

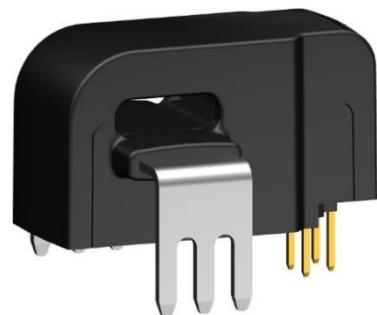


Current Sensor

Product Series: STK-PL/R

Part number: STK-50PL/R

Version: Ver1.3



Sinomags Technology Co., Ltd

Web site: www.sinomags.com

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1. Summary

The STK-50PL/R series is based on open-loop design. It is suitable for DC, AC, pulsed and any kind of irregular current measurement under the isolated conditions. The nominal current range of the STK-50PL/R current sensor consists of 50A.

Typical applications

- PV combiner box
- PV inverter (MPPT & AC)
- motor driver controller
- SMPS & UPS
- Battery management system

Standards

- EN50178:1997
- IEC 61010-1:2010
- IEC 61326-1:2012

General parameter

Parameter	Symbol	Unit	Value
Working temperature	T_A	°C	-40 ~ 105
Storage temperature	T_stg	°C	-40 ~ 105
Mass	m	g	10

Absolute maximum rating

Parameter	Symbol	Unit	Value
Supply voltage (non-destructive)	V_C	V	6.0
ESD rating (HBM)	U_ESD	kV	4
ESD rating (CDM)	U_CDM	kV	1.5

Remark: the unrecoverable damage may occur when the product works on the conditions over the absolute maximum ratings. Long-time working on the absolute maximum ratings may cause the degradation on performance and reliability.

Ratings

Parameter	Symbol	Unit	Value
Primary involved potential		V AC/DC	600
Ambient operating temperature	T_A	°C	105
Primary current	I_p	A	According to series primary current
Secondary supply voltage	U_c	V DC	5
Output voltage	V_out	V	0.1 ~ 4.9

Isolation parameter

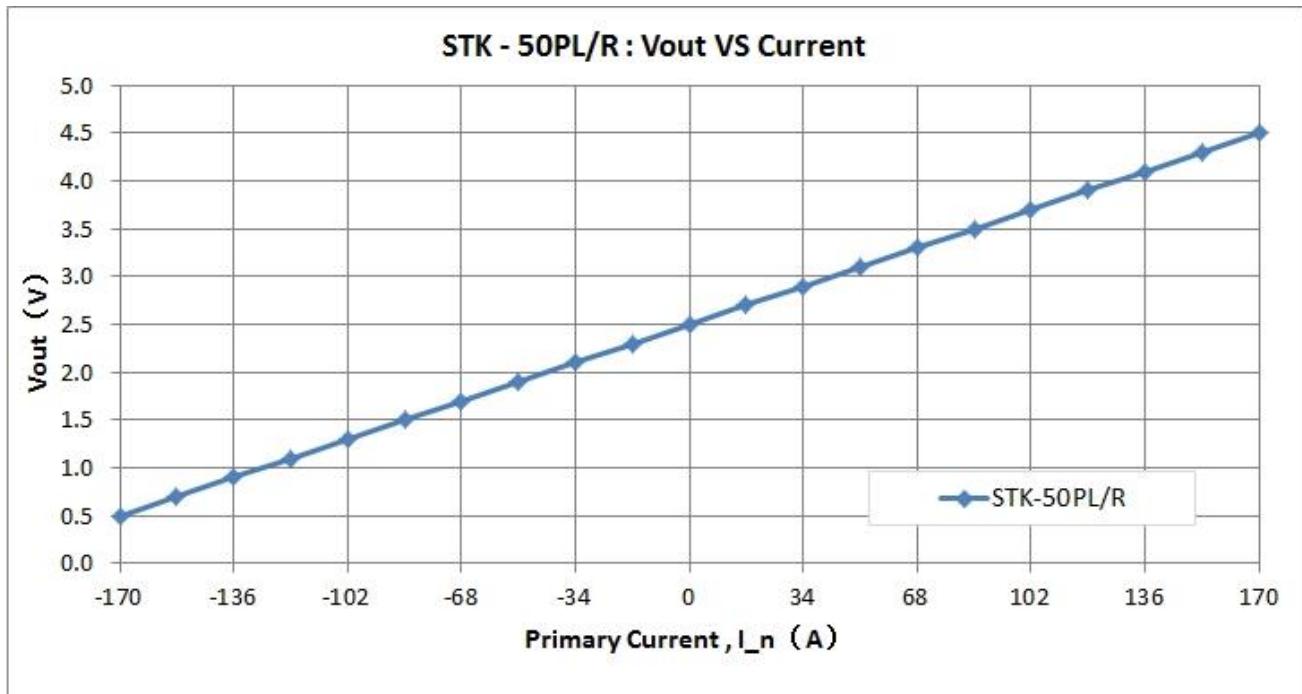
Parameter	Symbol	Unit	Value	Comment
RMS voltage for AC test 50Hz/1 min	Ud	kV	5	
Impulse withstand voltage 1.2/50μs	Üw	kV	8	
Clearance distance (pri. -sec)	dCI	mm	8	Shortest distance through air
Creepage distance (pri. -sec)	dCp	mm	8	Shortest path along device body
Case material			V0 according to UL 94	
Application example		V	600	Reinforced insulation, CAT III, PD 2, non uniform field according EN 50178, IEC 61010
Application example		V	1000	Basic insulation, CAT III, PD 2, non uniform field according EN 50178, IEC 61010
Application example		V	1500	Basic insulation, CAT III, PD 2, according to IEC 62109-1 Altitude ≤ 3000 m
Application example		V	600	CAT III, PD 2, according to UL 508

2. STK-50PL/R Electrical performance

Condition: T_A = 25°C Vcc = 5 V (Except special instructions)

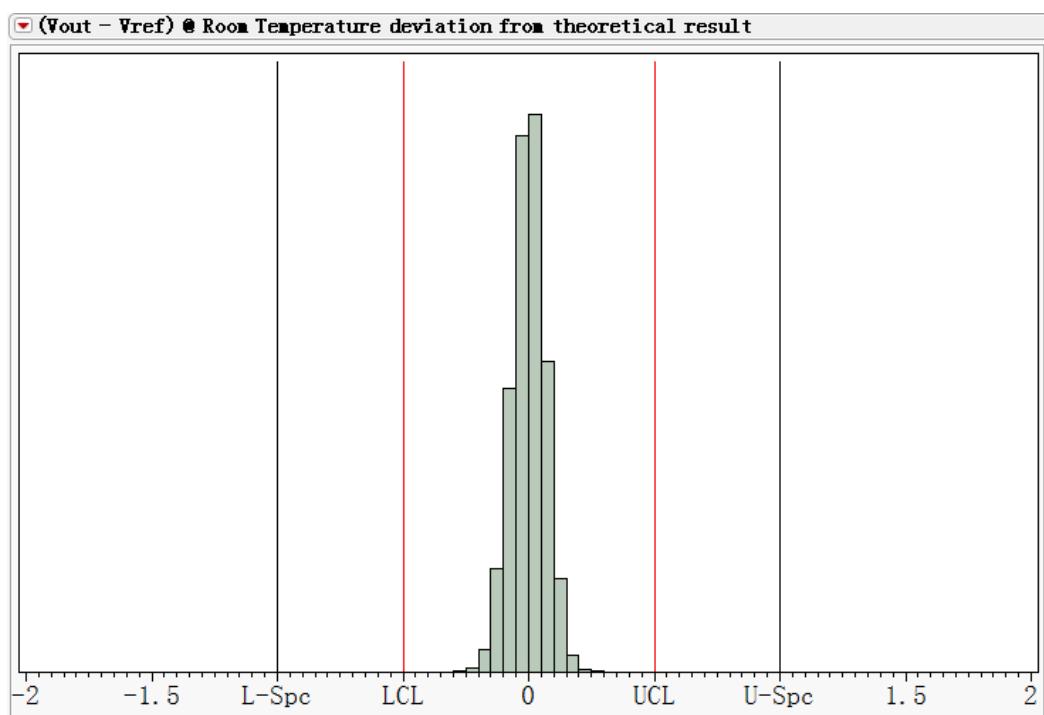
Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal current rms	I_pn	A		50		
Primary current measuring range	I_pm	A	-170		170	
Supply voltage	Vcc	V	4.75	5	5.25	
Current consumption	Icc	mA		5	10	
Reference voltage	Vref	V	2.48	2.5	2.52	Output function
output voltage@ I_pm	V_FS	V		2		(Vout - Vref)@ I_pm
Internal output resistance	R_out	Ω		1		Output
Quiescent voltage	Voff	V	2.48	2.5	2.52	Vout @ 0 A
Electrical offset voltage	Voe	mV	-10		10	(Vout – Vref) @ 0 A
Temperature drift of Voe	Voe_TRange	%V_FS	-1.5		1.5	-40°C ~ 105°C
Magnetic offset current	I_om	A	-0.25		0.25	@ ±10 x I_pn
Theoretical gain	G_th	mV/A		11.76		2V @ I_pm
Error of gain	Err_G	%G_th		±0.5		Trimmed in the factory @ 25°C
Temperature drift of gain	G_TR	%G_th	-1.0		1.0	-40°C ~ 105°C
Rated linearity error	Non-L_pn	%I_pn	-0.5		0.5	±I_pn
Linearity error @ I_P = 150A	Non-L_p	%I_pm	-1.5		1.5	±150A
Linearity error @ I_pm	Non-L_pm	%I_pm	-5		5	±I_pm
Reaction time	t_ra	μs		0.5		@ 10% of I_pn
Step response time	t_res	μs		1.8	2.5	@ 90% of I_pn
Delay time	t_delay	μs		1		200 kHz sine wave
Frequency bandwidth (-3dB)	BW	kHz		200		No RC circuit
Output voltage noise	Vnoise	mVpp		10		
DC ~ 10 kHz				15		
DC ~ 100 kHz						
Accuracy @ 25°C	X	% of I_pn	-1		1	@ 25°C
Accuracy @ -40°C ~ 105°C	X_TRange	% of I_pn	-3		3	-40°C ~ 105°C

3. Output voltage VS primary current



The dependence of V_{out} of STK-50PL/R on the primary current.

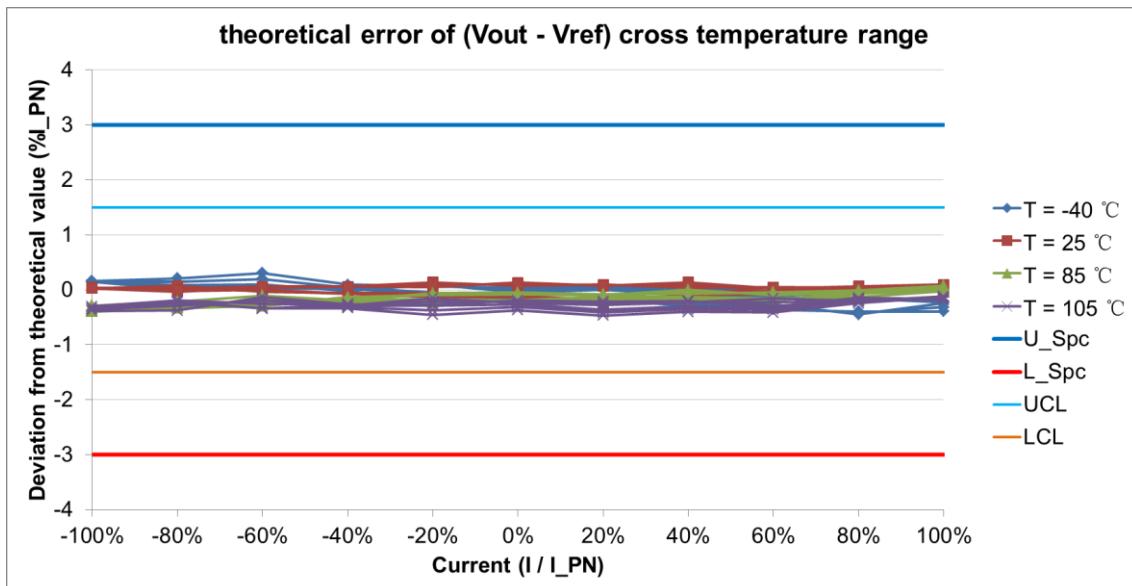
4. Accuracy characteristics in room temperature



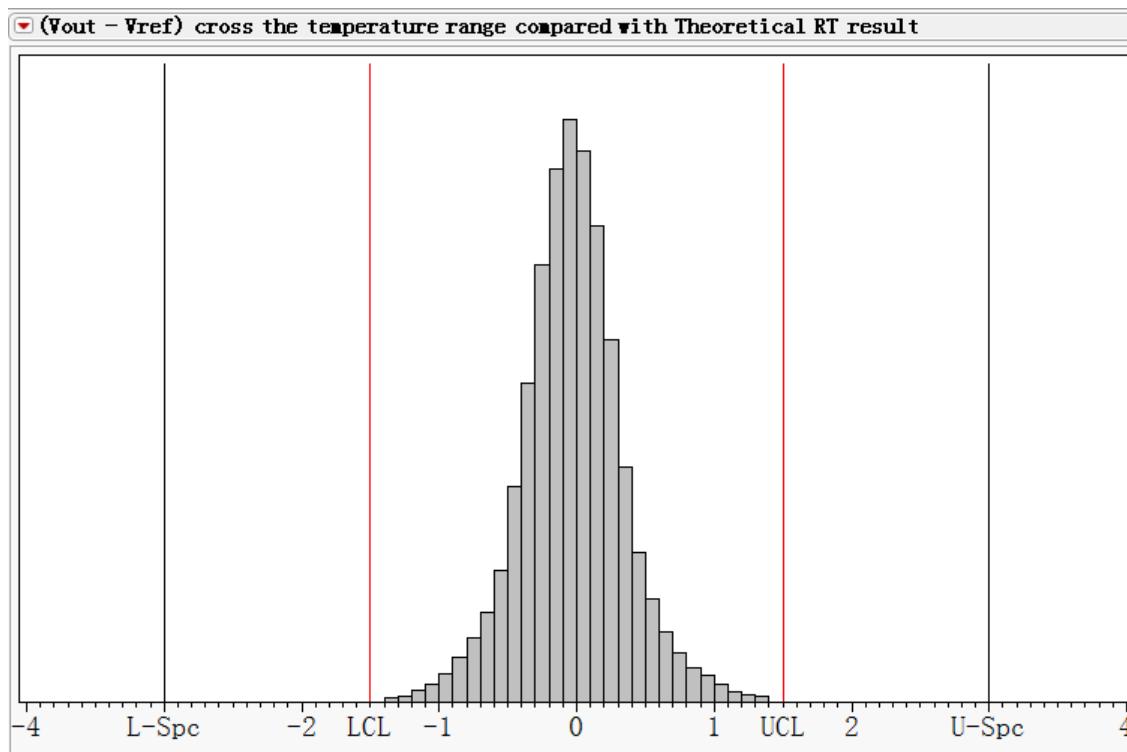
The error of STK-PL/R current sensor at 25 °C compared with the standard output, $((V_{out} - V_{ref})_{measure} @ I_n @ 25^\circ\text{C} - V_{oe}@25^\circ\text{C} - G_{th} * I_n) / V_{FS}$. V_{out} represents voltage of V_{out} , V_{ref} the

voltage of Vref, I_n the primary current, Voe the (Vout – Vref)@0A, G_th the theoretical gain, V_FS the rated output voltage.

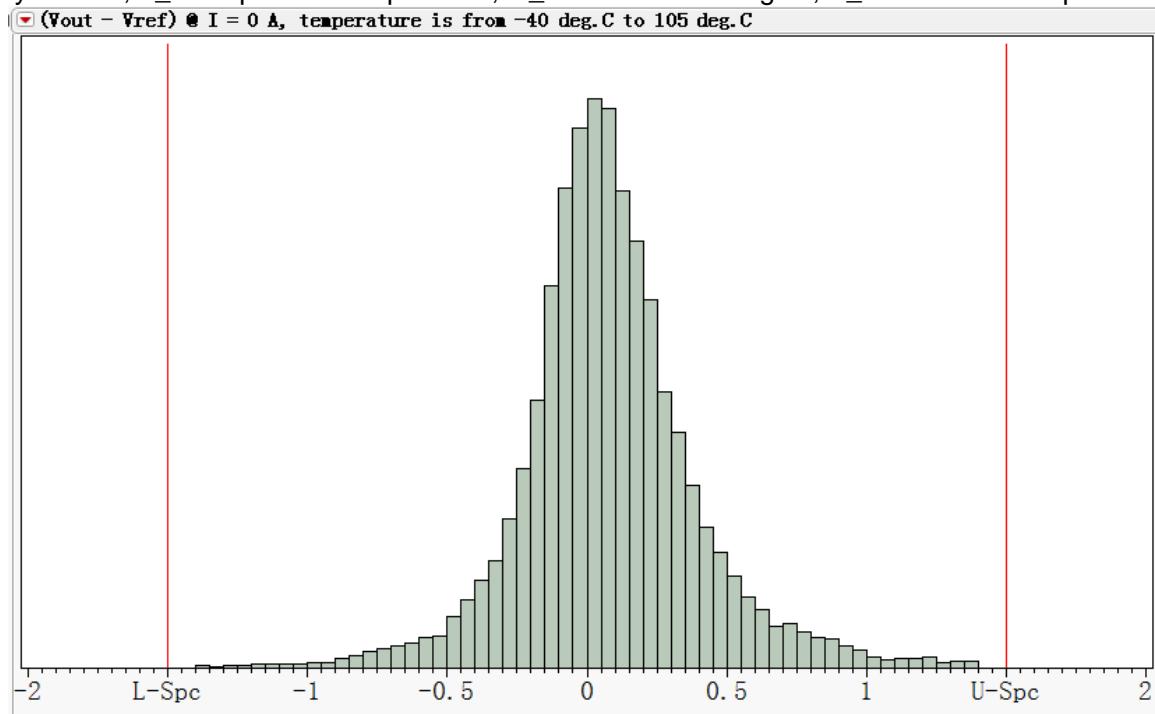
5. Accuracy cross temperature



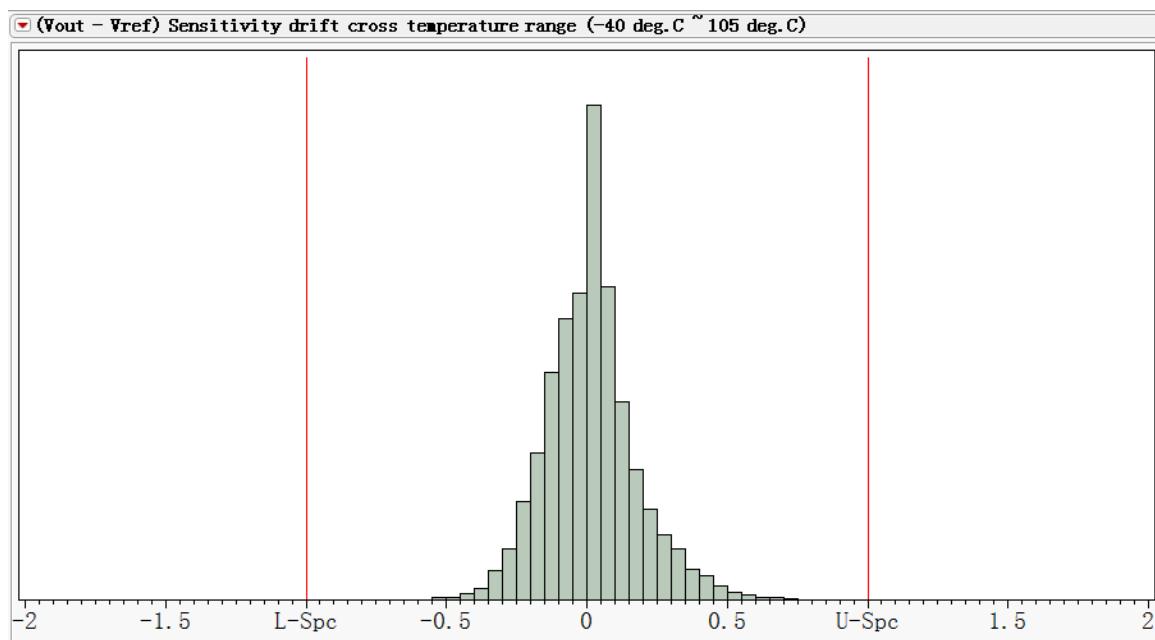
The error of STK-PL/R current sensor at $-40^{\circ}\text{C} \sim 105^{\circ}\text{C}$ compared with the standard output at room temperature, $((\text{Vout} - \text{Vref})_{\text{measure}} @ I_n @ T_x - \text{Voe} @ T_x - G_{\text{th}} * I_n) / V_{\text{FS}}$. Where, Vout represents voltage of Vout, Vref the voltage of Vref, I_n the primary current, T_x the present temperature, Voe the $(\text{Vout} - \text{Vref})@0\text{A}$, G_th the theoretical gain, V_FS the rated output voltage.



The error of STK-PL/R output ($V_{out} - V_{ref}$) current sensor at $-40^{\circ}\text{C} \sim 105^{\circ}\text{C}$ compared with the standard output ($V = G_{th} * I_n$), $((V_{out} - V_{ref}) @ I_n @ T_x - G_{th} * I_n) / V_{FS}$, Where, I_n represents present primary current, T_x the present temperature, G_{th} the theoretical gain, V_{FS} the rated output voltage.

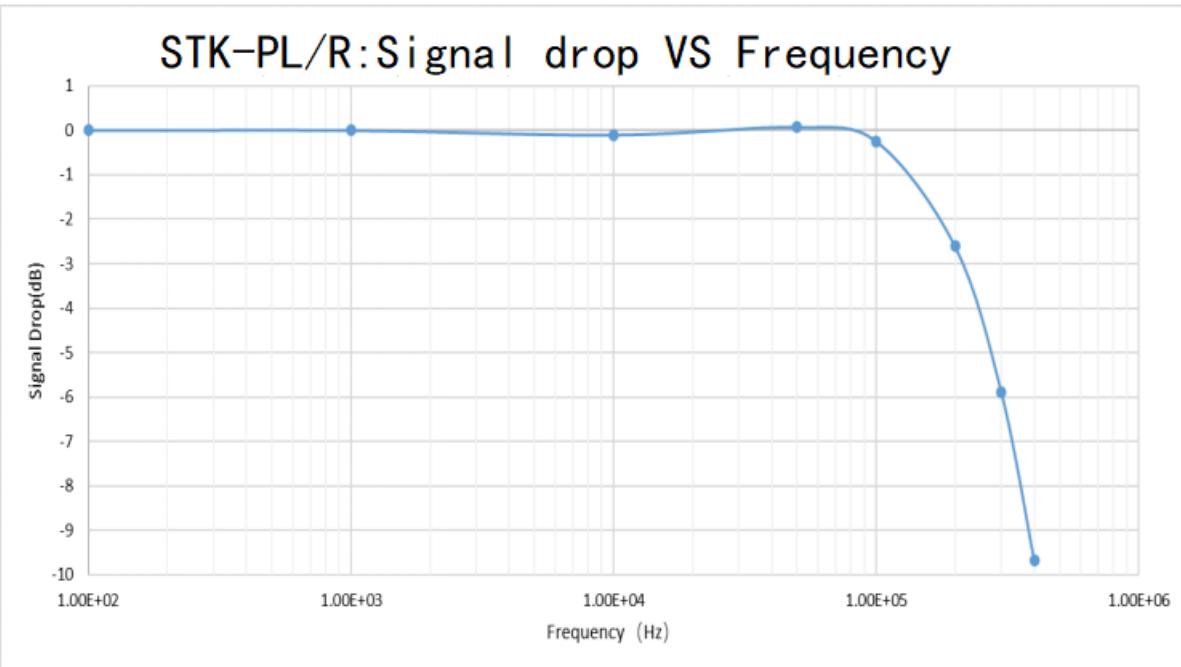


Temperature drift of V_{oe} , $V_{oe_TRange} = (V_{oe} @ T_x - V_{oe} @ 25^{\circ}\text{C}) / V_{FS}$. T_x represents present temperature, V_{FS} the rated output voltage.



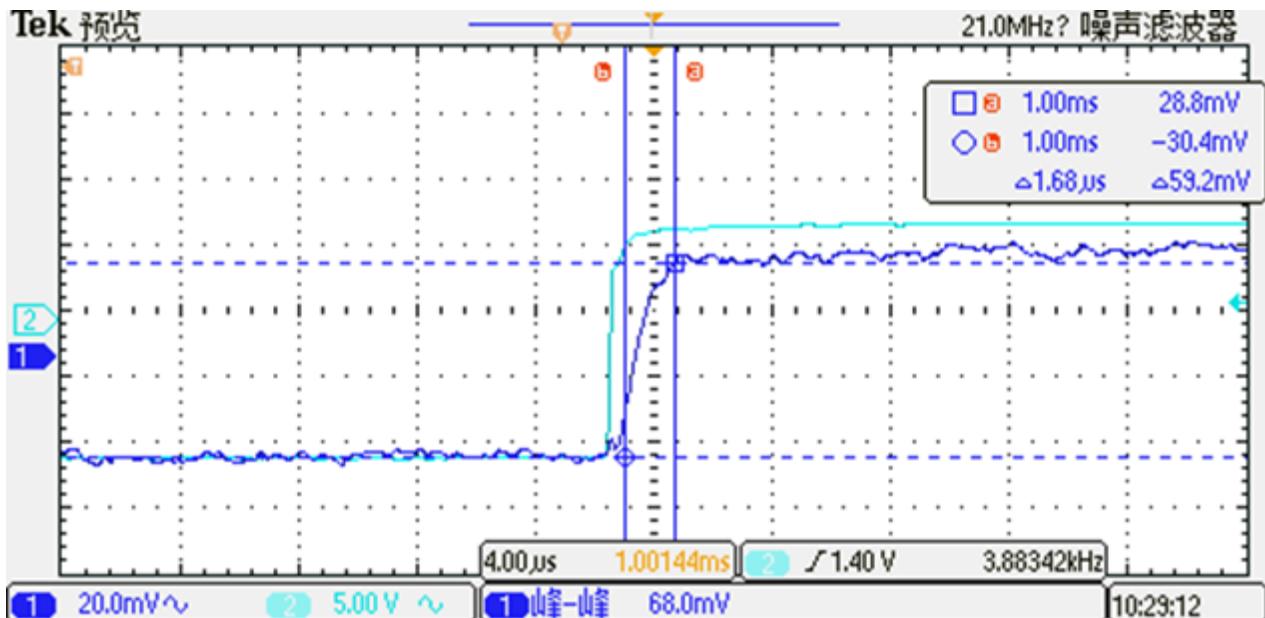
Error of gain, $\text{Err}_G = (((V_{out} - V_{ref}) @ I_{pn} - (V_{out} - V_{ref}) @ (-I_{pn})) / 2) - V_{FS} / V_{FS}$. Where I_{pn} represents the rated current, $-I_{pn}$ the reversed rated current.

6. Frequency response and bandwidth



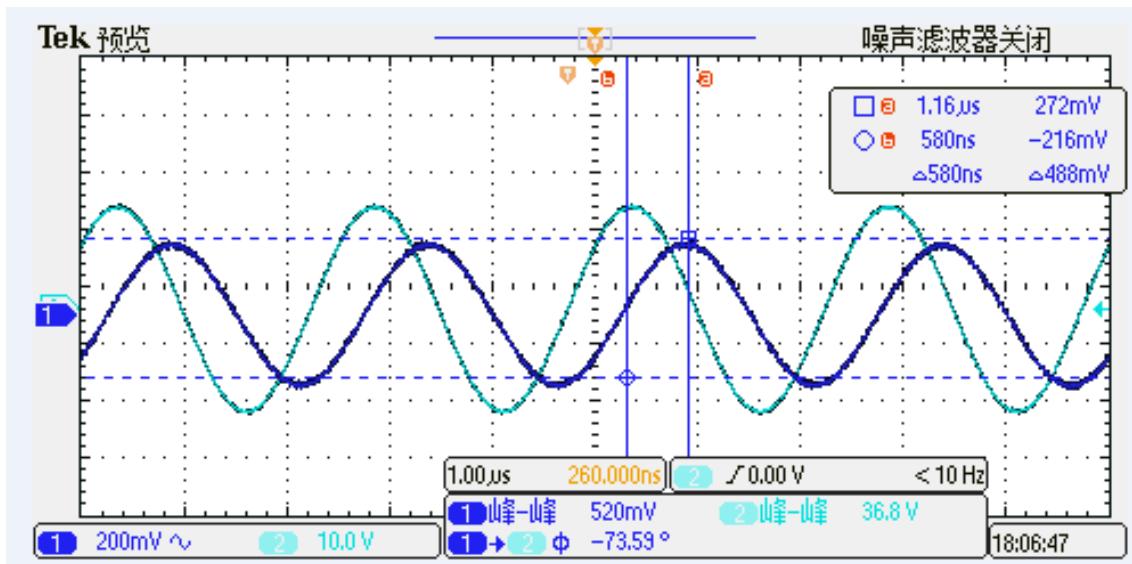
The frequency bandwidth of STK-50PL/R series current sensor. The bandwidth of current sensor is DC ~ 200 kHz (-3dB).

7. Step response time



The typical frequency response of STK-50PL/R current sensor. The response time from 90% of the primary current (light blue) to 90% of the secondary output (dark blue) is less than 2.5 μ s

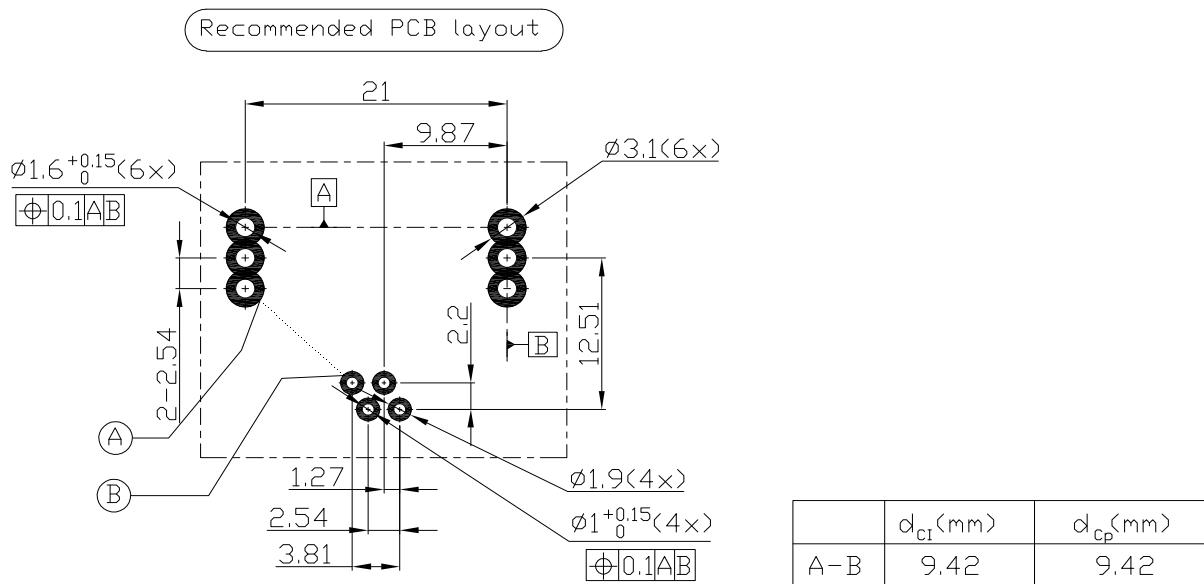
8. Frequency delay performance



When testing 200 kHz sine wave, the typical result of STK-50PL/R current sensor's output. The response time from the primary current (light blue) to the secondary output (dark blue) is less than 1 μ s.

9. Recommended PCB layout

Installation of view: overlooking (unit: mm)



1. Installing angle: Overlook (observe from the side of installing transducer)
2. Recommended bore diameter of primary current line, (diameter of primary current $\times 1.2$) mm
3. Recommended bore diameter of secondary current line, (diameter of secondary current $\times 1.2$) mm
4. The maximum thickness of PCB is 2.5 mm
5. The curve of wave soldering: 260°C \times 10 s

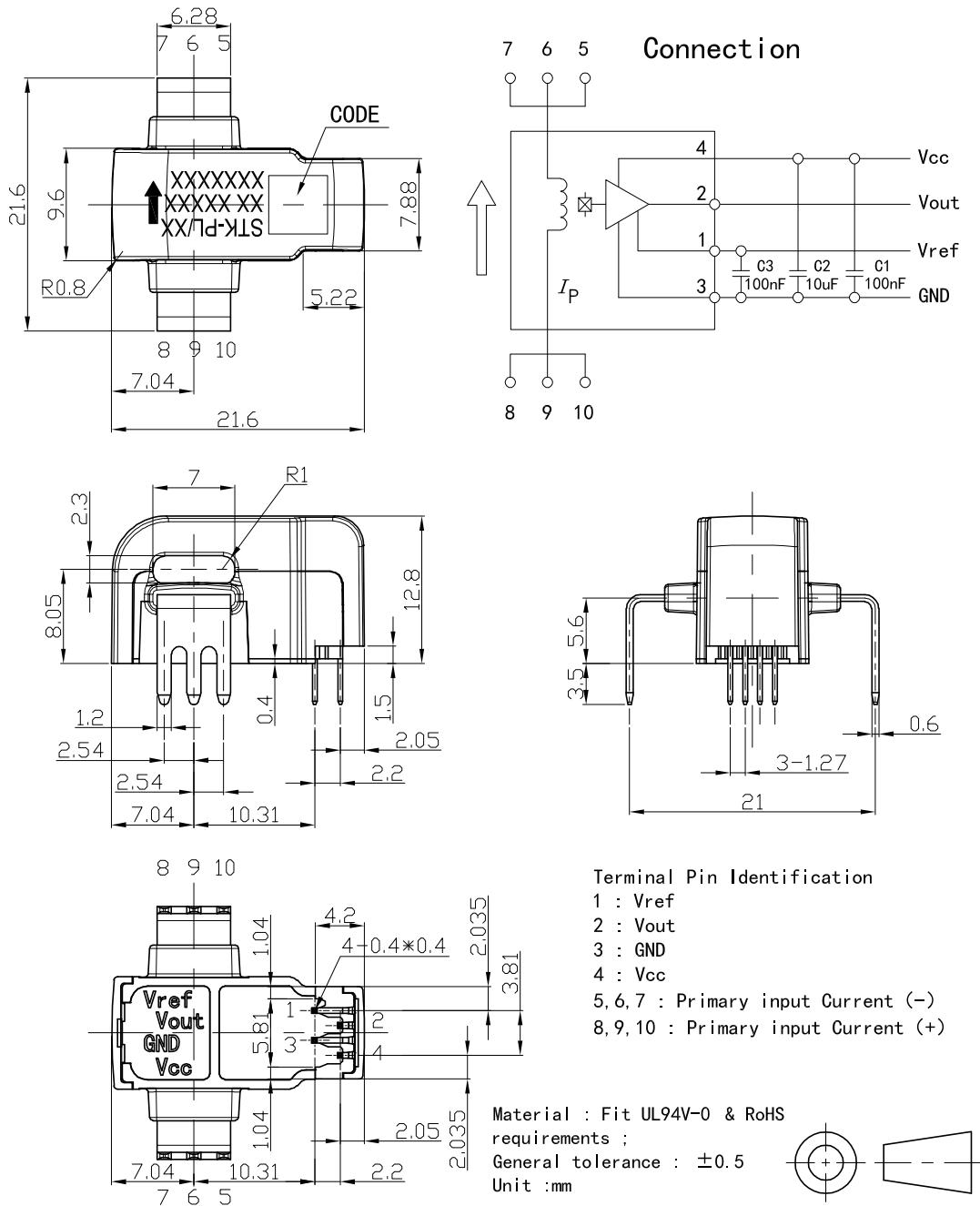


Security:

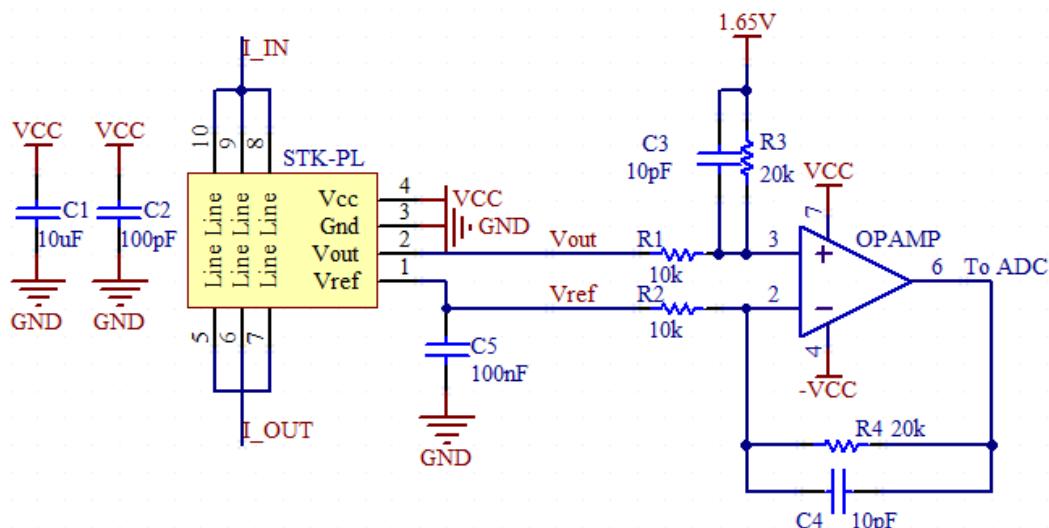
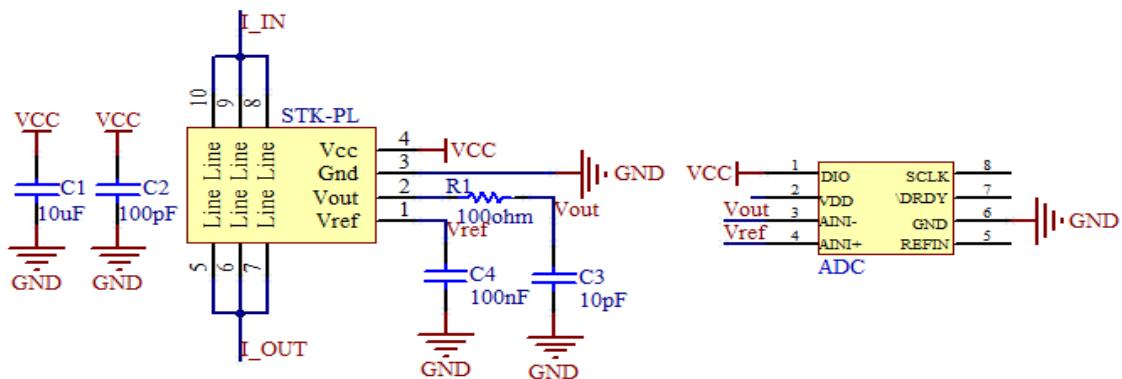
This current sensor must be used in limited-energy secondary circuit according to IEC 61010-1.

- This current sensor must be used in electric/electronic equipment with respect to appliance standards and safety requirement in accordance with the manufacture's operating instructions;
- When operating the current sensor, certain parts of the module can carry hazardous voltage;
- Failure to wiring as shown in the diagram will damage the current sensor;
- Ignoring this warning can lead to serious consequences.
- A protective housing or a additional shield could be used.
- Main supply must be able to disconnected.

10. Dimension & Pin definitions



11. Appendix: typical application circuit



R3 (kohm)	C3 (pF)	Theoretical -3dB $f = 1/(2\pi RC)$ (kHz)	Measured -3dB (kHz)
20	40	199	~ 200
20	81	98	~ 100
20	810	10	~ 10

The frequency characteristics of STK-xxPL/R series current sensor are not affected by the R-C setting (according to recommended R-C setting), therefore the active filter circuit or R-C circuit can be applied to modulate the sensor's frequency characteristics.

The signal input to ADC is $1.65 + R4/R2^*(V_{out} - V_{ref})$ with the conditions: $R1 = R2$, $R3 = R4$, $C3 = C4$.