DALLAS SEMICONDUCTOR

DS233A
Dual RS–232 Transmitter/Receiver

FEATURES

- Compatible with MAX233A
- High data rate – 250 kbits/sec under load
- No need for external capacitors
  - Charge pump capacitors built in
- 20–pin DIP and SOIC package
- Operate from single +5V power
- Driver outputs maintain high impedance with power off
- Meets all EIA–232E and V.28 specifications
- Optional industrial temperature range available (–40°C to +85°C)

ORDERING INFORMATION

DS233A	20–pin DIP
DS233A–N	20–pin DIP (Industrial)
DS233AS	20–pin SOIC
DS233AS–N	20–pin SOIC (Industrial)

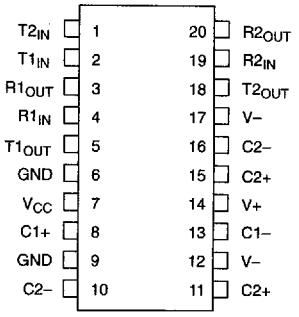
DESCRIPTION

The DS233A is a dual RS–232 driver/receiver pair that generates RS–232 voltage levels from a single +5 volt power supply. Additional ±12 volt supplies are not needed since the DS233A uses onboard charge pumps to convert the +5 volt supply to ±10 volts. The DS233A is fully compliant with EIA RS–232E and V.28/V.24 standards. The DS233A contains two drivers and two receivers. Driver slew rates and data rates are guaranteed up to 250 kbits/sec. The DS233A requires no external capacitors for the charge pump, because they are built–in to the device.

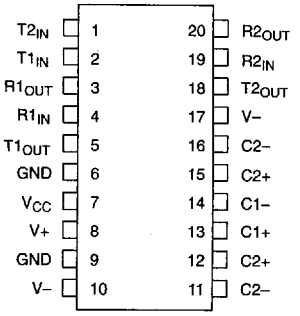
OPERATION

The diagram in Figure 1 shows the main elements of the DS233A. The following paragraphs describe the function of each pin.

PIN ASSIGNMENT



20–PIN DIP



20–PIN SOIC

PIN DESCRIPTION

V_{CC}	–	+5 Volt Supply
GND	–	Ground
V+	–	Positive Supply Output
V–	–	Negative Supply Output
$T1_{IN}$, $T2_{IN}$	–	RS–232 Driver Inputs
$T1_{OUT}$, $T2_{OUT}$	–	RS–232 Driver Outputs
$R1_{IN}$, $R2_{IN}$	–	Receiver Inputs
$R1_{OUT}$, $R2_{OUT}$	–	Receiver Outputs
C1+, C1–, C2+, C2–	–	Internal Capacitor Connections

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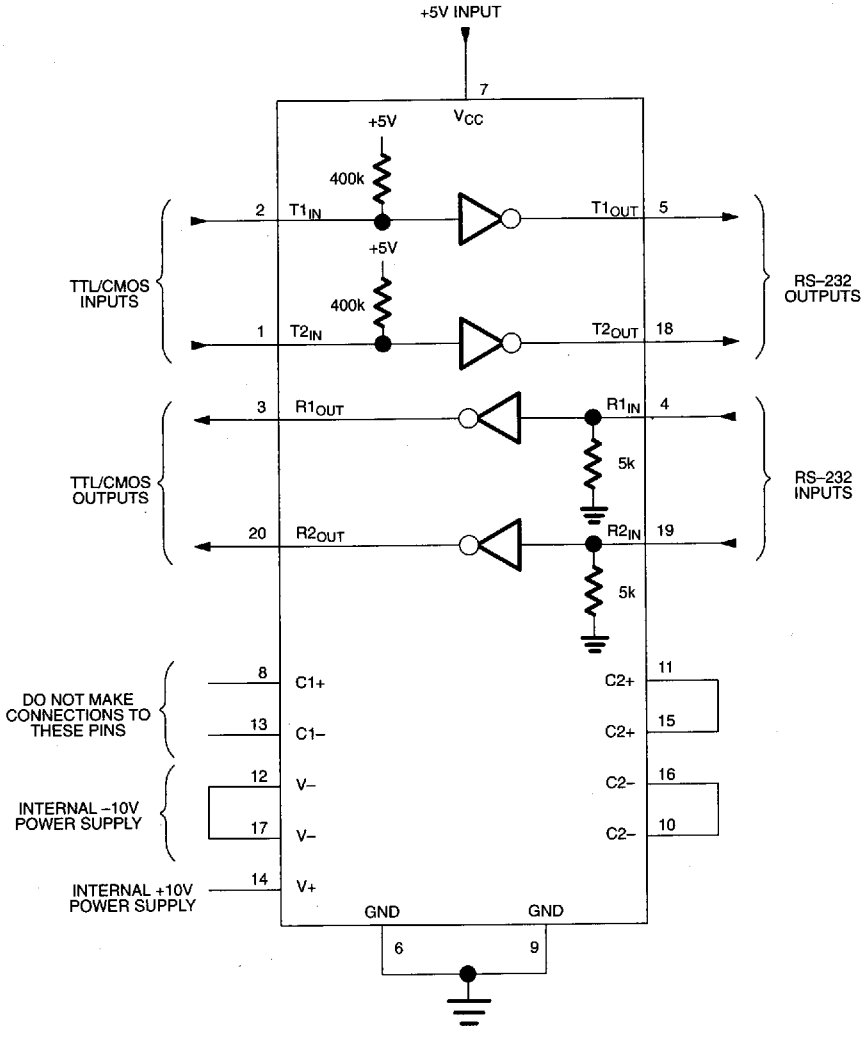
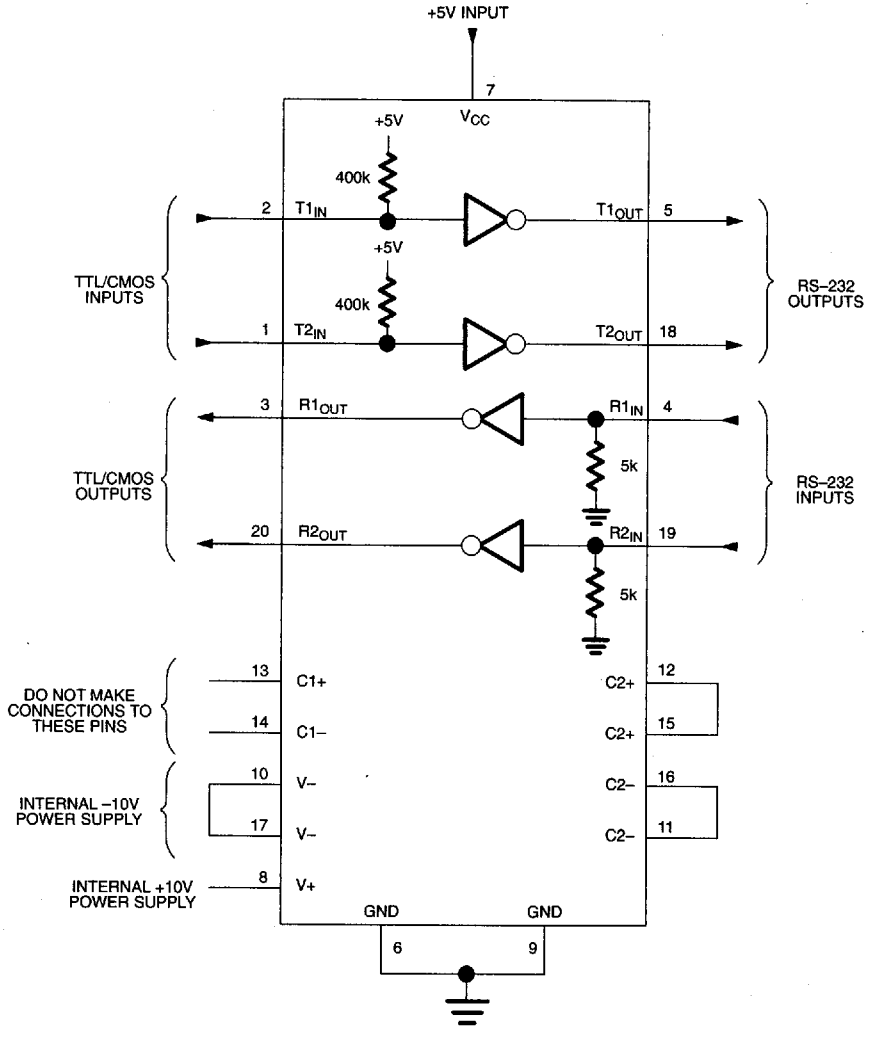
FUNCTIONAL DIAGRAM OF DS233A (20–PIN DIP) Figure 1



FUNCTIONAL DIAGRAM OF DS233A (20–PIN SOIC) Figure 2



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PIN DESCRIPTIONS

V_{CC}, GND: DC power is provided to the device on these pins. V_{CC} is the +5 volt input.

V+: Positive supply output (RS–232) generated by charge pump circuit.

V–: Negative supply output (RS–232) generated by charge pump circuit. The two V– pins must be connected together.

$T1_{IN}$, $T2_{IN}$: Standard TTL/CMOS inputs for the RS–232 drivers. The inputs of unused drivers can be left unconnected since each input has a 400 kΩ pull–up resistor.

$T1_{OUT}$, $T2_{OUT}$: Driver outputs at RS–232 levels. Driver output swing meets RS–232 levels for loads up to 3 kΩ. These driver outputs provide current necessary to meet RS–232 levels for loads up to 2500 pF.

$R1_{IN}$, $R2_{IN}$: Receiver inputs. These inputs accept RS–232 level signals (±25 volts) into a protected 5 kΩ terminating resistor. Each receiver provides 0.5V hysteresis (typical) for noise immunity.

$R1_{OUT}$, $R2_{OUT}$: Receiver outputs at TTL/CMOS levels.

C1+, C1–: These two pins are connected to the internal C1 capacitor. These pins must be left floating.

C2+, C2–: These two pins are connected to the internal C2 capacitor. There are two C2+ pins which must be connected together and two C2– pins which must also be connected together.

DUAL CHARGE PUMP CONVERTERS

The DS233A has a two stage on–board charge pump circuit that is used to generate ±10 volts from a single +5 volt supply. The first stage doubles the +5V supply to +10 volts.. The second stage inverts the +10V potential to –10V. The ±10 volt supplies allow the DS233A to provide the necessary output levels for RS–232 communication. External charge pump capacitors are not necessary because the DS233A has internal capacitors.

RS–232 DRIVERS

The two RS–232 drivers are powered by the internal ±10 volt supplies generated by the on–board charge pump. The driver inputs are both TTL and CMOS compatible. Each input has an internal 400 kΩ pull–up resistor so that unused transmitter inputs can be left unconnected. The open circuit output voltage swing is from (V+ – 0.6) to V– volts. Worst case conditions for EIA–232E/V.28 of ±5 volt driving a 3 kΩ load and 2500 pF are met at maximum operating temperature and V_{CC} equal to 4.5 volts. Typical voltage swings of ±8 volts occur when loaded with a nominal 5 kΩ RS–232 receiver. As required by EIA–232E and V.28 specifications, the slew rate at the output is limited to less than 30 volts/µs. Typical slew rates are 20 volts/µs unloaded and 12 volts/µs with 3 kΩ and 2500 pF load. These slew rates allow for bit rates of over 250 kbits/s. Driver outputs maintain high impedance when power is off.

RS–232 RECEIVERS

The two receivers conform fully to the RS–232E specifications. The input impedance is typically 5 kΩ and can withstand up to ±25 volts with or without V_{CC} applied. The input switching thresholds are within the ±3 volt limit of RS–232E specification with an input threshold low of 0.8 volts and an input threshold high of 2.4 volts. The receivers have 0.5 volts of hysteresis (typical) to improve noise rejection. The TTL/CMOS compatible outputs of the receivers will be low whenever the RS–232 input is greater than 2.4 volts. The receiver output will be high when the input is floating or driven between +0.8 volts and –25 volts.

ABSOLUTE MAXIMUM RATINGS*

Absolute Maximum Ratings

V_{CC}	–0.3V to +7.0V
V+	(V_{CC}–0.3V) to +14V
V–	+0.3V to –14V

Input Voltages

T_{IN}	–0.3V to (V_{CC}+0.3V)
R_{IN}	±30V

Output Voltages

T_{OUT}	(V+ + 0.3V) to (V– – 0.3V)
R_{OUT}	–0.3V to (V_{CC} + 0.3V)
Short Circuit Duration, T_{OUT}	Continuous

* This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operation sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

The Dallas Semiconductor DS233A is built to the highest quality standards and manufactured for long term reliability. All Dallas Semiconductor devices are made using the same quality materials and manufacturing methods. Ho wever, the DS233A is not exposed to environmental stresses, such as burn–in. For specific reliability information on this product, please contact the factory in Dallas at (214) 450–0448.

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RECOMMENDED DC OPERATING CONDITIONS

(0°C to 70°C)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Operating Supply Votlage	V_{CC}	4.5		5.5	V	1

DC ELECTRICAL CHARACTERISTICS

(0°C to 70°C)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Power Supply Current (No Load)	I_{CC1}		4	10	mA	
Power Supply Current (3 kΩ Load Both Outputs)	I_{CC2}		15		mA	
RS–232 Transmitters						
Output Voltage Swing	V_{ORS}	±5	±8		V	2
Input Logic Threshold Low	V_{TTL}	0.8	1.4		V	
Input Logic Threshold High	V_{TTH}		1.4	2.0	V	
Maximum Data Rate	f_D	250	350		kbits/s	

DC ELECTRICAL CHARACTERISTICS (continued)

(0°C to 70°C)

Logic Pull–up/Input Current	I_{PU}		5	40	µA	
Transmitter Output Resistance	R_{OUT}	300	10M		Ω	3
Output Short–Circuit Current	I_{TSC}	±15	±30	±100	mA	4
RS–232 Receivers						
RS–232 Input Voltage Operating Range	V_{IR}	±25	±30		V	
RS–232 Input Threshold Low	V_{RTL}	0.8	1.3		V	
RS–232 Input Threshold High	V_{RTH}		1.8	2.4	V	
RS–232 Input Hysteresis	V_{HY}	0.2	0.5	1	V	
RS–232 Input Resistance	R_{IN}	3	5	7	kΩ	
TTL/CMOS Output Voltage Low	V_{ROL}		0.2	0.4	V	5
TTL/CMOS Output Voltage High	V_{ROH}	3.5	V_{CC}–0.2		V	6
TTL/CMOS Output Short Circuit Current (V_{OUT}=GND)	I_{RSC}	–2	–10		mA	
TTL/CMOS Output Short Circuit Current (V_{OUT}=V_{CC})	I_{RSC}	10	30		mA	

AC ELECTRICAL CHARACTERISTICS

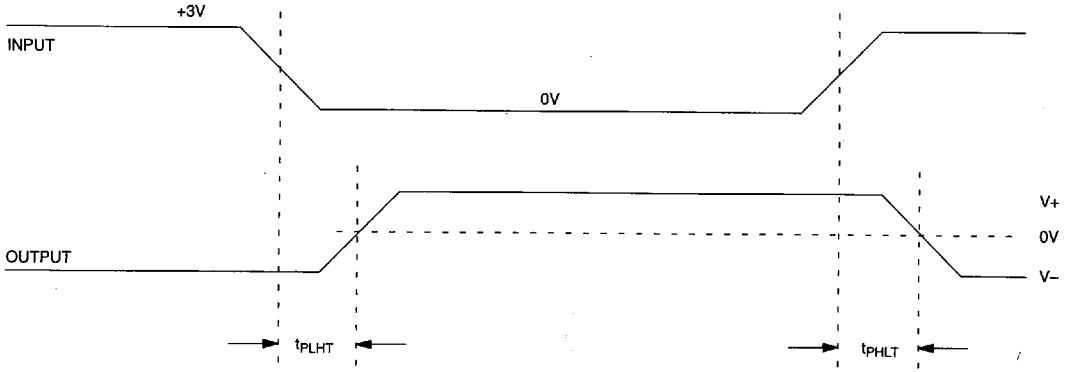
(0°C to 70°C)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Transition Slew Rate	t_{SR}	6	12	30	V/µs	7
Transmitter Propagation Delay TTL to RS–232	t_{PHLT} t_{PLHT}		1.3 1.5	3.5 3.5	µs µs	
Receiver Propagation Delay RS–232 to TTL	t_{PHLR} t_{PLHR}		0.5 0.6	1 1	µs µs	
Transmitter + to – Propagation Delay Difference	t_{PHLT} $-t_{PLHT}$		300		ns	
Receiver + to – Propagation Delay Difference	t_{PHLR} $-t_{PLHR}$		100		ns	

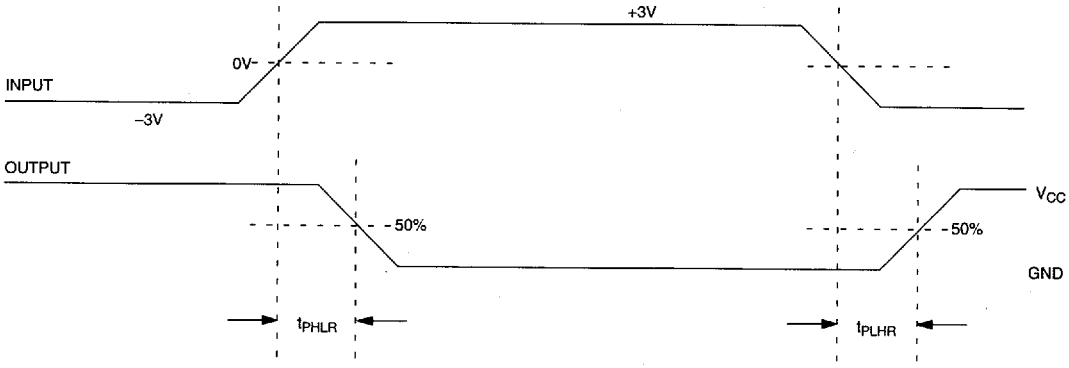
NOTES:

1. All voltages are referenced to ground.
2. All transmitter outputs loaded with 3 kΩ to ground.
3. V_{CC} = V+ = V– = 0V; V_{OUT} = ±2V .
4. V_{OUT} = 0V.
5. I_{OUT} = 3.2 mA.
6. I_{OUT} = –1.0 mA.
7. C_L = 50 pF – 2500 pF; RL = 3 kΩ – 7 kΩ; V_{CC} = 5V; TA = 25°C.

TRANSMITTER PROPAGATION DELAY TIMING Figure 3



RECEIVER PROPAGATION DELAY TIMING Figure 4



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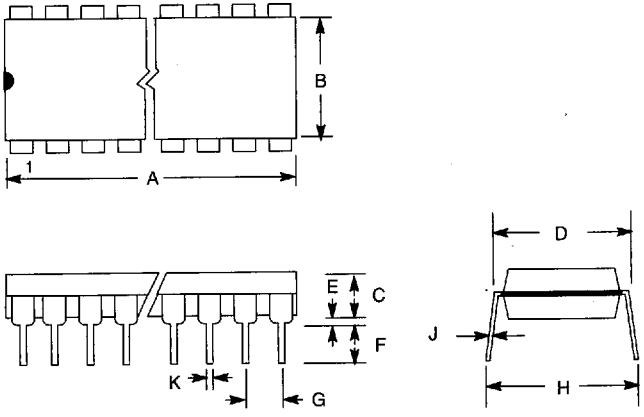
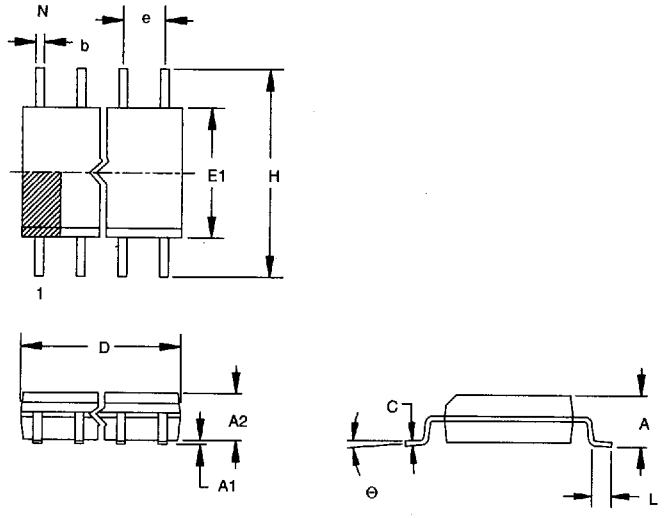
20–PIN DIP (300 MIL)



PKG	20-PIN	
DIM	MIN	MAX
A IN. MM	0.970 24.63	1.040 26.42
B IN. MM	0.240 6.09	0.270 6.86
C IN. MM	0.120 3.05	0.140 3.56
D IN. MM	0.295 7.49	0.325 8.26
E IN. MM	0.015 0.38	0.040 1.02
F IN. MM	0.120 3.04	0.140 3.56
G IN. MM	0.090 2.23	0.110 2.79
H IN MM	0.310 7.87	0.390 9.91
J IN MM	0.008 0.20	0.012 0.30
K IN. MM	0.015 0.38	0.021 0.53

20–PIN SOIC (300 MIL)



PKG	20-PIN	
DIM	MIN	MAX
A IN. MM	0.094 2.39	0.105 2.67
A1 IN. MM	0.004 0.102	0.012 0.30
A2 IN. MM	0.089 2.26	0.095 2.41
b IN. MM	0.013 0.33	0.020 0.51
C IN. MM	0.009 0.229	0.013 0.33
D IN. MM	0.498 12.65	0.511 12.99
e IN. MM	0.050 BSC 1.27 BSC	
E1 IN MM	0.290 7.37	0.300 7.62
H IN MM	0.398 10.11	0.416 10.57
L IN. MM	0.016 0.40	0.040 1.02
Θ	0°	8°

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