



# ST485

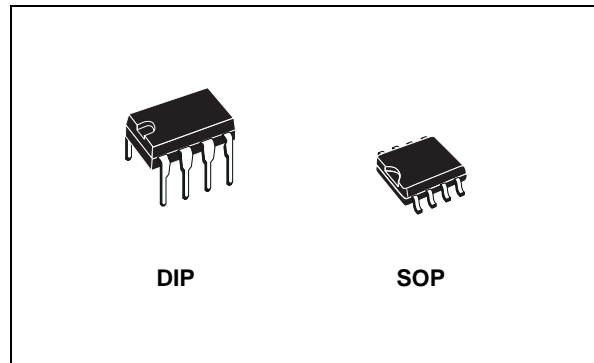
## LOW POWER RS-485/RS-422 TRANSCEIVER

- LOW QUIESCENT CURRENT: 300 $\mu$ A
- DESIGNED FOR RS-485 INTERFACE APPLICATIONS
- -7V TO 12V COMMON MODE INPUT VOLTAGE RANGE
- DRIVER MAINTAINS HIGH IMPEDANCE IN 3-STATE OR WITH THE POWER OFF
- 70mV TYPICAL INPUT HYSTERESIS
- 30ns PROPAGATION DELAYS, 5ns SKEW
- OPERATE FROM A SINGLE 5V SUPPLY
- CURRENT LIMITING AND THERMAL SHUTDOWN FOR DRIVER OVERLOAD PROTECTION
- ALLOWS UP TO 64 TRANSCEIVERS ON THE BUS

### DESCRIPTION

The ST485 is a low power transceiver for RS-485 and RS-422 communication. Each part contains 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 5V supply. 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.

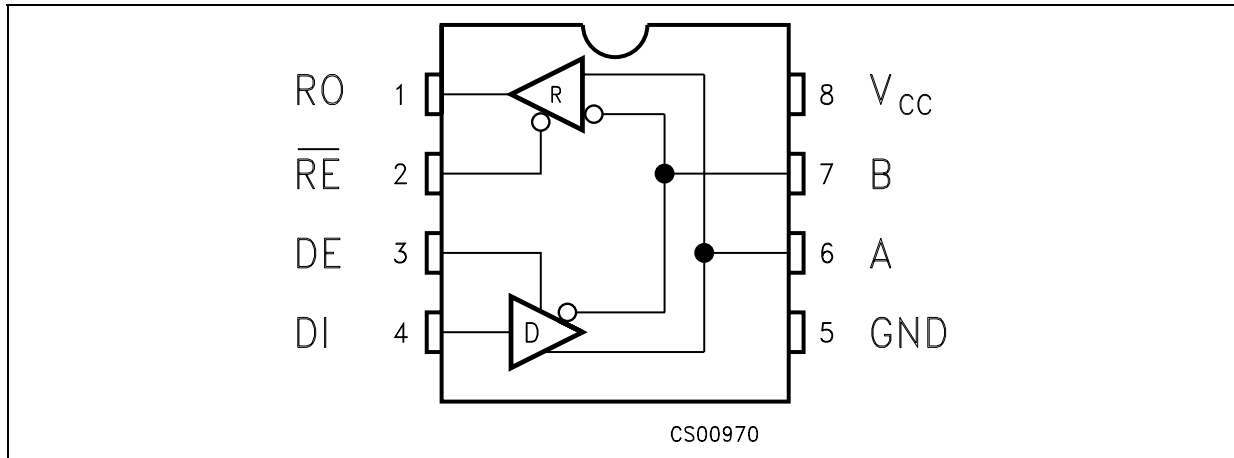
The ST485 is designed for bi-directional data communications on multipoint bus transmission line (half-duplex applications).

The ST485 is available in three temperature ranges: commercial (0°C to 70°C), industrial (-40°C to 85°C) and automotive (-55°C to 125°C)

### ORDERING CODES

Type	Temperature Range	Package	Comments
ST485CN	0 to 70 °C	DIP-8	50parts per tube / 40tube per box
ST485BN	-40 to 85 °C	DIP-8	50parts per tube / 40tube per box
ST485XN	-55 to 125 °C	DIP-8	50parts per tube / 40tube per box
ST485CD	0 to 70 °C	SO-8 (Tube)	100parts per tube / 20tube per box
ST485BD	-40 to 85 °C	SO-8 (Tube)	100parts per tube / 20tube per box
ST485XD	-55 to 125 °C	SO-8 (Tube)	100parts per tube / 20tube per box
ST485CDR	0 to 70 °C	SO-8 (Tape & Reel)	2500 parts per reel
ST485BDR	-40 to 85 °C	SO-8 (Tape & Reel)	2500 parts per reel
ST485XDR	-55 to 125 °C	SO-8 (Tape & Reel)	2500 parts per reel

**PIN CONFIGURATION**



**PIN DESCRIPTION**

PIN N°	SYMBOL	NAME AND FUNCTION
1	RO	Receiver Output
2	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

**TRUTH TABLE (DRIVER)**

INPUTS			OUTPUTS	
RE	DE	DI	B	A
X	H	H	L	H
X	H	L	H	L
X	L	X	Z	Z

X= Don't Care; Z=High Impedance

**TRUTH TABLE (RECEIVER)**

INPUTS			OUTPUT
RE	DE	A-B	RO
L	L	≥ +0.2V	H
L	L	≤ -0.2V	L
L	L	INPUTS OPEN	H
H	L	X	Z

X= Don't Care; Z=High Impedance

**ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	Supply Voltage	7	V
V <sub>I</sub>	Control Input Voltage (RE, DE)	-0.5 to (V <sub>CC</sub> + 0.5)	V
V <sub>DI</sub>	Driver Input Voltage (DI)	-0.5 to (V <sub>CC</sub> + 0.5)	V
V <sub>DO</sub>	Driver Output Voltage (A, B)	± 14	V
V <sub>RI</sub>	Receiver Input Voltage (A, B)	± 14	V
V <sub>RO</sub>	Receiver Output Voltage (RO)	-0.5 to (V <sub>CC</sub> + 0.5)	V

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

**DC ELECTRICAL CHARACTERISTICS**

( $V_{CC} = 5V \pm 5\%$ ,  $T_A = T_{MIN}$  to  $T_{MAX}$ , unless otherwise specified. Typical values are referred to  $T_A = 25^\circ C$ )  
(See Note 1)

Symbol	Parameter	Test Conditions	Value					Unit
			-40 to 85 °C			-55 to 125 °C		
			Min.	Typ.	Max.	Min.	Max.	
$V_{OD1}$	Differential Driver Output (No Load)				5		5	V
$V_{OD2}$	Differential Driver Output (With Load)	$R_L = 27\Omega$ (RS-485) (See Fig.1) $R_L = 50\Omega$ (RS-422) (See Fig.1)	1.5		5 5	1.4	5 5	V V
$\Delta V_{OD}$	Change in Magnitude of Driver Differential Output Voltage for Complementary Output States	$R_L = 27\Omega$ or $50\Omega$ (See Fig. 1)			0.2		0.2	V
$V_{OC}$	Driver Common-Mode Output Voltage	$R_L = 27\Omega$ or $50\Omega$ (See Fig. 1)			3		3	V
$\Delta V_{OC}$	Change in Magnitude of Driver Common-Mode Output Voltage for Complementary Output States	$R_L = 27\Omega$ or $50\Omega$ (See Fig. 1)			0.2		0.2	V
$V_{IH}$	Input High Voltage	$\overline{RE}$ , DE, DI	2.0			2.0		V
$V_{IL}$	Input Low Voltage	$\overline{RE}$ , DE, DI			0.8		0.8	V
$I_{IN1}$	Input Current	$\overline{RE}$ , DE, DI			$\pm 2$		$\pm 2$	$\mu A$
$I_{IN2}$	Input Current (A, B)	$V_{CM} = 0V$ or $5.25V$ $V_{DE} = 0V$ $V_{IN} = 12V$ $V_{IN} = -7V$			1 -0.8		1 -0.8	mA mA
$V_{TH}$	Receiver Differential Threshold Voltage	$V_{CM} = -7$ to $12V$	-0.2		0.2	-0.2	0.2	V
$\Delta V_{TH}$	Receiver Input Hysteresis	$V_{CM} = 0V$		70				mV
$V_{OH}$	Receiver Output High Voltage	$I_O = -4mA$ $V_{ID} = 200mV$	3.5			3.4		V
$V_{OL}$	Receiver Output Low Voltage	$I_O = 4mA$ $V_{ID} = -200mV$			0.4		0.55	V
$I_{OZR}$	3-State (High Impedance) Output Current at Receiver	$V_O = 0.4$ to $2.4V$			$\pm 1$		$\pm 1$	$\mu A$
$R_{IN}$	Receiver Input Resistance	$V_{CM} = -7$ to $12V$	24			24		K $\Omega$
$I_{CC}$	No Load Supply Current (Note 2)	$V_{RE} = 0V$ or $V_{CC}$ $V_{DE} = V_{CC}$ $V_{DE} = 0V$		400 300	900 500		900 500	$\mu A$ $\mu A$
$I_{OSD1}$	Driver Short-Circuit Current, $V_O=High$	$V_O = -7$ to $12V$ (Note 3)	35		250	35	250	mA
$I_{OSD2}$	Driver Short-Circuit Current, $V_O=Low$	$V_O = -7$ to $12V$ (Note 3)	35		250	35	250	mA
$I_{OSR}$	Receiver Short-Circuit Current	$V_O = 0V$ to $V_{CC}$	7		95	7	95	mA

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.

Note 2: Supply current specification is valid for loaded transmitters when  $V_{DE} = 0V$

Note 3: Applies to peak current. See typical Operating Characteristics.

**DRIVER SWITCHING CHARACTERISTICS**

( $V_{CC} = 5V \pm 5\%$ ,  $T_A = T_{MIN}$  to  $T_{MAX}$ , unless otherwise specified. Typical values are referred to  $T_A = 25^\circ C$ )  
(See Note 1)

Symbol	Parameter	Test Conditions	Value					Unit
			-40 to 85 °C			-55 to 125 °C		
			Min.	Typ.	Max.	Min.	Max.	
$t_{PLH}$ $t_{PHL}$	Propagation Delay Input to Output	$R_{DIFF} = 54\Omega$ $C_{L1} = C_{L2} = 100pF$ (See Fig. 3 and 5)	10	30	60		70	ns
$t_{SK}$	Output Skew to Output	$R_{DIFF} = 54\Omega$ $C_{L1} = C_{L2} = 100pF$ (See Fig. 3 and 5)		5	10		10	ns
$t_{TLH}$ $t_{THL}$	Rise or Fall Time	$R_{DIFF} = 54\Omega$ $C_{L1} = C_{L2} = 100pF$ (See Fig. 3 and 5)	3	15	40	3	45	ns
$t_{PZH}$	Output Enable Time	$C_L = 100pF$ $S2 = Closed$ (See Fig. 4 and 6)		70	90		90	ns
$t_{PZL}$	Output Enable Time	$C_L = 100pF$ $S1 = Closed$ (See Fig. 4 and 6)		70	90		90	ns
$t_{PLZ}$	Output Disable Time	$C_L = 15pF$ $S1 = Closed$ (See Fig. 4 and 6)		70	90		90	ns
$t_{PHZ}$	Output Disable Time	$C_L = 15pF$ $S2 = Closed$ (See Fig. 4 and 6)		70	90		90	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.

**RECEIVER SWITCHING CHARACTERISTICS**

( $V_{CC} = 5V \pm 5\%$ ,  $T_A = T_{MIN}$  to  $T_{MAX}$ , unless otherwise specified. Typical values are referred to  $T_A = 25^\circ C$ )  
(See Note 1)

Symbol	Parameter	Test Conditions	Value					Unit
			-40 to 85 °C			-55 to 125 °C		
			Min.	Typ.	Max.	Min.	Max.	
$t_{PLH}$ $t_{PHL}$	Propagation Delay Input to Output	$R_{DIFF} = 54\Omega$ $C_{L1} = C_{L2} = 100pF$ (See Fig. 3 and 7)	20	130	210		230	ns
$t_{SKD}$	Differential Receiver Skew	$R_{DIFF} = 54\Omega$ $C_{L1} = C_{L2} = 100pF$ (See Fig. 3 and 7)		13				ns
$t_{PZH}$	Output Enable Time	$C_{RL} = 15pF$ $S1 = Closed$ (See Fig. 2 and 8)		20	50		56	ns
$t_{PZL}$	Output Enable Time	$C_{RL} = 15pF$ $S2 = Closed$ (See Fig. 2 and 8)		20	50		56	ns
$t_{PLZ}$	Output Disable Time	$C_{RL} = 15pF$ $S1 = Closed$ (See Fig. 2 and 8)		20	50		56	ns
$t_{PHZ}$	Output Disable Time	$C_{RL} = 15pF$ $S2 = Closed$ (See Fig. 2 and 8)		20	50		56	ns
$f_{MAX}$	Maximum Data Rate		2.5			2.5		Mbps

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.

TEST CIRCUITS AND TYPICAL CHARACTERISTICS

Figure 1 : Driver DC Test Load

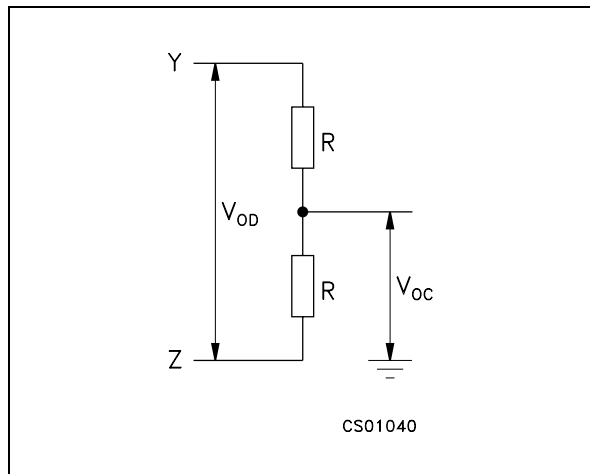


Figure 2 : Receiver Timing Test Load

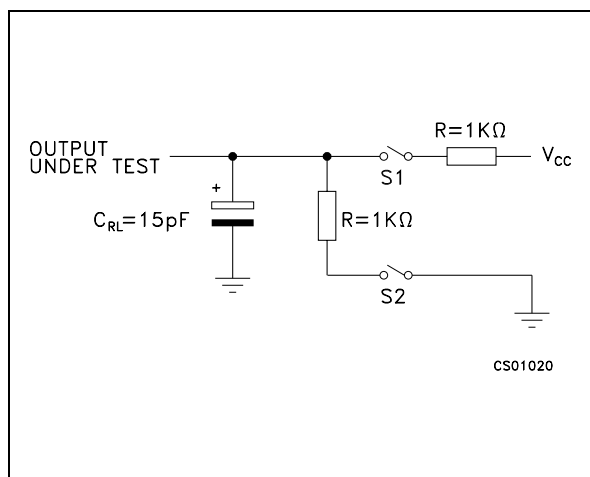


Figure 3 : Drive/Receiver Timing Test Circuit

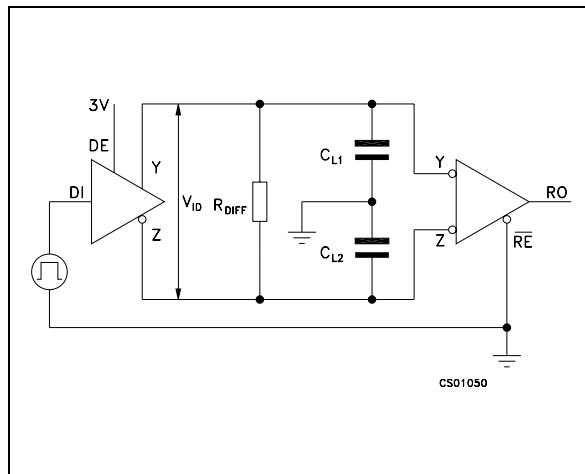


Figure 4 : Driver Timing Test Load

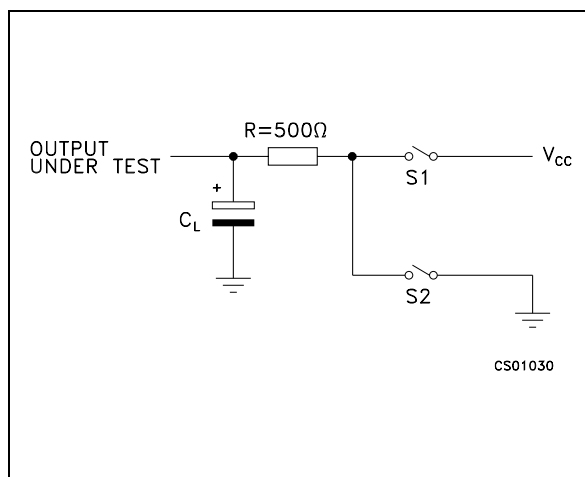


Figure 5 : Driver Propagation Delay

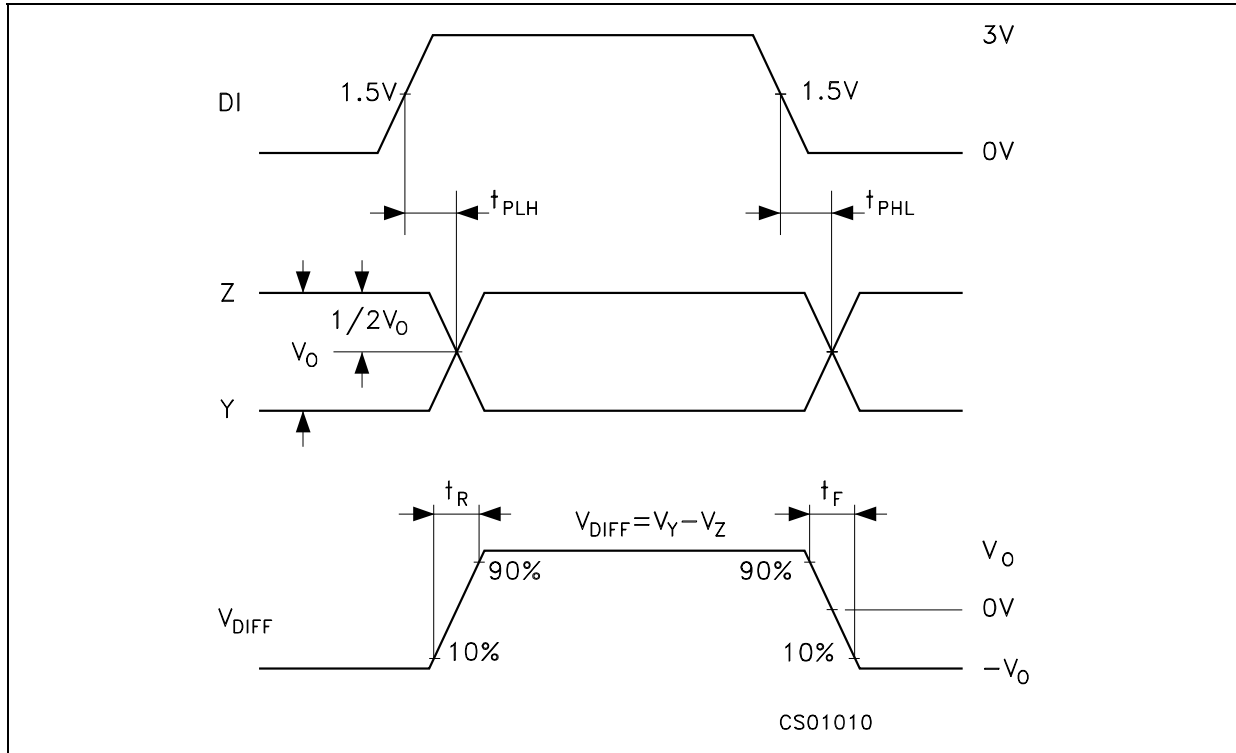


Figure 6 : Driver Enable and Disable Time

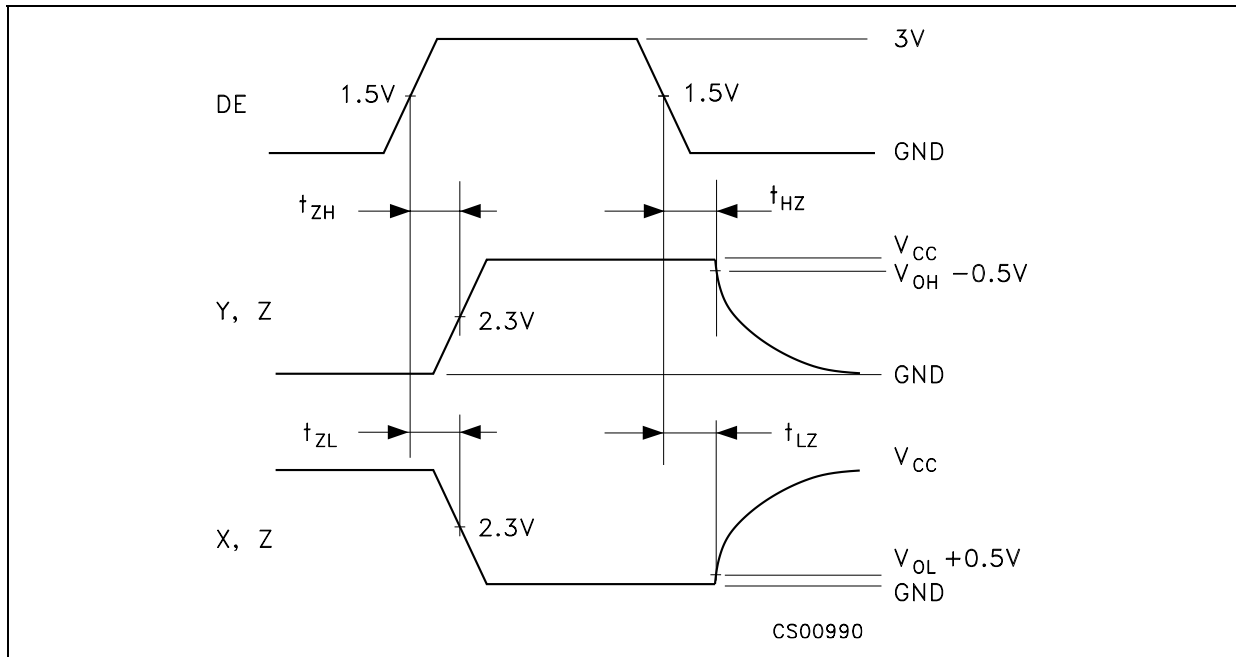


Figure 7 : Receiver Propagation Delay

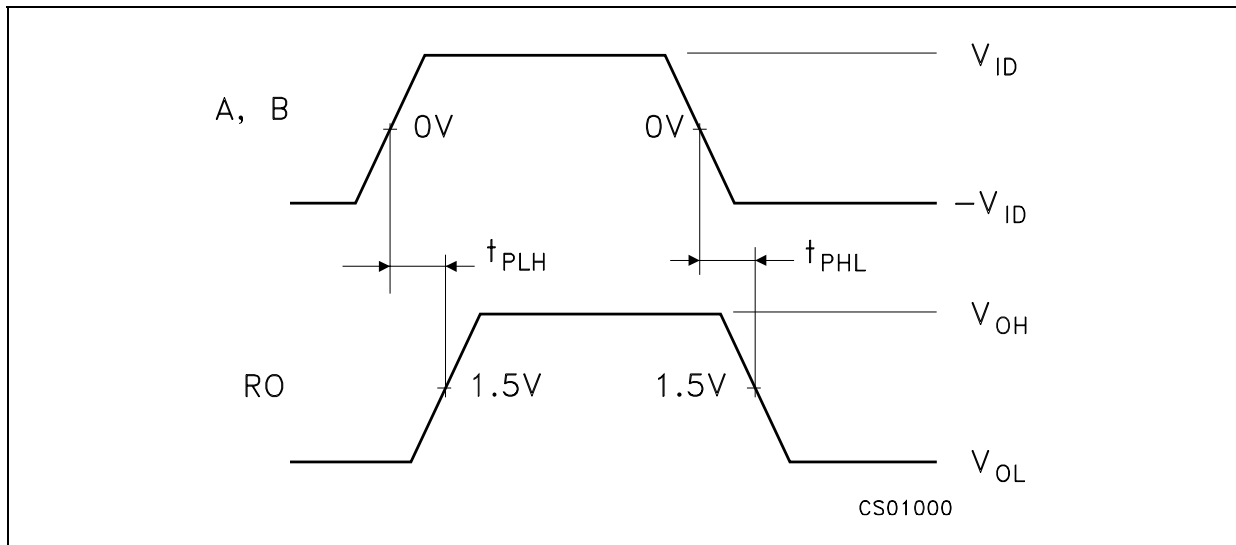
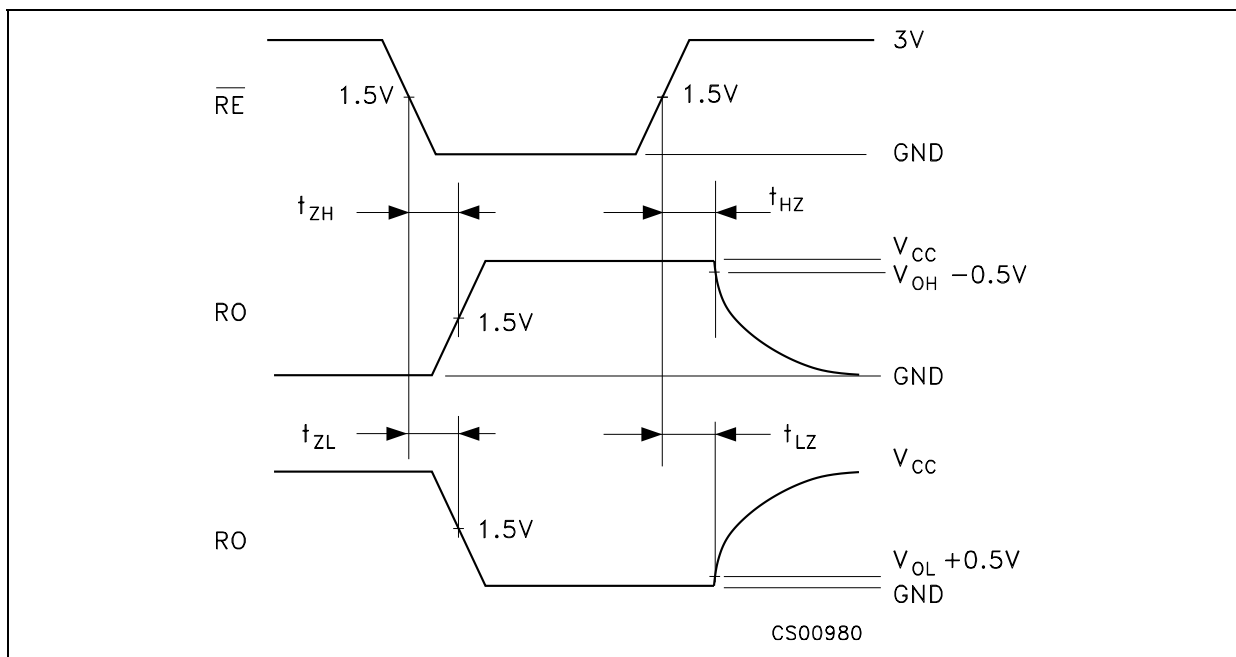
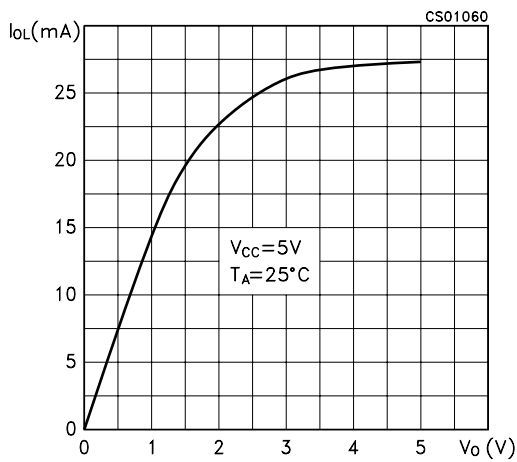


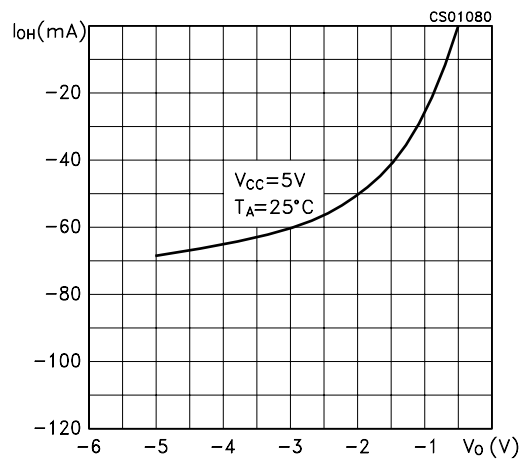
Figure 8 : Receiver Enable and Disable Time



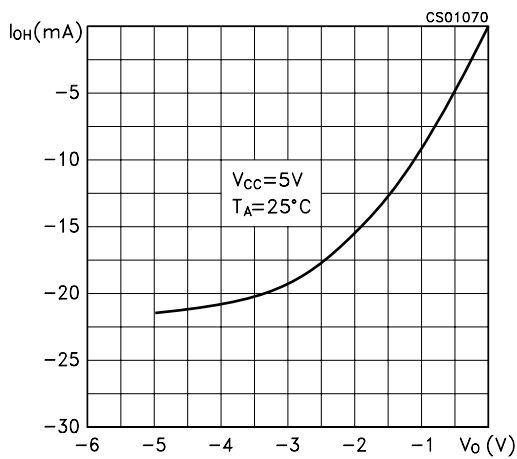
**Figure 9 : Receiver Output Current vs Output Low Voltage**



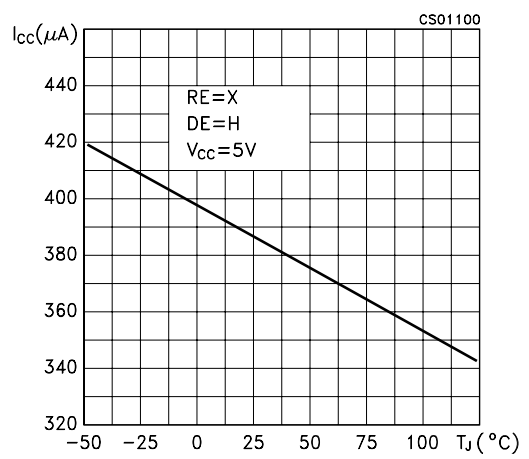
**Figure 12 : Driver Output Current vs Output High Voltage**



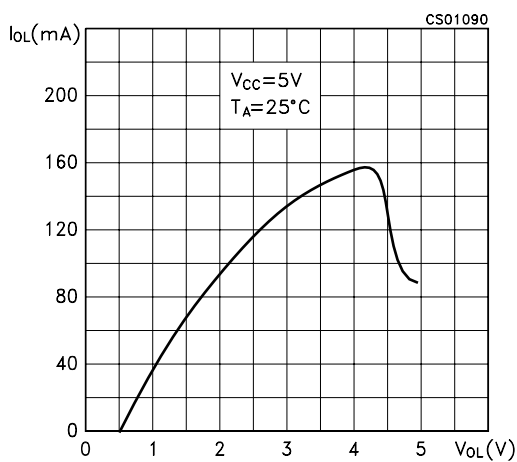
**Figure 10 : Receiver Output Current vs Output High Voltage**



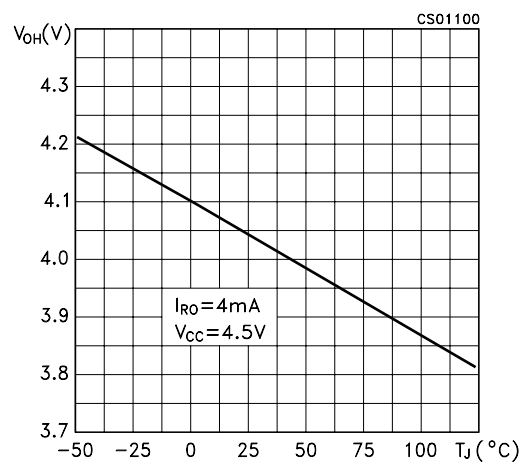
**Figure 13 : Supply Current vs Temperature**



**Figure 11 : Driver Output Current vs Output Low Voltage**

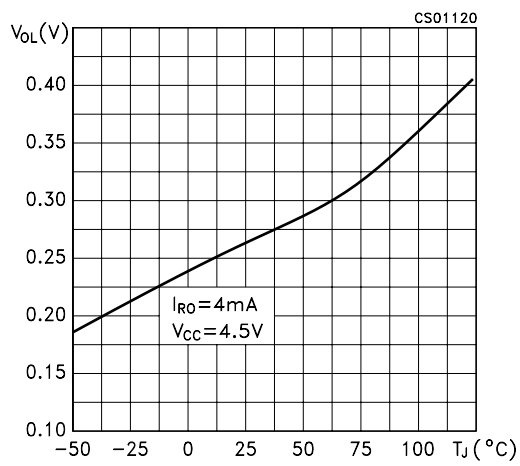


**Figure 14 : Receiver High Level Output Voltage vs Temperature**

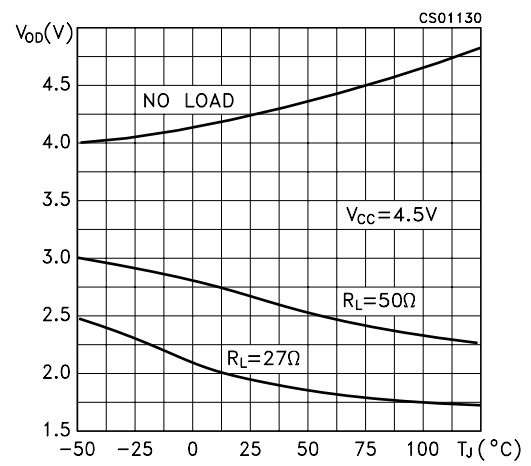




**Figure 15** : Receiver Low Level Output Voltage vs Temperature

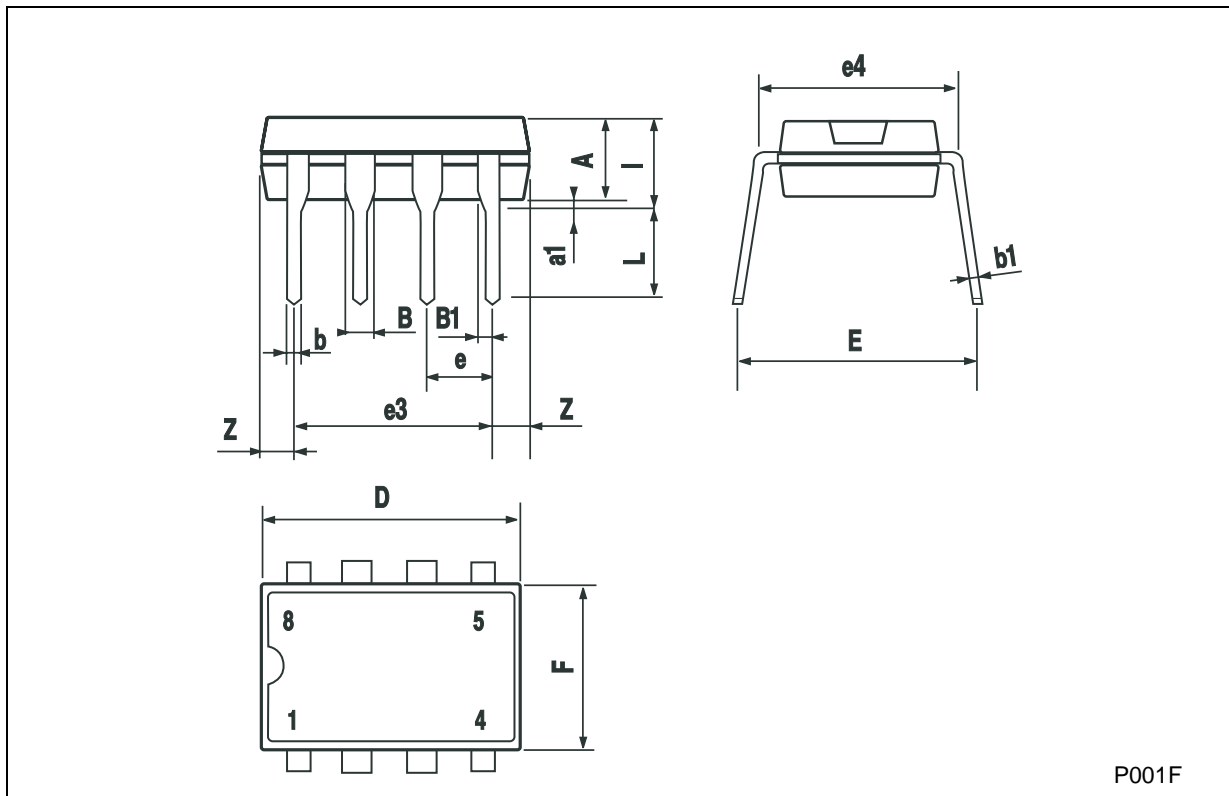


**Figure 16** : Differential Driver Output Voltage vs Temperature



**Plastic DIP-8 MECHANICAL DATA**

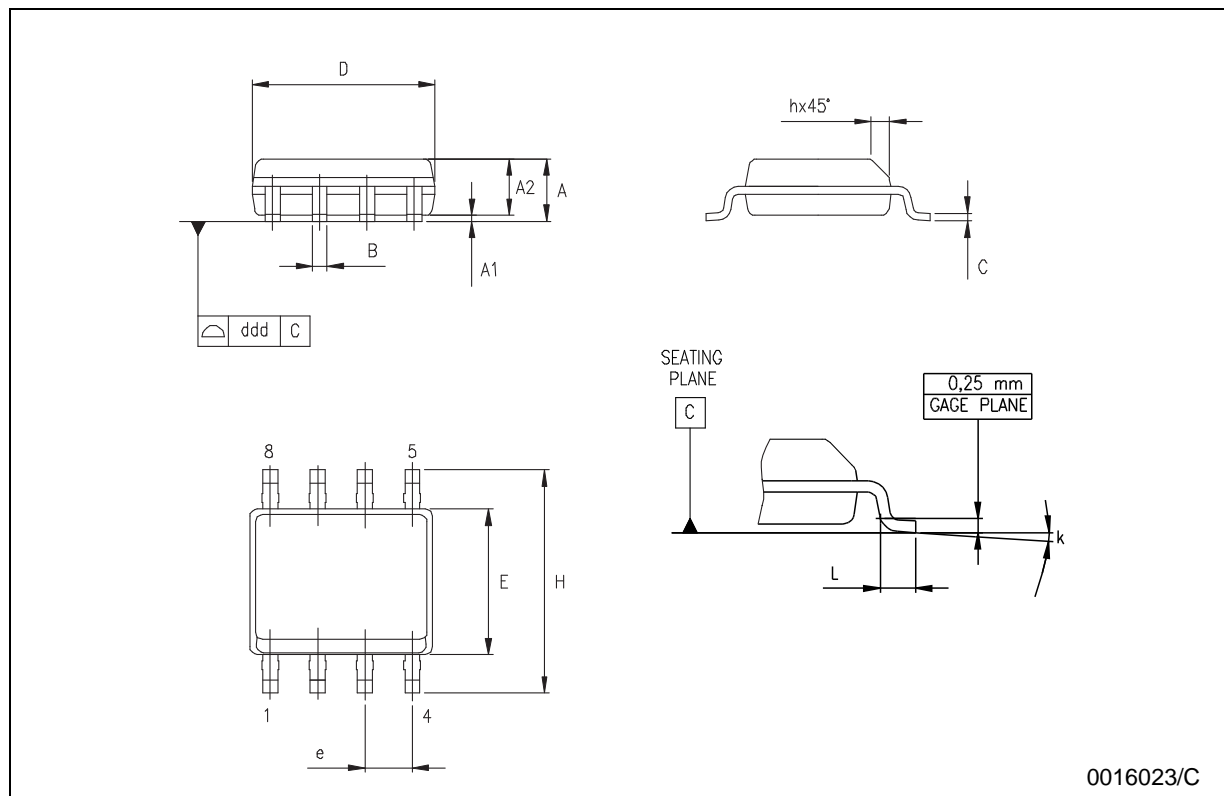
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A		3.3			0.130	
a1	0.7			0.028		
B	1.39		1.65	0.055		0.065
B1	0.91		1.04	0.036		0.041
b		0.5			0.020	
b1	0.38		0.5	0.015		0.020
D			9.8			0.386
E		8.8			0.346	
e		2.54			0.100	
e3		7.62			0.300	
e4		7.62			0.300	
F			7.1			0.280
l			4.8			0.189
L		3.3	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



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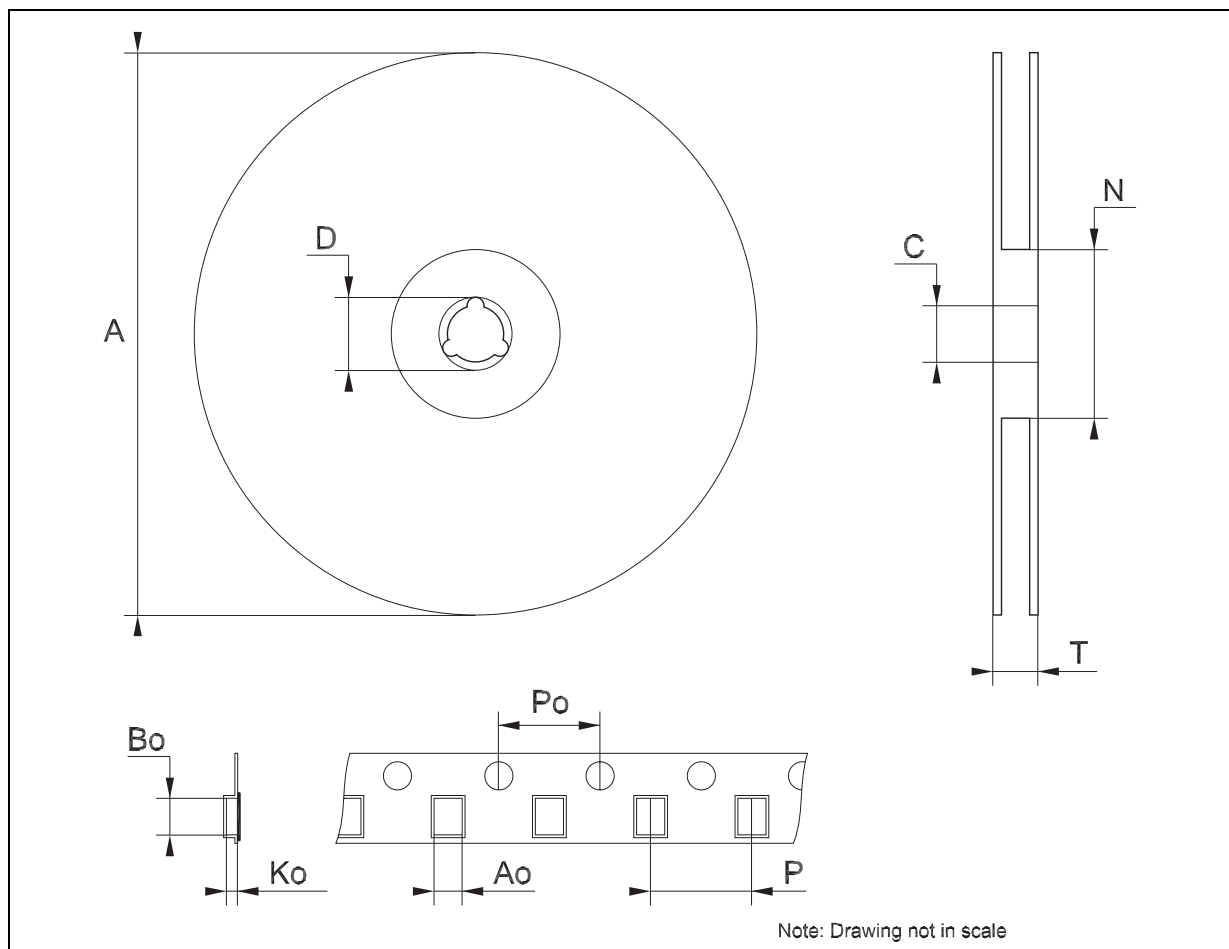
## SO-8 MECHANICAL DATA

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



## Tape &amp; 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



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