

LOW POWER SINGLE OPERATIONAL AMPLIFIER

Description

The AS321 is a high gain and internally frequency compensated operational amplifier specifically designed to operate from a single power supply. Operation from split power supply is also possible and the low power supply current drain is independent of the magnitude of the power supply voltages. Typical applications include battery charger, active filters, general purpose controllers and most conventional operational amplifier circuits.

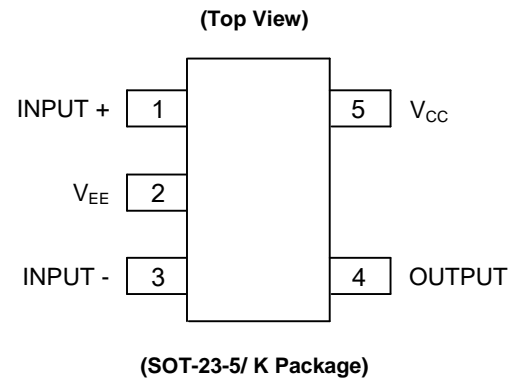
The AS321 is compatible with industry standard 321.

The AS321 is available in SOT-23-5 packages.

Features

- Excellent Phase Margin: 60 deg.
- Large Voltage Gain: 100dB (Typical)
- Low Input Bias Current: 20nA (Typical)
- Low Input Offset Voltage: 2mV (Typical)
- Low Supply Current: 0.35mA at $V_{CC} = 5V$
- Wide Power Supply Voltage:
 - Single Supply: 3V to 36V
 - Dual Supplies: $\pm 1.5V$ to $\pm 18V$
- Wide Input Common Mode Voltage Range: 0V to $V_{CC}-1.5V$

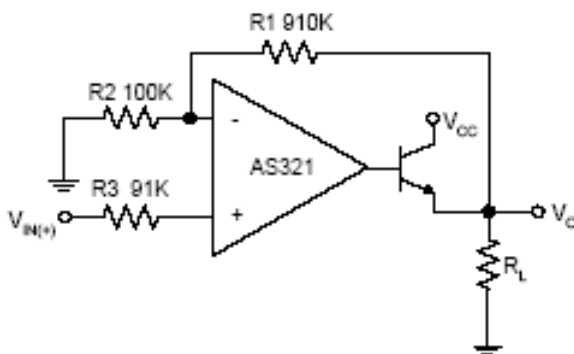
Pin Assignments



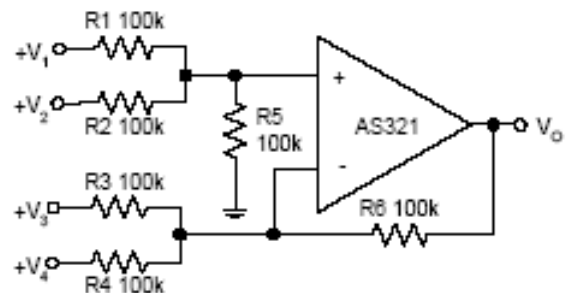
Applications

- Battery Charger
- Active Filters
- General Purpose Controllers, Instruments

Typical Applications Circuit

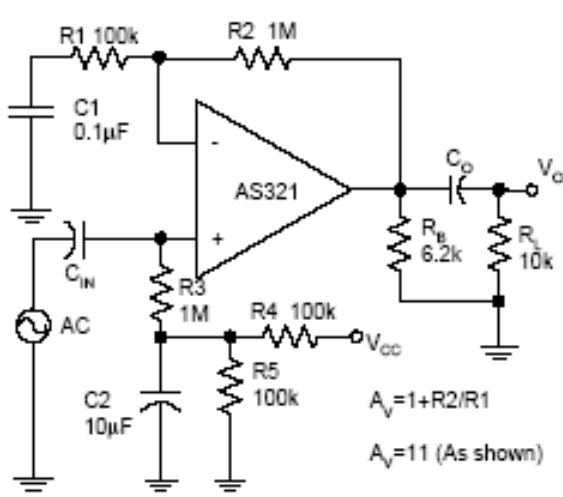


Power Amplifier

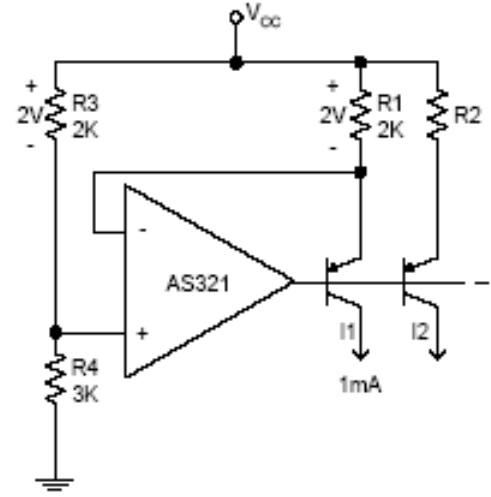


DC Summing Amplifier

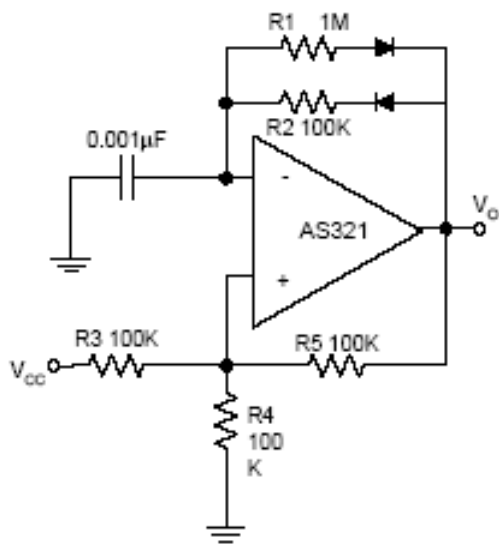
Typical Applications Circuit (Cont.)



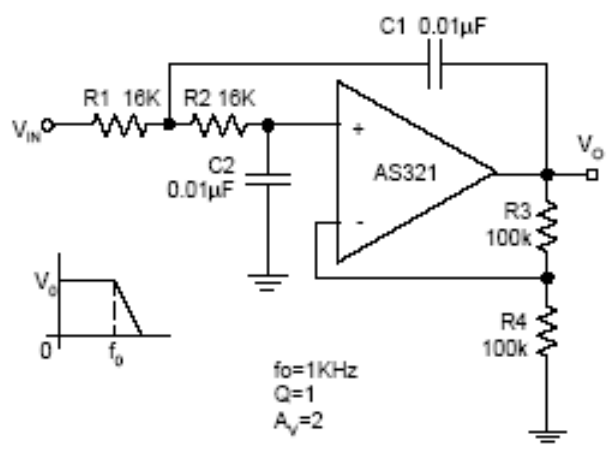
AC Coupled Non-Inverting Amplifier



Fixed Current Sources

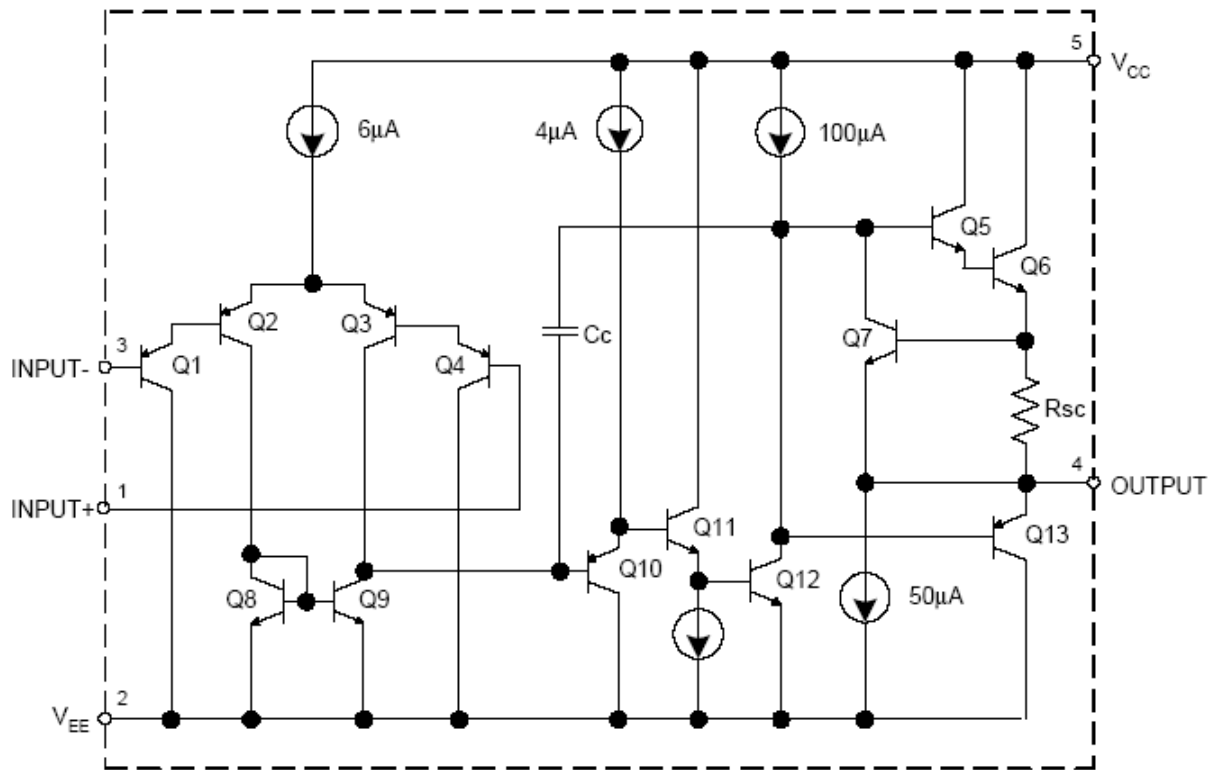


Pulse Generator



DC Coupled Low-Pass Active Filter

Functional Block Diagram



Absolute Maximum Ratings (Note 1)

Symbol	Parameter	Rating	Unit
$V_S (V_{CC}-V_{EE})$	Power Supply Voltage	40	V
V_{ID}	Differential Input Voltage	40	V
V_{IN}	Input Voltage	-0.3 to 40	V
θ_{JA}	Thermal Resistance to Ambient	260	°C/W
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

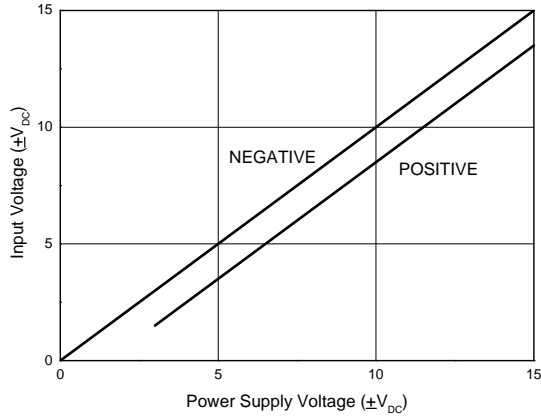
Electrical Characteristics (Limits in standard typeface are for $T_A = +25^\circ\text{C}$, **bold** typeface applies over -40°C to $+85^\circ\text{C}$ (Note 2), $V_{CC} = 5\text{V}$, $V_{EE} = 0\text{V}$, $V_O = 1.4\text{V}$, unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
V_{IO}	Input Offset Voltage	$V_O = 1.4\text{V}$, $R_S = 0\Omega$, $V_{CC} = 5\text{V}$ to 30V (Note 3)	–	2	5	mV	
			–	–	7		
$\Delta V_{IO}/\Delta T$	Average Temperature Coefficient of Input Offset Voltage	$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$	–	7	–	$\mu\text{V}/^\circ\text{C}$	
I_{BIAS}	Input Bias Current	I_{IN+} or I_{IN-} , $V_{CM} = 0\text{V}$	–	20	100	nA	
			–	–	200		
I_{IO}	Input Offset Current	$I_{IN+} - I_{IN-}$, $V_{CM} = 0\text{V}$	–	5	30	nA	
			–	–	100		
V_{CM}	Input Common Mode Voltage Range (Note 4)	$V_{CC} = 30\text{V}$, $\text{CMRR} \geq 50\text{dB}$	0	–	$V_{CC}-1.5$	V	
I_{CC}	Supply Current	$R_L = \infty$, $V_{CC} = 5\text{V}$	–	0.35	0.80	mA	
			–	0.45	1.0		
		$R_L = \infty$, $V_{CC} = 30\text{V}$	–	0.45	1.2		
			–	0.65	1.5		
G_V	Large Signal Voltage Gain	$V_{CC} = 15\text{V}$, $V_O = 1\text{V}$ to 11V , $R_L \geq 2\text{k}\Omega$	85	100	–	dB	
			80	–	–		
CMRR	Common Mode Rejection Ratio	$V_{CM} = 0\text{V}$ to $(V_{CC}-1.5)\text{V}$, $R_S \leq 10\text{k}\Omega$	60	70	–	dB	
			60	–	–		
PSRR	Power Supply Rejection Ratio	$V_{CC} = 5\text{V}$ to 30V , $R_S \leq 10\text{k}\Omega$	70	100	–	dB	
			60	–	–		
I_{SOURCE}	Output Current	Source	$V_{IN+} = 1\text{V}$, $V_{IN-} = 0\text{V}$, $V_{CC} = 15\text{V}$, $V_O = 2\text{V}$	20	40	–	mA
			20	–	–		
I_{SINK}		Sink	$V_{IN+} = 0\text{V}$, $V_{IN-} = 1\text{V}$, $V_{CC} = 15\text{V}$, $V_O = 2\text{V}$	10	15	–	mA
			5	–	–		
I_{SC}	Output Short Circuit Current to Ground	$V_{CC} = 15\text{V}$	$V_{IN+} = 0\text{V}$, $V_{IN-} = 1\text{V}$, $V_{CC} = 15\text{V}$, $V_O = 0.2\text{V}$	12	50	–	μA
			–	–	–	–	
V_{OH}	Output Voltage Swing	$V_{CC} = 30\text{V}$, $R_L = 2\text{k}\Omega$	–	–	–	V	
			26	–	–		
		$V_{CC} = 30\text{V}$, $R_L = 10\text{k}\Omega$	27	28	–		
			27	–	–		
V_{OL}		$V_{CC} = 5\text{V}$, $R_L = 10\text{k}\Omega$	–	5	20	mV	
			–	–	30		
THD	Total Harmonic Distortion	$f = 1\text{kHz}$, $\text{AV} = 20\text{dB}$, $R_L = 2\text{k}\Omega$, $V_O = 2\text{Vp-p}$, $C_L = 100\text{pF}$, $V_{CC} = 30\text{V}$	–	0.015	–	%	
Φ_M	Phase Margin	–	–	60	–	Deg	
θ_{JC}	Thermal Resistance (Junction to Case)	SOT-23-5	–	101	–	$^\circ\text{C}/\text{W}$	

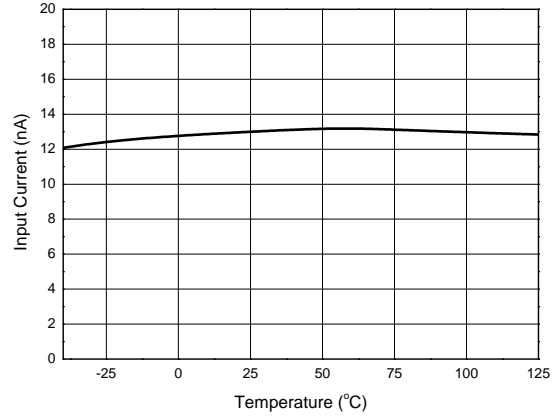
- Notes:
- Limits over the full temperature are guaranteed by design, but not tested in production.
 - Over the full input common-mode range 0V to $V_{CC}-1.5\text{V}$ (at $+25^\circ\text{C}$).
 - The input common-mode voltage of either input signal voltage should not be allowed to go negatively by more than 0.3V (at $+25^\circ\text{C}$). The upper end of the common-mode voltage range is $V_{CC}-1.5\text{V}$ (at $+25^\circ\text{C}$), but either or both inputs can go to $+36\text{V}$ without damages, independent of the magnitude of the V_{CC} .

Performance Characteristics

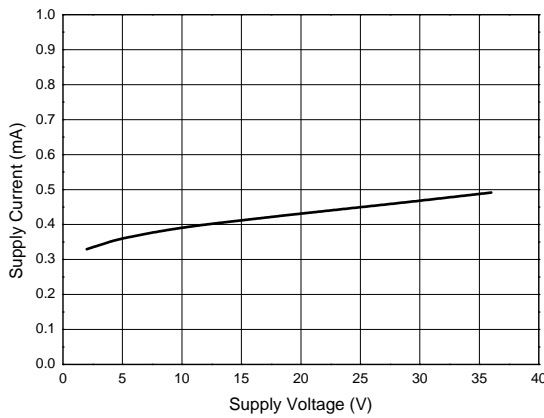
Input Voltage Range



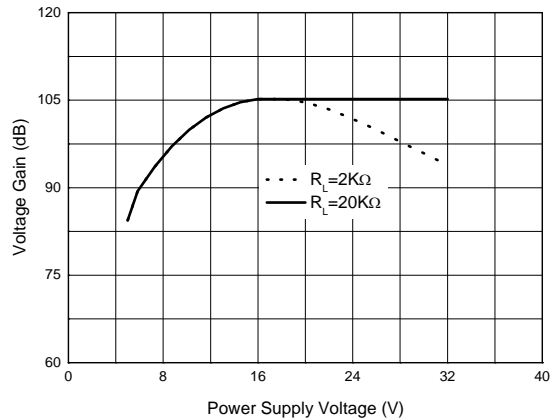
Input Current



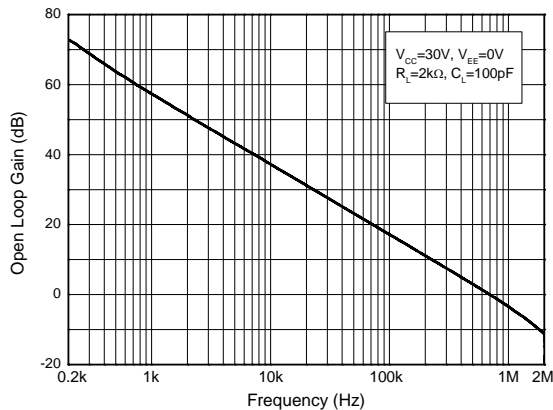
Supply Current



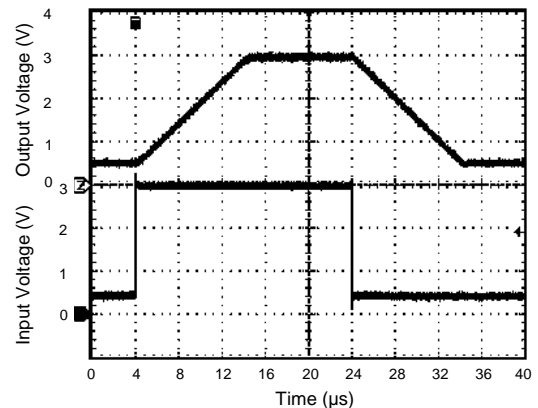
Voltage Gain



Open Loop Gain vs. Frequency

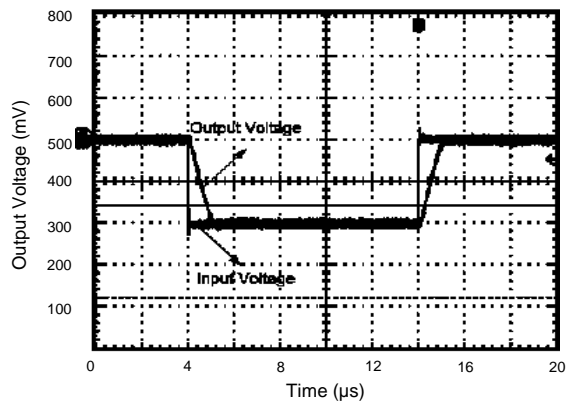


Voltage Follower Pulse Response

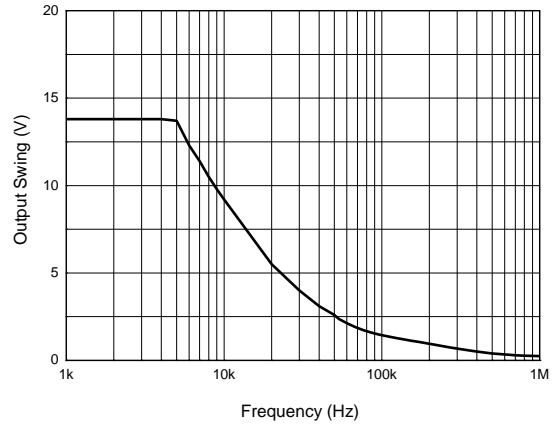


Performance Characteristics (Cont.)

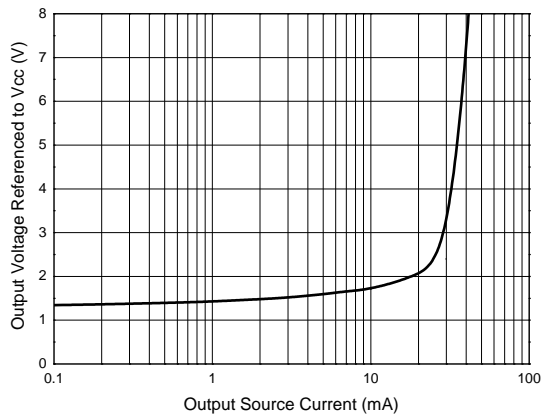
Voltage Follower Pulse Response (Small Signal)



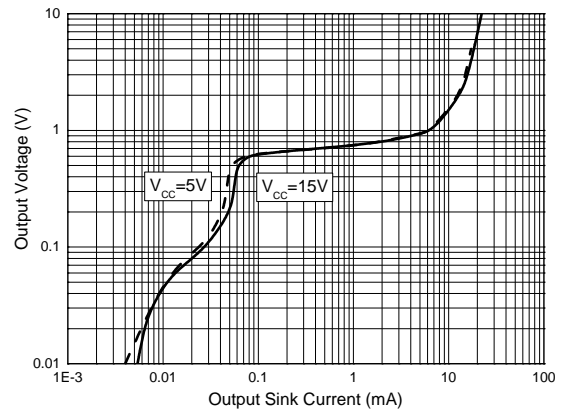
Large Signal Frequency Response



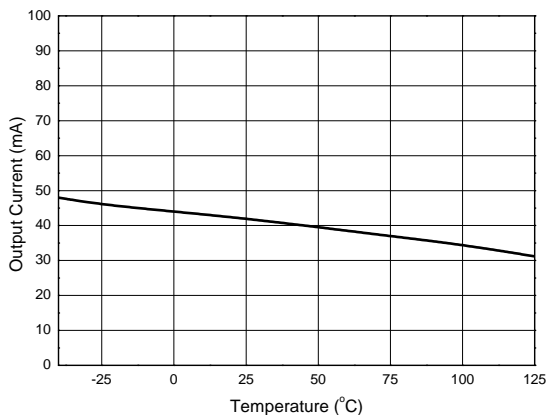
Output Characteristics: Current Sourcing



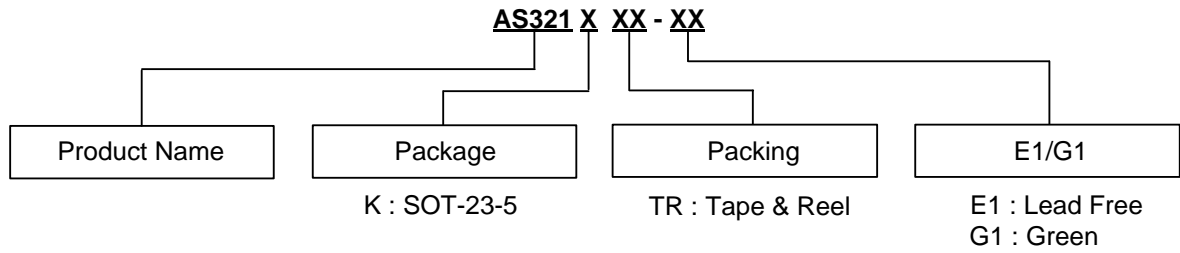
Output Characteristics: Current Sinking



Current Limiting



Ordering Information

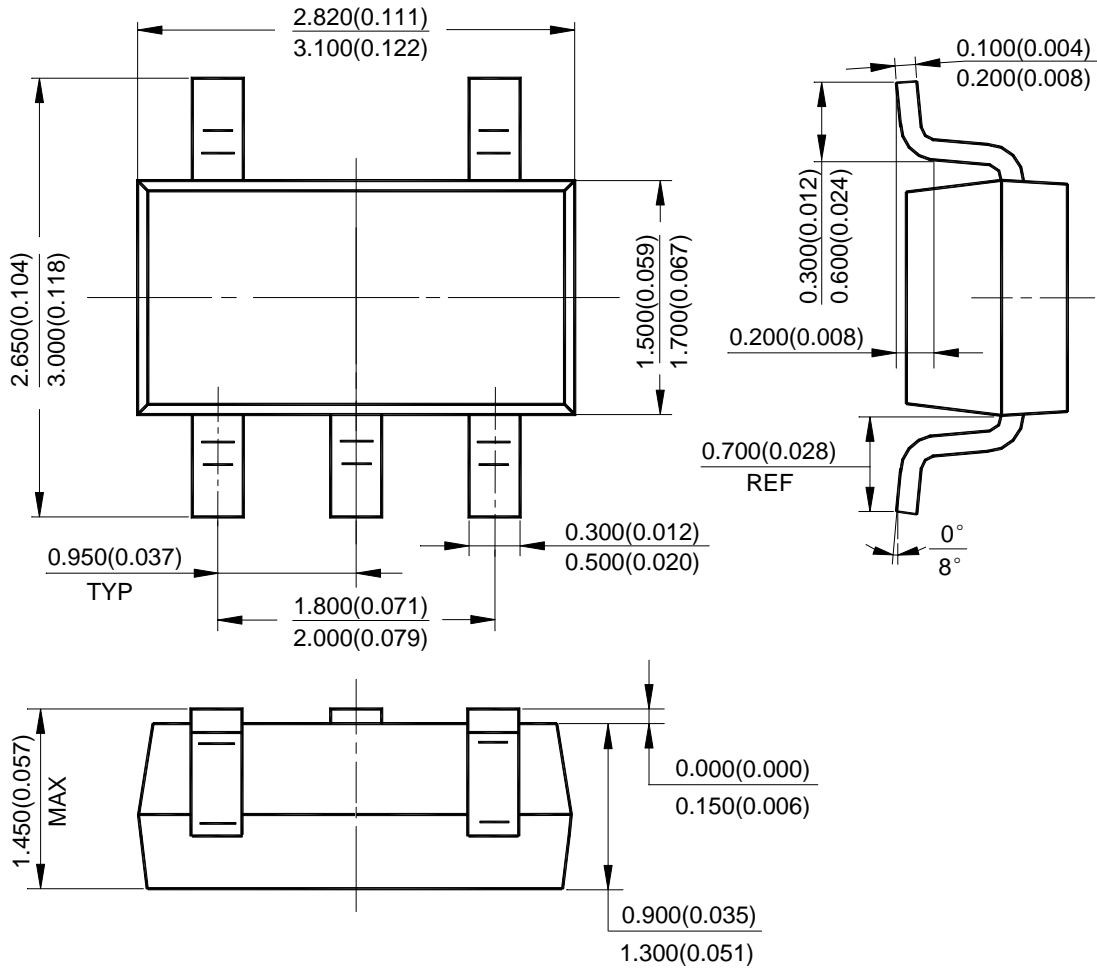


Diodes IC's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant.
Products with "G1" suffix are available in green packages.

Package	Temperature Range	Part Number		Marking ID		Packing Type
		Lead Free	Green	Lead Free	Green	
SOT-23-5	-40°C to +85°C	AS321KTR-E1	AS321KTR-G1	E6T	G6T	Tape & Reel

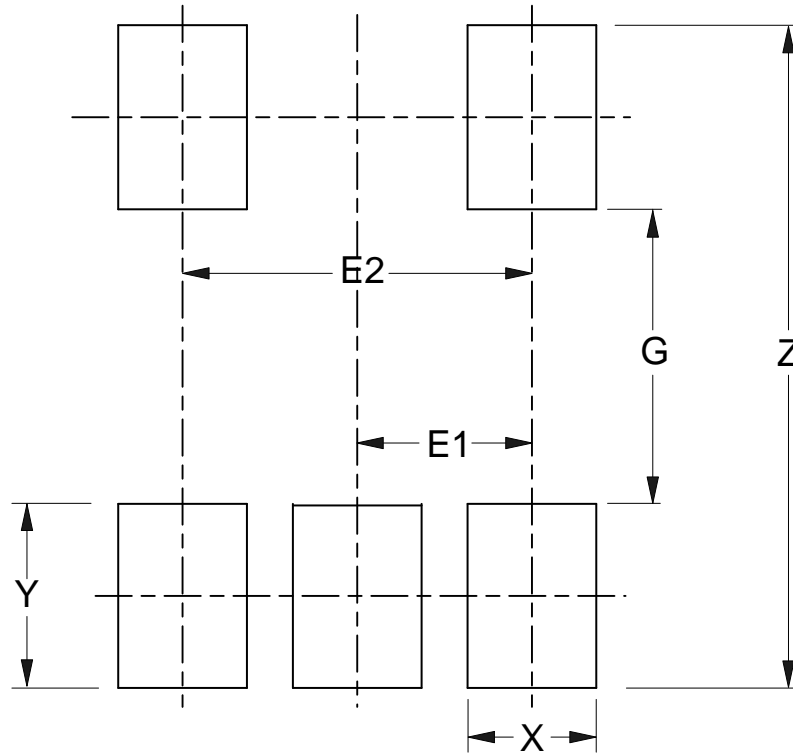
Package Outline Dimensions (All dimensions in mm(inch).)

(1) Package Type: SOT-23-5



Suggested Pad Layout

(1) Package Type: SOT-23-5



Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X (mm)/(inch)	Y (mm)/(inch)	E1 (mm)/(inch)	E2 (mm)/(inch)
Value	3.600/0.142	1.600/0.063	0.700/0.028	1.000/0.039	0.950/0.037	1.900/0.075

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