TMR7503-B

Unibody Low Temperature-Drift Current Sensor

Description

TMR7503-B is an open loop current sensor for accurate measurement of DC, AC, pulsed current and arbitrary waveform current with galvanic isolation between primary and secondary circuit.

Features and Benefits

- Low temperature coefficient
- High immunity to external interference
- Galvanic isolation
- Excellent linearity
- Light weight and compact
- RoHS & REACH compliant

Applications

- DC motor drives
- Inverters and variable frequency drives (VFD)
- Uninterruptible power supplies (UPS)
- Communication power supplies
- Battery management system (BMS)
- Switching power supplies
- Power supplies for welding application

Selection Guide

Model	Primary Nominal Current	Primary Current Measuring Range
TMR7503-0500B	50 A	±150 A
TMR7503-1000B	100 A	±300 A
TMR7503-2000B	200 A	±600 A
TMR7503-3000B	300 A	±900 A
TMR7503-4000B	400 A	±950 A
TMR7503-5000B	500 A	±950 A
TMR7503-6000B	600 A	±950 A

Insulation and Environmental Characteristics

Parameters	Symbol	Typical	Unit
Dielectric Strength	V_D	5	kV(50Hz, 1min)
Insulation Resistance	R_{IS}	1000	MΩ
Creepage Distance	d_{CP}	7.7	mm
Clearance	d_{CL}	4.8	mm
Ambient Operating Temperature	T_A	-40 to +105	°C
Ambient Storage Temperature	T_{STG}	-40 to +105	°C
Mass	m	61	g

Catalogue

1. Specifications

T_A = +25 °C, V_{CC} = ±15 V, R_L = 10 kΩ, unless otherwise noted

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
General Electrical Data						
Primary Nominal Current	I_{PN}	TMR7503-0500B	-	50	-	A
		TMR7503-1000B	-	100	-	
		TMR7503-2000B	-	200	-	
		TMR7503-3000B	-	300	-	
		TMR7503-4000B	-	400	-	
		TMR7503-5000B	-	500	-	
		TMR7503-6000B	-	600	-	
Primary Current Measuring Range	I_{PM}	TMR7503-0500B	-150	-	150	A
		TMR7503-1000B	-300	-	300	
		TMR7503-2000B	-600	-	600	
		TMR7503-3000B	-900	-	900	
		TMR7503-4000B	-950	-	950	
		TMR7503-5000B	-950	-	950	
		TMR7503-6000B	-950	-	950	
Sensitivity	S	I_P = 0 to ±I_{PN}, TMR7503-0500B	-	80.00	-	mV/A
		TMR7503-1000B	-	40.00	-	
		TMR7503-2000B	-	20.00	-	
		TMR7503-3000B	-	13.33	-	
		TMR7503-4000B	-	10.00	-	
		TMR7503-5000B	-	8.00	-	
		TMR7503-6000B	-	6.67	-	
Output Voltage	V_{OUT}	I_P =0 to ±I_{PM}	-	V_{OE} + S × I_P	-	V
Supply Voltage	V_{CC}	±5 %	-	±15	-	V
Current Consumption	I_C	I_P = 0	-	±20	-	mA
Load Resistance	R_L	I_P = 0 to ±I_{PN}	1	10	-	kΩ
Load Capacitance	C_L	I_P = 0 to ±I_{PN}	-	100	-	pF
Static Performance Data						
Accuracy	X_G	T_A = +25 °C, I_P = 0 to ±I_{PN}	-1	±0.5	1	% I_{PN}
		T_A = -40 °C to +85 °C, I_P = 0 to ±I_{PN}	-3	±1	3	
		T_A = -40 °C to +105 °C, I_P = 0 to ±I_{PN}	-3.5	±1.5	3.5	
Linearity Error	ε_L	T_A = -40 °C to +105 °C, I_P = 0 to ±I_{PN}	-	0.4	0.8	% I_{PN}
Symmetry	ε_{SYM}	T_A = -40 °C to +105 °C, I_P = 0 to ±I_{PN}	99	100	101	%
Sensitivity Error	ε_S	T_A = -40 °C to +105 °C, I_P = 0 to ±I_{PN}	-2	-	2	%
Temperature coefficient of Voltage Output	TCV_{OUT}	T_A = -40 °C ~ +105 °C	-	300	-	PPM/°C
Offset Error	V_{OE}	T_A = +25 °C, I_P = 0	-20	±10	20	mV
		T_A = -40 °C to +105 °C, I_P = 0	-60	±20	60	
Temperature coefficient of Offset Error	TCV_{OE}	T_A = -40 °C ~ +105 °C, I_{PN} = 50A	-	0.8	-	mV/°C
		Other ranges	-	0.4	-	
Hysteresis	V_{OH}	T_A = -40 °C to +105 °C, I_P = ±I_{PN} → 0	-20	±10	20	mV
Dynamic Performance Data						
Response Time	t_R	di/dt > 50 A/μs, 10% to 90% of I_{PN}	-	1	-	μs
Bandwidth	BW	-3 dB	DC	180	-	kHz

2. Typical Output Characteristics

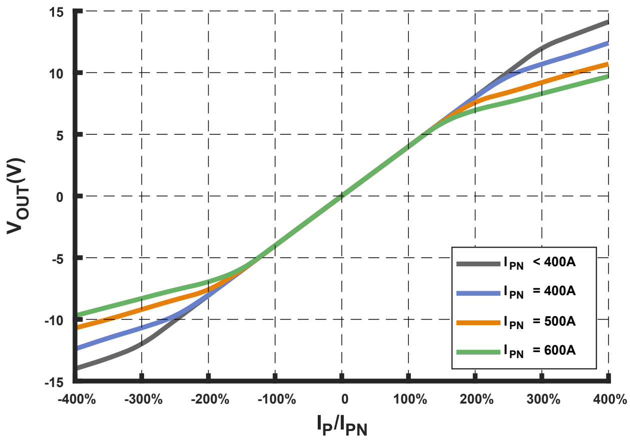

Figure 1. Output voltage versus primary current

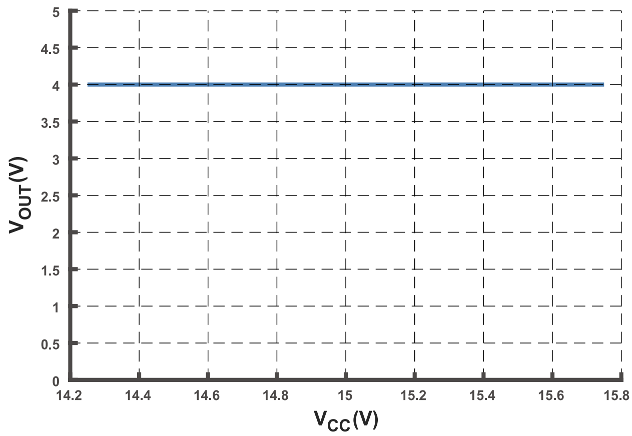

Figure 2. Output voltage versus supply voltage

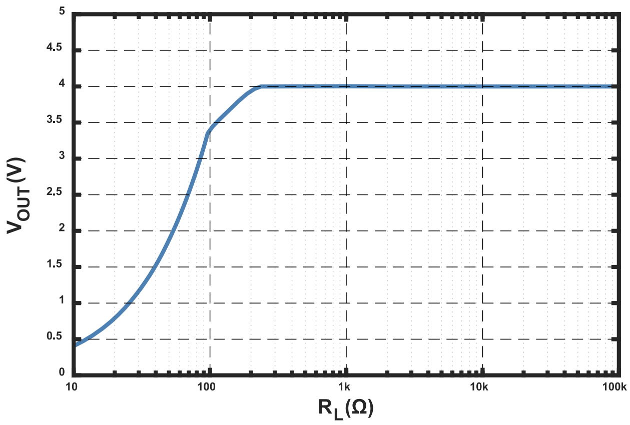

Figure 3. Output voltage versus load resistance (@I_P=I_{PN})

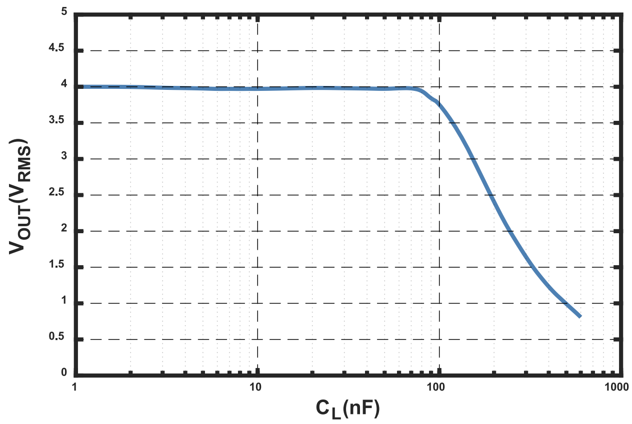

Figure 4. Output voltage versus load capacitance (@I_P=I_{PN})

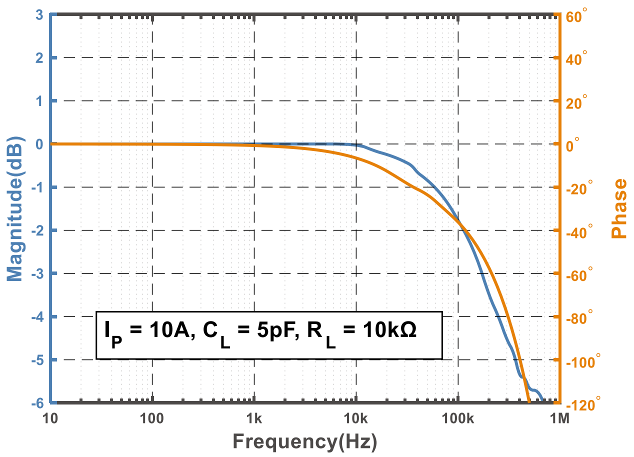

Figure 5. Bode plot of TMR7503-B

3. Typical Temperature Characteristics

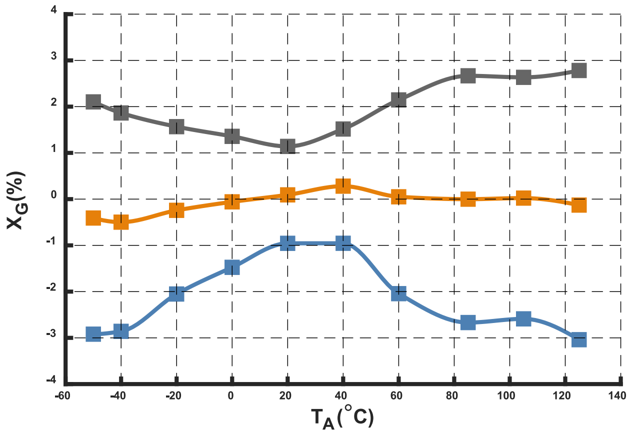

Figure 6. Total error versus ambient temperature

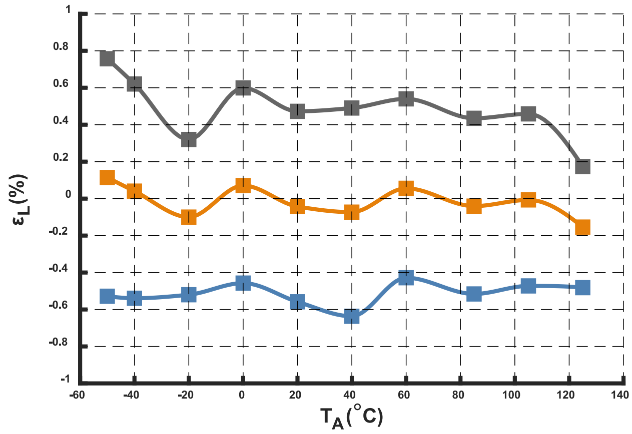

Figure 7. Linearity error versus ambient temperature

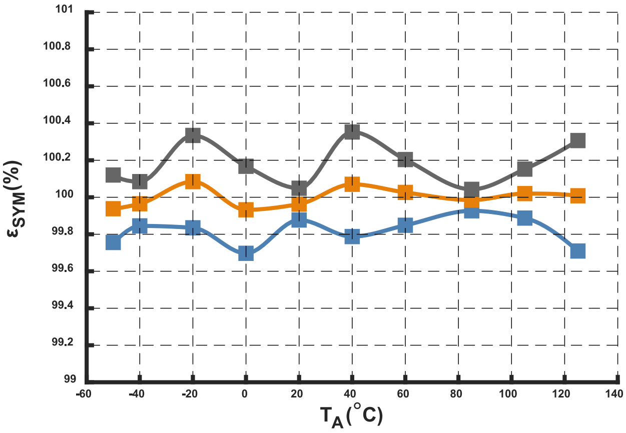

Figure 8. Symmetry versus ambient temperature

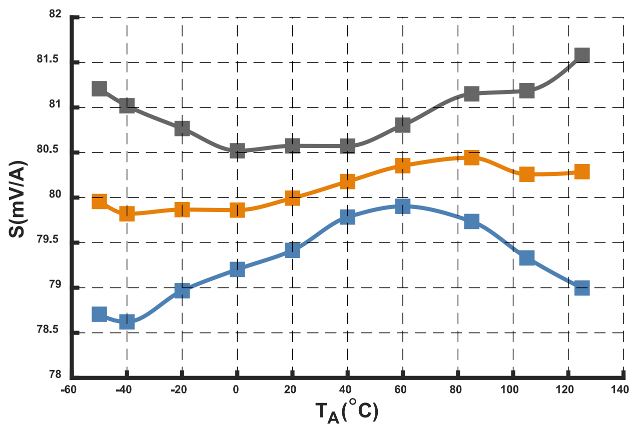

Figure 9. Sensitivity @I_{PN} = 50 A versus ambient temperature

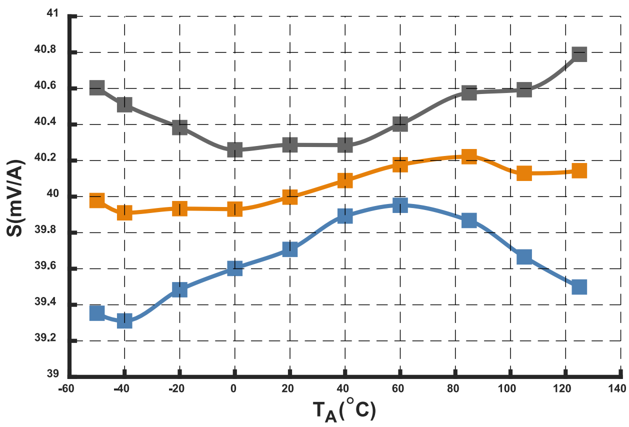

Figure 10. Sensitivity @I_{PN} = 100 A versus ambient temperature

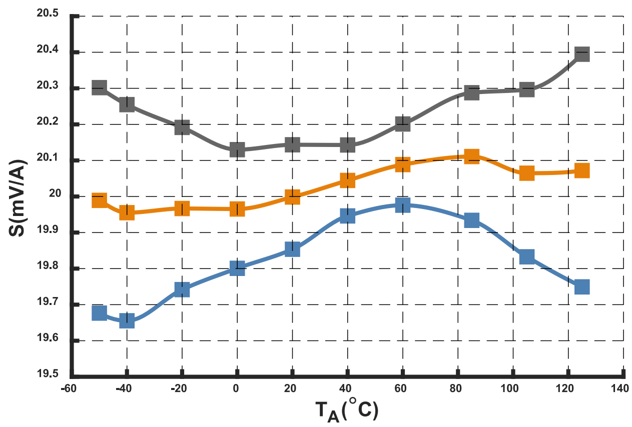

Figure 11. Sensitivity @I_{PN} = 200 A versus ambient temperature

Typical Temperature Characteristics

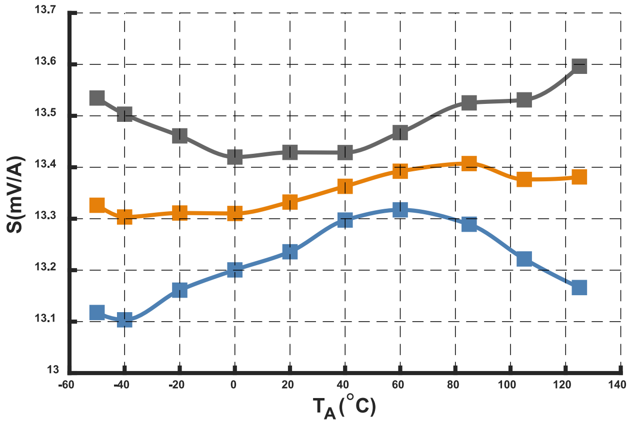

Figure 12. Sensitivity @I_{PN} = 300 A versus ambient temperature

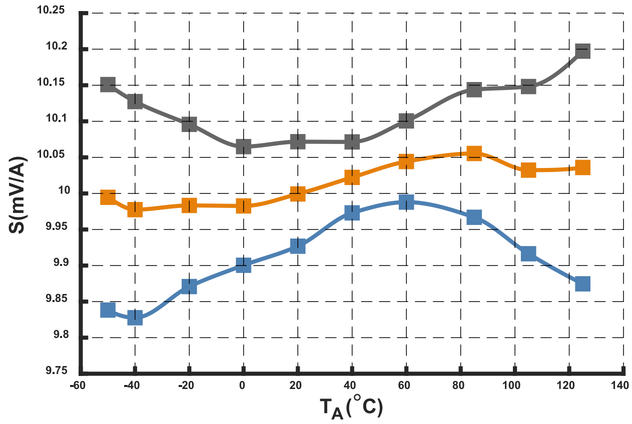

Figure 13. Sensitivity @I_{PN} = 400 A versus ambient temperature

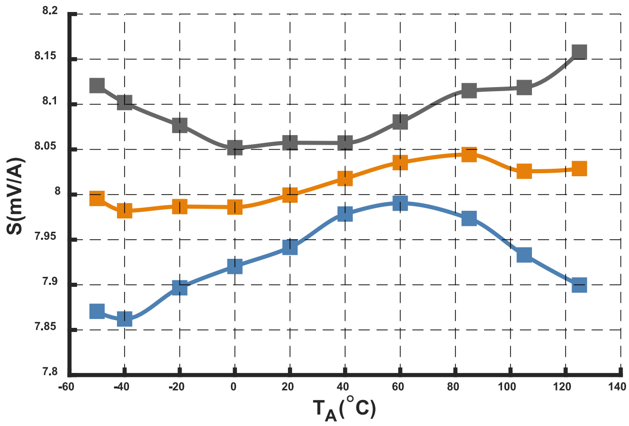

Figure 14. Sensitivity @I_{PN} = 500 A versus ambient temperature

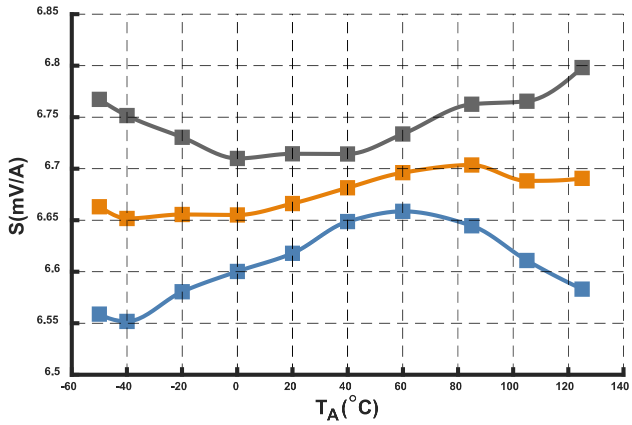

Figure 15. Sensitivity @I_{PN} = 600 A versus ambient temperature

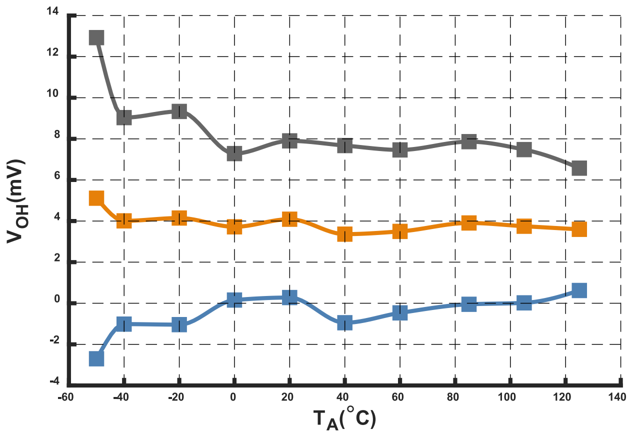

Figure 16. Hysteresis versus ambient temperature

4. Parameters Definition And Formula

1) Output Voltage

$$V_{OUT} = V_{OE} + S \times I_P$$

V_{OUT} stands for current sensor output voltage at given primary current, V_{OE} stands for offset error, S stands for sensitivity, I_P stands for primary current.

2) Accuracy

$$X_G = \underset{I_P \in [-I_{PN}, I_{PN}]}{MAX}\left(\frac{V_{OUT} - (S \times I_P)}{S \times I_{PN}} \times 100\%\right)$$

I_{PN} stands for nominal primary current

3) Sensitivity

$$S = \frac{V_{OUT(@ I_{PN})} - V_{OUT(@ -I_{PN})}}{2 \times I_{PN}}$$

$V_{OUT(@ I_{PN})}$ and $V_{OUT(@ -I_{PN})}$ stand for the voltage output at I_{PN} and $-I_{PN}$ respectively.

4) Linearity

$$\varepsilon_L = \underset{I_P \in [-I_{PN}, I_{PN}]}{MAX}\left(\frac{V_{OUT} - (\overline{V}_{OE} + \overline{S} \times I_P)}{S \times I_{PN}} \times 100\%\right)$$

$\overline{S}$ and $\overline{V}_{OE}$ stand for the average values of the sensitivity and offset error.

5) Symmetry

$$\varepsilon_{SYM} = \left|\frac{V_{OUT(@ I_{PN})} - \overline{V}_{OE}}{V_{OUT(@ -I_{PN})} - \overline{V}_{OE}}\right| \times 100\%$$

6) Hysteresis

$$V_{OH} = MAX\ \Delta H$$

ΔH is the maximum residual voltage between full scale positive and negative nominal current.

5. Application Information

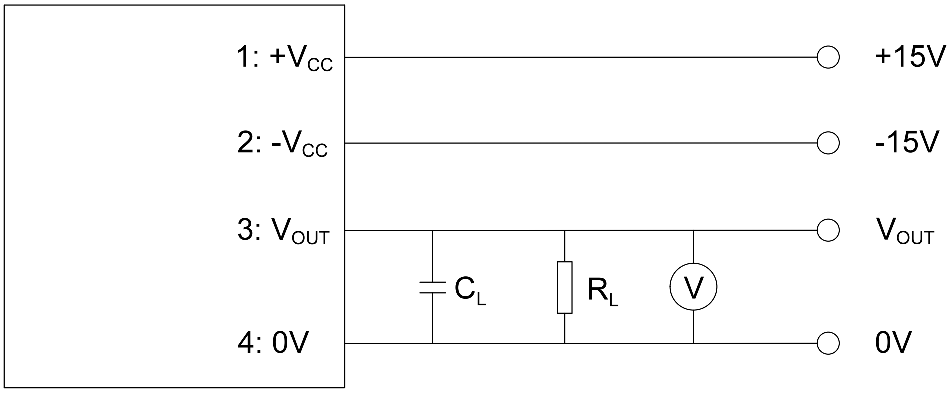

Figure 17. Connection diagram of TMR7503

Mounting Recommendation

1. Mounting method: Choose one of 3 × Φ 4.5 mm holes
   1 × M4 copper or SS304 screw (recommended applied torque 0.75 N•m)
2. Primary through-hole dimensions: 20 mm × 10 mm
3. Secondary terminal: Molex 22041041 (previous 5045-04A series)
   Crimp Housing: Molex 22011042, Crimping Terminal: Molex 08500113

Remarks

1. V_{OUT} is positive when the primary current is in the same direction as the arrow indication on the label and vice versa.
2. Improper connection can cause permanent damage of the sensor.
3. Excessive capacitive load may cause the distortion of output signals when the primary frequency is too high. Please refer to Figure 4.
4. Sensor is customizable upon request.
5. Dynamic performances (di/dt and response time) are best with a single busbar completely filling the primary hole.

6. Dimensions

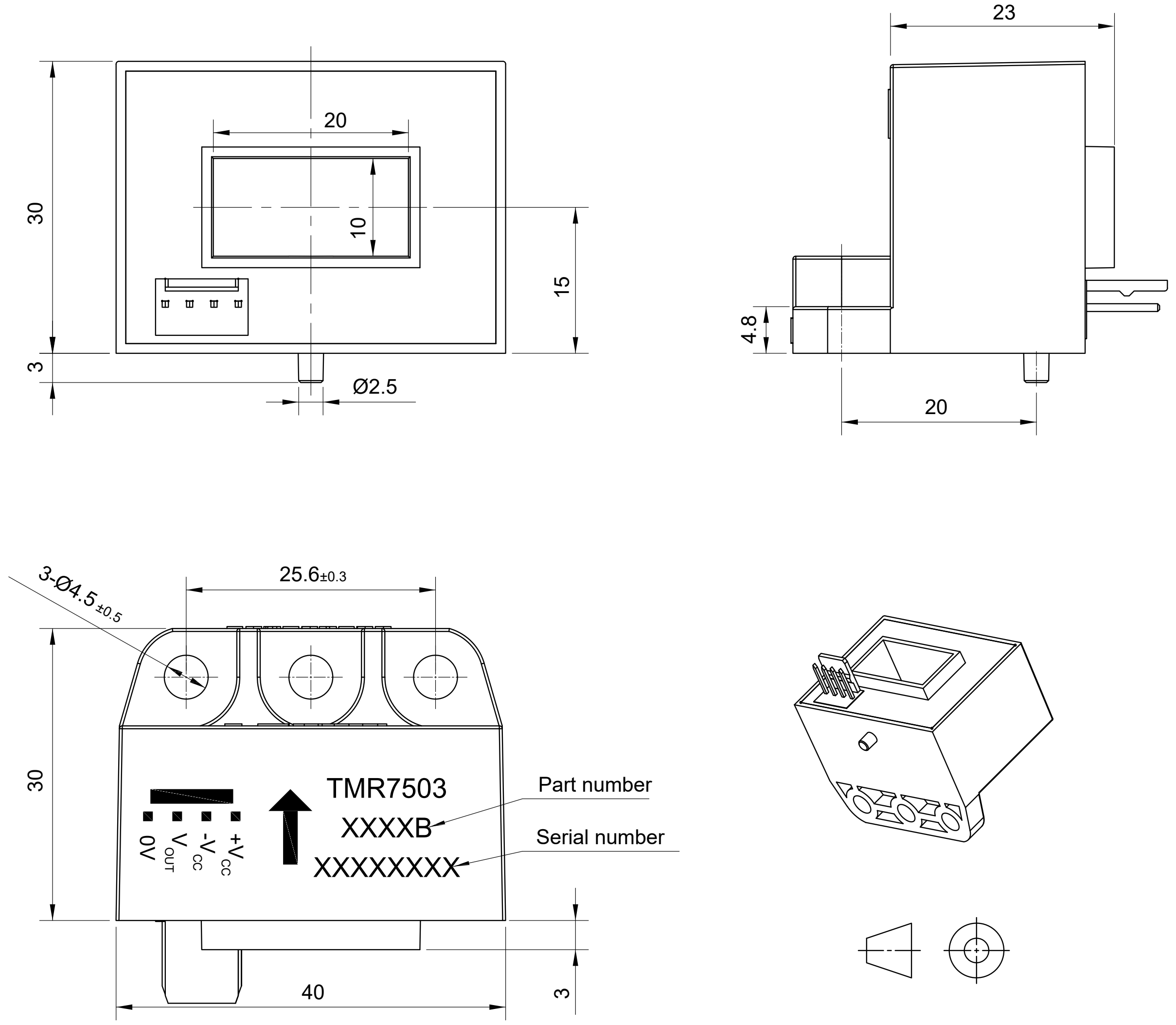

Figure 18. Sensor outline (unit: mm, tolerances for unmarked scales ±1 mm)

Recycling

The product(s) in this document need to be handed over to a qualified solid waste management services company for recycling in accordance with relevant regulations on waste classification after the end of the product(s) life.

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