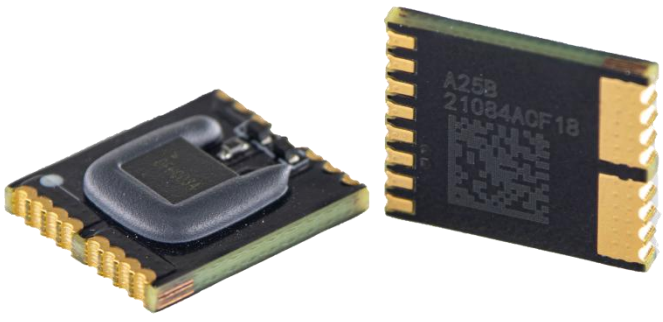
# Current Sensor

Product Series: STK-616A

Part number:
STK-616A-6AB
STK-616A-12AB
STK-616A-25AB
STK-616A-50AB
STK-616A-60AC
STK-616A-80AB

Version: Ver 1.6




Sinomags Technology Co., Ltd

Web site: www.sinomags.com

# CONTENT

# 1. Description

The STK-616A 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-616A series current sensor has build-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 |
| 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

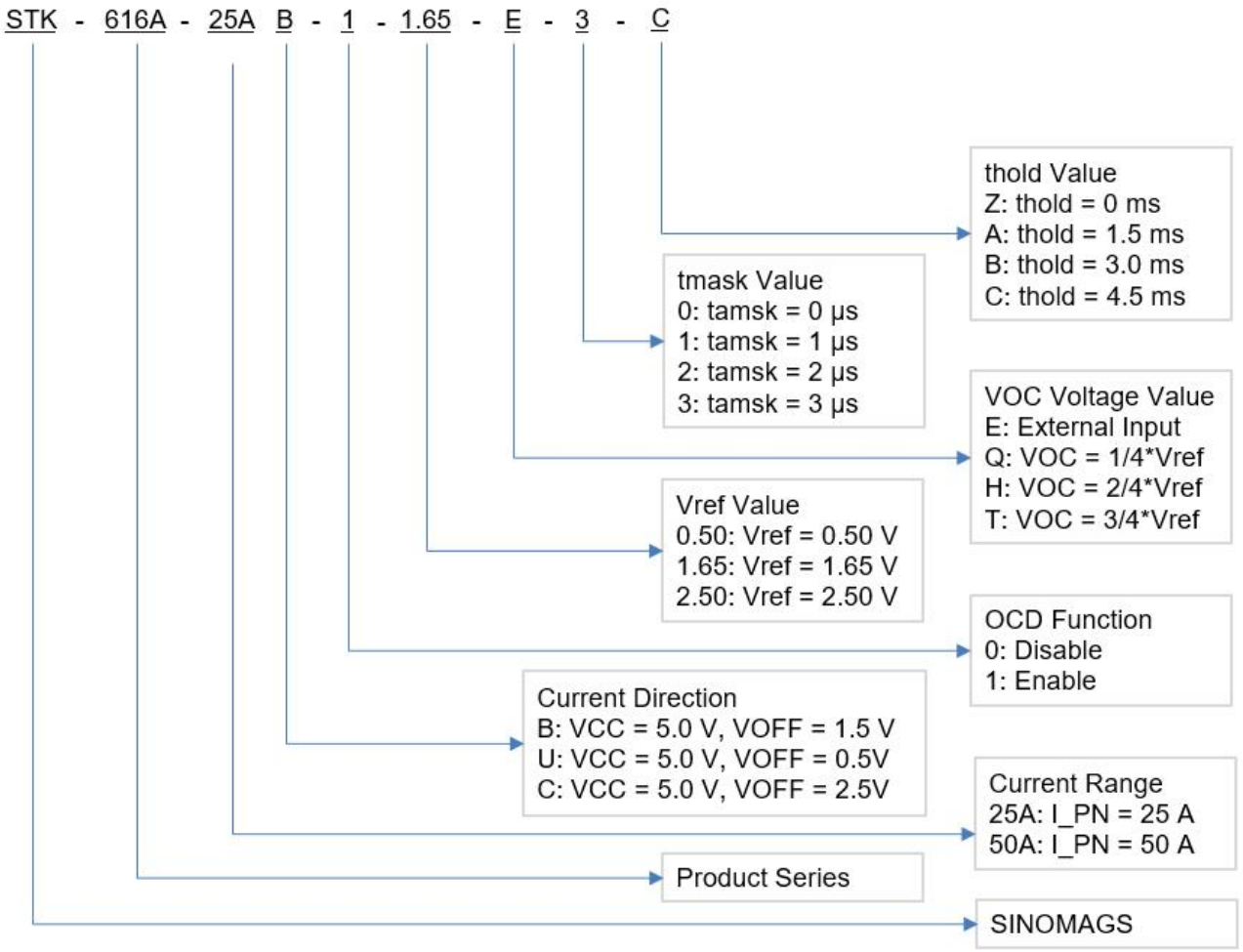
| Parameter | Symbol | Unit | Value | Comment |
|---|---|---|---|---|
| RMS voltage for AC test 50 Hz, 1 min | Ud | kV | 4 | |
| Impulse withstand voltage 1.2/50μs | Ûw | kV | 8 | |
| Clearance distance (pri. -sec) | dCl | mm | 6 | |
| Creepage distance (pri. -sec) | dCp | mm | 6 | |

## Measuring current table

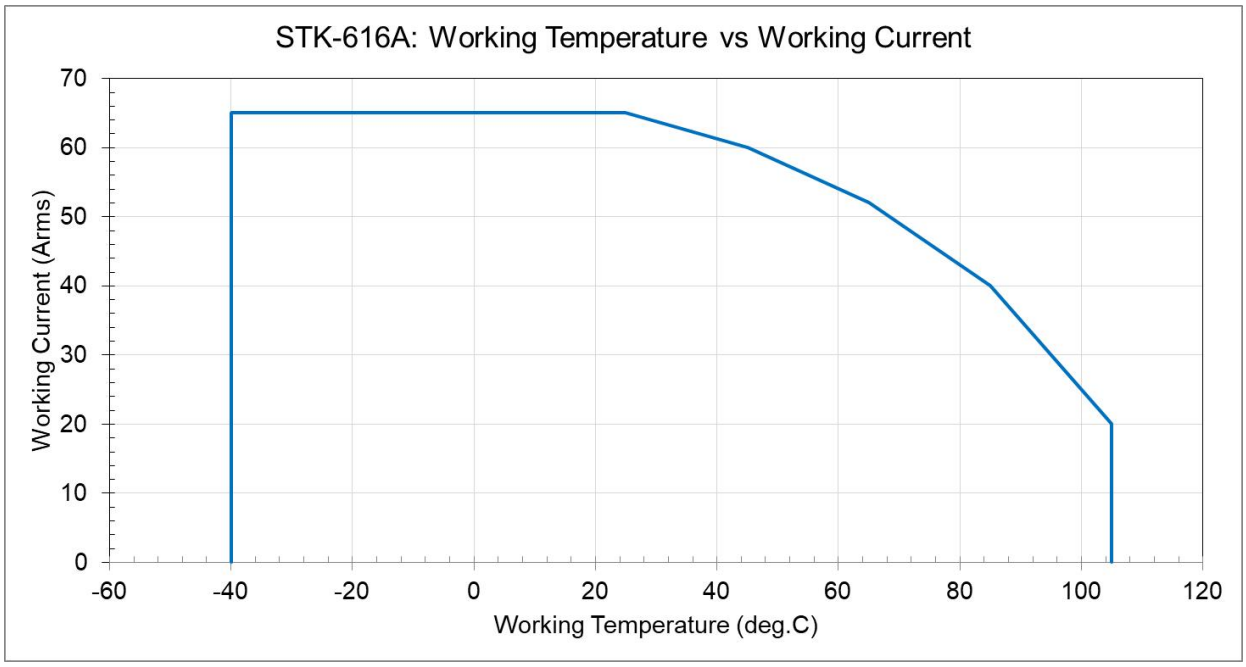
| Part number | Current Range | Sensitivity (mV/A) | T (℃) |
|---|---|---|---|
| STK-616A-25AB-1-1.65-E-2-C | ±25 A | 48 | -40 ~ 105 |
| STK-616A-50AB-1-1.65-E-2-C | ±50 A | 24 | -40 ~ 105 |
| STK-616A-60AB-1-1.65-E-3-C | ±60 A | 12 | -40 ~ 105 |
| STK-616A-80AB-1-1.65-E-3-C | ±80 A | 15 | -40 ~ 105 |
| STK-616A-25AB-1-1.65-E-1-C | ±25 A | 48 | -40 ~ 105 |
| STK-616A-25AB-1-1.65-E-3-C | ±25 A | 48 | -40 ~ 105 |
| STK-616A-12AB-1-1.65-E-1-C | ±12 A | 100 | -40 ~ 105 |

| | | | |
|---|---|---|---|
| STK-616A-12AB-1-1.65-E-2-C | ±12 A | 100 | -40 ~ 105 |
| STK-616A-12AB-1-1.65-E-3-C | ±12 A | 100 | -40 ~ 105 |
| STK-616A-6AB-1-1.65-E-1-C | ±6 A | 200 | -40 ~ 105 |
| STK-616A-6AB-1-1.65-E-2-C | ±6 A | 200 | -40 ~ 105 |
| STK-616A-6AB-1-1.65-E-3-C | ±6 A | 200 | -40 ~ 105 |

## 2. Part number definition




## 3. Temperature vs Current



# 4. Electrical data

Condition：T_A = 25℃, Vcc = 5 V

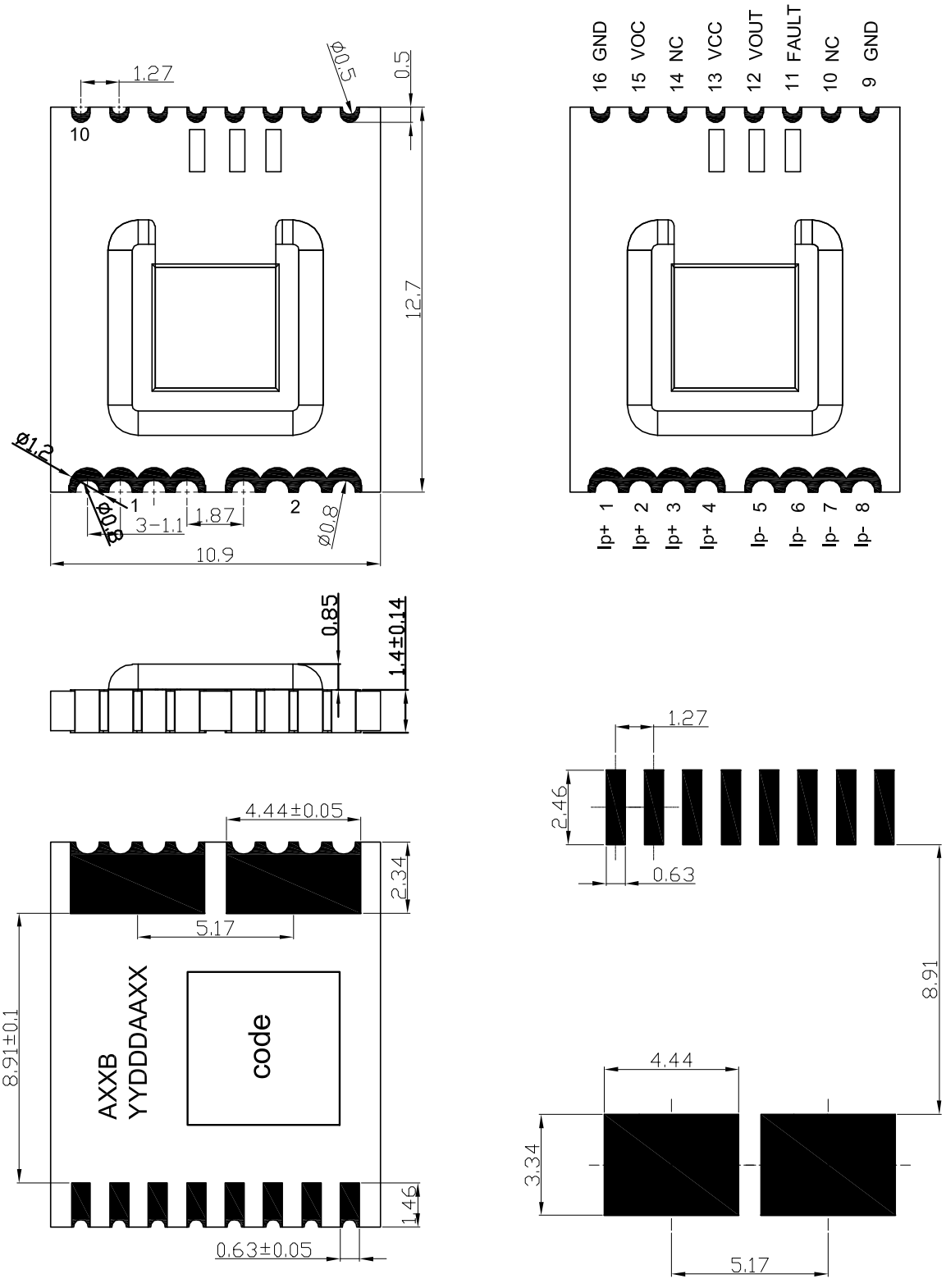
| Parameter | Symbol | Unit | Min | Typ | Max | Comment |
|---|---|---|---|---|---|---|
| Primary nominal current | I_pn | A | -25 | | 25 | STK-616A-25AB |
| | | | -50 | | 50 | STK-616A-50AB |
| | | | -60 | | 60 | STK-616A-60AB |
| | | | -80 | | 80 | STK-616A-80AB |
| | | | -12 | | 12 | STK-616A-12AB |
| | | | -6 | | 6 | STK-616A-6AB |
| Primary current measuring range | I_pm | A | -27 | | 27 | STK-616A-25AB |
| | | | -54 | | 54 | STK-616A-50AB |
| | | | -110 | | 110 | STK-616A-60AB |
| | | | -86 | | 86 | STK-616A-80AB |
| | | | -14 | | 14 | STK-616A-12AB |
| | | | -7 | | 7 | STK-616A-6AB |
| Supply voltage | Vcc | V | | 5 | | |
| Current consumption | Icc | mA | | 5 | 10 | |
| Primary conductor resistance | R_IP | mΩ | | 0.3 | | |
| Reference voltage | Vref | V | 1.6 | 1.65 | 1.7 | Internal use |
| | | | 2.45 | 2.5 | 2.55 | |
| Quiescent voltage | Voff | V | 1.45 | 1.5 | 1.55 | Vout @ I_p = 0 A |
| | | | 2.48 | 2.5 | 2.52 | |
| Internal output resistance | R_out | Ω | | 1 | | Vout |
| GAIN, Note 1) | G_th | mV/A | | 48 | | STK-616A-25AB |
| | | | | 24 | | STK-616A-50AB |
| | | | | 12 | | STK-616A-60AB |
| | | | | 15 | | STK-616A-80AB |
| | | | | 100 | | STK-616A-12AB |
| | | | | 200 | | STK-616A-6AB |
| OCD range | VOC | V | 0 | | 3.3 | Note 2) |
| FOULT 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 | | 1.5 | | @90% of I_pn |
| Frequency bandwidth (-3dB) | BW | kHz | | 150 | | No RC circuit |

| | | | | | | |
|---|---|---|---|---|---|---|
| Noise | I_noise | mA rms | | 200 | | DC ~ 100 kHz |
| Non-linearity @ 25℃ | ξ | % of I_pn | | ±1.5 | | STK-616A-25AB<br>STK-616A-50AB<br>STK-616A-60AB<br>STK-616A-80AB<br>STK-616A-12AB<br>STK-616A-6AB |
| Accuracy @ 25℃ | X | % of I_pn | | ±1 | | @ 25℃ |
| Thermal draft of G_th @ -40℃~85℃ | GAIN_T | % of G_th | -1.0 | | 1.0 | Draft value related to the value @ 25℃ |
| Thermal draft of Voff @ -40℃~85℃ | Voff_T | mV | -10 | | 10 | |
| Total Accuracy @ -40℃~85℃ | X_T | % of I_pn | -1.5 | | 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 2 us, while it can be set as 0, 1, 2, 3 us per demand.
4) The default time for OCD Fault Hold Time is 4.5 ms, while it can be set as 0, 1.5, 3, 4.5 ms per demand.

# 5. Dimensions

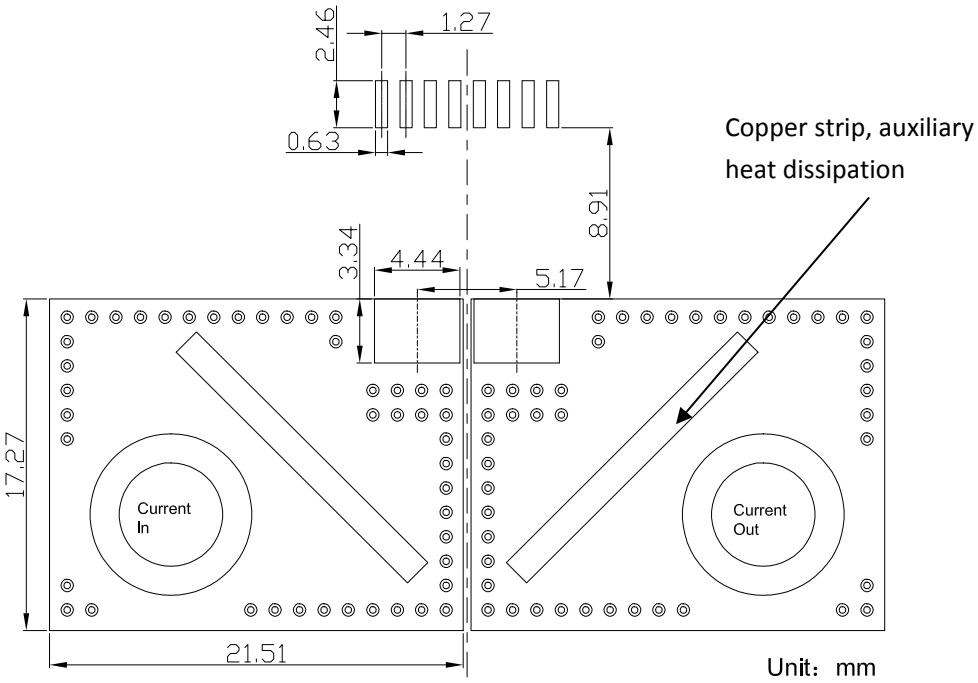



PCB Layout Reference View

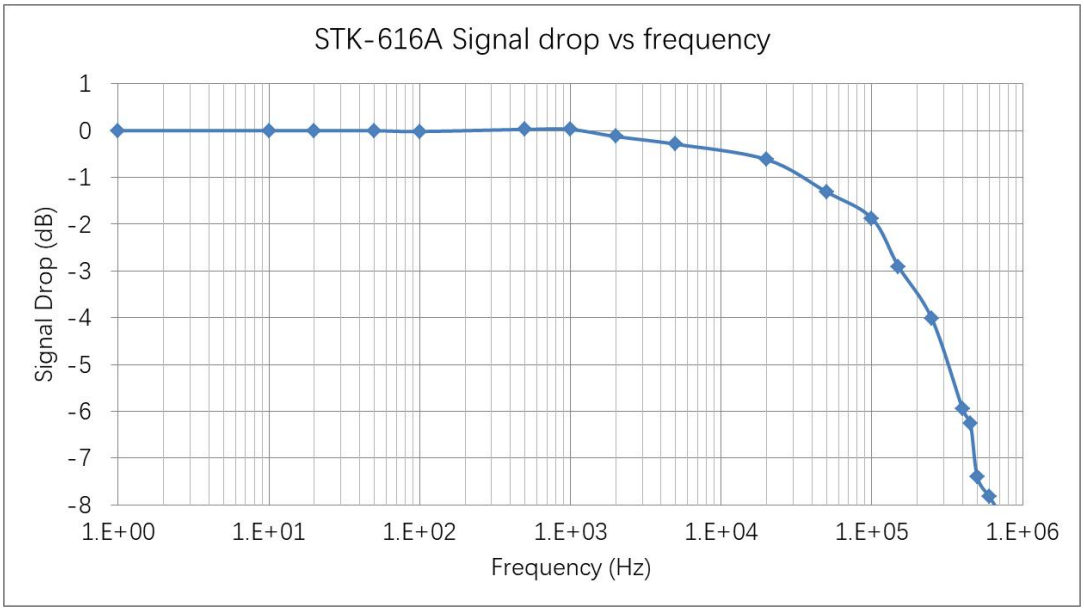
## 6. Pin definitions

| 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 |

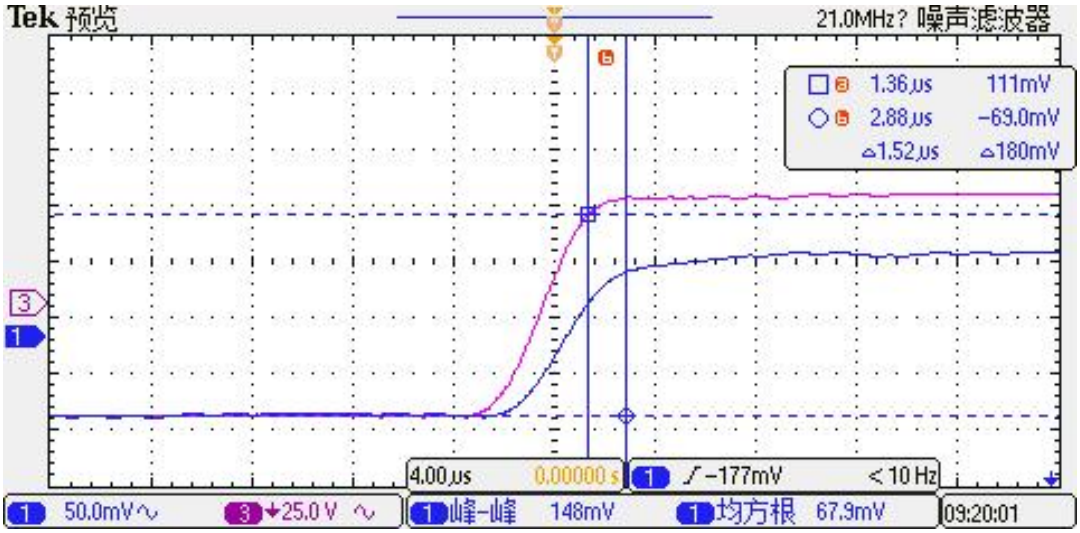
## 7. PCB layout recommendation



## 8. Frequency band width

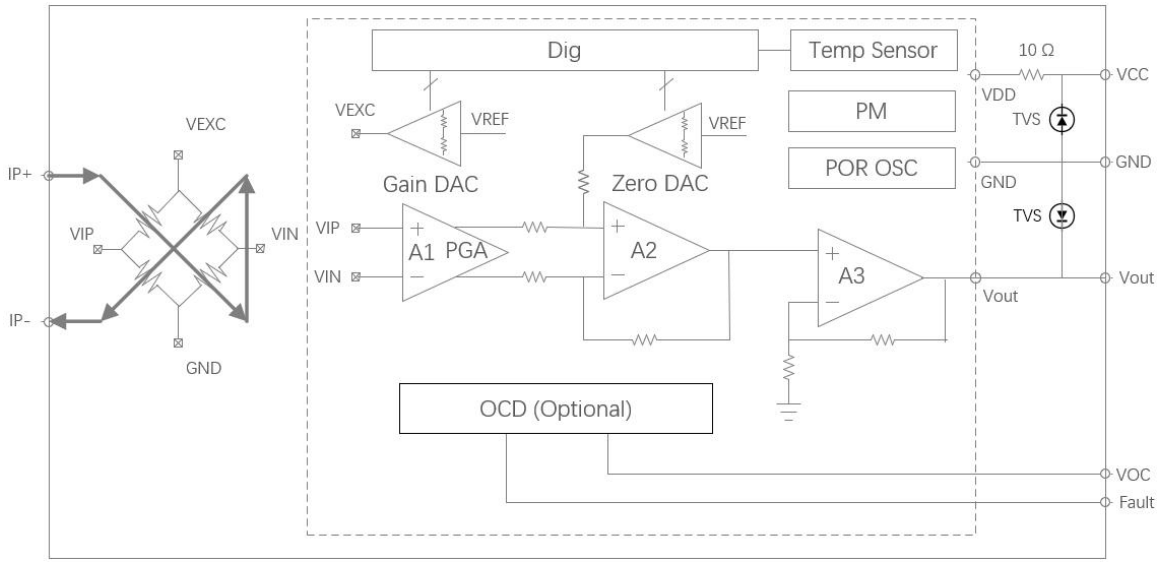



## 9. Step response time

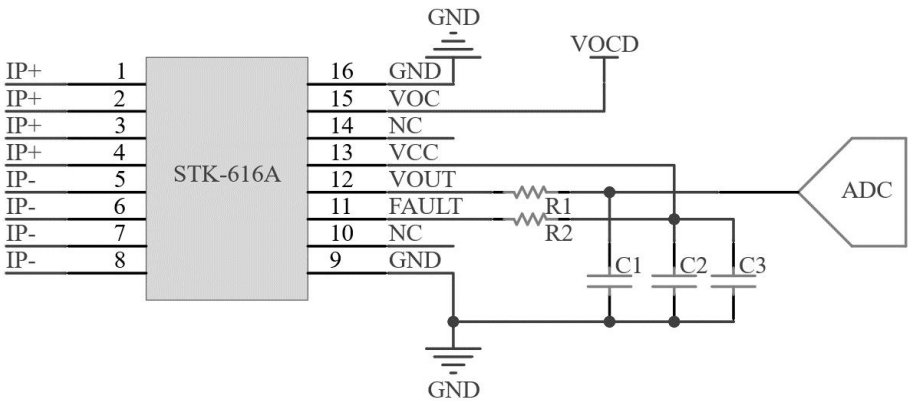



The typical frequency response of STK-616A current sensor. The response time from 90% of the primary current (blue) to 90% of the secondary output (green) is less than 1.5 µs.

## 10. Block diagram

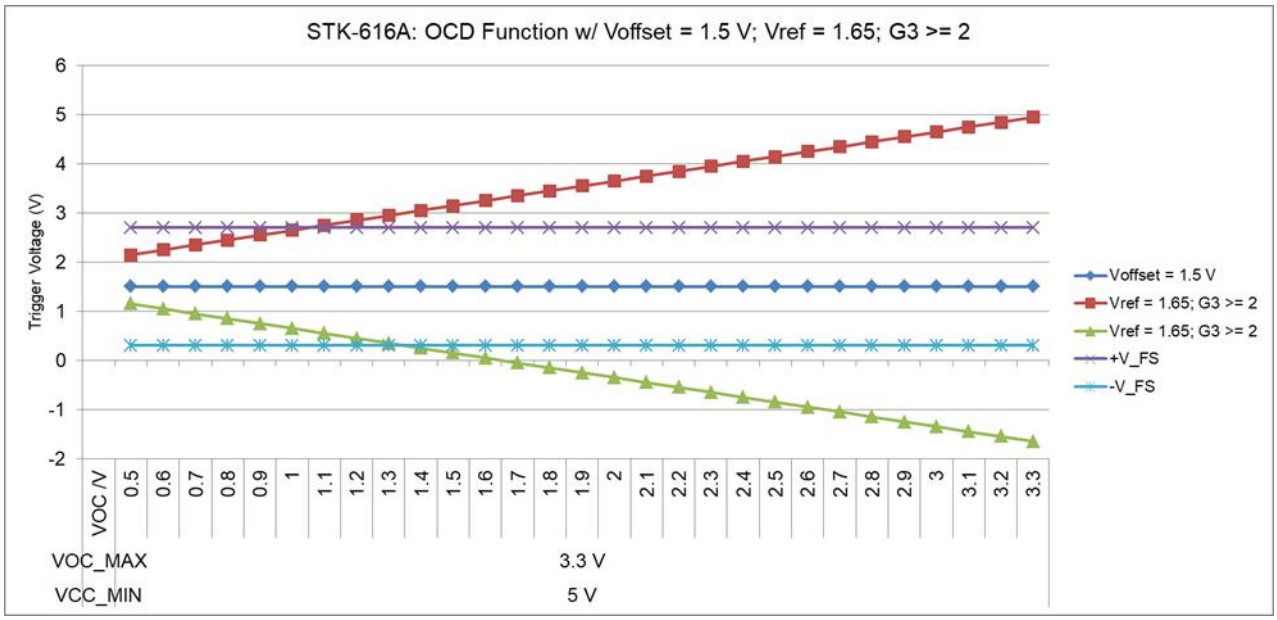



## 11. Typical application circuit




Remark: R2 = 10 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 ($f \approx 1/(2\pi RC)$). It should be considered that the band width of STK-616A is 150 kHz, so a RC setting of higher than 150 kHz will not achieve a band width higher than 150 kHz.

# 12. OCD voltage

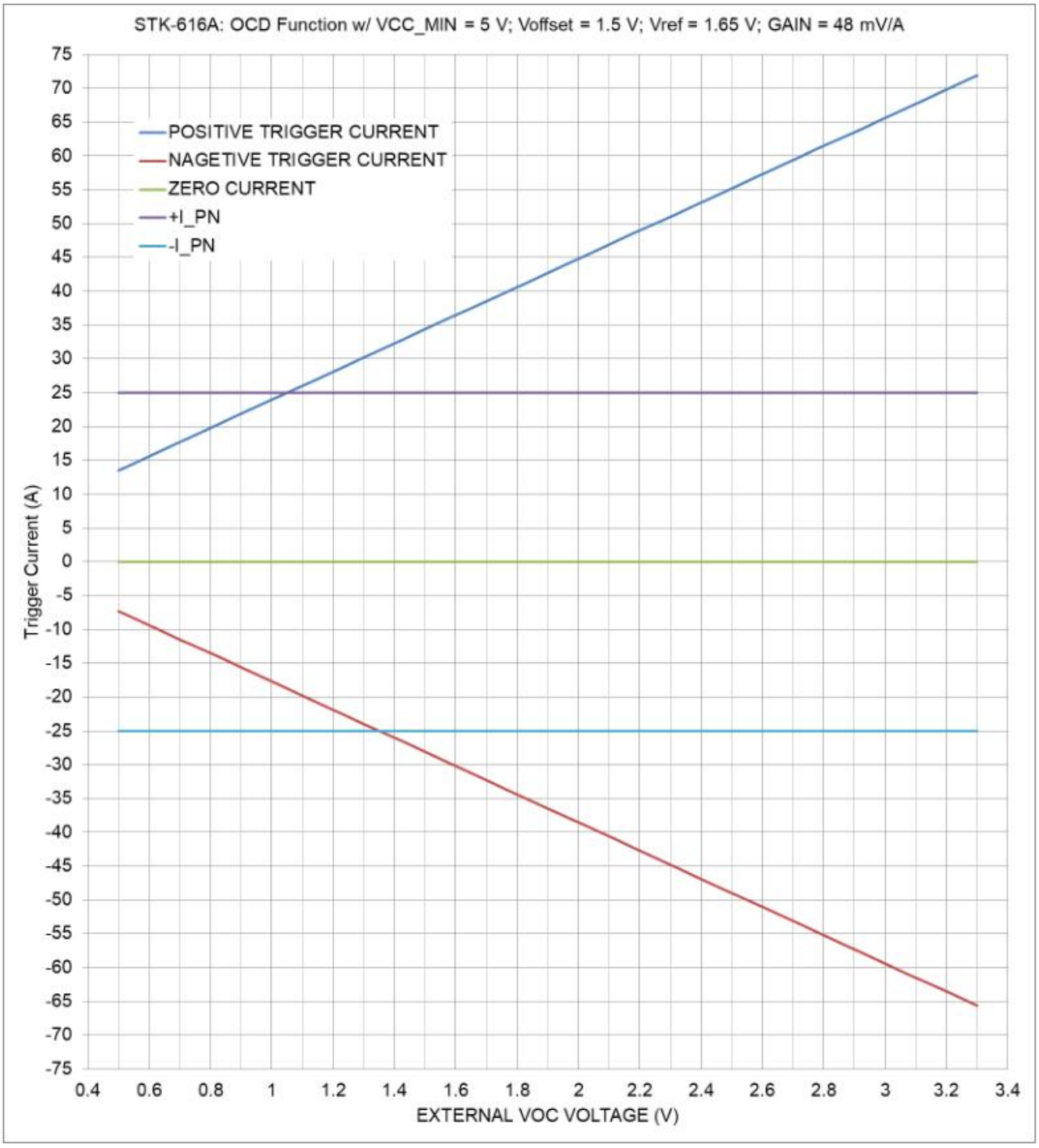



In the plot, the V_FS is output voltage @ +/-I_PN.

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

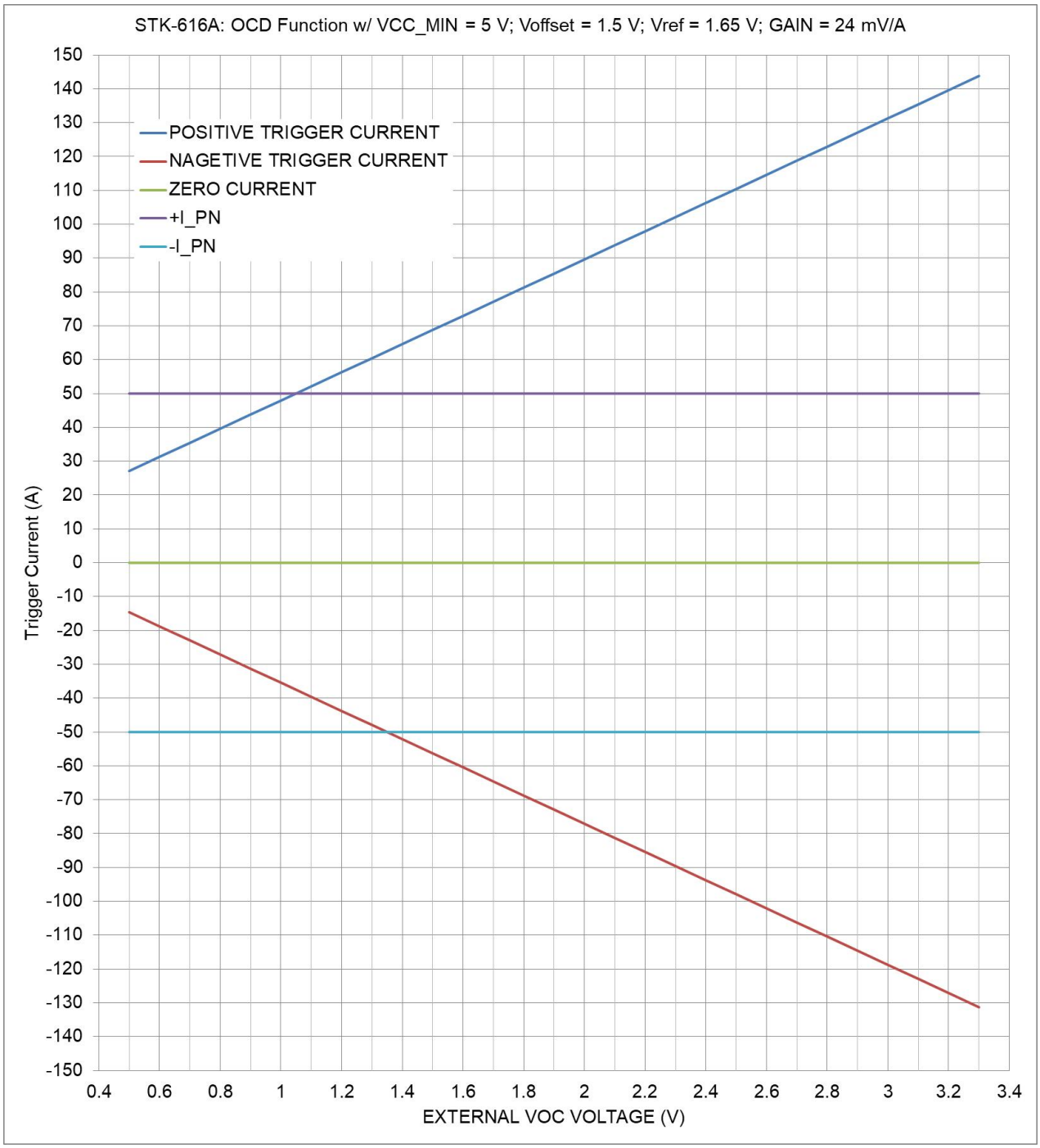
The trigger voltage = Vref +/- VOC, here, VOC ≦ Vcc – 1.7 V.

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



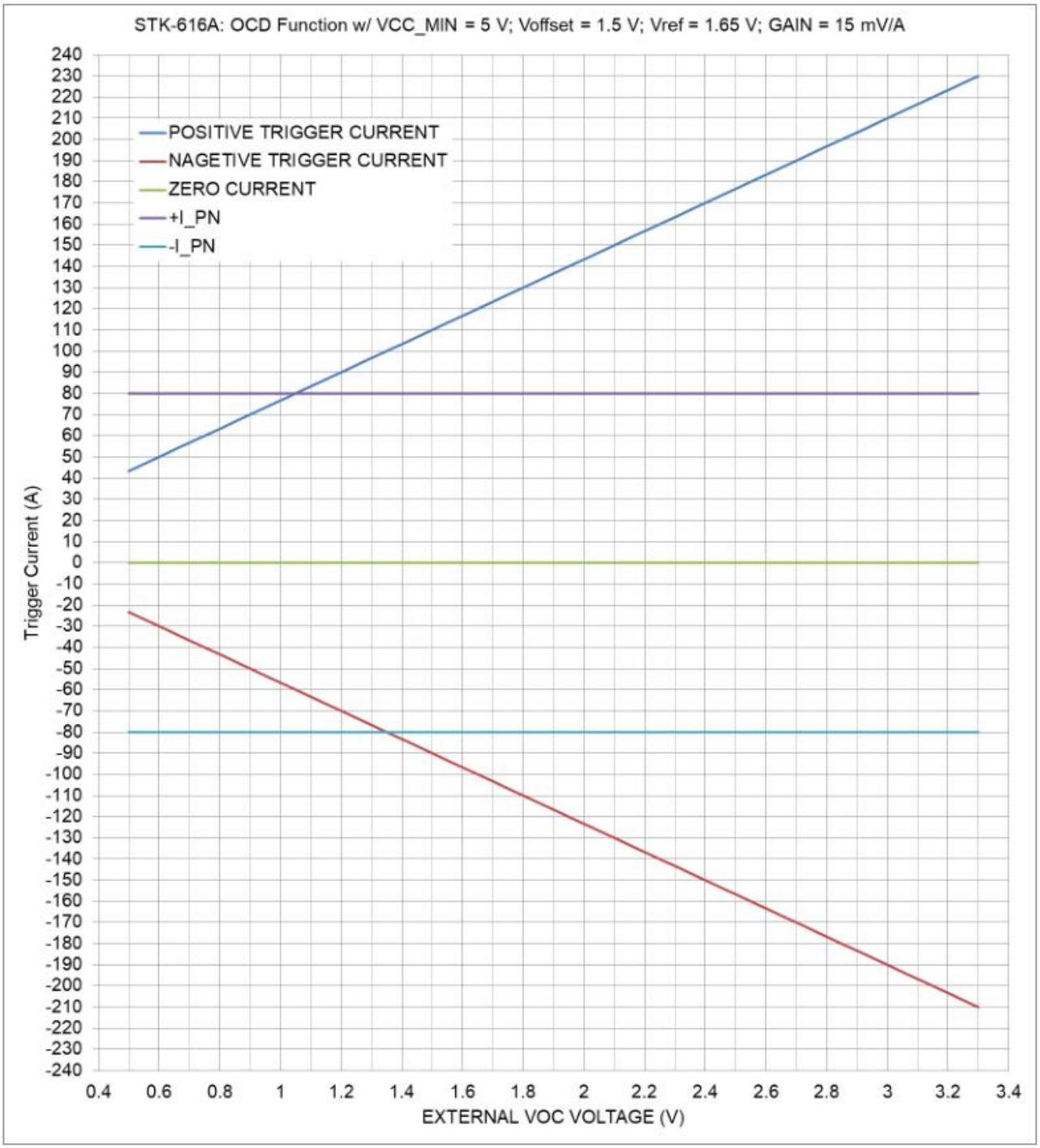

Based on the setting for STK-616A, since the Quiescent voltage, Voff of 1.5 V, is not the same as the reference voltage, Vref of 1.65 V, the trigger current is not equivalent for positive and negative current.

# 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

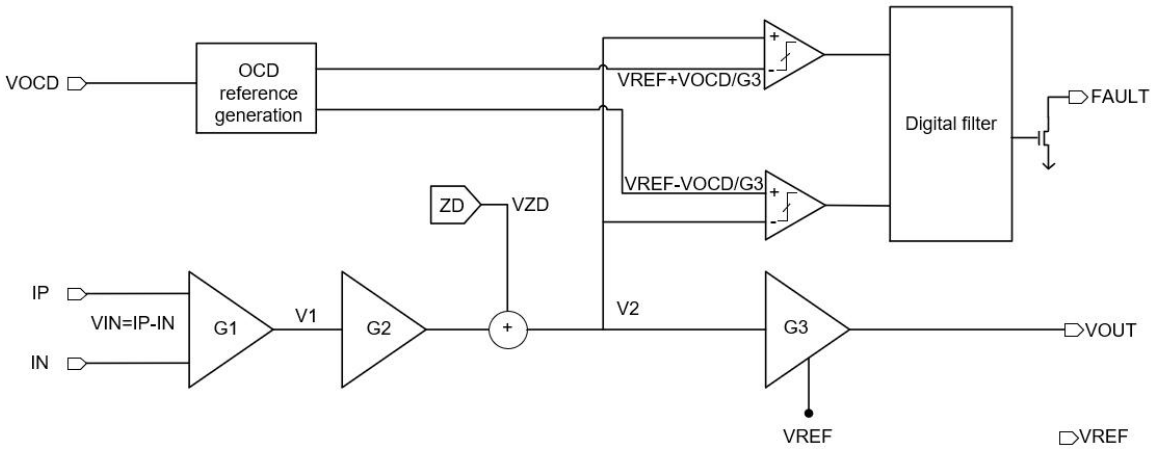
This section describes the general information on OCD function, the specific functions, which are not listed in the section of “electrical data”, can be defined per request.

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:

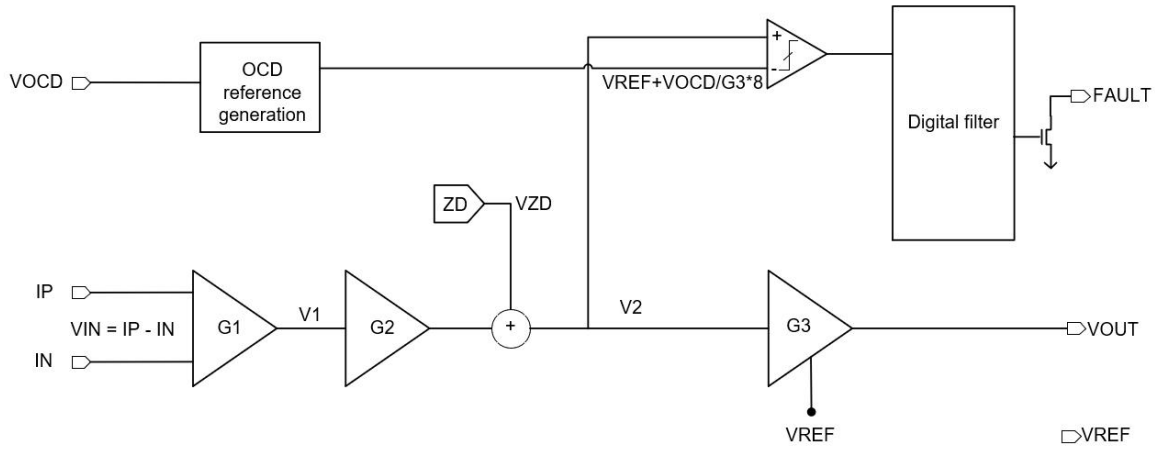
a) Trigger voltage = Vref +/- VOC, when Vref = 2.5 V or 1.65 V;

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

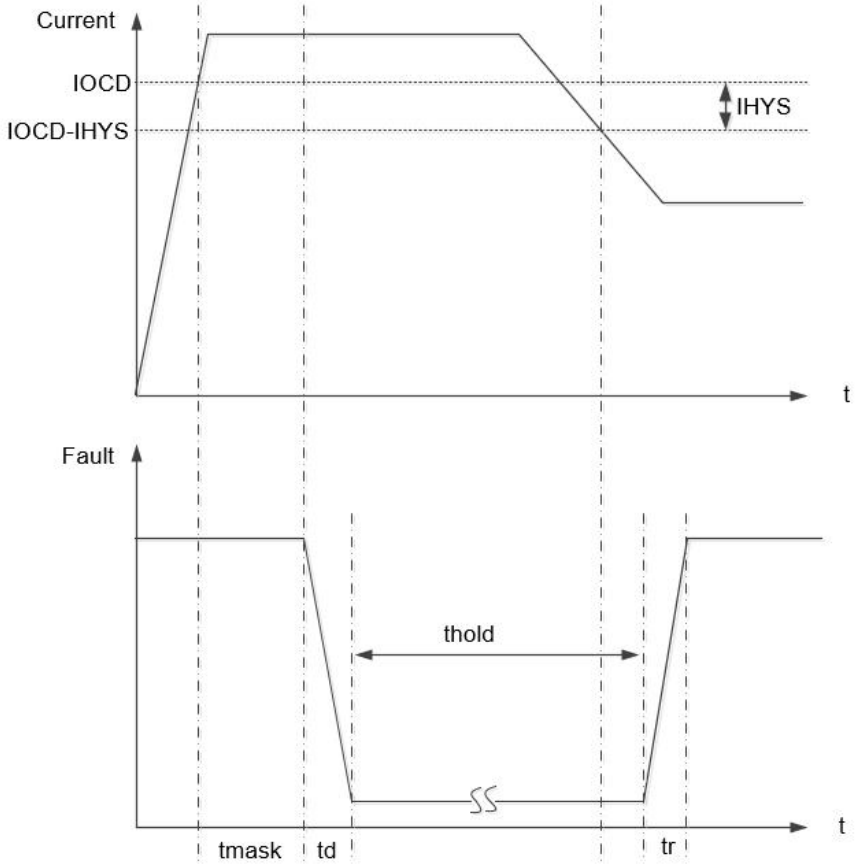
c) VOC ≦ Vcc – 1.7 V;




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:<br>(1) G3 ≥ 2, factory setting<br>(2) VOC ≤ Vcc - 1.7 V<br><br>The Trigger Voltage =<br>(1) Vref +/- Factor * VOC, when Vref = 2.5 V or 1.65 V<br>(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 | - | |