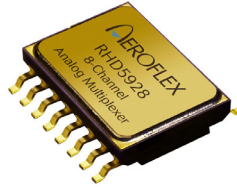


# RadHard-by-Design RHD5928 Analog Multiplexer 8-Channel

[www.aeroflex.com/RHDseries](http://www.aeroflex.com/RHDseries)

March 4, 2014



## FEATURES

- ❑ Single power supply operation at 3.3V to 5V
- ❑ Radiation performance
  - Total dose:  $> 1 \text{ Mrad(Si)}$ ; Dose rate = 50 - 300 rads(Si)/s
  - ELDRS Immune
  - SEL Immune  $> 100 \text{ MeV-cm}^2/\text{mg}$
  - Neutron Displacement Damage  $> 10^{14} \text{ neutrons/cm}^2$
- ❑ Full military temperature range
- ❑ Rail to Rail operation
- ❑ Low power consumption  $< 4.0\text{mW}$
- ❑ One address bus (A0-2), and one enable line
- ❑ Designed for aerospace and high reliability space applications
- ❑ Packaging – Hermetic ceramic SOIC
  - 16-pin, .411"L x .293"W x .105"Ht
  - Weight - 0.8 grams max
- ❑ Aeroflex Plainview's Radiation Hardness Assurance Plan is DLA Certified to MIL-PRF-38534, Appendix G.

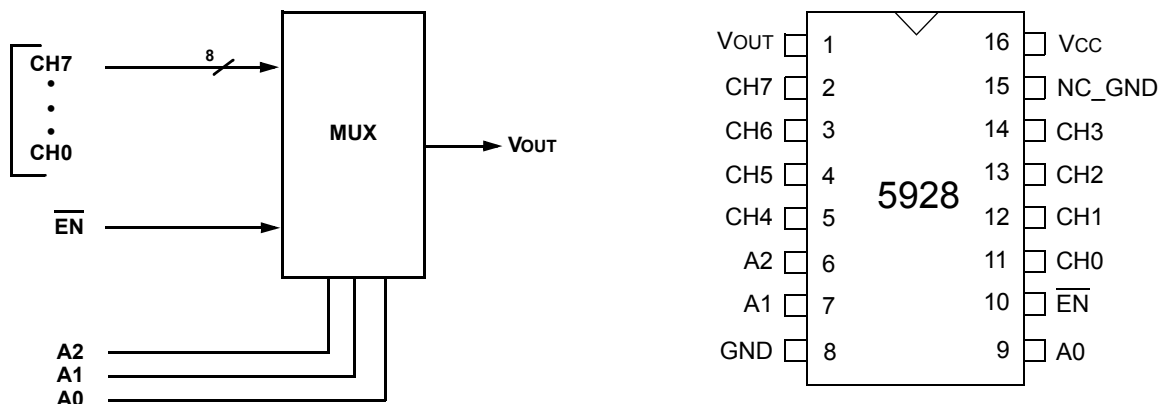
## GENERAL DESCRIPTION

Aeroflex's RHD5928 is a radiation hardened, single supply, 8 Channel Multiplexer in a 16-pin SOIC package. The RHD5928 design uses specific circuit topology and layout methods to mitigate total ionizing dose effects and single event latchup. These characteristics make the RHD5928 especially suited for the harsh environment encountered in Deep Space missions. It is guaranteed operational from  $-55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ . Available screened in accordance with MIL-PRF-38534 Class K, the RHD5928 is ideal for demanding military and space applications.

## ORGANIZATION AND APPLICATION

The RHD5928 is an 8 to 1 CMOS multiplexer. Channel selection is controlled by 3 bit binary addressing and an active low enable. All inputs and outputs are diode protected.

The devices will not latch with SEU events to above  $100 \text{ MeV-cm}^2/\text{mg}$ . Total dose degradation is minimal to above  $1 \text{ Mrad(Si)}$ . Displacement damage environments to neutron fluence equivalents in the mid  $10^{14}$  neutrons per  $\text{cm}^2$  range are readily tolerated. There is no sensitivity to low-dose rate (ELDRS) effects. SEU effects are application dependent.



## BLOCK DIAGRAM

## PACKAGE PIN-OUT

### Notes:

1. Package and Lid are electrically isolated from signal pads.
2. It is recommended that the Lid and NC\_GND pin be grounded. This prevents any ESD or static buildup.

| Pin | Signal Name            | Definition                                                                      |
|-----|------------------------|---------------------------------------------------------------------------------|
| 1   | VOUT                   | Output of Multiplexer.                                                          |
| 2   | CH7                    | Analog Input 8                                                                  |
| 3   | CH6                    | Analog Input 7                                                                  |
| 4   | CH5                    | Analog Input 6                                                                  |
| 5   | CH4                    | Analog Input 5                                                                  |
| 6   | A2                     | Address Bus (MSB)                                                               |
| 7   | A1                     | Address Bus                                                                     |
| 8   | GND                    | DC Supply Return.                                                               |
| 9   | A0                     | Address Bus (LSB)                                                               |
| 10  | $\overline{\text{EN}}$ | A Logic High will disable the Multiplexer so that the output is high impedance. |
| 11  | CH0                    | Analog Input 1                                                                  |
| 12  | CH1                    | Analog Input 2                                                                  |
| 13  | CH2                    | Analog Input 3                                                                  |
| 14  | CH3                    | Analog Input 4                                                                  |
| 15  | NC_GND                 | Ground this pin to prevent ESD or Static Buildup                                |
| 16  | VCC                    | DC Supply Voltage.                                                              |

## PIN-OUT DESCRIPTION

## ABSOLUTE MAXIMUM RATINGS

| Parameter                                      | Range                    | Units  |
|------------------------------------------------|--------------------------|--------|
| Case Operating Temperature Range               | -55 to +125              | °C     |
| Storage Temperature Range                      | -65 to +150              | °C     |
| Supply Voltage (+VCC)                          | +6.0                     | V      |
| Digital Input Overvoltage (VEN, VA)            | < VCC +0.4<br>> GND -0.4 | V<br>V |
| Analog Input Over Voltage (CH0-CH7)            | < VCC +0.4<br>> GND -0.4 | V      |
| ESD Rating (MIL-STD-883, Method 3015, Class 2) | 2,000 - 3,999            | V      |

NOTICE: Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress rating only; functional operation beyond the "Operation Conditions" is not recommended and extended exposure beyond the "Operation Conditions" may affect device reliability.

## RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter                | Typical    | Units |
|--------|--------------------------|------------|-------|
| +VCC   | Power Supply Voltage     | 3.3 to 5.0 | V     |
| VIL    | Low Level Input Voltage  | 30% VCC    | V     |
| VIH    | High Level Input Voltage | 70% VCC    | V     |

## ELECTRICAL PERFORMANCE CHARACTERISTICS

(TC = -55°C TO +125°C, +VCC = +5V -- UNLESS OTHERWISE SPECIFIED)

| Parameter                                     | Symbol | Conditions                                                                     |        | Min | Max  | Units |
|-----------------------------------------------|--------|--------------------------------------------------------------------------------|--------|-----|------|-------|
| Supply Current<br>(+Vcc) 1/                   | +Icc   | EN = 30% Vcc                                                                   |        | -   | 800  | μA    |
|                                               | +ISBY  | EN = 70% Vcc                                                                   |        | -   | 200  | μA    |
| Address Input Current<br>(A0-A2) 1/           | IAL    | VA = 30% Vcc                                                                   | +25°C  | -5  | 5    | nA    |
|                                               |        |                                                                                | +125°C | -50 | 50   | nA    |
|                                               | IAH    | VA = 70% Vcc                                                                   | +25°C  | -5  | 5    | nA    |
|                                               |        |                                                                                | +125°C | -50 | 50   | nA    |
| Enable Input Current<br>(EN) 1/               | IENL   | VEN = 30% Vcc                                                                  | +25°C  | -5  | 5    | nA    |
|                                               |        |                                                                                | +125°C | -50 | 50   | nA    |
|                                               | IENH   | VEN = 70%Vcc                                                                   | +25°C  | -5  | 5    | nA    |
|                                               |        |                                                                                | +125°C | -50 | 50   | nA    |
| High Input<br>Leakage Current<br>(CH0-CH7) 1/ | IINLK5 | VIN = +5V, VEN =70% Vcc,<br>Output and all unused MUX inputs under test = 0V   | +25°C  | -5  | 5    | nA    |
|                                               |        |                                                                                | +125°C | -50 | 50   | nA    |
| Low Input<br>Leakage Current<br>(CH0-CH7) 1/  | IINLK0 | VIN = 0V, VEN =70% Vcc<br>Output and all unused MUX inputs under test = +5V    | +25°C  | -5  | 5    | nA    |
|                                               |        |                                                                                | +125°C | -50 | 50   | nA    |
| Output Leakage Current<br>(VOUT) 1/           | IOUTLK | VOUT = +5V, VEN = 70% Vcc ,<br>All inputs grounded except channel being tested | +25°C  | -5  | 5    | nA    |
|                                               |        |                                                                                | +125°C | -50 | 50   | nA    |
| Switch ON Resistance<br>1/                    | RDSN   | VIN = 0V, VEN = 30% Vcc, IOUT = +1mA                                           | -55°C  | -   | 500  | Ω     |
|                                               |        | VIN = +2.5V, VEN = 30% Vcc, IOUT = -0.6mA                                      | +25°C  | -   | 750  | Ω     |
|                                               |        | VIN = +5V, VEN = 30% Vcc, IOUT = -1mA                                          | +125°C | -   | 1000 | Ω     |

NOTE: 1/ Specification derated to reflect Total Dose exposure to 1 Mrad(Si) @ +25°C

## SWITCHING CHARACTERISTICS

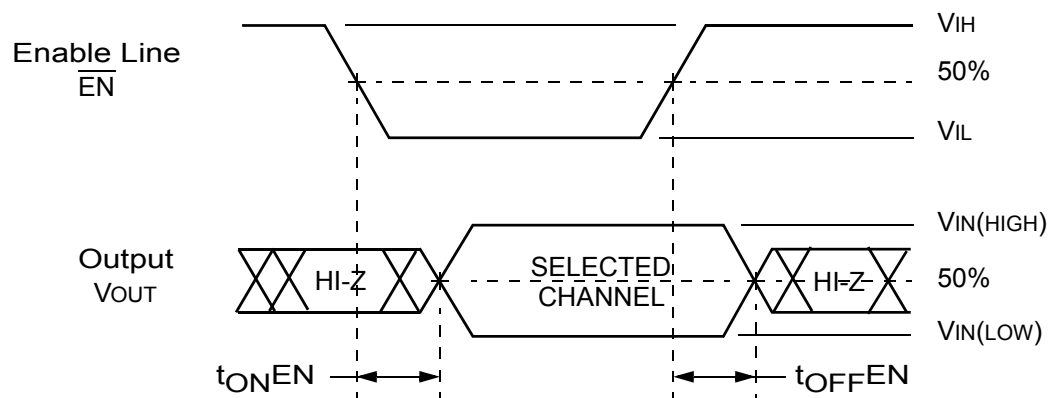
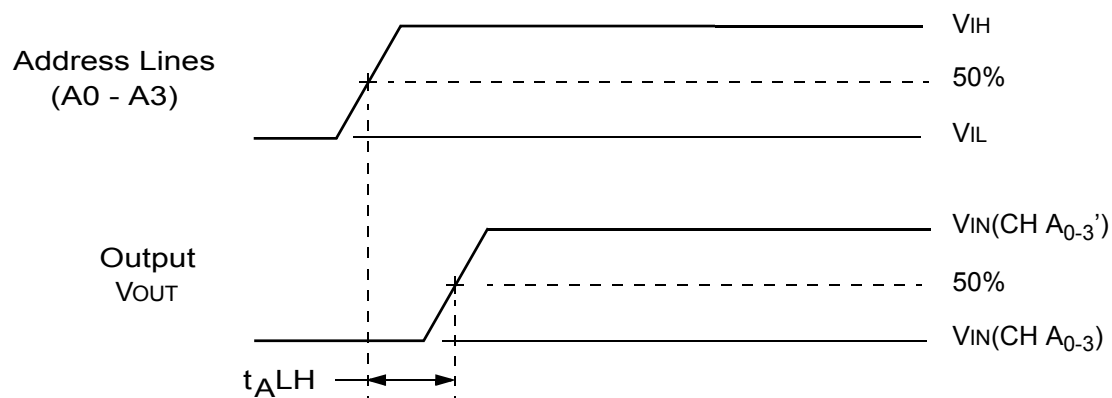
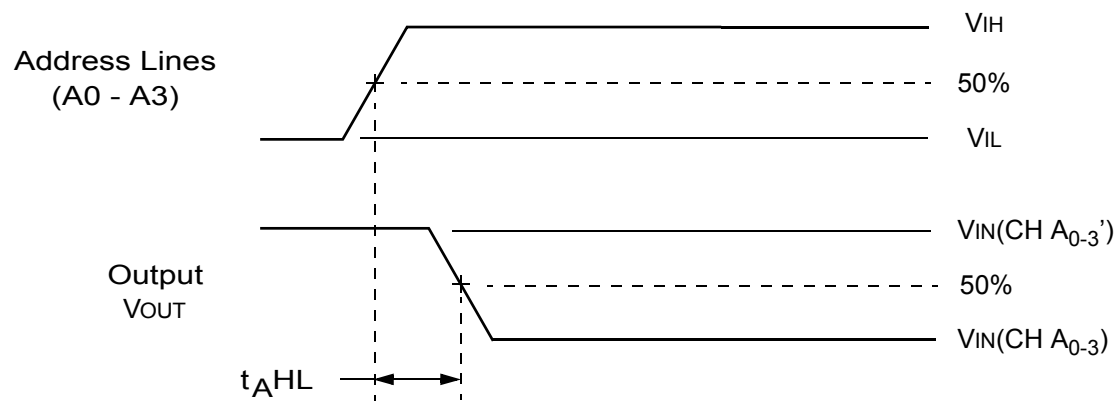
(T<sub>C</sub> = -55°C TO +125°C, +V<sub>CC</sub> = +5V -- UNLESS OTHERWISE SPECIFIED)

| Parameter               | Symbol             | Conditions                  | Temp   | Min | Max | Units |
|-------------------------|--------------------|-----------------------------|--------|-----|-----|-------|
| Address to Output Delay | t <sub>AHL</sub>   | VOUT High to Low Transition | -55°C  | 10  | 150 | ns    |
|                         |                    |                             | +25°C  | 10  | 150 | ns    |
|                         |                    |                             | +125°C | 10  | 200 | ns    |
|                         | t <sub>ALH</sub>   | VOUT Low to High Transition | -55°C  | 10  | 150 | ns    |
|                         |                    |                             | +25°C  | 10  | 150 | ns    |
|                         |                    |                             | +125°C | 10  | 200 | ns    |
| Enable to Output Delay  | t <sub>ONEN</sub>  | (Enabled)                   | -55°C  | 10  | 150 | ns    |
|                         |                    |                             | +25°C  | 10  | 150 | ns    |
|                         |                    |                             | +125°C | 10  | 200 | ns    |
|                         | t <sub>OFFEN</sub> | (Disabled)                  | ALL    | 10  | 200 | ns    |

## TRUTH TABLE (CH0 – CH7)

| A2 | A1 | A0 | $\overline{\text{EN}}$ | "ON" CHANNEL 1/ |
|----|----|----|------------------------|-----------------|
| X  | X  | X  | H                      | NONE            |
| L  | L  | L  | L                      | CH0             |
| L  | L  | H  | L                      | CH1             |
| L  | H  | L  | L                      | CH2             |
| L  | H  | H  | L                      | CH3             |
| H  | L  | L  | L                      | CH4             |
| H  | L  | H  | L                      | CH5             |
| H  | H  | L  | L                      | CH6             |
| H  | H  | H  | L                      | CH7             |

1/ Between (CH0-CH7) and Vout

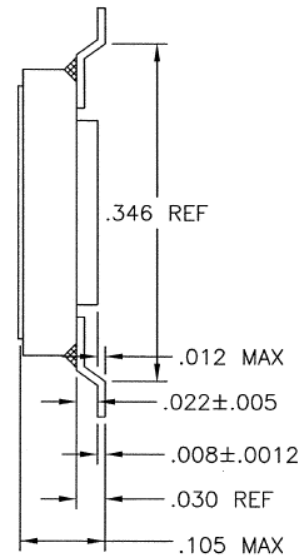
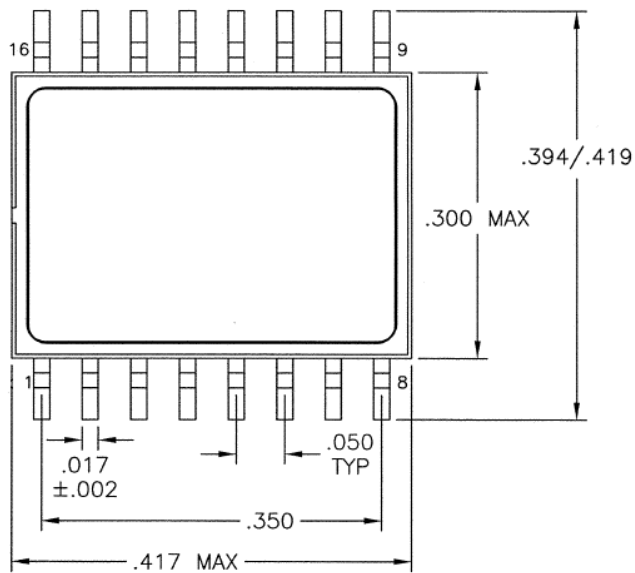


NOTE:  $f = 10\text{KHz}$ , Duty cycle = 50%.

## RHD5928 SWITCHING DIAGRAMS

## ORDERING INFORMATION

| Model          | DLA SMD #       | Screening                                                                                                                              | Package     |
|----------------|-----------------|----------------------------------------------------------------------------------------------------------------------------------------|-------------|
| RHD5928-7      | -               | Commercial Flow, +25°C testing only                                                                                                    | 16-pin SOIC |
| RHD5928-S      | -               | Military Temperature, -55°C to +125°C<br>Screened in accordance with the individual Test Methods of MIL-STD-883 for Space Applications |             |
| RHD5928-201-1S | 5962-1220801KXC | In accordance with DLA SMD                                                                                                             |             |
| RHD5928-201-2S | 5962-1220801KXA |                                                                                                                                        |             |
| RHD5928-901-1S | 5962H1220801KXC | In accordance with DLA Certified RHA Program Plan to RHA Level "H", 1Mrad(Si)                                                          |             |
| RHD5928-901-2S | 5962H1220801KXA |                                                                                                                                        |             |



Note: Package and lid are electrically isolated from signal pads.

## PACKAGE OUTLINE

### EXPORT CONTROL:

*This product is controlled for export under the International Traffic in Arms Regulations (ITAR). A license from the U.S. Department of State is required prior to the export of this product from the United States.*

### EXPORT WARNING:

*Aeroflex's military and space products are controlled for export under the International Traffic in Arms Regulations (ITAR) and may not be sold or proposed or offered for sale to certain countries. (See ITAR 126.1 for complete information.)*

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