

## Asahi **KASEI**

### Hall Effect Sensor Selection Guide

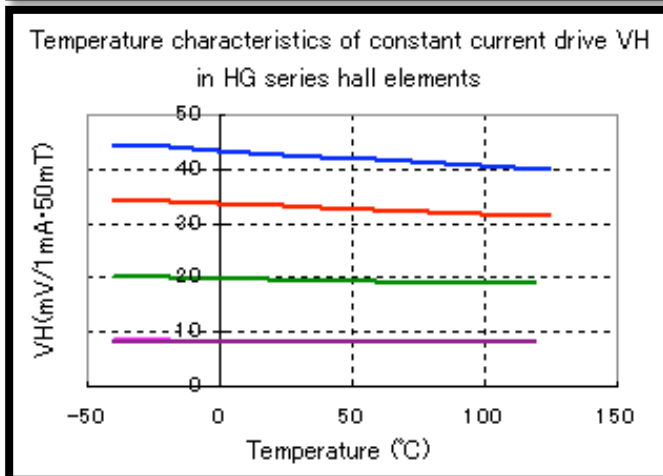
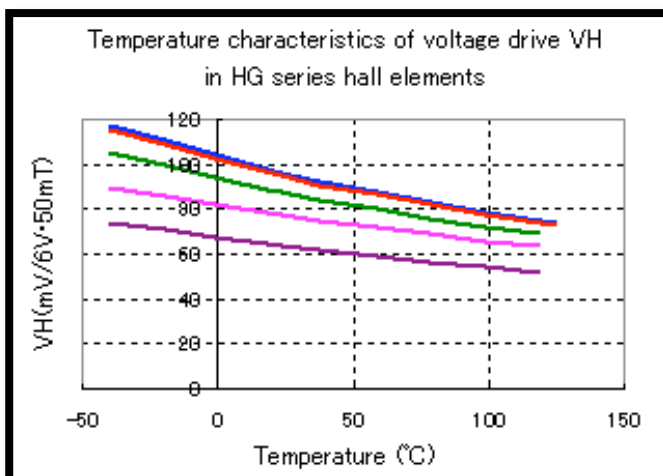
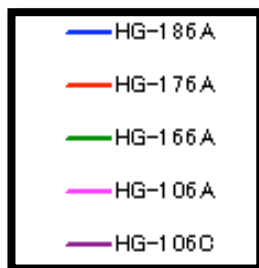
#### TABLE OF CONTENTS

<b>Introduction to Asahi Hall Element Devices</b>	<b>1</b>
<b>HG Series</b>	<b>5</b>
<b>HW-HS Series</b>	<b>8</b>
<b>HZ Series</b>	<b>10</b>
<b>HQ Series</b>	<b>11</b>
<b>IC Latches - EW &amp; EM Series</b>	<b>12</b>
<b>IC Switches - EW &amp; EM Series</b>	<b>15</b>
<b>EQ Series Ratiometric Linear IC's</b>	<b>18</b>
<b>CQ Series Hall Effect Current Sensors</b>	<b>19</b>

## HG Series: GaAs (Gallium Arsenide) Hall Element

The temperature coefficient of the hall element output voltage is approx. -0.2% per °C for the constant voltage drive, and approx. -0.02% to -0.08% per °C for the constant current drive. As you see, the constant current drive has better coefficient, therefore basically use in the constant current drive. In addition, the constant current drive can ignore the magnetic resistance effect and has better linearity against the magnetic flux density at high magnetic field. The linearity of 2% or lower defined in the specifications is achieved by the constant current drive.

As the type is graded up from the standard type to the ultra-sensitive type, both the constant voltage sensitivity and constant current sensitivity increase. Refer to the graphs and table below. However, since the input/output resistance values also increase, it is necessary to be careful of the circuit matching such as the amplifier rate. The standard type is the best in temperature characteristics of the hall element output voltage and unbalanced voltage, and the ultra-sensitive type is the worst.

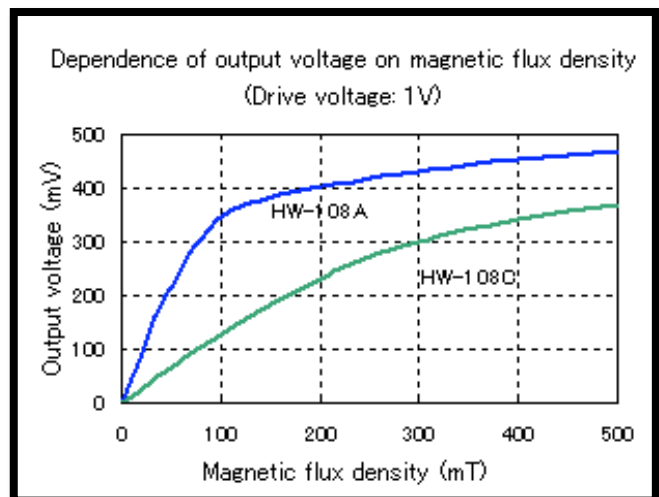
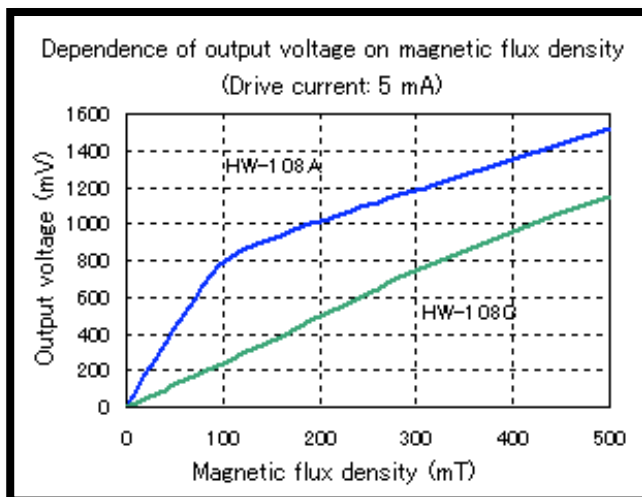


Item	Standard Sensitivity		Medium Sensitivity	High Sensitivity	Ultra Sensitivity
	Rin = Rout	Rin < Rout	Rin < Rout	Rin < Rout	Rin < Rout
Input Resistance ( $\Omega$ )	650~850	450~750	1000~1500	1600~2400	2200~3200
Output Resistance ( $\Omega$ )	650~850	1000~2000	1800~3000	3200~4800	4400~6400
Input Resistance Temp. Coeff. (%/°C)	~ -0.3				
Constant Voltage Drive Output Voltage (mV/6V•50mT)	55~75	75~95	78~102		80~110
Constant Voltage Drive Output Voltage Temp. Coeff. (%/°C)	~ -0.2~(*)				
Constant Current Drive Output Voltage (mV/1mA•50mT)	~8~(*)		~20~(*)	~33~(*)	~43~(*)
Constant Current Drive Output Voltage Temp. Coeff. (%/°C)	-0.03(*)~-0.06		-0.04(*)~-0.06	-0.06(*)~-0.07	-0.06(*)~-0.08

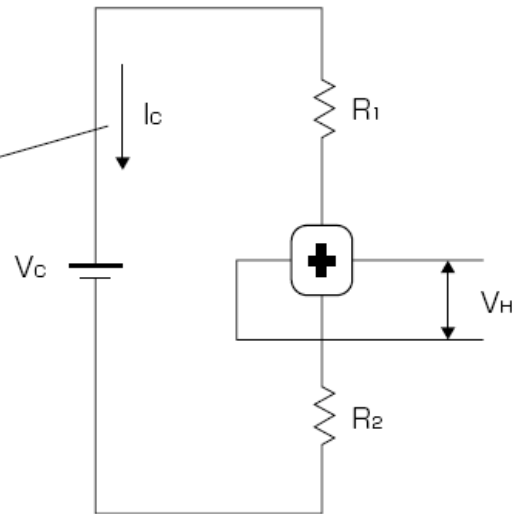
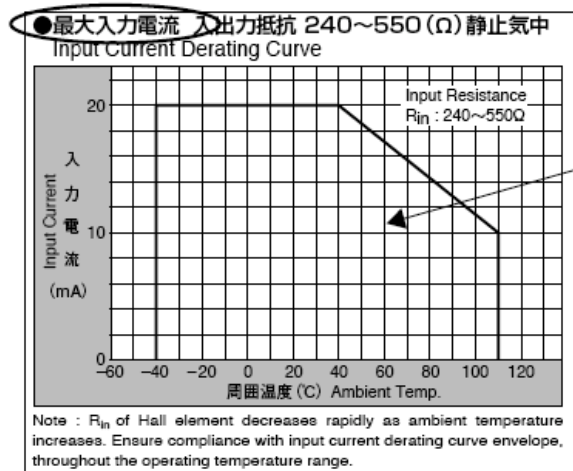
(\*) Indicates the actual value not defined in the specifications

## HW-HS Series: InSb (Indium Antimony)

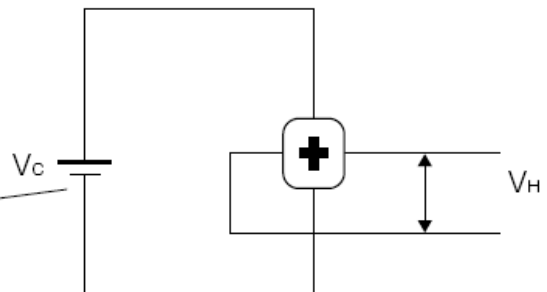
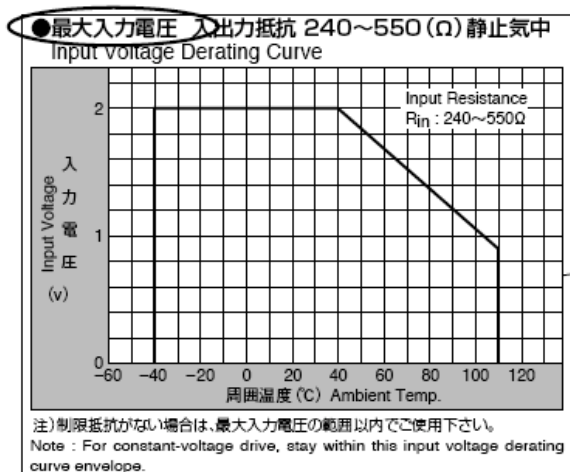
These are categorized into ultra-sensitive type and highly sensitive high linearity type. The ultra-sensitive type has a magnetic core inside of it, so the output becomes higher at low magnetic field, but when the magnetic core reaches magnetic saturation, the tilting direction changes and the output voltage is not proportional to the magnetic flux density. (Refer to the figures below.) Therefore, this type is not suitable for the measurement of the magnetic flux density, then used to detect presence of the magnet. Because the highly sensitive high linearity type has no magnet core inside of it, it can obtain the linear output characteristics in wide range. For your information, when requiring the linearity, use it in the constant current drive. The constant voltage drive is affected by the magnetic resistance effect, so it is not proportional to the magnetic flux density.











Rin of HW-series Hall Element decreases rapidly as ambient temperature increases. So it is easy to damage. Prevention of damage, we recommend restriction resistance is inserted in series. (Fig.3) Please decide the value of R1,R2,within input current derating curve envelope throughout the operating temperature range. It does not matter that input voltage is over input voltage derating curve envelope in this drive circuit.





## HZ Series: InAs (indium arsenide)







# HG Series




<b>Standard Type</b>								
Package	Package Size (mm)			Device P/N	Input Output Resistance ( $\Omega$ )	Offset Voltage (mV)	Hall Output Voltage (mV/mT*1mA)	
	L	W	H					
SMT	2.5	1.5	0.6	HG-106C  HG-106C-2U 	650 to 850	-11 to 11	.138 to .188	
SON	1.6	0.8	0.5	HG-0111 				
SIP	2.35	2.7	0.95	HG-302C 				
Package	Package Size (mm)			Device P/N	Input Output Resistance ( $\Omega$ )	Offset Voltage (mV)	Hall Output Voltage (mV/mT*1mA)	
	L	W	H					
SMT	2.5	1.5	0.6	HG-116C 	650 to 850	-7 to 7	.136 to .208	
Package	Package Size (mm)			Device P/N	Input Res. ( $\Omega$ )	Output Res. ( $\Omega$ )	Offset Voltage (mV)	Hall Output Voltage (mV/mT*1mA)
	L	W	H					
SMT	2.5	1.5	0.6	HG-106A  HG-106R 	450 to 750	1000 to 2000	-16 to 16	.150 to .190
SON	1.6	0.8	0.5	HG-0112 				

Package	Package Size (mm)			Device P/N	Input Res. ( $\Omega$ )	Output Res. ( $\Omega$ )	Offset Voltsge (mV)	Hall Output Voltage (mV/mT* 1mA)
	L	W	H					
SIP	2.35	2.7	0.95	HG-302A 	450 to 750	1000 to 2000	-16 to 16	.150 to .190
Package	Package Size (mm)			Device P/N	Input Res. ( $\Omega$ )	Output Res. ( $\Omega$ )	Offset Voltsge (mV)	Hall Output Voltage (mV/mT* 1mA)
	L	W	H					
SMT	2.5	1.5	0.6	HG-116A 	450 to 750	1000 to 2000	-8 to 8	.120 to .224



### *Medium Sensitivity Type*

Package	Package Size (mm)			Device P/N	Input Res. ( $\Omega$ )	Output Res. ( $\Omega$ )	Offset Voltsge (mV)	Hall Output Voltage (mV/mT* 1mA)
	L	W	H					
	2.5	1.5	0.6	HG-166A  HG-166A-2U 	1000 to 1500	1800 to 3000	-8 to 8	.325 to .425
SON	1.6	0.8	0.5	HG-0113 				
SIP	2.35	2.7	0.95	HG-362A 				

### **High Sensitivity Type**











Package	Package Size (mm)			Device P/N	Input Res. ( $\Omega$ )	Output Res. ( $\Omega$ )	Offset Voltsge (mV)	Hall Output Voltage (mV/mT* mA)
	L	W	H					
SMT	2.5	1.5	0.6	HG-176A 	1600 to 2400	3200 to 4800	-8 to 8	.520 to .680
SON	1.6	0.8	0.5	HG-0114 				
SIP	2.35	2.7	0.95	HG-372A 				

### **Ultra High Sensitivity Type**




Package	Package Size (mm)			Device P/N	Input Res. ( $\Omega$ )	Output Res. ( $\Omega$ )	Offset Voltsge (mV)	Hall Output Voltage (mV/mT* mA)
	L	W	H					
SMT	2.5	1.5	0.6	HG-186A 	2200 to 3200	4400 to 6400	-8 to 8	.533 to .733
SON	1.6	0.8	0.5	HG-0115 				



# HW & HS Series

<i>Hypersensitive Type</i>													
Package	Package Size (mm)			Device P/N	Input & Output Resistance ( $\Omega$ )	Offset Voltage (mV)	Hall Voltage Ranks						
	L	W	H				A	B	C	D	E	F	G
SMT	2.9	2.9	1.1	HW-101A 	240 to 550	-7 to 7			•	•	•	•	•
	3.9			HW-101A-4T 					•	•	•	•	
	2.1	2.1	0.8	HW-108A 					•	•	•	•	
			0.6	HW-105A 				-10 to 10		•	•	•	
45 deg SMT	2.1	2.7	1.45	HW-109A 	250 to 450				•	•	•	•	
	1.7		1.7	HW-209A 									
Special SMT		3.1	2.05	HW-102A 					•	•	•	•	
DIP	2.9	2.4	1.7	HW-300A 		-7 to 7			•	•	•	•	
SIP	2.35	2.7	0.95	HW-300B 	240 to 550			•	•	•	•	•	
				HW-322B 									•



## High Sensitivity & Linearity Type

Package	Package Size (mm)			Device P/N	Input Output Resistance ( $\Omega$ )	Offset Voltage (mV)	Hall Voltage Ranks	
	L	W	H				Q	R
SMT	2.1	2.1	0.8	HW-108C 	250 to 450	-7 to 7	●	●
			0.5	HW-105C 				
SON	1.6	0.8	0.5	HS-0111 	260 to 410	-6 to 6	1.04 to 1.34	






## HALL OUTPUT VOLTAGE RANKS

RANK	Hall Output Voltage (mV/mT*1V)
A	2.44 to 3.00
B	2.88 to 3.48
C	3.36 to 4.08
D	3.92 to 4.72
E	4.56 to 5.48
	5.32 to 6.40
G	6.20 to 7.40
Q	0.82 to 1.14
R	1.02 to 1.48








# HZ Series

Package	Package Size (mm)			Device P/N	Input & Output Resistance ( $\Omega$ )	Offset Voltage (mV/5mA)	Hall Output Voltage (mV/mT*1mA)
	L	W	H				
SMT	2.5	1.5	0.6	HZ-116C 	240 to 360	-2.5 to 2.5	.096 to .132
SIP	2.35	2.7	0.95	HZ-312C 			







# HQ Series

Package	Package Size (mm)			Device P/N	Input & Output Resistance ( $\Omega$ )	Offset Voltage (mV/3V)	Hall Output Voltage (mV/mT*1V)
	L	W	H				
SON	1.6	0.8	0.65	HQ-0111 	750 to 1150	-7 to 7	0.600 to 0.867
	2.7	1.25		HQ-0222 			
	2.0			HQ-0221 			
		0.65	0.5	HQ-0611 			
SMT	5.0	6.20	1.0	HQ-8220 			


# Hall Effect IC's - Latches






Continuous Excitation Type					
Operating Voltage Range Supply Voltage Range (Vcc)	Package Size (mm)			Output H to L Flux Density Operating Point (Bop)	
	L	W	H	High Sensitivity Typ. 3[mT]	Low Sensitivity Typ. 10[mT]
3.0 - 26.4 12.0 typ.	4.4	3.6	1.2	EW-410B EW-412B	
					
	2.2	3.0	1.0	EW-610B EW-612B	
					
	3.0	4.1	1.15	EW-710B EW-712B	
					
4.5 - 26.4 12.0 typ.	4.4	3.6	1.2	EW-414B	
					
4.5 - 18.0 12.0 typ.	4.4	3.6	1.2		EW-400 EW-402
					
	4.0	4.5	1.5	EW-510 EW-512	EW-500 EW-502
					

**Continous Excitation Type (continued)**











Operating Voltage Range Supply Voltage Range (Vcc)	Package Size (mm)			Output H to L Flux Density Operating Point (Bop)	
	L	W	H	High Sensitivity Typ. 3[mT]	Low Sensitivity Typ. 10[mT]
2.2 - 18.0 12.0 typ.	4.4	3.6	1.2	EW-432 	
	2.2	3.0	1.0	EW-632 	
	3.0	4.1	1.15	EW-732 	
2.5 - 5.5 3.0 typ.	4.4	3.6	1.2	EW-413 	EW-403 
3.5 - 18.0 12.0 typ.	2.1	2.1	0.55	EM-1011 	

**Continous Excitation Type - 125°C Operation**


Operating Voltage Range Supply Voltage Range (Vcc)	Package Size (mm)			Output H to L Flux Density Operating Point (Bop)
	L	W	H	High Sensitivity 4.2 [mT]
3.8 - 24.0 12.0 typ.	4.4	3.6	1.2	EZ-410 




With Power-Down Function					
Operating Voltage Range Supply Voltage Range (Vcc)	Package Size (mm)			Output H to L Flux Density Operating Point (Bop)	
	L	W	H	Typ. sensitivity 1.8 (Max. 4) [mT]	
				Continuous Excitation	Pulsed Excitation (Micro-Power)
1.6 - 5.5 3.0 typ.	1.8	1.2	0.38		EM-0713 
			0.5	EM-0711 	EM-0712 
	2.1	2.1	0.6	EM1711 	EM-1712 




# Hall Effect IC's - Switches

Continuous Excitation Type							
Operating Voltage Range Supply Voltage Range (Vcc)	Package Size (mm)			Output H to L Flux Density Operating Point (Bop)			
	L	W	H	High Sensitivity 3[mT]	Normal Sensitivity 6[mT]	Low Sensitivity 10[mT]	
2.5 - 5.5 3.0 typ.	4.4	3.6	1.2	EW-463 		EW-453 	
3.0 - 26.4 12 typ.					EW-450B 		
				3.1	3.0	1.0	EW-650B 
	3.0	4.1	1.15		EW-750B 	EW-752B	
4.5 - 18.0 12.0 typ.	4.4	3.6	1.2	EW-460 		EW-450 	
					EW-462		
	4.0	4.5	1.5	EW-560 		EW-550 	
				EW-562 			





<b>Continuous Excitation Type - 125°C Operation</b>				
Operating Voltage Range Supply Voltage Range (Vcc)	Package Size (mm)			Output H to L Flux Density Operating Point (Bop)
	L	W	H	Low Sensitivity 26 [mT]
2.0 - 24.0 12.0 typ.	4.4	3.6	1.2	EZ-470 

<b>Pulsed Excitation (Micro-Power)</b>					
Operating Voltage Range Supply Voltage Range (Vcc)	Package Size (mm)			Output H to L Flux Density Operating Point (Bop)	
	L	W	H	Hyper-sensitivity Typ. 1.5[mT]	High Sensitivity Typ. 3[mT]
1.6 - 5.5 1.8 typ.	2.1	2.1	0.55		EM-1771 
	1.8	1.2	0.50		EM-0771 
2.4 - 3.3 3.0 typ.	3.1	3.0	1.0	EW-6672 	



<b>Omnipolar Switches</b>					
<b>Pulsed Excitation (Micro-Power)</b>					
Operating Voltage Range Supply Voltage Range (Vcc)	Package Size (mm)			Output H to L Flux Density Operating Point (Bop)	
	L	W	H	Low Sensitivity 26 [mT]	
1.6 - 5.5 1.8 typ.	3.1	3.0	1.0	EM-6781	
	2.1	2.1	0.55	EM-1781	
	1.8	1.2	0.5	EM-0781	

## **Dual Output for S & N Pole Switches**

### **Pulsed Excitation (Micro-Power)**

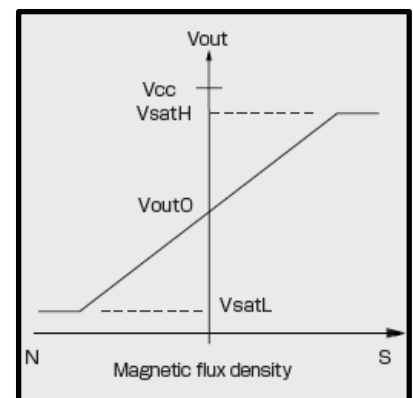
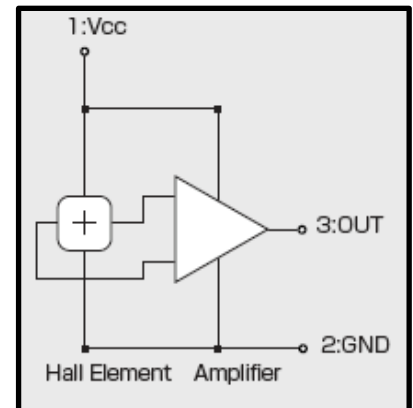
Operating Voltage Range Supply Voltage Range (Vcc)	Package Size (mm)			Output H to L Flux Density Operating Point (Bop)
	L	W	H	Low Sensitivity 26 [mT]
1.6 - 5.5 1.8 typ.	2.1	2.1	0.55	EM-1791 
	1.8	1.2	0.5	EM-0791 

# EQ Series



Operating Voltage Range Supply Voltage Range (Vcc)	Package Size (mm)			Sensitivity at Vcc=5.0, Ta=25°C, B=25 mT		10% Output Decrease Frequency
	L	W	H	Min/Nom/Max	50/65/80 mV/mT	
3.0 - 5.5	4.4	3.6	1.2		EQ-411L	50 kHz
	2.35	2.7	0.95		EQ-711L	100 kHz

## Operating Characteristics (Ta = 25°C Vcc=5.0V)

- ◆ Supply Voltage : 3~5.5V
- ◆ Nominal Supply Current: 9 mA
- ◆ Continuous-Time Ratiometric Analog Output
- ◆ Output Offset Voltage: 2.35 ~ 2.65 V
- ◆ High Output Saturation Voltage @ Iout = 0.5mA: Vcc-0.3 to Vcc
- ◆ Low Output Saturation Voltage @ Iout = 0.5 mA: 0 to 0.3 V
- ◆ Temperature coefficient of sensitivity : -5 to 5 %
- ◆ Temperature coefficient of offset Voltage : -0.5 to 0.5 mV/C
- ◆ Response time : Typ. 3μs (EW-711L) Typ. 5μs (EW-411L)
- ◆ Operating Temperature Range : -30~100°C



# CQ Series

Linear Hall Effect Current Sensor	
20A Type	30A Type
CQ-121E 	CQ-131E 

Parameter	CQ-121E	CQ-131E	Unit
Operating Temperature Range	-30 ~ 80		°C
Storage Temperature Range	-30 ~ 85		°C
Power Supply Voltage	3 ~ 5.5		V
Supply Current	9 (Typ.)		mA
DC Maximim Conduction Current	-30 ~ 30		A
Rated Input Current (Note 1)	-25 ~ 25	-50 ~ 50	A
Output Unsaturation Range	-30 ~ 30	-60 ~ 60	A
Sensitivity Voltage	63.5 (Typ.)	27 (Typ.)	mV/A
Neutral Point Potential (I = 0A)	2.35 ~ 2.65		V
Linearity	≤ 1.0		% F.S.
Sensitivity Voltage Temperature Drift	≤ 5.0		%
Neutral Point Potential Temperature Drift	≤ 0.5		mV/°C
Frequency Response (-3 db)	100 (Typ.)		kHz
Pulse Response	≤ 5.0		μs
Withstand Voltage (60 sec.)	1.5 (Typ.)		kV

Note 1: Shall be within the linearity assurance range

