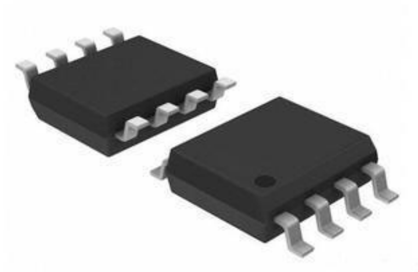
SCM3403ASA Half-Duplex RS485/RS422 Transceiver

Features

- 3.0V ~ 5.5V wide power range, half duplex
- Bus port ESD level 15kV HBM
- Bus fault tolerance withstand voltage up to±15V
- 1/8 Unit Load—Up to 256 Nodes on a Bus
- Driver short circuit protection
- Low power consumption shutdown function
- Receiver open circuit expired protection
- Stronger anti-chirp capacity
- The in a sudden changing of the integration voltage boycotts function
- Communication Speed up to 12Mbps in an electrical noise environment

Package



Product optional package: SOP-8, Screen Printing information please see "Ordering Information"

Applications

- Industrial automation
- Building automation
- Smart meter
- Long-distance signal interaction and transmission

Functional Description

The SCM3403ASA is a 3.0V ~ 5.5V wide power range, half-duplex,bus port ESD level reaches above 15kV HBM, bus withstand voltage range up to ±15V low-power RS-485 transceiver that fully meets the requirements of the TIA/EIA-485 standard.

The SCM3403ASA includes a driver and a receiver, both of which can be independently enabled and disabled. When both are disabled, both the driver and the receiver output a high-impedance state. The SCM3403ASA has a 1/8 load that allows 256 SCM3403ASA transceivers to be connected to the same communication bus. Error-free data transfer of up to 12Mbps is possible.

The SCM3403ASA operating voltage range is 3.0 ~ 5.5 V, with fail-safe, current limit protection, over voltage protection and other functions.

Typical Application

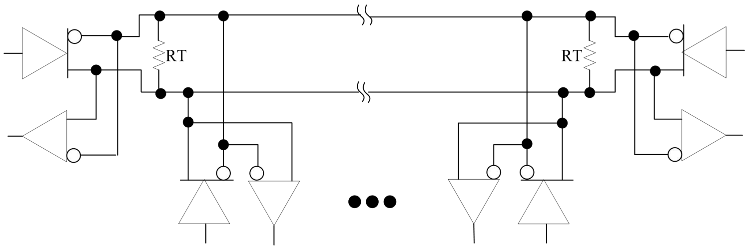


Figure 1. Typical application 1 (Half-Duplex network structure)

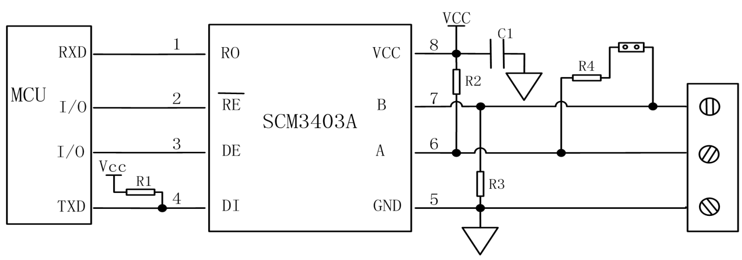
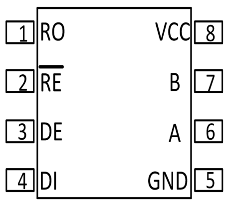


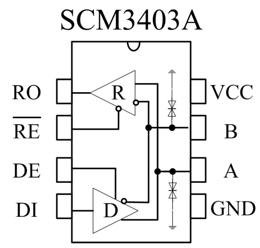
Figure 2. Typical application 2 (Typical design)

Contents

Pin Package



Internal Block Diagram



Truth Table

Driver						Receiver			
Input			Output			Input			Output
/RE	DE	DI	A	B		/RE	DE	A-B	RO
X	1	1	H	L		0	X	≥200mV	H
X	1	0	L	H		0	X	≤-200mV	L
0	0	X	Z	Z		0	X	Open/Short circuit	H
1	0	X	Z(shutdown)			1	X	X	Z
X: Don't care; Z: High impedance						X: Don't care; Z: High impedance			

Pin Configurations and Functions

Pins	Name	Pin Functions
1	RO	Receiver output port; When /RE is low-level: if A-B≧200mV, RO output high-level;If A-B≦-200mV, RO output low-level.
2	/RE	Receiver output enable control. When /RE is low-level, receiver output enable, RO output be available; When /RE is high-level, receiver output disable, RO is High impedance state; /RE is high-level and DE is low-level, the spare part enters a low power consumption mode.
3	DE	Driver output enable control. DE is high-level driver output be available, DE is low-level output High impedance; /RE is high-level and DE is low-level, the spare part enters a low power consumption mode.
4	DI	DI device input. When DE is high-level, The DI low level makes the driver co-phase carries A output for low level, the driver anti-phase carries the B output as high level; The DI high level will make co-phase port output for high level, the anti-phase carries output for low.
5	GND	Ground
6	A	Receiver co-phase input and driver co-phase the output carry.
7	B	Receiver anti-phase input and driver anti-phase the output carry.
8	VCC	Supply voltage.

Absolute Maximum Ratings

Parameters	Sym.	Value	Units
Supply Voltage	VCC	+7	V
Voltage of Control Port	/RE, DE, DI	-0.3~VCC+0.5	V
Bus Side Input Voltage	A, B	-15~+15	V
Receiver Output Voltage	RO	-0.3~VCC+0.5	V

Operating Ambient Temperature Range		-40 ~ 125	℃
Storage Temperature Range		-60 ~ 150	℃
Welding Temperature Range		300	℃
Continuous Power Dissipation	SOP8	470	mW

(1)The following data was measured in a naturally ventilated, normal operating temperature range (unless otherwise stated).
(2)The maximum limit parameter value means that exceeding these values may cause irreparable damage to the device. Under these conditions, it is not conducive to the normal operation of the device. Continuous operation of the device at the maximum allowable rating may affect device reliability. The reference point for all voltages is ground.

Recommended Operating Conditions

Recommended Operating Conditions	Min.	Typ.	Max.	Units
Supply Voltage, V_{VCC}	3.0		5.5	V
Any Bus Terminating Pin Voltage (Differential mode; Common mode), V_I	-7		12	V
High-level Input voltage(DI, DE, /RE), V_{IH}	2			V
Low-level Input Voltage(DI, DE, /RE), V_{IL}			0.8	V
Differential Load resistance	54	60		Ω
Baud Rate			12	Mbps
Operating Ambient Temperature Range, T_A	-40		85	℃

Electrical Characteristics

Unless otherwise stated, VCC=3.3/5V±10%, Temp=TMIN~TMAX, typical value is VCC=+3.3/5V, Temp=25°C

Driver Electrical Characteristics						
Sym.	**Parameters**	**Test Conditions**	**Min.**	**Typ.**	**Max.**	**Units**
V_{OD1}	Driver differentially output (no load)		3		5.5	V
V_{OD2}	Drive differentially output	Figure 3, RL = 54Ω VCC=3.3V	1.5		VCC	V
		Figure 3, RL = 54 Ω VCC=5V	1.5		VCC	
ΔV_{OD}	(NOTE1)	Figure 3, RL = 54 Ω			0.2	V
V_{OC}	Output common mode voltage	Figure 3, RL = 54 Ω			3	V
ΔV_{OC}	The change of output common mode voltage(NOTE1)	Figure 3, RL = 54 Ω			0.2	V
V_{IH}	High-level voltage input	DE, DI, /RE	2.0			V
V_{IL}	Low-level voltage input	DE, DI, /RE			0.8	V
I_{IN1}	Logic input current	DE, DI, /RE	-2		2	uA
I_{OSD1}	Output short-circuit current, short-circuit to high	short-circuit 0V ~ 12V			250	mA
I_{OSD2}	Output short-circuit current, short-circuit to low	short-circuit -7V ~ 0V	-250			mA
Receiver Electrical Characteristics						
Sym.	**Parameters**	**Test Conditions**	**Min.**	**Typ.**	**Max.**	**Units**
I_{IN2}	Input current(A, B)	DE = 0 V, VCC=0 or 3.3/5V, V_{IN} = 12 V			125	uA
		DE = 0 V, VCC=0 or 3.3/5V, V_{IN} = -7 V	-100			uA
V_{IT+}	Positive-going input threshold voltage	$-7V \leqq V_{CM} \leqq 12V$			-10	mV
V_{IT-}	Negative-going input threshold voltage	$-7V \leqq V_{CM} \leqq 12V$	-200			mV
V_{hys}	Hysteresis voltage	$-7V \leqq V_{CM} \leqq 12V$	10	30		mV
V_{OH}	High-level output voltage	I_{OUT} = −2.5mA, V_{ID} = +200 mV	VCC-1.5			V
V_{OL}	Low-level output voltage	I_{OUT} = +2.5mA, V_{ID} = -200 mV			0.4	V
I_{OZR}	Three state input leak current	0.4 V < V_O < 2.4 V			±1	uA
R_{IN}	Receive port input resistance	$-7V \leqq V_{CM} \leqq 12V$	96			kΩ
I_{OSR}	Receiver short-circuit current	0 V≤V_O≤VCC	±8		±90	mA
Power Supply Features						
I_{CC1}	Supply current	/RE=0V , DE = 0 V , VCC=3.3V		240	650	uA
		/RE=0V ,		270	750	uA

		DE = 0 V VCC=5V				
I_{CC2}		/RE=VCC , DE=VCC , VCC=3.3V		250	650	uA
		/RE=0V , DE = 0 V , VCC=5V		280	750	uA
I_{SHDN}	Shut-down Current	/RE=VCC , DE=0V , VCC=3.3V		0.2	10	uA
		/RE=VCC , DE=0V , VCC=5V		0.2	10	uA

(If not stated otherwise, VCC=3.3/5V±10%, Temp=TMIN~TMAX, typical value is VCC=+3.3/5V, Temp=25° C)
NOTE1: ∆VOD and ∆VOC are the changes in VOD and VOC amplitude caused by the change of DI state of the input signal.

Switching Characteristics

Unless otherwise stated, VCC=3.3/5V±10%, Temp=TMIN~TMAX, typical value is VCC=+3.3/5V, Temp=25°C

Driver Switching Characteristics						
Sym.	**Parameters**	**Test Conditions**	**Min.**	**Typ.**	**Max.**	**Units**
t_{DD}	Driver differentially, output delay	R_{DIFF} = 60 Ω, C_{L1}=C_{L2}=100pF (Figure4 与 Figure 5)		20	40	ns
t_{TD}	Driver differentially output, transfer time			12	28	ns
t_{PLH}	Driver input to output, low to high	R_{DIFF} = 27 Ω, (Figure4 与 Figure 5)		20	40	ns
t_{PHL}	Driver input to output, high to low			20	40	ns
t_{PDS}	$\|t_{PLH} - t_{PHL}\|$			1	8	ns
t_{PZH}	Driver enable to output high	R_L = 110Ω, (Figure6, 7)			55	ns
t_{PZL}	Driver enable to output low				55	ns
t_{PLZ}	Input low to disable	R_L = 110Ω, (Figure6, 7)			85	ns
t_{PHZ}	Input high to disable				85	ns
t_{DSH}	Under shoutdown, enable to output high	R_L = 110Ω, (Figure6, 7)		20	100	ns
t_{DSL}	Under shoutdown, enable to output low	R_L = 110Ω, (Figure6, 7)		20	100	ns
Receiver Switching Characteristics						
Sym.	**Parameters**	**Test Conditions**	**Min.**	**Typ.**	**Max.**	**Units**
t_{RPLH}	Receiver input to output dealy (low to high)	C_L=15pF Figure 8 and Figure 9		60		ns
t_{RPHL}	Receiver input to output dealy (high to low)			60		ns
t_{RPDS}	|tRPLH − tRPHL|			3	10	ns
t_{RPZL}	Enable to output low	C_L=15pF, Figure 8 and Figure 9		15	40	ns
t_{RPZH}	Enable to output high	C_L=15pF, Figure 8 and Figure 9		15	40	ns
t_{PRLZ}	Output low to disable	C_L=15pF, Figure 8 and Figure 9		25	55	ns
t_{PRHZ}	Output high to disable	C_L=15pF, Figure 8 and Figure 9		25	55	ns
t_{RPSH}	Under shoutdown, enable to output high	C_L=15pF, Figure 8 and Figure 9		150	500	ns
t_{RPSL}	Under shoutdown, enable to output low	C_L=15pF, Figure 8 and Figure 9		150	500	ns
t_{SHDN}	Enter shoutdown state	NOTE2	50		300	ns

NOTE2: When /RE=1, DE=0 continuously time is smaller than 80ns, The spare part necessarily doesn't enter shut-down state, when it is more than 300ns, necessarily enter shutdown state.

Parameter Test Circuit

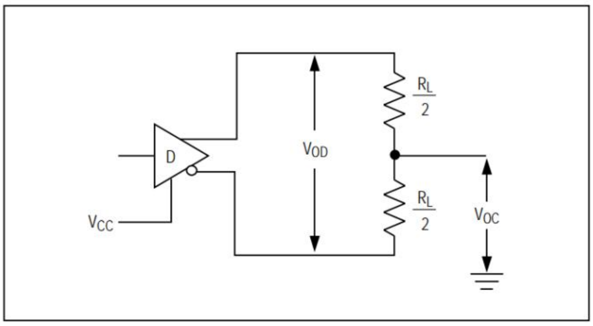
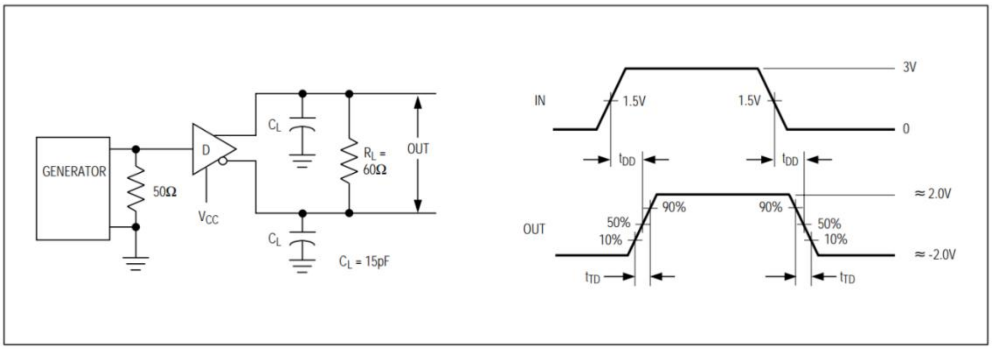


Figure3.   Driver DC testing load



CL includes probe and stray capacitance(Down together)

Figure4. Driver differentially delay and transfer time

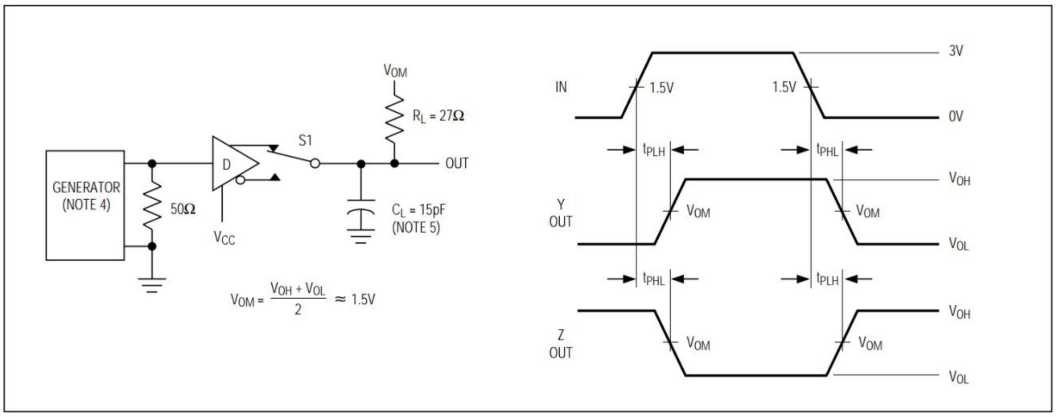


Figure 5. Driver propagation delay

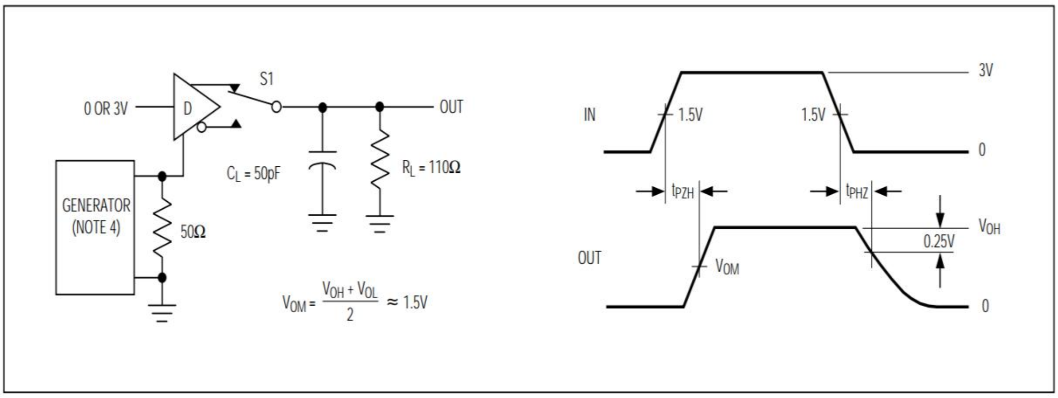


Figure 6. Driver enable and disable time

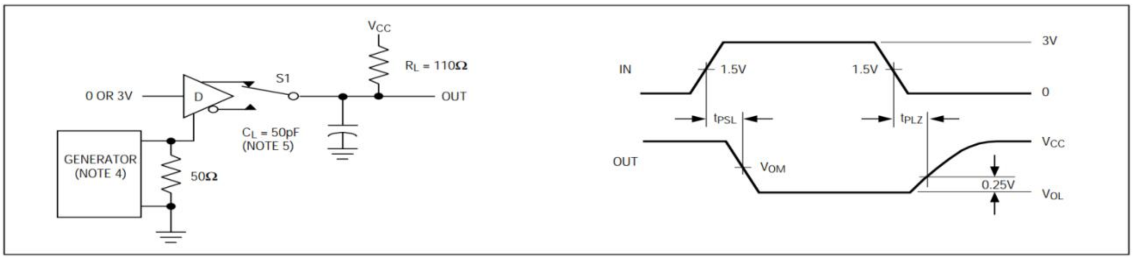


Figure 7. Driver enable and disable time

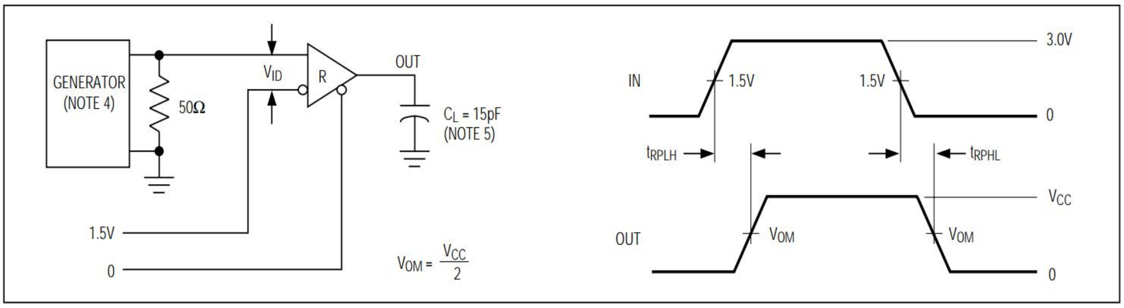


Figure 8. Receiver propagation delay test circuit

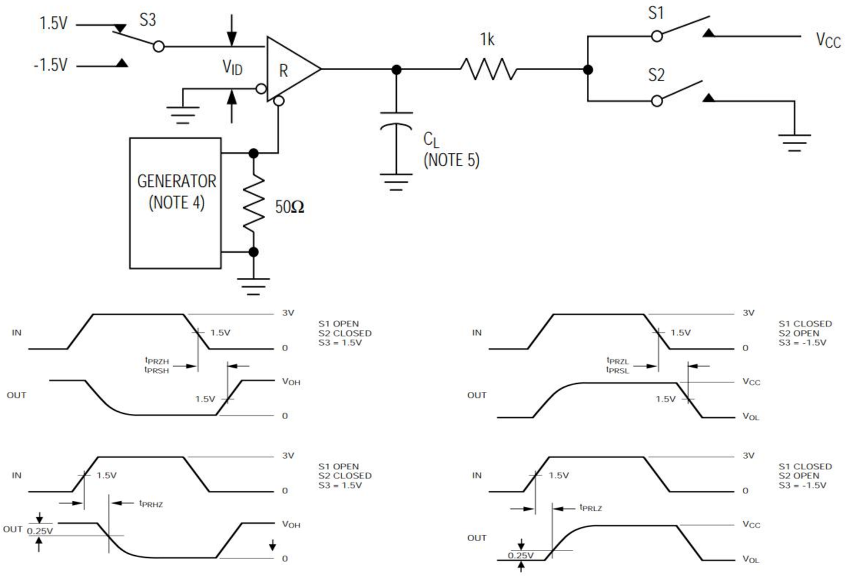


Figure 9. Receiver enable and disable time

General Description

1.Bus networking: The SCM3403ASA RS485 transceiver is designed for bidirectional data communication on multi-point bus transmission lines. Figure 10 shows a typical network application circuit. These devices can also be used as linear repeaters with cable lengths longer than 4000 feet. To reduce reflections, terminal matching should be done at both ends of the transmission line with their characteristic impedance, and the length of the branch wires other than the main line should be as short as possible.

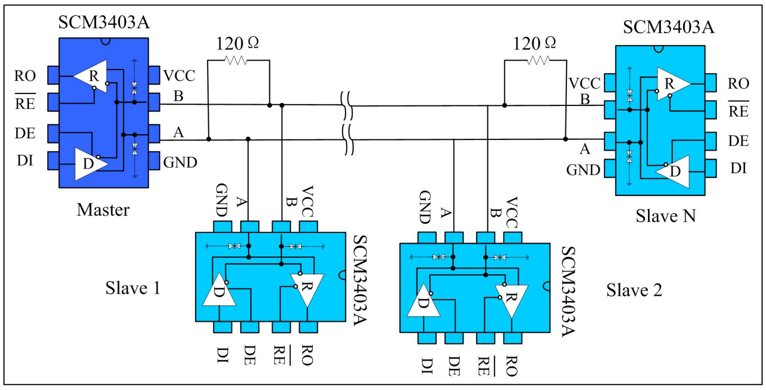


Figure 10. Bus lines type RS485 half-duplex telecommunication network

2.Hand-in-hand networking: Also known as daisy chain topology, it is the standard and specification of RS485 bus wiring, and is the recommended RS485 bus topology for organizations such as TIA. The wiring mode is that the main control device forms a hand-in-hand connection with a plurality of slave devices, as shown in Figure 11, the branch is not left. This wiring method has the advantages of small signal reflection and high communication success rate.

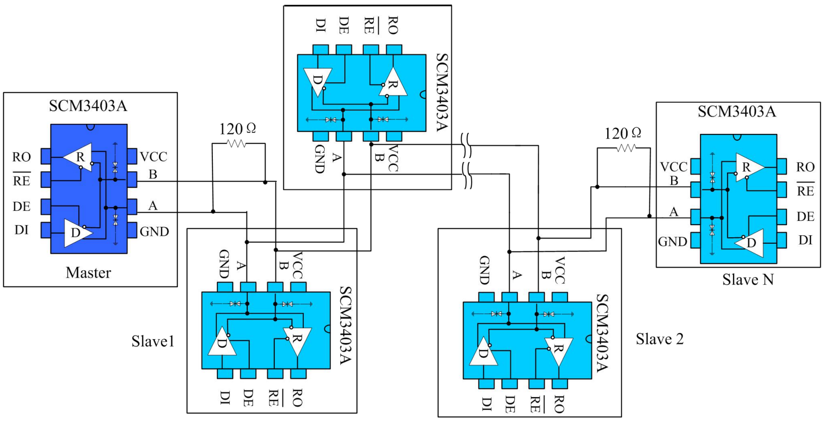
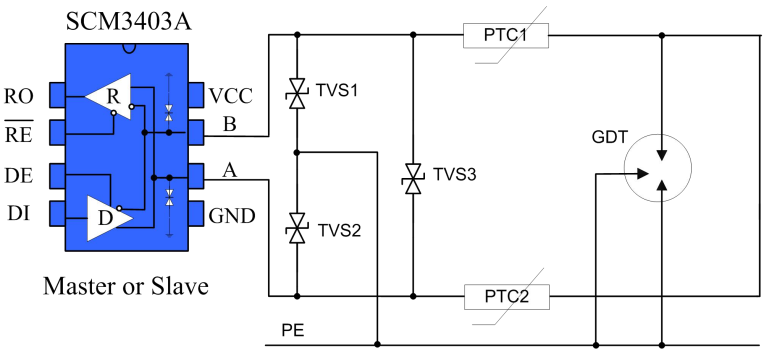


Figure 11. Hand in hand type RS485half-duplex telecommunication network

3.Bus port protection: In harsh environments, RS485 communication ports usually have additional protection against static electricity protection, lightning surge protection, and even need to prevent 380V power supply access to avoid smart meters and industrial control hosts. Damage. Figure 12 shows three common RS485 bus port protection schemes. The first is to connect the TVS device to the protection ground in parallel with the AB port, the TVS device in parallel with the AB port, the thermistor in series with the AB port, and the three-stage protection scheme by connecting the gas discharge tube to the protection ground; the second is AB. Parallel TVS to ground, series thermistor, AB parallel varistor three-stage protection scheme; third is AB connected to pull-down resistor to power and ground, AB connected to TVS, A or B port Connect the thermistor solution.



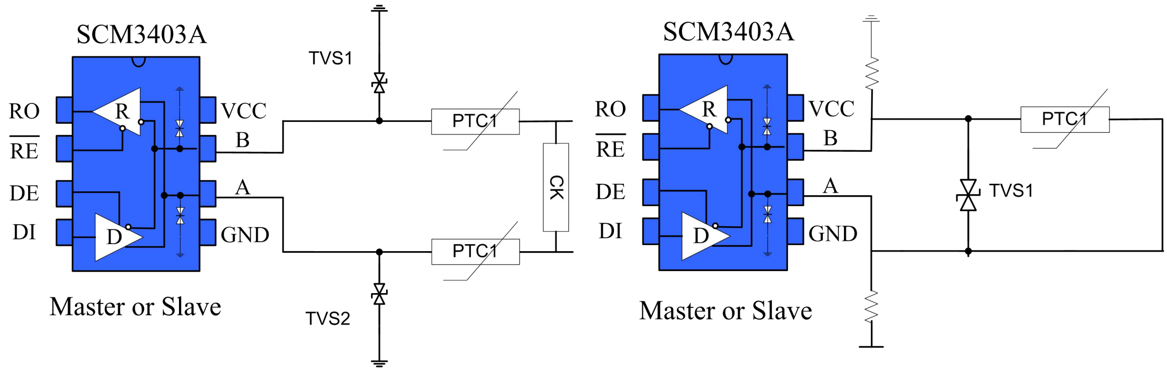


Figure 12. Port safeguard scheme

Design Circuit Expansion

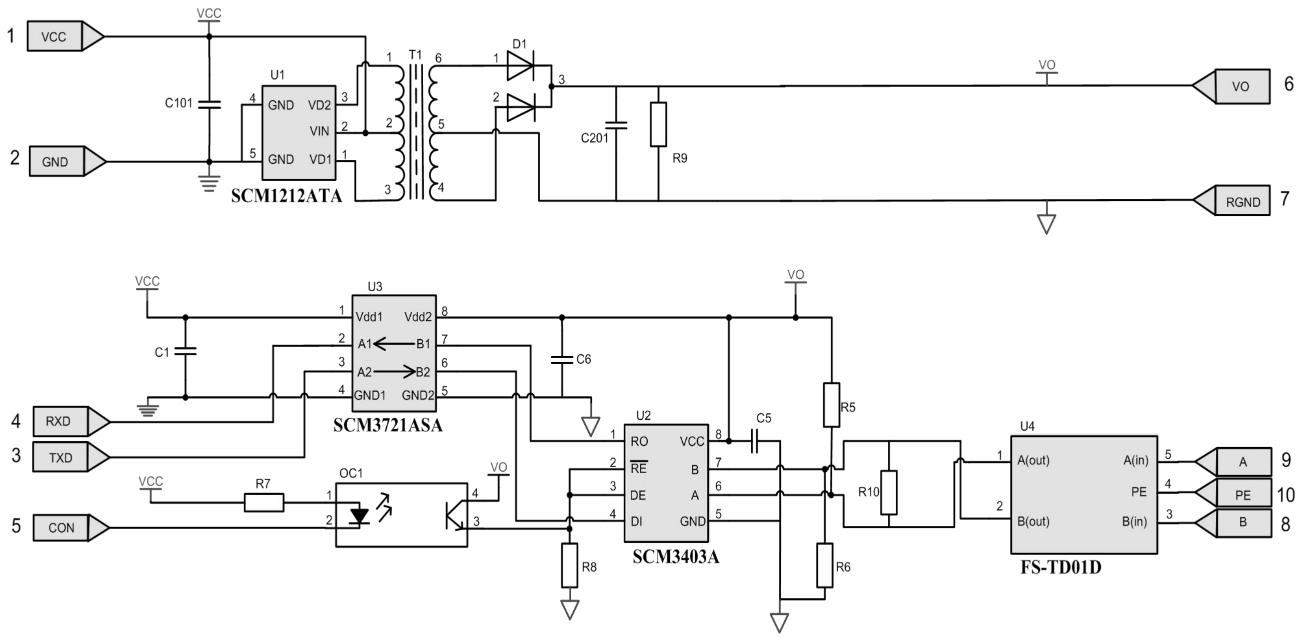


Figure 13. Isolated Application Circuit Schematic for Converting UART to RS485

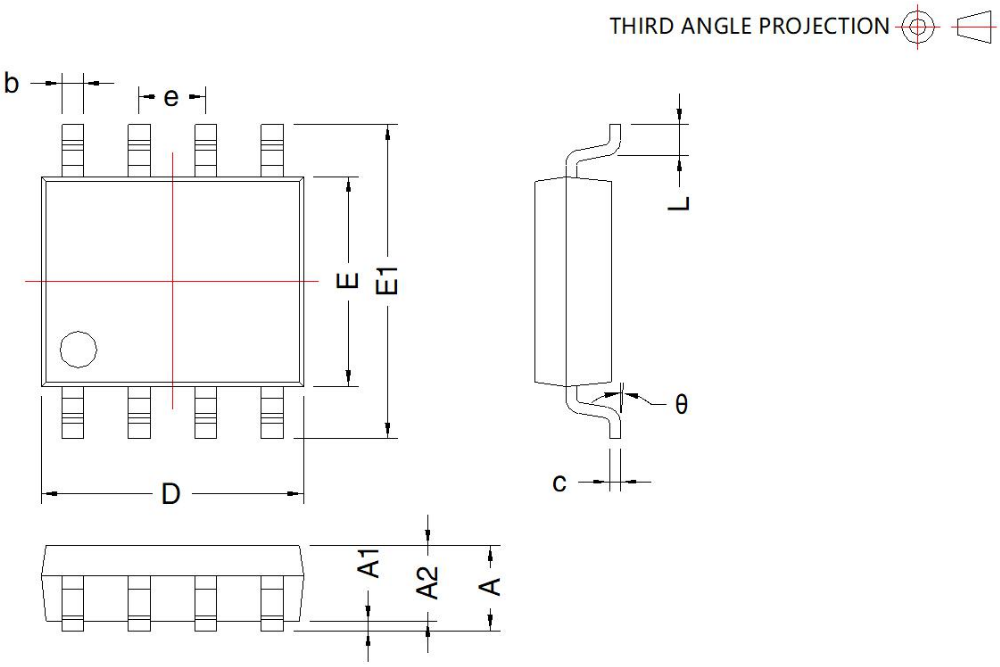
Power Usage Recommendations

Connecting the 0.1μF bypass capacitor as close as possible to the VCC pin of the device.

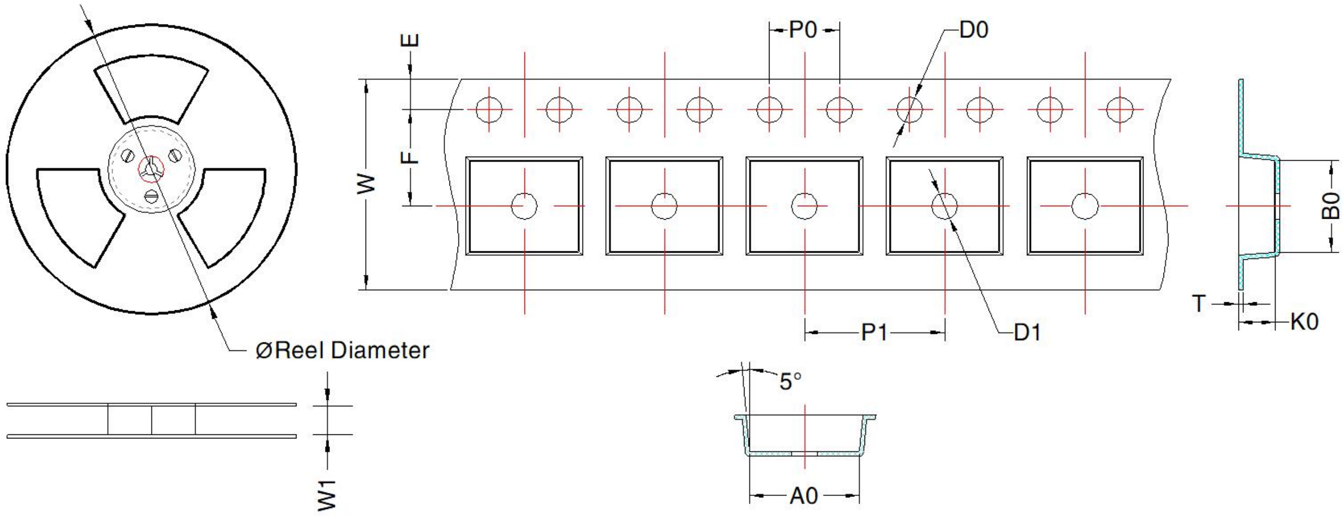
Ordering Information

Product number	Package Type	Pins	Screen Printing	package
SCM3403ASA	SOP	8	SCM 3403ASA YM	2.5K/reel

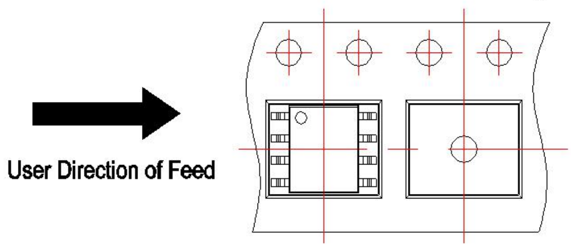
Product model and Screen Printing instructions:
SCM3403XYZ:
(1)SCM3403, Product Code.
(2)X = A-Z, Version code.
(3)Y = S Package code; S: SOP package.
(4)Z = C, I, A, M, Temperature class code; C: 0℃ - 70℃, I: -40℃-85℃, A: -40℃ - 125℃, M: -55℃ - 125℃。
(5)YM: Product traceability code; Y: Product year code, M: Product production month code.



SOP−8				
Mark	Dimension(mm)		Dimension(inch)	
	Min	Max	Min	Max
A	1.5	1.7	0.059	0.067
A1	0.1	0.2	0.004	0.008
A2	1.35	1.55	0.004	Min
D	4.8	5.0	0.053	0.197
E	3.78	3.98	0.149	0.157
E1	5.8	6.2	0.228	0.244
L	0.4	0.8	0.016	0.031
b	0.355	0.455	0.014	0.018
e	1.27 TYP		0.05 TYP	
c	0.153	0.253	0.006	0.001
θ	2°	6°	2°	6°



The orientation of IC in tape



Device	Package Type	MPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	T (mm)	W (mm)	E (mm)	F (mm)	P1 (mm)	P0 (mm)	D0 (mm)	D1 (mm)
SCM3403ASA	SOP-8	2500	330.0	12.4	6.4±0.1	5.3±0.1	2.1±0.1	0.25±0.03	12.0±0.1	1.75±0.1	5.5±0.1	8±0.1	4±0.1	1.5±0.1	1.5±0.1

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