

Current Sensor

Product Series: STK-HO-YP

Part number: STK-100HO-YP
STK-200HO-YP
STK-400HO-YP
STK-400HO-YP1
STK-500HO-YP
STK-560HO-YP

Version: Ver 1.4



Sinomags Technology Co., Ltd

Web site: www.sinomags.com

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1. Description

The STK-HO-YP series current sensor is based on Hall and open-loop design. It is suitable for DC, AC pulsed and any kind of irregular current measurement under the isolated conditions.

Typical applications

- AC Variable speed drives
- Power supplies for welding applications
- Switched model power supplies (SMPS)
- Battery supplied applications
- UPS
- MPPT
- Static converters for DC motor drives
- Combiner box

General parameter

Parameter	Symbol	Unit	Value
Working temperature	T_A	℃	-40 ~ 105
Storage temperature	T_stg	℃	-40 ~ 105
Mass	m	g	111

Absolute maximum rating

Parameter	Symbol	Unit	Value
Supply voltage	Vcc	V	6
ESD rating (HBM)	U_ESD	kV	4

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.

Isolation parameter

Parameter	Symbol	Unit	Value	Comment
RMS voltage for AC test 50Hz/1 min	Ud	kV	5.4	
Impulse withstand voltage 1.2/50 us	Uw	kV	9.6	
Clearance distance (pri. -sec)	dCl	mm	>10.5	Shortest distance through air
Creepage distance (pri. -sec)	dCp	mm	>10.5	Shortest path along device body
Case material			V0 according to UL 94	

2. Electrical data

Primary nominal rms current IPN (A)	Primary current measuring rang IPM (A)	Theoretical gain (mV/A)	Primary current, detection threshold ①	Type
100	±250	8	$2.93 * I_{pn}$	STK-100HO-YP
200	±500	4	$2.93 * I_{pn}$	STK-200HO-YP
400	±1000	2	$2.93 * I_{pn}$	STK-400HO-YP
400	±1000	2	$3.625 * I_{pn}$	STK-400HO-YP1
500	±1250	1.6	$2.93 * I_{pn}$	STK-500HO-YP
560	±1400	1.429	$2.93 * I_{pn}$	STK-560HO-YP

Remarks:

①. STK-HO-YP products may be ordered on request with a dedicated setting of the Trigger current . The product has a built-in overcurrent detection function, When the output voltage detected by the product exceeds the threshold, it is judged to be overcurrent and the output of fault pin changes to low level . The trigger error is $\pm 10\%$.

3. Electrical performance of STK-xxHO-YP

Condition: $T_A = 25^\circ\text{C}$, $V_{cc} = 5\text{ V}$

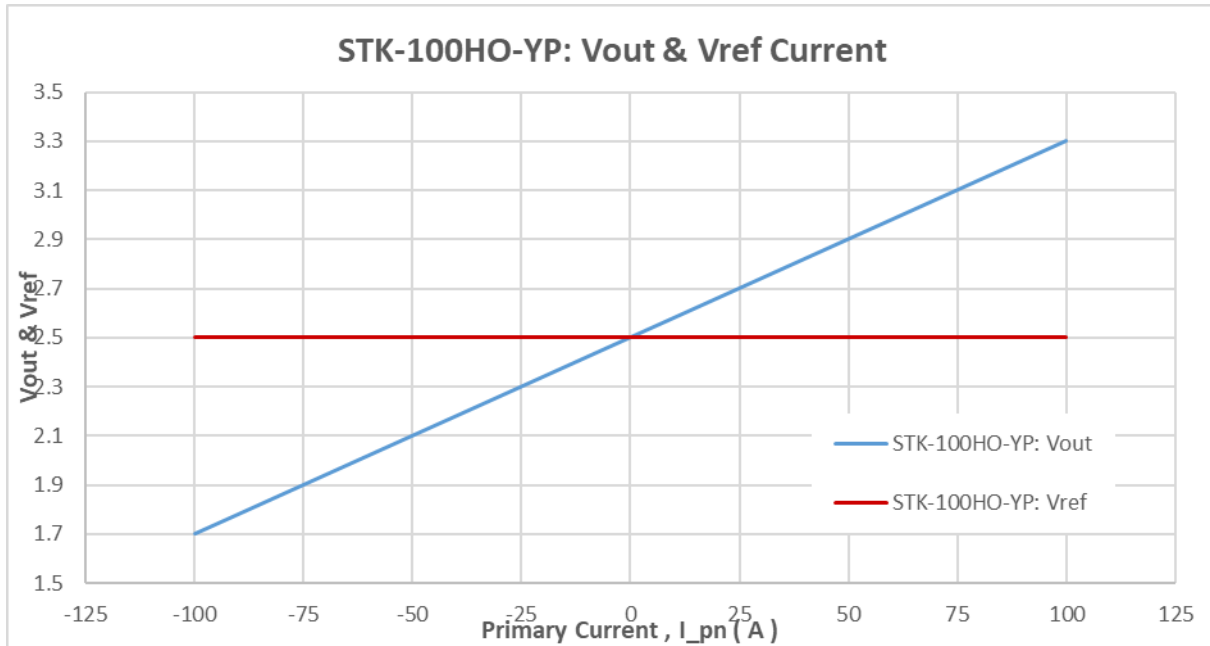
Parameter	Symbol	Unit	Min	Typ	Max	Comment
Supply voltage	V_{cc}	V	4.75	5	5.25	
Current consumption	I_{cc}	mA		10		
Quiescent voltage	V_{off}	V	2.48	2.5	2.52	$V_{out} @ 0\text{ A}$
Reference voltage	V_{ref}	V	2.48	2.5	2.52	Output function
Electrical offset voltage	V_{oe}	mV		± 8		$T_A @ 25^\circ\text{C}$
Internal Vref resistance	R_{ref}	Ω		1	10	Series
Internal output resistance	R_{out}	Ω		1	10	Series
Difference of output resistance ($R_{ref} - R_{out}$)	R_{oe}	Ω	-10		10	Series
OCD output mask time ②	T_{mask}	μs		2		
OCD output hold time ③	T_{hold}	ms		1.5		
Rated linearity error	Non-L	% I_{PN}		± 1		$\pm I_{PN}$
Temperature drift of V_{oe}	V_{oe_TRange}	mV	-10		10	$-40^\circ\text{C} \sim 105^\circ\text{C}$
Delay time @ 10 % of I_{PN}	t_{D10}	μs		3	3.5	@ 100 A/ μs
Delay time @ 90 % of I_{PN}	t_{D90}	μs		3	3.5	@ 100 A/ μs

Frequency bandwidth (-3dB)	BW	kHz		180		No RC circuit
Output voltage noise	Vnoise	mVpp		6		@140kHz Sampling Rate
Accuracy @ 25℃	X	% of I _{PN}		±1.5		@ 25℃
Accuracy @ -40℃~85℃	X_TRange	% of I _{PN}	-3.3		3.3	
Accuracy @ 85℃~105℃ ④	X_TRange	% of I _{PN}	-4		4	

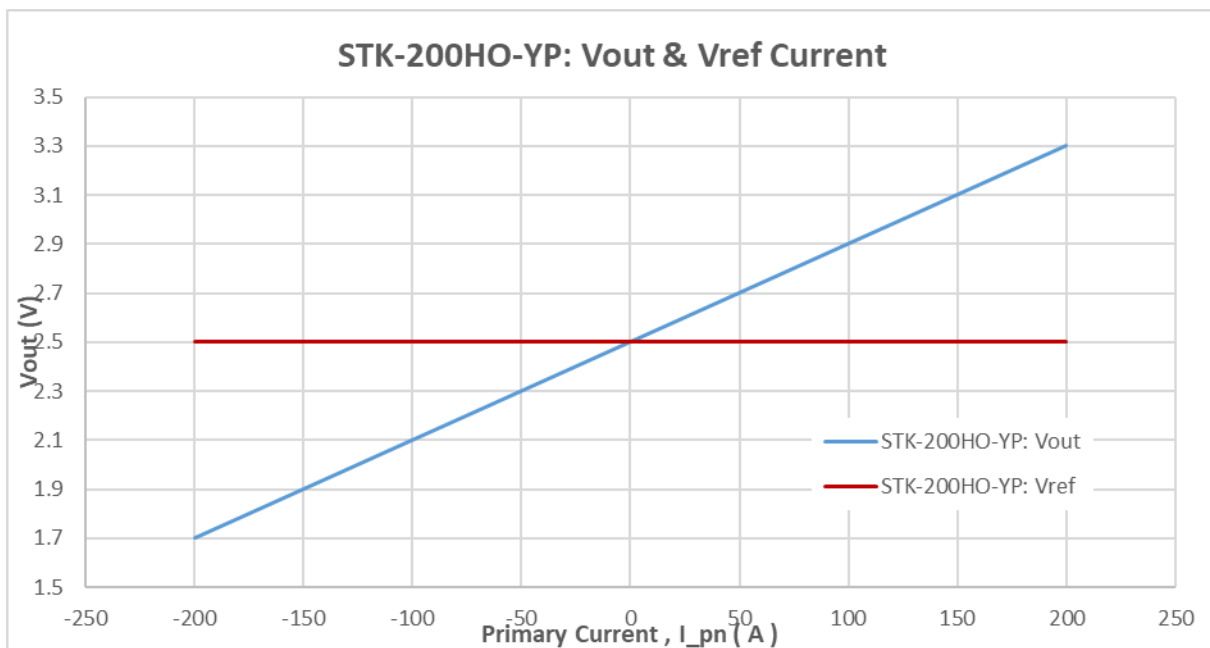
Remarks:

- ② ③. To prevent nuisance tripping, a tmask time is used. If an over current occurs, but does not persist for the duration of tmask, it does not trigger the fault pin. This prevents short transient spikes from causing erroneous fault detections. In the event where transient error reporting is desired, the tmask can be disabled. If the fault is triggered, it will remain active for a minimum time of thold and up to the end of the fault condition, whichever is greater.
- ④. the accuracy @ -85℃~105℃, $X_TRange = ((V_{out} - V_{ref})@ In @ T_x) - V_{oe@ 25℃} - G_{th} * In) / V_{FS}$, where T_x represents present temperature, G_th is fitted gain at room temperature .

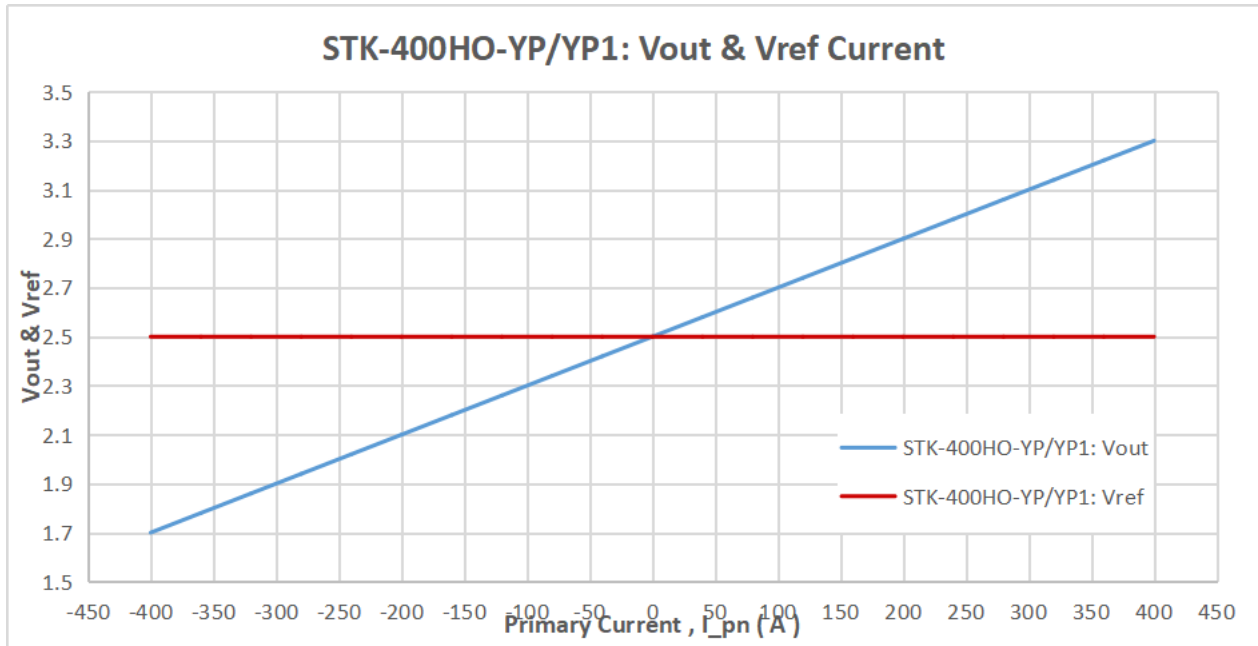
4. Output voltage VS primary current of STK-HO-YP



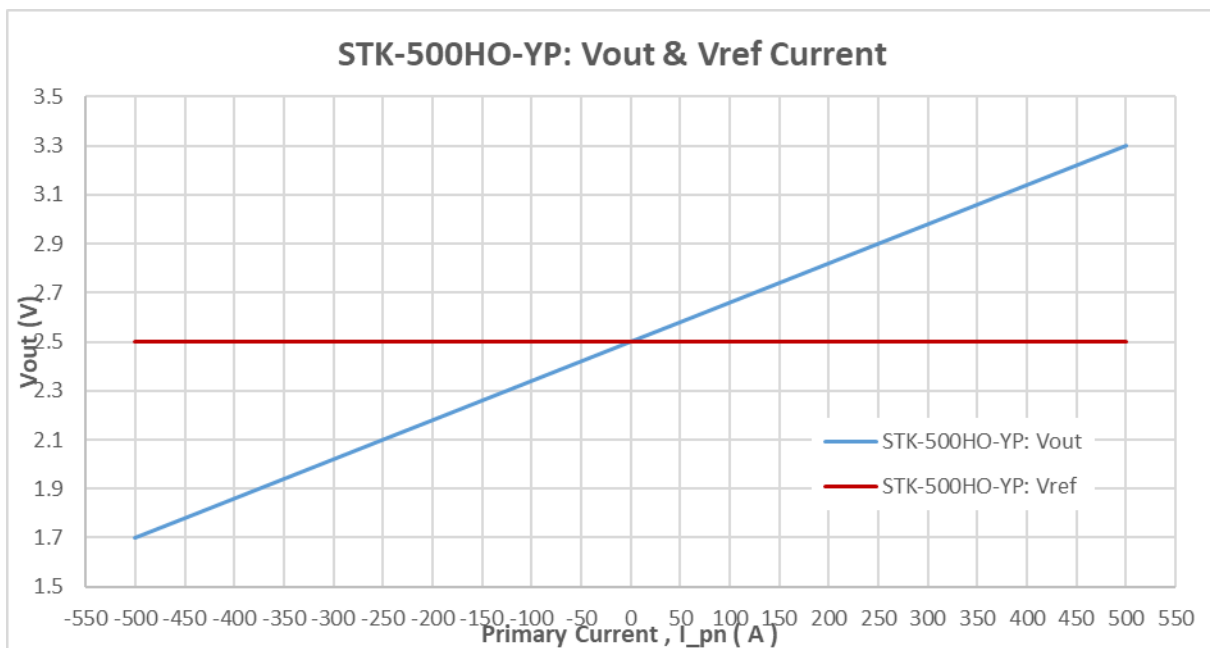
The dependence of Vout & Vref of STK-100HO-YP on the primary current.



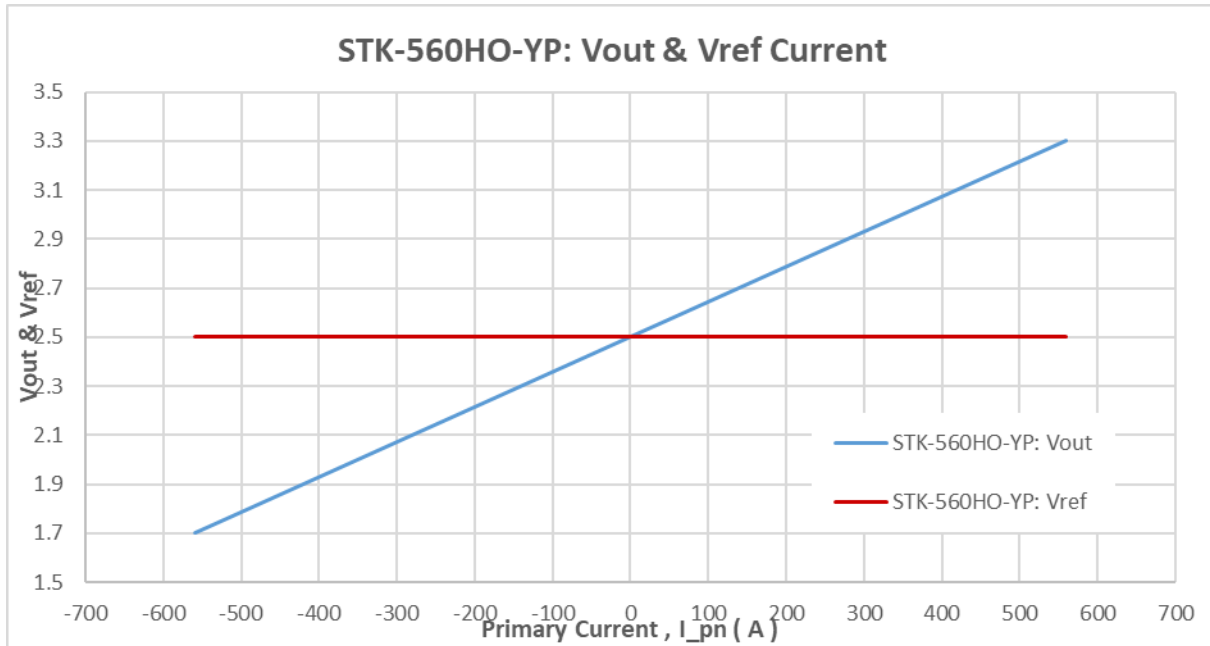
The dependence of Vout & Vref of STK-200HO-YP on the primary current.



The dependence of V_{out} & V_{ref} of STK-400HO-YP on the primary current.

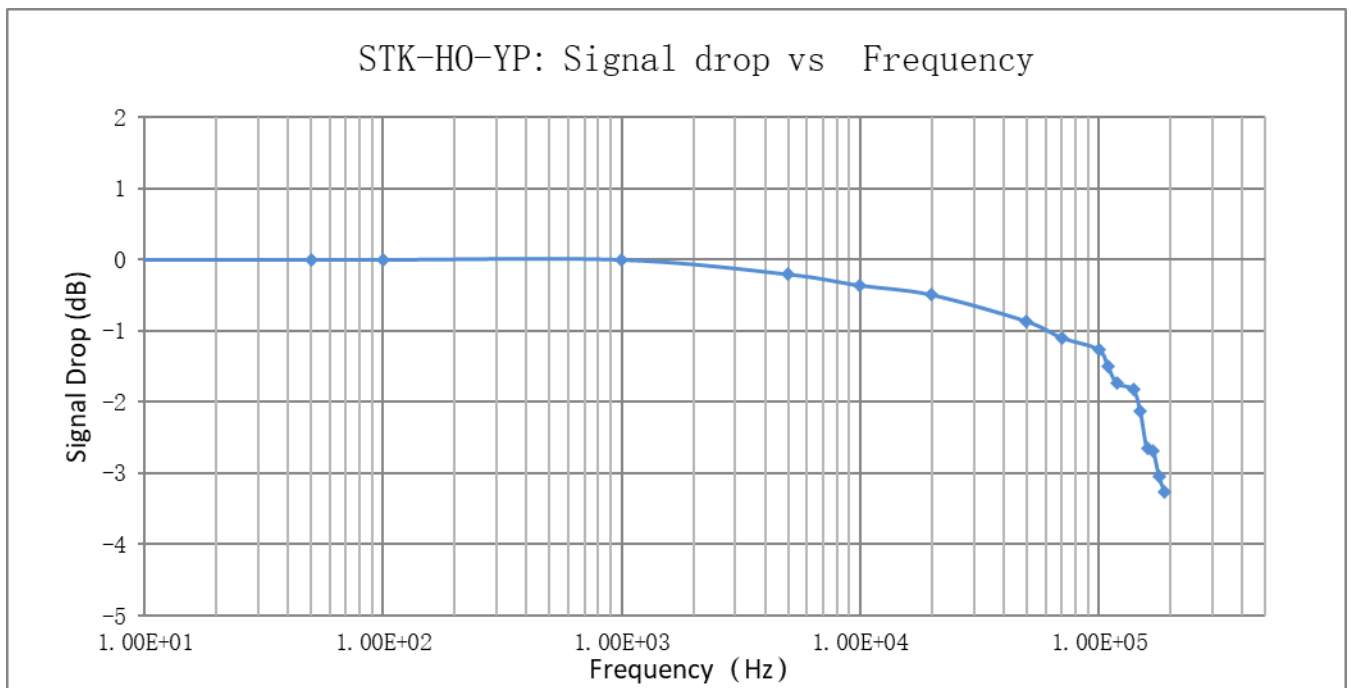


The dependence of V_{out} & V_{ref} of STK-500HO-YP on the primary current.



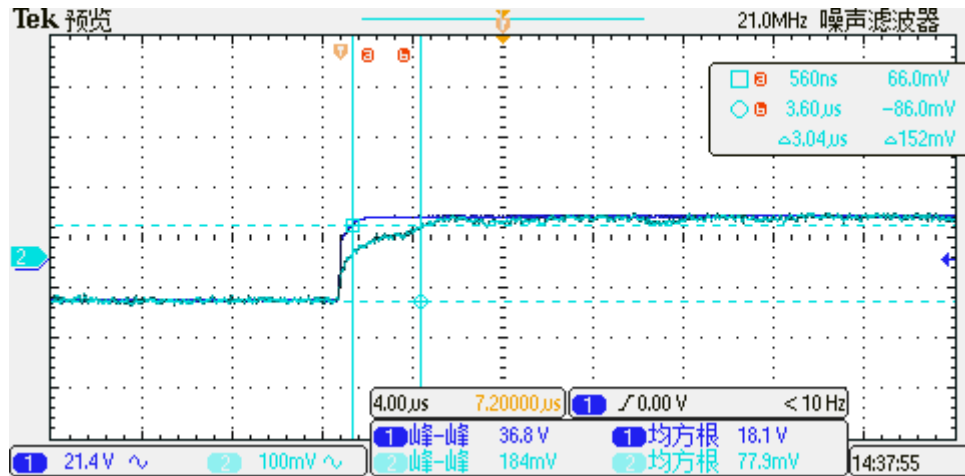
The dependence of Vout & Vref of STK-560HO-YP on the primary current.

5. Frequency bandwidth



The frequency band width of STK-HO-YP series current sensors.

6. Step response time



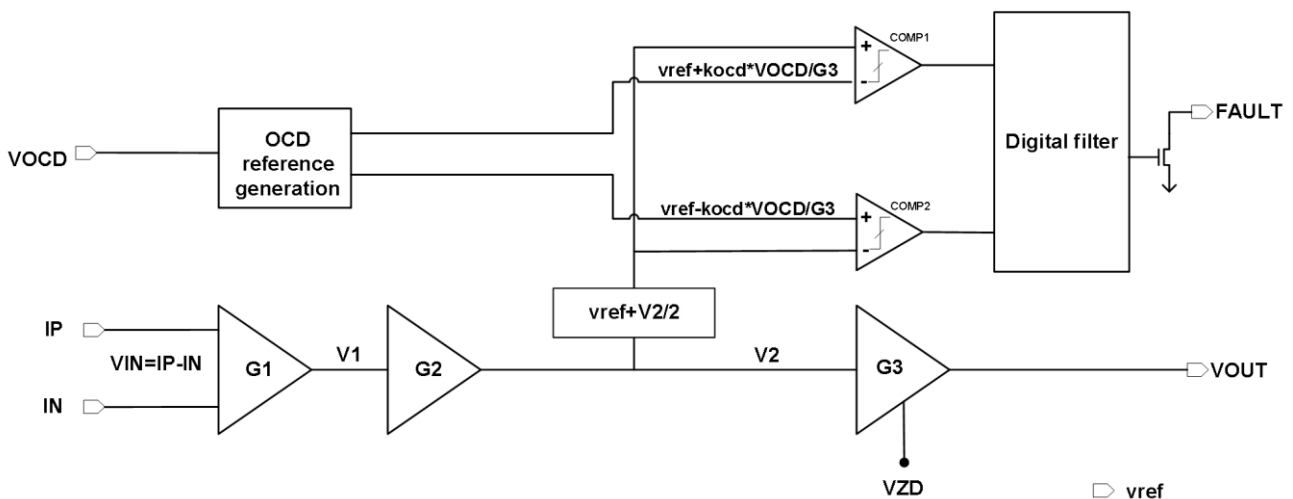
The step response time of STK-HO-YP current sensors. The dark light blue is primary current, while the light blue is output signal of current sensor. The step response time is about 3 μs.

7. General information on OCD

This section describes the general information on OCD function, the specific functions, which are not listed in the section of “electrical data”, can be defined per request.

Since the trigger voltage is set after the second amplifier, the OCD function supports that the trigger current can be higher than I_{pn} . The trigger voltage can be defined:

- a) $V_{ref} = 2.5 \text{ V}$
- b) $0.625 \text{ V} \leq V_{OC} \leq V_{ref}$;
- c) Trigger voltage = $V_{ref} \pm 2 \cdot V_{OC}$;
- d) Trigger current = $(V_{ref} \pm 2 \cdot V_{OC} - V_{off}) / G_{th}$;



Functional Block Diagram on OCD function when $V_{ref} = 2.5 \text{ V}$

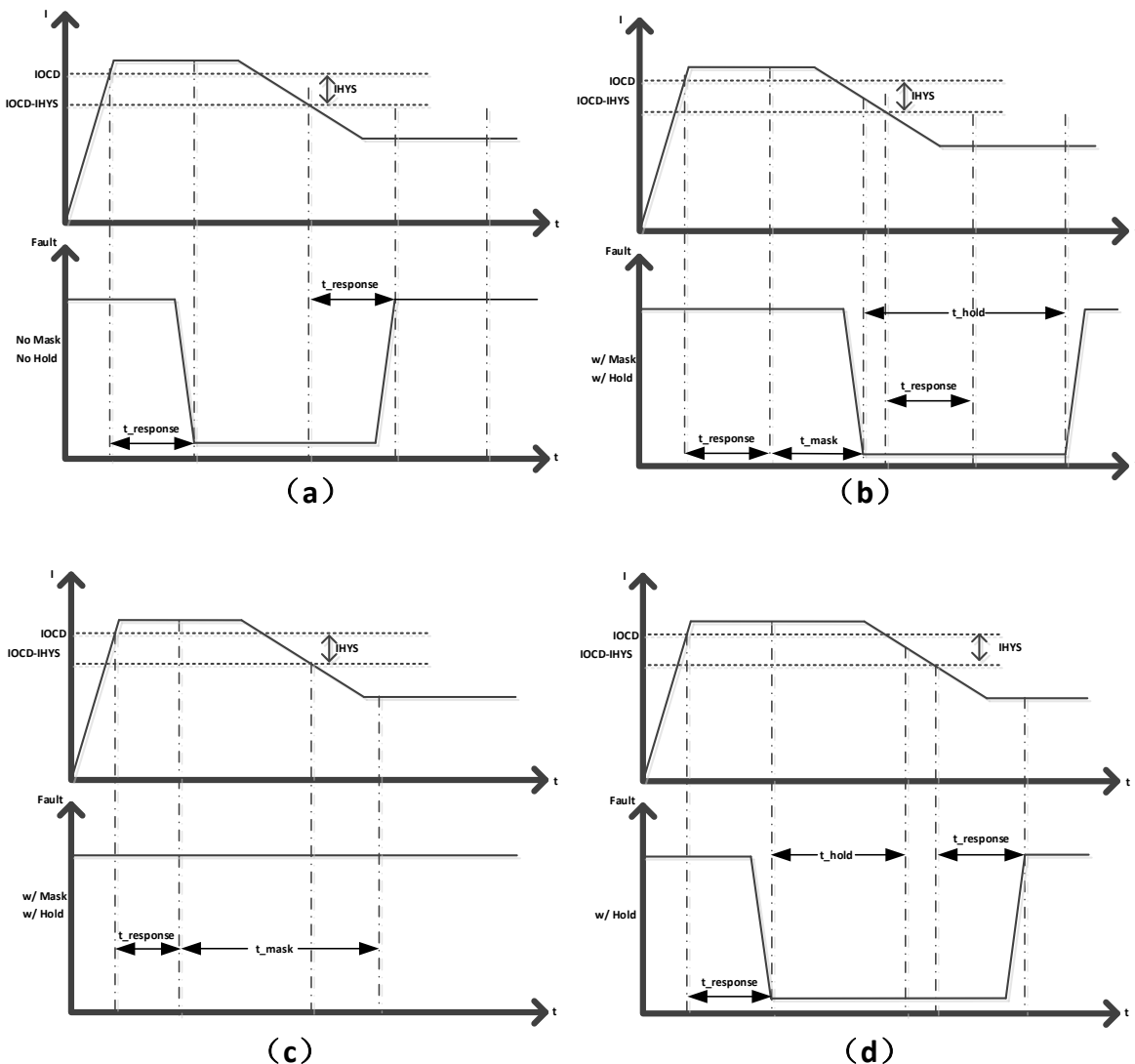
T_{response} is defined as the shortest time from when the chip detects the current exceeding the rated value to when the chip issues an alarm. When t_{mask} and t_{hold} are not set, the t_{response} time is equal to the time from when the chip detects the current exceeding the rated value to when the Fault pin is pulled low. To avoid false OCD alarms caused by current spikes, the chip provides a masking time t_{mask} , which can be set to mask spikes of different widths according to customer needs. The t_{hold} time is used to ensure that when an alarm occurs in the system (the Fault pin is pulled low), the alarm time exceeds a preset value to protect the system.

Figure (a) shows the default situation where t_{mask} and t_{hold} are not set. When an overcurrent occurs and is cleared, the response time of the Fault pin is only t_{response} .

Figure (b) shows the situation when t_{mask} and t_{hold} are set. After an overcurrent occurs, it takes $t_{\text{response}} + t_{\text{mask}}$ time for the Fault pin to be pulled low. After an overcurrent occurs, the alarm will be maintained for t_{hold} time. If the overcurrent is cleared during this period, the Fault pin will not be pulled high until t_{hold} ends.

Figure (c) shows the situation when t_{mask} is set. When an overcurrent occurs, it takes $t_{\text{response}} + t_{\text{mask}}$ time to pull the Fault pin low. However, during the waiting period, the overcurrent is cleared, so the Fault pin is never pulled low.

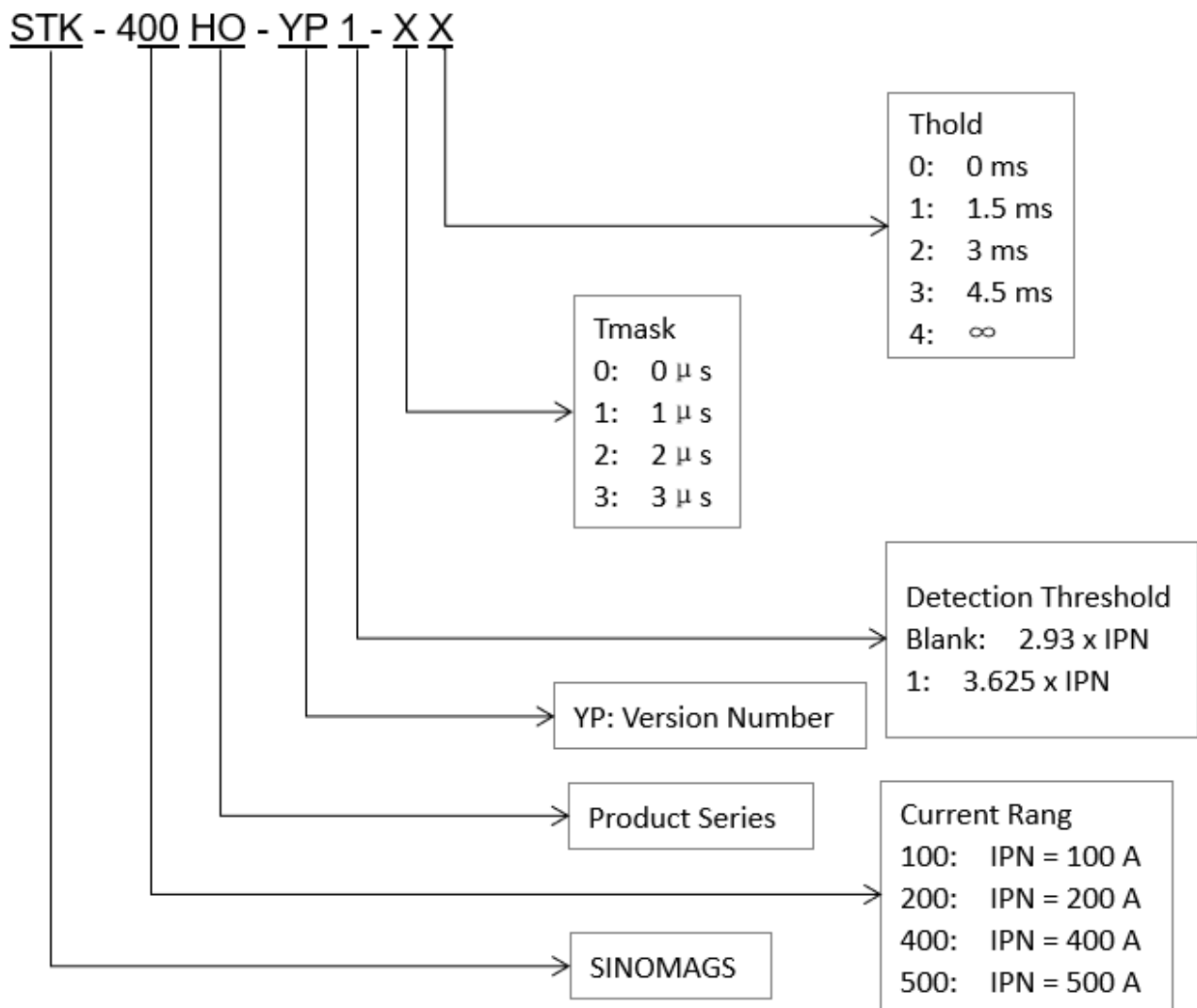
Figure (d) shows the situation when t_{hold} is set. When an event below the alarm threshold occurs after t_{hold} , the time required for the Fault pin to be pulled high is only t_{response} .



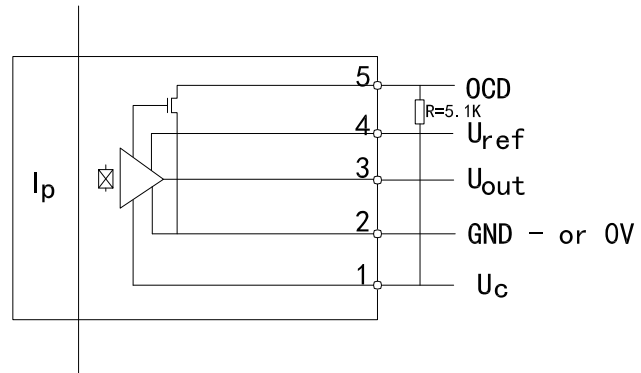
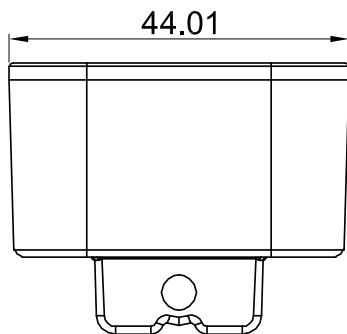
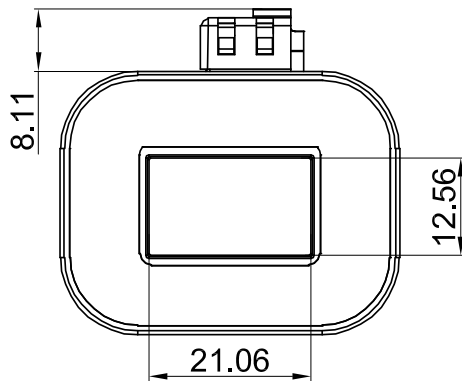
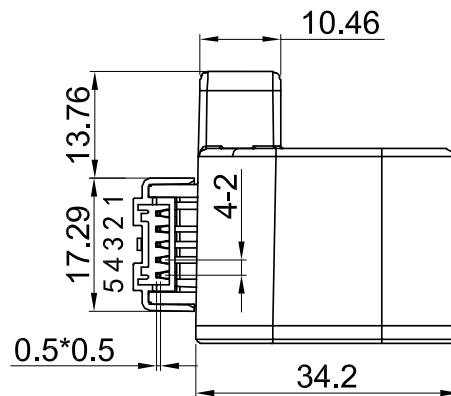
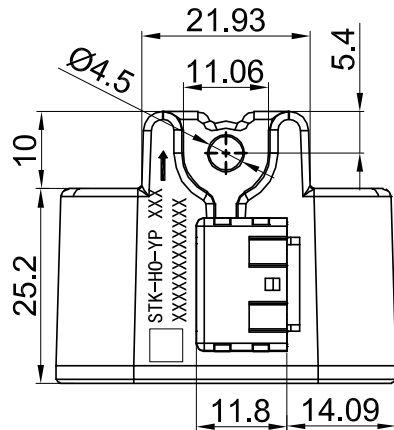
The above plot shows the definition on the time in OCD function. The typical value for tmask & thold is that tmask = 2 μs , and thold = 1.5ms . The overcurrent detection function can also set tmask and thold time.

8. STK-HO-YP series: name and codification

STK-HO-YP family products may be ordered on request¹⁾ with a dedicated setting of the parameters as described below (standard products will be delivered as STK-xxHO-YP-21). Tmask and Thold are internal codes, and they are distinguished only by the material number.



9. Dimension & Pin definitions



Terminals:

1	Vcc
2	GND
3	Vout
4	Vref (OUT)
5	OCD

Remarks:

- 1、Connection system equivalent to JST B05B-PASK
- 2、Transducer fastening
1 hole $\varnothing$ 4.5 mm
1 nonmagnetic screw M4
- 3、Recommended fastening torque 3.5 N.m

Material : Fit UL94V-0 & RoHS requirements ;

General tolerance : ± 0.5

Unit :mm

