CAN Transceiver

FEATURES

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

DESCRIPTION

The UC5350 Control Area Network 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 1Mbps. Especially designed for hostile environments, this device features cross wire, loss of ground, over voltage, and over temperature protections well as a wide common mode range.

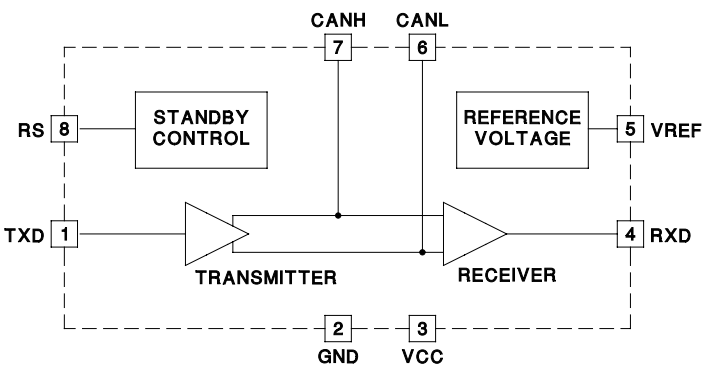
The transceiver interfaces the single ended CAN controller with the differential CAN bus found in industrial and automotive applications. It operates over the –7V to +12V common mode range of the bus and will withstand common mode transients of –25V to +18V as well as Schaffner tests. Performance features 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.

FUNCTIONAL TABLE (VCC = 4.5V to 5.5V)

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

BLOCK DIAGRAM



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ABSOLUTE MAXIMUM RATINGS

Supply Voltage . . . . . –0.3V to 9V
TXD, RXD, VREF, RS . . . . . –0.3V to VCC + 0.3V
CANL, CANH
0V < VCC < 5.5V. . . . . –8V to +36V
Non-Destructive, Non-Operative . . . . . –8V to +32V
Transient, Schaffner Test (Fig. 1) . . . . . –150 to +100V
Operating Temperature . . . . . –40°C to +85°C
Storage Temperature . . . . . –65°C to +150°C
Junction Temperature . . . . . –55°C to +150°C
Lead Temperature (Soldering, 10 sec.) . . . . . +300°C
Crosswire Protection Maximum VBUS 30V
Bus Differential Voltage* 30V
Cross Wire Protection T_A . . . . . –40°C to 125°C

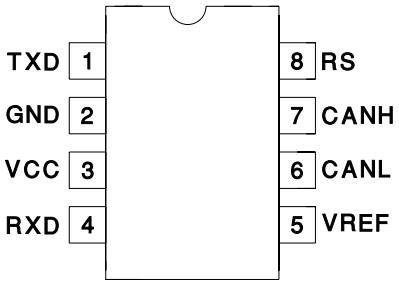
Currents are positive into, negative out of the specified terminal.

Consult Packaging Section of the Databook for thermal limitations and considerations of packages.

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

CONNECTION DIAGRAM

DIL-8, SOIC-8 (Top View)
N, D Package



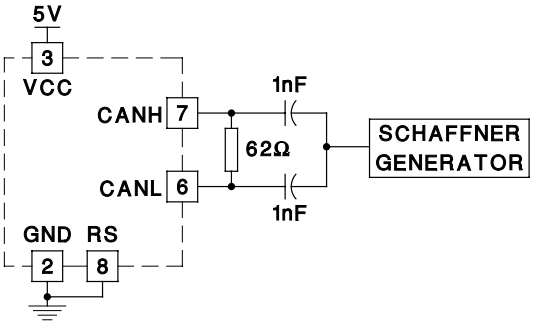


Figure 1. Schaffner Test

ELECTRICAL CHARACTERISTICS (Total Device)

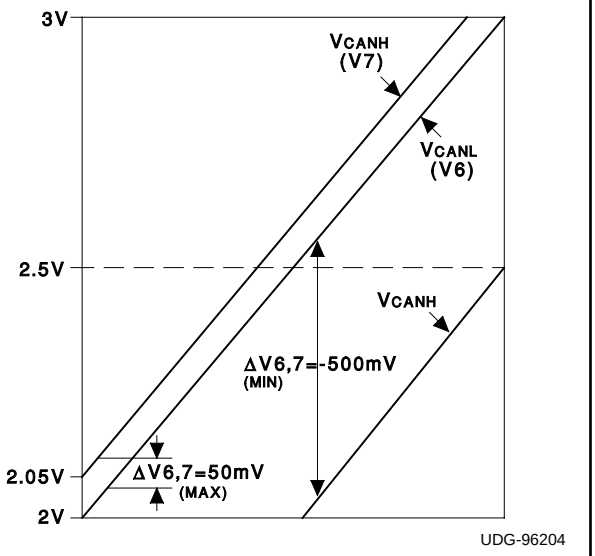
Unless otherwise stated, the device is disconnected from the bus line; VCC = 4.5V to 5.5V; 60_ in parallel with 100pF load between CANH and CANL; TA = –40°C to +85°C, $T_A = T_J$

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Supply Voltage		4.5		5.5	V
Supply Current	Dominant, TXD = 1V			70	mA
	Recessive, TXD = 4V		9	14	mA
	Standby, RS = 4V		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 = 4V			30	µA
Transmitter Current Input at Logic 0	TXD = 1V	–30		30	µA
Receiver Voltage Output = Logic 1	RXD = –100µA, TXD = 4V	VCC –1.25			V
Receiver Voltage Output = Logic 0	RXD = 1mA, TXD = 1V		0.75	1.2	V
	RXD = 10mA, TXD = 1V		1.2	1.7	V
CANH, CANL Input Resistance	No Load, TXD = 4V	20	40		kΩ
Differential Input Resistance	No Load, TXD = 4V	40	80		kΩ
CANH, CANL Input Capacitance	(Note 1)			20	pF
Differential Input Capacitance	(Note 1)			10	pF
Reference Output Voltage	VREF = ±50µA	0.45VCC		0.55VCC	V

Note 1: Guaranteed by design. Not 100% tested in production.

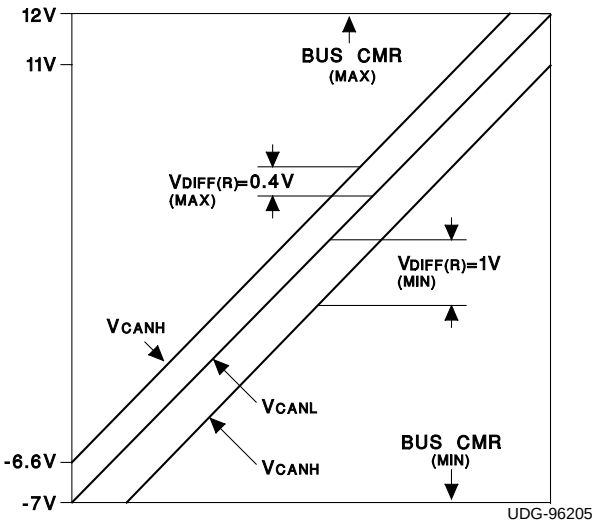
ELECTRICAL CHARACTERISTICS (DC Parameters For Recessive State) Unless otherwise stated, the device is disconnected from the bus line; 60Ω in parallel with 100pF load between CANH and CANL.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
V_{CANH}, V_{CANL}	No Load, TXD = 4V (Figure 2)	2	2.5	3	V
Differential Output Transmitter (V_{CANH} – V_{CANL})	No Load, TXD = 4V (Figure 2)	–500	0	50	mV
Differential Input Receiver	Common Mode Range = –7V to +12V, TXD = 4V, CANH, CANL Externally Driven (Figure 3)	–1		0.40	V
Differential Input Resistance	No Load	40			kΩ
CANH, CANL Input Resistance		20			kΩ



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

Figure 2. Recessive State Voltage Diagram

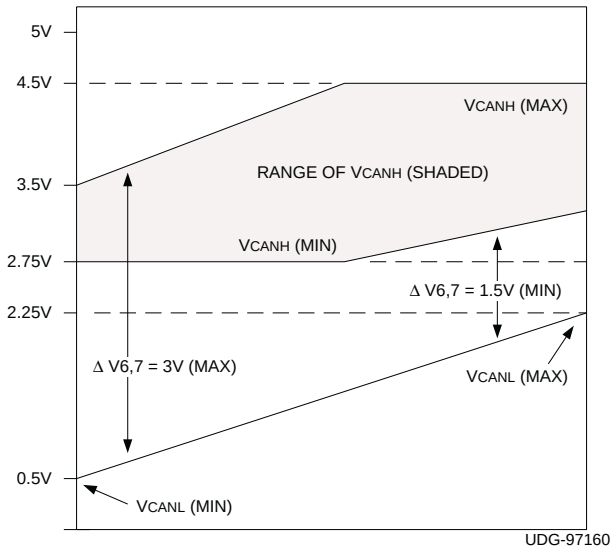


Valid voltage range of V_{CANH} for sensing dominant bus state as V_{CANL} varies over bus common range mode. TXD = LOGIC1

Figure 3. Recessive State Voltage Diagram

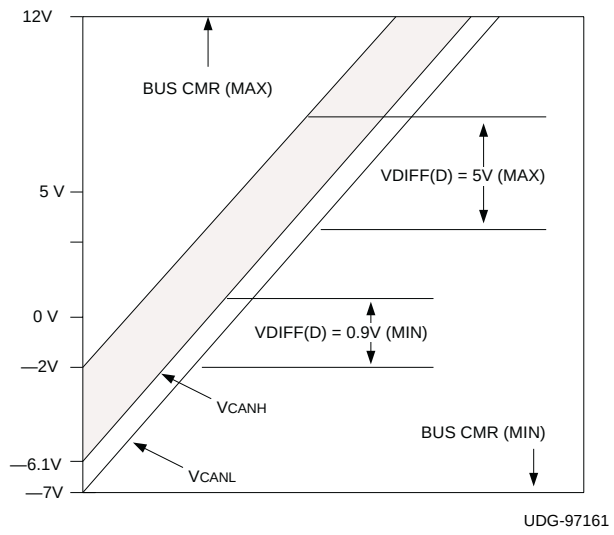
ELECTRICAL CHARACTERISTICS (DC Parameters For Dominant State) Unless otherwise stated, the device is disconnected from the bus line; 60 in parallel with 100pF load between CANH and CANL. VCC = 4.5V to 5.5V

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
CANH Output Voltage (V_{CANH})	TXD = 1V (Figure 4)	2.75		4.5	V
CANL Output Voltage (V_{CANL})	TXD = 1V (Figure 4)	0.50	1.1	2.25	V
Differential Output Transmitter (V_{CANH} - V_{CANL})	TXD = 1V (Figure 4)	1.5	2	3	V
Differential Input Receiver ($V_{DIFF(D)}$)	Common Mode Range = –2 to +7V, TXD = 4V, CANH, CANL Externally Driven (Figure 5)	0.9		5	V
	Common Mode Range = –7 to +12V, TXD = 4V, CANH, CANL Externally Driven (Figure 5)	1.0		5	V



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

Figure 4. Dominant State Voltage Diagram



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

Figure 5. Dominant State Voltage Diagram

TRANSMITTER CHARACTERISTICS Unless otherwise stated, the device is disconnected from the bus line; 60Ω in parallel with 100pF load between CANH and CANL.

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)	(Figure 6)		50	100	ns
Delay From TXD to Bus Inactive T_{OFF} (TXD)	60Ω Across CANH and CANL (Figure 6)		20	110	ns

RECEIVER CHARACTERISTICS

Unless otherwise stated, the device is disconnected from the bus line; 60Ω in parallel with 100pF load between CANH and CANL.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Differential Input Receiver (V_{CANH} - V_{CANL})	Dominant Mode, TXD = 4V	0.9			V
	Recessive Mode, TXD = 4V			0.4	V
Differential Input Hysteresis	TXD = 4V	75	150		mV
Delay From Bus to RXD (T_{ON})	Inactive to Active Bus (Figure 6)		60	100	ns
Delay From Bus to RXD (T_{OFF})	Active to Inactive Bus, 60Ω Across CANH and CANL (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

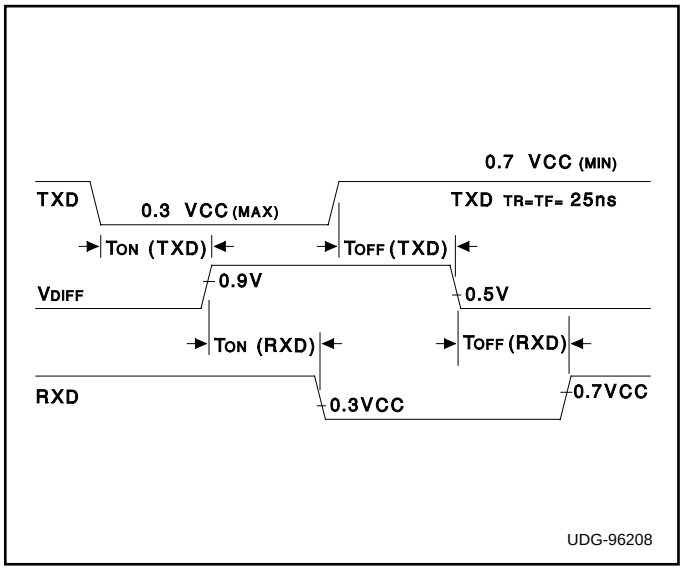


Figure 6. Transceiver AC Response

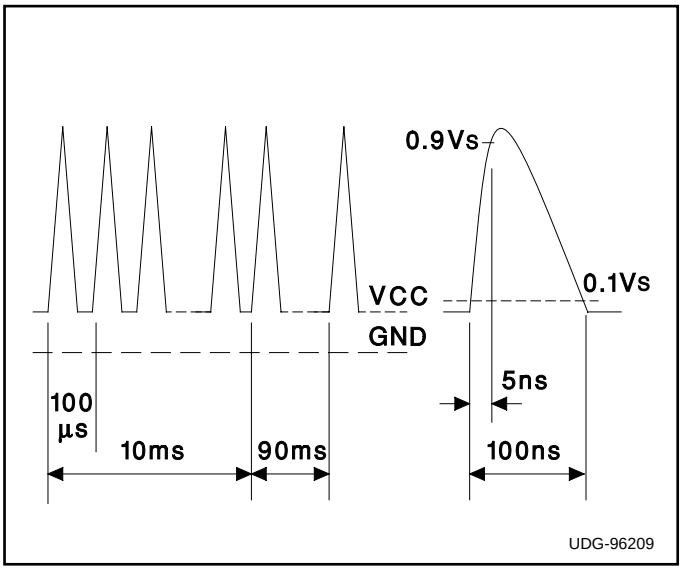


Figure 7. Timing Diagram for Schaffner Tests

Magnitude Specifications for Vs

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

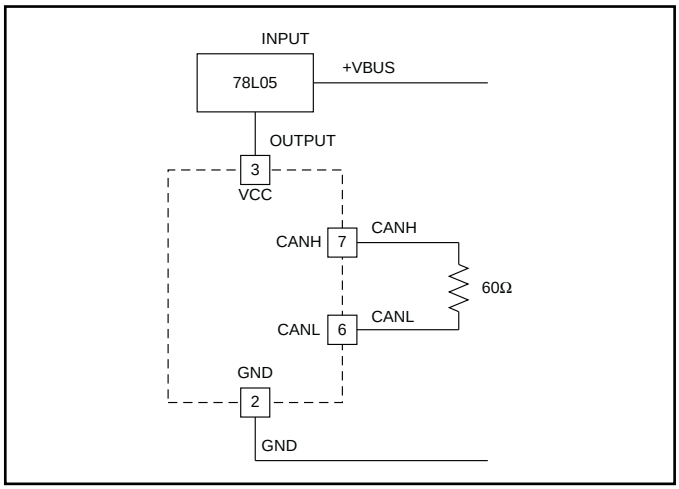


Figure 8. Normal Connection

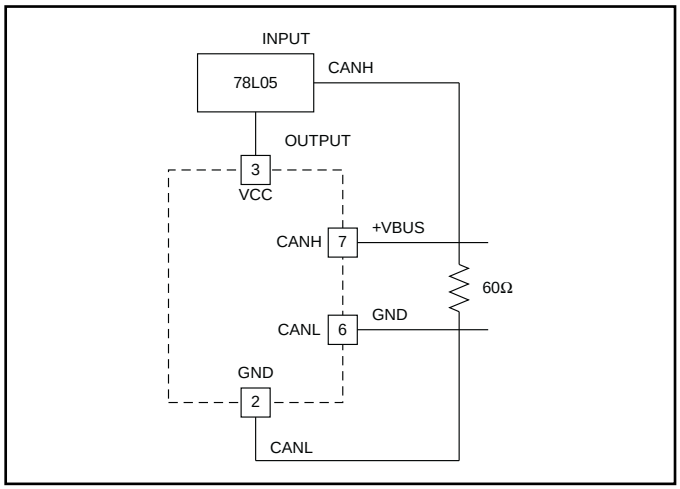


Figure 9. Crosswire No. 1

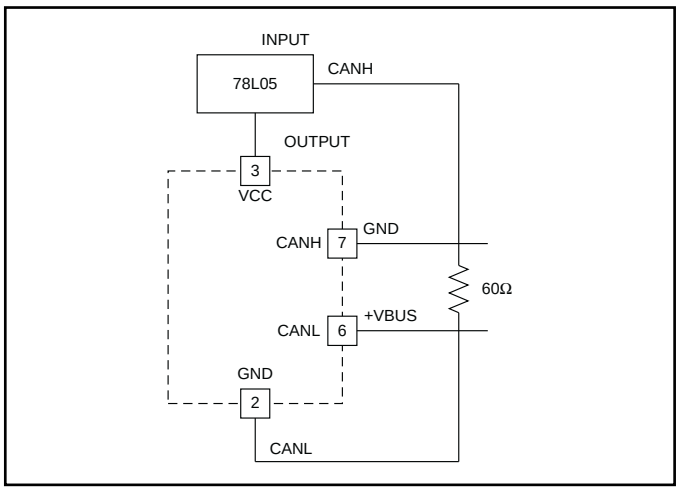


Figure 10. Crosswire No. 2

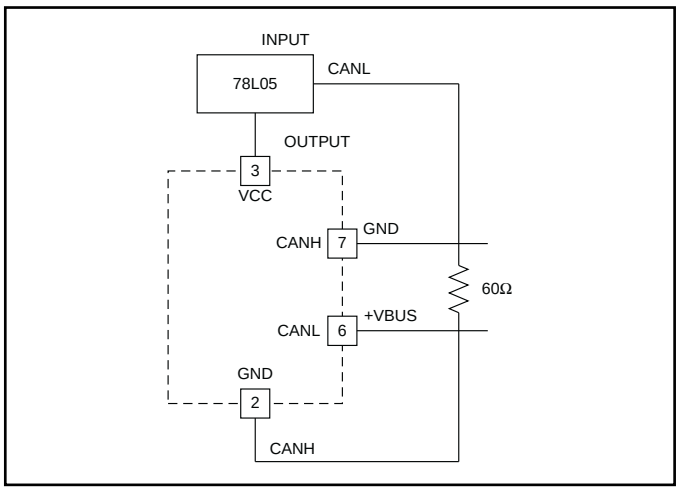


Figure 11. Crosswire No. 3

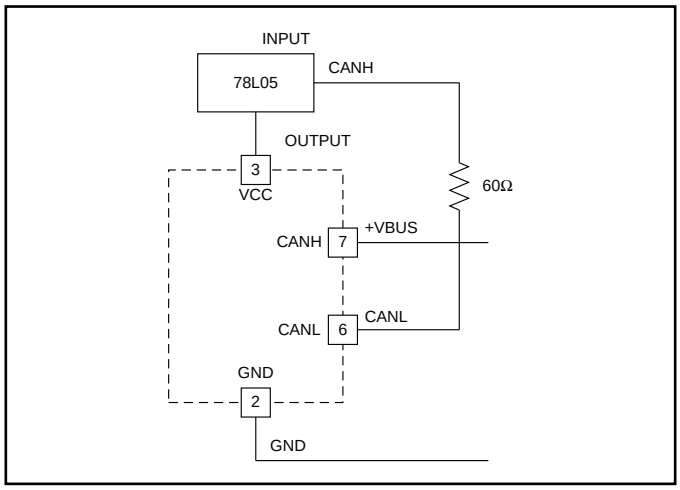


Figure 12. Crosswire No. 4

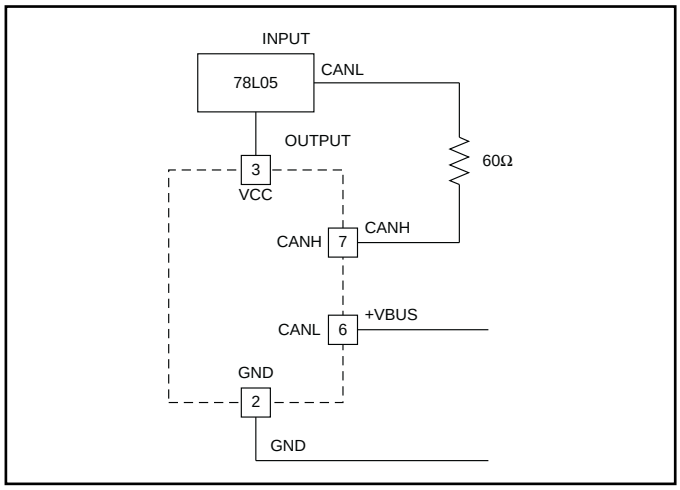


Figure 13. Crosswire No. 5

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