CURRENT SENSOR

PRODUCT SERIES: STK-HO/4

PRODUCT PARNUMBER: STK-50HO/4, STK-100HO/4
STK-150HO/4, STK-200HO/4
STK-240HO/4, STK-250HO/4

REVISION: Ver 1.0

Sinomags Technology Co., Ltd.

Web site: www.sinomags.com

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1. Description

STK-HO/4 current sensor is based on the open loop principle. DC, AC, pulses and any kind of irregular wave can be measured by the current sensor under the isolated conditions.

Typical application

- 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 parameters

Parameter	Symbol	Unit	Value
Working temperature	T_a	C°	-40 ~ 105
Storage temperature	T_stg	C°	-40 ~ 105
Mass	m	g	32

Absolute parameters

Parameters	Symbol	Unit	Value
Supply voltage (not-destructive)	V_c	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 parameters

Parameter	Symbol	Unit	Value	Remark
RMS voltage for AC test	Ud	kV	4.3	@ 50Hz/1 min
Impulse withstand voltage	Ûw	kV	8	1.2/50µs
Case material	-	-	V0	According to UL 94
Comparative tracking index	CTI	-	600	
Clearance (pri. - sec.)	D_ci	mm	>8	Shortest distance through air
Creepage distance (pri. - sec.)	D_cp	mm	>8	When mounted on PCB with recommended layout

2. Electrical performance of STK-50HO/4

Vcc = 5 V, T_A = 25C°

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal current rms	I_pn	A		50		
Primary current measuring range	I_pm	A	-125		125	
Supply voltage	Vcc	V	4.75	5	5.25	
Current consumption	Icc	mA		6	10	
Reference voltage (output)	Vref	V	2.48	2.5	2.52	Output function
Electrical offset voltage @ I P = 0 A	Voe	mV	-8		8	Vout – Vref @ Vref = 2.5 V
Electrical offset current referred to primary	Ioe	A	-0.5		0.5	
Output voltage range @ I P M	V_FS	V	-2		2	((Vout - Vref)@ I_pm) – Voe
Internal Vref resistance	R_ref	Ω	5	15	25	Series
Internal output resistance	R_out	Ω	10	20	30	Series
Difference of output resistance (R_ref – R_out)	Roe	Ω	-10		0	Series
OCD output mask time ①	Tmask	μs		2		
OCD output hold time ②	Thold	ms		1.5		
Theoretical gain	G	mV/A		16		800 mV @ I P N
Temperature drift of Voe	Voe_TRange	mV	-10		10	-40C° ~ 105C°
Error of gain	Err_G	%G_th	-0.5		0.5	Trimmed in the factory @ 25C°
Temperature drift of gain	G_TR	%G_th	-1		1	@ -40C°~105C°
Rated linearity error	Non-L_pn	%I_pn	-0.5		0.5	Within ±I_pn
Linearity error @ I_pm	Non-L_pm	%I_pm	-0.5		0.5	±I_pm
Step response time	t_res	μs		1.5	2	@ 90% of I_pn
Frequency bandwidth (-3dB)	BW	kHz		200		No RC circuit
Output voltage noise	Vnoise	mVpp		4.4		@140kHz Sampling Rate
Primary current, detection threshold ③	I_pth	A		2.93 * I_pn		Peak value ±10% overcurrent detection OCD
Accuracy @ 25C°	X	% of I_pn	-1		1	@ 25C°
Accuracy @ -40C°~105C° ④	X_TRange	% of I_pn	-3		3	-40C° ~ 105C°

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/4 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. the accuracy @ -40C°~105C°, X_TRange = (((Vout – Vref)@ In @ T_x) – Voe@ 25C° – G_th * In) / V_FS, where T_x represents present temperature, G_th is fitted gain at room temperature .

3. Electrical performance of STK-100HO/4

Vcc = 5 V, T_A = 25C°

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal current rms	I_pn	A		100		
Primary current measuring range	I_pm	A	-250		250	
Supply voltage	Vcc	V	4.75	5	5.25	
Current consumption	Icc	mA		6	10	
Reference voltage (output)	Vref	V	2.48	2.5	2.52	Output function
Electrical offset voltage @ I P = 0 A	Voe	mV	-8		8	Vout – Vref @ Vref = 2.5 V
Electrical offset current referred to primary	Ioe	A	-1.5		1.5	
Output voltage range @ I P M	V_FS	V	-2		2	((Vout - Vref)@ I_pm) – Voe
Internal Vref resistance	R_ref	Ω	5	15	25	Series
Internal output resistance	R_out	Ω	10	20	30	Series
Difference of output resistance (R_ref – R_out)	Roe	Ω	-10		0	Series
OCD output mask time ①	Tmask	μs		2		
OCD output hold time ②	Thold	ms		1.5		
Theoretical gain	G	mV/A		8		800 mV @ I P N
Temperature drift of Voe	Voe_TRange	mV	-10		10	-40C° ~ 105C°
Error of gain	Err_G	%G_th	-0.5		0.5	Trimmed in the factory @ 25C°
Temperature drift of gain	G_TR	%G_th	-1		1	@ -40C°~105C°
Rated linearity error	Non-L_pn	%I_pn	-0.5		0.5	Within ±I_pn
Linearity error @ I_pm	Non-L_pm	%I_pm	-0.5		0.5	±I_pm
Step response time	t_res	μs		1.5	2	@ 90% of I_pn
Frequency bandwidth (-3dB)	BW	kHz		200		No RC circuit
Output voltage noise	Vnoise	mVpp		4.4		@140kHz Sampling Rate
Primary current, detection threshold ③	I_pth	A		2.93 * I_pn		Peak value ±10% overcurrent detection OCD
Accuracy @ 25C°	X	% of I_pn	-1		1	@ 25C°
Accuracy @ -40C°~105C° ④	X_TRange	% of I_pn	-3		3	-40C° ~ 105C°

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/4 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. the accuracy @ -40C°~105C°, X_TRange = (((Vout – Vref)@ In @ T_x) – Voe@ 25C° – G_th * In) / V_FS, where T_x represents present temperature, G_th is fitted gain at room temperature .

4. Electrical performance of STK-150HO/4

Vcc = 5 V, T_A = 25C°

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal current rms	I_pn	A		150		
Primary current measuring range	I_pm	A	-375		375	
Supply voltage	Vcc	V	4.75	5	5.25	
Current consumption	Icc	mA		6	10	
Reference voltage (output)	Vref	V	2.48	2.5	2.52	Output function
Electrical offset voltage @ I P = 0 A	Voe	mV	-8		8	Vout – Vref @ Vref = 2.5 V
Electrical offset current referred to primary	Ioe	A	-2.56		2.56	
Output voltage range @ I P M	V_FS	V	-2		2	((Vout - Vref)@ I_pm) - Voe
Internal Vref resistance	R_ref	Ω	5	15	25	Series
Internal output resistance	R_out	Ω	10	20	30	Series
Difference of output resistance (R_ref – R_out)	Roe	Ω	-10		0	Series
OCD output mask time ①	Tmask	μs		2		
OCD output hold time ②	Thold	ms		1.5		
Theoretical gain	G	mV/A		5.333		800 mV @ I P N
Temperature drift of Voe	Voe_TRange	mV	-10		10	-40C° ~ 105C°
Error of gain	Err_G	%G_th	-0.5		0.5	Trimmed in the factory @ 25C°
Temperature drift of gain	G_TR	%G_th	-1		1	@ -40C°~105C°
Rated linearity error	Non-L_pn	%I_pn	-0.5		0.5	Within ±I_pn
Linearity error @ I_pm	Non-L_pm	%I_pm	-0.5		0.5	±I_pm
Step response time	t_res	μs		1.5	2	@ 90% of I_pn
Frequency bandwidth (-3dB)	BW	kHz		200		No RC circuit
Output voltage noise	Vnoise	mVpp		4.4		@140kHz Sampling Rate
Primary current, detection threshold ③	I_pth	A		2.93 * I_pn		Peak value ±10% overcurrent detection OCD
Accuracy @ 25C°	X	% of I_pn	-1		1	@ 25C°
Accuracy @ -40C°~105C° ④	X_TRange	% of I_pn	-3		3	-40C° ~ 105C°

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/4 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. the accuracy @ -40C°~105C°, X_TRange = (((Vout – Vref)@ In @ T_x) – Voe@ 25C° – G_th * In) / V_FS, where T_x represents present temperature, G_th is fitted gain at room temperature .

5. Electrical performance of STK-200HO/4

Vcc = 5 V, T_A = 25C°

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal current rms	I_pn	A		200		
Primary current measuring range	I_pm	A	-500		500	
Supply voltage	Vcc	V	4.75	5	5.25	
Current consumption	Icc	mA		6	10	
Reference voltage (output)	Vref	V	2.48	2.5	2.52	Output function
Electrical offset voltage @ I P = 0 A	Voe	mV	-8		8	Vout – Vref @ Vref = 2.5 V
Electrical offset current referred to primary	Ioe	A	-2		2	
Output voltage range @ I P M	V_FS	V	-2		2	((Vout - Vref)@ I_pm) - Voe
Internal Vref resistance	R_ref	Ω	5	15	25	Series
Internal output resistance	R_out	Ω	10	20	30	Series
Difference of output resistance (R_ref – R_out)	Roe	Ω	-10		0	Series
OCD output mask time ①	Tmask	µs		2		
OCD output hold time ②	Thold	ms		1.5		
Theoretical gain	G	mV/A		4		800 mV @ I P N
Temperature drift of Voe	Voe_TRange	mV	-10		10	-40C° ~ 105C°
Error of gain	Err_G	%G_th	-0.5		0.5	Trimmed in the factory @ 25C°
Temperature drift of gain	G_TR	%G_th	-1		1	@ -40C°~105C°
Rated linearity error	Non-L_pn	%I_pn	-0.5		0.5	Within ±I_pn
Linearity error @ I_pm	Non-L_pm	%I_pm	-0.5		0.5	±I_pm
Step response time	t_res	µs		1.5	2	@ 90% of I_pn
Frequency bandwidth (-3dB)	BW	kHz		200		No RC circuit
Output voltage noise	Vnoise	mVpp		4.4		@140kHz Sampling Rate
Primary current, detection threshold ③	I_pth	A		2.93 * I_pn		Peak value ±10% overcurrent detection OCD
Accuracy @ 25C°	X	% of I_pn	-1		1	@ 25C°
Accuracy @ -40C°~105C° ④	X_TRange	% of I_pn	-3		3	-40C° ~ 105C°

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/4 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. the accuracy @ -40C°~105C°, X_TRange = (((Vout – Vref)@ In @ T_x) – Voe@ 25C° – G_th * In) / V_FS, where T_x represents present temperature, G_th is fitted gain at room temperature .

6. Electrical performance of STK-240HO/4

Vcc = 5 V, T_A = 25C°

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal current rms	I_pn	A		240		
Primary current measuring range	I_pm	A	-600		600	
Supply voltage	Vcc	V	4.75	5	5.25	
Current consumption	Icc	mA		6	10	
Reference voltage (output)	Vref	V	2.48	2.5	2.52	Output function
Electrical offset voltage @ I P = 0 A	Voe	mV	-8		8	Vout – Vref @ Vref = 2.5 V
Electrical offset current referred to primary	Ioe	A	-2.4		2.4	
Output voltage range @ I P M	V_FS	V	-2		2	((Vout - Vref)@ I_pm) - Voe
Internal Vref resistance	R_ref	Ω	5	15	25	Series
Internal output resistance	R_out	Ω	10	20	30	Series
Difference of output resistance (R_ref – R_out)	Roe	Ω	-10		0	Series
OCD output mask time ①	Tmask	μs		2		
OCD output hold time ②	Thold	ms		1.5		
Theoretical gain	G	mV/A		3.333		800 mV @ I P N
Temperature drift of Voe	Voe_TRange	mV	-10		10	-40C° ~ 105C°
Error of gain	Err_G	%G_th	-0.5		0.5	Trimmed in the factory @ 25C°
Temperature drift of gain	G_TR	%G_th	-1		1	@ -40C°~105C°
Rated linearity error	Non-L_pn	%I_pn	-0.5		0.5	Within ±I_pn
Linearity error @ I_pm	Non-L_pm	%I_pm	-0.5		0.5	±I_pm
Step response time	t_res	μs		1.5	2	@ 90% of I_pn
Frequency bandwidth (-3dB)	BW	kHz		200		No RC circuit
Output voltage noise	Vnoise	mVpp		4.4		@140kHz Sampling Rate
Primary current, detection threshold ③	I_pth	A		2.93 * I_pn		Peak value ±10% overcurrent detection OCD
Accuracy @ 25C°	X	% of I_pn	-1		1	@ 25C°
Accuracy @ -40C°~105C° ④	X_TRange	% of I_pn	-3		3	-40C° ~ 105C°

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/4 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. the accuracy @ -40C°~105C°, X_TRange = (((Vout – Vref)@ In @ T_x) – Voe@ 25C° – G_th * In) / V_FS, where T_x represents present temperature, G_th is fitted gain at room temperature .

7. Electrical performance of STK-250HO/4

Vcc = 5 V, T_A = 25C°

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal current rms	I_pn	A		250		
Primary current measuring range	I_pm	A	-625		625	
Supply voltage	Vcc	V	4.75	5	5.25	
Current consumption	Icc	mA		6	10	
Reference voltage (output)	Vref	V	2.48	2.5	2.52	Output function
Electrical offset voltage @ I P = 0 A	Voe	mV	-8		8	Vout – Vref @ Vref = 2.5 V
Electrical offset current referred to primary	Ioe	A	-2.5		2.55	
Output voltage range @ I P M	V_FS	V	-2		2	((Vout - Vref)@ I_pm) - Voe
Internal Vref resistance	R_ref	Ω	5	15	25	Series
Internal output resistance	R_out	Ω	10	20	30	Series
Difference of output resistance (R_ref – R_out)	Roe	Ω	-10		0	Series
OCD output mask time ①	Tmask	μs		2		
OCD output hold time ②	Thold	ms		1.5		
Theoretical gain	G	mV/A		3.2		800 mV @ I P N
Temperature drift of Voe	Voe_TRange	mV	-10		10	-40C° ~ 105C°
Error of gain	Err_G	%G_th	-0.5		0.5	Trimmed in the factory @ 25C°
Temperature drift of gain	G_TR	%G_th	-1		1	@ -40C°~105C°
Rated linearity error	Non-L_pn	%I_pn	-0.5		0.5	Within ±I_pn
Linearity error @ I_pm	Non-L_pm	%I_pm	-0.5		0.5	±I_pm
Step response time	t_res	μs		1.5	2	@ 90% of I_pn
Frequency bandwidth (-3dB)	BW	kHz		200		No RC circuit
Output voltage noise	Vnoise	mVpp		4.4		@140kHz Sampling Rate
Primary current, detection threshold ③	I_pth	A		2.93 * I_pn		Peak value ±10% overcurrent detection OCD
Accuracy @ 25C°	X	% of I_pn	-1		1	@ 25C°
Accuracy @ -40C°~105C° ④	X_TRange	% of I_pn	-3		3	-40C° ~ 105C°

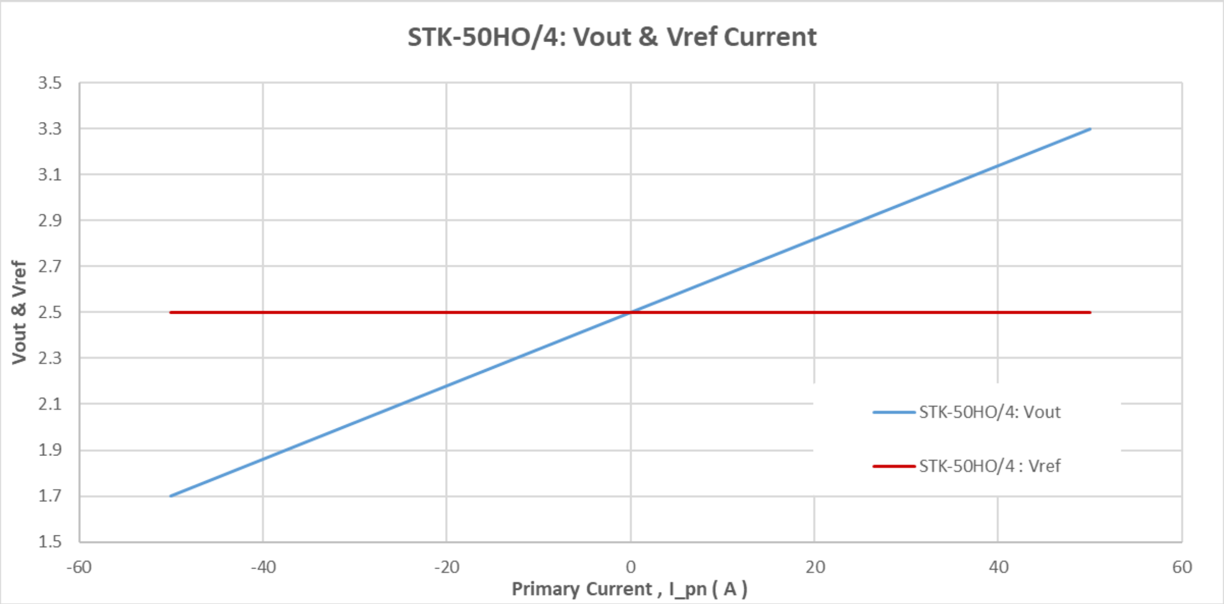
Remarks：

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.

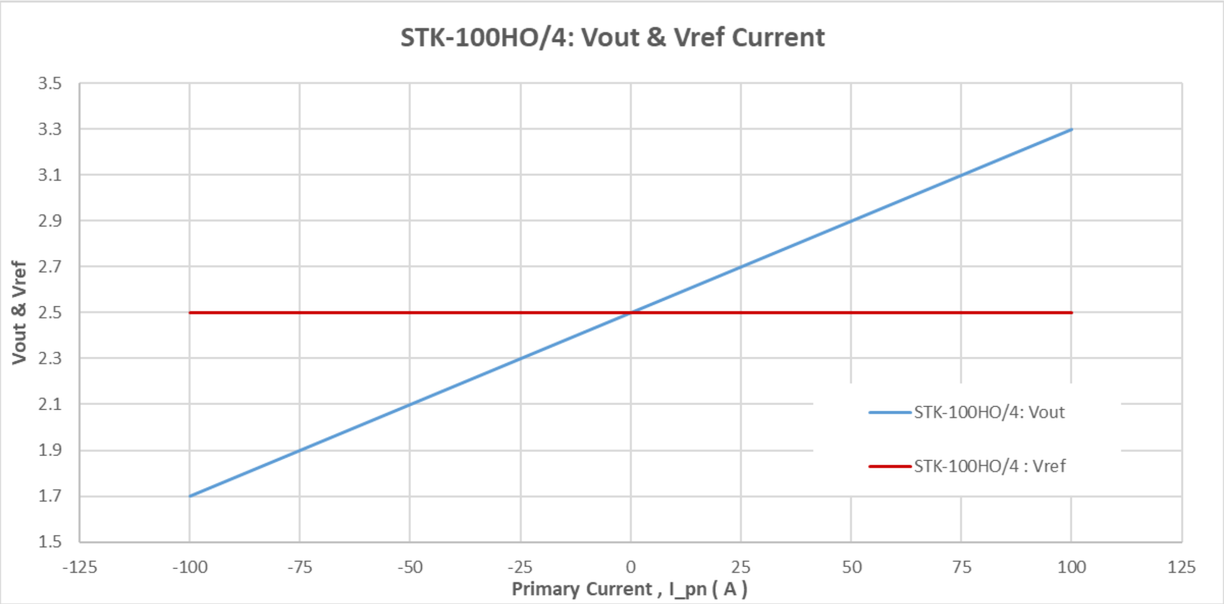
③. STK-HO/4 products may be ordered on request with a dedicated setting of the Trigger current . The product has a built-in overcurrent detection function, When the output voltage detected by the product exceeds the threshold, it is judged to be overcurrent and the output of fault pin changes to low level .

④. the accuracy @ -40C°~105C°, X_TRange = (((Vout – Vref)@ In @ T_x) – Voe@ 25C° – G_th * In) / V_FS, where T_x represents present temperature, G_th is fitted gain at room temperature .

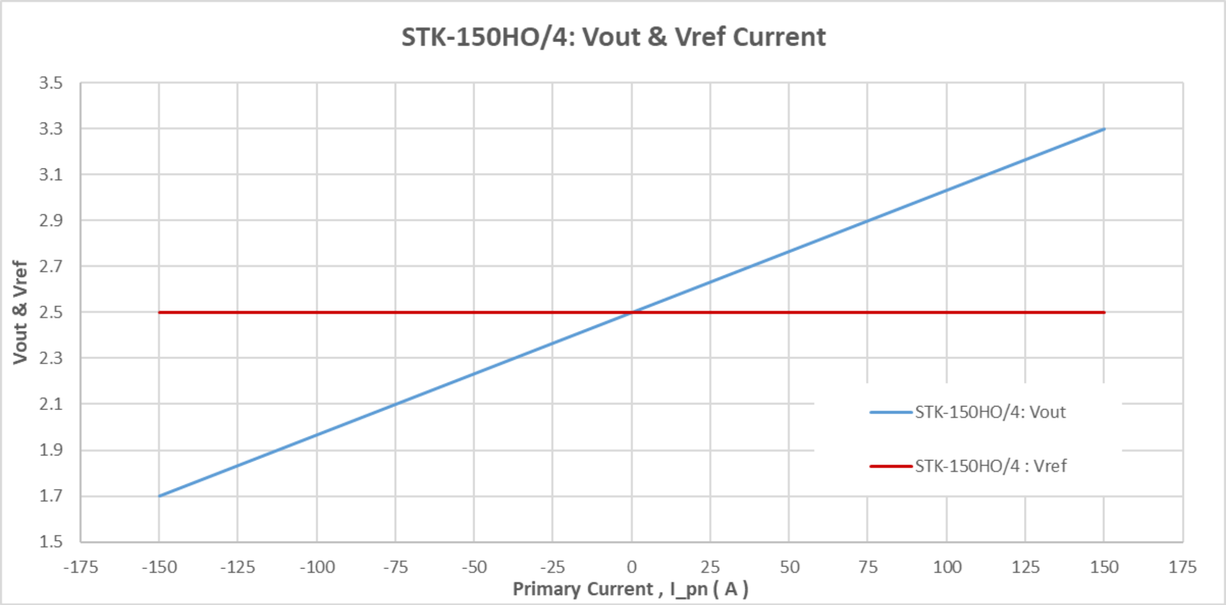
8. Output voltage VS primary current of STK-HO/4



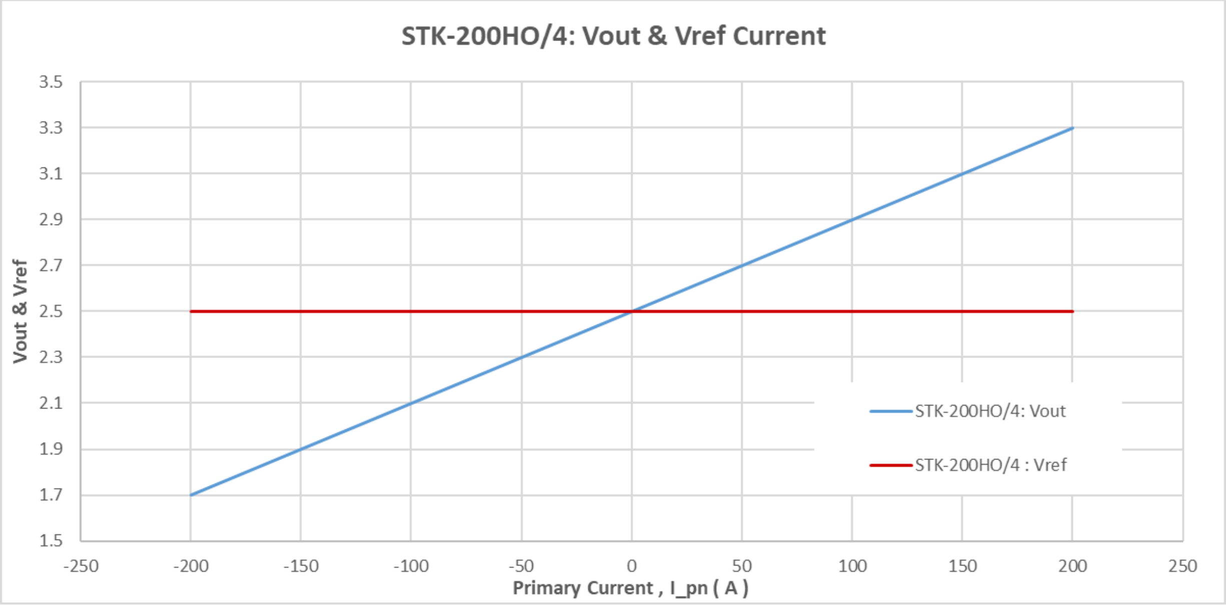
The dependence of Vout & Vref of STK-50HO/4 on the primary current.



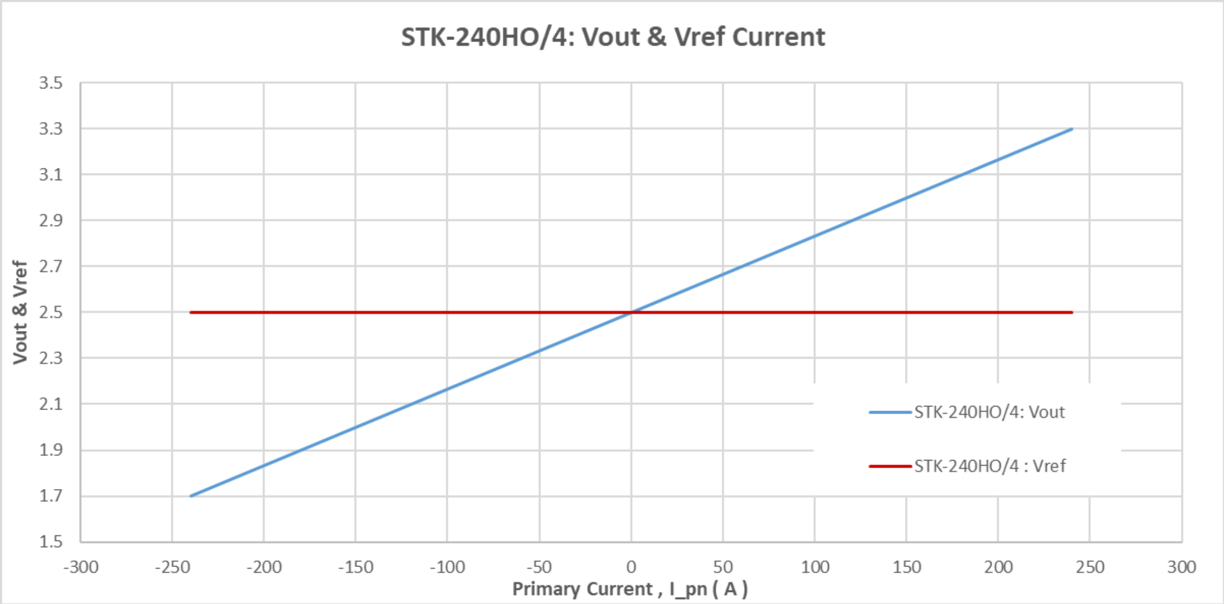
The dependence of Vout & Vref of STK-100HO/4 on the primary current.



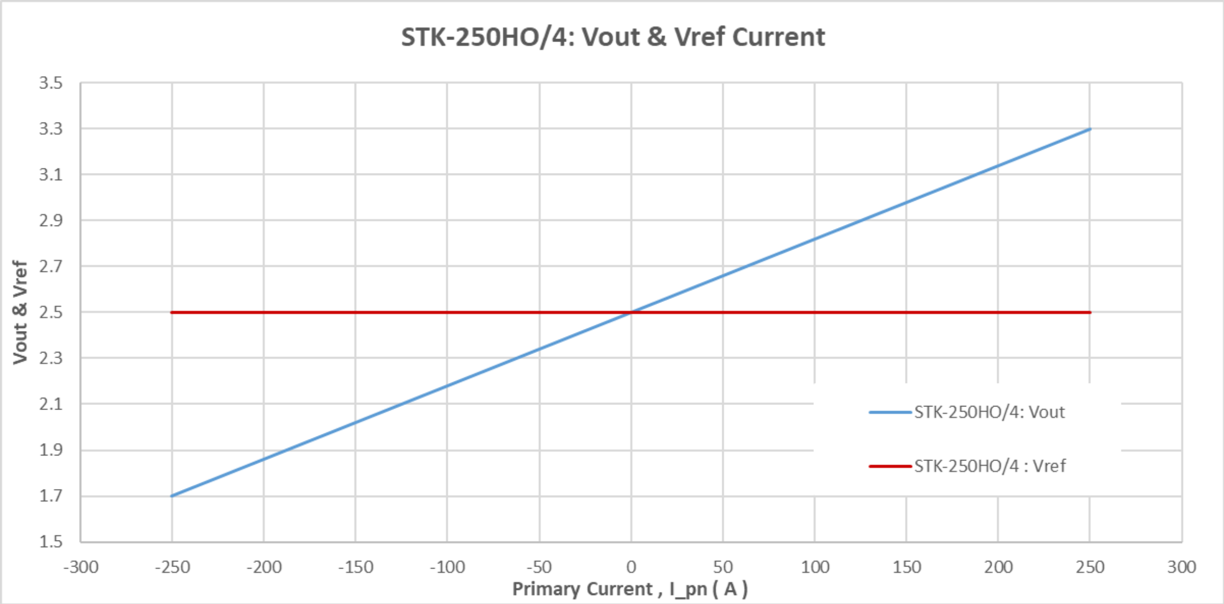
The dependence of Vout & Vref of STK-150HO/4 on the primary current.



The dependence of Vout & Vref of STK-200HO/4 on the primary current.

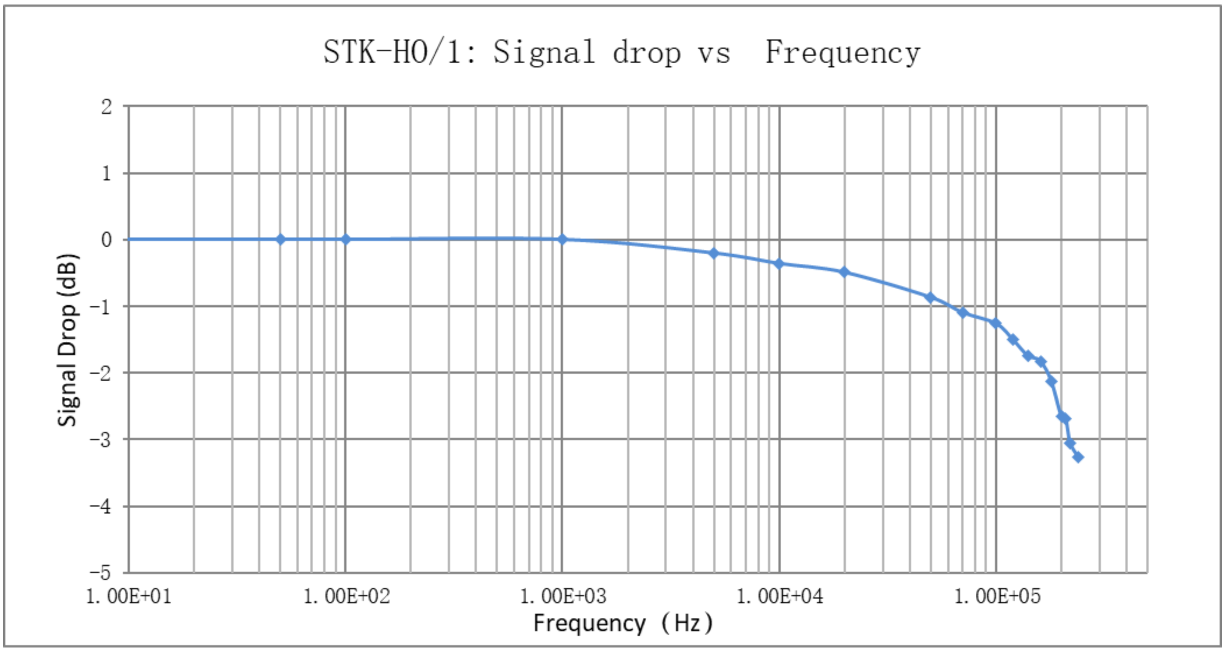


The dependence of Vout & Vref of STK-240HO/4 on the primary current.



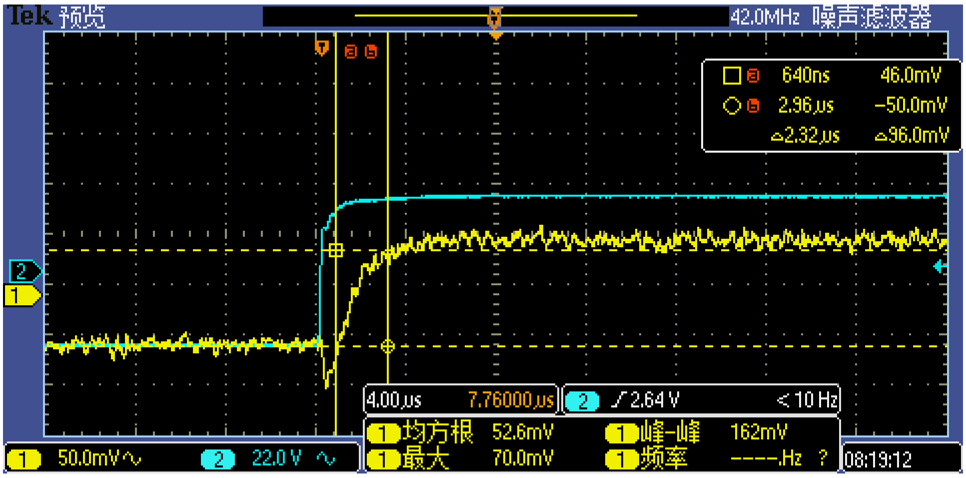
The dependence of Vout & Vref of STK-250HO/4 on the primary current.

9. Frequency bandwidth



The frequency band width of STK-HO/4 series current sensors.

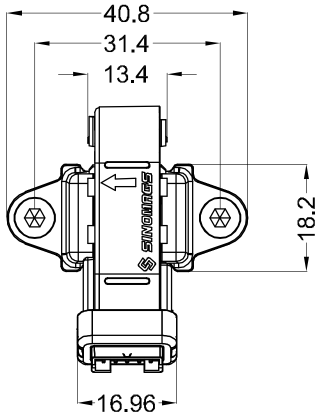
10. Step response time

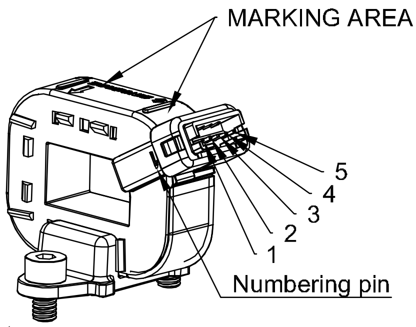


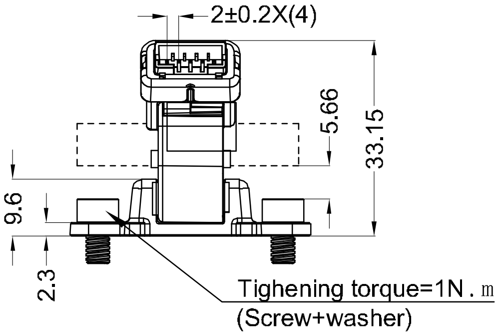
The step response time of STK-HO/4 current sensors. The dark light blue is primary current, while the light blue is output signal of current sensor. The step response time is about 2 μs.

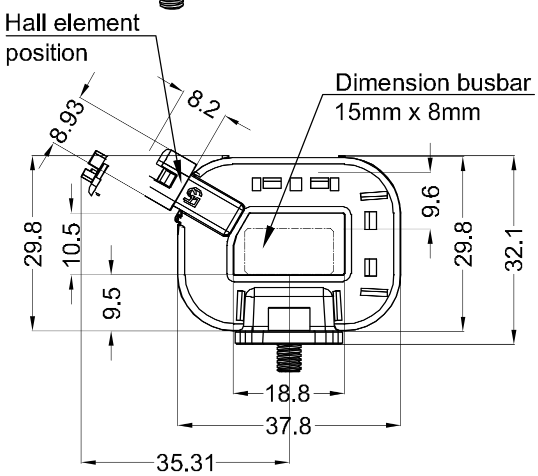
11. Dimensions & Pins & Footprint

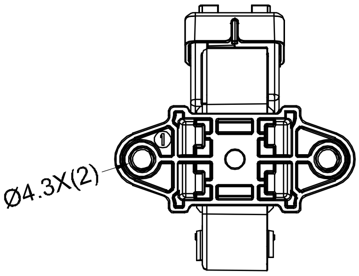
Assembly method 1：

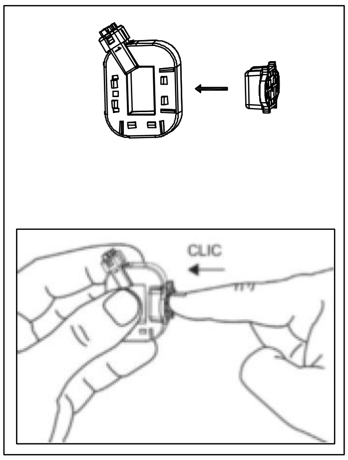




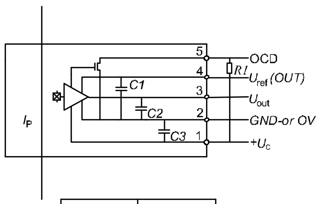






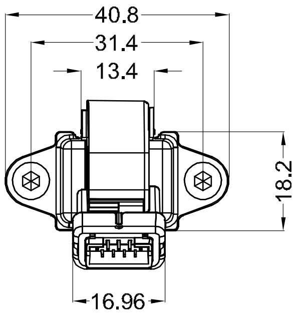


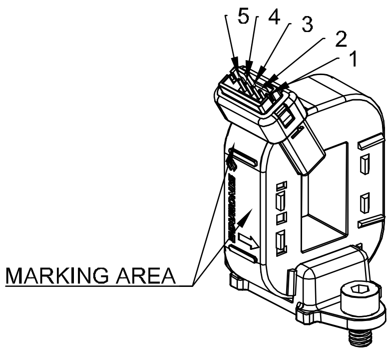
Connection

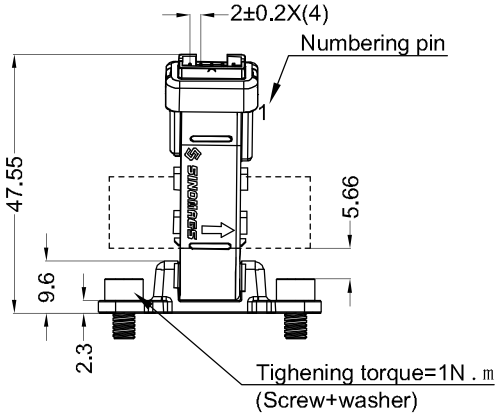


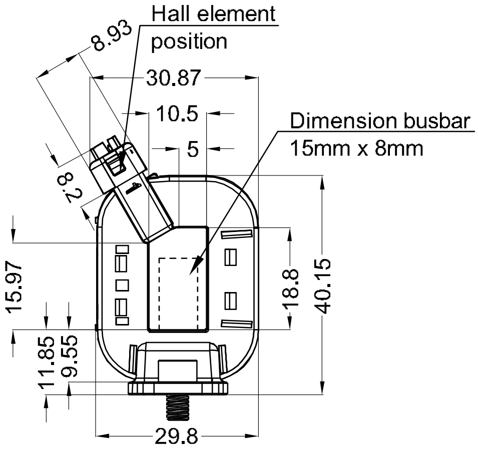
C1	47nF
C2	4.7nF
C3	47 nF
R1	5.1KΩ

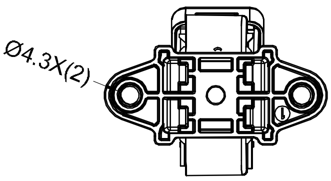
Assembly method 2：











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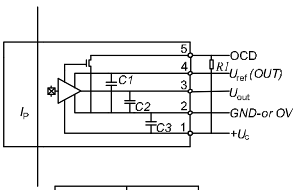
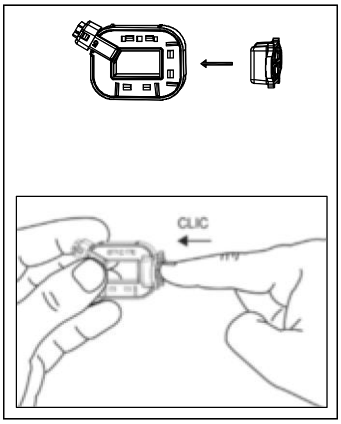
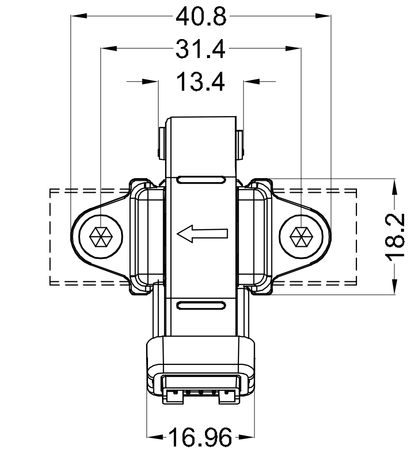
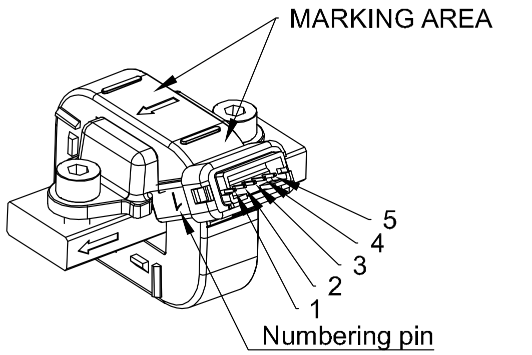


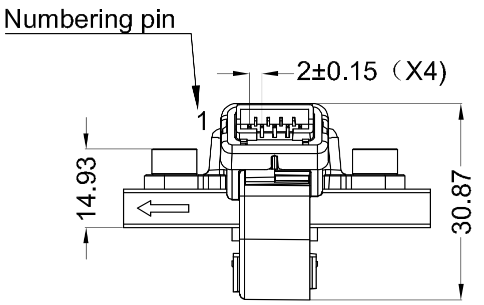
C1	47nF
C2	4.7nF
C3	47 nF
R1	5.1KΩ

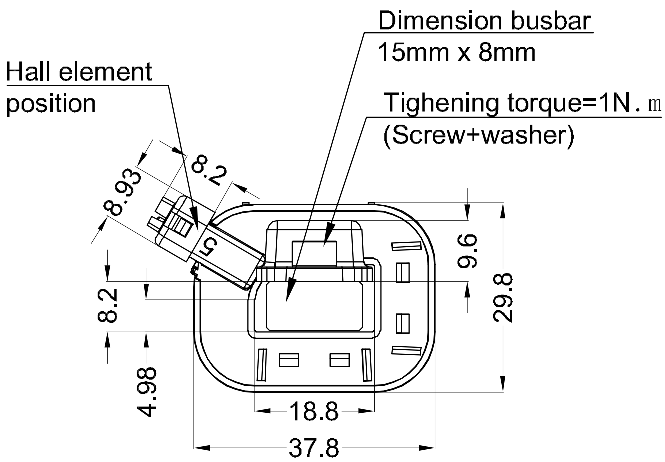


Assembly method 3：

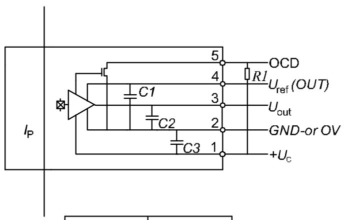




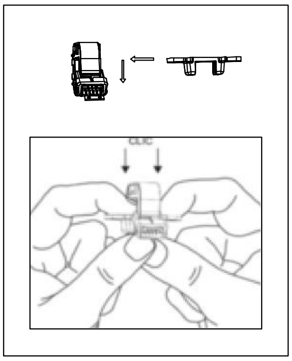




Connection



C1	47nF
C2	4.7nF
C3	47 nF
R1	5.1KΩ



Remarks:

- General linear tolerance ±0.5 mm.
- The above assembly methods can be freely chosen, We do not recommend always changing the assembly method

12. 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.

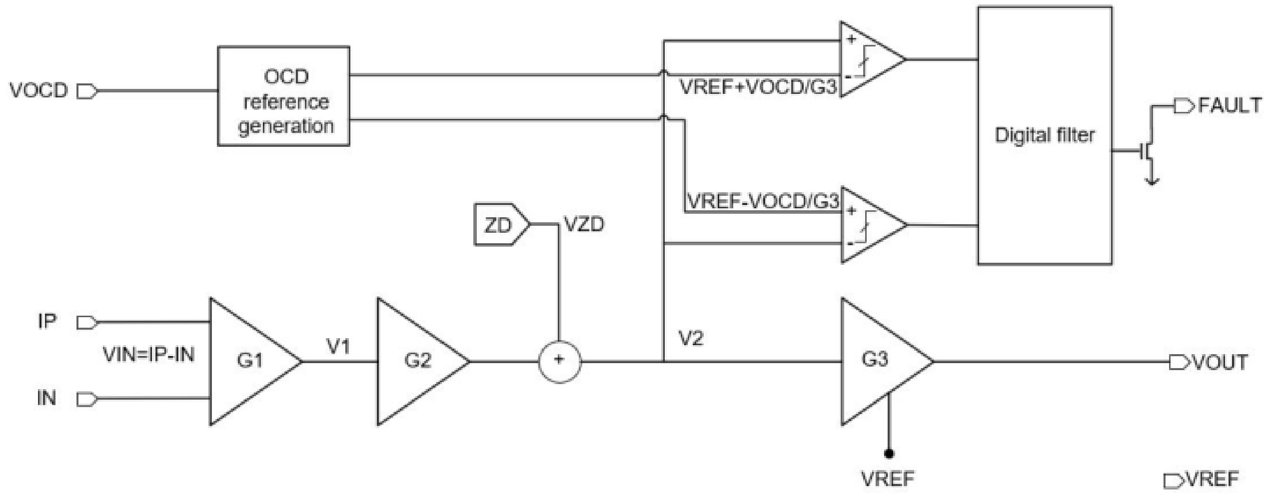
Since the trigger voltage is set after the second amplifier, the OCD function supports that the trigger current can be higher than I_pn. The trigger voltage can be defined:

a) Vref = 2.5 V

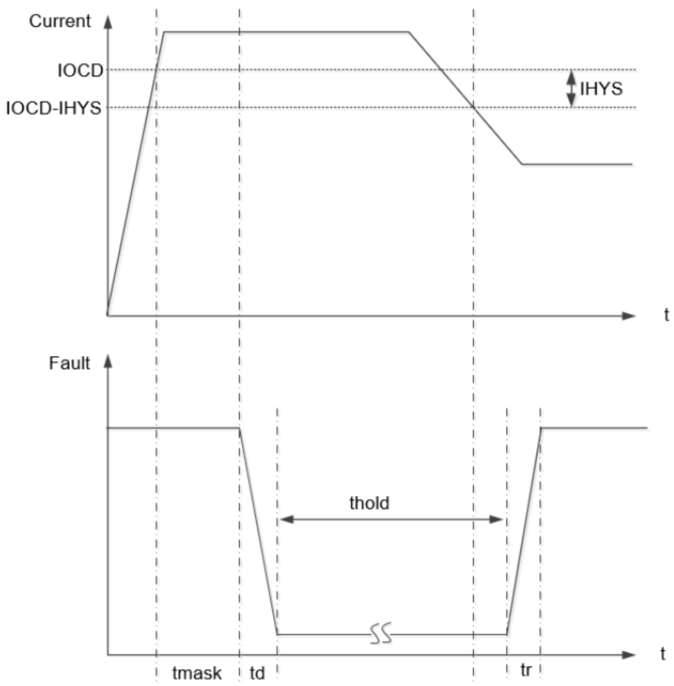
b) 0.5 V ≦ VOC ≦ Vref;

c) Trigger voltage = Vref +/- VOC;

d) Trigger current = (Vref +/- VOC -Voff) / G_th;



Functional Block Diagram on OCD function when Vref = 2.5 V



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