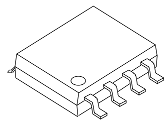
CAN CONTROLLER INTERFACE



SOP-8

■ DESCRIPTION

The UTC **UCA82C250** 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. It is primarily intended for applications up to 1 MBd in trucks and buses.

■ FEATURES

* Fully compatible with the “ISO 11898” standard
* Slope control to reduce Radio Frequency Interference (RFI)
* CAN controller interface
* An unpowered node does not disturb the bus lines
* Thermally protected
* Low-current Standby mode
* At least 110 nodes can be connected
* High speed (up to 1 MBd)
* High immunity against electromagnetic interference

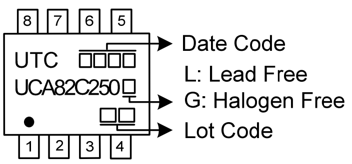
■ ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen Free		
UCA82C250L-S08-R	UCA82C250G-S08-R	SOP-8	Tape Reel

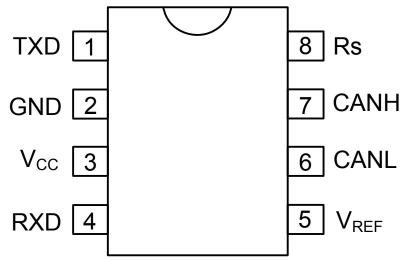
UCA82C250G-S08-R

(1)Packing Type	(1) R: Tape Reel
(2)Package Type	(2) S08: SOP-8
(3)Green Package	(3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING



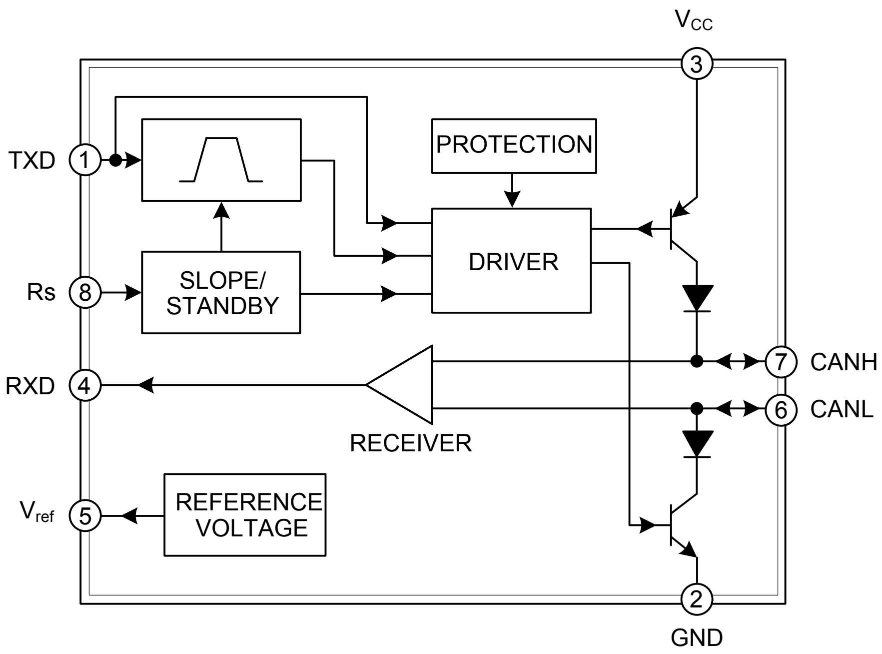
■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	TXD	Transmit data input
2	GND	Ground
3	V_{CC}	Supply voltage
4	RXD	Receive data output
5	V_{REF}	Reference voltage output
6	CANL	LOW-level CAN voltage input/output
7	CANH	HIGH-level CAN voltage input/output
8	Rs	Slope resistor input

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING

PARAMETER		SYMBOL	RATINGS	UNIT
Supply Voltage		V_{CC}	-0.3 ~ +9.0	V
DC Voltage at Pins 1, 4, 5 and 8		V_n	-0.3 ~ V_{CC}+0.3	V
DC voltage at pins 6 and 7	0V < V_{CC} < 5.5V, no time limit	$V_{6,7}$	-8.0 ~ +18	V
Transient Voltage at Pins 6 and 7	see Figure 6	V_{TRT}	-150 ~ +100	V
Ambient Temperature		T_A	-40 ~ +125	°C
Storage Temperature		T_{STG}	-55 ~ +150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Thermal Resistance from Junction to Ambient	in Free Air	θ_{JA}	160	K/W

■ ELECTRICAL CHARACTERISTICS

V_{CC}= 4.5V~5.5V; T_A=-40°C~+125°C; R_L=60Ω; I_8>-10μA; 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°C.

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
SUPPLY						
Supply Current	I_3	Dominant; V_1=1V			70	mA
		Recessive; V_1=4V; R_8=47kΩ			14	mA
		Recessive; V_1=4V; V_8=1V			18	mA
		Standby, T_{amb}<90°C (Note 1)		100	170	μA
DC BUS TRANSMITTER						
HIGH-Level Input Voltage	V_{IH}	Output Recessive	0.7×V_{CC}		V_{CC}+0.3	V
LOW-Level Input Voltage	V_{IL}	Output Dominant	-0.3		0.3×V_{CC}	V
HIGH-Level Input Current	I_{IH}	V_1=4V	-200		+30	μA
LOW-Level Input Current	I_{IL}	V_1=1V	-100		-600	μA
Recessive Bus Voltage	$V_{6,7}$	V_1=4V, No Load	2.0		3.0	V
CANH Output Voltage	V_7	V_1=1V	2.75		4.5	V
CANL Output Voltage	V_6	V_1=1V	0.5		2.25	V
Difference Between Output Voltage at Pins 6 and 7	$\triangle V_{6,7}$	V_1=1V	1.5		3.0	V
		V_1=1V, R_L=45Ω, V_{CC}≥4.9V	1.5			V
		V_1=4V; No Load	-500		+50	mV
Short-Circuit CANH Current	I_{SC7}	V_7=-5V, V_{CC}≤5V			-105	mA
		V_7=-5V, V_{CC}=5.5V			-120	mA
Short-Circuit CANL Current	I_{SC6}	V_6=18V			160	mA

■ ELECTRICAL CHARACTERISTICS (Cont.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
DC BUS RECEIVER: V_1= 4V; PINS 6 AND 7 EXTERNALLY DRIVEN; -2V<(V_6, V_7) < 7V; UNLESS OTHERWISE SPECIFIED						
Differential Input Voltage (Recessive)	$V_{DIFF(r)}$		-1.0		+0.5	V
		-7V<(V_6,V_7)<12V, not Standby Mode	-1.0		+0.4	V
Differential Input Voltage (Dominant)	$V_{DIFF\ (d)}$		0.9		5.0	V
		-7V<(V_6,V_7)<12V; not Standby Mode	1.0		5.0	V
Differential Input Hysteresis	$V_{DIFF\ (hys)}$	see Figure 3		150		mV
HIGH-Level Output Voltage	V_{OH}	pin 4; I_4= -100μA	0.8×V_{CC}		V_{CC}	V
LOW-Level Output Voltage	V_{OL}	pin 4; I_4=1mA	0		0.2×V_{CC}	V
		I_4=10mA	0		1.5	V
Input Resistance	R_I	CANH, CANL	5		25	kΩ
Differential Input Resistance	R_{DIFF}		20		100	kΩ
REFERENCE OUTPUT						
Reference Output Voltage	V_{ref}	V_8=1V; -50μA <I_5<50μA	0.45×V_{CC}		0.55×V_{CC}	V
		V_8=4V; -5μA <I_5<5μA	0.4×V_{CC}		0.6×V_{CC}	V
TIMING (C_L=100PF; SEE FIGURE 1, FIGURE 2, FIGURE 4 AND FIGURE 5)						
Minimum Bit Time	t_{BIT}	R_{EXT}=0Ω			1	μs
Delay TXD to Bus Active	t_{ON_TXD}	R_{EXT}=0Ω				ns
Delay TXD to Bus Inactive	t_{OFF_TXD}	R_{EXT}=0Ω		40		ns
Delay TXD to Receiver Active	t_{ON_RXD}	R_{EXT}=0Ω		55		ns
Delay TXD to Receiver Inactive	t_{OFF_RXD}	R_{EXT}=0Ω, V_{CC}<5.1V, T_A<+85°C		82		ns
		R_{EXT}=0Ω, V_{CC}<5.1V, T_A<+125°C		82	170	ns
		R_{EXT}=0Ω, V_{CC}<5.5V, T_A<+85°C		90	170	ns
		R_{EXT}=0Ω, V_{CC}<5.5V, T_A<+125°C		90	190	ns
Delay TXD to Receiver Active	t_{ON_RXD}	R_{EXT}=47kΩ		390	520	ns
		R_{EXT}=24kΩ		260	320	ns
Delay TXD to Receiver Inactive	t_{OFF_RXD}	R_{EXT}=47kΩ		260	450	ns
		R_{EXT}=24kΩ		210	320	ns
Differential Output Voltage Slew Rate	|SR|	R_{EXT}=47kΩ		14		V/μs
Wake-Up Time from Standby	t_{WAKE}	Via Pin 8			20	μs
Bus Dominant to RXD LOW	t_{D_RXDL}	V_8=4V; Standby mode			3	μs
STANDBY/SLOPE CONTROL (PIN 8)						
Input Voltage for High-Speed	V_8				0.3×V_{CC}	V
Input Current for High-Speed	I_8	V_8=0V			-500	μA
Input Voltage for Standby Mode	V_{STB}		0.75×V_{CC}			V
Slope Control Mode Current	I_{SLOPE}		-10		-200	μA
Slope Control Mode Voltage	V_{SLOPE}		0.4×V_{CC}		0.6×V_{CC}	V

Note: I_1=I_4=I_5=0mA; 0V<V_6 <V_{CC}; 0V < V_7 <V_{CC}; V_8=V_{CC}.

■ FUNCTIONAL DESCRIPTION

The UTC **UCA82C250** is the interface between a CAN protocol controller and the physical bus. It is primarily intended for high-speed automotive applications (up to 1 MBd). 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” 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 a value of approximately 160°C, the limiting current of both transmitter outputs is decreased. Because the transmitter is responsible for the major part of the power dissipation, 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.

For lower speeds or shorter bus length, an unshielded twisted pair or a parallel pair of wires can be used for the bus. To reduce RFI, the rise and fall slope should be limited. The rise and fall slope 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.

Table 1. 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
< 2V (Not Powered)	X (Note 1)	floating	floating	recessive	X (Note)
2V <V_{CC}<5.5V	>0.75V_{CC}	floating	floating	recessive	X (Note)
2V<V_{CC}< 4.5V	X (Note)	floating if V_{Rs} > 0.75V_{CC}	floating if V_{Rs} >0.75V_{CC}	recessive	X (Note)

Note: X = don’t care.

Table 2. Pin Rs summary

Condition Forced at Pin Rs	Mode	Resulting Voltage or Current at Pin Rs
V_{Rs} > 0.75xV_{CC}	Standby	I_{Rs} < |10μA|
-10μA < I_{Rs} < -200μA	Slope Control	0.4V_{CC} < V_{Rs} < 0.6xV_{CC}
V_{Rs} < 0.3xV_{CC}	High-Speed	I_{Rs} <- 500μA

■ TEST CIRCUIT

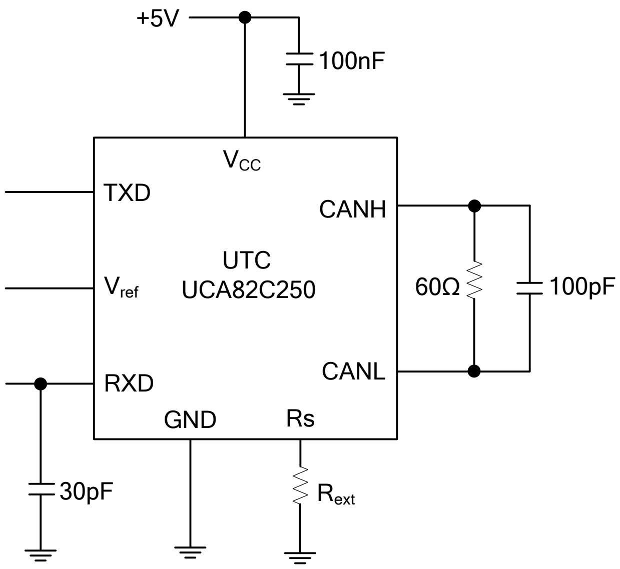


Figure 1. Test circuit for dynamic characteristics.

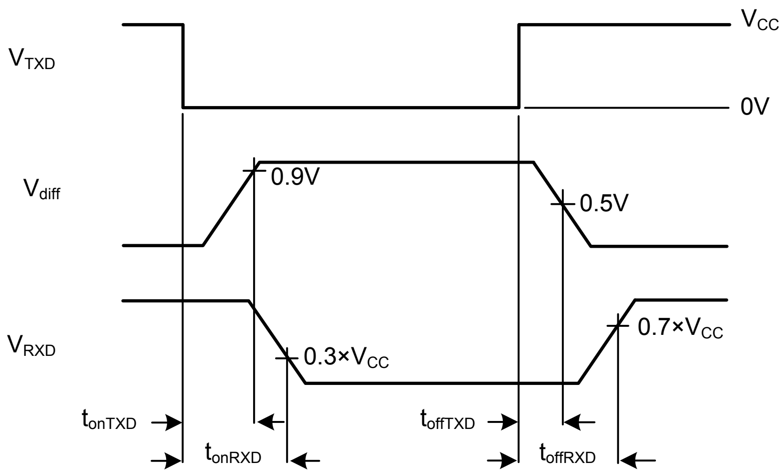


Figure 2. Timing diagram for dynamic characteristics.

■ TEST CIRCUIT (Cont.)

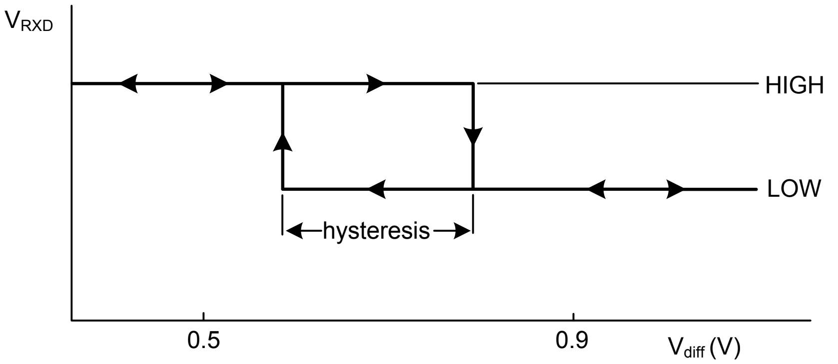


Figure 3. Hysteresis.

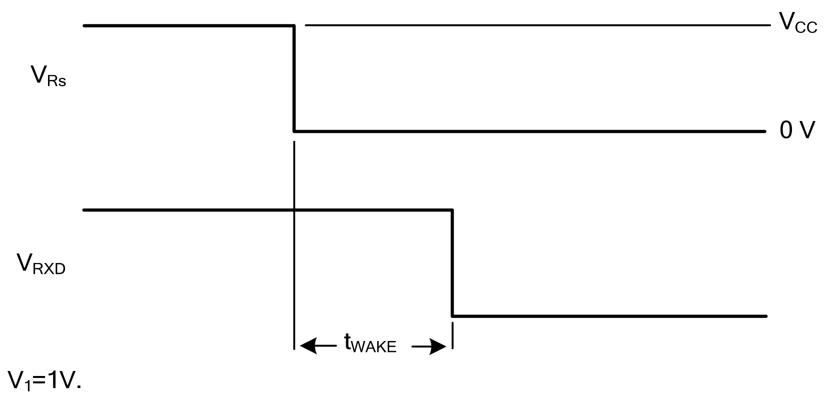


Figure 4. Timing diagram for wake-up from Standby.

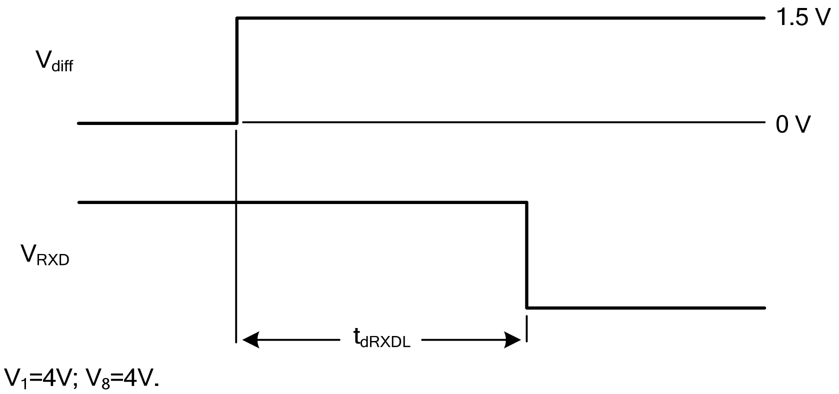
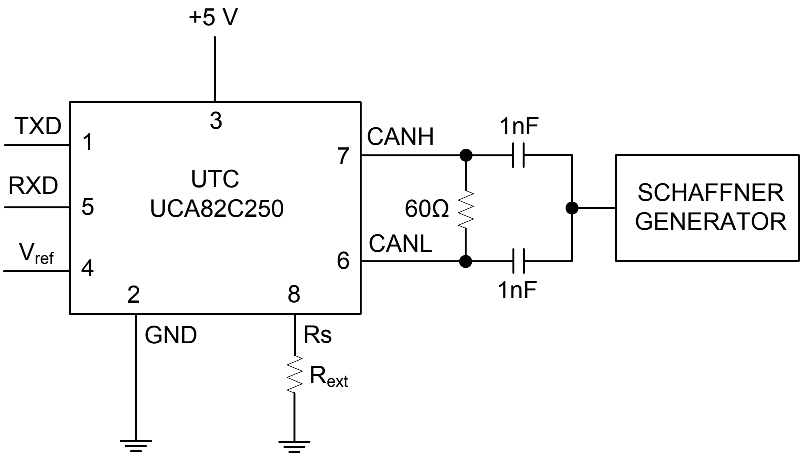


Figure 5. Timing diagram for bus dominant to RXD LOW.

■ TEST CIRCUIT (Cont.)



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

Figure 6. Test circuit for automotive transients.

■ TYPICAL APPLICATION CIRCUIT

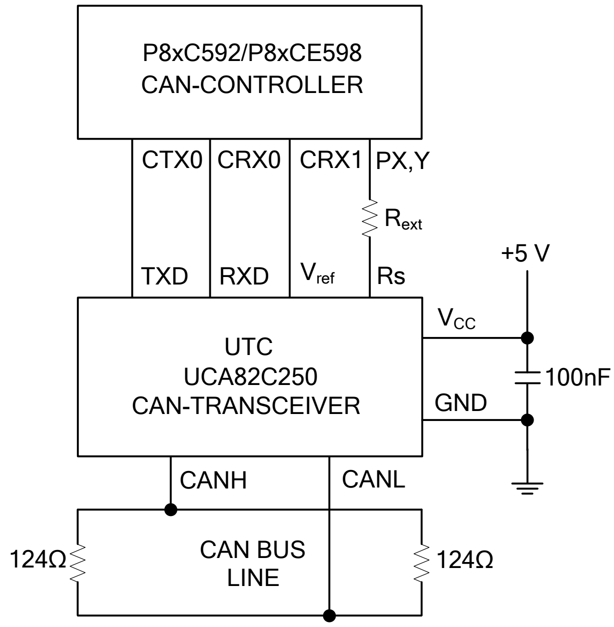


Figure 7. Application of the CAN transceiver.

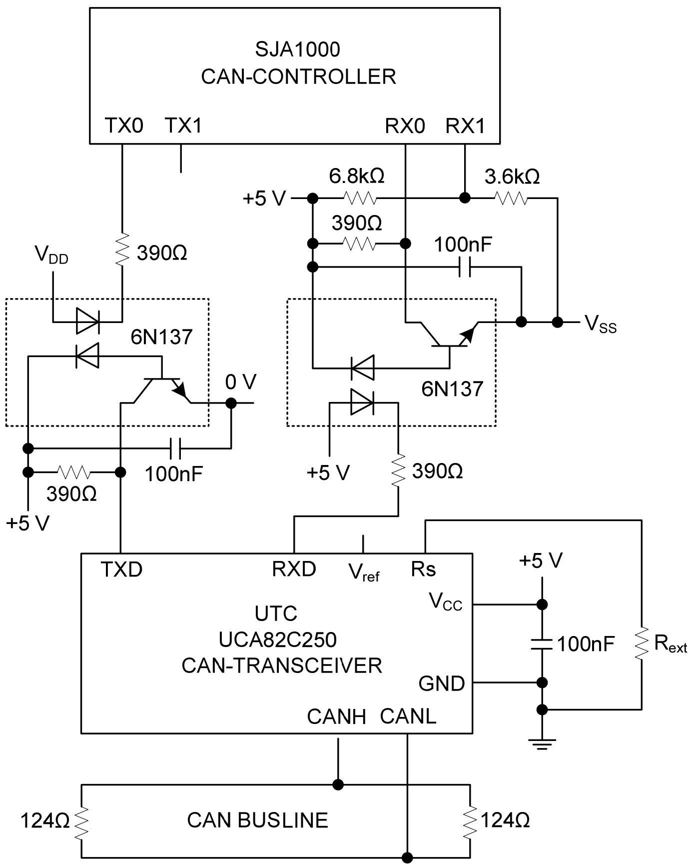


Figure 8. Application with galvanic isolation.