

# TMR7559-C

## Board Mount Precision Current Sensor

### Description

TMR7559-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
- 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
TMR7559-1000C	100 A	±300 A
TMR7559-1500C	150 A	±450 A
TMR7559-2000C	200 A	±500 A
TMR7559-2500C	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	$M\Omega$
Creepage Distance	$d_{CP}$	22	mm
Clearance	$d_{CL}$	14.5	mm
Ambient Operating Temperature	$T_A$	-40 to +85	$^{\circ}C$
Ambient Storage Temperature	$T_{STG}$	-50 to +105	$^{\circ}C$
Mass	m	85	g

## Catalogue

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## 1. Specifications

$T_A = +25\text{ }^\circ\text{C}$ ,  $V_{CC} = 5\text{ V}$ ,  $R_L = 10\text{ k}\Omega$ , unless otherwise noted

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	
General Electrical Data							
Primary Nominal Current	$I_{PN}$	TMR7559-1000C	-	100	-	A	
		TMR7559-1500C	-	150	-		
		TMR7559-2000C	-	200	-		
		TMR7559-2500C	-	250	-		
Primary Current Measuring Range	$I_{PM}$	TMR7559-1000C	-300	-	300	A	
		TMR7559-1500C	-450	-	450		
		TMR7559-2000C	-500	-	500		
		TMR7559-2500C	-500	-	500		
Sensitivity	S	$I_P = 0\text{ to } \pm I_{PN}$	TMR7559-1000C	-	6.25	-	mV/A
			TMR7559-1500C	-	4.167	-	
			TMR7559-2000C	-	3.125	-	
			TMR7559-2500C	-	2.7	-	
Supply Voltage	$V_{CC}$	$\pm 5\%$	-	5	-	V	
Reference Output Voltage	$V_{REF}$	-	2.485	2.5	2.515	V	
Offset Voltage	$V_{OFF}$	-	-	2.5	-	V	
Output Voltage	$V_{OUT}$	$I_P = 0\text{ to } \pm I_{PM}$	-	$V_{OFF} + S \times I_P$	-	V	
Current Consumption	$I_C$	$I_P = 0$	-	16	-	mA	
Static Performance Data							
Accuracy	$X_G$	$I_P = 0\text{ to } \pm I_{PN}$	-	$\pm 0.8$	-	% $I_{PN}$	
		$T_A = 85\text{ }^\circ\text{C}$ , $I_P = 0\text{ to } \pm I_{PN}$	-	$\pm 1.4$	-		
Linearity Error	$\epsilon_L$	$I_P = 0\text{ to } \pm I_{PN}$	-	$\pm 0.15$	-	% $I_{PN}$	
Symmetry	$\epsilon_{SYM}$	$T_A = -40\text{ }^\circ\text{C to } +85\text{ }^\circ\text{C}$ , $I_P = 0\text{ to } \pm I_{PN}$	99	100	101	%	
Offset Error	$V_{OE}$	$T_A = +25\text{ }^\circ\text{C}$ , $I_P = 0$	-	-	5	mV	
Dynamic Performance Data							
Response Time	$t_R$	$di/dt > 50\text{ A}/\mu\text{s}$ , 10% to 90% of $I_{PN}$	-	1	-	$\mu\text{s}$	
Bandwidth	BW	-3 dB	DC	300	-	kHz	

## 2. Typical Output Characteristics

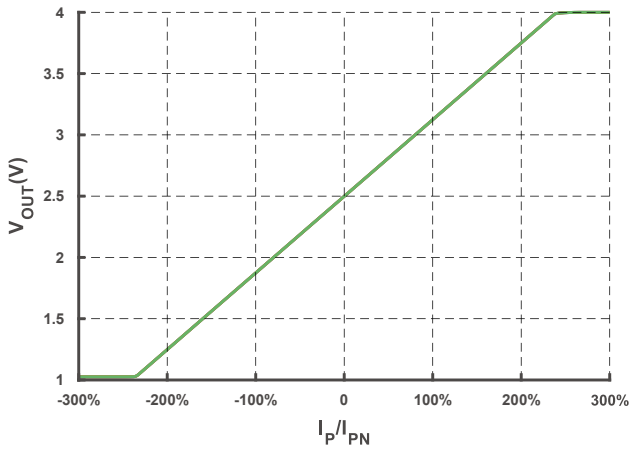


Figure 1. Output Voltage vs Primary Current

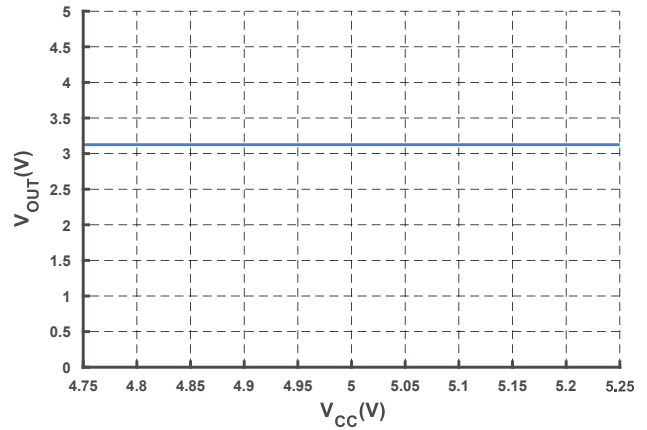


Figure 2. Output Voltage vs Supply Voltage (@ $I_P = I_{PN}$ )

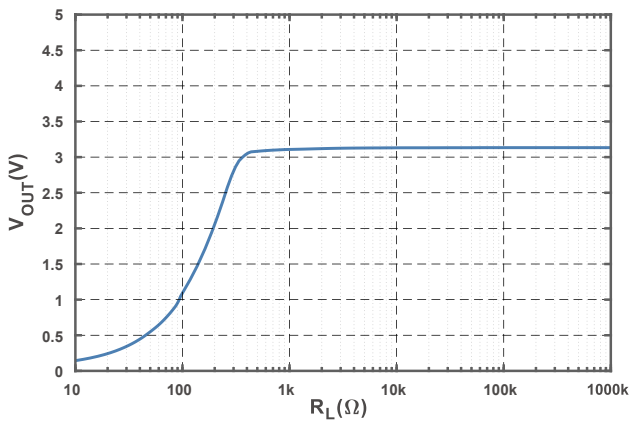


Figure 3. Output Voltage vs Load Resistance (@ $I_P = I_{PN}$ )

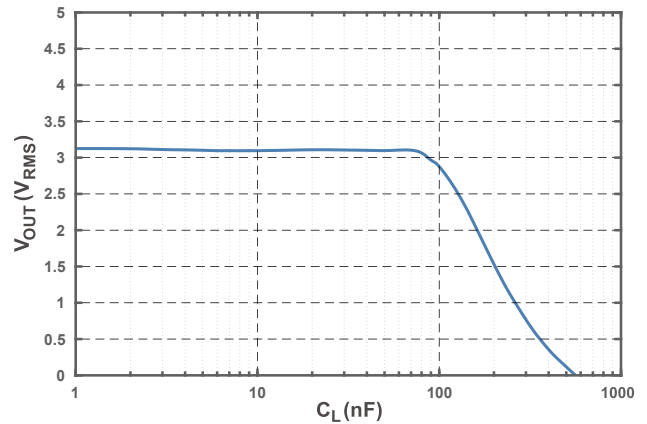


Figure 4. Output Voltage vs Load Capacitance (@ $I_P = I_{PN}$ )

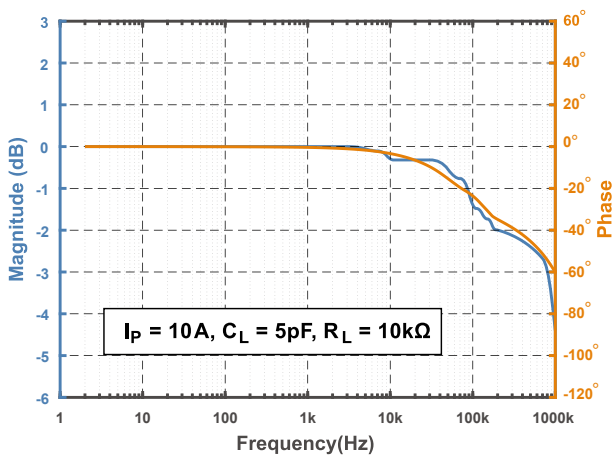


Figure 5. Bode Plot

### 3. Typical Temperature Characteristics

▲ AVG+3σ    ■ AVG    ◆ AVG-3σ

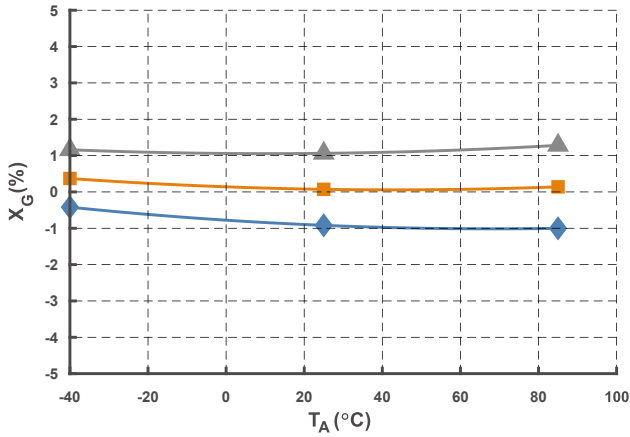


Figure 6. Accuracy

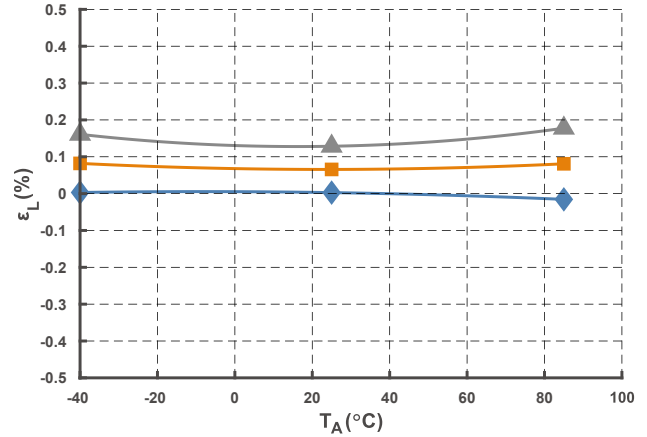


Figure 7. Linearity Error

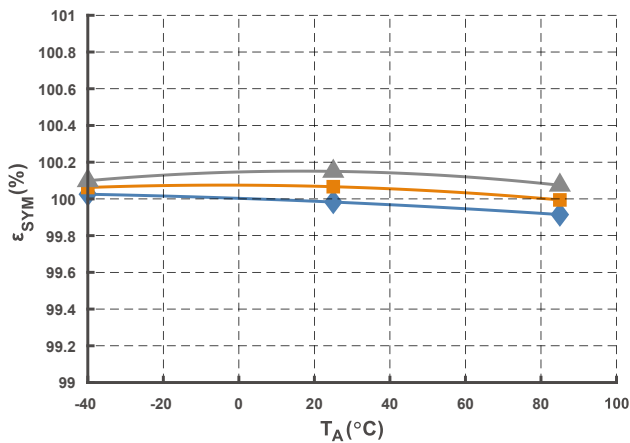


Figure 8. Symmetry

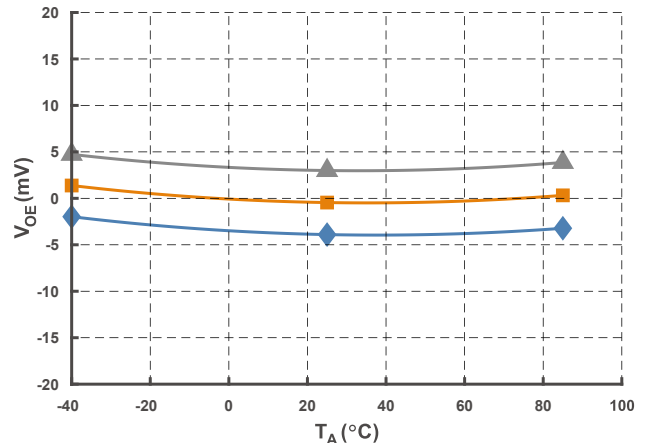


Figure 9. Offset Error

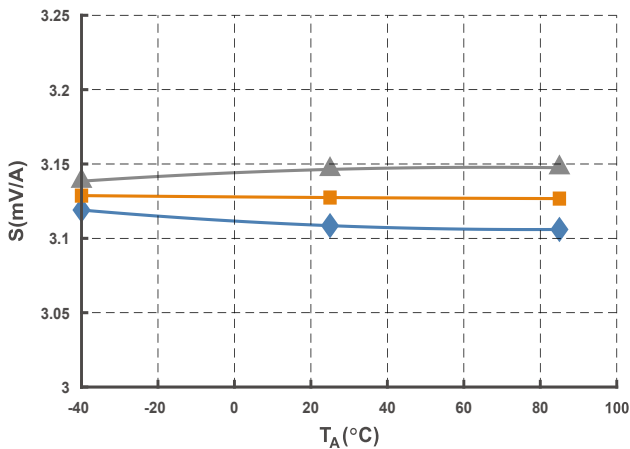


Figure 10. Sensitivity

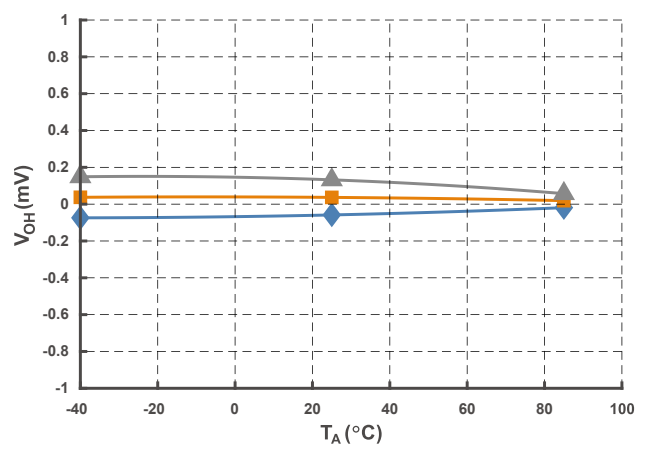


Figure 11. Hysteresis

## 4. 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

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

$I_{PN}$  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

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

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

### 5) Symmetry

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

### 6) Hysteresis

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

$\Delta H$  is the maximum residual output current between full scale positive and negative nominal current.

### 7) Offset Voltage

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

## 5. Electrical Connection Diagram

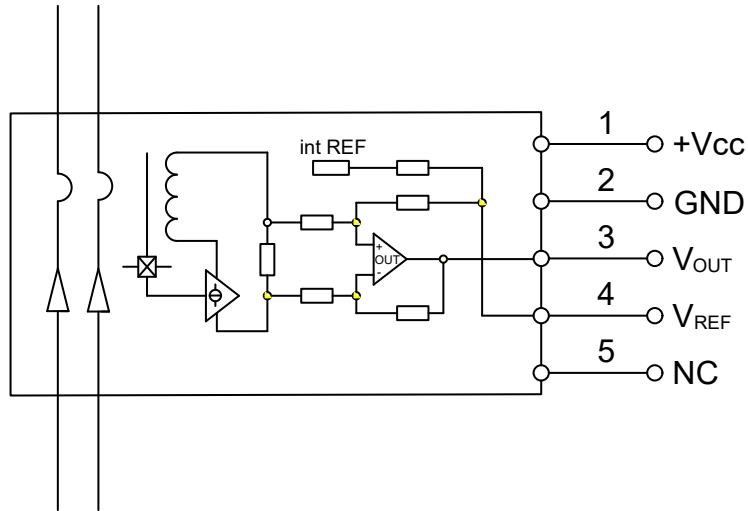
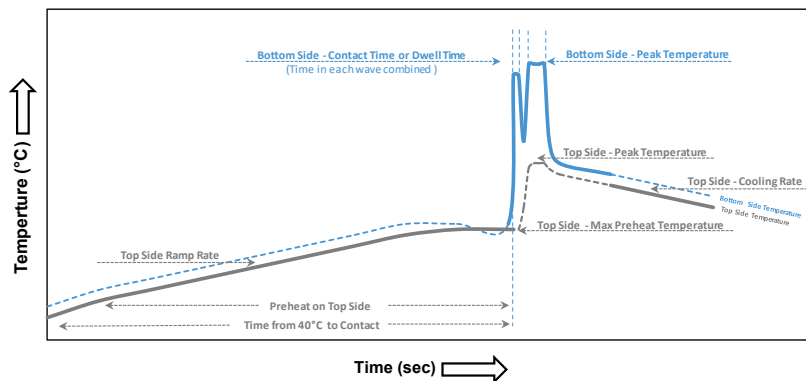


Figure 12. Electrical connection diagram

### 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) Wave soldering profile max temperature should be set no higher than 260°C for 10s.
  - a) Preheating spec: 130~160 °C for 60~90s.
  - b) Component through hole legs dwell time in solder wave maximum 10s (Sn93.5 - Ag3.0 - Cu0.5).



- 4) Sensor is customizable upon request.

## 6. Dimensions

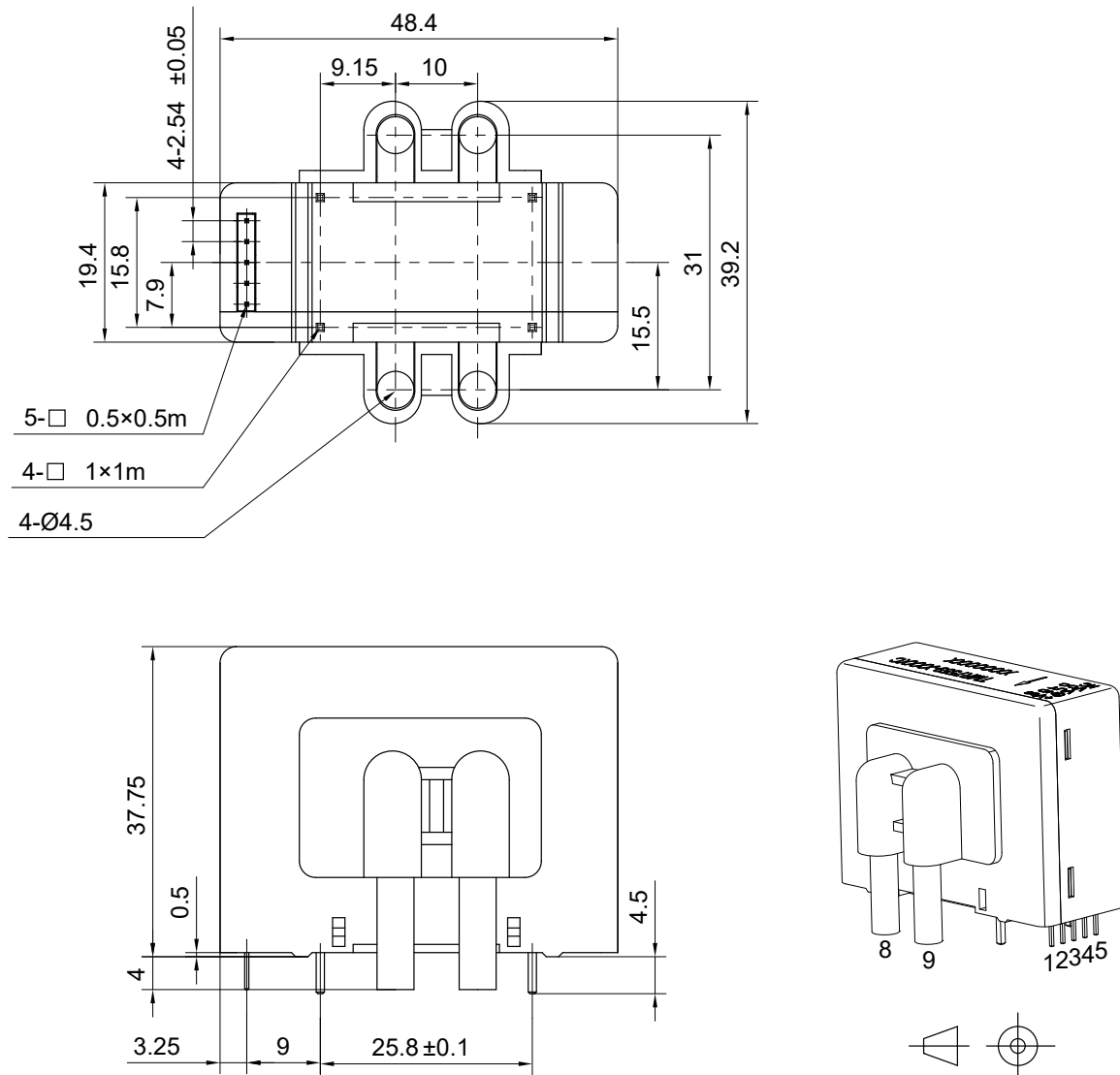


Figure 13. Dimension (unit: mm, tolerances for unmarked scales ±1 mm)

## 7. Recommended Pad Schematic Diagram

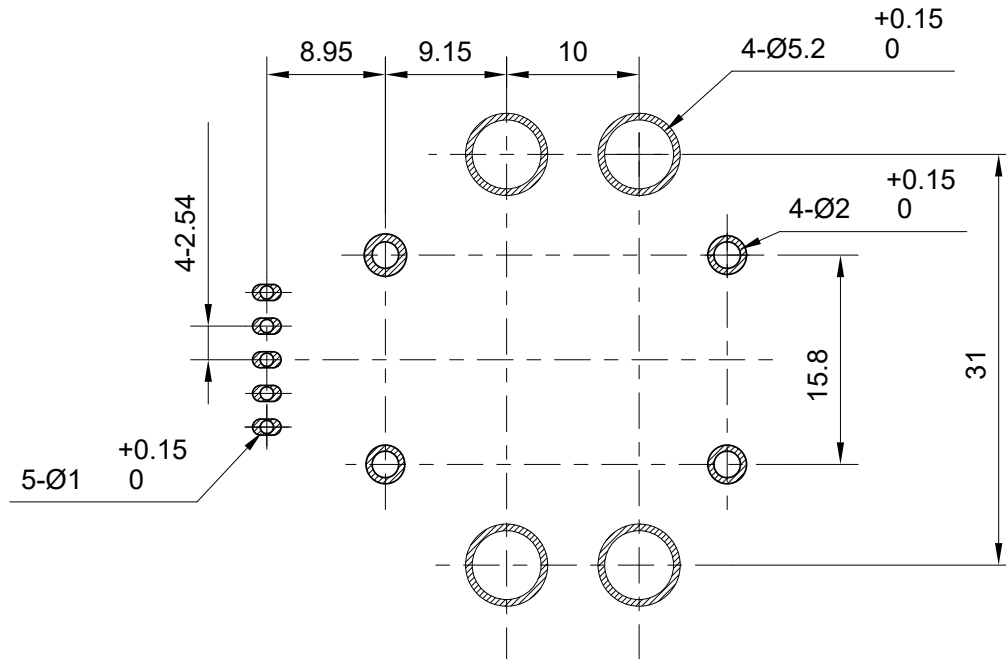


Figure 14. Recommended pad schematic diagram (unit: mm)

## 8. Typical Application Circuit

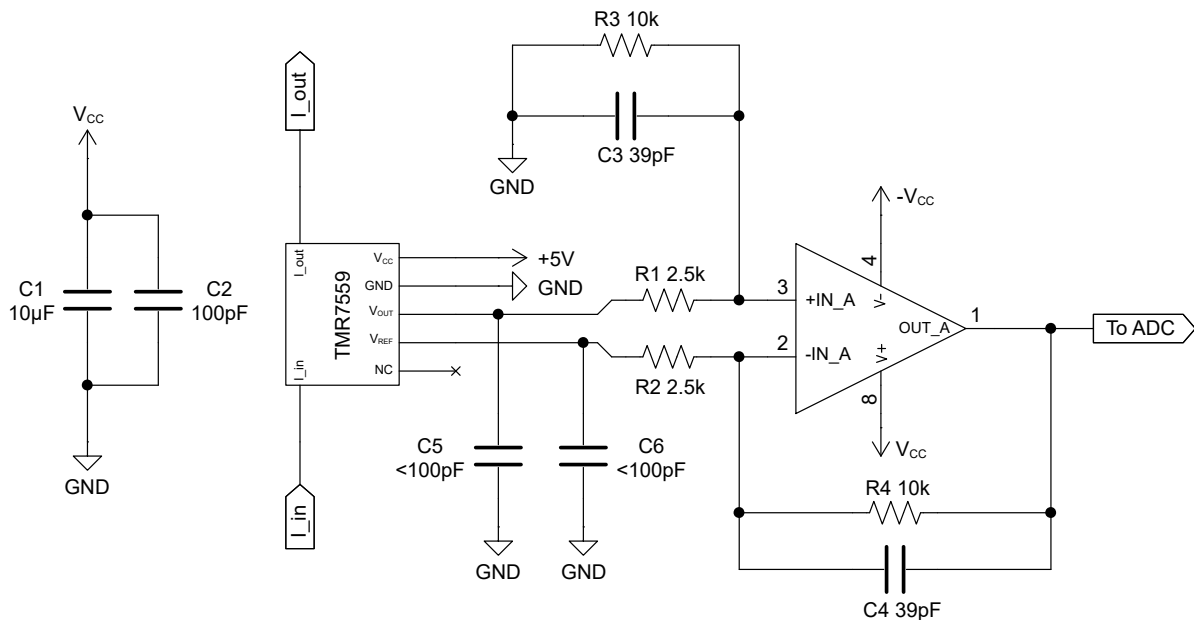


Figure 15. Typical application circuit

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.

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