

AS3363 - Three Channel VCA (voltage polarizer)

Features

- three VCA blocks with a wide range of functions containing three 4-quadrant multipliers and 3 2-quadrant multipliers
- two linear controls for each VCA
- simple signal mixing
- can combine high impedance outputs
- provides high attenuation (-100 dB)
- simplifies multiplexer design
- low current consumption of 3 mA typ at $\pm 12V$

Application

For electronic music

General description

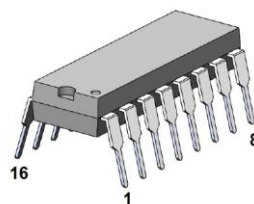
AS3363 contains three VCA blocks, which are intended for use in musical synthesizer applications (VCA blocks, voltage polarizer, multiplexers, morphing, ring modulators etc.). VCA1 and VCA2 implement function of controlling amplification and sign of output signal (voltage polarizing - changing sign and amplitude through “silence”). Additional control input controls attenuation of output current - thus realizing function of double multiplication input signal on two control signals. VCA3 block has additional feature – possibility of control/mixing of two input signals.

Such solution gives vast opportunities in designing new synth solutions.

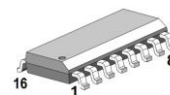
Pin information

PDIP-16, SOIC-16	Pin Name	Description
1	GND	Ground
2	In1	Input VCA1
3	CVMix1	Control Input Mixer VCA1
4	Vcntrl1	Control Input VCA1
5	Io1	Current Output VCA1
6	Io3	Current Output VCA3
7	Vcntrl3	Control Input VCA3
8	Vee	Negative Supply
9	In3A	Input VCA3_A
10	In3B	Input VCA3_B
11	CVMix3	Control Input Mixer VCA3
12	Io2	Current Output VCA2
13	Vcntrl2	Control Input VCA2
14	CVMix2	Control Input Mixer VCA2
15	In2	Input VCA2
16	Vcc	Positive supply

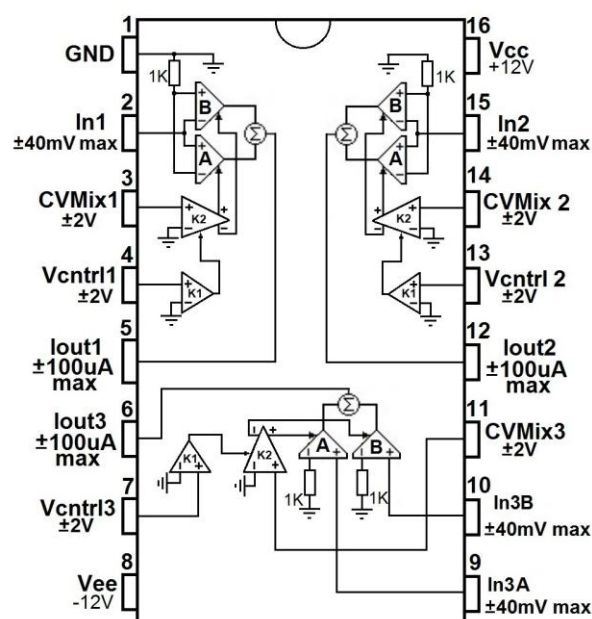
AS3363
PDIP-16 (300 mil)



AS3363D
SOIC-16 (150 Mil)



Circuit Block Diagram





Absolute Maximum Ratings

Voltage between Vcc and Vee pins	30V
Voltage between Vcc and GND pins	+3V to +16V
Voltage between Vee and GND pins	-3V to -16V
Control voltage range CVMix	-3V to +3V
Control voltage range Vcntrl	-3V to +3V
Vinx	-1V to +1V

Electrical Characteristics

Vcc = + 12V Vee = -12V Tamb = +20 ° C

Parameter	Min.	Typ.	Max.	Units
Total harmonic distortion(THD) 1)				%
Input voltage (±17 mV)		0,7		
Input voltage (±28 mV)		2		
Input voltage (±40 mV)		4		
Maximum output current (Vin=±40 mV)		±110		µA
Maximum amplification		2,5		µA/mV
Input bias current		1		µA
Feedthrough CVMix	-	±0,5	±0,7	µA
VCA1, 2				
Control voltage range CVMix, linear range 2)	-1,75	-	+1,75	V
Control voltage CVMix for maximum amplification of non-inverted signal		2		V
Control voltage CVMix for maximum amplification of inverted signal		-2		V
Control voltage CVMix for balance ("silence")	-20	0	20	mV
Maximum attenuation on output in balance ("silence") 3)		60*		dB
Control voltage Vcntrl linear range 2)	-1,65	-	+1,65	V
Control voltage Vcntrl for maximum VCA output current		2		V
Vcntrl maximum attenuation level (turn "OFF" VCA current)		-2		V
Attenuation (Vcntrl=-2V)		100		dB
Feedthrough Vcntrl		60		dB
VCA3				
Control voltage CVMix3 for maximum amplification In3A		2		V
Control voltage CVMix3 for maximum amplification In3B		-2		V
Control voltage CVMix for balance amplification In3A and In3B	-20	0	20	mV
Maximum output offset (Vin=0)	-1	0	+1	µA
Total harmonic distortion	-	4	6	%
Bandwith	8,0	10	-	MHz
Output current slew rate 3)	700	1000	-	µA/µs
Crosstalk between VCA (10 kHz)	-80	-90	-	dB
Maximum input current (for CVMix)	-	-3	-	µA
Maximim input current (Vcntrlx)	-	1	-	µA
Output impedance 3)		10	-	MOhm
Maximum voltage range for Outx	-100	-	+100	mV
Positive supply range Vcc	+5	12	+16	V
Negative supply range Vee	-5	-12	-16	V
Current consumption Icc	2,7	3,3	4,5	mA
Current consumption Iee	2,2	2,8	3,5	mA

Note 1. THD is independent from CVMix or Vcntrl

Note 2. Out of these range control is exponential

Note 3. Output current is ±100 µA

Application information

IC consists of 3 VCA blocks, which are controlled by voltage with maximum output current till $\pm 100 \mu\text{A}$ each. Outputs of VCA can be connected together, allowing current summing from different VCA's. Maximum output voltage on each VCA can't exceed $\pm 200 \text{ mV}$. If higher voltage is needed - IU converter must be used.

VCA1 and VCA2 each has one input signal. VCA3 has two non-inverting input signals IN3A and IN3B. Maximum voltage on these inputs can't exceed $\pm 40 \text{ mV}$, thus attenuator must be used with 1 k resistor connected to GND.

Each VCA has two control inputs CVMix and Vcntrl, with input voltage ranging from -2 V to $+2 \text{ V}$. Control voltages CVMix1 and CVMix2 allows to change amplification on the VCA output from maximum positive to maximum negative "through silence".

For example:

If CVMix = $+2 \text{ V}$ -> VCA output = maximum non-inverted input signal,

If CVMix = -2 V -> VCA output = maximum inverted input signal,

If CVMix = 0 V -> VCA output = positive and negative signal are 100% subtracted (silence).

CVMix3 of VCA3 controls mixing of input signals IN3A and IN3B:

If CVMix3 = $+2 \text{ V}$ -> VCA output = maximum amplification from input IN3A,

If CVMix3 = -2 V -> VCA output = maximum amplification from input IN3B,

If CVMix3 = 0 V -> VCA output = balance from IN3A and IN3B -> 50/50.

Vcntrl1,2,3 – controls output currents of VCA1,2,3 to attenuation -100 dB :

if Vcntrlx = $+2 \text{ V}$ -> VCA provides maximum current to output,

if Vcntrlx = 0 V -> VCA provides approximately 50% of maximum current,

if Vcntrlx = -2 V -> turns "OFF" output current.

For VCA1 and VCA2 mathematical equation is:

$$I_{outx} \sim (I_{nx} * CVMix - I_{nx} (1-CVMix)) * Vcntrlx$$

For VCA3 mathematical equation is:

$$I_{out3} \sim (I_{n3A} * CVMix3 + I_{n3B} * (1- CVMix3)) * Vcntrl3$$

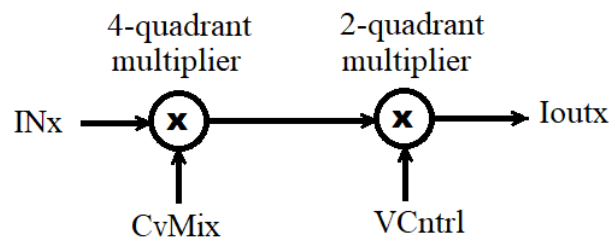
Other possible method of controlling VCA's:

CVMix VCA1 and VCA2 are used only as activation of function "direct" or "inversed" signal transfer and Vcntrl for independent linear control of chosen direct or inversed signals.

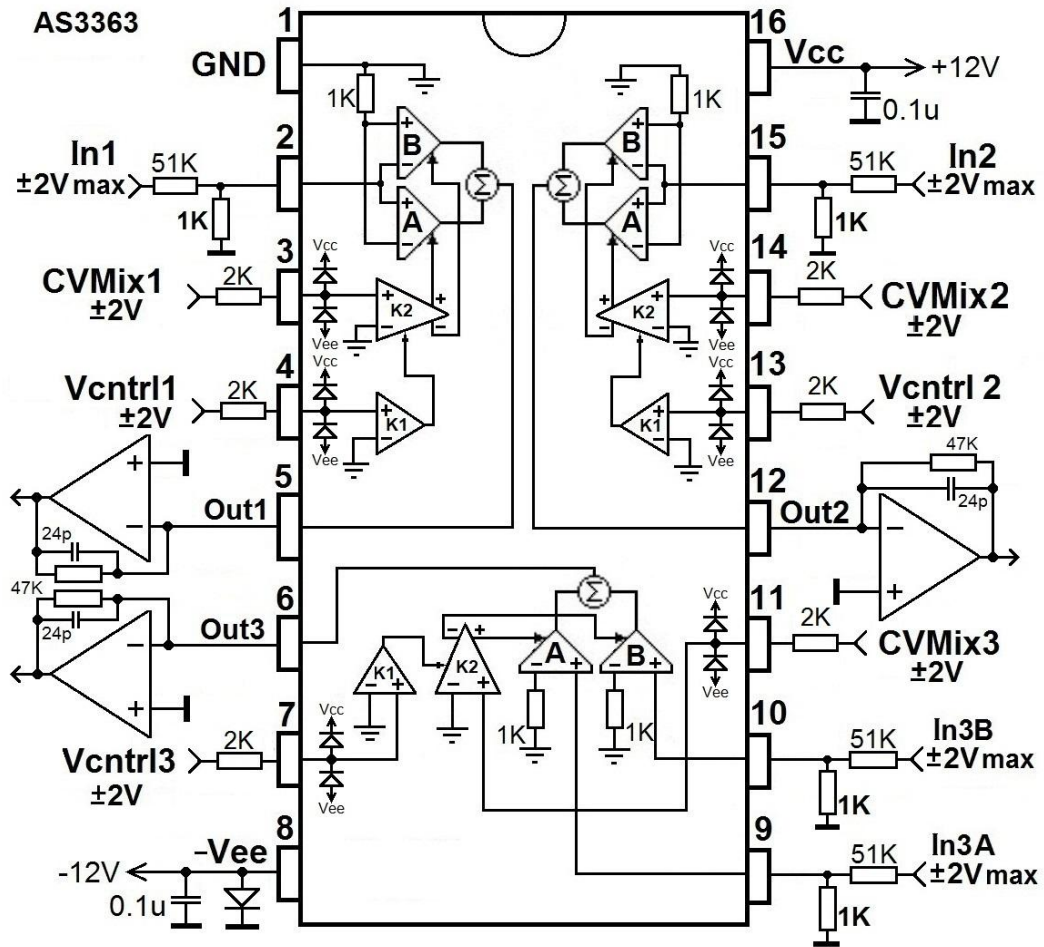
CVMix3 of VCA3 can be to used only for chose of transfer from In3A or from In3B, and Vcntrl for independent linear control of amplification of chosen input.

In such application can be controlled independently and inputs CVMix and Vcntrl "change" one another.

Simplified structure of each VCA block can be described as - 4-quadrant multiplier followed by 2- quadrant multiplier.



Simplified VCA structure



Application diagramm

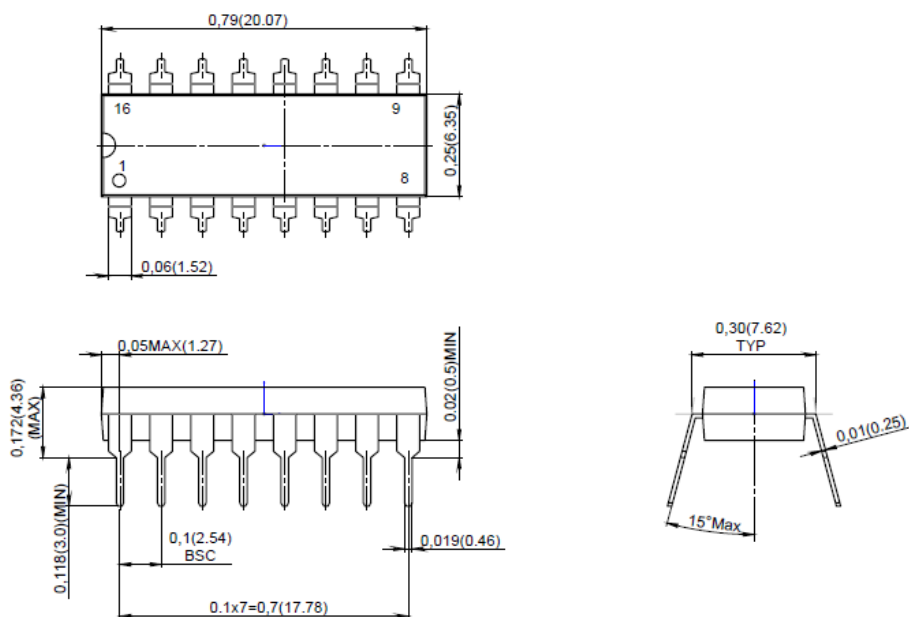


Package Information

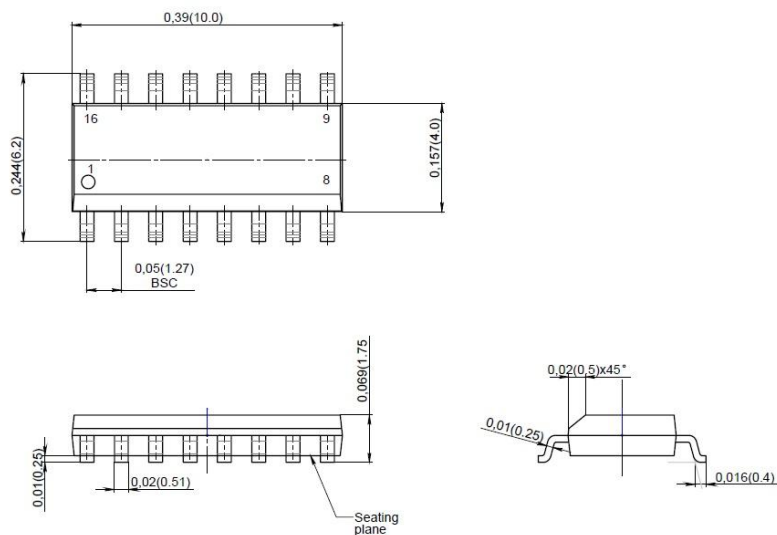
Device type	Package
AS 3363	PDIP-16 (300 Mil)
AS 3363 D	SOIC-16 (150 Mil)

Units: inch (mm)

PDIP-16 (300 mil)



SOIC-16 (150 mil)



Revision history

Date	Revision	Changes
27-Mar-2019	1	Initial version
25-Nov-2019	2	Added new package PDIP-16
13-Dec-2019	3	Application Scheme Changed
15-Jan-2020	4	THD conditions added
25-Mar-2020	5	Simplified VCA structure added
23-Jul-2020	6	Feedthrough CVMix Changed