

TD(H)541S485H

RS485 isolated transceiver in DFN package

Features

- Ultra-small, ultra-thin, chip level DFN Encapsulation
- meets the TIA/EIA-485-A standard
- integrated 5V Efficient isolated power supply
- I/O Voltage range support 3.3V and 5V microprocessor
- Isolation withstand voltage up to 3000VDC(TDH541S485H 5000VDC)
- The bus electrostatic protection capacity is as high as 15kV(HBM)
- The communication speed is up to 1Mbps
- >25kV/μs Transient immunity
- Very low communication delay.
- 1/8 Unit load, bus load capacity up to 256 node
- Bus fail protection
- Bus driver short circuit protection
- Industrial grade working temperature range:-40°C to +105°C
- meets the AEC-Q100 standard
- satisfy EN62368 standard

Scope of application

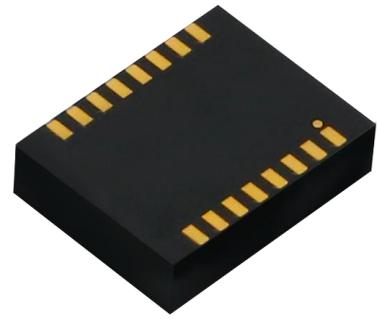
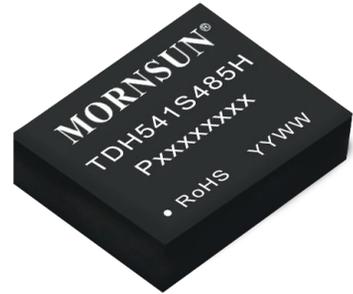
- automated industry
- Building automation
- Smart meter
- Long-distance signal interaction and transmission

Function description

TD(H)541S485H it's for RS-485 An isolated half-duplex enhanced transceiver designed by the bus network, and fully complies with TIA/EIA-485A standard. It adopts 5VDC Power supply 5V Isolated power supply, logic side support 3.3V and 5V Logic level conversion, the bus receiver adopts 1/8 Unit load design, its bus load capacity is as high as 256 A node element to meet the design requirements of multi-section design. The bus transfer rate is up to 1Mbps.

TD(H)541S485H More traditional IC Focus on strengthening A,B Pin reliability design, including driver overcurrent protection, enhanced ESD Design, etc., its A,B port ESD Withstand up to 15KV(Human Body Model).

Appearance

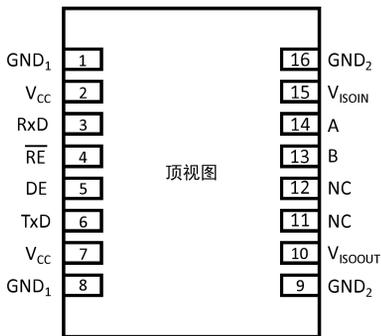


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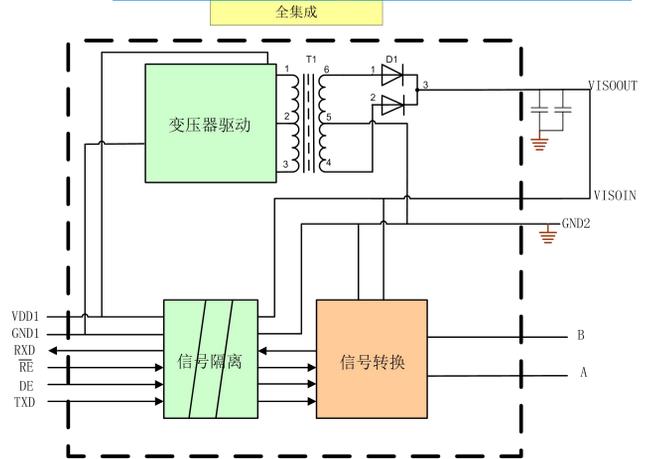
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Pin package



Note: all GND1 Internally connected; all GND2 The interior is connected.

Internal block diagram



Truth table

letter	describe
H	High level
L	Low level
X	Irrelevant
Z	High impedance

surface 1. Drive truth table

signal input (TXD)	Enable input (DE)	Output	
		A	B
H	H	H	L
L	H	L	H
X	L	Z	Z
OPEN	H	H	L

surface 2. Receiver truth table

Differential input	Enable input (RE)	Signal output (RXD)
> -0.01	L	H
< -0.2	L	L
-0.2 < A - B < -0.01	L	not sure
X	H	Z
open circuit	L	H
Short circuit	L	H

Pin description

Pin number	Pin name	Function description
1	GND ₁	Logic side reference ground.
2	V _{CC}	Chip power supply pin. Close to this pin must be connected 0.1uF and 10nF Ceramic capacitor to the logic side reference ground (GND ₁).
3	RXD	Receiver signal output pin
4	$\overline{\text{RE}}$	Receiver enable pin. $\overline{\text{RE}}$ Is low when (A-B) \geq -10mV, RO The output is high, when (A-B) \leq -200mV, RO The output is low.
5	DE	Driver enable pin. when DE When it is high, the driver output is enabled; when DE When it is low, the driver output is high impedance; when DE Is low, and $\overline{\text{RE}}$ When it is high, it enters shutdown mode.
6	TXD	Driver input pin.
7	V _{CC}	Logic side power supply pin. Close to this pin must be connected 10uF and 0.1uF Ceramic capacitor to the logic side reference ground. (GND ₁).
8	GND ₁	Logic side reference ground.
9	GND ₂	Bus side reference ground
10	V _{ISOOUT}	Isolated power output, this pin must pass 10uF and 100nF The capacitor is connected to 9 foot.
11	NC	No function pin, can be left floating
12	NC	No function pin, can be left floating
13	B	RS485 bus B Wire pin
14	A	RS485 bus A Wire pin
15	V _{ISOIN}	Isolated power input, this pin must pass 100nF and 10nF The capacitor is connected to 16 foot.
16	GND ₂	Isolated output reference ground

Limit rating

The column data is measured in natural ventilation and normal operating temperature range (unless otherwise stated).

parameter	unit
Supply voltage, V _{CC}	-0.3V~+6V
A, B Voltage range	-8V~+13V
DE, TXD, $\overline{\text{RE}}$, RXD voltage range	-0.3V~+6V
range of working temperature	40°C to +105°C
Storage temperature range	- 50°C to +125°C
Reflow temperature	Peak temperature T _c \leq 245°C, 217°C The maximum time above is 60 s, Please refer to IPC/JEDEC J-STD-020D.1 standard.

If it exceeds the stress value listed in the "Limit Ratings" table, it may cause permanent damage to the device. Working under extreme rated conditions for a long time may affect the reliability of the device. All voltage values are referenced to ground (GND) for reference.

Recommended working parameters

symbol	Recommended working conditions	Minimum	Typical value	Max	unit
V _{CC}	Supply voltage	4.75	5	5.25	V
V _I	Any bus terminal pin voltage (differential mode, common mode)	-7		12	
V _{IH}	High level input voltage (TXD, DE, $\overline{\text{RE}}$)	2		V _{CC}	
V _{IL}	Low-level input voltage (TXD, DE, $\overline{\text{RE}}$)	0		0.8	
I _{OS}	Output current	driver		60	mA
		receiver	- 8	8	
R _{TN}	Differential output load resistance	54	60		Ω
T _A	Working temperature	-40		105	°C
-	Transmission rate			1000	Kbps

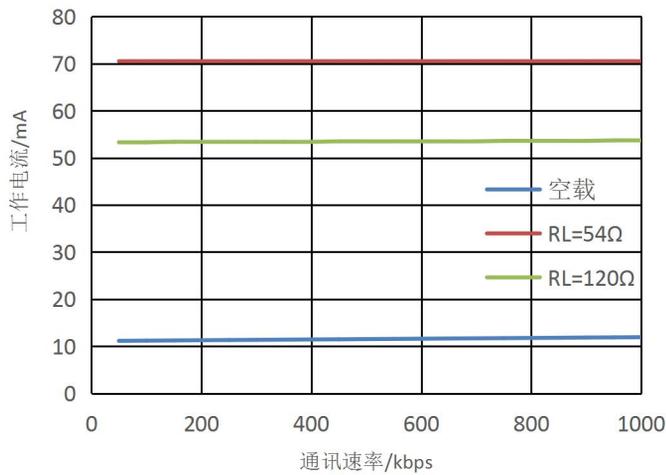
symbol	parameter	Test Conditions	Minimum	Typical value	Max	unit	
Drive characteristics							
V _{OD}	Differential drive output	No load	3.5			V	
		R _L =54Ω, picture 7	1.5	2.0		V	
		R _L =100Ω, picture 7	2.0			V	
ΔV _{OD}	Driver differential output voltage change	R _L =54Ω, picture 7			±0.2	V	
V _{OC}	Driver common mode output voltage	picture 7	1		3	V	
ΔV _{OC(SS)}	Driver common-mode output voltage variation amplitude	picture 7	-0.1		0.1	V	
I _{OS}	Driver short circuit	-7V ≤ V _{OUT} ≤ 12V		±110	±250	mA	
Receiver characteristics							
V _{IT(+)}	Positive differential input threshold voltage	-7 V ≤ V _{CM} ≤ +12 V			- 10	mV	
V _{IT(-)}	Negative differential input threshold voltage	-7 V ≤ V _{CM} ≤ +12 V	- 200			mV	
V _{hys}	Hysteresis voltage (V _{IT+} - V _{IT-})	-7 V ≤ V _{CM} ≤ +12 V		20		mV	
R _{ID}	Differential input impedance (A,B)	-7 V ≤ V _{CM} ≤ +12 V	96			kΩ	
I _I	Input Current(A,B Pin)	DE=0, RE =0, V _{CC} =0 or 5.5V	V _{OUT} =12V		190	250	uA
			V _{OUT} = -7V	-200	-110		uA
V _{OH}	RXD High level output voltage	I _{OUT} = 20 μA, V _A - V _B = 0.2 V	V _{CC} - 0.1			V	
		I _{OUT} = 4 mA, V _A - V _B = 0.2 V	V _{CC} - 0.4	V _{CC} - 0.2		V	
V _{OL}	RXD Low-level output voltage	I _{OUT} = -20 μA, V _A - V _B = -0.2 V			0.1	V	
		I _{OUT} = -4 mA, V _A - V _B = -0.2 V			0.4	V	
Power supply and protection characteristics							
I _{CC}	Static working current	DE=RE=0V		15	30	mA	
I _{CC}	Working current	A,B between 100Ωload		60	80	mA	
		A,B between 54Ωload		75	105	mA	
ESD	Electrostatic discharge immunity	HBM model	A,B Pin pair GND		±15	KV	
			Other pins		±2	KV	
		Contact discharge mode	A,B Pin pair GND		±4	KV	
EFT	Group pulse immunity	IEC61000-4-4	A,B Pin pair GND		±2	KV	
SURGE	Lightning surge immunity	IEC61000-4-5	A,B Pin pair GND(Common mode)		±2	KV	
VI-O	Isolation withstand voltage	TD541S485H			3000	VDC	
			TDH541S485H			5000	VDC
		Insulation resistance		1			GΩ
	Insulation capacitor			3		pF	
CMTI	Common mode transient immunity	TXD = VDD1 or 0 V, VCM = 1 kV, transient magnitude = 800 V	25			kV/us	

symbol	parameter	Test Conditions	Minimum	Typical value	Max	unit
-	Transmission rate	Duty cycle 40% ~ 60%			1000	Kbps
T_{PHL}, T_{PLH}	Drive transmission delay	$R_L = 54\Omega, C_L = 50pF, \text{picture 9}$		100	200	ns
$ T_{PHL}-T_{PLH} $	Driver differential output delay offset			30	100	ns
T_R, T_F	Driver output rise delay, fall delay		30	50	100	ns
T_{PHL}, T_{PLH}	Receiver transmission delay	$C_L = 15pF, \text{picture 10}$		50	150	ns
$ T_{PHL}-T_{PLH} $	Receiver transmission delay offset			15	50	ns
T_R, T_F	Receiver output rise delay and fall delay		$C_L = 15pF, V_{DI} = -1.5V \sim 1.5V, \text{picture 10}$		15	

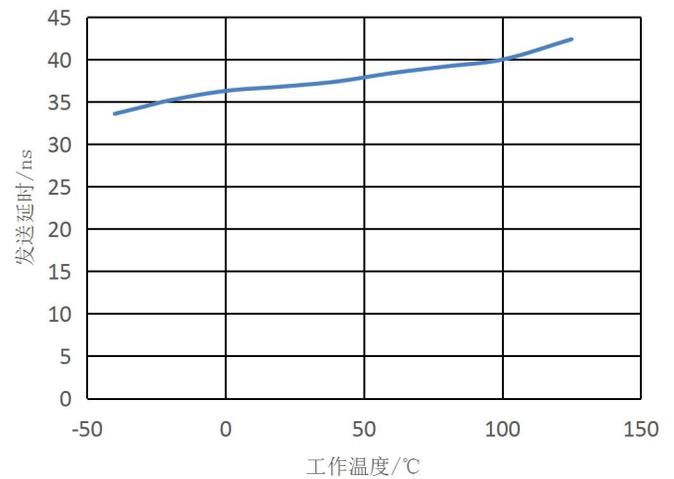
Physical properties

parameter	Numerical value	unit
weight	0.9(Typ.)	g

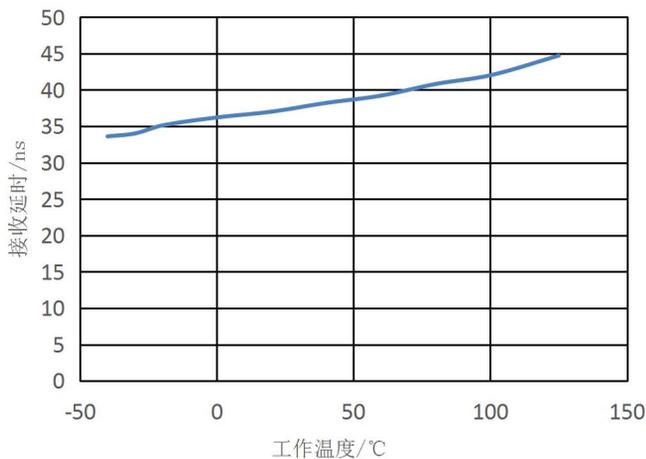
Typical curve



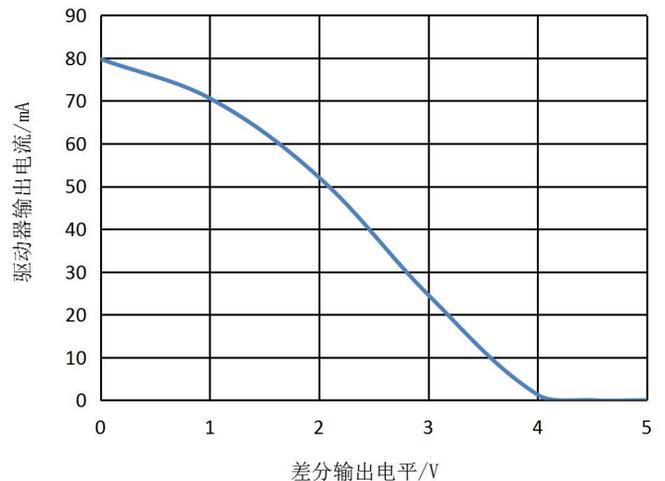
picture 1 Working current VS Communication rate



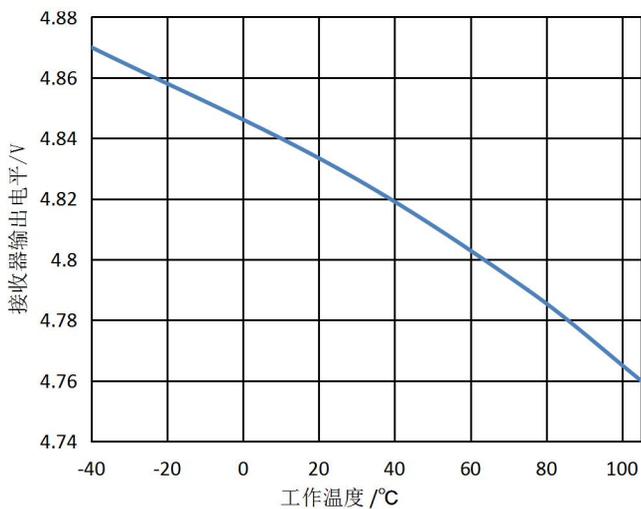
picture 2 Send delay VS Operating temperature



picture 3 Receive delay VS Operating temperature



picture 4 Driver output current VS Differential output level

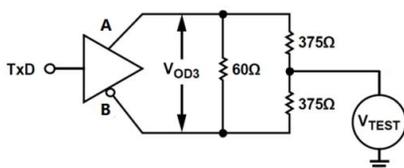


picture 5 Receiver output high level VS Operating temperature

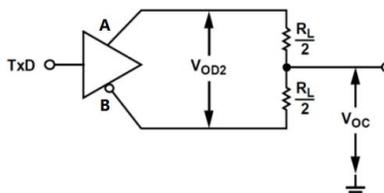
Parameter test circuit

Note: The test condition load capacitance includes the parasitic capacitance of the test probe and the test fixture (no special instructions)

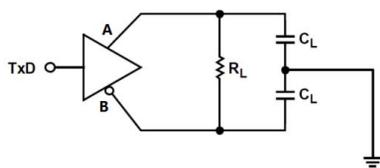
. Test signal rising and falling edge < 6ns, frequency 100KHz, Duty cycle 50%. Impedance matching $Z_0 = 54\Omega$ (No special instructions)



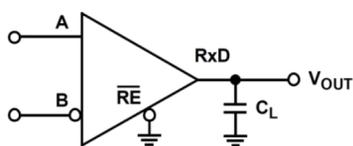
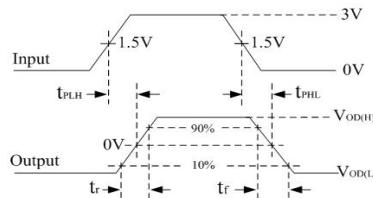
picture 6 Common mode output test circuit



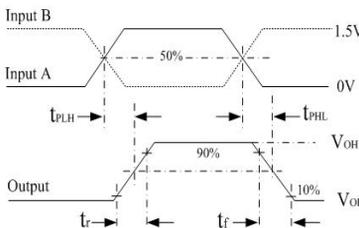
picture 7 Differential output test circuit



picture 8 Transmission delay test circuit



picture 9 Receiving delay test circuit



Job description and function

TD(H)541S485H It is a half-duplex reinforced type with isolated power supply RS485 Isolate the transceiver. In addition to an isolated power supply, each transceiver also contains a driver and a receiver. The transceiver has a bus failure protection function, when the receiver input is open, short-circuited or when the bus is in an idle state, it can ensure that the receiver output is high. TD(H)541S485H use 5VDC With a single power supply, the whole machine can monitor the overall working status of the module and limit the large output current to prevent irreversible damage to the transceiver caused by bus overload or short circuit.

Receiver input filter: TD(H)541S485H The receiver integrates a high-performance input filter, which can greatly enhance the receiver's noise suppression capability for high-speed differential signals. Therefore, the transmission delay of the receiver is also caused by this reason.

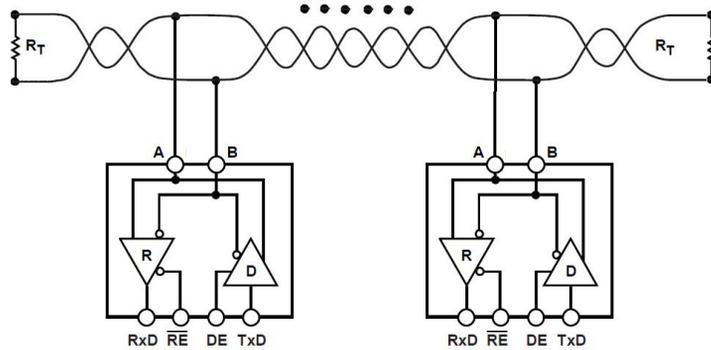
Bus failure protection: In general, when $-200\text{mV} < \text{AB} < -10\text{mV}$ When the time, the bus receiver will be in an indeterminate state. This phenomenon will appear when the bus is idle. The bus failure protection can ensure that when the receiver input is open, short-circuited, or the bus access port matching resistance, the receiver output is high. TD(H)541S485H The receiver threshold voltage is more accurate, and the threshold voltage to the reference ground is at least 10mV Margin, this feature can ensure that even if the bus differential voltage is 0V When the receiver output level is high and conforms to EIA/TIA-485 standard $\pm 200\text{mV}$ Requirements.

Bus load capacity (256 nodes) standard RS485 The receiver input impedance is defined as 12KΩ(1 Unit load) . A standard RS485 The drive can drive at least 32 Unit load. TDH541S485H Bus receiver press 1/8 Unit load design, its input impedance is greater than 96KΩ. Therefore, the bus can allow access to more transceivers (up to 256 Piece). TD(H)541S485H Can also be combined with other 32 Unit load standard RS485 Mixed use of transceivers (the accumulative receivers cannot exceed 32 Unit load).

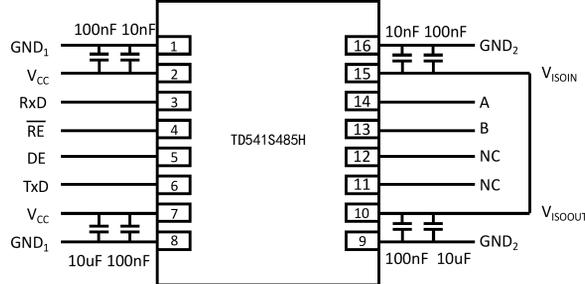
Low power consumption SHUTDOWN Mode: When RE Input high level, DE When the input low level, the transceiver enters shutdown (SHUTDOWN) model. When the transceiver enters shutdown mode, its overall standby power consumption is reduced. RE ,DE Can be short-circuited and pass the same I/O Take control. if RE Input high level, DE Input low level hold time is less than 50nS, The transceiver cannot enter the shutdown mode, if the hold time can be maintained at least 600nS, The transceiver will reliably enter the shutdown mode.

Drive output protection: TD(H)541S485H The internal integrated driver short circuit (or overcurrent) protection module. When an error occurs on the bus or the drive is short-circuited, the module can limit the output current of the drive to a certain limit.

Application circuit



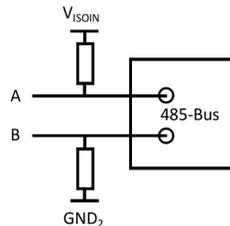
picture 10 Typical application circuit (half-duplex network topology)



picture 11 typical application PCB layout

Recommendations

- ① Isolated power output pin V_{ISOOUT} Need to connect to V_{ISOIN} Except for the pull-up and pull-down functions described in Article ④, this power supply is not recommended for other purposes, otherwise the bus voltage may not meet the communication requirements and cause communication failure.
- ② DE and RE The pin does not support floating, if the pin is not connected to the controller, the pin is recommended to pass 30kΩ The pull-down resistor is connected to GND. In order to keep the node only in the receiving state, and does not affect the bus.
- ③ The controller should not be connected at any time DE, RE, TXD The pin is set to the state of open-drain output, otherwise it will cause uncertain consequences.
- ④ To keep AB Bus idle stability requires at least one node on the bus end A Pull up to V_{ISOIN} , will B Drop down to GND_2 , And the parallel value of the pull-up and pull-down resistance of the overall network is 400Ω about.



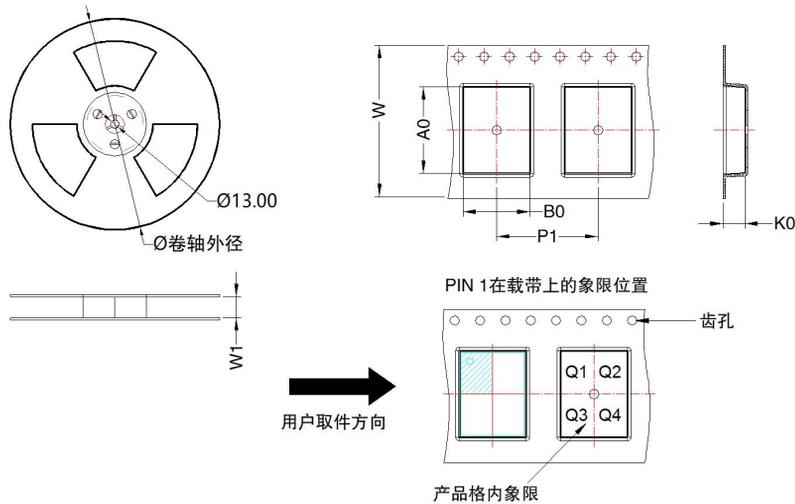
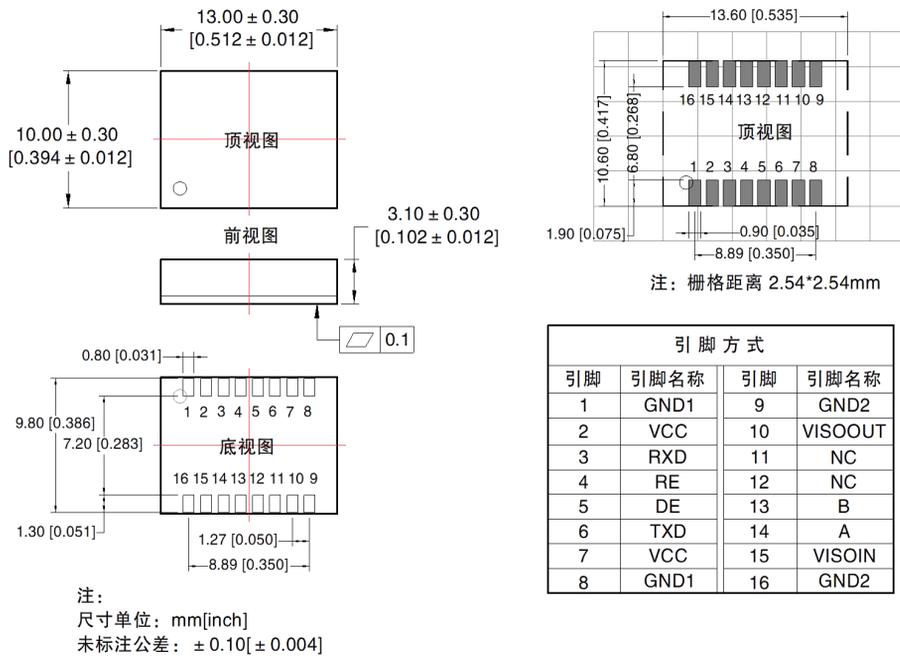
picture 12 Typical connection of pull-up and pull-down resistors

⑤ The product does not support hot swapping.

Ordering Information

Product number	Encapsulation	Number of pins	Silk screen	Package
TD541S485H	DFN	16	TD541S485H	1K/plate
TDH541S485H	DFN	16	TDH541S485H	1K/plate

第三角投影



器件型号	封装类型	Pin	MPQ	卷轴外径 (mm)	卷轴宽度 W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 象限
TD(H)541S485H	DFN 10x13	16	1000	330.0	24.4	13.52	10.52	3.5	16.0	24.0	Q1
TD(H)541SCANH		20									
TD(H)541SCANFD		20									

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