TTL Convert into RS485

Demo-board(SCM1201ADEB-3)User Guide

Modification Date	Version No.	Reasons for revision	Model	Application Field
2019.8.15	A0	First version	SCM1201ATA+SCM3402ASI	Industrial control; Communication; Instruments; Electricity

Contents

1. Overview

This application scheme is a reference design based on SCM1201ATA (MORNSUN) and SCM3402ASI (MORNSUN) that can realize TTL to RS485 bus differential output level conversion. It can be applied to many fields such as industrial control, communication, instrumentation and electricity. The power solution adopts the chip SCM1201ATA (MORNSUN) , the external circuits is simple with cost-effective advantage. The signal conversion adopts the chip SCM3402ASI (MORNSUN) 3.3V power supply, which can easily realize the conversion of TTL level to RS485 bus differential output level. In terms of product performance, the product achieves the power supply isolation and the signal lines isolation, does RS485 communication and protects the bus all in one and the same module.

2. Input & Output Specifications

Basic Characteristics					
Item	**Operating Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Power Supply Input Voltage		4.75	5	5.25	V
Static Current	VCC=5VDC	--	8	30	mA
Operating Current		--	46	110	
Baud Rate		--	--	150	kbps
Number of Nodes		--	--	64	--

Input Specifications						
Item		**Symbol**	**Min.**	**Typ.**	**Max.**	**Unit**
TXD Logic Level	High-level	VIH	0.7VCC	--	VCC	VDC
	Low-level	VIL	0	--	0.8	
RXD Logic Level	High-level	VOH	VCC-0.4	--	--	
	Low-level	VOL	--	--	0.4	

Transmission Specifications						
Item		**Symbol**	**Min.**	**Typ.**	**Max.**	**Unit**
Data Delay	TXD Transmitter Delay	t_T	--	3	5	us
	RXD Receiver Delay	t_R	--	3	5	
Handoff Delay		Insulate a scheme	--	3	18	

Output Specifications					
Item	**Symbol**	**Min.**	**Typ.**	**Max.**	**Unit**
Difference Level	$V_{diff(d)}$, R_L=54Ω	1.5	2	--	VDC
Difference load resistance		54	60	--	Ω

Truth Table Specifications					
Transceiver Control	**Input**		**Output**		
Send Status	CON	TXD	A	B	RXD
	0	1	1	0	1
	0	0	0	1	1
Receive Status	CON	VA-VB	RXD		
	1	≥200mV	1		
	1	≤-200mV	0		
	1	-200mV＜VA-VB＜200mV	uncertain		

3. Schematic Circuit Diagram

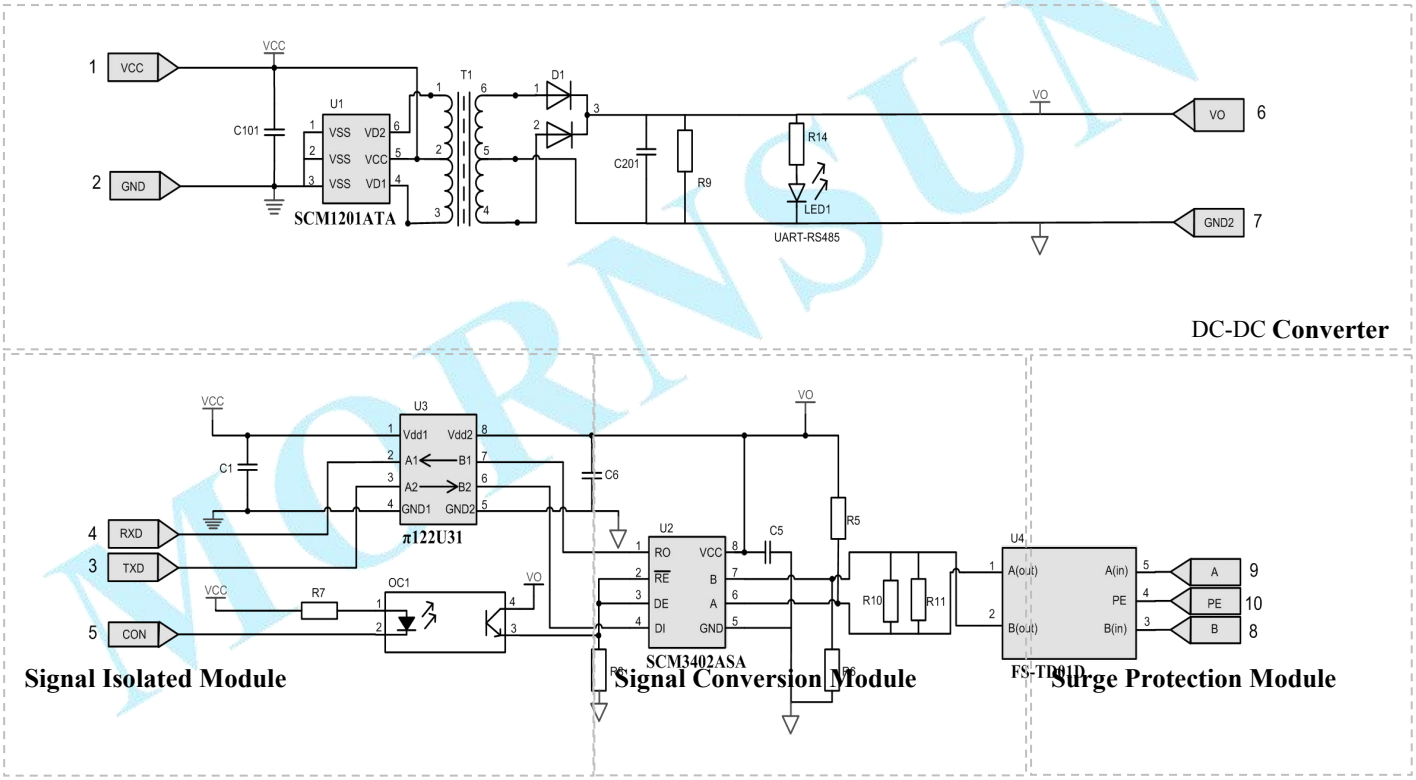


Figure 1-1. Schematic Circuit Diagram

Pin Function Description	
Pin	**Descriptio**
VCC	Input power supply positive
GND	Input power supply earth
TXD	Send out pin
RXD	Receive pin
CON	Handoff control pin
VO	Insulate power supply output pin
RGND	Insulate power supply output earth
A	485 bus driver output /receiver input pin A
B	485 bus driver output /receiver input pin B
PE	Earth

4. Bill of Material

Device description	Specification	Quantity	Position No.
Ceramic Capacitor	105K 100V 1206 X7R	2.0	C101/C201
Ceramic Capacitor	104K 50V 0805 X7R	3.0	C1/C5/C6
Chip Fixed Resistor	27KΩ 1/4W ±1% 1206	2.0	R5/R6
Chip Fixed Resistor	820Ω 1/8W ±1% 0805	1.0	R7
Chip Fixed Resistor	2KΩ 1/8W ±1% 0805	1.0	R8
Chip Fixed Resistor	4.22KΩ 1/8W ±1% 0805	1.0	R9
Chip Fixed Resistor	120Ω 1/8W ±1% 0805	2.0	R10/R11
Chip Fixed Resistor	680Ω 1/8W ±1% 0805	1.0	R14
LED	Green/5V/95mW/SMD	1.0	LED1
Schottky Barrier Diodes	30V 200mA SOT-23	1.0	D1
Power Chip	**SCM1201ATA (MORNSUN)**	1.0	U1
Signal Processing Chip	**SCM3402ASI SOP8 (MORNSUN)**	1.0	U2
Digital Isolators	**π122U31 SOIC-8 (2Pai Semi)**	1.0	U3
Phototransistor Photocoupler	SSOP4	1.0	OC1
Surge protector	**FS-TD01D ±2KV/±4KV (MORNSUN)**	1.0	U4
Transformer	POWER TRANSFORMER(18:14)	1.0	T1
Note: Recommended operating temperature range for MORNSUN IC: -40°C~85°C, withstand isolation voltage: 1650VDC, leakage current: less than 1mA. For different withstand voltage requirements, you can complete by selecting different transformers isolation IC and phototransistor photocoupler.			

5. PCB

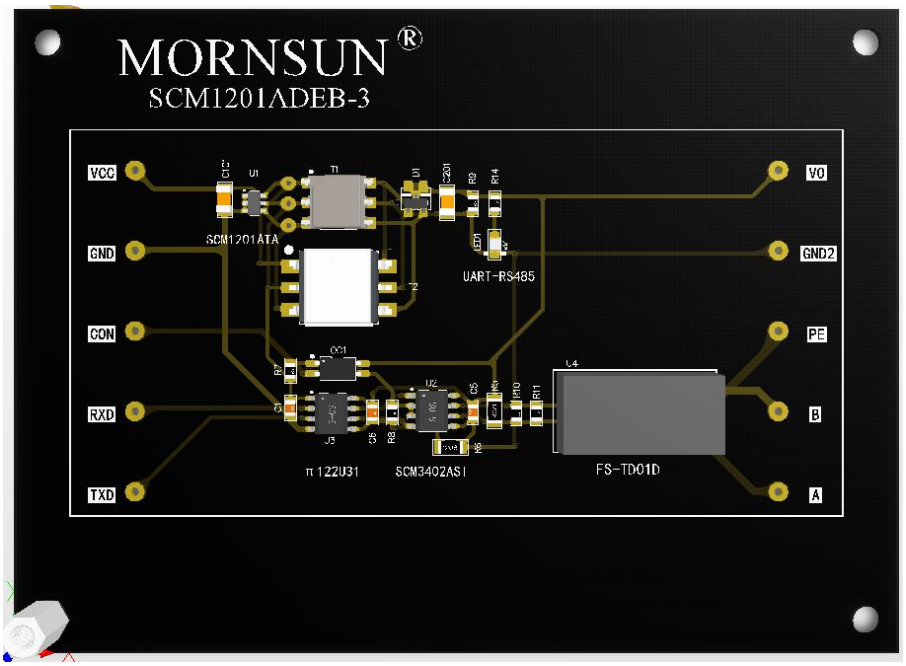
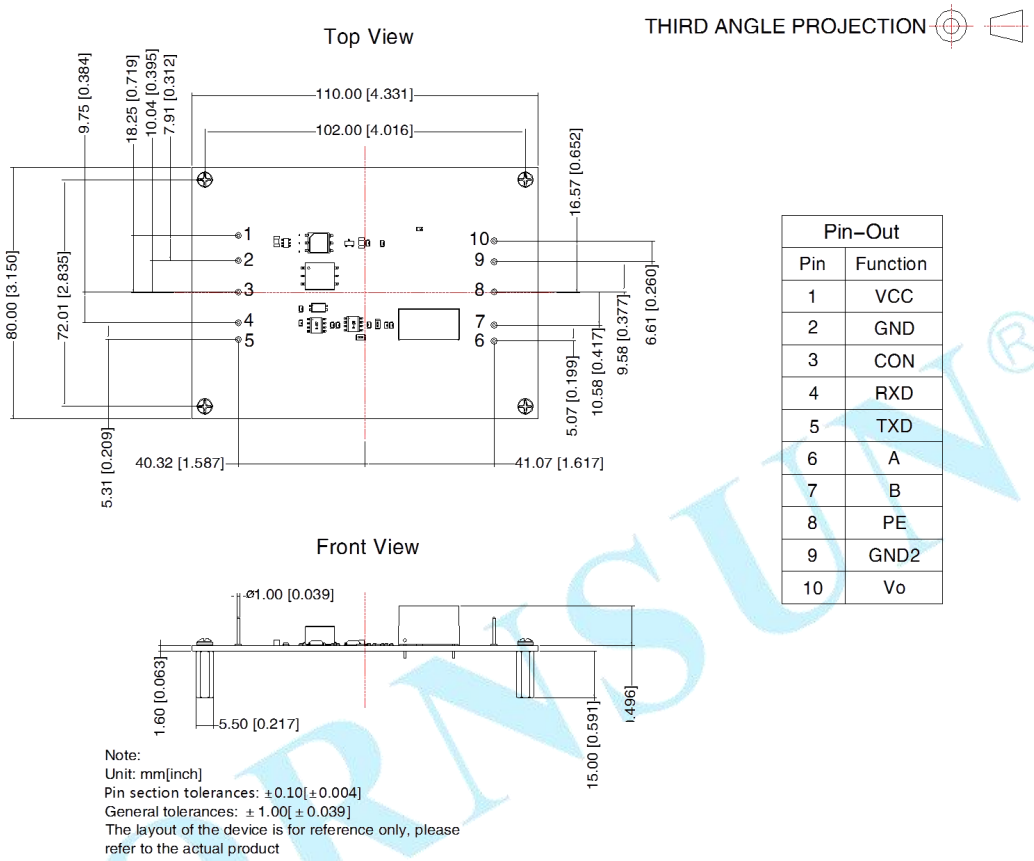


Figure1- 2 SCM1201ADEB-3 Top View(3D)



Pin-Out	
Pin	Function
1	VCC
2	GND
3	CON
4	RXD
5	TXD
6	A
7	B
8	PE
9	GND2
10	Vo

Figure 1-3 PCB Layout(Top View)

6. Test Data

Test Item	Test Result
1. Power Specifications	
Static Current (mA)	7.40
Operating Current (mA)	45.15
2. Input Specifications	
TXD Logic Level(VDC)	OK
RXD Logic Level (VDC)	5 / 0
3. Transmission Specifications	
TXD Transmitter Delay(us)	2.855
RXD Receiver Delay(us)	2.852
Handoff Delay(us)	2.400
4. Output Specifications	
Difference Level (VDC)	-2.22/2.22
Difference Load Resistance	OK
5. Receiving Threshold	
Receiving Threshold(VDC)	-0.17/ -0.14

6.1. Operating Current

6.1.1. Static Current

Operating Conditions: DC power input only;

Test Standard: Static current≦30mA.

Table 1. Static Current

Power Input(VDC)	4.75	5	5.25
Static Current(mA)	6.89	7.40	8.02

6.1.2. Operating Current

Operating Conditions: Sending status, nominal input signal, nominal difference load resistance;

Test Standard: Operating current≦110mA.

Table2. Operating Current

Power Input(VDC)	4.75	5	5.25
Operating Current(mA)	42.36	45.15	48.22

6.2. Input Specifications

6.2.1. TXD Logic Level

Operating Conditions: Nominal difference load resistance;

Test Standard: Signal transmission logic is correct.

Table3. TXD Logic Level

Power input(VDC)	4.75		5		5.25	
TXD Logic High-level: VIH=0.7VCC	OK	Figure2	OK	Figure3	OK	Figure4
TXD Logic Low-level: VIL=0.8VDC	OK	Figure5	OK	Figure6	OK	Figure7

6.2.2. RXD Logic Level

Operating Conditions: Nominal difference level input;

Test Standard: VOH≧VCC-0.4V, VOL≦0.4V.

Table 4. RXD Logic Level

Power Input(VDC)	4.75		5		5.25	
RXD Logic High-level (VDC)	4.8	Figure8	5	Figure9	5.1	Figure10
RXD Logic Low-level (VDC)	0		0		0	

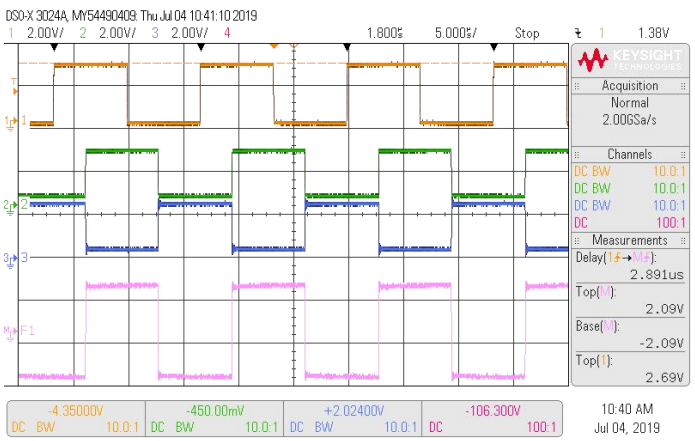


Figure2 TXD Logic High-level: Yellow: TXD, Green: A, Blue:B, Pink: A-B(Vin=4.75V)

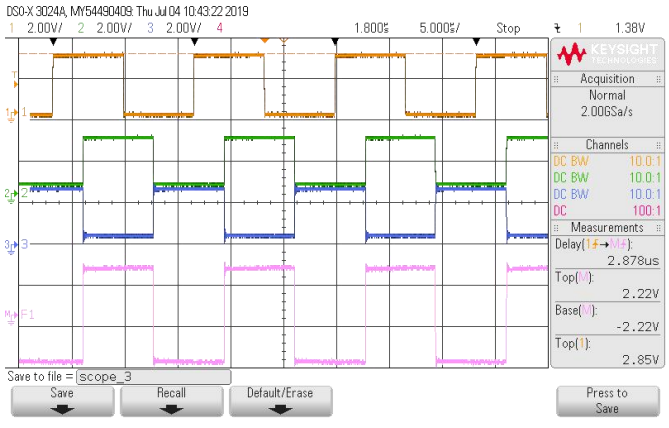


Figure3 TXD Logic High-level: Yellow: TXD, Green: A, Blue: B, Pink: A-B(Vin=5.00V)

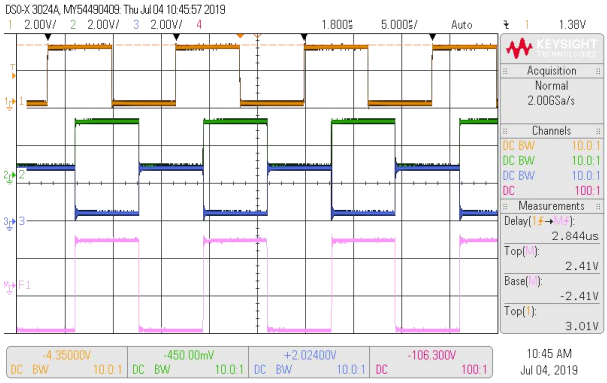


Figure4TXD Logic High-level: Yellow: TXD,
Green: A, Blue: B, Pink: A-B(Vin=5.25V)

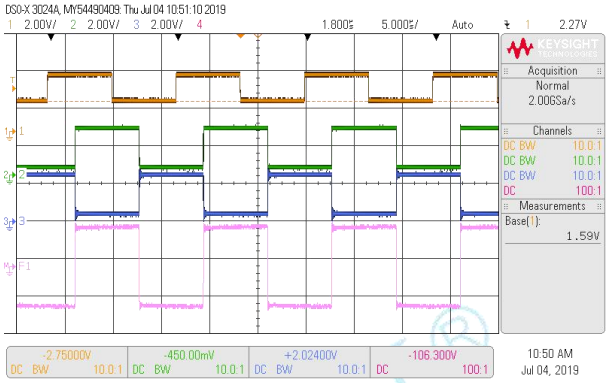


Figure5 TXD Logic Low-level: Yellow: TXD,
Green: A, Blue: B, Pink: A-B(Vin=4.75V)

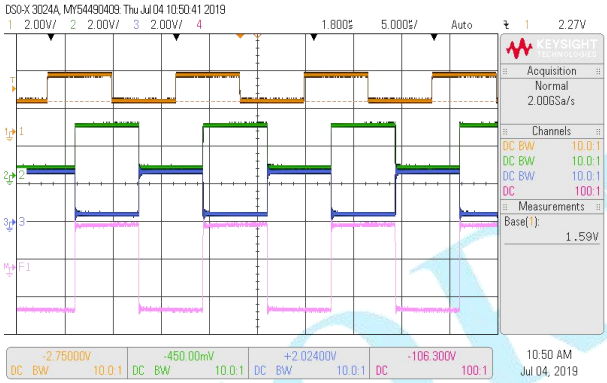


Figure6 TXD Logic Low-level: Yellow: TXD,
Green:A,Blue:B,Pink:A-B(Vin=5.00V)

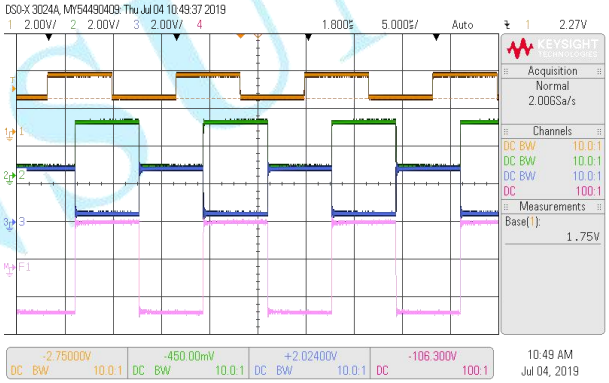


Figure7 TXD Logic High-level: Yellow: TXD,
Green:A,Blue:B,Pink:A-B(Vin=5.25V)

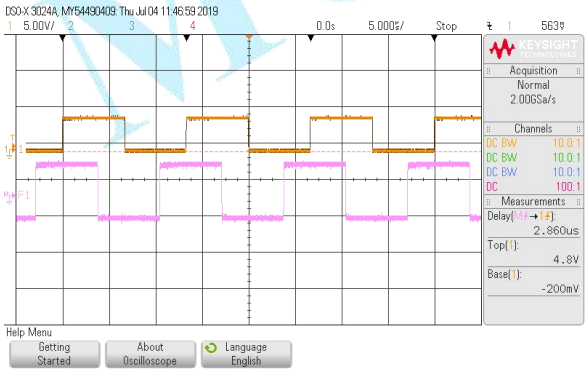


Figure 8. RXD Logic Level: Pink: A-B; Yellow: RXD
(Vin=4.75V)

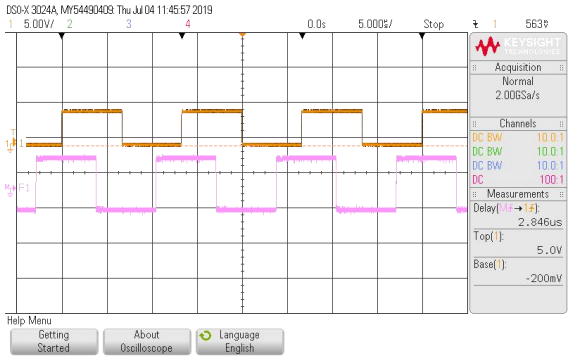


Figure9. RXD Logic Level: Pink: A-B; Yellow: RXD
(Vin=5.00V)

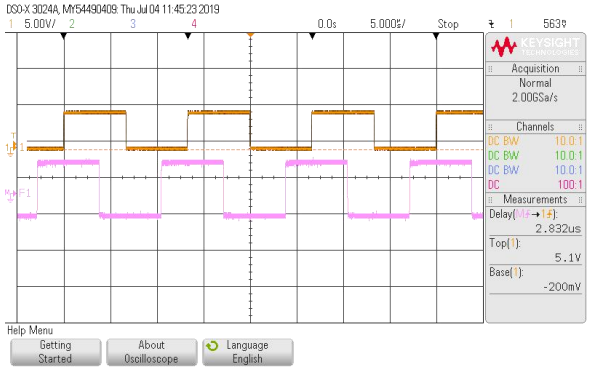


Figure 10. RXD Logic Level: Pink: A-B; Yellow: RXD
(Vin=5.25V)

6.3. Transmission Specifications

6.3.1. TXD Transmitter Delay

Operating Conditions: Nominal difference load resistance, maximum baud rate;

Test Standard: TXD Transmitter Delay≦5us.

Table 5. TXD Transmitter Delay

Power Input(VDC)	4.75		5		5.25	
TXD Transmitter Delay(us)	2.853	Figure11	2.855	Figure12	2.843	Figure13

6.3.2. RXD Receiver Delay

Operating Conditions: Maximum baud rate;

Test Standard: RXD Receiver Delay≦5us.

Table 6. RXD Receiver Delay

Power Input(VDC)	4.75		5		5.25	
RXD Receiver Delay(us)	2.861	Figure14	2.852	Figure15	2.835	Figure16

6.3.3. Handoff Delay

Operating Conditions: Nominal difference load resistance, the CON pin adds a square wave signal of 1KHZ rate;

Test Standard: Handoff Delay≦18us.

Table 7. Handoff Delay(Insulate a scheme)

Power Input(VDC)	4.75		5		5.25	
Handoff Delay(us)	3.2	Figure17	2.4	Figure18	2.4	Figure19

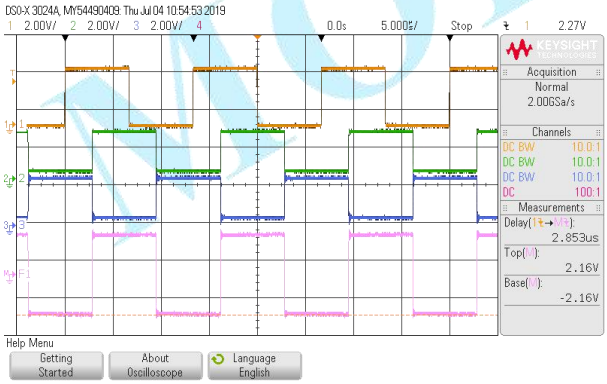


Figure 11. TXD Transmitter Delay: Yellow: TXD; Green: A; Blue: B; Pink: A-B(Vin=4.75V)

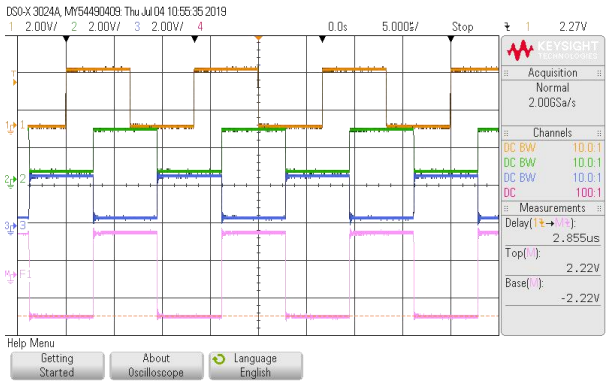


Figure 12. TXD Transmitter Delay: Yellow: TXD; Green: A; Blue: B; Pink: A-B(Vin=5.00V)

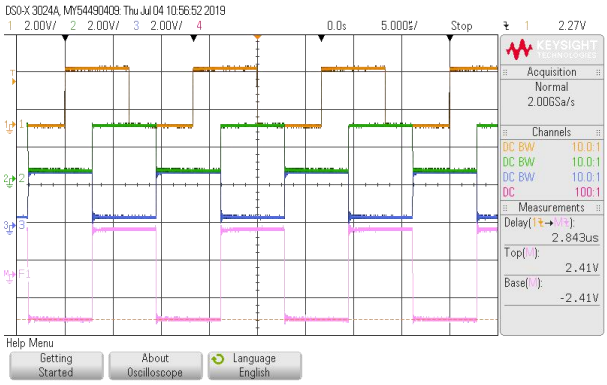


Figure 13. TXD Transmitter Delay: Yellow: TXD; Green: A; Blue: B; Pink: A-B(Vin=5.25V)

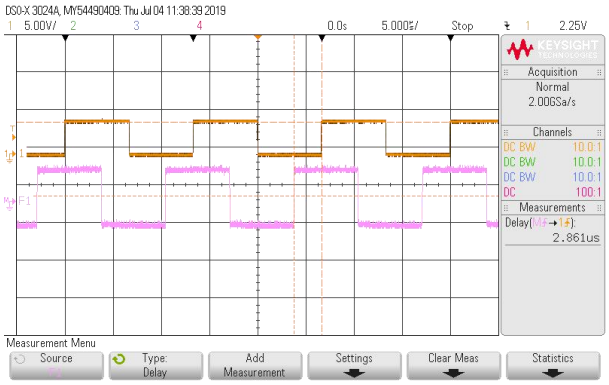


Figure 14. RXD Receiver Delay, Pink: A-B; Yellow: RXD (Vin=4.75V)

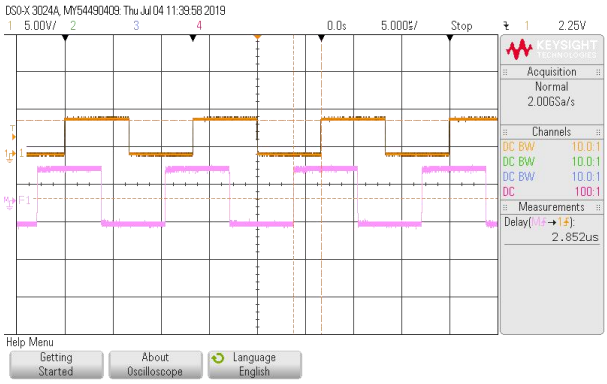


Figure 15. RXD Receiver Delay, Pink: A-B; Yellow: RXD (Vin=5.00V)

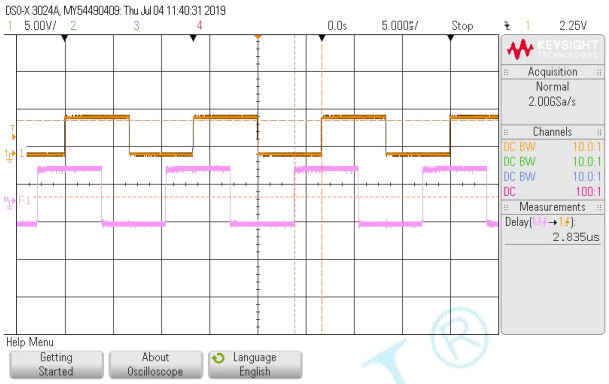


Figure 14. RXD Receiver Delay, Pink: A-B; Yellow: RXD (Vin=5.25V)

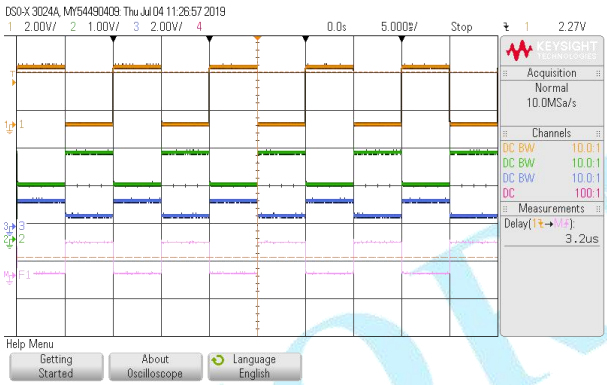


Figure 17. Handoff Delay: Yellow: CON; Pink: A-B (Vin=4.75V)

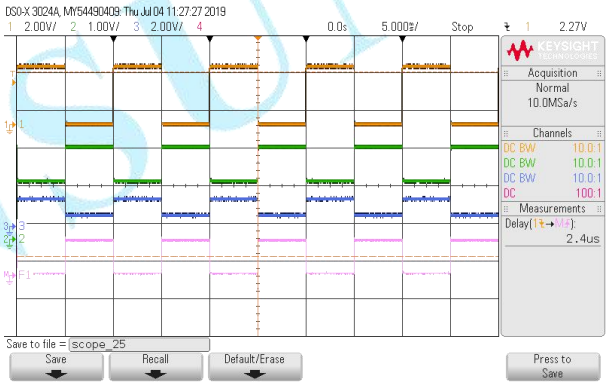


Figure 18. Handoff Delay: Yellow: CON; Pink: A-B (Vin=5.00V)

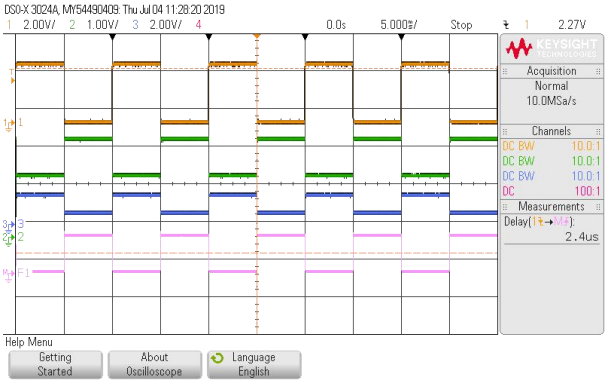


Figure 19. Handoff Delay: Yellow: CON; Pink: A-B (Vin=5.25V)

6.4. Output Specifications

6.4.1. Difference Level

Operating Conditions: Send status, nominal difference load resistance, nominal input signal;

Test Standard: Difference Level ≧ 1.5V.

Table 8. Difference Level

Power Input(VDC)	4.75		5		5.25	
Difference Level(VDC)	-2.16/ 2.16	Figure 20	-2.22 / 2.22	Figure 21	-2.41 / 2.41	Figure 22

6.4.2. Difference Load Resistance

Operating Conditions: Nominal power input, nominal input signal;

Test Standard: Difference Level≧1.5V.

Table 9. Difference load resistance

Difference Load Resistance (Ω)	54		60	
Difference Level(VDC)	-1.59/ 1.59	Figure 23	-1.66 / 1.66	Figure 24

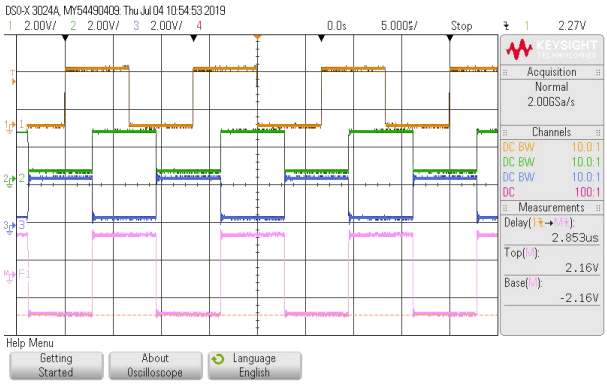


Figure 20 Difference Level: Yellow: TXD; Green: A; Blue: B; Pink: A-B(Vin=4.75V)

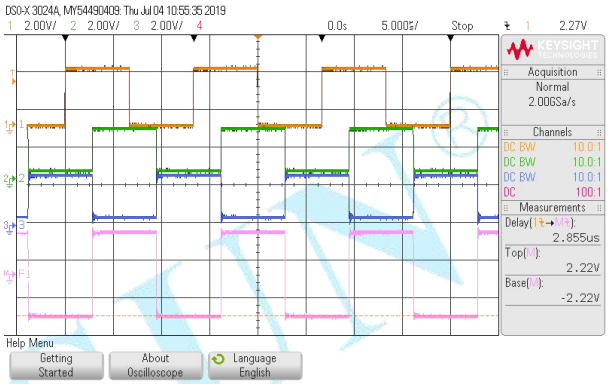


Figure 21 Difference Level: Yellow: TXD; Green: A; Blue: B; Pink: A-B(Vin=5.00V)

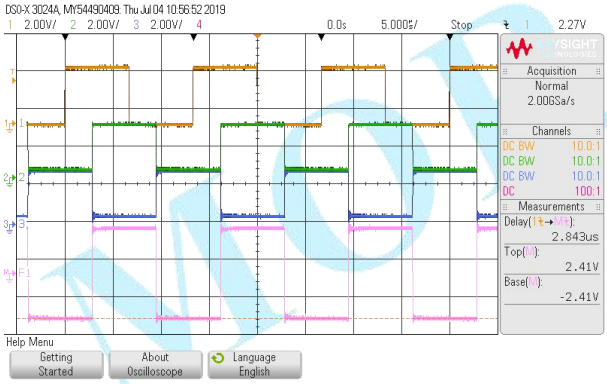


Figure22 Difference Level: Yellow: TXD; Green: A; Blue: B; Pink: A-B(Vin=5.25V)

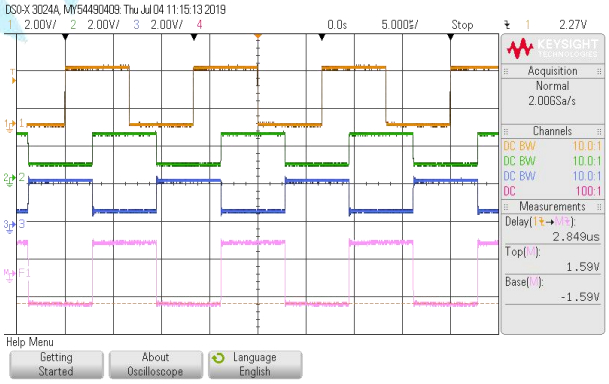


Figure23 Difference Load Resistance,Yellow: TXD; Green: A; Blue: B; Pink: A-B(RL=54Ω)

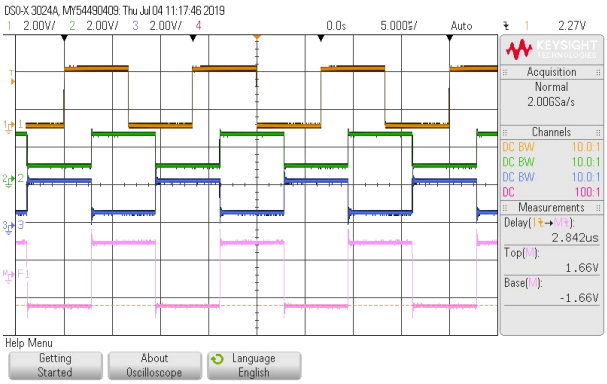


Figure 24 Difference Load Resistance,Yellow: TXD; Green: A; Blue: B; Pink: A-B(RL=60Ω)

6.5. Receiving Threshold

6.5.1. Receiving Threshold

Operating Conditions: VCC=4.75 to 5.25V;

Test Standard: -200mV<VA-VB<200mV.

Table 10. Receiving threshold

Power Input(VDC)	4.75	5	5.25
Receiving Threshold (VDC)	-0.076/-0.051	-0.080/-0.057	-0.096/-0.064

7. Appendix

None.

If you have any suggestions or questions about this article, or consult other applications, please contact us fae800@mornsun.cn, we will give you a detailed answer!