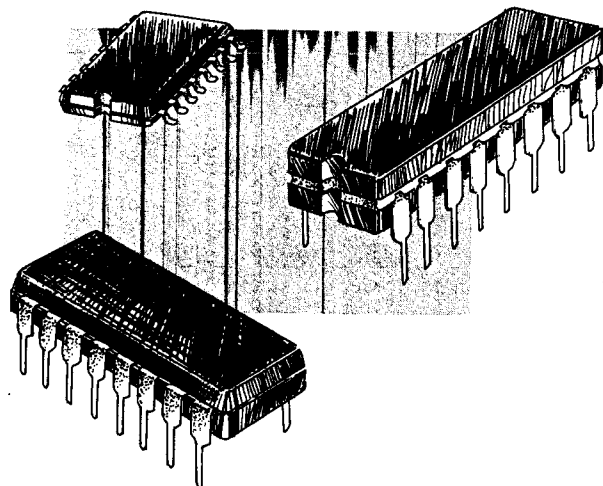


TSC232*

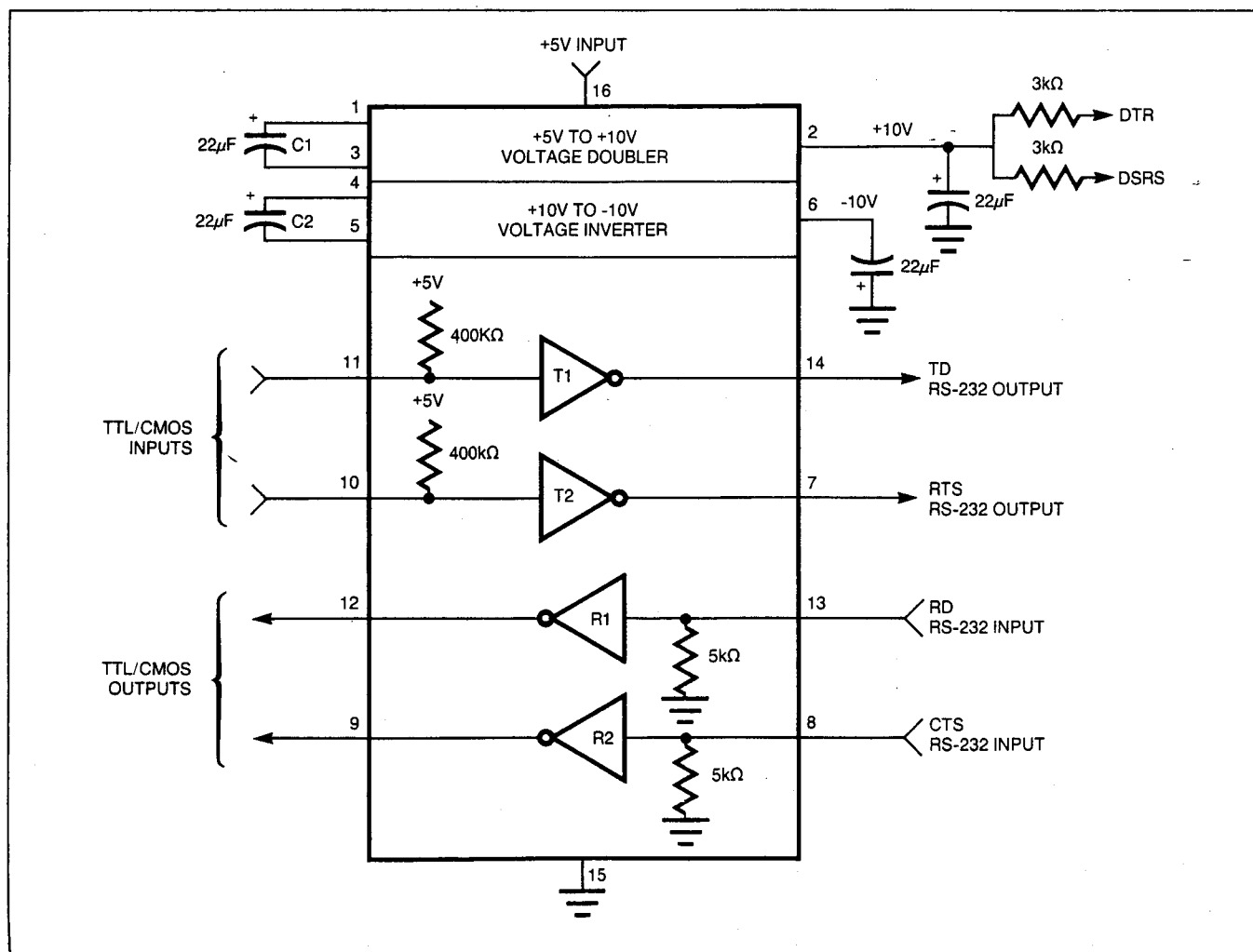
DUAL RS-232 TRANSMITTER/RECEIVER & POWER SUPPLY



FEATURES

- Meets all RS-232C Specifications
- Operates from Single 5V Power Supply
- 2 Drivers and 2 Receivers
- Onboard Voltage Quadrupler
- $\pm 30V$ Input Levels
- $\pm 9V$ Output Swing with +5V Supply
- Low Power CMOS: 5mA

FUNCTIONAL DIAGRAM



TSC232

GENERAL DESCRIPTION

The TSC232 from Teledyne Semiconductor is a dual RS-232 transmitter/receiver that complies with EIA RS-232C guidelines and is ideal for all RS-232C communication links. This device has a 5V power supply and two charge pump voltage converters that produce +10V/-10V power supplies.

The TSC232 has four level translators. Two are RS-232 transmitters that convert TTL/CMOS input levels to 9V RS-232 outputs. The other two translators are RS-232 receivers that convert RS-232 inputs to 5V TTL/CMOS output levels. The receivers have a nominal threshold of 1.3V, a typical hysteresis of 0.5V, and can operate with up to $\pm 30V$ inputs.

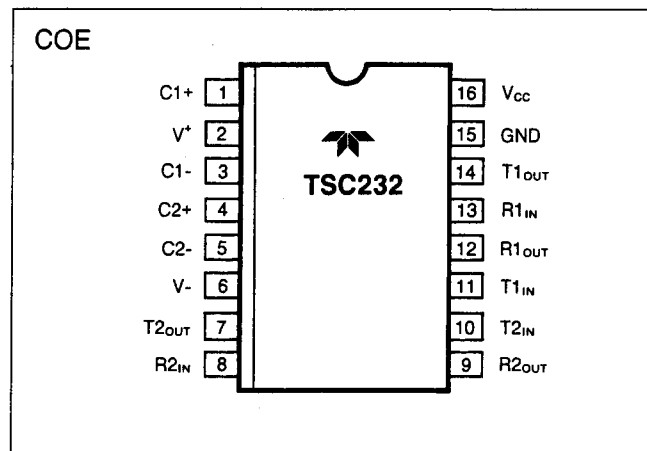
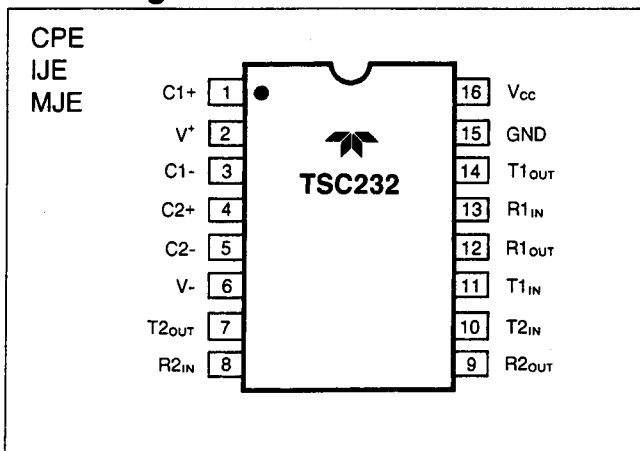
Applications

The TSC232 is ideal for all RS-232C communication links: Battery-Powered Systems, Computers, Instruments, Modems, and Peripherals. It can run without the 12V power supplies other RS-232 devices require. The TSC232 power supply can serve as a quadrupler for input voltage up to 5.5V.

Ordering Information

Part No.	Package	Temperature Range
TSC232 CPE	16 Pin Plastic	0°C to 70°C
TSC232 CJE	16 Pin Cerdip	0°C to 70°C
TSC232 IJE	16 Pin Cerdip	-25°C to 85°C
TSC232 EPE	16 Pin Plastic	-40°C to 85°C
TSC232 IPE	16 Pin Plastic	-25°C to 85°C
TSC232 EJE	16 Pin Cerdip	-40°C to 85°C
TSC232 COE	16 Pin "SO"	0°C to 70°C
TSC232 EOE	16 Pin "SO"	-40°C to 85°C
TSC232 MJE	16 Pin Cerdip	-55°C to 125°C
TSC232 CY	DIE	25°C

Pin Configurations



Absolute Maximum Ratings

V_{CC}	6V
V^+	12V
V^-	12V
Input Voltages	
$T1_{IN}, T2_{IN}$	-0.3 to ($V_{CC} + 0.3V$)
$R1_{IN}, R2_{IN}$	$\pm 30V$
Output Voltages	
$T1_{OUT}, T2_{OUT}$	($V^+ + 0.3V$) to ($V^- - 0.3V$)
$R1_{OUT}, R2_{OUT}$	-0.3V to ($V_{CC} + 0.3V$)

Short Circuit Duration	
V^+	30 seconds
V^-	30 seconds
$T1_{OUT}, T2_{OUT}$	continuous
Power Dissipation	
CERDIP	675mW
derate 9.5mW/°C above 70°C	
Plastic DIP	375mW
derate 7mW/°C above 70°C	
Small Outline (SO)	375mW
derate 7mW/°C above 70°C	

Electrical Characteristics: ($V_{CC} = 5V \pm 10\%$, T_A = operating temperature range, test circuit unless otherwise noted).

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage Swing	$T1_{OUT}, T2_{OUT}$ loaded with 3k Ω to ground.	$\pm 5V$	± 9	± 10	V
Power Supply Current			5	10	mA
Input Logic Threshold Low	$T1_{IN}, T2_{IN}$			0.8	V
Input Logic Threshold High	$T1_{IN}, T2_{IN}$	2.0			V
Logic Pullup Current	$T1_{IN}, T2_{IN} = 0V$		15	200	μA
RS-232 Input Voltage Operating Range		-30		+30	V
RS-232 Input Threshold Low	$V_{CC} = 5V$	0.8	1.2		V
RS-232 Input Threshold High	$V_{CC} = 5V$		1.7	2.4	V
RS-232 Input Hysteresis		0.2	0.5	1.0	V
TTL/CMOS Output Voltage Low	$I_{OUT} = 3.2mA$			0.4	V
TTL/CMOS Output Voltage High	$I_{OUT} = -1.0mA$	3.5			V
Propagation Delay	RS-232 to TTL or TTL to RS-232		0.5		μs
Instantaneous Slew Rate	$C_L = 10pF$, $R_L = 3-7k\Omega$, $T_A = 25^\circ C$ (Note 1)			30	V/ μs
Transition Region Slew Rate	$R_L = 3k\Omega$, $C_L = 2500pF$ Measured from 3V to -3V or -3V to +3V		3		V/ μs
Output Resistance	$V^+ = V^- = 0V$, $V_{OUT} = \pm 2V$	300			Ω
RS-232 Output Short Circuit Current			± 10		mA

Note 1: Sample Tested.

TSC232

Detailed Description

The TSC232 contains a +5V to $\pm 10V$ dual charge pump voltage converter, a dual transmitter, and a dual receiver.

+5V to $\pm 10V$ Dual Charge Pump Voltage Converter

The TSC232 power supply consists of two charge pumps. One uses external capacitor C1 to double the +5V input to +10V, with output impedance of about 200 ohms. The other uses C2 to invert +10V to -10V, with overall output impedance of 450 Ω (including effects of +5 to +10 voltage doubler impedance).

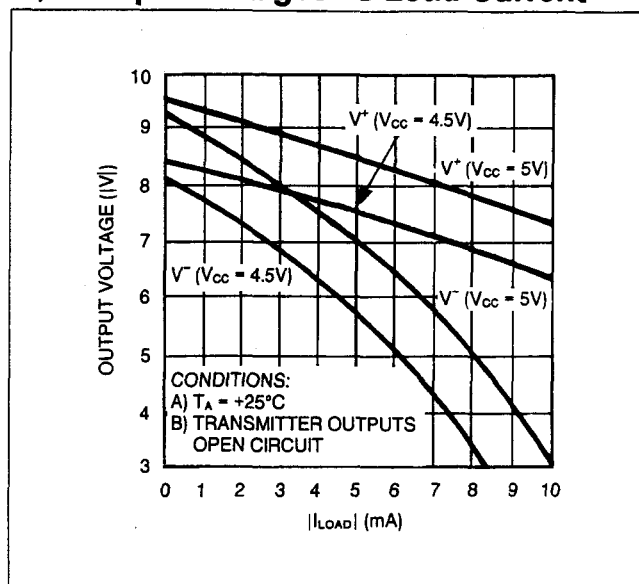
The clock in the doubler circuit will start at ≈ 4.2 volts in the typical part, but external loads may make this point rise to as high as 4.5 volts with 2K Ω of load on each of the two output supplies.

Because of this, use of the doubler and inverter to run external circuits should be limited. The maximum current should be no more than 2.5mA from the +10V and -10V in order to guarantee start-up of the doubler clock.

The test circuit employs 22 μF capacitors for C1 to C4, but the value is not critical. These capacitors usually are low-cost aluminum electrolytic capacitors, or polyester if size is critical.

Increasing C1 and C2 to 47 μF lowers the output impedance of +5V to +10V doubler and +10V to -10V inverter by the change in the ESR of the capacitors.

V^+ , V^- Output Voltages vs Load Current



Increasing C3 and C4 lowers ripple on the $\pm 10V$ power supplies and lowers 16kHz ripple on the RS-232 outputs. Where size is critical, value of C1 to C4 can be lowered to 1 μF .

The use of a low ESR value capacitor such as a Wima MKS-2 polyester film will help lower the output ripple and keep the output impedance of the +10V and -10V low.

Dual Transmitter

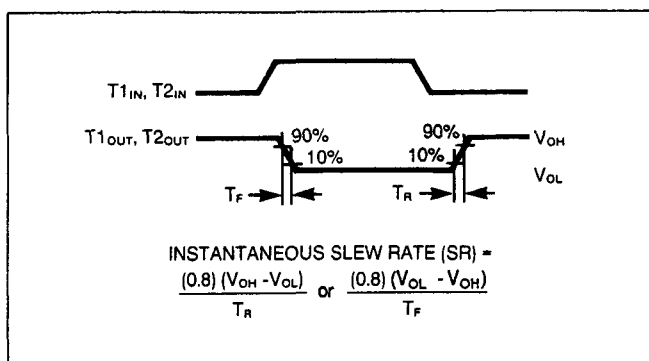
TSC232 transmitters are CMOS inverters driven by $\pm 10V$ internally generated supplies. The input is TTL/CMOS compatible, with a logic threshold of about 26% of V_{CC} (1.3V for 5V V_{CC}). The input of an unused transmitter can be left unconnected. An internal 400 K Ω pullup resistor connected between the transmitter input and V_{CC} pulls the input high and forces the unused transmitter output low.

Open circuit output voltage swing is from $(V+ - 0.6V)$ to $V-$. This conforms to RS-232 specs of 5V minimum output swing under the worst conditions when both transmitters drive the 3K Ω minimum load impedance, V_{CC} input at 4.5V, and maximum ambient temperature. Typical voltage swing with 5K Ω loads and V_{CC} of 5V is $\pm 9V$.

EIA RS-232C specs limit the slew rate at output to less than 30V/ μs . The powered-down output impedance is a minimum of 300 ohms with $\pm 2V$ applied to outputs with $V_{CC} = 0V$.

The outputs are short circuit protected and can be short circuited to ground indefinitely.

Slew Rate Definition

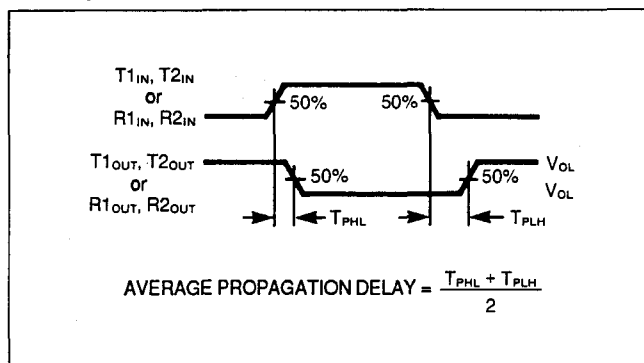


Dual Receiver

TSC232 receivers meet RS-232C input specs. Input impedance is between 3 and 7K Ω . Switching thresholds are within the $\pm 3V$ limits, and the receivers withstand up to $\pm 30V$ inputs. RS-232 and TTL/CMOS input compatible, the receivers have 0.8V V_{IL} and 2.4V V_{IH} with 0.5V hysteresis to reject noise.

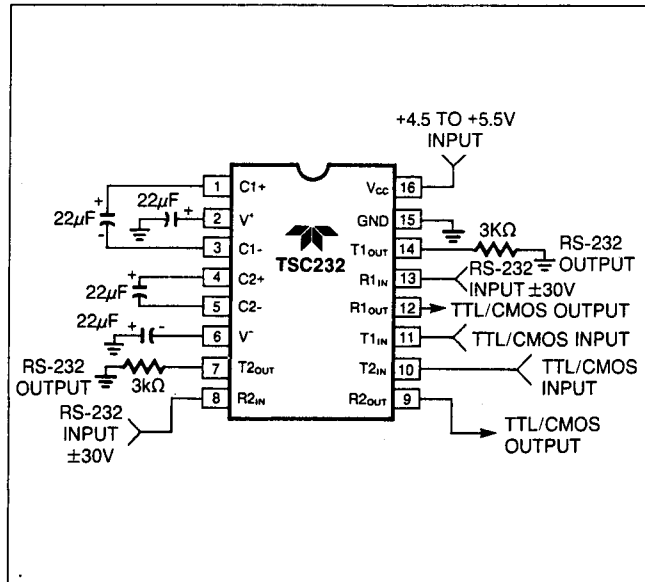
The TTL/CMOS compatible receiver output is low when RS-232 input is greater than 2.4V. It is high when input is floating or between +0.8V and -30V.

Propagation Delay Definition

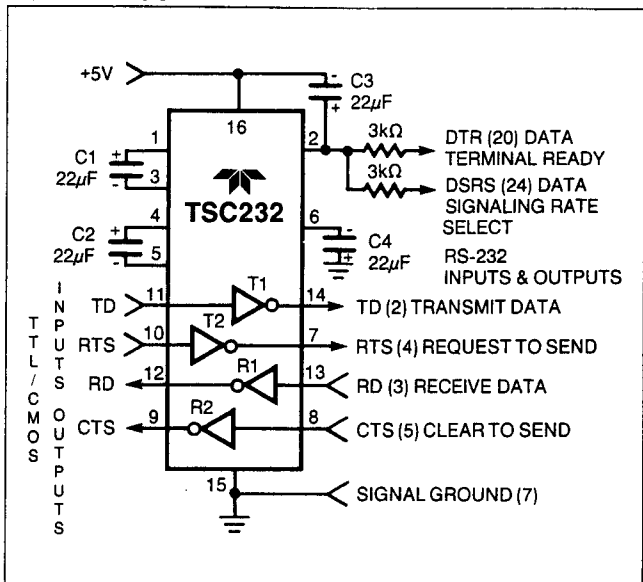


TSC232

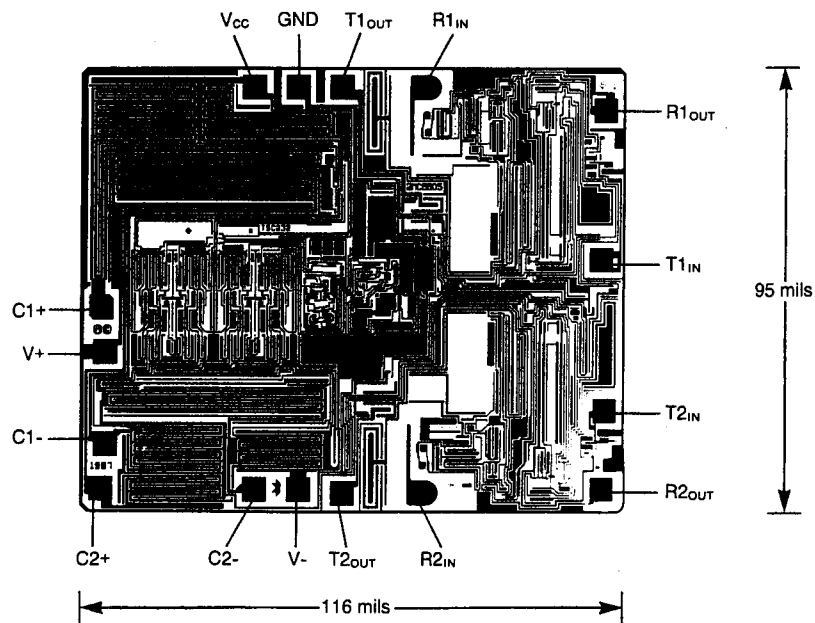
Test Circuit



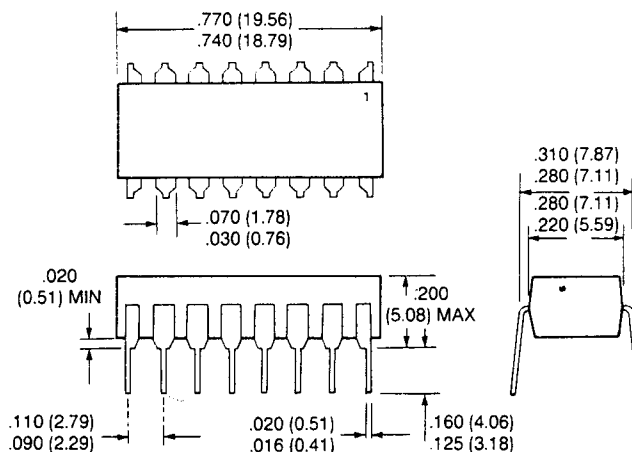
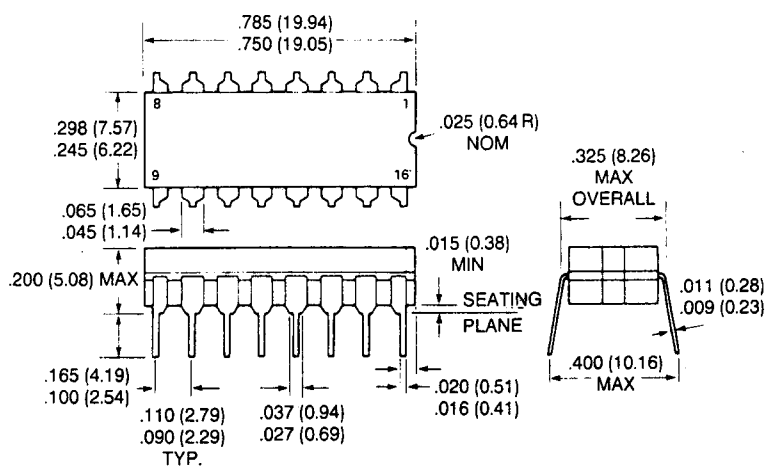
Typical Application



Bonding Diagram



Package Information

**16-Pin Plastic Dip
(Package #8)** $\theta_{JA} = 140^{\circ}\text{C/W}$ $\theta_{JC} = 70^{\circ}\text{C/W}$ **16-Pin CerDIP
(Package #9)** $\theta_{JA} = 110^{\circ}\text{C/W}$ $\theta_{JC} = 60^{\circ}\text{C/W}$ **16-Pin "SO" Wide
(Package #30)** $\theta_{JA} = 110^{\circ}\text{C/W}$ $\theta_{JC} = 60^{\circ}\text{C/W}$ 