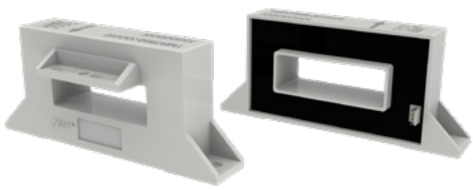
TMR7502-C

Unibody Low Temperature-Drift Current Sensor

Description

TMR7502-C 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 circuits.



Features and Benefits

- Low temperature drift
- Galvanic isolation
- High immunity to external interference
- RoHS and REACH compliant

Applications

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

Selection Guide

Model	Primary Nominal Current	Primary Current Measuring Range
TMR7502-5000C	500 A	±1500 A
TMR7502-6000C	600 A	±1800 A
TMR7502-8500C	850 A	±2550 A
TMR7502-1001C	1000 A	±3000 A
TMR7502-1201C	1200 A	±3600 A
TMR7502-1501C	1500 A	±4500 A
TMR7502-2001C	2000 A	±6000 A
TMR7502-2501C	2500 A	±6000 A
TMR7502-3001C	3000 A	±6000 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}	23	mm
Clearance	d_{CL}	14	mm
Ambient Operating Temperature	T_A	-40 to +105	°C
Ambient Storage Temperature	T_{STG}	-50 to +105	°C
Mass for I_{PN} < 850 A	m	300	g
Mass for $I_{PN} \geq$ 850A		450	g

Catalogue

1. Specifications

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

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
General Electrical Data							
Primary Nominal Current	I_{PN}	TMR7502-5000C		-	500	-	A
		TMR7502-6000C		-	600	-	
		TMR7502-8500C		-	850	-	
		TMR7502-1001C		-	1000	-	
		TMR7502-1201C		-	1200	-	
		TMR7502-1501C		-	1500	-	
		TMR7502-2001C		-	2000	-	
		TMR7502-2501C		-	2500	-	
		TMR7502-3001C		-	3000	-	
Primary Current Measuring Range	I_{PM}	TMR7502-5000C		-1500	-	1500	A
		TMR7502-6000C		-1800	-	1800	
		TMR7502-8500C		-2550	-	2550	
		TMR7502-1001C		-3000	-	3000	
		TMR7502-1201C		-3600	-	3600	
		TMR7502-1501C		-4500	-	4500	
		TMR7502-2001C		-6000	-	6000	
		TMR7502-2501C		-6000	-	6000	
		TMR7502-3001C		-6000	-	6000	
Sensitivity	S	I_P = 0 to ±I_{PN}	TMR7502-5000C	-	8.00	-	mV/A
			TMR7502-6000C	-	6.67	-	
			TMR7502-8500C	-	4.71	-	
			TMR7502-1001C	-	4.00	-	
			TMR7502-1201C	-	3.33	-	
			TMR7502-1501C	-	2.67	-	
			TMR7502-2001C	-	2.00	-	
			TMR7502-2501C	-	1.60	-	
			TMR7502-3001C	-	1.33	-	
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		-	+25/-5	-	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}		-1.2	±0.5	1.2	% I_{PN}
		T_A = -40 °C to +105 °C, I_P = 0 to ±I_{PN}		-4.5	±1.5	3.5	
Linearity Error	ε_L	T_A = -40 °C to +105 °C, I_P = 0 to ±I_{PN}		-	±0.5	-	% 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}		-3	-	3	%
Offset Error	V_{OE}	T_A = +25 °C, I_P = 0		-25	±10	25	mV
		T_A = -40 °C to +105 °C, I_P = 0		-40	±20	40	
Hysteresis	V_{OH}	I_P = ±I_{PN} → 0		-10	±5	10	mV
Dynamic Performance Data							
Response Time	t_R	di/dt > 50 A/μs, 10% to 90% of I_{PN}		-	5	-	μs
Bandwidth	BW	-3 dB		DC	25	-	kHz

2. Typical Output Characteristics

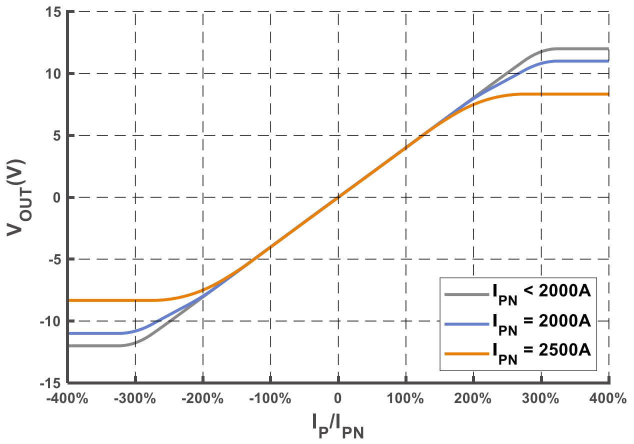


Figure 1. Output Voltage vs Primary Current

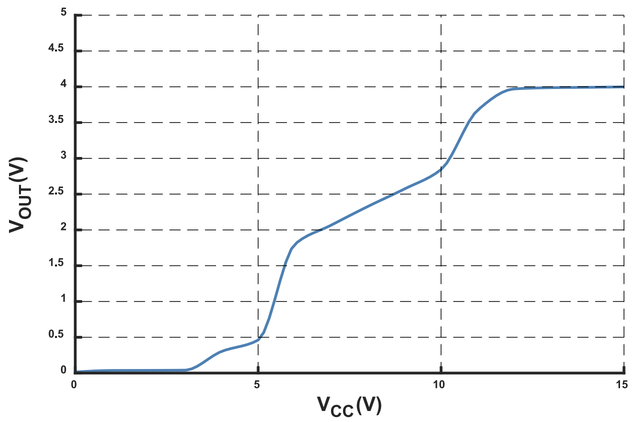


Figure 2. Output Voltage vs Supply Voltage (@$I_P = I_{PN}$)

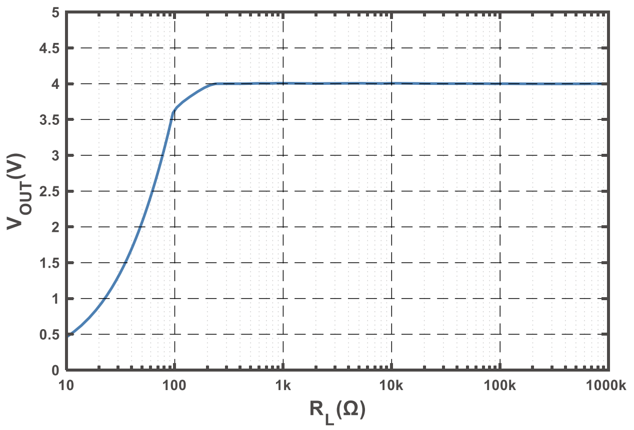


Figure 3. Output Voltage vs Load Resistance
(@$I_P = I_{PN}$)

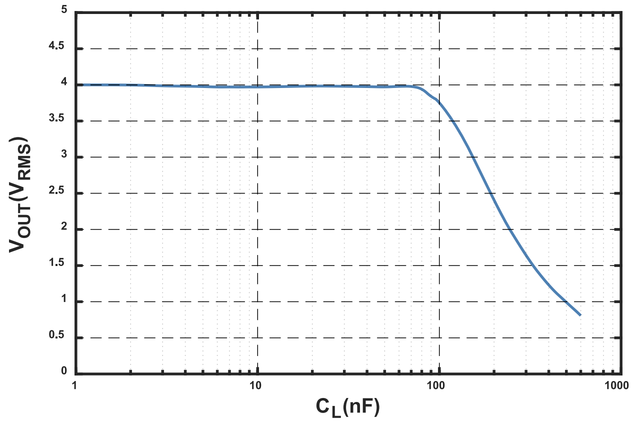


Figure 4. Output Voltage vs Load Capacitance
(@$I_P = I_{PN}$)

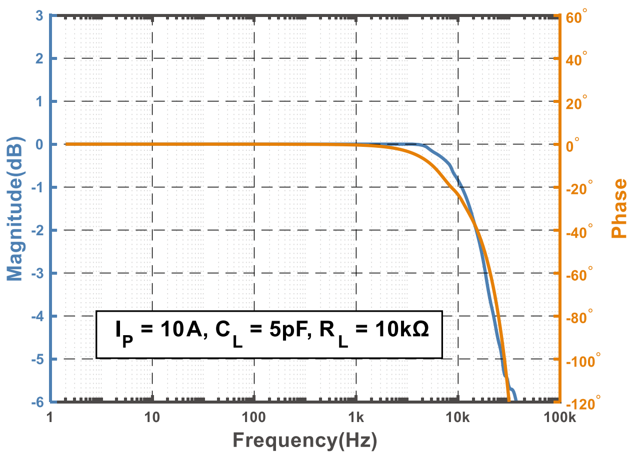
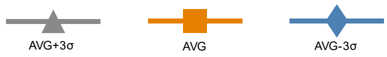


Figure 5. Bode Plot

3. Typical Temperature Characteristics



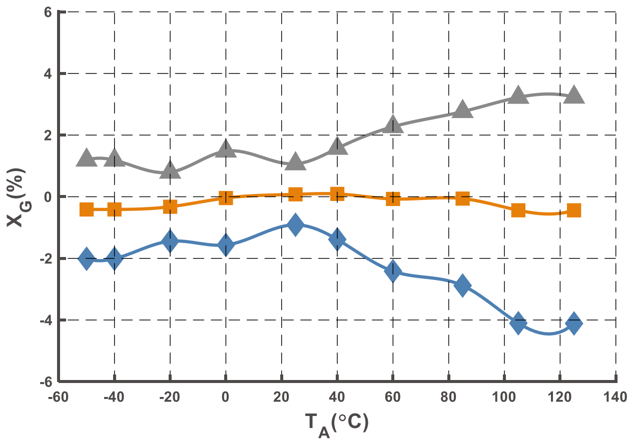


Figure 6. Accuracy

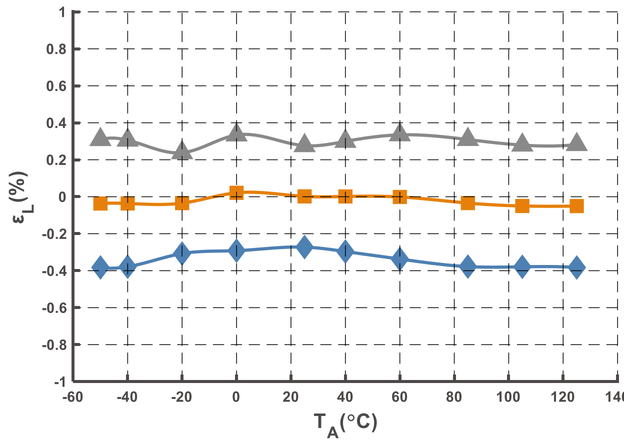


Figure 7. Linearity Error

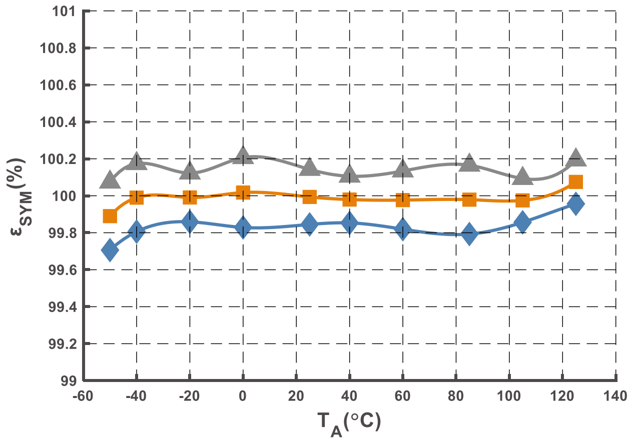


Figure 8. Symmetry

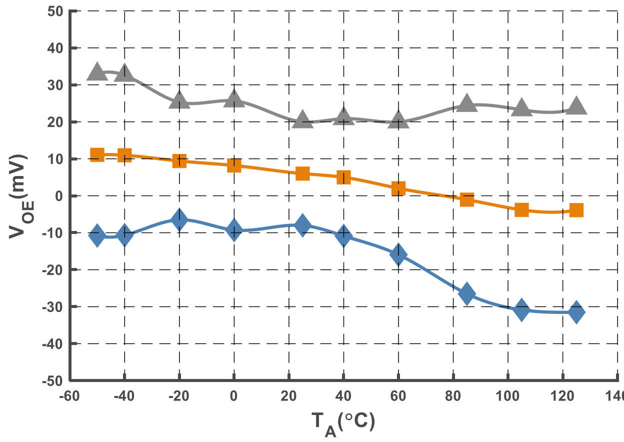


Figure 9. Offset Error

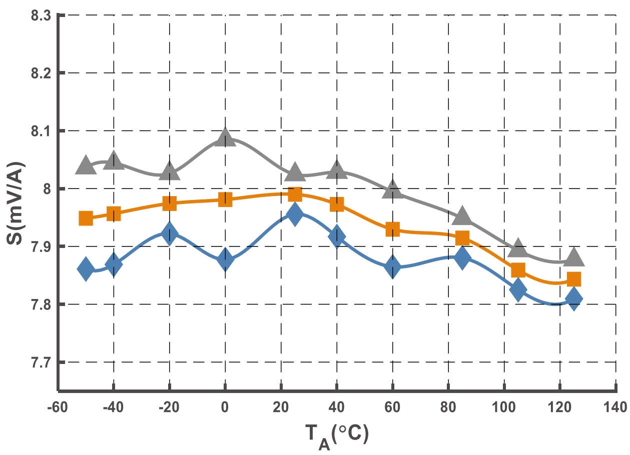


Figure 10. Sensitivity (@I_{PN} = 500 A)

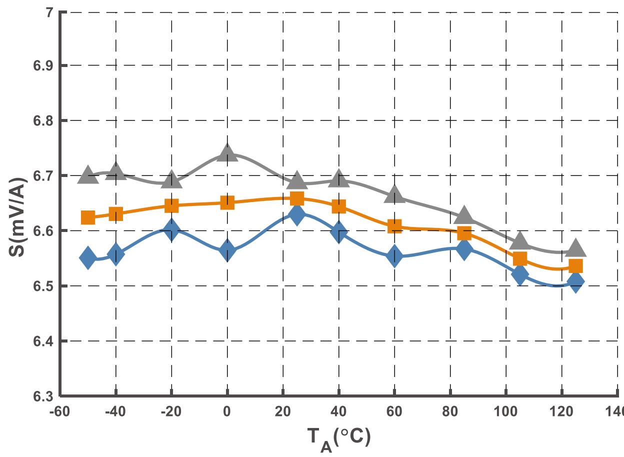


Figure 11. Sensitivity (@I_{PN} = 600 A)

Typical Temperature Characteristics

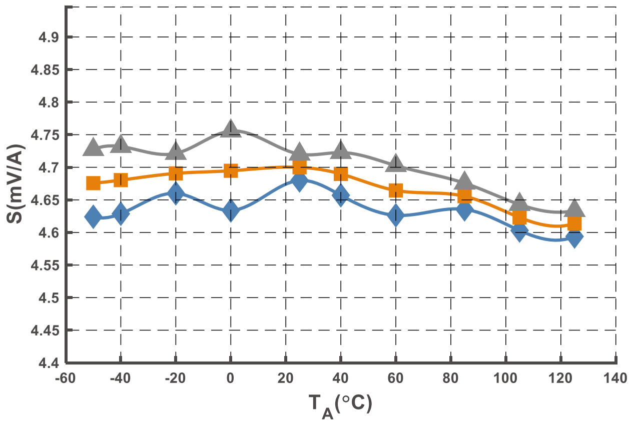


Figure 12. Sensitivity (@I_{PN} = 850 A)

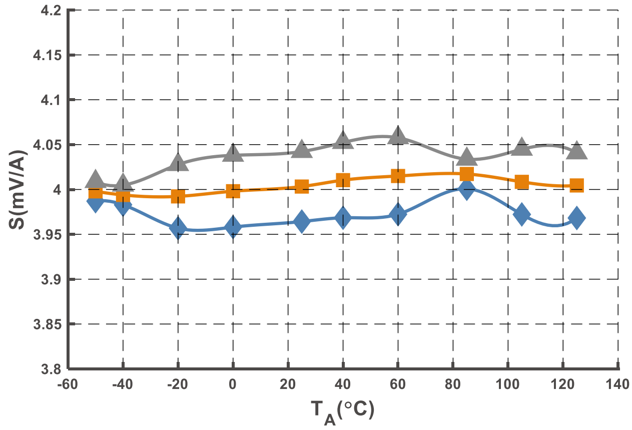


Figure 13. Sensitivity (@I_{PN} = 1000 A)

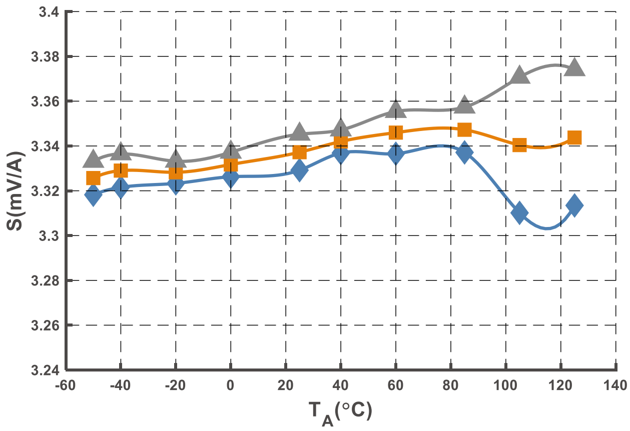


Figure 14. Sensitivity (@I_{PN} = 1200 A)

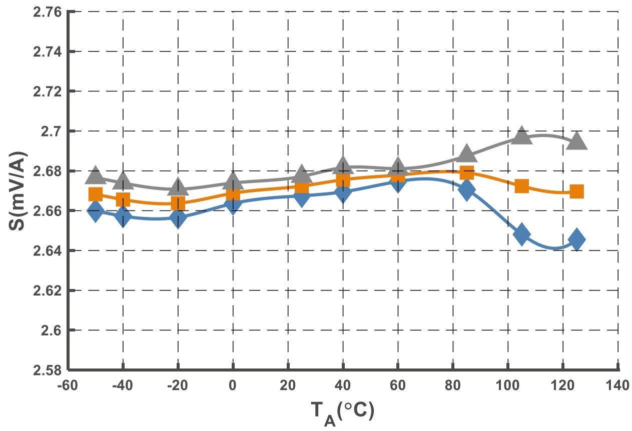


Figure 15. Sensitivity (@I_{PN} = 1500 A)

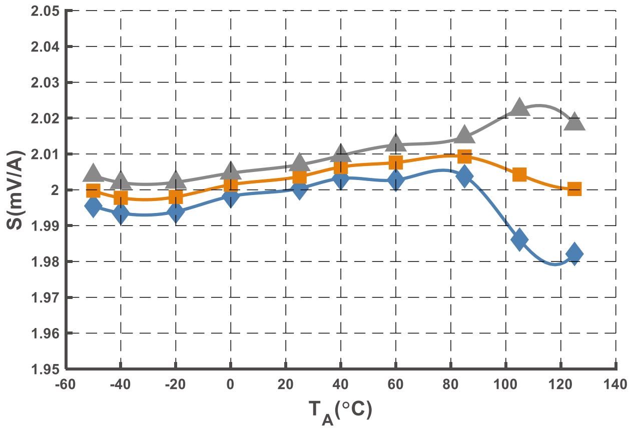


Figure 16. Sensitivity (@I_{PN} = 2000 A)

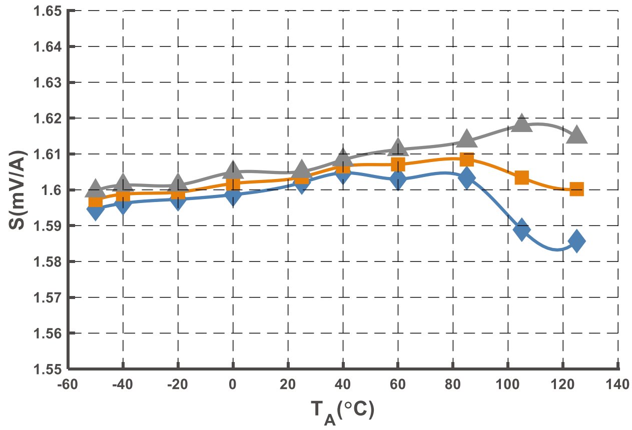
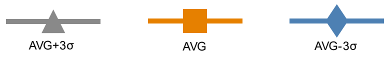


Figure 17. Sensitivity (@I_{PN} = 2500 A)

Typical Temperature Characteristics



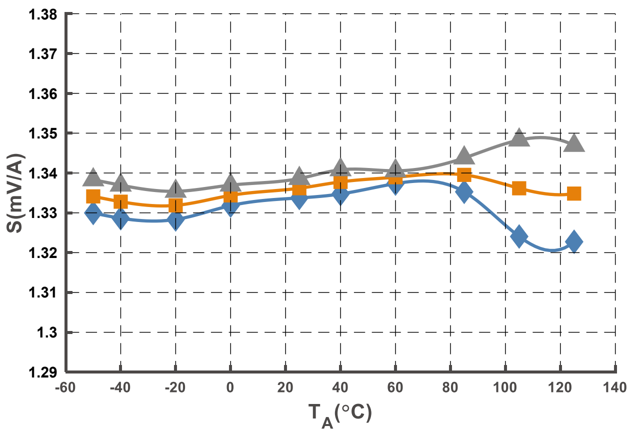


Figure 18. Sensitivity (@I_{PN} = 3000 A)

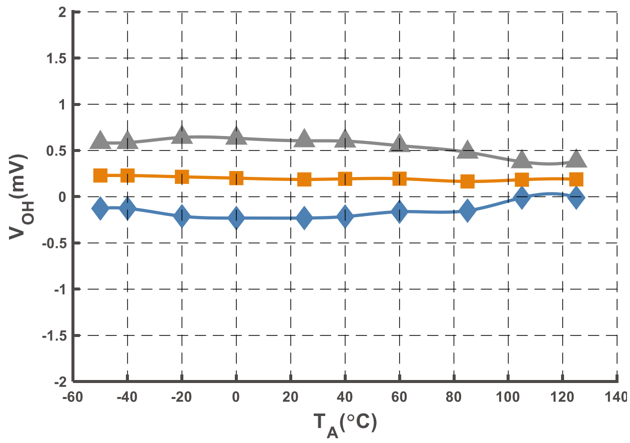


Figure 19. Hysteresis

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

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

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

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

$\overline{S}$ 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

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

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

5. Application Information

Electrical Connection

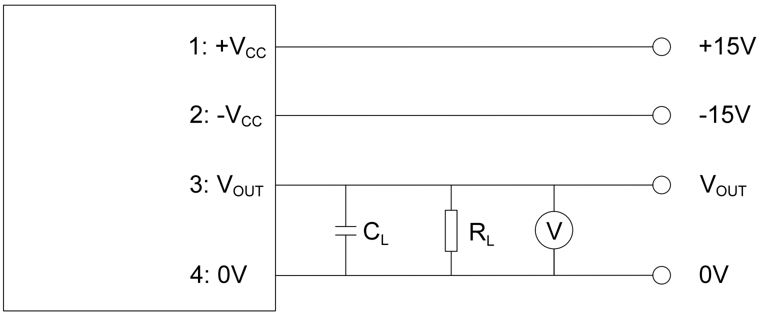


Figure 20. Electrical Connection

Mounting Recommendation

1. Mounting method: 1 × Φ 5.5 mm hole and 1 × Φ 5.5 mm slotted hole
   2 × M5 copper or SS304 screws (Recommended torque 2.5 N·m)
   Or
   1 × Φ 5.5 mm hole and 2 × Φ 5.5 mm slotted holes
   3 × M5 copper or SS304 screws (Recommended torque 2.5 N·m)
2. Primary through hole dimensions: 64 mm × 21 mm
3. Secondary electrical connection: Molex 22111041 (old PN: Molex 5045-04A)
   Crimp Housing: Molex 22011042
   Crimping Terminal: Molex 08500102

Remarks

1. V_{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. 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.
4. Dynamic performances (di/dt and response time) are best with a single busbar completely filling the primary through hole.
5. Sensor is customizable upon request.

6. Dimensions

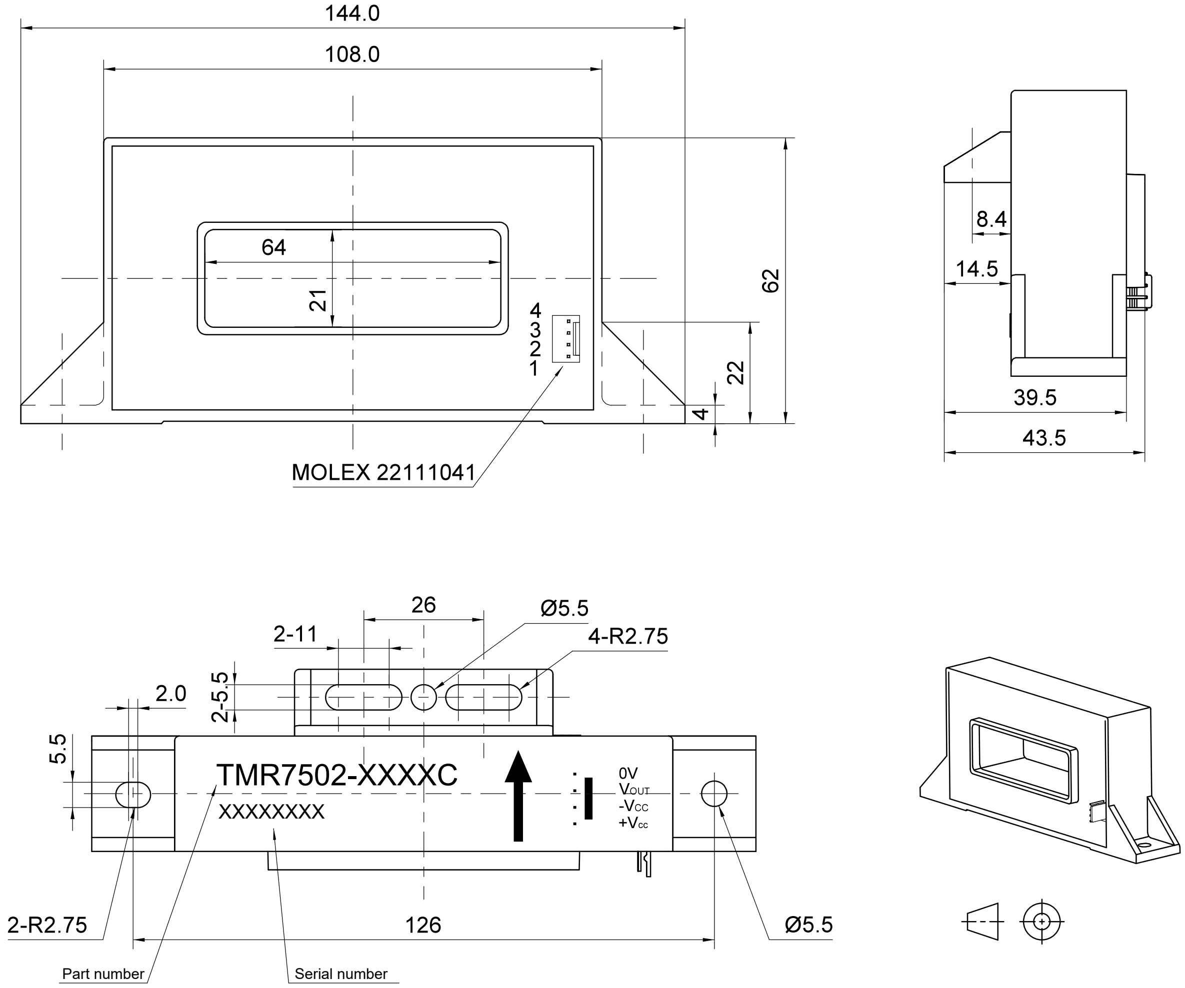


Figure 21. Dimension (unit: mm, tolerances for unmarked scales ±1 mm)

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
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