

Current Sensor

Product Series: STK-626T

STK-626T-40FB

STK-626T-50FB

STK-626T-65FB

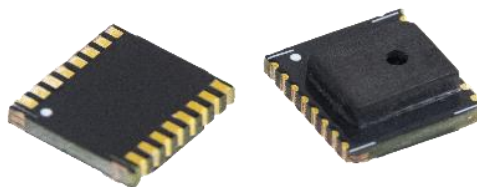
Part number: STK-626T-100FB

STK-626T-50FC

STK-626T-100FC

STK-626T-xxxFx

Version: Ver 1.0



Sinomags Technology Co., Ltd

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CONTENT

1. Description.....	2
2. Part number definition.....	3
3. Temperature vs Current	3
4. Electrical data STK-626T-xxxFB	4
5. Electrical data STK-626T-xxxFC.....	4
6. Dimensions.....	6
7. Pin definitions.....	6
8. PCB layout recommendation	7
9. Frequency band width	7
10. Step response time	8
11. Block diagram	8
12. Typical application circuit	9
13. OCD function for STK-626T-50FB.....	9
14. General information on OCD	10

1. Description

The STK-626T 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-626T series current sensor has built in OCD (Over Current Detection) function. The primary conductor has very low resistance of 0.4mΩ.

Typical applications

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

General parameter

Parameter	Symbol	Unit	Value
Working temperature	T_A	°C	-40 ~ 125
Storage temperature	T_stg	°C	-40 ~ 125
Mass	m	g	1.2

Absolute maximum rating

Parameter	Symbol	Unit	Value
Supply voltage	Vcc	V	6.5
ESD rating (HBM)	U_ESD	kV	4
Junction temperature	T_J	°C	150

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

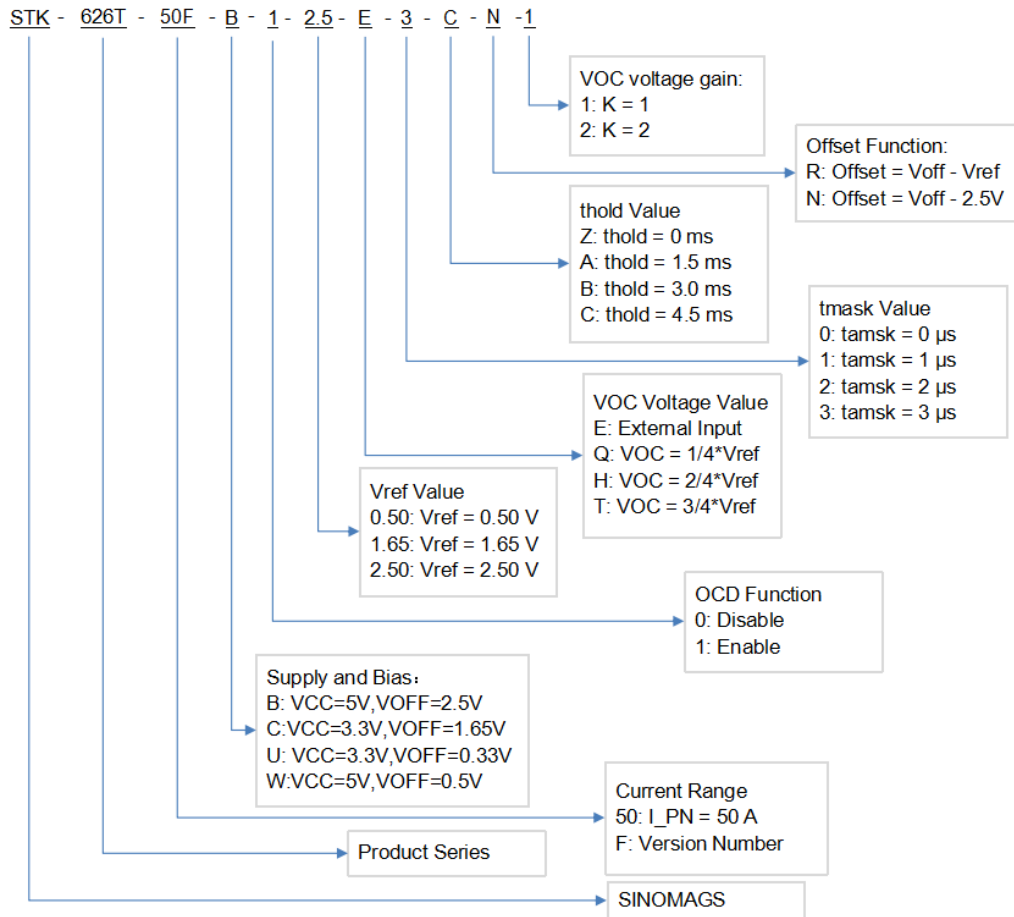
Parameter	Symbol	Unit	Value	Comment
RMS voltage for AC test 50 Hz, 1 min	Ud	kV	3.6	
Impulse withstand voltage 1.2/50μs	Ūw	kV	6	
Clearance distance (pri. -sec)	dCl	mm	7.5	Determined by customer's layout
Creepage distance (pri. -sec)	dCp	mm	7.5	

Measuring current table

Part number	Current Range	Sensitivity (mV/A)	T (°C)
STK-626T-40FB-1-2.5-E-2-C-N-1	±40 A	50	-40 ~ 125
STK-626T-50FB-1-2.5-E-2-C-N-1	±50 A	40	-40 ~ 125
STK-626T-65FB-1-2.5-E-2-C-N-2	±65 A	30.8	-40 ~ 125
STK-626T-100FB-1-2.5-E-2-C-N-1	±100 A	20	-40 ~ 125
STK-626T-50FC-1-1.65-E-2-C-N-1	±50 A	26.4	-40 ~ 125

STK-626T-100FC-1-1.65-E-2-C-N-1	±100 A	13.2	-40 ~ 125
STK-626T-xxxFX-x-x-x-x-x-x-x-x	Customize as need		

2. Part number definition



3. Temperature vs Current

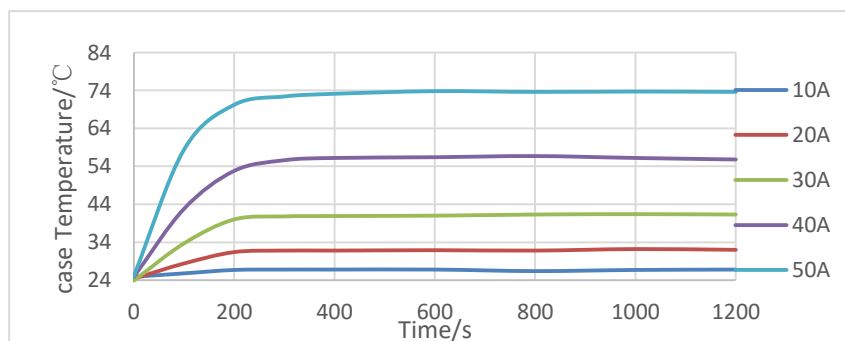


Figure 1. Relationship between STK-626T Case temperature and amount of input current.

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. Electrical data STK-626T-xxxFB

Condition: $T_A = 25^{\circ}\text{C}$, $V_{CC} = 5\text{ V}$

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal current	I _{pn}	A	-40		40	STK-626T-40FB
			-50		50	STK-626T-50FB
			-65		65	STK-626T-65FB
			-100		100	STK-626T-100FB
Supply voltage	V _{cc}	V		5		
Current consumption	I _{cc}	mA		5	10	
Primary conductor resistance	R _{IP}	mΩ		0.4		
Reference voltage	V _{ref}	V	2.45	2.50	2.55	Internal use
Quiescent voltage	V _{off}	V	2.45	2.50	2.55	V _{out} @ I _p = 0A
Internal output resistance	R _{out}	Ω		1		V _{out}
Theoretical gain (@ V _{off} = 2.5, Note 1)	G _{th}	mV/A		50		STK-626T-40FB
				40		STK-626T-50FB
				30.8		STK-626T-65FB
				20		STK-626T-100FB
OCD function (if applicable)						
OCD range	V _{OC}	V	0.3		3.3	K=1
			0.3		2	K=2
FAULT error		%		5%		% of OCD
OCD Hysteresis	I _{HYS}	%		10%		% of OCD
OCD Fault Mask	t _{mask}	μs		2		Note 2)
OCD Fault Mask error	T _{mask_error}	ns		125		
OCD Fault Hold Time	t _{hold}	ms		4.5		Note 3)
Accuracy performance						
Rated linearity @ 25°C	ξ	% of I _{pn}		±1.5		±I _{pn}
Step response time	t _{res}	μs		0.2		@90% of I _{pn}
Frequency bandwidth	BW	MHz		1		@ -3 dB
Output voltage noise	V _{noise}	mV _{pp}		10		DC ~ 1 MHz
Accuracy @ 25°C	X	% of I _{pn}		±1.5		@ 25°C
Thermal drift of G _{th}	G _{AIN_T}	% of G _{th}		±1.5		@-40~105°C
Thermal drift of V _{off}	V _{off_T}	mV		±15		Drift related to the
Total Accuracy	X _T	% of I _{pn}		±3.5		value @ 25°C

5. Electrical data STK-626T-xxxFC

Condition: $T_A = 25^{\circ}\text{C}$, $V_{CC} = 3.3\text{ V}$

Parameter	Symbol	Unit	Min	Typ	Max	Comment
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Primary nominal current	I_pn	A	-50		50	STK-626T-50FC
			-100		100	STK-626T-100FC
Primary current measuring range	I_pm	A	-50		50	STK-626T-50FC
			-100		100	STK-626T-100FC
Supply voltage	Vcc	V		3.3		
Current consumption	Icc	mA		5	10	
Primary conductor resistance	R_IP	mΩ		0.4		
Reference voltage	Vref	V	1.6	1.65	1.7	Internal use
Quiescent voltage	Voff	V	1.6	1.65	1.7	Vout @ I_pn = 0A
Internal output resistance	R_out	Ω		1		Vout
Theoretical gain (@ Voff = 1.65, Note 4)	G_th	mV/A		26.4		STK-626T-50FC
				13.2		STK-626T-100FC
OCD function (if applicable)						
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)
Accuracy performance						
Rated linearity @ 25°C	ξ	% of I_pn		±1.5		±I_pn
Step response time	t_res	μs		0.2		@90% of I_pn
Frequency bandwidth	BW	MHz		1		@ -3 dB
Output voltage noise	Vnoise	mVpp		10		DC ~ 1 MHz
Accuracy @ 25°C	X	% of I_pn		±1.5		@ 25°C
Thermal drift of G_th	GAIN_T	% of G_th		±1.5		@-40~105°C Drift related to the value @ 25°C
Thermal drift of Voff	Voff_T	mV		±15		
Total Accuracy	X_T	% of I_pn		±3.5		

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.

6. Dimensions

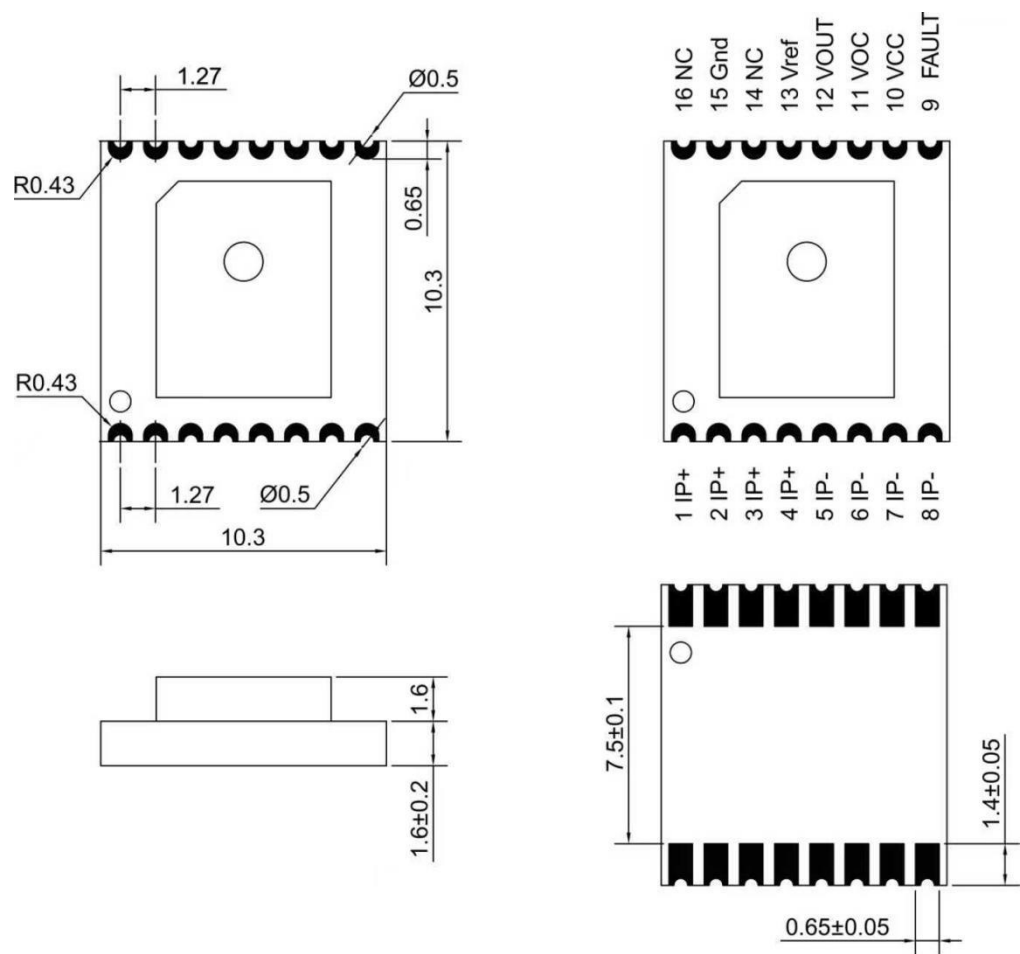


Figure 2. Dimensions of STK-626T series current sensors. The unit is mm.

7. Pin definitions

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

8. PCB layout recommendation

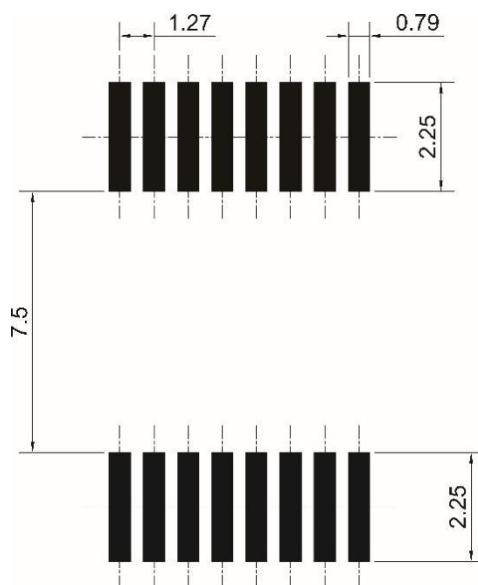


Figure 3. The recommended footprint of the SMT PCB layout for the STK-626T series products. The unit is mm.

9. Frequency band width

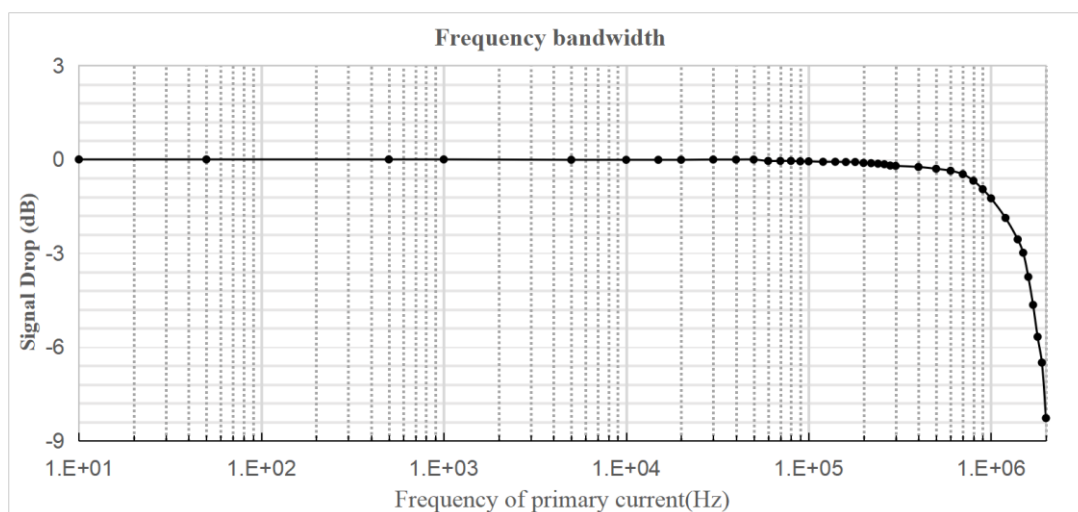


Figure 4. The frequency band width of the STK-626T series products. the upper limit of the -3 dB band width is 1 MHz.

10. Step response time

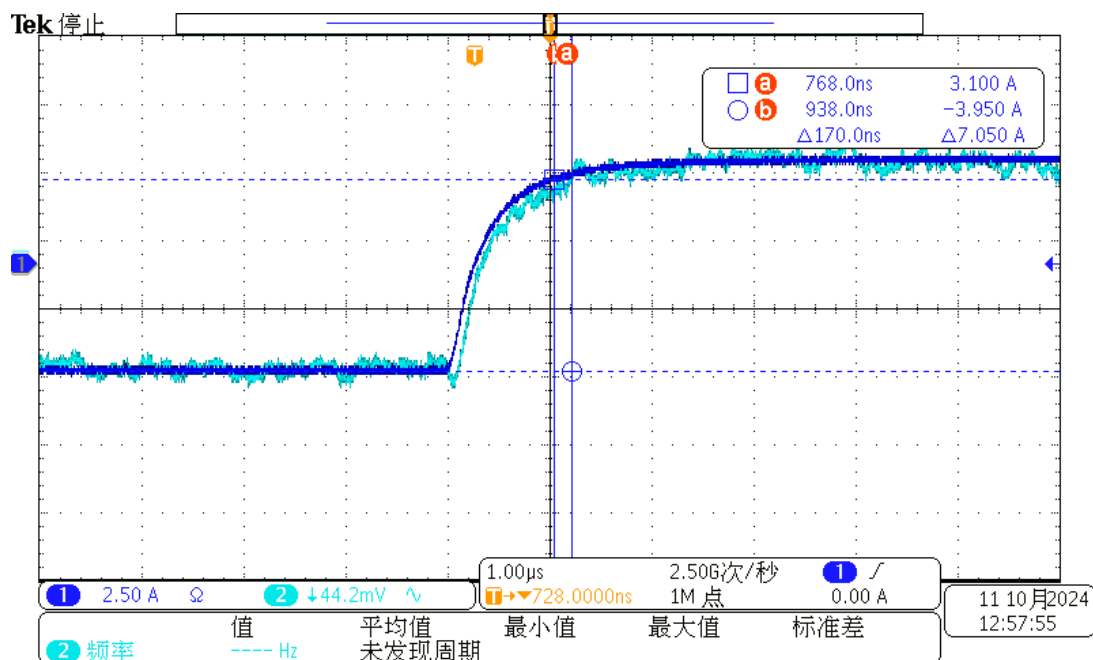


Figure 5. The typical frequency response of STK-626T series current sensor. The response time from 90% of the primary current to 90% of the secondary output is 0.2 μ s.

11. Block diagram

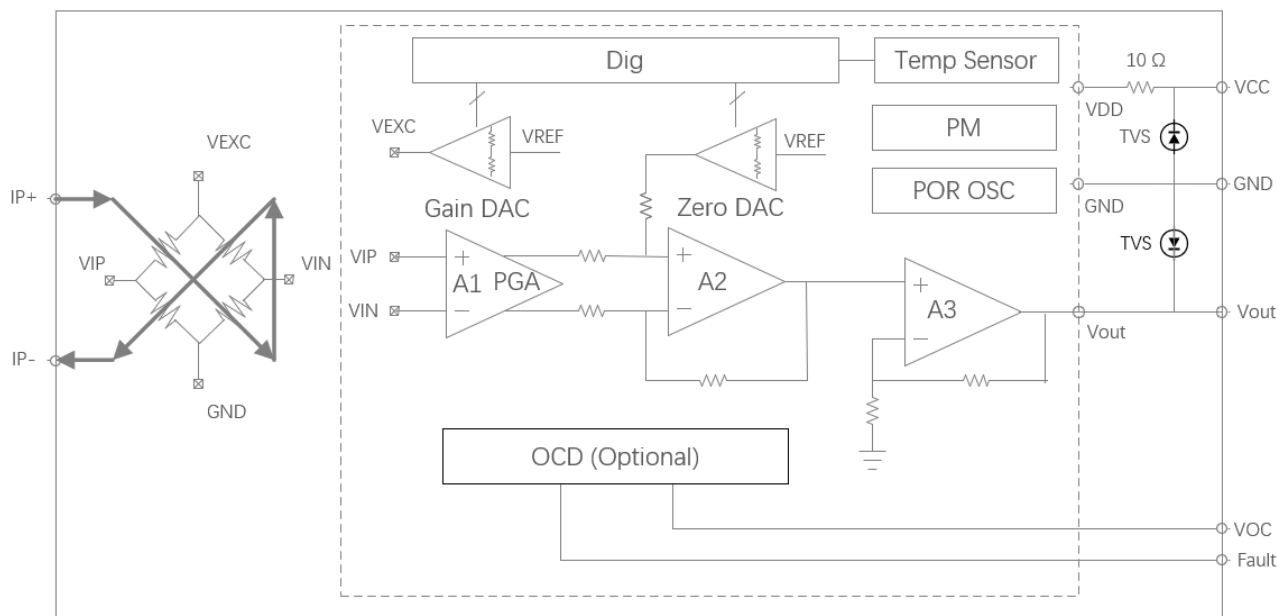


Figure 6. The functional block diagram for the STK-626T series products.

12. Typical application circuit

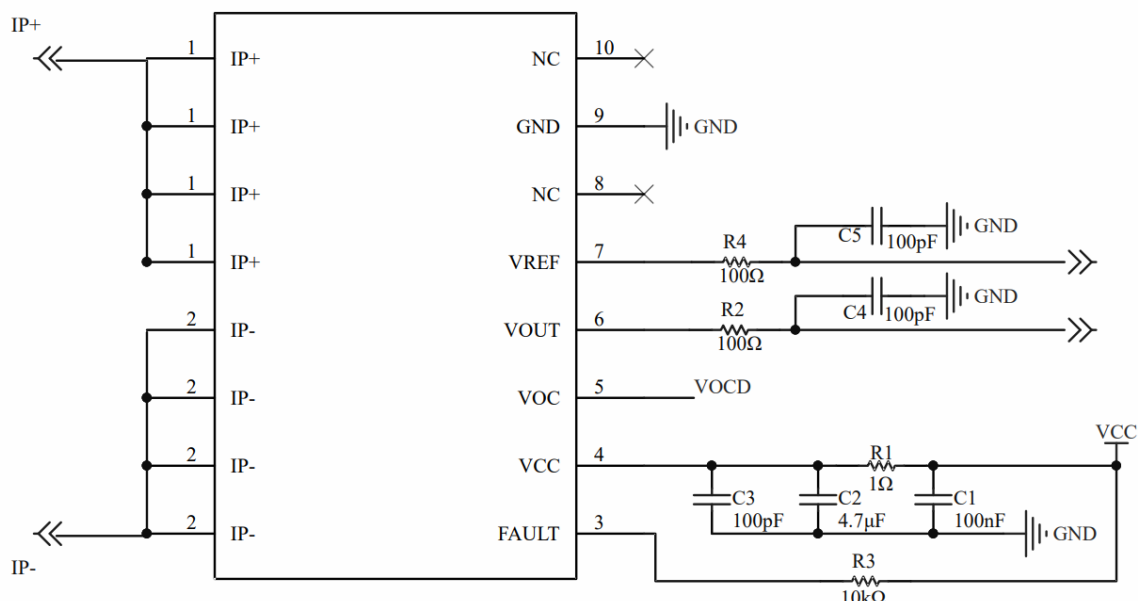


Figure 7. The reference application circuit for the STK-626T series products.

Remark 1: $R_3 = 10\text{ k}\Omega$, recommended $C_1 = 100\text{ nF}$, $C_2 = 4.7\text{ }\mu\text{F}$, $C_3 = 100\text{ pF}$, $C_4 = 100\text{ pF}$, $C_5 = 100\text{ pF}$. 100pF of C_4 and C_5 does not affect the response speed of the chip. R_2 and C_4 , R_4 and C_5 constitute RC filter circuit ($f \approx 1/(2\pi RC)$). The bandwidth of STK-626T is 1 MHz, and RC filter circuit above 1 MHz cannot realize a bandwidth above 1 MHz. If the VREF pin is not used, it can be left empty. If there is a need for an external capacitor, it is necessary to ensure that the capacitance value is greater than 100 nF.

Remark 2: The VREF and VOUT pins cannot be connected directly to a capacitor. If a capacitor is required in the circuit, connect a resistor in series before the capacitor. It is recommended to select a series resistance of 100 Ω or more.

13. OCD function for STK-626T-50FB

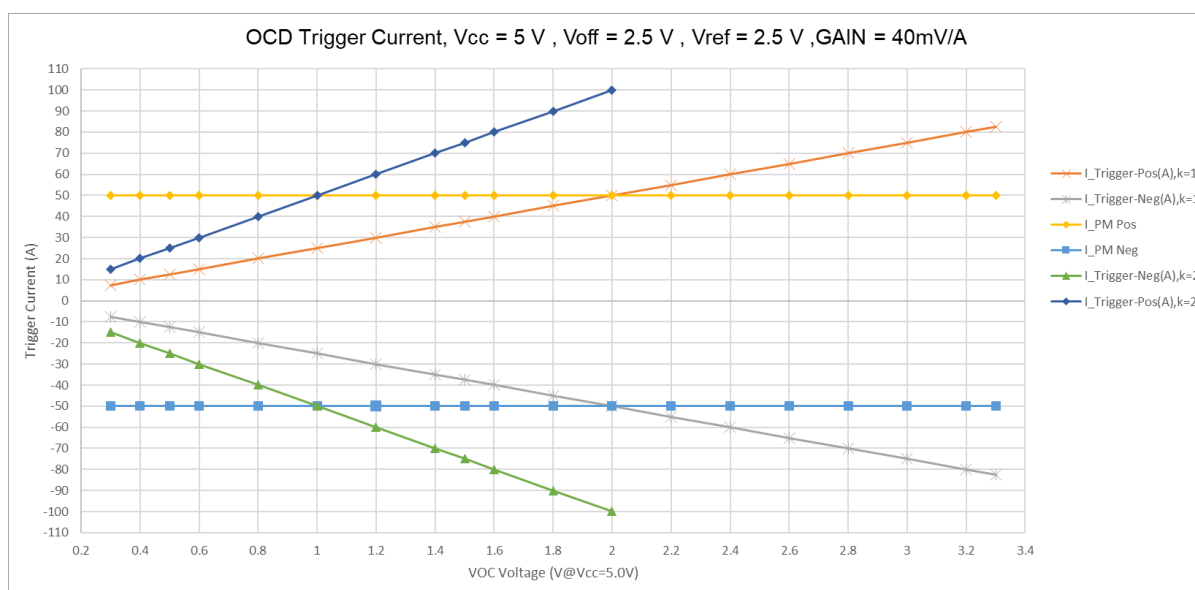


Figure 8 the relationship of trigger current and VOC setting for the STK-626T-50FB, with $V_{cc} = 5\text{ V}$. $I_{\text{trigger_pos}}$ represents the forward over-current protection trigger current. $I_{\text{trigger_neg}}$ represents the negative over-current protection trigger current. $I_{\text{pn_pos}}$ represents the forward primary nominal current. $I_{\text{pn_neg}}$ 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. 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 follows.

- a) $V_{cc} = 5\text{ V}$, $V_{ref} = 2.5\text{ V}$, $V_{off} = 2.5\text{ V}$, $K=1$.
- $0.3\text{ V} \leq \text{VOC} \leq 3.3\text{ V}$;
 - $V_{\text{trigger}} = V_{ref} \pm K * \text{VOC} / G3$;
 - $I_{\text{trigger}} = (V_{ref} \pm K * \text{VOC} - V_{off}) / G_{th}$;
- b) $V_{cc} = 5\text{ V}$, $V_{ref} = 2.5\text{ V}$, $V_{off} = 2.5\text{ V}$, $K=2$.
- $0.3\text{ V} \leq \text{VOC} \leq 2\text{ V}$;
 - $V_{\text{trigger}} = V_{ref} \pm K * \text{VOC} / G3$;
 - $I_{\text{trigger}} = (V_{ref} \pm K * \text{VOC} - V_{off}) / G_{th}$;
- c) $V_{cc} = 3.3\text{ V}$, $V_{ref} = 1.65\text{ V}$, $V_{off} = 1.65\text{ V}$, $K=1$.
- $0.3\text{ V} \leq \text{VOC} \leq 1.6\text{ V}$;
 - $V_{\text{trigger}} = V_{ref} \pm K * \text{VOC} / G3$;
 - $I_{\text{trigger}} = (V_{ref} \pm K * \text{VOC} - V_{off}) / G_{th}$;
- d) $V_{cc} = 3.3\text{ V}$, $V_{ref} = 1.65\text{ V}$, $V_{off} = 1.65\text{ V}$, $K=2$.
- $0.3\text{ V} \leq \text{VOC} \leq 1.6\text{ V}$;
 - $V_{\text{trigger}} = V_{ref} \pm K * \text{VOC} / G3$;
 - $I_{\text{trigger}} = (V_{ref} \pm K * \text{VOC} - V_{off}) / G_{th}$;

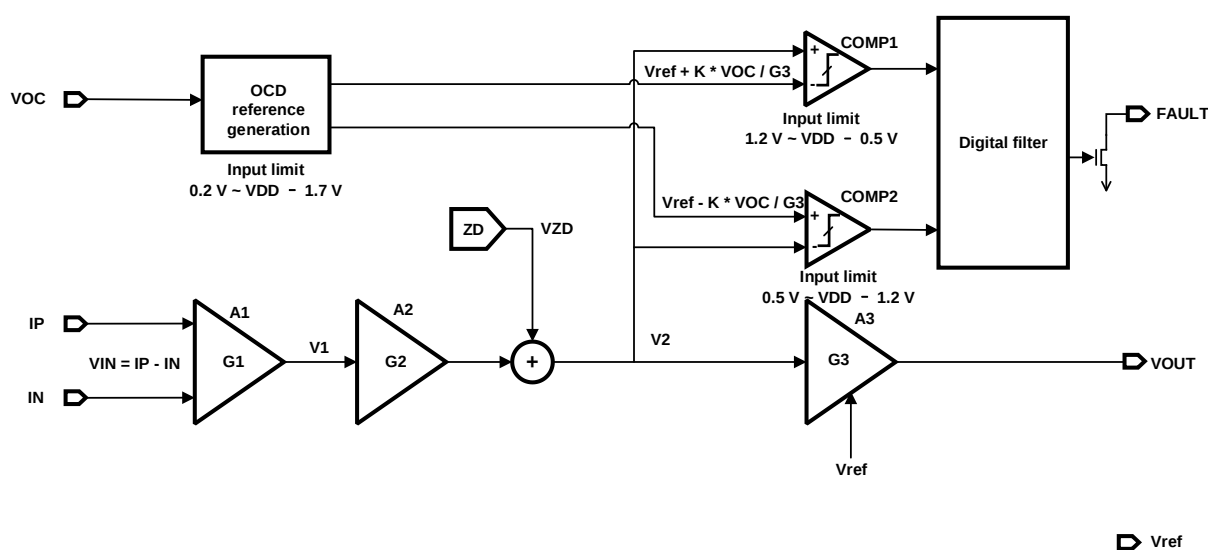


Figure 9 the functional block diagram for STK-626T on OCD function with conditions of $V_{cc} = 5\text{ V}$, $V_{off} = 2.5\text{ V}$, $V_{ref} = 2.5\text{ V}$.