

Integrated Current Transducer GO-SME series

Definition

The GO-SME series is a LEM integrated current transducer solution made to sense AC and DC currents on a SOIC8 package in both industrial and automotive applications. When soldered on the PCB, the current will flow from pins 1-2 to 3-4 and our Hall Plates will sense on a differential mode. The differential sensing is allowing the transducer to reject any external common field coming from magnetic noisy environment. Proprietary stress and temperature compensation algorithm are implemented in the ASIC in order to achieve an accuracy of around 1 % over temperature depending on the reference. The primary conductor (pins 1 to 4) has a very low electrical resistance of 0.9 mΩ which enables excellent performance over temperature and low losses. GO-SME is capable of supporting continuous currents from 20 A RMS to 50 A RMS over different temperatures. The galvanic insulation between the primary pins (1 to 4) and secondary (5 to 8) eliminates the need for any additional insulation, reducing this way the total footprint and cost of the system.

Main features & Advantages

- Open loop multi-range current transducer: 50 A
- Low electrical resistance 0.9 mΩ
- Dual supply voltage 5 V or 3.3 V
- Low power consumption
- High bandwidth: 300 kHz
- No magnetic hysteresis
- Galvanic separation between primary and secondary with 4 mm of d_{ci} and d_{cp}
- Insulated test voltage 2400 V RMS
- Small footprint with standard surface mount PCB mounting
- AEC-Q-100 Grade 1.

Typical applications

- Small drives
- HVAC inverters
- Appliances
- Solar inverters
- E-Bikes
- Automotive & Industry qualified.

Standards

- IEC 61800-5-1: 2007
- IEC 62109-1: 2010
- IEC 62368-1:2018 (supersedes IEC 60950-1: 2005)
- UL 1577: 2014
- UL 62368: 2019.

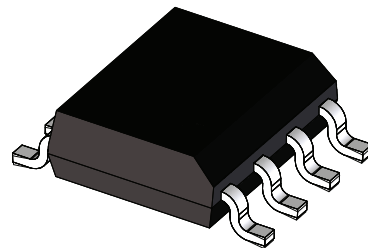


Figure 1: GO-SME package - SOIC-8
(Not to scale - For illustration: not representative)

Application circuit and pinout

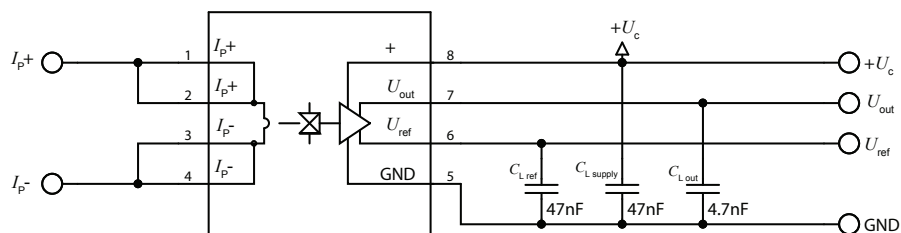


Figure 2: Application circuit

Table 1

| Pin# | Name | Function |
|--------|-----------|-------------------------------|
| 1 to 2 | I_{P+} | Input of the primary current |
| 3 to 4 | I_{P-} | Output of the primary current |
| 5 | GND | Ground terminal |
| 6 | U_{ref} | Reference voltage |
| 7 | U_{out} | Output voltage |
| 8 | $+U_C$ | Supply voltage |

Table 2

| External circuit example# | Min | Typ | Max | Unit |
|---------------------------|-----|-----|-----|------|
| $C_{L out}$ | | 4.7 | 6 | nF |
| $C_{L supply}$ | | 47 | | nF |
| $C_{L ref}$ | | 47 | 100 | nF |

Available products

| Product name# | Current measurement range (A max) | Nominal current (A RMS) ¹⁾ | Supply voltage U_c | Ratiometricity | Temperature range (°C) |
|---------------|-----------------------------------|---------------------------------------|----------------------|----------------|------------------------|
| GO 10-SME | ±25 | ±10 | 5 V | N | -40 ... 125 °C |
| GO 20-SME | ±50 | ±20 | 5 V | N | |
| GO 12-SME/SP2 | ±30 | ±12 | 5 V | Y | |
| GO 20-SME/SP2 | ±50 | ±20 | 5 V | Y | |
| GO 10-SME/SP3 | ±25 | ±10 | 3.3 V | N | |
| GO 20-SME/SP3 | ±50 | ±20 | 3.3 V | N | |
| GO 8-SME/SP4 | ±20 | ±8 | 3.3 V | Y | |
| GO 15-SME/SP4 | ±37.5 | ±15 | 3.3 V | Y | |

Other ratios available, contact LEM for more options.

Note: ¹⁾ Trimmings at LEM are done at this nominal current.

Block diagram

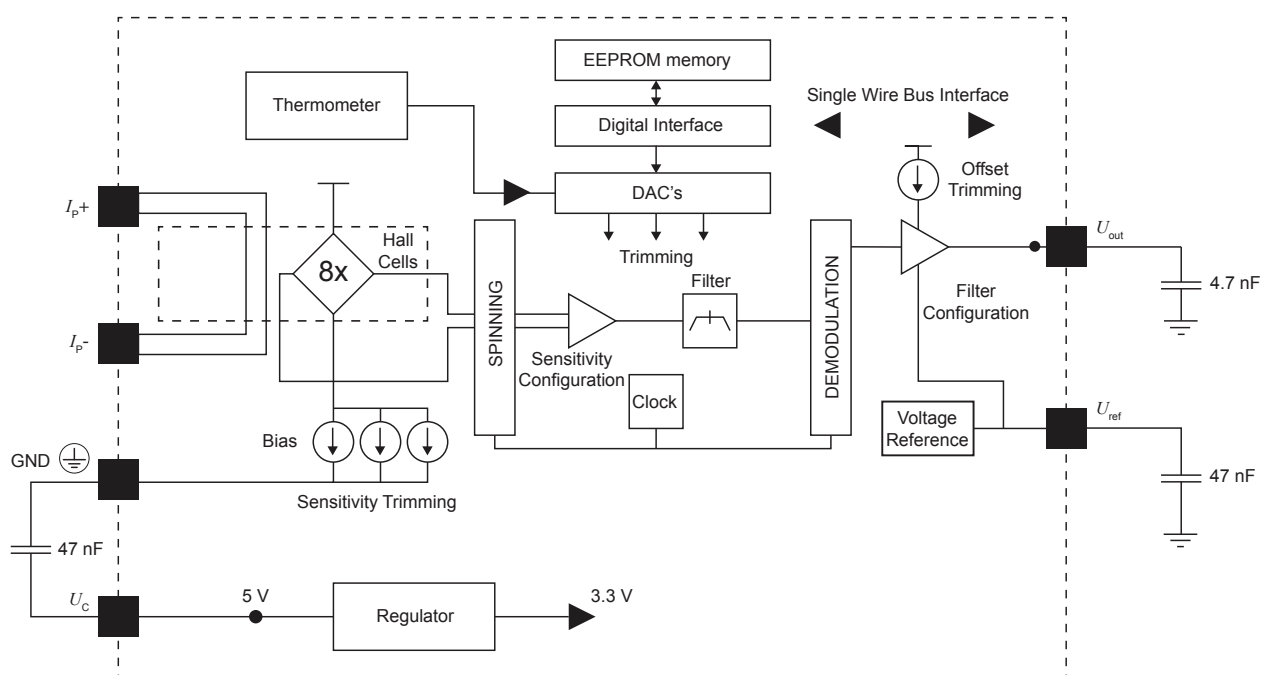


Figure 3: Block diagram GO-SME

Absolute maximum ratings

| Parameter | Symbol | Unit | Min | Max | Conditions |
|-------------------------------|-------------------|------|-----|-----|------------|
| Ambient operating temperature | T_A | °C | -40 | 125 | |
| Ambient storage temperature | $T_{A\text{st}}$ | °C | -40 | 150 | |
| Maximum junction temperature | $T_{J\text{max}}$ | °C | | 165 | |
| Output sink current | | mA | | 50 | |
| Output source current | | mA | | 25 | |

Absolute maximum ratings apply at 25 °C unless otherwise noted.
 Stresses above these ratings may cause permanent damage.
 Exposure to absolute maximum ratings for extended periods may degrade reliability.

Environmental and mechanical characteristics

| Parameter | Symbol | Unit | Value |
|--|----------------------|------|-------|
| Maximum supply voltage (not destructive) | $U_{C\text{max}}$ | V | 8 |
| Maximum supply voltage on other pins (not entering non-standard modes) | | | 6.5 |
| Electrostatic discharge voltage (HMB-Human Body Model) | $U_{\text{ESD HBM}}$ | kV | 2 |
| Electrostatic discharge voltage (CDM-Charged Device Model) | $U_{\text{ESD CDM}}$ | V | 500 |
| Thermal resistance junction to board ¹⁾ | $R_{\text{th JB}}$ | K/W | 15 |
| Time constant (to reach steady state) | t | s | 1 |
| Mass | m | g | 0.07 |

Note: ¹⁾ Done with LEM evaluation board PCB 2320-00 described on later paragraph.

| Parameter | Symbol | Unit | Value | Comment |
|--|----------|------|-------------------|---|
| RMS voltage for AC insulation test, 50 Hz, 1 min | U_d | kV | 2.5 ¹⁾ | According to IEC 62368 |
| RMS voltage for AC insulation test, 60 Hz, 1 min | U_d | kV | 2.5 | According to UL 62368 & UL 1577 |
| RMS voltage for AC insulation test, 50 Hz, 1 min | U_d | kV | 2.5 | According to IEC 60664-1 |
| Impulse withstand voltage 1.2/50 μ s | U_{Ni} | kV | 4 | According to IEC 62109-1, IEC 61800-5-1 |
| Partial discharge recurring peak voltage | U_{PD} | V | 330 | According to IEC 62109-1, IEC 61800-5-1 |
| Partial discharge test inception RMS voltage ²⁾ | U_i | V | 619 | According to IEC 62109-1, IEC 61800-5-1 |
| Partial discharge extinction RMS test voltage | | V | 495 | According to IEC 62109-1, IEC 61800-5-1 |
| Clearance (pri. - sec.) | d_{Cl} | mm | 4 | Shortest distance through air |
| Creepage distance (pri. - sec.) | d_{Cp} | | | Shortest path along body |
| Comparative tracking index | CTI | | 600 | Grade requirements mass compound |

Notes: ¹⁾ Tested at 2.5 kV in production

²⁾ $U_i = U_{PD} \cdot 1.875$.

Working voltage according to IEC 62368-1

| Working voltages | | PD 2 | Standards |
|-----------------------|--------------------|---------|---|
| Basic insulation | RMS voltage | > 600 V | According to IEC 62368-1 (replacing IEC 60950-1) |
| | Peak or DC voltage | 847 V | |
| Reinforced insulation | RMS voltage | 300 V | |
| | Peak or DC voltage | 423 V | |

Rated insulation voltage according to IEC 61800-5-1 / IEC 62109-1

| Rated insulation voltage | | OV II / PD 2 | OV III / PD 2 | Standards |
|--------------------------|--------------------|--------------|---------------|---|
| Basic insulation | RMS voltage | 600 / 600 | 300 / 300 | According to IEC 61800-5-1 and IEC 62109-1 |
| | Peak or DC voltage | NA/ 848 | NA/ 424 | |
| Reinforced insulation | RMS voltage | 300 / 300 | 150 / 150 | |
| | Peak or DC voltage | NA/ 424 | NA/ 212 | |

UL 62368-1 Audio/Video, information and communication technology equipment - Component

File # E521147, Vol 1

Audio/Video, Information and Communication Technology Equipment - component, 4800 V AC Insulation

Standard

- UL 62368-1, Audio/video, information and communication technology equipment.

Marking

Only those products bearing the UL or UR Mark should be considered to be Listed or Recognized and covered under UL's Follow-Up Service. Always look for the Mark on the product.

UL 1577 Non Optical isolating devices - Component

File # E486776, Vol 1

Single protection, non-optical isolators, 2500 V AC insulation

Standards

- UL 1577, Optical Isolators;
- CSA Component Acceptance Service Notice N°. 5 A, Component Acceptance Service for Optocouplers and Related Devices.

Marking

Only those products bearing the UL or UR Mark should be considered to be Listed or Recognized and covered under UL's Follow-Up Service. Always look for the Mark on the product.

Common electrical data (independent of sensitivity)

At $T_A = 25\text{ °C}$, $U_C = +5\text{ V}$ or $+3.3\text{ V}$, $R_L = 100\text{ k}\Omega$ unless otherwise noted
(see Definition of typical, minimum and maximum values paragraph in [page 12](#)).

| Parameter | Symbol | Unit | Min | Typ | Max | Conditions |
|--|---------------------|---------------|--------|-----|-------|---|
| DC supply voltage | U_C | V | 4.5 | 5 | 5.5 | Standard & SP2 versions |
| DC supply voltage | | | 3.14 | 3.3 | 3.47 | SP3 & SP4 versions |
| Output voltage range @ I_{PM} | $U_{out} - U_{ref}$ | V | -2 | | 2 | $U_C = 5\text{ V}$ |
| | | | -1.25 | | 1.25 | $U_C = 3.3\text{ V}$ |
| Output internal resistance of U_{out} | R_{out} | Ω | | 1 | 5 | Up to 10 kHz |
| Primary resistance @ $T_A = 25\text{ °C}$ | R_P | m Ω | | 0.9 | | |
| Internal series resistance of reference voltage source | R_{ref} | Ω | 120 | 200 | 333 | |
| Maximum output current source of U_{out} | | mA | 25 | | | Up to 10 kHz |
| Maximum input current sink of U_{out} | | mA | 20 | | | Up to 10 kHz |
| Output leakage current | | μA | | 2 | 20 | |
| Maximum output current source of U_{ref} | | mA | | 0.5 | | |
| Maximum input current sink of U_{ref} | | mA | | 0.5 | | |
| Load capacitance on U_{out} | C_L | nF | 0 | 4.7 | 6 | |
| Load capacitance on U_{ref} | | | 0 | 47 | 100 | |
| DC current consumption | I_C | mA | | 20 | 26 | $U_C = 5\text{ V}$ |
| | | | | 20 | 26 | $U_C = 3.3\text{ V}$ |
| Electrical offset voltage | U_{OE} | mV | -5 | | 5 | $U_{out} - U_{ref}$ @ $U_{ref} = 2.5\text{ V}$ |
| Temperature coefficient of U_{ref} | TCU_{ref} | ppm/K | -170 | | 170 | -40 °C... +125 °C |
| Temperature coefficient of U_{OE} | TCU_{OE} | mV/K | -0.075 | | 0.075 | -40 °C... +125 °C |
| Delay time to 10 % of the final output value for I_{PN} step | t_{D10} | ms | | | 1.5 | |
| Delay time to 90 % of the final output value for I_{PN} step | t_{D90} | ms | | | 2 | |
| Frequency bandwidth -3 dB, $T_A = 25\text{ °C}$ | BW | kHz | | 300 | | |

Electrical data GO 10-SME

GO-SME series

At $T_A = 25\text{ °C}$, $U_C = +5\text{ V}$, $R_L = 100\text{ k}\Omega$ unless otherwise noted
(see Definition of typical, minimum and maximum values paragraph in [page 12](#)).

| Parameter | Symbol | Unit | Min | Typ | Max | Conditions |
|---|----------------------|---------------------------|-------|---------|---------|----------------------|
| Primary nominal RMS current | I_{PN} | A | | 10 | | |
| Primary current, measuring range | I_{PM} | A | -25 | | 25 | |
| Internal reference voltage @ $I_{PN} = 0$ | U_{Iref} | V | 2.48 | 2.5 | 2.52 | |
| Nominal sensitivity | S_N | mV/A | | 80 | | 800 mV @ I_{PN} |
| Temperature coefficient of S | TCS | ppm/K | -150 | | 150 | -40 °C ... 125 °C |
| Electrical offset current referred to I_{PN} | I_{OE} | mA | -62.5 | | 62.5 | |
| Temperature coefficient of I_{OE} | TCI_{OE} | mA/K | -0.94 | | 0.94 | -40 °C ... 125 °C |
| Lifetime offset drift | | mV | | ± 2 | | |
| Noise voltage spectral density | u_{no} | $\frac{\mu V}{\sqrt{Hz}}$ | | 14.5 | | |
| Sensitivity error | ε_S | % | -1 | | 1 | |
| Lifetime sensitivity error | | % S | | ± 1 | ± 2 | |
| Linearity error 0 ... I_{PN} | ε_L | % of I_{PN} | -0.3 | | 0.3 | Referred to I_{PN} |
| Linearity error 0 ... I_{PM} | ε_L | % of I_{PM} | -0.6 | | 0.6 | Referred to I_{PM} |
| Sum of sensitivity and linearity @ I_{PN} , @ $T_A = 25\text{ °C}$ | ε_{SL25} | % of I_{PM} | -0.7 | | 0.7 | |
| Total error over temperature | ε_{tot} | % of I_{PM} | -1 | | 1 | |

Electrical data GO 20-SME

At $T_A = 25\text{ °C}$, $U_C = +5\text{ V}$, $R_L = 100\text{ k}\Omega$ unless otherwise noted
(see Definition of typical, minimum and maximum values paragraph in [page 12](#)).

| Parameter | Symbol | Unit | Min | Typ | Max | Conditions |
|---|----------------------|---------------------------|-------|---------|------|----------------------|
| Primary nominal RMS current | I_{PN} | A | | 20 | | |
| Primary current, measuring range | I_{PM} | A | -50 | | 50 | |
| Internal reference voltage @ $I_{PN} = 0$ | U_{Iref} | V | 2.48 | 2.5 | 2.52 | |
| Nominal sensitivity | S_N | mV/A | | 40 | | 800 mV @ I_{PN} |
| Temperature coefficient of S | TCS | ppm/K | -150 | | 150 | -40 °C ... 125 °C |
| Electrical offset current referred to I_{PN} | I_{OE} | mA | -125 | | 125 | |
| Temperature coefficient of I_{OE} | TCI_{OE} | mA/K | -1.88 | | 1.88 | -40 °C ... 125 °C |
| Lifetime offset drift | | mV | | ± 2 | | |
| Noise voltage spectral density | u_{no} | $\frac{\mu V}{\sqrt{Hz}}$ | | 7 | | |
| Sensitivity error | ε_S | % | -1 | | 1 | |
| Lifetime sensitivity error | | % S | | ± 2 | | |
| Linearity error 0 ... I_{PN} | ε_L | % of I_{PN} | -0.3 | | 0.3 | Referred to I_{PN} |
| Linearity error 0 ... I_{PM} | ε_L | % of I_{PM} | -0.6 | | 0.6 | Referred to I_{PM} |
| Sum of sensitivity and linearity @ I_{PN} , @ $T_A = 25\text{ °C}$ | ε_{SL25} | % of I_{PM} | -0.7 | | 0.7 | |
| Total error over temperature | ε_{tot} | % of I_{PM} | -1 | | 1 | |

Electrical data GO 12-SME/SP2

GO-SME series

At $T_A = 25\text{ °C}$, $U_C = +5\text{ V}$, $R_L = 100\text{ k}\Omega$ unless otherwise noted
(see Definition of typical, minimum and maximum values paragraph in [page 12](#)).

| Parameter | Symbol | Unit | Min | Typ | Max | Conditions |
|---|----------------------|---------------------------|-------|-------|------|----------------------|
| Primary nominal RMS current | I_{PN} | A | | 12.12 | | |
| Primary current, measuring range | I_{PM} | A | -30.3 | | 30.3 | |
| Internal reference voltage @ $I_{PN} = 0$ | $U_{I\text{ref}}$ | V | 2.48 | 2.5 | 2.52 | |
| Nominal sensitivity | S_N | mV/A | | 66 | | 800 mV @ I_{PN} |
| Temperature coefficient of S | TCS | ppm/K | -150 | | 150 | -40 °C ... 125 °C |
| Electrical offset current referred to I_{PN} | I_{OE} | mA | -75.7 | | 75.7 | |
| Temperature coefficient of I_{OE} | TCI_{OE} | mA/K | -1.14 | | 1.14 | -40 °C ... 125 °C |
| Lifetime offset drift | | mV | | ±2 | | |
| Noise voltage spectral density | u_{no} | $\frac{\mu V}{\sqrt{Hz}}$ | | 12.5 | | |
| Sensitivity error | ε_S | % | -1 | | 1 | |
| Lifetime sensitivity error | | % S | | ±1 | ±2 | |
| Linearity error 0 ... I_{PN} | ε_L | % of I_{PN} | -0.3 | | 0.3 | Referred to I_{PN} |
| Linearity error 0 ... I_{PM} | ε_L | % of I_{PM} | -0.6 | | 0.6 | Referred to I_{PM} |
| Sum of sensitivity and linearity @ I_{PN} , @ $T_A = 25\text{ °C}$ | ε_{SL25} | % of I_{PM} | -0.7 | | 0.7 | |
| Total error over temperature | ε_{tot} | % of I_{PM} | -1 | | 1 | |

Electrical data GO 20-SME/SP2

At $T_A = 25\text{ °C}$, $U_C = +5\text{ V}$, $R_L = 100\text{ k}\Omega$ unless otherwise noted
(see Definition of typical, minimum and maximum values paragraph in [page 12](#)).

| Parameter | Symbol | Unit | Min | Typ | Max | Conditions |
|---|----------------------|---------------------------|-------|-----|------|----------------------|
| Primary nominal RMS current | I_{PN} | A | | 20 | | |
| Primary current, measuring range | I_{PM} | A | -50 | | 50 | |
| Internal reference voltage @ $I_{PN} = 0$ | $U_{I\text{ref}}$ | V | 2.48 | 2.5 | 2.52 | |
| Nominal sensitivity | S_N | mV/A | | 40 | | 800 mV @ I_{PN} |
| Temperature coefficient of S | TCS | ppm/K | -150 | | 150 | -40 °C ... 125 °C |
| Electrical offset current referred to I_{PN} | I_{OE} | mA | -125 | | 125 | |
| Temperature coefficient of I_{OE} | TCI_{OE} | mA/K | -1.88 | | 1.88 | -40 °C ... 125 °C |
| Lifetime offset drift | | mV | | ±2 | | |
| Noise voltage spectral density | u_{no} | $\frac{\mu V}{\sqrt{Hz}}$ | | 7 | | |
| Sensitivity error | ε_S | % | -1 | | 1 | |
| Lifetime sensitivity error | | % S | | ±1 | ±2 | |
| Linearity error 0 ... I_{PN} | ε_L | % of I_{PN} | -0.3 | | 0.3 | Referred to I_{PN} |
| Linearity error 0 ... I_{PM} | ε_L | % of I_{PM} | -0.6 | | 0.6 | Referred to I_{PM} |
| Sum of sensitivity and linearity @ I_{PN} , @ $T_A = 25\text{ °C}$ | ε_{SL25} | % of I_{PM} | -0.7 | | 0.7 | |
| Total error over temperature | ε_{tot} | % of I_{PM} | -1 | | 1 | |

Electrical data GO 10-SME/SP3

GO-SME series

At $T_A = 25\text{ °C}$, $U_C = +3.3\text{ V}$, $R_L = 100\text{ k}\Omega$ unless otherwise noted
(see Definition of typical, minimum and maximum values paragraph in [page 12](#)).

| Parameter | Symbol | Unit | Min | Typ | Max | Conditions |
|---|----------------------|---------------------------|------|---------|---------|----------------------|
| Primary nominal RMS current | I_{PN} | A | | 10 | | |
| Primary current, measuring range | I_{PM} | A | -25 | | 25 | |
| Internal reference voltage @ $I_{PN} = 0$ | $U_{I\text{ref}}$ | V | 1.63 | 1.65 | 1.67 | |
| Nominal sensitivity | S_N | mV/A | | 50 | | 500 mV @ I_{PN} |
| Temperature coefficient of S | TCS | ppm/K | -150 | | 150 | -40 °C ... 125 °C |
| Electrical offset current referred to I_{PN} | I_{OE} | mA | -100 | | 100 | |
| Temperature coefficient of I_{OE} | TCI_{OE} | mA/K | -1.5 | | 1.5 | -40 °C ... 125 °C |
| Lifetime offset drift | | mV | | ± 2 | | |
| Noise voltage spectral density | u_{no} | $\frac{\mu V}{\sqrt{Hz}}$ | | 8 | | |
| Sensitivity error | ε_S | % | -1 | | 1 | |
| Lifetime sensitivity error | | % S | | ± 1 | ± 2 | |
| Linearity error 0 ... I_{PN} | ε_L | % of I_{PN} | -0.3 | | 0.3 | Referred to I_{PN} |
| Linearity error 0 ... I_{PM} | ε_L | % of I_{PM} | -0.6 | | 0.6 | Referred to I_{PM} |
| Sum of sensitivity and linearity @ I_{PN} , @ $T_A = 25\text{ °C}$ | ε_{SL25} | % of I_{PM} | -0.7 | | 0.7 | |
| Total error over temperature | ε_{tot} | % of I_{PM} | -1 | | 1 | |

Electrical data GO 20-SME/SP3

At $T_A = 25\text{ °C}$, $U_C = +3.3\text{ V}$, $R_L = 100\text{ k}\Omega$ unless otherwise noted
(see Definition of typical, minimum and maximum values paragraph in [page 12](#)).

| Parameter | Symbol | Unit | Min | Typ | Max | Conditions |
|---|----------------------|---------------------------|------|---------|---------|----------------------|
| Primary nominal RMS current | I_{PN} | A | | 20 | | |
| Primary current, measuring range | I_{PM} | A | -50 | | 50 | |
| Internal reference voltage @ $I_{PN} = 0$ | $U_{I\text{ref}}$ | V | 1.63 | 1.65 | 1.67 | |
| Nominal sensitivity | S_N | mV/A | | 25 | | 500 mV @ I_{PN} |
| Temperature coefficient of S | TCS | ppm/K | -150 | | 150 | -40 °C ... 125 °C |
| Electrical offset current referred to I_{PN} | I_{OE} | mA | -200 | | 200 | |
| Temperature coefficient of I_{OE} | TCI_{OE} | mA/K | -3 | | 3 | -40 °C ... 125 °C |
| Lifetime offset drift | | mV | | ± 2 | | |
| Noise voltage spectral density | u_{no} | $\frac{\mu V}{\sqrt{Hz}}$ | | 4.5 | | |
| Sensitivity error | ε_S | % | -1 | | 1 | |
| Lifetime sensitivity error | | % S | | ± 1 | ± 2 | |
| Linearity error 0 ... I_{PN} | ε_L | % of I_{PN} | -0.3 | | 0.3 | Referred to I_{PN} |
| Linearity error 0 ... I_{PM} | ε_L | % of I_{PM} | -0.6 | | 0.6 | Referred to I_{PM} |
| Sum of sensitivity and linearity @ I_{PN} , @ $T_A = 25\text{ °C}$ | ε_{SL25} | % of I_{PM} | -0.7 | | 0.7 | |
| Total error over temperature | ε_{tot} | % of I_{PM} | -1 | | 1 | |

Electrical data GO 8-SME/SP4

At $T_A = 25\text{ °C}$, $U_C = +3.3\text{ V}$, $R_L = 100\text{ k}\Omega$ unless otherwise noted (see Definition of typical, minimum and maximum values paragraph in [page 12](#)).

| Parameter | Symbol | Unit | Min | Typ | Max | Conditions |
|---|----------------------|---------------------------|------|------|------|---|
| Primary nominal RMS current | I_{PN} | A | | 8 | | |
| Primary current, measuring range | I_{PM} | A | -20 | | 20 | |
| Internal reference voltage @ $I_{PN} = 0$ | U_{Iref} | V | 1.63 | 1.65 | 1.67 | |
| Nominal sensitivity | S_N | mV/A | | 50 | | 500 mV @ I_{PN} |
| Temperature coefficient of S | TCS | ppm/K | -230 | | 230 | -40 °C ... 125 °C, including ratiometricity error |
| Electrical offset current referred to I_{PN} | I_{OE} | mA | -80 | | 80 | |
| Temperature coefficient of I_{OE} | TCI_{OE} | mA/K | -1.2 | | 1.2 | -40 °C ... 125 °C |
| Lifetime offset drift | | mV | | ±2 | | |
| Noise voltage spectral density | u_{no} | $\frac{\mu V}{\sqrt{Hz}}$ | | 8 | | |
| Sensitivity error | ε_S | % | -1 | | 1 | |
| Ratiometricity error | ε_r | % | | ±0.5 | | |
| Ratiometricity offset error | ε_{rO} | mV | -10 | | 10 | $U_C = 3.3\text{ V} \pm 10\%$ |
| Lifetime sensitivity error | | % S | | ±1 | ±2 | |
| Linearity error 0 ... I_{PN} | ε_L | % of I_{PN} | -0.3 | | 0.3 | Referred to I_{PN} |
| Linearity error 0 ... I_{PM} | ε_L | % of I_{PM} | -0.6 | | 0.6 | Referred to I_{PM} |
| Sum of sensitivity and linearity @ I_{PN} , @ $T_A = 25\text{ °C}$ | ε_{SL25} | % of I_{PM} | -0.7 | | 0.7 | |
| Total error over temperature | ε_{tot} | % of I_{PM} | -1.2 | 0.5 | 1.2 | |

Electrical data GO 15-SME/SP4

At $T_A = 25\text{ °C}$, $U_C = +3.3\text{ V}$, $R_L = 100\text{ k}\Omega$ unless otherwise noted (see Definition of typical, minimum and maximum values paragraph in [page 12](#)).

| Parameter | Symbol | Unit | Min | Typ | Max | Conditions |
|---|----------------------|---------------------------|-------|-------|------|---|
| Primary nominal RMS current | I_{PN} | A | | 15 | | |
| Primary current, measuring range | I_{PM} | A | -37.5 | | 37.5 | |
| Internal reference voltage @ $I_{PN} = 0$ | U_{Iref} | V | 1.63 | 1.65 | 1.67 | |
| Nominal sensitivity | S_N | mV/A | | 41.67 | | 500 mV @ I_{PN} |
| Temperature coefficient of S | TCS | ppm/K | -230 | | 230 | -40 °C ... 125 °C, including ratiometricity error |
| Electrical offset current referred to I_{PN} | I_{OE} | mA | -125 | | 125 | |
| Temperature coefficient of I_{OE} | TCI_{OE} | mA/K | -1.88 | | 1.88 | -40 °C ... 125 °C |
| Lifetime offset drift | | mV | | ±2 | | |
| Noise voltage spectral density | u_{no} | $\frac{\mu V}{\sqrt{Hz}}$ | | 5 | | |
| Sensitivity error | ε_S | % | -1 | | 1 | |
| Ratiometricity error | ε_r | % | | ±0.5 | | |
| Ratiometricity offset error | ε_{rO} | mV | -10 | | 10 | $U_C = 3.3\text{ V} \pm 10\%$ |
| Lifetime sensitivity error | | % S | | ±1 | ±2 | |
| Linearity error 0 ... I_{PN} | ε_L | % of I_{PN} | -0.3 | | 0.3 | Referred to I_{PN} |
| Linearity error 0 ... I_{PM} | ε_L | % of I_{PM} | -0.6 | | 0.6 | Referred to I_{PM} |
| Sum of sensitivity and linearity @ I_{PN} , @ $T_A = 25\text{ °C}$ | ε_{SL25} | % of I_{PM} | -0.7 | | 0.7 | |
| Total error over temperature | ε_{tot} | % of I_{PM} | -1.2 | 0.5 | 1.2 | |

Definition of typical, minimum and maximum values

Minimum and maximum values for specified limiting and safety conditions have to be understood as such as well as values shown in "typical" graphs.

On the other hand, measured values are part of a statistical distribution that can be specified by an interval with upper and lower limits and a probability for measured values to lie within this interval.

Unless otherwise stated (e.g. "100 % tested"), the LEM definition for such intervals designated with "min" and "max" is that the probability for values of samples to lie in this interval is 99.73 %.

For a normal (Gaussian) distribution, this corresponds to an interval between -3 sigma and +3 sigma. If "typical" values are not obviously mean or average values, those values are defined to delimit intervals with a probability of 68.27 %, corresponding to an interval between -sigma and +sigma for a normal distribution.

Typical, maximal and minimal values are determined during the initial characterization of the product.

Thermal characteristics

When designing a system containing a current transducer, self-heating due to the flow of the current should be considered. When a current pass through, the transducer's temperature will increase, and this may affect its performance. This change on temperature will depend on the current profile, PCB layout, cooling techniques and copper thickness. The following plots show an example of different thermal responses of the GO-SME transducer when used on an evaluation LEM board described on later paragraph.

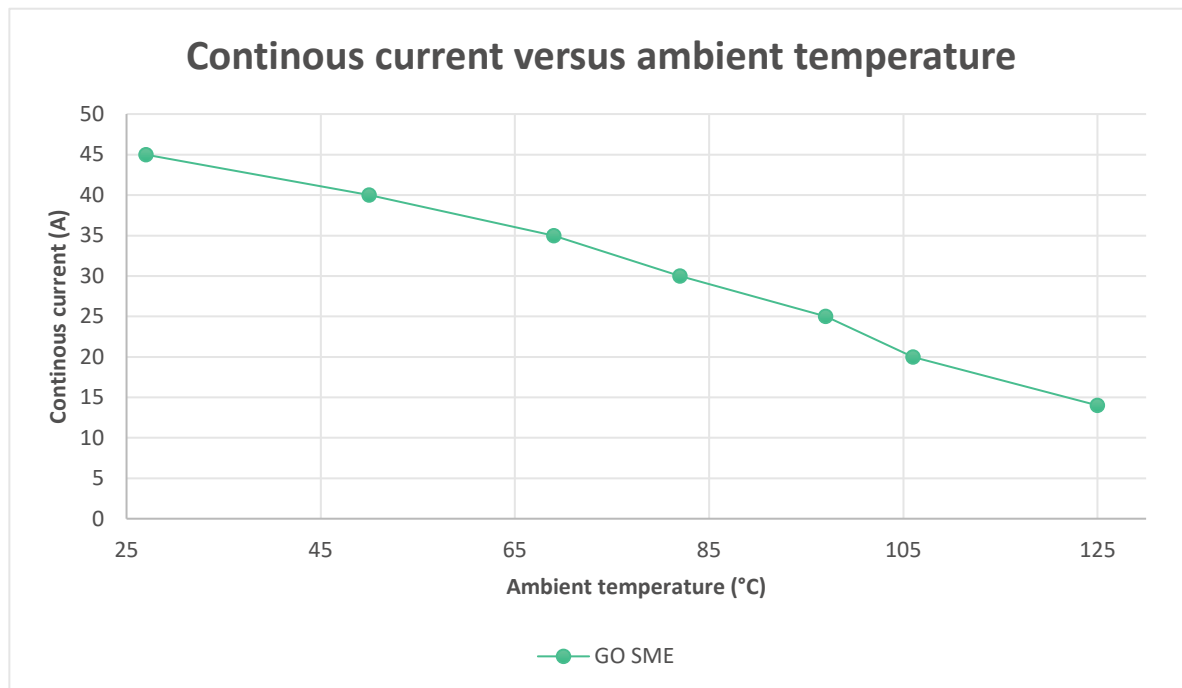


Figure 4: Continuous current vs temperature

The graph shows the mechanical capability of the GO-SME package.
 The maximum current measurement range of the product is limited at 50 A.
 The maximum temperature should be evaluated on the final system where the current transducer is integrated into the real application.
 This temperature should never exceed the maximum junction temperature as shown on the previous paragraphs.

Sensitivity error

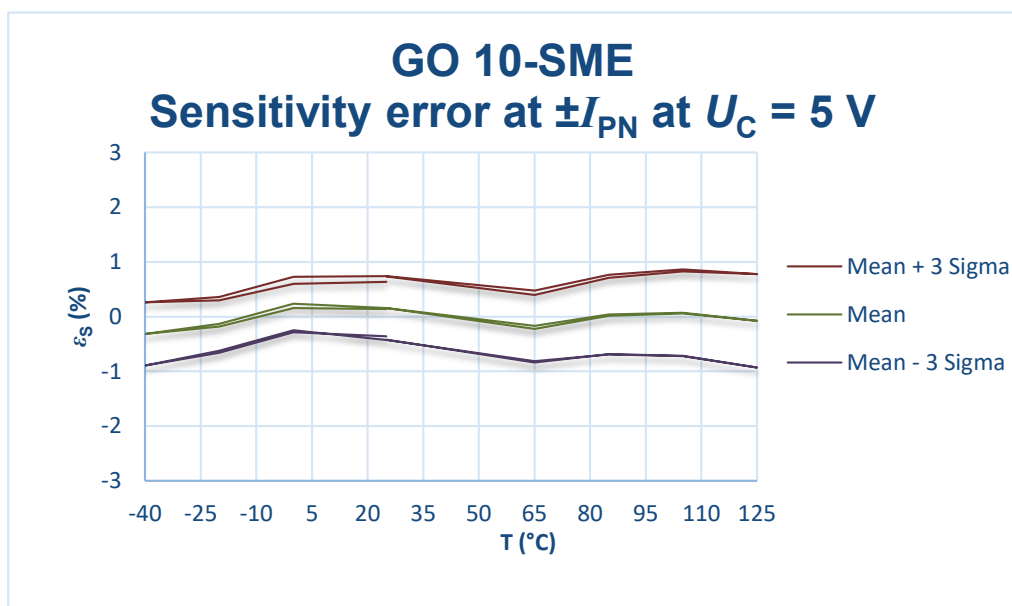


Figure 5: Sensitivity error (GO 10-SME)

Total error

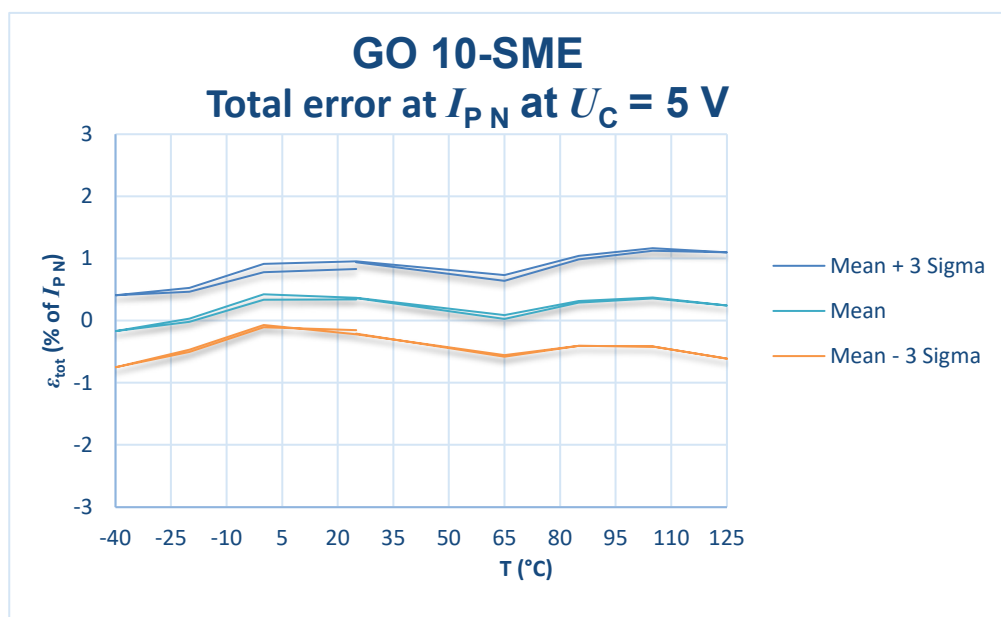


Figure 6: Total error over temperature

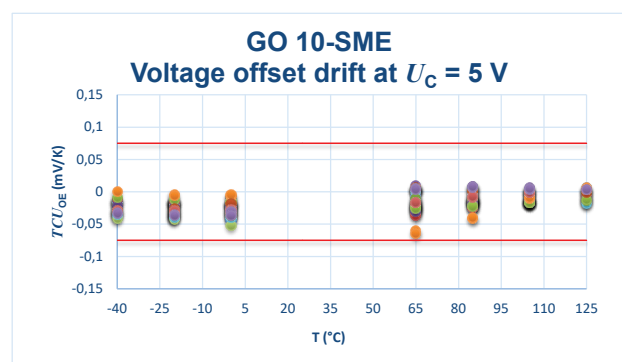
Delay time

Typical results measured on GO 10-SME @ I_{PN}

| Ambient temperature (°C) | Delay time @ 10 % | Limit | Delay time @ 90 % | Limit |
|--------------------------|-------------------|-------|-------------------|-------|
| 25 | 1.46 | 1.50 | 1.36 | 2.00 |
| 120 | 1.19 | 1.50 | 1.36 | 2.00 |
| -40 | 1.42 | 1.50 | 1.35 | 2.00 |

Drifts over temperature (GO 10-SME)

Voltage offset drift over temperature



Sensitivity drift over temperature

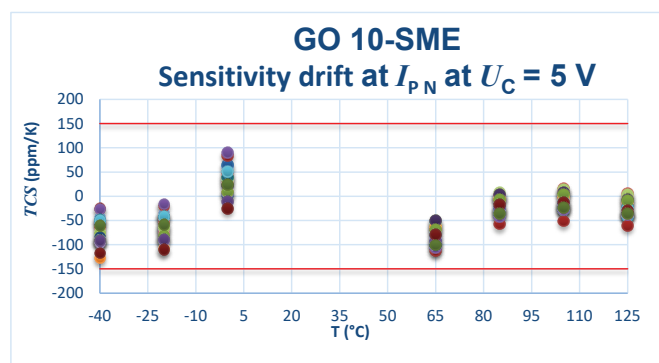


Figure 7: Drifts over temperature

Evaluation board PCB 2320

All the above results are based on a LEM evaluation board.

This evaluation board is available at our distributors or direct sales (please contact us).

Description:

Evaluation board is based on 6 x 105 μm (3oz) copper layers.

6 x 500 sq. mm copper stitched on primary side.

This layout improves thermal performances of the transducer.

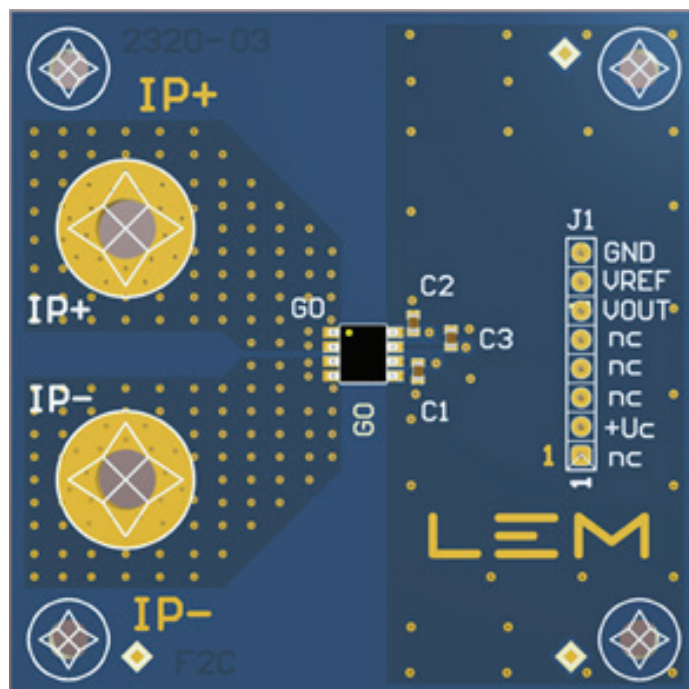


Figure 8: GO-SME Evaluation board

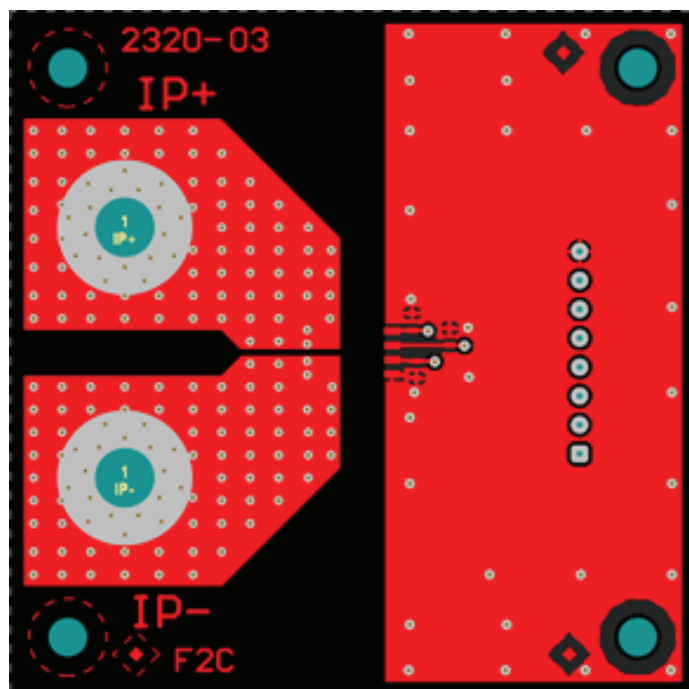


Figure 9: GO-SME Evaluation board layout

Contact LEM for more information about the evaluation board: <https://www.lem.com/en/go-series>

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Terms and definitions

Total error referred to primary

The total error ε_{tot} is the error at $\pm I_{PN}$, relative to the rated value I_{PN} .

It includes all errors mentioned above

- the electrical offset I_{OE}
- the magnetic offset I_{OM}
- the sensitivity error ε_S
- the linearity error ε_L (to I_{PN}).

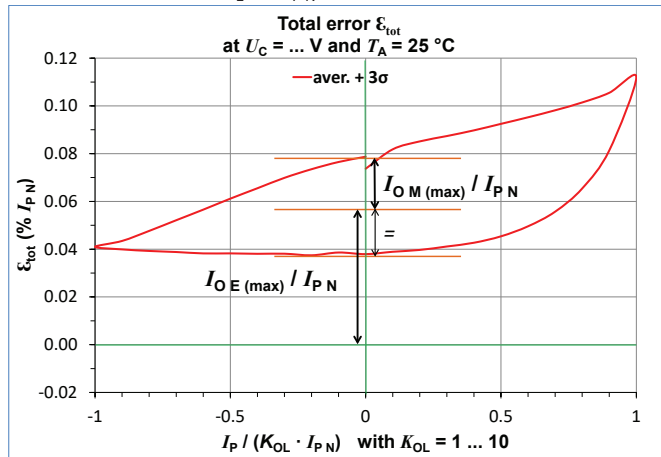


Figure 10: Total error ε_{tot}

Electrical offset referred to primary

Using the current cycle shown in figure 14, the electrical offset current I_{OE} is the residual output referred to primary when the input current is zero.

Magnetic offset referred to primary

$$I_{OE} = \frac{I_{P(3)} + I_{P(5)}}{2}$$

$$I_{OM} = \frac{I_{P(3)} - I_{P(5)}}{2}$$

The magnetic offset current I_{OM} is the consequence of a current on the primary side ("memory effect" of the transducer's ferro-magnetic parts). It is measured using the following primary current cycle. I_{OM} depends on the current value $I_P \geq I_{PN}$.

K_{OL} : Overload factor

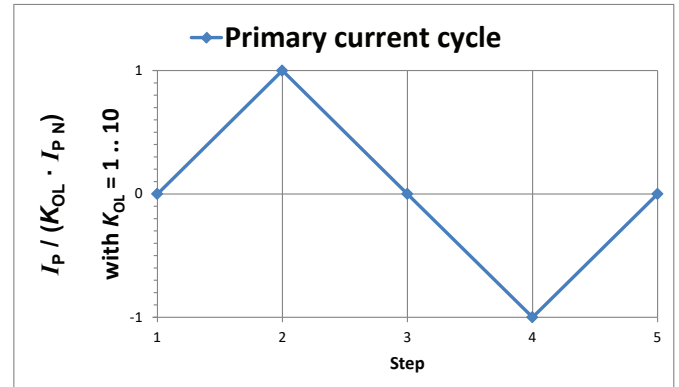


Figure 11: Current cycle used to measure magnetic and electrical offset (transducer supplied)

Sensitivity and linearity

To measure sensitivity and linearity, the primary current (DC) is cycled from 0 to I_P , then to $-I_P$ and back to 0 (equally spaced $I_P/10$ steps). The sensitivity S is defined as the slope of the linear regression line for a cycle between $\pm I_{PN}$.

The linearity error ε_L is the maximum positive or negative difference between the measured points and the linear regression line, expressed in % of I_{PN} .

Delay times

The delay time t_{D10} @ 10 % and the delay time t_{D90} @ 90 % with respect to the primary are shown in the next figure. Both slightly depend on the primary current di/dt . They are measured at nominal current.

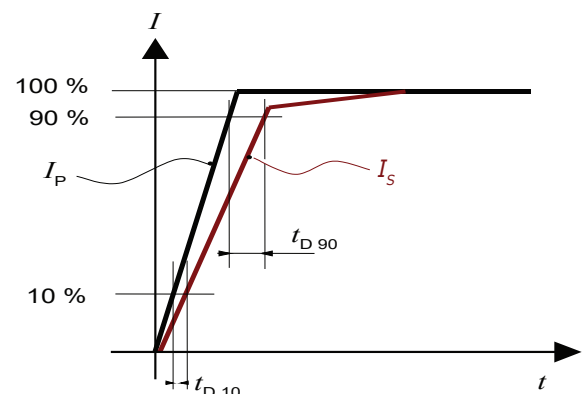
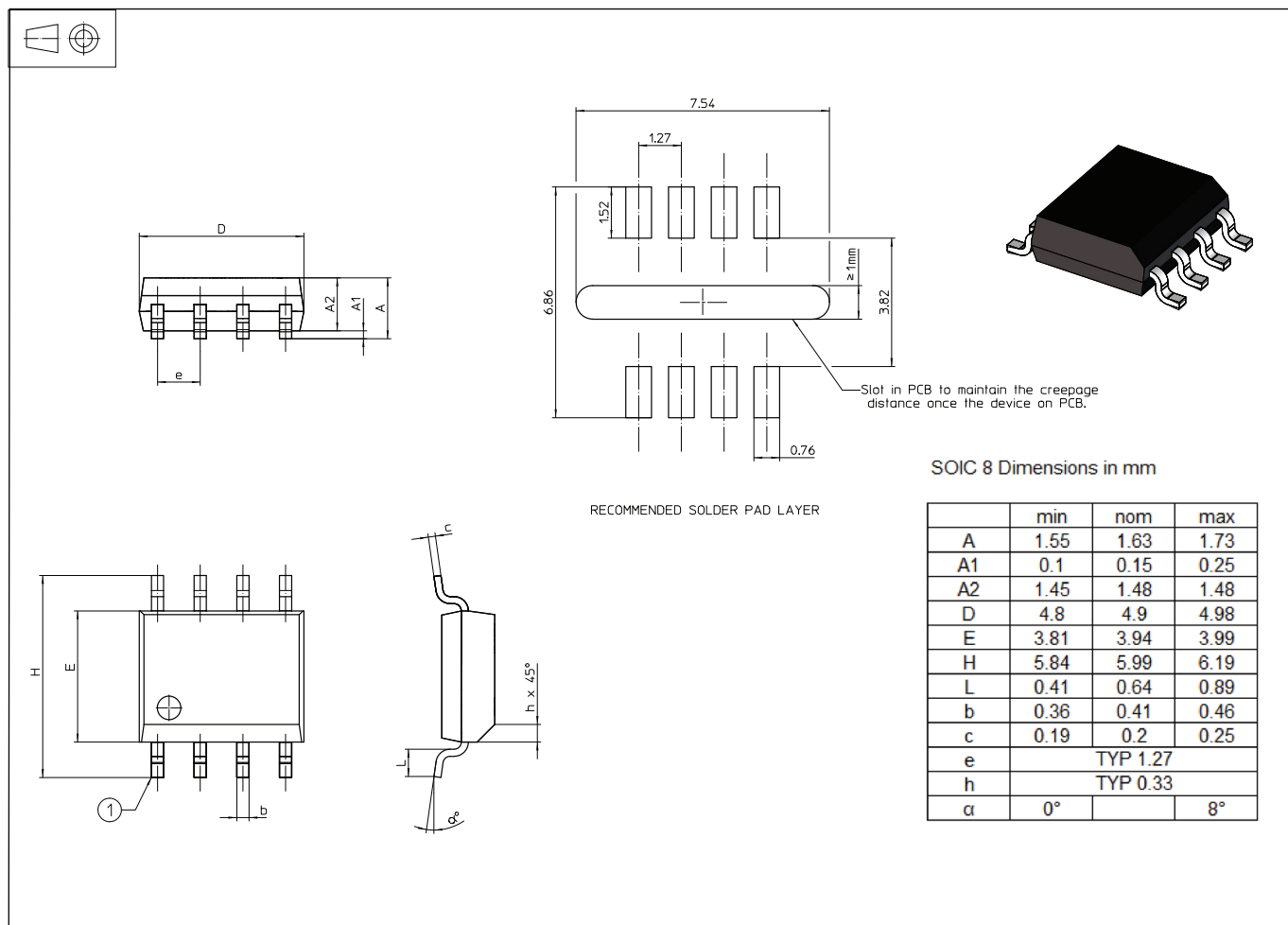


Figure 12: t_{D10} (delay time @ 10 %) and t_{D90} (delay time @ 90 %).

PCB footprint & dimensions (in mm)



Mechanical characteristics: General tolerance ± 0.15 mm

Remarks: $U_{out} - U_{ref}$ is positive when I_p flows in the direction of arrow (pin 1-2 to pin 3-4).

Soldering on PCB

Soldering remarks:

- GO-SME is qualified MSL3 for storage and mounting purposes.
- Per JEDEC J-STD-020 for packages less than 2.5 mm thick per table 4.2 (Pb-Free process) of the specification.
- Best practice is to use 7 zones or greater conventional reflow system, limiting the time at reflow temperature as indicated in profile above.
- Rework not recommended.

Tape and reel dimensions (in mm)

Leader & Trailer:

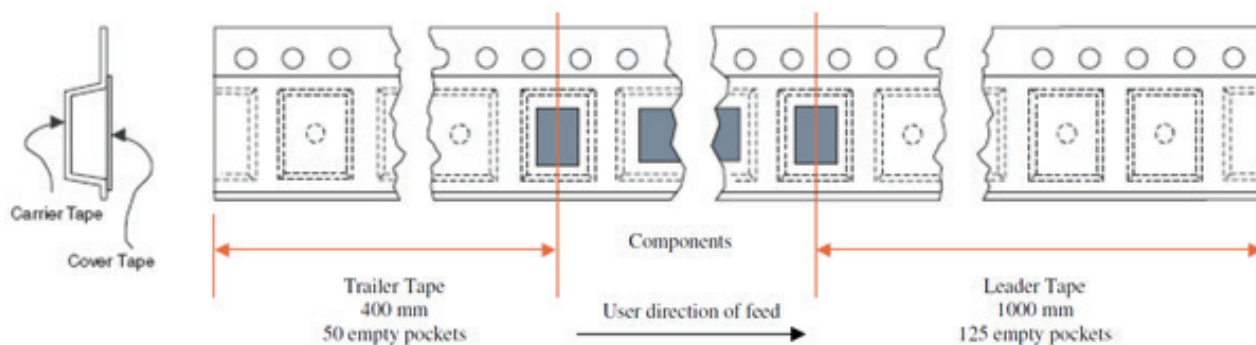


Figure 13: Leader and trailer

Carrier Tape Data:

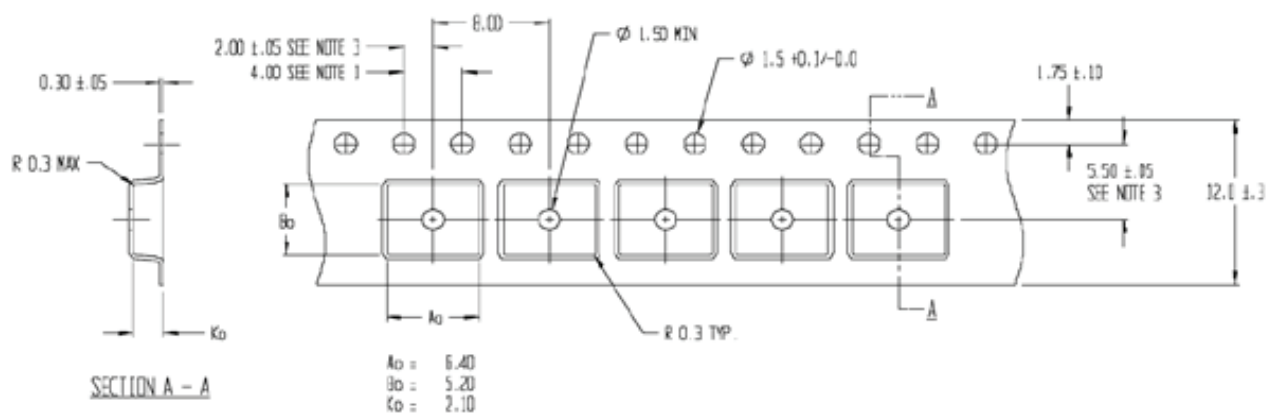


Figure 14: Carrier tape

Plastic Reel Data:

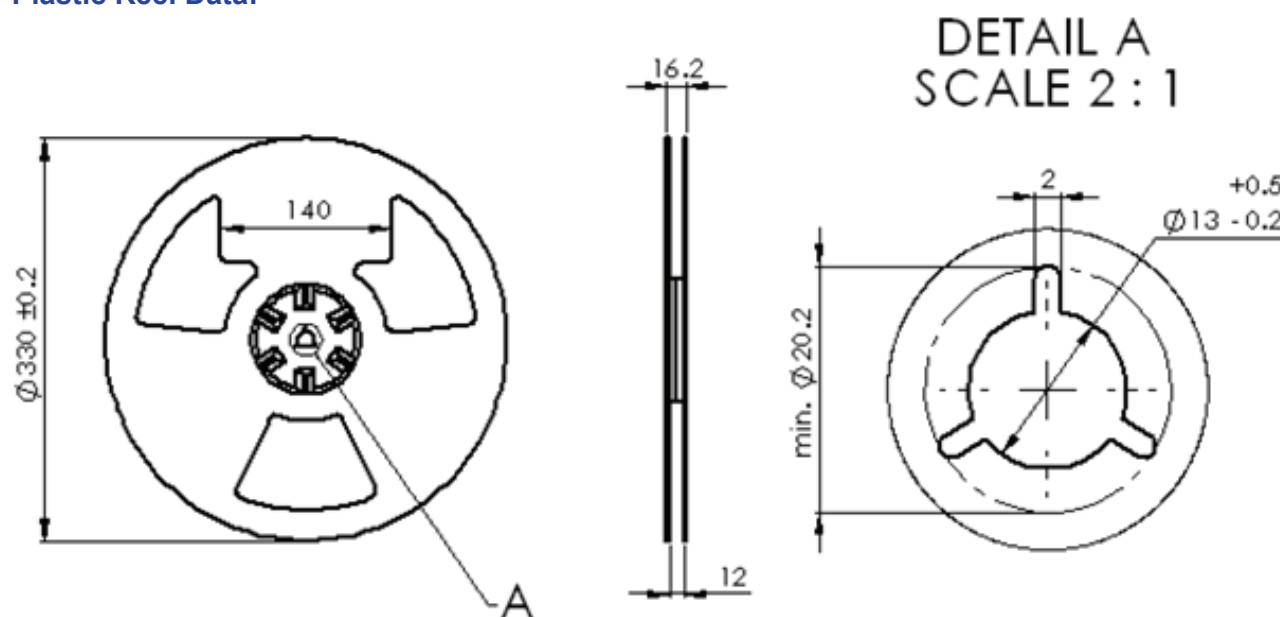


Figure 15: Plastic reel

Safety



Caution

This transducer must be used in electric/electronic equipment with respect to applicable standards and safety requirements in accordance with the manufacturer's operating instructions..



Caution, risk of electrical shock

This transducer must be used in limited-energy secondary circuits according to IEC 62368-1.
When operating the transducer, certain parts of the module can carry hazardous voltages and high currents (e.g. power supply, primary conductor).
Ignoring this warning can lead to injury and or/or cause serious damage.
This transducer is a build-in device, whose hazardous live parts must be inaccessible after installation.
A protective enclosure or additional shield could be used. Main supply must be able to be disconnected.

Therefore, LEM cannot be held liable for any potential hazards, damages, injuries or loss of life resulting from the use of this product.



ESD susceptibility

This product is susceptible to be damaged from an ESD event and the personnel and workspace should be grounded when handling it.



Underwriters Laboratory Inc. recognized component

Version history

| Date | Version | Comments |
|------------------|---------|--|
| 17 November 2021 | 0 | New generic datasheet with SP products |