

HS-3530ARH, HS-3530AEH

Radiation Hardened Programmable Low Power Op Amps

FN4653

Rev 4.00

Jun 18, 2018

The [HS-3530ARH](#) and [HS-3530AEH](#) are low power operational amplifiers, which are internally compensated monolithic devices offering a wide range of performance specifications. Parameters such as power dissipation, slew rate, bandwidth, noise, and input DC parameters are programmed by selecting an external resistor or current source. Supply voltages as low as $\pm 3V$ may be used with little degradation of AC performance. Operation from $-55^{\circ}C$ to $+125^{\circ}C$ is ensured.

A major advantage of the HS-3530ARH, HS-3530AEH is that operating characteristics remain virtually constant over a wide supply range ($\pm 3V$ to $\pm 15V$), allowing the amplifiers to offer maximum performance in almost any system, including battery operated equipment. A primary application for these devices is in active filtering and conditioning for a wide variety of signals that differ in frequency and amplitude. By modulating the set current, they can be used for designs such as current controlled oscillators/modulators, sample and hold circuits, and variable active filters.

Related Literature

For a full list of related documents, visit our website

- [HS-3530ARH](#), [HS-3530AEH](#) product pages

Features

- Radiation performance
 - Single event latch-up Immune (RSG DI Process)
 - High dose rate (50-300rad(Si)/s) 300krad(Si)
 - Low dose rate (0.01rad(Si)/s) 50krad(Si)
- Wide range AC programming
 - Slew rate 0.025 to 0.1V/ μ s
 - Gain X bandwidth 30kHz to 750kHz
- Wide range DC programming
 - Power supply range $\pm 3.0V$ to $\pm 15V$
- Supply current 15 μ A to 150 μ A
- Output current 0.25mA to 2.5mA
- Quiescent power. 4.8mW (max)
- Dielectrically isolated device islands
- Short-circuit protection
- Full $-55^{\circ}C$ to $+125^{\circ}C$ military temperature range
- Electrically screened to SMD [5962-95687](#)

Ordering Information

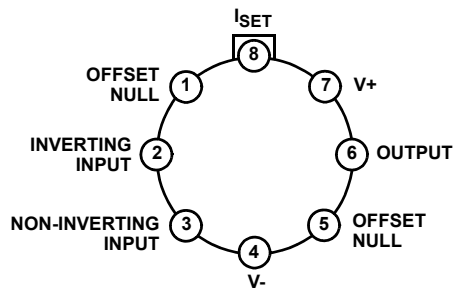
ORDERING NUMBER (Notes 1, 2)	PART NUMBER	Radiation Hardness		TEMP. RANGE (°C)	PACKAGE (RoHS COMPLIANT)	PKG. DWG. #
		HDR	LDR			
5962F9568701QGA	HS2-3530ARH-8	100krad(Si)	-	-55 to +125	8 LD METAL CAN	T8.C
5962F9568701VGA	HS2-3530ARH-Q	100krad(Si)	-	-55 to +125	8 LD METAL CAN	T8.C
5962F9568702VGA	HS2-3530AEH-Q	100krad(Si)	50krad(Si)	-55 to +125	8 LD METAL CAN	T8.C
5962F9568701VXC	HS9-3530ARH-Q	100krad(Si)	-	-55 to +125	10 LD FLATPACK, SOLDER SL	K10.A
5962F9568702VXC	HS9-3530AEH-Q	100krad(Si)	50krad(Si)	-55 to +125	10 LD FLATPACK, SOLDER SL	K10.A
5962F9568701V9A	HSO-3530ARH-Q	100krad(Si)	-	-55 to +125	DIE	-
5962F9568702V9A	HSO-3530AEH-Q	100krad(Si)	50krad(Si)	-55 to +125	DIE	-
HS2-3530ARH/PROTO (Note 3)	HS2-3530ARH/PROTO		-	-55 to +125	8 LD METAL CAN	T8.C
HS9-3530ARH/PROTO (Note 3)	HS9-3530ARH/PROTO		-	-55 to +125	10 LD FLATPACK, SOLDER SL	K10.A
HSO-3530ARH/SAMPLE (Note 3)	HSO-3530ARH/SAMPLE		-	-55 to +125	DIE	-

NOTES:

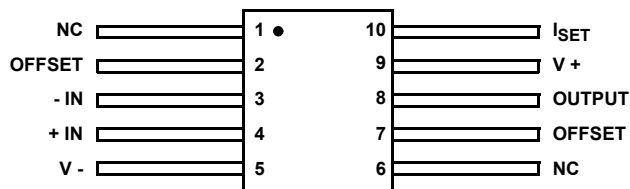
1. These Pb-free Hermetic packaged products employ 100% Au plate - e4 termination finish, which is RoHS compliant and compatible with both SnPb and Pb-free soldering operations.
2. Specifications for Rad Hard QML devices are controlled by the Defense Logistics Agency Land and Maritime (DLA). The SMD numbers listed must be used when ordering.
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.

Pin Configurations

HS2-3530ARH, HS2-3530AEH (CAN), MACY1-X8
TOP VIEW



HS9-3530ARH, HS9-3530AEH(FLATPACK), CDFP3-F10
TOP VIEW



Die Characteristics

DIE DIMENSIONS:

1720µm x 1390µm x 483µm ±25.4µm
(68 mils x 55 mils x 19 mils ±1 mil)

INTERFACE MATERIALS

GLASSIVATION

Type: Silox (SiO₂)
Thickness: 8.0kÅ ±1.0kÅ

TOP METALLIZATION

Type: AlSiCu
Thickness: 16.0kÅ ±2kÅ

SUBSTRATE:

Radiation Hardened Silicon Gate,
Dielectric Isolation

BACKSIDE FINISH:

Silicon

ASSEMBLY RELATED INFORMATION

SUBSTRATE POTENTIAL:

Unbiased (DI)

ADDITIONAL INFORMATION

WORST CASE CURRENT DENSITY:

<2.0 x 10⁵ A/cm²

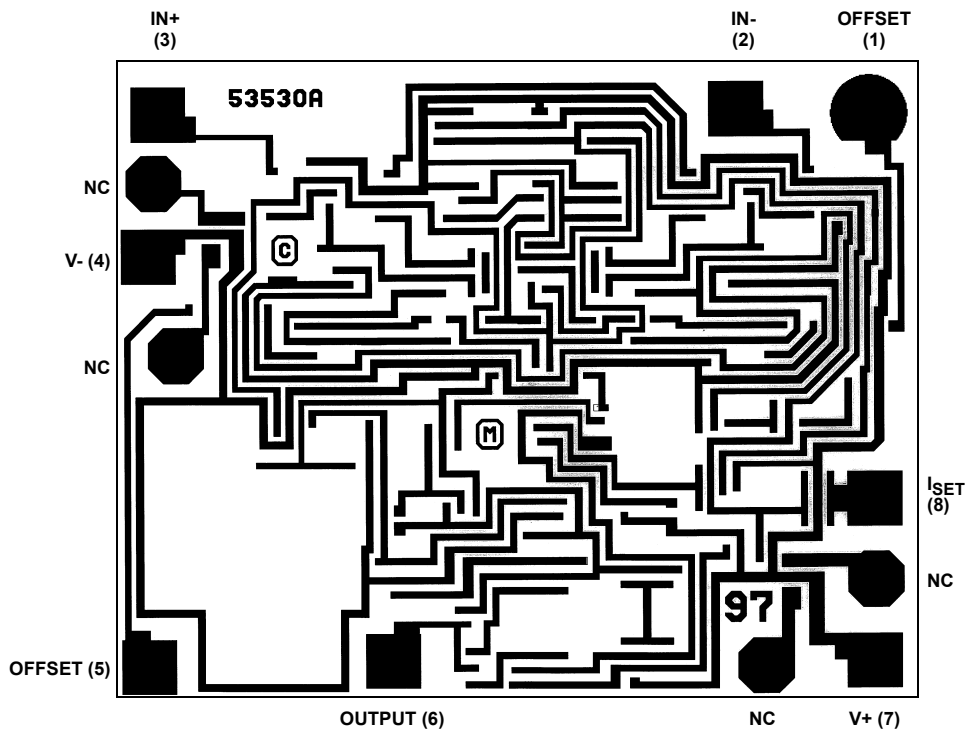
TRANSISTOR COUNT:

49

Metallization Mask Layout

Pin Numbers shown are for the Can Package

HS-3530ARH, HS-3530AEH



Revision History

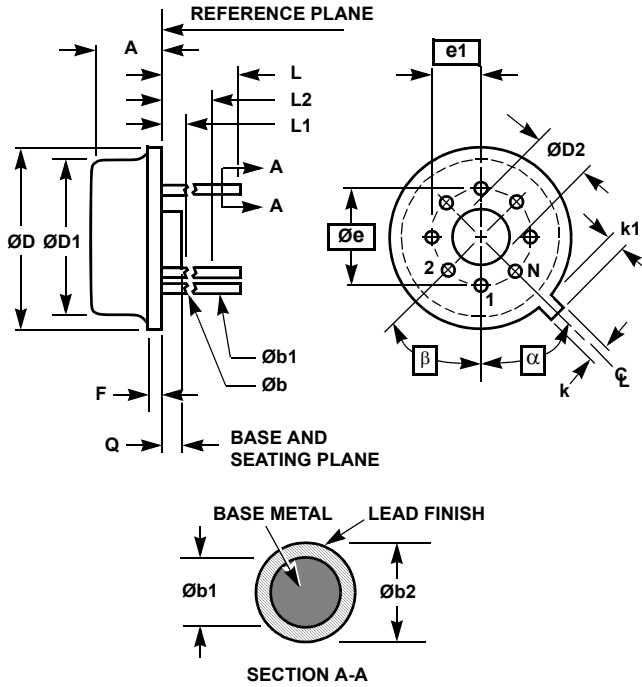
The revision history provided is for informational purposes only and is believed to be accurate, but not warranted. Please visit our website to make sure you have the latest revision.

DATE	REVISION	CHANGE
Jun 18, 2018	FN4653.4	Added Related Literature section. Moved information from Specifications section to Ordering Information on page 2. Added footnotes and packaging information to Ordering Information on page 2. Updated Die Dimensions on page 2. Removed About Intersil section and added new disclaimer.
Feb 9, 2015	FN4653.3	Added Rev History and About Intersil Verbiage. Updated datasheet by removing sentence that was not in compliance.

Package Outline Drawing

For the most recent package outline drawing, see [T8.C](#).

Metal Can Packages (Can)



T8.C MIL-STD-1835 MACY1-X8 (A1)
8 LEAD METAL CAN PACKAGE

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.165	0.185	4.19	4.70	-
Øb	0.016	0.019	0.41	0.48	1
Øb1	0.016	0.021	0.41	0.53	1
Øb2	0.016	0.024	0.41	0.61	-
ØD	0.335	0.375	8.51	9.40	-
ØD1	0.305	0.335	7.75	8.51	-
ØD2	0.110	0.160	2.79	4.06	-
e	0.200 BSC		5.08 BSC		-
e1	0.100 BSC		2.54 BSC		-
F	-	0.040	-	1.02	-
k	0.027	0.034	0.69	0.86	-
k1	0.027	0.045	0.69	1.14	2
L	0.500	0.750	12.70	19.05	1
L1	-	0.050	-	1.27	1
L2	0.250	-	6.35	-	1
Q	0.010	0.045	0.25	1.14	-
α	45° BSC		45° BSC		3
β	45° BSC		45° BSC		3
N	8		8		4

Rev. 0 5/18/94

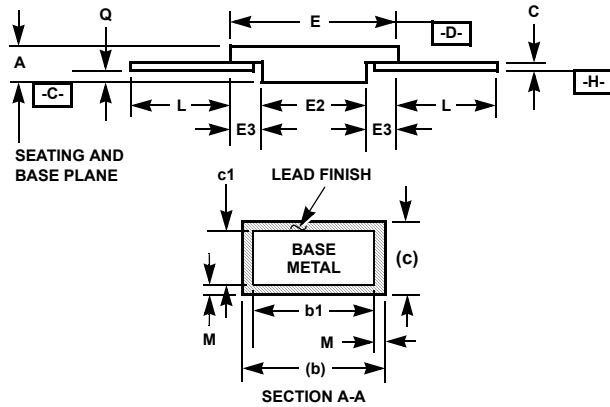
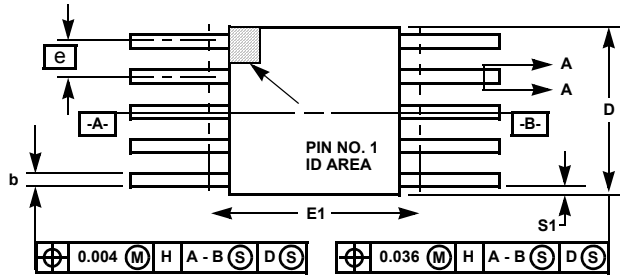
NOTES:

- (All leads) Øb applies between L1 and L2. Øb1 applies between L2 and 0.500 from the reference plane. Diameter is uncontrolled in L1 and beyond 0.500 from the reference plane.
- Measured from maximum diameter of the product.
- α is the basic spacing from the centerline of the tab to terminal 1 and β is the basic spacing of each lead or lead position (N - 1 places) from α, looking at the bottom of the package.
- N is the maximum number of terminal positions.
- Dimensioning and tolerancing per ANSI Y14.5M - 1982.
- Controlling dimension: INCH.

Package Outline Drawing

For the most recent package outline drawing, see [K10.A](#).

Ceramic Metal Seal Flatpack Packages (Flatpack)



**K10.A MIL-STD-1835 CDFP3-F10 (F-4A, CONFIGURATION B)
10 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	-	0.290	-	7.37	3
E	0.240	0.260	6.10	6.60	-
E1	-	0.280	-	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	0.250	0.370	6.35	9.40	-
Q	0.026	0.045	0.66	1.14	8
S1	0.005	-	0.13	-	6
M	-	0.0015	-	0.04	-
N	10		10		-

Rev. 0 3/07

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.

Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.
2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.
3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
4. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.
5. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The intended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.
"Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; industrial robots; etc.
"High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.
Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations; etc.), or may cause serious property damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user's manual or other Renesas Electronics document.
6. When using Renesas Electronics products, refer to the latest product information (data sheets, user's manuals, application notes, "General Notes for Handling and Using Semiconductor Devices" in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.
7. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.
8. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
9. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.
10. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.
11. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.
(Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.
(Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

(Rev.4.0-1 November 2017)



SALES OFFICES

Renesas Electronics Corporation

<http://www.renesas.com>

Refer to "<http://www.renesas.com/>" for the latest and detailed information.

Renesas Electronics America Inc.

1001 Murphy Ranch Road, Milpitas, CA 95035, U.S.A.
Tel: +1-408-432-8888, Fax: +1-408-434-5351

Renesas Electronics Canada Limited

9251 Yonge Street, Suite 8309 Richmond Hill, Ontario Canada L4C 9T3
Tel: +1-905-237-2004

Renesas Electronics Europe Limited

Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-651-700, Fax: +44-1628-651-804

Renesas Electronics Europe GmbH

Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-6503-0, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.

Room 1709 Quantum Plaza, No.27 ZhichunLu, Haidian District, Beijing, 100191 P. R. China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.

Unit 301, Tower A, Central Towers, 555 Langao Road, Putuo District, Shanghai, 200333 P. R. China
Tel: +86-21-2226-0888, Fax: +86-21-2226-0999

Renesas Electronics Hong Kong Limited

Unit 1601-1611, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2265-6688, Fax: +852 2886-9022

Renesas Electronics Taiwan Co., Ltd.

13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

Renesas Electronics Singapore Pte. Ltd.

80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre, Singapore 339949
Tel: +65-6213-0200, Fax: +65-6213-0300

Renesas Electronics Malaysia Sdn.Bhd.

Unit 1207, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

Renesas Electronics India Pvt. Ltd.

No.777C, 100 Feet Road, HAL 2nd Stage, Indiranagar, Bangalore 560 038, India
Tel: +91-80-67208700, Fax: +91-80-67208777

Renesas Electronics Korea Co., Ltd.

17F, KAMCO Yangjae Tower, 262, Gangnam-daero, Gangnam-gu, Seoul, 06265 Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5338