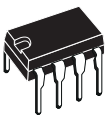
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ST485AB

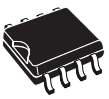
Very high speed low power RS-485/RS-422 transceiver

Features

- Low supply current: 5 mA max
- High data rate > 30 Mbps
- Designed for RS 485 interface applications
- -7 to 12 common mode input voltage range
- Driver maintains high impedance in 3-state or with the power off
- 70mV typical input hysteresis
- Operate from single 5 supply
- ±4 kV ESD protection
- Current limiting and thermal shutdown for driver overload protection
- Latch-up free up to 500 mA



DIP-8



SO-8

The ST485A is designed for bi-directional data communications or multipoint bus transmission lines.

Description

The ST485A is a low power, high speed transceiver for RS-485 and RS-422 communications. The device contains one driver and one receiver in half duplex configuration. The ST485A draws 3 mA (typ.) of supply current when unloaded or fully loaded with disabled drivers. It operates from a single 5 V supply.

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 receiver input has a fail-safe feature that guarantees a logic high output if both inputs are open circuit.

Table 1. Device summary

Order code	Temperature range	Package	Packaging
ST485ABN	-40 to 85 °C	DIP-8	50parts per tube / 40tube per box
ST485ABDR	-40 to 85 °C	SO-8 (Tape & reel)	2500 parts per reel

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1 Pin configuration

Figure 1. Pin configuration

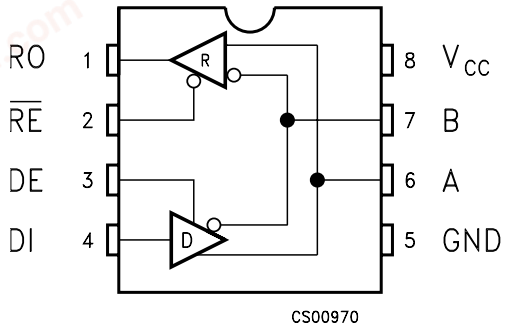


Table 2. Pin description

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}= 4.75 V to 5.25 V

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2 Truth tables

Table 3. Truth table (driver)

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

Note: X = Don't care; Z = High impedance

Table 4. Truth table (receiver)

Inputs			Outputs	Mode
$\overline{RE}$	DE	A-B	RO	
L	L	≥ -0.2 V	H	Normal
L	L	≤-0.2 V	L	Normal
L	L	Inputs open	H	Normal

Note: X = Don't care; Z = High impedance

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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)	-0.3 to 7	V
V_{DI}	Driver input voltage (DI)	-0.3 to 7	V
V_{DO}	Driver output voltage (A, B)	-7.5 to 12.5	V
V_{RI}	Receiver input voltage (A, B)	-7.5 to 12.5	V
V_{RO}	Receiver output voltage (RO)	-0.3 to (V_{CC} + 0.3)	V

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

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4 Electrical characteristics

Table 6. DC electrical characteristics (V_{CC} = 4.5 V to 5.5 V, T_A = -40 to 85°C, unless otherwise specified. Typical values are referred to T_A = 25°C, V_{CC} = 5 V) (*Note: 1*)

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
I_{SUPPLY}	V_{CC} Power supply current	No load, V_{RE}=0 V or V_{CC}	$V_{DE} = V_{CC}$		2.3	5	mA
			V_{DE} = 0 V		2.6	5	mA
$C_{I/O}$	Input/output capacitance				10		pF
C_{AB}	Driver output capacity				10		pF

Table 7. Logic input electrical characteristics (V_{CC} = 4.5 V to 5.5 V, T_A = -40 to 85°C, unless otherwise specified. Typical values are referred to T_A = 25°C, V_{CC} = 5 V) (*Note: 1*)

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
V_{IL}	Input logic threshold low	DE, DI, RE				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)	V_{DE}=0 V, V_{CC}= 0 or 5.25 V	V_{IN}=12 V			1	mA
			V_{IN}=-7 V			-0.8	mA

Table 8. Transmitter electrical characteristics (V_{CC} = 4.5 V to 5.5 V, T_A = -40 to 85°C, unless otherwise specified. Typical values are referred to T_A = 25°C, V_{CC} = 5 V) (*Note: 1*)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{OD1}	Differential driver output (No load)				5	V
V_{OD2}	Differential driver output (with load)	R_L= 54 Ω (RS-422) V_{CM}= -7 V to 12 V	1.5	2.7	5	V
ΔV_{OD}	Change in magnitude of driver differential output voltage for complementary output states (*Note: 1*)	R_L= 27 Ω or 50 Ω		0	0.2	V
V_{OC}	Driver common mode output voltage	R_L= 27 Ω or 50 Ω	1		3	V
ΔV_{OC}	Change in magnitude of driver common mode output voltage (*Note: 1*)	R_L= 54 Ω or 100 Ω		0	0.2	V
I_{OSD}	Driver short circuit output current	V_O= -7 V to 12 V			±250	mA

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Table 9. Receiver electrical characteristics (V_{CC} = 4.5 V to 5.5 V, T_A = -40 to 85°C, unless otherwise specified. Typical values are referred to T_A = 25°C, V_{CC} = 5 V) (*Note: 1*)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{TH}	Receiver Differential Threshold Voltage	V_{CM} = -7 V 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_{OUT} = -4 mA, V_{ID} = 200 mV	3.5	4.7		V
V_{OL}	Receiver Output Low Voltage	I_{OUT} = 4 mA, V_{ID} = -200 mV		0.2	0.4	V
I_{OZR}	3-State (High Impedance) Output Current at Receiver	V_O = 0.4 V to 2.4 V			±1	µA
R_{RIN}	Receiver Input Resistance	V_{CM} = -7 V to 12 V	12	24		KΩ
I_{OSR}	Receiver Short-Circuit Current	V_O = 0 V to V_{CC}	7		95	mA

Table 10. Driver switching characteristics (V_{CC} = 4.5 V to 5.5 V, T_A = -40 to 85°C, unless otherwise specified. Typical values are referred to T_A = 25°C, V_{CC} = 5 V) (See *Note: 1*, *Note 3*)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
D_R	Maximum data rate	Jitter < 5%	30	50		Mbps
t_{PLH} t_{PHL}	Propagation delay input to output	R_L= 54 Ω, C_{L1}=C_{L2}=50 pF, (*Figure 8.*)		18	30	ns
t_{SKEW}	Differential output delay skew	R_L= 54Ω, C_{L1}=C_{L2}=50 pF, (*Figure 6.*)		0.5	2	ns
t_{TLH} t_{THL}	Rise or fall differential time	R_L= 54Ω, C_{L1}=C_{L2}=50 pF, (*Figure 6.*)		8	12	ns
t_{PZL}	Output enable time	C_L= 50 pF, S1 Closed			30	ns
t_{PZH}	Output enable time	C_L= 50 pF, S2 Closed			30	ns
t_{PHZ}	Output disable time	C_L= 15 pF, S2 Closed			30	ns
t_{PLZ}	Output disable time	C_L= 15 pF, S1 Closed			30	ns
$t_{SK(EN)}$	Synchronous driver operation a-b at enable				2	ns
$t_{SK(DS)}$	Synchronous driver operation A-B at disable			4	6	ns

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Table 11. Driver switching characteristics (V_{CC} = 4.5V to 5.5V, T_A = -40 to 85°C, unless otherwise specified. Typical values are referred to T_A = 25°C, V_{CC} = 5V) (See *Note: 1*, *Note 3*)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_{PLH} t_{PHL}	Propagation Delay	C_L = 15 pF		18	30	ns
t_{RPDS}	$\|t_{PLH} - t_{PHL}\|$ Propagation delay skew	C_L = 15 pF		0.5	2	ns
t_{PZL}	Output enable time	C_{RL} = 15 pF, S1 Closed		7	12	ns
t_{PZH}	Output enable time	C_{RL} = 15 pF, S2 Closed		7	12	ns
t_{PHZ}	Output disable time	C_{RL} = 15 pF, S2 Closed		7	12	ns
t_{PLZ}	Output disable time	C_{RL} = 15 pF, S1 Closed		7	12	ns

Note: 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 Applies to peak current. See typical Operating Characteristics.

3 t_r=t_f ≤6 ms.

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5 Test circuit and typical characteristics

Figure 2. Driver DC test load

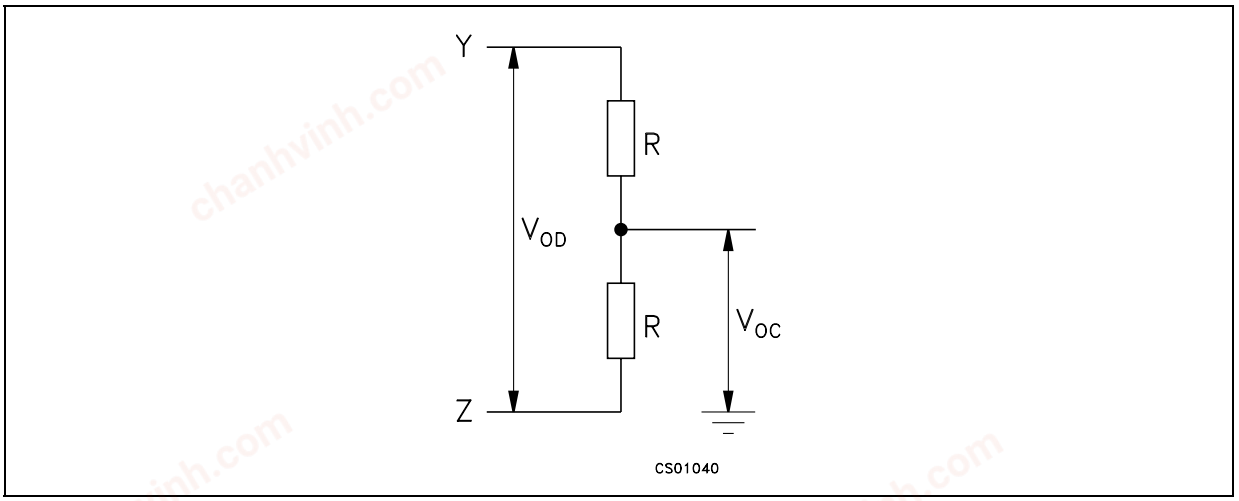


Figure 3. Receiver timing test load

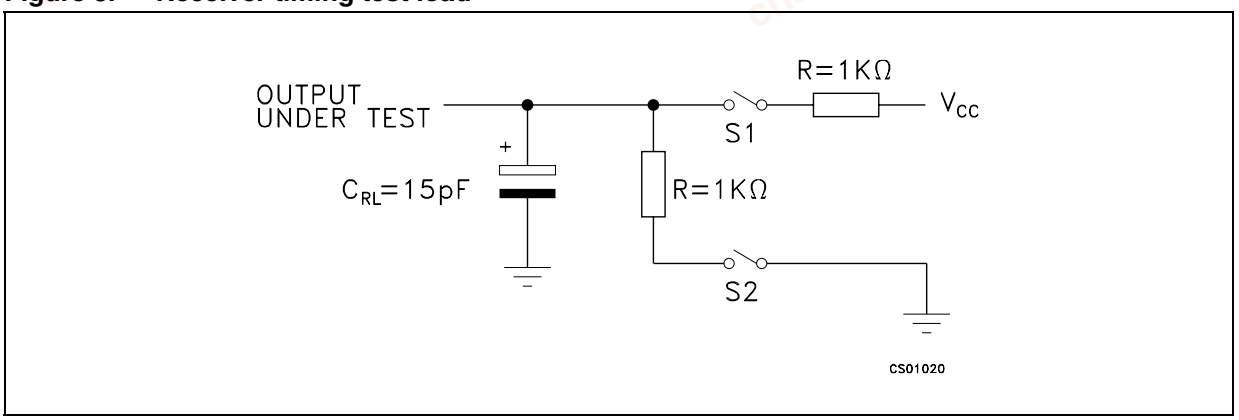
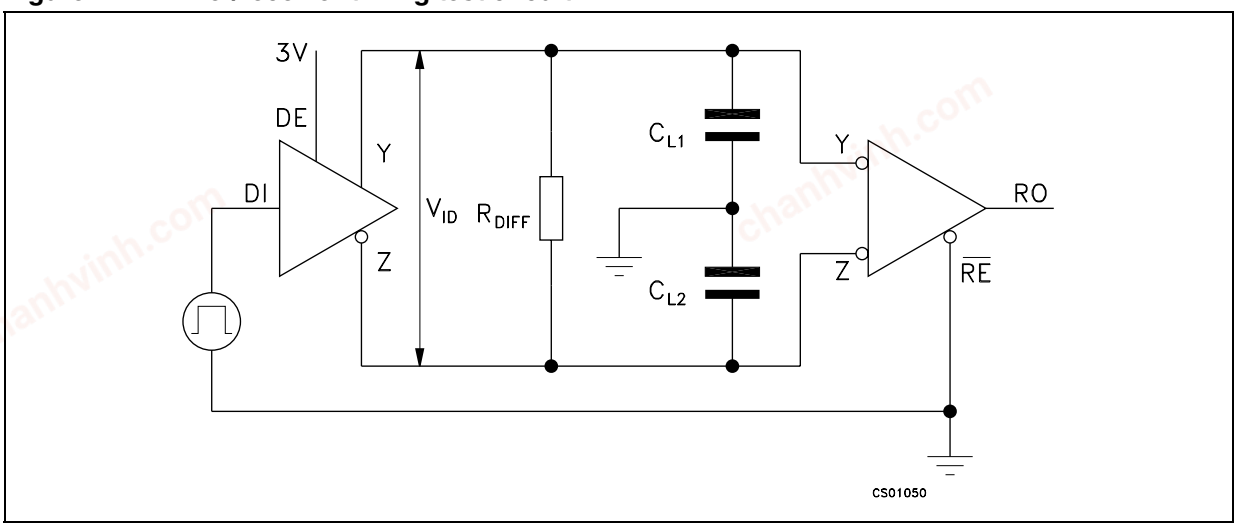


Figure 4. Driver/receiver timing test circuit



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Figure 5. Driver timing test load

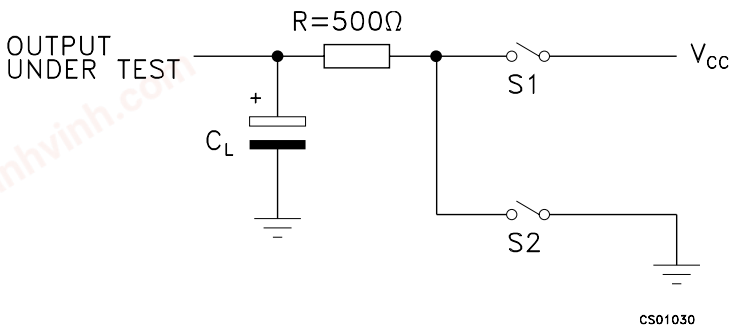
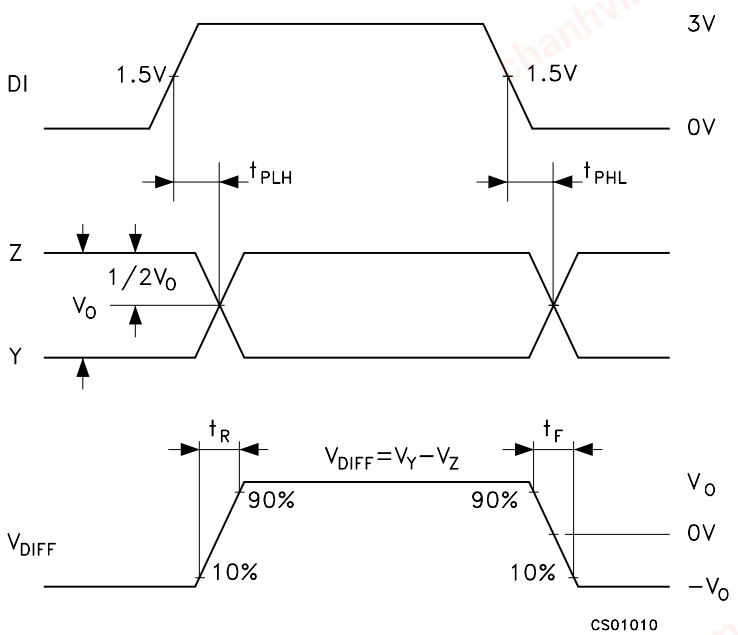


Figure 6. Driver timing test load



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Figure 7. Driver enable and disable time

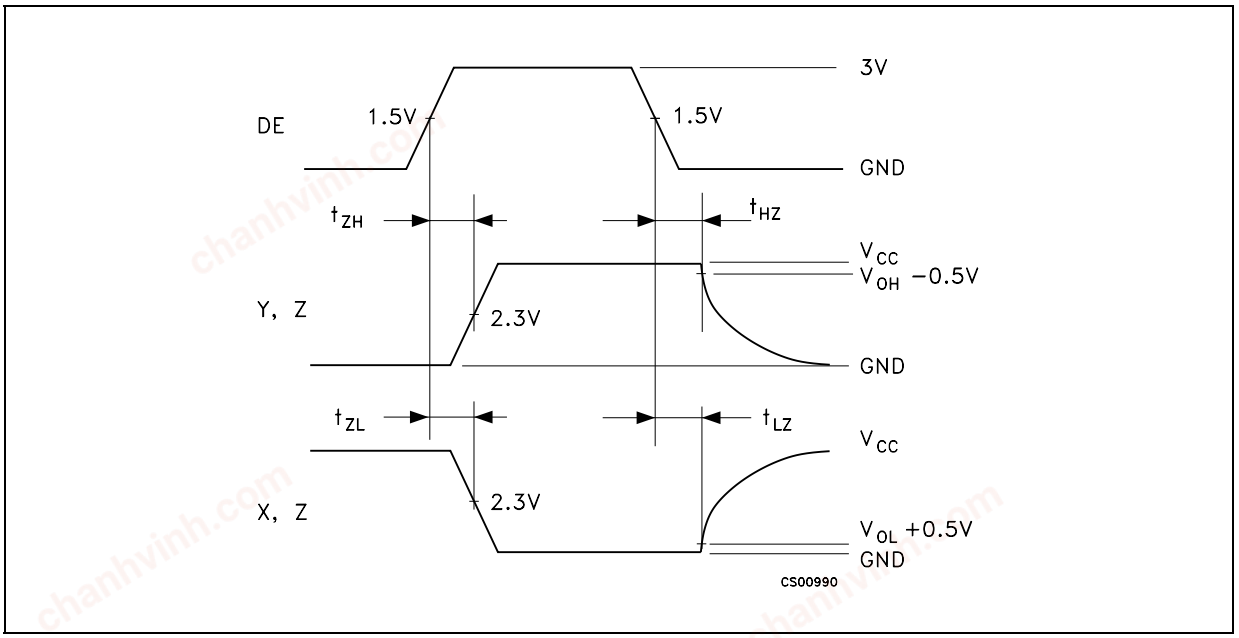
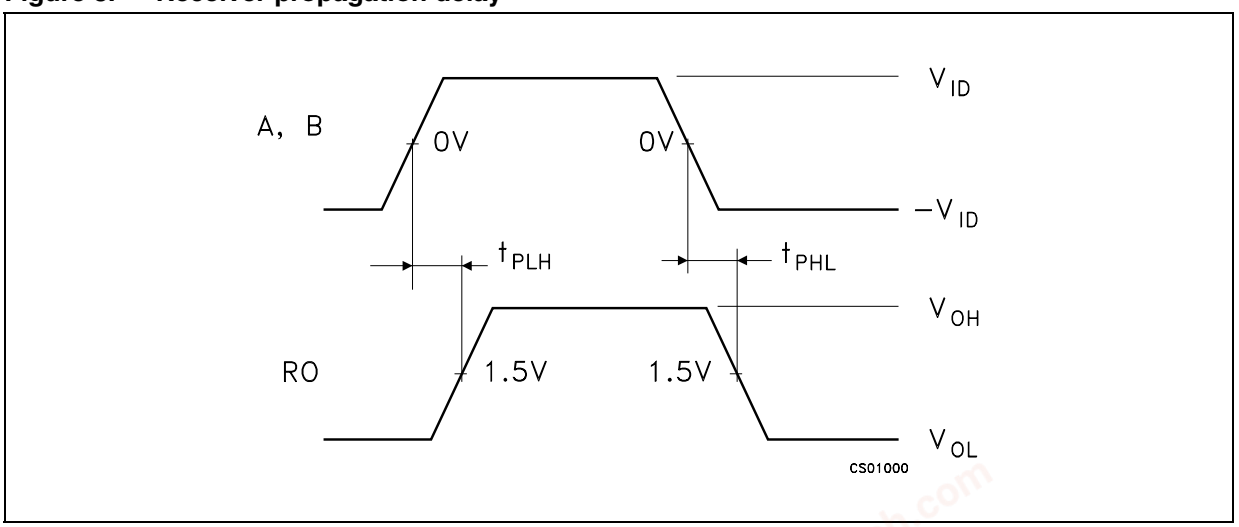


Figure 8. Receiver propagation delay



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Figure 9. Receiver enable and disable time

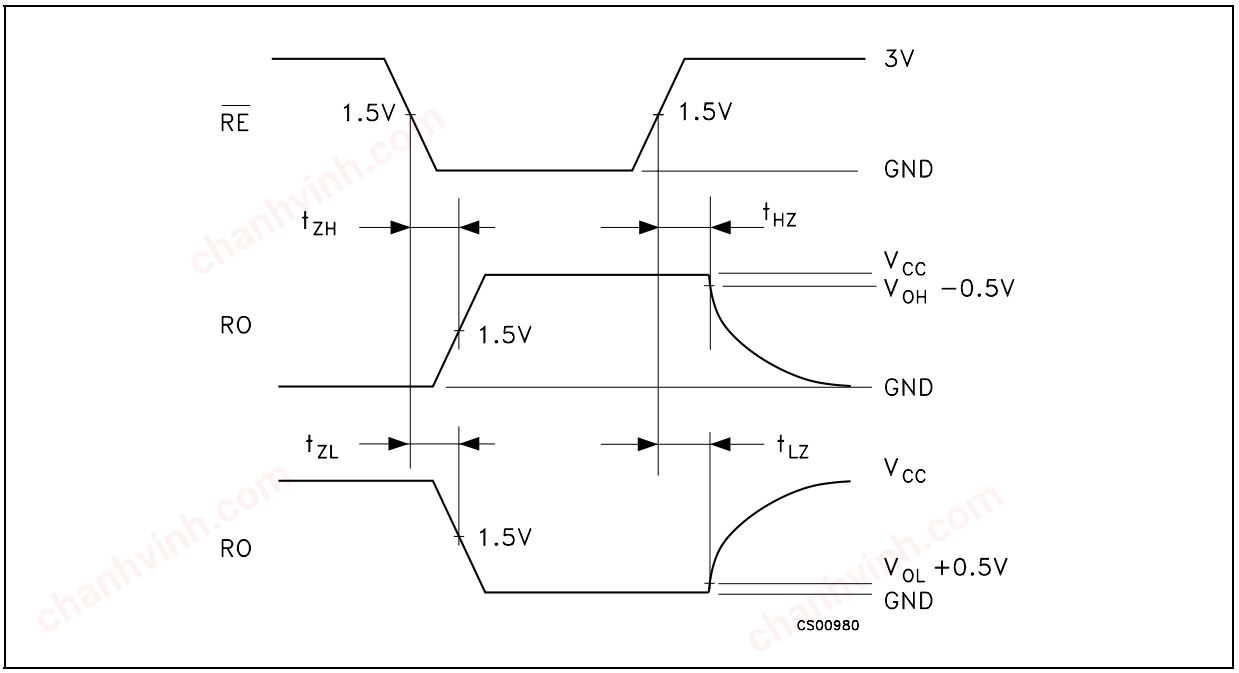


Figure 10. Receiver output current vs. output voltage (output low)

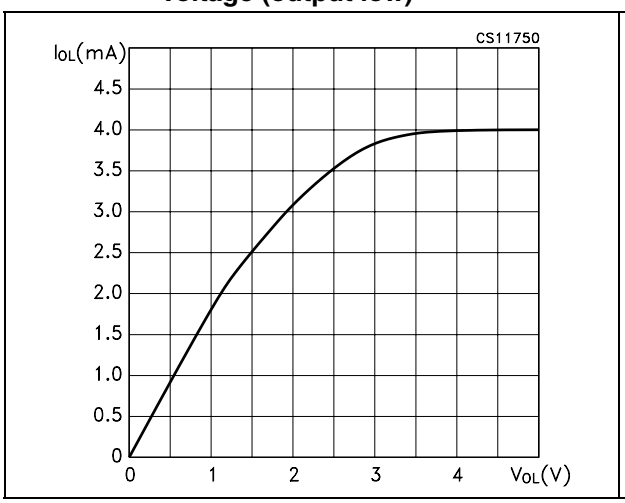
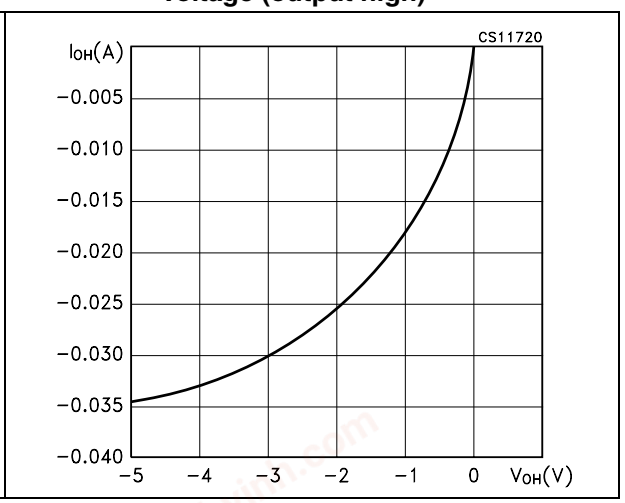


Figure 11. Receiver output current vs. output voltage (output high)



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Figure 12. Driver diff. output voltage vs common mode voltage (diff. output low)

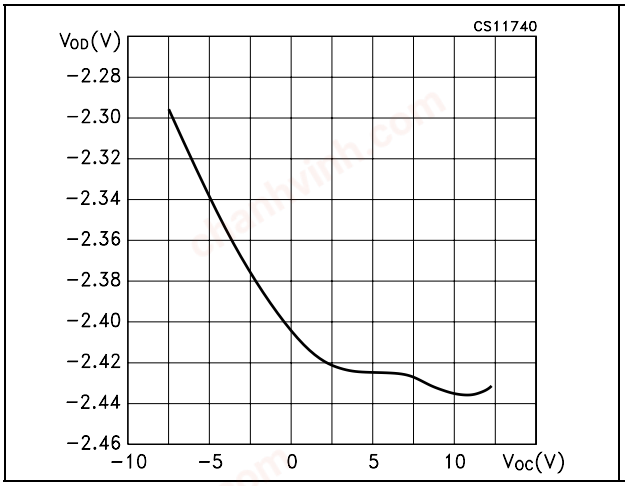


Figure 13. Driver diff. output voltage vs common mode voltage (diff. output low)

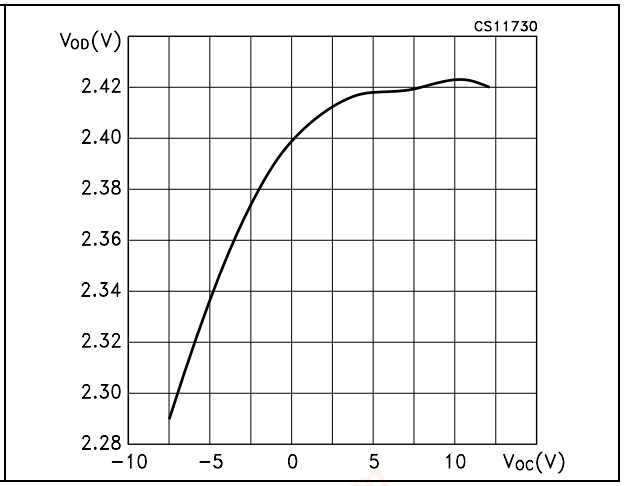


Figure 14. Driver short circuit current vs line voltage (output high)

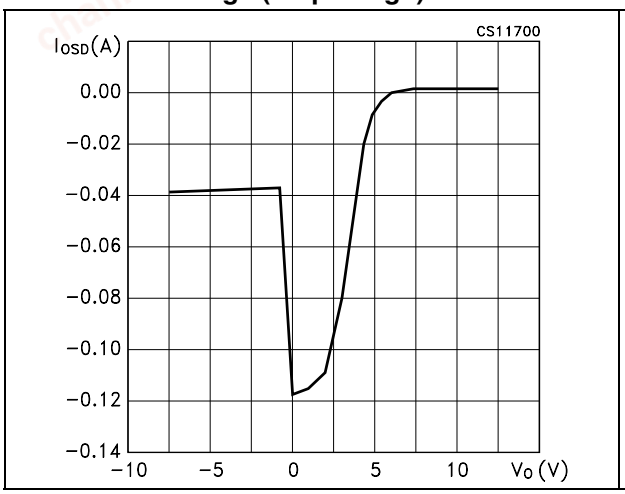


Figure 15. Driver short circuit current vs. line voltage (output low)

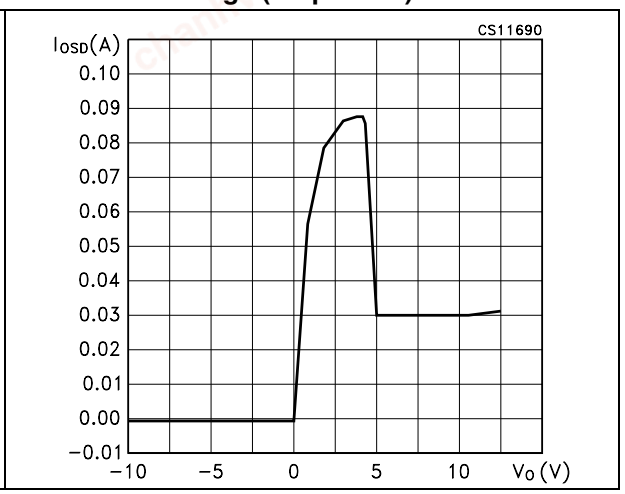
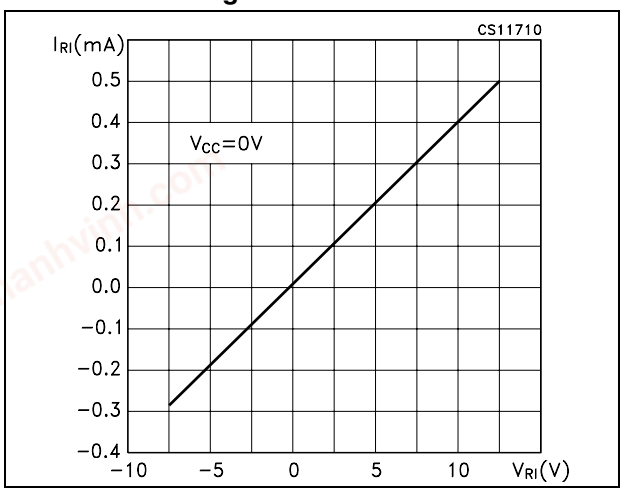


Figure 16. Receiver input current vs input voltage



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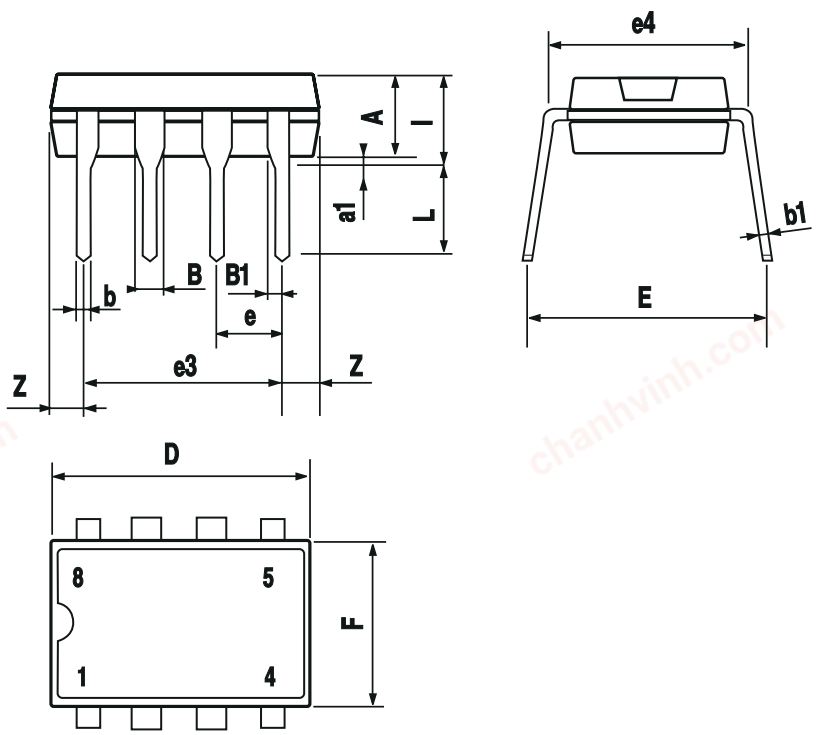
6 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com

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Plastic DIP-8 mechanical data

Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A		3.3			0.130	
a1	0.7			0.028		
B	1.39		1.65	0.055		0.065
B1	0.91		1.04	0.036		0.041
b		0.5			0.020	
b1	0.38		0.5	0.015		0.020
D			9.8			0.386
E		8.8			0.346	
e		2.54			0.100	
e3		7.62			0.300	
e4		7.62			0.300	
F			7.1			0.280
I			4.8			0.189
L		3.3			0.130	
Z	0.44		1.6	0.017		0.063

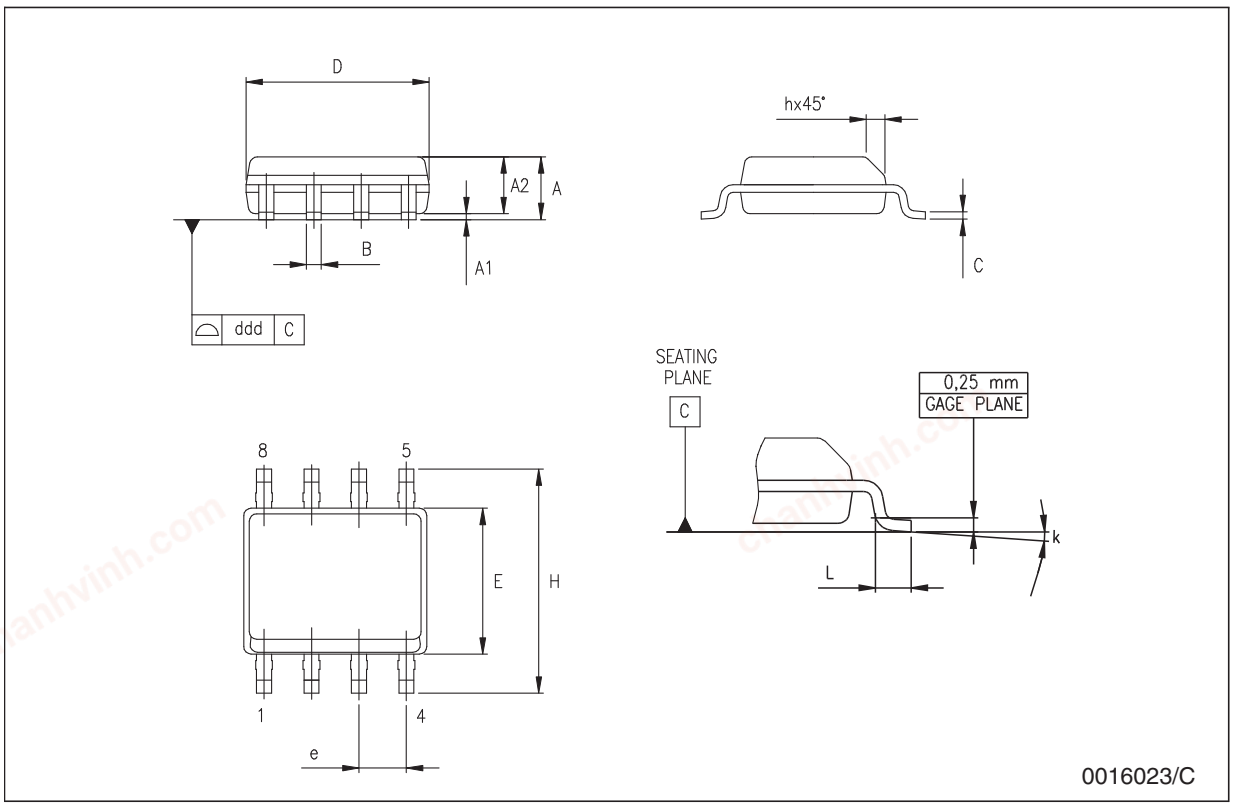


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SO-8 mechanical data

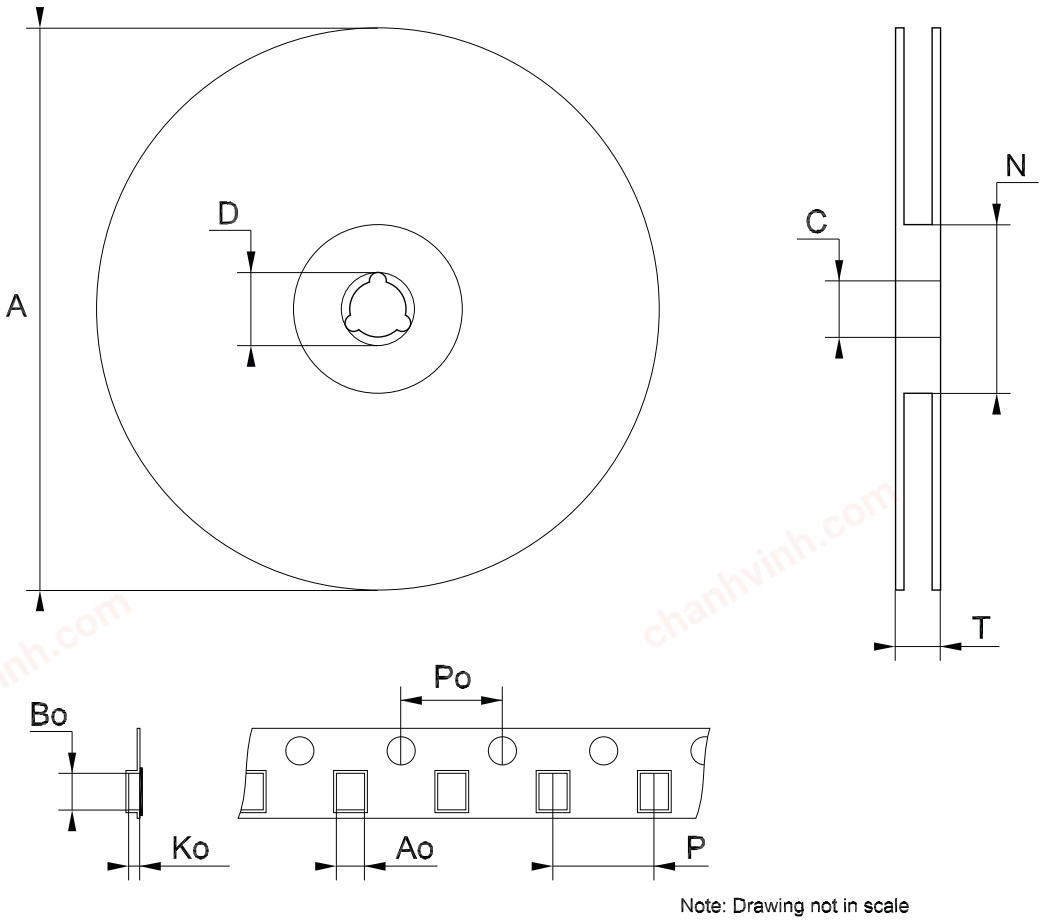
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	1.35		1.75	0.053		0.069
A1	0.10		0.25	0.04		0.010
A2	1.10		1.65	0.043		0.065
B	0.33		0.51	0.013		0.020
C	0.19		0.25	0.007		0.010
D	4.80		5.00	0.189		0.197
E	3.80		4.00	0.150		0.157
e		1.27			0.050	
H	5.80		6.20	0.228		0.244
h	0.25		0.50	0.010		0.020
L	0.40		1.27	0.016		0.050
k	8° (max.)					
ddd			0.1			0.04



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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

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7 Revision history

Table 12. Revision history

Date	Revision	Changes
28-Mar-2006	2	Order codes updated and new template.
24-Aug-2007	3	Added *Table 1.* in cover page.

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