Features

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

Applications

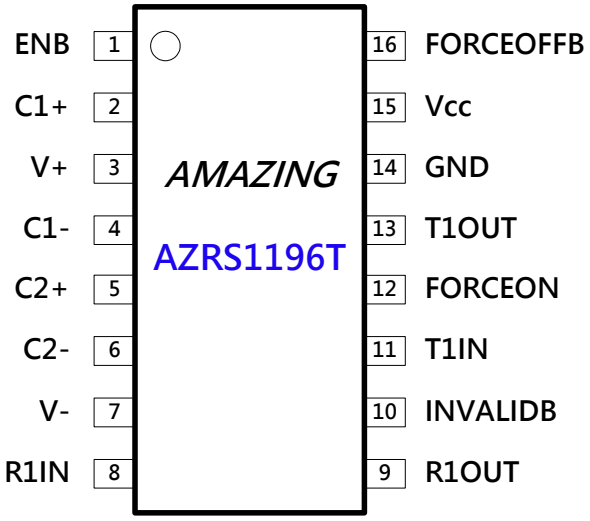
- Portable Computers
- Battery-Powered Systems
- Production Data Acquisition (PDA) and Point of Sale (POS) terminal
- Routers and HUBs
- Peripherals and Printers
- Industrial Controlled Machine

Description

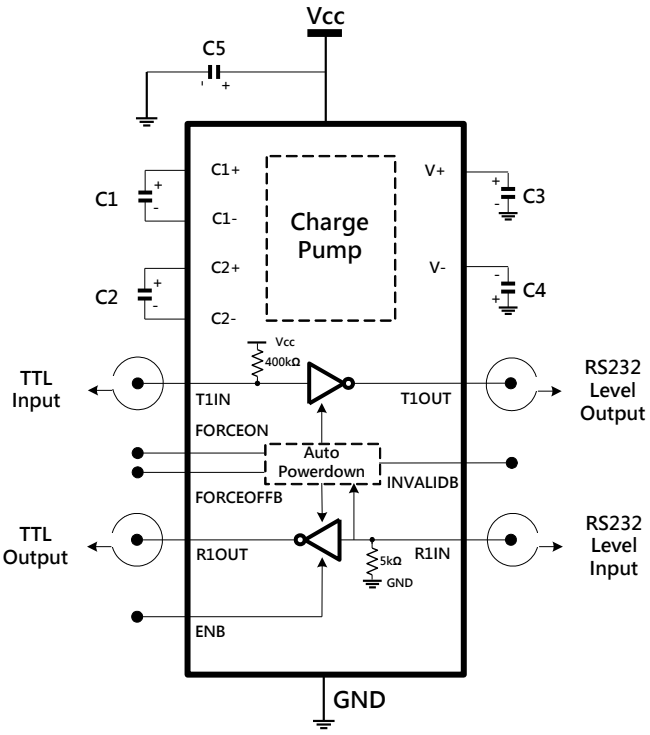
AZRS1196T is an RS-232 transceiver that meets the EIA/TIA-232-F standards under supply power +3.0V to +5.5V. AZRS1196T is a 1-transmitter and 1-receiver device with a high-efficient charge pump circuit embedded. This high-efficient charge pump circuit with 0.1μF external capacitors provides the bipolar output to the transmitter. AZRS1196T includes the AUTO-Powerdown function, which is functioned to wake up when peripheral is connected and to shut itself down when peripheral is disconnected. The AZRS1196T also includes one complementary receiver for monitor of external device's Ring Indicate signal.

AZRS1196T operates with ultra low power consumption under guaranteed data rate of 2Mbps. AZRS1196T is ideal transceiver IC for portable application such as notebook or PDA.

AZRS1196T is also a high reliable device with both latch-up free and enhanced ESD protection. The output of transmitter and the input of receiver can meet the specifications of IEC 61000-4-2 contact ±8kV, and air ±15kV.



Pin Configuration for AZRS1196T



Functional Block of AZRS1196T

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 and Enable Pin	TxIN , FORCEON, FORCEOFFB, ENB	-0.3 to (Vcc +0.3)	V
Receiver Input	RxIN	±25	V
Transmitter Output	TxOUT	±13.2	V
Receiver Output	RxOUT	-0.3 to (Vcc +0.3)	V
Operating Temperature	T_{OP}	-40 to +125	°C
Storage Temperature	T_{STO}	-65 to +150	°C

ELECTRICAL CHARACTERISTICS

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

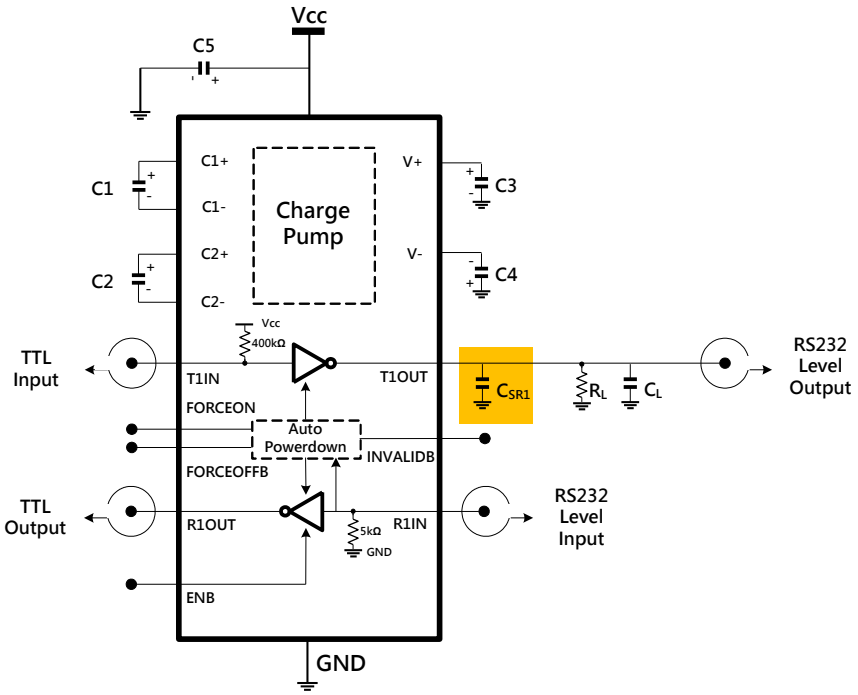
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
DC CHARACTERISTIC					
Supply Current (Auto-powerdown disabled)	FORCEON=Vcc, FORCEOFFB= Vcc, TxIN=Floating or Vcc or GND, No Load		0.3	3	mA
Powerdown Supply Current (Auto-powerdown enabled)	FORCEON=GND, FORCEOFFB= Vcc, TxIN=Floating or Vcc or GND, No Load		10	100	μA
Powerdown Supply Current (Shutdown)	FORCEON=Vcc or GND, FORCEOFFB=GND, TxIN=Floating or Vcc or GND, No Load		10	100	μA
LOGIC INPUTS					
Logic Input Voltage Low	TxIN, ENB, Vcc=3.3V			0.8	V
	TxIN, ENB, Vcc=5V			0.8	V
Logic Input Voltage High	TxIN, ENB, Vcc=3.3V	2.0			V
	TxIN, ENB, Vcc=5V	2.4			V

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Logic Input Pull-up Current	TxIN=GND		12	25	uA
TRANSMITTER OUTPUT					
Output Voltage Swing	3kΩ load to ground, Vcc=3.3V	±4.8	±5		V
	3kΩ load to ground, Vcc=5V	±5	±8		V
Output Resistance	Vcc=V+=V-=0V, V_{OUT}=±2V	300			Ω
Output Short-Circuit Current	V_{OUT}=0V		±25	±60	mA
Output Leakage Current	FORCEOFFB=GND, V_{OUT}=±12V, Vcc=0V or 3.0V to 5.5V, Transmitters disabled.		±10		uA
RECEIVER INPUT and OUTPUT					
Input Voltage Range		-25		25	V
Positive-going input threshold voltage	Vcc=3.3V		1.7	2.4	V
	Vcc=5.0V		2.0	2.4	
Negative-going input threshold voltage	Vcc=3.3V	0.8	1.4		V
	Vcc=5.0V	0.8	1.7		
Input Hysteresis			0.3		V
High-level output voltage	I_{OH}=-1mA	Vcc -0.6	Vcc – 0.1		V
Low-level output voltage	I_{OL}=+1.6mA			0.4	V
Output Leakage Current	Receivers disabled, ENB=Vcc V_{OUT}=0V to Vcc		±0.1	±25	μA
Input Resistance		3	5	7	kΩ
TIMING CHARACTERISTICS					
TRANSMITTER					
Maximum Data Rate	R_L=3kΩ, C_L=150pF, one transmitter switching		2		Mbps
Transmitter Propagation Delay	t_{DPHL}, TxIN to TxOUT, R_L=3kΩ, C_L=150pF		100		ns
	t_{DPLH}, TxIN to TxOUT, R_L=3kΩ, C_L=150pF		100		
Transmitter Skew	| t_{DPHL} – t_{DPLH} |, R_L=3kΩ, C_L=150pF		20		ns

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Transition-Region Slew Rate	R_L=3kΩ, C_{LT}=2200pF, One Transmitter Switching, transition from -3.0V to +3.0V or +3.0V to -3.0V (See Note 1)		12		V /μs
RECEIVER					
Receiver Propagation Delay	t_{RPHL}, RxIN to RxOUT, C_L=150pF		800		ns
	t_{RPLH}, RxIN to RxOUT, C_L=150pF		800		
Receiver Skew	| t_{RPHL} – t_{RPLH} |, C_L=150pF		20		ns
Receiver Output Enable Time	t_{PZL}, ENB to RxOUT, C_L=150pF, R_L=3kΩ to Vcc, RxIN=Vcc		35		ns
	t_{PZH}, ENB to RxOUT, C_L=150pF, R_L=3kΩ to GND, RxIN=GND				
Receiver Output Disable Time	t_{PLZ}, ENB to RxOUT, C_L=150pF, R_L=3kΩ to Vcc, RxIN=Vcc		350		ns
	t_{PHZ}, ENB to RxOUT, C_L=150pF, R_L=3kΩ to GND, RxIN=GND				
AUTO-POWERDOWN ELECTRICAL CHARACTERISTICS					
Receiver input voltage for INVALIDB high-level output	FORCEON=GND, FORCEOFFB=Vcc	-2.7		2.7	V
Receiver input voltage for INVALIDB low-level output	FORCEON=GND, FORCEOFFB=Vcc	-0.3		0.3	V
V_{OH} INVALIDB high-level output voltage	I_{OH}=-1.0mA, FORCEON=GND, FORCEOFFB=Vcc	V_{CC}-0.6			V
V_{OL} INVALIDB low-level output voltage	I_{OL}=+1.6mA, FORCEON=GND, FORCEOFFB=Vcc			0.4	V
AUTO-POWERDOWN TIMING					
Receiver Input to INVALIDB output high				1	μs
Receiver Input to INVALIDB output Low			30		μs
Powerdown mode to Supply enabled			100		μs
ESD PROTECTION					
Pin Name (Pin Number)	**Test Condition**				

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
RxIN(8), TxOUT(13)	IEC61000-4-2 Contact	-8		+8	kV
RxIN(8), TxOUT(13)	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	ENB	Receiver Enable. Logic Low for normal operation. Logic High for high impedance output.
2	C1+	Positive terminal of the first switch capacitor
3	V+	Positive voltage of charge pump output
4	C1-	Negative terminal of the first switch capacitor
5	C2+	Positive terminal of the second switch capacitor
6	C2-	Negative terminal of the second switch capacitor
7	V-	Negative voltage of charge pump output
8	R1IN	Receiver input
9	R1OUT	Receiver output
10	INVALIDB	Output of a valid signal detection. INVALIDB is enabled high if a valid RS232 level is present on any receiver input.
11	T1IN	Transmitter input
12	FORCEON	A logic HIGH to override AUTO-Powerdown circuit keeping transmitters on. (FORCEOFFB must be HIGH)
13	T1OUT	Transmitter output
14	GND	Ground of the device
15	Vcc	+3.0V to +5.5V supply voltage
16	FORCEOFFB	Force off control. Force both the charge pump and the transmitters off.

Detail Description

AZRS1196T is a RS-232 transceiver that meets the EIA/TIA-232 and V.28/V.24 communication protocols. AZRS1196T is a 1-transmitter /1-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 0.1μF 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, AZRS1196T can operate for guaranteed data rate of 2Mbps with ultra low power consumption. AZRS1196T is an ideal device for power saving issue due to the Auto-Powerdown circuit embedded. The Auto-Powerdown circuit will detect whether the RS232 cable is connected or not to decide to shut the device down or not. Therefore, AZRS1196T is ideal for portable application such as notebook or PDA.

AZRS1196T is also a high reliable device with both latch-up free and high ESD immunity. The high robust ESD devices embedded in AZRS1196T are also the properties of Amazing. The output of transmitter and the input of receiver can meet the specifications of IEC 61000-4-2 contact ±8kV, and air ±15kV.

Bipolar Charge Pump Circuit

High-efficient charge pump circuit in AZRS1196T is a four-capacitance structure with single power supply input. Bipolar voltage output of AZRS1196T can be pumped to above ±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 AZRS1196T is powered on, the bipolar output will be pumped to the steady output with low ripple voltage in the 500μs.

Transmitter

The design of the transmitter is an inverted translator that converts TTL/CMOS-logic voltage level to EIA/TIA-232 voltage level. The transmitter of AZRS1196T guarantees a 2Mbps data rate under the loading of 3kΩ resistance in parallel with 150pF capacitance. When the transmitter is active (FORCEOFFB=HIGH), the input signal of transmitter will be transported to the output of transmitter in inverting level.

The input of transmitter has 400kΩ pull-up resistor design to ensure the output of transmitter to be a LOW state when the input of transmitter is unconnected.

Receiver

The receiver of AZRS1196T converts EIA/TIA-232 voltage levels to TTL/CMOS-logic voltage levels. The receiver has an inverted tri-state output controlled by ENB. When ENB is HIGH, the output of receiver operates in tri-state. When ENB is LOW, the receiver is active, as listed in the Table2.

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

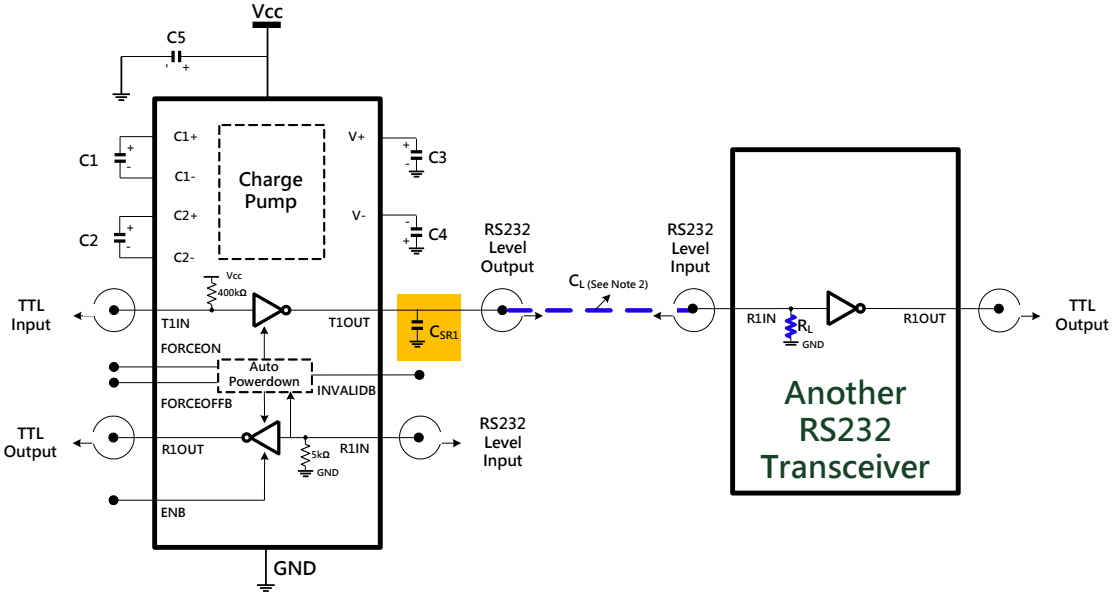
The input of receiver has 5kΩ pull-down resistor design to ensure the output of receiver to be a HIGH state when the input of receiver is unconnected.

Application Information

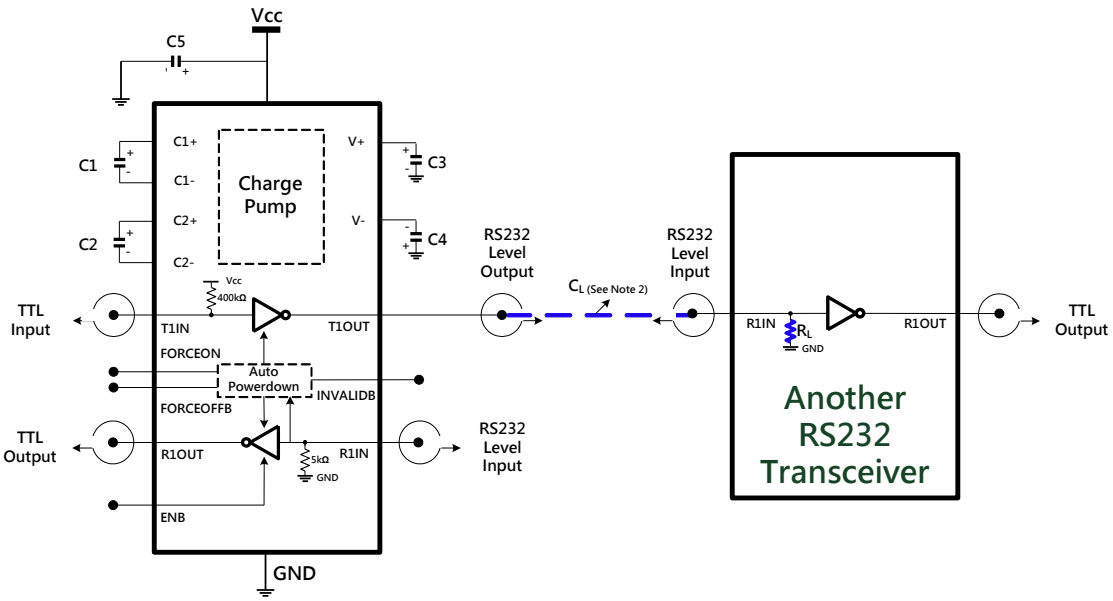
To generate the high-efficient bipolar charge pump, the four capacitors (C1 ~ C4) must be placed as closer to RS232 transceiver as possible. The trace of the PCB layout is suggested to be shorter than 1cm from the pinout of the charge pump to the dedicated capacitor. The other node of dedicated capacitor 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} is connected to T1OUT (Recommended value of C_{SR1} = 2200pF)

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

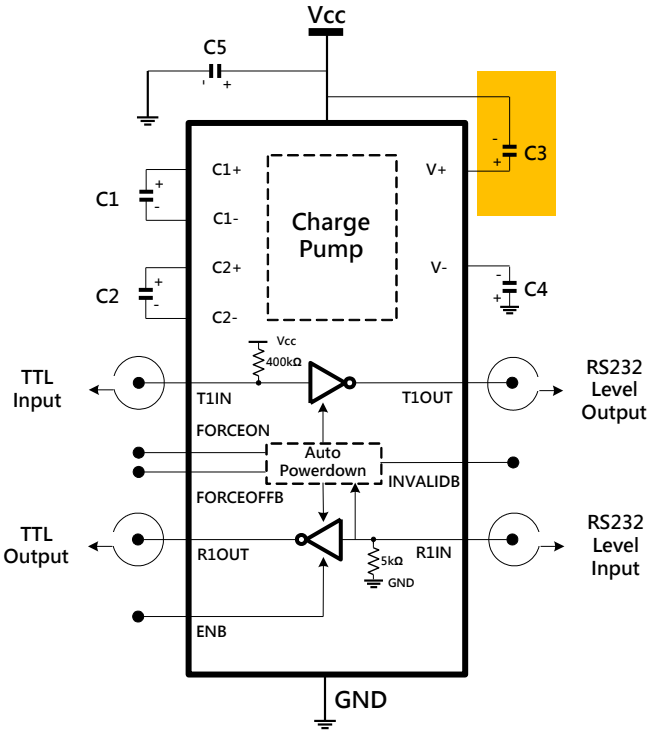


Operation of AZRS1196T for Slew-rate (Low-speed)



Operation of AZRS1196T (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

Table 1 Function Table of Transmitter

INPUTS				OUTPUT	Transmitter Status
TxIN	**FORCEOFFB**	**FORCEON**	**VALID RxIN RS-232 Level**	**TxOUT**	
X	L	X	X	Z	Shutdown
L	H	H	X	H	Active
H	H	H	X	L	(Auto-powerdown disabled)
L	H	L	Yes	H	Active
H	H	L	Yes	L	(Auto-powerdown enabled)
X	H	L	No	Z	Shutdown by Auto-powerdown feature

H = High level, L = Low level, X = Irrelevant, Z = High impedance.

Table 2 Function Table of Receiver

INPUTS			OUTPUT	Receiver Status
RxIN	**ENB**	**VALID RxIN RS-232 Level**	**RxOUT**	
L	L	X	H	Active
H	L	X	L	Active
X	H	X	Z	Shutdown
OPEN	L	No	H	Active

H = High level, L = Low level, X = Irrelevant, Z = High impedance,
OPEN = Input disconnected or connected driver off.

Table 3 Function Table of INVALIDB

INPUTS			OUTPUT	Output Status
VALID RxIN RS-232 Level	**FORCEOFFB**	**FORCEON**	**INVALIDB**	
Yes	X	X	H	Always active
No	X	X	L	

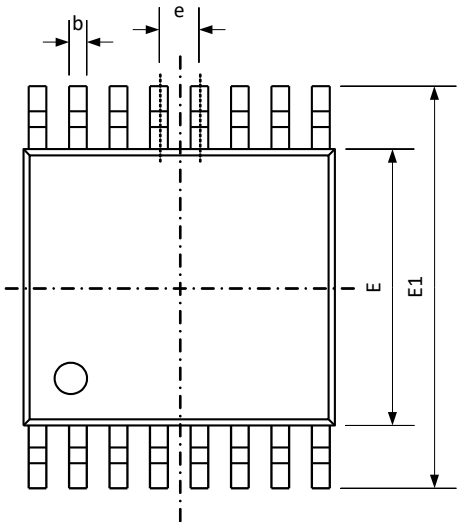
H = High level, L = Low level, X = Irrelevant

Mechanical Details

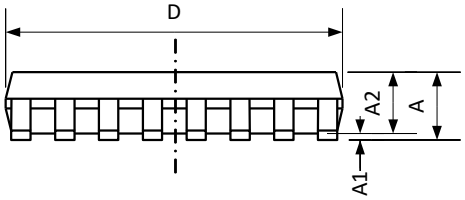
TSSOP-16L(173)

PACKAGE DIAGRAMS

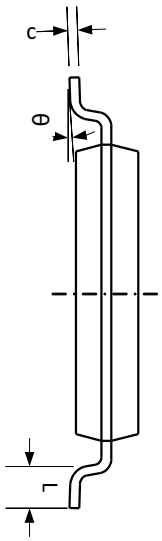
TOP VIEW



SIDE VIEW



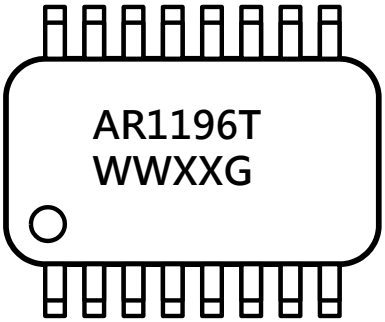
END VIEW



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
θ	0	8

Marking Code



AR1196T = Device Code

WW = Date Code ; XX = Control Code

G = Green Part Indication

Part Number	Marking Code
AZRS1196T.RDG (Green part)	AR1196T WWXXG

Ordering Information

PN#	Material	Type	Reel size	MOQ	MOQ/internal box	MOQ/carton
AZRS1196T.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 2024/10/31	Formal Release