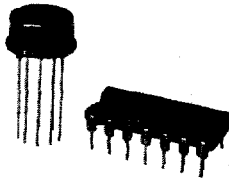


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MPY534

[www.burr-brown.com/databook/MPY534.html](http://www.burr-brown.com/databook/MPY534.html)

## Precision ANALOG MULTIPLIER

### FEATURES

- $\pm 0.25\%$  max 4-QUADRANT ACCURACY
- WIDE BANDWIDTH: 1MHz min, 3MHz typ
- ADJUSTABLE SCALE FACTOR
- STABLE AND RELIABLE MONOLITHIC CONSTRUCTION
- LOW COST

### APPLICATIONS

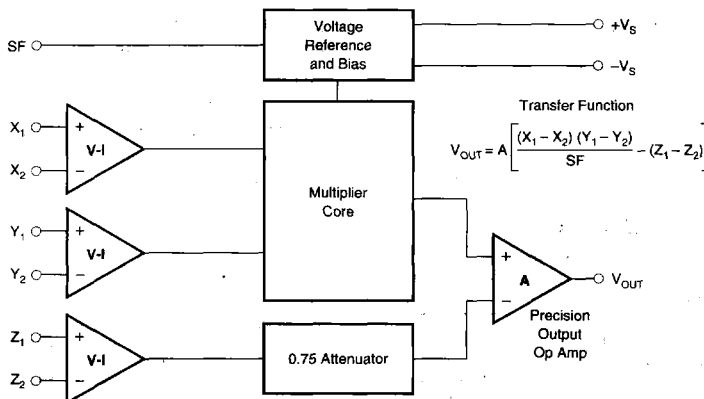
- PRECISION ANALOG SIGNAL PROCESSING
- VIDEO SIGNAL PROCESSING
- VOLTAGE CONTROLLED FILTERS AND OSCILLATORS
- MODULATION AND DEMODULATION
- RATIO AND PERCENTAGE COMPUTATION

### DESCRIPTION

The MPY534 is a high accuracy, general purpose four-quadrant analog multiplier. Its accurately laser trimmed transfer characteristics make it easy to use in a wide variety of applications with a minimum of external parts and trimming circuitry. Its differential X, Y and Z inputs allow configuration as multiplier, squarer, divider, square-rooter and other functions while maintaining high accuracy.

The wide bandwidth of this new design allows accurate signal processing at higher frequencies suitable for video signal processing. It is capable of performing IF and RF frequency mixing, modulation and demodulation with excellent carrier rejection and very simple feedthrough adjustment.

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.



International Airport Industrial Park • Mailing Address: PO Box 11400, Tucson, AZ 85734 • Street Address: 6730 S. Tucson Blvd., Tucson, AZ 85706 • Tel: (520) 746-1111 • Twx: 910-952-1111  
Internet: <http://www.burr-brown.com/> • FAXLine: (800) 548-6133 (US/Canada Only) • Cable: BBRCORP • Telex: 066-6491 • FAX: (520) 889-1510 • Immediate Product Info: (800) 548-6132

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

# SPECIFICATIONS

## ELECTRICAL

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

PARAMETER	MPY534J			MPY534K			MPY534L			MPY534S			MPY534T			UNITS
	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
<b>MULTIPLIER PERFORMANCE</b> Transfer Function		*		$(X_1 - X_2)(Y_1 - Y_2) + Z_2$ 10V				*			*			*		
Total Error <sup>(1)</sup> (-10V ≤ X, Y ≤ +10V)			±1.0			±0.5			±0.25			±1.0			*	%
$T_A = \text{min to max}$		±1.5			±1.0			±0.5			±2.0			*	±1.0	%
Total Error vs Temperature		±0.022			±0.015			±0.008			±0.02			*	±0.01	%/°C
Scale Factor Error (SF = 10.000V Nominal) <sup>(2)</sup>		±0.25			±0.1			*			±0.25			*		%
Temperature Coefficient of Scaling Voltage		±0.02			±0.01			±0.005			±0.02			±0.005		%/°C
Supply Rejection (±15V ±1V)		*			±0.01			*			*			*		%
Nonlinearity: X (X = 20Vp-p, Y = 10V) Y (Y = 20Vp-p, X = 10V)		±0.4			±0.2	±0.3		±0.10	±0.12		±0.4			*	*	%
Feedthrough <sup>(3)</sup> X (Y Nulled, Y = 20Vp-p 50Hz) Y (X Nulled, X = 20Vp-p 50Hz)		*			±0.01	±0.1		±0.005	*		*			*	*	%
Output Offset Voltage		±5	±30		±0.01	±0.1		±0.003	*		*			*	*	mV
Output Offset Voltage Drift		200			±2	±15		*	±10		±5	±30	500	*	*	μV/°C
<b>DYNAMICS</b> Small Signal BW, ( $V_{OUT} = 0.1\text{Vrms}$ ) 1% Amplitude Error ( $C_{LOAD} = 1000\text{pF}$ ) Slew Rate ( $V_{OUT} = 20\text{Vp-p}$ ) Settling Time (to 1%, $\Delta V_{OUT} = 20\text{V}$ )	*	*		1	3			*	*		*	*		*	*	MHz
		*			50			*	*		*	*		*	*	kHz
		*			20			*	*		*	*		*	*	V/μs
		*			2			*	*		*	*		*	*	μs
<b>NOISE</b> Noise Spectral Density: SF = 10V Wideband Noise: f = 10Hz to 5MHz f = 10Hz to 10kHz		*			0.8			*	*		*	*		*	*	μV/√Hz
		*			1			*	*		*	*		*	*	mVrms
		*			90			*	*		*	*		*	*	μVrms
<b>OUTPUT</b> Output Voltage Swing Output Impedance (f ≤ 1kHz) Output Short Circuit Current ( $R_L = 0$ , $T_A = \text{min to max}$ ) Amplifier Open Loop Gain (f = 50Hz)	*	*		±11	0.1			*	*		*	*		*	*	V Ω mA dB
<b>INPUT AMPLIFIERS</b> (X, Y and Z) Input Voltage Range Differential $V_{IN}$ ( $V_{CM} = 0$ ) Common-Mode $V_{IN}$ ( $V_{DIFF} = 0$ ) (see Typical Performance Curves) Offset Voltage X, Y Offset Voltage Drift X, Y Offset Voltage Z Offset Voltage Drift Z CMRR Bias Current Offset Current Differential Resistance		*			±12 ±10			*	*		*	*		*	*	V V mV μV/°C mV μV/°C dB μA μA MΩ
		±5	±20		±2	±10		*	*		±5	±20		*	*	mV
		100			50			*	*		100			*	*	μV/°C
		±5	±30		±2	±15		*	±10		±5	±30		*	*	mV
		200			100			*	*		500			*	300	μV/°C
	60	80		70	90		*	*	*	60	80		*	*	*	dB
		*	*		0.8	2.0		*	*		*	*		*	*	μA
		*			0.1			0.05	0.2		*	2.0		*	*	μA
		*			10			*	*		*			*	*	MΩ
<b>DIVIDER PERFORMANCE</b> Transfer Function ( $X_1 > X_2$ )		*		$10V \frac{(Z_2 - Z_1)}{(X_1 - X_2)} + Y_1$												
Total Error <sup>(1)</sup> (X = 10V, -10V ≤ Z ≤ +10V)		±0.75			±0.35			±0.2			±0.75			*		%
(X = 1V, -1V ≤ Z ≤ +1V)		±2.0			±1.0			±0.8			±2.0			*		%
(0.1V ≤ X ≤ 10V, -10V ≤ Z ≤ 10V)		±2.5			±1.0			±0.8			±2.5			*		%

MPY534

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SPECIAL FUNCTIONS

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## SPECIFICATIONS (CONT)

### ELECTRICAL

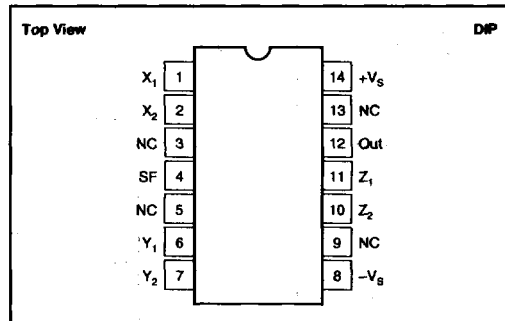
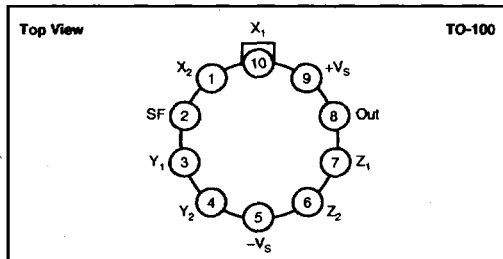
At  $T_A = +25^\circ\text{C}$  and  $V_S = \pm 15\text{VDC}$ , unless otherwise specified.

PARAMETER	MPY534J			MPY534K			MPY534L			MPY534S			MPY534T			UNITS
	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
<b>SQUARE PERFORMANCE</b>																
Transfer Function		*		$\frac{(X_1 - X_2)^2}{10V} + Z_2$				*			*			*		
Total Error ( $-10V \leq X \leq 10V$ )		0.6		$\pm 0.3$				$\pm 0.2$			$\pm 0.6$			$\pm 0.5$		%
<b>SQUARE-ROOTER PERFORMANCE</b>																
Transfer Function ( $Z_1 \leq Z_2$ )		*		$\sqrt{10V(Z_2 - Z_1)} + X_2$				*			*			*		
Total Error <sup>(1)</sup> ( $1V \leq Z \leq 10V$ )		$\pm 1.0$		$\pm 0.5$				$\pm 0.25$			$\pm 1.0$			$\pm 0.5$		%
<b>POWER SUPPLY</b>																
Supply Voltage:																
Rated Performance		*			$\pm 15$			*			*			*		VDC
Operating	*	*	*	$\pm 8$	$\pm 15$	$\pm 18$	*	*	*	*	$\pm 20$	*	*	$\pm 20$		VDC
Supply Current, Quiescent		*	*		4	6	*	*	*	*	*	*	*	*		mA
<b>TEMPERATURE RANGE</b>																
Operating	*		*	0		+70	*	*	*	-55		+125	-55		+125	$^\circ\text{C}$
Storage	*		*	-65		+150	*	*	*	*	*	*	*	*	*	$^\circ\text{C}$

\* Specifications same as MPY534K.

NOTES: (1) Figures given are percent of full scale,  $\pm 10V$  (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.

### PIN CONFIGURATIONS



### ABSOLUTE MAXIMUM RATINGS

PARAMETER	MPY534J, K, L	MPY534S, T
Power Supply Voltage	$\pm 18$	$\pm 20$
Power Dissipation	500mW	*
Output Short-Circuit to Ground	Indefinite	*
Input Voltage (all X, Y and Z)	$\pm V_S$	*
Operating Temperature Range	$0^\circ\text{C}$ to $+70^\circ\text{C}$	$-55^\circ\text{C}$ to $+125^\circ\text{C}$
Storage Temperature Range	$-65^\circ\text{C}$ to $+150^\circ\text{C}$	*
Lead Temperature (soldering, 10s)	$+300^\circ\text{C}$	*

\* Specification same as for MPY534K.

### 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.

### PACKAGE/ORDERING INFORMATION

PRODUCT	PACKAGE	PACKAGE DRAWING NUMBER <sup>(1)</sup>	TEMPERATURE RANGE
MPY534JD	Ceramic DIP	169	$0^\circ\text{C}$ to $+70^\circ\text{C}$
MPY534JH	Metal TO-100	007	$0^\circ\text{C}$ to $+70^\circ\text{C}$
MPY534KD	Ceramic DIP	169	$0^\circ\text{C}$ to $+70^\circ\text{C}$
MPY534KH	Metal TO-100	007	$0^\circ\text{C}$ to $+70^\circ\text{C}$
MPY534LD	Ceramic DIP	169	$0^\circ\text{C}$ to $+70^\circ\text{C}$
MPY534LH	Metal TO-100	007	$0^\circ\text{C}$ to $+70^\circ\text{C}$
MPY534SD	Ceramic DIP	169	$-55^\circ\text{C}$ to $+125^\circ\text{C}$
MPY534SH	Metal TO-100	007	$-55^\circ\text{C}$ to $+125^\circ\text{C}$
MPY534TD	Ceramic DIP	169	$-55^\circ\text{C}$ to $+125^\circ\text{C}$
MPY534TH	Metal TO-100	007	$-55^\circ\text{C}$ to $+125^\circ\text{C}$

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

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