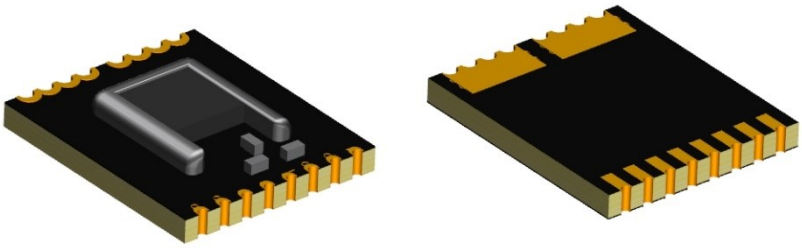
Current Sensor

Product Series: STK-616AF

Part number:
STK-616AF-10AB
STK-616AF-20AB
STK-616AF-40AB
STK-616AF-50AB
STK-616AF-80AB

Version: Ver 1.0



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CONTENT

1. Description

The STK-616AF series current sensor is based on TMR (tunnel magnetoresistance) technology and open-loop design. It is suitable for DC, AC pulsed and any kind of irregular current measurement under the isolated conditions.
The STK-616AF series current sensor has built-in OCD (Over Current Detection) function.

Typical applications

- AC Variable speed drives
- Inverter
- Power supply

General parameter

Parameter	Symbol	Unit	Value
Junction temperature	T_A	℃	-40 ~ 125
Storage temperature	T_stg	℃	-40 ~ 125
Mass	m	g	2

Absolute maximum rating

Parameter	Symbol	Unit	Value
Supply voltage	Vcc	V	5.5
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.

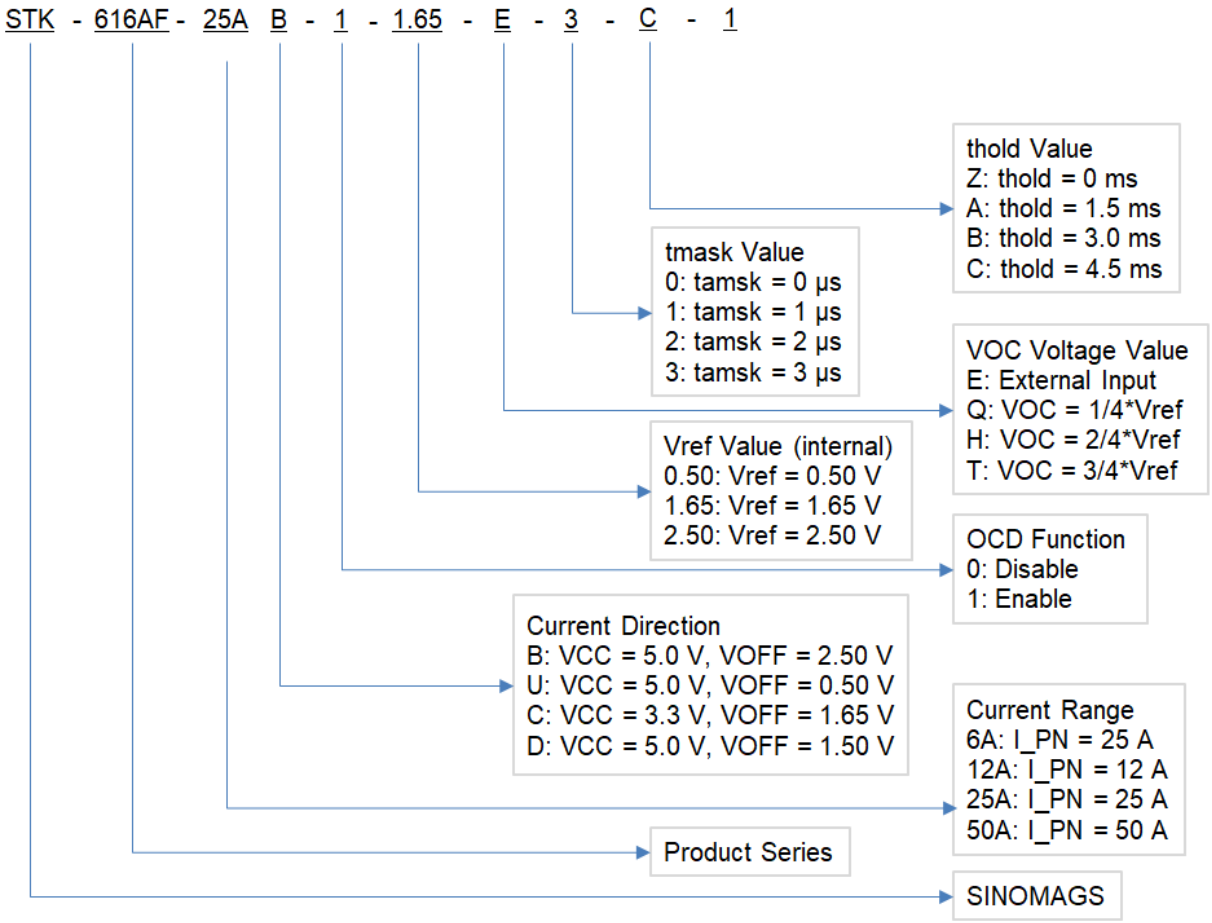
Isolation parameter

Parameter	Symbol	Unit	Value	Comment
RMS voltage for AC test 50 Hz, 1 min	Ud	kV	4	
Impulse withstand voltage 1.2/50μs	Ûw	kV	8	
Clearance distance (pri. -sec)	dCl	mm	6	
Creepage distance (pri. -sec)	dCp	mm	6	

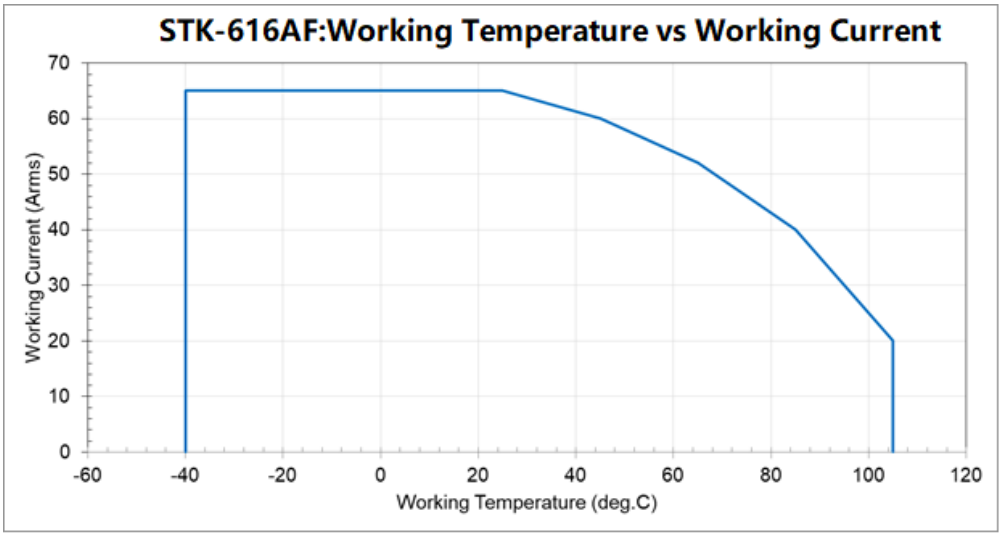
Measuring current table

Part number	Current Range	Sensitivity (mV/A)	T (℃)
STK-616AF-10AB-1-2.-E-2-C	±10 A	200	-40 ~ 105
STK-616AF-20 AB-1-2.-E-2-C	±20 A	100	-40 ~ 105
STK-616AF-40 AB-1-2.-E-2-C	±40 A	50	-40 ~ 105
STK-616AF-50 AB-1-2.-E-2-C	±50 A	40	-40 ~ 105
STK-616AF-80 AB-1-2.-E-2-C	±80 A	25	-40 ~ 105

2. Part number definition



3. Temperature vs Current (for Gain ≥ 48 mV/A)

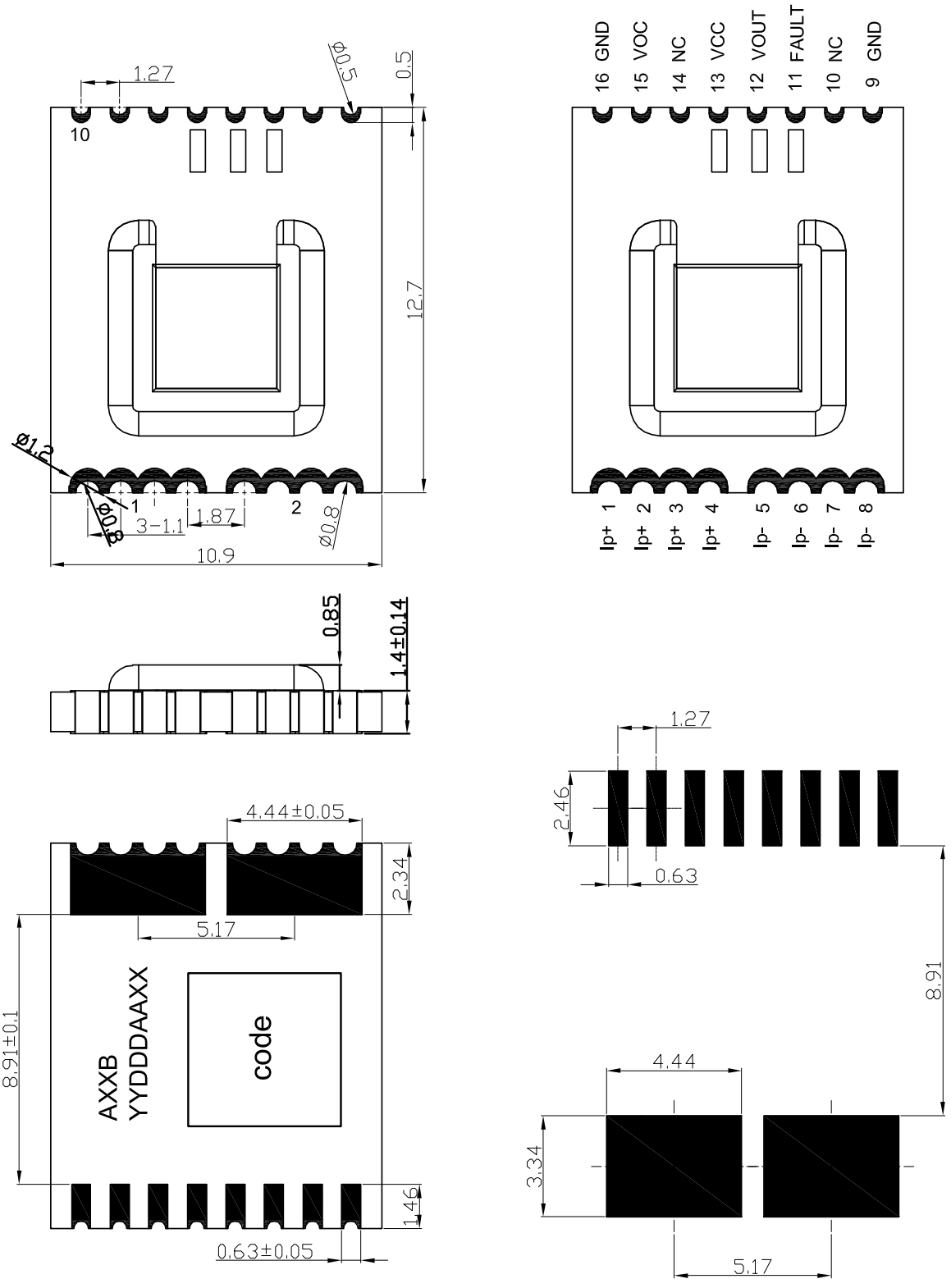


4. Electrical data

Condition: T_A = 25℃, Vcc = 5 V

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal current range	I_pn	A	-10		10	STK-616AF-10AB
			-20		20	STK-616AF-20AB
			-40		40	STK-616AF-40AB
			-50		50	STK-616AF-50AB
			-80		80	STK-616AF-80AB
Primary current measuring range	I_pm	A	-12		12	STK-616AF-10AB
			-24		24	STK-616AF-20AB
			-48		48	STK-616AF-40AB
			-60		60	STK-616AF-50AB
			-96		96	STK-616AF-80AB
Supply voltage	Vcc	V		5		±5%
Current consumption	Icc	mA		5	10	
Primary conductor resistance	R_IP	mΩ		0.3		I_PN ≥ 40 A
	R_IP	mΩ		0.7		I_PN = 20 A
	R_IP	mΩ		1.2		I_PN = 10 A
Reference voltage	Vref	V	1.6	1.65	1.7	Internal use
			2.45	2.5	2.55	
Quiescent voltage Error	Voff_err	V	-0.05		0.05	Vout@0A- VOFF
Internal output resistance	R_out	Ω		25		
OCD range	VOC	V	0 ~ (Vcc-1.7), see “OCD” section			
FOULT error		%		5%		% of VOC
OCD Hysteresis	IHYS	%		10%		% of VOC
OCD Fault Mask	tmask	μs	Typical = 2, see part number definition			
OCD Fault Mask error	Tmask_ error	ns		125		
OCD Fault Hold Time	thold	ms	Typical = 4.5, see part number definition			
Step response time	t_res	μs		0.3		@90% of I_pn
Frequency bandwidth (-3dB)	BW	kHz		900		No RC circuit
Noise	I_noise	%I_PN		1		DC ~ 100 kHz
Non-linearity @ 25℃	ξ	% of I_pn		±1.5		STK-616AF-25AB
Accuracy @ 25℃	X	% of I_pn		±2		@ 25℃
Thermal drift of G_th @ -40℃~105℃	GAIN_T	% of sensitivity	-1.5		1.5	Drift value related to the value @ 25℃
Thermal drift of Voff @ -40℃~105℃	Voff_T	mV	-15		15	

5. Dimensions

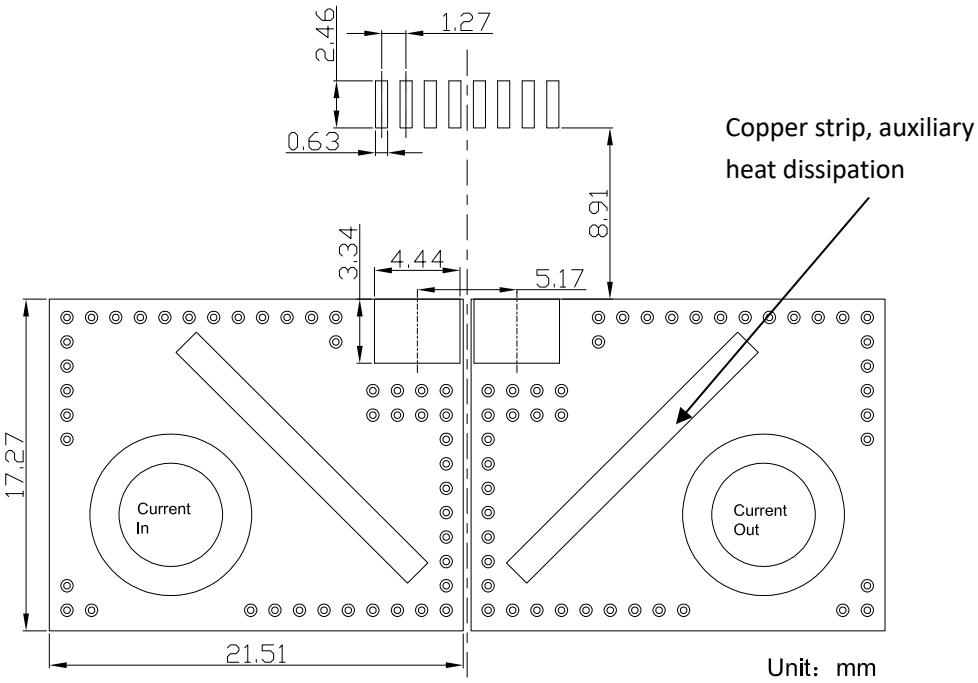


PCB Layout Reference View

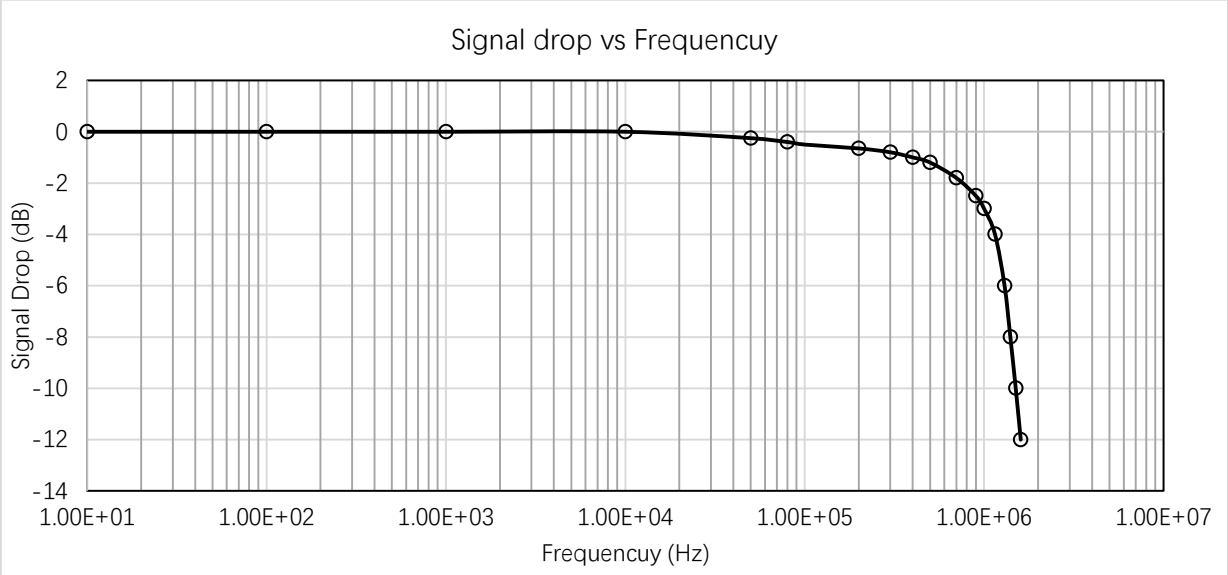
6. Pin definitions

PIN	Symbol	Description
1,2,3,4	IP+	Primary conductor pin (+)
5,6,7,8	IP-	Primary conductor pin (-)
9,16	GND	Ground pin (GND)
10	VREF	Reference voltage
11	FAULT	Over current detection alarm output, the pin is open leakage output
12	VOUT	Sensor output pin
13	VCC	Power supply pin
14	NC	NC
15	VOC	Over current detection threshold input pin

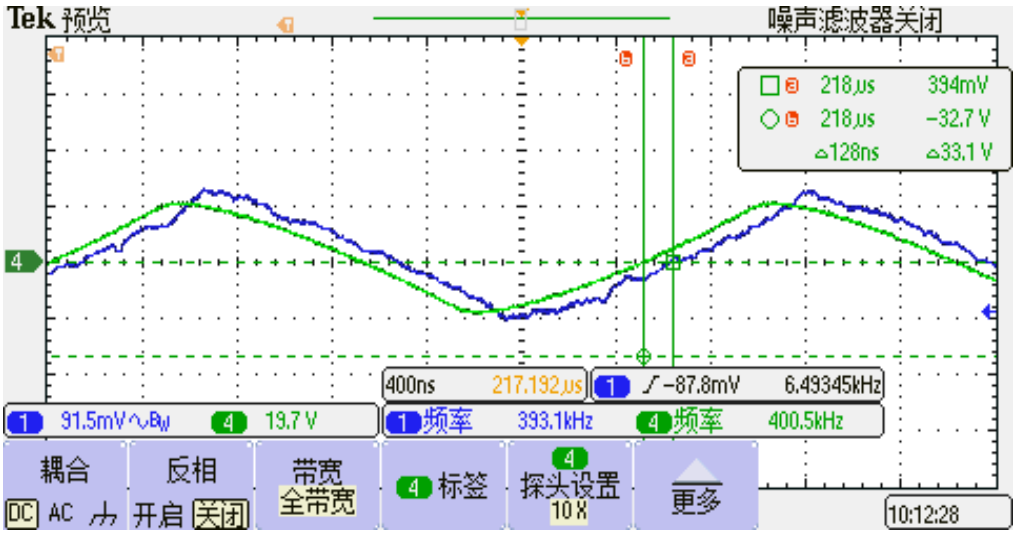
7. PCB layout recommendation



8. Frequency band width

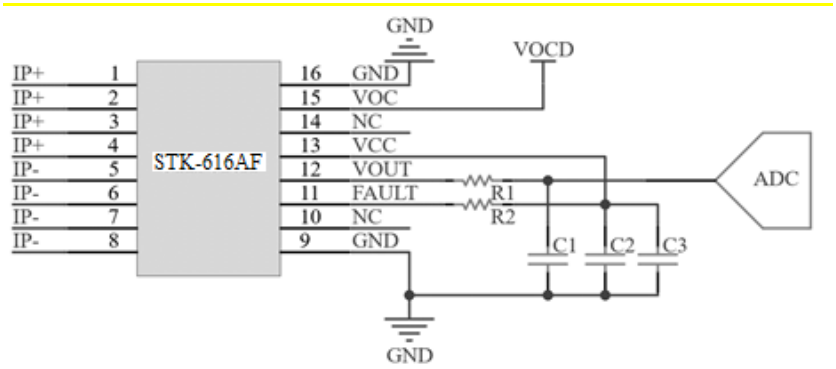


9. Step response time



The typical frequency response of STK-616AF current sensor. The delay of output to the primary triangle current with a frequency of 400 kHz is around 130 ns.

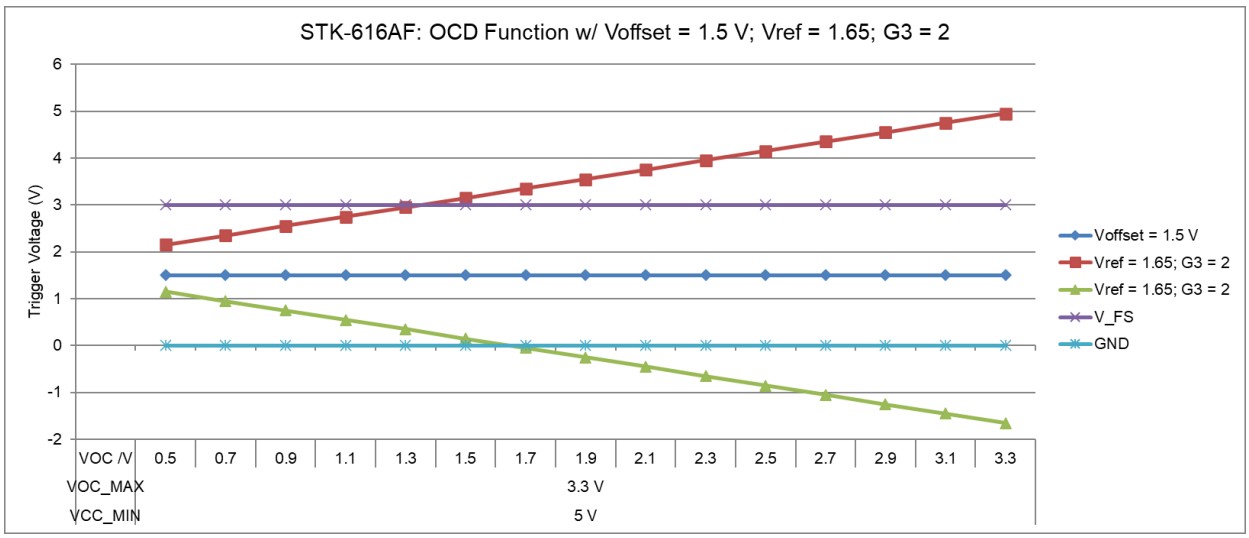
10. Typical application circuit



Remark: R2 = 5 kΩ, recommended C2 = 1 μf, C3 = 10 nf. 50 pf of C1 does not affect the response speed of the chip. R1 and C1 constitute RC filter circuit. The relationship between RC value and frequency is shown in below Table

R1 (kohm)	C1 (nF)	Theoretical band width f = 1/(2πRC) (kHz)	Measured band width (kHz)
1	1	150	~ 150
0.4	1	400	~ 400
0.16	1	1000	~ 1000

11. OCD voltage

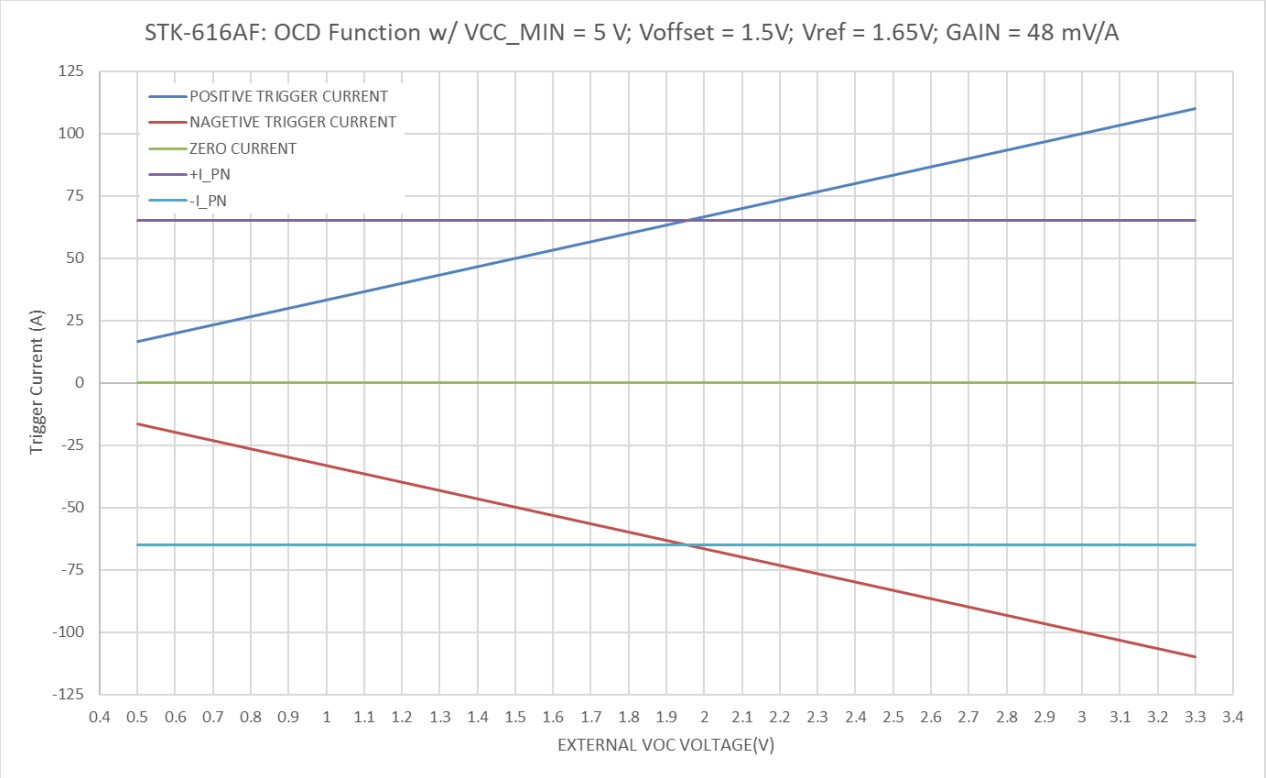


In the plot, the V_FS is output voltage @ +/-I_PN.

With conditions: Vcc = 5.0 V, Vref = 1.65 V (factory setting), G3 ≧ 2 (factory setting), Voff = 1.5 V, the STK-616AF current sensor can provide a protection trigger current higher than I_pn.

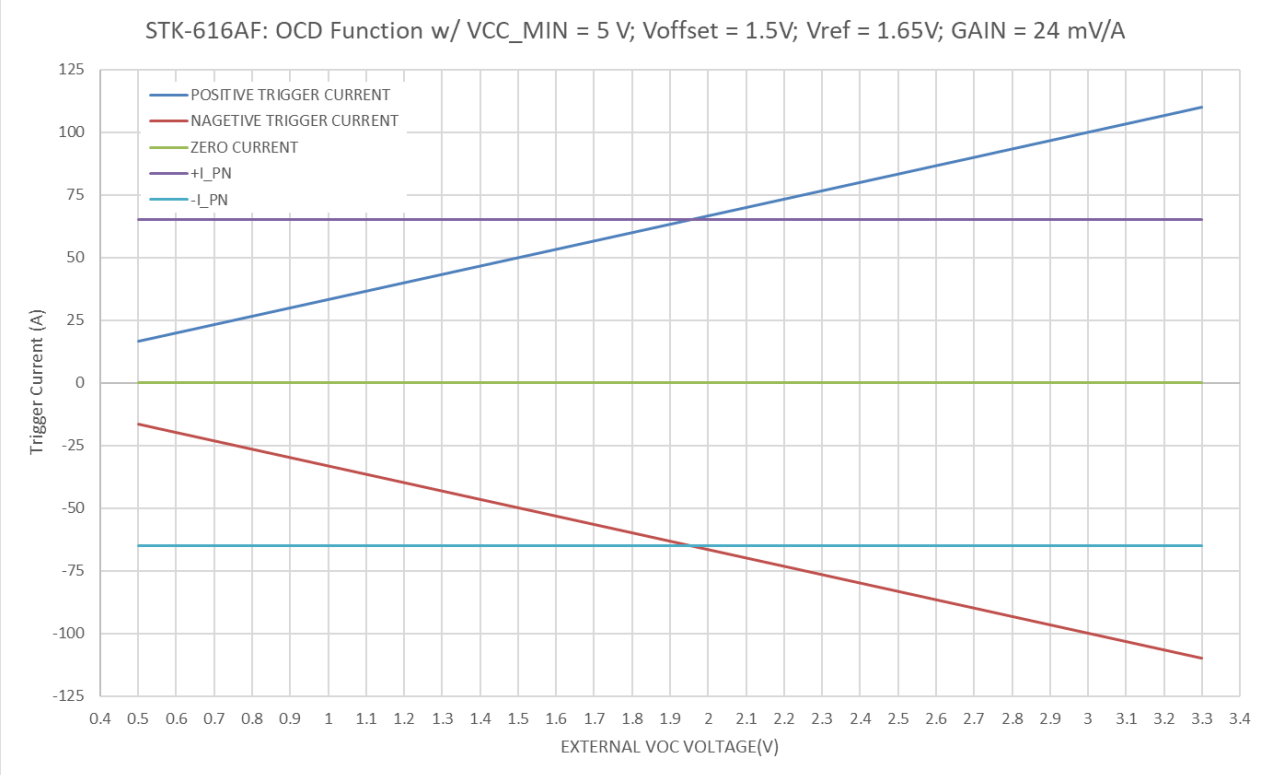
The trigger voltage = Vref +/- VOC, here, VOC ≦ Vcc – 1.7 V.

12. OCD function for STK-616AF-25AD



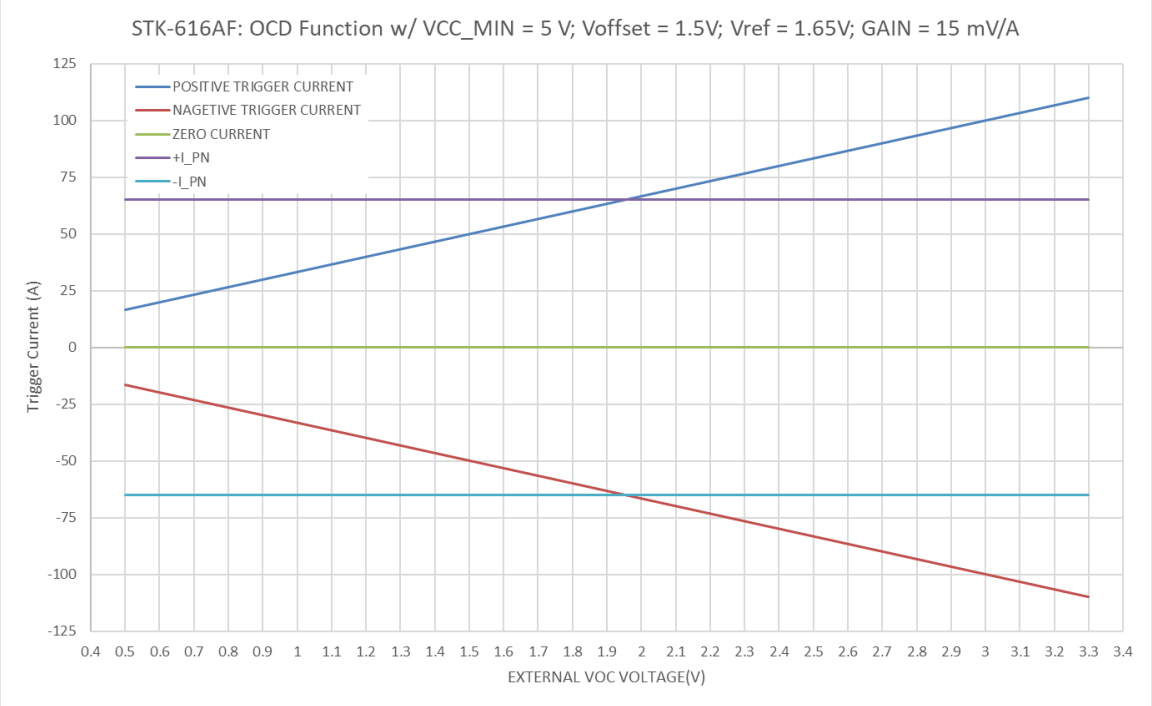
Based on the setting for STK-616AF, since the Quiescent voltage, Voff of 1.5 V, is not the same as the reference voltage, Vref of 1.65 V, the trigger current is not equivalent for positive and negative current.

13. OCD function for STK-616AF-50AD



Based on the setting for STK-616AF, since the Quiescent voltage, Voff of 1.5 V, is not the same as the reference voltage, Vref of 1.65 V, the trigger current is not equivalent for positive and negative current.

14. OCD function for STK-616AF-80AD



Based on the setting for STK-616AF, since the Quiescent voltage, Voff of 1.5 V, is not the same as the reference voltage, Vref of 1.65 V, the trigger current is not equivalent for positive and negative current.

15. General information on OCD

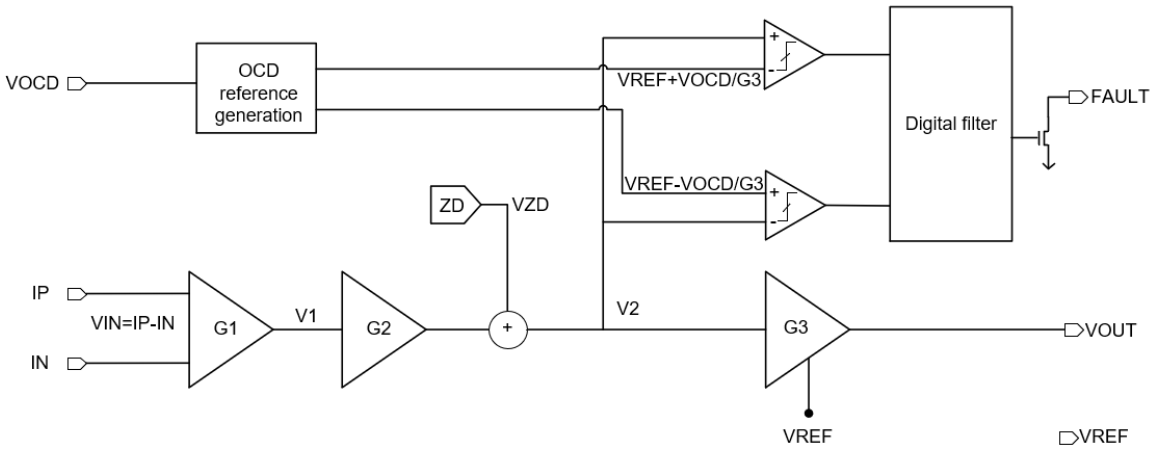
This section describes the general information on OCD function, the specific functions, which are not listed in the section of “electrical data”, can be defined per request.

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:

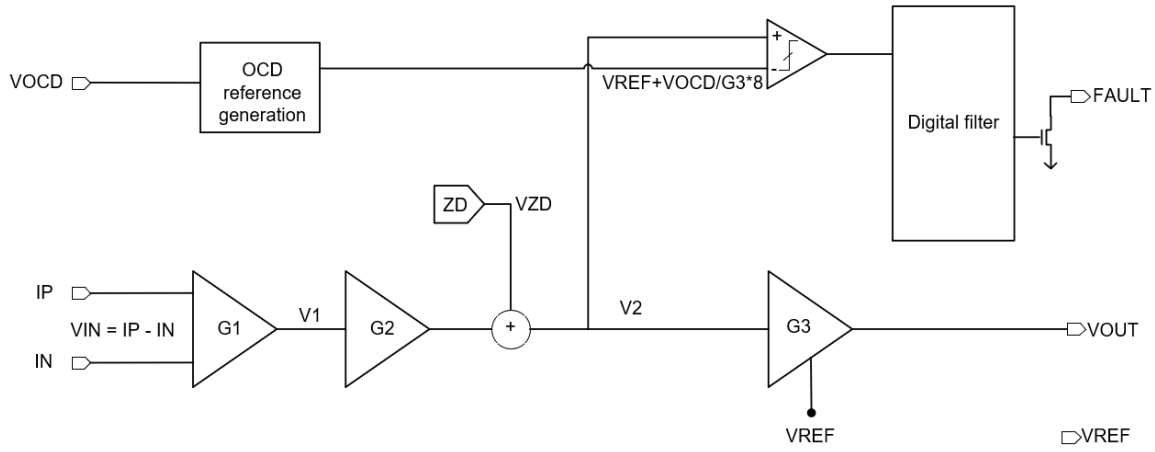
a) Trigger voltage = Vref +/- VOC, when Vref = 2.5 V or 1.65 V;

b) Trigger voltage = Vref + 8*VOC, when Vref = 0.5 V;

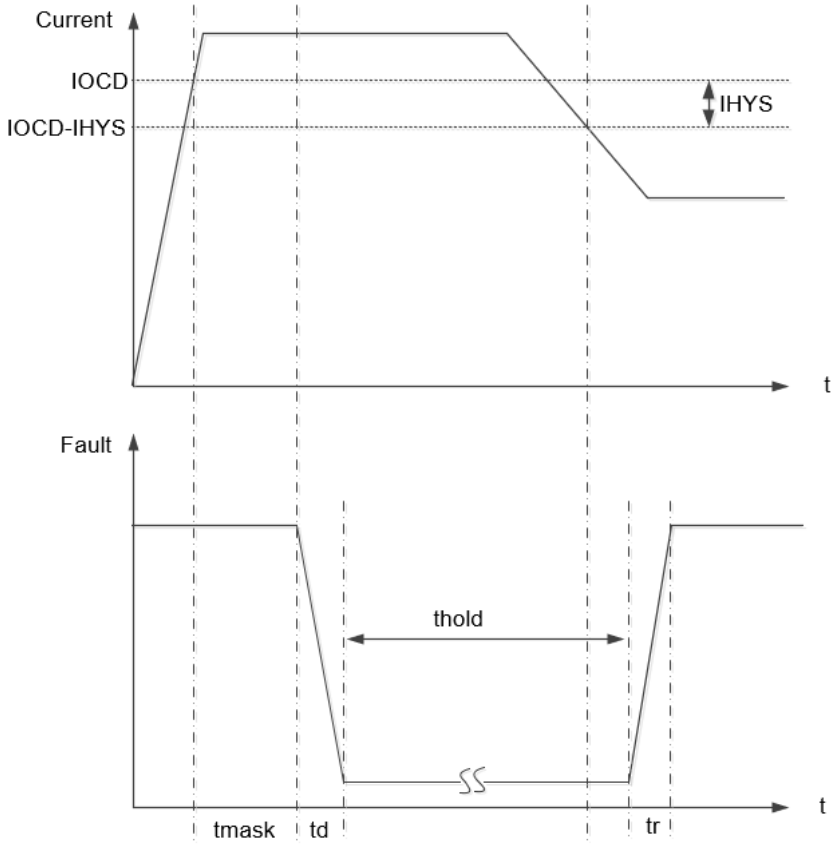
c) VOC ≦ Vcc – 1.7 V;



Functional Block Diagram on OCD function when Vref = 2.5 V or 1.65 V.



Functional Block Diagram on OCD function when Vref = 0.5 V.



The above plot shows the definition on the time in OCD function. The typical value for td & tr is that td = 2 ns, and tr = 91 ns with setting as show in the section of “typical application circuit”.

Supply	VOC Setting			Trigger Voltage		REMARK
Vcc / V	Vref Voltage / V	Factor	VOC Value	Positive	Negative	
5.0	2.5		External	External	External	Necessary Conditions: (1) G3 ≥ 2, factory setting (2) VOC ≤ Vcc - 1.7 V The Trigger Voltage = (1) Vref +/- Factor * VOC, when Vref = 2.5 V or 1.65 V (2) Vref + Factor * VOC, when Vref = 0.5 V
		1	1/4*Vref	3.125 V	1.875 V	
		1	2/4*Vref	3.75 V	1.25 V	
		1	3/4*Vref	4.375 V	0.625 V	
	1.65		External	External	External	
		1	1/4*Vref	2.0625 V	1.2375 V	
		1	2/4*Vref	2.475 V	0.825 V	
		1	3/4*Vref	2.8875 V	0.4125 V	
	0.5		External	External	-	
		8	1/4*Vref	1.5 V	-	
		8	2/4*Vref	2.5 V	-	
		8	3/4*Vref	3.5 V	-	
3.3	1.65		External	External	External	
		1	1/4*Vref	2.0625 V	1.2375 V	
		1	2/4*Vref	2.475 V	0.825 V	
		1	3/4*Vref	2.8875 V	0.4125 V	
	0.5		External	External	-	
		8	1/4*Vref	1.5 V	-	
		8	2/4*Vref	2.5 V	-	
		8	3/4*Vref	3.5 V	-	