# MUX8561 16-Channel Analog Multiplexer Module +5V, Radiation Tolerant
# Kelvin Measurement Configured

www.aeroflex.com/mux

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## FEATURES

- 16 Kelvin measurement channels provided by two 16-channel multiplexers

- Single +5V power supply

- Radiation performance
  - Total dose:        150 krads(Si), Dose rate = 50 - 300 rads(Si)/s
  - SEU:             Immune up to 90 MeV-cm$^2$/mg
  - SEL:             Immune by process design

- Full military temperature range

- Low power consumption < 5mW

- CMOS analog switching allows rail to rail operation and low switch impedance

- One address bus (A0-3), and one enable line

- Fast access time <  500ns typical

- Break-Before-Make switching

- High analog input impedance (power on or off )

- Designed for aerospace and high reliability space applications

- Packaging – Hermetic ceramic
  - 56 leads, 0.80"Sq x 0.20"Ht quad flat pack
  - Typical Weight 6 grams

- DSCC SMD 5962-10210 pending

*Note: Aeroflex Plainview does not currently have a DSCC certified Radiation Hardened Assurance Program.*
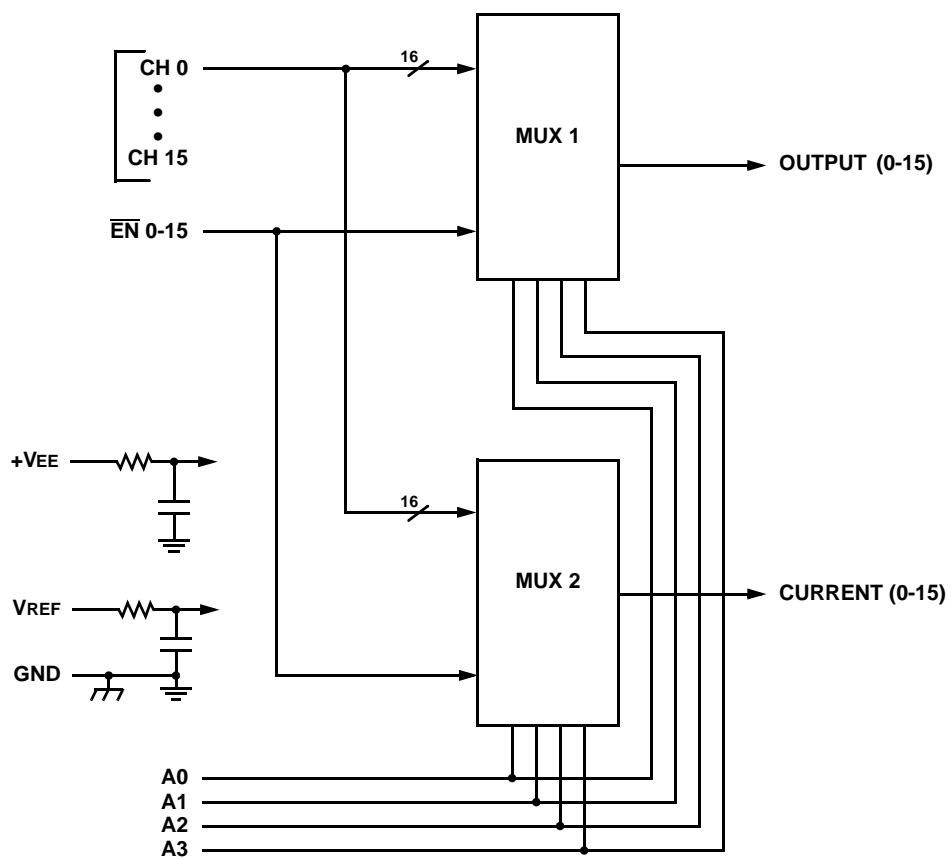
## GENERAL DESCRIPTION

Aeroflex's MUX8561 is a radiation tolerant +5V only 16 Kelvin measurement channel multiplexer MCM (Multi Chip Module).

The MUX8561 has been specifically designed to meet exposure to radiation environments. It is available in a 56 lead High Temperature Co-Fired Ceramic (HTCC) Quad Flatpack (CQFP). It is guaranteed operational from -55°C to +125°C. Available screened in accordance with MIL-PRF-38534, the MUX8561 is ideal for demanding military and space applications.

## ORGANIZATION AND APPLICATION

The MUX8561 consists of two 16 channel +5V only multiplexers arranged as shown in the block diagram, addressable by bus $A_0 \sim A_3$ including enable which connects the addressed channel to two separate outputs, "Output" and "Current". This technique enables selecting and reading a remote resistive sensor without the MUX resistance being part of the measurement. For grounded sensors, this is done by passing current  to the sensor by means of the "Current" pin and reading the resultant voltage (proportional to the sensor resistance) at the "Output" pin.

CH 0
•
•
•
CH 15

$\overline{EN}$ 0-15

+V<sub>EE</sub>

V<sub>REF</sub>

GND

A0
A1
A2
A3

16

MUX 1

OUTPUT (0-15)

16

MUX 2

CURRENT (0-15)

**MUX8561: 16 CHANNEL ANALOG MUX BLOCK DIAGRAM
KELVIN MEASUREMENT CONFIGURED**

# ABSOLUTE MAXIMUM RATINGS 1/

| Parameter | Range | Units |
|---|---|---|
| Case Operating Temperature Range | -55 to +125 | °C |
| Storage Temperature Range | -65 to +150 | °C |
| Supply Voltage<br>+VEE (Pin 18)<br>VREF (Pin 39) | +7.5<br>+7.5 | V<br>V |
| Digital Input Overvoltage<br>VEN (Pin 13), VA (Pins 14, 15, 16, 17) | < VREF +0.5<br>> GND -0.5 | V<br>V |
| Analog Input Over Voltage<br>Vs | -0.5 ≤ Vs ≤ +7.5 | V |

Notes:
1/ All measurements are made with respect to ground.

NOTICE: Stresses above those listed under "Absolute Maximums Rating" 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 1/

| Symbol | Parameter | Typical | Units |
|---|---|---|---|
| +VEE | +5V Power Supply Voltage | +5.0 | V |
| VREF | Reference Voltage | +5.00 | V |
| VAL | Logic Low Level | +0.8 | V |
| VAH | Logic High Level | +4.0 | V |

1/ Power Supply turn-on sequence shall be as follows: +VEE, followed by VREF (or tie these together).


# DC ELECTRICAL PERFORMANCE CHARACTERISTICS 1/
(TC = -55°C to +125°C, +VEE = +5V, VREF = +5.0V - Unless otherwise specified)

| Parameter | Symbol | Conditions | Min | Max | Units |
|---|---|---|---|---|---|
| Supply Current | +IEE | VEN(0-15) = VA(0-3) = 0 | 0 | 1 | mA |
| | +ISBY | VEN(0-15) = 4V, VA(0-3) = 0   7/ | 0 | 1 | mA |
| Address Input Current | IAL(0-3)A | VA = 0V | -1 | 1 | μA |
| | IAH(0-3)A | VA = 5V | -1 | 1 | μA |
| Enable Input Current | IENL(0-15) | VEN(0-15) = 0V | -1 | 1 | μA |
| | IENH(0-15) | VEN(0-15) = 5V | -1 | 1 | μA |
| Positive Input Leakage Current CH0-CH15 | +ISOFFOUTPUT(ALL) | VIN = +5V, VEN = 4V, Outputs and all unused MUX inputs under test = 0V   2/, 3/ | -200 | +200 | nA |
| Negative Input Leakage Current CH0-CH15 | -ISOFFOUTPUT(ALL) | VIN = 0V, VEN = 4V, Outputs and all unused MUX inputs under test = +5V   2/, 3/ | -200 | +200 | nA |
| Positive Output Leakage Current OUTPUTS (pins 12,45) | +IDOFFOUTPUT(ALL) | VOUT = +5V, VEN = 4V, All inputs grounded except channel being tested   3/, 4/ | -50 | +1500 | nA |

# DC ELECTRICAL PERFORMANCE CHARACTERISTICS 1/ (continued)
($T_C$ = -55°C to +125°C, +$V_{EE}$ = +5V, $V_{REF}$ = +5.0V - Unless otherwise specified)

| Parameter | Symbol | Conditions | Min | Max | Units |
|---|---|---|---|---|---|
| Switch ON Resistance OUTPUTS (pins 12,45) 6/ | $R_{DS(ON)(0-15)_A}$ | $V_{IN}$ = +5V, $V_{EN}$ = 0.8V, $I_{OUT}$ = -1mA 2/, 3/, 5/ | 50 | 1000 | Ω |

Notes:

1/ Measure inputs sequentially. Ground all unused inputs of the device under test. $V_A$ is the applied input voltage to the address lines A(0-3).

2/ $V_{IN}$ is the applied input voltage to the input channels CH0-CH15.

3/ $V_{EN}$ is the applied input voltage to the enable line EN (0-15).

4/ $V_{OUT}$ is the applied input voltage to the output lines OUTPUT (0-15), CURRENT (0-15)

5/ Negative current is the current flowing out of each of the MUX pins. Positive current is the current flowing into each MUX pin.

6/ The MUX8561 cannot be operated with analog inputs below 0 volts.

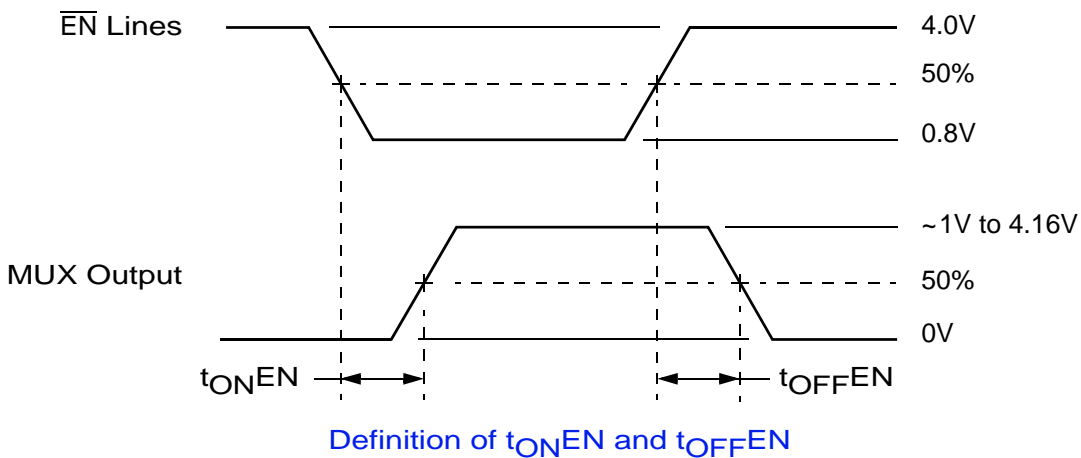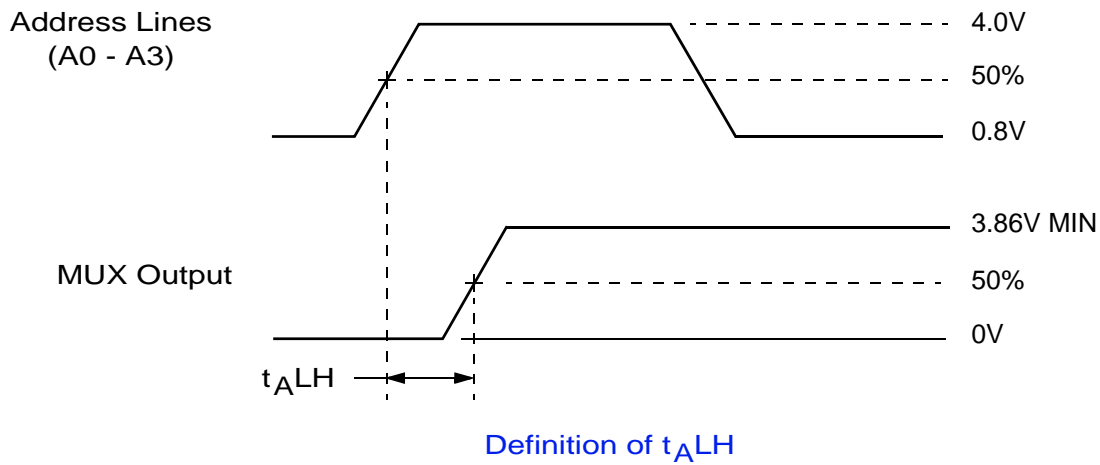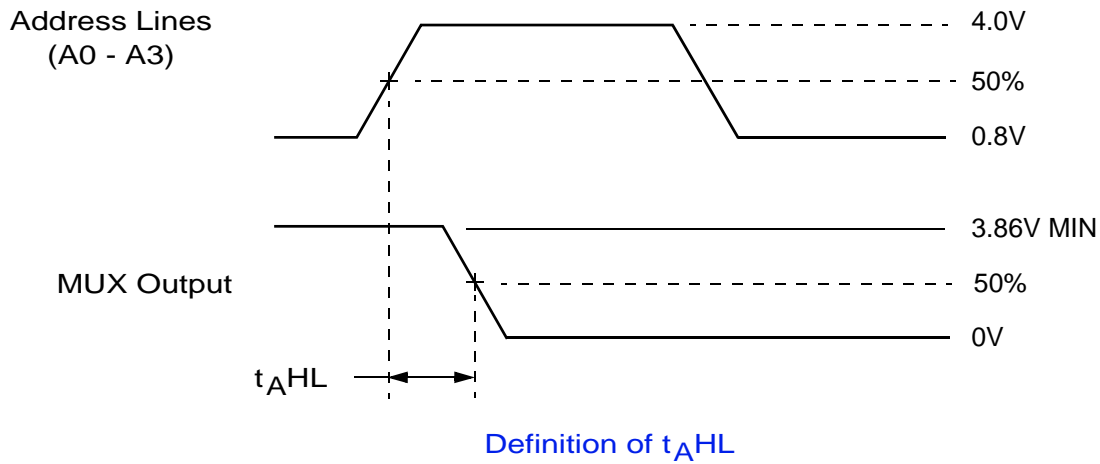7/ Not tested, guaranteed to the specified limits.

# SWITCHING CHARACTERISTICS
($T_C$ = -55°C to +125°C, +$V_{EE}$ = +5V, $V_{REF}$ = +5.0V - Unless otherwise specified)

| Parameter | Symbol | Conditions | Min | Max | Units |
|---|---|---|---|---|---|
| Switching Test MUX | $t_A HL$ | $R_L$ = 10KΩ, $C_L$ = 50pF | 100 | 700 | ns |
| | $t_A LH$ | | 100 | 700 | ns |
| | $t_{ON} EN$ | $R_L$ = 1KΩ, $C_L$ = 50pF | 100 | 700 | ns |
| | $t_{OFF} EN$ | | 100 | 700 | ns |

# TRUTH TABLE (CH0 – CH15)

| A3 | A2 | A1 | A0 | $\overline{EN}$ (0-15) | "ON" CHANNEL 1/ |
|----|----|----|----|------|-----------------|
| X | X | X | X | H | NONE |
| L | L | L | L | L | CH0 |
| L | L | L | H | L | CH1 |
| L | L | H | L | L | CH2 |
| L | L | H | H | L | CH3 |
| L | H | L | L | L | CH4 |
| L | H | L | H | L | CH5 |
| L | H | H | L | L | CH6 |
| L | H | H | H | L | CH7 |
| H | L | L | L | L | CH8 |
| H | L | L | H | L | CH9 |
| H | L | H | L | L | CH10 |
| H | L | H | H | L | CH11 |
| H | H | L | L | L | CH12 |
| H | H | L | H | L | CH13 |
| H | H | H | L | L | CH14 |
| H | H | H | H | L | CH15 |

1/ Between CH0-15 and OUTPUT (0-15), CURRENT (0-15)

Address Lines
(A0 - A3)

4.0V

50%

0.8V

3.86V MIN

MUX Output

50%

0V

$t_A HL$

Definition of $t_A HL$

Address Lines
(A0 - A3)

4.0V

50%

0.8V

3.86V MIN

MUX Output

50%

0V

$t_A LH$

Definition of $t_A LH$

$\overline{EN}$ Lines

4.0V

50%

0.8V

~1V to 4.16V

MUX Output

50%

0V

$t_{ON}EN$

$t_{OFF}EN$

Definition of $t_{ON}EN$ and $t_{OFF}EN$

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

**MUX8561 SWITCHING DIAGRAMS**

# PIN NUMBERS & FUNCTIONS

| MUX8561 – 56 Leads Ceramic QUAD Flat Pack | | | |
|---|---|---|---|
| Pin # | Function | Pin # | Function |
| 1 | CH0 | 29 | NC |
| 2 | CH1 | 30 | NC |
| 3 | CH2 | 31 | NC |
| 4 | CH3 | 32 | NC |
| 5 | CH4 | 33 | NC |
| 6 | CH5 | 34 | NC |
| 7 | GND | 35 | GND |
| 8 | GND | 36 | GND |
| 9 | CH6 | 37 | NC |
| 10 | CH7 | 38 | NC |
| 11 | CASE GND | 39 | $V_{REF}$ |
| 12 | OUTPUT (0-15) | 40 | NC |
| 13 | $\overline{EN}$ 0-15 | 41 | NC |
| 14 | A0 | 42 | NC |
| 15 | A1 | 43 | NC |
| 16 | A2 | 44 | NC |
| 17 | A3 | 45 | CURRENT (0-15) |
| 18 | $+V_{EE}$ | 46 | GND |
| 19 | CH15 | 47 | NC |
| 20 | CH14 | 48 | NC |
| 21 | GND | 49 | GND |
| 22 | GND | 50 | GND |
| 23 | CH13 | 51 | NC |
| 24 | CH12 | 52 | NC |
| 25 | CH11 | 53 | NC |
| 26 | CH10 | 54 | NC |
| 27 | CH9 | 55 | NC |
| 28 | CH8 | 56 | NC |

Notes:
1.  It is recommended that all "NC" or "no connect pin", be grounded. This eliminates or minimizes any ESD or static buildup.
2.  Package lid is internally connected to circuit ground (Pins 7, 8, 11, 21, 22, 35, 36, 46, 49, 50).

# ORDERING INFORMATION

| Model | DSCC SMD # | Screening | Package |
|-------|-----------|-----------|---------|
| MUX8561-S | - | Military Temperature, -55°C to +125°C<br>Screened in accordance with MIL-PRF-38534, Class K | QUAD Flat Pack |
| MUX8561-7 | - | Commercial Flow, +25°C testing only | |
| MUX8561-201-1S | 5962-1021002KXC<br>Pending | In accordance with DSCC SMD | |

## PACKAGE OUTLINE



0.650 ±.005
(13 Spaces at .050)
Tol Non-Cum
4 Sides

Pin 1

Pin 7

Pin 50
Pin 49

Pin 8

.200 MAX

.0165 ±.003

0.800 SQ ±.010

Pin 21

Pin 36

(.650)

Pin 22

Pin 35

.006 ±.002
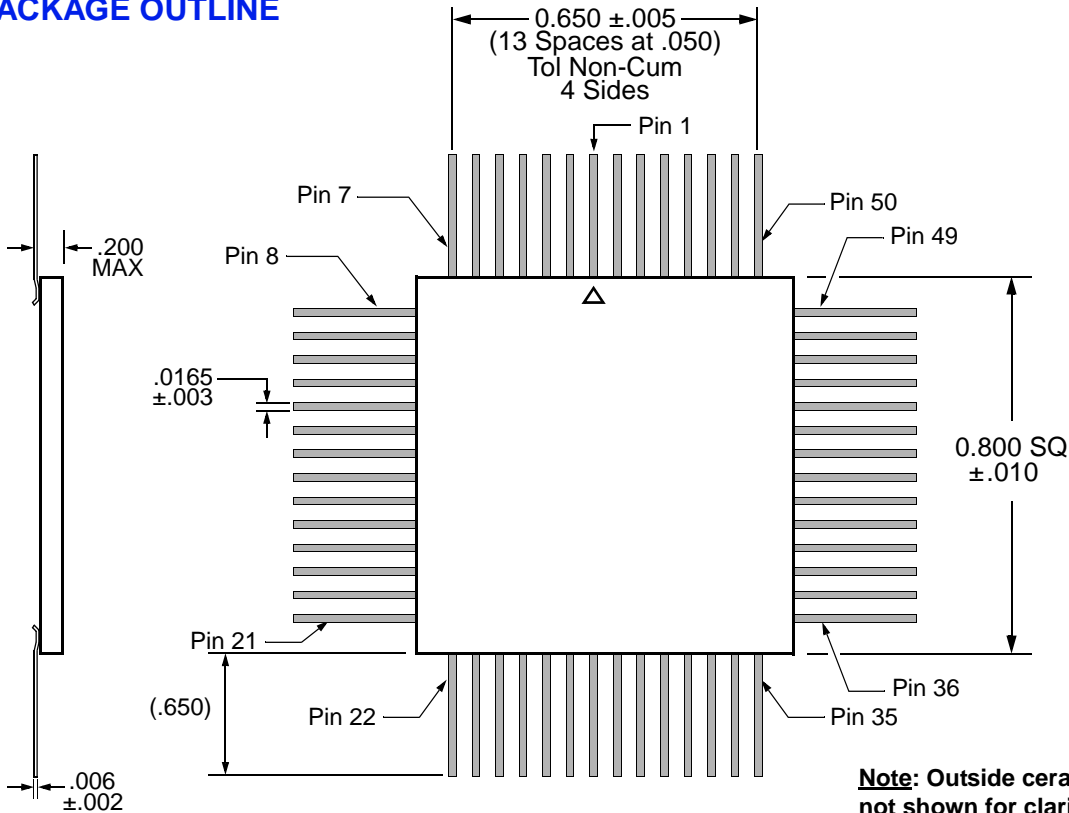
**Note: Outside ceramic tie bars not shown for clarity. Contact factory for details.**

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