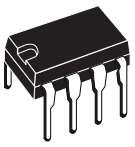
ST485B
ST485C

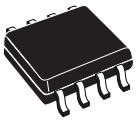
Low power RS-485/RS-422 transceiver

Features

- Low quiescent current: 300 µA
- 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



DIP-8



SO-8

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 al low power transceiver for RS-485 and RS-422 communication. Each part contains one driver and one receiver.

This transceiver draw 300 µA (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 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

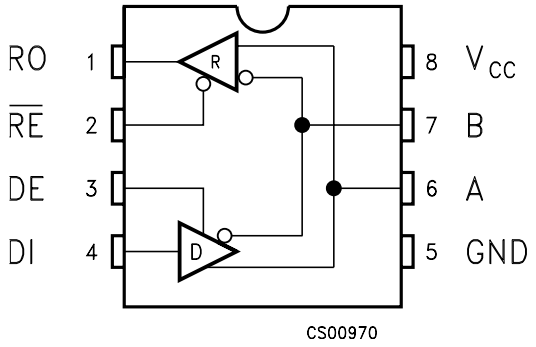


Table 2. Pin description

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	≥ +0.2V	H
L	L	≤-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. V+ and V- can have a maximum magnitude of +7 V, but their absolute addition can not exceed 13 V.

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)

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) *Figure 2* R_L = 50Ω (RS-422) *Figure 2*	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 *Figure 2*			0.2		0.2	V
V_{OC}	Driver common-mode output voltage	R_L = 27Ω or 50Ω *Figure 2*			3		3	V
ΔV_{OC}	Change in magnitude of driver common-mode output voltage for complementary output states	R_L = 27Ω or 50Ω *Figure 2*			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)

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

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

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 cuttents out of device pins are negative; all voltages are referenced to device ground unless specified.

Table 8. Receiver switching 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)

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 cuttents 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

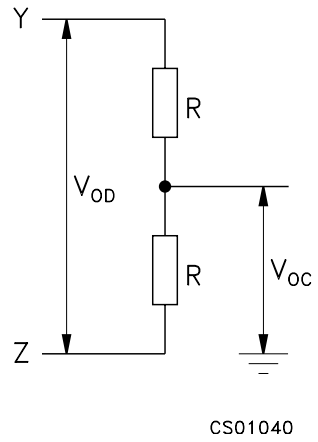


Figure 3. Receiver timing test load

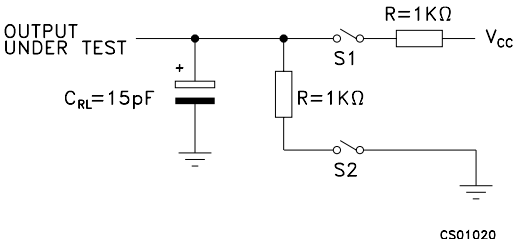


Figure 4. Drive/receiver timing test circuit

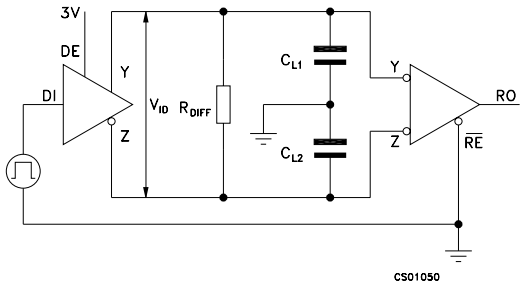


Figure 5. Driver timing test load

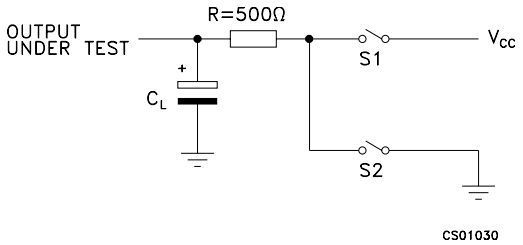


Figure 6. Driver propagation delay

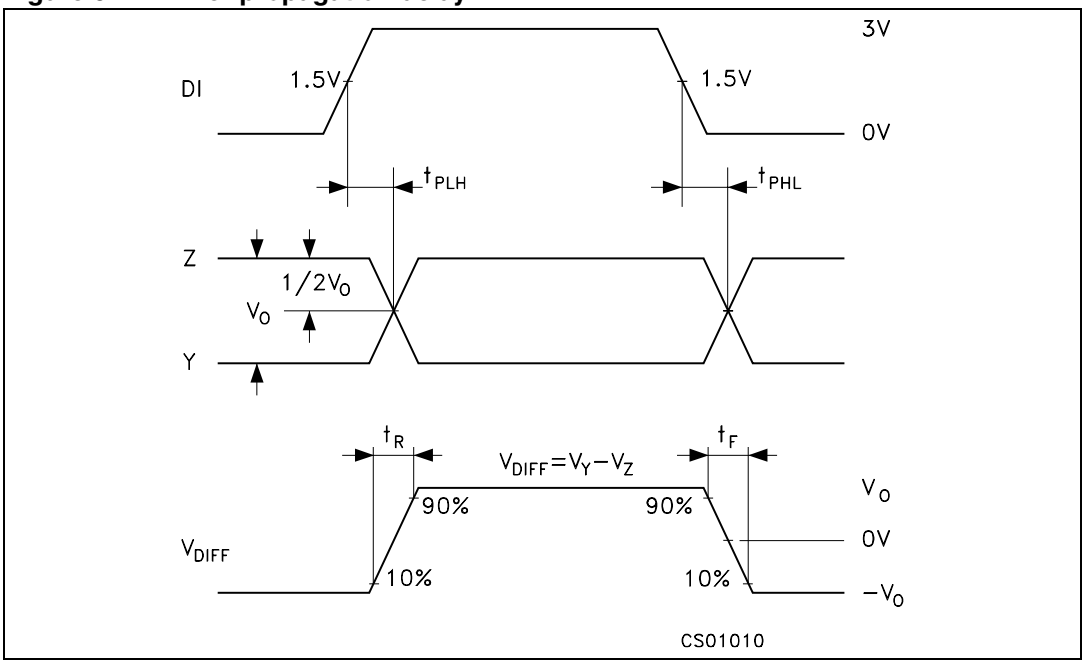


Figure 7. Driver enable and disable time

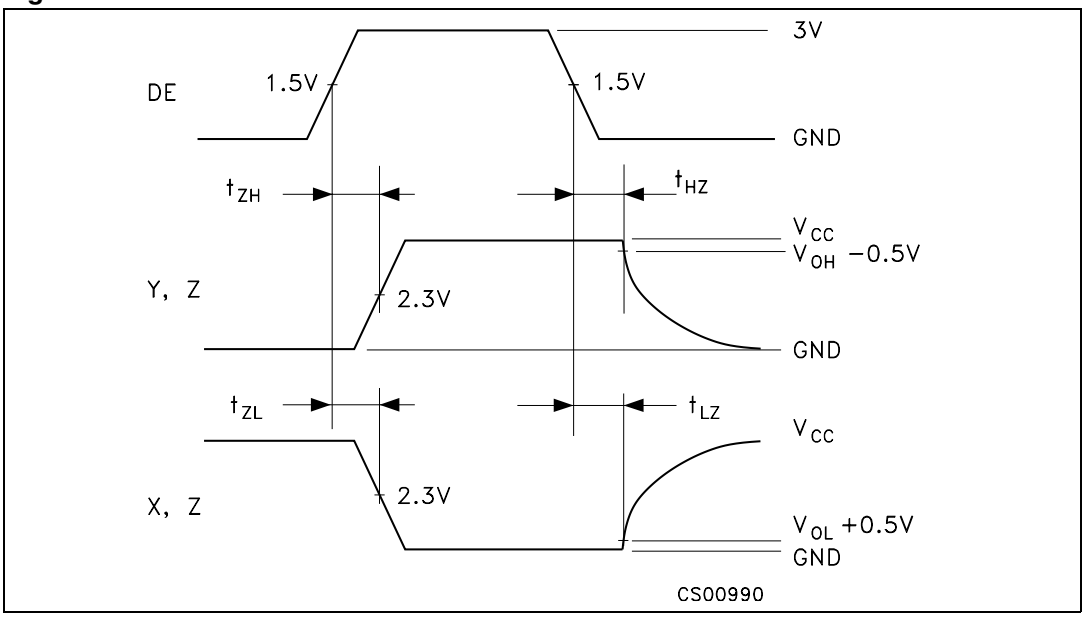


Figure 8. Receiver propagation delay

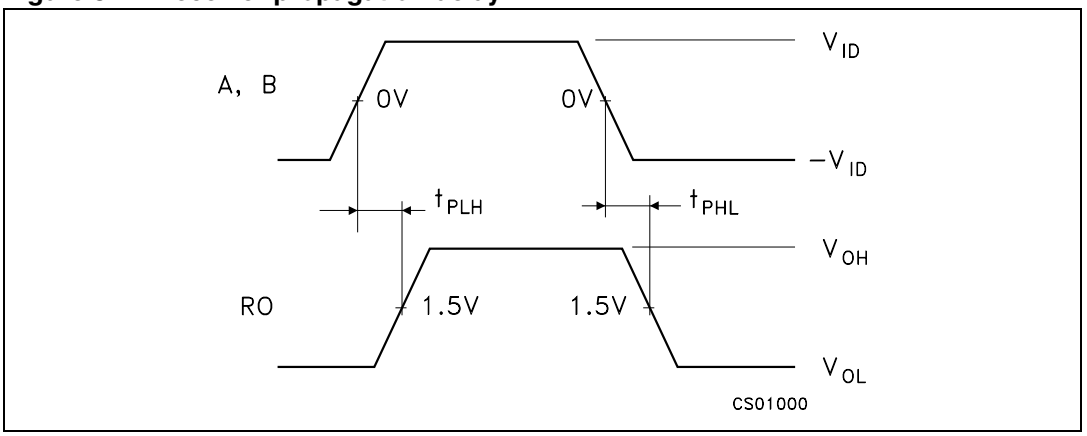


Figure 9. Receiver enable and disable time

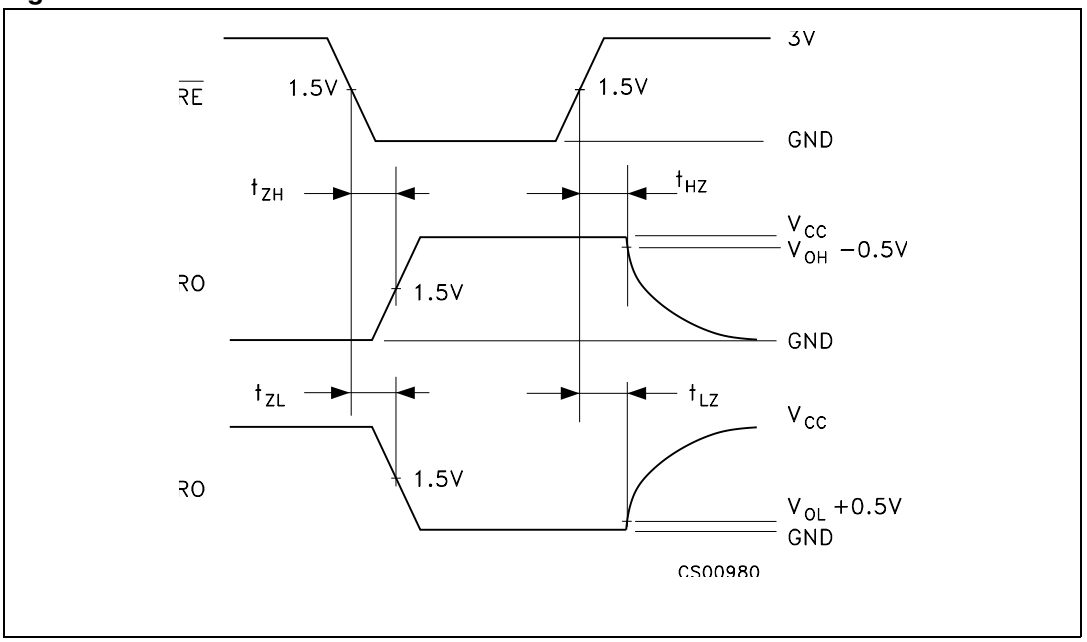


Figure 10. Receiver output current vs output low voltage

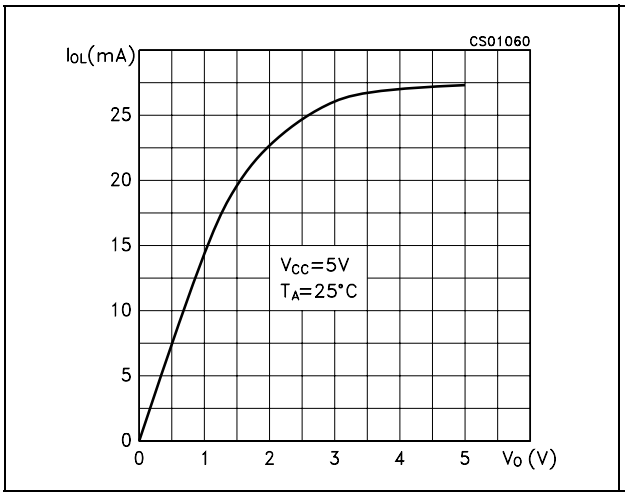


Figure 11. Receiver output current vs output high voltage

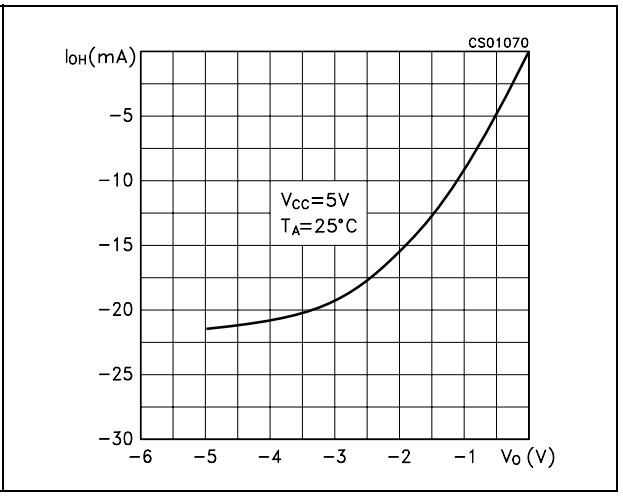


Figure 12. Driver output current vs output low voltage

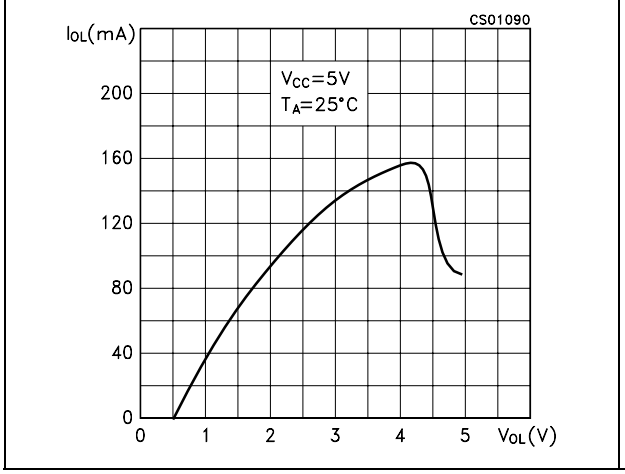


Figure 13. Driver output current vs output high voltage

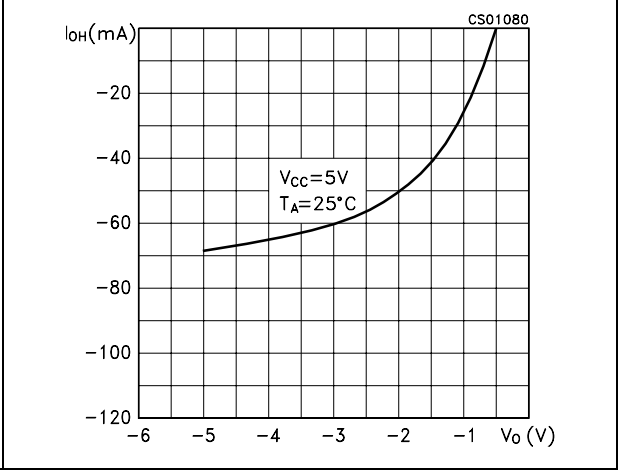


Figure 14. Supply current vs temperature

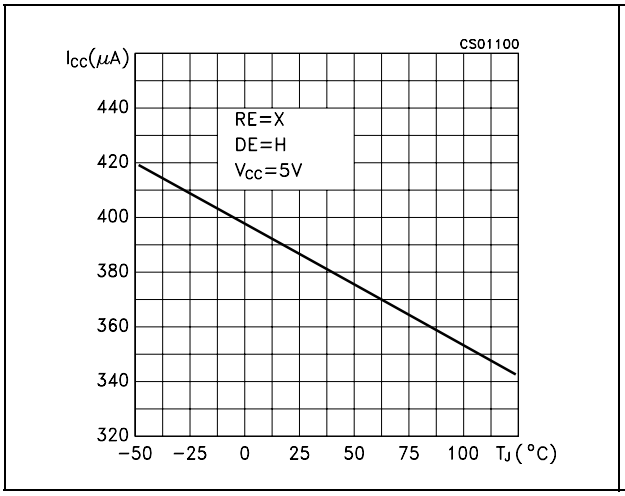


Figure 15. Receiver high level output voltage vs temperature

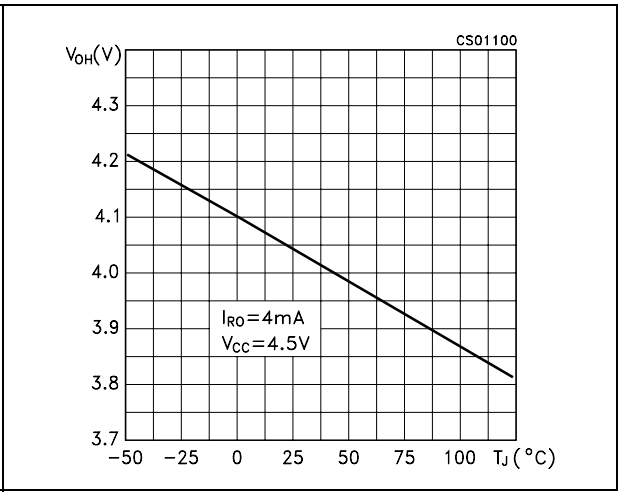


Figure 16. Receiver low level output voltage vs temperature

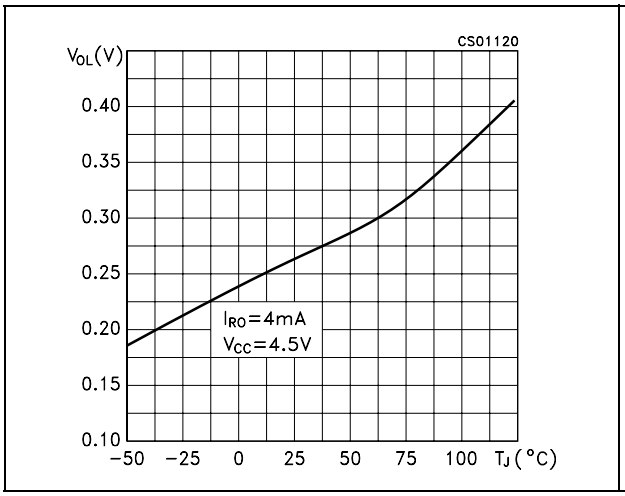
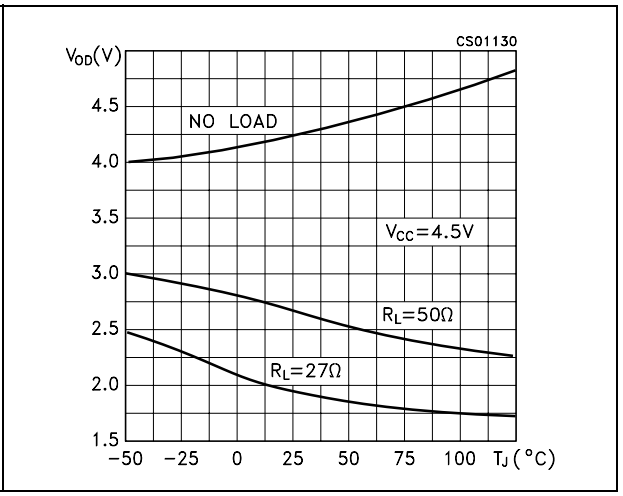


Figure 17. Differential driver output voltage vs temperature

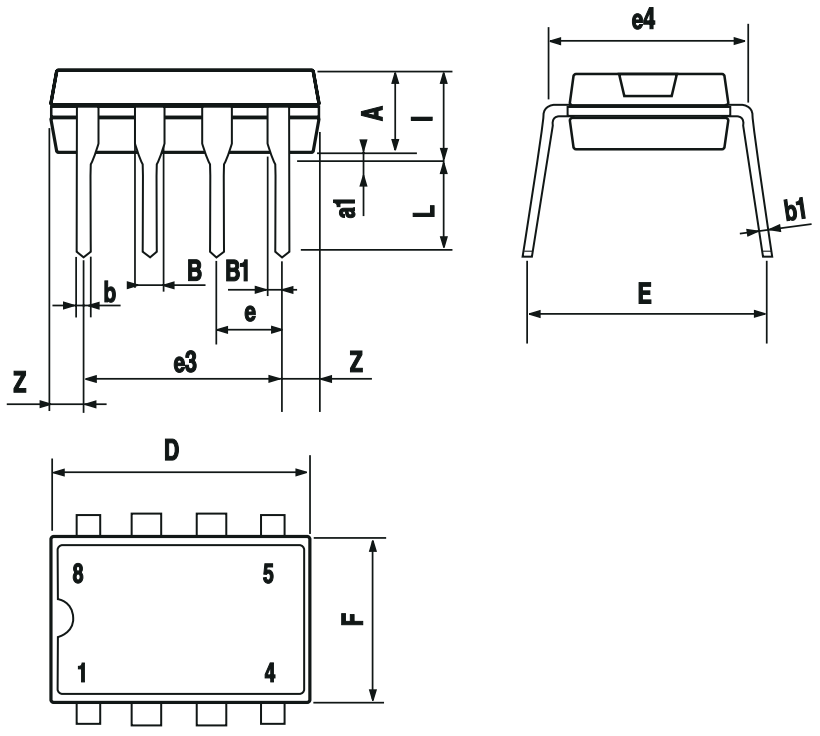


6 Package mechanical data

In order to meet environmental requirements, ST offers these devices in 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

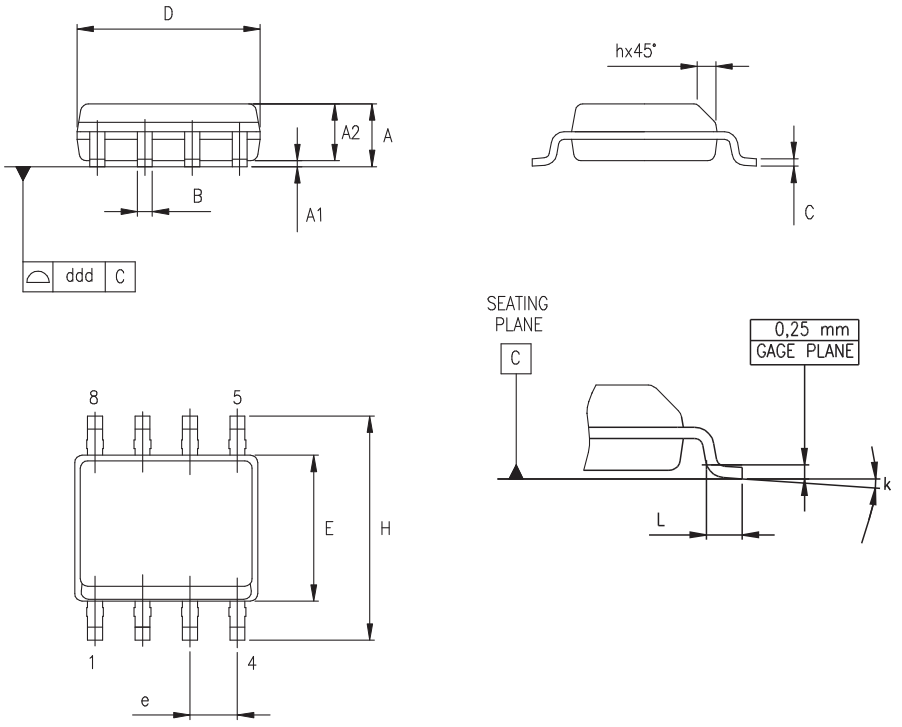
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A		3.3			0.130	
a1	0.7			0.028		
B	1.39		1.65	0.055		0.065
B1	0.91		1.04	0.036		0.041
b		0.5			0.020	
b1	0.38		0.5	0.015		0.020
D			9.8			0.386
E		8.8			0.346	
e		2.54			0.100	
e3		7.62			0.300	
e4		7.62			0.300	
F			7.1			0.280
I			4.8			0.189
L		3.3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



P001F

SO-8 mechanical data

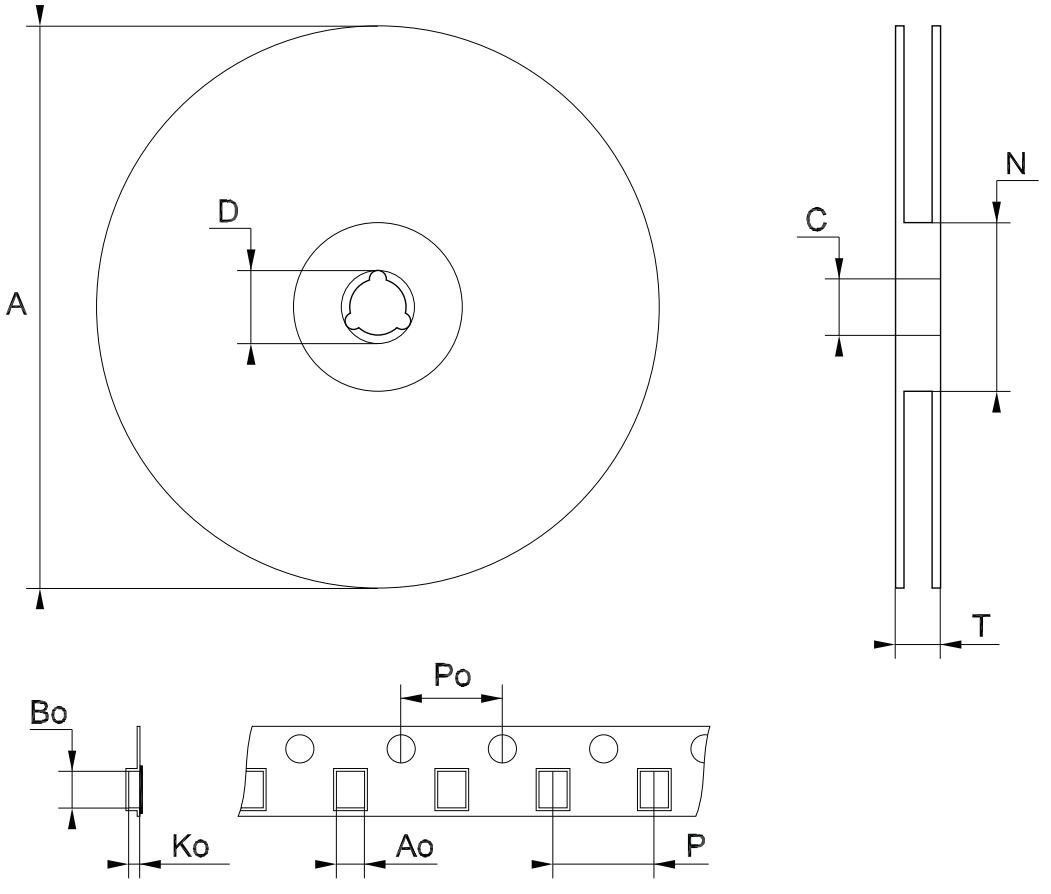
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	1.35		1.75	0.053		0.069
A1	0.10		0.25	0.04		0.010
A2	1.10		1.65	0.043		0.065
B	0.33		0.51	0.013		0.020
C	0.19		0.25	0.007		0.010
D	4.80		5.00	0.189		0.197
E	3.80		4.00	0.150		0.157
e		1.27			0.050	
H	5.80		6.20	0.228		0.244
h	0.25		0.50	0.010		0.020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



0016023/C

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



Note: Drawing not in scale

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 ==> µA.
08-Nov-2006	14	Added: *Table 1*.
07-Feb-2008	15	Modified: *Table 1 on page 1*.