钍地半导体
Tudi Semiconductor

Product Specification

TUDI-PCA82C251

CAN transceiver for 24 V systems

网址 www.sztdbdt.com

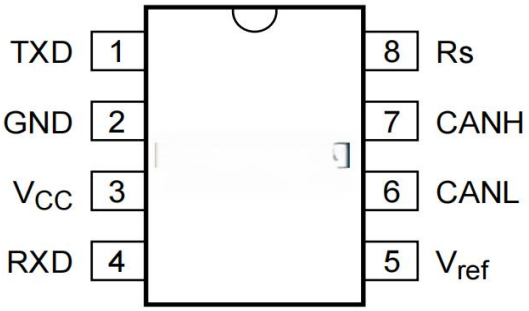
用芯智造·卓越品质

semiconductor device manufacturer

- Design
- research and development
- production
- and sales

Features

- ●Fully compatible with the “ISO 11898-24 V ” standard
- ● Slope control to reduce Radio Frequency Interference (RFI)
- ●Thermally protected
- ●Short-circuit proof to battery and ground in 24 V powered systems
- ●Low-current Standby mode
- ● An unpowered node does not disturb the bus lines
- ● At least 110 nodes can be connected
- ● High speed (up to 1 MBd)
- ●High immunity against electromagnetic interference.



DIP8/SOP8

Applications

- ●High-speed applications (up to 1 MBd) in trucks and busses.

Description

The PCA82C251 is the interface between a CAN protocol controller and the physical bus. The device provides differential transmit capability to the bus and differential receive capability to the CAN controller.

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Max	Unit
V_{cc}	supply voltage		4.5	5.5	V
I_{cc}	supply current	Standby mode	-	275	μA
$1/t_{bit}$	maximum transmission speed	non-return-to-zero	1	-	MBd
V_{CAN}	CANH,CANL input/output voltage		-36	+36	V
V_{diff}	differential bus voltage		1.5	3.0	V
t_{PD}	propagation delay	High-speed mode	-	50	ns
T_{amb}	ambient temperature		-40	+125	℃

Block diagram

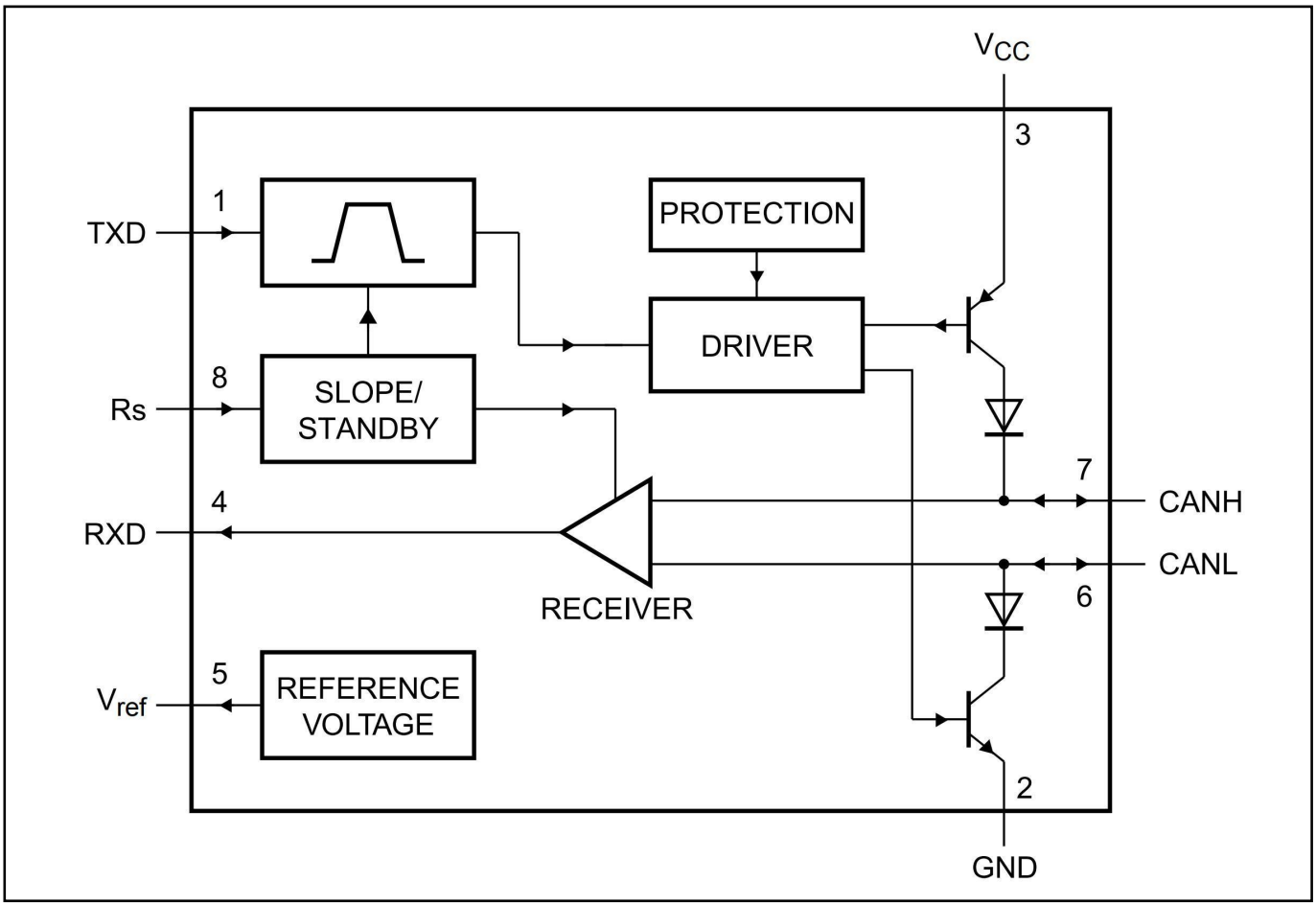


Table 2. Pin description

Symbol	Pin	Description
TXD	1	transmit data input
GND	2	ground
V_{cc}	3	supply voltage
RXD	4	receive data output
V_{ref}	5	reference voltage output
CANL	6	LOW-level CAN voltage input/output
CANH	7	HIGH-level CAN voltage input/output
R_s	8	slope resistor input

Functional description

The PCA82C251 is the interface between a CAN protocol controller and the physical bus. It is primarily intended for applications up to 1 MBd in trucks and buses. The device provides differential transmit capability to the bus and differential receive capability to the CAN controlle. It is fully compatible with the “ISO 11898-24 V” standard.

A current-limiting circuit protects the transmitter output stage against short-circuits to positive and negative battery voltage. Although power dissipation will increase as a result of a short circuit fault condition, this feature will prevent destruction of the transmitter output stage.

If the junction temperature exceeds approximately 160 ℃, the limiting current of both transmitter outputs is decreased. Because the transmitter is responsible for most of the power dissipated, this will result in reduced power dissipation and hence a lower chip temperature. All other parts of the IC will remain operational. The thermal protection is needed, in particular, when a bus line is short-circuited.

The CANH and CANL lines are also protected against electrical transients which may occur in an automotive environment.Pin 8 (Rs) allows three different modes of operation to be selected: High-speed, Slope control and Standby.

For high-speed operation, the transmitter output transistors are simply switched on and off as fast as possible. In this mode, no measures are taken to limit the rise and fall slopes. A shielded cable is recommended to avoid RFI problems. High-speed mode is selected by connecting pin 8 to ground.

Slope control mode allows the use of an unshielded twisted pair or a parallel pair of wires as bus lines. To reduce RFI, the rise and fall slopes should be limited. The rise and fall slopes can be programmed with a resistor connected from pin 8 to ground. The slope is proportional to the current output at pin 8.

If a HIGH level is applied to pin 8, the circuit enters a low-current Standby mode. In this mode, the transmitter is switched off and the receiver is switched to a low current. If dominant bits are detected (differential bus voltage >0.9 V), RXD will be switched to a LOW level.

The microcontroller should react to this condition by switching the transceiver back to normal operation (via pin 8). Because the receiver is slower in Standby mode, the first message will be lost at higher bit rates.

Table 3. Truth table of the CAN transceiver

Supply	TXD	CANH	CANL	Bus state	RXD
4.5V to 5.5V	0	HIGH	LOW	dominant	0
4.5V to 5.5V	1(or floating)	floating	floating	recessive	1(1)
4.5V<V_{cc}<5.5V	X(2)	floating if V_{RS}>0.75V_{cc}	floating if V_{RS}>0.75V_{cc}	floating	X(1)
0V<V_{cc}<4.5V	floating	floating	floating	floating	X(2)

(1) If another bus node is transmitting a dominant bit, then RXD is logic 0.
(2) X = don ' t care.

Table 4. 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}<0.3V_{cc}	High-speed	-I_{RS}<500 μA

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). All voltages are referenced to pin 2; positive input current.

Symbol	Parameter	Conditions	Min	Max	Unit
V_{cc}	supply voltage		-0.3	+7.0	V
V_n	DC voltage at pins 1,4,5 and 8		-0.3	V_{cc}+0.3	V
V_6	DC voltage at pin 6(CANL)	0V<V_{cc}<5.5V;TXD HIGH or floating	-36	+36	V
		0V<V_{cc}<5.5V;no time limit	[1 -36	+36	V
		0V<V_{cc}<5.5V;no time limit	[2]-36	+36	V
V_7	DC voltage at pins 7(CANH)	0V<V_{cc}<5.5V;no time limit	-36	+36	V

Table 5. Limiting values (Continued)

In accordance with the Absolute Maximum Rating System (IEC 60134). All voltages are referenced to pin 2; positive input current.

Symbol	Parameter	Conditions	Min	Max	Unit
V_{trt}	transient voltage at pins 6 and 7	see Figure 6	-200	+200	V
T_{stg}	storage temperature		-55	+150	℃
T_{amb}	ambient temperature		-40	+125	℃
T_{vj}	virtual junction temperature		(3)-40	+150	℃
V_{ESD}	electrostatic discharge voltage		(4)-2500	+2500	V
			5-250	+250	V

(1) TXD is LOW. Short-circuit protection provided for slew rates up to 5 V/μs for voltages above +30 V.
(2) Short-circuit applied when TXD is HIGH, followed by TXD switched to LOW.
(3) In accordance with "IEC 60747-1". An alternative definition of virtual junction temperature is: $T_{vj} = T_{amb} + P_d \times R_{th(vj-a)}$, where $R_{th(j-a)}$ is a fixed value to be used for the calculation of T_{vj}. The rating for T_{vj} limits the allowable combinations of power dissipation (P_d) and ambient temperature (T_{amb}).
(4) Classification A: human body model; C = 100 pF; R = 1500 Ω; V =±2000 V.
(5) Classification B: machine model; C = 200 pF; R = 25 Ω; V =±200 V.

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	160	KW

Table 7. Characteristics

V_{cc} = 4.5 V to 5.5 V; T_{amb} = -40℃ to +125 ℃; R_L = 60Ω; I_8 > -10 μA; unless otherwise specified; all voltages referenced to ground (pin 2); positive input current; all parameters are guaranteed over the ambient temperature range by design, but only 100 % tested at +25℃.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Supply						
I_3	supply current	dominant;V_1=1V;V_{cc}=5.1V	-		78	mA
		dominant;V_1=1V;V_{cc}=5.25V	-	-	80	mA
		dominant;V_1=1V;V_{cc}=5.5V	-	-	85	mA
		recessive;V_1=4V;R_8=47kΩ	-	-	10	mA
		Standby	(1)-	-	275	μA
DC bus transmitter						
V_{IH}	HIGH-level input voltage	output recessive	0.7V_{cc}		V_{cc}+0.3	V
V_{IL}	LOW-level input voltage	output dominant	-0.3		0.3V_{cc}	V
I_{IH}	HIGH-level input current	V_1=4V	-200		+30	μA
I_{IL}	LOW-level input current	V_1=1V	-100	1	-600	μA
$V_{6,7}$	recessive bus voltage	V_1=4V;no load	2.0	1	3.0	V
I_{LO}	off-state output leakage current	-2V<(V_6,V_7)<7V	-2	-	+2	mA
		-5V<(V_6,V_7)<36V	-10	-	+10	mA
V_7	CANH output voltage	V_1=1V;V_{cc}=4.75V to 5.5V	3.0	1	4.5	V
		V_1=1V;V_{cc}=4.5V to 4.75V	2.75		4.5	
V_6	CANL output voltage	V_1=1V	0.5	-	2.0	V
△$V_{6,7}$	difference between output	V_1=1V	1.5	-	3.0	V
	voltage at pins 6 and 7	V_1=1V;R_L=45Ω	1.5	-	-	V
		V_1=4V;no load	-500	-	+50	mV
I_{SC7}	short-circuit CANH current	V_7=-5V	-	-	-200	mA
		V_7=-36V	-	-100	-	mA

Table 7. Characteristics (Continued)

V_{cc} = 4.5 V to 5.5 V; T_{amb} = -40℃ to +125 ℃; R_L = 60Ω; I_8 > -10 μA; unless otherwise specified; all voltages referenced to ground (pin 2); positive input current; all parameters are guaranteed over the ambient temperature range by design, but only 100 % tested at +25℃.

Symbol	Parameter	Conditions	Min	Typ	Max	
I_{sc6}	short-circuit CANL current	V_6 =36V	-		200	mA
DC bus receiver:V_1=4V;pins 6 and 7 externally driven;-2V<(V_6,V_7)<7V;unless otherwise specified						
$V_{diff(r)}$	differential input voltage		(2)-1		+0.5	V
	(recessive)	-7V<(V_6,V_7)<12V	(2)-1	-	+0.4	V
$V_{diff(d)}$	differential input voltage		0.9	-	5.0	V
	(dominant)	-7V<(V_6,V_7)<12V;not Standbymode	1.0	1	5.0	V
		Standby mode	0.97		5.0	V
		Standby mode; V_{cc}=4.5V to 5.10V	0.91		5.0	V
$V_{aiff(hys)}$	differential input hysteresis	see Figure 3		150	-	mV
V_{oH}	HIGH-level output voltage	pin 4;I_4=-100 μA	0.8V_{cc}	-	V_{cc}	V
V_{oL}	LOW-level output voltage	pin 4;I_4=1mA	0		0.2V_{cc}	V
		I_4=10 mA	0	-	1.5	V
R_i	input resistance	CANH,CANL	5	-	25	kS
R_{diff}	differential input resistance		20	-	100	kΩ
		Reference output				
V_{ref}	reference output voltage	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

Table 7. Characteristics (continued)

V_{cc} = 4.5 V to 5.5 V; T_{amb} = -40 ℃ to +125 ℃; R_L = 60 Ω; I_8 > -10 μA; unless otherwise specified; all voltages referenced to ground (pin 2); positive input current; all parameters are guaranteed over the ambient temperature range by design, but only 100 % tested at +25℃.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Timing(C_L=100 pF;see Figure 1,Figure 2,Figure 4 and Figure 5)						
t_{bit}	minimum bit time	R_{ext}=0Ω	-	-	1	μs
t_{onTXD}	delay TXD to bus active	R_{ext}=0Ω	-	-	50	ns
t_{offTXD}	delay TXD to bus inactive	R_{ext}=0Ω	-	40	80	ns
t_{onRXD}	delay TXD to receiver active	R_{ext}=0Ω	-	55	120	ns
t_{offRXD}	delay TXD to receiver inactive	R_{ext}=0Ω;T_{amb}<+85℃ V_{cc} =4.5V to 5.1 V	-	80	150	ns
		R_{ext}=0Ω;V_{cc}=4.5V to 5.1V	-	80	170	ns
		R_{ext}=0Ω;Tamb<+85℃	-	90	170	ns
		R_{ext}=0 kΩ	-	90	190	ns
		R_{ext}=47 kΩ	-	290	400	ns
t_{onRXD}	delay TXD to receiver active	R_{ext} =47 kΩ	-	440	550	ns
$I_{SR}I$	CANH,CANL slew rate	R_{ext}=47 kΩ	-	7	-	VIμs
t_{WAKE}	wake-up time from Standby(via pin 8)	see Figure 6	-	-	20	μs
t_{aRXDL}	bus dominant to RXD LOW	V_8=4V;see Figure 5			3	μs
Standby/Slope control (pin 8)						
V_{stb}	input voltage for Standby mode		0.75V_{cc}	-		V
I_{slope}	Slope control mode current		-10		-200	μA
V_{slope}	Slope control mode voltage		0.4V_{cc}	-	0.6V_{cc}	V

[1] I_1 = I_4 = I_5 = 0 mA; 0 V < V_6 < V_{cc}; 0 V < V_7 < V_{cc}; V_8 = V_{cc}; T_{amb} < 90℃.
[2] This is valid for the receiver in all modes: High-speed, Slope control and Standby.

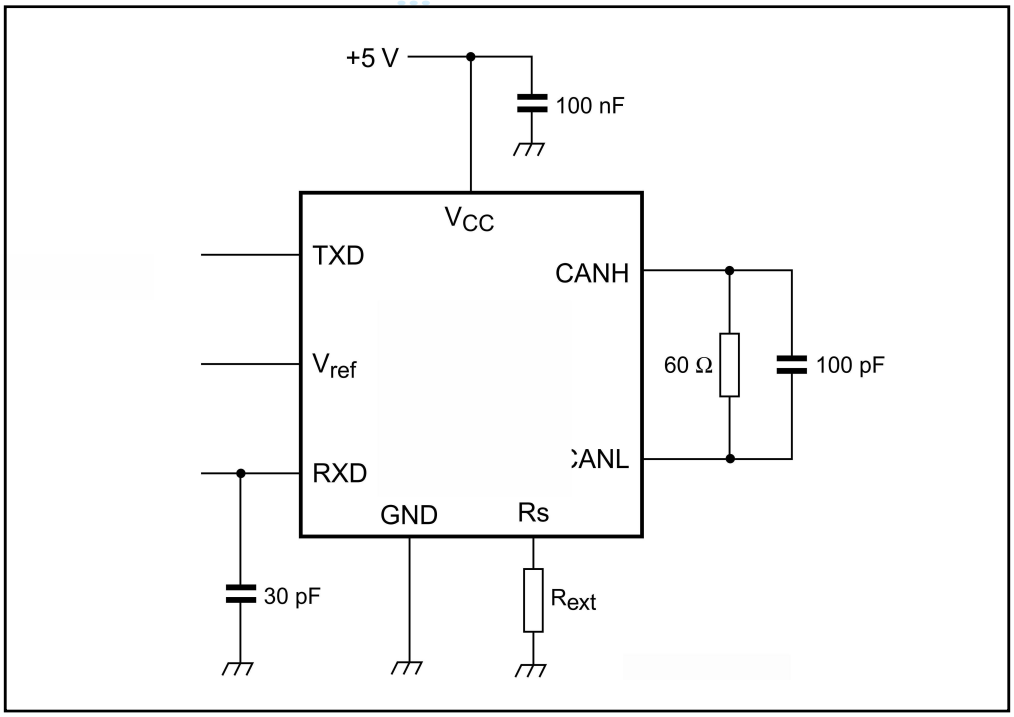


Figure 1. Test circuit for dynamic characteristics.

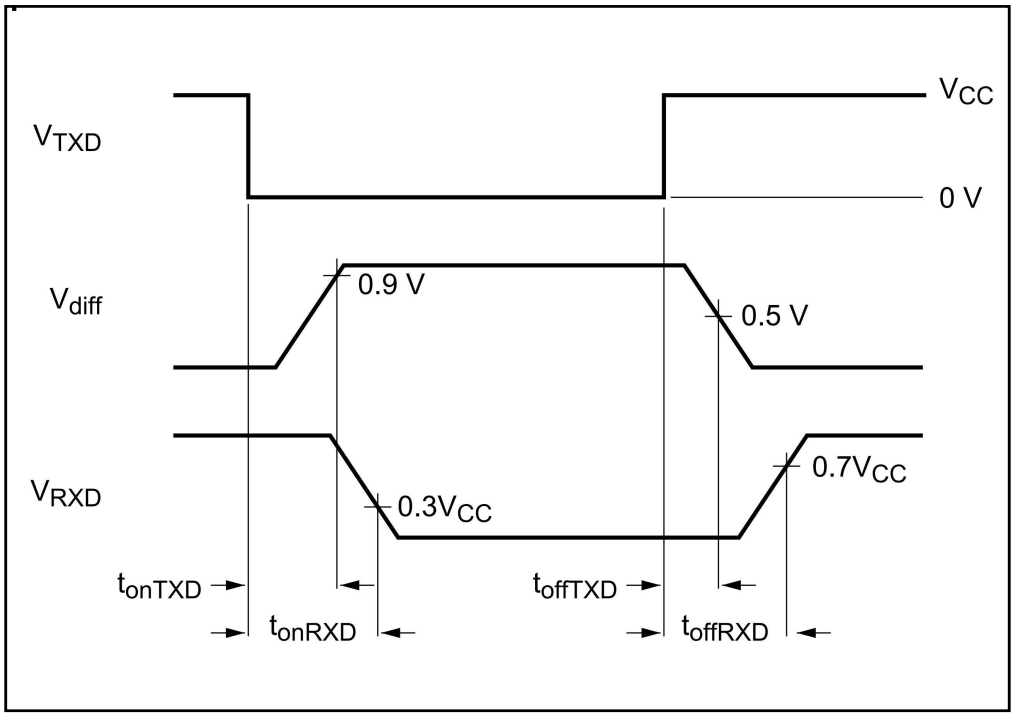


Figure 2. Timing diagram for dynamic characteristics.

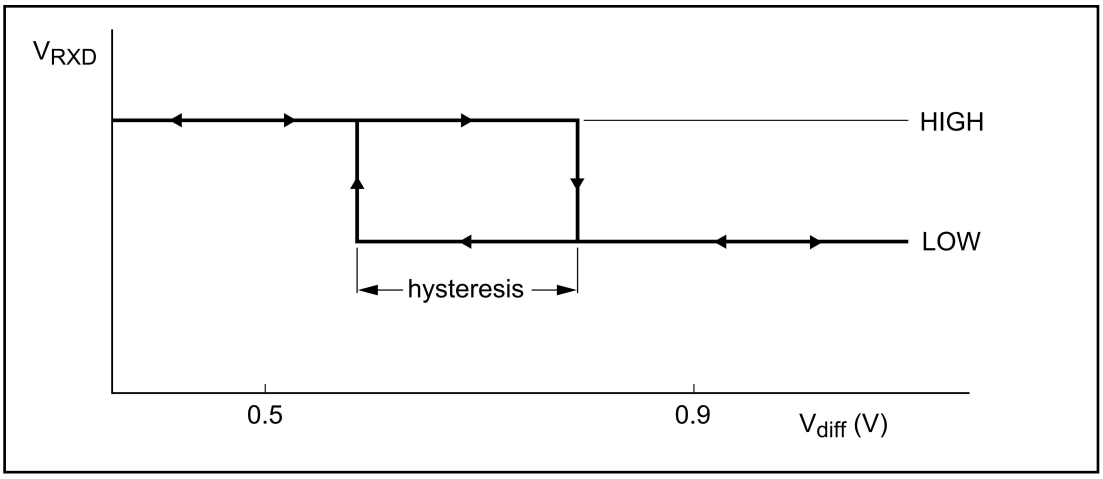


Figure 3. Hysteresis.

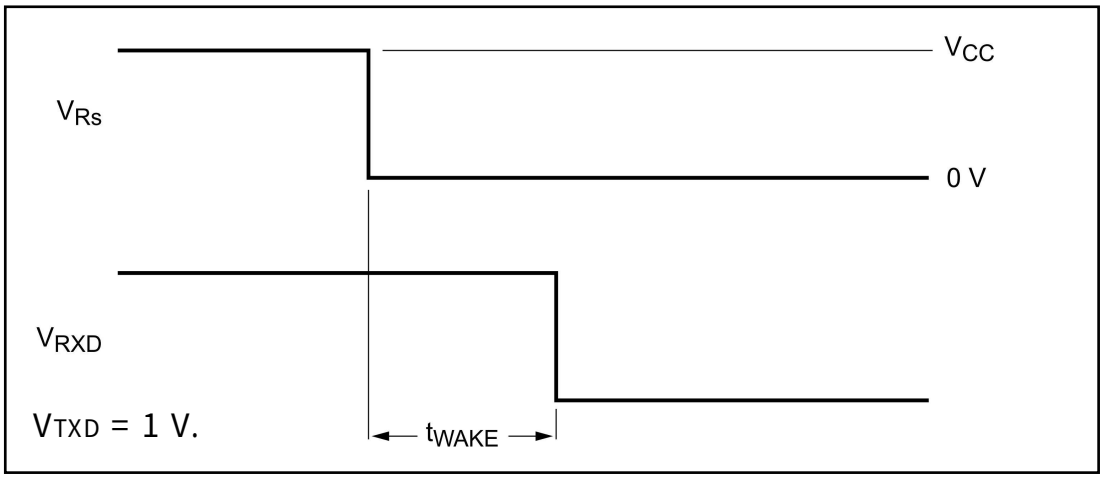


Figure 4. Timing diagram for wake-up from Standby.

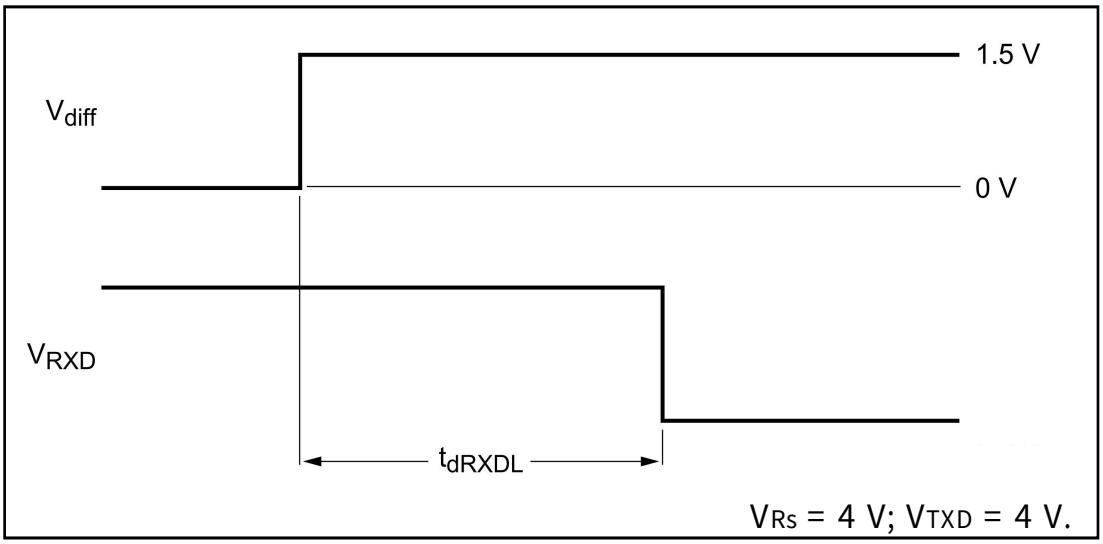


Figure 5. Timing diagram for bus dominant to RXD LOW.

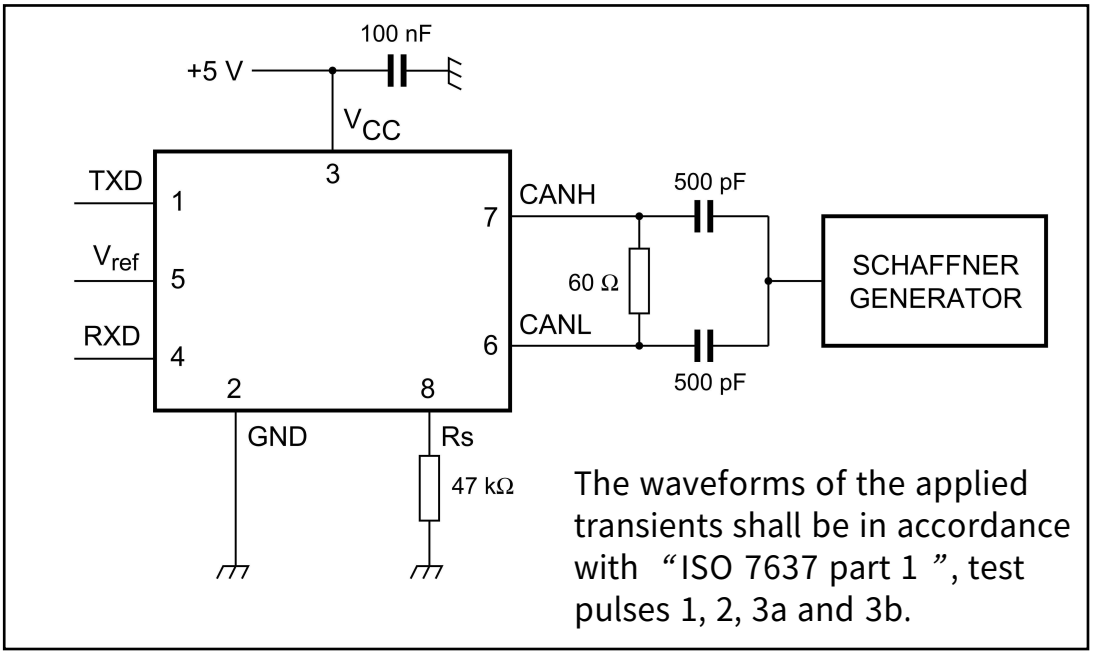


Figure 6. Test circuit for automotive transients.

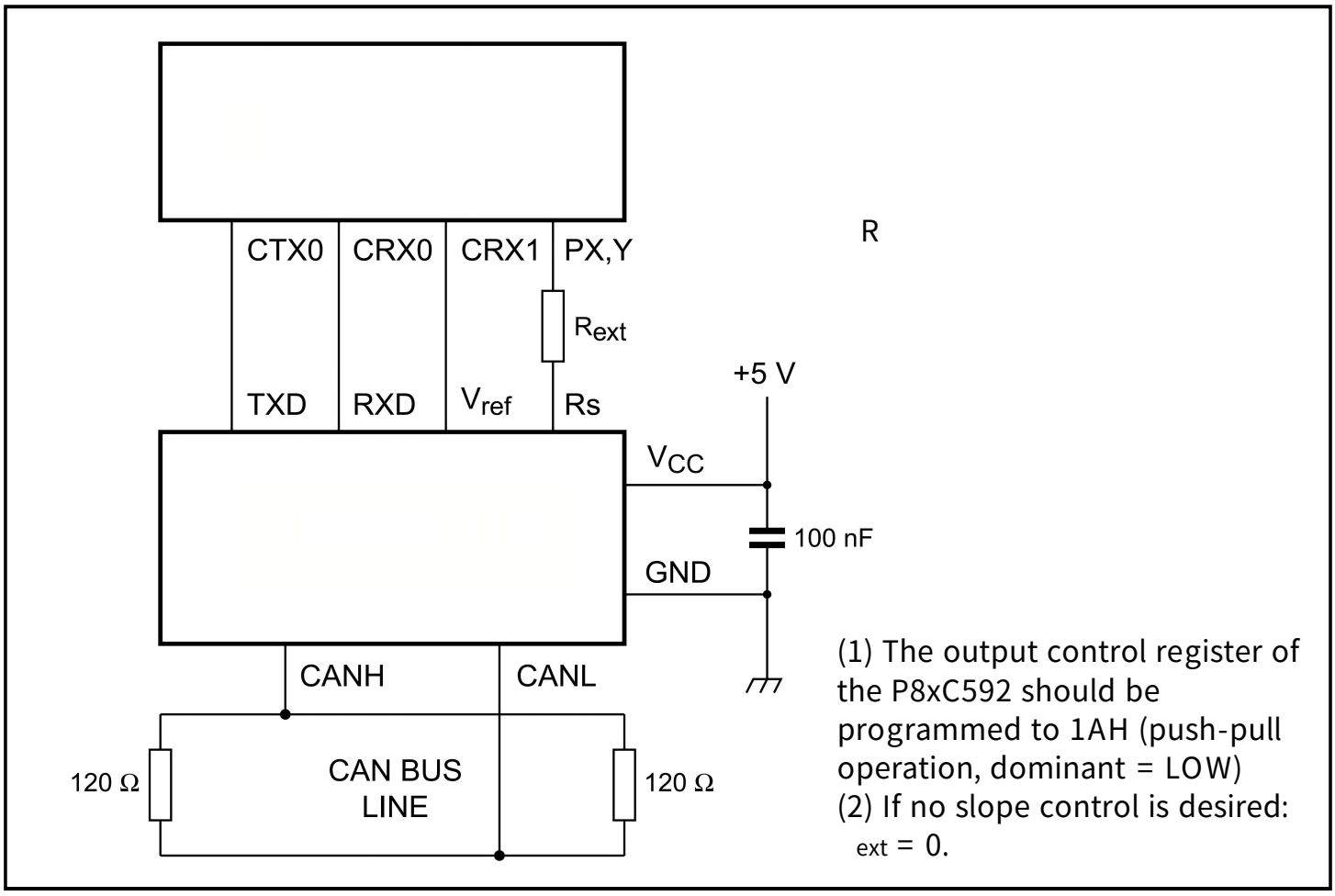


Figure 7. PCA82C251 CAN transceiver application diagram

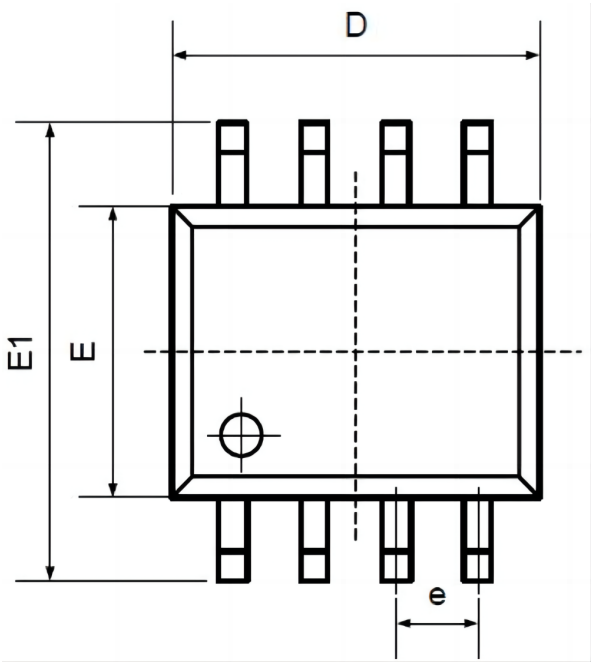
Order information

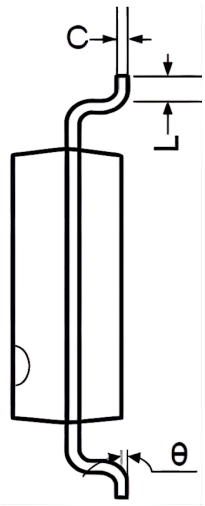
Order Number	Package	Package Quantity	Marking On The park	Temperature
PCA82C251T/YM-TUDI	SOP8	Tape,Reel,4000	82C251Y	–40 to +125 °C
PCA82C251N-TUDI	DIP8	Tube,50,A box of 2000	PCA82C251N	

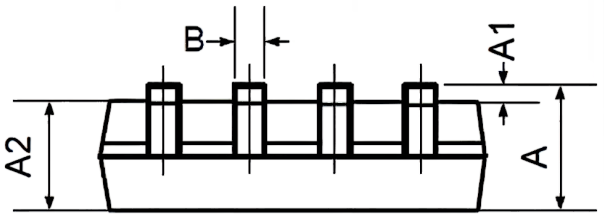
Revision history

	Date	Revision	Page
V1.0	2020/9	New	1-12
V1.1	2025-4	Update model and PDF template	1-16

Package SOP8

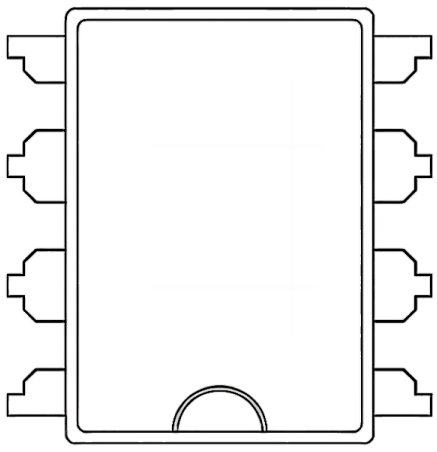


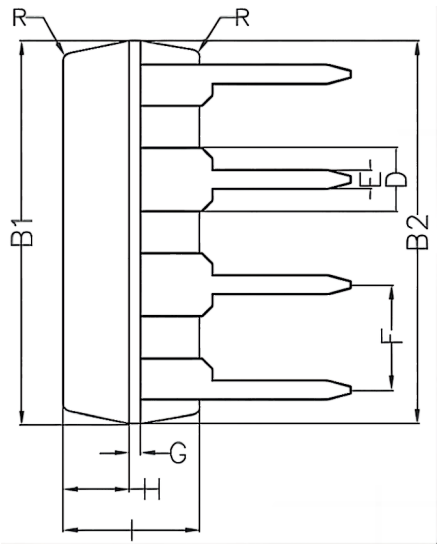


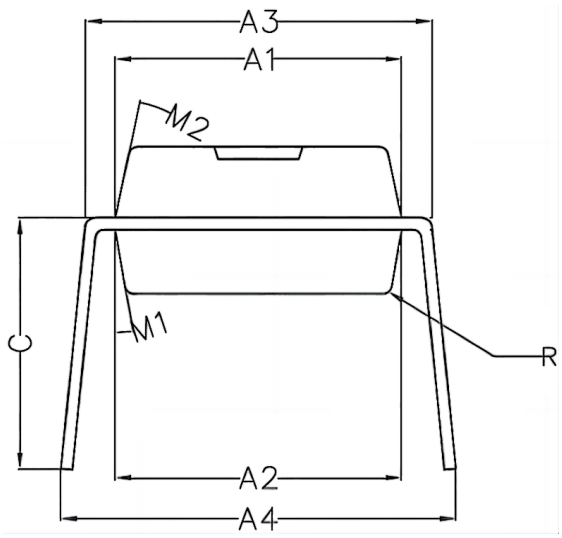


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
B	0.330	0.510	0.013	0.020
C	0.190	0.250	0.007	0.010
D	4.780	5.000	0.188	0.197
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.248
e	1.270TYP		0.050TYP	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

Package DIP8







Symbol	Min	Non	Max
A1	6.28	6.33	6.38
A2	6.33	6.38	6.43
A3	7.52	7.62	7.72
A4	7.80	8.40	9.00
B1	9.15	9.20	9.25
B2	9.20	9.25	9.30
C		5.57	
D		1.52	
E	0.43	0.45	0.47
F		2.54	
G		0.25	
H	1.54	1.59	1.64
工	3.22	3.27	3.32
R		0.20	
M1	9°	10°	11°
M2	11°	12°	13°

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