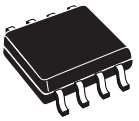
ST485EB
ST485EC - ST485EX

±15 kV ESD protected, 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
- Operates 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



SO-8

Driver is short-circuit current limited and is protected against excessive power dissipation by thermal shutdown circuitry that place the driver outputs into a high-impedance state.

The ST485E is designed for bi-directional data communications on multipoint bus transmission lines (half-duplex applications).

Description

The ST485E 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) (ESD) shocks, without latch-up. These parts contain one driver and one receiver in half duplex configuration.

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

It operates from a single 5 V supply.

Table 1. Device summary

Order codes	Temperature range	Package	Packaging
ST485EBD	- 40 to 85 °C	SO-8 (tube)	100 parts per tube / 20 tube per box
ST485ECDR	0 to 70 °C	SO-8 (tape and reel)	2500 parts per reel
ST485EBDR	- 40 to 85 °C	SO-8 (tape and reel)	2500 parts per reel
ST485EXDR	- 55 to 125 °C	SO-8 (tape and reel)	2500 parts per reel

Contents

1 Pin configuration

Figure 1. Pin connections (top view)

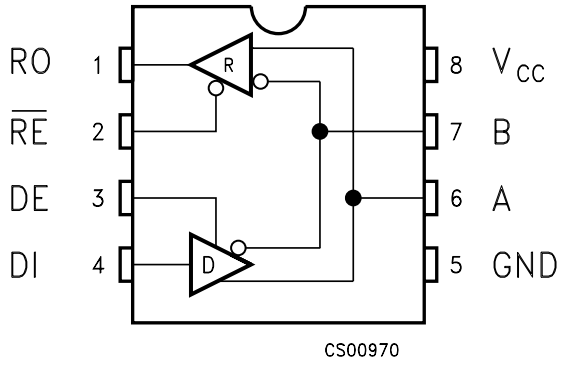


Table 2. Pin description

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	
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 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 V ± 5 %, T_A = T_{MIN} to T_{MAX}, unless otherwise specified. Typical values are referred to T_A = 25 °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 Ω (RS-485) (*Figure 2*) R_L = 50 Ω (RS-422) (*Figure 2.*)	1.5		5 5	V V
ΔV_{OD}	Change in magnitude of driver differential output voltage for complementary output states	R_L = 27 Ω or 50 Ω (*Figure 2*)			0.2	V
V_{OC}	Driver common-mode output voltage	R_L = 27 Ω or 50 Ω (*Figure 2*)			3	V
ΔV_{OC}	Change in magnitude of driver common-mode output voltage for complementary output states	R_L = 27 Ω or 50 Ω (*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} = 0 V or 5.25 V, V_{DE} = 0 V V_{IN} = 12 V V_{IN} = -7 V			1 -0.8	mA mA
V_{TH}	Receiver differential threshold voltage	V_{CM} = -7 to 12 V	-0.2		0.2	V
ΔV_{TH}	Receiver input hysteresis	V_{CM} = 0 V		70		mV
V_{OH}	Receiver output high voltage	I_O = -4 mA, V_{ID} = 200 mV	3.5			V
V_{OL}	Receiver output low voltage	I_O = 4 mA, V_{ID} = -200 mV			0.4	V
I_{OZR}	3-State (high impedance) output current at receiver	V_O = 0.4 to 2.4 V			± 1	µA
R_{IN}	Receiver input resistance	V_{CM} = -7 to 12 V	96			kΩ
I_{CC}	No load supply current (2)	V_{RE} = 0V or V_{CC} V_{DE} = V_{CC} V_{DE} = 0 V		400 300	900 500	µA µA

Table 7. DC electrical characteristics (continued)

Symbol	Parameter	Test conditions (1)	Min.	Typ.	Max.	Unit
I_{OSD1}	Driver short-circuit current, V_O=High	V_O = -7 to 12 V (3)	35		250	mA
I_{OSD2}	Driver short-circuit current, V_O=Low	V_O = -7 to 12 V (3)	35		250	mA
I_{OSR}	Receiver short-circuit current	V_O = 0 V to V_{CC}	7		95	mA

1. All currents into device pins are positive; all 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 ± 5 %, T_A = T_{MIN} to T_{MAX}, unless otherwise specified. Typical values are referred to T_A = 25 °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 Ω, C_{L1} = C_{L2} = 100 pF (See *Figure 4* and *Figure 6*)		25	45	ns
t_{SK}	Output skew to output	R_{DIFF} = 54 Ω, C_{L1} = C_{L2} = 100 pF (See *Figure 4* and *Figure 6*)		2	5	ns
t_{TLH} t_{THL}	Rise or fall time	R_{DIFF} = 54 Ω, C_{L1} = C_{L2} = 100 pF (See *Figure 4* and *Figure 6*)		15	40	ns
t_{PZH}	Output enable time	C_L = 100 pF, S2 = Closed (See *Figure 5* and *Figure 7*)		35	50	ns
t_{PZL}	Output enable time	C_L = 100 pF, S1 = Closed (See *Figure 5* and *Figure 7*)		25	40	ns
t_{PLZ}	Output disable time	C_L = 15 pF, S1 = Closed (See *Figure 5* and *Figure 7*)		25	40	ns
t_{PHZ}	Output disable time	C_L = 15 pF, S2 = Closed (See *Figure 5* and *Figure 7*)		35	50	ns

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

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 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 Ω, C_{L1} = C_{L2} = 100 pF (See *Figure 4* and *Figure 8*)		110	130	ns
t_{SKD}	Differential receiver skew	R_{DIFF} = 54 Ω, C_{L1} = C_{L2} = 100 pF (See *Figure 4* and *Figure 8*)		5	10	ns
t_{PZH}	Output enable time	C_{RL} = 15 pF, S1 = Closed (See *Figure 2* and *Figure 9*)		11	35	ns
t_{PZL}	Output enable time	C_{RL} = 15 pF, S2 = Closed (See *Figure 2* and *Figure 9*)		13	35	ns
t_{PLZ}	Output disable time	C_{RL} = 15 pF, S1 = Closed (See *Figure 2* and *Figure 9*)		13	35	ns
t_{PHZ}	Output disable time	C_{RL} = 15 pF, S2 = Closed (See *Figure 2* and *Figure 9*)		11	35	ns
f_{MAX}	Maximum data rate		5			Mbps

1. All currents into device pins are positive; all 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

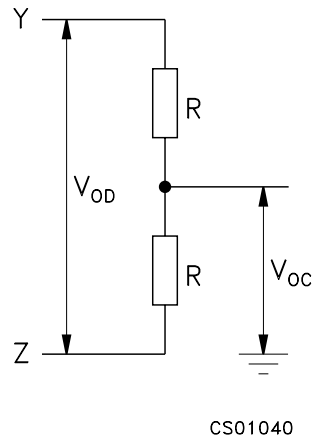


Figure 3. Receiver timing test load

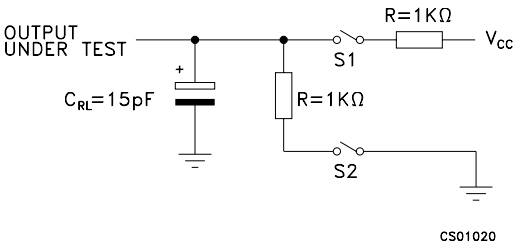


Figure 4. Drive/receiver timing test circuit

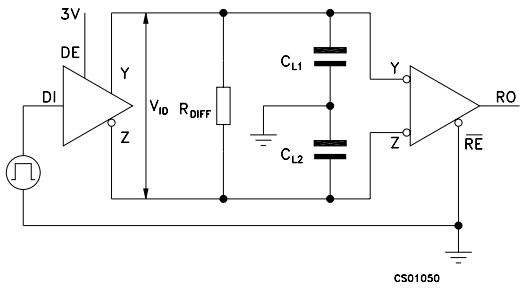


Figure 5. Driver timing test load

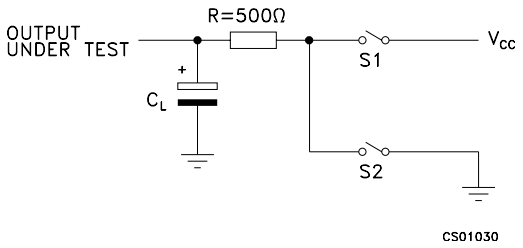


Figure 6. Driver propagation delay

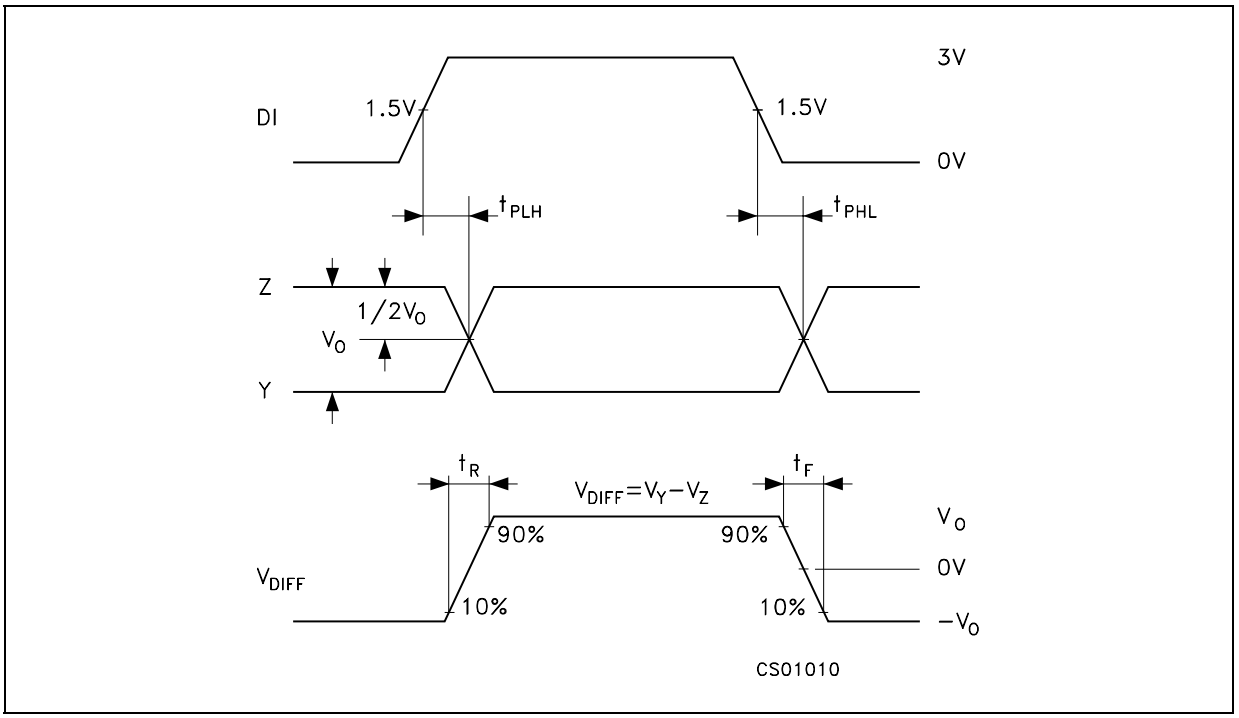


Figure 7. Driver enable and disable time

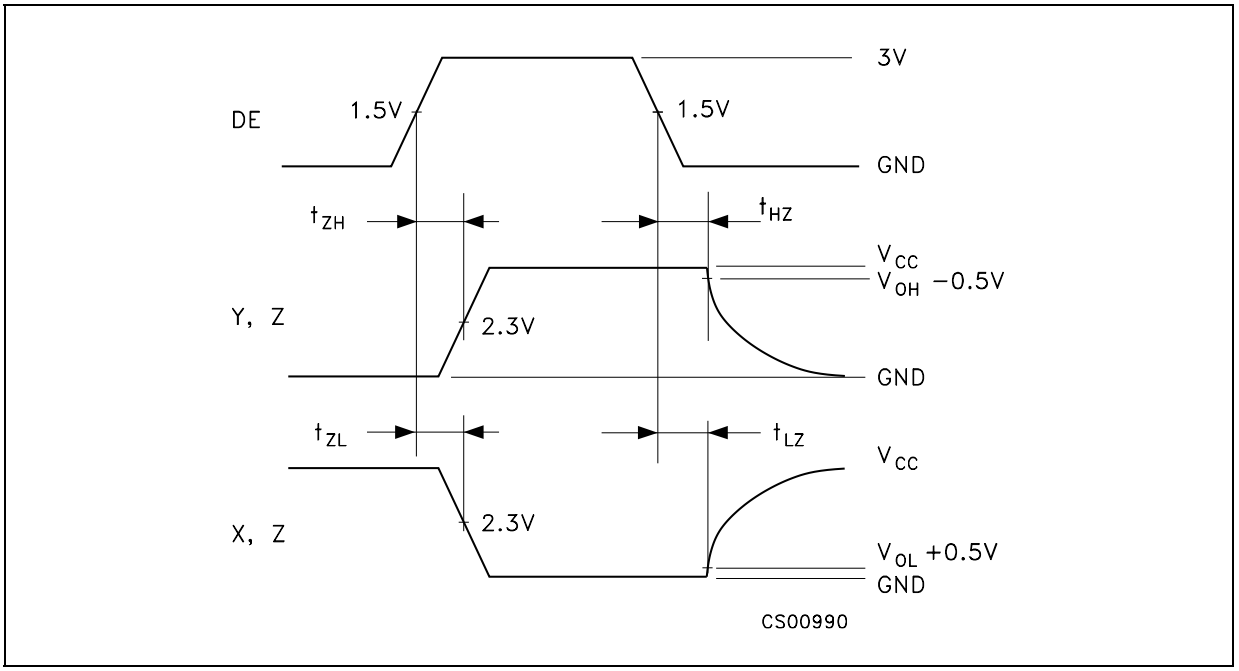


Figure 8. Receiver propagation delay

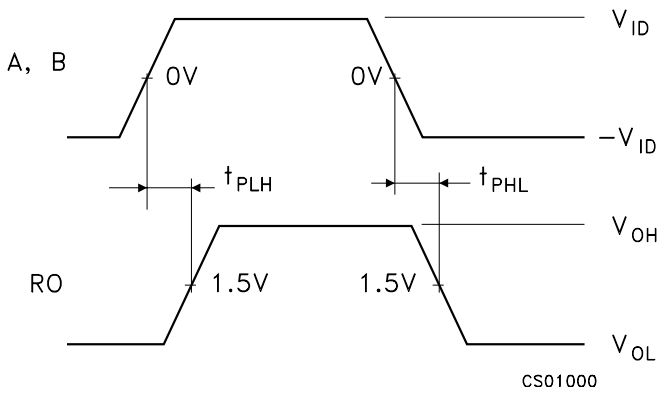


Figure 9. Receiver enable and disable time

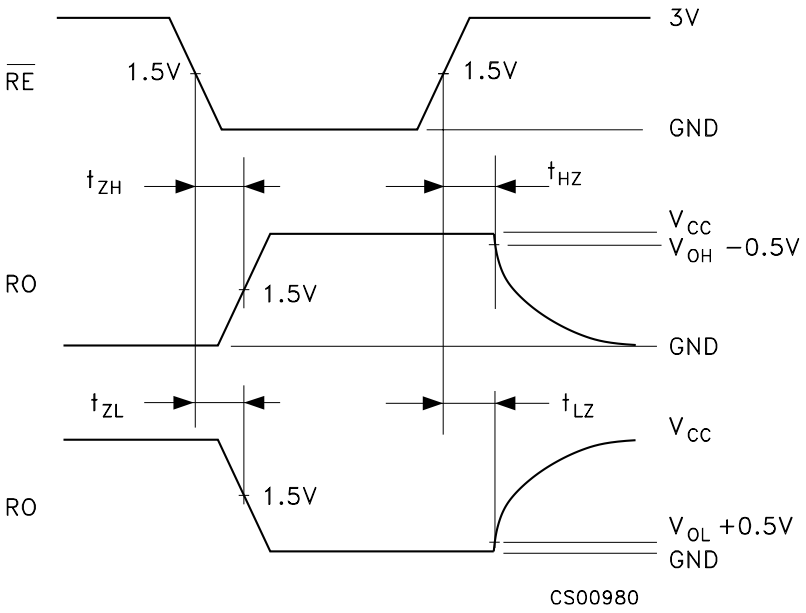


Figure 10. Receiver output current vs. output low voltage

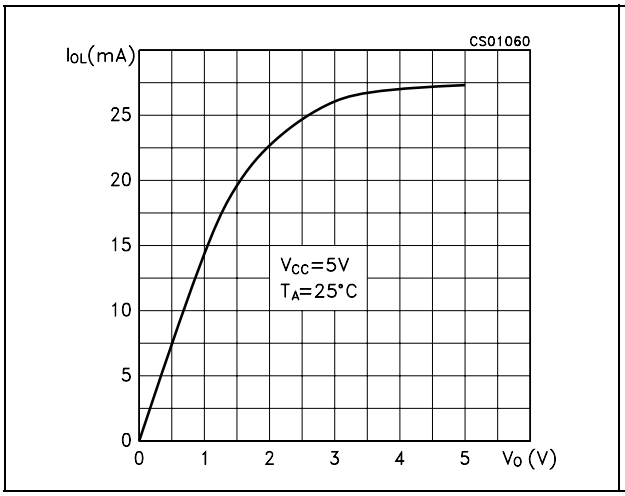


Figure 11. Receiver output current vs. output high voltage

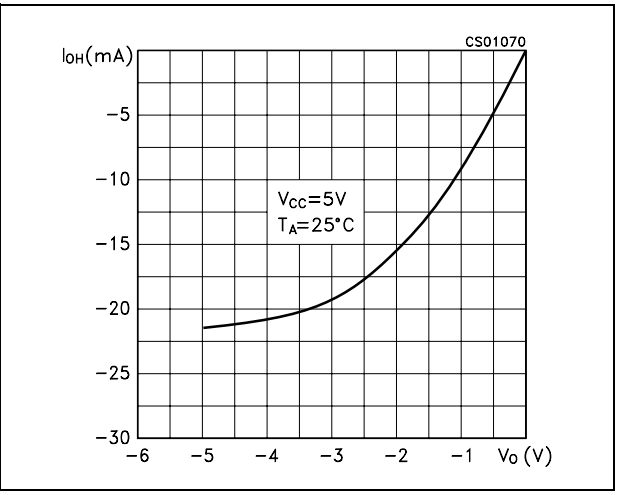


Figure 12. Driver output current vs. output low voltage

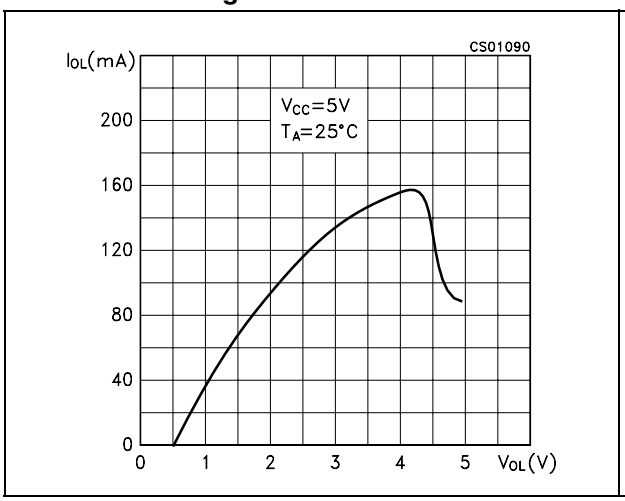


Figure 13. Driver output current vs. output high voltage

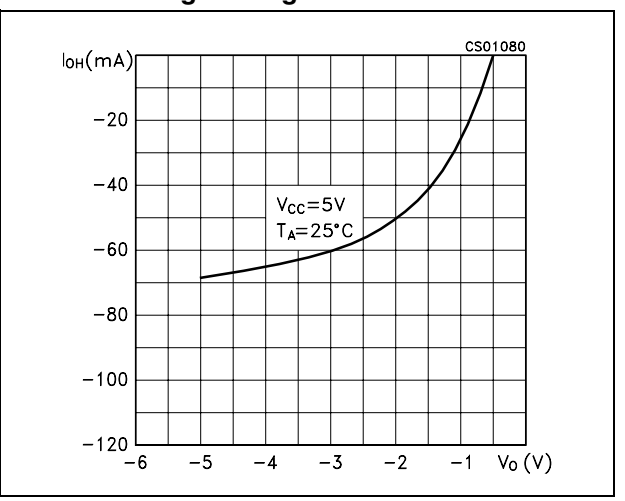


Figure 14. Supply current vs. temperature

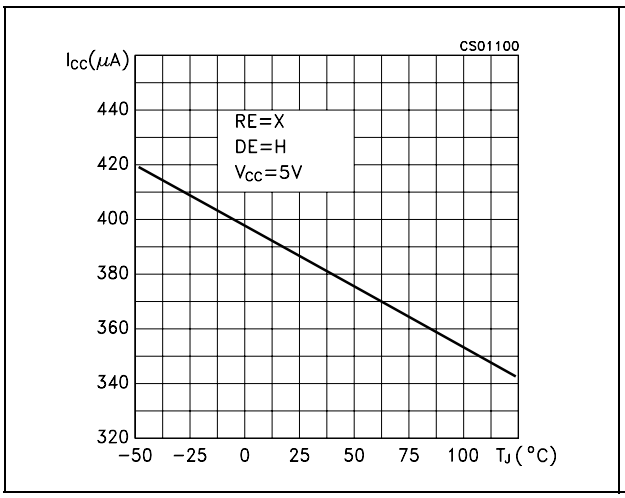


Figure 15. Receiver high level output voltage vs. temperature

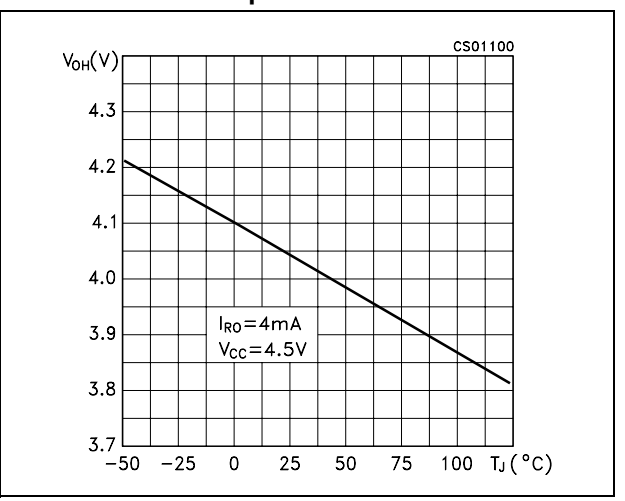


Figure 16. Receiver low level output voltage vs. temperature

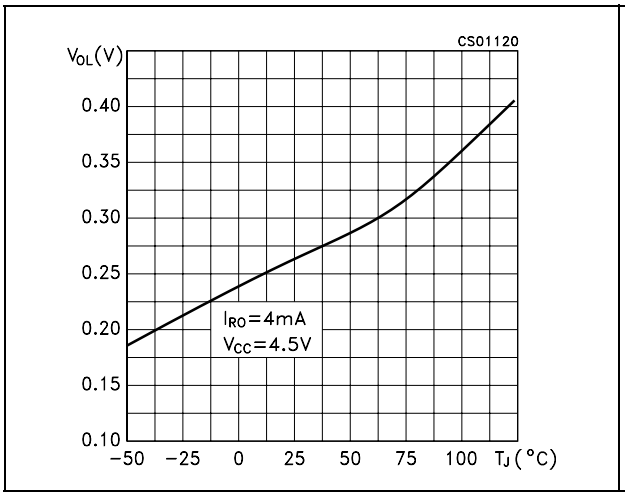
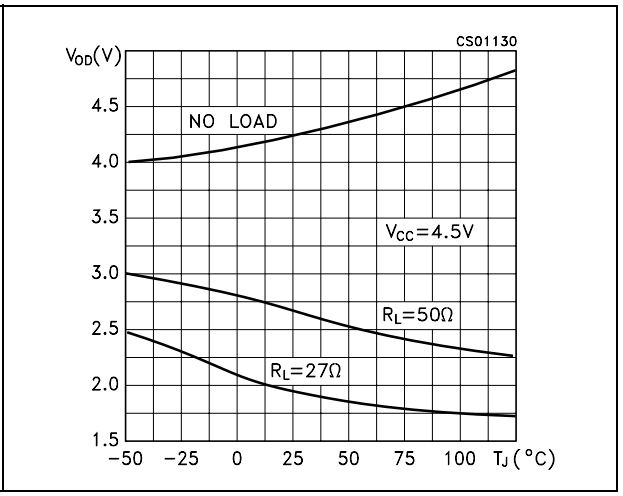


Figure 17. Differential driver output voltage vs. temperature

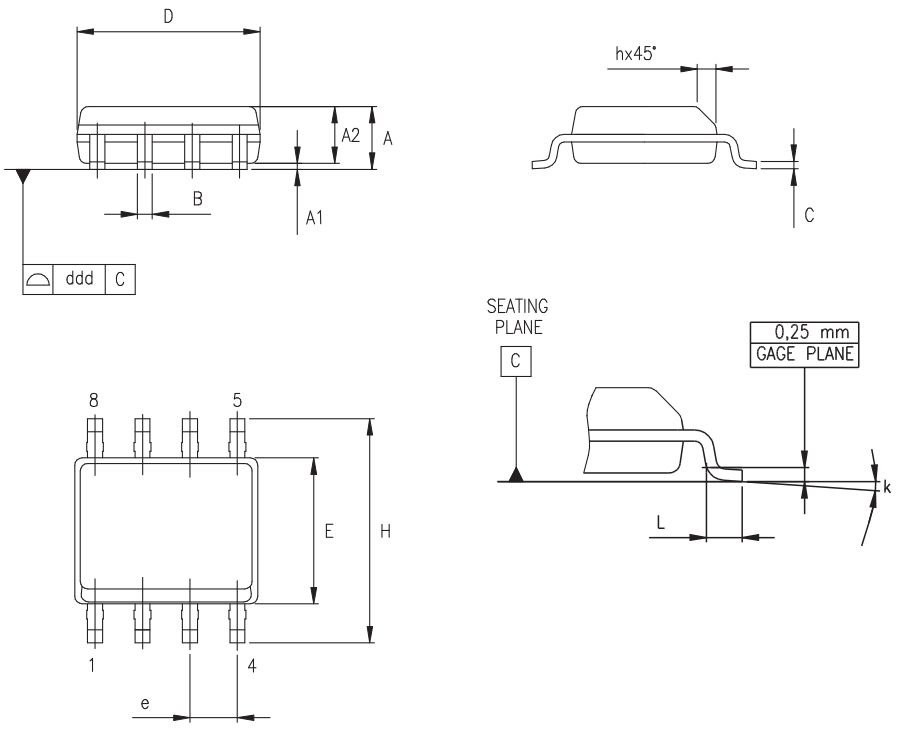


6 Package mechanical data

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.

SO-8 mechanical data

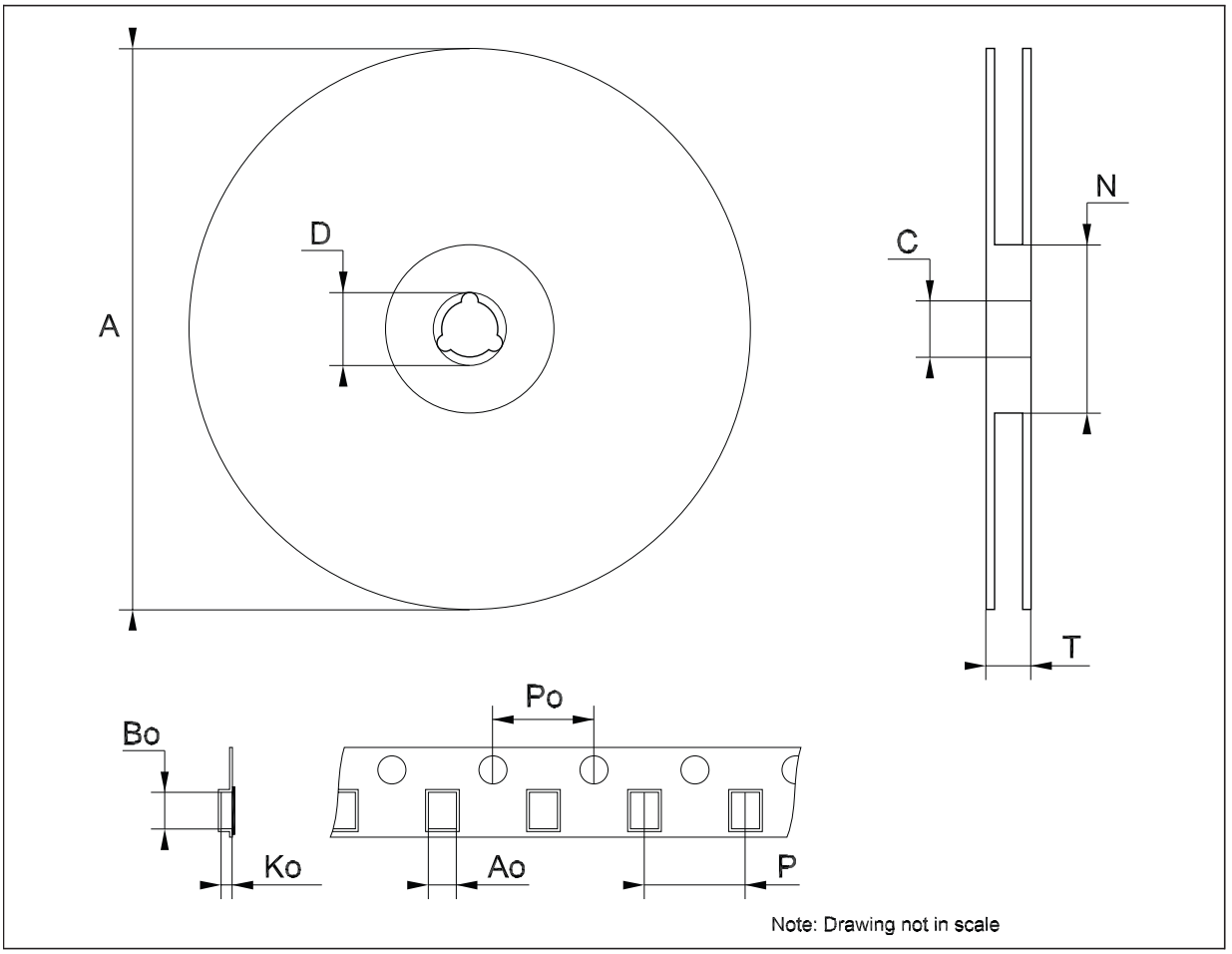
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	1.35		1.75	0.053		0.069
A1	0.10		0.25	0.04		0.010
A2	1.10		1.65	0.043		0.065
B	0.33		0.51	0.013		0.020
C	0.19		0.25	0.007		0.010
D	4.80		5.00	0.189		0.197
E	3.80		4.00	0.150		0.157
e		1.27			0.050	
H	5.80		6.20	0.228		0.244
h	0.25		0.50	0.010		0.020
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 10. Document revision history

Date	Revision	Changes
21-Mar-2006	9	Order codes has been updated and new template.
05-Jun-2006	10	Change value row 10 on the features and R_{IN} in *Table 7*.
29-Jan-2007	11	Typo mistake on page 1.
29-Aug-2007	12	Change value R_{IN} min. on *Table 7*.
07-Feb-2008	13	Modified: *Table 1 on page 1*.
16-Feb-2009	14	Modified: *Note: on page 5*.