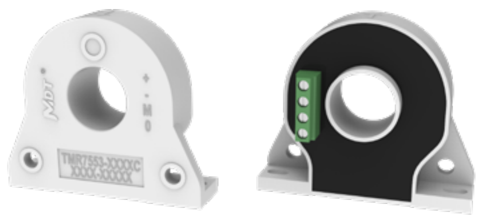
TMR7553-C

Unibody Precision Current Sensor

Description

TMR7553-C is a close loop current sensor for accurate measurement of DC, AC, pulsed current and arbitrary waveform current with galvanic isolation between primary and secondary circuits.



Features and Benefits

- High accuracy
- Excellent linearity
- Ultra low temperature drift
- Fast response time
- Galvanic isolation
- High immunity to external interference
- Anti-CAF

Applications

- DC motor drives
- Inverter and variable frequency drives (VFD)
- Uninterruptible power supplies (UPS)
- Power supplies for welding application
- Switching power supplies

Selection Guide

Part Number	Primary Nominal Current	Primary Current Measuring Range
TMR7553-1000C	100 A	±200 A
TMR7553-2000C	200 A	±400 A
TMR7553-3000C	300 A	±600 A

Insulation and Environmental Characteristics

Parameters	Symbol	Typ.	Unit
Dielectric Strength	V_D	5	kV(50 Hz, 1 min)
Insulation Resistance	R_{IS}	1000	MΩ
Creepage Distance	d_{CP}	20	mm
Clearance	d_{CL}	5	mm
Ambient Operating Temperature	T_A	-40 to +85	°C
Ambient Storage Temperature	T_{STG}	-40 to +85	°C
Mass	m	78	g

Catalogue

1. Specifications

T_A = +25 °C, V_{CC} = ±15 V, R_M = 5 Ω, unless otherwise noted

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
General Electrical Data						
Primary Nominal Current	I_{PN}	TMR7553-1000C	-	100	-	A
		TMR7553-2000C	-	200	-	
		TMR7553-3000C	-	300	-	
Primary Current Measuring Range	I_{PM}	TMR7553-1000C	-200	-	200	A
		TMR7553-2000C	-400	-	400	
		TMR7553-3000C	-600	-	600	
Sensitivity	S	I_P = 0 to $\pm I_{PN}$	-	0.5	-	mA/A
Number of Secondary Turns	N_S	-	-	2000	-	-
Output Current	I_{OUT}	I_P = 0 to $\pm I_{PM}$	-	$I_{OE} + S \times I_P$	-	mA
Supply Voltage	V_{CC}	±5 %	±12	±15	±20	V
Current Consumption	I_C	I_P = 0	-	±12	-	mA
Secondary Coil Resistance	R_S	T_A = +25 °C	-	-	23	Ω
Measuring Resistance	R_M	For maximum measuring resistance value, please refer to Figure 2, 3 and 4	0	-	-	Ω
Static Performance Data						
Accuracy	X_G	T_A = +25 °C, I_P = 0 to $\pm I_{PN}$	-0.6	±0.3	0.6	% I_{PN}
		T_A = -40 °C to +85 °C, I_P = 0 to $\pm I_{PN}$	-1	±0.5	1	
Linearity Error	ε_L	T_A = -40 °C to +85 °C, I_P = 0 to $\pm I_{PN}$	-	±0.1	-	% I_{PN}
Symmetry	ε_{SYM}	T_A = -40 °C to +85 °C, I_P = 0 to $\pm I_{PN}$	99.5	100	100.5	%
Sensitivity Error	ε_S	T_A = -40 °C to +85 °C, I_P = 0 to $\pm I_{PN}$	-0.8	-	0.8	%
Electric Offset	I_{OE}	T_A = +25 °C, I_P = 0	-0.2	±0.1	0.2	mA
Hysteresis	I_{OH}	$I_P = \pm I_{PN} \rightarrow 0$	-0.2	-	0.2	mA
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	100	-	kHz

2. Typical Output Characteristics

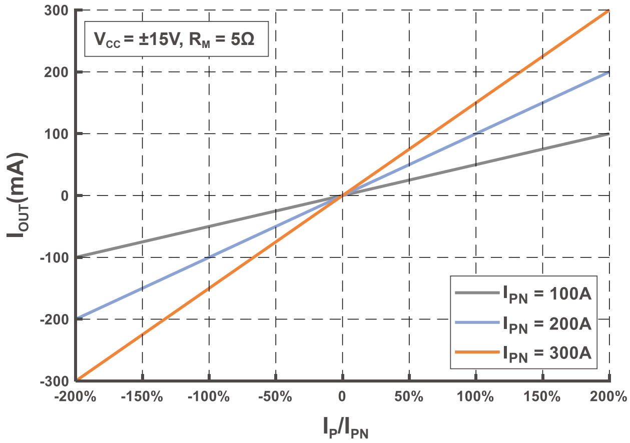


Figure 1. Output Voltage vs Primary Current

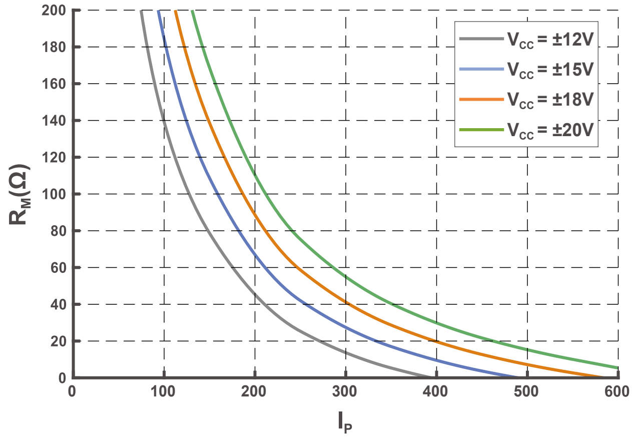


Figure 2. Measuring Resistance (@T_A = 85 °C)

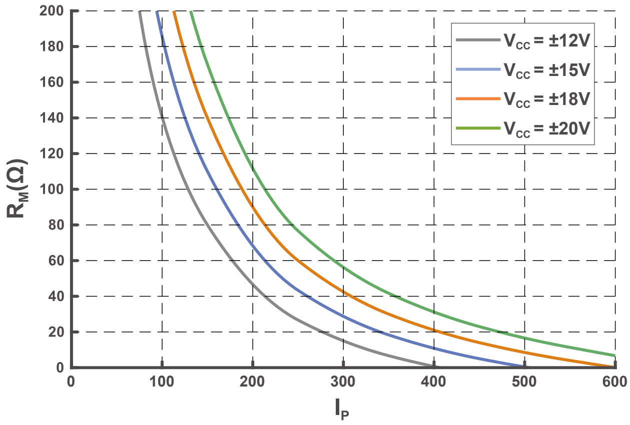


Figure 3. Measuring Resistance (@T_A = 70 °C)

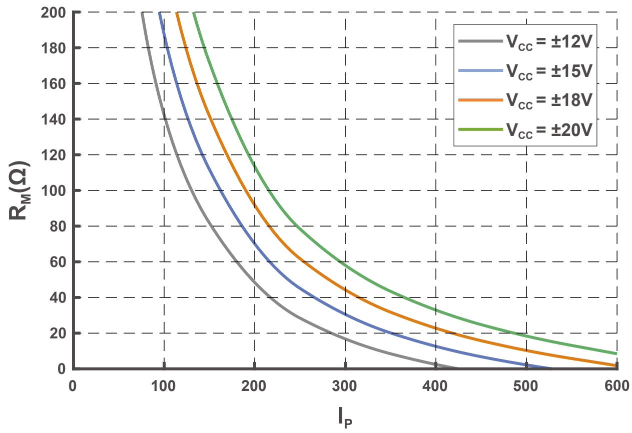


Figure 4. Measuring Resistance (@T_A = 50 °C)

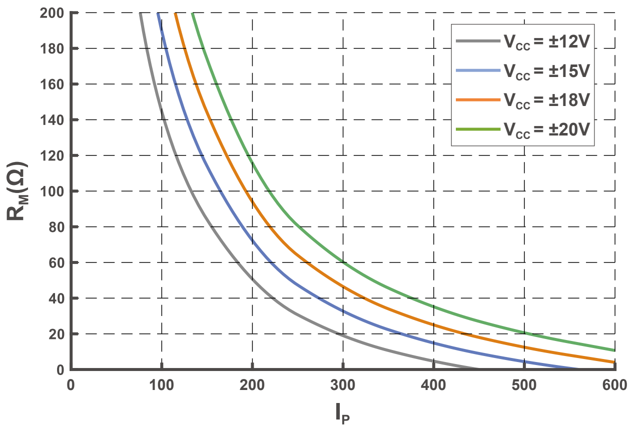


Figure 5. Measuring Resistance (@T_A = 25 °C)

3. Typical Temperature Characteristics

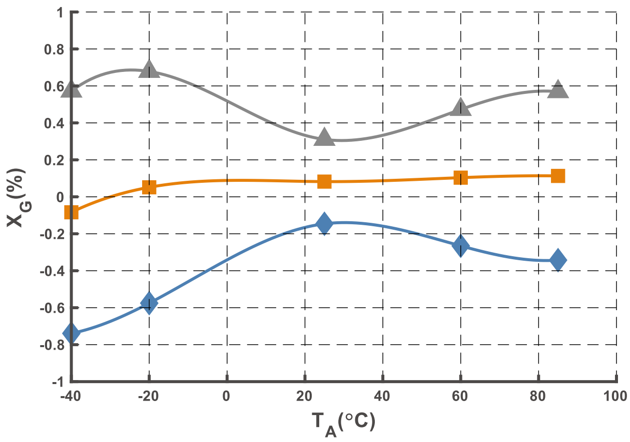


Figure 6. Accuracy

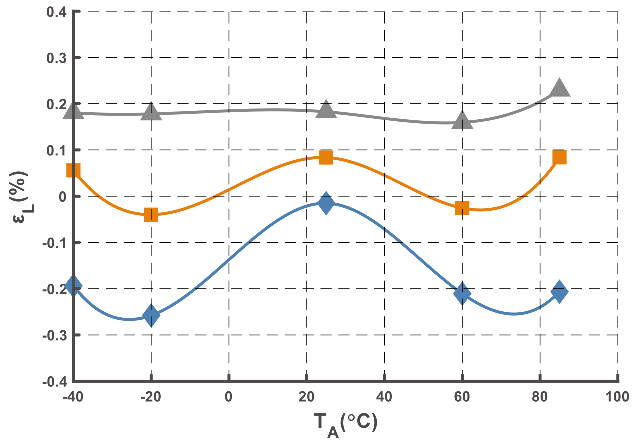


Figure 7. Linearity Error

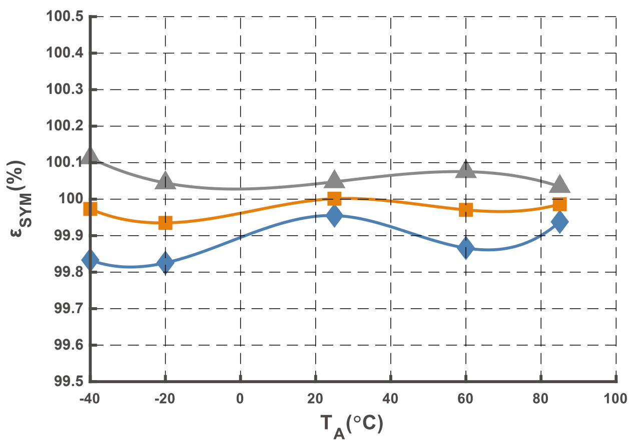


Figure 8. Symmetry

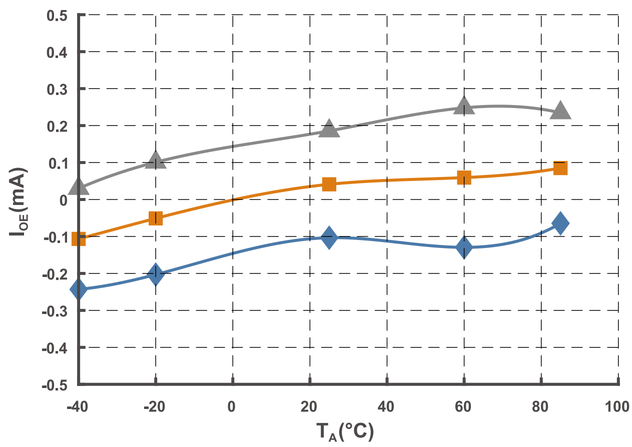


Figure 9. Electric Offset

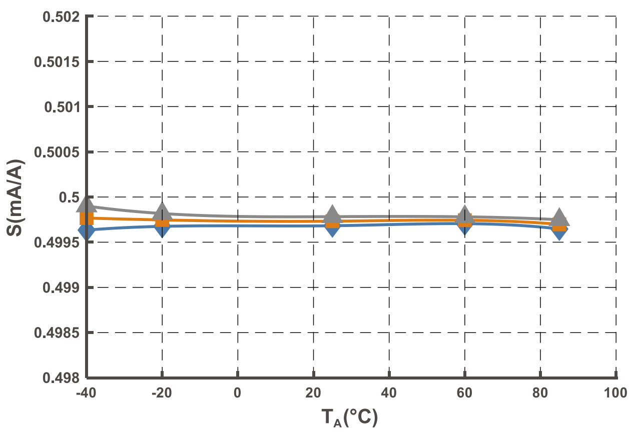


Figure 10. Sensitivity

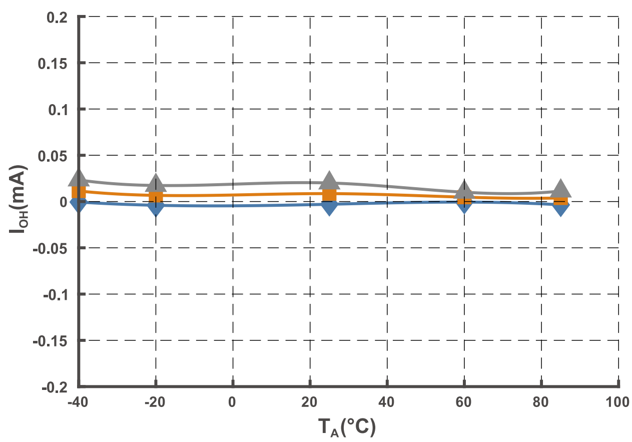


Figure 11. Hysteresis

4. Parameters Definition And Formula

1) Output Current

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

I_{OUT} stands for current sensor output current at given primary current, I_{OE} stands for electric offset, S stands for sensitivity, I_P stands for primary current.

2) Accuracy

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

I_{PN} stands for nominal primary current

3) Sensitivity

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

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

4) Linearity

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

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

5) Symmetry

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

6) Hysteresis

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

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

7) Measuring Resistance

$$R_{M\ MAX} = N_S \times \frac{V_{CC} - 3.7V}{I_P} - 4 - R_S \times \frac{234.5 + 25}{234.5 + T_A}$$

$R_{M\ MAX}$ is the maximum measuring resistance, N_S is the number of turns of the secondary coil winding and T_A stands for ambient operating temperature

5. Application Information

Electrical Connection

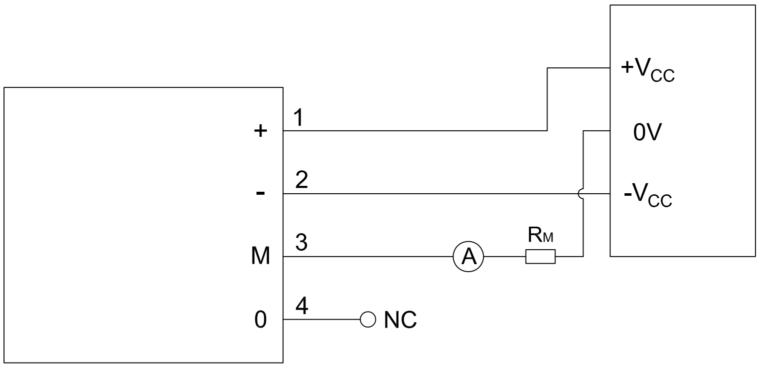


Figure 12. Electrical Connection

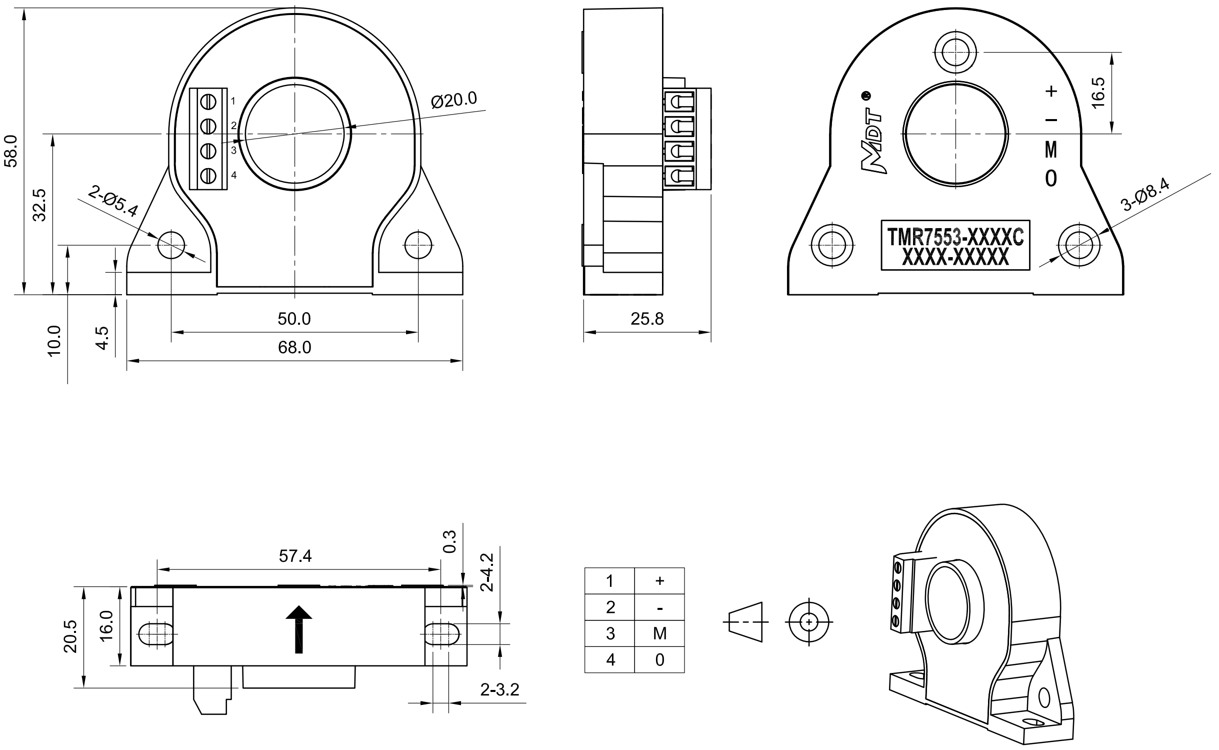
Mounting Recommendation

1. Mounting method: 1 × Φ 4.2 mm hole and 1 × Φ 4.2 mm slotted hole
   2 × M4 copper or SS304 screws (Recommended torque 1.2 N·m)
   Or
   2 × Φ 5.4 mm hole
   2 × M5 copper or SS304 screws (Recommended torque 1.2 N·m)
2. Primary through hole dimensions: Φ 20 mm
3. Secondary electrical connection: JTB450-00 screw PCB terminal
   Max conductor dimension 1.5 mm^2

Remarks

1. I_{OUT} is positive when the primary current (I_P) is in the same direction as the arrow indication on the label and vice versa.
2. Improper connection may result in permanent damage of the sensor.
3. Sensor secondary circuitry must be powered prior primary current is being added and when depowering secondary circuitry, primary current must be close to 0A. Improper procedure may result in worse accuracy or result in permanent damage of the sensor.
4. Excessive capacitive load may result in distortion of output signals when measuring high frequency primary signal. Please refer to Output Voltage vs Load Capacitance Curve.
5. Dynamic performances (di/dt and response time) are best with a single busbar completely filling the primary through hole.
6. Sensor is customizable upon request.

6. Dimensions



1	+
2	-
3	M
4	0

Figure 13. Dimension (unit: mm, tolerances for unmarked scales ±1 mm)

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

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.

MULTIDIMENSION
MultiDimension Technology Co., Ltd.
No.2 Guangdong Road, Zhangjiagang Free Trade Zone, Jiangsu, China
Web：www.dowaytech.com/en E-mail：info@dowaytech.com