

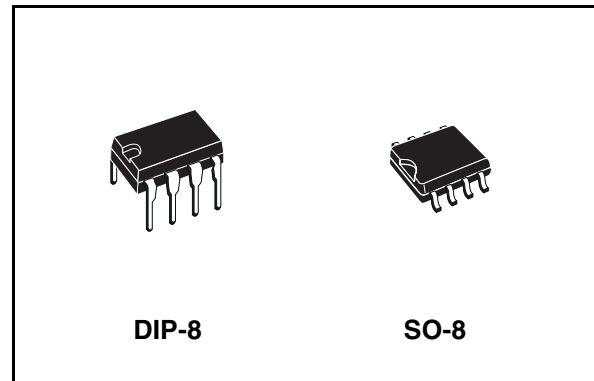


# ST485ERB

±15 kV ESD protected, low power  
RS-485/RS-422 transceiver

## Features

- Low quiescent current: 300  $\mu$ 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
- ESD protection:
  - ± 15 kV (HBM)
  - ± 8 kV (IEC-1000-4-2 contact discharge)
- Allows up to 256 transceivers on the bus



The ST485ERB is designed for bi-directional data communications on multipoint bus transmission line (half-duplex applications).

## Description

The ST485ERB is a low power transceiver for RS-485 and RS-422 communication. Each driver output and receiver input is protected against  $\pm 15$  kV electrostatic discharge (HBM)  $\pm 8$  kV (IEC-1000-4-2 contact discharge) shocks, without latch-up. These parts contain one driver and one receiver.

This transceiver draws 300  $\mu$ 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.

**Table 1. Device summary**

Order code	Temperature range	Package	Packaging
ST485ERBN	- 40 to 85 °C	DIP-8	50 parts per tube / 40 tube per box
ST485ERBDR	- 40 to 85 °C	SO-8 (tape and reel)	2500 parts per reel

# Contents

1	Pin settings .....	3
2	Truth tables .....	4
3	Maximum ratings .....	5
4	Electrical characteristics .....	6
5	Test circuit and typical characteristics .....	9
6	Package mechanical data .....	14
7	Revision history .....	18

# 1 Pin settings

Figure 1. Pin configuration

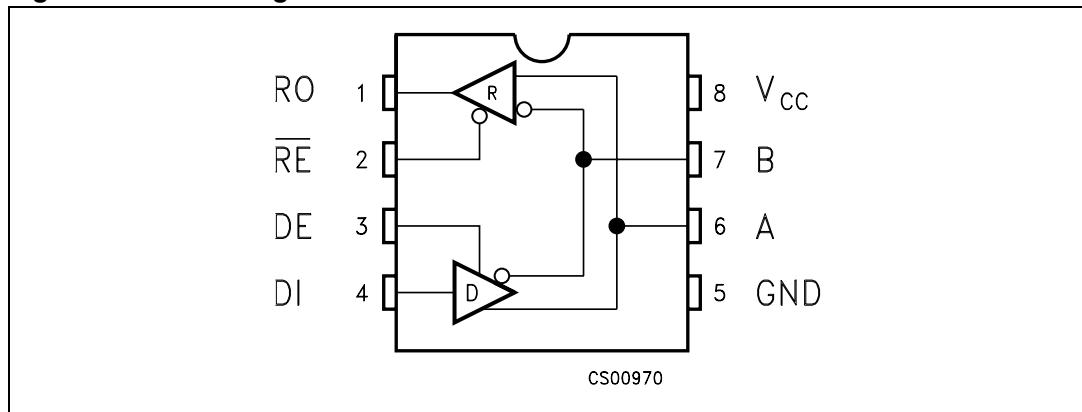


Table 2. Pin description

Pin n°	Symbol	Name and function
1	RO	Receiver output
2	$\overline{RE}$	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 <sub>CC</sub>	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			Outputs
$\overline{RE}$	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)	$\pm 14$	V
$V_{RI}$	Receiver input voltage (A, B)	$\pm 14$	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. ESD performance: transmitter outputs, receiver inputs**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
ESD	ESD protection voltage	Human body model	±15			kV
ESD	ESD protection voltage	IEC-1000-4-2	±8			kV

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

**Table 7. DC electrical characteristics**

Symbol	Parameter	Test conditions <sup>(1)</sup>	Min.	Typ.	Max.	Unit
$V_{OD1}$	Differential driver output (no load)				5	V
$V_{OD2}$	Differential driver output (with load)	$R_L = 27\Omega$ (RS-485) ( <i>Figure 2</i> ) $R_L = 50\Omega$ (RS-422) ( <i>Figure 2</i> )	1.5		5 5	V V
$\Delta V_{OD}$	Change in magnitude of driver differential output voltage for complementary output states	$R_L = 27\Omega$ or $50\Omega$ ( <i>Figure 2</i> )			0.2	V
$V_{OC}$	Driver common-mode output voltage	$R_L = 27\Omega$ or $50\Omega$ ( <i>Figure 2</i> )			3	V
$\Delta V_{OC}$	Change in magnitude of driver common-mode output voltage for complementary output states	$R_L = 27\Omega$ or $50\Omega$ ( <i>Figure 2</i> )			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)	$V_{CM} = 0\text{V}$ or $5.25\text{V}$ , $V_{DE} = 0\text{V}$ $V_{IN} = 12\text{V}$ $V_{IN} = -7\text{V}$			1 -0.8	mA mA
$V_{TH}$	Receiver differential threshold voltage	$V_{CM} = -7$ to $12\text{V}$	-0.2		0.2	V
$\Delta V_{TH}$	Receiver input hysteresis	$V_{CM} = 0\text{V}$		70		mV
$V_{OH}$	Receiver output high voltage	$I_O = -4\text{mA}$ , $V_{ID} = 200\text{mV}$	3.5			V
$V_{OL}$	Receiver output low voltage	$I_O = 4\text{mA}$ , $V_{ID} = -200\text{mV}$			0.4	V
$I_{OZR}$	3-State (high impedance) output current at receiver	$V_O = 0.4$ to $2.4\text{V}$			±1	μA
$R_{IN}$	Receiver input resistance	$V_{CM} = -7$ to $12\text{V}$	24			kΩ

**Table 7. DC electrical characteristics (continued)**

Symbol	Parameter	Test conditions <sup>(1)</sup>	Min.	Typ.	Max.	Unit
$I_{CC}$	No load supply current <sup>(2)</sup>	$V_{RE} = 0V$ or $V_{CC}$ $V_{DE} = V_{CC}$ $V_{DE} = 0V$		400 300	900 500	$\mu A$ $\mu A$
$I_{OSD1}$	Driver short-circuit current, $V_O=High$	$V_O = -7$ to $12V$ <sup>(3)</sup>	35		250	mA
$I_{OSD2}$	Driver short-circuit current, $V_O=Low$	$V_O = -7$ to $12V$ <sup>(3)</sup>	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 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  $V_{DE} = 0 V$
3. Applies to peak current. See typical Operating Characteristics.

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

**Table 8. Driver switching characteristics**

Symbol	Parameter	Test conditions <sup>(1)</sup>	Min.	Typ.	Max.	Unit
$t_{PLH}$ $t_{PHL}$	Propagation delay input to output	$R_{DIFF} = 54\Omega$ , $C_{L1} = C_{L2} = 100pF$ (see <a href="#">Figure 4</a> and <a href="#">Figure 6</a> )	10	30	60	ns
$t_{SK}$	Output skew to output	$R_{DIFF} = 54\Omega$ , $C_{L1} = C_{L2} = 100pF$ (see <a href="#">Figure 4</a> and <a href="#">Figure 6</a> )		5	10	ns
$t_{TLH}$ $t_{THL}$	Rise or fall time	$R_{DIFF} = 54\Omega$ , $C_{L1} = C_{L2} = 100pF$ (see <a href="#">Figure 4</a> and <a href="#">Figure 6</a> )	3	15	40	ns
$t_{PZH}$	Output enable time	$C_L = 100pF$ , $S2 = Closed$ (see <a href="#">Figure 5</a> and <a href="#">Figure 7</a> )		70	90	ns
$t_{PZL}$	Output enable time	$C_L = 100pF$ , $S1 = Closed$ (see <a href="#">Figure 5</a> and <a href="#">Figure 7</a> )		70	90	ns
$t_{PLZ}$	Output disable time	$C_L = 15pF$ , $S1 = Closed$ (see <a href="#">Figure 5</a> and <a href="#">Figure 7</a> )		70	90	ns
$t_{PHZ}$	Output disable time	$C_L = 15pF$ , $S2 = Closed$ (see <a href="#">Figure 5</a> and <a href="#">Figure 7</a> )		70	90	ns
$C_{AB}$	Output AB capacitance			43		pF

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 9. Receiver switching characteristics**

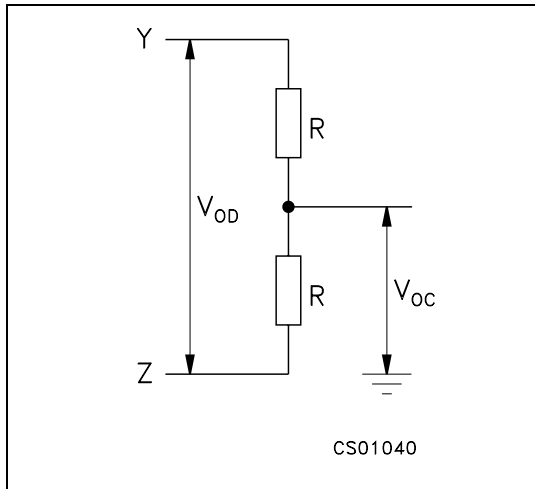
Symbol	Parameter	Test conditions <sup>(1)</sup>	Min.	Typ.	Max.	Unit
$t_{PLH}$ $t_{PHL}$	Propagation delay input to output	$R_{DIFF} = 54\Omega$ , $C_{L1} = C_{L2} = 100\text{pF}$ (see <a href="#">Figure 4</a> and <a href="#">Figure 8</a> )	20	130	210	ns
$t_{SKD}$	Differential receiver skew	$R_{DIFF} = 54\Omega$ , $C_{L1} = C_{L2} = 100\text{pF}$ (see <a href="#">Figure 4</a> and <a href="#">Figure 8</a> )		13		ns
$t_{PZH}$	Output enable time	$C_{RL} = 15\text{pF}$ , S1 = Closed (see <a href="#">Figure 2</a> and <a href="#">Figure 9</a> )		20	50	ns
$t_{PZL}$	Output enable time	$C_{RL} = 15\text{pF}$ , S2 = Closed (see <a href="#">Figure 2</a> and <a href="#">Figure 9</a> )		20	50	ns
$t_{PLZ}$	Output disable time	$C_{RL} = 15\text{pF}$ , S1 = Closed (see <a href="#">Figure 2</a> and <a href="#">Figure 9</a> )		20	50	ns
$t_{PHZ}$	Output disable time	$C_{RL} = 15\text{pF}$ , S2 = Closed (see <a href="#">Figure 2</a> and <a href="#">Figure 9</a> )		20	50	ns
$f_{MAX}$	Maximum data rate		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

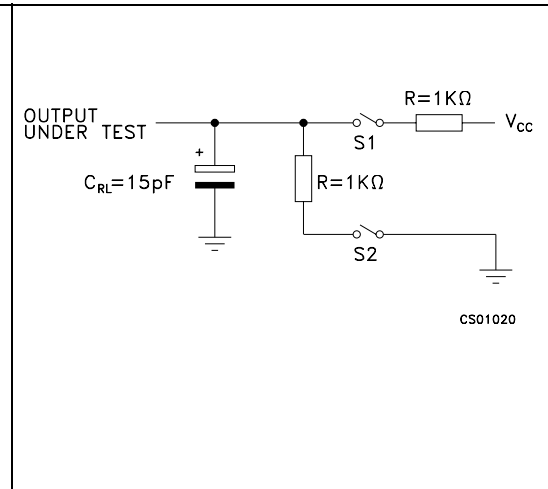


# 5 Test circuit and typical characteristics

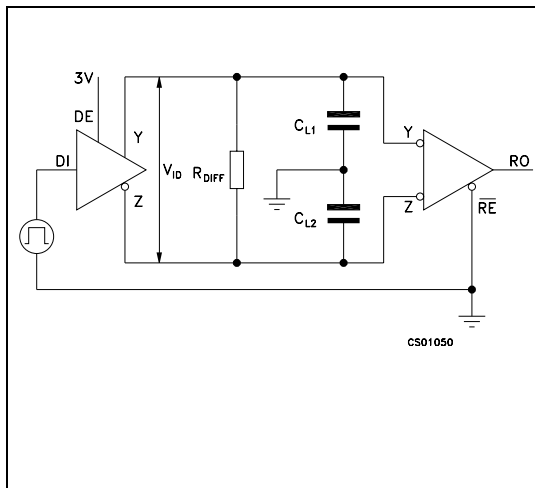
**Figure 2. Driver DC test load**



**Figure 3. Receiver timing test load**



**Figure 4. Drive/receiver timing test circuit**



**Figure 5. Driver timing test load**

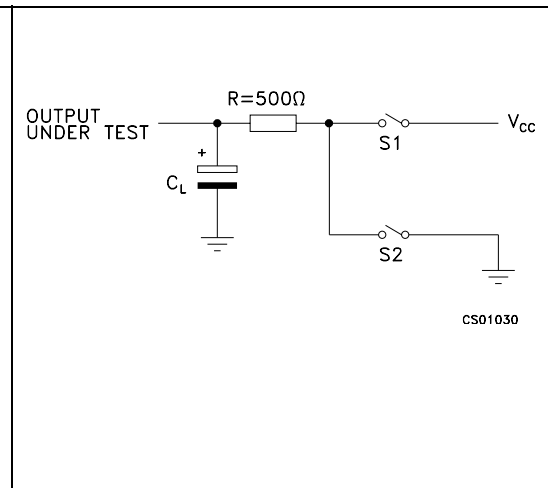


Figure 6. Driver propagation delay

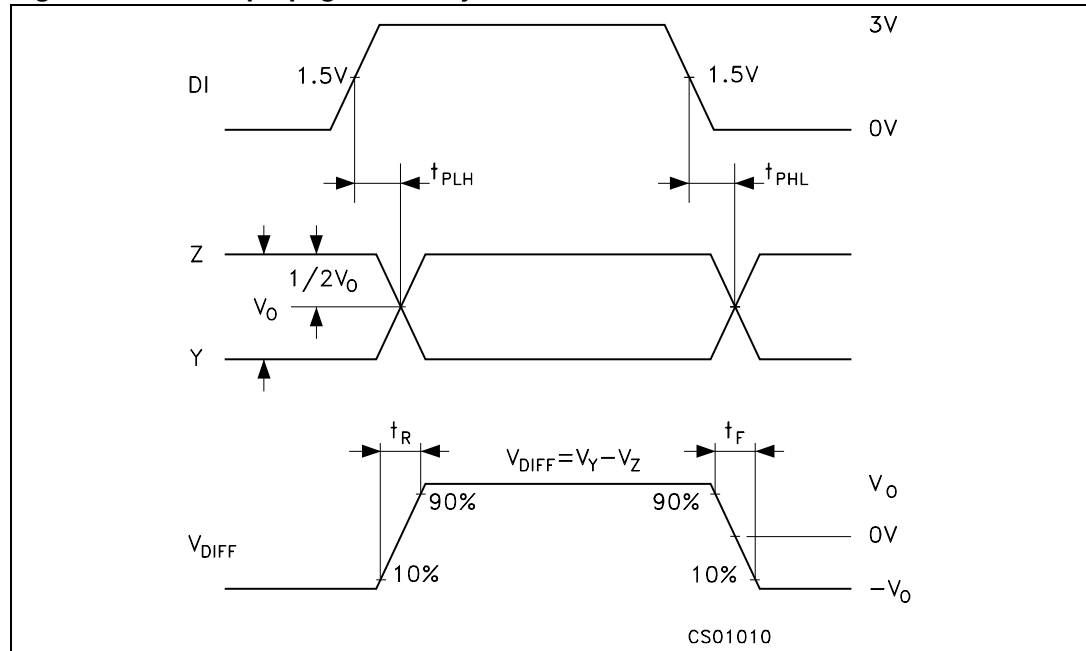
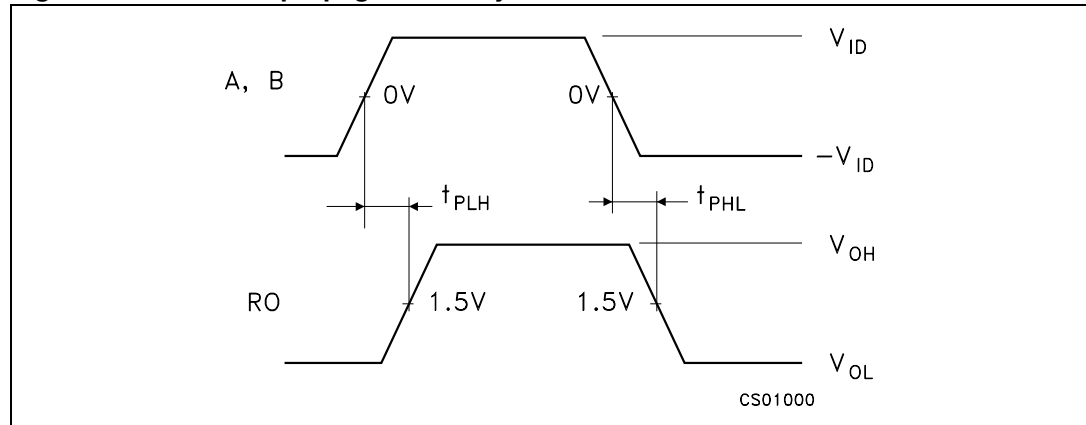


Figure 7. Driver enable and disable time



**Figure 8. Receiver propagation delay**



**Figure 9. Receiver enable and disable time**

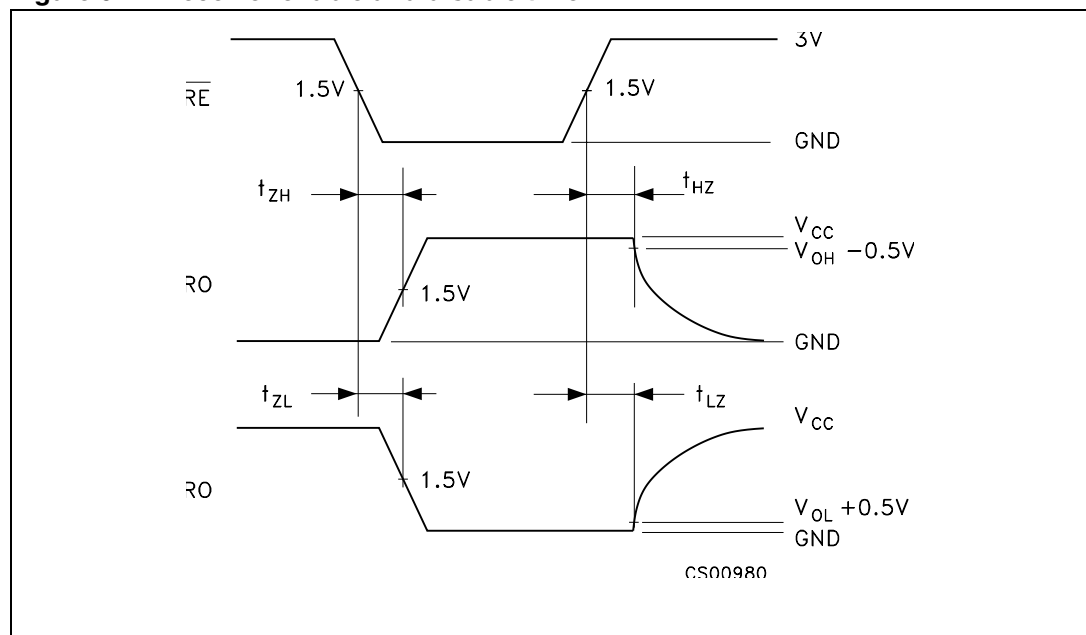


Figure 10. Receiver output current vs. output low voltage



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

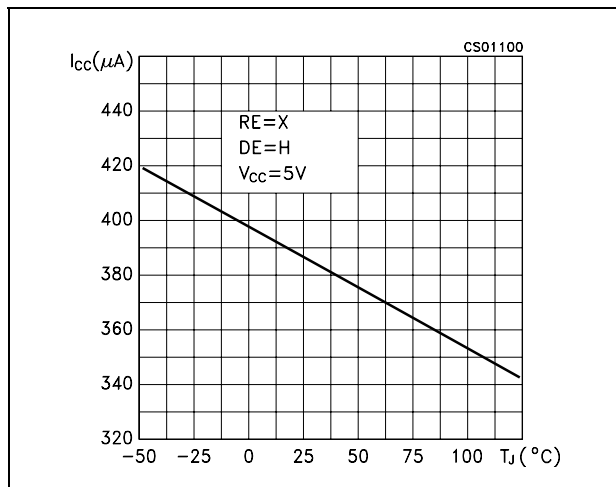


Figure 15. Receiver high level output voltage vs. temperature

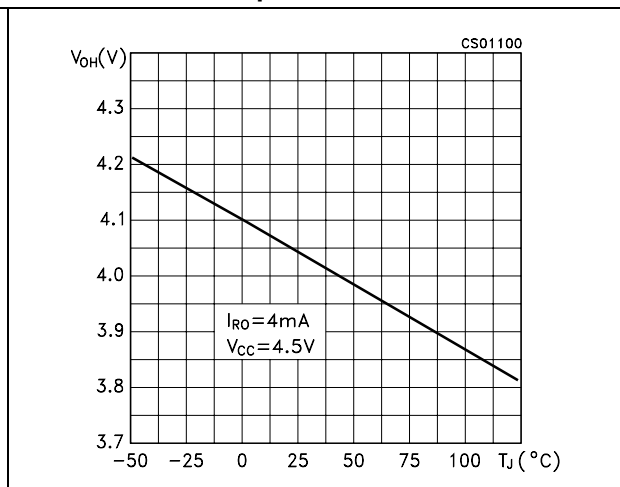


Figure 16. Receiver low level output voltage vs. temperature



Figure 17. Differential driver output voltage vs. temperature

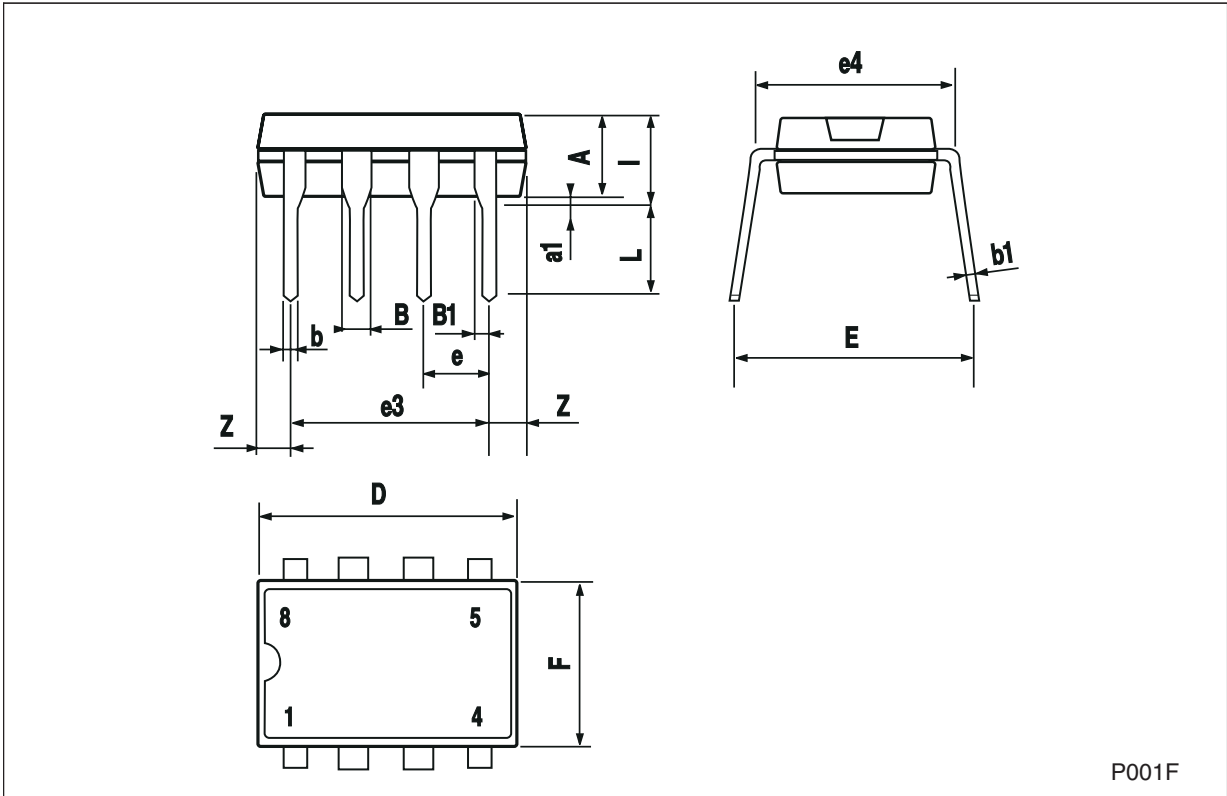


## 6 Package mechanical data

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](http://www.st.com). ECOPACK is an ST trademark.

**Plastic DIP-8 mechanical data**

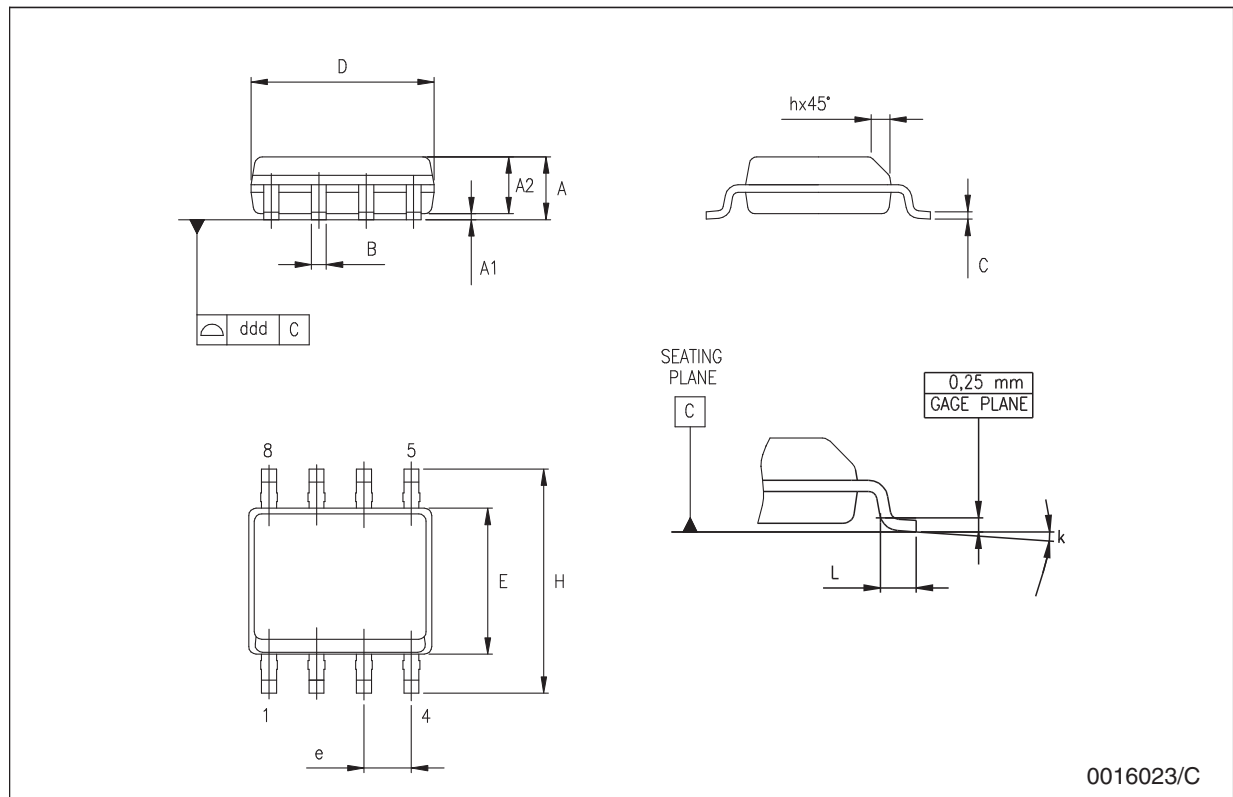
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A		3.3			0.130	
a1	0.7			0.028		
B	1.39		1.65	0.055		0.065
B1	0.91		1.04	0.036		0.041
b		0.5			0.020	
b1	0.38		0.5	0.015		0.020
D			9.8			0.386
E		8.8			0.346	
e		2.54			0.100	
e3		7.62			0.300	
e4		7.62			0.300	
F			7.1			0.280
I			4.8			0.189
L		3.3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



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





**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 10. Document revision history**

Date	Revision	Changes
21-Mar-2006	3	Order codes has been updated and new template.
01-Aug-2006	4	Mistake in cover page description 300 mA ==> 300 µA.
25-Oct-2006	5	Order codes updated.
02-Dec-2008	6	Modified: device name <i>Table 1 on page 1</i> .
16-Feb-2008	7	Modified <i>Note: on page 5</i> .

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