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RS-232, RS-422 Low Power Drivers/Receivers

Preliminary Technical Information

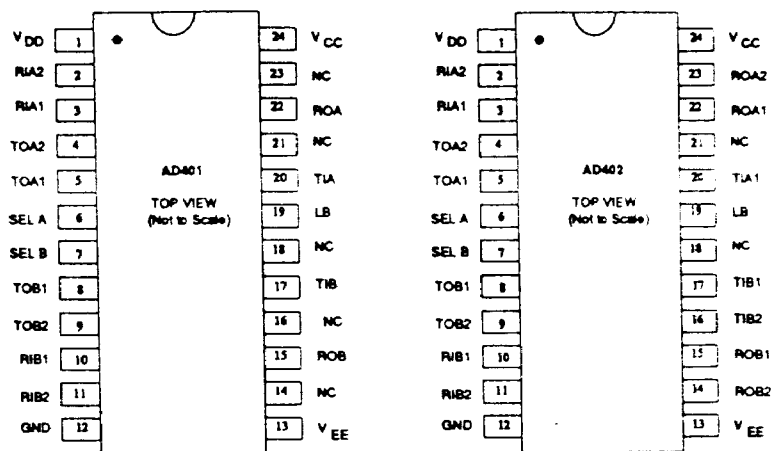
AD401/AD402

FEATURES

- RS-232 and RS-422 on One Chip
- Loopback for Self-testing
- Mode Selectable
- Short Circuit Protection
- Excellent Noise Immunity
- Three-State Driver Outputs
- Low Power BICMOS Technology
- $\pm 15V$ Receiver Input Levels
- Small 0.3" 24-Pin DIP Package

APPLICATIONS

- DTE-DCE Interface
- Packet Switching
- Local Area Networks
- Data Concentration
- Data Multiplexers
- Integrated Services Digital Network (ISDN)



DESCRIPTION

The AD401 and AD402 line drivers/receivers are monolithic products which provide an interface between TTL level signals and EIA standard signals. They can be configured for either the single-ended interface standard RS-232 for low speed communications or the differential interface standard RS-422 for high speed/long distance communications. It is also possible to select a combination of RS-232/RS-422 channels where an interface to both standards is required. Each device has four different combinations of RS-232 and/or RS-422 drivers and receivers. The combination is selected by the logic inputs on the two select pins - SEL A and SEL B.

The AD401 contains two channels, each channel containing one driver and one receiver. Each channel may be configured as an RS-232 channel or as an RS-422 channel.

The AD402 also contains two channels which can be configured as RS-232 or as RS-422. The number of drivers/receivers per channel depends on whether RS-232 or RS-422 is selected. With RS-232 selected, each channel contains two drivers and two receivers, while with RS-422 selected, each channel contains one differential transmitter and one differential receiver.

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The RS232 line drivers convert TTL input levels into inverted RS232 outputs signals. The RS-422 line drivers convert TTL input levels into RS-422 differential output signals.

The RS-232 line driver output feature high source and sink current capability. All the line drivers are internally protected against short circuits on their outputs. The RS-232 receivers convert the RS-232 input signal into inverted TTL output logic levels. The RS-422 line receivers convert the RS-422 differential input signals into non-inverted TTL output logic levels.

A loopback function is also provided which internally connects the driver outputs to their associated receiver inputs. This is a very useful function which allows a complete diagnostic self test of the transmit/receive circuitry. During the self test, the driver outputs are placed in a high impedance state so that the test does not interfere with external circuitry. The self test may be performed at speeds up to 3kbaud. It is enabled by applying a logic 0 to the LB input.

Excellent noise immunity is ensured at the receiver input by the use of internal filtering circuitry. Pulse durations of less than 1 μ s are ignored and this eliminates spurious output transitions even with noisy inputs. Further noise immunity on the RS-232 inputs is achieved using Schmitt trigger circuitry.

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GENERAL DESCRIPTION

The AD401/AD402 drivers/receivers provide an interface which is compatible with RS-232/RS-422 standard interfaces. As both standards are widely accepted it is often necessary to provide an interface which is compatible with both. The AD401/402 is ideally suited to this type of application as a combination of RS-232/RS-422 channels may be selected in the same package.

RS-232 Drivers

The RS-232 drivers in the AD401/AD402 meet the EIA RS-232-C specifications. The drivers are inverting level shifters which convert TTL/CMOS levels into RS-232-C output levels. The input switching threshold is typically 1.3V. With a typical RS-232 load, the output levels are $\pm 10V$. Even under worst case load conditions, the drivers are guaranteed to provide $\pm 6V$ which surpasses the minimum RS-232-C requirement of $\pm 5V$ minimum. The output slew rate is internally limited to $<30V/\mu s$ without the need for an external slew-limiting capacitor. Short circuit protection is also provided which prevents damage in the event of output fault conditions.

RS-232 Receivers

The receivers are inverting level shifters which accept RS-232-C input levels ($\pm 3V$ to $\pm 15V$) and translates them into 5V TTL/CMOS levels. The input switching thresholds are 0.75V minimum and 2.5V maximum which are well within the RS-232-C requirement of $\pm 3V$. Internal pull-down resistors to GND are provided on the receiver inputs. This ensures that an unconnected input will be interpreted as a low level giving a logic "1" on the TTL/CMOS output. Excellent noise immunity is achieved by the use of hysteresis and internal filtering circuitry. The filter rejects noise glitches of up to 0.5 μs in duration.

RS-422 Drivers

The RS-422 drivers on the AD401/AD402 accept TTL/CMOS inputs and translates them into differential RS-422 level signals. The input switching threshold is typically 1.3V. The unloaded output differential voltage is typically $\pm 4.5V$. (See typical performance characteristics). Short circuit protection is provided on the output which limits the current to less than 100mA. Only one output should be shorted at any time to avoid exceeding the total power dissipation for the package.

RS-422 Receivers

The RS-422 receivers on the AD401/AD402 accept differential input signals and translates them into TTL/CMOS output levels. Excellent noise immunity is achieved using the differential configuration.

Loop-Back

A loopback function is provided which can be used as a diagnostic self-test of the transmit/receive channels. When the loopback is enabled, the driver outputs are internally connected to the corresponding receiver inputs, providing a noninverting signal path from the TTL/CMOS inputs on the driver to the TTL/CMOS outputs on the receiver.

AD401 Channel Selection

The AD401 contains two channels, A and B. Each channel contains one driver and one receiver. The channels may be configured as RS-232 or as RS-422 interface channels using the SEL pins. With SEL A = logic "0", then channel A is configured as an RS-232 channel having one RS-232 driver and one RS-232 receiver. Similarly with SEL B = logic "0", channel B is configured as an RS-232 channel.

With SEL A = logic "1", channel A is configured as an RS-422 interface channel having one RS-422 driver and one RS-422 receiver. Similarly, with SEL B = logic "1", channel B is configured as an RS-422 channel. The AD401 channel selection truth table is shown in Figure 1.

SEL A	SEL B	Channel A		Channel B	
		Driver	Receiver	Driver	Receiver
0	0	1 RS-232	1 RS-232	1 RS-232	1 RS-232
0	1	1 RS-232	1 RS-232	1 RS-422	1 RS-422
1	0	1 RS-422	1 RS-422	1 RS-232	1 RS-232
1	1	1 RS-422	1 RS-422	1 RS-422	1 RS-422

Figure 1 AD401 Truth Table

AD402 Channel Selection

The AD402 contains two channels, A and B. Each channel may be configured to be an RS-232 or an RS-422 channel using the SEL pins. The number of drivers/receivers per channel depends on whether RS-232 or RS-422 is selected. With RS-232 selected, each channel contains two drivers and two receivers. With RS-422 selected, each channel contains one differential transmitter and one differential receiver.

With SEL A = logic "0", channel A is configured as an RS-232 channel with two RS-232 drivers and two RS-232 receivers. Similarly with SEL B = logic "0", channel B is configured as an RS-232 channel.

With SEL A = logic "1", channel A is configured as an RS-422 channel with one RS-422 driver and one RS-422 receiver. Similarly with SEL B = logic "1", channel B is configured as an RS-422 channel. The AD402 truth table selection is shown in Figure 2.

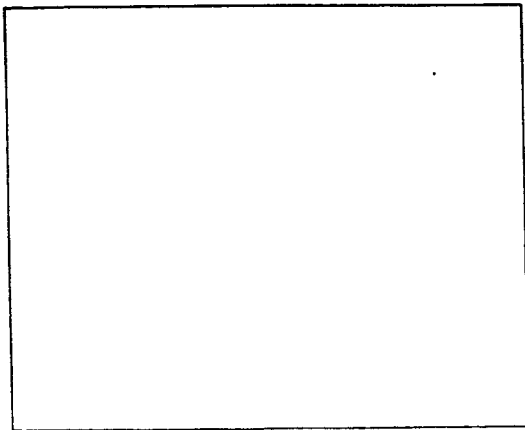
SEL A	SEL B	Channel A		Channel B	
		Driver	Receiver	Driver	Receiver
0	0	2 RS-232	2 RS-232	2 RS-232	2 RS-232
0	1	2 RS-232	2 RS-232	1 RS-422	1 RS-422
1	0	1 RS-422	1 RS-422	2 RS-232	2 RS-232
1	1	1 RS-422	1 RS-422	1 RS-422	1 RS-422

Figure 2 AD402 Truth Table

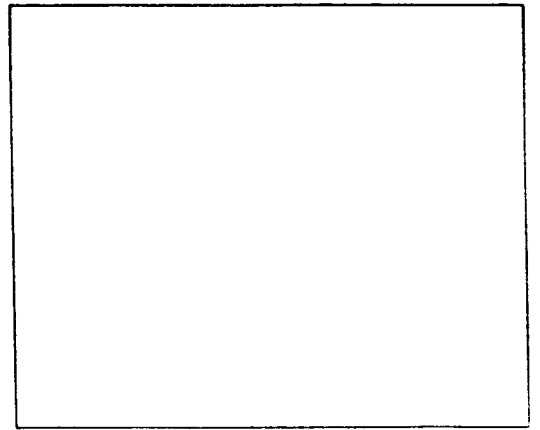
AD401 SELECTION TABLE (DIAGNOSTIC OPERATION, LB=0)

SEL A	SEL B	CHANNEL A	CHANNEL B
0	0		
0	1		
1	0		
1	1		

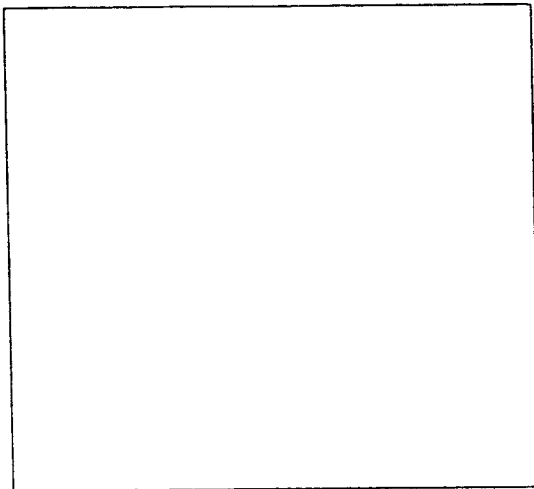
TYPICAL PERFORMANCE CHARACTERISTICS



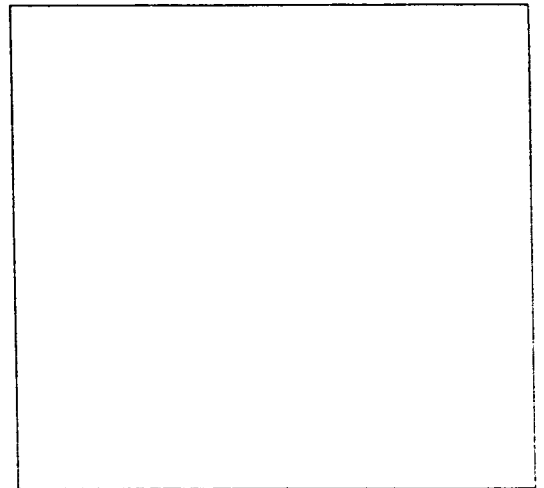
RS-232 DRIVER



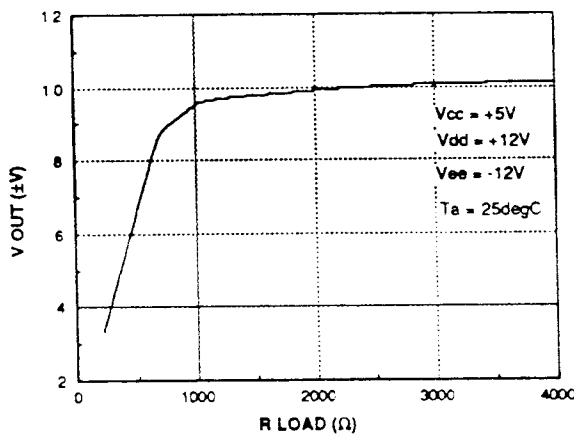
RS-232 RECEIVER



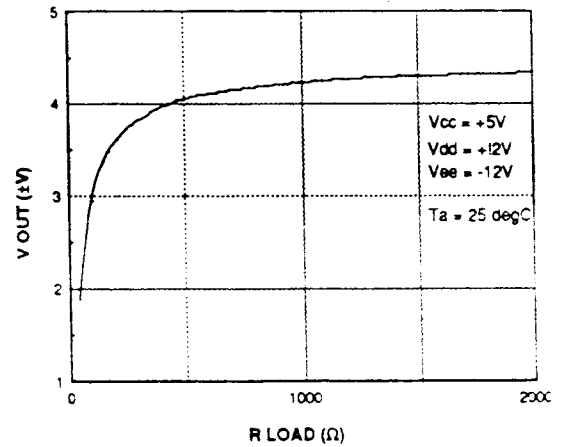
RS-422 DRIVER



RS-422 RECEIVER



RS-232 DRIVER VOLTAGE vs R_L



RS-422 DRIVER DIFFERENTIAL VOLTAGE vs R_L

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