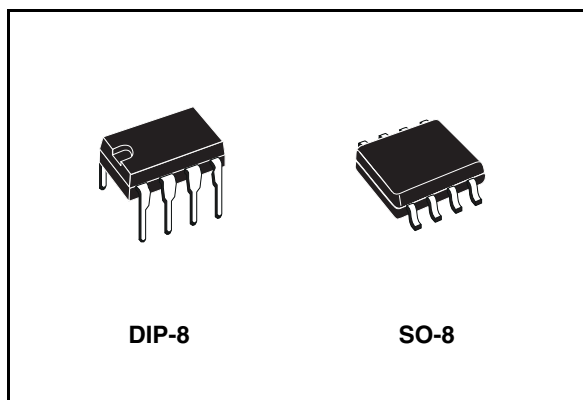


Low power RS-485/RS-422 transceiver

Features

- Low quiescent current: 300 μ A
- Designed for RS-485 interface application
- - 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 delay, 5 ns skew
- Operate from a single 5 V supply
- Current limiting and thermal shutdown for driver overload protection
- Allows up to 64 transceivers on the bus



The ST485 is available in three temperature range: commercial (0 °C to 70 °C), industrial (- 40 °C to 85 °C) and automotive (- 55 °C to 125 °C).

Description

The ST485 is a low power transceiver for RS-485 and RS-422 communication. Each part contains one driver and one receiver.

This transceiver draws 300 μ A (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 places the driver outputs into a high-impedance state.

The ST485 is designed for bi-directional data communications on multipoint bus transmission line (half-duplex applications).

Table 1. Device summary

Order code	Temperature range	Package	Packaging
ST485CN	0 to 70 °C	DIP-8	50 parts per tube / 40 tube per box
ST485BN	- 40 to 85 °C	DIP-8	50 parts per tube / 40 tube per box
ST485CDR	0 to 70 °C	SO-8 (tape and reel)	2500 parts per reel
ST485BDR	- 40 to 85 °C	SO-8 (tape and reel)	2500 parts per reel

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1 Pin configuration

Figure 1. Pin connections

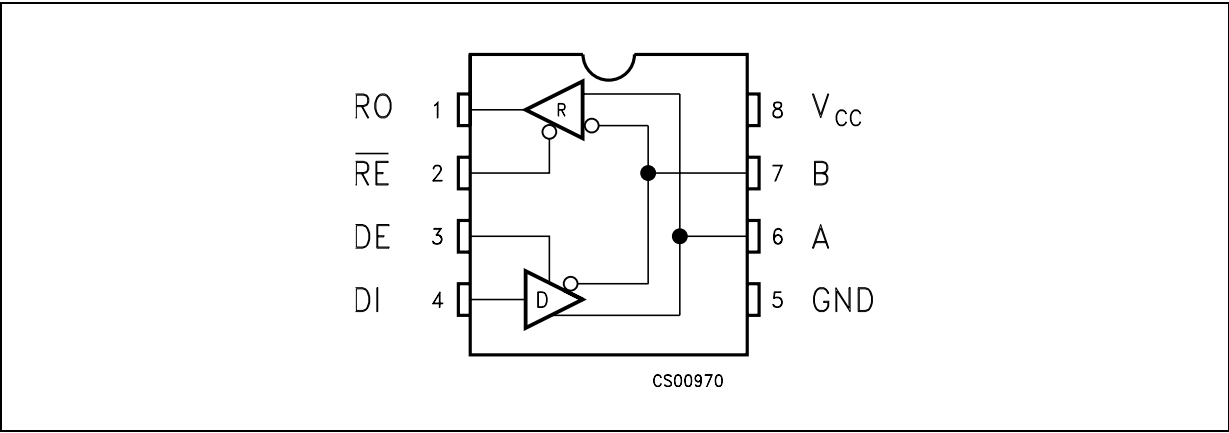


Table 2. Pin description

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	
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			Outputs
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

$V_{CC} = 5\text{ V} \pm 5\%$, $T_A = T_{MIN}$ to T_{MAX} , unless otherwise specified. Typical values are referred to $T_A = 25\text{ }^{\circ}\text{C}$

Table 6. DC electrical characteristics

Symbol	Parameter	Test conditions ⁽¹⁾	Value					Unit
			-40 to 85 °C			-55 to 125 °C		
			Min.	Typ.	Max.	Min.	Max.	
V _{OD1}	Differential driver output (no load)				5		5	V
V _{OD2}	Differential driver output (with load)	R _L = 27Ω (RS-485) <i>Figure 2</i> R _L = 50Ω (RS-422) <i>Figure 2</i>	1.5		5 5	1.4	5 5	V V
ΔV _{OD}	Change in magnitude of driver differential output voltage for complementary output states	R _L = 27Ω or 50Ω <i>Figure 2</i>			0.2		0.2	V
V _{OC}	Driver common-mode output voltage	R _L = 27Ω or 50Ω <i>Figure 2</i>			3		3	V
ΔV _{OC}	Change in magnitude of driver common-mode output voltage for complementary output states	R _L = 27Ω or 50Ω <i>Figure 2</i>			0.2		0.2	V
V _{IH}	Input high voltage	$\overline{RE}$, DE, DI	2.0			2.0		V
V _{IL}	Input low voltage	$\overline{RE}$, DE, DI			0.8		0.8	V
I _{IN1}	Input current	$\overline{RE}$, DE, DI			± 2		± 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		1 -0.8	mA mA
V _{TH}	Receiver differential threshold voltage	V _{CM} = -7 to 12V	-0.2		0.2	-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			3.4		V
V _{OL}	Receiver output low voltage	I _O = 4mA, V _{ID} = -200mV			0.4		0.55	V
I _{OZR}	3-state (high impedance) output current at receiver	V _O = 0.4 to 2.4V			± 1		± 1	μA
R _{IN}	Receiver input resistance	V _{CM} = -7 to 12V	24			24		kΩ
I _{CC}	No load supply current ⁽²⁾	V _{RE} = 0V or V _{CC} V _{DE} = V _{CC} V _{DE} = 0V		400 300	900 500		900 500	μA μA

Table 6. DC electrical characteristics (continued)

Symbol	Parameter	Test conditions ⁽¹⁾	Value					Unit
			-40 to 85 °C			-55 to 125 °C		
			Min.	Typ.	Max.	Min.	Max.	
I _{OSD1}	Driver short-circuit current, V _O =High	V _O = -7 to 12V ⁽³⁾	35		250	35	250	mA
I _{OSD2}	Driver short-circuit current, V _O =Low	V _O = -7 to 12V ⁽³⁾	35		250	35	250	mA
I _{OSR}	Receiver short-circuit current	V _O = 0V to V _{CC}	7		95	7	95	mA

1. All currents into device pins are positive; all currents 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.

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

Table 7. Driver switching characteristics

Symbol	Parameter	Test conditions ⁽¹⁾	Value					Unit
			-40 to 85 °C			-55 to 125°C		
			Min.	Typ.	Max.	Min.	Max.	
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		70	ns
t _{SK}	Output skew to output	R _{DIFF} = 54Ω, C _{L1} = C _{L2} = 100pF (See Figure 4 and Figure 6)		5	10		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	3	45	ns
t _{PZH}	Output enable time	C _L = 100pF, S2 = Closed (See Figure 5 and Figure 7)		70	90		90	ns
t _{PZL}	Output enable time	C _L = 100pF, S1 = Closed (See Figure 5 and Figure 7)		70	90		90	ns
t _{PLZ}	Output disable time	C _L = 15pF, S1 = Closed (See Figure 5 and Figure 7)		70	90		90	ns
t _{PHZ}	Output disable time	C _L = 15pF, S2 = Closed (See Figure 5 and Figure 7)		70	90		90	ns

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

$V_{CC} = 5\text{ V} \pm 5\%$, $T_A = T_{MIN}$ to T_{MAX} , unless otherwise specified. Typical values are referred to $T_A = 25\text{ }^{\circ}\text{C}$

Table 8. Receiver switching characteristics

Symbol	Parameter	Test conditions ⁽¹⁾	Value					Unit
			-40 to 85 °C			-55 to 125°C		
			Min.	Typ.	Max.	Min.	Max.	
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		230	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 Fig. 2 and Figure 9)		20	50		56	ns
t _{PZL}	Output enable time	C _{RL} = 15pF, S2 = Closed (See Fig. 2 and Figure 9)		20	50		56	ns
t _{PLZ}	Output disable time	C _{RL} = 15pF, S1 = Closed (See Fig. 2 and Figure 9)		20	50		56	ns
t _{PHZ}	Output disable time	C _{RL} = 15pF, S2 = Closed (See Fig. 2 and Figure 9)		20	50		56	ns
f _{MAX}	Maximum data rate		2.5			2.5		Mbps

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

5 Test circuit and typical characteristics

Figure 2. Driver DC test load

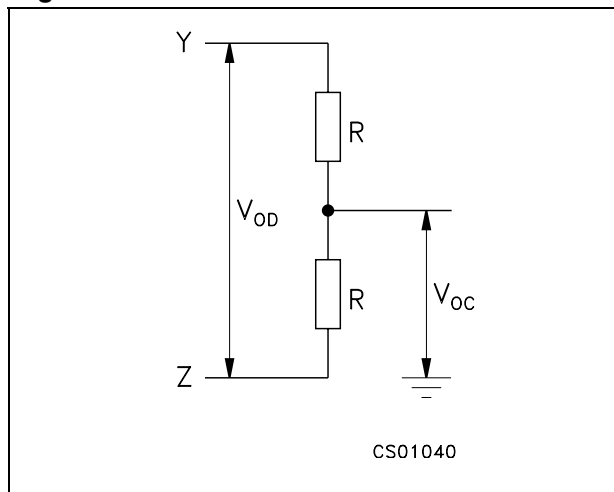


Figure 3. Receiver timing test load

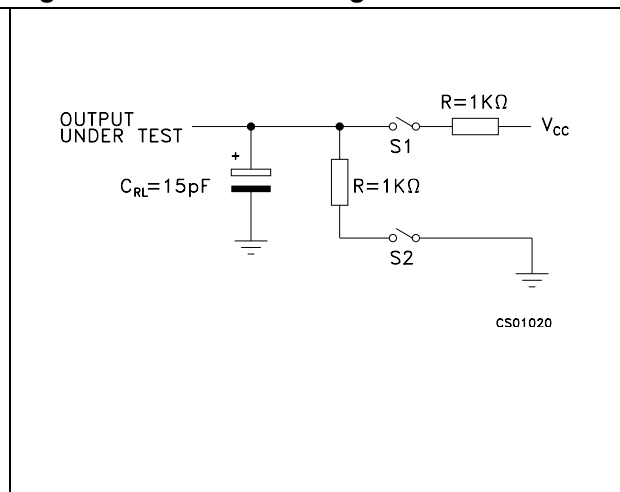


Figure 4. Drive/receiver timing test circuit

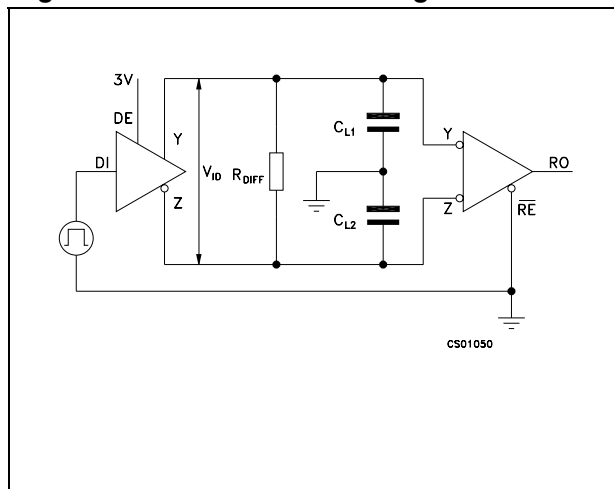


Figure 5. Driver timing test load

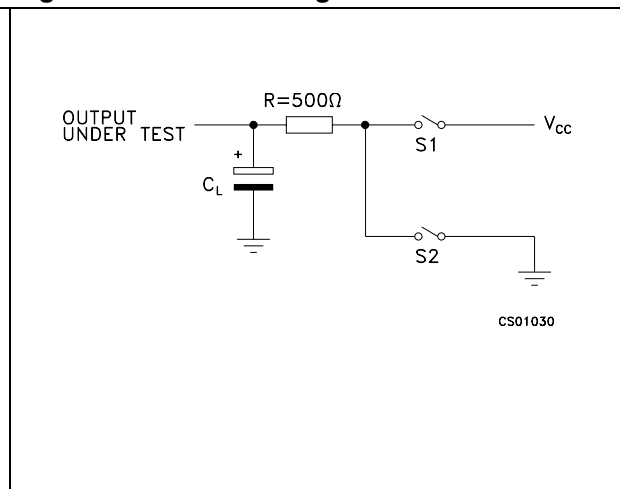


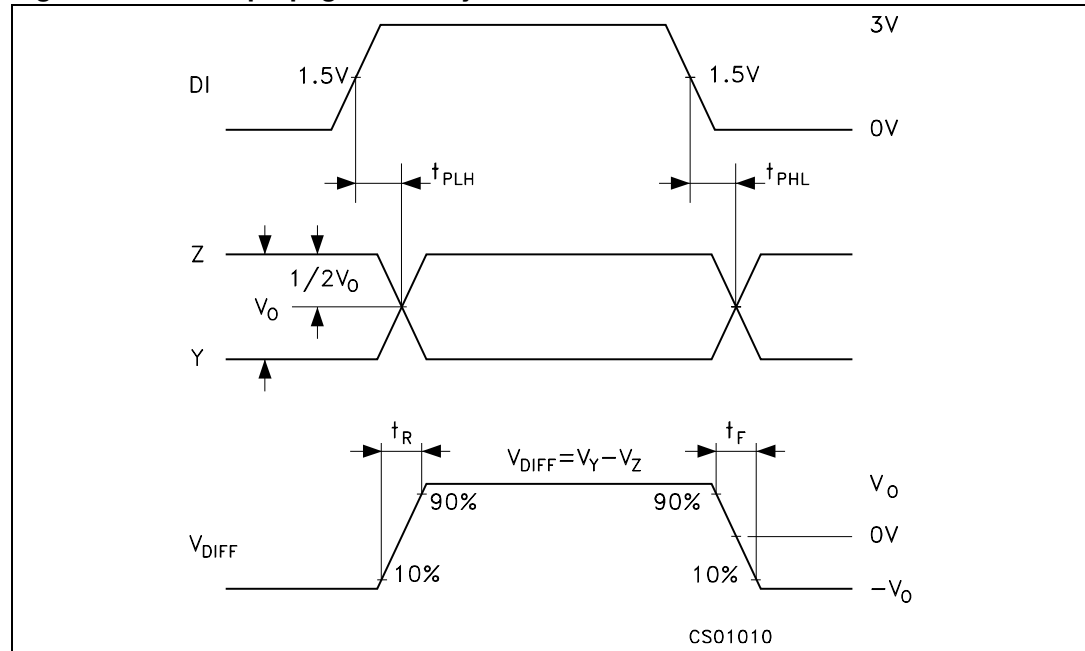
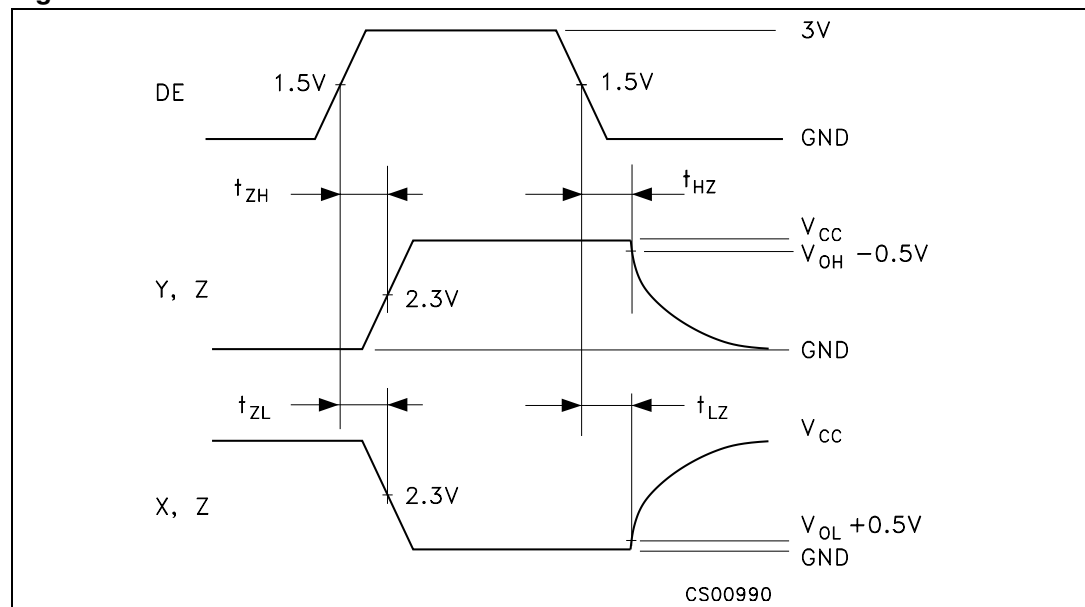
Figure 6. Driver propagation delay**Figure 7. Driver enable and disable time**

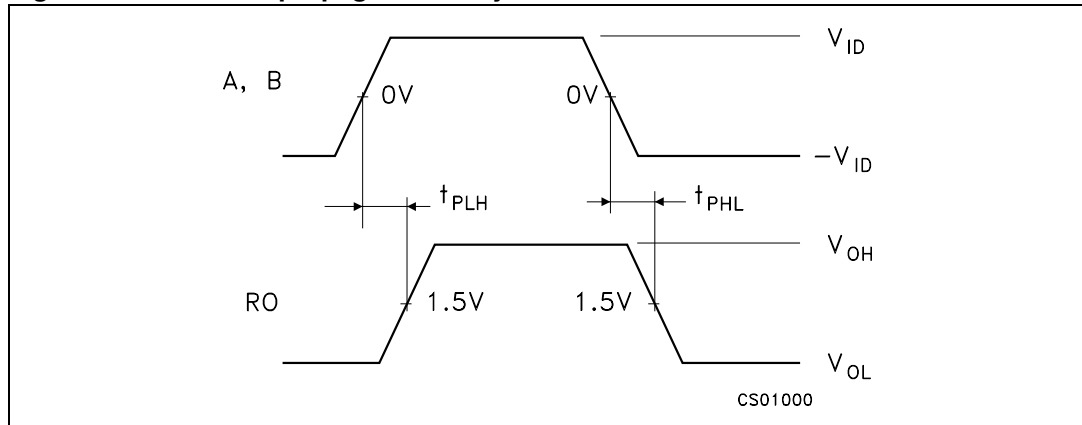
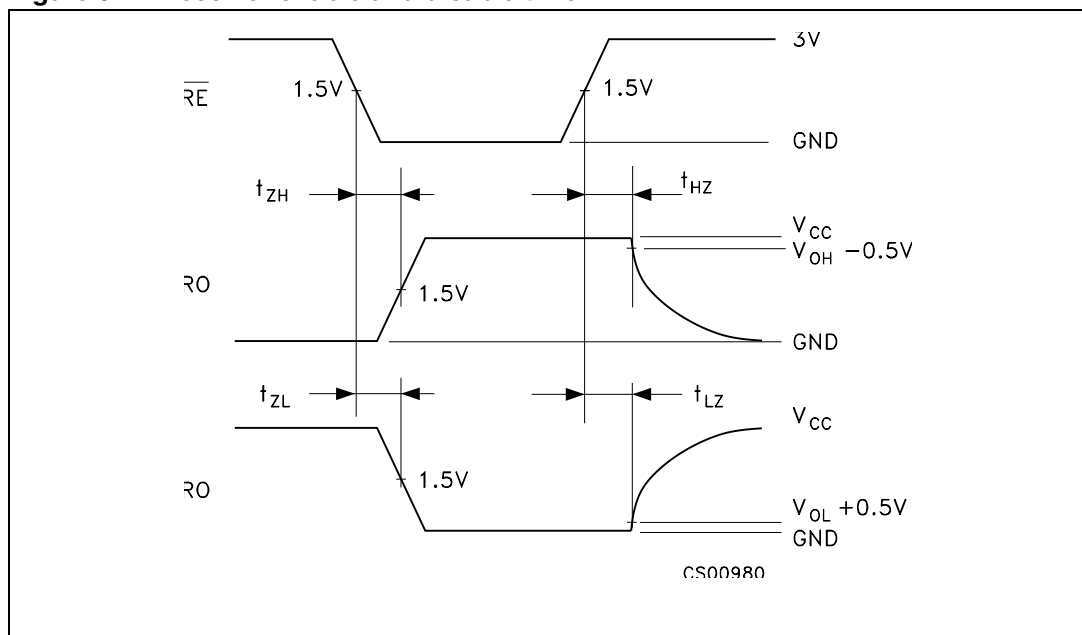
Figure 8. Receiver propagation delay**Figure 9. Receiver enable and disable time**

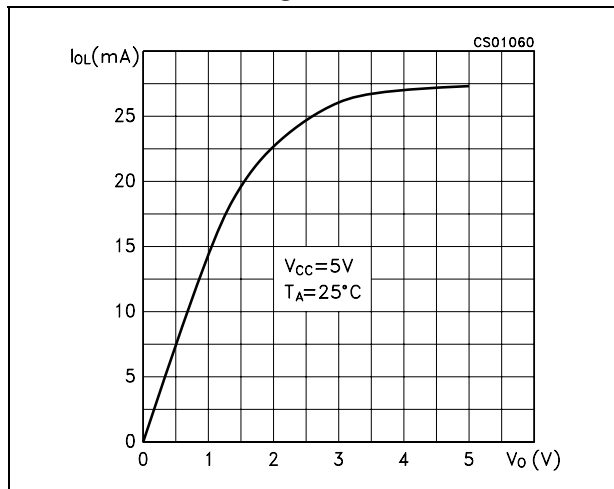
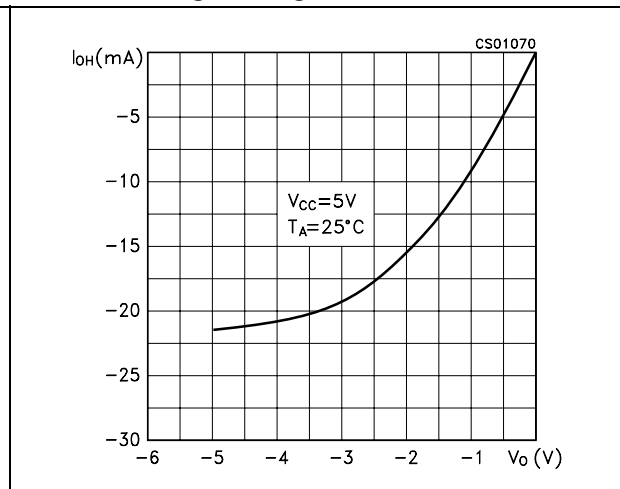
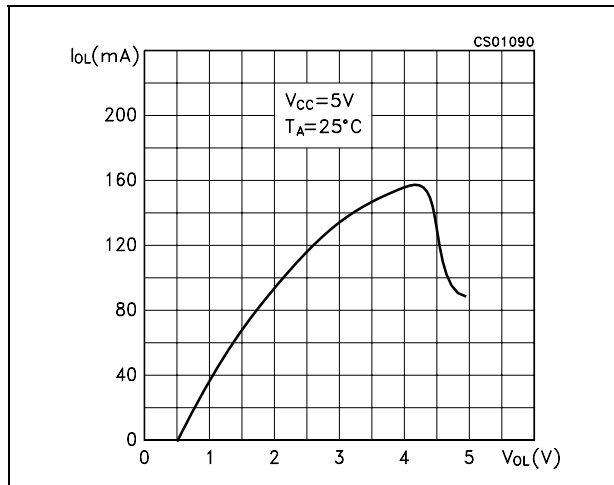
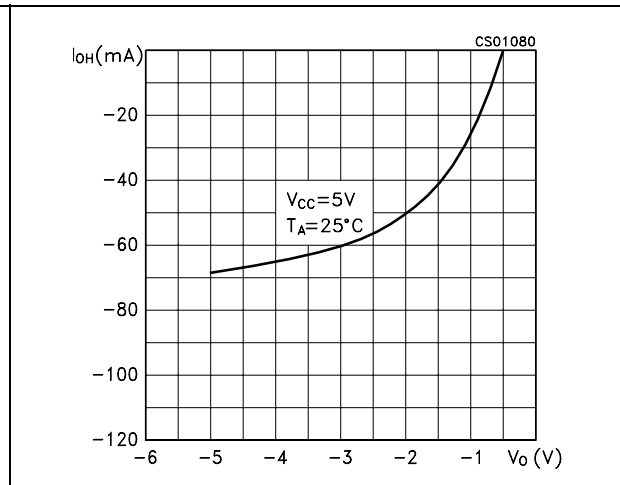
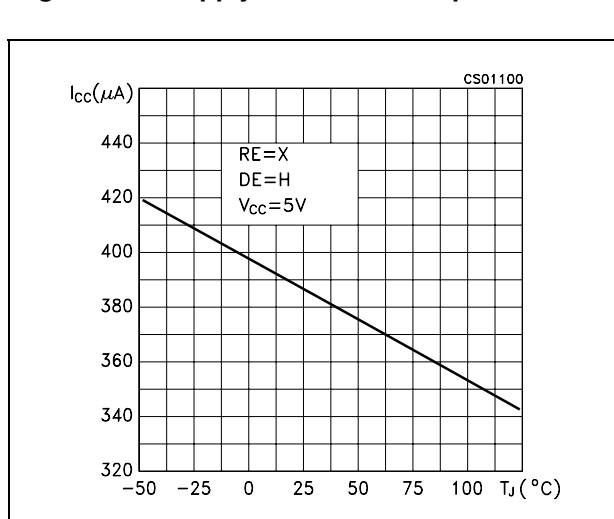
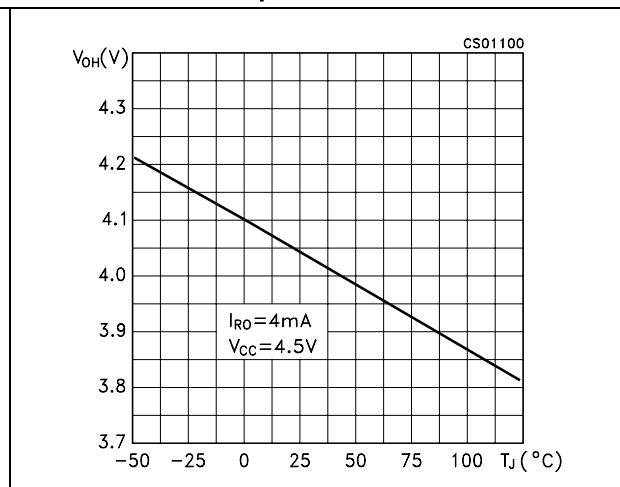
Figure 10. Receiver output current vs. output low voltage**Figure 11. Receiver output current vs. output high voltage****Figure 12. Driver output current vs. output low voltage****Figure 13. Driver output current vs. output high voltage****Figure 14. Supply current vs. temperature****Figure 15. Receiver high level output voltage vs. temperature**

Figure 16. Receiver low level output voltage vs. temperature

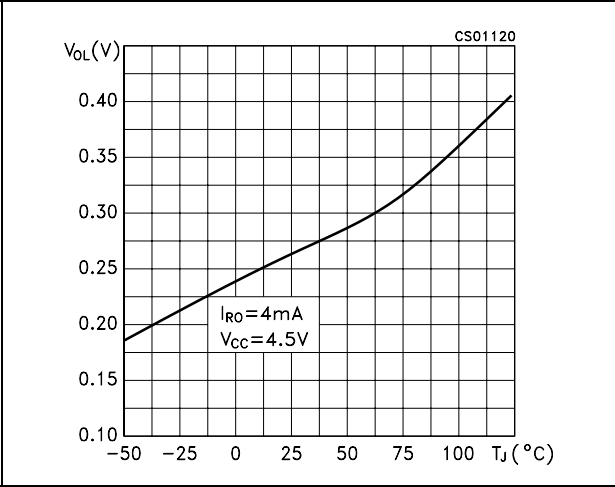
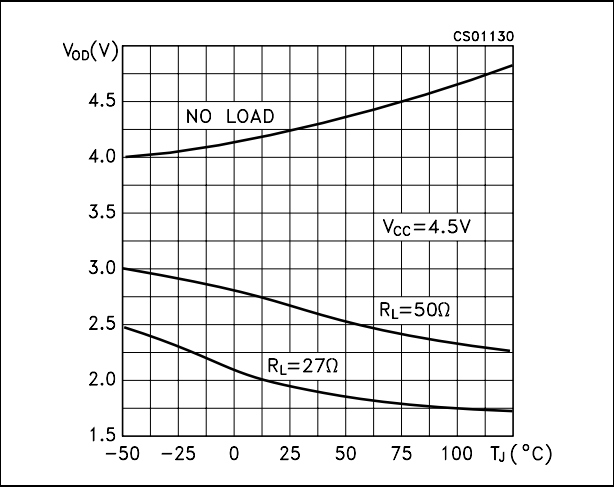


Figure 17. Differential driver output voltage vs. temperature

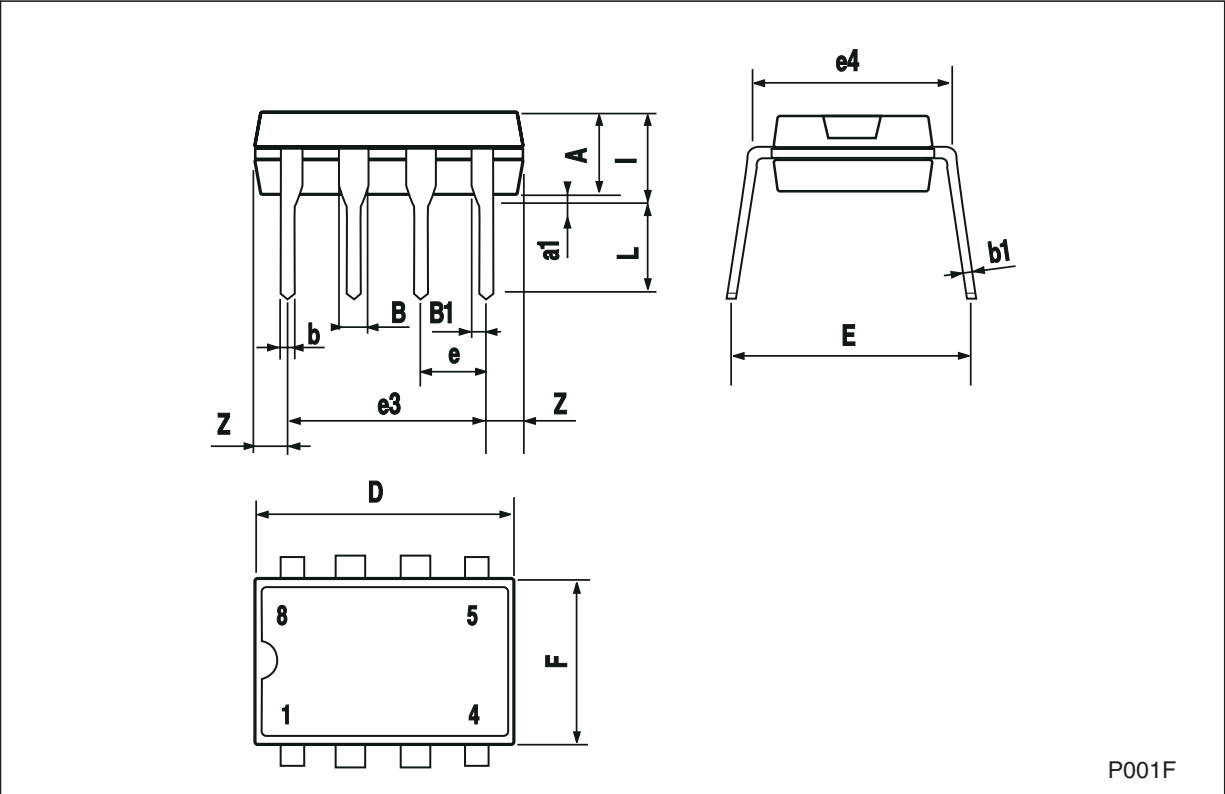


6 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

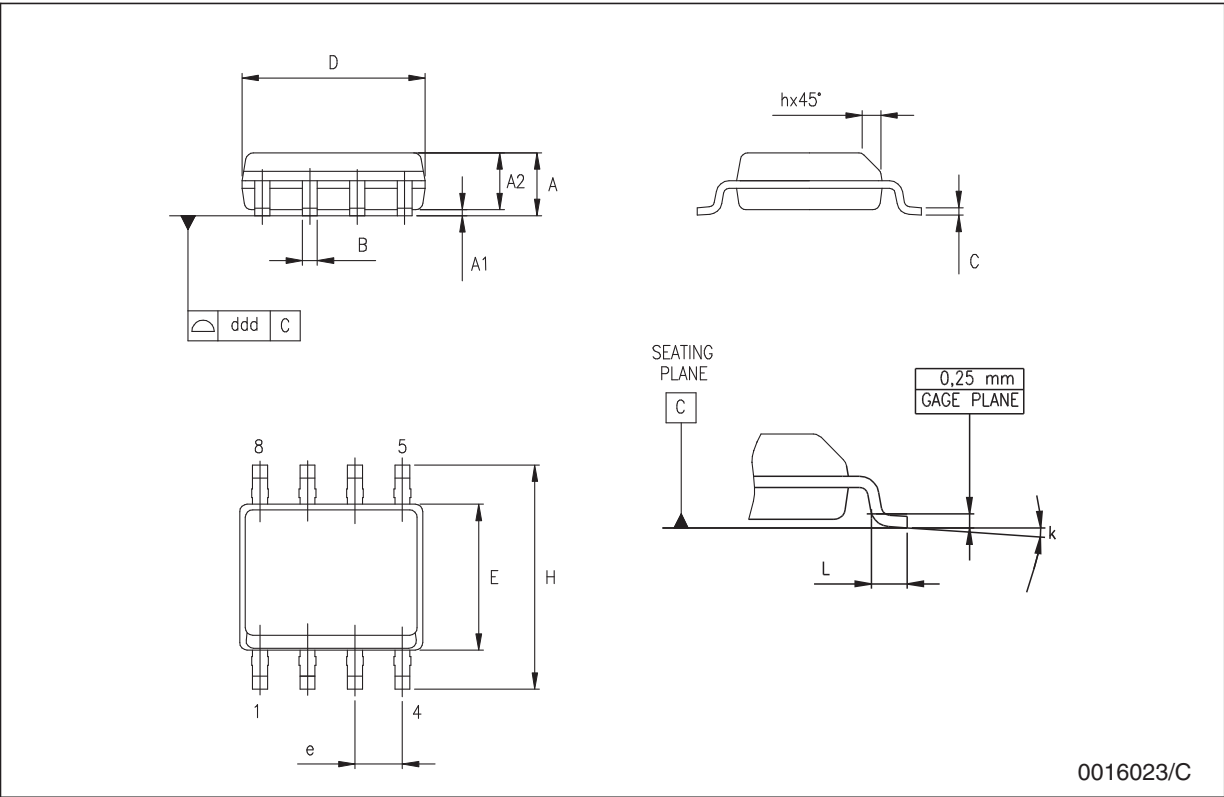
Plastic DIP-8 mechanical data

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



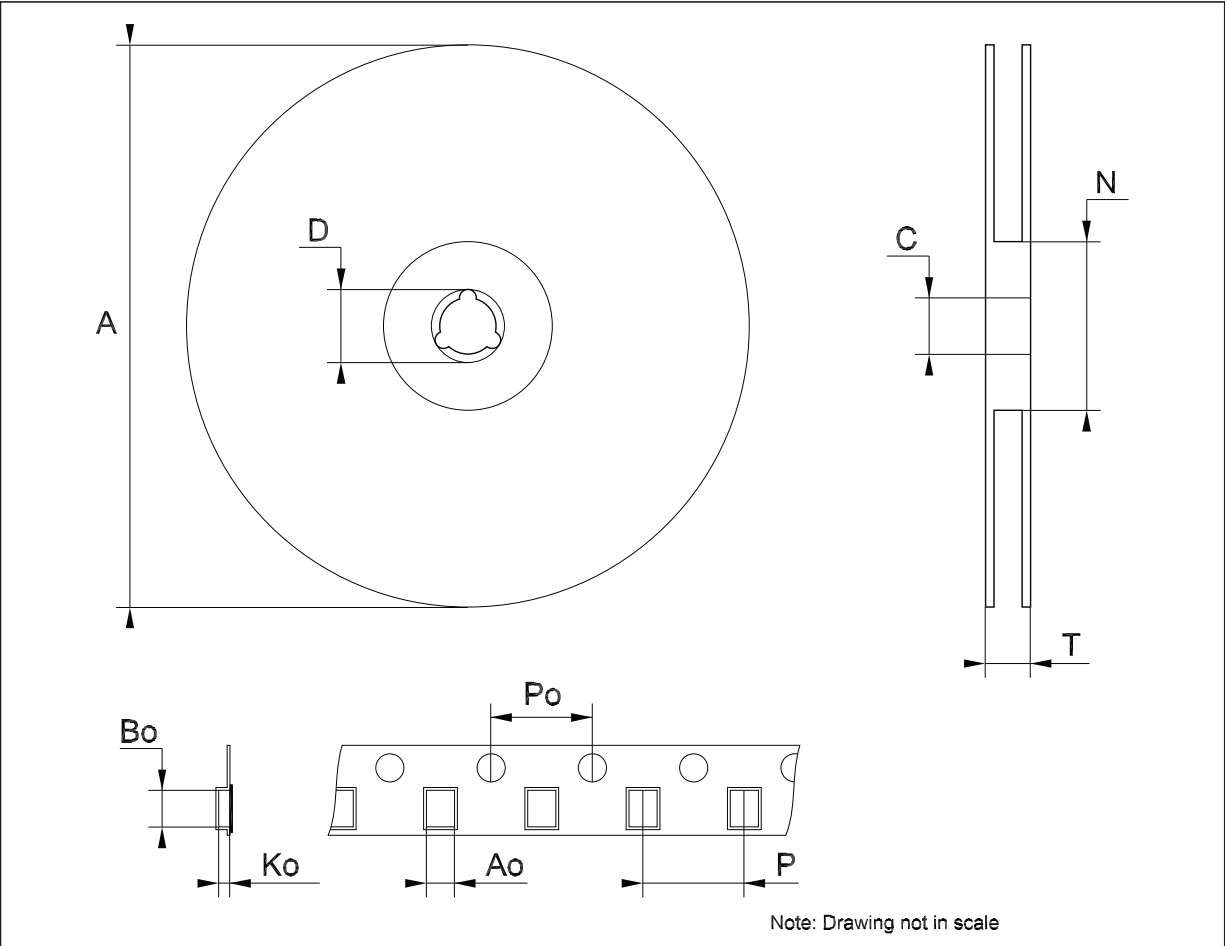
SO-8 mechanical data

Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	1.35		1.75	0.053		0.069
A1	0.10		0.25	0.04		0.010
A2	1.10		1.65	0.043		0.065
B	0.33		0.51	0.013		0.020
C	0.19		0.25	0.007		0.010
D	4.80		5.00	0.189		0.197
E	3.80		4.00	0.150		0.157
e		1.27			0.050	
H	5.80		6.20	0.228		0.244
h	0.25		0.50	0.010		0.020
L	0.40		1.27	0.016		0.050
k	8° (max.)					
ddd			0.1			0.04



Tape & reel SO-8 mechanical data

Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			330			12.992
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	60			2.362		
T			22.4			0.882
Ao	8.1		8.5	0.319		0.335
Bo	5.5		5.9	0.216		0.232
Ko	2.1		2.3	0.082		0.090
Po	3.9		4.1	0.153		0.161
P	7.9		8.1	0.311		0.319



7 Revision history

Table 9. Document revision history

Date	Revision	Changes
21-Mar-2006	12	Order codes has been updated and new template.
02-Aug-2006	13	Mistake in cover page first row mA ==> μ A.
08-Nov-2006	14	Added: Table 1 .
07-Feb-2008	15	Modified: Table 1 on page 1 .
16-Feb-2009	16	Modified Note: on page 5 .

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