TMR7503-D

Unibody Low Temperature-Drift Current Sensor

Description

TMR7503-D 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 drift
- High immunity to external interference
- Good linearity
- Galvanic isolation
- Compact size and light weight

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
TMR7503-0500D	50 A	±150 A
TMR7503-1000D	100 A	±300 A
TMR7503-2000D	200 A	±600 A
TMR7503-3000D	300 A	±900 A
TMR7503-4000D	400 A	±900 A
TMR7503-5000D	500 A	±900 A
TMR7503-6000D	600 A	±900 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}	11	mm
Clearance	d_{CL}	5	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}	TMR7503-0500D		-	50	-	A
		TMR7503-1000D		-	100	-	
		TMR7503-2000D		-	200	-	
		TMR7503-3000D		-	300	-	
		TMR7503-4000D		-	400	-	
		TMR7503-5000D		-	500	-	
		TMR7503-6000D		-	600	-	
Primary Current Measuring Range	I_{PM}	TMR7503-0500D		-150	-	150	A
		TMR7503-1000D		-300	-	300	
		TMR7503-2000D		-600	-	600	
		TMR7503-3000D		-900	-	900	
		TMR7503-4000D		-900	-	900	
		TMR7503-5000D		-900	-	900	
		TMR7503-6000D		-900	-	900	
Sensitivity	S	I_P = 0 to $\pm I_{PN}$	TMR7503-0500D	-	80.00	-	mV/A
			TMR7503-1000D	-	40.00	-	
			TMR7503-2000D	-	20.00	-	
			TMR7503-3000D	-	13.33	-	
			TMR7503-4000D	-	10.00	-	
			TMR7503-5000D	-	8.00	-	
			TMR7503-6000D	-	6.67	-	
Output Voltage	V_{OUT}	I_P = 0 to $\pm I_{PM}$		-	$V_{OE} + S \times I_P$	-	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 $\pm I_{PN}$		1	10	-	kΩ
Load Capacitance	C_L	I_P = 0 to $\pm I_{PN}$		-	100	-	pF
Static Performance Data							
Accuracy	X_G	T_A = +25 °C, I_P = 0 to $\pm I_{PN}$		-1	±0.5	1	% I_{PN}
		T_A = -40 °C to +105 °C, I_P = 0 to $\pm I_{PN}$		-3.5	±1.5	3.5	
Linearity Error	ε_L	T_A = -40 °C to +105 °C, I_P = 0 to $\pm I_{PN}$		-	0.4	0.8	% I_{PN}
Symmetry	ε_{SYM}	T_A = -40 °C to +105 °C, I_P = 0 to $\pm I_{PN}$		99	100	101	%
Sensitivity Error	ε_S	T_A = -40 °C to +105 °C, I_P = 0 to $\pm I_{PN}$		-2	-	2	%
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	
Hysteresis	V_{OH}	T_A = -40 °C to +105 °C, $I_P = \pm I_{PN} \rightarrow 0$		-20	±10	20	mV
Dynamic Performance Data							
Response Time	t_R	di/dt > 50 A/µs, 10% to 90% of I_{PN}		0.9	2	-	µs
Bandwidth	BW	-1 dB		DC	50	-	kHz

2. Typical Output Characteristics

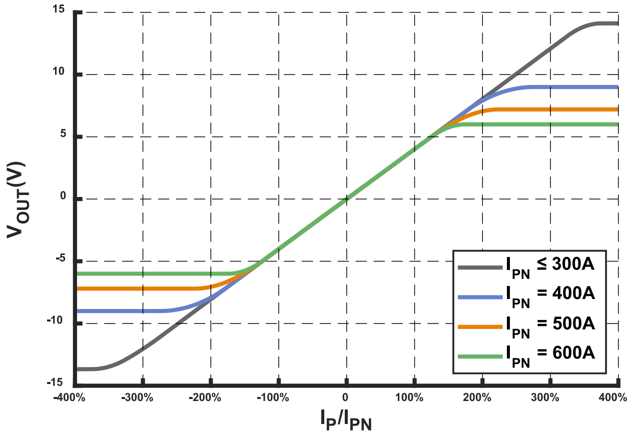

Figure 1. Output voltage versus primary current

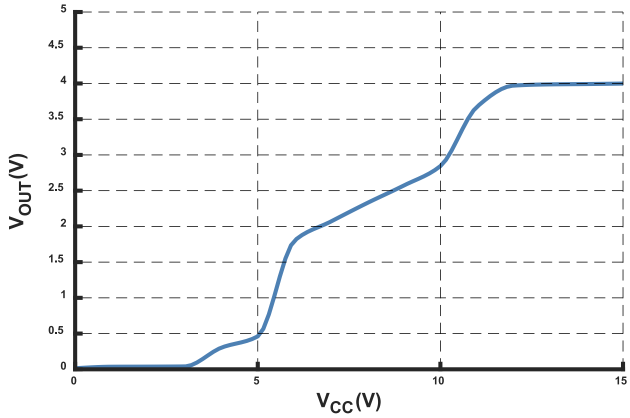

Figure 2. Output voltage versus supply voltage

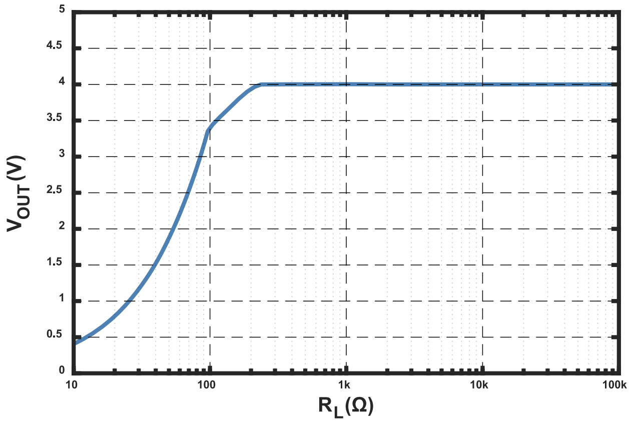

Figure 3. Output voltage versus load resistance
(@I_P = I_{PN})

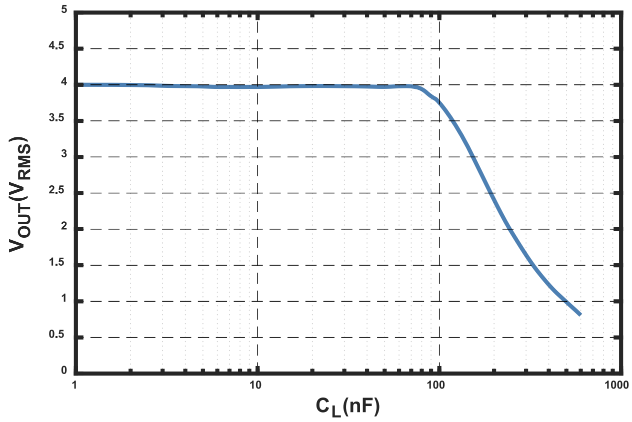

Figure 4. Output voltage versus load capacitance
(@I_P = I_{PN})

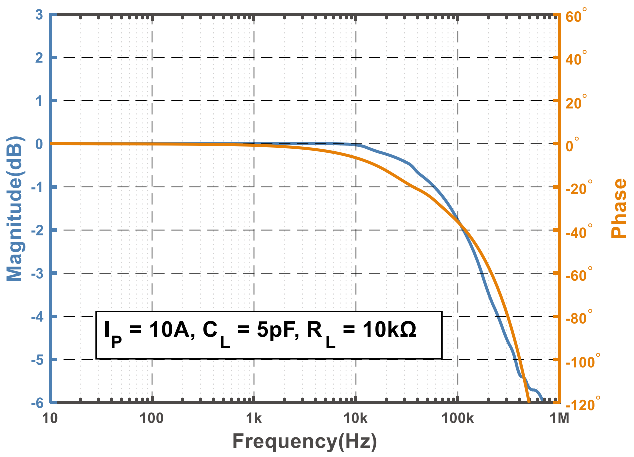

Figure 5. Bode plot of TMR7503-D

3. Typical Temperature Characteristics

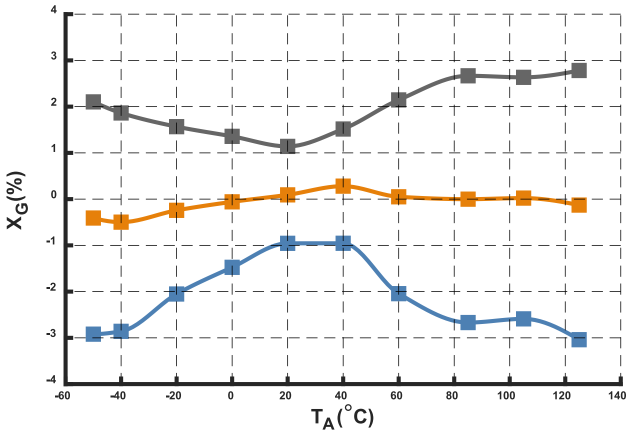

Figure 6. Total error versus ambient temperature

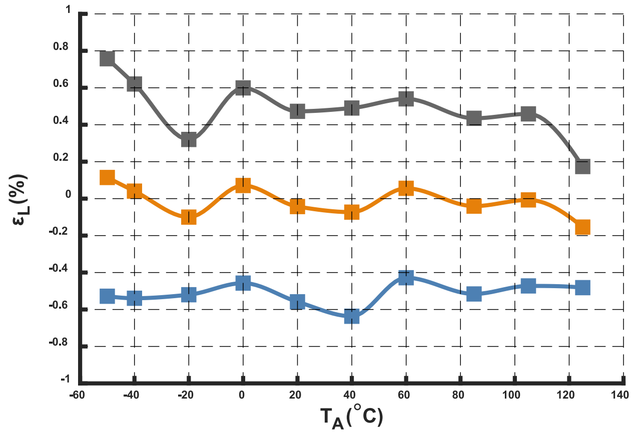

Figure 7. Linearity error versus ambient temperature

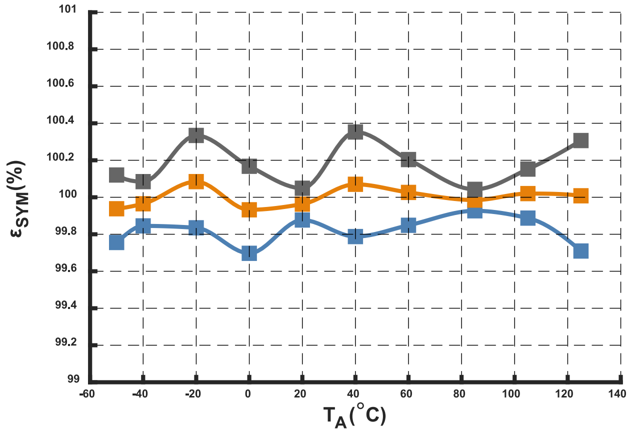

Figure 8. Symmetry versus ambient temperature

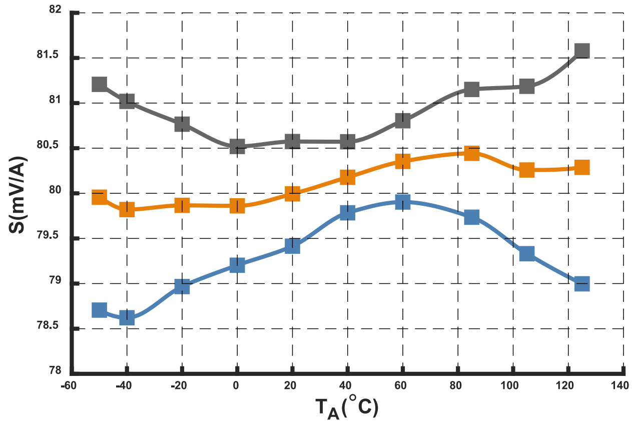

Figure 9. Sensitivity @I_{PN} = 50 A versus ambient temperature

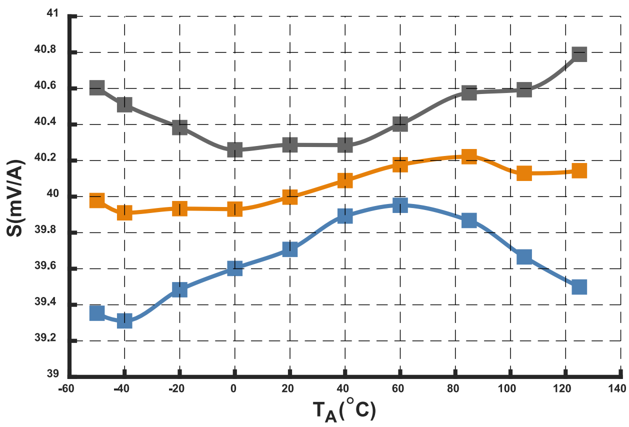

Figure 10. Sensitivity @I_{PN} = 100 A versus ambient temperature

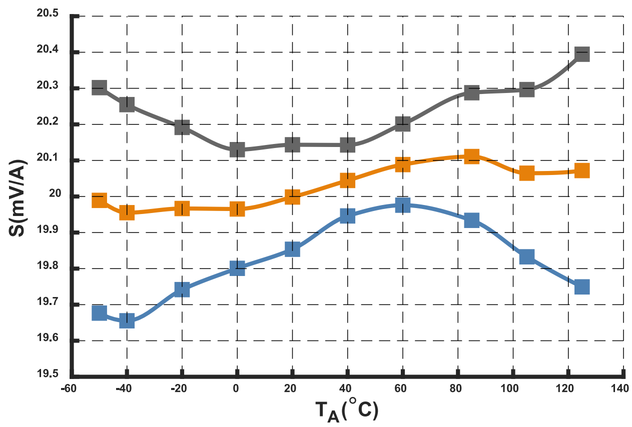

Figure 11. Sensitivity @I_{PN} = 200 A versus ambient temperature

Typical Temperature Characteristics

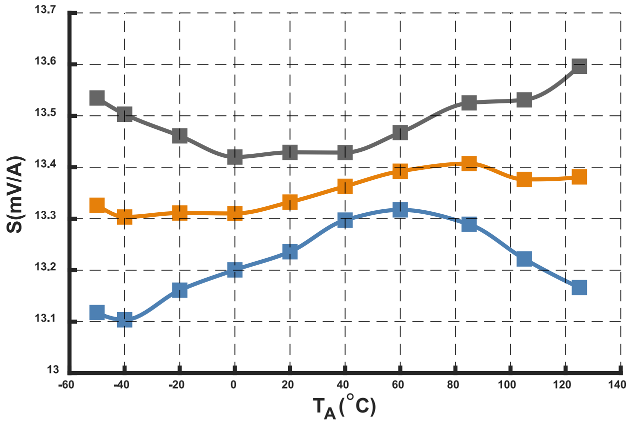

Figure 12. Sensitivity @I_{PN} = 300 A versus ambient temperature

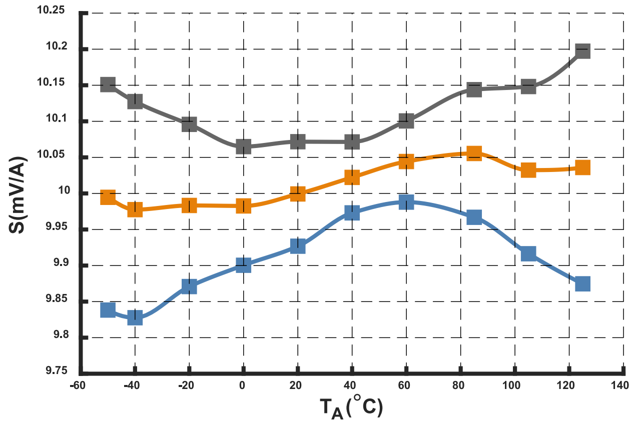

Figure 13. Sensitivity @I_{PN} = 400 A versus ambient temperature

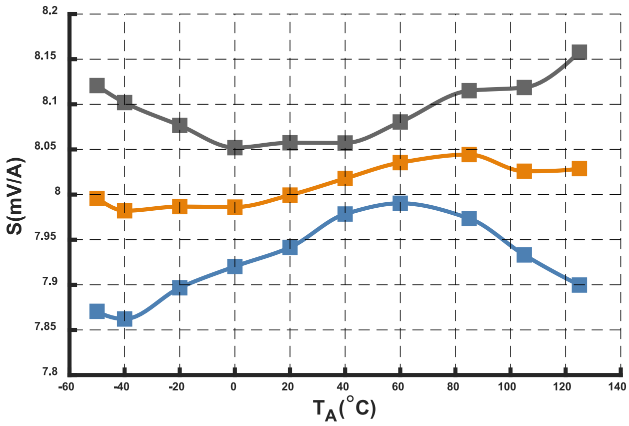

Figure 14. Sensitivity @I_{PN} = 500 A versus ambient temperature

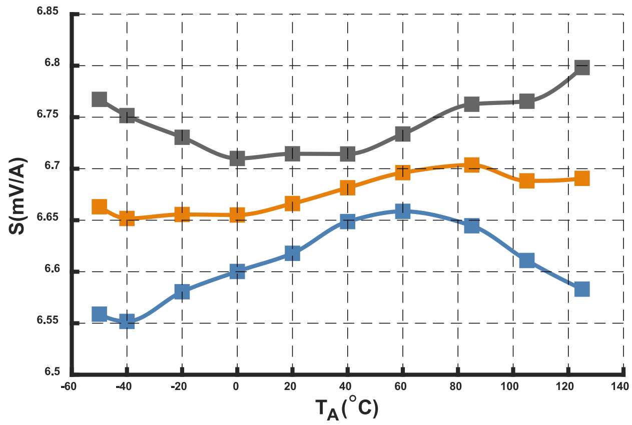

Figure 15. Sensitivity @I_{PN} = 600 A versus ambient temperature

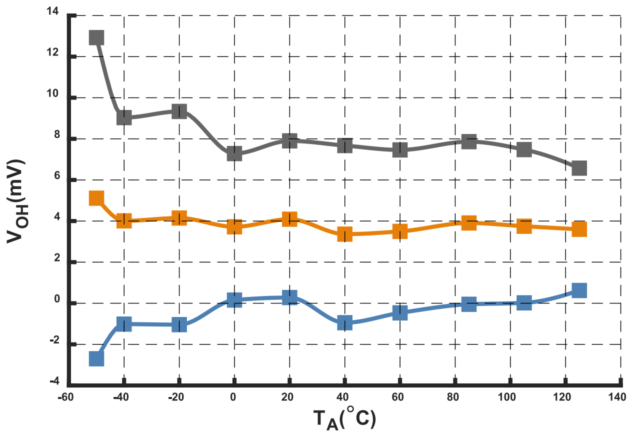

Figure 16. Hysteresis versus ambient temperature

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

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

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

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

$\overline{S}$ 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

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

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

5. Application Information

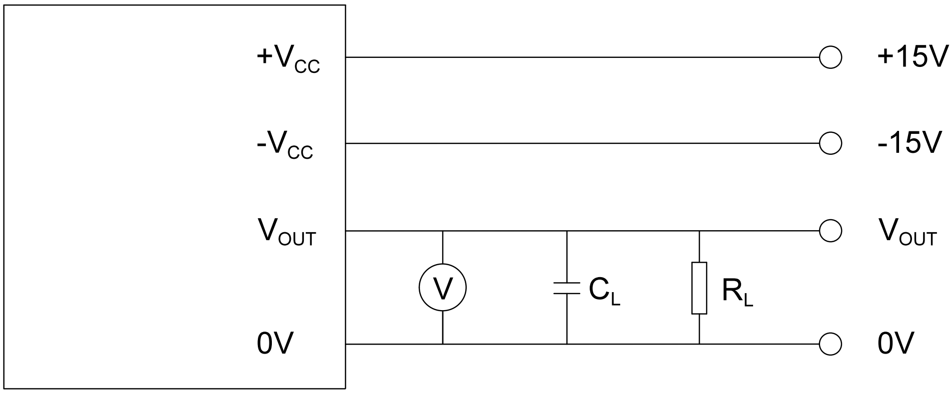

Figure 17. Connection diagram of TMR7503

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 353120460

   Crimp Housing: Molex 351550400, Crimping Terminal: Molex 08700056

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

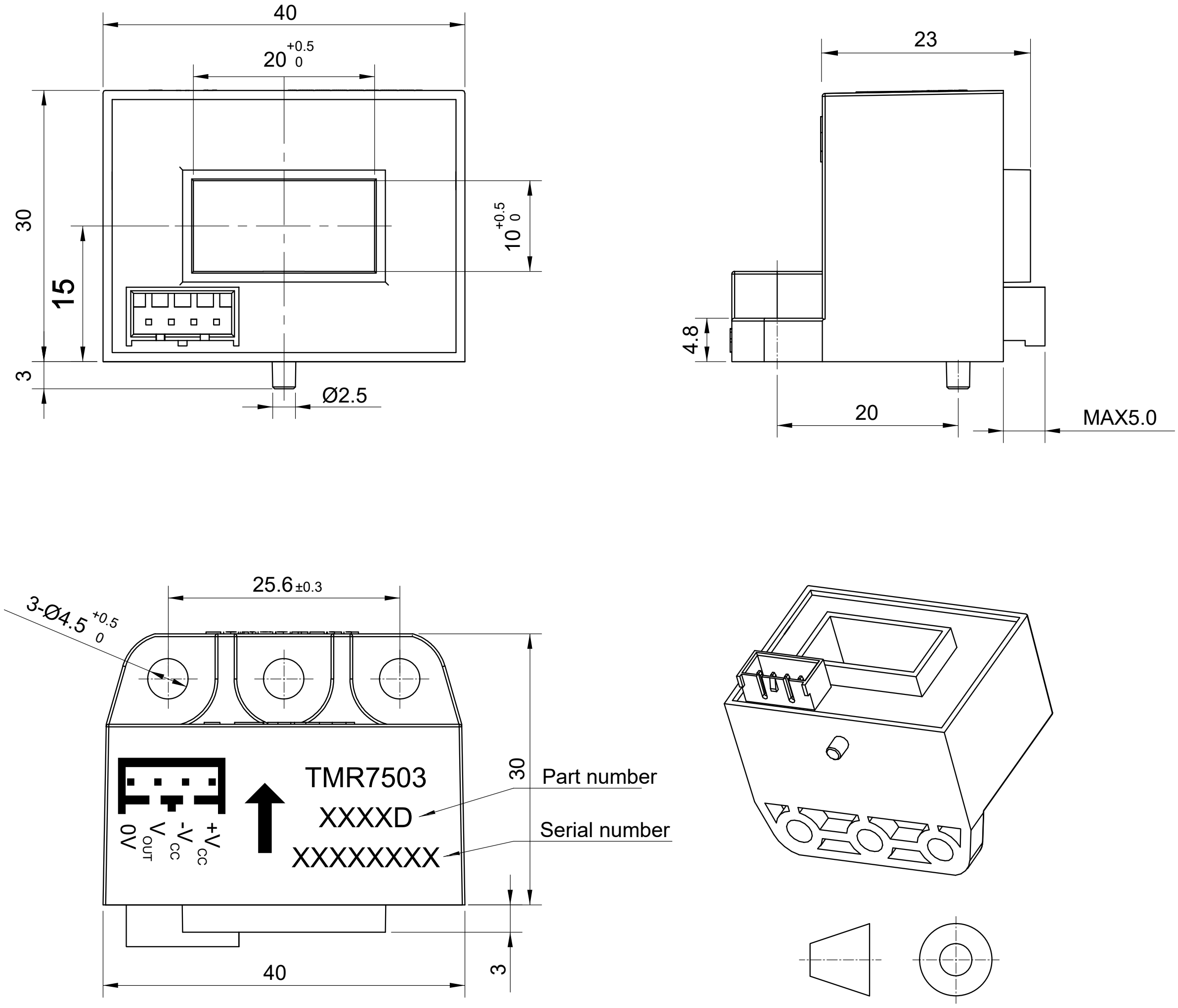

Figure 18. Sensor outline (unit: mm, tolerances for unmarked scales ±1 mm)

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Absolute maximum ratings are the extreme limits the device will withstand without damage to the MDT product. However, the electrical and mechanical characteristics are not guaranteed as the maximum limits (above recommended operating conditions) are approached. MDT disclaims any and all warranties and liabilities of the MDT product will operate at absolute maximum ratings.

Specifications may change without notice.

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Recycling

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