CENTRO UNIVERSITARIO DE AUTOMACIÓN Y ROBÓTICA

Facultad Regional Córdoba

TECNICAS DIGITALES III

CUDAR
CENTRO UNIVERSITARIO DE AUTOMACIÓN Y ROBÓTICA

UTN
Facultad Regional Córdoba

LA INSTRUMENTACIÓN VIRTUAL

Agenda

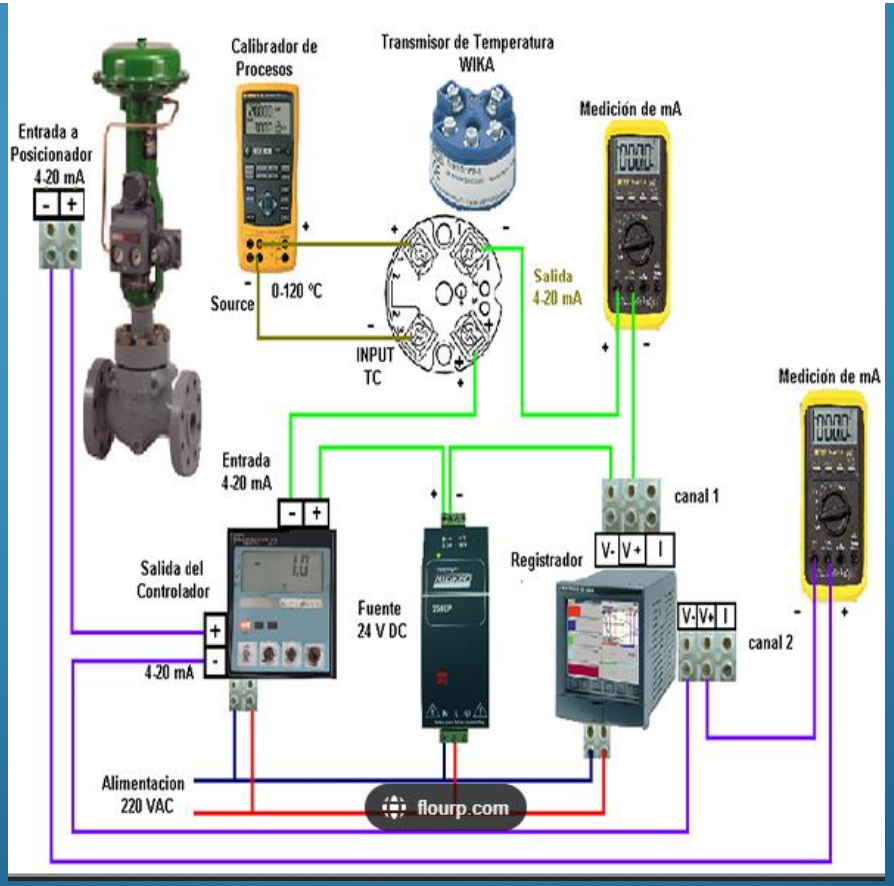
-¿De que hablamos cuando hablamos de instrumentación virtual?.
-¿LabView como software de desarrollo para instrumentos virtuales.
- Librerías PyVisa para desarrollo de instrumentos virtuales.

Instrumento

Un instrumento de medición es aquel que permite medir la longitud, volumen, extensión o capacidad por comparación de un elemento estandarizado el cual es tomado como referencia para posteriormente asignarle un valor numérico mediante algún instrumento graduado con dicha unidad.

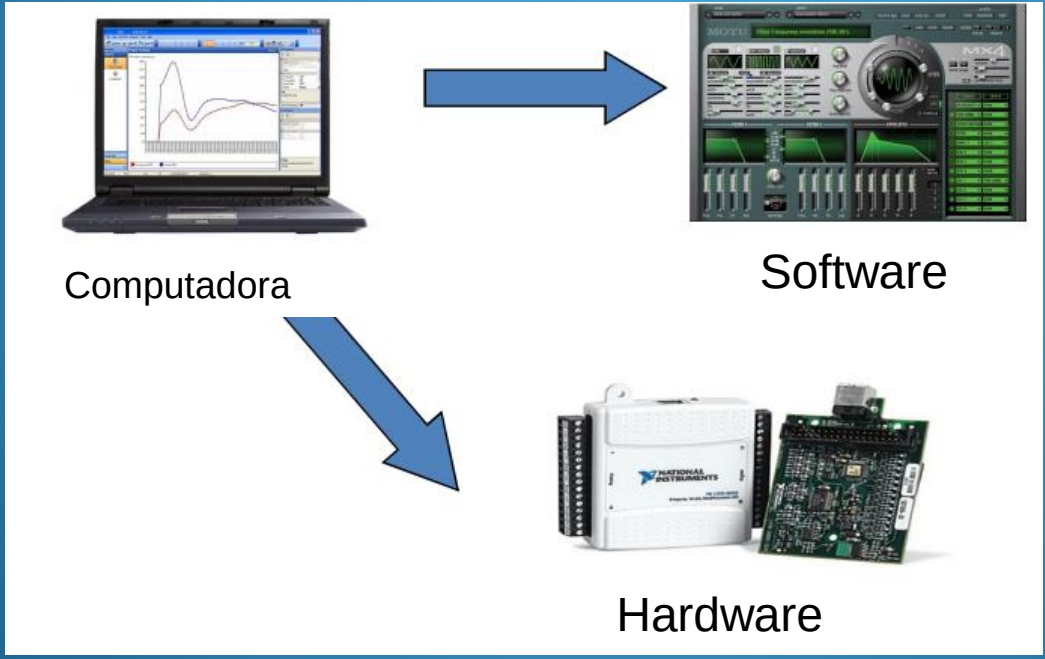
Instrumentación

Instrumentación es el proceso en el que el conjunto de varios instrumentos eléctricos/electrónicos, de medición y control interconectados para medir, analizar y controlar las magnitudes físicas eléctricas y no eléctricas.



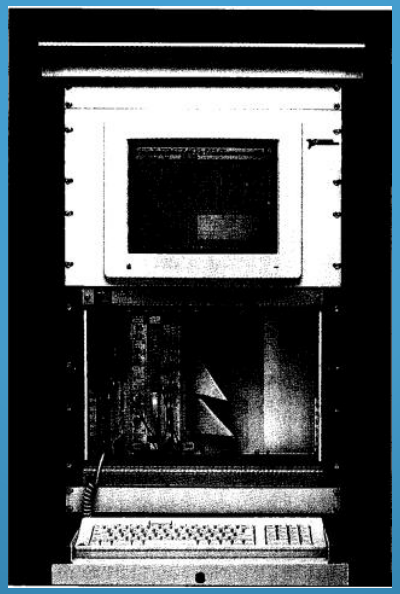
Paradigma de la instrumentación virtual

Un instrumento virtual es aquel cuya funcionalidad es determinada por software.



Historia de los instrumentos virtuales

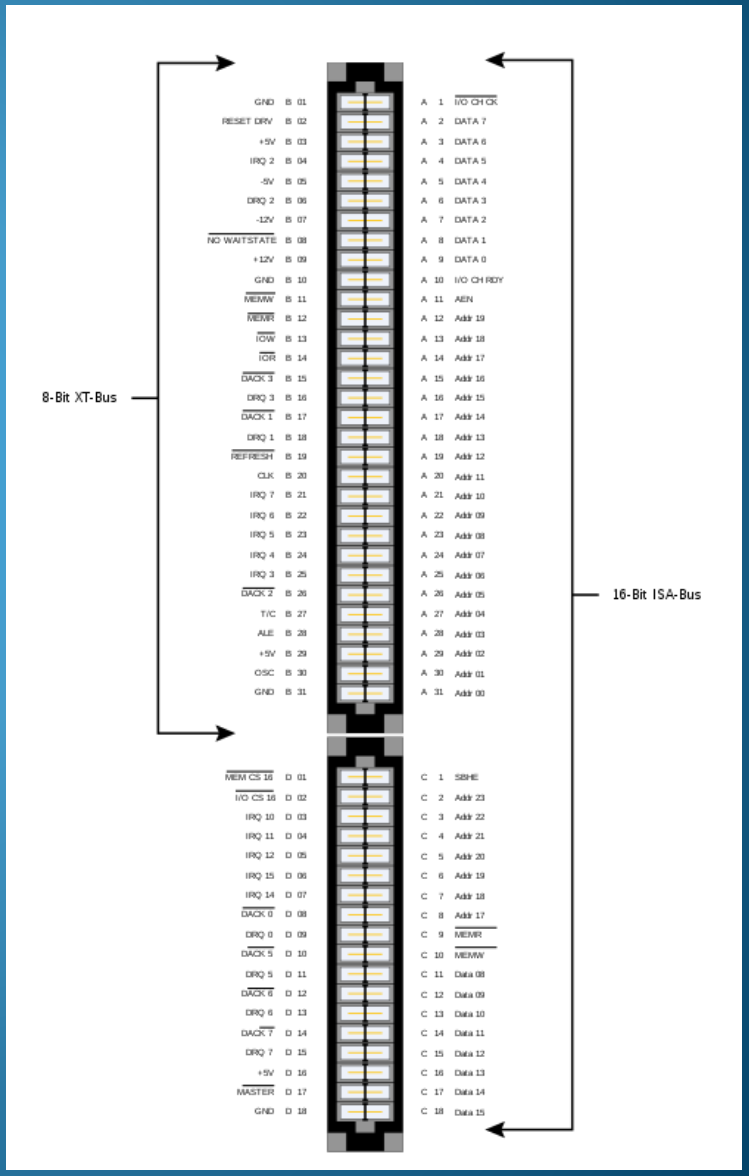
El concepto de instrumentos virtuales nace a fines de 1970, cuando la tecnología de los microprocesadores habilita a que la funcionalidad de una maquina sea fácilmente modificable por software. Hasta principios de los 80 consistían en conectar instrumentos tradicionales a la PC



M. Santori, "An instrument that isn't really", IEEE Spectrum 27(8), 36 - 39 (1990).

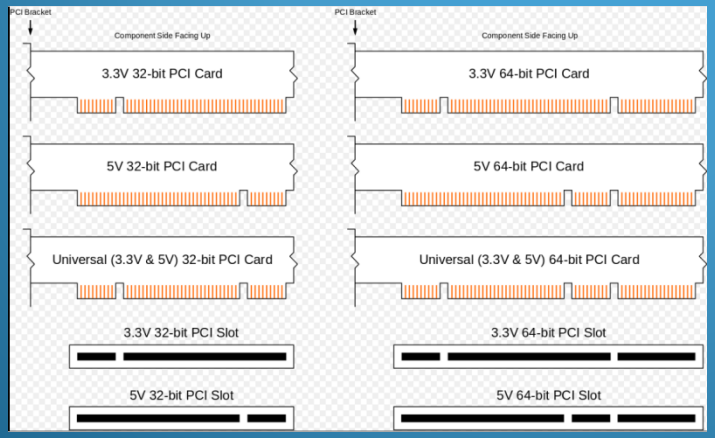
Primeros instrumentos e interfaz paralelo

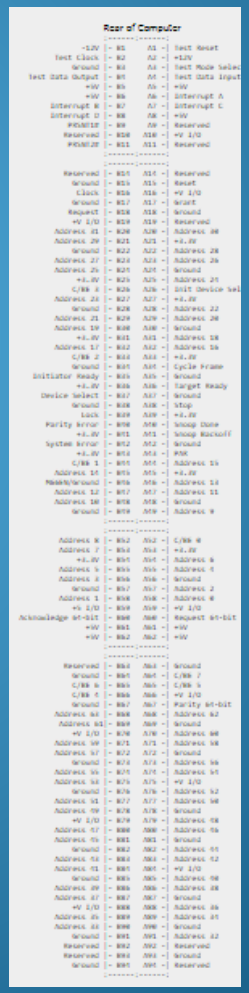
BUS ISA (Industry Standard Architecture)



Interfaz paralelo

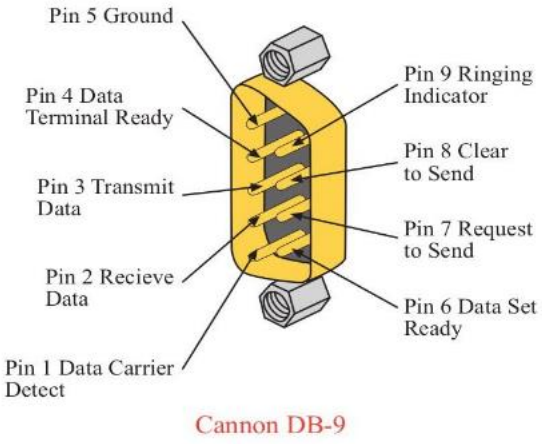
BUS PCI (Peripheral Component Interconnect)



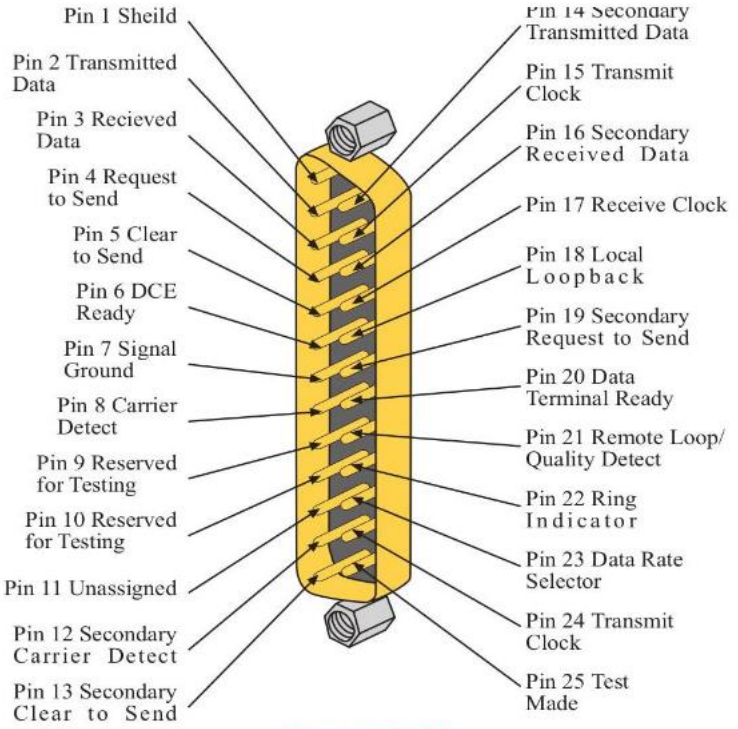


https://pinouts.ru/Slots/PCI_pinout.shtml

Interfaces serie RS232

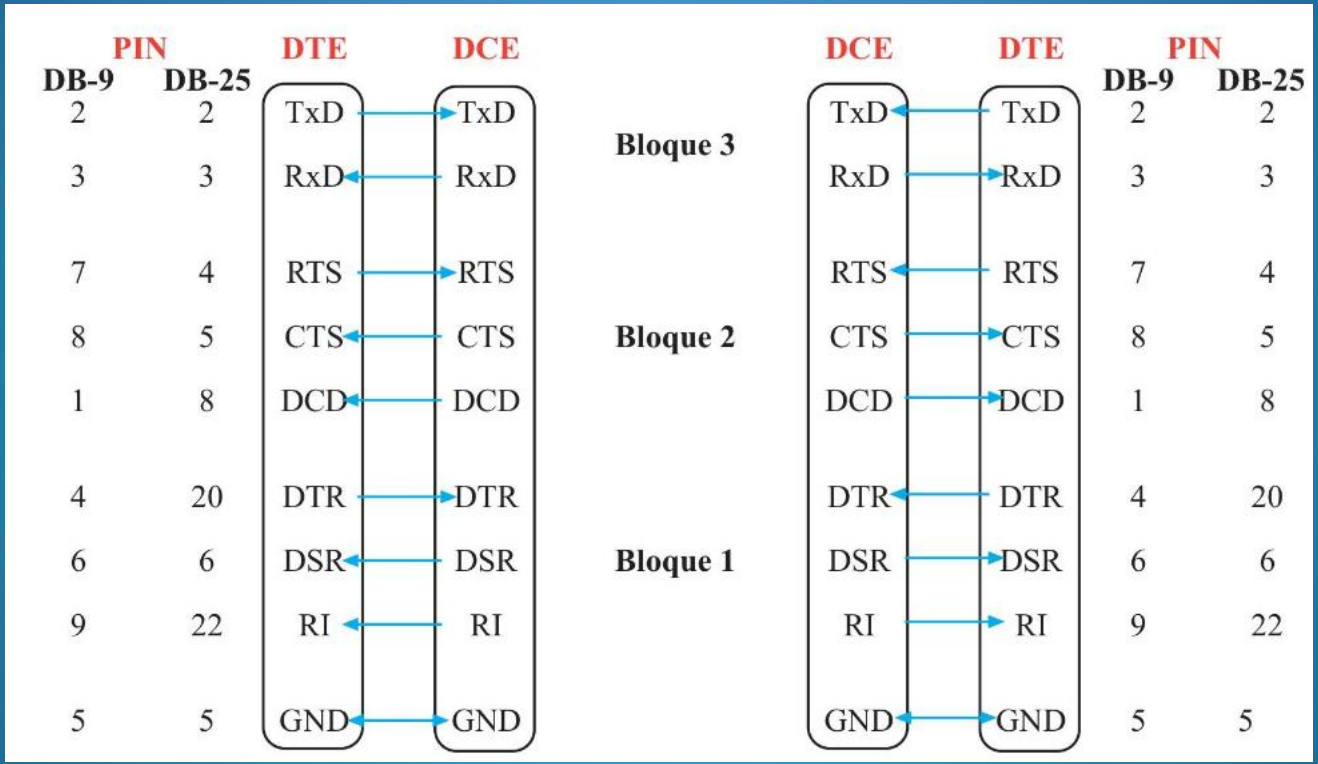


Cannon DB-9

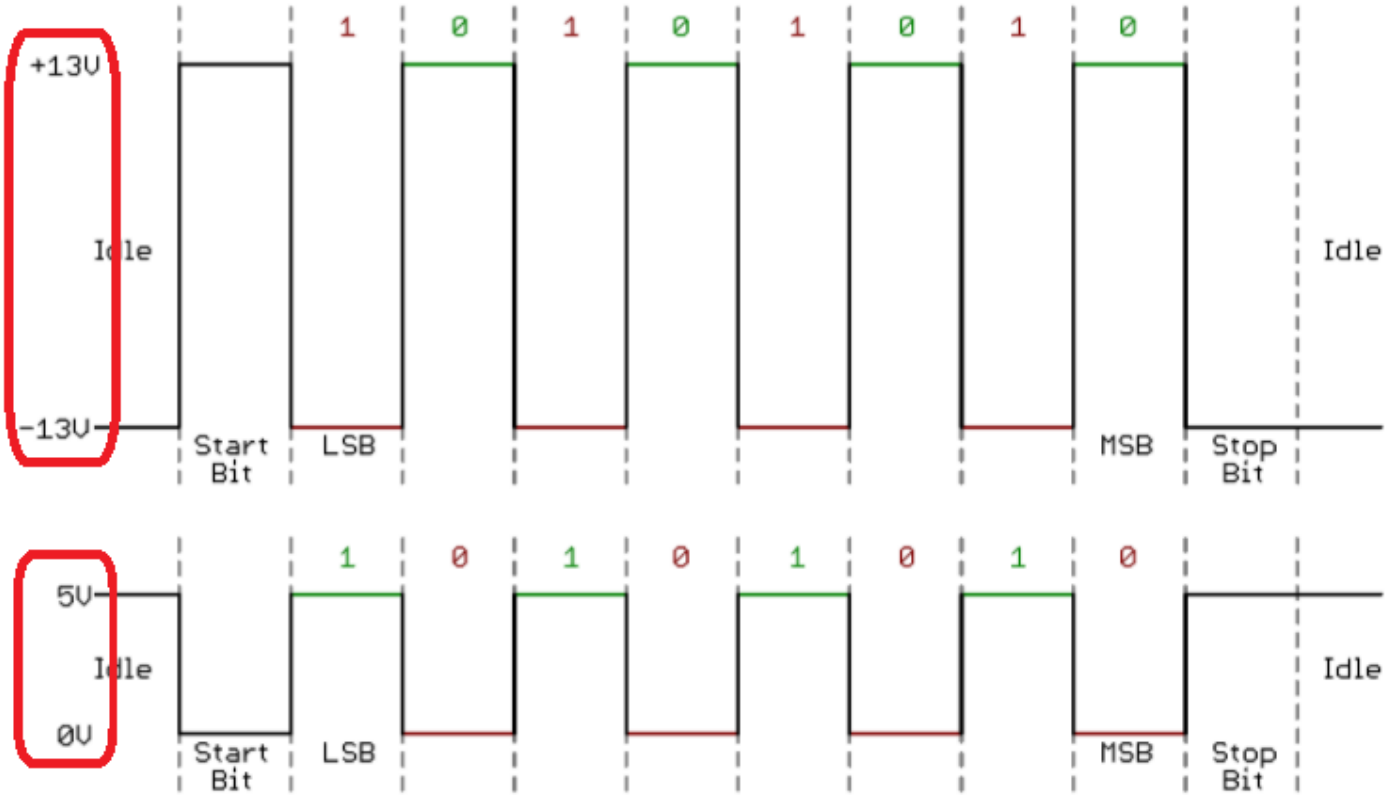


Cannon DB-25

Interfaces serie RS232

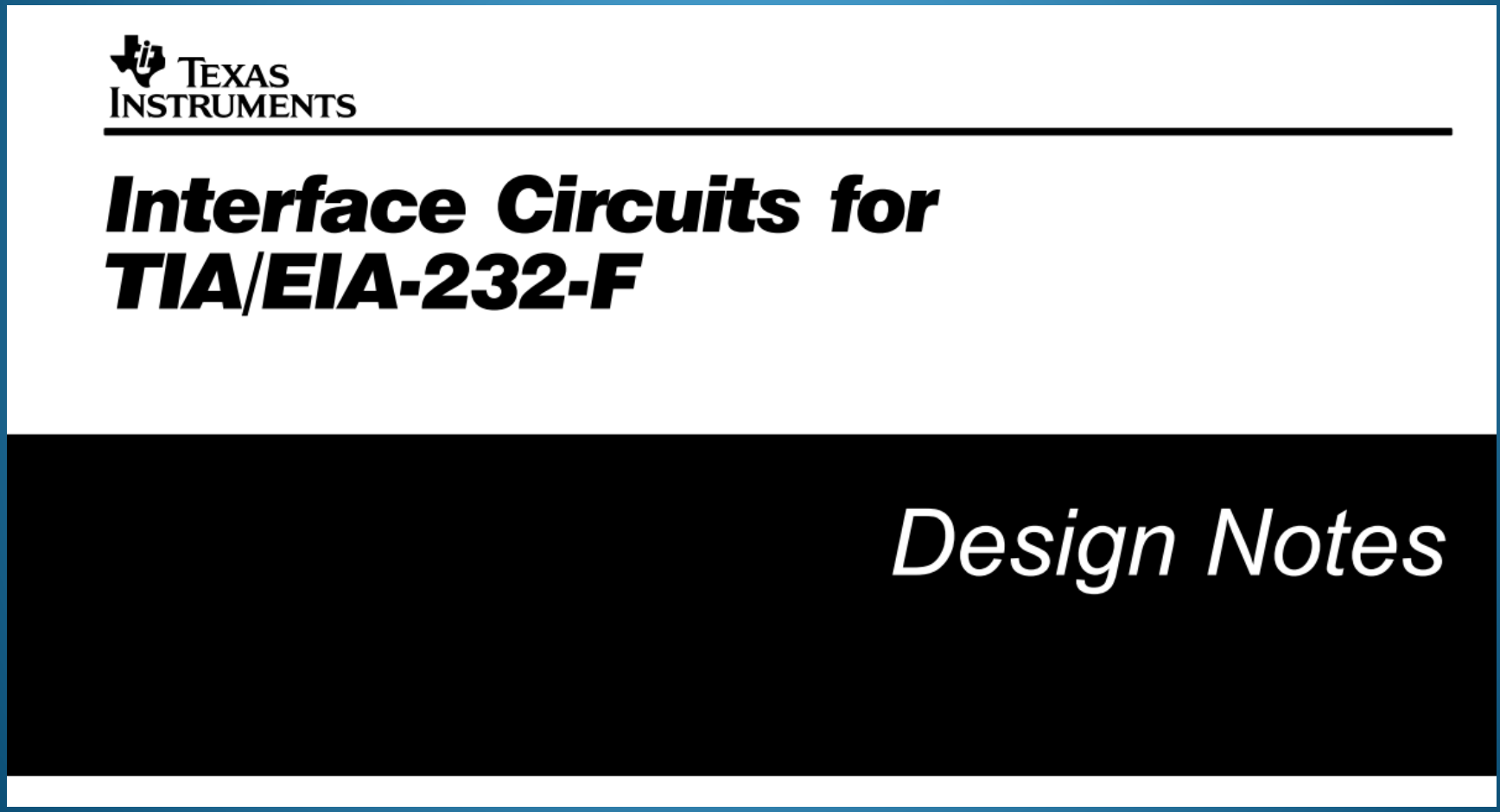


Interfaces serie
RS232



This timing diagram shows both a TTL (bottom) and RS-232 signal sending 0b01010101

Nota de aplicación RS232



RS232- Detalles de la señal

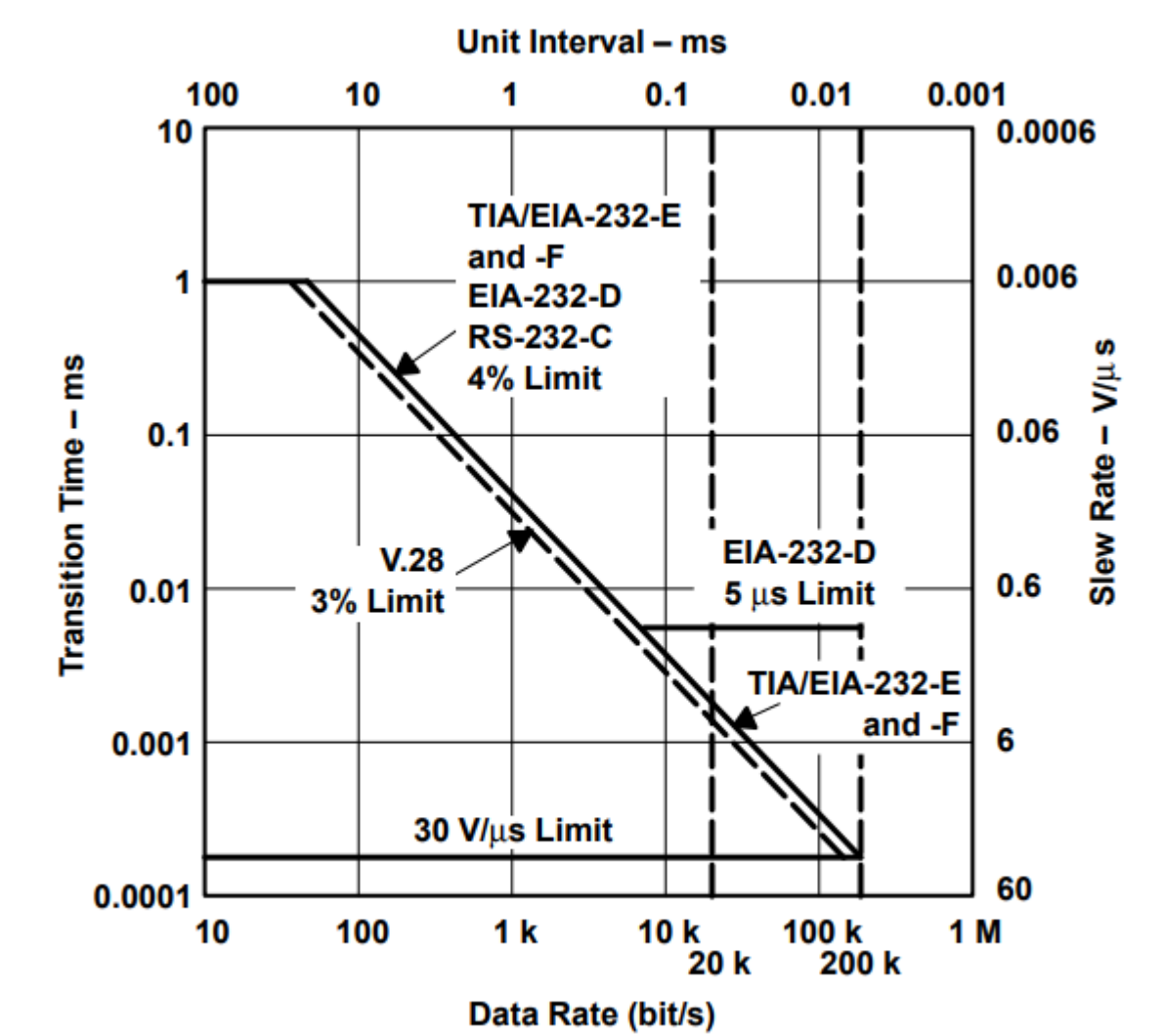
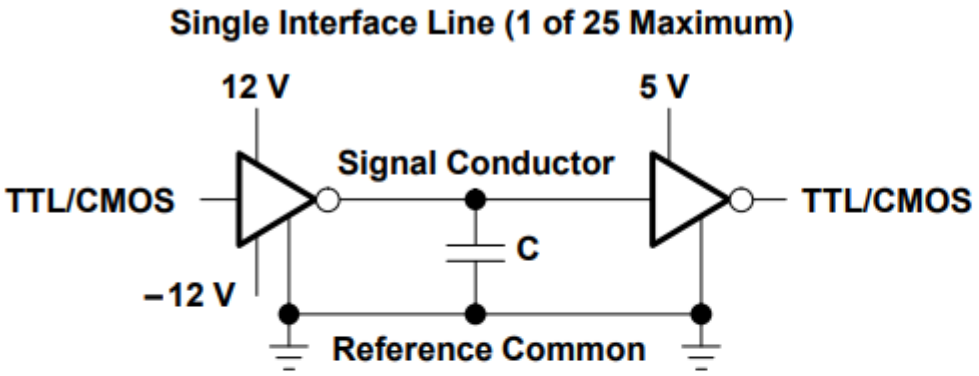
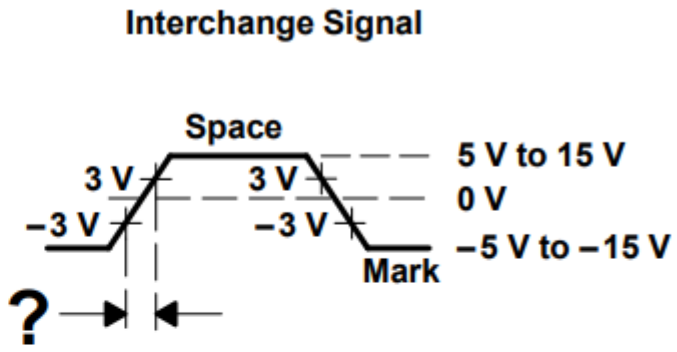


Figure 2. 232 Transition Time vs Data Rate

Especificaciones electrica



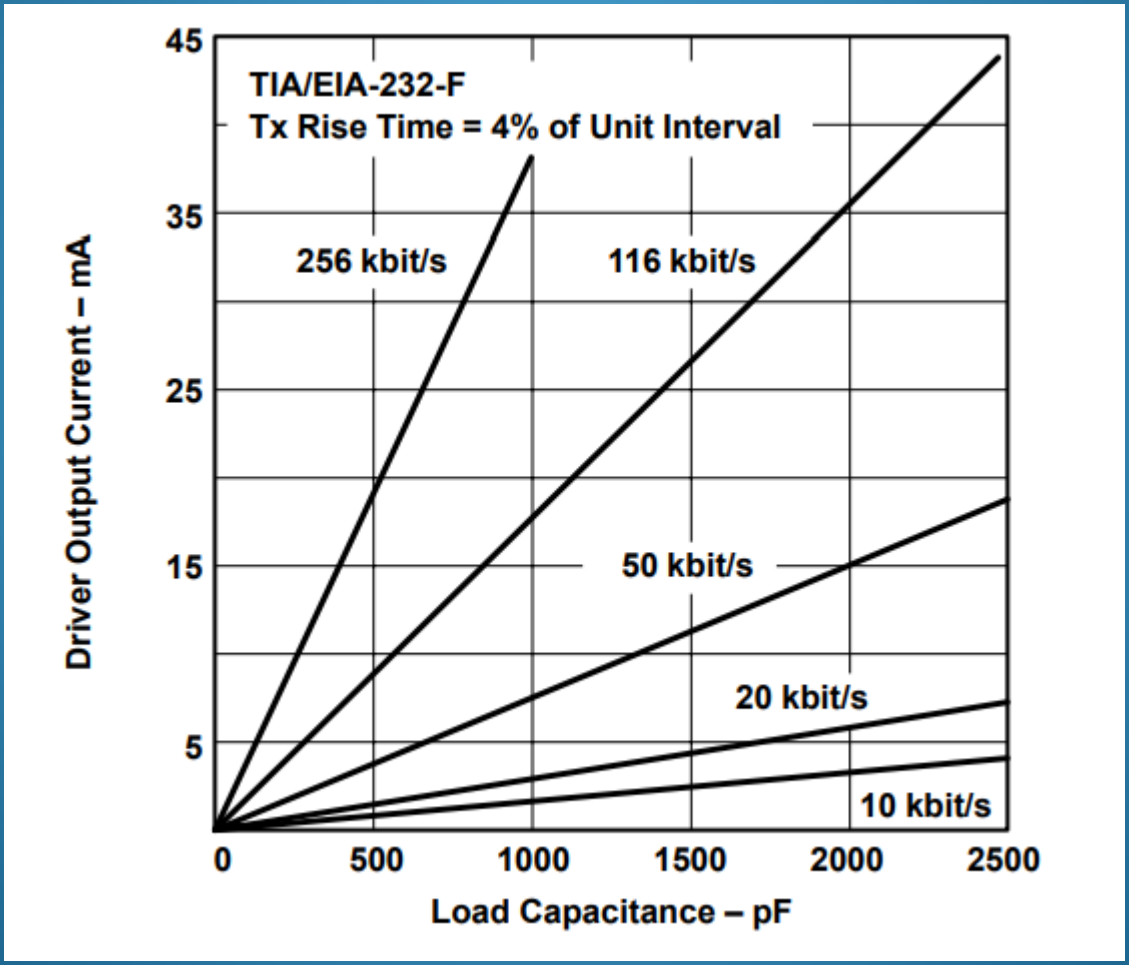


- Receiver Input Impedance, 3 kΩ to 7 kΩ
- Driver Power-Off Impedance, > 300 Ω
- Load Capacitance < 2500 pF Includes Receiver Input

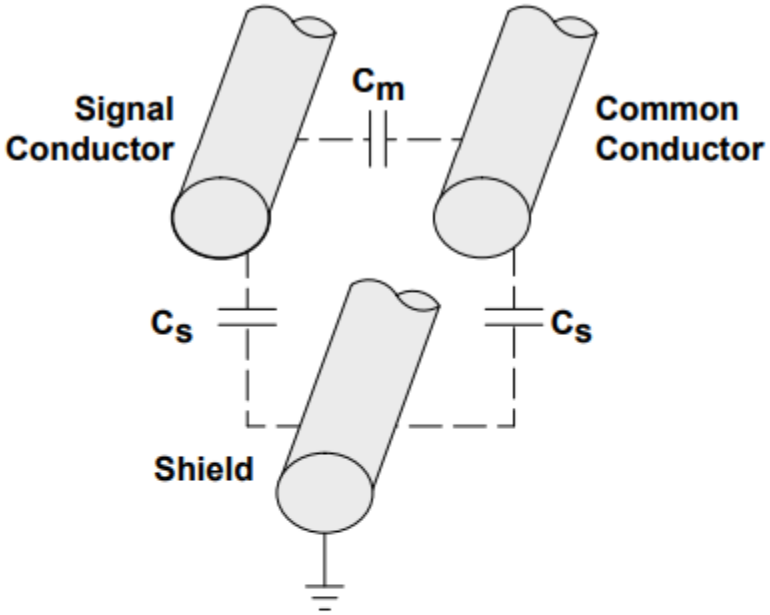
- Tx Rise/Fall Time Within Transition Region
  1 ms — Below 40 bit/s
  4% of Unit Interval — 30 bit/s to 20 kbit/s
- Slew Rate: 30 V/μs max

Figure 3. TIA/EIA-232-F Electrical Specification

RS232 – Relación entre la capacidad distribuida del cable y la longitud



RS232 – Calculo de la distancia máxima de comunicaciones



Line-Length Calculation

Maximum Capacitance	= 2500 pF
Receiver I/P Capacitance	< 20 pF
Maximum Line Capacitance	= 2480 pF
Total Line Capacitance/m	$C_C = C_M + C_S$
Mutual Capacitance of Cable/m	$C_M \approx 100$ pF
Stray Capacitance/m	$C_S \approx 200$ pF
Maximum Line Length	$= 2480/C_c$
Standard Cable C_M	= 24 pF/m
Maximum Line Length Shielded	= 10 Meters

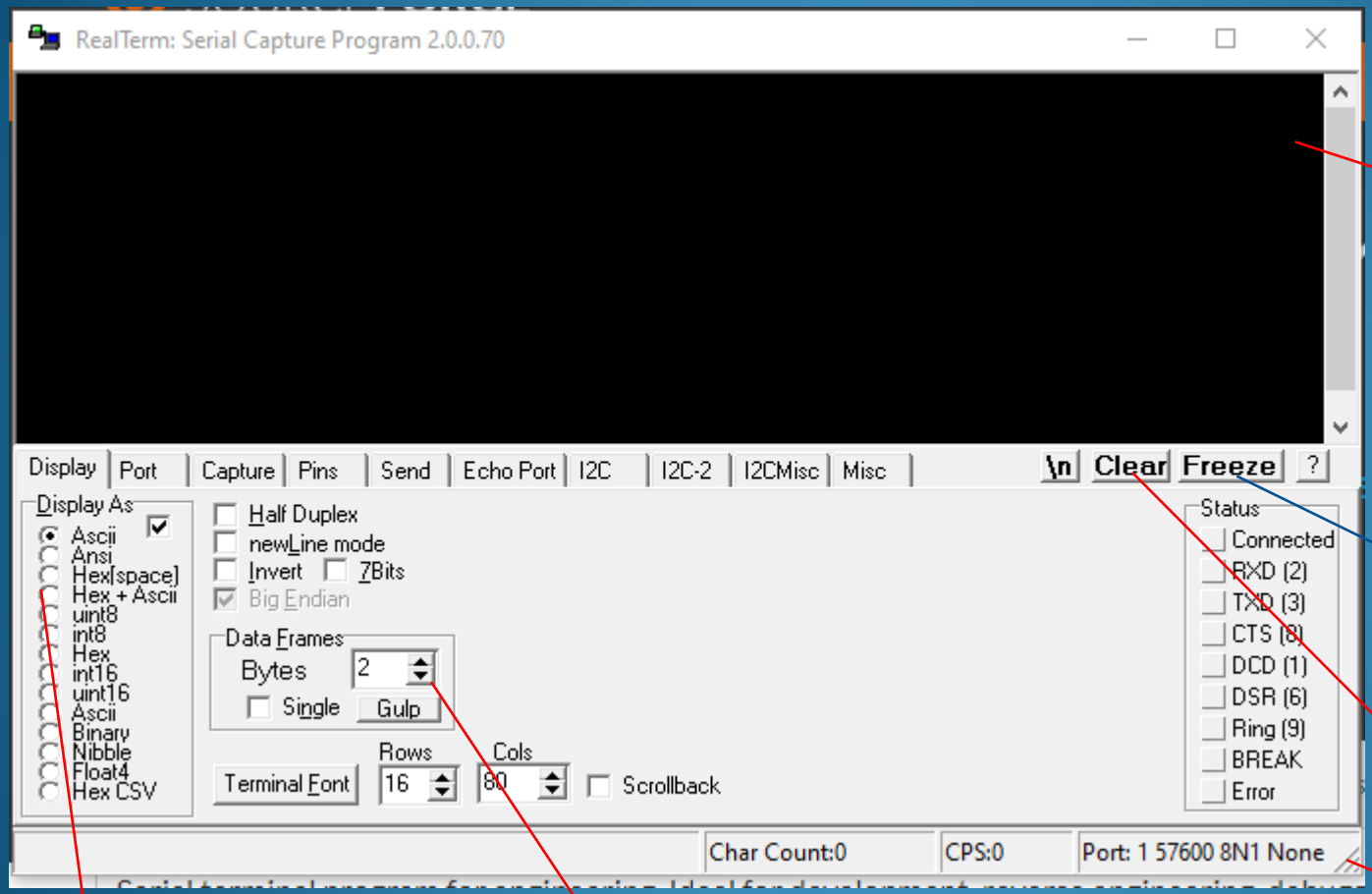
Data-Rate Calculation

$$\text{Unit Interval} = 1/3 \; \frac{0.04}{C_C \ln\left(\frac{I_O + 1}{I_O - 1}\right)}$$

I_O = Short-Circuit Current of Driver

Figure 5. Calculating Line Length and Data Rate

RS232 – RealTerm



Muestra los datos de entrada y de salida (si esta activo el “echo”)

Congela la pantalla

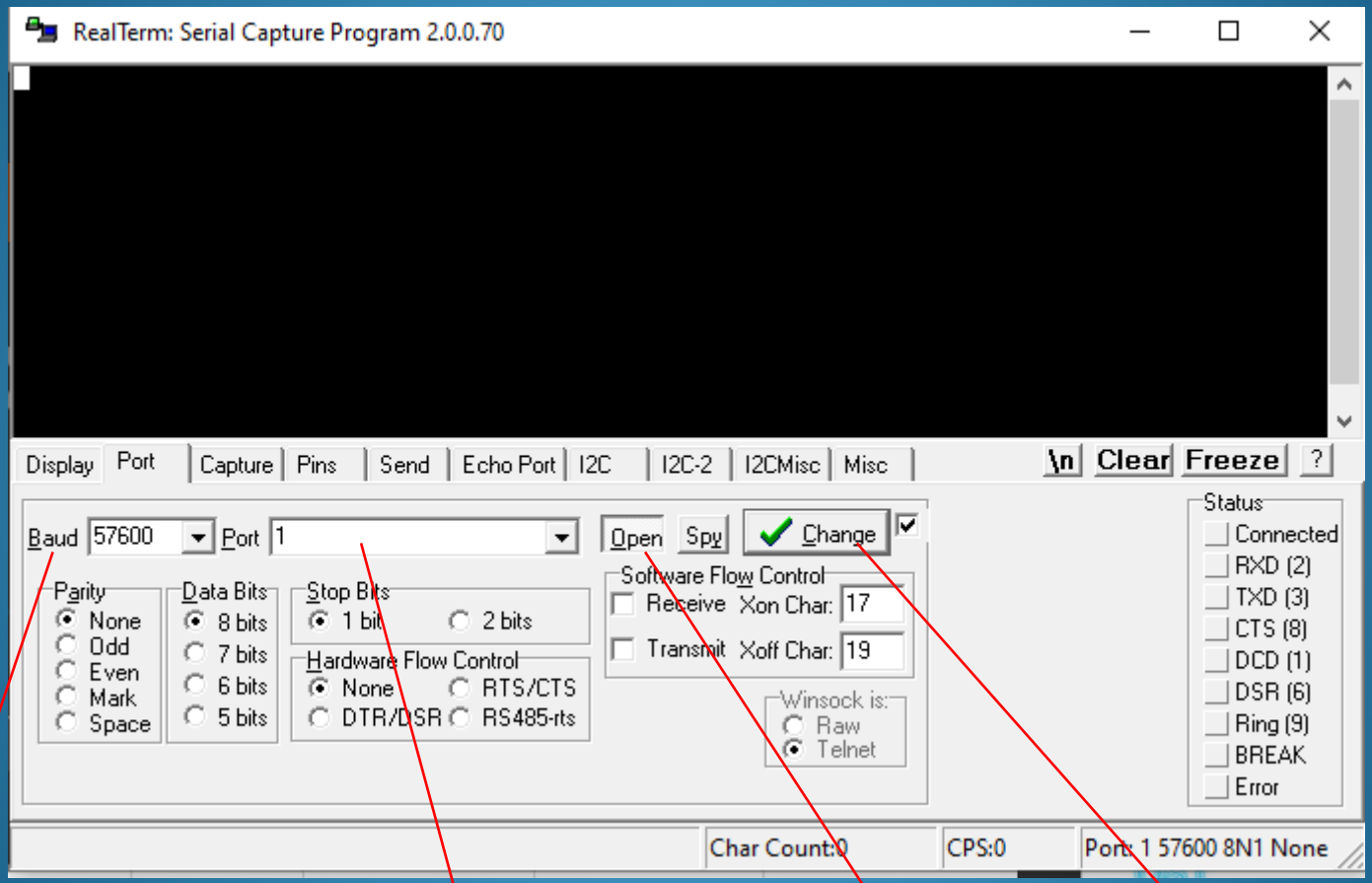
Limpia pantalla

Como mostrar el dato

Permite especificar el largo de la trama de datos

Datos del puerto

RS232 – RealTerm



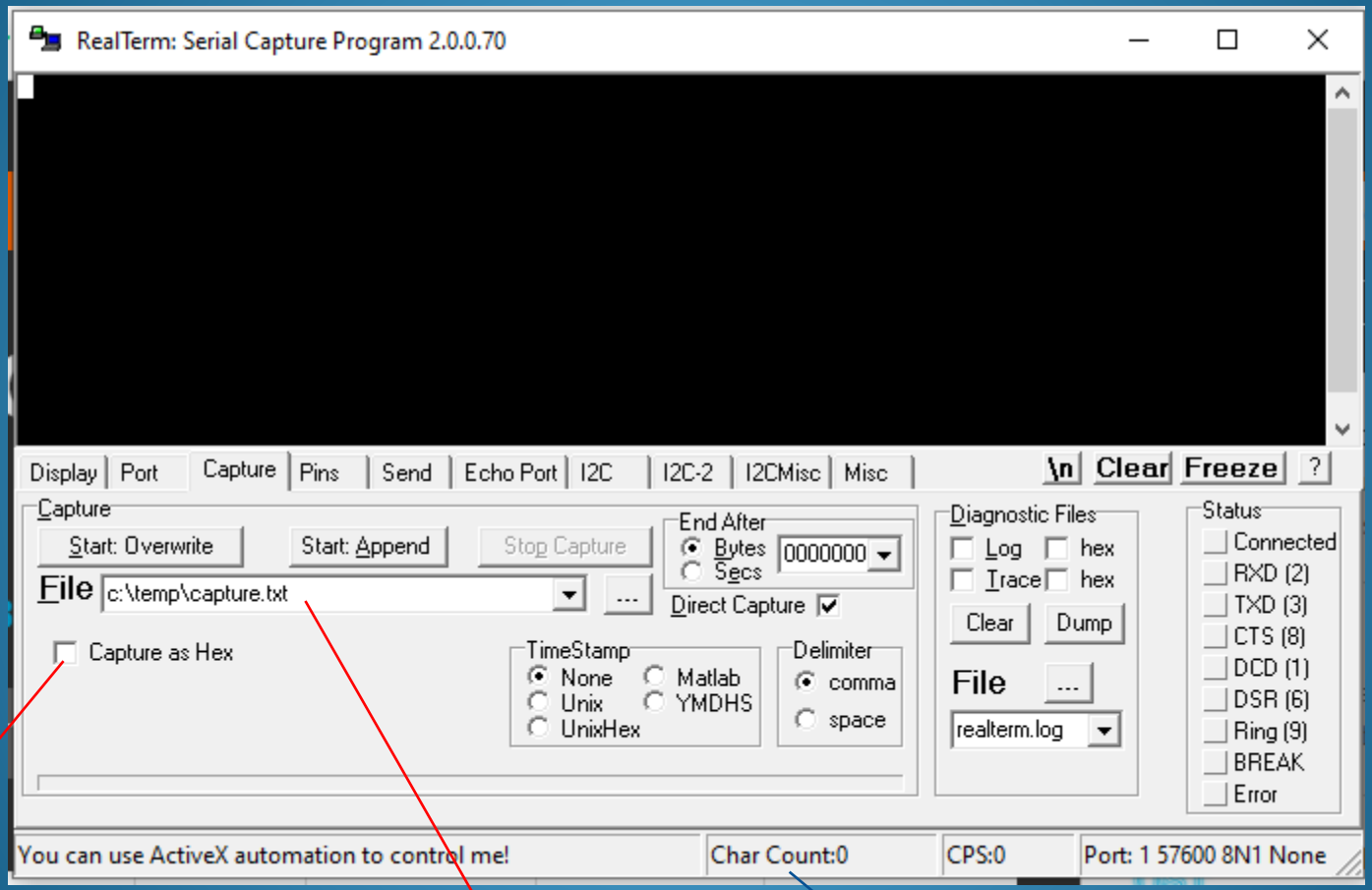
Velocidad de comunicaciones

Puerto de comunicaciones

Abre/cierra el puerto

Aplica cambios

RS232 – RealTerm

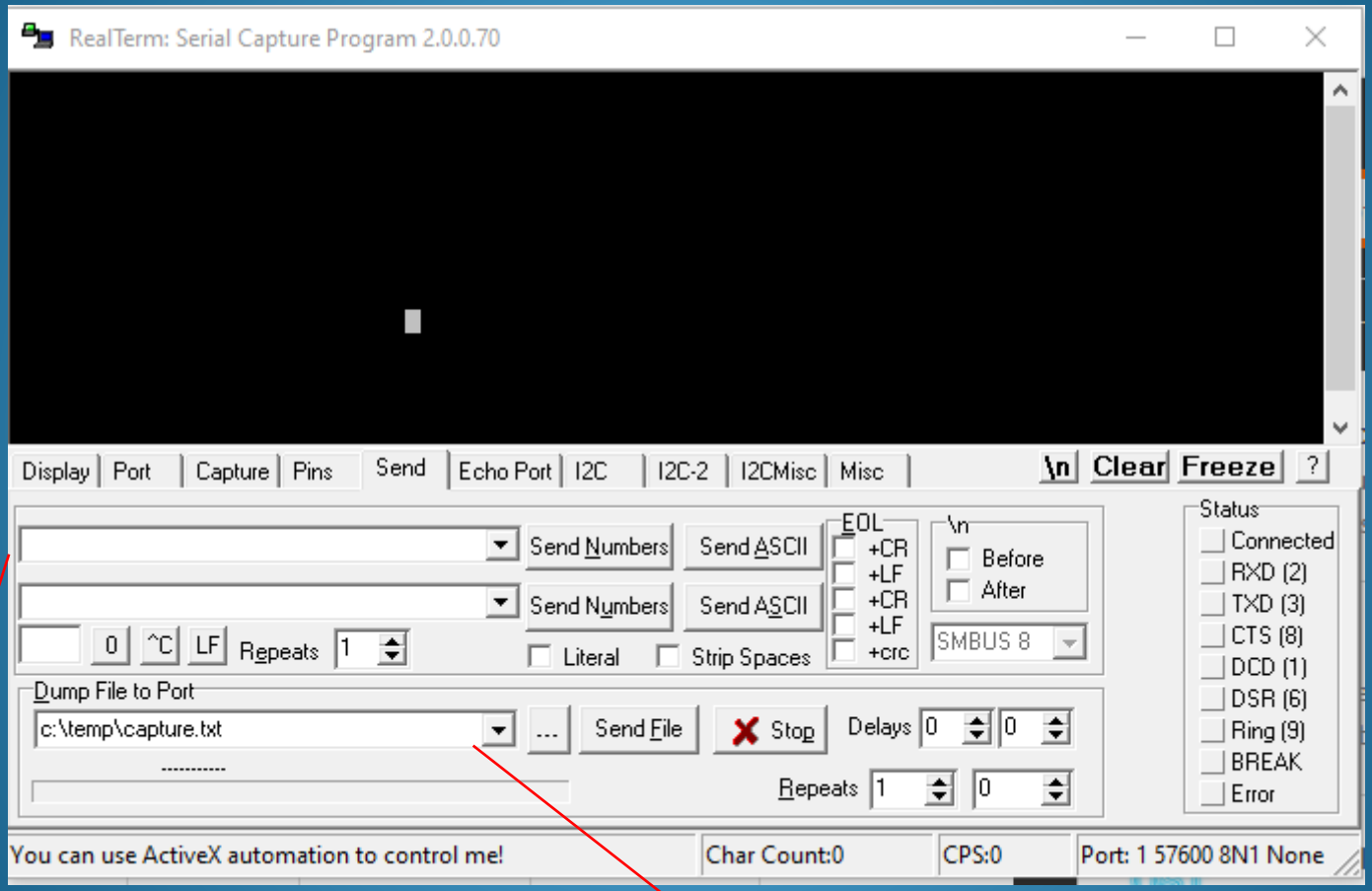


Forma de almacenamiento, hexadecimal o binario

Ubicación y nombre de archivo

Caracteres adquiridos

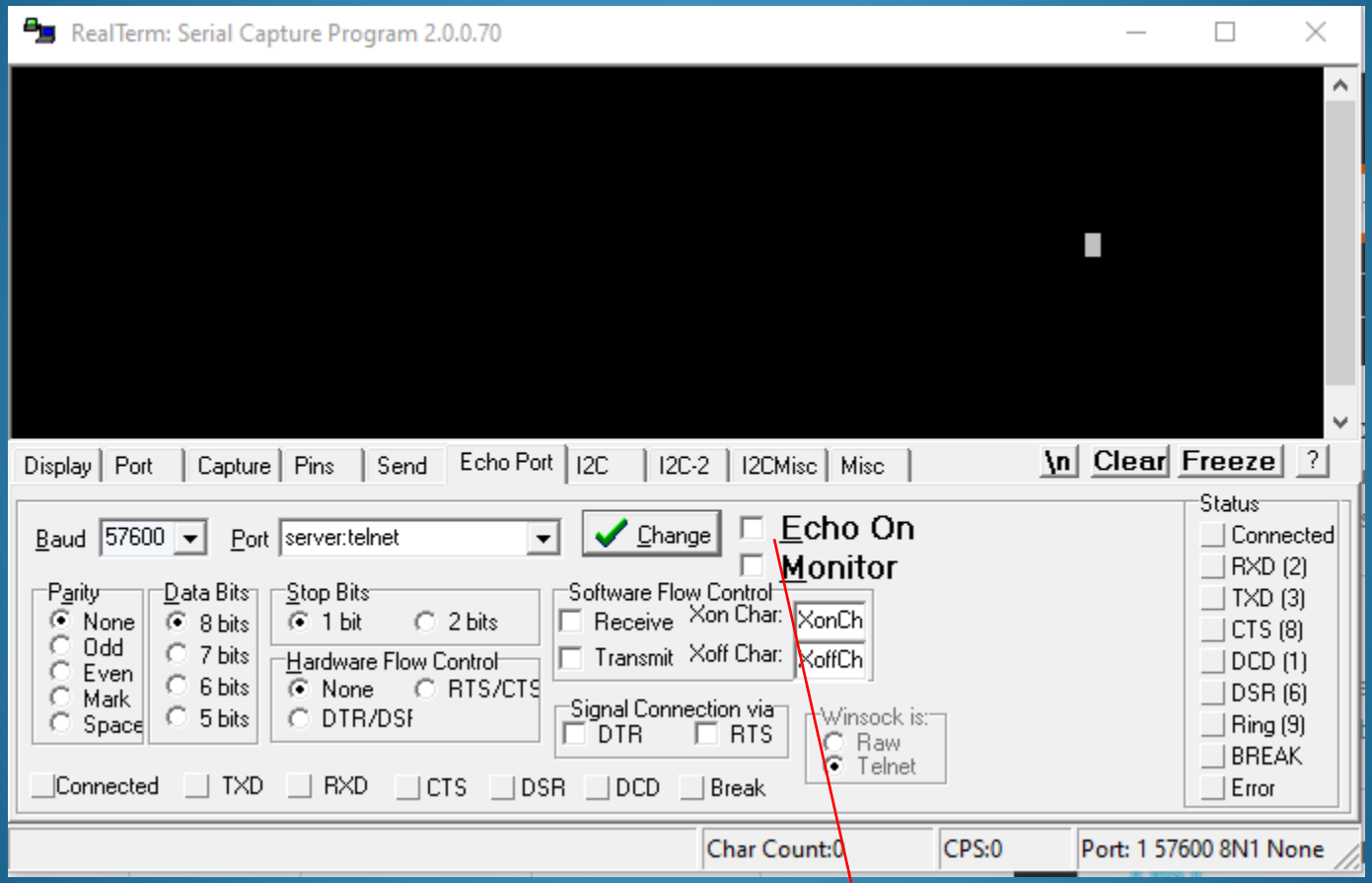
RS232 – RealTerm



Permite enviar una cadena de datos, puede enviarse en ASII o en hexadecimal

Permite enviar un archivo completo

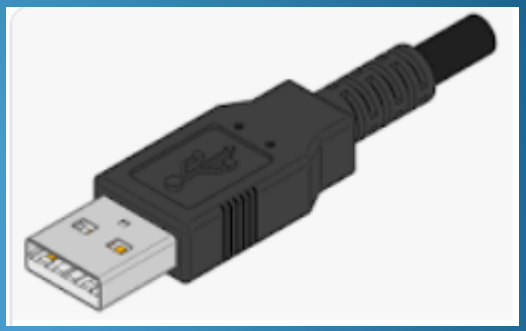
RS232 – RealTerm

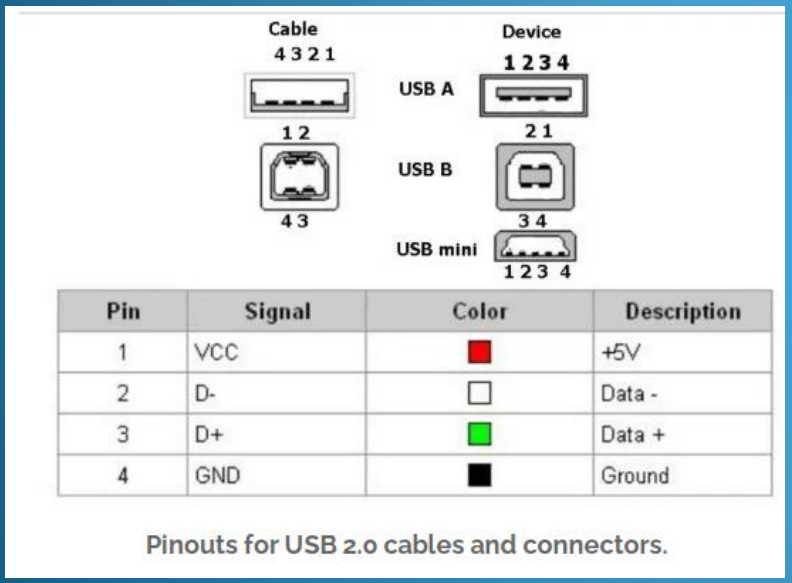


Permite ver lo que se envía por el terminal

Interfaces serie

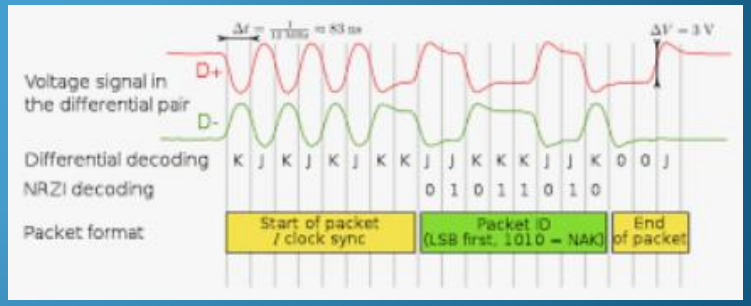
USB (Universal Serial Bus)



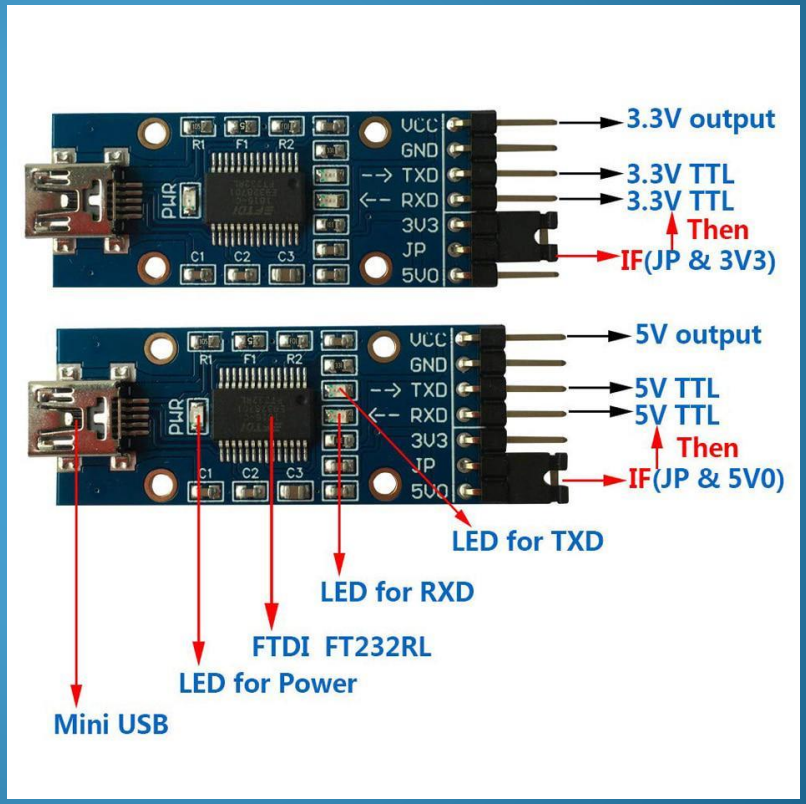


Pin	Signal	Color	Description
1	VCC		+5V
2	D-		Data -
3	D+		Data +
4	GND		Ground

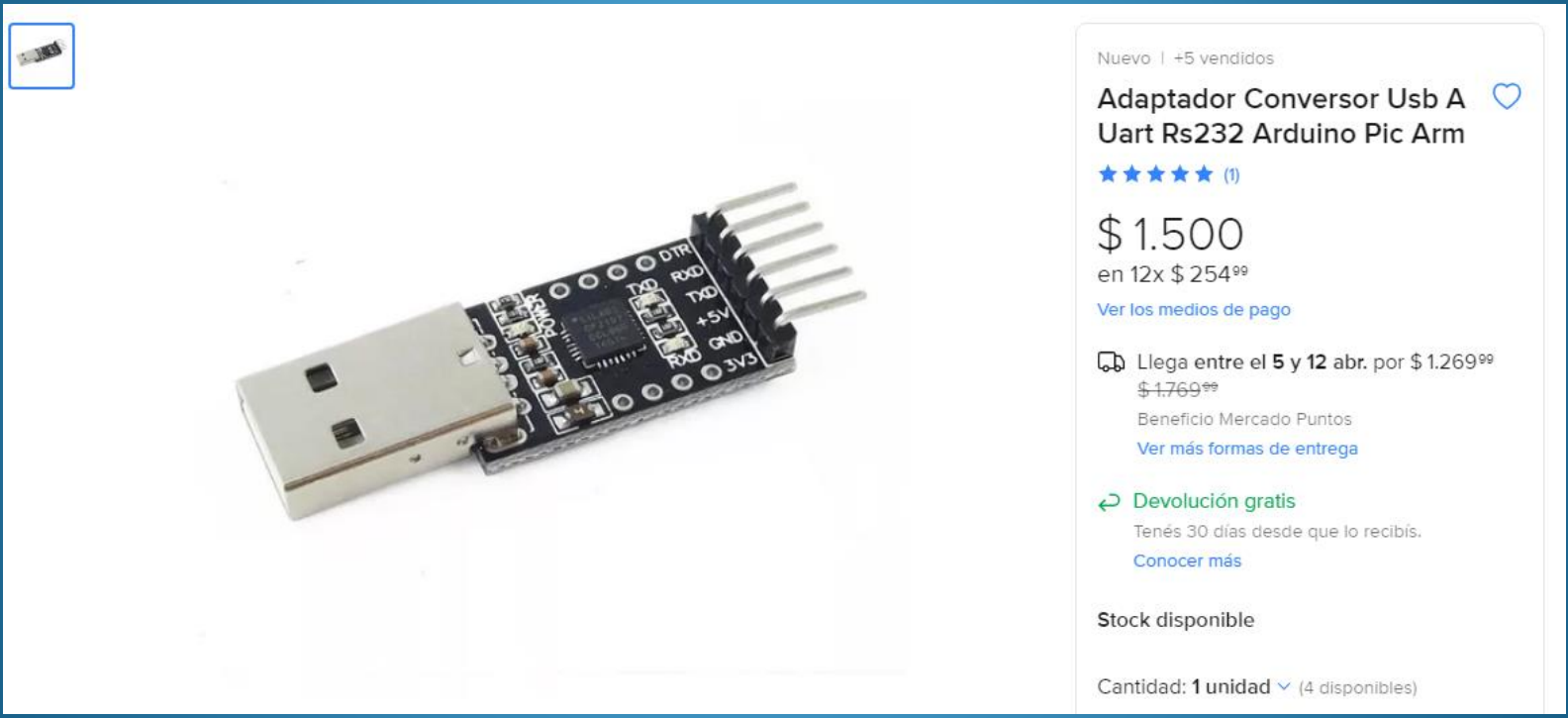
Pinouts for USB 2.0 cables and connectors.



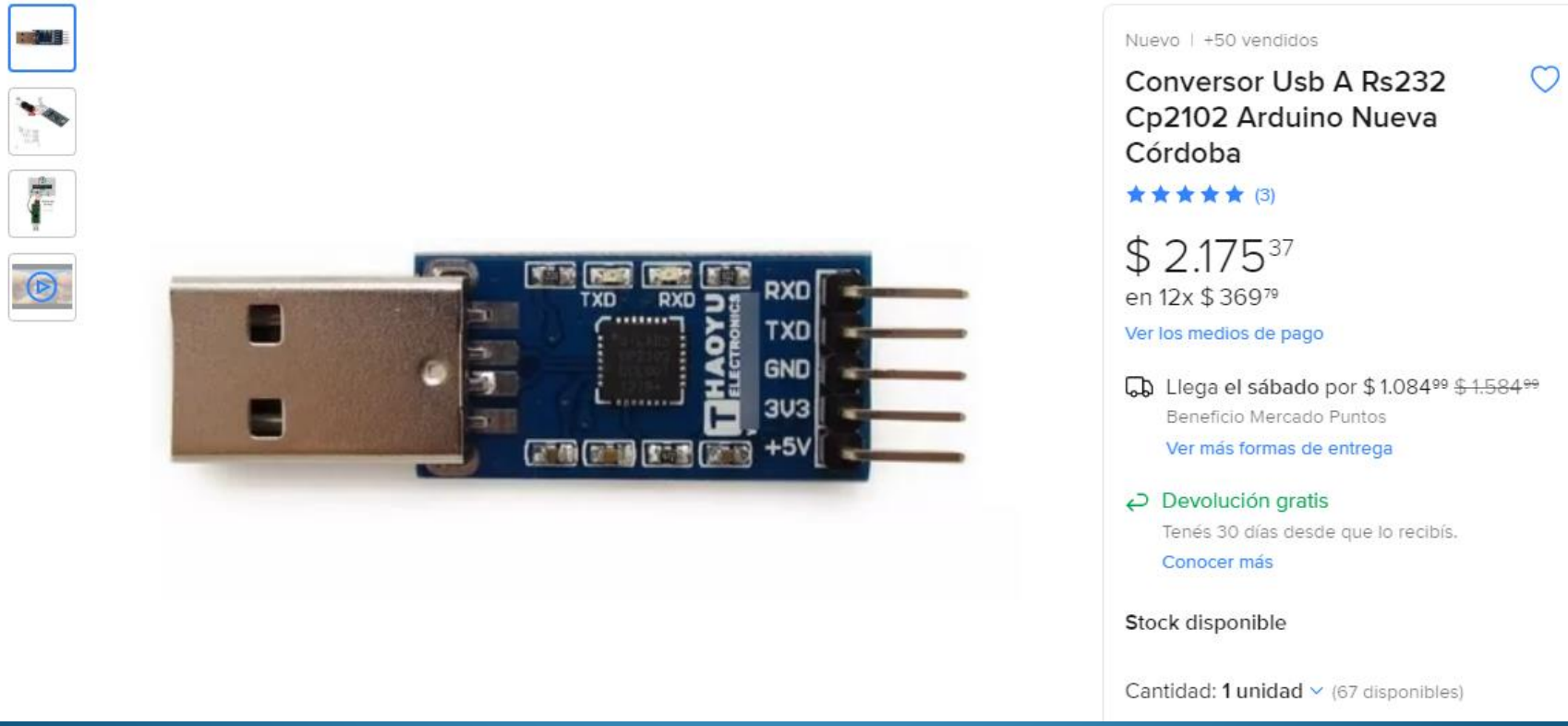
Interfaces serie
RS232 -USB



Interfaces serie
RS232 -USB



Interfaces serie
RS232 -USB



Interfaces serie RS232

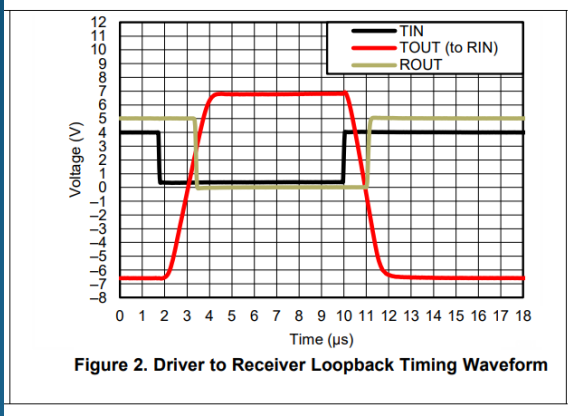
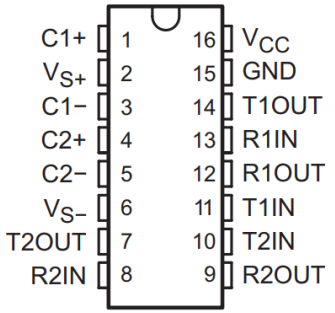


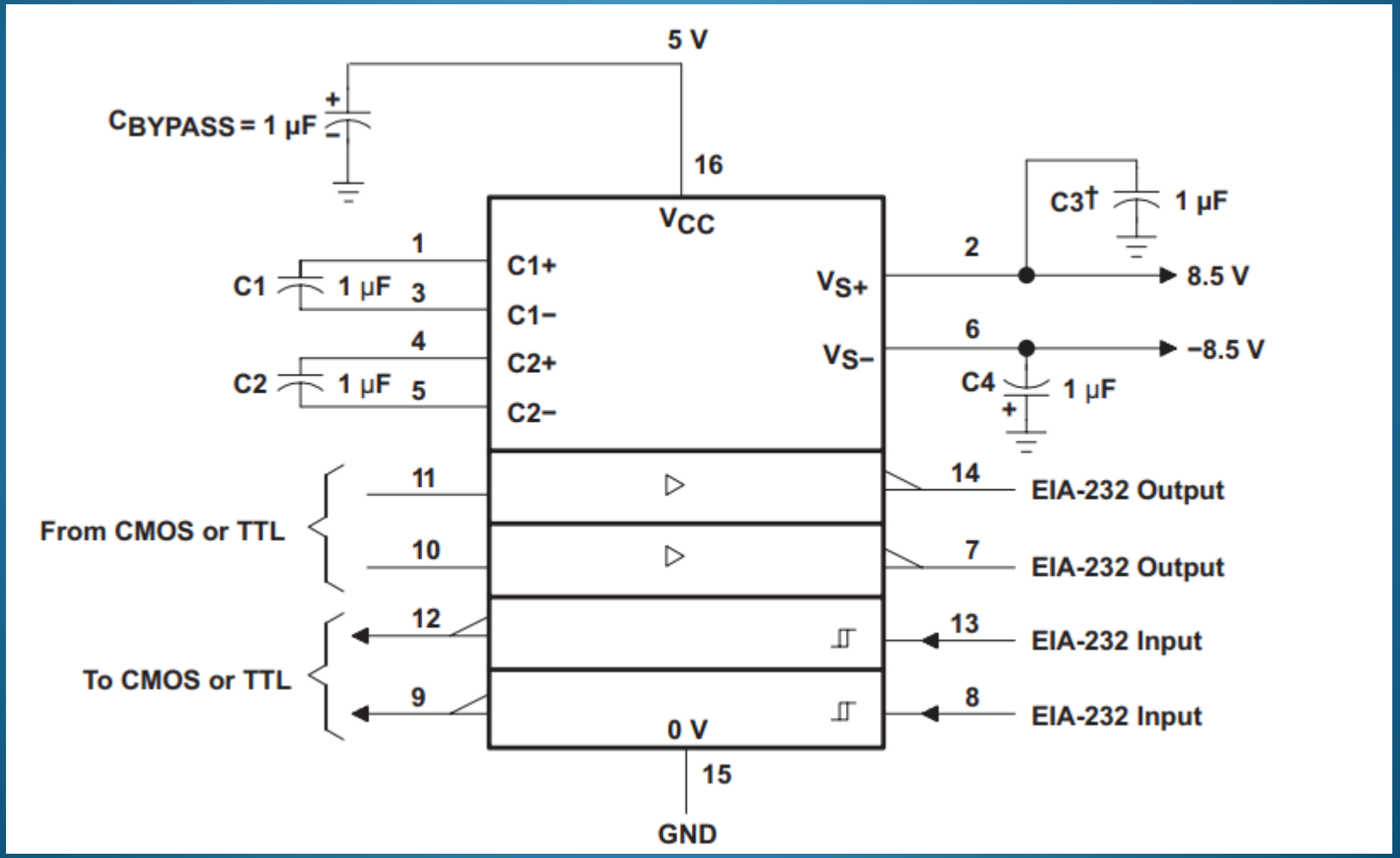
Figure 2. Driver to Receiver Loopback Timing Waveform

MAX232 . . . D, DW, N, OR NS PACKAGE
MAX232I . . . D, DW, OR N PACKAGE
(TOP VIEW)

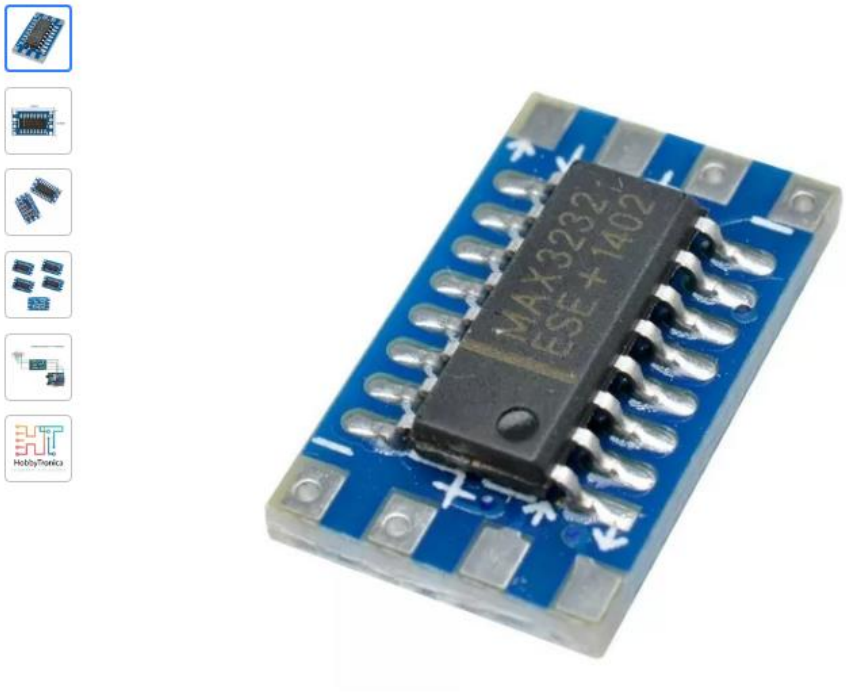


PIN		TYPE	DESCRIPTION
NAME	NO.		
C1+	1	—	Positive lead of C1 capacitor
VS+	2	O	Positive charge pump output for storage capacitor only
C1-	3	—	Negative lead of C1 capacitor
C2+	4	—	Positive lead of C2 capacitor
C2-	5	—	Negative lead of C2 capacitor
VS-	6	O	Negative charge pump output for storage capacitor only
T2OUT, T1OUT	7, 14	O	RS232 line data output (to remote RS232 system)
R2IN, R1IN	8, 13	I	RS232 line data input (from remote RS232 system)
R2OUT, R1OUT	9, 12	O	Logic data output (to UART)
T2IN, T1IN	10, 11	I	Logic data input (from UART)
GND	15	—	Ground
V_{CC}	16	—	Supply Voltage, Connect to external 5V power supply

Interfaces serie
RS232



Interfaces serie RS232



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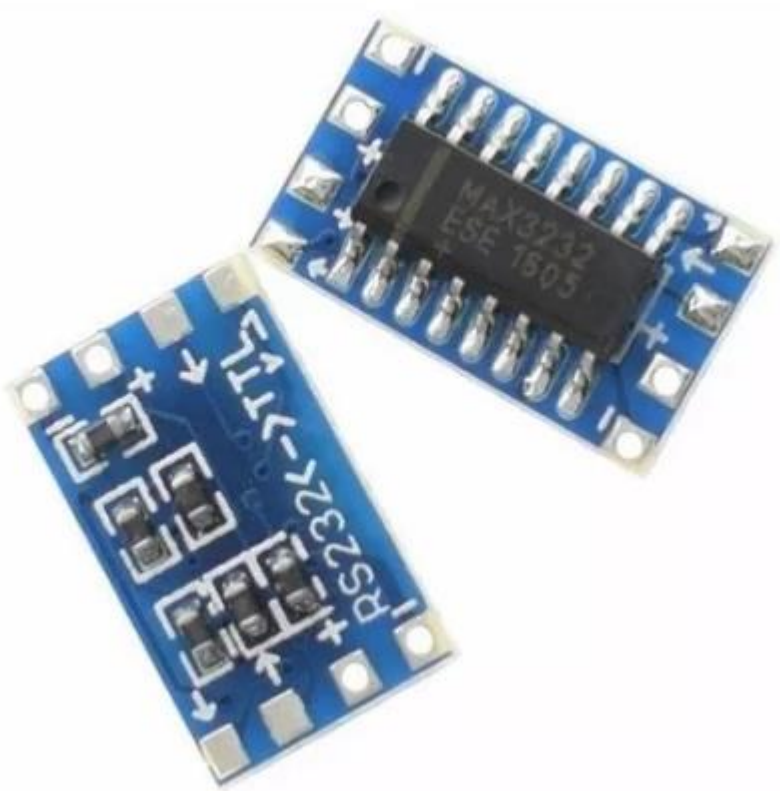
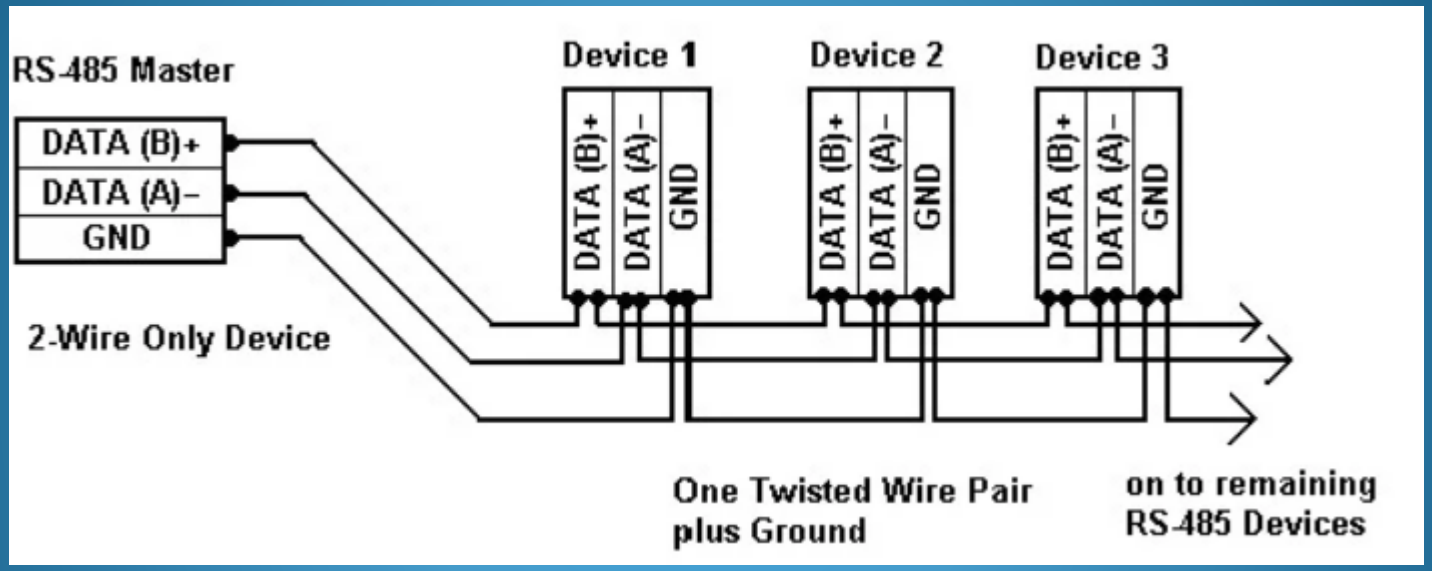
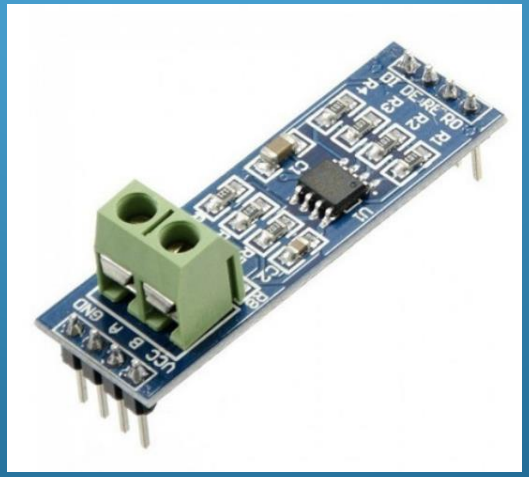
RS232



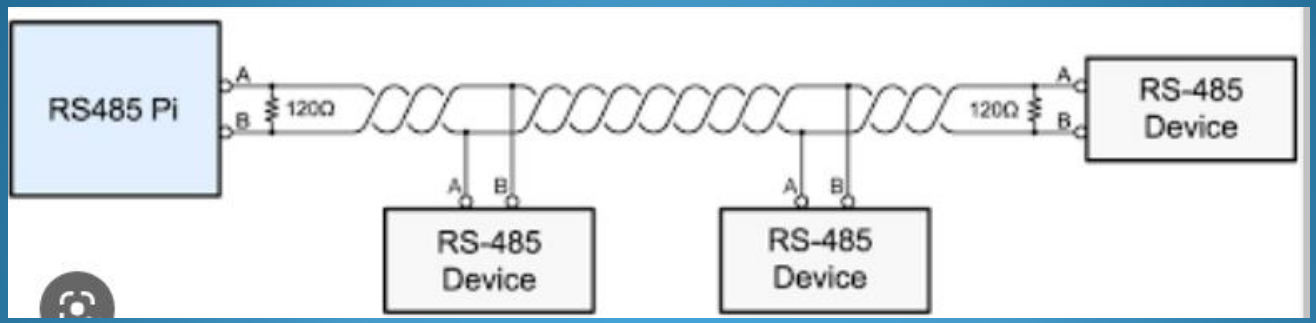
Interfaces serie
USB – RS485

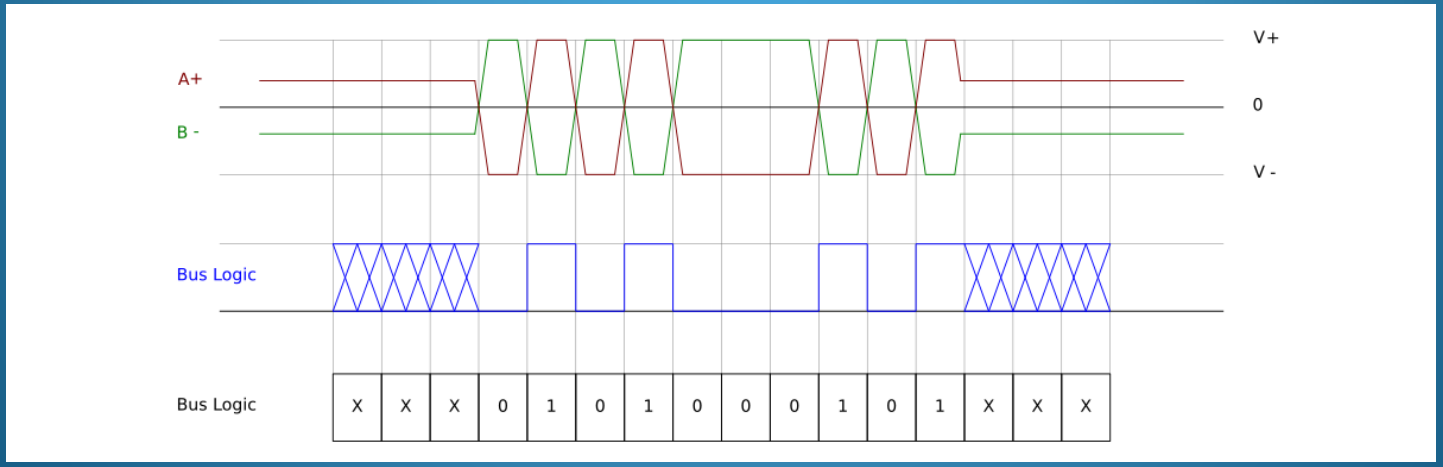
Interfaces serie
RS485



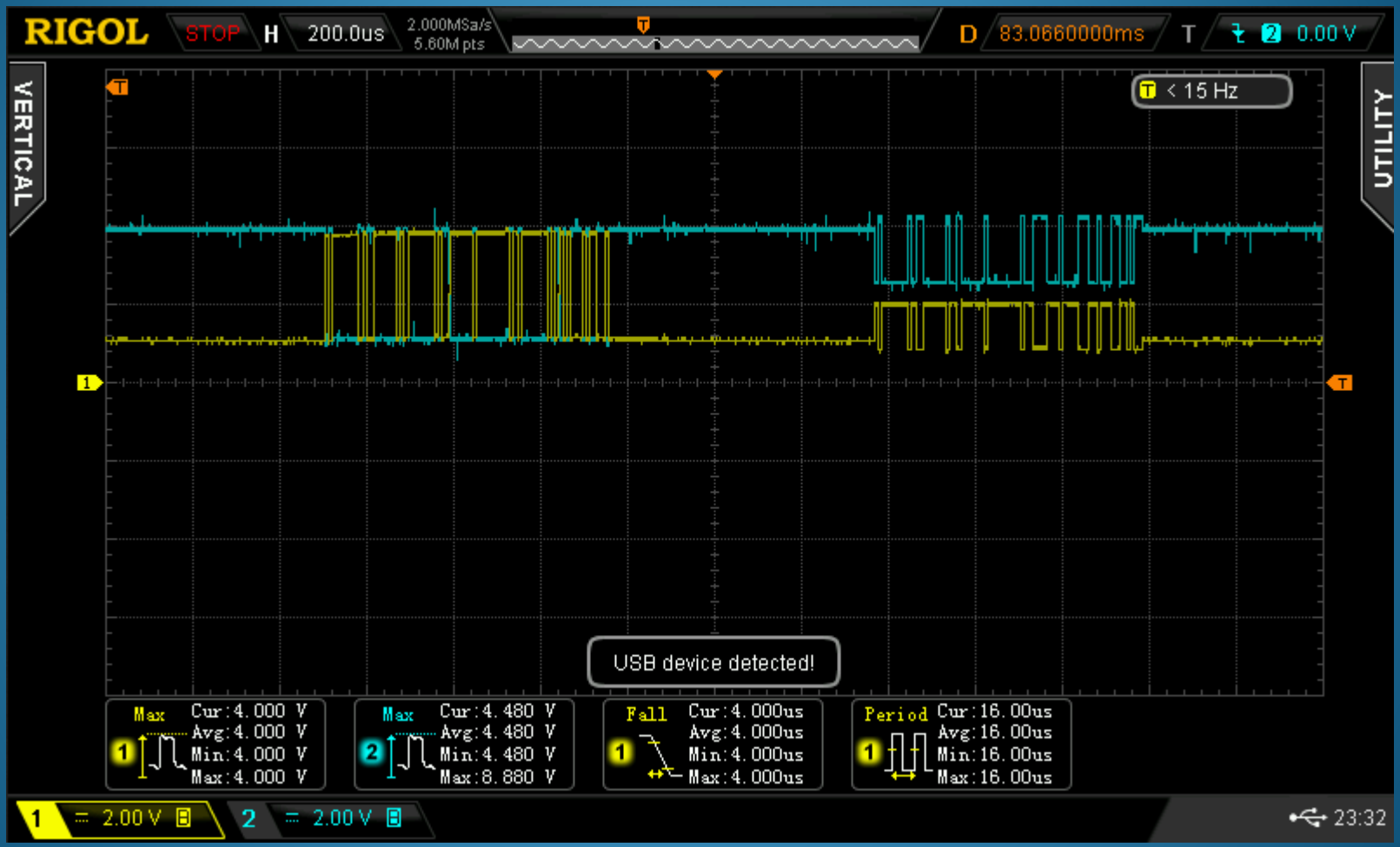


Interfaces serie
RS485





Interfaces serie RS485



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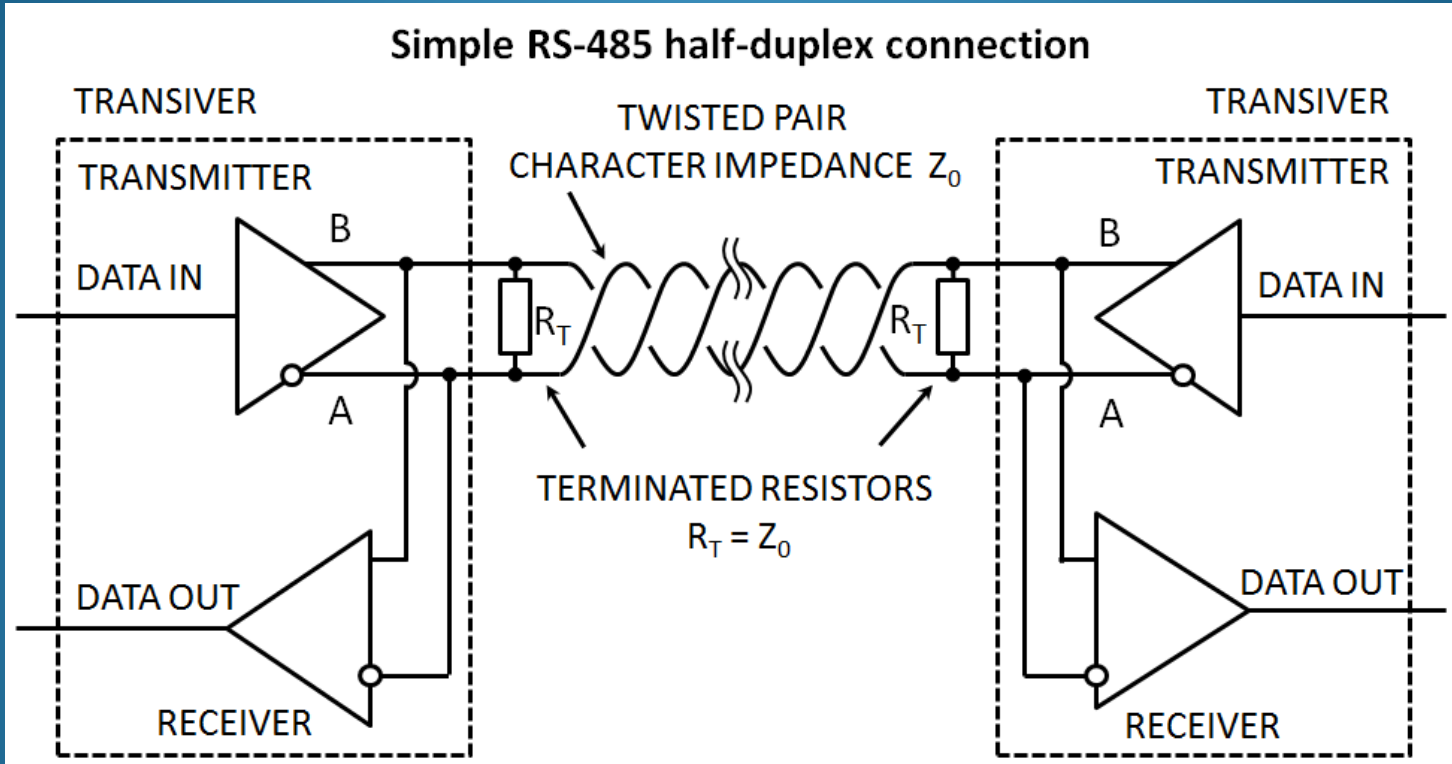
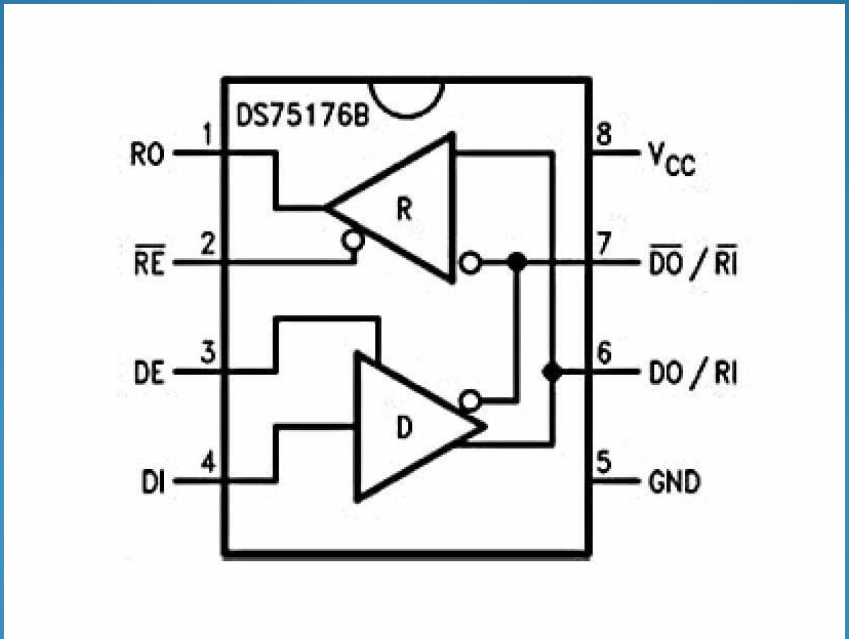
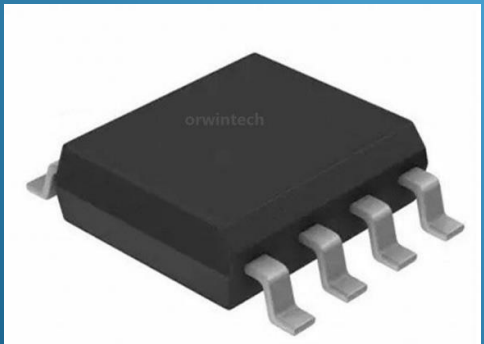


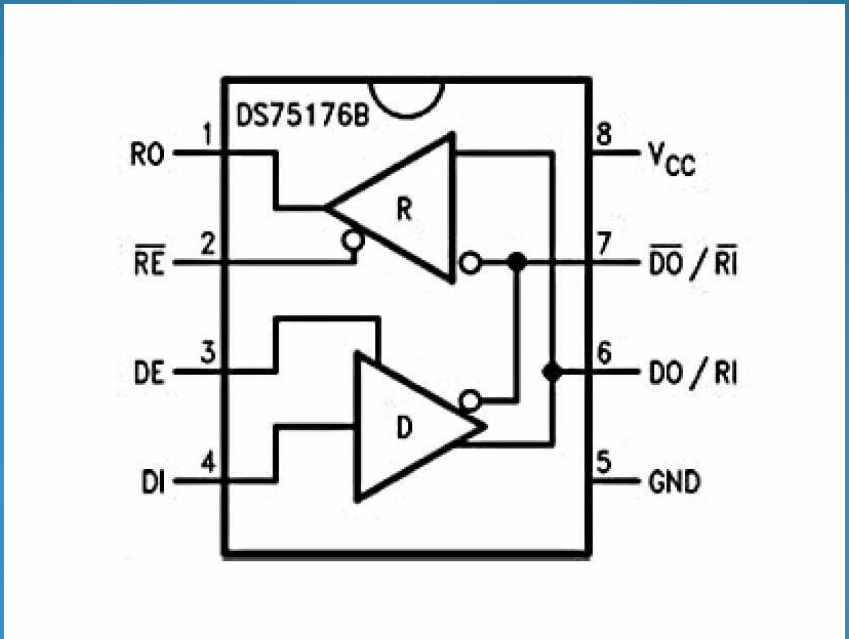
DATA IN	A	B	DATA OUT
0	1	0	0
1	0	1	1

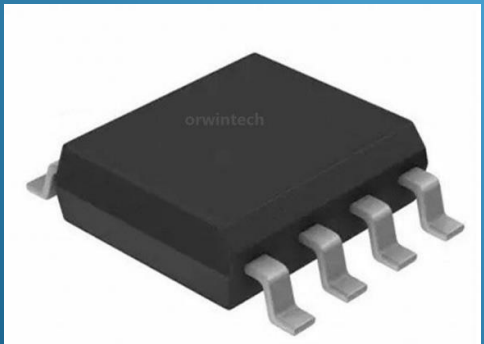
Interfaces serie RS485



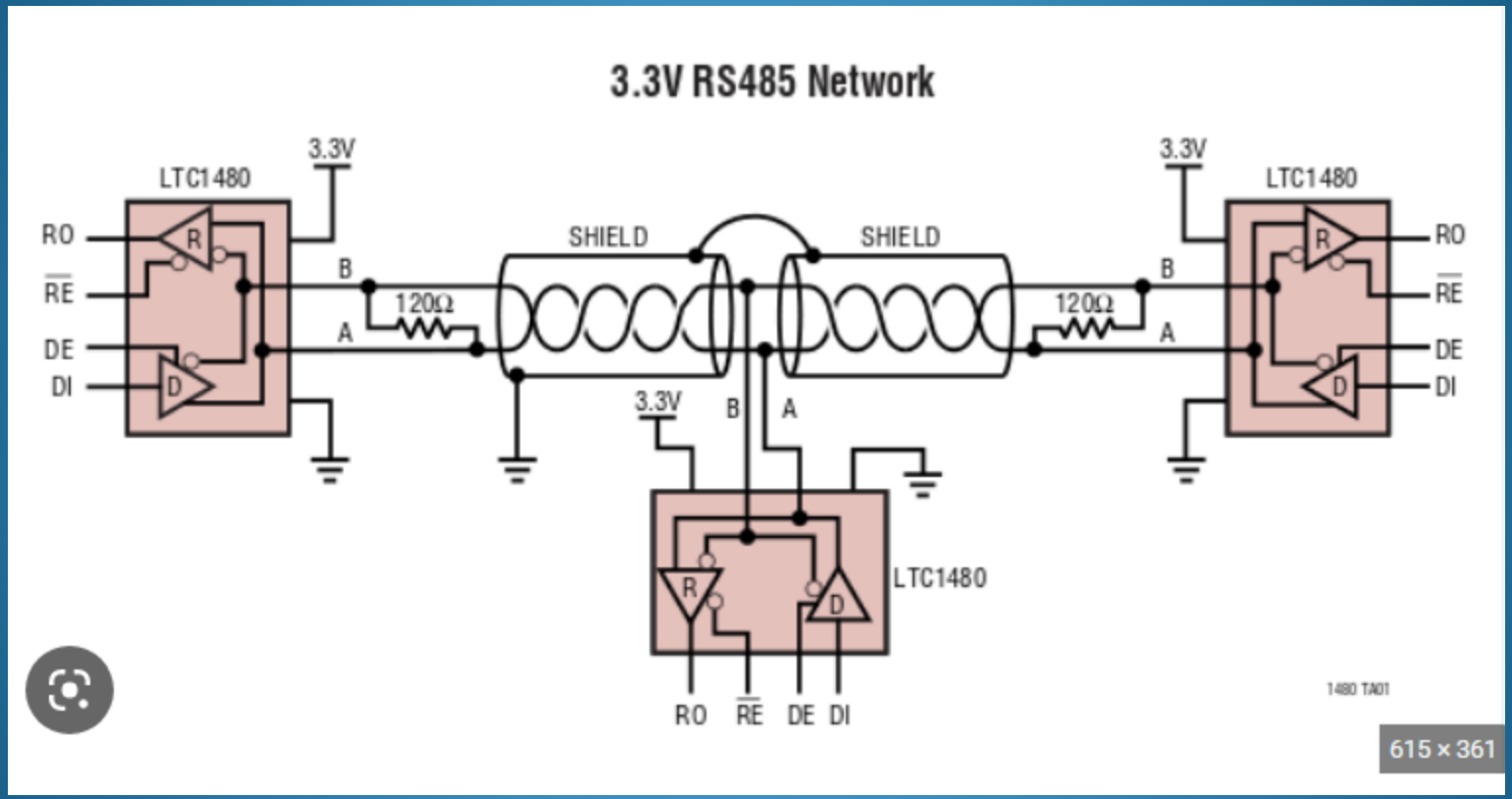


Interfaces serie RS485





Interfaces serie RS485



Interfaces serie RS485

D OR P PACKAGE
(TOP VIEW)

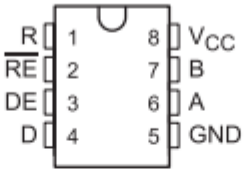
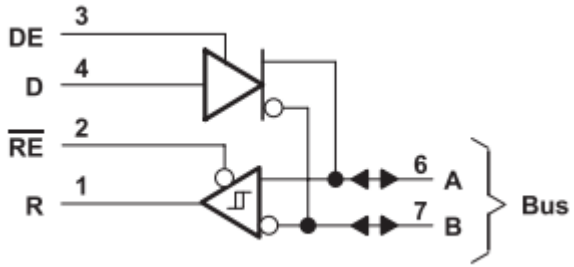


Table 5-1. Pin Functions

PIN		TYPE	DESCRIPTION
NAME	NO.		
R	1	O	Logic Data Output from RS-485 Receiver
$\overline{RE}$	2	I	Receive Enable (active low)
DE	3	I	Driver Enable (active high)
D	4	I	Logic Data Input to RS-485 Driver
GND	5	—	Device Ground Pin
A	6	I/O	RS-422 or RS-485 Data Line
B	7	I/O	RS-422 or RS-485 Data Line
V_{CC}	8	—	Power Input. Connect to 5-V Power Source.



Interfaces serie RS485

6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)(1)

		MIN	MAX	UNIT
V_{CC}	Supply Voltage(2)		7	V
	Voltage range at any bus terminal	–10	15	V
V_I	Enable input voltage		5.5	V
	Continuous Total power Dissipation	See Dissipation Rating Table		
T_A	Operating free-air temperature range	0	70	°C
T_{stg}	Storage temperature range	65	150	°C

6.2 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

			MIN	TYP	MAX	UNIT
V_{CC}	Supply Voltage		4.75	5	5.25	V
V_I or V_{IC}	Voltage at any buss terminal (separately or common mode)		–7		12	V
V_{IH}	High-level input voltage	D, DE, and $\overline{RE}$	2			V
V_{IL}	Low-level input voltage	D, DE, and $\overline{RE}$			0.8	V
V_{ID}	Differential input voltage(1)				±12	V
I_{OH}	High-level output current	Driver			–60	mA
		Receiver			–400	µA
I_{OL}	Low-level output current	Driver			60	mA
		Receiver			8	
T_A	Operating free-air temperature		0		70	°C

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6.5 Electrical Characteristics – Driver

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP(1)	MAX	UNIT
V_{IK}	Input clamp voltage	I_I = –18 mA				–1.5	V
V_{OH}	High-level output voltage	V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OH} = –33 mA			3.7		V
V_{OL}	Low-level output voltage	V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OH} = 33 mA			1.1		V
$\lvert V_{OD1}\rvert$	Differential output voltage	I_O = 0				$2V_{OD2}$	V
$\lvert V_{OD2}\rvert$	Differential output voltage	RL = 100 Ω, see Figure 7-1		2	2.7		V
		RL = 54 Ω, see Figure 7-1		1.5	2.4		
$\Delta\lvert V_{OD}\rvert$	Change in magnitude of differential output voltage(2)					±0.2	V
V_{OC}	Common-mode output voltage(3)	RL = 54 Ω or 100 Ω, see Figure 7-1				3	V
$\Delta\lvert V_{OC}\rvert$	Change in magnitude of common-mode output voltage(2)					±0.2	V
I_O	Output current	Output disabled(4)	V_O = 12 V			1	mA
			V_O = –7 V			–0.8	
I_{IH}	High-level input current	V_I = 2.4 V				20	µA
I_{IL}	Low-level input current	V_I = 0.4 V				–400	µA
I_{OS}	Short-circuit output current	V_O = –7 V				–250	mA
		V_O = V_{CC}				250	
		V_O = 12 V				500	
I_{CC}	Supply current (total package)	No load	Outputs enabled		35	50	mA
			Outputs disabled		26	40	

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6.6 Electrical Characteristics – Receiver

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP(1)	MAX	UNIT
V_{IT+}	Positive-going input threshold voltage	V_O = 2.7 V, I_O = –0.4 mA				0.2	V
V_{IT-}	Negative-going input threshold voltage	V_O = 0.5 V, I_O = 8 mA		–0.2			V
V_{hys}	Input hysteresis voltage ($V_{IT+} – V_{IT-}$)				50		mV
V_{IK}	Enable clamp voltage	I_I = –18 mA				–1.5	V
V_{OH}	High-level output voltage	V_{ID} = 200 mV, I_{OH} = –400 µA See Figure 7-2		2.7			V
V_{OL}	Low-level output voltage	V_{ID} = 200 mV, I_{OH} = 8 mA See Figure 7-2				0.45	V
I_{OZ}	High-impedance-state output current	V_O = 0.4 V to 2.4 V				±20	µA
I_I	Line input current	Other input = 0 V(2)	V_I = 12 V			1	mA
			V_I = –7 V			–0.8	
I_{IH}	High-level enable input current	V_{IH} = 2.7 V				20	µA
I_{IL}	Low-level enable input current	V_{IL} = 0.4 V				–100	µA
r_i	Input resistance			12			kΩ
I_{OS}	Short-circuit output current			–15		–85	mA

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6.6 Electrical Characteristics – Receiver (continued)

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP(1)	MAX	UNIT
I_{CC}	Supply current (total package)	No load	Outputs enabled		35	50	mA
			Outputs disabled		26	40	

(1) All typical values are at V_{CC} = 5 V, TA = 25°C.
(2) This applies for both power on and power off. Refer to ANSI Standard EIA/TIA-422-B for exact conditions.

6.7 Switching Characteristics – Driver

V_{CC} = 5 V, T_A = 25°C

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{d(OD)}$	Differential-output delay time	R_L = 60 Ω, See Figure 7-3		40	60	ns
$t_{t(OD)}$	Differential-output transition time			65	95	ns
t_{PZH}	Output enable time to high level	R_L = 110 Ω, See Figure 7-4		55	90	ns
t_{PZL}	Output enable time to low level	R_L = 110 Ω, See Figure 7-5		30	50	ns
t_{PHZ}	Output disable time form high level	R_L = 110 Ω, See Figure 7-4		85	130	ns
t_{PLZ}	Output disable time from low level	R_L = 110 Ω, See Figure 7-5		20	40	ns

6.8 Switching Characteristics – Receiver

V_{CC} = 5 V, C_L = 15 pF, T_A = 25°C

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	Propagation delay time, low-to-high-level output	V_{ID} = –1.5 V to 1.5 V, See Figure 7-6		21	35	ns
t_{PHL}	Propagation delay time, high-to-low-level output			23	35	ns
t_{PZH}	Output enable time to high level	See Figure 7-7		10	30	ns
t_{PZL}	Output enable time to low level			12	30	ns
t_{PHZ}	Output disable time from high level	See Figure 7-7		20	35	ns
t_{PLZ}	Output disable time from low level			17	25	ns