



MAX3-232

3 To 5.5V Powered, Dual RS-232 Drivers/Receivers

DESCRIPTION

The MAX3-232 is a dual RS-232 driver/receiver interface circuit that meets all EIA RS-232C and V.28 specifications. It requires a single 3V to 5.5V power supply, and features two onboard charge pump voltage converters. The drivers feature true TTL/CMOS input compatibility, slew-rate-limited output, and 300Ω power-off source impedance. The receivers also have hysteresis to improve noise rejection and ±2-kV ESD protection.

FEATURES

- Meet or Exceed TIA/EIA-232-F and ITU Recommendation V.28
- Operate With Single 3V to 5.5V Power Supply
- Operate Up to 120 kbit/s
- Two Drivers and Two Receivers
- ±30-V Input Levels
- Low Input Current . . . 1.0 μA Typical
- Designed to be Interchangeable With Maxim and TI MAX3232, ICL3232, SP3232
- ESD Protection Exceeds JESD 22 - C 2000-V Human-Body Model (A114-A)

APPLICATIONS

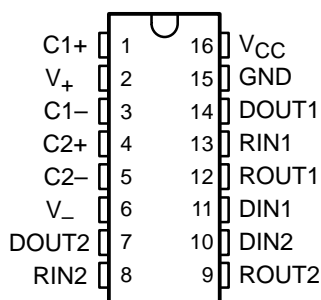
- Any System Requiring RS-232 Communications Port
- Battery Powered Systems, PDAs, Notebooks, Laptops, Palmtop PCs, and Hand-Held Equipment
- Modems, Printers and other Peripherals
- Digital Cameras
- Cellular/Mobile Phones

ORDERING INFORMATION

PART NO.	Temp. Range (°C)	Package
MAX3-232CPE	0 to 70	16 Pin DIP
MAX3-232CSE	0 to 70	16 Pin Narrow SO
MAX3-232EPE	-40 to 85	16 Pin DIP
MAX3-232ESE	-40 to 85	16 Pin Narrow SO

PINOUT

MAX3-232 (DIP, SOIC)
(TOP VIEW)



PIN DESCRIPTIONS

Pin No.	PIN NAME	DESCRIPTION
01	C1+	External capacitor "+" for internal voltage doubler.
02	V+	Internally generated +5.5V (typical) supply.
03	C1-	External capacitor "-" for internal voltage doubler.
04	C2+	External capacitor "+" internal voltage inverter.
05	C2-	External capacitor "-" internal voltage inverter.
06	V-	Internally generated -5.5V (typical) supply.
07	D _{OUT2}	RS-232 Driver 2 output $\pm 5.5V$ (typical).
08	R _{IN2}	RS-232 Receiver 2 input, with internal 5K pulldown resistor to GND.
09	R _{OUT2}	Receiver 2 TTL/CMOS output.
10	D _{IN2}	Driver 2 TTL/CMOS input.
11	D _{IN1}	Driver 1 TTL/CMOS input.
12	R _{OUT1}	Receiver 1 TTL/CMOS output.
13	R _{IN1}	RS-232 Receiver 1 input, with internal 5K pulldown resistor to GND.
14	D _{OUT1}	RS-232 Driver 1 output $\pm 5.5V$ (typical).
15	GND	Supply Ground.
16	V _{CC}	Positive Power Supply 3V to +5.5V

Function Tables

EACH DRIVER

INPUT DIN	OUTPUT DOUT
L	H
H	L

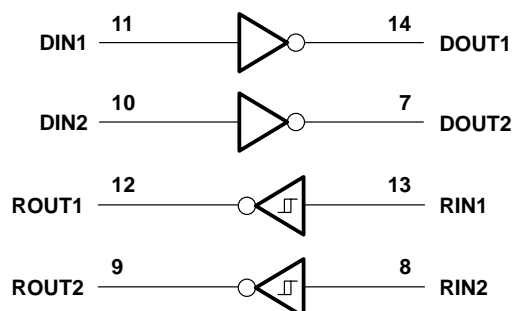
H = high level, L = low level

EACH RECEIVER

INPUT RIN	OUTPUT ROUT
L	H
H	L
Open	H

H = high level, L = low level, Open = input disconnected or connected driver off

Logic diagram (positive logic)



Absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage range, V_{CC} (see Note 1)	.....	-0.3 V to 6 V
Positive output supply voltage range, V_+$	.....	V_{CC} - 0.3$ V to 14 V
Negative output supply voltage range, V_-	.....	-0.3 V to -14 V
Input voltage range, V_I : Driver	.....	-0.3 V to $V_{CC} + 0.3$ V
Receiver	± 30 V
Output voltage range, V_O : Driver	.....	$V_{S-} - 0.3$ V to $V_{S+} + 0.3$ V
Receivers	.....	-0.3 V to $V_{CC} + 0.3$ V
Short-circuit duration: T1OUT, T2OUT	.....	Unlimited
Package thermal impedance, θ_{JA} (see Note 2): SO package	.....	73°C/W
DIP package	.....	67°C/W
SO W package	.....	57°C/W
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	.....	260°C
Storage temperature range, T_{stg}	.....	-65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: All voltage values are with respect to network ground terminal.

2: The package thermal impedance is measured with the component mounted on an evaluation PC board in free air.

Recommended operating conditions

		MIN	NOM	MAX	UNIT
V_{CC}	Supply voltage	3.0		5.5	V
V_{IH}	Driver high-level input voltage (DIN)	2			V
V_{IL}	Driver low-level input voltage (DIN)			0.8	V
RIN	Receiver input voltage			± 30	V
T_A	Operating free-air temperature	MAX3-232C	0	70	°C
		MAX3-232E	-40	85	

Electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Note 3 and Figure 4)

PARAMETER	TEST CONDITIONS	MIN	TYP‡	MAX	UNIT
I_{CC} Supply current	$V_{CC} = 3.3$ or 5V, All outputs open, $T_A = 25^\circ\text{C}$			10	mA

‡ All typical values are at $V_{CC} = 3.3$ V and $T_A = 25^\circ\text{C}$.

NOTE 3: Test conditions are C1–C4 = 0.1 μF at $V_{CC} = 3.3$ V \pm 0.3 V.

DRIVER SECTION

Electrical characteristics over recommended ranges of supply voltage and operating free-air temperature range (see Note 3)

PARAMETER		TEST CONDITIONS	MIN	TYP†	MAX	UNIT
V _{OH}	High-level output voltage	DOUT R _L = 3 kΩ to GND	3.5			V
V _{OL}	Low-level output voltage‡	DOUT R _L = 3 kΩ to GND	-3.5			V
R _O	Output resistance	DOUT1, DOUT2 V ₊ = V ₋ = 0, V _O = ±2 V	300			Ω
I _{OS} §	Short-circuit output current	DOUT1, DOUT2 V _{CC} = 3.3 V, V _O = 0		±10		mA
I _{IS}	Short-circuit input current	DIN1, DIN2 V _I = 0			200	μA

† All typical values are at V_{CC} = 3.3 V, T_A = 25°C.

‡ The algebraic convention, in which the least positive (most negative) value is designated minimum, is used in this data sheet for logic voltage levels only.

§ Not more than one output should be shorted at a time.

NOTE 3: Test conditions are C1–C4 = 0.1 μF at V_{CC} = 3.3 V ± 0.3 V.

Switching characteristics, V_{CC} = 3.3 V, T_A = 25°C (see Note 3)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
SR	Driver slew rate	R _L = 3 kΩ to 7 kΩ, See Figure 2			30	V/μs
SR(t)	Driver transition region slew rate	See Figure 3		3		V/μs
	Data rate	One DOUT switching		120		kbit/s

NOTE 3: Test conditions are C1–C4 = 0.1 μF at V_{CC} = 3.3 V ± 0.3 V.

RECEIVER SECTION

Electrical characteristics over recommended ranges of supply voltage and operating free-air temperature range (see Note 3)

PARAMETER		TEST CONDITIONS	MIN	TYP†	MAX	UNIT
V _{OH}	High-level output voltage	ROUT I _{OH} = -1 mA	2.4			V
V _{OL}	Low-level output voltage‡	ROUT I _{OL} = 3.2 mA			0.3	V
V _{IT+}	Receiver positive-going input threshold voltage	RIN V _{CC} = 3.3 V, T _A = 25°C		1.7	2.4	V
V _{IT-}	Receiver negative-going input threshold voltage	RIN V _{CC} = 3.3 V, T _A = 25°C	0.6	1.2		V
V _{hys}	Input hysteresis voltage	RIN V _{CC} = 3.3 V	0.2	0.5	1	V
R _I	Receiver input resistance	RIN V _{CC} = 3.3 V, T _A = 25°C	3	5	7	kΩ

† All typical values are at V_{CC} = 3.3 V, T_A = 25°C.

‡ The algebraic convention, in which the least positive (most negative) value is designated minimum, is used in this data sheet for logic voltage levels only.

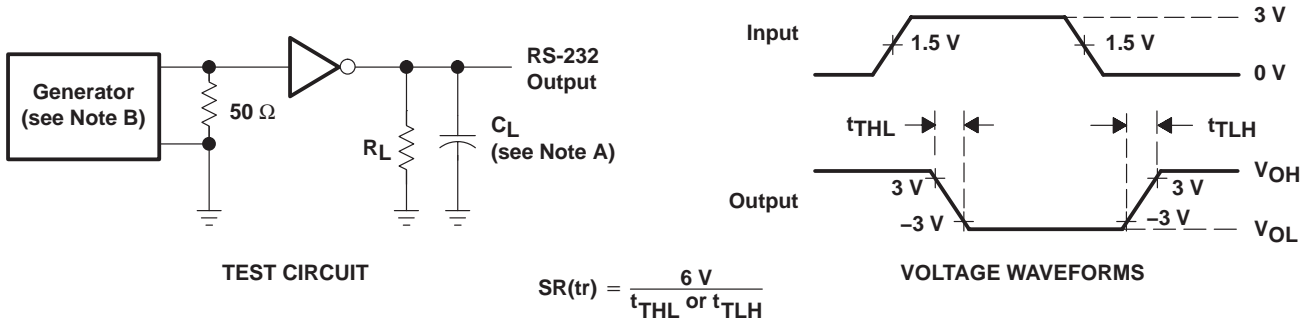
NOTE 3: Test conditions are C1–C4 = 0.1 μF at V_{CC} = 3.3 V ± 0.3 V.

Switching characteristics, V_{CC} = 3.3 V, T_A = 25°C (see Note 3 and Figure 1)

PARAMETER		TYP	UNIT
t _{PLH(R)}	Receiver propagation delay time, low- to high-level output	500	ns
t _{PHL(R)}	Receiver propagation delay time, high- to low-level output	500	ns

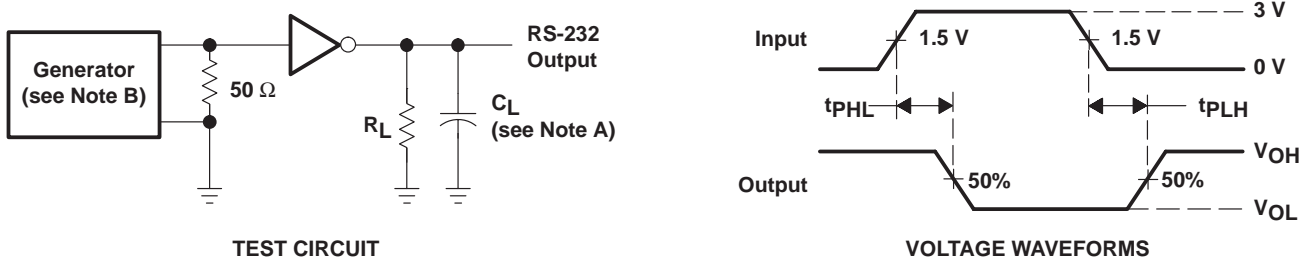
NOTE 3: Test conditions are C1–C4 = 0.1 μF at V_{CC} = 3.3 V ± 0.5 V.

PARAMETER MEASUREMENT INFORMATION



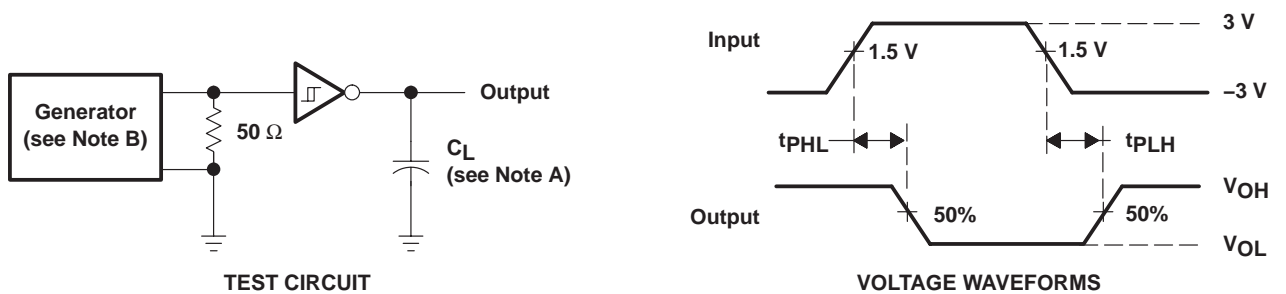
NOTES: A. C_L includes probe and jig capacitance.
 B. The pulse generator has the following characteristics: PRR = 120 kbit/s, $Z_O = 50 \Omega$, 50% duty cycle

Figure 1. Driver Slew Rate



NOTES: A. C_L includes probe and jig capacitance.
 B. The pulse generator has the following characteristics: PRR = 120 kbit/s, $Z_O = 50 \Omega$, 50% duty cycle

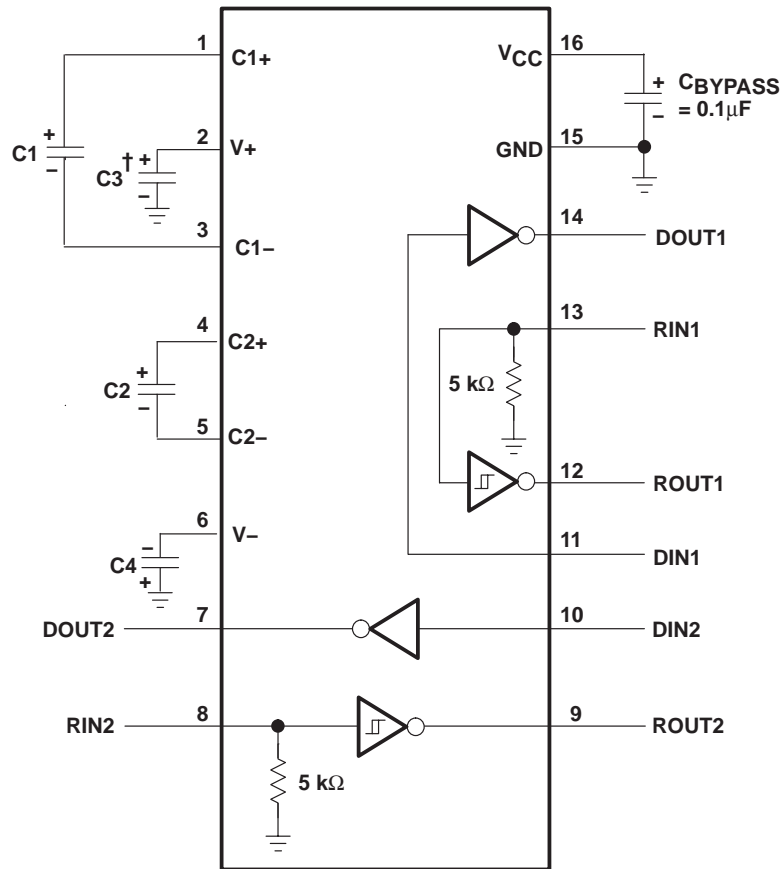
Figure 2. Driver Pulse Skew



NOTES: A. C_L includes probe and jig capacitance.
 B. The pulse generator has the following characteristics: $Z_O = 50 \Omega$, 50% duty cycle

Figure 3. Receiver Propagation Delay Times

APPLICATION INFORMATION



† C3 can be connected to V_{CC} or GND.

NOTES: A. Resistor values shown are nominal.

B. Nonpolarized ceramic capacitors are acceptable. If polarized tantalum or electrolytic capacitors are used, they should be connected as shown.

Figure 4. Typical Operating Circuit and Capacitor Values

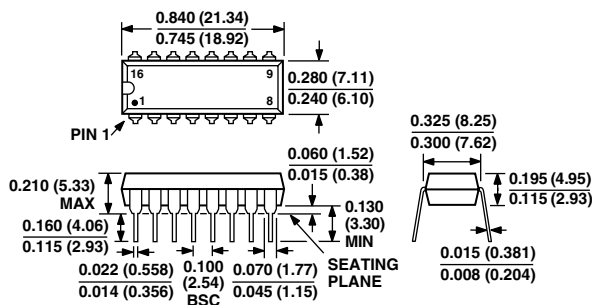
V_{CC} vs CAPACITOR VALUES

V _{CC}	C1	C2, C3, C4
3.3 V ± 0.3 V	0.1 μF	0.1 μF
5 V ± 0.5 V	0.047 μF	0.33 μF
3 V to 5.5 V	0.1 μF	0.47 μF

OUTLINE DIMENSIONS

Dimensions shown in inches and (mm).

16-Lead Plastic DIP



16-Lead Narrow SOIC

