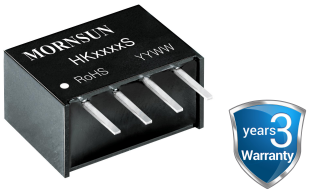
MORNSUN®

Single output, specially designed for application of intelligent passive transmitter



Patent Protection RoHS

FEATURES

- Specialized for power supply of two-wire loop application
- High output current up to 3.5mA
- Isolation voltage: 1.5K VDC
- Operating temperature range: -40℃ to +85℃
- International standard pin-out

HK_S series is specialized for applications of two-wire signal and HART transmission. It can solve a series of problems, such as, the signal transmission errors around 3.5~20mA, followed by the interruption of HART communication or damage to equipment port device, which are caused by the ground potential difference with different ground loops. HK_S series supply power through the loop, so that it can eliminate transmission errors caused by electric potential difference and ensure the accuracy of the communication transmission.

Selection Guide

Part No.	Input		Output		Max. Capacitive Load(μF)
	Input Voltage (VDC)	Input Current(mA)	Output Voltage(VDC)	Output Current (mA)(Max.)	
HK0503S	5	3.5~20	3.3	2.5	10
HK0803S	7~8	3.5~20	3.3	3.5	
HK0805S	7~8	3.5~20	5	2	

Note: All index testing methods of HK0803S and HK0805S are based on the input voltage of 7 V.

Input Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Surge Voltage (1sec. max.)	5V input	-0.7	--	9	VDC
	7V input	-0.7	--	14	
Input Filter		Capacitor filter			
Hot Plug		Unavailable			

Output Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Output Voltage Accuracy	3.3VDC output		-9	--	+9	%
	5VDC output		-5	--	+5	
Load Regulation	10%-100% load	3.3VDC output	--	2	10	%
		5VDC output	--	2	5	
Ripple & Noise*	20MHz bandwidth		--	15	75	mVp-p
Output Short Circuit Protection**			Continuous, self-recovery			

Note: * Ripple and noise tested with "parallel cable" method, please see *DC-DC Converter Application Notes* for specific operation methods.
**Input Current range: 3.5~20mA

General Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Isolation Voltage	Input-output, with the test time of 1 minute and the leak current lower than 1mA	1500	--	--	VDC
Isolation Resistance	Input-output, isolation voltage 500VDC	1000	--	--	MΩ
Isolation Capacitance	Input-output, 100KHz/0.1V	--	20	--	pF
Operating Temperature		-40	--	85	℃
Storage Temperature		-55	--	125	
Casing Temperature Rise	Ta=25℃	--	3	--	
Pin Welding Resistance Temperature	Welding spot is 1.5mm away from the casing, 10 seconds	--	--	300	
Storage Humidity	Non-condensing	--	--	95	%RH
MTBF	MIL-HDBK-217F@25℃	3500	--	--	K hours

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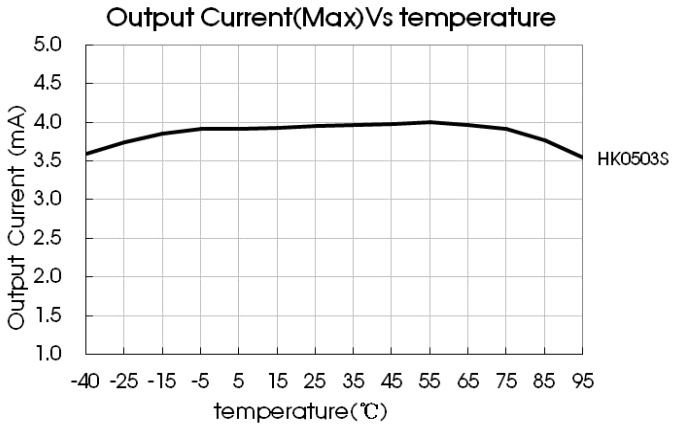
Physical Specifications

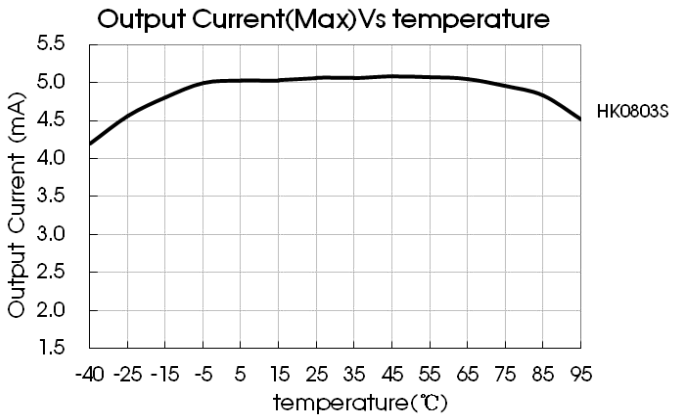
Casing Material	Black flame-retardant and heat-resistant plastic (UL94 V-0)
Package Dimensions	11.60*6.00*10.16 mm
Weight	1.3g (Typ.)
Cooling Method	Free air convection

EMC Specifications

EMS	ESD	IEC/EN61000-4-2	Contact	±8KV	perf. Criteria B

Product Characteristic Curve





Note: In the curves, the maximum output current is typical value in different temperature.

Design Reference

1. Ground Loop Problem In Signal Transmission And Ground Electric Potential Difference

There are many reasons causing ground loop problem in instrument circuit, when the signal transmission and receiving devices connected to different location or different power supplies, it will lead to ground loop, which is common in long cable transmission. Most of the reason is that the equipment of the metal shell had physical contact with the ground, so that ground loop produces electric circuit.

Because the accuracy of the signal can not be measured through simple observation in the receiving end of the signal. the land circulation for different ground potential will bring error that can't be detected to signal loop. There is also a signal error problem caused by ground loop in the absence of two-wire signal isolation transmission. Signals like lightning signal and surge signal will load on the signal line along with long wire, and damage modulation and detection devices on the port. In another case, two components of the different potential port may lead to the port voltage exceeding, and damage the device port subsequently.

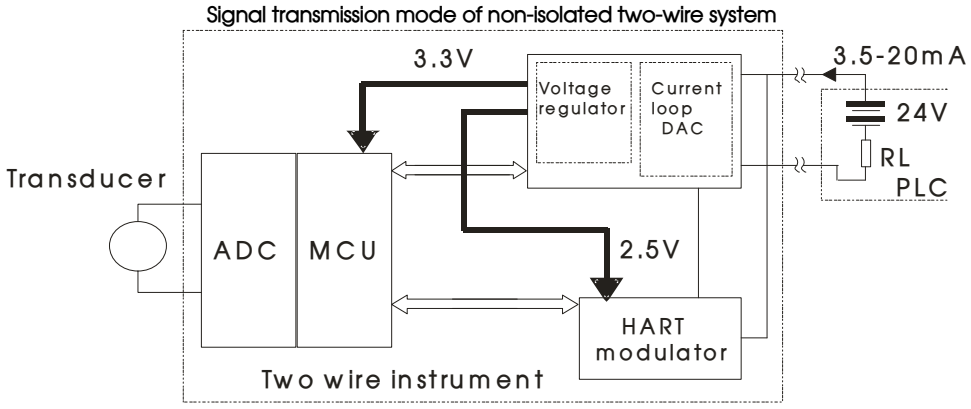


Fig. 1

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In the circuit of fig. 1, Sensor signal is converted into digital signals through the ADC, then sent to the current loop DAC and HART modulator through MCU, and form 3.5~20 mA signal output. Current loop DAC get power supply from the PLC bus of output 3.5~20 mA, and output 3.3 V and 2.5 V through the built-in voltage regulator, supply a small amount of power for MCU and HART modulator.

In the transmission of fig. 1, there are ground electric potential differences between two-wire system instrument and PLC on the far side, causing the common mode interference. The disturbance causes the transmission error of 3.5~20 mA, and affects the normal communication HART bus. If the common mode interference is too large (over the voltage range of the components in the common-mode), it may cause damage in the internal instrument of two wire devices.

Signal transmission mode of isolated two-wire system

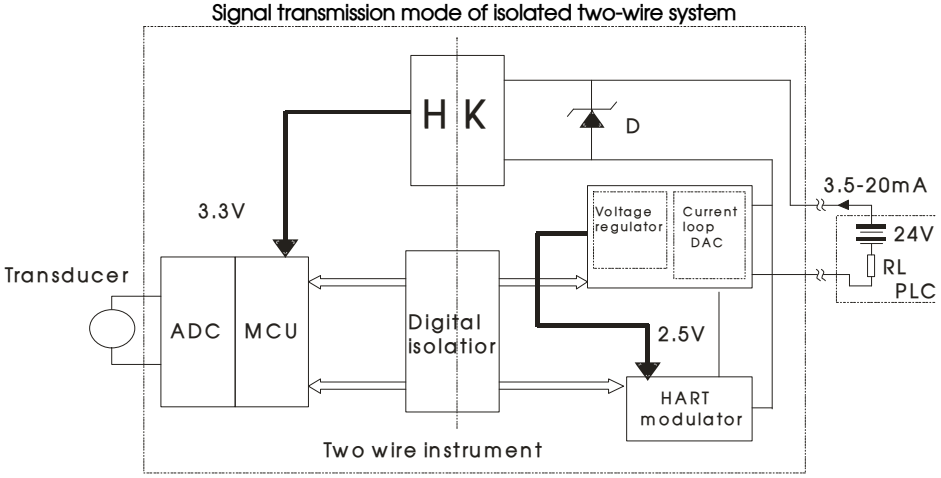


Fig. 2

Due to the potential risks based on the different ground, you can isolate the MCU and the current loop DAC and HART modulator by digital isolation. Current loop DAC and HART modulator is floating form. They make the high impedance formed to two ground potential between two-wire instrument and PLC system, and reduce the loop current between the ground wire,So that two systems are isolated and the hidden trouble of common mode interference is eliminated.

The two-wire instrument goes without additional power supply port. The power supply takes power through the 3.5-20mA loop. By the isolation way,2.5V power of HART modulator is still formed from the built-in voltage regulator of loop DAC regulator, but the power supply for the 3.3V MCU system is a difficult problem. A better solution is to connect with a voltage stabilizing diode in the 3.5-20mA circuit as shown in Fig.2. Then you can use HK module of MORNSUN to isolate and output 3.3Vpower to the MCU power system. Using the HK module and digital isolation circuit, you can isolate two-wire instrument and PLC system .It avoids the measuring error of the system and damaging equipment caused by ground potential, and it further enhances the reliability of the system.

2. Recommended circuit

Recommended circuit 1:

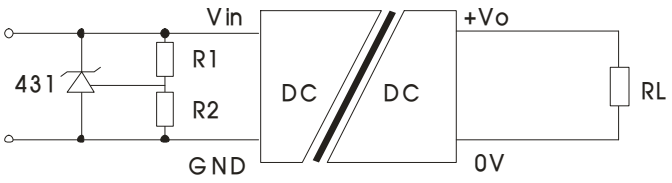


Fig. 3

Recommended circuit 2:

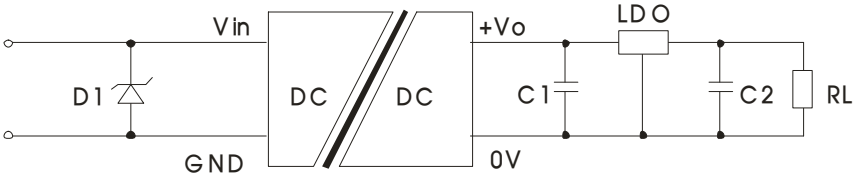


Fig. 4

BZT52C series voltage regulator tube is recommended for D1. HK05xxS needs 5.1 V voltage regulator tube. HK08xxS needs 7.5 V voltage regulator tube;

XC6209 series is recommended for LDO. HK0503S/HK0803S need LDO with 3.3 V output. HK0805S needs LDO with 5V output;

C1、C2：1uF/16V.

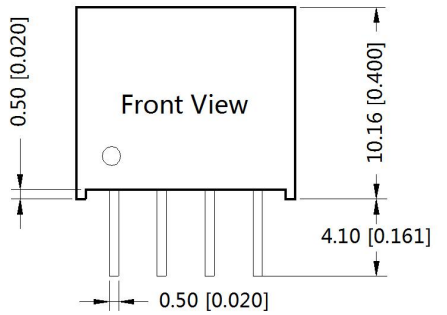
Note: 1. Due to the difference of voltage regulator tube accuracy, it will affect the maximum output current and output voltage accuracy of the product;
2. All index testing methods in this datasheet are based on Recommended circuit 1.

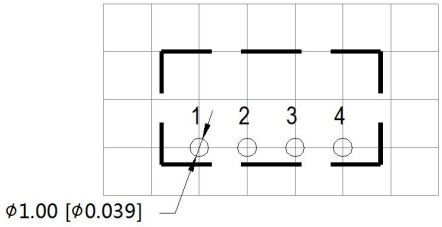
3. For more information please find the application notes on www.mornsun-power.com

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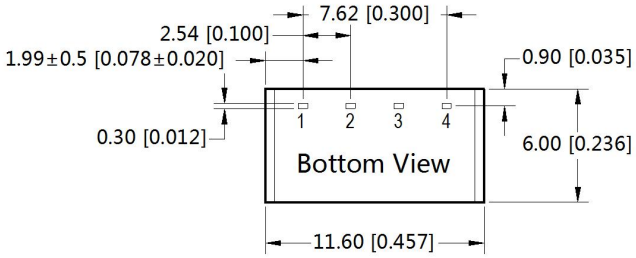
Dimensions and Recommended Layout

THIRD ANGLE PROJECTION





Note : Grid 2.54*2.54mm



Pin-Out	
Pin	Function
1	GND
2	Vin
3	0V
4	+Vo

Note:
Unit :mm[inch]
Pin section tolerances :±0.10[±0.004]
General tolerances:±0.25[±0.010]

Notes:

1. Packing information please refer to Product Packing Information which can be downloaded from www.mornsun-power.com. Packing bag number: 58200003;
2. If the product is not operated within the required load range, the product performance cannot be guaranteed to comply with all parameters in the datasheet;
3. The maximum capacitive load offered were tested at input voltage range and full load;
4. Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta=25℃, humidity<75%RH with nominal input voltage and rated output load;
5. All index testing methods in this datasheet are based on our Company's corporate standards;
6. We can provide product customization service, please contact our technicians directly for specific information;
7. Specifications are subject to change without prior notice.

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