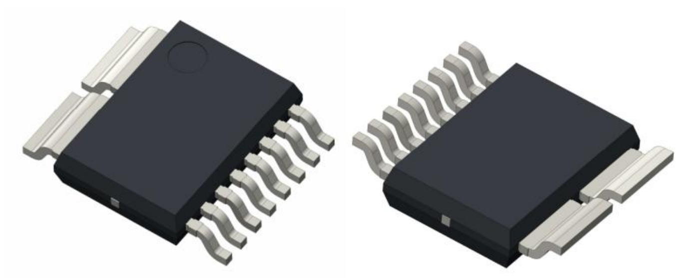
SINOMAGS 希磁科技

Current Sensor

Product Series: STK-616AM

Part number:
STK-616A-25MLB5
STK-616A-50MLB5
STK-616A-60MLB5
STK-616A-80MLB5
STK-616A-100MLB5

Version: Ver 1.5



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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 0.27mΩ.

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

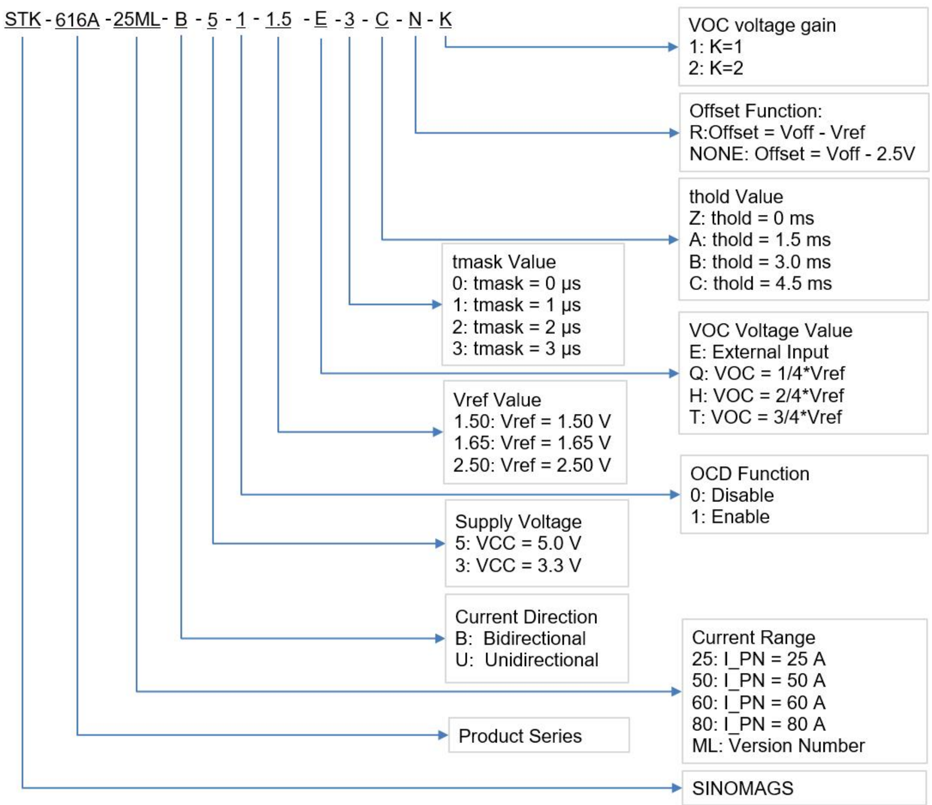
Parameter	Symbol	Unit	Value	Comment
RMS voltage for AC test 50 Hz, 1 min	Ud	kV	4	
Impulse withstand voltage 1.2/50μs	Ûw	kV	6	
Clearance distance (pri. -sec)	dCI	mm	8.5	Determined by customer's layout
Creepage distance (pri. -sec)	dCp	mm	8.5	

Measuring current table

Part number	Current Range	Sensitivity (mV/A)	T (℃)
STK-616A-25MLB5-1-1.5-E-1-C-N-2	±25 A	48	-40 ~ 105
STK-616A-25MLB5-1-1.5-E-2-C-N-2	±25 A	48	-40 ~ 105
STK-616A-25MLB5-1-1.5-E-3-C-N-2	±25 A	48	-40 ~ 105
STK-616A-50MLB5-1-1.5-E-2-C-N-2	±50 A	24	-40 ~ 105
STK-616A-60MLB5-1-1.5-E-3-C-N-2	±60 A	20	-40 ~ 105

STK-616A-80MLB5-1-1.5-E-3-C-N-2	±80 A	15	-40 ~ 105
STK-616A-100MLB5-1-1.5-E-3-C-N-2	±100 A	12	-40 ~ 105

2. Part number definition



3. Temperature vs Current

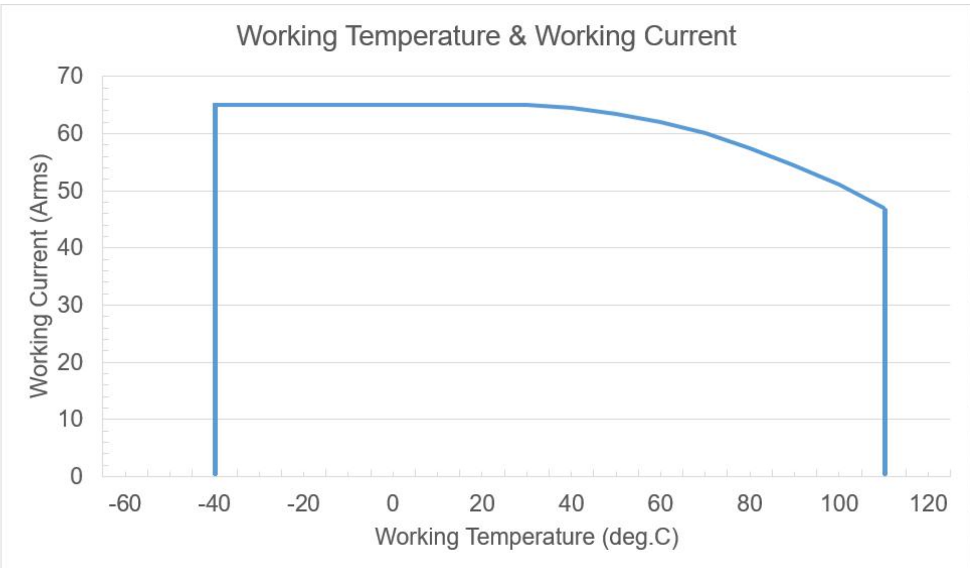


Figure 1 the recommended working current at different working surrounding temperature. Tested by using a standard demo test board, with 4 layers of copper conductors, where the thickness for each layer is 2 oz, the total thickness of demo board is 1.6 mm.

4. Electrical data STK-616A-XXMLB5

Condition：T_A = 25℃, Vcc = 5 V

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal current	I_pn	A	-25		25	STK-616A-25MLB5
			-50		50	STK-616A-50MLB5
			-60		60	STK-616A-60MLB5
			-80		80	STK-616A-80MLB5
			-100		100	STK-616A-100MLB5
Primary current measuring range	I_pm	A	-25		25	STK-616A-25MLB5
			-50		50	STK-616A-50MLB5
			-60		60	STK-616A-60MLB5
			-80		80	STK-616A-80MLB5
			-100		100	STK-616A-100MLB5
Supply voltage	Vcc	V		5		
Current consumption	Icc	mA		5	10	
Primary conductor resistance	R_IP	mΩ		0.27		
Reference voltage	Vref	V	1.45	1.50	1.55	Internal use
Quiescent voltage	Voff	V	1.45	1.50	1.55	Vout @ I_p = 0A
Internal output resistance	R_out	Ω		1		Vout
GAIN @ Voff = 1.5 Note 1)	G_th	mV/A		48		STK-616A-25MLB5
				24		STK-616A-50MLB5
				20		STK-616A-60MLB5
				15		STK-616A-80MLB5
				12		STK-616A-100MLB5
OCD range	VOC	V	0.3		2	K=1
			0.3		1.8	K=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-25MLB5
						STK-616A-50MLB5

						STK-616A-60MLB5
						STK-616A-80MLB5
						STK-616A-100MLB5
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 default time for OCD Fault Mask Time is 3us, while it can be set as 0, 1, 2, 3 us per demand.
3) 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. Electrical data STK-616A-XXMLB3

Condition：T_A = 25℃, Vcc = 3.3 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
			-100		100	STK-616A-100MLB3
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
			-100		100	STK-616A-100MLB3
Supply voltage	Vcc	V		3.3		
Current consumption	Icc	mA		5	10	
Primary conductor resistance	R_IP	mΩ		0.27		
Reference voltage	Vref	V	1.6	1.65	1.7	Internal use
Quiescent voltage	Voff	V	1.6	1.65	1.7	Vout @ I_p = 0A
Internal output resistance	R_out	Ω		1		Vout
GAIN, Note 4)	G_th	mV/A		52.8		STK-616A-25MLB3
				26.4		STK-616A-50MLB3
				33.3		STK-616A-60MLB3
				16.5		STK-616A-80MLB3
				13.2		STK-616A-100MLB3
OCD range	VOC	V	0.3		1.6	K=1
			0.3		1.6	K=2
FAULT error		%		5%		% of OCD
OCD Hysteresis	IHYS	%		10%		% of OCD
OCD Fault Mask	tmask	μs		2		Note 5)
OCD Fault Mask error	Tmask_error	ns		125		
OCD Fault Hold Time	thold	ms		4.5		Note 6)
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
						STK-616A-100MLB3
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

4) The gain of the sensor should be calibrated in software level if an accurate measuring is required.
5) The default time for OCD Fault Mask Time is 3us, while it can be set as 0, 1, 2, 3 us per demand.
6) 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.

6. Dimensions

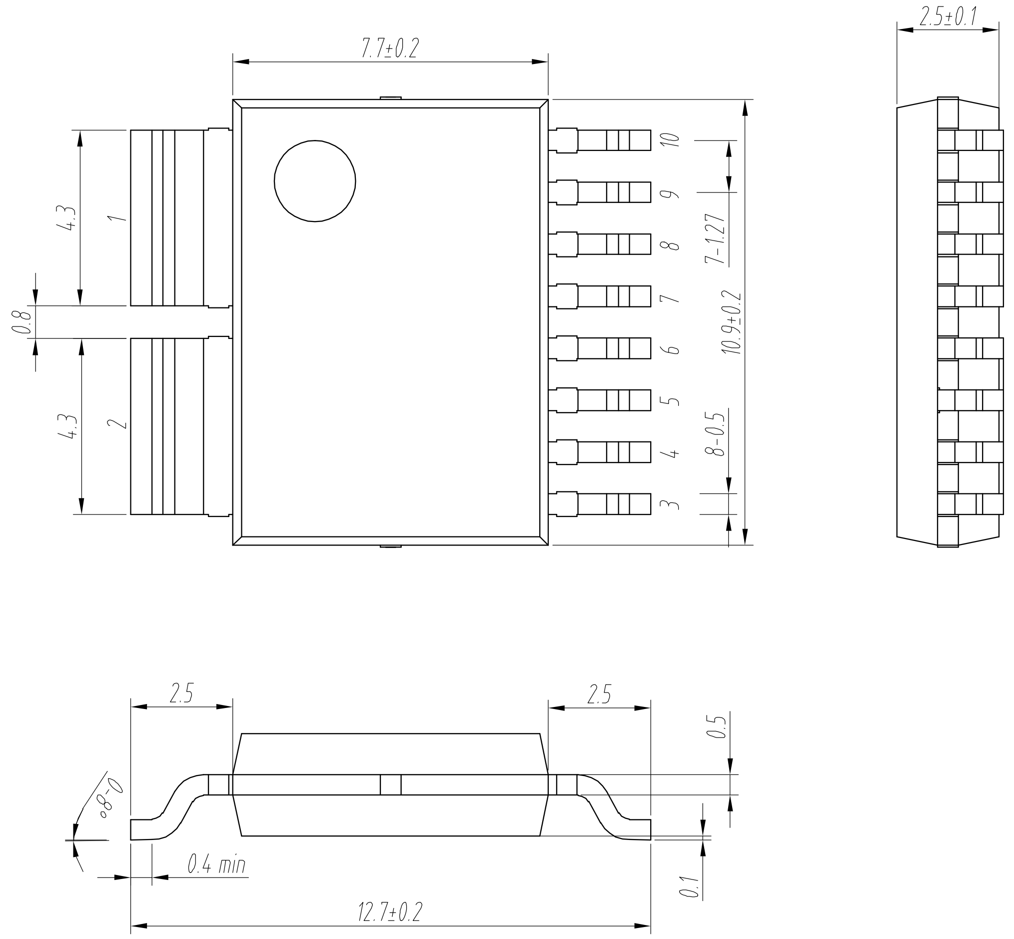


Figure 2 dimensions of STK-616AM series current sensors. The unit is mm.

7. 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

8. PCB layout recommendation

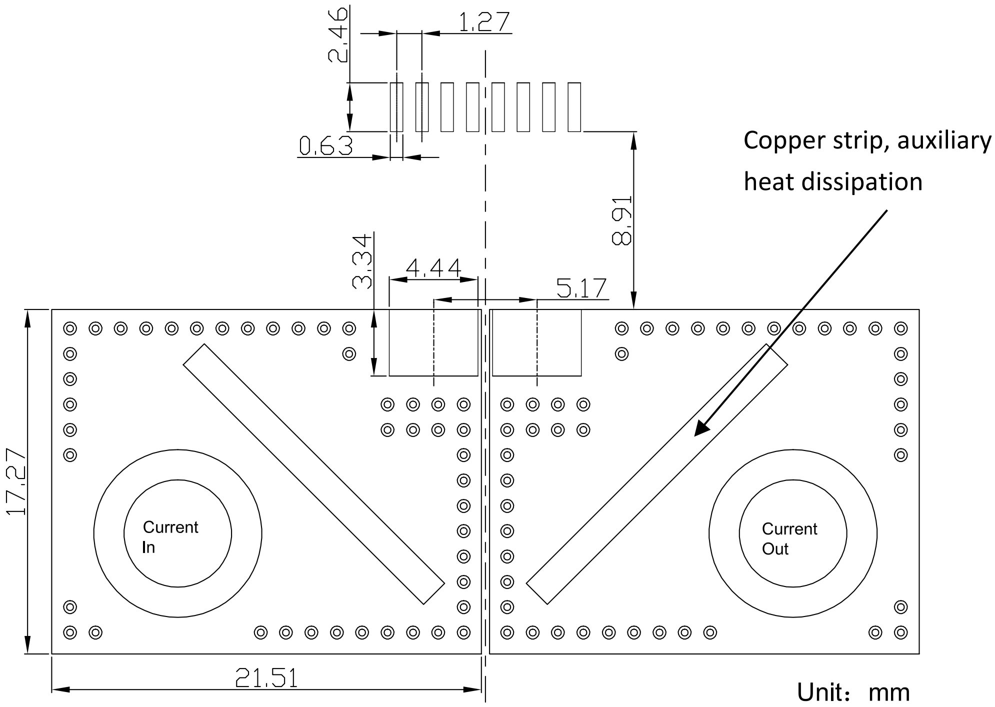


Figure 3 the recommended footprint of the SMT PCB layout for the STK-616AM series products. The unit is mm.

9. Frequency band width

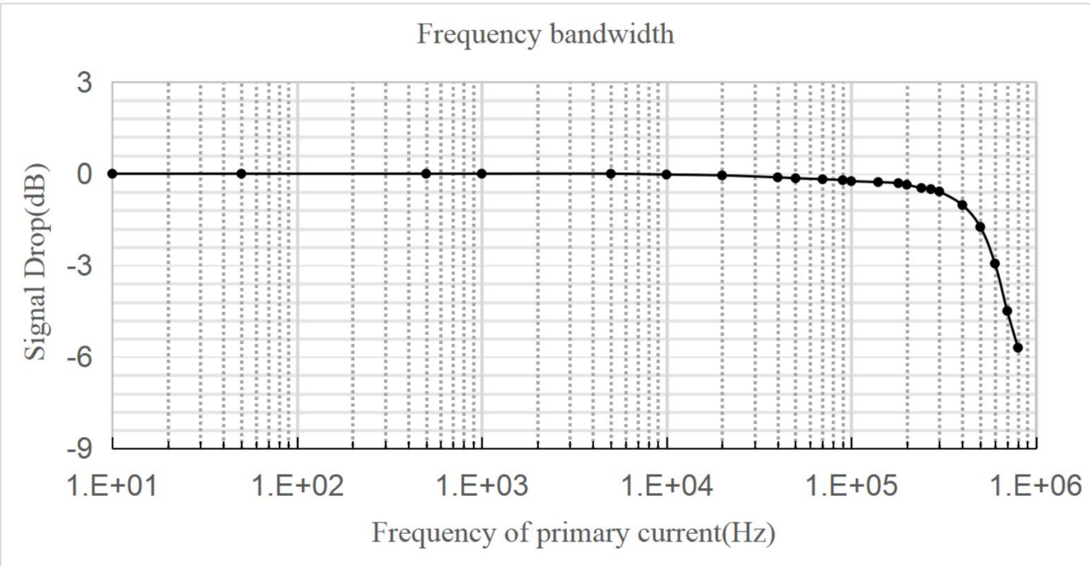


Figure 4 the frequency band width of the STK-616AM series products. the upper limit of the -3 dB band width is 600 kHz.

10. Step response time

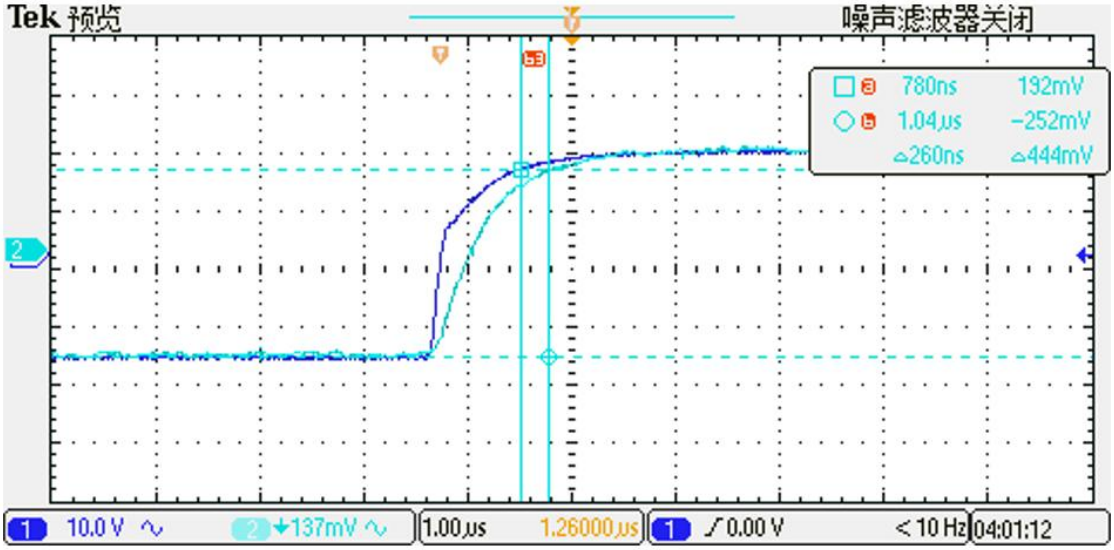


Figure 5 the typical frequency response of STK-616AM series current sensor. The response time from 90% of the primary current to 90% of the secondary output is 0.5 μs.

11. Block diagram

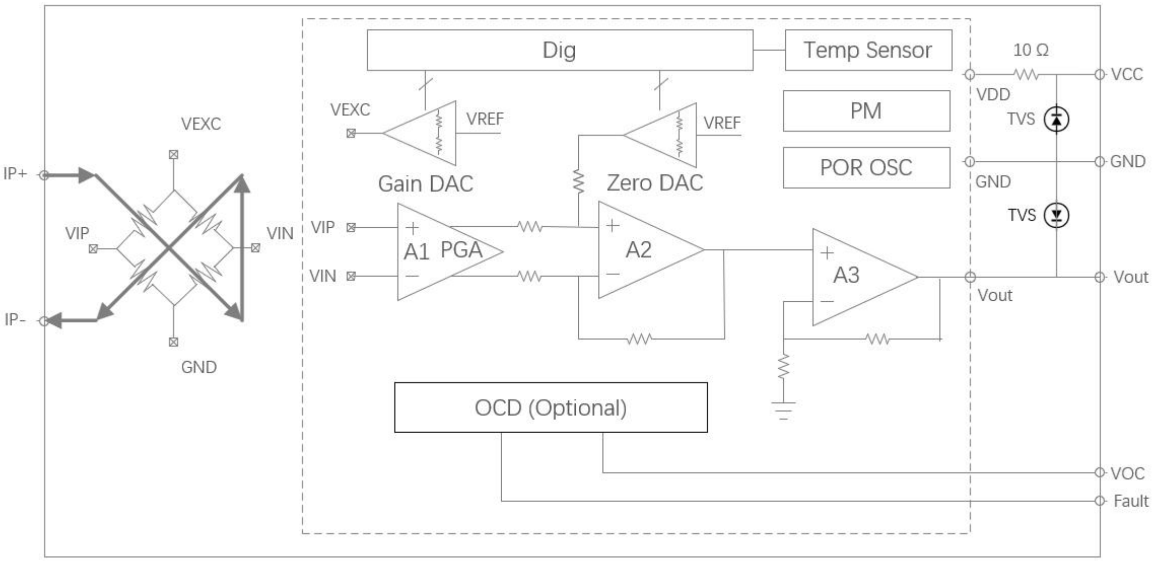


Figure 6 the functional block diagram for the STK-616AM series products.

12. Typical application circuit

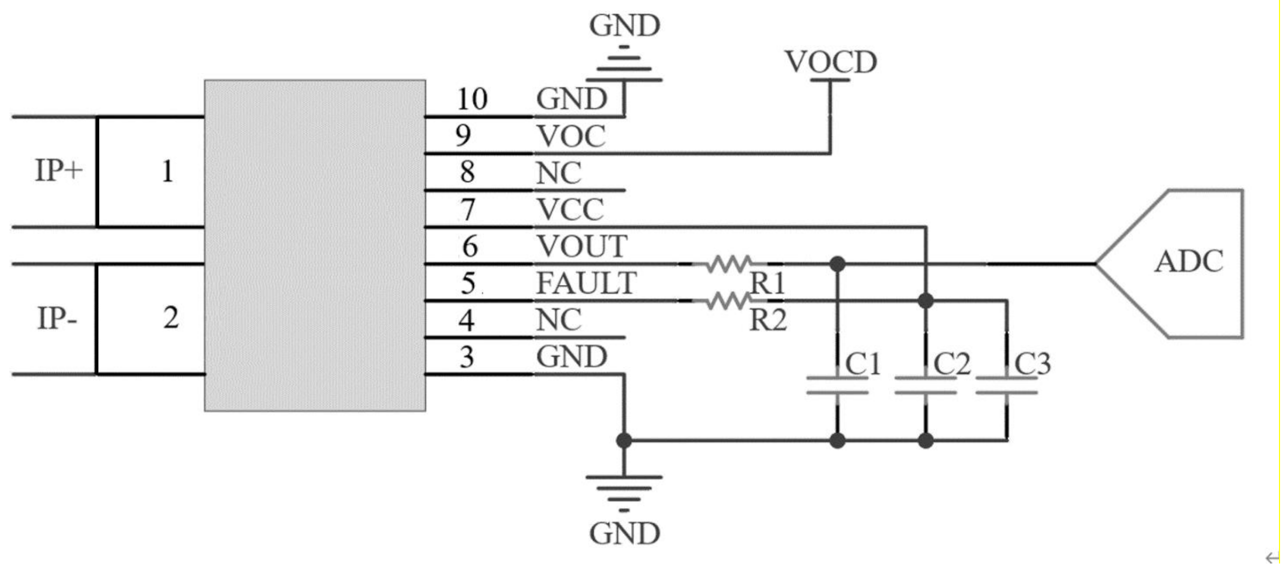


Figure 7 the reference application circuit for the STK-616AM series products.

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.

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

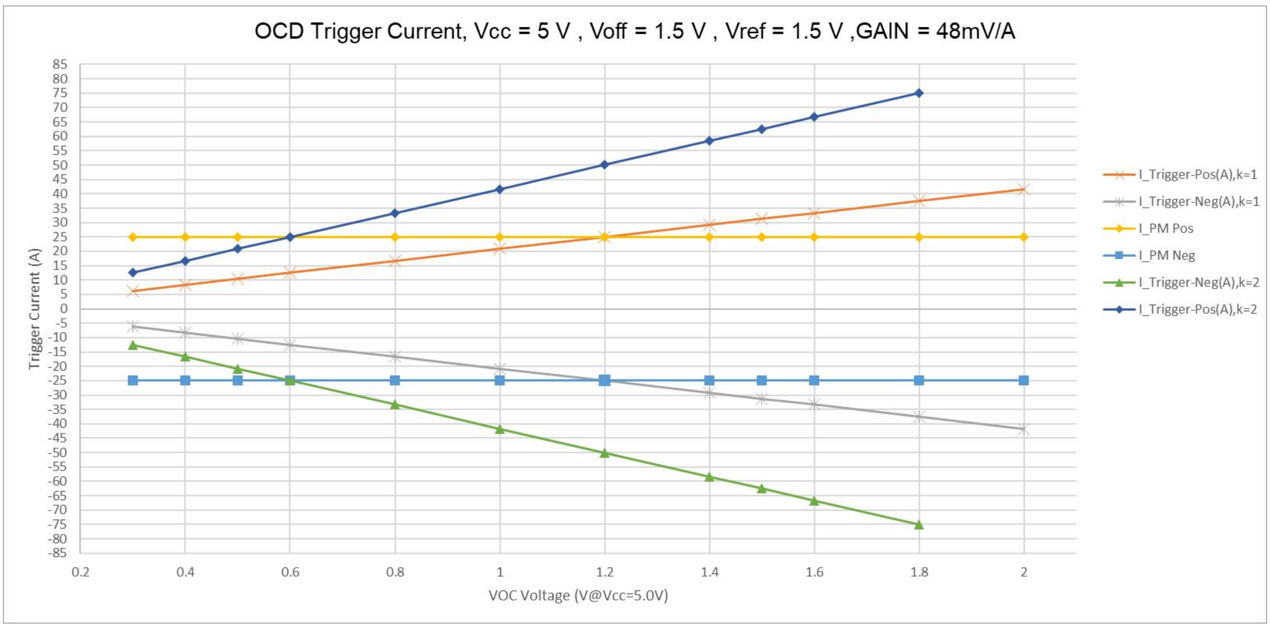


Figure 8 the relationship of trigger current and VOC setting for the STK-616A-25MLB5, with Vcc = 5 V. I_trigger_pos represents the forward over-current protection trigger current. I_trigger_neg represents the negative over-current protection trigger current. I_PN_pos represents the forward primary nominal current. I_PN_neg represents the negative primary nominal current. K is OCD coefficient, with typical values of 1, 2. I_PN is shown in the electrical data table.

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

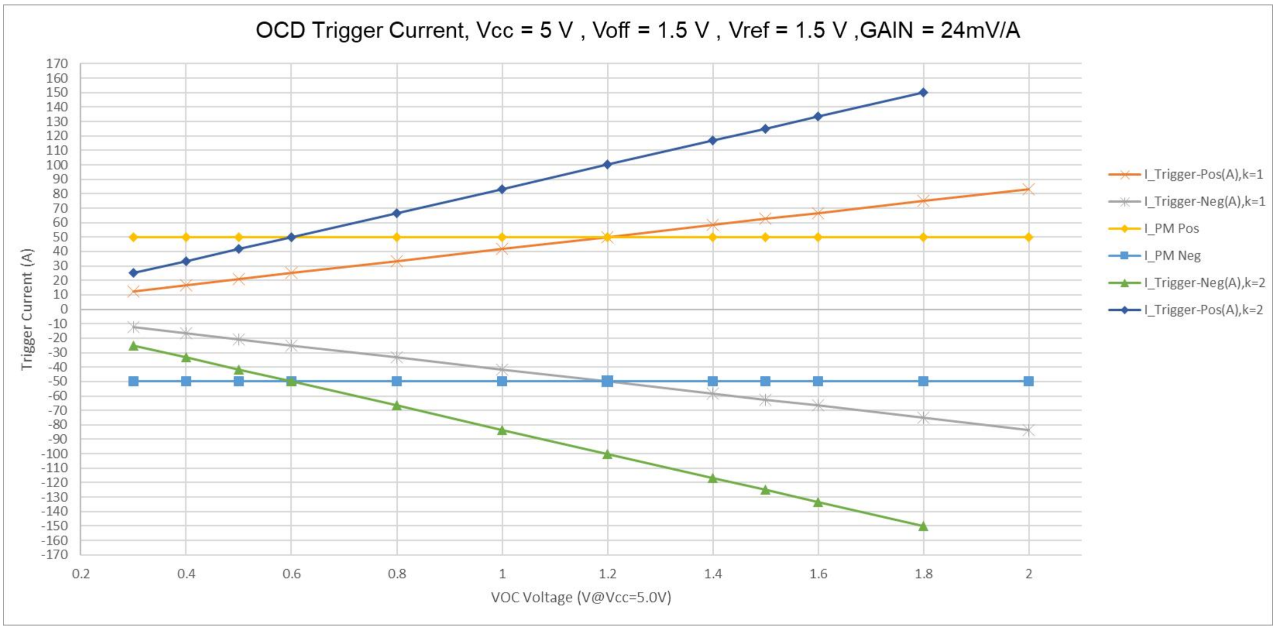


Figure 9 the relationship of trigger current and VOC setting for the STK-616A-50MLB5, with Vcc = 5 V. I_trigger_pos represents the forward over-current protection trigger current. I_trigger_neg represents the negative over-current protection trigger current. I_PN_pos represents the forward primary nominal current. I_PN_neg represents the negative primary nominal current. K is OCD coefficient, with typical values of 1, 2. I_PN is shown in the electrical data table.

15. OCD function for STK-616A-80A

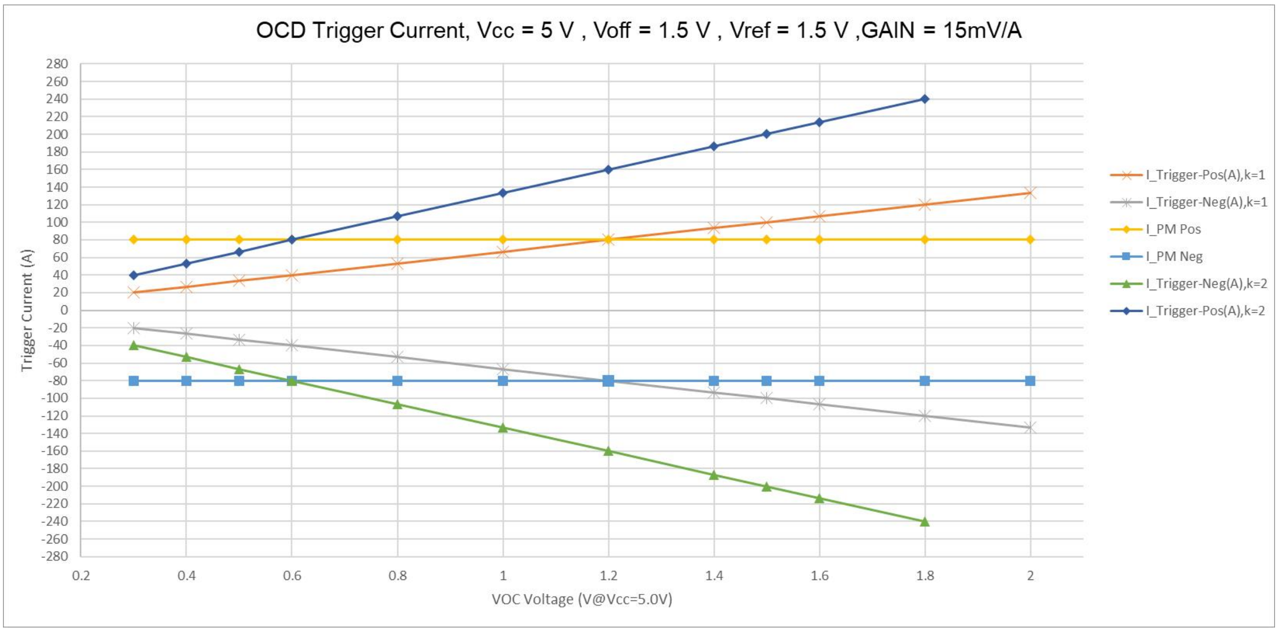


Figure 10 the relationship of trigger current and VOC setting for the STK-616A-80MLB5, with Vcc = 5 V. I_trigger_pos represents the forward over-current protection trigger current. I_trigger_neg represents the negative over-current protection trigger current. I_PN_pos represents the forward primary nominal current. I_PN_neg represents the negative primary nominal current. K is OCD coefficient, with typical values of 1, 2. I_PN is shown in the electrical data table.

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 and the trigger current are shown as fellows.

a) Vcc = 5 V, Vref = 1.5 V, Voff = 1.5 V, K = 1.
   a) 0.3 V ⩽ VOC ⩽ 2 V;
   b) V_trigger = Vref ± K * VOC / G3;
   c) I_trigger = (Vref ± K * VOC - Voff) / G_th;
b) Vcc = 5 V, Vref = 1.5 V, Voff = 1.5 V, K = 2
   a) 0.3 V ⩽ VOC ⩽ 1.8 V;
   b) V_trigger = Vref ± K * VOC / G3;
   c) I_trigger = (Vref ± K * VOC - Voff) / G_th;

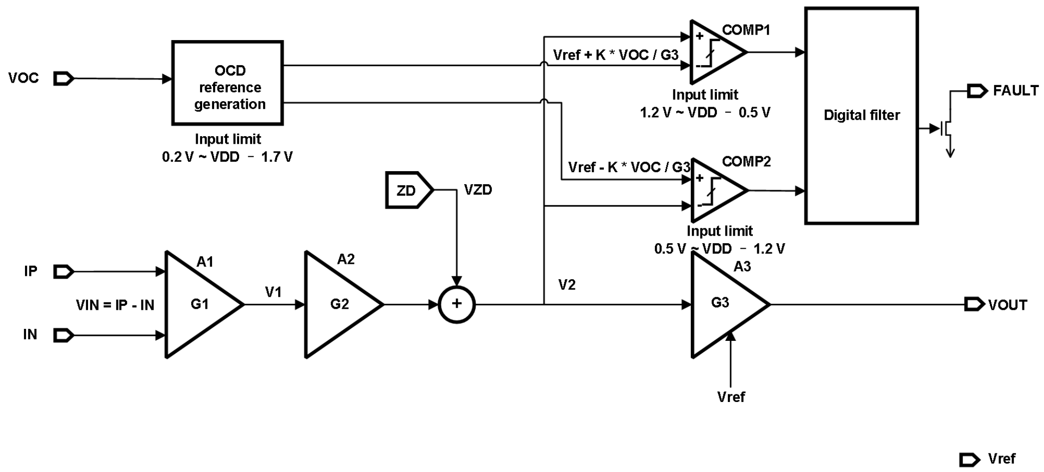


Figure 11 the functional block diagram for STK-616AM on OCD function with conditions of Vcc = 5 V, Voff = 1.5 V, Vref = 1.5V.