

NHC3010FSWXXXBXTR Current Sensor IC

NHC3010 provides economical and precise solutions for AC or DC current sensing. Typical applications include photovoltaic system, industrial power supply, charging pile, and motor control.

Features

- Current Sensing range: $\pm 50\text{A} \sim \pm 200\text{A}$
 - Operating temperature range: $-40 \sim 125^{\circ}\text{C}$
 - Sensitivity error: within $\pm 2\%$
 - Offset error: within $\pm 10\text{ mV}$
 - Ultra-low on-resistance: $0.27\text{ m}\Omega$
- Withstand Isolation Voltage: $5000\text{ V}_{\text{RMS}}$
 - Surge current withstand capability: 20 kA
 - Bandwidth: 320 kHz
 - Output response time: $1.5\text{ }\mu\text{s}$
 - Overcurrent protection response time: $1.5\text{ }\mu\text{s}$



Application

- Photovoltaic(PV) System
 - Industrial Power Supply
 - Charging Pile
- Load Detection System
 - Motor Control
 - OBC/DCDC/PTC

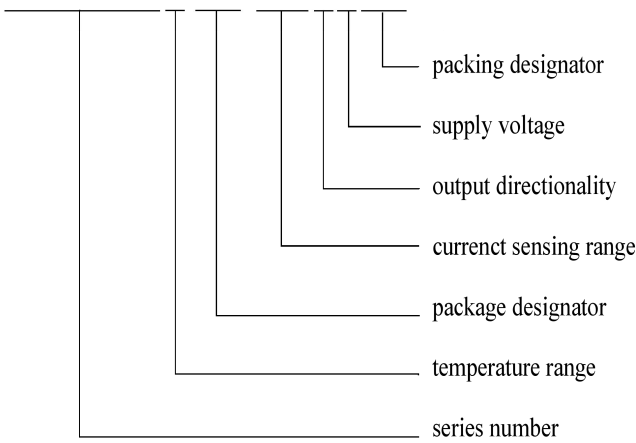
Ordering Information

Part number	Primary Current(A)	Nominal Supply Voltage(V)	Sensitivity (mV/A)	Overcurrent Threshold	Package	Packing (pieces/reel)
NHC3010FSW050B5TR	$\pm 50\text{A}$	5	40	100%IP_MAX	SOW10	1000
NHC3010FSW075B5TR	$\pm 75\text{A}$	5	26.67	100%IP_MAX	SOW10	1000
NHC3010FSW100B5TR	$\pm 100\text{A}$	5	20	100%IP_MAX	SOW10	1000
NHC3010FSW150B5TR	$\pm 150\text{A}$	5	13.33	100%IP_MAX	SOW10	1000
NHC3010FSW200B5TR	$\pm 200\text{A}$	5	10	100%IP_MAX	SOW10	1000
NHC3010FSW050B3TR	$\pm 50\text{A}$	3.3	26.4	100%IP_MAX	SOW10	1000
NHC3010FSW080B3TR	$\pm 80\text{A}$	3.3	16.5	100%IP_MAX	SOW10	1000
NHC3010FSW100B3TR	$\pm 100\text{A}$	3.3	13.2	100%IP_MAX	SOW10	1000
NHC3010FSW150B3TR	$\pm 150\text{A}$	3.3	8.8	100%IP_MAX	SOW10	1000
NHC3010FSW200B3TR	$\pm 200\text{A}$	3.3	6.6	100%IP_MAX	SOW10	1000
More part numbers can be customized within the primary current range of 50 A to 200 A ...						

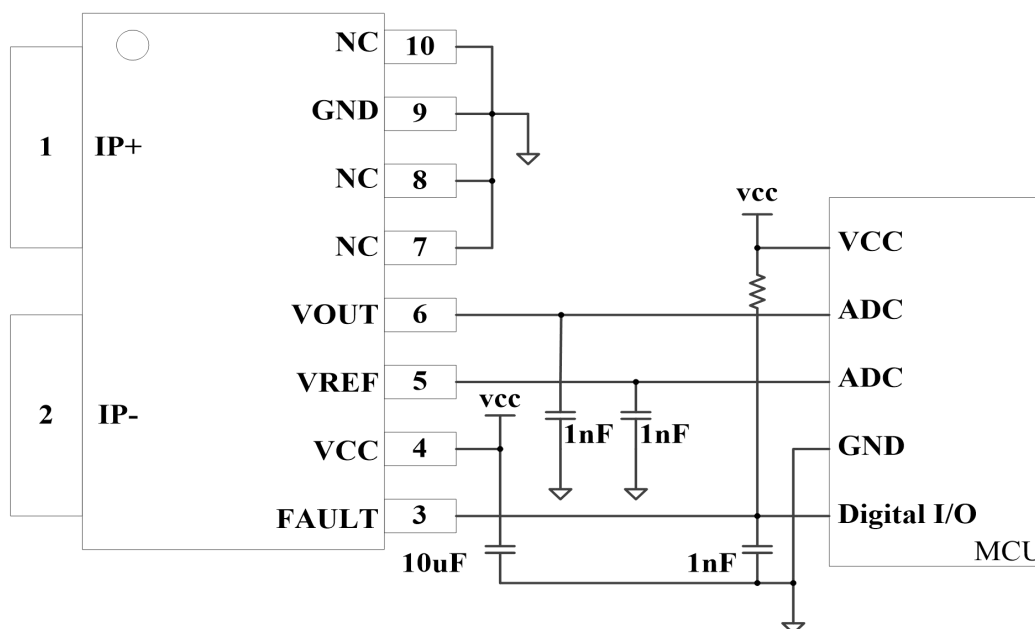
The default overcurrent threshold for the NHC3010 is 100% of the primary full-scull current (IP_MAX). Other threshold can be customized. The selectable range for the overcurrent threshold is as follows:

Parameter	Current Threshold (I _{tr})						
Optional Range (%IP_MAX)	50	75	100	125	150	175	200

Part Number Definition

Instance	Parameters	Definition
NHC3010FSW100B5TR  packing designator supply voltage output directionality current sensing range package designator temperature range series number	Series Number	NHC3010
	Temperature Range	F - -40~125°C
	Package Designator	SW - SOW10
	Current Sensing Range	100 - IPR = -100A~100A(Bidirectional) or 0~100A(Unidirectional)
	Output Directionality	B - Bidirectional U - Unidirectional
	Supply Voltage	5 - VCC = 5V 3 - VCC = 3.3V
	Packing Designator	Tape and Reel

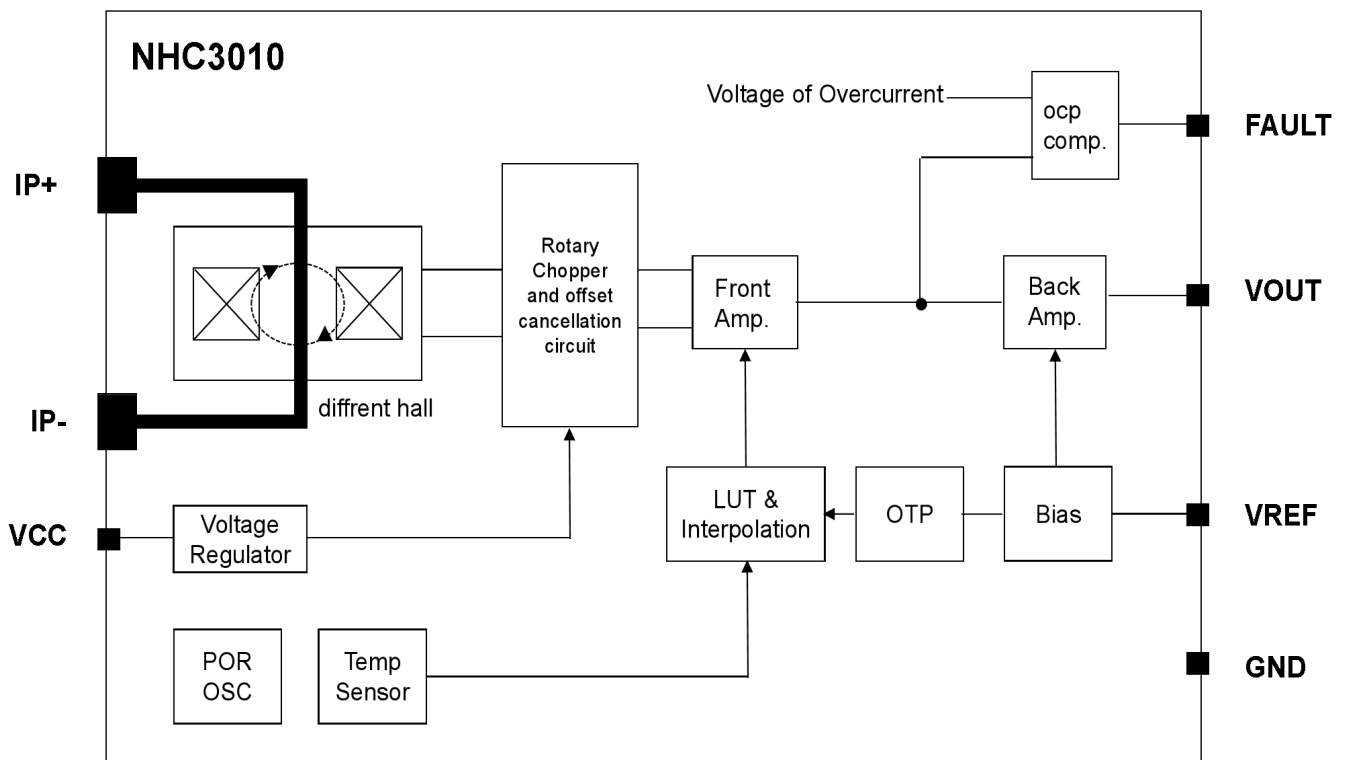
Typical Application Circuits



Pin Configuration

Pin Diagram	Name	Number	Description
	IP+	1	Current flows into the chip, positive direction
	IP-	2	Current flows out of the chip, negative direction
	FAULT	3	Overcurrent fault, Active Low
	VCC	4	Supply voltage
	VREF	5	Reference voltage output
	VOUT	6	Output voltage
	NC	7	No internal electrical connection
	NC	8	No internal electrical connection
	GND	9	Ground
	NC	10	No internal electrical connection

Functional Block Diagram



Absolute Maximum Ratings

Parameters	Symbol	Min.	Typ.	Max.	Unit	Conditions
V_{CC}		-0.3		6.5	V	25°C
V_{OUT}		-0.3		$V_{CC}+0.3$	V	25°C
Other Pins		-0.3		$V_{CC}+0.3$	V	25°C
Ambient Temperature	T_A	-40		125	°C	
Junction Temperature	T_J			150	°C	
Storage Temperature	T_S	-40		150	°C	
Electrostatic Discharge	HBM	± 8			kV	
	CDM	± 2			kV	
Moisture Sensitivity Level	MSL	3				

Note: Do not exceed the limit parameter values during use to prevent damage. Operating continuously at the limit parameter values for a long time may affect the reliability of the current sensor.

[1] Application to IPC/JEDECJ-STD-020D-2007.

Isolation Characteristics

Parameters	Symbol	Conditions/Notes	Rating	unit
Withstand Isolation Voltage	V_{ISO}	50/60Hz, 1min	5000	V_{RMS}
		$t = 1s$	6000	
Working Voltage for Basic Insulation	V_{WVBI}	Basic insulation, per UL 62368-1	1618	V_{PK} or V_{DC}
			1144	V_{RMS}
Clearance	D_{cl}	Minimum distance through air from IP pins to signal pins	8.2	mm
Creepage	D_{cr}	Minimum distance along the package surface from IP pins to signal pins	8.2	mm
Surge Voltage	V_{surge}	IEC61000-4-5, 1.2 μs /50 μs	10	kV
Surge Current	I_{surge}	IEC61000-4-5, 8 μs /20 μs	20	kA
Comparative Track Index	CTI		≥ 600	

Common Electrical Characteristics (unless otherwise specified, $V_{CC}=5V$ or $3.3V$,

$C_{OUTL}/C_{REFL}=1nF, T_A=-40^{\circ}C$ to $125^{\circ}C$)

Parameters	Symbol	Min.	Typ.	Max.	Unit	Conditions
Primary Conductor Parameters						
Primary Conductor Resistance	R_p		0.27		m Ω	$T_A = 25^{\circ}C$
Primary Continuous Current	I_{CON}			100	A	$T_A=25^{\circ}C, T_J<150^{\circ}C$, the value is dependent on PCB design and measured on the NHC3010 demo board
Power Supply Parameters						
Supply Voltage	V_{CC}	4.5	5	5.5	V	5V version
		3	3.3	3.6		3.3V version
Supply Current	I_{CC}		12	15	mA	No load, $V_{CC} = 5V$
			9	15		No load, $V_{CC} = 3.3V$
Power-On Time	T_{PO}		1		ms	The internal OTP is loading before 1 ms, $T_A = 25^{\circ}C$
Under Voltage Lockout Rising Threshold	V_{UVLOH}		2.5		V	$V_{CC} > V_{UVLOH}, V_{OUT} > V_{REF}$ power-on
Under Voltage Lockout Hysteresis Voltage	$V_{UVLOHYS}$		180		mV	$V_{CC} < V_{UVLOH} - V_{UVLOHYS}, V_{OUT} < V_{REF}$ power-off
VOU Characteristics						
Output Capacitance Load	C_{OUTL}		1	10	nF	
Output Resistance Load	R_{OUTL}	10			k Ω	
Output Short Current	I_{SHORT}			± 30	mA	Short to VCC or GND, $T_A = 25^{\circ}C$
Rail-To-Rail Output Voltage	V_S	0.1		$V_{CC}-0.1$	V	$T_A = 25^{\circ}C, C_{OUTL}=1nF$
Rise Time	T_r		1.2		μs	$T_A = 25^{\circ}C, C_{OUTL}=1nF, V_{CC}=5V$
Delay Time	T_{pd}		1.2		μs	$T_A = 25^{\circ}C, C_{OUTL}=1nF, V_{CC}=5V$
Response Time	$T_{response}$		1.5	3	μs	$T_A = 25^{\circ}C, C_{OUTL}=1nF, V_{CC}=5V$
Bandwith	BW(-3dB)		320		kHz	-3 dB bandwidth, $T_A = 25^{\circ}C, C_{OUTL}=1nF, V_{CC}=5V$
VREF Characteristics						
VREF Short Current	I_{VREF_SHORT}			± 30	mA	Short to VCC and GND, $T_A = 25^{\circ}C$
Reference Voltage	V_{REF}	2.49	2.5	2.51	V	Bidirectional version, $V_{CC}= 5V$
		1.64	1.65	1.66	V	Bidirectional version, $V_{CC}= 3.3V$
		0.49	0.5	0.51	V	Unidirectional version, $V_{CC}= 5V$
		0.32	0.33	0.34	V	Unidirectional version, $V_{CC}= 3.3V$

Continuation from previous table

Parameters	Symbol	Min.	Typ.	Max.	Unit	Conditions
Overcurrent Fault Detection						
Fault Pull-up Resistor	R_{pu}	4.7		100	k Ω	
Overcurrent Fault Threshold	I_{ft}		100		%	Factory default 100%IP_MAX, other thresholds can be customized
Overcurrent Fault Hysteresis	I_{hys}		10		%IP_MAX	$T_A = 25^{\circ}\text{C}$, $C_{FAULTL} = 1\text{nF}$
Fault Response Time	T_{fr}		1.5		μs	
Fault Error	E_{ft}		± 8		%IP_MAX	$T_A = 25^{\circ}\text{C}$, $C_{FAULTL} = 1\text{nF}$
Reliability Test^[1]						
Sensitivity Lifetime Drift	E_{sens_drift}		± 2.5		%	After the reliability test, $T_A = 25^{\circ}\text{C}$
Offset Voltage Lifetime Drift	V_{OE_drift}		± 8		mV	After the reliability test, $T_A = 25^{\circ}\text{C}$
Reference Voltage Lifetime Drift	V_{REF_drift}		± 5		mV	After the reliability test, $T_A = 25^{\circ}\text{C}$
Total Output Error Lifetime Drift	E_{TOT_drift}		± 2.1		%	After the reliability test, $T_A = 25^{\circ}\text{C}$

[1]Reliability data is implemented in accordance with the JESD47 standard.

NHC3010FSW050B5TR (unless otherwise specified, $V_{CC}=5V$, $C_{OUTL}/C_{REFL}=1nF$, $T_A=-40^{\circ}C$ to $125^{\circ}C$)

Parameters	Symbol	Conditions	Min. ^[1]	Typ.	Max. ^[1]	Unit
Current Sensing Range	IPR		-50		50	A
Sensitivity	Sens	Full scale		40		mV/A
Noise RMS(VOUT)	$V_{N(RMS)}$	IP = 0A		9		mV
Zero current output voltage	$V_{OUT(Q)}$	IP = 0A		2.5		V
Offset Error	V_{OE}	IP = 0A, $T_A = 25^{\circ}C \sim 125^{\circ}C$	-8		8	mV
		IP = 0A, $T_A = -40^{\circ}C \sim 25^{\circ}C$	-10		8	mV
Offset error temperature Drift	ΔV_{OE}	$T_A = -40^{\circ}C \sim 125^{\circ}C$ $\Delta V_{OE} = V_{OE-T_A} - V_{OE-25^{\circ}C}$	-6		6	mV
Reference Error	E_{REF}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-15		10	mV
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-15		10	mV
Sensitivity Error	E_{Sens}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-2		2	%
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-2.5		2.5	%
Total Output Error	E_{TOT}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-2		2	%
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-2.5		2.5	%
Non-linearity Error	E_{NL}	$T_A = -40^{\circ}C \sim 125^{\circ}C$	-0.4	± 0.2	0.4	%

NHC3010FSW075B5TR (unless otherwise specified, $V_{CC}=5V$, $C_{OUTL}/C_{REFL}=1nF$, $T_A=-40^{\circ}C$ to $125^{\circ}C$)

Parameters	Symbol	Conditions	Min. ^[1]	Typ.	Max. ^[1]	Unit
Current Sensing Range	IPR		-75		75	A
Sensitivity	Sens	Full scale		26.6		mV/A
Noise RMS(VOUT)	$V_{N(RMS)}$	IP = 0A		7.5		mV
Zero current output voltage	$V_{OUT(Q)}$	IP = 0A		2.5		V
Offset Error	V_{OE}	IP = 0A, $T_A = 25^{\circ}C \sim 125^{\circ}C$	-8		8	mV
		IP = 0A, $T_A = -40^{\circ}C \sim 25^{\circ}C$	-8		8	mV
Offset error temperature Drift	ΔV_{OE}	$T_A = -40^{\circ}C \sim 125^{\circ}C$ $\Delta V_{OE} = V_{OE-T_A} - V_{OE-25^{\circ}C}$	-6		6	mV
Reference Error	E_{REF}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-15		10	mV
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-15		10	mV
Sensitivity Error	E_{Sens}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-2		2	%
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-2		2	%
Total Output Error	E_{TOT}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-2		2	%
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-2.5		2.5	%
Non-linearity Error	E_{NL}	$T_A = -40^{\circ}C \sim 125^{\circ}C$	-0.4	± 0.2	0.4	%

[1] The maximum and minimum values correspond to the $\pm 3\sigma$ range of the test data.

NHC3010FSW100B5TR (unless otherwise specified, $V_{CC}=5V$, $C_{OUTL}/C_{REFL}=1nF$, $T_A=-40^{\circ}C$ to $125^{\circ}C$)

Parameters	Symbol	Conditions	Min. ^[1]	Typ.	Max. ^[1]	Unit
Current Sensing Range	IPR		-100		100	A
Sensitivity	Sens	Full scale		20		mV/A
Noise RMS(VOUT)	$V_{N(RMS)}$	IP = 0A		6		mV
Zero current output voltage	$V_{OUT(Q)}$	IP = 0A		2.5		V
Offset Error	V_{OE}	IP = 0A, $T_A = 25^{\circ}C \sim 125^{\circ}C$	-8		8	mV
		IP = 0A, $T_A = -40^{\circ}C \sim 25^{\circ}C$	-8		8	mV
Offset error temperature Drift	ΔV_{OE}	$T_A = -40^{\circ}C \sim 125^{\circ}C$ $\Delta V_{OE} = V_{OE-T_A} - V_{OE-25^{\circ}C}$	-6		6	mV
Reference Error	E_{REF}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-15		10	mV
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-15		10	mV
Sensitivity Error	E_{Sens}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-2		2	%
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-2.5		2.5	%
Total Output Error	E_{TOT}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-2		2	%
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-2.5		2.5	%
Non-linearity Error	E_{NL}	$T_A = -40^{\circ}C \sim 125^{\circ}C$	-0.4	± 0.2	0.4	%

NHC3010FSW150B5TR (unless otherwise specified, $V_{CC}=5V$, $C_{OUTL}/C_{REFL}=1nF$, $T_A=-40^{\circ}C$ to $125^{\circ}C$)

Parameters	Symbol	Conditions	Min. ^[1]	Typ.	Max. ^[1]	Unit
Current Sensing Range	IPR		-150		150	A
Sensitivity	Sens	Full scale		13.33		mV/A
Noise RMS(VOUT)	$V_{N(RMS)}$	IP = 0A		4		mV
Zero current output voltage	$V_{OUT(Q)}$	IP = 0A		2.5		V
Offset Error	V_{OE}	IP = 0A, $T_A = 25^{\circ}C \sim 125^{\circ}C$	-8		8	mV
		IP = 0A, $T_A = -40^{\circ}C \sim 25^{\circ}C$	-8		8	mV
Offset error temperature Drift	ΔV_{OE}	$T_A = -40^{\circ}C \sim 125^{\circ}C$ $\Delta V_{OE} = V_{OE-T_A} - V_{OE-25^{\circ}C}$	-6		6	mV
Reference Error	E_{REF}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-15		10	mV
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-15		10	mV
Sensitivity Error	E_{Sens}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-2		2	%
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-2		2	%
Total Output Error	E_{TOT}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-2		2	%
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-2		2	%
Non-linearity Error	E_{NL}	$T_A = -40^{\circ}C \sim 125^{\circ}C$	-0.4	± 0.2	0.4	%

[1] The maximum and minimum values correspond to the $\pm 3\sigma$ range of the test data.

NHC3010FSW200B5TR (unless otherwise specified, $V_{CC}=5V$, $C_{OUTL}/C_{REFL}=1nF$, $T_A=-40^{\circ}C$ to $125^{\circ}C$)

Parameters	Symbol	Conditions	Min. ^[1]	Typ.	Max. ^[1]	Unit
Current Sensing Range	IPR		-200		200	A
Sensitivity	Sens	Full scale		10		mV/A
Noise RMS(VOUT)	$V_{N(RMS)}$	IP = 0A		3		mV
Zero current output voltage	$V_{OUT(Q)}$	IP = 0A		2.5		V
Offset Error	V_{OE}	IP = 0A, $T_A = 25^{\circ}C \sim 125^{\circ}C$	-8		8	mV
		IP = 0A, $T_A = -40^{\circ}C \sim 25^{\circ}C$	-8		8	mV
Offset error temperature Drift	ΔV_{OE}	$T_A = -40^{\circ}C \sim 125^{\circ}C$ $\Delta V_{OE} = V_{OE-T_A} - V_{OE-25^{\circ}C}$	-6		6	mV
Reference Error	E_{REF}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-15		10	mV
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-15		10	mV
Sensitivity Error	E_{Sens}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-2		2	%
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-2.5		2.5	%
Total Output Error	E_{TOT}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-2		2	%
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-2.5		2.5	%
Non-linearity Error	E_{NL}	$T_A = -40^{\circ}C \sim 125^{\circ}C$	-0.4	± 0.2	0.4	%

NHC3010FSW050B3TR (unless otherwise specified, $V_{CC}=3.3V$, $C_{OUTL}/C_{REFL}=1nF$, $T_A=-40^{\circ}C$ to $125^{\circ}C$)

Parameters	Symbol	Conditions	Min. ^[1]	Typ.	Max. ^[1]	Unit
Current Sensing Range	IPR		-50		50	A
Sensitivity	Sens	Full scale		26.4		mV/A
Noise RMS(VOUT)	$V_{N(RMS)}$	IP = 0A		9.5		mV
Zero current output voltage	$V_{OUT(Q)}$	IP = 0A		1.65		V
Offset Error	V_{OE}	IP = 0A, $T_A = 25^{\circ}C \sim 125^{\circ}C$	-8		8	mV
		IP = 0A, $T_A = -40^{\circ}C \sim 25^{\circ}C$	-10		8	mV
Offset error temperature Drift	ΔV_{OE}	$T_A = -40^{\circ}C \sim 125^{\circ}C$ $\Delta V_{OE} = V_{OE-T_A} - V_{OE-25^{\circ}C}$	-6		6	mV
Reference Error	E_{REF}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-15		10	mV
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-15		10	mV
Sensitivity Error	E_{Sens}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-2.5		2.5	%
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-2		2	%
Total Output Error	E_{TOT}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-2		2	%
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-2.5		2.5	%
Non-linearity Error	E_{NL}	$T_A = -40^{\circ}C \sim 125^{\circ}C$	-0.4	± 0.2	0.4	%

[1] The maximum and minimum values correspond to the $\pm 3\sigma$ range of the test data.

NHC3010FSW080B3TR (unless otherwise specified, $V_{CC}=3.3V$, $C_{OUTL}/C_{REFL}=1nF$, $T_A=-40^{\circ}C$ to $125^{\circ}C$)

Parameters	Symbol	Conditions	Min. ^[1]	Typ.	Max. ^[1]	Unit
Current Sensing Range	IPR		-80		80	A
Sensitivity	Sens	Full scale		16.5		mV/A
Noise RMS(VOUT)	$V_{N(RMS)}$	IP = 0A		9.5		mV
Zero current output voltage	$V_{OUT(Q)}$	IP = 0A		1.65		V
Offset Error	V_{OE}	IP = 0A, $T_A = 25^{\circ}C \sim 125^{\circ}C$	-8		8	mV
		IP = 0A, $T_A = -40^{\circ}C \sim 25^{\circ}C$	-8		8	mV
Offset error temperature Drift	ΔV_{OE}	$T_A = -40^{\circ}C \sim 125^{\circ}C$ $\Delta V_{OE} = V_{OE-T_A} - V_{OE-25^{\circ}C}$	-6		6	mV
Reference Error	E_{REF}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-15		10	mV
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-15		10	mV
Sensitivity Error	E_{Sens}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-2		2	%
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-2.5		2.5	%
Total Output Error	E_{TOT}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-2		2	%
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-2.5		2.5	%
Non-linearity Error	E_{NL}	$T_A = -40^{\circ}C \sim 125^{\circ}C$	-0.4	± 0.2	0.4	%

NHC3010FSW100B3TR (unless otherwise specified, $V_{CC}=3.3V$, $C_{OUTL}/C_{REFL}=1nF$, $T_A=-40^{\circ}C$ to $125^{\circ}C$)

Parameters	Symbol	Conditions	Min. ^[1]	Typ.	Max. ^[1]	Unit
Current Sensing Range	IPR		-100		100	A
Sensitivity	Sens	Full scale		13.2		mV/A
Noise RMS(VOUT)	$V_{N(RMS)}$	IP = 0A		6.5		mV
Zero current output voltage	$V_{OUT(Q)}$	IP = 0A		1.65		V
Offset Error	V_{OE}	IP = 0A, $T_A = 25^{\circ}C \sim 125^{\circ}C$	-8		8	mV
		IP = 0A, $T_A = -40^{\circ}C \sim 25^{\circ}C$	-8		8	mV
Offset error temperature Drift	ΔV_{OE}	$T_A = -40^{\circ}C \sim 125^{\circ}C$ $\Delta V_{OE} = V_{OE-T_A} - V_{OE-25^{\circ}C}$	-6		6	mV
Reference Error	E_{REF}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-15		10	mV
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-15		10	mV
Sensitivity Error	E_{Sens}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-2		2	%
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-2		2	%
Total Output Error	E_{TOT}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-2		2	%
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-2		2	%
Non-linearity Error	E_{NL}	$T_A = -40^{\circ}C \sim 125^{\circ}C$	-0.4	± 0.2	0.4	%

[1] The maximum and minimum values correspond to the $\pm 3\sigma$ range of the test data.

NHC3010FSW150B3TR (unless otherwise specified, $V_{CC}=3.3V$, $C_{OUTL}/C_{REFL}=1nF$, $T_A=-40^{\circ}C$ to $125^{\circ}C$)

Parameters	Symbol	Conditions	Min. ^[1]	Typ.	Max. ^[1]	Unit
Current Sensing Range	IPR		-150		150	A
Sensitivity	Sens	Full scale		8.8		mV/A
Noise RMS(VOUT)	$V_{N(RMS)}$	IP = 0A		6		mV
Zero current output voltage	$V_{OUT(Q)}$	IP = 0A		1.65		V
Offset Error	V_{OE}	IP = 0A, $T_A = 25^{\circ}C \sim 125^{\circ}C$	-8		8	mV
		IP = 0A, $T_A = -40^{\circ}C \sim 25^{\circ}C$	-8		8	mV
Offset error temperature Drift	ΔV_{OE}	$T_A = -40^{\circ}C \sim 125^{\circ}C$ $\Delta V_{OE} = V_{OE-T_A} - V_{OE-25^{\circ}C}$	-6		6	mV
Reference Error	E_{REF}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-15		10	mV
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-15		10	mV
Sensitivity Error	E_{Sens}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-2		2	%
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-2.5		2.5	%
Total Output Error	E_{TOT}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-2		2	%
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-2.5		2.5	%
Non-linearity Error	E_{NL}	$T_A = -40^{\circ}C \sim 125^{\circ}C$	-0.4	± 0.2	0.4	%

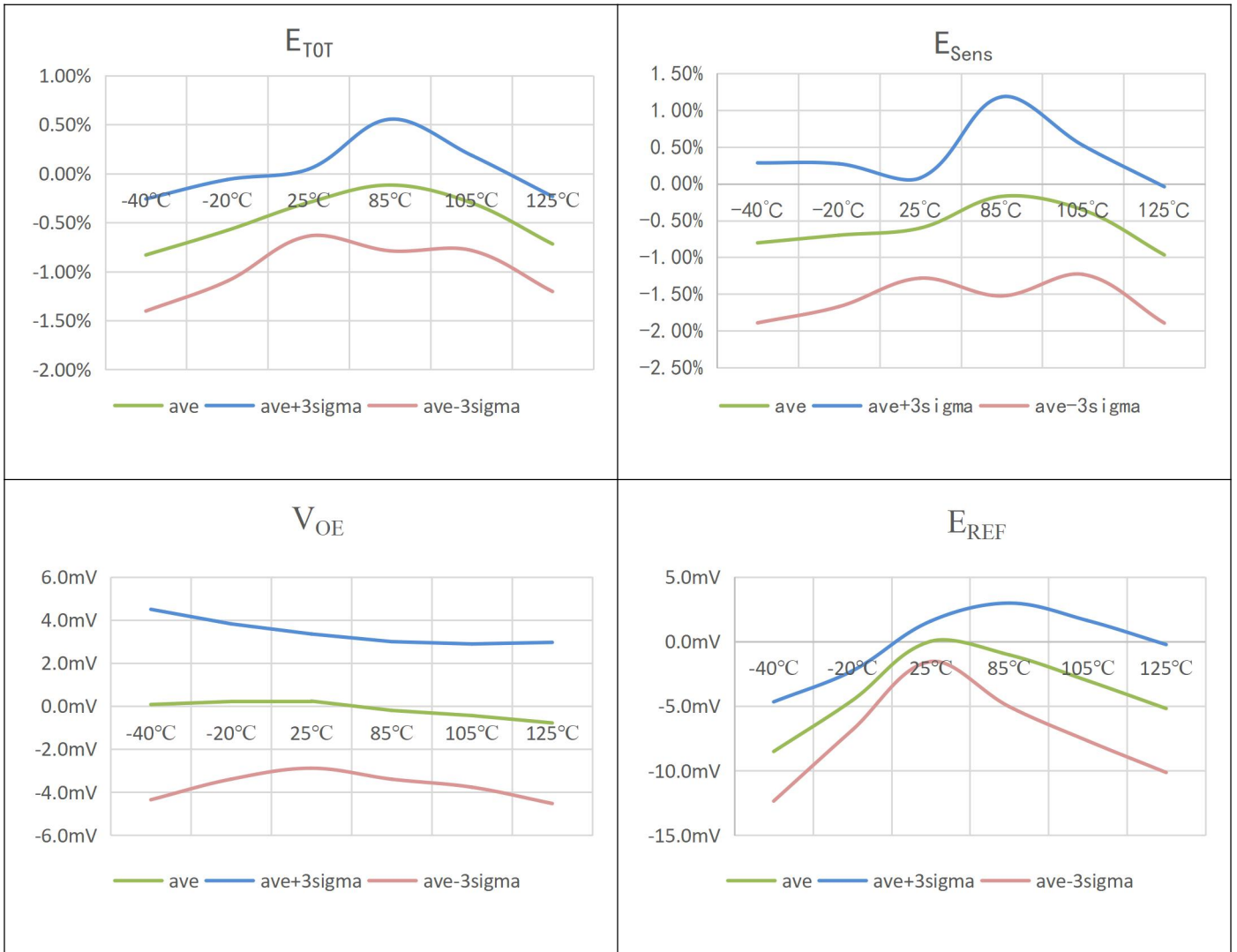
NHC3010FSW200B3TR (unless otherwise specified, $V_{CC}=3.3V$, $C_{OUTL}/C_{REFL}=1nF$, $T_A=-40^{\circ}C$ to $125^{\circ}C$)

Parameters	Symbol	Conditions	Min. ^[1]	Typ.	Max. ^[1]	Unit
Current Sensing Range	IPR		-200		200	A
Sensitivity	Sens	Full scale		6.6		mV/A
Noise RMS(VOUT)	$V_{N(RMS)}$	IP = 0A		5.5		mV
Zero current output voltage	$V_{OUT(Q)}$	IP = 0A		1.65		V
Offset Error	V_{OE}	IP = 0A, $T_A = 25^{\circ}C \sim 125^{\circ}C$	-8		8	mV
		IP = 0A, $T_A = -40^{\circ}C \sim 25^{\circ}C$	-8		8	mV
Offset error temperature Drift	ΔV_{OE}	$T_A = -40^{\circ}C \sim 125^{\circ}C$ $\Delta V_{OE} = V_{OE-T_A} - V_{OE-25^{\circ}C}$	-6		6	mV
Reference Error	E_{REF}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-15		10	mV
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-15		10	mV
Sensitivity Error	E_{Sens}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-2.5		2.5	%
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-2.5		2.5	%
Total Output Error	E_{TOT}	$T_A = 25^{\circ}C \sim 125^{\circ}C$	-2.5		2.5	%
		$T_A = -40^{\circ}C \sim 25^{\circ}C$	-2.5		2.5	%
Non-linearity Error	E_{NL}	$T_A = -40^{\circ}C \sim 125^{\circ}C$	-0.4	± 0.2	0.4	%

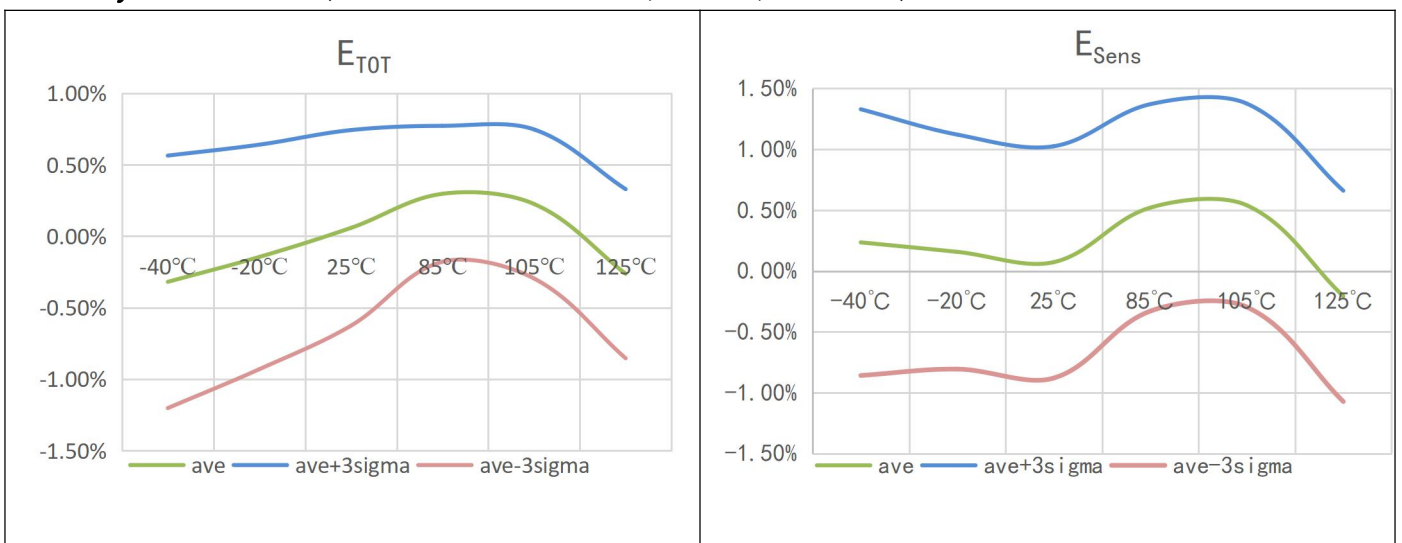
[1] The maximum and minimum values correspond to the $\pm 3\sigma$ range of the test data.

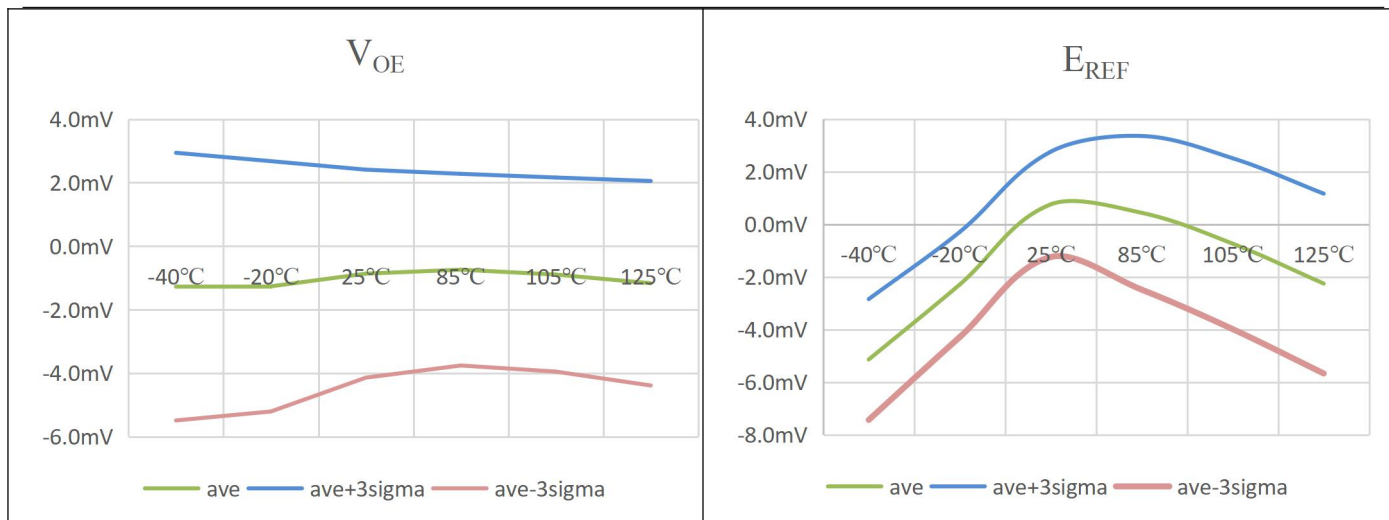
Typical Characteristics

Accuracy Characteristics (for NHC3010FSW100B5TR, IP = 50A, -40~125 °C)

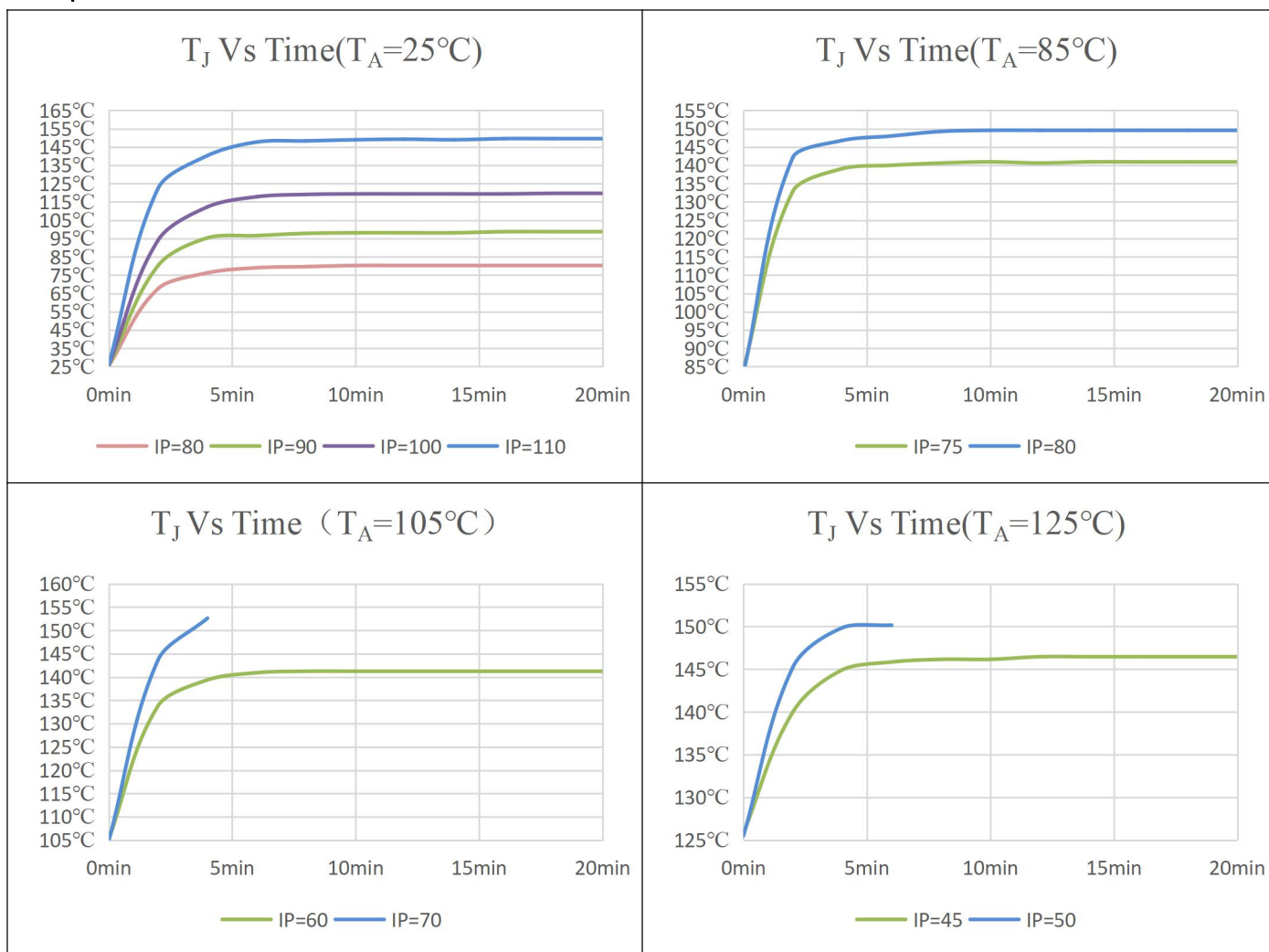


Accuracy Characteristics (for NHC3010FSW100B3TR, IP = 50A, -40~125 °C)





Temperature Characteristics^[1]



[1] The temperature characteristic curve shows the variation of the chip's junction temperature over time at given ambient temperatures and currents. The data is obtained from the internal temperature sensor and is dependent on the PCB thermal design, The data shown is based on the NHC3010 demo board.

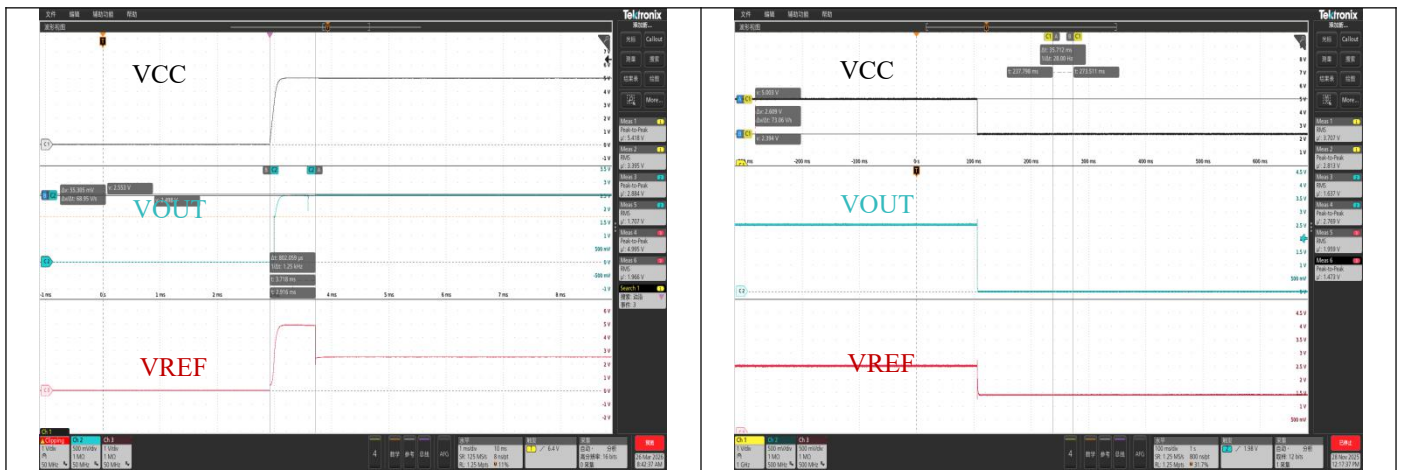
Overcurrent Fault Response ($I_{ft}=100\%IP_MAX$, $T_A=25^{\circ}C$, Output Response ($T_A=25^{\circ}C$, response time= 1.48 μ s).

fault response time= 220ns)



Power-On Timing($T_{PO}<1ms$)

Under-Voltage Protection Timing($V_{UVLOL}=2.394V$)

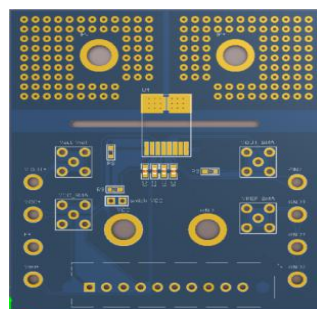


NHC3010 Demo Board

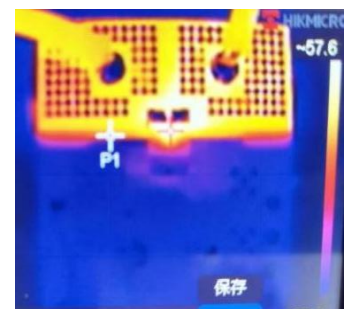
NHC3010 demo board uses a 2-layer PCB with 34 mm $\times$ 26 mm copper pour areas connected to pin 1 and to pin 2.

Each layer uses 4 oz determined by its own design, but also closely related to the measurement of current and the heat dissipation structure of the PCB design. To ensure good heat dissipation of the PCB, the following measures are recommended: increasing the thickness of the copper

plate on the PCB, using multi-layer boards, adopting through-hole heat dissipation or adding active heat dissipation around primary conductor of the chip.

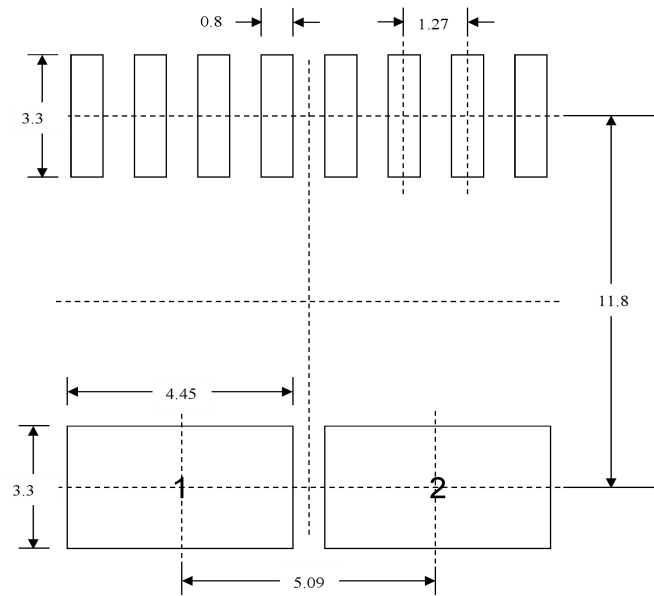


NHC3010 Demo Board



Thermal

PCB Layout Reference View (Unit: mm) :



Term Definitions

IP、 IP_MAX and IPR

The input current is considered positive when flowing from IP+ to IP-, and negative otherwise.

IP denotes the actual current from IP+ to IP-.For instance,when the actual current flowing from IP+ to IP- is 20A,IP equals 20A.

IP_MAX represents the max current within the current range, and IPR denotes the current range. Taking NHC3010FSW100B5TR as an example, IP_MAX is $\pm 100A$, and IPR is from -100A to 100A.

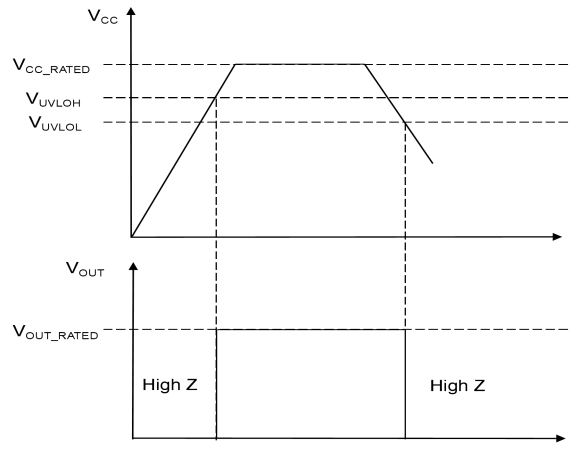
Parallel resistors are prohibited between IP+ and IP-. This is except for extremely special cases, in which case the current flowing through the chip will decrease, and the resistance of the wires will also be affected by temperature drift. An external system calibration for temperature and accuracy correction is required.

Under Voltage Lockout Rising Threshold (V_{UVLOH})

To ensure accurate device operation and prevent malfunctions, NHC3010 includes a under voltage lockout circuit. When V_{CC} rises above the rising threshold V_{UVLOH} , the device begins normal operation.

Under Voltage Lockout Hysteresis Voltage ($V_{UVLOHYS}$)

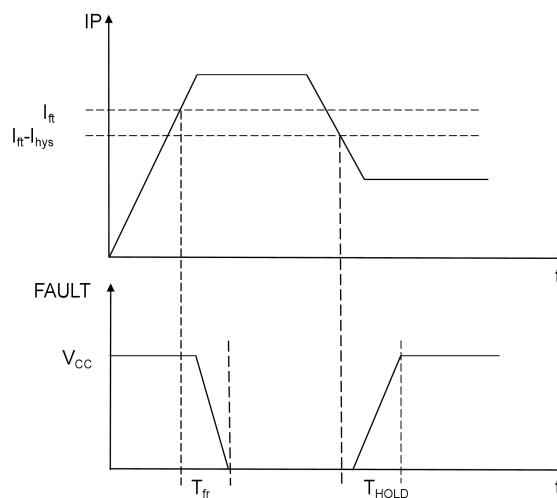
The under voltage lockout circuit incorporates a hysteresis voltage $V_{UVLOHYS}$ to prevent chattering and oscillation when V_{CC} is near the threshold. The device enters under-voltage lockout(output high impedance) when V_{CC} falls below $V_{UVLOH}-V_{UVLOHYS}$ (V_{UVLOL}) and recovers when V_{CC} rises above V_{UVLOH} .The typical hysteresis voltage $V_{UVLOHYS}$ is defined as the difference between the rising threshold and the falling threshold.



Under-Voltage Protection Timing Diagram

Overcurrent Fault Response Time (T_{fr})

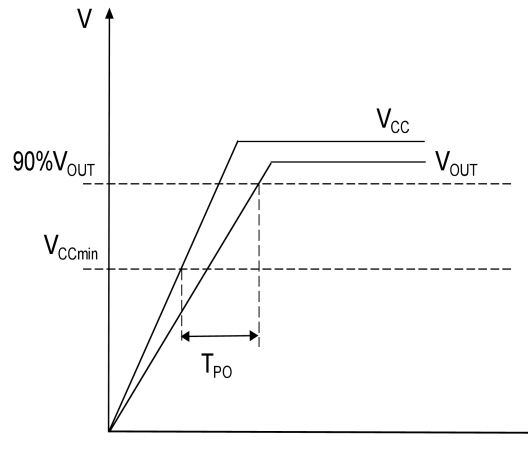
NHC3010 features a fast overcurrent protection (OCP) circuit. When the magnitude of the primary current I_P exceeds the overcurrent threshold I_{fr} , the internal comparator triggers and pulls the open-drain FAULT pin low. The fault condition is cleared when I_P falls below $I_{fr} - I_{hys}$. The fault response time, T_{fr} is measured from the moment the overcurrent condition is met to the moment the FAULT pin is pulled low. The timing sequence for the overcurrent protection is as follows:



Overcurrent Protection Timing Diagram

Power-On Time (T_{PO})

When the power supply voltage rises to the operating voltage range of the chip, NHC3010 requires some time to establish its internal operating logic. The power-on time is defined as the duration from when V_{CC} reaches its minimum operating voltage V_{CCmin} until the output voltage V_{OUT} settles within $\pm 10\%$ of its final value for the first time.



Power-on Reset

Rise Time (T_r)

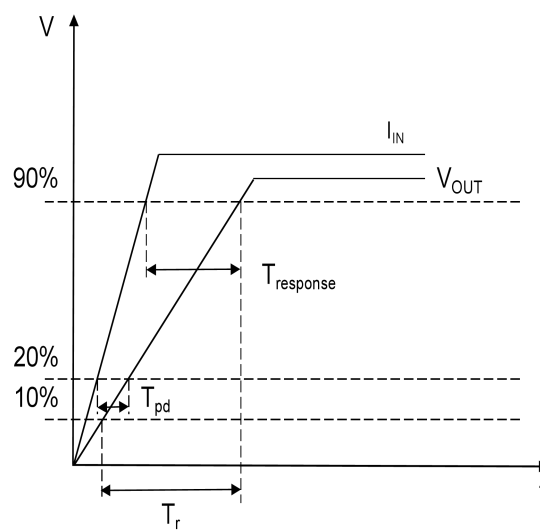
Rise time is defined as the time taken for the output signal to go from 10% to 90% of its final value.

Delay Time (T_{pd})

Propagation delay is defined as the time from when the primary current crosses 20% of its final value to when the output voltage crosses 20% of its final value.

Response Time ($T_{response}$)

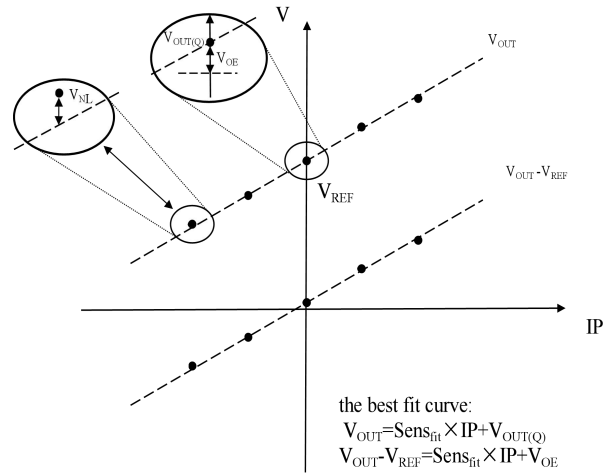
Response time is defined as the time from when the primary current crosses 90% of its final value to when the output voltage crosses 90% of its final value.



Output Response

Sensitivity(Sens)

Sensitivity is defined as the ratio of the output voltage to the primary input current. Sensitivity is the slope of the curve as below.



Output Vs IP

Sensitivity error is the deviation between the slope of the best-fit curve and the slope of the ideal curve.

$$E_{Sens} = \frac{Sens_{fit} - Sens_{ideal}}{Sens_{ideal}}$$

Offset Error and Offset Drift

Offset error is defined as the difference between the output voltage and the reference voltage when the primary current is 0 A; $V_{REF} = 2.5 \text{ V @}$

$V_{CC} = 5 \text{ V}$, $V_{REF} = 1.65 \text{ V @ } V_{CC} = 3.3 \text{ V}$.

$$V_{OE} = V_{OUT(Q)} - V_{REF}$$

Offset drift is defined as the variation of the zero-current output offset error with temperature:

$$\Delta V_{OE} = V_{OE} @ T_A - V_{OE} @ 25^\circ \text{C}$$

Non-linear Error

Nonlinear error is defined as the error from the point with the maximum deviation from the best-fit curve to the full scale range. The mathematical expression is as follows: is the maximum deviation of the actual output (as a function of IP) from an ideal straight line, calculated using the best-fit straight line method, and expressed as a percentage of the full-scale range.

$$V_{NL} = V_{OUTMAX} - (S_{fit} * IP_{MAX} + V_{OUT(Q)})$$

Where: V_{OUTMAX} is the output voltage furthest from the fitted curve; IP_{MAX} is the primary current furthest from the fitted curve; Therefore, the nonlinear error data expression is as follows:

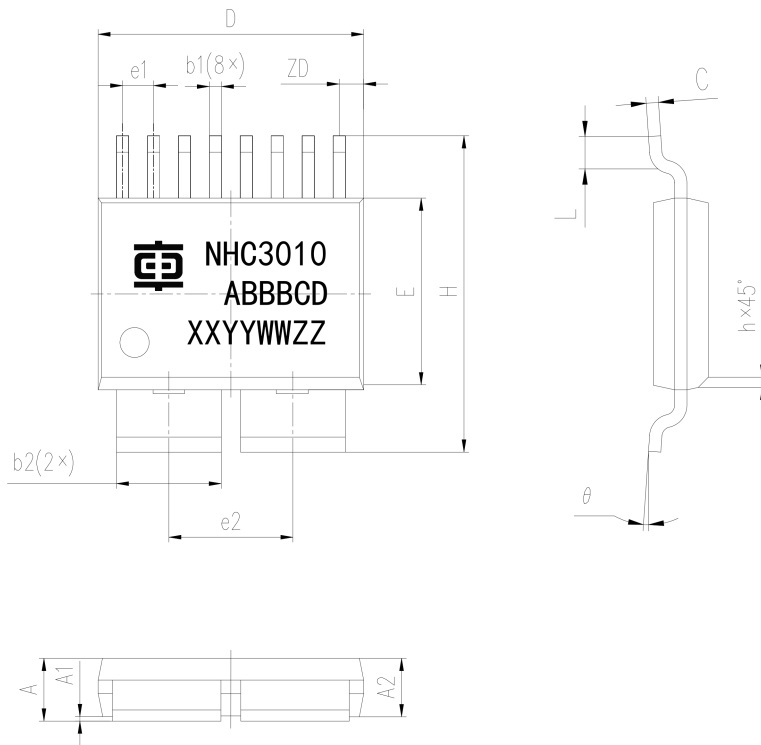
$$E_{NL} = \frac{V_{NL}}{FS} * 100\%$$

Total Output Error

Total output error is defined as the discrepancy between the actual specified current and the current measured by the chip; in other words, it is the difference between the actual output voltage and the ideal output voltage. It should be noted that the factors dominating the total output error vary across different current ranges. During small-current measurements, offset error is the primary source of error; during large-current measurements, the total error caused by offset error is minimal, with sensitivity error constituting the dominant source of error.

$$E_{TOT}(IP) = \frac{V_{OUT}(IP) - V_{OUTIDEAL}(IP)}{FS}$$

Package Outline Drawing



Labeling Instructions:

First line: NHC3010 – Product Series second line:

ABBBCD —Product Specifications

A—Temperature Range

BBB — Current Sensing Range

C—Output Directionality

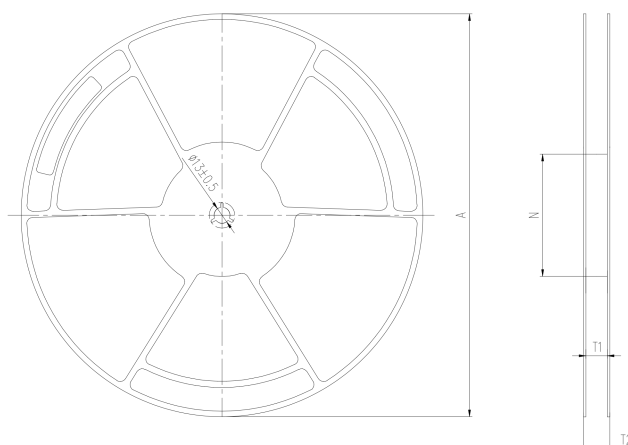
D—Supply Voltage

Third line: XXYYWWZZ — Production batch number

Symbol	Dimensions (mm)		
	Min.	Typ.	Max.
A	-	-	2.65
A1	0.10	-	0.30
A2	2.18	2.25	2.32
b1	0.45	-	0.55
b2	4.25	-	4.35
C	0.508REF		
D	10.875	10.90	10.925
E	7.675	7.70	7.725
e1	1.27		
e2	5.09		
H	12.50	12.70	12.90
h	0.21	-	0.61
L	1.00	-	1.40
θ	0°	-	8°

Packing Information

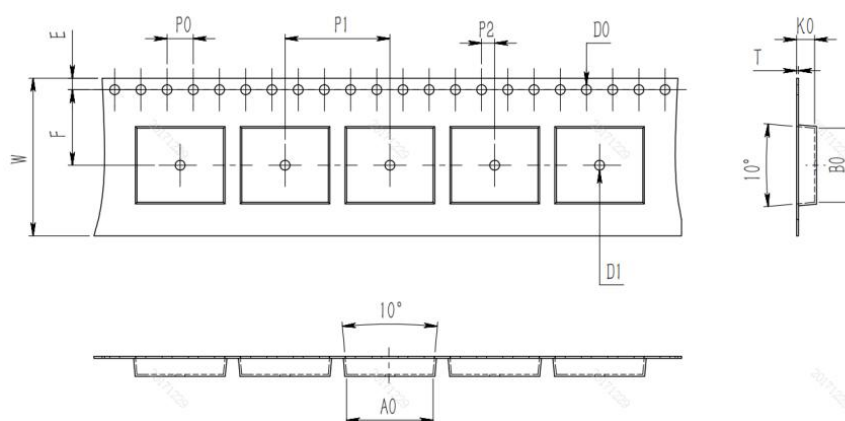
Reel Dimensions



Reel Dimensions (mm)

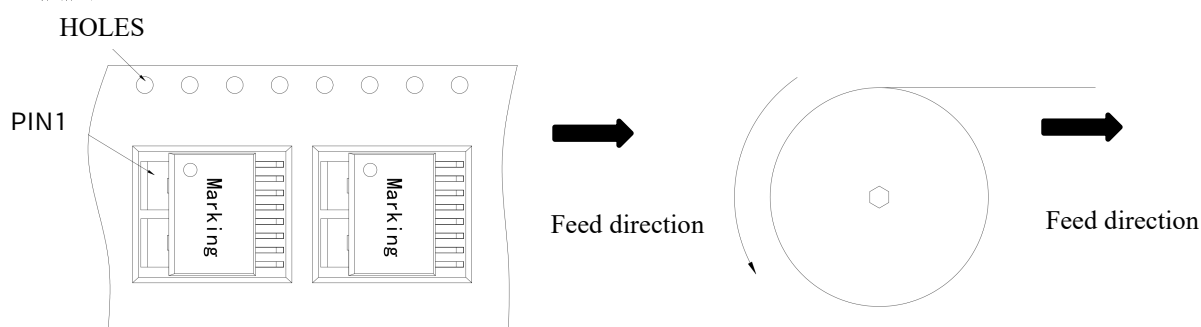
A	N	T1	T2
$\Phi 330 \pm 2$	$\Phi 100 \pm 5$	24.5 ± 0.5	28 ± 2

Tape Dimensions



Tape Dimensions (mm)

W	A0	B0	K0	P0	P1
24.0 ± 0.3	13.2 ± 0.1	11.30 ± 0.1	2.75 ± 0.1	4.0 ± 0.1	16.0 ± 0.1
P2	E	F	D0	D1	T
2.0 ± 0.1	1.75 ± 0.1	11.5 ± 0.1	$1.5^{+0.1}_{-0.0}$	$1.5^{+0.1}_{-0.0}$	0.3 ± 0.05



Remark

Although the differential Hall architecture effectively suppresses common-mode magnetic fields, measurement errors can still be introduced by stray magnetic fields in complex industrial environments. During PCB layout, avoid routing high-current traces directly underneath the chip.

Comments

- Items with “*” in this datasheet are recommended value for reference only. The final value must be determined by customer.
- CRRC reserves the right to carry out modifications on its transducers, in order to improve them.
- Product updates will not notified separately. The final version of the datasheet shall be confirmed through specific communication between both parties.

Revision History

Revised Date	Revised Content	Edition
2025-04-18	Initial Release	V0
2026-03-02	Update of typical application circuits for chips and related parameter calculations Add chip packing dimensions diagrams	V1
2026-07-07	Update the template, and add typical characteristics	V2