Features

- Meet the Requirements of the EIA/TIA-485 Standards with 5V Power Supply
- Integrated Transient Voltage Suppressor (TVS)
- TVS Protection for Bus Terminals :
  ±30 kV IEC 61000-4-2, Contact/Air Discharge
  ±88 A IEC 61000-4-4, EFT (5/50ns)
  ±30 A IEC 61000-4-5, Surge (8/20μs)
- **HBM ±15kV** ESD Protection for all pins
- **MM ±800V** ESD Protection for all pins
- Latchup immunity up to **±400mA**.
- High CDM protection up to **±2kV**.
- True Fail-Safe Receiver While Maintaining EIA/TIA-485 Compatibility
- Hot-Swap Glitch free Protection on Control Inputs
- Up to 256 Transceivers on the Bus
- Maximum Baud Rate up to **10Mbps**

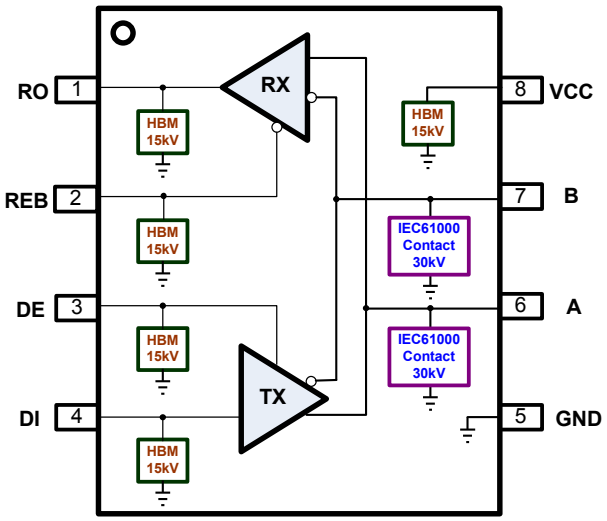
Applications

- Motor Control
- Industrial Control
- Telecommunications Equipment
- Security System
- Building Automation Networks

Description

The AZRS3088 is a ±30 kV IEC 61000-4-2 Contact/Air Discharge protected, half-duplex transceiver designed for RS-485 data bus network, which contains one transmitter and one receiver. This device is fully compliant with the EIA/TIA-485 standard with 5V power supply.

The AZRS3088 features a fail-safe receiver, which guarantees the receiver to output high when the receiver inputs are open, short or idle.
The AZRS3088 features a hot-swap glitch free protection circuits which guarantee outputs of both the transmitter and the receiver in a high impedance state during the power up period. So that the large short current from power to ground will be disable by glitch free function, which will save the power and enhance the efficiency of the power up.
The AZRS3088 is optimized for signal rates up to 10Mbps with differential voltage of 2.3V. The AZRS3088 also has the thermal shutdown function when the temperature is over 150℃ and the protection of the current limitation in the transmitter to protect the itself from the damage by the system-fault conditions during normal operation.
The AZRS3088 is also a high reliable device with built-in system level ESD protector device (TVS) against high-energy noise transients without any external components.



Functional Block of AZRS3088

Part Number	Duplex	Tx/Rx	Supply	Data Rate (Mbps)	Fail-safe	HBM on All pins	IEC 61000-4-5 Surge on A,B	IEC 61000-4-2 Contact on A,B	Package Type
AZRS3088	Half	1/1	5	10	Yes	±15kV	±30A	± 30kV	SO-8

ABSOLUTE MAXIMUM RATINGS

PARAMETER	PARAMETER	RATING	UNITS
Power Supply Vcc	Vcc	-0.3 to 8.0	V
Control Input Voltage	REB, DE	-0.3 to (Vcc+ 0.3)	V
Receiver Input Voltage	A, B	±13	V
Receiver Output Voltage	RO	-0.3 to (Vcc+ 0.3)	V
Transmitter Output Voltage	A, B	±13	V
Transmitter Input	DI	-0.3 to (Vcc+ 0.3)	V
Operating Temperature	T_{OP}	-40 to +85	°C
Storage Temperature	T_{STO}	-65 to +150	°C

DC ELECTRICAL CHARACTERISTICS

(Vcc=5V ±5% with T_{AMB}= T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at Vcc=5V and T_{AMB}= 25 °C.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
TRANSMITTER							
Differential Transmitter Output	V_{OD1}	No load				5	V
Differential Transmitter Output	V_{OD2}	Fig.1, R_L= 27 Ω		1.7			V
Change in Magnitude of Differential Output Voltage	ΔV_{OD}	Fig.1, R_L= 27 Ω				0.2	V
Transmitter Common- Mode Output Voltage	V_{OC}	Fig.1, R_L= 27 Ω				3	V
Change in Magnitude of Common- Mode Voltage	ΔV_{OC}	Fig.1, R_L= 27 Ω				0.2	V
Input High Voltage	V_{IH}	DE, DI, REB		2.0			V
Input Low Voltage	V_{IL}	DE, DI, REB				0.8	V
Input Current	I_{IN1}	DI				±1	μA
Input Current	I_{IN2}	DE, REB				±50	μA
DI Input Hysteresis	V_{HYS}				100		mV
Input Current (A and B)	I_{IN3}	DE = GND, VCC = GND or 5.25V	V_{IN} = 12V			125	μA
			V_{IN} = -7V			-75	
Transmitter Short-Circuit Output Current	I_{OS}	-7V ≤ V_{OUT} ≤ Vcc		-250			mA
		0V ≤ V_{OUT} ≤ 12V				250	
RECEIVER							
Receiver Differential Threshold Voltage	V_{TH}	-7V ≤ V_{CM} ≤ +12V		-200	-125	-50	mV
Receiver Input Hysteresis	ΔV_{TH}				25		mV
Receiver Output High Voltage	V_{OH}	Io= -4mA, VID= -50mV		Vcc-1.5			V
Receiver Output Low Voltage	V_{OL}	Io= 4mA, VID= -200mV				0.4	V
Three- State Output Current at Receiver	I_{OZR}	0.4V ≤ V_{CM} ≤ 2.4V				±1	μA
Receiver Input Resistance	R_{IN}	-7V ≤ V_{CM} ≤ +12V		96			kΩ
Receiver Output Short-Circuit Current	I_{OSR}	Fig.6 , 0V ≤ V_{RO} ≤ Vcc		±7		±95	mA

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
SUPPLY CURRENT							
Supply Current	Icc	No load, REB= GND, DI= Vcc or GND.	DE= Vcc		420	600	µA
			DE= GND		320	500	µA
Supply Current in Shutdown Mode	I_{SHDN}	REB= Vcc, DE= GND			1n	10µ	A

SWITCHING CHARACTERISTICS

(Vcc=5V ±5% with T_{AMB}= T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at Vcc=5V and T_{AMB}= 25 °C.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Transmitter Input to Output	t_{DPLH}, t_{DPHL}	Fig.2 and 7, R_{DIFF}=54Ω, C_{L1}=C_{L2}= 100pF		35	60	ns
Transmitter Output Skew $\lvert t_{DPLH} - t_{DPHL} \rvert$	t_{DSKEW}	Fig.2 and 7, R_{DIFF}=54Ω, C_{L1}=C_{L2}= 100pF		5	±10	ns
Transmitter Rise or Fall Time	t_{DF}, t_{DR}	Fig.2 and 7, R_{DIFF}=54Ω, C_{L1}=C_{L2}= 100pF		15	25	ns
Maximum Data Rate	f_{MAX}			10		Mbps
Transmitter Enable to Output Low	t_{DZL}	Fig.4 and 8, C_{DL}= 100pF, S1 closed			150	ns
Transmitter Enable to Output High	t_{DZH}	Fig.4 and 8, C_{DL}= 100pF, S2 closed			150	ns
Transmitter Disable Time from Low	t_{DLZ}	Fig.4 and 8, C_{DL}= 15pF, S1 closed			100	ns
Transmitter Disable Time from High	t_{DHZ}	Fig.4 and 8, C_{DL}= 15pF, S2 closed			100	ns
Receiver Input to Output	t_{RPLH}, t_{RPHL}	Fig.5 and 9 , $\lvert V_{ID} \rvert \geq$ 2.0V; rise and fall time of $V_{ID} \leq$ 15ns		150	200	ns
$\lvert t_{RPLH} - t_{RPHL} \rvert$ Different Receiver Skew	t_{RSKD}	Fig.5 and 9, $\lvert V_{ID} \rvert \geq$ 2.0V; rise and fall time of $V_{ID} \leq$ 15ns		1	±10	ns
Receiver Enable to Output Low	t_{RZL}	Fig.3 and 10, C_{RL}= 100pF, S1 closed		20	50	ns
Receiver Enable to Output High	t_{RZH}	Fig.3 and 10, C_{RL}= 100pF, S2 closed		20	50	ns
Receiver Disable Time from Low	t_{RLZ}	Fig.3 and 10, C_{RL}= 100pF, S1 closed		20	50	ns
Receiver Disable Time from High	t_{RHZ}	Fig.3 and 10, C_{RL}= 100pF, S2 closed		20	50	ns
Time to Shutdown	t_{SHDN}		50	200	600	ns
Transmitter Enable from Shutdown to Output Low	$t_{DZL(SHDN)}$	Fig.4 and 8, C_{DL}= 15pF, S1 closed			250	ns
Transmitter Enable from Shutdown to Output High	$t_{DZH(SHDN)}$	Fig.4 and 8, C_{DL}= 15pF, S2 closed			250	ns
Receiver Enable from Shutdown to Output Low	$t_{RZL(SHDN)}$	Fig.3 and 10, C_{RL}= 100pF, S1 closed			3000	ns
Receiver Enable from Shutdown to Output High	$t_{RZH(SHDN)}$	Fig.3 and 10, C_{RL}= 100pF, S2 closed			3000	ns

PIN FUNCTION DESCRIPTION

Pin Number	Mnemonic	Function
1	RO	Receiver Output: When REB is low and if (A - B) ≥ -50mV, RO is high; if (A - B) ≤ -200mV, RO is low.
2	REB	Receiver Output Enable: REB is low to enable the Receiver; REB is high to disable the Receiver.
3	DE	Transmitter Output Enable: DE is high to enable the transmitter; DE is low to disable the transceiver.
4	DI	Transmitter Input: When DE is high, a low on DI forces A output low and B output high. Similarly, a high on DI forces A output high and B output low.
5	GND	Ground pin. Must be connected to 0V.
6	A	Non-inverting Receiver Input and Non-inverting Transmitter Output
7	B	Inverting Receiver Input and Inverting Transmitter Output
8	VCC	Power Supply Input 5V.

FUNCTION TABLE

TRANSMITTING				
INPUTS			OUTPUTS	
REB	DE	DI	A	B
X	1	0	0	1
X	1	1	1	0
0	0	X	HIGH- Z	HIGH- Z
1	0	X	Shutdown	

X= Don't care

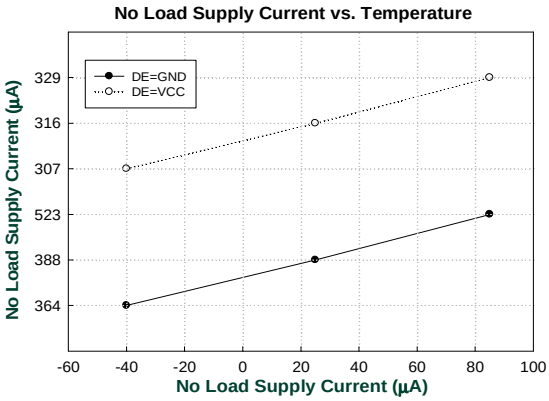
HIGH- Z= High impedance

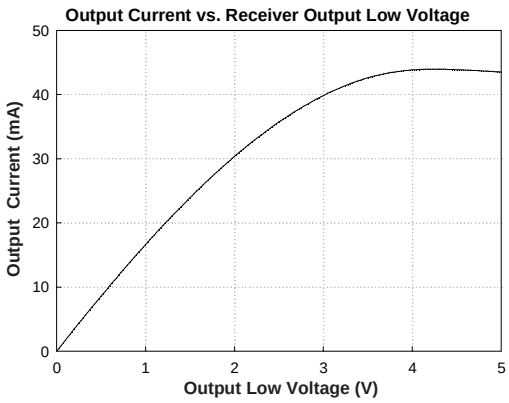
RECEIVING			
INPUTS			OUTPUTS
REB	DE	A - B	RO
0	X	≥ –0.05 V	1
0	X	≤ –0.2 V	0
0	X	Open/Shorted	1
1	1	X	HIGH- Z
1	0	Shutdown	

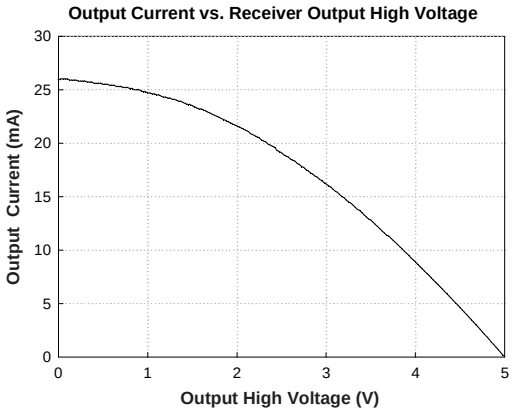
X= Don't care

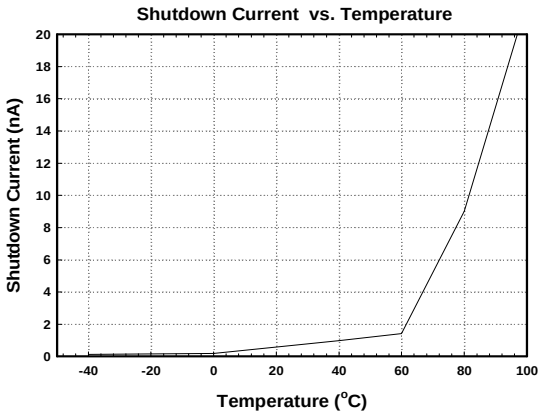
HIGH- Z= High impedance

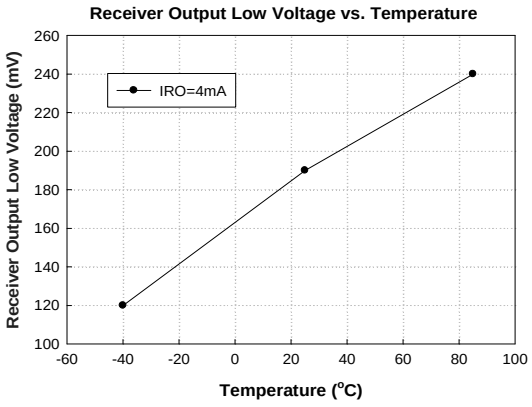
(Vcc = +5V, T_{AMB} = 25 °C, unless otherwise noted.)

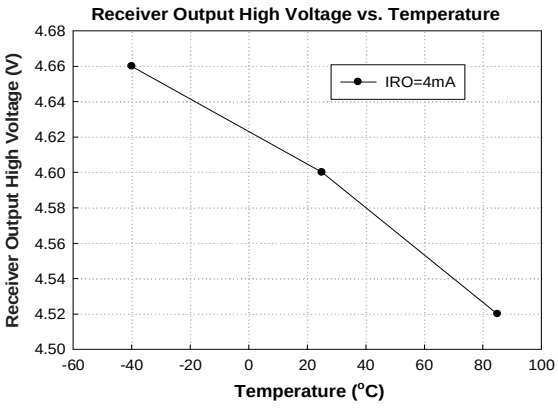


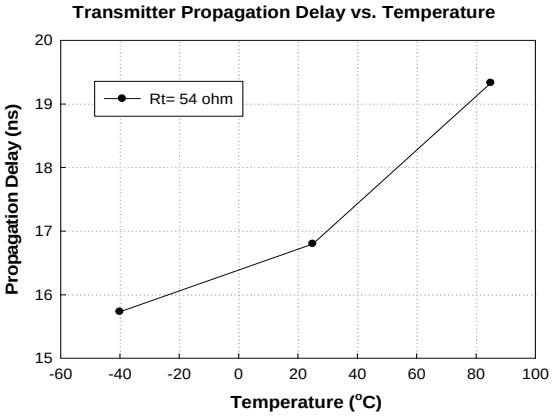


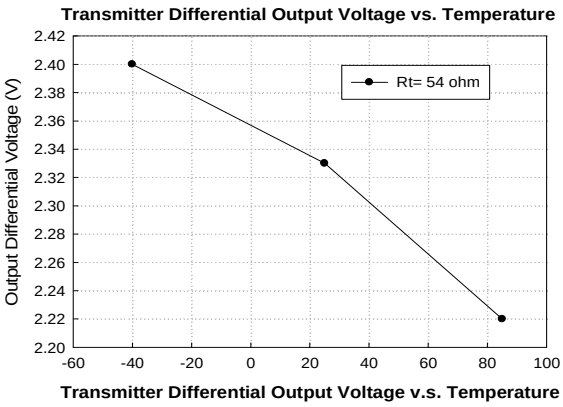












Detail Description

The AZRS3088 is a half-duplex RS-485 transceiver, which contains one transmitter and one receiver with 5V power supply. This device is fully compliant with the EIA/TIA-485 standard.

The AZRS3088 features a fail-safe receiver, which guarantees the receiver output high when the receiver inputs are open, short or idle. This is the true fail-safe receiver, which can save both the external pull-high off-chip resistor on bus A and pull-low off-chip resistor on bus B.

The AZRS3088 features the hot-swap circuit which guarantees the outputs of both the transmitter and receiver in a high impedance state during the power-up period until the supply voltage has stabilized.

The AZRS3088 operates at signal rates up to 10Mbps and which also has the thermal shutdown function and the current limited protection in the transmitter to protect the device from damage by system fault conditions during normal operation.

The immunity of the latchup is up to ±400mA that will enhance the system to be more safety and reliable.

Transmitter

The design of the transmitter is a non-inverted translator that converts the TTL single-ended input signal to differential EIA/TIA-485 signal level. The transmitter of the AZRS3088 guarantees a 10Mbps data rate communication. When the transmitter is active (DE= HIGH), the single-end input signals of transmitter will be transported to differential output signals of the transmitter. Under the disable state (DE= LOW), the outputs of transmitter are stay at high impedance state. The driving ability of the transmitter is referred to the differential output voltage under loading condition, which meets the EIA/TIA 485 standard. The fully differential output of transmitter are connected to the differential input of the receiver due to half-duplex operation.

Receiver

The receiver of the AZRS3088 converts the differential EIA/TIA-485 signals to single-end output TTL signal when receiver is in active state (REB=LOW), which incorporates input filtering in addition to input hysteresis, which enhances noise immunity with differential signals that have very slow rise and fall times.

Fail-Safe

The AZRS3088 guarantees a receiver output high when the receiver inputs are short, open, or idle. The threshold voltage of receiver input is between -50mV and -200mV. If the differential receiver input voltage (A - B) is greater than or equal to -50mV, receiver output (RO) is logic-high. If (A - B) is less than or equal to -200mV, RO is logic-low. In the case of a terminated bus with all transmitters disabled, the receiver's differential input voltage (A - B) is 0V; therefore, the RO is logic-high at that time.

Transmitter Output Protection

The AZRS3088 has the current limitation function and the thermal shutdown protection in the transmitter. Firstly, the function of current limitation provides immediate protection against short circuits over the whole common-mode voltage range (-7V to +12V). Secondly, the function of thermal shutdown protection will be active to force the transmitter outputs into a high impedance state if the operating temperature is over 150 ^{o}C.

1/8 Unit Load

The RS-485 standard defines both receiver inputs impedance are 12kΩ (1 unit load) and the maximum 32-unit loads on the bus. The AZRS3088 transceiver has a 96kΩ input impedance (1/8 unit load) of the receiver, allowing up to 256 devices to be connected in parallel on the RS485 bus.

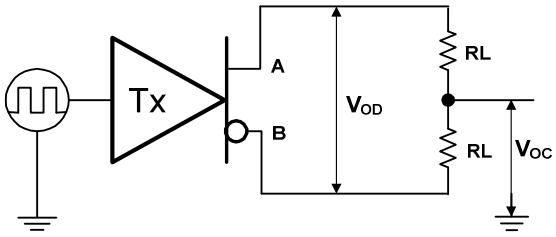


Fig.1 Transmitter DC test circuit

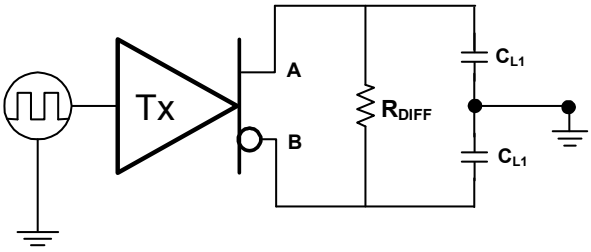


Fig.2 Transmitter timing test circuit

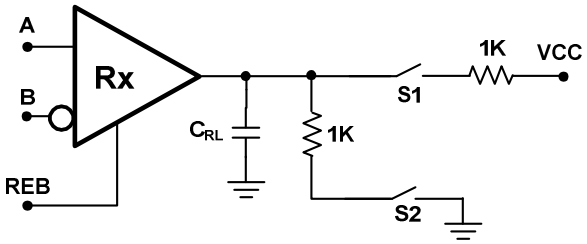


Fig.3 Receiver enable/disable timing test load

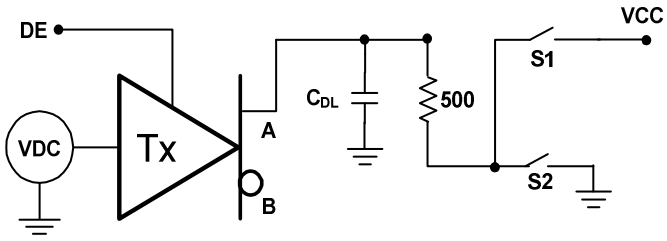


Fig.4 Transmitter enable/disable timing test load

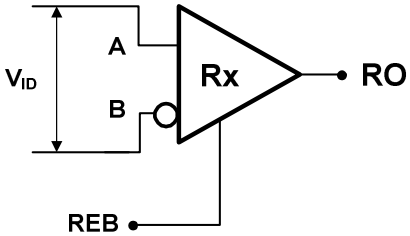


Fig.5 Receiver timing test circuit

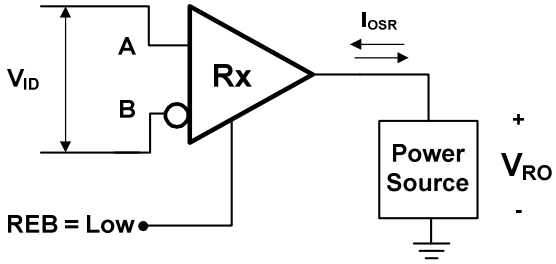


Fig.6 Receiver output short circuit

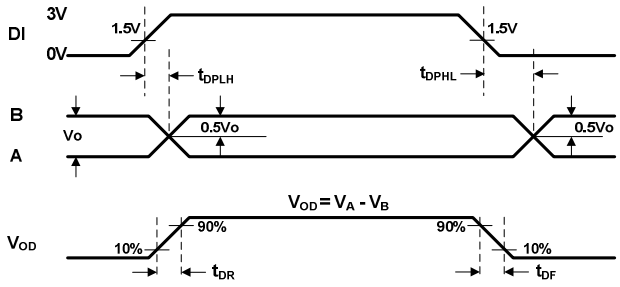


Fig.7 Transmitter Propagation Delays

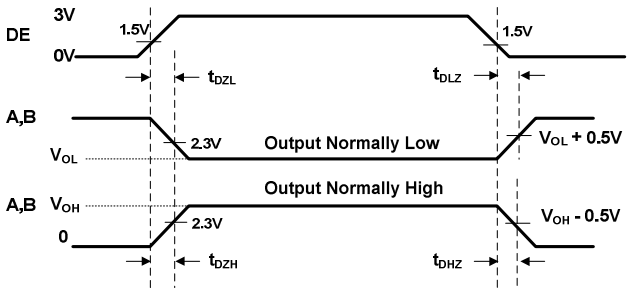


Fig.8 Transmitter Enable and Disable Times

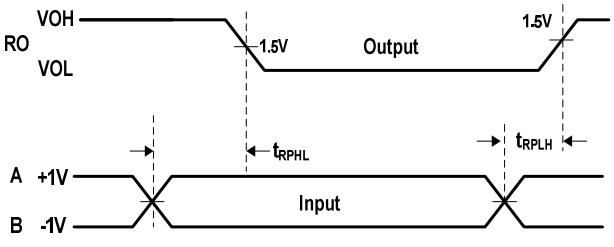


Fig.9 Receiver Propagation Delays

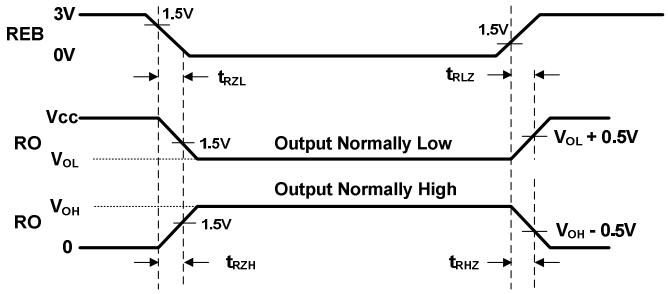


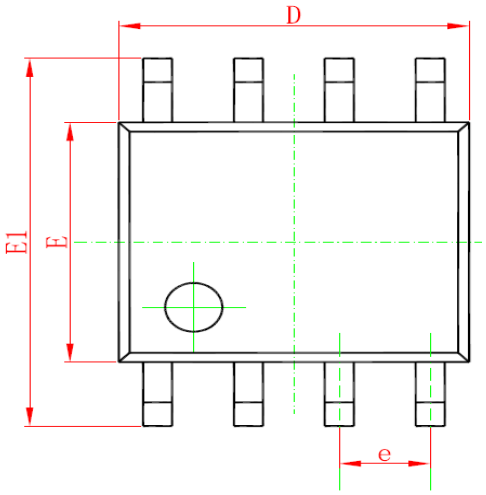
Fig.10 Receiver Enable and Disable Times

Mechanical Details

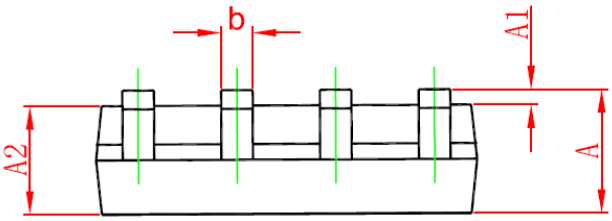
SO-8

PACKAGE DIAGRAMS

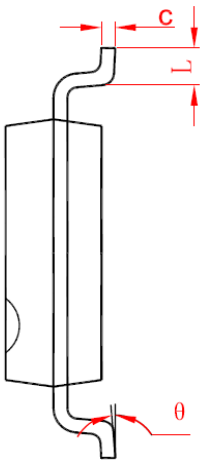
TOP VIEW



SIDE VIEW



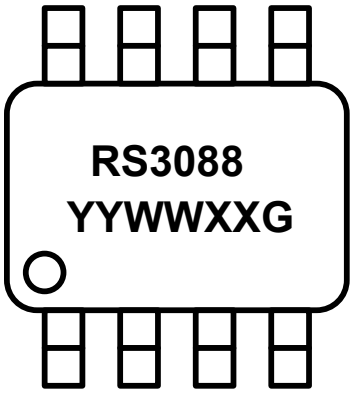
END VIEW



PACKAGE DIMENSIONS

Symbol	Millimeters		Inches	
	min	max	min	max
A	1.35	1.75	0.053	0.069
A1	0.10	0.25	0.004	0.010
A2	1.35	1.55	0.053	0.061
b	0.33	0.51	0.013	0.020
C	0.17	0.26	0.007	0.010
D	4.70	5.10	0.185	0.201
E	3.70	4.10	0.146	0.161
E1	5.80	6.20	0.228	0.244
e	1.27 BSC		0.05BSC	
L	0.40	1.27	0.016	0.050
Θ	0	8	0	8

MARKING CODE



RS3088 = Device Code
YYWWXX = Date Code
G = Green Part Indication

Part Number	Marking Code
AZRS3088	RS3088

Ordering Information

PN#	Material	Type	Reel size	MOQ/interal box	MOQ/carton
AZRS3088.RDG	Green	T/R	13 inch	1 reel=2,500/box	5 box=12,500/carton

Revision History

Revision	Modification Description
Revision 2010/12/30	The Preliminary Release.
Revision 2011/03/01	The Formal Release.
Revision 2011/03/21	Correct the Package type from SOP-8 to SO-8.
Revision 2011/05/25	Update the Company Logo.
Revision 2011/06/19	1. Add the Ordering Information. 2. Eliminate the index of L1 in the PACKAGE DIMENSIONS.