

Wideband Four Quadrant Current Output Analog Multiplier

March 1993

Features

- Low Multiplication Error 1.5%
- Input Bias Currents 8 μ A
- Y Input Feedthrough @ 5MHz -50dB
- Wide X and Y Channel Bandwidth 100MHz

Applications

- Military Avionics
- Missile Guidance Systems
- Medical Imaging Displays
- Video Mixers
- Sonar AGC Processors
- Radar Signal Conditioning
- Voltage Controlled Amplifier
- Vector Generator

Ordering Information

PART NUMBER	TEMPERATURE RANGE	PACKAGE
HA3-2557-9	-40°C to +85°C	16 Lead Plastic DIP
HA9P2557-9	-40°C to +85°C	16 Lead Widebody SOIC
HA1-2557-9	-40°C to +85°C	16 Lead Ceramic DIP

Description

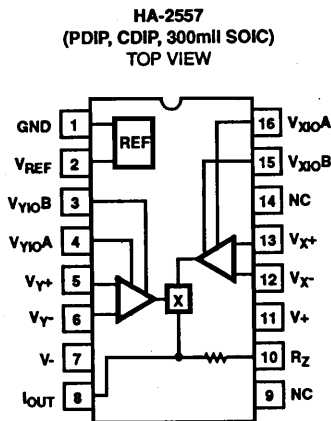
The HA-2557 is a monolithic, high speed, four quadrant, analog multiplier constructed in Harris' Dielectrically Isolated High Frequency Process. The high frequency performance of the HA-2557 rivals the best analog multipliers currently available including hybrids.

The single-ended current output of the HA-2557 has a 100MHz signal bandwidth ($R_L = 50\Omega$). High bandwidth and low distortion make this part an ideal component in video systems. The suitability for precision video applications is demonstrated further by low multiplication error (1.5%), low feedthrough (-50dB), and differential inputs with low bias currents (8 μ A). The HA-2557 is also well suited for mixer circuits as well as AGC applications for sonar, radar, and medical imaging equipment.

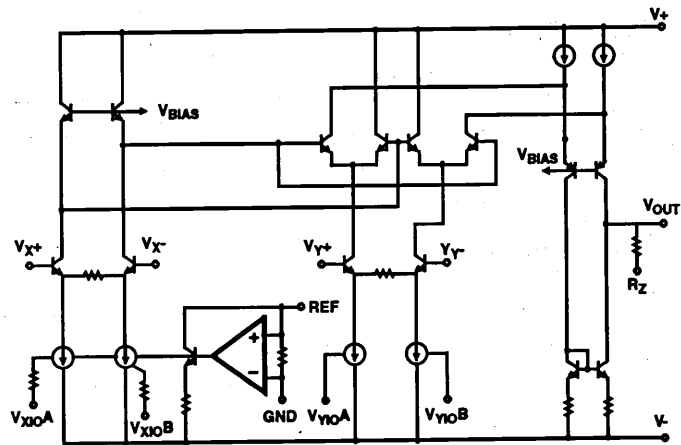
The current output of the HA-2557 allows it to achieve higher bandwidths than voltage output multipliers. Full scale output current is trimmed to 1.6mA. An internal 2500 Ω feedback resistor is also provided to accurately convert the current, if desired, to a full scale output voltage of $\pm 4V$. The HA-2557 is not limited to multiplication applications only; frequency doubling and power detection are also possible.

For MIL-STD-883 compliant product consult the HA-2557/883 datasheet.

Pinout



Schematic



CAUTION: These devices are sensitive to electrostatic discharge. Users should follow proper I.C. Handling Procedures.
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File Number 2478.3

Specifications HA-2557

Absolute Maximum Ratings (Note 1)

Voltage Between V+ and V- Terminals	35V
Differential Input Voltage	6V
Output Current	3mA
Junction Temperature	+175°C
Junction Temperature (Plastic Packages)	+150°C
Lead Temperature (Soldering 10 Sec.)	+300°C

Operating Conditions

Operating Temperature Range	$-40^{\circ}\text{C} \leq T_A \leq +85^{\circ}\text{C}$
HA-2557-9	$-40^{\circ}\text{C} \leq T_A \leq +85^{\circ}\text{C}$
Storage Temperature Range	$-65^{\circ}\text{C} \leq T_A \leq +150^{\circ}\text{C}$

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

Electrical Specifications V+ = +15V, V- = -15V, Unless Otherwise Specified

PARAMETER	TEMP	HA-2557-9			UNITS
		MIN	TYP	MAX	
MULTIPLIER PERFORMANCE					
Multiplication Error (Note 2)	+25°C	-	1.5	3	%FS
	Full	-	3.0	6	%FS
Multiplication Error Drift	Full	-	0.003	-	%/°C
Linearity (V _X , V _Y = ±4V)	+25°C	-	0.1	0.25	%
Scale Factor	+25°C	-	10	-	kV-Ω
THD+N (Note 3)	+25°C	-	0.03	-	%
Output Offset Current	+25°C	-	2.4	6	μA
	Full	-	5.6	8	μA
V_X, V_Y					
Input Offset Voltage	+25°C	-	4	15	mV
	Full	-	8	20	mV
Average Offset Voltage Drift	Full	-	35	-	μV/°C
Input Bias Current	+25°C	-	8	15	μA
	Full	-	12	25	μA
Input Offset Current	+25°C	-	0.5	2	μA
	Full	-	1.0	3	μA
Differential Input Resistance	+25°C	-	720	-	kΩ
Small Signal Bandwidth (-3dB) (Note 5)	+25°C	-	100	-	MHz
Y Input Feedthrough (Note 8)	+25°C	-	-50	-	dB
Differential Input Range	+25°C	±4	-	-	V
Common Mode Range	+25°C	-	±9	-	V
CMRR (Note 6)	Full	65	78	-	dB
V_X, V_Y TRANSIENT RESPONSE (Note 5)					
Rise Time	+25°C	-	5	-	ns
Propagation Delay	+25°C	-	3	-	ns
OUTPUT CHARACTERISTICS					
Full Scale Output Compliance Voltage	Full	-	4	-	V
Full Scale Output Current	+25°C	-	1.6	-	mA
Internal Resistor (R _I)	+25°C	-	2500	-	Ω
Output Resistance (±10V)	+25°C	1.0	1.5	-	MΩ

Specifications HA-2557

Electrical Specifications $V_+ = +15V, V_- = -15V$, Unless Otherwise Specified (Continued)

PARAMETER	TEMP	HA-2557-9			UNITS
		MIN	TYP	MAX	
Output Capacitance	+25°C	-	6.5	-	pF
POWER SUPPLY					
+PSRR (Note 7)	Full	65	80	-	dB
-PSRR (Note 7) (-)	Full	45	55	-	dB
I_{CC}	Full	-	13	17	mA

NOTES:

1. Absolute maximum ratings are limiting values, applied individually, beyond which the servicability of the circuit may be impaired. Functional operation under any of these conditions is not necessarily implied.
2. Error is percent of full scale, 1% = 16 μ A.
3. $f = 10\text{kHz}$, $V_Y = 1V_{RMS}$, $V_X = 4V$.
4. $V_X = 0V$, $V_Y = 0V$.
5. $R_L = 50\Omega$.
6. $V_{CM} = 0$ to $\pm 9V$.
7. $V_S = \pm 12V$ to $\pm 17V$.
8. $f = 5\text{MHz}$. Relative to full scale output.

Test Circuits

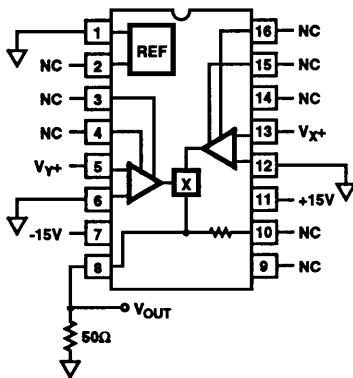
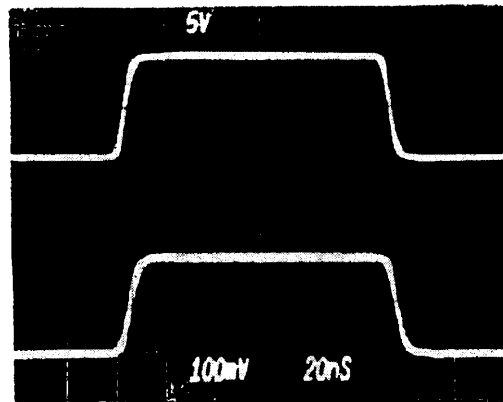


FIGURE 1. AC AND TRANSIENT RESPONSE TEST CIRCUIT

V_Y TRANSIENT RESPONSE
 Vertical Scale: Top 5V/Div. Bottom: 100mV/Div.
 Horizontal Scale: 20ns/Div.



Applications Information

Operation at Reduced Supply Voltages

The HA-2557 will operate over a range of supply voltages, $\pm 5V$ to $\pm 15V$. Use of supply voltages below $\pm 12V$ will cause degradation of electrical parameters.

Offset Adjustment

The channel offset voltage may be nulled by using a 20K potentiometer between the V_{Y10} or V_{X10} adjust pin A and B and connecting the wiper to V_- . Reducing the channel offset voltage will reduce AC feedthrough and improve the multiplication error.