TMR7559-B

Board Mount Precision Current Sensor

Description

TMR7559-B 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
- Low temperature coefficient
- Fast response time
- Galvanic isolation
- RoHS & REACH compliant

Applications

- Solar inverter
- Direct-current dynamo
- Uninterruptible power supplies (UPS)
- Switched model power supplies (SMPS)
- Variable frequency drive (VFD)

Selection Guide

Part Number	Primary Nominal Current	Primary Current Measuring Range
TMR7559-1000B	100 A	±300 A
TMR7559-1500B	150 A	±450 A
TMR7559-2000B	200 A	±500 A
TMR7559-2500B	250 A	±500 A

Insulation and Environmental Characteristics

Parameters	Symbol	Typ.	Unit
Dielectric Strength	V_D	4	kV(50 Hz, 1 min)
Insulation Resistance	R_{IS}	1000	MΩ
Creepage Distance	d_{CP}	22	mm
Clearance	d_{CL}	14.5	mm
Ambient Operating Temperature	T_A	-40 to +85	°C
Ambient Storage Temperature	T_{STG}	-50 to +105	°C
Mass	m	60	g

Catalogue

1. Specifications

T_A = +25 °C, V_{CC} = 5 V, R_L = 10 kΩ, unless otherwise noted

Parameter	Symbol	Condition		Min.	Typ.	Max.	Unit
General Electrical Data							
Primary Nominal Current	I_{PN}	TMR7559-1000B		-	100	-	A
		TMR7559-1500B		-	150	-	
		TMR7559-2000B		-	200	-	
		TMR7559-2500B		-	250	-	
Primary Current Measuring Range	I_{PM}	TMR7559-1000B		-300	-	300	A
		TMR7559-1500B		-450	-	450	
		TMR7559-2000B		-500	-	500	
		TMR7559-2500B		-500	-	500	
Sensitivity	S	I_P = 0 to ±I_{PN}	TMR7559-1000B	-	6.25	-	mV/A
			TMR7559-1500B	-	4.167	-	
			TMR7559-2000B	-	3.125	-	
			TMR7559-2500B	-	2.7	-	
Supply Voltage	V_{CC}	±5 %		-	5	-	V
Reference Output Voltage	V_{REF}	-		2.485	2.5	2.515	V
Offset Voltage	V_{OFF}	-		-	2.5	-	V
Output Voltage	V_{OUT}	I_P = 0 to ±I_{PM}		-	V_{OFF} + S × I_P	-	V
Current Consumption	I_C	I_P = 0		-	16	-	mA
Static Performance Data							
Accuracy	X_G	I_P = 0 to ±I_{PN}		-	±0.8	-	% I_{PN}
		T_A = 85 °C, I_P = 0 to ±I_{PN}		-	±1.4	-	
Linearity Error	ε_L	I_P = 0 to ±I_{PN}		-	±0.15	-	% I_{PN}
Symmetry	ε_{SYM}	T_A = -40 °C to +85 °C, I_P = 0 to ±I_{PN}		99	100	101	%
Offset Error	V_{OE}	T_A = +25 °C, I_P = 0		-	-	5	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	300	-	kHz

2. Maximum Continuous DC Primary Current

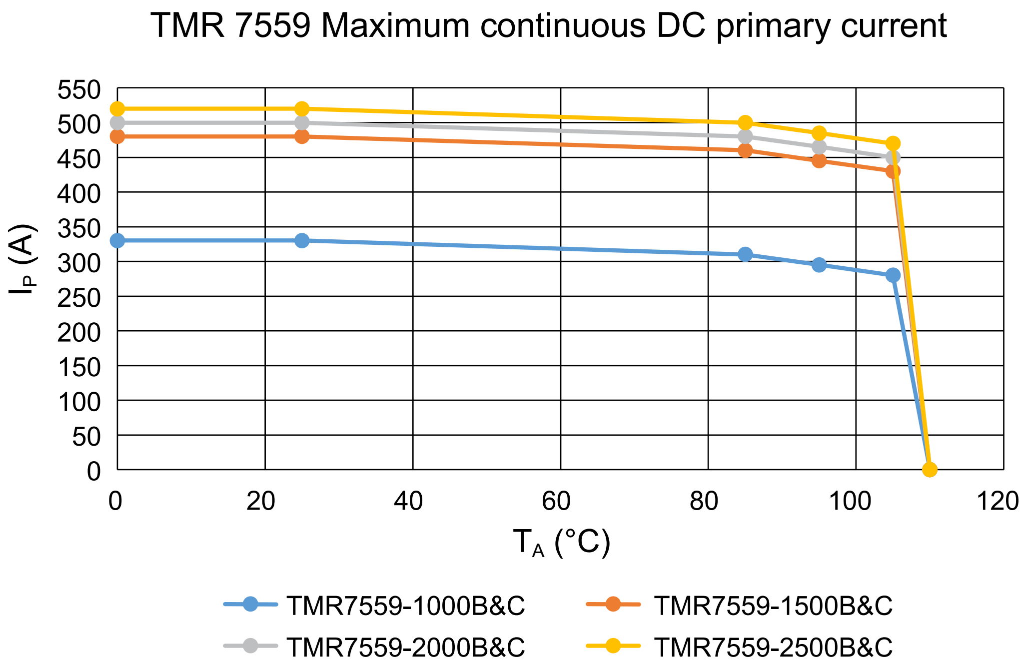

Figure 1. I_P vs T_A for TMR7559

The maximum continuous DC primary current plot shows the boundary of the area for which all the following conditions are true:

- $I_P < I_{PM}$
- Junction temperature $T_j < 125°C$
- Primary conductor temperature $T_A < 110°C$

3. Typical Output Characteristics

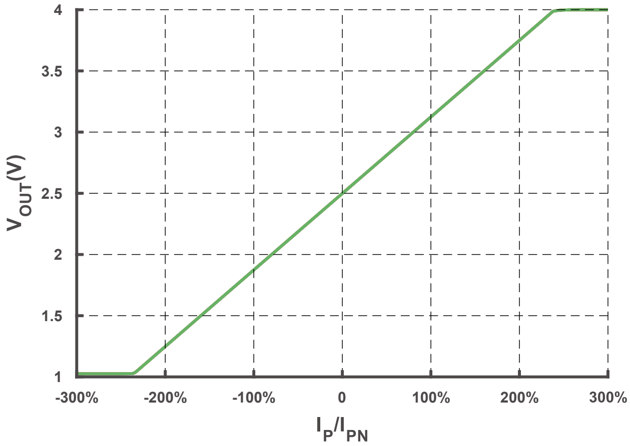

Figure 2. Output Voltage vs Primary Current

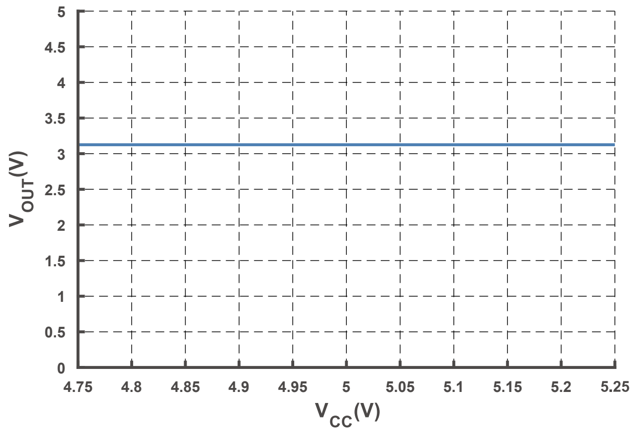

Figure 3. Output Voltage vs Supply Voltage (@$I_P = I_{PN}$)

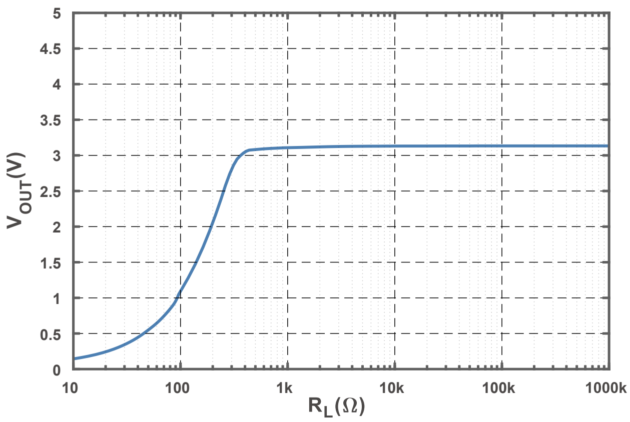

Figure 4. Output Voltage vs Load Resistance (@$I_P = I_{PN}$)

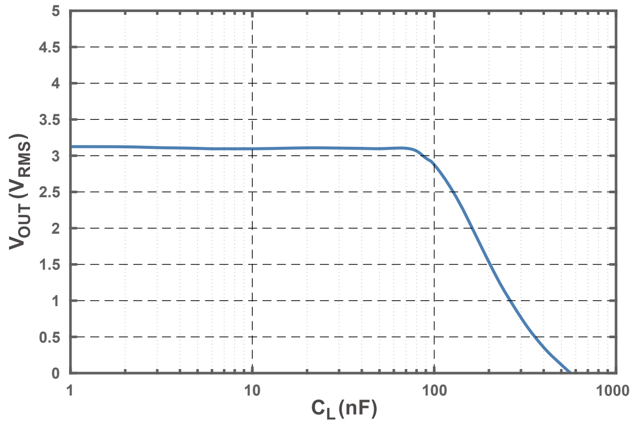

Figure 5. Output Voltage vs Load Capacitance (@$I_P = I_{PN}$)

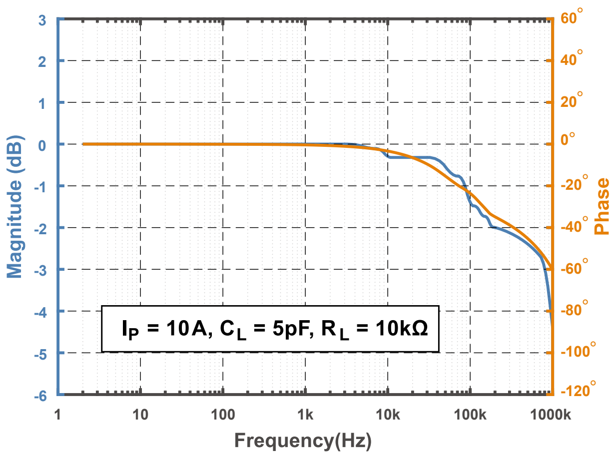

Figure 6. Bode Plot

4. Typical Temperature Characteristics

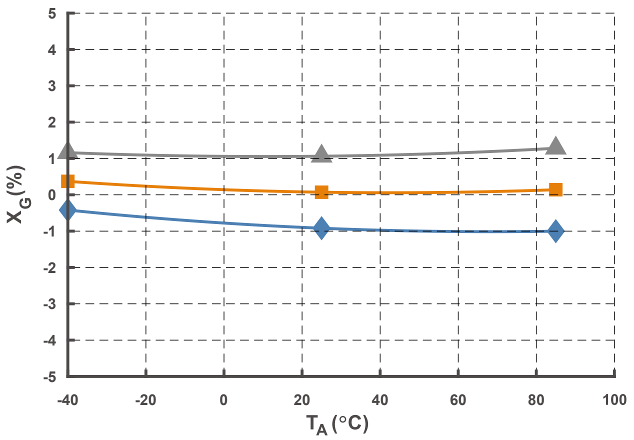

Figure 7. Accuracy

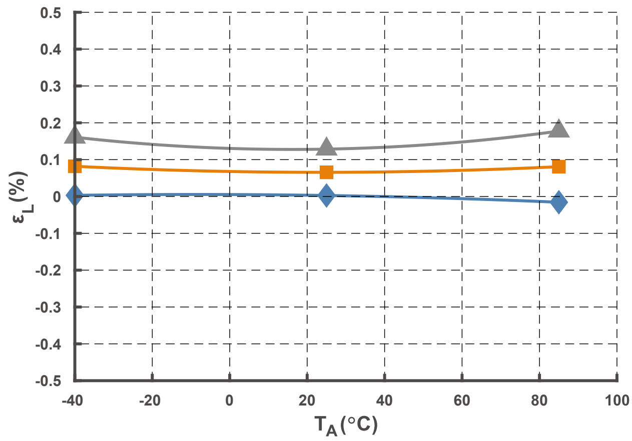

Figure 8. Linearity Error

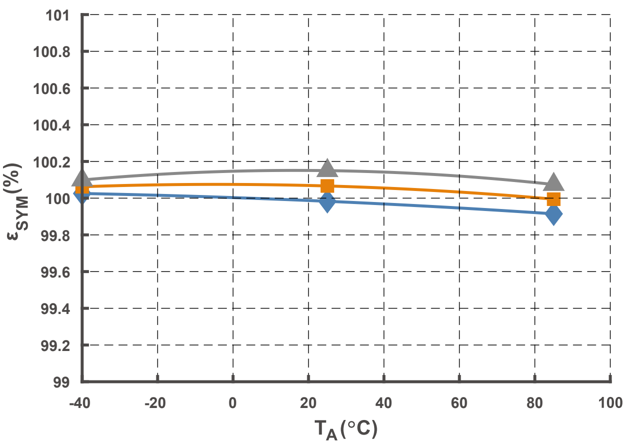

Figure 9. Symmetry

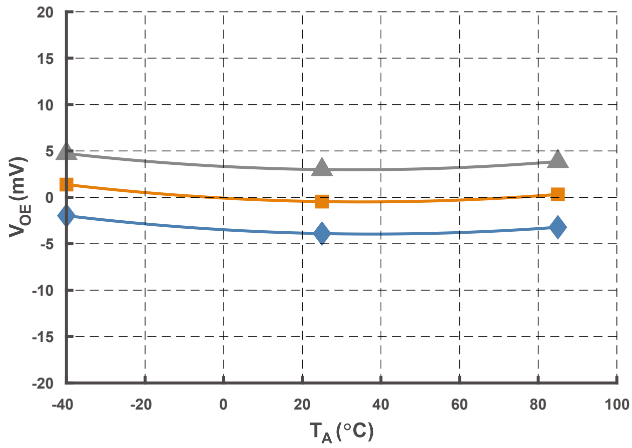

Figure 10. Offset Error

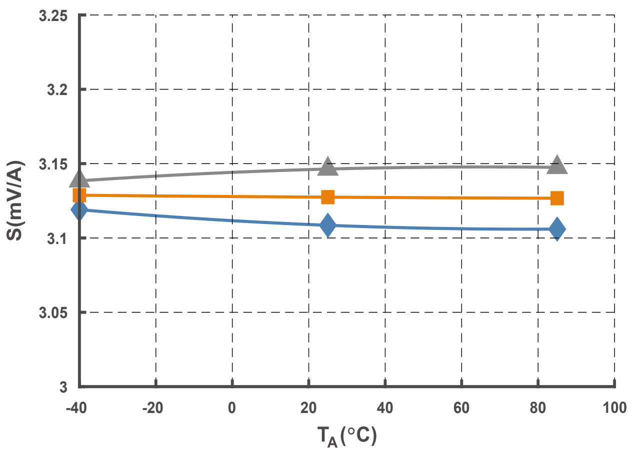

Figure 11. Sensitivity

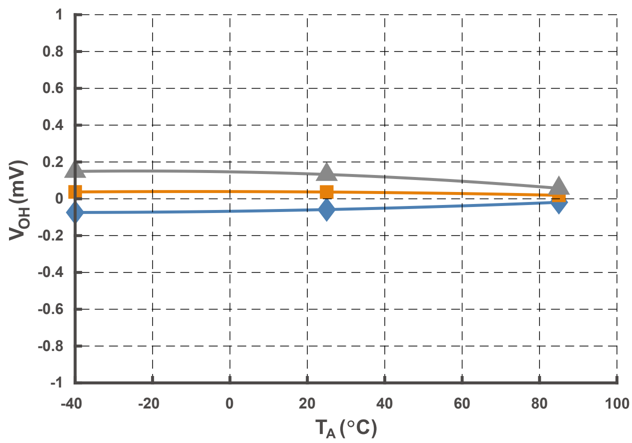

Figure 12. Hysteresis

5. Parameters Definition and Formula

1) Output Voltage

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

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

2) Accuracy

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

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 current output at I_{PN} and $-I_{PN}$ respectively.

4) Linearity

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

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

5) Symmetry

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

6) Hysteresis

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

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

7) Offset Voltage

$$V_{OE} = V_{OUT\,(@\,I_P = 0)} - V_{REF}$$

6. Electrical Connection Diagram

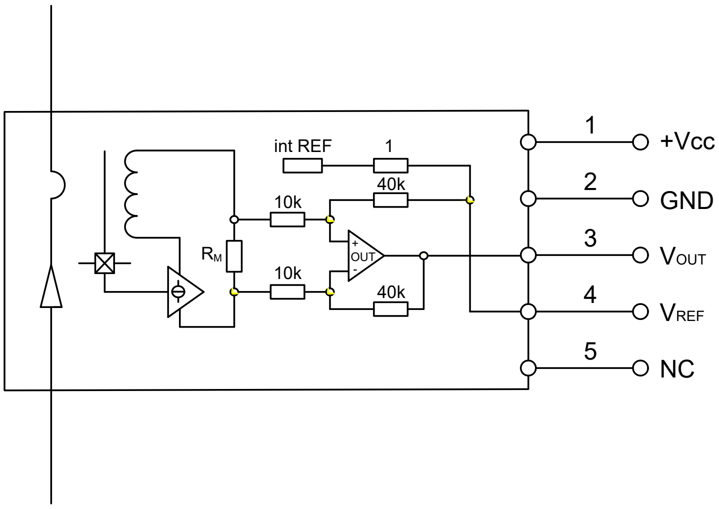

Figure 13. Electrical connection diagram

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.

7. Dimensions

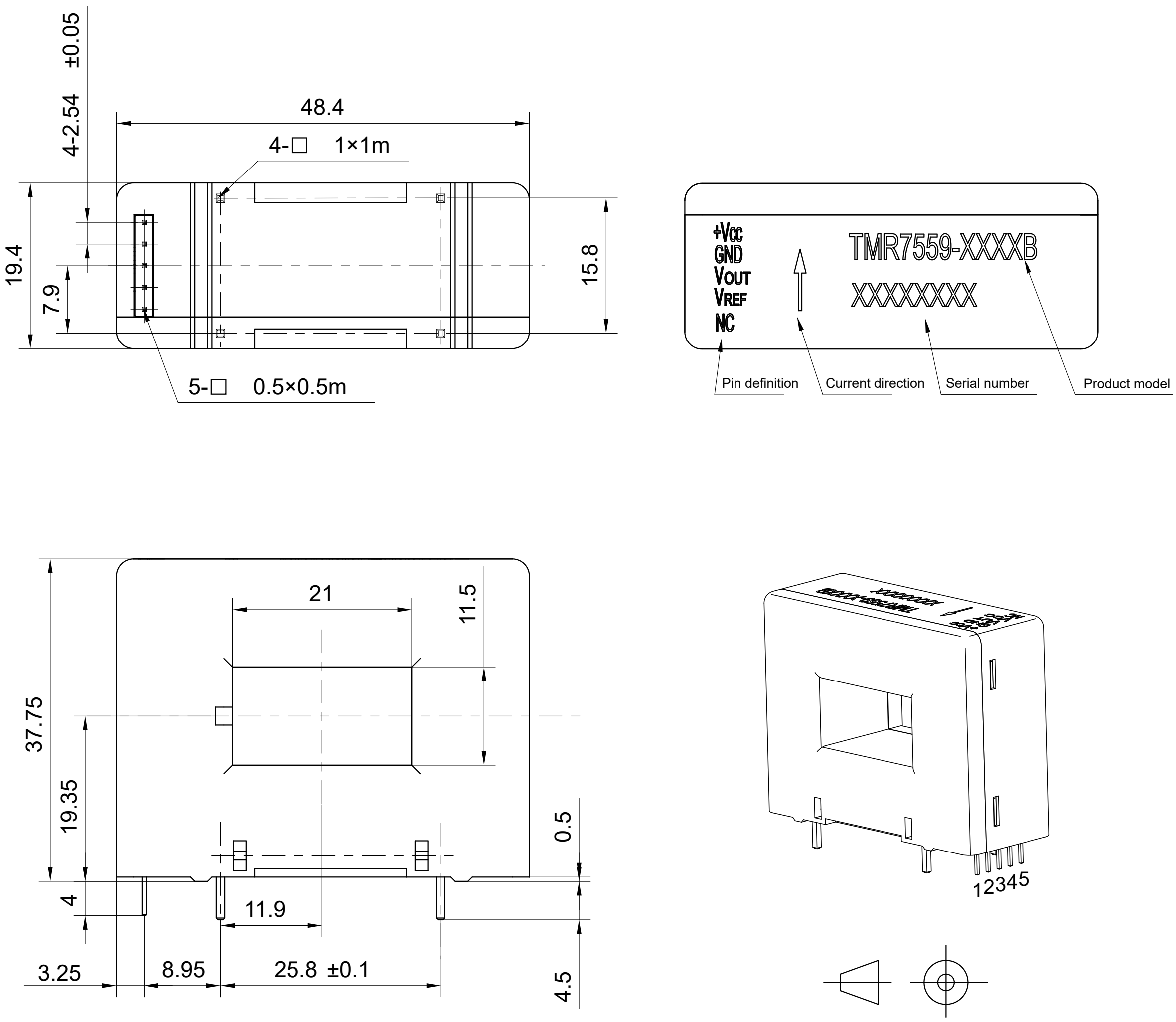

Figure 14. Dimension (unit: mm, tolerances for unmarked scales ±1 mm)

8. Recommended Pad Schematic Diagram

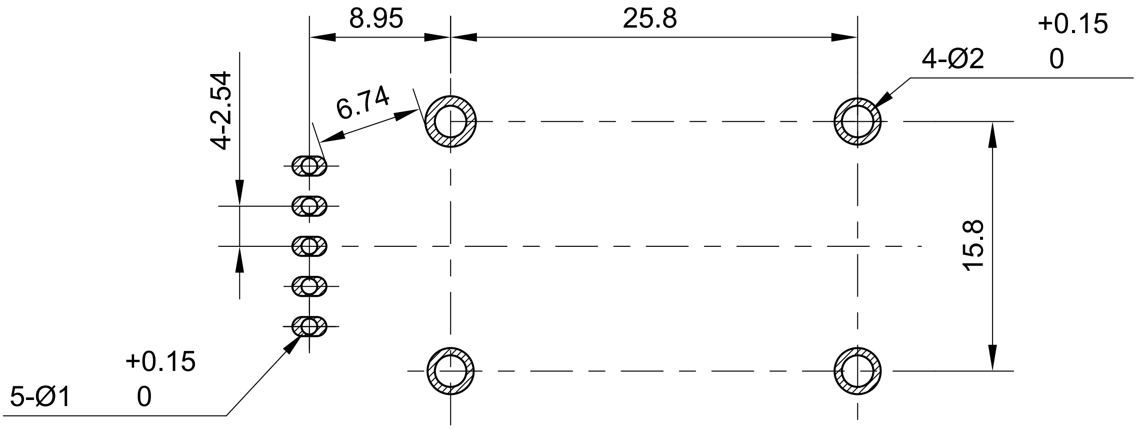

Figure 15. Recommended pad schematic diagram (unit: mm)

9. Typical Application Circuit

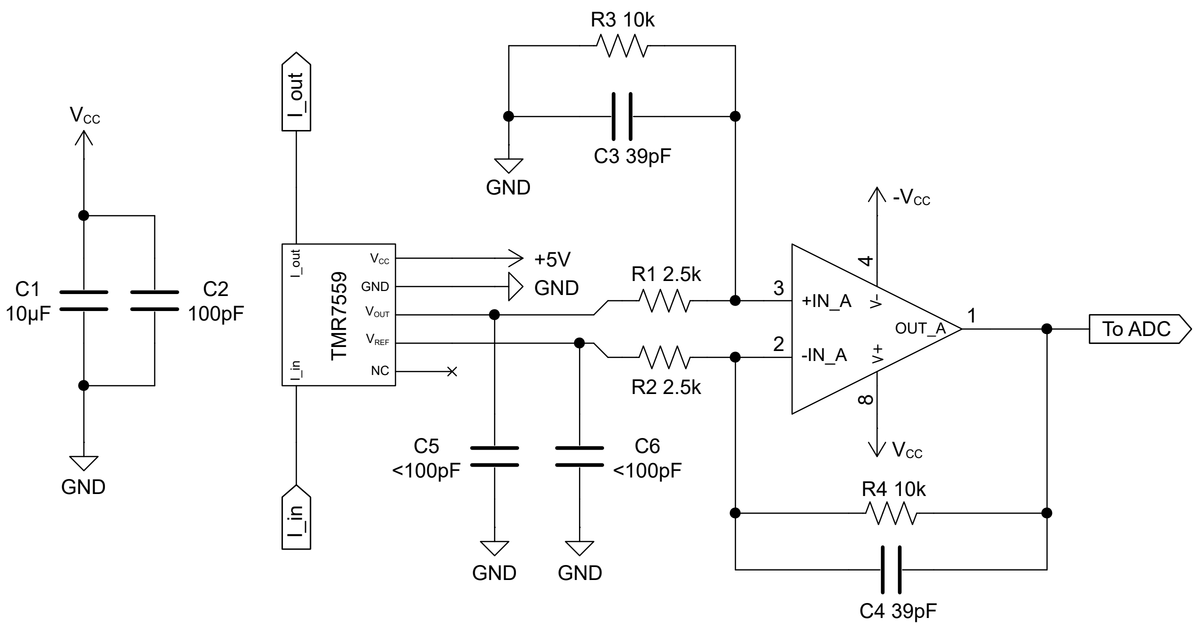

Figure 16. Typical application circuit

Typical application circuit of the TMR7559 series current sensor. The amplification factor is approximately K = R4 / R2, which requires satisfying R1 = R2 and R3 = R4. The amplification factor of the above circuit is about 4. The load capacitance of V_{OUT} and V_{REF} shall be less than 100 pF to avoid oscillation.

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.

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