FSD7559-B 系列板载式、高精度电流传感器

产品概述/Product overview

FSD7559-B 系列电流传感器，基于 TMR 隧道磁阻 闭环原理。原 / 副边电路之间电气绝缘，可以测量直流、 交流和脉冲电流。

FSD7559-B series current sensor based on TMR tunnel reluctance closed-loop principle. The electrical insulation between the primary and secondary circuits can measure DC, AC and pulse current.

产品特性/Product characteristics

- 高精度/High precision
- 优异的线性度/Excellent linearity
- 低温度漂移/Low temperature drift
- 快速响应时间/Fast response time
- 耐压隔离性能强/High voltage isolation performance
- 符合 RoHS & REACH/RoHS & REACH compliant

典型应用/Typical application

- 太阳能逆变器/Solar inverter
- 直流发电机/Dc generator
- 不间断电源(UPS)/Uninterruptible Power Supply (UPS)
- 开关电源(SMPS)/Switching Power Supply (SMPS)
- 变频转换器(VFD)/Variable Frequency Converter (VFD)

产品选型表/Product selection table

型号 Type	额定测量电流 Rated measuring current	测量电流范围 Measuring range
FSD7559-1000B	100 A	±300 A
FSD7559-1500B	150 A	±450 A
FSD7559-2000B	200 A	±500 A
FSD7559-2500B	250 A	±500 A

安规及环境参数/Safety and environmental parameters

参数 parameter	符号 Symbol	典型值 Typical value	单位 Unit
绝缘强度 Insulation strength	V_D	4	kV(50 Hz, 1 min)
绝缘电阻 Insulation resistance	R_{IS}	1000	MΩ
爬电距离 Creepage distance	d_{CP}	22	mm
电气间隙 Electrical clearance	d_{CL}	14.5	mm
使用温度 Operating temperature	T_A	-40 ~ +85	° C
储存温度 Storage temperature	T_{STG}	-50 ~ +105	° C
质量 Mass	m	60	g

性能参数/Performance parameter

除特殊说明外 T_A = +25 °C, V_{CC} = 5 V, R_L = 10 kΩ

T_A = +25 °C, V_{CC} = 5 V, R_L = 10 kΩ unless otherwise specified

参数 Parameter	符号 Symbol	条件 Conditions		最小值 Minimum value	典型值 Typical value	最大值 Maximum value	单位 Unit
常规指标Conventional index							
额定输入电流 Rated input current	I_{PN}	FSD7559-1000B		-	100	-	A
		FSD7559-1500B		-	150	-	
		FSD7559-2000B		-	200	-	
		FSD7559-2500B		-	250	-	
测量电流范围 Measuring range	I_{PM}	FSD7559-1000B		-300	-	300	A
		FSD7559-1500B		-450	-	450	
		FSD7559-2000B		-500	-	500	
		FSD7559-2500B		-500	-	500	
灵敏度 sensitivity	S	I_P = 0 ~ ±I_{PN}	FSD7559-1000B	-	6.25	-	mV/A
			FSD7559-1500B	-	4.167	-	
			FSD7559-2000B	-	3.125	-	
			FSD7559-2500B	-	2.7	-	
电源电压 Supply voltage	V_{CC}	±5 %		-	5	-	V

基准输出电压 Reference output voltage	V_{REF}	-	2.485	2.5	2.515	V
零点偏置电压 Zero bias voltage	V_{OFF}	-	-	2.5	-	V
输出电压 Output voltage	V_{OUT}	$I_P = 0 \sim \pm I_{PM}$	-	$V_{OFF} + S \times I_P$	-	V
电流消耗 Current consumption	I_C	$I_P = 0$	-	16	-	mA
静态指标Static index						
基本误差 Basic error	X_G	$I_P = 0 \sim \pm I_{PN}$	-	±0.8	-	% I_{PN}
		T_A = 85 ℃, $I_P = 0 \sim \pm I_{PN}$	-	±1.4	-	
线性度 linearity	ε_L	$I_P = 0 \sim \pm I_{PN}$	-	±0.15	-	% I_{PN}
增益对称性 Gain symmetry	ε_{SYM}	T_A = -40 ℃ ~ +85 ℃, $I_P = 0 \sim \pm I_{PN}$	99	100	101	%
零点失调电压 Zero offset voltage	V_{OE}	T_A = +25 ℃, $I_P = 0$	-	-	5	mV
动态指标Dynamic index						
响应时间 Response time	t_R	di/dt > 50 A/μs, 10% to 90% of I_{PN}	-	1	-	μs
频带宽度 Band width	BW	-3 dB	DC	300	-	kHz

典型输出特性曲线/Typical output characteristic curve

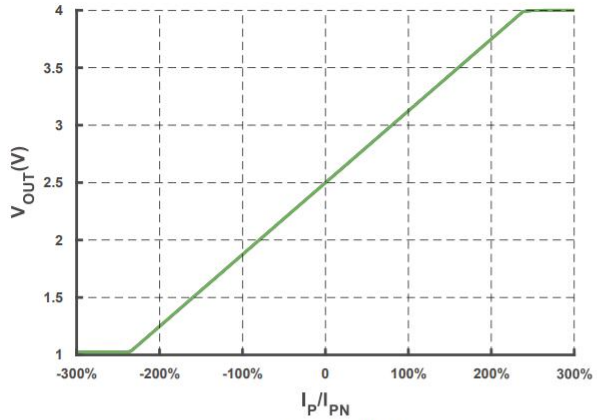

图 1 输出特性曲线

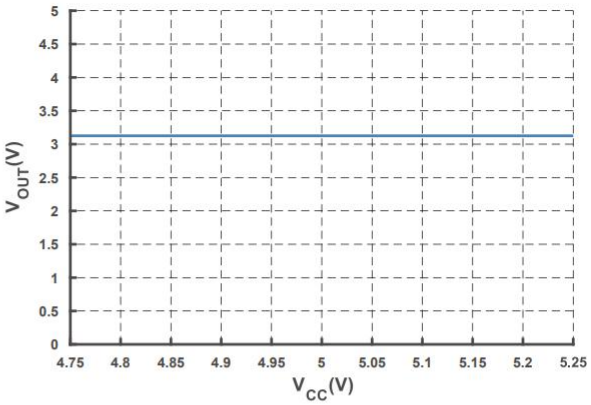

图 2 输出特性与供电电压曲线（@$I_P = I_{PN}$）

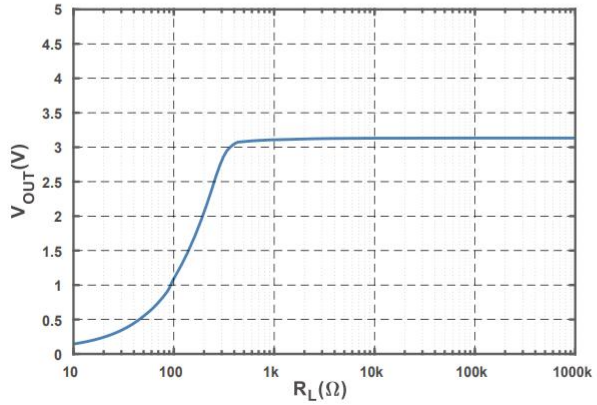

图 3 负载电阻特性曲线（@$I_P = I_{PN}$）

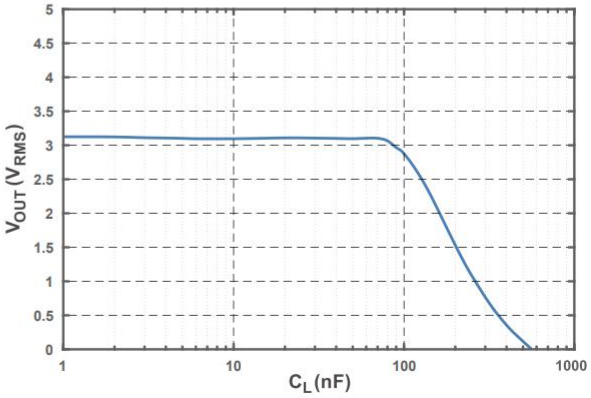

图 4 负载电容特性曲线（@$I_P = I_{PN}$）

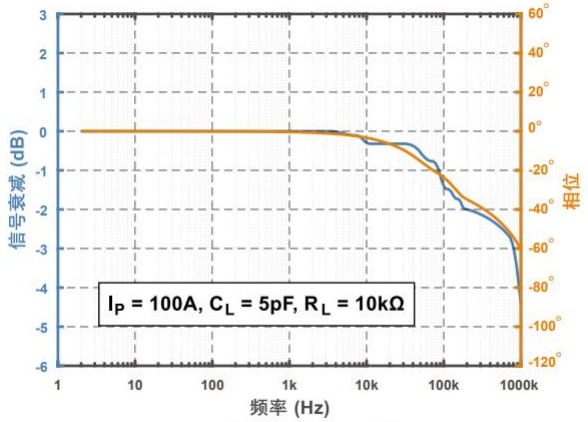

图 5 频响特性曲线

温度特性曲线/Temperature characteristic curve

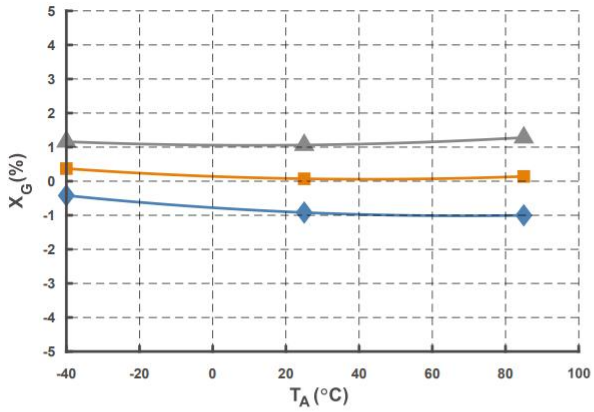

图 6 基本误差曲线

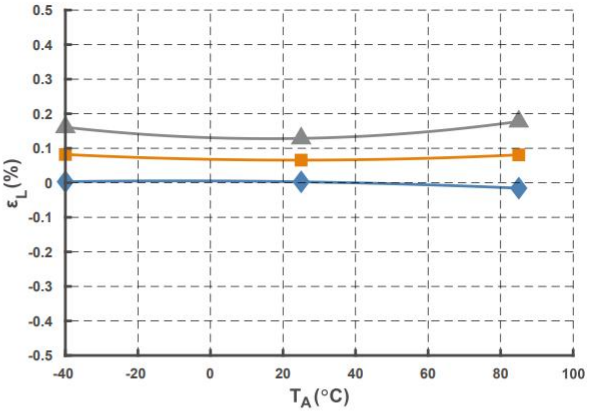

图 7 线性度曲线

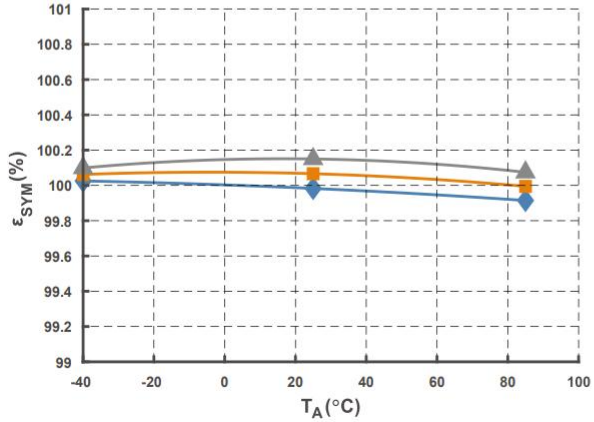

图 8 增益对称性曲线

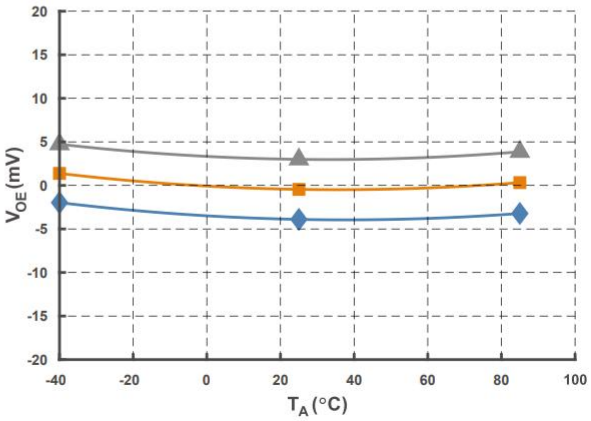

图 9 零点失调电压曲线

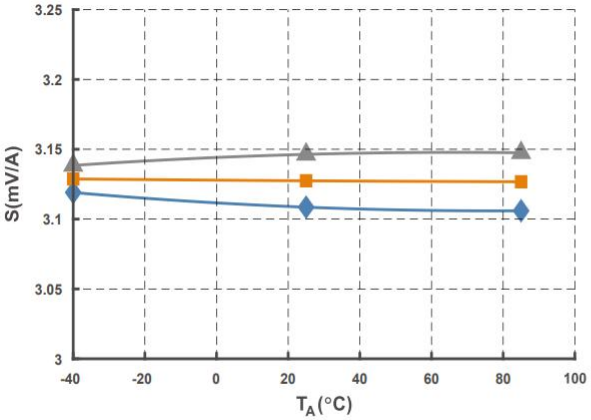

图 10 灵敏度曲线

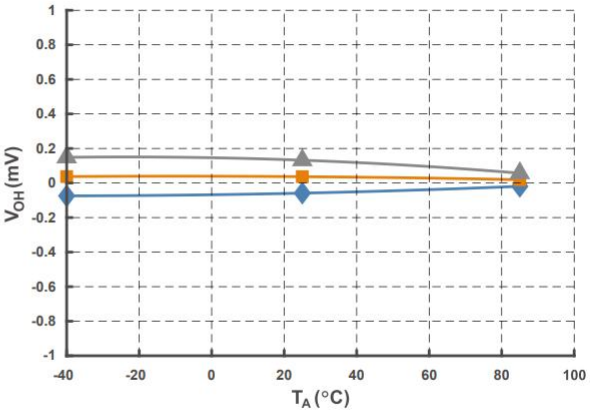

图 11 磁滞特性曲线

参数定义及计算公式/Parameter definition and calculation formula

1) 输出电压/Output voltage

$$V_{OUT} = V_{OFF} + S \times I_P$$

式中，V_{OFF} 为传感器零点偏置电压，S为传感器灵敏度，I_P为传感器原边输入待测电流，V_{OUT} 为原边输入电流I_P 时传感器输出。

Where, V_{OFF} is the zero-bias voltage of the sensor, S is the sensitivity of the sensor, I_P is the input current to be measured on the primary side of the sensor, and V_{OUT} is the output of the sensor when the input current I_P on the primary side is used.

2) 基本误差/Basic error

$$X_G = \underset{I_P \in [-I_{PN}, I_{PN}]}{MAX} \left(\frac{(V_{OUT} - V_{REF}) - (S \times I_P)}{S \times I_{PN}} \times 100\% \right)$$

式中， I_{PN} 为额定输入电流。

Where I_{PN} is the rated input current.

3) 灵敏度/sensitivity

$$S = \frac{V_{OUT(@\ I_{PN})} - V_{OUT(@\ -I_{PN})}}{2 \times I_{PN}}$$

式中， $V_{OUT}(@\ I_{PN})$ 、 $V_{OUT}(@-I_{PN})$ 分别为原边输入电流为 I_{PN} 、 $-I_{PN}$ 时传感器的输出。

Where, $V_{OUT}(@I_{PN})$ and $V_{OUT}(@-I_{PN})$ are respectively the output of the sensor when the input current on the primary side is I_{PN} and $-I_{PN}$.

4) 线性度/linearity

$$\varepsilon_L = \underset{I_P \in [-I_{PN}, I_{PN}]}{MAX} \left(\frac{(V_{OUT} - V_{REF}) - (\bar{V}_{OE} + \bar{S} \times I_P)}{S \times I_{PN}} \times 100\% \right)$$

式中，$\bar{S}$ 、 $\bar{V}_{OE}$ 分别为传感器实际多次测量的平均灵敏度和零点失调电压。

In the formula, $\bar{S}$ and $\bar{V}_{OE}$ are respectively the average sensitivity and zero offset voltage of the actual multiple measurements of the sensor.

5) 增益对称度/Gain symmetry

$$\varepsilon_{SYM} = \left| \frac{V_{OUT(@\ I_{PN})} - \bar{V}_{OFF}}{V_{OUT(@\ -I_{PN})} - \bar{V}_{OFF}} \right| \times 100\%$$

6) 磁滞/hysteresis

$V_{OH} = MAX\ \Delta H$

式中， ΔH 为同一输入电流 I_P 时传感器在上、下行程实际输出的差值。

Where ΔH is the difference between the actual output of the sensor in the upper and lower stroke when the same input current I_P is used.

7) 零点失调电压/Zero offset voltage

$$V_{OE} = V_{OUT\ (@\ IP\ =\ 0)} - V_{REF}$$

外形尺寸/Overall dimension

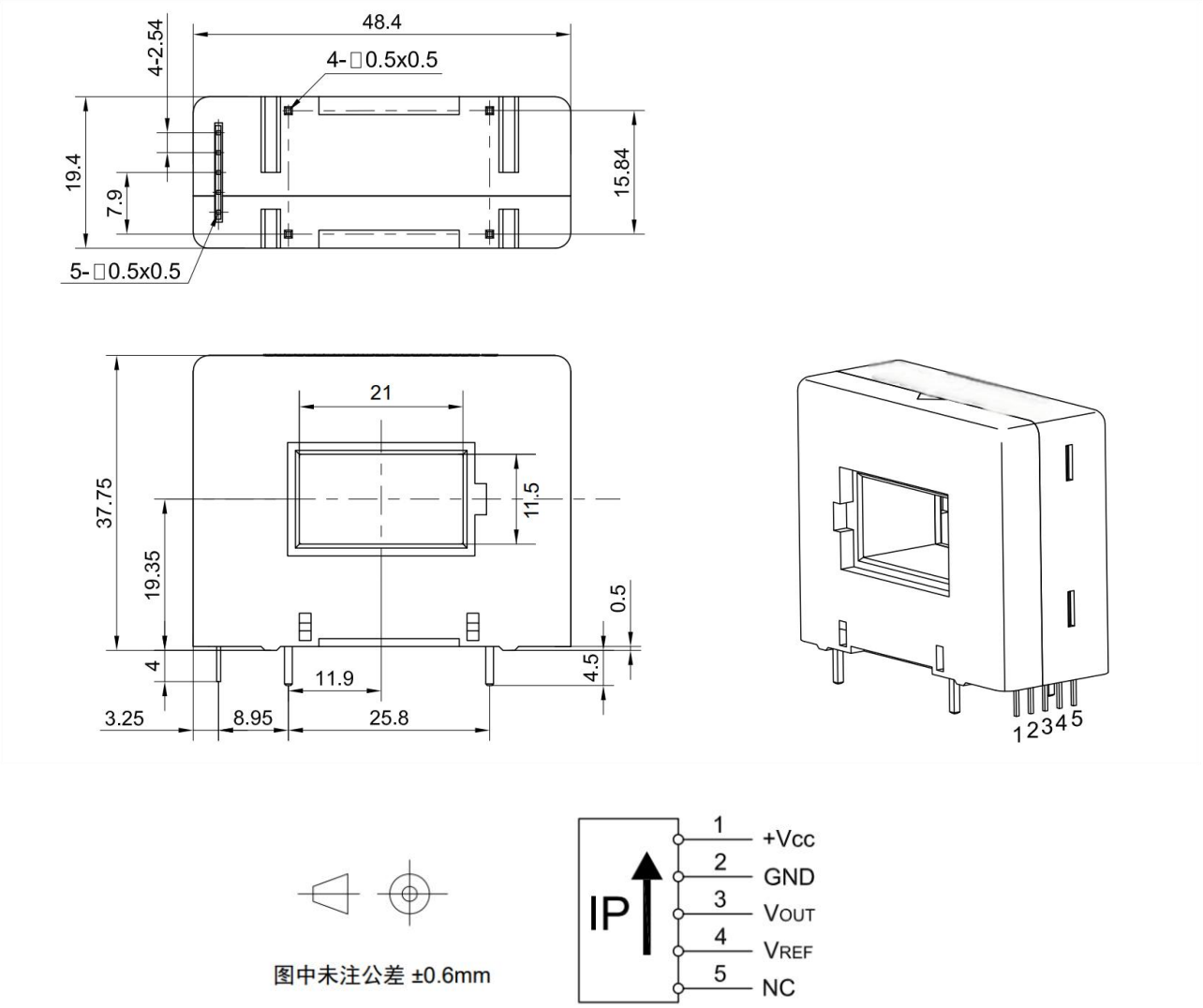

图 12 外形尺寸图（尺寸单位：mm）/Figure 12 Overall dimensions (size unit: mm)

FSD7559 使用说明/Instructions

1) 当原边电流（I_p）方向沿产品打标处箭头方向流动时，V_{OUT} 为正向，反之则为负向；

When the primary current (I_p) direction flows along the arrow direction of the product marking,

V_{OUT} is positive; otherwise, it is negative.

2) 错误接线可能导致传感器损坏；

Incorrect wiring may cause sensor damage.

3) 当原边频率过高时，过大的容性负载可能导致传感器波形可能失真，具体请参考容性负载曲线；

When the primary side frequency is too high, excessive capacitive load may cause distortion of the sensor waveform. For details, refer to the capacitive load curve.

4) 推荐原边铜排充满原边中心穿孔，此时动态表现（di/dt 和响应时间）为最佳；

The dynamic performance (di/dt and response time) is the best when the primary copper bar is full of primary center perforation.

5) 可根据客户需求定制传感器。

Sensors can be customized according to customer needs.