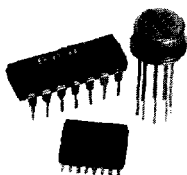


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MPY634

www.burr-brown.com/databook/MPY634.html

Wide Bandwidth PRECISION ANALOG MULTIPLIER

FEATURES

- **WIDE BANDWIDTH:** 10MHz typ
- **±0.5% MAX FOUR-QUADRANT ACCURACY**
- **INTERNAL WIDE-BANDWIDTH OP AMP**
- **EASY TO USE**
- **LOW COST**

APPLICATIONS

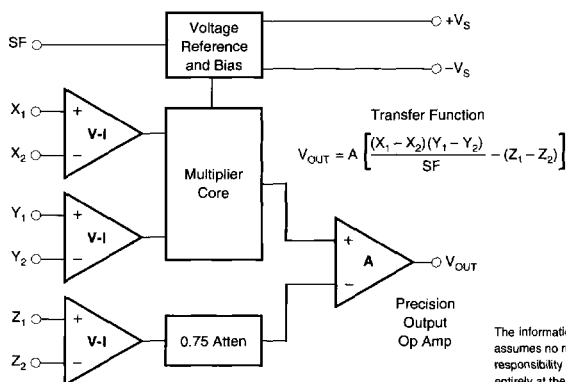
- **PRECISION ANALOG SIGNAL PROCESSING**
- **MODULATION AND DEMODULATION**
- **VOLTAGE-CONTROLLED AMPLIFIERS**
- **VIDEO SIGNAL PROCESSING**
- **VOLTAGE-CONTROLLED FILTERS AND OSCILLATORS**

DESCRIPTION

The MPY634 is a wide bandwidth, high accuracy, four-quadrant analog multiplier. Its accurately laser-trimmed multiplier characteristics make it easy to use in a wide variety of applications with a minimum of external parts, often eliminating all external trimming. Its differential X, Y, and Z inputs allow configuration as a multiplier, squarer, divider, square-rooter, and other functions while maintaining high accuracy.

The wide bandwidth of this new design allows signal processing at IF, RF, and video frequencies. The internal output amplifier of the MPY634 reduces design complexity compared to other high frequency multipliers and balanced modulator circuits. It is capable of performing frequency mixing, balanced modulation, and demodulation with excellent carrier rejection.

An accurate internal voltage reference provides precise setting of the scale factor. The differential Z input allows user-selected scale factors from 0.1 to 10 using external feedback resistors.



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Internet: <http://www.burr-brown.com/> • FAXLine: (800) 546-6133 (US/Canada Only) • Cable: BBRCORP • Telex: 066-6491 • FAX: (520) 889-1510 • Immediate Product Info: (800) 546-6132

Or, Call Customer Service at 1-800-548-6132 (USA Only)

SPECIFICATIONS

At $T_A = +25^\circ\text{C}$ and $V_S = \pm 15\text{VDC}$, unless otherwise noted.

MODEL	MPY634KP/KU			MPY634AM			MPY634BM			MPY634SM			UNITS
	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
MULTIPLIER													
PERFORMANCE													
Transfer Function		*		$(X_1 - X_2)(Y_1 - Y_2) + Z_2$				*			*		
Total Error ⁽¹⁾			± 2.0	$\frac{10V}{10V}$					± 0.5			*	%
($-10V \leq X, Y \leq +10V$)												± 2.0	%
$T_A = \text{min to max}$		± 2.5		± 1.5				± 1.0				± 0.02	%/°C
Total Error vs Temperature		± 0.03		± 0.022				± 0.015					%/°C
Scale Factor Error											*		%
(SF = 10,000V Nominal) ⁽²⁾		± 0.25		± 0.1				*			*		%
Temperature Coefficient of											*		%
Scaling Voltage		± 0.02		± 0.01				± 0.01			*		%/°C
Supply Rejection ($\pm 15V \pm 1V$)		*		± 0.01				*			*		%
Nonlinearity											*		%
X ($X = 20Vp-p, Y = 10V$)		*		± 0.4				0.2	± 0.3		*		%
Y ($Y = 20Vp-p, X = 10V$)		*		± 0.01				± 0.1			*		%
Feedthrough ⁽³⁾											*		%
X (Y Nulled, $X = 20Vp-p, 50\text{Hz}$)		*		± 0.3				± 0.15	± 0.3		*		%
Y (X Nulled, $Y = 20Vp-p, 50\text{Hz}$)		*		± 0.01				*	± 0.1		*		%
Both Inputs (500kHz, 1Vrms)											*		%
Unnulled	40 ⁽⁴⁾	50		45	55		*	60		*	*		dB
Nulled	55 ⁽⁴⁾	60		55	65		60	70		*	*		dB
Output Offset Voltage		± 50	± 100		± 5	± 30		*	± 15		*	*	mV
Output Offset Voltage Drift		*			± 200			± 100			*	± 500	$\mu\text{V}/^\circ\text{C}$
DYNAMICS													
Small Signal BW, ($V_{OUT} = 0.1\text{Vrms}$)	6 ⁽⁴⁾	*		8	10		*	*		6	*		MHz
1% Amplitude Error ($C_{LOAD} = 1000\text{pF}$)		*			100			*			*		kHz
Slew Rate ($V_{OUT} = 20Vp-p$)		*			20			*			*		V/ μs
Settling Time (to 1%, $\Delta V_{OUT} = 20V$)		*			2			*			*		μs
NOISE													
Noise Spectral Density: SF = 10V		*			0.8			*			*		$\mu\text{V}/\sqrt{\text{Hz}}$
Wideband Noise: f = 10Hz to 5MHz		*			1			*			*		mVrms
f = 10Hz to 10kHz		*			90			*			*		μVrms
OUTPUT													
Output Voltage Swing	*			± 11			*			*			V
Output Impedance (f $\leq 1\text{kHz}$)		*			0.1			*			*		Ω
Output Short Circuit Current ($R_L = 0, T_A = \text{min to max}$)		*			30			*			*		mA
Amplifier Open Loop Gain (f = 50Hz)		*			85			*			*		dB
INPUT AMPLIFIERS (X, Y and Z)													
Input Voltage Range													V
Differential V_{IN} ($V_{CM} = 0$)		*			± 12			*			*		V
Common-Mode V_{IN} ($V_{DIFF} = 0$) (see Typical Performance Curves)		*			± 10			*			*		V
Offset Voltage X, Y		± 25	± 100		± 5	± 20		± 2	± 10		*	*	mV
Offset Voltage Drift X, Y		200			100			50			*	*	$\mu\text{V}/^\circ\text{C}$
Offset Voltage Z		± 25	± 100		± 5	± 30		± 2	± 15		*	*	mV
Offset Voltage Drift Z		*			200			100			*	500	$\mu\text{V}/^\circ\text{C}$
CMRR	*	*		60	80		70	90		*	*		dB
Bias Current		*	*		0.8	2.0		*	*		*	*	μA
Offset Current		*			0.1			*			*	2.0	μA
Differential Resistance		*			10			*			*		M Ω
DIVIDER PERFORMANCE													
Transfer Function ($X_i > X_2$)		*		$10V \frac{(Z_2 - Z_1)}{(X_1 - X_2)} + Y_1$				*			*		
Total Error ⁽¹⁾ untrimmed													%
($X = 10V, -10V \leq Z \leq +10V$)		1.5		± 0.75				± 0.35			± 0.75		%
($X = 1V, -1V \leq Z \leq +1V$)		4.0		± 2.0				± 1.0			*		%
($0.1V \leq X \leq 10V, -10V \leq Z \leq +10V$)		5.0		± 2.5				± 1.0			*		%
SQUARE PERFORMANCE													
Transfer Function		*		$\frac{(X_1 - X_2)^2}{10V} + Z_2$				*			*		
Total Error ($-10V \leq X \leq 10V$)		± 1.2		± 0.6				± 0.3			*		%

MPY634

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SPECIAL FUNCTIONS

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SPECIFICATIONS (CONT)

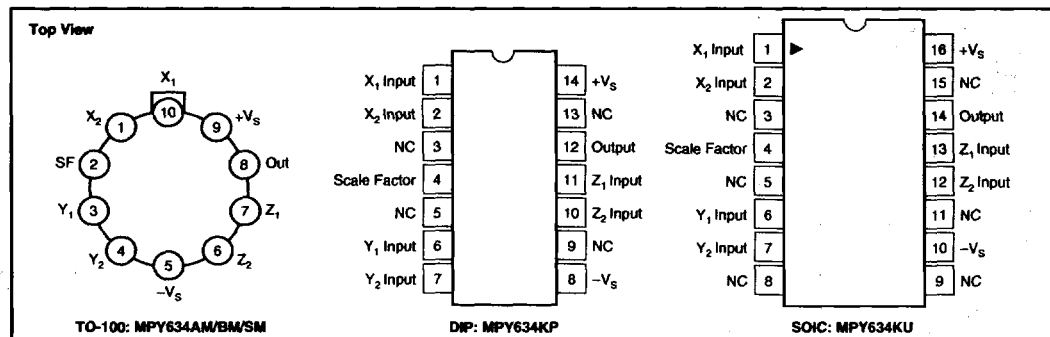
At $T_A = +25^\circ\text{C}$ and $V_S = \pm 15\text{VDC}$, unless otherwise noted.

MODEL	MPY634KP/KU			MPY634AM			MPY634BM			MPY634SM			UNITS
	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
SQUARE-ROOTER PERFORMANCE Transfer Function ($Z_1 \leq Z_2$) Total Error ⁽¹⁾ ($1\text{V} \leq Z \leq 10\text{V}$)		*		$\sqrt{10\text{V}(Z_2 - Z_1)} + X_2$				*			*		%
		± 2.0			± 1.0			± 0.5			± 0.5		
POWER SUPPLY Supply Voltage: Rated Performance Operating Supply Current, Quiescent		*			± 15			*			*		VDC
	*	*	*	± 8	± 15	± 18	*	*	*	*	*	± 20	VDC
		*	*		4	6		*	*		*	*	mA
TEMPERATURE RANGE Specification Storage	$^{(5)}$		$^{(5)}$	-25		+85	*		*	-55		+125	$^\circ\text{C}$
	-40		+85	-65		+150	*		*	*		*	$^\circ\text{C}$

* Specification same as MPY634AM.

NOTES: (1) Figures given are percent of full scale, $\pm 10\text{V}$ (i.e., $0.01\% = 1\text{mV}$). (2) May be reduced to 3V using external resistor between $-V_S$ and SF. (3) Irreducible component due to nonlinearity; excludes effect of offsets. (4) KP grade only. (5) KP grade only. 0°C to $+70^\circ\text{C}$ for KU grade.

PIN CONFIGURATIONS



ABSOLUTE MAXIMUM RATINGS

PARAMETER	MPY634AM/BM	MPY634KP/KU	MPY634SM
Power Supply Voltage	± 18	*	± 20
Power Dissipation	500mW	*	*
Output Short-Circuit to Ground	Indefinite	*	*
Input Voltage (all X, Y and Z)	$\pm V_S$	*	*
Temperature Range:			
Operating	$-25^\circ\text{C}/+85^\circ\text{C}$	*	$-55^\circ\text{C}/+125^\circ\text{C}$
Storage	$-65^\circ\text{C}/+150^\circ\text{C}$	$-40^\circ\text{C}/+85^\circ\text{C}$	*
Lead Temperature (soldering, 10s)	$+300^\circ\text{C}$	*	*
SOIC "KU" Package		$+260^\circ\text{C}$	

* Specification same as for MPY634AM/BM.

ORDERING INFORMATION

Basic Model Number **MPY634** () ()

Performance Grade⁽¹⁾ ()

K: -25°C to $+85^\circ\text{C}$ ("U" package 0°C to $+70^\circ\text{C}$)

A: -25°C to $+85^\circ\text{C}$

B: -25°C to $+85^\circ\text{C}$

S: -55°C to $+125^\circ\text{C}$

Package Code ()

M: TO-100 Metal

P: Plastic 14-pin DIP

U: 16-pin SOIC

NOTE: (1) Performance grade identifier may not be marked on the SOIC package; a blank denotes "K" grade.

PACKAGE INFORMATION

PRODUCT	PACKAGE	PACKAGE DRAWING NUMBER ⁽¹⁾
MPY634KP	14-Pin PDIP	010
MPY634KU	16-Pin SOIC	211
MPY634AM	TO-100	007
MPY634BM	TO-100	007
MPY634SM	TO-100	007

NOTE: (1) For detailed drawing and dimension table, please see end of data sheet, or Appendix C of Burr-Brown IC Data Book.



ELECTROSTATIC DISCHARGE SENSITIVITY

This integrated circuit can be damaged by ESD. Burr-Brown recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.