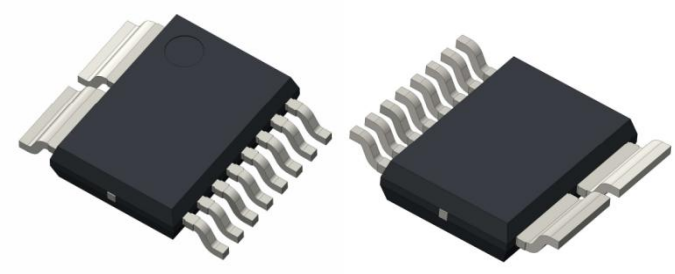
Current Sensor

Product Series: STK-616AM

Part number:
STK-616A-25MLB3
STK-616A-50MLB3
STK-616A-60MLB3
STK-616A-80MLB3

Version: Ver 1.1



Sinomags Technology Co., Ltd

Web site: www.sinomags.com

CONTENT

1. Description

The STK-616AM 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-616AM series current sensor has built in OCD (Over Current Detection) function. The primary conductor has very low resistance of 0.12mΩ.

Typical applications

- AC Variable speed driver
- PV inverter
- AC/DC, DC/DC power supply
- Servo motor driver

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	6.5
ESD rating (HBM)	U_ESD	kV	4
Surge	A_{SURGE}	kA	20 @8 μs (rise) / 20 μs (width)

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.

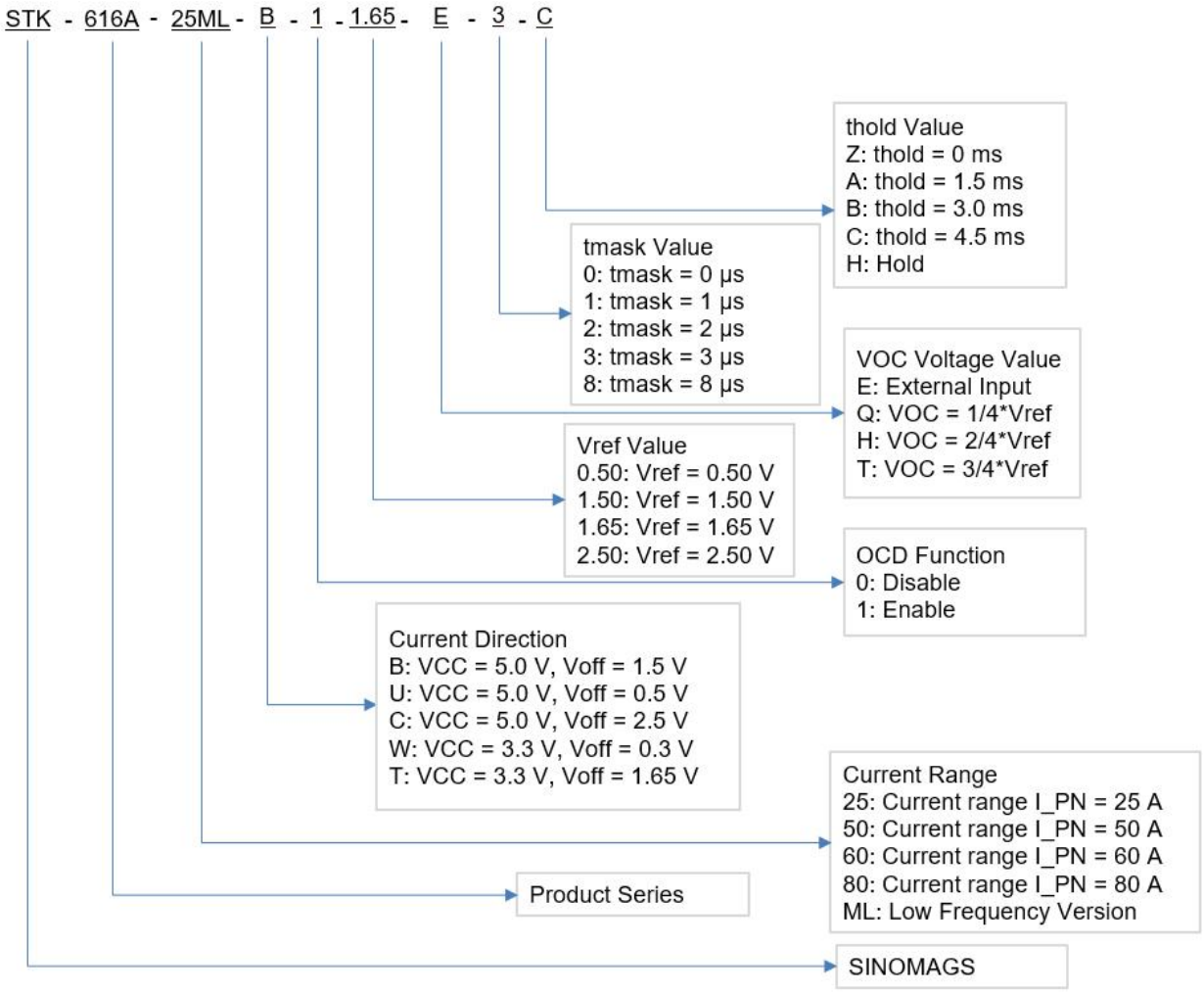
Isolation parameter

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	6	
Clearance distance (pri. -sec)	dCl	mm	8.5	Determined by customer's layout
Creepage distance (pri. -sec)	dCp	mm	8.5	

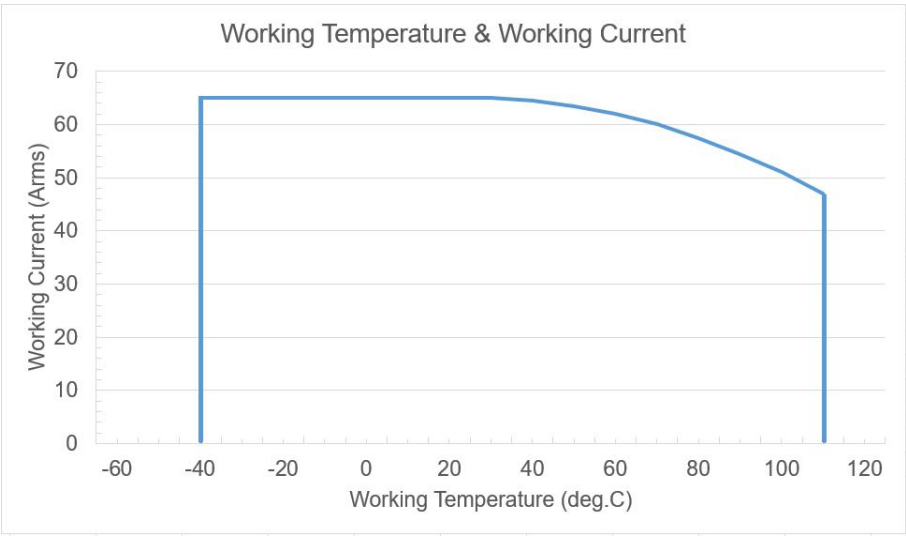
Measuring current table

Part number	Current Range	Sensitivity (mV/A)	T (℃)
STK-616A-25MLB3-1-1.65-E-1-C	±25 A	48	-40 ~ 105
STK-616A-25MLB3-1-1.65-E-2-C	±25 A	48	-40 ~ 105
STK-616A-25MLB3-1-1.65-E-3-C	±25 A	48	-40 ~ 105
STK-616A-50MLB3-1-1.65-E-2-C	±50 A	24	-40 ~ 105
STK-616A-60MLB3-1-1.65-E-3-C	±60 A	20	-40 ~ 105
STK-616A-80MLB3-1-1.65-E-3-C	±80 A	15	-40 ~ 105

2. Part number definition



3. Temperature vs Current



4. Electrical data

Condition：T_A = 25℃, Vcc = 5 V

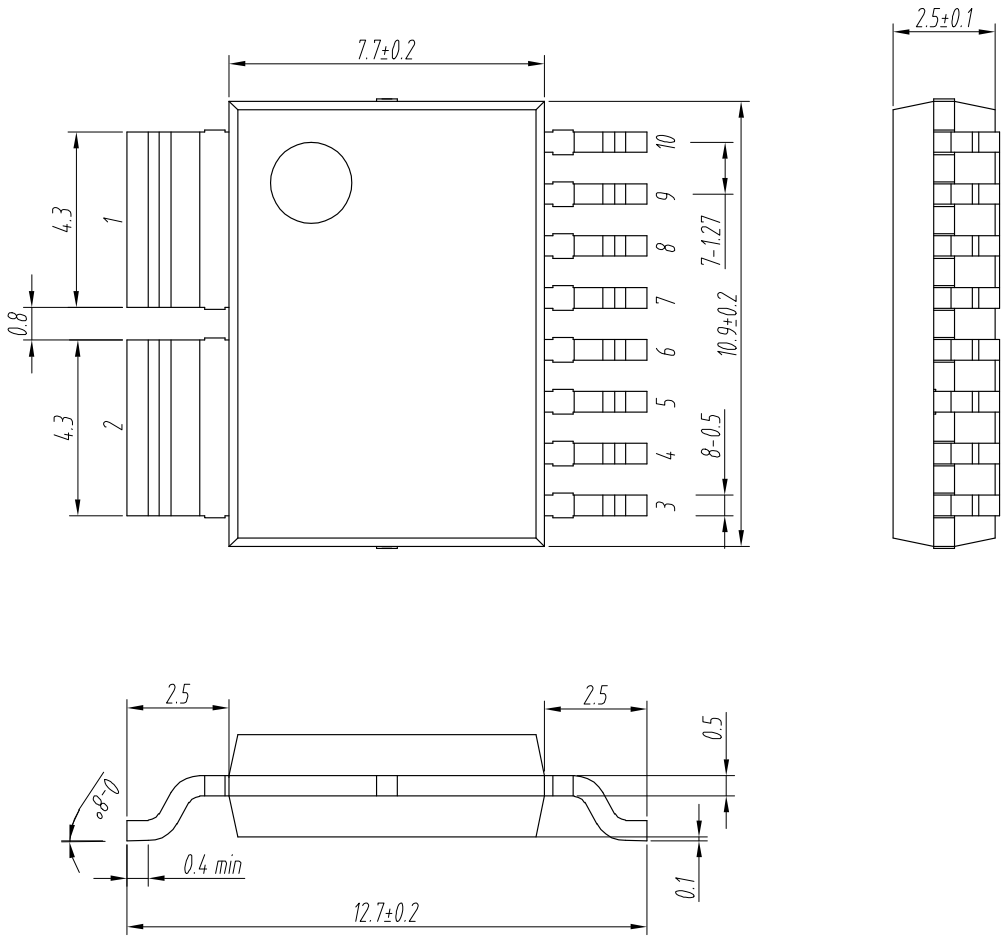
Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal current	I_pn	A	-25		25	STK-616A-25MLB3
			-50		50	STK-616A-50MLB3
			-60		60	STK-616A-60MLB3
			-80		80	STK-616A-80MLB3
Primary current measuring range	I_pm	A	-25		25	STK-616A-25MLB3
			-50		50	STK-616A-50MLB3
			-60		60	STK-616A-60MLB3
			-80		80	STK-616A-80MLB3
Supply voltage	Vcc	V		5		
Current consumption	Icc	mA		5	10	
Primary conductor resistance	R_IP	mΩ		0.12		
Reference voltage	Vref	V	0.45	0.5	0.55	Internal use
			1.45	1.50	1.55	
			1.6	1.65	1.7	
			2.45	2.5	2.55	
Quiescent voltage	Voff	V	0.28	0.30	0.32	Vout @ I_p = 0A
			0.48	0.5	0.52	
			1.48	1.5	1.52	
			1.63	1.65	1.67	
			2.48	2.5	2.52	
Internal output resistance	R_out	Ω		1		Vout
GAIN, Note 1)	G_th	mV/A		48		STK-616A-25MLB3
				24		STK-616A-50MLB3
				20		STK-616A-60MLB3
				15		STK-616A-80MLB3
OCD range	VOC	V	0		VCC-1.7V	Note 2)
FAULT error		%		5%		% of OCD
OCD Hysteresis	IHYS	%		10%		% of OCD
OCD Fault Mask	tmask	μs		2		Note 3)
OCD Fault Mask error	Tmask_error	ns		125		
OCD Fault Hold Time	thold	ms		4.5		Note 4)
Step response time	t_res	μs		0.5		@90% of I_pn
Frequency bandwidth (-3dB)	BW	kHz		600		No RC circuit

Noise	I_noise	mA rms		200		DC ~ 600 kHz
Non-linearity @ 25℃	ξ	% of I_pn		± 1.5		STK-616A-25MLB3
						STK-616A-50MLB3
						STK-616A-60MLB3
						STK-616A-80MLB3
Accuracy @ 25℃	X	% of I_pn		±1		@ 25℃
Thermal draft of G_th @ -40℃~85℃	GAIN_T	% of G_th		±1		Draft value related to the value @25℃
Thermal draft of Voff @ -40℃~85℃	Voff_T	mV		±10		
Total Accuracy @ -40℃~85℃	X_T	% of I_pn		±1.5		

Note

1) The gain of the sensor should be calibrated in software level if an accurate measuring is required.
2) The OCD trigger voltage = Vref +/- VOC. VOC voltage can be input by external voltage, but VOC shall be less than Vcc - 1.7 V. Refer the sections of “OCD function” & “General information on OCD” for more details.
3) The default time for OCD Fault Mask Time is 3us, while it can be set as 0, 1, 2, 3 us per demand.
4) The default time for OCD Fault Hold Time is 4.5ms, while it can be set as 0, 1.5, 3, 4.5ms per demand.

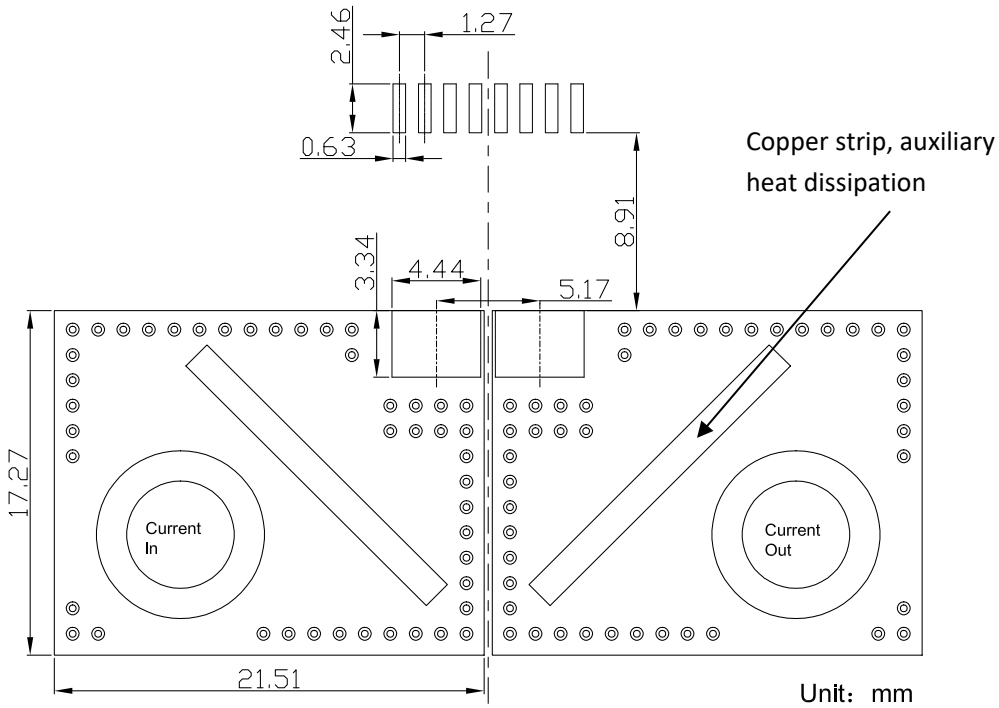
5. Dimensions



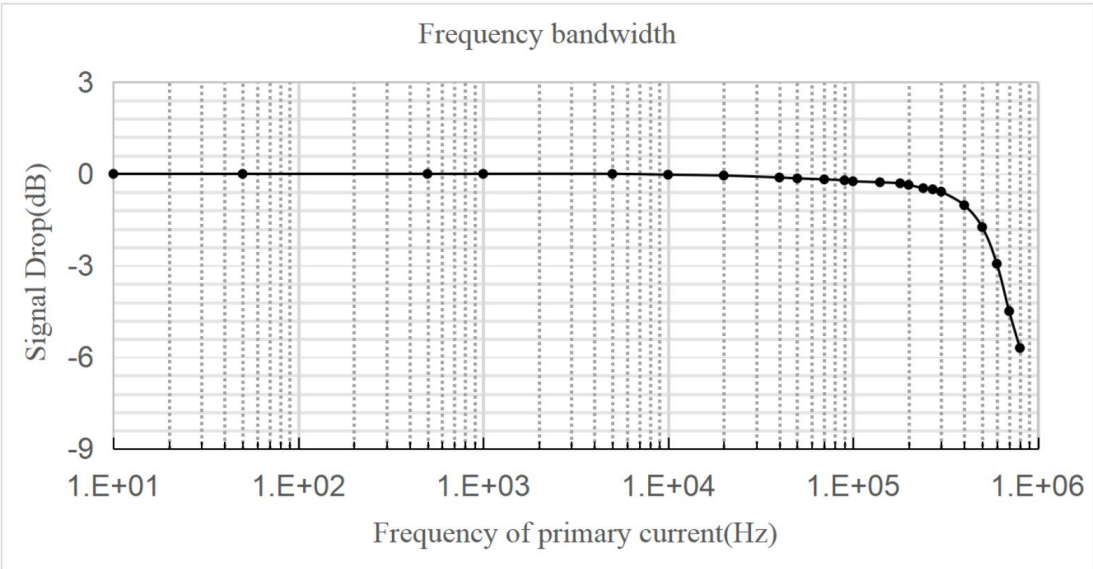
6. Pin definitions

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

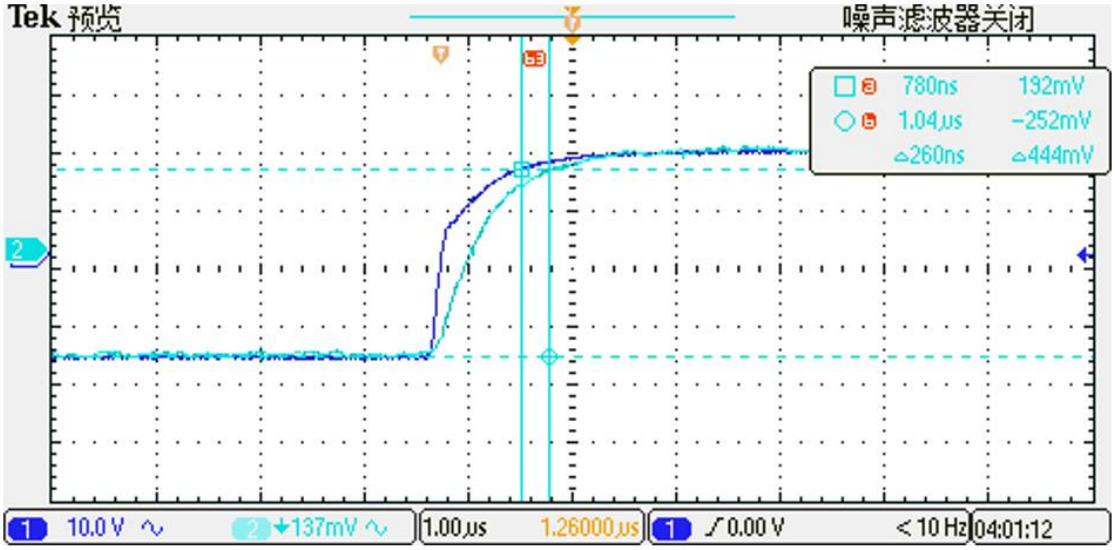
7. PCB layout recommendation



8. Frequency band width

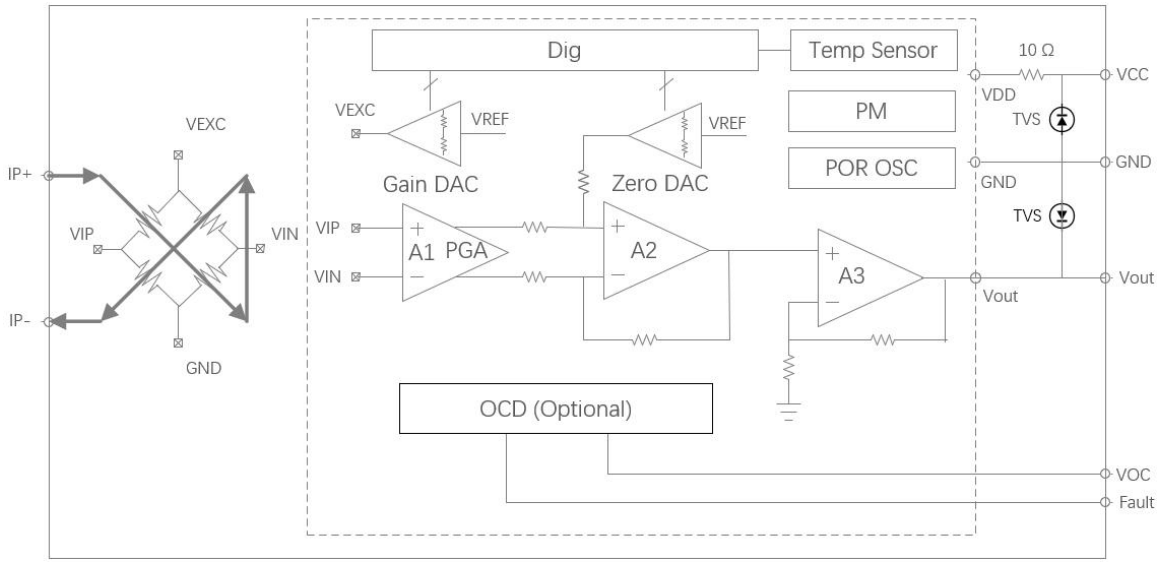


9. Step response time

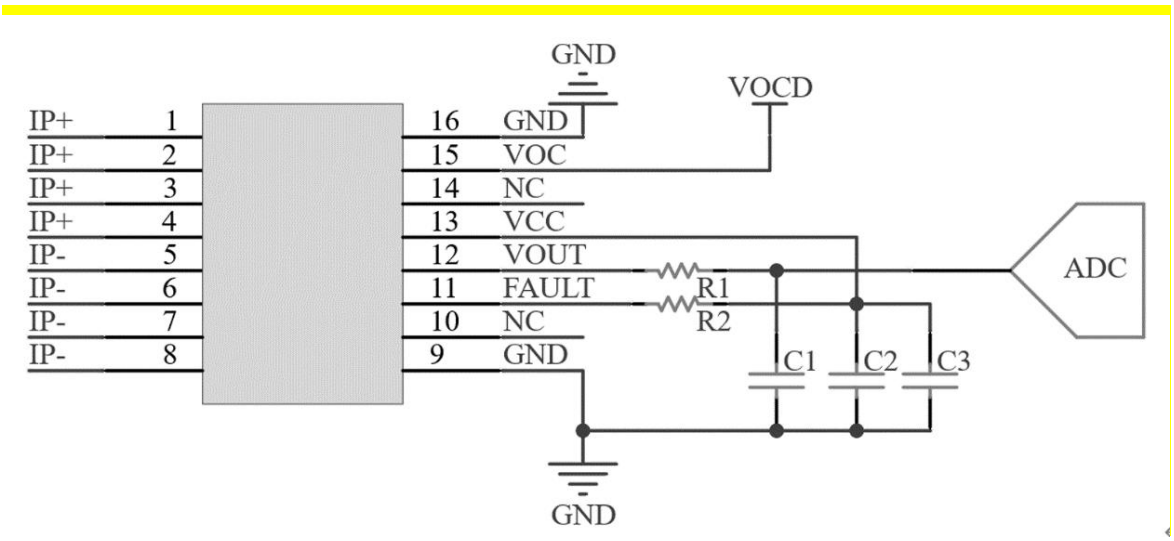


The typical frequency response of STK-616A current sensor. The response time from 90% of the primary current (blue) to 90% of the secondary output (green) is less than 0.5µs.

10. Block diagram

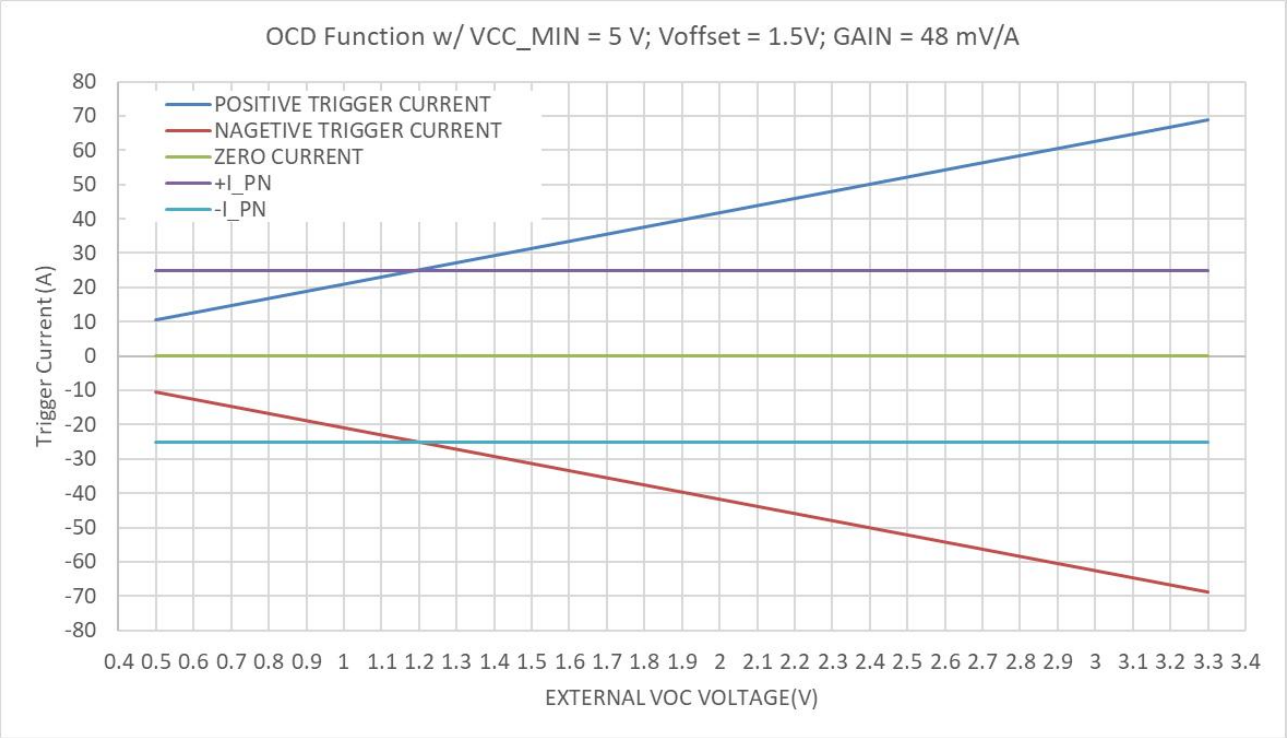


11. Typical application circuit



Remark: R2 = 10kΩ, recommended C2 = 1μf, C3 = 10nf. 50pf of C1 does not affect the response speed of the chip. R1 and C1 constitute RC filter circuit (f ≈ 1/(2πRC)). It should be considered that the band width of STK-616AM is 600kHz, so a RC setting of higher than 600kHz will not achieve a band width higher than 600kHz.

12. OCD voltage

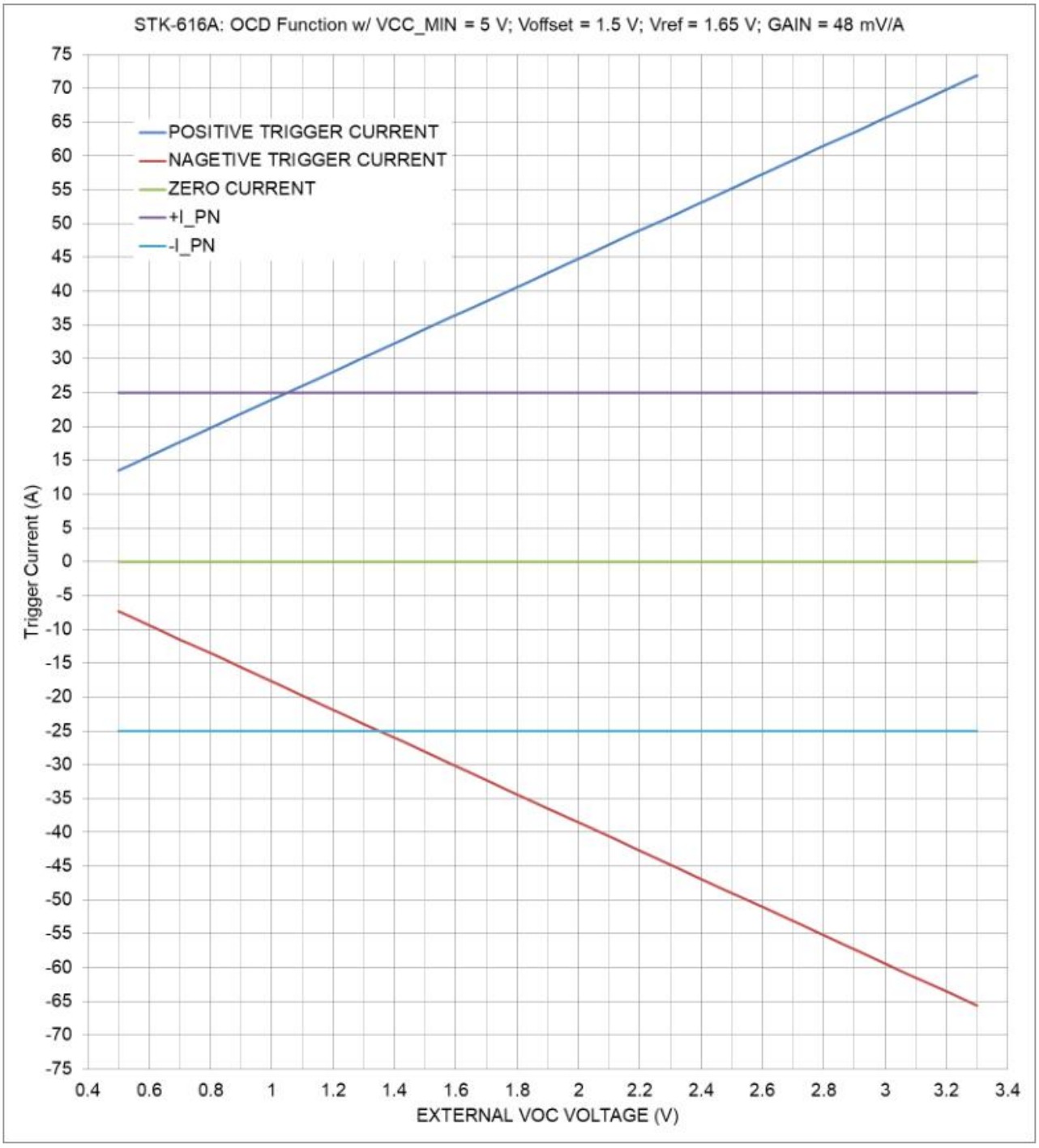


In the plot, the V_FS is output voltage @ +/-I_PN.

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

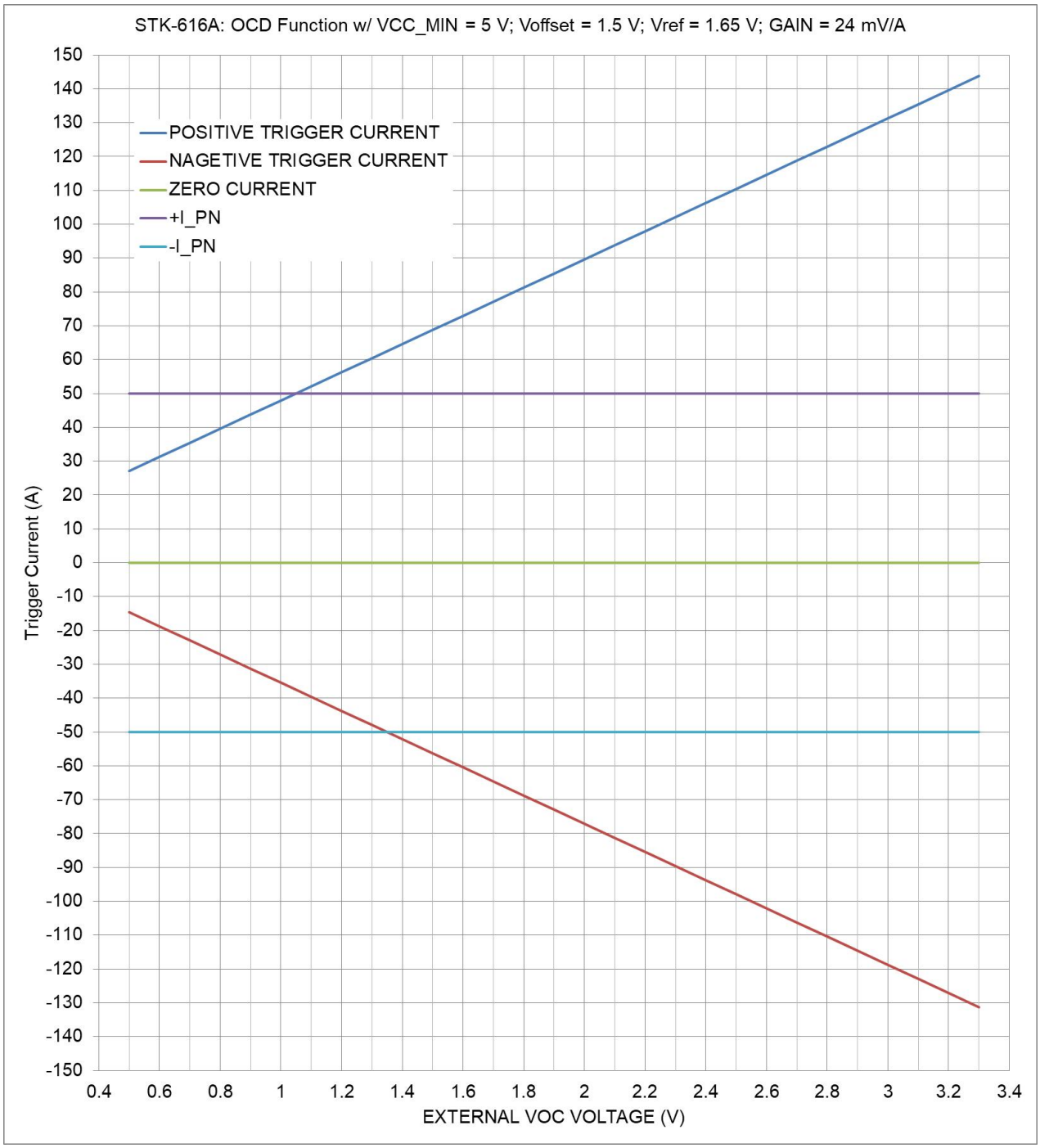
The trigger voltage = Vref +/- VOC, here, VOC ≦ Vcc － 1.7 V.

13. OCD function for STK-616A-25A



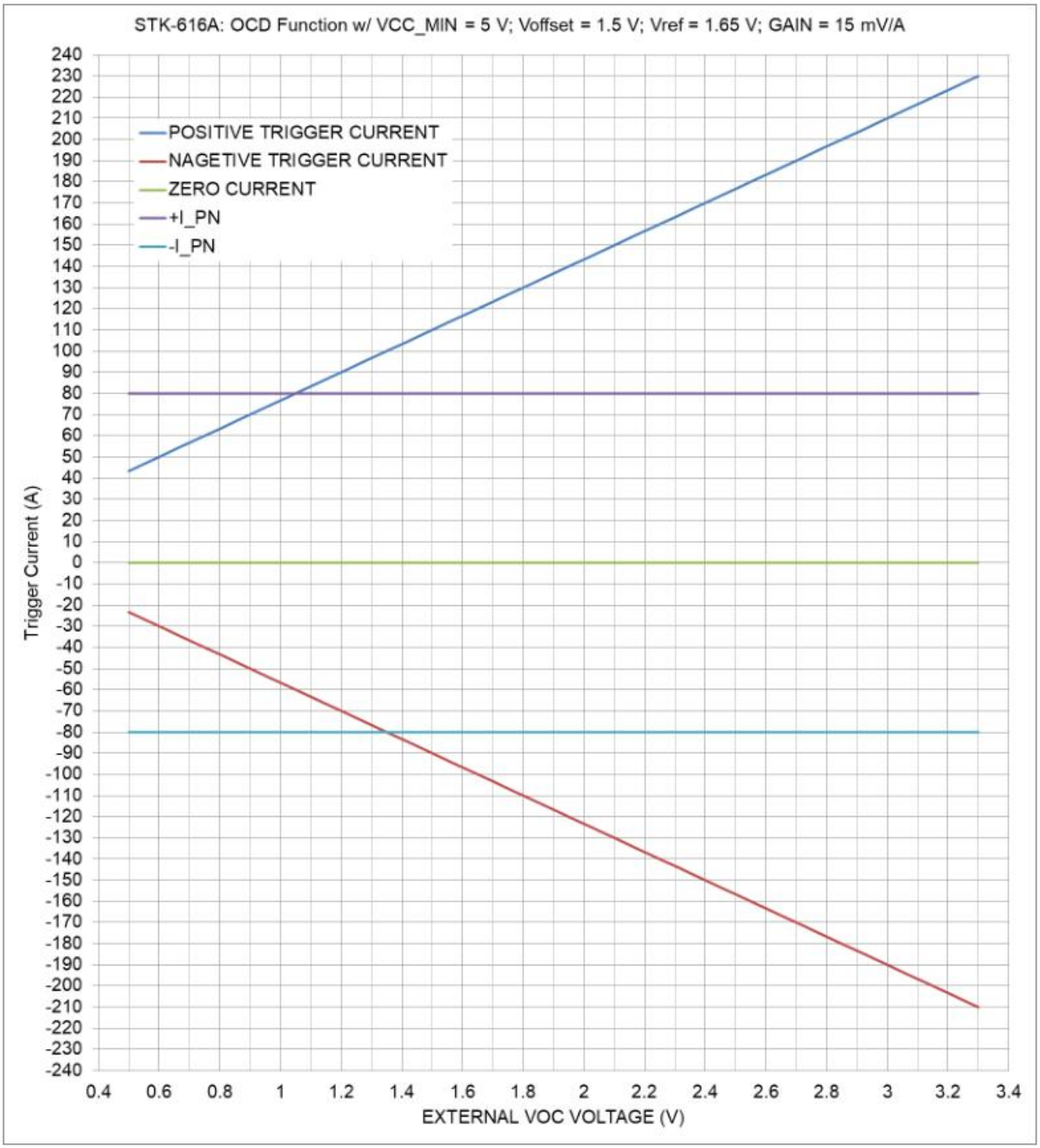
Based on the setting for STK-616A, since the Quiescent voltage, Voff of 1.5 V, is not the same as the reference voltage, Vref of 1.65 V, the trigger current is not equivalent for positive and negative current.

14. OCD function for STK-616A-50A



Based on the setting for STK-616A, 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. OCD function for STK-616A-80A



Based on the setting for STK-616A, 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.

16. General information on OCD

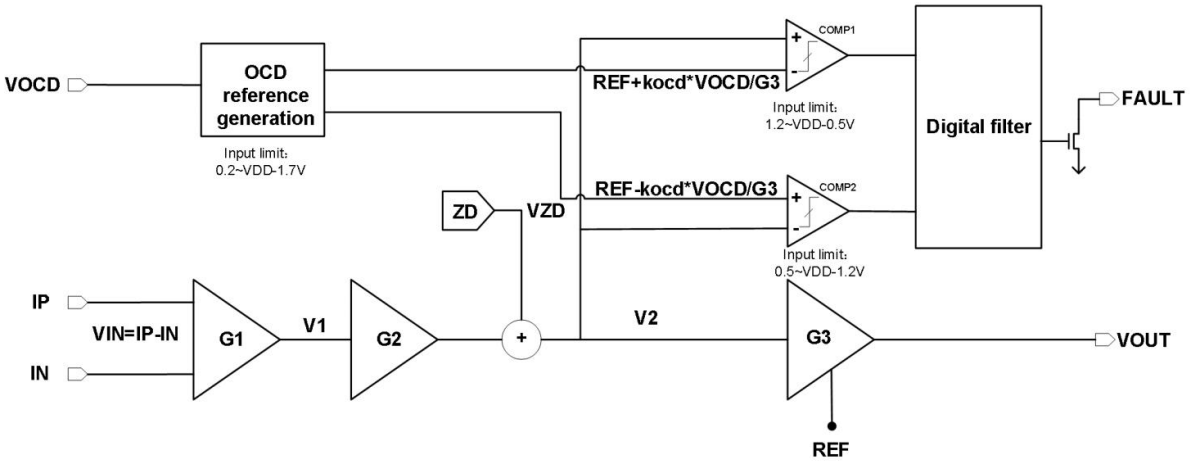
This section describes the general information on OCD function, the specific functions, which are not listed in the section of “electrical data”, can be defined per request.

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:

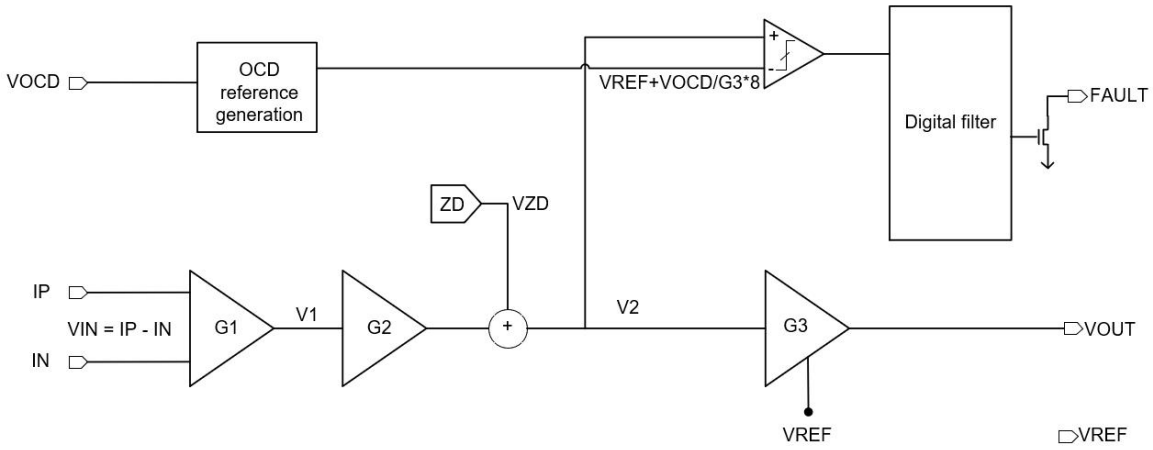
a) Trigger voltage = Vref +/- K*VOC (K=1 or 2), when Vref = 2.5 V or 1.65 V or 1.5V;

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

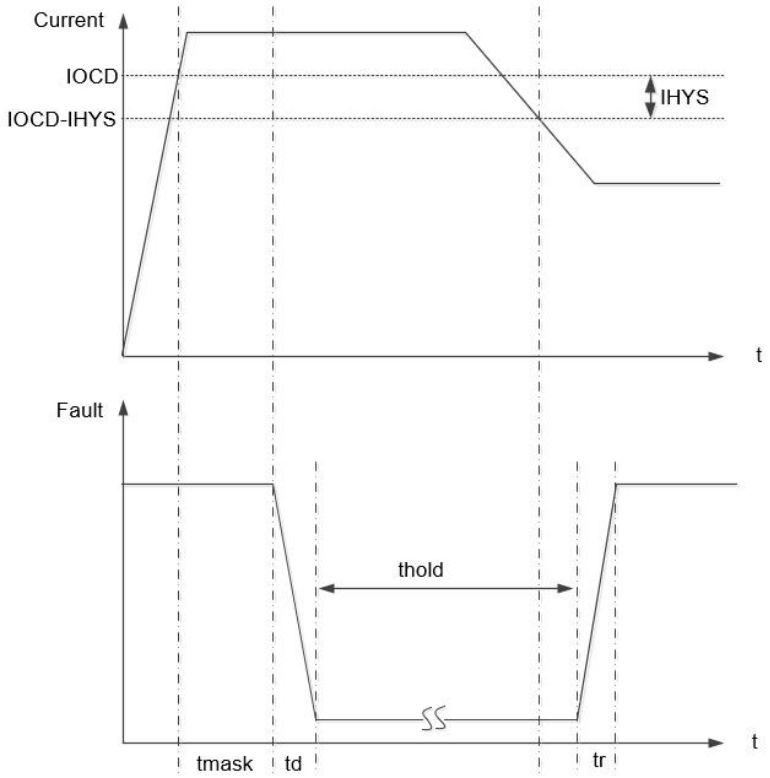
c) VOC ≦ Vcc – 1.7 V;



Functional Block Diagram on OCD function when Vref = 2.5 V or 1.65 V or 1.5V.



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 or 1.5V (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	
	1.5		External	External	External	
		1	1/4*Vref	1.875 V	1.125 V	
		1	2/4*Vref	2.25 V	0.75 V	
		1	3/4*Vref	2.625 V	0.375 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	
	1.5		External	External	External	
		1	1/4*Vref	1.875 V	1.125 V	
		1	2/4*Vref	2.25 V	0.75 V	
		1	3/4*Vref	2.625 V	0.375 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	-	