HARRIS SEMICONDUCTOR

HA-2546/883

Wideband Two Quadrant Analog Multiplier (Voltage Output)

July 1994

Features

- This Circuit is Processed in Accordance to MIL-STD-883 and is Fully Conformant Under the Provisions of Paragraph 1.2.1.
- High Speed Voltage Output..... 300V/μs (Min)
- Low Multiplication Error .....3.0% (Max)
  1.6% (Typ)
- Input Bias Currents ..... 5μA (Max)
  1.2μA (Typ)
- Signal Input Feedthrough .....-52dB (Typ)
- Wide Signal Bandwidth.....30MHz (Typ)
- Wide Control Bandwidth.....17MHz (Typ)
- Gain Flatness to 5MHz.....0.10dB (Typ)

Applications

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

Description

The HA-2546/883 is a monolithic, high speed, two quadrant, analog multiplier constructed in the Harris Dielectrically Isolated High Frequency Process. The HA-2546/883 has a voltage output with a 30MHz signal bandwidth, 300V/μs slew rate and a 17MHz control input bandwidth. High bandwidth and slew rate make this part an ideal component for use in video systems. The suitability for precision video applications is demonstrated further by the 0.1dB gain flatness at 5MHz, 1.6% multiplication error, -52dB feedthrough and differential inputs with 1.2μA bias currents. The HA-2546/883 also has low differential gain (0.1% typ.) and phase (0.1° typ.) errors.

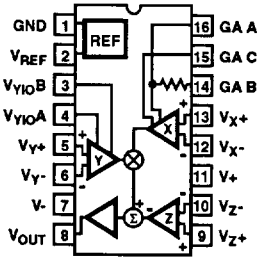
The HA-2546/883 is well suited for AGC circuits as well as mixer applications for sonar, radar, and medical imaging equipment. The voltage output of the HA-2546/883 simplifies many designs by eliminating the current-to-voltage conversion stage required for current output multipliers.

Ordering Information

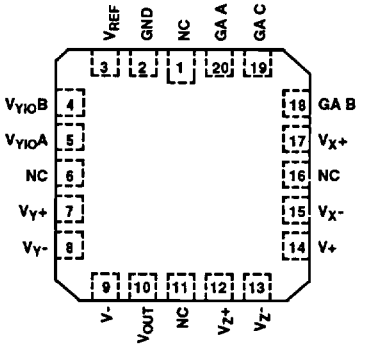
PART NUMBER	TEMPERATURE RANGE	PACKAGE
HA1-2546/883	-55°C to +125°C	16 Lead CerDIP
HA4-2546/883	-55°C to +125°C	20 Lead Ceramic LCC

Pinouts

HA-2546/883
(CERDIP)
TOP VIEW



HA-2546/883
(CLCC)
TOP VIEW



8 ANALOG MULTIPLIERS

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

Spec Number **511050-883**

File Number **2444.1**

Absolute Maximum Ratings

Voltage Between V+ and V- 35V
Differential Input Voltage 6V
Output Current 60mA
Junction Temperature ..... +175°C
Storage Temperature Range ..... $-65°C \le T_A \le +150°C$
ESD Rating ..... <2000V
Lead Temperature (Soldering 10s) ..... +300°C

Thermal Information

Thermal Resistance	θ_{JA}	θ_{JC}
CerDIP Package	80°C/W	25°C/W
Ceramic LCC	61°C/W	12°C/W

Maximum Package Power Dissipation
CerDIP Package at +75°C 1.25W
Ceramic LCC Package at +75°C 1.64W
Package Power Dissipation Derating Factor above +75°C
CerDIP Package ..... 12mW/°C
Ceramic LCC Package ..... 16mW/°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.

Operating Conditions

Operating Temperature Range ..... -55°C to +125°C
Operating Supply Voltage ..... ±8V to ±15V

TABLE 1. DC ELECTRICAL PERFORMANCE CHARACTERISTICS

Device Tested at: $V_{SUPPLY} = \pm15V$, $R_{LOAD} = 1k\Omega$, $C_{LOAD} = 50pF$, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	TEMPERATURE	LIMITS MIN	LIMITS MAX	UNITS
Multiplication Error	ME	$V_Y = \pm5V$	1	+25°C	-3	3	%FS
			2, 3	+125°C, -55°C	-5	5	%FS
Scale Factor Error	SF		1	+25°C	-5	5	%
			2, 3	+125°C, -55°C	-5	5	%
Common Mode Range	+CMR		1	+25°C	5	-	V
			2, 3	+125°C, -55°C	5	-	V
	-CMR		1	+25°C	-	-5	V
			2, 3	+125°C, -55°C	-	-5	V
Input Offset Voltage (V_Y)	$V_{IO}(V_Y)$	$V_{CM} = 0V$	1	+25°C	-10	10	mV
			2, 3	+125°C, -55°C	-15	15	mV
Input Bias Current (V_Y)	$I_B(V_Y)$	$V_{CM} = 0V$	1	+25°C	-15	15	µA
			2, 3	+125°C, -55°C	-20	20	µA
Input Offset Current (V_Y)	$I_{IO}(V_Y)$	$V_{CM} = 0V$	1	+25°C	-2	2	µA
			2, 3	+125°C, -55°C	-3	3	µA
Common Mode (V_Y) Rejection Ratio	+CMRR(V_Y)	$V_Y = 0$ to +5V, $V_X = +2V$	1	+25°C	60	-	dB
			2, 3	+125°C, -55°C	60	-	dB
	-CMRR(V_Y)	$V_Y = 0$ to -5V, $V_X = +2V$	1	+25°C	60	-	dB
			2, 3	+125°C, -55°C	60	-	dB
Input Offset Voltage (V_X)	$V_{IO}(V_X)$	$V_{CM} = 0V$	1	+25°C	-2	2	mV
			2, 3	+125°C, -55°C	-15	15	mV
Input Bias Current (V_X)	$I_B(V_X)$	$V_{CM} = 0V$	1	+25°C	-2	2	µA
			2, 3	+125°C, -55°C	-5	5	µA
Input Offset Current (V_X)	$I_{IO}(V_X)$	$V_{CM} = 0V$	1	+25°C	-2	2	µA
			2, 3	+125°C, -55°C	-3	3	µA
Input Offset Voltage (V_Z)	$V_{IO}(V_Z)$	$V_X = 0V$, $V_Y = 0V$	1	+25°C	-15	15	mV
			2, 3	+125°C, -55°C	-15	15	mV
Output Voltage Swing	$+V_{OUT}$	$V_Y = +5V$, $V_X = +2.5V$	1	+25°C	5	-	V
			2, 3	+125°C, -55°C	5	-	V
	$-V_{OUT}$	$V_Y = -5V$, $V_X = +2.5V$	1	+25°C	-	-5	V
			2, 3	+125°C, -55°C	-	-5	V
Output Current	$+I_{OUT}$	$V_Y = +5V$, $V_X = +2.5V$	1	+25°C	20	-	mA
			2, 3	+125°C, -55°C	20	-	mA
	$-I_{OUT}$	$V_Y = -5V$, $V_X = +2.5V$	1	+25°C	-	-20	mA
			2, 3	+125°C, -55°C	-	-20	mA

TABLE 1. DC ELECTRICAL PERFORMANCE CHARACTERISTICS (Continued)

Device Tested at: V_{SUPPLY} = ±15V, R_{LOAD} = 1kΩ, C_{LOAD} = 50pF, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	TEMPERATURE	LIMITS MIN	LIMITS MAX	UNITS
Power Supply Rejection Ratio	+PSRR	ΔV_S = 3V, V+ = +15V, V- = -15V, V+ = +12V, V- = -15V	1	+25°C	58	-	dB
			2, 3	+125°C, -55°C	58	-	dB
	-PSRR	ΔV_S = 3V, V+ = +15V, V- = -15V, V+ = +15V, V- = -12V	1	+25°C	58	-	dB
			2, 3	+125°C, -55°C	58	-	dB
Quiescent Power Supply Current	$+I_{CC}$	$V_X = V_Y$ = 0V, I_{OUT} = 0mA	1	+25°C	29	-	mA
			2, 3	+125°C, -55°C	29	-	mA
	$-I_{CC}$	$V_X = V_Y$ = 0V, I_{OUT} = 0mA	1	+25°C	-	-29	mA
			2, 3	+125°C, -55°C	-	-29	mA

TABLE 2. AC ELECTRICAL PERFORMANCE CHARACTERISTICS

Table 2 Intentionally Left Blank. See AC Specifications in Table 3.

TABLE 3. ELECTRICAL PERFORMANCE CHARACTERISTICS

Device Tested at: V_{SUPPLY} = ±15V, R_{LOAD} = 1kΩ, C_{LOAD} = 50pF, Unless Otherwise Specified.

PARAMETER	SYMBOL	CONDITIONS	NOTES	TEMPERATURE	LIMITS MIN	LIMITS MAX	UNITS
Slew Rate	+SR	V_{OUT} = -5V to +5V, $V_X = 2V_{DC}$	1	+25°C	300	-	V/µs
			1	+125°C, -55°C	300	-	V/µs
	-SR	V_{OUT} = +5V to -5V, $V_X = 2V_{DC}$	1	+25°C	300	-	V/µs
			1	+125°C, -55°C	300	-	V/µs
Rise and Fall Time	TR	V_{OUT} = -100mV to +100mV $V_X = 2V_{DC}$	1, 3	+25°C	-	15	ns
			1, 3	+125°C, -55°C	-	17	ns
	TF	V_{OUT} = +100mV to -100mV $V_X = 2V_{DC}$	1, 3	+25°C	-	15	ns
			1, 3	+125°C, -55°C	-	17	ns
Overshoot	+OS	V_{OUT} = -100mV to +100mV $V_X = 2V_{DC}$	1	+25°C	-	30	%
			1	+125°C, -55°C	-	30	%
	-OS	V_{OUT} = +100mV to -100mV $V_X = 2V_{DC}$	1	+25°C	-	30	%
			1	+125°C, -55°C	-	30	%
Full Power Bandwidth	FPBW	V_{PEAK} = 5V, $V_X = 2V_{DC}$	1, 2	+25°C	9.5	-	MHz
			1, 2	+125°C, -55°C	9.5	-	MHz

NOTES:

1. Parameters listed in Table 3 are controlled via design or process parameters and are not directly tested at final production. These parameters are lab characterized upon initial design release, or upon design changes. These parameters are guaranteed by characterization based upon data from multiple production runs which reflect lot to lot and within lot variation.
2. Full Power Bandwidth guarantee based on Slew Rate measurement using FPBW = Slew Rate/($2\pi V_{PEAK}$).
3. Measured between 10% and 90% points.

TABLE 4. ELECTRICAL TEST REQUIREMENTS

MIL-STD-883 TEST REQUIREMENTS	SUBGROUPS (SEE TABLE 1)
Interim Electrical Parameters (Pre Burn-in)	1
Final Electrical Test Parameters	1(Note 1), 2, 3
Group A Test Requirements	1, 2, 3
Groups C and D Endpoints	1

NOTE:

1. PDA applies to Subgroup 1 only.

Die Characteristics

DIE DIMENSIONS:
79.9mils x 119.7mils x 19mils ± 1mils

METALLIZATION:
Type: Al, 1%Cu
Thickness: 16kÅ ± 2kÅ

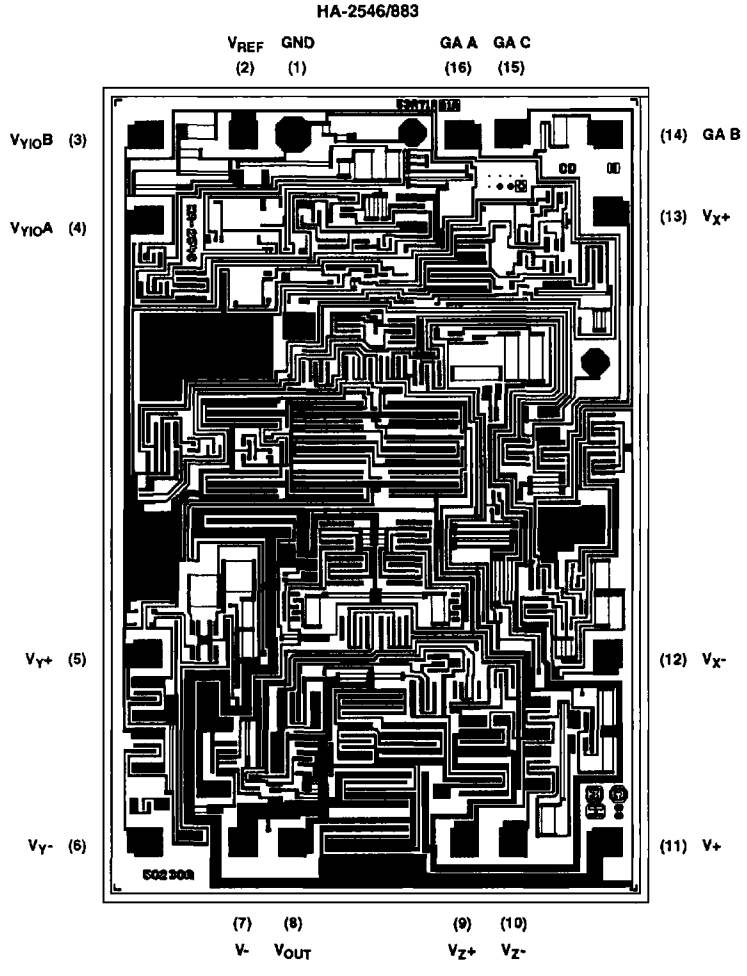
GLASSIVATION:
Type: Nitride (Si_3N_4) over Silox (SiO_2, 5% Phos)
Silox Thickness: 12kÅ ± 1.5kÅ
Nitride Thickness: 3.5kÅ ± 1.5kÅ

WORST CASE CURRENT DENSITY:
0.72 x 10^5 A/cm^2

TRANSISTOR COUNT: 87

Metallization Mask Layout

HA-2546/883



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