Features

- Integrated Transient Voltage Suppressor (TVS) in the Transceiver IC
- TVS Protection for Bus Terminals :
  ±15 kV IEC 61000-4-2, Contact Discharge
  ±18 kV IEC 61000-4-2, Air-Gap Discharge
  ±15 kV EIA/JEDEC Human Body Model
- HBM ±8kV 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 ±1kV 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
- Data Rate up to 10Mbps
  Hot-Swap Glitch free Protection on Control Inputs
- High driving ability of VOD2 up to 2.3V
- Up to 256 Transceivers on the Bus

Applications

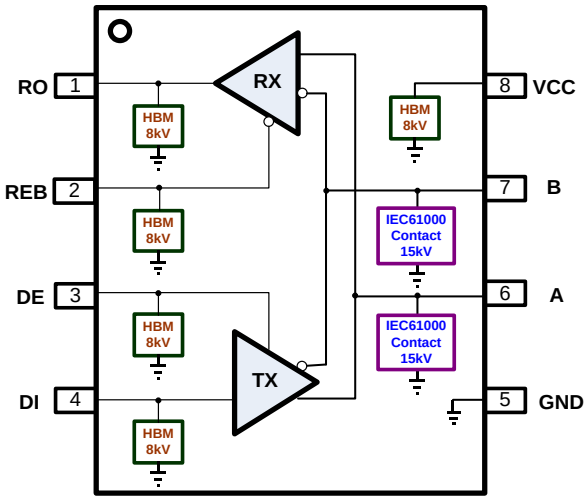
- Energy Meter
- Industrial Automation
- Building Automation
- Telecommunications Equipment

Description

The AZRS485E is a ±15kV IEC 61000-4-2 contact 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.

The AZRS485E 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 AZRS485E 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 AZRS485E 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 AZRS485E is designed 1/8 unit load with minimum 96kohm of input impedance, which can connect 256 devices on a bus at least. The AZRS485E is also a high reliable device with built-in system level ESD protected devices against high-energy noise transients without requiring any external components.



Functional Block of AZRS485E

Part Number	Duplex	Tx/Rx	Supply	Max Data Rate (Mbps)	Fail- safe	Rx Input Filtering	HBM on A,B	IEC 61000-4-2 Contact on A,B	Package Type
AZRS485E	Half	1/1	5	10	Yes	Yes	±15kV	± 15kV	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 ±10% 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				Vcc	V
Differential Transmitter Output	V_{OD2}	Fig.1, R_L= 27Ω		1.5	2.3	5.0	V
Change in Magnitude of Differential Output Voltage	ΔV_{OD}	Fig.1, R_L= 27Ω				0.2	V
Transmitter Common- Mode Output Voltage	V_{OC}	Fig.1, R_L= 27Ω		1.0		3.0	V
Change in Magnitude of Common- Mode Voltage	ΔV_{OC}	Fig.1, R_L= 27Ω				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}	DE, DI, REB				±2	μA
Input Current for A and B	I_{IN2}	DE=0, Vcc=0V or 5.5V	V_{IN}=12V			125	uA
			V_{IN}=-7V	-100			
Transmitter Short-Circuit Output Current	I_{OSD}	A Pin Short to B Pin		-100		100	mA
RECEIVER							
Receiver Differential Threshold Voltage	V_{TH}			-200		-50	mV
Receiver Input Hysteresis	ΔV_{TH}				20		mV
Receiver Output High Voltage	V_{OH}	Io= -4mA, VID= 200mV		4.0			V
Receiver Output Low Voltage	V_{OL}	Io= 4mA, VID= -200mV				0.4	V
Three- State Output Current	I_{OZR}	REB=Vcc, DE=Vcc				±1	μA

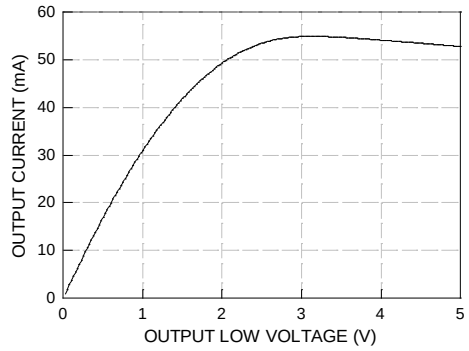
PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
RECEIVER							
Receiver Input Resistance	R_{IN}	-7V ≤ V_{CM} ≤ +12V		96			kΩ
Receiver Output Short-Circuit Current	I_{OSR}	Fig. 6, 0V ≤ V_{RO} ≤ Vcc		±7		±95	m A
SUPPLY CURRENT							
Supply Current	Icc	No load, REB= GND, DI= Vcc or GND.	DE= Vcc		400	600	μA
			DE= GND		300	500	μA

SWITCHING CHARACTERISTICS

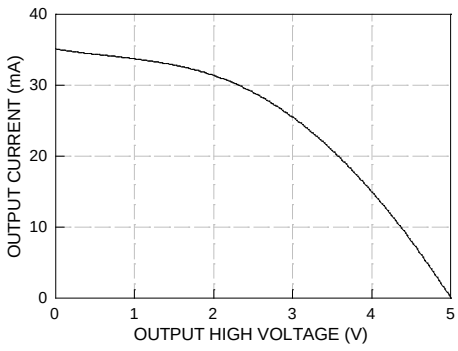
(Vcc=5V ±10% with T_{AMB}= T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at Vcc=5V and T_{AMB}= 25 °C.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Transmitter Output Skew $\lvert t_{DPLH} - t_{DPHL} \rvert$	t_{DSKEW}	Fig.2, Fig.7, R_{DIFF}=54Ω, C_{L1}=C_{L2}= 100pF		5	10	ns
Transmitter Rise or Fall Time	t_{DF}, t_{DR}	Fig.2, Fig.7, R_{DIFF}=54Ω, C_{L1}=C_{L2}= 100pF	3	20	40	ns
Data Rate	f_{Data}				10	Mbps
Transmitter Enable to Output Low	t_{DZL}	Fig.4, Fig.8, C_{DL}= 100pF, S1 closed		45	70	ns
Transmitter Enable to Output High	t_{DZH}	Fig.4, Fig.8, C_{DL}= 100pF, S2 closed		45	70	ns
Transmitter Disable Time from Low	t_{DLZ}	Fig.4, Fig.8, C_{DL}= 15pF, S1 closed		45	70	ns
Transmitter Disable Time from High	t_{DHZ}	Fig.4, Fig.8, C_{DL}= 15pF, S2 closed		45	70	ns
Receiver Input to Output	t_{RPLH}, t_{RPHL}	Fig.5, Fig.9, $\lvert V_{ID} \rvert$ ≥ 2.0V; rise and fall time of V_{ID} ≤ 15ns	20	120	200	ns
Different Receiver Skew $\lvert t_{RPLH} - t_{RPHL} \rvert$	t_{RSKD}	Fig.5, Fig.9, $\lvert V_{ID} \rvert$ ≥ 2.0V; rise and fall time of V_{ID} ≤ 15ns		5		ns
Receiver Enable to Output Low	t_{RZL}	Fig.3, Fig.10, C_{RL}= 15pF, S1 closed		20	50	ns
Receiver Enable to Output High	t_{RZH}	Fig.3, Fig.10, C_{RL}= 15pF, S2 closed		20	50	ns
Receiver Disable Time from Low	t_{RLZ}	Fig.3, Fig.10, C_{RL}= 15pF, S1 closed		20	50	ns
Receiver Disable Time from High	t_{RHZ}	Fig.3, Fig.10, C_{RL}= 15pF, S2 closed		20	50	ns

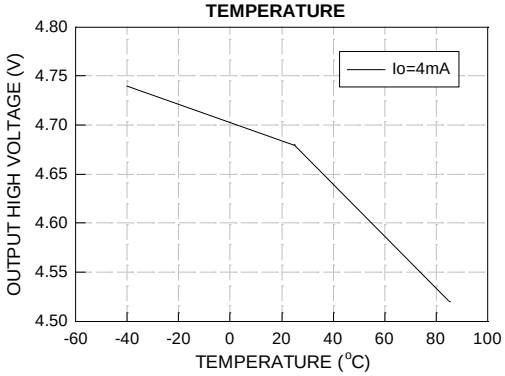
OUTPUT CURRENT vs. RECEIVER OUTPUT LOW VOLTAGE



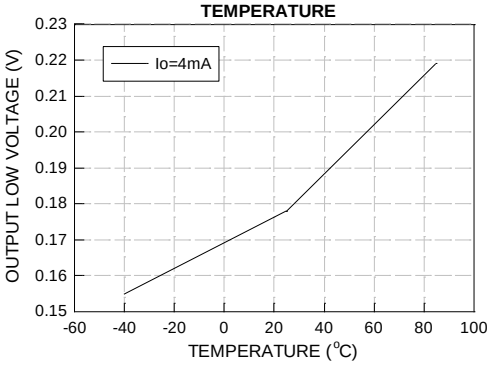
OUTPUT CURRENT vs. RECEIVER OUTPUT HIGH VOLTAGE



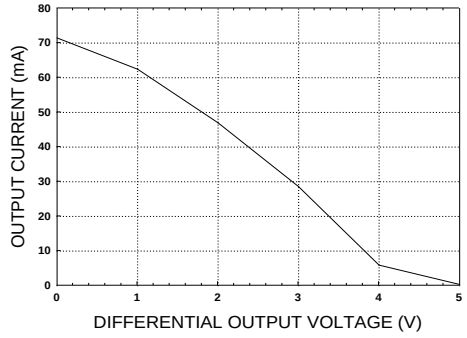
RECEIVER OUTPUT HIGH VOLTAGE vs. TEMPERATURE



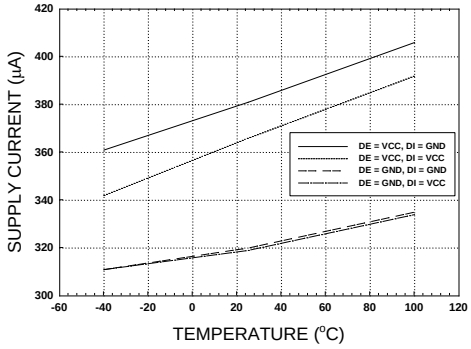
RECEIVER OUTPUT LOW VOLTAGE vs. TEMPERATURE



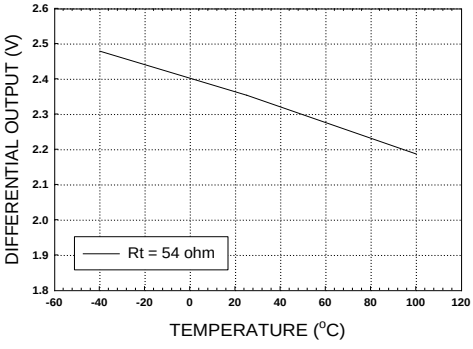
DRIVER OUTPUT CURRENT vs. DIFFERENTIAL OUTPUT VOLTAGE



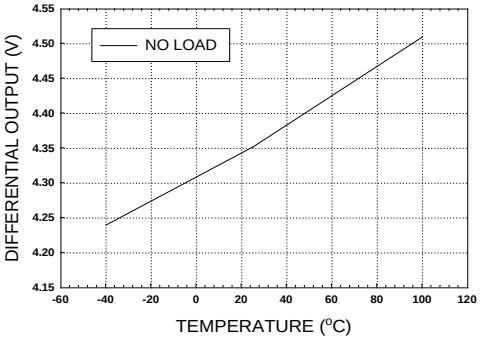
SUPPLY CURRENT vs. TEMPERATURE



DRIVER DIFFERENTIAL OUTPUT vs. TEMPERATURE



DRIVER DIFFERENTIAL OUTPUT vs. TEMPERATURE



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
X	0	X	HIGH- Z	HIGH- Z

X= Don't care
HIGH- Z= High impedance

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

X= Don't care
HIGH- Z= High impedance

Detail Description

The AZRS485E is a half-duplex RS-485 transceiver IC with IEC61000-4-2 contact ±15kV 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 AZRS485E 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 AZRS485E with whole chip ESD protected design for all of the I/O pins has robust ESD protection up to both HBM ±8kV and MM ±800V. Moreover, the latchup immunity of the AZRS485E is up to ±400mA for all of the pins. For IC self discharge issue, the CDM protection level of the AZRS485E is up to ±1kV.

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 AZRS485E guarantees 10Mbps 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 AZRS485E is 2.3V with 54 ohm load under Vcc = 5.0V, T= 25^{o}C.

Receiver

The receiver of the AZRS485E 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, which is only the open fail-safe.

The AZRS485E 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 RS-485 standard defines both receiver inputs impedance are 12kΩ (1 unit load) and the maximum 32-unit loads on the bus. The AZRS485E 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 AZRS485E 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.

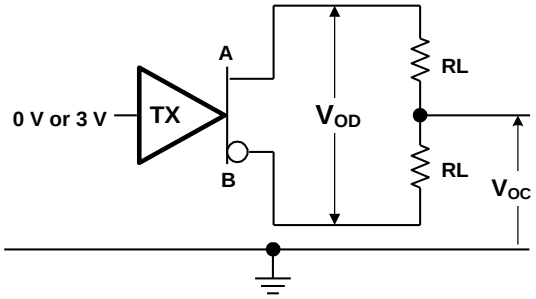


Fig.1 Transmitter DC test circuit

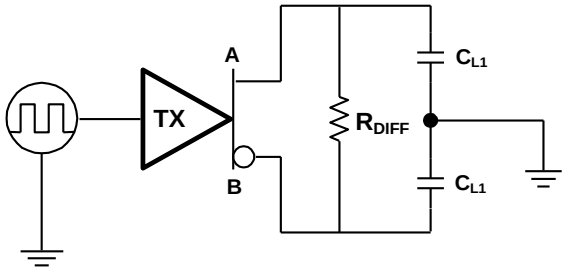


Fig.2 Transmitter timing test circuit

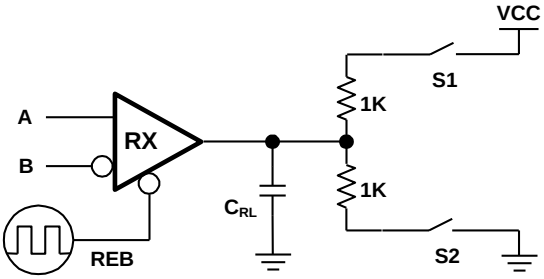


Fig.3 Receiver enable/disable timing test load

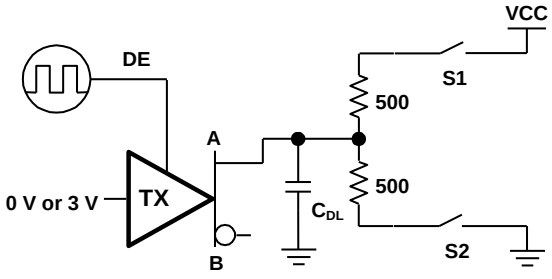


Fig.4 Transmitter enable/disable timing test load

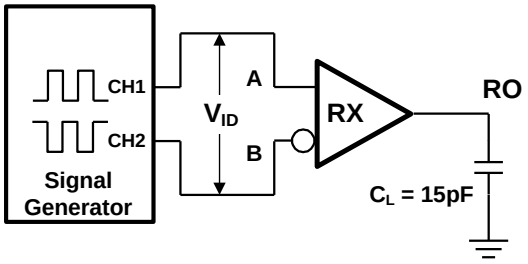


Fig.5 Receiver timing test circuit

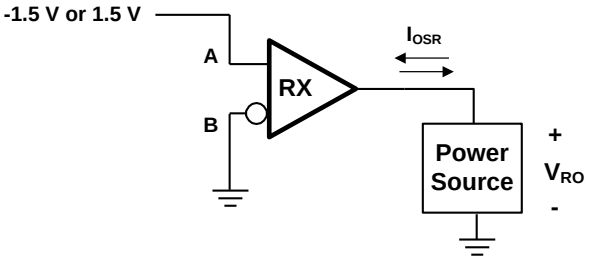


Fig.6 Receiver output short circuit

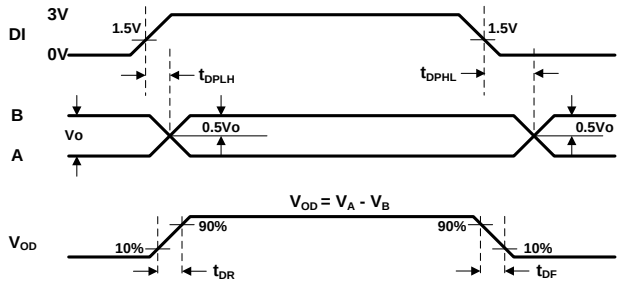


Fig.7 Transmitter Propagation Delays

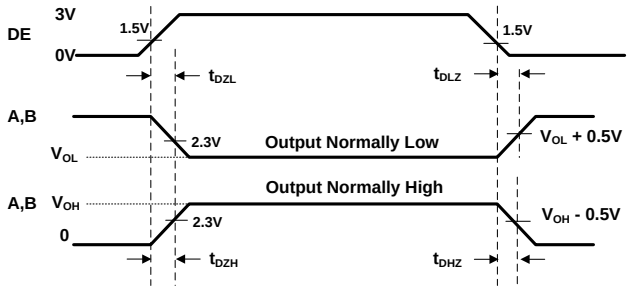


Fig.8 Transmitter Enable and Disable Times

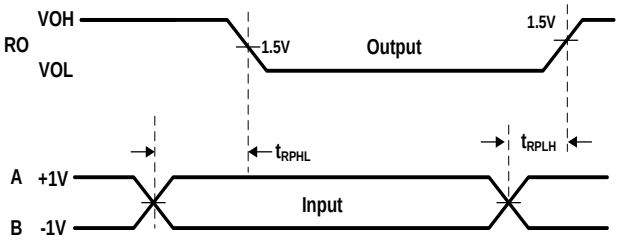


Fig.9 Receiver Propagation Delays

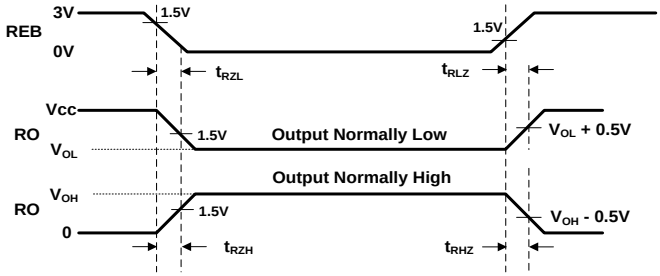


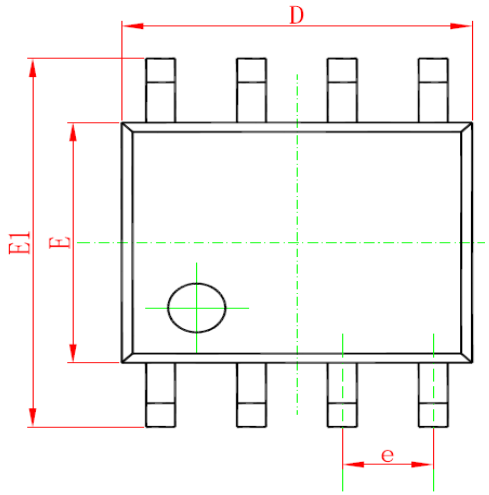
Fig.10 Receiver Enable and Disable Times

Mechanical Details

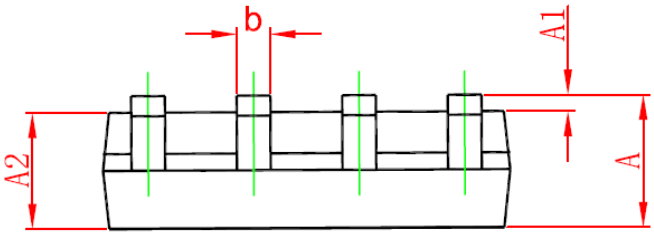
SO-8

PACKAGE DIAGRAMS

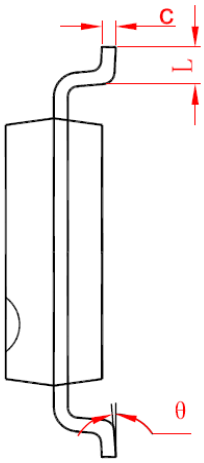
TOP VIEW



SIDE VIEW



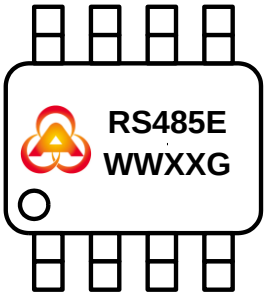
END VIEW



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	1.25	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



RS485E = Device Code
WW = Date Code
XX = Control Code
G = Green Part Indication

Part Number	Marking Code
AZRS485E.RDG	RS485E WWXXG

Ordering Information

PN#	Material	Type	Reel size	MOQ/interal box	MOQ/carton
AZRS485E.RDG	Green	T/R	13 inch	1 reel=2,500/box	5 box=12,500/carton

Revision History

Revision	Modification Description
Revision 2016/07/07	Formal Release.
Revision 2017/02/15	Adds logo and modifies Part Number at Marking Information