AS324/324A

LOW POWER QUAD OPERATIONAL AMPLIFIERS

Description

The AS324/324A consist of four independent, high gain and internally frequency compensated operational amplifiers. They are specifically designed to operate from a single power supply. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage. Typical applications include transducer amplifiers, DC gain blocks and most conventional operational amplifier circuits.

The AS324/324A series are compatible with industry standard 324. The AS324A has more stringent input offset voltage than AS324.

The AS324 is available in SOIC-14, DIP-14 and TSSOP-14 packages, and the AS324A is available in SOIC-14 package.

Features

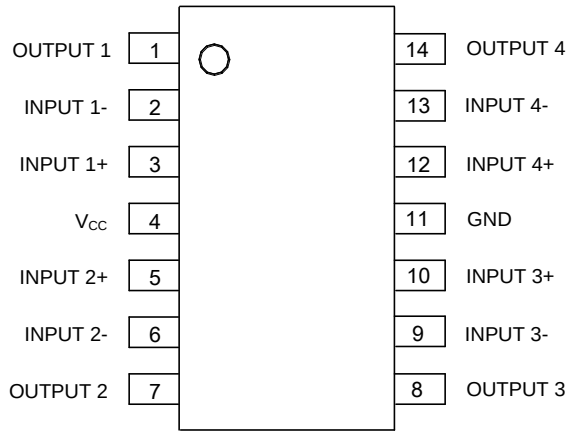
- Internally Frequency Compensated for Unity Gain
- Large Voltage Gain: 100dB (Typical)
- Low Input Bias Current: 20nA (Typical)
- Low Input Offset Voltage: 2mV (Typical)
- Low Supply Current: 0.5mA (Typical)
- Wide Power Supply Voltage Range:
  - Single Supply: 3V to 36V
  - Dual Supplies: ±1.5V to ±18V
- Input Common Mode Voltage Range Includes Ground
- Large Output Voltage Swing: 0V to V_{CC} -1.5V
- Power Drain Suitable for Battery Operation

Applications

- Battery Charger
- Cordless Telephone
- Switching Power Supply

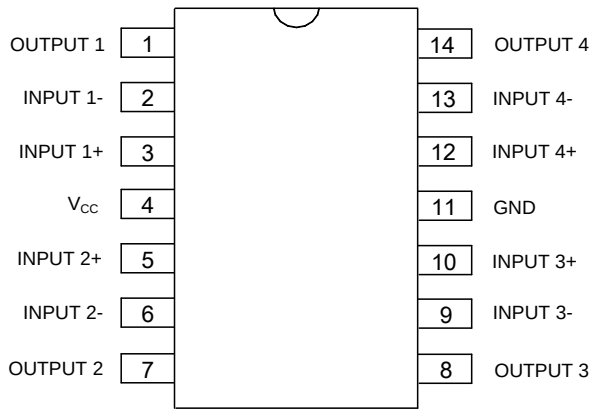
Pin Assignments

(Top View)



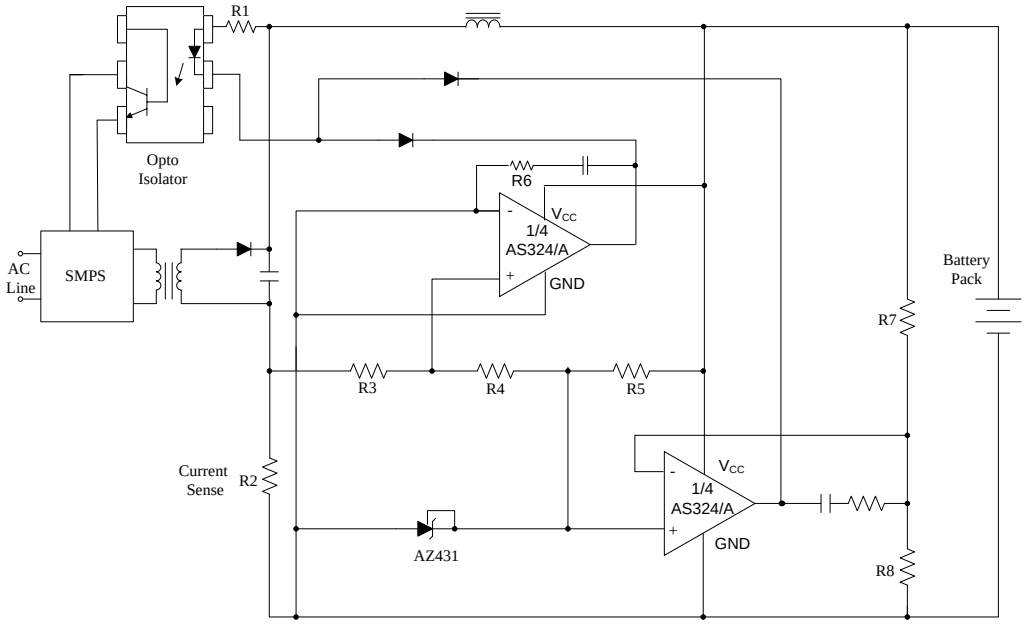
(SOIC-14/TSSOP-14 / M/G Package)

(Top View)

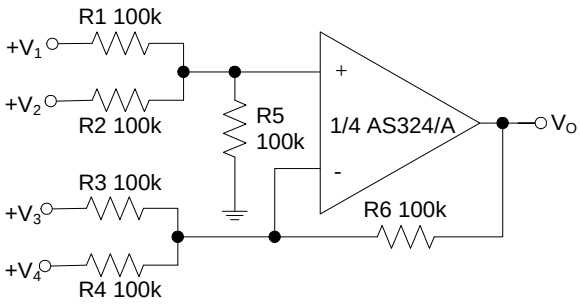


(DIP-14/ P Package)

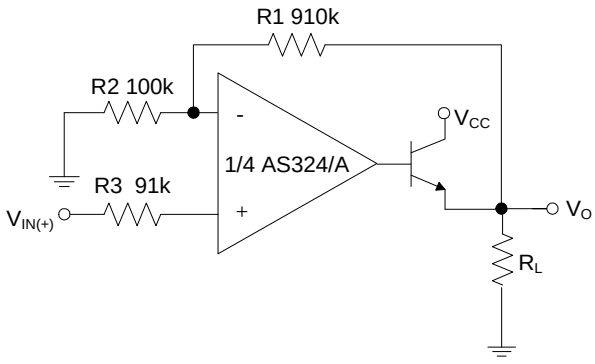
Typical Applications Circuit



Battery Charger

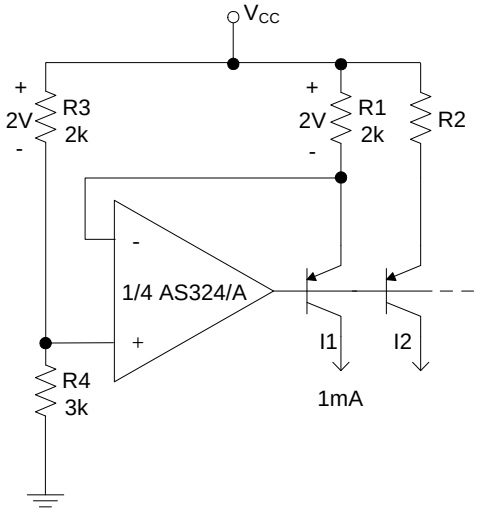


DC Summing Amplifier

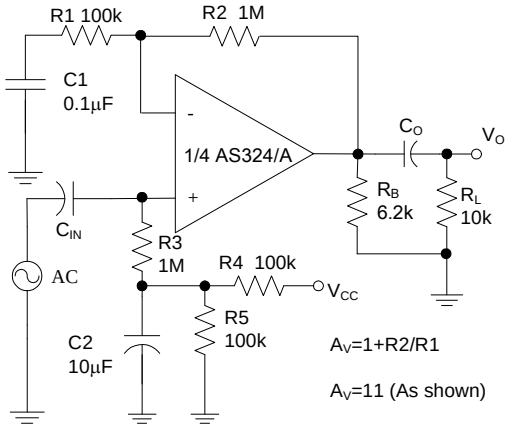


Power Amplifier

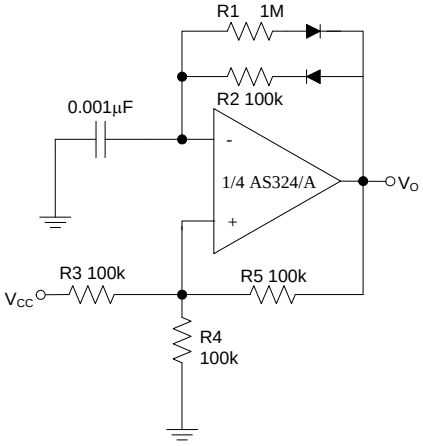
Typical Applications Circuit (Cont.)



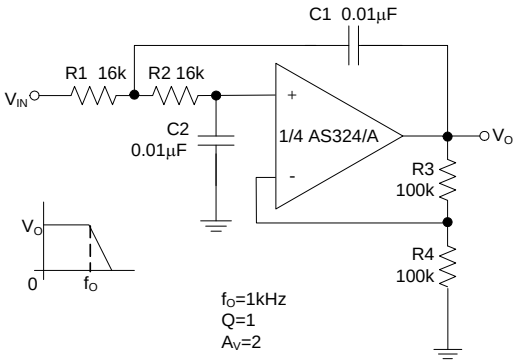
Fixed Current Sources



AC Coupled Non-Inverting Amplifier

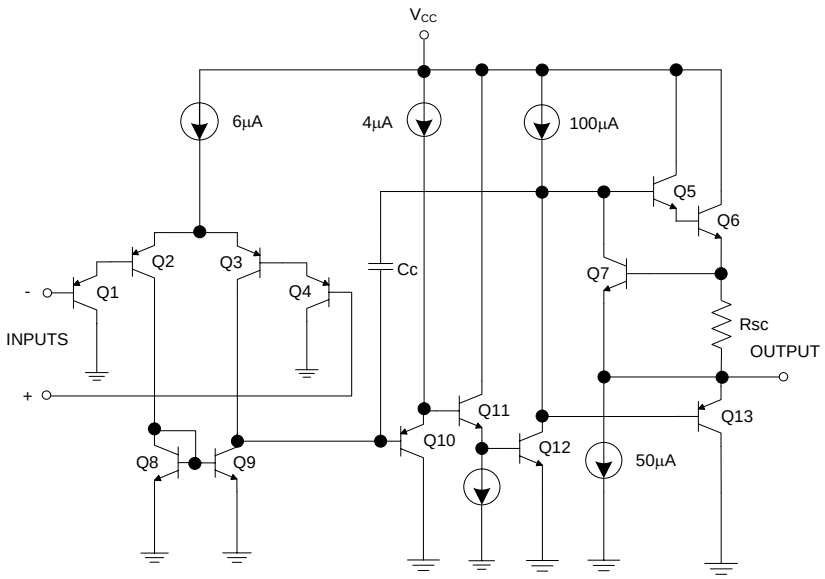


Pulse Generator



DC Coupled Low-Pass RC Active Filter

Functional Block Diagram



Absolute Maximum Ratings (Note 1)

Symbol	Parameter	Rating		Unit
V_{CC}	Supply Voltage	40		V
V_{ID}	Differential Input Voltage	40		V
V_{IN}	Input Voltage	-0.3 to 40		V
P_D	Total Power Dissipation (T_A = +25°C)	DIP-14	1130	mW
		SOIC-14	800	
		TSSOP-14	710	
T_J	Operating Junction Temperature	+150		°C
T_{STG}	Storage Temperature Range	-65 to +150		°C
T_{LEAD}	Lead Temperature (Soldering, 10 Seconds)	+260		°C

Note 1: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
V_{CC}	Supply Voltage	3	36	V
T_A	Ambient Operating Temperature Range	-40	+85	°C

Electrical Characteristics (Limits in standard typeface are for T_A = +25°C, **bold** typeface applies over T_A = -40°C to +85°C (Note 2), V_{CC} = 5V, GND = 0V, unless otherwise specified.)

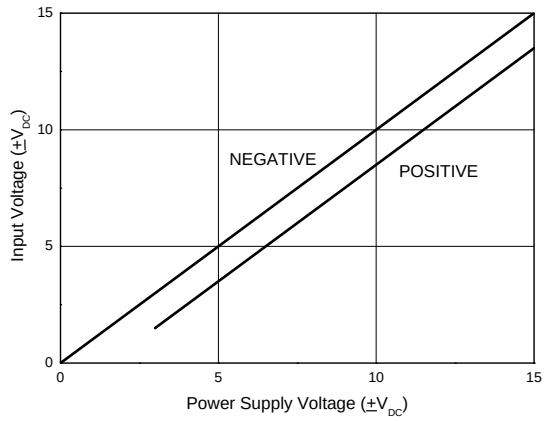
Symbol	Parameter		Conditions		Min	Typ	Max	Unit
V_{IO}	Input Offset Voltage		V_O = 1.4V, R_S = 0Ω, V_{CC} = 5V to 30V	AS324	–	2	5	mV
					–	–	**7**	
				AS324 A	–	2	3	mV
					–	–	**5**	
$\Delta V_{IO}/\Delta T$	Average Temperature Coefficient of Input Offset Voltage		T_A = -40 to +85°C		–	7	–	µV/°C
I_{IO}	Input Offset Current		I_{IN}+ - I_{IN}-, V_{CM} = 0V		–	5	30	nA
					–	–	**100**	
I_{BIAS}	Input Bias Current		I_{IN}+ or I_{IN}-, V_{CM} = 0V		–	20	100	nA
					–	–	**200**	
V_{IR}	Input Common Mode Voltage Range (Note 3)		V_{CC} = 30V		0	–	V_{CC}-1.5	V
I_{CC}	Supply Current		T_A = -40 to +85°C, R_L = ∞	V_{CC} = 30V	–	1.0	3	mA
				V_{CC} = 5V	–	0.7	1.2	
G_V	Large Signal Voltage Gain		V_{CC} = 15V, R_L ≥ 2kΩ, V_O = 1V to 11V		85	100	–	dB
					80	–	–	
CMRR	Common Mode Rejection Ratio		DC, V_{CM} = 0 to (V_{CC}-1.5)V		60	70	–	dB
					60	–	–	
PSRR	Power Supply Rejection Ratio		V_{CC} = 5 to 30V		70	100	–	dB
					60	–	–	
CS	Channel Separation		f = 1kHz to 20kHz		–	-120	–	dB
I_{SOURCE}	Output Current	Source	V_{IN}+ = 1V, V_{IN}- = 0V, V_{CC} = 15V, V_O = 2V		20	40		mA
					20	–	–	
I_{SINK}		Sink	V_{IN}+ = 0V, V_{IN}- = 1V, V_{CC} = 15V, V_O = 2V		10	15	–	mA
					5	–	–	
			V_{IN}+ = 0V, V_{IN}- = 1V, V_{CC} = 15V, V_O = 0.2V		12	50	–	µA
I_{SC}	Output Short Circuit Current to Ground		V_{CC} = 15V		–	40	60	mA
V_{OH}	Output Voltage Swing		V_{CC} = 30V, R_L = 2kΩ		26	–	–	V
					26	–	–	
			V_{CC} = 30V, R_L = 10kΩ		27	28	–	
					27	–	–	
V_{OL}			V_{CC} = 5V, R_L = 10kΩ		–	5	20	mV
					–	–	**30**	
θ_{JC}	Thermal Resistance (Junction to Case)		DIP-14		–	24.78	–	°C/W
			SOIC-14		–	36.78	–	

Notes: 2. Limits over the full temperature are guaranteed by design, but not tested in production.

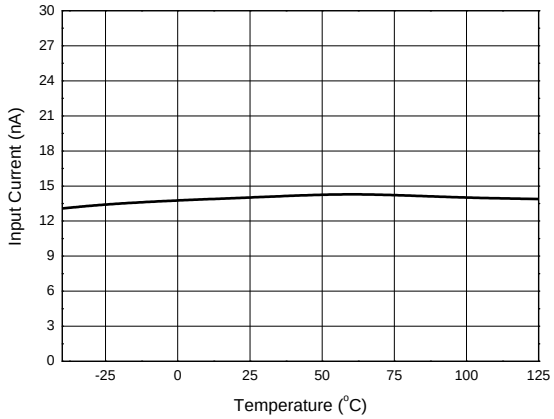
3. The input common-mode voltage of either input signal voltage should not be allowed to go negatively by more than 0.3V (at +25°C). The upper end of the common-mode voltage range is V_{CC} -1.5V (at +25°C), but either or both inputs can go to +36V without damages, independent of the magnitude of the V_{CC}.

Performance Characteristics

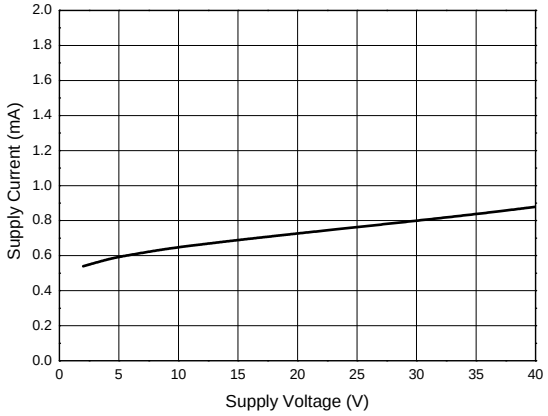
Input Voltage Range



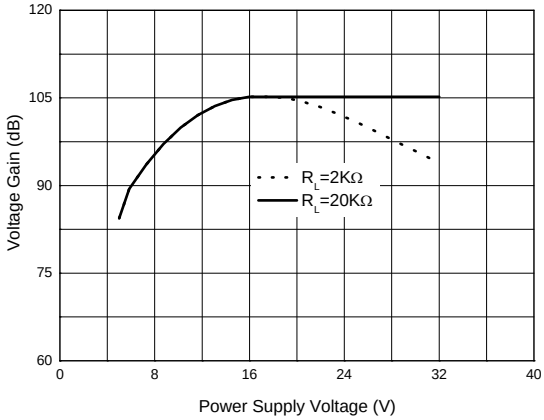
Input Current



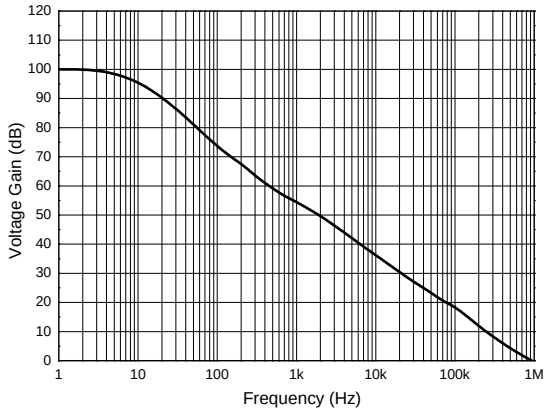
Supply Current



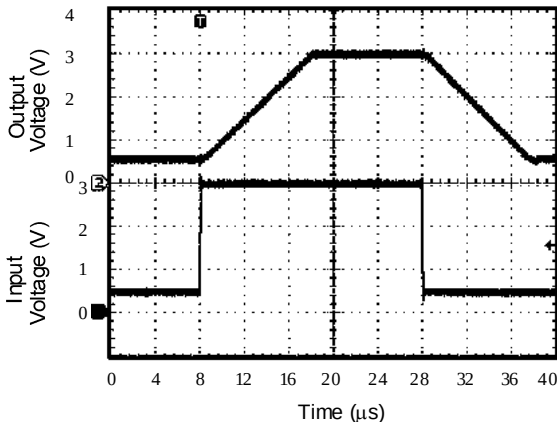
Voltage Gain



Open Loop Frequency Response

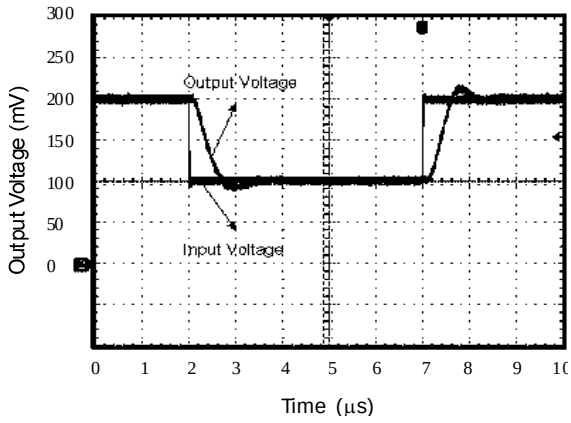


Voltage Follower Pulse Response

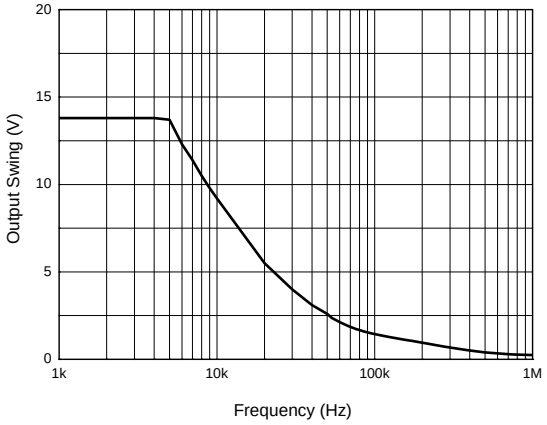


Performance Characteristics (Cont.)

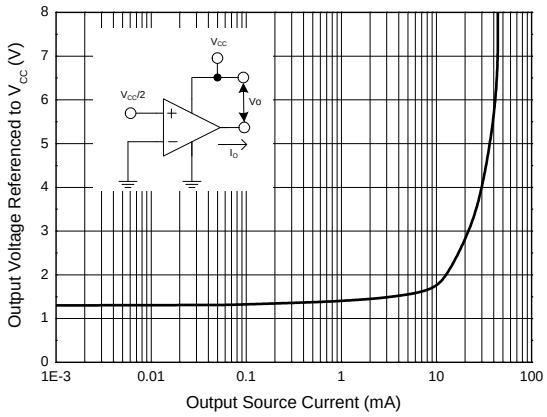
Voltage Follower Pulse Response (Small Signal)



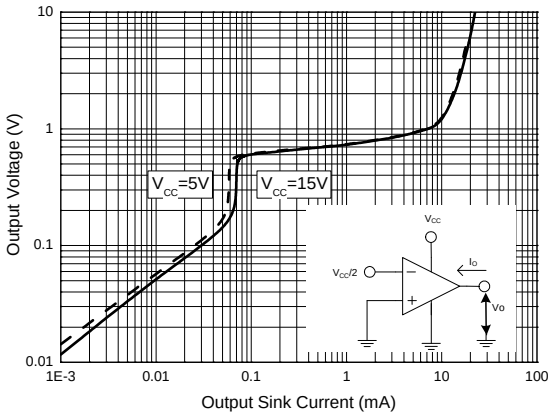
Large Signal Frequency Response



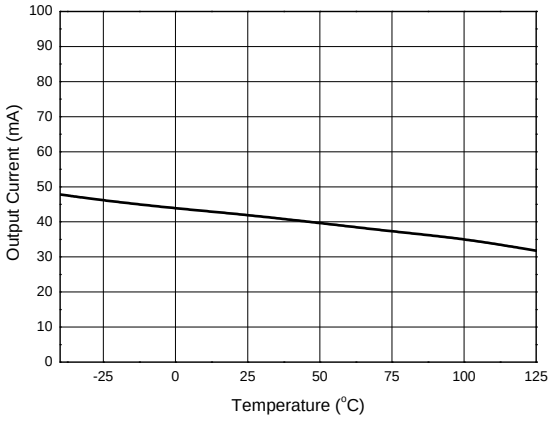
Output Characteristics: Current Sourcing



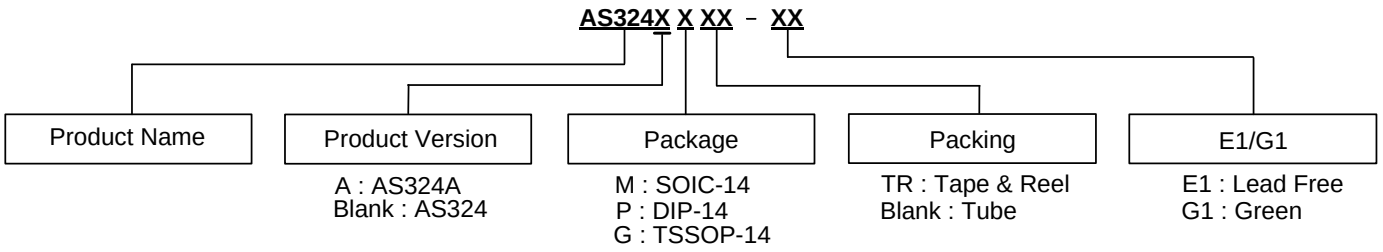
Output Characteristics: Current Sinking



Current Limiting



Ordering Information



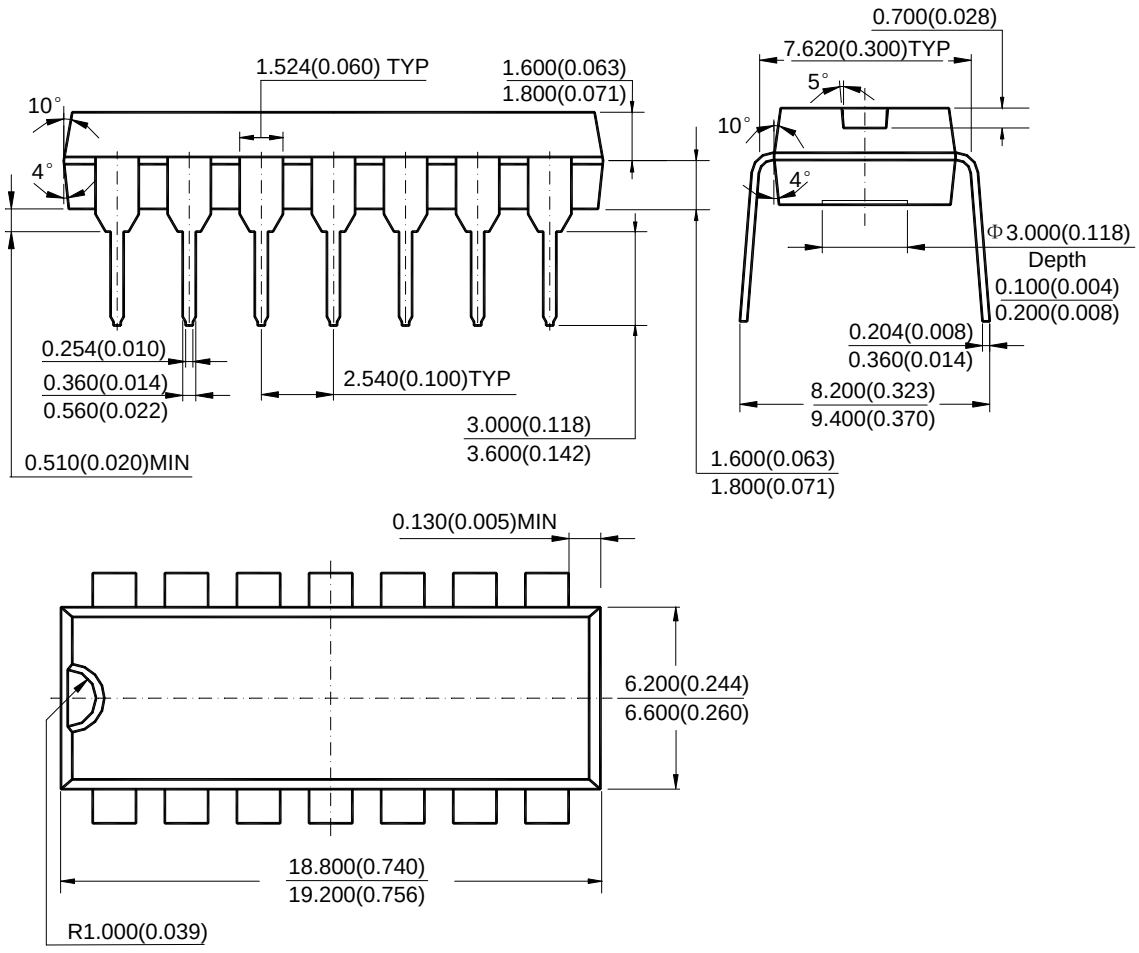
Diodes IC's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant.

Products with "G1" suffix are available in green packages.

Package	Temperature Range	Part Number		Marking ID		Packing Type
		Lead Free	Green	Lead Free	Green	
SOIC-14	-40 to +85°C	AS324M-E1	AS324M-G1	AS324M-E1	AS324M-G1	Tube
		AS324MTR-E1	AS324MTR-G1	AS324M-E1	AS324M-G1	Tape & Reel
		AS324AM-E1	AS324AM-G1	AS324AM-E1	AS324AM-G1	Tube
		AS324AMTR-E1	AS324AMTR-G1	AS324AM-E1	AS324AM-G1	Tape & Reel
DIP-14		AS324P-E1	AS324P-G1	AS324P-E1	AS324P-G1	Tube
TSSOP-14		AS324GTR-E1	AS324GTR-G1	EGS324	GGS324	Tape & Reel

Package Outline Dimensions (All dimensions in mm(inch).)

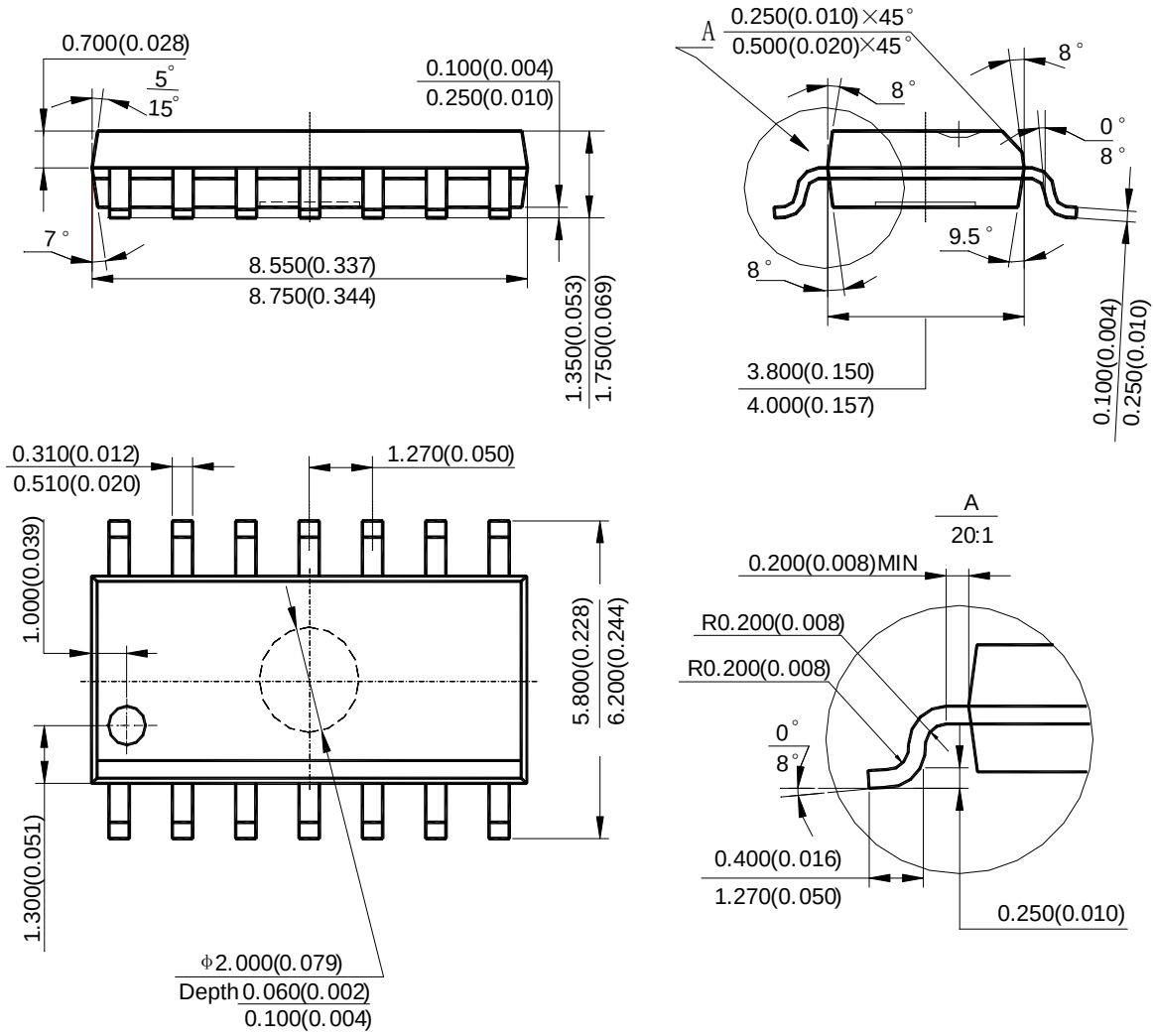
(1) Package Type: DIP-14



Note: Eject hole, oriented hole and mold mark is optional.

Package Outline Dimensions (Cont. All dimensions in mm(inch).)

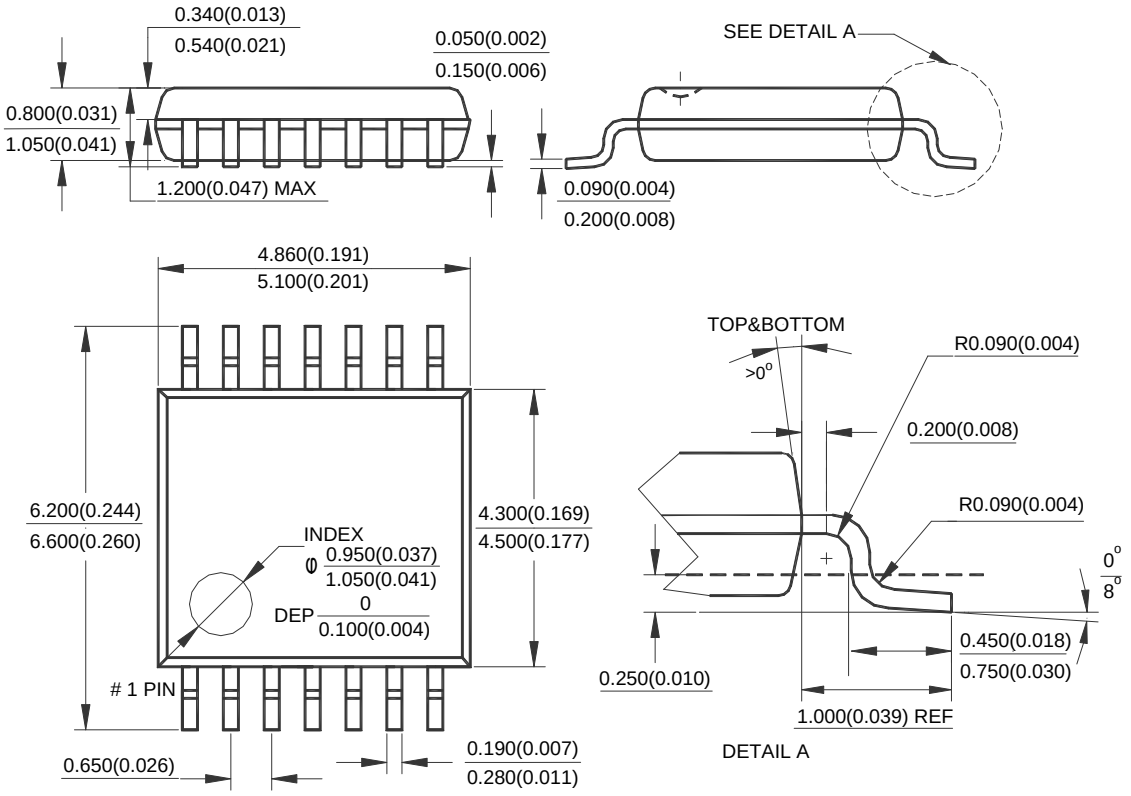
(2) Package Type: SOIC-14



Note: Eject hole, oriented hole and mold mark is optional.

Package Outline Dimensions (Cont. All dimensions in mm(inch).)

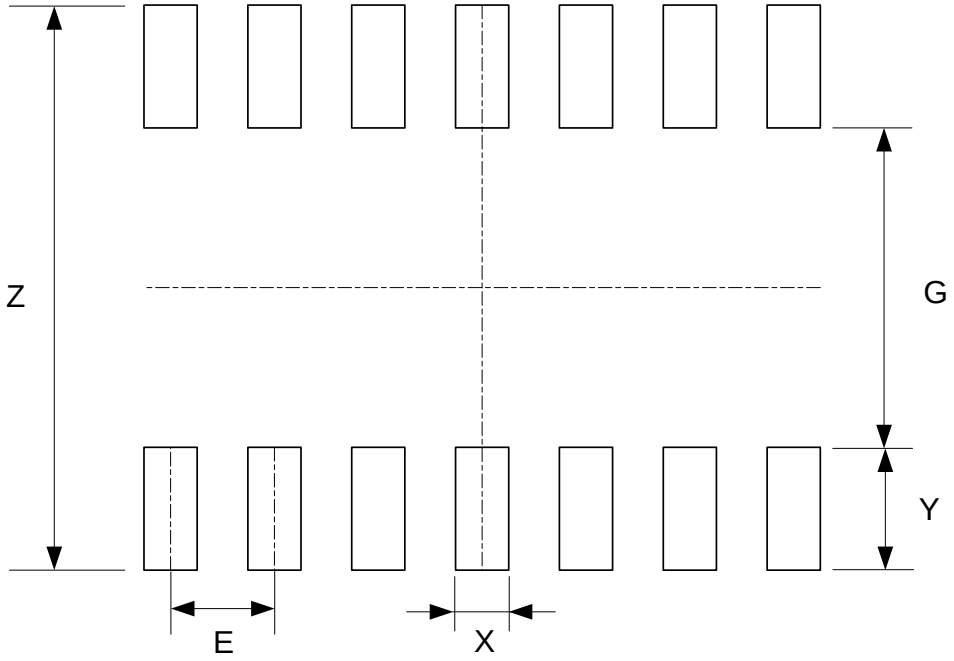
(3) Package Type: TSSOP-14



Note: Eject hole, oriented hole and mold mark is optional.

Suggested Pad Layout

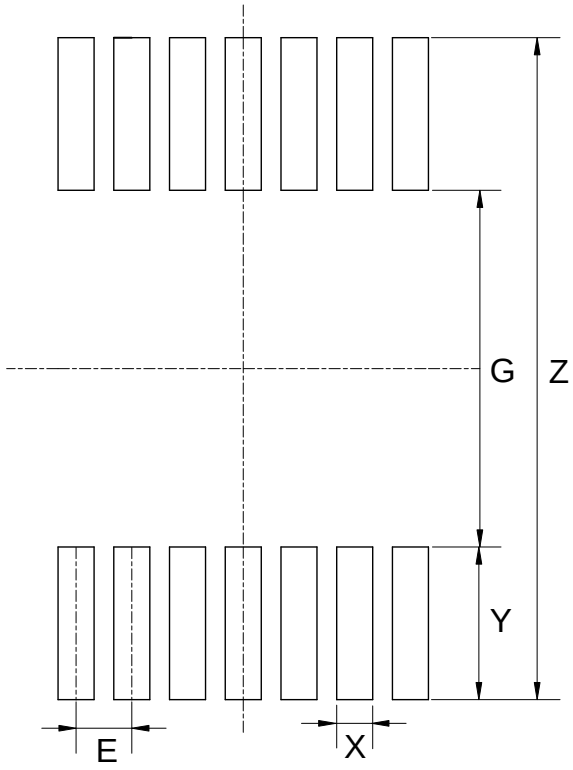
(1) Package Type: SOIC-14



Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X (mm)/(inch)	Y (mm)/(inch)	E (mm)/(inch)
Value	6.900/0.272	3.900/0.154	0.650/0.026	1.500/0.059	1.270/0.050

Suggested Pad Layout (Cont.)

(2) Package Type: TSSOP-14



Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X (mm)/(inch)	Y (mm)/(inch)	E (mm)/(inch)
Value	7.720/0.304	4.160/0.164	0.420/0.017	1.780/0.070	0.650/0.026

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