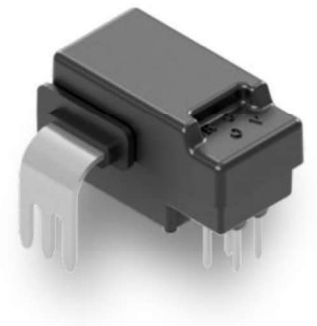
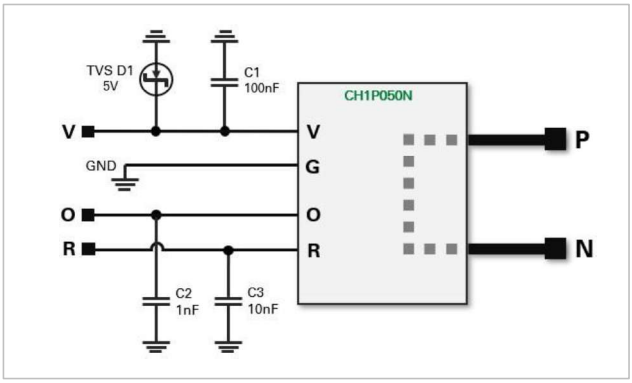
Current Sensor
CH1P050N



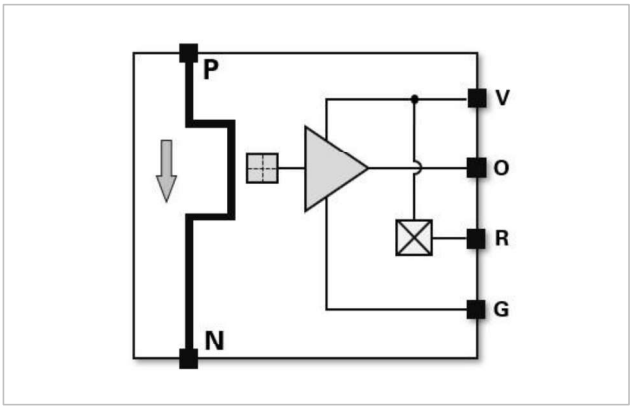
General Description

The Littelfuse CH1P050N current sensor is an Open-loop Hall effect current sensor which can measure AC, DC, or pulsed currents with galvanic separation between primary and secondary circuits.

Typical Application Diagram



Functional Block Diagram



Features

- Open loop Hall effect sensor
- Single +5V power supply
- Reference Voltage pin
- Programmable analog output
- Integration frequency filter
- PCB through-hole mounting
- Operating temperature range:
  -40 °C< T <+105 °C
- Primary nominal RMS current:
  20A / 32A / 40A / 50A
- Primary measuring range:
  up to: 50A / 80A / 100 / 125A

Benefits

- Very small package size
- Easy mounting via automated handling
- High immunity to external interference
- Low Temperature coefficient
- Low insertion loss

Applications

- Static Converters for DC motor drives
- Solar inverters (DC side)
- AC variable speed drives
- Home appliances
- Uninterruptible power supplies
- Shunt replacement solution

Standards

- EN50178: 1997
- IEC61010-1: 2010
- UL 508: 2013

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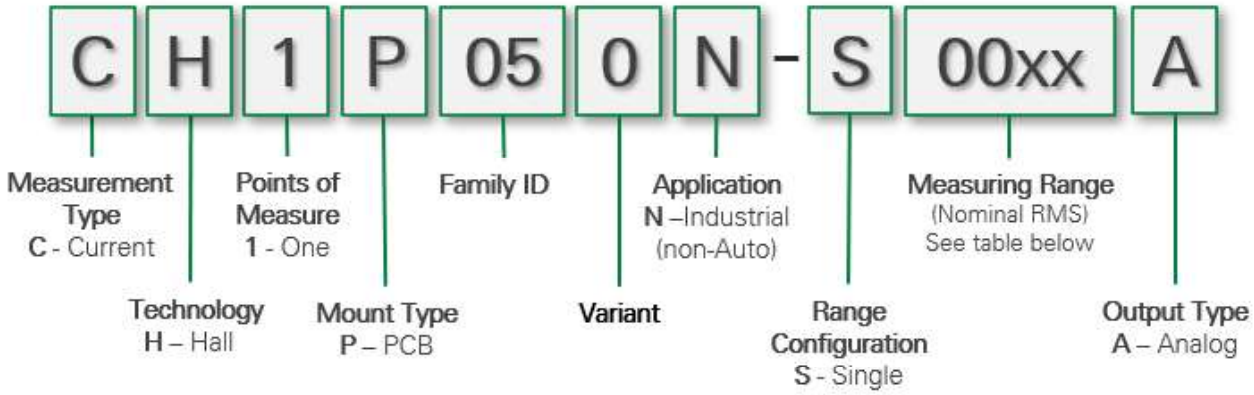
CH1P050N

Littelfuse Current Sensor Naming Convention



Product Identification (per nominal RMS current range)

Part Name	Littelfuse Part Number	Nominal RMS Current
CH1P050N-S0020A	24944-00-01	±20 A
CH1P050N-S0032A	24944-00-02	±32 A
CH1P050N-S0040A	24944-00-03	±40 A
CH1P050N-S0050A	24944-00-04	±50 A

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Current Sensor
CH1P050N

Absolute Maximum Ratings

Symbol	Parameter	Value	Units
V_{CC}	Supply Voltage	6	V
T_A	Ambient operating temperature	-40…+105	°C
T_A	Ambient storage temperature	-40…+105	°C
T_J	Primary conductor temperature	120	°C
V_{ESD}	Electrostatic Discharge (ESD) / Human Body Model (HBM	4	kV

Isolation Parameters

Symbol	Parameter	Data	Units
V_d	RMS Voltage for AC insulation test, 50/60 Hz, 1 minute	4.3	kV
V_W	Impulse withstand voltage 1.2/50 us	8	kV
D_{CREE}	Creepage	8.3	mm
D_{CLEA}	Clearance	8	mm
CTI	Comparative Tracking Index (Group IIIa)	600	V
---	Application example: Basic Insulation CAT III, PD2 non-uniform field per EN 50178, IEC 61010	1000	V
---	Application example: Reinforced Insulation CAT III, PD2 non-uniform field per EN 50178, IEC 61010	600	V
---	Application example: Basic Insulation CAT III, PD2 non-uniform field per IEC 62109-1, Altitude ≤3000m	1500	V

Mechanical Properties

Symbol	Parameter	Information	Comment
---	Case material	PA66	VDI 21
---	Jumper / Terminal material	Cu	Ni over Sn plating
---	Mass	5g	±10%

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Current Sensor
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Electrical Data

CH1P050N-S00**20**A

Unless otherwise noted: T_A=25°C, V_{CC}=5V, RL=10kΩ

Symbol	Parameter	Min.	Typ.	Max.	Units
I_{PN}	Primary nominal RMS current		20		A
I_{PM}	Primary current, measuring range	-50		50	A
V_{CC}	Supply voltage	4.75	5	5.25	V
I_C	Current consumption	15	20	25	mA
N_P	Number of primary turns		1		ea.
R_P	Resistance of primary jumper		0.3		mΩ
V_{ref}	Reference voltage (output)	2.48	2.5	2.52	V
V_{ref}	Reference voltage (input)	0.5		2.65	V
$V_{out} - V_{ref}$	Output voltage range @ I_{PM}	-2		2	V
R_{ref}	V_{ref} output resistance		2	3	Ω
R_{out}	V_{out} output resistance		1.7		Ω
C_L	Allowable capacitive load (on V_{OUT})	0	1	10	nF
V_{OE}	Electrical offset voltage @ I_P = 0A		10	15	mV
I_{OM}	Magnetic offset current (@ 10x I_{PN})	-0.25		0.25	A
TCV_{OE}	Temperature coefficient of V_{OE}	-0.075		0.075	mV/K
TCG	Temperature coefficient of Gain	-300		300	ppm/K
G_{th}	Sensitivity (theoretical)		40		mV/A
E_G	Sensitivity error @ I_{PN}		±0.5		%
E_L	Linearity error @ I_{PN}	-0.5		0.5	%
E_L	Linearity error @ I_{PM}	-1		1	%
X	Accuracy @ I_{PN}, +25°C	-1.2		1.2	%
	Accuracy @ I_{PN}, +85°C	-2.9		2.9	%
	Accuracy @ I_{PN}, +105°C	-3.4		3.4	%
G_{no}	Output RMS noise Voltage (DC ~10kHz)		8		mV
G_{no}	Output RMS noise Voltage (DC ~100kHz)		12		mV
t_{ra}	Reaction time @ 10% of I_{PN}			1.5	us
t_r	Response time @ 90% of I_{PN}			3	us
BW	Frequency bandwidth (-3 db) @+25°C		200		kHz

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Current Sensor
CH1P050N

Electrical Data

CH1P050N-S00**32**A

Unless otherwise noted: T_A=25°C, V_{CC}=5V, RL=10kΩ

Symbol	Parameter	Min.	Typ.	Max.	Units
I_{PN}	Primary nominal RMS current		32		A
I_{PM}	Primary current, measuring range	-80		80	A
V_{CC}	Supply voltage	4.75	5	5.25	V
I_C	Current consumption	15	20	25	mA
N_P	Number of primary turns		1		ea.
R_P	Resistance of primary jumper		0.3		mΩ
V_{ref}	Reference voltage (output)	2.48	2.5	2.52	V
V_{ref}	Reference voltage (input)	0.5		2.65	V
$V_{out} - V_{ref}$	Output voltage range @ I_{PM}	-2		2	V
R_{ref}	V_{ref} output resistance		2	3	Ω
R_{out}	V_{out} output resistance		1.7		Ω
C_L	Allowable capacitive load (on V_{OUT})	0	1	10	nF
V_{OE}	Electrical offset voltage @ I_P = 0A		10	15	mV
I_{OM}	Magnetic offset current (@ 10x I_{PN})	-0.25		0.25	A
TCV_{OE}	Temperature coefficient of V_{OE}	-0.075		0.075	mV/K
TCG	Temperature coefficient of Gain	-300		300	ppm/K
G_{th}	Sensitivity (theoretical)		25		mV/A
E_G	Sensitivity error @ I_{PN}		±0.5		%
E_L	Linearity error @ I_{PN}	-0.5		0.5	%
E_L	Linearity error @ I_{PM}	-1		1	%
X	Accuracy @ I_{PN}, +25°C	-1.2		1.2	%
	Accuracy @ I_{PN}, +85°C	-2.9		2.9	%
	Accuracy @ I_{PN}, +105°C	-3.4		3.4	%
G_{no}	Output RMS noise Voltage (DC ~10kHz)		8		mV
G_{no}	Output RMS noise Voltage (DC ~100kHz)		12		mV
t_{ra}	Reaction time @ 10% of I_{PN}			1.5	us
t_r	Response time @ 90% of I_{PN}			3	us
BW	Frequency bandwidth (-3 db) @+25°C		200		kHz

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Current Sensor
CH1P050N

Electrical Data

CH1P050N-S00**40**A

Unless otherwise noted: T_A=25°C, V_{CC}=5V, RL=10kΩ

Symbol	Parameter	Min.	Typ.	Max.	Units
I_{PN}	Primary nominal RMS current		40		A
I_{PM}	Primary current, measuring range	-100		-100	A
V_{CC}	Supply voltage	4.75	5	5.25	V
I_C	Current consumption	15	20	25	mA
N_P	Number of primary turns		1		ea.
R_P	Resistance of primary jumper		0.3		mΩ
V_{ref}	Reference voltage (output)	2.48	2.5	2.52	V
V_{ref}	Reference voltage (input)	0.5		2.65	V
$V_{out} - V_{ref}$	Output voltage range @ I_{PM}	-2		2	V
R_{ref}	V_{ref} output resistance		2	3	Ω
R_{out}	V_{out} output resistance		1.7		Ω
C_L	Allowable capacitive load (on V_{OUT})	0	1	10	nF
V_{OE}	Electrical offset voltage @ I_P = 0A		10	15	mV
I_{OM}	Magnetic offset current (@ 10x I_{PN})	-0.25		0.25	A
TCV_{OE}	Temperature coefficient of V_{OE}	-0.075		0.075	mV/K
TCG	Temperature coefficient of Gain	-300		300	ppm/K
G_{th}	Sensitivity (theoretical)		20		mV/A
E_G	Sensitivity error @ I_{PN}		±0.5		%
E_L	Linearity error @ I_{PN}	-0.5		0.5	%
E_L	Linearity error @ I_{PM}	-1		1	%
X	Accuracy @ I_{PN}, +25°C	-1		1	%
	Accuracy @ I_{PN}, +85°C	-2.7		2.7	%
	Accuracy @ I_{PN}, +105°C	-3		3	%
G_{no}	Output RMS noise Voltage (DC ~10kHz)		8		mV
G_{no}	Output RMS noise Voltage (DC ~100kHz)		12		mV
t_{ra}	Reaction time @ 10% of I_{PN}			1.5	us
t_r	Response time @ 90% of I_{PN}			3	us
BW	Frequency bandwidth (-3 db) @+25°C		200		kHz

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Current Sensor
CH1P050N

Electrical Data

CH1P050N-S00**50**A

Unless otherwise noted: T_A=25°C, V_{CC}=5V, RL=10kΩ

Symbol	Parameter	Min.	Typ.	Max.	Units
I_{PN}	Primary nominal RMS current		50		A
I_{PM}	Primary current, measuring range	-125		125	A
V_{CC}	Supply voltage	4.75	5	5.25	V
I_C	Current consumption	15	20	25	mA
N_P	Number of primary turns		1		ea.
R_P	Resistance of primary jumper		0.3		mΩ
V_{ref}	Reference voltage (output)	2.48	2.5	2.52	V
V_{ref}	Reference voltage (input)	0.5		2.65	V
$V_{out} - V_{ref}$	Output voltage range @ I_{PM}	-2		2	V
R_{ref}	V_{ref} output resistance		2	3	Ω
R_{out}	V_{out} output resistance		1.7		Ω
C_L	Allowable capacitive load (on V_{OUT})	0	1	10	nF
V_{OE}	Electrical offset voltage @ I_P = 0A		10	15	mV
I_{OM}	Magnetic offset current (@ 10x I_{PN})	-0.25		0.25	A
TCV_{OE}	Temperature coefficient of V_{OE}	-0.075		0.075	mV/K
TCG	Temperature coefficient of Gain	-300		300	ppm/K
G_{th}	Sensitivity (theoretical)		16		mV/A
E_G	Sensitivity error @ I_{PN}		±0.5		%
E_L	Linearity error @ I_{PN}	-0.5		0.5	%
E_L	Linearity error @ I_{PM}	-1		1	%
X	Accuracy @ I_{PN}, +25°C	-1		1	%
	Accuracy @ I_{PN}, +85°C	-2.7		2.7	%
	Accuracy @ I_{PN}, +105°C	-3		3	%
G_{no}	Output RMS noise Voltage (DC ~10kHz)		8		mV
G_{no}	Output RMS noise Voltage (DC ~100kHz)		12		mV
t_{ra}	Reaction time @ 10% of I_{PN}			1.5	us
t_r	Response time @ 90% of I_{PN}			3	us
BW	Frequency bandwidth (-3 db) @+25°C		200		kHz

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Total Error

Variant-Primary Current Rating $\pm I_{PN}$	Total Error CH1P050N-S0020A CH1P050N-S0032A	Total Error CH1P050N-S0040A CH1P050N-S0050A
Temperature	%	%
-40	±3.4	±3
25	±1.2	±1
85	±2.9	±2.7
105	±3.4	±3

Maximum Continuous Direct Current (DC)

Applicable for all current range variants

Note: Primary current jumper temperature must not exceed the maximum rating of 120°C regardless of application.

Handling

- Handling of sensors should be minimized by maintaining parts within packaging until point of assembly.
- Contact with sensor terminals should be avoided.
- To avoid potential damage, adherence to ESD handling best practices is recommended.
- Dropped parts should be scrapped regardless of evidence of external damage.

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Current Sensor Dimensions (in mm)

Applicable for all current range variants

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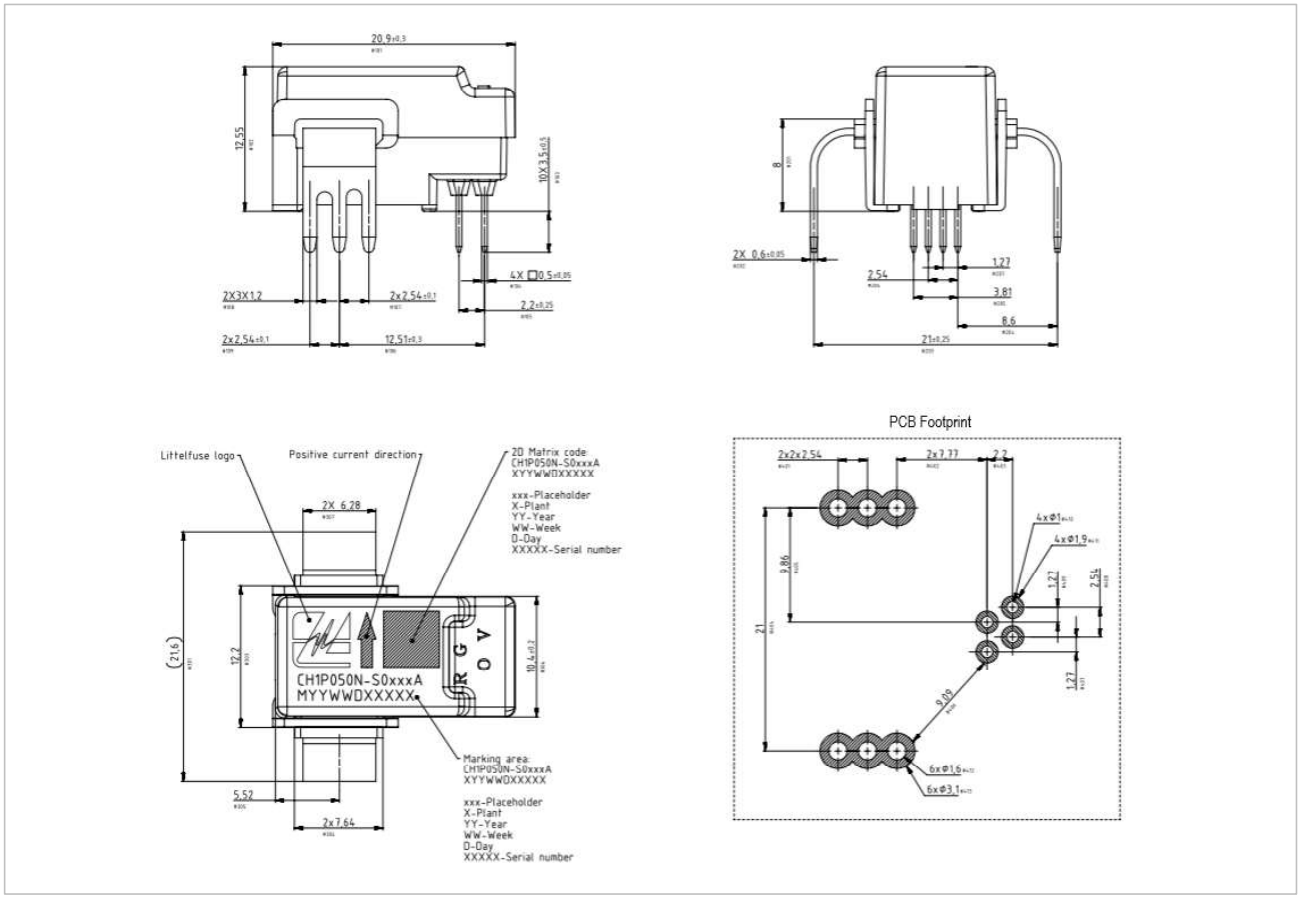
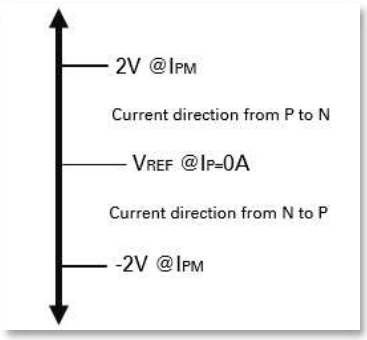


Pinout

Pin	Description
V	Power supply voltage
G	Ground
O	Output Signal
R	Reference voltage output



Relationship between IP and Output voltage

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Contact

Custom electrical and environmental specifications can be designed to meet any need, please contact Littelfuse Engineering for details.

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