SINOMAGS 希磁科技

Current Sensor

Product Series: STK-HO-YS

Part number:
STK-200HO-YS
STK-400HO-YS
STK-500HO-YS
STK-560HO-YS

Version: Ver 1.2

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CONTENT

1. Description

The STK-HO-YS 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)	dCI	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 performance of STK-200HO-YS

Condition：T_A = 25℃，Vcc = 5 V

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal current rms	I_pn	A		200		STK-200HO-YS
Primary current measuring range	I_pm	A	-600		600	STK-200HO-YS
Supply voltage	Vcc	V	4.75	5	5.25	
Current consumption	Icc	mA		10		
Quiescent voltage	Voff	V	2.492	2.5	2.508	Vout @ 0 A (20℃ ~ 30℃)
Temperature drift of Voff	Voff_TRange	V	2.48		2.52	Vout @ 0 A (-40℃ ~ 105℃)
Internal output resistance	R_out	Ω	4.5	12	19.5	Series
OCD output mask time ①	Tmask	µs		2		
OCD output hold time ②	Thold	ms		1.5		
Output voltage range @ I P N	V_FS	V		0.6313		(Vout @ ±I_pn) – Voff
Theoretical gain	G_th	mV/A		3.156		STK-200HO-YS
Rated linearity error	Non-L	% I_{PN}		±1		±I_{PN}
Delay time @ 10 % of I_{PN}	$t_{D\ 10}$	µs		3	3.5	@ 100 A/µs
Delay time @ 90 % of I_{PN}	$t_{D\ 90}$	µs		3	3.5	@ 100 A/µs
Frequency bandwidth (-3dB)	BW	kHz		180		No RC circuit
Output voltage noise	Vnoise	mVpp		8		@140kHz Sampling Rate
Primary current, detection threshold ③	I_pth	A		3.75 * I_pn		Peak value ±10% overcurrent detection OCD
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：

① ②. 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.

③. STK-HO-YS 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 .

④. Accuracy,X_TRange = ((Vout @ In @ T_x) – (G_fit@25℃ * In+Voff @ 25℃)) / V_FS,The fitting gain of the product at G_fit@25 ℃ is 25 ℃.

3. Electrical performance of STK-400HO-YS

Condition：T_A = 25℃，Vcc = 5 V

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal current rms	I_pn	A		400		STK-400HO-YS
Primary current measuring range	I_pm	A	-1000		1000	STK-400HO-YS
Supply voltage	Vcc	V	4.75	5	5.25	
Current consumption	Icc	mA		10		
Quiescent voltage	Voff	V	2.492	2.5	2.508	Vout @ 0 A (20℃ ~ 30℃)
Temperature drift of Voff	Voff_TRange	V	2.48		2.52	Vout @ 0 A (-40℃ ~ 105℃)
Internal output resistance	R_out	Ω	4.5	12	19.5	Series
OCD output mask time ①	Tmask	µs		3		
OCD output hold time ②	Thold	ms		1.5		
Output voltage range @ I P N	V_FS	V		0.808		(Vout @ ±I_pn) – Voff
Theoretical gain	G_th	mV/A		2.02		STK-400HO-YS
Rated linearity error	Non-L	% I_{PN}		±1		±I_{PN}
Delay time @ 10 % of I_{PN}	$t_{D\ 10}$	µs		3	3.5	@ 100 A/µs
Delay time @ 90 % of I_{PN}	$t_{D\ 90}$	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
Primary current, detection threshold ③	I_pth	A		2.93 * I_pn		Peak value ±8% overcurrent detection OCD
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：

① ②. 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.

③. STK-HO-YS 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 .

④. Accuracy,X_TRange = ((Vout @ In @ T_x) – (G_fit@25℃ * In+Voff @ 25℃)) / V_FS,The fitting gain of the product at G_fit@25 ℃ is 25 ℃.

4. Electrical performance of STK-500HO-YS

Condition：T_A = 25℃，Vcc = 5 V

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal current rms	I_pn	A		500		STK-500HO-YS
Primary current measuring range	I_pm	A	-1250		1250	STK-500HO-YS
Supply voltage	Vcc	V	4.75	5	5.25	
Current consumption	Icc	mA		10		
Quiescent voltage	Voff	V	2.492	2.5	2.508	Vout @ 0 A (20℃ ~ 30℃)
Temperature drift of Voff	Voff_TRange	V	2.48		2.52	Vout @ 0 A (-40℃ ~ 105℃)
Internal output resistance	R_out	Ω	4.5	12	19.5	Series
OCD output mask time ①	Tmask	µs		2		
OCD output hold time ②	Thold	ms		1.5		
Output voltage range @ I P N	V_FS	V		0.789		(Vout @ ±I_pn) – Voff
Theoretical gain	G_th	mV/A		1.578		STK-500HO-YS
Rated linearity error	Non-L	% I_{PN}		±1		$\pm I_{PN}$
Delay time @ 10 % of I_{PN}	$t_{D\ 10}$	µs		3	3.5	@ 100 A/µs
Delay time @ 90 % of I_{PN}	$t_{D\ 90}$	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
Primary current, detection threshold ③	I_pth	A		3 * I_pn		Peak value ±10% overcurrent detection OCD
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：

① ②. 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.

③. STK-HO-YS 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 .

④. Accuracy,X_TRange = ((Vout @ In @ T_x) – (G_fit@25℃ * In+Voff @ 25℃)) / V_FS,The fitting gain of the product at G_fit@25 ℃ is 25 ℃.

5. Electrical performance of STK-560HO-YS

Condition：T_A = 25℃，Vcc = 5 V

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal current rms	I_pn	A		560		STK-560HO-YS
Primary current measuring range	I_pm	A	-1400		1400	STK-560HO-YS
Supply voltage	Vcc	V	4.75	5	5.25	
Current consumption	Icc	mA		10		
Quiescent voltage	Voff	V	2.492	2.5	2.508	Vout @ 0 A (20℃ ～30℃)
Temperature drift of Voff	Voff_TRange	V	2.48		2.52	Vout @ 0 A (-40℃ ～105℃)
Internal output resistance	R_out	Ω	4.5	12	19.5	Series
OCD output mask time ①	Tmask	µs		2		
OCD output hold time ②	Thold	ms		1.5		
Output voltage range @ I P N	V_FS	V		0.808		(Vout @ ±I_pn) – Voff
Theoretical gain	G_th	mV/A		1.443		STK-560HO-YS
Rated linearity error	Non-L	% I_{PN}		±1		±I_{PN}
Delay time @ 10 % of I_{PN}	$t_{D\,10}$	µs		3	3.5	@ 100 A/µs
Delay time @ 90 % of I_{PN}	$t_{D\,90}$	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
Primary current, detection threshold ③	I_pth	A		2.93 * I_pn		Peak value ±10% overcurrent detection OCD
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	

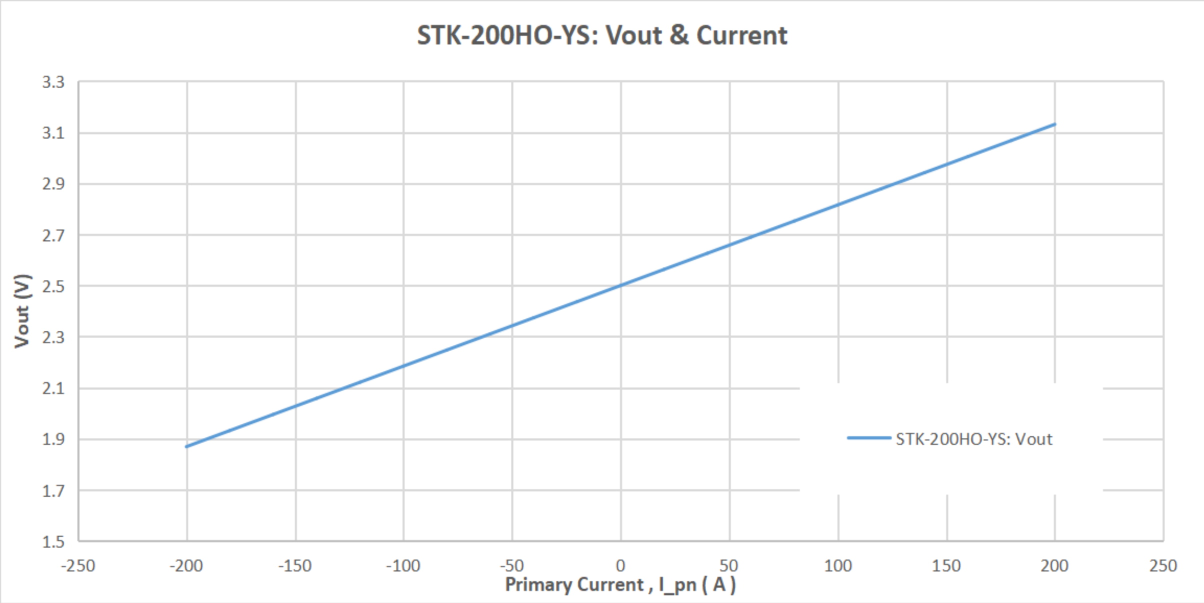
Remarks：

① ②. 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.

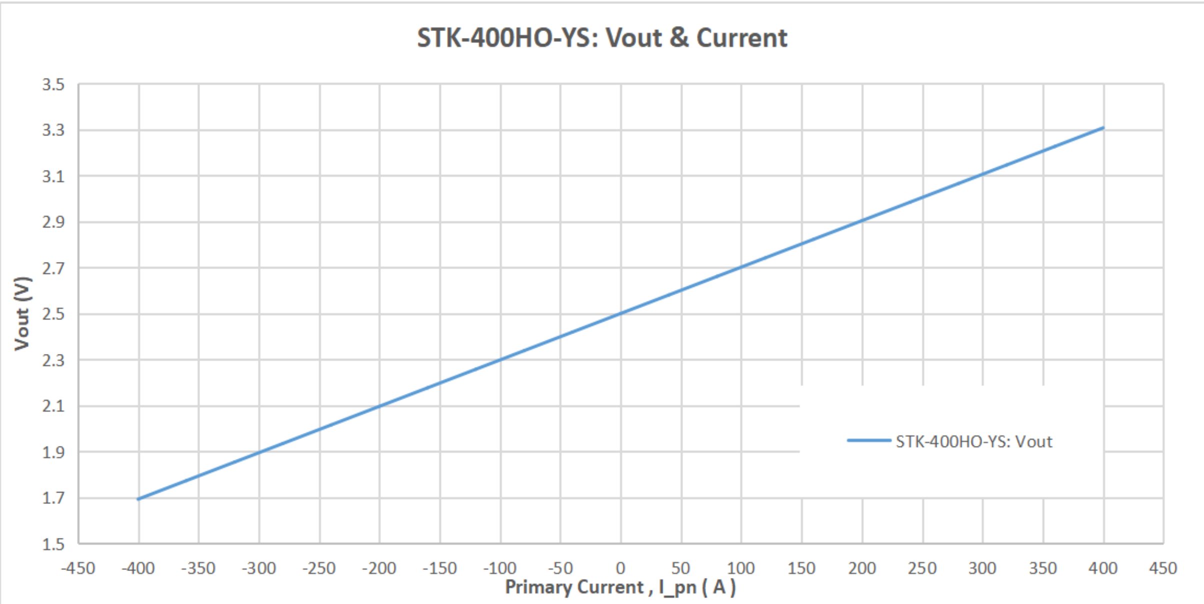
③. STK-HO-YS products may be ordered on request with a dedicated setting of the Trigger current . The product has a built-in overcurrent detection function, When the output voltage detected by the product exceeds the threshold, it is judged to be overcurrent and the output of fault pin changes to low level .

④. Accuracy,X_TRange = ((Vout @ In @ T_x) – (G_fit@25℃ * In+Voff @ 25℃)) / V_FS,The fitting gain of the product at G_fit@25 ℃ is 25 ℃.

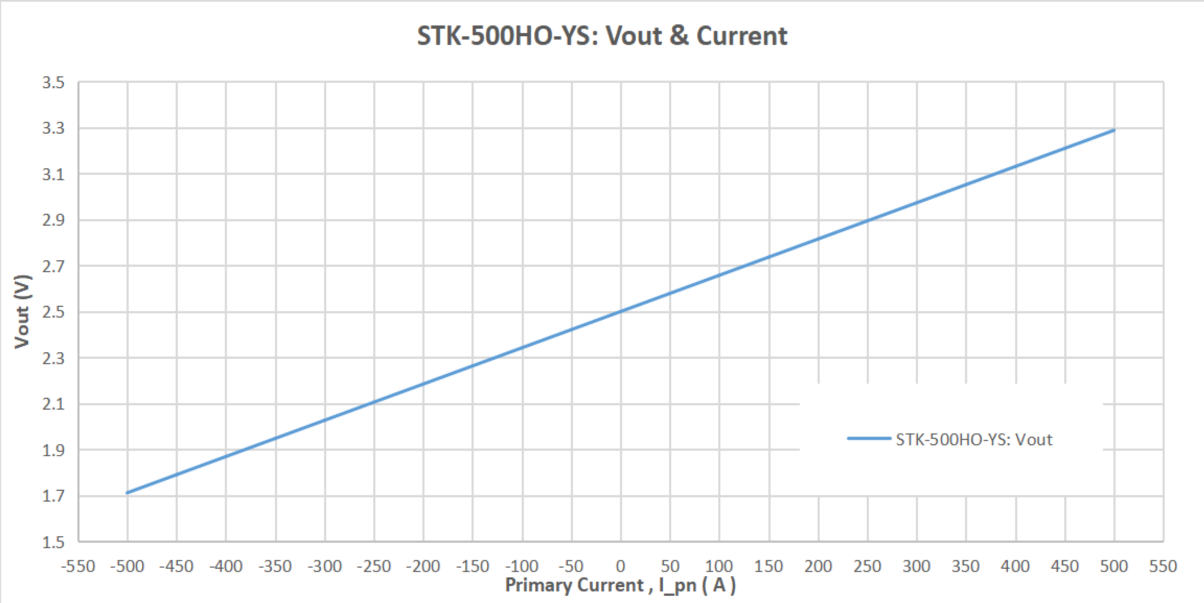
6. Output voltage VS primary current of STK-HO-YS



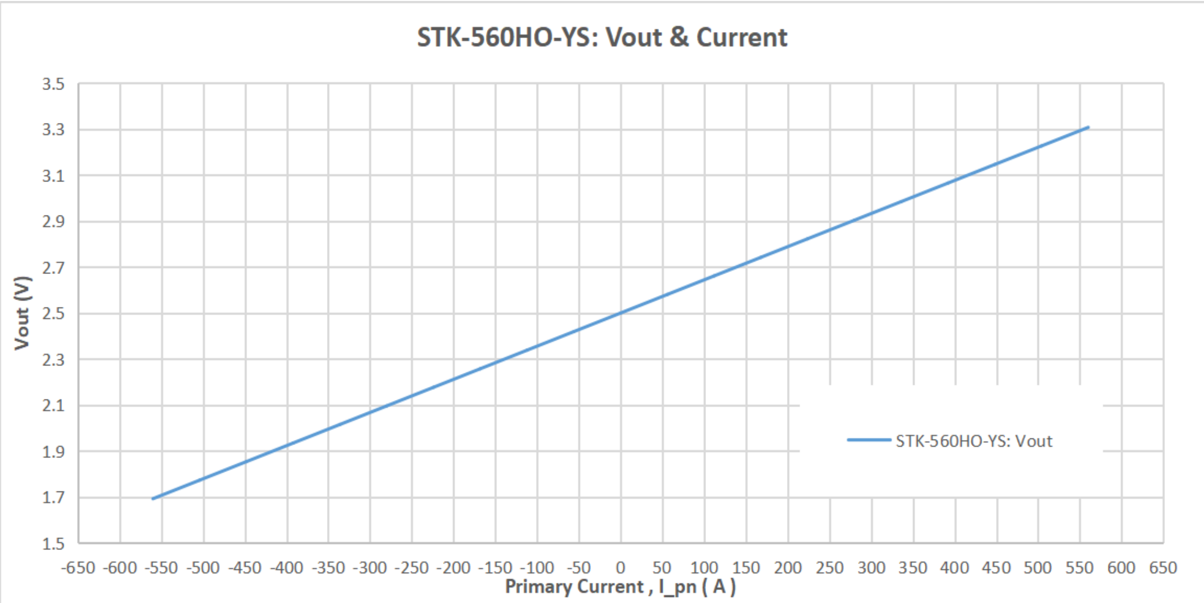
The dependence of Vout of STK-200HO-YS on the primary current.



The dependence of Vout of STK-400HO-YS on the primary current.

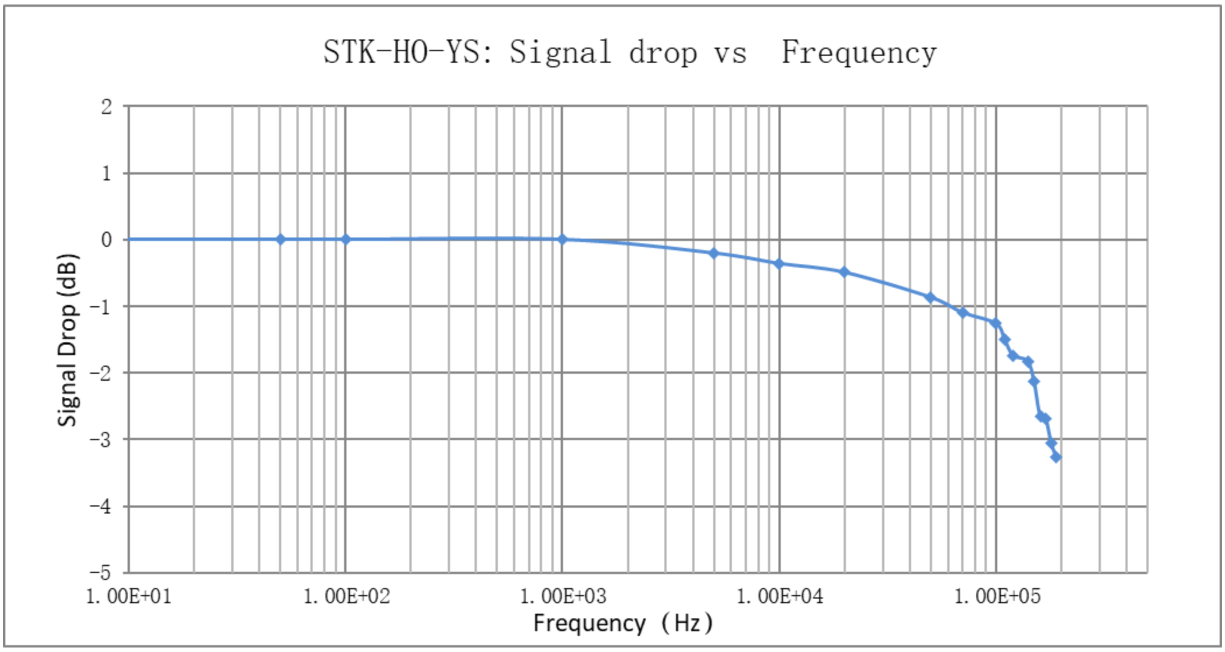


The dependence of Vout of STK-500HO-YS on the primary current.



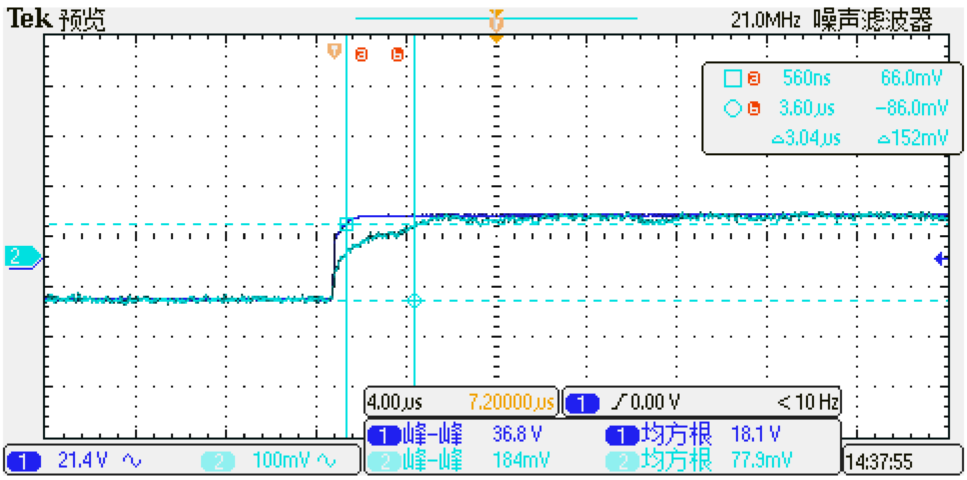
The dependence of Vout of STK-560HO-YS on the primary current.

7. Frequency bandwidth



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

8. Step response time



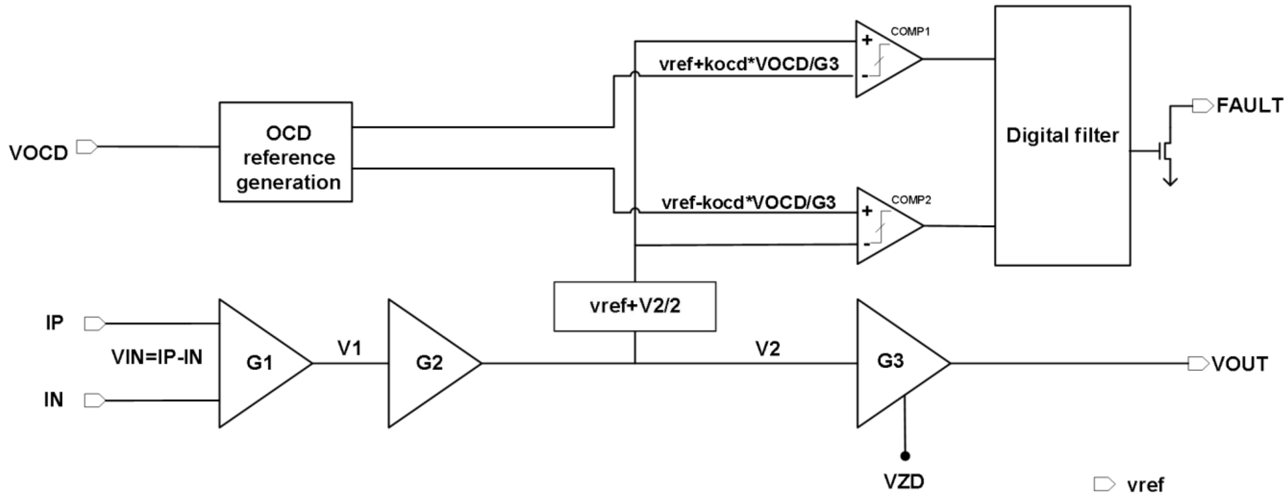
The step response time of STK-HO-YS current sensors. The dark light blue is primary current, while the light blue is output signal of current sensor. The step response time is about 3 µs.

9. 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.

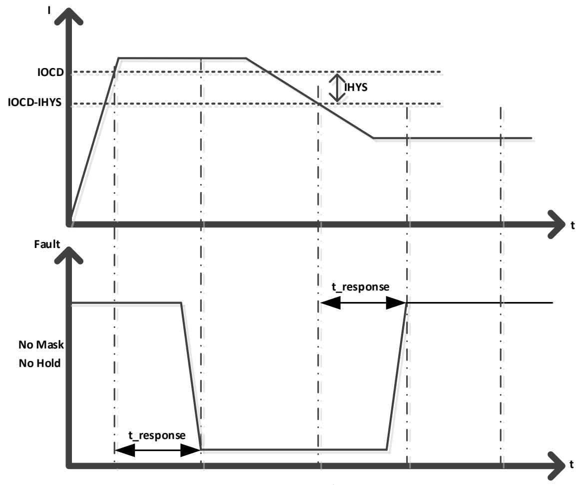
Since the trigger voltage is set after the second amplifier, the OCD function supports that the trigger current can be higher than I_pn. The trigger voltage can be defined:

a) Vref = 2.5 V
b) 0.625 V ≦ VOC ≦ Vref;
c) Trigger voltage = Vref +/- 2*VOC;
d) Trigger current = (Vref +/- 2*VOC -Voff) / G_th;

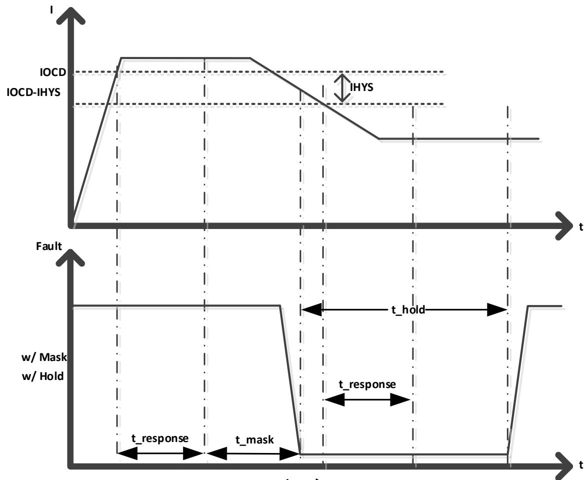


Functional Block Diagram on OCD function when Vref = 2.5 V

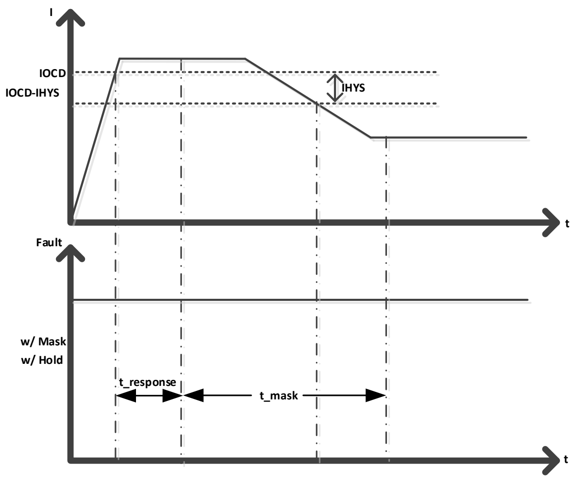
T_response is defined as the shortest time from when the chip detects the current exceeding the rated value to when the chip issues an alarm. When t_mask and t_hold are not set, the t_response time is equal to the time from when the chip detects the current exceeding the rated value to when the Fault 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_response + t_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_response + t_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.



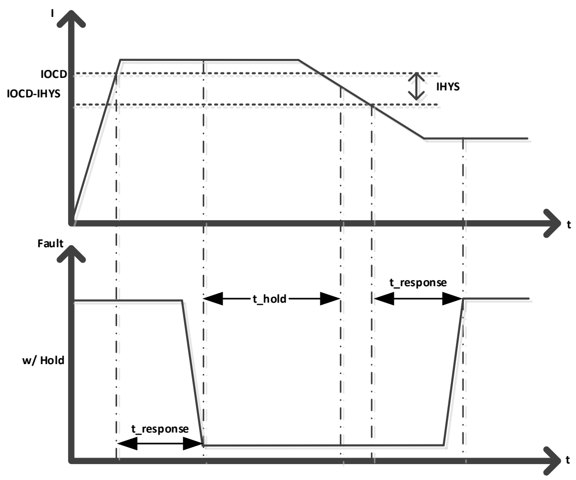
（a）



（b）



（c）



（d）

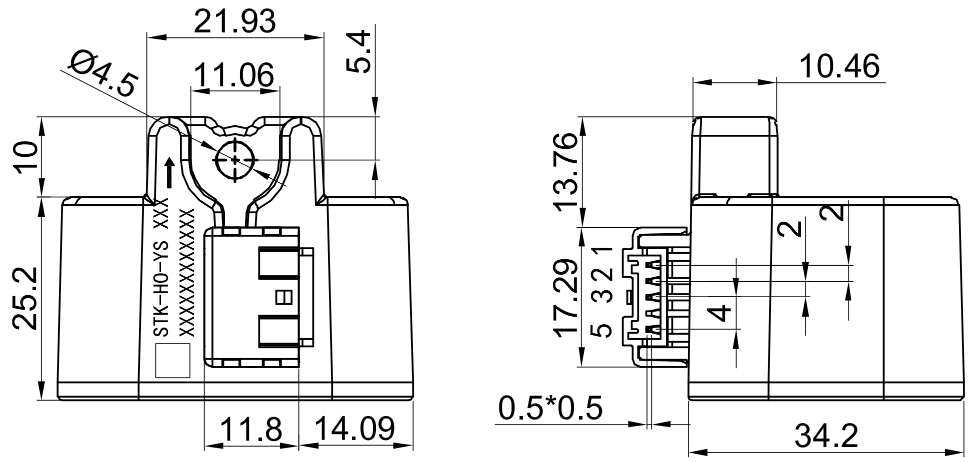
The above plot shows the definition on the time in OCD function. The typical values for tmask and thold of this product are tmask = 3 μs and thold = 1.5 ms. The overcurrent detection function can also set tmask and thold time:

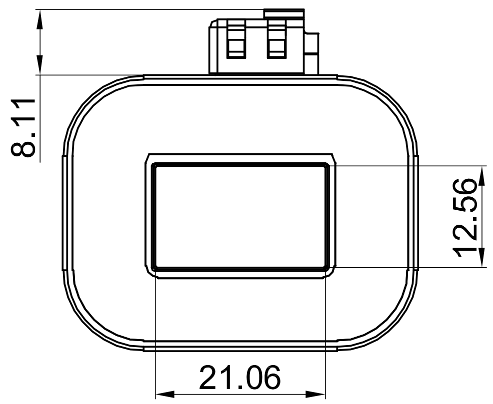
a)

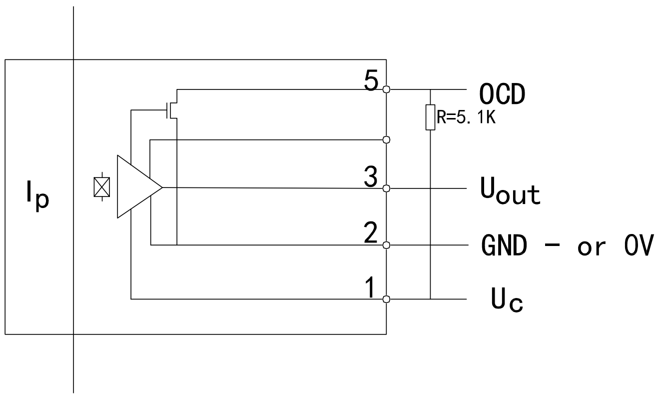
Tmask:set	Value
1	0μs
2	1μs
3	2μs
4	3μs

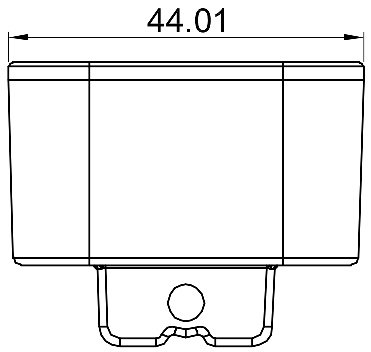
Thold:set	Value
1	0ms
2	1.5ms
3	3ms
4	4.5ms
5	∞

10. Dimension & Pin definitions









Terminals:

1	Vcc
2	GND
3	Vout
5	OCD

Remarks:

1、Connection system equivalent to JST B05B-PASK
2、Transducer fastening 1 hole Ø 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