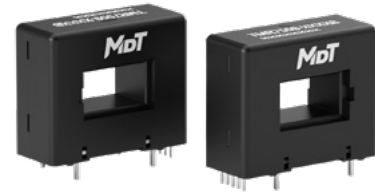


TMR7559-B

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 mode 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 | $M\Omega$ |
| 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 | 60 | 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} | TMR7559-1000B | - | 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 | $I_P = 0\text{ to } \pm I_{PN}$ | TMR7559-1000B | - | 6.25 | - | mV/A |
| | | | TMR7559-1500B | - | 4.167 | - | |
| | | | TMR7559-2000B | - | 3.125 | - | |
| | | | TMR7559-2500B | - | 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. Maximum Continuous DC Primary Current

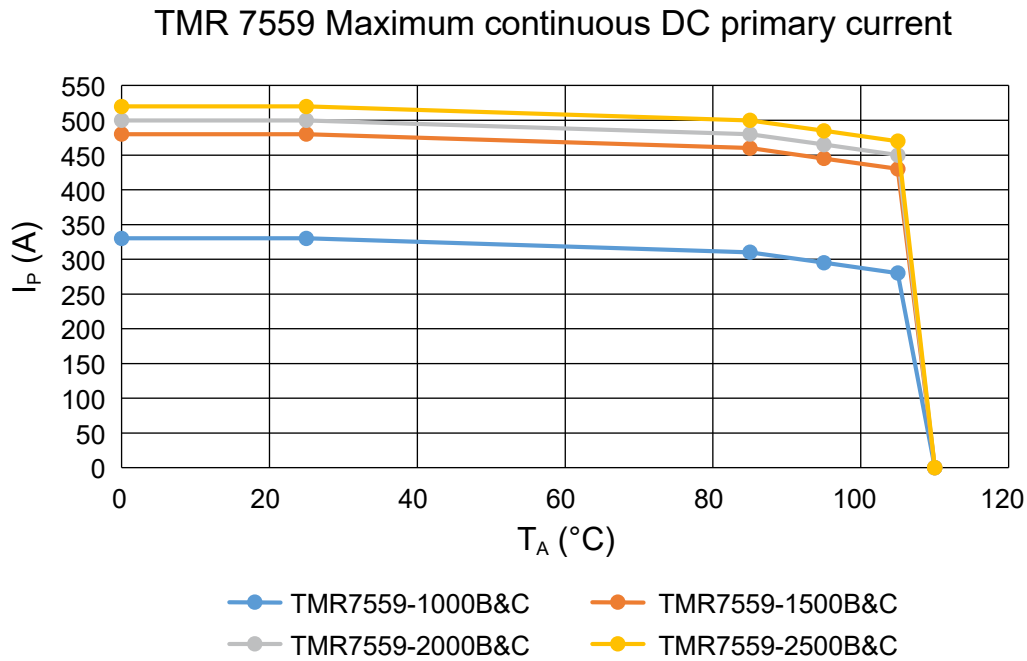


Figure 1. I_P vs T_A for TMR7559

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 $T_j < 125^\circ\text{C}$
- Primary conductor temperature $T_A < 110^\circ\text{C}$

3. Typical Output Characteristics

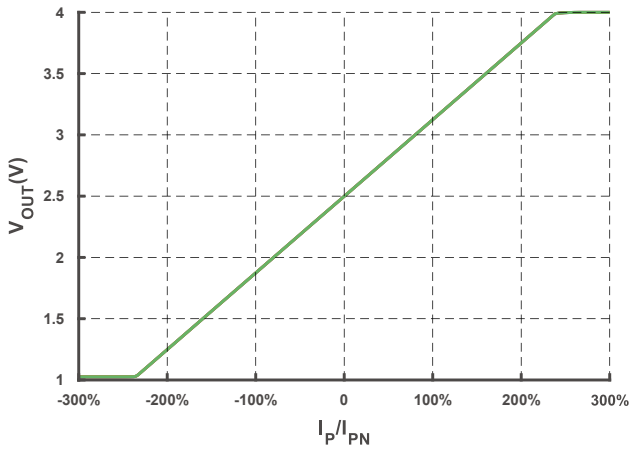


Figure 2. Output Voltage vs Primary Current

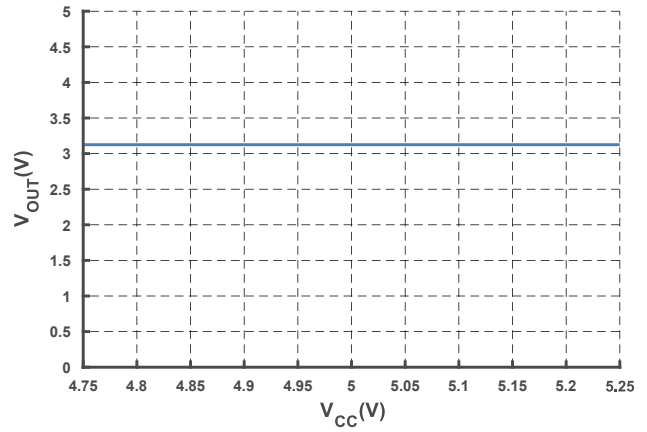


Figure 3. Output Voltage vs Supply Voltage (@ $I_P = I_{PN}$)

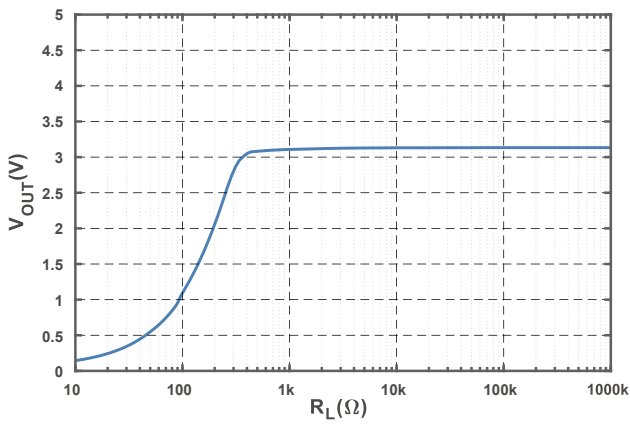


Figure 4. Output Voltage vs Load Resistance (@ $I_P = I_{PN}$)

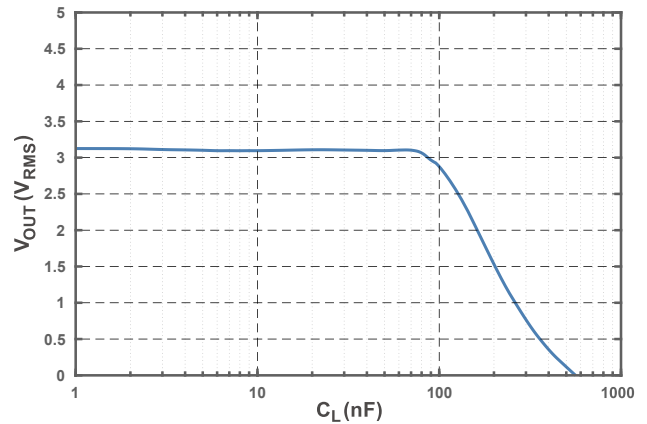


Figure 5. Output Voltage vs Load Capacitance (@ $I_P = I_{PN}$)

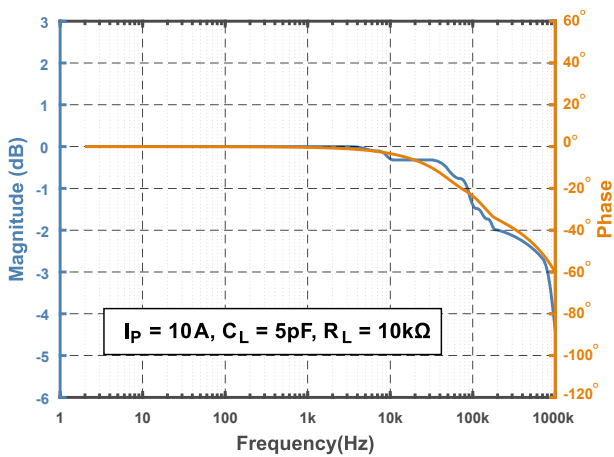


Figure 6. Bode Plot

4. Typical Temperature Characteristics

▲ AVG+3σ ■ AVG ◆ AVG-3σ

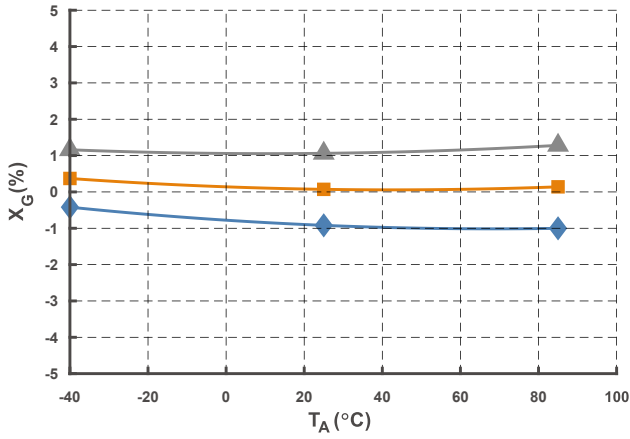


Figure 7. Accuracy

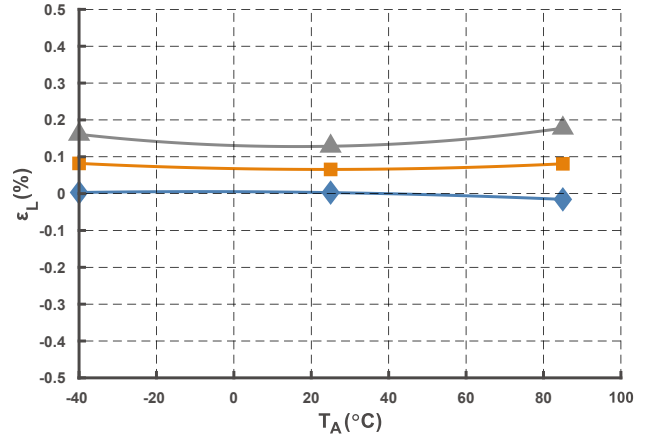


Figure 8. Linearity Error

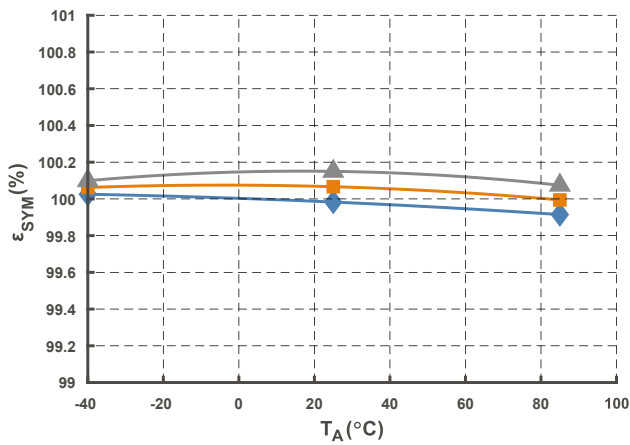


Figure 9. Symmetry

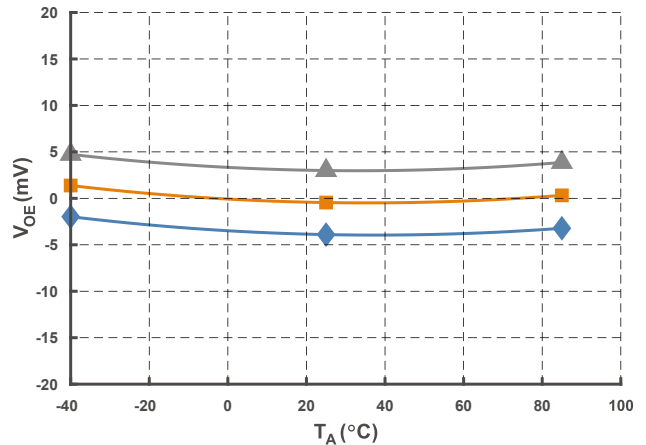


Figure 10. Offset Error

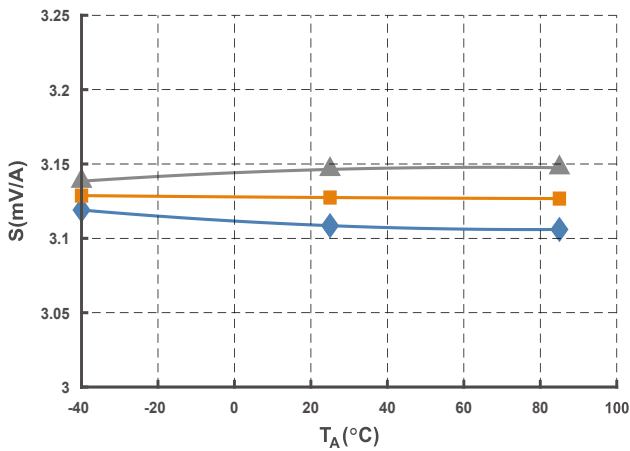


Figure 11. Sensitivity

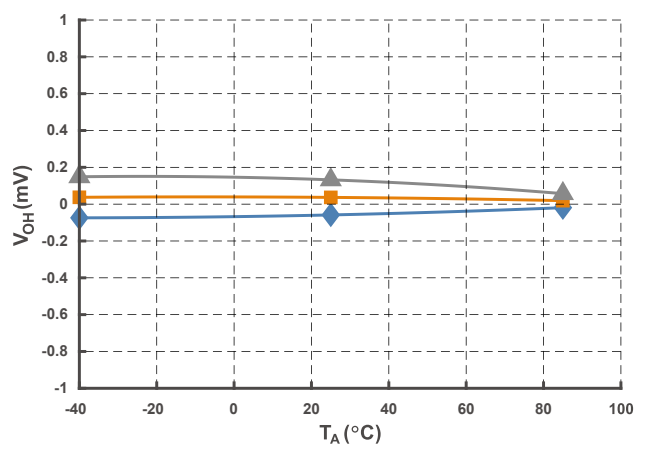


Figure 12. Hysteresis

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

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

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

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

6. Dimensions

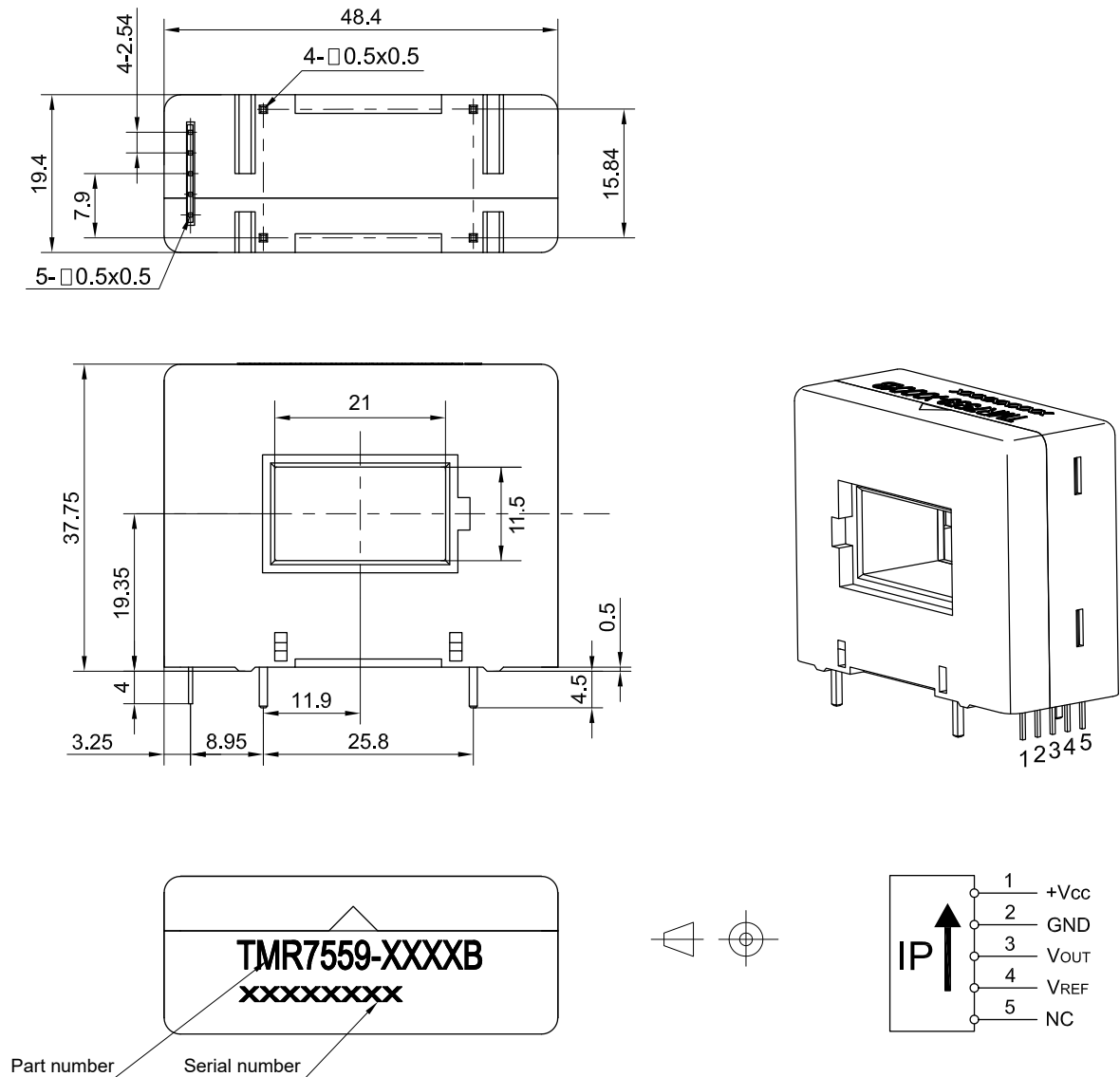


Figure 13. Dimension (unit: mm, tolerances for unmarked scales ± 1 mm)

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.

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