Isolated Single Channel RS-232 Line Driver/Receiver

Preliminary Technical Data

ADM3251E

FEATURES

460 kbps Data Rate
1 Tx and 1 Rx
Meets EIA-232E specifications
0.1uF charge pump capacitors
Integrated isolated dc-to-dc converter
ESD protection to IEC1000-4-2(801.2)
on R_{IN} and T_{OUT} pins.
±8kV: contact discharge
±15kV: air gap discharge
Integrated isolated dc-to-dc converter
High common-mode transient immunity: >25kV/us
Safety and regulatory approvals (pending)
UL recognition
VDE certificate of conformity
20 Lead WSOIC package

APPLICATIONS

High noise data communications
Industrial Communications
Industrial/Telecom Diagnostic Ports

FUNCTIONAL BLOCK DIAGRAM

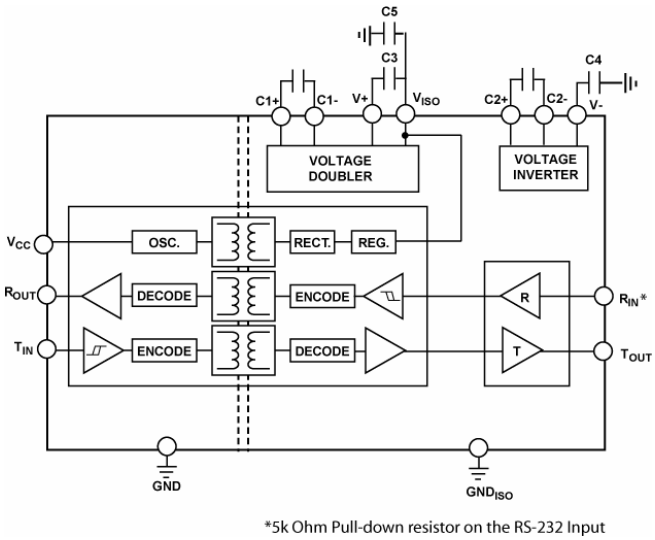

Figure 1.

GENERAL DESCRIPTION

The ADM3251E is a high speed, single-channel RS-232 transceiver device that operates from a single power supply.

This device is ideally suited to operation in electrically harsh environments or where RS-232 cables are frequently being plugged/unplugged.

The ADM3251E incorporates dual-channel digital isolators with *iso*Power integrated, isolated power. There is no requirement for a separate isolated dc-to-dc converter as the ADM3251E has a chip-scale dc-to-dc converter which is based on Analog Devices, Inc. *i*Coupler® technology.

Analog Devices' chip-scale transformer *i*Coupler technology is used both for the isolation of the logic signals as well as for the dc-to-dc converter. The result is a small form factor, total isolation solution.

Five external 0.1µF charge pump capacitors are used for the voltage doubler/inverter permitting operation from a single supply.

The ADM3251E conforms to the EIA-232E specifications and operates at data rates up to 460 kbps.

The device is ideally suited to operation in electrically harsh environments. RS-232 pins, R_{IN} and T_{OUT} are protected against electrostatic discharges (up to ±15 kV ESD protection).

The ADM3251E is available in a 20 lead Wide Body SOIC package.

Rev. PrA

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TARGET SPECIFICATIONS

All voltages are relative to their respective ground. All min/max specifications apply over the entire recommended operating range, unless otherwise noted. All typical specifications in Table 1 are at T_A = 25°C, V_{CC} = 5.0V, unless otherwise noted.

Table 1.

Parameter	Min	Typ	Max	Unit	Test Conditions/Comments
DC CHARACTERISTICS					
V_{CC} Operating Voltage Range	4.5		5.5	V	
DC-to-DC Converter Enable Threshold, $V_{CC(Enable)}$ [1]	4.5			V	
DC-to-DC Converter Disable Threshold, $V_{CC(Disable)}$ [1]			3.7	V	
DC-to-DC CONVERTER ENABLED					
Input Supply Current			TBD	mA	No Load
			TBD	mA	R_L = 3kΩ
V_{ISO} Output[2]		5.0		V	I_{ISO} =0uA
DC-to-DC CONVERTER DISABLED					
Primary Side Supply Input Current, $I_{CC(Disable)}$			TBD	mA	V_{ISO} = 3.3V, Vcc ≤3.7V
LOGIC					
Transmitter Input, T_{IN}					
Logic Input Current, I_{TIN}	-10	+0.01	+10	µA	
Logic Low Input Threshold, V_{TINL}	0.3 V_{CC}			V	
Logic High Input Threshold, V_{TINH}			0.7 V_{CC}	V	
Receiver Output, R_{OUT}					
Logic High Output V_{ROUTH}	V_{CC} – 0.1	V_{CC}		V	I_{ROUTH}= - 20 µA
	V_{CC} – 0.5	V_{CC} – 0.2		V	I_{ROUTH} = - 4 mA
Logic Low Output V_{ROUTL}		0.0	0.1	V	I_{ROUTH} = 20 µA
		0.0	0.4	V	I_{ROUTH} = 4 mA
RS-232					
RECEIVER					
EIA-232 Input Voltage Range [3]	−30		+30	V	
EIA-232 Input Threshold Low	0.6	1.3		V	
EIA-232 Input Threshold High		1.6	2.4	V	
EIA-232 Input Hysteresis		0.4		V	
EIA-232 Input Resistance	3	5	7	kΩ	
TRANSMITTER					
Output Voltage Swing (RS-232)	±5	±5.7		V	R_L = 3kΩ to Gnd
Transmitter Output Resistance	300			Ω	V_{ISO} = 0V
RS-232 Output Short Circuit Current		TBD		mA	
TIMING CHARACTERISTICS					
Maximum Data Rate	460			kbps	R_L = 3kΩ to7kΩ, C_L=50 pF to 1000 pF
Receiver Propagation Delay					
t_{PHL}		190		µs	
t_{PLH}		135		µs	
Transmitter Propagation Delay		650		µs	R_L = 3kΩ, C_L=1000 pF
Transmitter Skew		80		ns	
Receiver Skew		70		ns	
Transition Region Slew Rate[3]	5.5	10	30	V/µs	*+3V to -3V or -3V t0 3V, V_{cc} =+3.3V, R_L=+3kΩ, C_L=1000pF, T_A=25C.*
AC SPECIFICATIONS					
Output Rise, t_R/Fall time, t_F (10% to 90%)		2.3		ns	C_L = 15 pF, CMOS signal levels
Common-Mode Transient Immunity at Logic High Output		TBD		KV/ µs	
Common-Mode Transient Immunity at Logic Low Output		TBD		KV/ µs	
ESD PROTECTION (R_{IN} and T_{OUT} Pins)		±15		kV	Human Body Model Air Discharge
		±8		kV	Human Body Model Contact Discharge

1 Enable/disable threshold is the VCC voltage at which the internal DC-to-DC converter is enabled/disabled.
2 To maintain datasheet specifications no current should be drawn from V_{ISO}.
3 Guaranteed by design

TARGET SPECIFICATIONS

All voltages are relative to their respective ground. All min/max specifications apply over the entire recommended operating range, unless otherwise noted. All typical specifications in Table 2 are at T_A = 25°C, V_{CC} = 3.3V (DC-to-DC converter disabled), the secondary side is powered externally by V_{ISO}=3.3V, unless otherwise noted.

Table 2.

Parameter	Min	Typ	Max	Unit	Test Conditions/Comments
DC CHARACTERISTICS					
V_{CC} Operating Voltage Range	3.0		3.7	V	
DC-to-DC Converter Disable Threshold, $V_{CC(Disable)}$ [1]			3.7	V	
DC-to-DC CONVERTER DISABLED					
V_{ISO}	3.0		5.5	V	
Primary Side Supply Input Current, $I_{CC(Disable)}$			TBD	mA	No Load
Secondary Side Supply Input Current, $I_{ISO(Disable)}$			TBD	mA	R_L=3kΩ
LOGIC					
Transmitter Input, T_{IN}					
Logic Input Current, I_{TIN}	-10	+0.01	+10	µA	
Logic Low Input Threshold, V_{TINL}	0.3 V_{CC}			V	
Logic High Input Threshold, V_{TINH}			0.7 V_{CC}	V	
Receiver Output, R_{OUT}					
Logic High Output V_{ROUTH}	V_{CC} – 0.1	V_{CC}		V	I_{ROUTH}= - 20 µA
	V_{CC} – 0.5	V_{CC} – 0.2		V	I_{ROUTH} = - 4 mA
Logic Low Output V_{ROUTL}		0.0	0.1	V	I_{ROUTH} = 20 µA
		0.0	0.4	V	I_{ROUTH} = 4 mA
RS-232					
RECEIVER					
EIA-232 Input Voltage Range [2]	−30		+30	V	
EIA-232 Input Threshold Low	0.6	1.3		V	
EIA-232 Input Threshold High		1.6	2.4	V	
EIA-232 Input Hysteresis		0.4		V	
EIA-232 Input Resistance	3	5	7	kΩ	
TRANSMITTER					
Output Voltage Swing (RS-232)	±5	±5.7		V	V_{ISO} = 3.3V, R_L = 3kΩ to Gnd
Transmitter Output Resistance	300			Ω	V_{ISO} = 0V
RS-232 Output Short Circuit Current		TBD		mA	
TIMING CHARACTERISTICS					
Maximum Data Rate	460			kbps	V_{ISO} = 3.3V, R_L = 3kΩ to7kΩ, C_L=50 pF to 1000pF
Receiver Propagation Delay					
t_{PHL}		190		µs	
t_{PLH}		135		µs	
Transmitter Propagation Delay		650		µs	R_L = 3kΩ, C_L=1000 pF
Transmitter Skew		80		ns	
Receiver Skew		55		ns	
Transition Region Slew Rate[2]	5.5	10	30	V/µs	+3V to -3V, or -3V to +3V, V_{cc} = 3.3V, R_L=3kΩ, C_L=1000pF, T_A=25C.
AC SPECIFICATIONS					
Output Rise, t_R/Fall time, t_F (10% to 90%)		2.3		ns	C_L = 15 pF, CMOS signal levels
Common-Mode Transient Immunity at Logic High Output		TBD		KV/ µs	
Common-Mode Transient Immunity at Logic Low Output		TBD		KV/ µs	
ESD PROTECTION (R_{IN} and T_{OUT} Pins)		±15		kV	Human Body Model Air Discharge
		±8		kV	Human Body Model Contact Discharge

1 Enable/disable threshold is the VCC voltage at which the internal DC-to-DC converter is enabled/disabled.
2 Guaranteed by design

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ABSOLUTE MAXIMUM RATINGS

Table 6.

Parameter	Rating
V_{CC}	−0.3 V to +6 V
V+	(V_{CC} − 0.3 V) to +13 V
V−	+0.3 V to −13 V
Input Voltages	
T_{IN}	−0.3 V to (V+, +0.3 V)
R_{IN}	±30 V
Output Voltages	
T_{OUT}	±15 V
R_{OUT}	−0.3 V to (V_{CC} + 0.3 V)
Short Circuit Duration	
T_{OUT}	Continuous
Power Dissipation	
Power dissipation CP-12	TBD
θ_{JA}, Thermal Impedance	TBD
Operating Temperature Range	
Industrial	−40°C to +85°C
Storage Temperature Range	−65°C to +150°C
Pb-Free Temperature (Soldering, 30 sec)	260°C

Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ESD CAUTION

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

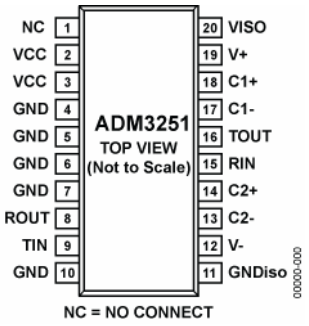

Figure 2. ADM3251E Pin Configuration

Table 7. Pin Function Descriptions

Pin No.	Mneumonic	Description
1	NC	Not Connected
2	V_{cc}	Power Supply Input
3	V_{cc}	Power Supply Input
4	GND	Ground Pin
5	GND	Ground Pin
6	GND	Ground Pin
7	GND	Ground Pin
8	R_{OUT}	Receiver Output. This outputs CMOS output logic levels.
9	T_{IN}	Transmitter (Driver) Input. This input accepts TTL/CMOS levels.
10	GND	Ground Pin
11	GND_{ISO}	Ground reference for Isolator Primary Side.
12	V-	Internally Generated Negative Supply
13	C2-	External Capacitor 2 is connected between pins 13 and 14. A 0.1µF capacitor is recommended but larger capacitors up to 47uF may be used.
14	C2+	External Capacitor 2 is connected between pins 13 and 14. A 0.1µF capacitor is recommended but larger capacitors up to 47uF may be used.
15	R_{IN}	Receiver Input. This input accepts RS-232 signal levels.
16	T_{OUT}	Transmitter (Driver) Output. This outputs RS-232 signal levels.
17	C1-	External Capacitor 1 is connected between pins 17 and 18. A 0.1µF capacitor is recommended but larger capacitors up to 47uF may be used.
18	C1+	External Capacitor 1 is connected between pins 17 and 18. A 0.1µF capacitor is recommended but larger capacitors up to 47uF may be used.
19	V+	Internally Generated Positive Supply
20	V_{ISO}	Isolated Supply Voltage for Isolator Secondary Side.

OUTLINE DIMENSIONS

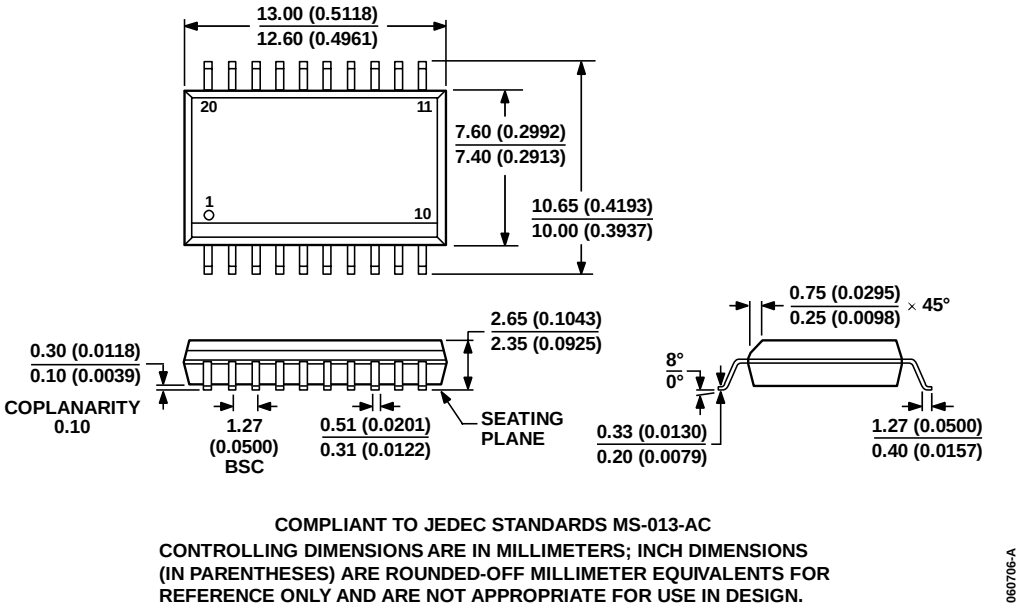

Figure 5. 20-Lead Standard Small Outline Package. Dimensions shown in millimeters and (inches).