

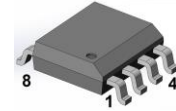


## AS633 - 4-quadrant multiplier

### FEATURES

- 4-quadrant multiplication
- Laser trimmed total error < 1%
- Bandgap reference
- Maximum supply voltage ± 22V

AS633D, AS633\*D  
 SOIC-8 (150mil)



### APPLICATIONS

For electronic music  
 Multiplication, division, squaring  
 Modulation/demodulation, phase detection  
 Voltage-controlled amplifiers/attenuators/filters

### General Description

The AD633 is a functionally complete, four-quadrant, analog multiplier. It includes high impedance, differential X and Y inputs, and a high impedance summing input (Z). The low impedance output voltage is a nominal 10 V full scale provided by a laser trimmed bandgap reference.

The AS633 is laser calibrated to a guaranteed total accuracy of 1 % of full scale. Nonlinearity for the Y input is typically less than 0.1% and noise referred to the output is typically less than 100 μV rms in a 10 Hz to 10 kHz bandwidth. A 1 MHz bandwidth, 35 V/μs slew rate, and the ability to drive capacitive loads make the AS633 useful in a wide variety of applications where simplicity is a key concern.

The versatility of the AS633 is not compromised by its simplicity.

The Z input provides access to the output buffer amplifier, enabling the user to sum the outputs of two or more multipliers, increase the multiplier gain, convert the output voltage to a current, and configure a variety of applications.

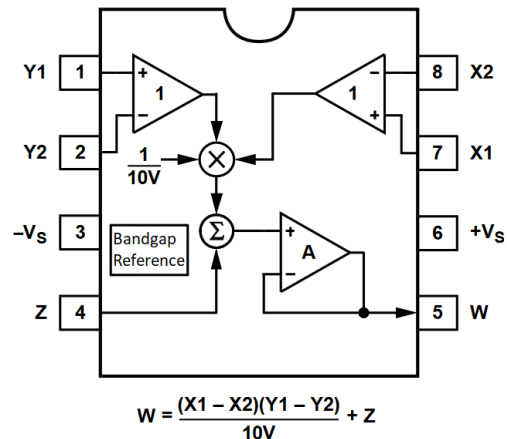
AS534 is available only in die form.

### Pin Information

AS633

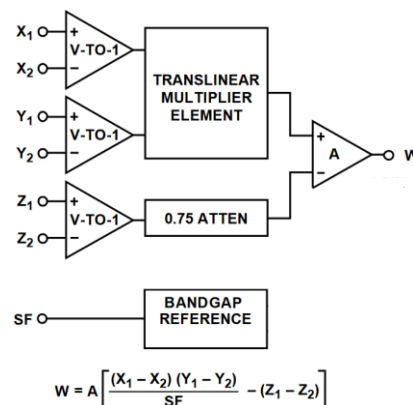
SOIC-8 Pin No	Pin Name	Description
1	Y1	Y1 Multiplicand Noninverting input
2	Y2	Y1 Multiplicand Inverting Input
3	-Vs	Negative Supply
4	Z	Summing Input
5	W	Product Output
6	+Vs	Positive Supply
7	X1	X1 Multiplicand Noninverting Input
8	X2	X2 Multiplicand Inverting Input

### Block Diagram



AS534

Die's Pad Name	Description
Y1	Y1 Multiplicand Noninverting Input
Y2	Y1 Multiplicand Inverting Input
-Vs	Negative Supply
Z2	Summing Inverting Input
Z1	Summing Noninverting Input
W	Product Output
+Vs	Positive Supply
X1	X1 Multiplicand Noninverting Input
X2	X2 Multiplicand Inverting Input
SF	Scale Factor Input





**Absolute Maximum Ratings**

Voltage between +V<sub>s</sub> and -V<sub>s</sub> Pins 44V  
 Input voltage (X1, X2, Y1, Y2, Z) for AS633, AS633\* ± V<sub>s</sub>  
 (X1, X2, Y1, Y2, Z1, Z2) for AS534 ± V<sub>s</sub>

**Typical Electrical Characteristics**

T<sub>A</sub>= 20°C, V<sub>s</sub>=+15V, -V<sub>s</sub> = -15V, R<sub>L</sub> ≥ 2kΩ

Parameter	Conditions	Min	Typ	Max	Units
TRANSFER FUNCTION	AS633, AS633* AS534	$W=(X1-X2)(Y1-Y2)/10V+Z$ $W=A[(X1-X2)(Y1-Y2)/10V-(Z1-Z2)]$			
MULTIPLIER PERFORMANCE					
Total Error AS633*	-10 V ≤ X, Y ≤ +10 V	-1	±0.5	1	% full scale
AS633, AS534		-0.5	±0.25	0.5	% full scale
Scale Voltage Error AS633*	SF = 10.00 V nominal	-1	± 0.5	1	% full scale
AS633, AS534		-0.5	± 0.2	0.5	% full scale
AS534	SF = 3.00 V nominal		± 0.5		% full scale
Supply Rejection	V <sub>s</sub> = ± 14 V to ± 16 V	-0.1	± 0.01	0.1	% full scale
Nonlinearity, X	X = ± 10 V, Y = +10 V	-1	± 0.2	1	% full scale
Nonlinearity, Y	Y = ± 10 V, X = +10 V	-0.4	± 0.1	0.4	% full scale
X Feedthrough	Y1, Y2 = 0, X = ± 10 V	-1	± 0.3	1	% full scale
Y Feedthrough	X1, X2 = 0, Y = ± 10 V	-0.4	± 0.1	0.4	% full scale
Output Offset Voltage		-25	± 5	25	mV
DYNAMICS					
Small Signal Bandwidth	V <sub>O</sub> = 0.1 V rms		1		MHz
Slew Rate	V <sub>O</sub> = 20 V p-p		35	50	V/μs
Settling Time to 1%	ΔV <sub>O</sub> = 20 V		0.4	2	μs
OUTPUT NOISE					
Spectral Density			0.8		μV/√Hz
Wideband Noise	f = 10 Hz to 5 MHz		1		mV rms
	f = 10 Hz to 10 kHz		90		μV rms
OUTPUT					
Output Voltage Swing		-11		11	V
Short Circuit Current	R <sub>L</sub> = 0 Ω	-60	±35	60	mA
INPUT AMPLIFIERS					
Signal Voltage Range	Differential	-10		10	V
	Common mode	-10		10	V
Offset Voltage (X, Y)		-25	±5	25	mV
CMRR (X, Y)	V <sub>CM</sub> = ±10 V, f = 50 Hz	70	80		dB
Bias Current (X, Y, Z)			0.7	2	μA
Differential Resistance			10		MΩ
POWER SUPPLY					
Supply Voltage			±15		V
Rated Performance					
Operating Range					
Supply Current	Quiescent	±8		±22	V
		4	5.5	7	mA

