

FEATURES

- 4-quadrant multiplication
- Low cost, 8-lead SOIC package
- Complete—no external components required
- Laser-trimmed accuracy and stability
- Total error within 2% of full scale
- Differential high impedance X and Y inputs
- High impedance unity-gain summing input
- Laser-trimmed 10 V scaling reference

ENHANCED PRODUCT FEATURES

- Supports defense and aerospace applications (AQEC standard)
- Military temperature range (-55°C to $+125^{\circ}\text{C}$)
- Controlled manufacturing baseline
- One assembly/test site
- One fabrication site
- Enhanced product change notification
- Qualification data available on request

APPLICATIONS

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

GENERAL DESCRIPTION

The AD633-EP 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 buried Zener.

The AD633-EP is laser calibrated to a guaranteed total accuracy of 2% 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, 20 V/ μs slew rate, and the ability to drive capacitive loads make the AD633-EP useful in a wide variety of applications where simplicity and cost are key concerns.

The versatility of the AD633-EP 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. For further information, see the [Multiplier Application Guide](#).

FUNCTIONAL BLOCK DIAGRAM

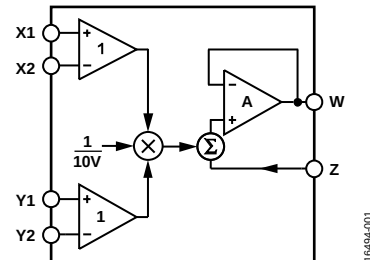


Figure 1.

The AD633-EP is available in an 8-lead SOIC package. It is specified to operate over the -55°C to $+125^{\circ}\text{C}$ military temperature range.

Additional application and technical information can be found in the [AD633](#) data sheet.

PRODUCT HIGHLIGHTS

1. The AD633-EP is a complete four-quadrant multiplier offered in a low cost 8-lead SOIC package. The result is a product that is cost effective and easy to apply.
2. No external components or expensive user calibration are required to apply the AD633-EP.
3. Monolithic construction and laser calibration make the device stable and reliable.
4. High (10 M Ω) input resistances make signal source loading negligible.
5. Power supply voltages can range from ± 8 V to ± 18 V. The internal scaling voltage is generated by a stable Zener diode; multiplier accuracy is essentially supply insensitive.

Rev. B

[Document Feedback](#)

Information furnished by Analog Devices is believed to be accurate and reliable. However, no responsibility is assumed by Analog Devices for its use, nor for any infringements of patents or other rights of third parties that may result from its use. Specifications subject to change without notice. No license is granted by implication or otherwise under any patent or patent rights of Analog Devices. Trademarks and registered trademarks are the property of their respective owners.

One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.
Tel: 781.329.4700 ©2017-2018 Analog Devices, Inc. All rights reserved.
[Technical Support](#) www.analog.com

TABLE OF CONTENTS

Features	1	Absolute Maximum Ratings	4
Enhanced Product Features	1	Thermal Resistance	4
Applications	1	Power Derating Curve	4
Functional Block Diagram	1	ESD Caution.....	4
General Description	1	Pin Configuration and Function Descriptions.....	5
Product Highlights	1	Typical Performance Characteristics	6
Revision History	2	Outline Dimensions	7
Specifications.....	3	Ordering Guide	7

REVISION HISTORY

6/2018—Rev. A to Rev. B	
Changes to Figure 3.....	5
1/2018—Rev. 0 to Rev. A	
Changes to Thermal Resistance Section, Table 3, and Figure 2.....	4
Changes to Endnote 1, Table 3.....	4
Added Endnote 2, Table 3	4
12/2017—Revision 0: Initial Version	

SPECIFICATIONS

$T_A = 25^\circ\text{C}$, $V_S = \pm 15\text{ V}$, $R_L \geq 2\text{ k}\Omega$.

Table 1.

Parameter	Conditions	Min	Typ	Max	Unit
TRANSFER FUNCTION		$W = \frac{(X1 - X2)(Y1 - Y2)}{10\text{ V}} + Z$			
MULTIPLIER PERFORMANCE					
Total Error	$-10\text{ V} \leq X, Y \leq +10\text{ V}$		± 1	± 2	% full scale
T_{MIN} to T_{MAX}			± 3		% full scale
Scale Voltage Error	SF = 10.00 V nominal		$\pm 0.25\%$		% full scale
Supply Rejection	$V_S = \pm 14\text{ V}$ to $\pm 16\text{ V}$		± 0.01		% full scale
Nonlinearity, X	$X = \pm 10\text{ V}$, $Y = +10\text{ V}$		± 0.4	± 1	% full scale
Nonlinearity, Y	$Y = \pm 10\text{ V}$, $X = +10\text{ V}$		± 0.1	± 0.4	% full scale
X Feedthrough	Y nulled, $X = \pm 10\text{ V}$		± 0.3	± 1	% full scale
Y Feedthrough	X nulled, $Y = \pm 10\text{ V}$		± 0.1	± 0.4	% full scale
Output Offset Voltage ¹			± 5	± 50	mV
DYNAMICS					
Small Signal Bandwidth	$V_O = 0.1\text{ V rms}$		1		MHz
Slew Rate	$V_O = 20\text{ V p-p}$		20		V/ μs
Settling Time to 1%	$\Delta V_O = 20\text{ V}$		2		μs
OUTPUT NOISE					
Spectral Density			0.8		$\mu\text{V}/\sqrt{\text{Hz}}$
Wideband Noise	$f = 10\text{ Hz}$ to 5 MHz		1		mV rms
	$f = 10\text{ Hz}$ to 10 kHz		90		$\mu\text{V rms}$
OUTPUT					
Output Voltage Swing		± 11			V
Short Circuit Current	$R_L = 0\ \Omega$		30	40	mA
INPUT AMPLIFIERS					
Signal Voltage Range	Differential	± 10			V
	Common mode	± 10			V
Offset Voltage (X, Y)			± 5	± 30	mV
CMRR (X, Y)	$V_{\text{CM}} = \pm 10\text{ V}$, $f = 50\text{ Hz}$	60	80		dB
Bias Current (X, Y, Z)			0.8	2.0	μA
Differential Resistance			10		M Ω
POWER SUPPLY					
Supply Voltage			± 15		V
Rated Performance					V
Operating Range		± 8		± 18	V
Supply Current	Quiescent		4	6	mA

¹ Allow approximately 0.5 ms for settling following power on.

ABSOLUTE MAXIMUM RATINGS

Table 2.

Parameter	Rating
Supply Voltage	$\pm 18\text{ V}$
Internal Power Dissipation	See Figure 2
Input Voltages ¹	$\pm 18\text{ V}$
Output Short-Circuit Duration	Indefinite
Storage Temperature Range	-65°C to $+150^{\circ}\text{C}$
Operating Temperature Range	-55°C to $+125^{\circ}\text{C}$
Junction Temperature	150°C
Lead Temperature (Soldering, 60 sec)	260°C
ESD Rating	1000 V

¹ For supply voltages less than $\pm 18\text{ V}$, the absolute maximum input voltage is equal to the supply voltage.

Stresses at or above those listed under Absolute Maximum Ratings may cause permanent damage to the product. This is a stress rating only; functional operation of the product at these or any other conditions above those indicated in the operational section of this specification is not implied. Operation beyond the maximum operating conditions for extended periods may affect product reliability.

THERMAL RESISTANCE

Thermal performance is directly linked to printed circuit board (PCB) design and operating environment. Careful attention to PCB thermal design is required.

Table 3.

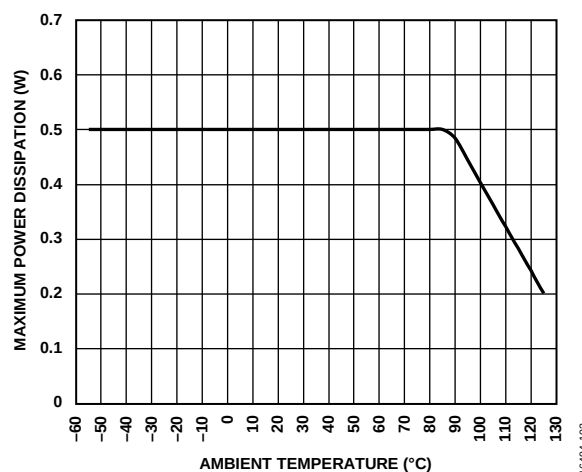
Package Type	θ_{JA} ¹	θ_{JC} ²	Unit
R-8	123.9	42.8	$^{\circ}\text{C/W}$

¹ Test Condition 1: Thermal impedance simulated values are based on JEDEC 252P thermal test board. See JEDEC JESD51.

² Test Condition 2: Thermal impedance simulate values are based on JEDEC 150P thermal test board. See JEDEC JESD51.

POWER DERATING CURVE

Figure 2 shows the maximum power dissipation vs. the ambient temperature.

Figure 2. Maximum Power Dissipation vs. Ambient Temperature (T_A)

ESD CAUTION



ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

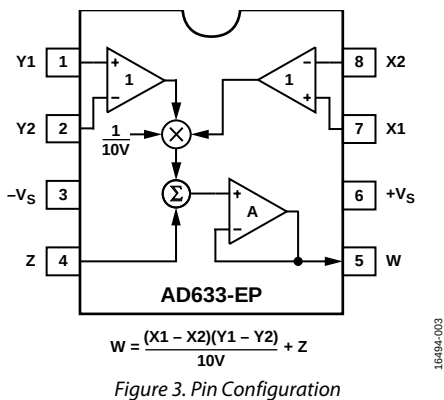


Table 4. Pin Function Descriptions

Pin No.	Mnemonic	Description
1	Y1	Y Multiplicand Noninverting Input
2	Y2	Y Multiplicand Inverting Input
3	-Vs	Negative Supply Rail
4	Z	Summing Input
5	W	Product Output
6	+Vs	Positive Supply Rail
7	X1	X Multiplicand Noninverting Input
8	X2	X Multiplicand Inverting Input

TYPICAL PERFORMANCE CHARACTERISTICS

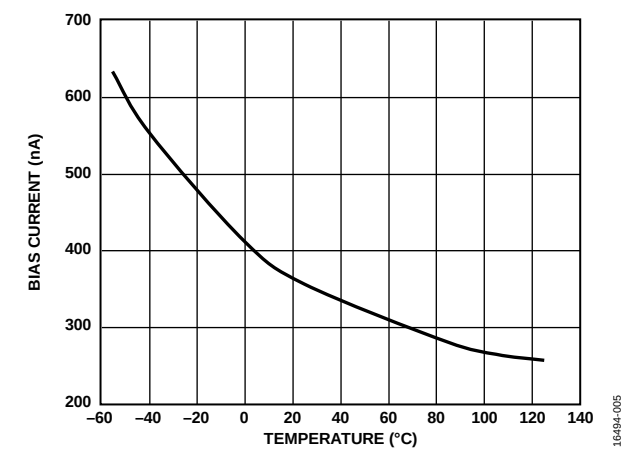


Figure 4. Input Bias Current vs. Temperature (X, Y, or Z Inputs)

Figure 1: Dimensions of the coplanar waveguide. The figure shows two views of the waveguide: a top view and a side view. The top view shows a rectangular waveguide with a central slot. Dimensions include: top width 5.00 (0.1968) and 4.80 (0.1890); left height 4.00 (0.1574) and 3.80 (0.1497); right height 6.20 (0.2441) and 5.80 (0.2284); bottom width 1.27 (0.0500) and 1.75 (0.0688); and bottom height 1.35 (0.0532). The side view shows the waveguide's profile with a 45-degree angle, a 0.25 (0.0098) top thickness, a 0.10 (0.0040) bottom thickness, a 0.10 coplanarity dimension, a 0.51 (0.0201) top width, a 0.31 (0.0122) bottom width, and a 0.25 (0.0098) bottom thickness. The side view also shows a 1.27 (0.0500) top width and a 0.40 (0.0157) bottom width.

012407-A

Dimensions shown in millimeters and (inches)

Model ¹	Temperature Range	Package Description	Package Option
AD633TRZ-EP	–55°C to +125°C	8-Lead Standard Small Outline Package [SOIC_N]	R-8
AD633TRZ-EP-R7	–55°C to +125°C	8-Lead Standard Small Outline Package [SOIC_N]	R-8


**ANALOG
DEVICES**

Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

Мы предлагаем:

- Конкурентоспособные цены и скидки постоянным клиентам.
- Специальные условия для постоянных клиентов.
- Подбор аналогов.
- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
- Приемлемые сроки поставки, возможна ускоренная поставка.
- Доставку товара в любую точку России и стран СНГ.
- Комплексную поставку.
- Работу по проектам и поставку образцов.
- Формирование склада под заказчика.
- Сертификаты соответствия на поставляемую продукцию (по желанию клиента).
- Тестирование поставляемой продукции.
- Поставку компонентов, требующих военную и космическую приемку.
- Входной контроль качества.
- Наличие сертификата ISO.

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- Регистрацию проекта у производителя компонентов.
- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



Тел: +7 (812) 336 43 04 (многоканальный)

Email: org@lifeelectronics.ru

www.lifeelectronics.ru