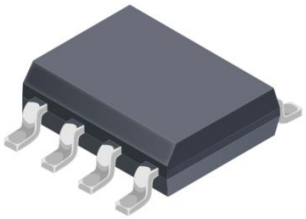
MCS06K Current Sensor Specifications

MCS series current sensors are applicable to all markets, including AC in automotive, industrial, commercial and communication system applications. DC current detection provides a solution with smaller size and higher cost performance, and can provide multiple output modes.

Dominant characteristics:

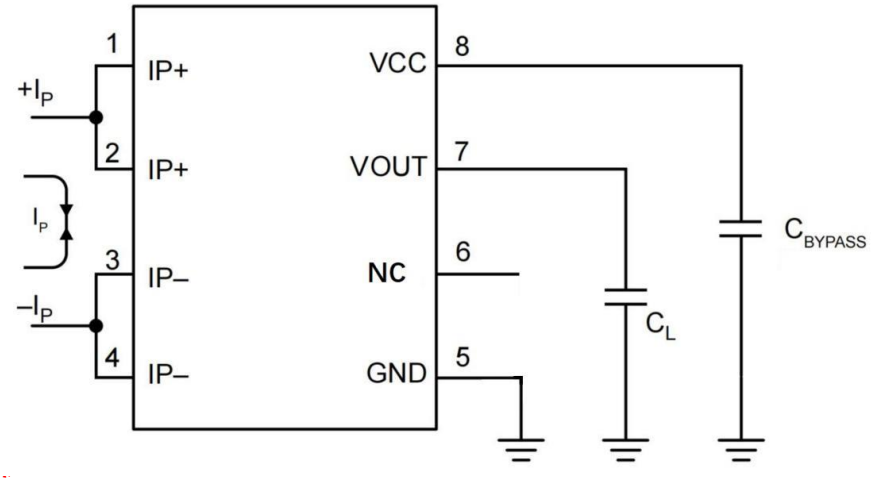


- Open loop current sensor based on Hall induction principle
- Single power supply 5V power supply
- Support one-way or two-way output
- Analog signal output
- The measuring current range of the primary side can be from ± 5A to ± 50A
- Sensor operating temperature range: - 40 ℃ to+125 ℃
- Zero point output voltage:
- -XR: Offset QVO and power supply V_{CC} are output in equal proportion, and gain Gain is fixed $V_{QVO}=V_{CC}/2$ or $V_{CC}/10$
- -XF: bias QVO and gain Gain are fixed $V_{QVO}=2.50$ or 0.50
- Good precision, linearity and temperature drift
- Low internal resistance, which can effectively control heating power consumption

Product application:

- EV/HEV motor controller
- Frequency converter
- DC/DC

Pin definition:

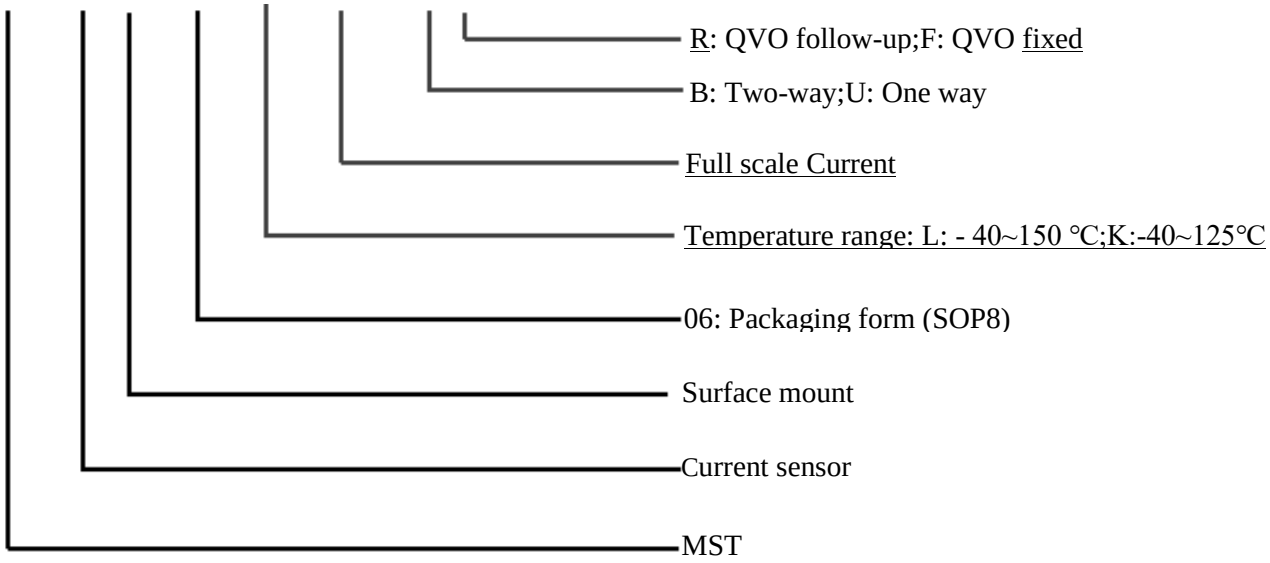


C_{BYPASS} The capacitance needs to be placed close to the V_{CC} sensor

C_{BYPASS} The capacitance needs to be placed close to the V_{OUT} sensor

Naming rules:

M C S xx x - xxx x x



Ordering information:

Model	Zero point voltage VOUT(Q)(V)	Primary current range I_P(A)	Sensitivity Sens(Type.) (mV/A)	T_A (℃)	MPQ (PCS)
MCS06K-010BR	V_{CC}/2	±10	200	-40~125	1000
MCS06K-020BR	V_{CC}/2	±20	100	-40~125	1000
MCS06K-030BR	V_{CC}/2	±30	66.7	-40~125	1000
MCS06K-050BR	V_{CC}/2	±50	40	-40~125	1000
MCS06K-010BF	2.5	±10	200	-40~125	1000
MCS06K-020BF	2.5	±20	100	-40~125	1000
MCS06K-030BF	2.5	±30	66.7	-40~125	1000
MCS06K-050BF	2.5	±50	40	-40~125	1000
MCS06K-020UR	V_{CC}/10	20	200	-40~125	1000
MCS06K-030UR	V_{CC}/10	30	133.3	-40~125	1000
MCS06K-050UR	V_{CC}/10	50	80	-40~125	1000
MCS06K-020UF	0.5	20	200	-40~125	1000
MCS06K-030UF	0.5	30	133.3	-40~125	1000
MCS06K-050UF	0.5	50	80	-40~125	1000

**For currents beyond the standard current specification, please contact the factory*

Maximum rated parameters

Characteristic	Symbol	Rating	Unit
Supply voltage	V_{CC}	-0.3 to 6.5	V
Power supply current	I_{CC}	18	but
output voltage	V_{OUT}	0.15 to VCC-0.15	V
Output current	I_{OUT}	±40	but
working temperature	T_A	-40 to 125	℃
Maximum junction temperature	T_J	165	℃
Storage temperature	T_S	-40 to 150	℃

General Electric parameters

V_{CC}= 5.0V dc operating parameters (unless otherwise specified), T_A Within the specified temperature range.

Parameter	Symbol	Condition		Min	Type.	Max	Unit
Supply voltage	V_{CC}			4.5	5	5.5	V
Power supply current	I_{CC}	RL ≥ 10KΩ			13	18	mA
Power on delay	T_{PO}	TA=25℃, CL =100pF, B=0mT			80		uS
QVO follow-up error (-R)	Er			-0.3		0.3	%
Output voltage range @ I_P	V_{OUT}-V_{QVO}	MCS06K-xxxBR	TA = 25℃	±2			V
		MCS06K-xxxBF					
		MCS06K-xxxUR		4			
		MCS06K-xxxUF					
Zero current output	V_{QVO}	MCS06K-xxxBR	TA = 25℃	V_{CC}/2			V
		MCS06K-xxxBF		2.50			
		MCS06K-xxxUR		V_{CC}/10			
		MCS06K-xxxUF		0.50			
Load resistance	R_L	V_{OUT} to V_{CC} or GND		10			KΩ
Load capacitance	C_L	V_{OUT} TO GND			1		nF
Response time	$t_{RESPONSE}$	TA=25 ℃, CL=100pF, IP step=50% of IP+, 90% input to 90% output			2		uS
Bandwidth	BW	Small signal – 3dB, CL=1nF, TA=25 ℃			200		KHz
ESD	V_{ESD}				4		KV
Power supply terminal capacitance	C_{BYPASS}	V_{CC} TO GND			0.1		uF

Isolation characteristics

Characteristic	Symbol	Notes	Rating	Unit
Dielectric strength test voltage*1	V_{ISO}	According to the second version of UL standard 60950-1, the Agency type test lasted for 60 seconds	2400	VAC
Working voltage (basic insulation)	V_{WVBI}	Basic (single) isolation according to UL standard 60950-1, second edition	420	VDC or Vpk
			297	Vrms
Electrical distance	D_{CL}	Minimum distance from IP pin to signal pin (air)	4.2	mm
Creepage distance	D_{CR}	Minimum distance from IP pin to signal pin (plastic package)	4.2	mm

**1: The 60 second test is only used for UL test;In production, it is tested according to UL60950-1 version 2.*

MCS06K-010BR (BF) Performance parameter

V_{CC}= 5.0V dc operating parameters (unless otherwise specified), T_A=- 40 ℃~125 ℃

Parameter	Symbol	Condition	Min	Type.	Max	Unit
Nominal parameters						
Measuring range of primary current	I_P		-10		10	A
Sensor sensitivity	$Sens_{TA}$	@V_{CC}=5.0V		200		mV/A
Precision parameters						
Sensitivity error	E_{Sens}	@T_A=25℃; V_{CC}=5.0V	-6		6	%
Zero point electric offset voltage	V_{OE}	I_P=0A, T_A=25℃	-50		50	mV
Linearity error	Lin_{ERR}	Of full rang		±1.5		%
Total output error	$E_{TOT(HT)}$	Full scale of I_P, T_A=25℃		±2		%
	$E_{TOT(LT)}$	Full scale of IP, T_A=-40℃~125℃	-7		7	%

MCS06K-020BR (BF) performance parameter

V_{CC}= 5.0V dc operating parameters (unless otherwise specified), T_A=- 40 ℃~125 ℃

Parameter	Symbol	Condition	Min	Type.	Max	Unit
Nominal parameters						
Measuring range of primary current	I_P		-20		20	A
Sensor sensitivity	$Sens_{TA}$	@VCC=5.0V		100		mV/A
Precision parameters						
Sensitivity error	Esens	@T_A=25℃;V_{CC}=5.0V	-5		5	%
Zero point electric offset voltage	V_{OE}	I_P=0A, T_A=25℃	-40		40	mV
Linearity error	Lin_{ERR}	Of full rang		±1.5		%
Total output error	$E_{TOT(HT)}$	Full scale of I_P, T_A=25℃		±2		%
	$E_{TOT(LT)}$	Full scale of I_P, T_A=–40℃~125℃	-6		6	%

MCS06K-030BR (BF) performance parameter

V_{CC}=5.0V dc operating parameters (unless otherwise specified), T_A=- 40 ℃~125 ℃

Parameter	Symbol	Condition	Min	Type.	Max	Unit
Nominal parameters						
Measuring range of primary current	I_P		-30		30	A
Sensor sensitivity	$Sens_{TA}$	@V_{CC}=5.0V		66.7		mV/A
Precision parameters						
Sensitivity error	E_{Sens}	@T_A=25℃;V_{CC}=5.0V	-5		5	%
Zero point electric offset voltage	V_{OE}	I_P=0A,T_A=25℃	-40		40	mV
Linearity error	Lin_{ERR}	Of full rang		±1.5		%
Total output error	$E_{TOT(HT)}$	Full scale of I_P, T_A=25℃		±2		%
	$E_{TOT(LT)}$	Full scale of I_P, T_A=–40℃~125℃	-6		6	%

MCS06K-050BR (BF) performance parameter

V_{CC}= 5.0V dc operating parameters (unless otherwise specified), T_A=- 40 ℃~125 ℃

Parameter	Symbol	Condition	Min	Type.	Max	Unit
Nominal parameters						
Measuring range of primary current	I_P		-50		50	A
Sensor sensitivity	$Sens_{TA}$	@V_{CC}=5.0V		40		mV/A
Precision parameters						
Sensitivity error	E_{Sens}	@T_A=25℃;V_{CC}=5.0V	-6		6	%
Zero point electric offset voltage	V_{OE}	I_P=0A,T_A=25℃	-40		40	mV
Linearity error	Lin_{ERR}	Of full rang		±1.5		%
Total output error	$E_{TOT(HT)}$	Full scale of I_P, T_A=25℃		±2		%
	$E_{TOT(LT)}$	Full scale of I_P, T_A=–40℃~125℃		±6		%

MCS06K-020UR (UF) performance parameter

V_{CC}= 5.0V dc operating parameters (unless otherwise specified), T_A=- 40 ℃~125 ℃

Parameter	Symbol	Condition	Min	Type.	Max	Unit
Nominal parameters						
Measuring range of primary current	I_P		0		20	A
Sensor sensitivity	$Sens_{TA}$	@V_{CC}=5.0V		200		mV/A
Precision parameters						
Sensitivity error	E_{Sens}	@T_A=25℃; V_{CC}=5.0V	-6		6	%
Zero point electric offset voltage	V_{OE}	I_P=0A, T_A=25℃	-50		50	mV
Linearity error	Lin_{ERR}	Of full rang		±1.5		%
Total output error	$E_{TOT(HT)}$	Full scale of I_P, T_A=25℃		±2		%
	$E_{TOT(LT)}$	Full scale of I_P, T_A=–40℃~125℃	-7		7	%

MCS06K-030UR (UF) performance parameter

V_{CC}= 5.0V dc operating parameters (unless otherwise specified), T_A=- 40 ℃~125 ℃

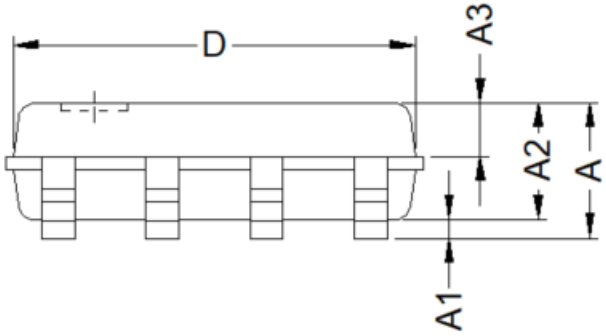
Parameter	Symbol	Condition	Min	Type.	Max	Unit
Nominal parameters						
Measuring range of primary current	I_P		0		30	A
Sensor sensitivity	$Sens_{TA}$	@V_{CC}=5.0V		133.3		mV/A
Precision parameters						
Sensitivity error	E_{Sens}	@T_A=25℃; V_{CC}=5.0V	-5		5	%
Zero point electric offset voltage	V_{OE}	I_P=0A, T_A=25℃	-40		40	mV
Linearity error	Lin_{ERR}	Of full rang		±1.5		%
Total output error	$E_{TOT(HT)}$	Full scale of I_P, T_A=25℃		±2		%
	$E_{TOT(LT)}$	Full scale of I_P, T_A=–40℃~125℃	-6		6	%

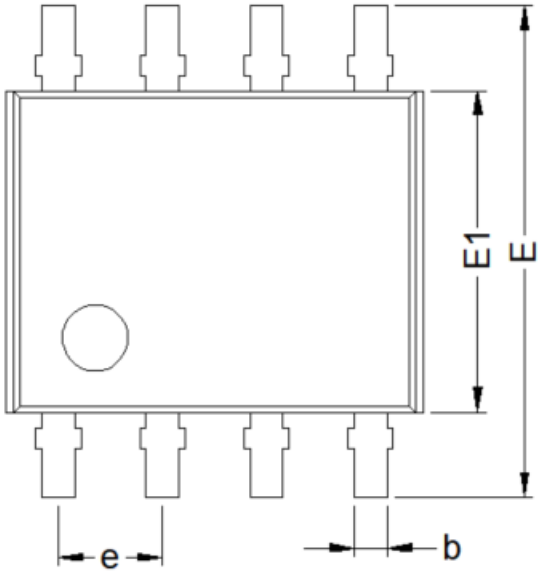
MCS06K-050UR (UF) performance parameter

VCC= 5.0V dc operating parameters (unless otherwise specified), T_A=- 40 ℃~125 ℃

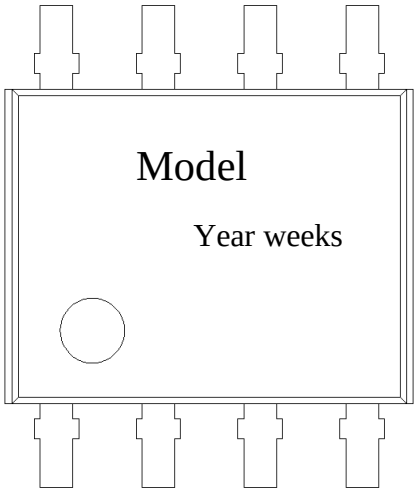
Parameter	Symbol	Condition	Min	Type.	Max	Unit
Nominal parameters						
Measuring range of primary current	I_P		0		50	A
Sensor sensitivity	$Sens_{TA}$	@V_{CC}=5.0V		80		mV/A
Precision parameters						
Sensitivity error	E_{Sens}	@T_A=25℃; V_{CC}=5.0V	-6		6	%
Zero point electric offset voltage	V_{OE}	I_P=0A, T_A=25℃	-40		40	mV
Linearity error	Lin_{ERR}	Of full rang		±1.5		%
Total output error	$E_{TOT(HT)}$	Full scale of I_P, T_A=25℃		±2		%
	$E_{TOT(LT)}$	Full scale of I_P, T_A=–40℃~125℃		±6		%

Package dimension drawing





SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	--	--	1.65
A1	0.10	--	0.25
A2	1.40	1.42	1.50
A3	0.60	0.65	0.70
b	0.33	--	0.47
c	0.20	--	0.24
D	4.80	4.90	5.00
E	5.90	6.00	6.20
E1	3.85	3.90	4.00
e	1.27 (BSC)		
L	0.50	0.60	0.70
L1	1.05 (BSC)		



Definition of performance parameters

- **Static output voltage (QVO):** sensor output voltage V_{QVO} in the state of no obvious magnetic field B =0G

  -TR: V_{QVO} and the supply voltage V_{CC} has a constant ratio; $\boldsymbol{V_{QVO} = V_{CC}/2}$ or $\boldsymbol{V_{QVO} = V_{CC}/10}$

  -TF: V_{QVO} doesn't follow the supply voltage V_{CC} within a certain range Change for change, $\boldsymbol{V_{QVO}}$**= 2.5**$\boldsymbol{V}$ or $\boldsymbol{V_{QVO}}$ = **0.5**$\boldsymbol{V}$

- **Sensitivity Sens:** Sens is the reference output straight line $\boldsymbol{V_{OUT} = V_{QVO} + 2 \times I_P/I_{P\_MAX}}$, refers to the change of the output as the current changes, and it's relationship with the current is as follows:$\boldsymbol{Sens = 2/I_{P\_MAX}}$.

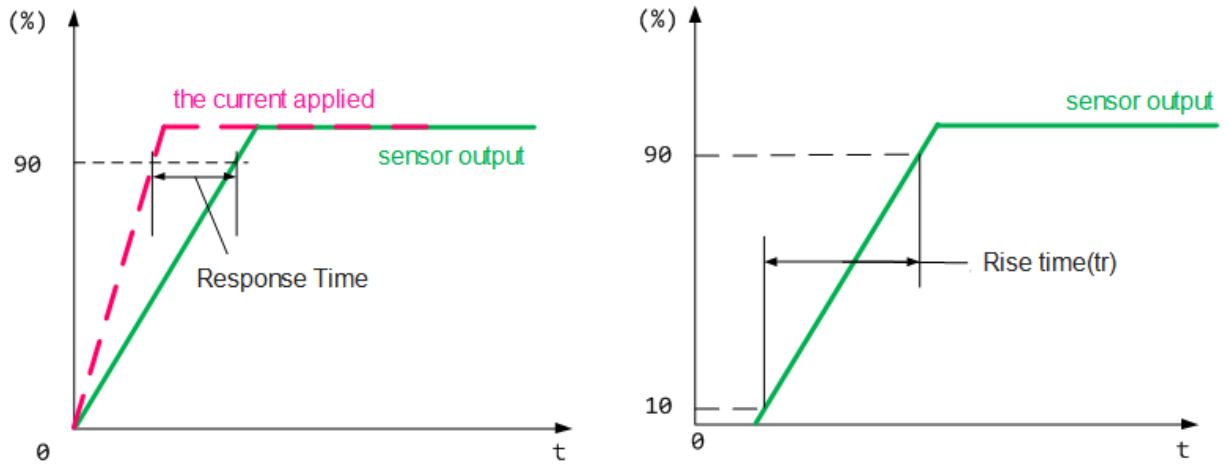
- **Offset with Temperature:** Due to tolerances, stresses and heat dissipation of internal components, zero Offset may occur at operating ambient Temperature.

- **Sensitivity with temperature:** Due to the internal temperature compensation factor, the Sensitivity will change over the entire operating temperature compared to what is expected at room temperature.

- **Offset voltage:** The offset voltage is the output voltage when the original edge current is zero. The ideal value is $\boldsymbol{V_{QVO} = V_{CC}/2}$**(Or 2.5V)**. As a result, the difference between V_{QVO} and the ideal value is called the total zero offset voltage error.This offset error can be attributed to the zero offset voltage (due to the QVO adjusted resolution within the ASIC), magnetic offset, temperature drift, and temperature induced hysteresis.

- **Response Time:** The response time of the sensor refers to the Time interval between the output of the sensor and the corresponding value of the applied current when the applied current reaches 90% of the final value

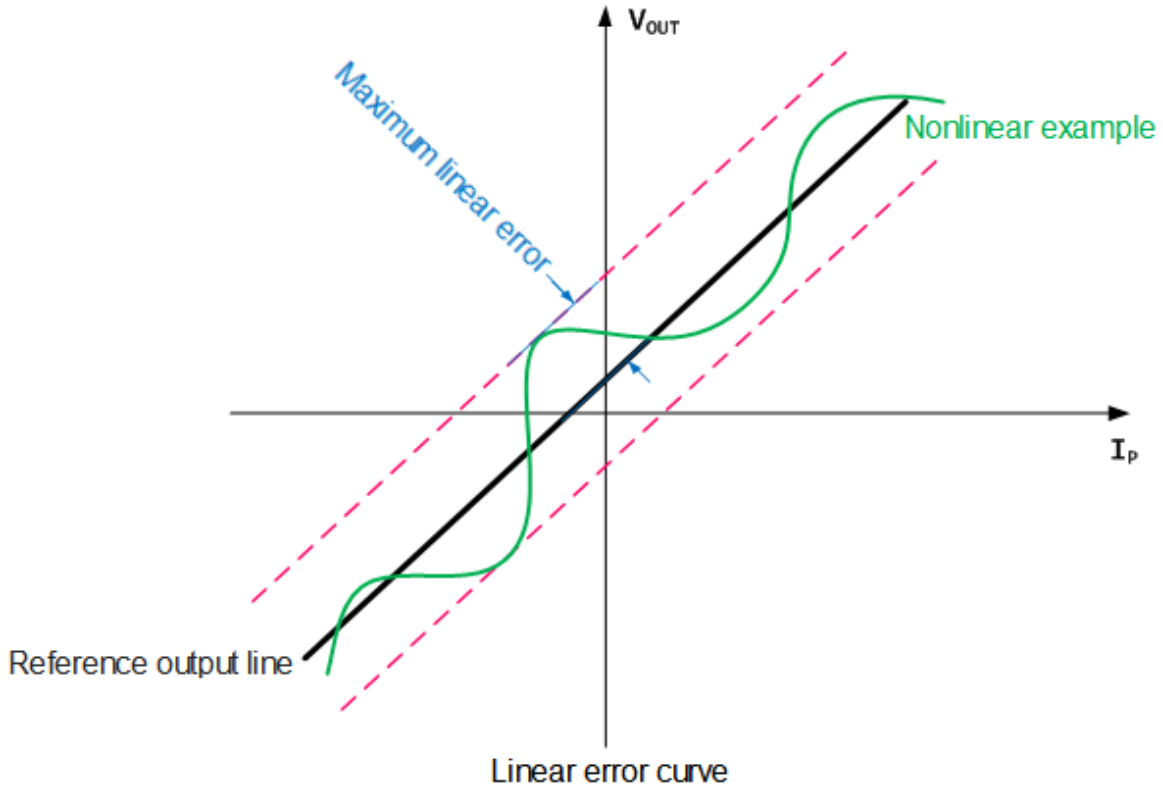
- **Rise time:** The rise time of the sensor refers to the time interval between 10% of the output of the sensor and the final 90%



- **QVO Ratiometricity Error:** When supply voltage V_{CC} goes from 5V to 4.75<V_{CC1} <5.25V, the deviation between the sensor's zero point output and the theoretical value is defined as follows:

$$\boldsymbol{E_r = \frac{V_{QVO(V_{CC1})}}{V_{QVO(5V)} - V_{CC1}/5} \times 100\%}$$

- **Linearity:**Contrast with the reference output line **(**-TR mode:$\boldsymbol{V_{OUT} = V_{CC}/2 + 2 \times I_P/I_{P\_MAX}}$-TF mode:$\boldsymbol{V_{OUT} = 2.5 + 2 \times I_P/I_{P\_MAX}}$**)**, the largest forward or reverse error



Notes:

1. Faulty wiring may cause damage to the sensor. After the sensor is connected to the 5V power supply, the measured current passes through the direction of the sensor arrow, and the corresponding voltage value can be measured at the output end.

2. BR mode: output voltage V_{OUT} is in direct proportion to supply voltage V_{CC}:$V_{OUT} = \boldsymbol{V_{CC}/2 + 2 \times I_P/I_{P\_MAX}}$. A change in the supply voltage will cause a change in V_{OUT}.
   For example: V_{CC} range 4.75V to 5.25V-The output range of static output voltage V_{QVO} under the corresponding 0A is 2.375V~2.625V, and the range of full range output($V_{OUT(IPMAX)}$) is 4.275V~4.725V.

3. BF mode: zero output voltage V_{QVO}=2.5V, the gain is fixed at 2V, the output curve is:$\boldsymbol{V_{OUT} = 2.5 + 2 \times I_P/I_{P\_MAX}}$;
   For example: V_{CC} range 4.75V to 5.25V-The static output voltage V_{QVO} under the corresponding 0A is 2.5V;and the output of full range($V_{OUT(IPMAX)}$) is constant at 4.5V.