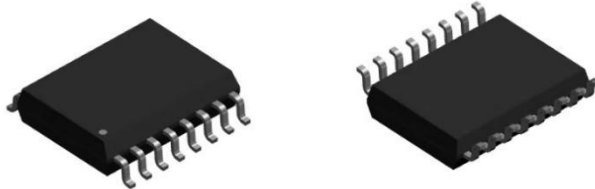# Current Sensor

Product Series: STK-616HM

Part number: STK-616H-10MLB5
STK-616H-15MLB5
STK-616H-20MLB5
STK-616H-30MLB5

Version: Ver1.5

Sinomags Technology Co., Ltd

Web site: www.sinomags.com

CONTENT

1. Description

The STK-616H 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.

Typical applications

- AC Variable speed drives
- Inverter
- Electric welder power supply
- Switched model power supplies (SMPS)

General parameter

Parameter	Symbol	Unit	Value
Working temperature	T_A	℃	-40 ~ 125
Storage temperature	Htg	℃	-40 ~ 125
Mass	m	g	0.5

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.
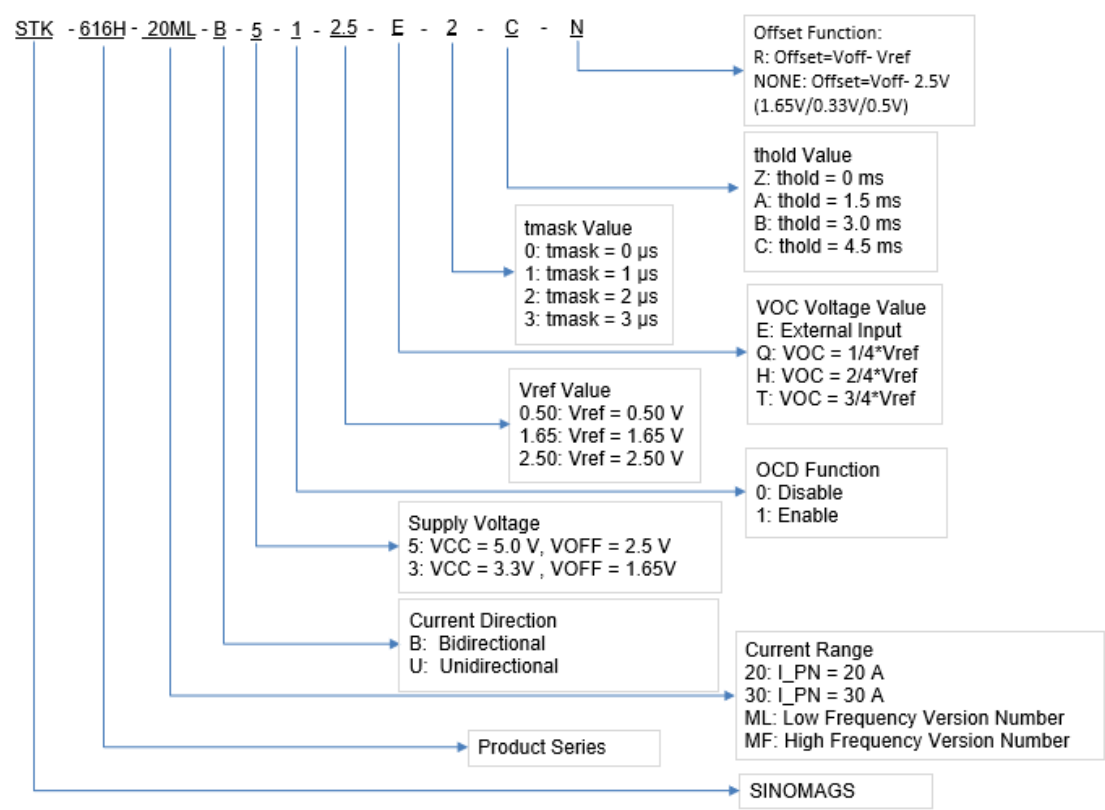
Isolation parameter

Parameter	Symbol	Unit	Value	Comment
RMS voltage for AC test 50Hz/1 min	Ud	kV	3.6	
Impulse withstand voltage 1.2/50μs	Ûw	kV	6	
Clearance distance (pri. -sec)	dCl	mm	8	Determined by customer's layout
Creepage distance (pri. -sec)	dCp	mm	8	

Measuring current table

Product	Optimized Range I_pn (A)	Sensitivity, (mV/A)	T(℃)
STK-616H-10MLB5-1-2.5-E-2-A-N	±10A	80	-40 ~ 125
STK-616H-15MLB5-1-2.5-E-2-A-N	±15A	53.33	-40 ~ 125
STK-616H-20MLB5-1-2.5-E-2-C-N	±20 A	40	-40 ~ 125
STK-616H-30MLB5-1-2.5-E-2-C-N	±30 A	26.67	-40 ~ 125

2. Part number definition

STK - 616H - 20ML - B - 5 - 1 - 2.5 - E - 2 - C - N

Offset Function:
R: Offset=Voff- Vref
NONE: Offset=Voff- 2.5V
(1.65V/0.33V/0.5V)

thold Value
Z: thold = 0 ms
A: thold = 1.5 ms
B: thold = 3.0 ms
C: thold = 4.5 ms

tmask Value
0: tmask = 0 µs
1: tmask = 1 µs
2: tmask = 2 µs
3: tmask = 3 µs

VOC Voltage Value
E: External Input
Q: VOC = 1/4*Vref
H: VOC = 2/4*Vref
T: VOC = 3/4*Vref

Vref Value
0.50: Vref = 0.50 V
1.65: Vref = 1.65 V
2.50: Vref = 2.50 V

OCD Function
0: Disable
1: Enable

Supply Voltage
5: VCC = 5.0 V, VOFF = 2.5 V
3: VCC = 3.3V , VOFF = 1.65V

Current Direction
B: Bidirectional
U: Unidirectional

Current Range
20: I_PN = 20 A
30: I_PN = 30 A
ML: Low Frequency Version Number
MF: High Frequency Version Number

Product Series

SINOMAGS
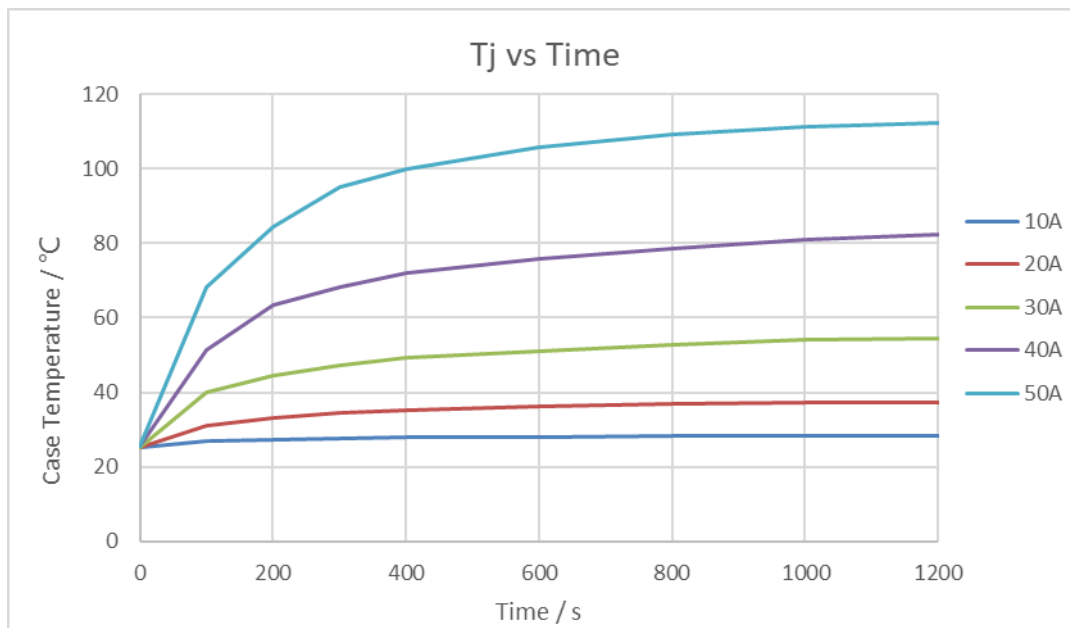
3. Temperature vs Current

Figure 1. Relationship between STK-616HM Case temperature and amount of input current

Remark 1：Figure 1 shows the results of current & temperature measurement. 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. This result is a reference data. Tc is changed much by the board layout and the heat dissipation. Please confirm it in your evaluation environment.
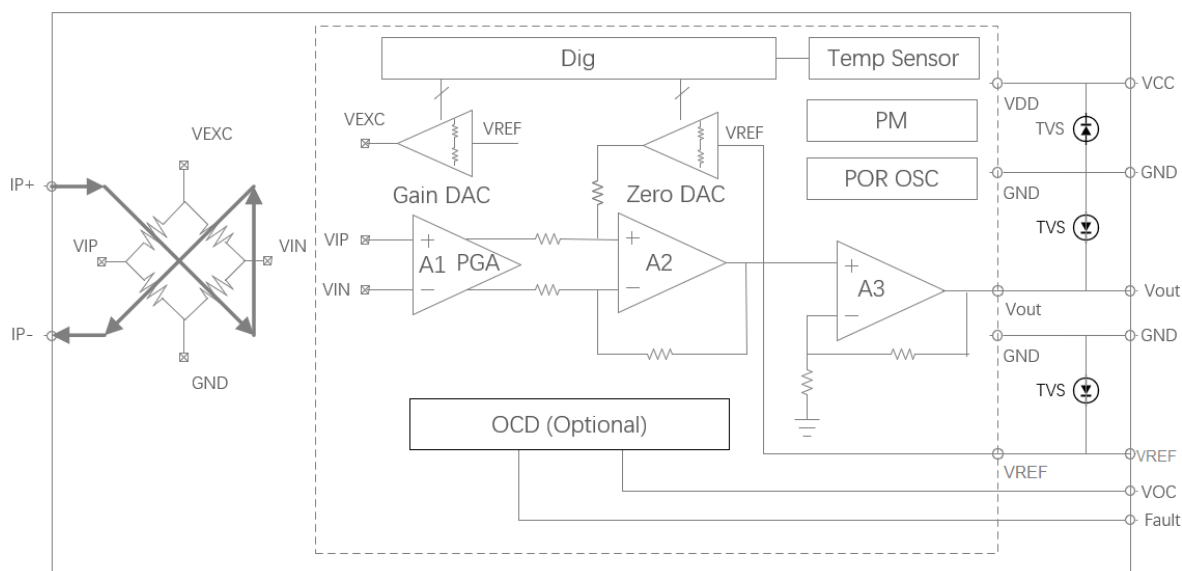
4. Functional Block Diagram

Figure 2 the functional block diagram for the STK-616TM series products.

Remark 2: A1, A2 and A3 represent the operational amplifiers of the current sensor.

5. Electrical data STK-616H-xxMLB5

Condition：T_A = 25℃, Vcc = 5 V

Parameter	Symbol	Unit	Min	Typ	Max	Comment
General parameters						
Primary nominal current	I_pn	A	-10		10	STK-616H-10MLB5
			-15		15	STK-616H-15MLB5
			-20		20	STK-616H-20MLB5
			-30		30	STK-616H-30MLB5
Primary current, measuring range	I_pm	A	-25		25	STK-616H-10MLB5
			-37.5		37.5	STK-616H-15MLB5
			-50		50	STK-616H-20MLB5
			-75		75	STK-616H-30MLB5
Supply voltage	Vcc	V	4.5	5	5.5	
Current consumption	Icc	mA		7	12	
Primary conductor resistance	R_IP	mΩ		0.85		
Quiescent voltage@0A	Voff	V	2.45	2.5	2.55	
Reference voltage	Vref	V	2.45	2.5	2.55	
Electrical offset voltage	Offset	mV		±10		Voff - Vref
Output Specifications	R_out	Ω	1		30	
	R_ref		1		80	
Theoretical gain	G_th	mV/A		80		STK-616H-10MLB5
				53.33		STK-616H-15MLB5
				40		STK-616H-20MLB5
				26.67		STK-616H-30MLB5
OCD function (if applicable)						
OCD range	VOC	V	0.3		3.3	
FAULT error		%		5%		% of OCD
OCD Hysteresis	IHYS	%		10%		% of OCD
OCD Fault Mask	tmask	μs		2		0, 1, 2, 3 μs
OCD Fault Mask error	Tmask_error	ns		125		
OCD Fault Hold Time	thold	ms		4.5		0, 1.5, 3, 4.5 ms
Accuracy performance						
Rated linearity error@25℃	Non-L	%I_pn		±1.5		±I_pn
Step response time	t_res	μs		0.9		@90% of I_pn
Frequency bandwidth	BW	kHz		600		@-3dB
Output voltage noise	Vnoise	mVpp		10		
Accuracy @ 25℃	X	% I_pn		±1.5		@ 0.5*I_pn
Thermal drift of G_th	GAIN_T	% G_th		±1.5		@ -40~125℃
Thermal drift of Voff	Voff_T	mV		±15		drift related to the

Total Accuracy	X_TRange	% I_pn		±3.5		value @25℃

6. Dimension of STK-616HM
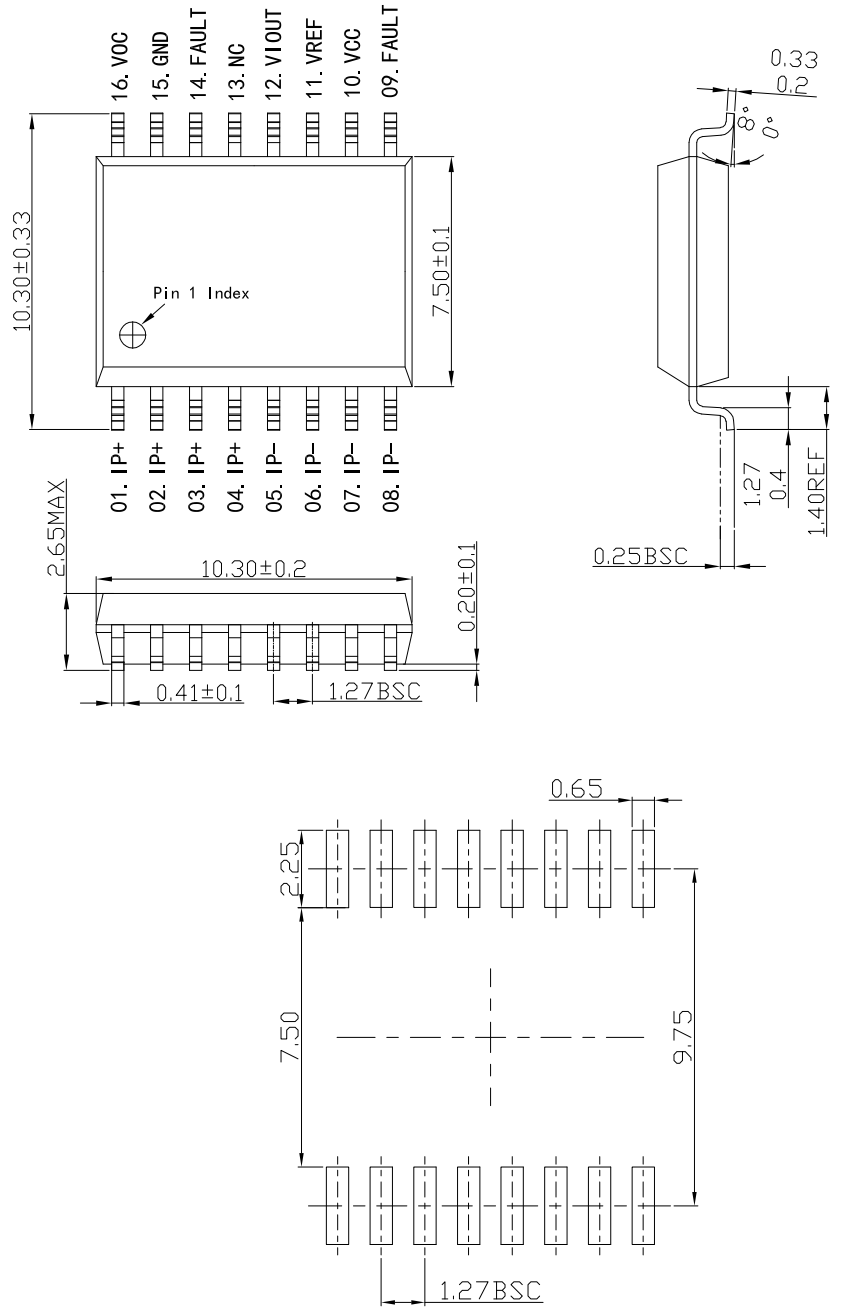

Figure 3 dimensions of STK-616HM series current sensors. The unit is mm.

7. Pin definition for product

PIN	Symbol	Description
1,2,3,4	IP+	Primary conductor pin (+)
5,6,7,8	IP-	Primary conductor pin (-)
9	Fault	Over current detection alarm output, the pin is open leakage output. Normally, the output of fault pin is high level.
10	VCC	Power supply pin
11	Vref	Reference pin, output function
12	VOUT	Sensor output pin
13	NC	NC
14	Fault	Over current detection alarm output, the pin is open leakage output. Normally, the output of fault pin is high level.
15	GND	Ground terminal
16	VOC	Over current detection threshold input pin

8. PCB layout recommendation
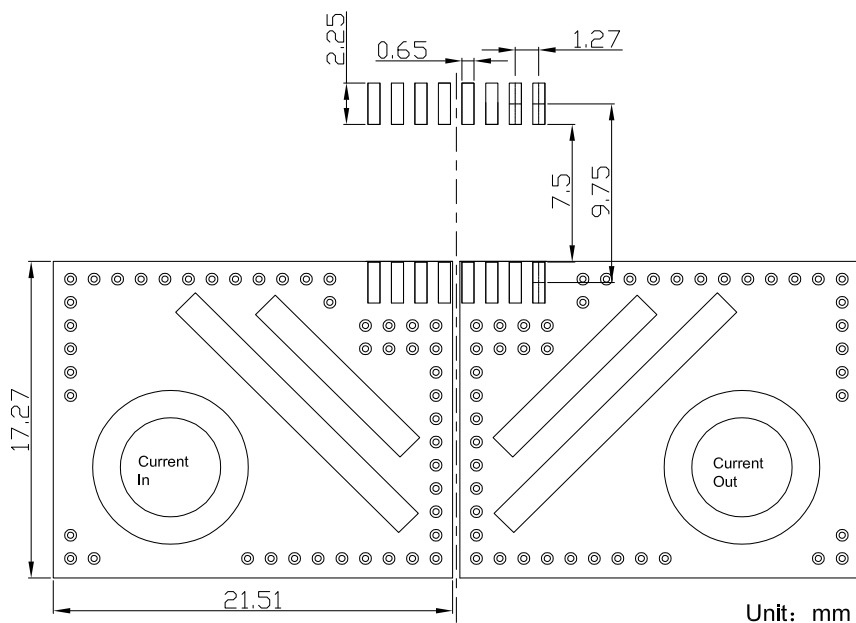
Figure 4 the recommended footprint of the SMT PCB layout for the STK-616HM series products. The unit is mm.
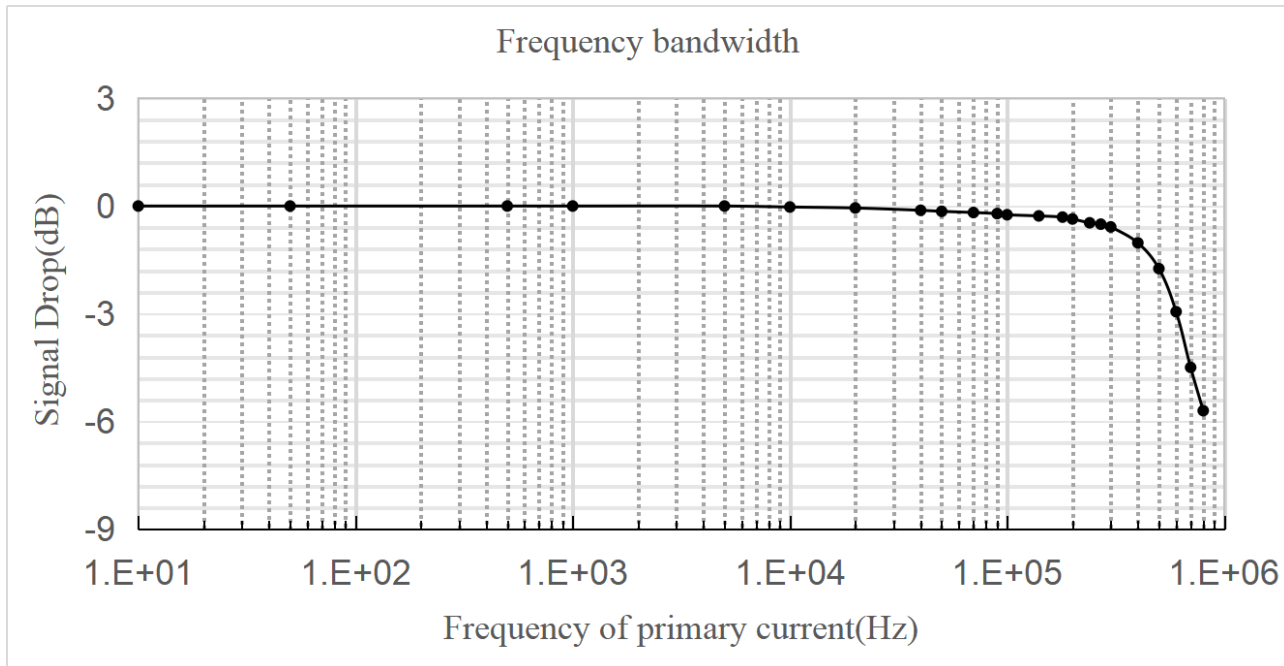
9. Frequency bandwidth

Figure 5 the frequency band width of the STK-616HM series products. the upper limit of the -3 dB band width is 0.6 MHz.
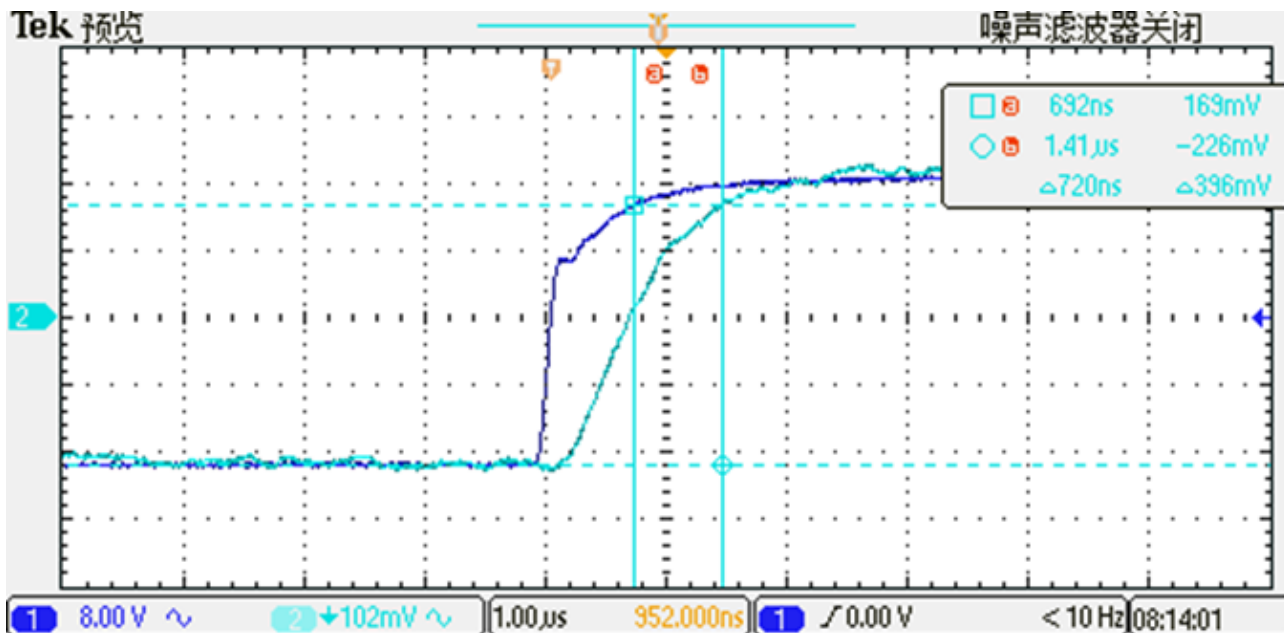
10. Step response time

Figure 6 the typical high frequency response of STK-616HM current sensor. The response time from 90% of the primary current to 90% of the secondary output is 0.9μs.
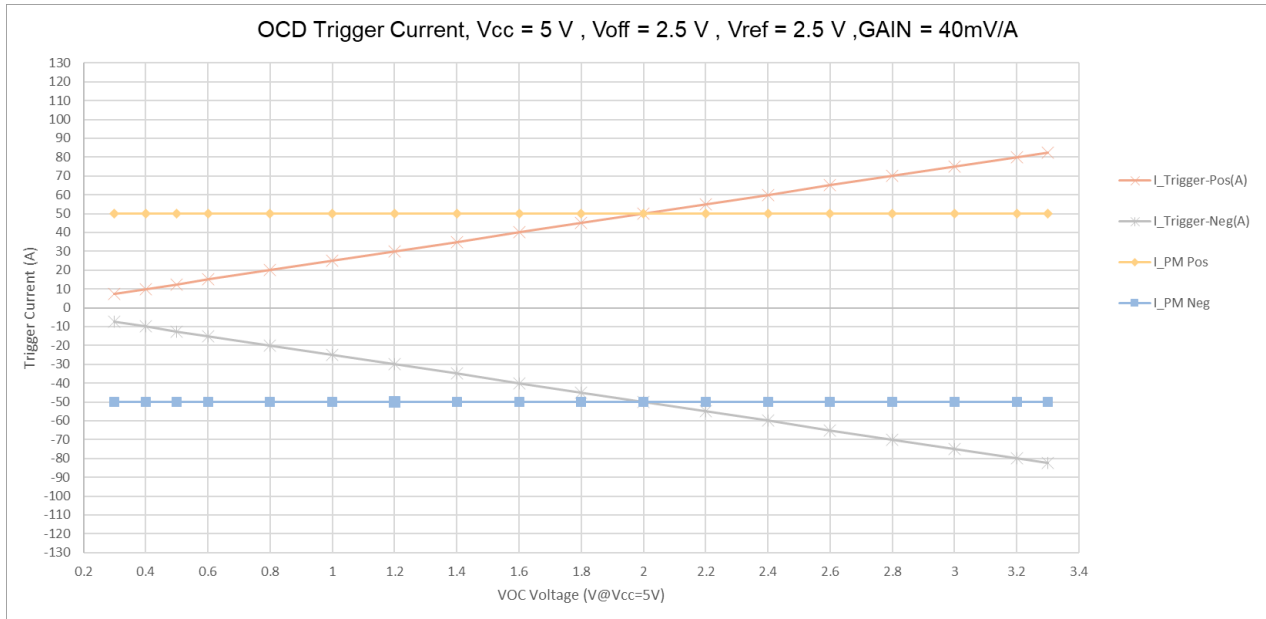
11. Examples of OCD function

OCD Trigger Current, Vcc = 5 V , Voff = 2.5 V , Vref = 2.5 V ,GAIN = 40mV/A

Figure 7 the relationship of trigger current and VOC setting for the STK-616H-20MLB5, 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. I_PN is shown in the electrical data table.

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
   ①. 0.3 V ≦ VOC ≦ Vcc – 1.7 V;
   ②. Trigger voltage = Vref +/- VOC;
   ③. Trigger current = (Vref +/- VOC -Voff) / G_th;

b) Vref = 1.65 V
   ①. 0.3 V ≦ VOC ≦ Vcc – 1.7 V;
   ②. Trigger voltage = Vref +/- VOC;
   ③. Trigger current = (Vref +/- VOC -Voff) / G_th

c) Vref = 0.5 V
   ①. 0.3 V ≦ VOC ≦ 0.5 V;
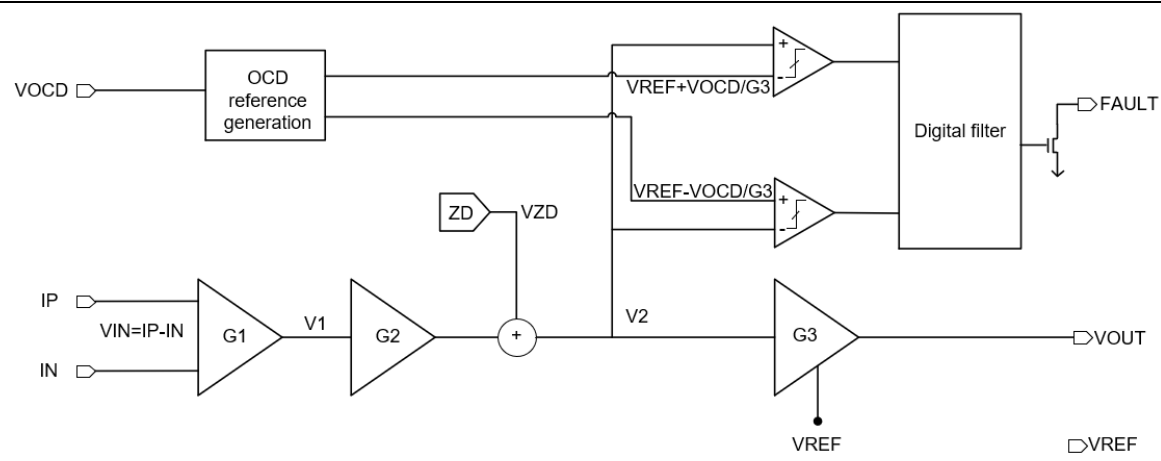   ②. Trigger voltage = Vref + 8*VOC;
   ③. Trigger current = (Vref + VOC -Voff) / G_th

Figure 8 the functional block diagram for STK-616HM on OCD function with conditions of Vcc = 5 V, Voff = 2.5 V, Vref = 2.5V.
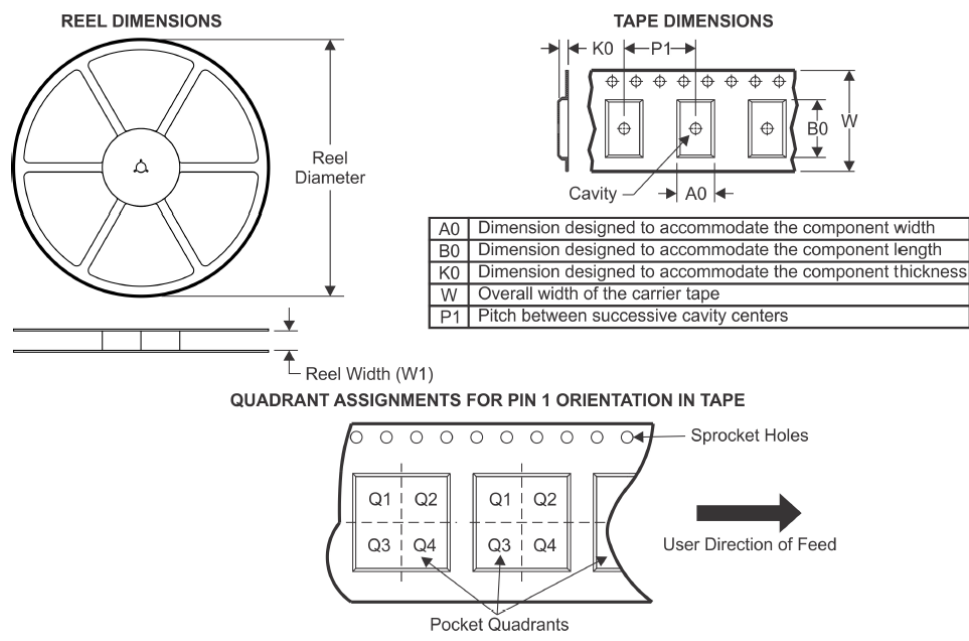
13. PACKAGE MATERIALS INFORMATION

Figure 9 package materials information.