

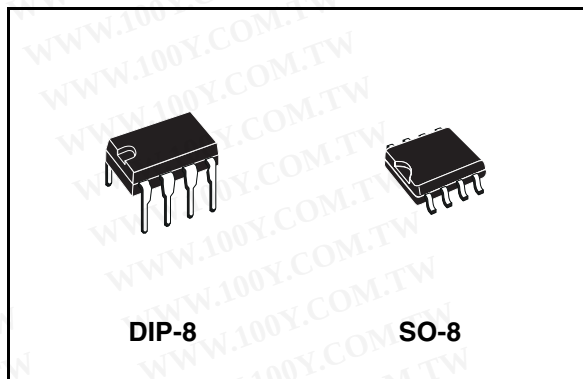


ST485ERB

±15 kV ESD protected, 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
- 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 ± 15 kV electrostatic discharge (HBM) ± 8 kV (IEC-1000-4-2 contact discharge) shocks, without latch-up. These parts contain 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.

Table 1. Device summary

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

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1Pin settings

Figure 1. Pin configuration

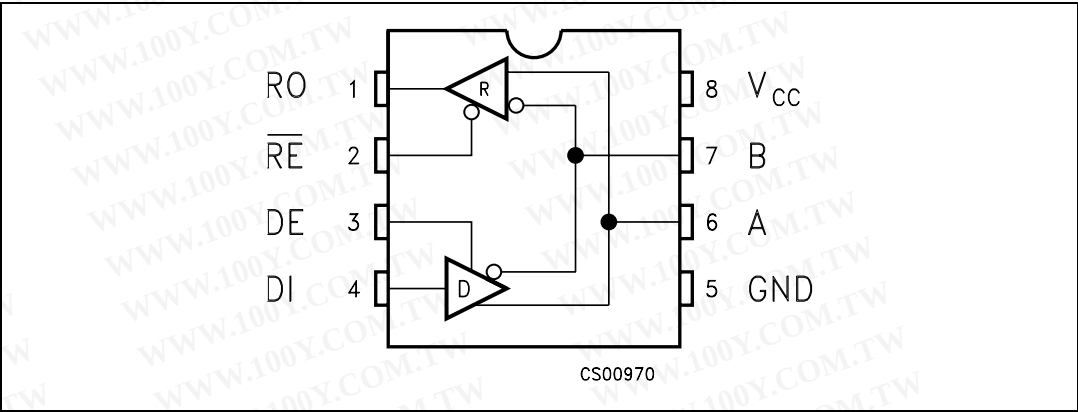


Table 2. Pin description

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 _{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			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)	± 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. 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 $T_A = 25\text{ }^{\circ}\text{C}$

Table 7. DC electrical characteristics

Symbol	Parameter	Test conditions ⁽¹⁾	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
ΔV_{OD}	Change in magnitude of driver differential output voltage for complementary output states	$R_L = 27\Omega$ or 50Ω (<i>Figure 2</i>)			0.2	V
V_{OC}	Driver common-mode output voltage	$R_L = 27\Omega$ or 50Ω (<i>Figure 2</i>)			3	V
ΔV_{OC}	Change in magnitude of driver common-mode output voltage for complementary output states	$R_L = 27\Omega$ or 50Ω (<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 5.25V , $V_{DE} = 0\text{V}$ $V_{IN} = 12\text{V}$ $V_{IN} = -7\text{V}$			1 -0.8	mA mA
V_{TH}	Receiver differential threshold voltage	$V_{CM} = -7$ to 12V	-0.2		0.2	V
ΔV_{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 2.4V			± 1	μA
R_{IN}	Receiver input resistance	$V_{CM} = -7$ to 12V	24			kΩ

Table 7. DC electrical characteristics (continued)

Symbol	Parameter	Test conditions ⁽¹⁾	Min.	Typ.	Max.	Unit
I_{CC}	No load supply current ⁽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, $V_O = \text{High}$	$V_O = -7$ to $12V$ ⁽³⁾	35		250	mA
I_{OSD2}	Driver short-circuit current, $V_O = \text{Low}$	$V_O = -7$ to $12V$ ⁽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 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.

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

Table 8. Driver switching characteristics

Symbol	Parameter	Test conditions ⁽¹⁾	Min.	Typ.	Max.	Unit
t_{PLH} t_{PHL}	Propagation delay input to output	$R_{DIFF} = 54\Omega$, $C_{L1} = C_{L2} = 100pF$ (see Figure 4 and Figure 6)	10	30	60	ns
t_{SK}	Output skew to output	$R_{DIFF} = 54\Omega$, $C_{L1} = C_{L2} = 100pF$ (see Figure 4 and Figure 6)		5	10	ns
t_{TLH} t_{THL}	Rise or fall time	$R_{DIFF} = 54\Omega$, $C_{L1} = C_{L2} = 100pF$ (see Figure 4 and Figure 6)	3	15	40	ns
t_{PZH}	Output enable time	$C_L = 100pF$, $S2 = \text{Closed}$ (see Figure 5 and Figure 7)		70	90	ns
t_{PZL}	Output enable time	$C_L = 100pF$, $S1 = \text{Closed}$ (see Figure 5 and Figure 7)		70	90	ns
t_{PLZ}	Output disable time	$C_L = 15pF$, $S1 = \text{Closed}$ (see Figure 5 and Figure 7)		70	90	ns
t_{PHZ}	Output disable time	$C_L = 15pF$, $S2 = \text{Closed}$ (see Figure 5 and Figure 7)		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 ⁽¹⁾	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 Figure 4 and Figure 8)	20	130	210	ns
t_{SKD}	Differential receiver skew	$R_{DIFF} = 54\Omega$, $C_{L1} = C_{L2} = 100\text{pF}$ (see Figure 4 and Figure 8)		13		ns
t_{PZH}	Output enable time	$C_{RL} = 15\text{pF}$, S1 = Closed (see Figure 2 and Figure 9)		20	50	ns
t_{PZL}	Output enable time	$C_{RL} = 15\text{pF}$, S2 = Closed (see Figure 2 and Figure 9)		20	50	ns
t_{PLZ}	Output disable time	$C_{RL} = 15\text{pF}$, S1 = Closed (see Figure 2 and Figure 9)		20	50	ns
t_{PHZ}	Output disable time	$C_{RL} = 15\text{pF}$, S2 = Closed (see Figure 2 and Figure 9)		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

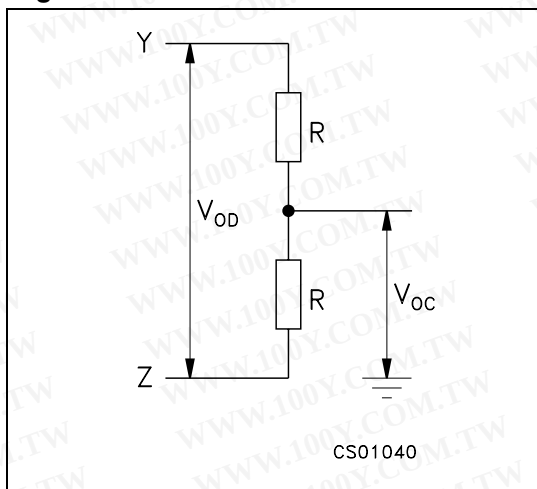


Figure 3. Receiver timing test load

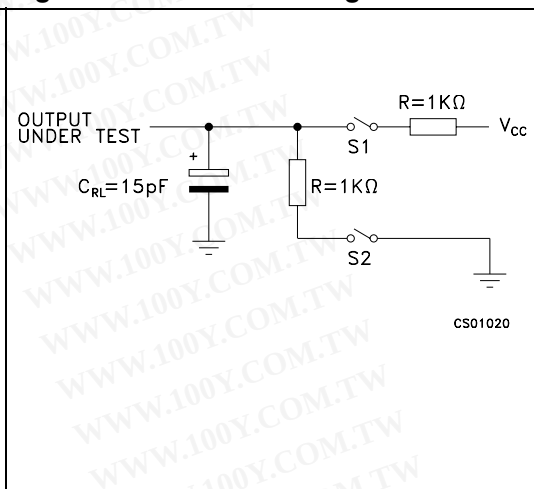


Figure 4. Drive/receiver timing test circuit

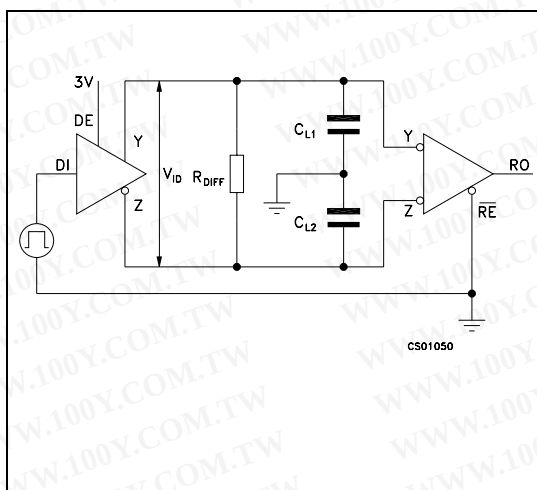


Figure 5. Driver timing test load

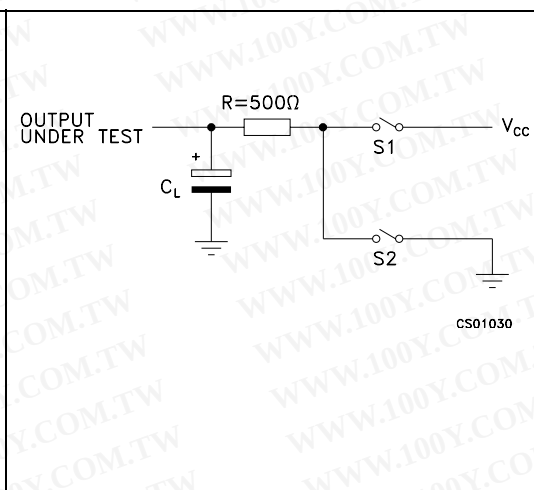


Figure 6. Driver propagation delay

The diagram illustrates the driver propagation delay for a differential signal. It shows the relationship between the input signal DI , the output signals Z and Y , the differential voltage V_{DIFF} , and the output voltage V_O .

- DI (Input):** A square wave signal that transitions between 0V and 1.5V. The transition time is marked as t_{PLH} (propagation delay low-to-high) and t_{PHL} (propagation delay high-to-low).
- Z and Y (Outputs):** Differential signals that transition between V_O and $-V_O$. The transition time is marked as t_R (rise time) and t_F (fall time).
- V_{DIFF} (Differential Voltage):** A signal that transitions between $V_{DIFF} = V_Y - V_Z$ and 0V. The transition time is marked as t_{PLH} and t_{PHL} .
- V_O (Output Voltage):** A signal that transitions between V_O and $-V_O$. The transition time is marked as t_R and t_F .

The diagram also shows the relationship between the input signal DI and the output signals Z and Y . The input signal DI is shown as a square wave with a high level of 1.5V and a low level of 0V. The output signals Z and Y are shown as differential signals that transition between V_O and $-V_O$. The transition time is marked as t_R and t_F .

The diagram also shows the relationship between the input signal DI and the differential voltage V_{DIFF} . The input signal DI is shown as a square wave with a high level of 1.5V and a low level of 0V. The differential voltage V_{DIFF} is shown as a signal that transitions between $V_{DIFF} = V_Y - V_Z$ and 0V. The transition time is marked as t_{PLH} and t_{PHL} .

The diagram also shows the relationship between the input signal DI and the output voltage V_O . The input signal DI is shown as a square wave with a high level of 1.5V and a low level of 0V. The output voltage V_O is shown as a signal that transitions between V_O and $-V_O$. The transition time is marked as t_R and t_F .

CS01010

Timing diagram for CS00990 showing signals DE, Y, Z, and X, Z. The diagram illustrates the relationship between the data enable signal (DE) and the data outputs (Y, Z and X, Z). DE is a square wave with a high level of 1.5V and a low level of GND. The data outputs Y, Z and X, Z are shown as a single signal that transitions from a high level ($V_{OH} - 0.5V$) to a low level ($V_{OL} + 0.5V$) when DE is high. The transition times are labeled t_{ZH} , t_{ZL} , t_{LH} , and t_{LZ} . The signal levels are 3V, 1.5V, 2.3V, GND, $V_{OH} - 0.5V$, $V_{OL} + 0.5V$, and V_{CC} .

Figure 8. Receiver propagation delay

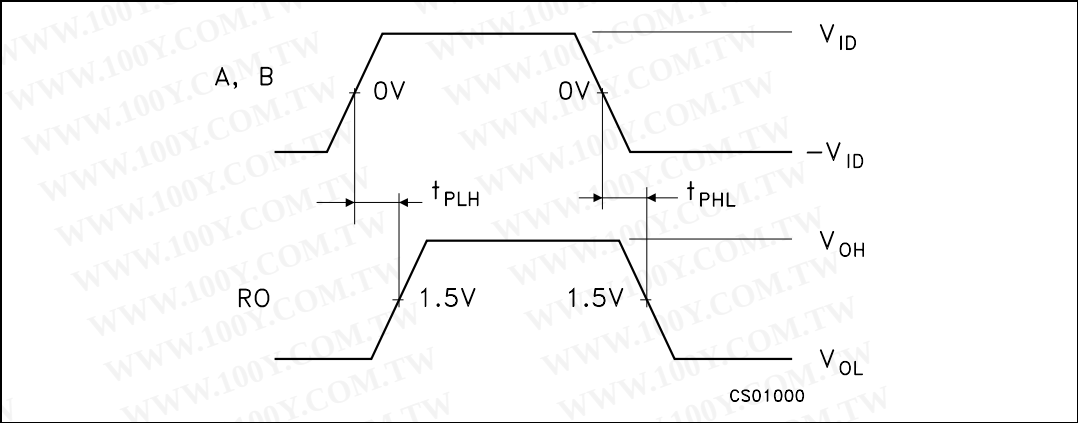


Figure 9. Receiver enable and disable time

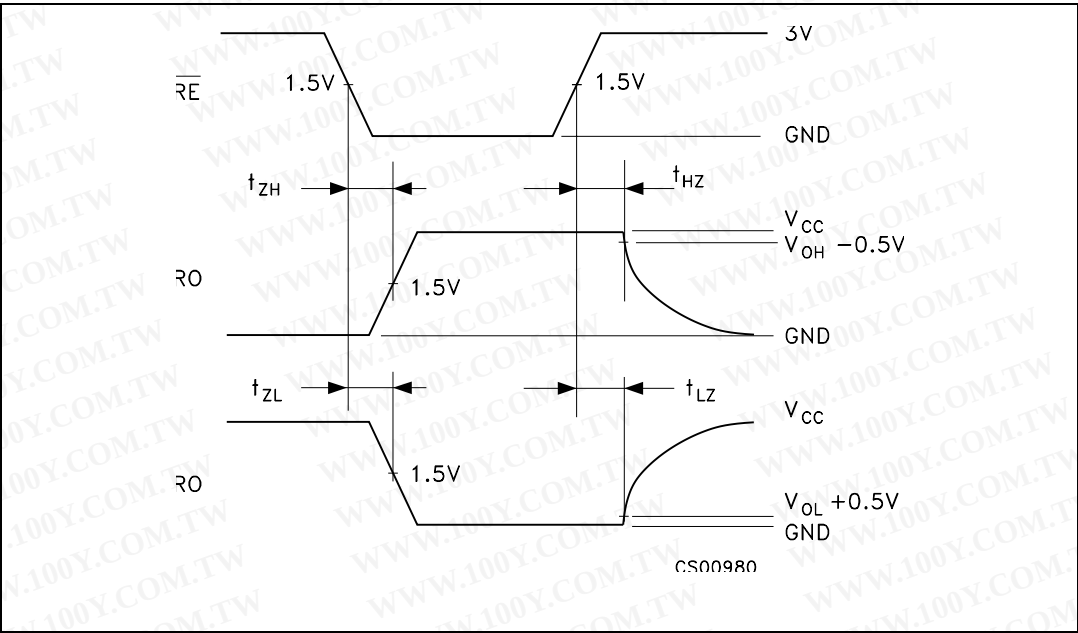


Figure 10. Receiver output current vs. output low voltage

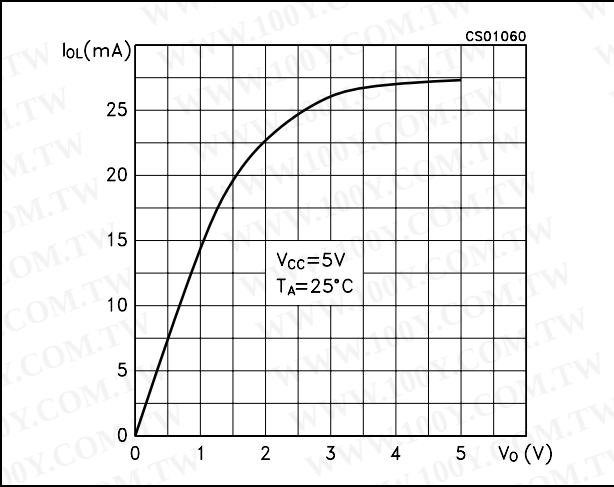


Figure 11. Receiver output current vs. output high voltage

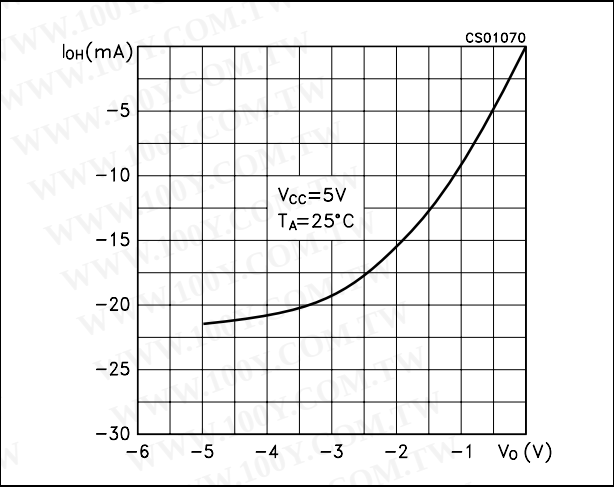


Figure 12. Driver output current vs. output low voltage

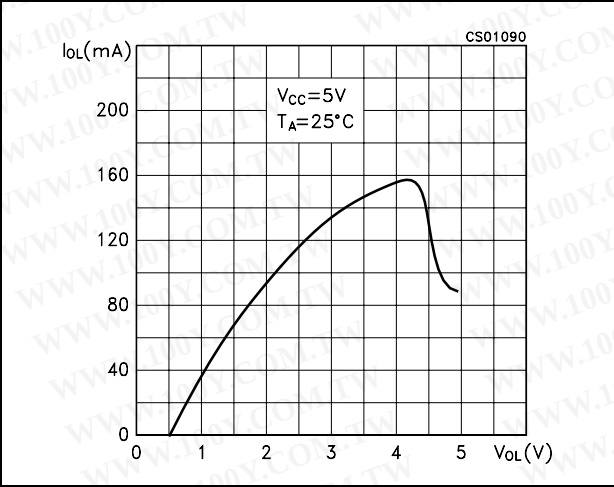


Figure 13. Driver output current vs. output high voltage

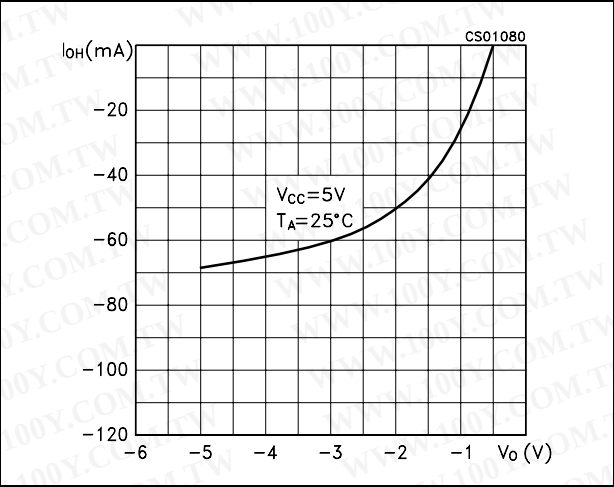


Figure 14. Supply current vs. temperature

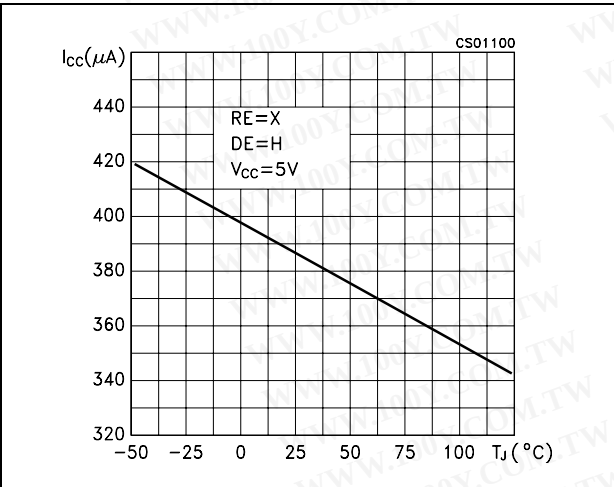


Figure 15. Receiver high level output voltage vs. temperature

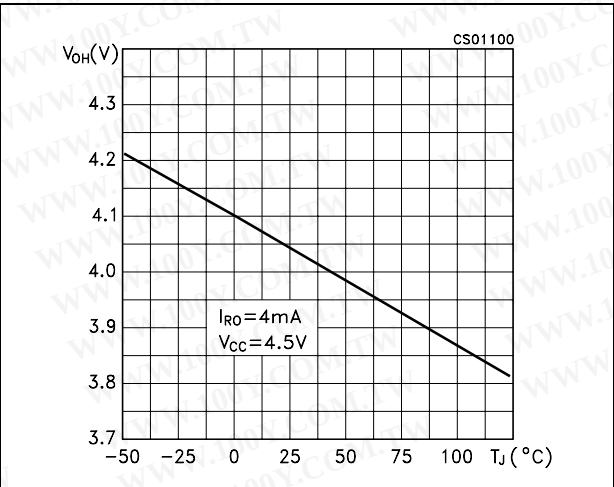


Figure 16. Receiver low level output voltage vs. temperature

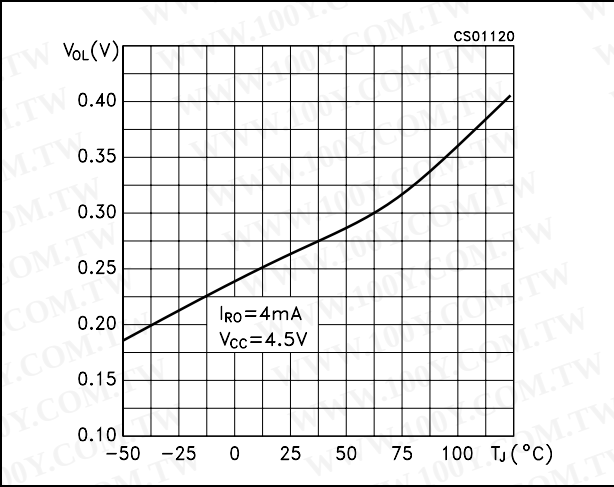
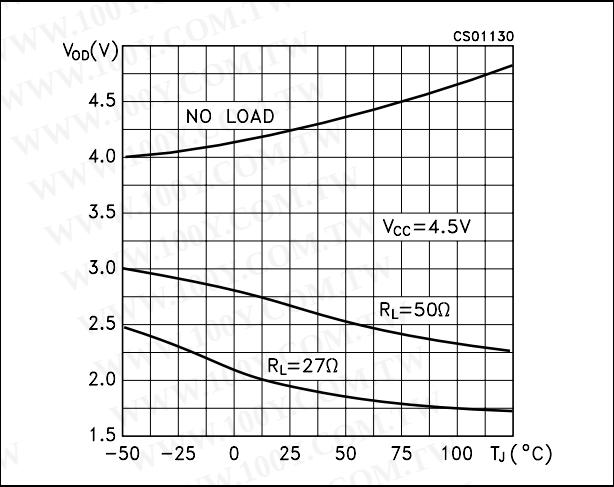


Figure 17. Differential driver output voltage vs. temperature

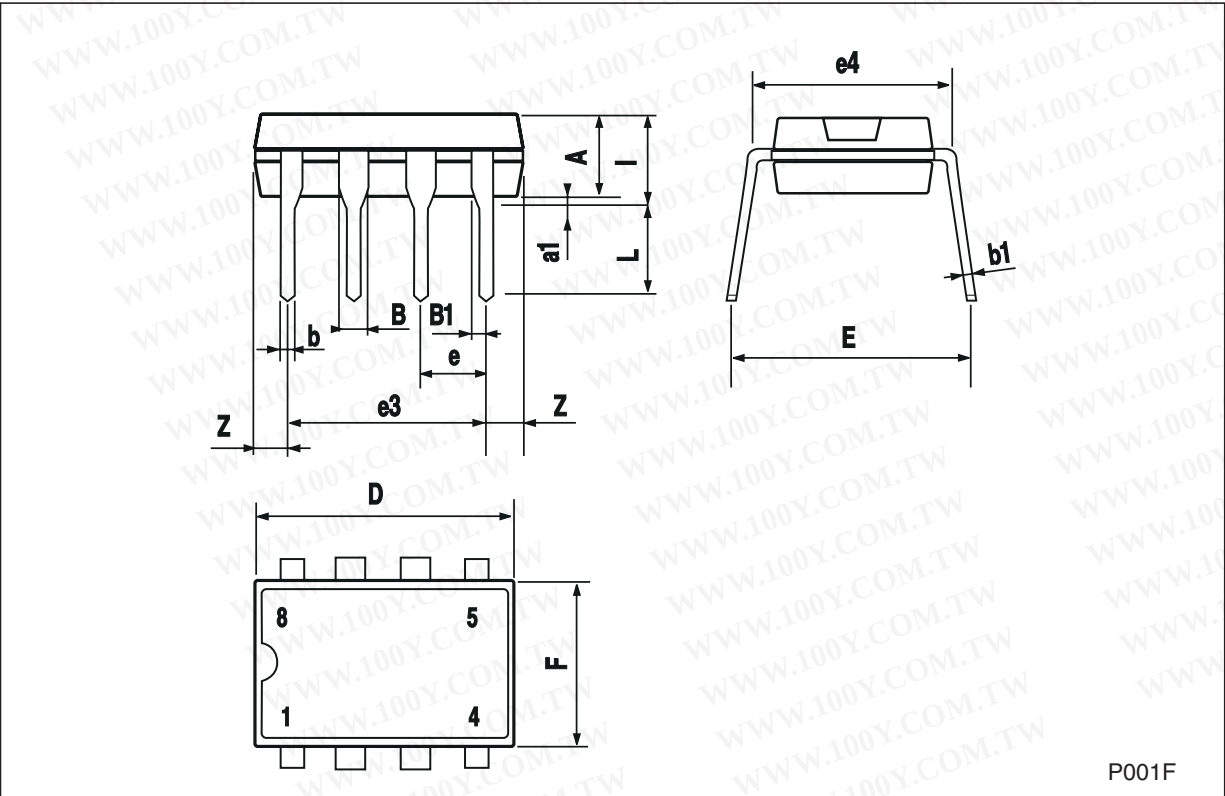


6 Package mechanical data

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.

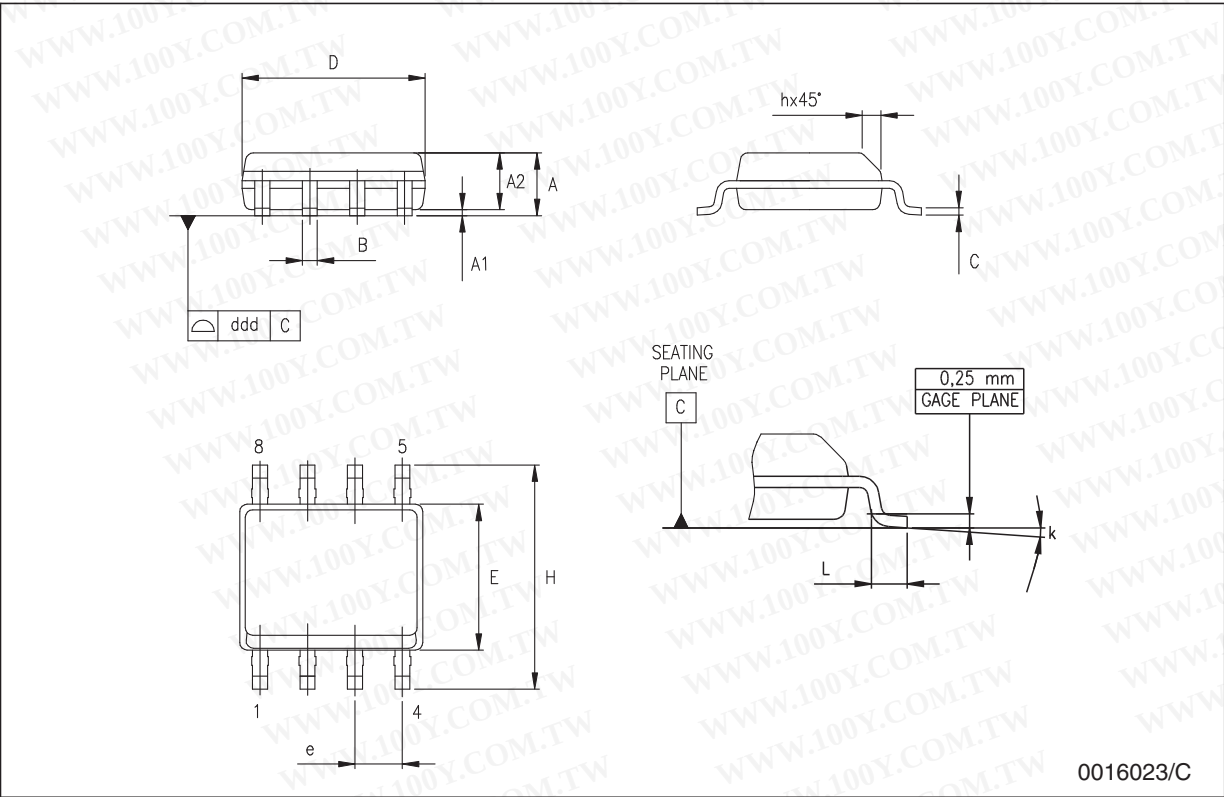
Plastic DIP-8 mechanical data

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



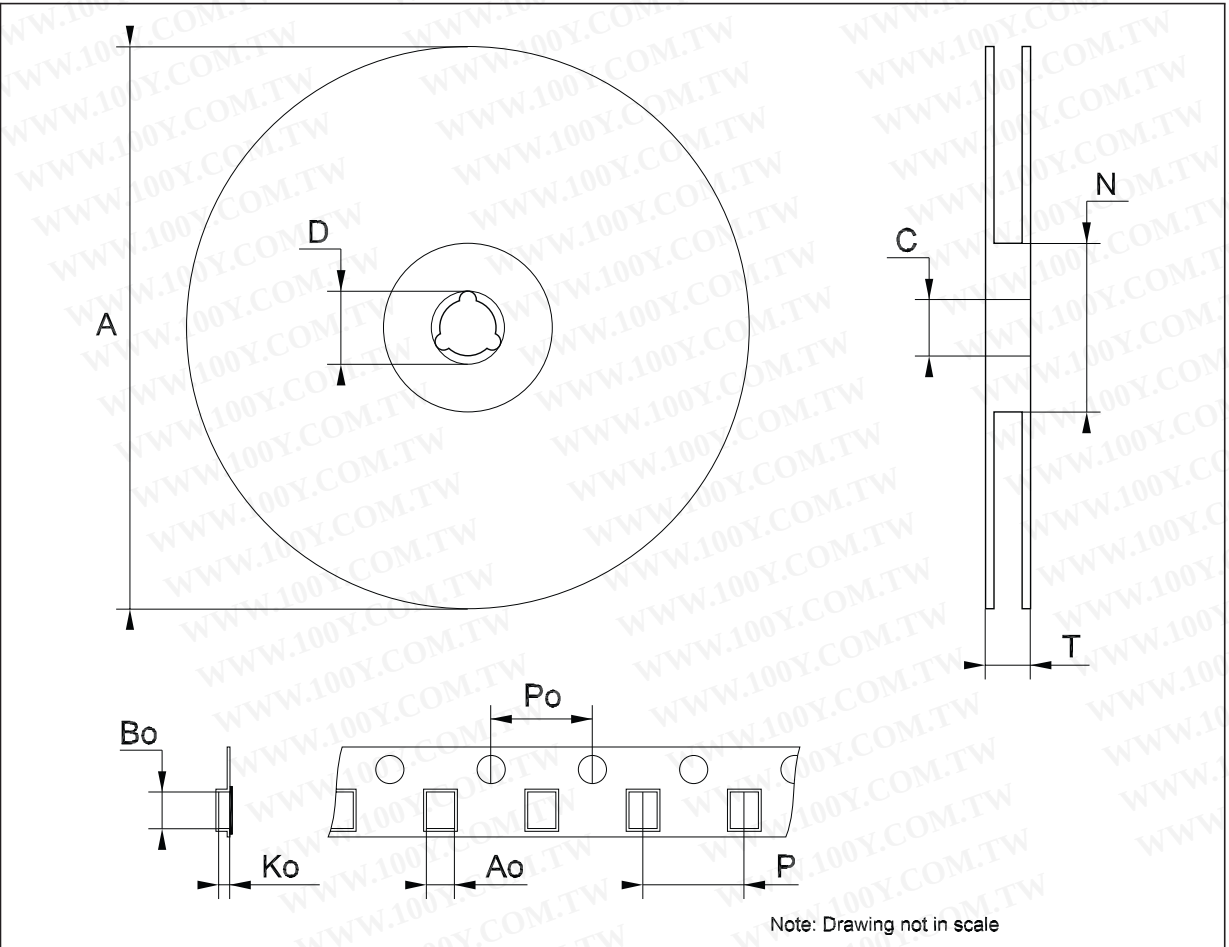
SO-8 mechanical data

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 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 μ A.
25-Oct-2006	5	Order codes updated.
02-Dec-2008	6	Modified: device name Table 1 on page 1 .
16-Feb-2008	7	Modified Note: on page 5 .

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