

**Low Power, High Performance Radiation Hardened Operational Amplifier**

HS-2700RH is radiation hardened internally compensated operational amplifiers which employ dielectric isolation to achieve excellent DC and dynamic performance with very low quiescent power consumption.

DC performance of the amplifier input is characterized by high CMRR (106dB), low offset voltage (0.5mV), along with low bias and offset current (5.0nA and 2.5nA respectively). These input specifications, in conjunction with offset null capability and open-loop gain of 300,000V/V, enable HS-2700RH to provide accurate, high-gain signal amplification. Gain bandwidth 1MHz and slew rate of 20V/μs allow for processing of fast, wideband signals. Input and output signal amplitudes of at least ±11V can be accommodated while providing output drive capability of 10mA. For maximum reliability, the output is protected in the event of short circuits to ground.

The amplifier operates from a wide range of supplies (±5.5V to ±20V) with a maximum quiescent supply drain of only 150μA. HS-2700RH is therefore, ideally suited to low-power instrumentation and filtering applications that require fast, accurate response over a wide range of signal frequency.

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

Detailed Electrical Specifications for these devices are contained in SMD 5962-95670. A "hot-link" is provided on our homepage for downloading.  
[www.intersil.com/spacedefense/space.asp](http://www.intersil.com/spacedefense/space.asp)

**Features**

- Electrically Screened to SMD # 5962-95670
- QML Qualified per MIL-PRF-38535 Requirements
- Low Power Supply Current . . . . . 150μA (Max)  
90μA (Typ)
- High CMRR . . . . . 86dB (Min)  
106dB (Typ)
- Low Input Bias Current . . . . . 20nA (Min)  
5nA (Typ)
- Low Offset Current . . . . . 10nA (Min)  
2.5nA (Typ)
- Total Dose . . . . . 1 x 10<sup>4</sup> RAD(Si)

**Applications**

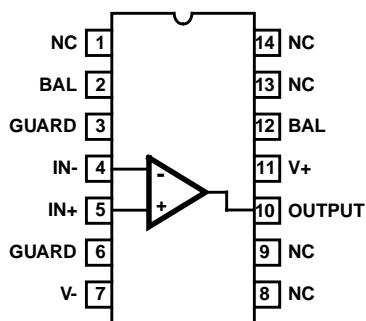
- High Gain Amplifier
- Instrumentation Amplifiers
- Active Filters
- Telemetry Systems
- Battery-Powered Equipment

**Ordering Information**

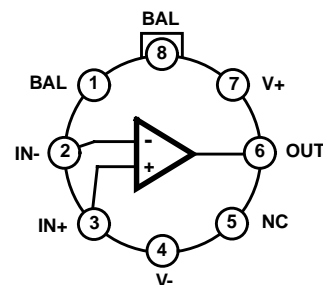
ORDERING NUMBER	INTERNAL MKT. NUMBER	TEMP. RANGE (°C)
5962D9567002VCA	HS1-2700RH-Q	-55 to 125
5962D9567002VCC	HS1B-2700RH-Q	-55 to 125
5962D9567002VGA	HS2-2700RH-Q	-55 to 125

**Pinouts**

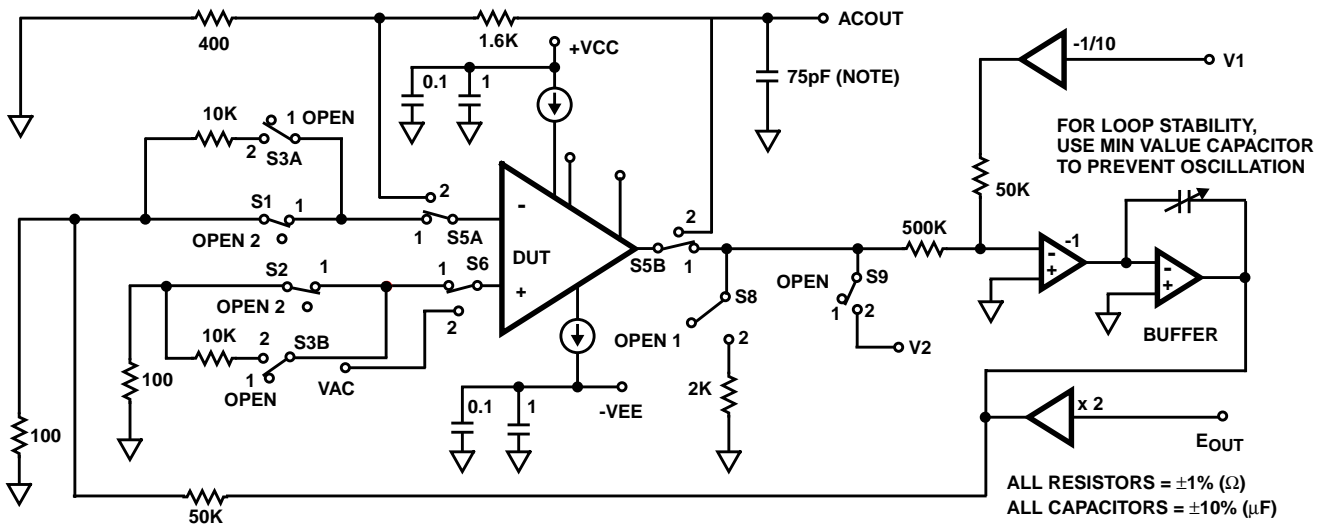
**HS1-2700RH (CERDIP) GDIP1-T14  
OR  
HS1B-2700RH (SBDIP) CDIP2-T14  
TOP VIEW**



**HS2-2700RH (CAN) MACY1-X8  
TOP VIEW**



Test Circuit



NOTE: Includes stray capacitances.

Timing Waveforms

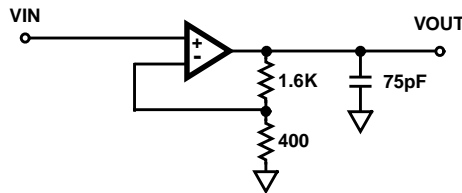


FIGURE 1. SIMPLIFIED TEST CIRCUIT

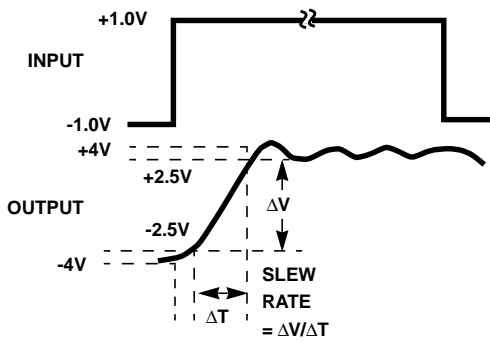


FIGURE 2. SLEW RATE WAVEFORM

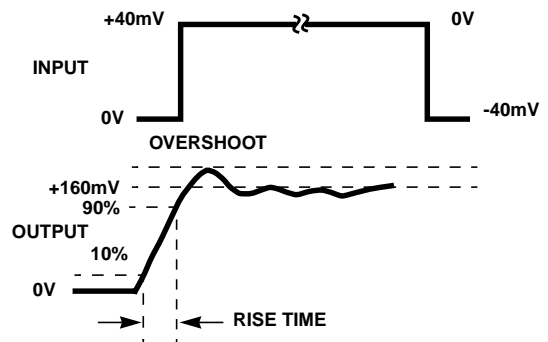


FIGURE 3. TRANSIENT RESPONSE WAVEFORM

NOTE: Measured on both positive and negative transitions. Capacitance at Compensation pin should be minimized.

**Typical Performance Curves**  $T_A = 25^\circ\text{C}$ ,  $V_{\text{SUPPLY}} = \pm 15\text{V}$ , Unless Otherwise Specified

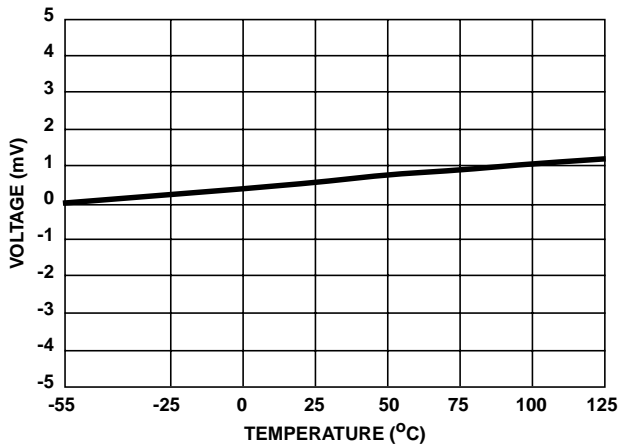


FIGURE 4. OFFSET VOLTAGE AS A FUNCTION OF TEMPERATURE

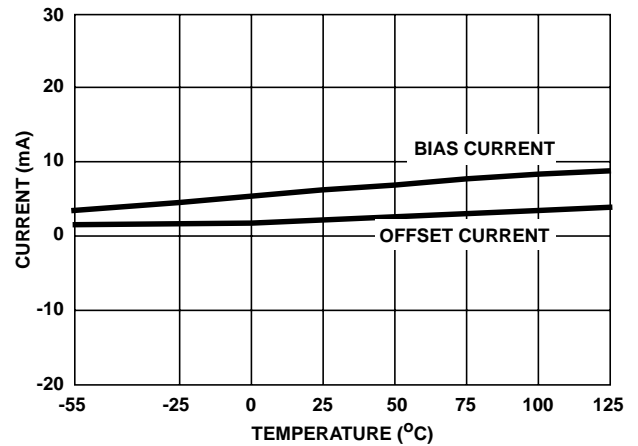


FIGURE 5. INPUT BIAS CURRENT AND OFFSET CURRENT AS A FUNCTION OF TEMPERATURE

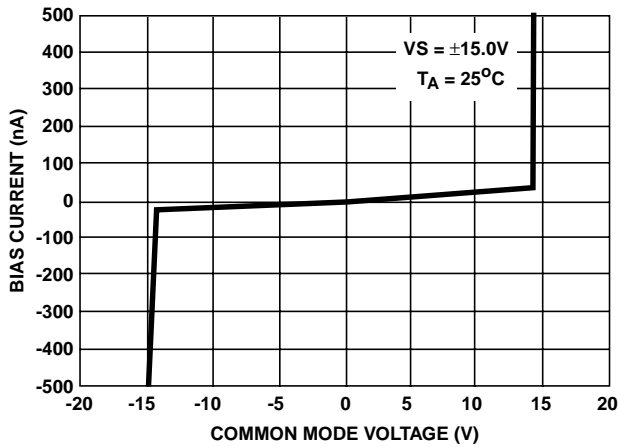


FIGURE 6. BIAS CURRENT AS A FUNCTION OF COMMON MODE VOLTAGE

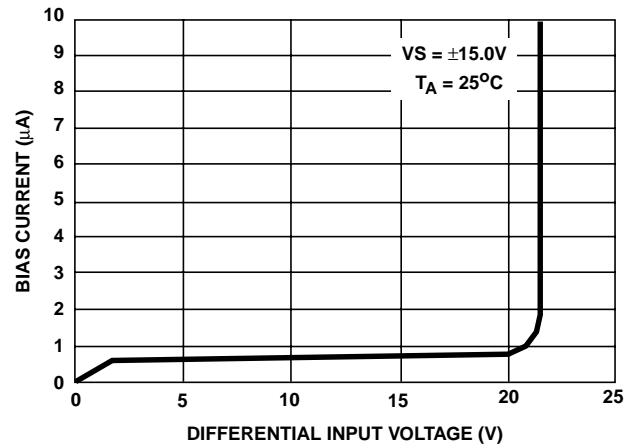


FIGURE 7. BIAS CURRENT AS A FUNCTION OF DIFFERENTIAL INPUT VOLTAGE

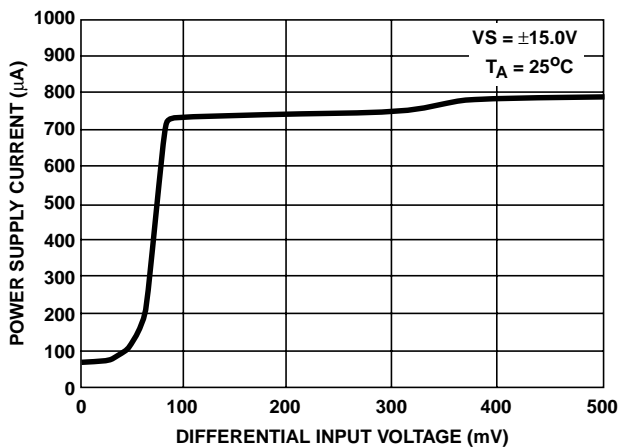


FIGURE 8. POWER SUPPLY CURRENT AS A FUNCTION OF DIFFERENTIAL INPUT VOLTAGE

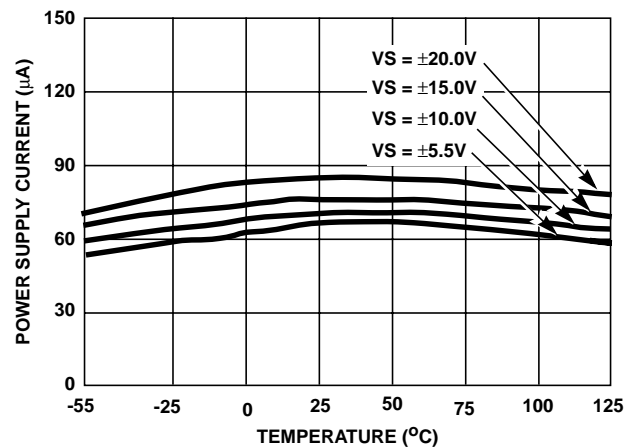


FIGURE 9. POWER SUPPLY CURRENT AS A FUNCTION OF TEMPERATURE

**Typical Performance Curves**  $T_A = 25^\circ\text{C}$ ,  $V_{\text{SUPPLY}} = \pm 15\text{V}$ , Unless Otherwise Specified (Continued)

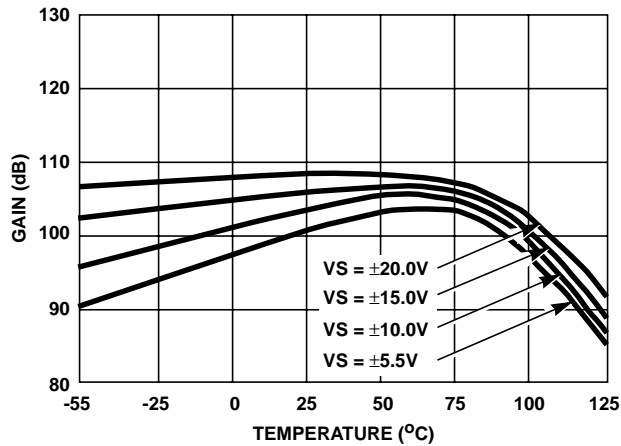
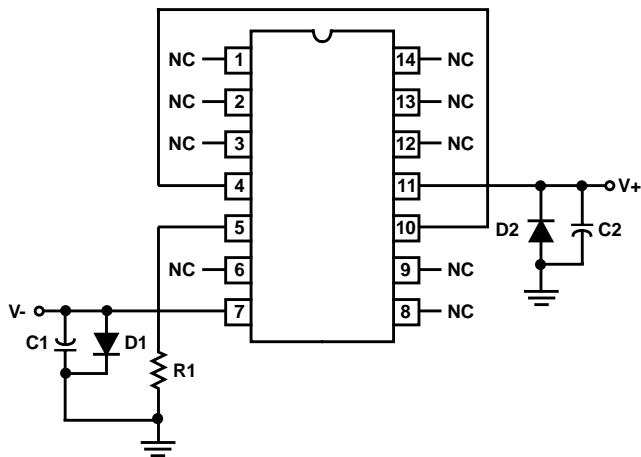


FIGURE 10. VOLTAGE GAIN AS A FUNCTION OF TEMPERATURE

NOTE: Open loop (comparator) applications are not recommended, because of the above characteristic.

**Burn-In Circuits**

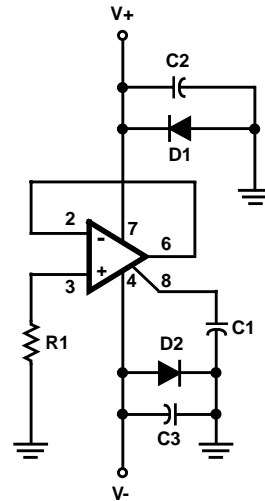
HS1-2700RH CERDIP



NOTES:

1.  $R1 = 1\text{M}\Omega$ ,  $\pm 5\%$ , 1/4W (Min)
2.  $C1 = C2 = 0.01\mu\text{F}/\text{Socket}$  (Min) or  $0.1\mu\text{F}/\text{Row}$  (Min)
3.  $D1 = D2 = 1\text{N}4002$  or equivalent (per board)
4.  $|(V_+) - (V_-)| = 31\text{V} \pm 1\text{V}$

HS2-2700RH METAL CAN



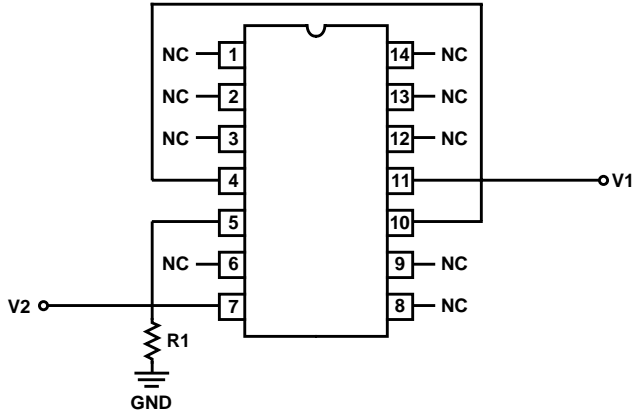
NOTES:

5.  $R1 = 1\text{M}\Omega$ ,  $\pm 5\%$ , 1/4W (Min)
6.  $C1 = 0.01\mu\text{F}/\text{Socket}$  (Min)
7.  $C2 = C3 = 0.01\mu\text{F}/\text{Socket}$  (Min) or  $0.1\mu\text{F}/\text{Row}$  (Min)
8.  $D1 = D2 = 1\text{N}4002$  or equivalent (per board)
9.  $|(V_+) - (V_-)| = 31\text{V} \pm 1\text{V}$
10. Insulated scope probe must be used during board check-out.

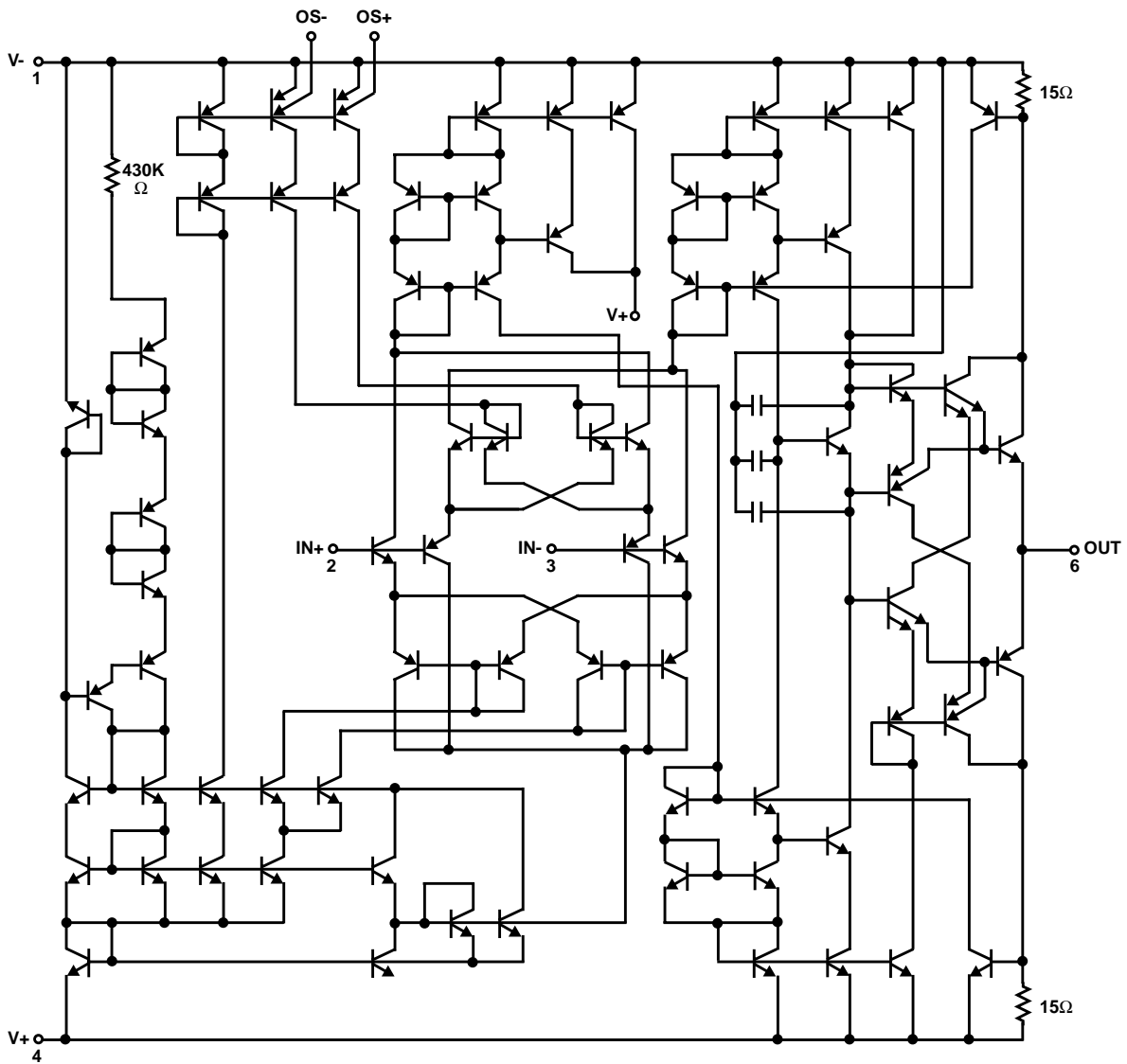
**Irradiation Circuit**

NOTES:

- 11.  $R = 1M\Omega, \pm 5\%, 1/4W$
- 12.  $V1 = +15V + 1.0V$
- 13.  $V2 = -15V + 1.0V$



**Schematic Diagram**



NOTE: Nominal currents shown in microamperes.

**Die Characteristics**

**DIE DIMENSIONS:**

70 mils x 60 mils x 20 mils  
(1780µm x 1530µm x 1530µm)

**INTERFACE MATERIALS:**

**Glassivation:**

Type: Nitride  
Thickness: 7kÅ ±0.7kÅ

**Top Metallization:**

Type: Aluminum  
Thickness: 16kÅ ±2kÅ

**Substrate:**

Linear Bipolar, DI

**Backside Finish:**

Silicon

**ASSEMBLY RELATED INFORMATION:**

**Substrate Potential (Powered Up):**

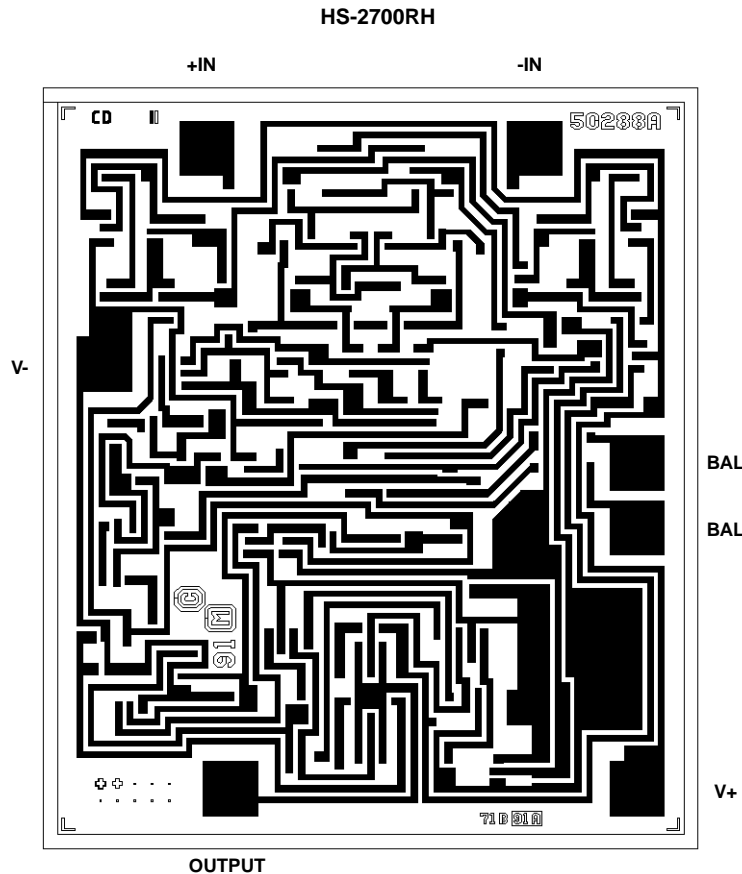
Unbiased

**ADDITIONAL INFORMATION:**

**Worst Case Current Density:**

< 2 x 10<sup>5</sup> A/cm<sup>2</sup>

**Metallization Mask Layout**



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