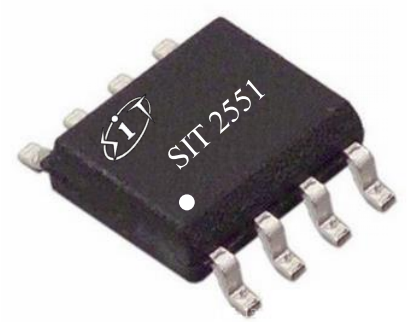
FEATURES

- Fully compatible with the ISO 11898 standard
- Thermal protection
- Overcurrent protection
- Transmit Data (TXD) dominant time-out function
- Low current standby operation (typical value 5μA)
- Transceiver in unpowered state disengages from the bus (zero load)
- At least 110 nodes can be connected
- High speed (up to 1 MBaud)
- Very low Electro Magnetic Emission (EME)

OUTLINE



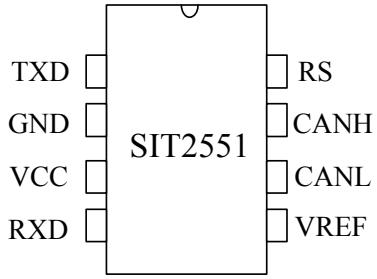
Provide green and environmentally friendly lead-free package

DESCRIPTION

The SIT2551 is the interface between the Controller Area Network (CAN) protocol controller and the physical bus. It is primarily intended for high speed applications, up to 1 MBaud, in passenger cars, trucks, buses, industrial applications etc. The device provides differential transmit capability to the bus and differential receive capability to the CAN controller.

PARAMETER	SYMBOL	CONDITION	MIN.	MAX.	UNIT
Supply voltage	V_{cc}		4.5	5.5	V
Maximum transmission rate	$1/t_{bit}$	Non-return to zero code	1		Mbaud
CANH/CANL input or output voltage	V_{can}		-40	+40	V
Bus differential voltage	V_{diff}		1.5	3.0	V
Virtual junction temperature	T_{amb}		-40	125	℃

PIN CONFIGURATION



LIMITING VALUES

PARAMETER	SYMBOL	VALUE	UNIT
Supply voltage	V_{CC}	-0.3~+6	V
MCU side DC voltage	TXD, RXD, RS, VREF	-0.3~VCC+0.3	V
Voltage range at any bus terminal	CANL，CANH	-40~40	V
Transient voltage on pins 6,7; see Fig.7	V_{tr}	-200~+200	V
Storage temperature		-55~150	℃
Virtual junction temperature		-40~125	℃
Welding temperature range		300	℃
Continuous power consumption	SOP8	400	mW
	DIP8	700	mW

The maximum limit parameters means that exceeding these values may cause irreversible damage to the device. Under these conditions, it is not conductive to the normal operation of the device. The continuous operation of the device at the maximum allowable rating may affect the reliability of the device. The reference point for all voltages is ground.

PINNING

PIN	SYMBOL	DESCRIPTION
1	TXD	transmit data input
2	GND	ground supply
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	high-speed / standby mode control input

DRIVER ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
CANH dominant output voltage	$V_{OH(D)}$	VI=0V, RS=0V, RL=60Ω, Fig.1, Fig.2	2.9	3.4	4.5	
CANL dominant output voltage	$V_{OL(D)}$		0.8		1.5	
Bus recessive output voltage	$V_{O(R)}$	VI=3V, RS=0V, RL=60Ω, Fig.1, Fig.2	2	2.5	3	V
Bus dominant differential output voltage	$V_{OD(D)}$	VI=0V, RS=0V, RL=60Ω, Fig.1, Fig.2	1.5		3	V
Bus recessive differential output voltage	$V_{OD(R)}$	VI=3V, RS=0V, Fig.1, Fig.2	-0.012		0.012	V
		VI=3V, RS=0V, NO LOAD	-0. 5		0.05	V
Transmitter dominant voltage symmetry	$V_{dom(TX)sym}$	$V_{dom(TX)sym}=V_{CC}-V_{CANH}-V_{CANL}$	-400		400	mV
Transmitter voltage symmetry	V_{TXsym}	$V_{TXsym}=V_{CANH}+V_{CANL}$	$0.9V_{CC}$		$1.1V_{CC}$	V
Common-mode output voltage	V_{OC}	RS=0V, Fig.8	2	2.5	3	V
Peak-to-peak common-mode output voltage	$\triangle V_{OC}$			30		mV
Short-circuit output current	I_{OS}	CANH=-12V, CANL=open, Fig.11	-105	-72		mA
		CANH=12V, CANL=open, Fig.11		0.36	1	
		CANL=-12V, CANH=open, Fig.11	-1	0.5		
		CANL=12V, CANH=open, Fig.11		71	105	
Recessive output current	$I_{O(R)}$	-27V<CANH<32V 0<VCC<5.25V	-2.0		2.5	mA

V_{CC}=5V±10% and Temp=T_{MIN}~T_{MAX} unless specified otherwise; typical in V_{CC}=+5V and Temp=25℃

DRIVER SWITCHING CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Propagation delay time, low-to-high-level output	tPLH	RS=0V, Fig.4	25	65	120	ns
Propagation delay time, high-to-low-level output	tPHL		25	45	90	ns
Differential output signal rise time	tr			25		ns
Differential output signal fall time	tf			50		ns
Enable time from silent mode to dominant	t_{EN}	Fig.7			10	μs
Bus dominant time-out time	t_{dom}	Fig.10	300	450	700	μs
Bus wake-up time	t_{BUS}		0.7		5	μs

V_{CC}=5V±10% and Temp=T_{MIN}~T_{MAX} unless specified otherwise; typical in V_{CC}=+5V and Temp=25℃

RECEIVER ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Positive-going input threshold voltage	V_{IT+}	RS=0V, Fig.5		800	900	mV
Negative-going input threshold voltage	V_{IT-}		500	650		
Hysteresis voltage (VIT+ – VIT–)	V_{HYS}		100	125		
High-level output voltage	V_{OH}	IO=-2mA, Fig.6	4	4.6		V
Low-level output voltage	V_{OL}	IO=2mA, Fig.6		0.2	0.4	V
Power-off bus input current	$I_{(OFF)}$	CANH or CANL=5V Other pin=0V			5	μA
Input capacitance to ground (CANH, CANL)	C_I			13		pF
Differential input capacitance	C_{ID}			5		pF
Input resistance (CANH, CANL)	R_{IN}	TXD=3V，RS=0V	15	30	40	KΩ
Differential input resistance	R_{ID}		30		80	KΩ
RI(CANH), RIN(CANL) resistance matching	RI_{match}	CANH=CANL	-3%		3%	
The range of common-mode voltage	V_{COM}		-12		12	V

V_{CC}=5V±10% and Temp=T_{MIN}~T_{MAX} unless specified otherwise; typical in V_{CC}=+5V and Temp=25℃

RECEIVER SWITCHING CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Propagation delay time low-to-high-level output	tPLH	RS=0Vor VCC, Fig. 6	60	100	130	ns
Propagation delay time high-to-low-level output	tPHL		45	70	90	ns
RXD signal rise time	tr			8		ns
RXD signal fall time	tf			8		ns

V_{CC}=5V±10% and Temp=T_{MIN}~T_{MAX} unless specified otherwise; typical in V_{CC}=+5V and Temp=25℃

DEVICE SWITCHING CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Loop delay1, driver input to receiver output, Recessive to Dominant	Td(LOOP1)	RS=0V, Fig.9	90		190	ns
Loop delay 2, driver input to receiver output, Dominant to Recessive	Td(LOOP2)		90		190	ns

V_{CC}=5V±10% and Temp=T_{MIN}~T_{MAX} unless specified otherwise; typical in V_{CC}=+5V and Temp=25℃

OVER TEMPERATURE PROTECTION

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Shutdown junction temperature	Tj(sd)			160		℃

TXD-PIN CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
TXD HIGH-level input current	I_{IH}(TXD)	VI=VCC	-2		2	μA
TXD LOW-level input current	I_{IL}(TXD)	VI=0	-50		-10	μA
When VCC=0V, current on TXD pin	I_O(off)	VCC=0V, TXD=5V			1	μA

HIGH-level input voltage	V_{IH}		2		VCC+0.3	V
LOW-level input voltage	V_{IL}		-0.3		0.8	V
Open voltage on TXD pin	TXD_O		H			logic

V_{CC}=5V±10% and Temp=T_{MIN}~T_{MAX} unless specified otherwise; typical in V_{CC}=+5V and Temp=25℃

REFERENCE VOLTAGE OUTPUT

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Reference output voltage	V_O	-500uA<I_o<500uA	$0.3V_{CC}$		$0.7V_{CC}$	V
Standby current	$I_{O(stb)}$	RS=2V, -12V<V_O<12V	-5		5	μA

V_{CC}=5V±10% and Temp=T_{MIN}~T_{MAX} unless specified otherwise; typical in V_{CC}=+5V and Temp=25℃

SUPPLY CURRENT

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Standby	I_{CC}	RS=VCC, V_I=VCC		5	12	μA
Dominant		V_I=0V, RS=0V, LOAD=60Ω		50	70	mA
Recessive		V_I=VCC, RS=0V, NO LOAD		6	10	mA

V_{CC}=5V±10% and Temp=T_{MIN}~T_{MAX} unless specified otherwise; typical in V_{CC}=+5V and Temp=25℃

FUNCTION TABLE

Table1. CAN TRANSCEIVER TRUTH TABLE

V_{CC}	TXD(1)	RS(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 Open	X	$0.5V_{CC}$	$0.5V_{CC}$	Recessive	H
4.5V~5.5V	X	H or Open	$0.5V_{CC}$	$0.5V_{CC}$	Recessive	H
0<V_{CC}<4.5V	X	X	0V<V_{CANH}<V_{CC}	0V<V_{CANL}<V_{CC}	Recessive	X

(1) H=high level; L=low level; X=irrelevant

Table 2. DRIVER FUNCTION TABLE

INPUTS		OUTPUTS		Bus State
TXD(1)	RS(1)	CANH(1)	CANL(1)	
L	L	H	L	Dominant
H or Open	X	Z	Z	Recessive
X	H or Open	Z	Z	Recessive

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

Table 3. RECEIVER FUNCTION TABLE

V_{ID}=CANH-CANL	RXD(1)	Bus State(1)
V_{ID}≥0.9V	L	Dominant
0.5< V_{ID}<0.9V	?	?
V_{ID}≤0.5V	H	Recessive
Open	H	Recessive

（1）H=high-level; L=low-level; ?=uncertain

TEST CIRCUIT

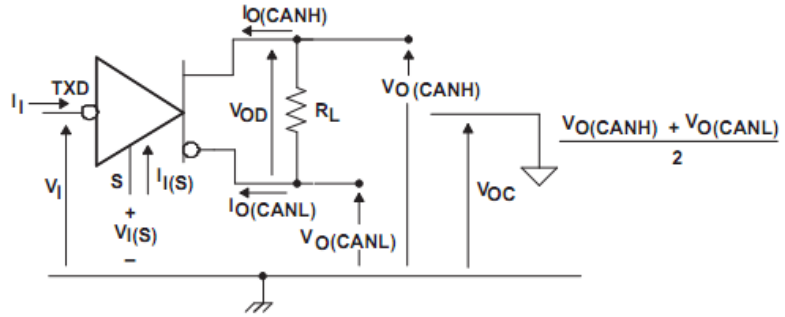


Fig.1 Driver Voltage And Current Definition

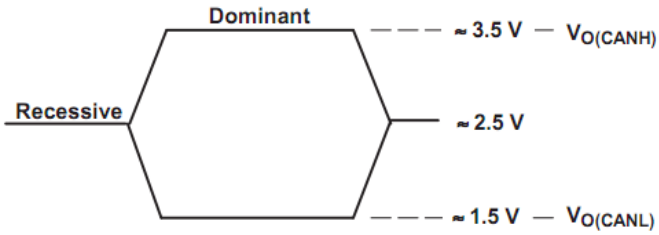


Fig.2 Bus Logic State Voltage Definition

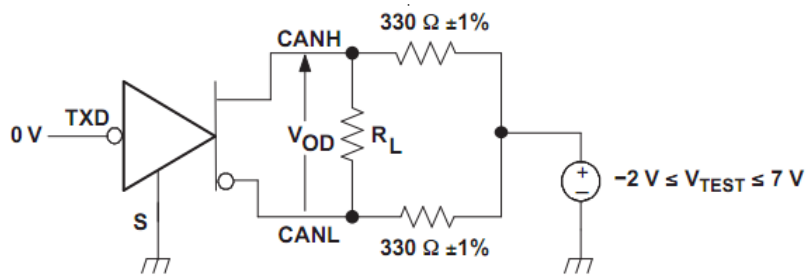


Fig.3 Driver V_{OD} Test Circuit

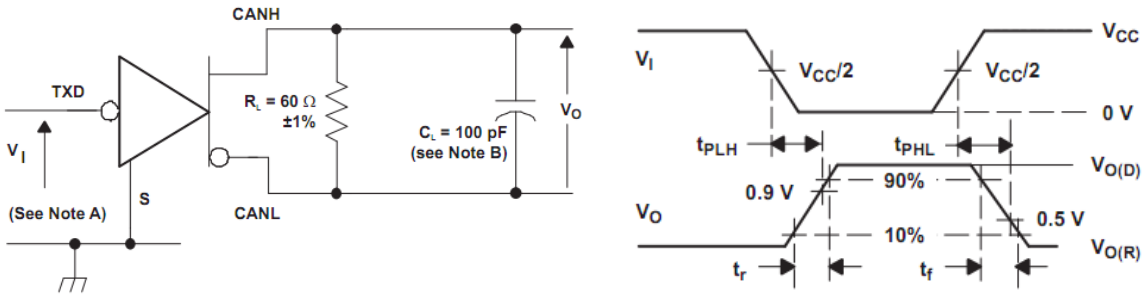


Fig.4 Driver Test Circuit and Waveform

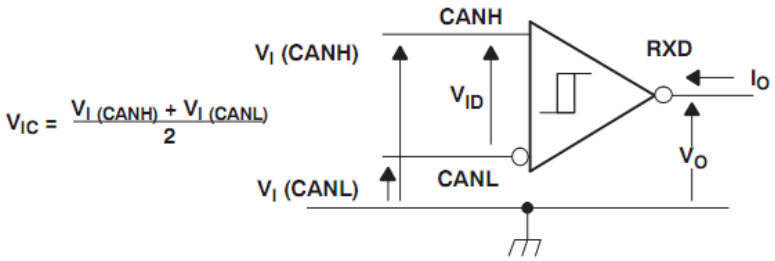
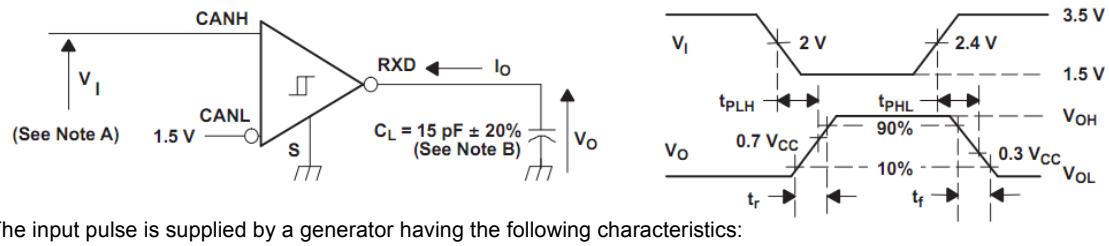


Fig.5 Receiver Voltage and Current Definition



A. The input pulse is supplied by a generator having the following characteristics:

PRR ≤ 125 kHz, 50% duty cycle, tr < 6 ns, tf < 6 ns, Zo=50Ω

B. C_L includes instrumentation and fixture capacitance within ±20%.

Fig.6 Receiver Test Circuit and Waveform

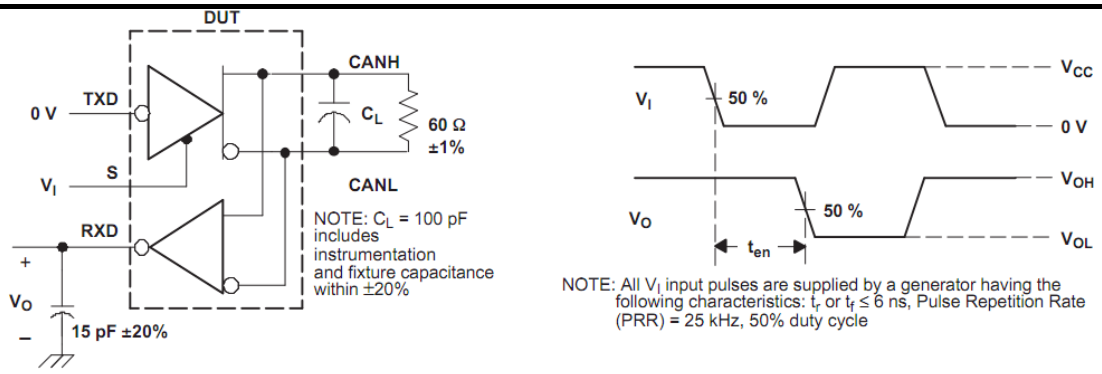
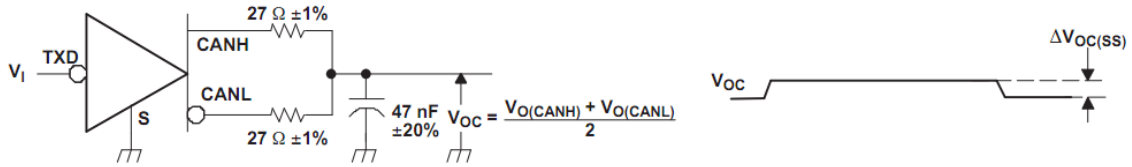


Fig.7 t_{EN} Test Circuit and Waveform



A. All VI input pulses are from 0 V to VCC and supplied by a generator having the following characteristics:
PRR ≤ 125 kHz, 50% duty cycle, tr < 6 ns, tf < 6 ns, Zo=50Ω

Fig.8 Peak-to-Peak Common Mode Output Voltage Test and Waveform

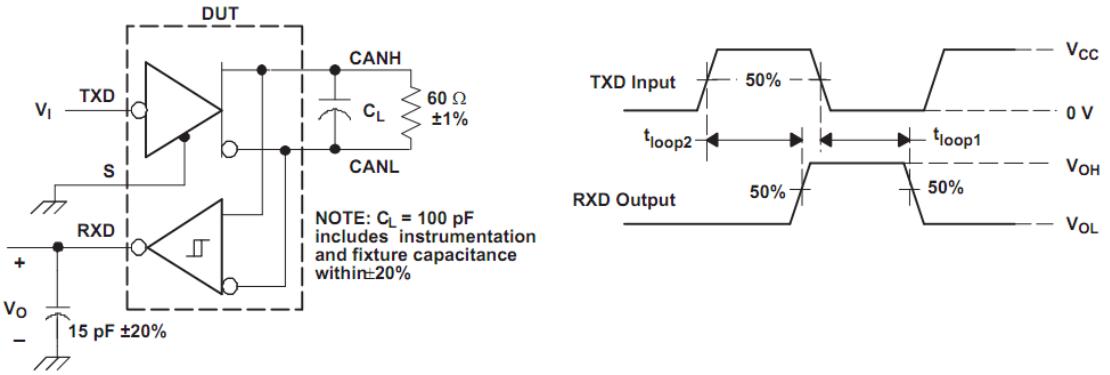


Fig.9 $t_{(LOOP)}$ Test Circuit and Waveform

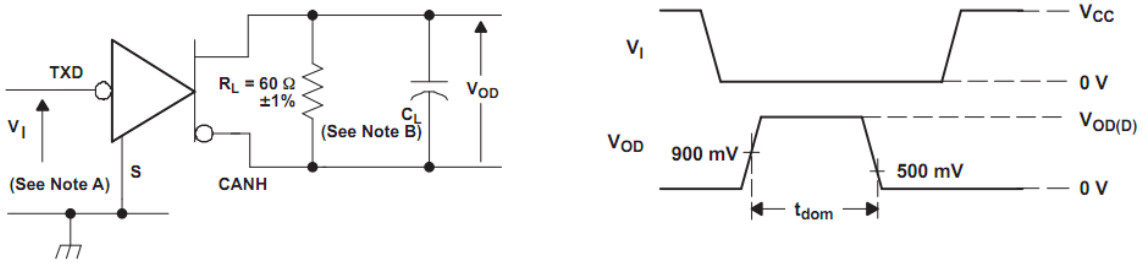


Fig.10 Dominant Time-Out Test Circuit and Waveform

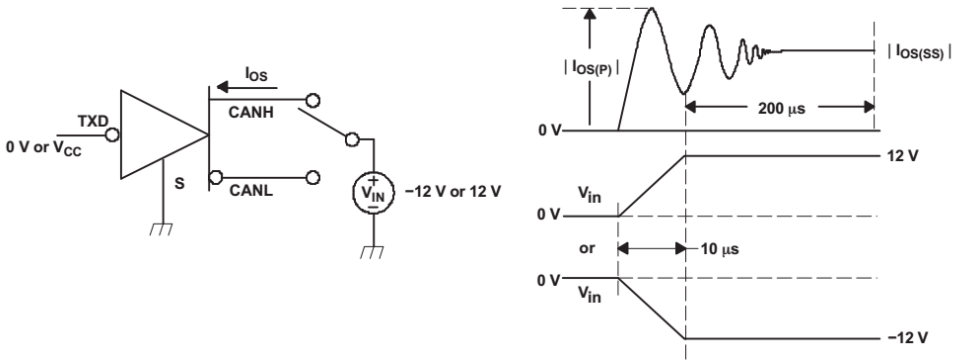


Fig.11 Driver Short-Circuit Current Test Circuit and Waveform

ADDITIONAL DESCRIPTION

1 Sketch

The SIT2551 is the interface between the Controller Area Network (CAN) protocol controller and the physical bus. It is primarily intended for high speed applications, up to 1 MBaud, in passenger cars, trucks, buses, industrial applications etc. The device provides differential transmit capability to the bus and differential receive capability to the CAN controller and is fully compatible with the ISO 11898 standard.

2 Current protection

A current-limiting circuit protects the transmitter output stage from damage caused by accidental short-circuit to either positive or negative supply voltage, although power dissipation increases during this fault condition.

3 Fail-safe features

Pin TXD provides a pull-up towards VCC in order to force a recessive level in case pin TXD is unsupplied. Pin RS provides a pull-up towards VCC in order to force the transceiver into standby mode in case pin RS is unsupplied. In the event that the VCC is lost, pins TXD, RS and RXD will become floating to prevent reverse supplying conditions via these pins.

4 Over temperature protection

The SIT2551 has an integrated overtemperature protection circuit. In case of an overtemperature condition 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.

5 TXD dominant time-out function

A ‘TXD dominant time-out’ timer circuit prevents the bus lines from being driven to a permanent dominant state (blocking all network communication) if pin TXD is forced permanently LOW by a hardware and/or software application failure. The timer is triggered by a negative edge on pin TXD. If the duration of the LOW level on pin TXD exceeds the internal timer value (tdom), the transmitter is disabled, driving the bus lines into a recessive state. The timer is reset by a positive edge on pin TXD.

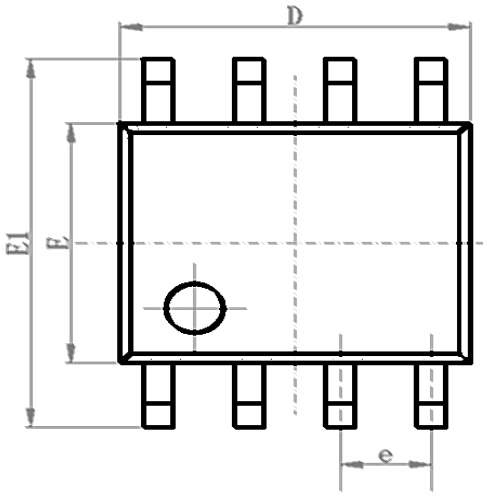
6 Operating modes

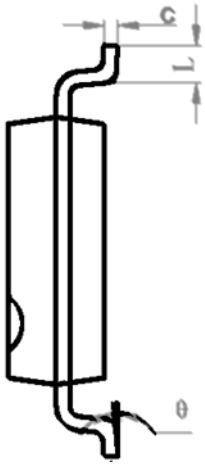
The SIT2551 provides two modes of operation which are selectable via pin RS:
HIGH-SPEED MODE and STANDBY MODE
High-Speed mode is a normal operating mode of the device and it is selected by setting RS low.
In this mode the transceiver is able to transmit and receive data via the bus lines CANH and CANL.
The differential receiver converts the analog data on the bus lines into digital data which is output to pin RXD via the multiplexer (MUX).
A high level on the RS pin selects the Standby mode. In this mode the transmitter and receiver are switched off, and the low-power differential receiver will monitor the bus lines. A high level on pin RS activates this low-power receiver and the wake-up filter, and after tBUS the state of the CAN bus is reflected on pin RXD.

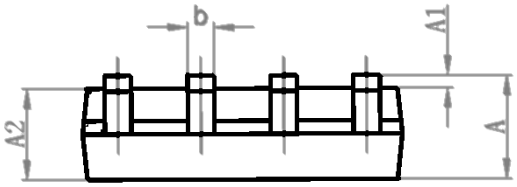
SOP8 DIMENSIONS

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°



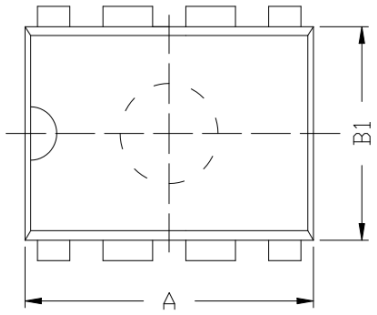


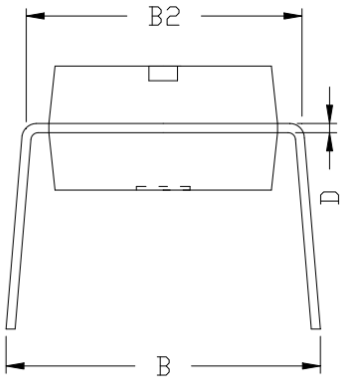


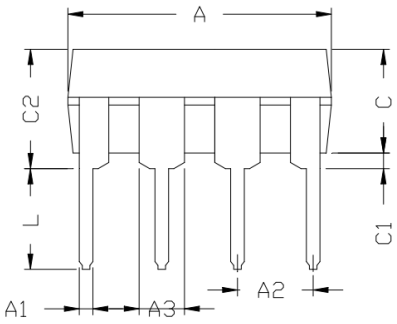
DIP8 DIMENSIONS

PACKAGE SIZE

SYMBOL	MIN./mm	TYP./mm	MAX./mm
A	9.00	9.20	9.40
A1	0. 38	0. 47	0. 57
A2	2.54TYP		
A3	1.524TYP		
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

TYPE NUMBER	TEMPERATURE	PACKAGE
SIT2551T	-40℃~125℃	SOP8
SIT2551P	-40℃~125℃	DIP8

Tape/reel package is 2500 pieces