HS-OP470ARH, HS-OP470AEH

Radiation Hardened, Very Low Noise Quad Operational Amplifiers

FN4471
Rev.3.00
Sep 21, 2018

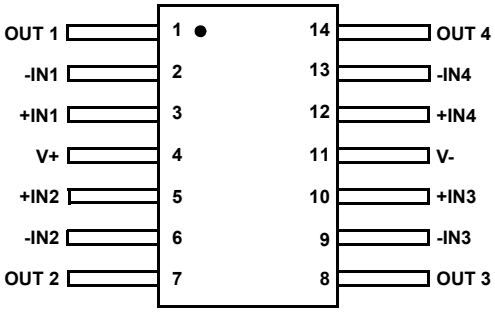
The HS-OP470ARH and HS-OP470AEH are radiation hardened, monolithic quad operational amplifiers that provide highly reliable performance in harsh radiation environments. Excellent noise characteristics coupled with a unique array of dynamic specifications make these amplifiers well-suited for a variety of satellite system applications. Dielectrically isolated, bipolar processing makes these devices immune to single event latch-up.

The HS-OP470ARH and HS-OP470AEH show almost no change in offset voltage after exposure to 100krad(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.

These quad operational amplifiers are available in an industry standard pinout, allowing for immediate interchangeability with most other quad operational amplifiers.

Pin Configuration

(14 LD FLATPACK)
TOP VIEW



Features

- Electrically screened to SMD # 5962-98533
- QML qualified per MIL-PRF-38535 requirements
- Radiation environment
  - High dose rate (50-300rad(Si)/s) . . . . . 100krad(Si)
  - Low dose rate (0.01rad(Si)/s) . . . . . .50krad(Si)
- Low noise
  - At 1kHz . . . . . 4.3nV/$\sqrt{Hz}$ (typical)
  - At 1kHz . . . . . 0.6pA/$\sqrt{Hz}$ (typical)
- Low offset voltage . . . . . 2.1mV (maximum)
- High slew rate . . . . . 1.7V/µs (minimum)
- Gain bandwidth product . . . . . .8.0MHz (typical)

Applications

- High Q, active filters
- Voltage regulators
- Integrators
- Signal generators
- Voltage references
- Space environments

Related Literature

For a full list of related documents, visit our website:

- HS-OP470ARH, HS-OP470AEH product pages

Ordering Information

ORDERING SMD NUMBER (Note 1)	PART NUMBER (Note 2)	TEMP. RANGE (°C)	PACKAGE (RoHS Compliant)	PKG. DWG. #
5962R9853301VXC	HS9-OP470ARH-Q	-55 to +125	14 Ld Flatpack	K14.A
5962R9853302VXC	HS9-OP470AEH-Q	-55 to +125	14 Ld Flatpack	K14.A
5962R9853301V9A	HS0-OP470ARH-Q	-55 to +125	Die	
5962R9853302V9A	HS0-OP470AEH-Q	-55 to +125	Die	
N/A	HS0-OP470ARH/SAMPLE (Note 3)	-55 to +125	Die	
N/A	HS0-OP470AEH/SAMPLE (Note 3)	-55 to +125	Die	
5962R9853301QXC	HS9-OP470ARH-8	-55 to +125	14 Ld Flatpack	K14.A
N/A	HS9-OP470ARH/PROTO (Note 3)	-55 to +125	14 Ld Flatpack	K14.A
N/A	HS9-OP470AEH/PROTO (Note 3)	-55 to +125	14 Ld Flatpack	K14.A
HS-OP470ARHEV1Z	HS-OP470ARHEV1Z (Note 4)	Evaluation Board		

1. Specifications for Rad Hard QML devices are controlled by the Defense Logistics Agency Land and Maritime (DLA). The SMD numbers listed must be used when ordering.
2. These Pb-free Hermetic packaged products employ 100% Au plate - e4 termination finish, which is RoHS compliant and compatible with both SnPb and Pb-free soldering operations.
3. The /PROTO and /SAMPLE are not rated or certified for Total Ionizing Dose (TID) or Single Event Effect (SEE) immunity. These parts are intended for engineering evaluation purposes only. The /PROTO parts meet the electrical limits and conditions across the temperature range specified in the DLA SMD and are in the same form and fit as the qualified device. The /SAMPLE die is capable of meeting the electrical limits and conditions specified in the DLA SMD at +25°C only. The /SAMPLE is a die and does not receive 100% screening across the temperature range to the DLA SMD electrical limits. These part types do not come with a certificate of conformance because there is no radiation assurance testing and they are not DLA qualified devices.
4. Evaluation board uses the /PROTO parts. The /PROTO parts are not rated or certified for Total Ionizing Dose (TID) or Single Event Effect (SEE) immunity.

Die Characteristics

DIE DIMENSIONS:

95 mils x 99 mils x 19 mils ±1 mil
(2420µm x 2530µm x 483µm ±25.4µm)

METALLIZATION:

Type: Al, 1% Cu
Thickness: 16kÅ ±2kÅ

SUBSTRATE POTENTIAL (Powered Up):

Unbiased

BACKSIDE FINISH:

Silicon

PASSIVATION:

Type: Nitride (SI3N4) over Silox (SIO2, 5% Phos.)
Silox Thickness: 12kÅ ±2kÅ
Nitride Thickness: 3.5kÅ ±1.5kÅ

WORST CASE CURRENT DENSITY:

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

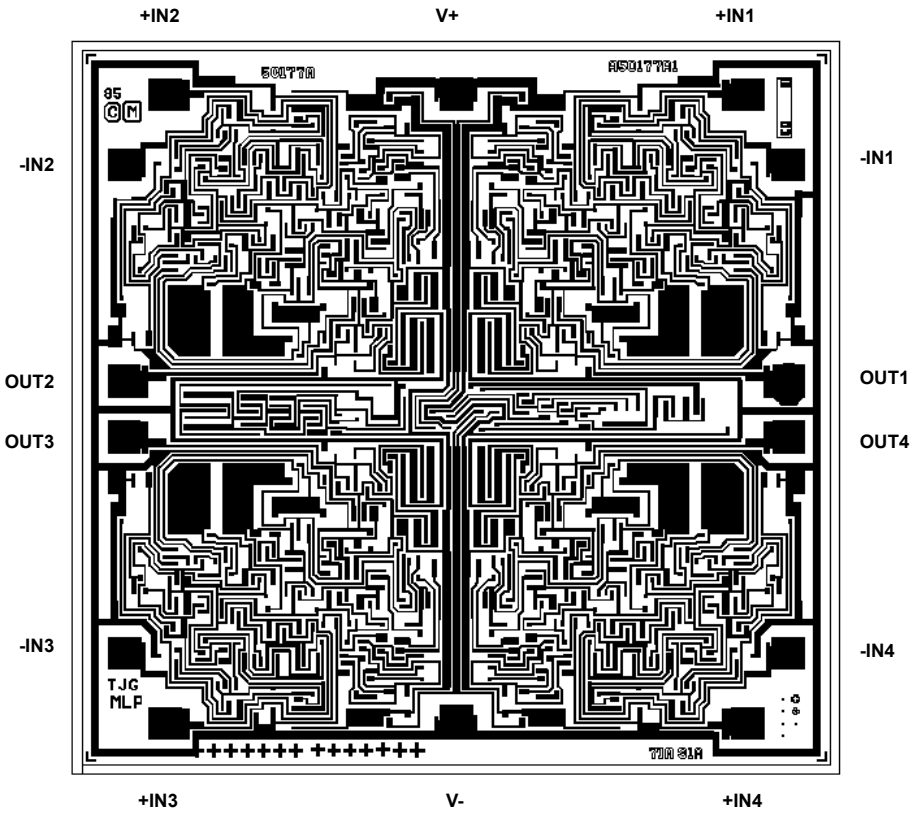
TRANSISTOR COUNT:

175

PROCESS:

Bipolar Dielectric Isolation

Metallization Mask Layout



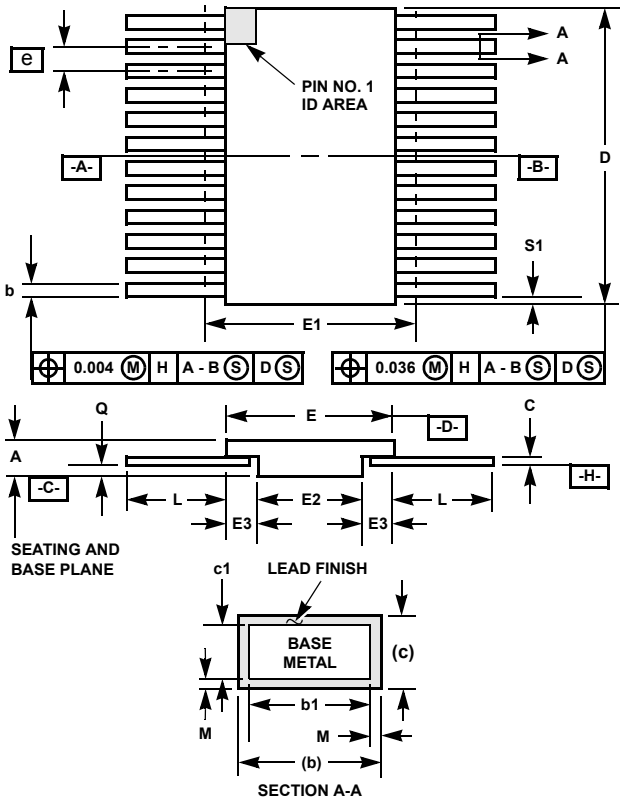
Revision History

The revision history provided is for informational purposes only and is believed to be accurate, but not warranted. Please visit our website to make sure you have the latest revision.

DATE	REVISION	CHANGE
Sep 21, 2018	FN4471.3	Added Related Literature section. Updated the Ordering Information table by adding HS0-OP470AEH/SAMPLE and HS0-OP470AEH/PROTO parts, removing part marking column, and adding Notes 3 and 4. Added Revision History section. Updated Disclaimer.

Ceramic Metal Seal Flatpack Packages (Flatpack)

For the most recent package outline drawing, see K14.A.



K14.A MIL-STD-1835 CDFP3-F14 (F-2A, CONFIGURATION B)
14 LEAD CERAMIC METAL SEAL FLATPACK PACKAGE

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.045	0.115	1.14	2.92	-
b	0.015	0.022	0.38	0.56	-
b1	0.015	0.019	0.38	0.48	-
c	0.004	0.009	0.10	0.23	-
c1	0.004	0.006	0.10	0.15	-
D	-	0.390	-	9.91	3
E	0.235	0.260	5.97	6.60	-
E1	-	0.290	-	7.11	3
E2	0.125	-	3.18	-	-
E3	0.030	-	0.76	-	7
e	0.050 BSC		1.27 BSC		-
k	0.008	0.015	0.20	0.38	2
L	0.270	0.370	6.86	9.40	-
Q	0.026	0.045	0.66	1.14	8
S1	0.005	-	0.13	-	6
M	-	0.0015	-	0.04	-
N	14		14		-

Rev. 0 5/18/94

NOTES:

1. Index area: A notch or a pin one identification mark shall be located adjacent to pin one and shall be located within the shaded area shown. The manufacturer's identification shall not be used as a pin one identification mark. Alternately, a tab (dimension k) may be used to identify pin one.
2. If a pin one identification mark is used in addition to a tab, the limits of dimension k do not apply.
3. This dimension allows for off-center lid, meniscus, and glass overrun.
4. Dimensions b1 and c1 apply to lead base metal only. Dimension M applies to lead plating and finish thickness. The maximum limits of lead dimensions b and c or M shall be measured at the centroid of the finished lead surfaces, when solder dip or tin plate lead finish is applied.
5. N is the maximum number of terminal positions.
6. Measure dimension S1 at all four corners.
7. For bottom-brazed lead packages, no organic or polymeric materials shall be molded to the bottom of the package to cover the leads.
8. Dimension Q shall be measured at the point of exit (beyond the meniscus) of the lead from the body. Dimension Q minimum shall be reduced by 0.0015 inch (0.038mm) maximum when solder dip lead finish is applied.
9. Dimensioning and tolerancing per ANSI Y14.5M - 1982.
10. Controlling dimension: INCH.

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