NHC3001FSWXXXBXTR Current Sensor IC

NHC3001 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: ±20A~ ±100A
- Operating temperature range: -40~125 °C
- Sensitivity error: ±2%
- Offset error: within ±8 mV
- Ultra-low on-resistance: 0.66 mΩ
- Withstand Isolation Voltage: 5000 V_{RMS}
- Surge current withstand capability: 13 kA
- Bandwidth: 320 kHz
- Overcurrent protection response time: 1.5 μs
- Output response time: 1.2 μs



Application

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

Ordering Information

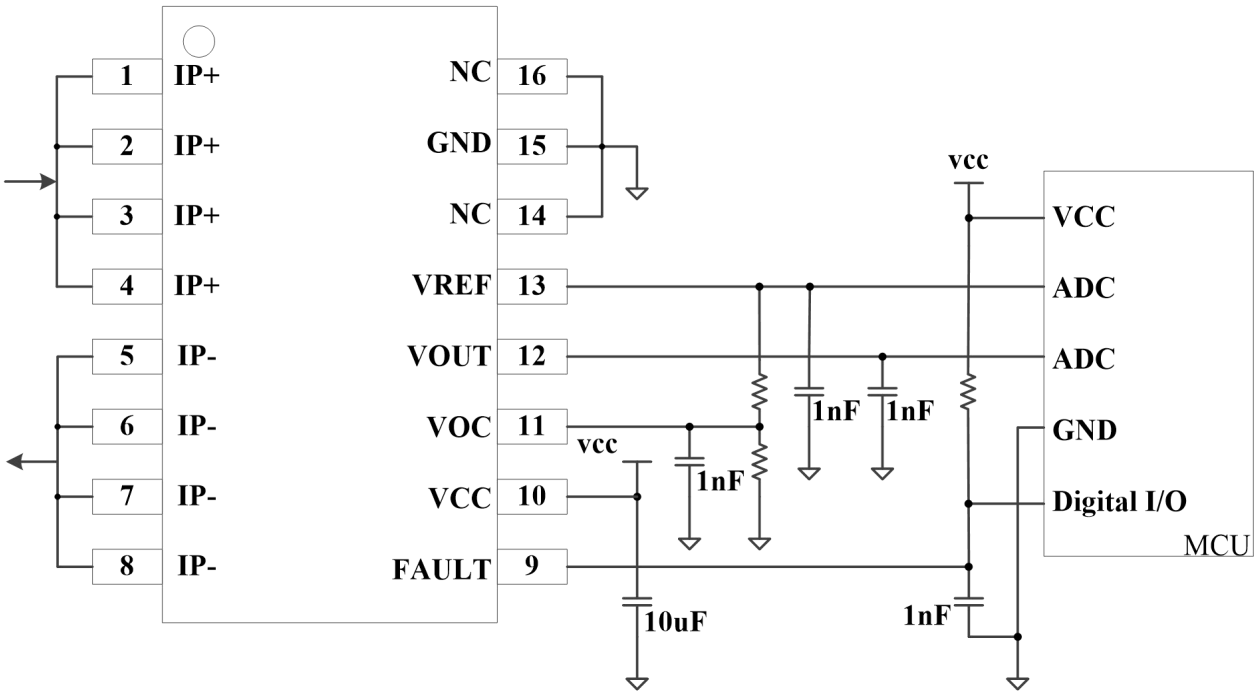
Part number	Primary Current(A)	Nominal Supply Voltage(V)	Sensitivity (mV/A)	Overcurrent Threshold	Package	Packing (pieces/reel)
NHC3001FSW020B5TR	±20A	5	100	75%~200%[1] IP_MAX	SOP16W	1000
NHC3001FSW030B5TR	±30A	5	66.7		SOP16W	1000
NHC3001FSW040B5TR	±40A	5	50		SOP16W	1000
NHC3001FSW050B5TR	±50A	5	40		SOP16W	1000
NHC3001FSW066B5TR	±66A	5	30.3		SOP16W	1000
NHC3001FSW075B5TR	±75A	5	26.7		SOP16W	1000
NHC3001FSW080B5TR	±80A	5	25		SOP16W	1000
NHC3001FSW100B5TR	±100A	5	20		SOP16W	1000
NHC3001FSW020B3TR	±20A	3.3	66		SOP16W	1000
NHC3001FSW030B3TR	±30A	3.3	44		SOP16W	1000
NHC3001FSW040B3TR	±40A	3.3	33		SOP16W	1000
NHC3001FSW050B3TR	±50A	3.3	26.4		SOP16W	1000
NHC3001FSW066B3TR	±66A	3.3	20		SOP16W	1000
NHC3001FSW075B3TR	±75A	3.3	17.6		SOP16W	1000
NHC3001FSW080B3TR	±80A	3.3	16.5		SOP16W	1000
NHC3001FSW100B3TR	±100A	3.3	13.2		SOP16W	1000
More part numbers can be customized within the primary current range of 20 to 100A...						

[1] The overcurrent threshold can be set by the VOC supply voltage. For more details, please refer to “Overcurrent Fault Threshold” section in page 18.

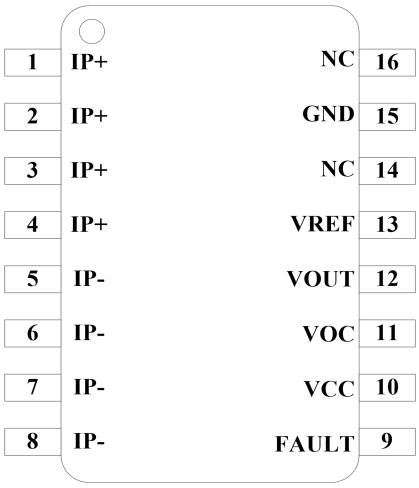
Part Number Definition

Instance	Parameters	Definition
NHC3001FSW050B5TR packing designater nominal supply voltage output directionality currenct sensing range package designater temperature range series number	Series Number	NHC3001
	Temperature Range	F - -40~125°C
	Package Designator	SW - SOP16W
	Current Sensing Range	050 - IPR = -50A~50A(Bidirectional) or 0~50A(Unidirectional)
	Output Directionality	B - Bidirectional U - Unidirectional
	Nominal Supply Voltage	5 - VCC = 5V 3 - VCC = 3.3V
	Packing Designator	Tape and Reel

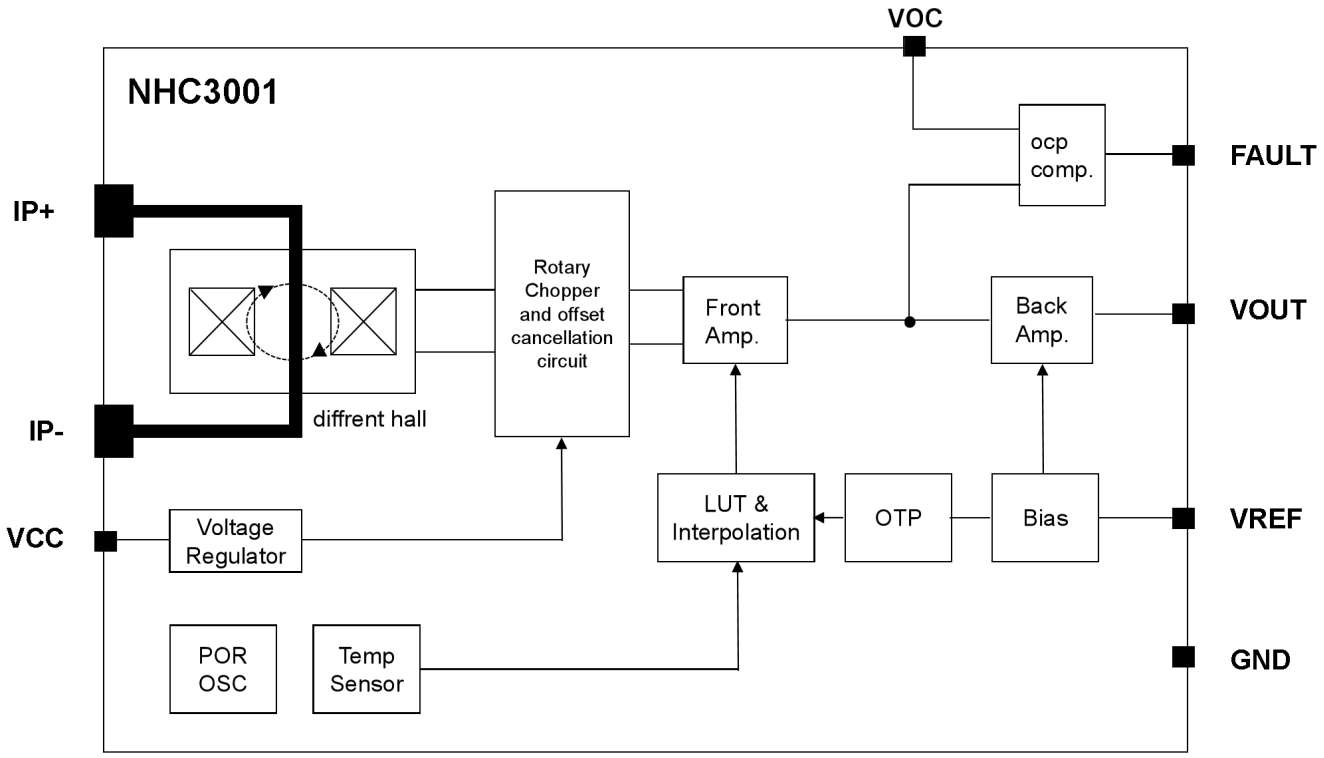
Typical Application Circuits



Pin Configuration

Pin Diagram	Name	Number	Description
	IP+	1~4	Current flows into the chip, positive direction
	IP-	5~8	Current flows out of the chip, negative direction
	FAULT	9	Overcurrent fault, Active Low
	VCC	10	Supply voltage
	VOC	11	Overcurrent fault operation point input
	VOUT	12	Output voltage
	VREF	13	Reference voltage output
	NC	14	No internal electrical connection
	GND	15	Ground
	NC	16	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		VCC+0.3	V	25°C
Other Pins		-0.3		VCC+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				
Latch-Up	LU	500			mA	

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 Insulatiom	V_{WVBI}	Basic insulation,per UL 62368-1	1550	V_{PK} or V_{DC}
			1097	V_{RMS}
Clearance	D_{cl}	Minimum distance through air from IP pins to signal pins	8	mm
Creepage	D_{cr}	Minimum distance along the package surface from IP pins to signal pins	8	mm
Surge Voltage	V_{surge}	IEC61000-4-5, 1.2μs/50μs	10	kV
Surge Current	I_{surge}	IEC61000-4-5, 8μs/20μs	13	kA

Common Electrical Characteristics (unless otherwise specified, V_{CC}=5V or 3.3V, C_{VOC}=1nF, C_{OUTL}/C_{REFL}=1nF, T_A=-40°C to 125°C)

Parameters	Symbol	Min.	Typ.	Max.	Unit	Conditions
Primary Conductor Parameters						
Primary Conductor Resistance	Rp		0.66		mΩ	T_A = 25°C
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°C
Under Voltage Lockout Rising Threshold	V_{UVLOH}		2.5		V	Vcc> V_{UVLOH}, V_{OUT}、 V_{REF} power-on
Under Voltage Lockout Hysteresis Voltage	$V_{UVLOHYS}$		180		mV	Vcc <V_{UVLOH}–$V_{UVLOHYS}$, V_{OUT}、 V_{REF} power-off
VOUT Characteristics						
Output Capacitance Load	C_{OUTL}		1	10	nF	VOUT to GND
Output Resistance Load	R_{OUTL}	10			kΩ	VOUT to GND
Output Short Current	I_{SHORT}			±30	mA	Short to VCC or GND, T_A = 25°C
VOUT High Saturation Voltage	V_{SATH}		0.1	0.2	V	V_{SATH}=V_{CC} – $V_{OUT,}$ R_{OUTL}=10kΩ to GND, T_A = 25°C
VOUT Low Saturation Voltage	V_{SATL}		0.1	0.2	V	$V_{SATL=}$ $V_{OUT,}$ R_{OUT_VCC}=10kΩ to VCC, T_A = 25°C
Response Time	$T_{response}$		1.2	2	μs	T_A = 25°C， C_{OUTL}=lnF, V_{CC}=5V, for “050B5” Version
Bandwith	BW(-3dB)		320		kHz	-3 dB bandwidth, T_A = 25°C, C_{OUTL}=lnF, V_{CC}=5V, for “050B5” Version
VREF Characteristics						
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						
VOC Voltage range	V_{OC}	0.5		2	V	5V version
		0.33		1.32	V	3.3V version
VOC Capacitance Load	C_{VOC}			1	nF	
Fault Pull-up Resistor	R_{pu}	4.7		100	kΩ	
Overcurrent Fault Threshold	I_{ft}	75		200	%FS	The Fault pin active low while IP > I_{ft}
Overcurrent Fault Hysteresis	I_{hys}		10		%IP_MAX	The Fault pin returns to high level while IP < I_{ft} −I_{hys} “050B5” Version, I_{ft} =100%IP_MAX T_A= 25°C, C_{FAULTL}=1nF
Fault Response Time	T_{fr}		1.5		µs	R_{pu}=4.7 kΩ
Fault Error	E_{ft}		±8		%IP_MAX	“050B5” Version, I_{ft} =100%IP_MAX T_A= 25°C, C_{FAULTL}=1nF
Reliability Test [1]						
Sensitivity Lifetime Drift	E_{sens_drift}		±2.5		%	After the reliability test, T_A = 25 °C
Offset Voltage Lifetime Drift	V_{OE_drift}		±15		mV	After the reliability test, T_A = 25 °C
Reference Voltage Lifetime Drift	V_{REF_drift}		±15		mV	After the reliability test, T_A = 25 °C
Total Output Error Lifetime Drift	E_{TOT_drift}		±2.8		%	After the reliability test,T_A = 25 °C

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

NHC3001FSW020B5TR (unless otherwise specified, V_{CC}=5V, $C_{OUTL}/C_{REFL}/C_{VOC}$=1nF, -40°Cto 125°C)

Parameters	Symbol	Conditions	Min.[1]	Typ.	Max.[1]	Unit
Current Sensing Range	IPR		-20		20	A
Sensitivity	Sens	Full scale		100		mV/A
Noise RMS(VOUT)	$V_{N(RMS)}$	IP = 0A		12		mV
Zero current output voltage	$V_{OUT(Q)}$	IP = 0A		2.5		V
Offset Error	V_{OE}	IP = 0A, T_A = 25°C~125°C	-8		8	mV
		IP = 0A, T_A = -40°C~25°C	-8		8	mV
Offset error temperature Drift	ΔV_{OE}	T_A = -40°C~125°C $\Delta V_{OE} = V_{OE_}T_A - V_{OE_}25°C$	-6		6	mV
Reference Error	E_{REF}	T_A = 25°C~125°C	-10		5	mV
		T_A = -40°C~25°C	-15		5	mV
Sensitivity Error	E_{Sens}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2.5		2.5	%
Total Output Error	E_{TOT}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2.5		2.5	%
Non-linearity Error	E_{NL}	T_A = -40°C~125°C	-0.4	±0.2	0.4	%

NHC3001FSW030B5TR (unless otherwise specified, V_{CC}=5V, $C_{OUTL}/C_{REFL}/C_{VOC}$=1nF, -40°C to 125°C)

Parameters	Symbol	Conditions	Min.[1]	Typ.	Max.[1]	Unit
Current Sensing Range	IPR		-30		30	A
Sensitivity	Sens	Full scale		66.7		mV/A
Noise RMS(VOUT)	$V_{N(RMS)}$	IP = 0A		10		mV
Zero current output voltage	$V_{OUT(Q)}$	IP = 0A		2.5		V
Offset Error	V_{OE}	IP = 0A, T_A = 25°C~125°C	-8		8	mV
		IP = 0A, T_A = -40°C~25°C	-8		8	mV
Offset error temperature Drift	ΔV_{OE}	T_A = -40°C~125°C $\Delta V_{OE} = V_{OE_}T_A - V_{OE_}25°C$	-6		6	mV
Reference Error	E_{REF}	T_A = 25°C~125°C	-10		5	mV
		T_A = -40°C~25°C	-15		5	mV
Sensitivity Error	E_{Sens}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2		2	%
Total Output Error	E_{TOT}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2		2	%
Non-linearity Error	E_{NL}	T_A = -40°C~125°C	-0.4	±0.2	0.4	%

[1] The maximum and minimum values correspond to the ±3σ range of the test data.

NHC3001FSW040B5TR(unless otherwise specified, V_{CC}=5V, $C_{OUTL}/C_{REFL}/C_{VOC}$=1nF, to 125°C)

Parameters	Symbol	Conditions	Min.[1]	Typ.	Max.[1]	Unit
Current Sensing Range	IPR		-40		40	A
Sensitivity	Sens	Full scale		50		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°C~125°C	-8		8	mV
		IP = 0A, T_A = -40°C~25°C	-8		8	mV
Offset error temperature Drift	ΔV_{OE}	T_A = -40°C~125°C $\Delta V_{OE} = V_{OE_}T_A - V_{OE_}25°C$	-6		6	mV
Reference Error	E_{REF}	T_A = 25°C~125°C	-10		5	mV
		T_A = -40°C~25°C	-15		5	mV
Sensitivity Error	E_{Sens}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2		2	%
Total Output Error	E_{TOT}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2		2	%
Non-linearity Error	E_{NL}	T_A = -40°C~125°C	-0.4	±0.2	0.4	%

NHC3001FSW050B5TR (unless otherwise specified, V_{CC}=5V, $C_{OUTL}/C_{REFL}/C_{VOC}$=1nF, -40°C to 125°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		7		mV
Zero current output voltage	$V_{OUT(Q)}$	IP = 0A		2.5		V
Offset Error	V_{OE}	IP = 0A, T_A = 25°C~125°C	-8		8	mV
		IP = 0A, T_A = -40°C~25°C	-8		8	mV
Offset error temperature Drift	ΔV_{OE}	T_A = -40°C~125°C $\Delta V_{OE} = V_{OE_}T_A - V_{OE_}25°C$	-6		6	mV
Reference Error	E_{REF}	T_A = 25°C~125°C	-10		5	mV
		T_A = -40°C~25°C	-15		5	mV
Sensitivity Error	E_{Sens}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2		2	%
Total Output Error	E_{TOT}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2		2	%
Non-linearity Error	E_{NL}	T_A = -40°C~125°C	-0.4	±0.2	0.4	%

[1] The maximum and minimum values correspond to the ±3σ range of the test data.

NHC3001FSW066B5TR(unless otherwise specified, V_{CC}=5V, $C_{OUTL}/C_{REFL}/C_{VOC}$=1nF, -40°C to 125°C)

Parameters	Symbol	Conditions	Min.[1]	Typ.	Max.[1]	Unit
Current Sensing Range	IPR		-66		66	A
Sensitivity	Sens	Full scale		30.3		mV/A
Noise RMS(VOUT)	$V_{N(RMS)}$	IP = 0A		7		mV
Zero current output voltage	$V_{OUT(Q)}$	IP = 0A		2.5		V
Offset Error	V_{OE}	IP = 0A, T_A = 25°C~125°C	-8		8	mV
		IP = 0A, T_A = -40°C~25°C	-8		8	mV
Offset error temperature Drift	ΔV_{OE}	T_A = -40°C~125°C $\Delta V_{OE} = V_{OE_}T_A - V_{OE_}25°C$	-6		6	mV
Reference Error	E_{REF}	T_A = 25°C~125°C	-10		5	mV
		T_A = -40°C~25°C	-15		5	mV
Sensitivity Error	E_{Sens}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2.5		2.5	%
Total Output Error	E_{TOT}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2.5		2.5	%
Non-linearity Error	E_{NL}	T_A = -40°C~125°C	-0.4	±0.2	0.4	%

NHC3001FSW075B5TR(unless otherwise specified, V_{CC}=5V, $C_{OUTL}/C_{REFL}/C_{VOC}$=1nF, -40°C to 125°C)

Parameters	Symbol	Conditions	Min.[1]	Typ.	Max.[1]	Unit
Current Sensing Range	IPR		-75		75	A
Sensitivity	Sens	Full scale		26.7		mV/A
Noise RMS(VOUT)	$V_{N(RMS)}$	IP = 0A		7		mV
Zero current output voltage	$V_{OUT(Q)}$	IP = 0A		2.5		V
Offset Error	V_{OE}	IP = 0A, T_A = 25°C~125°C	-8		8	mV
		IP = 0A, T_A = -40°C~25°C	-8		8	mV
Offset error temperature Drift	ΔV_{OE}	T_A = -40°C~125°C $\Delta V_{OE} = V_{OE_}T_A - V_{OE_}25°C$	-6		6	mV
Reference Error	E_{REF}	T_A = 25°C~125°C	-10		5	mV
		T_A = -40°C~25°C	-15		5	mV
Sensitivity Error	E_{Sens}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2.5		2.5	%
Total Output Error	E_{TOT}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2.5		2.5	%
Non-linearity Error	E_{NL}	T_A = -40°C~125°C	-0.4	±0.2	0.4	%

[1] The maximum and minimum values correspond to the ±3σ range of the test data.

NHC3001FSW080B5TR(unless otherwise specified, V_{CC}=5V, $C_{OUTL}/C_{REFL}/C_{VOC}$=1nF, -40°C to 125°C)

Parameters	Symbol	Conditions	Min.[1]	Typ.	Max.[1]	Unit
Current Sensing Range	IPR		-80		80	A
Sensitivity	Sens	Full scale		25		mV/A
Noise RMS(VOUT)	$V_{N(RMS)}$	IP = 0A		5		mV
Zero current output voltage	$V_{OUT(Q)}$	IP = 0A		2.5		V
Offset Error	V_{OE}	IP = 0A, T_A = 25°C~125°C	-8		8	mV
		IP = 0A, T_A = -40°C~25°C	-8		8	mV
Offset error temperature Drift	ΔV_{OE}	T_A = -40°C~125°C $\Delta V_{OE} = V_{OE_}T_A - V_{OE_}25°C$	-6		6	mV
Reference Error	E_{REF}	T_A = 25°C~125°C	-10		5	mV
		T_A = -40°C~25°C	-15		5	mV
Sensitivity Error	E_{Sens}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2		2	%
Total Output Error	E_{TOT}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2		2	%
Non-linearity Error	E_{NL}	T_A = -40°C~125°C	-0.4	±0.2	0.4	%

NHC3001FSW100B5TR (unless otherwise specified, V_{CC}=5V, $C_{OUTL}/C_{REFL}/C_{VOC}$=1nF, -40°C to 125°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		5		mV
Zero current output voltage	$V_{OUT(Q)}$	IP = 0A		2.5		V
Offset Error	V_{OE}	IP = 0A, T_A = 25°C~125°C	-8		8	mV
		IP = 0A, T_A = -40°C~25°C	-8		8	mV
Offset error temperature Drift	ΔV_{OE}	T_A = -40°C~125°C $\Delta V_{OE} = V_{OE_}T_A - V_{OE_}25°C$	-6		6	mV
Reference Error	E_{REF}	T_A = 25°C~125°C	-10		5	mV
		T_A = -40°C~25°C	-15		5	mV
Sensitivity Error	E_{Sens}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2.5		2.5	%
Total Output Error	E_{TOT}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2.5		2.5	%
Non-linearity Error	E_{NL}	T_A = -40°C~125°C	-0.4	±0.2	0.4	%

[1] The maximum and minimum values correspond to the ±3σ range of the test data.

NHC3001FSW020B3TR (unless otherwise specified, V_{CC}=3.3V, $C_{OUTL}/C_{REFL}/C_{VOC}$=1nF, -40°C to 125°C)

Parameters	Symbol	Conditions	Min.[1]	Typ.	Max.[1]	Unit
Current Sensing Range	IPR		-20		20	A
Sensitivity	Sens	Full scale		66		mV/A
Noise RMS(VOUT)	$V_{N(RMS)}$	IP = 0A		12		mV
Zero current output voltage	$V_{OUT(Q)}$	IP = 0A		1.65		V
Offset Error	V_{OE}	IP = 0A, T_A = 25°C~125°C	-8		8	mV
		IP = 0A, T_A = -40°C~25°C	-8		8	mV
Offset error temperature Drift	ΔV_{OE}	T_A = -40°C~125°C $\Delta V_{OE} = V_{OE_}T_A - V_{OE_}25°C$	-6		6	mV
Reference Error	E_{REF}	T_A = 25°C~125°C	-10		5	mV
		T_A = -40°C~25°C	-15		5	mV
Sensitivity Error	E_{Sens}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2.5		2.5	%
Total Output Error	E_{TOT}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2.5		2.5	%
Non-linearity Error	E_{NL}	T_A = -40°C~125°C	-0.4	±0.2	0.4	%

NHC3001FSW030B3TR (unless otherwise specified, V_{CC}=3.3V, $C_{OUTL}/C_{REFL}/C_{VOC}$=1nF, -40°C to 125°C)

Parameters	Symbol	Conditions	Min.[1]	Typ.	Max.[1]	Unit
Current Sensing Range	IPR		-30		30	A
Sensitivity	Sens	Full scale		44		mV/A
Noise RMS(VOUT)	$V_{N(RMS)}$	IP = 0A		11		mV
Zero current output voltage	$V_{OUT(Q)}$	IP = 0A		1.65		V
Offset Error	V_{OE}	IP = 0A, T_A = 25°C~125°C	-8		8	mV
		IP = 0A, T_A = -40°C~25°C	-8		8	mV
Offset error temperature Drift	ΔV_{OE}	T_A = -40°C~125°C $\Delta V_{OE} = V_{OE_}T_A - V_{OE_}25°C$	-6		6	mV
Reference Error	E_{REF}	T_A = 25°C~125°C	-10		5	mV
		T_A = -40°C~25°C	-15		5	mV
Sensitivity Error	E_{Sens}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2.5		2.5	%
Total Output Error	E_{TOT}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2.5		2.5	%
Non-linearity Error	E_{NL}	T_A = -40°C~125°C	-0.4	±0.2	0.4	%

[1] The maximum and minimum values correspond to the ±3σ range of the test data.

NHC3001FSW040B3TR (unless otherwise specified, V_{CC}=3.3V, $C_{OUTL}/C_{REFL}/C_{VOC}$=1nF, -40°C to 125°C)

Parameters	Symbol	Conditions	Min.[1]	Typ.	Max.[1]	Unit
Current Sensing Range	IPR		-40		40	A
Sensitivity	Sens	Full scale		33		mV/A
Noise RMS(VOUT)	$V_{N(RMS)}$	IP = 0A		9		mV
Zero current output voltage	$V_{OUT(Q)}$	IP = 0A		1.65		V
Offset Error	V_{OE}	IP = 0A, T_A = 25°C~125°C	-8		8	mV
		IP = 0A, T_A = -40°C~25°C	-8		8	mV
Offset error temperature Drift	ΔV_{OE}	T_A = -40°C~125°C $\Delta V_{OE} = V_{OE_}T_A - V_{OE_}25°C$	-6		6	mV
Reference Error	E_{REF}	T_A = 25°C~125°C	-10		5	mV
		T_A = -40°C~25°C	-15		5	mV
Sensitivity Error	E_{Sens}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2		2	%
Total Output Error	E_{TOT}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2		2	%
Non-linearity Error	E_{NL}	T_A = -40°C~125°C	-0.4	±0.2	0.4	%

NHC3001FSW050B3TR (unless otherwise specified, V_{CC}=3.3V, $C_{OUTL}/C_{REFL}/C_{VOC}$=1nF, -40°C to 125°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		7		mV
Zero current output voltage	$V_{OUT(Q)}$	IP = 0A		1.65		V
Offset Error	V_{OE}	IP = 0A, T_A = 25°C~125°C	-8		8	mV
		IP = 0A, T_A = -40°C~25°C	-8		8	mV
Offset error temperature Drift	ΔV_{OE}	T_A = -40°C~125°C $\Delta V_{OE} = V_{OE_}T_A - V_{OE_}25°C$	-6		6	mV
Reference Error	E_{REF}	T_A = 25°C~125°C	-15		10	mV
		T_A = -40°C~25°C	-15		10	mV
Sensitivity Error	E_{Sens}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2.5		2.5	%
Total Output Error	E_{TOT}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2.5		2.5	%
Non-linearity Error	E_{NL}	T_A = -40°C~125°C	-0.4	±0.2	0.4	%

[1] The maximum and minimum values correspond to the ±3σ range of the test data.

NHC3001FSW066B3TR (unless otherwise specified, V_{CC}=3.3V, $C_{OUTL}/C_{REFL}/C_{VOC}$=1nF, -40°C to 125°C)

Parameters	Symbol	Conditions	Min.[1]	Typ.	Max.[1]	Unit
Current Sensing Range	IPR		-66		66	A
Sensitivity	Sens	Full scale		20		mV/A
Noise RMS(VOUT)	$V_{N(RMS)}$	IP = 0A		7		mV
Zero current output voltage	$V_{OUT(Q)}$	IP = 0A		1.65		V
Offset Error	V_{OE}	IP = 0A, T_A = 25°C~125°C	-8		8	mV
		IP = 0A, T_A = -40°C~25°C	-8		8	mV
Offset error temperature Drift	ΔV_{OE}	T_A = -40°C~125°C $\Delta V_{OE} = V_{OE_}T_A - V_{OE_}25°C$	-6		6	mV
Reference Error	E_{REF}	T_A = 25°C~125°C	-10		5	mV
		T_A = -40°C~25°C	-15		5	mV
Sensitivity Error	E_{Sens}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2.5		2.5	%
Total Output Error	E_{TOT}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2.5		2.5	%
Non-linearity Error	E_{NL}	T_A = -40°C~125°C	-0.4	±0.2	0.4	%

NHC3001FSW075B3TR (unless otherwise specified, V_{CC}=3.3V, $C_{OUTL}/C_{REFL}/C_{VOC}$=1nF, -40°C to 125°C)

Parameters	Symbol	Conditions	Min.[1]	Typ.	Max.[1]	Unit
Current Sensing Range	IPR		-75		75	A
Sensitivity	Sens	Full scale		17.6		mV/A
Noise RMS(VOUT)	$V_{N(RMS)}$	IP = 0A		7		mV
Zero current output voltage	$V_{OUT(Q)}$	IP = 0A		1.65		V
Offset Error	V_{OE}	IP = 0A, T_A = 25°C~125°C	-8		8	mV
		IP = 0A, T_A = -40°C~25°C	-8		8	mV
Offset error temperature Drift	ΔV_{OE}	T_A = -40°C~125°C $\Delta V_{OE} = V_{OE_}T_A - V_{OE_}25°C$	-6		6	mV
Reference Error	E_{REF}	T_A = 25°C~125°C	-10		5	mV
		T_A = -40°C~25°C	-15		5	mV
Sensitivity Error	E_{Sens}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2.5		2.5	%
Total Output Error	E_{TOT}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2.5		2.5	%
Non-linearity Error	E_{NL}	T_A = -40°C~125°C	-0.4	±0.2	0.4	%

[1] The maximum and minimum values correspond to the ±3σ range of the test data.

NHC3001FSW080B3TR (unless otherwise specified, V_{CC}=3.3V, $C_{OUTL}/C_{REFL}/C_{VOC}$=1nF, -40°C to 125°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		5		mV
Zero current output voltage	$V_{OUT(Q)}$	IP = 0A		1.65		V
Offset Error	V_{OE}	IP = 0A, T_A = 25°C~125°C	-8		8	mV
		IP = 0A, T_A = -40°C~25°C	-8		8	mV
Offset error temperature Drift	ΔV_{OE}	T_A = -40°C~125°C $\Delta V_{OE} = V_{OE_}T_A - V_{OE_}25°C$	-6		6	mV
Reference Error	E_{REF}	T_A = 25°C~125°C	-10		5	mV
		T_A = -40°C~25°C	-15		5	mV
Sensitivity Error	E_{Sens}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2.5		2.5	%
Total Output Error	E_{TOT}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2.5		2.5	%
Non-linearity Error	E_{NL}	T_A = -40°C~125°C	-0.4	±0.2	0.4	%

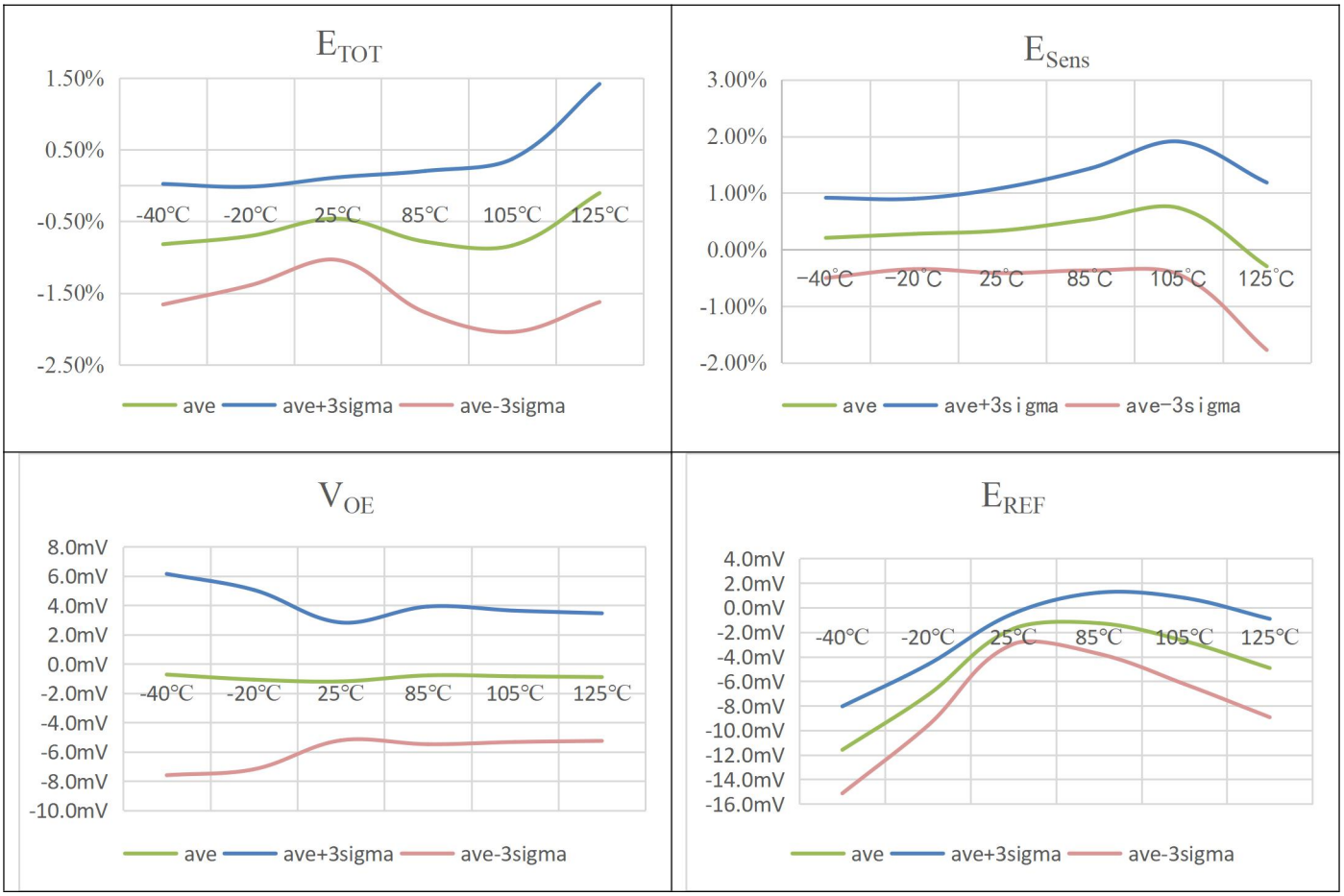
NHC3001FSW100B3TR (unless otherwise specified, V_{CC}=3.3V, $C_{OUTL}/C_{REFL}/C_{VOC}$=1nF, -40°C to 125°C)

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		5		mV
Zero current output voltage	$V_{OUT(Q)}$	IP = 0A		1.65		V
Offset Error	V_{OE}	IP = 0A, T_A = 25°C~125°C	-8		8	mV
		IP = 0A, T_A = -40°C~25°C	-8		8	mV
Offset error temperature Drift	ΔV_{OE}	T_A = -40°C~125°C $\Delta V_{OE} = V_{OE_}T_A - V_{OE_}25°C$	-6		6	mV
Reference Error	E_{REF}	T_A = 25°C~125°C	-10		5	mV
		T_A = -40°C~25°C	-15		5	mV
Sensitivity Error	E_{Sens}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2.5		2.5	%
Total Output Error	E_{TOT}	T_A = 25°C~125°C	-2		2	%
		T_A = -40°C~25°C	-2.5		2.5	%
Non-linearity Error	E_{NL}	T_A = -40°C~125°C	-0.4	±0.2	0.4	%

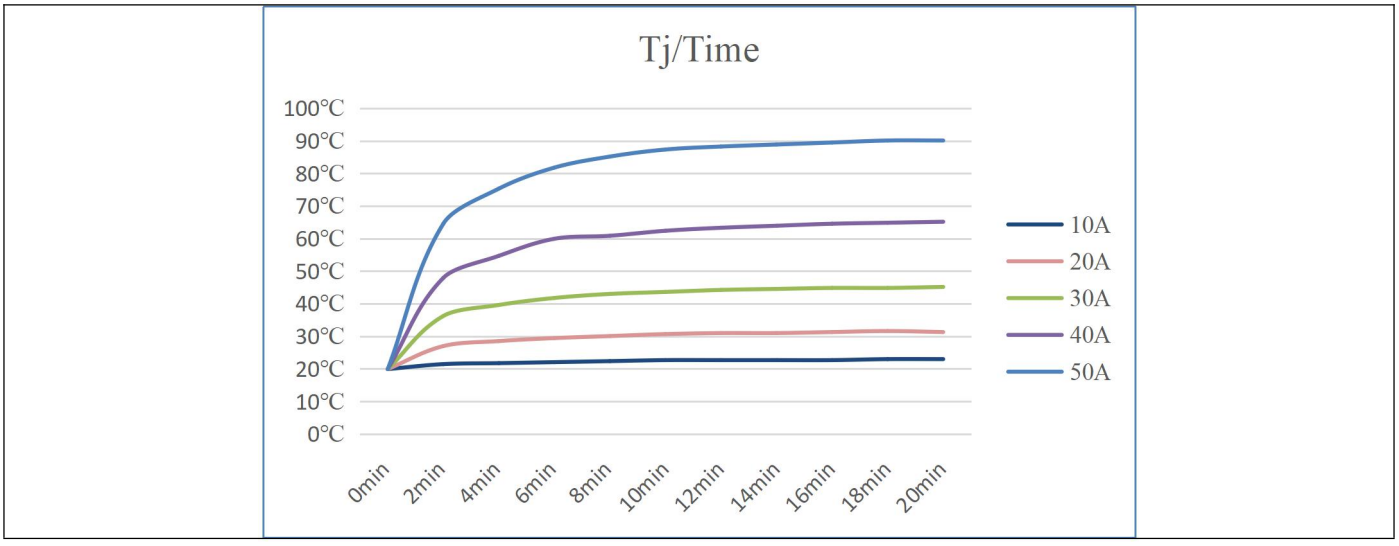
[1] The maximum and minimum values correspond to the ±3σ range of the test data.

Typical Characteristics

Accuracy Characteristics (for NHC3001FSW050B5TR, IP = 50A, -40–125 °C)

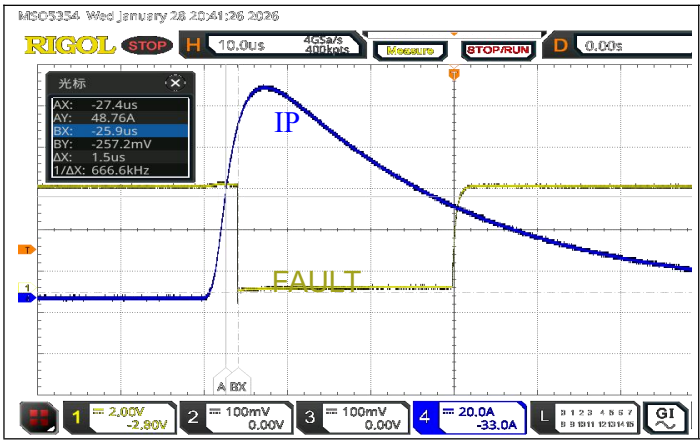


Temperature Characteristics [1]

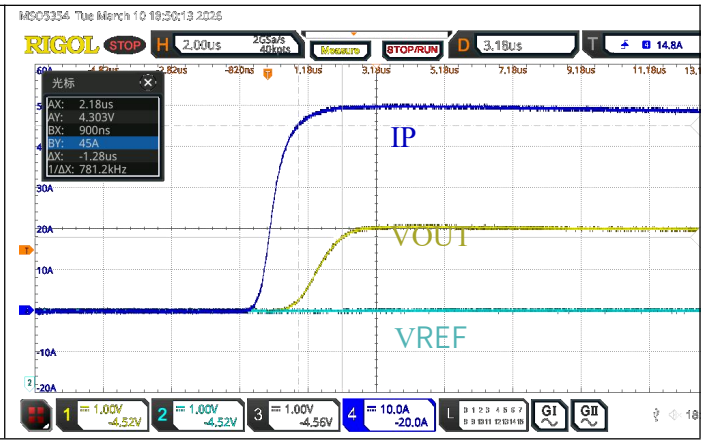


[1] The temperature characteristic curve shows the variation of the chip's junction temperature over time at given ambient temperatures and currents at T_A=20°C. The data is obtained from the internal temperature sensor and is dependent on the PCB thermal design, The data shown is based on the NHC3001 demo board.

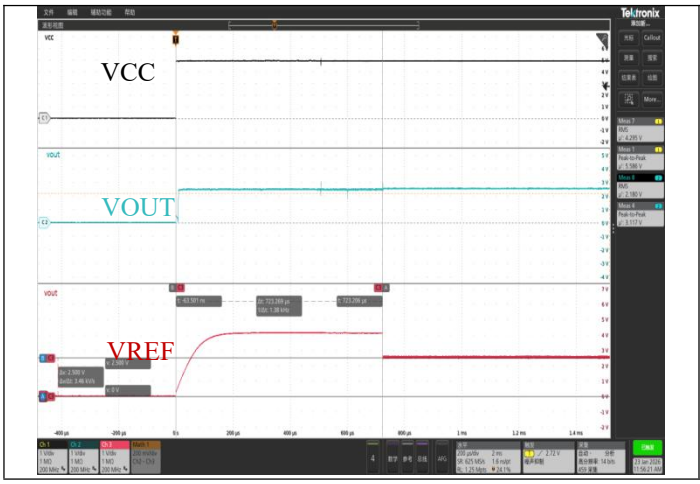
Overcurrent Fault Response（I_{ft}=100%IP_MAX，T_A=25°C, fault response time= 1.5us)



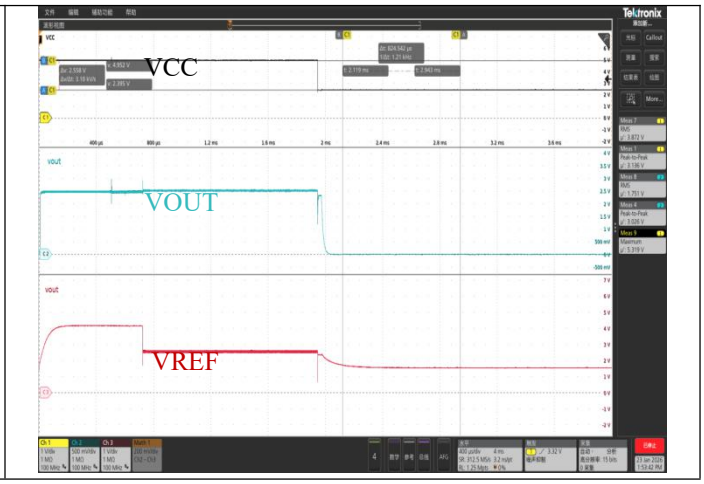
Output Response (TA=25 °C, response time= 1.28 μs)



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



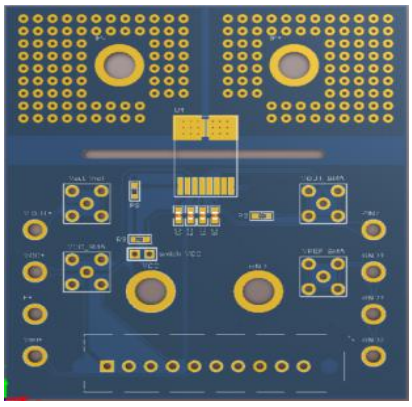
Under-Voltage Protection Timing(V_{UVLOL}=2.395V)



NHC3001 Demo Board

NHC3001 demo board uses a 2-layer PCB with 34 mm × 26 mm copper pour areas connected to pins 1 through 4, and to pins 5 through 8. Each layer uses 4 oz copper, and the total PCB thickness is 1.6 mm.

The heat dissipation capacity of the chip is not only 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.



NHC3001 Demo Board

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 NHC3001FSW050B5TR as an example, IP_MAX is ±50A, and IPR is from -50A to 50A.

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.

V_{OUT}

V_{OUT} denotes the output voltage of the VOUT pin.V_{OUT} of the NHC3001 is 2.5V/1.65V while IP is 0A .When IP increases or decreases, V_{OUT} increases or decreases until the saturation voltage (V_{CC}-V_{SATH} or V_{SATL}). It ' s recommend that V_{OUT} be maintained within 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, but it is not recommended for customers to use this margin.

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, V_{OUT} will return to normal without any damage to the chip.

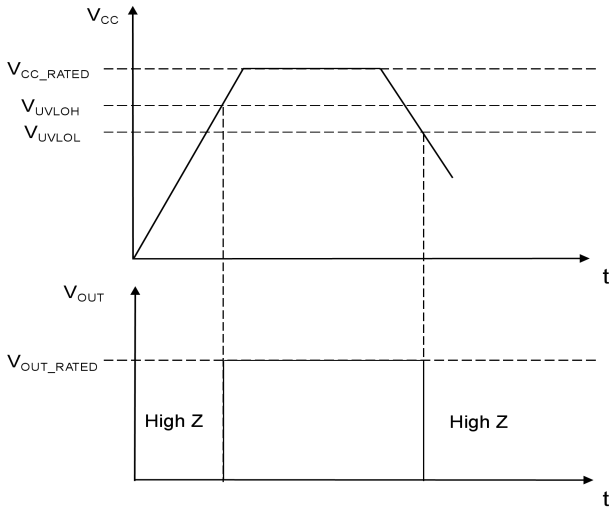
Part Numbers	$V_{OUT(Q)}$(mV)	Sensitivity(mV/A)	V_{OUT} Calculation Formula(mV)
NHC3001FSW020B5TR	2500	100	V_{OUT} =2500 + IP × 100
NHC3001FSW030B5TR	2500	66.7	V_{OUT} =2500 + IP × 66.7
NHC3001FSW040B5TR	2500	50	V_{OUT} =2500 + IP × 50
NHC3001FSW050B5TR	2500	40	V_{OUT} =2500 + IP × 40
NHC3001FSW066B5TR	2500	30.3	V_{OUT} =2500 + IP × 30.3
NHC3001FSW075B5TR	2500	26.7	V_{OUT} =2500 + IP × 26.7
NHC3001FSW080B5TR	2500	25	V_{OUT} =2500 + IP × 25
NHC3001FSW100B5TR	2500	20	V_{OUT} =2500 + IP × 20
NHC3001FSW020B3TR	1650	66	V_{OUT} =1650 + IP × 66
NHC3001FSW030B3TR	1650	44	V_{OUT} =1650 + IP × 44
NHC3001FSW040B3TR	1650	33	V_{OUT} =1650 + IP × 33
NHC3001FSW050B3TR	1650	26.4	V_{OUT} =1650 + IP × 26.4
NHC3001FSW066B3TR	1650	20	V_{OUT} =1650 + IP × 20
NHC3001FSW075B3TR	1650	17.6	V_{OUT} =1650 + IP × 17.6
NHC3001FSW080B3TR	1650	16.5	V_{OUT} =1650 + IP × 16.5
NHC3001FSW100B3TR	1650	13.2	V_{OUT} =1650 + IP × 13.2

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 Threshold (I_{ft})

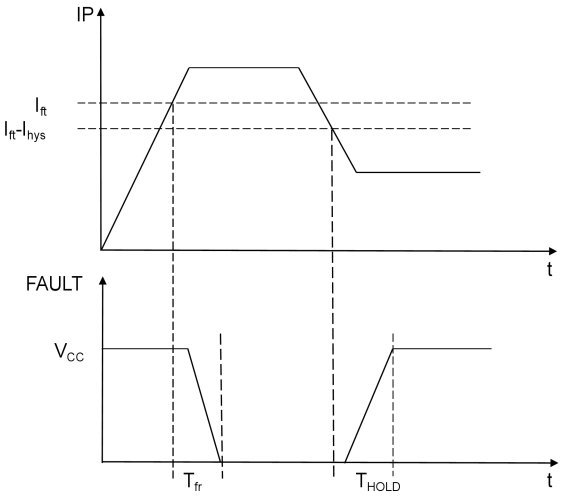
NHC3001 features a fast overcurrent protection (OCP) circuit. When the magnitude of the primary current IP exceeds the overcurrent threshold I_{ft}, the internal comparator triggers and pulls the open-drain FAULT pin low.

I_{ft} can be set by the VOC supply voltage(V_{OC}) . This voltage source can be from the V_{REF}. The effective V_{OC} is between 0.33V and 2V. The corresponding relationship between I_{ft} and V_{OC} is shown as follows:

V_{OC}		Bidirectional version	Unidirectional version
V_{CC}=3.3V	V_{CC}=5V		
0.33 ~ 0.495	0.5 ~ 0.75	75%	75%
0.495 ~ 0.661	0.75 ~ 1	100%	100%
0.661 ~ 0.826	1 ~ 1.25	125%	125%
0.826 ~ 0.991	1.25 ~ 1.5	150%	150%
0.991 ~ -1.156	1.5 ~ 1.75	175%	175%
1.156 ~ 1.32	1.75 ~ 2	200%	200%

Overcurrent Fault Response Time (T_{fr})

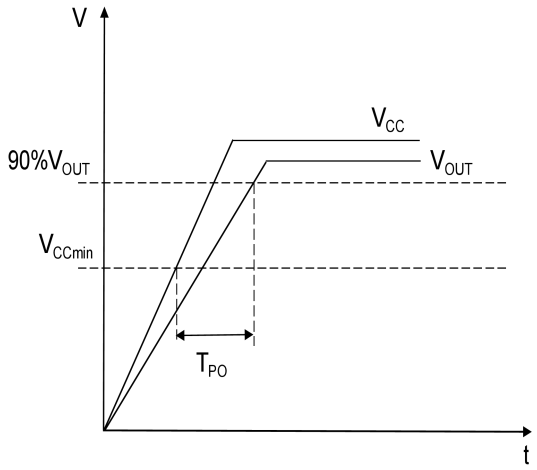
The fault condition is cleared when IP falls below I_{ft} - I_{hys}. The fault response time, T_{fr} is measured from the moment the overcurrent condition is met to the moment the FAULT pin is pulled low.The timing sequence for the overcurrent protection is as follows:



Overcurrent Protection Timing Diagram

Power-On Time (T_{PO})

When the power supply voltage rises to the operating voltage range of the chip, NHC3001 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 ±10% of its final value for the first time.



Power-on Reset

Rise Time （T_r）

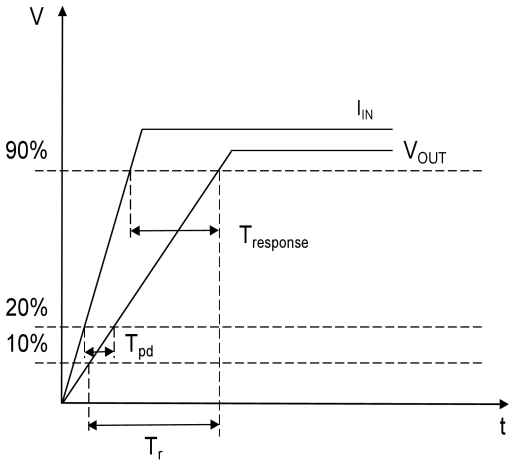
Rise time is defined as the time taken for the output signal to go from 10% to 90% of its final value. For a step input, the approximate relationship to bandwidth is: $f(-3dB) = 0.35/T_r$.

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

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

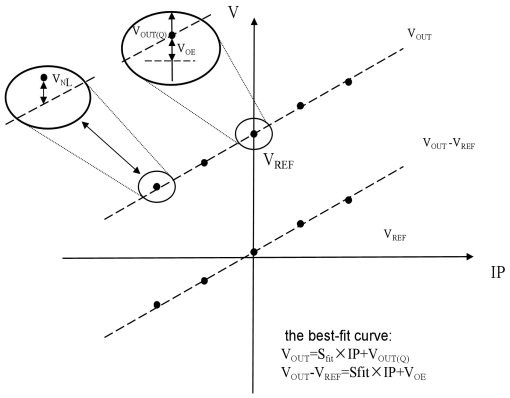
$$V_{OE} = V_{OUT(Q)} - V_{REF}$$

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

$$\Delta V_{OE} = V_{OE} @ T_A - V_{OE} @ 25℃$$

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 slop of the best-fit curve and the slop of the ideal curve.

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

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.

$$V_{NL} = V_{OUTMAX} - \left(S_{fit} * IP_MAX + V_{OUT(Q)}\right)$$

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:

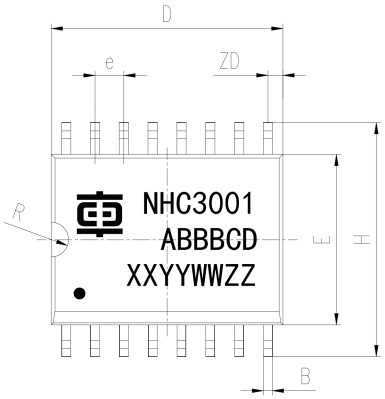
$$E_{NL} = \frac{V_{NL}}{FS} * 100\%$$

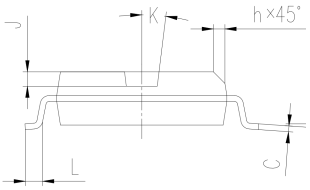
Total Output Error

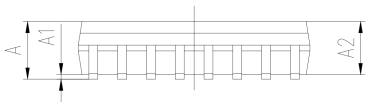
Total output error is defined as the discrepancy between the actual specified current and the current measured by the chip; in other words, it is the difference between the actual output voltage and the ideal output voltage. It should be noted that the factors dominating the total output error vary across 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: NHC3001 – Product Series

second line:

ABBBCD —Product Specifications

A—Temperature Range

BBB — Current Sensing Range

C—Output Directionality

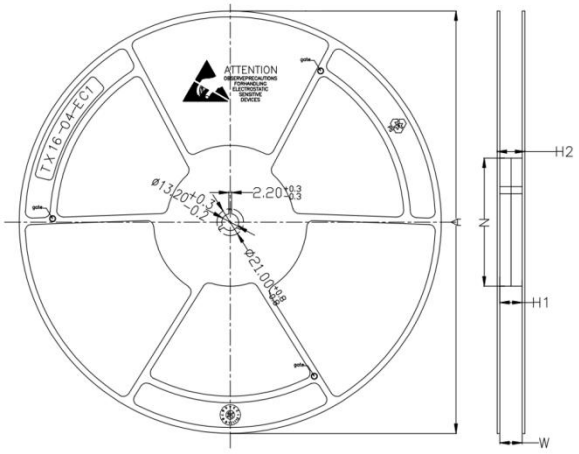
D—Supply Voltage

Third line： XXYYWWZZ — Production batch number

Symbol	Dimensions (mm)		
	Min.	Typ.	Max.
A	2.44	-	2.65
A1	0.10	-	0.30
A2	2.24	2.34	2.44
B	0.36	-	0.46
C	0.23	-	0.32
D	10.11	10.21	10.31
E	7.40	7.50	7.60
e	1.27		
H	10.10	10.31	10.50
h	0.31	-	0.71
J	0.53	-	0.73
K	7°		
L	0.51	-	1.01
R	0.63	-	0.89
ZD	0.66REF		
α	0°	-	8°

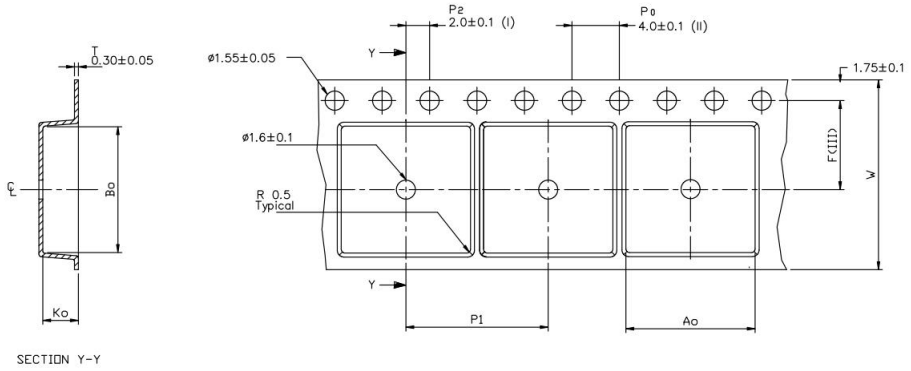
Packing Information

Reel Dimensions

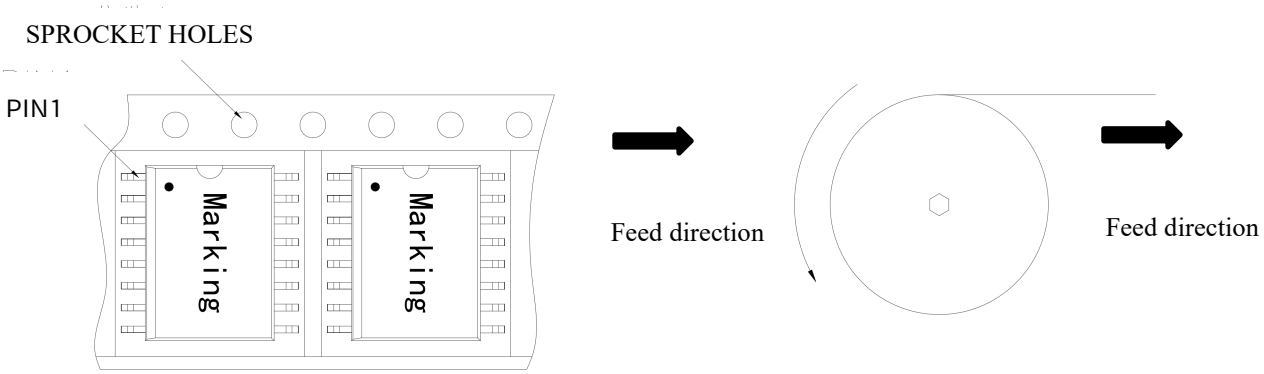


Reel Dimensions (mm)				
A	N	H1	H2	W
Φ330±2	Φ100±2	16.4^{+2}_{-0}	20.6±1	$16.4^{+3.5}_{-0.2}$

Tape Dimensions



Tape Dimensions（mm）					
A_0	B_0	K_0	F	P_1	W
10.90±0.1	10.70±0.1	3.00±0.1	7.5±0.1	12.00±0.1	16.00±0.3



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
2026-01-06	Initial Release	V0
2026-02-09	Update the functional block diagram, term definations, and chip packing information	V1
2026-08-06	Update the template and add typical characteristics	V2