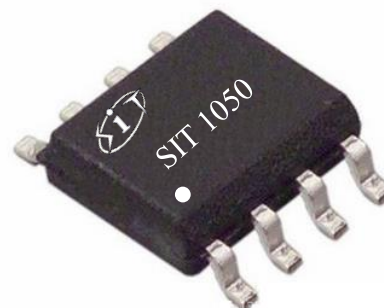


FEATURES

- Fully compatible with the ISO 11898 standard
- Thermally protected
- Input levels compatible with 3.3 V and 5 V devices
- Transmit Data (TXD) dominant time-out function
- Silent mode in which the transmitter is disabled
- 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)

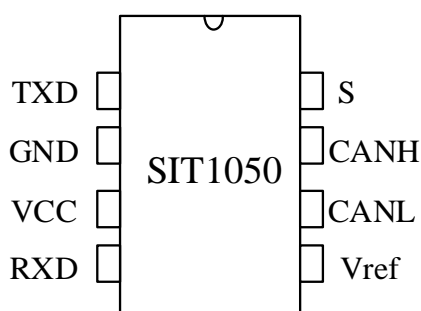
OUTLINE


Provide green and environmentally friendly lead-free package

DESCRIPTION

The SIT1050 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. 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	°C

PIN CONFIGURATION


LIMITING VALUES

PARAMETER	SYMBOL	VALUE	UNIT
Supply voltage	V_{CC}	-0.3~+6	V
DC voltage on TXD/RXD/S/Vref pins		-0.3~ $V_{CC}+0.3$	V
Voltage range at any bus terminal (CANH, CANL)	CANL, CANH	-40~40	V
Transient voltage on pins CANH, CANL see Fig.7	V_{tr}	-200~+200	V
Storage temperature		-55~150	°C
Virtual junction temperature		-40~125	°C
Welding temperature range		300	°C
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 conducive 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; reads out data from the bus lines
5	Vref	reference voltage output
6	CANL	LOW-level CAN bus line
7	CANH	HIGH-level CAN bus line
8	S	silent mode control input

DRIVER ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
CANH dominant output voltage	$V_{OH(D)}$	VI=0V, S=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, S=0V, RL=60Ω, Fig.1, Fig.2	2	2.5	3	V
Bus dominant differential output voltage	$V_{OD(D)}$	VI=0V, S=0V, RL=60Ω, Fig.1, Fig.2	1.5		3	V
Bus recessive differential output voltage	$V_{OD(R)}$	VI=3V, S=0V, Fig.1, Fig.2	-0.012		0.012	V
		VI=3V, S=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}	S=0V, Fig.8	2	2.5	3	V
Peak-to-peak Common-mode output voltage	ΔV_{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

($V_{CC}=5V \pm 10\%$ and $Temp=T_{MIN} \sim T_{MAX}$ unless specified otherwise; typical in $V_{CC}=+5V$ and $Temp=25^{\circ}C$)

DRIVER SWITCHING CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Propagation delay time, low-to-high-level output	tPLH	S=0V, Fig.4	25	65	120	ns
Propagation delay time, low-to-high-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	tEN	Fig.7			1	μs
Bus dominant time-out time	tdom	Fig.10	300	450	700	μs

($V_{CC}=5V \pm 10\%$ and $Temp=T_{MIN} \sim T_{MAX}$ unless specified otherwise; typical in $V_{CC}=+5V$ and $Temp=25^{\circ}C$)

RECEIVER ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Positive-going input threshold voltage	V_{IT+}	S=0V, Fig.5		800	900	mV
Negative-going input threshold voltage	V_{IT-}		500	650		
Hysteresis voltage ($V_{IT+} - V_{IT-}$)	V_{HYS}		100	125		
High-level output voltage	V_{OH}	$I_{O}=-2mA$, Fig.6	4	4.6		V
Low-level output voltage	V_{OL}	$I_{O}=2mA$, Fig.6		0.2	0.4	V
Power-off bus input current	$I_{(OFF)}$	CANH or CANL=5V, Other pin=0V		165	250	μA
Input capacitance to ground, (CANH or CANL)	C_I			13		pF

Differential input capacitance	C_{ID}			5		pF
Input resistance, (CANH or CANL)	R_{IN}	TXD=3V, STB=0V	15	30	40	K Ω
Differential input resistance	R_{ID}		30		80	K Ω
Input resistance matching	$R_{I_{match}}$	CANH=CANL	-3%		3%	
The range of common-mode voltage	V_{COM}		-12		12	V

($V_{CC}=5V \pm 10\%$ and $Temp=T_{MIN} \sim T_{MAX}$ unless specified otherwise; typical in $V_{CC}=+5V$ and $Temp=25^{\circ}C$)

RECEIVER SWITCHING CHARACTERISTICS

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

($V_{CC}=5V \pm 10\%$ and $Temp=T_{MIN} \sim T_{MAX}$ unless specified otherwise; typical in $V_{CC}=+5V$ and $Temp=25^{\circ}C$)

DEVICE SWITCHING CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Loop delay 1, driver input to receiver output, Recessive to Dominant	Td(LOOP1)	S=0V, Fig.9	90		190	ns
Loop delay 2, driver input to receiver output, Dominant to Recessive	Td(LOOP2)		90		190	ns

($V_{CC}=5V \pm 10\%$ and $Temp=T_{MIN} \sim T_{MAX}$ unless specified otherwise; typical in $V_{CC}=+5V$ and $Temp=25^{\circ}C$)

OVER TEMPERATURE PROTECTION

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

TXD-PIN CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
HIGH-level input current	I _{IH} (TXD)	V _I =V _{CC}	-2		2	μA
LOW-level input current	I _{IL} (TXD)	V _I =0	-50		-10	μA
When V _{CC} =0V, current on TXD pin	I _O (off)	V _{CC} =0V, TXD=5V			1	μA
HIGH-level input voltage	V _{IH}		2		V _{CC} +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°C)

REFERENCE VOLTAGE OUTPUT

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Reference output voltage	V _{ref}	-50uA < I _o < 50uA	0.4V _{CC}		0.6V _{CC}	V

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

SUPPLY CURRENT

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Silent	I_{CC}	$S=V_{CC}, V_I=V_{CC}$		6	10	mA
Dominant		$V_I=0V, S=0V,$ $LOAD=60\Omega$		50	70	mA
Recessive		$V_I=V_{CC}, S=0V,$ $NO\ LOAD$		6	10	mA

($V_{CC}=5V \pm 10\%$ and $Temp=T_{MIN} \sim T_{MAX}$ unless specified otherwise; typical in $V_{CC}=+5V$ and $Temp=25^\circ C$)

FUNCTION TABLE
Table1.CAN TRANSCEIVER TRUTH TABLE

V_{CC}	$TXD^{(1)}$	$S^{(1)}$	$CANH^{(1)}$	$CANL^{(1)}$	BUS STATE	$RXD^{(1)}$
4.5V~5.5V	L	L or Open	H	L	Dominate	L
4.5V~5.5V	H or Open	X	$0.5V_{CC}$	$0.5V_{CC}$	Recessive	H
4.5V~5.5V	X	H	$0.5V_{CC}$	$0.5V_{CC}$	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

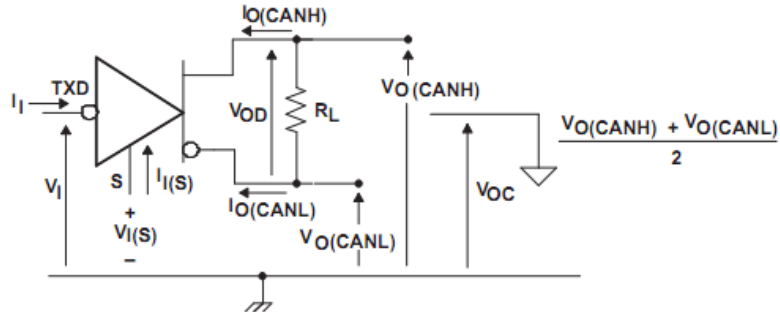
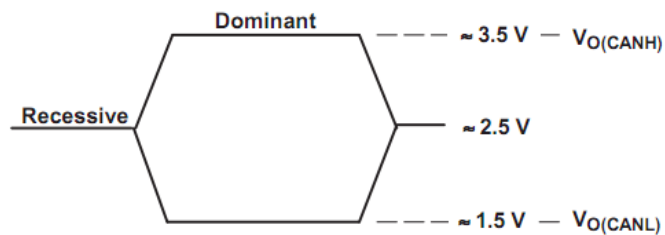
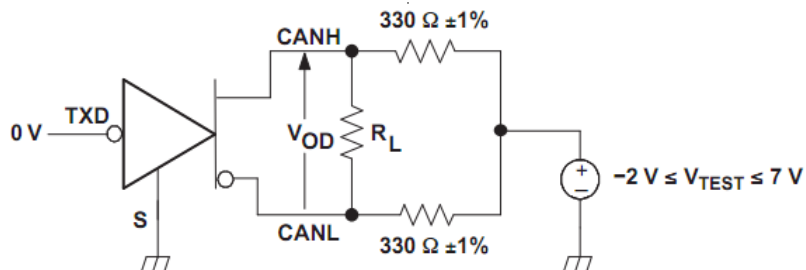
INPUTS		OUTPUTS		Bus State
$TXD^{(1)}$	$S^{(1)}$	$CANH^{(1)}$	$CAL^{(1)}$	
L	L or Open	H	L	Dominate
H or Open	X	Z	Z	Recessive
X	H	Z	Z	Recessive

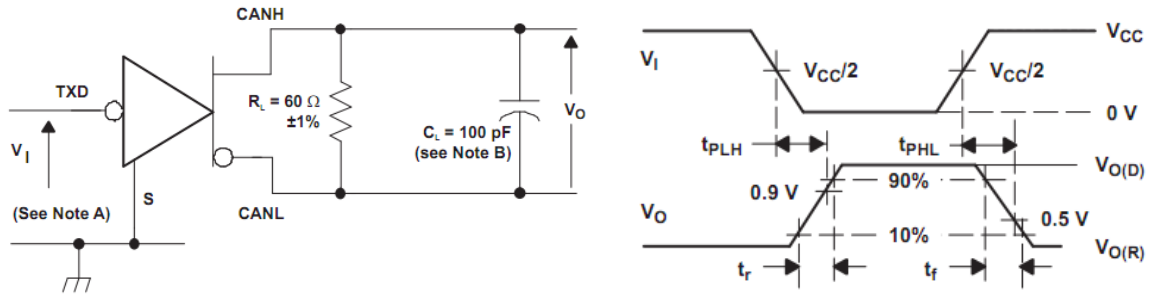
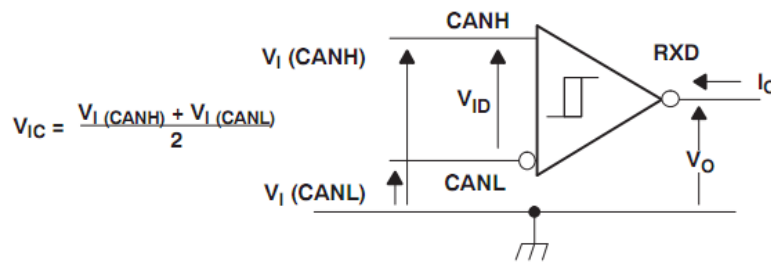
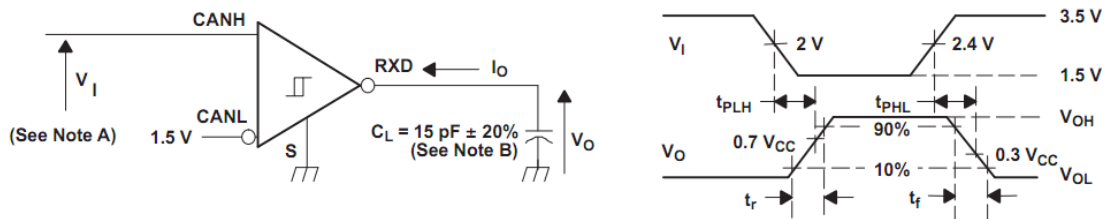
(1) H=high level; L=low level; X=irrelevant; Z=high impedance

Table 3. RECEIVER FUNCTION TABLE

$V_{ID}=CANH-CANL$	$RXD^{(1)}$	Bus State ⁽¹⁾
$V_{ID} \geq 0.9V$	L	Dominate
$0.5 < V_{ID} < 0.9V$?	?
$V_{ID} \leq 0.5V$	H	Recessive
Open	H	Recessive

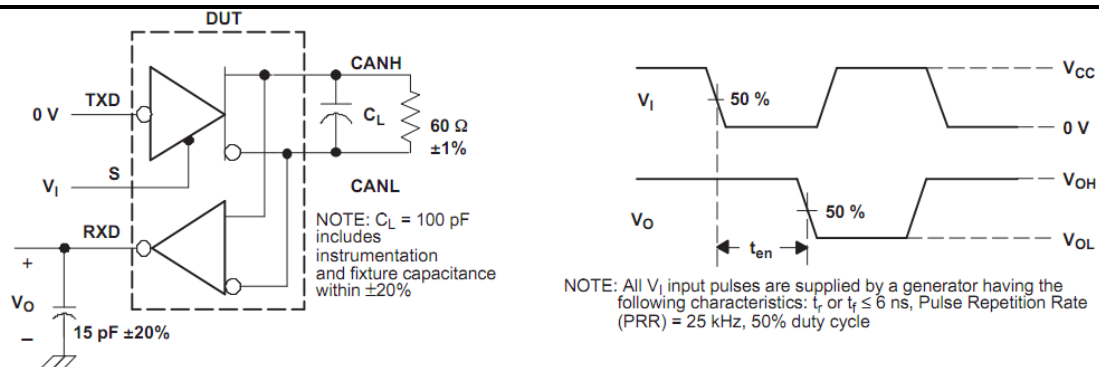
(1) H=high-level; L=low-level; ?=uncertain

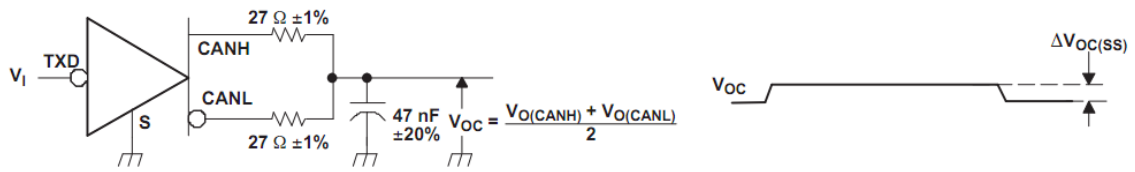
TEST CIRCUIT

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, $t_r \leq 6$ ns, $t_f \leq 6$ ns, $Z_0 = 50 \Omega$.

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 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.

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

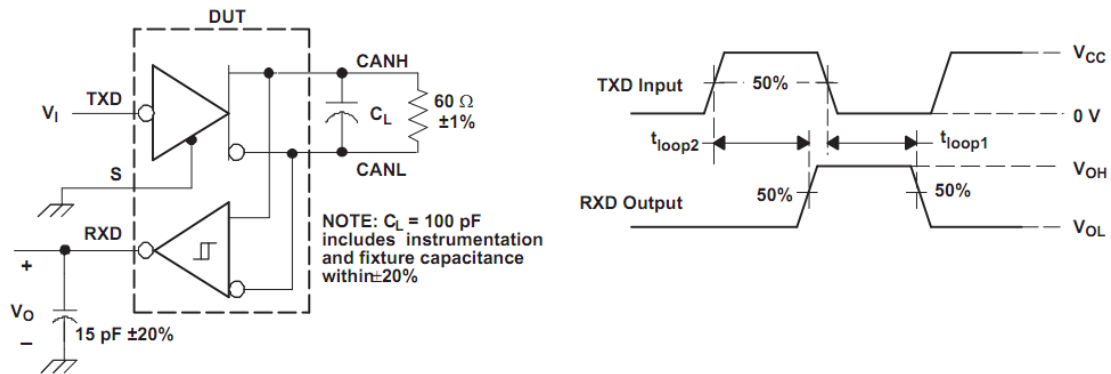


Fig.9 $t_{(LOOP)}$ Test Circuit and Waveform

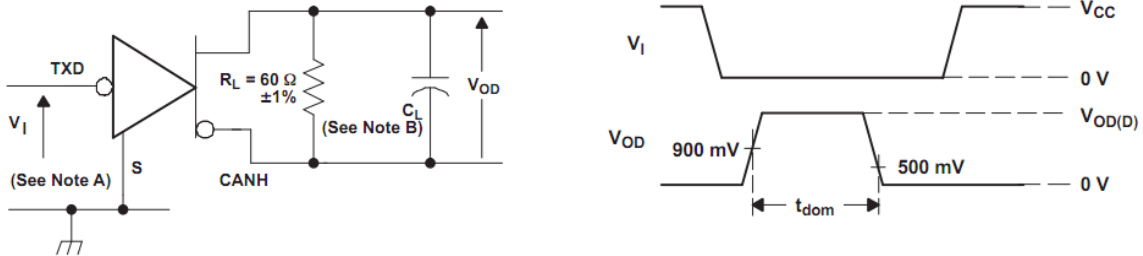


Fig.10 Dominant Time-Out Test Circuit and Waveform

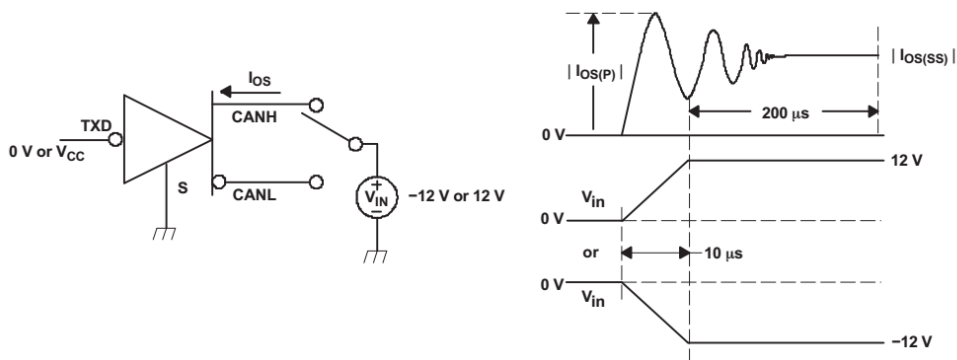


Fig.11 Driver Short-Circuit Current Test Circuit and Waveform

ADDITIONAL DESCRIPTION**1 Sketch**

The SIT1050 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. The device provides differential transmit capability to the bus and differential receive capability to the CAN controller, and 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 Over temperature protection

The output drivers are protected against over-temperature conditions. If the virtual junction temperature exceeds the shutdown junction temperature $T_{j(sd)}$, the output drivers will be disabled until the virtual junction temperature becomes lower than $T_{j(sd)}$ and TXD becomes recessive again.

By including the TXD condition, the occurrence of output driver oscillation due to temperature drifts is avoided.

4 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 (t_{dom}), the transmitter is disabled, driving the bus lines into a recessive state. The timer is reset by a positive edge on pin TXD.

5 Operating modes

The SIT1050 provides two modes of operation which are selectable via pin S:

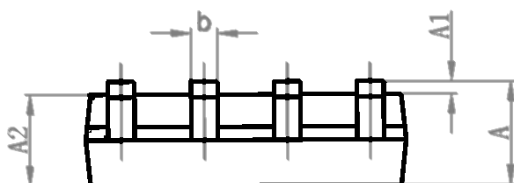
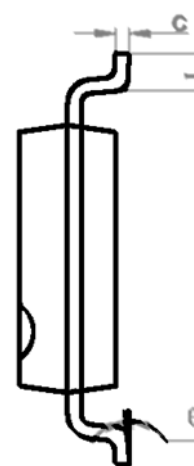
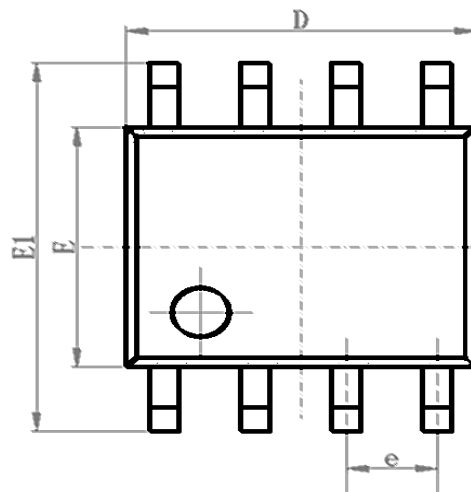
High-speed mode and silent mode.

The high-speed mode is the normal operating mode and is selected by connecting pin S to ground. Due to an internal pull-down function it is the default mode if pin S is unconnected. In this mode the bus output signals are switched as fast as possible with a fixed slope. It is the appropriate mode for achieving a maximum bit rate and/or bus length and provides minimum transceiver loop delays.

In silent mode the transmitter is disabled regardless of the TXD input signal. Thus the transceiver behaves as in non-transmitting state consuming the same supply current as in recessive state. The silent mode is selected with a HIGH signal at pin S.

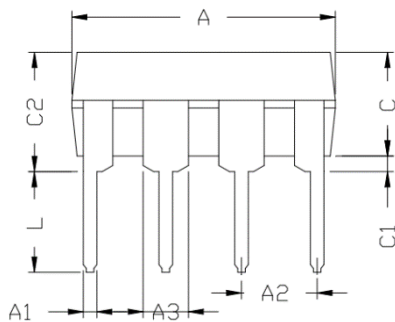
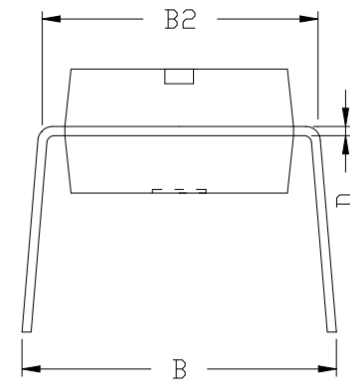
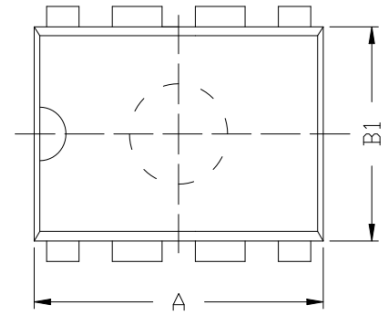
SOP8 DIMENSIONS
PACKAGE SIZE

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

TYPE NUMBER	TEMPERATURE	PACKAGE
SIT1050T	-40°C~125°C	8 SO
SIT1050	-40°C~125°C	DIP8

Tapered package is 2500 pieces/disc.