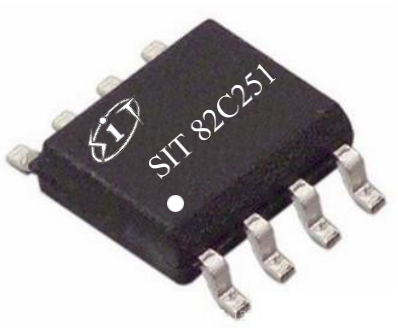
FEATURES

- Fully compatible with the "ISO 11898-24V" standard, can be used in 24V systems
- Slope control (Rs pin) to reduce RFI;
- Thermal protection;
- Overcurrent protection;
- Low current standby mode;
- An unpowered node does not disturb the bus lines;
- At least 110 nodes can be connected to the bus;
- High speed (up to 1 Mbps);
- High immunity against ElectroMagnetic Interference

OUTLINE



Provide green and environmentally friendly lead-free packaging

DESCRIPTION

The SIT82C251-A is an interface between the Controller Area Network (CAN) protocol controller and the physical bus. It is primarily intended for high speed applications, up to 1 Mbps, in buses, trucks industrial applications etc. The device provides differential transmit capability to the bus and differential receive capability to the CAN controller.

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	MAX	UNIT
Supply voltage	Vcc		4.5	5.5	V
Supply current	Icc	Standby mode		275	μA
Maximum transmission rate	$1/t_{bit}$	Non-return-to-zero code	1		Mbaud
CANH, CANL input or output voltage	Vcan		-36	+36	V
Bus differential voltage	Vdiff		1.5	3.0	V
Ambient temperature	Tamb		-40	125	°C

PIN CONFIGURATION

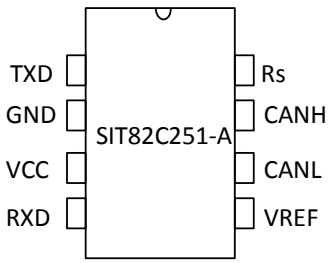


Figure 1 SIT82C251-A pin configuration

LIMITING VALUES

Parameter	Symbol	Value	Unit
Supply voltage	V_{CC}	-0.3~+7	V
MCU side DC voltage	TXD, RXD, VREF, Rs	-0.3~VCC+0.3	V
Voltage range at any bus terminal	CANL, CANH	-36~36	V
Transient voltage on pins 6,7; see Fig.7	V_{tr}	-200~+200	V
Storage temperature range		-55~150	°C
Ambient temperature range		-40~125	°C
Welding temperature range		300	°C
Continuous power consumption	SOP8	400	mW
	DIP8	700	mW

The maximum limit parameter value means that exceeding these values may cause irreversible damage to the device. Under these conditions, it is not conducive to the normal operation of the device. Continuous operation of the device under the maximum allowable rating may affect the reliability of the device. The reference point of all voltages is ground.

PINNING

Pin number	Pin name	Pin function
1	TXD	Transmit data input
2	GND	Ground
3	VCC	Supply voltage
4	RXD	Receive data output
5	VREF	Reference voltage output
6	CANL	Low level CAN bus line
7	CANH	High level CAN bus line
8	Rs	Slope control input

BUS TRANSMITTER DC CHARACTERISTICS

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
High level input voltage	V_{IH}	Output recessive	$0.7V_{CC}$		V_{CC}+0.3	V
Low level input voltage	V_{IL}	Input recessive	-0.3		0.3 V_{CC}	V
High level input current	V_{IH}	V_I=4V	-200		+30	μA
Low level input current	V_{IL}	V_I=1V	-100		-600	μA
Recessive bus voltage	$V_{6,7}$	V_I=4V, no load	2.0		3.0	V
Off-state output leakage current	I_{LO}	-2V < (V_6, V_7) < -7V	-2		+2	mA
		-5V < (V_6, V_7) <36V	-10		+10	mA
CANH output voltage	V_7	V_I=1V, VCC=4.75~5.5V	2.75		4.5	V
CANL output voltage	V_6	V_I=1V	0.5		2.0	V
Difference between output voltage at pins 6 and 7	$\Delta V_{6,7}$	V_I=1V	1.5		3.0	V
		V_I=1V, RL=45Ω	1.5			V
		V_I=4V, no load	-500		+50	mV
Short-circuit CANH current	I_{sc7}	V_7=-36V		-100	-200	mA
Short-circuit CANL current	I_{sc6}	V_6=+36V			200	mA

(If not otherwise stated, V_{CC}=5V±10%, Temp=T_{MIN}~T_{MAX}, the typical value is V_{CC}=+5V, Temp=25°C)

BUS RECEIVER DC CHARACTERISTICS

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Differential input voltage (recessive)	Vdiff(r)	NOTE1	-1		0.5	V
		-7V < (V_6, V_7) < 12V, NOTE1	-1		0.4	V
Differential input voltage (dominant)	Vdiff(d)		0.9		5.0	V
		-7V < (V_6, V_7) < 12V, Non-standby mode	1.0		5.0	V
		Standby mode	0.97		5.0	V
		VCC=4.5~5.1V, Standby mode	0.91		5.0	V
Differential input hysteresis	Vdiff(hys)	See picture 4		150		mV
High level output voltage	V_{OH}, pin4	I_4=-100μA	$0.8V_{CC}$		VCC	V

Low level output voltage	V_{OL}, pin4	I_4=1mA	0		0.2 V_{CC}	V
		I_4=10mA	0		1.5	V
CANH, CANL input resistance	R_i		5		25	KΩ
Differential input resistance	R_{diff}		20		100	KΩ

(If not otherwise stated, V_{CC}=5V±10%, Temp=T_{MIN}~T_{MAX}, the typical value is V_{CC}=+5V, Temp=25°C, V_I=4V; pins 6 and 7 externally driven, -2V<($V_{6,7}$)<7V)

NOTE1: Including high speed, slope control and standby mode.

REFERENCE VOLTAGE OUTPUT

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Reference output voltage	Vref	V_8=1V; $\|I_5\|$ < 50μA	0.45V_{CC}		0.55V_{CC}	V
		V_8=4V; $\|I_5\|$ < 5μA	0.4V_{CC}		0.6V_{CC}	V

(If not otherwise stated, V_{CC}=5V±10%, Temp=T_{MIN}~T_{MAX}, the typical value is V_{CC}=+5V, Temp=25°C)

TIMING CHARACTERISTICS

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Minimum bit time	t_{bit}	R_8=0Ω			1	μs
Delay TXD to bus active	t_{onTXD}	R_8=0Ω			50	ns
Delay TXD to bus inactive	t_{offTXD}	R_8=0Ω		40	80	ns
Delay TXD to receiver active	t_{onRXD}	R_8=0Ω		55	120	ns
Delay TXD to receiver inactive	t_{offRXD}	R_8=0Ω		100	190	ns
		R_8=47KΩ		300	400	ns
CANH, CANL slew rate	|SR|	R_8=47KΩ		7		V/μs
Wake-up time from standby (via pin8)	t_{wake}	See picture 5			20	μs
Bus dominant to RXD LOW	t_{dRXDL}	V_8=4V; See picture 6			3	μs

(If not otherwise stated, RL=60Ω; CL=100pF; See picture 2, picture 3)

(If not otherwise stated, V_{CC}=5V±10%, Temp=T_{MIN}~T_{MAX}, the typical value is V_{CC}=+5V, Temp=25°C)

STANDBY/SLOPE CONTROL (PIN 8)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Standby mode input voltage	V_{stb}		$0.75V_{CC}$			V
Slope control mode current	I_{slope}		-10		-200	μA
Slope control mode voltage	V_{slope}		$0.4V_{CC}$		$0.6V_{CC}$	V

(If not otherwise stated, V_{CC}=5V±10%, Temp=T_{MIN}~T_{MAX}, the typical value is V_{CC}=+5V, Temp=25°C)

SUPPLY CURRENT

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Power supply current	I_3	Dominant; V_I=1V; V_{CC}<5.1V			78	mA
		Dominant; V_I=1V; V_{CC}<5.25V			80	mA
		Dominant; V_I=1V; V_{CC}<5.5V			85	mA
		Recessive; V_I=4V; R_8=47kΩ			10	mA
		Standby mode; NOTE2			275	μA

(If not otherwise stated, V_{CC}=5V±10%, Temp=T_{MIN}~T_{MAX}, the typical value is V_{CC}=+5V, Temp=25°C)

NOTE2: I_1=I_4=I_5=0mA; 0V<V_6,V_7<V_{CC}; V_8=V_{CC}; T_{amb}<90°C

FUNCTION TABLE

Table 1 Truth Table of CAN Transceiver

V_{CC}	TXD	CANH	CANL	BUS STATE	RXD
4.5~5.5V	0	H	L	Dominant	0
4.5~5.5V	1 (or floating)	Floating	Floating	Recessive	1(2)
4.5~5.5V	X(1)	Floating if V_{RS}>0.75V_{CC}	Floating if V_{RS}>0.75V_{CC}	Floating	1(2)
0<V_{CC}<4.5V	Floating	Floating	Floating	Floating	X(1)

(1): X = don't care

(2): If another bus node is transmitting a dominant bit on the CAN bus, then RXD=0

Table 2 Pin Rs summary

Condition forced at pin Rs	Mode	Resulting voltage or current at pin Rs
V_{Rs}>0.75V_{CC}	Standby	-I_{Rs}<10μA
10μA<-I_{Rs}<200μA	Slope control	0.4V_{CC}<V_{Rs}<0.6V_{CC}
V_{Rs}<0.3 V_{CC}	High speed	-I_{Rs}<500μA

TEST CIRCUIT

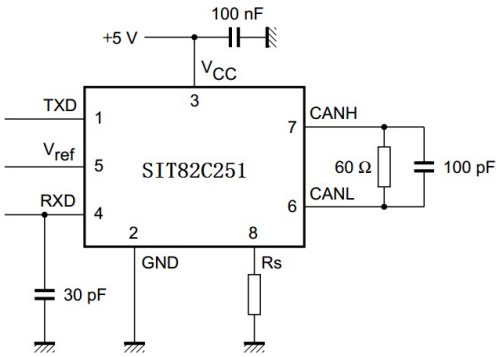


Figure 2 Test circuit for dynamic characteristics

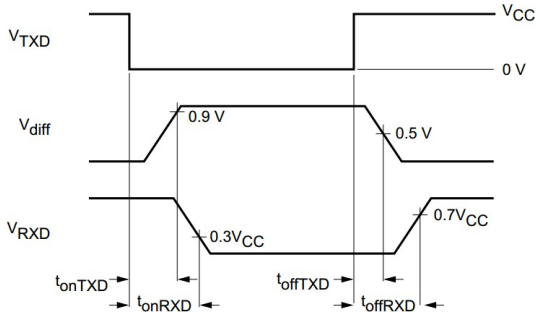


Figure 3 Timing diagram for dynamic characteristics

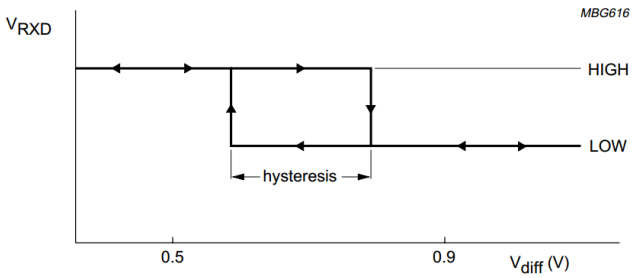
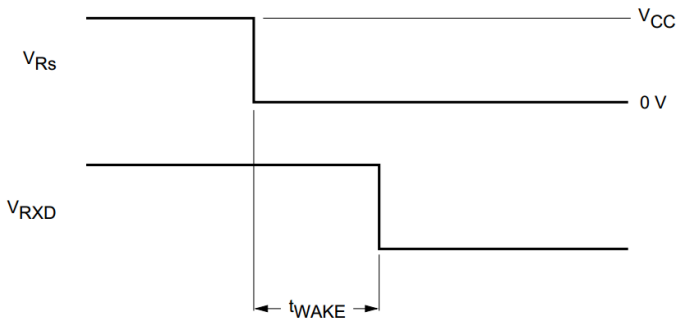
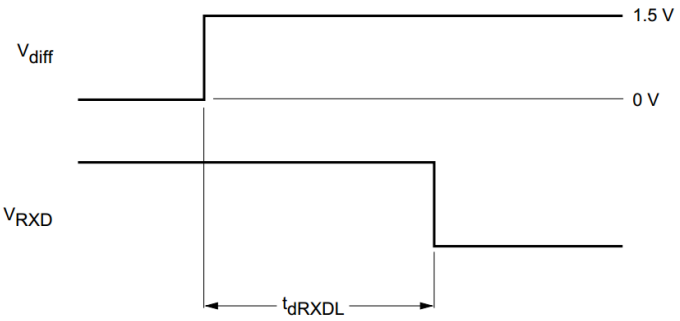


Figure 4 Hysteresis



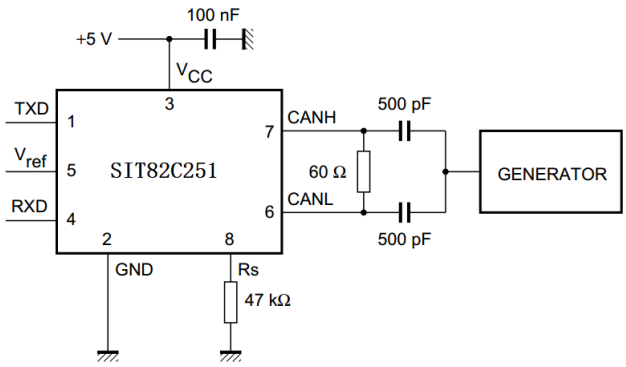
V_{TXD} = 1 V.

Figure 5 Timing diagram for wake-up from Standby



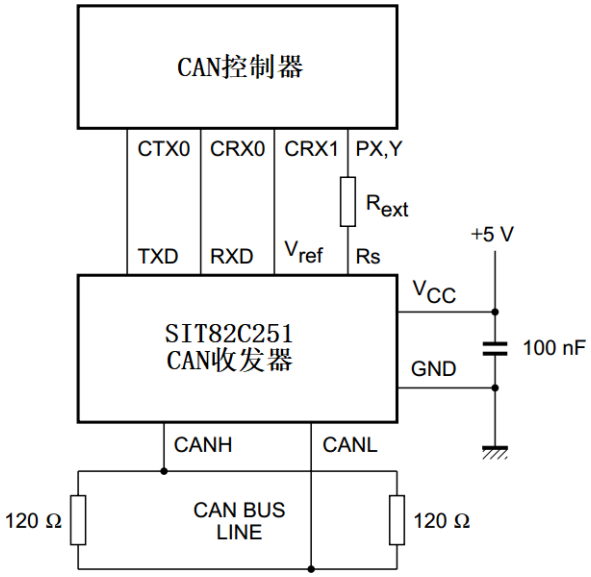
V_{Rs} = 4 V; V_{TXD} = 4 V.

Figure 6 Timing diagram for bus dominant to RXD LOW



The waveforms of the applied transients shall be in accordance with "ISO 7637 part 1", test pulses 1, 2, 3a and 3b

Figure 7 Test circuit for automotive transients



(1) The output control register of the CAN controller should be programmed for push-pull operation, dominant = LOW.

(2) If no slope control is desired: Rext=0

Figure 8 Application of the CAN transceiver.

DESCRIPTION

1 Brief description

The SIT82C251-A is the interface between a CAN protocol controller and the physical bus. It is primarily intended for high speed applications, up to 1 Mbps, in buses, trucks, industrial applications etc. The device provides differential transmit capability to the bus and differential receive capability to the CAN controller. It is fully compatible with the “ISO 11898-24V” standard.

2 Short circuit protection

A current-limiting circuit protects the driver output stage of the SIT82C251-A against short-circuits to positive and negative supply voltage. When short-circuit occurs the power dissipation increases but the short-circuit protection function will prevent destruction of the driver output stage.

3 Over temperature protection

The SIT82C251-A has an integrated over-temperature protection circuit. If the junction temperature exceeds approximately 160°C, the current in the driver stage will decrease. Because the driver stage dissipates most of the power, the power dissipation and temperature of the IC is reduced. All other parts of the chip remain operational.

4 Electrical transient protection

Electrical transients often occur in automotive applications. The CANH and CANL of the SIT82C251-A are also protected against electrical transients.

5 Control mode

Three operating modes are available: high speed, slope control, and standby. Pin 8 (Rs) is used to select the operating mode.

The high-speed mode of operation is selected by connecting pin 8 to ground. In this mode, no measures are taken to limit the slopes. A shielded cable is recommended to avoid RFI problems.

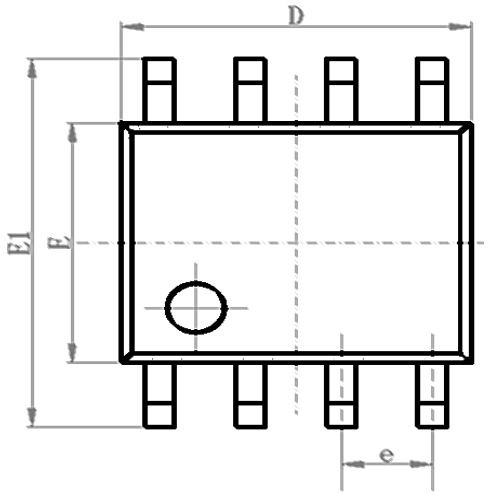
The device can be set to operate with slope control by connecting pin 8 with a resistor to ground to modify the rise and fall of slopes. The rise and fall of slopes are proportional to the pin's output current. By controlling the slope, the RFI can be reduced. This mode facilitates the use of an unshielded twisted pair or a parallel pair of wires as bus lines.

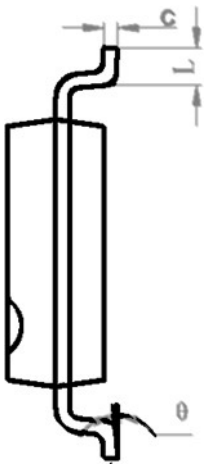
The device enters a low-current standby mode during which the driver is switched off and the receiver is switched to a low current if a high logic level is applied to pin 8. When a dominant state (bus differential voltage > 900 mV typical) occurs on the bus, RXD will be switched to a LOW level. The attached microcontroller should reverse this low-current standby mode and place the transceiver into normal operation via pin 8. Because the receiver is slower in this mode, the first CAN message may be lost at higher bit rates.

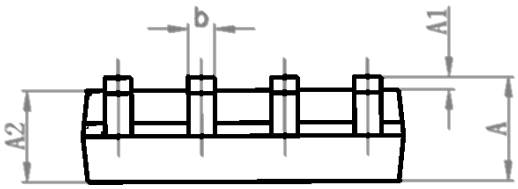
SOP8 DIMENSIONS

PACKAGE SIZE

SYMBOL	MIN./mm	TYP./mm	MAX./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°



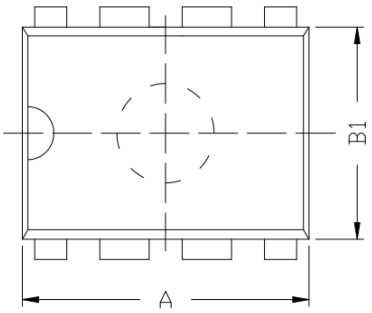


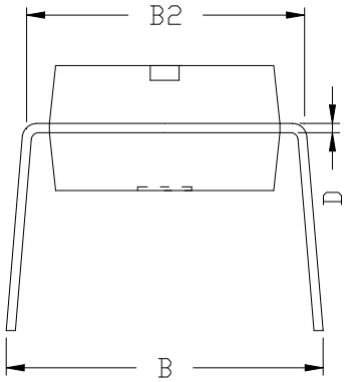


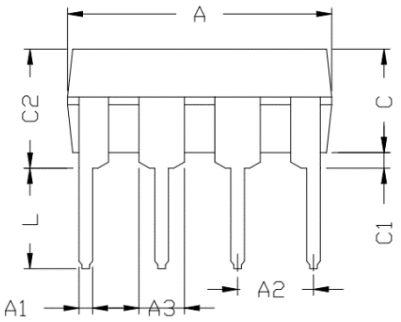
DIP8 DIMENSIONS

PACKAGE SIZE

SYMBOL	MIN./mm	TYP./mm	MAX./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







ORDERING INFORMATION

PART NUMBER	TEMPERATURE	PACKAGE
SIT82C251T-A	-40°C~125°C	SOP8
SIT82C251-A	-40°C~125°C	DIP8

Tape/reel package is 2500 pieces,