



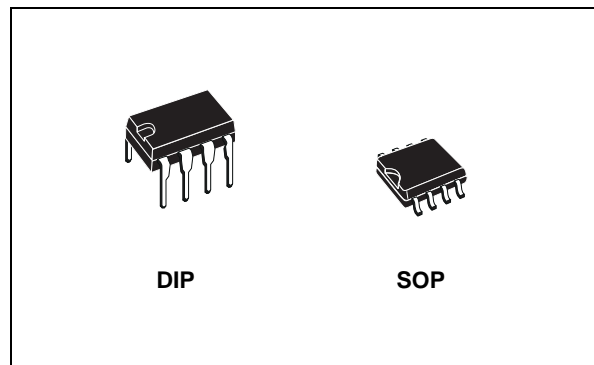
# ST485E

## ±15KV ESD PROTECTED, LOW POWER RS-485/RS-422 TRANSCEIVER

- LOW QUIESCENT CURRENT: 300µA
- 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
- ESD PROTECTION:
  - ±15KV (H.B.M.)
  - ±8KV (IEC-1000-4-2 CONTACT DISCHARGE)
- ALLOWS UP TO 64 TRANSCEIVERS ON THE BUS

### DESCRIPTION

The ST485E is a low power transceiver for RS-485 and RS-422 communication. Each driver output and receiver input is protected against ±15KV electrostatic discharge (H.B.M.) (ESD) shocks, without latchup. These parts contain one



driver and one receiver in half duplex configuration.

This transceiver draws 300µA (typ.) of supply current when unloaded or fully loaded with disabled drivers.

It operates from a single 5V supply.

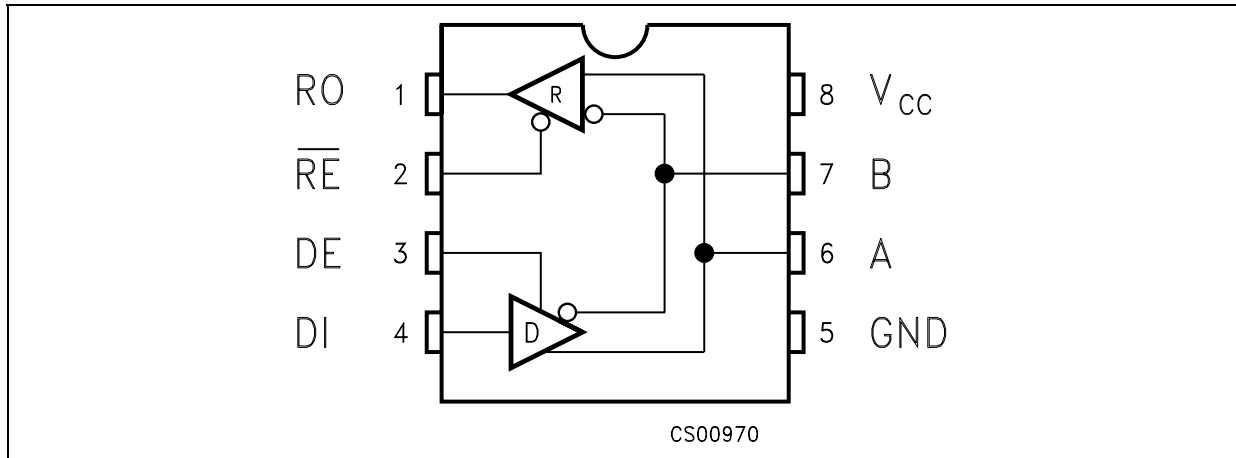
Driver is short-circuit current limited and is protected against excessive power dissipation by thermal shutdown circuitry that places the driver outputs into a high-impedance state.

The ST485E is designed for bi-directional data communications on multipoint bus transmission line (half-duplex applications).

### ORDERING CODES

Type	Temperature Range	Package	Comments
ST485ECN	0 to 70 °C	DIP-8	50parts per tube / 40tube per box
ST485EBN	-40 to 85 °C	DIP-8	50parts per tube / 40tube per box
ST485EXN	-55 to 125 °C	DIP-8	50parts per tube / 40tube per box
ST485ECD	0 to 70 °C	SO-8 (Tube)	100parts per tube / 20tube per box
ST485EBD	-40 to 85 °C	SO-8 (Tube)	100parts per tube / 20tube per box
ST485EXD	-55 to 125 °C	SO-8 (Tube)	100parts per tube / 20tube per box
ST485ECDR	0 to 70 °C	SO-8 (Tape & Reel)	2500 parts per reel
ST485EBDR	-40 to 85 °C	SO-8 (Tape & Reel)	2500 parts per reel
ST485EXDR	-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.

**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	±8			KV

**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	Min.	Typ.	Max.	Unit
$V_{OD1}$	Differential Driver Output (No Load)				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	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	V
$V_{OC}$	Driver Common-Mode Output Voltage	$R_L = 27\Omega$ or $50\Omega$ (See Fig. 1)			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	V
$V_{IH}$	Input High Voltage	RE, DE, DI	2.0			V
$V_{IL}$	Input Low Voltage	RE, DE, DI			0.8	V
$I_{IN1}$	Input Current	RE, DE, DI			± 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	mA mA
$V_{TH}$	Receiver Differential Threshold Voltage	$V_{CM} = -7$ to $12V$	-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			V
$V_{OL}$	Receiver Output Low Voltage	$I_O = 4mA$ $V_{ID} = -200mV$			0.4	V
$I_{OZR}$	3-State (High Impedance) Output Current at Receiver	$V_O = 0.4$ to $2.4V$			± 1	$\mu A$
$R_{IN}$	Receiver Input Resistance	$V_{CM} = -7$ to $12V$	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	$\mu A$ $\mu A$
$I_{OSD1}$	Driver Short-Circuit Current, $V_O = High$	$V_O = -7$ to $12V$ (Note 3)	35		250	mA
$I_{OSD2}$	Driver Short-Circuit Current, $V_O = Low$	$V_O = -7$ to $12V$ (Note 3)	35		250	mA
$I_{OSR}$	Receiver Short-Circuit Current	$V_O = 0V$ to $V_{CC}$	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	Min.	Typ.	Max.	Unit
$t_{PLH}$ $t_{PHL}$	Propagation Delay Input to Output	$R_{DIFF} = 54\Omega$ $C_{L1} = C_{L2} = 100pF$ (See Fig. 3 and 5)		25	45	ns
$t_{SK}$	Output Skew to Output	$R_{DIFF} = 54\Omega$ $C_{L1} = C_{L2} = 100pF$ (See Fig. 3 and 5)		2	5	ns
$t_{TLH}$ $t_{THL}$	Rise or Fall Time	$R_{DIFF} = 54\Omega$ $C_{L1} = C_{L2} = 100pF$ (See Fig. 3 and 5)		15	40	ns
$t_{PZH}$	Output Enable Time	$C_L = 100pF$ $S2 = Closed$ (See Fig. 4 and 6)		35	50	ns
$t_{PZL}$	Output Enable Time	$C_L = 100pF$ $S1 = Closed$ (See Fig. 4 and 6)		25	40	ns
$t_{PLZ}$	Output Disable Time	$C_L = 15pF$ $S1 = Closed$ (See Fig. 4 and 6)		25	40	ns
$t_{PHZ}$	Output Disable Time	$C_L = 15pF$ $S2 = Closed$ (See Fig. 4 and 6)		35	50	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	Min.	Typ.	Max.	Unit
$t_{PLH}$ $t_{PHL}$	Propagation Delay Input to Output	$R_{DIFF} = 54\Omega$ $C_{L1} = C_{L2} = 100pF$ (See Fig. 3 and 7)		110	130	ns
$t_{SKD}$	Differential Receiver Skew	$R_{DIFF} = 54\Omega$ $C_{L1} = C_{L2} = 100pF$ (See Fig. 3 and 7)		5	10	ns
$t_{PZH}$	Output Enable Time	$C_{RL} = 15pF$ $S2 = Closed$ (See Fig. 2 and 8)		11	35	ns
$t_{PZL}$	Output Enable Time	$C_{RL} = 15pF$ $S1 = Closed$ (See Fig. 2 and 8)		13	35	ns
$t_{PLZ}$	Output Disable Time	$C_{RL} = 15pF$ $S1 = Closed$ (See Fig. 2 and 8)		13	35	ns
$t_{PHZ}$	Output Disable Time	$C_{RL} = 15pF$ $S2 = Closed$ (See Fig. 2 and 8)		11	35	ns
$f_{MAX}$	Maximum Data Rate		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

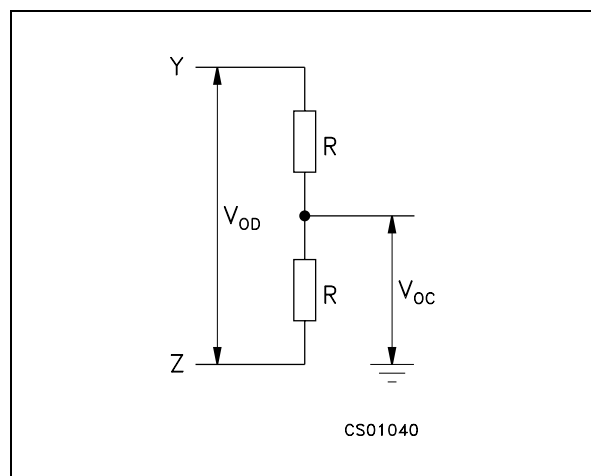


Figure 2 : Receiver Timing Test Load

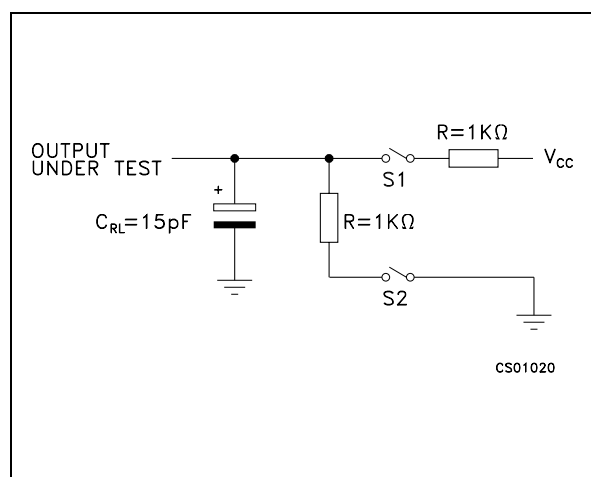


Figure 3 : Drive/Receiver Timing Test Circuit

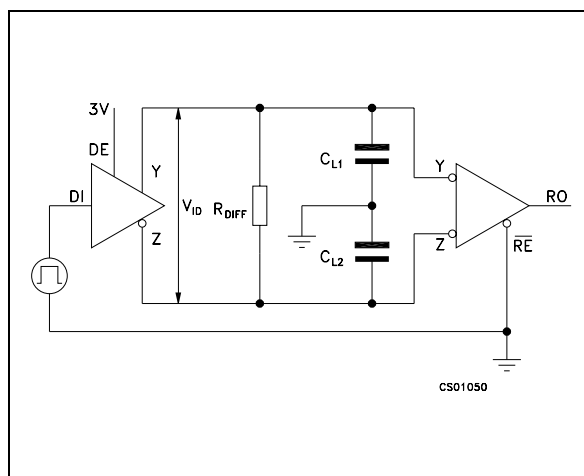


Figure 4 : Driver Timing Test Load

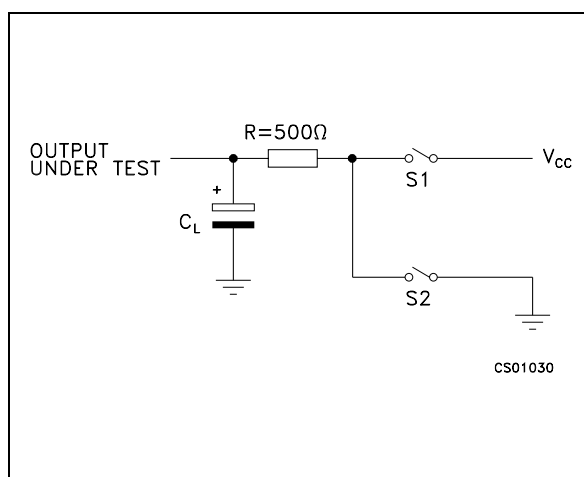


Figure 5 : Driver Propagation Delay

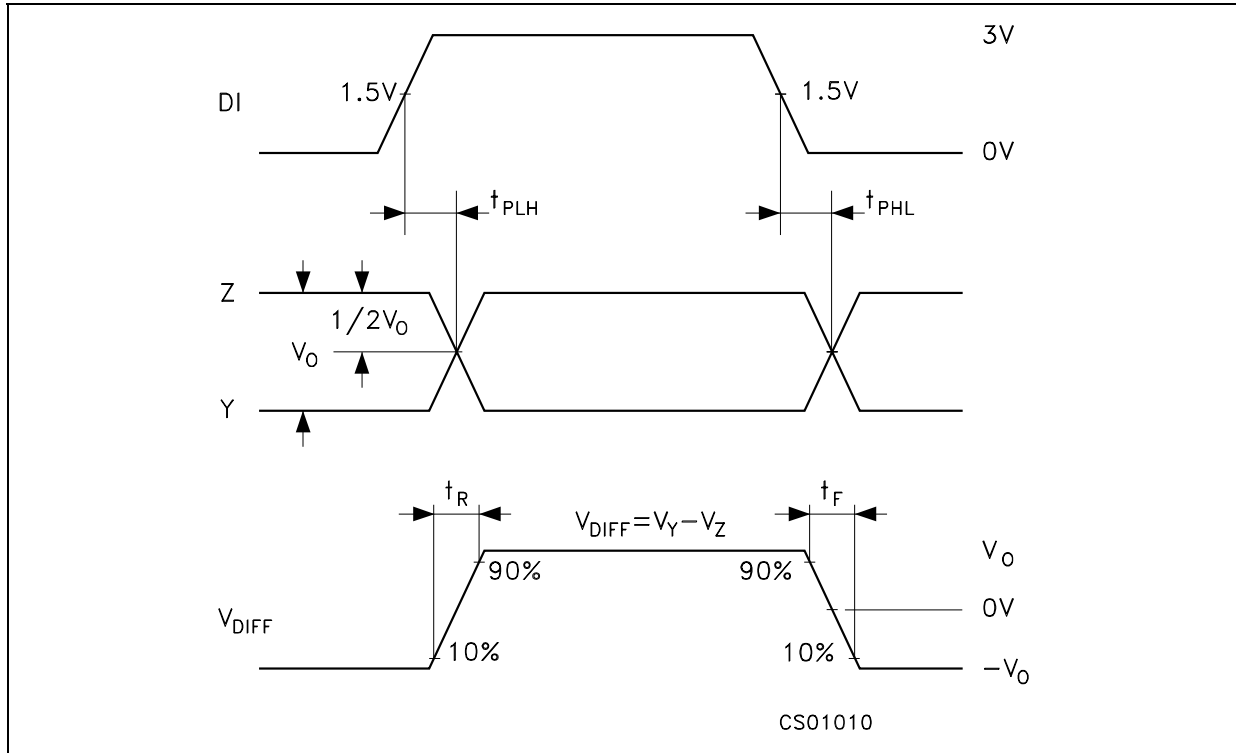


Figure 6 : Driver Enable and Disable Time

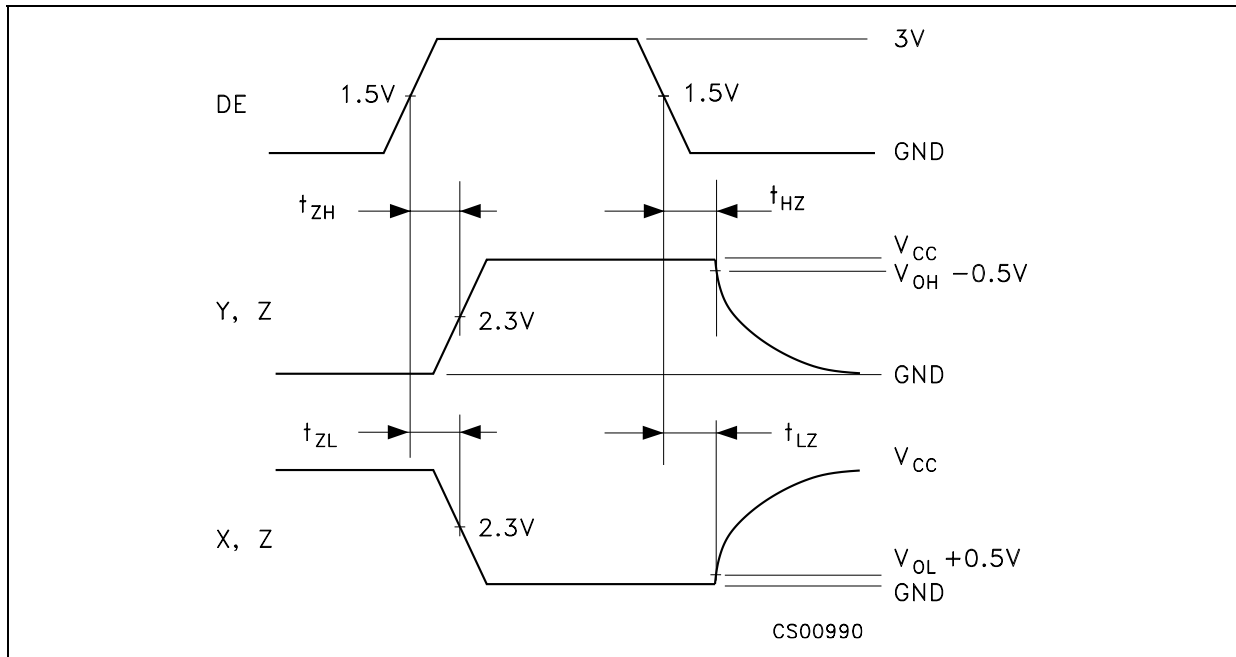


Figure 7 : Receiver Propagation Delay

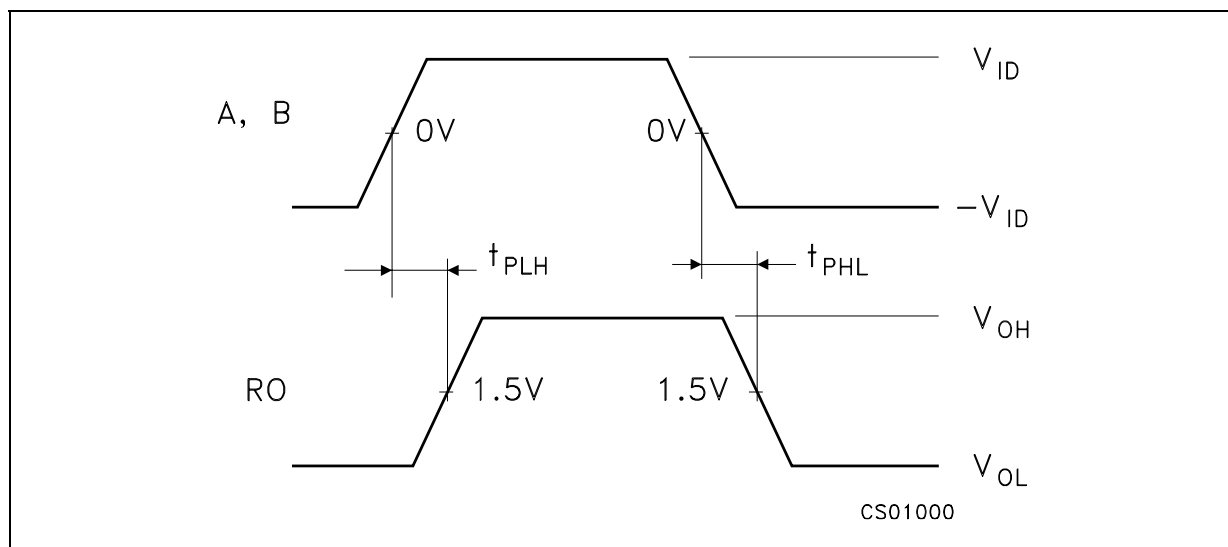
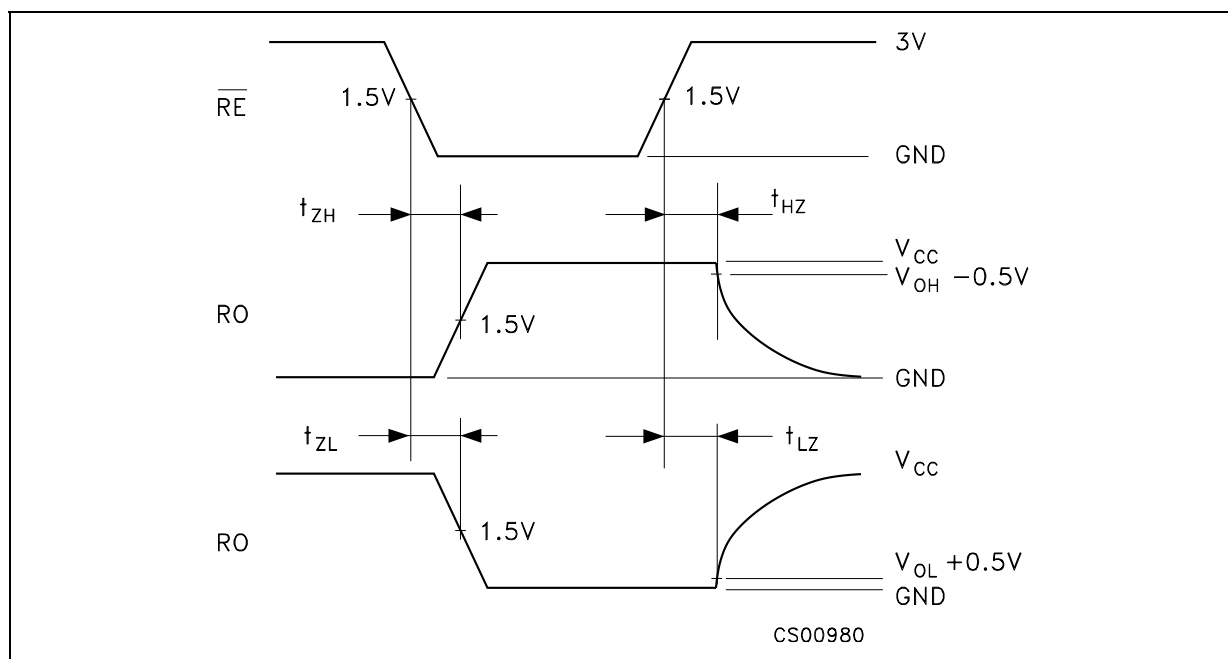
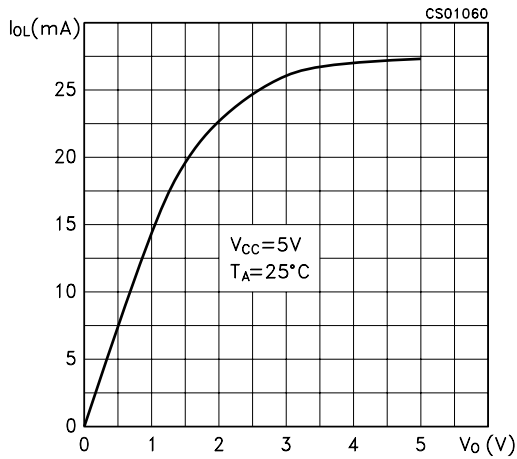


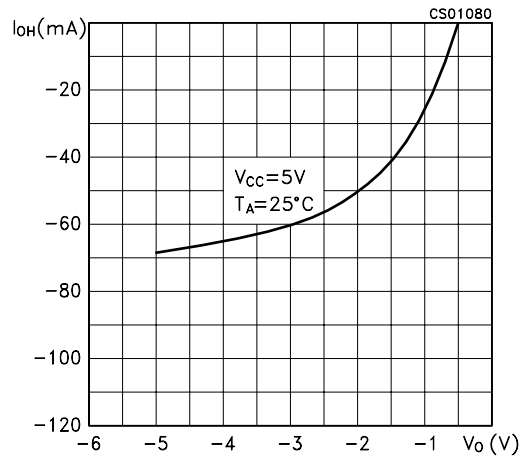
Figure 8 : Receiver Enable and Disable Time



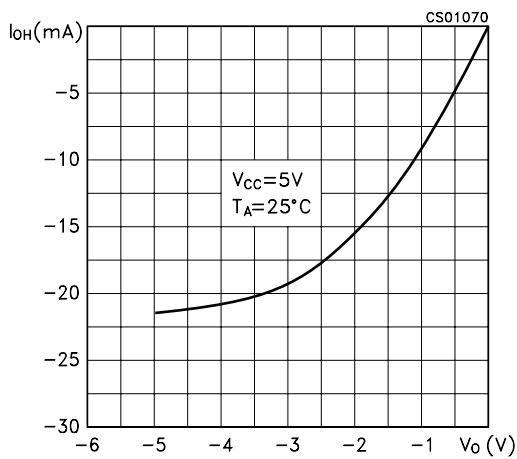
**Figure 9 : Receiver Output Current vs Output Low Voltage**



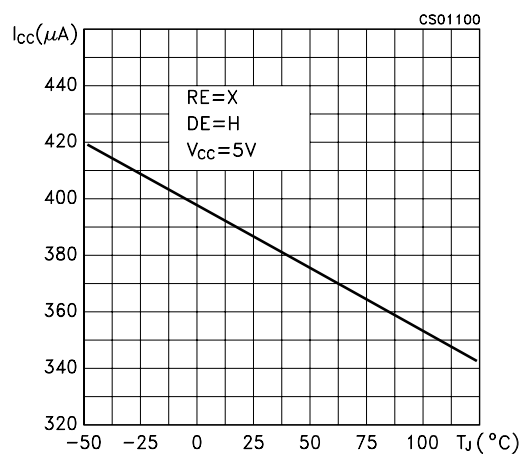
**Figure 12 : Driver Output Current vs Output High Voltage**



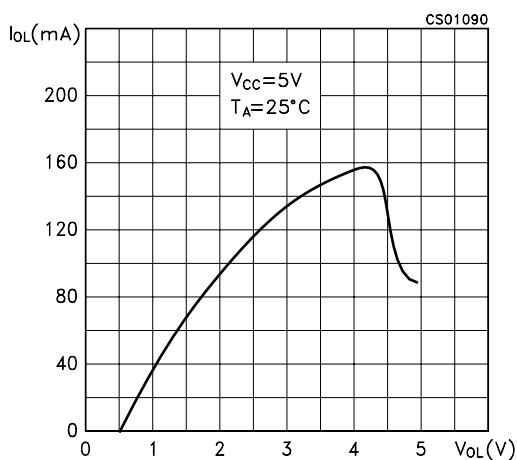
**Figure 10 : Receiver Output Current vs Output High Voltage**



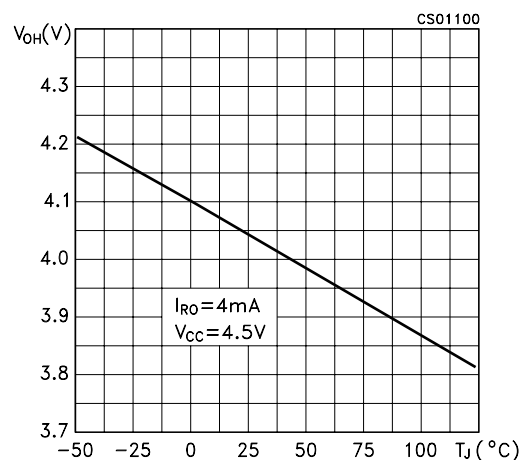
**Figure 13 : Supply Current vs Temperature**



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

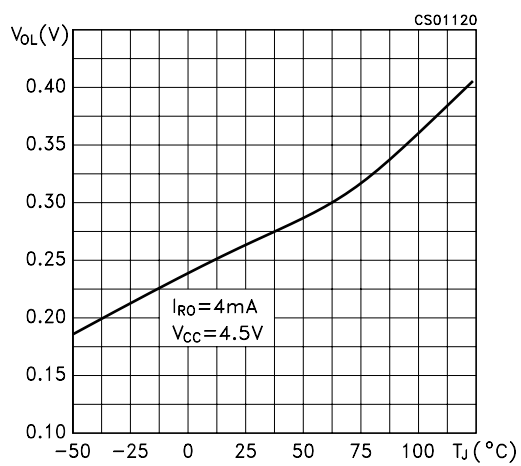


**Figure 14 : Receiver High Level Output Voltage vs Temperature**

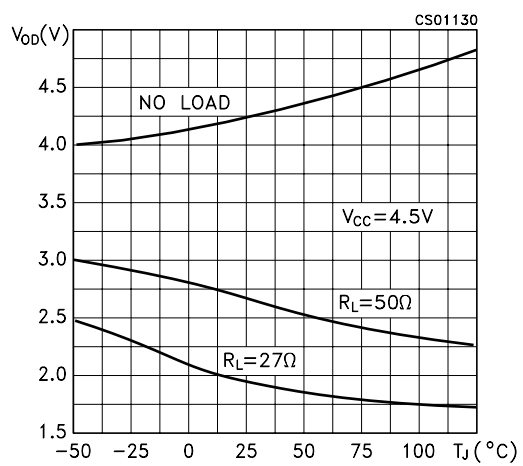




**Figure 15** : Receiver Low Level Output Voltage vs Temperature

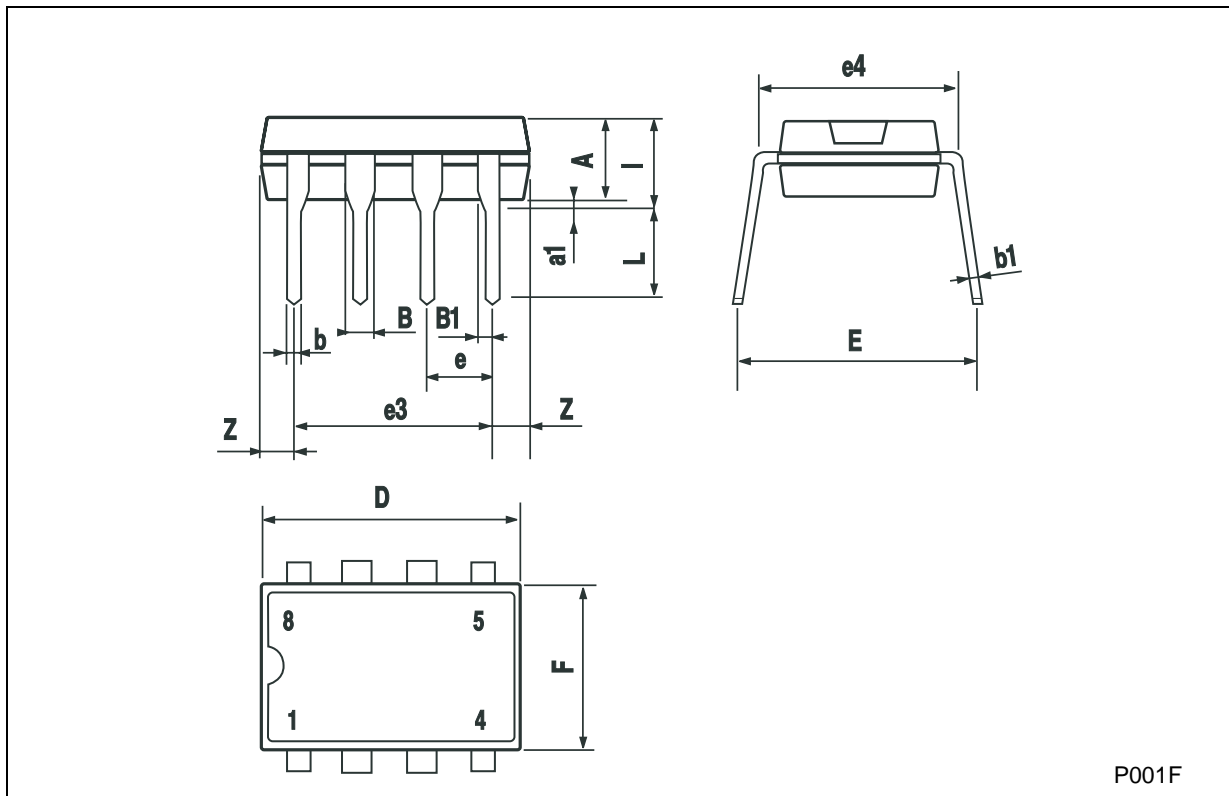


**Figure 16** : Differential Driver Output Voltage vs Temperature



**Plastic DIP-8 MECHANICAL DATA**

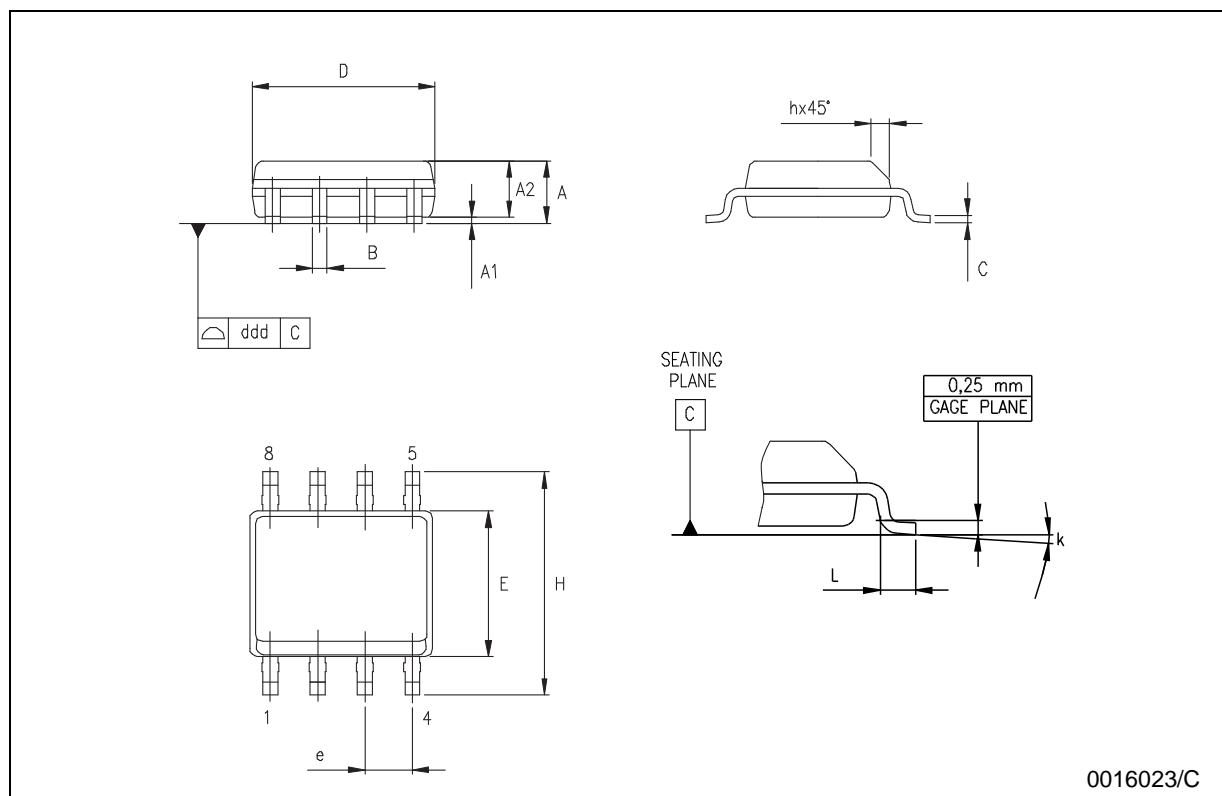
DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A		3.3			0.130	
a1	0.7			0.028		
B	1.39		1.65	0.055		0.065
B1	0.91		1.04	0.036		0.041
b		0.5			0.020	
b1	0.38		0.5	0.015		0.020
D			9.8			0.386
E		8.8			0.346	
e		2.54			0.100	
e3		7.62			0.300	
e4		7.62			0.300	
F			7.1			0.280
I			4.8			0.189
L		3.3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



P001F

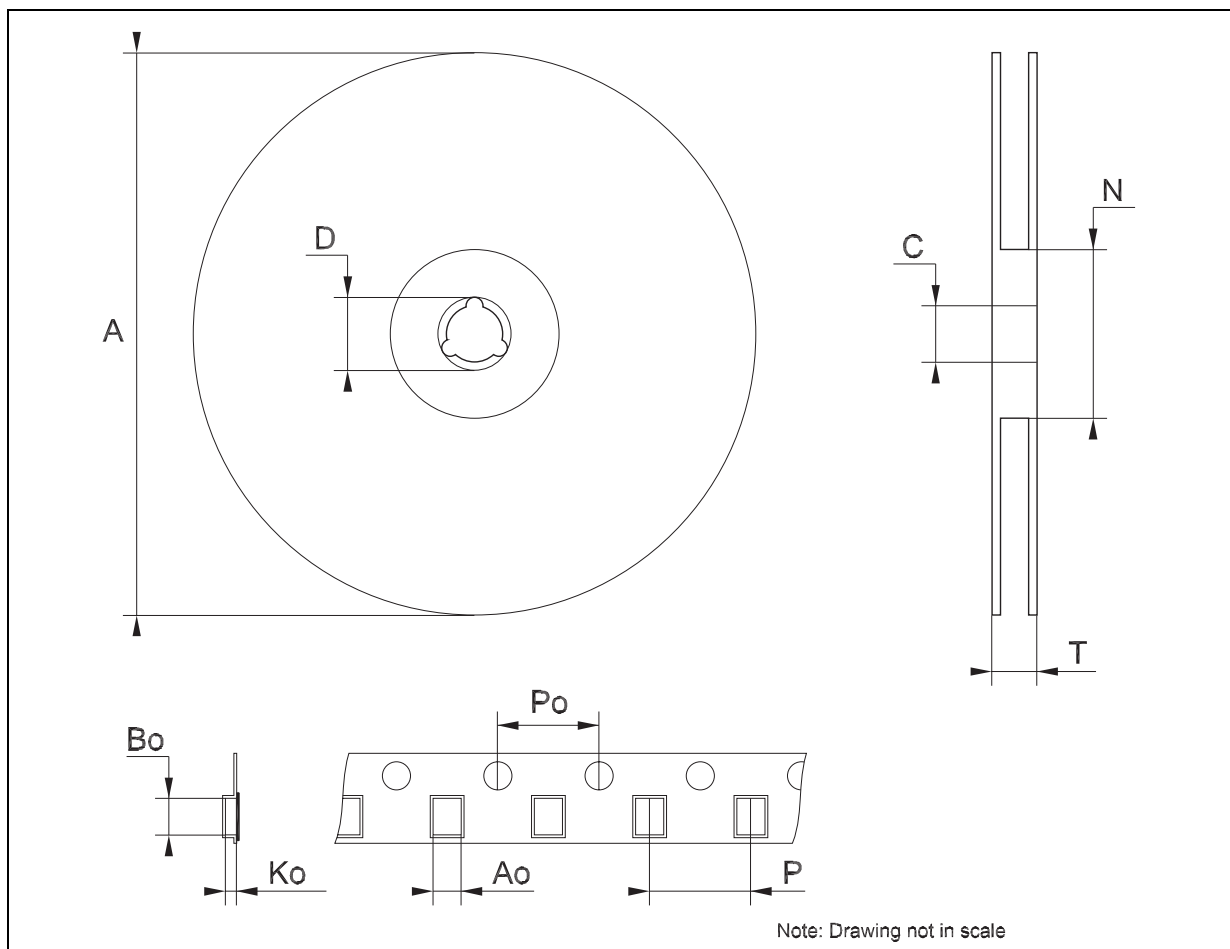
## SO-8 MECHANICAL DATA

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	$8^{\circ}$ (max.)					
ddd			0.1			0.04



**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



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