

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 mode 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 | $I_P = 0\text{ to } \pm I_{PN}$ | - | ± 0.8 | - | % I_{PN} | |
| | | $T_A = 85\text{ }^\circ\text{C}$, $I_P = 0\text{ to } \pm I_{PN}$ | - | ± 1.4 | - | | |
| Linearity Error | ϵ_L | $I_P = 0\text{ to } \pm I_{PN}$ | - | ± 0.15 | - | % I_{PN} | |
| Symmetry | ϵ_{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 | - | μs | |
| Bandwidth | BW | -3 dB | DC | 300 | - | kHz | |

2. Typical Output Characteristics

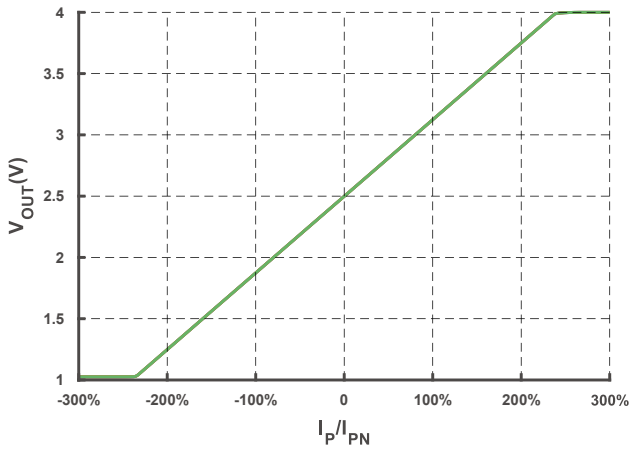


Figure 1. Output Voltage vs Primary Current

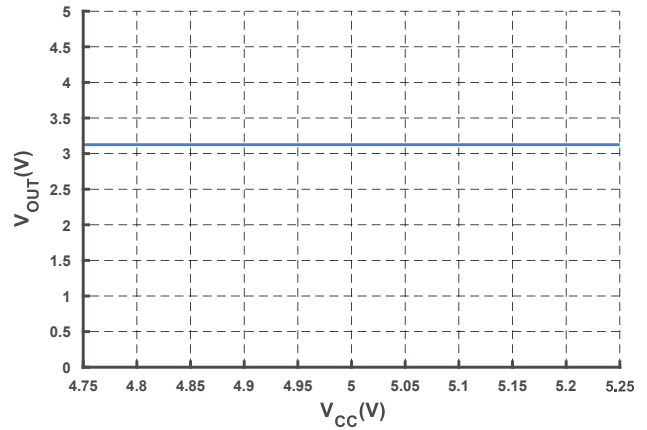


Figure 2. Output Voltage vs Supply Voltage (@ $I_P = I_{PN}$)

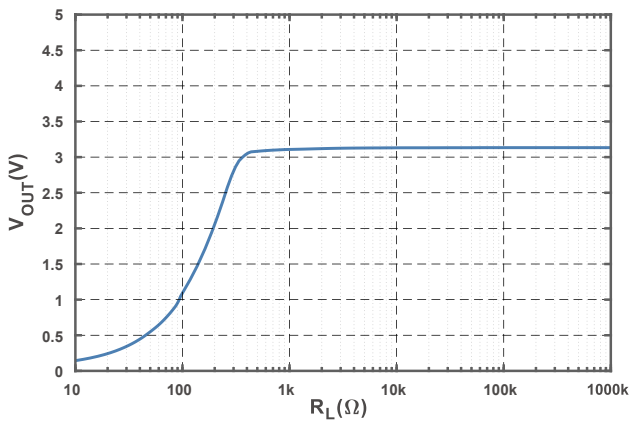


Figure 3. Output Voltage vs Load Resistance (@ $I_P = I_{PN}$)

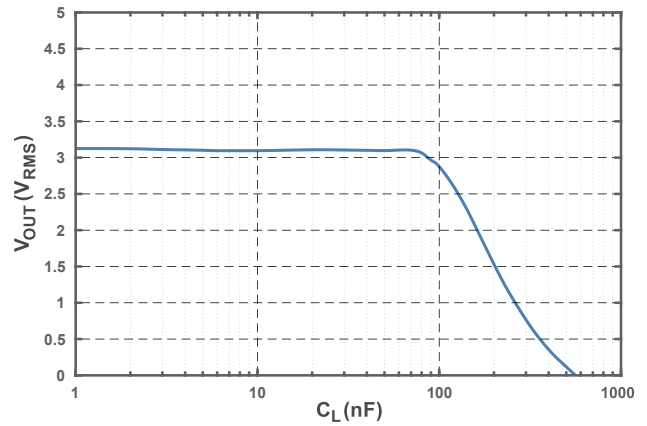


Figure 4. Output Voltage vs Load Capacitance (@ $I_P = I_{PN}$)

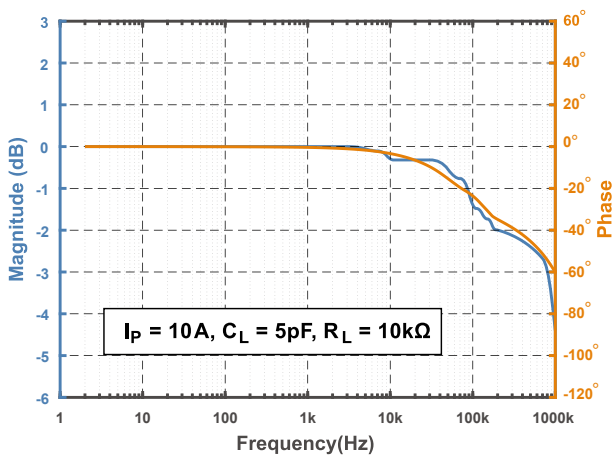


Figure 5. Bode Plot

3. Typical Temperature Characteristics

▲ AVG+3σ ■ AVG ◆ AVG-3σ

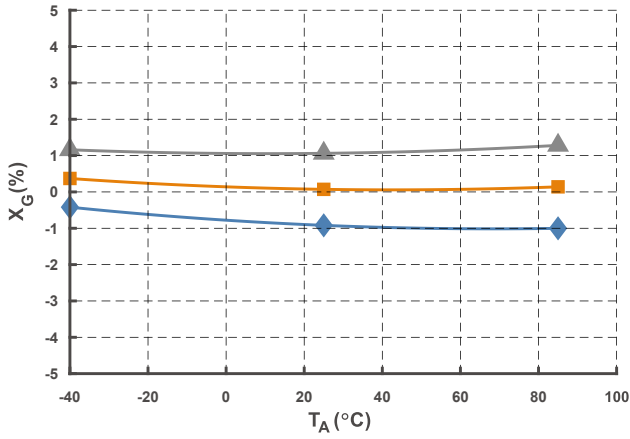


Figure 6. Accuracy

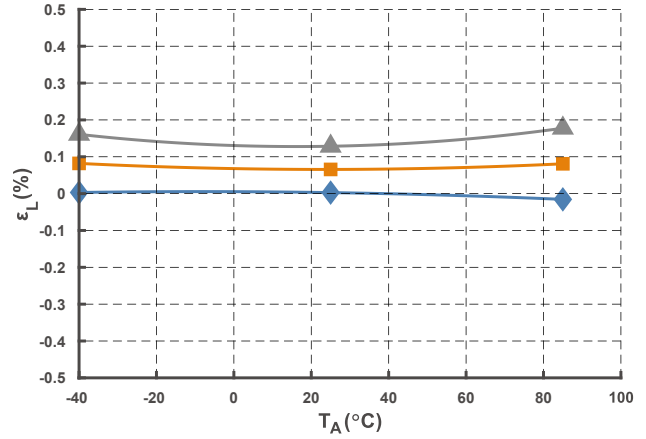


Figure 7. Linearity Error

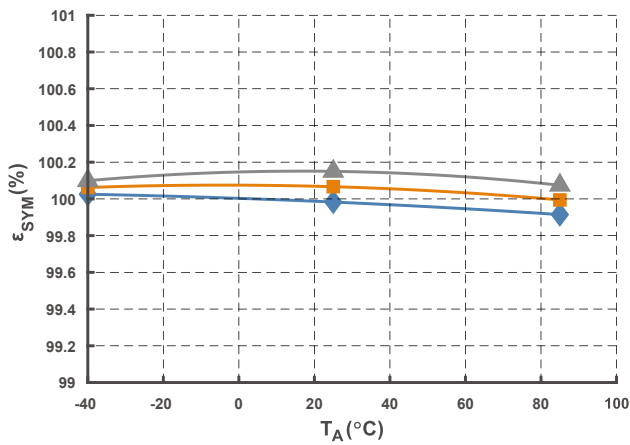


Figure 8. Symmetry

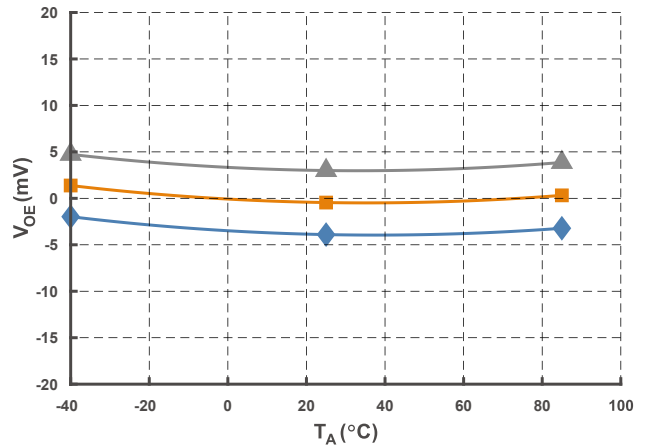


Figure 9. Offset Error

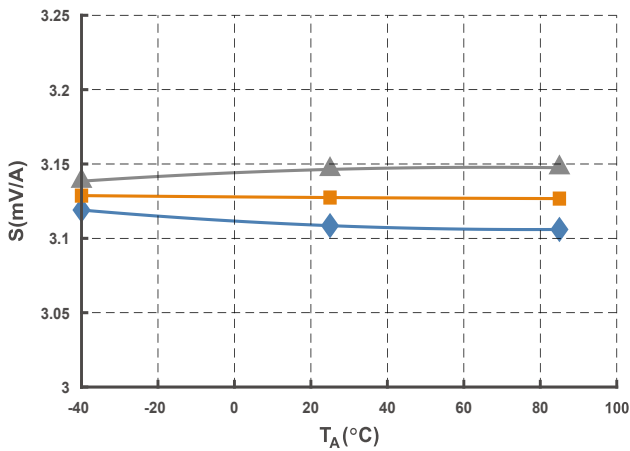


Figure 10. Sensitivity

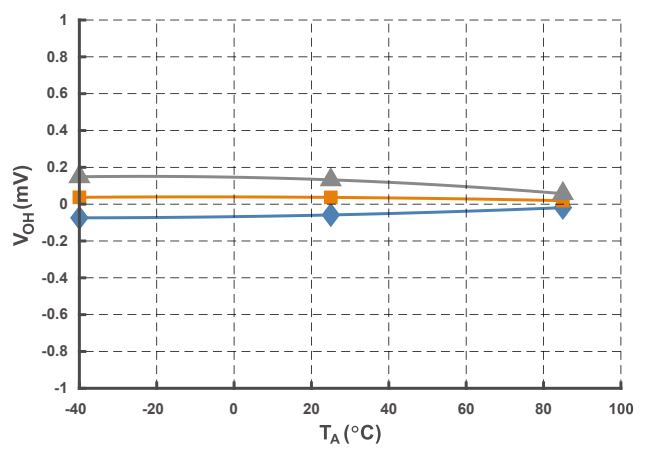


Figure 11. Hysteresis

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

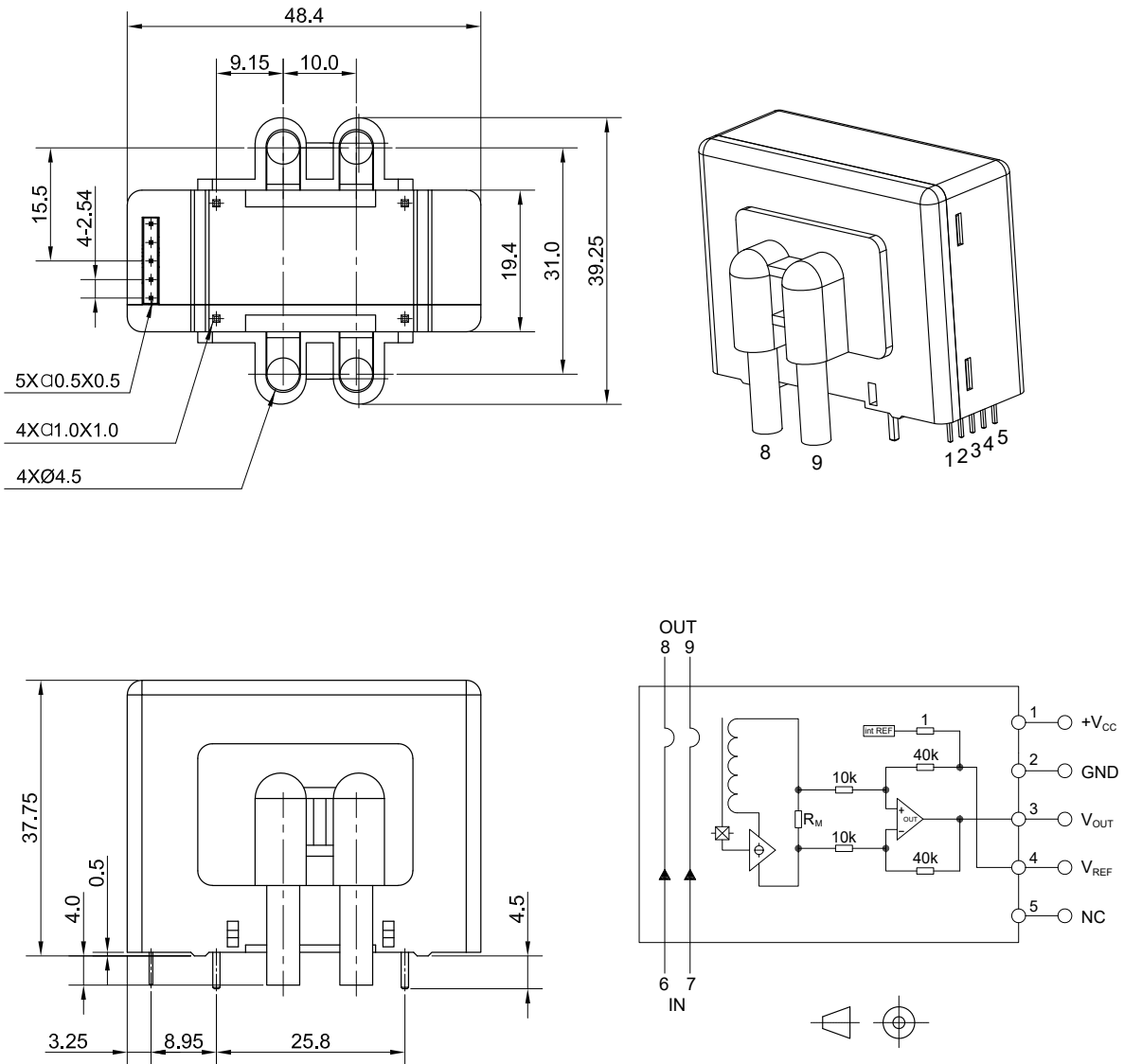
$$V_{OH} = \text{MAX } \Delta H$$

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

7) Offset Voltage

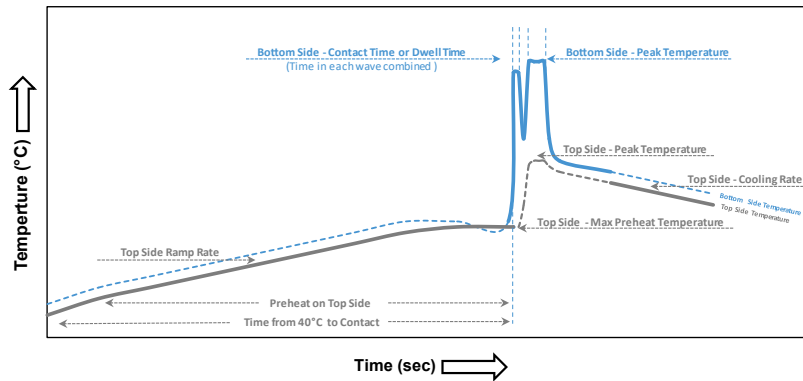
$$V_{OE} = V_{OUT(@ I_P = 0)} - V_{REF}$$

5. Dimensions



6. 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.

7. Recommended size of pad

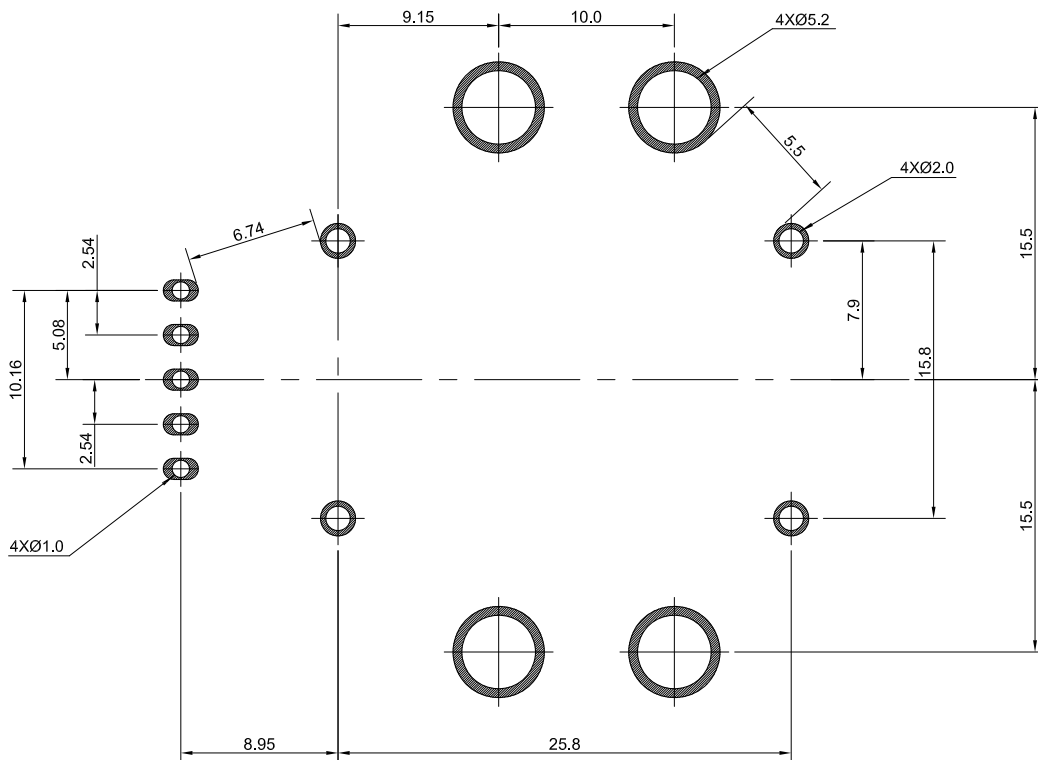


Figure 13. TMR7559-C Pin layout diagram (unit: mm)

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