

CMS2050

MagnetoResistive Current Sensor ($I_{PN} = 50\text{ A}$)

Data sheet

The CMS2000 current sensor family is designed for highly dynamic electronic measurement of DC, AC, pulsed and mixed currents with integrated galvanic isolation. The MagnetoResistive technology enables an excellent dynamic response without the hysteresis that is present in iron core based designs.

The CMS2000 product family offers PCB-mountable THT current sensors from 5 A up to 50 A nominal current for industrial applications.



CMS2050

Product overview

Product description	Package	Delivery Type
CMS2050-SP3	THT	Tray
CMS2050-SP7	THT	Tray
CMS2050-SP10	THT	Tray

Quick reference guide

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{CC}	Positive supply voltage	+11.4	+15.0	+15.7	V
V_{SS}	Negative supply voltage	-11.4	-15.0	-15.7	V
I_{PN}	Primary nominal current (RMS)	-	-	50	A
I_{PR}	Primary measuring range ¹⁾	-150	-	+150	A
$I_{PR,SP7}$	Primary measuring range ²⁾	-220	-	+220	A
$\epsilon_{\Sigma,SP3}$	Overall accuracy for SP3 ³⁾	-	-	± 0.8	% of I_{PN}
$\epsilon_{\Sigma,SP10}$	Overall accuracy for SP10 ³⁾	-	-	± 0.5	% of I_{PN}
f_{co}	Upper cut-off frequency (-3 dB)	-	100	-	kHz
T_{amb}	Ambient temperature ⁴⁾	-25	-	+85	$^{\circ}\text{C}$

¹⁾ For 3 s in a 60 s interval and $V_{CC} = \pm 15\text{ V}$.

²⁾ For 20 ms in a 60 s interval and $V_{CC} = \pm 15\text{ V}$.

³⁾ $\epsilon_{\Sigma} = \epsilon_G + \epsilon_{lin}$ with $V_{CC} = \pm 15\text{ V}$, $I_P = I_{PN}$ and $T_{amb} = 25\text{ }^{\circ}\text{C}$.

⁴⁾ Operating condition.

Qualification overview

Standard	Status
CE-sign EN 61010	Certified
RoHS-conform 2002/95/EC	Certified
UL Recognized Component E251279	Certified

CMS2050.DSE.02

Features

- Based on the Anisotropic Magneto Resistive (AMR) effect
- Measuring range up to 3 times nominal current
- Galvanic isolation between primary and measurement circuit
- Bipolar 15 V power supply

Advantages

- Excellent accuracy
- Low temperature drift
- Small and compact size
- Highly dynamic response
- Automatically mountable on PCB
- Integrated burden resistor
- Low primary inductance
- Negligible hysteresis

Applications

- Solar power converters
- AC variable speed drives
- Converters for DC motor drives
- Uninterruptible power supplies
- Switched mode power supplies
- Power supplies for welding applications



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Absolute maximum ratings

In accordance with the absolute maximum rating system (IEC60134).

Symbol	Parameter	Min.	Max.	Unit
V_{CC}	Positive supply voltage	-0.3	+16	V
V_{SS}	Negative supply voltage	-16	+0.3	V
I_{PM}	Maximum primary current ¹⁾	-500	+500	A
T_{amb}	Ambient temperature	-25	+85	°C
T_{stg}	Storage temperature	-25	+85	°C

¹⁾ For 20 ms in a 20 s interval. At SP7 for 20 μ s in 20 s interval.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Electrical data of SP3 and SP10

$T_{amb} = 25 \text{ °C}$; $V_{CC} = \pm 15 \text{ V}$; unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{CC}	Positive supply voltage		+11.4	+15.0	+15.7	V
V_{SS}	Negative supply voltage		-11.4	-15.0	-15.7	V
I_{PN}	Primary nominal current (RMS)		-	-	50	A
I_{PR}	Measuring range ²⁾		-150	-	+150	A
V_{outN}	Nominal output voltage (RMS)	$I_P = I_{PN}$	-	2.5	-	V
R_M	Internal burden resistor for output signal		-	-	150	Ω
R_P	Resistance of primary conductor		-	-	0.15	m Ω
I_C	Current consumption	$I_C = 22 + (I_P/I_{PN}) \cdot 23$	22	-	91	mA

²⁾ For 3 s in a 60 s interval.

Electrical data of SP3 and SP10

$T_{amb} = 25 \text{ °C}$; $V_{CC} = \pm 12 \text{ V}$; unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{CC}	Positive supply voltage		+11.4	+12.0	+12.6	V
V_{SS}	Negative supply voltage		-11.4	-12.0	-12.6	V
I_{PN}	Primary nominal current (RMS)		-	-	50	A
I_{PR}	Measuring range ³⁾		-100	-	+100	A
V_{outN}	Nominal output voltage (RMS)	$I_P = I_{PN}$	-	2.5	-	V
R_M	Internal burden resistor for output signal		-	-	150	Ω
R_P	Resistance of primary conductor		-	-	0.15	m Ω
I_C	Current consumption	$I_C = 22 + (I_P/I_{PN}) \cdot 23$	22	-	91	mA

³⁾ For 3 s in a 60 s interval.

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Electrical data of SP7

$T_{amb} = 25 \text{ }^\circ\text{C}$; $V_{CC} = \pm 15 \text{ V}$; unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{CC}	Positive supply voltage		+14.7	+15.0	+15.3	V
V_{SS}	Negative supply voltage		-14.7	-15.0	-15.3	V
I_{PN}	Primary nominal current (RMS)		-	-	50	A
I_{PR}	Measuring range ¹⁾		-220	-	+220	A
V_{outN}	Nominal output voltage (RMS)	$I_P = I_{PN}$	-	1.25	-	V
R_M	Internal burden resistor for output signal		-	-	75	Ω
R_P	Resistance of primary conductor		-	-	0.15	m Ω
I_C	Current consumption	$I_C = 22 + (I_P/I_{PN}) \cdot 23$	22	-	91	mA

¹⁾ For 20 ms in a 2 s interval.

Electrical data of SP7

$T_{amb} = 25 \text{ }^\circ\text{C}$; $V_{CC} = \pm 12 \text{ V}$; unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{CC}	Positive supply voltage		+11.8	+12.0	+12.2	V
V_{SS}	Negative supply voltage		-11.8	-12.0	-12.2	V
I_{PN}	Primary nominal current (RMS)		-	-	50	A
I_{PR}	Measuring range ²⁾		-150	-	+150	A
V_{outN}	Nominal output voltage (RMS)	$I_P = I_{PN}$	-	1.25	-	V
R_M	Internal burden resistor for output signal		-	-	75	Ω
R_P	Resistance of primary conductor		-	-	0.15	m Ω
I_C	Current consumption	$I_C = 22 + (I_P/I_{PN}) \cdot 23$	22	-	91	mA

²⁾ For 20 ms in a 2 s interval.

Qualifications

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_I	Isolation test voltage (RMS)	50/60 Hz, 60 s	-	3.5	-	kV
V_B	Rated voltage (RMS)	Pollution degree 2, Kat. II	-	600	-	V

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Accuracy of CMS2050-SP3

$T_{amb} = 25 \text{ }^\circ\text{C}$; $V_{CC} = \pm 15 \text{ V}$; unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
ϵ_{Σ}	Overall accuracy ¹⁾	$I_P = I_{PN}$	-	-	± 0.8	% of I_{PN}
ϵ_{off}	Offset error	$I_P = 0$	-	-	± 0.8	% of I_{PN}
ϵ_{Lin}	Linearity error	$I_P \leq I_{PN}$	-	-	± 0.1	% of I_{PN}
$T\epsilon_G$	Maximum temperature induced gain error	$T_{amb} = (-25\dots+85)^\circ\text{C}$	-	-	150	ppm/K
$T\epsilon_{off}$	Maximum temperature induced offset error	$T_{amb} = (-25\dots+85)^\circ\text{C}$	-	-	± 1.0	% of I_{PN}

¹⁾ $\epsilon_{\Sigma} = \epsilon_G + \epsilon_{Lin}$ with ϵ_G = gain error and ϵ_{Lin} = linearity error

Accuracy of CMS2050-SP7

$T_{amb} = 25 \text{ }^\circ\text{C}$; $V_{CC} = \pm 15 \text{ V}$; unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
ϵ_{Σ}	Overall accuracy ²⁾	$I_P = I_{PN}$	-	-	± 0.8	% of I_{PN}
ϵ_{off}	Offset error	$I_P = 0$	-	-	± 0.8	% of I_{PN}
ϵ_{Lin}	Linearity error	$I_P \leq I_{PN}$	-	-	± 0.2	% of I_{PN}
$T\epsilon_G$	Maximum temperature induced gain error	$T_{amb} = (-25\dots+85)^\circ\text{C}$	-	-	150	ppm/K
$T\epsilon_{off}$	Maximum temperature induced offset error	$T_{amb} = (-25\dots+85)^\circ\text{C}$	-	-	± 1.0	% of I_{PN}

²⁾ $\epsilon_{\Sigma} = \epsilon_G + \epsilon_{Lin}$ with ϵ_G = gain error and ϵ_{Lin} = linearity error

Accuracy of CMS2050-SP10

$T_{amb} = 25 \text{ }^\circ\text{C}$; $V_{CC} = \pm 15 \text{ V}$; unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
ϵ_{Σ}	Overall accuracy ³⁾	$I_P = I_{PN}$	-	-	± 0.5	% of I_{PN}
ϵ_{off}	Offset error	$I_P = 0$	-	-	± 0.2	% of I_{PN}
ϵ_{Lin}	Linearity error	$I_P \leq I_{PN}$	-	-	± 0.1	% of I_{PN}
$T\epsilon_G$	Maximum temperature induced gain error	$T_{amb} = (-25\dots+85)^\circ\text{C}$	-	-	150	ppm/K
$T\epsilon_{off}$	Maximum temperature induced offset error	$T_{amb} = (-25\dots+85)^\circ\text{C}$	-	-	± 1.0	% of I_{PN}

³⁾ $\epsilon_{\Sigma} = \epsilon_G + \epsilon_{Lin}$ with ϵ_G = gain error and ϵ_{Lin} = linearity error

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Dynamic data

$T_{amb} = 25 \text{ }^\circ\text{C}$; $V_{CC} = \pm 15 \text{ V}$; unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
t_{ra}	Reaction time	10% I_{PN} to 10% I_{out}	-	-	0.15	μs
t_{ri}	Rise time	10% to 90% I_{out}	-	-	1.7	μs
f_{co}	Upper cut-off frequency	-3 dB	-	100	-	kHz

General data

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
T_{amb}	Ambient temperature		-25	-	+85	$^\circ\text{C}$
T_{stg}	Storage temperature		-25	-	+85	$^\circ\text{C}$
T	Solder temperature	For 7 seconds.	-	-	250	$^\circ\text{C}$
m	Mass		-	6.5	-	g

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Pinning

Pin	Symbol	Parameter
1	V_{CC}	Positive supply voltage
2	V_{SS}	Negative supply voltage
3	GND	Ground
4	SGND	Signal ground
5	V_{out}	Signal output
6	I_{in}	Primary current input
7	I_{out}	Primary current output

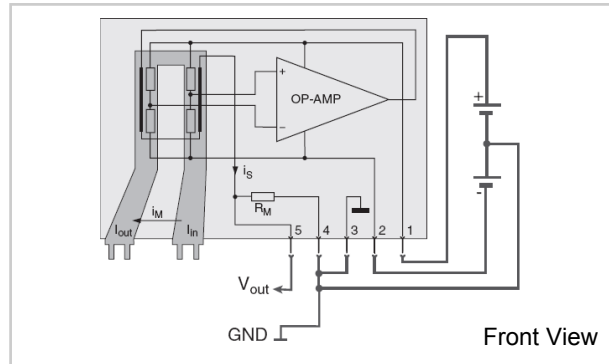


Fig.1: Pinning of CMS2050.

Dimensions

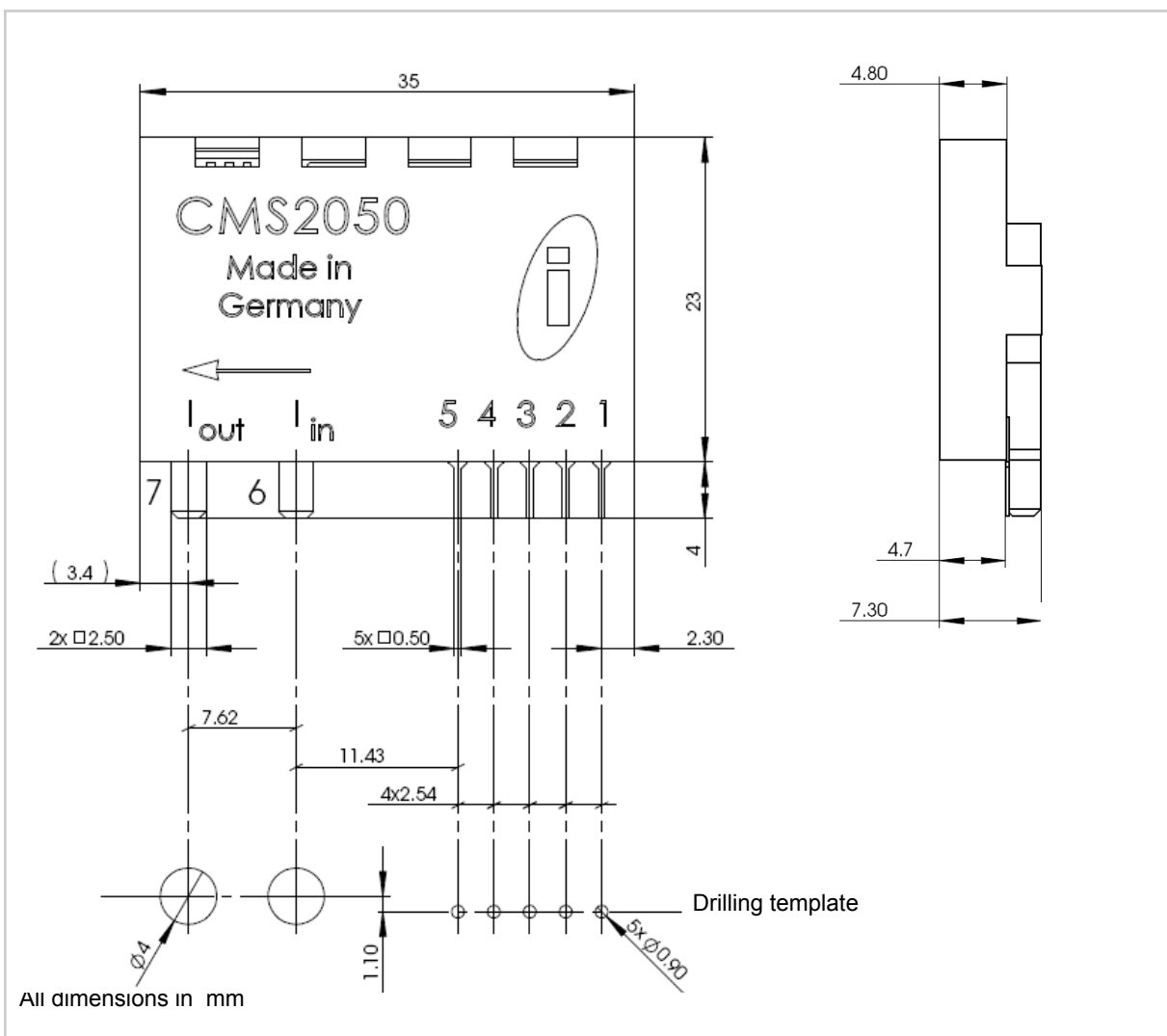


Fig.2: Package outline with $\pm 0.2 \text{ mm}$ and drilling plan with 0.05 mm tolerance.

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PCB Layout

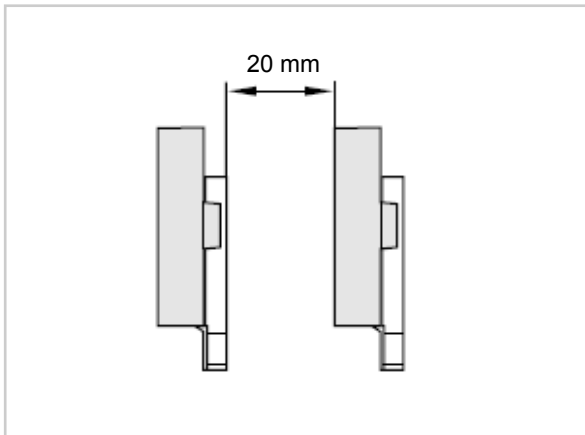


Fig.3: Recommended clearance among each other.

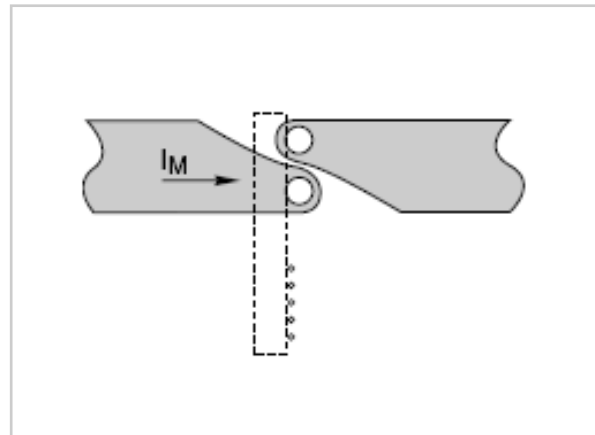


Fig.4: Recommended current path layout.

The CMS2000 product family

The CMS2050 is a member of the CMS2000 product family offering PCB-mountable THT current sensors from 5 A up to 50 A nominal current for various industrial applications.

Product	I_{PN} (A)	I_{PR} (A)	ϵ_{Σ} (% of I_{PN})	ϵ_{off} (% of I_{PN})	$T\epsilon_{off}$ (% of I_{PN})	Package
CMS2005-SP3	5	15	± 0.8	± 0.8	± 1.0	
CMS2005-SP10	5	15	± 0.5	± 0.2	± 1.0	
CMS2015-SP3	15	45	± 0.8	± 0.8	± 1.0	
CMS2015-SP10	15	45	± 0.5	± 0.2	± 1.0	
CMS2025-SP3	25	75	± 0.8	± 0.8	± 1.0	
CMS2025-SP10	25	75	± 0.5	± 0.2	± 1.0	
CMS2050-SP3	50	150	± 0.8	± 0.8	± 1.0	
CMS2050-SP7	50	220	± 0.8	± 1.6	± 0.9	
CMS2050-SP10	50	150	± 0.5	± 0.2	± 1.0	

I_{PN} : Nominal primary current (RMS).

I_{PR} : Measurement range for 3 s in a 60 s interval (@SP7 only 20 ms in a 2 s interval).

ϵ_{Σ} : Overall accuracy $\epsilon_{\Sigma} = \epsilon_G + \epsilon_{in}$ with $V_{CC} = \pm 15\text{ V}$, $I_P = I_{PN}$ and $T_{amb} = 25\text{ }^{\circ}\text{C}$.



ϵ_{off} : Offset error with $V_{CC} = \pm 15\text{ V}$, $I_P = 0$ and $T_{amb} = 25\text{ }^{\circ}\text{C}$.

$T\epsilon_{off}$: Maximum temperature induced offset error with $T_{amb} = (-25\dots+85)\text{ }^{\circ}\text{C}$.

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Safety Notes

	<p>Warning! This sensor shall be used in electric and electronic devices according to applicable standards and safety requirements. Sensitec's datasheet and handling instructions must be complied with. Handling instructions for current sensors are available at www.sensitec.com.</p>
	<p>Caution! Risk of electric shock! When operating the sensor, certain parts, e. g. the primary busbar or the power supply, may carry hazardous voltage. Ignoring this warning may lead to serious injuries! Conducting parts of the sensor shall not be accessible after installation.</p>

General Information

Product Status

The product is in series production. **Note:** The status of the product may have changed since this data sheet was published. The latest information is available on the internet at www.sensitec.com.

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Life critical applications

These products are not qualified for use in life support appliances, aeronautical applications or devices or systems where malfunction of these products can reasonably be expected to result in personal injury.

MagnetoResistive Sensors

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Solutions for measuring:

- Position
- Angle
- Magnetic field
- Current

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