



**ANALOG
DEVICES**

8-Chan/Dual 4-Chan JFET Analog Multiplexers (Overvoltage & Power Supply Loss Protected)

MUX-08/MUX-24

FEATURES

- JFET Switches Rather Than CMOS
- Low "ON" Resistance 220Ω Typ
- Highly Resistant to Static Discharge Damage
- No SCR Latch-Up Problems
- Digital Inputs Compatible With TTL and CMOS
- 125°C Temperature Tested Dice Available
- MUX-08 Pin Compatible With DG508, HI-508A, IH5108, IH6108, LF11508/12508/13508, AD7506
- MUX-24 Pin Compatible With DG509, HI-509A, IH5208, IH6208, LF11509/12509/13509, AD7507
- Available in Surface Mount Packages
- Available in Die Form

ORDERING INFORMATION †

25°C ON RESISTANCE	PACKAGE			OPERATING TEMPERATURE RANGE
	CERDIP 16-PIN	PLASTIC 16-PIN	LCC 20-CONTACT	
220Ω	MUX08AQ*	-	-	MIL
	MUX08EQ	-	-	IND
	-	MUX08EP	-	COM
300Ω	MUX08BQ*	-	MUX08BRC/883	MIL
	MUX08FQ	-	-	IND
	-	MUX08FP	-	XIND
	-	MUX08FS††	-	XIND
220Ω	MUX24AQ*	-	-	MIL
	MUX24EQ	-	-	IND
	-	MUX24EP	-	COM
300Ω	MUX24BQ*	-	-	MIL
	MUX24FQ	-	-	IND
	-	MUX24FP	-	XIND
	-	MUX24FS††	-	XIND

* For devices processed in total compliance to MIL-STD-883, add /883 after part number. Consult factory for 883 data sheet.

† Burn-in is available on commercial and industrial temperature range parts in CerDIP, plastic DIP, and TO-can packages.

†† For availability and burn-in information on SO and PLCC packages, contact your local sales office.

GENERAL DESCRIPTION

The MUX-08 is a monolithic eight-channel analog multiplexer which connects a single output to one of the eight analog inputs depending upon the state of a 3-bit binary address.

The MUX-24 is a monolithic four-channel differential analog multiplexer configured in a double pole, four-position (plus OFF) electronic switch array. A two-bit binary input address connects a pair of independent analog inputs from each four-channel input section to the corresponding pair of independent analog outputs.

All switches in the MUX-08/MUX-24 are turned OFF by applying logic "0" to the ENABLE pin, thereby providing a package select function.

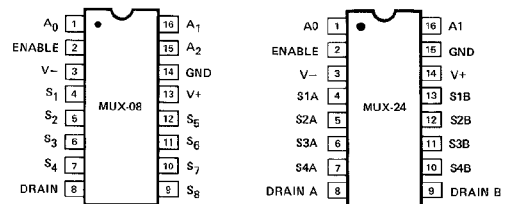
REV. A

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Fabricated with Precision Monolithics' high performance Bipolar-JFET technology, these devices offer low, constant "ON" resistance, low leakage currents and fast settling time with low crosstalk to satisfy a wide variety of applications. These multiplexers do not suffer from latch-up or static charge blow-out problems associated with similar CMOS parts. The digital inputs are designed to operate from both TTL and CMOS levels while always providing a definite break-before-make action without the need for external pull-up resistors over the full operating temperature range.

For single sixteen-channel and dual eight-channel models, refer to the MUX-16/MUX-28 data sheet.

PIN CONNECTIONS

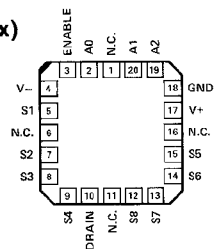


16-PIN CERDIP (Q-Suffix)

16-PIN PLASTIC DIP (P-Suffix)

16-PIN SO (S-Suffix)

20-CONTACT LCC
(RC-Suffix)

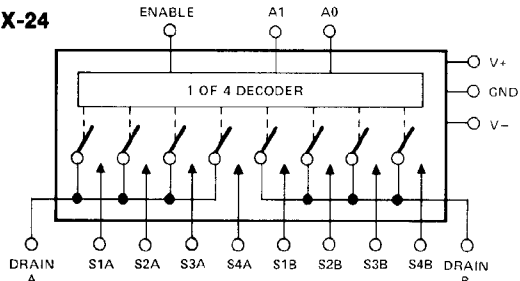


FUNCTIONAL DIAGRAMS

MUX-08



MUX-24



One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.
Tel: 617/329-4700 Fax: 617/326-8703 Twx: 710/394-6577
Telex: 924491 Cable: ANALOG NORWOODMASS

MUX-08/MUX-24

ABSOLUTE MAXIMUM RATINGS (Note 1)

Operating Temperature Range	
MUX-08/24-AQ, BQ, BRC	-55°C to +125°C
MUX-02/24-EQ, FQ	-25°C to +85°C
MUX-08/24-EP	0°C to +70°C
MUX-08/24-FP, FS	-40°C to +85°C
Junction Temperature (T _J)	-65°C to +150°C
Storage Temperature Range	-65°C to +150°C
P-Suffix	-65°C to +125°C
Lead Temperature (Soldering, 60 sec)	300°C
Maximum Junction Temperature	150°C
V+ Supply to V- Supply	36V
Logic Input Voltage	(-4V or V-) to V+ Supply

Analog Input Voltage V- Supply -20V to V+ Supply +20V
 Maximum Current Through Any Pin 25mA

PACKAGE TYPE	θ_{JA} (Note 2)	θ_{JC}	UNITS
16-Pin Hermetic DIP (Q)	100	16	°C/W
16-Pin Plastic DIP (P)	82	39	°C/W
20-Contact LCC (RC)	98	38	°C/W
16-Pin SO (S)	111	35	°C/W

NOTES:

1. Absolute maximum ratings apply to both DICE and packaged parts, unless otherwise noted.
2. θ_{JA} is specified for worst case mounting conditions, i.e., θ_{JA} is specified for device in socket for CerDIP, P-DIP, and LCC packages; θ_{JA} is specified for device soldered to printed circuit board for SO package.

ELECTRICAL CHARACTERISTICS at V+ = +15V, V- = -15V and T_A = 25°C, unless otherwise noted.

PARAMETER	SYMBOL	CONDITIONS	MUX-08A/E MUX-24A/E			MUX-08B/F MUX-24B/F			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
"ON" Resistance	R _{ON}	V _S ≤ 10V, I _S ≤ 200μA	—	220	300	—	300	400	Ω
ΔR _{ON} With Applied Voltage	ΔR _{ON}	-10V ≤ V _S ≤ 10V, I _S = 200μA	—	1	5	—	3	7	%
R _{ON} Match Between Switches	R _{ON} Match	V _S = 0V, I _S = 200μA	—	7	15	—	9	20	%
Analog Voltage Range	V _A	(Note 6)	+10 -10	+10.4 -15	—	+10 -10	+10.4 -15	—	V
Source Current (Switch "OFF")	I _{S(OFF)}	V _S = 10V, V _D = -10V (Note 1)	—	0.01	1.0	—	0.01	2.0	nA
Drain Current (Switch "OFF")	I _{D(OFF)}	V _S = 10V, V _D = -10V (Note 1)	MUX-08 MUX-24	— 0.05	0.1 1.0	— 0.05	0.1 1.0	2.0 2.0	nA
Leakage Current (Switch "ON")	I _{D(ON)} + I _{S(ON)}	V _D = 10V (Note 1)	MUX-08 MUX-24	— 0.05	0.1 1.0	— 0.05	0.1 1.0	2.0 2.0	nA
Digital Input Current	I _{IN}	V _{IN} = 0.4V to 15V	—	1	10	—	1	10	μA
Digital "0" Enable Current	I _{INL(EN)}	V _{EN} = 0.4V	—	4	10	—	4	10	μA
Digital Input Capacitance	C _{DIG}		—	3	—	—	3	—	pF
Switching Time (t _{TRAN})	t _{PHL} t _{PLH}	(Notes 2, 5) Figure 1 (Test Circuit)	—	1.5 1.0	2.1 1.3	—	1.5 1.0	2.1 1.3	μs
Output Settling Time	t _S	10V Step to 0.10% 10V Step to 0.05% 10V Step to 0.02%	—	2.2 2.7 3.4	— — —	—	2.2 2.7 3.4	— — —	μs
Break-Before-Make Delay	t _{OPEN}	Figure 3 (Test Circuit)	—	0.8	—	—	1.0	—	μs
Enable Delay "ON"	t _{ON(EN)}	(Note 5) Figure 2 (Test Circuit)	—	1	2	—	1	2	μs
Enable Delay "OFF"	t _{OFF(EN)}	(Note 5) Figure 2 (Test Circuit)	MUX-08 MUX-24	— 0.2	0.1 0.5	0.4 0.5	— 0.3	0.2 0.6	μs
"OFF" Isolation	ISO _{OFF}	(Note 4) Figure 5 (Test Circuit)	MUX-08 MUX-24	— 66	60 —	— 66	60 —	— —	dB
Crosstalk	CT	(Note 3) Figure 4 (Test Circuit)	MUX-08 MUX-24	— 76	70 —	— 76	70 —	— —	dB
Source Capacitance	C _{S(OFF)}	Switch "OFF", V _S = 0V, V _D = 0V	MUX-08 MUX-24	— 2	2.5 —	— —	2.5 2	— —	pF
Drain Capacitance	C _{D(OFF)}	Switch "OFF", V _S = 0V, V _D = 0V	MUX-08 MUX-24	— 4	7 —	— —	7 4	— —	pF
Input to Output Capacitance	C _{DS(OFF)}	(Note 4)	MUX-08 MUX-24	— 0.15	0.3 —	— —	0.3 0.15	— —	pF
Positive Supply Current (All Digital Inputs Logic "0" or "1")	I+	V+ = 15V V+ = 5V	—	10 8	12 —	—	6 5	12 —	mA
Negative Supply Current (All Digital Inputs Logic "0" or "1")	I-	V+ = -15V V+ = -5V	—	3.0 2.5	3.8 —	—	2.0 1.8	3.8 —	mA

MUX-08/MUX-24

ELECTRICAL CHARACTERISTICS at $V_+ = 15V$, $V_- = -15V$ and $-55^\circ C \leq T_A \leq 125^\circ C$, unless otherwise noted.

PARAMETER	SYMBOL	CONDITIONS	MUX-08A/ MUX-24A			MUX-08B/ MUX-24B			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
"ON" Resistance	R_{ON}	$V_S \leq 10V, I_S \leq 200\mu A$	—	—	400	—	—	500	Ω
ΔR_{ON} With Applied Voltage	ΔR_{ON}	$-10V \leq V_S \leq 10V, I_S = 200\mu A$	—	1.5	—	—	4.5	—	%
R_{ON} Match Between Switches	R_{ON} Match	$V_S = 0V, I_S = 200\mu A$	—	10	—	—	15	—	%
Analog Voltage Range	V_A	(Note 6)	+10 -10	+10.4 -15	—	+10 -10	+10.4 -15	—	V
Source Current (Switch "OFF")	$I_{S(OFF)}$	$V_S = 10V, V_D = -10V$ (Notes 1, 7)	—	—	25	—	—	50	nA
Drain Current (Switch "OFF")	$I_{D(OFF)}$	$V_S = 10V, V_D = -10V$ (Notes 1, 7)	MUX-08 MUX-24	— —	100 50	— —	— —	500 500	nA
Leakage Current (Switch "ON")	$I_{D(ON)}$ $+I_{S(ON)}$	$V_D = 10V$ (Notes 1, 7)	MUX-08 MUX-24	— —	100 50	— —	— —	500 500	nA
Digital "1" Input Voltage	V_{INH}	(Note 6)	2	—	—	2	—	—	V
Digital "0" Input Voltage	V_{INL}	(Note 6)	—	—	0.7	—	—	0.7	V
Digital Input Current	I_{IN}	$V_{IN} = 0.4V$ to 15V	—	—	20	—	—	20	μA
Digital "0" Enable Current	$I_{INL(EN)}$	$V_{EN} = 0.4V$	—	—	20	—	—	20	μA
Positive Supply Current	I_+	All Digital Inputs Logic "0" or "1"	—	—	15	—	—	15	mA
Negative Supply Current	I_-	All Digital Inputs Logic "0" or "1"	—	—	5	—	—	5	mA

ELECTRICAL CHARACTERISTICS at $V_+ = 15V$, $V_- = -15V$ and $-25^\circ C \leq T_A \leq +85^\circ C$ for MUX-08EQ/FQ and MUX-24EQ/FQ; $0^\circ C \leq T_A \leq +70^\circ C$ for MUX-08EP and MUX-24EP; $-40^\circ C \leq T_A \leq +85^\circ C$ for MUX-08FP/FS and MUX-24FP/FS, unless otherwise noted

PARAMETER	SYMBOL	CONDITIONS	MUX-08E/ MUX-24E			MUX-08F/ MUX-24F			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
"ON" Resistance	R_{ON}	$V_S \leq 10V, I_S \leq 200\mu A$	—	—	400	—	—	500	Ω
ΔR_{ON} With Applied Voltage	ΔR_{ON}	$-10V \leq V_S \leq 10V, I_S = 200\mu A$	—	1.5	—	—	4.5	—	%
R_{ON} Match Between Switches	R_{ON} Match	$V_S = 0V, I_S = 200\mu A$	—	10	—	—	15	—	%
Analog Voltage Range	V_A	(Note 6)	+10 -10	+10.4 -15	—	+10 -10	+10.4 -15	—	V
Source Current (Switch "OFF")	$I_{S(OFF)}$	$V_S = 10V, V_D = -10V$ (Notes 1, 7)	—	—	10	—	—	10	nA
Drain Current (Switch "OFF")	$I_{D(OFF)}$	$V_S = 10V, V_D = -10V$ (Notes 1, 7)	MUX-08 MUX-24	— —	100 50	— —	— —	100 50	nA
Leakage Current (Switch "ON")	$I_{D(ON)}$ $+I_{S(ON)}$	$V_D = 10V$ (Notes 1, 7)	MUX-08 MUX-24	— —	100 50	— —	— —	100 50	nA
Digital "1" Input Voltage	V_{INH}	(Note 6)	2	—	—	2	—	—	V
Digital "0" Input Voltage	V_{INL}	(Note 6)	—	—	0.8	—	—	0.8	V
Digital Input Current	I_{IN}	$V_{IN} = 0.4V$ to 15V	—	—	20	—	—	20	μA
Digital "0" Enable Current	$I_{INL(EN)}$	$V_{EN} = 0.4V$	—	—	20	—	—	20	μA
Positive Supply Current	I_+	All Digital Inputs Logic "0" or "1"	—	—	15	—	—	15	mA
Negative Supply Current	I_-	All Digital Inputs Logic "0" or "1"	—	—	5	—	—	5	mA

NOTES:

- Conditions applied to leakage tests insure worst case leakages. Exceeding 11V on the analog input may cause an "OFF" channel to turn "ON".
 $R_L = 10M\Omega$, $C_L = 10pF$.
- Crosstalk is measured by driving channel 8 with channel 4 "ON".
 $R_L = 1M\Omega$, $C_L = 10pF$, $V_S = 5V$ RMS, $f = 500kHz$.
- "OFF" isolation is measured by driving channel 8 with ALL channels "OFF".
 $R_L = 1k\Omega$, $C_L = 10pF$, $V_S = 5V$ RMS, $f = 500kHz$. C_{DS} is computed from the OFF isolation measurement.
- Sample tested.
- Guaranteed by leakage current and R_{ON} tests.
- Leakage tests are performed only on military temperature grades at $125^\circ C$.

MUX-08/MUX-24

DICE CHARACTERISTICS (125°C TESTED DICE AVAILABLE)



MUX-08



MUX-24

**DIE SIZE 0.093 × 0.059 inch, 5487 sq. mils
(2.362 × 1.500 mm, 3543 sq. mm)**

<p>1. A0</p> <p>2. ENABLE</p> <p>3. V- (SUBSTRATE)</p> <p>4. S1</p> <p>5. S2</p> <p>6. S3</p> <p>7. S4</p> <p>8. DRAIN</p>	<p>9. S8</p> <p>10. S7</p> <p>11. S6</p> <p>12. S5</p> <p>13. V+</p> <p>14. GND</p> <p>15. A2</p> <p>16. A1</p>
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<p>1. A0</p> <p>2. ENABLE</p> <p>3. V- (SUBSTRATE)</p> <p>4. S1 A</p> <p>5. S2 A</p> <p>6. S3 A</p> <p>7. S4 A</p> <p>8. DRAIN A</p>	<p>9. DRAIN B</p> <p>10. S4 B</p> <p>11. S3 B</p> <p>12. S2 B</p> <p>13. S1 B</p> <p>14. V+</p> <p>15. GND</p> <p>16. A1</p>
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WAFER TEST LIMITS at $V+ = 15V$, $V- = -15V$, $T_A = 25^\circ C$, unless otherwise noted. (Note 1)

PARAMETER	SYMBOL	CONDITIONS	MUX-08/ MUX-24NT LIMIT	MUX-08/ MUX-24N LIMIT	MUX-08/ MUX-24G LIMIT	UNITS
"ON" Resistance	R_{ON}	$V_S = 0V$, $I_S = 200\mu A$ $T_A = 125^\circ C$	300 400	300 —	400 —	Ω MAX
Digital "1" Input Voltage	V_{INH}	(Note 2)	2	2	2	V MIN
Digital "0" Input Voltage	V_{INL}	(Note 2)	0.8	0.8	0.8	V MAX
Digital "0" Input Current	I_{INL}	$V_{IN} = 0.4V$ $T_A = 125^\circ C$	10 20	10 —	10 —	μA MAX
Digital "0" Enable Current	$I_{INL(EN)}$	$V_{IN} = 0.4V$ $T_A = 125^\circ C$	10 20	10 —	10 —	μA MAX
Positive Supply Current (All Digital Inputs Logic "0")	$I+$	$T_A = 125^\circ C$	12 15	12 —	12 —	mA MAX
Negative Supply Current (All Digital Inputs Logic "0")	$I-$	$T_A = 125^\circ C$	3.8 5	3.8 —	3.8 —	mA MAX
Analog Input Range	V_A	(Note 2)	± 10	± 10	± 10	V MIN

NOTE:

Electrical tests are performed at wafer probe to the limits shown. Due to variations in assembly methods and normal yield loss, yield after packaging is not guaranteed for standard product dice. Consult factory to negotiate specifications based on dice lot qualification through sample lot assembly and testing.

TYPICAL ELECTRICAL CHARACTERISTICS at $V+ = 15V$, $V- = -15V$ and $T_A = 25^\circ C$ for MUX-08/24N & G, $T_A = 125^\circ C$ for MUX-08/24NT, unless otherwise noted.

PARAMETER	SYMBOL	CONDITIONS	MUX-08/ MUX-24NT TYPICAL	MUX-08/ MUX-24N TYPICAL	MUX-08/ MUX-24G TYPICAL	UNITS
Switching Time (t_{TRAN})	t_{PHL}	(Note 1)	1.7	1.3	2.1	μS
	t_{PLH}		1.1	0.9	1.3	
Output Settling Time	t_S	10V Step to 0.1% (Note 1)	2.1	1.5	1.9	μS
Break-Before-Make Delay	t_{OPEN}	(Note 1)	0.8	0.8	1.0	μS
Crosstalk	CT	(Note 1)	70	70	70	dB
ΔR_{ON} With Applied Voltage	ΔR_{ON}	$-10V \leq V_S \leq 10V$, $I_S = 200\mu A$	2	2	6	%
Leakage Current (Switch "ON")	$I_{D(ON)}$	$V_D = 10V$ (Note 1)	20	0.5	0.5	nA
Analog Input Range	V_A		+ 10.4/-15	+ 10.4/-15	+ 10.4/-15	V

NOTES:

1. The data shown is extrapolated from measurements made on the packaged devices.

2. Guaranteed by leakage current and R_{ON} tests.

**MUX-08
LOGIC STATE**

A ₂	A ₁	A ₀	EN	"ON" CHANNEL
X	X	X	L	NONE
L	L	L	H	1
L	L	H	H	2
L	H	L	H	3
L	H	H	H	4
H	L	L	H	5
H	L	H	H	6
H	H	L	H	7
H	H	H	H	8

**MUX-24
LOGIC STATE**

A ₁	A ₀	EN	"ON" CHANNEL
X	X	L	NONE
L	L	H	1
L	H	H	2
H	L	H	3
H	H	H	4

TYPICAL PERFORMANCE CHARACTERISTICS (Applies to all grades, unless otherwise noted.)

**MUX-08
BREAK-BEFORE-MAKE
SWITCHING**



R_L = 1kΩ, C_L = 10pF, V₁ = 10V
VOLTAGE = 2V/DIV
TIME = 200ns/DIV

**MUX-08
LARGE-SIGNAL SWITCHING**



R_L = 1MΩ, C_L = 10pF, V₁ = -10V, V₈ = +10V
VOLTAGE = 5V/DIV
TIME = 1µs/DIV

**MUX-08
SMALL-SIGNAL SWITCHING**



R_L = 1MΩ, C_L = 10pF, V₁ = -500mV, V₈ = +500mV
VOLTAGE = 500mV/DIV
TIME = 1µs/DIV

**MUX-08
SMALL-SIGNAL SWITCHING
WITH FILTERING**



R_L = 1MΩ, C_L = 500pF, V₁ = 500mV, V₈ = +500mV
VOLTAGE = 500mV/DIV
TIME = 1µs/DIV

**MUX-08
SMALL-SIGNAL SWITCHING
WITH 2µs SAMPLE TIME**



R_L = 1MΩ, C_L = 10pF, V₁ = -500mV, V₈ = +500mV
VOLTAGE = 500mV/DIV
TIME = 500ns/DIV

**MUX-08
SMALL-SIGNAL SWITCHING
WITH FILTERING AND
2.5µs SAMPLE TIME**



R_L = 1MΩ, C_L = 500pF, V₁ = -500mV, V₈ = +500mV
VOLTAGE = 500mV/DIV
TIME = 500ns/DIV

NOTE:

Top waveforms: Digital Input 5V/DIV
Bottom waveforms: Multiplexer Output