±16kV ESD Protected，1Mbps，Half-duplex RS485/RS422 Transceiver

General Description

WT485 is a 5V power supply, half-duplex, low power, low slew rate RS485 Transceiver. WT485Fully meets the TIA/EIA-485 standard.

WT485 includes a driver and a receiver, both of which can be independently enabled and disabled. When both are disabled, the driver and receiver outputs are high-impedance state. WT485 has a 1/8-unit-load receiver input impedance, that allows up to 256 transceivers on the bus. TheWT485 features reduced slew-rate drivers that minimize EMI and reduce reflections caused by improperly terminated cables, allowing error-free data transmission up to 1Mbps.

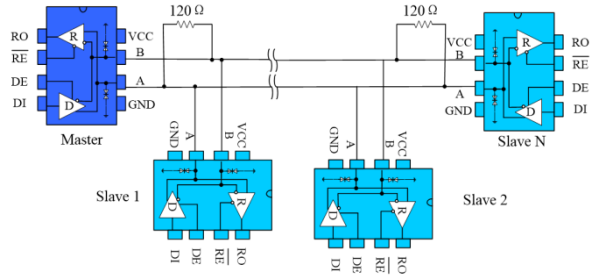
WT485 operates under the supply voltage of 4.5V to 5.5V. WT485 is a true fail-safe transceiver. WT485 also has the function of thermal shutdown protection, current limiting protection, overvoltage protection. DE and $\overline{RE}$ control port input features such as hot-swappable.

The transceiver is intergraded with TVS device, the contact discharge voltage is ±16KV, and HBM is ±16KV, air discharge is ±16KV.

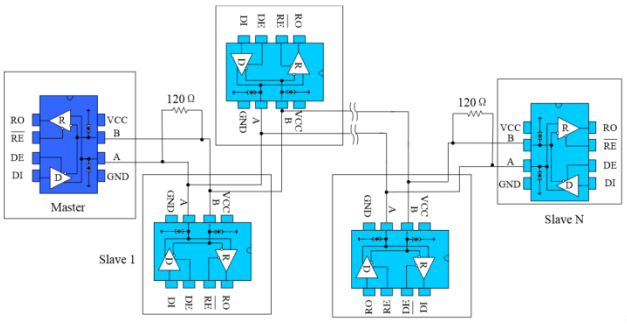
Features

- 5V Power Supply, Half-duplex
- 1/8-unit-load, allows up to 256 transceivers on the bus
- Short-circuit protection
- Thermal shutdown protection
- Low-Current Shutdown Mode
- Hot-Swap Input Structures on DE and /RE
- True Fail-Safe Receiver
- Excellent noise immunity
- Integrated transient voltage suppression
- 1Mbps in Electrically Noise Environments
- ESD Protection for Bus Terminals：
- Contact Discharge ±16KV, HBM ±16KV

Typical Application



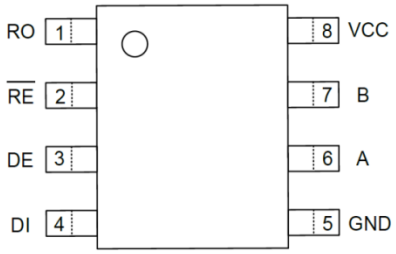
Backbone cable type RS485 communications network



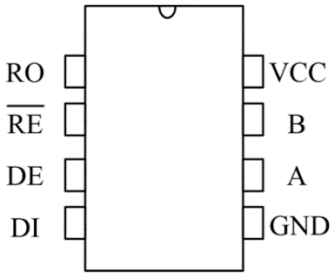
Daisy chain topology type RS485 communications network

Pin Configuration

(Top View)



SOP8



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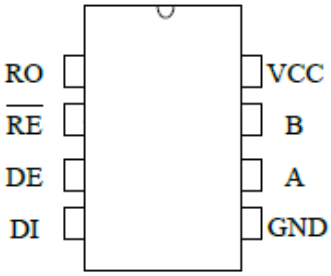


MSOP8

Pin Description

Pin Number	Pin Name	Pin Function
1	RO	Receiver Output. When enabled, if A –B ≥-50 mV, then RO = high. If A -B ≤ -200 mV, then RO = low.
2	$\overline{RE}$	Receiver Output Enable. A low level enables the RO; a high level places it in a high impedance state.
3	DE	Driver Output Enable. A high level enables the driver differential outputs, Pin A and Pin B; a low level places the driver in a high impedance state.
4	DI	Driver Input. When the driver is enabled, a logic low on DI forces Pin A low and Pin B high; a logic high on DI forces Pin A high and Pin B low.
5	GND	Ground Connection (0 V).
6	A	Non inverting Receiver Input A/Driver Output A.
7	B	Inverting Receiver Input B/Driver Output B.
8	VCC	Power Supply.

Absolute Maximum Ratings (NOTE)

Parameter		Rating	Unit
Supply Voltage		+7	V
CTR Port ($\overline{RE}$，DE，DI）		-0.3~VCC+0.3	V
Driver Output Voltage		-7~13	V
Receiver Output Voltage		-0.3~VCC+0.3	V
Temperature Range		-40~85	°C
Storage Temperature Range		-60~150	°C
Soldering Temperature (reflow)		300	°C
Continuous Power Dissipation	SOP8	400	mW
	DIP8	700	mW

Note: Stresses listed as the above "Absolute Maximum Ratings" may cause permanent damage to the device. These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may remain possibility to affect device reliability.

Electrical Characteristics

(V_{CC}=5V, Temp=T_{MIN}~T_{MAX}，typically V_{CC}=+5V，Temp＝25°C, unless otherwise noted)

Parameter	Conditions	Min	Typ	Max	Units
DC Electrical Characteristics of Driver					
Differential Driver Output (no load)			5		V
Differential Driver Output	Fig 1, R_L = 27 Ω	1.5		V_{CC}	V
	Fig 1, R_L = 50 Ω	2		V_{CC}	
Change in Magnitude of Differential Output Voltage (NOTE1)	Fig 1, R_L = 27 Ω			0.2	V
Driver Common-Mode Output Voltage	Fig 1, R_L = 27 Ω			3	V
Change in Magnitude of Common-Mode Voltage (NOTE1)	Fig 1, R_L = 27 Ω			0.2	V
Input High Voltage	DE，DI，$\overline{RE}$	2.0			V
Input Low Voltage	DE，DI，$\overline{RE}$			0.8	V
Input Current (RE, DI, $\overline{RE}$)	DE，DI，$\overline{RE}$	-2		2	μA
Driver Short-Circuit Output Current (short to high)	Short to 0V~12V	35		250	mA
Driver Short-Circuit Output Current (short to low)	Short to-7V~0V	-250		-35	mA
Thermal-Shutdown Threshold			150		°C
Thermal-Shutdown Hysteresis			20		°C
Input Current（A，B）	DE = 0 V, V_{CC}=0 or 5V, V_{IN} = 12 V			125	μA
	DE = 0 V, V_{CC}=0 or 5V, V_{IN} = -7 V	-100			μA
Positive-going input threshold voltage	-7V≤V_{CM}≤12V			-50	mV
Negative-going input threshold voltage	-7V≤V_{CM}≤12V	-200			mV

Parameter	Conditions	Min	Typ	Max	Units
Receiver Input Hysteresis	-7V≤V_{CM}≤12V	10	30		mV
RO Output-High Voltage	I_{OUT} = −4mA, V_{ID} = +200 mV	V_{CC}-1.5			V
RO Output-Low Voltage	I_{OUT} = +4mA, V_{ID} = -200 mV			0.4	V
Three-State Output Current at Receiver	0.4 V < V_O< 2.4 V			±1	μA
Receiver Input Resistance	-7V≤V_{CM}≤12V	96			kΩ
Receiver Output Short-Circuit	0 V≤V_O≤V_{CC}	±7		±95	mA
Supply Current					
Supply Current	$\overline{RE}$=0V or V_{CC}, DE = 0 V		180	300	μA
	$\overline{RE}$=V_{CC}, DE=V_{CC}		150	300	μA
Supply Current in Shutdown Mode	$\overline{RE}$=V_{CC}, DE=0V		0.5	10	μA
A、B	Human Body Model（HBM）		±16		KV
	Contact Discharge		±16		KV
OTHER PINS	Human Body Model（HBM）		±6		KV

NOTE1： ΔV_{OD} and ΔV_{OC} are the changes in V_{OD} and V_{OC}, respectively, when the DI input changes state.

Switching Characteristics

Parameter	Conditions	Min	Typ	Max	Units
Driver Propagation Delay（low to high）	R_{DIFF} = 54 Ω, C_{L1}=C_{L2}=100pF (Fig 2,3)		100	150	ns
Driver Propagation Delay（high to low）			100	150	ns
$\|t_{DPLH}- t_{DPHL}\|$				±10	ns
Driver Differential Output Rise or Fall Time			190	250	ns
Driver Enable to Output High	C_L = 100 pF，S1 closed（Fig 4,5）		70	160	ns
Driver Enable to Output Low			70	160	ns
Driver Disable Time from Low	C_L = 15 pF，S2 closed（Fig 4,5）		70	100	ns
Driver Disable Time from High			70	100	ns
Driver Enable from Shutdown to Output High	C_L = 15 pF,S2 closed（Fig 4,5）		80	120	ns
Driver Enable from Shutdown to Output Low	C_L = 15 pF,S1 closed（Fig 4,5）		80	120	ns
Receiver Propagation Delay (low to high)	V_{ID}≥2.0V；Rise and fall time V_{ID}≤15ns（Fig 6 and 7）		50	80	ns
Receiver Propagation Delay (high to low)			50	80	ns
$\|t_{RPLH} - t_{RPHL}\|$			5	15	ns
Receiver Enable to Output Low	C_L = 100 pF，S1closed(Fig 8,9)		25	40	ns
Receiver Enable to Output High	C_L = 100 pF，S2 closed(Fig 8,9)		25	40	ns
Receiver Disable Time from Low	C_L = 100 pF, S1 closed(Fig 8,9)		25	50	ns
Receiver Disable Time from High	C_L= 100pF，S2 closed(Fig 8,9)		25	50	ns
Receiver Enable from shutdown to Output High	C_L = 100 pF，S2 closed(Fig 8,9)			1000	ns
Receiver Enable from Shutdown to Output Low	C_L = 100 pF，S1 closed(Fig 8,9)			1000	ns
Time to Shutdown	NOTE2	50	200	600	ns

NOTE2： The device is put into shutdown by bringing RE high and DE low. If the enable inputs are in this state for less than 50ns, the device is guaranteed not to enter shutdown. If the enable inputs are in this state for at least 600ns, the device is guaranteed to have entered shutdown.

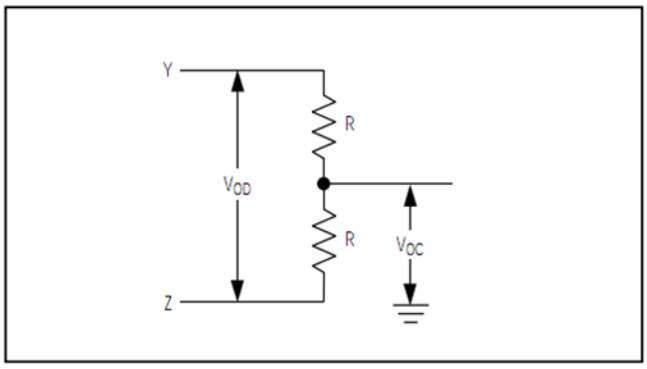


Fig 1 Driver DC Test Load

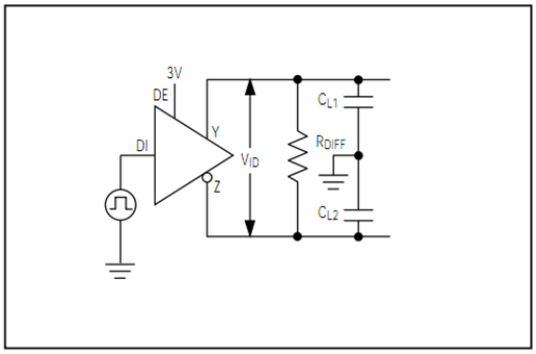


Fig 2 Driver Timing Test Circuit

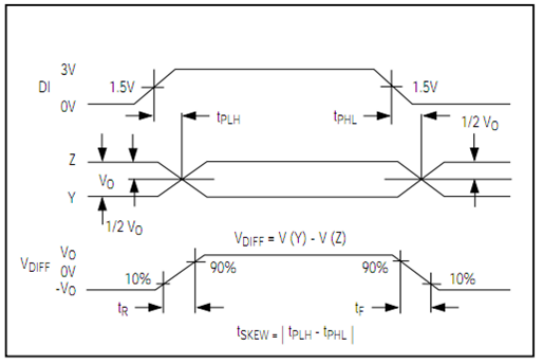


Fig 3 Driver Propagation Delays

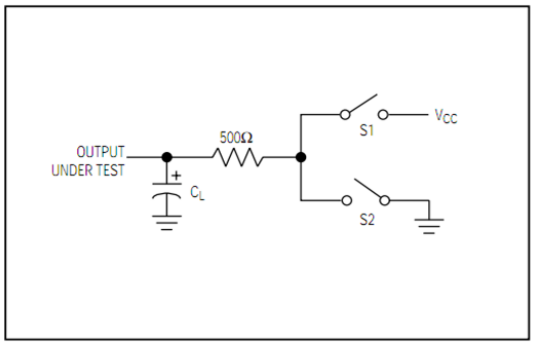


Fig 4 Driver Enable/Disable Timing Test Load

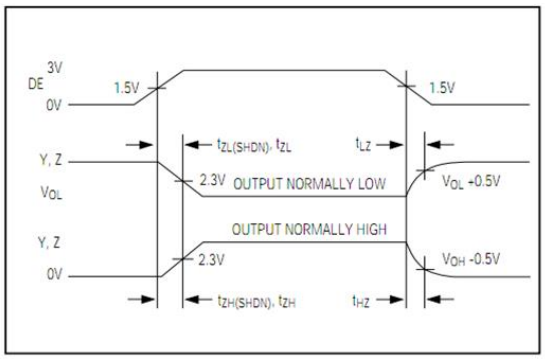


Fig 5 Driver Enable and Disable Times

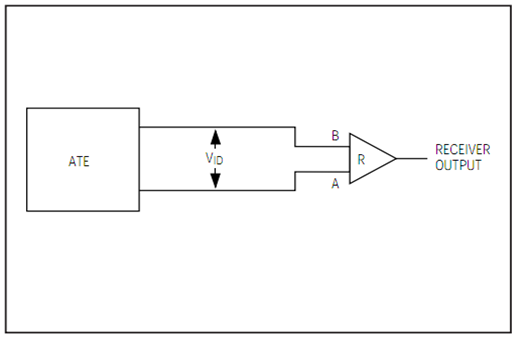


Fig 6 Receiver Propagation Delay Test Circuit

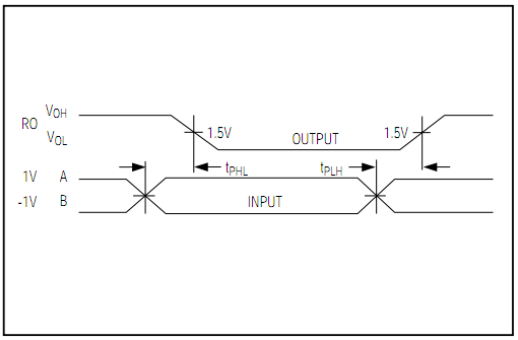


Fig 7 Receiver Propagation Delays

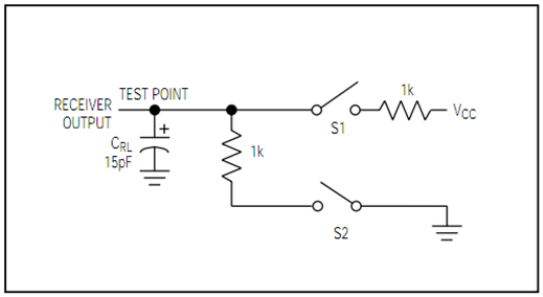


Fig 8 Receiver Enable/Disable Timing Test Load

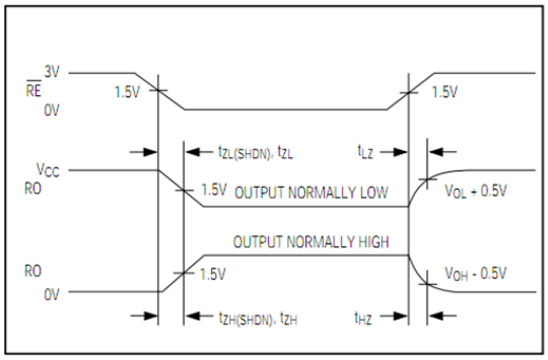
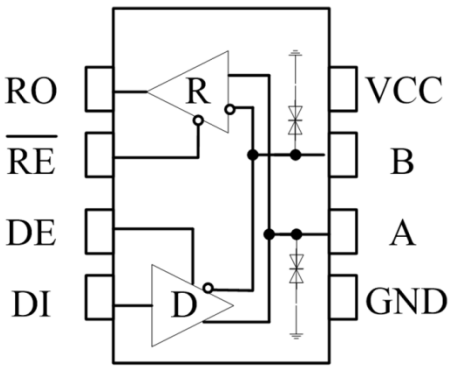


Fig 9 Receiver Enable and Disable Times

Block Diagram



Function Tables

TRANSMITTING

CTR		INPUTS	OUTPUTS	
$\overline{RE}$	DE	DI	A	B
X	1	1	H	L
X	1	0	L	H
0	0	X	Z	Z
1	0	X	Z(shutdown)	
X：Don’t care；Z：high impedance。				

RECEIVING

CTR		INPUTS	OUTPUTS
$\overline{RE}$	DE	A-B	RO
0	X	⩾-50mV	H
0	X	⩽-200mV	L
0	X	Open/shorted	H
1	X	X	Z
X：Don’t care；Z：high impedance。			

Application Information

Fail Safe

When the receiver inputs are shorted or open, or when they are connected to a terminated transmission line with all drivers disabled, WT485 guarantees a logic-high receiver output. This is done by the receiver input thresholds are set between -50mV and -200mV. If the differential receiver input voltage (A-B) ≥-50mV, RO is logic high; if the voltage (A-B) ≤-200mV, RO is logic low. When attached to the terminal all transmitters on the bus are disabled, the receiver differential input voltage is pulled to 0V by the termination resistor. With the receiver threshold of the WT485, this results in a logic-high with a 50mV minimum noise margin. The -50mV to -200mV threshold complies with the ±200mV EIA/TIA-485 standard.

Connecting 256 Transceivers on one Bus

The standard RS-485 receiver input impedance is 12kΩ (1 unit load), the standard driver can drive up to 32 unit loads. Receiver WT485 transceiver has a 1/8 unit load receiver input impedance (96kΩ), allowing up to 256 transceivers to be connected in parallel on one bus. These devices can be any combination, or in combination with other RS-485 transceiver combination, as long as the total load does not load more than 32 units, can be connected on the same bus.

Drive Output Protection

Through two mechanisms to avoid failure or a bus contention causes power consumption is too high. First, in the entire common Mode voltage range, overcurrent protection circuit provides a fast short protection. Second, when the die temperature exceeds 150℃, driver output is forced into a high impedance state by the thermal shutdown circuit.

Typical Application

- Backbone cable type

WT485 transceiver is designed for multi-point bi-directional data communication bus transmission lines. Figure 10 shows a typical network application circuit. These devices can also be used as a cable longer than 4,000 feet of line repeater, to reduce the reflection, the transmission line should be in its ends terminated in its characteristic impedance, and stub lengths off the main line should be as short as possible.

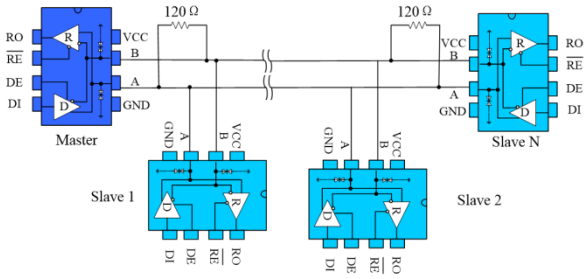
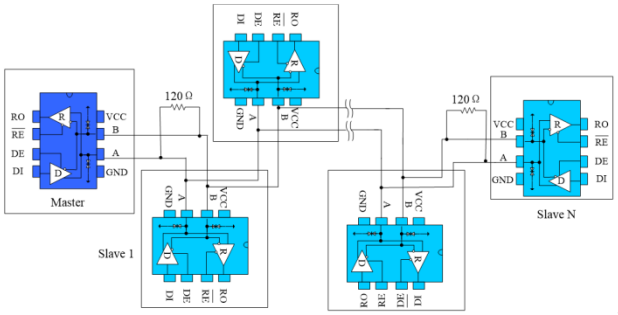


Fig 10 Backbone cable type RS485 communications network

- Hand in hand type

Also known as daisy chain topology, is the prior RS485 bus topology recommended by the TIA organization. The routing method is the master device and a number of slave devices connected in hand-handle configuration, as shown in Figure 11. It' should be noted at that hand in handle means no branch line. This kind of topology has the advantages of small reflection and high rate of success communication.

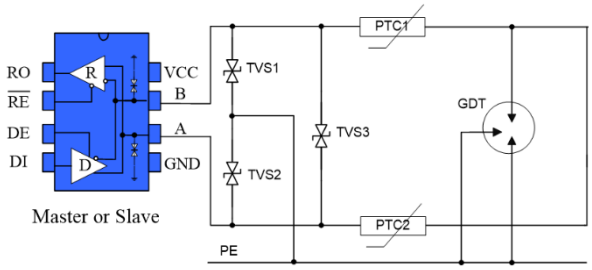
Fig 11 Daisy chain topology type RS485 communications network

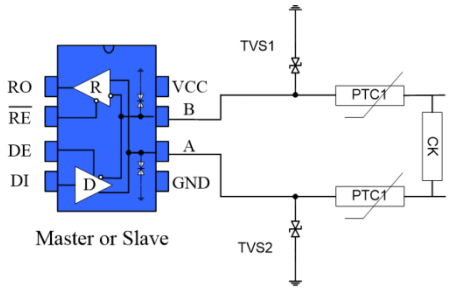


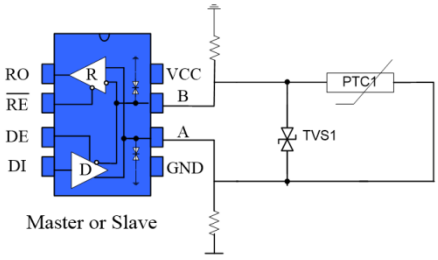
- The bus port protection

In harsh environments，RS485 communication ports are usually done with static protection, lightning surge protection, and other additional protection，even prepared to prevent 380V electricity access by mistake. To avoid the destruction of intelligent instruments and industrial control host, figure 12demonstrates three general kinds of RS485 bus port protection configuration.

Fig 12RS485 bus ports Protection configuration

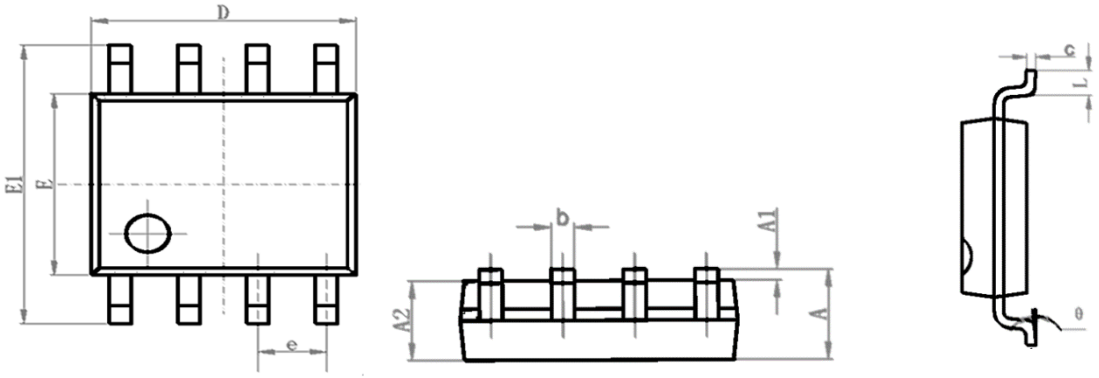






Package Information

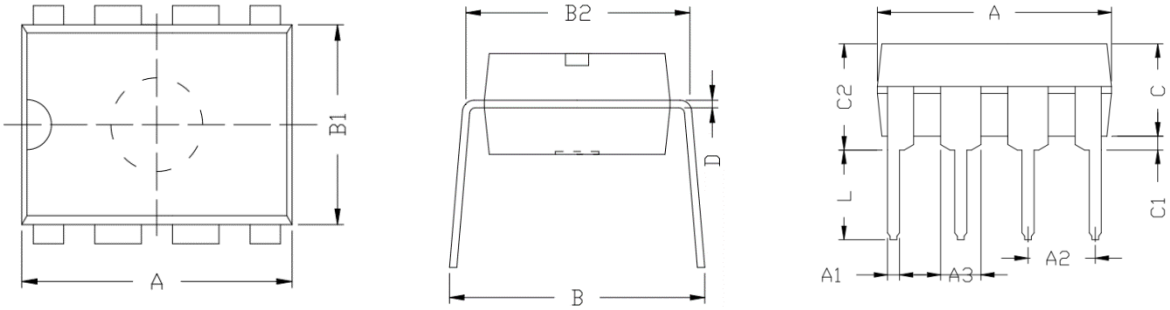
SOP8



Dimensions in Millimeters

Symbols	Min	Nom	Max
A	1.50	1.60	1.70
A1	0.1	0.15	0.2
A2	1.35	1.45	1.55
b	0.355	0.400	0.455
D	4.800	4.900	5.00
E	3.780	3.880	3.980
E1	5.800	6.000	6.200
e		1.270BSC	
L	0.40	0.60	0.80
c	0.153	0.203	0.253
θ	-2°	-4°	-6°

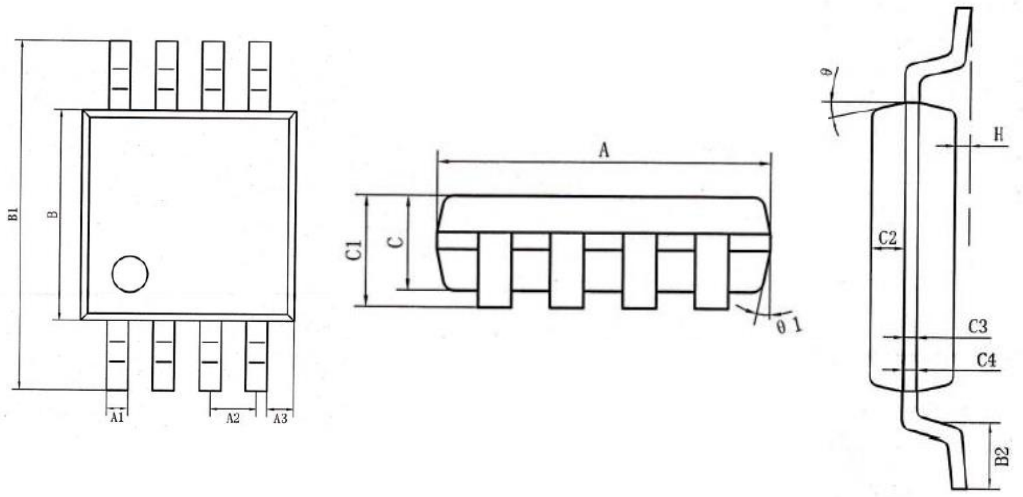
DIP8



Dimensions in Millimeters

Symbols	Min	Nom	Max
A	9.00	9.20	9.40
A1	0.33	0.45	0.51
A2	2.54TYP		
A3	1.525TYP		
B	8.40	8.70	9.10
B1	6.20	6.40	6.60
B2	7.32	7.62	7.92
C	3.20	3.40	3.60
C1	0.50	0.60	0.80
C2	3.71	4.00	4.31
D	0.20	0.28	0.36
L	3.00	3.30	3.60

MSOP8



Dimensions in Millimeters

Symbols	Min	Nom	Max
A	2.9	3.0	3.1
A1	0.28		0.35
A2	0.65TYP		
A3	0.375TYP		
B	2.9	3.0	3.1
B1	4.7		5.1
B2	0.45		0.75
C	0.75		0.95
C1			1.1
C2	0.328TYP		
C3	0.152		
C4	0.15		0.23
H	0.00		0.09
θ	12°TYP		

Ordering Information

Part Number	Temp Range	Package	Packing Quantity
WT485-S80R	-40°C ~85°C	SOP8	4k/Reel
WT485-D80T	-40°C ~85°C	DIP8	50/Tube
WT485-M80R	-40°C ~85°C	MSOP8	4k/Reel

Contact Information

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WAYON website: **http://www.way-on.com**

For additional information, please contact your local Sales Representative.

Specifications are subject to change without notice.

The device characteristics and parameters in this data sheet can and do vary in different applications and actual device performance may vary over time.

Users should verify actual device performance in their specific applications.