

**Design reference of 1W
DC-DC power supply
5V output, input 4.5-5.5VDC
SCM1201ATA & TTB0505-1T**

Modification Date	Version No.	Reasons for Revision	Model	Main Application Field
2019.04.29	A0	First version	SCM1201ATA	industrial control, communication, electric power, instruments, etc.

Contents

1. Overview.....	3
2. Input & Output Specifications.....	3
3. Schematic Circuit Diagram.....	4
4. Bill of material.....	4
5. Test Data.....	4
5.1. Input Specifications.....	5
5.1.1. Input Current.....	5
5.1.2. No Load Power Consumption.....	5
5.2. Output Specifications.....	5
5.2.1. Linear Regulation, Load Regulation, Voltage Accuracy.....	5
5.2.2. Ripple & Noise.....	5
5.2.3. Efficiency.....	6
5.3. Time Series Test.....	7
5.3.1. Start-up and Turn-off Test.....	7
5.4. Protection Specifications.....	7
5.4.1. Short-circuit Protection(SCP).....	7
6. Appendix.....	8

1. Overview

This application solution features 4.5-5.5VDC input, 5VDC/1W output, isolated DC-DC power supply based on chip of SCM1201ATA (MORNSUN), and TTB0505-1T (MORNSUN) transformer. It can be applied to industrial control, communication, instrumentation, electricity and other fields. The circuit solution takes push-pull circuit topology, control IC with SCM1201ATA (MORNSUN), with simple external circuits and cost-effective advantages. In terms of performance, the chip with soft start function, which avoids damaging device due to the high current during start-up, so that the converter start-up normally with full load in CC mode of the electronic load. In addition, SCM1201ATA (MORNSUN) has integrated output short-circuit protection and over-temperature protection functions, which greatly improves the reliability of the system.

2. Input & Output Specifications

Input Specifications

Item	Operating Conditions	Min	Typ	Max	Unit
Input Voltage		4.5	5	5.5	VDC
Input Current (full load/no-load)	nominal input voltage	--	270/5	--	mA

Output Specifications

Item	Operating Conditions	Min	Typ	Max	Unit
Output Voltage	Input voltage range	--	5	-	VDC
Output Current	nominal input voltage	20	--	200	mA
Output Power	Input voltage range	--	--	1	W
Capacitive Load	Input voltage range	--	--	1000	uF
Voltage Accuracy	nominal input voltage	See output regulation curve (Figure 1)			
Linear Regulation	Input voltage change: $\pm 1\%$	--	--	± 1.2	--
Load Regulation	10%-100% load	--	12	15	%
Ripple & Noise	20MHz bandwidth	--	60	100	mVp-p
Efficiency	nominal input voltage , full load	--	82	--	%
Short-circuit Protection	Input voltage range	Continuous, self-recovery			

Product Characteristic Curve

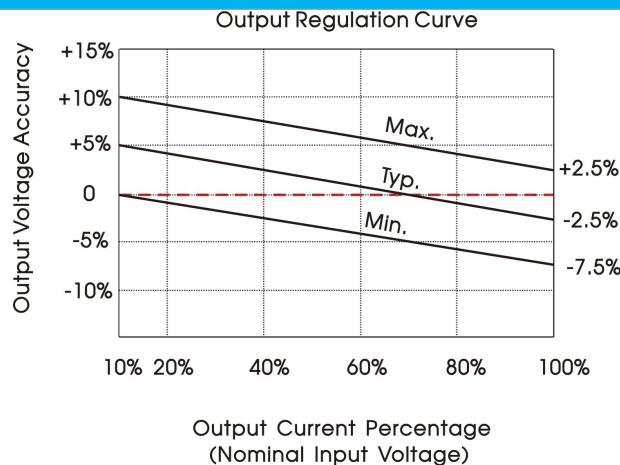


Figure 1

3. Schematic Circuit Diagram

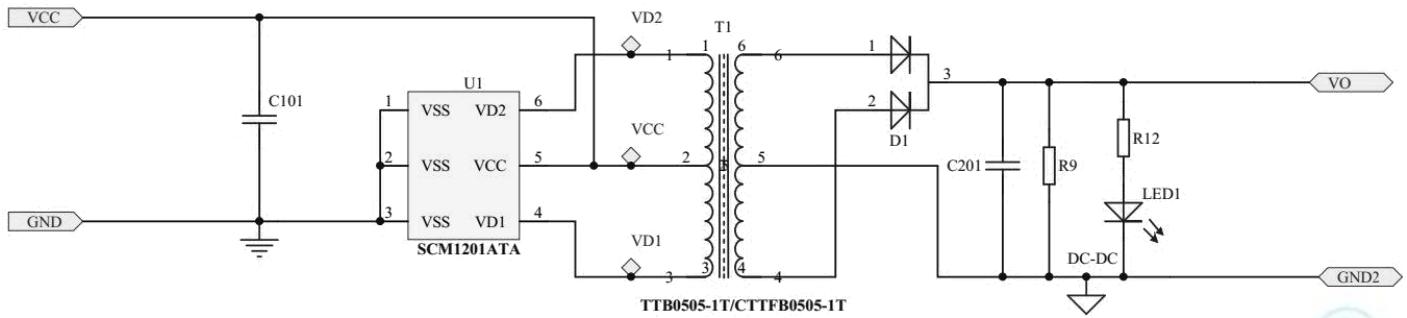


Figure 2. Schematic Circuit Diagram

4. Bill of material

Device Description	Specification	Quantity	Position No.
IC	SCMI201ATA SOT-23-6 (MORNSUN)	1	U1
Capacitor	475K 16V 1206 X7R	2	C101, C201
Schottky Diode	40V 0.4A SOT-23	1	D1
Resistor	5.6KΩ 1/8W ±1% 0805	1	R9
Resistor	5.1KΩ 1/8W ±1% 0805	1	R12
Light Emitting Diode	17-21 GHC-XS1T2M 3T	1	LED1
Transformer	TTB0505-1T (MORNSUN)	1	T1

Note: The operating temperature and withstand isolation voltage depend on the selection of the customer's component and relate to the PCB layout. Recommended surface operating temperature range for MORNSUN IC and transformer TTB0505-1T: -40°C~+125°C, the withstand isolation voltage of transformer TTB0505-1T: 1650VDC, leakage current: less than 1mA.

5. Test Data

Test Item	Test Result
1. Input Specifications	
Input Current (5VDC/Full Load)	228mA
No Load Power Consumption (5VDC/no load)	26.2mW
2. Output Specifications	
Output Voltage (5VDC/Full Load)	4.74VDC
Load Regulation	10.76%
Linear Regulation	1.05
Voltage Accuracy (5VDC/Full Load)	-5.2%
Voltage Accuracy (5VDC/Minimum Load)	5.0%
Ripple & Noise (5VDC/Full Load)	18.25mV
Efficiency (5VDC/Full Load)	82.7%
3. Protection Specification	
Short-circuit Protection	Output continuous, self-recovery

Note: The minimum load : 10% I_{omax}, I_{omax} : Rated load.

5.1. Input Specifications

5.1.1. Input Current

Operating Conditions: Normal temperature, input voltage range, full load output, test Input Current;

Test Standard: 5VDC input, Input Current typical value: 270mA.

Table 1. Input Current With Full Load

Input Voltage	4.5VDC	5VDC	5.5VDC
Input Current (mA)	204	228	253

5.1.2. No Load Power Consumption

Operating Conditions: Normal temperature, input voltage range, no load output, test Input Power;

Test Standard: 5VDC input, Input Power typical value: 25mW.

Table 2. Input Power With No Load

Input Voltage	4.5VDC	5VDC	5.5VDC
Input Power (mW)	20.8	26.2	32.6

5.2. Output Specifications

5.2.1. Linear Regulation, Load Regulation, Voltage Accuracy

Operating Conditions: Normal temperature, input voltage range, output load range;

Test Standard: Linear Regulation $\leq \pm 1.2$, Load Regulation $\leq 15\%$.

Table 3 Output Voltage Test Data

Input Voltage	Output Voltage (VDC)		
	Minimum Load	Half Load	Full Load
4.5VDC	4.71	4.47	4.23
5VDC	5.25	5.02	4.74
5.5VDC	5.80	5.55	5.23

Table 4 Linear Regulation, Load Regulation, Voltage Accuracy

Test Item	Load Regulation (%)		Linear Regulation			Voltage Accuracy (%)		
Input Voltage	5VDC		4.5VDC	5VDC	5.5VDC	5VDC		
Output Current (mA)	Minimum Load	Full Load	Full Load			Minimum Load	Half Load	Full Load
Test Result	10.76		1.05			5.0	0.4	-5.2

5.2.2. Ripple & Noise

Operating Conditions: Normal temperature, input voltage range, output load range, “parallel cable” method;

Test Standard: 20MHz bandwidth, input voltage range, output load range, Ripple & Noise ≤ 100 mV.

Table 5. Ripple & Noise Test Data

Input Voltage	Ripple & Noise (mV)		Wave Table
	No Load	Full Load	
4.5VDC	7.25	18.50	Figure 3/Figure 4
5VDC	7.00	18.25	Figure 5/Figure 6
5.5VDC	8.50	20.00	Figure 7/Figure 8

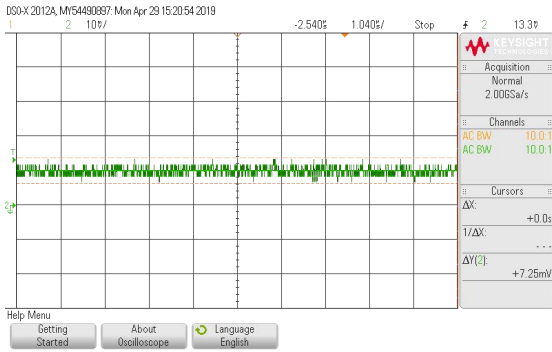


Figure 3. Ripple & Noise Wave Table (4.5VDC No Load)

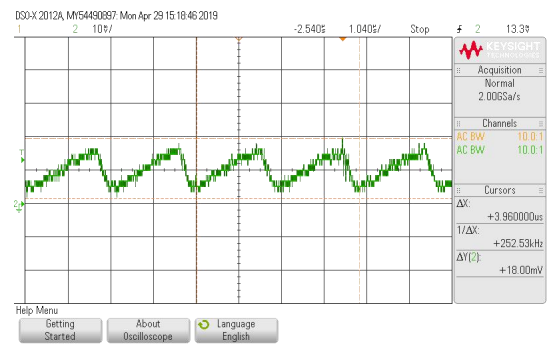


Figure 4. Ripple & Noise Wave Table (4.5VDC Full Load)

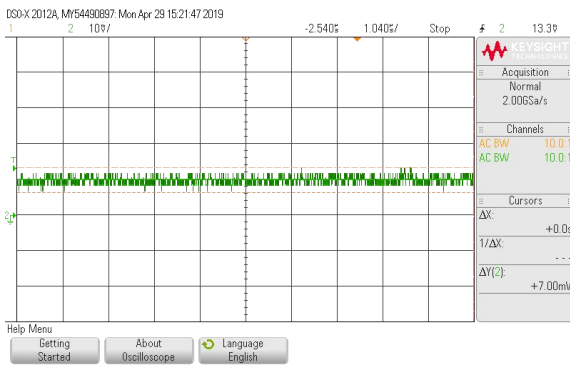


Figure 5. Ripple & Noise Wave Table (5VDC No Load)

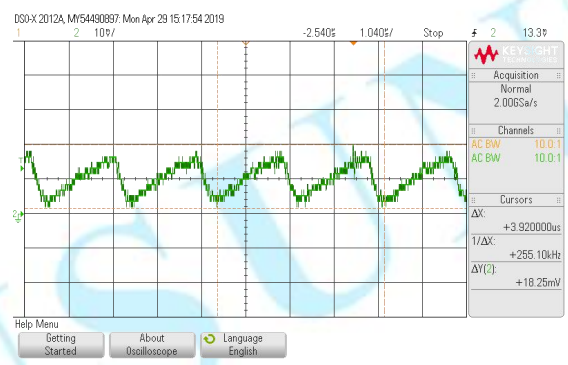


Figure 6. Ripple & Noise Wave Table (5VDC Full Load)

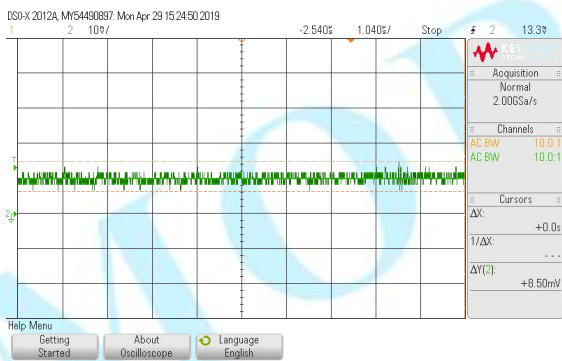


Figure 7. Ripple & Noise Wave Table (5.5VDC No Load)

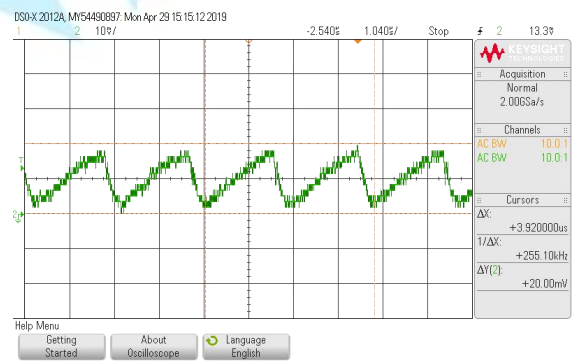


Figure 8. Ripple & Noise Wave Table (5.5VDC Full Load)

5. 2. 3. Efficiency

Operating Conditions: Normal temperature, input voltage range, output load range;

Test Standard: 5VDC input, full load output, efficiency typical value: 82%.

Table 6. Efficiency Test Data

Input Voltage	Efficiency (%)				
	10% Iomax	25% Iomax	50% Iomax	75% Iomax	100% Iomax
4.5VDC	76.1	84.3	85.3	84.0	82.1
5VDC	76.3	84.5	85.5	84.7	82.7
5.5VDC	76.4	84.7	86.0	85.0	83.0

5.3. Time Series Test

5.3.1. Start-up and Turn-off Test

Operating Conditions: Normal temperature, 5VDC input, full load output;

Test Standard: /.

Table 7. Start-up and Turn-off Test

Test Item		Start-up Wave Table	Turn-off Wave Table
Input Voltage	5VDC	Figure 9	Figure 10
Output Current	Full Load		

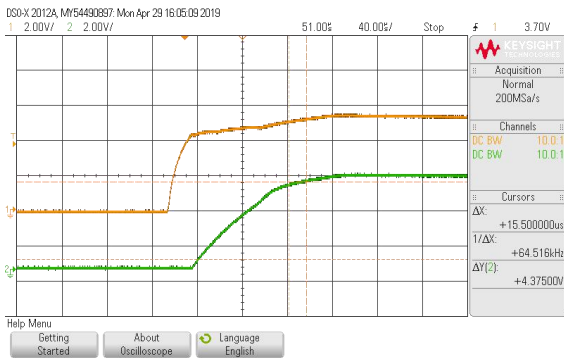


Figure 9. Start-up Wave Table, Yellow: Vin, Green: Vo

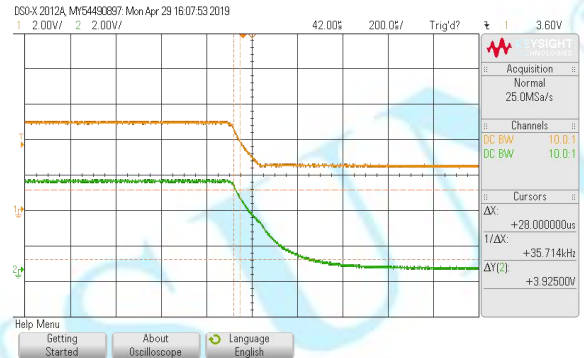


Figure 10. Turn-off Wave Table, Yellow: Vin, Green: Vo

5.4. Protection Specifications

5.4.1. Short-circuit Protection (SCP)

Operating Conditions: Normal temperature, 5VDC input, full load output;

Test Standard: Output continuous, self-recovery.

Table 8. Short-circuit Protection Test

Input Voltage	5VDC
Short-circuit Protection Recovery Wave Table	Figure 11

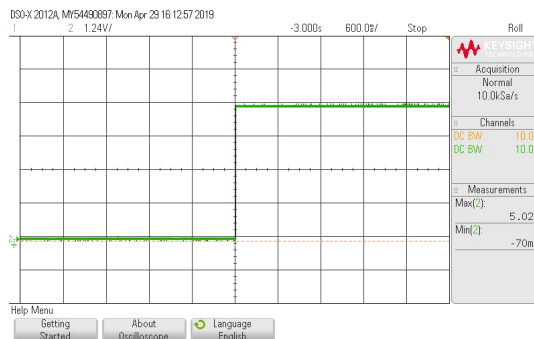


Figure 11. Short-circuit Protection Recovery Wave Table (5VDC)

6. 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!

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