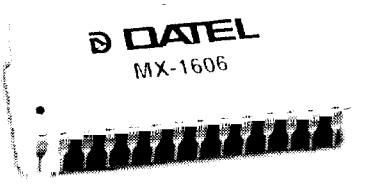
MX/MXD Series

4/8/16-Channel, Input Protected CMOS, Analog Multiplexers

DATEL
INNOVATION and EXCELLENCE

FEATURES

- **200kHz sampling rates**
- **±0.01% accuracy**
- **Dielectrically isolated CMOS technology**
- **Break-before-make switching**
- **Single-ended or differential inputs**
- **Overvoltage protection, ±35V**
- **DTL/TTL/CMOS compatible**
- **7.5mW standby power**



GENERAL DESCRIPTION

The MX and MXD Series analog multiplexers are 4, 8, and 16-channel monolithic devices manufactured with a dielectrically isolated complementary MOS process. The circuits incorporate analog and digital input protection which protects the units from both overvoltage and loss of power. The digital inputs are DTL/TTL/CMOS compatible and address the proper channel by means of a 2, 3, or 4-bit binary code. An inhibit input enables or disables the entire device and thus permits expansion of the number of channels by using several devices together. Another important feature of these multiplexers is the use of break-before-make switching to ensure that no two channels are ever momentarily shorted together.

Transfer accuracies of ±0.01% can be achieved at channel sampling rates up to 200kHz and over ±10V signal ranges. These multiplexers are ideal for multichannel data acquisition systems where the multiplexer operates into a high-impedance load such as a sample-hold, buffer amplifier, or instrumentation amplifier.

Power consumption is only 7.5mW at standby and 15mW at 100kHz switching rates. Power supply range is ±5V to ±20V. The devices are packaged in 16 or 28-pin DIP's and operate over the 0 to +70°C temperature range.

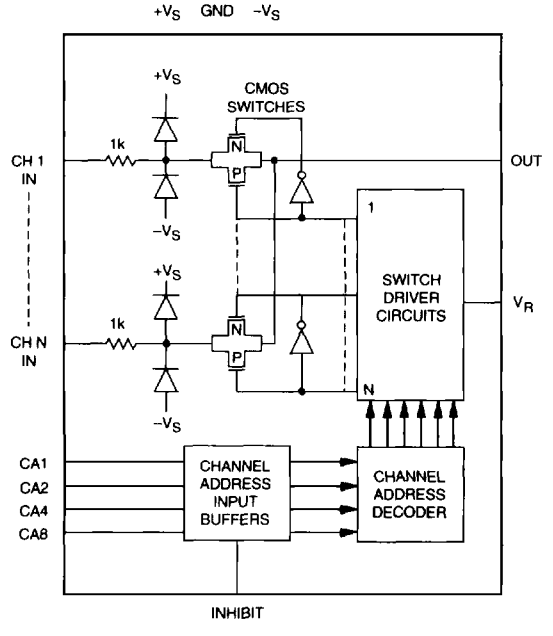


Figure 1. MX Series Functional Block Diagram

INPUT/OUTPUT CONNECTIONS

PIN	FUNCTION MX-808	FUNCTION MXD-409	PIN	FUNCTION MX-808	FUNCTION MXD-409
1	CA1	CA1	16	CA2	CA2
2	INHIBIT	INHIBIT	15	CA4	GND
3	-VS	-VS	14	GND	+VS
4	1 IN	1A IN	13	+VS	1B IN
5	2 IN	2A IN	12	5 IN	2B IN
6	3 IN	3A IN	11	6 IN	3B IN
7	4 IN	4A IN	10	7 IN	4B IN
8	OUT	A OUT	9	8 IN	B OUT

PIN	FUNCTION MX-1606	FUNCTION MXD-807	PIN	FUNCTION MX-1606	FUNCTION MXD-807
1	+VS	+VS	28	OUT	A OUT
2	N.C.	B OUT	27	-VS	-VS
3	N.C.	N.C.	26	8 IN	8A IN
4	16 IN	8B IN	25	7 IN	7A IN
5	15 IN	7B IN	24	6 IN	6A IN
6	14 IN	6B IN	23	5 IN	5A IN
7	13 IN	5B IN	22	4 IN	4A IN
8	12 IN	4B IN	21	3 IN	3A IN
9	11 IN	3B IN	20	2 IN	2A IN
10	10 IN	2B IN	19	1 IN	1A IN
11	9 IN	1B IN	18	INHIBIT	INHIBIT
12	GND	GND	17	CA1	CA1
13	VR	VR	16	CA2	CA2
14	CA8	N.C.	15	CA4	CA4

NOTES: CA = Channel address VS = Supply voltage
VR = Reference voltage N.C. = No connection

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ABSOLUTE MAXIMUM RATINGS

PARAMETERS	MX-808	MX-1606	MXD-409	MXD-807
Voltage Between Supply Pins	40V	40V	40V	40V
V_{REF} to Ground, V + to Ground	+20V	+20V	+20V	+20V
Input Overvoltage				
Digital	$\pm(V_S + 4V)$	$\pm(V_S + 4V)$	$\pm(V_S + 4V)$	$\pm(V_S + 4V)$
Analog	$\pm(V_S + 20V)$	$\pm(V_S + 20V)$	$\pm(V_S + 20V)$	$\pm(V_S + 20V)$
Power Dissipation	725mW	1200mW	725mW	1200mW

FUNCTIONAL SPECIFICATIONS

(Typical at +25°C, ±15V supplies and R source <1k, unless otherwise noted.)

ANALOG INPUTS	MX-808	MX-1606	MXD-409	MXD-807
Number of Channels	8	16	4	8
Type	Single-ended	Single-ended	Differential	Differential
Input Voltage Range	±15V	±15V	±15V	±15V
Channel ON				
Resistance	1.5kΩ	1.5kΩ	1.5kΩ	1.5kΩ
Resistance Over Temperature (maximum)	2kΩ	2kΩ	2kΩ	2kΩ
Leakage	100pA	100pA	100pA	100pA
Channel OFF				
Input Leakage	30pA	30pA	30pA	30pA
Output Leakage	0.1nA	0.1nA	0.1nA	0.1nA
Input Capacitance	12pF	12pF	12pF	12pF
Output Capacitance	25pF	50pF	12pF	30pF
DIGITAL INPUTS ①				
Logic "0" Threshold (maximum)	+0.8V	+0.8V	+0.8V	+0.8V
Logic "1" Threshold, TTL (minimum) ②	+4.0V	+4.0V	+4.0V	+4.0V
Logic "1" Threshold, CMOS (minimum) ③	—	+6.0V	—	+6.0V
Input Current (maximum, high or low)	5µA	5µA	5µA	5µA
Channel Address Coding	3 bits	4 bits	2 bits	3 bits
Channel Inhibit (all channels OFF)	Logic "0"	Logic "0"	Logic "0"	Logic "0"
PERFORMANCE				
Transfer Error (maximum)	±0.01%	±0.01%	±0.01%	±0.01%
Crosstalk (1kHz)	0.005%	0.005%	0.005%	0.005%
Common Mode Rejection	—	—	120dB	120dB
Settling Time (20V to ±0.1%) ④	1.2µs	1.2µs	1.2µs	1.2µs
Settling Time (20V to ±0.01%) ④	3.5µs	3.5µs	3.5µs	3.5µs
Turn ON Time	500ns	500ns	500ns	500ns
Turn OFF Time	300ns	300ns	300ns	300ns
Inhibit/Enable Delay	300ns	300ns	300ns	300ns
Break-Before-Make Delay	80ns	80ns	80ns	80ns
POWER REQUIREMENTS				
Rated Power Supply Voltage	±15V	±15V	±15V	±15V
Power Supply Voltage Range	±5 to ±20V	±5 to ±20V	±5 to ±20V	±5 to ±20V
Quiescent Current (maximum)	+2, −1mA	+2, −1mA	+2, −1mA	+2, −1mA
Power Consumption (10kHz sampling)	7.5mW	7.5mW	7.5mW	7.5mW
PHYSICAL/ENVIRONMENTAL				
Operating Temperature Range	0 to +70°C	0 to +70°C	0 to +70°C	0 to +70°C
Storage Temperature Range	−65 to +150°C	−65 to +150°C	−65 to +150°C	−65 to +150°C
Package	16-pin DIP	28-pin DIP	16-pin DIP	28-pin DIP

Footnotes:

① The digital inputs are the channel address inputs and the inhibit input.

② To drive from DTL/TTL circuits, 1k pull-up resistors to +5V are recommended. With models MX-1606 and MXD-807, pin 13 should be left open.

③ For a +6.0V threshold with models MX-1606 and MXD-807, pin 13 is connected to +10V.

④ With a load impedance of >100 megohms in parallel with 2pF.

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TECHNICAL NOTES

1. The transfer accuracy of these multiplexers depends on both the source resistance and the load resistance. With zero source resistance, and assuming 2k Ohms maximum channel ON resistance, the load impedance should be at least 20 megohms to achieve 0.01% accuracy. In practice, it is recommended that a load impedance of at least 100 megohms be used to minimize errors. This can be done by using a good high-gain, high-CMR operational amplifier (such as DATEL's AM 462) as a buffer. Source resistance should be kept as low as possible so that accuracy is not affected; less than 1k Ohms is recommended. Higher source resistance, in addition to affecting accuracy, will degrade the settling time of the multiplexer.
2. For differential operation, two buffer amplifiers or a good quality instrumentation amplifier should be used. To maintain high CMR, source impedance unbalance should be kept to a minimum, the highest possible load impedance should be used, and an amplifier with high CMR should be chosen.
3. Channel expansion is accomplished using the inhibit input of the multiplexer. A logic "0" on this input disables the multiplexer. The expansion technique shown in Figure 2 applies to all of the multiplexer models.
4. The reference terminal (V_R) sets the noise immunity level of the input logic for models MX-1606 and MXD-807. In most cases, this terminal is left open (TTL inputs). For higher level inputs (+6V minimum), this terminal should be connected to +10V. When addressing from DTL/TTL logic, use 1k Ohm pull-up resistors to the +5V supply.

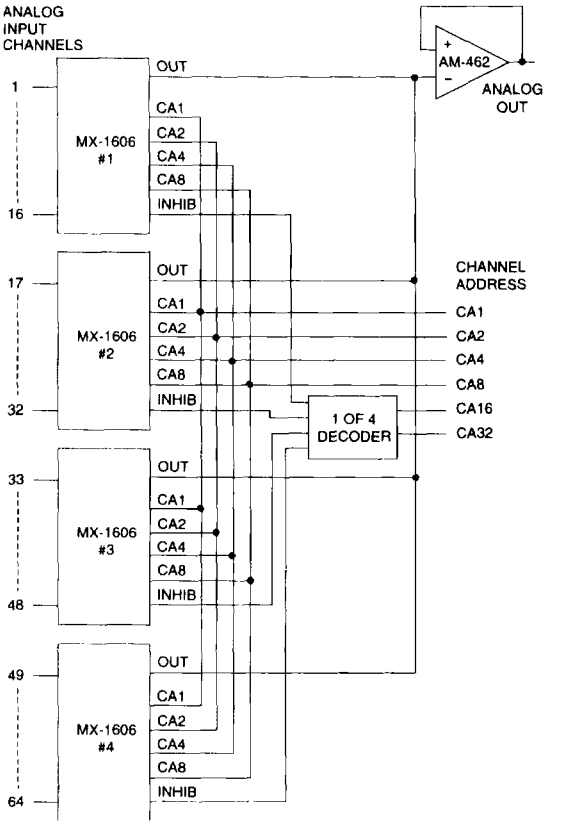

Figure 2. Expansion to 64 Channels

CHANNEL ADDRESSING

MX-1606

CA 8 4 2 1	Inhibit	ON Channel
X X X X	0	None
0 0 0 0	1	1
0 0 0 1	1	2
0 0 1 0	1	3
0 0 1 1	1	4
0 1 0 0	1	5
0 1 0 1	1	6
0 1 1 0	1	7
0 1 1 1	1	8
1 0 0 0	1	9
1 0 0 1	1	10
1 0 1 0	1	11
1 0 1 1	1	12
1 1 0 0	1	13
1 1 0 1	1	14
1 1 1 0	1	15
1 1 1 1	1	16

MX-808, MXD-807

CA 4 2 1	Inhibit	ON Channel
X X X	0	None
0 0 0	1	1
0 0 1	1	2
0 1 0	1	3
0 1 1	1	4
1 0 0	1	5
1 0 1	1	6
1 1 0	1	7
1 1 1	1	8

MXD-409

CA 2 1	Inhibit	ON Channel
X X	0	None
0 0	1	1
0 1	1	2
1 0	1	3
1 1	1	4

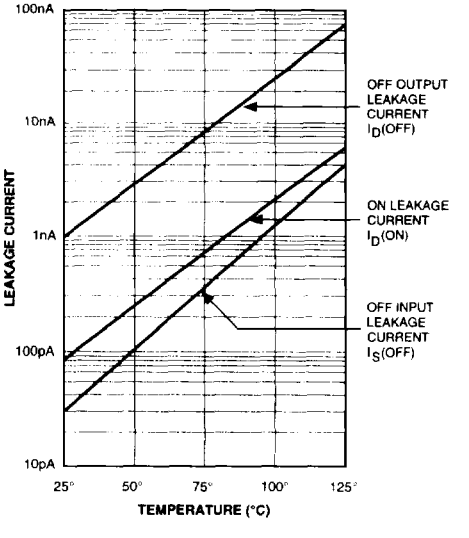

Figure 3. Leakage Current vs. Temperature

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PERFORMANCE GRAPHS

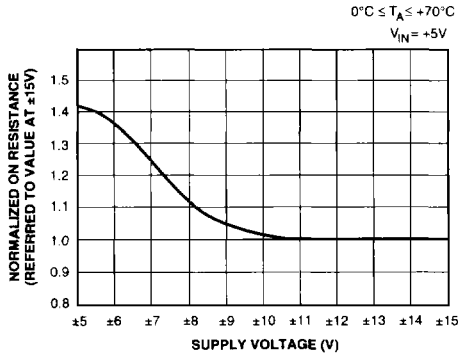


Figure 4. Normalized ON Resistance vs. Supply Voltage

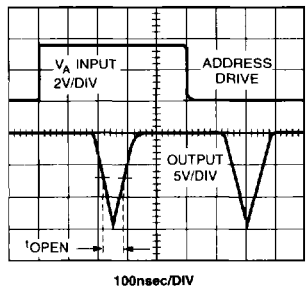


Figure 6. Break-Before-Make Delay (t_{OPEN})

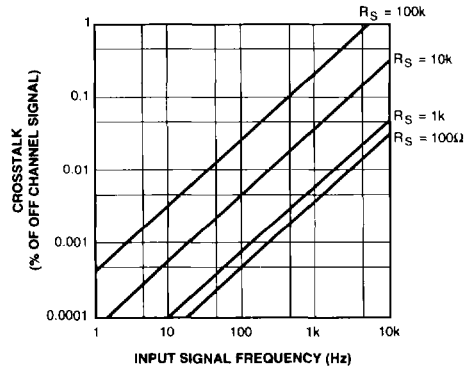


Figure 5. Crosstalk vs. Frequency of Input Signal

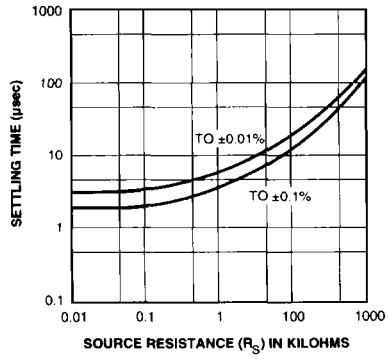


Figure 7. Settling Time vs. Source Resistance (20V Step)

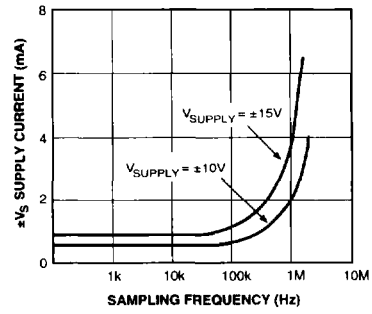
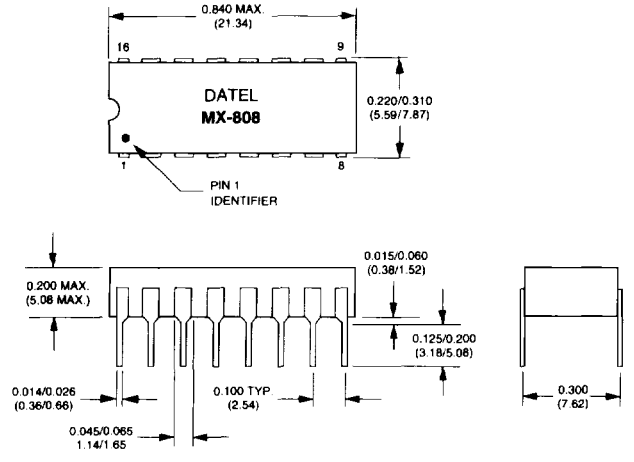


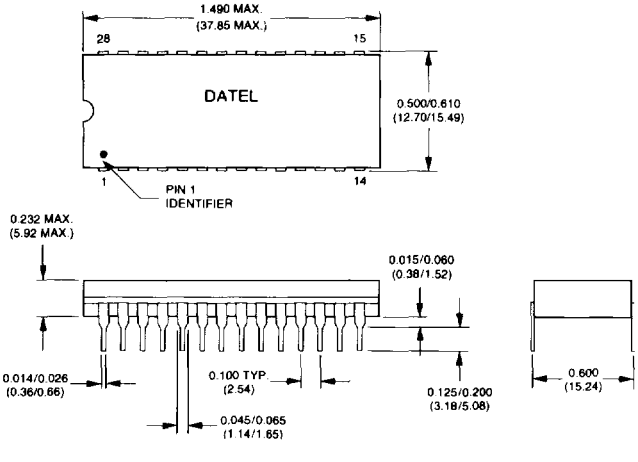
Figure 8. Supply Current vs. Sampling Frequency

MECHANICAL DIMENSIONS
INCHES (mm)

MX-808, MXD-409



MX-1606, MXD-807



ORDERING INFORMATION

MODEL	CHANNELS	OPERATING TEMP. RANGE
MX-808	8 S.E.	0 to +70°C
MX-1606	16 S.E.	0 to +70°C
MXD-409	4 Diff.	0 to +70°C
MXD-807	8 Diff.	0 to +70°C

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