XR33202

Wide Supply TIA-485/TIA-422 Transceiver with 1.65V-5.5V I/O Interface

Description

The XR33202 is a high performance TIA-485/TIA-422 transceiver designed to meet the increasing system requirements found in today's portable/handheld, process control and industrial equipment environments. This is a wide supply (3.0V to 5.5V) device that operates at maximum data rate of 20Mbps and features a 1.65V to 5.5V I/O logic supply, simplifying multi-voltage system interfacing requirements.

The receiver includes full fail-safe circuitry, guaranteeing a logic-high receiver output when the receiver inputs are open, shorted or undriven. The XR33202 receiver input impedance is at least 96kΩ (1/8 unit load), allowing more than 256 devices on the bus.

The driver is protected by short circuit detection as well as thermal shutdown and maintains high impedance in shutdown or when powered off. The XR33202 does not have slew limiting and is intended for high speed applications requiring data rates up to 20Mbps.

The DE and $\overline{RE}$ pins include hot swap circuitry to prevent false transitions on the bus during power up or live insertion and can enter a 1µA low current shutdown mode for extreme power savings.

The XR33202 is a half-duplex device that operates at max data rates of 20Mbps. It is available in a 10-pin DFN package.

FEATURES

- Wide 3.0V to 5.5V supply operation
- 1.65V to 5.5V I/O logic interface VL pin
- Enhanced receiver fail-safe protection for open, shorted or terminated but idle data lines
- Hot swap glitch protection on DE and $\overline{RE}$ Pins
- Robust ESD (Electrostatic Discharge) protection for TIA-485 bus pins
  - ±15kV human body model
  - ±15kV IEC61000-4-2 air discharge
  - ±8kV IEC61000-4-2 contact discharge
- Driver short circuit limit and thermal shutdown for overload protection
- -40°C to 125°C ambient operating temperature range
- Lead-free (RoHS 6) DFN

APPLICATIONS

- Portable and handheld equipment
- Industrial and process control equipment
- Point-of-sale equipment
- Building security and automation

Typical Application

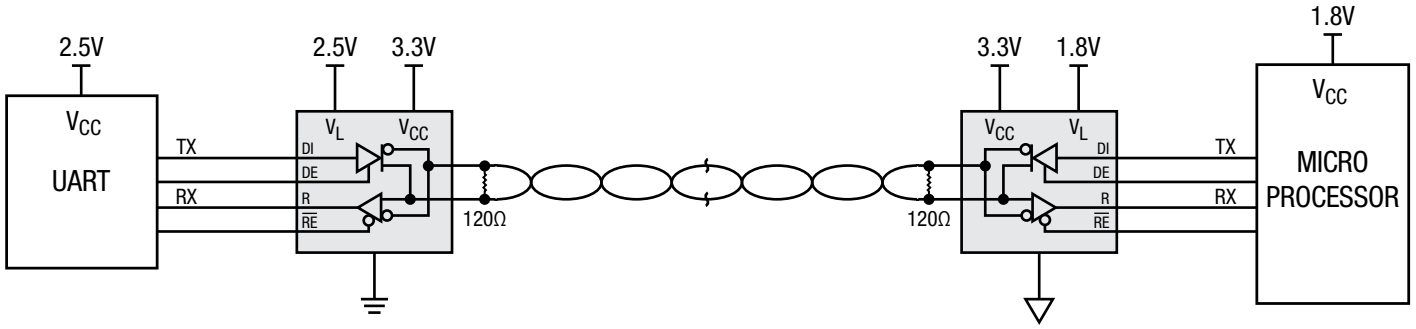


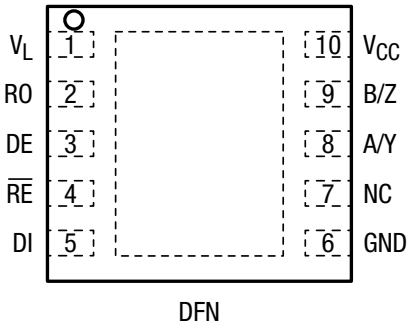
Figure 1. Typical Application

Absolute Maximum Ratings

Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Maximum Rating condition for extended periods may affect device reliability and lifetime.

Supply voltage (V_{CC})		-0.3V to 7.0V
Logic interface voltage (V_L)		$V_L \le V_{CC}$
Junction temperature		150ºC
Input voltages	DE and DI	-0.3V to 6.0V
	$\overline{RE}$	-0.3V to (V_L + 0.3V)
Output voltage	RO	-0.3V to (V_L + 0.3V)
Driver output voltage	A/Y, B/Z	±18V
Receiver input voltages	A/Y, B/Z	±18V
Operating Conditions		
Operating temperature range		-40°C to 125°C
V_{CC} supply range		3.0V to 5.5V
V_L I/O supply range (VL ≤ V_{CC})		1.65V to 5.5V
Thermal Information		
θ_{JA}		40.5°C/W
θ_{JC}		8.5°C/W

Pin Configuration



DFN

Pin Functions

Pin Number	Pin Name	Type	Description
1	V_L	Supply	I/O power supply, sets the logic levels for RO, DE, $\overline{RE}$ and DI
2	RO	Output	Receiver output
3	DE	Input	Driver enable, driver active when DE = 1, disabled when DE = 0
4	$\overline{RE}$	Input	Receiver enable, receiver is disabled when $\overline{RE}$ = 1, enabled when $\overline{RE}$ = 0
5	DI	Input	Driver input
6	GND	Supply	Ground
7	NC		No connection, can be connected to ground
8	A/Y	I/O	±15kV ESD protected, TIA-485/TIA-422 half-duplex non-inverting receiver input and non-inverting driver output
9	B/Z	I/O	±15kV ESD protected, TIA-485/TIA-422 half-duplex inverting receiver input and inverting driver output
10	V_{CC}	Supply	Power supply
*	Paddle		Exposed paddle (DFN package), connect to ground

Electrical Characteristics

Specifications are at T_A = 25°C, V_{CC} = 3.3V±10% or 5.0V±10%, V_L = V_{CC} unless otherwise noted. Typical values represent the most likely parametric norm at T_A = 25°C, and are provided for reference purposes only.

Symbol	Parameter	Conditions	Min	Typ	Max	Units
Driver DC Characteristics						
V_{OD}	Differential driver output	RL = 100Ω (TIA-422), V_{CC} = 3.0V	2.0			V
		RL = 54Ω (TIA-485), V_{CC} = 3.0V	1.5			V
		RL = 100Ω (TIA-422), V_{CC} = 4.5V	2.25			V
		RL = 54Ω (TIA-485), V_{CC} = 4.5V	2.25			V
ΔV_{OD}	Change in magnitude of differential output voltage	RL = 100Ω or 54Ω	-0.2		0.2	V
V_{CM}	Driver common-mode output voltage (steady state)	RL = 100Ω or 54Ω		$V_{CC/2}$	3	V
ΔV_{CM}	Change in magnitude of common-mode output voltage	RL = 100Ω or 54Ω	-0.2		0.2	V
$I_{A, B}$	Input current (A and B)	V_{OUT} = 12V, DE = 0V V_{CC} = 0V or 5.5V			125	µA
		V_{OUT} = -7V, DE = 0V V_{CC} = 0V or 5.5V	-100			µA
I_{OL}	Output leakage (Y and Z)	V_{OUT} = 12V, DE = 0V V_{CC} = 0V or 5.5V			125	µA
		V_{OUT} = -7V, DE = 0V V_{CC} = 0V or 5.5V	-100			µA
I_{OSD}	Driver short-circuit output current	-7V ≤ V_{OUT} ≤ +12V	-250		250	mA
Receiver DC Characteristics						
V_{TH}	Receiver differential threshold voltage (V_A - V_B)	-7V ≤ V_{CM} ≤ 12V	-200	-125	-50	mV
ΔV_{OH}	Receiver input hysteresis	V_{CM} = 0V		25		mV
R_{IN}	Receiver input resistance	-7V ≤ V_{CM} ≤ 12V	96			kΩ
I_{OSC}	Receiver output short-circuit current	0V ≤ V_{RO} ≤ V_L	-120		120	mA
Logic Inputs and Outputs						
V_{IH}	Logic input thresholds (DI, DE, $\overline{RE}$) 1.65V ≤ V_L ≤ 5.5V & V_L ≤ V_{CC}	Logic input high	2/3*V_L			V
V_{IL}		Logic input low			1/3*V_L	V
V_{HYS}	Input hysteresis (DI, DE, $\overline{RE}$)			50		mV
I_{IN}	Logic input current (DI, DE, $\overline{RE}$)	0V ≤ V_{IN} ≤ V_L, after first transition			1	µA
I_{INHS}	Logic input current hot swap (DE and $\overline{RE}$)	Until first transition			±320	µA
V_{OH}	Receiver output high voltage (RO)	3.0V ≤ V_L ≤ 5.5V, I_{OUT} = -1mA 1.6V ≤ V_L ≤ 3.0V, I_{OUT} = -1mA	V_L - 0.6			V
V_{OL}	Receiver output low voltage (RO)	3.0V ≤ V_L ≤ 5.5V, I_{OUT} = 1mA 1.6V ≤ V_L ≤ 3.0V, I_{OUT} = 1mA			0.4	V
I_{OZR}	High-Z receiver output current	0V ≤ V_{OUT} ≤ V_L	-1		1	µA

Electrical Characteristics

Specifications are at T_A = 25°C, V_{CC} = 3.3V±10% or 5.0V±10%, V_L = V_{CC} unless otherwise noted. Typical values represent the most likely parametric norm at T_A = 25°C, and are provided for reference purposes only.

Symbol	Parameter	Conditions	Min	Typ	Max	Units
Supply						
V_{CC}	Supply voltage range		3.0		5.5	V
I_{CC}	Supply current	No load. $\overline{RE}$ = 0V, DE = V_L, DI = 0V		400	600	µA
		No load. $\overline{RE}$ = V_L, DE = V_L, DI = 0V		300	600	µA
		No load. $\overline{RE}$ = 0V, DE = 0V, receiver A and B inputs open		300	500	µA
I_{SHDN}	Supply current in shutdwon mode	$\overline{RE}$ = V_L, DE = 0V		0.05	3	µA
ESD Protection						
	ESD protection for TIA-485 bus pins (A/Y, B/Z)	Human body model (HBM)		±15		kV
		IEC 61000-4-2 airgap		±15		kV
		IEC 61000-4-2 contact		±8		kV
	ESD protection for all other pins	Human body model (HBM)		±4		kV

Driver AC Characteristics - XR33202

Specifications are at T_A = 25°C, V_{CC} = 3.3V±10% or 5.0V±10%, V_L = V_{CC} unless otherwise noted. Typical values represent the most likely parametric norm at T_A = 25°C, and are provided for reference purposes only.

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{DPLH}	Driver prop. delay (low to high)	C_L = 50pF, R_L = 54Ω,			30	ns
t_{DPHL}	Driver prop. delay (high to low)				30	ns
$\lvert t_{DPLH}-t_{DPHL} \rvert$	Differential driver output skew				5	ns
t_{DR}, t_{DF}	Driver differential output rise or fall time				17	ns
	Maximum data rate	$1/t_{UI}$, duty cycle 40% to 60%	20			Mbps
t_{DZH}	Driver enable to output high	C_L = 50pF, R_L = 500Ω,			50	ns
t_{DZL}	Driver enable to output low				50	ns
t_{DHZ}	Driver disable from output high				50	ns
t_{DLZ}	Driver disable from output low				50	ns
$t_{DZH(SHDN)}$	Driver enable from shutdown to output high	C_L = 50pF, R_L = 500Ω,			250	ns
$t_{DZL(SHDN)}$	Driver enable from shutdown to output low				250	ns
t_{SHDN}	Time to shutdown		50	200	600	ns

Receiver AC Characteristics - XR33202

Specifications are at T_A = 25°C, V_{CC} = 3.3V±10% or 5.0V±10%, V_L = V_{CC} unless otherwise noted. Typical values represent the most likely parametric norm at T_A = 25°C, and are provided for reference purposes only.

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{RPLH}	Receiver prop. delay (low to high)	C_L = 50pF, R_L = 54Ω			50	ns
t_{RPHL}	Receiver prop. delay (high to low)				50	ns
$\lvert t_{RPLH}-t_{RPHL}\rvert$	Receiver propagation delay skew				5	ns
	Maximum data rate	$1/t_{UI}$, duty cycle 40% to 60%	20			Mbps
t_{RZH}	Receiver enable to output high	C_L = 50pF, R_L = 1kΩ,			50	ns
t_{RZL}	Receiver enable to output low				50	ns
t_{RHZ}	Receiver disable from output high				50	ns
t_{RLZ}	Receiver disable from output low				50	ns
$t_{RZH(SHDN)}$	Receiver enable from shutdown to output high	C_L = 50pF, R_L = 1kΩ,			2200	ns
$t_{RZL(SHDN)}$	Receiver enable from shutdown to output low				2200	ns
t_{SHDN}	Time to shutdown		50	200	600	ns

Block Diagram

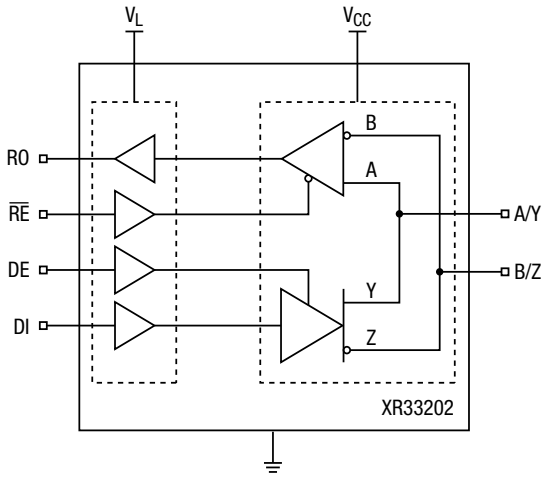
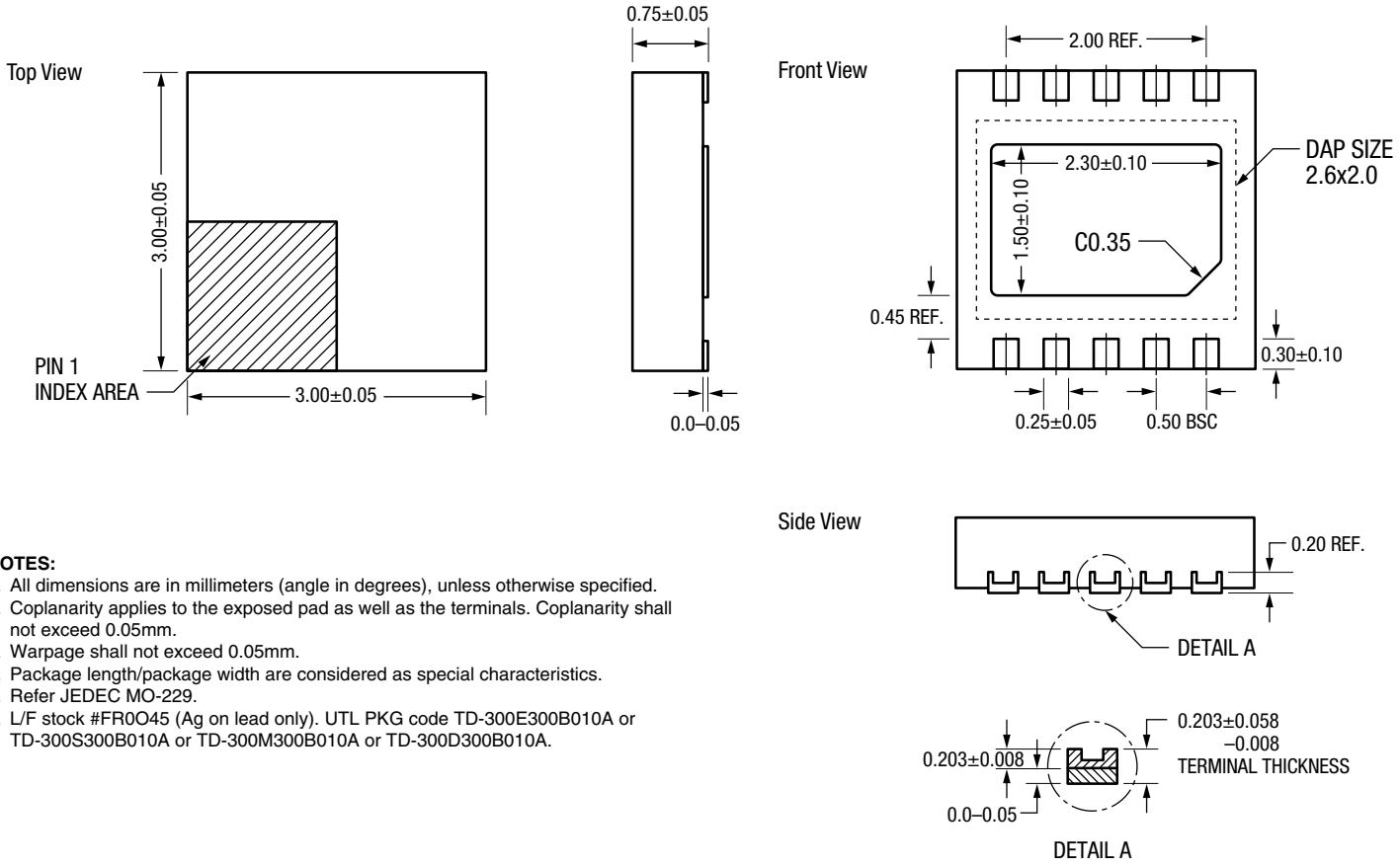


Figure 2. Block Diagram

Package Description

10-Pin DFN Package (3mm x 3mm)



NOTES:
1. All dimensions are in millimeters (angle in degrees), unless otherwise specified.
2. Coplanarity applies to the exposed pad as well as the terminals. Coplanarity shall not exceed 0.05mm.
3. Warpage shall not exceed 0.05mm.
4. Package length/package width are considered as special characteristics.
5. Refer JEDEC MO-229.
6. L/F stock #FR0O45 (Ag on lead only). UTL PKG code TD-300E300B010A or TD-300S300B010A or TD-300M300B010A or TD-300D300B010A.

Order Information

Part Number	Package	Environmental Rating	Operating Temperature Range
XR33202EEHB-F	10-pin DFN	Green	-40°C to 125°C
XR33202EEHBTR-F	10-pin DFN	Green	-40°C to 125°C

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