exceeds 160℃, the current of the driver level will be reduced, because the driver tube is the main energy consuming component, and the current reduction can reduce the power consumption and thus reduce the chip temperature. At the same time, other parts of the chip still maintain normal operation.

4 Electrical transient protection

Electrical transients often occur in automotive applications, and SIT65HVD233 CANH and CANL have the function of preventing electrical transients from damaging.

5 control model

Three different operating modes are provided by the RS pin (pin 8): high speed mode, slope control mode and low power mode.

(1) High speed mode:

Applying a logic low level to the RS pin (pin 8) selects the high-speed mode. High-speed operation is typically used in industrial applications. High-speed mode allows the output to switch as quickly as possible and imposes no internal limits on the rise and fall times of the output. If high-speed switching affects radiation performance, a slope control mode can be used.

If the application requires both high speed and low power standby modes, the mode selection pin can be directly connected to the microprocessor

The MCU or DSP has a general output pin. When the controller outputs a logic low level (<1.2 V), the device enters high speed mode; when the controller outputs a logic high level (> 0.75 VCC), the device enters standby mode.

(2) Slope control mode

For many applications that still use unshielded twisted pair bus cables to reduce system costs, electromagnetic compatibility is critical. The device has added a slope control mode, which can reduce the electromagnetic interference caused by the rise and fall times of the driver and the harmonics generated as a result. By connecting a resistor between RS (pin 8) and ground or logic low voltage, the rise and fall slopes of the driver output can be adjusted. The slope of the driver output signal is proportional to the output current of the pin, and this slope control is achieved through an external resistor (typically 10k Ω to 100kΩ).

(3) standby mode

If a logic high level (> 0.75 VCC) is applied to RS (pin 8), the device circuit will enter low current, listen-only standby mode. During this mode, the driver will be turned off, and the receiver will remain active. In this listen-only state, the transceiver is completely passive with respect to the bus. There is no difference whether or not a slew control resistor is placed. When a rising edge of an active state (bus differential voltage> 900mV (typical value)) appears on the bus, the microprocessor can put the transceiver out of this low-power standby mode. The microprocessor senses bus activity and reactivates the driver circuit by applying a logic low level (<1.2V) to RS (pin 8).

6 Test loop function

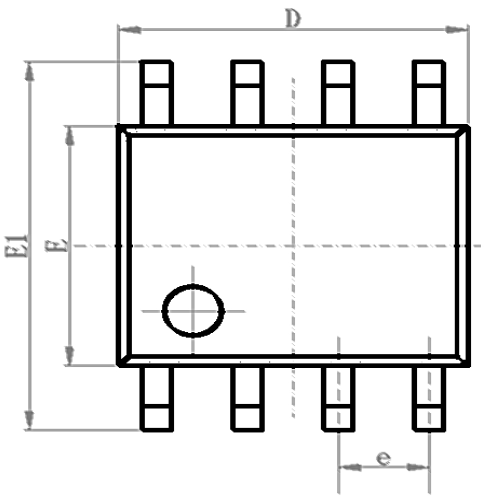
The diagnostic loopback or internal loopback function of the SIT65HVD233 is enabled by a high-level input on pin 5 LBK. This mode disables the driver output while keeping the bus pin biased to the implicit state. Additionally, this mode logically redirects D data input (sending data) to the receive data output pin, creating an internal loopback to the receive data path. This simulates the loopback of a CAN transceiver under normal conditions, as the receiver drives the output loopback to the R (receive data) pin. This mode allows the host protocol controller to input and read bit sequences or CAN messages for diagnostics without interfering with the CAN bus.

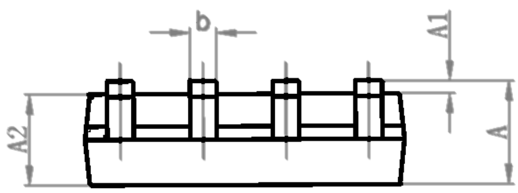
If the LBK pin is not used, it may be grounded (GND). However, it is internally pulled down (default low level input) and may remain open if not used.

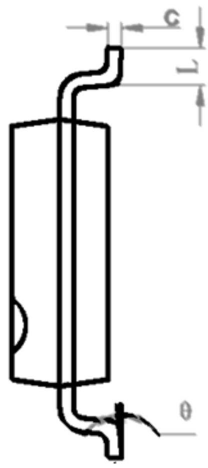
SOP8, external dimensions

Package size

Symbol	Least value /mm	Representative value /mm	Crest value /mm
A	1.50	1.60	1.70
A1	0.1	0.15	0.2
A2	1.35	1.45	1.55
b	0.355	0.400	0.455
D	4.800	4.900	5.00
E	3.780	3.880	3.980
E1	5.800	6.000	6.200
e		1.270BSC	
L	0.40	0.60	0.80
c	0.153	0.203	0.253
θ	-2°	-4°	-6°



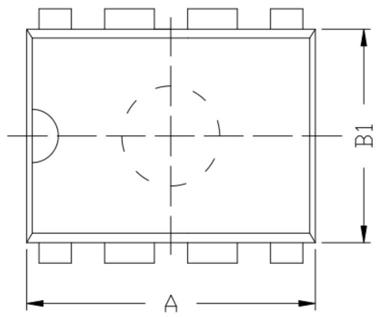


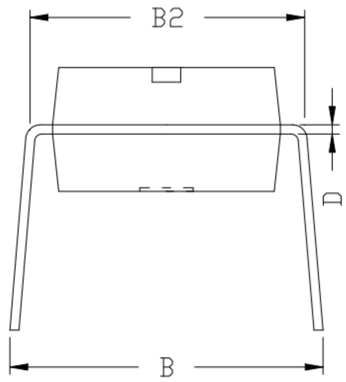


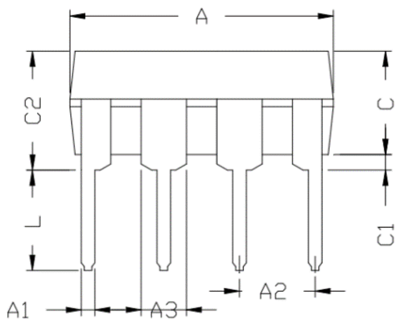
DIP8, external dimensions

Package size

Symbol	Least value /mm	Representative value /mm	Crest value /mm
A	9.00	9.20	9.40
A1	0.33	0.45	0.51
A2	2.54TYP		
A3	1.525TYP		
B	8.40	8.70	9.10
B1	6.20	6.40	6.60
B2	7.32	7.62	7.92
C	3.20	3.40	3.60
C1	0.50	0.60	0.80
C2	3.71	4.00	4.31
D	0.20	0.28	0.36
L	3.00	3.30	3.60







Order information

Order code	Temperature	Package
SIT65HVD233DR	-40℃~125℃	SOP8
SIT65HVD233P	-40℃~125℃	DIP8

The tape packaging is 2500 beads per disc