

intech

ADVANCED ANALOG

A-701, A-702

FEATURES:

- Slew Rate 90 V/ μ s typ
- Accuracy 0.5% typ
- Nonlinearity 0.4%
- Small Size, 1.5 x 1.5 x 0.4"

HIGH SPEED, FOUR QUADRANT MULTIPLIER MODULES

DESCRIPTION:

The Models A-701 and A-702 are high-speed, four quadrant multiplier modules using the variable transconductance principle. They also are useful for dividing, square rooting, squaring, frequency doubling and other mathematical computations. Division can be accomplished with the A-701 and A-702 with the addition of only one external potentiometer thereby eliminating the need for an external amplifier. The model A-702 has an internal trim accuracy of 1% and can be externally trimmed to an accuracy better than 0.5%, (Fig. 1).

As can be noted from Fig. 1, accuracies much better than 0.5% can be obtained whenever the requirement is less than full scale, particularly in the range of a 5 V difference between X and Y, an accuracy approaching 0.1% can be realized.

The addition of an internal amplifier suitable for use in divider applications greatly enhances the versatility of the A-701 and A-702, Figure 2. This allows the maximum usage of the module in the

minimum amount of space, without the added complication and expense of finding suitable external components.

Some definition of two important parameters of a high speed multiplier module such as the A-701 and A-702 need explanation. Slew rate is measured from worst case conditioning where input changes on either input are 10 V and is measured from 30% to 70% points. In the case of the A-701 and A-702 this rate is better than 80 V/ μ s. Settling time is also measured at worst case (10 V change in input) and is defined as the total time required from start of change to some stated percentage of final value. In the case of the A-701 and A-702 the settling time to 1% of final value is 0.4 μ s for X or Y input changes. Therefore, if the X input were assumed to be at a value of 10V and the Y input were instantaneously changed from -5 V to +5 V, the output would achieve 1% of the final value 0.4 μ s later.

X INPUT (volts)	Y INPUT (volts)	OUTPUT ERROR (millivolts)
-10	+10	+26
-5	-1	-0.8
-1	+0.5	+2.4
-0.5	+5	+1
+0.5	-5	-2.5
+1	-0.5	-4
+5	+1	+16
+10	-10	+51

Figure 1 TYPICAL OUTPUT ERROR (mV) vs X AND Y INPUT VOLTAGE

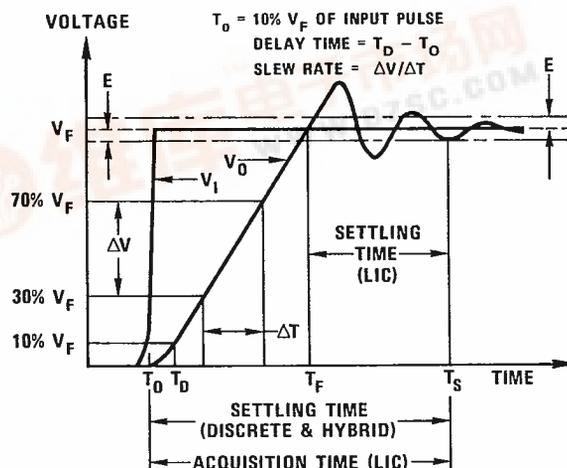


Figure 2 WAVEFORMS FOR SLEW RATE AND SETTLING TIME

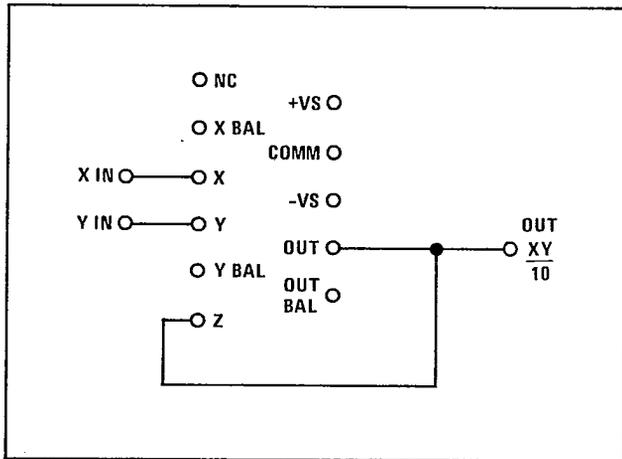


SPECIFICATIONS (at +25°C and ±15 VDC) MODELS A-701 and A-702

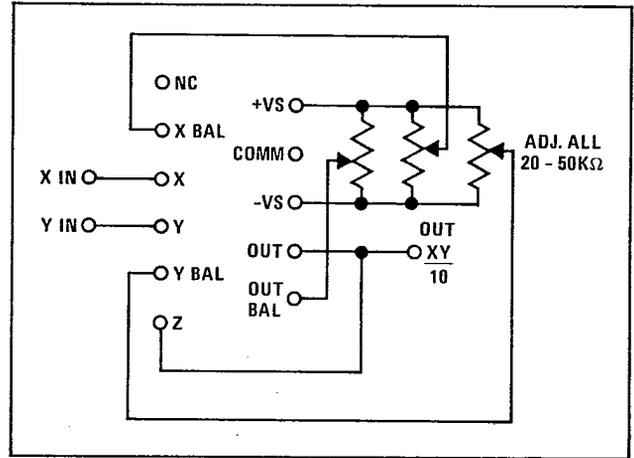
MODEL	X	Y	MIN	TYP	MAX	UNIT
Output Function				XY/10		
Error (internal trim)	±10 V	±10 V			/1	%
Error (external trim)	±10 V	±10 V		0.5		%
Accuracy vs Temp, 0 to 60°C	±10 V	±10 V		0.02	0.04*	%
Accuracy vs Supply	±10 V	±10 V		0.03		%/%
Initial Error	±10 V	±10 V			0.5	%
Avg. vs Temp, 0 to 60°C				0.025		%/°C
Avg. vs Supply				0.03		%/%
Output Offset						
Initial	0	0			20	mV
Avg. vs Temp, 0 to 60°C	0	0		1.0	1.5*	mV/°C
Avg. vs Supply	0	0		1		mV/%
Non-Linearity						
X Input	20 V p-p**	±10 V		0.4		%
Y Input	±10 V	20 V p-p**		0.4		%
Feedthrough	0	20 V p-p**		40	50	mV
	20 V p-p**	0		40		mV
BANDWIDTH						
-3 dB Small Signal			4	5		MHz
Slew Rate, -5 V to +5 V						
30 to 70%			80	90		V/μs
Small Signal Amplitude error				1		%
Small Signal Vector Error				1		%
Settling Time	-5 to +5 V step	±10 V		0.40		μs
Differential Phase						
Shift ($\theta_X - \theta_Y$) @ 1 MHz				1		°
Overload Recovery				0.15		μs
OUTPUT CHARACTERISTICS						
Noise, 10 Hz to 10 kHz	0	0		0.25		mV rms
10 Hz to 5 MHz	0	0		1.5		mV rms
Output Voltage			±10			V
Output Current			±5			mA
Load Capacitance			0.001	0.01		μF
INPUT CHARACTERISTICS						
Input Bias Current, X Y input				-2	-10	μA
Input Bias Current, Z input				-100		μA
Input Impedance, X, Y input			0.5	1		MΩ
Input Impedance, Z input				10		kΩ
Input voltage for rated acc.					10.3	V
Absolute max input					16	V
POWER SUPPLY						
Rated Performance			±14		±16	V
Derated specifications			±12		±18	V
Quiescent Current				±18		mA
TEMPERATURE RANGE						
Rated Performance			0		+60	°C
Derated specifications			-25		+85	°C
Storage			-55		+125	°C

*A-702 only

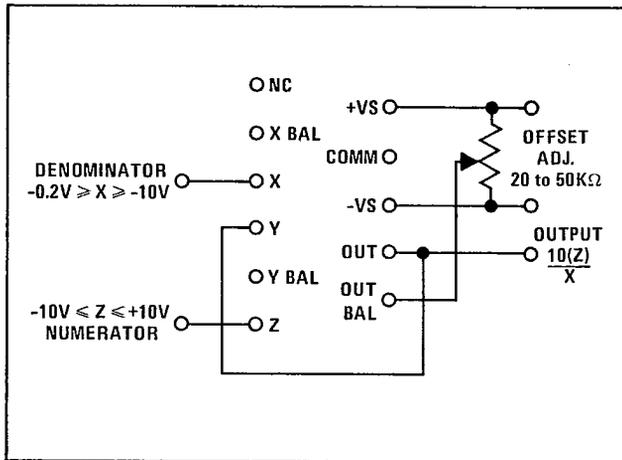
**At 50 Hz



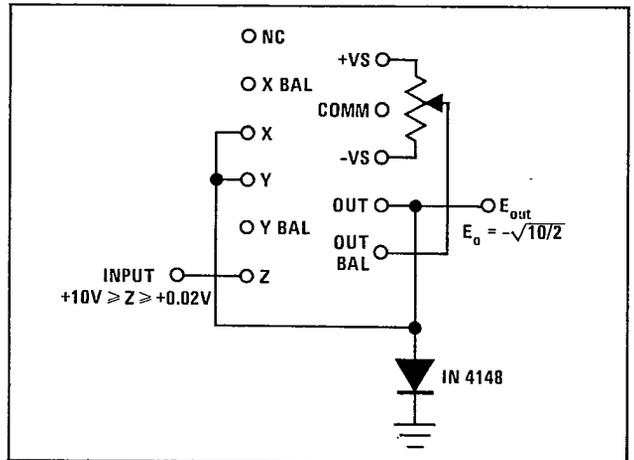
MULTIPLIER (internal trim)



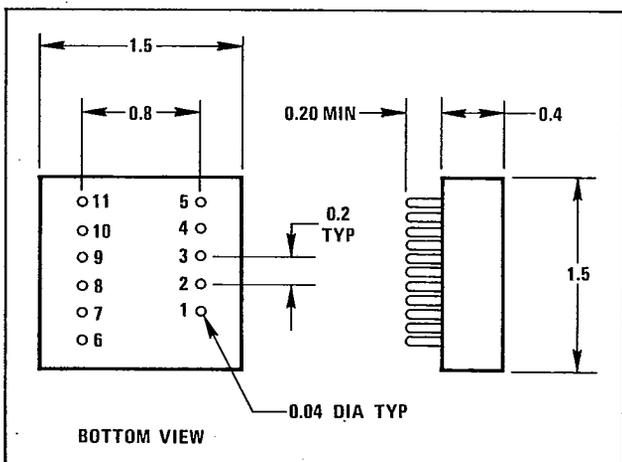
MULTIPLIER (external trim)



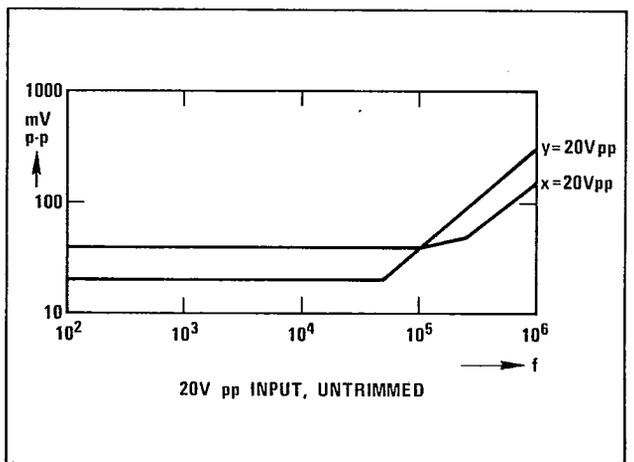
DIVIDER



SQUARE ROOTING



OUTLINE DIMENSIONS



MULTIPLIER FEEDTHROUGH AT 20V p'-p INPUT, UNTRIMMED

2-0383