

Advance Technical Information

ADM3311

FEATURES

- Green-Idle™ Power-Saving Mode
- Full RS-232 Compliance
- Operates with 3V or 5V Logic
- Ultra Low Power CMOS: 450µA Operation
- Low Power Shutdown: 0.2µA
- 460kbits/s Data rate
- 0.1µF Charge Pump Capacitors
- Single +2.7V to +3.6V Power Supply
- One Receiver Active in Shutdown
- Pin Compatible with DS14C335

APPLICATIONS

- Laptop Computers
- Notebook Computers
- Printers
- Peripherals
- Modems
- PDA's

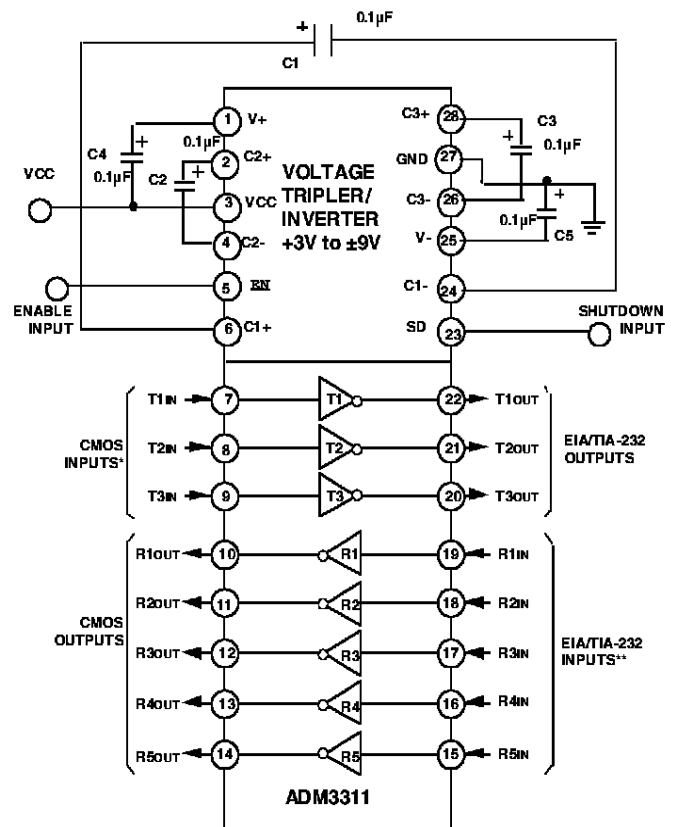
GENERAL DESCRIPTION

The ADM3311 is a three driver/five receiver product designed to fully meet the EIA-232 standard while operating with a single +2.7 to 3.6V power supply. The devices feature an on-chip DC to DC converter, eliminating the need for dual power supplies. This DC-DC converter contains a voltage tripler and voltage inverter which internally generates a regulated $\pm 7.5V$ from the input 3V power supply. An internal voltage monitoring circuit continually adjusts the oscillator frequency to maintain the desired output voltage levels. In an unloaded state, the oscillator idles at a minimum frequency (Green-Idle Mode™) thereby minimizing the power consumption. This makes these products ideal for battery powered portable devices.

The ADM3311 contains three drivers and five receivers and is intended for serial port applications on notebook/laptop computers.

A shutdown facility is also provided which reduces the power consumption to 0.6µW. While in shutdown, one receiver remains active thereby allowing monitoring of peripheral devices. This feature allows the device to be

FUNCTIONAL BLOCK DIAGRAM



Notes:
 * INTERNAL 400kΩ PULL-UP RESISTOR ON EACH CMOS INPUT
 ** INTERNAL 5kΩ PULL-DOWN RESISTOR ON EACH RS-232 INPUT

shutdown until a peripheral device begins communication. The active receiver can alert the processor which can then take the ADM3311 out of the shutdown mode.

The ADM3311 is fabricated using BiCMOS technology for minimal power consumption. It features a high level of overvoltage protection and latch-up immunity.

The ADM3311 is packaged in a 28 pin SSOP and TSSOP packages.

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ADM3311—SPECIFICATIONS

Advance Technical Information

($V_{CC} = +2.7V$ to $+3.6V$, $C1-C5 = 0.1 \mu F$. All specifications T_{MIN} to T_{MAX} unless otherwise noted.)

Parameter	Min	Typ	Max	Units	Test Conditions/Comments
Operating Voltage Range V_{CC} Power Supply Current	+2.7	+3.0	+3.6	Volts mA	No Load
Shutdown Supply Current		0.2	5	μA	
Input Pull-Up Current		10	25	μA	$T_{IN} = GND$
Input Logic Threshold Low, V_{INL}			0.8	V	$T_{IN}, \underline{EN}, SHDN,$
Input Logic Threshold High, V_{INH}	2.0			V	$T_{IN}, \underline{EN}, SHDN,$
CMOS Output Voltage Low, V_{OL}			0.4	V	$I_{OUT} = 1.6 mA$
CMOS Output Voltage High, V_{OH}	$V_{CC}-0.3$			V	$I_{OUT} = -40 \mu A$
CMOS Output Leakage Current	$V_{CC}-0.6$	0.05	± 5	μA	$I_{OUT} = -1 mA$ $\underline{EN} = V_{CC}, 0 V < R_{OUT} < V_{CC}$
EIA-232 Input Voltage Range	-25		+25	V	
EIA-232 Input Threshold Low	0.4	1.0		V	
EIA-232 Input Threshold High		1.6	2.0	V	
EIA-232 Input Hysteresis	0.2	0.6	1.0	V	
EIA-232 Input Resistance	3	5	7	k Ω	
Output Voltage Swing	± 5.0	± 7.5		Volts	All Transmitter Outputs Loaded with 3 k Ω to Ground
Transmitter Output Resistance	300			Ω	$V_{CC} = 0 V, V_{OUT} = \pm 2 V$
RS-232 Output Short Circuit Current	± 10	± 20	± 60	mA	
Maximum Data Rate	460			kbps	$R_L = 3k\Omega$ to $7k\Omega, C_L = 50pF$ to $1000pF$
Receiver Propagation Delay TPHL, TPLH		0.4	2	μs	$C_L = 150 pF$
Receiver Output Enable Time, t_{ER}		120		ns	
Receiver Output Disable Time, t_{DR}		120		ns	
Transmitter Propagation Delay TPHL, TPLH		1		μs	$R_L = 3 k\Omega, C_L = 2500 pF$
Transition Region Slew Rate	3	10	30	V/ μs	$R_L = 3 k\Omega, C_L = 50 pF$ to $2500 pF$ Measured from $+3 V$ to $-3 V$ or $-3 V$ to $+3 V$

Specifications subject to change without notice.

ABSOLUTE MAXIMUM RATINGS*

($T_A = +25^\circ C$ unless otherwise noted)

V_{CC}	-0.3 V to +6 V
$V+$	($V_{CC} - 0.3 V$) to +8 V
$V-$	+0.3 V to -8 V
Input Voltages	
T_{IN}	-0.3 V to ($V+$, +0.3 V)
R_{IN}	$\pm 25 V$
Output Voltages	
T_{OUT}	$\pm 15 V$
R_{OUT}	-0.3 V to ($V_{CC} + 0.3 V$)
Short Circuit Duration	
T_{OUT}	Continuous

Power Dissipation

RS-28 SSOP	900 mW
RU-28 TSSOP (+70°C)	900 mW
Operating Temperature Range	
Industrial (A Version)	-40°C to +85°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10 sec)	+300°C
ESD Rating (MIL-STD-883B)	$\pm 3 kV$

*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.

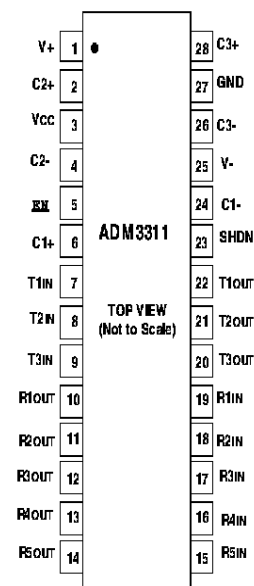
PIN FUNCTION DESCRIPTION

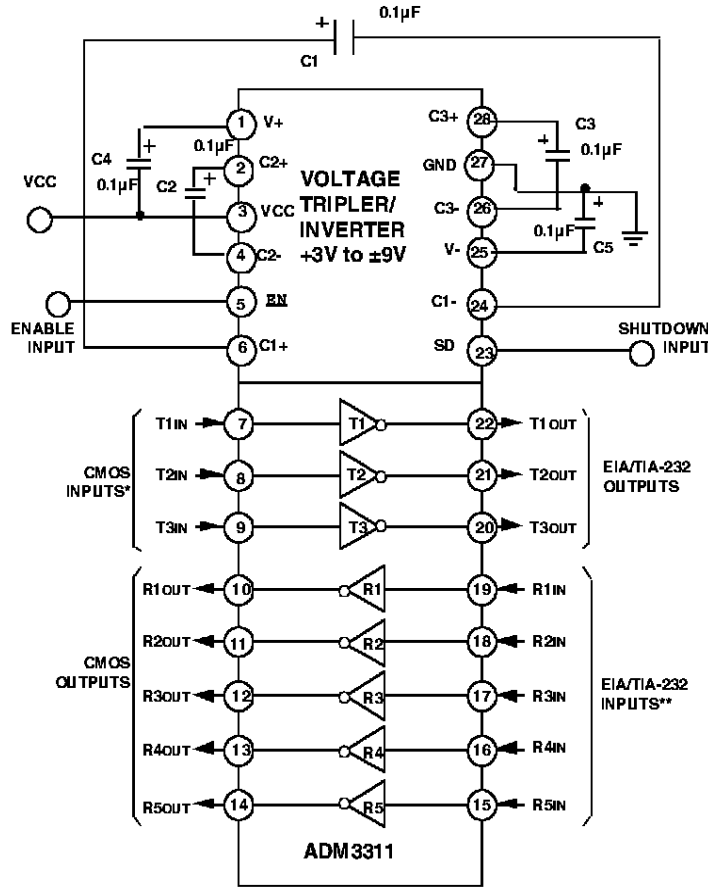
Mnemonic	Function
V _{CC}	Power Supply Input +2.7V to +3.6V.
V+	Internally generated positive supply (+7.5V nominal) Capacitor C4 is connected between V _{CC} and V+
V-	Internally generated negative supply (-7.5V nominal) Capacitor C5 is connected between V- and GND
GND	Ground pin. Must be connected to 0V
C1+, C1-	External capacitor 1 is connected between these pins. A 0.1μF capacitor is recommended..
C2+, C2-	External capacitor 2 is connected between these pins. A 0.1μF capacitor is recommended.
C3+, C3-	External capacitor 3 is connected between these pins. A 0.1μF capacitor is recommended.
T _{IN}	Transmitter (Driver) Inputs. These inputs accept TTL/CMOS levels. An internal 400kΩ pull-up resistor to V _{CC} is connected on each input.
T _{OUT}	Transmitter(Driver)Outputs. (typically ± 7.5V)
R _{IN}	Receiver Inputs. These inputs accept RS-232 signal levels. An internal 5kΩ pull-down resistor to GND is connected on each of these inputs
R _{OUT}	Receiver outputs. These are TTL/CMOS levels.
EN	Receiver Enable. A high level three-states all the receiver outputs.
SD	Shutdown Control. A high level will disable the charge pump and reduce the quiescent current to less than 5μA. All transmitters and receivers R1-R4 are disabled. Receiver R5 remains active in shutdown

SHDN	EN	STATUS	T _{OUT} 1-3	R _{OUT} 1-4	R _{OUT} 5
0	0	Normal Operation	Enabled	Enabled	Enabled
0	1	Receivers Disabled	Enabled	Disabled	Disabled
1	0	ShutDown	Disabled	Disabled	Enabled
1	1	ShutDown	Disabled	Disabled	Disabled

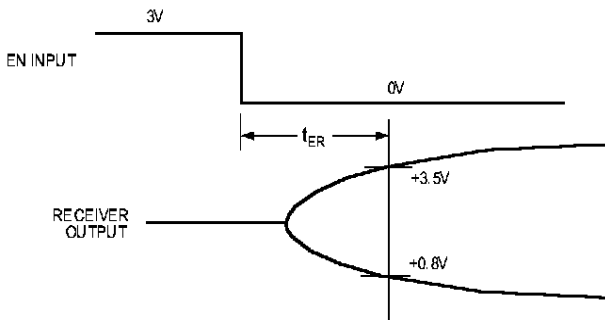
ORDERING GUIDE

Model	Temperature Range	Package Option
ADM3311ARS	-40°C to +85°C	RS-28
ADM3311ARU	-40°C to +85°C	RU-28

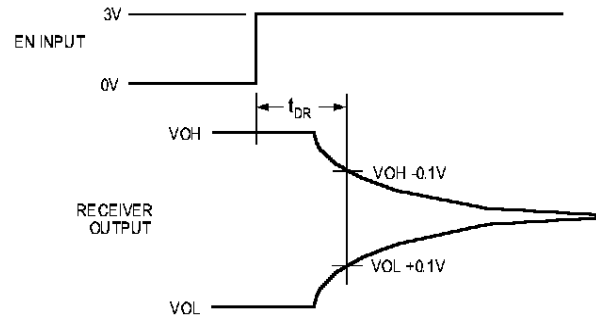




Notes:
 * INTERNAL 400kΩ PULL-UP RESISTOR ON EACH CMOS INPUT
 ** INTERNAL 5kΩ PULL-DOWN RESISTOR ON EACH RS-232 INPUT



Receiver Enable Timing



Receiver Disable Timing

GENERAL DESCRIPTION

The ADM3311 is a ruggedized RS-232 line transceiver which operate from a single +3 V supply. Step-up voltage converters coupled with level shifting transmitters and receivers allow RS-232 levels to be developed while operating from a single +2.7V to +3.6 V supply.

CIRCUIT DESCRIPTION

The internal circuitry consists of four main sections. These are:

1. A charge pump voltage converter.
2. 3 V logic to EIA-232 transmitters.
3. EIA-232 to 3 V logic receivers.
4. Transient protection circuit on all I-O lines.

Charge Pump DC-DC Voltage Converter

The charge pump voltage converter consists of an 200 kHz oscillator and a switching matrix. The converter generates a regulated $\pm 7.5V$ supply from the input +3 V level. This is done in two stages using a switched capacitor technique. First, the 3V input supply is tripled and regulated to 7.5V V using capacitor C1 and C2 as the charge storage elements. The +7.5V level is then inverted to generate -7.5 V using C3 as the storage element.

Capacitors C4 and C5 are used to reduce the output ripple.

The V+ and V- supplies may also be used to power external circuitry if the current requirements are small. Please refer to the Typical Performance section.

Green-Idle™ Power Saving Mode

As described above, the charge pump generates a regulated $\pm 7.5V$ level independent of load. This is achieved using a voltage controlled oscillator to drive the charge pump.

During no load conditions the oscillator switches into an idling state (Green-Idle™) whereby the charge pump is trickle charged.

Transmitter (Driver) Section

The drivers convert 3 V logic input levels into EIA-232 output levels. With $V_{CC} = +3 V$ and driving an EIA-232 load, the output voltage swing is typically $\pm 7 V$.

Unused inputs may be left unconnected, as an internal 400 k Ω pull-up resistor pulls them high forcing the outputs into a low state. The input pull-up resistors typically source 8 μA when grounded, so unused inputs should either be connected to V_{CC} or left unconnected in order to

minimize power consumption.

Receiver Section

The receivers are inverting level shifters which accept EIA-232 input levels and translate them into 3V logic output levels.

The inputs have internal 5 k Ω pull-down resistors to ground and are also protected against overvoltages of up to $\pm 25 V$. The guaranteed switching thresholds are 0.4 V minimum and 2 V maximum. Unconnected inputs are pulled to 0 V by the internal 5 k Ω pull-down resistor. This, therefore, results in a Logic 1 output level for unconnected inputs or for inputs connected to GND.

The receivers have Schmitt trigger input with a hysteresis level of 0.5 V. This ensures error-free reception for both noisy inputs and for inputs with slow transition times.

ENABLE AND SHUTDOWN

Table I shows the truth tables for the enable and shutdown control signals. The enable function is intended to facilitate data bus connections where it is desirable to three state the receiver outputs. In the disabled mode, all receiver outputs are placed in a high impedance state. The shutdown function is intended to shut the device down, thereby minimizing the quiescent current. In shutdown, all transmitters and receivers R1 to R4 are disabled. Receiver R5 remains enabled in shutdown. Note that disabled transmitters are not three-stated in shutdown, so it is not permitted to connect multiple (RS-232) driver outputs together.

The shutdown feature is very useful in battery operated systems since it reduces the power consumption to 0.6 μW . During shutdown the charge pump is also disabled. When exiting shutdown, the charge pump is restarted and it takes approximately 100 μs for it to reach its steady state operating conditions.

High Baud Rate

The ADM3311 feature high slew rates permitting data transmission at rates well in excess of the EIA-232-E specifications. RS-232 levels are maintained at data rates up to 230 kb/s even under worst case loading conditions. This allows for high speed data links between two terminals or indeed it is suitable for the new generation modem standards which requires data rates of 200 kb/s. The slew rate is internally controlled to less than 30 V/ μs in order to minimize EMI interference.

SHDN	EN	STATUS	T _{OUT1-3}	R _{OUT1-4}	R _{OUT5}
0	0	Normal Operation	Enabled	Enabled	Enabled
0	1	Receivers Disabled	Enabled	Disabled	Disabled
1	0	ShutDown	Disabled	Disabled	Enabled
1	1	ShutDown	Disabled	Disabled	Disabled

Table 1. ADM3311 Truth Table