

## NJM4200

The NJM4200 is the industry's first integrated circuit multiplier to have complete compensation for nonlinearity, the primary source of error and distortion. This is also the first IC multiplier to have three on-board operational amplifiers designed specifically for use in multiplier logging circuits. These specially-designed amplifiers are frequency compensated for optimum AC response in a logging circuit; the heart of a multiplier, and can therefore provide superior AC response in comparison to other analog multipliers.

Versatility is unprecedented; this is the first IC multiplier that can be used in a wide variety of applications without sacrificing accuracy. Four-quadrant multiplication, one-quadrant division or square-rooting, and RMS-to-DC conversion can all be easily implemented with predictable accuracy. The nonlinearity compensation is not just trimmed at a single temperature, it is designed to provide compensation over the full temperature range. This nonlinearity compensation combined with the low gain and offset drift inherent in a well-designed monolithic chip provides a very low tempco on accuracy.

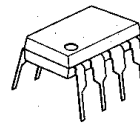
The excellent linearity and versatility were achieved through circuit design rather than special grading or trimming therefore unit cost is very low. Analog multipliers can now be used in application where price was previously an inhibiting factor.

The NJM4200 is ideal for use in low-distortion audio modulation circuits, voltage-controlled active filters, and precision oscillators.

### ■ Features

- High accuracy
  - Non-linearity 0.1% maximum
  - Temperature coefficient 0.005%/°C maximum
- Multiple functions
  - Multiply, divide, square, square root, RMS-to-DC conversion, AGC, and modulate/demodulate
- Wide bandwidth 4MHz

### ■ Package Outline



NJM4200D

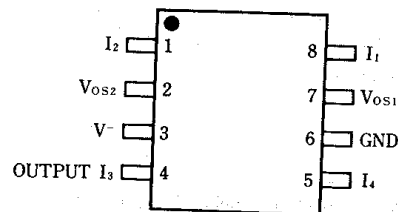


NJM4200M

### ■ Absolute Maximum Ratings (Ta=25°C)

Supply Voltage	V <sup>-</sup>	-22V
Power Dissipation	P <sub>D</sub> (D-Type)	500mW
	(M-Type)	300mW
Input Current	I <sub>IN</sub>	-5mA
Operating Temperature Range	T <sub>opr</sub>	-20~+75°C
Storage Temperature Range	T <sub>stg</sub>	-40~+125°C

### ■ Connection Diagram



■ **Electrical Characteristics** ( $T_a=25^\circ\text{C}$ ,  $V^-=-15\text{V}$  unless otherwise noted)

Parameter	Symbol	Test Conditions	NJM4200			Unit
			Min.	Typ.	Max.	
Input range ( $I_1, I_2$ and $I_4$ )	$I_{IN}$		1.0		1000	$\mu\text{A}$
Total error as multiplier						
Untrimmed	—				$\pm 3.0$	%
With external trim	—				$\pm 0.5$	%
Vs temperature	—			$\pm 0.005$		$\% / ^\circ\text{C}$
Vs supply ( $-9$ to $-18\text{V}$ )	—			$\pm 0.1$		$\% / \text{V}$
Nonlinearity	—	$50\mu\text{A} < I < 250\mu\text{A}$			$\pm 0.3$	%
Input offset voltage	$V_{10}$	$I_1=I_2=I_4=150\mu\text{A}$			$\pm 10$	mV
Input bias current	$I_{IB}$	$I_1=I_2=I_4=150\mu\text{A}$			500	nA
Average temperature coefficient of input offset voltage	—	$I_1=I_2=I_4=150\mu\text{A}$			$\pm 100$	$\mu\text{V} / ^\circ\text{C}$
Output current range ( $I_3$ )	$I_0$	(Note 1)	1.0		1000	$\mu\text{A}$
Frequency response, $-3$ dB	$f_R$			4		MHz
Supply voltage range	$V^-$		$-9$	$-15$	$-18$	V
Supply current	$I_{CC}$	$I_1=I_2=I_4=150\mu\text{A}$ , $T_a=25^\circ\text{C}$			4	mA

Note 1: These specifications apply with output ( $I_3$ ) connected to an op amp summing junction. If desired, the output ( $I_3$ ) at pin (4) can be used to drive a resistive load directly. The resistive load should be less than 700 ohms and must be pulled up to a positive supply such that the voltage on pin (3) stays within a range of 0 to  $+5\text{V}$ .