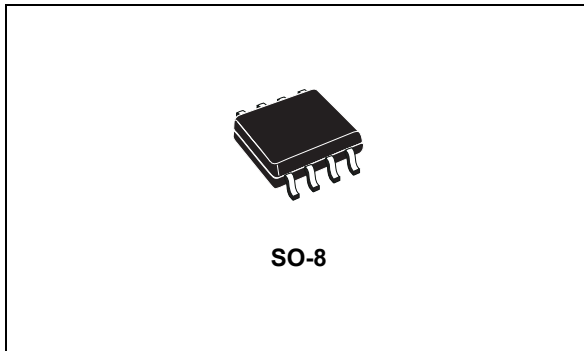


3.3 V powered, 15 kV ESD protected, up to 20 Mbps RS-485/ RS-422 transceiver

Datasheet - production data



- Guaranteed high receiver output state for floating inputs with no signal present
- Allow up to 64 transceivers on the bus
- Wide operating temperature range: -40 to +105 °C

Applications

- Industrial systems control
- Telecommunications

Features

- ESD protection
 - ± 15 kV human body model
 - ± 8 kV IEC 1000-4-2 contact discharge
- Operate from a single 3.3 V supply - no charge pump required
- Interoperable with 5 V logic
- 1 µA low current shutdown mode max.
- Guaranteed 20 Mbps data rate
- -7 to 12 V common mode input voltage range
- Half duplex versions available
- Industry standard 75176 pinout
- Current limiting and thermal shutdown for driver overload protection

Description

The ST4485EB device is a ± 15 kV ESD protected, 3.3 V low power transceiver for RS-485 and RS-422 communications. The device contains one driver and one receiver in half duplex configuration.

The ST4485EB transmits and receives at a guaranteed data rate of at least 20 Mbps.

All transmitter outputs and receiver inputs are protected to ± 15 kV using “Human Body Model”.

The 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
ST4485EBDR	-40 to 105 °C	SO-8 (tape and reel)	2500 parts per reel

Contents

1	Pin configuration	3
2	Truth tables	4
3	Maximum ratings	5
4	Electrical characteristics	6
5	Test circuits and typical characteristics	9
6	Package mechanical data	14
7	Revision history	17

1 Pin configuration

Figure 1. Pin connections

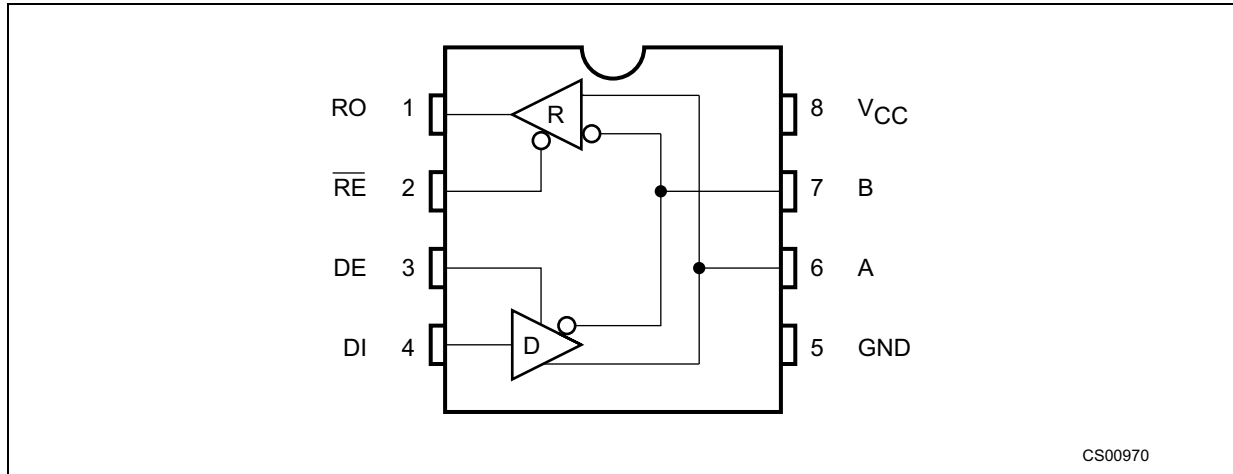


Table 2. Pin description

Pin n°	Symbol	Name and function
1	RO	Receiver output. If $A > B$ by 200 mV, RO will be high; if $A < B$ by 200 mV, RO will be low.
2	\overline{RE}	Receiver output enable. RO is enabled when RE is low; RO is high impedance when RE is high. If RE is high and DE is low, the device will enter a low power shutdown mode.
3	DE	Driver output enable. The driver outputs are enabled by bringing DE high. They are high impedance when DE is low. If RE is high DE is low, the device will enter a low-power shutdown mode. If the driver outputs are enabled, the part functions as line driver, while they are high impedance, it functions as line receivers if RE is low.
4	DI	Driver input. A low on DI forces output A low and output B high. Similarly, a high on DI forces output A high and output B low.
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: $V_{CC} = 3\text{ V to }3.6\text{ V}$

2 Truth tables

Table 3. Truth table (driver)

Inputs			Outputs		Mode
RE	DE	DI	B	A	
X ⁽¹⁾	H	H	L	H	Normal
X ⁽¹⁾	H	L	H	L	Normal
L	L	X ⁽¹⁾	Z ⁽²⁾	Z ⁽²⁾	Normal
H	L	X ⁽¹⁾	Z ⁽²⁾	Z ⁽²⁾	Shutdown

1. X = don't care.
2. Z = high impedance.

Table 4. Truth table (receiver)

Inputs			Output	Mode
RE	DE	A-B	RO	
L	L	$\geq 0.2\text{ V}$	H	Normal
L	L	$\leq -0.2\text{ V}$	L	Normal
L	L	Inputs open	H	Normal
H	L	X ⁽¹⁾	Z ⁽²⁾	Shutdown

1. X = don't care.
2. Z = high impedance.

3 Maximum ratings

Table 5. Absolute maximum ratings⁽¹⁾

Symbol	Parameter	Value	Unit
V_{CC}	Supply voltage	7	V
V_I	Control input voltage (\overline{RE} , DE)	-0.3 to 7	V
V_{DI}	Driver input voltage (DI)	-0.3 to 7	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)	-0.3 to ($V_{CC} + 0.3$)	V

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

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 contact discharge		± 8		kV

4 Electrical characteristics

Table 7. Electrical characteristics ($V_{CC} = 3\text{ V to }3.6\text{ V}$, $T_A = -40\text{ to }105\text{ }^\circ\text{C}$, unless otherwise specified. Typical values are referred to $T_A = 25\text{ }^\circ\text{C}$)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit	
I_{SUPPLY}	V_{CC} power supply current	No load, DI = 0 V or V_{CC}	$\overline{DE} = V_{CC}$, $\overline{RE} = 0\text{ V or }V_{CC}$		1.3	2.2	mA
			$DE = 0\text{ V}$, $\overline{RE} = 0\text{ V}$		1.2	1.9	mA
I_{SHDN}	Shutdown supply current	$DE = 0\text{ V}$, $RE = V_{CC}$, DI = 0 V or V_{CC}		0.002	1	μA	

Table 8. Logic input electrical characteristics ($V_{CC} = 3\text{ V to }3.6\text{ V}$, $T_A = -40\text{ to }105\text{ }^\circ\text{C}$, unless otherwise specified. Typical values are referred to $T_A = 25\text{ }^\circ\text{C}$)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{IL}	Input logic threshold low	DE, DI, RE		1.3	0.8	V
V_{IH}	Input logic threshold high	DE, DI, RE	2			V
I_{IN1}	Logic input current	DE, DI, RE			± 2.0	μA
I_{IN2}	Input current (A, B)	$DE = 0\text{ V}$, $V_{CC} = 0\text{ or }3.6\text{ V}$	$V_{IN} = 12\text{ V}$		1	mA
			$V_{IN} = -7\text{ V}$		-0.8	mA

Table 9. Transmitter electrical characteristics ($V_{CC} = 3\text{ V to }3.6\text{ V}$, $T_A = -40\text{ to }105\text{ }^\circ\text{C}$, unless otherwise specified. Typical values are referred to $T_A = 25\text{ }^\circ\text{C}$)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{OD}	Differential drive output	$R_L = 100\ \Omega$ (RS-422) (<i>Figure 1</i>)	2			V
		$R_L = 54\ \Omega$ (RS-485) (<i>Figure 1</i>)	1.5			V
		$R_L = 60\ \Omega$ (RS-485) (<i>Figure 2</i>)	1.5			V
ΔV_{OD}	Change in magnitude of driver differential output voltage for complementary output states ⁽¹⁾	$R_L = 54\ \Omega$ or $100\ \Omega$ (<i>Figure 1</i>)			0.2	V
V_{OC}	Driver common mode output voltage	$R_L = 54\ \Omega$ or $100\ \Omega$ (<i>Figure 1</i>)			3	V
ΔV_{OC}	Change in magnitude of driver common mode output voltage ⁽¹⁾	$R_L = 54\ \Omega$ or $100\ \Omega$ (<i>Figure 1</i>)			0.2	V
I_{OSD}	Driver short-circuit output current				± 250	mA

1. ΔV_{OD} and ΔV_{OC} are the changes in V_{OD} and V_{OC} , respectively, when the DI input changes state.

Table 10. Receiver electrical characteristics ($V_{CC} = 3\text{ V to }3.6\text{ V}$, $T_A = -40\text{ to }105\text{ }^\circ\text{C}$, unless otherwise specified. Typical values are referred to $T_A = 25\text{ }^\circ\text{C}$)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{TH}	Receiver differential threshold voltage	$V_{CM} = -7\text{ V to }12\text{ V}$, $DE = 0$	-0.2		0.2	V
ΔV_{TH}	Receiver input hysteresis	$V_{CM} = 0\text{ V}$		70		V
V_{OH}	Receiver output high voltage	$I_{OUT} = -4\text{ mA}$, $V_{ID} = 200\text{ mV}$ (Figure 8 and Figure 9)	2			V
V_{OL}	Receiver output low voltage	$I_{OUT} = 4\text{ mA}$, $V_{ID} = -200\text{ mV}$, (Figure 3)			0.4	V
I_{OZR}	3-state (high impedance) output current at receiver	$V_{CC} = 3.6\text{ V}$, $V_O = 0\text{ V to }V_{CC}$			± 1	μA
R_{RIN}	Receiver input resistance	$V_{CM} = -7\text{ V to }12\text{ V}$	24			$\text{k}\Omega$
I_{OSR}	Receiver short-circuit current	$V_{RO} = 0\text{ V to }V_{CC}$	7		60	mA

Table 11. Driver switching characteristics ($V_{CC} = 3\text{ V to }3.6\text{ V}$, $T_A = -40\text{ to }105\text{ }^\circ\text{C}$, unless otherwise specified. Typical values are referred to $T_A = 25\text{ }^\circ\text{C}$)⁽¹⁾

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
D_R	Maximum data rate		20			Mbps
t_{DD}	Differential output delay	$R_L = 60\ \Omega$, $C_L = 15\text{ pF}$, (Figure 4 and Figure 5)		18	30	ns
t_{TD}	Differential output transition time	$R_L = 60\ \Omega$, $C_L = 15\text{ pF}$, (Figure 4 and Figure 5)		12	20	ns
t_{PLH} t_{PHL}	Propagation delay	$R_L = 27\ \Omega$, $C_L = 15\text{ pF}$, (Figure 8 and Figure 9)		18	30	ns
t_{PDS}	$ t_{PLH} - t_{PHL} $ Propagation delay skew ⁽²⁾	$R_L = 27\ \Omega$, $C_L = 15\text{ pF}$, (Figure 8 and Figure 9)		2	5	ns
t_{PZL}	Output enable time	$R_L = 110\ \Omega$, (Figure 10 and Figure 11)		19	35	ns
t_{PZH}	Output enable time	$R_L = 110\ \Omega$, (Figure 6 and Figure 7)		30	50	ns
t_{PHZ}	Output disable time	$R_L = 110\ \Omega$, (Figure 6 and Figure 7)		19	35	ns
t_{PLZ}	Output disable time	$R_L = 110\ \Omega$, (Figure 10 and Figure 11)		30	50	ns
t_{SKEW}	Differential output delay skew			1	3	ns
$t_{ZH(SHDN)}$	Driver enable from shutdown to output high			30	50	ns
$t_{ZL(SHDN)}$	Driver enable from shutdown to output low			19	35	ns

1. The transceivers are put into shutdown by bring RE high and DE low. If the input are in state for less than 80 ns, the part are guaranteed not to enter shutdown. If the inputs are in this state for at least 300 ns, the parts are guaranteed to have entered shutdown.

2. Measured on $|t_{PLH}(A) - t_{PHL}(A)|$ and $|t_{PLH}(B) - t_{PHL}(B)|$.

Table 12. Receiver switching characteristics ($V_{CC} = 3\text{ V}$ to 3.6 V , $T_A = -40$ to $105\text{ }^\circ\text{C}$, unless otherwise specified. Typical values are referred to $T_A = 25\text{ }^\circ\text{C}$)⁽¹⁾

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_{PLH} t_{PHL}	Propagation delay	$V_{ID} = 0\text{ V}$ to 3 V , $C_{L1} = 15\text{ pF}$ (<i>Figure 12</i> and <i>Figure 13</i>)		30	50	ns
t_{RPDS}	$ t_{PLH} - t_{PHL} $ Propagation delay skew	$V_{ID} = 0\text{ V}$ to 3 V , $C_{L1} = 15\text{ pF}$ (<i>Figure 12</i> and <i>Figure 13</i>)		1	3	ns
t_{PZL}	Output enable time	$C_{RL} = 15\text{ pF}$, (<i>Figure 14</i> and <i>Figure 18</i>)		10	20	ns
t_{PZH}	Output enable time	$C_{RL} = 15\text{ pF}$, (<i>Figure 14</i> and <i>Figure 18</i>)		10	20	ns
t_{PHZ}	Output disable time	$C_{RL} = 15\text{ pF}$, (<i>Figure 14</i> and <i>Figure 18</i>)		10	20	ns
t_{PLZ}	Output disable time	$C_{RL} = 15\text{ pF}$, (<i>Figure 14</i> and <i>Figure 18</i>)		10	20	ns
$t_{ZH(SHDN)}$	Receiver enable from shutdown to output high	$C_{RL} = 15\text{ pF}$, (<i>Figure 14</i> and <i>Figure 18</i>)		10	20	ns
$t_{ZL(SHDN)}$	Receiver enable from shutdown to output low	$C_{RL} = 15\text{ pF}$, (<i>Figure 14</i> and <i>Figure 18</i>)		20	40	μs

1. The transceivers are put into shutdown by bring RE high and DE low. If the input are in state for less than 80 ns, the part are guaranteed not to enter shutdown. If the inputs are in this state for at least 300 ns, the parts are guaranteed to have entered shutdown.

5 Test circuits and typical characteristics

Figure 2. Driver and V_{OC} test load

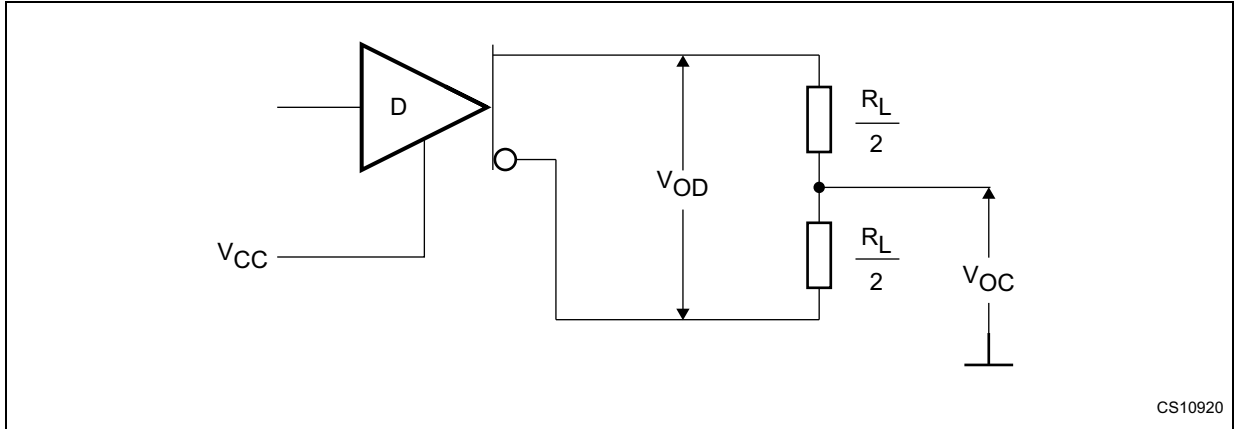


Figure 3. Driver V_{OD} with varying common mode voltage test load

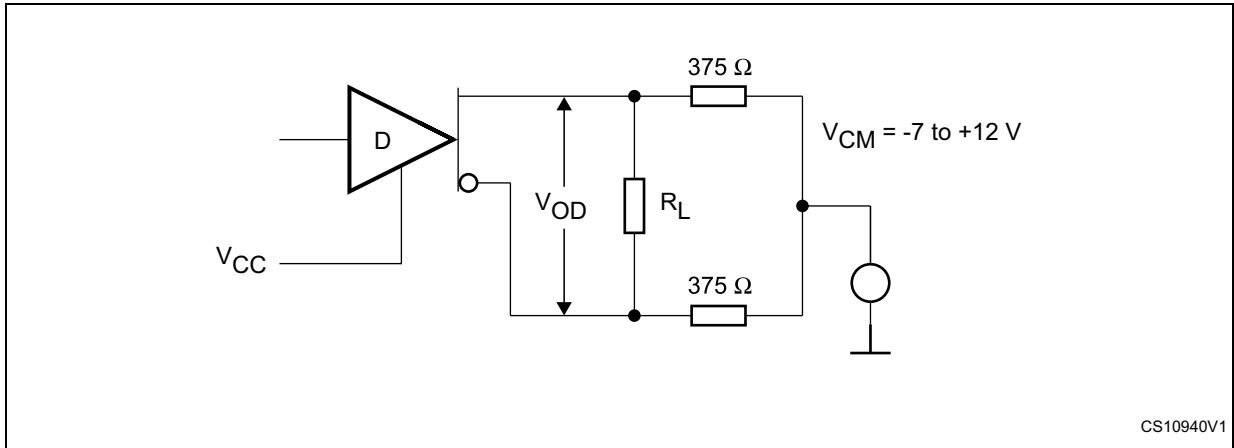


Figure 4. Receiver V_{OH} and V_{OL} test circuit

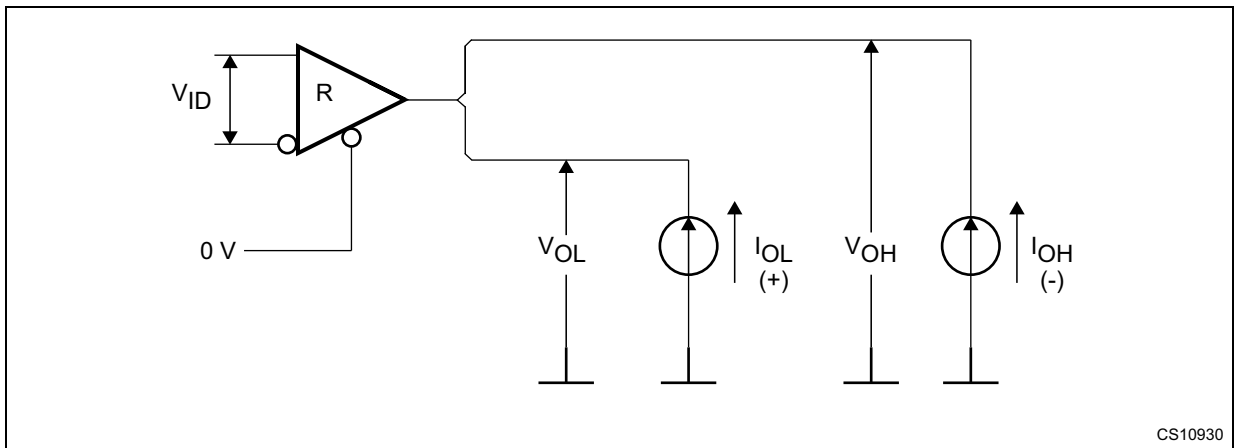
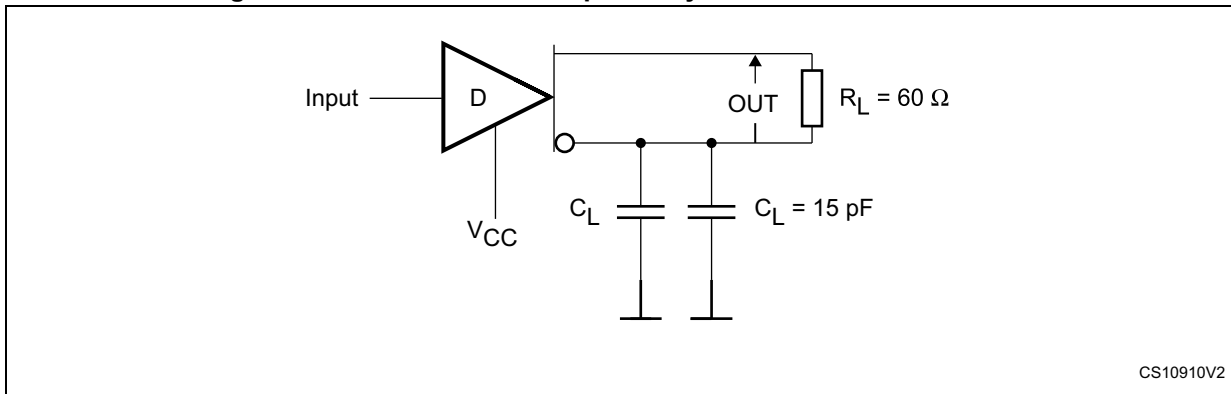
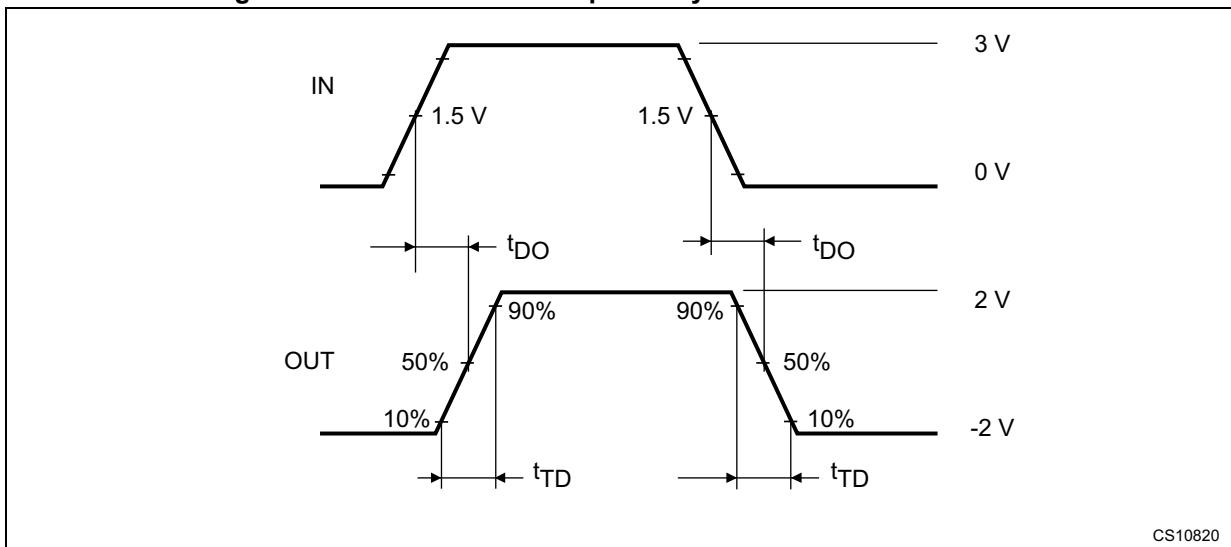


Figure 5. Drive differential output delay transition time test circuit



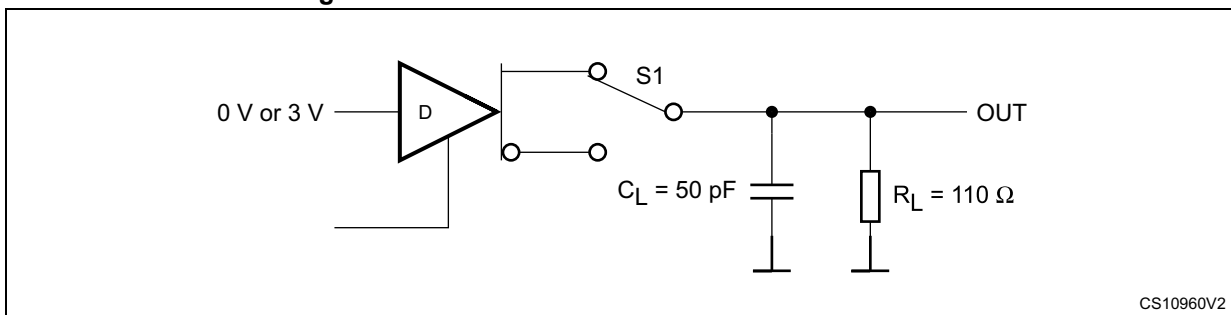
CS10910V2

Figure 6. Drive differential output delay transition time waveform



CS10820

Figure 7. Drive enable and disable times test circuit



CS10960V2

Figure 8. Drive enable and disable times waveforms

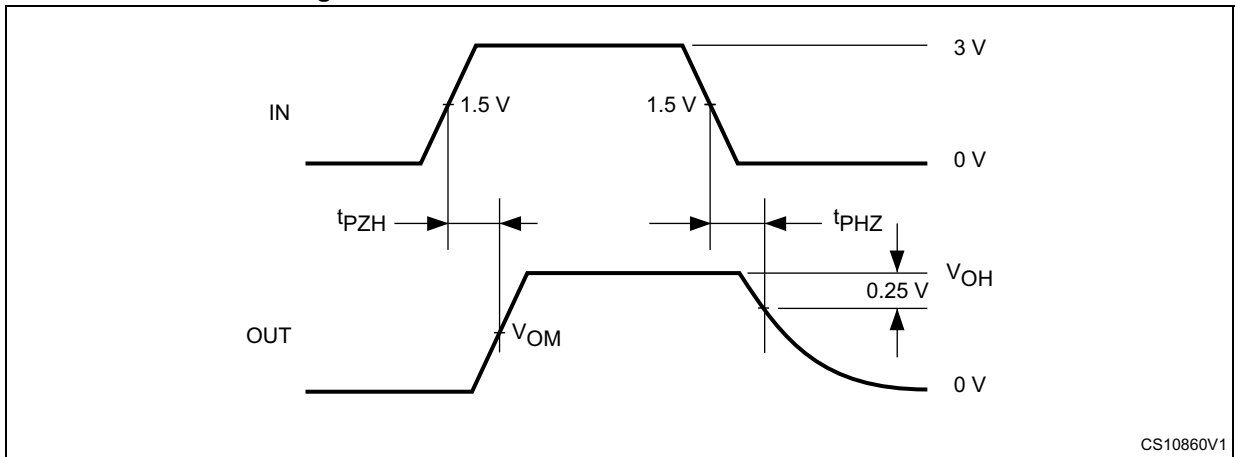


Figure 9. Drive propagation time test circuit

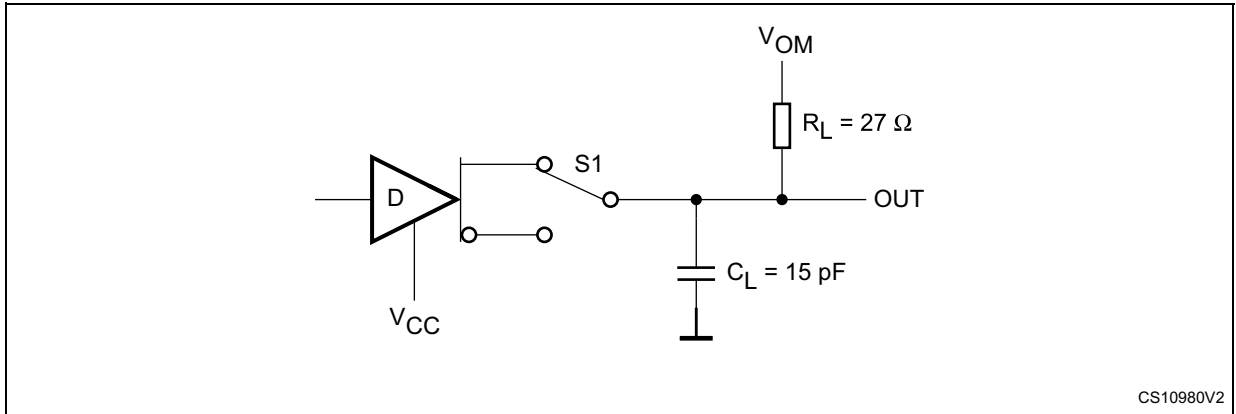


Figure 10. Drive propagation time waveform

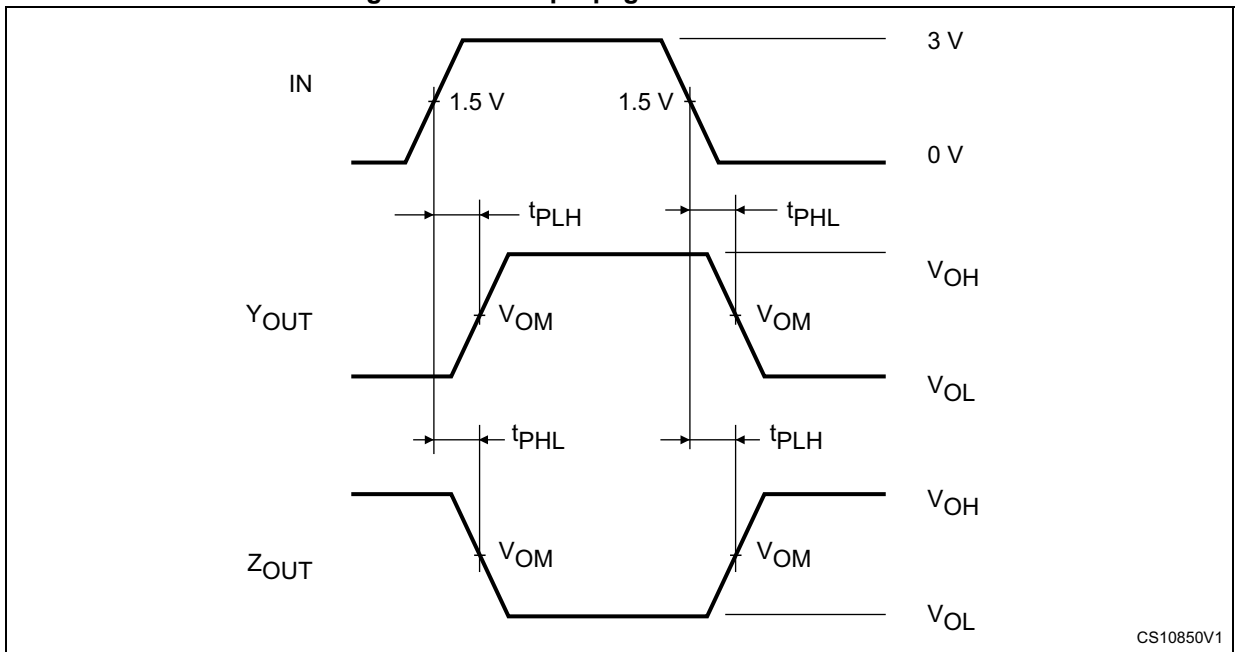


Figure 11. Drive enable and disable times test circuit

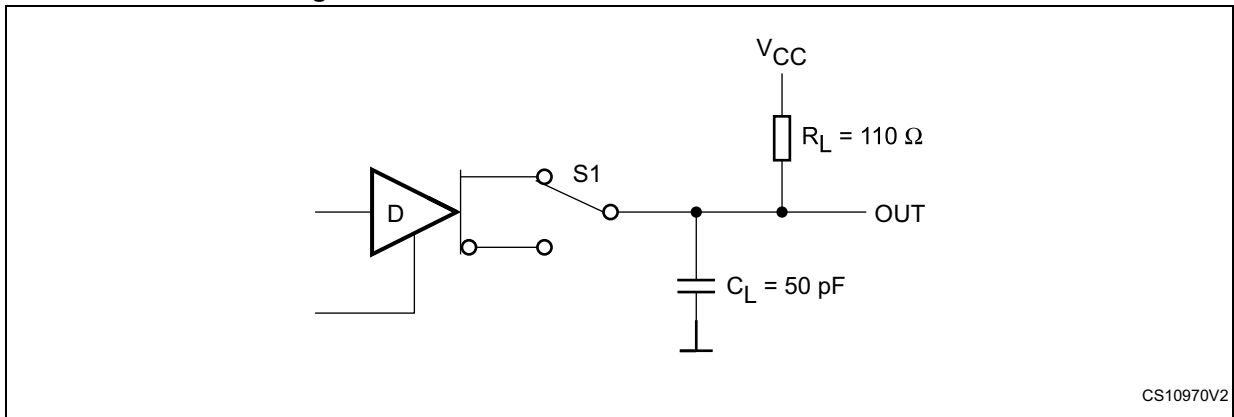


Figure 12. Drive enable and disable times waveforms

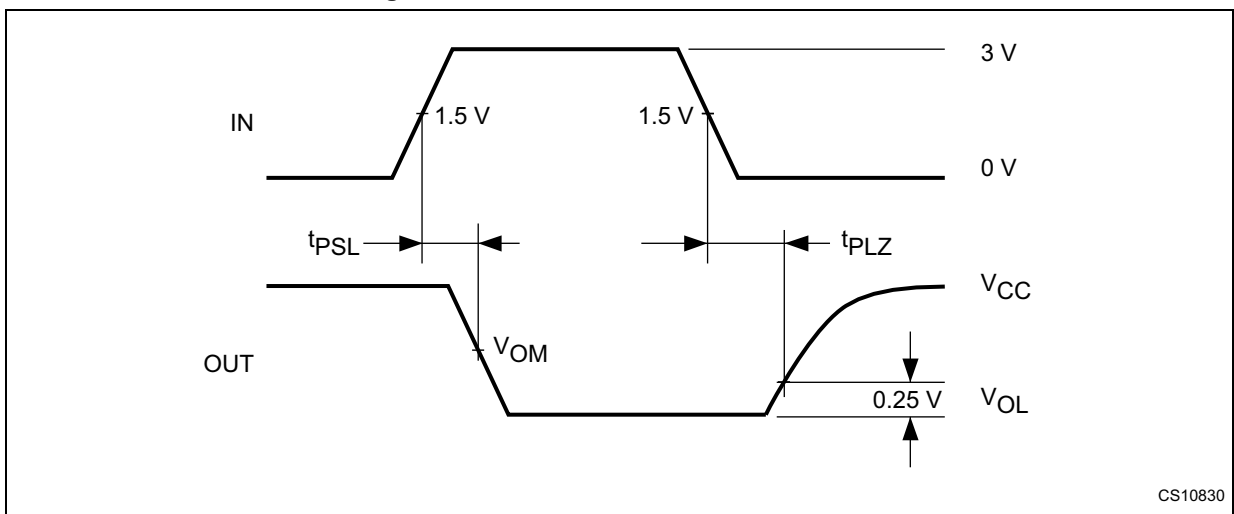


Figure 13. Receiver propagation delay time test circuit

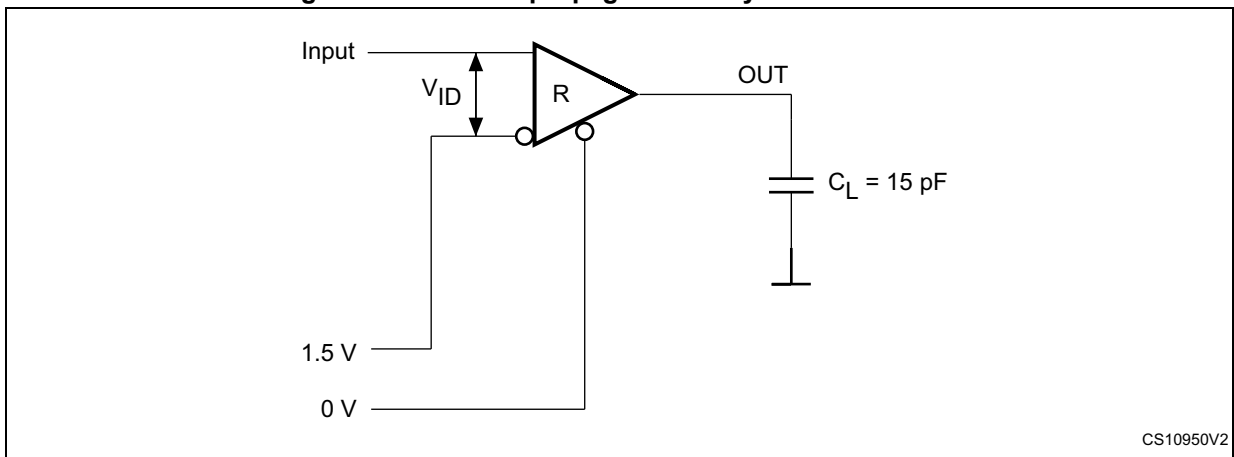
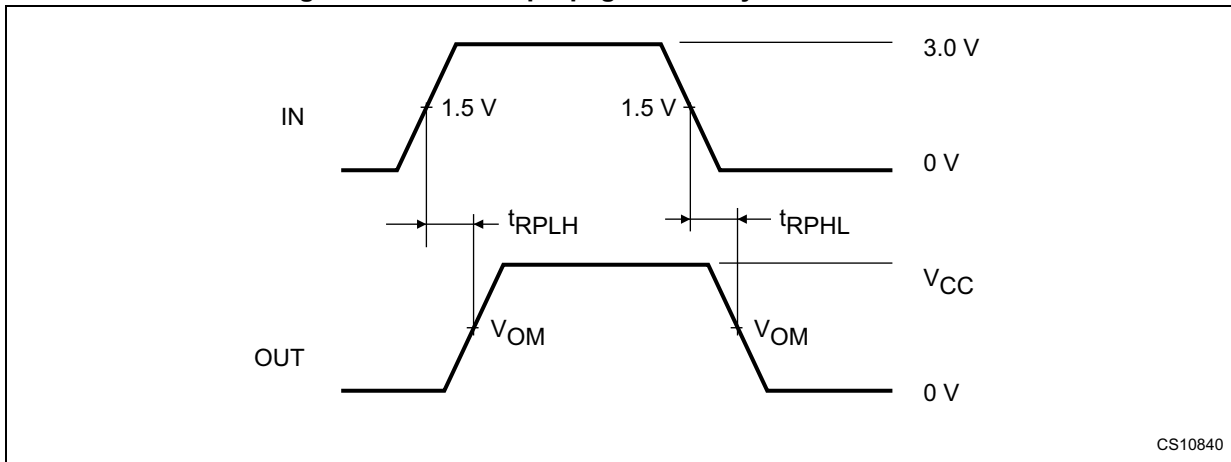
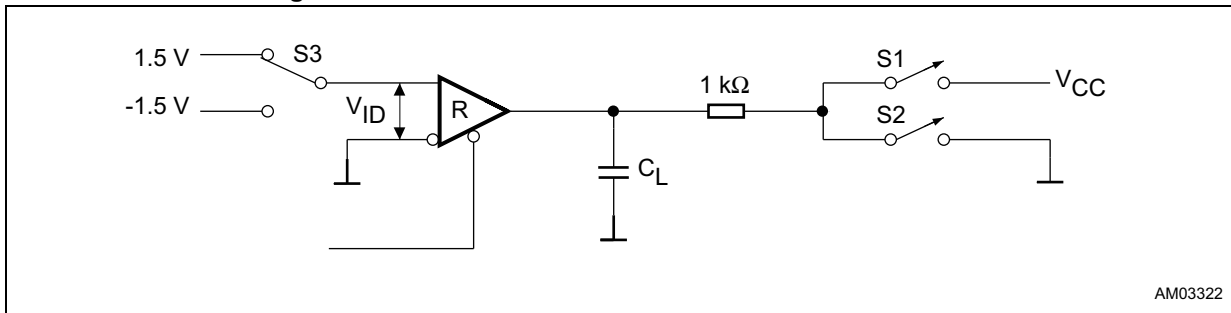


Figure 14. Receiver propagation delay time waveforms



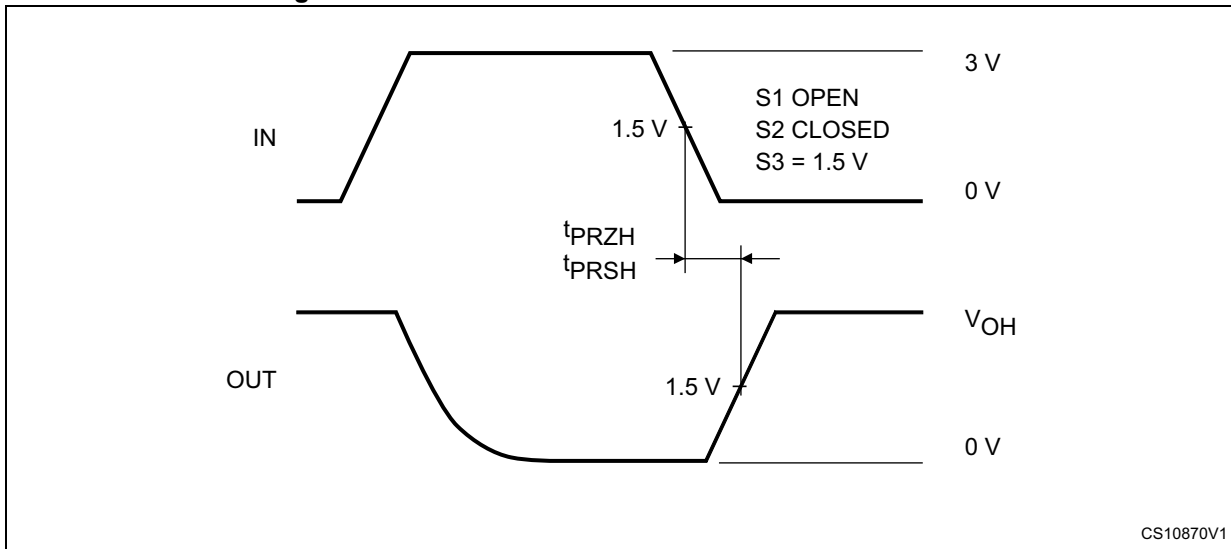
CS10840

Figure 15. Receiver enable and disable times test circuit



AM03322

Figure 16. Receiver enable and disable times waveform

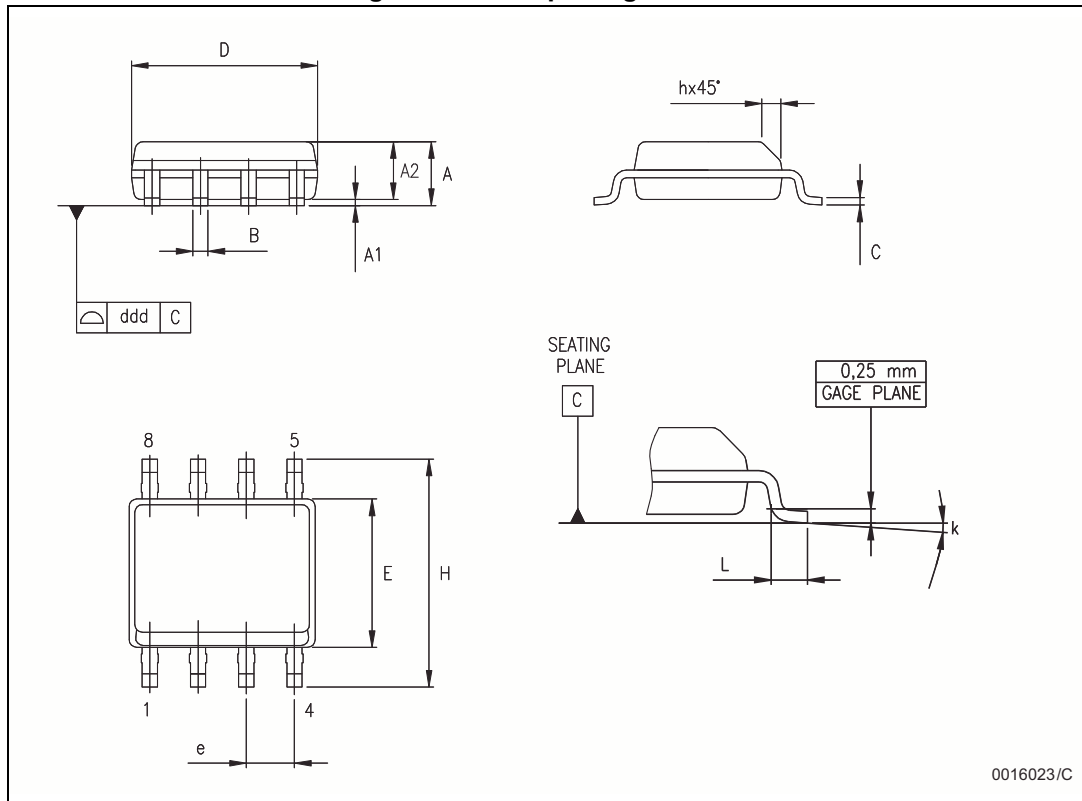


CS10870V1

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.

Figure 17. SO-8 package outline



0016023/C

Table 13. SO-8 package mechanical data

Symbol	Dimensions					
	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

Figure 18. Tape and reel SO-8 outline

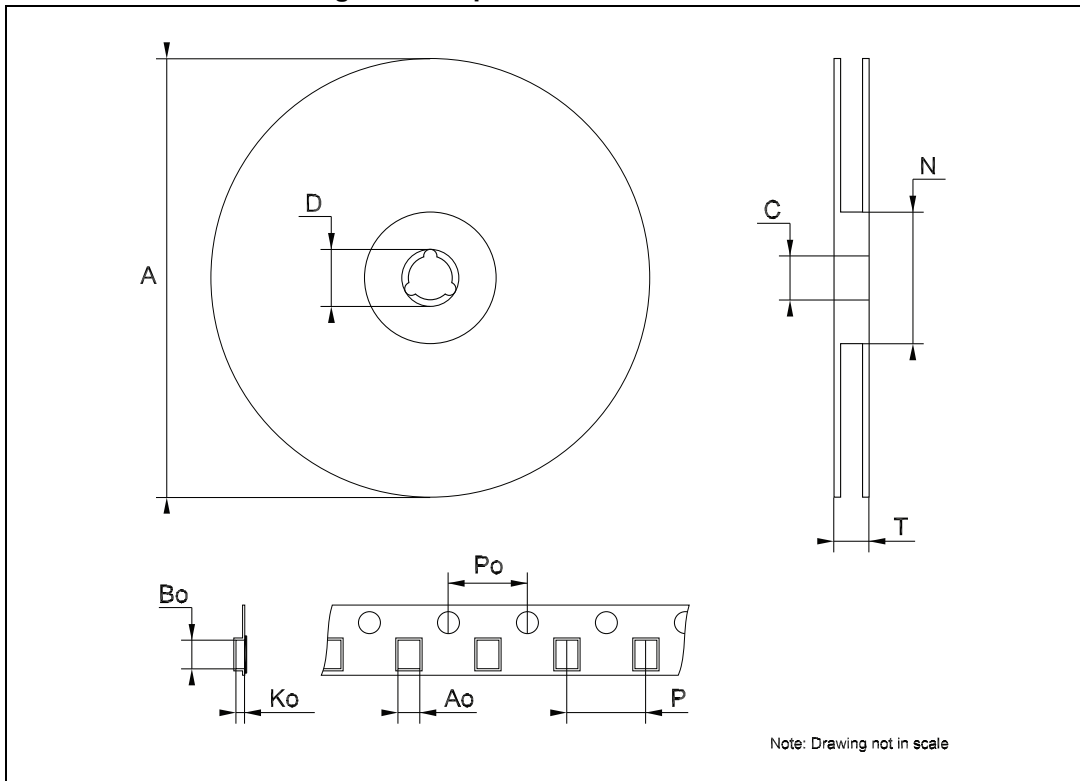


Table 14. Tape and reel SO-8 mechanical data

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 Revision history

Table 15. Document revision history

Date	Revision	Changes
26-Aug-2013	1	Initial release.
05-Sep-2013	2	Updated document status to "production data". Updated Figure 2 to Figure 16 (minor corrections: removed "+", added subscripts, unified/modified line shapes and thickness, fonts). Minor modifications throughout document.

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

ST PRODUCTS ARE NOT AUTHORIZED FOR USE IN WEAPONS. NOR ARE ST PRODUCTS DESIGNED OR AUTHORIZED FOR USE IN: (A) SAFETY CRITICAL APPLICATIONS SUCH AS LIFE SUPPORTING, ACTIVE IMPLANTED DEVICES OR SYSTEMS WITH PRODUCT FUNCTIONAL SAFETY REQUIREMENTS; (B) AERONAUTIC APPLICATIONS; (C) AUTOMOTIVE APPLICATIONS OR ENVIRONMENTS, AND/OR (D) AEROSPACE APPLICATIONS OR ENVIRONMENTS. WHERE ST PRODUCTS ARE NOT DESIGNED FOR SUCH USE, THE PURCHASER SHALL USE PRODUCTS AT PURCHASER'S SOLE RISK, EVEN IF ST HAS BEEN INFORMED IN WRITING OF SUCH USAGE, UNLESS A PRODUCT IS EXPRESSLY DESIGNATED BY ST AS BEING INTENDED FOR "AUTOMOTIVE, AUTOMOTIVE SAFETY OR MEDICAL" INDUSTRY DOMAINS ACCORDING TO ST PRODUCT DESIGN SPECIFICATIONS. PRODUCTS FORMALLY ESCC, QML OR JAN QUALIFIED ARE DEEMED SUITABLE FOR USE IN AEROSPACE BY THE CORRESPONDING GOVERNMENTAL AGENCY.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2013 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[STMicroelectronics:](#)

[ST4485EBDR](#)