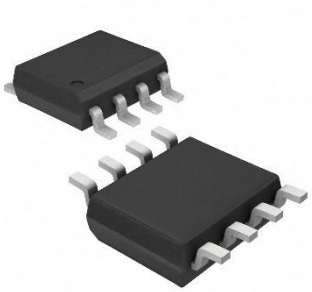
HX65LBC031-S CAN Bus Transceiver

General Description

The HX65LBC031-S serves as the intermediary between the Controller Area Network (CAN) protocol controller and the physical bus, primarily designed for high-speed applications in passenger cars, with a maximum speed of up to 1 MBaud. It facilitates differential transmission to the bus and differential reception for the CAN controller.



SOP-8

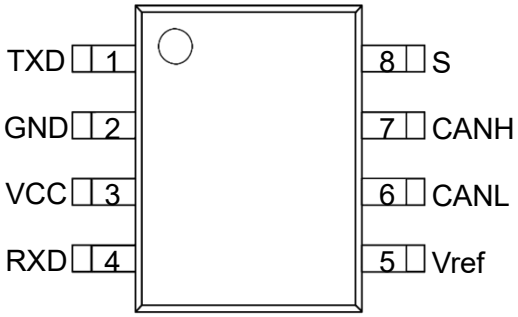
Features

- Operating voltage range: VCC = 5V ± 10%
- Fully compliant with the ISO 11898 standard
- High-speed operation (up to 1 MBaud)
- Transceiver disengages from the bus in unpowered state (zero load)
- At least 110 nodes can be connected
- Very low-current standby mode with remote wake-up capability via the bus
- Differential receiver with high common-mode range for ElectroMagnetic Immunity (EMI)
- Transmit Data (TXD) dominant time-out function
- Bus pins protected against transients in automotive environments
- Thermally stabilized

Applications

- Automotive electronics
- Security systems
- Industrial control automation
- Intelligent instrumentation
- Building automation systems
- Road traffic control automation
- Point-to-point and point-to-multipoint communications
- Level converter
- Serial servers

PIN CONFIGURATIONS AND FUNCTIONS



Pin Descriptio		
Pin	**SYMBOL**	**Description**
1	TXD	transmit data input
2	GND	ground supply
3	VCC	supply voltage, VCC=5V±10%
4	RXD	receive data output; reads out data from the bus lines
5	Vref	common-mode stabilization output
6	CANL	LOW-level CAN bus line
7	CANH	HIGH-level CAN bus line
8	S	High speed and standby mode selection, low for high speed

Absolute Maximum Rating

SYMBOL	PARAMETER	MIN	MAX	UNIT
VCC	Supply voltage range	-0.3	+6	V
TXD, RXD, S	MCU Side Port	-0.3	VCC+0.3	V
CANL, CANH, Vref	Bus-side port voltage	-60	+60	V
Vtr	Pin 6, 7 Transient Voltage	-200	+200	V
	storage temperature	-55	150	℃
	ambient temperature	-40	85	℃
	Welding temperature range		300	℃
SOP8	Continuous power consumption		400	mW

SPECIFICATIONS

(VCC=5V±10%, Temp=TMIN~TMAX, typical values at VCC=+5V, Temp=25°C, unless otherwise noted)

Bus Transmitter DC Characteristics

SYMBOL	PARAMETER	TESTCONDITIONS	MIN	MAX	UNIT	SYMBOL
VOH(D)	CANH output voltage (dominant)	VI=0V，S=0V，RL=60Ω F1、2	2.9	3.4	4.5	
VOL(D)	CANL output voltage (dominant)		0.8		1.5	
VO(R)	Bus Output Differential Voltage(implicit)	VI=3V,S=0V，RL=60Ω，F1、2	2	2.5	3	V
VOD(D)	Bus Output Differential Voltage (dominant)	VI=0V,S=0V，RL=60Ω，F1、2	1.5		3	V
VOD(R)	Bus Output Differential Voltage (implicit)	VI=3V, S=0V, F1、 2	-0.012		0.012	V
		VI=3V，S=0V，NO LOAD	-0. 5		0.05	V
Vdom(TX)sym	dominant output voltage symmetry	Vdom(TX)sym=VCC- VCANH VCANL	-400		400	mV
VTXsym	Output Voltage Symmetry	VTXsym= VCANH + VCANL	0.9V_{CC}		1.1V_{CC}	V
VOC	Common mode output voltage	S=0V，F 8	2	2.5	3	V
△VOC	Explicit and implicit common mode output voltage difference			30		mV
IOS	Short-circuit output current	CANH=-12V，CANL=open，F11	-105	-72		mA
		CANH=12V，CANL=open，F11		0.36	1	
		CANL=-12V，CANH=open，F11	-1	0.5		
		CANL=12V，CANH=open，F11		71	105	
IO(R)	Hidden output current	-27V<CANH<32V 0<VCC<5.25V	-2.0		2.5	mA
VIL	Low Level Input			0.36	1	
I_{OS} $I_{O(R)}$	Short-circuit output current Hidden output current	CANH=-12V, CANL=open， F 11	-1	0.5		
		CANH=12V, CANL=open, F 11		71	105	
		-27V<CANH<32V 0<VCC<5.25V	-2.0		2.5	mA

Bus Transmitter Switch Characteristic

tPLH	Transmission delay (low to high)	S=0V，F 4	25	65	120	ns
tPHL	Transmission delay (high to low)		25	45	90	ns
tr	Differential output rise delay time			25		ns
tf	Differential output fall delay time			50		ns
tEN	Enable time from listen mode to dominant	F 7			10	μs
tdom	Explicit timeout	F 10	300	450	700	μs
tBUS	Bus wake-up time		0.7		5	μs

SYMBOL	PARAMETER	TESTCONDITIONS	MIN	MAX	UNIT	SYMBOL
Bus Receiver DC Paramete						
V_{IT+}	Positive Input Threshold	S=0V，F5		800	900	mV
V_{IT-}	Negative Input Threshold		500	650		
V_{HYS}	Comparator Threshold Hysteresis Interval		100	125		
V_{OH}	High Level Output Voltage	IO=-2mA，F6	4	4.6		V
V_{OL}	Low Level Output Voltage	IO=2Ma,F6		0.2	0.4	V
$I_{(OFF)}$	Bus input current at power down	CANH or CANL=5V，Other pin=0V			5	μA
C_I	CANH, CANL input capacitance to ground			13		pF
C_{ID}	CANH, CANL Differential Input Capacitors			5		pF
R_{IN}	CANH, CANL Input Resistance	TXD=3V，S=0V	15	30	40	KΩ
R_{ID}	CANH, CANL Differential Input Resistors		30		80	KΩ
RI_{match}	RI(CANH), RIN(CANL) mismatches	CANH=CANL	-3%		3%	
V_{COM}	Common mode voltage range		-12		12	V
Bus Receiver Switching Characteris						
tPLH	Propagation delay (low to high)	S=0V or VCC F6	60	100	130	ns
tPHL	Propagation delay (high to low)		45	70	90	ns
tr	RXD signal rise time			8		ns
tf	RXD signal fall time			8		ns
Device Switching Character						
Td(LOOP1)	Loop delay 1, driver input to receiver output, implicit to explicit	S=0V，F9	90		190	ns
Td(LOOP2)	Loop Delay 2, Driver Input to Receiver Output, Explicit to Implicit		90		190	ns
Over-temperature protectio						
Tj(sd)	Over temperature shutdown		155	165	180	℃
TXD Pin Characteristi						
VO	Common mode stabilised output voltage	-500uA<Io<500uA	0.3VCC		0.7VCC	V
IO(S)	leakage current	S=2V,-12V<VO<12V	-5		5	μA
IIH(TXD)	TXD port high level input current	VI=VCC	-2		2	μA
IIL(TXD)	TXD Port Low Level Input Current	VI=0	-50		-10	μA
IO(off)	Current in TXD when VCC=0V	VCC=0V，TXD=5V			1	μA
VIH	Input High LowerLimit		2		VCC+0.3	V
VIL	Input Low Limit		-0.3		0.8	V
TXDO	TXD Port Dangle Voltage		H			logic
Power consumption characteristic						
ICC	Silent Mode Power Consumption	S=VCC，VI=VCC		5	12	μA
	Dominant power consumption	VI=0V，S=0V LOAD=60Ω		50	70	mA
	Implicit power consumption	VI=VCC，S=0V NO LOAD		6	10	mA

Menu (1)H=high; L=low; X=no care

Table 1 CAN Transceiver Truth

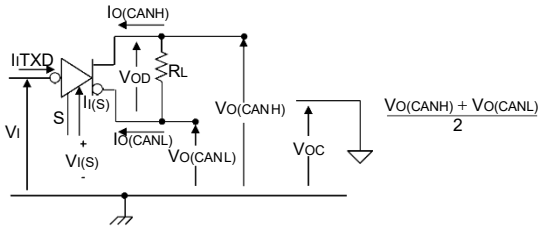
Vcc	TXD(1)	S(1)	CANH(1)	CANL(1)	BUS STATE	RXD(1)
4.5V~5.5V	L	L	H	L	dominant	L
4.5V~5.5V	H (or float)	X	0.5VCC	0.5VCC	implicit	H
4.5V~5.5V	X	H(or float)	0.5VCC	0.5VCC	implicit	H
0<VCC<4.5V	X	X	0V<VCANH<VCC	0V<VCANL<VCC	implicit	X

Table 2 Driver Function

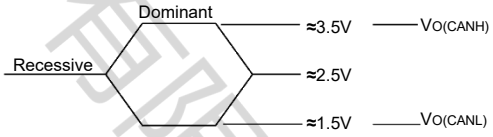
INPUTS		OUTPUTS		Bus State
L	L	H	L	Dominate(dominant)
H (or floa)	X	Z	Z	Recessive(implicit)
X	H(or float)	Z	Z	Recessive(implicit)

Table 3 Receiver Function

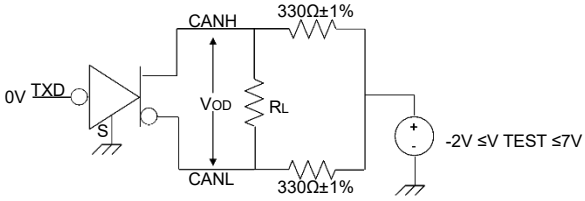
VID=CANH-CANL	RXD(1)	Bus State(1)
VID≥0.9V	L	Dominate(dominant)
0.5< VID<0.9V		
VID≤0.5V	H	Recessive (implicit)
Open	H	Recessive (implicit)



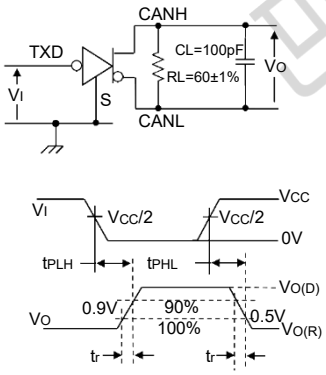
F1.Driver Voltage, Current Test Definitions



F2. Bus Logic Voltage Definition

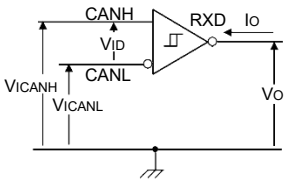


F3. Driver VOD Test Circuit

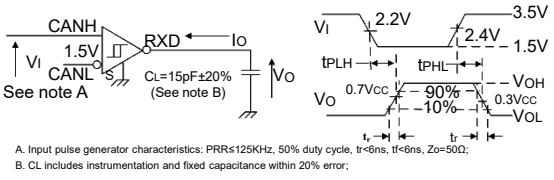


F4. Driver Test Circuit and Voltage Waveforms

$$V_{IC} = \frac{V_{I(CANH)} + V_{I(CANL)}}{2}$$

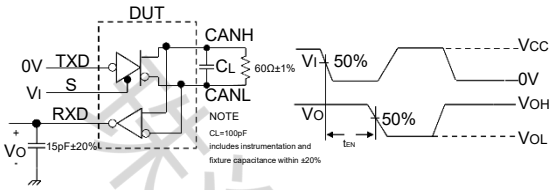


F5. Receiver Voltage and Current Definitions

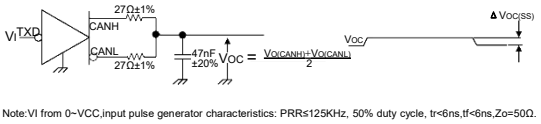


A. Input pulse generator characteristics: PRR≤125KHz, 50% duty cycle, tr<6ns, tf<6ns, Zo=50Ω;
B. CL includes instrumentation and fixed capacitance within 20% error;

F6. Receiver test circuit and voltage waveform

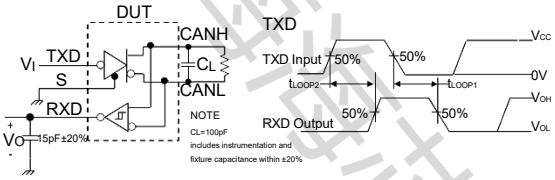


F7. tEN Test Circuit and Voltage Waveforms

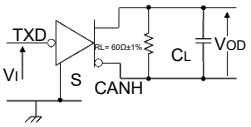


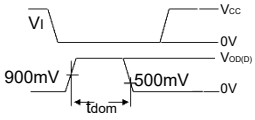
Note:VI from 0~VCC,input pulse generator characteristics: PRR≤125KHz, 50% duty cycle, tr<6ns,tf<6ns,Zo=50Ω.

F8. Common Mode Output Voltage Test and

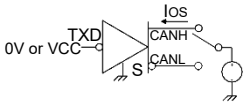


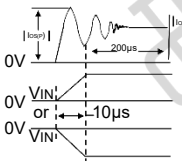
F9. t(LOOP) Test Circuit and Waveforms





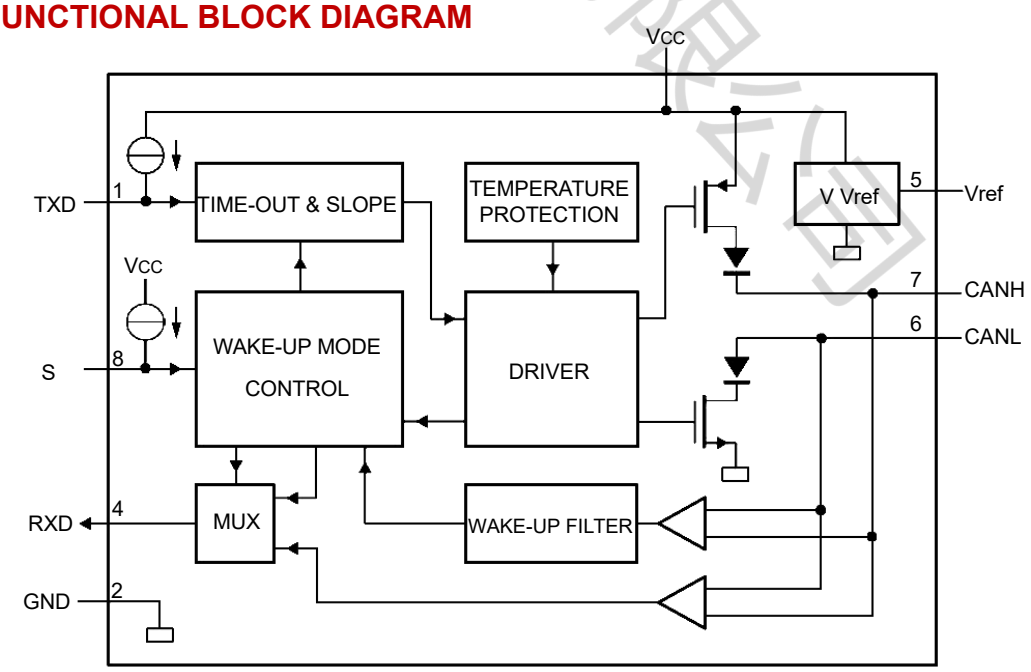
F10. Revealed Timeout Test Circuit and Waveforms





F9. Driver Short Circuit Current Test Circuit and Waveforms

FUNCTIONAL BLOCK DIAGRAM



DESCRIPTION

Brief description

The HX65LBC031-S is an interface chip that connects the CAN protocol controller with the physical bus. It can be used in trucks, buses, cars, industrial control, and other applications. With a data transmission rate of 1Mbps, the HX65LBC031-S has the capability to transmit differential signals between the bus and the CAN protocol controller, fully compliant with the ISO 11898 standard.

Short circuit protection

The HX65LBC031-S's driver stage incorporates a current limit protection feature, designed to safeguard the circuit from shorts to the positive and negative supply voltages. In the event of a short-circuit, power consumption would rise, but thanks to the short-circuit protection function, the driver stage is protected from potential damage.

Fail Safe

The TXD pin features a pull-up to VCC connection, ensuring that the bus remains in a recessive state when the TXD pin is not powered. The S pin has a pull-up to VCC pass-through, ensuring that the transceiver remains in the standby state when the S pin is not powered. In the event of a power supply drop, the TXD, S, and RXD pins will become unconnected to prevent reverse power flow through these pins.

Over Temperature Protection

The HX65LBC031-S features an over-temperature protection function. When the junction temperature exceeds 160°C, the current of the driver stage is reduced. As the driver tube is the main energy-consuming component, reducing the current lowers power consumption, ultimately cooling the chip. Other parts of the chip continue to operate normally during this process.

Significant Timeout Function

The TXD dominant timeout timer circuit is built-in to prevent the bus line from being driven to a permanently dominant state (blocking all network communications) if the TXD pin is forced permanently low due to a hardware or software application failure. The timer is triggered by a negative edge on the TXD pin.

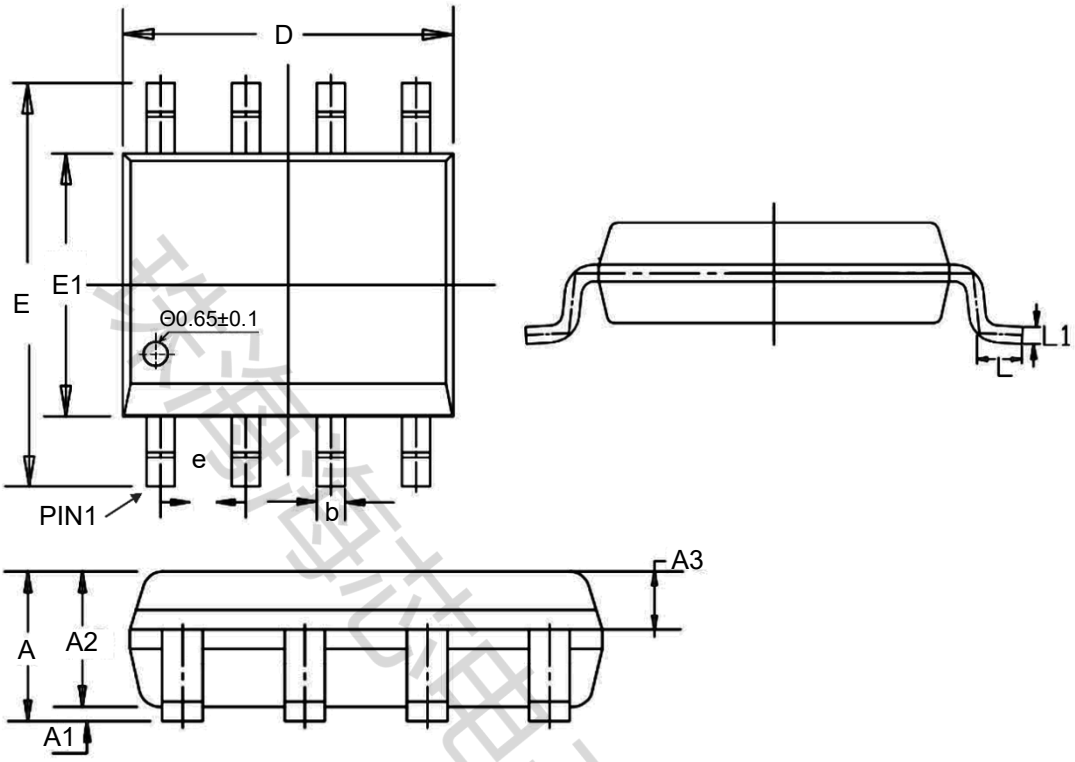
If the low level on the TXD pin persists longer than the internal timer value (tdom), the transmitter is disabled, driving the bus into a recessive state. The timer is reset by a positive edge on the TXD pin.

Control Modes

The control pin S allows selection between two operation modes: high-speed mode and standby mode. In high-speed mode—the normal mode—the transceiver sends and receives data over the CANH and CANL buses by grounding the S pin. In this mode, the differential receiver converts analogue data on the bus to digital data and outputs it via a multiplexer (MUX) to the RXD pin.

If the S pin is left unconnected or connected to a high voltage level, it enters standby mode. In this mode, the transmitter and receiver are turned off, and the bus line is monitored by a low-power differential comparator. When a high voltage level is applied to the S pin, it activates the low-power receiver and wake-up filter. As soon as the low-power differential comparator detects a dominant bus level above tBUS, the RXD pin goes low.

DIMENSIONAL DRAWINGS



SOP-8

UNIT:mm

	MIN	NOM	MAX
A	1.450	1.550	1.650
A1	0.100	0.150	0.200
A2	1.300	1.400	1.500
A3	0.600	0.650	0.700
b	0.380		0.510
e	1.240	1.270	1.300
D	4.800	4.900	5.000
E	5.800	6.000	6.200
E1	3.800	3.900	4.000
L	0.450	0.600	0.750
L1		0.25BSC	

Part Number	Package Type	Package	quantity
HX65LBC031-S	SOP-8	Taping	2500

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