CC6906 High-performance Hall-effect current sensor 50A/100A/150A/200A/300A

FEATURES

- Built-in VREF Output，External VREF Input:
  - Built-in VREF Output: V_{OE} is programmable to < 5mV
  - External VREF Input: V_{OUT} quiescent output voltage is consistent with it
- Measuring current range: 50A, 100A, 150A, 200A, 300A
- The overcurrent point VOC is user-set, with a low latency error alarm output xFAULT
- Low noise, single-ended analogue output
- Less power loss, internal conductor's resistance is 30uΩ
- High bandwidth, up to 250kHz, 1.2us output rise time in response to step input current
- 200V_{RMS} withstand isolation voltage between pins 8~9 and 1~7
- Room temperature error = 1%, Sensitivity Error up to ±2.5%
- Good temperature stability, using Hall signal amplification circuit and temperature compensation circuit
- Differential Hall structure, strong resistance to external magnetic interference
- Strong resistance to mechanical stress, magnetic parameters will not be offset by external pressure
- ESD (HBM) 4kV，ESD(CDM)1kV，LU 200mA

APPLCATIONS

- Motor Controller
- Load Monitoring System
- Switch-Mode Power Supplies
- Overcurrent Fault Protection
- PV and Energy Storage

GENERAL DESCRIPTION

The CC6906 device is a high-performance Hall-effect current sensor that can measure DC or AC current more efficiently, and has the advantages of high accuracy, excellent linearity and temperature stability in industrial, consumer, and communication equipment.

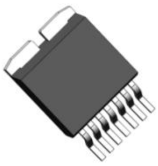
The CC6906 device consists of a high-precision, low-noise linear Hall integrated circuit and a low-resistance main current conductor. Ultra-low impedance conductor of 30uΩ leads minimize power loss and heat dissipation. The internal inherent insulation provides a 200 V_{RMS} isolation withstand voltage between the primary and secondary circuits. The sensor adopts linear Hall sensor temperature compensation technology, which has high temperature stability characteristics.

The differential common-mode suppression circuit integrated in CC6906 can make the chip output unaffected by external interference magnetic signals. The integrated dynamic offset elimination circuit makes the sensitivity of the chip independent of external stress and chip packaging stress.

Another advantage of the CC6906 is the fast fault monitoring function of the open-drain output, which is ideal for overcurrent fault detection. This feature is flexible in fault detection and greatly simplifies board application layout. Reference voltage (VREF) allows differential measurements as well as a reference voltage (VOC) for setting overcurrent fault thresholds

CC6906 is available in TO263-7 package. It's operating ambient temperature range is -40~125°C. Comply with RoHS requirements.

PRODUCT PACKAGE DRAWING



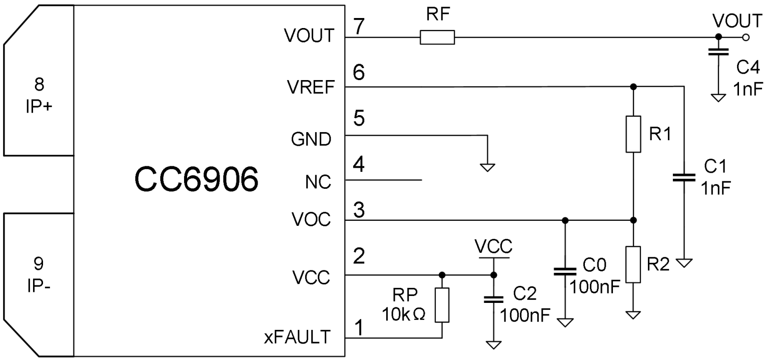
front view

back view

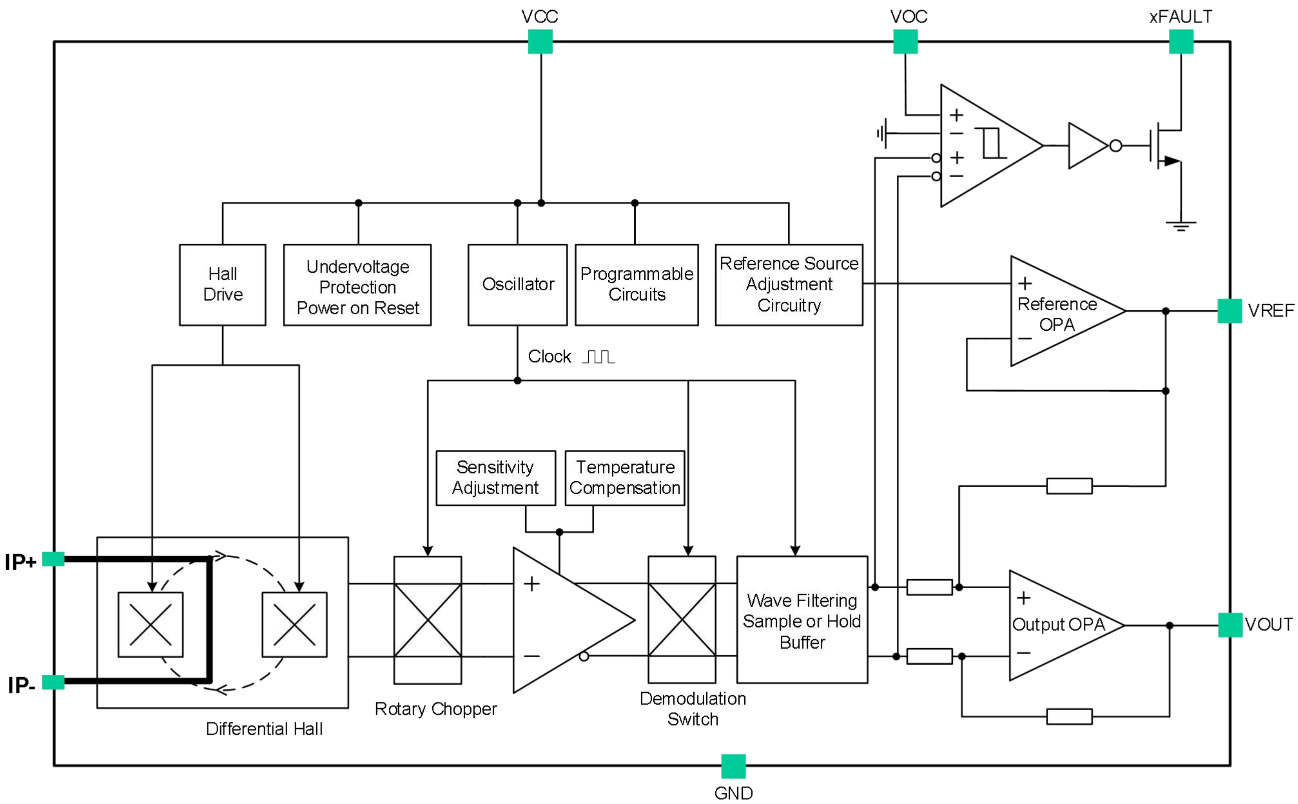
DEVICE INFORMATION

Part Number	Package	Body Size（TYP.）
CC6906T9	TO263-7	10.0mm×9.2mm

TYPICAL APPLICATION



FUNCTION BLOCK DIAGRAM



ORDERING INFORMATION

Part No.	SENS. (mV/A)	Package	Packing Form
CC6906T9-5FB050	40	TO263-7	tape reel, 800 pcs/reel
CC6906T9-5FB100	20	TO263-7	tape reel, 800 pcs/reel
CC6906T9-5FB150	13.33	TO263-7	tape reel, 800 pcs/reel
CC6906T9-5FB200	10	TO263-7	tape reel, 800 pcs/reel
CC6906T9-5FB300	6.67	TO263-7	tape reel, 800 pcs/reel
CC6906T9-3FB050	26.4	TO263-7	tape reel, 800 pcs/reel
CC6906T9-3FB100	13.2	TO263-7	tape reel, 800 pcs/reel
CC6906T9-3FB150	8.8	TO263-7	tape reel, 800 pcs/reel
CC6906T9-3FB200	6.6	TO263-7	tape reel, 800 pcs/reel
CC6906T9-3FB300	4.4	TO263-7	tape reel, 800 pcs/reel
CC6906T9-XXX (Note **1**)	-	TO263-7	tape reel, 800 pcs/reel

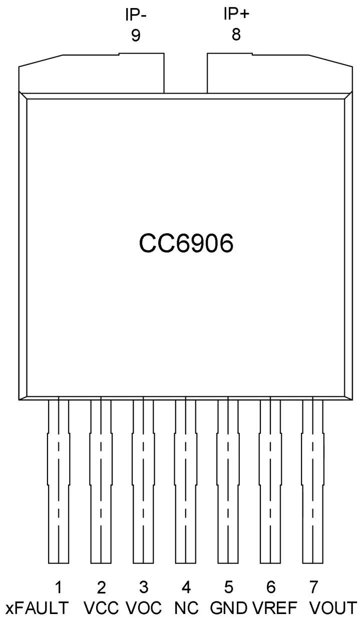
Note 1：When XXX is within the range of 300A, it can be customized according to customer needs.

PRODUCTION NAME DEFINITION:

CC 6906 T9 - 5 FB 050

- 050 → Current Range
  050: 50A current range
- FB → Output Type and Directionality
  F: Fixed output
  B: Bidirectional
- 5 → Supply Voltage
  5: VCC=5V
  3: VCC=3.3V
- T9 → Package Part Number
  T9: TO263-7
- 6906 → Main Device Name
  6906
- CC → CrossChip Part Number
  Fixed to CC

PINOUT DIAGRAM



TO263-7 Package

PIN Name	PIN NO.	Description
xFAULT	1	Overcurrent sign pin，Open-drain output (low active) connect a 10kΩ pull-up resistor to the 5V power supply； Ground is recommended when this function is not used
VDD	2	Supply voltage
VOC	3	Define the overcurrent fault threshold； Ground is recommended when this function is not used
NC	4	Hang in the air, no internal connection
GND	5	Ground
VREF	6	Reference input and output
VOUT	7	Analog voltage output
IP+	8	Current sampled +
IP-	9	Current sampled -

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Power Supply	V_{CC}	6.5	V
Output Voltage	V_{OUT}，V_{REF}，xFAULT	-0.3~V_{CC}+0.3	V
Input Voltage	V_{OC}	-0.3~V_{CC}+0.3	V
Input Current Peak Current (3 s)	I_{PEAK}	500	A
Input Current Continuous Current	I_{CON}	200	A
Operating Ambient Temperature	T_A	-40~125	°C
Junction Temperature	T_J	165	°C
Storage Temperature	T_S	-55~150	°C
Electrostatic Discharge Voltage	HBM	4	kV
	CDM	1	kV
Latch-up	LU	200	mA

Note: Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

ISOLATION CHARACTERISTICS

Parameter	Symbol	测试条件/注释	数值	单位
Withstand Isolation Voltage	V_{ISO}	50/60Hz，1min	150	V_{RMS}
		t = 1s	200	
Clearance	D_{cl}	minimum distance through air from IP leads to signal leads	8.3	mm
Creepage	D_{cr}	minimum distance from the IP wire to the signal wire along the package	8.3	mm

ELECTRICAL PARAMETERS (V_{CC}=5V/3.3V，C_{OUT}=1nF，C_{REF}=1nF，T_A=25°C, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply Section，VCC=5V						
Power Supply	V_{CC}	5V nominal supply voltage series	4.5	5	5.5	V
Undervoltage Protection Release Threshold	UV	V_{CC}=5V, V_{CC}> UV，Undervoltage protection release		4.15		V
Undervoltage Protection Hysteresis Voltage	UV_{HYS}	V_{CC} < UV - UV_{HYS}，Lock the chip		0.2		V
Supply Current	I_{CC}		18	22	28	mA
Power-on Reset Time	t_{POR}			22		us
Supply Section，VCC=3.3V						
Power Supply	V_{CC}	3.3V nominal supply voltage series	3	3.3	3.6	V
Undervoltage Protection Release Threshold	UV	V_{CC}=3.3V, V_{CC}> UV，Undervoltage protection release		2.85		V
Undervoltage Protection Hysteresis Voltage	UV_{HYS}	V_{CC} < UV - UV_{HYS}，Lock the chip		0.2		V
Supply Current	I_{CC}		16	19	25	mA
Power-on Reset Time	t_{POR}			22		us
Output Section，VOUT						
VOUT Filter Capacitors	C_{OUT}	VOUT to GND		1	2.2	nF
VOUT Load Resistance	R_{L_OUT}	VOUT to GND	4.7			kΩ
VOUT High Saturation Voltage	V_{SATH}	V_{SATH}= V_{CC} – V_{OUT}，R_L = 10kΩ to GND		0.1	0.2	V
VOUT Low Saturation Voltage	V_{SATL}	V_{SATL}= V_{OUT}，R_L = 10kΩ to VCC		0.1	0.2	V
VOUT Output Source Current	I_{OUT_SOURCE}	VOUT to GND short-circuit current		8		mA
VOUT Output Sink Current	I_{OUT_SINK}	VOUT to VCC short-circuit current		28		mA
Signal Chain -3dB Bandwidth	f_{-3dB}	Small signal -3dB bandwidth		250		kHz
Signal Response Time	t_{RES}	Input current up to 90% to VOUT 90%		1.2	2	us
Reference Section，VREF						
VREF Filter Capacitors	C_{REF}	VREF to GND		1	2.2	nF
VREF Load Resistance	R_{L_REF}	VREF to GND	4.7			kΩ
VREF Output Voltage	V_{REF}	5V nominal supply voltage series	2.49	2.50	2.51	V
		3.3V nominal supply voltage series	1.64	1.65	1.66	V
VREF Input Voltage	$VREF_{IN}$	VREF Input voltage range	0.1×V_{CC}		0.9×V_{CC}	V
VREF Output Source Current	I_{REF_SOURCE}	VREF to GND short-circuit current		2.8		mA
VREF Output Sink Current	I_{REF_SINK}	VREF to VCC short-circuit current		6		mA

Continued:

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Alarm section，VOC，xFAULT						
VOC Input Range	V_{VOC}	VOC Input voltage range	$0.2\times V_{VREF}$		$0.8\times V_{VREF}$	V
VOC Input Leakage Current	I_{LKVOC}	VOC pin input leakage current	-50		50	nA
Overcurrent Alarm Gain	A_{VOC}	$I_{VOC}=I_{MAX}\times(V_{OC}/V_{REF})\times A_{VOC}$， I_{VOC} is the set alarm current value， I_{MAX} is the current value corresponding to V_{OUT}(rail-to-rail)		2.5		-
Overcurrent Alarm Hysteresis	I_{VOCHYS}	After $I_P < I_{VOC} - I_{VOCHYS}$， xFAULT changes from pull-low to high-impedance		$0.2\times I_{MAX}$		A
VOC Alarm Error	E_{xFAULT}	$V_{OC}=0.4\times V_{REF}$ Output error relative to ideal value		±5		%
xFAULT Output Low	V_{xFAULT}	In the case of overcurrent, xFAULT outputs low, the xFAULT pin is connected to a 10kΩ pull-up resistor to V_{CC}			0.4	V
xFAULT Sink Current	I_{FAULT}	No alarms		100		nA
		xFAULT alarm pull down			4	mA
xFAULT Response Time	t_{VOC}	The delay time of the input current transitions from 0A step to $1.2\times I_{VOC}$, and the xFAULT pin pulls down from high to V_{xFAULT}		1.6		us
xFAULT Hold Time	t_{HOLD}	The delay time of the input current transitions from $1.2\times I_{VOC}$ step to 0A, and the xFAULT pin pulls up from low to V_{xFAULT}		6.8		us
On-resistance						
Primary on-resistance	R_P	T_A=25°C, I_P=10A		30		uΩ

CC6906T9-5FB050 (V_{CC}=5V，C_{OUT}=1nF，C_{REF}=1nF，T_A=25°C, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Current Accuracy Range	I_P	-	-50		50	A
Sensitivity	Sens	full range of I_P		40		mV/A
Zero Current Differential Output Error	V_{OE}	$V_{OE}=V_{OUT}-V_{REF}$，I_P=0A	-5		5	mV
Noise	$V_{N(RMS)}$	I_P=0A		12		mV
Zero Current Output Offset Drift	ΔV_{OE}	T_A=-40°C ~125°C V_{OE} offset voltage drift=V_{OE_TA} - $V_{OE\_25^\circ C}$	-30		30	mV
Zero Current Quiescent Output Voltage Temperature Drift	$\Delta V_{OUT(Q)}$	T_A=-40°C ~125°C $V_{OUT(Q)}$ voltage drift=$V_{OUT(Q)\_TA}$ -$V_{OUT(Q)\_25^\circ C}$	-30		30	mV
Sensitivity Error	Δ_{SENS}	T_A=-40°C ~125°C	-4.0		4.0	%
Total Output Error	E_{TOT}	T_A=-40°C ~125°C，I_P=I_{P_MAX}	-4.5		4.5	%
Linearity Error	LIN_{ERR}	T_A=-40°C ~125°C		0.2	0.4	%

CC6906T9-5FB100 (V_{CC}=5V，C_{OUT}=1nF，C_{REF}=1nF，T_A=25°C, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Current Accuracy Range	I_P	-	-100		100	A
Sensitivity	Sens	full range of I_P		20		mV/A
Zero Current Differential Output Error	V_{OE}	$V_{OE}=V_{OUT}-V_{REF}$，I_P=0A	-5		5	mV
Noise	$V_{N(RMS)}$	I_P=0A		6		mV
Zero Current Output Offset Drift	ΔV_{OE}	T_A=-40°C ~125°C V_{OE} offset voltage drift=V_{OE_TA} - $V_{OE\_25^\circ C}$	-15		15	mV
Zero Current Quiescent Output Voltage Temperature Drift	$\Delta V_{OUT(Q)}$	T_A=-40°C ~125°C $V_{OUT(Q)}$ voltage drift=$V_{OUT(Q)\_TA}$ -$V_{OUT(Q)\_25^\circ C}$	-20		20	mV
Sensitivity Error	Δ_{SENS}	T_A=-40°C ~125°C	-2.5		2.5	%
Total Output Error	E_{TOT}	T_A=-40°C ~125°C，I_P=I_{P_MAX}	-3.0		3.0	%
Linearity Error	LIN_{ERR}	T_A=-40°C ~125°C		0.2	0.4	%

CC6906T9-5FB150 (V_{CC}=5V，C_{OUT}=1nF，C_{REF}=1nF，T_A=25°C, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Current Accuracy Range	I_P	-	-150		150	A
Sensitivity	Sens	full range of I_P		13.33		mV/A
Zero Current Differential Output Error	V_{OE}	$V_{OE}=V_{OUT}-V_{REF}$，I_P=0A	-5		5	mV
Noise	$V_{N(RMS)}$	I_P=0A		4		mV
Zero Current Output Offset Drift	ΔV_{OE}	T_A=-40°C ~125°C V_{OE} offset voltage drift=V_{OE_TA} - $V_{OE\_25^\circ C}$	-15		15	mV
Zero Current Quiescent Output Voltage Temperature Drift	$\Delta V_{OUT(Q)}$	T_A=-40°C ~125°C $V_{OUT(Q)}$ voltage drift=$V_{OUT(Q)\_TA}$ -$V_{OUT(Q)\_25^\circ C}$	-20		20	mV
Sensitivity Error	Δ_{SENS}	T_A=-40°C ~125°C	-2.5		2.5	%
Total Output Error	E_{TOT}	T_A=-40°C ~125°C，I_P=I_{P_MAX}	-3.0		3.0	%
Linearity Error	LIN_{ERR}	T_A=-40°C ~125°C		0.2	0.4	%

CC6906T9-5FB200 (V_{CC}=5V, C_{OUT}=1nF, C_{REF}=1nF, T_A=25°C, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Current Accuracy Range	I_P	-	-200		200	A
Sensitivity	Sens	full range of I_P		10		mV/A
Zero Current Differential Output Error	V_{OE}	$V_{OE}=V_{OUT}-V_{REF}$, I_P=0A	-5		5	mV
Noise	$V_{N(RMS)}$	I_P=0A		3		mV
Zero Current Output Offset Drift	ΔV_{OE}	T_A=-40°C ~125°C V_{OE} offset voltage drift=V_{OE_TA} - $V_{OE\_25℃}$	-15		15	mV
Zero Current Quiescent Output Voltage Temperature Drift	$\Delta V_{OUT(Q)}$	T_A=-40°C ~125°C $V_{OUT(Q)}$ voltage drift=$V_{OUT(Q)\_TA}$ -$V_{OUT(Q)\_25℃}$	-20		20	mV
Sensitivity Error	Δ_{SENS}	T_A=-40°C ~125°C	-2.5		2.5	%
Total Output Error	E_{TOT}	T_A=-40°C ~125°C, $I_P=I_{P\_MAX}$	-3.0		3.0	%
Linearity Error	LIN_{ERR}	T_A=-40°C ~125°C		0.2	0.4	%

CC6906T9-5FB300 (V_{CC}=5V, C_{OUT}=1nF, C_{REF}=1nF, T_A=25°C, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Current Accuracy Range	I_P	-	-300		300	A
Sensitivity	Sens	full range of I_P		6.67		mV/A
Zero Current Differential Output Error	V_{OE}	$V_{OE}=V_{OUT}-V_{REF}$, I_P=0A	-5		5	mV
Noise	$V_{N(RMS)}$	I_P=0A		2		mV
Zero Current Output Offset Drift	ΔV_{OE}	T_A=-40°C ~125°C V_{OE} offset voltage drift=V_{OE_TA} - $V_{OE\_25℃}$	-15		15	mV
Zero Current Quiescent Output Voltage Temperature Drift	$\Delta V_{OUT(Q)}$	T_A=-40°C ~125°C $V_{OUT(Q)}$ voltage drift=$V_{OUT(Q)\_TA}$ -$V_{OUT(Q)\_25℃}$	-20		20	mV
Sensitivity Error	Δ_{SENS}	T_A=-40°C ~125°C	-2.5		2.5	%
Total Output Error	E_{TOT}	T_A=-40°C ~125°C, $I_P=I_{P\_MAX}$	-3.0		3.0	%
Linearity Error	LIN_{ERR}	T_A=-40°C ~125°C		0.2	0.4	%

CC6906T9-3FB050 (V_{CC}=3.3V，C_{OUT}=1nF，C_{REF}=1nF，T_A=25°C, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Current Accuracy Range	I_P	-	-50		50	A
Sensitivity	Sens	full range of I_P		26.4		mV/A
Zero Current Differential Output Error	V_{OE}	V_{OE}=V_{OUT}-V_{REF}，I_P=0A	-5		5	mV
Noise	$V_{N(RMS)}$	I_P=0A		12		mV
Zero Current Output Offset Drift	ΔV_{OE}	T_A=-40°C ~125°C V_{OE} offset voltage drift=V_{OE_TA} - $V_{OE\_25°C}$	-15		15	mV
Zero Current Quiescent Output Voltage Temperature Drift	$\Delta V_{OUT(Q)}$	T_A=-40°C ~125°C $V_{OUT(Q)}$ voltage drift=$V_{OUT(Q)\_TA}$ -$V_{OUT(Q)\_25°C}$	-20		20	mV
Sensitivity Error	Δ_{SENS}	T_A=-40°C ~125°C	-2.5		2.5	%
Total Output Error	E_{TOT}	T_A=-40°C ~125°C，I_P=I_{P_MAX}	-3.0		3.0	%
Linearity Error	LIN_{ERR}	T_A=-40°C ~125°C		0.2	0.4	%

CC6906T9-3FB100 (V_{CC}=3.3V，C_{OUT}=1nF，C_{REF}=1nF，T_A=25°C, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Current Accuracy Range	I_P	-	-100		100	A
Sensitivity	Sens	full range of I_P		13.2		mV/A
Zero Current Differential Output Error	V_{OE}	V_{OE}=V_{OUT}-V_{REF}，I_P=0A	-5		5	mV
Noise	$V_{N(RMS)}$	I_P=0A		6		mV
Zero Current Output Offset Drift	ΔV_{OE}	T_A=-40°C ~125°C V_{OE} offset voltage drift=V_{OE_TA} - $V_{OE\_25°C}$	-15		15	mV
Zero Current Quiescent Output Voltage Temperature Drift	$\Delta V_{OUT(Q)}$	T_A=-40°C ~125°C $V_{OUT(Q)}$ voltage drift=$V_{OUT(Q)\_TA}$ -$V_{OUT(Q)\_25°C}$	-20		20	mV
Sensitivity Error	Δ_{SENS}	T_A=-40°C ~125°C	-1.5		1.5	%
Total Output Error	E_{TOT}	T_A=-40°C ~125°C，I_P=I_{P_MAX}	-2.0		2.0	%
Linearity Error	LIN_{ERR}	T_A=-40°C ~125°C		0.2	0.4	%

CC6906T9-3FB150 (V_{CC}=3.3V，C_{OUT}=1nF，C_{REF}=1nF，T_A=25°C, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Current Accuracy Range	I_P	-	-150		150	A
Sensitivity	Sens	full range of I_P		8.8		mV/A
Zero Current Differential Output Error	V_{OE}	V_{OE}=V_{OUT}-V_{REF}，I_P=0A	-5		5	mV
Noise	$V_{N(RMS)}$	I_P=0A		4		mV
Zero Current Output Offset Drift	ΔV_{OE}	T_A=-40°C ~125°C V_{OE} offset voltage drift=V_{OE_TA} - $V_{OE\_25°C}$	-6		6	mV
Zero Current Quiescent Output Voltage Temperature Drift	$\Delta V_{OUT(Q)}$	T_A=-40°C ~125°C $V_{OUT(Q)}$ voltage drift=$V_{OUT(Q)\_TA}$ -$V_{OUT(Q)\_25°C}$	-15		15	mV
Sensitivity Error	Δ_{SENS}	T_A=-40°C ~125°C	-2.5		2.5	%
Total Output Error	E_{TOT}	T_A=-40°C ~125°C，I_P=I_{P_MAX}	-3.0		3.0	%
Linearity Error	LIN_{ERR}	T_A=-40°C ~125°C		0.2	0.4	%

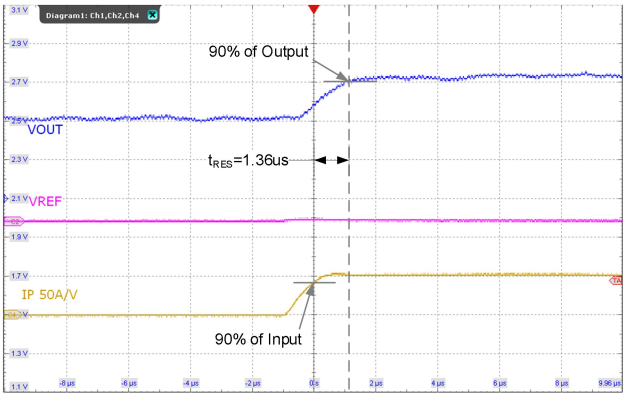
CC6906T9-3FB200 (V_{CC}=3.3V, C_{OUT}=1nF, C_{REF}=1nF, T_A=25°C, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Current Accuracy Range	I_P	-	-200		200	A
Sensitivity	Sens	full range of I_P		6.6		mV/A
Zero Current Differential Output Error	V_{OE}	$V_{OE}=V_{OUT}-V_{REF}$, I_P=0A	-5		5	mV
Noise	$V_{N(RMS)}$	I_P=0A		3		mV
Zero Current Output Offset Drift	ΔV_{OE}	T_A=-40°C ~125°C V_{OE} offset voltage drift=V_{OE_TA} - $V_{OE\_25°C}$	-15		15	mV
Zero Current Quiescent Output Voltage Temperature Drift	$\Delta V_{OUT(Q)}$	T_A=-40°C ~125°C $V_{OUT(Q)}$ voltage drift=$V_{OUT(Q)\_TA}$ -$V_{OUT(Q)\_25°C}$	-15		15	mV
Sensitivity Error	Δ_{SENS}	T_A=-40°C ~125°C	-1.5		1.5	%
Total Output Error	E_{TOT}	T_A=-40°C ~125°C, $I_P=I_{P\_MAX}$	-2.0		2.0	%
Linearity Error	LIN_{ERR}	T_A=-40°C ~125°C		0.2	0.4	%

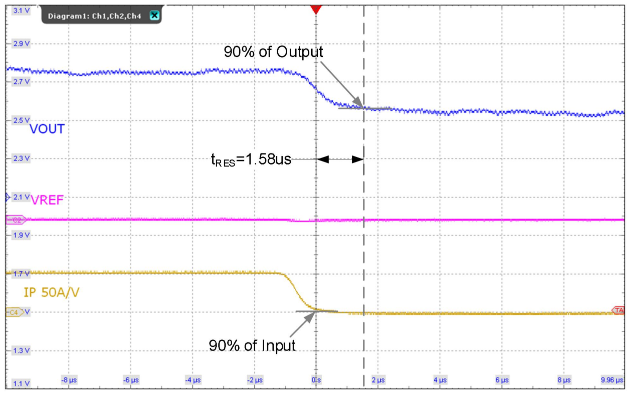
CC6906T9-3FB300 (V_{CC}=3.3V, C_{OUT}=1nF, C_{REF}=1nF, T_A=25°C, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Current Accuracy Range	I_P	-	-300		300	A
Sensitivity	Sens	full range of I_P		4.4		mV/A
Zero Current Differential Output Error	V_{OE}	$V_{OE}=V_{OUT}-V_{REF}$, I_P=0A	-5		5	mV
Noise	$V_{N(RMS)}$	I_P=0A		2		mV
Zero Current Output Offset Drift	ΔV_{OE}	T_A=-40°C ~125°C V_{OE} offset voltage drift=V_{OE_TA} - $V_{OE\_25°C}$	-6		6	mV
Zero Current Quiescent Output Voltage Temperature Drift	$\Delta V_{OUT(Q)}$	T_A=-40°C ~125°C $V_{OUT(Q)}$ voltage drift=$V_{OUT(Q)\_TA}$ -$V_{OUT(Q)\_25°C}$	-15		15	mV
Sensitivity Error	Δ_{SENS}	T_A=-40°C ~125°C	-2.5		2.5	%
Total Output Error	E_{TOT}	T_A=-40°C ~125°C, $I_P=I_{P\_MAX}$	-3.0		3.0	%
Linearity Error	LIN_{ERR}	T_A=-40°C ~125°C		0.2	0.4	%

CURVE & WAVEFORM

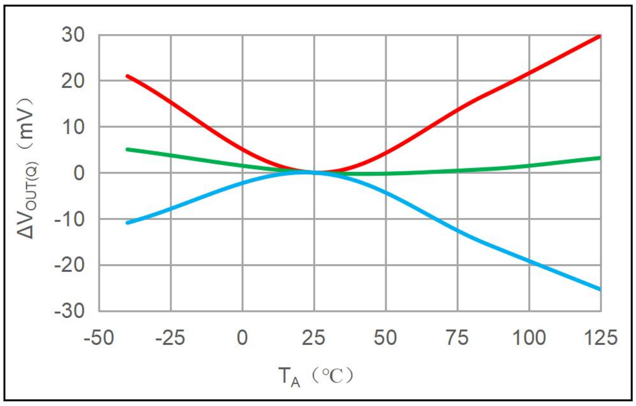


Transmission Response Rise Waveform

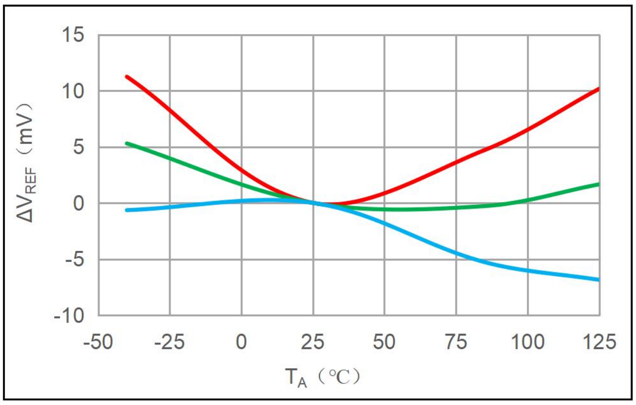


Transmission Response Fall Waveform

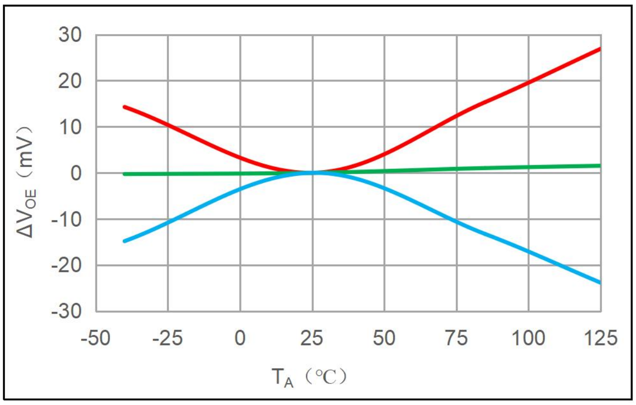
CC6906T9-5FB050[1]



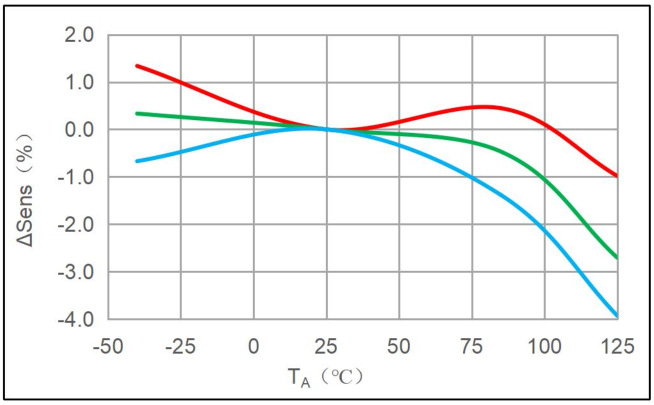
Δ $V_{OUT(Q)}$ vs T_A



Δ V_{REF} vs T_A



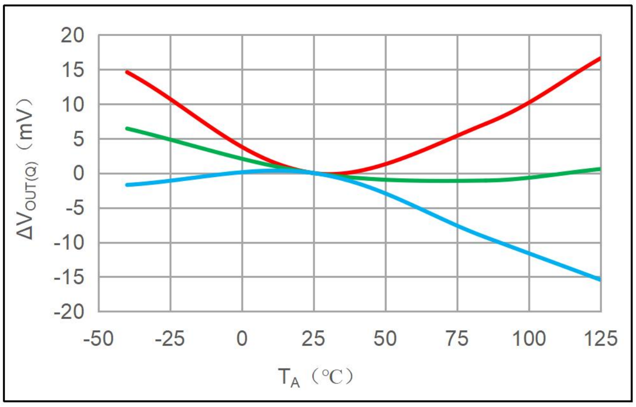
Δ V_{OE} vs T_A



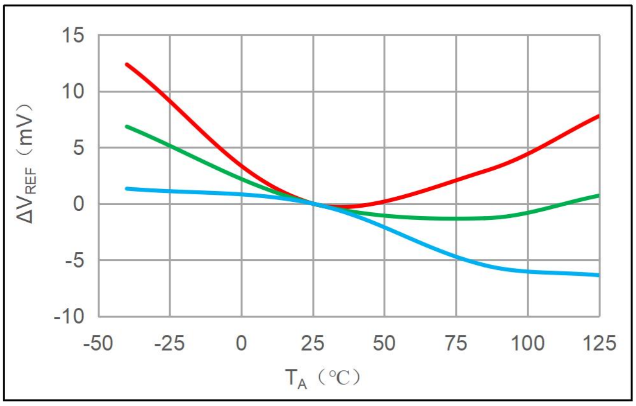
Δ Sens vs T_A

[1] Green represents the average，Red represents the average+3Sigma，Blue represents the average-3Sigma(-40°C，25°C，85°C，125°C)

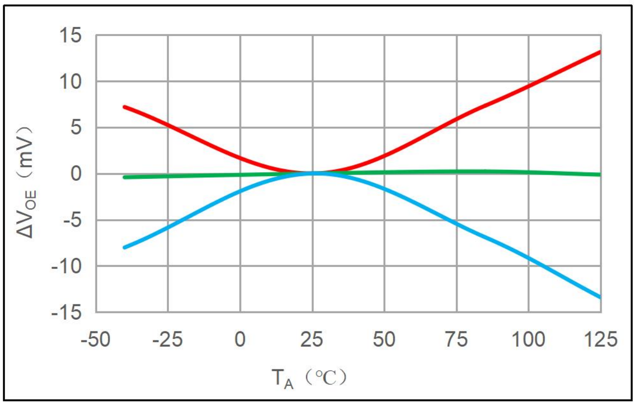
CC6906T9-5FB100[1]



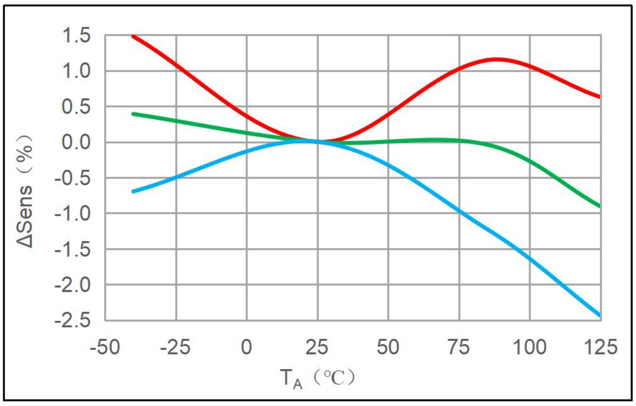
Δ $V_{OUT(Q)}$ vs T_A



Δ V_{REF} vs T_A



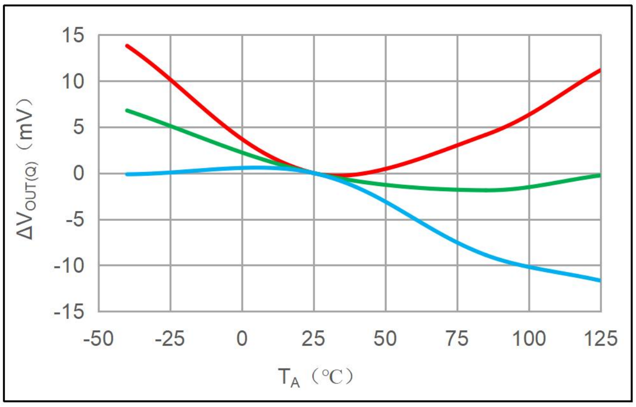
Δ V_{OE} vs T_A



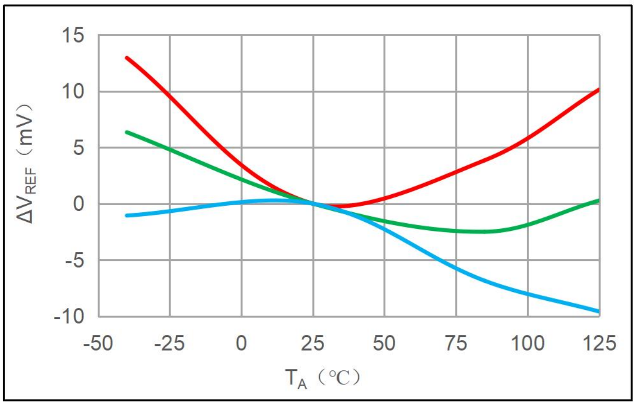
Δ Sens vs T_A

[1] Green represents the average，Red represents the average+3Sigma，Blue represents the average-3Sigma(-40°C，25°C，85°C，125°C)

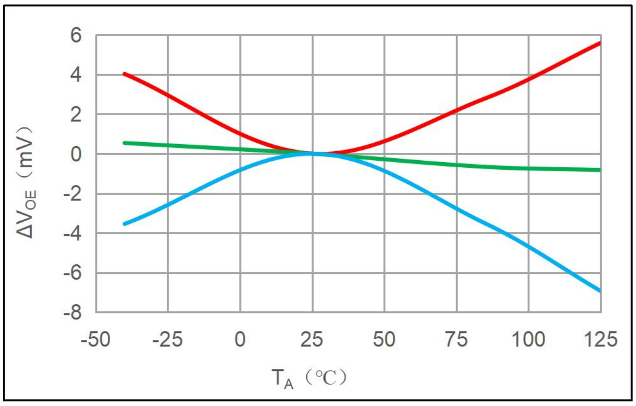
CC6906T9-5FB150[1]



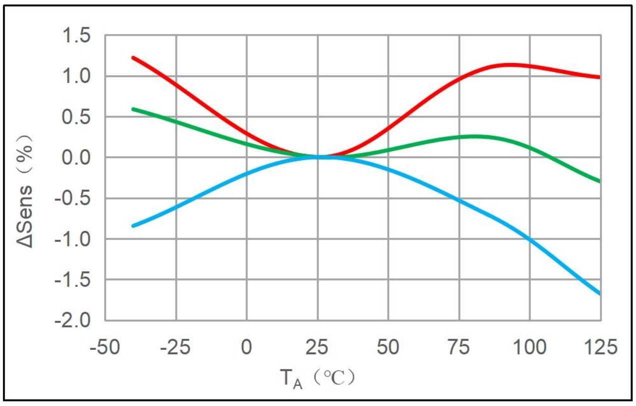
Δ $V_{OUT(Q)}$ vs T_A



Δ V_{REF} vs T_A



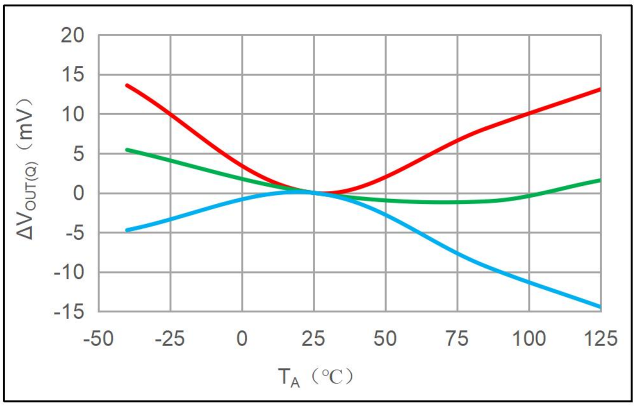
Δ V_{OE} vs T_A



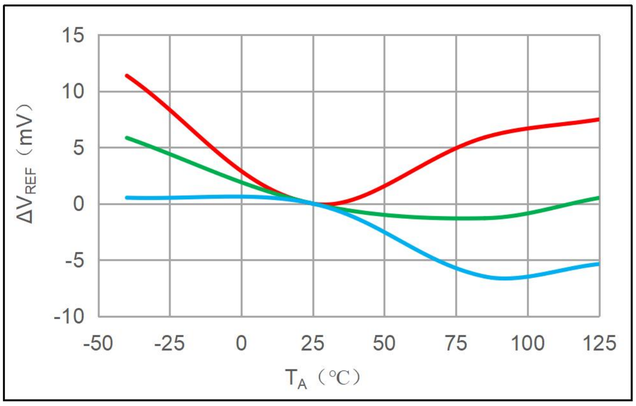
Δ Sens vs T_A

[1] Green represents the average，Red represents the average+3Sigma，Blue represents the average-3Sigma(-40°C，25°C，85°C，125°C)

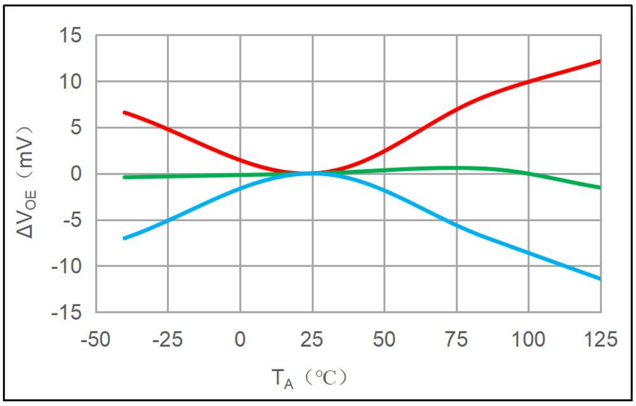
CC6906T9-5FB200[1]



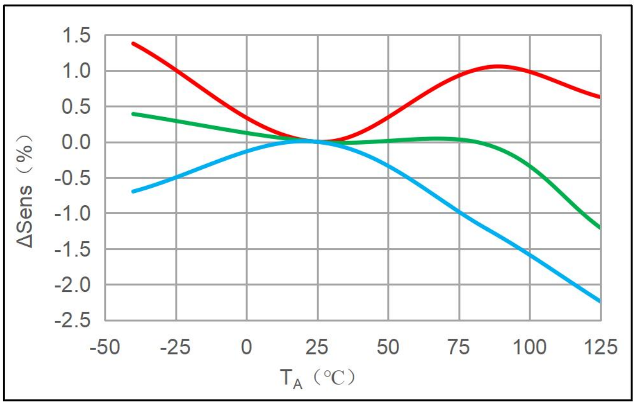
Δ $V_{OUT(Q)}$ vs T_A



Δ V_{REF} vs T_A



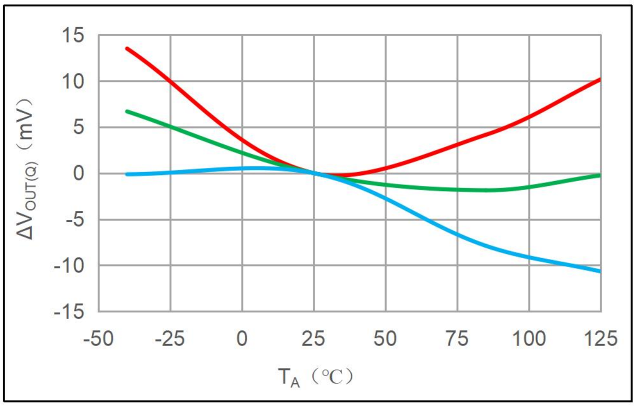
Δ V_{OE} vs T_A



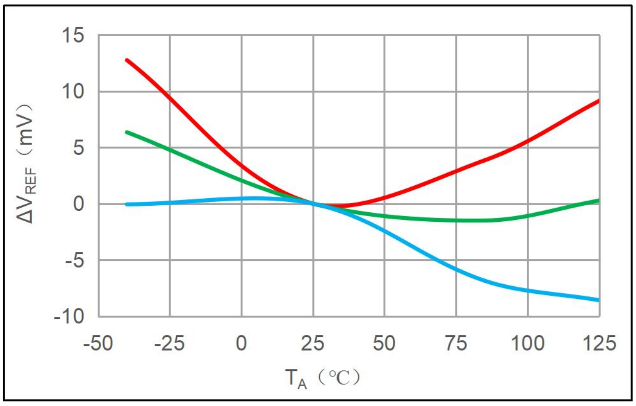
Δ Sens vs T_A

[1] Green represents the average，Red represents the average+3Sigma，Blue represents the average-3Sigma(-40°C，25°C，85°C，125°C)

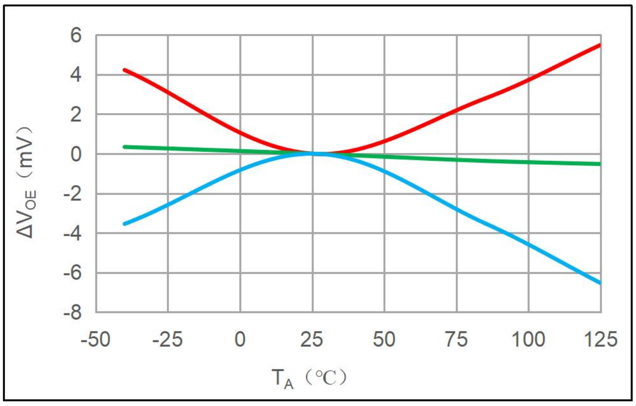
CC6906T9-5FB300[1]



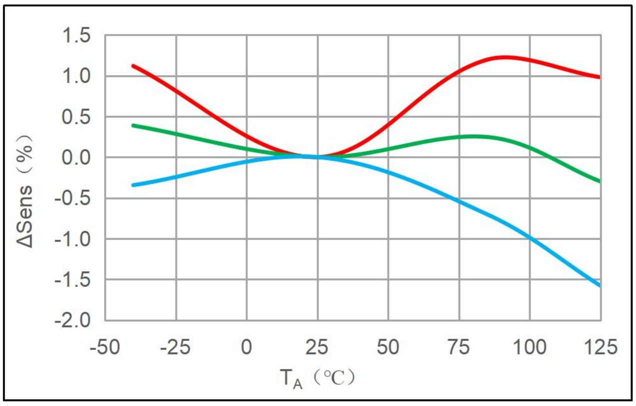
Δ $V_{OUT(Q)}$ vs T_A



Δ V_{REF} vs T_A



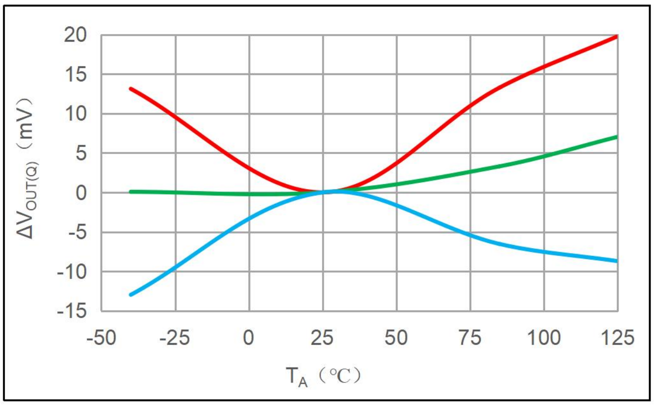
Δ V_{OE} vs T_A



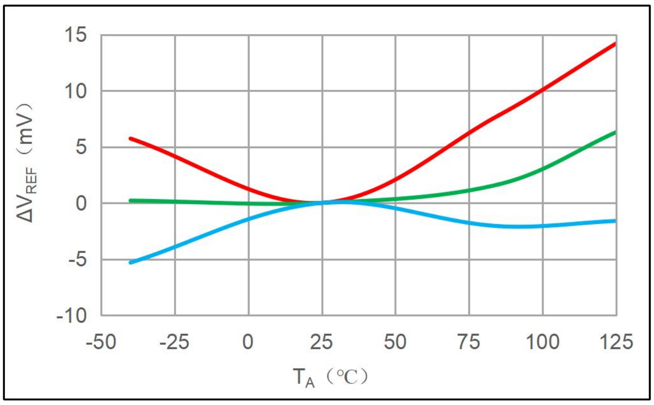
Δ Sens vs T_A

[1] Green represents the average，Red represents the average+3Sigma，Blue represents the average-3Sigma(-40°C，25°C，85°C，125°C).

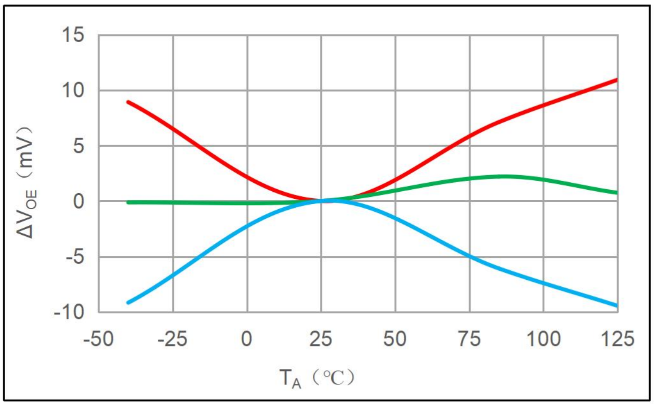
CC6906T9-3FB050[1]



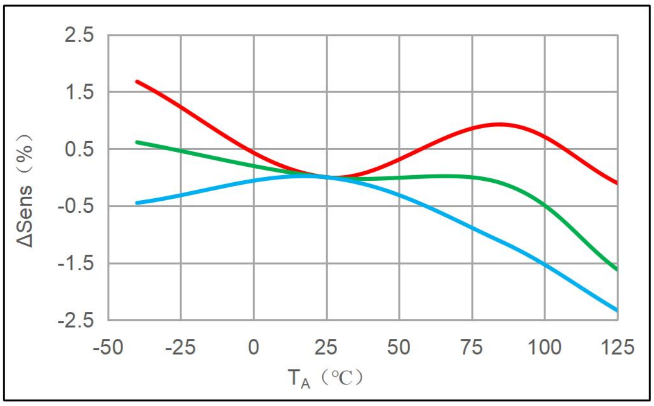
Δ $V_{OUT(Q)}$ vs T_A



Δ V_{REF} vs T_A



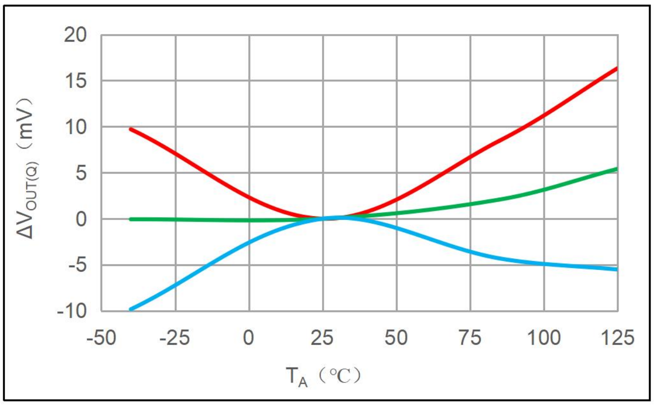
Δ V_{OE} vs T_A



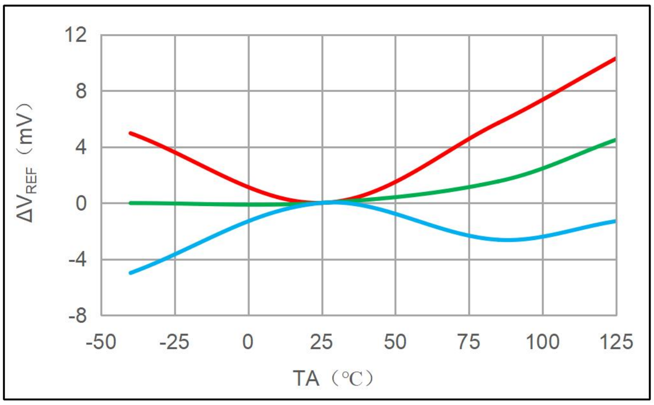
Δ Sens vs T_A

[1] Green represents the average，Red represents the average+3Sigma，Blue represents the average-3Sigma(-40°C，25°C，85°C，125°C).

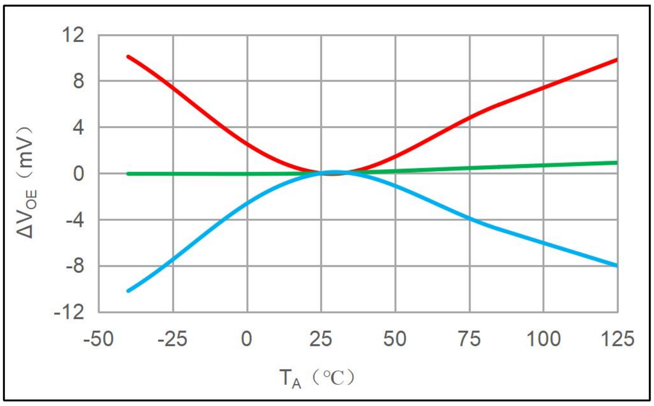
CC6906T9-3FB100[1]



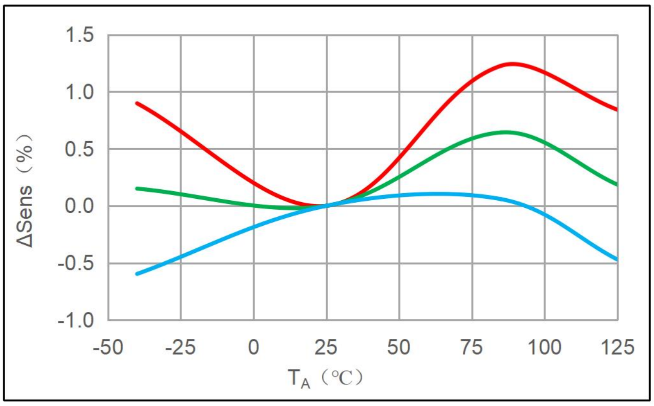
Δ $V_{OUT(Q)}$ vs T_A



Δ V_{REF} vs T_A



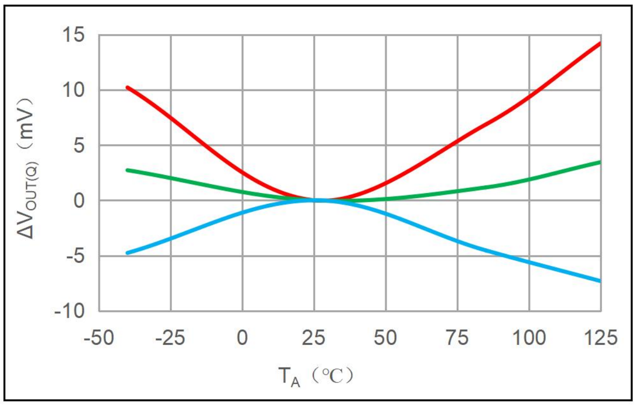
Δ V_{OE} vs T_A



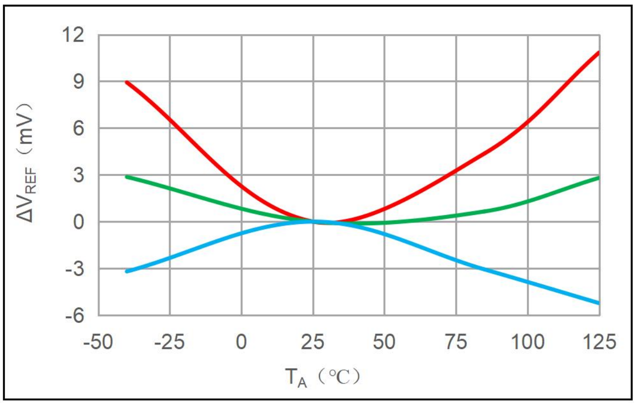
Δ Sens vs T_A

[1] Green represents the average，Red represents the average+3Sigma，Blue represents the average-3Sigma(-40°C，25°C，85°C，125°C).

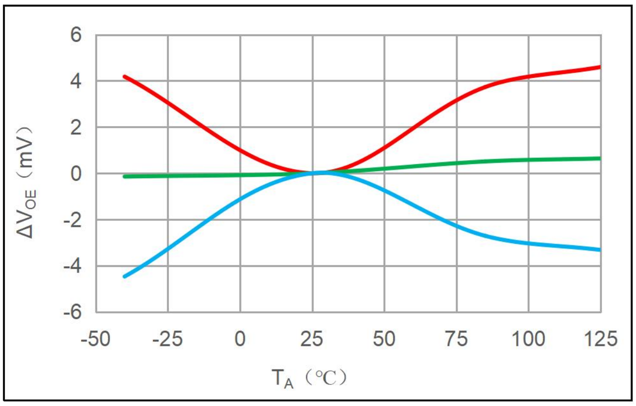
CC6906T9-3FB150[1]



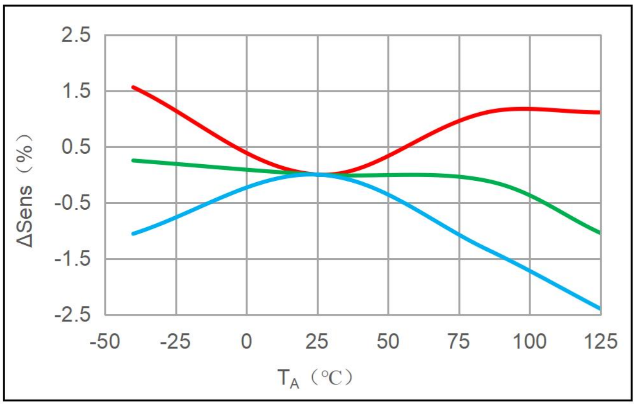
Δ $V_{OUT(Q)}$ vs T_A



Δ V_{REF} vs T_A



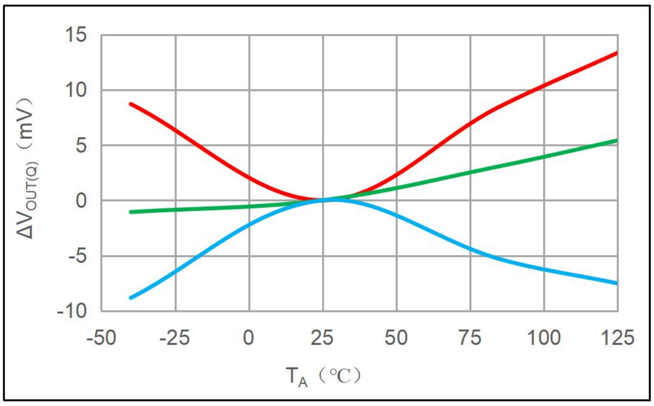
Δ V_{OE} vs T_A



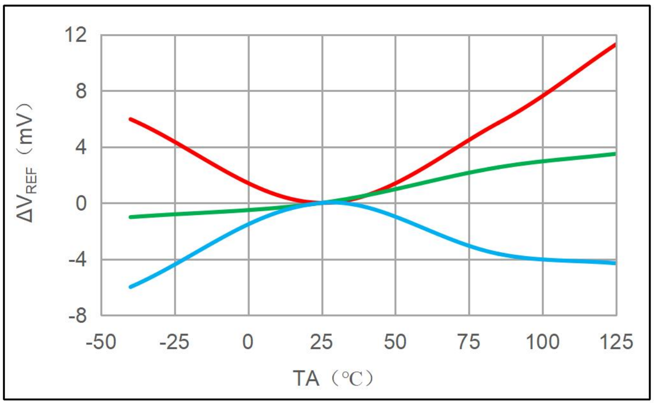
Δ Sens vs T_A

[1] Green represents the average，Red represents the average+3Sigma，Blue represents the average-3Sigma(-40°C，25°C，85°C，125°C).

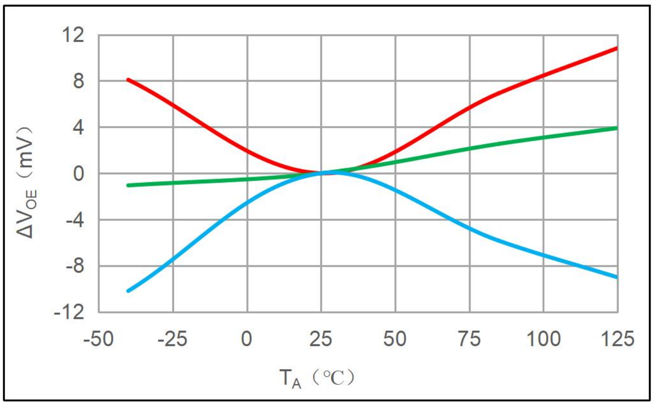
CC6906T9-3FB200[1]



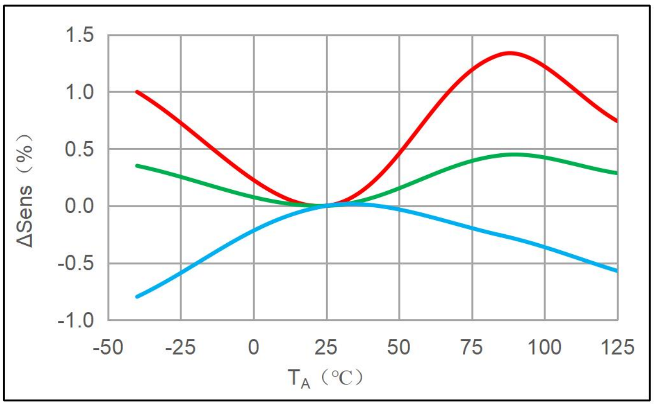
Δ $V_{OUT(Q)}$ vs T_A



Δ V_{REF} vs T_A



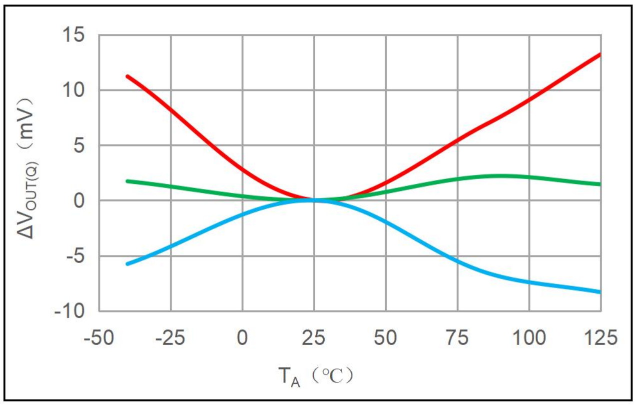
Δ V_{OE} vs T_A



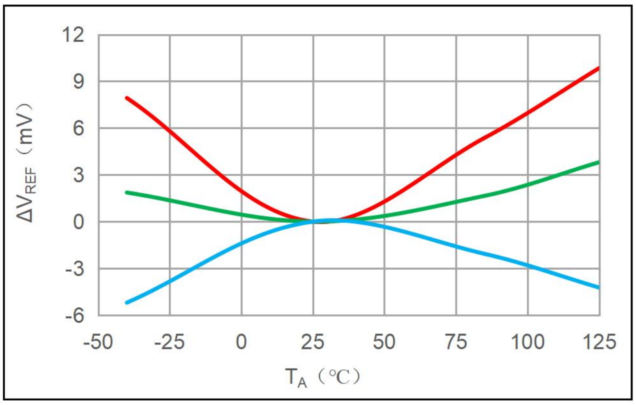
Δ Sens vs T_A

[1] Green represents the average，Red represents the average+3Sigma，Blue represents the average-3Sigma(-40°C，25°C，85°C，125°C).

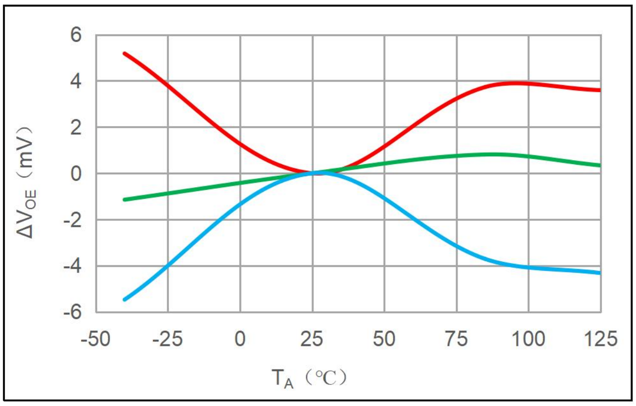
CC6906T9-3FB300[1]



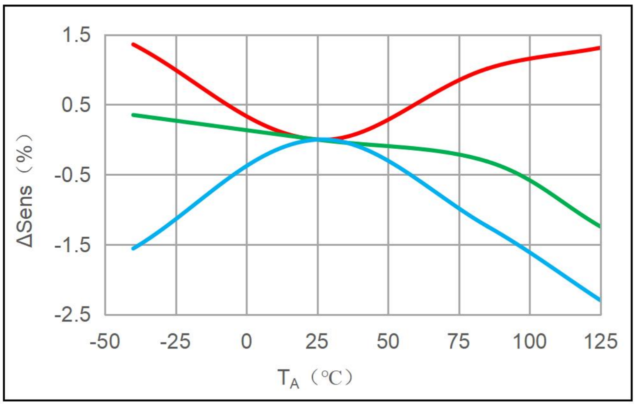
Δ $V_{OUT(Q)}$ vs T_A



Δ V_{REF} vs T_A



Δ V_{OE} vs T_A



Δ Sens vs T_A

[1] Green represents the average，Red represents the average+3Sigma，Blue represents the average-3Sigma(-40°C，25°C，85°C，125°C).

FUNCTION DESCRIPTION

The CC6906 device is a precision current sensor based on Hall sensor.It has less than 3% full scale error and zero current reference signal output in the whole temperature range, which can realize unidirectional or bidirectional current detection.The input current flows through a wire between isolated input current pins, which has a resistance of 30uΩ at room temperature to reduce insertion loss.The magnetic field generated by the input current is sensed by Hall sensor and amplified by precise signal chain. It can be used for AC and DC current measurement with a bandwidth of 250kHz.The measuring current is 50A~300A. There are 5 kinds of Current sensing range to choose. CC6906 is optimized for high accuracy and temperature stability, compensating for misalignment and sensitivity over the entire range.

The input current of CC6906 flows through the primary side of the package through IP+ and IP- pins, the current flowing through the chip generates a magnetic field proportional to the input current and is measured by an isolated Precision Hall sensor IC. Compared with other current measurement methods, the low impedance lead frame path reduces power consumption and does not require any external devices on the primary side. In addition, the internal integrated differential common mode suppression circuit can make the chip output not affected by external interference magnetic signal, and only measure the magnetic field generated by the input current, so as to suppress the interference of external magnetic field.

The typical resistance of the primary current input conductor at 25°C is 30uΩ. The lead frame is made of copper. The temperature coefficient of the input wire is positive, and the wire resistance increases with the increase of temperature. The typical temperature coefficient is 3900 ppm/°C. For every 100°C increase in temperature, the primary side resistance will increase by 39%.

CC6906 has an on-chip overcurrent reminder function, when the primary side current exceeds the set overcurrent threshold, the internal comparator is reversed, driving the OD output to work, and the pin is pulled down. The overcurrent threshold can be set by an external resistor on the VOC pin, which can be derived from V_{REF} or another external voltage input. When using the xFAULT function, VREF can only use the reference output mode. The effective input voltage of V_{OC} is between $0.2\times V_{VREF}$ and $0.8\times V_{VREF}$, and the correspondence of the overcurrent threshold and the V_{OC} voltage is as follows:

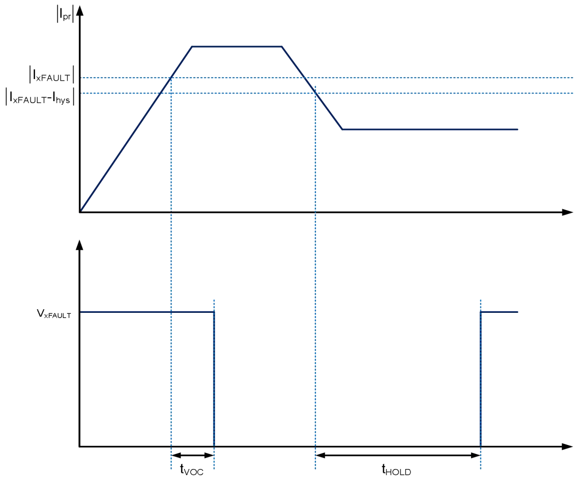
$$I_{xFAULT} = \frac{V_{OC}}{V_{REF}} \times 2.5 \times I_{pr}$$

e.g.: CC6906T9-5FB100，it's overcurrent protection point threshold range that can be set is 50A ~ 200A.

When $V_{OC}=0.2\times V_{VREF}=0.5V$, the threshold = 50A, the current is above 50A or the reverse is less than -50A, xFAULT pin pull down;

When $V_{OC}=0.8\times V_{VREF}=2.0V$, the threshold = 200A, the current is above 200A or the reverse is less than -200A, xFAULT pin pull down.

When the primary current (positive and negative currents) exceeds the overcurrent threshold set above, an overcurrent alarm is triggered. xFAULT is cleared when the absolute value of the primary current is less than the set current threshold minus the current hysteresis. t_{VOC} is the overcurrent response time, which is the time when the primary current reaches the overcurrent point to the xFAULT pin pulls down. t_{HOLD} is the overcurrent duration time, which is the time the original edge current is less than the set threshold | I_{xFAULT}-I_{hys} | to the xFAULT pin pulls up. The overcurrent protection timing is as follows:



INPUT CURRENT

In use, the primary side of the chip (package pins 8-9) is connected in series at any position in the whole circuit. The input current flowing from IP+ (package pins 8) to IP- (package pins 9) is positive, otherwise it is negative. Do not shunt resistors between IP+ and IP-, unless there are very special reasons — such as minimizing insertion loss — which will reduce the current flowing through the chip, and the wire resistance will also be affected by temperature drift, which requires external temperature and precision correction of the whole system.

VREF INPUT/OUTPUT CHARACTERISTIC

The quiescent output voltage V_{OQ} of V_{OUT} is V_{REF} as a reference, VREF has two modes: input / output, which can be used as an internal reference to an external circuit or to adjust the V_{OQ}.

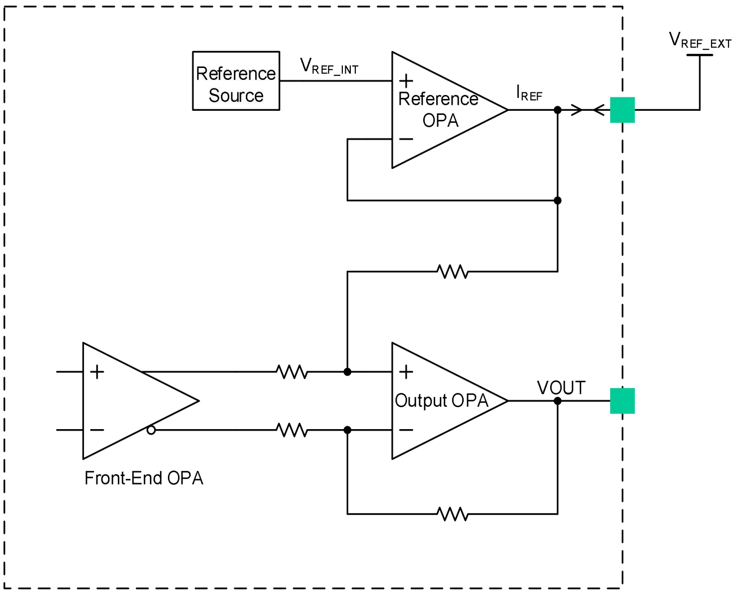
1. When using the VREF output mode:

After factory programming, the nominal value error ≤ 5mV;

The typical value of I_{VREF_SOURCE} = 2.8mA, and the typical value of I_{VREF_SINK} = 6mA. Upon application, the recommended current value of V_{REF} ≤ 2mV.

2. When using the VREF input mode:

When the drive capability of the external reference exceeds the output of the Reference Op Amp, the external reference forces VOQ to use the external reference as a reference.When the input voltage is lower than the nominal value of V_{REF}, the drive capability of the input source needs to be higher than I_{VREF_SOURCE}; When the input voltage is higher than the nominal value of V_{REF}, the drive capability of the input source needs to be higher than I_{VREF_SINK}. It is recommended that customers use an external reference source that ±10mA drive capability for input. Limited by the rail-to-rail output range of the output op amp, the voltage range of the external input of V_{REF} is $0.1 \times V_{CC}$ ~ $0.9 \times V_{CC}$, V_{OQ} changes with V_{REF}, and the sensitivity of CC6906 remains unchanged.



VOUT OUTPUT CHARACTERISTIC

The quiescent output point of the CC6906 (IP = 0A, with VREF in output mode) is 2.5V/1.65V.

When the current increases, the V_{OUT} increases until the saturation voltage of the output operational amplifier (VCC – rail voltage); when the current decreases, the V_{OUT} decreases until the saturation voltage (GND + rail voltage) of the Output OP Amp. Crosschip ensures the accuracy and linearity of V_{OUT} in the range of 0.5~4.5V/0.33~2.97V. In order to ensure the consistency of mass manufacturing, there is a certain margin in this range, but it is not recommended for customers to use this margin.

When the input current exceeds the range, the output of V_{OUT} is close to the rail voltage of the power supply. When the input current does not exceed the tolerance limit of the chip, the voltage will always be maintained. After the input current returns to the range, the output of V_{OUT} will return to normal without any damage to the chip.

When using the VREF output mode:

Product Name	Input Current	Nominal Supply Voltage(V)	Sensitivity(mV/A)	Calculation Formula (Note 1)
CC6906T9-5FB050	-50A ~ +50A	5	40	V_{OUT} = 2500 + I_P(A) × 40 ....(mV)
CC6906T9-5FB100	-100A ~ +100A	5	20	V_{OUT} = 2500 + I_P(A) × 20.............(mV)
CC6906T9-5FB150	-150A ~ +150A	5	13.33	V_{OUT} = 2500 + I_P(A) × 13.33 ....(mV)
CC6906T9-5FB200	-200A ~ +200A	5	10	V_{OUT} = 2500 + I_P(A) × 10 ....(mV)
CC6906T9-5FB300	-300A ~ +300A	5	6.67	V_{OUT} = 2500 + I_P(A) × 6.67 ....(mV)
CC6906T9-3FB050	-50A ~ +50A	3.3	26.4	V_{OUT} = 1650 + I_P(A) × 26.4...........(mV)
CC6906T9-3FB100	-100A ~ +100A	3.3	13.2	V_{OUT} = 1650 + I_P(A) × 13.2...........(mV)
CC6906T9-3FB150	-150A ~ +150A	3.3	8.8	V_{OUT} = 1650 + I_P(A) × 8.8.............(mV)
CC6906T9-3FB200	-200A ~ +200A	3.3	6.6	V_{OUT} = 1650 + I_P(A) × 6.6.............(mV)
CC6906T9-3FB300	-300A ~ +300A	3.3	4.4	V_{OUT} = 1650 + I_P(A) × 4.4.............(mV)

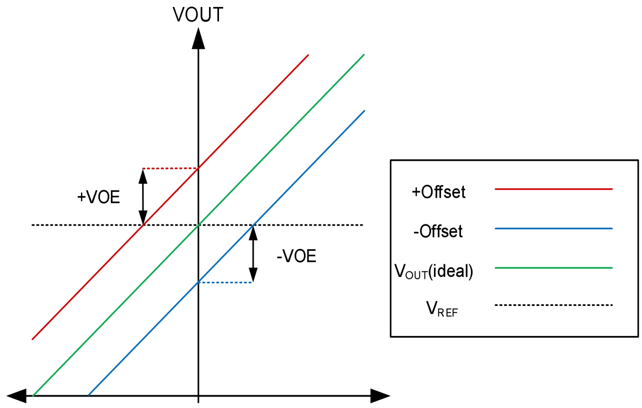
When using the VREF input mode: （$0.1 \times V_{CC} \le V_{REF} \le 0.9 \times V_{CC}$）

Product Name	Input Current	Nominal Supply Voltage(V)	Sensitivity(mV/A)	Calculation Formula (Note 1)
CC6906T9-5FB050	-50A ~ +50A	5	40	V_{OUT} = VREF + I_P(A) × 40 ....(mV)
CC6906T9-5FB100	-100A ~ +100A	5	20	V_{OUT} = VREF + I_P(A) × 20 ....(mV)
CC6906T9-5FB150	-150A ~ +150A	5	13.33	V_{OUT} = VREF + I_P(A) × 13.33 ....(mV)
CC6906T9-5FB200	-200A ~ +200A	5	10	V_{OUT} = VREF + I_P(A) × 10 ....(mV)
CC6906T9-5FB300	-300A ~ +300A	5	6.67	V_{OUT} = VREF + I_P(A) × 6.67 ....(mV)
CC6906T9-3FB050	-50A ~ +50A	3.3	26.4	V_{OUT} = VREF + I_P(A) × 26.4..........(mV)
CC6906T9-3FB100	-100A ~ +100A	3.3	13.2	V_{OUT} = VREF + I_P(A) × 13.2..........(mV)
CC6906T9-3FB150	-150A ~ +150A	3.3	8.8	V_{OUT} = VREF + I_P(A) × 8.8............(mV)
CC6906T9-3FB200	-200A ~ +200A	3.3	6.6	V_{OUT} = VREF + I_P(A) × 6.6............(mV)
CC6906T9-3FB300	-300A ~ +300A	3.3	4.4	V_{OUT} = VREF + I_P(A) × 4.4............(mV)

Note1: This formula is only applicable to DC current calculations, when AC current applications, one should pay attention to I_{PEAK}=1.414 × I_{RMS} and pay attention to the positive and negative current direction.

OFFSET VOLTAGE

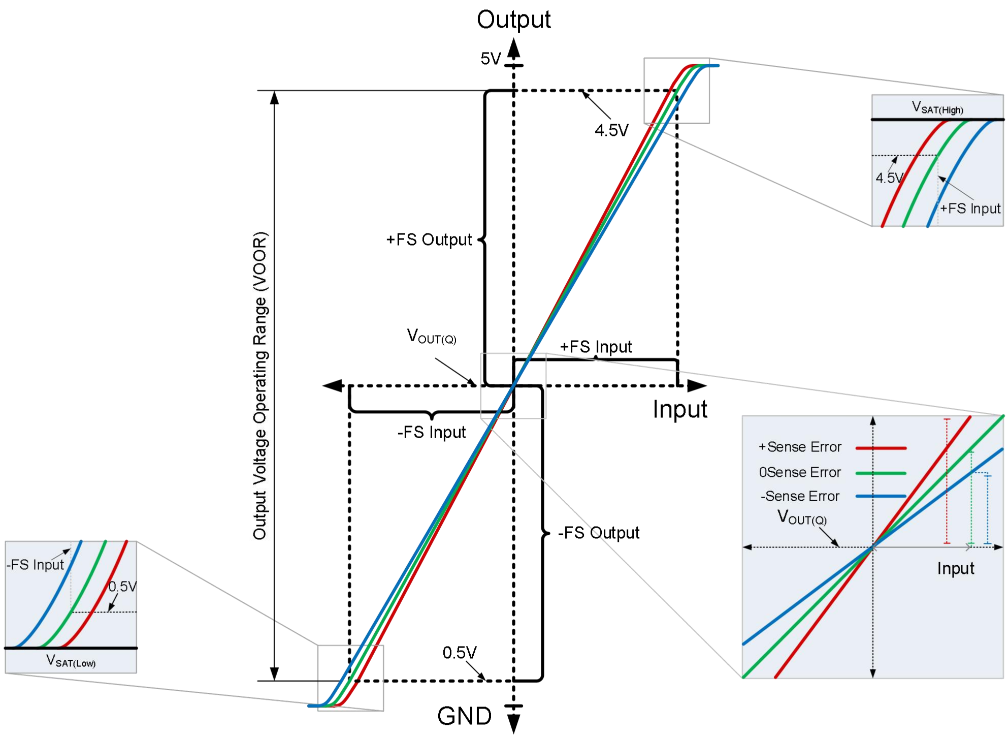
Offset Voltage, or V_{OE}, is defined as the difference between $V_{OUT(Q)}$ and V_{REF} (as shown in the figure below). V_{OE} includes the drift of $V_{OUT(Q)}$ minus V_{REF} from room to hot or room to cold (25°C to 125°C or 25°C to –40°C respectively).



OUTPUT VOLTAGE OPERATING RANGE

As shown in the figure, the output voltage operating range V_{OOR} is the swing range of the linear output of V_{OUT}. V_{OUT} beyond V_{OOR} could still work until V_{SAT}, but performance deteriorated in this range.

Voltage Output Operating Range for V_{CC} and Output Modes	
V_{CC}	Bidirectional
5V	±2
3.3V	±1.32



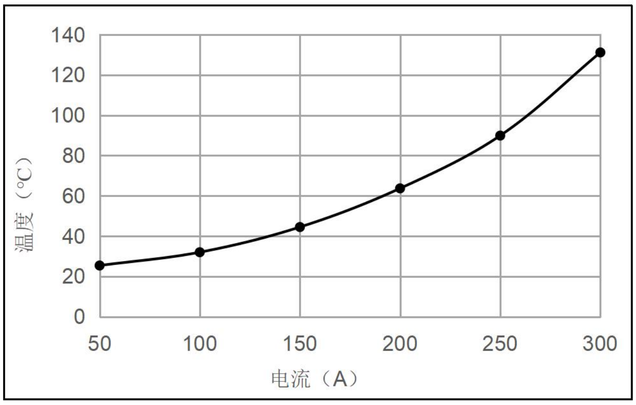
TEMPERATURE RISE vs. INPUT CURRENT

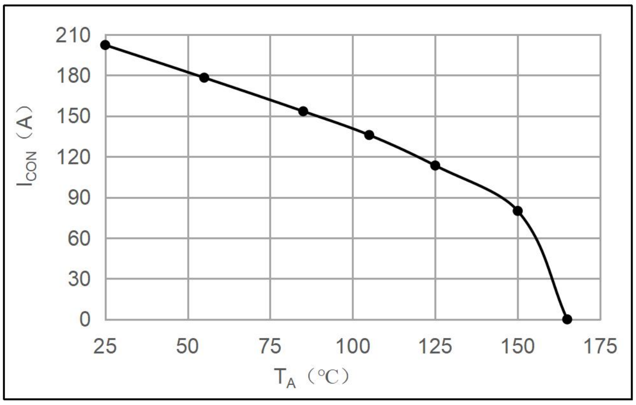
When designing any current sensing system, self-heating due to a single current measurement should be considered. As current flows through the system, the sensor, printed circuit board (PCB), and contact resistance all generate heat. Temperature rise is highly dependent on PCB layout, copper foil thickness, cooling method, and input current method. The primary current includes peak current,the conducting time of current and duty cycle. The data presented in this section is a DC test that can be used to approximate the temperature rise of AC and pulse currents.

The test environment of this experiment is: room temperature, open environment, no wind; The temperature rise test method is: the chip surface is attached to our Demo Board, and the temperature data is collected after the chip temperature is stable. The following chart shows the CC6906 package body surface temperature vs. the continuous current flowing through the primary side.

The heat capacity of the CC6906 should be verified by final customer under the specific conditions of the application. The maximum junction temperature $T_{J(MAX)}$ (165°C) should not be exceeded.

Relationship between Package Temperature & Input Current



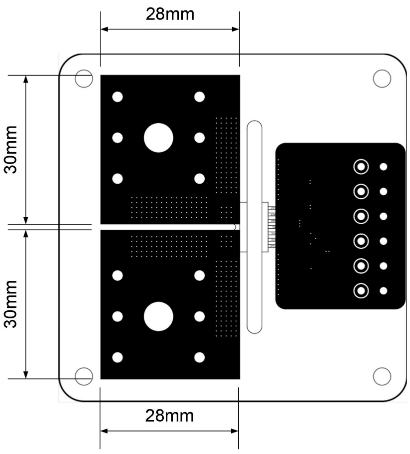


Input Current (IP) vs. Package Temperature

I_{CON} vs T_A

Note：Based on the demo board test, for specific applications, it is necessary to strengthen heat dissipation or choose Tg high plates according to actual application scenarios.

Continuous power supply at 200A current, if the wind speed of the auxiliary cooling fan is 17.5 m/s, the temperature rise can be controlled within the 5°C range.

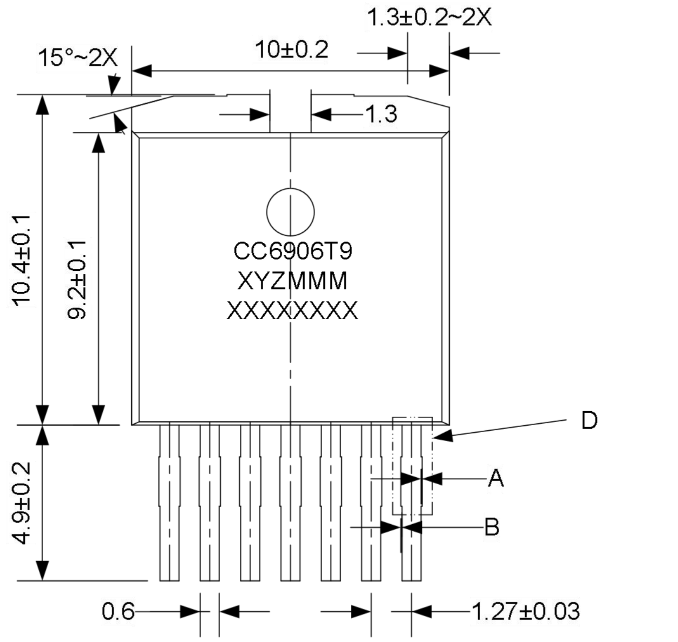


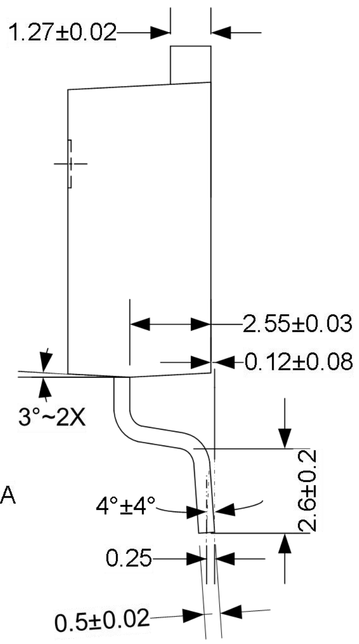
Thickness 1.6mm, FR-4 double layer board, top and bottom 4.5oz copper foils, about 840mm^2 per foil connected to IP pins, each layer connected with via holes.

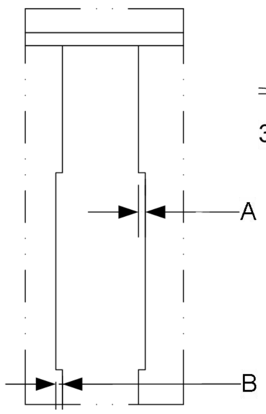
Test environment: open environment, quiescent air

PACKAGE INFORMATION

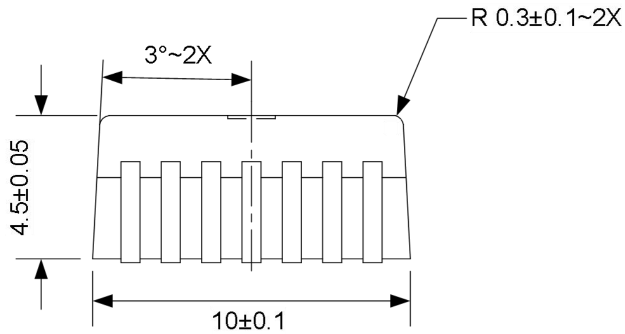
TO263-7 Package

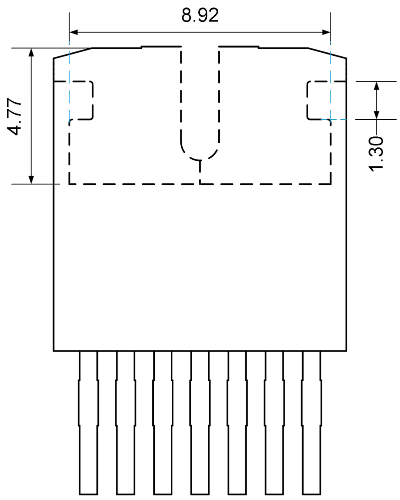






0<A,B<0.076
DETAIL "D"





Back

Note:

1. All dimensions are in millimeters.

Marking:

1st Line: CC6906T9 – Device Name

2nd Line: XYZMMM

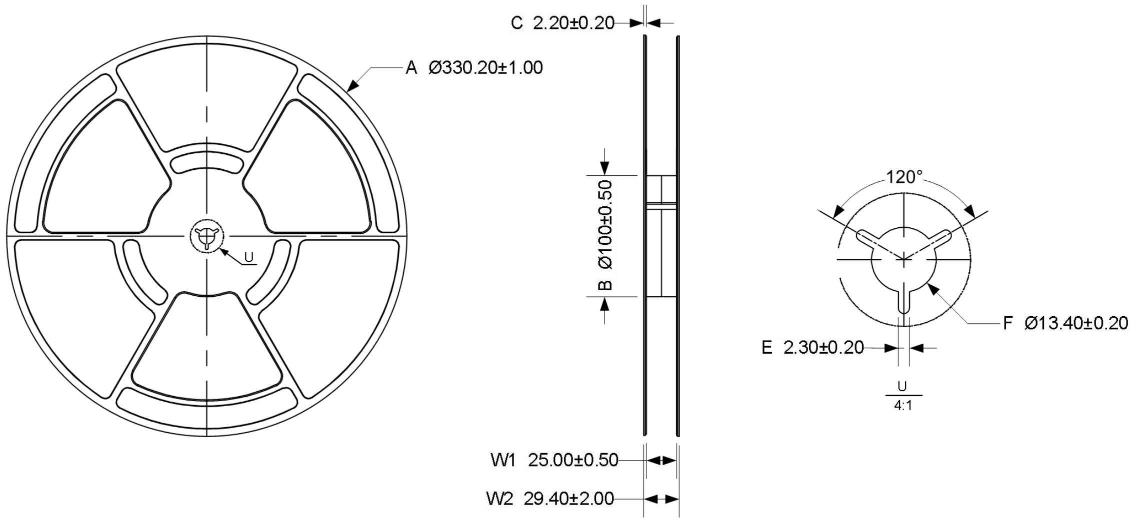
- X：Rated operational voltage
- Y：Output type
- Z：Output polarity
- MMM：Current measurement range

3rd Line: XXXXXXXX

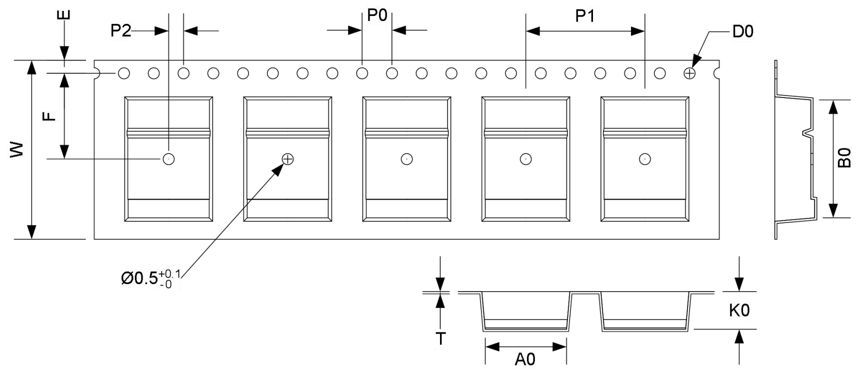
XXXXXXXX - Production serial number

TAPE AND REEL INFORMATION

Reel Dimensions



Tape Dimensions



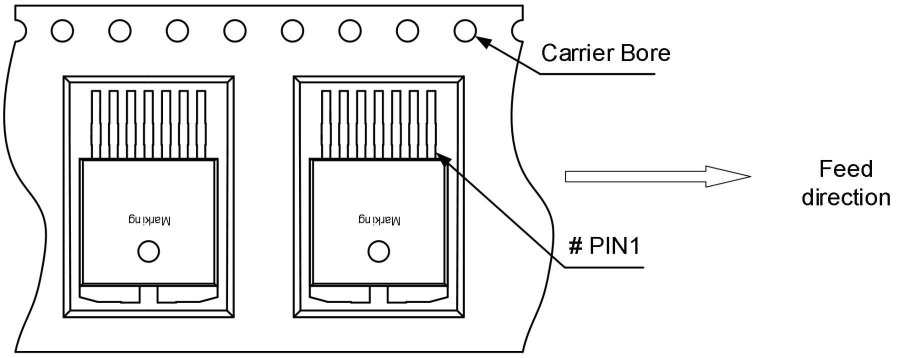
Carrier Tape Basic Size (mm)					
W	A0	B0	K0	P0	P1
24±0.30	10.80±0.1	15.80±0.1	5.00±0.1	4.0±0.1	16.00±0.1
P2	F	S	E	D0	T
2.0±0.1	11.5±0.1	0.0±0.1	1.75±0.1	$1.5^{+0.1}_{-0.0}$	0.35±0.05

Note:

（1）The cumulative error of any 10 carrier tape holes consecutively does not exceed ±0.2mm, and the non-parallelism of 250mm distance in the length direction of the carrier tape cannot exceed 1mm.

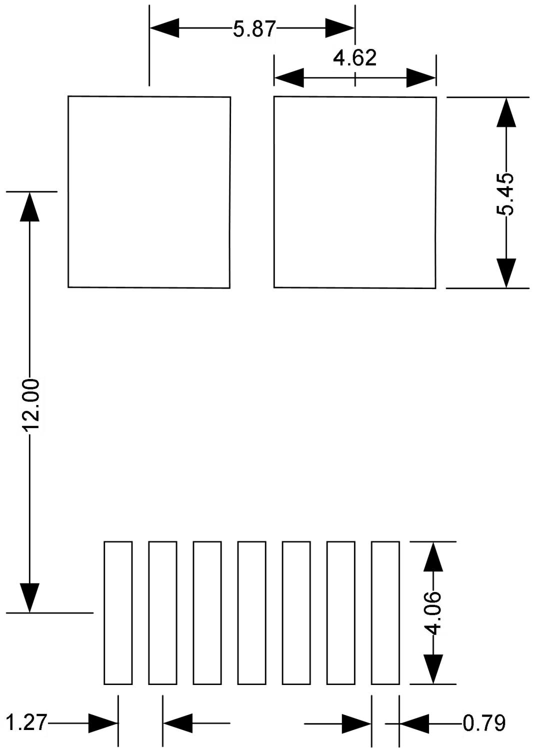
（2）Tolerance ± 0.2mm is not specified.

QUADRANT ASSIGNMENTS FOR PIN1 ORIENTATION IN TAPE

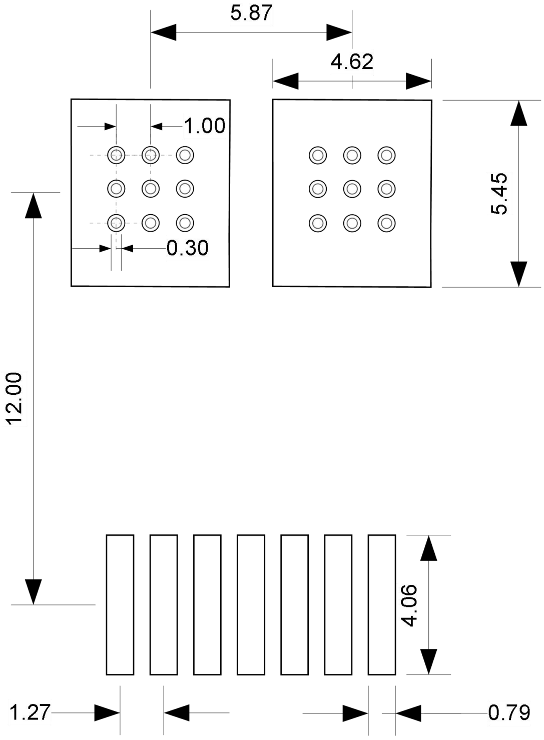


PACKAGE REFERENCE

Recommended welding disc



When the current exceeds 100A, the recommended welding disc need to be punched.



Note: All dimensions are in millimeters.

REVISION HISTORY

Revision Date	Description of Revision	Revision
2024.06.20	Newly issued.	rev1.0
2024.09.14	V_{ISO} update to $200V_{RMS}$.	rev1.1

CrossChip

CrossChip Microsystems Inc. was founded in 2013, is a national high-tech enterprise, engaged in integrated circuit design and sales. The company has strong technical strength, has more than 60 kinds of patents, mainly used in Hall sensor signal processing, with the following product lines:

- ✓ High precision linear Hall sensor
- ✓ All kinds of Hall switches
- ✓ Single phase motor drive
- ✓ Single chip current sensor
- ✓ AMR Magnetoresistance sensor
- ✓ Isolation drive class chip

Contact us

Chengdu

Address: 4th floor, unit 2, building 3, No. 88, Tianchen Road, Gaoxinxi Zone, Chengdu, Sichuan Province

Tel: + 86 - 028 - 87787685

Email: support@crosschipmicro.com

Website: https://www.crosschipmicro.com

Shenzhen

Address: 605 room, 6F, Beike building, NO.18 Keyuan Rd, Yuehai Street, Nanshan District, Shenzhen

Shanghai

Address: Room 602, Building 1, Shengda Tiandi Yuanchuanggu, No. 88, Shengrong Road, Pudong New District, Shanghai

Suzhou

Address: NO.78 Jinshan Rd East, Suzhou High-tech Zone,Huqiu District, Suzhou City, Jiangsu Province