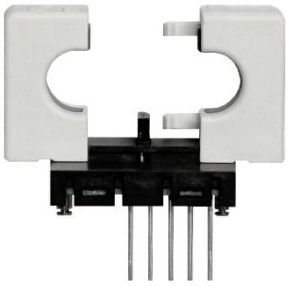
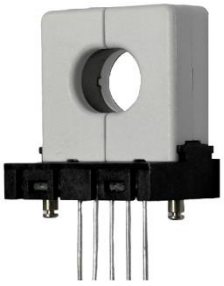
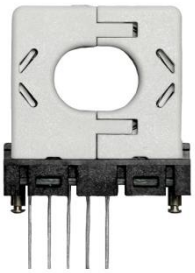
Micro AC / DC Current Module with Digital Data output

Feature:



- New spring structure with high measurement stability
- 10.4 x 8 mm split through hole design
- Small package with digital current output
- Continuous, AT Command, Modbus-RTU, I2C, RS485
- Operating voltage DC5.0V
- Temperature and voltage compensation
- Sensing current range:
  AC: 0~17A (50Hz, 60Hz)
  DC: 0~±25A





- High accuracy:
  AC: (0~5A) ± 0.15A
  (5~17A) ±3%
- DC: ±(0~5A) ± 0.15A
  ±(5~25A) ±3%
- Resolution: 18mA
- UART interface, baud rate : 9600 bps(1)
- I2C interface: standard mode (100kHz)
- Isolation voltage 4KV
- Application note: http://www.winson.com.tw/Product/83

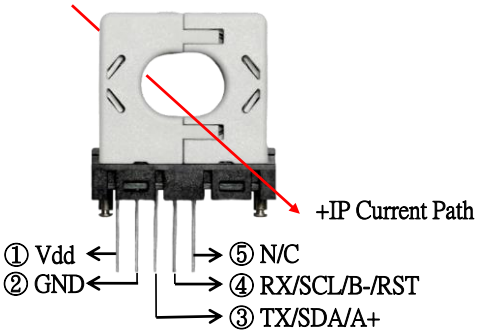
(1) Programmable baud rate options : 9200, 38400, 57600, 125000 bps

General Description:

The DWCS7800 consists of a current sensor, temperature sensor, a very high accuracy A/D converter and digital signal output of current.

The unique spring structure of DWCS7800 can improve the tightness on both sides of the iron core, making measurement more stable and reducing the influence of structural opening and closing tolerances. Users can just use system's own electric wire by pass it through this hole to measure passing current without breaking original system, user's MCU can get the real data from DATA pin.

The DWCS7800 provides temperature and supply voltage calibration of the internal current sensor and accurately measures the current of AC 50 / 60Hz and DC at temperature from -20˚C~85˚C. The DWCS7800 also offers solutions for true RMS current measurement of various loads.



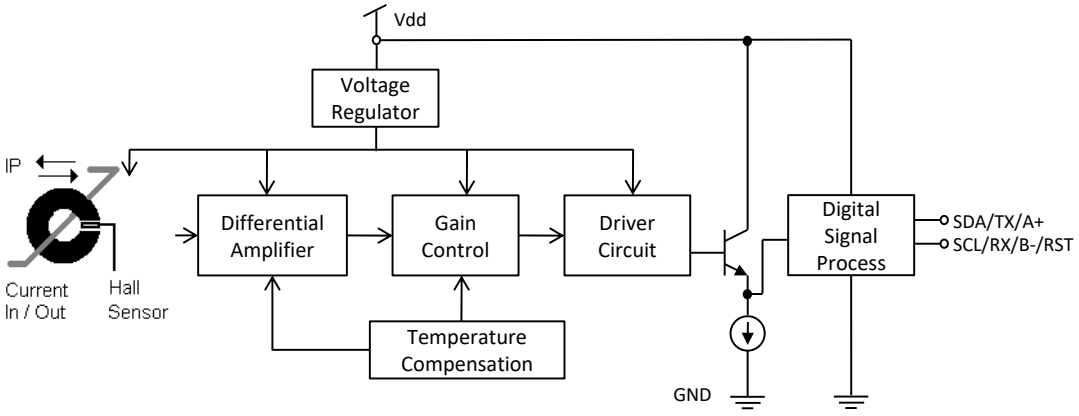
Absolute Maximum Range

Supply Voltage, Vdd ---------- **6V**
Pass Through Wire Channel -------- **10.4 x 8mm**
Basic Isolation Voltage ---------- **4000V**
Operating Temperature, Ta ----------
---------- **-20ºC to +105ºC** (2)
Storage Temperature, Ts ----------
---------- **-60ºC to +125ºC**

Note:

1.Stresses above those listed may cause permanent damage to the devices

2. Operating temperature(RS485 Modbus), Ta: -20ºC to +85ºC



Functional Block Diagram

Selection Guide:

Model	Maximum Current		Operating Voltage	Frequency	Interface	Version
	AC	DC				
DWCS7800-50C	17A	±25A	5.0V	50Hz/60Hz,DC	TTL	Continuous(1)
DWCS7800-50T					TTL	AT Command(2)
DWCS7800-50M					TTL	Modbus-RTU (2)
DWCS7800-50M485					RS485	RS485 Modbus(3)
DWCS7800-50I					I2C	I2C

1. Continuous: UART interface, external reset method (RST pull low to GND).
2. AT Command & Modbus-RTU: UART interface, TX (Transmitter) / RX (Receiver), internal reset method.
3. RS485 Modbus: Uses the RS485 (2-wire) hardware interface with the standard industrial Modbus-RTU protocol.

Winson reserves the right to make changes to improve reliability or manufacturability.

Pad Description:

Pad No	Pad Name	I/O	Description
1	VDD	-	The positive power input pin
2	GND	-	The system ground
3	SDA/ TX/ A+	I/O O I/O	I2C SDA: I2C Data UART TX: UART Transmitter RS485 A+
4	SCL/ RX/ B-/ RST	I I I/O I	I2C SCL: I2C Clock UART RX: UART Receiver RS485 B- IO RST(Continuous): IO Reset

The digital I/O (pins 3 and 4) of DWCS is an open drain structure need be pulled to high (VDD) through an external resistor to function properly.

Electrical Characteristics:

Common Operating Characteristics

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
VDD	Operation Voltage	-	4.900	5	5.100	V
IDD	Operation Current	VDD = 5.000V	-	6	10	mA
TOP	Operating Temperature	-	-20	-	85	˚C
A_{CC}	Internal Temperature Accuracy	4.9V ≦ V_{DD} ≦ 5.1V	-5	-	5	˚C
A_{DD}	Internal Voltage Accuracy	-20˚C ≦ T_{op} ≦ 85˚C	-1		+1	%
-	Conductor Through Hole	-	-	10.4x8	-	mm

-AC

V_{DD} = 5.000V

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
IOP	Current Range	-	0	-	17	A
ETOT	Current Output Error	I_{OP}= 0~5A, T_{op} = 25˚C	-	±0.15	-	A
		I_{OP}= 5~17A, T_{op} = 25˚C	-	±3	-	%
		I_{OP}= 0~17A, -20˚C ≦ T_{op} ≦ 85˚C	-	±6	-	%

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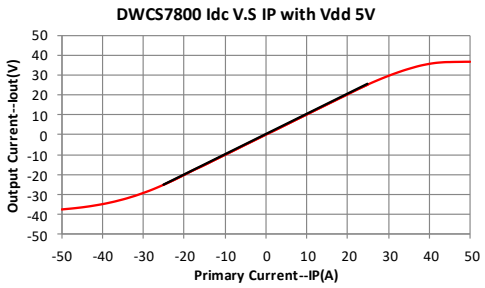
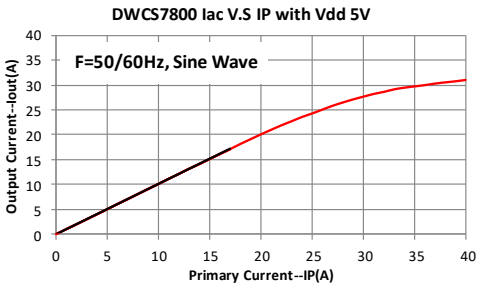
-DC **V_{DD} = 5.000V**

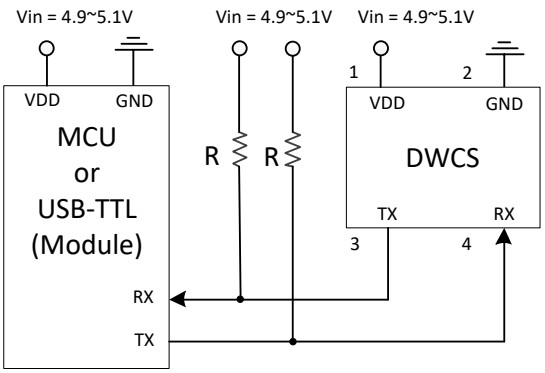
Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
IOP	Current Range	-	0	-	±25	A
ETOT	Current Output Error	I_{OP}=±(0~5)A, T_{op} = 25°C	-	±0.15	-	A
		I_{OP}=±(5~25)A, T_{op} = 25°C	-	±3	-	%
		I_{OP}=±(0~25)A, -20°C ≦ T_{op} ≦ 85°C	-	±6	-	%



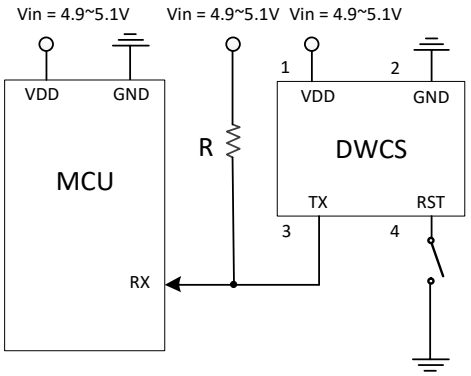


Application Note:

(1) Application Diagram:

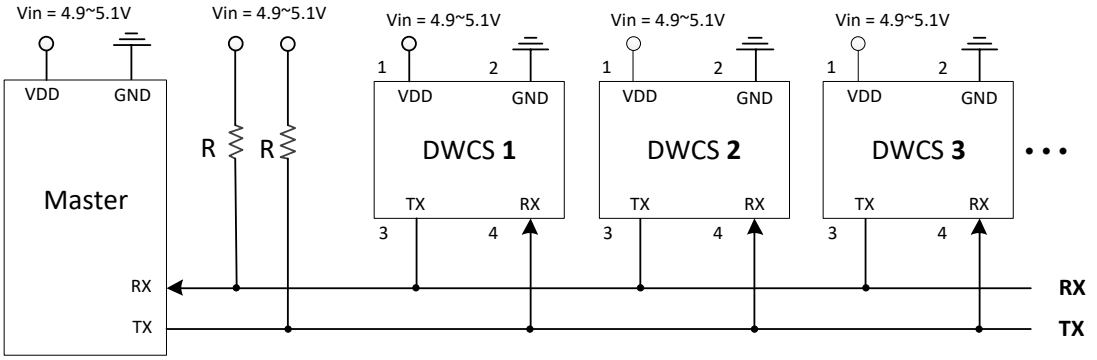


App. 1 Connect to MCU or USB-TTL (UART: AT Command)

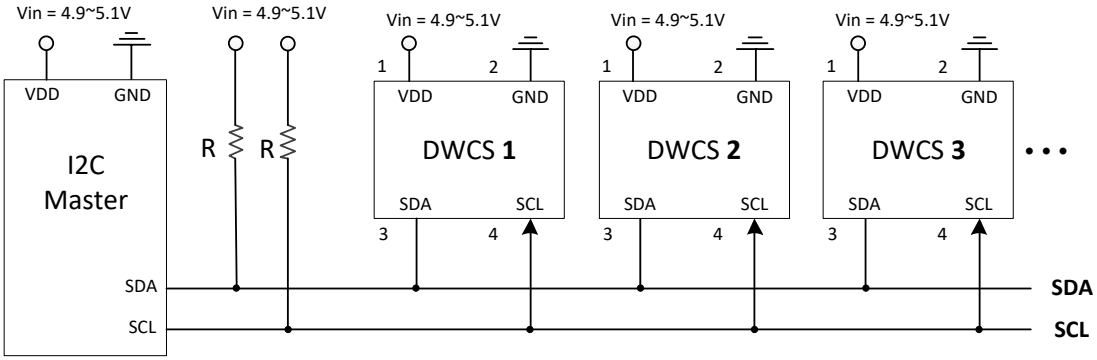


App. 2 Connect to MCU (UART: Continuous)

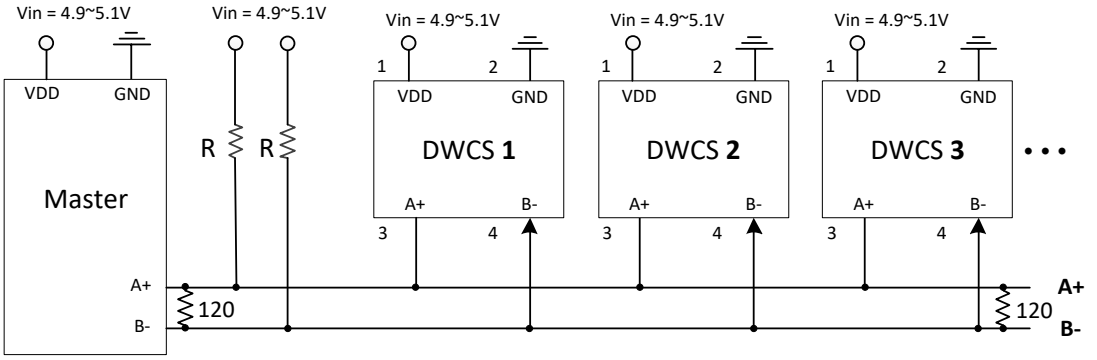
Winson reserves the right to make changes to improve reliability or manufacturability.



App. 3 Modbus Connection



App. 4 I2C Connection



App. 5 RS485 Connection

(2) AT Command:

Setting Command	Command	Example	Return Parameter
Reset Current	AT+RST\r\n	"AT+RST\r\n"	"OK\r\n"(1)
0: DC 1: AC	AT+CURR\r\n	"AT+CURR,0\r\n" "AT+CURR,1\r\n"	"OK\r\n"(1)
Measure Current	AT+MEAS\r\n	"AT+MEAS\r\n"	<Current>
Measure Temperature	AT+TEMP\r\n	"AT+TEMP\r\n"	<Temperature>
Measure 120 Points of Current Data	AT+BUF\r\n	"AT+BUF\r\n"	<I1,I2,I3,…\r\n>
Change Baud Rate	AT+BR\r\n	"AT+BR,1\r\n"(2)	"OK\r\n"(1)

1. Command is error : return "Err\r\n" ◦
2. Baud Rate (1: 9600, 2: 19200, 3: 38400, 4: 57600, 5: 125000 (bit/s))

(2.1) Current Data Output (Continuous & AT Command Version):

(2.1.1) If the measured data is AC “1.23”A, then the output data is ‘~’, ‘1’, ‘.’, ‘2’, ‘3’, ‘0’, ‘\r’, ‘\n’, total of 8 bytes. If the measured data is “10.45” A, then the output data is ‘~’, ‘1’, ‘0’, ‘.’, ‘4, ‘5, ‘\r’, ‘\n’, total of 8 bytes.

(2.1.2)If the measured data is +DC “1.23”A, then the output data is ‘+’, ‘1’, ‘.’, ‘2’, ‘3’, ‘0’, ‘\r’, ‘\n’, total of 8 bytes. If the measured data is -DC “1.23”A, then the output data is ‘-’, ‘1’, ‘.’, ‘2’, ‘3’, ‘0’, ‘\r’, ‘\n’, total of 8 bytes.

(2.2) Temperature Data Output (AT Command Version):

If the measured data is 25.5˚C, then the output data is ‘2’, ‘5’, ‘.’, ‘5’, ‘\r’, ‘\n’, total of 6 bytes. If the measured data is 5.0˚C, then the output data is ‘5’, ‘.’, ‘0’, ‘\r’, ‘\n’, total of 5 bytes. If the measured data is -10.0˚C, then the output data is ‘-’, ‘1’, ‘0’, ‘.’, ‘0’, ‘\r’, ‘\n’, total of 7 bytes.

(2.3) Measure 120 Points of Current Data Output (AT Command Version):

The output data is "+1.234, +1.233, +10.23,…..\r\n" , total of 120 bytes.

(3) Modbus-RTU Command:

(3.1) Modbus Parameter List

Item	Address	Byte	R/W	Description
Reset	0x0000	2	Write	Write 0x0100 to Reset
Measuring Flag Data Valid Flag (1)	0x0001	2	Write/ Read	**Write:** 0x0002: measuring flag set **Read:** 0x0000: measuring flag reset, data flag is invalid 0x0001: measuring flag reset, data flag is valid 0x0002: measuring flag set, data flag is invalid 0x0003: measuring flag set, data flag is valid
Current	0x0002	4	Read	Hexadecimal signed (HEX),Unit:0.001A Current= HEX/1000 (A)
Temperature	0x0004	4	Read	Hexadecimal signed (HEX), Unit:0.1°C Temperature= HEX/10 (°C)
Slave Address	0x0010	2	Write	Default address: 1 Write address1~247
Baud Rate	0x0011	2	Write	Default: 1 (Baud Rate = 9600 bit/s) 0x0001: Baud Rate = 9600 bit/s 0x0002: Baud Rate = 19200 bit/s 0x0003: Baud Rate = 38400 bit/s 0x0004: Baud Rate = 57600 bit/s 0x0005: Baud Rate = 125000 bit/s
DC/AC	0x0020	2	Write	0: DC 1: AC

1. In the scenario of multi-sensor simultaneous monitoring, using measuring flag can greatly improve measurement speed.

(3.2) Modbus-RTU Data Format

Slave Address	Function Code	Data	Check Code (CRC16)
1 Byte	1 Byte	N x Byte	2 Byte (low byte first)

(3.3) Function Code

Function Code	Description
03H	Read up to 125 continuous memory words
06H	Write one memory word

(3.4) Exception Code

Exception Code	Description
01H	Illegal function code
02H	Illegal data address
03H	Illegal data count
04H	Slave device busy

When the exception occurs, the MSB (most significant bit) of the function code will automatically be set to 1. For example, the exception code of the function code 0x03 is 0x83.

(4) I2C Command:

(4.1) Register address configuration

Address	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Function	Range
00h	0	0	0	0	0	0	0	Auto	Control	0-1
01h	0	Address							Slave Address	-
02h	0	0	0	0	0	0	0	Reset	Current Reset	0-1
03h	0	0	0	0	0	0	Status	Valid	Status	0-3
04h~07h	Temperature								Temperature	-
08h~0Bh	+/-Current								DC Current	-
0Ch~0Fh	~Current								AC Current	-

Unless otherwise specified, the registers' state is not defined when power is first applied. For more detail on I2C description, please refer to the "DWCS Application Note"

(5) True RMS Current Measurement:

In order to calculate true RMS of AC current, you need to know "zero" value of AC current first. The "zero" value of symmetric AC current is the average value *Vo*(dc) of the current shown in Figure 1.

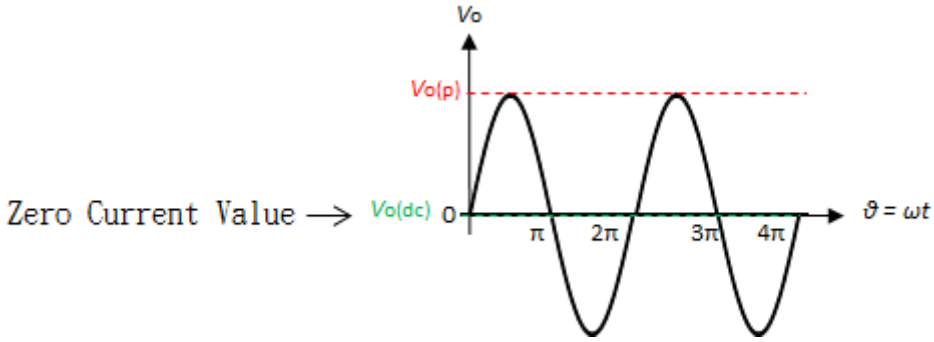


Figure 1 The zero current value of sine waveform

But in asymmetrical AC current, the "zero" value is not the average value *Vo*(dc) of the current. Based on this "zero" value and do RMS calculation. You will get wrong answer.

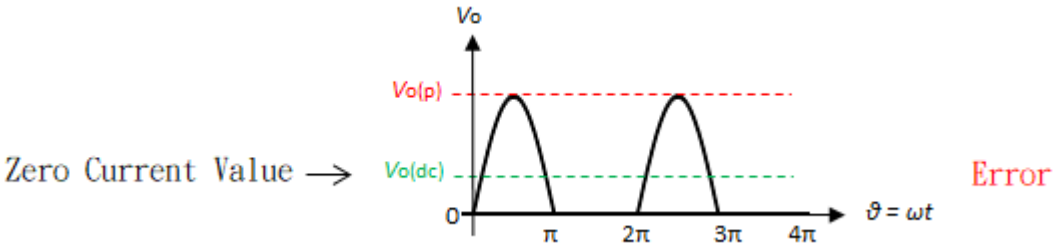


Figure 2 The zero current value of the asymmetric waveform (Error)

The DWCS series offers a true RMS solution for both symmetric and asymmetric AC current. It can correctly detect "zero" current value, shown in Figure 3. and do perfect RMS calculation.

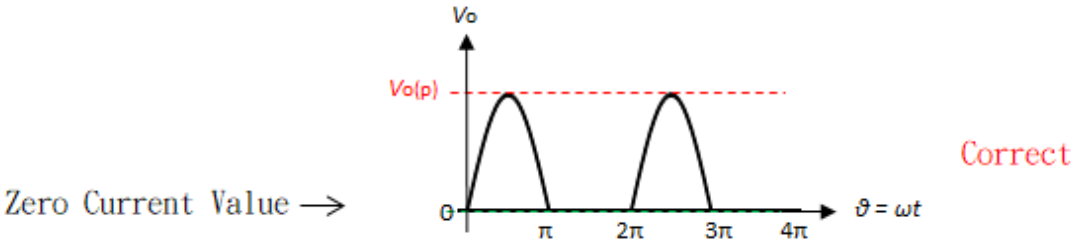


Figure 3 The zero current value of the asymmetric waveform (Correct)

Package: (Units: mm)