



**AS3341 - linear in dB temperature compensated  
 voltage controlled current source (VCCS)**

- controlled range – till 14 octave
- fully temperature compensated
- summing node inputs for current control
- matched differential NPN pair
- high exponential scale accuracy

**AS3341D**  
 SOIC-16 (150 mil)



**APPLICATIONS**

- stabilized current sources
- MOOG-type filters
- for electronic music

**General Description**

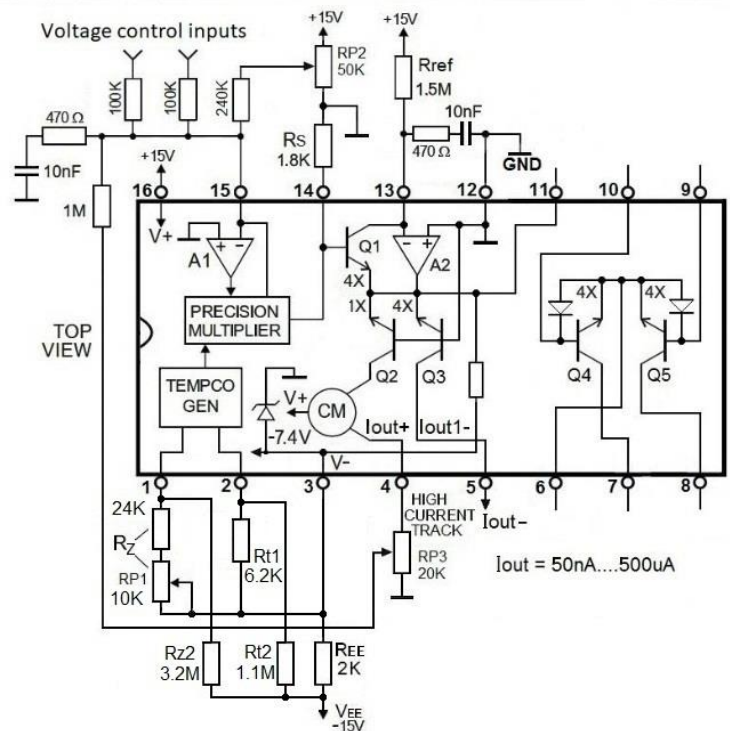
AS3341 is a voltage controlled current source with internal temperature compensation and a matched pair of NPN transistors. Current source uses a temperature-compensated core of the VCO AS3340, with an exponential and linear control scale.

The output current  $I_{out-}$  can be varied within a wide range from 50 nA to 500  $\mu$ A. AS3341 also has a current output  $I_{out+} = 1 / 4 I_{out-}$  which can be used to compensate for the linearity of the control characteristic for a large output current  $I_{out-}$ .

**AS3341 Pin Information**

SOIC-16 Pin No	Pin Name	Description
1	I_Ref	Reference current adjust
2	I_Temp	Temperature dependent current adjust
3	V <sub>EE</sub>	Negative supply
4	I <sub>out+</sub>	High current track (source)
5	I <sub>out-</sub>	Output current (sink)
6	CE	Common emitter Q4,Q5
7	CQ4	Collector Q4
8	CQ5	Collector Q5
9	BQ5	Base of Q5
10	BQ4	Base of Q4
11	EQ1	Emitter of Q1
12	GND	Ground
13	IRefIn	Current Reference Input
14	V <sub>s</sub>	Scale
15	I <sub>c</sub>	Current control input
16	V <sub>cc</sub>	Positive supply

**Fig.1 AS3341 Circuit Block and Connection Diagram**





### Absolute Maximum Ratings

Voltage Between V <sub>CC</sub> and V <sub>EE</sub> Pins	+24V, -0,5V
Voltage Between V <sub>CC</sub> and GND Pins	+18V, -0,5V
Voltage Between V <sub>EE</sub> and GND Pins	-6V, +0,5V
Current through Any Pin	±40mA
Voltage Between Current Control Pin or Reference Current Pin and GND Pin	±6V
Voltage Between Multiplier Output Pin and GND Pin	+6V, -1V
Storage Temperature Range	- 55°C to 120°C
Operating Temperature Range	- 25°C to 75°C

### Electrical Characteristics

V<sub>CC</sub>=+15V V<sub>EE</sub> = Internal Zener T<sub>A</sub> = 20°

Parameter	Min	Typ	Max	Units
Output current range , I <sub>out-</sub>	0.05	-	500	μA
Maximum output current , I <sub>out-</sub>	500	600	700	μA
Control voltage range, with trimming 1)	0	-	10	V
Control voltage tracking , with trimming 1)		1		V/octave
Control current for maximum output current		150		μA
Control current for minimal output current		0		μA
Input current, reference current	80	200	400	nA
Input current, output current control	80	200	400	nA
Tempco of input current	-1000	-	+1000	ppm
U <sub>offset</sub> , reference current input	-5	-	+5	mV
U <sub>offset</sub> , output current control	-5	-	+5	mV
R <sub>out</sub> (I <sub>out-</sub> )		10	-	MΩ
U <sub>out max</sub> (on I <sub>out-</sub> )	-0.2	-	+10	V
Positive supply, V <sub>cc</sub>	10	12	18	V
Negative supply, V <sub>ee</sub> 3)	-4.7	-6	-18	V
Current consumption, I <sub>cc</sub>	2.0	2.5	3.5	mA
Current consumption, I <sub>ee</sub> 2)	2.0	2.5	3.5	mA
<b>Matched NPN pair</b>				
H <sub>FE</sub> ( U <sub>CB</sub> = 0V till U <sub>max</sub> , I <sub>c</sub> = 100 μA )		200		
Matching of H <sub>FE</sub> ( U <sub>CB</sub> = 0V till U <sub>max</sub> , I <sub>c</sub> = 100 μA )		0.5	2	%
U <sub>BE offset</sub> (U <sub>CB</sub> = 0V, I <sub>c</sub> = from 10 μA till 1 mA 5)	-	100	200	μV
U <sub>CE saturation</sub> (I <sub>c</sub> = 1 mA, I <sub>B</sub> = 100 μA 6)			0.25	V

Notes:

1. With 100K resistor at the output current control input
2. With a negative supply voltage of -6 V
3. If the negative supply voltage is more than -7 V, a current-limiting resistor is required.
4. U<sub>CB</sub> = 0V to U<sub>max</sub>, I<sub>c</sub> = 100 μA
5. U<sub>CB</sub> = 0V, I<sub>c</sub> = 10 μA to 1 mA
6. I<sub>c</sub> = 1 mA, I<sub>B</sub> = 100 μA

**Specifications subject to change without notice.**

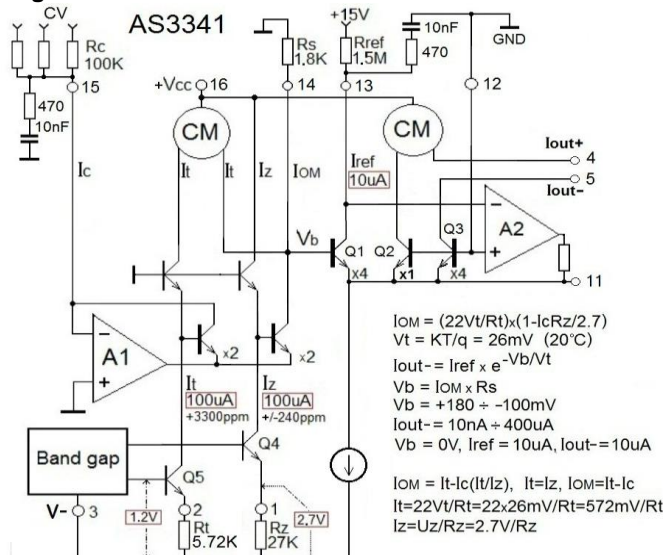


Fig.2 Structure of AS3341 multiplication block and exponentiator

### Application information

AS3341 uses a temperature-compensated core of the VCO AS3340, with an exponential and linear control scale. The output current  $I_{out-}$  can be varied within a wide range from 50 nA to 500  $\mu$ A.

Current output  $I_{out+} = I_{out-} / 4$  can be used to compensate non-linearity of the control characteristic for a large output current  $I_{out-}$ , as shown in Fig. 1 by potentiometer RP3.

Control voltages are fed through a 100 k $\Omega$  input resistors to the control input pin 15 (summing current node). The 240 k $\Omega$  resistor from the control input must be connected to a stable voltage source. This resistor sets the initial value of the output current when there is no control voltage (240 k $\Omega$  resistor connected to RP2 potentiometer connected to + Vcc Fig.1).

Control voltage range can be set from 0 to 10 V as shown in Fig. 1, and set the standard output current control voltage step to 1 V / octave. Several control signals can be applied simultaneously to the control input through summing resistors so that the total current through them is not negative and does not exceed +200  $\mu$ A.

Maximum output current  $I_{out-}$  is 550  $\mu$ A. The most accurate part of the output current range is from 100 nA to 200  $\mu$ A.

Voltage at pin 2 of the AS3341 is 0.572 V relative to the negative supply voltage at pin 3. Resistor  $R_t$  sets the current at pin 2 to approximately 100  $\mu$ A. The voltage at pin 1 is 2.7 V relative to pin 3. By adjusting the potentiometer RP1, as shown in Fig. 1, the total resistance of the resistor  $R_z$  is set so, that at pin 1 a current of 100  $\mu$ A is also obtained.

Reference current  $I_{ref}$  is supplied to the reference current input pin 13 RefIn through the reference resistor  $R_{ref}$  connected to a stable voltage source. The reference current can be selected from 5 to 15  $\mu$ A. The recommended typical current value  $I_{ref} = 10 \mu$ A, then at zero based on the Q1 transistor (pin 14), the output current of the  $I_{out-}$  microcircuit will be 10  $\mu$ A. This can be obtained with a control voltage  $CV = 5$  V. The value of the output current  $I_{out}$  can be fine-tuned with the RP2 potentiometer. The current reference input can also be used to linearly control the output current.

An on-chip 7.4 volt Zener diode allows the device to operate off  $\pm 15$  volt supplies, as well as +12, -5 volt supplies. For voltages greater than -7.4 volts, a series current limiting resistor  $R_{EE}$  must be added between pin 3 and the negative supply. Its value is calculated as follows:

$$R_{EE} = (V_{EE} - 7.4) / 0.004.$$

For example, with  $V_{EE} = -12$  V, the resistance of the  $R_{EE}$  resistor can be set to 1.2K.

To minimize self-heating and improve thermo-stability it is recommended to keep  $V_{EE} = -5$  V...-6 V (external power supply). External  $V_{EE}$  also minimize current through GND and improves stability.

AS3341 Typical connection diagram for use in a ladder filter circuit

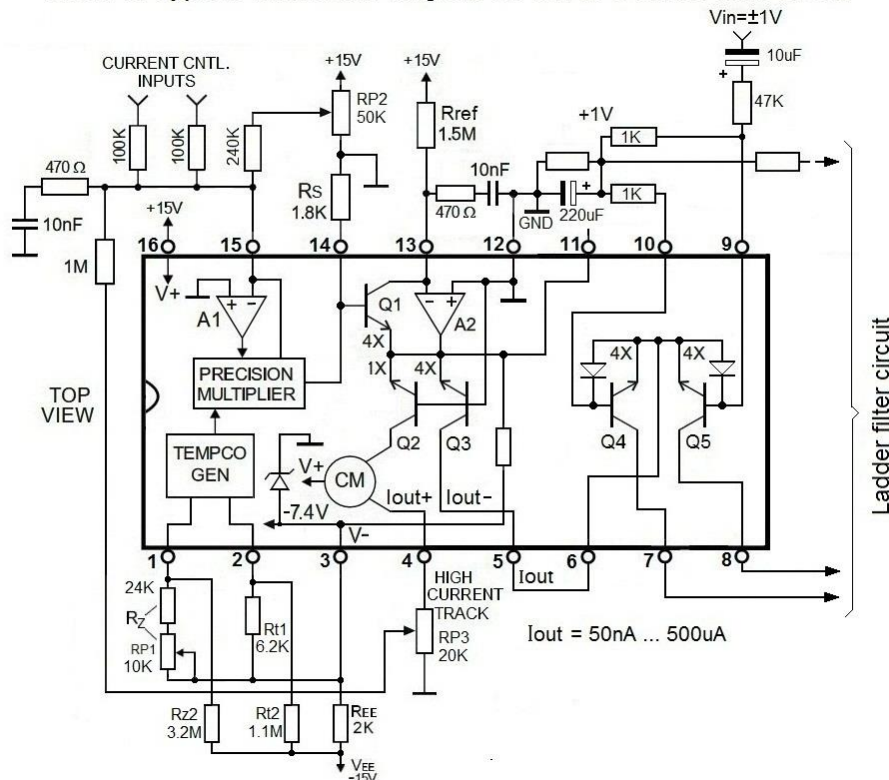


Fig. 3  $V_{cc} = +15V$   $V_{ee} = -15V$

To improve and adjust temperature compensation fine trimming of TempCo must be used.  $I_{temp}$  (pin 2) total current  $\sim 100 \mu A$  must be composed from two parts – current through  $R_{T1}$  (approximately  $92 \mu A$ ) and current through  $R_{T2}$  (approximately  $8 \mu A$ ) connected between external voltage source and pin2 ( $I_{Temp}$ ).  $R_{T1}$  organizes the main part of thermal compensation, and  $R_{T2}$  allows it to finely adjust to several tenth of ppm/C°. For improving stability depending on  $-V_{ee}$ , resistor  $R_{Z2}$  must be used. In this case, fluctuations of  $-V_{ee}$  simultaneously affect both control inputs  $I_{ref}$  (Pin1) and  $I_{temp}$  (Pin 2).

Examples of such applications for different supply voltages are shown on Fig.1, 3 , 4, 5.

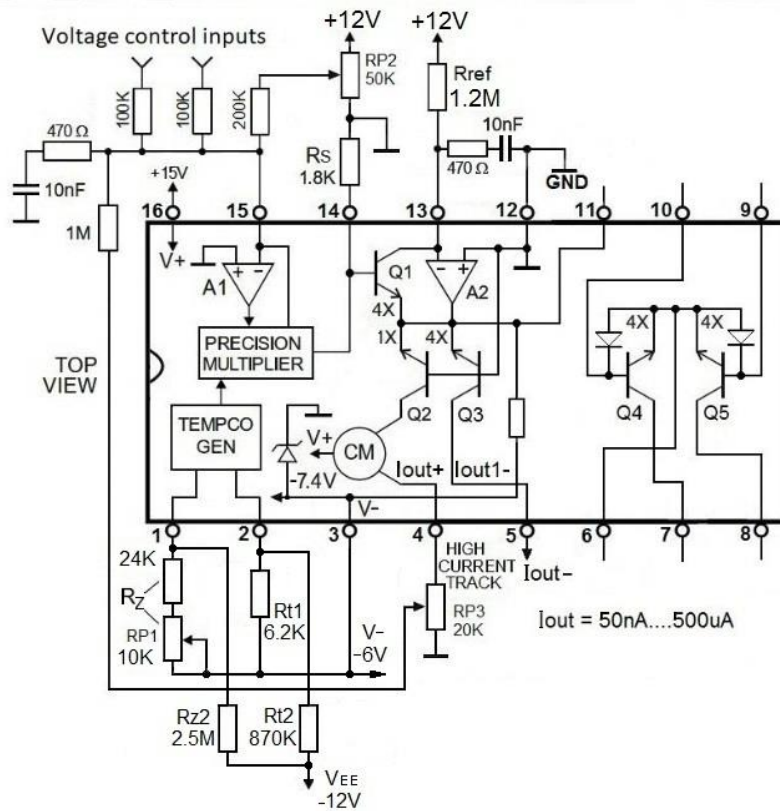


Fig. 4  $V_{cc} = +12V$   $V_{ee} = -6V / -12V$

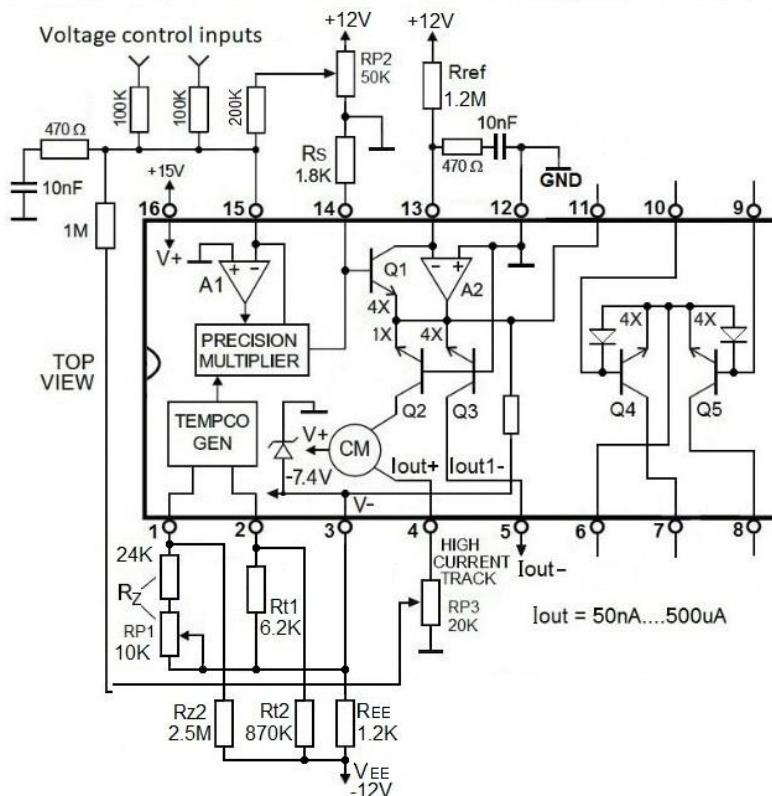


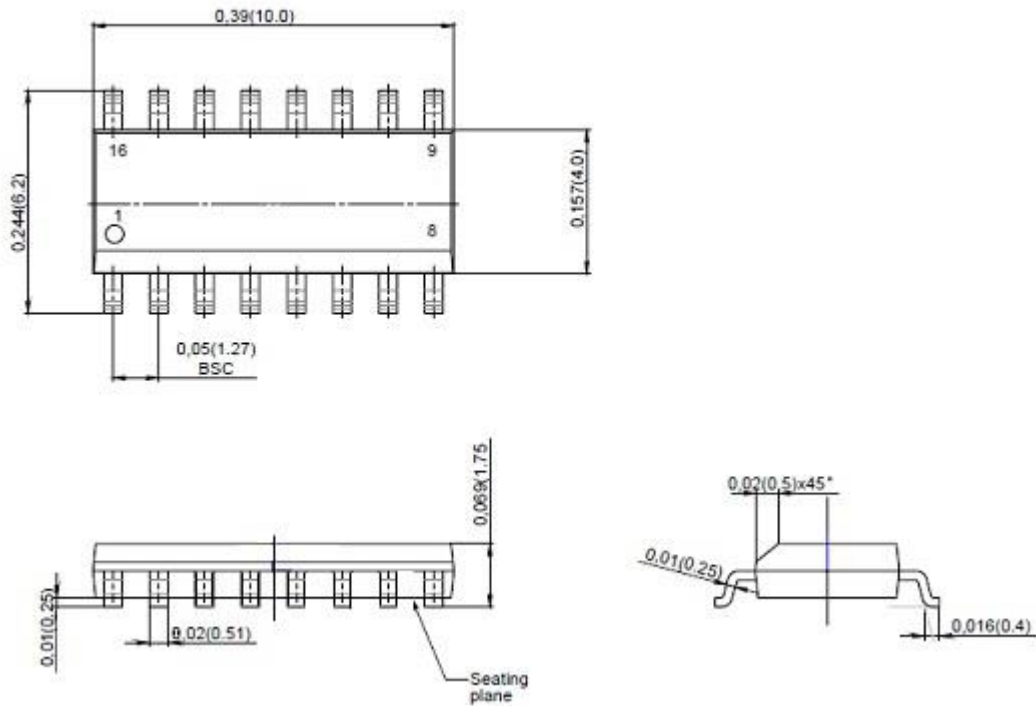
Fig.5 Vcc =+12V Vee= -12V

**Package Information.**

Device type	Package
AS3341D	SOIC-16 (150 Mil)

**Units: inch (mm)**

**SOIC-16 (150 Mil)**



Date	Revision	Changes
04-May-2021	1	Preliminary version 1
09-Jun-2021	2	Trimming of TempCo added