1. 特性

- 便于使用
  - 外部电阻设置增益(1 到 10,000)
  - 宽供电电压范围(±2V 到±19V)
  - 更高的性能，相较于 3 运放类仪器放大器
  - 8 PIN SOIC 封装
  - 低功耗，0.6mA 静态电流
- 优异的 DC 性能
  - 最大 10μV，输入失调电压
  - 最大 3.0nA，输入偏置电流
  - 110dB 共模抑制比(G = 1)
- 低噪声
  - 26nV/√Hz @ 1kHz，输入噪声电压
  - 1.5μV$_{PP}$ (0.1Hz 到 10Hz)
- 优异的 AC 性能
  - 640kHz 带宽(G = 1)
- 工作温度
  - INA111: –40°C 到 85°C
  - INA112: –55°C 到 125°C

2. 应用

- 测量仪器
- ECG 与医疗应用
- 传感器接口
- 数据采集系统
- 工业过程控制
- 电池与移动设备

3. 说明

INA111/INA112 是一款低成本，高精度仪器放大器，只需要一个外部电阻，即可设定 1-10000 的增益。INA111/INA112 使用 SOIC-8 封装，待机功耗低(仅 0.6mA)，非常适宜于电池供电类移动设备。

INA111/INA112 是一款高精度仪器放大器，最大 10μV 的输入失调电压，是高精度数据采集系统的理想选择，可应用于测量仪器及传感器接口。并且，INA111/INA112 的低噪声、低输入偏置电流、低功耗特性，使其非常适合应用于医疗应用，比如 ECG 及血压仪。

低至 26nV/√Hz @ 1kHz，1.5μV$_{PP}$ (0.1Hz 到 10Hz)的低噪声电压及 0.35pA/√Hz 的低噪声电流特性，使 INA111/INA112 成为预放大的理想选择。使 INA111/INA112 非常适合于多路复合应用，并且由于低成本特性，使每通道都拥有运放的设计成为可能。有关订购信息，请参见 Table 1。

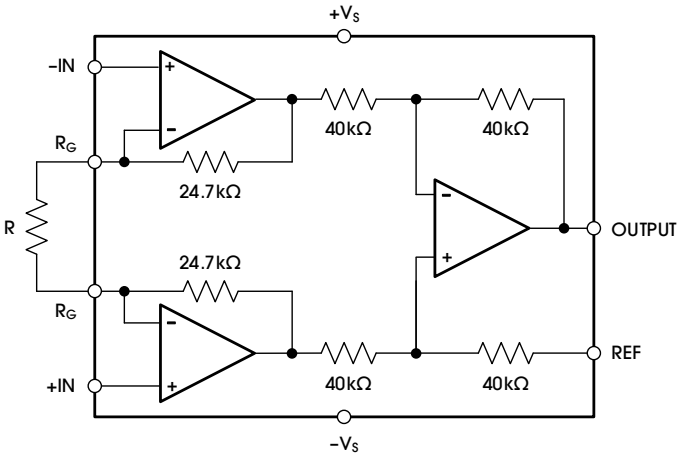


Table 1 lists the order information.

Table 1. Order Information

ORDER NUMBER(1)	CH (#)	PACKAGE	MARK	I_Q PER CH (TYP) (mA)	BW (kHz)	GAIN	GAIN TYPE	OPERATING TEMP (°C)	PACKAGE OPTION
INA111ASOIC8	1	SOIC-8	INA111	0.6	600	1-10000	R_G	–40-85	T/R-4000
INA112ASOIC8	1	SOIC-8	INA112	0.6	600	1-10000	R_G	–55-125	T/R-4000

Table 2. Family Selection Guide

ORDER NUMBER(1)	CH (#)	PACKAGE	MARK	I_Q PER CH (TYP) (mA)	BW (kHz)	GAIN	GAIN TYPE	OPERATING TEMP (°C)	PACKAGE OPTION
INA101ASOIC8	1	SOIC-8	INA101	1.56	1300	1-10000	R_G	–40-85	T/R-4000
INA102ASOIC8	1	SOIC-8	INA102	1.56	1300	1-10000	R_G	–55-125	T/R-4000
INA201ASOIC8	1	SOIC-8	INA201	1.5	256	10-100	R_G and OS	–40-85	T/R-4000
INA202ASOIC8	1	SOIC-8	INA202	1.5	256	10-100	R_G and OS	–55-125	T/R-4000
INA211ASOIC8(2)	1	SOIC-8	INA211	0.6	160	10-100	R_G and OS	–40-125	T/R-4000
INA212ASOIC8(2)	1	SOIC-8	INA212	0.6	160	10-100	R_G and OS	–40-125	T/R-4000
INA501LASOIC8(2)	1	SOIC-8	INA501L	1.56	1300	2	Fixed	–40-125	T/R-4000
INA501MASOIC8(2)	1	SOIC-8	INA501M	1.56	1300	5	Fixed	–40-125	T/R-4000
INA501HASOIC8(2)	1	SOIC-8	INA501H	1.56	1300	10	Fixed	–40-125	T/R-4000
INA501NASOIC8(2)	1	SOIC-8	INA501N	1.56	1300	20	Fixed	–40-125	T/R-4000
INA501PASOIC8(2)	1	SOIC-8	INA501P	1.56	1300	25	Fixed	–40-125	T/R-4000
INA501RASOIC8(2)	1	SOIC-8	INA501R	1.56	1300	50	Fixed	–40-125	T/R-4000
INA501SASOIC8(2)	1	SOIC-8	INA501S	1.56	1300	75	Fixed	–40-125	T/R-4000
INA501TASOIC8(2)	1	SOIC-8	INA501T	1.56	1300	100	Fixed	–40-125	T/R-4000
INA501KASOIC8(2)	1	SOIC-8	INA501K	1.56	1300	125	Fixed	–40-125	T/R-4000
INA501JASOIC8(2)	1	SOIC-8	INA501J	1.56	1300	200	Fixed	–40-125	T/R-4000
INA501GASOIC8(2)	1	SOIC-8	INA501G	1.56	1300	250	Fixed	–40-125	T/R-4000
INA501FASOIC8(2)	1	SOIC-8	INA501F	1.56	1300	500	Fixed	–40-125	T/R-4000
INA511LASOIC8(2)	1	SOIC-8	INA511L	0.6	130	2	Fixed	–40-125	T/R-4000
INA511MASOIC8(2)	1	SOIC-8	INA511M	0.6	130	5	Fixed	–40-125	T/R-4000
INA511HASOIC8(2)	1	SOIC-8	INA511H	0.6	130	10	Fixed	–40-125	T/R-4000
INA511NASOIC8(2)	1	SOIC-8	INA511N	0.6	130	20	Fixed	–40-125	T/R-4000
INA511PASOIC8(2)	1	SOIC-8	INA511P	0.6	130	25	Fixed	–40-125	T/R-4000
INA511RASOIC8(2)	1	SOIC-8	INA511R	0.6	130	50	Fixed	–40-125	T/R-4000
INA511SASOIC8(2)	1	SOIC-8	INA511S	0.6	130	75	Fixed	–40-125	T/R-4000
INA511TASOIC8(2)	1	SOIC-8	INA511T	0.6	130	100	Fixed	–40-125	T/R-4000
INA511KASOIC8(2)	1	SOIC-8	INA511K	0.6	130	125	Fixed	–40-125	T/R-4000
INA511JASOIC8(2)	1	SOIC-8	INA511J	0.6	130	200	Fixed	–40-125	T/R-4000
INA511GASOIC8(2)	1	SOIC-8	INA511G	0.6	130	250	Fixed	–40-125	T/R-4000
INA511FASOIC8(2)	1	SOIC-8	INA511F	0.6	130	500	Fixed	–40-125	T/R-4000

Note : Available in the future.

Devices can be ordered via the following two ways:
1. Place orders directly on our website (www.analogysemi.com), or;
2. Contact our sales team by mailing to sales@analogysemi.com.

4. PIN CONFIGURATION AND FUNCTIONS

Figure 1 illustrates the pin configuration.

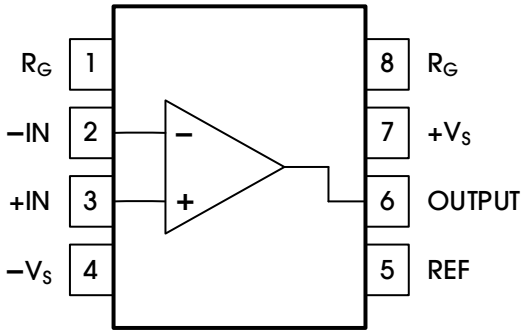


Figure 1. Pin Configuration

Table 3 lists the pin functions.

Table 3. Pin Functions

POSITION	NAME	TYPE	DESCRIPTION
1, 8	R_G	Analog output	Connect a resistor between two R_G to set gain. See more information in the GAIN SELECTION section.
2	−IN	Analog input	Signal negative input
3	+IN	Analog input	Signal positive input
4	$-V_S$	Power supply	Negative power supply
5	REF	Analog input	Output reference voltage input
6	OUTPUT	Analog output	Output
7	$+V_S$	Power supply	Positive power supply

5. SPECIFICATIONS

5.1 ABSOLUTE MAXIMUM RATINGS

Table 4 lists the absolute maximum ratings of the INA111/INA112.

Table 4. Absolute Maximum Ratings

PARAMETER	DESCRIPTION	MIN	MAX	UNITS
Voltage	Supply		±20	V
	Input voltage	$-V_S$ – 0.3	$+V_S$ + 0.3	V
Current	Any pin except power supply	–10	+10	mA
Output Short-Circuit Duration		Indefinite		
Temperature	Operating, T_A, INA111	–40	85	°C
	Operating, T_A, INA112	–55	125	
	Storage, T_{stg}, Q	–65	150	
	Soldering, 10s		300	

Note 1: Stresses beyond those listed under Table 4 may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Table 6. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

5.2 ESD RATINGS

Table 5 lists the ESD ratings of the INA111/INA112.

Table 5. ESD Ratings

PARAMETER	SYMBOL	DESCRIPTION	VALUE	UNITS
Electrostatic Discharge	$V_{(ESD)}$	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001(1), all pins except –IN and +IN	±2000	V
		Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001(1), –IN and +IN pin	±3500	
		Charged-device model (CDM), per JEDEC specification JESD22-C101(2)	±2000	

Note 1: The JEDEC document JEP155 indicates that 500V HBM allows safe manufacturing with a standard ESD control process.

Note 2: The JEDEC document JEP157 indicates that 250V CDM allows safe manufacturing with a standard ESD control process.

5.3 RECOMMENDED OPERATING CONDITIONS

Table 6 lists the recommended operating conditions for the INA111/INA112.

Table 6. Recommended Operating Conditions

PARAMETER	DESCRIPTION	MIN	NOM	MAX	UNITS
Operating Voltage Range	Split supply	±2	±18	±19	V
	Single supply	4	36	38	V
Specified Temperature Range	INA111	–40		85	°C
	INA112	–55		125	°C

5.4 THERMAL INFORMATION

Table 7 lists the thermal information for the INA111/INA112.

Table 7. Thermal Information

PARAMETER	SYMBOL	SOIC-8	UNITS
Junction-to-Ambient Thermal Resistance	$R_{\theta JA}$	90.6	°C/W
Junction-to-Board Thermal Resistance	$R_{\theta JB}$	47.6	°C/W
Junction-to-Top Characterization Parameter	ψ_{JT}	3.6	°C/W
Junction-to-Board Characterization Parameter	ψ_{JB}	47	°C/W
Junction-to-Case (Top) Thermal Resistance	$R_{\theta JC(top)}$	35	°C/W

5.5 ELECTRICAL CHARACTERISTICS

Table 8 and Table 9 list the electrical characteristics of INA111/INA112. At 25°C, V_S = ±18V, and R_L = 2kΩ to GND, unless otherwise noted.

Table 8. Electrical Characteristics (INA111)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
GAIN						
Gain Range		G = 1 + (49.4kΩ / R_G)	1		10K	V/V
Gain Error(1)		V_{OUT} = ±10V, G = 1, 25°C		0.01	0.06	%
		V_{OUT} = ±10V, G = 10, 25°C		0.01	0.1	%
		V_{OUT} = ±10V, G = 100, 25°C		0.01	0.1	%
		V_{OUT} = ±10V, G = 1000, 25°C		0.01	0.4	%
Gain vs. Temperature		G = 1(5)		1		ppm/°C
		Gain > 1(1)(5)		12		ppm/°C
VOLTAGE OFFSET(2)						
Input Offset, V_{OSI}		V_S = ±18V, 25°C		±2.5	±10	µV
		V_S = ±2V to ±19V, average TC(5)		0.2		µV/°C
Output Offset, V_{OSO}		V_S = ±18V, 25°C		±20	±60	µV
		V_S = ±2V to ±19V, average TC(5)		0.2		µV/°C
Offset Referred to The Input vs. Supply (PSR)		V_S = ±2V to ±20V, G = 1	125	143		dB
		V_S = ±2V to ±20V, G = 10	145	163		dB
		V_S = ±2V to ±20V, G = 100	145	163		dB
		V_S = ±2V to ±20V, G = 1000	145	163		dB
INPUT CURRENT						
Input Bias Current		25°C		±0.7	±2.5	nA
		Overtemperature(5)			±3	nA
Input Offset Current		25°C		0.5	2	nA
		Overtemperature(5)			3	nA
INPUT						
Input Impedance		Differential		34 || 5		GΩ_pF
		Common-Mode		34 || 6		GΩ_pF
Input Voltage Range(3)		V_S = ±2V to ±19V	$-V_S$ + 0.1		$+V_S$ – 2	V
COMMON-MODE REJECTION						
Common-Mode Rejection Ratio DC		V_{CM} = ($-V_S$ + 0.1V) to ($+V_S$ – 2V), G = 1	95	110		dB
		V_{CM} = ($-V_S$ + 0.1V) to ($+V_S$ – 2V), G = 10	115	140		dB
		V_{CM} = ($-V_S$ + 0.1V) to ($+V_S$ – 2V), G = 100	135	170		dB
		V_{CM} = ($-V_S$ + 0.1V) to ($+V_S$ – 2V), G = 1000	155	180		dB
OUTPUT						
Output Swing		R_L = 10kΩ, V_S = ±2V to ±19V	$-V_S$ + 0.2		$+V_S$ – 0.2	V
Short Circuit Current				±20		mA
DYNAMIC RESPONSE						
Small Signal –3dB Bandwidth		G = 1		640		kHz
		G = 10		160		kHz
		G = 100		15		kHz
		G = 1000		1.5		kHz
Slew Rate		G = 1, 10V step		1		V/µs
		G = 100, 10V step		0.15		V/µs
NOISE						
Voltage Noise, 1kHz(4)		Input, Voltage Noise, e_{ni}		26		nV/√Hz
		Output, Voltage Noise, e_{no}		70		nV/√Hz

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
RTI, 0.1Hz to 10Hz		G = 1		1.5		μV_{PP}
		G = 100		0.55		μV_{PP}
Current Noise		f = 1kHz		350		$fA/\sqrt{Hz}$
		0.1Hz to 10Hz		10		pA_{PP}
REFERENCE INPUT						
R_{IN}				80		kΩ
Voltage Range			$-V_S$		$+V_S$	V
Reference Gain to Output				1.2	15	μV/V
POWER SUPPLY						
Operating Range			±2		±19	V
Quiescent Current		V_S = ±2V to ±19V		0.62	0.75	mA
Overtemperature					0.8	mA
TEMPERATURE RANGE						
For Specified Performance			–40		+85	°C

Note 1: Does not include effects of external resistor R_G.
Note 2: Total RTI Error = $V_{OSI} + V_{OSO} / G$
Note 3: One input grounded. G = 1.
Note 4: Total RTI Noise = $\sqrt{e^2ni + (e_{no} / G)^2}$
Note 5: All devices are 100% production tested at T_A = +25°C. All temperature limits are guaranteed by bench test lot.

Table 9. Electrical Characteristics (INA112)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
GAIN						
Gain Range		G = 1 + (49.4kΩ / R_G)	1		10K	V/V
Gain Error(1)		V_{OUT} = ±10V, G = 1, 25°C		0.01	0.06	%
		V_{OUT} = ±10V, G = 10, 25°C		0.01	0.1	%
		V_{OUT} = ±10V, G = 100, 25°C		0.01	0.1	%
		V_{OUT} = ±10V, G = 1000, 25°C		0.01	0.4	%
Gain vs. Temperature		G = 1(5)		1		ppm/°C
		Gain > 1(1)(5)		10		ppm/°C
VOLTAGE OFFSET(2)						
Input Offset, V_{OSI}		V_S = ±18V, 25°C		±2.5	±10	µV
		V_S = ±2V to ±19V, average TC(5)		0.2		µV/°C
Output Offset, V_{OSO}		V_S = ±18V, 25°C		±20	±60	µV
		V_S = ±2V to ±19V, average TC(5)		0.4		µV/°C
Offset Referred to The Input vs. Supply (PSR)		V_S = ±2V to ±20V, G = 1	125	143		dB
		V_S = ±2V to ±20V, G = 10	145	163		dB
		V_S = ±2V to ±20V, G = 100	145	163		dB
		V_S = ±2V to ±20V, G = 1000	145	163		dB
INPUT CURRENT						
Input Bias Current		25°C		±0.7	±3	nA
		Overtemperature(5)			±10	nA
Input Offset Current		25°C		0.5	2	nA
		Overtemperature(5)			4	nA
INPUT						
Input Impedance		Differential		34 || 5		GΩ_pF
		Common-Mode		34 || 6		GΩ_pF
Input Voltage Range(3)		V_S = ±2V to ±19V	$-V_S$ + 0.1		$+V_S$ – 2	V
COMMON-MODE REJECTION						
Common-Mode Rejection Ratio DC		V_{CM} = ($-V_S$ + 0.1V) to ($+V_S$ – 2V), G = 1	95	110		dB
		V_{CM} = ($-V_S$ + 0.1V) to ($+V_S$ – 2V), G = 10	115	140		dB
		V_{CM} = ($-V_S$ + 0.1V) to ($+V_S$ – 2V), G = 100	135	170		dB
		V_{CM} = ($-V_S$ + 0.1V) to ($+V_S$ – 2V), G = 1000	155	180		dB
OUTPUT						
Output Swing		R_L = 10kΩ, V_S = ±2V to ±19V	$-V_S$ + 0.2		$+V_S$ – 0.2	V
Short Circuit Current				±20		mA
DYNAMIC RESPONSE						
Small Signal –3dB Bandwidth		G = 1		640		kHz
		G = 10		160		kHz
		G = 100		15		kHz
		G = 1000		1.5		kHz
Slew Rate		G = 1, 10V step		1		V/µs
		G = 100, 10V step		0.15		V/µs
NOISE						
Voltage Noise, 1kHz(4)		Input, Voltage Noise, e_{ni}		26		nV/√Hz
		Output, Voltage Noise, e_{no}		70		nV/√Hz
RTI, 0.1Hz to 10Hz		G = 1		1.5		μV_{PP}
		G = 100		0.55		μV_{PP}
Current Noise		f = 1kHz		350		fA/√Hz
		0.1Hz to 10Hz		10		pA_{PP}

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
REFERENCE INPUT						
R_{IN}				80		kΩ
Voltage Range			$-V_S$		$+V_S$	V
Reference Gain to Output				1.2	15	μV/V
POWER SUPPLY						
Operating Range			±2		±19	V
Quiescent Current		V_S = ±2V to ±19V		0.62	0.75	mA
Overtemperature					0.8	mA
TEMPERATURE RANGE						
For Specified Performance			–55		+125	°C

Note 1: Does not include effects of external resistor R_G.
Note 2: Total RTI Error = $V_{OSI} + V_{OSO} / G$
Note 3: One input grounded. G = 1.
Note 4: Total RTI Noise = $\sqrt{e^2ni + (e_{no} / G)^2}$
Note 5: All devices are 100% production tested at T_A = +25°C. All temperature limits are guaranteed by bench test lot.

6. TYPICAL CHARACTERISTICS

T_A = 25°C, V_S = ±18V, R_L = 2kΩ, unless otherwise noted.

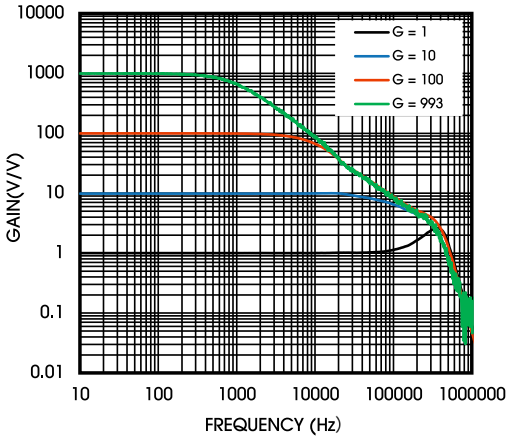


Figure 2. Gain vs. Frequency

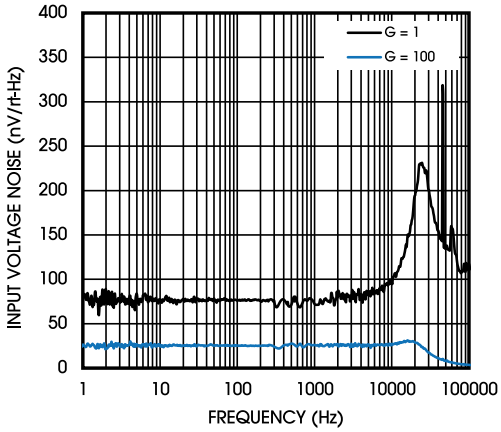


Figure 3. Input Voltage Noise Density

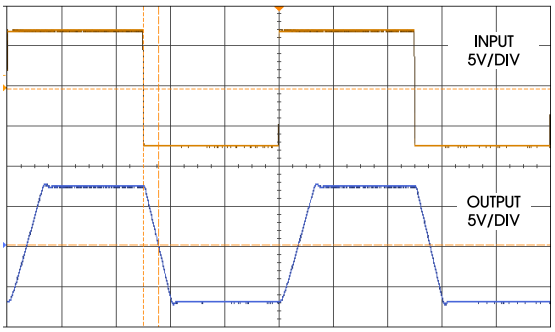


Figure 4. Large Signal Response (G = 1)

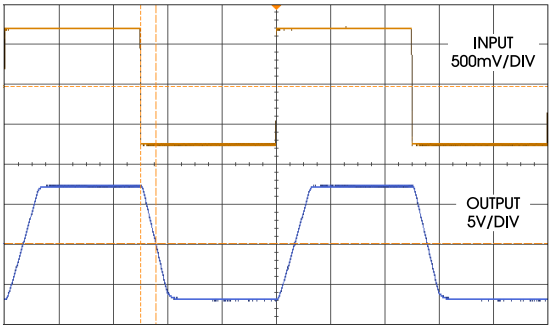


Figure 5. Large Signal Response (G = 10)

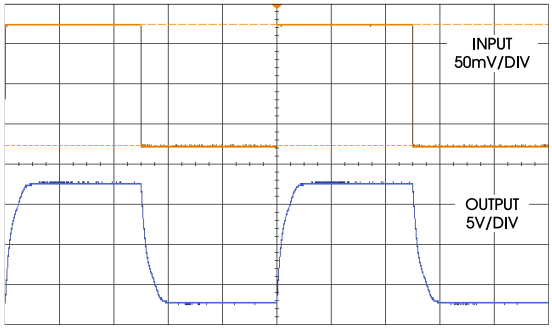


Figure 6. Large Signal Response (G = 100)

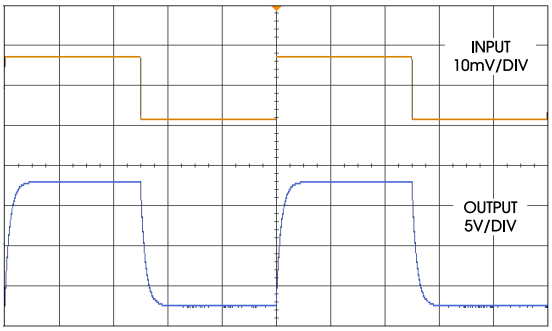


Figure 7. Large Signal Response (G = 993)

7. 详细说明

7.1 概述

INA111/INA12 是一款基于经典三运算放大器方法改进的单片仪表放大器。绝对值微调允许用户仅用一个电阻器就可以准确地对增益进行设置。单片结构和微调允许电路元件的紧密匹配和跟踪，从而确保该电路固有的高性能。

内部增益电阻器 R1 和 R2 被调整为 24.7kΩ 的绝对值，从而允许使用单个外部电阻器对增益进行精确编程。

那么增益方程为：

$$G = \frac{49.4k\Omega}{R_G} + 1 \quad (1)$$

$$R_G = \frac{49.4k\Omega}{G - 1} \quad (2)$$

作为参考 REF 引脚的单端输出，可将 REF 引脚连接到地或低电阻源。

7.2 功能模块框图

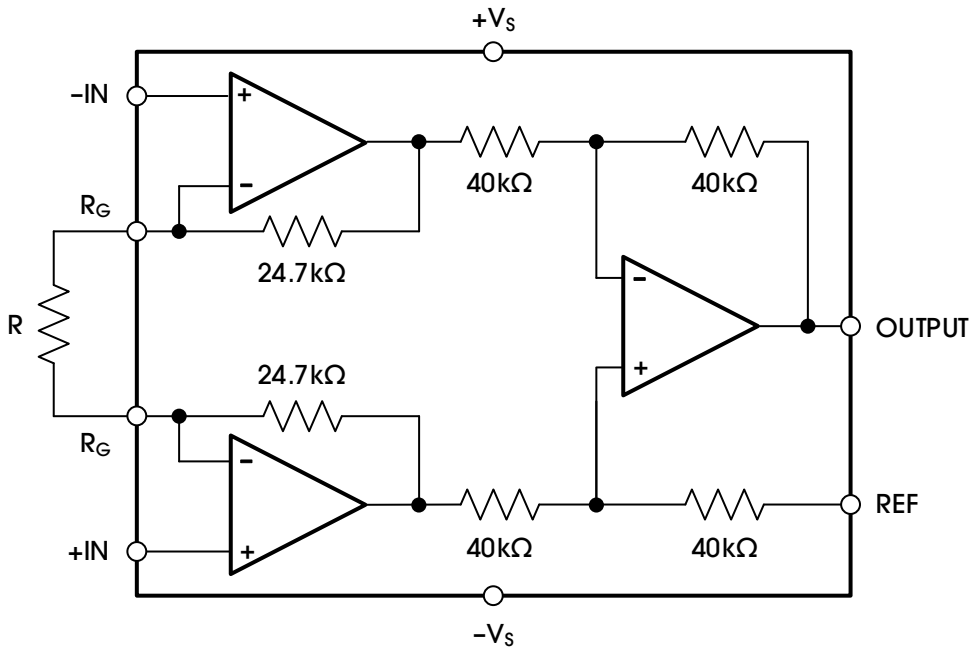


Figure 8. Functional Block Diagram

7.3 特性描述

7.3.1 精密 V-I 转换器

INA111/INA112 与另一个运算放大器和两个电阻器一起构成精密电流源(Figure 9)。运算放大器缓冲参考端子以保持良好的 CMR。INA111/INA112 的输出电压 V_X 出现在 R1 两端，将其转换为电流。该电流，仅减去运算放大器的输入偏置电流，然后流出至负载。

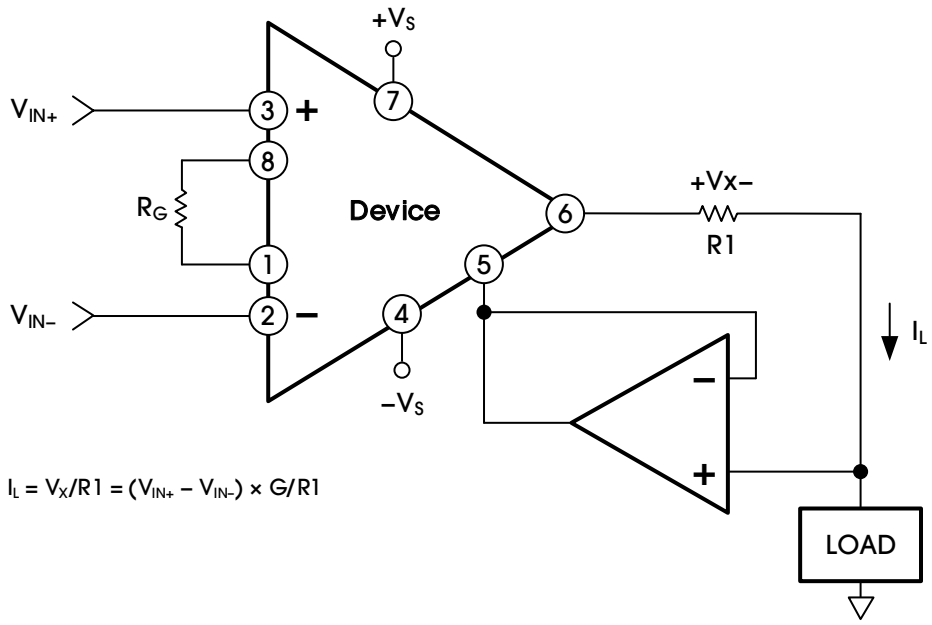


Figure 9. Precision Voltage-to-Current Converter

7.3.2 增益选择

INA111/INA112 增益由 R_G 电阻器编程，或更准确地说，由引脚 1 和 8 之间出现的任何阻抗进行设置。INA111/INA112 旨在使用 0.1%至 1%的电阻器提供精确增益。Table 10 显示了各种增益所需的 R_G 值。请注意，对于 G = 1，R_G 引脚未连接(R_G = ∞)。对于任意增益，可以使用以下公式计算 R_G：

$$R_G = \frac{49.4k\Omega}{G - 1} \quad (3)$$

为了尽量减少增益误差，避免与 R_G 串联的高寄生电阻；为了最大限度地减少增益漂移，R_G 应具有较低的 TC——低于 10ppm/°C 以获得最佳性能。

Table 10. Required Values of Gain Resistors

1% STD TABLE VALUE OF R_G (Ω)	CALCULATED GAIN	0.1% STD TABLE VALUE OF R_G (Ω)	CALCULATED GAIN
49.9k	1.990	49.3k	2.002
12.4k	4.984	12.4k	4.984
5.49k	9.998	5.49k	9.998
2.61k	19.93	2.61k	19.93
1.00k	50.40	1.01k	49.91
499	100.0	499	100.0
249	199.4	249	199.4
100	495.0	98.8	501.0
49.9	991.0	49.3	1,003.0

7.3.3 输入和输出失调电压

INA111/INA112 的低误差归因于两个来源，输入和输出误差。当参考输入时，输出误差除以 G。实际上，输入误差在高增益时占主导地位，而输出误差在低增益时占主导地位。给定增益的总 V_{OS} 计算如下：

$$\text{Total Error RTI} = \text{Input Error} + (\text{Output Error} / G) \quad (4)$$

$$\text{Total Error RTO} = (\text{Input Error} \times G) + \text{Output Error} \quad (5)$$

7.3.4 参考终端

参考端子电位定义了零输出电压，当负载不与系统的其余部分共享精确接地时尤其有用。它提供了一种向输出注入精确偏移的直接方法，在电源电压范围内允许 2V 的范围。为获得最佳 CMR，寄生电阻应保持在最低水平。

7.3.5 输入保护

对于超出电源的输入电压，应在每个输入端串联一个保护电阻器，以将电流限制在 10mA。这些可以是与 RFI 滤波器中使用的电阻器相同的电阻器。高电阻值会影响系统的噪声和交流 CMRR 性能。可以在输入端放置低漏电二极管(例如 BAV199)以降低所需的保护电阻。

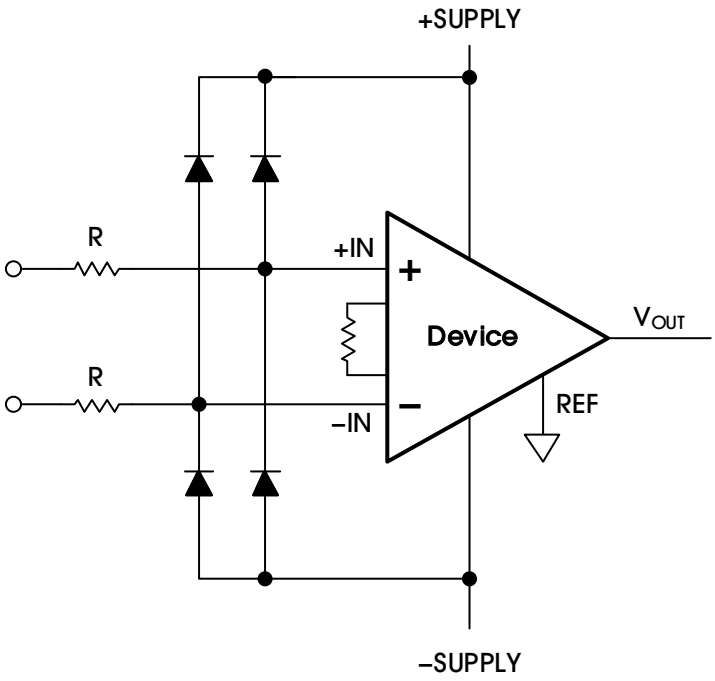


Figure 10. Diode Protection for Voltages Beyond Supply

7.3.6 射频干扰

所有仪表放大器都会对小的带外信号进行整流。干扰可能表现为一个小的直流电压偏移。可以使用放置在仪表放大器输入端的低通 R-C 网络过滤高频信号。Figure 11 展示了这样的配置。滤波器根据以下关系限制输入信号：

$$\text{FilterFreq}_{DIFF} = \frac{1}{2\pi R(2C_D + C_C)} \quad (6)$$

$$\text{FilterFreq}_{CM} = \frac{1}{2\pi RC_C} \quad (7)$$

其中：

- $C_D \geq 10C_C$.

C_D 影响差值信号。C_C 影响共模信号。$R \times C_C$ 的任何不匹配都会降低 INA111/INA112 CMRR。为避免无意中降低 CMRR 带宽性能，请确保 C_C 至少比 C_D 小一个数量级。不匹配的 C_C 的影响随着 C_D:C_C 比率的增加而降低。

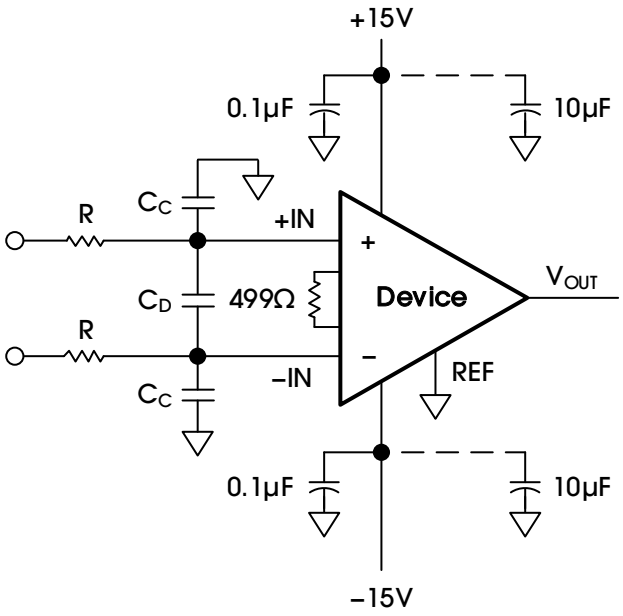


Figure 11. Circuit to Attenuate RF Interference

7.3.7 共模抑制

INA111/INA112 仪表放大器提供高 CMR，这是衡量两个输入等量变化时输出电压变化的指标。这些规格通常针对全范围输入电压变化和指定的源不平衡给出。

为获得最佳 CMR，参考端子应连接到低阻抗点，并且两个输入之间的电容和电阻差异应保持在最小值。在许多应用中，屏蔽电缆被用于最小化噪声；为了在频率范围内获得最佳 CMR，应正确驱动屏蔽。Figure 12 和 Figure 13 显示了有源数据保护，它们被配置为通过“自举”输入电缆屏蔽层的电容来提高交流共模抑制，从而最大限度地减少输入之间的电容失配。

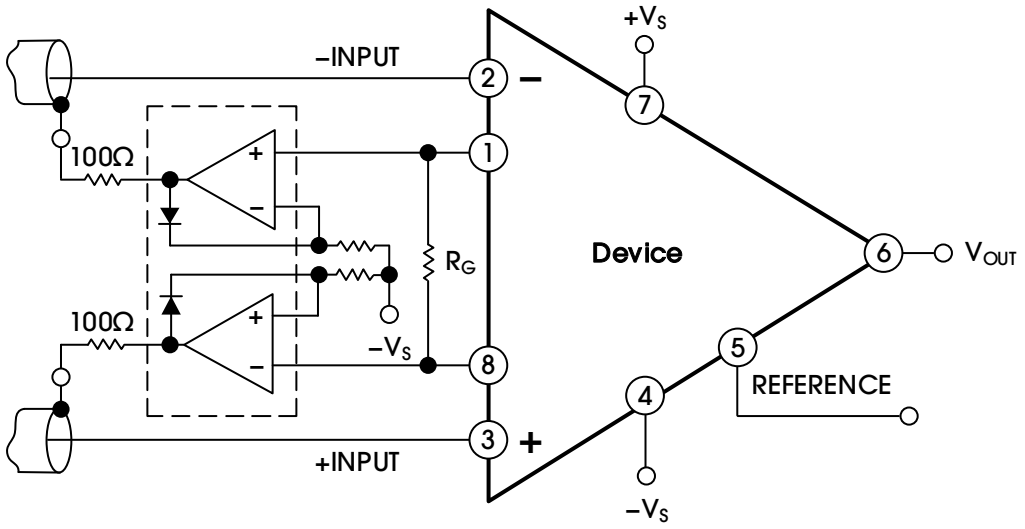


Figure 12. Differential Shield Driver

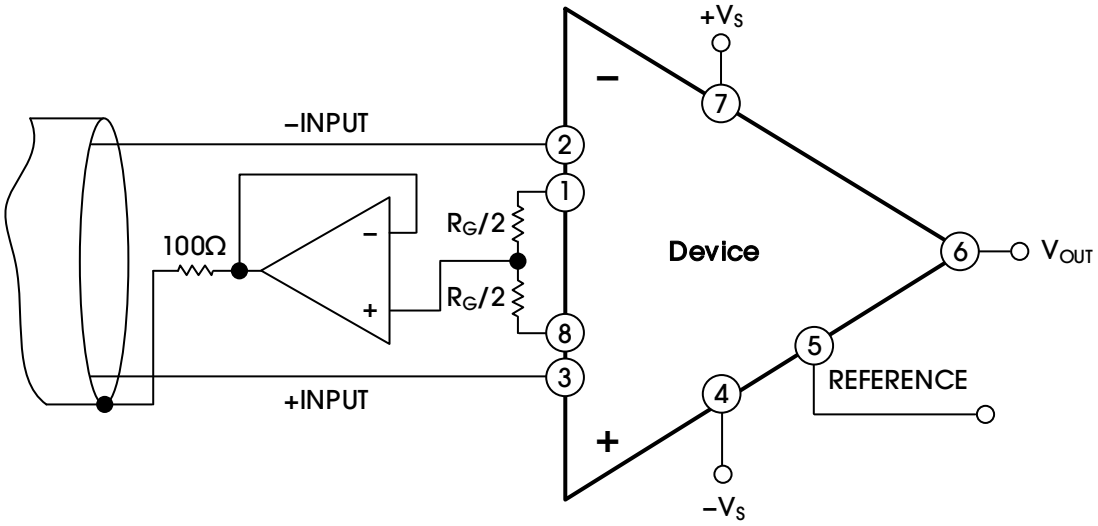


Figure 13. Common-Mode Shield Driver

7.3.8 输入偏置电流的接地回路

输入偏置电流是偏置放大器输入晶体管所必需的电流。这些电流必须有直接返回路径。因此，当放大“浮动”输入源(例如变压器或交流耦合源)时，每个输入到地之间必须有一条直流路径，如 Figure 14、Figure 15 和 Figure 16 所示。

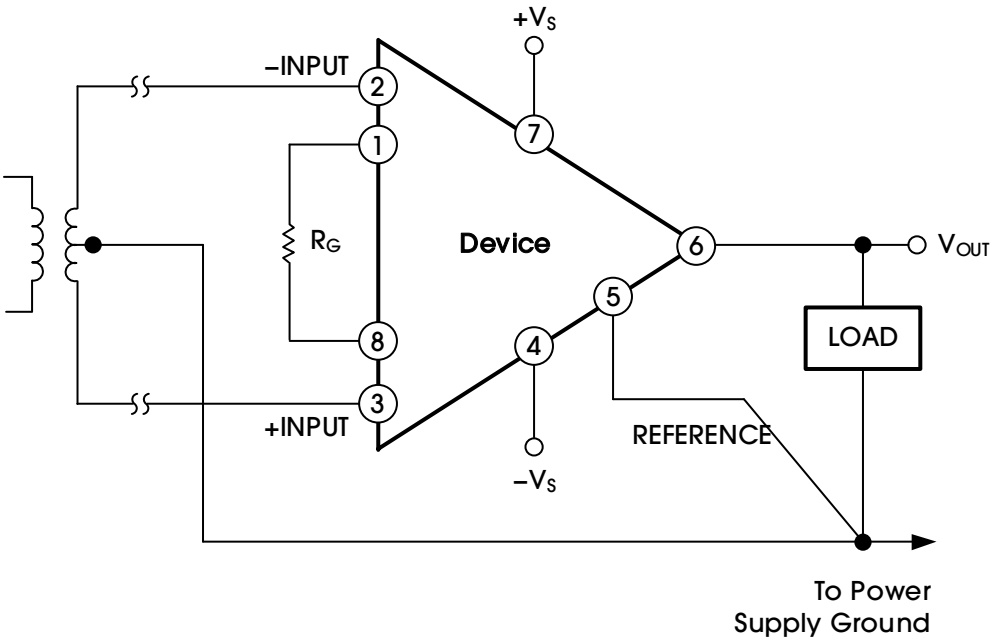


Figure 14. Ground Returns for Bias Currents with Transformer-Coupled Inputs

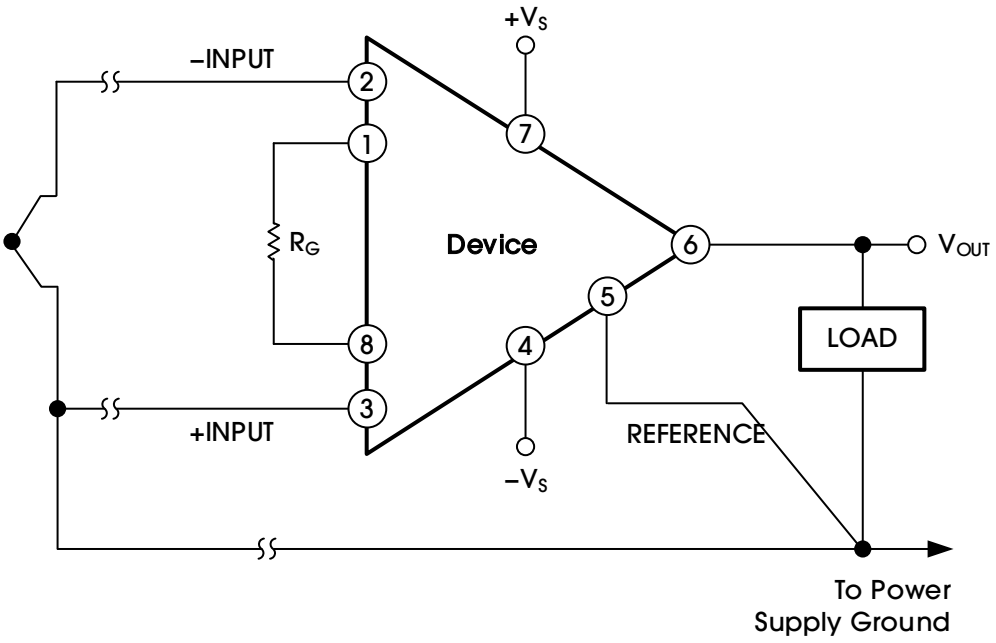


Figure 15. Ground Returns for Bias Currents with Thermocouple Inputs

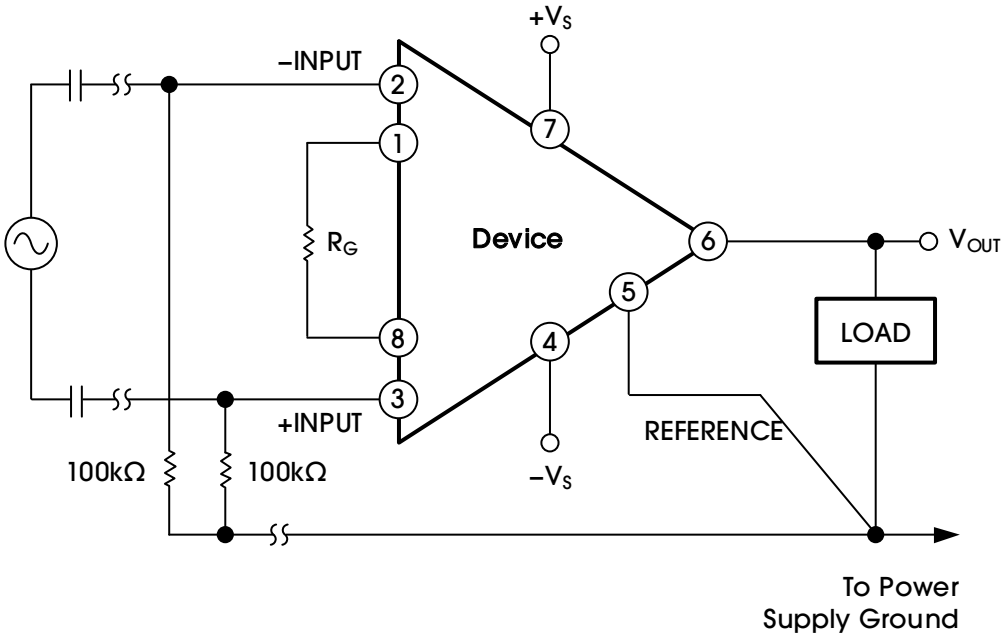


Figure 16. Ground Returns for Bias Currents with AC-Coupled Inputs

8. PACKAGE INFORMATION

The INA111/INA112 is available in the SOIC-8 package. Figure 17 shows the package view.

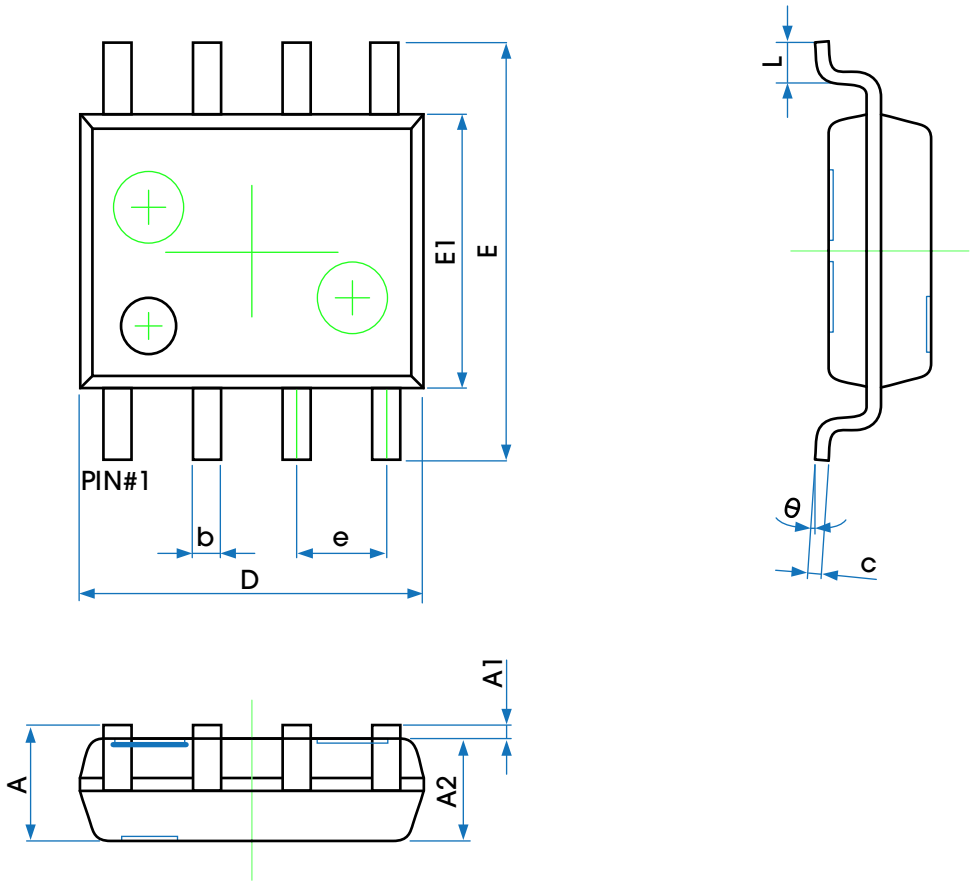


Figure 17. Package View

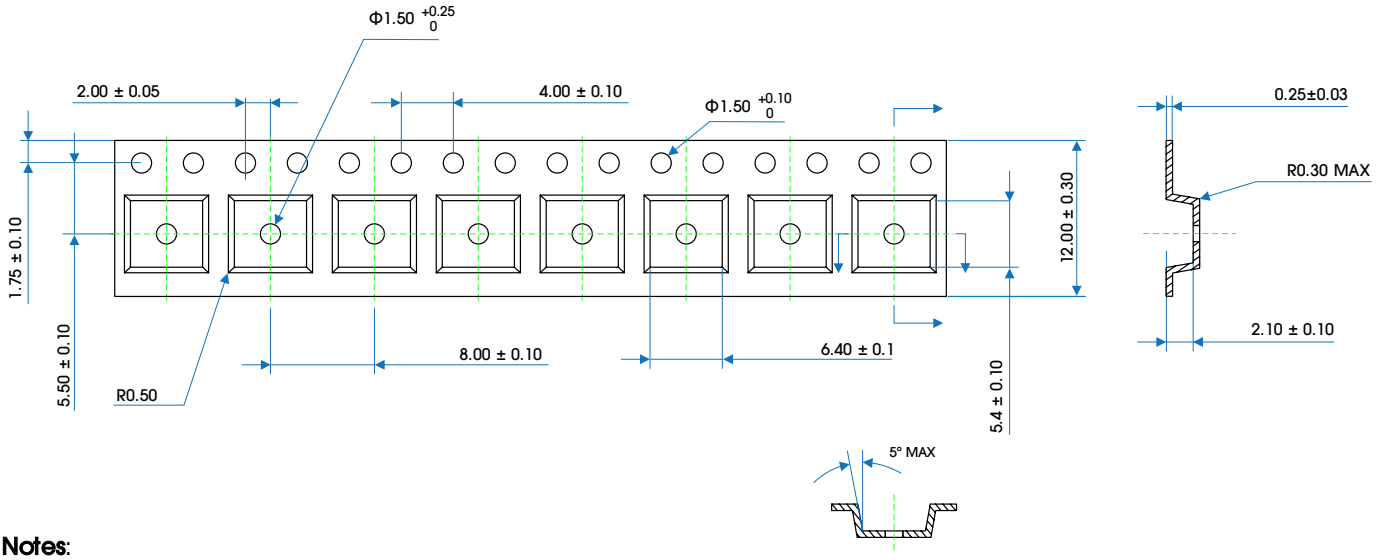
Table 11 provides detailed information about the dimensions.

Table 11. Dimensions

SYMBOL	DIMENSIONS IN MILLIMETERS		DIMENSIONS IN INCHES	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.201
E	5.800	6.200	0.228	0.244
E1	3.800	4.000	0.150	0.157
e	1.270 (BSC)		0.050 (BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

9. TAPE AND REEL INFORMATION

Figure 18 illustrates the carrier tape.



Notes:
1. Cover tape width: 9.5 ± 0.10.
2. Cumulative tolerance of 10 sprocket hole pitch: ±0.20 (max).
3. Camber: not to exceed 1mm in 100mm.
4. Mold#: SOIC-8.
5. All dimensions: mm.
6. Direction of view:

Figure 18. Carrier Tape Drawing

Table 12 provides information about tape and reel.

Table 12. Tape and Reel Information

PACKAGE TYPE	REEL	QTY/REEL	REEL/ INNER BOX	INNER BOX/ CARTON	QTY/CARTON	INNER BOX SIZE (MM)	CARTON SIZE (MM)
SOIC-8	13''	4000	1	8	32000	358*340*50	430*380*390

Figure 19 shows the product loading orientation—pin 1 is assigned at Q1.

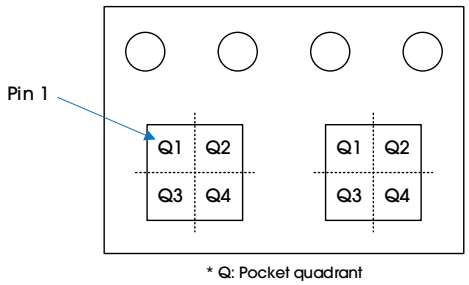


Figure 19. Product Loading Orientation

REVISION HISTORY

REVISION	DATE	DESCRIPTION
Rev A	13 April 2023	Rev A release.
Rev B	26 October 2023	1. Added information about INA112. 2. Updated Page 1. 3. Updated the order information. 4. Updated Section 5.1, Section 5.3, and Section 5.5. 5. Updated the TYPICAL CHARACTERISTICS section.