

Current Sensor

Product Series: STK-626DMF

STK-626D-20MFB5

STK-626D-30MFB5

STK-626D-40MFB5

STK-626D-50MFB5

STK-626D-65MFB5

Part number: STK-626D-20MFB3

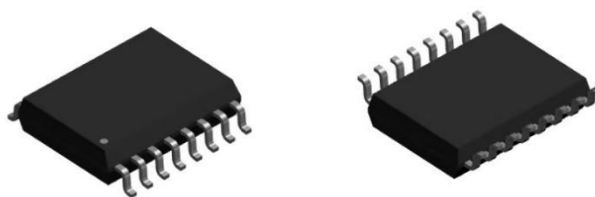
STK-626D-30MFB3

STK-626D-40MFB3

STK-626D-50MFB3

STK-626D-65MFB3

Version: Ver 1.3



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1. Description

The STK-626DM series current sensor is based on TMR (tunnel magneto resistance) technology and open-loop design. It is suitable for DC, AC pulsed and any kind of irregular current measurement under the isolated conditions.

- The product is packaged in standard SOIC16 form.
- AEC-Q100, automotive qualified.

Typical applications

- AC Variable speed drives
- AC/DC, DC/DC power supplies
- Inverter
- Switched model power supplies (SMPS)

General parameter

Parameter	Symbol	Unit	Value
Working temperature	T_A	°C	-40 ~ 125
Storage temperature	T_stg	°C	-40 ~ 125
Mass	m	g	0.5

Absolute maximum rating

Parameter	Symbol	Unit	Value
Supply voltage	V _{cc}	V	6
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.

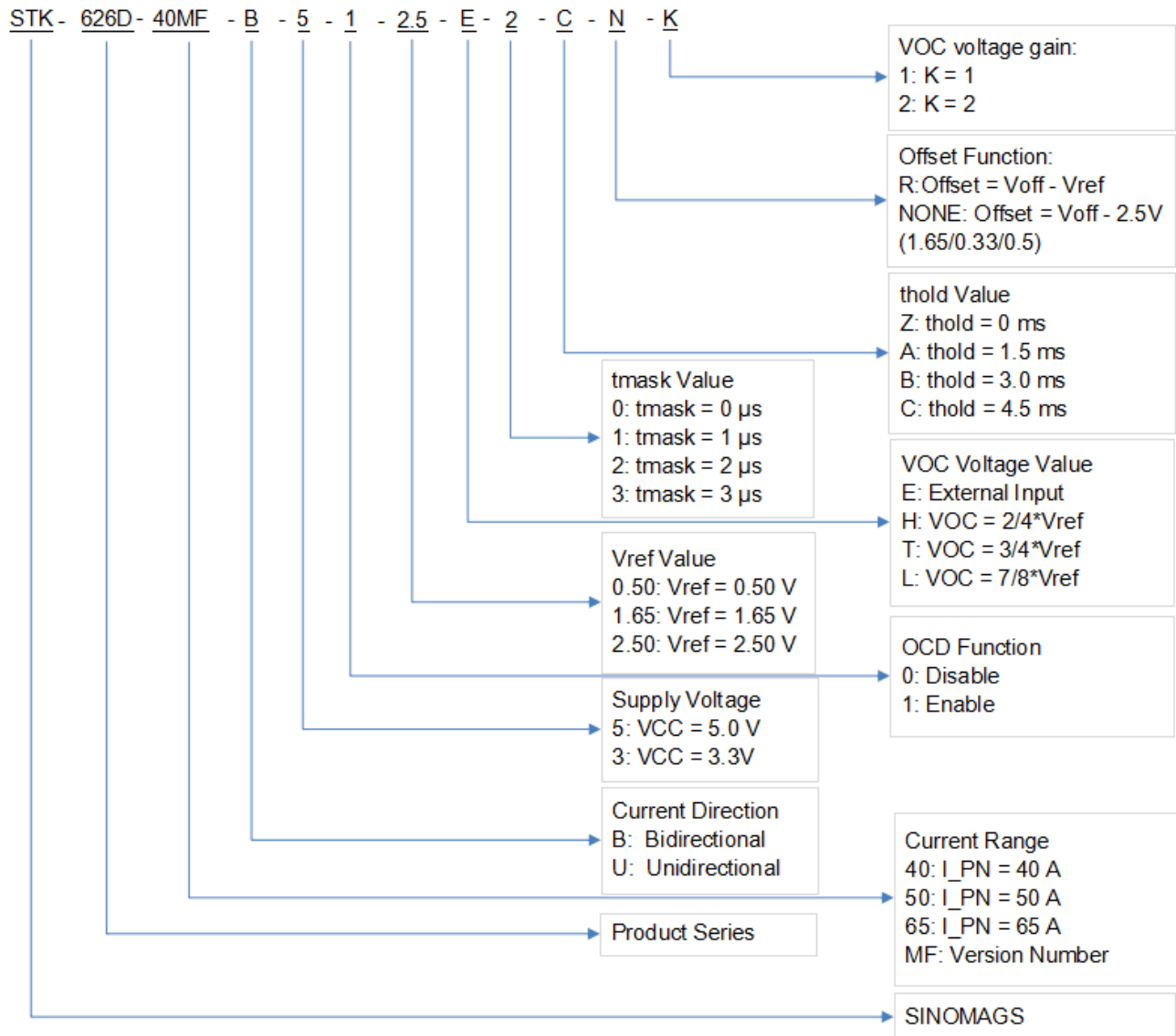
Isolation parameter

Parameter	Symbol	Unit	Value	Comment
RMS voltage for AC test 50Hz/1 min	U _d	kV	3.6	
Impulse withstand voltage 1.2/50μs	Ū _w	kV	6	
Surge voltage	V _{surge}	kV	10	
Surge current	I _{surge}	kA	13	
Clearance distance (pri. -sec)	D _{ci}	mm	8	Determined by customer's layout
Creepage distance (pri. -sec)	D _{cp}	mm	8	
Working voltage for basic isolation	V _{WVBI}	V _{rms}	1097	
		V _{dc}	1550	

Measuring current table

Product	Meas. Range I _{pn} (A)	Sensitivity (mV/A)	V _{cc} (V)	T (°C)
STK-626D-20MFB3-1-1.65-E-2-C-N-2	±20A	66	3.3	-40 ~ 125
STK-626D-30MFB3-1-1.65-E-0-Z-R-2	±30A	44	3.3	-40 ~ 125
STK-626D-40MFB3-1-1.65-E-2-C-N-2	±40A	33	3.3	-40 ~ 125
STK-626D-50MFB3-1-1.65-E-2-C-N-2	±50A	26.4	3.3	-40 ~ 125
STK-626D-65MFB3-1-1.65-E-0-Z-R-2	±65A	20.3	3.3	-40 ~ 125
STK-626D-20MFB5-1-2.5-E-2-C-N-2	±20A	100	5	-40 ~ 125
STK-626D-30MFB5-1-2.5-E-2-C-N-2	±30A	66.6	5	-40 ~ 125
STK-626D-40MFB5-1-2.5-E-2-C-N-2	±40A	50	5	-40 ~ 125
STK-626D-50MFB5-1-2.5-E-2-C-N-2	±50A	40	5	-40 ~ 125
STK-626D-65MFB5-1-2.5-E-2-C-N-2	±65A	30.8	5	-40 ~ 125

2. Part number definition



3. Temperature vs Current

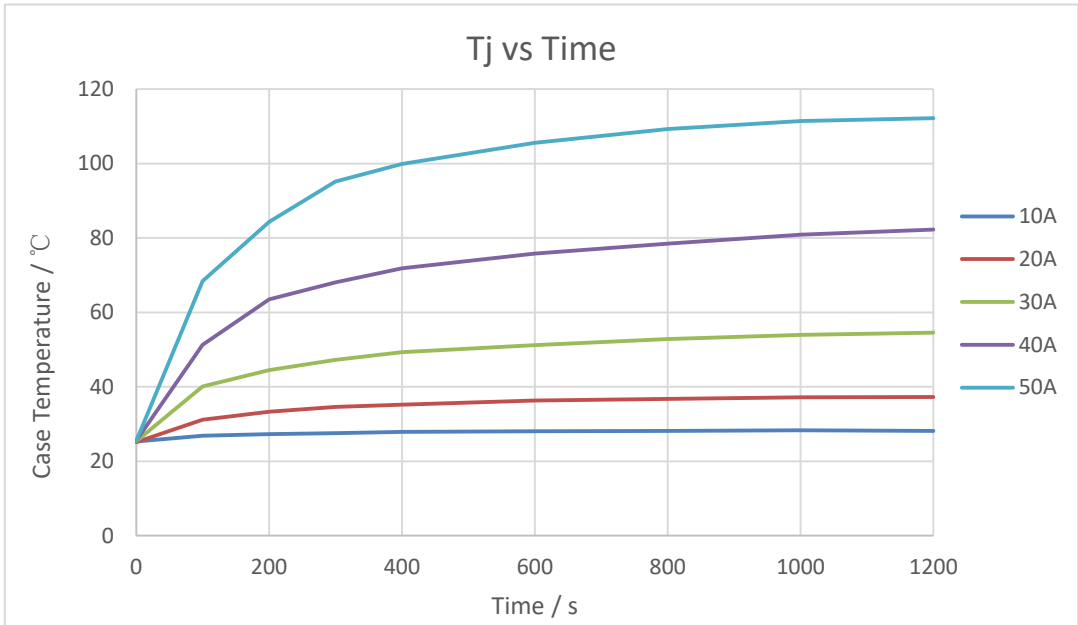


Figure 1. Relationship between STK-626DM Case temperature and amount of input current

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

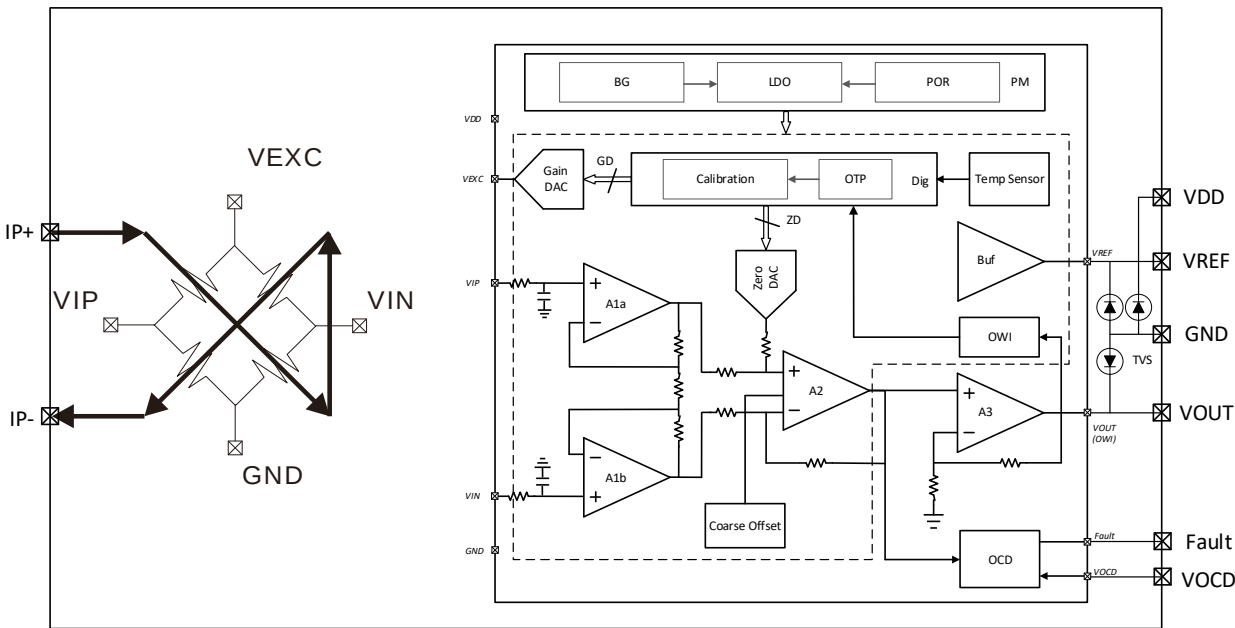


Figure 2 the functional block diagram for the STK-626DM series products.

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

5. Electrical data STK-626D-XXMFB5

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

Parameter	Symbol	Unit	Min	Typ	Max	Comment
General parameters						
Primary nominal current	I _{pn}	A	-20		20	STK-626D-20MFB5
			-30		30	STK-626D-30MFB5
			-40		40	STK-626D-40MFB5
			-50		50	STK-626D-50MFB5
			-65		65	STK-626D-65MFB5
Supply voltage	V _{cc}	V	4.5	5	5.5	
Current consumption	I _{cc}	mA		11	15	
Primary conductor resistance	R _{IP}	mΩ		0.85		
Quiescent voltage@0A	V _{off}	V	2.45	2.5	2.55	
Reference voltage	V _{ref}	V	2.45	2.5	2.55	
Electrical offset voltage	Offset	mV		±10		V _{off} - V _{ref}
Output Specifications	R _{out}	Ω	1		30	
	R _{ref}		1		80	
Theoretical gain	G _{th}	mV/A		100		STK-626D-20MFB5
				66.6		STK-626D-30MFB5
				50		STK-626D-40MFB5
				40		STK-626D-50MFB5
				30.8		STK-626D-65MFB5
OCD function (if applicable)						
OCD range	V _{OC}	V	1.3		2.6	K=1
			0.5		2	K=2
FAULT error		%		5%		% of OCD
OCD	I _{HYS}	%		10%		% of OCD
OCD Fault Mask	t _{mask}	μs		2		0, 1, 2, 3 μs
OCD Fault Mask error	T _{mask_error}	ns		125		
OCD Fault Hold Time	t _{hold}	ms		4.5		0, 1.5, 3, 4.5 ms
Accuracy performance						
Rated linearity error@25°C	Non-L	%I _{pn}		±1.5		±I _{pn}
Step response time	t _{res}	ns		80		@90% of I _{pn} STK-626D-XXMFBX
Frequency bandwidth	BW	MHz		2		@-3dB STK-626D-XXMFBX
Output voltage noise	V _{noise}	mV _{pp}		10		@1.4 MHz
Thermal drift of G _{th}	GAIN _T	% G _{th}		±1.5		@ -40~105°C

Thermal drift of Voff	Voff_T	mV		±15		drift related to the value @25°C
Total Accuracy	X_TRange	% I _{pn}		±3.5		

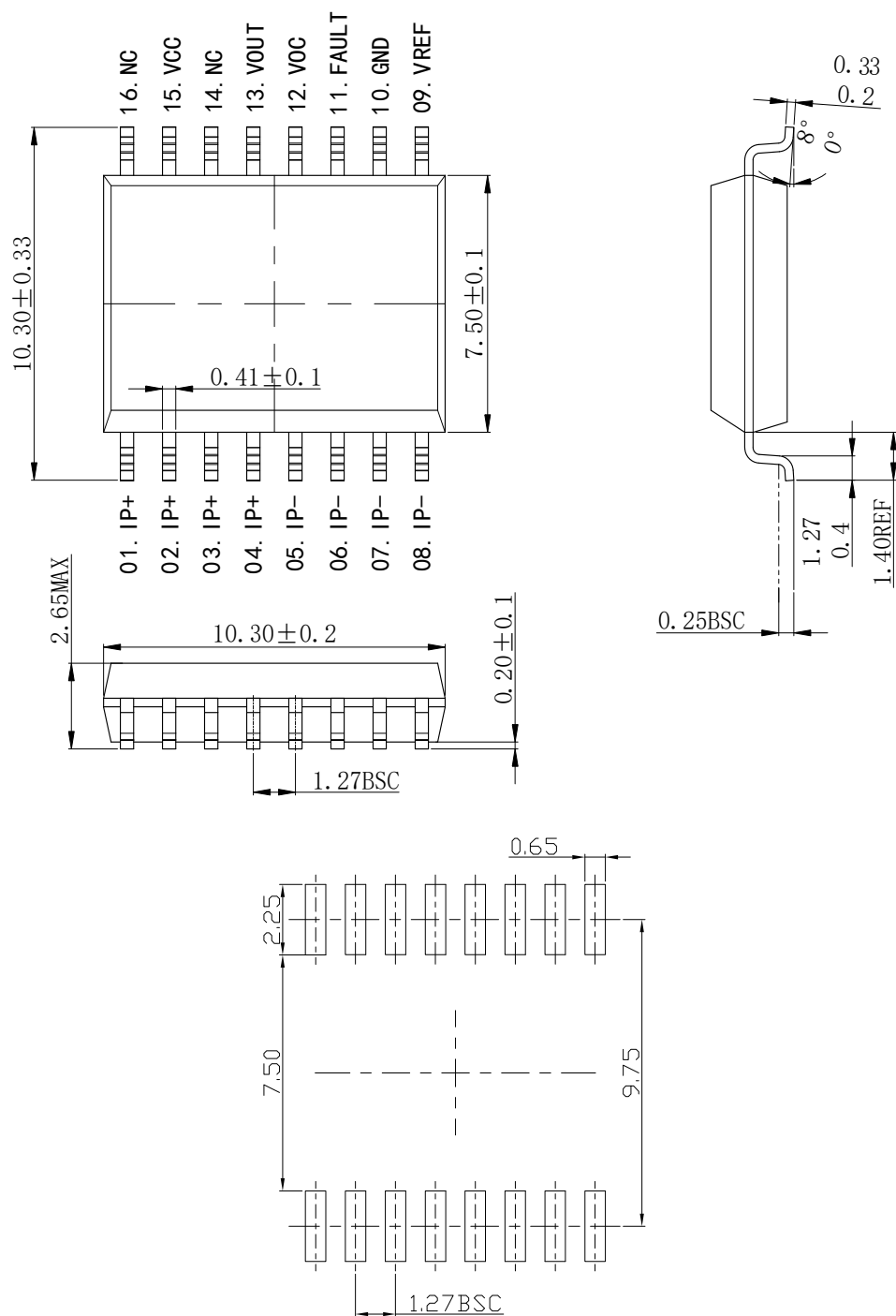
6. Electrical data STK-626D-XXMFB3

Condition: T_A = 25°C, V_{cc} = 3.3 V

Parameter	Symbol	Unit	Min	Typ	Max	Comment
General parameters						
Primary nominal current	I _{pn}	A	-20		20	STK-626D-20MFB3
			-30		30	STK-626D-30MFB3
			-40		40	STK-626D-40MFB3
			-50		50	STK-626D-50MFB3
			-65		65	STK-626D-65MFB3
Supply voltage	V _{cc}	V	3.15	3.3	3.45	
Current consumption	I _{cc}	mA		11	15	
Primary conductor resistance	R _{IP}	mΩ		0.9		
Quiescent voltage@0A	V _{off}	V	1.6	1.65	1.7	
Reference voltage	V _{ref}	V	1.6	1.65	1.7	
Electrical offset voltage	Offset	mV		±10		V _{off} - V _{ref}
Output Specifications	R _{out}	Ω	1		30	
	R _{ref}		1		80	
Theoretical gain	G _{th}	mV/A		66		STK-626D-20MFB3
				44		STK-626D-30MFB3
				33		STK-626D-40MFB3
				26.4		STK-626D-50MFB3
				20.3		STK-626D-65MFB3
OCD function (if applicable)						
OCD range	V _{OC}	V	0.625		1.4	K=1
			0.625		1.4	K=2
FAULT error		%		5%		% of OCD
OCD Hysteresis	I _{HYS}	%		10%		% of OCD
OCD Fault Mask	t _{mask}	μs		2		0, 1, 2, 3 μs
OCD Fault Mask error	T _{mask_error}	ns		125		
OCD Fault Hold Time	t _{hold}	ms		4.5		0, 1.5, 3, 4.5 ms
Accuracy performance						
Rated linearity error@25°C	Non-L	%I _{pn}		±1.5		±I _{pn}
Step response time	t _{res}	ns		80		@90% of I _{pn} STK-626D-XXMFBX
Frequency bandwidth	BW	MHz		2		@-3dB STK-626D-XXMFBX
Output voltage noise	V _{noise}	mV _{pp}		10		@1.4 MHz

Thermal drift of G _{th}	GAIN_T	% G _{th}		±1.5		@ -40~105℃ drift related to the value @25℃
Thermal drift of V _{off}	Voff_T	mV		±15		
Total Accuracy	X_TRange	% I _{pn}		±3.5		

7. Dimension & Pin definitions with OCD function



PCB Layout Reference View

Figure 3 dimensions of STK-626DM series current sensors. The unit is mm.

8. Pin definitions

Pin definition for product with OCD function

PIN	Symbol	Description
1,2,3,4	IP+	Primary conductor pin (+)
5,6,7,8	IP-	Primary conductor pin (-)
9	VREF	Reference pin, output function
10	GND	Ground pin (GND)
11	FAULT	Over current detection alarm output, the pin is open leakage output. Normally, the output of fault pin is high level.
12	VOC	Over current detection threshold input pin
13	VIOUT	Sensor output pin
14	NC	No connection
15	VCC	Power supply pin
16	NC	No connection

9. PCB layout recommendation

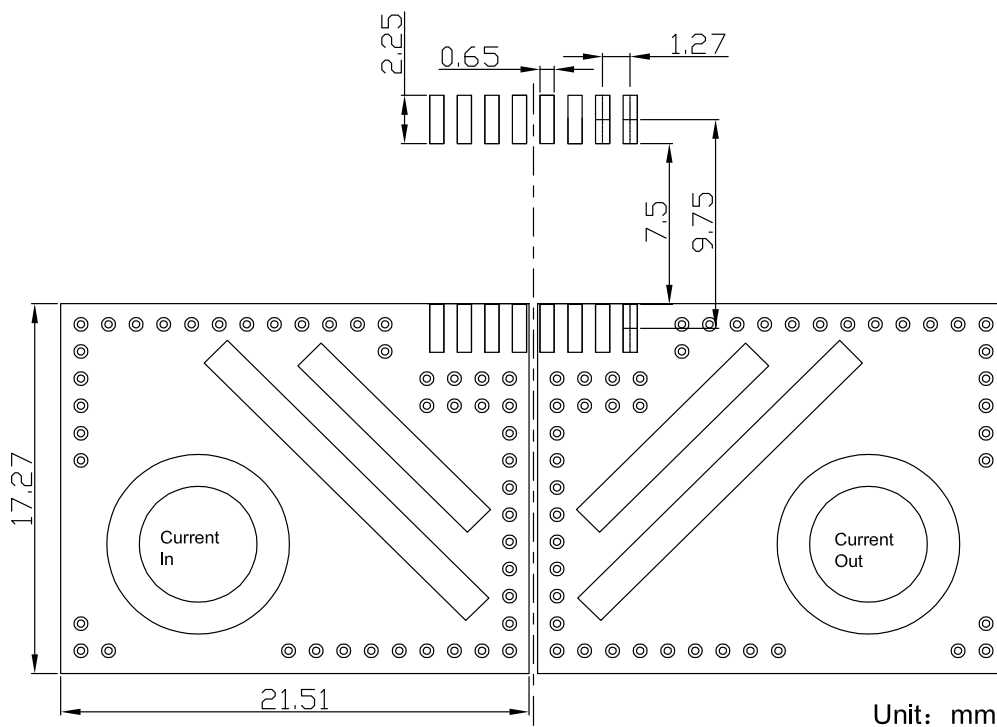


Figure 4 the recommended footprint of the SMT PCB layout for the STK-626DM series products. The unit is mm.

10.Frequency bandwidth of STK-626D-XXMFBX

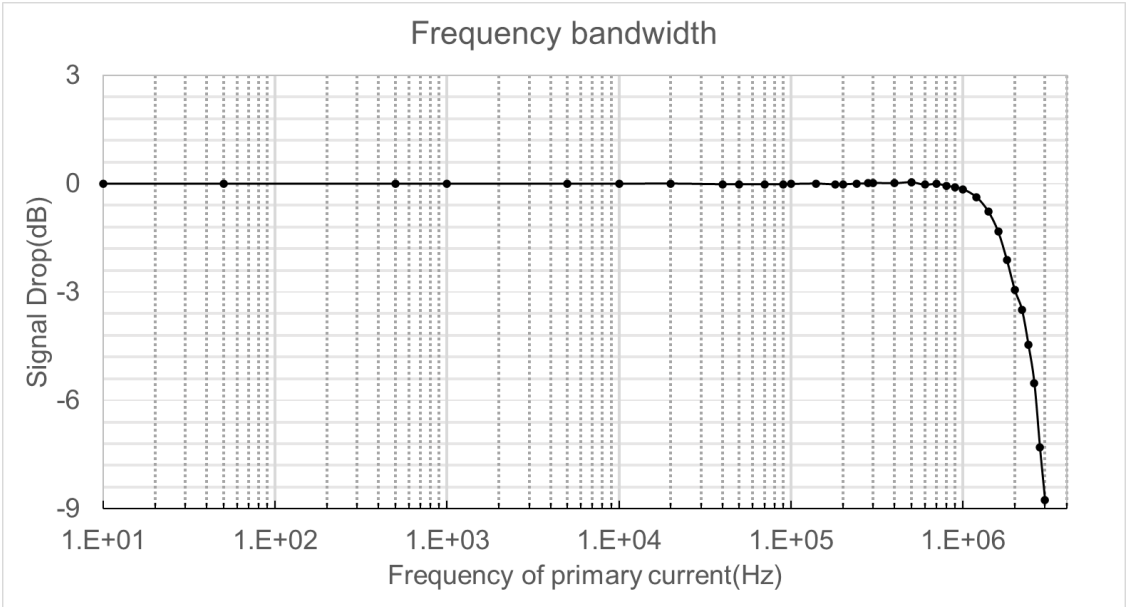


Figure 5 the frequency band width of the STK-626DM series products. the upper limit of the -3 dB band width is 2 MHz.

11.Step response time of STK-626D-XXMFBX

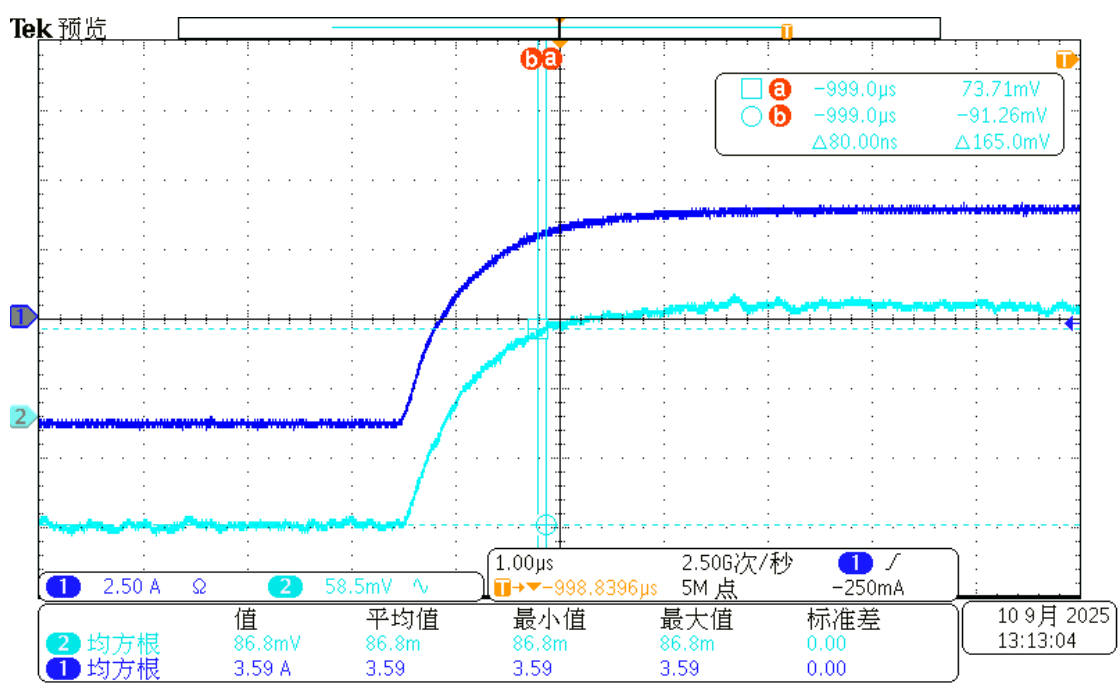


Figure 6 the typical high frequency response of STK-626DM current sensor. The response time from 90% of the primary current to 90% of the secondary output is 80 ns.

12.The delay time of the Triangular wave

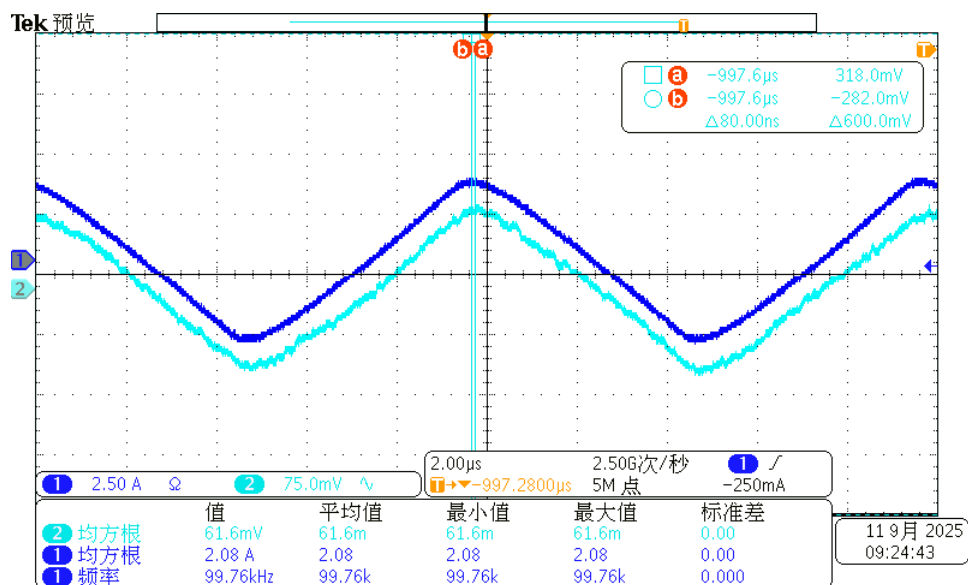


Figure 7 the typical triangular response curve of the STK-626DM current sensor at a frequency of 100 kHz. From primary current input to secondary current output, the response time is 80 ns.

13. Typical Application of STK-626DMF

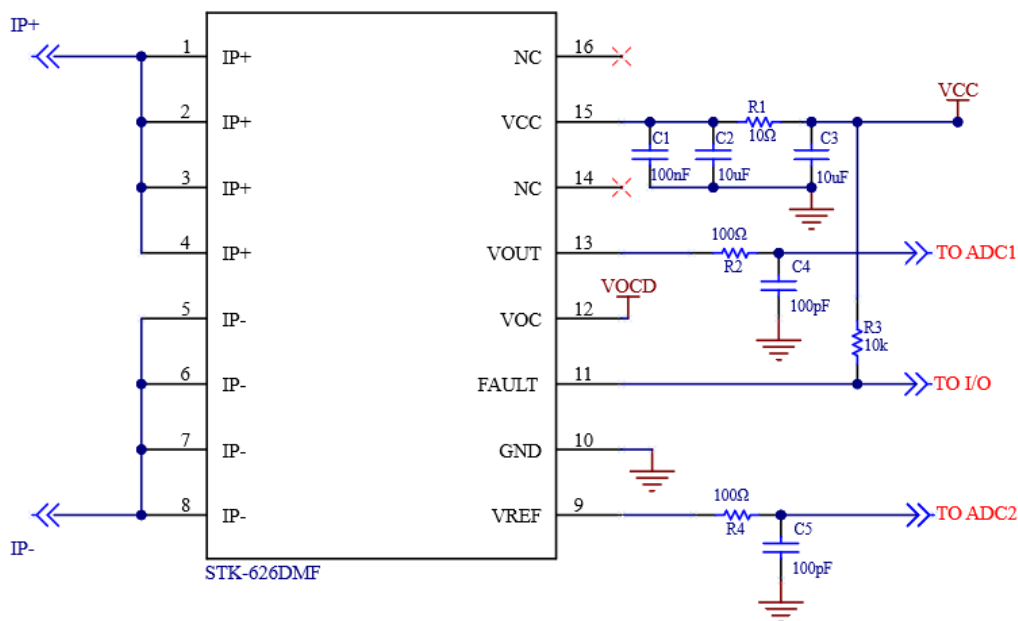


Figure 8 the reference application circuit for the STK-626DM series products.

Remark 3: R3 = 10 kΩ, recommended C4 = 100 pF, C2 = 10 μF, C3 = 10 μF, C5 = 10 μF. 100 pF of C4 does not affect the response speed of the chip. R2 and C4 constitute RC filter circuit ($f \approx 1 / (2\pi RC)$). The bandwidth of the STK-626DMF is 2 MHz, and RC filter circuit above 2 MHz cannot realize a bandwidth above 2 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 100nf.

Remark 4: 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.

14.Examples of OCD function

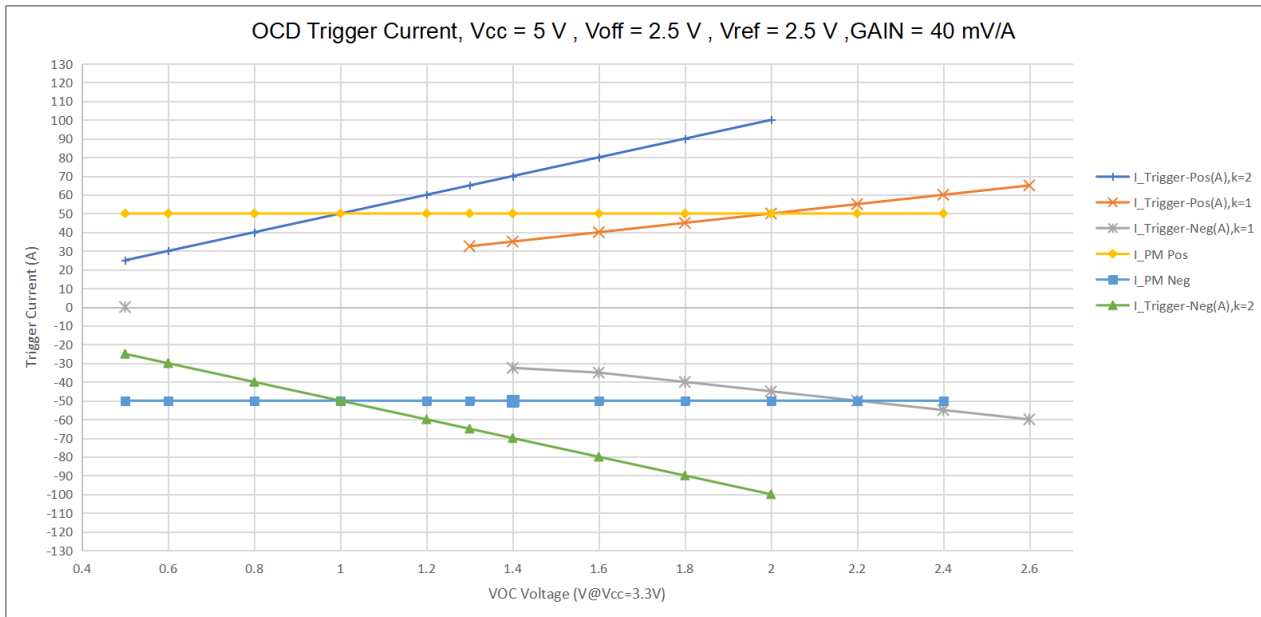


Figure 9 the relationship of trigger current and VOC setting for the STK-626D-50MFB5, with $V_{cc} = 5\text{ V}$. $I_{trigger_pos}$ represents the forward over-current protection trigger current. $I_{trigger_neg}$ represents the negative over-current protection trigger current. I_{PN_pos} represents 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.

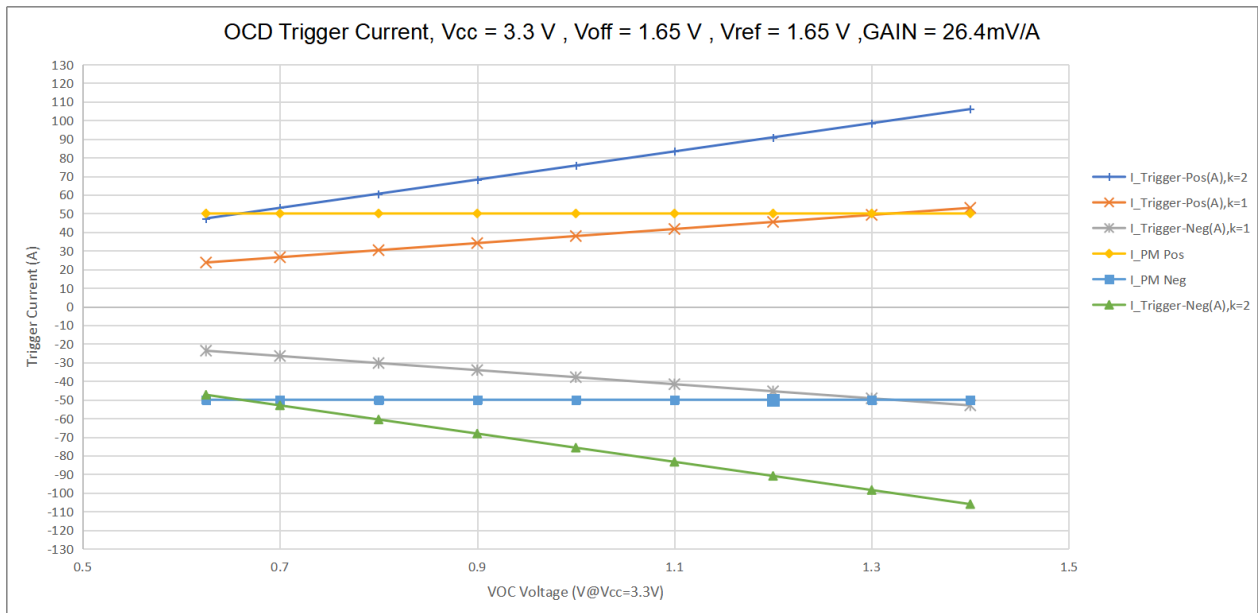


Figure 10 the relationship of trigger current and VOC setting for the STK-626D-50MFB3, with $V_{cc} = 3.3\text{ V}$. $I_{trigger_pos}$ represents the forward over-current protection trigger current. $I_{trigger_neg}$ represents the negative over-current protection trigger current. I_{PN_pos} represents 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. 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) $V_{ref} = 2.5\text{ V}, K=1$
 - ①. $1.3\text{ V} \leq V_{OC} \leq 2.6\text{ V};$
 - ②. Trigger voltage = $V_{ref} \pm V_{OC};$
 - ③. Trigger current = $(V_{ref} \pm V_{OC} - V_{off}) / G_{th};$
- b) $V_{ref} = 1.65\text{ V}, K=1$
 - ①. $0.625\text{ V} \leq V_{OC} \leq 1.4\text{ V};$
 - ②. Trigger voltage = $V_{ref} \pm V_{OC};$
 - ③. Trigger current = $(V_{ref} \pm V_{OC} - V_{off}) / G_{th};$
- c) $V_{ref} = 2.5\text{ V}, K=2$
 - ①. $0.5\text{ V} \leq V_{OC} \leq 2\text{ V};$
 - ②. Trigger voltage = $V_{ref} \pm K \cdot V_{OC};$
 - ③. Trigger current = $(V_{ref} \pm K \cdot V_{OC} - V_{off}) / G_{th};$
- d) $V_{ref} = 1.65\text{ V}, K=2$
 - ①. $0.625\text{ V} \leq V_{OC} \leq 1.4\text{ V};$
 - ②. Trigger voltage = $V_{ref} \pm K \cdot V_{OC};$
 - ③. Trigger current = $(V_{ref} \pm K \cdot V_{OC} - V_{off}) / G_{th};$

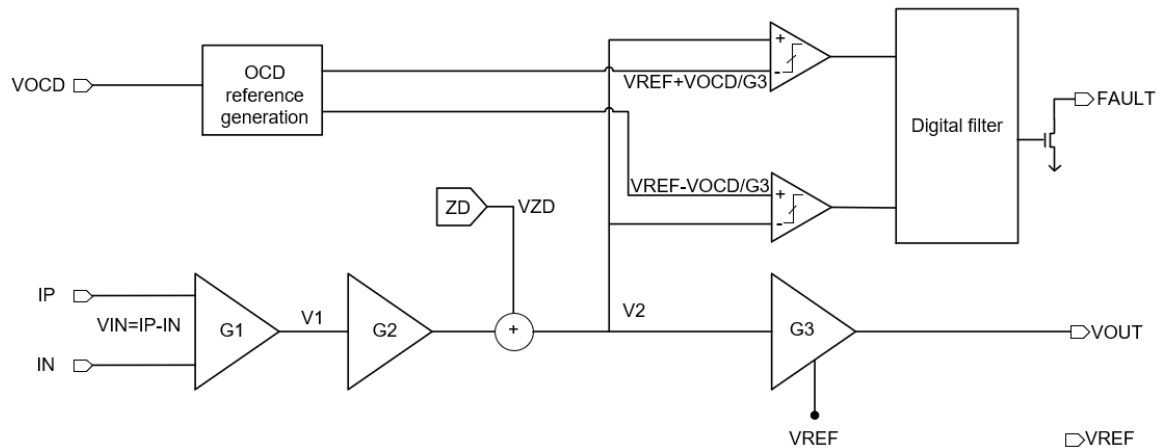


Figure 11 the functional block diagram for STK-626DM on OCD function with conditions of $V_{cc} = 5\text{ V}$, $V_{off} = 2.5\text{ V}$, $V_{ref} = 2.5\text{ V}$.

16.PACKAGE MATERIALS INFORMATION

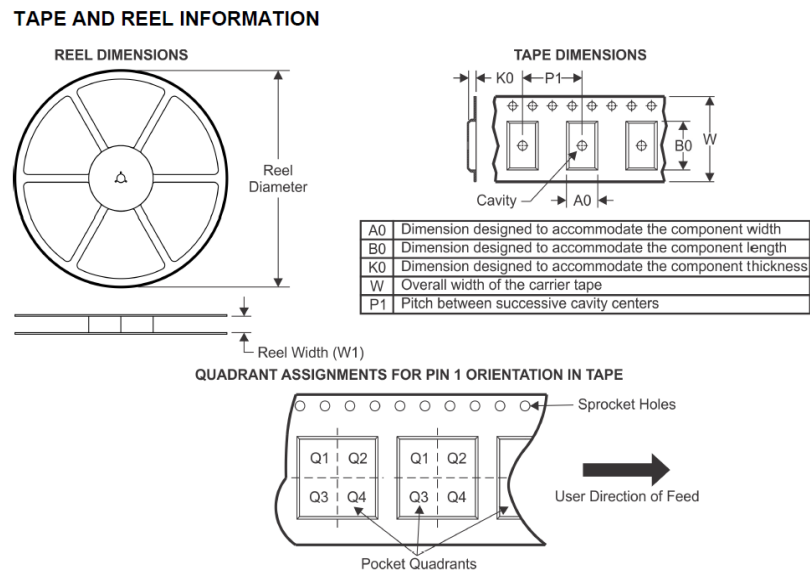


Figure 12 package materials information.