

1 Pin configuration

Figure 1. Pin connections

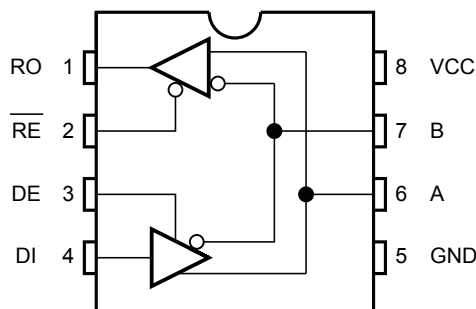


Table 1. Pin description

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 $\overline{RE}$ is low; RO is high impedance when $\overline{RE}$ is high. If $\overline{RE}$ 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 $\overline{RE}$ 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 $\overline{RE}$ 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	VCC	Supply voltage: $V_{CC} = 3\text{ V to }3.6\text{ V}$.

2 Truth tables

Table 2. Truth table (driver)

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

Note: X = “don’t care”; Z = high impedance

Table 3. Truth table (receiver)

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

Note: X = “do not 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)	-0.3 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
R_{thj-a}	Junction-ambient	125	°C/W
ESD	HBM: human body model for the line inputs (A and B) ⁽¹⁾	12	kV
	HBM: human body model for the logic inputs (DI, DE, $\overline{RE}$) ⁽¹⁾	4	
	HBM: human body model for all other pins ⁽¹⁾	2	
	CDM: charged device model ⁽²⁾	1.5	

1. Human body model: 100 pF discharged through a 1.5 k Ω resistor between two pins of the device, done for all couples of pin combinations with other pins floating.
2. Charged device model: all pins plus package are charged together to the specified voltage and then discharged directly to ground.

4 Electrical characteristics

Table 5. Electrical characteristics ($V_{CC} = 3\text{ V}$ to 3.6 V , $T_A = 0$ to 70 °C for ST3485ECDR, $T_A = -40$ to 85 °C for the ST3485EBDR, $T_A = -40$ to 125 °C for the ST3485EIDT and ST3485EIYDT, unless otherwise specified. Typical values are referred to $T_A = 25\text{ °C}$)

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

Table 6. Logic input electrical characteristics ($V_{CC} = 3\text{ V}$ to 3.6 V , $T_A = 0$ to 70 °C for ST3485ECDR, $T_A = -40$ to 85 °C for the ST3485EBDR, $T_A = -40$ to 125 °C for the ST3485EIDT and ST3485EIYDT, unless otherwise specified. Typical values are referred to $T_A = 25\text{ °C}$)

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

Table 7. Transmitter electrical characteristics ($V_{CC} = 3\text{ V}$ to 3.6 V , $T_A = 0$ to 70 °C for ST3485ECDR, $T_A = -40$ to 85 °C for the ST3485EBDR, $T_A = -40$ to 125 °C for the ST3485EIDT and ST3485EIYDT, unless otherwise specified. Typical values are referred to $T_A = 25\text{ °C}$)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{OD}	Differential drive output	$R_L = 100\text{ }\Omega$ (RS-422) Figure 2. Driver and V_{OC} test load	2	—		V
		$R_L = 54\text{ }\Omega$ (RS-485) Figure 2. Driver and V_{OC} test load	1.5			
		$R_L = 60\text{ }\Omega$ (RS-485) Figure 3. Driver V_{OD} with varying common mode voltage test load	1.5			
ΔV_{OD}	Change in magnitude of driver differential output voltage for complementary output states ⁽¹⁾	$R_L = 54\text{ }\Omega$ or $100\text{ }\Omega$ Figure 2. Driver and V_{OC} test load			0.2	
V_{OC}	Driver common mode output voltage	$R_L = 54\text{ }\Omega$ or $100\text{ }\Omega$ Figure 2. Driver and V_{OC} test load			3	
ΔV_{OC}	Change in magnitude of driver common mode output voltage ⁽¹⁾	$R_L = 54\text{ }\Omega$ or $100\text{ }\Omega$ Figure 2. Driver and V_{OC} test load			0.2	
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 8. Receiver electrical characteristics ($V_{CC} = 3\text{ V to }3.6\text{ V}$, $T_A = 0\text{ to }70\text{ °C}$ for ST3485ECDR, $T_A = -40\text{ to }85\text{ °C}$ for ST3485EBDR, $T_A = -40\text{ to }125\text{ °C}$ for ST3485EIDT and ST3485EIYDT, unless otherwise specified. Typical values are referred to $T_A = 25\text{ °C}$)

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		mV
V_{OH}	Receiver output high voltage	$I_{OUT} = -4\text{ mA}$, $V_{ID} = 200\text{ mV}$ (Figure 4. Receiver V_{OH} and V_{OL} test circuit)	2			V
V_{OL}	Receiver output low voltage	$I_{OUT} = 4\text{ mA}$, $V_{ID} = -200\text{ mV}$ (Figure 4. Receiver V_{OH} and V_{OL} test circuit)			0.4	
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			k Ω
I_{OSR}	Receiver short-circuit current	$V_{RO} = 0\text{ V to }V_{CC}$	7		60	mA

Table 9. Driver switching characteristics ($V_{CC} = 3\text{ V to }3.6\text{ V}$, $T_A = 0\text{ to }70\text{ °C}$ for the ST3485ECDR, $T_A = -40\text{ to }85\text{ °C}$ for the ST3485EBDR, $T_A = -40\text{ to }125\text{ °C}$ for the ST3485EIDT and ST3485EIYDT, unless otherwise specified. Typical values are referred to $T_A = 25\text{ °C}$)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
D_R	Maximum data rate		12	15		Mbps
t_{DD}	Differential output delay	$R_L = 60\text{ }\Omega$, $C_L = 15\text{ pF}$ Figure 5. Drive differential output delay transition time test circuit Figure 6. Drive differential output delay transition time waveform		18	30	ns
t_{TD}	Differential output transition time	$R_L = 60\text{ }\Omega$, $C_L = 15\text{ pF}$ Figure 5. Drive differential output delay transition time test circuit Figure 6. Drive differential output delay transition time waveform		12	20	
t_{PLH} t_{PHL}	Propagation delay	$R_L = 27\text{ }\Omega$, $C_L = 15\text{ pF}$ Figure 9. Drive propagation time test circuit Figure 10. Drive propagation time waveform		18	30	
t_{PDS}	$ t_{PLH} - t_{PHL} $ driver propagation delay skew ⁽¹⁾	$R_L = 27\text{ }\Omega$, $C_L = 15\text{ pF}$ Figure 9. Drive propagation time test circuit Figure 10. Drive propagation time waveform		2	5	
t_{PZL}	Output enable time	$R_L = 110\text{ }\Omega$ Figure 11. Drive enable and disable times test circuit (pull-up configuration) Figure 12. Drive enable and disable times waveforms (pull-up configuration)		19	35	
t_{PZH}	Output enable time	$R_L = 110\text{ }\Omega$ Figure 7. Drive enable and disable times test circuit (pull-down configuration) Figure 8. Drive enable and disable times waveforms (pull-down configuration)		30	50	
t_{PHZ}	Output disable time	$R_L = 110\text{ }\Omega$ Figure 7. Drive enable and disable times test circuit (pull-down configuration) Figure 8. Drive enable and disable times waveforms (pull-down configuration)		19	35	
t_{PLZ}	Output disable time	$R_L = 110\text{ }\Omega$ Figure 11. Drive enable and disable times test circuit (pull-up configuration) Figure 12. Drive enable and disable times waveforms (pull-up configuration)		30	50	

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_{SKEW}	Differential output delay skew			1	3	ns
t_{PSH}	Driver enable from shutdown to output high	$R_L = 110 \Omega$ Figure 7. Drive enable and disable times test circuit (pull-down configuration) Figure 8. Drive enable and disable times waveforms (pull-down configuration)		30	50	
t_{PSL}	Driver enable from shutdown to output low	$R_L = 110 \Omega$ Figure 11. Drive enable and disable times test circuit (pull-up configuration) Figure 12. Drive enable and disable times waveforms (pull-up configuration)		19	35	

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

Table 10. Receiver switching characteristics ($V_{\text{CC}} = 3 \text{ V}$ to 3.6 V , $T_A = 0$ to 70°C for ST3485ECDR, $T_A = -40$ to 85°C for ST3485EBDR, $T_A = -40$ to 125°C for ST3485EIDT and ST3485EIYDT, unless otherwise specified. Typical values are referred to $T_A = 25^\circ\text{C}$)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{\text{RPLH}}, t_{\text{RPHL}}$	Propagation delay	$V_{\text{ID}} = 0 \text{ V}$ to 3 V , $C_L = 15 \text{ pF}$ (Figure 13. Receiver propagation delay time test circuit and Figure 14. Receiver propagation delay time waveforms)	—	30	50	ns
t_{RPDS}	$ t_{\text{RPLH}} - t_{\text{RPHL}} $ receiver propagation delay skew	$V_{\text{ID}} = 0 \text{ V}$ to 3 V , $C_L = 15 \text{ pF}$ (Figure 13. Receiver propagation delay time test circuit and Figure 14. Receiver propagation delay time waveforms)		1	3	
t_{PRZL}	Receiver output enable time to low level	$C_L = 15 \text{ pF}$ (Figure 15. Receiver enable and disable times test circuit and Figure 17. Receiver enable and disable times waveform (test 2))		10	20	
t_{PRZH}	Receiver output enable time to high level	$C_L = 15 \text{ pF}$ (Figure 15. Receiver enable and disable times test circuit and Figure 16. Receiver enable and disable times waveform (test 1))		10	20	
t_{PRHZ}	Receiver output disable time from high level	$C_L = 15 \text{ pF}$ (Figure 15. Receiver enable and disable times test circuit and Figure 18. Receiver enable and disable times waveform (test 3))		10	20	
t_{PRLZ}	Receiver output disable time from low level	$C_L = 15 \text{ pF}$ (Figure 15. Receiver enable and disable times test circuit and Figure 19. Receiver enable and disable times waveform (test 4))		10	20	
t_{PRSH}	Receiver output enable time from shutdown to high level	$C_L = 15 \text{ pF}$ (Figure 15. Receiver enable and disable times test circuit and Figure 16. Receiver enable and disable times waveform (test 1))		10	20	
t_{PRSL}	Receiver output enable time from shutdown to low level	$C_L = 15 \text{ pF}$ (Figure 15. Receiver enable and disable times test circuit and Figure 17. Receiver enable and disable times waveform (test 2))		20	40	μs

Notes:

1. ΔV_{OD} and ΔV_{OC} are the changes in V_{OD} and V_{OC} , respectively, when the DI input changes state.
2. Measured on $|t_{\text{PLH}}(A) - t_{\text{PHL}}(A)|$ and $|t_{\text{PLH}}(B) - t_{\text{PHL}}(B)|$.
3. The transceivers are put into shutdown by bring $\overline{\text{RE}}$ 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_{OD} test load

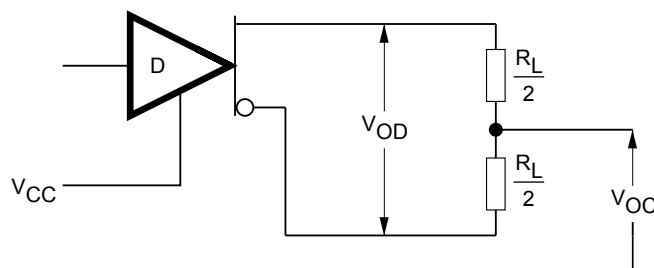


Figure 3. Driver V_{OD} with varying common mode voltage test load

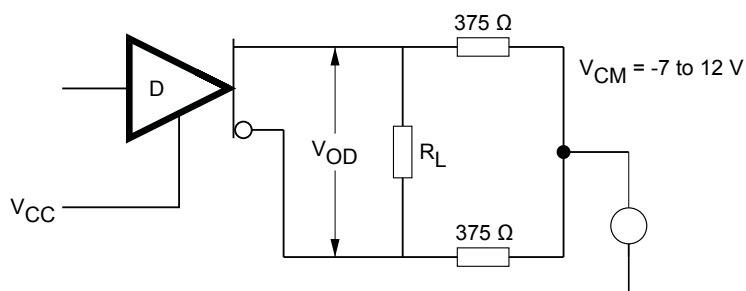


Figure 4. Receiver V_{OH} and V_{OL} test circuit

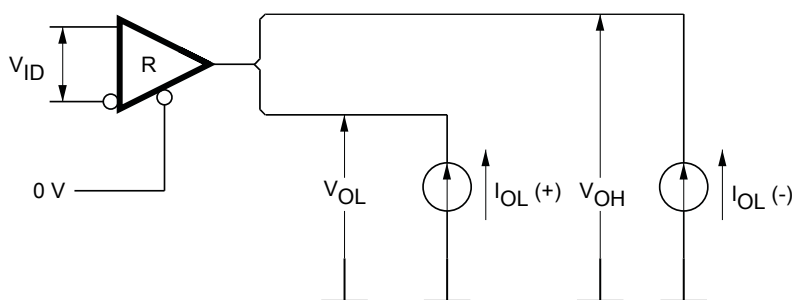
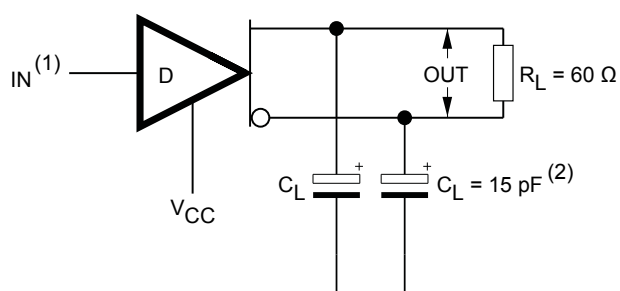
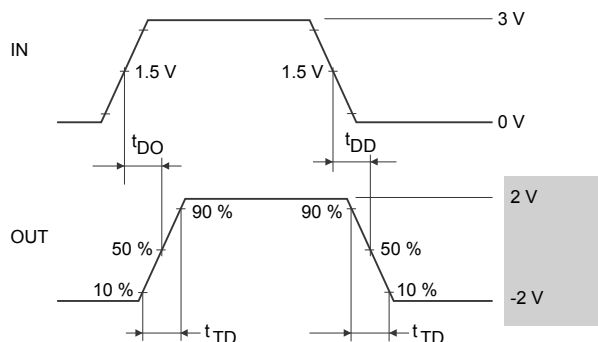
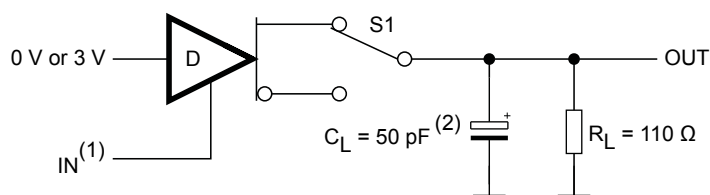


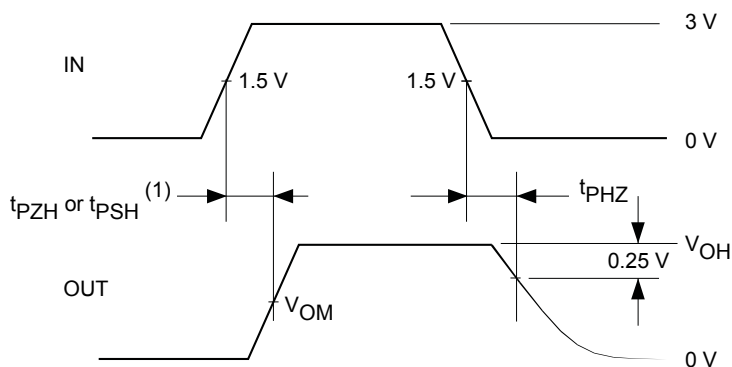
Figure 5. Drive differential output delay transition time test circuit



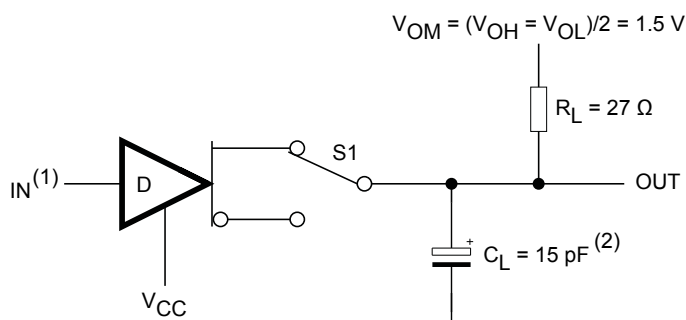
1. The input pulse is supplied by a generator with the following characteristics: PRR = 250 kHz, 50 % duty cycle, $t_r \leq 6.0$ ns, $Z_O = 50 \Omega$.
2. C_L includes probe and stray capacitance

Figure 6. Drive differential output delay transition time waveform

Figure 7. Drive enable and disable times test circuit (pull-down configuration)


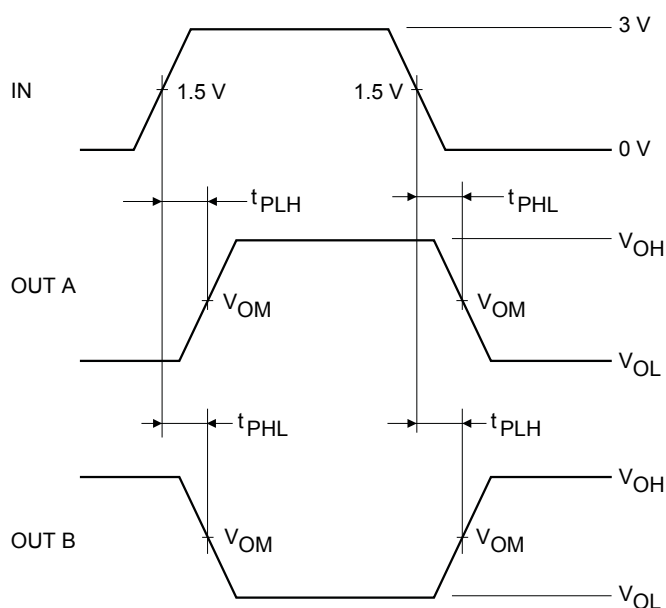
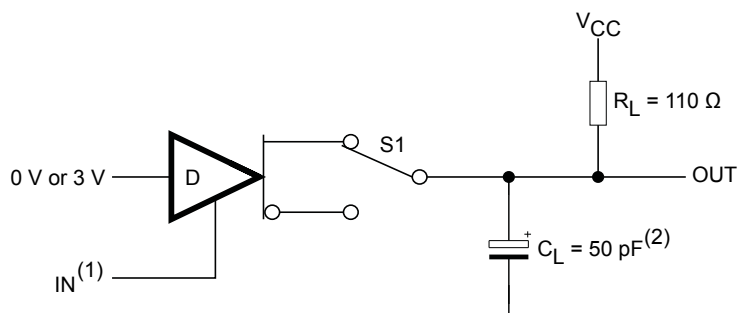
1. The input pulse is supplied by a generator with the following characteristics: PRR = 250 kHz, 50 % duty cycle, $t_r \leq 6.0$ ns.
2. C_L includes probe and stray capacitance

Figure 8. Drive enable and disable times waveforms (pull-down configuration)


1. t_{PZH} is valid if the driver is initially disabled ($\overline{RE}$ is high), t_{PSH} is valid if the driver is initially in shutdown mode ($\overline{RE}$ is low).

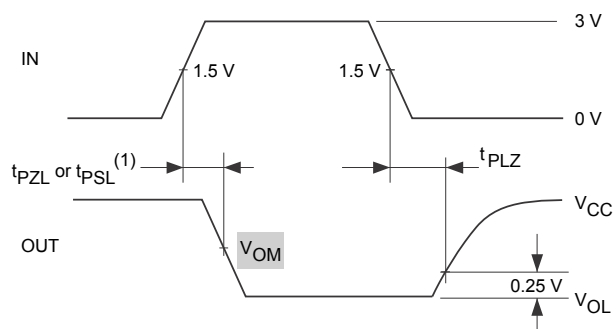
Figure 9. Drive propagation time test circuit


1. The input pulse is supplied by a generator with the following characteristics: PRR = 250 kHz, 50 % duty cycle, $t_r \leq 6.0$ ns.
2. C_L includes probe and stray capacitance

Figure 10. Drive propagation time waveform

Figure 11. Drive enable and disable times test circuit (pull-up configuration)


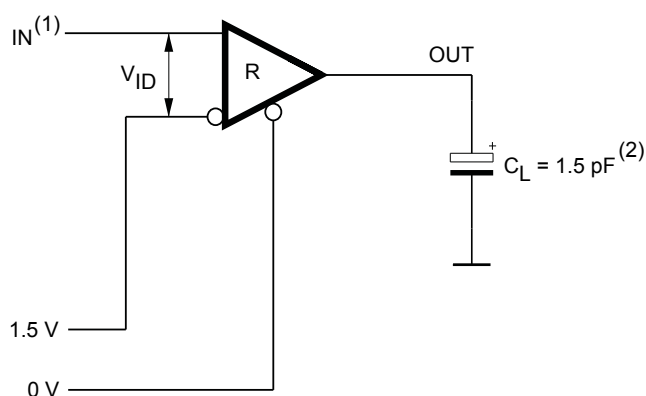
1. The input pulse is supplied by a generator with the following characteristics: PRR = 250 kHz, 50 % duty cycle, $t_r \leq 6.0$ ns.
2. C_L includes probe and stray capacitance

Figure 12. Drive enable and disable times waveforms (pull-up configuration)

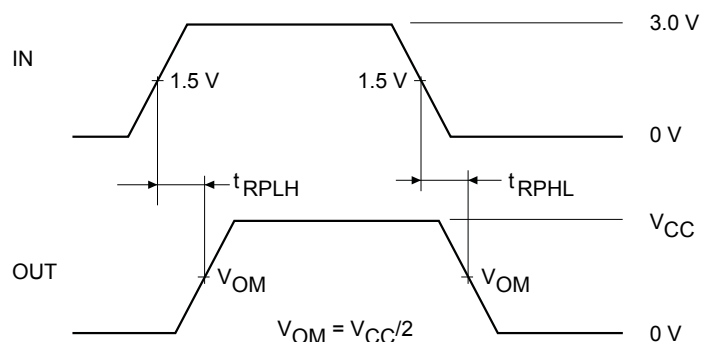
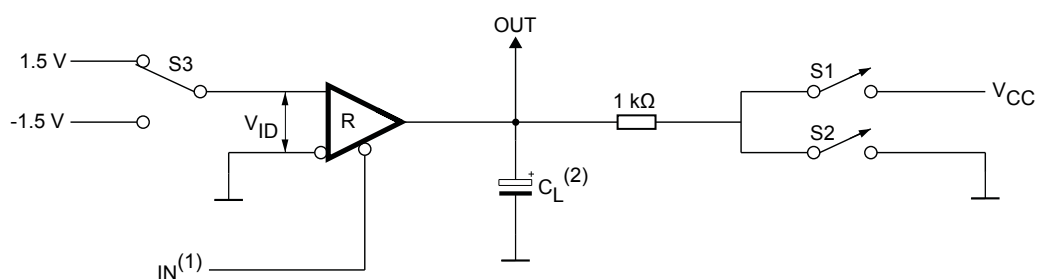


1. t_{PZL} is valid if the driver is initially disabled ($\overline{RE}$ is high), t_{PSL} is valid if the driver is initially in shutdown mode ($\overline{RE}$ is low).

Figure 13. Receiver propagation delay time test circuit



1. The input pulse is supplied by a generator with the following characteristics: PRR = 250 kHz, 50 % duty cycle, $t_r \leq 6.0$ ns.
2. C_L includes probe and stray capacitance

Figure 14. Receiver propagation delay time waveforms

Figure 15. Receiver enable and disable times test circuit


1. The input pulse is supplied by a generator with the following characteristics: PRR = 250 kHz, 50 % duty cycle, $t_r \leq 6.0$ ns.
2. C_L includes probe and stray capacitance

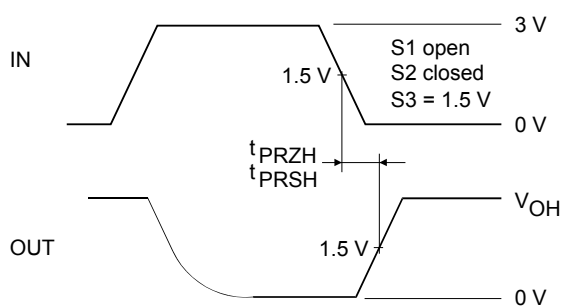
Figure 16. Receiver enable and disable times waveform (test 1)


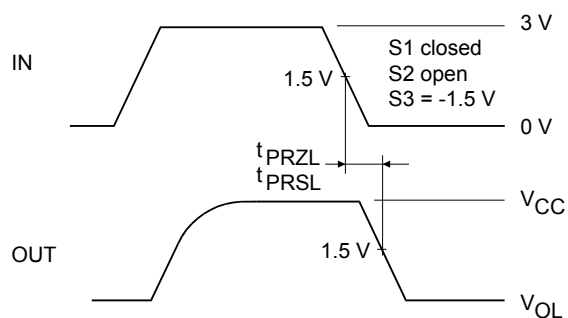
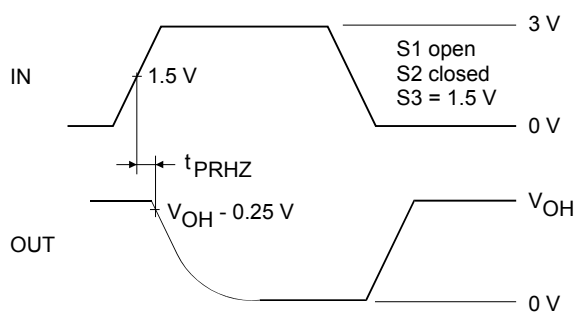
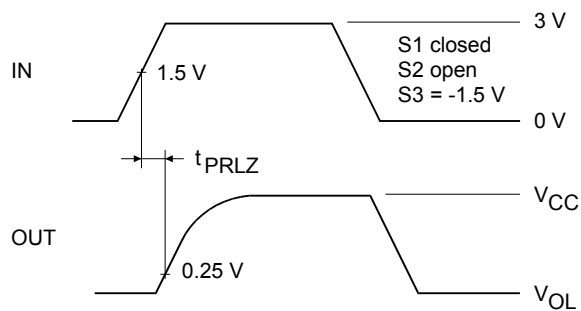
Figure 17. Receiver enable and disable times waveform (test 2)

Figure 18. Receiver enable and disable times waveform (test 3)

Figure 19. Receiver enable and disable times waveform (test 4)


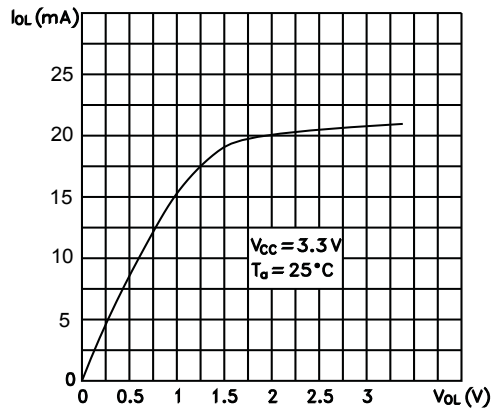
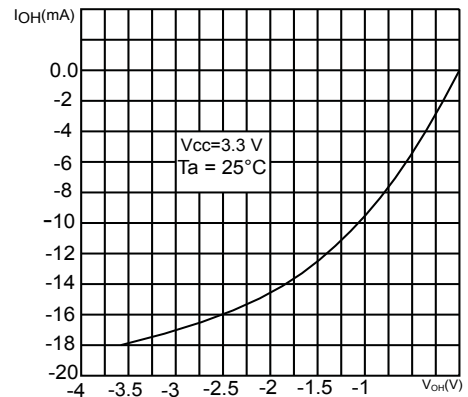
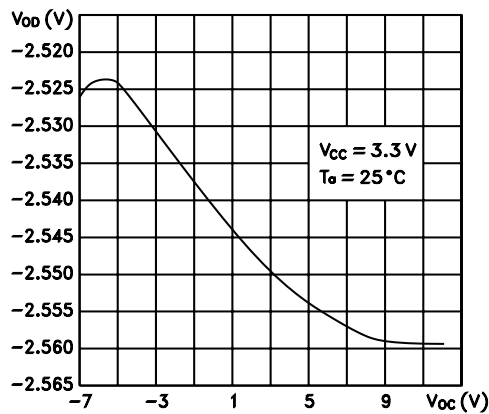
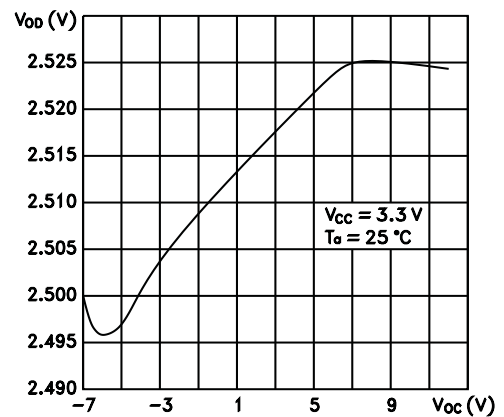
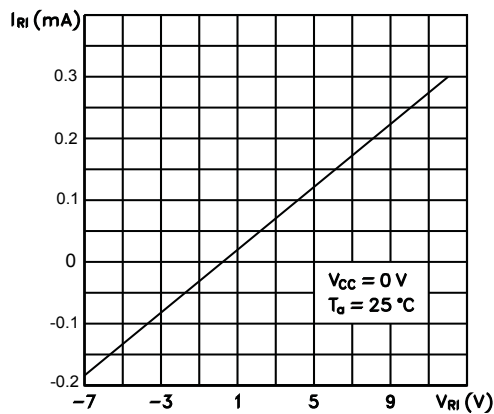
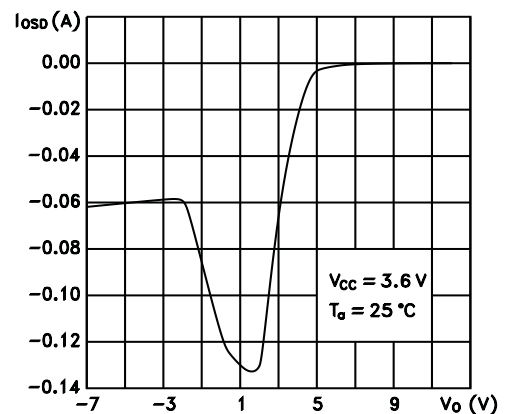
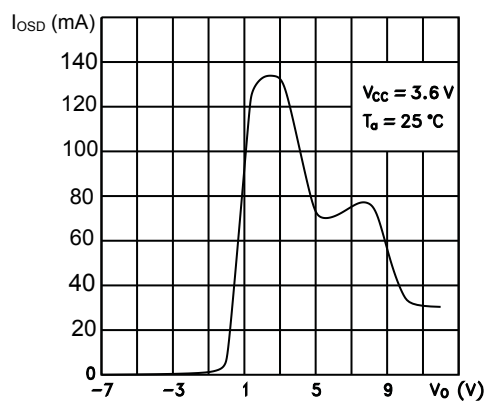
Figure 20. Receiver output current vs. output low voltage

Figure 21. Receiver output current vs. output high voltage

Figure 22. Low level driver output capability

Figure 23. High level driver output capability

Figure 24. Receiver input characteristics

Figure 25. Driver short-circuit current (test 1)


Figure 26. Driver short-circuit current (test 2)


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 27. SO8 package outline

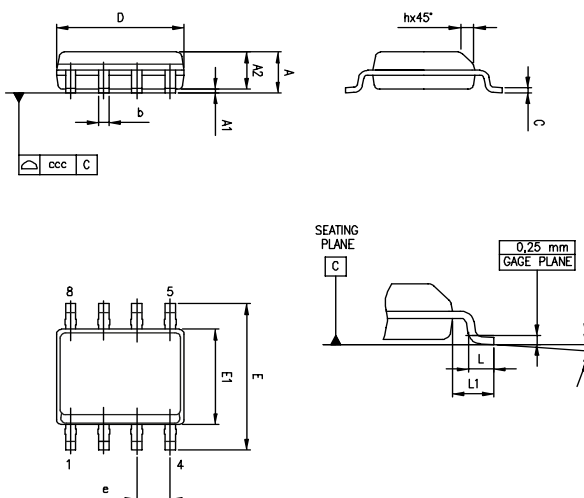
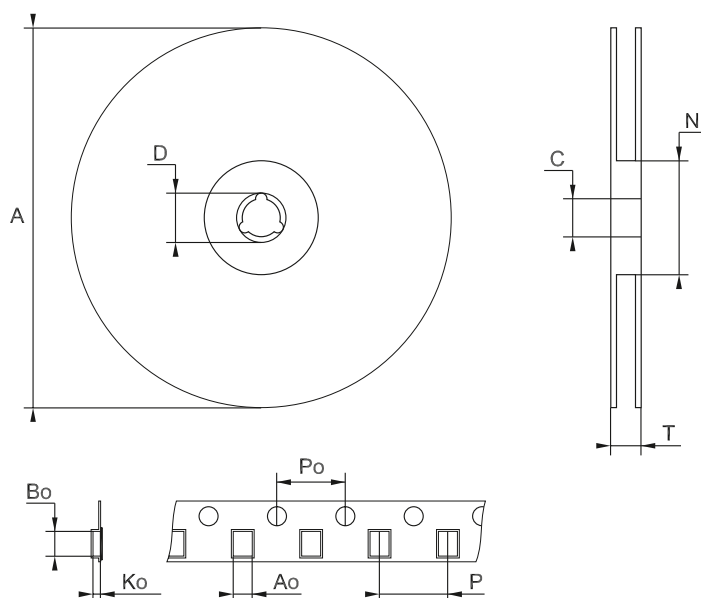


Table 11. SO8 package mechanical data

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 packing information

Figure 28. SO8 tape and reel outline



1. Drawing not to scale

Table 12. SO8 tape and reel mechanical data

Symbol	Dimensions					
	mm			Inches		
	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 13. Order codes

Order code	Temperature range	Package	Packing	Marking
ST3485ECDR	0 to 70 °C	SO8	2500 parts per reel	3485EC
ST3485EBDR	-40 to 85 °C			3485EB
ST3485EIDT	-40 to 125 °C			3485EI
ST3485EIYDT ⁽¹⁾	-40 to 125 °C (automotive grade)			3485EIY

1. Qualification and characterization according to AEC Q100 and Q003 or equivalent, advanced screening according to AEC Q001 and Q 002 or equivalent.

Revision history

Table 14. Document revision history

Date	Revision	Changes
20-Jun-2005	2	Mistake on table 12 $t_{ZL(SHDN)}$ ms ==> μ s.
30-Aug-2005	3	Remove (TRUE) on title, description has been updated in cover page. The V_{TH} and DV_{TH} values are changed in table 10.
07-Apr-2006	4	Order codes updated.
12-Nov-2007	5	Added Table 1.
18-Dec-2013	6	Updated Features (added SO-8 package, replaced human body model by ± 15 kV IEC 61000-4-2 air discharge and IEC 1000-4-2 by IEC 61000-4-2). Updated Description (renamed device to ST3485EB/EC, replaced human body model by ± 15 kV IEC 61000-4-2 air discharge). Removed ST3485ECN device from Table 1. Updated title of Table 6, cross-references, replaced human body model (HBM) by ± 15 kV IEC 61000-4-2 air discharge and IEC 1000-4-2 by IEC 61000-4-2. Added notes below Table 9. Updated Table 10 to Table 12 (updated data, cross-references). Updated Figure 5 to Figure 16 (updated data, added notes below figures and highlighted some parts of Figure 6 and Figure 12). Removed DIP-8 package from Section 6: "Package information" and whole document. Reformatted Section 6: "Package information" (added Figure 27, Figure 28, Table 13 and Table 14, reversed order of figures and table). Minor corrections throughout document.
12-Jun-2015	7	Added part number ST3485EIY Added order code ST3485EIYDT and pointed out in Features it is automotive grade. Table 7 and Table 9 through to Table 12: replaced $T_A = -40$ to 85 °C with $T_A = 0$ to 70 °C (ST3485ECDR), $T_A = -40$ to 85 °C (ST3485EBDR), and $T_A = -40$ to 125 °C (ST3485EIYDT). Updated titles of figures 7, 8, 11, 12, 16, 17, 18, 19, 25, and 26
15-Mar-2016	8	Table 5: added ESD information Removed "Table 6: ESD performance: transmitter outputs, receiver inputs (A, B)". Added Section 7: "Ordering information"
02-Aug-2016	9	Added new part number ST3485EI Table 1: "Device summary": added information for new part number ST3485EI. Removed " Note " icons throughout datasheet Section 4: "Electrical characteristics": updated T_A information Section 5: "Test circuits and typical characteristics": removed overline bar concerning "RE is low" in note 1 of figures 8 and 12. Table 14: "Order codes": added ST3485EIDT and updated footnote 1 (ST3485EIYDT now qualified).
25-Aug-2016	10	Table 14: "Order codes": updated order codes ST3485EBDR and ST3485ECDR.
26-Oct-2017	11	Updated Figure 20: "Receiver output current vs. output low voltage", Figure 21: "Receiver output current vs. output high voltage", Figure 24: "Receiver input characteristics" and Figure 26: "Driver short-circuit current (test 2)".
05-Mar-2021	12	Updated Table 4. Absolute maximum ratings.

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