



## Features

- Integrated Transient Voltage Suppressor (TVS) in the Transceiver IC
- TVS Protection for Bus Terminals :
  - ±30 A IEC 61000-4-5, Surge (8/20μs)
  - ±30 kV IEC 61000-4-2, Contact/Air Discharge
  - ±4.0 kV IEC 61000-4-4, EFT (5/50ns)
- HBM ±15kV ESD Protection for all pins
- MM ±800V ESD Protection for all pins
- Latchup immunity up to ±400mA for all pins
- High CDM protection up to ±2kV for all pins
- Meet the Requirements of the EIA/TIA-485 Standards with 5V Power Supply
- 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

The AZRS5354P features a fail-safe receiver, which guarantees the output of the receiver to be logic high when the differential inputs (bus pins, A and B) of the receiver are open, short or idle under abnormal operating conditions.

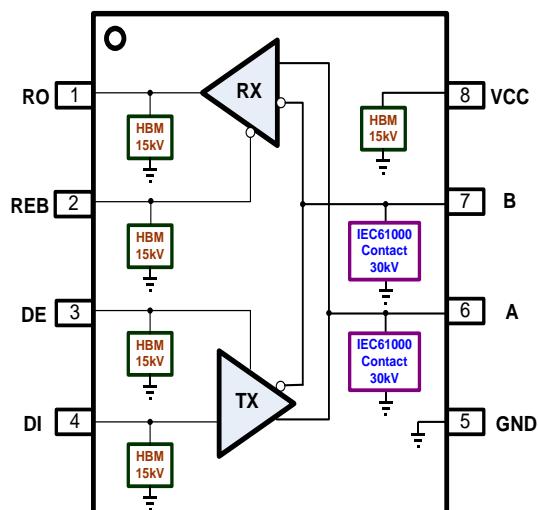
The AZRS5354P features a hot-swap glitch free design which guarantees outputs of the transmitter and the receiver in a high impedance state and even no short current event during the power up period. The AZRS5354P has the thermal shutdown and the current limited function in the transmitter to protect the device from damage by system fault conditions during normal operating condition. The AZRS5354P is designed 1/8 unit load with minimum 96kΩ of input impedance, which can connect 256 devices on a bus at most. The AZRS5354P is also a high reliable device with built-in system level ESD protected devices against high-energy noise transients without any external components.

## Applications

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

## Description

The AZRS5354P is a ±30kV IEC 61000-4-2 Contact/Air Discharge protected half-duplex RS485 transceiver IC, which contains one transmitter and one receiver inside. This device is fully compliant with the EIA/TIA-485 standard with 5V power supply.



Functional Block of AZRS5354P

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
AZRS5354P	Half	1/1	5	8	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	$\pm 13$	V
Receiver Output Voltage	RO	-0.3 to (Vcc+ 0.3)	V
Transmitter Output Voltage	A, B	$\pm 13$	V
Transmitter Input	DI	-0.3 to (Vcc+ 0.3)	V
Operating Temperature	T <sub>OP</sub>	-40 to +85	°C
Storage Temperature	T <sub>STO</sub>	-65 to +150	°C

## DC ELECTRICAL CHARACTERISTICS

(Vcc=5V  $\pm 5\%$  with T<sub>AMB</sub>= T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted. Typical values are at Vcc=5V and T<sub>AMB</sub>= 25 °C.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
<b>TRANSMITTER</b>						
Supply Voltage Range	Vcc		4.75		5.25	V
Differential Transmitter Output	V <sub>OD1</sub>	No load			Vcc	V
Differential Transmitter Output	V <sub>OD2</sub>	Fig.1, R <sub>L</sub> = 27Ω	1.5	2.4		V
Change in Magnitude of Differential Output Voltage	Δ V <sub>OD</sub>	Fig.1, R <sub>L</sub> = 27Ω			0.2	V
Transmitter Common- Mode Output Voltage	V <sub>OC</sub>	Fig.1, R <sub>L</sub> = 27Ω			3.1	V
Change in Magnitude of Common- Mode Voltage	Δ V <sub>OC</sub>	Fig.1, R <sub>L</sub> = 27Ω			0.2	V
Input High Voltage	V <sub>IH</sub>	DE, DI, REB	2.0			V
Input Low Voltage	V <sub>IL</sub>	DE, DI, REB			0.8	V
Input Current	I <sub>IN1</sub>	DI			$\pm 1$	μA
Input Current	I <sub>IN2</sub>	DE, REB			$\pm 50$	μA
DI Input Hysteresis	V <sub>HYS</sub>			100		mV
Input Current (A and B)	I <sub>IN3</sub>	DE = GND, VCC = GND or 5.25V	V <sub>IN</sub> = 12V		125	μA
			V <sub>IN</sub> = -7V	-75		
Transmitter Short-Circuit Output Current	I <sub>OS</sub>	-7V $\leq$ V <sub>OUT</sub> $\leq$ 12V, Vcc=5.0V	-250		250	mA
<b>RECEIVER</b>						
Receiver Differential Threshold Voltage	V <sub>TH</sub>		-200		-50	mV
Receiver Input Hysteresis	Δ V <sub>TH</sub>			25		mV
Receiver Output High Voltage	V <sub>OH</sub>	I <sub>O</sub> = -4mA, VID= -50mV	Vcc-1.5			V
Receiver Output Low Voltage	V <sub>OL</sub>	I <sub>O</sub> = 4mA, VID= -200mV			0.4	V
Three- State Output Current at Receiver	I <sub>OZR</sub>	0V $\leq$ V <sub>RO</sub> $\leq$ Vcc			$\pm 1$	μA
Receiver Input Resistance	R <sub>IN</sub>	-7V $\leq$ V <sub>CM</sub> $\leq$ +12V	96			kΩ



PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	
Receiver Output Short-Circuit Current	$I_{OSR}$	$Fig.6, 0V \leq V_{RO} \leq V_{CC}$			$\pm 95$	mA	
<b>SUPPLY CURRENT</b>							
Supply Current	$I_{CC}$	No load, REB=GND, DI=Vcc or GND.	DE= Vcc		420	800	$\mu A$
			DE= GND		320	600	$\mu A$

## SWITCHING CHARACTERISTICS

( $V_{CC}=5V \pm 5\%$  with  $T_{AMB}=T_{MIN}$  to  $T_{MAX}$ , unless otherwise noted. Typical values are at  $V_{CC}=5V$  and  $T_{AMB}=25^{\circ}C$ .)

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



## PIN FUNCTION DESCRIPTION

Pin Number	Mnemonic	Function
1	RO	Receiver Output: When REB is low and if $(A - B) \geq -50\text{mV}$ , RO is high; if $(A - B) \leq -200\text{mV}$ , 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. Must adding a 100nF decoupling capacitor as close to the VCC pin as possible.

## 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		Standby

X= Don't care

HIGH- Z= High impedance

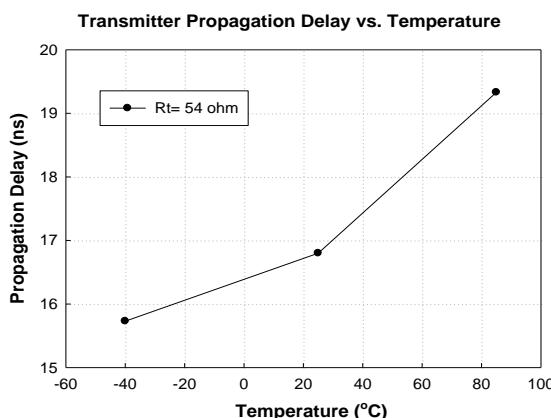
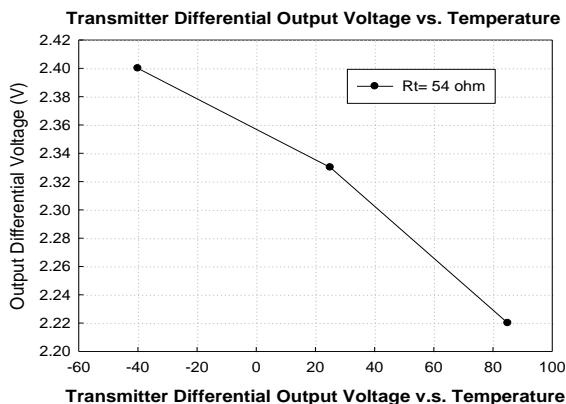
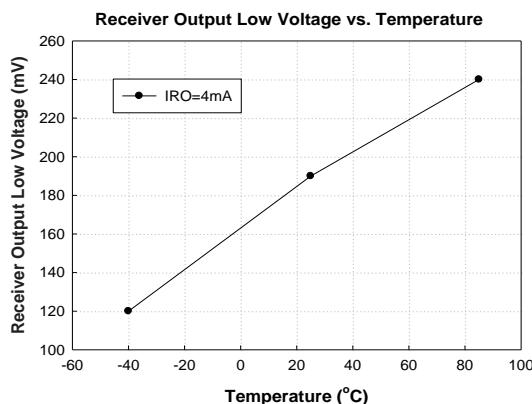
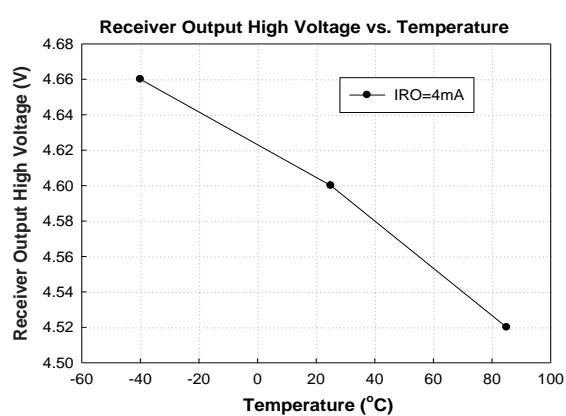
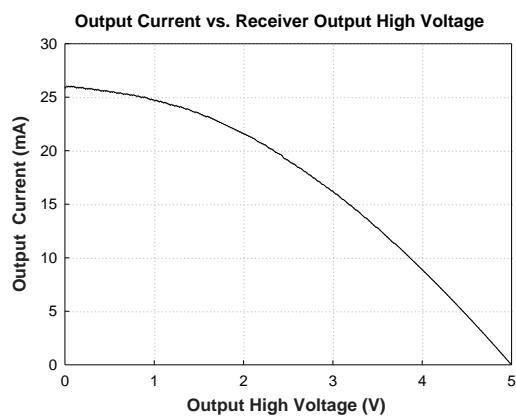
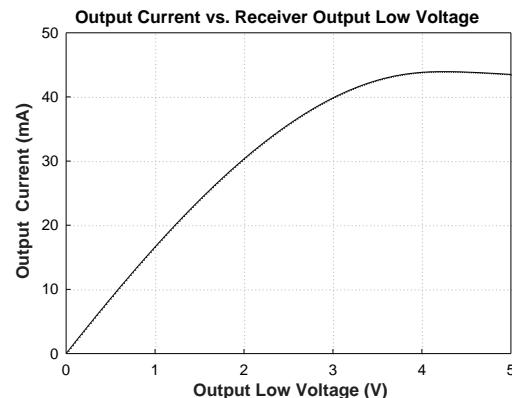
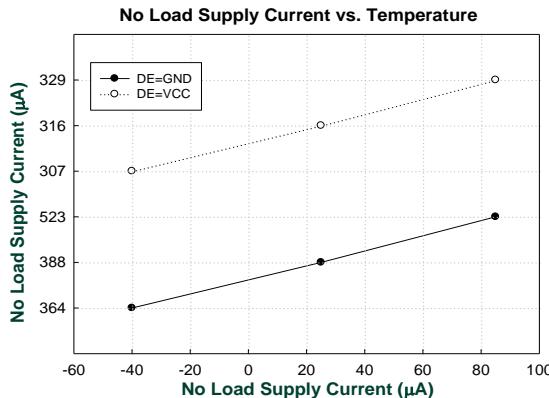
RECEIVING			
INPUTS			OUTPUTS
REB	DE	A - B	RO
0	0	$\geq -0.05\text{V}$	1
0	0	$\leq -0.2\text{V}$	0
0	0	Open/Shorted	1
1	1	X	HIGH- Z
1	0	X	Standby

X= Don't care

HIGH- Z= High impedance



( $V_{CC} = +5V$ ,  $T_{AMB} = 25^{\circ}C$ , unless otherwise noted.)





## Detail Description

The AZRS5354P is a half-duplex RS-485 transceiver IC with IEC61000-4-2 contact  $\pm 30\text{kV}$  ESD protection for bus pins (A and B), which contains one transmitter and one receiver inside with 5V power supply. This device is fully compliant with the EIA/TIA-485 standard.

The AZRS5354P features the hot-swap glitch free design which guarantees the outputs of the transceiver in a high impedance state during the power-up period until the supply voltage has stabilized. The AZRS5354P with whole chip ESD protected design for all of the I/O pins has robust ESD protection up to both HBM  $\pm 15\text{kV}$  and MM  $\pm 800\text{V}$ . Moreover, the latchup immunity of the AZRS5354P is up to  $\pm 400\text{mA}$  for all of the pins. For IC self-discharge issue, the CDM protection level of the AZRS5354P is up to  $\pm 2\text{kV}$ .

## Transmitter

The design of the transmitter is a non-inverted translator that converts the single-ended TTL input signal to differential EIA/TIA-485 signal level. The transmitter of the AZRS5354P guarantees 8Mbps data rate communication. When the transmitter is active (DE= HIGH), the single-end TTL input signals of transmitter will be transported to differential output RS485 signals of the transmitter. Under the disable state (DE= LOW), the outputs of transmitter keep at high impedance state. The differential output voltage VA-VB(VOD2) of the AZRS5354P is 2.4V with 54Ω load under Vcc = 5.0V, T= 25°C.

## Receiver

The receiver of the AZRS5354P 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. The input filtering

enhances the noise immunity under normal operating condition. When the receiver is disable (REB=HIGH), the output of the receiver keeps in high impedance state no matter what the input of the receiver is.

## True Fail-Safe

In traditional design, the fail-safe function is implemented by two resistors on the PCB. One resistor is terminated pin A to VCC; the other is terminated pin B to GND to keep RO at high state when bus is idle.

The AZRS5354P guarantees a receiver output high when the receiver inputs are short, open or idle, that is true fail-safe. The threshold voltage of receiver input is between -50mV and -200mV. If the differential input voltage (A - B) of receiver 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, so the RO is logic-high at that time.

## 1/8 Unit Load

The AZRS5354P transceiver has a 96kΩ input impedance (1/8 unit load) of the receiver, allowing up to 256 or fewer devices to be connected in parallel on the RS485 bus.

## Transmitter Output Protection

The AZRS5354P 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 forces the transmitter outputs into a high impedance state if the die temperature becomes excessive.

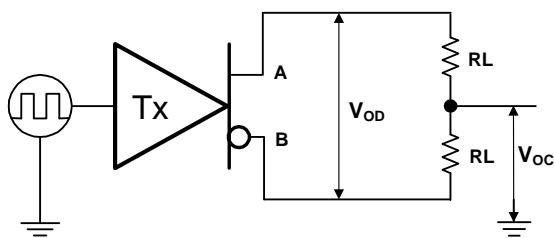


Fig.1 Transmitter DC test circuit

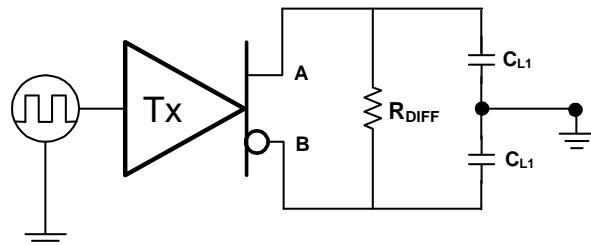


Fig.2 Transmitter timing test circuit

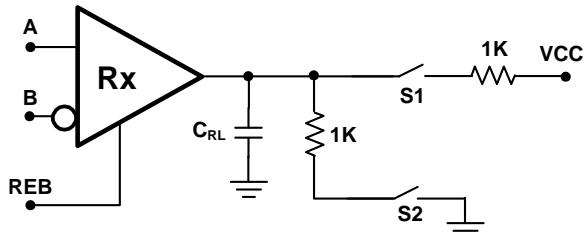


Fig.3 Receiver enable/disable timing test load

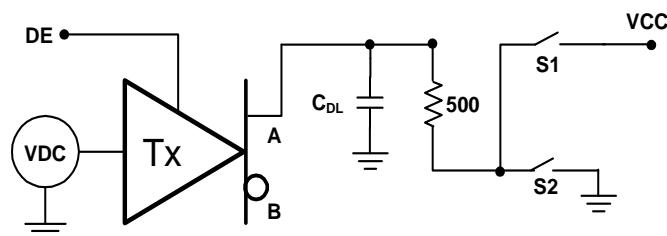


Fig.4 Transmitter enable/disable timing test load

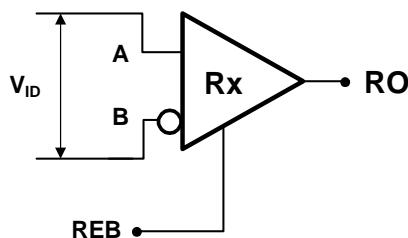


Fig.5 Receiver timing test circuit

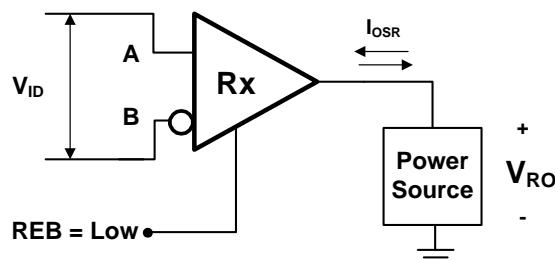


Fig.6 Receiver output short circuit

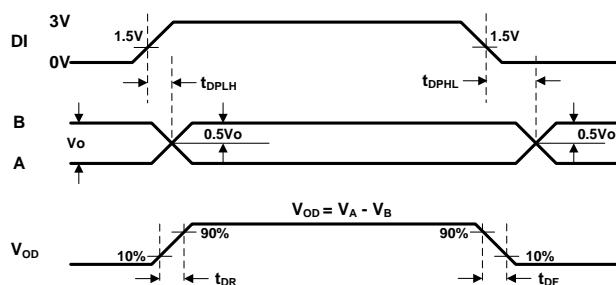


Fig.7 Transmitter Propagation Delays

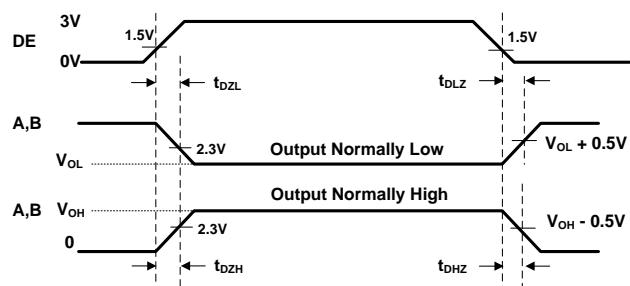


Fig.8 Transmitter Enable and Disable Times

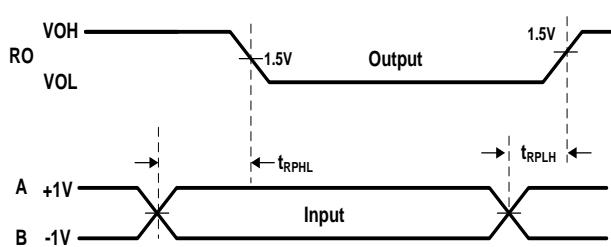


Fig.9 Receiver Propagation Delays

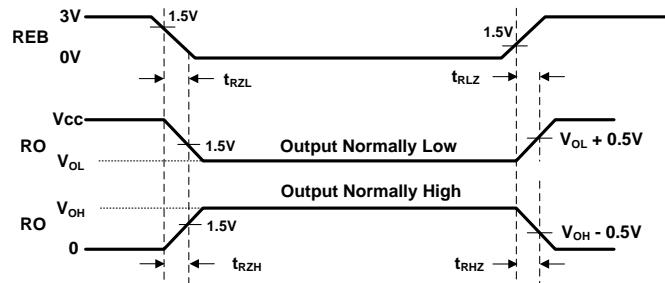
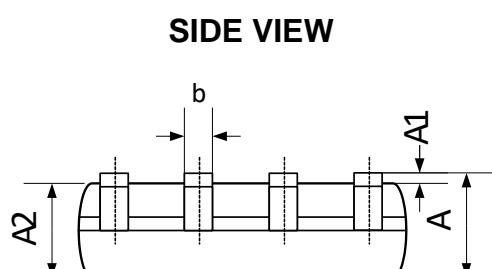
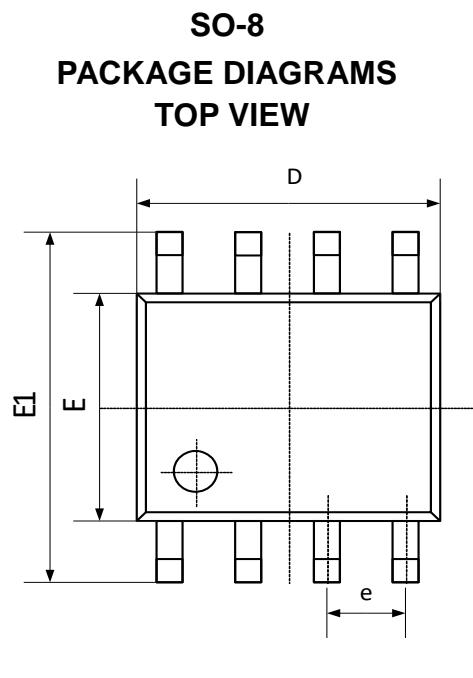


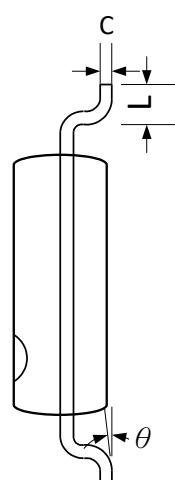
Fig.10 Receiver Enable and Disable Times



## Mechanical Details



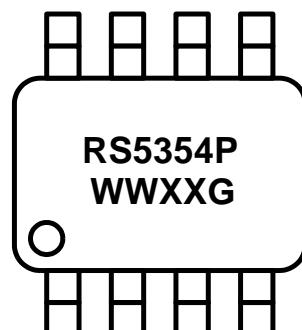
**END VIEW**



### 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	1.25	1.55	0.049	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



RS5354P = Device Code

WW = Date Code

XX = Control Code

G = Green Part Indication

Part Number	Marking Code
AZRS5354P.RDG	RS5354P WWXXG



## Ordering Information

PN#	Material	Type	Reel size	MOQ	MOQ/internal box	MOQ/carton
AZRS5354P.RDG	Green	T/R	13 inch	2,500/reel	1 reel=2,500/box	5 boxes=12,500/carton

## Revision History

Revision	Modification Description
Revision 2025/11/03	The Formal Release.