



## Features

- Meet EIA/TIA-232-F standards from a +3.0V to +5.5V power supply
- Guaranteed data rate 2Mbps under loading
- Two Transmitters and Two Receivers design
- Latch-up free
- External Capacitor : 4 x 0.1 $\mu$ F
- Accepts 5V Logic Input under 3.3V supply
- Integrated ESD Transient Voltage Suppressor (TVS) in the Transceiver IC
- TVS protection Immunities for Bus Terminals:  
   $\pm 8$  kV IEC 61000-4-2 Contact Discharge  
   $\pm 15$ kV IEC 61000-4-2 Air Discharge

## Applications

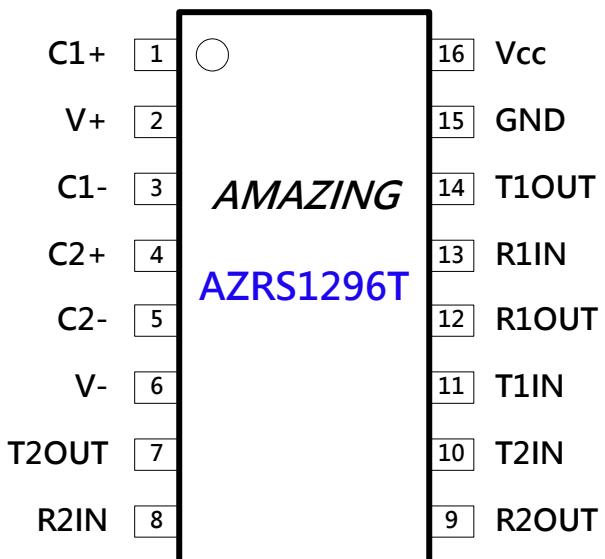
- Portable Computers
- Battery-Powered Systems
- Production Data Acquisition (PDA) and Point of Sale (POS) terminal
- Routers and HUBs
- Peripherals and Printers
- Industrial Controlled Machine

## Description

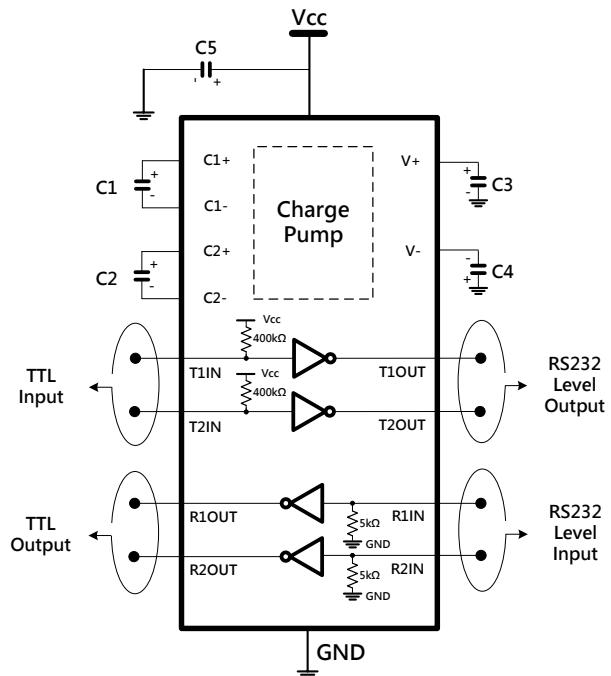
AZRS1296T is an RS-232 transceiver that meets the EIA/TIA-232-F standards under supply power +3.0V to +5.5V. AZRS1296T is a 2-transmitter and 2-receiver device with a high-efficient charge pump circuit embedded. This high-efficient charge pump circuit with 0.1 $\mu$ F external capacitors provides the bipolar output to the transmitters.

AZRS1296T operates with ultra low power consumption under guaranteed data rate of 2Mbps. AZRS1296T is ideal transceiver IC for portable application such as notebook or PDA.

AZRS1296T is also a high reliable device with both latch-up free and enhanced ESD protection. All the outputs of transmitters and the inputs of receivers can meet the specifications of IEC 61000-4-2 contact  $\pm 8$ kV, and air  $\pm 15$ kV.



Pin Configuration for AZRS1296T





## SPECIFICATIONS

| ABSOLUTE MAXIMUM RATINGS         |           |                    |             |
|----------------------------------|-----------|--------------------|-------------|
| PARAMETER                        | PARAMETER | RATING             | UNIT        |
| Power Supply Vcc                 | Vcc       | -0.3 to +6.0       | V           |
| Charge Pump Positive Output V+   | V+        | -0.3 to +9.5       | V           |
| Charge Pump Negative Output V-   | V-        | +0.3 to -9.5       | V           |
| V+, V- Supply voltage difference | V+ - V-   | 19                 | V           |
| Transmitter Input                | TxIN      | -0.3 to (Vcc +0.3) | V           |
| Receiver Input                   | RxIN      | $\pm 25$           | V           |
| Transmitter Output               | TxOUT     | $\pm 13.2$         | V           |
| Receiver Output                  | RxOUT     | -0.3 to (Vcc +0.3) | V           |
| Operating Temperature            | $T_{OP}$  | -40 to +125        | $^{\circ}C$ |
| Storage Temperature              | $T_{STO}$ | -65 to +150        | $^{\circ}C$ |

## ELECTRICAL CHARACTERISTICS

Unless otherwise noted, the following specifications apply for  $Vcc=+3.0V$  to  $+5.5V$  with  $T_{AMB} = -40^{\circ}C$  to  $+125^{\circ}C$ ,  $C1$  to  $C4=0.1\mu F$ . Typical values apply at  $Vcc=+5V$  and  $T_{AMB}=25^{\circ}C$ .

| PARAMETER                    | CONDITIONS                             | MIN       | TYP      | MAX      | UNIT     |
|------------------------------|--|-----------|----------|----------|----------|
| <b>DC CHARACTERISTIC</b>     |  |           |          |          |          |
| Supply Current               | TxIN=Floating or Vcc or GND, No Load   |           | 0.3      | 3        | mA       |
| <b>LOGIC INPUTS</b>          |  |           |          |          |          |
| Logic Input Voltage Low      | TxIN, $Vcc=3.3V$                       |           |          | 0.8      | V        |
|                              | TxIN, $Vcc=5V$                         |           |          | 0.8      | V        |
| Logic Input Voltage High     | TxIN, $Vcc=3.3V$                       | 2.0       |          |          | V        |
|                              | TxIN, $Vcc=5V$                         | 2.4       |          |          | V        |
| Logic Input Pull-up Current  | TxIN=GND                               |           | 12       | 25       | uA       |
| <b>TRANSMITTER OUTPUTS</b>   |  |           |          |          |          |
| Output Voltage Swing         | 3k $\Omega$ load to ground, $Vcc=3.3V$ | $\pm 4.4$ | $\pm 5$  |          | V        |
|                              | 3k $\Omega$ load to ground, $Vcc=5V$   | $\pm 5$   | $\pm 8$  |          | V        |
| Output Resistance            | $Vcc=V+=V-=0V$ , $V_{OUT}=\pm 2V$      | 300       |          |          | $\Omega$ |
| Output Short-Circuit Current | $V_{OUT}=0V$                           |           | $\pm 25$ | $\pm 60$ | mA       |
| Output Leakage Current       | $V_{OUT}=\pm 12V$ , $Vcc=0V$           |           | $\pm 10$ |          | uA       |



| PARAMETER                              | CONDITIONS  | MIN                     | TYP                      | MAX | UNIT        |
|--|---|-------------------------|--------------------------|-----|-------------|
| <b>RECEIVER INPUTS and OUTPUTS</b>     |   |                         |                          |     |             |
| Input Voltage Range                    |   | -25                     |                          | 25  | V           |
| Positive-going input threshold voltage | V <sub>cc</sub> =3.3V   |                         | 1.7                      | 2.4 | V           |
|  | V <sub>cc</sub> =5.0V   |                         | 2.0                      | 2.4 |             |
| Negative-going input threshold voltage | V <sub>cc</sub> =3.3V   | 0.8                     | 1.4                      |     | V           |
|  | V <sub>cc</sub> =5.0V   | 0.8                     | 1.7                      |     |             |
| Input Hysteresis                       |   |                         | 0.3                      |     | V           |
| High-level output voltage              | I <sub>OH</sub> =-1mA   | V <sub>cc</sub><br>-0.6 | V <sub>cc</sub> -<br>0.1 |     | V           |
| Low-level output voltage               | I <sub>OL</sub> =+1.6mA   |                         |                          | 0.4 | V           |
| Input Resistance                       |   | 3                       | 5                        | 7   | k $\Omega$  |
| <b>TIMING CHARACTERISTICS</b>          |   |                         |                          |     |             |
| <b>TRANSMITTER</b>                     |   |                         |                          |     |             |
| Maximum Data Rate                      | R <sub>L</sub> =3k $\Omega$ , C <sub>L</sub> =150pF, one transmitter switching  |                         | 2                        |     | Mbps        |
| Transmitter Propagation Delay          | t <sub>DPHL</sub> , TxIN to TxOUT, R <sub>L</sub> =3k $\Omega$ , C <sub>L</sub> =150pF  |                         | 100                      |     | ns          |
|  | t <sub>DPLH</sub> , TxIN to TxOUT, R <sub>L</sub> =3k $\Omega$ , C <sub>L</sub> =150pF  |                         | 100                      |     |             |
| Transmitter Skew                       | t <sub>DPHL</sub> - t <sub>DPLH</sub>  , R <sub>L</sub> =3k $\Omega$ , C <sub>L</sub> =150pF  |                         | 20                       |     | ns          |
| Transition-Region Slew Rate            | R <sub>L</sub> =3k $\Omega$ , C <sub>LT</sub> =2200pF, One Transmitter Switching, transition from -3.0V to +3.0V or +3.0V to -3.0V (See Note 1) |                         | 12                       |     | V / $\mu$ s |
| <b>Receiver</b>                        |   |                         |                          |     |             |
| Receiver Propagation Delay             | t <sub>RPHL</sub> , RxIN to RxOUT, C <sub>L</sub> =150pF  |                         | 800                      |     | ns          |
|  | t <sub>RPLH</sub> , RxIN to RxOUT, C <sub>L</sub> =150pF  |                         | 800                      |     |             |
| Receiver Skew                          | t <sub>RPHL</sub> - t <sub>RPLH</sub>  , C <sub>L</sub> =150pF  |                         | 20                       |     | ns          |
| <b>ESD PROTECTION</b>                  |   |                         |                          |     |             |
| <b>Pin Name (Pin Number)</b>           | <b>Test Condition</b>   |                         |                          |     |             |
| RxIN(8,13) TxOUT(7,14)                 | IEC61000-4-2 Contact  | -8                      |                          | +8  | kV          |



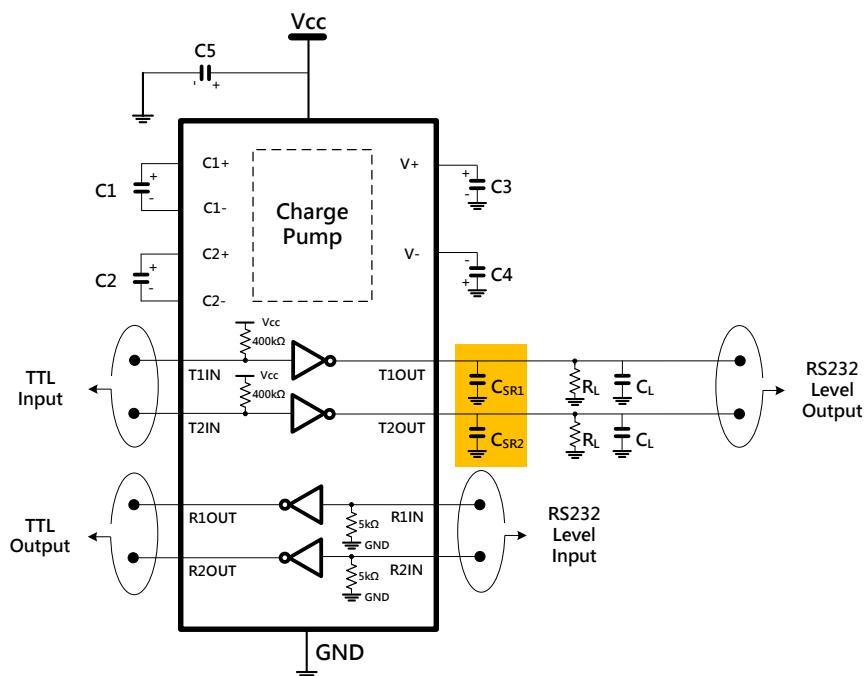
| PARAMETER      | CONDITIONS       | MIN | TYP | MAX | UNIT |
|----------------|------------------|-----|-----|-----|------|
|                | IEC61000-4-2 Air | -15 |     | +15 | kV   |
| All Other Pins | HBM              | -2  |     | +2  | kV   |

**Note 1:**

$C_{LT}$  includes  $C_{SR}$  &  $C_L$ .

$C_{SR}$  is application circuit for slew-rate (Low-speed).

$C_L$  includes probe and jig capacitance.



Application circuit for note 1



### PIN FUNCTION DESCRIPTION

| Pin Number | Mnemonic | Description                                      |
|------------|----------|--|
| 1          | C1+      | Positive terminal of the first switch capacitor  |
| 2          | V+       | Positive voltage of charge pump output           |
| 3          | C1-      | Negative terminal of the first switch capacitor  |
| 4          | C2+      | Positive terminal of the second switch capacitor |
| 5          | C2-      | Negative terminal of the second switch capacitor |
| 6          | V-       | Negative voltage of charge pump output           |
| 7          | T2OUT    | Second transmitter output                        |
| 8          | R2IN     | Second receiver input                            |
| 9          | R2OUT    | Second receiver output                           |
| 10         | T2IN     | Second transmitter input                         |
| 11         | T1IN     | First transmitter input                          |
| 12         | R1OUT    | First receiver output                            |
| 13         | R1IN     | First receiver input                             |
| 14         | T1OUT    | First transmitter output                         |
| 15         | GND      | Ground of the device                             |
| 16         | Vcc      | +3.0V to +5.5V supply voltage                    |



## Detail Description

AZRS1296T is a RS-232 transceiver that meets the EIA/TIA-232 and V.28/V.24 communication protocols. AZRS1296T is a 2-transmitter /2-receiver device with a high-efficient charge pump circuit embedded. The design of high-efficient charge pump circuit is Amazing's property that can generate RS-232 voltage levels from +3.0V to +5.5V power supply. This high-efficient charge pump circuit with  $0.1\mu F$  capacitors provides the bipolar output to the transmitters, and makes the transmitters deliver the RS-232 output voltage levels. The design of transmitter is also the property of Amazing. Under normal operation and with loaded, AZRS1296T can operate for guaranteed data rate of 2Mbps with ultra low power consumption. Therefore, AZRS1296T is ideal for portable application such as notebook or PDA.

AZRS1296T is also a high reliable device with both latch-up free and high ESD immunity. The high robust ESD devices embedded in AZRS1296T are also the properties of Amazing. All the outputs of transmitters and the inputs of receivers can meet the specifications of IEC 61000-4-2 contact  $\pm 8kV$ , and air  $\pm 15kV$ .

## Bipolar Charge Pump Circuit

High-efficient charge pump circuit in AZRS1296T is a four-capacitance structure with single power supply input. Bipolar voltage output of AZRS1296T can be pumped to above  $\pm 5.0V$  under the +3.0V to +5.5V supply power range. Because a negative feedback regulator is embedded, the output voltage is independent of supply power voltage. Moreover, the charge pump can select 2-phase or 4-phase operation for more flexible design. When AZRS1296T is powered on, the bipolar output will be pumped to the steady output with low ripple voltage in the  $500\mu s$ .

## Transmitter

The design of the transmitter is an inverted translator that converts TTL/CMOS-logic voltage level to EIA/TIA-232 voltage level. The transmitters of AZRS1296T guarantee a 2Mbps data rate under the loading of  $3k\Omega$  resistance in parallel with  $150pF$  capacitance. When the

transmitters are active, the input signals of transmitters will be transported to the outputs of transmitters in inverting level.

The inputs of transmitters have  $400k\Omega$  pull-up resistors design to ensure the output of transmitter to be a LOW state when the input of transmitter is unconnected.

## Receiver

The receivers of AZRS1296T convert EIA/TIA-232 voltage levels to TTL/CMOS-logic voltage levels.

The receiver guarantees a 2Mbps data rate under the loading of a  $150pF$ .

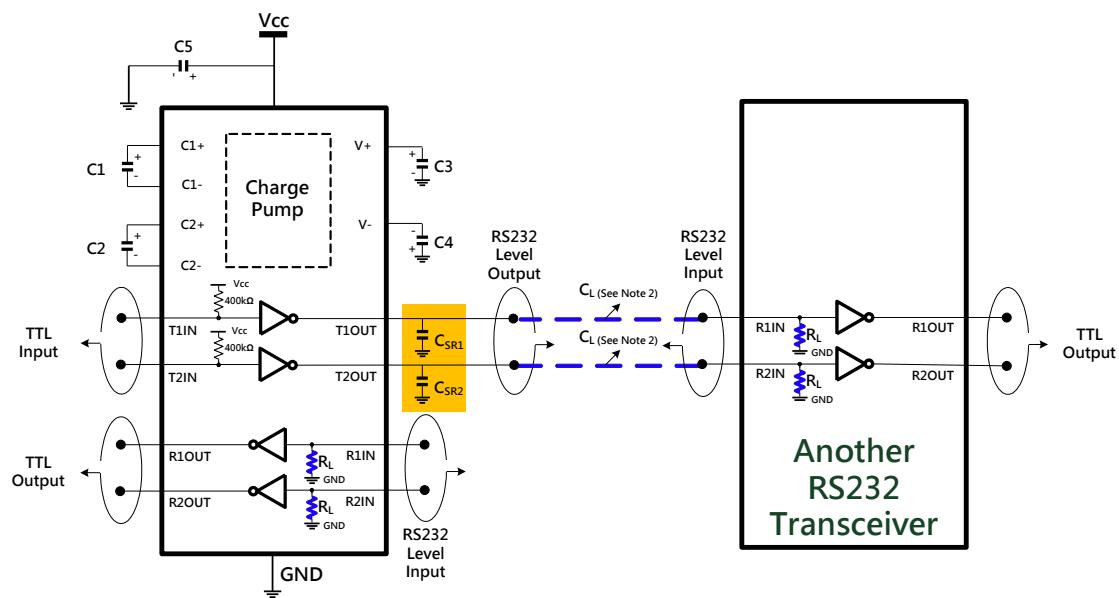
The inputs of receivers have  $5k\Omega$  pull-down resistors design to ensure the output of receiver to be a HIGH state when the input of receiver is unconnected.

## Application Information

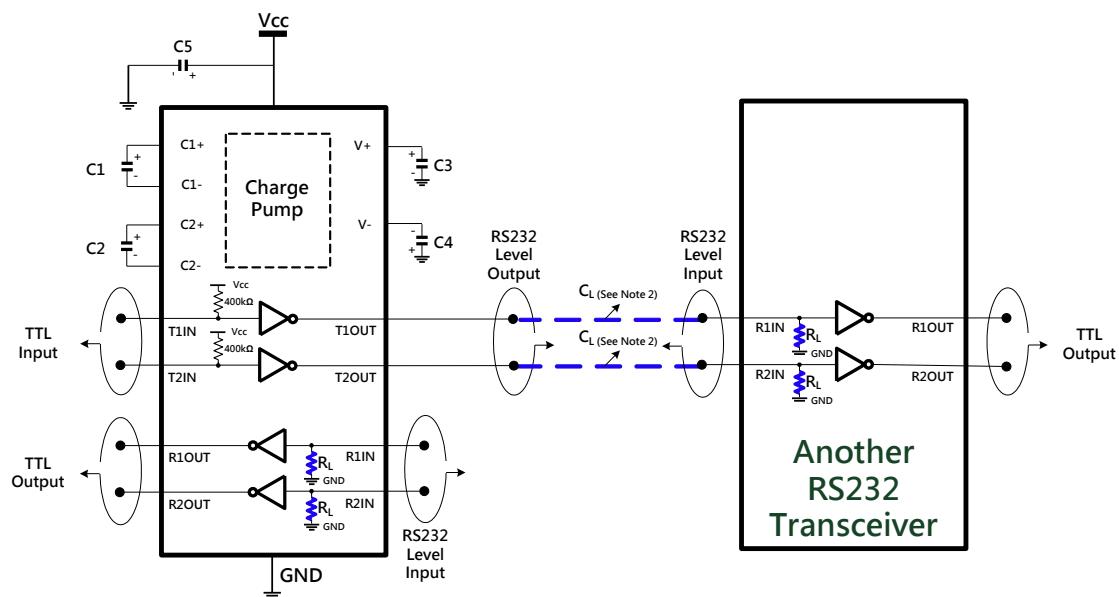
To generate the high-efficient bipolar charge pump, the four capacitors (C1 ~ C4) must be placed as closer to RS232 transceiver as possible. The trace of the PCB layout is suggested to be shorter than 1cm from the pinout of the charge pump to the dedicated capacitor. The other node of dedicated capacitor should be connected to ground shortly, too. Moreover, the capacitor of power supply (C5) should be placed as close to the transceiver as possible, and connect to ground nearby.

If Slew-rate (Low speed) is required, it can be connected to the application circuit:  $C_{SR1}$  &  $C_{SR2}$  are connected to T1OUT & T2OUT (Recommended value of  $C_{SR1}$  &  $C_{SR2} = 2200pF$ )

In other applications, C3 could be changed to connect to Vcc.



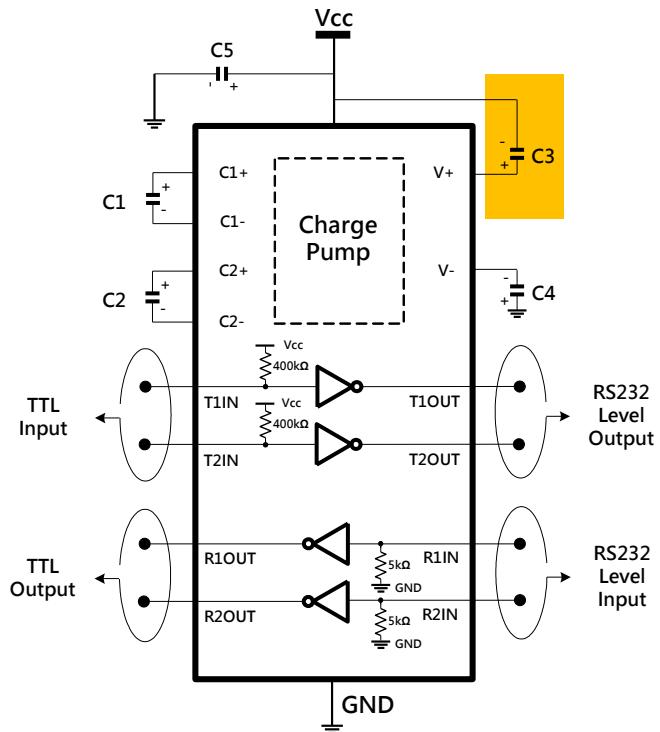
### Operation of AZRS1296T for Slew-rate (Low-speed)



### Operation of AZRS1296T (High-speed)

#### Note 2:

$C_L$  includes probe and jig capacitance



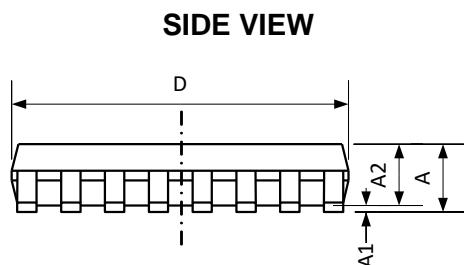
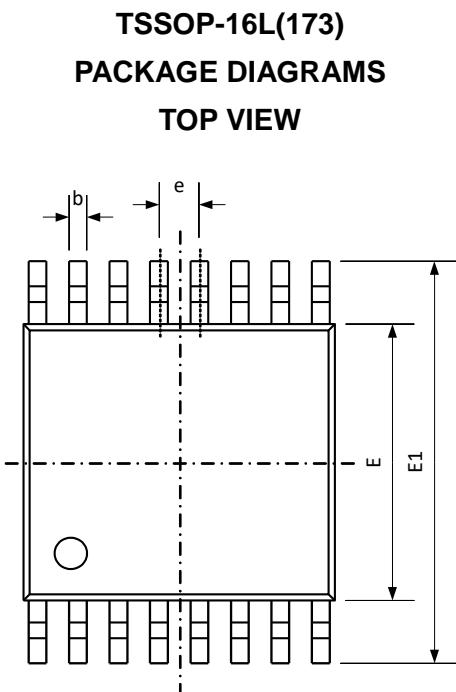
Application circuit for note 3

**Note 3:**

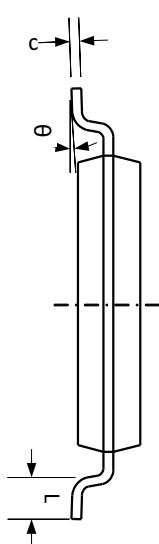
C3 could be changed to connect to Vcc



## Mechanical Details



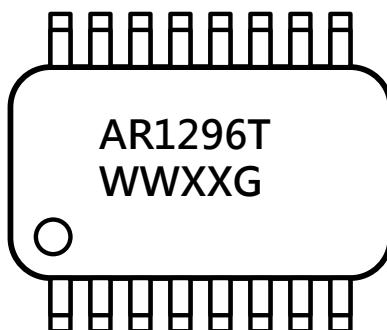
**END VIEW**



### PACKAGE DIMENSIONS

| SYMBOL   | MILLIMETERS |      |
|----------|-------------|------|
|          | MIN.        | MAX. |
| A        | -           | 1.20 |
| A1       | 0.05        | 0.15 |
| A2       | 0.80        | 1.05 |
| b        | 0.19        | 0.30 |
| c        | 0.09        | 0.20 |
| D        | 4.90        | 5.10 |
| E1       | 6.20        | 6.60 |
| E        | 4.30        | 4.50 |
| e        | 0.65 BSC    |      |
| L        | 0.45        | 0.75 |
| $\theta$ | 0           | 8    |

### Marking Code



AR1296T = Device Code

WW = Date Code ; XX = Control Code

G = Green Part Indication

| Part Number                   | Marking Code     |
|-------------------------------|------------------|
| AZRS1296T.RDG<br>(Green part) | AR1296T<br>WWXXG |



## Ordering Information

| PN#           | Material | Type | Reel size | MOQ        | MOQ/internal box  | MOQ/carton            |
|---------------|----------|------|-----------|------------|-------------------|-----------------------|
| AZRS1296T.RDG | Green    | T/R  | 13 inch   | 3,000/reel | 1 reel =3,000/box | 5 box = 15,000/carton |

## Revision History

| Revision            | Modification Description   |
|---------------------|--|
| Revision 2024/03/29 | Formal Release   |
| Revision 2024/09/23 | Upgrade min. of Output Voltage Swing & Add Application information |
|                     |  |
|                     |  |
|                     |  |
|                     |  |
|                     |  |