RadHard-by-Design Analog

RHD5928

8-Channel Analog Multiplexer
Released Datasheet
Cobham.com/HiRel
March 28, 2016

The most important thing we build is trust

FEATURES

- ❑ Single power supply operation at 3.3V to 5V
- ❑ Radiation performance
  - Total dose: > 1 Mrad(Si); Dose rate = 50-300 rad(Si)/s
  - ELDRS Immune
  - SEL Immune > 100 MeV-cm^2/mg
  - Neutron Displacement Damage > 10^{14} neutrons/cm^2
- ❑ Full military temperature range
- ❑ Rail to Rail operation
- ❑ Low power consumption < 4.0mW
- ❑ One address bus (A0-2), and one enable line
- ❑ Designed for aerospace and high reliability space applications
- ❑ Packaging – Hermetic ceramic SOIC
  - 16-pin, .417"L x .300"W x .120"Ht
  - Weight - 0.8 grams max

- ❑ **Radiation Hardness Assurance Plan: DLA Certified to MIL-PRF-38534, Appendix G.**

GENERAL DESCRIPTION

The 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°C to +125°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 MeV-cm^2/mg. Total dose degradation is minimal to above 1 Mrad(Si). Displacement damage environments to neutron fluence equivalents in the mid 10^{14} neutrons per cm^2 range are readily tolerated. There is no sensitivity to low-dose rate (ELDRS) effects. SEU effects are application dependent.

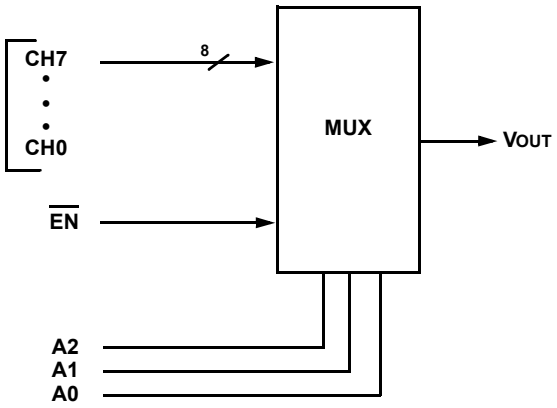


FIGURE 1: BLOCK DIAGRAM

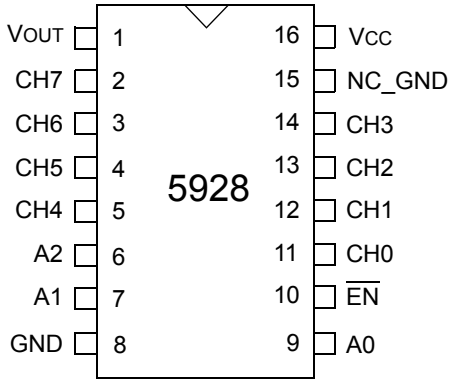


FIGURE 2: PACKAGE PIN-OUT

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	$\overline{EN}$	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.

FIGURE 3: 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 ($+V_{CC}$)	+7.0	V
Digital Input Overvoltage (V_{EN}, V_A)	< V_{CC} +0.4 > GND -0.4	V V
Analog Input Over Voltage (CH0-CH7)	< V_{CC} +0.4 > GND -0.4	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
$+V_{CC}$	Power Supply Voltage	3.3 to 5.0	V
V_{IL}	Low Level Input Voltage	30% V_{CC}	V
V_{IH}	High Level Input Voltage	70% V_{CC}	V

ELECTRICAL PERFORMANCE CHARACTERISTICS

(T_C = -55°C TO +125°C, $+V_{CC}$ = +5V -- UNLESS OTHERWISE SPECIFIED)

Parameter	Symbol	Conditions		Min	Max	Units
Supply Current ($+V_{CC}$) 1/	$+I_{CC}$	$\overline{EN}$ = 30% V_{CC}		-	800	µA
	$+I_{SBY}$	$\overline{EN}$ = 70% V_{CC}		-	200	µA
Address Input Current (A0-A2) 1/	I_{AL}	V_A = 30% V_{CC}	+25°C	-5	5	nA
			+125°C	-50	50	nA
	I_{AH}	V_A = 70% V_{CC}	+25°C	-5	5	nA
			+125°C	-50	50	nA
Enable Input Current ($\overline{EN}$) 1/	I_{ENL}	V_{EN} = 30% V_{CC}	+25°C	-5	5	nA
			+125°C	-50	50	nA
	I_{ENH}	V_{EN} = 70%V_{CC}	+25°C	-5	5	nA
			+125°C	-50	50	nA
High Input Leakage Current (CH0-CH7) 1/	I_{INLK_5}	V_{IN} = +5V, V_{EN} =70% V_{CC}, Output and all unused MUX inputs under test = 0V	+25°C	-5	5	nA
			+125°C	-50	50	nA
Low Input Leakage Current (CH0-CH7) 1/	I_{INLK_0}	V_{IN} = 0V, V_{EN} =70% V_{CC} Output and all unused MUX inputs under test = +5V	+25°C	-5	5	nA
			+125°C	-50	50	nA
Output Leakage Current (V_{OUT}) 1/	I_{OUTLK}	V_{OUT} = +5V, V_{EN} = 70% V_{CC} , All inputs grounded except channel being tested	+25°C	-5	5	nA
			+125°C	-50	50	nA
Switch ON Resistance 1/	R_{DSON}	V_{IN} = 0V, V_{EN} = 30% V_{CC}, I_{OUT} = +1mA	-55°C	-	500	Ω
		V_{IN} = +2.5V, V_{EN} = 30% V_{CC}, I_{OUT} = -0.6mA	+25°C	-	750	Ω
		V_{IN} = +5V, V_{EN} = 30% V_{CC}, I_{OUT} = -1mA	+125°C	-	1000	Ω

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

SWITCHING CHARACTERISTICS

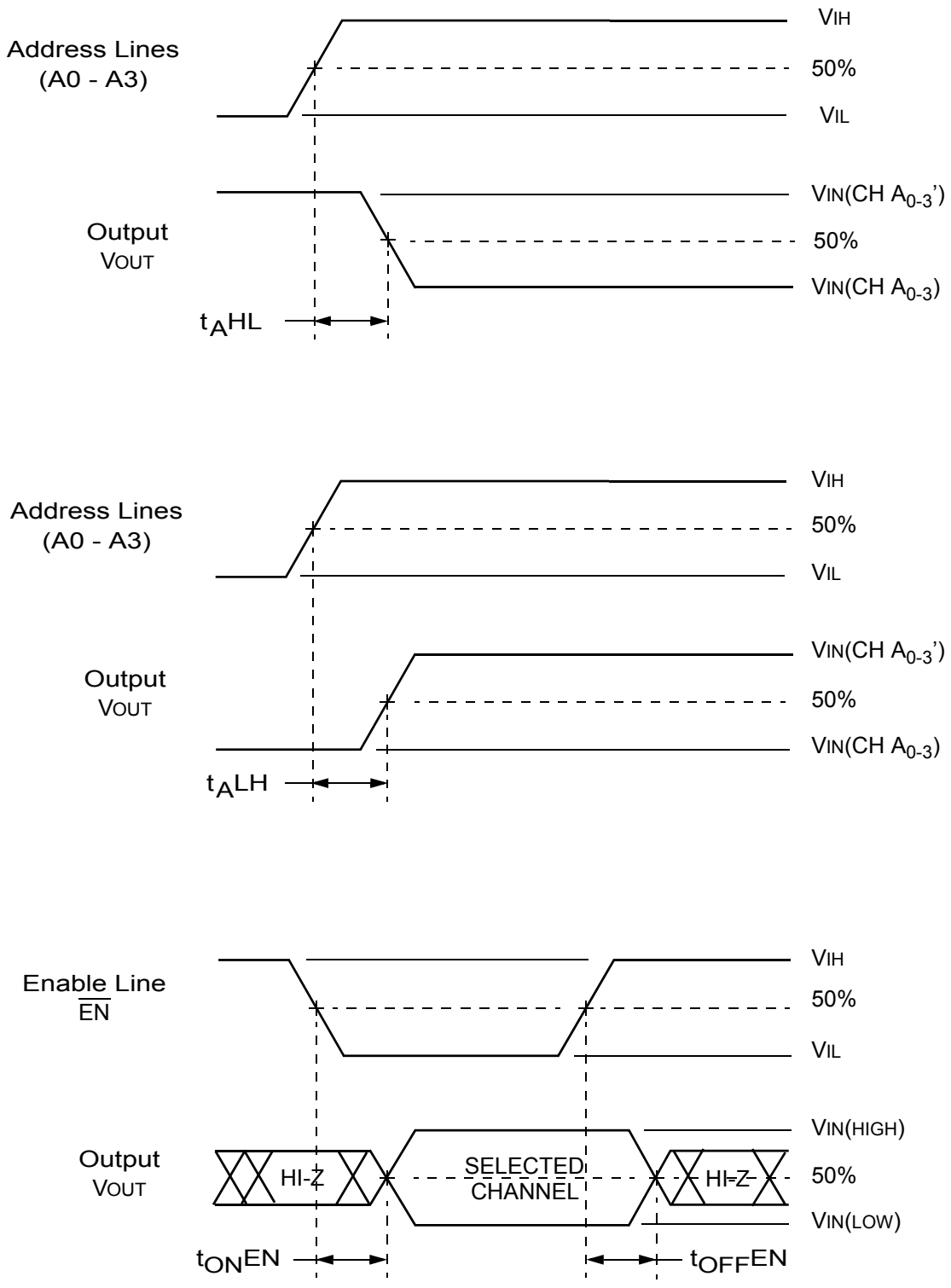
(TC = -55°C TO +125°C, +VCC = +5V -- UNLESS OTHERWISE SPECIFIED)

Parameter	Symbol	Conditions	Temp	Min	Max	Units
Address to Output Delay	t_AHL	VOUT High to Low Transition	-55°C	10	150	ns
			+25°C	10	150	ns
			+125°C	10	200	ns
	t_ALH	VOUT Low to High Transition	-55°C	10	150	ns
			+25°C	10	150	ns
			+125°C	10	200	ns
Enable to Output Delay	$t_{ON}EN$	(Enabled)	-55°C	10	150	ns
			+25°C	10	150	ns
			+125°C	10	200	ns
	$t_{OFF}EN$	(Disabled)	ALL	10	200	ns

TRUTH TABLE (CH0 – CH7)

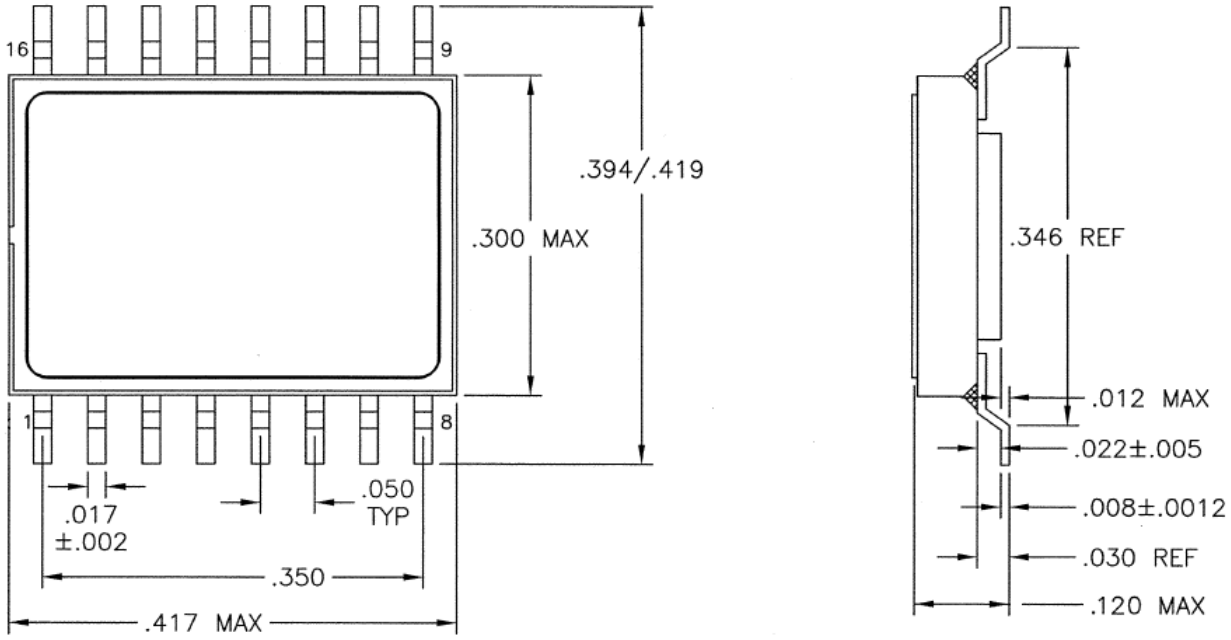
A2	A1	A0	$\overline{EN}$	"ON" CHANNEL 1/
X	X	X	H	NONE
L	L	L	L	CH0
L	L	H	L	CH1
L	H	L	L	CH2
L	H	H	L	CH3
H	L	L	L	CH4
H	L	H	L	CH5
H	H	L	L	CH6
H	H	H	L	CH7

1/ Between (CH0-CH7) and VOUT



NOTE: f = 10KHz, Duty cycle = 50%.

FIGURE 4: RHD5928 SWITCHING DIAGRAMS



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

FIGURE 5: PACKAGE OUTLINE

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 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", 1 Mrad(Si)	
RHD5928-901-2S	5962H1220801KXA		

REVISION HISTORY

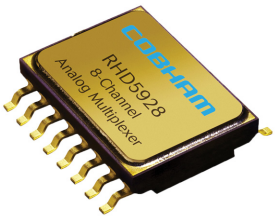
Date	Revision	Change Description
03/28/2016	E	Import into Cobham format

Datasheet Definition

Advanced Datasheet - Product In Development

Preliminary Datasheet - Shipping Prototype

Datasheet - Shipping QML & Reduced Hi-Rel



EXPORT CONTROL:
This product is controlled for export under the Export Administration Regulations (EAR), 15 CFR Parts 730-774.
A license from the Department of Commerce may be required prior to the export of this product from the United States.

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