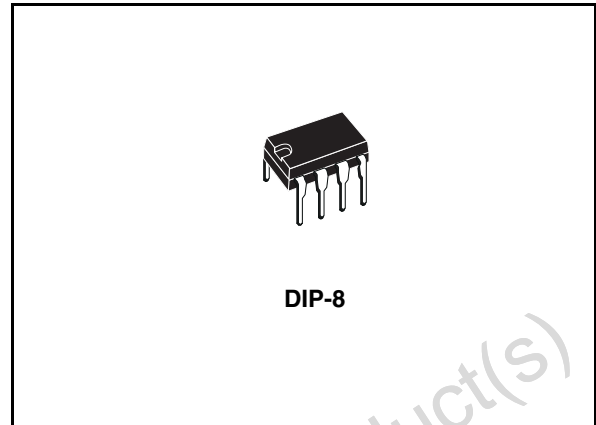# ST75C176B
ST75C176C

Low power RS-485/RS-422 transceiver

Features

- Low quiescent current: 300 mA
- Designed for RS-485 interface applications
- -7 V to 12 V common mode input voltage range
- Driver maintains high impedance in 3-state or with the power OFF
- 70 mV typical input hysteresis
- 30 ns propagation delays, 5 ns skew
- Operate from a single 5 V supply
- Current limiting and thermal shutdown for driver overload protection
- Allows up to 32 transceivers on the bus
- BiCMOS technology

DIP-8

The ST75C176B/C is designed for bidirectional data communications on multipoint bus transmission line (half-duplex applications).

Description

The ST75C176B/C is al low power transceiver for RS-485 and RS-422 communication. Each part contains one driver and one receiver.

This transceiver draw 300 mA (typ.) of supply current when unloaded or fully loaded with disabled drivers.

It operates from a single 5 V supply.

Driver is short-circuit current limited and is protected against excessive power dissipation by thermal shutdown circuitry that placed the driver outputs into a high-impedance state. The receiver input has a fail safe feature that guarantees a logic-high output if the input is open circuit.

Table 1.   Device summary

Order code	Temperature range	Package	Packaging
ST75C176CN	0 to 70 °C	DIP-8	50parts per tube / 40tube per box
ST75C176BN	-40 to 85 °C	DIP-8	50parts per tube / 40tube per box

Contents

1 Pin configuration

Figure 1. Pin connections

CS00970
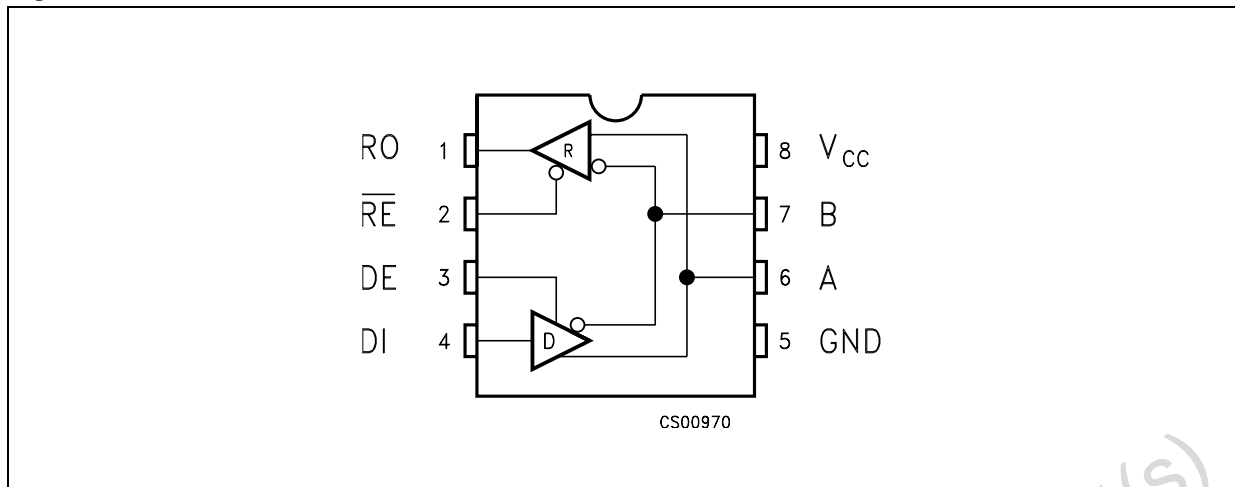
Table 2. Pin description

Pin n°	Symbol	Name and function
1	RO	Receiver output
2	RE	Receiver output enable
3	DE	Driver output enable
4	DI	Driver input
5	GND	Ground
6	A	Non-inverting receiver input and non-inverting driver output
7	B	Inverting receiver input and inverting driver output
8	V_{CC}	Supply voltage

2 Truth tables

Table 3. Truth table (driver)

Inputs			Outputs	
$\overline{RE}$	DE	DI	B	A
X	H	H	L	H
X	H	L	H	L
X	L	X	Z	Z

Note: *X= Don't care; Z=High impedance*

Table 4. Truth table (receiver)

Inputs			Output
RE	DE	A-B	RO
L	L	$\geq$ +0.2V	H
L	L	$\leq$-0.2V	L
L	L	INPUTS OPEN	H
H	L	X	Z

Note: *X= Don't care; Z=High impedance*

3   Maximum ratings

Table 5.   Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CC}	Supply voltage	7	V
V_I	Control input voltage ($\overline{RE}$, DE)	-0.5 to (V_{CC} + 0.5)	V
V_{DI}	Driver input voltage (DI)	-0.5 to (V_{CC} + 0.5)	V
V_{DO}	Driver output voltage (A, B)	± 14	V
V_{RI}	Receiver input voltage (A, B)	± 14	V
V_{RO}	Receiver output voltage (RO)	-0.5 to (V_{CC} + 0.5)	V

Note: Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

4 Electrical characteristics

Table 6. **DC electrical characteristics**

(V_{CC} = 5 V ± 5 %, T_A = T_{MIN} to T_{MAX}, unless otherwise specified. Typical values are referred to T_A = 25 °C) (See *Note 1*)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{OD1}	Differential driver output (no load)				5	V
V_{OD2}	Differential driver output (with load)	R_L = 27Ω (RS-485), (See *Figure 2.*) R_L = 50Ω (RS-422), (See *Figure 2.*)	1.5		5 5	V V
ΔV_{OD}	Change in magnitude of driver differential output voltage for complementary output states	R_L = 27Ω or 50Ω (See *Figure 2.*)			0.2	V
V_{OC}	Driver common-mode output voltage	R_L = 27Ω or 50Ω (See *Figure 2.*)			3	V
ΔV_{OC}	Change in magnitude of driver common-mode output voltage for complementary output states	R_L = 27Ω or 50Ω (See *Figure 2.*)			0.2	V
V_{IH}	Input high voltage	$\overline{RE}$, DE, DI	2.0			V
V_{IL}	Input low voltage	$\overline{RE}$, DE, DI			0.8	V
I_{IN1}	Input current	$\overline{RE}$, DE, DI			± 2	µA
I_{IN2}	Input current (A, B)	V_{CM} = 0V or 5.25V, V_{DE} = 0V V_{IN} = 12V V_{IN} = -7V			1 -0.8	mA mA
V_{TH}	Receiver differential threshold voltage	V_{CM} = -7 to 12V	-0.2		0.2	V
ΔV_{TH}	Receiver input hysteresis	V_{CM} = 0V		70		mV
V_{OH}	Receiver output high voltage	I_O = -4mA, V_{ID} = 200mV	3.5			V
V_{OL}	Receiver output low voltage	I_O = 4mA, V_{ID} = -200mV			0.4	V
I_{OZR}	3-State (high impedance) output current at receiver	V_O = 0.4 to 2.4V			± 1	µA
R_{IN}	Receiver input resistance	V_{CM} = -7 to 12V	12			KW
I_{CC}	No load supply current (*Note 2*)	V_{RE} = 0V or V_{CC} V_{DE} = V_{CC} V_{DE} = 0V		400 300	900 500	µA µA
I_{OSD1}	Driver short-circuit current, V_O=High	V_O = -7 to 12V (*Note 3*)	35		250	mA

Table 6. **DC electrical characteristics (continued)**
(V_{CC} = 5 V $\pm$ 5 %, T_A = T_{MIN} to T_{MAX}, unless otherwise specified. Typical values are referred to T_A = 25 °C) (See *Note 1*)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{OSD2}	Driver short-circuit current, V_O=Low	V_O = -7 to 12V (*Note 3*)	35		250	mA
I_{OSR}	Receiver short-circuit current	V_O = 0V to V_{CC}	7		95	mA

1   *All currents into device pins are positive; all cuts out of device pins are negative; all voltages are referenced to device ground unless specified.*

2   *Supply current specification is valid for loaded transmitters when V_{DE} = 0V*

3   *Applies to peak current. See typical operating characteristics.*

Table 7. **Driver switching characteristics**
(V_{CC} = 5V $\pm$ 5%, T_A = T_{MIN} to T_{MAX}, unless otherwise specified. Typical values are referred to T_A = 25°C) (See Note 1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t_{PLH} t_{PHL}	Propagation delay input to output	R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF (See *Figure 4* and *Figure 6*)	10	30	60	ns
t_{SK}	Output skew to output	R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF (See *Figure 4* and *Figure 6*)		5	10	ns
t_{TLH} t_{THL}	Rise or fall time	R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF (See *Figure 4* and *Figure 6*)	3	15	40	ns
t_{PZH}	Output enable time	C_L = 100pF, S2 = Closed (See *Figure 5* and *Figure 7*)		40	70	ns
t_{PZL}	Output enable time	C_L = 100pF, S1 = Closed (See *Figure 5* and *Figure 7*)		40	70	ns
t_{PLZ}	Output disable time	C_L = 15pF, S1 = Closed (See *Figure 5* and *Figure 7*)		40	70	ns
t_{PHZ}	Output disable time	C_L = 15pF, S2 = Closed (See *Figure 5* and *Figure 7*)		40	70	ns

Note: 1   *All currents into device pins are positive; all cuts out of device pins are negative; all voltages are referenced to device ground unless specified.*

Table 8. Receiver switching characteristics
(V_{CC} = 5V ± 5%, T_A = T_{MIN} to T_{MAX}, unless otherwise specified. Typical values are referred to T_A = 25°C) (See Note 1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t_{PLH} t_{PHL}	Propagation delay input to output	R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF (See *Figure 4* and *Figure 8*)	20	130	210	ns
t_{SKD}	Differential receiver skew	R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF (See *Figure 4* and *Figure 8*)		13		ns
t_{PZH}	Output enable time	C_{RL} = 15pF, S1 = Closed (See *Figure 3* and *Figure 9*)		20	50	ns
t_{PZL}	Output enable time	C_{RL} = 15pF, S2 = Closed (See *Figure 3* and *Figure 9*)		20	50	ns
t_{PLZ}	Output disable time	C_{RL} = 15pF, S1 = Closed (See *Figure 3* and *Figure 9*)		20	50	ns
t_{PHZ}	Output disable time	C_{RL} = 15pF, S2 = Closed (See *Figure 3* and *Figure 9*)		20	50	ns
f_{MAX}	Maximum data rate		2.5			Mbps

Note: *All currents into device pins are positive; all cuts out of device pins are negative; all voltages are referenced to device ground unless specified.*

5 Test circuits and typical characteristics

Figure 2. Driver DC test load
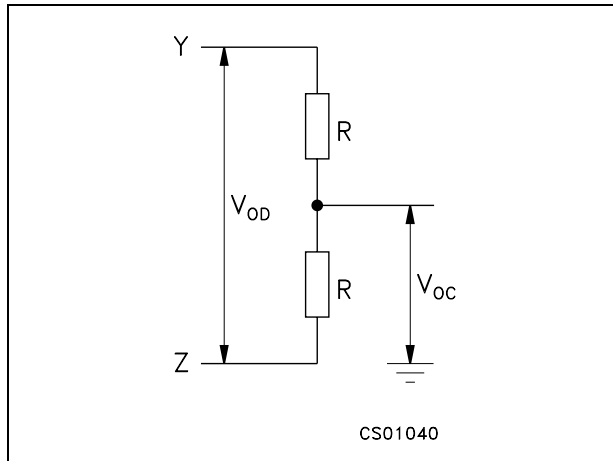
Figure 3. Receiver timing test load
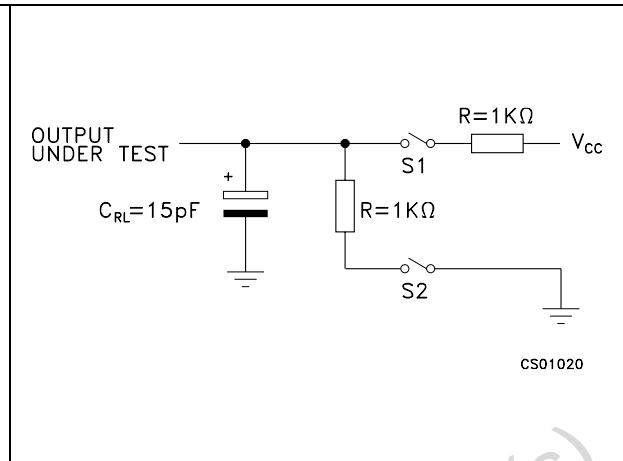
Figure 4. Drive/receiver timing test circuit

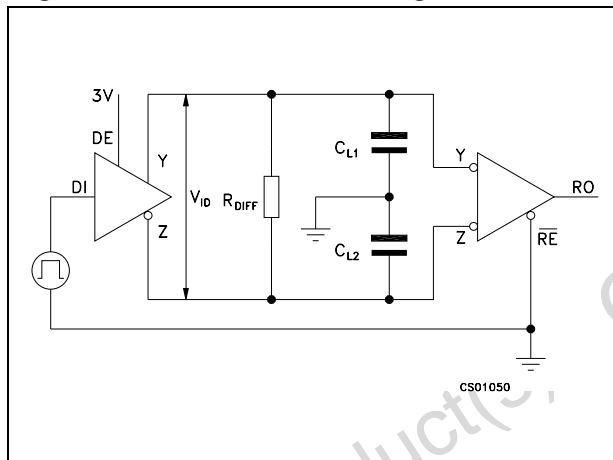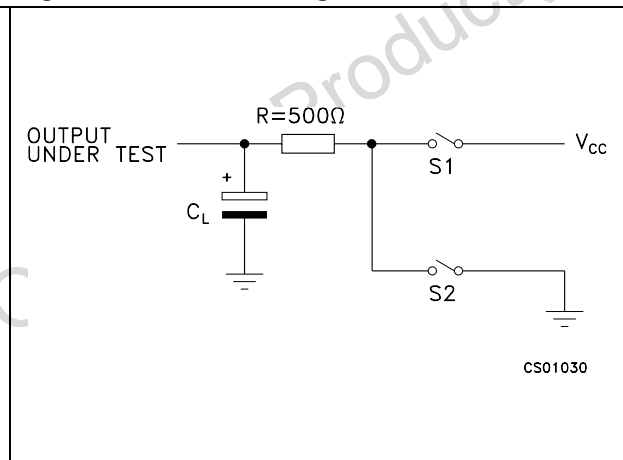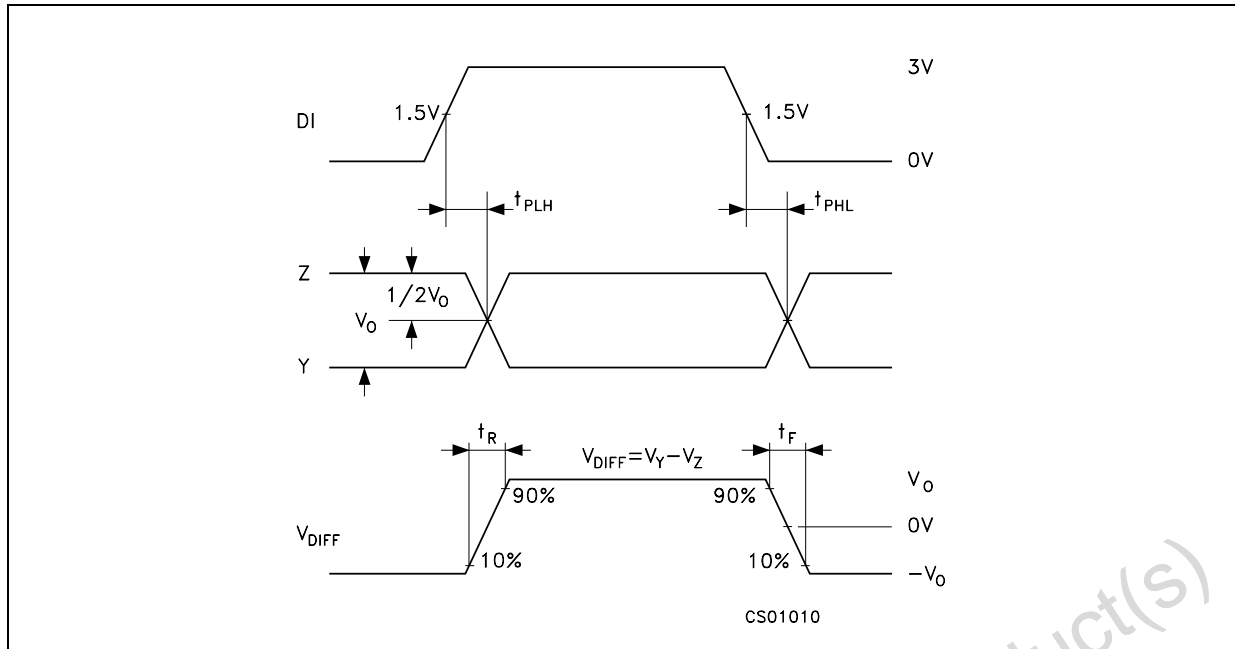Figure 5. Driver timing test load

Figure 6.   Driver propagation delay

CS01010

Figure 7.   Driver enable and disable time

CS00990
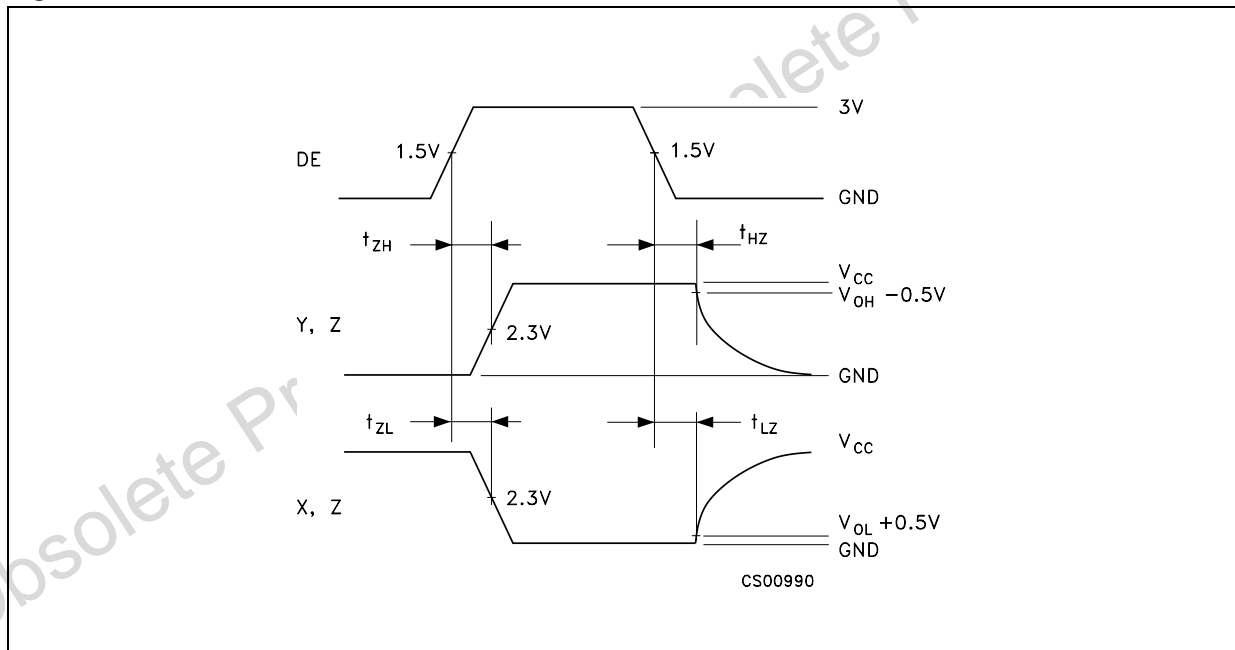
Figure 8.   Receiver propagation delay

CS01000
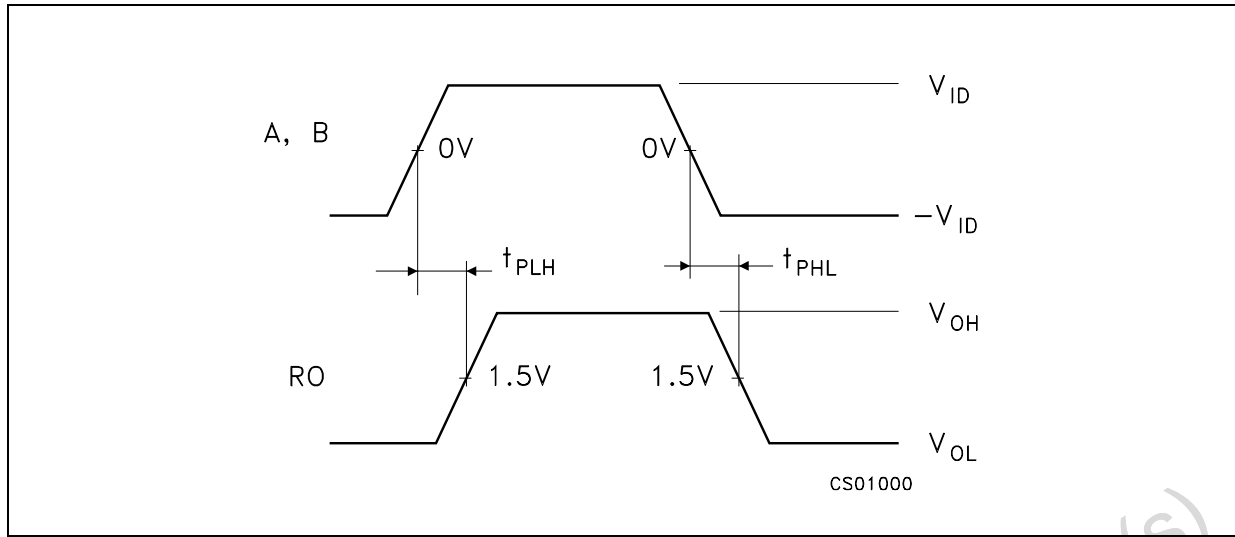
Figure 9.   Receiver enable and disable time

CS00980
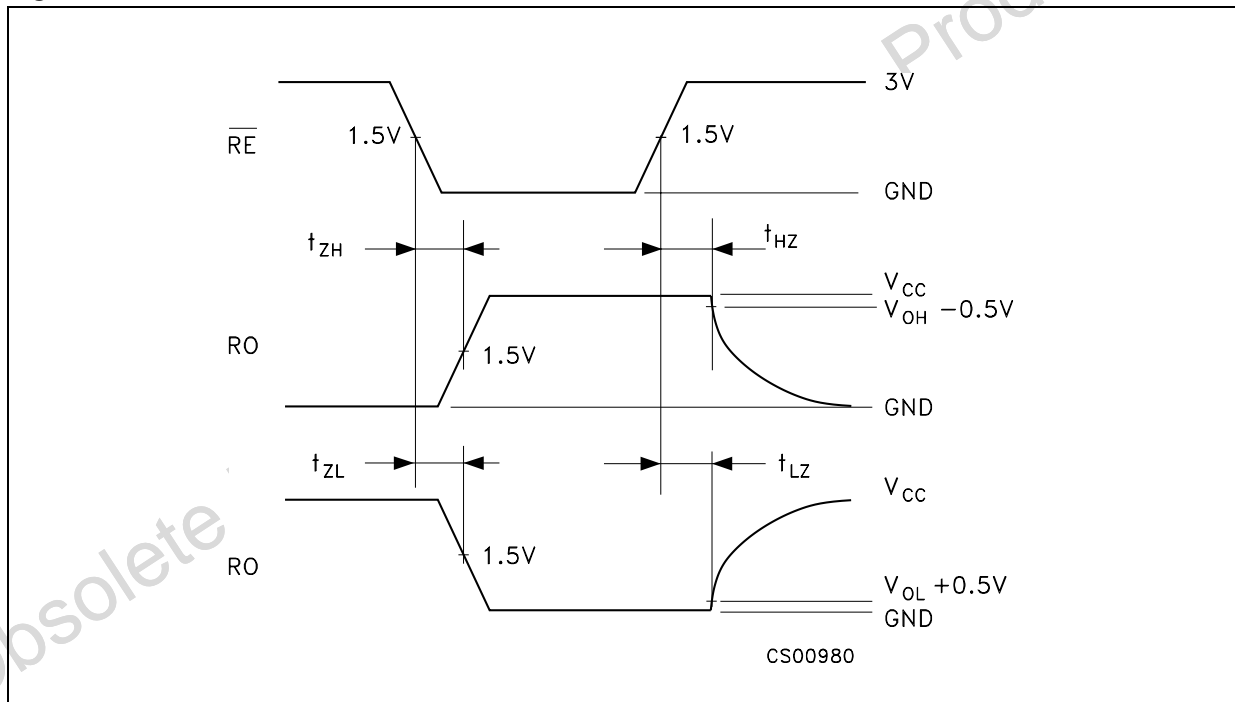
Figure 10.   Receiver output current vs output low voltage
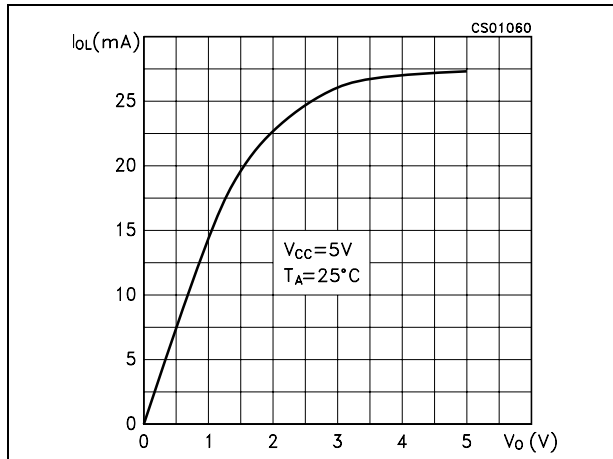
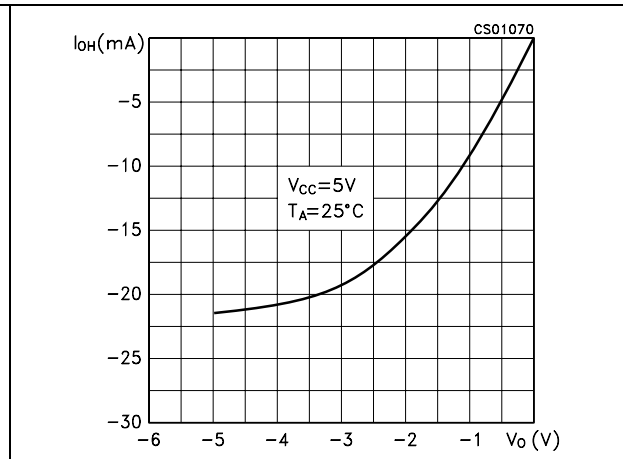**Figure 11.   Receiver output current vs output high voltage**

Figure 12.   Driver output current vs output low voltage
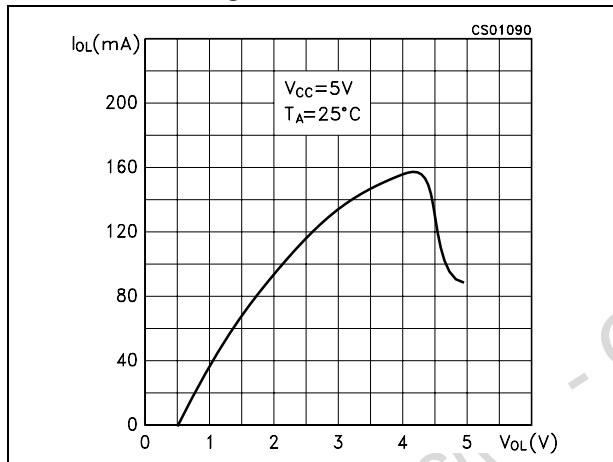

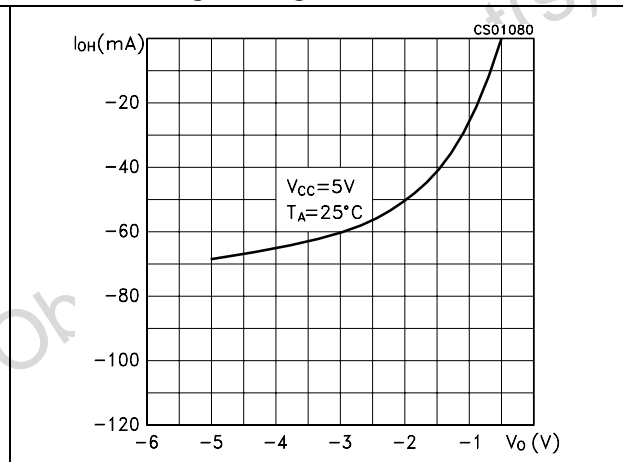**Figure 13.   Driver output current vs output high voltage**

Figure 14.   Supply current vs temperature
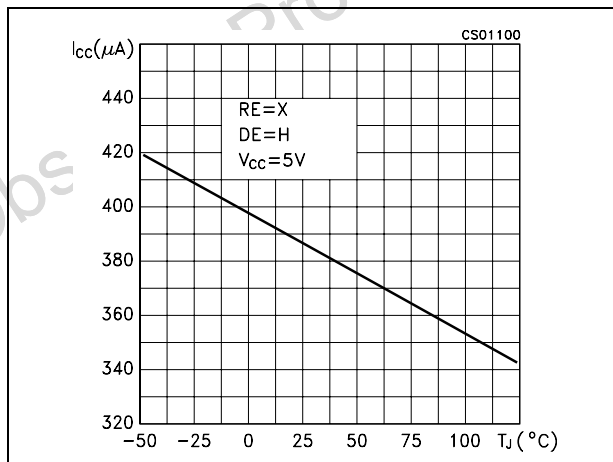

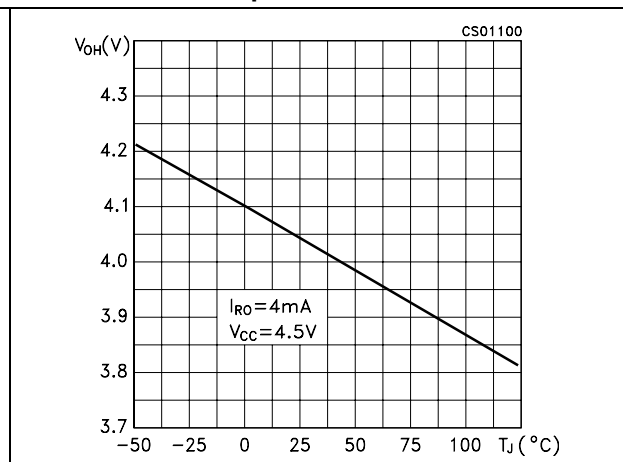**Figure 15.   Receiver high level output voltage vs temperature**

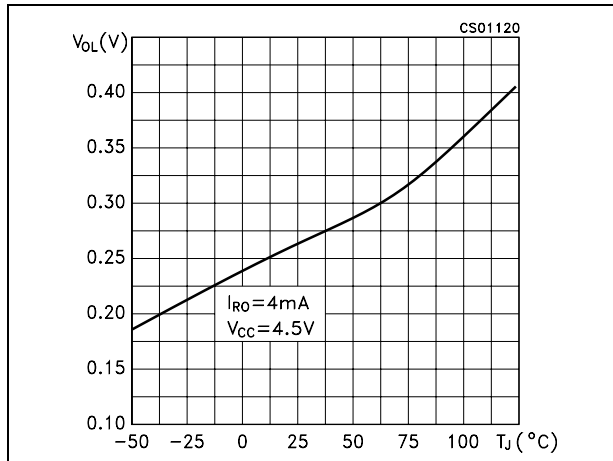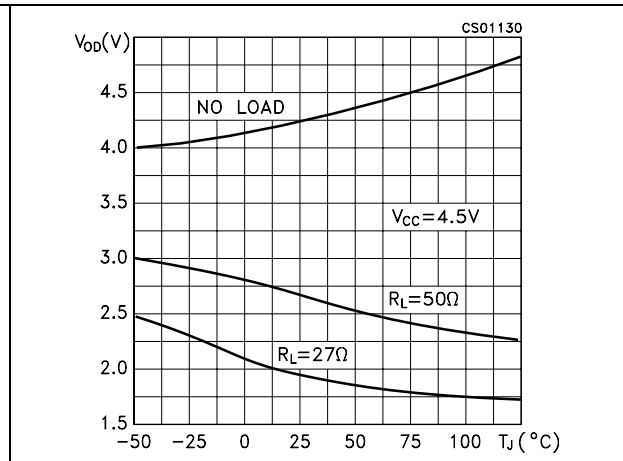**Figure 16.   Receiver low level output voltage vs temperature**

Figure 17.   Differential driver output voltage vs temperature

6   Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK®
packages. These packages have a lead-free second level interconnect. The category of
second level interconnect is marked on the package and on the inner box label, in
compliance with JEDEC Standard JESD97. The maximum ratings related to soldering
conditions are also marked on the inner box label. ECOPACK is an ST trademark.
ECOPACK specifications are available at: www.st.com

Plastic DIP-8 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A		3.3			0.130	
a1	0.7			0.028		
B	1.39		1.65	0.055		0.065
B1	0.91		1.04	0.036		0.041
b		0.5			0.020	
b1	0.38		0.5	0.015		0.020
D			9.8			0.386
E		8.8			0.346	
e		2.54			0.100	
e3		7.62			0.300	
e4		7.62			0.300	
F			7.1			0.280
I			4.8			0.189
L		3.3			0.130	
Z	0.44		1.6	0.017		0.063

P001F
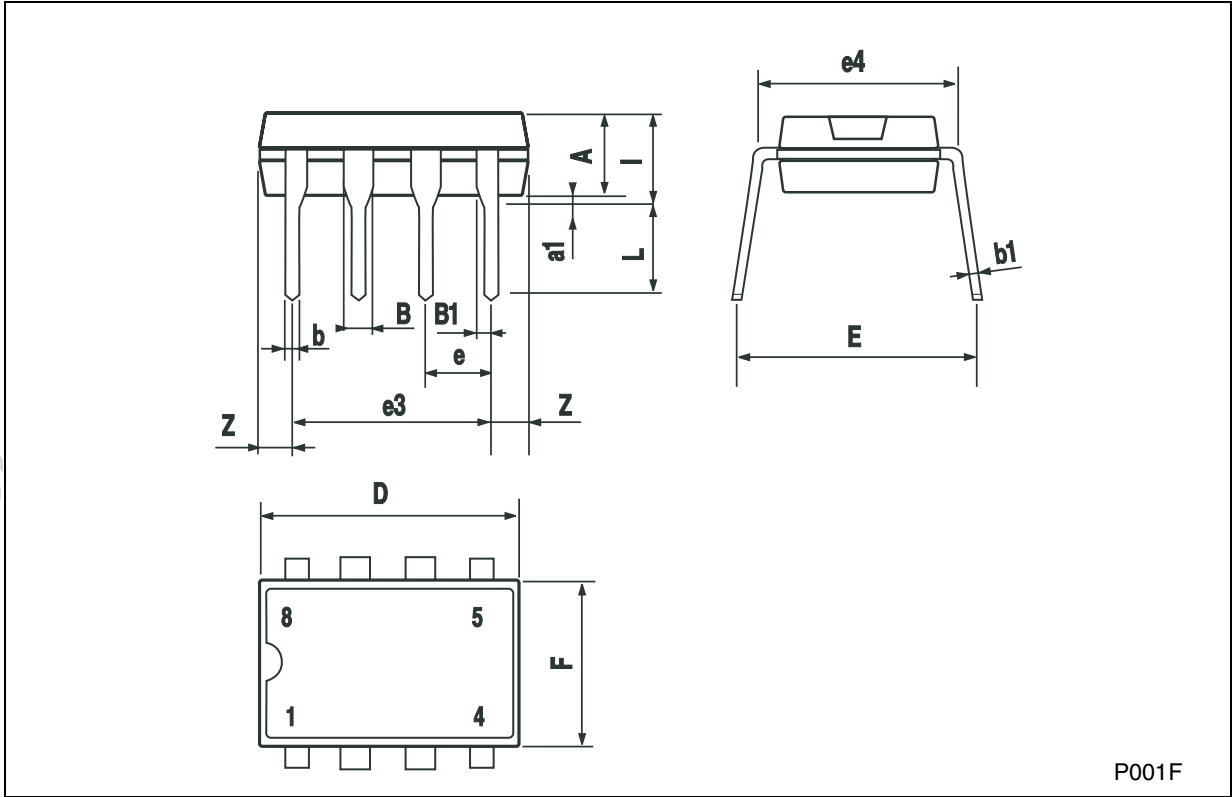
7   Revision history

Table 9.   Document revision history

Date	Revision	Changes
04-May-2006	3	Order codes updated.
07-Nov-2007	4	Added *Table 1.*

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