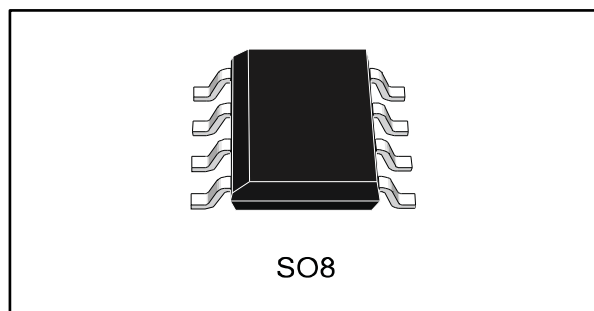


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**±15 kV ESD protected, low-power RS-485/RS-422 transceiver**

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Datasheet - production data

**Features**

- Low quiescent current: 300  $\mu$ A
- Designed for RS-485 interface applications
- - 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:
  - $\pm 15$  kV (HBM)
  - $\pm 8$  kV (IEC-1000-4-2 contact discharge)
- Allows up to 64 transceivers on the bus

**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.

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

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

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## Contents

<b>1</b>	<b>Pin settings</b> .....	<b>3</b>
<b>2</b>	<b>Truth tables</b> .....	<b>4</b>
<b>3</b>	<b>Maximum ratings</b> .....	<b>5</b>
<b>4</b>	<b>Electrical characteristics</b> .....	<b>6</b>
<b>5</b>	<b>Test circuit and typical characteristics</b> .....	<b>9</b>
<b>6</b>	<b>Package information</b> .....	<b>14</b>
	6.1    SO8 package information.....	15
	6.2    SO8 tape and reel information .....	16
<b>7</b>	<b>Ordering information</b> .....	<b>17</b>
<b>8</b>	<b>Revision history</b> .....	<b>18</b>

# 1 Pin settings

Figure 1: Pin configuration

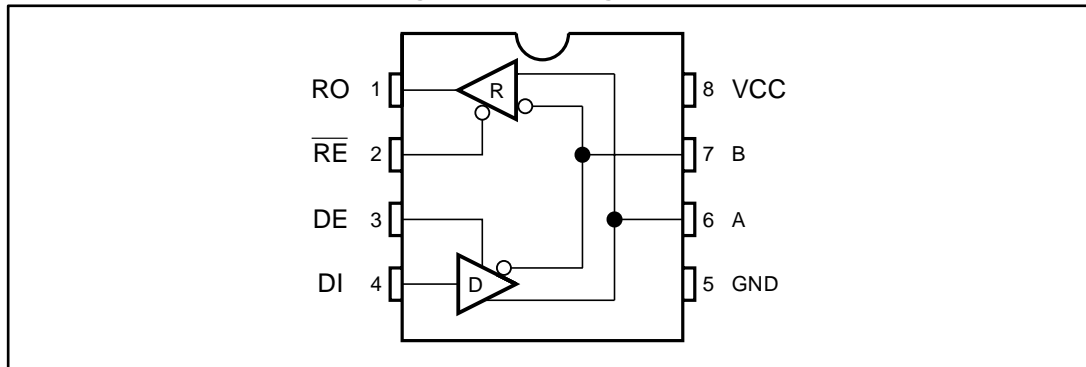


Table 1: Pin description

Pin number	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 2: Truth table (driver)

Inputs			Outputs	
$\overline{\text{RE}}$	DE	DI	B	A
X	H	H	L	H
		L	H	L
	L	X	Z	Z

**Note:** X = "don't care"; Z = high impedance

Table 3: Truth table (receiver)

Inputs			Outputs
$\overline{\text{RE}}$	DE	A-B	RO
L	L	$\geq 0.2 \text{ V}$	H
		$\leq -0.2 \text{ V}$	L
		Inputs open	H
H		X	Z

**Note:** X = "don't care"; Z = high impedance

### 3 Maximum ratings

Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

**Table 4: Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply voltage	7	V
$V_I$	Control input voltage ( $\overline{RE}$ , DE)	-0.5 to ( $V_{CC} + 0.5$ )	
$V_{DI}$	Driver input voltage (DI)	-0.5 to ( $V_{CC} + 0.5$ )	
$V_{DO}$	Driver output voltage (A, B)	$\pm 14$	
$V_{RI}$	Receiver input voltage (A, B)	$\pm 14$	
$V_{RO}$	Receiver output voltage (RO)	-0.5 to ( $V_{CC} + 0.5$ )	

## 4 Electrical characteristics

Table 5: ESD performance: transmitter outputs, receiver inputs

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

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

Table 6: 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), see <a href="#">Figure 2</a>	1.5		5		
		$R_L = 50\ \Omega$ (RS-422), see <a href="#">Figure 2</a>	1.5		5		
$\Delta V_{OD}$	Change in magnitude of driver differential output voltage for complementary output states	$R_L = 27\ \Omega$ or $50\ \Omega$ , see <a href="#">Figure 2</a>			0.2		
$V_{OC}$	Driver common-mode output voltage	$R_L = 27\ \Omega$ or $50\ \Omega$ , see <a href="#">Figure 2</a>			3		
$\Delta V_{OC}$	Change in magnitude of driver common-mode output voltage for complementary output states	$R_L = 27\ \Omega$ or $50\ \Omega$ , see <a href="#">Figure 2</a>			0.2		
$V_{IH}$	Input high voltage	$\overline{RE}$ , DE, DI	2.0				
$V_{IL}$	Input low voltage	$\overline{RE}$ , DE, DI			0.8		
$I_{IN1}$	Input current	$\overline{RE}$ , DE, DI			± 2		µA
$I_{IN2}$	Input current (A, B), $V_{CM} = 0\text{ V}$ or $5.25\text{ V}$ , $V_{DE} = 0\text{ V}$	$V_{IN} = 12\text{ V}$			1		mA
		$V_{IN} = -7\text{ V}$			-0.8		
$V_{TH}$	Receiver differential threshold voltage	$V_{CM} = -7\text{ to }12\text{ V}$	-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		
$I_{OZR}$	3-state (high impedance) output current at receiver	$V_O = 0.4\text{ to }2.4\text{ V}$			± 1	µA	
$R_{IN}$	Receiver input resistance	$V_{CM} = -7\text{ to }12\text{ V}$	24			kΩ	
$I_{CC}$	No load supply current, $V_{RE} = 0\text{ V}$ or $V_{CC}$ <sup>(2)</sup>	$V_{DE} = V_{CC}$		400	900	µA	
		$V_{DE} = 0\text{ V}$		300	500		

Symbol	Parameter	Test conditions <sup>(1)</sup>	Min.	Typ.	Max.	Unit
I <sub>OSD1</sub>	Driver short-circuit current, V <sub>O</sub> = high	V <sub>O</sub> = -7 to 12 V <sup>(3)</sup>	35		250	mA
I <sub>OSD2</sub>	Driver short-circuit current, V <sub>O</sub> = low	V <sub>O</sub> = -7 to 12 V <sup>(3)</sup>	35		250	
I <sub>OSR</sub>	Receiver short-circuit current	V <sub>O</sub> = 0 V to V <sub>CC</sub>	7		95	

**Notes:**

<sup>(1)</sup>All currents into device pins are positive; all currents out of device pins are negative; all voltages are referenced to device ground unless specified.

<sup>(2)</sup>Supply current specification is valid for loaded transmitters when V<sub>DE</sub> = 0 V

<sup>(3)</sup>Applies to peak current

**Table 7: Driver switching characteristics**

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

**Notes:**

<sup>(1)</sup>All currents into device pins are positive; all currents out of device pins are negative; all voltages are referenced to device ground unless specified.

Table 8: Receiver switching characteristics

Symbol	Parameter	Test conditions <sup>(1)</sup>	Min.	Typ.	Max.	Unit
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation delay input to output	R <sub>DIFF</sub> = 54 Ω, C <sub>L1</sub> = C <sub>L2</sub> = 100 pF, see <a href="#">Figure 4</a> and <a href="#">Figure 8</a>	20	130	210	ns
t <sub>SKD</sub>	Differential receiver skew	R <sub>DIFF</sub> = 54 Ω, C <sub>L1</sub> = C <sub>L2</sub> = 100 pF, see <a href="#">Figure 4</a> and <a href="#">Figure 8</a>		13		
t <sub>PZH</sub>	Output enable time	C <sub>RL</sub> = 15 pF, S1 = closed, see <a href="#">Figure 2</a> and <a href="#">Figure 9</a>		20	50	
t <sub>PZL</sub>	Output enable time	C <sub>RL</sub> = 15 pF, S2 = closed, see <a href="#">Figure 2</a> and <a href="#">Figure 9</a>		20	50	
t <sub>PLZ</sub>	Output disable time	C <sub>RL</sub> = 15 pF, S1 = closed, see <a href="#">Figure 2</a> and <a href="#">Figure 9</a>		20	50	
t <sub>PHZ</sub>	Output disable time	C <sub>RL</sub> = 15 pF, S2 = closed, see <a href="#">Figure 2</a> and <a href="#">Figure 9</a>		20	50	
f <sub>MAX</sub>	Maximum data rate		2.5			Mbps

**Notes:**

<sup>(1)</sup>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

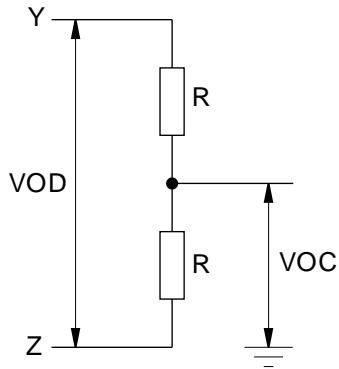


Figure 3: Receiver timing test load

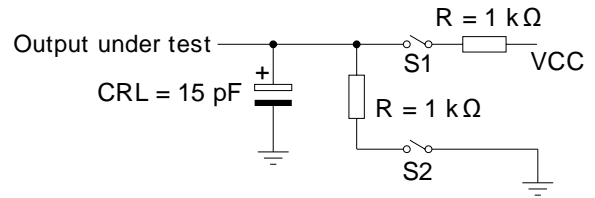


Figure 4: Drive/receiver timing test circuit

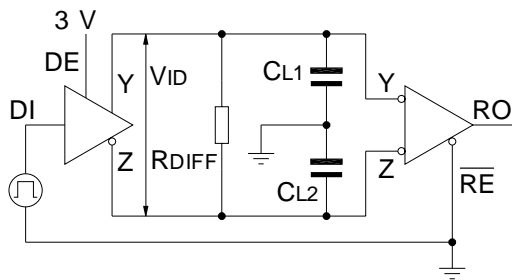
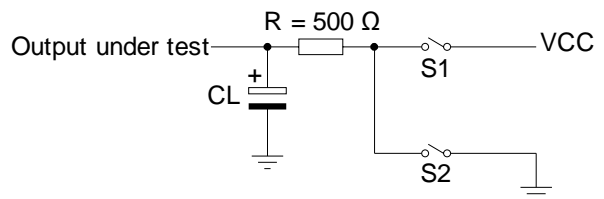


Figure 5: Driver timing test load



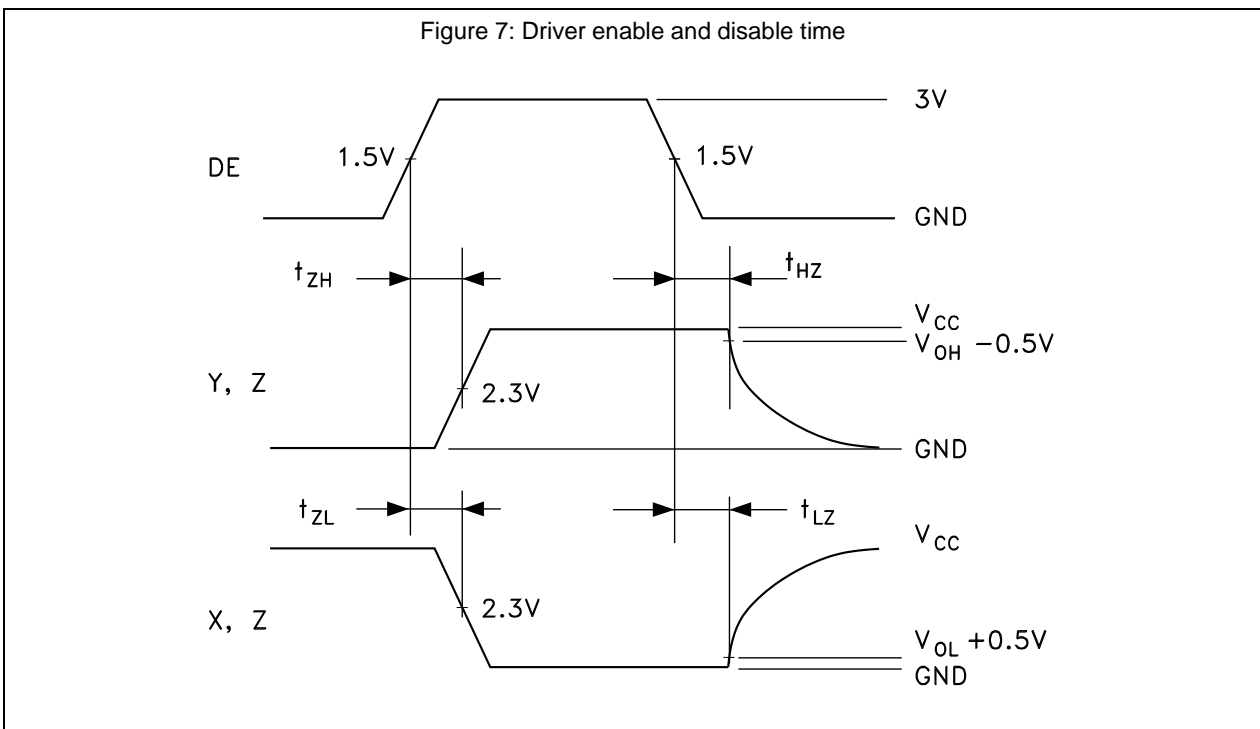
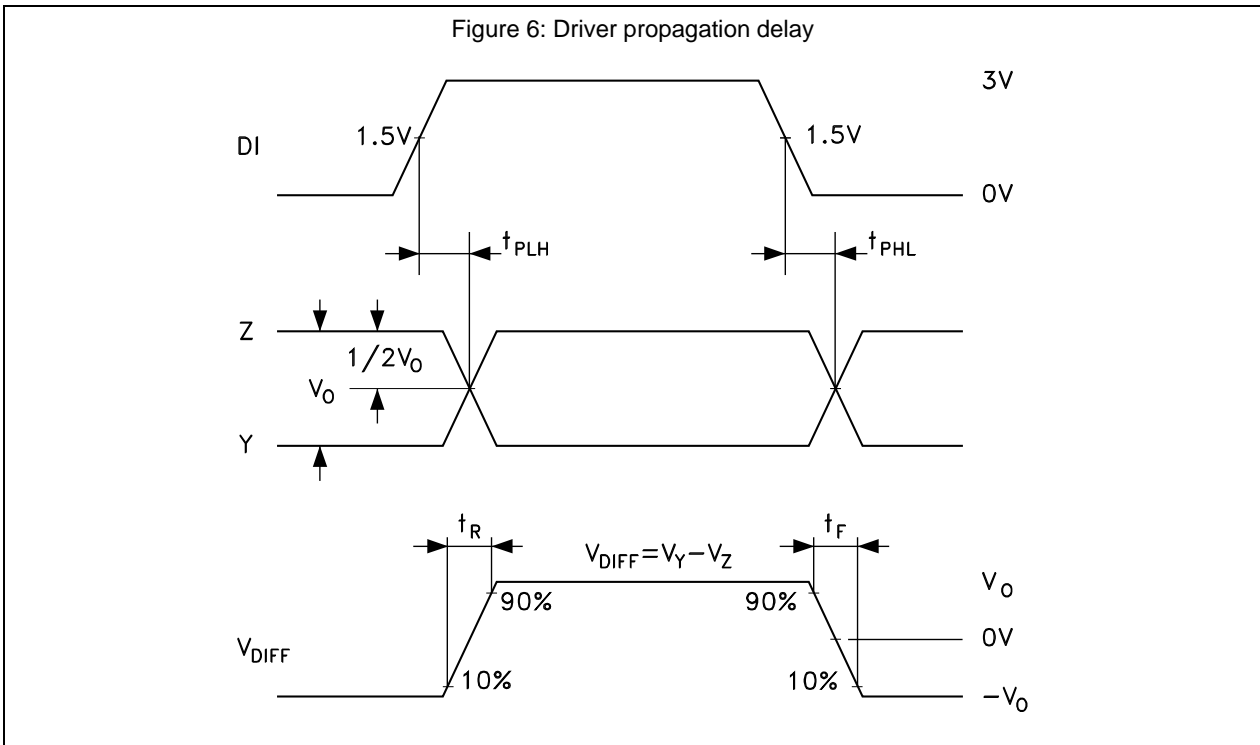


Figure 8: Receiver propagation delay

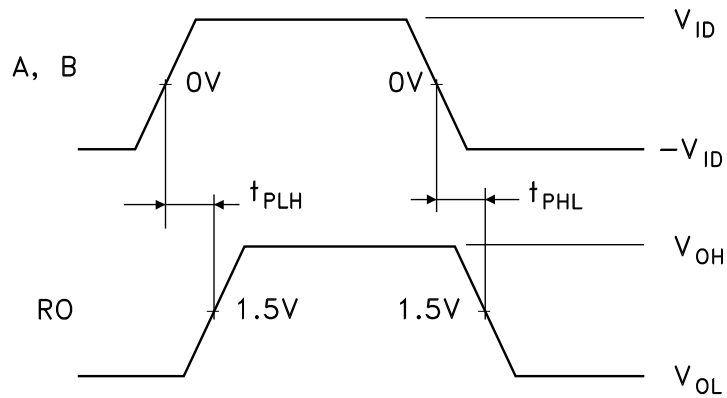


Figure 9: Receiver enable and disable time

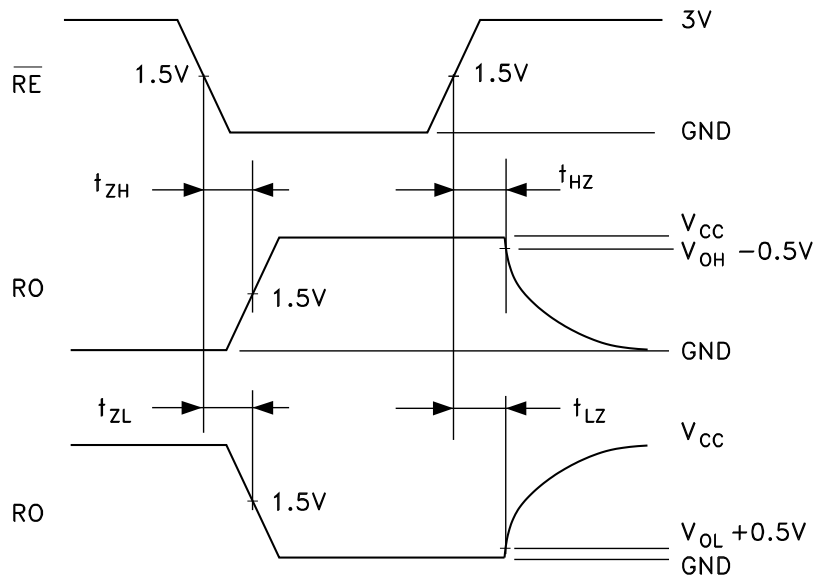


Figure 10: Receiver output current vs. output low voltage

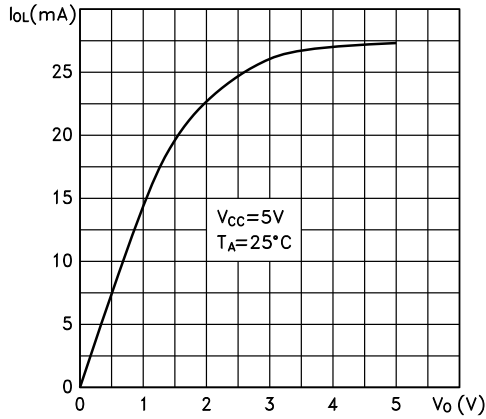


Figure 11: Receiver output current vs. output high voltage

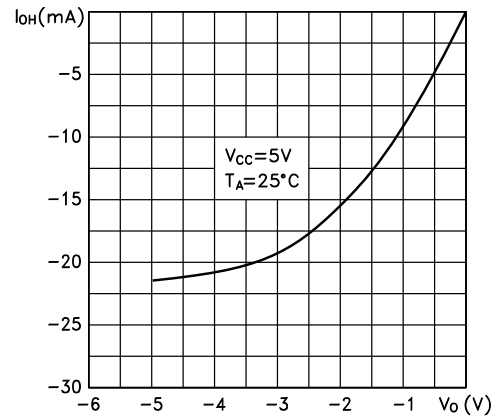


Figure 12: Driver output current vs. output low voltage

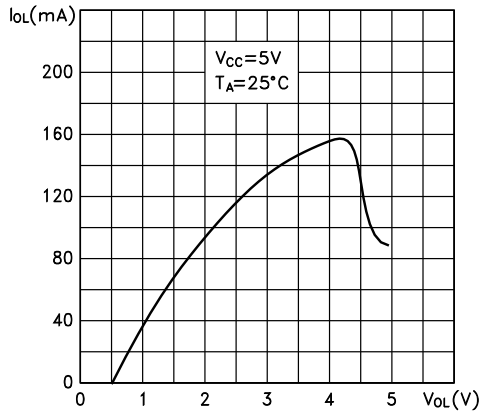


Figure 13: Driver output current vs. output high voltage

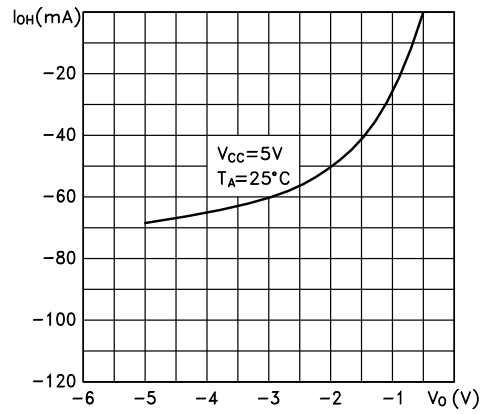


Figure 14: Supply current vs. temperature

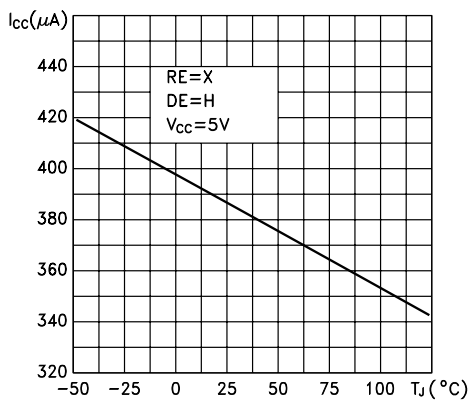


Figure 15: Receiver high level output voltage vs. temperature

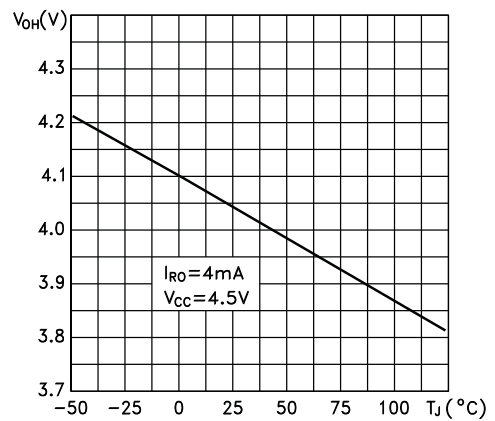


Figure 16: Receiver low level output voltage vs. temperature

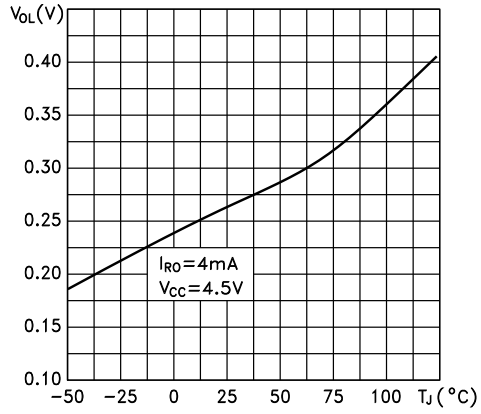
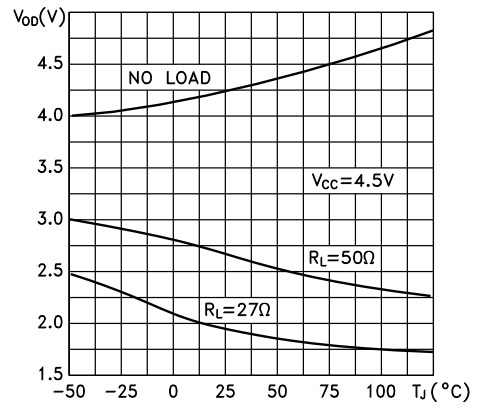


Figure 17: Differential driver output voltage vs. temperature



## 6 Package information

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.

### 6.1 SO8 package information

Figure 18: SO8 package outline

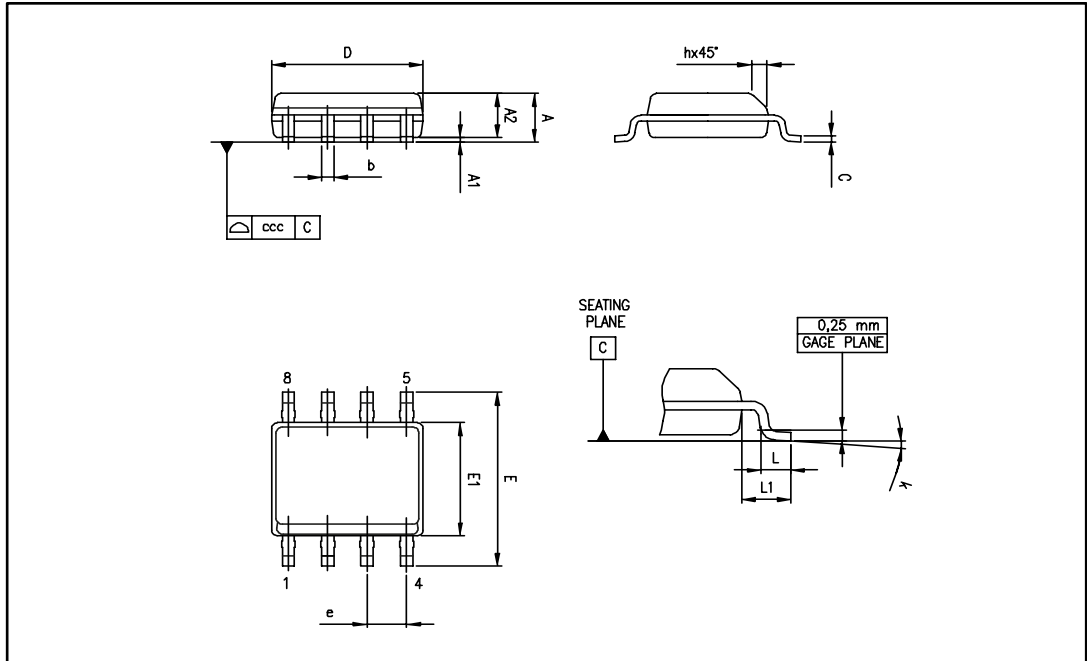
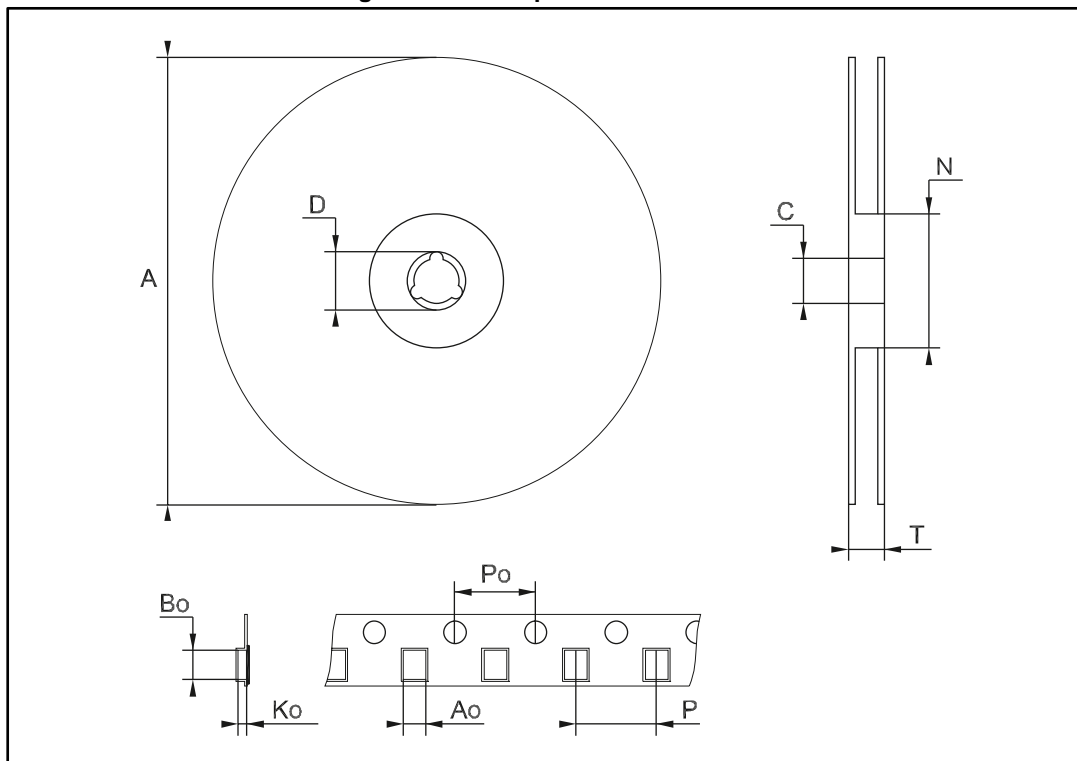


Table 9: SO8 mechanical data

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max
A			1.75			0.069
A1	0.10		0.25	0.004		0.010
A2	1.25			0.049		
b	0.28		0.48	0.011		0.019
c	0.17		0.23	0.007		0.010
D	4.80	4.90	5.00	0.189	0.193	0.197
E	5.80	6.00	6.20	0.228	0.236	0.244
E1	3.80	3.90	4.00	0.150	0.154	0.157
e		1.27			0.050	
h	0.25		0.50	0.010		0.020
L	0.40		1.27	0.016		0.050
L1		1.04			0.040	
k	0°		8°	0°		8°
ccc			0.10			0.004

## 6.2 SO8 tape and reel information

Figure 19: SO8 tape and reel outline



1. Drawing not to scale

Table 10: SO8 tape and reel mechanical data

Symbol	Dimensions					
	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 Ordering information

Table 11: Order code

Order code	Temperature range	Package	Packaging
ST485ERBDR	-40 to 85 °C	SO8 (tape and reel)	2500 parts per reel

## 8 Revision history

Table 12: 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 $\mu$ 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.
04-Oct-2016	8	<p>Updated "<i>Features</i>": replaced "allows up to 256 transceivers on the bus" by "64 transceivers".</p> <p><i>Table 6: "DC electrical characteristics"</i>: updated footnote 3</p> <p>Removed DIP package</p> <p>Updated SO8 package</p> <p>Removed "Device summary" table to <i>Section 7: "Ordering information"</i>.</p> <p>Removed obsolete order code ST485ERBN</p>

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