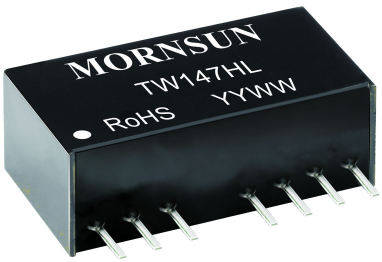
Signal conditioning module
TW147HL Series

MORNSUN®

Two-wire loop power supply signal conditioning module
HART Signal Transmission is available



RoHS CE 3 years Warranty

FEATURES

- Loop power
- High linearity (0.1% F.S.)
- High isolation voltage(2kVAC/1mA/60s)
- Compact size: SIP9 (26*9.5*12.5mm)
- Extremely low temperature coefficient: 50ppm/℃ (Typ.)
- Operating temperature range: -40℃ to +85℃
- HART Signal Transmission is available
- ESD protection(Bare component ±4kV)
- EN60950 approval

TW147HL is a specific signal conditioning module for smart field instruments with HART, The isolation module is designed for transmitting the PWM input signal to output isolated standard 4-20mA through output loop-powered .Meanwhile the module can offer a isolation micro-power for the pre-devices. The module also has an integrated HART signal channel. according to the recommended solutions, it can realize the Half duplex communication between the field and control area. which greatly reduce the wiring cost between the field and the control area.

The module adopts unique electromagnetic isolation mode and high performance power feedback. The module achieves the function of transmitting PWM signal to isolated standard 4-20mA accurately, which can match instruments analog input port(such as PLC , DCS , etc).In addition, this module has small package (SIP9) and excellent temperature drift characteristics (at -40℃ to +85℃ operating temperature range drift is less than 50PPM /℃). This module can bear 2kVAC isolation voltage between the input and output.

Selection Guide

Certification	Part No.	Power Supply input Typ. (VDC)	Input Signal(Duty Cycle)	Linearity Output Range(mA)*	Isolation Power Output (VDC)
CE	TW147HL	10-24	0-100%	4-20	3.3

Notes: *The specific relationship between input and output can refer to product characteristics curve

Input Specifications

Item		Operating Conditions	Min.	Typ.	Max.	Unit
Power Input	Input Voltage		10	--	24	VDC
Single Input	Frequency	Operating temperature range of -40℃ to +85℃,ViH-ViL=3.3V	100	--	1000	Hz
	Duty Cycle	Operating temperature range of -40℃ to +85℃, ViH-ViL=3.3V	0	--	100%	--
	Edge Time	500Hz，Ta=25℃；	--	--	100	nS
	PWM Amplitude	ViH-ViL	3	--	5	V
	Input amplitude over range	Ta=25℃	--	--	7	V

Output Specifications

Item		Operating Conditions	Min.	Typ.	Max.	Unit
Isolation Power Output	Output Voltage	Output current of isolated power supply full loads	-3%(Nominal value)	Nominal value	+3%(Nominal value)	V
	Output Current	Operating temperature range of -40℃ to +85℃	--	--	4	mA
	Short Circuit Protection	Ta=25℃	Continuous short-circuit protection，After debugging , it resumed normal work			
Single Output	Output Signal		Reference selection guide (The minimum output signal range is 3.7-4mA)			
	Load Capacity	Output signal@22mA	RL≤(Vin-Vin(min))/0.022 & RL＜550，Vin refers to the power supply voltage; Vin (min) refers to the nominal minimum supply voltage			
	Load Regulation	24V Power supply, 0-250Ω load	±0.05%F.S./100Ω			--
	Ripple & Noise	20MHz bandwidth(Max)，250Ω/0.01μF load，Ta=25℃	--	30	--	mVp-p

Transmission Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
linearity	Ta=25℃	-0.1%F.S.	--	+0.1%F.S.	--
Temperature Coefficient	Operating temperature range of -40℃ to +85℃	--	50	100	PPM/℃
Response Time	Ta=25℃	--	--	1	s
Communication	Operating temperature range of -40℃ to +85℃	Support HART communication with recommended circuit (Reference the Design Reference)			

General Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Electric Isolation		Two- port isolation (signal input and signal output)			
Isolation Voltage	Testing for 1 minute, leakage current <1mA, humidity <70%	2	--	--	kVAC
Insulation Resistance	500VDC	100	--	--	MΩ
Operating Temperature		-40	--	+85	℃
Transportation and Storage Temperature		-40	--	+85	℃
Max Casing Temperature	Ta=25℃,24V Power supply, 250Ω load	--	--	+50	℃
Safety Standard		EN60950			
Safety Certification		EN60950			
Safety Class		CLASS III			
Application Environment		The presence of dust, fierce vibration, impulsion and corrosive gas may cause damage to the product.			

Physical Specifications

Casing Material	Black flame-retardant and heat-resistant plastic
Package	SIP9
Weight	6g(Typ.)
Cooling Method	Free air convection

EMC Specifications

EMS	ESD	IEC/EN61000-4-2	Contact ±4kV	perf. Criteria B
	RS	IEC/EN61000-4-3	3V/m	perf. Criteria A
	EFT	IEC/EN61000-4-4	Two-wire loop port ±2kV (see Fig. 4 for recommended circuit)	perf. Criteria B
	Surge	IEC/EN61000-4-5	Two-wire loop port ±1kV (see Fig. 4 for recommended circuit)	perf. Criteria B
	CS	IEC/EN61000-4-6	3 Vr.m.s	perf. Criteria A

Product Characteristic Curve

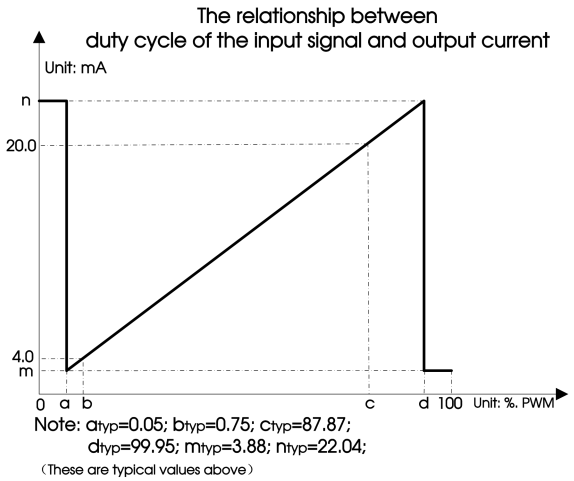


Fig.1 input signal duty cycle and output current relationship

Application Precautions

1. Please read the instructions carefully before use; contact our technical directly if you have any problem.
2. Do not use the product in hazardous areas.
3. Use DC power supply for the product and 220V AC power supply is prohibited.
4. Do not dismount and assemble the product without permission to avoid failure or malfunction of equipment.

After-sales service

1. Ex-factory inspection and quality control have been strictly conducted for the product; if there occurs abnormal operation or possibility of failure of internal module, please contact the local representative or our technical support.
2. The warranty period for the product is 3 years as calculated from the date of delivery. If any quality problem occurs under normal use within the warranty period, the product can be repaired or changed for free.

Applied circuit

See *Application Notes for Signal conditioning module application manual.*

Design Reference

1. Typical application

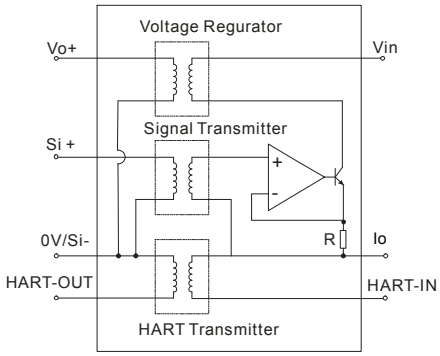


Fig. 2 signal conditioning module functional diagram

2. Product application wiring diagram

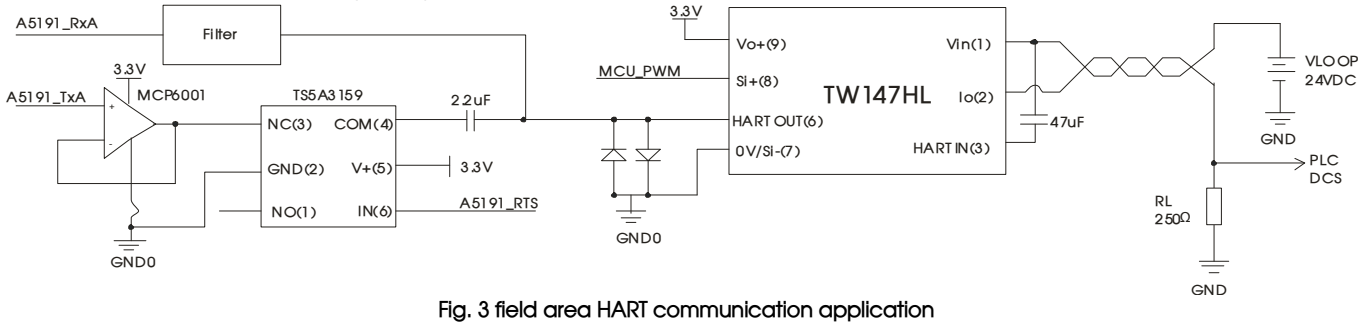


Fig. 3 field area HART communication application

Description

Fig.3 shows a typical application of the Signal conditioning module TWxxxHL. MCU system, HART modem IC A5191 and the signal conditioning module TWxxxHL work together for the communication between smart field devices and control systems .

Note: A5191 chip is a IC from Onsemi with HART modulation and demodulation

Signal Access Description:

A5191_TxA: Connect A5191 chip TxA pin, A5191_RxA: Connect A5191 chip RxA pin
A5191_RTS: Connect A5191 chip RTS pin, MCU_PWM: Connect MCU chip PWM pin
Filter: Filter for receiving . Please refer to the technical manual of Onsemi A5191 chip for details if necessary .

Working principle:

PWM signal isolation transmission and conversion: PWM signal input into Si+ pin and isolated in the module Then it outputs 4-20mA current in the output side after reduction, filtering, V / I conversion.

HART signal sending:

When HART signal is sending , it's modulated to FSk signal . FSk signal output through A5191 chip TxA pin . Because of the weak drive capability of A5191 , we use MCP6001 to follow voltage . Then we use TS5A3159 as low voltage analog switch . A5191 chip RTS pin control the switch . When sending HART signal , RTS is low level . The analog switch NC and COM pin break over . In this time , FSk signal is sent to HART_OUT pin . After isolated , FSk signal will be sent to two wire port to finish HART signal sending . (When sending HART signal continuously , the circuit loss is about 0.6mA, the static loss of about 0.1mA)

HART signal detection:

A5191 chip RTS pin should be high level when detecting HART signal . So the analog switch is off now . HART signal from two-wire port will be coupled with HART_IN pin through the 47μF capacitance . After isolated , the signal is sent to HART_OUT pin (The analog swtich must turn off , otherwise HART_OUT pin could not receive HART signal) . Then through filter , A5191 RxA pin can receive HART signal .

The whole system which shown in Fig.2, provides a solution for the transmitting of the sensor signal to the 4-20mA standard current signal and the HART communication between smart field devices and control systems. what's more, all the connections between field area and control area are only two analog wires. Therefore, lower cost for systems is possible. The output of module could match the input of common instruments by sampling resistance RL . If the function of HART communicating is not necessary, please remove the HART modem IC A5191、MCP6001、TS5A3159 in the system, and do not connect the HART_IN PIN and HART_OUT PIN of TWxxxHL into any circuits.

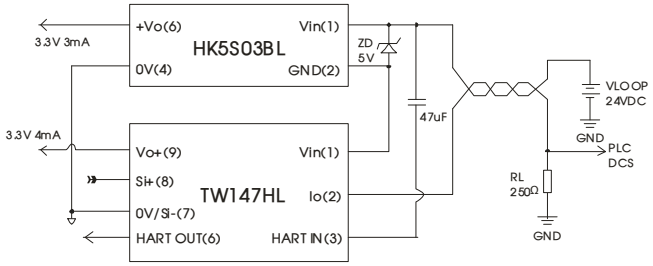


Fig. 4 Power capacity expansion program of field area

Description

Fig.4 shows another typical application of TWxxxHL . In order to expand the power supply to field area, a power module Hk5S03BL is added into the system.

As Fig.4 shows, the capacity of TWxxxHL power supplying is 3mA, By adding Hk5S03BL , the capacity of power supplying rises to 7mA .

3. EMC solution-recommended circuit

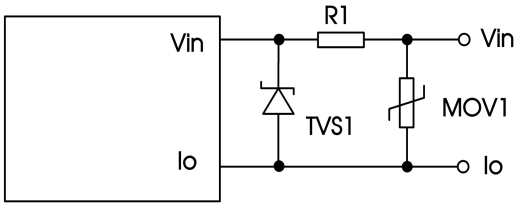
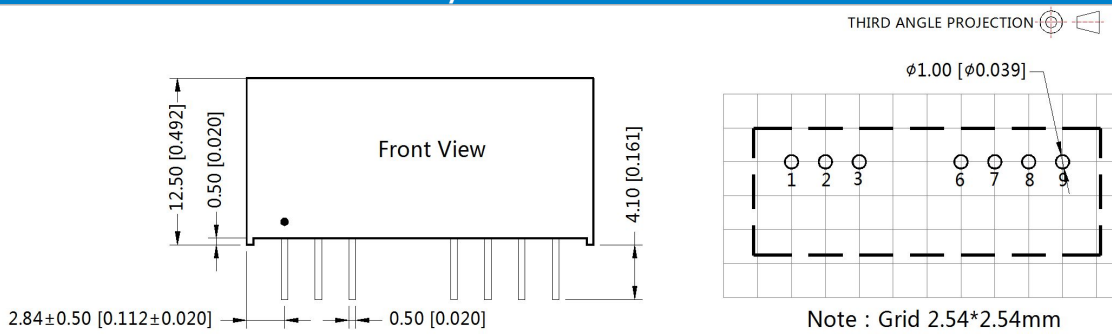


Fig. 5

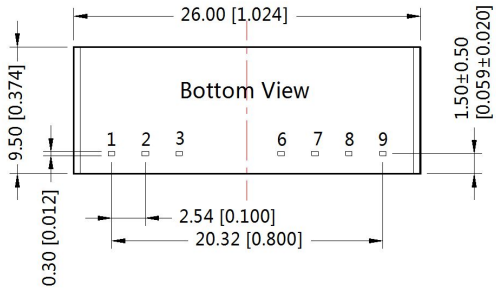
Components	Recommended parameters
MOV1	S07k30
R1	12Ω/2W
TVS1	SMCJ30A

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

Dimensions and Recommended Layout



Note : Grid 2.54*2.54mm



Pin-Out		
Pin	Function	
1	Vin	Power input
2	Io	Current output
3	HART_IN	HART Signal input
6	HART_OUT	HART Signal output
7	0V/Si-	Distribution GND
8	Si+	Signal input +
9	Vo+	Distribution Power output +

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: 58240002;
2. All index testing methods in this datasheet are based on our Company's corporate standards;
3. The performance indexes of the product models listed in this datasheet are as above, but some indexes of non-standard model products will exceed the above-mentioned requirements, and please directly contact our technician for specific information;
4. We can provide product customization service;
5. Products are related to laws and regulations: see "Features" and "EMC";
6. Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units.

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