

## Radiation Hardened, Very Low Noise Quad Operational Amplifier

February 1998

### Features

- QML Qualified Per MIL-PRF-38535 Requirements
- Radiation Environment
  - Total Dose .....  $1 \times 10^5$  RAD(Si)
- Low Noise
  - At 1kHz .....  $4.3nV/\sqrt{Hz}$  (Typ)
  - At 1kHz .....  $0.6pA/\sqrt{Hz}$  (Typ)
- Low Offset Voltage..... 2.1mV (Max)
- High Slew Rate ..... 1.7V/ $\mu$ s (Min)
- Gain Bandwidth Product ..... 8.0MHz (Typ)

### Applications

- High Q, Active Filters
- Voltage Regulators
- Integrators
- Signal Generators
- Voltage References
- Space Environments

### Description

The HS-OP470ARH is a radiation hardened, monolithic quad operational amplifier that provides highly reliable performance in harsh radiation environments. Its excellent noise characteristics coupled with a unique array of dynamic specifications make this amplifier well-suited for a variety of satellite system applications. Dielectrically isolated, bipolar processing makes this device immune to Single Event Latch-up.

The HS-OP470ARH shows almost no change in offset voltage after exposure to 100K RAD(Si) gamma radiation, with only a minor increase in current. Complementing these specifications is a post radiation open loop gain in excess of 40kV/V.

This quad operational amplifier is available in an industry standard pinout, allowing for immediate interchangeability with most other quad operational amplifiers.

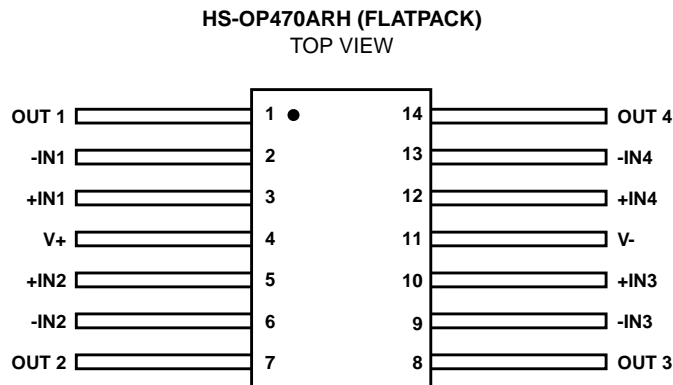
**Specifications for Rad Hard QML devices are controlled by the Defense Supply Center in Columbus (DSCC). SMD numbers must be used when ordering.**

**Detailed Electrical Specifications for this are contained in SMD 5962-98533. A "hot-link" is provided on our homepage with instructions for downloading.**  
<http://www.intersil.com/data/sm/index.htm>

### Ordering Information

SMD PART NUMBER	INTERSIL PART NUMBER	TEMP. RANGE (°C)	PACKAGE	CASE OUTLINE
5962R9853301VXC	HS9-OP470ARH-Q	-55 to 125	14 Ld Flatpack	CDFP3-F14
N/A	HS9-OP470ARH/Sample	25	14 Ld Flatpack	CDFP3-F14

### Pinout



# HS-OP470ARH

## Metallization Mask Layout

### DIE DIMENSIONS:

95 mils x 99 mils x 19 mils  $\pm 1$  mil  
(2420 $\mu$ m x 2530 $\mu$ m x 483 $\mu$ m  $\pm 25.4\mu$ m)

### METALLIZATION:

Type: Al, 1% Cu  
Thickness: 16k $\text{\AA}$   $\pm 2$ k $\text{\AA}$

### SUBSTRATE POTENTIAL (Powered Up):

Unbiased

### BACKSIDE FINISH:

Silicon

### PASSIVATION:

Type: Nitride (Si<sub>3</sub>N<sub>4</sub>) over Silox (SiO<sub>2</sub>, 5% Phos.)  
Silox Thickness: 12k $\text{\AA}$   $\pm 2$ k $\text{\AA}$   
Nitride Thickness: 3.5k $\text{\AA}$   $\pm 1.5$ k $\text{\AA}$

### WORST CASE CURRENT DENSITY:

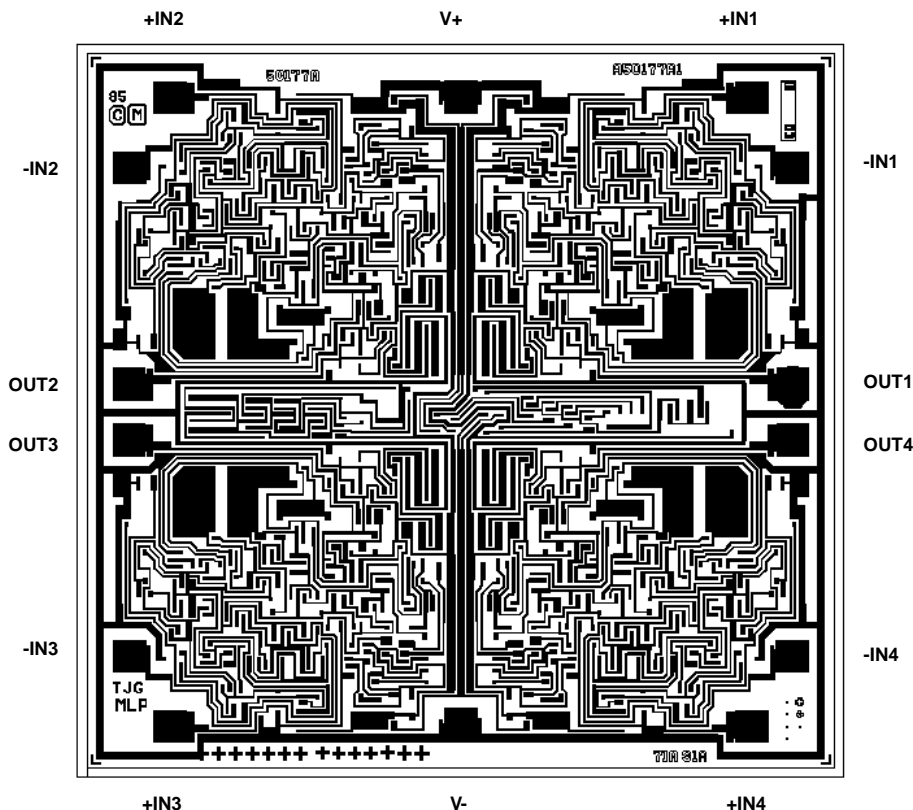
$< 2.0 \times 10^5$  A/cm<sup>2</sup>

### TRANSISTOR COUNT:

175

### PROCESS:

Bipolar Dielectric Isolation



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## Sales Office Headquarters

### NORTH AMERICA

Intersil Corporation  
P. O. Box 883, Mail Stop 53-204  
Melbourne, FL 32902  
TEL: (321) 724-7000  
FAX: (321) 724-7240

### EUROPE

Intersil SA  
Mercure Center  
100, Rue de la Fusee  
1130 Brussels, Belgium  
TEL: (32) 2.724.2111  
FAX: (32) 2.724.22.05

### ASIA

Intersil (Taiwan) Ltd.  
Taiwan Limited  
7F-6, No. 101 Fu Hsing North Road  
Taipei, Taiwan  
Republic of China  
TEL: (886) 2 2716 9310  
FAX: (886) 2 2715 3029