

1 Description

The CN54125X is a high-performance ground fault circuit interrupter (GFCI) controller used for detecting ground fault leakage paths in electrical circuits, which can detect type AC leakage currents, featuring a wide AC input voltage range (50V–380V, 50/60Hz), high input sensitivity (5mV), consistent leakage detection thresholds, a wide operating voltage range (3V–5.5V), low quiescent current, a wide operating temperature range, and strong resistance to electromagnetic interference. It is particularly suitable for Ground Fault Circuit breakers and Ground Fault Circuit relays.

When a leakage current occurs in the L and N lines passing through the current transformers, the zero-sequence current transformer detects the leakage current signal. The subsequent circuitry converts this signal into a voltage signal, which is transmitted to the chip's input. Once the peak value of the input voltage signal exceeds 5 mV, the chip's output pin generates a high-level signal lasting for at least 20 ms to ensure the external SCR conducts.

The CN54125X integrates functional modules such as a regulated power supply, amplification circuit, comparison circuit, trip controller and trip driver circuit; externally, only a current transformer and a small number of components such as resistors and capacitors are required.

2 Features

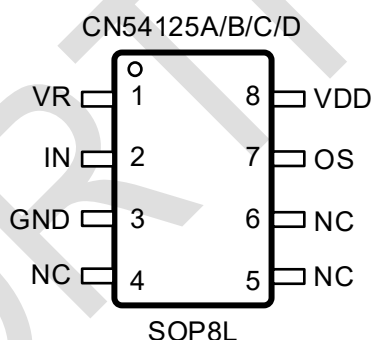
- Applied in type AC leakage detection
- High input sensitivity (5mV typical)
- Low quiescent current of 140uA
- Wide operating voltage range (3V~5.5V)
- Operating temperature range (Ta = -40 to +105 °C)
- Wide AC input voltage range:
50V~380V(50/60Hz)
- >20ms output pulse width can drive SCR

- Consistent leakage detection threshold
- Excellent EMC protection

3 Applications

- Ground Fault Circuit breakers
- Ground Fault Circuit relays

4 Pin Configuration



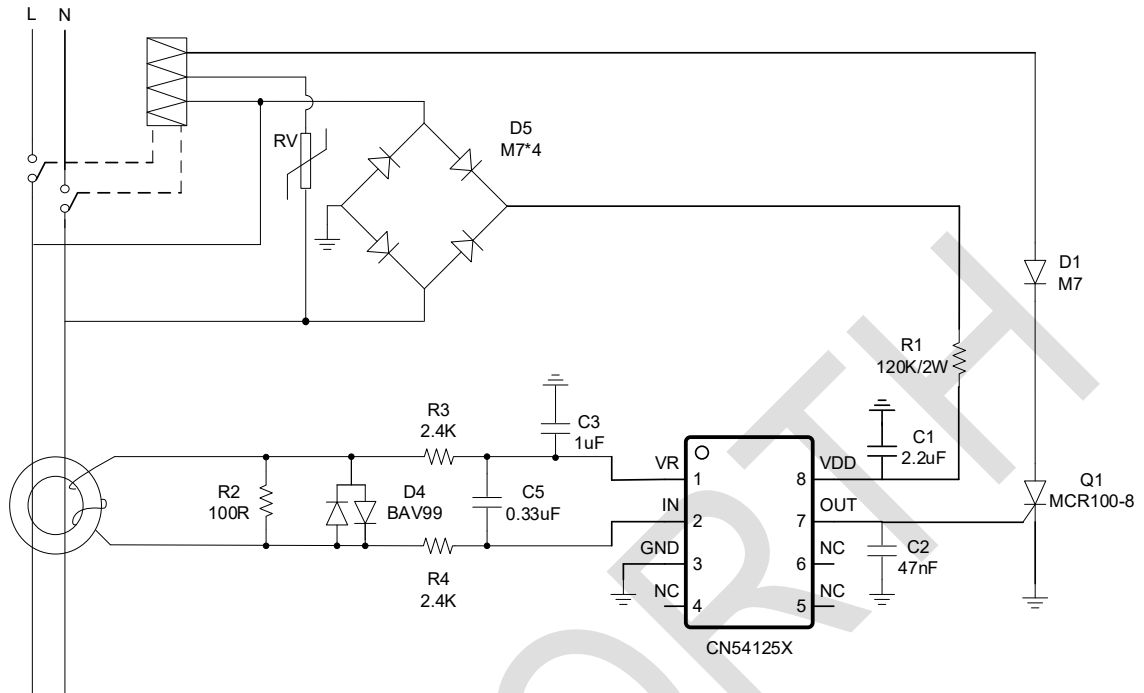
5 Ordering Information

Part NO.	Marking	Package	Qty/Tape
CN54125A	CN54125A YYWW	SOP8	4000/tape
CN54125B	CN54125B YYWW	SOP8	4000/tape
CN54125C	CN54125C YYWW	SOP8	4000/tape
CN54125D	CN54125D YYWW	SOP8	4000/tape

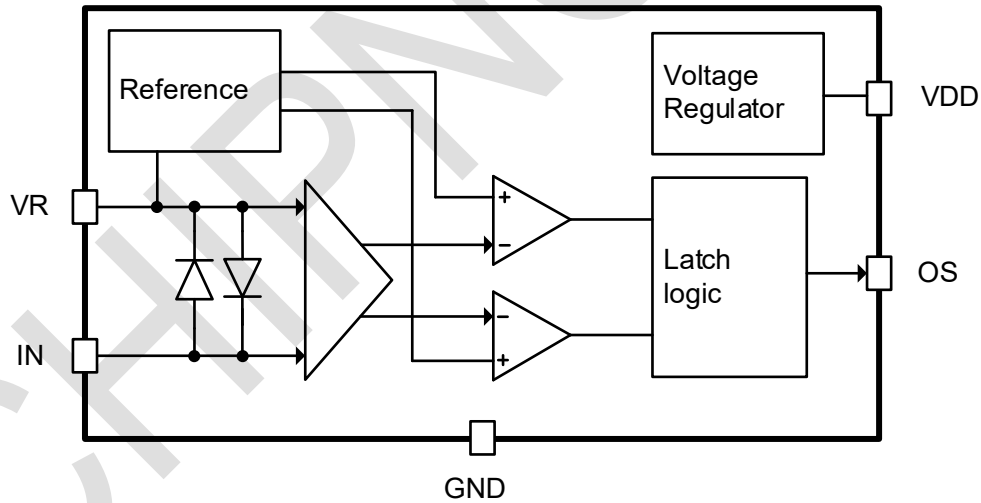
Note: YY=Year WW=Week.

Green (RoHS & HF): CHIPNORTH defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your CHIPNORTH representative directly.
Moisture sensitivity level(MSL):3

6 Typical Application



7 Block Diagram



8 Pin Descriptions

Pin number	Pin Name	Descaptions
1	VR	Internal Reference Voltage Output
2	IN	Ground Fault Leakage Signal Input
3	GND	Ground
4, 5, 6	NC	No Connect
7	OS	Output Control SCR
8	VDD	Power Supply

9 Specifications

9.1 Absolute Maximum Ratings

Parameter	Symbol	Value	Units
Operation Voltage	VDD	-0.4~+7	V
Other Pins	VIO	GND - 0.3, VDD + 0.3	V
Soldering temperature	T _{LEAD}	260 (soldering,10s)	°C
Operating Ambient Temperature Range	T _A	-40~+105	°C
Storage Temperature Range	T _{STG}	-55~+150	°C

Note: Stress exceeds these ratings listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Expose to absolute-maximum-rated conditions for extended periods may affect device reliability.

9.2 ESD Ratings

Discharge mode	Specification	Value	Units
HBM	ESDA/JEDEC JS-001-2017	±6000	V
CDM	ANSI/ESDA/JEDEC JS-002-2022	±2000	V

9.3 Recommended Operating Range

Parameter	Symbol	Min.	Max.	Units
Operation Voltage	VDD	3	5.5	V
Operating Ambient Temperature Range	T _A	-40	105	°C

9.4 Thermal Information

Parameter	Symbol	Value	Unit
Junction-to-ambient thermal resistance	R _{θJA}	100	°C/W

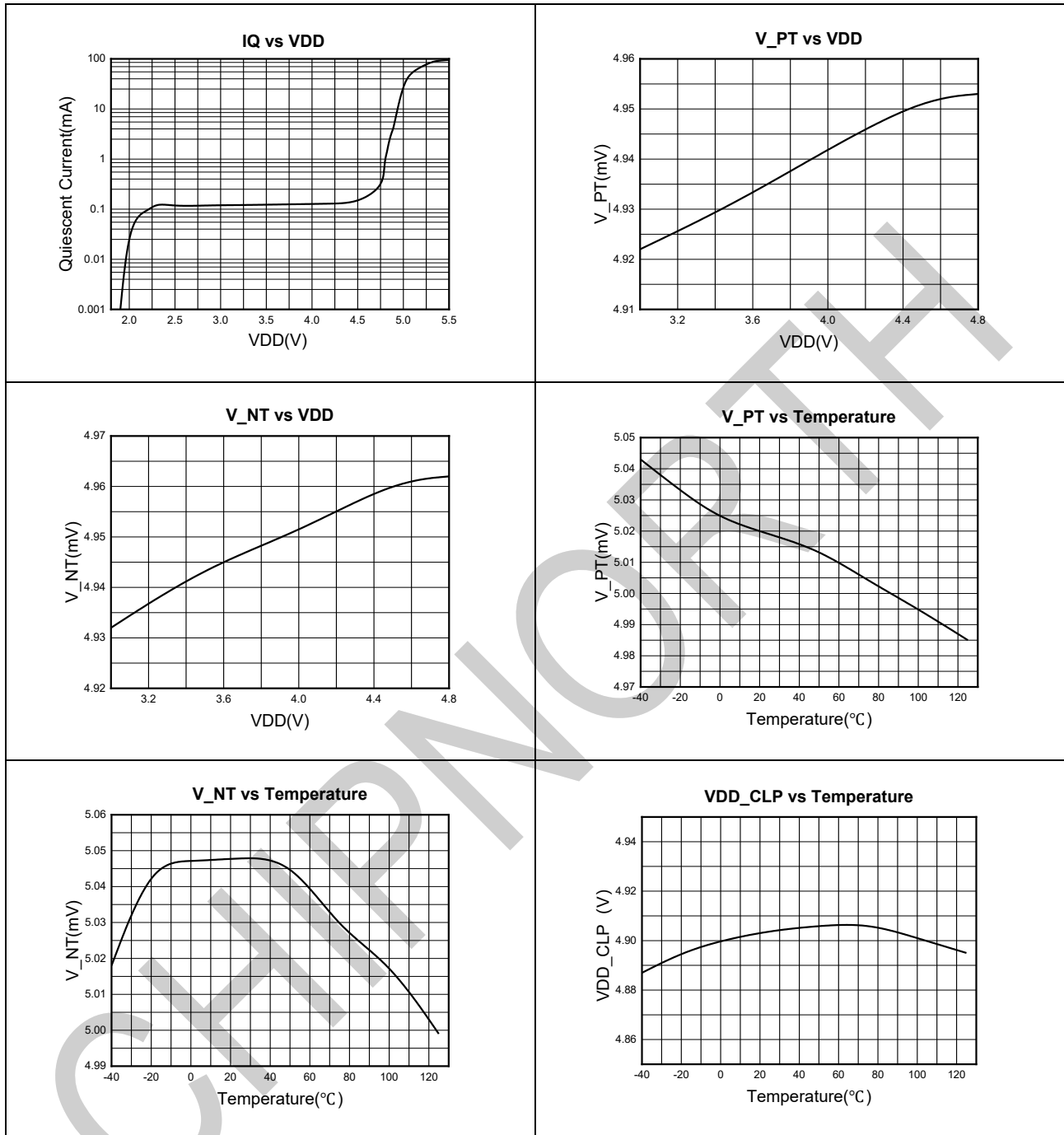
9.5 Electrical Characteristics

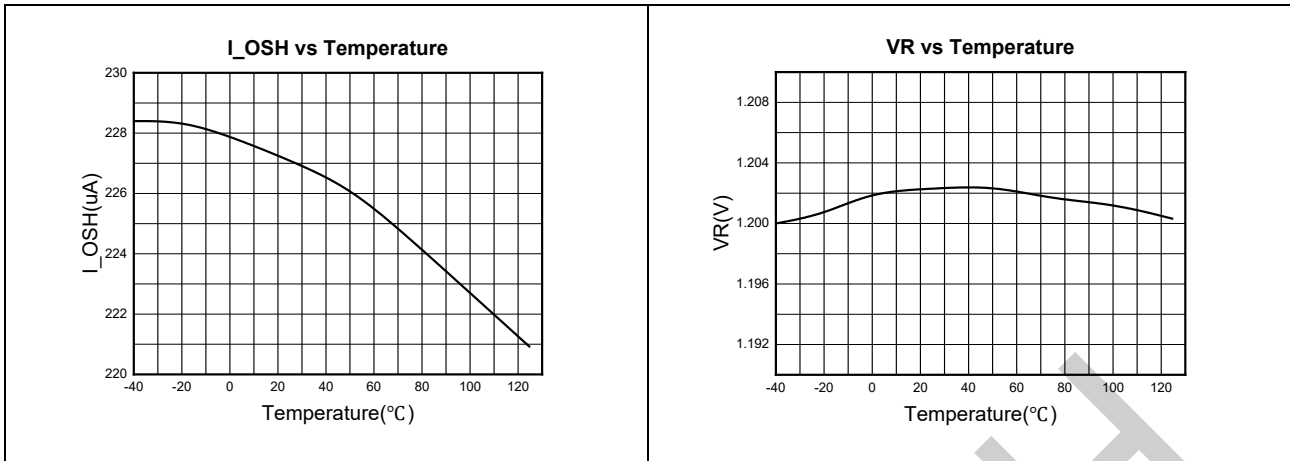
(V_{DD}=4.5V, T_A=25°C, unless otherwise specified.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Quiescent current	I _Q	V _{DD} =4.5V V _R - I _N =0mV	100	140	180	uA
Power supply clamping voltage	V _{DD_CLAP}	I _{VDD} =5mA	4.7	4.9	5.2	V
Internal reference voltage output	V _R		1.18	1.2	1.22	V
OS outputs high current	I _{OSH}	CN54125A, V _R - I _N =30mV		1.7		mA
		CN54125B, V _R - I _N =30mV		1.7		mA
		CN54125C, V _R - I _N =30mV	0.18	0.23	0.32	mA
		CN54125D, V _R - I _N =30mV	0.18	0.23	0.32	mA
OS outputs low voltage	V _{OSL}	V _R - I _N =0mV I _{OSL} =10mA		0.04	0.2	V
Positive trip voltage	V _{PT}	V _R - I _N	4.7	5	5.3	mV
Negative trip voltage	V _{NT}	I _N - V _R	4.7	5	5.3	mV
Latch time	T _{ON}	CN54125A	20			ms
		CN54125B	20	32	45	ms
		CN54125C	20			ms
		CN54125D	20	32	45	ms
Thermal shutdown threshold	OTP			155		°C
Thermal shutdown hysteresis	OTP_hys			30		°C

9.6 Characteristics Curve

(V_{DD}=4.5V, T_A=25°C, unless otherwise specified.)

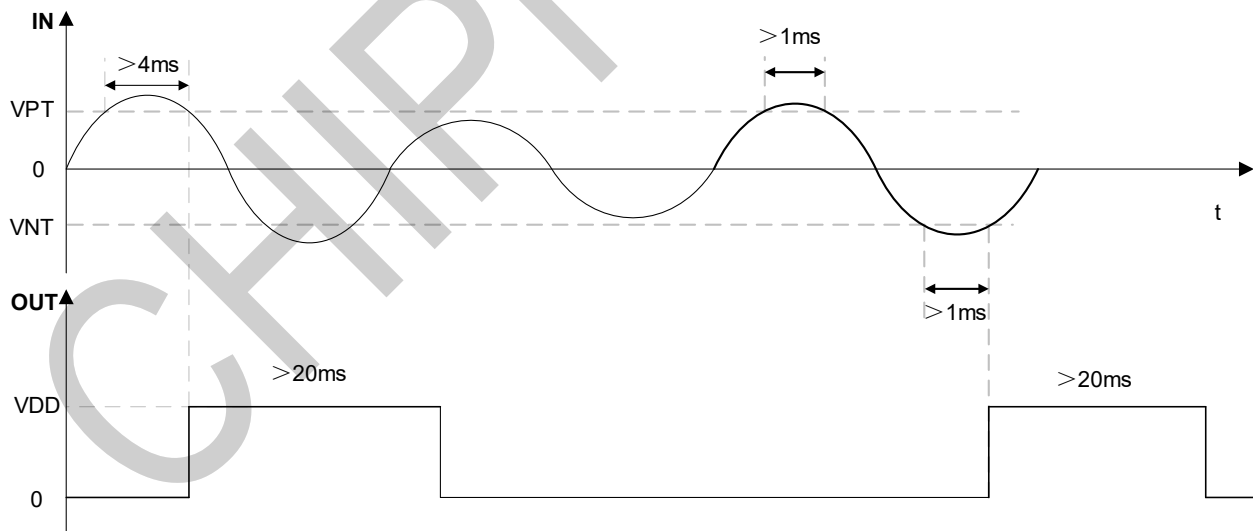




10 Detailed Description

The CN54125 is used to detect the leakage on the live and neutral lines. When a leakage signal is generated, the ZCT detects the leakage signal and the secondary coil outputs an inductive signal as the input of the main chip for the earth leakage circuit breaker. The chip can detect the residual current of type AC. When the RMS value of the leakage current exceeds the rated current (RMS) specified for the RCD, the output pin OS of the RCD chip generates an actuation level. This level has a pulse width of at least 20 ms, driving an external SCR into conduction.

The figure below shows a schematic diagram of the CN54125 in operation. When the leakage current signal between VR and IN exceeds the 5 mV threshold and is sustained for 4 ms, a drive pulse is generated at the output pin OS; when the rising edge of the leakage current signal exceeds +5 mV and is sustained for 1 ms, whilst the falling edge is below -5 mV and is sustained for 1 ms, a drive pulse is generated at the output pin OS; The pulse width is at least 20ms, driving the external SCR into conduction.



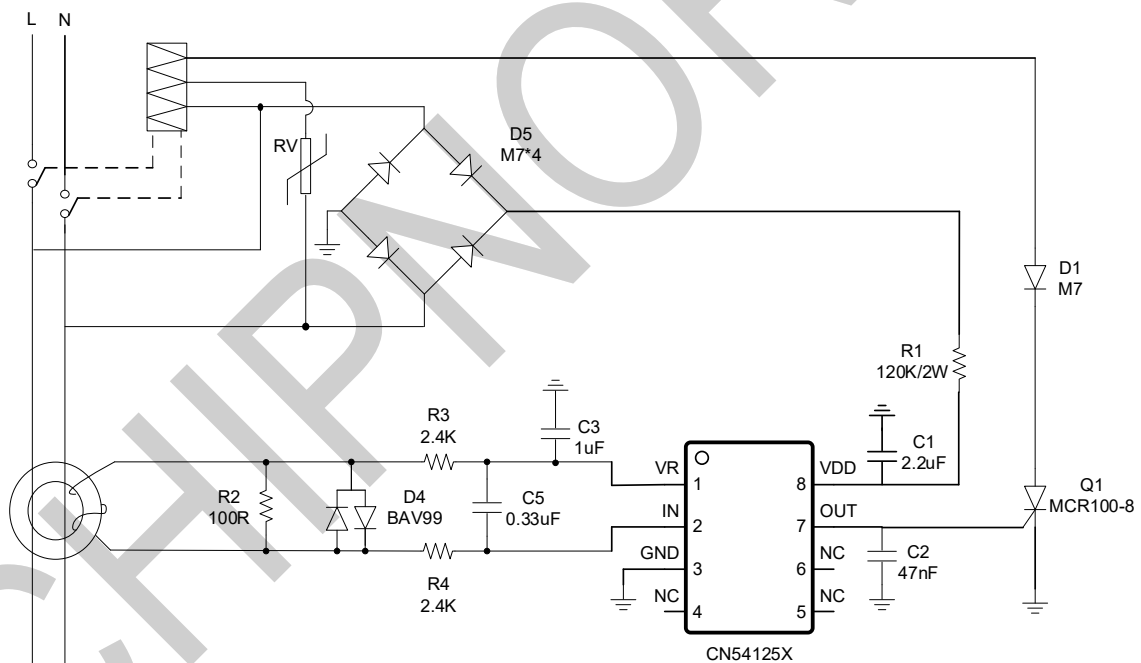
11 Application Information

11.1 CN54125A/B/C/D selection table

Chip model	OS current	OS	Applicable scenarios
CN54125A	1.7mA	Upon detection of a leakage current, the OS pin outputs a high level until the leakage is resolved	Input: 50 V to 380 V, full-bridge rectification, AC leakage
CN54125B	1.7mA	Upon detection of a leakage current, the OS pin outputs a single pulse of at least 20 ms	Input: 50 V to 380 V, full-bridge rectification, AC leakage
CN54125C	0.23mA	Upon detection of a leakage current, the OS pin outputs a high level until the leakage is resolved	Input: 50V–380V, half-bridge or full-bridge rectification, AC leakage
CN54125D	0.23mA	Upon detection of a leakage current, the OS pin outputs a single pulse of at least 20ms	Input: 50V–380V, half-bridge or full-bridge rectification, AC leakage

11.2 Component selection

The figure below shows a schematic diagram of CN54125 typical application circuit that can be used to evaluate its performance.



- In the above application circuit diagram, T0 is the ZCT used to induce the leakage current on the power supply line, R2 is the leakage protection action sensitivity adjustment resistance, the value of the resistance is related to the leakage current required to act and the turn ratio of the ZCT, the action sensitivity inside the CN54125 is 5mV, then ideally

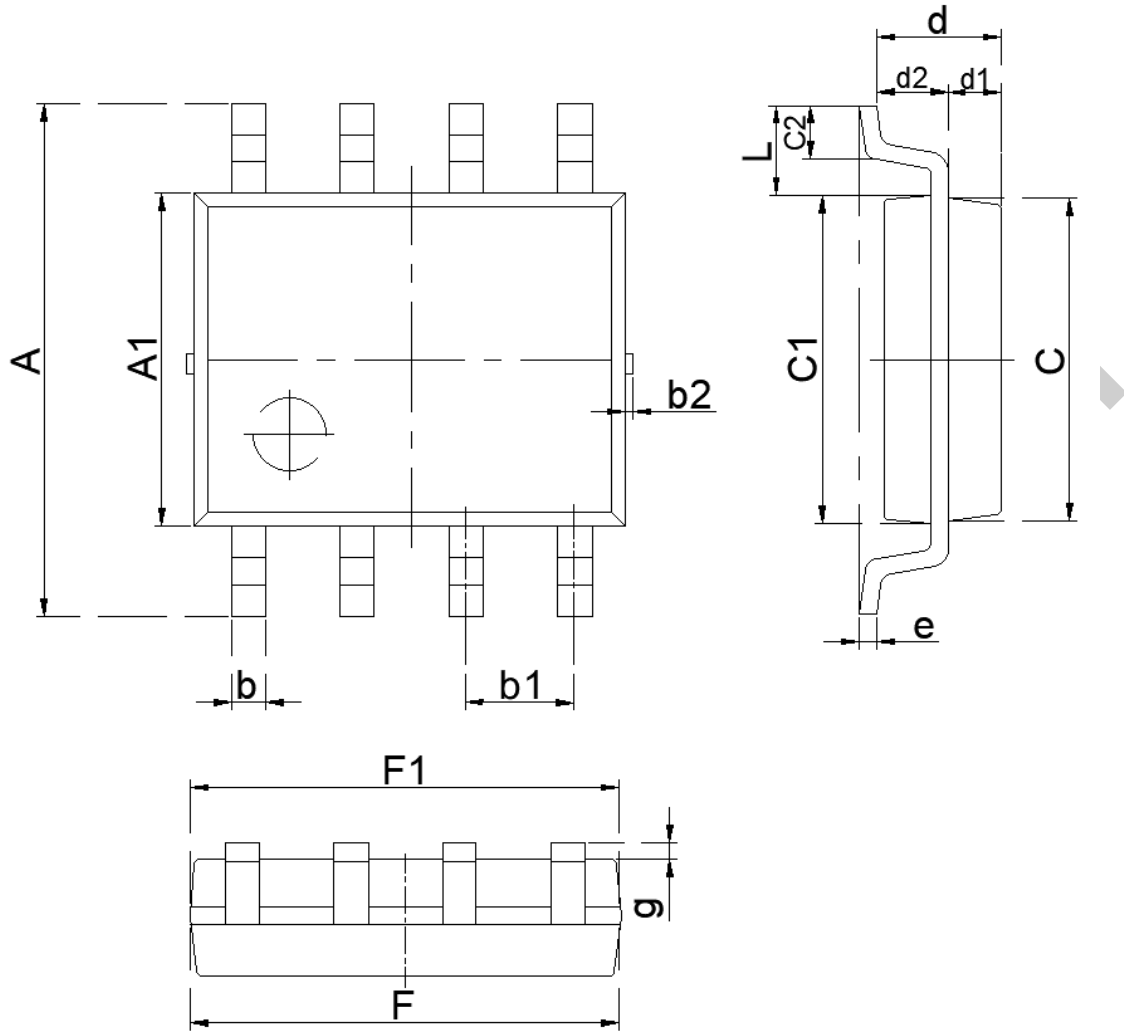
$$R_2 = \frac{5mV \times n \times k}{\sqrt{2} \times I_{\Delta n}}$$

$I_{\Delta n}$ is the set threshold current for leakage action, n is the number of turns of the zero-sequence current transformer T0, k is the inductance coefficient of the current transformer.

- R1, C1 and the clamping circuit inside the CN54125 form the power supply circuit, the value of R1 needs to consider the power requirements under the condition of maximum working voltage and the minimum working voltage requirements. Under the condition that the minimum operating voltage is 50 V AC, the maximum clamping current of VDD is 50 mA, considering the heat generation, 120k Ω /2W is recommended for R1 and 2.2 μ F for C1.
- C2 filters out any high-frequency interference noise that may occur in the circuit breaker, whilst preventing the thyristor from being triggered erroneously during the circuit breaker's energisation process; a 47 nF capacitor is recommended.
- C3 is a VR filter capacitor; we recommend using a 1 μ F capacitor.
- R3 and R4 are current-limiting resistors, and theoretically R3 and R4 are larger to protect the IC, but because the CN54125 uses a voltage amplifier internally, its impedance is limited, so it is recommended that the values of R3 and R4 should not exceed 2.4k Ω . At the same time, R3, R4 and C5 form a low-pass filter circuit (the cut-off frequency is 100Hz). It is recommended that the value of C5 should not be greater than 330 nF.

12 Package Information

SOP8L



Symbol	Value	Min (mm)	Max (mm)
A		5.8	6.2
A1		3.8	4.0
b		0.38	0.50
b1		1.17	1.37
b2		0	0.15
C		3.75	3.95
C1		3.8	4.0
C2		0.5	0.7
d		1.35	1.45
d1		0.55	0.65
d2		0.75	0.85
e		0.18	0.25
L		0.9	1.2
F		4.75	4.95
F1		4.8	5.0
g		0.06	0.16

13 Important Statement

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14 Revision History

Date	Version	Revision Notes
2026/09/15	R1.0	Official Release

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