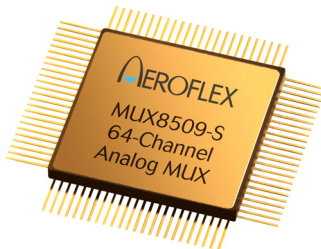


MUX8509 64-Channel Analog Multiplexer Module

Radiation Tolerant

www.aeroflex.com/mux

May 5, 2014



FEATURES

- ❑ 64-channels provided by four 16-channel multiplexers
- ❑ Radiation performance
 - Total dose: 300 krads(Si), Dose rate = 50 - 300 rads(Si)/s
 - SEU: Immune up to 120 MeV-cm²/mg
 - SEL: Immune by process design
- ❑ Full military temperature range
- ❑ Low power consumption < 60mW
- ❑ Two address buses (A0-3 & B0-3) and four enable lines afford flexible organization
- ❑ Fast access time 1500ns typical
- ❑ Break-Before-Make switching
- ❑ Same *Form / Fit / Function* as ACT8501 minus channel input transorbs
- ❑ High analog input impedance (power on or off)
- ❑ Designed for aerospace and high reliability space applications
- ❑ Packaging – Hermetic ceramic
 - 96 leads, 1.32" Sq x 0.20"Ht quad flat pack
 - Typical Weight 15 grams
- ❑ Aeroflex Plainview's Radiation Hardness Assurance Plan is DLA Certified to MIL-PRF-38534, Appendix G.

GENERAL DESCRIPTION

Aeroflex's MUX8509 is a radiation tolerant, 64 channel multiplexer MCM (multi-chip module).

The MUX8509 has been specifically designed to meet exposure to radiation environments. It is available in a 96 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 MUX8509 is ideal for demanding military and space applications.

ORGANIZATION AND APPLICATION

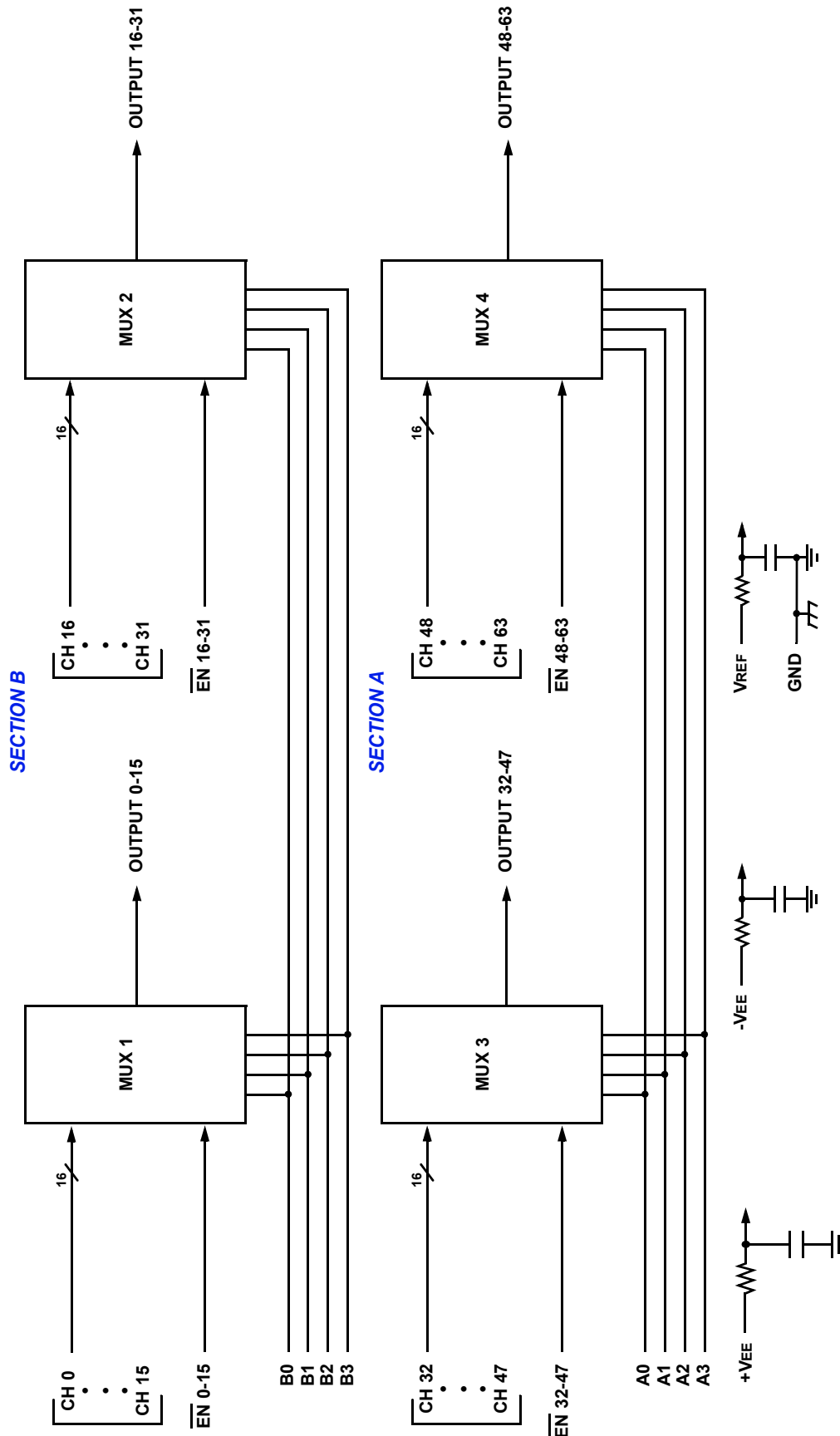
The MUX8509 consists of four 16 channel multiplexers arranged as shown in the Block Diagram. The MUX8509 design is inherently radiation tolerant.

A SECTION

Thirty-two (32) channels addressable by bus A₀~A₃, in two 16 channel blocks, each block enabled separately.

B SECTION

Thirty-two (32) channels addressable by bus B₀~B₃, in two 16 channel blocks, each block enabled separately.



MUX8509 64-CHANNEL ANALOG MUX BLOCK DIAGRAM

ABSOLUTE MAXIMUM RATINGS ^{1/}

| Parameter | Range | Units |
|--|-----------------------------------|-------------|
| Case Operating Temperature Range | -55 to +125 | °C |
| Storage Temperature Range | -65 to +150 | °C |
| Supply Voltage +V _{EE} (Pin 44) -V _{EE} (Pin 46) V _{REF} (Pin 48) | +16.5 -16.5 +16.5 | V V V |
| Digital Input Overvoltage V _{EN} (Pins 5, 6, 91, 92), V _A (Pins 1, 3, 93, 95), V _B (Pins 2, 4, 94, 96) | < V _{REF} +4 > GND -4 | V V |
| Analog Input Over Voltage V _{IN} | ±35 | V |

Notes:

^{1/} All measurements are made with respect to ground.

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 ^{1/}

| Symbol | Parameter | Typical | Units |
|------------------|-------------------------------|------------------------|-------|
| +V _{EE} | Positive Power Supply Voltage | +12.0 to +15.0 dc ± 5% | V |
| -V _{EE} | Negative Power Supply Voltage | -12.0 to -15.0 dc ± 5% | V |
| V _{REF} | Reference Voltage | +5.0 | V |
| V _{AL} | Logic Low Level | +0.8 | V |
| V _{AH} | Logic High Level | +4.0 | V |

Notes:

^{1/} Power Supply turn-on sequence shall be as follows: +V_{EE}, -V_{EE}, followed by V_{REF}.

DC ELECTRICAL PERFORMANCE CHARACTERISTICS ^{1/}

(T_c = -55°C to +125°C, +V_{EE} = +15.75V, -V_{EE} = -15.75V, V_{REF} = +5.0V, Unless otherwise specified)

| Parameter | Symbol | Conditions | Min | Max | Units |
|-----------------------|------------------------------------|--|-----|-----|-------|
| Supply Current | +I _{EE} | V _{EN} (0-63) = V _A (0-3) _A = V _A (0-3) _B = 0 | 0 | 2 | mA |
| | -I _{EE} | | -2 | 0 | mA |
| | +I _{SBY} | V _{EN} (0-63) = 4V, V _A (0-3) _A = V _A (0-3) _B = 0 ^{6/} | 0 | 2 | mA |
| | -I _{SBY} | | -2 | 0 | mA |
| Address Input Current | I _{AL} (0-3) _A | V _A = 0V ^{8/} | -2 | 2 | μA |
| | I _{AH} (0-3) _A | V _A = 5V ^{8/} | -2 | 2 | μA |
| | I _{AL} (0-3) _B | V _B = 0V ^{8/} | -2 | 2 | μA |
| | I _{AH} (0-3) _B | V _B = 5V ^{8/} | -2 | 2 | μA |
| Enable Input Current | I _{ENL} (0-15) | V _{EN} (0-15) = 0V ^{8/} | -1 | 1 | μA |
| | I _{ENH} (0-15) | V _{EN} (0-15) = 5V ^{8/} | -1 | 1 | μA |
| | I _{ENL} (16-31) | V _{EN} (16-31) = 0V ^{8/} | -1 | 1 | μA |
| | I _{ENH} (16-31) | V _{EN} (16-31) = 5V ^{8/} | -1 | 1 | μA |
| | I _{ENL} (32-47) | V _{EN} (32-47) = 0V ^{8/} | -1 | 1 | μA |
| | I _{ENH} (32-47) | V _{EN} (32-47) = 5V ^{8/} | -1 | 1 | μA |
| | I _{ENL} (48-63) | V _{EN} (48-63) = 0V ^{8/} | -1 | 1 | μA |
| | I _{ENH} (48-63) | V _{EN} (48-63) = 5V ^{8/} | -1 | 1 | μA |

DC ELECTRICAL PERFORMANCE CHARACTERISTICS 1/ (continued)

(Tc = -55°C to +125°C, +VEE = +15.75V, -VEE = -15.75V, VREF = +5.0V, Unless otherwise specified)

| Parameter | Symbol | Conditions | Min | Max | Units | |
|--|--------------------|--|-------|------|-------|----|
| Positive Input Leakage Current CH0-CH63 | +ISOFFOUTPUT(0-63) | VIN = +10V, VEN = 4V, output and all unused MUX inputs under test = -10V 2/, 3/, 8/ | +25°C | -10 | +10 | nA |
| | | | - | -100 | +100 | nA |
| Negative Input Leakage Current CH0-CH63 | -ISOFFOUTPUT(0-63) | VIN = -10V, VEN = 4V, output and all unused MUX inputs under test = +10V 2/, 3/, 8/ | +25°C | -10 | +10 | nA |
| | | | - | -100 | +100 | nA |
| Output Leakage Current OUTPUTS (pins 25,26, 68 & 70) | +IDOFFOUTPUT | VOUT = +10V, VEN = 4V, output and all unused MUX inputs under test = -10V 3/, 4/, 8/ | -100 | +100 | nA | |
| Output Leakage Current OUTPUTS (pins 25,26, 68 & 70) | -IDOFFOUTPUT | VOUT = -10V, VEN = 4V, output and all unused MUX inputs under test = +10V 3/, 4/, 8/ | -100 | +100 | nA | |
| Switch ON Resistance OUTPUTS (pins 25,26, 68 & 70) | RDS(ON)(0-63)A | VIN = +15.75V, VEN = 0.8V, IOUT = -1mA 2/, 3/, 5/ | 500 | 3000 | Ω | |
| | RDS(ON)(0-63)B | VIN = +5V, VEN = 0.8V, IOUT = -1mA 2/, 3/, 5/ | 500 | 3000 | Ω | |
| | RDS(ON)(0-63)C | VIN = -5V, VEN = 0.8V, IOUT = +1mA 2/, 3/, 5/ | 500 | 3000 | Ω | |
| Switch ON Resistance OUTPUTS (pins 25,26, 68 & 70) | RDS(ON)(0-63)A | VIN = +11.4V, VEN = 0.8V, IOUT = -1mA 2/, 3/, 5/, 7/ | 500 | 3200 | Ω | |
| | RDS(ON)(0-63)B | VIN = +5V, VEN = 0.8V, IOUT = -1mA 2/, 3/, 5/, 7/ | 500 | 3000 | Ω | |
| | RDS(ON)(0-63)C | VIN = -5V, VEN = 0.8V, IOUT = +1mA 2/, 3/, 5/, 7/ | 500 | 3000 | Ω | |

Notes:

- 1/ Measure inputs sequentially. Ground all unused inputs of the device under test. VA is the applied input voltage to the address lines A(0-3). VB is the applied input voltage to the address lines B(0-3).
- 2/ VIN is the applied input voltage to the input channels CH0-CH63.
- 3/ VEN is the applied input voltage to the enable lines EN (0-15), EN (16-31), EN (32-47) and EN (48-63).
- 4/ VOUT is the applied input voltage to the output lines OUTPUT(0-15), OUTPUT(16-31), OUTPUT(32-47) and OUTPUT(48-63).
- 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/ Not tested, guaranteed to the specified limits.
- 7/ +VEE = +11.4 Vdc, -VEE = -11.4 Vdc and VREF = 5.0 V
- 8/ These parameters for Tc = -55°C are guaranteed by design, characterization, or correlation to other test parameters but not production tested.

SWITCHING CHARACTERISTICS

(Tc = -55°C to +125°C, +VEE = +15.75V, -VEE = -15.75V, VREF = +5.0V, Unless otherwise specified)

| Parameter | Symbol | Conditions | Min | Max | Units | |
|--------------------|--------|------------------------|--------------------|-----|-------|----|
| Switching Test MUX | tAHL | RL = 10KΩ, CL = 50pF | Tc = +25°C, +125°C | 10 | 1500 | ns |
| | | | Tc = -55°C | 10 | 3500 | ns |
| | tALH | RL = 10KΩ, CL = 50pF | Tc = +25°C, +125°C | 10 | 2000 | ns |
| | | | Tc = -55°C | 10 | 5000 | ns |
| | tONEN | RL = 1KΩ, CL = 50pF | | 10 | 1500 | ns |
| | tOFFEN | RL = 1KΩ, CL = 50pF 1/ | | 10 | 1000 | ns |

Notes:

- 1/ +VEE = +11.4 Vdc, -VEE = -11.4 Vdc and VREF = 5.0 V

TRUTH TABLE (CH0 – CH15)

| B3 | B2 | B1 | B0 | EN(0-15) | "ON" CHANNEL <u>1/</u> |
|----|----|----|----|----------|------------------------|
| 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)

TRUTH TABLE (CH16 – CH31)

| B3 | B2 | B1 | B0 | EN(16-31) | "ON" CHANNEL <u>1/</u> |
|----|----|----|----|-----------|------------------------|
| X | X | X | X | H | NONE |
| L | L | L | L | L | CH16 |
| L | L | L | H | L | CH17 |
| L | L | H | L | L | CH18 |
| L | L | H | H | L | CH19 |
| L | H | L | L | L | CH20 |
| L | H | L | H | L | CH21 |
| L | H | H | L | L | CH22 |
| L | H | H | H | L | CH23 |
| H | L | L | L | L | CH24 |
| H | L | L | H | L | CH25 |
| H | L | H | L | L | CH26 |
| H | L | H | H | L | CH27 |
| H | H | L | L | L | CH28 |
| H | H | L | H | L | CH29 |
| H | H | H | L | L | CH30 |
| H | H | H | H | L | CH31 |

1/ Between CH16-31 and OUTPUT (16-31)

TRUTH TABLE (CH32 – CH47)

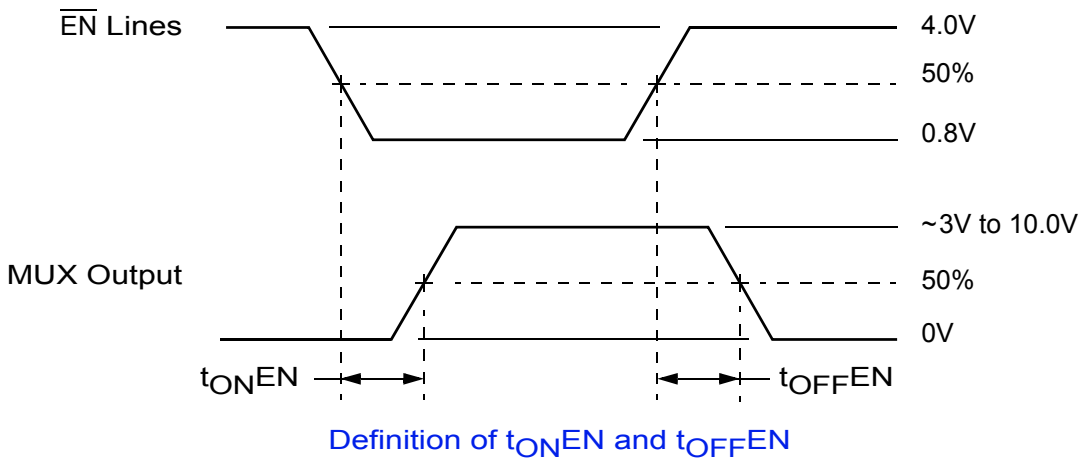
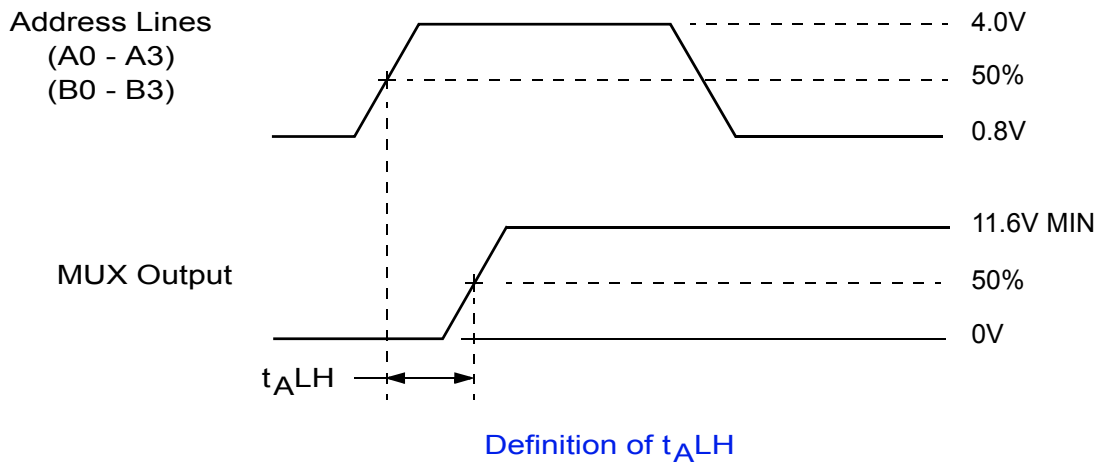
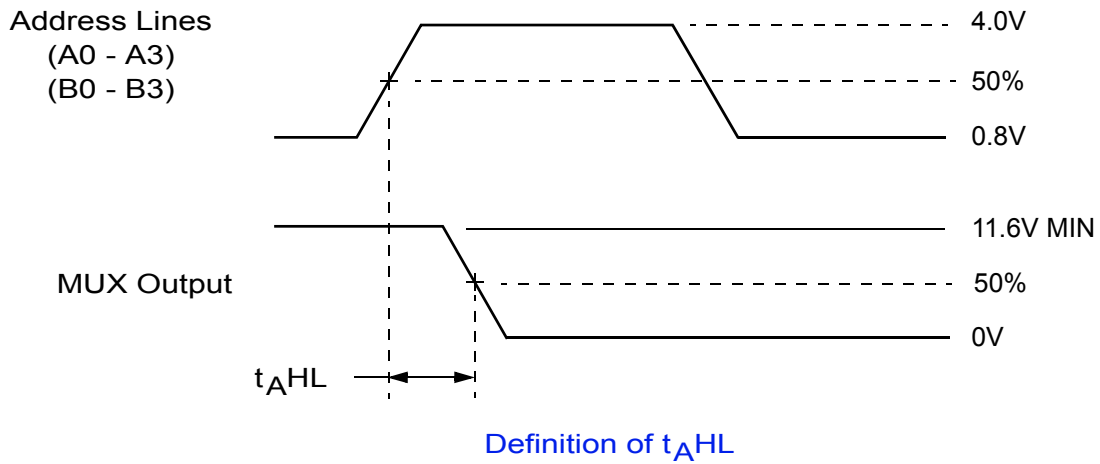
| A3 | A2 | A1 | A0 | EN(32-47) | "ON" CHANNEL <u>1/</u> |
|----|----|----|----|-----------|------------------------|
| X | X | X | X | H | NONE |
| L | L | L | L | L | CH32 |
| L | L | L | H | L | CH33 |
| L | L | H | L | L | CH34 |
| L | L | H | H | L | CH35 |
| L | H | L | L | L | CH36 |
| L | H | L | H | L | CH37 |
| L | H | H | L | L | CH38 |
| L | H | H | H | L | CH39 |
| H | L | L | L | L | CH40 |
| H | L | L | H | L | CH41 |
| H | L | H | L | L | CH42 |
| H | L | H | H | L | CH43 |
| H | H | L | L | L | CH44 |
| H | H | L | H | L | CH45 |
| H | H | H | L | L | CH46 |
| H | H | H | H | L | CH47 |

1/ Between CH32-47 and OUTPUT (32-47)

TRUTH TABLE (CH48 – CH63)

| A3 | A2 | A1 | A0 | EN(48-63) | "ON" CHANNEL <u>1/</u> |
|----|----|----|----|-----------|------------------------|
| X | X | X | X | H | NONE |
| L | L | L | L | L | CH48 |
| L | L | L | H | L | CH49 |
| L | L | H | L | L | CH50 |
| L | L | H | H | L | CH51 |
| L | H | L | L | L | CH52 |
| L | H | L | H | L | CH53 |
| L | H | H | L | L | CH54 |
| L | H | H | H | L | CH55 |
| H | L | L | L | L | CH56 |
| H | L | L | H | L | CH57 |
| H | L | H | L | L | CH58 |
| H | L | H | H | L | CH59 |
| H | H | L | L | L | CH60 |
| H | H | L | H | L | CH61 |
| H | H | H | L | L | CH62 |
| H | H | H | H | L | CH63 |

1/ Between CH48-63 and OUTPUT (48-63)



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

MUX8509 SWITCHING DIAGRAMS

PIN NUMBERS & FUNCTIONS

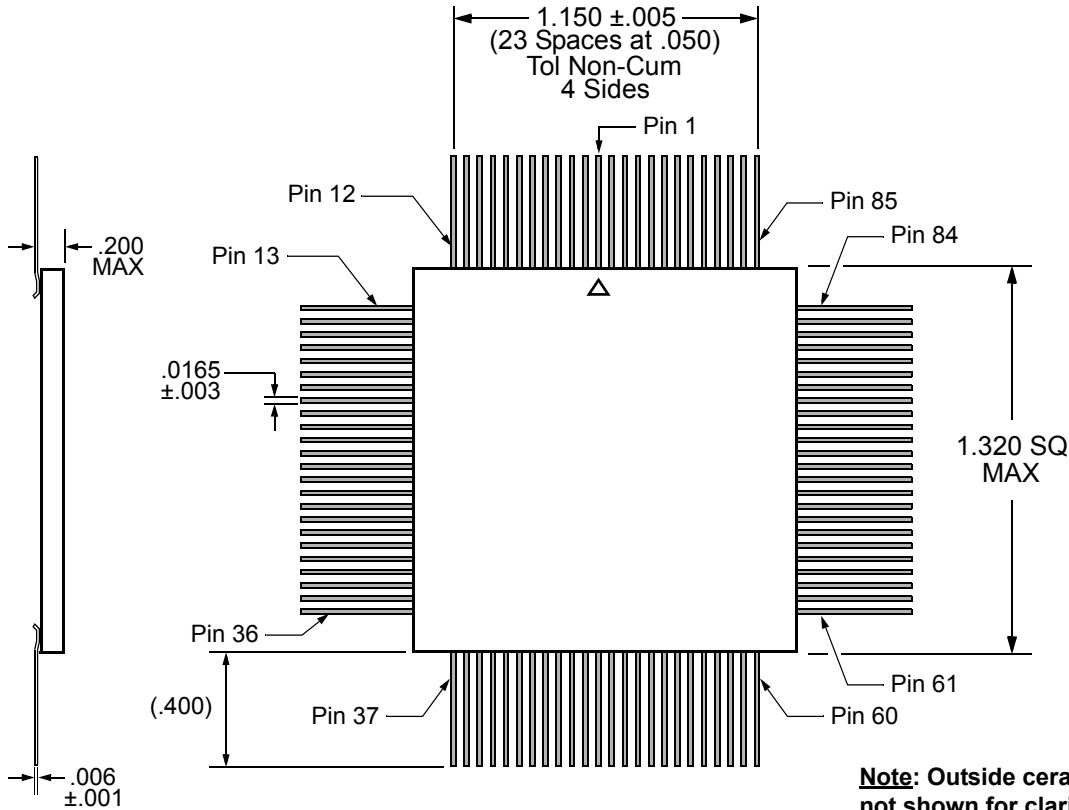
| MUX8509 – 96 Leads Ceramic QUAD Flat Pack | | | | | |
|---|-----------------------|-------|----------|-------|-----------------------|
| Pin # | Function | Pin # | Function | Pin # | Function |
| 1 | A2 | 33 | CH11 | 65 | CH49 |
| 2 | B2 | 34 | CH27 | 66 | CH48 |
| 3 | A3 | 35 | CH12 | 67 | NC |
| 4 | B3 | 36 | CH28 | 68 | Output V (48-63) |
| 5 | \overline{EN} 0-15 | 37 | CH13 | 69 | NC |
| 6 | \overline{EN} 16-31 | 38 | CH29 | 70 | Output V (32-47) |
| 7 | CH0 | 39 | CH14 | 71 | GND |
| 8 | CH16 | 40 | CH30 | 72 | GND |
| 9 | CH1 | 41 | CH15 | 73 | CH47 |
| 10 | CH17 | 42 | CH31 | 74 | CH46 |
| 11 | CH2 | 43 | NC | 75 | CH45 |
| 12 | CH18 | 44 | +VEE | 76 | CH44 |
| 13 | CH3 | 45 | NC | 77 | CH43 |
| 14 | CH19 | 46 | -VEE | 78 | CH42 |
| 15 | CH4 | 47 | NC | 79 | CH41 |
| 16 | CH20 | 48 | VREF | 80 | CH40 |
| 17 | CH5 | 49 | NC | 81 | CH39 |
| 18 | CH21 | 50 | CASE GND | 82 | CH38 |
| 19 | CH6 | 51 | CH63 | 83 | CH37 |
| 20 | CH22 | 52 | CH62 | 84 | CH36 |
| 21 | CH7 | 53 | CH61 | 85 | CH35 |
| 22 | CH23 | 54 | CH60 | 86 | CH34 |
| 23 | GND | 55 | CH59 | 87 | CH33 |
| 24 | GND | 56 | CH58 | 88 | CH32 |
| 25 | Output V (0-15) | 57 | CH57 | 89 | GND |
| 26 | Output V (16-31) | 58 | CH56 | 90 | GND |
| 27 | CH8 | 59 | CH55 | 91 | \overline{EN} 48-63 |
| 28 | CH24 | 60 | CH54 | 92 | \overline{EN} 32-47 |
| 29 | CH9 | 61 | CH53 | 93 | A0 |
| 30 | CH25 | 62 | CH52 | 94 | B0 |
| 31 | CH10 | 63 | CH51 | 95 | A1 |
| 32 | CH26 | 64 | CH50 | 96 | B1 |

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 23, 24, 50, 71, 72, 89 & 90)

ORDERING INFORMATION

| Model | DLA SMD # | Screening | Package |
|----------------|-----------------|---|-------------------|
| MUX8509-7 | - | Commercial Flow, +25°C testing only | QUAD Flat Pack |
| MUX8509-201-1S | 5962-1021202KXC | In accordance with DLA SMD | |
| MUX8509-901-1S | 5962F1021202KXC | In accordance with DLA Certified RHA Program Plan to RHA Level "F", 300krad(Si) | |



FLAT PACKAGE OUTLINE

Note: Outside ceramic tie bars not shown for clarity. Contact factory for details.

EXPORT CONTROL:

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

www.aeroflex.com/HiRel info-ams@aeroflex.com

Datasheet Definitions:

| | |
|---------------------------------------|---|
| <i>Advanced Preliminary Datasheet</i> | <i>Product in Development Shipping Non-Flight Prototypes Shipping QML and Reduced HiRel</i> |
|---------------------------------------|---|



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Our passion for performance is defined by three attributes.

