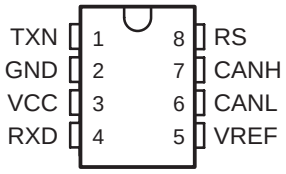
UC5350
CAN TRANSCEIVER

SLUS258C − MARCH 2000 − REVISED DECEMBER 2001

- **Pin Compatible With PCA82C250 and DeviceNet, SDS**
- **ISO11898 Compatible**
- **High Speed, up to 1 Mbps**
- **Differential Transmit to the Bus and Receive From the Bus to the CAN Controller**
- **At Least 110 Nodes Can Be Connected**
- **100-V Transient Protection on the Transmit Output**
- **24-V Supply Cross Wire Protection on CANH and CANL**
- **No Bus Loading When Powered Down**
- **Operates Between –40°C to 85°C**
- **Unitrode DeviceNet ID#107**

D AND N PACKAGE
(TOP VIEW)



NOTE:
THIS PRODUCT IS NOT RECOMMENDED FOR NEW DESIGNS. IT WILL SOON BE REPLACED BY PART NUMBER SN65HVD251.

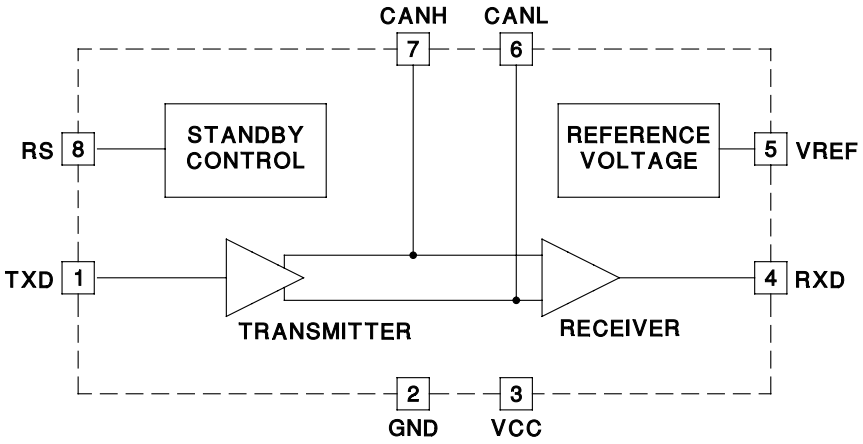
description

The UC5350 control area network (CAN) transceiver is designed for industrial applications employing the CAN serial communications physical layer per ISO 11898 standard. The device is a high-speed transceiver designed for use up to 1 Mbps. Especially designed for hostile environments, this device features cross wire, loss of ground, overvoltage, and overtemperature protections as well as a wide common-mode range.

The transceiver interfaces the single-ended CAN controller with the differential CAN bus found in industrial and automotive applications. It operates over the −7-V to 12-V common-mode range of the bus and will withstand common-mode transients of –25 V to 18 V as well as Schaffner tests. Performance features include high differential-input impedance, a symmetrical-differential-signal driver, and very-low propogation delay that improves bus bandwidth and length by reducing reflection and distortion.

The transceiver operates over a wide temperature range, –40°C to 85°C and is available in 8-pin SOIC and dual-in-line packages.

block diagram



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functional table (VCC = 4.5 V to 5.5 V)

Inputs		System Mode	Output Mode	Outputs	
TXD	RS			$V_{CANH} - V_{CANL}$	RXD
0	0	High speed	Dominant	1.5 V to 3 V	0
1	0	High speed	Recessive	–120 mV to 12 mV	1
High Z	0	High speed	Recessive	–120 mV to 12 mV	1
X	1	Standby	—	High Z	0 at Bus = Dominant
					1 at Bus = Recessive

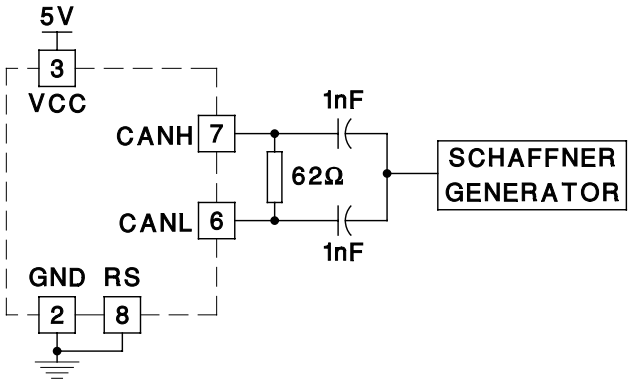
absolute maximum ratings over operating free-air temperature (unless otherwise noted)†‡

Supply voltage . . . . . –0.3 V to 9 V
TXD, RXD, VREF, RS . . . . . –0.3 V to VCC + 0.3 V
CANL, CANH, (0 V < VCC < 5.5 V) . . . . . –8 V to 36 V
CANL, CANH, (non-destructive, non-operative) . . . . . –8 V to 32 V
CANL, CANH, (transient, Schaffner test) See Figure 1 . . . . . –150 V to 100 V
Operating temperature . . . . . –40°C to 85°C
Storage temperature, T_{stg} . . . . . –65°C to 150°C
Junction temperature, T_J . . . . . –55°C to 150°C
Lead temperature (soldering, 10 sec.) . . . . . 300°C
Crosswire protection maximum VBUS . . . . . 30 V
Bus differential voltage☆ . . . . . 30 V
Cross wire protection T_A . . . . . –40°C to 125°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

‡ Currents are positive into, negative out of the specified terminal. Consult Packaging Section of the *Interface Products Data Book* (TI Literature Number SLUU002) for thermal limitations and considerations of packages.

☆Refers to Figures 9, 10, 11, 12 and 13.



NOTE: See Figure 7 for pulse timing.

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Figure 1. Schaffner Test

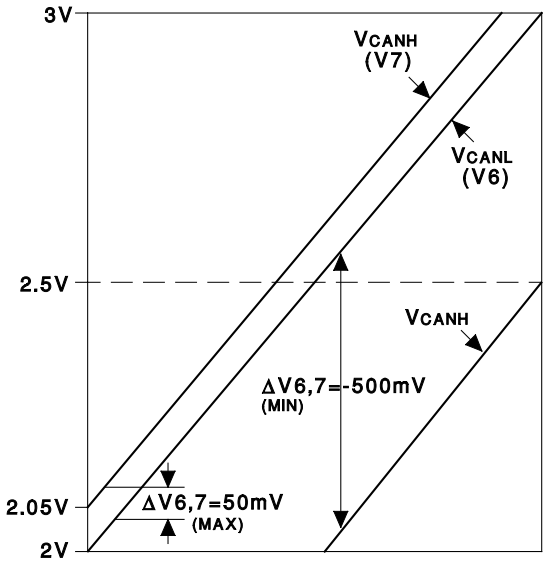
electrical characteristics (total device disconnected from the bus line), VCC = 4.5 V to 5.5 V, 60 Ω in parallel with 100-pF load between CANH and CANL, T_A = –40°C to 85°C, T_A = T_J, (unless otherwise stated)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Supply voltage		4.5		5.5	V
Supply current	Dominant, TXD = 1 V			70	mA
	Recessive, TXD = 4 V		9	14	mA
	Standby, RS = 4 V		1.2	2.0	mA
RS input current		–10		5	µA
RS voltage input = logic 1	Standby	0.75VCC			V
RS voltage input = logic 0	High speed			0.3VCC	V
Transmitter voltage input = logic 1	Transmitter output recessive	0.7VCC			V
Transmitter voltage input = logic 0	Transmitter output dominant			0.3VCC	V
Transmitter current input at logic 1	TXD = 4 V			30	µA
Transmitter current input at logic 0	TXD = 1 V	–30		30	µA
Receiver voltage output = logic 1	RXD = –100 mA, TXD = 4 V	VCC –1.25			V
Receiver voltage output = logic 0	RXD = 1 mA, TXD = 1 V		0.75	1.2	V
	RXD = 10 mA, TXD = 1 V		1.2	1.7	V
CANH, CANL input resistance	No load, TXD = 4 V	20	40		kΩ
Differential input resistance	No load, TXD = 4 V	40	80		kΩ
CANH, CANL input capacitance	See Note 1			20	pF
Differential input capacitance	See Note 1			10	pF
Reference output voltage	VREF = ±50 mA	0.45VCC		0.55VCC	V

NOTE 1: Ensured by design. Not production tested.

electrical characteristics, (dc parameters for recessive state disconnected from the bus line), 60 Ω in parallel with 100-pF load between CANH and CANL, T_A = −40°C to 85°C, T_A = T_J, (unless otherwise stated)

PARAMETER	TEST CONDITIONS			MIN	TYP	MAX	UNITS
V_{CANH}, V_{CANL}	No load,	TXD = 4 V,	See Figure 2	2	2.5	3	V
Differential output transmitter ($V_{CANH} - V_{CANL}$)	No load,	TXD = 4 V,	See Figure 2	–500	0	50	mV
Differential input receiver	Common mode range = –7 V to 12 V, CANH, CANL externally driven		TXD = 4 V, See Figure 3	–1		0.40	V
Differential input resistance	No load			40			kΩ
CANH, CANL input resistance				20			kΩ



NOTE: Valid output of CANH, CANL during recessive state transmission. TXD = LOGIC 1

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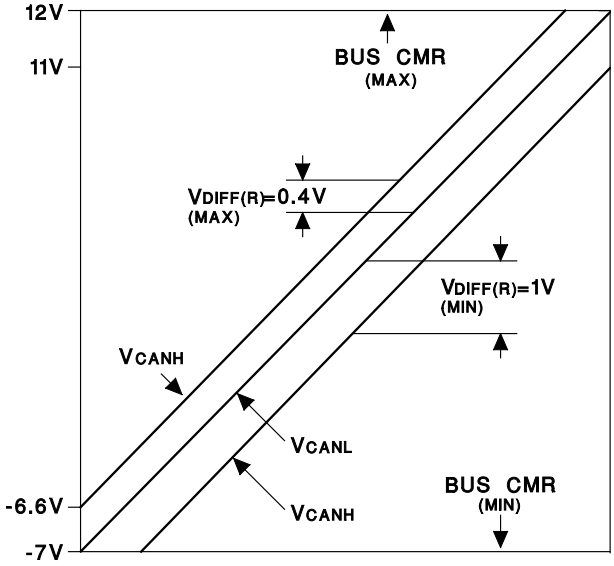
Figure 2. Recessive State Voltage Diagram



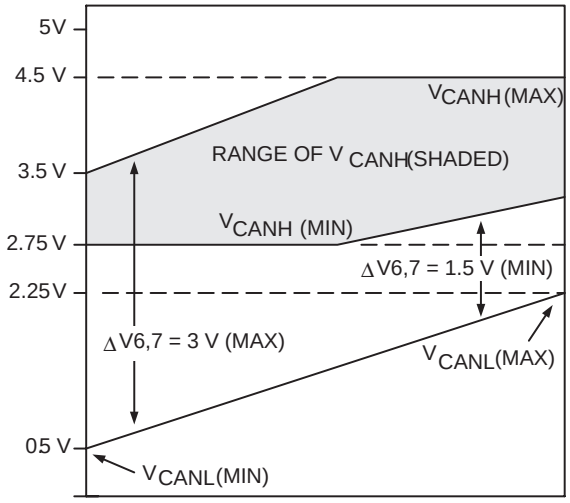
NOTE: Valid voltage range of V_{CANH} for sensing dominant bus state as V_{CANL} varies over bus common range mode. TXD = LOGIC1

UDG-96205

Figure 3. Recessive State Voltage Diagram

electrical characteristics, (dc parameters for dominant state disconnected from the bus line), 60 Ω in parallel with 100-pF load between CANH and CANL. VCC = 4.5 V to 5.5 V,) (unless otherwise stated)

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNITS
CANH output voltage (V_{CANH})	TXD = 1 V,	See Figure 4	2.75		4.5	V
CANL output voltage (V_{CANL})	TXD = 1 V,	See Figure 4	0.50	1.1	2.25	V
Differential output transmitter ($V_{CANH} - V_{CANL}$)	TXD = 1 V,	See Figure 4	1.5	2	3	V
Differential input receiver ($V_{DIFF(D)}$)	Common mode range = –2 to 7 V, CANH, CANL externally driven,	TXD = 4 V, See Figure 5	0.9		5	V
	Common mode range = –7 to 12 V, CANH, CANL externally driven,	TXD = 4 V, See Figure 5	1.0		5	V



NOTE: Valid voltage range of V_{CANH} for sensing dominant bus state as V_{CANL} varies. TXD = LOGIC 0

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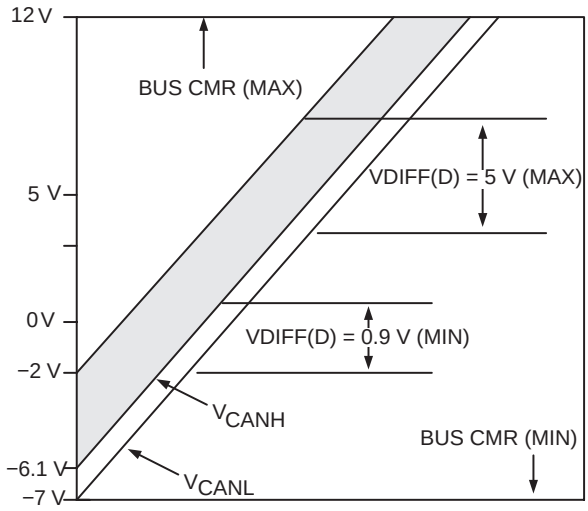
Figure 4. Dominant State Voltage Diagram



NOTE: Valid voltage range of V_{CANH} for sensing dominant bus state as V_{CANL} varies over bus common mode range. TXD = LOGIC 0

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Figure 5. Dominant State Voltage Diagram

transmitter characteristics, (disconnected from the bus line), 60 Ω in parallel with 100-pF load between CANH and CANL, (unless otherwise stated)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Differential output transmitter ($V_{CANH} - V_{CANL}$)	Dominant mode	1.5	2	3	V
	Recessive mode	–500		50	mV
Delay from TXD to bus active T_{ON} (TXD)	See Figure 6		50	100	ns
Delay from TXD to bus inactive T_{OFF} (TXD)	60 Ω across CANH and CANL, See Figure 6		20	110	ns

receiver characteristics, (disconnected from the bus line), 60 Ω in parallel with 100-pF load between CANH and CANL, (unless otherwise stated)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Differential input receiver ($V_{CANH} - V_{CANL}$)	Dominant mode, TXD = 4 V	0.9			V
	Recessive mode, TXD = 4 V			0.4	V
Differential input hysteresis	TXD = 4 V	75	150		mV
Delay from bus to RXD (T_{ON})	Inactive to active bus, See Figure 6		60	100	ns
Delay from bus to RXD (T_{OFF})	Active to inactive bus, 60 Ω across CANH and CANL, See Figure 6		80	115	ns

transceiver characteristics

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Loop time	T_{ON} (TXD) + T_{ON} (RXD) inactive to active bus		110	200	ns
	T_{OFF} (TXD) + T_{OFF} (RXD) active to inactive bus		100	225	ns

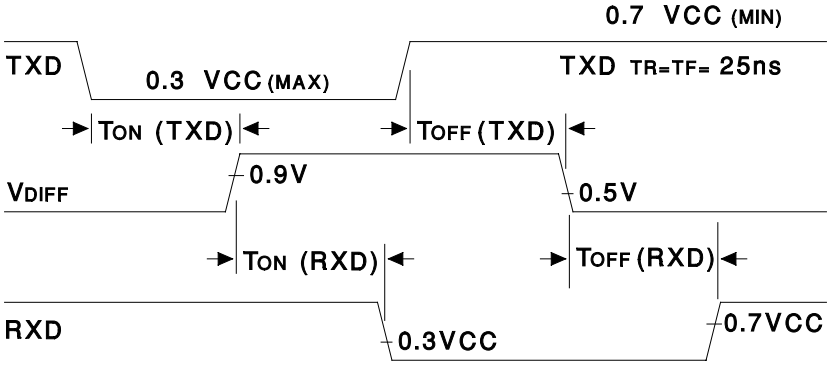

Figure 6. Transceiver ac Response

APPLICATION INFORMATION

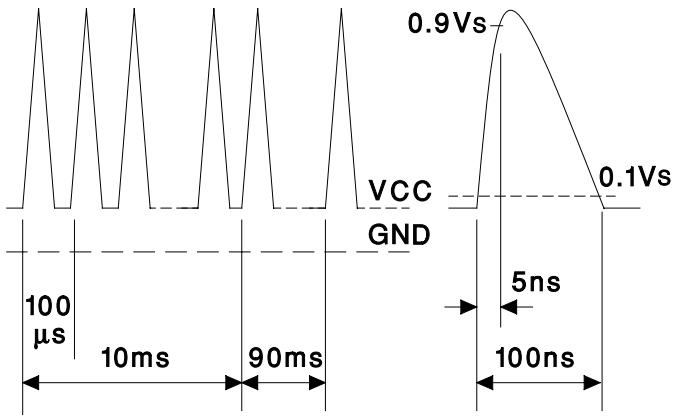

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Figure 7. Timing Diagram for Schaffner Tests

Table 1. Magnitude Specifications for V_S

ISO	DIN 40839−1	Schaffner
DP7637/1	(Draft)	NSG500C/506C
Up to 150 V	Up to 150 V	40 V to 200 V

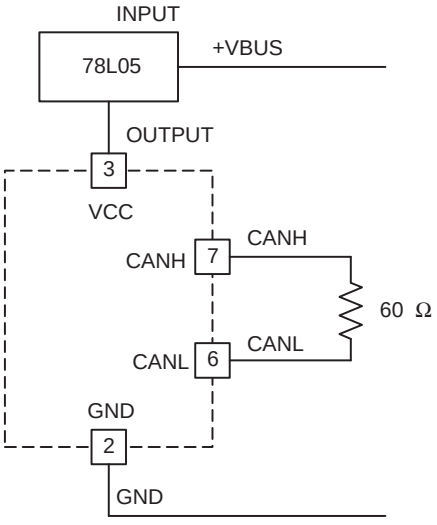

Figure 8. Normal Connection UDG-97175

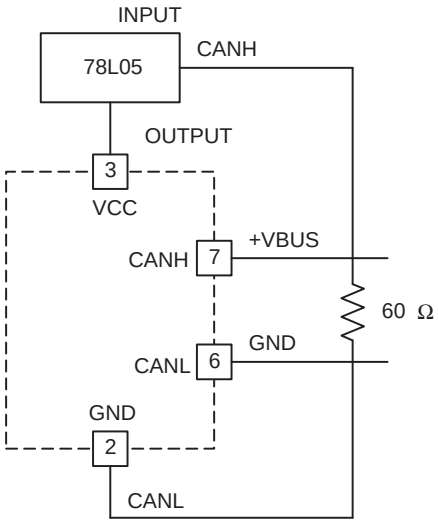

Figure 9. Crosswire No. 1 UDG-97176

APPLICATION INFORMATION

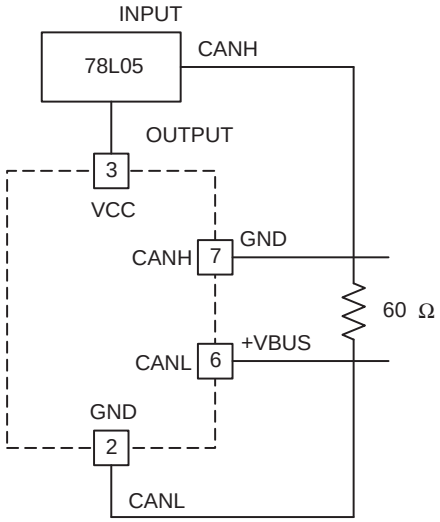

Figure 10. Crosswire No. 2 UDG-97177

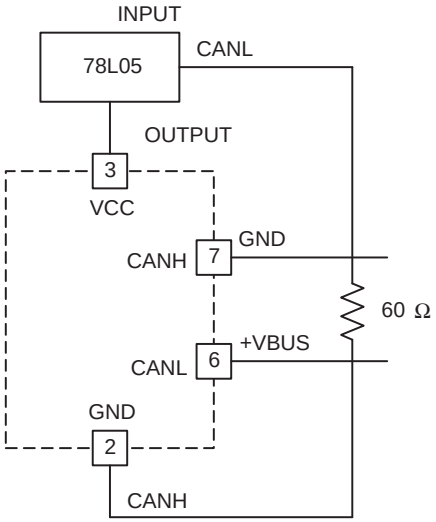

Figure 11. Crosswire No. 3 UDG-97178

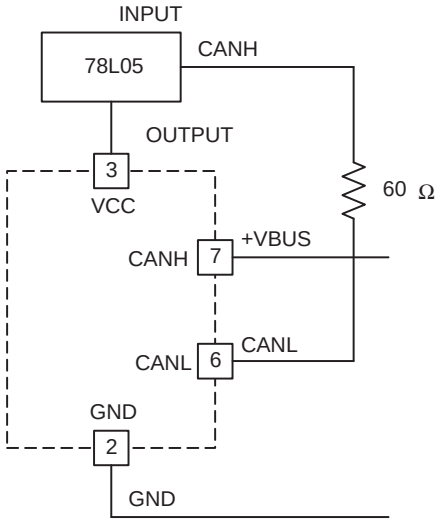

Figure 12. Crosswire No. 4 UDG-97179

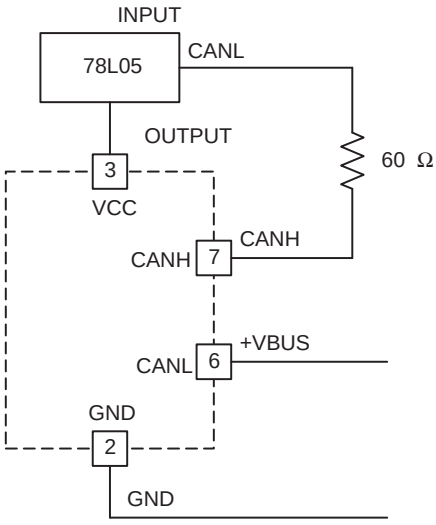

Figure 13. Crosswire No. 5 UDG-97180

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