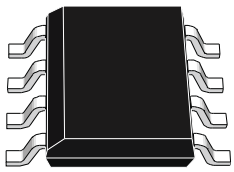
ST485ERB

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

Datasheet - production data



SO8

Features

- Low quiescent current: 300 µA
- 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:
  - ± 15 kV (HBM)
  - ± 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 ±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 µA (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).

Contents

1 Pin settings

Figure 1: Pin configuration

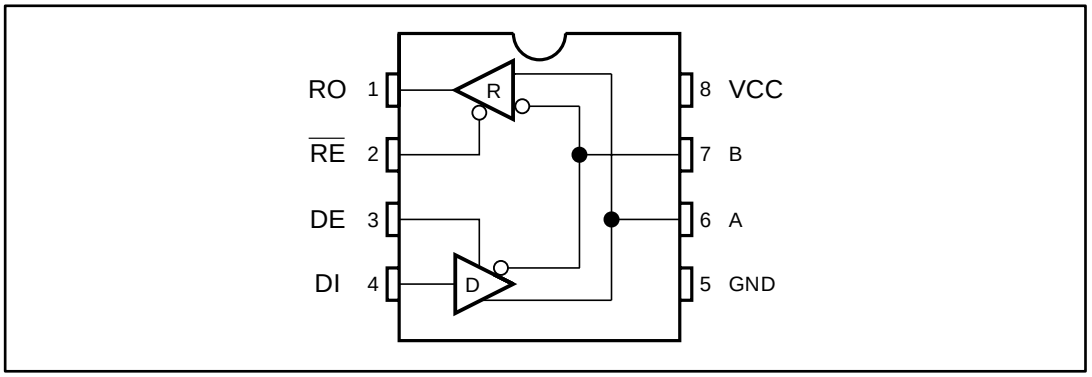


Table 1: Pin description

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_{CC}	Supply voltage

2 Truth tables

Table 2: Truth table (driver)

Inputs			Outputs	
$\overline{RE}$	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
$\overline{RE}$	DE	A-B	RO
L	L	≥ 0.2 V	H
		≤ -0.2 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)	± 14	
V_{RI}	Receiver input voltage (A, B)	± 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 V ± 5 %, $T_A = T_{MIN}$ to T_{MAX}, unless otherwise specified. Typical values are referred to T_A = 25 °C.

Table 6: 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), see *Figure 2*	1.5		5	
		R_L = 50 Ω (RS-422), see *Figure 2*	1.5		5	
ΔV_{OD}	Change in magnitude of driver differential output voltage for complementary output states	R_L = 27 Ω or 50 Ω, see *Figure 2*			0.2	
V_{OC}	Driver common-mode output voltage	R_L = 27 Ω or 50 Ω, see *Figure 2*			3	
ΔV_{OC}	Change in magnitude of driver common-mode output voltage for complementary output states	R_L = 27 Ω or 50 Ω, see *Figure 2*			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 V or 5.25 V, V_{DE} = 0 V	V_{IN} = 12 V			1	mA
		V_{IN} = -7 V			-0.8	
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	
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	24			kΩ
I_{CC}	No load supply current, V_{RE} = 0 V or V_{CC} (2)	$V_{DE} = V_{CC}$		400	900	µA
		V_{DE} = 0 V		300	500	

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	
I_{OSR}	Receiver short-circuit current	V_O = 0 V to V_{CC}	7		95	

Notes:

(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

Table 7: 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*	10	30	60	ns
t_{SK}	Output skew to output	R_{DIFF} = 54 Ω, C_{L1} = C_{L2} = 100 pF, see *Figure 4* and *Figure 6*		5	10	
t_{TLH}, t_{THL}	Rise or fall time	R_{DIFF} = 54 Ω, C_{L1} = C_{L2} = 100 pF, see *Figure 4* and *Figure 6*	3	15	40	
t_{PZH}	Output enable time	C_L = 100 pF, S2 = closed, see *Figure 5* and *Figure 7*		70	90	
t_{PZL}	Output enable time	C_L = 100 pF, S1 = closed, see *Figure 5* and *Figure 7*		70	90	
t_{PLZ}	Output disable time	C_L = 15 pF, S1 = closed, see *Figure 5* and *Figure 7*		70	90	
t_{PHZ}	Output disable time	C_L = 15 pF, S2 = closed, see *Figure 5* and *Figure 7*		70	90	
C_{AB}	Output AB capacitance			43		pF

Notes:

(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.

Table 8: 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*	20	130	210	ns
t_{SKD}	Differential receiver skew	R_{DIFF} = 54 Ω, C_{L1} = C_{L2} = 100 pF, see *Figure 4* and *Figure 8*		13		
t_{PZH}	Output enable time	C_{RL} = 15 pF, S1 = closed, see *Figure 2* and *Figure 9*		20	50	
t_{PZL}	Output enable time	C_{RL} = 15 pF, S2 = closed, see *Figure 2* and *Figure 9*		20	50	
t_{PLZ}	Output disable time	C_{RL} = 15 pF, S1 = closed, see *Figure 2* and *Figure 9*		20	50	
t_{PHZ}	Output disable time	C_{RL} = 15 pF, S2 = closed, see *Figure 2* and *Figure 9*		20	50	
f_{MAX}	Maximum data rate		2.5			Mbps

Notes:

(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

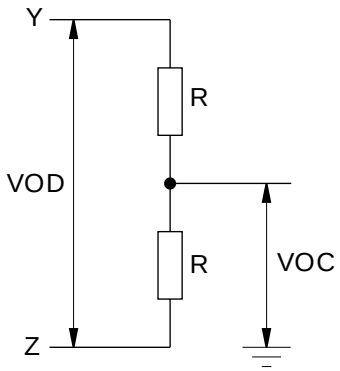


Figure 3: Receiver timing test load

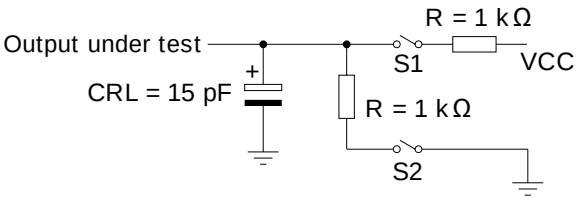


Figure 4: Drive/receiver timing test circuit

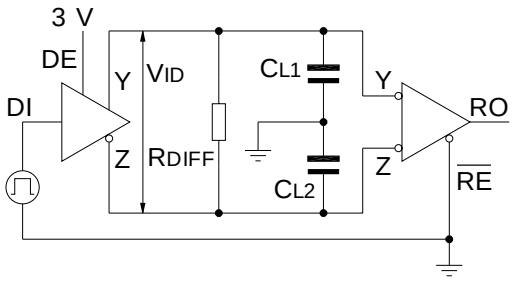


Figure 5: Driver timing test load

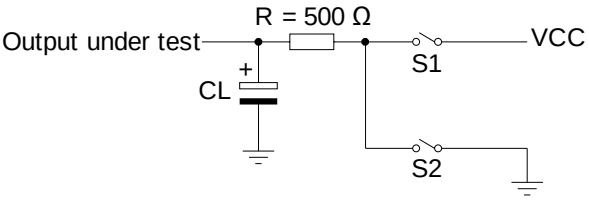


Figure 6: Driver propagation delay

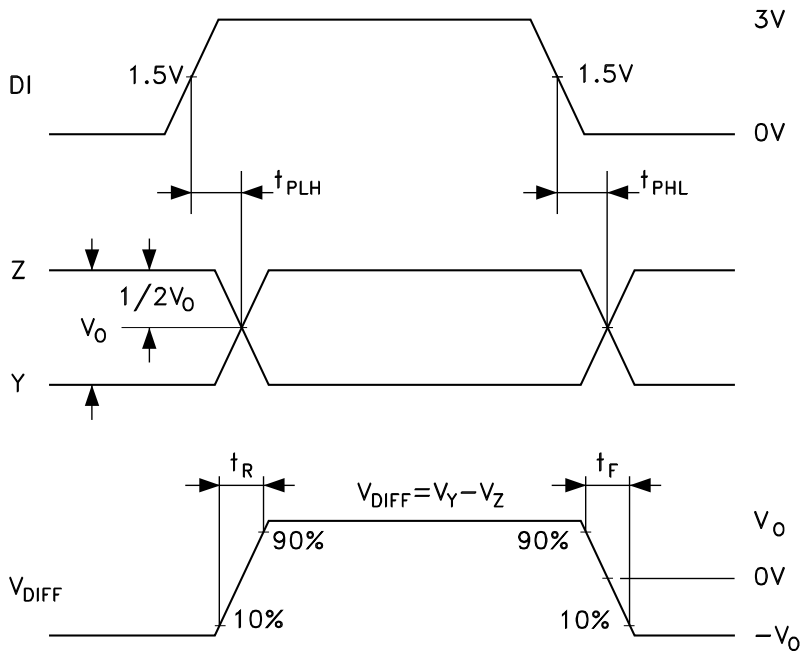


Figure 7: Driver enable and disable time

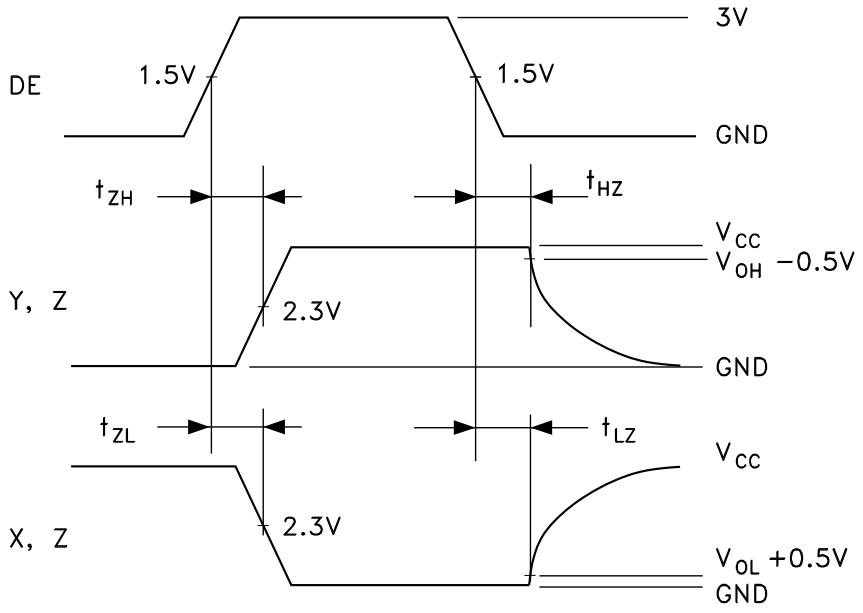


Figure 8: Receiver propagation delay

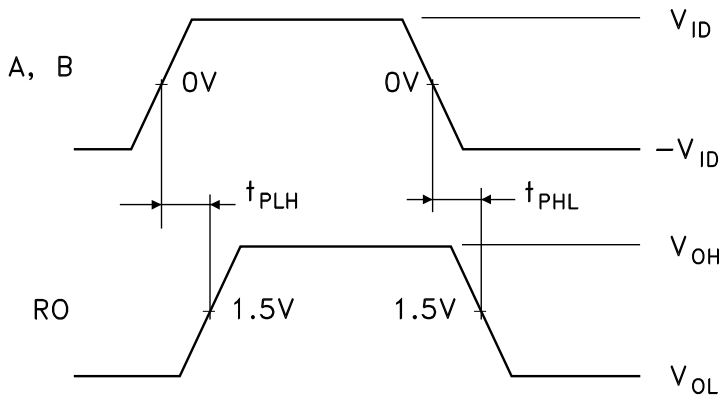


Figure 9: Receiver enable and disable time

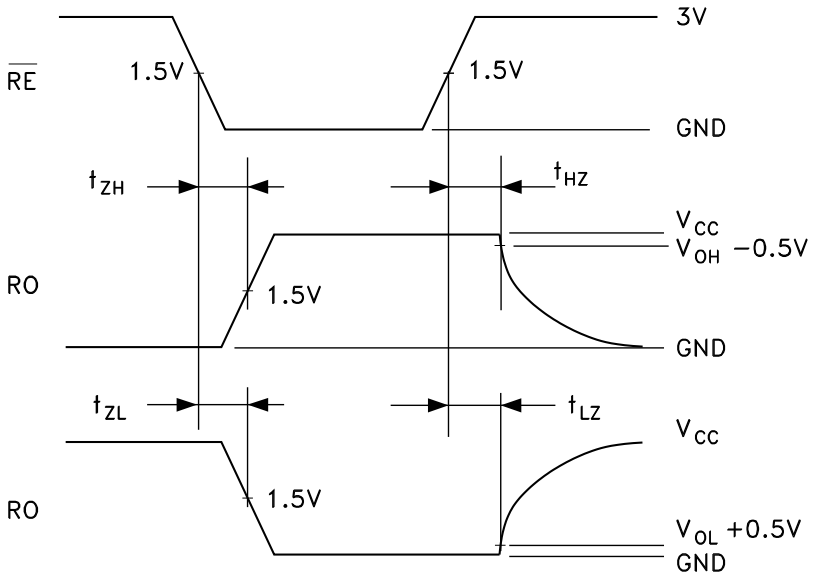


Figure 10: Receiver output current vs. output low voltage

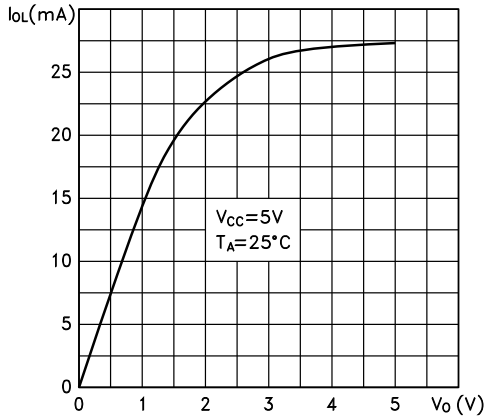


Figure 11: Receiver output current vs. output high voltage

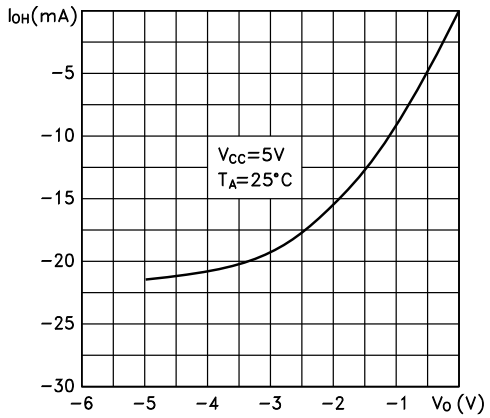


Figure 12: Driver output current vs. output low voltage

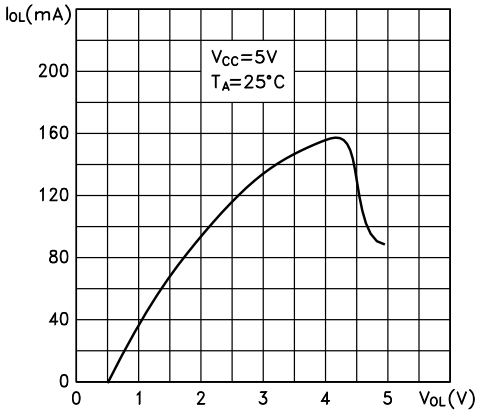


Figure 13: Driver output current vs. output high voltage

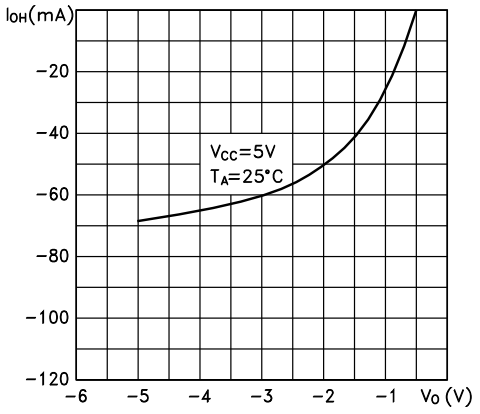


Figure 14: Supply current vs. temperature

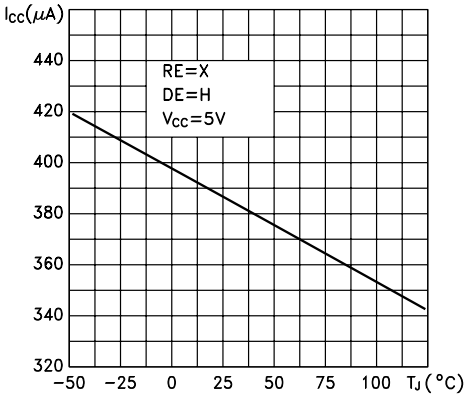


Figure 15: Receiver high level output voltage vs. temperature

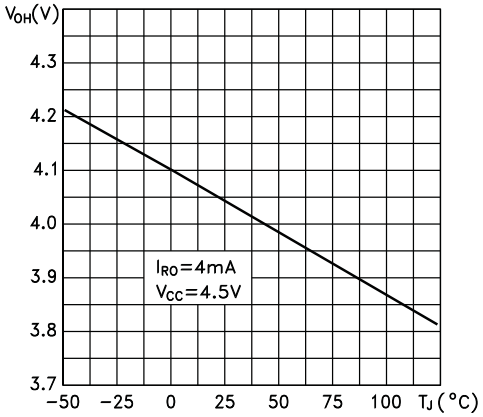


Figure 16: Receiver low level output voltage vs. temperature

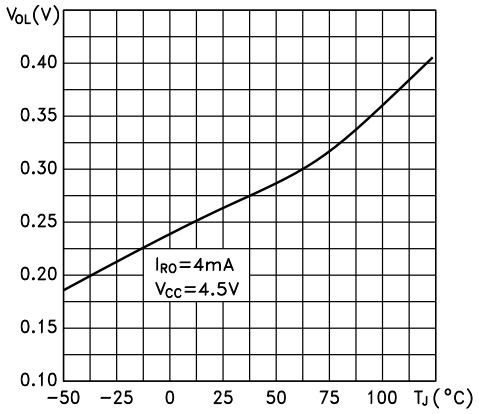
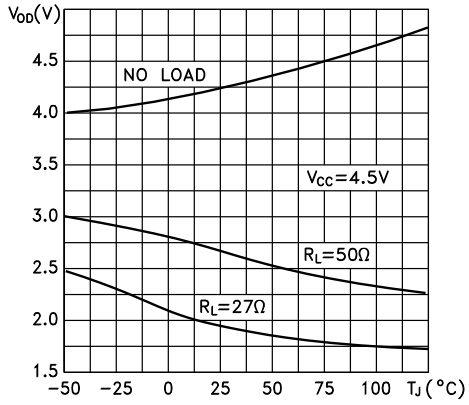


Figure 17: Differential driver output voltage vs. temperature



6 Package 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***. ECOPACK® is an ST trademark.

6.1 SO8 package information

Figure 18: SO8 package outline

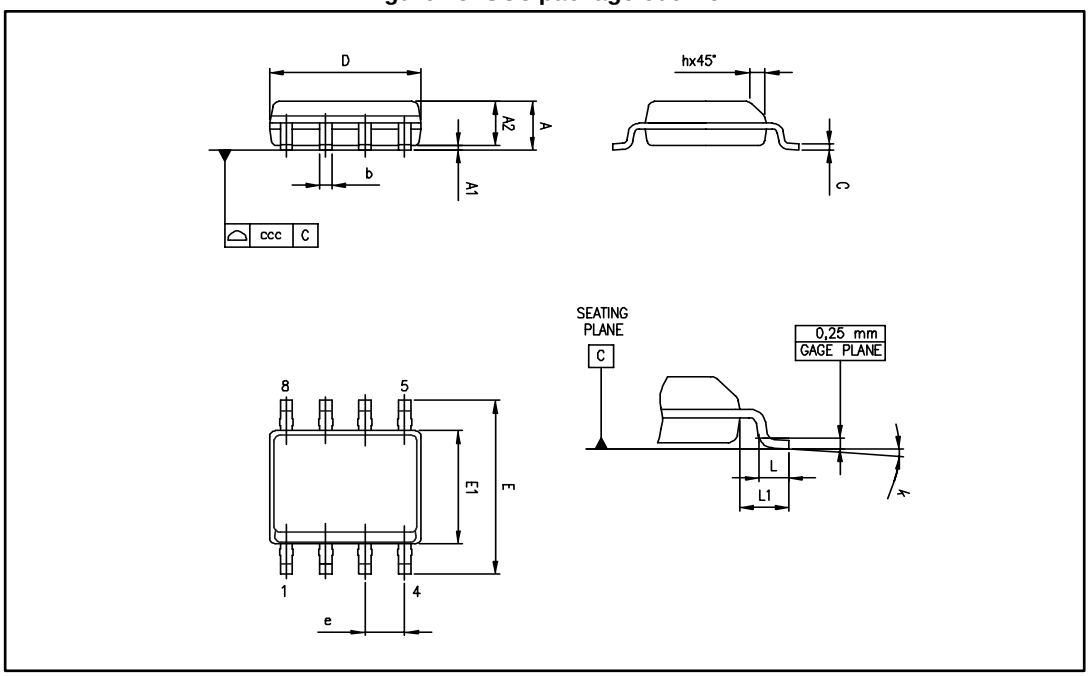
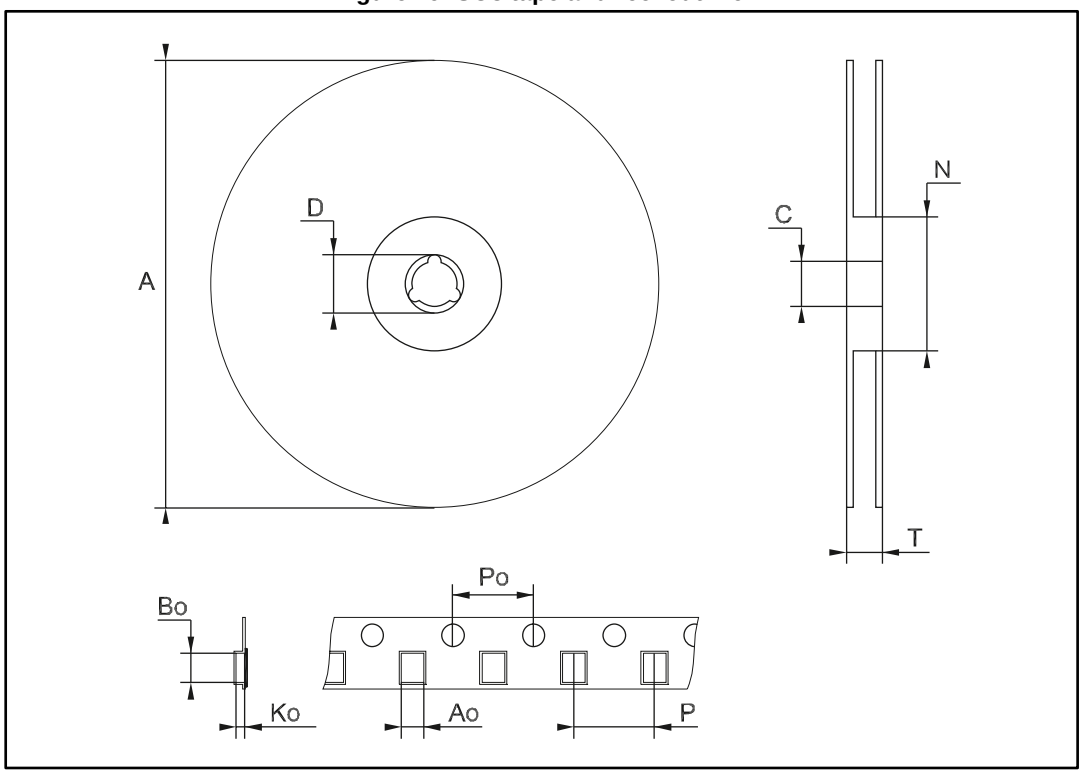


Table 9: SO8 mechanical data

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 µA.
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	Updated *"Features"*: replaced “allows up to 256 transceivers on the bus” by “64 transceivers”. *Table 6: "DC electrical characteristics"*: updated footnote 3 Removed DIP package Updated SO8 package Removed “Device summary” table to *Section 7: "Ordering information"*. Removed obsolete order code ST485ERBN

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