Micro AC / DC Current Module with Digital Data output

Feature:

- Small package with digital current output
- Continuous, AT Command, Modbus-RTU, I2C
- Operating voltage DC5.0V
- Temperature and voltage compensation
- Diameter 9.0mm conductor through hole
- Sensing current range:
  AC: 0~70A (50Hz, 60Hz)
  DC: 0~±100A
- High accuracy:
  AC: (0~9A) ± 0.09A
  (9~70A) ±1%
- DC: (0~9A) ± 0.09A
  (9~100A) ±1%
- Resolution: 30mA
- UART interface, baud rate : 9600 bps
- I2C interface: standard mode (100kHz)
- Isolation voltage 4KV
- Application note: http://www.winson.com.tw/Product/83

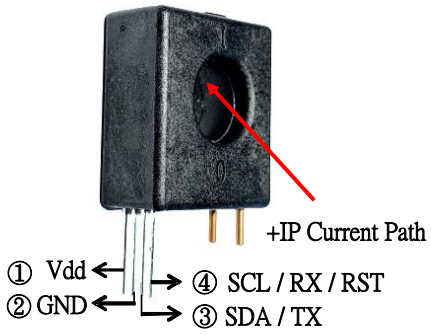
General Description:

DWCS3300 is a AC/DC current sensor with calibrated digital signal output. It applies exclusive digital signal collecting technique and allows for easy implementation without breaking original system. Typical applications include load detection and management, over-current fault detection and any intelligent power management system etc…

DWCS3300 is composed of a precise, low-temperature drift, differential output linear hall sensor IC with temperature compensation circuit, temperature sensor, digital signal processor and through-hole mechanism with a diameter of 9.0mm etc. through differential output, DWCS3300 improves its sensitivity twice as much as the original.

All the sensors on DWCS3300 are temperature compensated and calibrated with accurate calibration instrument. The UART interface directly transmits digital current signals, making system integration simple and fast. Small size, low consumption and the terminals of the conductive path are electrically isolated from the sensor leads enable DWCS3300 to be suited in all kinds of harsh application occasions.

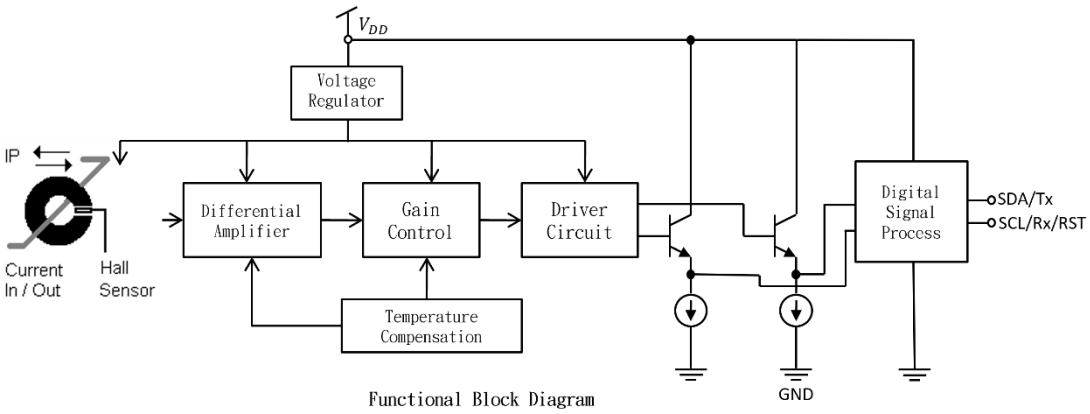
Winson reserves the right to make changes to improve reliability or manufacturability.



Absolute Maximum Range

Supply Voltage,Vdd ---------- **6V**
Pass Through Wire Diameter ---------- **9.0mm**
Basic Isolation Voltage ---------- **4000V**
Operating Temperature Range,Ta ---------- **-40ºC to +105ºC**
Storage Temperature Range,Ts ---------- **-60ºC to +125ºC**

Note: Stresses above those listed may cause permanent damage to the devices



Functional Block Diagram

Selection Guide:

Model	Maximum Current		Operating Voltage	Frequency	Interface	Version
	AC	DC				
DWCS3300_1-50C	70A	100A	5.0V	50Hz/60Hz,DC	UART	Continuous(1)
DWCS3300_1-50T	70A	100A	5.0V	50Hz/60Hz,DC	UART	AT Command(2)
DWCS3300_1-50M	70A	100A	5.0V	50Hz/60Hz,DC	UART	Modbus-RTU(2)
DWCS3300_1-50I	70A	100A	5.0V	50Hz/60Hz,DC	I2C	I2C
DWCS3300(3)	50A	75A	5.0V	50Hz/60Hz,DC	UART	Datasheet

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. The resolution of the DWCS3300 series is 100mA.

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Pad Description:

Pad No	Pad Name	I/O	Description
1	VDD	-	The positive power input pin
2	GND	-	The system ground
3	SDA/ TX	I/O O	I2C SDA: I2C Data UART TX: UART Transmitter
4	SCL/ RX/ RST	I I I	I2C SCL: I2C Clock UART RX: UART Receiver 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	-	6.5	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	-	-	9	-	mm^2

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

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
IOP	Current Range	-	0	-	70	A
ETOT	Current Output Error	I_{OP}= 0~9A, T_{op} = 25˚C	-	±0.09	-	A
		I_{OP}= 9~70A, T_{op} = 25˚C	-	±1	-	%
		I_{OP}= 0~70A, -20˚C ≦ T_{op} ≦ 85˚C	-	±4	-	%

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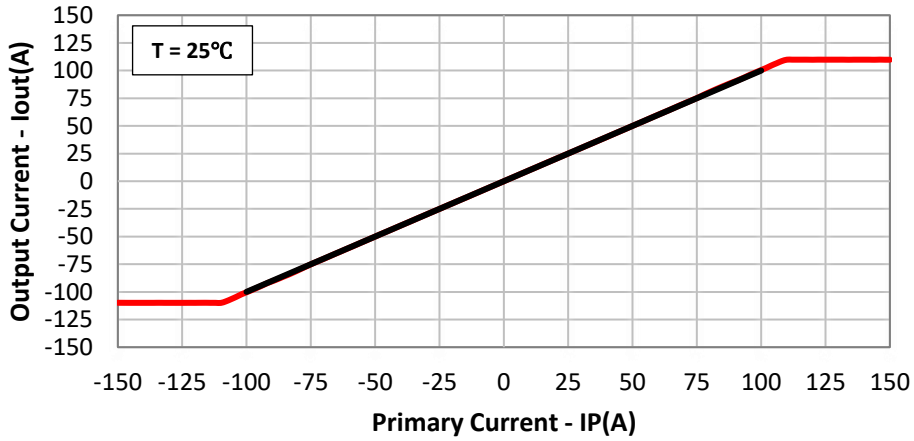
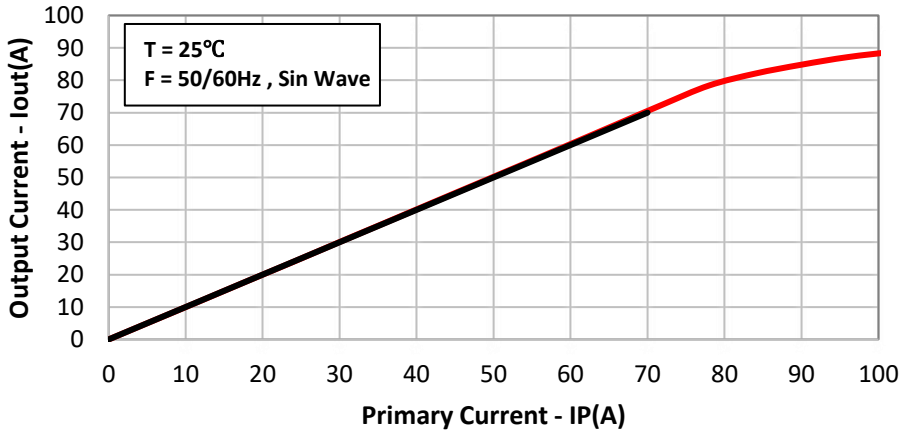
-DC **V_{DD} = 5.000V**

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
IOP	Current Range	-	0	-	100	A
ETOT	Current Output Error	I_{OP}=0~9A, T_{op} = 25°C	-	±0.09	-	A
		I_{OP}=9~100A, T_{op} = 25°C	-	±1	-	%
		I_{OP}=0~100A, -20°C ≦ T_{op} ≦ 85°C	-	±4	-	%

DWCS3300 IDC V.S. IP at Vdd 5V



DWCS3300 IAC V.S. IP at Vdd 5V



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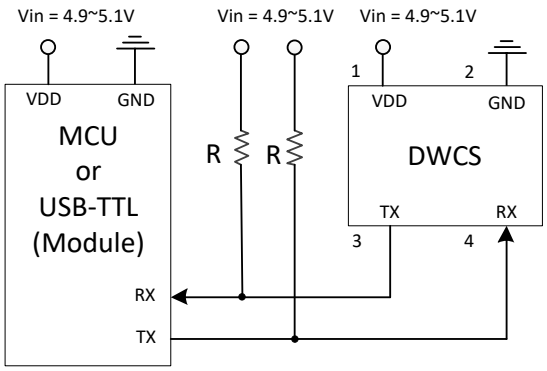
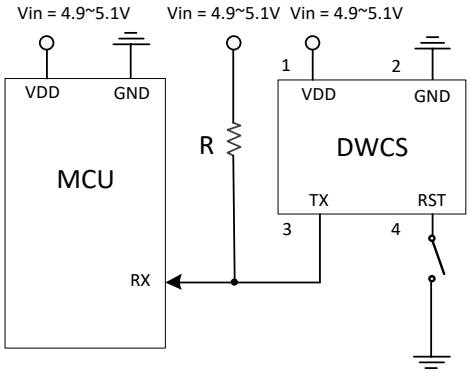
Application Note:

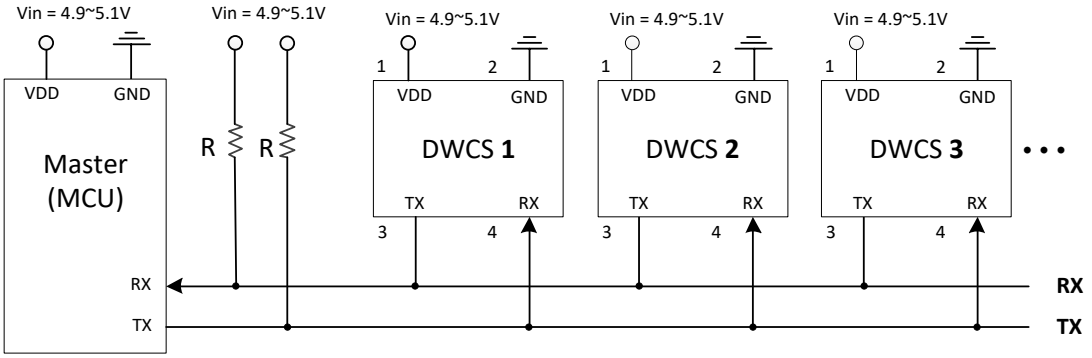
(1) Application Diagram:



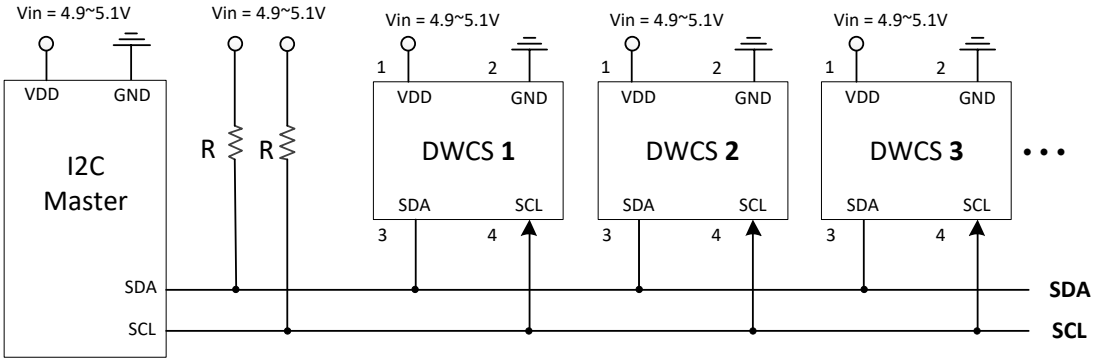
App. 1 Connect to MCU or USB-TTL (UART: AT Command)



App. 2 Connect to MCU (UART: Continuous)



App. 3 Modbus Connection



App. 4 I2C Connection

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(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.

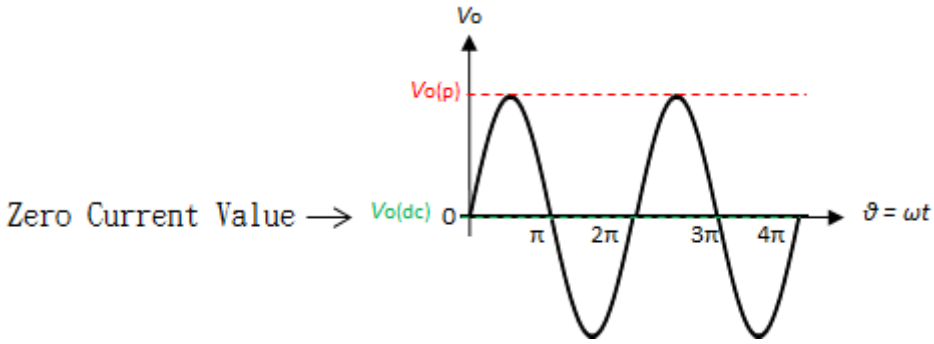


Figure 1 The zero current value of sine waveform

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.

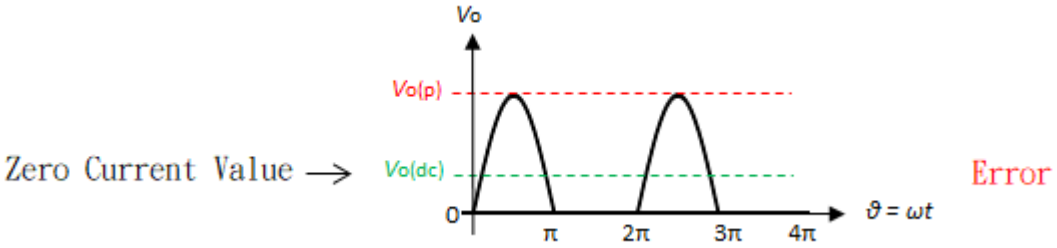


Figure 2 The zero current value of the asymmetric waveform (Error)

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.

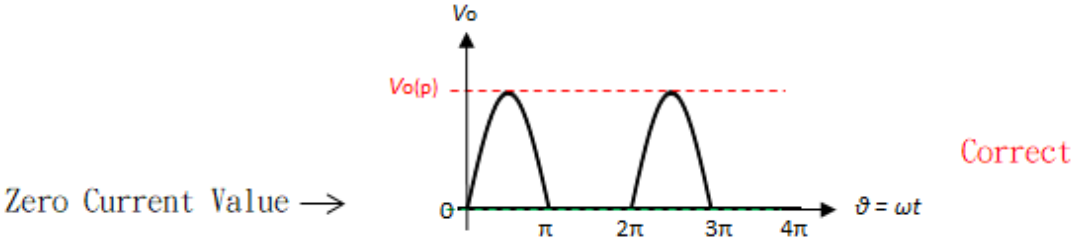
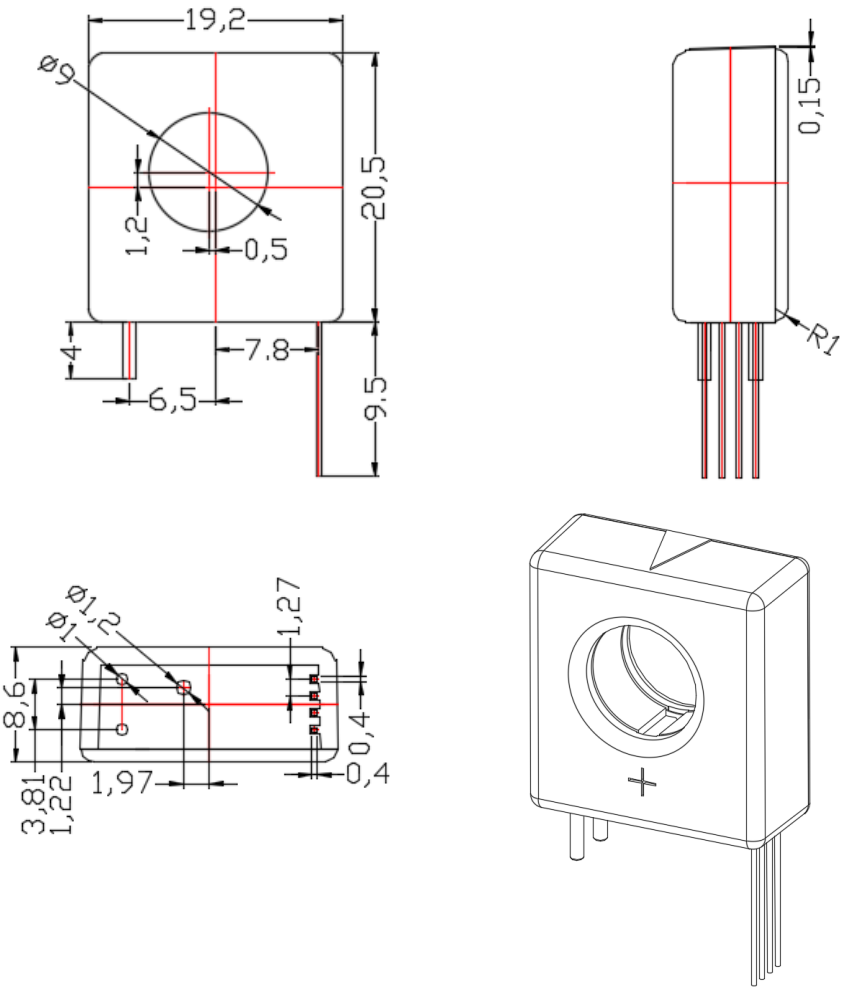
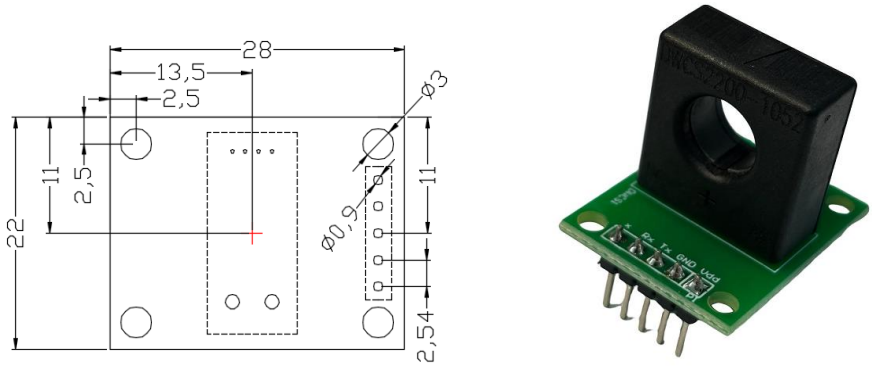


Figure 3 The zero current value of the asymmetric waveform (Correct)

Package: (Units: mm)



DWCS PCB: (Units: mm)



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